Deployment of the IMS at Telefónica Germany, fixed and mobile: why and how.

Workshop - Serviços de Comunicação de Próxima Geração
http://atnog.av.it.pt/wscpg/

Aveiro, 27 de Abril, 2012 - Instituto de Telecomunicações

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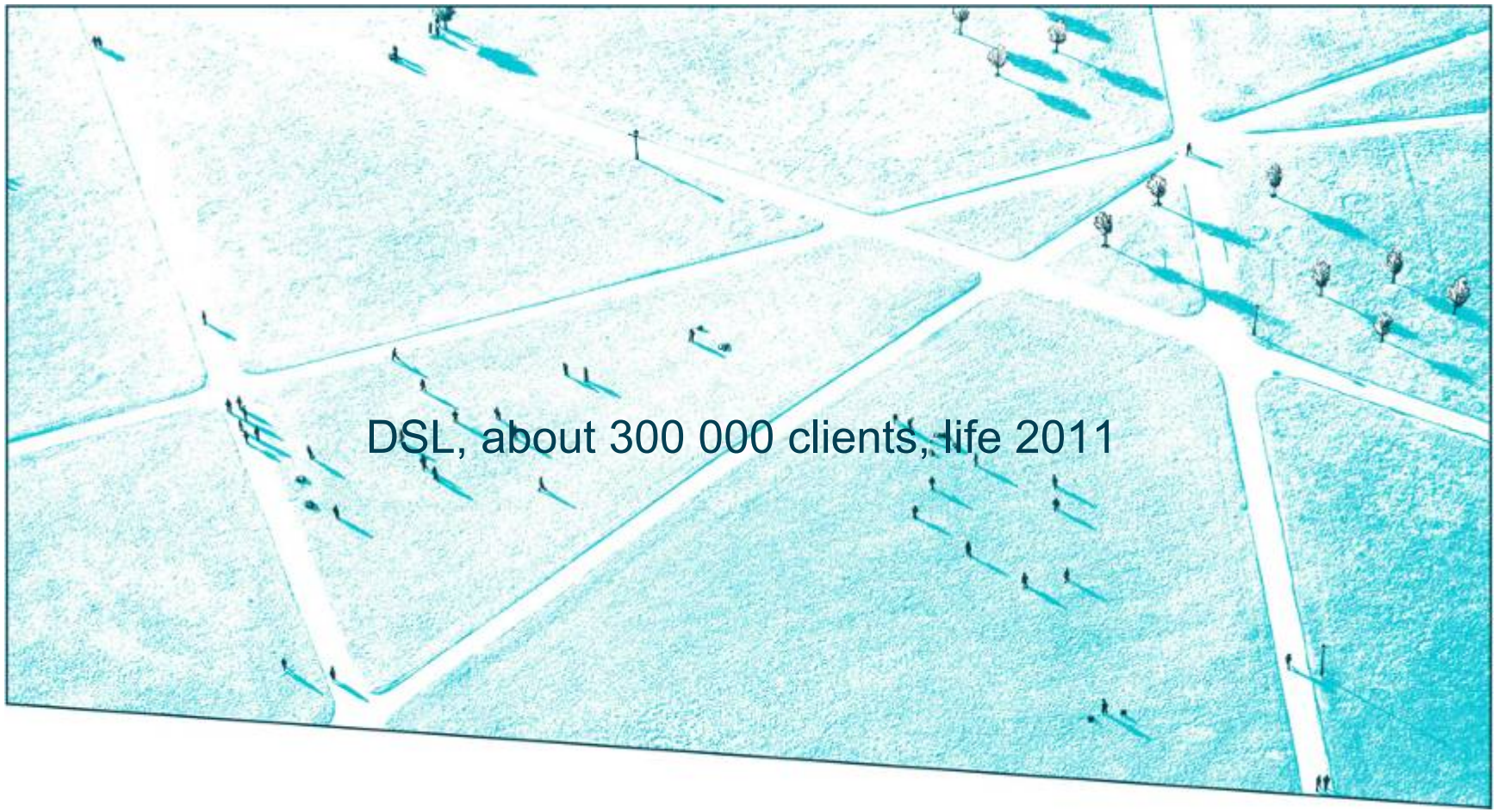

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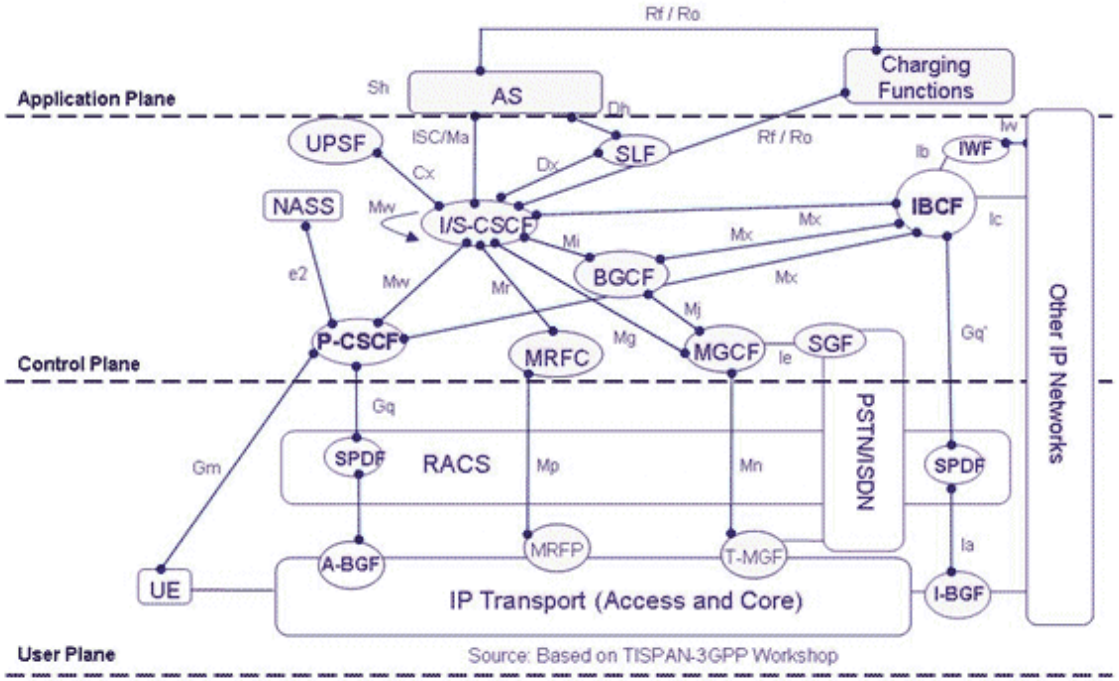
IMS was almost dead

IMS is very complicated and plain IMS just offers voice

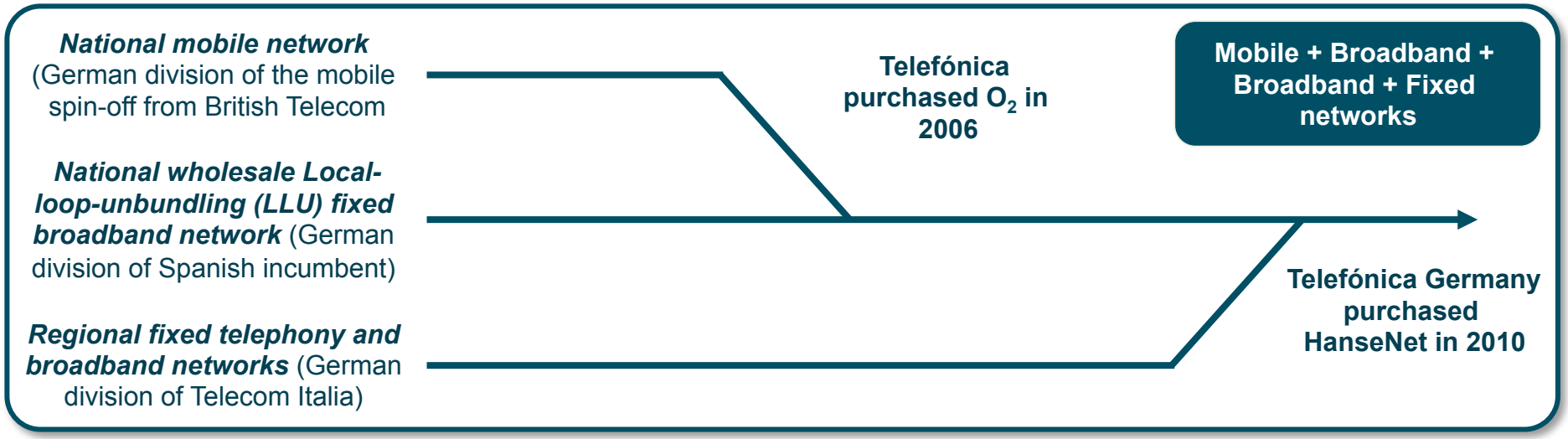
As long as operators can keep offering voice over CS, no real need or business case to migrate to IMS

IMS “was” almost dead. See next…



History of Telefónica Germany is essential to understand the introduction of IMS

a collection of Networks, created through various acquisitions



Introduction of the IMS

O_2, mobile only operator, never saw the need to introduce the IMS

Telefónica Deutchland had a "*National wholesale Local-loop-unbundling (LLU) fixed broadband network*"

- No CS voice, only VoIP
- VoIP was subcontracted

In 2006, Telefónica S.A. bought O_2

Create a German Integrated Operator

Create own fixed VoIP platform

No need to replace CS voice, there was not in fixed domain

IMS was selected (2008) for replacing the subcontracted VoIP (fixed)

Only in latter stages will the IMS replace CS voice (fixed and mobile)

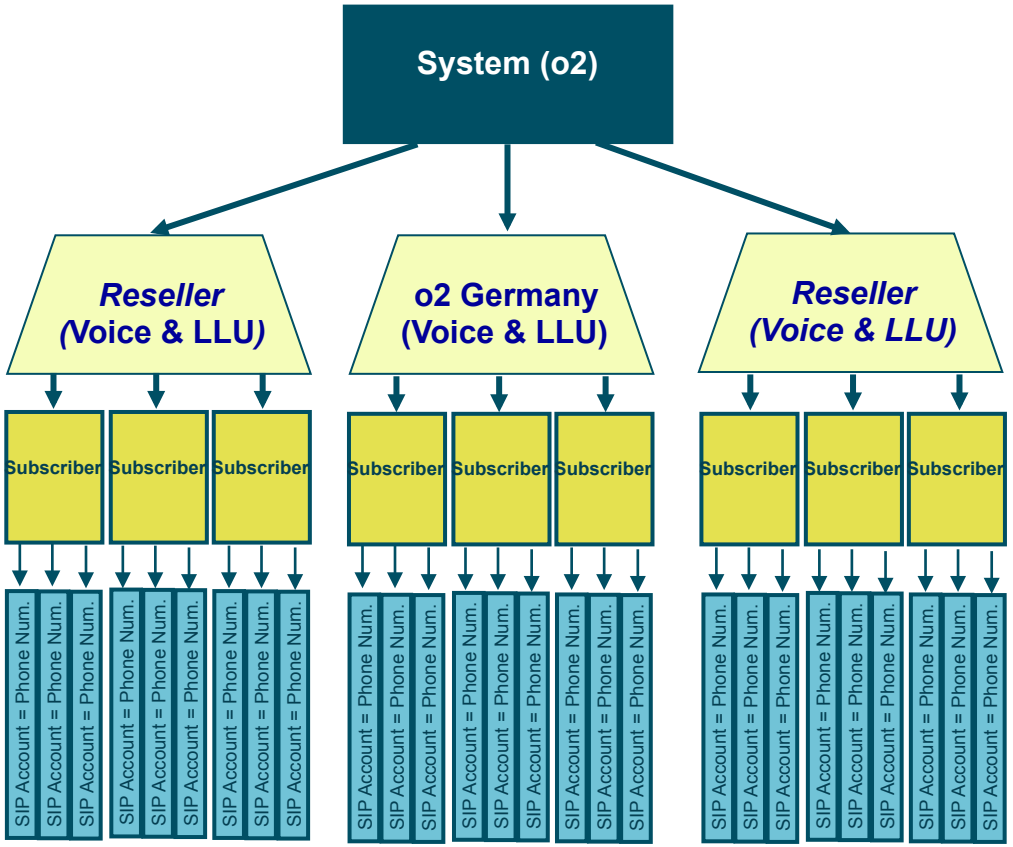
O2 and its resellers

The IMS deployed by o2 can be used by:

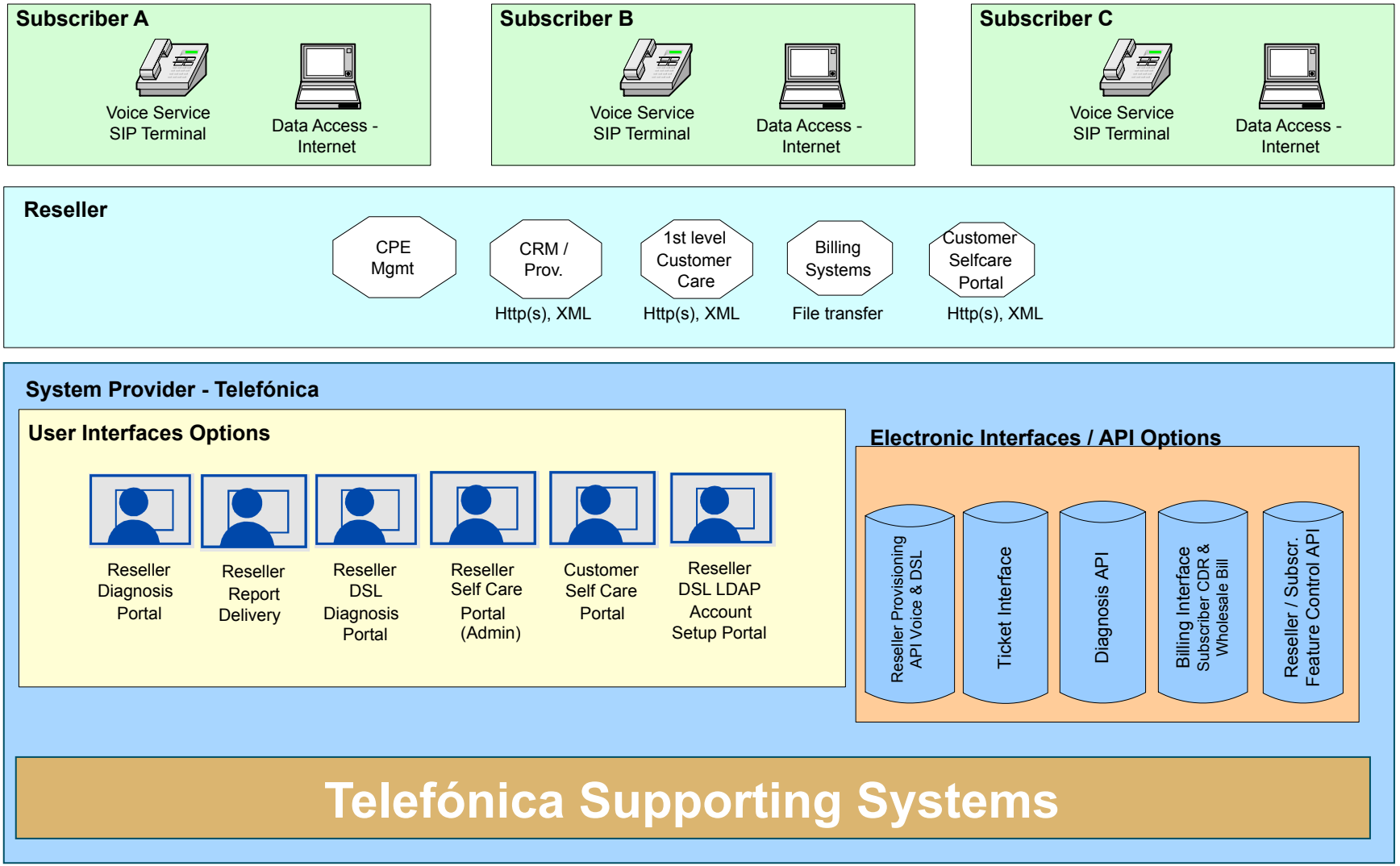
- O2 itself
- Resellers, having their own clients

