Media Handling in FreeSWITCH

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Agenda

- Audio Codecs
- Transcoding
- Codec Negotiation
- Bypass Media
- Proxy Media
- Sangoma Transcoding

Audio Codecs

Audio Codecs

- Codecs encode and decode voice for network transmission
  - Algorithm (compression technology)
  - Bit rate
  - Sampling rate
  - Packetization
- Algorithm is the core of the codec
- Bit rate defines bandwidth required. (how many bits per second)
- Sampling rate defines the quality. (all other things being equal)
- Packetization affects latency and bandwidth overhead

Audio Codecs

- G.711 (PCMU/PCMA, Ulaw/Alaw) – Narrowband.
  - 64kbps per second (Bit rate)
  - 8kHz (Sampling rate)
  - 10ms, 20ms, 30ms, 40ms … + (Packetization)
- G.722 – Wideband
  - 48kbps, 56kbps and 64kbps
  - 16kHz (IANA clocks it at 8kHz due to historical error in RFC1890)
  - 10ms, 20ms, 30ms, 40ms … +
- G.722.1 Annex C - Ultra-wideband
  - 48kbps
  - 32kHz
  - 20ms, 40ms, 60ms

FreeSWITCH Audio Codecs

- FreeSWITCH supports a wide range of codecs
  - Narrowband (G.711, G.726, G.723.1, G.729AB, Speex …)
  - Wideband (G.722, G.722.1, G.722.2, Speex …)
  - Ultra-wideband (G.722.1C, Speex)
  - CD-quality (CELT)
- FreeSWITCH core requires the media to be in L16 (signed linear, raw digital audio) format for manipulation (mixing, tone detection etc)
- Codec modules encode and decode from/to L16 format
- Pass-thru codec modules are dummies (mod_g729, mod_g723_1)

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FreeSWITCH Audio Codecs

```
freeswitch@sigchld> show codecs

type,name,ikey
codec,ADPCM (IMA),mod_spandsp
codec,G.711 alaw,CORE_PCM_MODULE
codec,G.711 ulaw,CORE_PCM_MODULE
codec,G.722,mod_spandsp
codec,G.723.1 6.3k,mod_g723_1
codec,G.726 16k,mod_spandsp
codec,G.726 16k (AAL2),mod_spandsp
codec,G.726 24k,mod_spandsp
codec,G.726 24k (AAL2),mod_spandsp
codec,G.726 32k,mod_spandsp
codec,G.726 32k (AAL2),mod_spandsp
codec,G.726 40k,mod_spandsp
codec,G.726 40k (AAL2),mod_spandsp
codec,G.729,mod_g729
codec,GSM,mod_spandsp
codec,LPC-10,mod_spandsp
codec,PROXY PASS-THROUGH,CORE_PCM_MODULE
codec,PROXY VIDEO PASS-THROUGH,CORE_PCM_MODULE
codec,Polycom(R) G722.1/G722.1C,mod_siren
codec,RAW Signed Linear (16 bit),CORE_PCM_MODULE
codec,Sangoma G729,mod_sangoma_codec
codec,Speex,mod_speex
codec,iLBC,mod_ilbc

23 total.

freeswitch@sigchld>
```

