



telefaks* application server for FreeSWITCH

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Who we are

- Coming from Asterisk
- On Freeswitch since beg. of June 2008
- Transferred all our applications to Freeswitch since then
- Strong focus on
 - Integrating Freeswitch
 - Ruby and Rails Development
 - Encryption



Why an application server framework?

- Our Freeswitch projects usually have a larger scale than e.g. an Asterisk PBX
- A single Freeswitch is per default configured by XML files
- On top there exists a number of interfaces for configuration and synchronous/asynchronous call control
- Integrating large projects therefore requires a lot of groundwork to be done
- Some nice GUIs exist already, each one targeting a dedicated scenario (e.g. PBX, Callcenter)
- however, a system which will cover all scenarios by 100% will most probably never exist



Bottom line

We need a framework
to abstract functionalities for
integrating large Freeswitch projects



What is basically needed for that?

- Administration GUI
- Handling of more than one freeswitch server
- Customer hierarchies
- IVR functionalities
- Callcenter support
- Asynchronous call handling
- Realtime interface with web browser (e.g. push status)



What is it built of

- Freeswitch of course
- some Ruby processes for interfacing with Freeswitch
- Ruby on Rails for the web interface
- Javascript and AJAX for the web interface
- a bit of LUA
- a push server

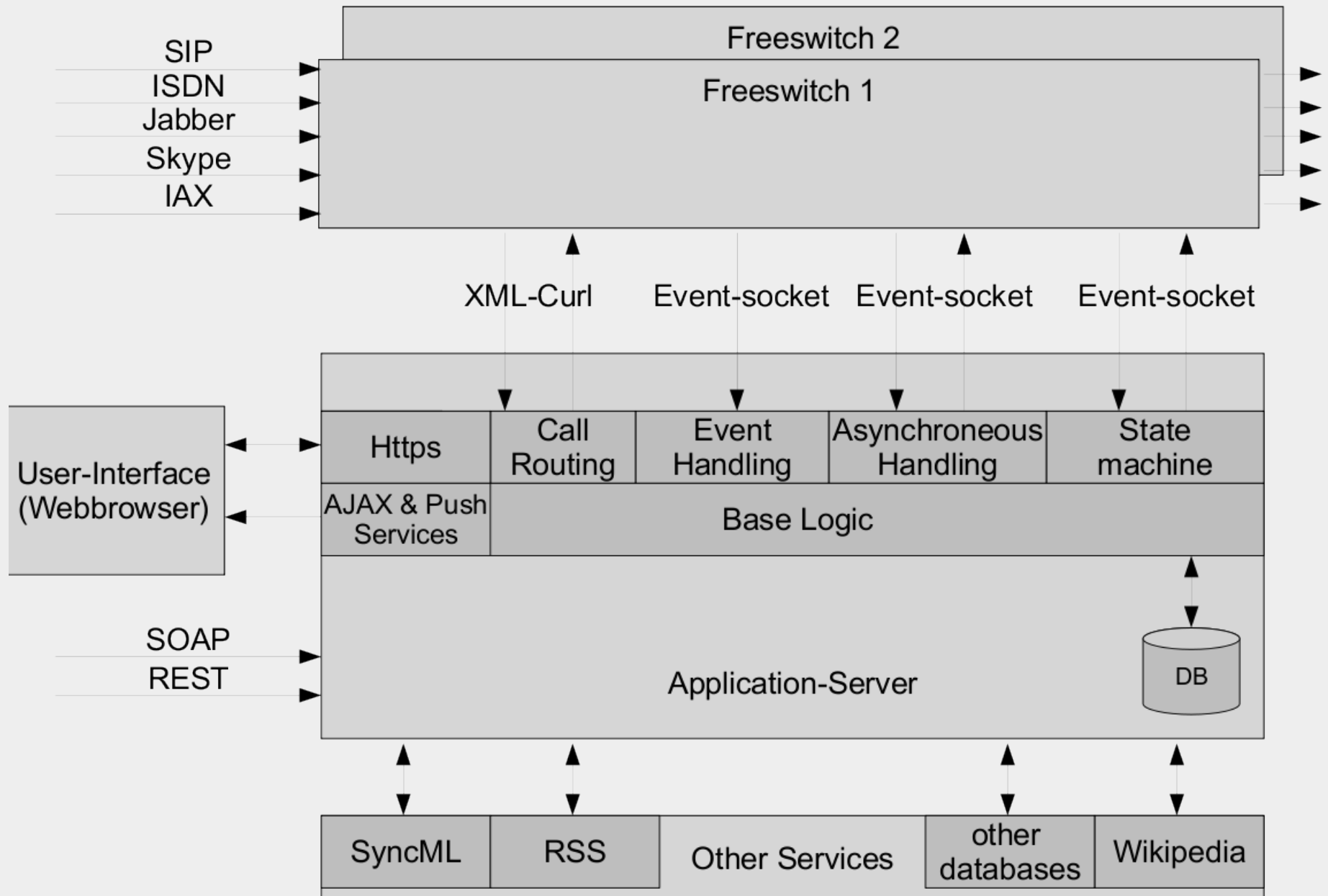


What ist covers

- Support of multiple Freeswitch servers
- Basic PBX functionalities (is needed almost everywhere)
- Conferencing (setup and „live“ management)
- Call Queues
- Callback/dialthru
- IVR State machine with setup via GUI
- Callcenter workflows with direct interaction between browser and freeswitch
- TTS and ASR Support
- Encryption of calls (TLS/SRTP)
- Complex routing algorithms for larger networks
- Prepared for billing functionalities
- Channel Spy
- Custom applications
- Interface to SyncML

... more

How it's designed





PBX functionalities

