VFF IND/IKR Workshop "Dienste im NGN", March 3rd, 2006

FMC Network Evolution

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Fixed Mobile Convergence Network Evolution
Agenda

3GPP IMS network/service architecture

ETSI/TISPAN network architecture

Mobility and use case scenarios

Fixed Mobile Convergence

Session Mobility - service provisioning in a heterogeneous Access Network environment

Conclusion

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NGN = Legacy Phone with Lower Cost
IMS = Internet Multimedia Phone for the Future

Page 3

Phone Network

NGN

Modernize phone infrastructure:
- same services
- different technology

Reduce the complexity and the costs CAPEX/OPEX

Avoid rupture keeping the phone architecture and making replacement of objects element per element

What NGN is not:
- The new voice call architecture for the future with Internet and Multimedia
- Internet Telephony with VoIP

Internet Network

IMS

"IP Multimedia Subsystem" IMS is the Voice/Video over Internet designed for 3G networks

Now considered to be the standard for fix, wireless and mobile Internet-based telephony by operators

The protocols come from the IETF:
- RTP for media
- SIP for signaling / address resolution
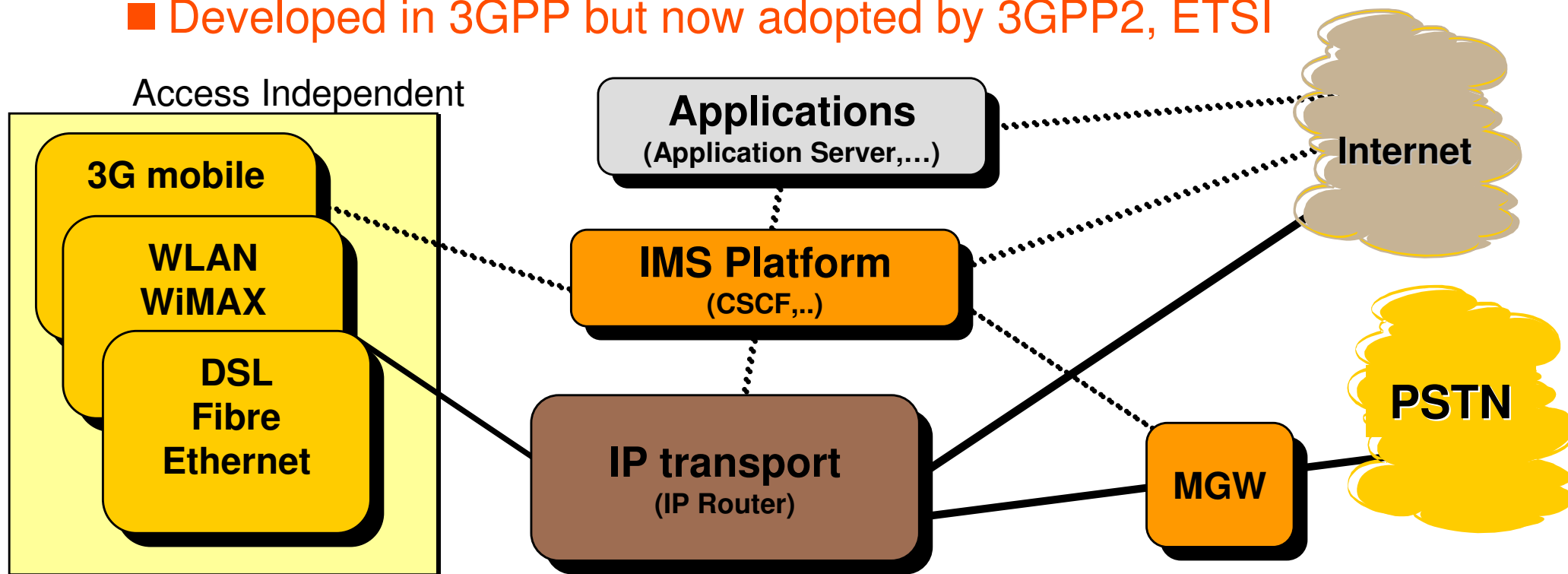- applicable to domains: a country, an enterprise, a home…

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IMS (IP Multimedia Subsystem)
New services for mobile … and fixed networks

Open, standardised, operator friendly, multimedia architecture for mobile, wireless and fixed services

- Based on SIP, DIAMETER and MEGACO controls
- Supports legal interception, localization, PSTN interworking, etc.
- Developed in 3GPP but now adopted by 3GPP2, ETSI

Access Independent

3G mobile

WLAN WiMAX

DSL Fibre Ethernet

Applications
(Application Server,…)

Internet

IMS Platform
(CSCF,..)