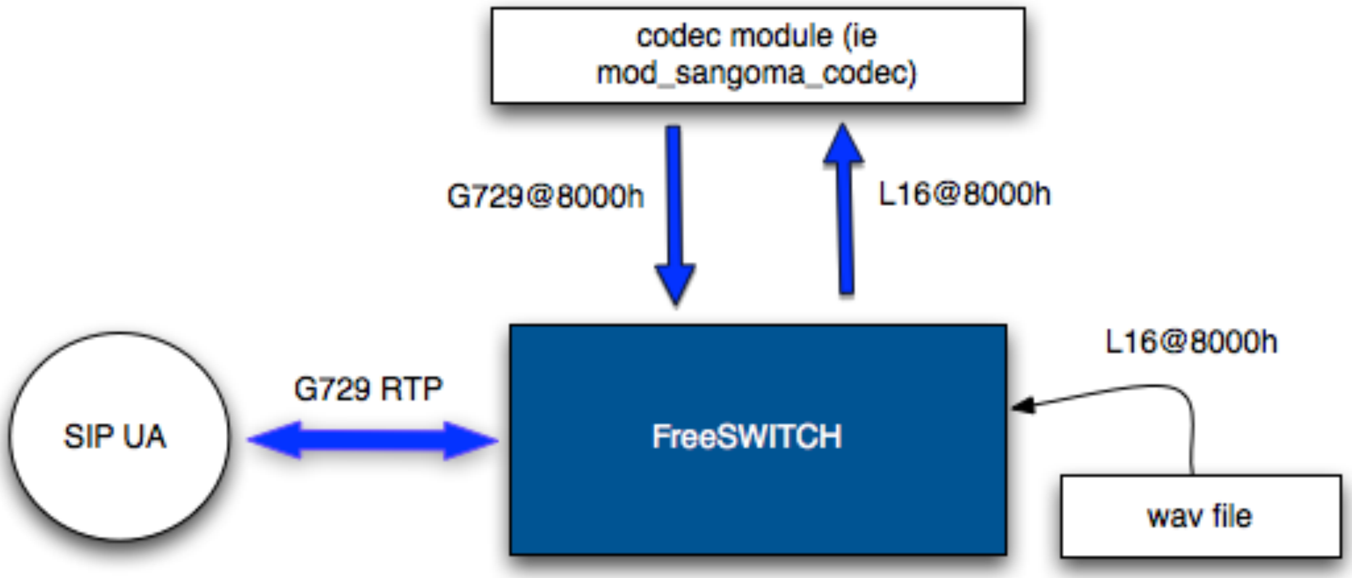
Transcoding

Transcoding

- Required when endpoints have no codec in common
- FreeSWITCH must stay in the media path
- Increases CPU usage (particularly if done in software)
- Is a must if you need:
  - Call recording
  - Tone detection
  - Play announcements or tones