Sample PBX functionalities

- Serve multiple clients
- Clients can be spread over multiple instances of Freeswitch
- User administration with client hierarchies
- Management of SIP endpoints
- Voicemail
- Call forwarding (parallel + sequential hunting)
- Short numbers for each endpoint
- One-time numbers (or n times usage), obfuscated numbers
- Dialthru/Callback
- Special numbers
- Conferences
- Call queues
- Encryption TLS/SRTP
- ... more



Sample PBX functionalities

Telefaks Freeswitch Management

Login: peter Role: Super Admin(Telefaks)

Phone Numbers/Conferences

- Operator Panel
- Phone numbers
- Voicemails
- User Parameter
- Masked numbers
- Short numbers
- Special numbers
- Dialthrus
- Conferences
- Active Conferences
- Queues
- SIP registrations

Customers

- Routing
- Callcenter
- Basic Setup
- IVR State Machine
- Billing
- Freeswitch Mgt.
- Test XML requests
- Memcache
- System Status

Editing directory

Customer id
Telefaks

Exten
835331

Password

Gateway
sip5.telefaks.biz

Fullname
Peter Steinbach

External CID
06081688533

Enable direct callforward

Direct callforward to
06081688533

Voicemail
835331

Vm-Password

Vm-Email
steinbach@telefaks.biz

SyncML User
peter_s

Forwards

835331 835333
01.71.336

All numbers entered in one line will be called altogether.
Numbers in the following lines will be called in sequence.
Call timeout is 15 seconds.
Call timeout for the last line is 30 seconds.
If you enter any numbers here, do not forget to add the current extension also.

Available Numbers

for exten number

Customer	Exten_from	Exten_to
Telefaks	83533	8353399999
Internal	99998	99998
	9999999900	9999999999
Mein50Plus	26824	2682499999
	83534	8353499999

Sample Conferencing functionalities

- Conference definition

Telefaks Freeswitch Management

Phone

Numbers/Conferences

- Operator Panel
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- Conferences
- Active Conferences
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Customers

Routing

Callcenter

Basic Setup

IVR State Machine

Billing

Freeswitch Mgt.