To efficiently manage the system, a reseller and a system level are available:

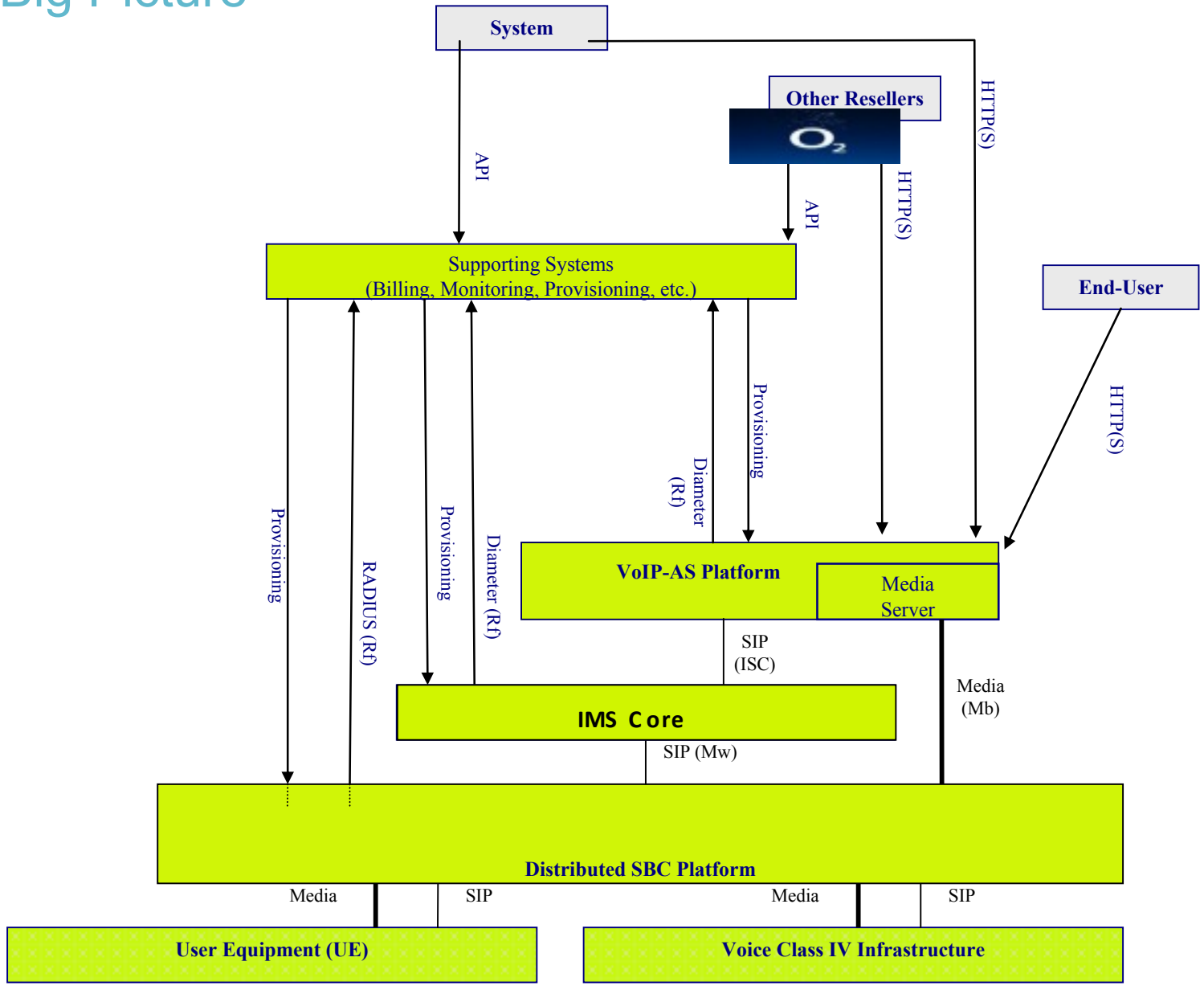
- Reseller: All have the same characteristics, including o2
- System: top level, “only 1 System”. Managed by o2 but independent from the o2-reseller



Interfaces to resellers



The Big Picture



A standard IMS…

SBC: P-CSCF (and IBCF)

IMS Core: CSCF (+HSS)

Supporting Systems: charging plus provisioning of users

Standard interfaces (note RADIUS and not DIAMETER for the SBC Rf.)

First for DSL network, not for mobile UMTS networks

No PCRF (still QoS granted, see next)

LTE+EPC mobile network in a next step

Media does reach the P-CSCF (SBC)!!!! For lawful interception

Resellers have an API to the support systems. Used, among others, to provision users. Support systems configure IMS core and AS

Resellers and users have a web-based self-care interface for the telephony service provided by the AS

VoIP to the Home: the CPE

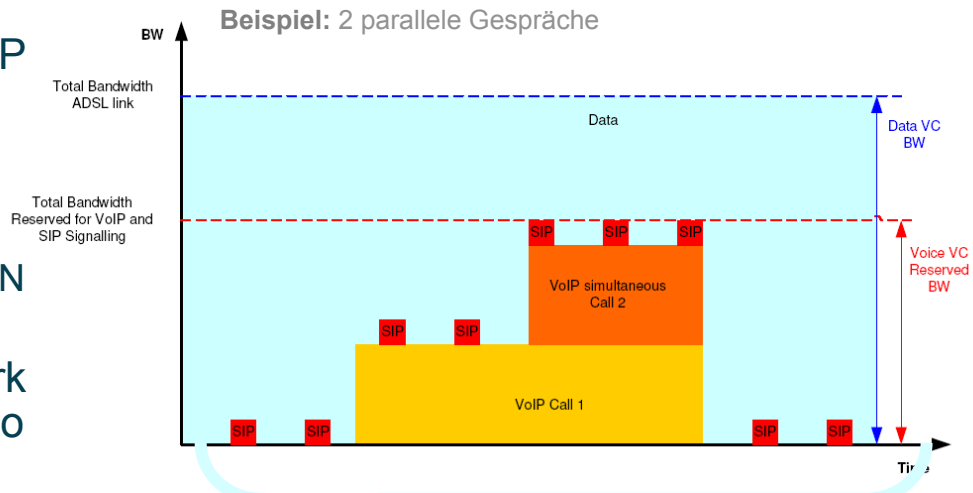
Core is IMS-IP

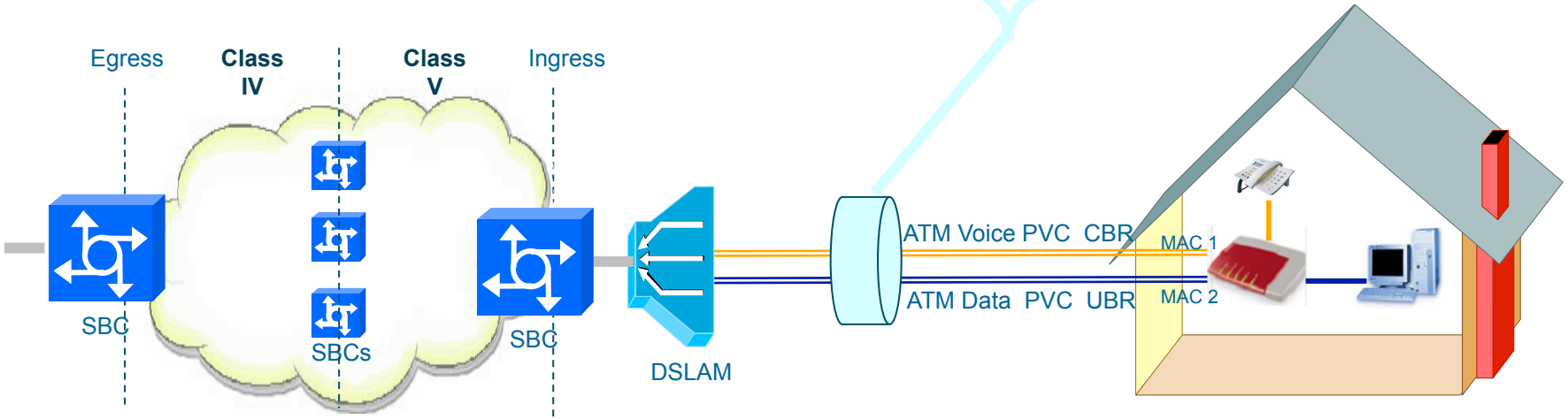
But how to bring VoIP to the home? VoIP phones are very expensive

The terminal (CPE)

- Router + NAT
- “Digitizes” existing analog and ISDN phones

- No separate circuit switched network for the phone. QoS mechanisms so that IP “data” does not hamper VoIP





A robust network

P-CSCF logically distributed: easy and efficient to achieve resiliency

SBCs geographically distributed all over Germany

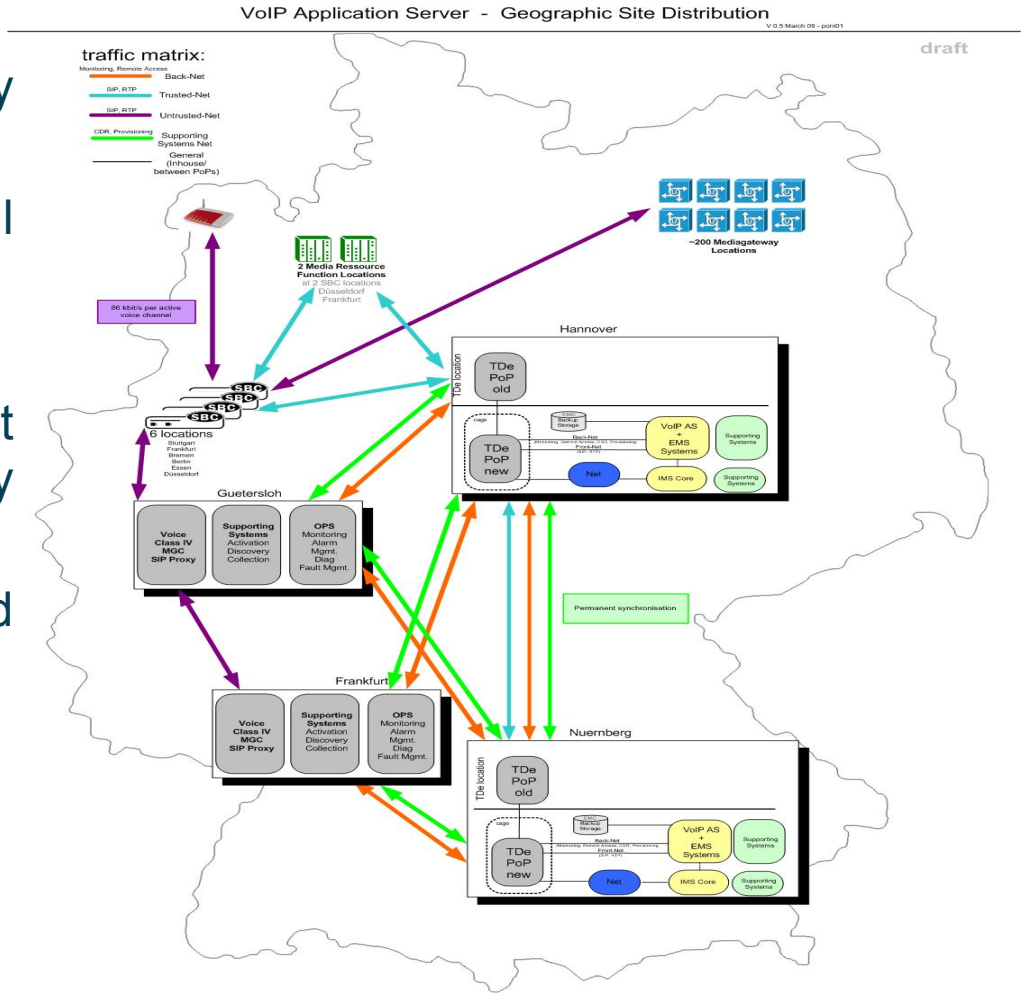
But IMS core elements are not logically distributed: redundancy needed to achieve resiliency

Two core sites: Hannover and Nürnberg

Main engineering tasks:

Load Distribution

Detecting when nodes fail



Services and features

MMTEL Services.
Many offered, deployed a few:

- Call forwarding
- Voice2mail
- Call blocking / barring
- Call logs
- Parallel ringing
- Fax2mail

AND:
User Web UI
FAC control

Services and features

- Multi-reseller
- Call capacity per subscriber (no to exceed DSL BW limit)
- announcements

- Dial plan, call categories
- operator / reseller barrings
- Destination number normalisation

Plans for IMS and mVoLTE

IP and VoIP in mobile networks are not new

Release 99, from 3GPP

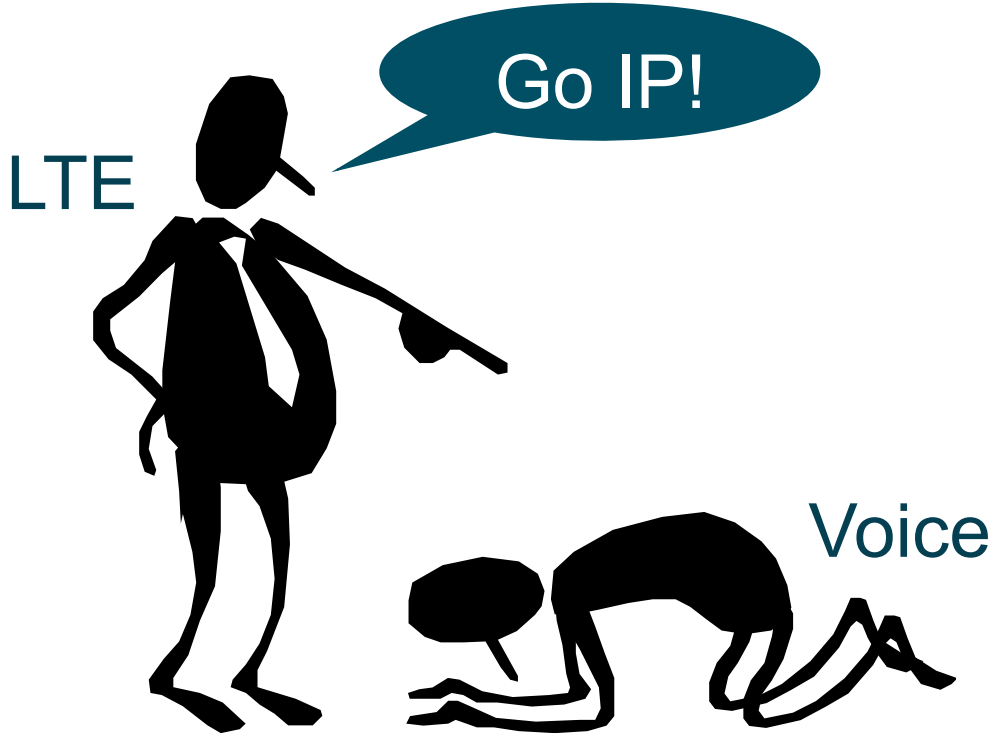
But there was a back door

Voice could still use circuit switched

And operators were lazy and kept using circuit switched for voice

In LTE-EPC there is no back door

To have voice, operators must use IP => ALL is IP



Voice over IP means:

- Skype (not wanted, I imagine!)
- For operators, VoIP ⇔ IMS
- Telefónica Germany has already deployed the IMS (great advantage). Voice over mobile LTE (mVoLTE) will use it
- Telefónica Germany will be the first “OB” in Telefónica to have mVoLTE and one of the first in the world.

