CGRateS Documentation

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Contents

Welcome to CGRateS's documentation!

CGRateS is a *very fast* (**50k+ CPS**) and *easily scalable* (**load-balancer + replication** included) **Real-time Enterprise Billing Suite** targeted especially for ISPs and Telecom Operators (but not only).

CHAPTER 1

Overview

Starting as a pure **billing engine**, CGRateS has evolved over the years into a reliable **real-time charging framework**, able to accommodate various business cases in a *generic way*.

Being an *"engine style"* the project focuses on providing best ratio between **functionality** (over 15 daemons/services implemented with a rich number of *features* and a development team agile in implementing new ones) and **performance** (dedicated benchmark tool, asynchronous request processing, own transactional cache component), however not losing focus of **quality** (test driven development policy).

It is written in Go programming language and accessible from any programming language via JSON RPC. The code is well documented (**go doc** compliant API docs) and heavily tested (**5k+** tests are part of the unit test suite).

Meant to be pluggable into existing billing infrastructure and as non-intrusive as possible, CGRateS passes the decisions about logic flow to system administrators and incorporates as less as possible business logic.

Modular and flexible, CGRateS provides APIs over a variety of simultaneously accessible communication interfaces:

- **In-process** : optimal when there is no need to split services over different processes
- **JSON over TCP** : most preferred due to its simplicity and readability
- **JSON over HTTP** : popular due to fast interoperability development
- **JSON over Websockets** : useful where 2 ways interaction over same TCP socket is required
- **GOB over TCP** : slightly faster than JSON one but only accessible for the moment out of Go (https://golang.org/).

CGRateS is capable of four charging modes:

- ***prepaid**
  - Session events monitored in real-time
  - Session authorization via events with security call timer
  - Real-time balance updates with configurable debit interval
  - Support for simultaneous sessions out of the same account

  - Real-time fraud detection with automatic mitigation
  - *Advantage*: real-time overview of the costs and fast detection in case of fraud, concurrent account sessions supported
  - *Disadvantage*: more CPU intensive.

- ***pseudoprepaid**
  - Session authorization via events
  - Charging done at the end of the session out of CDR received
  - *Advantage*: less CPU intensive due to less events processed
  - *Disadvantage*: as balance updates happen only at the end of the session there can be costs discrepancy in case of multiple sessions out of same account (including going on negative balance).

- ***postpaid**
  - Charging done at the end of the session out of CDR received without session authorization
  - Useful when no authorization is necessary (trusted accounts) and no real-time event interaction is present (balance is updated only when CDR is present).

- ***rated**
  - Special charging mode where there is no accounting interaction (no balances are used) but the primary interest is attaching costs to CDRs.
  - Specific mode for Wholesale business processing high-throughput CDRs
  - Least CPU usage out of the four modes (fastest charging).

1.1 Features

- **Performance oriented. To get an idea about speed, we have benchmarked 50000+ req/sec on comodity hardware without a**
  - Using most modern programming concepts like multiprocessor support, asynchronous code execution within microthreads, channel based locking
  - Built-in data caching system with LRU and TTL support
  - Linear performance increase via simple hardware addition
  - On demand performance increase via in-process / over network communication between engine services.

- **Modular architecture**
  - Plugable into existing infrastructure
  - Non-intrusive into existing setups
  - Easy to enhance functionality by writing custom components
  - Flexible API accessible via both **GOB** (Go specific, increased performance) or **JSON** (platform independent, universally accessible)
  - Easy distribution (one binary concept, can run via NFS on all Linux servers without install).

- **Easy administration**
  - One binary can run on all Linux servers without additional installation (simple copy)

  - Can run diskless via NFS
  - Virtualization/containerization friendly(runs on Docker).
- **GOCS (Global Online Charging System)**
  - Support for global networks with one master + multi-cache nodes around the globe for low query latency
  - Mutiple Balance types per Account (*monetary, *voice, *sms, *data, *generic)
  - Unlimited number of Account Balances with weight based prioritization
  - Various Balance filters (ie: per-destination, roaming-only, weekend-only)
  - Support for Volume based discounts and automatic bonuses (ie: 5 SMS free for every 10 minutes in one hour to specific destination)
  - Session based charging with support for concurrent sessions per account and per session dynamic debit interval
  - Session emulation combined with Derived Charging (separate charging for distributors chaining, customer/supplier parallel calculations)
  - Balance reservation and refunds
  - Event based charging (ie: SMS, MESSAGE)
  - Built-in Task-Scheduler supporting both one-time as well as recurrent actions (automatic subscriptions management, recurrent *debit/*topup, DID charging)
  - Real-time balance monitors with automatic actions triggered (bonuses or fraud detection).
- **Highly configurable Rating**
  - Connect Fees
  - Priced Units definition
  - Rate increments
  - Rate groups (ie. charge first minute in a call as a whole and next ones per second)
  - Verbose durations(up to nanoseconds billing)
  - Configurable decimals per destination
  - Rating subject categorization (ie. premium/local charges, roaming)
  - Recurrent rates definition (per year, month, day, dayOfWeek, time)
  - Rating Profiles activation times (eg: rates becoming active at specific time in the future)
  - Rating Profiles fallback (per subject destinations with fallback to server wide pricing)
  - Verbose charging logs to comply strict rules imposed by some country laws.
- **Multi-Tenant from day one**
  - Default Tenant configurable for one-tenant systems
  - Security enforced for RPC-API on Tenant level.
- **Online configuration reloads without restart**
  - Engine configuration from .json folder or remote http server
  - Tariff Plans from .csv folder or database storage.
- **CDR server**

  - Optional offline database storage
  - Online (rating queues) or offline (via RPC-API) exports with customizable content via .json templates
  - Multiple export interfaces: files, HTTP, AMQP, SQS, Kafka.
- **Generic Event Reader**
  - Process various sources of events and convert them into internal ones which are sent to CDR server for rating
  - Conversion rules defined in .json templates
  - Supported interfaces: .csv, .xml, fixed width files, Kafka.
- **Events mediation**
  - Ability to add/change/remove information within *Events* to achieve additional services or correction
  - Performance oriented.
- **Routing server for VoIP**
  - Implements strategies like *Least Cost Routing*, *Load Balacer*, *High Availability*
  - Implements *Number Portability* service.
- **Resource allocation controller**
  - Generic filters for advanced logic
  - In-memory operations for increased performance
  - Backup in offline storage.
- **Stats service**
  - Generic stats (*sum, *difference, *multiply, *divide)
  - In-memory operations for increased performance
  - Backup in offline storage.
- **Thresholds monitor**
  - Particular implementation of *Fraud Detection with automatic mitigation*
  - Execute independent actions which can serve various purposes (notifications, accounts disables, bonuses to accounts).
- **Multiple RPC interfaces**
  - Support for *JSON-RPC*, *GOB-PC* over TCP, HTTP, websockets
  - Support for HTTP-REST interface.
- **Various agents to outside world:**
  - Asterisk
  - FreeSWITCH
  - Kamailio
  - OpenSIPS
  - Diameter
  - Radius
  - Generic HTTP

    - DNS/ENUM.
- **Built in High-Availability mechanisms:**
    - Dispatcher with static or dynamic routing
    - Server data replication
    - Client remote data querying.
- Good documentation (that's me :).
- **"Free as in Beer"** with commercial support available on-demand.

1.2 Links

- CGRateS home page http://www.cgrates.org
- Documentation http://cgrates.readthedocs.io
- API docs https://godoc.org/github.com/cgrates/cgrates/apier
- Source code https://github.com/cgrates/cgrates
- Travis CI https://travis-ci.org/cgrates/cgrates
- Google group https://groups.google.com/forum/#!forum/cgrates
- IRC irc.freenode.net #cgrates

1.3 License

CHAPTER 2

Architecture

The CGRateS framework consists of functionality packed within **five** software applications, described below.

2.1 cgr-engine

Groups most of functionality from services and components.

Customisable through the use of *json JSON configuration* or command line arguments (higher prio).

Able to read the configuration from either a local directory of *.json* files with an unlimited number of subfolders (ordered alphabetically) or a list of http paths (separated by ";").

```
$ cgr-engine -help
Usage of cgr-engine:
 -config_path string
     Configuration directory path. (default "/etc/cgrates/")
 -cpuprof_dir string
     write cpu profile to files
 -httprof_path string
     http address used for program profiling
 -log_level int
     Log level (0-emergency to 7-debug) (default -1)
 -logger string
     logger <*syslog|*stdout>
 -memprof_dir string
     write memory profile to file
 -memprof_interval duration
     Time betwen memory profile saves (default 5s)
 -memprof_nrfiles int
     Number of memory profile to write (default 1)
 -node_id string
     The node ID of the engine
 -pid string
     Write pid file
```

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```
-scheduled_shutdown string
    shutdown the engine after this duration
-singlecpu
    Run on single CPU core
-version
    Prints the application version.
```

Hint: $ cgr-engine -config_path=/etc/cgrates

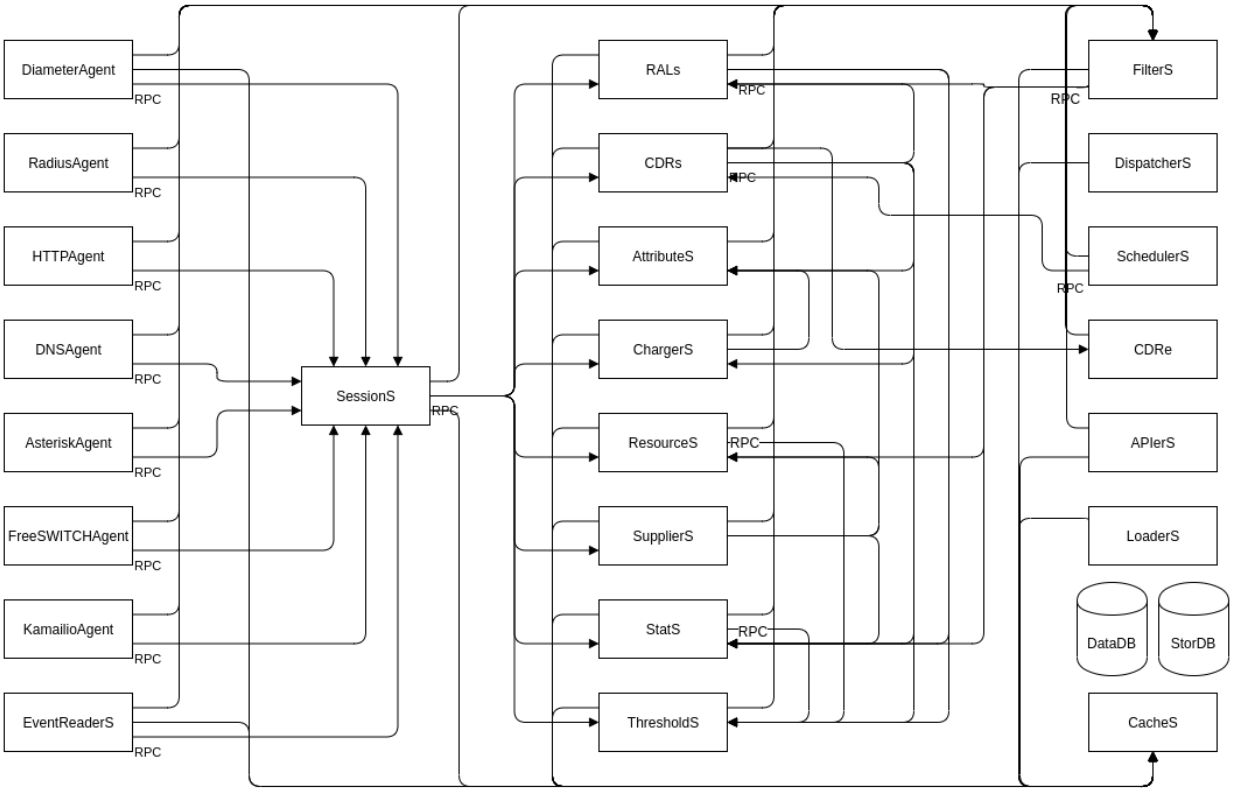

Fig. 1: Internal Architecture of **cgr-engine**

The components from the diagram can be found documented in the links bellow:

2.1.1 Agents

Agents are interfaces towards external systems, implementing protocols enforced by the communication channels opened. These can be standard or privately defined.

All of the **Agents** implemented within CGRateS are flexible to be configured with generic parameters configurable for both *request* and *replies*.

Following *Agents* are implemented within CGRateS:

2.1.1.1 DiameterAgent

DiameterAgent translates between Diameter and **CGRateS**, sending *RPC* requests towards **CGRateS/SessionS** component and returning replies from it to the *DiameterClient*.

Implements Diameter protocol in a standard agnostic manner, giving users the ability to implement own interfaces by defining simple *processor templates* within the *JSON configuration* files.

Used mostly in modern mobile networks (LTE/xG).

Configuration

The **DiameterAgent** is configured within *diameter_agent* section from *JSON configuration*.

Sample config

With explanations in the comments:

```
"diameter_agent": {
       "enabled": false,                                    // enables the␣
↪diameter agent: <true|false>
       "listen": "127.0.0.1:3868",                      // address where to listen for␣
↪diameter requests <x.y.z.y/x1.y1.z1.y1:1234>
       "listen_net": "tcp",                             // transport type for diameter
↪<tcp|sctp>
       "dictionaries_path": "/usr/share/cgrates/diameter/dict/",       // path␣
↪towards directory
                                                                                //  ␣
↪holding additional dictionaries to load
       "sessions_conns": ["*internal"],         // connection towards SessionS
       "origin_host": "CGR-DA",                         // diameter Origin-Host AVP␣
↪used in replies
       "origin_realm": "cgrates.org",           // diameter Origin-Realm AVP used in␣
↪replies
       "vendor_id": 0,                                      // diameter Vendor-Id␣
↪AVP used in replies
       "product_name": "CGRateS",                       // diameter Product-Name AVP␣
↪used in replies
       "concurrent_requests": -1,                       // limit the number of active␣
↪requests processed by the server <-1|0-n>
       "synced_conn_requests": false,           // process one request at the time per␣
↪connection
       "asr_template": "*asr",                          // enable AbortSession message␣
↪being sent to client
                                                                                //␣
↪forcing session disconnection from CGRateS side
       "templates":{                                        // message templates␣
↪which can be injected within request/replies
              "*err": [                                                 // *err is␣
↪used mostly in automatic diameter replies with errors
                              {
                                      "tag": "SessionId", "path": "*rep.Session-Id",
                                      "type": "*variable", "mandatory": true,
                                      "value": "~*req.Session-Id"
                              },
```

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```
                                {
                                        "tag": "OriginHost", "path": "*rep.Origin-Host
↪",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*vars.OriginHost"
                                },
                                {
                                        "tag": "OriginRealm", "path": "*rep.Origin-
↪Realm",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*vars.OriginRealm"
                                },
                ],
                "*cca": [               // *cca is used into CallControlAnswer messages
                                {
                                        "tag": "SessionId", "path": "*rep.Session-Id",
                                        "type": "*composed", "mandatory": true,
                                        "value": "~*req.Session-Id"
                                },
                                {
                                        "tag": "ResultCode", "path": "*rep.Result-Code
↪",
                                        "type": "*constant", "value": "2001"},
                                {
                                        "tag": "OriginHost", "path": "*rep.Origin-Host
↪",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*vars.OriginHost"
                                },
                                {
                                        "tag": "OriginRealm", "path": "*rep.Origin-
↪Realm",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*vars.OriginRealm"
                                },
                                {
                                        "tag": "AuthApplicationId",
                                        "path": "rep.Auth-Application-Id",
                                        "type": "*variable", "mandatory": true,
                                         "value": "~*vars.*appid"
                                },
                                {
                                        "tag": "CCRequestType",
                                        "path": "*rep.CC-Request-Type",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.CC-Request-Type"
                                },
                                {
                                        "tag": "CCRequestNumber",
                                        "path": "*rep.CC-Request-Number",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.CC-Request-Number"
                                },
                ],
                "*asr": [       // *asr is used to build AbortSessionRequest
                                {
                                        "tag": "SessionId", "path": "*diamreq.Session-
↪Id",
```

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```
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.Session-Id"
                                },
                                {
                                        "tag": "OriginHost", "path": "diamreq.Origin-
↪Host",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.Destination-Host"
                                },
                                {
                                        "tag": "OriginRealm", "path": "diamreq.Origin-
↪Realm",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.Destination-Realm"
                                },
                                {
                                        "tag": "DestinationRealm",
                                        "path": "*diamreq.Destination-Realm",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.Origin-Realm"
                                },
                                {
                                        "tag": "DestinationHost",
                                        "path": "*diamreq.Destination-Host",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.Origin-Host"
                                },
                                {
                                        "tag": "AuthApplicationId",
                                        "path": "*diamreq.Auth-Application-Id",
                                        "type": "*variable", "mandatory": true,
                                         "value": "~*vars.*appid"
                                },
                                {
                                        "tag": "UserName", "path": "*diamreq.User-Name
↪",
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.User-Name"
                                },
                                {
                                        "tag": "OriginStateID",
                                        "path": "*diamreq.Origin-State-Id",
                                        "type": "*constant", "value": "1"
                                }
                        ]
                },
                "request_processors": [         // decision logic for message processing
                        {
                                "id": "SMSes",          // id is used for debug in logs (ie:␣
↪using *log flag)
                                "filters": [            // list of filters to be applied on␣
↪message for this processor to run
                                        "*string:~*vars.*cmd:CCR",
                                        "*string:~*req.CC-Request-Type:4",
                                        "*string:~*req.Service-Context-Id:LPP"
                                ],
                                "flags": ["*event", "*accounts", "*cdrs"],      // influence␣
↪processing logic within CGRateS workflow
```

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```
                    "request_fields":[
↪          // data exchanged between Diameter and CGRateS
                        {
                            "tag": "ToR",                       // tag is used␣
↪in debug,
                            "path": "*cgreq.ToR",    // path is the field␣
↪on CGRateS side
                            "type": "*constant",     // type defines the␣
↪method to provide the value
                            "value": "*sms"}
                        {
                            "tag": "OriginID",                          //␣
↪OriginID will identify uniquely
                            "path": "*cgreq.OriginID",       // the session␣
↪on CGRateS side
                            "type": "*variable",             // it's value␣
↪will be taken from Diameter AVP:
                            "mandatory": true,                          //␣
↪Multiple-Services-Credit-Control.Service-Identifier
                            "value": "~*req.Multiple-Services-Credit-
↪Control.Service-Identifier"
                        },
                        {
                            "tag": "OriginHost",             // OriginHost␣
↪combined with OriginID
                            "path": "*cgreq.OriginHost",// is used by␣
↪CGRateS to build the CGRID
                            "mandatory": true,
                            "type": "*variable",             // have the␣
↪value out of special variable: *vars
                            "value": "*vars.OriginHost"
                        },
                        {
                            "tag": "RequestType",                       //␣
↪RequestType instructs SessionS
                            "path": "*cgreq.RequestType",    //  about␣
↪charging type to apply for the event
                            "type": "*constant",
                            "value": "*prepaid"
                        },
                        {
                            "tag": "Category",                          //␣
↪Category serves for ataching Account
                            "path": "*cgreq.Category",       //   and␣
↪RatingProfile to the request
                            "type": "*constant",
                            "value": "sms"
                        },
                        {
                            "tag": "Account",                           //␣
↪Account is required by charging
                            "path": "*cgreq.Account",
                            "type": "*variable",             // value is␣
↪taken dynamically from a group AVP
                            "mandatory": true,                          //  ␣
↪where Subscription-Id-Type is 0
                            "value": "~*req.Subscription-Id.Subscription-
↪Id-Data[~Subscription-Id-Type(0)]"
```

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```
                                },
                                {
                                        "tag": "Destination",                   //␣
↪Destination is used for charging
                                        "path": "*cgreq.Destination",   // value from␣
↪Diameter will be mediated before sent to CGRateS
                                        "type": "*variable",
                                        "mandatory": true,
                                        "value": "~*req.Service-Information.SMS-
↪Information.Recipient-Info.Recipient-Address.Address-Data:s/^\\+49(\\d+)/int${1}/:s/
↪^0049(\\d+)/int${1}/:s/^49(\\d+)/int${1}/:s/^00(\\d+)/+${1}/:s/^[\\+]?(\\d+)/int${1}
↪/:s/int(\\d+)/+49${1}/"
                                },
                                {
                                        "tag": "Destination",           // Second␣
↪Destination will overwrite the first if filter matches
                                        "path": "*cgreq.Destination",
                                        "filters":[                                 ␣
↪ // Only overwrite when filters are matching
                                                "*notprefix:~*req.Service-Information.
↪SMS-Information.Recipient-Info.Recipient-Address.Address-Data:49",
                                                "*notprefix:~*req.Service-Information.
↪SMS-Information.Recipient-Info.Recipient-Address.Address-Data:3312"
                                        ],
                                        "type": "*variable",
                                        "mandatory": true,
                                        "value": "~*req.Service-Information.SMS-
↪Information.Recipient-Info.Recipient-Address.Address-Data:s/^[\\+]?(\\d+)/int${1}/
↪:s/int(\\d+)/+00${1}/"
                                },
                                {
                                        "tag": "SetupTime",                     //␣
↪SetupTime is used by charging
                                        "path": "*cgreq.SetupTime",
                                        "type": "*variable",
                                        "value": "~*req.Event-Timestamp",
                                        "mandatory": true
                                },
                                {
                                        "tag": "AnswerTime",            // AnswerTime␣
↪is used by charging
                                        "path": "*cgreq.AnswerTime",
                                        "type": "*variable",
                                        "mandatory": true,
                                        "value": "~*req.Event-Timestamp"
                                },
                                {
                                        "tag": "Usage",                 // Usage is␣
↪used by charging
                                        "path": "*cgreq.Usage",
                                        "type": "*variable",
                                        "mandatory": true,
                                        "value": "~*req.Multiple-Services-Credit-
↪Control.Requested-Service-Unit.CC-Service-Specific-Units"
                                },
                                {
                                        "tag": "Originator-SCCP-Address",       ␣
↪         // Originator-SCCP-Address is an extra field which we want in CDR
```

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```
                                        "path": "*cgreq.Originator-SCCP-Address",
↪ // not used by CGRateS
                                        "type": "*variable", "mandatory": true,
                                        "value": "~*req.Service-Information.SMS-
↪Information.Originator-SCCP-Address"
                                    },
                            ],
                            "reply_fields":[                        // fields which are
↪sent back to DiameterClient
                                    {
                                        "tag": "CCATemplate",    // inject complete
↪Template defined as *cca above
                                        "type": "*template",
                                        "value": "*cca"
                                    },
                                    {
                                        "tag": "ResultCode",     // Change the
↪ResultCode if the reply received from CGRateS contains a 0 MaxUsage
                                        "filters": ["*eq:~*cgrep.MaxUsage:0"],
                                        "path": "*rep.Result-Code",
                                        "blocker": true,                // do not
↪consider further fields if this one is processed
                                        "type": "*constant",
                                        "value": "4012"},
                                    {"tag": "ResultCode",            // Change the
↪ResultCode AVP if there was an error received from CGRateS
                                        "filters": ["*notempty:~*cgrep.Error:"],
                                        "path": "*rep.Result-Code",
                                        "blocker": true,
                                        "type": "*constant",
                                        "value": "5030"}
                            ]
                }

        ]
                },

        ],
},
```

Config params

Most of the parameters are explained in *JSON configuration*, hence we mention here only the ones where additional info is necessary or there will be particular implementation for *DiameterAgent*.

listen_net The network the *DiameterAgent* will bind to. CGRateS supports both **tcp** and **sctp** specified in Diameter standard.

concurrent_requests The maximum number of active requests processed at one time by the *DiameterAgent*. When this number is reached, new inbound requests will be rejected with *DiameterError* code until the concurrent number drops bellow again. The default value of *-1* imposes no limits.

asr_template The template (out of templates config section) used to build the AbortSession message. If not specified the ASR message is never sent out.

templates Group fields based on their usability. Can be used in both processor templates as well as hardcoded within

CGRateS functionality (ie **err* or **asr*). The IDs are unique, defining the same id in multiple configuration places/files will result into overwrite.

***err** Is a hardcoded template used when *DiameterAgent* cannot parse the incoming message. Aside from logging the error via internal logger the message defined via **err* template will be sent out.

***asr** Can be activated via *asr_template* config key to enable sending of *Diameter ASR* message to *DiameterClient*.

***cca** Defined for convenience to follow the standard for the fields used in *Diameter CCA* messages.

request_processors List of processor profiles applied on request/replies.

Once a request processor will be matched (it's *filters* should match), the *request_fields* will be used to craft a request object and the flags will decide what sort of procesing logic will be applied to the crafted request.

After request processing, there will be a second part executed: reply. The reply object will be built based on the *reply_fields* section in the request processor.

Once the *reply_fields* are finished, the object converted and returned to the *DiameterClient*, unless *continue* flag is enabled in the processor, which makes the next request processor to be considered.

filters Will specify a list of filter rules which need to match in order for the processor to run (or field to be applied).

For the dynamic content (prefixed with ~) following special variables are available:

***vars** Request related shared variables between processors, populated especially by core functions. The data put inthere is not automatically transfered into requests sent to CGRateS, unless instructed inside templates.

Following vars are automatically set by core:

- **OriginHost**: agent configured *origin_host*
- **OriginRealm**: agent configured *origin_realm*
- **ProductName**: agent configured *product_name*
- **RemoteHost**: the Address of the remote client
- ***app**: current request application name (out of diameter dictionary)
- ***appid**: current request application id (out of diameter dictionary)
- ***cmd**: current command short naming (out of diameter dictionary) plus *R" as suffix - ie: *CCR*

***req** Diameter request as it comes from the *DiameterClient*.

Special selector format defined in case of groups **req.Path.To.Attribute[$groupIndex]* or **req.Absolute.Path.To.Attribute[~AnotherAttributeRelativePath($valueAnotherAttribute)]*.

Example 1: *~*req.Multiple-Services-Credit-Control.Rating-Group[1]* translates to: value of the group attribute at path Multiple-Services-Credit-Control.Rating-Group which is located in the second group (groups start at index 0). Example 2: *~*req.Multiple-Services-Credit-Control.Used-Service-Unit.CC-Input-Octets[~Rating-Group(1)]* which translates to: value of the group attribute at path: *Multiple-Services-Credit-Control.Used-Service-Unit.CC-Input-Octets* where Multiple-Services-Credit-Control.Used-Service-Unit.Rating-Group has value of "1".

***rep** Diameter reply going to *DiameterClient*.

***cgreq** Request sent to CGRateS.

***cgrep** Reply coming from CGRateS.

***diamreq** Diameter request generated by CGRateS (ie: *ASR*).

flags Found within processors, special tags enforcing the actions/verbs done on a request. There are two types of flags: **main** and **auxiliary**.

There can be any number of flags or combination of those specified in the list however the flags have priority one against another and only some simultaneous combinations of *main* flags are possible.

The **main** flags will select mostly the action taken on a request.

The **auxiliary** flags only make sense in combination with **main** ones.

Implemented **main** flags are (in order of priority, and not working simultaneously unless specified):

***log** Logs the Diameter request/reply. Can be used together with other *main* actions.

***none** Disable transfering the request from *Diameter* to *CGRateS* side. Used mostly to pasively answer *Diameter* requests or troubleshoot (mostly in combination with **log* flag).

***dryrun** Together with not transfering the request on CGRateS side will also log the *Diameter* request/reply, useful for troubleshooting.

***auth** Sends the request for authorization on CGRateS.

Auxiliary flags available: ***attributes**, ***thresholds**, ***stats**, ***resources**, ***accounts**, ***suppliers**, ***suppliers_ignore_errors**, ***suppliers_event_cost** which are used to influence the auth behavior on CGRateS side. More info on that can be found on the **SessionS** component's API behavior.