Test XML requests

Memcache

System Status

Editing conference

Host

sip5.telefaks.biz

Customer

Mein50Plus

Conference description

Sales

Number

26824200

Conference-type

Conference 8KHz en ComfortNoise EnergyLevel 3000

Valid from

2008 September 26 13 : 33

Valid to

2009 November 27 13 : 33

Active

Yes

Pin

Kick all members out of the conference after initiator hangs up

No

Record whole conference

No

Conference Numbers to invite

No	Extension	Active	Originator
1	835331	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	01712 2022	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	06081688533	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4		<input type="checkbox"/>	<input type="checkbox"/>
5		<input type="checkbox"/>	<input type="checkbox"/>
6		<input type="checkbox"/>	<input type="checkbox"/>
7		<input type="checkbox"/>	<input type="checkbox"/>

Available number ranges

for Conferences

Customer	Range_from	Range_to
Telefaks	83533	8353399999
Internal	99998	99998
	9999999900	9999999999
Mein50Plus	26824	2682499999
	83534	8353499999

Sample Conferencing functionalities

- Conference live management

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Customers

- Routing
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- Basic Setup
- IVR State Machine
- Billing
- Test XML requests
- Test with https
- Freeswitch
- Memcache
- System Status

Listing active_conferences

Conference

Conference Name	Record conference	Conference lock	Conference PIN	Send data to all members	Invite into conference
83533200	<input checked="" type="checkbox"/>	<input type="checkbox"/>	PIN	<input type="text" value="conference/8000/conf-welcome.wav"/> <input type="button" value="play"/> <input type="text"/> <input type="button" value="Speak"/> <input type="text"/> <input type="button" value="DTMF"/>	<input type="text"/> <input type="button" value="INVITE"/>

Conference members

Member	Member's Speaker	Member's Mikrophone	Energy Level	Kick out	Send data to this member	Transfer member
835331 TLS SRTP	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	0 Set	<input type="checkbox"/>	<input type="text" value="conference/8000/conf-welcome.wav"/> <input type="button" value="play"/> <input type="text"/> <input type="button" value="Speak"/> <input type="text"/> <input type="button" value="DTMF"/>	<input type="button" value="select conf & transfer"/> <input type="text"/> <input type="button" value="enter conf & transfer"/> <input type="text"/> <input type="button" value="enter no & transfer"/>
835333 TLS SRTP	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	0 Set	<input type="checkbox"/>	<input type="text" value="conference/8000/conf-welcome.wav"/> <input type="button" value="play"/> <input type="text"/> <input type="button" value="Speak"/> <input type="text"/> <input type="button" value="DTMF"/>	<input type="button" value="select conf & transfer"/> <input type="text"/> <input type="button" value="enter conf & transfer"/> <input type="text"/> <input type="button" value="enter no & transfer"/>



IVR functionalities

IVR Functionalities

- Built-in state machine for defining IVRs and other workflows
- IVRs are defined the following way:
 - draw the callflow as UML state diagramm
 - define actions
 - define transitions
 - Upload UML state diagram to the application server
 - specify actions on the web GUI
 - test the state machine on the web GUI (html)
 - take the state machine into production (now with voice)
- Interaction with the caller
 - play sound files or sound streams
 - text to speech
 - read DTMF
 - voice menus (DTMF)
 - record users voice and playback later
 - word recognition (ASR)
- early media mode for some actions