IP transport
(IP Router)

MGW

PSTN

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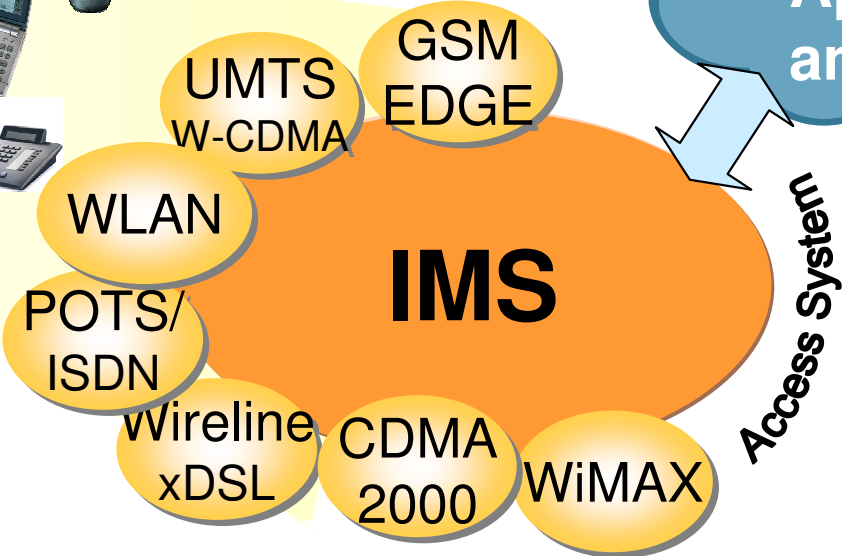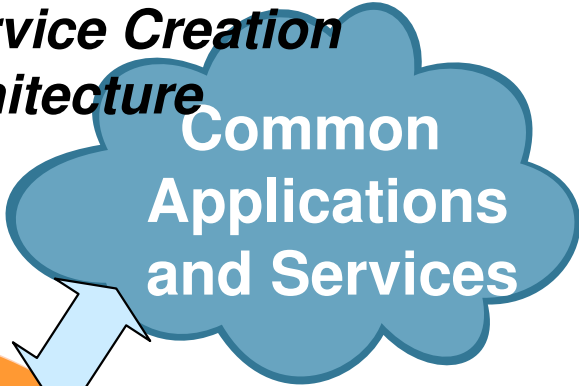
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IMS a Single MM Service Provisioning Platform

Support the *full* range of devices

Support *access-agnostic* Application and Services and Open Service Creation Architecture

Common Applications and Services

GSM EDGE

UMTS W-CDMA

WLAN

IMS

POTS/ ISDN

Wireline xDSL

CDMA 2000

WiMAX

Access System

Support of converged All-IP network infrastructure for *all access network types*