LTE and Voice: Hop, Step and Jump

① Whitespot DSL Replacement („fixed VoLTE“)

② Mobile Data With Circuit Switched Fallback (CSFB)

③ Mobile Data With IMS-based Voice („mobile VoLTE“)

Fixed Subscriber Provisioning

Mobile Subscriber Provisioning

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mVoLTE Challenges

From day 0 we could do voice calls over LTE (tests)

- IMS pre-prod and test eNode B in München

As we can also do voice calls over WiFi (tested from Boston, Sydney, Madrid, …)!!!

No Wonder: IMS uses IP and IP is agnostic to the layer 2 access technology. And LTE is “just” another radio access technology

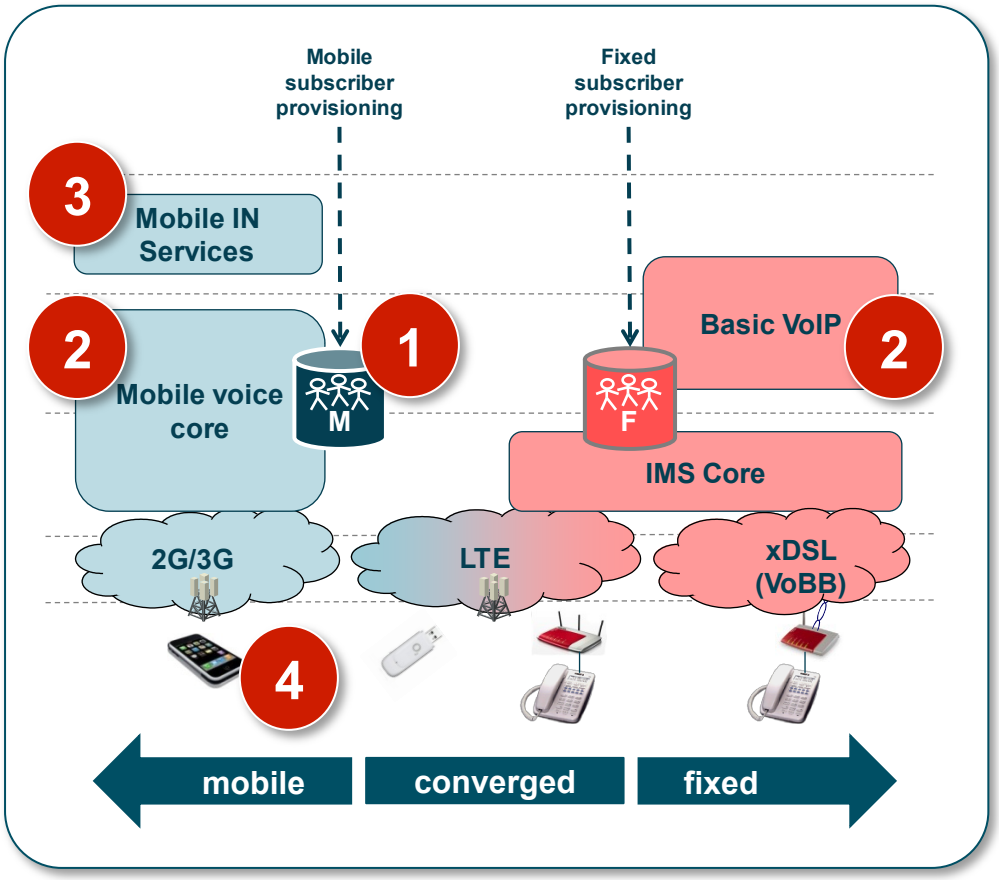
So…that’s it? Nothing to do???

NO!!!!!

Actually, mVoLTE is one of the most challenging projects. Why? See next

Challenges and Pitfalls of “mobile VoLTE”

An operator extending an IMS deployed for fixed services into the mobile domain faces some key questions.



1. Subscriber data

- Mobile subscribers on to ‘fixed’ HSS vs. evolution of HLR to be a ‘mobile’ HSS

2. Consistent services

- Customer should not notice when he is ‘upgraded’ to IMS-based mobile voice

3. Re-use vs. re-implementation of IN-based services

4. Availability of SRVCC in devices

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Many possible scenarios to consider:

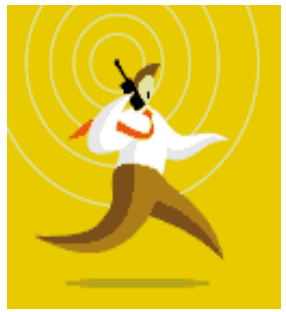
- When will Circuit Switched Fall Back (CSFB) be available (devices)?
- When will devices have IP-LTE voice capabilities?
- What to deploy in our network?
- Coexistence of 3G/2.5G and LTE

And none of these scenarios is easy!!!

The challenges

Two networks coexist. Coverage and mobility:

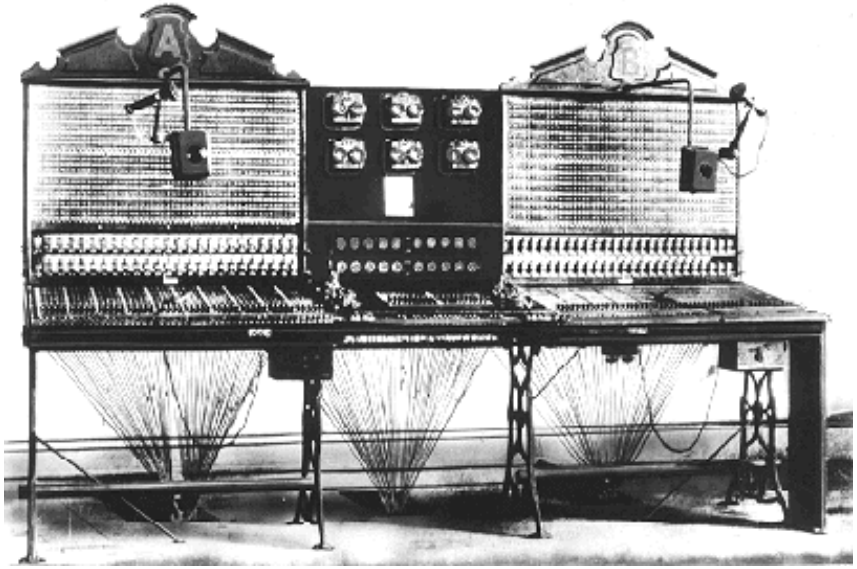
- What happens if a device is having a voice call over LTE Packet Switched (PS)-IP and moves to a 3G network where, even if PS is available for data, circuit switched (CS) must be used for voice?
- PS to CS handover! Not Simple!!!
  - devices will not have two radios (too much batery power)
  - Is the control of the call also transfered??



The challenges

Two networks coexist. And the difference is not just the “network technology” (data transport, CS vs. IP) but also the service and user control.

Where are calls and advanced services controlled?



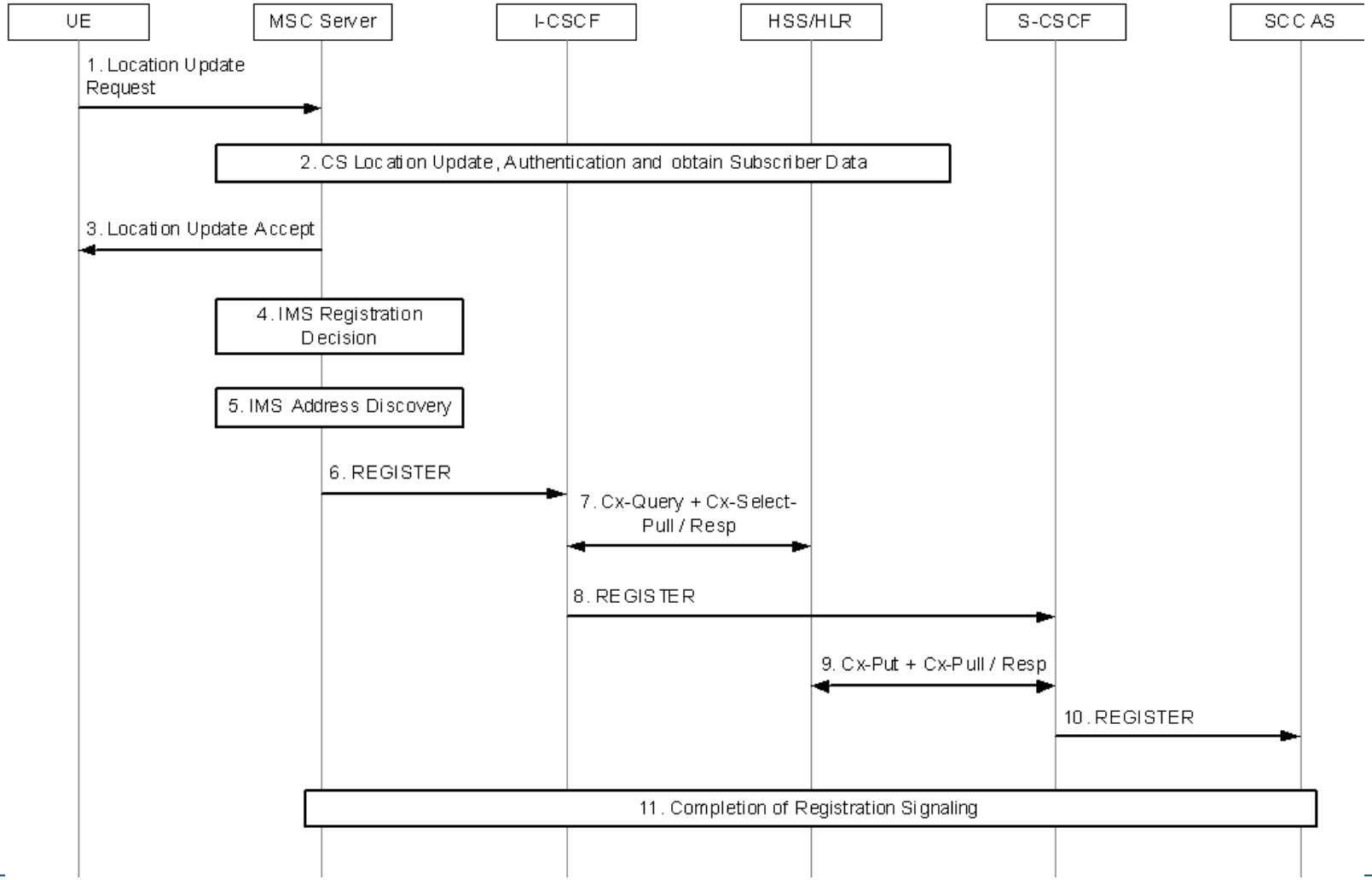
The challenges

Two networks coexist. And the difference is not just the “network technology” (data transport, CS vs. IP) but also the service and user control.

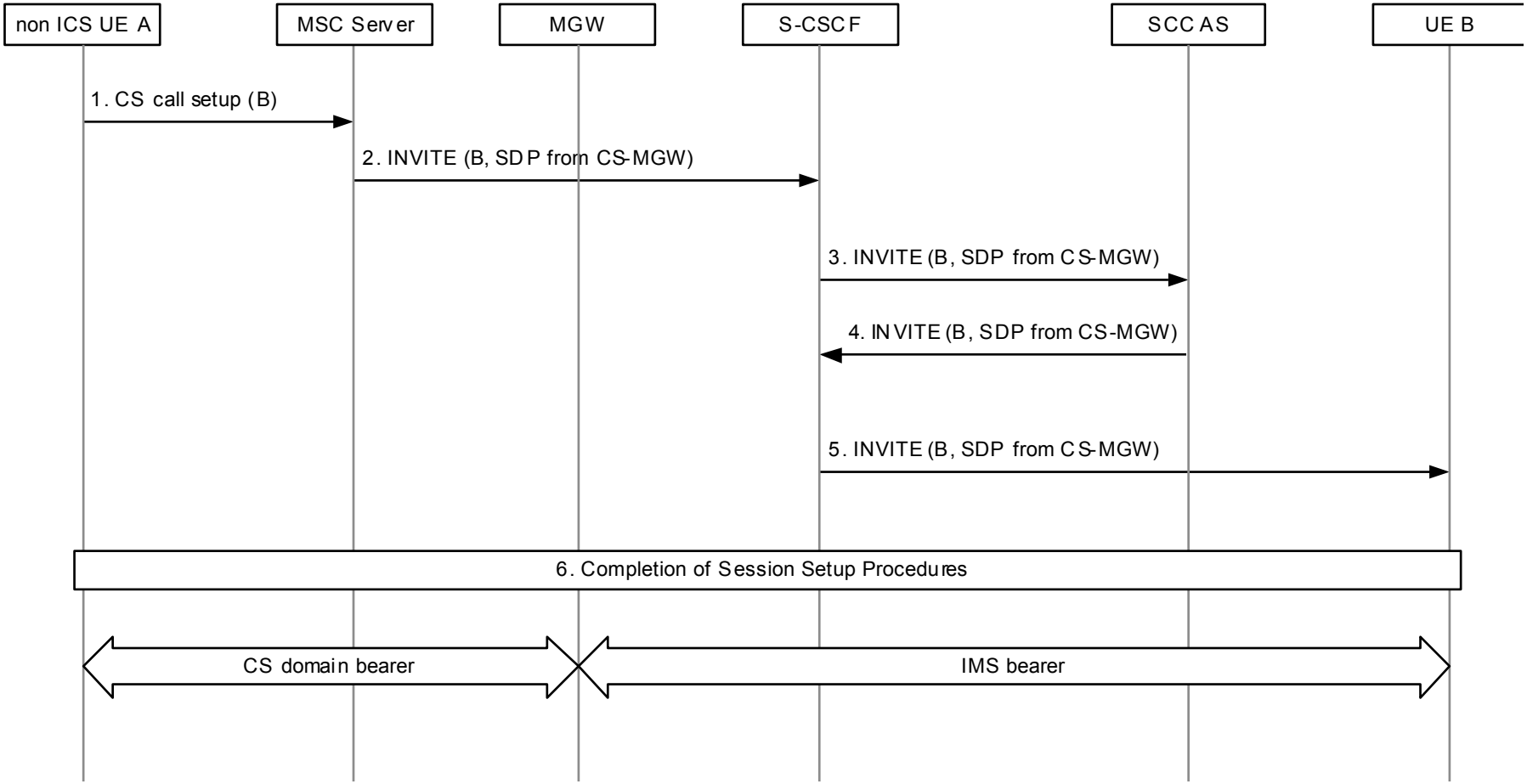
What is the user database? HLR vs HSS

Users will employ both networks, do they need to be stored in both databases?

