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# An Erlang Integration for Real-Time Call Cost Control

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# Goals

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- ❖ show how to use Erlang features to control call costs
- ❖ show how to enable Kamailio to communicate with Erlang
- ❖ Kamailio module implementation for our Bicom Systems project: SWITCHware
- ❖ major features of SWITCHware



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# Erlang

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- ❖ *processes* are a fundamental concept
- ❖ *functional* programming language
- ❖ designed for *concurrency*
- ❖ processes communicate by *message passing*
- ❖ message passing primitives are *asynchronous*
  - ❖ *Process ! Message*
- ❖ fault tolerance infrastructure
  - ❖ process links (receive notification when process exit)

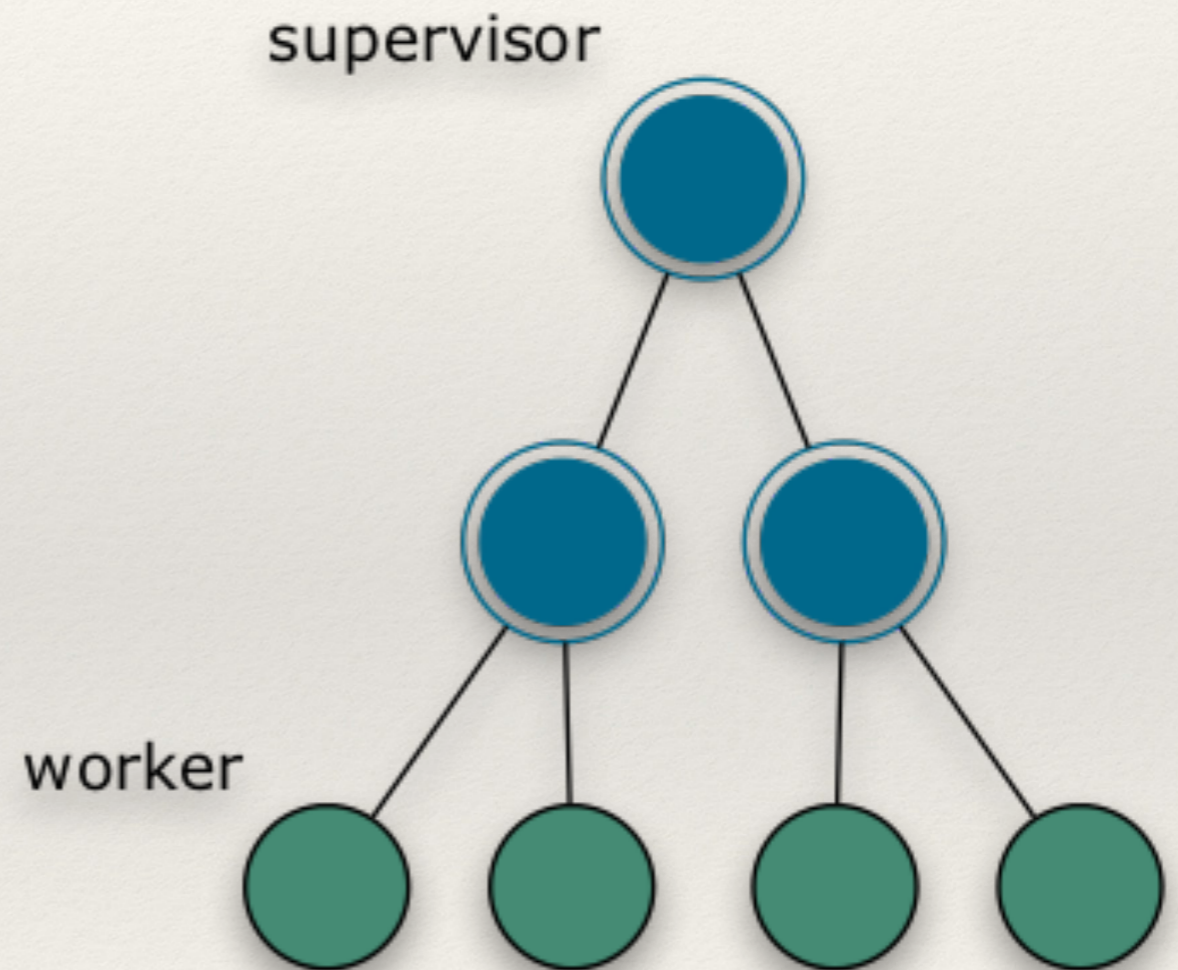


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# Erlang/OTP

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- ❖ supervision and trapping of exit signals
- ❖ distributed
  - ❖ transparent message passing
  - ❖ RPC
- ❖ Open Telephony Platform (OTP)