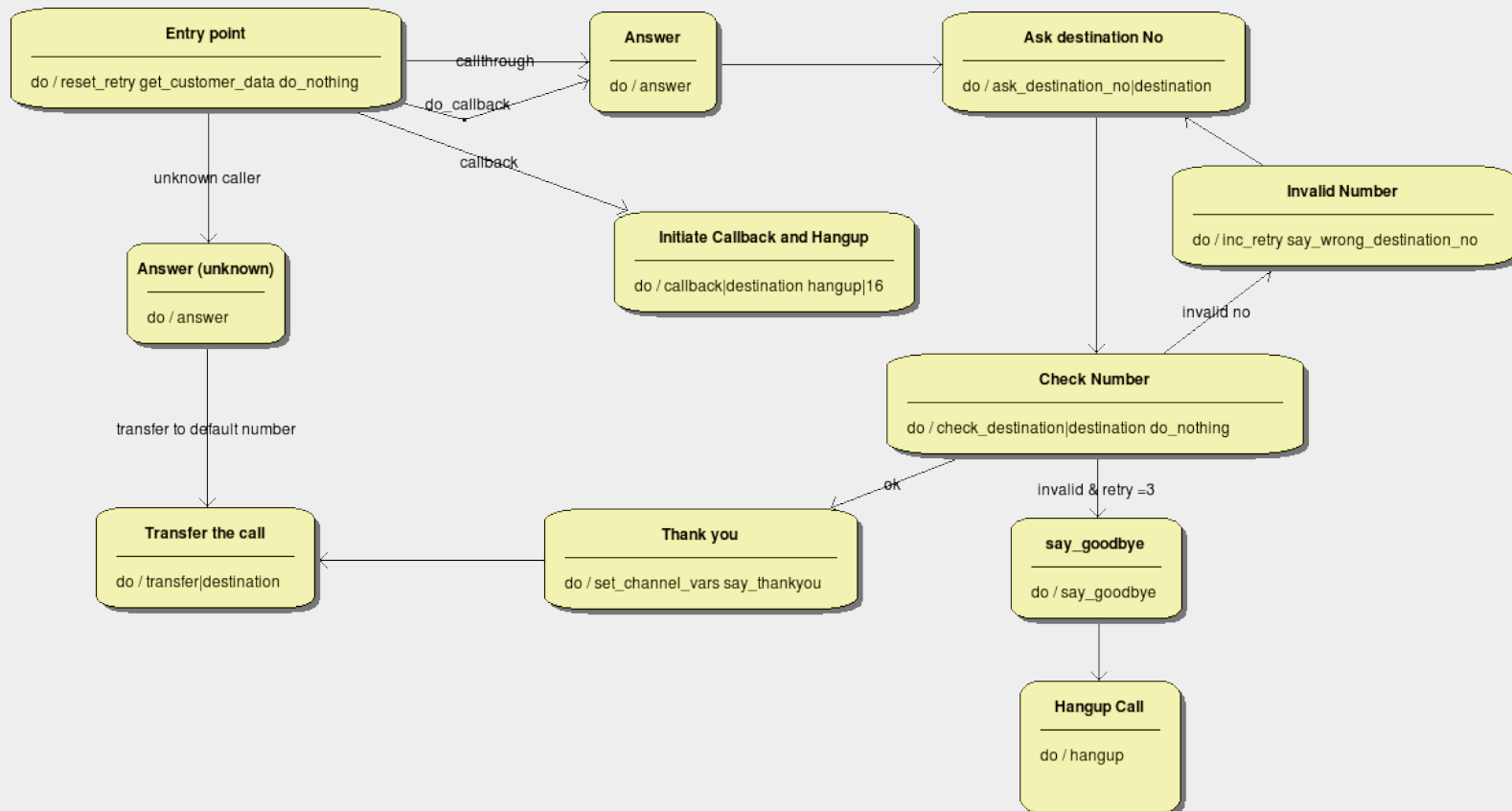


IVR Callback and Callthru application

Step1: Draw the workflow

Goal:

- Identify client/caller
- Hangup, then store callback number if client is callback customer
- Next step: callback to the client
- Offer to enter target number via DTMF and connect the call



IVR Callback and Callthru applikation

Step2: Specify actions in detail

Action name

ask_destination_no

Tts text

Please enter the destination Number (10 or 11 digits)

Voice files (separate multiple sound files by linefeeds)

welcome.wav
you-are-using.wav
\$service\$.wav
please-enter-num-to-call.PCMU

Do TTS? (Otherwise play sound files)

No of Digits when asked for Input

11

Interruptable by keypress?

Hear Params



IVR Callback and Callthru applikation

Step 2: Test workflow on the web browser



State: 128312 "Ask destination No"

Compare: No conditions



Executed: ask_destination_no|destination



Input:

Play zigit/welcome.wav

Play zigit/you-are-using.wav

Play zigit/callback.wav

Play zigit/please-enter-num-to-call.PCMU

Input:



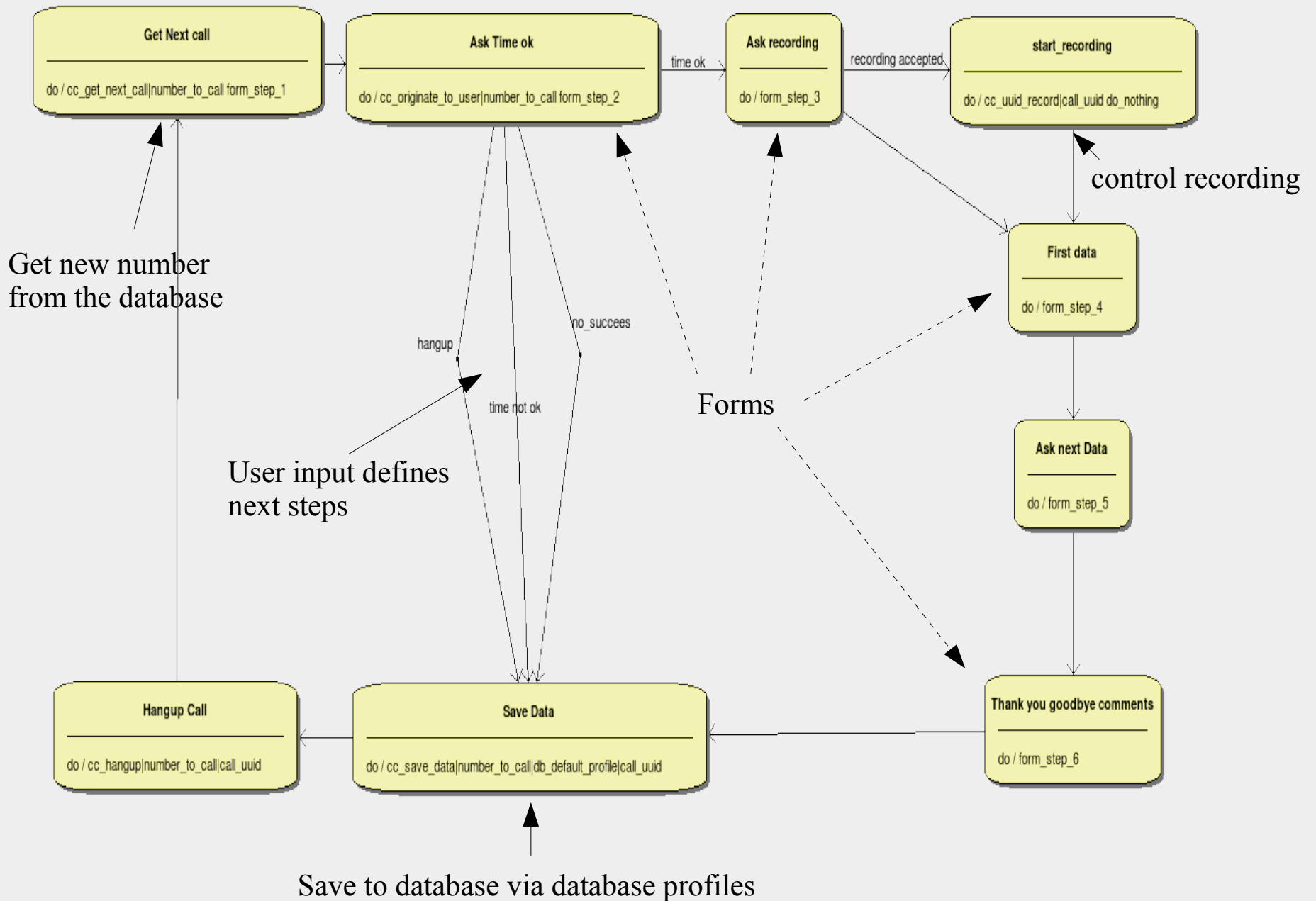


Callcenter functionalities



- Extension to IVR Application
- Webbrowser initiates actions on Freeswitch
- Freeswitch pushes data to the web browser (AJAX push services)
- Interactions to Freeswitch
 - Dial a number from a database
 - Answer a call
 - Play messages
 - Start recording
 - Stop recording
 - Forward call
 - Hangup Call
- Push services to the web browser
 - Show status of a call
 - Alert incoming calls
 - Open CRM window

Sample callcenter application: Step 1: Define Workflow



Sample callcenter application: Step 2: Define Forms

Callcenter form assistant

Enter variable name to be used in processing:

favourite

Please select control type:

select

Enter description text for this control:

What is your favourite brand to buy a vehicle

Enter parameters for this control:

Volvo,Mercedes,DAF,Iveco,MAN,Toyota,VW,Audi,BMW

Enter default options for this control:

Volvo

Show controls on Form

Add control to form

Delete last control

Delete all controls

Submit form & close

Define new form elements

Form preview

Ask for new procurements

When are you planning to buy your next vehicles?