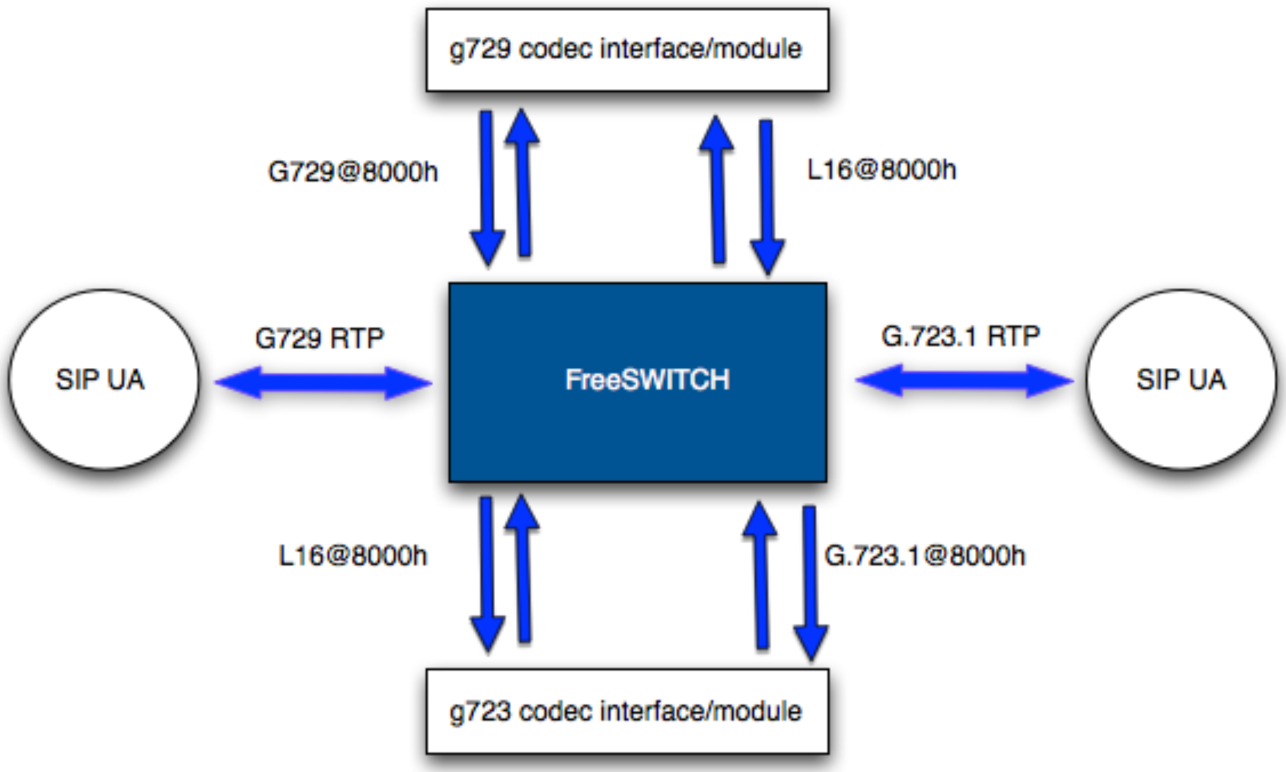
FreeSWITCH Transcoding

- Transcoding in one-legged call



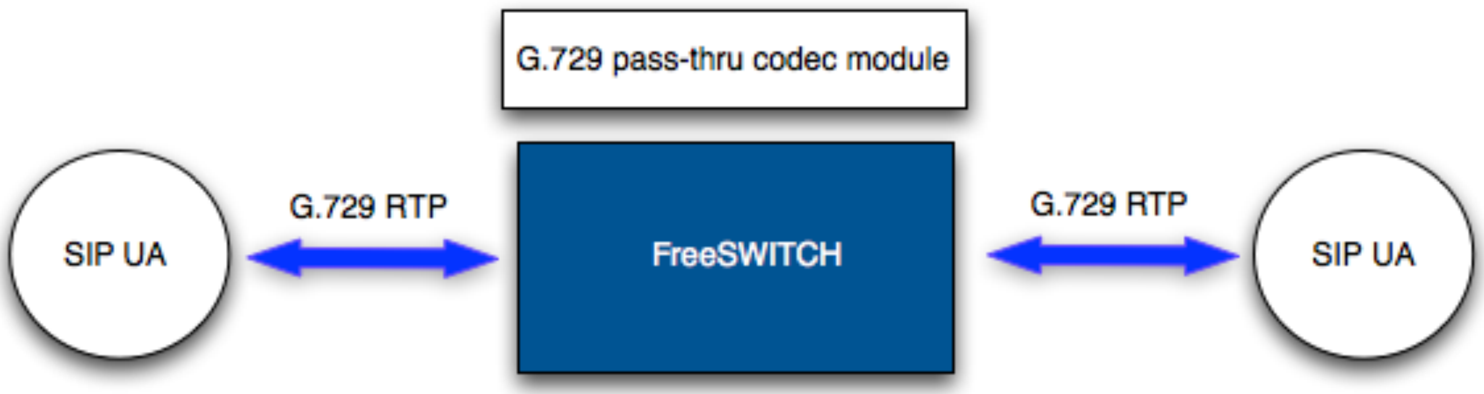
FreeSWITCH Transcoding

- Transcoding 2 SIP legs



FreeSWITCH codec pass-thru

- Pass-thru codecs do not do transcoding



Codec Negotiation

Codec Negotiation

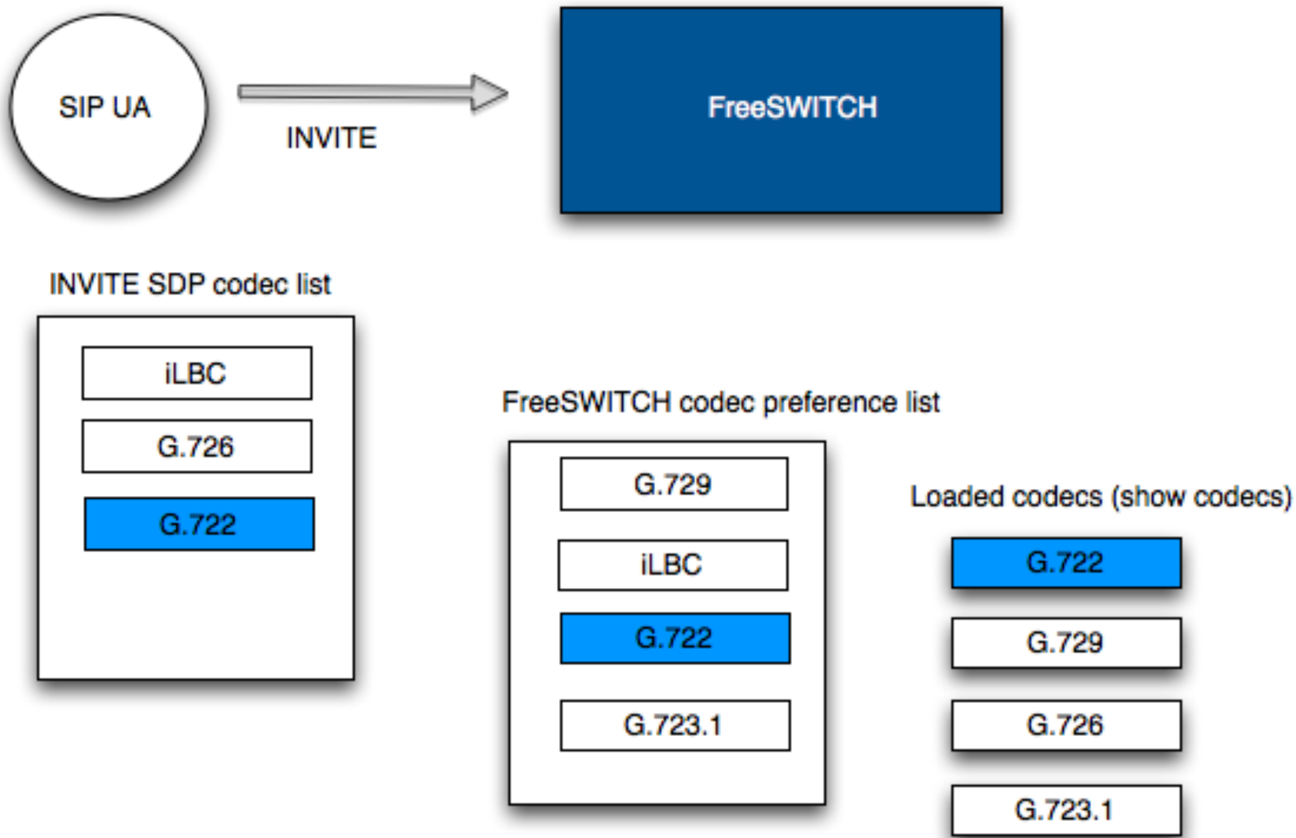
- Decisions to be made to choose a codec for a call
- From a list of codecs, pick one!
- You can choose when this happens (early vs late)
- Early happens before call hits the dial plan
- Late will happen when the leg is answered (or in pre-answer)