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# Erlang/OTP ecosystem

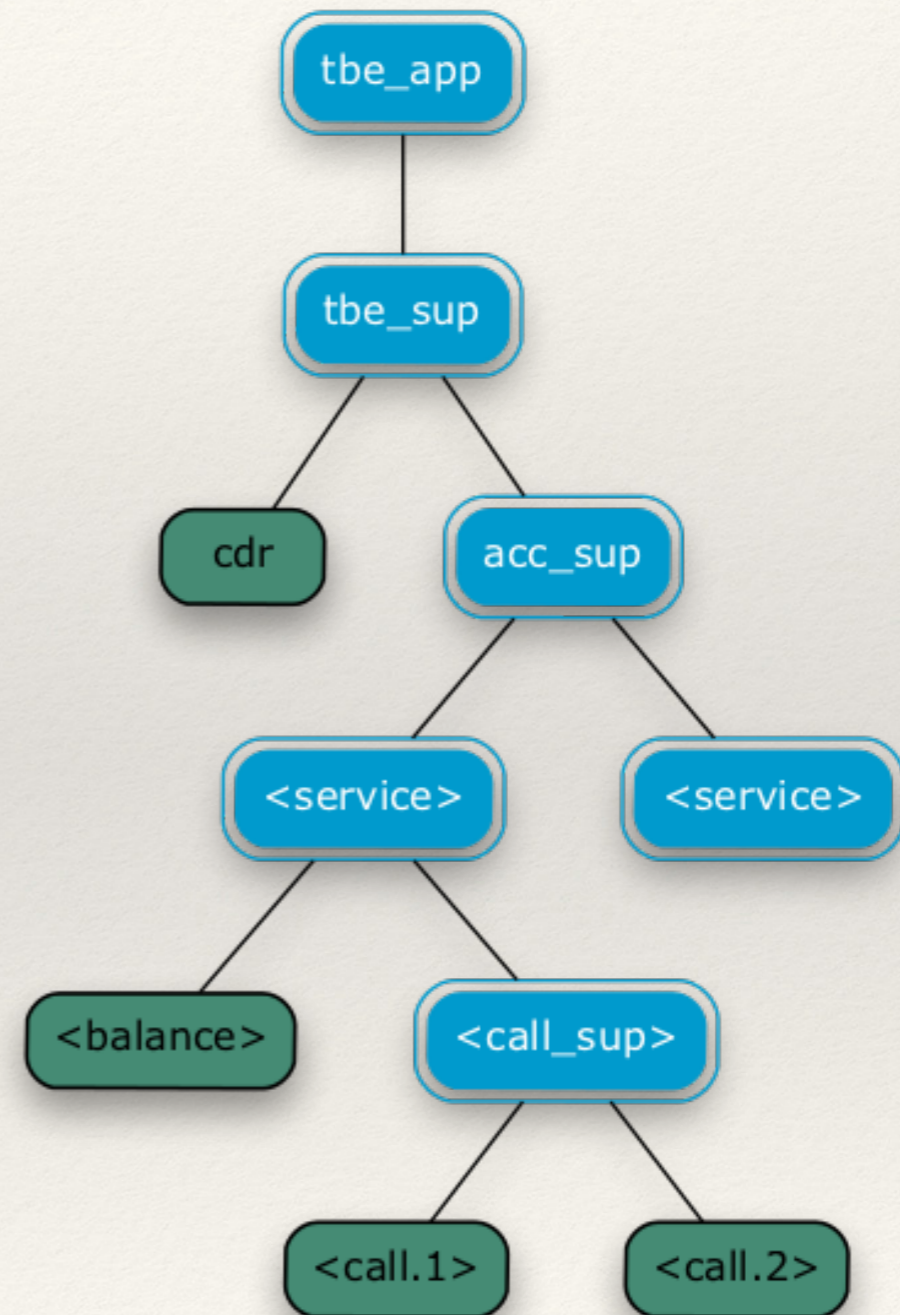
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- ❖ *supervision tree*
  - ❖ *supervisor, worker*
  - ❖ *restart strategies*
- ❖ *applications*
- ❖ *behaviors:*
  - ❖ *supervisor, gen\_server, gen\_fsm, gen\_event*
- ❖ *releases (subset of Erlang/OTP applications)*
- ❖ *release handling (upgrade or downgrade)*