***initiate** Initiates a session out of request on CGRateS side.

Auxiliary flags available: ***attributes**, ***thresholds**, ***stats**, ***resources**, ***accounts** which are used to influence the auth behavior on CGRateS side.

***update** Updates a session with the request on CGRateS side.

Auxiliary flags available: ***attributes**, ***accounts** which are used to influence the behavior on CGRateS side.

***terminate** Terminates a session using the request on CGRateS side.

Auxiliary flags available: ***thresholds**, ***stats**, ***resources**, ***accounts** which are used to influence the behavior on CGRateS side.

***message** Process the request as individual message charging on CGRateS side.

Auxiliary flags available: ***attributes**, ***thresholds**, ***stats**, ***resources**, ***accounts**, ***suppliers**, ***suppliers_ignore_errors**, ***suppliers_event_cost** which are used to influence the behavior on CGRateS side.

***event** Process the request as generic event on CGRateS side.

Auxiliary flags available: all flags supported by the "SessionSv1.ProcessEvent" generic API

***cdrs** Build a CDR out of the request on CGRateS side. Can be used simultaneously with other flags (except **dry_run)

path Defined within field, specifies the path where the value will be written. Possible values:

***vars** Write the value in the special container, **vars*, available for the duration of the request.

***cgreq** Write the value in the request object which will be sent to CGRateS side.

***cgrep** Write the value in the reply returned by CGRateS.

***rep** Write the value to reply going out on *Diameter* side.

***diamreq** Write the value to request built by *DiameterAgent* to be sent out on *Diameter* side.

type Defined within field, specifies the logic type to be used when writing the value of the field. Possible values:

***none** Pass

***filler** Fills the values with an empty string

***constant** Writes out a constant

***remote_host** Writes out the Address of the remote *DiameterClient* sending us the request

***variable** Writes out the variable value, overwriting previous one set

***composed** Writes out the variable value, postpending to previous value set

***group** Writes out the variable value, postpending to the list of variables with the same path

***usage_difference** Calculates the usage difference between two arguments passed in the *value*. Requires 2 arguments: *$stopTime;$startTime*

***cc_usage** Calculates the usage out of *CallControl* message. Requires 3 arguments: *$reqNumber;$usedCCTime;$debitInterval*

***sum** Calculates the sum of all arguments passed within *value*. It supports summing up duration, time, float, int autodetecting them in this order.

***difference** Calculates the difference between all arguments passed within *value*. Possible value types are (in this order): duration, time, float, int.

***value_exponent** Calculates the exponent of a value. It requires two values: *$val;$exp*

***template** Specifies a template of fields to be injected here. Value should be one of the template ids defined.

value The captured value. Possible prefixes for dynamic values are:

***req** Take data from current request coming from diameter client.

***vars** Take data from internal container labeled **vars*. This is valid for the duration of the request.

***cgreq** Take data from the request being sent to *SessionS*. This is valid for one active request.

***cgrep** Take data from the reply coming from *SessionS*. This is valid for one active reply.

***diamreq** Take data from the diameter request being sent to the client (ie: *ASR*). This is valid for one active reply.

***rep** Take data from the diameter reply being sent to the client.

mandatory Makes sure that the field cannot have empty value (errors otherwise).

tag Used for debug purposes in logs.

width Used to control the formatting, enforcing the final value to a specific number of characters.

strip Used when the value is higher than *width* allows it, specifying the strip strategy. Possible values are:

***right** Strip the suffix.

***xright** Strip the suffix, postpending one *x* character to mark the stripping.

***left** Strip the prefix.

***xleft** Strip the prefix, prepending one *x* character to mark the stripping.

padding Used to control the formatting. Applied when the data is smaller than the *width*. Possible values are:

***right** Suffix with spaces.

***left** Prefix with spaces.

***zeroleft** Prefix with *0* chars.

2.1.1.2 RadiusAgent

TBD

2.1.1.3 HTTPAgent

TBD

2.1.1.4 DNSAgent

TBD

2.1.1.5 AsteriskAgent

TBD

2.1.1.6 FreeSWITCHAgent

TBD

2.1.1.7 KamailioAgent

TBD

2.1.1.8 EventReaderService

EventReaderService/ERs is a subsystem designed to read events coming from external sources and convert them into internal ones. The converted events are then sent to other CGRateS subsystems, like *SessionS* where further processing logic is applied to them.

The translation between external and internal events is done based on field mapping, defined in *JSON configuration*.

Configuration

The **EventReaderService** is configured within *ers* section from *JSON configuration*.

Sample config

With explanations in the comments:

```
"ers": {
       "enabled": true,                                        // enable the service
       "sessions_conns": ["*internal"],        // connection towards SessionS
       "readers": [                                            // list of active␣
↪readers
               {
                       "id": "file_reader2",           // file_reader2 reader
                       "run_delay":  "-1",                     // reading of events␣
↪it is triggered outside of ERs
```

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```
                    "field_separator": ";",          // field separator definition
                    "type": "*file_csv",             // type of reader, *file_csv␣
↪can read .csv files
                    "flags": [                                          // influence␣
↪processing logic within CGRateS workflow
                        "*cdrs",                                        //   *cdrs␣
↪will create CDRs
                        "*log"                                          //   *log will␣
↪log the events to syslog
                    ],
                    "source_path": "/tmp/ers2/in",          // location of the␣
↪files
                    "processed_path": "/tmp/ers2/out",      // move the files here␣
↪once processed
                    "content_fields":[                                          //␣
↪mapping definition between line index in the file and CGRateS field
                        {
                            "tag": "OriginID",                          //␣
↪OriginID together with OriginHost will
                            "path": "*cgreq.OriginID",      //   uniquely␣
↪identify the session on CGRateS side
                            "type": "*variable",
                            "value": "~*req.0",q            // take the␣
↪content from line index 0
                            "mandatory": true                           //  ␣
↪in the request file
                        },
                        {
                            "tag": "RequestType",           // RequestType␣
↪instructs SessionS
                            "path": "*cgreq.RequestType",//   about␣
↪charging type to apply for the event
                            "type": "*variable",
                            "value": "~*req.1",
                            "mandatory": true
                        },
                        {
                            "tag": "Category",                          //␣
↪Category serves for ataching Account
                            "path": "*cgreq.Category",      //   and␣
↪RatingProfile to the request
                            "type": "*constant",
                            "value": "call",
                            "mandatory": true
                        },
                        {
                            "tag": "Account",                           //␣
↪Account is required by charging
                            "path": "*cgreq.Account",
                            "type": "*variable",
                            "value": "~*req.3",
                            "mandatory": true
                        },
                        {
                            "tag": "Subject",                           //␣
↪Subject is required by charging
                            "path": "*cgreq.Subject",
```

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(continued from previous page)

```
                                        "type": "*variable",
                                        "value": "~*req.3",
                                        "mandatory": true
                                },
                                {
                                        "tag": "Destination",           // Destination␣
↪is required by charging
                                        "path": "*cgreq.Destination",
                                        "type": "*variable",
                                        "value": "~*req.4:s/0([1-9]\\d+)/+49${1}/",
                                        "mandatory": true                       //␣
↪Additional mediation is performed on number format
                                },
                                {
                                        "tag": "AnswerTime",            // AnswerTime␣
↪is required by charging
                                        "path": "*cgreq.AnswerTime",
                                        "type": "*variable",
                                        "value": "~*req.5",
                                        "mandatory": true
                                },
                                {
                                        "tag": "Usage",                         //␣
↪Usage is required by charging
                                        "path": "*cgreq.Usage",
                                        "type": "*variable",
                                        "value": "~*req.6",
                                        "mandatory": true
                                },
                                {
                                        "tag": "HDRExtra1",                     //␣
↪HDRExtra1 is transparently stored into CDR
                                        "path": "*cgreq.HDRExtra1",     //   as extra␣
↪field not used by CGRateS
                                        "type": "*composed",
                                        "value": "~*req.6",
                                        "mandatory": true
                                }
                        ],
                }
        ]
}
```

Config params

Most of the parameters are explained in *JSON configuration*, hence we mention here only the ones where additional info is necessary or there will be particular implementation for *EventReaderService*.

readers List of reader profiles which ERs manages. Simultaneous readers of the same type are possible.

id Reader identificator, used mostly for debug. The id should be unique per each reader since it can influence updating configuration from different *.json* configuration.

type Reader type. Following types are implemented:

***file_csv** Reader for *comma separated* files.

***partial_csv** Reader for *comma separated* where content spans over multiple files.

***flatstore** Reader for Kamailio/OpenSIPS *db_flatstore* files.

***file_xml** Reader for *.xml* formatted files.

***file_fwv** Reader for *fixed width value* formatted files.

***kafka_json_map** Reader for hashmaps within **Kafka_** database.

***sql** Reader for generic content out of *SQL* databases. Supported databases are: MySQL, PostgreSQL and MSSQL.

run_delay Duration interval between consecutive reads from source. If 0 or less, *ERs* relies on external source (ie. Linux inotify for files) for starting the reading process.

concurrent_requests Limits the number of concurrent reads from source (ie: the number of simultaneously opened files).

source_path Path towards the events source

processed_path Optional path for moving the events source to after processing.

xml_root_path Used in case of XML content and will specify the prefix path applied to each xml element read.

tenant Will auto-populate the Tenant within the API calls sent to CGRateS. It has the form of a RSRField. If undefined, default one from *general* section will be used.

timezone Defines the timezone for source content which does not carry that information. If undefined, default one from *general* section will be used.

filters List of filters to pass for the reader to process the event. For the dynamic content (prefixed with ~) following special variables are available:

***vars** Request related shared variables between processors, populated especially by core functions. The data put inthere is not automatically transfered into requests sent to CGRateS, unless instructed inside templates.

***tmp** Temporary container to be used when exchanging information between fields.

***req** Request read from the source. In case of file content without field name, the index will be passed instead of field source path.

***hdr** Header values (available only in case of **file_fwv*). In case of file content without field name, the index will be passed instead of field source path.

***trl** Trailer values (available only in case of **file_fwv*). In case of file content without field name, the index will be passed instead of field source path.

flags Special tags enforcing the actions/verbs done on an event. There are two types of flags: **main** and **auxiliary**.

There can be any number of flags or combination of those specified in the list however the flags have priority one against another and only some simultaneous combinations of *main* flags are possible.

The **main** flags will select mostly the action taken on a request.

The **auxiliary** flags only make sense in combination with **main** ones.

Implemented **main** flags are (in order of priority, and not working simultaneously unless specified):

***log** Logs the Event read. Can be used together with other *main* flags.

***none** Disable transfering the Event from *Reader* to *CGRateS* side.

***dryrun** Together with not transfering the Event on CGRateS side will also log it, useful for troubleshooting.

***auth** Sends the Event for authorization on CGRateS.

Auxiliary flags available: ***attributes**, ***thresholds**, ***stats**, ***resources**, ***accounts**, ***suppliers**, ***suppliers_ignore_errors**, ***suppliers_event_cost** which are used to influence the auth behavior on CGRateS side. More info on that can be found on the **SessionS** component's API behavior.

***initiate** Initiates a session out of Event on CGRateS side.

Auxiliary flags available: ***attributes**, ***thresholds**, ***stats**, ***resources**, ***accounts** which are used to influence the behavior on CGRateS side.

***update** Updates a session with the Event on CGRateS side.

Auxiliary flags available: ***attributes**, ***accounts** which are used to influence the behavior on CGRateS side.

***terminate** Terminates a session using the Event on CGRateS side.

Auxiliary flags available: ***thresholds**, ***stats**, ***resources**, ***accounts** which are used to influence the behavior on CGRateS side.

***message** Process the Event as individual message charging on CGRateS side.

Auxiliary flags available: ***attributes**, ***thresholds**, ***stats**, ***resources**, ***accounts**, ***suppliers**, ***suppliers_ignore_errors**, ***suppliers_event_cost** which are used to influence the behavior on CGRateS side.

***event** Process the Event as generic event on CGRateS side.

Auxiliary flags available: all flags supported by the "SessionSv1.ProcessEvent" generic API

***cdrs** Build a CDR out of the Event on CGRateS side. Can be used simultaneously with other flags (except **dry_run)

path Defined within field, specifies the path where the value will be written. Possible values:

***vars** Write the value in the special container, **vars*, available for the duration of the request.

***cgreq** Write the value in the request object which will be sent to CGRateS side.

***hdr** Header values (available only in case of **file_fwv*). In case of file content without field name, the index will be passed instead of field source path.

***trl** Trailer values (available only in case of **file_fwv*). In case of file content without field name, the index will be passed instead of field source path.

type Defined within field, specifies the logic type to be used when writing the value of the field. Possible values:

***none** Pass

***filler** Fills the values with an empty string

***constant** Writes out a constant

***remote_host** Writes out the Address of the remote host sending us the Event

***variable** Writes out the variable value, overwriting previous one set

***composed** Writes out the variable value, postpending to previous value set

***usage_difference** Calculates the usage difference between two arguments passed in the *value*. Requires 2 arguments: *$stopTime;$startTime*

***sum** Calculates the sum of all arguments passed within *value*. It supports summing up duration, time, float, int autodetecting them in this order.

***difference** Calculates the difference between all arguments passed within *value*. Possible value types are (in this order): duration, time, float, int.

***value_exponent** Calculates the exponent of a value. It requires two values: *$val;$exp*

***template** Specifies a template of fields to be injected here. Value should be one of the template ids defined.

value The captured value. Possible prefixes for dynamic values are:

***req** Take data from current request coming from the reader.

***vars** Take data from internal container labeled **vars*. This is valid for the duration of the request.

***cgreq** Take data from the request being sent to *SessionS*. This is valid for one active request.

***cgrep** Take data from the reply coming from *SessionS*. This is valid for one active reply.

mandatory Makes sure that the field cannot have empty value (errors otherwise).

tag Used for debug purposes in logs.

width Used to control the formatting, enforcing the final value to a specific number of characters.

strip Used when the value is higher than *width* allows it, specifying the strip strategy. Possible values are:

***right** Strip the suffix.

***xright** Strip the suffix, postpending one *x* character to mark the stripping.

***left** Strip the prefix.

***xleft** Strip the prefix, prepending one *x* character to mark the stripping.

padding Used to control the formatting. Applied when the data is smaller than the *width*. Possible values are:

***right** Suffix with spaces.

***left** Prefix with spaces.

***zeroleft** Prefix with *0* chars.

2.1.2 SessionS

SessionS is a standalone subsystem within **CGRateS** responsible to manage virtual sessions based on events received. It is accessed via CGRateS RPC APIs.

2.1.2.1 Parameters

SessionS

Configured within **sessions** section within *JSON configuration* via the following parameters:

enabled Will enable starting of the service. Possible values: <true|false>.

listen_bijson Address where the *SessionS* listens for bidirectional JSON requests.

chargers_conns Connections towards ChargerS component to query charges for events.

rals_conns Connections towards RALs component to implement auth and balance reservation for events.

cdrs_conns Connections towards *CDRs* component where CDRs and session costs will be sent.

resources_conns Connections towards *ResourceS* component for resources management.

thresholds_conns Connections towards *ThresholdS* component to monitor and react to information within events.

stats_conns Connections towards StatS component to compute stat metrics for events.

suppliers_conns Connections towards *SupplierS* component to compute suppliers for events.

attributes_conns Connections towards AttributeS component for altering the events.

replication_conns Connections towards other *SessionS* components, used in case of session high-availability.

debit_interval Default debit interval in case of **prepaid* requests. Zero will disable automatic debits in favour of manual ones.

store_session_costs Used in case of decoupling events charging from CDR processing. The session costs debitted by *SessionS* will be stored into *StorDB.sessions_costs* table and merged into the CDR later when received.

min_call_duration Imposes a minimum call duration for event authorization.

max_call_duration Imposes the maximum call duration for event authorization.

session_ttl Enables automatic detection/removal of stale sessions. Zero will disable the functionality.

session_ttl_max_delay Used in tandem with *session_ttl* to randomize disconnects in order to avoid system peaks.

session_ttl_last_used Used in tandem with *session_ttl* to emulate the last used information for missing terminate event.

session_ttl_usage Used in tandem with *session_ttl* to emulate the total usage information for the incomplete session.

session_indexes List of fields to index out of events. Used to speed up response time for session queries.

client_protocol Protocol version used when acting as a JSON-RPC client (ie: force disconnecting the sessions).

channel_sync_interval Sync channels at regular intervals to detect stale sessions. Zero will disable this functionality.

terminate_attempts Limit the number of attempts to terminate a session in case of errors.

alterable_fields List of fields which are allowed to be changed by update/terminate events.

2.1.2.2 Processing logic

Depends on the implementation of particular *RPC API* used.

GetActiveSessions, GetActiveSessionsCount, GetPassiveSessions, GetPassiveSessionsCount

Returns the list of sessions based on the received filters.

SetPassiveSession

Used by *CGRateS* in High-Availability setups to replicate sessions between different *SessionS* nodes.

ReplicateSessions

Starts manually a replication process. Useful in cases when a node comes back online or entering maintenance mode.

AuthorizeEvent, AuthorizeEventWithDigest

Used for event authorization. It's behaviour can be controlled via a number of different parameters:

GetAttributes Activates altering of the event by AttributeS.

AttributeIDs Selects only specific attribute profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

AuthorizeResources Activates event authorization via *ResourceS*. Returns *RESOURCE_UNAVAILABLE* if no resources left for the event.

GetMaxUsage Queries RALs for event's maximum usage allowed.

ProcessThresholds Sends the event to *ThresholdS* to be used in monitoring.

ThresholdIDs Selects only specific threshold profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

ProcessStats Sends the event to StatS for computing stat metrics.

StatIDs Selects only specific stat profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

GetSuppliers Sends the event to *SupplierS* to return the list of suppliers for it as part as authorization.

SuppliersMaxCost Mechanism to implement revenue assurance for suppliers coming from *SupplierS* component. Can be defined as a number or special meta variable: **event_cost*, assuring that the supplier cost will never be higher than event cost.

SuppliersIgnoreErrors Instructs to ignore suppliers with errors(ie: without price for specific destination in tariff plan). Without this setting the whole query will fail instead of just the supplier being ignored.

InitiateSession, InitiateSessionWithDigest

Used in case of session initiation. It's behaviour can be influenced by following arguments:

GetAttributes Activates altering of the event by AttributeS.

AttributeIDs Selects only specific attribute profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

AllocateResources Process the event with *ResourceS*, allocating the matching requests. Returns *RESOURCE_UNAVAILABLE* if no resources left for the event.

InitSession Initiates the session executing following steps:

- Fork session based on matched ChargerS profiles.
- Start debit loops for **prepaid* requests if *DebitInterval* is higher than 0.
- Index the session internally and start internal timers for detecting stale sessions.

ProcessThresholds Sends the event to *ThresholdS* to be used in monitoring.

ThresholdIDs Selects only specific threshold profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

ProcessStats Sends the event to StatS for computing stat metrics.

StatIDs Selects only specific stat profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

UpdateSession

Used to update an existing session or initiating a new one if none found. It's behaviour can be influenced by the following arguments:

GetAttributes Use AttributeS to alter the event.

AttributeIDs Selects only specific attribute profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

UpdateSession Involves charging mechanism into processing. Following steps are further executed:

- Relocate session if *InitialOriginID* field is present in the event.
- Initiate session if the *CGRID* is not found within the active sessions.
- Update timers for session stale detection mechanism.
- Debit the session usage for all the derived **prepaid* sessions.

TerminateSession

Used to terminate an existing session or to initiate+terminate a new one. It's behaviour can be influenced by the following arguments:

TerminateSession Stop the charging process. Involves the following steps:

- Relocate session if *InitialOriginID* field is present in the event.
- Initiate session if the *CGRID* is not found within the active sessions.
- Unindex the session so it does not longer show up in active sessions queries.
- Stop the timer for session stale detection mechanism.
- Stop the debit loops if exist.
- Balance the charges (refund or debit more).
- Store the session costs if configured.
- Cache the session for later CDRs if configured.

ReleaseResources Will release the aquired resources within *ResourceS*.

ProcessThresholds Send the event to *ThresholdS* for monitoring.

ThresholdIDs Selects only specific threshold profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

ProcessStats Send the event to StatS for building the stat metrics.

StatIDs Selects only specific stat profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

ProcessMessage

Optimized for event charging, without creating sessions based on it. Influenced by the following arguments:

GetAttributes Alter the event via AttributeS.

AttributeIDs Selects only specific attribute profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

AllocateResources Alter the event via *ResourceS* for resource allocation.

Debit Debit the event via RALs. Uses ChargerS to fork the event if needed.

ProcessThresholds Send the event to *ThresholdS* for monitoring.

ThresholdIDs Selects only specific threshold profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

ProcessStats Send the event to StatS for building the stat metrics.

StatIDs Selects only specific stat profiles (instead of discovering them via *FilterS*). Faster in processing than the discovery mechanism.

GetSuppliers Sends the event to *SupplierS* to return the list of suppliers for it.

SuppliersMaxCost Mechanism to implement revenue assurance for suppliers coming from *SupplierS* component. Can be a number or special meta variable: **event_cost*, assuring that the supplier cost will never be higher than event cost.

SuppliersIgnoreErrors Instructs to ignore suppliers with errors(ie: without price for specific destination in tariff plan). Without this setting the whole query will fail instead of just the supplier being ignored.

ProcessCDR

Build the CDR out of the event and send it to *CDRs*. It has the ability to use cached sessions for obtaining additional information like fields with values or derived charges, forking also the CDR based on that.

ProcessEvent

Will generically process an event, having the ability to merge all the functionality of previous processing APIs.

Instead of arguments, the options for enabling various functionaity will come in the form of *Flags*. These will be of two types: **main** and **auxiliary**, the last ones being considered suboptions of the first. The available flags are:

***attributes** Activates altering of the event via AttributeS.

***cost** Queries RALs for event cost.

***resources** Process the event with *ResourceS*. Additional auxiliary flags can be specified here:

- ***authorize** Authorize the event.
- ***allocate** Allocate resources for the event.
- ***release** Release the resources used for the event.

***rals** Process the event with RALs. Auxiliary flags available:

- ***authorize** Authorize the event.
- ***initiate** Initialize a session out of event.
- ***update** Update a sesssion (or initialize + update) out of event.
- ***terminate** Terminate a session (or initialize + terminate) out of event.

***suppliers** Process the event with *SupplierS*. Auxiliary flags available:

- ***ignore_errors** Ignore the suppliers with errors instead of failing the request completely.
- ***event_cost** Ignore suppliers with cost higher than the event cost.

***thresholds** Process the event with *ThresholdS* for monitoring.

***stats** Process the event with StatS for metrics calculation.

***cdrs** Create a CDR out of the event with *CDRs*.

GetCost

Queries the cost for event from RALs. Additional processing options can be selected via the *Flags* argument. Possible flags:

***attributes** Use AttributeS to alter the event before cost being calculated.

SyncSessions

Manually initiate a sync sessions mechanism. All the connections will be synced and stale sessions will be automatically disconnected.

ForceDisconnect

Disconnect the session matching the filter.

ActivateSessions

Manually activate a session which is marked as passive.

DeactivateSessions

Manually deactivate a session which is marked as active.

2.1.3 RALs

TBD

2.1.4 CDRs

CDRs is a standalone subsystem within **CGRateS** responsible to process *CDR* events. It is accessed via CGRateS RPC APIs or separate *HTTP handlers* configured within *http* section inside *JSON configuration*.

Due to multiple interfaces exposed, the CDRs is designed to function as centralized server for *CDRs* received from sourc
**real-time events* from interfaces like *Diameter*, *Radius*, *Asterisk*, *FreeSWITCH*, *Kamailio*, *OpenSIPS* * *files* like *.csv*, *.fwv*, *.xml*, *.json*. * *database events* like *sql*, *kafka*, *rabbitmq*.

2.1.4.1 Parameters

CDRs

CDRs is configured within **cdrs** section from *JSON configuration* via the following parameters:

enabled Will enable starting of the service. Possible values: <true|false>.

extra_fields Select extra fields from the request, other than the primary ones used by CGRateS (see storage schemas for listing those). Used in particular applications where the received fields are not selectable at the source(ie. FreeSWITCH JSON).

store_cdrs Controls storing of the received CDR within the *StorDB*. Possible values: <true|false>.

session_cost_retries In case of decoupling the events charging from CDRs, the charges done by *SessionS* will be stored in *sessions_costs StorDB* table. When receiving the CDR, these costs will be retrieved and attached to the CDR. To avoid concurrency between events and CDRs, it is possible to configure a multiple number of retries from *StorDB* table.

chargers_conns Connections towards ChargerS component to query charges for CDR events. Empty to disable the functionality.

rals_conns Connections towards RALs component to query costs for CDR events. Empty to disable the functionality.

attributes_conns Connections towards AttributeS component to alter information within CDR events. Empty to disable the functionality.

thresholds_conns Connections towards *ThresholdS* component to monitor and react to information within CDR events. Empty to disable the functionality.

stats_conns Connections towards StatS component to compute stat metrics for CDR events. Empty to disable the functionality.

online_cdr_exports List of *CDRe* profiles which will be processed for each CDR event. Empty to disable online CDR exports.

2.1.4.2 APIs logic

ProcessEvent

Receives the CDR in the form of *CGRateS Event* together with processing flags attached. Activating of the flags will trigger specific processing mechanisms for the CDR. Missing of the flags will be interpreted based on defaults. The following flags are available, based on the processing order:

***attributes** Will process the event with AttributeS. This allows modification of content in early stages of processing(ie: add new fields, modify or remove others). Defaults to *true* if there are connections towards AttributeS within *JSON configuration*.

***chargers** Will process the event with ChargerS. This allows forking of the event into multiples. Defaults to *true* if there are connections towards ChargerS within *JSON configuration*.

***refund** Will perform a refund for the *CostDetails* field in the event. Defaults to *false*.

***rals** Will calculate the *Cost* for the event using the RALs. If the event is **prepaid* the *Cost* will be attempted to be retrieved out of event or from *sessions_costs* table in the *StorDB* and if these two steps fail, RALs will be queried in the end. Defaults to *false*.

***rerate** Will re-rate the CDR as per the **rals* flag, doing also an automatic refund in case of **prepaid*, **postpaid* and **pseudoprepaid* request types. Defaults to *false*.

***store** Will store the *CDR* to *StorDB*. Defaults to *store_cdrs* parameter within *JSON configuration*. If store process fails for one of the CDRs, an automated refund is performed for all derived.

***export** Will export the event matching export profiles. These profiles are defined within *cdre* section inside *JSON configuration*. Defaults to *true* if there is at least one *online_cdr_exports* profile configured within *JSON configuration*.

***thresholds** Will process the event with the *ThresholdS*, allowing us to execute actions based on filters set for matching profiles. Defaults to *true* if there are connections towards *ThresholdS* within *JSON configuration*.

***stats** Will process the event with the StatS, allowing us to compute metrics based on the matching *StatQueues*. Defaults to *true* if there are connections towards StatS within *JSON configuration*.

2.1.4.3 Use cases

- Classic rating of your CDRs.
- Rating queues where one can receive the rated CDR few milliseconds after the *CommSwitch* has issued it. With custom export profiles there can be given the feeling that the *CommSwitch* itself sends rated CDRs.
- Rating with derived charging where we calculate automatically the cost for the same CDR multiple times (ie: supplier/customer, customer/distributor or local/premium/mobile charges).
- Fraud detection on CDR Costs with profiling.
- Improve network transparency based on monitoring Cost, ASR, ACD, PDD out of CDRs.

2.1.5 CDRe

CDRe is an extension of *CDRs*, responsible for exporting the *CDR* events processed by *CDRs*. It is accessed via CGRateS RPC APIs and configured within *cdre* section inside *JSON configuration*.

2.1.5.1 Export types

There are two types of exports with common configuration but different data sources:

Online exports

Are real-time exports, triggered by the CDR event processed by *CDRs*, and take these events as data source.

The *online exports* are enabled via *online_cdr_exports JSON configuration* option within *cdrs*.

You can control the templates which are to be executed via the filters which are applied for each export template individually.

Offline exports

Are exports which are triggered via CGRateS RPC APIs and they have as data source the CDRs stored within *StorDB*.

2.1.5.2 Parameters

CDRe

CDRe it is configured within **cdre** section from *JSON configuration*.

One **export profile** includes the following parameters:

export_format Specify the type of export which will run. Possible values are:

***file_csv** Exports into a comma separated file format.

***file_fwv** Exports into a fixed width file format.

***http_post** Will post the CDR to a HTTP server. The export content will be a HTTP form encoded representation of the internal CDR object.

***http_json_cdr** Will post the CDR to a HTTP server. The export content will be a JSON serialized representation of the internal CDR object.

***http_json_map** Will post the CDR to a HTTP server. The export content will be a JSON serialized hmap with fields defined within the *fields* section of the template.

***amqp_json_cdr** Will post the CDR to an AMQP queue. The export content will be a JSON serialized representation of the internal CDR object. Uses AMQP protocol version 0.9.1.

***amqp_json_map** Will post the CDR to an AMQP queue. The export content will be a JSON serialized hmap with fields defined within the *fields* section of the template. Uses AMQP protocol version 1.0.

***amqpv1_json_map** Will post the CDR to an AMQP queue. The export content will be a JSON serialized hmap with fields defined within the *fields* section of the template. Uses AMQP protocol version 1.0.

***sqs_json_map** Will post the CDR to an Amazon SQS queue. The export content will be a JSON serialized hmap with fields defined within the *fields* section of the template.

***s3_json_map** Will post the CDR to Amazon S3 storage. The export content will be a JSON serialized hmap with fields defined within the *fields* section of the template.

***kafka_json_map** Will post the CDR to an Apache Kafka. The export content will be a JSON serialized hmap with fields defined within the *fields* section of the template.

export_path Specify the export path. It has special format depending of the export type.

***file_csv, *file_fwv** Standard unix-like filesystem path.

***http_post, *http_json_cdr, *http_json_map** Full HTTP URL

***amqp_json_map, *amqpv1_json_map** AMQP URL with extra parameters.

Sample: *amqp://guest:guest@localhost:5672/?queue_id=cgrates_cdrs&exchange=exchangename&exchange_type=fanout*

***sqs_json_map** SQS URL with extra parameters.

Sample: *http://sqs.eu-west-2.amazonaws.com/?aws_region=eu-west-2&aws_key=testkey&aws_secret=testsecret&queue_id=cdrs*

***s3_json_map** S3 URL with extra parameters.

Sample: *http://s3.us-east-2.amazonaws.com/?aws_region=eu-west-2&aws_key=testkey&aws_secret=testsecret&queue_id=cdrs*

***kafka_json_map** Kafka URL with extra parameters.

Sample: *localhost:9092?topic=cgrates_cdrs*

filters List of filters to pass for the export profile to execute. For the dynamic content (prefixed with ~) following special variables are available:

***req** The *CDR* event itself.

***ec** The *EventCost* object with subpaths for all of it's nested objects.

tenant Tenant owning the template. It will be used mostly to match inside *FilterS*.

synchronous Block further exports until this one finishes. In case of *false* the control will be given to the next export template as soon as this one was started.

attempts Number of attempts before giving up on the export and writing the failed request to file. The failed request will be written to *failed_posts_dir* defined in *general* section.

field_separator Field separator to be used in some export types (ie. **file_csv*).

attributes_context The context used when sending the CDR event to AttributeS for modifications. If empty, there will be no event sent to AttributeS.

fields List of fields for the exported event. Not affecting templates like **http_json_cdr* or **amqp_json_cdr* with fixed content.

One **field template** will contain the following parameters:

path Path for the exported content. Possible prefixes here are:

***exp** Reference to the exported record.

***hdr** Reference to the header content. Available in case of ***file_csv** and ***file_fwv** export types.

***trl** Reference to the trailer content. Available in case of ***file_csv** and ***file_fwv** export types.

type The field type will give out the logic for generating the value. Values used depend on the type of prefix used in path.

For **exp*, following field types are implemented:

***variable** Writes out the variable value, overwriting previous one set.

***composed** Writes out the variable value, postpending to previous value set

***filler** Fills the values with a fixed lentgh string.

***constant** Writes out a constant

***datetime** Parses the value as datetime and reformats based on the *layout* attribute.

***combimed** Writes out a combined mediation considering events with the same *CGRID*.

***masked_destination** Masks the destination using * as suffix. Matches the destination field against the list defined via *mask_destinationd_id* field.

***http_post** Uses a HTTP server as datasource for the value exported.

For **hdr* and **trl*, following field types are possible:

***filler** Fills the values with a string.

***constant** Writes out a constant

***handler** Will obtain the content via a handler. This works in tandem with the attribute *handler_id*.

value The exported value. Works in tandem with *type* attribute. Possible prefixes for dynamic values:

***req** Data is taken from the current request coming from the *CDRs* component.

mandatory Makes sure that the field cannot have empty value (errors otherwise).

tag Used for debug purposes in logs.

width Used to control the formatting, enforcing the final value to a specific number of characters.

strip Used when the value is higher than *width* allows it, specifying the strip strategy. Possible values are:

***right** Strip the suffix.

***xright** Strip the suffix, postpending one *x* character to mark the stripping.

***left** Strip the prefix.

***xleft** Strip the prefix, prepending one *x* character to mark the stripping.

padding Used to control the formatting. Applied when the data is smaller than the *width*. Possible values are:

***right** Suffix with spaces.

***left** Prefix with spaces.

***zeroleft** Prefix with *0* chars.

mask_destinationd_id The destinations profile where we match the *masked_destinations*.

hander_id The identifier of the handler to be executed in case of **handler type*.

2.1.6 AttributeS

AttributeS is a standalone subsystem within **CGRateS** and it is the equivalent of a key-value store. It is accessed via CGRateS RPC APIs.

As most of the other subsystems, it is performance oriented, stored inside *DataDB* but cached inside the *cgr-engine* process. Caching can be done dynamically/on-demand or at start-time/precached and it is configurable within *cache* section in the *JSON configuration*.

2.1.6.1 Selection

It is able to process generic events (hashmaps) and decision for matching it is outsourced to *FilterS*.

If there are multiple profiles (configurations) matching, the one with highest *Weight* will be the winner. There can be only one *AttributeProfile* processing the event per *process run*. If one configures multiple *process runs* either in *JSON configuration* or as parameter to the *.ProcessEvent* API call, the output event from one *process run* will be forwarded as input to the next selected profile. There will be independent *AttributeProfile* selection performed for each run, hence the event fields modified in one run can be applied as filters to the next *process run*, giving out the possibility to chain *AttributeProfiles* and have multiple replacements with a minimum of performance penalty (in-memory matching).

2.1.6.2 Parameters

AttributeS

AttributeS is the **CGRateS** component responsible of handling the *AttributeProfiles*.

It is configured within **attributes** section from *JSON configuration* via the following parameters:

enabled Will enable starting of the service. Possible values: <true|false>.

indexed_selects Enable profile matching exclusively on indexes. If not enabled, the *ResourceProfiles* are checked one by one which for a larger number can slow down the processing time. Possible values: <true|false>.

string_indexed_fields Query string indexes based only on these fields for faster processing. If commented out, each field from the event will be checked against indexes. If uncommented and defined as empty list, no fields will be checked.

prefix_indexed_fields Query prefix indexes based only on these fields for faster processing. If defined as empty list, no fields will be checked.

nested_fields Applied when all event fields are checked against indexes, and decides whether subfields are also checked.

process_runs Limit the number of loops when processing an Event. The event loop is however clever enough to stop when the same processing occurs or no more additional profiles are matching, so higher numbers are ignored if not needed.

AttributeProfile

Represents the configuration for a group of attributes applied.

Tenant The tenant on the platform (one can see the tenant as partition ID)

ID Identifier for the *AttributeProfile*, unique within a *Tenant*

Context A list of *contexts* applying to this profile. A *context* is usually associated with a logical phase during event processing (ie: **sessions* or **cdrs* for events parsed by *SessionS* or *CDRs*)

FilterIDs List of *FilterProfiles* which should match in order to consider the *AttributeProfile* matching the event.

ActivationInterval The time interval when this profile becomes active. If undefined, the profile is always active. Other options are start time, end time or both.

Blocker In case of multiple *process runs* are allowed, this flag will break further processing.

Weight Used in case of multiple profiles matching an event. The higher, the better (0 has lowest possible priority).

Attributes List of *Attribute* objects part of this profile.

Attribute

FilterIDs List of *FilterProfiles* which should match in order to consider the *Attribute* matching the event.

Path Identifying the targeted absolute path within the processed event.

Type Represents the type of substitution which will be performed on the Event. The following *Types* are available:

***constant** The *Value* is a constant value, it will just set the *FieldName* to this value as it is.

***variable** The *Value* is a *RSRParser* which will be able to capture the value out of one or more fields in the event (also combined with other constants) and write it to *Path*.

***composed** Same as **variable* but instead of overwriting *Path*, it will append to it.

***usage_difference** Will calculate the duration difference between two field names defined in the *Value*. If the number of fields in the *Value* are different than 2, it will error.

***sum** Will sum up the values in the *Value*.

***value_exponent** Will compute the exponent of the first field in the *Value*.

Value The value which will be set for *Path*. It can be a list of RSRParsers capturing even from multiple sources in the same event. If the *Value* is **remove* the field with *Path* will be removed from *Event*

Inline Attribute

In order to facilitate quick attribute definition (without the need of separate *AttributeProfile*), one can define attributes directly as *AttributeIDs* following the special format.

Inline filter format:

```
attributeType:attributePath:attributeValue
```

Example:

```
*constant:*req.RequestType:*prepaid
```

2.1.6.3 Use cases

- Fields aliasing * Number portability (replacing a dialed number with it's translation) * Roaming (using *Category* to point out the zone where the user is roaming in so we can apply different rating or consume out of restricted account bundles).
- Appending new fields * Adding separate header with location information * Adding additional rating information (ie: SMS only contains origin+destination, add *Tenant*, *Account*, *Subject*, *RequestType*) * Using as query language (ie: append user password for a given user so we can perform authorization on SIP Proxy side).

2.1.7 ChargerS

ChargerS is a **CGRateS** subsystem designed to produce billing runs via *DerivedCharging* mechanism.

It works as standalone component of **CGRateS**, accessible via CGRateS RPC via a rich set of *APIs*. As input **ChargerS** is capable of receiving generic events (hashmaps) with dynamic types for fields.

ChargerS is an **important** part of the charging process within **CGRateS** since with no *ChargingProfile* matching, there will be no billing run performed.

2.1.7.1 DerivedCharging

Is a process of receiving an event as input and *deriving* that into multiples (unlimited) out. The *derived* event will be a standalone clone of original with possible modifications of individual event fields. In case of billing, this will translate into multiple Events or CDRs being billed simultaneously for the same input.

2.1.7.2 Processing logic

For the received *Event* we will retrieve the list of matching *ChargingProfiles' via :ref:'FilterS'. These profiles will be then ordered based on their *Weight* - higher *Weight* will have more priority. If no profile will match due to *Filter* or *ActivationInterval*, *NOT_FOUND* will be returned back to the RPC client.

Each *ChargingProfile* matching the *Event* will produce a standalone event based on configured *RunID*. These events will each have a special field added (or overwritten), the *RunID*, which is taken from the applied *ChargingProfile*.

If *AttributeIDs* are different than **none*, the newly created *Event* will be sent to AttributeS and fields replacement will be performed based on the logic there. If the *AttributeIDs* is populated, these profile IDs will be selected directly for faster processing, otherwise (if empty) the *AttributeProfiles* will be selected using *FilterS*.

2.1.7.3 Parameters

ChargerProfile

A *ChargerProfile* is the configuration producing the *DerivedCharging* for the Event received. It's made of the following fields:

Tenant Is the tenant on the platform (one can see the tenant as partition ID)

ID Identifier for the ChargerProfile, unique within a *Tenant*.

FilterIDs List of *FilterProfiles* which should match in order to consider the ChargerProfile matching the event.

ActivationInterval Is the time interval when this profile becomes active. If undefined, the profile is always active. Other options are start time, end time or both.

RunID The identifier for a single bill run / charged output *Event*.

AttributeIDs List of *AttributeProfileIDs* which will be applied for the output *Event* in order to change some of it's fields. If empty, the list is discovered via FilterS (*AttributeProfiles* matching the event). If **none, no AttributeProfile will be applied, event will be a simple clone of the one at input with just *RunID* being different.

Weight Used in case of multiple profiles matching an event. The higher, the better (0 has lowest possible priority).

2.1.7.4 Use cases

- Calculating standard charges for the *Customer* calling as well as for the *Reseller/Distributor*. One can build chains of charging rules if multiple *Resellers* are involved.
- Calculating revenue based on *Customer* vs *Supplier* pricing.
- Calculating pricing for multiple *Suppliers* for revenue protection.
- Adding *local* vs *mobile* charges for *premium numbers* when accessed from mobile headsets.
- etc.

2.1.8 ResourceS

ResourceS is a standalone subsystem part of the **CGRateS** infrastructure, designed to allocate virtual resources for the generic *Events* (hashmaps) it receives.

Both receiving of *Events* as well as operational commands on the virtual resources is performed via a complete set of CGRateS RPC APIs.

Due it's real-time nature, **ResourceS** are designed towards high throughput being able to process thousands of *Events* per second. This is doable since each *Resource* is a very light object, held in memory and eventually backed up in *DataDB*.

2.1.8.1 Parameters

ResourceS

ResourceS is the **CGRateS** component responsible of handling the *Resources*.

It is configured within **resources** section from *JSON configuration* via the following parameters:

enabled Will enable starting of the service. Possible values: <true|false>.

store_interval Time interval for backing up the stats into *DataDB*.

thresholds_conns Connections IDs towards *ThresholdS* component. If not defined, there will be no notifications sent to *ThresholdS* on *Resource* changes.

indexed_selects Enable profile matching exclusively on indexes. If not enabled, the *ResourceProfiles* are checked one by one which for a larger number can slow down the processing time. Possible values: <true|false>.

string_indexed_fields Query string indexes based only on these fields for faster processing. If commented out, each field from the event will be checked against indexes. If uncommented and defined as empty list, no fields will be checked.

prefix_indexed_fields Query prefix indexes based only on these fields for faster processing. If defined as empty list, no fields will be checked.

nested_fields Applied when all event fields are checked against indexes, and decides whether subfields are also checked.

ResourceProfile

The **ResourceProfile** is the configuration of a *Resource*. This will be performed over CGRateS RPC APIs or *.csv* files. A profile is comprised out of the following parameters:

Tenant The tenant on the platform (one can see the tenant as partition ID).

ID Identifier for the *ResourceProfile*, unique within a *Tenant*.

FilterIDs List of *FilterProfiles* which should match in order to consider the *ResourceProfile* matching the event.

ActivationInterval The time interval when this profile becomes active. If undefined, the profile is always active. Other options are start time, end time or both.

UsageTTL Autoexpire resource allocation after this time duration.

Limit The number of allocations this resource is entitled to.

AllocationMessage The message returned when this resource is responsible for allocation.

Blocker When specified, no futher resources are processed after this one.

Stored Enable offline backups for this resource

Weight Order the *Resources* matching the event. Higher value - higher priority.

ThresholdIDs List of ThresholdProfiles targetted by the *Resource*. If empty, the match will be done in *ThresholdS* component.

ResourceUsage

A **ResourceUsage** represents a counted allocation within a *Resource*. The following parameters are present within:

Tenant The tenant on the platform (one can see the tenant as partition ID).

ID Identifier for the *ResourceUsage*.

ExpiryTime Exact time when this allocation expires.

Units Number of units allocated by this *ResourceUsage*.

2.1.8.2 Processing logic

When a new *Event* is received, **ResourceS** will pass it to *FilterS* in order to find all *Resource* objects matching the *Event*.

As a result of the selection process we will further get an ordered list of *Resource* which are matching the *Event* and are active at the request time.

Depending of the *RPC API* used, we will have the following behavior further:

ResourcesForEvent Will simply return the list of *Resources* matching so far.

AuthorizeResources Out of *Resources* matching, ordered based on *Weight*, it will use the first one with available units to authorize the request. Returns *RESOURCE_UNAVAILABLE* error back in case of no available units found. No actual allocation is performed.

AllocateResource All of the *Resources* matching the event will be operated and requested units will be deducted, independent of being available or going on negative. The first one with value higher or equal to zero will be responsible of allocation and it's message will be returned as allocation message. If no allocation message is defined for the allocated resource, it's ID will be returned instead.

If no resources are allocated *RESOURCE_UNAVAILABLE* will be returned as error.

ReleaseResource Will release all the previously allocated resources for an *UsageID*. If *UsageID* is not found (which can be the case of restart), will perform a standard search via *FilterS* and try to dealocate the resources matching there.

Depending on configuration each *Resource* can be backed up regularly and asynchronously to DataDB so it can survive process restarts.

After each resource modification (allocation or release) the *ThresholdS* will be notified with the *Resource* itself where mechanisms like notifications or fraud-detection can be triggered.

2.1.8.3 Use cases

- Monitor resources for a group of accounts(ie. based on a special field in the events).
- Limit the number of CPS for a destination/supplier/account (done via UsageTTL of 1s).
- Limit resources for a destination/supplier/account/time of day/etc.

2.1.9 SupplierS

SupplierS is a standalone subsystem within **CGRateS** responsible to compute a list of suppliers which can be used for a specific event received to process. It is accessed via CGRateS RPC APIs.

As most of the other subsystems, it is performance oriented, stored inside *DataDB* but cached inside the *cgr-engine* process. Caching can be done dynamically/on-demand or at start-time/precached and it is configurable within *cache* section in the *JSON configuration*.

2.1.9.1 Processing logic

When a new *Event* is received, **SupplierS** will pass it to *FilterS* in order to find all *SupplierProfiles* matching the *Event*.

As a result of the selection process we will get a single *SupplierProfile* matching the *Event*, is active at the *EventTime* and has a higher priority than the other matching *SupplierProfiles*.

Depending on the *Strategy* defined in the *SupplierProfile*, further steps will be taken (ie: query cost, stats, ordering) for each of the individual *SupplierIDs* defined within the *SupplierProfile*.

2.1.9.2 APIs logic

GetSupplierProfilesForEvent

Given the *Event* it will return a list of ordered *SupplierProfiles* matching at the *EventTime*.

This API is useful to test configurations.

GetSuppliers

Will return a list of *Suppliers* from within a *SupplierProfile* ordered based on *Strategy*.

2.1.9.3 Parameters

SupplierS

SupplierS is the **CGRateS** component responsible for handling the *SupplierProfiles*.

It is configured within **suppliers** section from *JSON configuration* via the following parameters:

enabled Will enable starting of the service. Possible values: <true|false>.

indexed_selects Enable profile matching exclusively on indexes. If not enabled, the *SupplierProfiles* are checked one by one which for a larger number can slow down the processing time. Possible values: <true|false>.

string_indexed_fields Query string indexes based only on these fields for faster processing. If commented out, each field from the event will be checked against indexes. If defined as empty list, no fields will be checked.

prefix_indexed_fields Query prefix indexes based only on these fields for faster processing. If defined as empty list, no fields will be checked.

nested_fields Applied when all event fields are checked against indexes, and decides whether subfields are also checked.

attributes_conns Connections to AttributeS for altering events before supplier queries. If undefined, fields modifications are disabled.

resources_conns Connections to ResourceS for *res sorting, empty to disable functionality.

stats_conns Connections to StatS for *stats sorting, empty to disable stats functionality.

default_ratio Default ratio used in case of *load strategy

SupplierProfile

Contains the configuration for a set of suppliers which will be returned in case of match. Following fields can be defined:

Tenant The tenant on the platform (one can see the tenant as partition ID).

ID The profile identificator.

FilterIDs List of *FilterProfileIDs* which should match in order to consider the profile matching the event.

ActivationInterval The time interval when this profile becomes active. If undefined, the profile is always active. Other options are start time, end time or both.

Sorting Sorting strategy applied when ordering the individual *Suppliers* defined bellow. Possible values are:

***weight** Classic method of statically sorting the suppliers based on their priority.

***lc** LeastCost will sort the suppliers based on their cost (lowest cost will have higher priority). If two suppliers will be identical as cost, their *Weight* will influence the sorting further. If *AccountIDs* will be specified, bundles can be also used during cost calculation, the only condition is that the bundles should cover complete usage.

The following fields are mandatory for cost calculation: *Account*/*Subject*, *Destination*, *SetupTime*. *Usage* is optional and if present in event, it will be used for the cost calculation.

***hc** HighestCost will sort the suppliers based on their cost(higher cost will have higher priority). If two suppliers will be identical as cost, their *Weight* will influence the sorting further.

The following fields are mandatory for cost calculation: *Account*/*Subject*, *Destination*, *SetupTime*. *Usage* is optional and if present in event, it will be used for the cost calculation.

***qos** QualityOfService strategy will sort the suppliers based on their stats. It takes the StatIDs to check from the supplier *StatIDs* definition. The metrics used as part of sorting are to be defined in *SortingParameters* field bellow. If Stats are missing the metrics defined in *SortingParameters* defaults for those will be populated for order (10000000 as PDD and -1 for the rest).

***reas** ResourceAscendentSorter will sort the suppliers based on their resource usage, lowest usage giving higher priority. The resources will be queried for each supplier based on it's *ResourceIDs* field and the final usage for each supplier will be given by the sum of all the resource usages queried.

***reds** ResourceDescendentSorter will sort the suppliers based on their resource usage, highest usage giving higher priority. The resources will be queried for each supplier based on it's *ResourceIDs* field and the final usage for each supplier will be given by the sum of all the resource usages queried.

***load** LoadDistribution will sort the suppliers based on their load. An important parameter is the **ratio* which is defined as *supplierID:Ratio* within the SortingParameters. If no supplierID is present within SortingParameters, the system will look for **default* or fallback in the configuration to *default_ratio* within *JSON configuration*. The **ratio* will specify the probability to get traffic on a *Supplier*, the higher the **ratio* more chances will a *Supplier* get for traffic.

The load will be calculated out of the *StatIDs* parameter of each *Supplier*. It is possible to also specify there directly the metric being used in the format *StatID:MetricID*. If only *StatID* is instead specified, all metrics will be summed to get the final value.

SortingParameters Will define additional parameters for each strategy. Following extra parameters are available(based on strategy):

***qos** List of metrics to be used for sorting in order of importance.

Weight Priority in case of multiple *SupplierProfiles* matching an *Event*. Higher *Weight* will have more priority.

Suppliers List of *Supplier* objects which are part of this *SupplierProfile*

Supplier

The *Supplier* represents one supplier within the *SupplierProfile*. Following parameters are defined for it:

ID Supplier ID, will be returned via APIs. Should be known on the remote side and match some business logic (ie: gateway id or directly an IP address).

FilterIDs List of *FilterProfileIDs* which should match in order to consider the *Supplier* in use/active.

AccountIDs List of account IDs which should be checked in case of some strategies (ie: *lc, *hc).

RatingPlanIDs List of RatingPlanIDs which should be checked in case of some strategies (ie: *lc, *hc).

ResourceIDs List of ResourceIDs which should be checked in case of some strategies (ie: *reas or *reds).

StatIDs List of StatIDs which should be checked in case of some strategies (ie: *qos or *load). Can also be defined as *StatID:MetricID*.

Weight Used for sorting in some strategies (ie: *weight, *lc or *hc).

Blocker No more suppliers are provided after this one.

SupplierParameters Container which is trasparently passed to the remote client to be used in it's own logic (ie: gateway prefix stripping or other gateway parameters).

2.1.9.4 Use cases

- Calculate LCR directly by querying APIs (GetSuppliers).
- LCR system together with Kamailio *dispatcher* module where the *SupplierID* whithin *CGRateS* will be used as dispatcher set within Kamailio.
- LCR system together with OpenSIPS drouting module where the *SupplierID* whithin *CGRateS* will be used as drouting carrier id.
- LCR system together with FreeSWITCH or Asterisk where the *SupplierID* whithin *CGRateS* will be used as gateway ID within the dialplan of FreesWITCH or Asterisk.

2.1.10 StatS

StatS is a standalone subsystem part of the **CGRateS** infrastructure, designed to aggregate and calculate statistical metrics for the generic *Events* (hashmaps) it receives.

Both receiving of *Events* as well as *Metrics* displaying is performed via a complete set of CGRateS RPC APIs.

Due it's real-time nature, **StatS** are designed towards high throughput being able to process thousands of *Events* per second. This is doable since each *StatQueue* is a very light object, held in memory and eventually backed up in *DataDB*.

2.1.10.1 Processing logic

When a new *Event* is received, **StatS** will pass it to *FilterS* in order to find all *StatProfiles* matching the *Event*.

As a result of the selection process we will further get an ordered list of *StatProfiles* which are matching the *Event* and are active at the request time.

For each of these profiles we will further calculate the metrics it has configured for the *Event* received. If *ThresholdIDs* are not **none*, we will include the *Metrics* into special *StatUpdate* events, defined internally, and pass them further to the ThresholdS for processing.

Depending on configuration each *StatQueue* can be backed up regularly and asynchronously to DataDB so it can survive process restarts.

2.1.10.2 Parameters

StatS

StatS is the **CGRateS** component responsible of handling the *StatQueues*.

It is configured within **stats** section from *JSON configuration* via the following parameters:

enabled Will enable starting of the service. Possible values: <true|false>.

store_interval Time interval for backing up the stats into *DataDB*.

store_uncompressed_limit After this limit is hit the events within *StatQueue* will be stored aggregated.

thresholds_conns Connections IDs towards *ThresholdS* component. If not defined, there will be no notifications sent to *ThresholdS* on *StatQueue* changes.

indexed_selects Enable profile matching exclusively on indexes. If not enabled, the *StatQueues* are checked one by one which for a larger number can slow down the processing time. Possible values: <true|false>.

string_indexed_fields Query string indexes based only on these fields for faster processing. If commented out, each field from the event will be checked against indexes. If uncommented and defined as empty list, no fields will be checked.

prefix_indexed_fields Query prefix indexes based only on these fields for faster processing. If defined as empty list, no fields will be checked.

nested_fields Applied when all event fields are checked against indexes, and decides whether subfields are also checked.

StatQueueProfile

Ís made of the following fields:

Tenant The tenant on the platform (one can see the tenant as partition ID).

ID Identifier for the *StatQueueProfile*, unique within a *Tenant*.

FilterIDs List of *FilterProfileIDs* which should match in order to consider the profile matching the event.

ActivationInterval The time interval when this profile becomes active. If undefined, the profile is always active. Other options are start time, end time or both.

QueueLength Maximum number of items stored in the queue. Once the *QueueLength* is reached, new items entering will cause oldest one to be dropped (FIFO mode).

TTL Time duration causing items in the queue to expire and be removed automatically from the queue.

Metrics List of statistical metrics to build for items within this *StatQueue*. See [bellow](#statqueue-metrics) for possible values here.

ThresholdIDs List of threshold IDs to check on when new items are updating the queue metrics.

Blocker Do not process further *StatQueues*.

Stored Enable offline backups for this *StatQueue*

Weight Order the *StatQueues* matching the event. Higher value - higher priority.

MinItems Display metrics only if the number of items in the queue is higher than this.

StatQueue Metrics

Following metrics are implemented:

***asr** Answer-seizure ratio. Relies on *AnswerTime* field in the *Event*.

***acd** Average call duration. Uses *AnswerTime* and *Usage* fields in the *Event*.

***tcd** Total call duration. Uses *Usage* out of *Event*.

***acc** Average call cost. Uses *Cost* field out of *Event*.

***tcc** Total call cost. Uses *Cost* field out of *Event*.

***pdd** *Post dial delay <https://www.voip-info.org/pdd/>*. Uses *PDD* field in the event.

***ddc** Distinct destination count will keep the number of unique destinations found in *Events*. Relies on *Destination* field in the *Event*.

***sum** Generic metric to calculate mathematical sum for a specific field in the *Events*. Format: *<*sum#FieldName>*.

***average** Generic metric to calculate the mathematical average of a specific field in the *Events*. Format: *<*average#FieldName>*.

***distinct** Generic metric to return the distinct number of appearance of a field name within *Events*. Format: *<*distinct#FieldName>*.

2.1.10.3 Use cases

- Aggregate various traffic metrics for traffic transparency.
- Revenue assurance applications.

- Fraud detection by aggregating specific billing metrics during sensitive time intervals (*acc, *tcc, *tcd).
- Building call patterns.
- Building statistical information to train systems capable of artificial intelligence.
- Building quality metrics used in traffic routing.

2.1.11 ThresholdS

ThresholdS is a standalone subsystem within **CGRateS** responsible to execute a list of *Actions* for a specific event received to process. It is accessed via CGRateS RPC APIs.

As most of the other subsystems, it is performance oriented, stored inside *DataDB* but cached inside the *cgr-engine* process. Caching can be done dynamically/on-demand or at start-time/precached and it is configurable within *cache* section in the *JSON configuration*.

2.1.11.1 Processing logic

When a new *Event* is received, **ThresholdS** will pass it to *FilterS* in order to find all *SupplierProfiles* matching the *Event*.

As a result of the selection process we will get a list of *Thresholds* matching the *Event* and are active at the *EventTime*.

2.1.11.2 APIs logic

GetThresholdIDs

Returns a list of *ThresholdIDs* configured on a *Tenant*.

GetThresholdsForEvent

Returns a list of *Thresholds* matching the event.

GetThreshold

Returns a specific *Threshold* based on it's *Tenant* and *ID*.

ProcessEvent

Technically processes the *Event*, executing all the *Actions* configured within all the matching *Thresholds*.

2.1.11.3 Parameters

ThresholdS

ThresholdS is the **CGRateS** component responsible for handling the *Thresholds*.

It is configured within **thresholds** section from *JSON configuration* via the following parameters:

enabled Will enable starting of the service. Possible values: <true|false>.

store_interval Time interval for backing up the thresholds into *DataDB*.

indexed_selects Enable profile matching exclusively on indexes. If not enabled, the *Thresholds* are checked one by one which for a larger number can slow down the processing time. Possible values: <true|false>.

string_indexed_fields Query string indexes based only on these fields for faster processing. If commented out, each field from the event will be checked against indexes. If defined as empty list, no fields will be checked.

prefix_indexed_fields Query prefix indexes based only on these fields for faster processing. If defined as empty list, no fields will be checked.

nested_fields Applied when all event fields are checked against indexes, and decides whether subfields are also checked.

ThresholdProfile

Contains the configuration to create a *Threshold*. Following fields can be defined:

Tenant The tenant on the platform (one can see the tenant as partition ID).

ID The profile identificator.

FilterIDs List of *FilterProfileIDs* which should match in order to consider the profile matching the event.

ActivationInterval The time interval when this profile becomes active. If undefined, the profile is always active. Other options are start time, end time or both.

MaxHits Limit number of hits for this threshold. Once this is reached, the threshold is considered disabled.

MinHits Only execute actions after this number is reached.

MinSleep Disable the threshold for consecutive hits for the duration of *MinSleep*.

Blocker Do not process thresholds who's *Weight* is lower.

Weight Sorts the execution of multiple thresholds matching the event. The higher the *Weight* is, the higher the priority to be executed.

ActionIDs List of *Actions* to execute for this threshold.

Async If true, do not wait for actions to complete.

Threshold

Represents one threshold, instantiated from a *ThresholdProfile*. It contains the following fields:

Tenant The tenant on the platform (one can see the tenant as partition ID).

ID The threshold identificator.

Hits Number of hits so far.

Snooze If initialized, it will contain the time when this threshold will become active again.

2.1.11.4 Use cases

- Improve network transparency and automatic reaction to outages monitoring stats produced by StatS.
- Monitor active channels used by a supplier/customer/reseller/destination/weekends/etc out of *ResourceS* events.
- Monitor balance consumption out of *Account* events.

- Monitor calls out of *CDRs* events or *SessionS*.
- Fraud detection with automatic mitigation based of all events mentioned above.

2.1.12 FilterS

FilterS are code blocks applied to generic events (hashmaps) in order to allow/deny further processing.

A Tenant will define multiple Filter profiles via .csv or API calls. The Filter profile ID is unique within a tenant but it can be repeated over multiple Tenants.

In order to be used in event processing, a Filter profile will be attached inside another subsystem profile definition, otherwise Filter profile will have no effect on it's own.

A subsystem can use a *Filter* via *FilterProfile* or in-line (ad-hock in the same place where subsystem profile is defined).

2.1.12.1 Filter profile

Definition:

```
type Filter struct {
       Tenant              string
       ID                  string
       Rules               []*FilterRule
       ActivationInterval  *utils.ActivationInterval
}
```

A Filter profile can be shared between multiple subsystem profile definitions.

A Filter profile can contain any number of Filter rules and each of them must pass in order for the filter profile to pass.

A Filter profile can be activated on specific interval, if multiple filters are used within a subsystem profile at least one needs to be active and passing in order for the subsystem profile to pass the event.

2.1.12.2 Filter rule

Definition:

```
type FilterRule struct {
       Type            string              // Filter type
       Element         string              // Name of the field providing us the␣
↪Values to check (used in case of some )
       Values          []string            // Filter definition
}
```

The matching logic of each FilterRule is given by it's type.

The following types are implemented:

string Will match in full the *Element* with at least one value defined inside *Values*. Any of the values matching will have the FilterRule as *matched*.

notstring Is the negation of **string*.

prefix Will match at beginning of *Element* one of the values defined inside *Values*.

notprefix Is the negation of **prefix*.

suffix Will match at end of *Element* one of the values defined inside *Values*.

notsuffix Is the negation of **suffix*.

***empty** Will make sure that *Element* is empty or it does not exist in the event.

***notempty** Is the negation of **empty*.

***exists** Will make sure that *Element* exists in the event.

***notexists** Is the negation of **exists*.

***timings** Will compare the time contained in *Element* with one of the TimingIDs defined in Values.

***nottimings** Is the negation of **timings*.

***destinations** Will make sure that the *Element* is a prefix contained inside one of the destination IDs as *Values*.

***notdestinations** Is the negation of **destinations*.

***rsr** Will match the *RSRRules* defined in Values.

notrsr Is the negation of **rsr*.

****lt* (less than), **lte* (less than or equal), **gt* (greather than), **gte* (greather than or equal)** Are comparison operators and they pass if at least one of the values defined in *Values* are passing for the *Element* of event. The operators are able to compare string, float, int, time.Time, time.Duration, however both types need to be the same, otherwise the filter will raise *incomparable* as error.

2.1.12.3 Inline Filter

In order to facilitate quick filter definition (without the need of separate FilterProfile), one can define filters directly as FilterIDs following the special format.

Inline filter format:

```
filterType:fieldName:fieldValue
```

Example:

```
*string:WebsiteName:CGRateS.org
```

2.1.12.4 Subsystem profiles selection based on Filters

When a subsystem will process an event it will need to find fast enough (close to real-time and most preferably with constant speed) all the profiles having filters matching the event. For low number of profiles (tens of) we can go through all available profiles and check their filters but as soon as the number of profiles is growing, processing time will exponentially grow also. As an example, the *AttributeS* need to deal with 20 mil+ profiles in case of number portability implementation.

In order to guarantee constant processing time - **O(1)** - *CGRateS* will use internally a profile selection mechanism based on indexed filters which can be enabled within *.json* configuration file via *indexed_selects*. When *indexed_selects* is disabled, the indexes will not be used at all and profiles will be checked one by one. On the other hand, if *indexed_selects* is enabled, each FilterProfile needs to have at least one **string* or **prefix* type in order to be visible to the indexes (otherwise being completely ignored).

The following settings are further applied once *indexed_selects* is enabled:

string_indexed_fields list of field names in the event which will be checked against string indexes (defaults to nil which means check all fields)

prefix_indexed_fields list of field names in the event which will be checked against prefix indexes (default is empty, hence prefix matching is disabled inside indexes - small optimization since for prefixes there are multiple queries done for one field)

2.1.13 DispatcherS

TBD

2.1.14 SchedulerS

TBD

2.1.15 APIerS

TBD

2.1.16 LoaderS

TBD

2.1.17 CacheS

TBD

2.1.18 DataDB

TBD

2.1.19 StorDB

TBD

2.2 cgr-console

Command line tool used to interface via the APIs implemented within :ref:cgr-engine.

Configurable via command line arguments.

```
$ cgr-console -help
Usage of cgr-console:
 -ca_path string
       path to CA for tls connection(only for self sign certificate)
 -crt_path string
       path to certificate for tls connection
 -key_path string
       path to key for tls connection
 -reply_timeout int
```

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```
      Reply timeout in seconds  (default 300)
 -rpc_encoding string
      RPC encoding used <*gob|*json> (default "*json")
 -server string
      server address host:port (default "127.0.0.1:2012")
 -tls
      TLS connection
 -verbose
      Show extra info about command execution.
 -version
      Prints the application version.
```

Hint: # cgr-console status

2.3 cgr-loader

Tool used to load/import TariffPlan data into CGRateS databases.

Can be used to:

- load TariffPlan data from **csv files** to **DataDB**.
- import TariffPlan data from **csv files** to **StorDB** as offline data. `-to_stordb -tpid`
- import TariffPlan data from **StorDB** to **DataDB**. `-from_stordb -tpid`

Customisable through the use of *JSON configuration* or command line arguments (higher prio).

```
$ cgr-loader -h
Usage of cgr-loader:
 -api_key string
      Api Key used to comosed ArgDispatcher
 -caches_address string
      CacheS component to contact for cache reloads, empty to disable automatic␣
↪cache reloads (default "*localhost")
 -caching string
      Caching strategy used when loading TP
 -config_path string
      Configuration directory path.
 -datadb_host string
      The DataDb host to connect to. (default "127.0.0.1")
 -datadb_name string
      The name/number of the DataDb to connect to. (default "10")
 -datadb_passwd string
      The DataDb user's password.
 -datadb_port string
      The DataDb port to bind to. (default "6379")
 -datadb_type string
      The type of the DataDB database <*redis|*mongo> (default "redis")
 -datadb_user string
      The DataDb user to sign in as. (default "cgrates")
 -dbdata_encoding string
      The encoding used to store object data in strings (default "msgpack")
 -disable_reverse_mappings
```

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```
      Will disable reverse mappings rebuilding
 -dry_run
      When true will not save loaded data to dataDb but just parse it for␣
↪consistency and errors.
 -field_sep string
      Separator for csv file (by default "," is used) (default ",")
 -flush_stordb
      Remove tariff plan data for id from the database
 -from_stordb
      Load the tariff plan from storDb to dataDb
 -import_id string
      Uniquely identify an import/load, postpended to some automatic fields
 -path string
      The path to folder containing the data files (default "./")
 -recursive
      Loads data from folder recursive.
 -redis_sentinel string
      The name of redis sentinel
 -remove
      Will remove instead of adding data from DB
 -route_id string
      RouteID used to comosed ArgDispatcher
 -rpc_encoding string
      RPC encoding used <*gob|*json> (default "*json")
 -scheduler_address string
       (default "*localhost")
 -stordb_host string
      The storDb host to connect to. (default "127.0.0.1")
 -stordb_name string
      The name/number of the storDb to connect to. (default "cgrates")
 -stordb_passwd string
      The storDb user's password.
 -stordb_port string
      The storDb port to bind to. (default "3306")
 -stordb_type string
      The type of the storDb database <*mysql|*postgres|*mongo> (default "mysql")
 -stordb_user string
      The storDb user to sign in as. (default "cgrates")
 -timezone string
      Timezone for timestamps where not specified <""|UTC|Local|$IANA_TZ_DB>
 -to_stordb
      Import the tariff plan from files to storDb
 -tpid string
      The tariff plan ID from the database
 -verbose
      Enable detailed verbose logging output
 -version
      Prints the application version.
```

2.4 cgr-migrator

Command line migration tool.

Customisable through the use of *JSON configuration* or command line arguments (higher prio).

```
$ cgr-migrator -h
Usage of cgr-migrator:
 -config_path string
       Configuration directory path.
 -datadb_host string
       the DataDB host (default "127.0.0.1")
 -datadb_name string
       the name/number of the DataDB (default "10")
 -datadb_passwd string
       the DataDB password
 -datadb_port string
       the DataDB port (default "6379")
 -datadb_type string
       the type of the DataDB Database <*redis|*mongo> (default "redis")
 -datadb_user string
       the DataDB user (default "cgrates")
 -dbdata_encoding string
       the encoding used to store object Data in strings (default "msgpack")
 -dry_run
       parse loaded data for consistency and errors, without storing it
 -exec string
       fire up automatic migration <*set_versions|*cost_
↪details|*accounts|*actions|*action_triggers|*action_plans|*shared_
↪groups|*filters|*stordb|*datadb>
 -out_datadb_host string
       output DataDB host to connect to (default "*datadb")
 -out_datadb_name string
       output DataDB name/number (default "*datadb")
 -out_datadb_passwd string
       output DataDB password (default "*datadb")
 -out_datadb_port string
       output DataDB port (default "*datadb")
 -out_datadb_type string
       output DataDB type <*redis|*mongo> (default "*datadb")
 -out_datadb_user string
       output DataDB user (default "*datadb")
 -out_dbdata_encoding string
       the encoding used to store object Data in strings in move mode (default
↪"*datadb")
 -out_redis_sentinel string
       the name of redis sentinel (default "*datadb")
 -out_stordb_host string
       output StorDB host (default "*stordb")
 -out_stordb_name string
       output StorDB name/number (default "*stordb")
 -out_stordb_passwd string
       output StorDB password (default "*stordb")
 -out_stordb_port string
       output StorDB port (default "*stordb")
 -out_stordb_type string
       output StorDB type for move mode <*mysql|*postgres|*mongo> (default "*stordb")
 -out_stordb_user string
       output StorDB user (default "*stordb")
 -redis_sentinel string
       the name of redis sentinel
 -stordb_host string
       the StorDB host (default "127.0.0.1")
```

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```
 -stordb_name string
       the name/number of the StorDB (default "cgrates")
 -stordb_passwd string
       the StorDB password
 -stordb_port string
       the StorDB port (default "3306")
 -stordb_type string
       the type of the StorDB Database <*mysql|*postgres|*mongo> (default "mysql")
 -stordb_user string
       the StorDB user (default "cgrates")
 -verbose
       enable detailed verbose logging output
 -version
       prints the application version
```

2.5 cgr-tester

Command line stress testing tool configurable via command line arguments.

```
$ cgr-tester -h
Usage of cgr-tester:
 -category string
       The Record category to test. (default "call")
 -config_path string
       Configuration directory path.
 -cpuprofile string
       write cpu profile to file
 -datadb_host string
       The DataDb host to connect to. (default "127.0.0.1")
 -datadb_name string
       The name/number of the DataDb to connect to. (default "10")
 -datadb_pass string
       The DataDb user's password.
 -datadb_port string
       The DataDb port to bind to. (default "6379")
 -datadb_type string
       The type of the DataDb database <redis> (default "redis")
 -datadb_user string
       The DataDb user to sign in as. (default "cgrates")
 -dbdata_encoding string
       The encoding used to store object data in strings. (default "msgpack")
 -destination string
       The destination to use in queries. (default "1002")
 -file_path string
       read requests from file with path
 -json
       Use JSON RPC
 -memprofile string
       write memory profile to this file
 -parallel int
       run n requests in parallel
 -rater_address string
       Rater address for remote tests. Empty for internal rater.
 -redis_sentinel string
```

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```
      The name of redis sentinel
-req_separator string
      separator for requests in file (default "\n\n")
-runs int
      stress cycle number (default 100000)
-subject string
      The rating subject to use in queries. (default "1001")
-tenant string
      The type of record to use in queries. (default "cgrates.org")
-tor string
      The type of record to use in queries. (default "*voice")
-usage string
      The duration to use in call simulation. (default "1m")
-version
      Prints the application version.
```

CHAPTER 3

3. Installation

CGRateS can be installed via packages as well as Go automated source install. We recommend using source installs for advanced users familiar with Go programming and packages for users not willing to be involved in the code building process.

3.1 3.1. Using packages

Depending on the packaged distribution, following methods are available:

3.1.1 3.1.1. Debian

This is for the moment the only packaged and the most recommended to use method to install CGRateS. CGRateS development team maintains official debian packages out of master branch, released under nightly tag in aptitude.

There are two main ways of installing the maintained packages:

3.1.1.1 3.1.1.1. Aptitude repository

Add the gpg key:

```
sudo wget -O - http://apt.cgrates.org/apt.cgrates.org.gpg.key | sudo apt-key add -
```

Add the repository in apt sources list:

```
echo "deb http://apt.cgrates.org/debian/ v0.10 main" | sudo tee /etc/apt/sources.list.
↪d/cgrates.list
```

Update & install:

```
sudo apt-get update
sudo apt-get install cgrates
```

Once the installation is completed, one should perform the post-install section in order to have the CGRateS properly set and ready to run. After *post-install* actions are performed, CGRateS will be configured in **/etc/cgrates/cgrates.json** and enabled in **/etc/default/cgrates**.

3.1.1.2 3.1.1.2. Manual installation of .deb package out of archive server

Run the following commands:

```
wget http://pkg.cgrates.org/deb/v0.10/cgrates_current_amd64.deb
dpkg -i cgrates_current_amd64.deb
```

As a side note on http://pkg.cgrates.org one can find an entire archive of CGRateS packages.

3.1.2 3.1.2. Redhat/Fedora/CentOS

There are two main ways of installing the maintained packages:

3.1.2.1 3.1.2.1. YUM repository

To install CGRateS out of YUM execute the following commands

```
sudo tee -a /etc/yum.repos.d/cgrates.repo > /dev/null <<EOT
[cgrates]
name=CGRateS
baseurl=http://yum.cgrates.org/yum/v0.10/
enabled=1
gpgcheck=1
gpgkey=http://yum.cgrates.org/yum.cgrates.org.gpg.key
EOT
sudo yum update
sudo yum install cgrates
```

Once the installation is completed, one should perform the post-install section in order to have the CGRateS properly set and ready to run. After *post-install* actions are performed, CGRateS will be configured in **/etc/cgrates/cgrates.json** and enabled in **/etc/default/cgrates**.

3.1.2.2 3.1.2.2. Manual installation of .rpm package out of archive server

Run the following commands:

```
sudo rpm -i http://pkg.cgrates.org/rpm/v0.10/cgrates_current.rpm
```

As a side note on http://pkg.cgrates.org one can find an entire archive of CGRateS packages.

3.2 3.2. Using source

For developing CGRateS and switching between its versions, we are using the **new go mods feature** introduced in go 1.14.

3.2.1 3.2.1 Install GO Lang

First we have to setup the GO Lang to our OS. Feel free to download the latest GO binary release from https://golang.org/dl/ In this Tutorial we are going to install Go 1.14

```
rm -rf /usr/local/go
cd /tmp
wget https://dl.google.com/go/go1.13.1.linux-amd64.tar.gz
sudo tar -xvf go1.13.1.linux-amd64.tar.gz -C /usr/local/
export PATH=$PATH:/usr/local/go/bin:$GOPATH/bin
```

3.2.2 3.2.2 Build CGRateS from Source

Configure the project with the following commands:

```
go get github.com/cgrates/cgrates
cd $GOPATH/src/github.com/cgrates/cgrates
./build.sh
```

3.2.3 3.2.3 Create Debian / Ubuntu Packages from Source

After compiling the source code you are ready to create the .deb packages for your Debian like OS. But First lets install some dependencies.

```
sudo apt-get install build-essential fakeroot dh-systemd
```

Finally we are ready to create the system package. Before creation we make sure that we delete the old one first.

```
cd $GOPATH/src/github.com/cgrates/cgrates/packages
rm -rf $GOPATH/src/github.com/cgrates/*.deb
make deb
```

After some time and maybe some console warnings, your CGRateS package will be ready.

3.2.4 3.2.4 Install Custom Debian / Ubuntu Package

```
cd $GOPATH/src/github.com/cgrates
sudo dpkg -i cgrates_*.deb
```

3.3 3.3. Post-install

3.3.1 3.3.1. Database setup

For its operation CGRateS uses **one or more** database types, depending on its nature, install and configuration being further necessary.

At present we support the following databases:

- Redis

Can be used as `data_db` . Optimized for real-time information access. Once installed there should be no special requirements in terms of setup since no schema is necessary.

- MySQL

Can be used as `stor_db` . Optimized for CDR archiving and offline Tariff Plan versioning. Once MySQL is installed, CGRateS database needs to be set-up out of provided scripts. (example for the paths set-up by debian package)

```
cd /usr/share/cgrates/storage/mysql/
./setup_cgr_db.sh root CGRateS.org localhost
```

- PostgreSQL

Can be used as `stor_db` . Optimized for CDR archiving and offline Tariff Plan versioning. Once PostgreSQL is installed, CGRateS database needs to be set-up out of provided scripts (example for the paths set-up by debian package)

```
cd /usr/share/cgrates/storage/postgres/
./setup_cgr_db.sh
```

- MongoDB

Can be used as `data_db` - `stor_db` . It is the first database that can be used to store all kinds of data stored from CGRateS from accounts, tariff plans to cdrs and logs. This is provided as an alternative to Redis and/or MySQL/PostgreSQL and right now there are NO plans to drop support for any of them soon.

Once MongoDB is installed, CGRateS database needs to be set-up out of provided scripts (example for the paths set-up by debian package)

```
cd /usr/share/cgrates/storage/mongo/
./setup_cgr_db.sh
```

3.3.2 3.3.2 Set versions data

Once database setup is completed, we need to write the versions data. To do this, run migrator tool with the parameters specific to your database.

Sample usage for MySQL:

```
cgr-migrator -stordb_passwd="CGRateS.org" -exec="*set_versions"
```

CHAPTER 4

Configuration

Has a *JSON* format with commented lines starting with *//*.

Organized into configuration sections which offers the advantage of being easily splitable.

Hint: You can split the configuration into any number of *.json* files/directories since the :ref:cgr-engine loads recursively the complete configuration folder, alphabetically ordered

All configuration options come with defaults and we have tried our best to choose the best ones for a minimum of efforts necessary when running.

Can be loaded from local folders or remotely using HTTP transport.

The configuration can be loaded at start and reloaded at run time using APIs designed for that. This can be done either as *config pull* (reload from path) or as *config push* (the *JSON BLOB* is sent via API to the engine).

Hint: You can reload from remote HTTP server as well.

Below is the default configuration file which comes hardcoded into :ref:cgr-engine:

```
{

// Real-time Online/Offline Charging System (OCS) for Telecom & ISP environments
// Copyright (C) ITsysCOM GmbH
//
// This file contains the default configuration hardcoded into CGRateS.
// This is what you get when you load CGRateS with an empty configuration file.