Codec Negotiation

- 3 inbound negotiation algorithms
  - generous
  - greedy
  - Scrooge (Bah HUMBUG!)

- Use **inbound-codec-negotiation** in SIP profile
- Use **sip_codec_negotiation** variable in the dial plan

Codec Negotiation



Early Negotiation

- Default negotiation mode in FreeSWITCH
- The codec is chosen matching SDP vs inbound-codec-prefs in the SIP profile
- “disable-transcoding” offers the same codec chosen for the inbound leg to the outbound leg
- absolute_codec_str is a good brute-force approach

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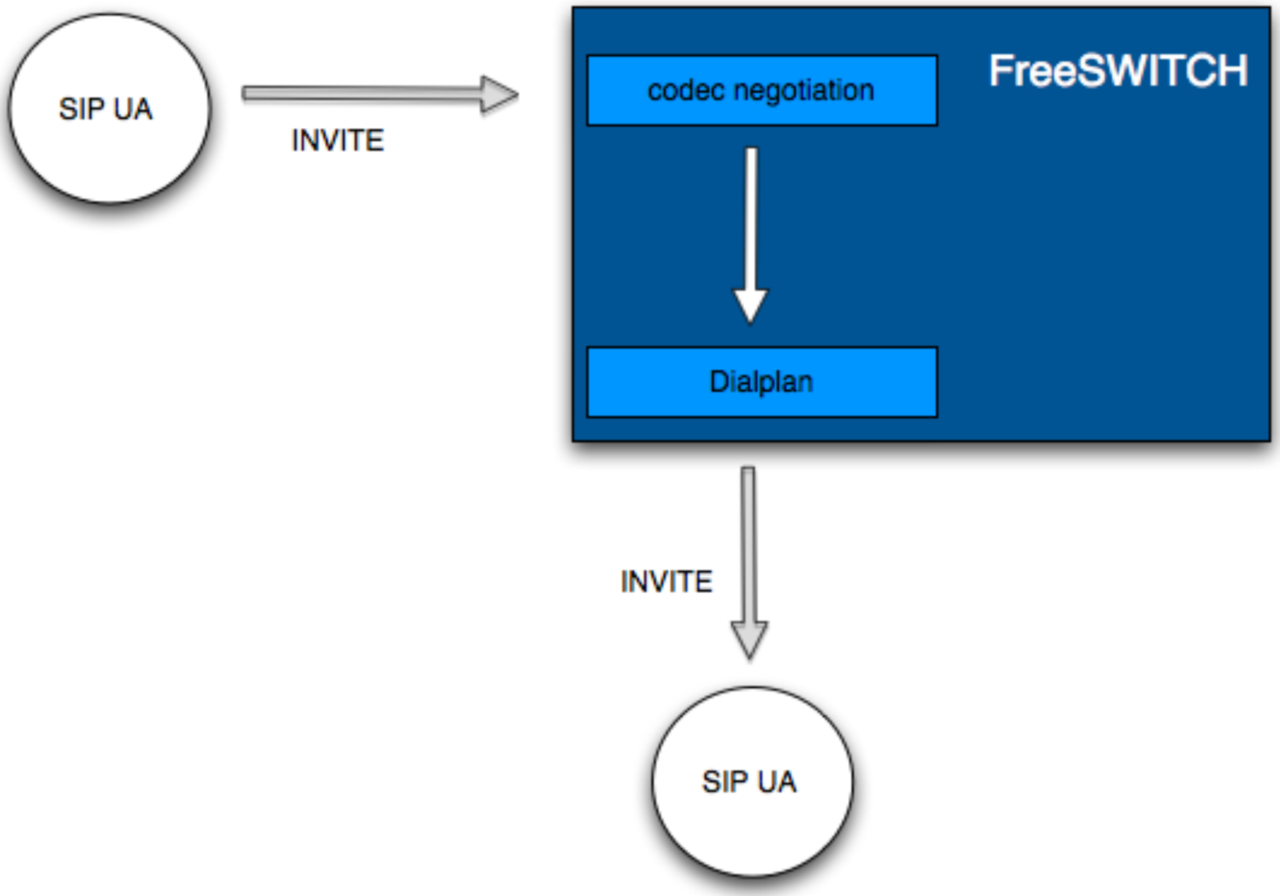
Early Negotiation