# Billing app skeleton

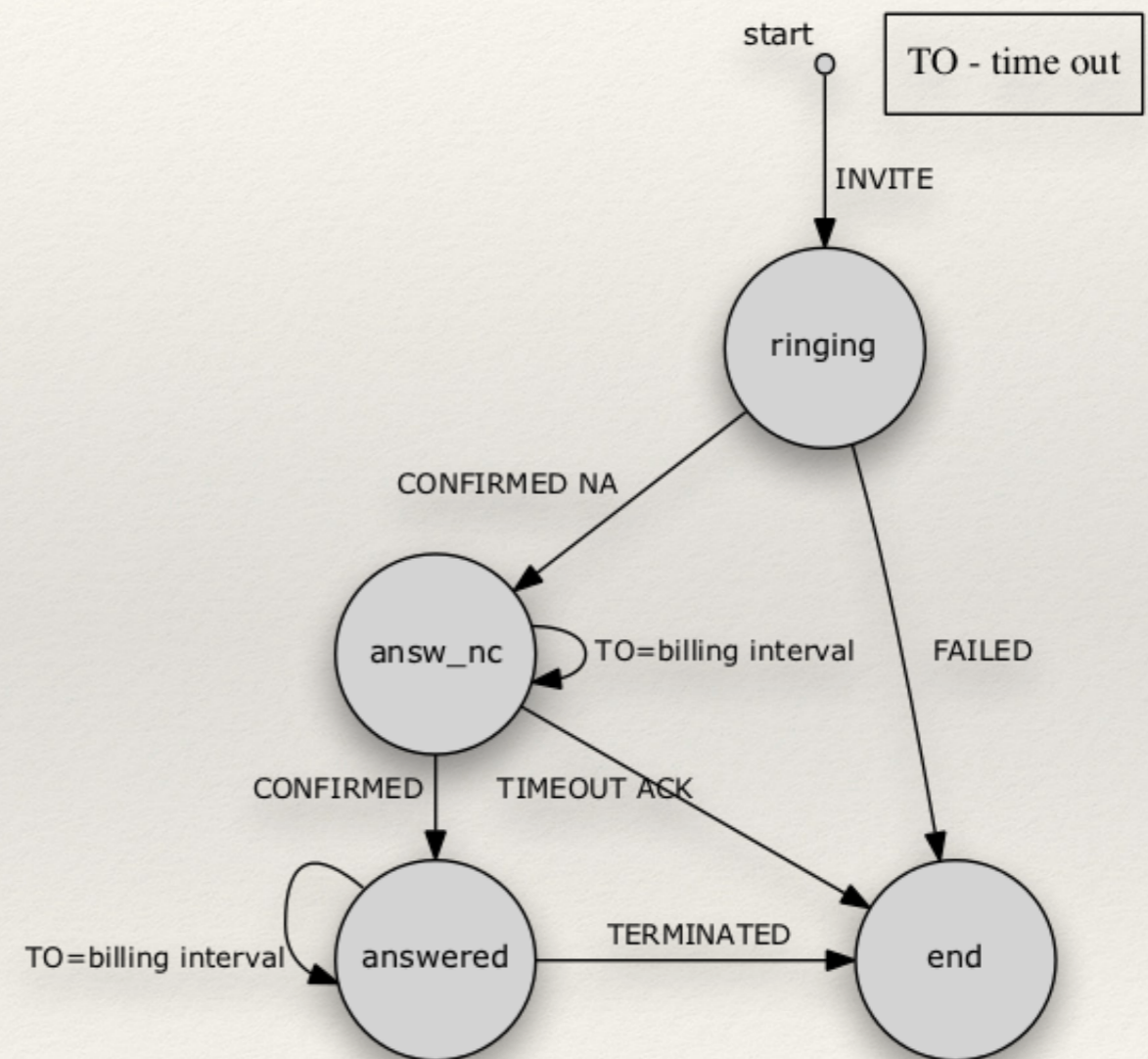
- ❖ tbe\_app: *application*
- ❖ tbe\_sup: *root supervisor*
- ❖ cdr: CDR OLTP server  
[Mnesia DB, odbc]
- ❖ acc\_sup: *accounting supervisor*
- ❖ service: *service supervisor*
- ❖ balance: *balance control server*
- ❖ call\_sup: *call control supervisor*
- ❖ call: *FSM call control*





