IMS Workshop

Carsten Bock - KamailioWorld 2018

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Todays Goals

- Introduction into the IP Multimedia Subsystem - IMS
  - Possible use-cases for IMS
- Components in an IMS network
- IMS with Kamailio - Installation howto
  - Applications for IMS - with Kamailio & friends

Introduction into IMS

What is IMS?

- First of all: It's an architecture for services
  - Primary service: Voice & related services
  - But could be any service, e.g. IP-TV, Games, Chat, ...
- Created by the 3GPP - in 1999
  - follows IETF standards where possible

Why LTE?

- 4G is 5x cheaper for voice than 3G
- 4G is 20x cheaper than 2G
- Growth in network demands:
  - 4G/5G is 2-3x more efficient compared to 2G/3G
  - 40% of the spectrum is used for Voice on 2G/3G
  - **On 4G it's 10%**
- 4G/5G provides an IP Only network – no voice capabilities!

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Why VoLTE?

- Simpler, more cost effective networks

- Improved voice quality

- Faster connecting times

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Surviving acronym hell

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New Interfaces for Kamailio

- Cx
- Dx
- Rx
- Ro
- Rf
- ISC
- GM
- MW
- Ut

Feel lost???

Some slides ago:

3GPP follows IETF, whereever possible:

Signalling:

- SIP / RTP / RTCP
- H.248

Services

- Diameter - an extended Version of RADIUS
- HTTP

New Interfaces for Kamailio

(2nd attempt)

- Cx - Diameter
- Dx - Diameter
- Rx - Diameter
- Ro - Diameter
- Rf - Diameter
- ISC - SIP/RTP
- GM - SIP/RTP
- MW - SIP/RTP
- Ut - XCAP/HTTP

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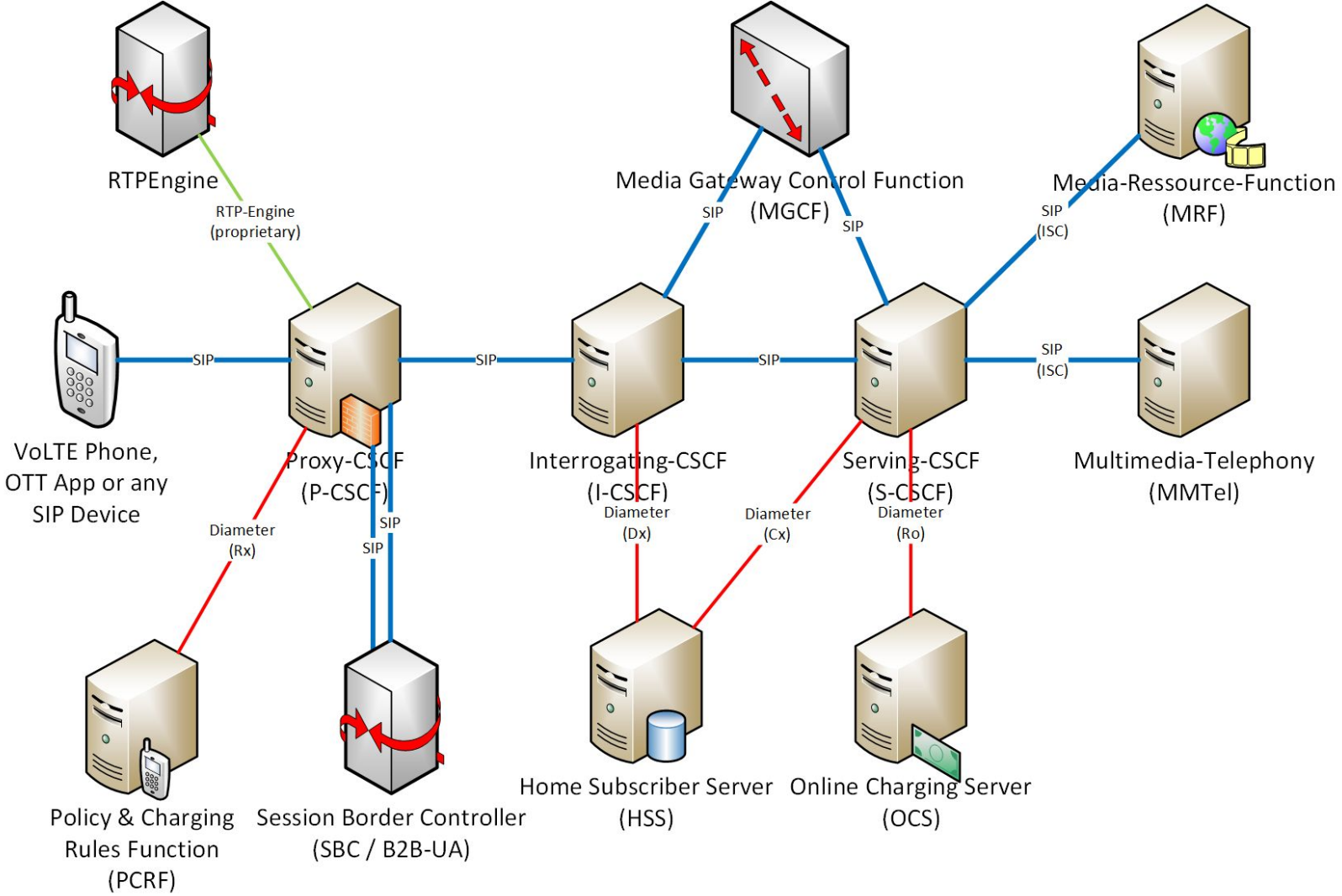
The architecture and servers