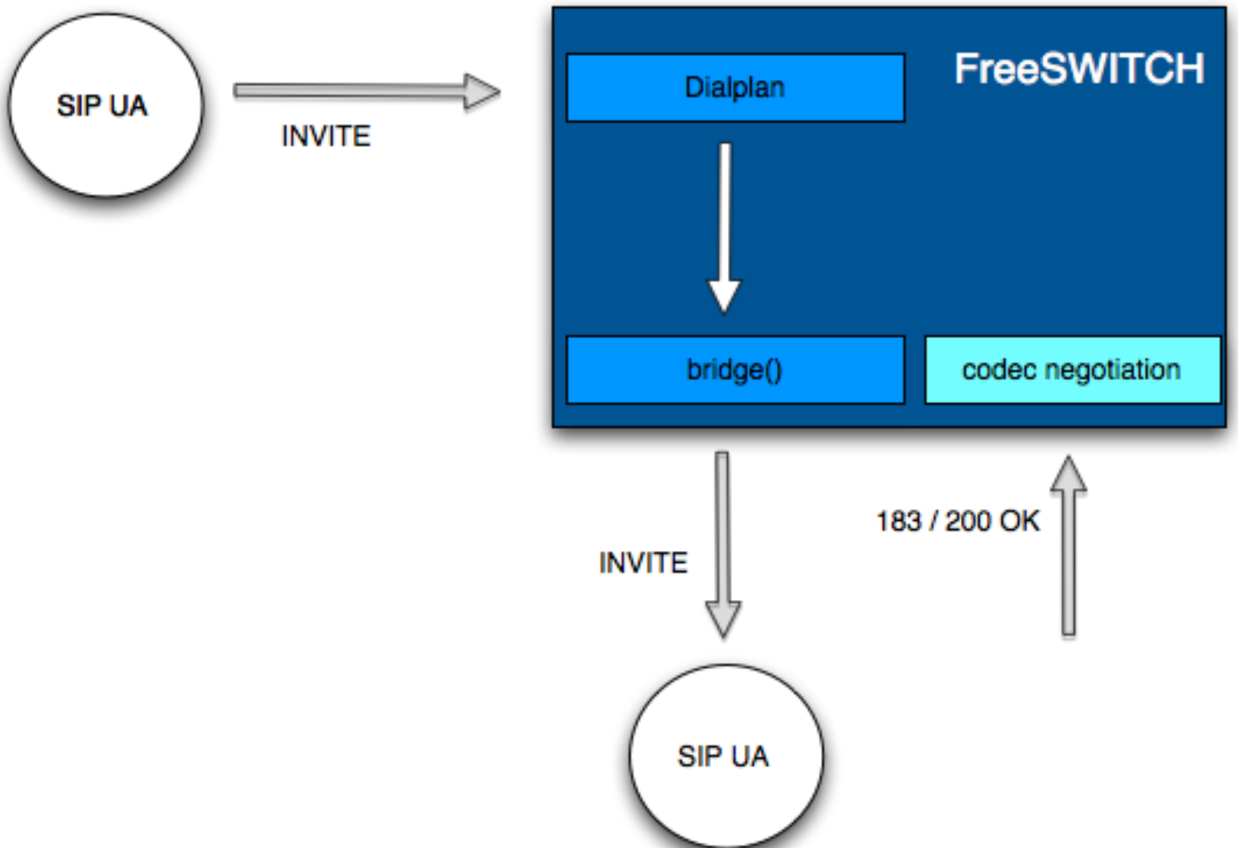
Late Negotiation

- “Smarter” approach to codec negotiation
- “inbound-late-negotiation” set to “true” in the SIP profile
- Call will hit the dial plan without looking at codecs
- Negotiation will occur when incoming leg is answered (or requires early media)

Late Negotiation

- You can examine the incoming SDP and re-write SDP to fit your own needs
- “inherit_codec” variable is available to try to use the codec from the B leg for the A leg
- “ep_codec_string” contains the codecs offered by the endpoint