// "general": {
//         "node_id": "",
 ↪                                                                              /
 ↪/ identifier of this instance in the cluster, if empty it will be autogenerated
//         "logger":"*syslog",
 ↪                                                                              //
 ↪controls the destination of logs <*syslog|*stdout>
```

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```
12 //         "log_level": 6,
    ↪                                                                                /
    ↪/ control the level of messages logged (0-emerg to 7-debug)
13 //         "http_skip_tls_verify": false,
    ↪                                                  // if enabled HttpClient␣
    ↪will accept any TLS certificate
14 //         "rounding_decimals": 5,
    ↪                                                                  // system␣
    ↪level precision for floats
15 //         "dbdata_encoding": "*msgpack",
    ↪                                                  // encoding used to store␣
    ↪object data in strings: <*msgpack|*json>
16 //         "tpexport_dir": "/var/spool/cgrates/tpe",                          //
    ↪ path towards export folder for offline TariffPlans
17 //         "poster_attempts": 3,
    ↪                                                                  // number␣
    ↪of attempts before considering post request failed (eg: *http_post, CDR exports)
18 //         "failed_posts_dir": "/var/spool/cgrates/failed_posts",        // directory␣
    ↪path where we store failed requests
19 //         "failed_posts_ttl": "5s",
    ↪                                                          // time to wait␣
    ↪before writing the failed posts in a single file
20 //         "default_request_type": "*rated",
    ↪                                              // default request type to consider␣
    ↪when missing from requests: <""|*prepaid|*postpaid|*pseudoprepaid|*rated>
21 //         "default_category": "call",
    ↪                                                          // default category␣
    ↪to consider when missing from requests
22 //         "default_tenant": "cgrates.org",
    ↪                                              // default tenant to consider when␣
    ↪missing from requests
23 //         "default_timezone": "Local",
    ↪                                                  // default timezone for␣
    ↪timestamps where not specified <""|UTC|Local|$IANA_TZ_DB>
24 //         "default_caching":"*reload",
    ↪                                                  // default actions to do␣
    ↪when caching items
25 //         "connect_attempts": 5,
    ↪                                                                  // initial␣
    ↪server connect attempts
26 //         "reconnects": -1,
    ↪                                                                      //␣
    ↪number of retries in case of connection lost
27 //         "connect_timeout": "1s",
    ↪                                                          // consider␣
    ↪connection unsuccessful on timeout, 0 to disable the feature
28 //         "reply_timeout": "2s",
    ↪                                                                  // consider␣
    ↪connection down for replies taking longer than this value
29 //         "locking_timeout": "0",
    ↪                                                                  // timeout␣
    ↪internal locks to avoid deadlocks
30 //         "digest_separator": ",",
    ↪                                                          // separator to use␣
    ↪in replies containing data digests
31 //         "digest_equal": ":",
    ↪                                                                  // equal␣
    ↪symbol used in case of digests
```

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```
32 //         "rsr_separator": ";",                                                    //␣
   ↪separator used within RSR fields
33 //         "max_parralel_conns": 100,                                          // the maximum␣
   ↪number of connection used by the *parallel strategy
34 // },
35
36
37 // "rpc_conns": {
38 //         "*localhost": {
39 //                 "conns": [{"address": "127.0.0.1:2012", "transport":"*json"}],
40 //         },
41 // },                                                          // rpc connections␣
   ↪definitions
42
43
44 // "data_db": {                                                                    //␣
   ↪database used to store runtime data (eg: accounts)
45 //         "db_type": "*redis",                                              // data_db␣
   ↪type: <*redis|*mongo>
46 //         "db_host": "127.0.0.1",                                             // data_db␣
   ↪host address
47 //         "db_port": 6379,                                                      // data_
   ↪db port to reach the database
48 //         "db_name": "10",                                                      // data_
   ↪db database name to connect to
49 //         "db_user": "cgrates",                                               // username␣
   ↪to use when connecting to data_db
50 //         "db_password": "",                                                    //␣
   ↪password to use when connecting to data_db
51 //         "redis_sentinel":"",                                              // the name of␣
   ↪sentinel when used
52 //         "query_timeout":"10s",
53 //         "remote_conns":[],
54 //         "replication_conns":[],
55 //         "items":{
56 //                 "*accounts":{"remote":false,"replicate":false,"ttl": ""},␣
   ↪
57 //                 "*reverse_destinations": {"remote":false,"replicate":false,"ttl": "
   ↪"},
58 //                 "*destinations": {"remote":false,"replicate":false,"ttl": ""},
59 //                 "*rating_plans": {"remote":false,"replicate":false,"ttl": ""},
60 //                 "*rating_profiles":{"remote":false,"replicate":false,"ttl": ""},
61 //                 "*actions":{"remote":false,"replicate":false,"ttl": ""},
62 //                 "*action_plans": {"remote":false,"replicate":false,"ttl": ""},
63 //                 "*account_action_plans":{"remote":false,"replicate":false,"ttl": "
   ↪"},
64 //                 "*action_triggers":{"remote":false,"replicate":false,"ttl": ""},
65 //                 "*shared_groups":{"remote":false,"replicate":false,"ttl": ""},
66 //                 "*timings": {"remote":false,"replicate":false,"ttl": ""},
67 //                 "*resource_profiles":{"remote":false,"replicate":false,"ttl": ""},
68 //                 "*resources":{"remote":false,"replicate":false,"ttl": ""},
69 //                 "*statqueue_profiles": {"remote":false,"replicate":false,"ttl": ""}
   ↪,
70 //                 "*statqueues": {"remote":false,"replicate":false,"ttl": ""},
71 //                 "*threshold_profiles": {"remote":false,"replicate":false,"ttl": ""}
   ↪,
```

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```
//                  "*thresholds": {"remote":false,"replicate":false,"ttl": ""},
//                  "*filters": {"remote":false,"replicate":false,"ttl": ""},
//                  "*supplier_profiles":{"remote":false,"replicate":false,"ttl": ""},
//                  "*attribute_profiles":{"remote":false,"replicate":false,"ttl": ""},
//                  "*charger_profiles": {"remote":false,"replicate":false,"ttl": ""},
//                  "*dispatcher_profiles":{"remote":false,"replicate":false,"ttl": ""},
//                  "*dispatcher_hosts":{"remote":false,"replicate":false,"ttl": ""},
//                  "*filter_indexes" :{"remote":false,"replicate":false,"ttl": ""},
//                  "*load_ids":{"remote":false,"replicate":false,"ttl": ""},
//          },
// },


// "stor_db": {                                                                    //database used to store offline tariff plans and CDRs
//          "db_type": "*mysql",                                                // stor database type to use: <*mongo|*mysql|*postgres|*internal>
//          "db_host": "127.0.0.1",                                               // the host to connect to
//          "db_port": 3306,                                                     // the port to reach the stor_db
//          "db_name": "cgrates",                                               // stor database name
//          "db_user": "cgrates",                                               // username to use when connecting to stor_db
//          "db_password": "",                                                   //password to use when connecting to stor_db
//          "max_open_conns": 100,                                              // maximum database connections opened, not applying for mongo
//          "max_idle_conns": 10,                                               // maximum database connections idle, not applying for mongo
//          "conn_max_lifetime": 0,                                            // maximum amount of time in seconds a connection may be reused (0 for unlimited), not applying for mongo
//          "string_indexed_fields": [],                                       // indexes on cdrs table to speed up queries, used in case of *mongo and *internal
//          "prefix_indexed_fields":[],                                        // prefix indexes on cdrs table to speed up queries, used in case of *internal
//          "query_timeout":"10s",
//          "sslmode":"disable",                                                // sslmode in case of *postgres
//          "items":{
//                  "session_costs": {"ttl": ""},
//                  "cdrs": {"ttl": ""},
//                  "tp_timings":{"ttl": ""},
//                  "tp_destinations": {"ttl": ""},
//                  "tp_rates": {"ttl": ""},
//                  "tp_destination_rates": {"ttl": ""},
//                  "tp_rating_plans":{"ttl": ""},
//                  "tp_rating_profiles":{"ttl": ""},
//                  "tp_shared_groups": {"ttl": ""},
//                  "tp_actions":{"ttl": ""},
//                  "tp_action_plans":{"ttl": ""},
//                  "tp_action_triggers":{"ttl": ""},
//                  "tp_account_actions": {"ttl": ""},
```

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```
//                  "tp_resources":{"ttl": ""},
//                  "tp_stats":{"ttl": ""},
//                  "tp_thresholds": {"ttl": ""},
//                  "tp_filters": {"ttl": ""},
//                  "tp_suppliers": {"ttl": ""},
//                  "tp_attributes":{"ttl": ""},
//                  "tp_chargers":{"ttl": ""},
//                  "versions": {"ttl": ""},
//                  "tp_dispatcher_profiles":{"ttl": ""},
//                  "tp_dispatcher_hosts":{"ttl": ""},
//          },
// },


// "listen": {
//          "rpc_json": "127.0.0.1:2012",                       // RPC JSON listening address
//          "rpc_gob": "127.0.0.1:2013",                        // RPC GOB listening address
//          "http": "127.0.0.1:2080",                           // HTTP listening address
//          "rpc_json_tls" : "127.0.0.1:2022",                  // RPC JSON TLS listening address
//          "rpc_gob_tls": "127.0.0.1:2023",                    // RPC GOB TLS listening address
//          "http_tls": "127.0.0.1:2280",                       // HTTP TLS listening address
// },


// "tls": {
//          "server_certificate" : "",                          // path to server certificate
//          "server_key":"",                                    // path to server key
//          "client_certificate" : "",                          // path to client certificate
//          "client_key":"",                                    // path to client key
//          "ca_certificate":"",                                // path to CA certificate (populate for self-signed certificate otherwise let it empty)
//          "server_policy":4,                                  // server_policy determines the TLS Client Authentication (0-NoClientCert, 1-RequestClientCert, 2-RequireAnyClientCert, 3-VerifyClientCertIfGiven, 4-RequireAndVerifyClientCert)
//          "server_name":"",
// },


// "http":
// {                                                                                   // HTTP server configuration
//          "json_rpc_url": "/jsonrpc",                                                // JSON RPC relative URL ("" to disable)
//          "ws_url": "/ws",                                                           // WebSockets relative URL ("" to disable)
//          "freeswitch_cdrs_url": "/freeswitch_json",          // Freeswitch CDRS relative URL ("" to disable)
```

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```
152 //         "http_cdrs": "/cdr_http",                                    // CDRS relative URL ("" to disable)
153 //         "use_basic_auth": false,                                     // use basic authentication
154 //         "auth_users": {},                                            // basic authentication usernames and base64-encoded passwords (eg: { "username1": "cGFzc3dvcmQ=", "username2": "cGFzc3dvcmQy "})
155 // },
156
157
158 // "schedulers": {
159 //         "enabled": false,                                    // start Scheduler service: <true|false>
160 //         "cdrs_conns": [],                                    // connections to CDRs for *cdrlog actions <*internal|x.y.z.y:1234>
161 //         "filters": [],                                           // only execute actions matching these filters
162 // },
163
164
165 // "caches":{
166 //         "*destinations": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                        // destination caching
167 //         "*reverse_destinations": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},        // reverse destinations index caching
168 //         "*rating_plans": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                        // rating plans caching
169 //         "*rating_profiles": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                // rating profiles caching
170 //         "*actions": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                                // actions caching
171 //         "*action_plans": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                        // action plans caching
172 //         "*account_action_plans": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},        // account action plans index caching
173 //         "*action_triggers": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                // action triggers caching
174 //         "*shared_groups": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                        // shared groups caching
175 //         "*timings": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                                // timings caching
176 //         "*resource_profiles": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                // control resource profiles caching
177 //         "*resources": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                                // control resources caching
178 //         "*event_resources": {"limit": -1, "ttl": "", "static_ttl": false},                                                        // matching resources to events
179 //         "*statqueue_profiles": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},        // statqueue profiles
180 //         "*statqueues": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                        // statqueues with metrics
181 //         "*threshold_profiles": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},        // control threshold profiles caching
182 //         "*thresholds": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                        // control thresholds caching
183 //         "*filters": {"limit": -1, "ttl": "", "static_ttl": false, "precache": false},                                // control filters caching
```

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```
184 //         "*supplier_profiles": {"limit": -1, "ttl": "", "static_ttl": false,
    ↪"precache": false},                 // control supplier profile caching
185 //         "*attribute_profiles": {"limit": -1, "ttl": "", "static_ttl": false,
    ↪"precache": false},         // control attribute profile caching
186 //         "*charger_profiles": {"limit": -1, "ttl": "", "static_ttl": false,
    ↪"precache": false},                 // control charger profile caching
187 //         "*dispatcher_profiles": {"limit": -1, "ttl": "", "static_ttl": false,
    ↪"precache": false},         // control dispatcher profile caching
188 //         "*dispatcher_hosts": {"limit": -1, "ttl": "", "static_ttl": false,
    ↪"precache": false},                 // control dispatcher hosts caching
189 //         "*resource_filter_indexes" : {"limit": -1, "ttl": "", "static_ttl": false},
    ↪                                  // control resource filter indexes caching
190 //         "*stat_filter_indexes" : {"limit": -1, "ttl": "", "static_ttl": false},␣
    ↪                                        // control stat filter indexes caching
191 //         "*threshold_filter_indexes" : {"limit": -1, "ttl": "", "static_ttl": false}
    ↪,                                   // control threshold filter indexes caching
192 //         "*supplier_filter_indexes" : {"limit": -1, "ttl": "", "static_ttl": false},
    ↪                                  // control supplier filter indexes caching
193 //         "*attribute_filter_indexes" : {"limit": -1, "ttl": "", "static_ttl": false}
    ↪,                                   // control attribute filter indexes caching
194 //         "*charger_filter_indexes" : {"limit": -1, "ttl": "", "static_ttl": false},␣
    ↪                                        // control charger filter indexes caching
195 //         "*dispatcher_filter_indexes" : {"limit": -1, "ttl": "", "static_ttl":␣
    ↪false},                                 // control dispatcher filter indexes caching
196 //         "*dispatcher_routes": {"limit": -1, "ttl": "", "static_ttl": false},␣
    ↪                                           // control dispatcher routes caching
197 //         "*diameter_messages": {"limit": -1, "ttl": "3h", "static_ttl": false},
    ↪                                           // diameter messages caching
198 //         "*rpc_responses": {"limit": 0, "ttl": "2s", "static_ttl": false},
    ↪                                                 // RPC responses caching
199 //         "*closed_sessions": {"limit": -1, "ttl": "10s", "static_ttl": false},
    ↪                                           // closed sessions cached for CDRs
200 //         "*cdr_ids": {"limit": -1, "ttl": "10m", "static_ttl": false},
    ↪                                                                  // protects␣
    ↪CDRs against double-charging
201 //         "*load_ids": {"limit": -1, "ttl": "", "static_ttl": false, "precache":␣
    ↪false},                                 // control the load_ids for items
202 //         "*rpc_connections": {"limit": -1, "ttl": "", "static_ttl": false},
    ↪                                                 // RPC connections caching
203 // },
204
205
206 // "filters": {                                                              //␣
    ↪Filters configuration (*new)
207 //         "stats_conns": [],                                              //␣
    ↪connections to StatS for <*stats> filters, empty to disable stats functionality: <"
    ↪"|*internal|x.y.z.y:1234>
208 //         "resources_conns": [],                                          //␣
    ↪connections to ResourceS for <*resources> filters, empty to disable stats␣
    ↪functionality: <""|*internal|x.y.z.y:1234>
209 // },
210
211
212 // "rals": {
213 //         "enabled": false,                                                 // enable␣
    ↪Rating/Accounting service: <true|false>
214 //         "thresholds_conns": [],                                         //␣
    ↪connections to ThresholdS for account/balance updates, empty to disable thresholds␣
    ↪functionality: <""|*internal|x.y.z.y:1234>
```

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```
//         "stats_conns": [],                                                    //␣
↪connections to StatS for account/balance updates, empty to disable stats␣
↪functionality: <""|*internal|x.y.z.y:1234>
//         "caches_conns":["*internal"],                        // connections to␣
↪CacheS for account/balance updates
//         "rp_subject_prefix_matching": false,        // enables prefix matching for␣
↪the rating profile subject
//         "remove_expired":true,                                          // enables␣
↪automatic removal of expired balances
//         "max_computed_usage": {                                          // do not␣
↪compute usage higher than this, prevents memory overload
//                 "*any": "189h",
//                 "*voice": "72h",
//                 "*data": "107374182400",
//                 "*sms": "10000"
//         },
//         "max_increments": 1000000,
//         "balance_rating_subject":{                                  // default␣
↪rating subject in case that balance rating subject is empty
//                 "*any": "*zero1ns",
//                 "*voice": "*zero1s",
//                 "*data": "*zero1ns",
//                 "*sms": "*zero1ns",
//                 "*monetary":"*zero1ns",
//                 "*generic":"*zero1ns",
//         },
// },


// "cdrs": {                                                                    //
↪ CDRs config
//         "enabled": false,                                              // start␣
↪the CDR Server:  <true|false>
//         "extra_fields": [],                                             //␣
↪extra fields to store in CDRs for non-generic CDRs (ie: FreeSWITCH JSON)
//         "store_cdrs": true,                                             //␣
↪store cdrs in StorDB
//         "session_cost_retries": 5,                                  // number of␣
↪queries to session_costs before recalculating CDR
//         "chargers_conns": [],                                    // connection␣
↪to ChargerS for CDR forking, empty to disable billing for CDRs: <""|*internal|x.y.z.
↪y:1234>
//         "rals_conns": [],                                                    //
↪ connections to RALs for cost calculation: <""|*internal|x.y.z.y:1234>
//         "attributes_conns": [],                                          //␣
↪connection to AttributeS for altering *raw CDRs, empty to disable attributes␣
↪functionality: <""|*internal|x.y.z.y:1234>
//         "thresholds_conns": [],                                          //␣
↪connection to ThresholdS for CDR reporting, empty to disable thresholds␣
↪functionality: <""|*internal|x.y.z.y:1234>
//         "stats_conns": [],                                               //␣
↪connections to StatS for CDR reporting, empty to disable stats functionality: <"
↪"|*internal|x.y.z.y:1234>
//         "online_cdr_exports":[],                                 // list of CDRE␣
↪profiles to use for real-time CDR exports
// },

```

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```
250
251 // "cdre":
    ↪{
    ↪/ CDRe config
252 //         "*default": {
253 //                 "export_format": "*file_csv",
    ↪                                       // exported CDRs format <*file_csv|*file_
    ↪fwv|*http_post|*http_json_cdr|*http_json_map|*amqp_json_cdr|*amqp_json_map|*sqs_
    ↪json_map>
254 //                 "export_path": "/var/spool/cgrates/cdre",                // path␣
    ↪where the exported CDRs will be placed
255 //                 "filters" :[],
    ↪                                                                        // filters␣
    ↪for this export
256 //                 "tenant": "",
    ↪                                                                        // tenant␣
    ↪used in filterS.Pass
257 //                 "synchronous": false,
    ↪                                                    // block processing until␣
    ↪export has a result
258 //                 "attempts": 1,
    ↪                                                                        // export␣
    ↪attempts
259 //                 "field_separator": ",",
    ↪                                                    // used field separator in␣
    ↪some export formats, eg: *file_csv
260 //                 "attributes_context": "",
    ↪                                               // attributes context - empty␣
    ↪disables attributes processing
261 //                 "fields":␣
    ↪[                                                                  // template of the␣
    ↪exported content fields
262 //                         {"path": "*exp.CGRID", "type": "*composed", "value": "~
    ↪*req.CGRID"},
263 //                         {"path": "*exp.RunID", "type": "*composed", "value": "~
    ↪*req.RunID"},
264 //                         {"path": "*exp.ToR", "type": "*composed", "value": "~*req.
    ↪ToR"},
265 //                         {"path": "*exp.OriginID", "type": "*composed", "value": "~
    ↪*req.OriginID"},
266 //                         {"path": "*exp.RequestType", "type": "*composed", "value":
    ↪"~*req.RequestType"},
267 //                         {"path": "*exp.Tenant", "type": "*composed", "value": "~
    ↪*req.Tenant"},
268 //                         {"path": "*exp.Category", "type": "*composed", "value": "~
    ↪*req.Category"},
269 //                         {"path": "*exp.Account", "type": "*composed", "value": "~
    ↪*req.Account"},
270 //                         {"path": "*exp.Subject", "type": "*composed", "value": "~
    ↪*req.Subject"},
271 //                         {"path": "*exp.Destination", "type": "*composed", "value":
    ↪"~*req.Destination"},
272 //                         {"path": "*exp.SetupTime", "type": "*composed", "value": "~
    ↪*req.SetupTime", "layout": "2006-01-02T15:04:05Z07:00"},
273 //                         {"path": "*exp.AnswerTime", "type": "*composed", "value":
    ↪"~*req.AnswerTime", "layout": "2006-01-02T15:04:05Z07:00"},
274 //                         {"path": "*exp.Usage", "type": "*composed", "value": "~
    ↪*req.Usage"},
```

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```
275 //                          {"path": "*exp.Cost", "type": "*composed", "value": "~*req.
    ↪Cost", "rounding_decimals": 4},
276 //                  ],
277 //          },
278 // },
279
280
281 // "ers": {                                                                    //␣
    ↪EventReaderService
282 //          "enabled": false,                                                 // starts␣
    ↪the EventReader service: <true|false>
283 //          "sessions_conns":["*internal"],                                 // RPC Connections␣
    ↪IDs
284 //          "readers": [
285 //                  {
286 //                          "id": "*default",
    ↪                                                                           //␣
    ↪identifier of the EventReader profile
287 //                          "type": "*file_csv",
    ↪                                                                       // reader type
    ↪<*file_csv>
288 //                          "field_separator": ",",
    ↪                                                                       // separator used␣
    ↪in case of csv files
289 //                          "run_delay": "0",
    ↪                                                                           //␣
    ↪sleep interval in seconds between consecutive runs, -1 to use automation via␣
    ↪inotify or 0 to disable running all together
290 //                          "concurrent_requests": 1024,
    ↪                                           // maximum simultaneous requests/
    ↪files to process, 0 for unlimited
291 //                          "source_path": "/var/spool/cgrates/cdrc/in",
    ↪                 // read data from this path
292 //                          "processed_path": "/var/spool/cgrates/cdrc/out",        //␣
    ↪move processed data here
293 //                          "xml_root_path": "",
    ↪                                                                       // path towards one␣
    ↪event in case of XML CDRs
294 //                          "tenant": "",
    ↪                                                                           //␣
    ↪tenant used by import
295 //                          "timezone": "",
    ↪                                                                           //␣
    ↪timezone for timestamps where not specified <""|UTC|Local|$IANA_TZ_DB>
296 //                          "filters": [],
    ↪                                                                           //␣
    ↪limit parsing based on the filters
297 //                          "flags": [],
    ↪                                                                           //␣
    ↪flags to influence the event processing
298 //                          "fields
    ↪":[                                                                                /
    ↪/ import fields template, tag will match internally CDR field, in case of .csv␣
    ↪value will be represented by index of the field value
299 //                                  {"tag": "ToR", "path": "*cgreq.ToR", "type":
    ↪"*variable", "value": "~*req.2", "mandatory": true},
300 //                                  {"tag": "OriginID", "path": "*cgreq.OriginID",
    ↪"type": "*variable", "value": "~*req.3", "mandatory": true},
```

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```
//                                  {"tag": "RequestType", "path": "*cgreq.RequestType
↪", "type": "*variable", "value": "~*req.4", "mandatory": true},
//                                  {"tag": "Tenant", "path": "*cgreq.Tenant", "type":
↪"*variable", "value": "~*req.6", "mandatory": true},
//                                  {"tag": "Category", "path": "*cgreq.Category",
↪"type": "*variable", "value": "~*req.7", "mandatory": true},
//                                  {"tag": "Account", "path": "*cgreq.Account", "type
↪": "*variable", "value": "~*req.8", "mandatory": true},
//                                  {"tag": "Subject", "path": "*cgreq.Subject", "type
↪": "*variable", "value": "~*req.9", "mandatory": true},
//                                  {"tag": "Destination", "path": "*cgreq.Destination
↪", "type": "*variable", "value": "~*req.10", "mandatory": true},
//                                  {"tag": "SetupTime", "path": "*cgreq.SetupTime",
↪"type": "*variable", "value": "~*req.11", "mandatory": true},
//                                  {"tag": "AnswerTime", "path": "*cgreq.AnswerTime",
↪"type": "*variable", "value": "~*req.12", "mandatory": true},
//                                  {"tag": "Usage", "path": "*cgreq.Usage", "type":
↪"*variable", "value": "~*req.13", "mandatory": true},
//                          ],
//                          "cache_dump_fields": [],
//                  },
//          ],
// },


// "sessions": {
//          "enabled": false,                                                   // starts␣
↪the session service: <true|false>
//          "listen_bijson": "127.0.0.1:2014",                  // address where to␣
↪listen for bidirectional JSON-RPC requests
//          "chargers_conns": [],                                                //␣
↪connections to ChargerS for session forking <*internal|x.y.z.y:1234>
//          "rals_conns": [],                                                    //␣
↪connections to RALs for rating/accounting <""|*internal|127.0.0.1:2013>
//          "cdrs_conns": [],                                                    //␣
↪connections to CDRs for CDR posting <*internal|x.y.z.y:1234>
//          "resources_conns": [],                                              //␣
↪connections to ResourceS for resources monitoring <""|*internal|127.0.0.1:2013>
//          "thresholds_conns": [],                                              //␣
↪connections to ThresholdS for reporting session events <""|*internal|127.0.0.1:2013>
//          "stats_conns": [],                                                   //␣
↪connections to StatS for reporting session events <""|*internal|127.0.0.1:2013>
//          "suppliers_conns": [],                                              //␣
↪connections to SupplierS for querying suppliers for event <""|*internal|127.0.0.
↪1:2013>
//          "attributes_conns": [],                                              //␣
↪connections to AttributeS for altering event fields <""|*internal|127.0.0.1:2013>
//          "replication_conns": [],                                  // replicate␣
↪sessions towards these session services
//          "debit_interval": "0s",                                              // interval␣
↪to perform debits on.
//          "store_session_costs": false,                          // enable storing of␣
↪the session costs within CDRs
//          "min_call_duration": "0s",                                    // only␣
↪authorize calls with allowed duration higher than this
//          "max_call_duration": "3h",                                    // maximum call␣
↪duration a prepaid call can last
```

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```
333 //         "session_ttl": "0s",                                          // time after␣
    ↪a session with no updates is terminated, not defined by default
334 //         //"session_ttl_max_delay": "",                             // activates session_
    ↪ttl randomization and limits the maximum possible delay
335 //         //"session_ttl_last_used": "",                             // tweak LastUsed␣
    ↪for sessions timing-out, not defined by default
336 //         //"session_ttl_usage": "",                                   // tweak Usage␣
    ↪for sessions timing-out, not defined by default
337 //         "session_indexes": [],                                        // index␣
    ↪sessions based on these fields for GetActiveSessions API
338 //         "client_protocol": 1.0,                                        // version␣
    ↪of protocol to use when acting as JSON-PRC client <"0","1.0">
339 //         "channel_sync_interval": "0",                            // sync channels to␣
    ↪detect stale sessions (0 to disable)
340 //         "terminate_attempts": 5,                                  // attempts to get␣
    ↪the session before terminating it
341 //         "alterable_fields": [],                                        // the␣
    ↪session fields that can be updated
342 // },
343
344
345 // "asterisk_agent": {
346 //         "enabled": false,                                               // starts␣
    ↪the Asterisk agent: <true|false>
347 //         "sessions_conns": ["*internal"],
348 //         "create_cdr": false,                                          // create CDR␣
    ↪out of events and sends it to CDRS component
349 //         "asterisk_conns":[                                             //␣
    ↪instantiate connections to multiple Asterisk servers
350 //                 {"address": "127.0.0.1:8088", "user": "cgrates", "password":
    ↪"CGRateS.org", "connect_attempts": 3,"reconnects": 5}
351 //         ],
352 // },
353
354
355 // "freeswitch_agent": {
356 //         "enabled": false,                                               // starts␣
    ↪the FreeSWITCH agent: <true|false>
357 //         "sessions_conns": ["*internal"],
358 //         "subscribe_park": true,                                       //␣
    ↪subscribe via fsock to receive park events
359 //         "create_cdr": false,                                          // creates CDR␣
    ↪out of events and sends them to CDRS component
360 //         "extra_fields": [],                                            //␣
    ↪extra fields to store in auth/CDRs when creating them
361 //         //"min_dur_low_balance": "5s",                             // threshold which␣
    ↪will trigger low balance warnings for prepaid calls (needs to be lower than debit_
    ↪interval)
362 //         //"low_balance_ann_file": "",                              // file to be played␣
    ↪when low balance is reached for prepaid calls
363 //         "empty_balance_context": "",                            // if defined, prepaid␣
    ↪calls will be transferred to this context on empty balance
364 //         "empty_balance_ann_file": "",                            // file to be played␣
    ↪before disconnecting prepaid calls on empty balance (applies only if no context␣
    ↪defined)
365 //         "max_wait_connection": "2s",                             // maximum duration to␣
    ↪wait for a connection to be retrieved from the pool
```

