

# Build your ENUM LCR Server using CGRateS

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## About us



**Located in Bavaria/Germany with back-offices in Romania and Albania, over 17 years of experience with architecting server side solutions in VoIP environment**

**Platform implementations covering both wholesale and retail business categories**

**Responsibly understanding real-time processing constraints and the seriousness of live system outages**



# About CGRateS

## Real-time Enterprise Billing Suite

Pluggable into existing infrastructure  
Accommodate new components into  
ISP/ITSP network (eg: new Comm switch,  
SMS Service)  
Non-intrusive into existing setups

## Open Source Software

Born in 2010, first sources published in  
2012  
Full sources available on Github repository  
100% Go (golang.org) from beginning  
No add-ons in private repositories  
Consideration for community contributions

## Performance Oriented

Built-in advanced cache system  
(transactional, LRU + TTL records)  
Asynchronous processing with  
micro-threads  
Including API load balancer

## 3 branches, indefinitely supported

v0.10, Master, 1.0

## Test driven development

Over 10000 tests as part of test suite

## Modular architecture

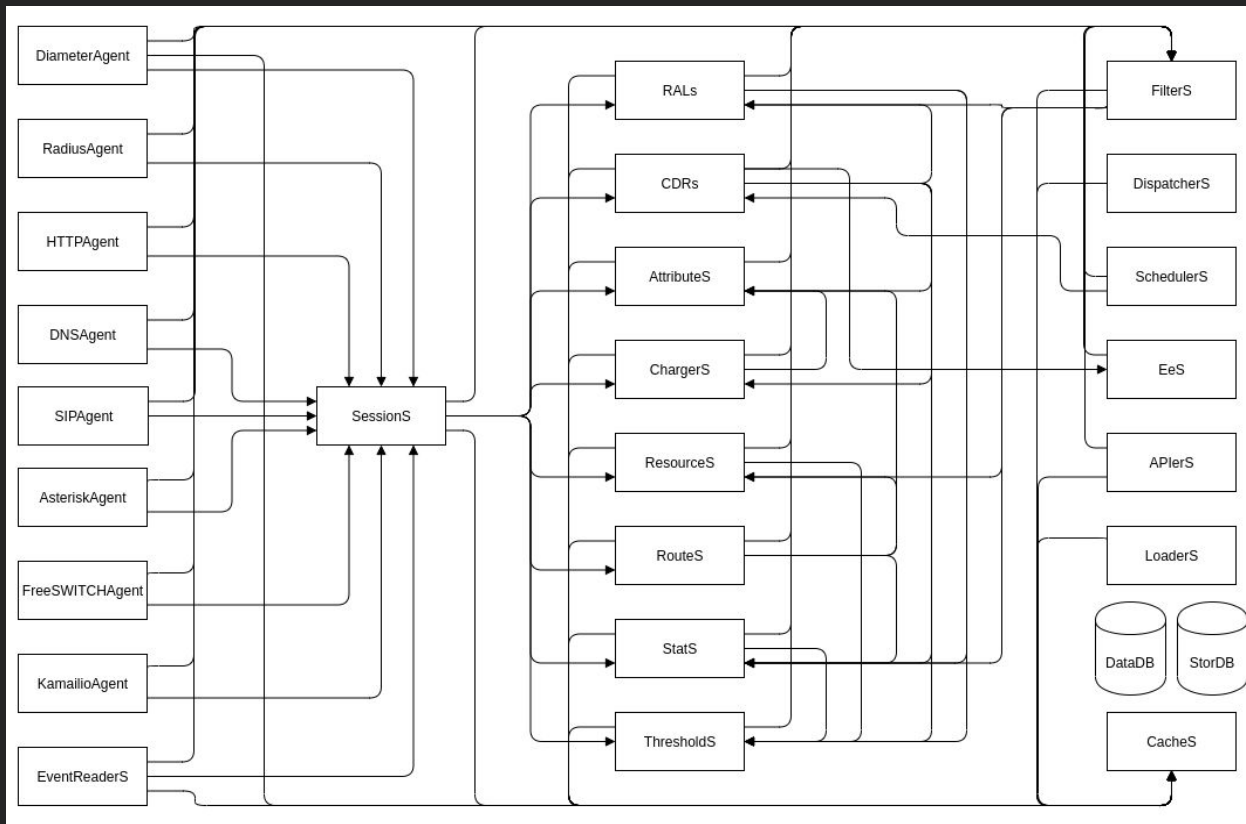
Cloud-ready, micro-services with rich set  
of RPC APIs  
Easy to enhance by rewriting specific  
components