ICS (IMS Centralised Services)
IMS registration: MSC impersonates UE when UE in CS
trigger: CS “Location Update”



ICS (IMS Centralised Services)
MSC translates signaling: CS SS#7 => SIP
MGW translates media



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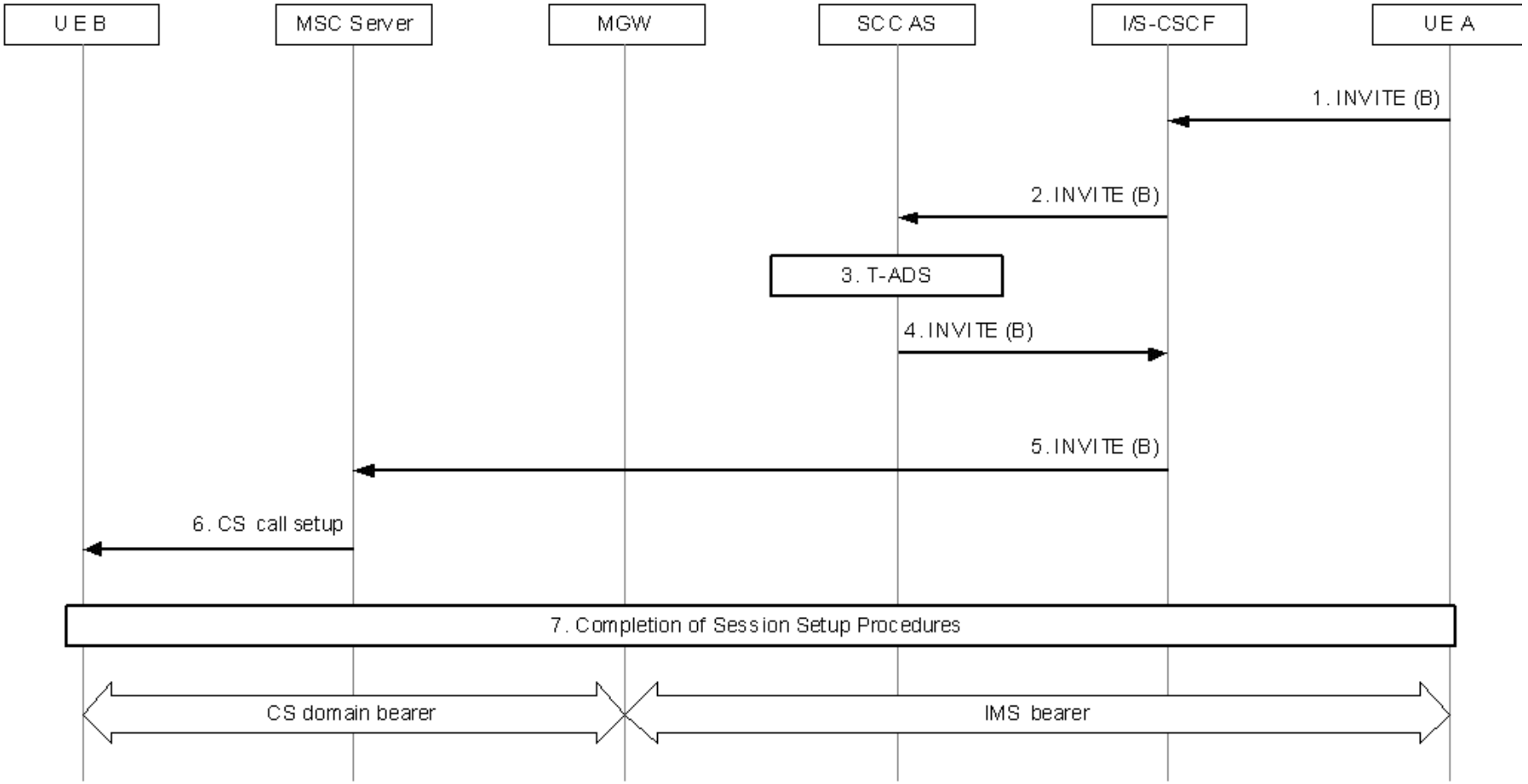
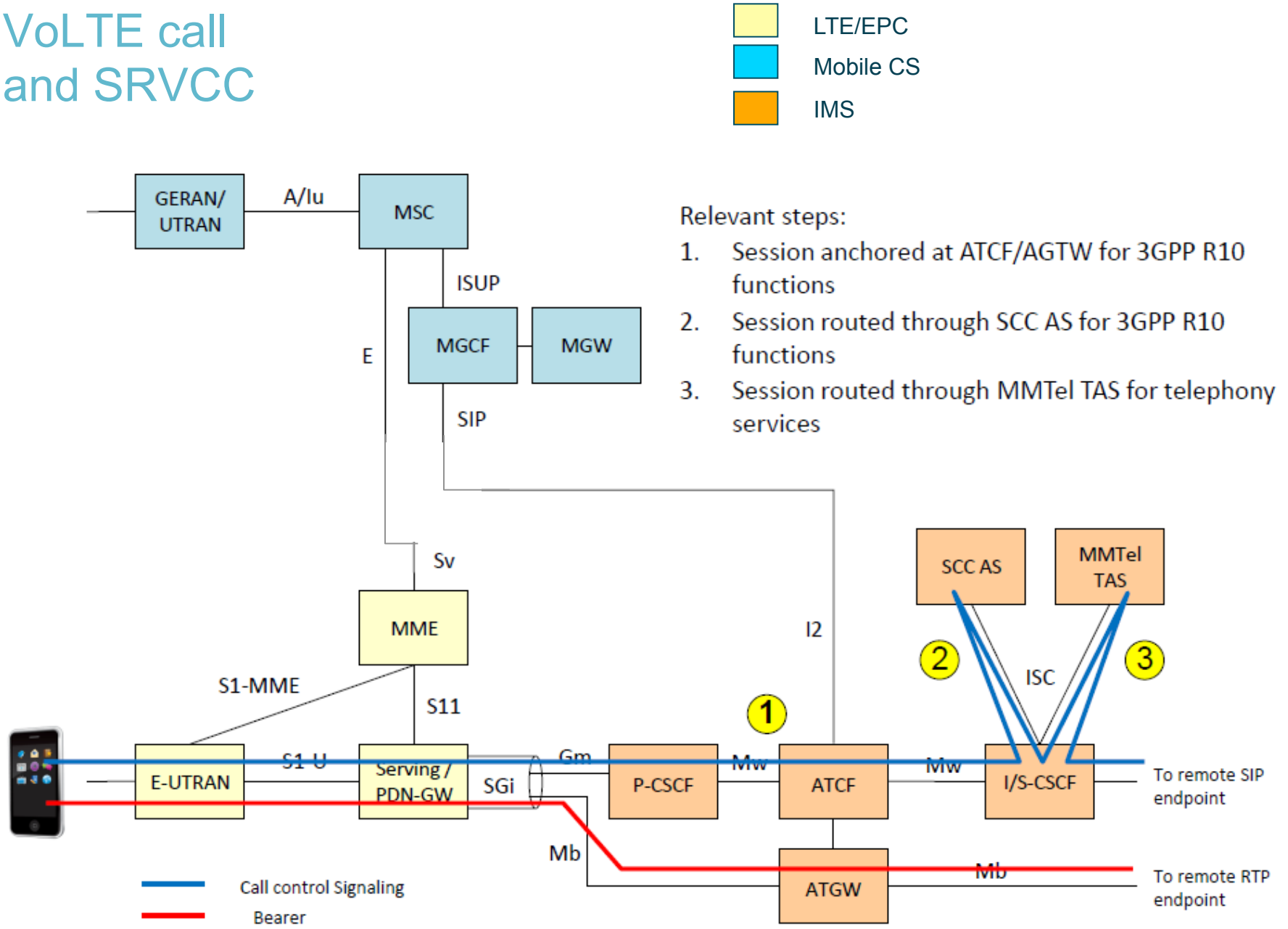


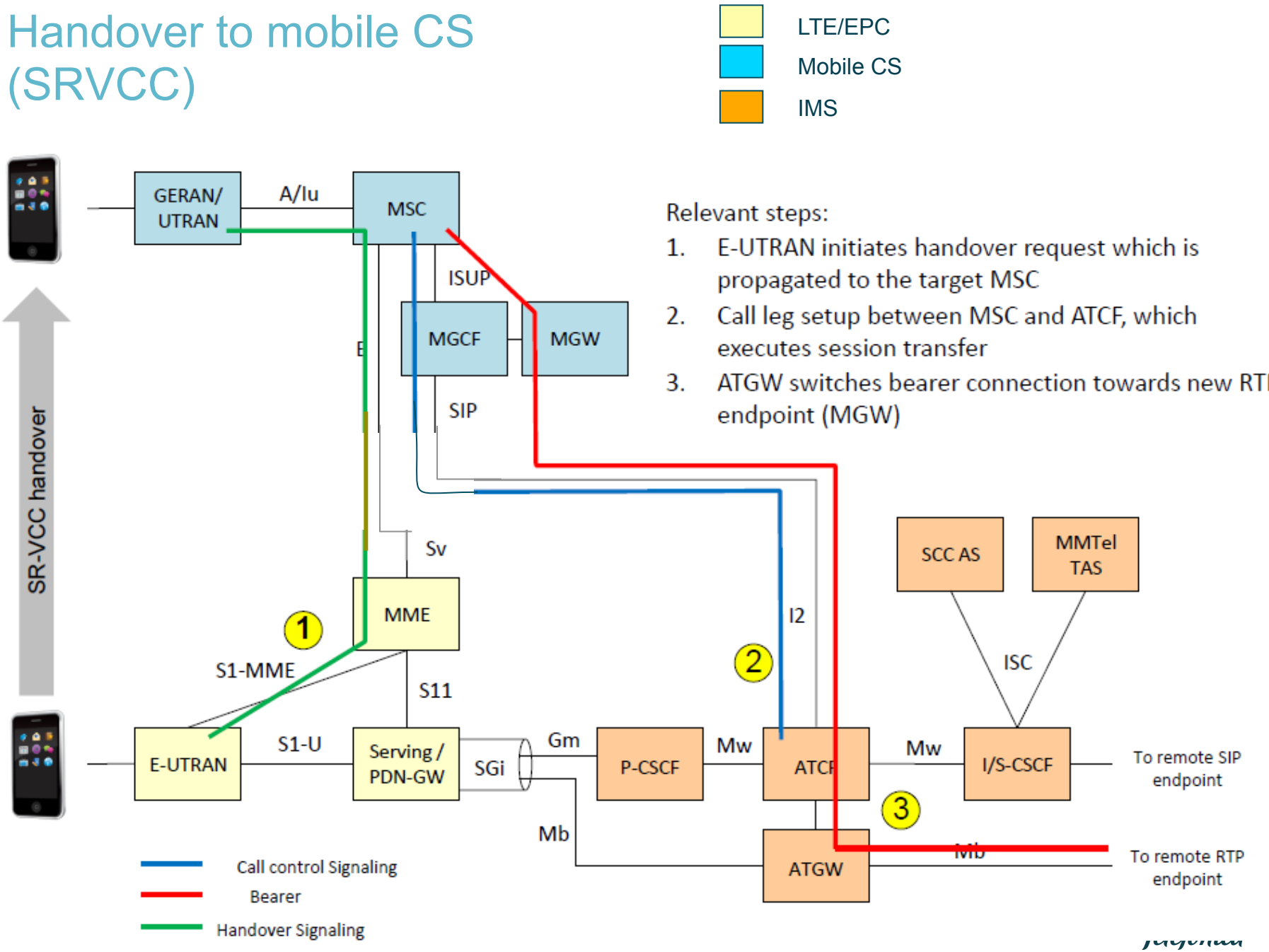
VoLTE call and SRVCC



Relevant steps:

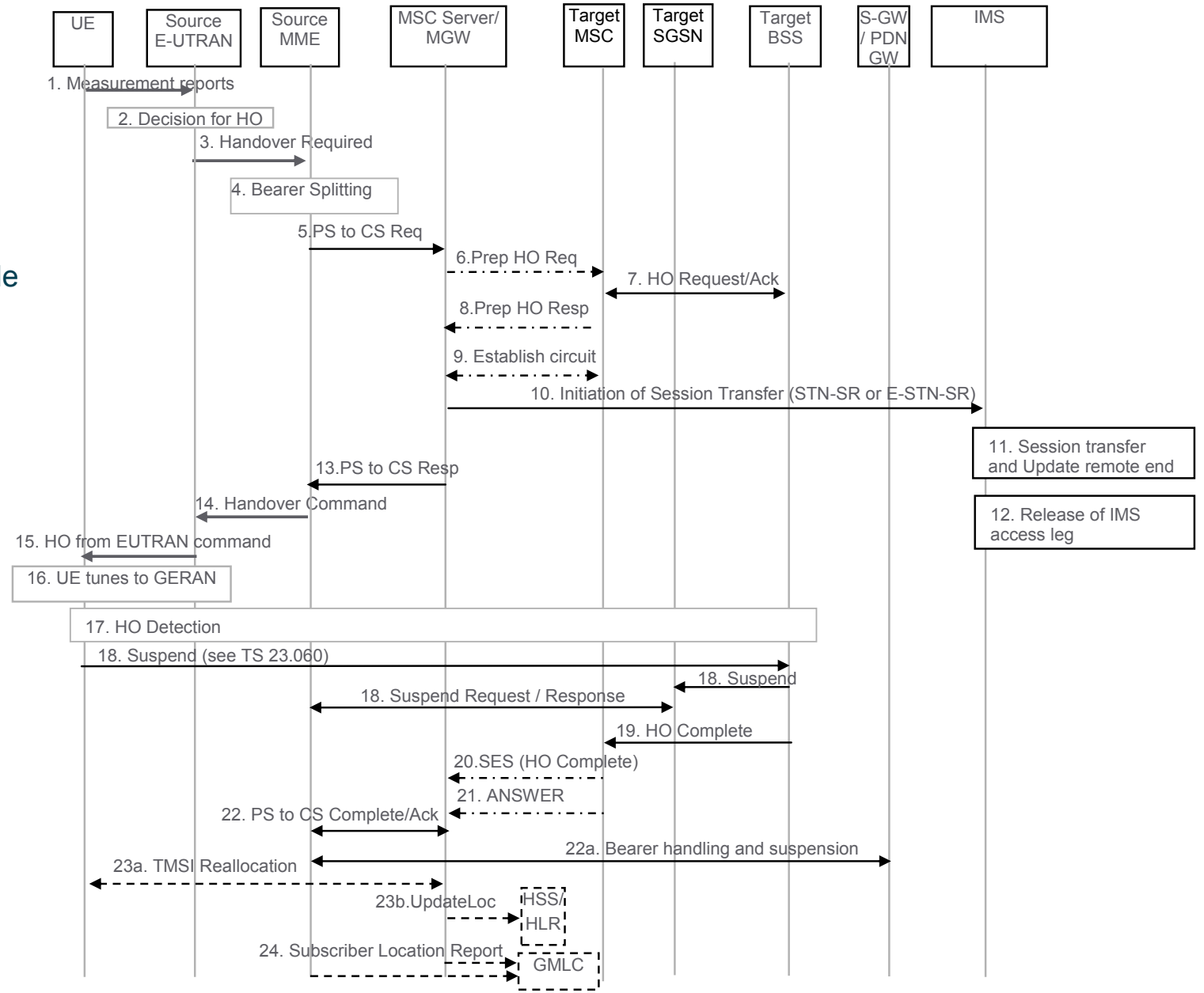
1. Session anchored at ATCF/AGTW for 3GPP R10 functions
2. Session routed through SCC AS for 3GPP R10 functions
3. Session routed through MMTel TAS for telephony services

Handover to mobile CS (SRVCC)



SRVCC detail:

EPC and CS Mobile



User database HSS vs. HLR

HSS was in introduced in 3G UMTS mobile networks

- HSS is the evolution of the HLR, the subscriber database in GSM mobile networks

IMS CSCFs (Call Session Control Function, “enhanced” SIP proxies) are designed to Interact with HSS

So…what is the problem?