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```
366 //         "event_socket_conns":[                                          //␣
    ↪instantiate connections to multiple FreeSWITCH servers
367 //                 {"address": "127.0.0.1:8021", "password": "ClueCon", "reconnects":␣
    ↪5,"alias":""}
368 //         ],
369 // },
370
371
372 // "kamailio_agent": {
373 //         "enabled": false,                                                 // starts␣
    ↪Kamailio agent: <true|false>
374 //         "sessions_conns": ["*internal"],
375 //         "create_cdr": false,                                           // create CDR␣
    ↪out of events and sends them to CDRS component
376 //         "timezone": "",                                                         //␣
    ↪timezone of the Kamailio server
377 //         "evapi_conns":[                                                         //␣
    ↪instantiate connections to multiple Kamailio servers
378 //                 {"address": "127.0.0.1:8448", "reconnects": 5}
379 //         ],
380 // },
381
382
383 // "diameter_agent": {
384 //         "enabled": false,
    ↪                                                                                  /
    ↪/ enables the diameter agent: <true|false>
385 //         "listen": "127.0.0.1:3868",
    ↪                                                                  // address␣
    ↪where to listen for diameter requests <x.y.z.y/x1.y1.z1.y1:1234>
386 //         "listen_net": "tcp",
    ↪                                                                          //␣
    ↪transport type for diameter <tcp|sctp>
387 //         "dictionaries_path": "/usr/share/cgrates/diameter/dict/",        // path␣
    ↪towards directory holding additional dictionaries to load
388 //         "sessions_conns": ["*internal"],
389 //         "origin_host": "CGR-DA",
    ↪                                                                  // diameter␣
    ↪Origin-Host AVP used in replies
390 //         "origin_realm": "cgrates.org",
    ↪                                                          // diameter Origin-
    ↪Realm AVP used in replies
391 //         "vendor_id": 0,
    ↪                                                                                 /
    ↪/ diameter Vendor-Id AVP used in replies
392 //         "product_name": "CGRateS",
    ↪                                                                  // diameter␣
    ↪Product-Name AVP used in replies
393 //         "concurrent_requests": -1,
    ↪                                                                  // limit␣
    ↪the number of active requests processed by the server <-1|0-n>
394 //         "synced_conn_requests": false,
    ↪                                                          // process one␣
    ↪request at the time per connection
395 //         "asr_template": "",
    ↪                                                                                 /
    ↪/ enable AbortSession message being sent to client on DisconnectSession
```

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```
//         "templates":
↪{
↪/ default message templates
//                 "*err": [
//                                 {"tag": "SessionId", "path": "*rep.Session-Id",
↪"type": "*variable",
//                                         "value": "~*req.Session-Id", "mandatory":␣
↪true},
//                                 {"tag": "OriginHost", "path": "*rep.Origin-Host",
↪"type": "*variable",
//                                         "value": "~*vars.OriginHost", "mandatory":␣
↪true},
//                                 {"tag": "OriginRealm", "path": "*rep.Origin-Realm",
↪ "type": "*variable",
//                                         "value": "~*vars.OriginRealm", "mandatory
↪": true},
//                 ],
//                 "*cca": [
//                                 {"tag": "SessionId", "path": "*rep.Session-Id",
↪"type": "*variable",
//                                         "value": "~*req.Session-Id", "mandatory":␣
↪true},
//                                 {"tag": "ResultCode", "path": "*rep.Result-Code",
↪"type": "*constant",
//                                         "value": "2001"},
//                                 {"tag": "OriginHost", "path": "*rep.Origin-Host",
↪"type": "*variable",
//                                         "value": "~*vars.OriginHost", "mandatory":␣
↪true},
//                                 {"tag": "OriginRealm", "path": "*rep.Origin-Realm",
↪ "type": "*variable",
//                                         "value": "~*vars.OriginRealm", "mandatory
↪": true},
//                                 {"tag": "AuthApplicationId", "path": "*rep.Auth-
↪Application-Id", "type": "*variable",
//                                          "value": "~*vars.*appid", "mandatory":␣
↪true},
//                                 {"tag": "CCRequestType", "path": "*rep.CC-Request-
↪Type", "type": "*variable",
//                                         "value": "~*req.CC-Request-Type",
↪"mandatory": true},
//                                 {"tag": "CCRequestNumber", "path": "*rep.CC-
↪Request-Number", "type": "*variable",
//                                         "value": "~*req.CC-Request-Number",
↪"mandatory": true},
//                 ],
//                 "*asr": [
//                                 {"tag": "SessionId", "path": "*diamreq.Session-Id",
↪ "type": "*variable",
//                                         "value": "~*req.Session-Id", "mandatory":␣
↪true},
//                                 {"tag": "OriginHost", "path": "*diamreq.Origin-Host
↪", "type": "*variable",
//                                         "value": "~*req.Destination-Host",
↪"mandatory": true},
//                                 {"tag": "OriginRealm", "path": "*diamreq.Origin-
↪Realm", "type": "*variable",
```

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```
427 //                                          "value": "~*req.Destination-Realm",
    ↪"mandatory": true},
428 //                                  {"tag": "DestinationRealm", "path": "*diamreq.
    ↪Destination-Realm", "type": "*variable",
429 //                                          "value": "~*req.Origin-Realm", "mandatory
    ↪": true},
430 //                                  {"tag": "DestinationHost", "path": "*diamreq.
    ↪Destination-Host", "type": "*variable",
431 //                                          "value": "~*req.Origin-Host", "mandatory":␣
    ↪true},
432 //                                  {"tag": "AuthApplicationId", "path": "*diamreq.
    ↪Auth-Application-Id", "type": "*variable",
433 //                                           "value": "~*vars.*appid", "mandatory":␣
    ↪true},
434 //                                  {"tag": "UserName", "path": "*diamreq.User-Name",
    ↪"type": "*variable",
435 //                                          "value": "~*req.User-Name", "mandatory":␣
    ↪true},
436 //                                  {"tag": "OriginStateID", "path": "*diamreq.Origin-
    ↪State-Id", "type": "*constant",
437 //                                          "value": "1"},
438 //                  ]
439 //          },
440 //          "request_processors": [                                 // list of␣
    ↪processors to be applied to diameter messages
441 //          ],
442 // },
443
444
445 // "radius_agent": {
446 //          "enabled": false,
    ↪                                                                                /
    ↪/ enables the radius agent: <true|false>
447 //          "listen_net": "udp",
    ↪                                                                              //␣
    ↪network to listen on <udp|tcp>
448 //          "listen_auth": "127.0.0.1:1812",
    ↪                                                  // address where to listen␣
    ↪for radius authentication requests <x.y.z.y:1234>
449 //          "listen_acct": "127.0.0.1:1813",
    ↪                                                  // address where to listen␣
    ↪for radius accounting requests <x.y.z.y:1234>
450 //          "client_secrets":
    ↪{                                                                               /
    ↪/ hash containing secrets for clients connecting here <*default|$client_ip>
451 //                  "*default": "CGRateS.org"
452 //          },
453 //          "client_dictionaries":
    ↪{                                                                    // per␣
    ↪client path towards directory holding additional dictionaries to load (extra to RFC)
454 //                  "*default": "/usr/share/cgrates/radius/dict/",
    ↪                       // key represents the client IP or catch-all <*default|
    ↪$client_ip>
455 //          },
456 //          "sessions_conns": ["*internal"],
457 //          "request_processors":␣
    ↪[                                                                             //␣
    ↪request processors to be applied to Radius messages
```

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```
458 //         ],
459 // },
460
461
462 // "http_agent": [                                          // HTTP Agents, ie␣
    ↪towards cnc.to MVNE platform
463 // ],
464
465
466 // "dns_agent": {
467 //         "enabled": false,
    ↪                                                                          /
    ↪/ enables the DNS agent: <true|false>
468 //         "listen": "127.0.0.1:2053",
    ↪                                                                  // address␣
    ↪where to listen for DNS requests <x.y.z.y:1234>
469 //         "listen_net": "udp",
    ↪                                                                      //␣
    ↪network to listen on <udp|tcp|tcp-tls>
470 //         "sessions_conns": ["*internal"],
471 //         "timezone": "",
    ↪                                                                           /
    ↪/ timezone of the events if not specified  <UTC|Local|$IANA_TZ_DB>
472 //         "request_processors":␣
    ↪[                                                                      //␣
    ↪request processors to be applied to DNS messages
473 //         ],
474 // },
475
476
477 // "attributes": {                                          //␣
    ↪AttributeS config
478 //         "enabled": false,                                  // starts␣
    ↪attribute service: <true|false>.
479 //         "indexed_selects":true,                          // enable␣
    ↪profile matching exclusively on indexes
480 //         //"string_indexed_fields": [],                 // query indexes␣
    ↪based on these fields for faster processing
481 //         "prefix_indexed_fields": [],                 // query indexes based␣
    ↪on these fields for faster processing
482 //         "nested_fields": false,                          //␣
    ↪determines which field is checked when matching indexed filters(true: all; false:␣
    ↪only the one on the first level)
483 //         "process_runs": 1,                                 //␣
    ↪number of run loops when processing event
484 // },
485
486
487 // "chargers": {                                              //␣
    ↪ChargerS config
488 //         "enabled": false,                                  // starts␣
    ↪charger service: <true|false>.
489 //         "attributes_conns": [],                          //␣
    ↪connections to AttributeS for event fields altering <""|127.0.0.1:2013>
490 //         "indexed_selects":true,                          // enable␣
    ↪profile matching exclusively on indexes
491 //         //"string_indexed_fields": [],                 // query indexes␣
    ↪based on these fields for faster processing
```

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```
//         "prefix_indexed_fields": [],                    // query indexes based on these fields for faster processing
//         "nested_fields": false,                         // determines which field is checked when matching indexed filters(true: all; false: only the one on the first level)
// },


// "resources": {                                          // ResourceS config
//         "enabled": false,                               // starts ResourceLimiter service: <true|false>.
//         "store_interval": "",                           // dump cache regularly to dataDB, 0 - dump at start/shutdown: <""|$dur>
//         "thresholds_conns": [],                         // connections to ThresholdS for resource reporting, empty to disable thresholds functionality: <""|*internal|x.y.z.y:1234>
//         "indexed_selects":true,                         // enable profile matching exclusively on indexes
//         //"string_indexed_fields": [],                  // query indexes based on these fields for faster processing
//         "prefix_indexed_fields": [],                    // query indexes based on these fields for faster processing
//         "nested_fields": false,                         // determines which field is checked when matching indexed filters(true: all; false: only the one on the first level)
// },


// "stats": {                                              // StatS config
//         "enabled": false,                               // starts Stat service: <true|false>.
//         "store_interval": "",                           // dump cache regularly to dataDB, 0 - dump at start/shutdown: <""|$dur>
//         "store_uncompressed_limit": 0,                  // used to compress data
//         "thresholds_conns": [],                         // connections to ThresholdS for StatUpdates, empty to disable thresholds functionality: <""|*internal|x.y.z.y:1234>
//         "indexed_selects":true,                         // enable profile matching exclusively on indexes
//         //"string_indexed_fields": [],                  // query indexes based on these fields for faster processing
//         "prefix_indexed_fields": [],                    // query indexes based on these fields for faster processing
//         "nested_fields": false,                         // determines which field is checked when matching indexed filters(true: all; false: only the one on the first level)
// },


// "thresholds": {                                         // ThresholdS
//         "enabled": false,                               // starts ThresholdS service: <true|false>.
//         "store_interval": "",                           // dump cache regularly to dataDB, 0 - dump at start/shutdown: <""|$dur>
```

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```
523 //         "indexed_selects":true,                                    // enable␣
    ↪profile matching exclusively on indexes
524 //         //"string_indexed_fields": [],                          // query indexes␣
    ↪based on these fields for faster processing
525 //         "prefix_indexed_fields": [],                          // query indexes based␣
    ↪on these fields for faster processing
526 //         "nested_fields": false,                                    //␣
    ↪determines which field is checked when matching indexed filters(true: all; false:␣
    ↪only the one on the first level)
527 // },
528
529
530 // "suppliers": {                                                      //␣
    ↪SupplierS config
531 //         "enabled": false,                                            // starts␣
    ↪SupplierS service: <true|false>.
532 //         "indexed_selects":true,                                    // enable␣
    ↪profile matching exclusively on indexes
533 //         //"string_indexed_fields": [],                          // query indexes␣
    ↪based on these fields for faster processing
534 //         "prefix_indexed_fields": [],                          // query indexes based␣
    ↪on these fields for faster processing
535 //         "nested_fields": false,                                    //␣
    ↪determines which field is checked when matching indexed filters(true: all; false:␣
    ↪only the one on the first level)
536 //         "attributes_conns": [],                                    //␣
    ↪connections to AttributeS for altering events before supplier queries: <"
    ↪"|*internal|127.0.0.1:2013>
537 //         "resources_conns": [],                                   //␣
    ↪connections to ResourceS for *res sorting, empty to disable functionality: <"
    ↪"|*internal|x.y.z.y:1234>
538 //         "stats_conns": [],                                         //␣
    ↪connections to StatS for *stats sorting, empty to disable stats functionality: <"
    ↪"|*internal|x.y.z.y:1234>
539 //         "default_ratio":1                                          //␣
    ↪default ratio used in case of *load strategy
540 // },
541
542
543 // "loaders":␣
    ↪[                                                                                  /
    ↪/ LoaderS config
544 //         {
545 //                 "id": "*default",
    ↪                                                                   //␣
    ↪identifier of the Loader
546 //                 "enabled": false,
    ↪                                                                   // starts␣
    ↪as service: <true|false>.
547 //                 "tenant": "",
    ↪                                                                           //␣
    ↪tenant used in filterS.Pass
548 //                 "dry_run": false,
    ↪                                                                   // do not␣
    ↪send the CDRs to CDRS, just parse them
549 //                 "run_delay": 0,
    ↪                                                                           //␣
    ↪sleep interval in seconds between consecutive runs, 0 to use automation via inotify
```

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```
//                 "lock_filename": ".cgr.lck",
↪                                                 // Filename containing concurrency␣
↪lock in case of delayed processing
//                 "caches_conns": ["*internal"],
//                 "field_separator": ",",
↪                                                                 // separator used␣
↪in case of csv files
//                 "tp_in_dir": "/var/spool/cgrates/loader/in",                //␣
↪absolute path towards the directory where the TPs are stored
//                 "tp_out_dir": "/var/spool/cgrates/loader/out",                //␣
↪absolute path towards the directory where processed TPs will be moved
//                 "data
↪":[                                                                                /
↪/ data profiles to load
//                         {
//                             "type": "*attributes",
↪                                                 // data source type
//                             "file_name": "Attributes.csv",
↪                            // file name in the tp_in_dir
//                             "fields": [
//                                 {"tag": "TenantID", "path": "Tenant", "type
↪": "*variable", "value": "~0", "mandatory": true},
//                                 {"tag": "ProfileID", "path": "ID", "type":
↪"*variable", "value": "~1", "mandatory": true},
//                                 {"tag": "Contexts", "path": "Contexts",
↪"type": "*variable", "value": "~2"},
//                                 {"tag": "FilterIDs", "path": "FilterIDs",
↪"type": "*variable", "value": "~3"},
//                                 {"tag": "ActivationInterval", "path":
↪"ActivationInterval", "type": "*variable", "value": "~4"},
//                                 {"tag": "AttributeFilterIDs", "path":
↪"AttributeFilterIDs", "type": "*variable", "value": "~5"},
//                                 {"tag": "Path", "path": "Path", "type":
↪"*variable", "value": "~6"},
//                                 {"tag": "Type", "path": "Type", "type":
↪"*variable", "value": "~7"},
//                                 {"tag": "Value", "path": "Value", "type":
↪"*variable", "value": "~8"},
//                                 {"tag": "Blocker", "path": "Blocker", "type
↪": "*variable", "value": "~9"},
//                                 {"tag": "Weight", "path": "Weight", "type
↪": "*variable", "value": "~10"},
//                             ],
//                         },
//                         {
//                             "type": "*filters",
↪                                                 // data source type
//                             "file_name": "Filters.csv",
↪                            // file name in the tp_in_dir
//                             "fields": [
//                                 {"tag": "Tenant", "path": "Tenant", "type
↪": "*variable", "value": "~0", "mandatory": true},
//                                 {"tag": "ID", "path": "ID", "type":
↪"*variable", "value": "~1", "mandatory": true},
//                                 {"tag": "Type", "path": "Type", "type":
↪"*variable", "value": "~2"},
//                                 {"tag": "Element", "path": "Element", "type
↪": "*variable", "value": "~3"},
```

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```
//                                          {"tag": "Values", "path": "Values", "type
↪": "*variable", "value": "~4"},
//                                          {"tag": "ActivationInterval", "path":
↪"ActivationInterval", "type": "*variable", "value": "~5"},
//                                  ],
//                          },
//                          {
//                                  "type": "*resources",
↪                                                  // data source type
//                                  "file_name": "Resources.csv",
↪                                 // file name in the tp_in_dir
//                                  "fields": [
//                                          {"tag": "Tenant", "path": "Tenant", "type
↪": "*variable", "value": "~0", "mandatory": true},
//                                          {"tag": "ID", "path": "ID", "type":
↪"*variable", "value": "~1", "mandatory": true},
//                                          {"tag": "FilterIDs", "path": "FilterIDs",
↪"type": "*variable", "value": "~2"},
//                                          {"tag": "ActivationInterval", "path":
↪"ActivationInterval", "type": "*variable", "value": "~3"},
//                                          {"tag": "TTL", "path": "UsageTTL", "type":
↪"*variable", "value": "~4"},
//                                          {"tag": "Limit", "path": "Limit", "type":
↪"*variable", "value": "~5"},
//                                          {"tag": "AllocationMessage", "path":
↪"AllocationMessage", "type": "*variable", "value": "~6"},
//                                          {"tag": "Blocker", "path": "Blocker", "type
↪": "*variable", "value": "~7"},
//                                          {"tag": "Stored", "path": "Stored", "type
↪": "*variable", "value": "~8"},
//                                          {"tag": "Weight", "path": "Weight", "type
↪": "*variable", "value": "~9"},
//                                          {"tag": "ThresholdIDs", "path":
↪"ThresholdIDs", "type": "*variable", "value": "~10"},
//                                  ],
//                          },
//                          {
//                                  "type": "*stats",
↪                                                  // data source type
//                                  "file_name": "Stats.csv",
↪                                 // file name in the tp_in_dir
//                                  "fields": [
//                                          {"tag": "Tenant", "path": "Tenant", "type
↪": "*variable", "value": "~0", "mandatory": true},
//                                          {"tag": "ID", "path": "ID", "type":
↪"*variable", "value": "~1", "mandatory": true},
//                                          {"tag": "FilterIDs", "path": "FilterIDs",
↪"type": "*variable", "value": "~2"},
//                                          {"tag": "ActivationInterval", "path":
↪"ActivationInterval", "type": "*variable", "value": "~3"},
//                                          {"tag": "QueueLength", "path": "QueueLength
↪", "type": "*variable", "value": "~4"},
//                                          {"tag": "TTL", "path": "TTL", "type":
↪"*variable", "value": "~5"},
//                                          {"tag": "MinItems", "path": "MinItems",
↪"type": "*variable", "value": "~6"},
//                                          {"tag": "MetricIDs", "path": "MetricIDs",
↪"type": "*variable", "value": "~7"},
```

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```
614 //                                          {"tag": "MetricFilterIDs", "path":
    ↪"MetricFilterIDs", "type": "*variable", "value": "~8"},
615 //                                          {"tag": "Blocker", "path": "Blocker", "type
    ↪": "*variable", "value": "~9"},
616 //                                          {"tag": "Stored", "path": "Stored", "type
    ↪": "*variable", "value": "~10"},
617 //                                          {"tag": "Weight", "path": "Weight", "type
    ↪": "*variable", "value": "~11"},
618 //                                          {"tag": "ThresholdIDs", "path":
    ↪"ThresholdIDs", "type": "*variable", "value": "~12"},
619 //                                  ],
620 //                          },
621 //                          {
622 //                                  "type": "*thresholds",
    ↪                                           // data source type
623 //                                  "file_name": "Thresholds.csv",
    ↪                                  // file name in the tp_in_dir
624 //                                  "fields": [
625 //                                          {"tag": "Tenant", "path": "Tenant", "type
    ↪": "*variable", "value": "~0", "mandatory": true},
626 //                                          {"tag": "ID", "path": "ID", "type":
    ↪"*variable", "value": "~1", "mandatory": true},
627 //                                          {"tag": "FilterIDs", "path": "FilterIDs",
    ↪"type": "*variable", "value": "~2"},
628 //                                          {"tag": "ActivationInterval", "path":
    ↪"ActivationInterval", "type": "*variable", "value": "~3"},
629 //                                          {"tag": "MaxHits", "path": "MaxHits", "type
    ↪": "*variable", "value": "~4"},
630 //                                          {"tag": "MinHits", "path": "MinHits", "type
    ↪": "*variable", "value": "~5"},
631 //                                          {"tag": "MinSleep", "path": "MinSleep",
    ↪"type": "*variable", "value": "~6"},
632 //                                          {"tag": "Blocker", "path": "Blocker", "type
    ↪": "*variable", "value": "~7"},
633 //                                          {"tag": "Weight", "path": "Weight", "type
    ↪": "*variable", "value": "~8"},
634 //                                          {"tag": "ActionIDs", "path": "ActionIDs",
    ↪"type": "*variable", "value": "~9"},
635 //                                          {"tag": "Async", "path": "Async", "type":
    ↪"*variable", "value": "~10"},
636 //                                  ],
637 //                          },
638 //                          {
639 //                                  "type": "*suppliers",
    ↪                                           // data source type
640 //                                  "file_name": "Suppliers.csv",
    ↪                                 // file name in the tp_in_dir
641 //                                  "fields": [
642 //                                          {"tag": "Tenant", "path": "Tenant", "type
    ↪": "*variable", "value": "~0", "mandatory": true},
643 //                                          {"tag": "ID", "path": "ID", "type":
    ↪"*variable", "value": "~1", "mandatory": true},
644 //                                          {"tag": "FilterIDs", "path": "FilterIDs",
    ↪"type": "*variable", "value": "~2"},
645 //                                          {"tag": "ActivationInterval", "path":
    ↪"ActivationInterval", "type": "*variable", "value": "~3"},
646 //                                          {"tag": "Sorting", "path": "Sorting", "type
    ↪": "*variable", "value": "~4"},
```

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```
//                                          {"tag": "SortingParamameters", "path":
↪"SortingParamameters", "type": "*variable", "value": "~5"},
//                                          {"tag": "SupplierID", "path": "SupplierID",
↪ "type": "*variable", "value": "~6"},
//                                          {"tag": "SupplierFilterIDs", "path":
↪"SupplierFilterIDs", "type": "*variable", "value": "~7"},
//                                          {"tag": "SupplierAccountIDs", "path":
↪"SupplierAccountIDs", "type": "*variable", "value": "~8"},
//                                          {"tag": "SupplierRatingPlanIDs", "path":
↪"SupplierRatingPlanIDs", "type": "*variable", "value": "~9"},
//                                          {"tag": "SupplierResourceIDs", "path":
↪"SupplierResourceIDs", "type": "*variable", "value": "~10"},
//                                          {"tag": "SupplierStatIDs", "path":
↪"SupplierStatIDs", "type": "*variable", "value": "~11"},
//                                          {"tag": "SupplierWeight", "path":
↪"SupplierWeight", "type": "*variable", "value": "~12"},
//                                          {"tag": "SupplierBlocker", "path":
↪"SupplierBlocker", "type": "*variable", "value": "~13"},
//                                          {"tag": "SupplierParameters", "path":
↪"SupplierParameters", "type": "*variable", "value": "~14"},
//                                          {"tag": "Weight", "path": "Weight", "type
↪": "*variable", "value": "~15"},
//                                  ],
//                          },
//                          {
//                                  "type": "*chargers",
↪                                                 // data source type
//                                  "file_name": "Chargers.csv",
↪                                // file name in the tp_in_dir
//                                  "fields": [
//                                          {"tag": "Tenant", "path": "Tenant", "type
↪": "*variable", "value": "~0", "mandatory": true},
//                                          {"tag": "ID", "path": "ID", "type":
↪"*variable", "value": "~1", "mandatory": true},
//                                          {"tag": "FilterIDs", "path": "FilterIDs",
↪"type": "*variable", "value": "~2"},
//                                          {"tag": "ActivationInterval", "path":
↪"ActivationInterval", "type": "*variable", "value": "~3"},
//                                          {"tag": "RunID", "path": "RunID", "type":
↪"*variable", "value": "~4"},
//                                          {"tag": "AttributeIDs", "path":
↪"AttributeIDs", "type": "*variable", "value": "~5"},
//                                          {"tag": "Weight", "path": "Weight", "type
↪": "*variable", "value": "~6"},
//                                  ],
//                          },
//                          {
//                                  "type": "*dispatchers",
↪                                                 // data source type
//                                  "file_name": "DispatcherProfiles.csv",
↪                // file name in the tp_in_dir
//                                  "fields": [
//                                          {"tag": "Tenant", "path": "Tenant", "type
↪": "*variable", "value": "~0", "mandatory": true},
//                                          {"tag": "ID", "path": "ID", "type":
↪"*variable", "value": "~1", "mandatory": true},
//                                          {"tag": "Contexts", "path": "Contexts",
↪"type": "*variable", "value": "~2"},
```

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```
680 //                                          {"tag": "FilterIDs", "path": "FilterIDs",
    ↪"type": "*variable", "value": "~3"},
681 //                                          {"tag": "ActivationInterval", "path":
    ↪"ActivationInterval", "type": "*variable", "value": "~4"},
682 //                                          {"tag": "Strategy", "path": "Strategy",
    ↪"type": "*variable", "value": "~5"},
683 //                                          {"tag": "StrategyParameters", "path":
    ↪"StrategyParameters", "type": "*variable", "value": "~6"},
684 //                                          {"tag": "ConnID", "path": "ConnID", "type
    ↪": "*variable", "value": "~7"},
685 //                                          {"tag": "ConnFilterIDs", "path":
    ↪"ConnFilterIDs", "type": "*variable", "value": "~8"},
686 //                                          {"tag": "ConnWeight", "path": "ConnWeight",
    ↪ "type": "*variable", "value": "~9"},
687 //                                          {"tag": "ConnBlocker", "path": "ConnBlocker
    ↪", "type": "*variable", "value": "~10"},
688 //                                          {"tag": "ConnParameters", "path":
    ↪"ConnParameters", "type": "*variable", "value": "~11"},
689 //                                          {"tag": "Weight", "path": "Weight", "type
    ↪": "*variable", "value": "~12"},
690 //                                  ],
691 //                          },
692 //                          {
693 //                                  "type": "*dispatcher_hosts",
    ↪                                           // data source type
694 //                                  "file_name": "DispatcherHosts.csv",
    ↪                                     // file name in the tp_in_dir
695 //                                  "fields": [
696 //                                          {"tag": "Tenant", "path": "Tenant", "type
    ↪": "*variable", "value": "~0", "mandatory": true},
697 //                                          {"tag": "ID", "path": "ID", "type":
    ↪"*variable", "value": "~1", "mandatory": true},
698 //                                          {"tag": "Address", "path": "Address", "type
    ↪": "*variable", "value": "~2"},
699 //                                          {"tag": "Transport", "path": "Transport",
    ↪"type": "*variable", "value": "~3"},
700 //                                          {"tag": "TLS", "path": "TLS", "type":
    ↪"*variable", "value": "~4"},
701 //                                  ],
702 //                          },
703 //                  ],
704 //          },
705 // ],
706
707
708 // "mailer": {
709 //          "server": "localhost",
    ↪                                                                   // the server to␣
    ↪use when sending emails out
710 //          "auth_user": "cgrates",
    ↪                                                                   // authenticate to␣
    ↪email server using this user
711 //          "auth_password": "CGRateS.org",
    ↪                                                 // authenticate to email server␣
    ↪with this password
712 //          "from_address": "cgr-mailer@localhost.localdomain"        // from address␣
    ↪used when sending emails out
```

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```
// },


// "suretax": {
//         "url": "",                                                          /
↪/ API url
//         "client_number": "",                                        // client␣
↪number, provided by SureTax
//         "validation_key": "",                                        // validation␣
↪key provided by SureTax
//         "business_unit": "",                                        // client's␣
↪Business Unit
//         "timezone": "Local",                                        // convert the␣
↪time of the events to this timezone before sending request out <UTC|Local|$IANA_TZ_
↪DB>
//         "include_local_cost": false,                          // sum local␣
↪calculated cost with tax one in final cost
//         "return_file_code": "0",                                 // default or␣
↪Quote purposes <0|Q>
//         "response_group": "03",                                    //␣
↪determines how taxes are grouped for the response <03|13>
//         "response_type": "D4",                                    //␣
↪determines the granularity of taxes and (optionally) the decimal precision for the␣
↪tax calculations and amounts in the response
//         "regulatory_code": "03",                                 // provider type
//         "client_tracking": "~*req.CGRID",                 // template extracting␣
↪client information out of StoredCdr; <RSRParsers>
//         "customer_number": "~*req.Subject",                 // template extracting␣
↪customer number out of StoredCdr; <RSRParsers>
//         "orig_number":  "~*req.Subject",                 // template extracting␣
↪origination number out of StoredCdr; <RSRParsers>
//         "term_number": "~*req.Destination",                 // template extracting␣
↪termination number out of StoredCdr; <RSRParsers>
//         "bill_to_number": "",                                    // template␣
↪extracting billed to number out of StoredCdr; <RSRParsers>
//         "zipcode": "",                                                 //␣
↪template extracting billing zip code out of StoredCdr; <RSRParsers>
//         "plus4": "",                                                 //␣
↪template extracting billing zip code extension out of StoredCdr; <RSRParsers>
//         "p2pzipcode": "",                                          //␣
↪template extracting secondary zip code out of StoredCdr; <RSRParsers>
//         "p2pplus4": "",                                              //␣
↪template extracting secondary zip code extension out of StoredCdr; <RSRParsers>
//         "units": "1",                                                //␣
↪template extracting number of "lines" or unique charges contained within the␣
↪revenue out of StoredCdr; <RSRParsers>
//         "unit_type": "00",                                          //␣
↪template extracting number of unique access lines out of StoredCdr; <RSRParsers>
//         "tax_included": "0",                                        // template␣
↪extracting tax included in revenue out of StoredCdr; <RSRParsers>
//         "tax_situs_rule": "04",                                      // template␣
↪extracting tax situs rule out of StoredCdr; <RSRParsers>
//         "trans_type_code": "010101",                          // template extracting␣
↪transaction type indicator out of StoredCdr; <RSRParsers>
//         "sales_type_code": "R",                                      // template␣
↪extracting sales type code out of StoredCdr; <RSRParsers>
//         "tax_exemption_code_list": "",                        // template␣
↪extracting tax exemption code list out of StoredCdr; <RSRParsers>
```

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```
// },


// "loader":
↪{                                                                    // loader␣
↪for tariff plans out of .csv files
//         "tpid": "",
↪                                                                  // tariff plan␣
↪identificator
//         "data_path": "./",                                              // path␣
↪towards tariff plan files
//         "disable_reverse": false,                                 // disable␣
↪reverse computing
//         "field_separator": ",",                                        //␣
↪separator used in case of csv files
//         "caches_conns":["*localhost"],
//         "scheduler_conns": ["*localhost"],
// },


// "migrator": {
//         "out_datadb_type": "redis",
//         "out_datadb_host": "127.0.0.1",
//         "out_datadb_port": "6379",
//         "out_datadb_name": "10",
//         "out_datadb_user": "cgrates",
//         "out_datadb_password": "",
//         "out_datadb_encoding" : "msgpack",
//         "out_stordb_type": "mysql",
//         "out_stordb_host": "127.0.0.1",
//         "out_stordb_port": "3306",
//         "out_stordb_name": "cgrates",
//         "out_stordb_user": "cgrates",
//         "out_stordb_password": "",
//         "users_filters":[],
// },


// "dispatchers":{                                                                //␣
↪DispatcherS config
//         "enabled": false,                                          // starts␣
↪DispatcherS service: <true|false>.
//         "indexed_selects":true,                                   // enable␣
↪profile matching exclusively on indexes
//         //"string_indexed_fields": [],                        // query indexes␣
↪based on these fields for faster processing
//         "prefix_indexed_fields": [],                       // query indexes based␣
↪on these fields for faster processing
//         "nested_fields": false,                                        //␣
↪determines which field is checked when matching indexed filters(true: all; false:␣
↪only the one on the first level)
//         "attributes_conns": [],                                        //␣
↪connections to AttributeS for API authorization, empty to disable auth␣
↪functionality: <""|*internal|x.y.z.y:1234>
// },


```

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```
// "analyzers":{                                                                    //␣
↪AnalyzerS config
//          "enabled":false                                                          //␣
↪starts AnalyzerS service: <true|false>.
// },


// "apiers": {
//          "enabled": false,
//          "caches_conns":["*internal"],
//          "scheduler_conns": [],                                                  //␣
↪connections to SchedulerS for reloads
//          "attributes_conns": [],                                                 //␣
↪connections to AttributeS for CDRExporter
// },

}
```

CHAPTER 5

5. Administration

The general steps to get CGRateS operational are:

1. Create CSV files containing the initial data for CGRateS.
2. Load the data in the databases using the Loader application.
3. Start a Rater.
4. Start the SessionManager talking to your VoIP Switch or directly make API calls to the Rater.
5. Make API calls to the Rater or just let the SessionManager do the work.