Late Negotiation



Media Modes

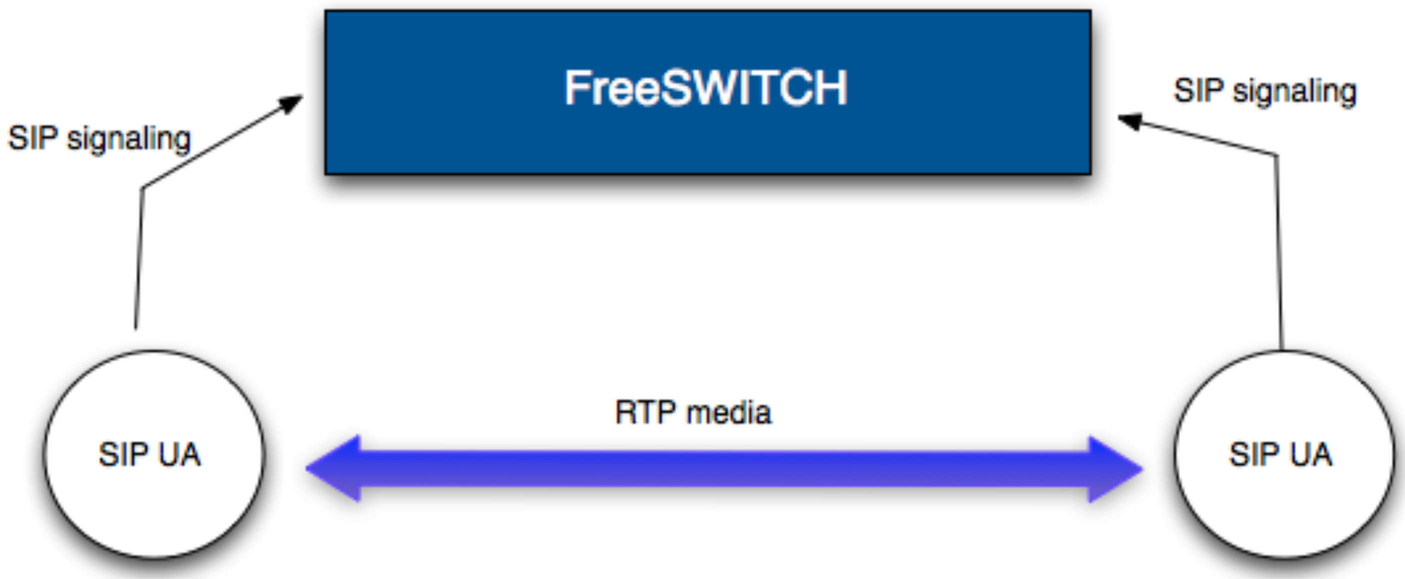
Bypass Media

- Media goes around FreeSWITCH (not through) directly between the endpoints
- SIP signaling stays in FreeSWITCH
- Enable by setting variable “bypass_media=true” before bridging
- Set inbound-no-media or inbound-bypass-media in the SIP profile for a permanent solution

Bypass Media

- You can still play files! (uuid_broadcast)
- uuid_media [off] can re-invite FreeSWITCH on/off the media path
- Recording will fail unless you manually put back FreeSWITCH on the media path

Bypass Media



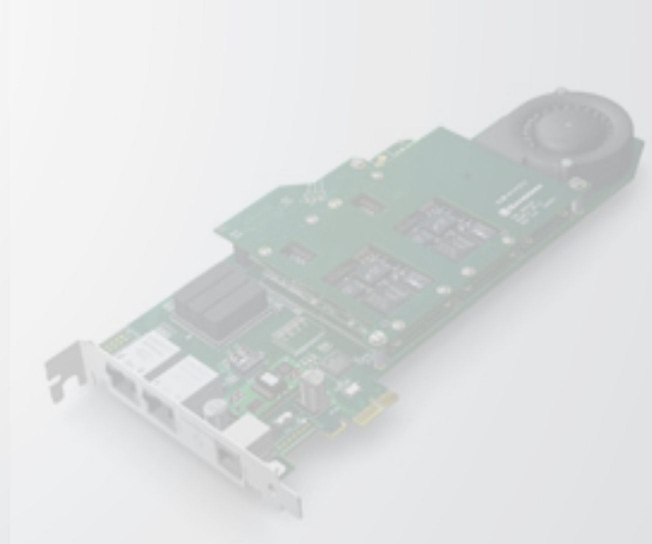
Proxy Media

- Also called “transparent proxy mode” for the RTP
- No media capabilities enabled
- Only the “c=” part in the SDP is modified
- Allows FreeSWITCH to pass-thru codec media that does not support