# Feature-rich

- Online/Offline Charging System (OCS)
- Multi-tenancy from day one
- Multiple DBs supported
- Real-time configuration reloads
- Rating Engine with Derived Charging and A-Number rating
- Account Balances Management with Bundles and *\*dynaprepaid*
- Session or Event Charging with balance reservation and refunds
- STIR/SHAKEN authentication
- CDR logging with support for Interim Records and RatingQueues
- High number of interfaces for event reader/exporter (AMQP/SQS/SQL/CSV/XML..)

- Fraud detection with automatic mitigation
- LCR with QoS/Bundles
- Call Statistics with pattern monitoring
- Dynamic pricing imports with templates
- Diameter/Radius/DNS/SIP Server with process templates (standard agnostic)
- Resource allocation controller
- API server with GOB, JSON, HTTP-JSON support
- Built-in High-Availability and Dynamic-Partitioning support
- API capturing/analysis service
- Clustering through remote/replication for internal cache and database
- Data versioning with automatic migration
- Agile in developing new features



# Online/Offline Charging System

## Highly configurable rating

Connect fees, rate units, rate increments, rates grouping, a-number rating, various rounding methods, configurable decimals in costs, maximum cost per destination with hit strategy, rating profile scheduling  
Derived charging for distributors/suppliers  
parallel charging

## Unlimited Balances per Account

\*voice, \*data, \*sms, \*mms, \*monetary, \*generic

Unlimited bundle combinations with balance prioritisation

## Concurrent sessions handling

Balance reservation in chunks of debit interval

Balance refunds

Debit sleep when needed

## Centralized CDR server

Online exports (support for Rating Queues)

CDR client importing generic .csv, .fwv, .xml offline files



carrier grade realtime charging

# Dynamic Routing System

## Using dedicated subsystem - Routes

Full APIs coverage  
Integrated inside SessionSv1.Authorize Event API  
Integrated within all agents

## LRN support via Attributes

Looped queries for same event  
Optimized for O(1) response time with large data sets (>20 mil profiles)

## Bundle and cost based support via RALs

Looped queries for same event  
Optimized for O(1) response time with large data sets (>20 mil profiles)



carrier grade realtime charging

## QoS filters based on Stats subsystem

In-memory, performance optimized  
Independent data feed (forced or processed)

## QoS monitoring via Thresholds subsystem

Various notifications/actions  
Automatic escalation procedures available

## Load balancing

Balancing the traffic based on supplier ratio  
Real calls considered out of CDRs

# ENUM LCR Server using CGRateS



# DNS

## The internet's phonebook

- **A Records (IPv4 Addresses)**  
*cgrates.org* → *51.38.77.188*
- **SRV Records (Service Locator)**  
*\_sip.\_tcp.opensips.org.* → *Priority: 10, Weight: 5, Port: 5060, Target: opensips.org.*
- **NAPTR Records (Naming Authority Pointer)**  
*3.6.9.4.7.1.7.1.5.6.8.9.4.e164.arpa.* → *Order: 10, Preference: 50, Flags: "U", Service: "E2U+SIP", Regexp: "!^(.\*)\$!sip:1@172.16.1.10.!"*

# ENUM

## **E.164 number to URI(Uniform Resource Identifier) mapping.**

A standard to translate telephone numbers into URI-s.