RTPEngine
RTP-Engine
(proprietary)
Media Gateway Control Function
(MGCF)
SIP
SIP
Media-Ressource-Function
(MRF)
SIP
(ISC)
VoLTE Phone,
OTT App or any
SIP Device
SIP
Proxy-CSCF
(P-CSCF)
SIP
Interrogating-CSCF
(I-CSCF)
SIP
Serving-CSCF
(S-CSCF)
SIP
(ISC)
Multimedia-Telephony
(MMTel)
Diameter
(Rx)
SIP
SIP
Diameter
(Dx)
Diameter
(Cx)
Diameter
(Ro)
Policy & Charging
Rules Function
(PCRF)
Session Border Controller
(SBC / B2B-UA)
Home Subscriber Server
(HSS)
Online Charging Server
(OCS)

Proxy-CSCF (P-CSCF)

- Assigned to the user-equipment
  - e.g. during LTE attach (PCO), DHCP, DNS, static
- Provides message validation
- Stays in the signalling path
- May provide QoS
  - Rx-Interface towards the Proxy-CSCF
- May provide SigComp, IPSec, TLS/SRTP translation, ...

Interrogating-CSCF (I-CSCF)

- This IP is published in the DNS for the Domain
- Queries the HSS for the S-CSCF to be used
  - or selects a HSS for a subscriber based on his requirements
- Forwards the request to the according S-CSCF
- more or less a “intelligent loadbalancer”

Serving-CSCF (S-CSCF)

- Provides SIP Registration services (a SIP Registrar)
- Forwards requests to Application Servers, if necessary
- Provides Routing-Services
  - to a Breakout-Gateway
  - to other IMS networks (using ENUM)
- Provides Online/Offline Charging

Home Subscriber Server (HSS)

- Supports Call related systems (e.g. Application-Servers, S-CSCF, I-CSCF)
- Provides a User-Profile to the according systems
- Provides Authentication / Authorization
  - Both for MME and IMS
- Stores association between Subscriber and S-CSCF

Getting mandatory information from the SIM-Card

- It's all based on the IMSI (International Mobile Subscriber Identity), e.g. 262-01-1234567890
  - 262 > Country-Code (MCC)
  - 01 > Network-Code (MNC)
  - Resulting Domain: ims.mnc001.mcc262.3gppnetwork.org
- Proxy-CSCF is "learned" during LTE attach (PCO Options)
- A VoLTE phone will connect to the "well-known" "IMS" APN

Installation and configuration

Installation of IMS with Kamailio

- Requirements:
  - Linux ;-)
  - a DNS-Server (e.g. PowerDNS or BIND)
  - a database for persistent storage
- A network HSS, e.g.
  - Fraunhofer's FHoSS
  - Any other network HSS

Installation of IMS with Kamailio (2)

- Typically: apt-get install kamailio kamailio-ims-modules (and a few others)
- Configuration files are split into several files, e.g.:
  - kamailio.cfg - main configuration
  - pcscf.cfg/icscf.cfg/scscf.cfg - server specific configuration (e.g. IP's, database links, features)
  - pcscf.xml/icscf.xml/scscf.xml - Diameter configuration

Services

What did we achieve (so far)?

- At this stage, IMS supports:
  - User-Registration
  - Basic Call Routing
  - Charging (Pre- and Postpaid)
  - Optional: Quality of Service (e.g. on LTE/VoLTE)

Let’s talk services!

- In IMS, everything is a application- even Voice
- Supplementary services are provided by an Application Server (MMTel)
- All services beyond basics are applications

Prerequisites

- Connectivity to the IMS ;-)
- Service Profile definition

Use-Cases:

- Number manipulation
- Barring
- Call-Forwarding
- “Rich services”, e.g. Presence, SMS, ...
- ...

A simple service: Number manipulation (dialplan)

kamailio.cfg

```
route {
  # Evaluate Route-Header and set $route_uri
  loose_route();

  if (dp_translate("1")) {
    xlog("L_INFO", "R-URI rewritten to $rU (Rule 1) - M=$rm R=$ru F=$fu T=$tu ($si:$sp) ID=$ci\n");
  }

  t_relay();
}
```

Number manipulation (dialplan) & Call-Forwarding

kamailio.cfg

```
route {
  # Evaluate Route-Header and set $route_uri
  loose_route();

  if ($hdr(Record-Route) =~ "^.*sip:mt.*$") {
    $rU = '+4940525759340';
  } else {
    if (dp_translate("1")) {
      xlog("L_INFO", "R-URI rewritten to $rU (Rule 1) - M=$rm R=$ru F=$fu T=$tu ($si:$sp) ID=$ci\n");
    }
  }
  t_relay();
}
```

Use-Cases:

- Voicemail
- IVR
- Announcements
- As an MRF*

*) Media-Resource-Function

Pre-Call announcement

kamailio.cfg

```
[scscf]
exten => _X!,1,Wait(1) ; Wait a second, just for fun
exten => _X!,n,Answer ; Answer the line
; Execute the AGI in order to play the announcement
exten => _X!,n,agi(qod-agi.php)
; Dial and pass-through some headers
exten =>
_X!,n,Dial(PJSIP/scscf/sip:${EXTEN:3}@${SIPDOMAIN},,b(handler^addheader^1,(${PJSIP_HEADER(read,Route)},${P
JSIP_HEADER(read,P-Charging-Vector)},${PJSIP_HEADER(read,P-Visited-Network-ID)},${PJSIP_HEADER(read,X-Sess
ion-Case)})))
exten => _X!,n,Hangup
```

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