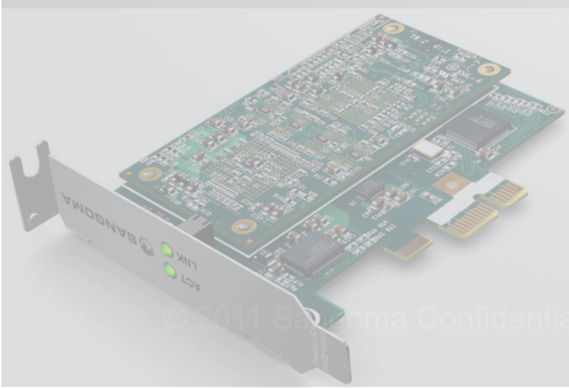
Proxy Media

- Set “proxy_media=true” variable before the bridge to enable it
- Set “inbound-proxy-media” in the SIP profile for a permanent solution
- You most likely want to have “late negotiation” enabled

Proxy Media



Sangoma Transcoding



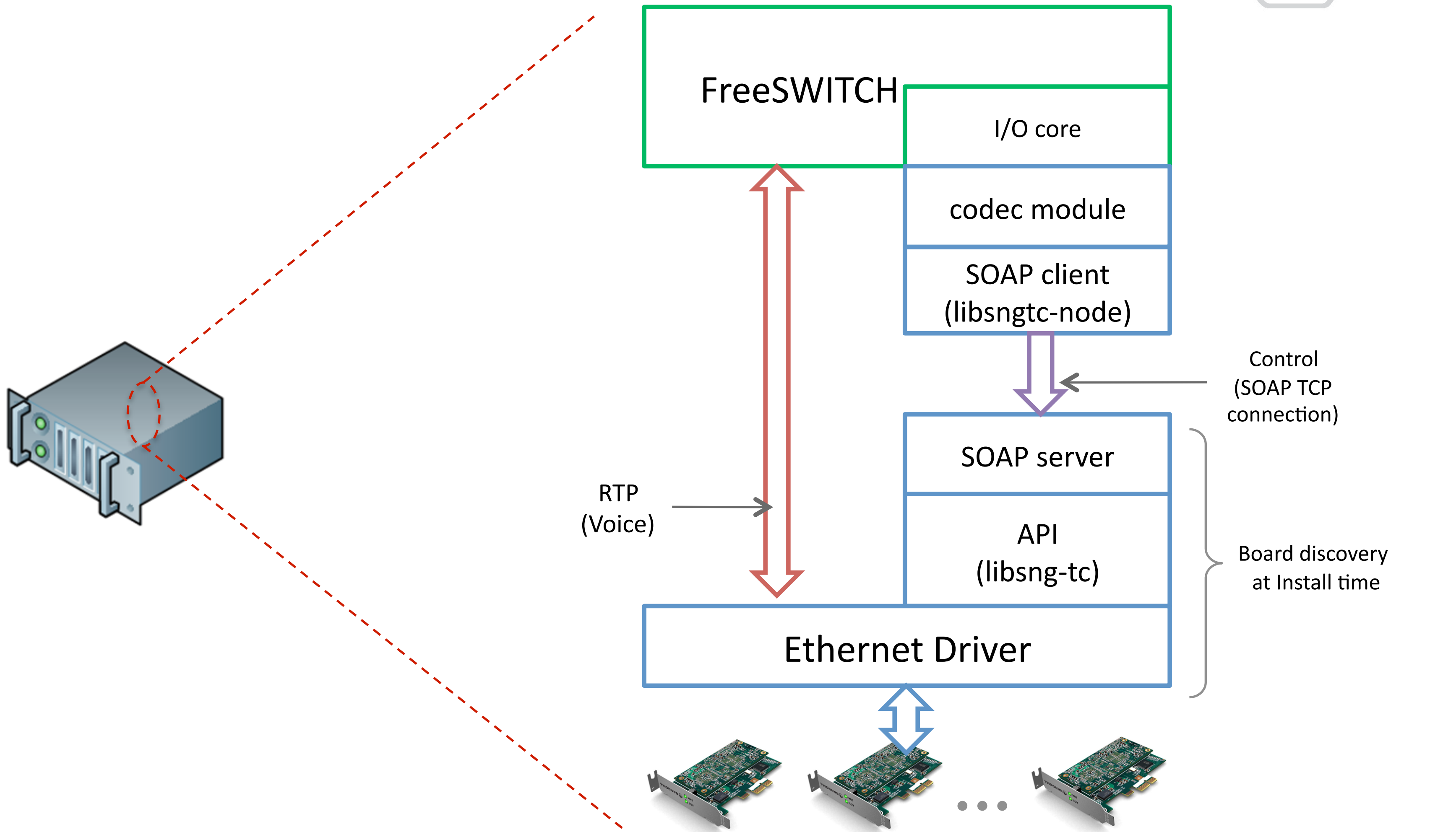
Sangoma Transcoding

- Wider codec support in the industry
- Seen as an ethernet interface by the operating system
- SOAP interface for transcoding control
- Multiple servers can use a single card
- Firmware upgradable on the field
- License upgradable (from 30 licenses to 400)