+32 12 34 56 789    =>    9.8.7.6.5.4.3.2.1.2.3.e164.arpa

# DNS Agent

## DNS Server implementation

Standard agnostic via processor templates

Transports: UDP, TCP, TCP-TLS

(Concurrent/Configurable)

Supported query types: A, SRV, NAPTR

# Configuration

```
"dns_agent": {  
  "enabled": true,  
  "listeners": [  
    {"address": ":2053", "network": "udp"},  
    {"address": ":2053", "network": "tcp"},  
    {"address": ":2054",  
  "network": "tcp-tls"}  
  ],  
  "sessions_conns": ["*localhost"]  
},
```

```
"request_processors": [
  {
    "id": "NAPTRLeastCostRoute",
    "filters": ["*string:~*vars.QueryType:NAPTR", "*prefix:~*vars.QueryName{*e164}:32"],
    "flags": ["*event", "*rals:*authorize", "*routes", "*log"],
    "request_fields": [
      {"path": "*cgreg.Account", "type": "*variable", "value": "~*vars.QueryName:s/^.*e164\\.\\. (\\w+)\\.\\. /${1}/"},
      {"path": "*cgreg.Destination", "type": "*variable", "value": "~*vars.QueryName{*e164}"},
      {"path": "*cgreg.SetupTime", "type": "*constant", "value": "*now"},
      {"path": "*cgreg.ToR", "type": "*constant", "value": "*voice"},
      {"path": "*cgreg.Usage", "type": "*constant", "value": "1m"},
    ],
    "reply_fields": [
      {"path": "*rep.Answer.Order", "type": "*constant", "value": "100"},
      {"path": "*rep.Answer.Preference", "type": "*constant", "value": "10"},
      {"path": "*rep.Answer.Flags", "type": "*constant", "value": "U"},
      {"path": "*rep.Answer.Service", "type": "*constant", "value": "E2U+SIP"},
      {"path": "*rep.Answer.Regexp", "type": "*variable",
        "value": "~*cgreg.RouteProfiles.*raw[0].Routes[0].RouteParameters"},
      {"path": "*rep.Answer.Replacement", "type": "*constant", "value": "."}
    ]
  }
]
```

# Dig (DNS Client)

```
$ dig @127.0.0.1 -p 2053 -t naptr  
9.8.7.6.5.4.3.2.1.2.3.e164.1001
```

# CGRateS

```
{"method": "SessionSv1.ProcessEvent",  
  "params": [{  
    "Flags": ["*log", "*event", "*rals:*authorize", "*routes"],  
    "Tenant": "cgrates.org",  
    "ID": "037703c",  
    "Time": "2024-01-23T17:00:26.007458167+02:00",  
    "Event": {  
      "Account": "1001",  
      "Destination": "32123456789",  
      "SetupTime": "*now",  
      "ToR": "*voice",  
      "Usage": "1m"  
    },  
  }],  
  "id": 1}
```

# CGRateS reply

```
{ "id": 1, "result": {
  "MaxUsage": { "*raw": 60000000000 },
  "RouteProfiles": { "*raw": [ {
    "ProfileID": "ROUTE_ACNT_1001",
    "Sorting": "*lc",
    "Routes": [ {
      "RouteID": "route2",
      "RouteParameters": "!^(.*)$!sip:\\1@172.16.1.12!",
      "SortingData": { "Cost": 60, "RatingPlanID": "RP_ANY", "Weight": 5 }
    }, {
      "RouteID": "route1",
      "RouteParameters": "!^(.*)$!sip:\\1@172.16.1.11!",
      "SortingData": { "Cost": 5940, "RatingPlanID": "RP_EXPENSIVE", "Weight": 10 }
    } ] } ] } },
  "error": null }
```

# DIG (DNS Client) Reply

```
; <<>> DiG 9.16.42-Debian <<>> @127.0.0.1 -p 2053 -t naptr 9.8.7.6.5.4.3.2.1.2.3.e164.1001
```

```
;; QUESTION SECTION:
```

```
;9.8.7.6.5.4.3.2.1.2.3.e164.1001. INNAPTR
```

```
;; ANSWER SECTION:
```

```
9.8.7.6.5.4.3.2.1.2.3.e164.1001. 60 IN NAPTR 100 10 "U" "E2U+SIP" "!^(.*)$!sip:1@172.16.1.12!" .
```

```
;; Query time: 47 msec
```

```
;; SERVER: 127.0.0.1#2053(127.0.0.1)
```

```
;; WHEN: Tue Jan 23 17:00:26 CAT 2024
```

```
;; MSG SIZE rcvd: 134
```



# Questions

## Website

<http://www.cgrates.org>

## Documentation

<http://cgrates.readthedocs.org>

## Code + issues tracker

<https://github.com/cgrates/cgrates>

## Support

Google group: **CGRateS**

IRC Freenode: **#cgrates**