- Our 2.5G, 3G and, even, LTE/EPC keep using the HLR and…
- IMS is NOT designed to interact with HLR, just with HSS!!

User database HSS vs. HLR

- So, we deployed the IMS in DSL with its own HSS
- And with its own provisioning mechanisms
- As a result, IMS-HSS Fixed World provisioning is independent from the mobile HLR provisioning (and billing and many other FAB topics)

User database HSS vs. HLR

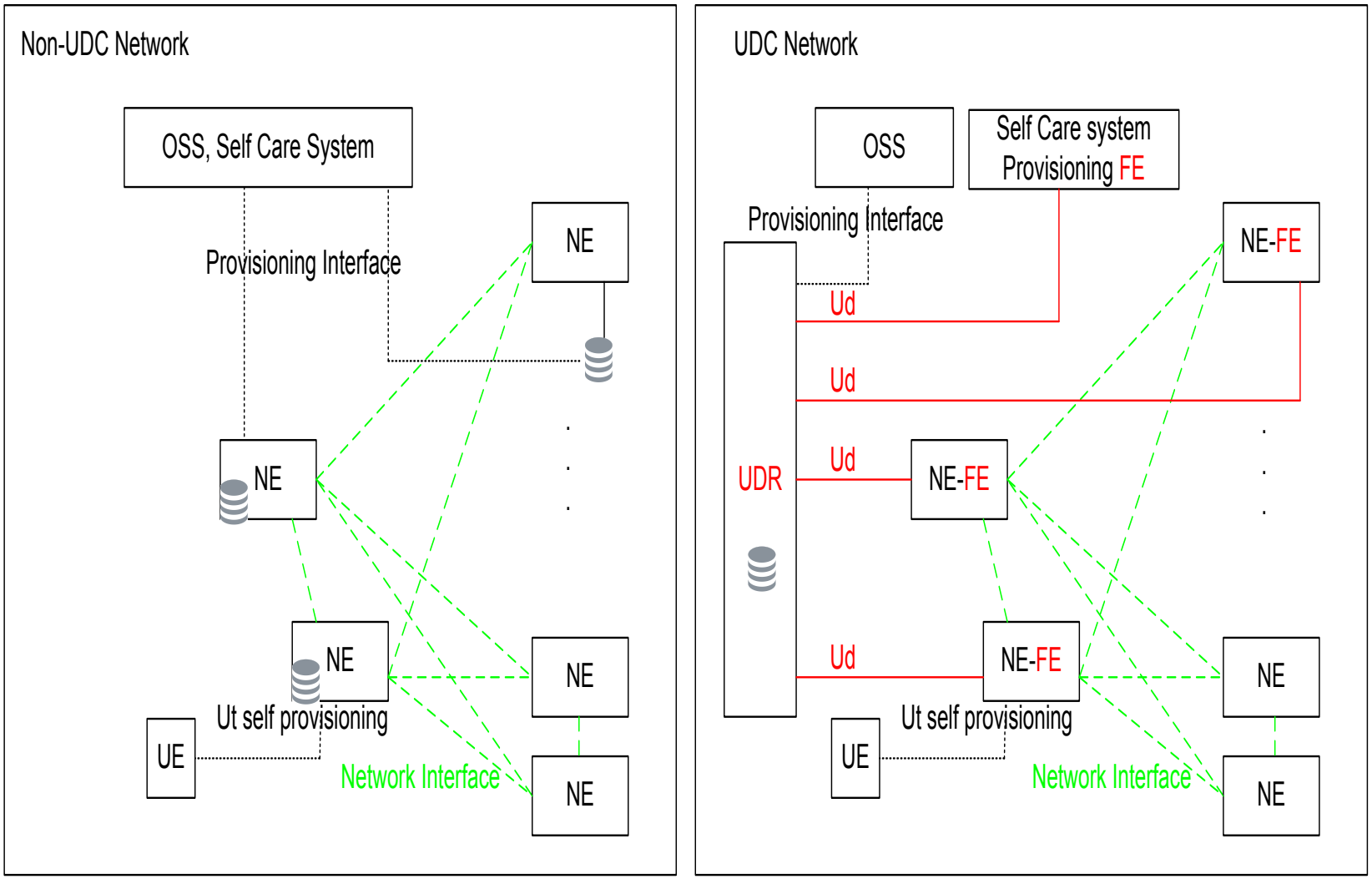
Most evident, ”academical” and straight forward solution would be to migrate the mobile users from the HLR to the HSS

But there are about 18M mobile HLR users and 300K HSS users…

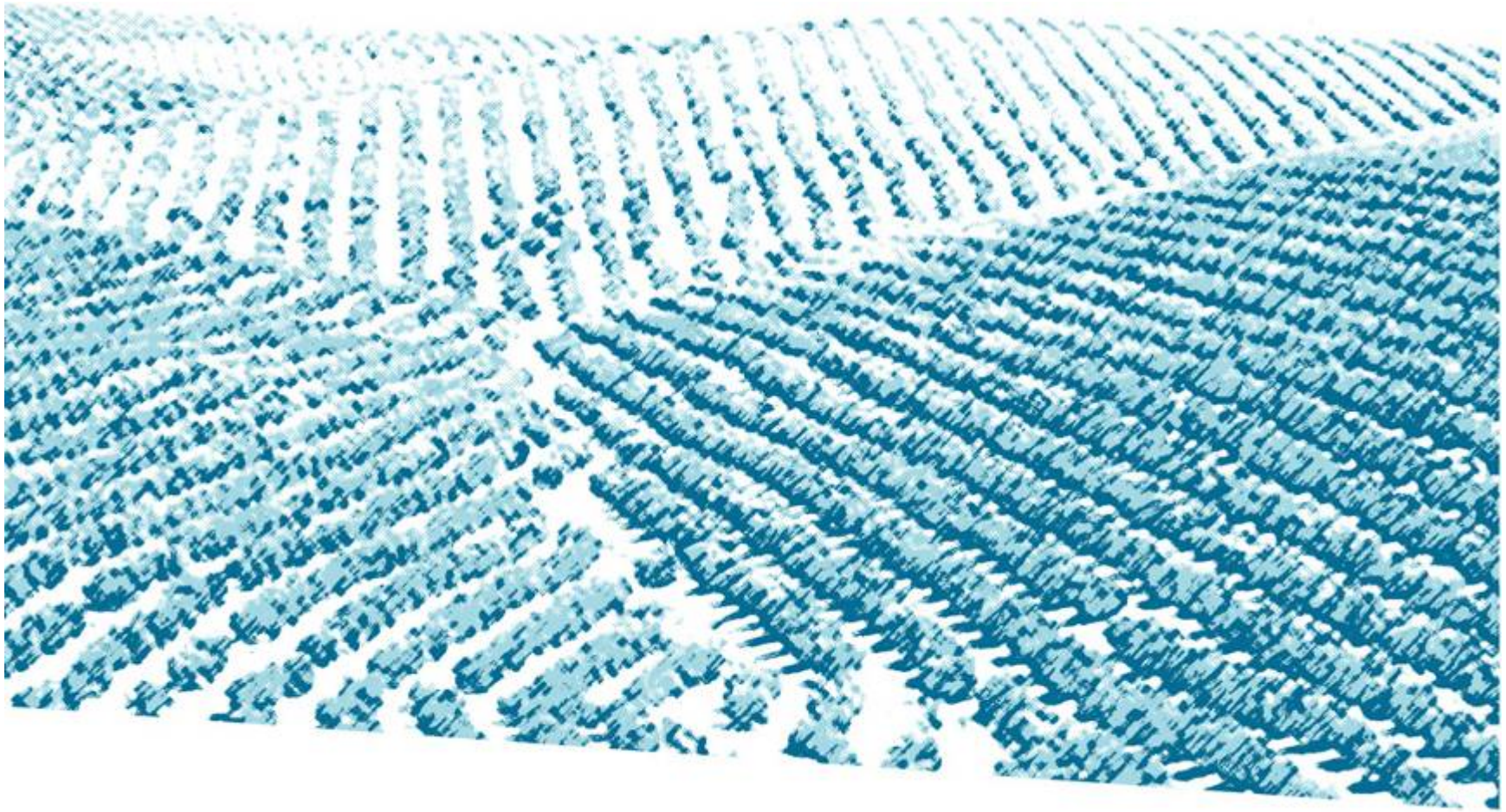
High Risk!

Still, the target is one consolidated database for HLR & HSS subscriber data and for mobile and fixed subscribers.

User database HSS vs. HLR
Telefónica is planning to go for UDC



RCSe



RCSe

Nothing new: IM.

One of the first integrated IM was in Portugal

Needs to be different from existing IM: easy to use, universal, native on devices, etc.

Uses the IMS

Although RCS is standardised since long, it is only now, (as a reaction to WhatsApp), that operators will use it

- Presence was very complicated => RCSe

ENUM and IMS interconnect

Currently, a global ENUM database is not yet implented (≠ DNS)

IMS to IMS interconnection is very rare…

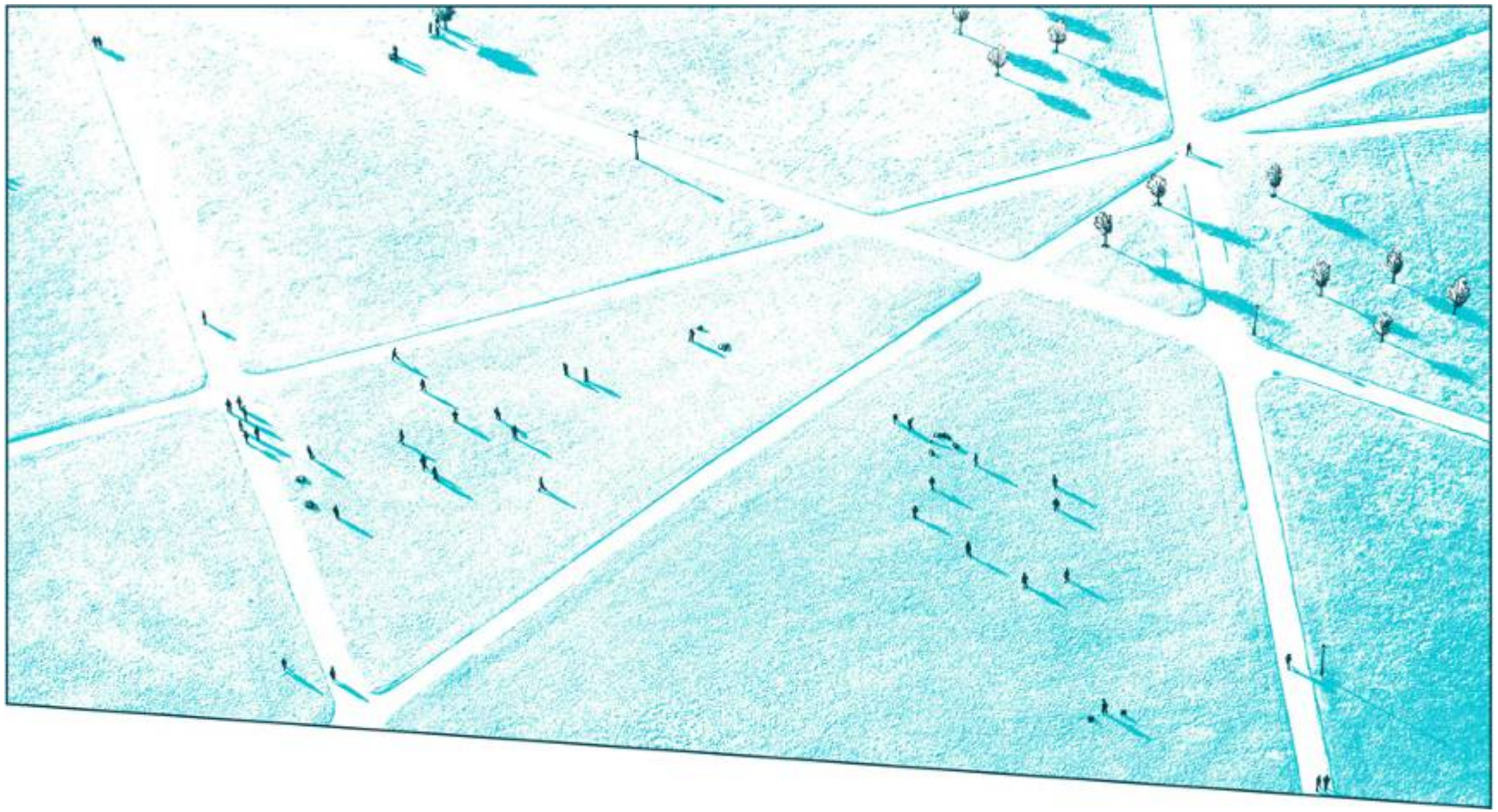
OK because IMS is only offering voice (mainly) and voice can be interconnected over the PSTN

But, for IM, the PSTN can not be used: need of interconnection

Interacction with mVoLTE

Terminals may have the RCSe APP but, still, use Circuit Switched for voice. Problem to be solved.

Conclusions and discussion



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Conclusions and discussion

Telefónica Germany initially introduced the IMS as a replacement of a standalone VoIP infrastructure.

- The long-term strategic goal is to use the IMS as a tool to “converge” different networks

consolidation of networks: a strategy for IMS introduction is related to and dependent on convergence and evolution strategies in other parts of the network.

In our experience, it is not easy to maintain a mid-term IMS evolution course while short-term disruptive influences cause “Fear, Uncertainty and Doubt” throughout the organisation.

It is also not easy to maintain the interest of commercial units in the advanced features promised by IMS over a many-year transition period.

Finally, a key factor for IMS is an ‘organizational convergence’, so that previously separated teams from fixed and mobile divisions (often from completely different companies) join forces to address the challenges that must be answered to enable technical convergence to take place.

Introduction to IMS (backup slides)

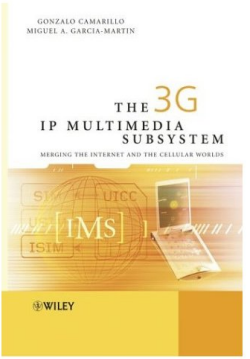
References

The 3G IP Multimedia Subsystem (IMS): Merging the Internet and the Cellular Worlds

Gonzalo Camarillo et al.

John Wiley & Sons

ISBN-13: 978-0470871560



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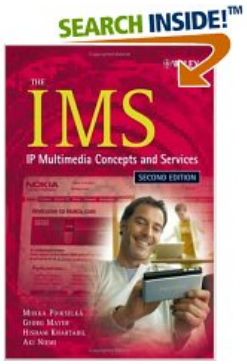
Miikka Poikselka

Wiley

ISBN-13: 978-0470019061



The IMS Service Platform: A Solution for Next Generation Network Operators to Be More Than Bit Pipes

Antonio Cuevas, Jose I. Moreno, Pablo Vidales, Hans Einsiedler,

IEEE Communications Magazine, ISSN 0163-6804

August 2006.