CHAPTER 6

6. Advanced Topics

6.1 API Calls

API calls are documented in the following GoDoc

6.2 CDR Server

An important component of every rating system is represented by the CDR Server. CGRateS includes an out of the box CDR Server component, controlable in the configuration file and supporting multiple interfaces for CDR feeds. This component makes the CDRs real-time accessible (influenced by the time of receiving them) to CGRateS subsystems.

Following interfaces are supported:

6.2.1 CDR-CGR

Available as handler within http server.

To feed CDRs in via this interface, one must use url of the form: <http://\protect\T1\textdollarip_configured:\protect\T1\textdollarport_configured/cdr_http>.

The CDR fields are received via http form (although for simplicity we support inserting them within query parameters as well) and are expected to be urlencoded in order to transport special characters reliably. All fields are expected by CGRateS as string, particular conversions being done on processing each CDR. The fields received are split into two different categories based on CGRateS interest in them:

Primary fields: the fields which CGRateS needs for it's own operations and are stored into cdrs_primary table of storDb.

- ToR: type of record, meta-field, should map to one of the TORs hardcoded inside the server <*voice|*data|*sms>
- OriginID: represents the unique accounting id given by the telecom switch generating the CDR
- OrderID: Stor order id used as export order id

- OriginHost: represents the IP address of the host generating the CDR (automatically populated by the server)
- Source: formally identifies the source of the CDR (free form field)
- RequestType: matching the supported request types by the **CGRateS**, accepted values are hardcoded in the server <prepaid|postpaid|pseudoprepaid|rated>.
- Category: free-form filter for this record, matching the category defined in rating profiles.
- Tenant: tenant whom this record belongs
- Account: account id (accounting subsystem) the record should be attached to
- Subject: rating subject (rating subsystem) this record should be attached to
- Destination: destination to be charged
- SetupTime: set-up time of the event. Supported formats: datetime RFC3339 compatible, SQL datetime (eg: MySQL), unix timestamp.
- AnswerTime: answer time of the event. Supported formats: datetime RFC3339 compatible, SQL datetime (eg: MySQL), unix timestamp.
- Usage: event usage information (eg: in case of tor=*voice this will represent the total duration of a call)
- CostSource: The source of this cost
- Rated: Mark the CDR as rated so we do not process it during rating

Extra fields: any field coming in via the http request and not a member of primary fields list. These fields are stored as json encoded into *cdrs_extra* table of storDb.

Example of sample CDR generated simply using curl:

```
curl --data "ToR=*voice \
 &Source=curl_cdr \
 &OrderID=abcde \
 &OriginHost=192.168.1.2 \
 &Source=sbc1 \
 &OriginID=qwerty3234567 \
 &ToR=*voice \
 &RequestType=*raw \
 &Tenant=192.168.56.66 \
 &Category=call \
 &Account=1004 \
 &Subject=1004 \
 &Destination=%2B4986517174963 \
 &SetupTime=2018-05-21T12:32:50Z \
 &AnswerTime=2018-05-21T12:32:56Z \
 &Usage=306 \
 &CostSource=*cdrs" http://127.0.0.1:2080/cdr_http
```

6.2.2 CDR-FS_JSON

Available as handler within http server, it implements the mechanism to store CDRs received from FreeSWITCH mod_json_cdr.

This interface is available at url: <http://\protect\T1\textdollarip_configured:\protect\T1\textdollarport_configured/freeswitch_json>.

This handler has a different implementation logic than the previous CDR-CGR, filtering fields received in the CDR from FreeSWITCH based on predefined configuration. The mechanism of extracting CDR information out of JSON encoded CDR received from FreeSWITCH is the following:

- When receiving the CDR from FreeSWITCH, CGRateS will extract the content of ''variables" object.
- **Content of the ''variables" will be filtered out and the following information will be stored into an internal CDR object:**
  - **Fields used by CGRateS in primary mediation, known as primary fields. These are:**
    - uuid: internally generated uuid by FreeSWITCH for the call
    - sip_local_network_addr: IP address of the FreeSWITCH box generating the CDR
    - sip_call_id: call id out of SIP protocol
    - cgr_reqtype: request type as understood by the CGRateS
    - cgr_category: call category (optional)
    - cgr_tenant: tenant this call belongs to (optional)
    - cgr_account: account id in CGRateS (optional)
    - cgr_subject: rating subject in CGRateS (optional)
    - cgr_destination: destination being rated (optional)
    - user_name: username as seen by FreeSWITCH (considered if cgr_subject or cgr_account not present)
    - dialed_extension: destination number considered if cgr_destination is missing
  - Fields stored at request in cdr_extra and definable in configuration file under *extra_fields*.
- Once the content will be filtered, the real CDR object will be processed, stored into storDb under *cdrs_primary* and *cdrs_extra* tables and, if configured, it will be passed further for mediation.

6.2.3 CDR-RPC

Available as RPC handler on top of CGR APIs exposed (in-process as well as GOB-RPC and JSON-RPC). This interface is used for example by CGR-SM component capturing the CDRs over event interface (eg: OpenSIPS or FreeSWITCH-ZeroConfig scenario)

The RPC function signature looks like this:

```
CDRSV1.ProcessCdr(cdr *utils.StoredCdr, reply *string) error
```

The simplified StoredCdr object is represented by following:

```
type StoredCdr struct {
  CgrId          string
  OrderId        int64             // Stor order id used as export order id
  ToR            string            // type of record, meta-field, should map to one␣
↪of the TORs hardcoded inside the server <*voice|*data|*sms>
  AccId          string            // represents the unique accounting id given by␣
↪the telecom switch generating the CDR
  CdrHost        string            // represents the IP address of the host␣
↪generating the CDR (automatically populated by the server)
  CdrSource      string            // formally identifies the source of the CDR (free␣
↪form field)
```

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```
  ReqType         string            // matching the supported request types by the␣
↪**CGRateS**, accepted values are hardcoded in the server
↪<prepaid|postpaid|pseudoprepaid|rated>.
  Direction       string            // matching the supported direction identifiers of␣
↪the CGRateS <*out>
  Tenant          string            // tenant whom this record belongs
  Category        string            // free-form filter for this record, matching the␣
↪category defined in rating profiles.
  Account         string            // account id (accounting subsystem) the record␣
↪should be attached to
  Subject         string            // rating subject (rating subsystem) this record␣
↪should be attached to
  Destination     string            // destination to be charged
  SetupTime       time.Time         // set-up time of the event. Supported formats:␣
↪datetime RFC3339 compatible, SQL datetime (eg: MySQL), unix timestamp.
  AnswerTime      time.Time         // answer time of the event. Supported formats:␣
↪datetime RFC3339 compatible, SQL datetime (eg: MySQL), unix timestamp.
  Usage           time.Duration     // event usage information (eg: in case of␣
↪tor=*voice this will represent the total duration of a call)
  ExtraFields     map[string]string // Extra fields to be stored in CDR
}
```

6.3 CDR Client (cdrc)

It's role is to gather offline CDRs and post them to CDR Server(CDRS) component.

Part of the *cgr-engine*, can be started on a remote server as standalone component.

Controlled within *cdrc* section of the configuration file.

Has two modes of operation:

- Automated: CDR file processing is triggered on file creation/move.
- Periodic: CDR file processing will be triggered at configured time interval (delay/sleep between processes) and it will be performed on all files present in the folder (IN) at run time.

Principles behind functionality:

- Monitor/process a CDR folder (IN) as outlined above.
- For every file processed, extract the information based on configuration and post it via configured mechanism to CDRS.
- The fields extracted out of each CDR row are the same ones depicted in the CDRS documentation (following primary and extra fields concept).
- Once the file processing completes, move it in it's original format in another folder (OUT) in order to avoid re-processing. Here it's worth mentioning the auto-detection of duplicated CDRs at server side based on accid and host fields.
- Advanced configuration like forking a number of simultaneous client instances monitoring different folders possible through the use of *.xml* configuration.

6.3.1 Import Templates

To specifiy custom imports (for various sources) one can specify *Import Templates*. These are definable within both *.cfg* as well as *.xml* advanced configuration files. For increased flexibility the Import Template can be defined using CGR-RSR fields capturing both ReGexp as well as static rules. The static values will be way faster in processing but limited in functionality.

6.3.1.1 CGR-RSR Regexp Rule

Format:

```
~path:s/regexp_search_and_capture_rule/output_teplate/
```

Example of usage:

```
Input CDR field:
       {
       "account": "First-Account123"
       }
Capture Rule:
       ~account:s/^*+(Account123)$/$1-processed/
Result after processing:
       {
       "account": "Account123-processed"
       }
```

6.3.1.2 CGR-RSR Static Rule

Format:

```
^path:static_value
```

Example of usage:

Input CDR field:

{ “account”: “First-Account123” }

Capture Rule: ^account:MasterAccount

Result after processing: { “account”: “MasterAccount” }

CDR Formats supported:

6.3.2 CDR .CSV

Most widely used format by Telecom Switches.

Light to read and generic to process. CDRC should be able to process in this way any .csv CDR, independent of the Telecom Switch generating them. Incompatibilities here can come out of answer time and duration formats which can vary between CDR writer implementations. As answer time we support a number of formats already - rfc3339, SQL/MySQL, unix timestamp. As duration we support nanoseconds granularity in our code. Time unit can be specified (eg: ms, s, m, h), or if missing, will default to nanoseconds.

In case of *.csv* files the Import Template will contain indexes for the possition where primary fields are located (0 representing the first field) and fieldname/position format for extra fields which need

not only to be extracted by row index but also to be named since .csv format does not save field names/labels. CDRC uses the following convention for extra fields in the configuration: *<label_extrafield_1>:<index_extrafield_1>[...,<label_extrafield_n>:<index_extrafield_n>]...*.

6.4 CDR Exporter

Component to retrieve rated CDRs from internal CDRs database.

Although nowadays it is custom to read a storage/database with tools, we do not recommend doing it so due to possibility that reads can slow down complete rating system. For this purpose we have created exporter plugins which are meant to work in tight relationship with CGRateS internal components in order to best optimize performance and avoid system locks.

6.4.1 Export Templates

For advanced needs CGRateS Export Templates are configurable via *.cfg*, *.xml* as well as directly within RPC call requesting the export to be performed. Inside each Export Template one can either specify simple CDR field ids or use CGR-RSR fields capturing both Regexp as well as static rules.

6.4.1.1 CGR-RSR Regexp Rule

Format:

```
~path:s/regexp_search_and_capture_rule/output_teplate/
```

Example of usage:

```
Input CDR field:
  {
  "account": "First-Account123"
  }
Capture Rule:
  ~account:s/^*+(Account123)$/$1-processed/
Result after processing:
  {
  "account": "Account123-processed"
  }
```

6.4.1.2 CGR-RSR Static Rule

Format:

```
^path:static_value
```

Example of usage:

Input CDR field:

{ “account”: “First-Account123” }

Capture Rule: ^account:MasterAccount

Result after processing: { “account”: “MasterAccount” }

Export interfaces implemented:

6.4.2 CGR-CSV

Simplest way to export CDRs in a format internally defined (with parts like *CDRExtraFields* configurable in main configuration file).

Principles behind exports:

- Exports are to be manually requested (although automated is planned for the future through the used of built-in scheduled actions) via exposed JSON-RPC api. Example of api call from python call provided as sample script:

```
rpc.call("APIerSv1.ExportCsvCdrs",{"TimeStart":"1383823746","TimeEnd":
↪"1383833746"} )
```

- On each export call there will be a .csv format file generated using configured separator. Location of the export folder is definable inside *cgrates.cfg*.
- File name of the export will appear like: *cdrs_$(timestamp).csv* where $(timestamp) will be replaced by unix timestamp of the server running the export process or requested via API call.
- Each exported file will have as content all the CDRs inside time interval defined in the API call. Both TimeStart and TimeEnd are optional, hence being able to obtain a full export of the available CDRs with one API call.
- To be noted here that CGRateS does not keep anywhere a history of exports, hence it is the responsibility of the system administrator to make sure that his exports are not doubled.
- If not otherwise defined, each line within the exported file will follow an internally predefined template:

cgrid,mediation_runid,tor,accid,reqtype,direction,tenant,category,account,subject,destination,setup_time,answer_time,usage,co

```
$(cgrid),$(mediation_runid),$(tor),$(accid),$(reqtype),$(direction),$(direction),
↪$(tenant),$(category),$(account),$(subject),$(destination),$(setup_time),
↪$(answer_time),$(usage),$(cost)
```

The significance of the fields exported:

- tor: type of record, meta-field, should map to one of the TORs hardcoded inside the server <*voice|*data|*sms>
- accid: represents the unique accounting id given by the telecom switch generating the CDR
- cdrhost: represents the IP address of the host generating the CDR (automatically populated by the server)
- cdrsource: formally identifies the source of the CDR (free form field)
- reqtype: matching the supported request types by the **CGRateS**, accepted values are hardcoded in the server <prepaid|postpaid|pseudoprepaid|rated>.
- direction: matching the supported direction identifiers of the CGRateS <*out>
- tenant: tenant whom this record belongs
- category: free-form filter for this record, matching the category defined in rating profiles.
- account: account id (accounting subsystem) the record should be attached to
- subject: rating subject (rating subsystem) this record should be attached to
- destination: destination to be charged

- setup_time: set-up time of the event. Supported formats: datetime RFC3339 compatible, SQL datetime (eg: MySQL), unix timestamp.
- answer_time: answer time of the event. Supported formats: datetime RFC3339 compatible, SQL datetime (eg: MySQL), unix timestamp.
- usage: event usage information (eg: in case of tor=*voice this will represent the total duration of a call)
- **extra_cdr_fields:**
  - selected list of cdr_extra fields via *cgrates.cfg* configuration or
  - alphabetical order of the cdr extra fields stored in cdr_extra table

Sample CDR export file content which was made available at path: */var/log/cgrates/cdr/out/cgr/csv/cdrs_1384104724.csv*

```
dbafe9c8614c785a65aabd116dd3959c3c56f7f6,default,*voice,dsafdsaf,rated,*out,cgrates.
↪org,call,1001,1001,1002,2013-11-07T08:42:25Z,2013-11-07T08:42:26Z,10000000000,1.0100
```

6.4.3 CGR-FWV

Fixed width form of export CDR. Advanced template configuration available via *.xml* configuration file.

6.4.4 Hybrid CSV-FWV

For advanced needs **CGRateS** supports exporting the CDRs as combination between *.csv* and *.fwv* formats.

6.5 CDR Stats Server

Collects CDRs from various sources (eg: CGR-CDRS, CGR-Mediator, CGR-SM, third-party CDR source via RPC) and builds real-time stats based on them. Each StatsQueue has attached *ActionTriggers* with monitoring and actions capabilities.

Principles of functionality:

- Standalone component (can be started individually on remote hardware, isolated form other CGRateS compoenents).
- Performance oriented. Should be able to process tens of thousands of CDRs per second.
- Cache driven technology. But SaveInterval can be set to store this information on redis.
- Stats are build within *StatsQueues* a CDR Stats Server being able to support unlimited number of StatsQueues. Each CDR will be passed to all of StatsQueues available and will be processed by individual StatsQueue based on configuration.
- Stats will be build inside Metrics (eg: ASR, ACD, ACC, TCC) and attached to specific StatsQueue.
- Each StatsQueue will have attached one *ActionTriggers* profile which will monitor Metrics values and react on thresholds reached (unlimited number of thresholds and reactions configurable).
- CDRs are processed by StatsQueues if they pass CDR field filters.
- CDRs are auto-removed from StatsQueues in a *fifo* manner if the QueueLength is reached or if they do not longer fit within TimeWindow defined.

6.5.1 Configuration

Individual StatsQueue configurations are loaded inside TariffPlan defitions, one configuration object is internally represented as:

```
type CdrStats struct {
    Id                string          // Config id, unique per config instance
    QueueLength       int             // Number of items in the stats buffer
    TimeWindow        time.Duration   // Will only keep the CDRs who's call setup␣
↪time is not older than time.Now()-TimeWindow
    SaveInterval      time.Duration   // Interval to store the info into database
    Metrics           []string        // ASR, ACD, ACC, TCC, TCD, PDD
    SetupInterval     []time.Time     // CDRFieldFilter on SetupInterval, 2 or less␣
↪items (>= start interval,< stop_interval)
    ToR               []string        // CDRFieldFilter on TORs
    CdrHost           []string        // CDRFieldFilter on CdrHosts
    CdrSource         []string        // CDRFieldFilter on CdrSources
    ReqType           []string        // CDRFieldFilter on ReqTypes
    Direction         []string        // CDRFieldFilter on Directions
    Tenant            []string        // CDRFieldFilter on Tenants
    Category          []string        // CDRFieldFilter on Categories
    Account           []string        // CDRFieldFilter on Accounts
    Subject           []string        // CDRFieldFilter on Subjects
    DestinationPrefix []string        // CDRFieldFilter on DestinationPrefixes
    UsageInterval     []time.Duration // CDRFieldFilter on UsageInterval, 2 or less␣
↪items (>= Usage, <Usage)
    PddInterval       []time.Duration // CDRFieldFilter on PddInterval, 2 or less␣
↪items (>= Pdd, <Pdd)
    Supplier          []string        // CDRFieldFilter on Suppliers
    DisconnectCause   []string        // Filter on DisconnectCause
    MediationRunIds   []string        // CDRFieldFilter on MediationRunIds
    RatedAccount      []string        // CDRFieldFilter on RatedAccounts
    RatedSubject      []string        // CDRFieldFilter on RatedSubjects
    CostInterval      []float64       // CDRFieldFilter on CostInterval, 2 or less␣
↪items, (>=Cost, <Cost)
    Triggers          ActionTriggerPriotityList
}
```

6.5.2 Metrics Types

- ACC *(Average Call Cost)*: Queue with the average call cost
- ACD *(Average Call Duration)*: Queue with the average call duration
- ASR *(Answer-Seizure Ratio)*: Queue with the answer ratio
- PDD *(Post Dial Delay)*: Queue with the average Post Dial Delay in seconds
- TCC *(Total Call Cost)*: Queue with the Total cost for the time frame.
- TCD *(Total Call Duration)*: Queue with the total call duration for the

time frame

6.5.3 ExternalQueries

The Metrics calculated are available to be real-time queried via RPC methods.

To facilitate interaction there are four commands built in the provided *cgr-console* tool:

- *cdrstats_queueids*: returns the queue ids processing CDR Stats.
- *cdrstats_metrics*: returns metrics calculated within specific CDRStatsQueue.
- *cdrstats_reload*: reloads the CdrStats configurations out of DataDb.
- *cdrstats_reset*: resets calculated metrics for one specific or all StatsQueues.

6.5.4 Example use

When you work with balance maybe you want to keep a eye in your users, so you can add a new queue for the last 5 hours to check that your customer it's not hacked, this is an example:

CDR stats:

```
"result":{
    "CdrStats": [
      {
        "Accounts": "my_account",
        "ActionTriggers": "FRAUD_CHECK",
        "Categories": "",
        "CdrHosts": "",
        "CdrSources": "",
        "CostInterval": "",
        "DestinationPrefixes": "",
        "Directions": "",
        "DisconnectCauses": "",
        "MediationRunIds": "",
        "Metrics": "TCC",
        "PddInterval": "",
        "QueueLength": "0",
        "RatedAccounts": "",
        "RatedSubjects": "",
        "ReqTypes": "",
        "SaveInterval": "15s",
        "SetupInterval": "",
        "Subjects": "",
        "Suppliers": "",
        "TORs": "",
        "Tenants": "foehn",
        "TimeWindow": "5h",
        "UsageInterval": ""
      }
    ],
    "CdrStatsId": "FRAUD_ACCOUNT",
    "TPid": "test"
  }
```

Action Trigger:

```
"result": {
    "ActionTriggers": [
      {
        "ActionsId": "LOG_WARNING",
        "BalanceCategory": "",
        "BalanceDestinationIds": "",
```

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```
        "BalanceDirection": "",
        "BalanceExpirationDate": "",
        "BalanceId": "",
        "BalanceRatingSubject": "",
        "BalanceSharedGroup": "",
        "BalanceTimingTags": "",
        "BalanceType": "",
        "BalanceWeight": 0,
        "Id": "",
        "MinQueuedItems": 0,
        "MinSleep": "3h",
        "Recurrent": true,
        "ThresholdType": "\\*max_tcc",
        "ThresholdValue": 150,
        "Weight": 10
      }
    ],
    "ActionTriggersId": "FRAUD_CHECK",
    "TPid": "test"
  }
```

Using *cgr-console* you can check the status of the queue anytime:

```
cgr-console 'cdrstats_metrics StatsQueueId="FRAUD_ACCOUNT"'
```

6.6 DerivedCharging

DerivedCharging is the process of forking original request into a number (configured) of emulated ones, derived from the original parameters. This mechanism used in combination with multi-tenancy supported by default by **CGRateS** can give out complex charging scenarios, needed for example in case of whitelabel-ing.

DerivedCharging occurs in two separate places:

- SessionManager: necessary to handle each derived (emulated) session in it's individuall loop (eg: individual resellers will have their own charging policies implemented, some paying per minute, others per second and so on) and keep them in sync (eg: one reseller is left out of money, original call should be disconnected and all emulated sessions should end their debit loops).
- Mediator: necessary to fork the CDRs into a number of derived ones influenced by the derived charging configuration and rate them individually.

6.6.1 Configuration

DerivedCharging is configured in two places:

- Platform level configured within *cgrates.cfg* file.
- Account level configured as part of TarrifPlans defition or interactively via RPC methods.

One DerivedCharger object will be configured by an internal object like:

```
type DerivedCharger struct {
       RunId               string      // Unique runId in the chain
       RunFilters          string      // Only run the charger if all the filters␣
↪match
```

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```
        ReqTypeField         string      // Field containing request type info, number␣
↪in case of csv source, '^' as prefix in case of static values
        DirectionField       string      // Field containing direction info
        TenantField          string      // Field containing tenant info
        CategoryField        string      // Field containing tor info
        AccountField         string      // Field containing account information
        SubjectField         string      // Field containing subject information
        DestinationField     string      // Field containing destination information
        SetupTimeField       string      // Field containing setup time information
        AnswerTimeField      string      // Field containing answer time information
        UsageField           string      // Field containing usage information
}
```

CGRateS is able to attach an unlimited number of DerivedChargers to a single request, based on configuration.

6.7 Rating logic

Let's start with the most important function: finding the cost of a certain call.

The call information comes to CGRateS having the following vital information like subject, destination, start time and end time. The engine will look up the database for the rates applicable to the received subject and destination.

```
type CallDescriptor struct {
        Direction
        ToR
        Tenant, Subject, Account, Destination
        TimeStart, TimeEnd
        LoopIndex       // indicates the position of this segment in a cost request␣
↪loop
        CallDuration    // the call duration so far (partial or final)
        FallbackSubject // the subject to check for destination if not found on␣
↪primary subject
        RatingPlans
}
```

When the session manager receives a call start event it will first check if the call is prepaid or postpaid. If the call is postpaid than the cost will be determined only once at the end of the call but if the call is prepaid there will be a debit operation every X seconds (X is configurable).

In prepaid case the rating engine will have to set rates for multiple parts of the call so the *LoopIndex* in the above structure will help the engine add the connect fee only to the first part. The *CallDuration* attribute is used to set the right rate in case the rates database has different costs for the different parts of a call e.g. first minute is more expensive (we can also define the minimum rate unit).

The **FallbackSubject** is used in case the initial call subject is not found in the rating profiles list (more on this later in this chapter).

What are the activation periods?

> At one given time there is a set of prices that applay to different time intervals when a call can be made. In CGRateS one can define multiple such sets that will become active in various point of time called activation time. The activation period is a structure describing different prices for a call on different intervals of time. This structure has an activation time, which specifies the active prices for a period of time by one ore more (usually more than one) rate intervals.