# Call costs control process

- ❖ implemented by `gen_fsm` *behavior*
- ❖ spawn process on request INVITE
- ❖ check available balance for first interval
- ❖ TIMEOUTs:
  - ❖ billing interval - calculates bill amount and check available balance
  - ❖ terminate call if no available balance
  - ❖ events follow dialog states





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# C Node

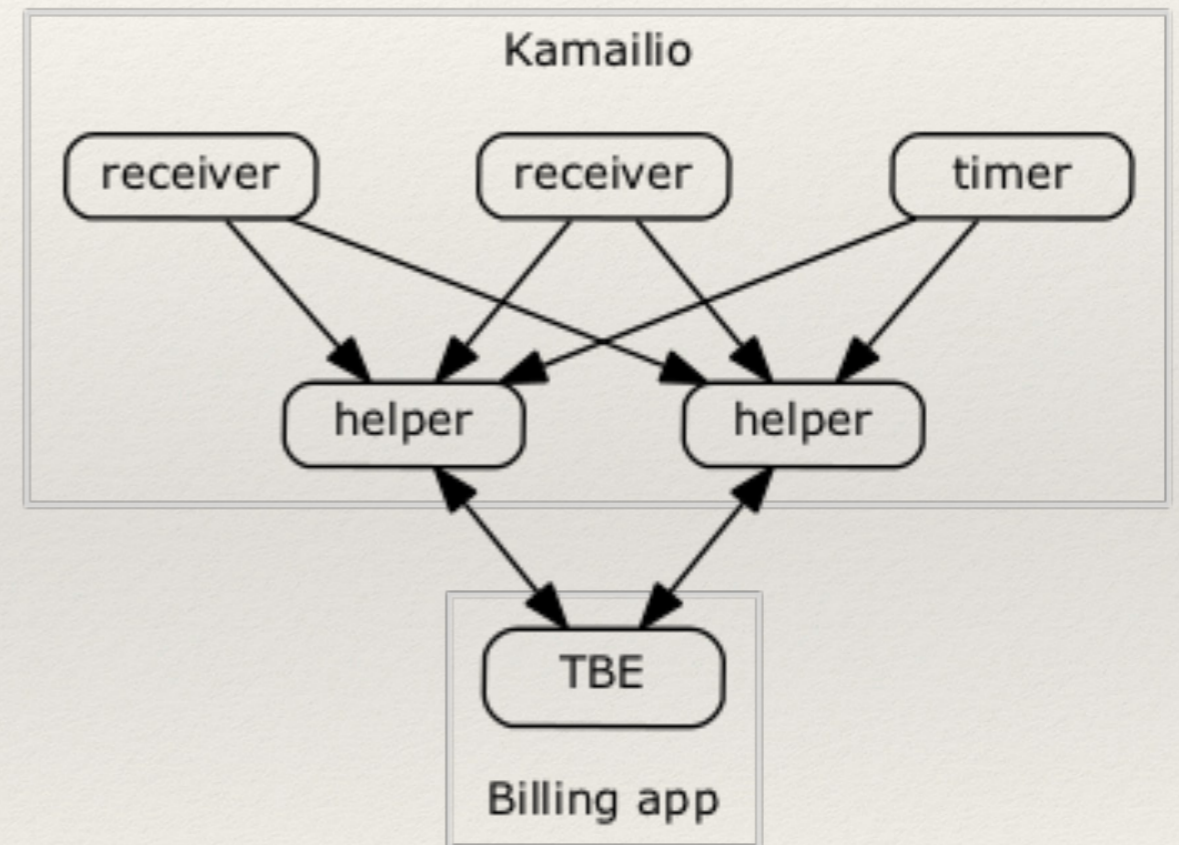
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- ❖ communicate with Erlang node
- ❖ erl\_interface library
- ❖ erl\_connect and **ei\_connect**
- ❖ send / receive messages
- ❖ RPC call
- ❖ handle keep alive (ERL\_TICK)
- ❖ hidden node
- ❖ EPMD (Erlang Port Mapper Daemon)