IMS as a merge of two worlds

IMS is a SIP platform running and interacting with a UMTS mobile network. Thus merge of two worlds, IETF and 3GPP

3GPP. Standardizes the UMTS mobile network:

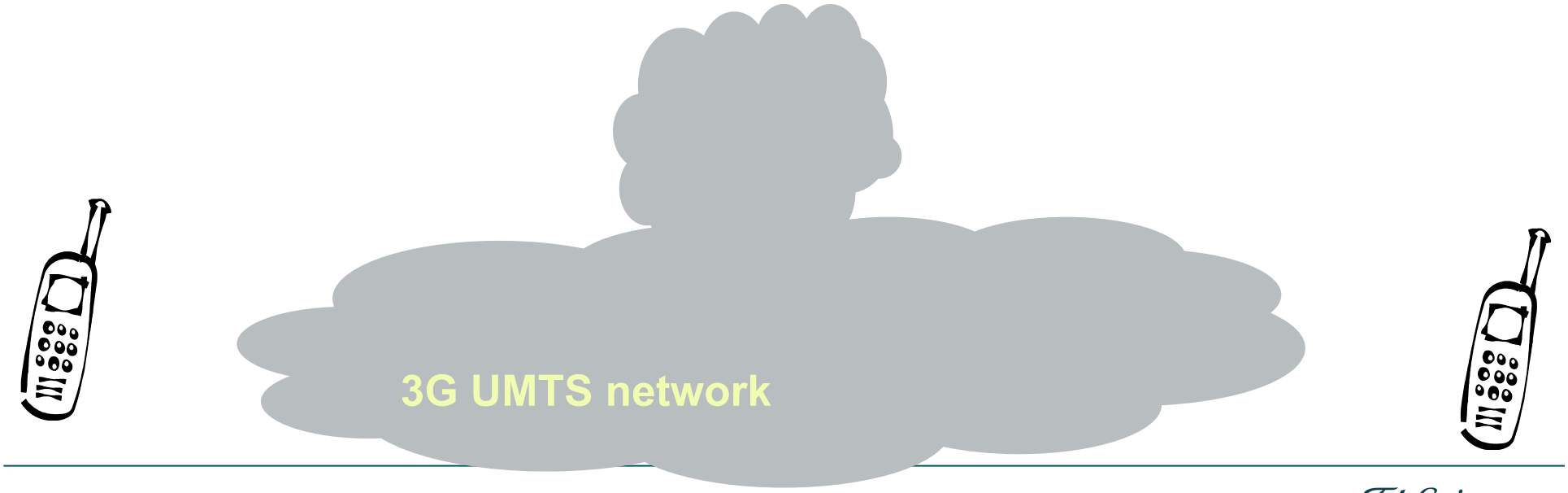
- IMS was introduced in UMTS release 5 (June 2002)
- Keeps evolving: Release 10

IETF. Internet standardization, among others SIP

- More than 40 RFCs dedicated to IMS, e.g. tailoring IETF protocols to IMS

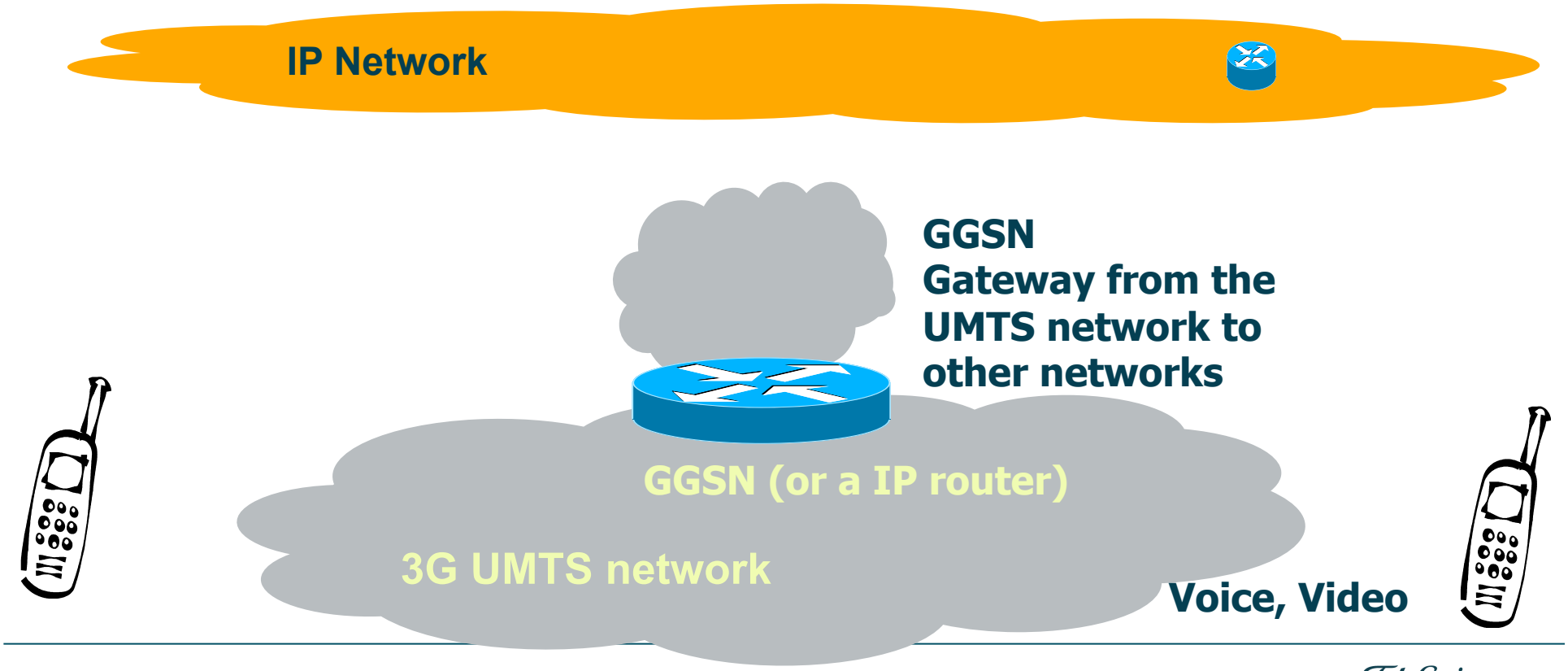
IMS step by step

Designed for 3G UMTS networks



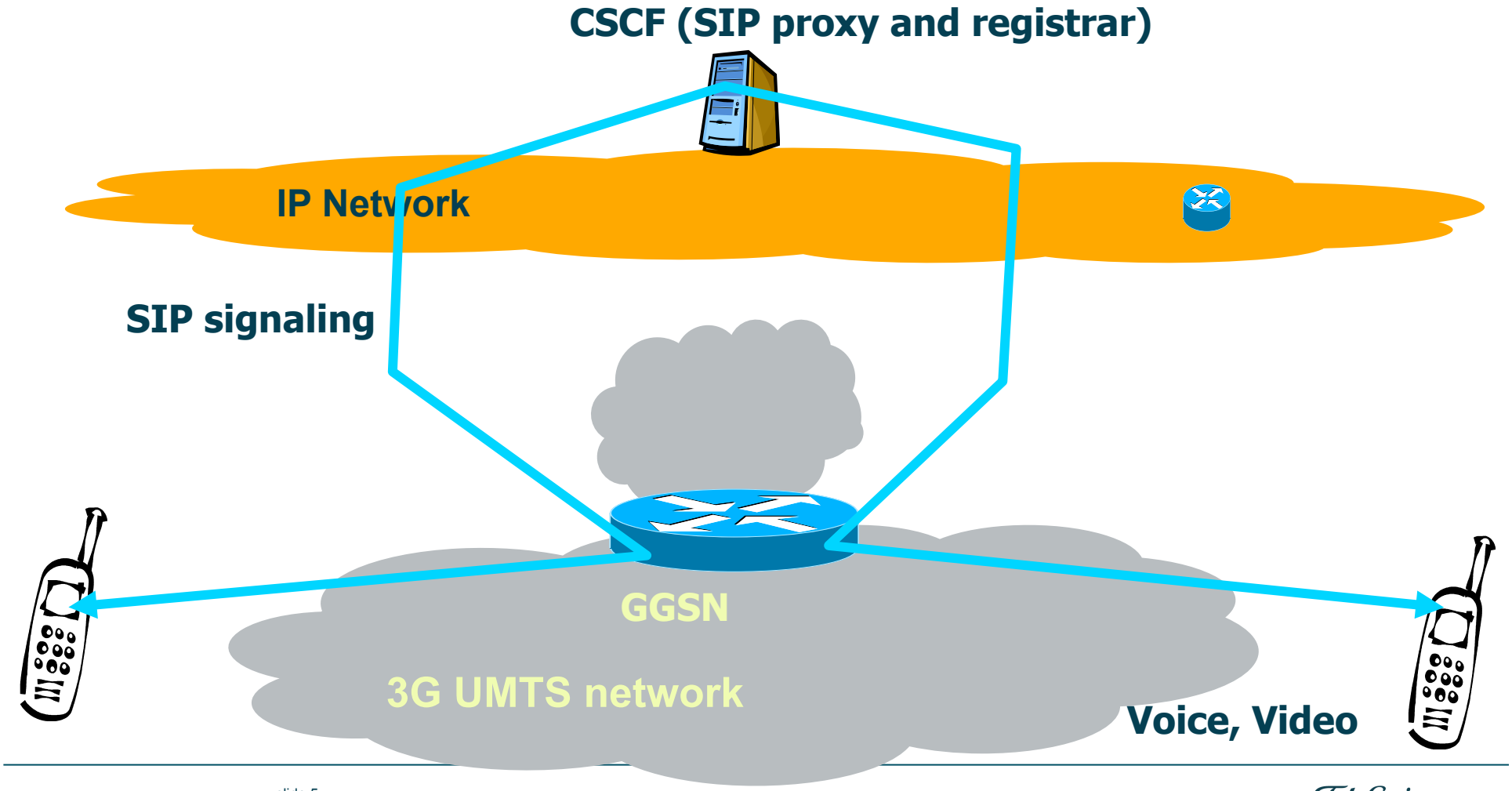
IMS step by step

But IMS works over IP (v6)