```
type RateInterval struct {
       Years
       Months
       MonthDays
       WeekDays
       StartTime, EndTime
       Weight, ConnectFee
       Prices
       RoundingMethod
       RoundingDecimals
}

type Price struct {
       GroupIntervalStart
       Value
       RateIncrement
       RateUnit
}
```

An **RateInterval** specifies the Month, the MonthDay, the WeekDays, the StartTime and the EndTime when the RateInterval's price profile is in effect.

> **Example** The RateInterval {"Month": [1], "WeekDays":[1,2,3,4,5], "StartTime":"18:00:00"} specifies the *Price* for the first month of each year from Monday to Friday starting 18:00. Most structure elements are optional and they can be combined in any way it makes sense. If an element is omitted it means it is zero or any.

The *ConnectFee* specifies the connection price for the call if this interval is the first one of the call.

The *Weight* will establish which interval will set the price for a call segment if more then one applies to it.

> **Example** Let's assume there is an interval defining price for the weekdays and another interval that defines a special holiday rates. As that holiday is also one of the regular weekdays than both intervals are applicable to a call made on that day so the interval with the smaller Weight will give the price for the call in question. If both intervals have the same Weight than the interval with the smaller price wins. It is, however, a good practice to set the Weight for the defined intervals.

The *RoundingMethod* and the *RoundingDecimals* will adjust the price using the specified function and number of decimals (more on this in the rates definition chapter).

The **Price** structure defines the start (*GroupIntervalStart*) of a section of a call with a specified rate *Value* per *RateUnit* diving and rounding the section in *RateIncrement* subsections.

So when there is a need to define new sets of prices just define new RatingPlans with the activation time set to the moment when it becomes active.

Let's get back to the engine. When a GetCost or Debit call comes to the engine it will try to match the best rating profile for the given *Direction*, *Tenant*, *ToR* and *Subject* using the longest *Subject* prefix method or using the *FallbackSubject* if not found. The rating profile contains the activation periods that might apply to the call in question.

At this point in rating process the engine will start splitting the call into various time spans using the following criterias:

1. Minute Balances: first it will handle the call information to the originator user acount to be split by available minute balances. If the user has free or special price minutes for the call destination they will be consumed by the call.
2. Activation periods: if there were not enough special price minutes available than the engine will check if the call spans over multiple activation periods (the call starts in initial rates period and continues in another).
3. RateIntervals: for each activation period that apply to the call the engine will select the best rate intervals that apply.

```
type TimeSpan struct {
       TimeStart, TimeEnd
       Cost
       RatingPlan
       RateInterval
       MinuteInfo
       CallDuration  // the call duration so far till TimeEnd
}
```

The result of this splitting will be a list of *TimeSpan* structures each having attached the MinuteInfo or the RateInterval that gave the price for it. The *CallDuration* attribute will select the right *Price* from the *RateInterval Prices* list. The final cost for the call will be the sum of the prices of these times spans plus the *ConnectionFee* from the first time span of the call.

6.7.1 User balances

The user account contains a map of various balances like money, sms, internet traffic, internet time, etc. Each of these lists contains one or more Balance structure that have a wheight and a possible expiration date.

```
type UserBalance struct {
       Type           // prepaid-postpaid
       BalanceMap
       UnitCounters
       ActionTriggers
}

type Balance struct {
       Value
       ExpirationDate
       Weight
}
```

CGRateS treats special priced or free minutes different from the rest of balances. They will be called free minutes further on but they can have a special price.

The free minutes must be handled a little differently because usually they are grouped by specific destinations (e.g. national minutes, ore minutes in the same network). So they are grouped in balances and when a call is made the engine checks all applicable balances to consume minutes according to that call.

When a call cost needs to be debited these minute balances will be queried for call destination first. If the user has special minutes for the specific destination those minutes will be consumed according to call duration.

A standard debit operation consist of selecting a certaing balance type and taking all balances from that list in the weight order to be debited till the total amount is consumed.

CGRateS provide api for adding/substracting user's money credit. The prepaid and postpaid are uniformly treated except that the prepaid is checked to be always greater than zero and the postpaid can go bellow zero.

Both prepaid and postpaid can have a limited number of free SMS and Internet traffic per month and this budget is replenished at regular intervals based on the user tariff plan or as the user buys more free SMSs (for example).

Another special feature allows user to get a better price as the call volume increases each month. This can be added on one ore more thresholds so the more he/she talks the cheaper the calls.

Finally bonuses can be rewarded to users who received a certain volume of calls.

CHAPTER 7

7. Tutorials

7.1 Asterisk Integration Tutorials

In these tutorials we exemplify a few cases of integration between Asterisk and CGRateS. We start with common steps, installation and postinstall processes, then we dive into particular configurations, depending on the case we run.

7.1.1 Software installation

We have chosen Debian Jessie as operating system.

7.1.1.1 CGRateS

CGRateS can be installed using the instructions found *here*.

7.1.1.2 Asterisk

We got Asterisk14 installed via following commands:

```
apt-get install autoconf build-essential openssl libssl-dev libsrtp-dev libxml2-dev␣
↪libncurses5-dev uuid-dev sqlite3 libsqlite3-dev pkg-config libedit-dev
cd /tmp
wget --no-check-certificate https://raw.githubusercontent.com/asterisk/third-party/
↪master/pjproject/2.7.2/pjproject-2.7.2.tar.bz2
wget --no-check-certificate https://raw.githubusercontent.com/asterisk/third-party/
↪master/jansson/2.11/jansson-2.11.tar.bz2
wget http://downloads.asterisk.org/pub/telephony/asterisk/asterisk-16-current.tar.gz
tar xzvf asterisk-16-current.tar.gz
cd asterisk-16.1.0/
./configure --with-jansson-bundled
make
```

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```
make install
adduser --quiet --system --group --disabled-password --shell /bin/false --gecos
↪"Asterisk" asterisk || true
```

Once installed we proceed with loading the configuration out of specific tutorial cases bellow.

7.1.2 SIP UA - Jitsi

On our ubuntu desktop host, we have installed Jitsi to be used as SIP UA, out of stable provided packages on Jitsi download and had Jitsi configured with 4 accounts: 1001/CGRateS.org, 1002/CGRateS.org, 1003/CGRateS.org and 1004/CGRateS.org.

7.1.3 Asterisk interaction via *ARI*

7.1.3.1 Scenario

- Asterisk out of *basic-pbx* configuration samples.
- Considering the following users: 1001-prepaid, 1002-postpaid, 1003-pseudoprepaid, 1004-rated, 1007-rated.
- **CGRateS** with following components:
- CGR-SM started as translator between Asterisk and **CGR-RALs** for both authorization events (prepaid/pseudoprepaid) as well as postpaid ones.
- CGR-CDRS component processing raw CDRs from CGR-SM component and storing them inside CGR StorDB.
- CGR-CDRE exporting rated CDRs from CGR StorDB (export path: */tmp*).
- CGR-History component keeping the archive of the rates modifications (path browsable with git client at */tmp/cgr_history*).

7.1.3.2 Starting Asterisk with custom configuration

```
/usr/share/cgrates/tutorials/asterisk_ari/asterisk/etc/init.d/asterisk start
```

To verify that Asterisk is running we run the console command:

```
asterisk -r -s /tmp/cgr_asterisk_ari/asterisk/run/asterisk.ctl

  ari show status
```

7.1.3.3 Starting CGRateS with custom configuration

```
/usr/share/cgrates/tutorials/asterisk_ari/cgrates/etc/init.d/cgrates start
```

Make sure that cgrates is running

```
cgr-console status
```

7.1.3.4 CDR processing

At the end of each call Asterisk will generate an CDR event and due to automatic handler registration built in **CGRateS-SM** component, this will be directed towards the port configured inside *cgrates.json*. This event will reach inside **CGRateS** through the *SM* component (close to real-time). Once in-there it will be instantly rated and be ready for export.

7.1.3.5 CGRateS Usage

Since it is common to most of the tutorials, the example for **CGRateS** usage is provided in a separate page here

7.1.4 CGRateS Usage

7.1.4.1 Loading CGRateS Tariff Plans

Before proceeding to this step, you should have **CGRateS** installed and started with custom configuration, depending on the tutorial you have followed.

For our tutorial we load again prepared data out of shared folder, containing following rules:

- Create the necessary timings (always, asap, peak, offpeak).
- Configure 3 destinations (1002, 1003 and 10 used as catch all rule).
- As rating we configure the following:
- Rate id: *RT_10CNT* with connect fee of 20cents, 10cents per minute for the first 60s in 60s increments followed by 5cents per minute in 1s increments.
- Rate id: *RT_20CNT* with connect fee of 40cents, 20cents per minute for the first 60s in 60s increments, followed by 10 cents per minute charged in 1s increments.
- Rate id: *RT_40CNT* with connect fee of 80cents, 40cents per minute for the first 60s in 60s increments, follwed by 20cents per minute charged in 10s increments.
- Rate id: *RT_1CNT* having no connect fee and a rate of 1 cent per minute, chargeable in 1 minute increments.
- Rate id: *RT_1CNT_PER_SEC* having no connect fee and a rate of 1 cent per second, chargeable in 1 second increments.
- Accounting part will have following configured:
- Create 3 accounts: 1001, 1002, 1003.
- 1001, 1002 will receive 10units of **monetary* balance.

```
cgr-loader -verbose -path=/usr/share/cgrates/tariffplans/tutorial
```

To verify that all actions successfully performed, we use following *cgr-console* commands:

- Make sure all our balances were topped-up:

```
cgr-console 'accounts Tenant="cgrates.org" AccountIds=["1001"]'
cgr-console 'accounts Tenant="cgrates.org" AccountIds=["1002"]'
```

- Query call costs so we can see our calls will have expected costs (final cost will result as sum of *ConnectFee* and *Cost* fields):

```
cgr-console 'cost Category="call" Tenant="cgrates.org" Subject="1001"␣
↪Destination="1002" AnswerTime="2014-08-04T13:00:00Z" Usage="20s"'
cgr-console 'cost Category="call" Tenant="cgrates.org" Subject="1001"␣
↪Destination="1002" AnswerTime="2014-08-04T13:00:00Z" Usage="1m25s"'
cgr-console 'cost Category="call" Tenant="cgrates.org" Subject="1001"␣
↪Destination="1003" AnswerTime="2014-08-04T13:00:00Z" Usage="20s"'
```

7.1.4.2 Test calls

1001 -> 1002

Since the user 1001 is marked as *prepaid* inside the telecom switch, calling between 1001 and 1002 should generate pre-auth and prepaid debits which can be checked with *get_account* command integrated within *cgr-console* tool. Charging will be done based on time of day as described in the tariff plan definition above.

Note: An important particularity to note here is the ability of **CGRateS** SessionManager to refund units booked in advance (eg: if debit occurs every 10s and rate increments are set to 1s, the SessionManager will be smart enough to refund pre-booked credits for calls stoped in the middle of debit interval).

Check that 1001 balance is properly deducted, during the call, and moreover considering that general balance has priority over the shared one debits for this call should take place at first out of general balance.

```
cgr-console 'accounts Tenant="cgrates.org" AccountIds=["1001"]'
```

1002 -> 1001

The user 1002 is marked as *postpaid* inside the telecom switch hence his calls will be debited at the end of the call instead of during a call and his balance will be able to go on negative without influencing his new calls (no pre-auth).

To check that we had debits we use again console command, this time not during the call but at the end of it:

```
cgr-console 'accounts Tenant="cgrates.org" AccountIds=["1002"]'
```

1001 -> 1003

The user 1001 call user 1003 and after 12 seconds the call will be disconnected.

7.1.4.3 CDR Exporting

Once the CDRs are mediated, they are available to be exported. One can use available RPC APIs for that or directly call exports from console:

```
cgr-console 'cdrs_export CdrFormat="csv" ExportPath="/tmp"'
```

7.1.4.4 Fraud detection

Since we have configured some action triggers (more than 20 units of balance topped-up or less than 2 and more than 5 units spent on *FS_USERS* we should be notified over syslog when things like unexpected events happen (eg: fraud with more than 20 units topped-up). Most important is the monitor for 100 units topped-up which will also trigger an account disable together with killing it's calls if prepaid debits are used.

To verify this mechanism simply add some random units into one account's balance:

```
cgr-console 'balance_set Tenant="cgrates.org" Account="1003" Direction="*out" Value=23
↪'
tail -f /var/log/syslog -n 20

cgr-console 'balance_set Tenant="cgrates.org" Account="1001" Direction="*out"␣
↪Value=101'
tail -f /var/log/syslog -n 20
```

On the CDRs side we will be able to integrate CdrStats monitors as part of our Fraud Detection system (eg: the increase of average cost for 1001 and 1002 accounts will signal us abnormalities, hence we will be notified via syslog).

7.2 FreeSWITCH Integration Tutorials

In these tutorials we exemplify a few cases of integration between FreeSWITCH and **CGRateS**. We start with common steps, installation and postinstall processes, then we dive into particular configurations.

7.2.1 Software installation

As operating system we have chosen Debian Jessie, since all the software components we use provide packaging for it.

7.2.1.1 CGRateS

CGRateS can be installed using the instructions found *here*.

7.2.1.2 FreeSWITCH

More information regarding the installation of FreeSWITCH on Debian can be found on it's official installation wiki.

To get FreeSWITCH installed and configured, we have choosen the simplest method, out of *vanilla* packages, plus one individual module we need: *mod-json-cdr*.

We will install FreeSWITCH via following commands:

```
wget -O - http://files.freeswitch.org/repo/deb/freeswitch-1.6/key.gpg |apt-key add -
echo "deb http://files.freeswitch.org/repo/deb/freeswitch-1.6/ jessie main" > /etc/
↪apt/sources.list.d/freeswitch.list
apt-get update
apt-get install freeswitch-meta-vanilla freeswitch-mod-json-cdr libyuv-dev
```

Once installed, we will proceed with loading the configuration out of specific tutorial cases bellow.

7.2.2 FreeSWITCH generating *http-json* CDRs

7.2.2.1 Scenario

- FreeSWITCH with *vanilla* configuration adding *mod_json_cdr* for CDR generation.
- Modified following users (with configs in *etc/freeswitch/directory/default*): 1001-prepaid, 1002-postpaid, 1003-pseudoprepaid, 1004-rated, 1006-prepaid, 1007-rated.

- Have added inside default dialplan CGR own extensions just before routing towards users (*etc/freeswitch/dialplan/default.xml*).
- FreeSWITCH configured to generate default *http-json* CDRs.
- **CGRateS** with following components:
- CGR-SM started as prepaid controller, with debits taking place at 5s intervals.
- CGR-CDRS component receiving raw CDRs from FreeSWITCH, storing them and attaching costs inside CGR StorDB.
- CGR-CDRE exporting processed CDRs from CGR StorDB (export path: */tmp*).
- CGR-History component keeping the archive of the rates modifications (path browsable with git client at */tmp/cgr_history*).

7.2.2.2 Starting FreeSWITCH with custom configuration

```
/usr/share/cgrates/tutorials/fs_evsock/freeswitch/etc/init.d/freeswitch start
```

To verify that FreeSWITCH is running we run the console command:

```
fs_cli -x status
```

7.2.2.3 Starting CGRateS with custom configuration

```
/usr/share/cgrates/tutorials/fs_evsock/cgrates/etc/init.d/cgrates start
```

Check that cgrates is running

```
cgr-console status
```

7.2.2.4 CDR processing

At the end of each call FreeSWITCH will issue a http post with the CDR. This will reach inside **CGRateS** through the *CDRS* component (close to real-time). Once in-there it will be instantly rated and it is ready to be exported:

```
cgr-console 'cdrs_export CdrFormat="csv" ExportPath="/tmp"'
```

7.2.2.5 CGRateS Usage

Since it is common to most of the tutorials, the example for **CGRateS** usage is provided in a separate page here

7.3 Kamailio Integration Tutorials

In these tutorials we exemplify a few cases of integration between Kamailio and CGRateS. We start with common steps, installation and postinstall processes, then we dive into particular configurations, depending on the case we run.

7.3.1 Software installation

We have chosen Debian Jessie as operating system, since all the software components we use provide packaging for it.

7.3.1.1 CGRateS

CGRateS can be installed using the instructions found *here*.

7.3.1.2 Kamailio

We got Kamailio installed via following commands:

```
wget -O- http://deb.kamailio.org/kamailiodebkey.gpg | sudo apt-key add -
echo "deb http://deb.kamailio.org/kamailio52 stretch main" > /etc/apt/sources.list.d/
↪kamailio.list
apt-get update
apt-get install kamailio kamailio-extra-modules kamailio-json-modules
```

Once installed we proceed with loading the configuration out of specific tutorial cases bellow.

7.3.2 Kamailio interaction via *evapi* module

7.3.2.1 Scenario

- Kamailio default configuration modified for **CGRateS** interaction. For script maintainability and simplicity we have separated CGRateS specific routes in *kamailio-cgrates.cfg* file which is included in main *kamailio.cfg* via include directive.
- Considering the following users (with configs hardcoded in the *kamailio.cfg* configuration script and loaded in htable): 1001-prepaid, 1002-postpaid, 1003-pseudoprepaid, 1004-rated, 1005-rated, 1006-prepaid, 1007-prepaid.
- **CGRateS** with following components:
- CGR-SM started as translator between Kamailio and CGR-Rater for both authorization events as well as accounting ones.
- CGR-CDRS component processing raw CDRs from CGR-SM component and storing them inside CGR StorDB.
- CGR-CDRE exporting rated CDRs from CGR StorDB (export path: */tmp*).
- CGR-History component keeping the archive of the rates modifications (path browsable with git client at */tmp/cgr_history*).

7.3.2.2 Starting Kamailio with custom configuration

```
/usr/share/cgrates/tutorials/kamevapi/kamailio/etc/init.d/kamailio start
```

To verify that Kamailio is running we run the console command:

```
kamctl moni
```

7.3.2.3 Starting CGRateS with custom configuration

```
/usr/share/cgrates/tutorials/kamevapi/cgrates/etc/init.d/cgrates start
```

Make sure that cgrates is running

```
cgr-console status
```

7.3.2.4 CDR processing

At the end of each call Kamailio will generate an CDR event via *evapi* and this will be directed towards the port configured inside *cgrates.json*. This event will reach inside **CGRateS** through the *SM* component (close to real-time). Once in-there it will be instantly rated and be ready for export.

7.3.2.5 CGRateS Usage

Since it is common to most of the tutorials, the example for **CGRateS** usage is provided in a separate page here

7.4 OpenSIPS Integration Tutorials

In these tutorials we exemplify a few cases of integration between OpenSIPS and CGRateS. We start with common steps, installation and postinstall processes, then we dive into particular configurations, depending on the case we run.

7.4.1 Software installation

We have chosen Debian Jessie as operating system, since all the software components we use provide packaging for it.

7.4.1.1 CGRateS

CGRateS can be installed using the instructions found *here*.

7.4.1.2 OpenSIPS

We got OpenSIPS installed via following commands:

```
apt-key adv --keyserver keyserver.ubuntu.com --recv-keys 049AD65B
echo "deb http://apt.opensips.org jessie 2.4-nightly" >/etc/apt/sources.list.d/
↪opensips.list
apt-get update
apt-get install opensips opensips-cgrates-module
```

Once installed we proceed with loading the configuration out of specific tutorial cases bellow.

7.4.2 OpenSIPS interaction via *event_datagram*

7.4.2.1 Scenario

- OpenSIPS out of *residential* configuration generated.
- Considering the following users (with configs hardcoded in the *opensips.cfg* configuration script): 1002-postpaid, 1003-pseudoprepaid, 1004-rated, 1007-rated.
- For simplicity we configure no authentication (WARNING: Not for production usage).
- **CGRateS** with following components:
- CGR-SM started as translator between OpenSIPS and **cgr-rater** for both authorization events (pseudoprepaid) as well as CDR ones.
- CGR-CDRS component processing raw CDRs from CGR-SM component and storing them inside CGR StorDB.
- CGR-CDRE exporting rated CDRs from CGR StorDB (export path: */tmp*).
- CGR-History component keeping the archive of the rates modifications (path browsable with git client at */tmp/cgr_history*).

7.4.2.2 Starting OpenSIPS with custom configuration

```
/usr/share/cgrates/tutorials/osips_native/opensips/etc/init.d/opensips start
```

To verify that OpenSIPS is running we run the console command:

```
opensipsctl moni
```

7.4.2.3 Starting CGRateS with custom configuration

```
/usr/share/cgrates/tutorials/osips_native/cgrates/etc/init.d/cgrates start
```

Make sure that cgrates is running

```
cgr-console status
```

7.4.2.4 CDR processing

At the end of each call OpenSIPS will generate an CDR event and due to automatic handler registration built in **CGRateS-SM** component, this will be directed towards the port configured inside *cgrates.json*. This event will reach inside **CGRateS** through the *SM* component (close to real-time). Once in-there it will be instantly rated and be ready for export.

7.4.2.5 CGRateS Usage

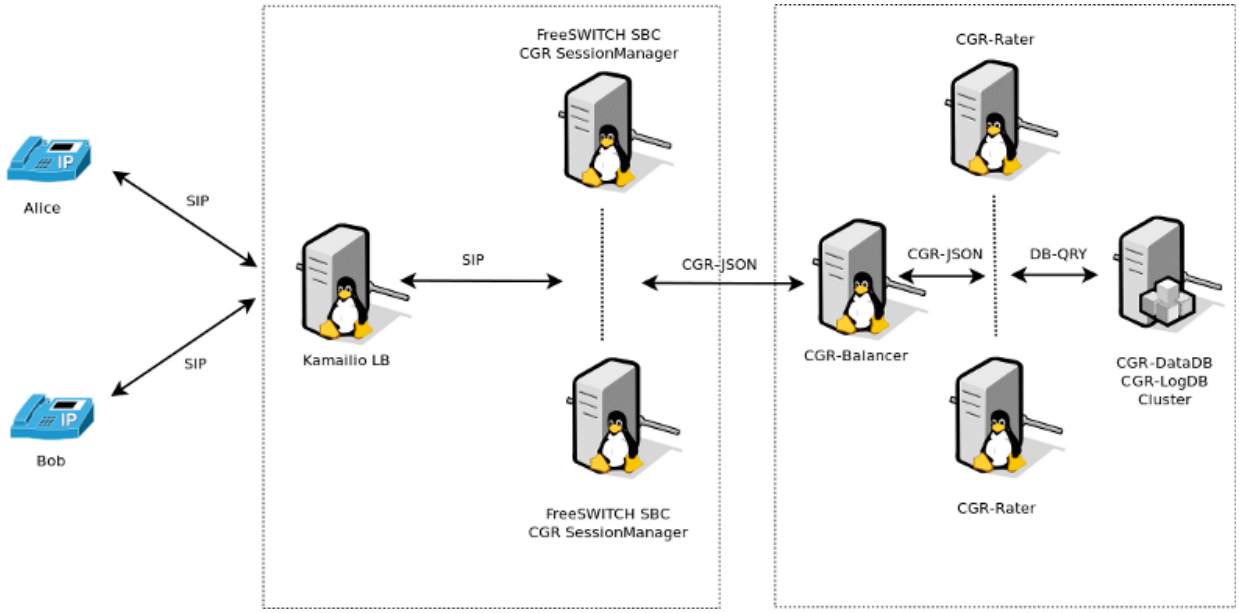
Since it is common to most of the tutorials, the example for **CGRateS** usage is provided in a separate page here

CHAPTER 8

8. Miscellaneous

8.1 8.1. FreeSWITCH integration

Being the original platform supported by CGRateS, FreeSWITCH has the advantage of support for complete set of CGRateS features. When used as Telecom Switch it fully supports all rating modes: **prepaid/postpaid/pseudoprepaid/rated**. A typical use case would be like the one in the diagram below:



The process of rating is decoupled into two different components:

8.1.1 8.1.1. SessionManager

TODO - update and add CDRs and CDRc.

- Attached to FreeSWITCH via the socket library, enhancing CGRateS with real-time call monitoring and call control functions.
- **In Prepaid mode implements the following behaviour:**
  - **On *CHANNEL_PARK* event received from FreeSWITCH:**
    - Authorize the call by calling *GetMaxSessionTime* on the Rater.
    - **Sets the channel variable *cgr_notify* via *uuid_setvar* to one of the following values:**
      - MISSING_PARAMETER: if one of the required channel variables is missing and CGRateS cannot make rating.
      - SYSTEM_ERROR: if rating could not be performed due to a system error.
      - INSUFFICIENT_FUNDS: if MaximSessionTime is 0.
      - AUTH_OK: Call is authorized to proceed.
    - Un-Park the call via *uuid_transfer* to original dialed number. The FreeSWITCH administrator is expected to make use of *cgr_notify* variable value to either allow the call going further or reject it (eg: towards an IVR or returning authorization fail message to call originator).
  - **On *CHANNEL_ANSWER* event received:**
    - Index the call into CGRateS's cache.
    - Starts debit loop by calling at configured interval *MaxDebit* on the Rater.
    - **If any of the debits fail:**
      - Set *cgr_notify* channel variable to either SYSTEM_ERROR in case of errors or INSUFFICIENT_FUNDS of there would be not enough balance for the next debit to proceed.
      - Send *hangup* command with cause *MANAGER_REQUEST*.
  - **On *CHANNEL_HANGUP_COMPLETE* event received:**
    - Refund the reserved balance back to the user's account (works for both monetary and minutes debited).
    - Save call costs into CGRateS LogDB.
- In Postpaid mode:
  - **On *CHANNEL_ANSWER* event received:**
    - Index the call into CGRateS's cache.
  - **On *CHANNEL_HANGUP_COMPLETE* event received:**
    - Call *Debit* RPC method on the Rater.
    - Save call costs into CGRateS LogDB.
- **On CGRateS Shutdown execute, for security reasons, hangup commands on calls which can be CGR related:**
  - *hupall MANAGER_REQUEST cgr_reqtype prepaid*
  - *hupall MANAGER_REQUEST cgr_reqtype postpaid*

8.1.2 8.1.2. Mediator

TODO - remove this section. Mediator functionality is handled by CDRs and CDRc.

Attaches costs to FreeSWITCH native written .csv files. Since writing channel variables during hangup is asynchronous and can be missed by the CDR recorder mechanism of FreeSWITCH, we decided to keep this as separate process after the call is completed and do not write the costs via channel variables.

8.1.2.1 8.1.2.1. Modes of operation

The Mediator process for FreeSWITCH works in two different modes:

- **Costs from LogDB (activated by setting -1 as *subject_idx* in the *cgrates.cfg*:**
  - Queries LogDB for a previous saved price by SessionManager.
  - This behavior is typical for prepaid/postpaid calls which were previously processed by SessionManager and important in the sense that we write in CDRs exactly what was billed real-time from user's account.
- **Costs queried from Rater:**
  - This mode is specific for multiple process mediation and does not necessary reflect the price which was deducted from the user's account during real-time rating.
  - Another application for this mode is pseudoprepaid when there is no SessionManager monitoring and charging calls in real-time (debit done directly from CDRs).
  - This mode is triggered from configuration file by setting proper indexes (or leave them defaults if cgrates rating template is using whitin FreeSWITCH cdr_csv configuration file.

A typical usage into our implementations is a combination between the two modes of operation (by setting at a minimum -1 as subject_idx to run from LogDB and succesive mediation processes with different indexes).

8.1.2.2 8.1.2.2. Implementation logic

- The Mediator process is configured and started in the *cgrates.cfg* file and is alive as long as the *cgr-engine* application is on.
- To avoid concurrency issues, the Mediator does not process active maintained CDR csv files by FreeSWITCH but picks them up as soon as FreeSWITCH has done with them by rotating. The information about rotation comes in real-time on the Linux OS through the use of inotify.
- Based on configured indexes in the configuration file, the Mediator will start multiple processes for the same CDR.
- For each mediation process configured the Mediator will apped the original CDR with costs calculated. In case of errors of some kind, the value *-1* will be prepended.
- When mediation is completed on a file, the file will be moved to configured *cdr_out_dir* path.