Registration and Session Set-up Call Flow

Home Network of UE A

Home Network of UE B

HSS-A

I-CSCF-B

HSS-B

4

3

5

I-CSCF-A

S-CSCF-A

S-CSCF-B

6

REGISTER

INVITE

Call Control

REGISTER

UE A

1

P-CSCF-A

2

P-CSCF-B

7

UE B

Network visited by MS A

Network visited by MS B
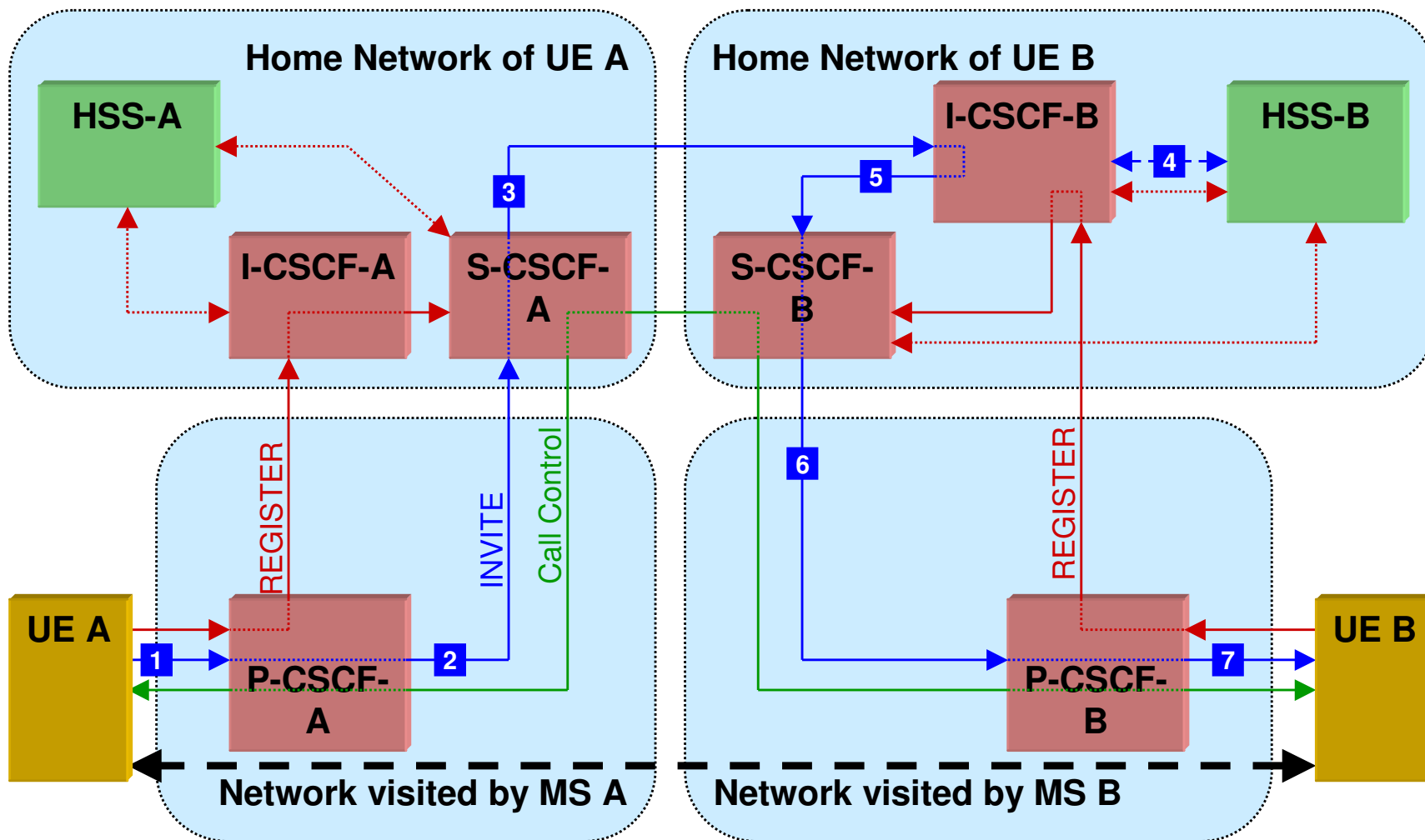
S-CSCF: Serving Call Session Control Server
I-CSCF: Interrogating CSCF)

P-CSCF: Proxy CSCF
HSS: Home Subscriber Server

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Call Session Control Function (CSCF)

Proxy CSCF (P-CSCF)

- behaves as a **proxy** or may also terminate and generate SIP transactions
- authorize the bearer resources for the appropriate QoS level
- identification of I-CSCF in the user's home domain