- not_planned_yet
- 2009
- 2010
- 2012
- 2013
- later

What is your favourite brand to buy a vehicle

Volvo

Customer history:

Date	User	Campaign	FollowUp	Comment
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Preview new form

Sample callcenter application: Step 3: Run workflow



Telefaks Freeswitch Management

- Phone
- Numbers/Conferences
- Customers
- Routing
- Callcenter
- Basic Setup
- IVR State Machine
- Test XML requests
- Test with https
- Freeswitch
- Memcache
- System Status

Callcenter form state: 128626 "Ask next Data"

Compare: No conditions

Executed: form_step_5

Ask for new procurements

When are you planning to buy your next vehicles?

- not_planned_yet
- 2009
- 2010
- 2012
- 2013
- later

What is your favourite brand to buy a vehicle

Volvo

Customer history:

Date	User	Campaign	FollowUp	Comment
2009-06-09 15:01:35	peter	poll_cars		Completed
2009-06-08 13:07:07	peter	poll_cars	2009-06-09 15:00	
2009-06-07 13:06:29	peter	poll_cars	2009-06-08 13:00	

submit

← History



Push services

Push services

- every GUI user has an assigned phone number
- web browser registers on this phone number
- web browser gets status pushed from Freeswitch
 - Example: successful hangup

Status	Incoming Call from: 72332(Peter Steinbach FS) and IP 217.11.186 Event: CHANNEL_EXECUTE_COMPLETE, state: CS_HANGUP	Login: peter Role: Super Admin Subscribed to phone#: 723321
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Telefaks Freeswitch Management Login: peter Role: Super Admin

Phone Numbers/Conferences
Phone numbers

Listing directories
New directory entry (exten)

- Incoming call:

Status	Call from: 835333(835333) and IP 217.11.186 Event: CHANNEL_PROGRESS, state: CS_CONSUME_MEDIA	Click here to manage this call in the Callcenter Application Click here to manage in CRM	Login: peter Role: Super Admin Subscribed to phone#: 835331
--------	---	---	--

- Active call:

Status	Call from: 723323(Peter Steinbach FS) and IP 217.11.186 Event: CHANNEL_ANSWER, state: CS_EXECUTE	Login: peter Role: Super Admin Subscribed to phone#: 723321
--------	---	--





Customizing your application

Call Routing with regular expressions



- Phone
- Numbers/Conferences
- Customers
- Routing**
 - Gateways
 - Gateway-types
 - Gateway aliases
 - Host_gateways
 - Routings
 - Routings1
 - Routings2
 - Routings3
 - Routings4
 - Routings5
 - Dialplans
 - XML Parameter
- Callcenter
- Basic Setup
- IVR State Machine
- Billing
- Freeswitch Mgt.
- Test XML requests
- Memcache
- System Status

Editing routing

Profile

1

Description

German Provider QSC International

Active

No

Dialplan

Next Gateway insecure

Context from

default

Gateway from

sip5.telefaks.biz

Time Interval

whole day

Sort Id

0

Number From (enter regular expression)

^(00[1-9]\d{4,13})\$

Context to

default

Gateway to

QSC_07141

Number To (enter fixed number, or \$1 for the dialled number or \$target_number\$ for the replaced number)

\$target_number\$

Number To Match (Regex which shall apply to the finally dialled number, leave empty if no change shall apply)

^00([1-9]\d{4,13})\$

Comment

Strip off 00 from 0049xxx

Call handling via templates

```
<!-- start a generic conference with the settings of the "default" conference profile -->
<!-- Target No $target_number$ -->
<extension name="conference $conference_name$" >
  <condition field="destination_number" expression="^\(d+\)$">
    <action application="set" data="dialplan_comment=$dialplan_comment$"/>
    <!-- this is filled up with external participants and a hangup hook if needed -->
    $conference_invitations$
    <action application="answer"/>
    <action application="send_display" data="Conference $1"/>
    <action application="conference" data="$conference_number@$context$"/>
  </condition>
</extension>
```

- Application server defines additional variables
- Variables are expanded at runtime