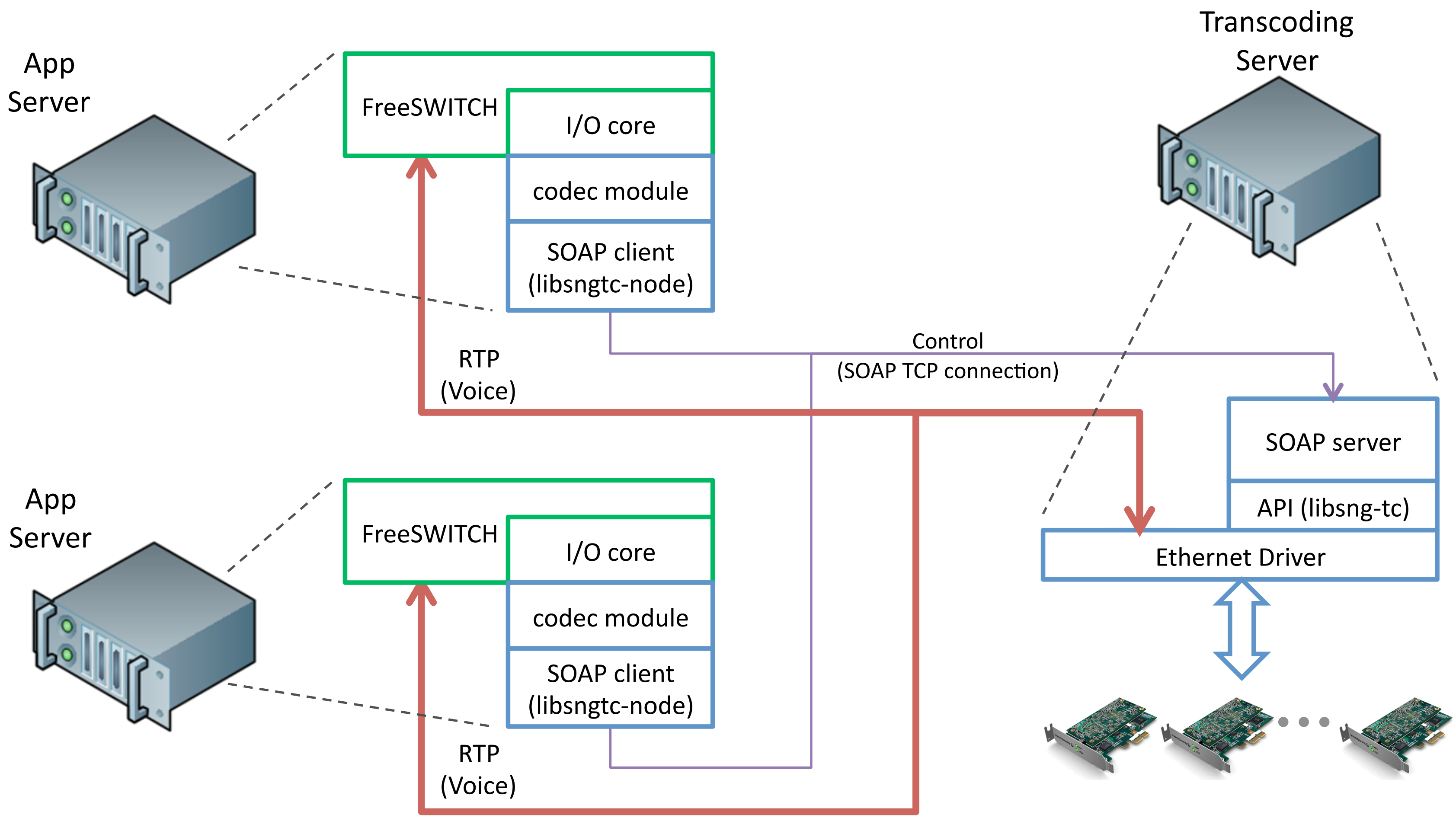
Capacity

Codec/P Time	10 ms	20 ms	30 ms	40 ms	50 ms
G.729 AB	300	440	459	462	466
G.722	290	388	410	388	
GSM		480			
AMR 12.20		200		226	
AMR 4.75		258		281	
ILBC 15.2		310		298	
ILBC 13.3			273		
G.723 5.3			200		
G.723 6.3			200		
G.726 32	310	450	480	480	480
PCM/U	310	390	420	440	460
PCM/A	310	390	420	440	460

Single Server Setup



Distributed Setup



Supported Codecs

- G.729
- G.726-32
- G.722
- G.722.1
- G.723.1
- iLBC
- AMR

  – *more codecs supported by the D-series cards but not yet implemented by FreeSWITCH codec module

THANK YOU

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