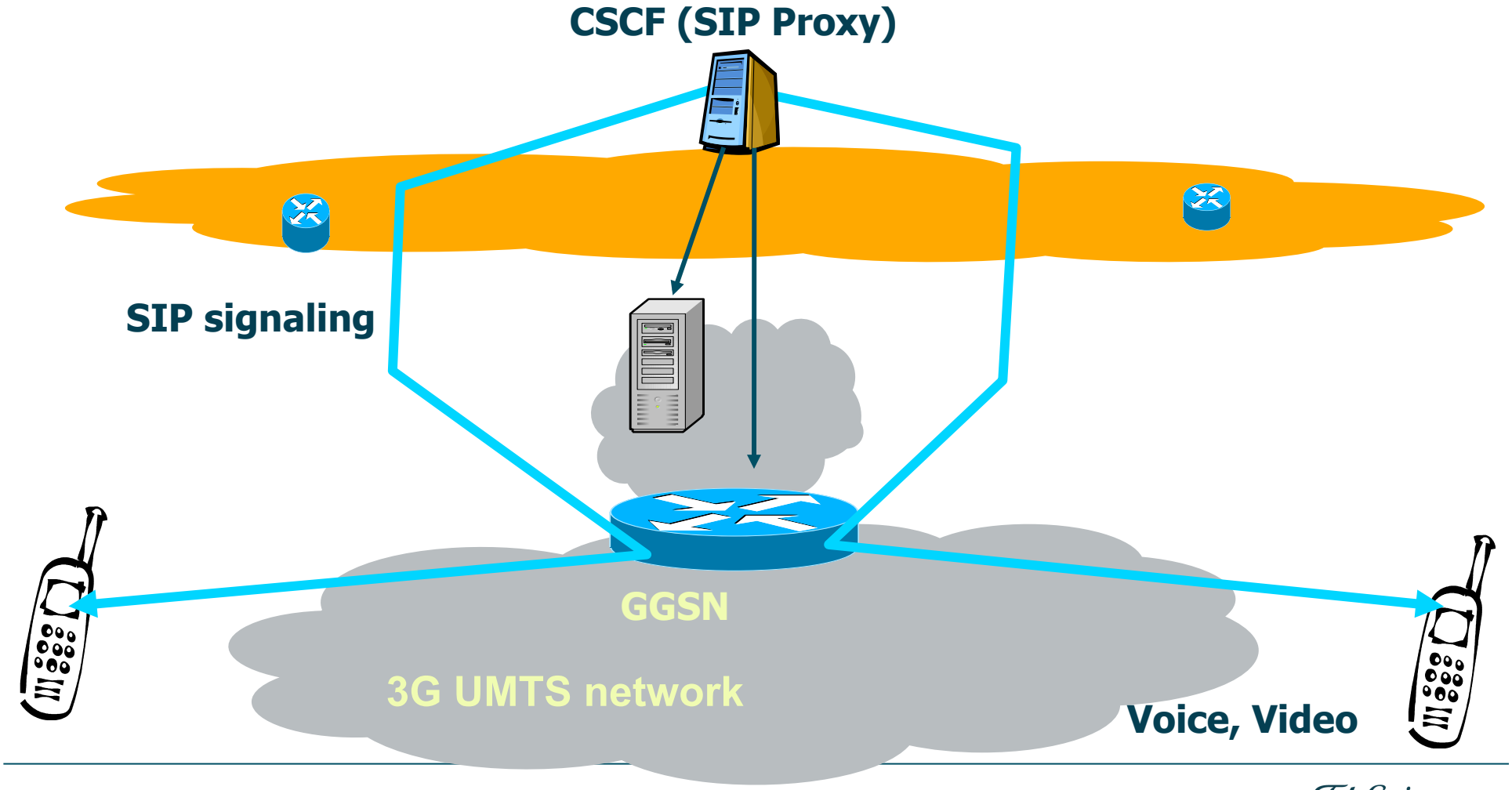
IMS step by step

IMS is a infrastructure of SIP servers…



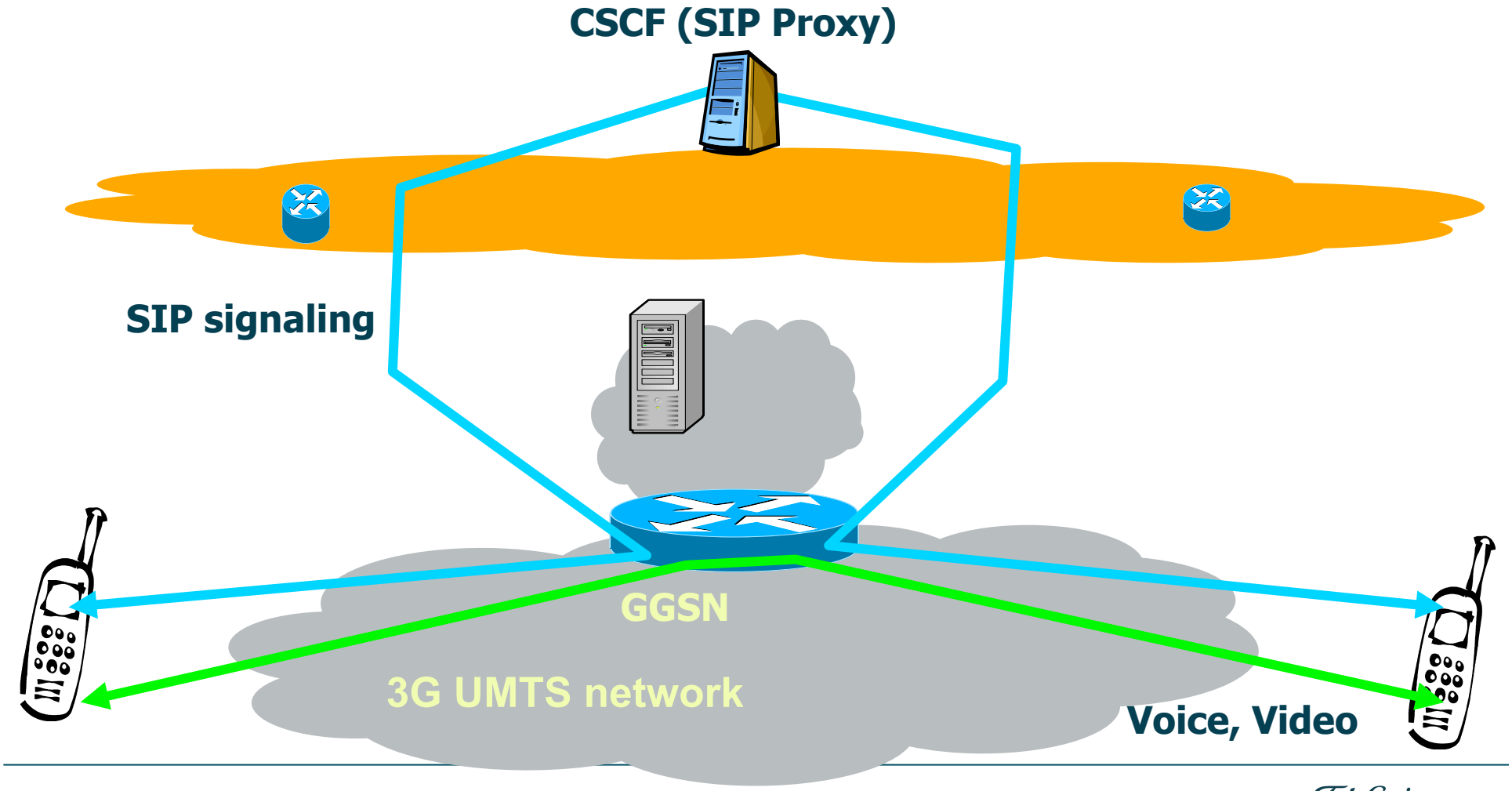
IMS step by step

…that can interact with some UMTS nodes



IMS step by step

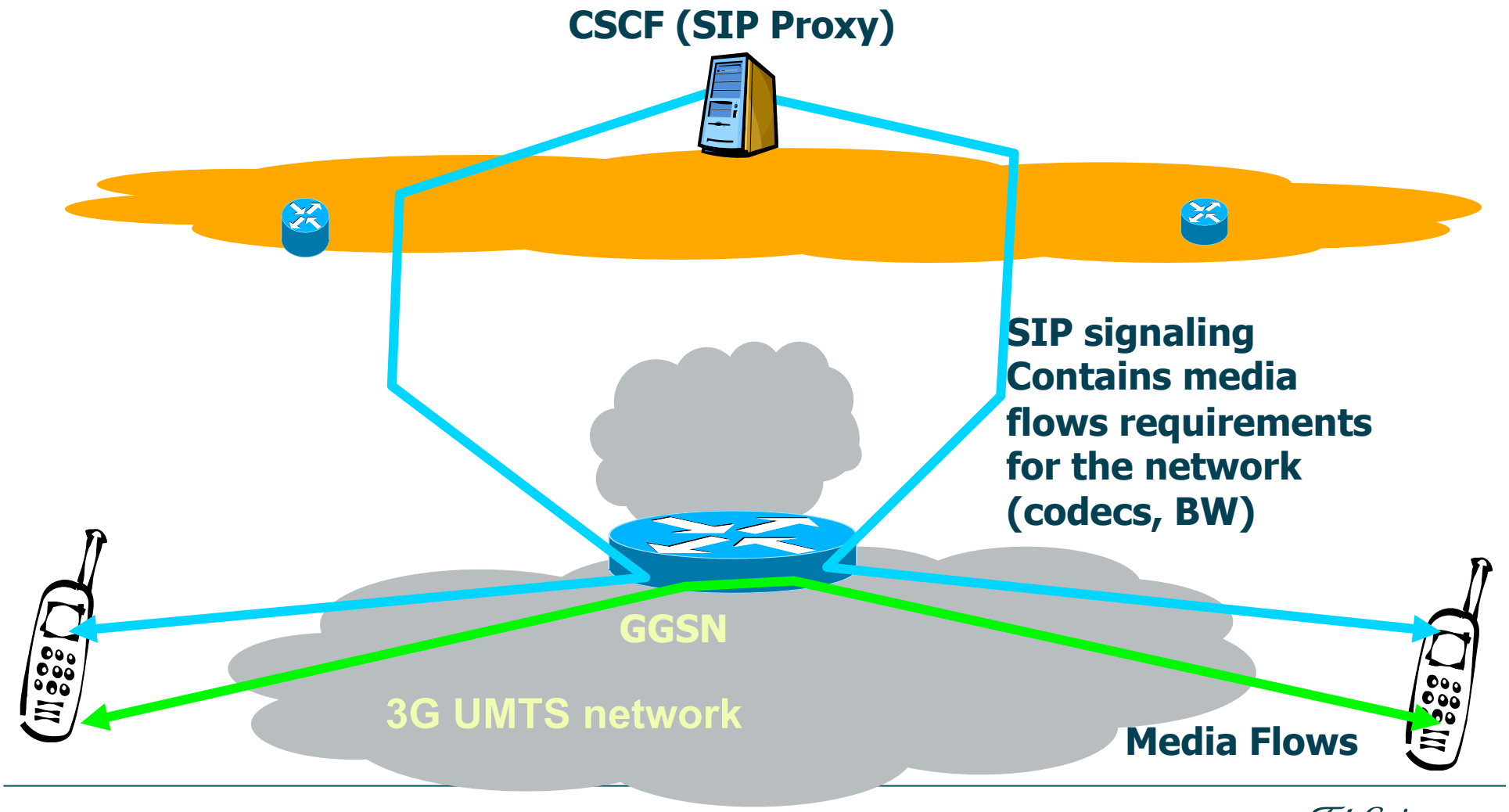
Media does not reach the IMS



QoS in IMS: a scenario

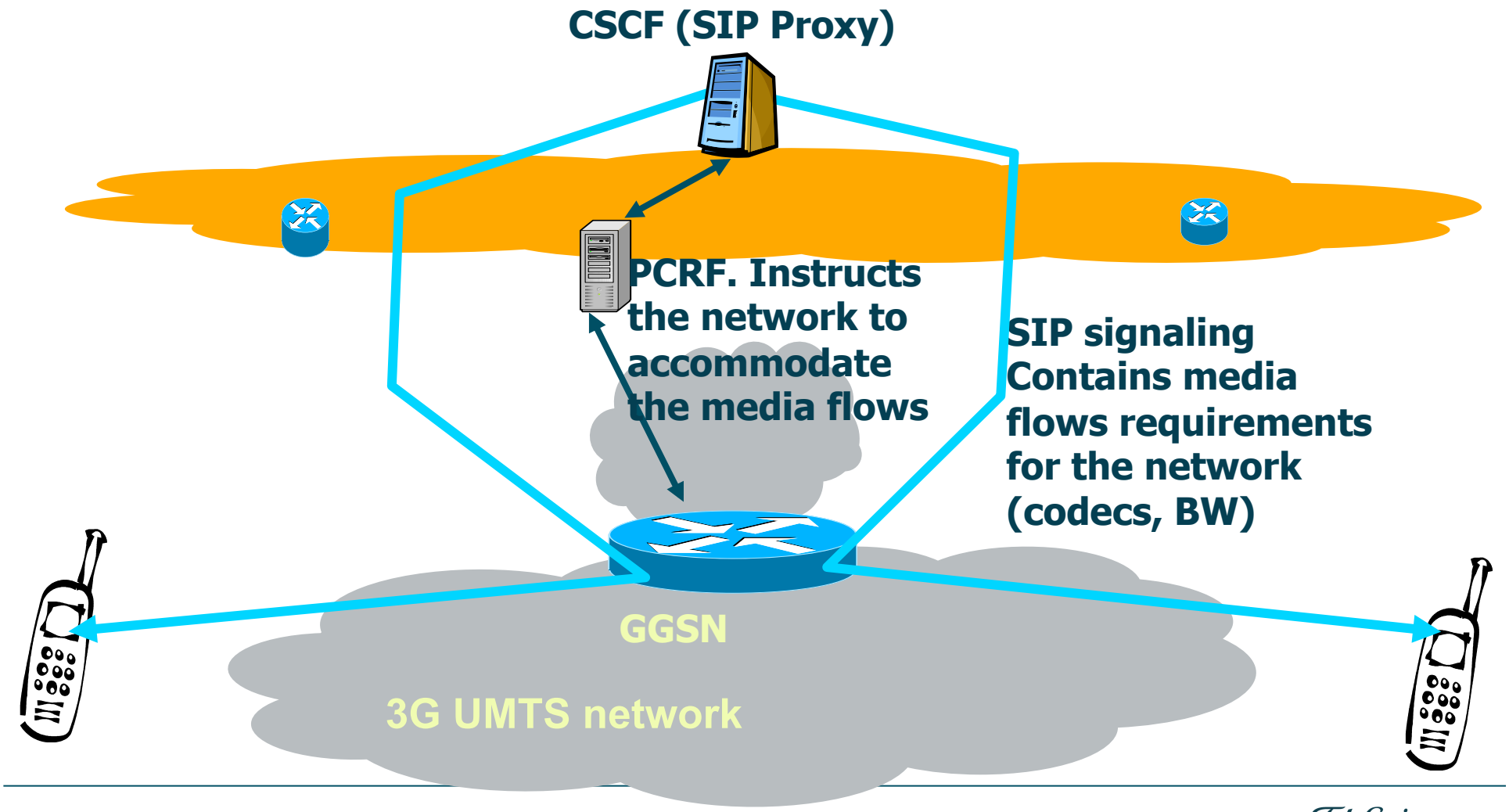
Two users want to setup a video call.