Customizing your own applications

Example: Wikipedia

- Special numbers can be used to trigger own dialplan actions
- dialplan actions can be XML templates or customized Ruby code

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Editing special_number

Customer

Telefaks

Number

83533405

Description

Speak Wikipedia

Active



Show on panel



Dialplan

Execute

Execute (select Execute dialplan before when using

```
Custom.speak_wikipedia("Frankfurt_am_Main")
```

Update

[Show](#) | [Back](#)

Available number ranges

for Special numbers

Customer	Range_from	Range_to
Telefaks	83533	8353399999
Internal	99998	99998
Telefaks_public	9999999900	9999999999
Mein50Plus	26824	2682499999
Telefaks_private	83534	8353499999

Customizing your own applications

Example: Wikipedia

```
def self.speak_wikipedia(search_exp)
  text=self.get_wikipedia_text(search_exp)
  master="<action application=\"speak\" data=\"cepstral|katrin|$text$\"/>\n"
  erg= "<!-- Wikipedia entry to speak: '#{search_exp}' -->\n"
  if text
    text.each do |line|
      if !line.strip.empty?
        erg+=master.gsub("$text$", line)
      end
    end
  end
end
end
erg
end
```

```
<!-- Wikipedia entry to speak: 'Frankfurt am Main' -->
<action application="speak" data="cepstral|katrin|Frankfurt am Main." />
<action application="speak" data="cepstral|katrin|aus Wikipedia, der freien Enzyklopaedie." />
<action application="speak" data="cepstral|katrin|Frankfurt am Main ist mit ueber 659.000 Einwohnern die groesste Stadt Hessens und nach Berlin, Hamburg, Muenchen und Koeln die fuenftgroesste Deutschlands.." />
<action application="speak" data="cepstral|katrin|Seit dem Mittelalter gehoert Frankfurt zu den bedeutendsten urbanen Zentren Deutschlands. 794 erstmals urkundlich erwaehnt, war es seit dem Hochmittelalter Freie Reichsstadt und bis 1806 Wahl- und seit 1562 auch Kroenungsstadt der roemisch-deutschen Kaiser. Von 1816 bis 1866 war Frankfurt Sitz des Deutschen Bundes und 1848/49 des ersten frei gewaehnten deutschen Parlaments.." />
<action application="speak" data="cepstral|katrin|Heute ist Frankfurt ein bedeutendes europaeisches Finanz-, Messe- und Dienstleistungszentrum. Die Stadt is Sitz der Europaeischen Zentralbank, der Deutschen Bundesbank, der Frankfurter Wertpapierboerse und der Frankfurter Messe. Durch ihre zentrale Lage gehoert sie mit dem Frankfurter Flughafen, dem Hauptbahnhof und dem Frankfurter Kreuz zu den wichtigsten Verkehrsknotenpunkten Europas.." />
<action application="speak" data="cepstral|katrin|1875 zaehlte Frankfurt erstmals ueber 100.000 Einwohner, 1928 zum ersten Mal mehr als 500.000. In der engeren Stadtregion leben heute etwa 1,8 Millionen, im gesamten Rhein-Main-Gebiet 5,8 Millionen Einwohner.." />
<action application="speak" data="cepstral|katrin|Eine Besonderheit Frankfurts ist die Skyline, deren Wolkenkratzer zu den hoechsten Gebaueden Europas gehoeren.." />
```

Some examples for customizing

- Wikipedia as shown before
- Speak selected content of news sites
- Speak RSS feeds
- Speak file contents
- Speak meter values from external interfaces
- Access calendar from SyncML (Funambol)
- Intercom, global announcements
- Reverse internet CID lookup



Performance

- using caching techniques wherever applicable
 - „Memcache“ allows distributed caching over multiple servers
- Tested under High Load
 - up to 250 call setups per second out of the box on a Dual Core AMD 2,5GHz (caching enabled)
 - up to 160 call setups per second out of the box on a Dual Core AMD 2,5GHz (caching disabled)
- Outlook:
 - scales well with the number of processors (processes are CPU intensive)
 - scales well with the number of machines (http cluster techniques used)
 - Further performance improvement with Ruby 1.9 and optimized, self-compiled Ruby binaries



Thank you!

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