# Kamailio as Erlang node

- ❖ kamailio module (tbe)
  - ❖ script commands
  - ❖ kamailio RPC
  - ❖ bind on dialog call backs
- ❖ *helper*:
  - ❖ Erlang C node
  - ❖ data marshaling
  - ❖ RPC call to Erlang
  - ❖ API for TBE





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# tbe module params

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- ❖ node\_name (node\_sname)
  - ❖ kamailio node name e.g. "sw@kamailio.lan"
- ❖ tbe\_node\_name (tbe\_node\_sname)
  - ❖ billing application node name e.g. "tbe1@tbe.lan"
- ❖ bill\_call\_flag
  - ❖ flag indicate call billing is "on | off"
- ❖ cookie
  - ❖ determines which nodes are allowed to communicate with each other



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# tbe module commands

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- ❖ script commands:

- ❖ tbe\_bill\_call

- ❖ REQUEST\_ROUTE | FAILURE\_ROUTE

- ❖ init and bind to dialog

- ❖ tbe\_lcr\_init

- ❖ LCR over vendors

- ❖ next\_vendor

- ❖ RPC commands

- ❖ service\_refresh

- ❖ service\_balance

- ❖ updated\_transaction

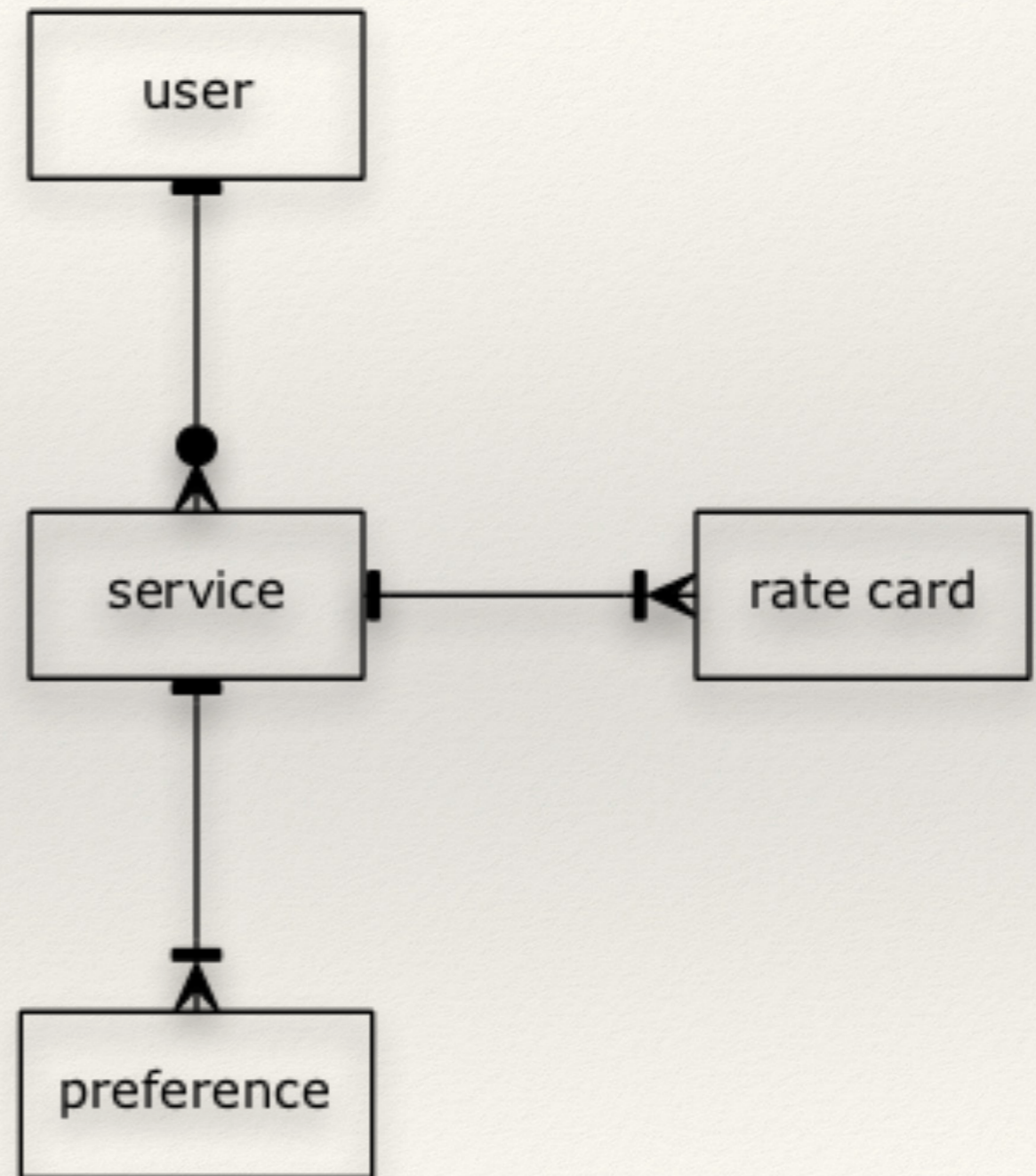
```
# EXAMPLE:
```

```
tbe_bill_call("$avp(user_id)", "$avp(service_id)");  
switch ($rc) {  
  case 1:  
  case 2:  
    break;  
  case -1:  
    sl_send_reply("402", "Call credit limit exceeded");  
    exit;  
  case -2:  
    sl_send_reply("402", "Payment required");  
    exit;  
  case -4:  