The video flow needs 128 kbps, the audio one 16 kbps



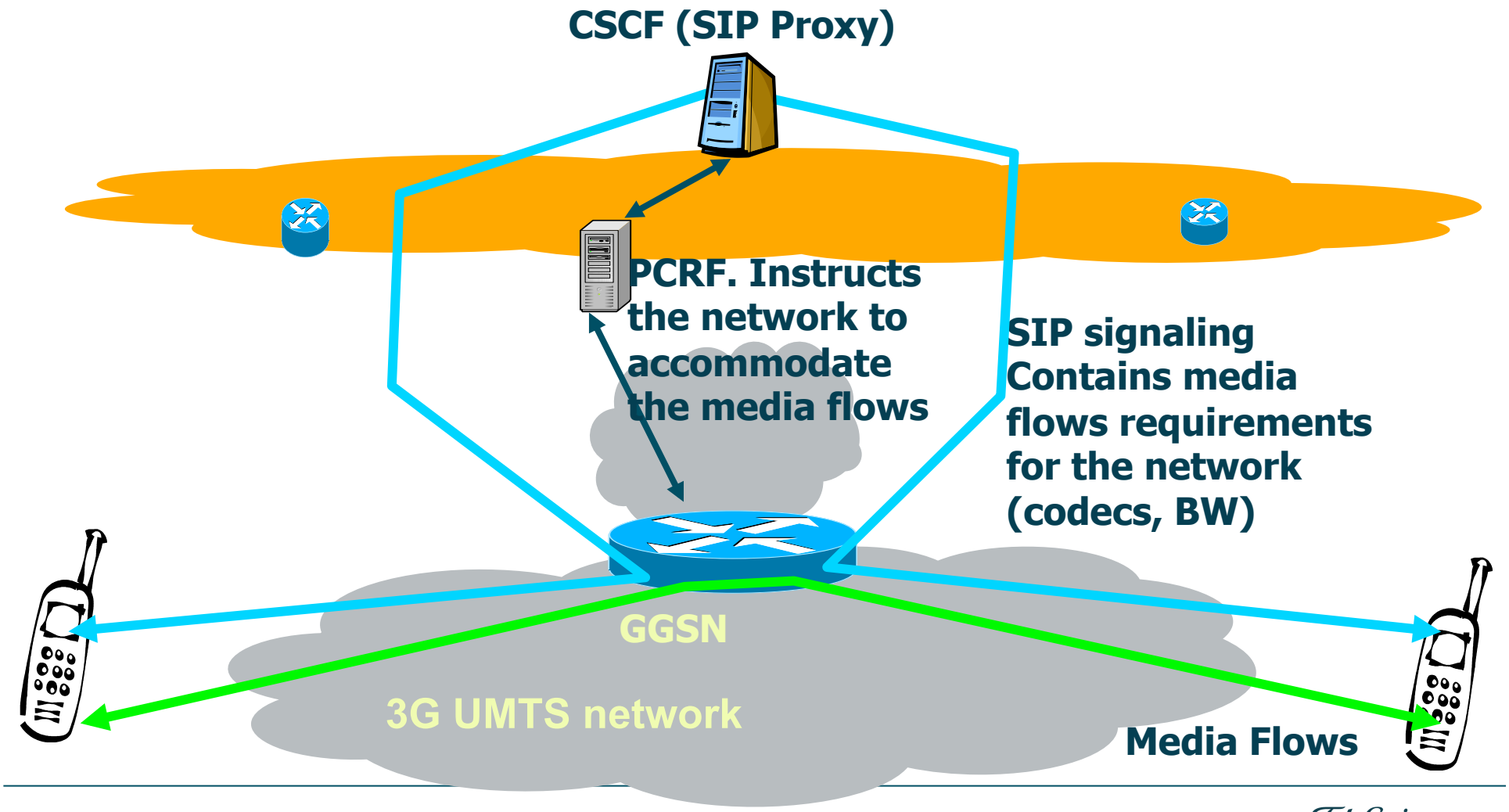
QoS in IMS: a scenario

The PCRF instructs the network to accommodate these flows



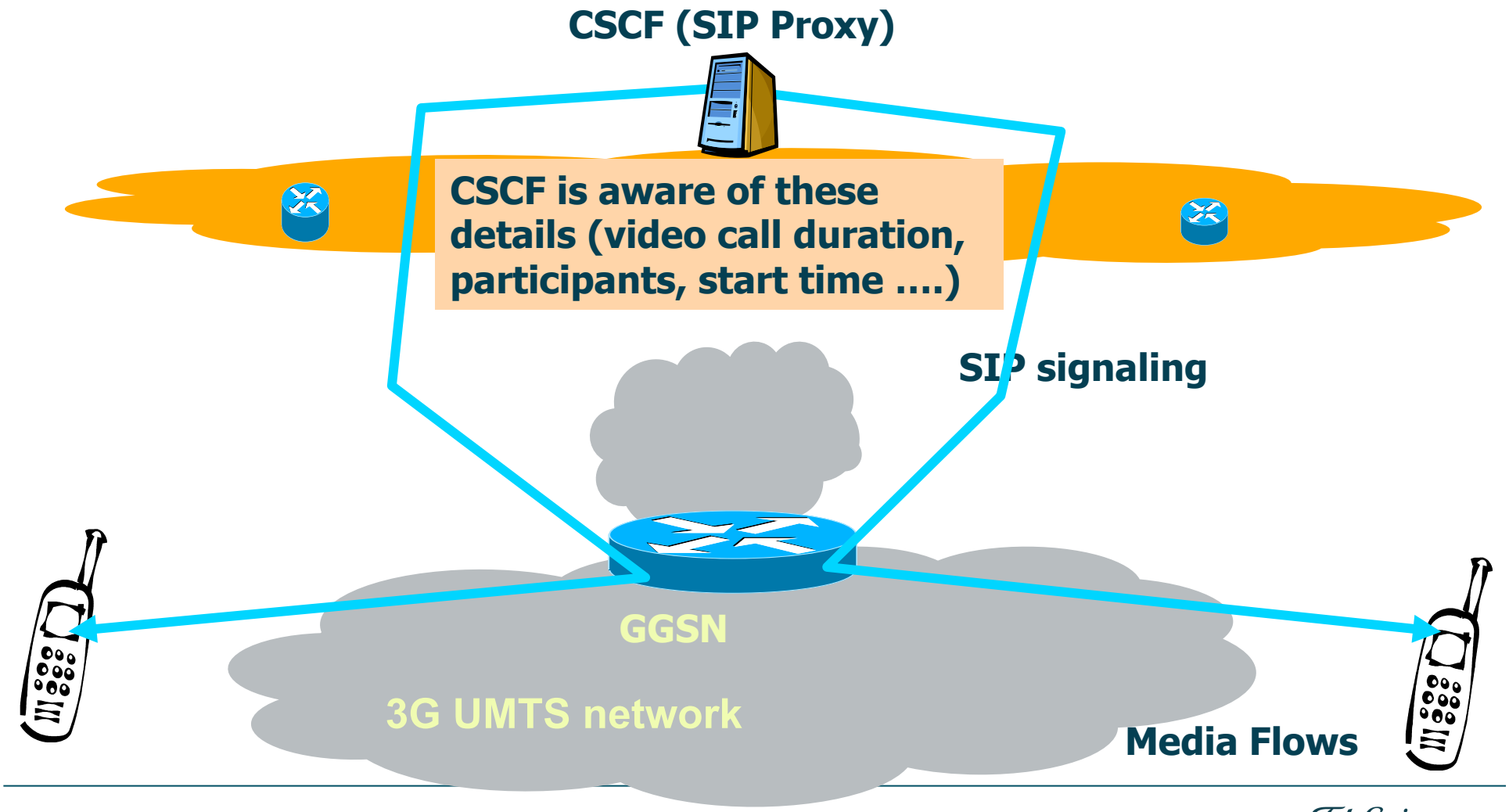
QoS in IMS: a scenario

Media flows traverse the network



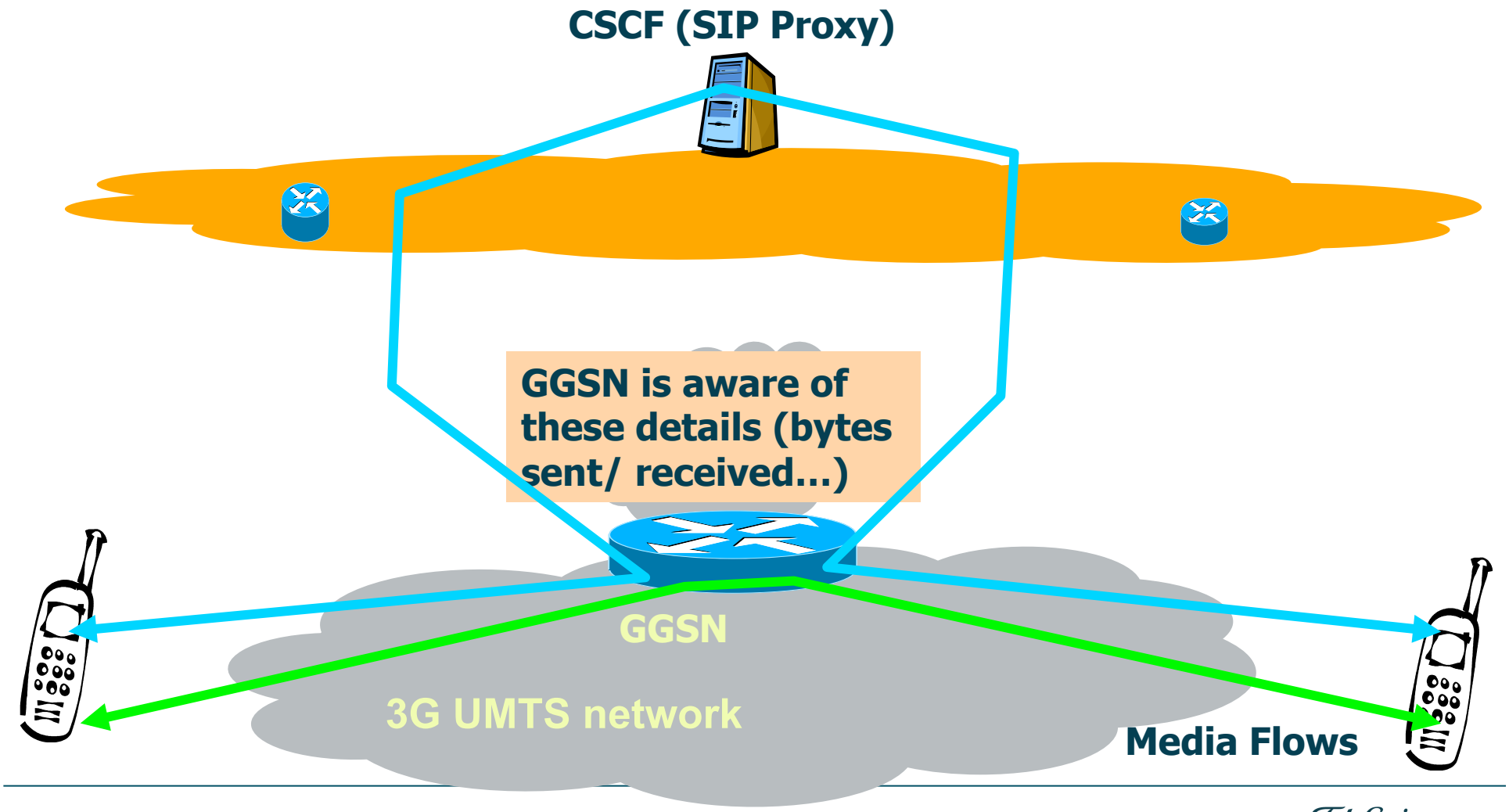
Charging in IMS: a scenario

Two users want to setup a video call. One is <18 years old, the other not. Time is 9 pm.



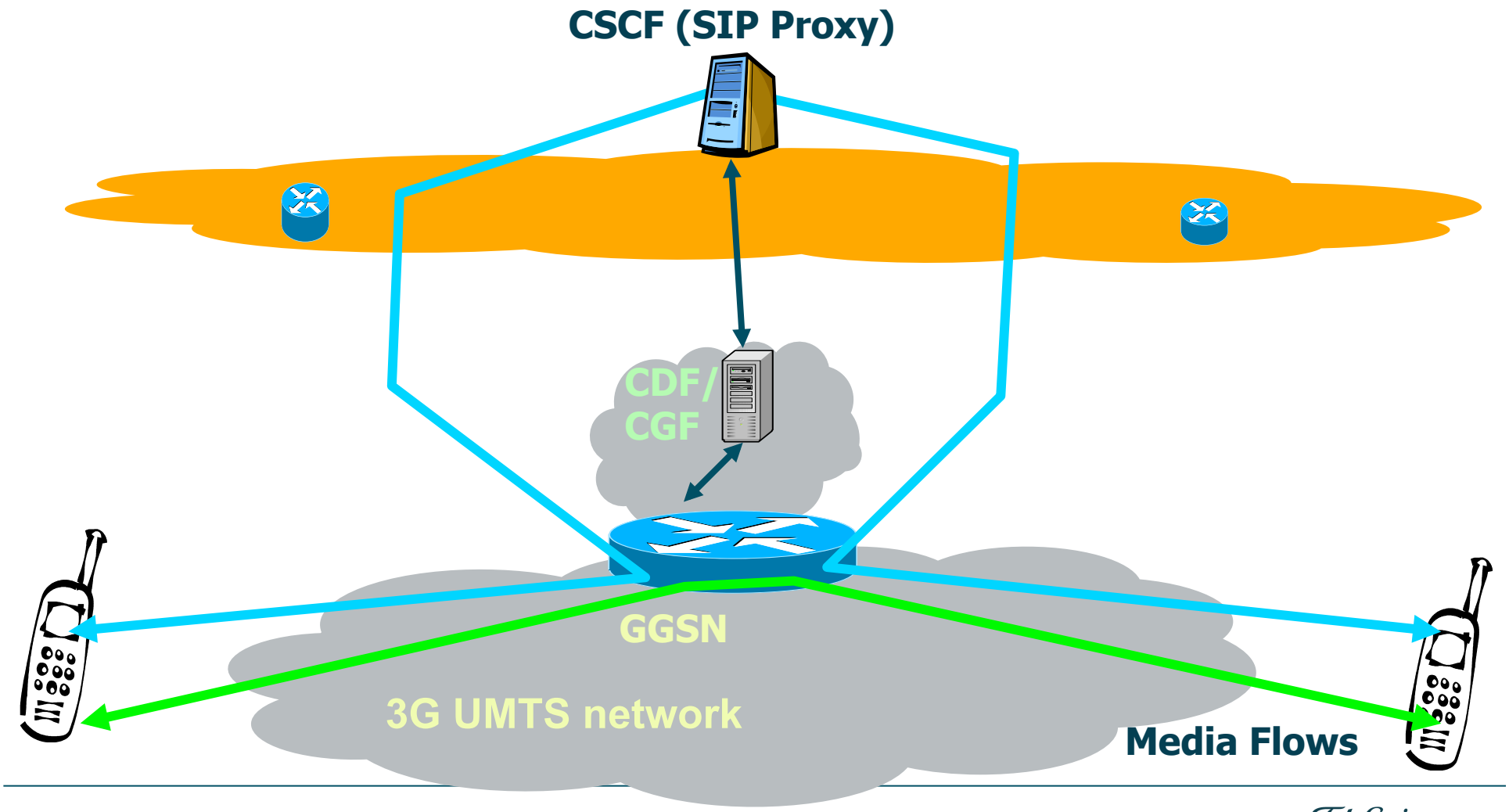
Charging in IMS: a scenario

video audio flows consume network resources



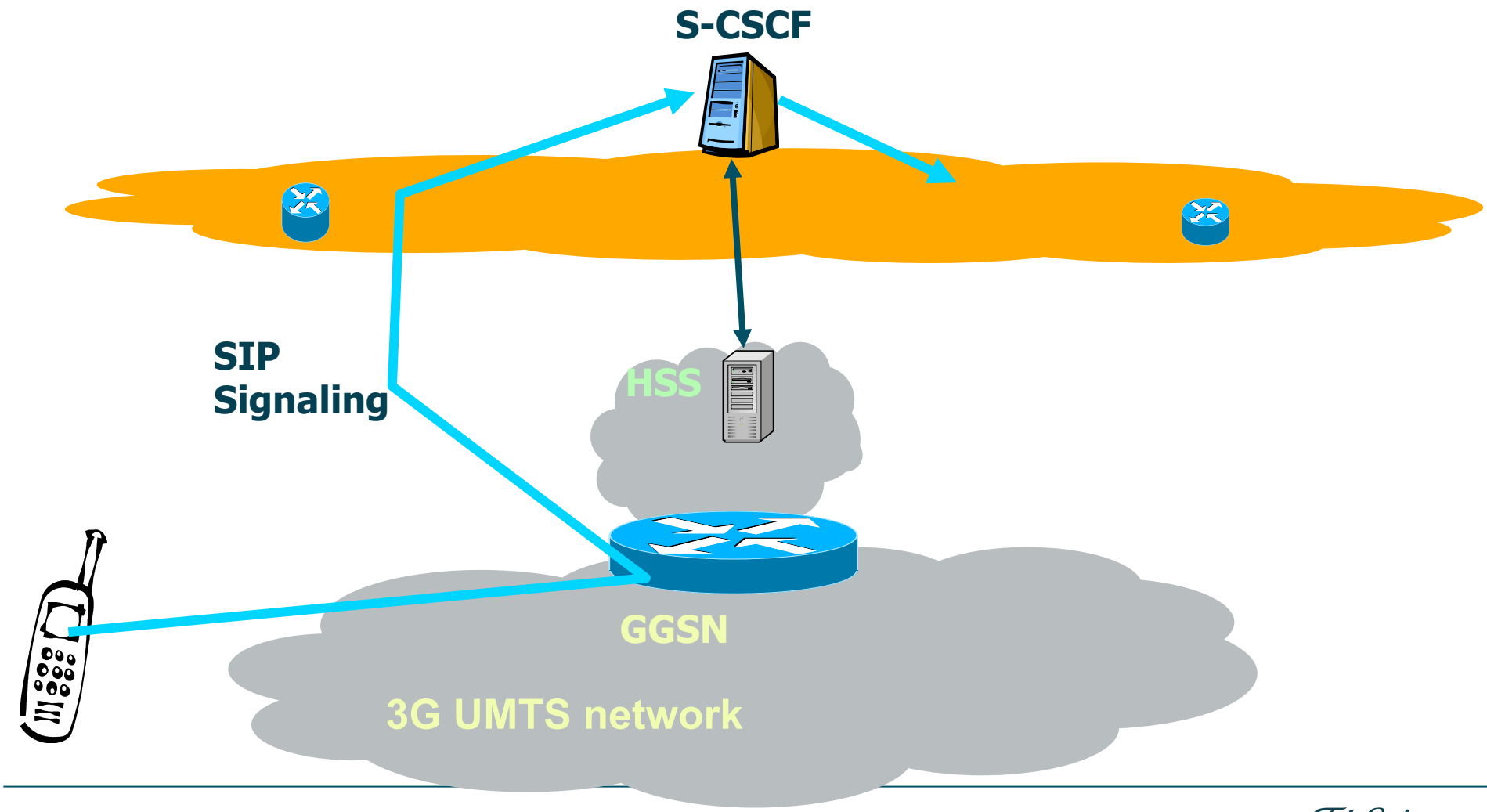
Charging in IMS: a scenario

UMTS' CDF/CGF gathers and correlates both data



Authe. and Autho. in IMS

Depends on 3G user control. SIP signaling proceeds only after contacting the HSS



Abbreviations

SIP: session initiation protocol. Used to negotiate (multimedia) sessions e.g. codecs to employ

CSCF: Call Session Control Function. A SIP server / registrar

HSS: Home Subscriber Service. User data base of the mobile operator

CDF/CGF: Charging Data/Gateway function. Collects accounting data from several entities

GGSN: Gateway GPRS Support Node. A router to other networks (IP, Internet)

PCRF: Policy and charging rules data function. Link between the codecs and BW negotiation via CSCF and the BW reservation in PCEF

PCEF: Policy and Charging Enforcement Function. Enforces the PCRF decision. A router in IP NGN, a GGSN in UMTS, PDN-GW in LTE