    sl_send_reply("404", "Not found");  
    exit;  
  default:  
    sl_send_reply("500", "Internal server error");  
    exit;  
}
```



# data model & billing

- ❖ major service types:
  - ❖ subscriber line
  - ❖ vendor SIP trunk
  - ❖ wholesales SIP trunk
  - ❖ hosted PBX
- ❖ SWITCHware billing:
  - ❖ prepaid & postpaid
  - ❖ buy & sell calls
  - ❖ scheduled rate cards
  - ❖ time based dialing





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# SWITCHware

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- ❖ API based telecommunication platform
- ❖ service types: residential, business, wholesales, hosted PBX - service templates
- ❖ billing for vendors and subscribers
- ❖ SIP trunks, rates and service plans
- ❖ store and manage billing data
- ❖ owner, reseller and user portals
- ❖ manage DID: porting and reservation
- ❖ automatic LCR and MCR



SWITCHWARE OWNER

- Domains
- Dial Plan
- Subscriber Accounts
- CDRs
- Rate Cards
- Service Plans
- Settings

# Switchware administration pannel

## Switchware statistics

- 3 domains
- 8 service plans 2 Active
- 2 administrators
- 3 banned IPs

## Subscribers statistics

- 3 subscribers
- 8 lines
- 12 DIDs
- 4 service plans 2 Active

## Vendors statistics

- 5 vendors
- 7 rate cards 7 Active
- 2256 calls
- 1432 outbound
- 824 inbound

## System status

- OK Nginx
- OK MySQL
- OK PHP-FPM
- OK Kamailo RPC
- OK Redis Server





*Thank you for your time.*

*Questions?*