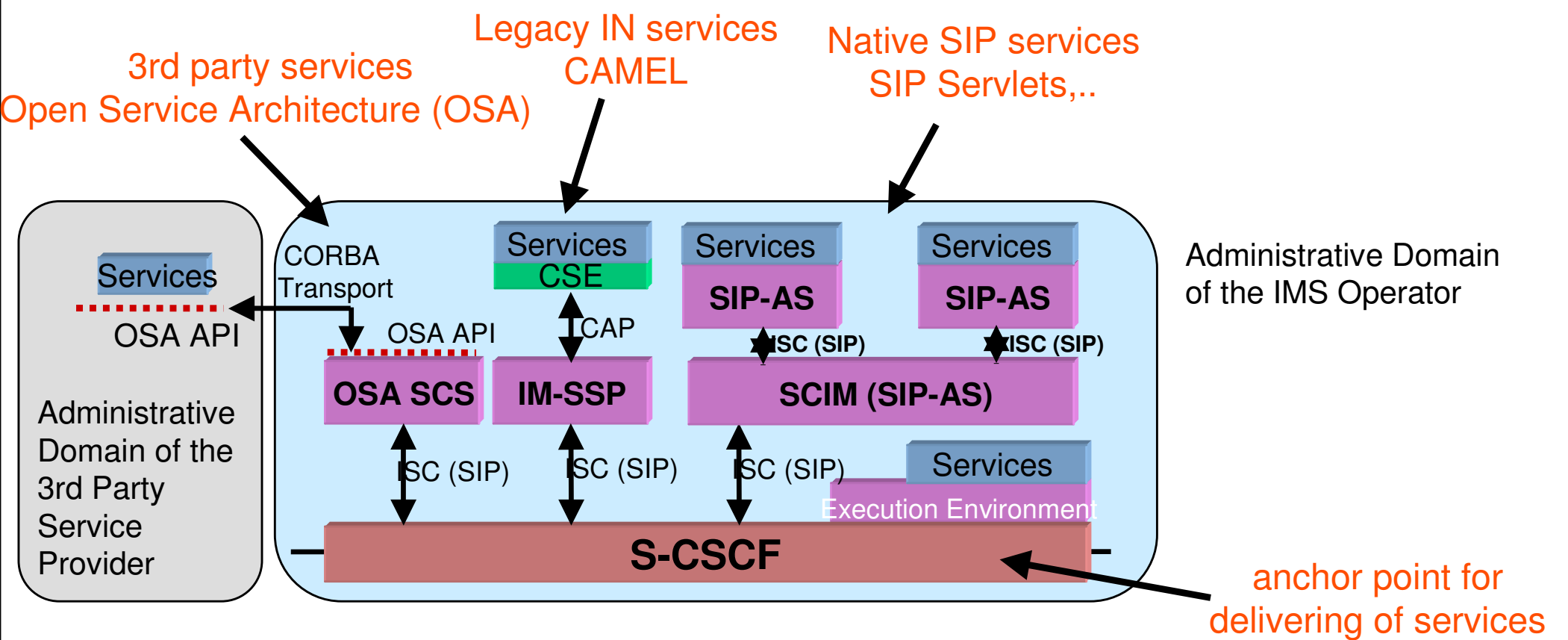**Interrogating CSCF (I-CSCF)**

- contact point within an operator's network for all connections destined for an user of that network
- assigns an S-CSCF to the user performing SIP registration
- forward the SIP request or response to the S-CSCF (topology hiding)

Serving CSCF (S-CSCF)

- behave as a **SIP Registrar** and makes user profiles available through HSS
- maintains the session state as needed for support of the services
- interaction with Services Platform for the support of services
- performs the session control services for the end point

IMS Service Architecture
Multiple Service Platform

3rd party services
Open Service Architecture (OSA)

Legacy IN services
CAMEL

Native SIP services
SIP Servlets,..

Administrative Domain
of the IMS Operator

CORBA
Transport

Services
CSE

Services
SIP-AS

Services
SIP-AS

Services

OSA API

ISC (SIP)

ISC (SIP)

TCAP

OSA API

OSA SCS

IM-SSP

SCIM (SIP-AS)

Services

Administrative
Domain of the
3rd Party
Service
Provider

Execution Environment

ISC (SIP)

ISC (SIP)

ISC (SIP)

S-CSCF

anchor point for
delivering of services

S-CSCF:	Serving Call Session Control Server	CORBA:	Common Object Request Broker Architecture
ISC:	IMS Service Control (SIP based)	CAMEL	Customized Appl. for Mobile network Enhanced Logic
OSA SCS:	Open Service Architecture Service Capability Server	CAP:	CAMEL Application Part
IM-SSP:	IP Multimedia – Service Switching Point	CSE:	CAMEL Service Environment
SIP AS	SIP based Application Server	SCIM:	Service Capability Interaction Manager

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ETSI: TIPHON + SPAN → **TISPAN**

Formed in 1997 as an ETSI Project to study VoIP and subsequently extended to any Telecom (including Multimedia) services over IP

Formed as a Technical Body from the joining of SPS (Services, Protocols & Switching) and NA (Network Aspects

TIPHON

Telecommunications and IP Harmonization Over Networks

SPAN

Services and Protocols for Advanced Networks

TISPAN
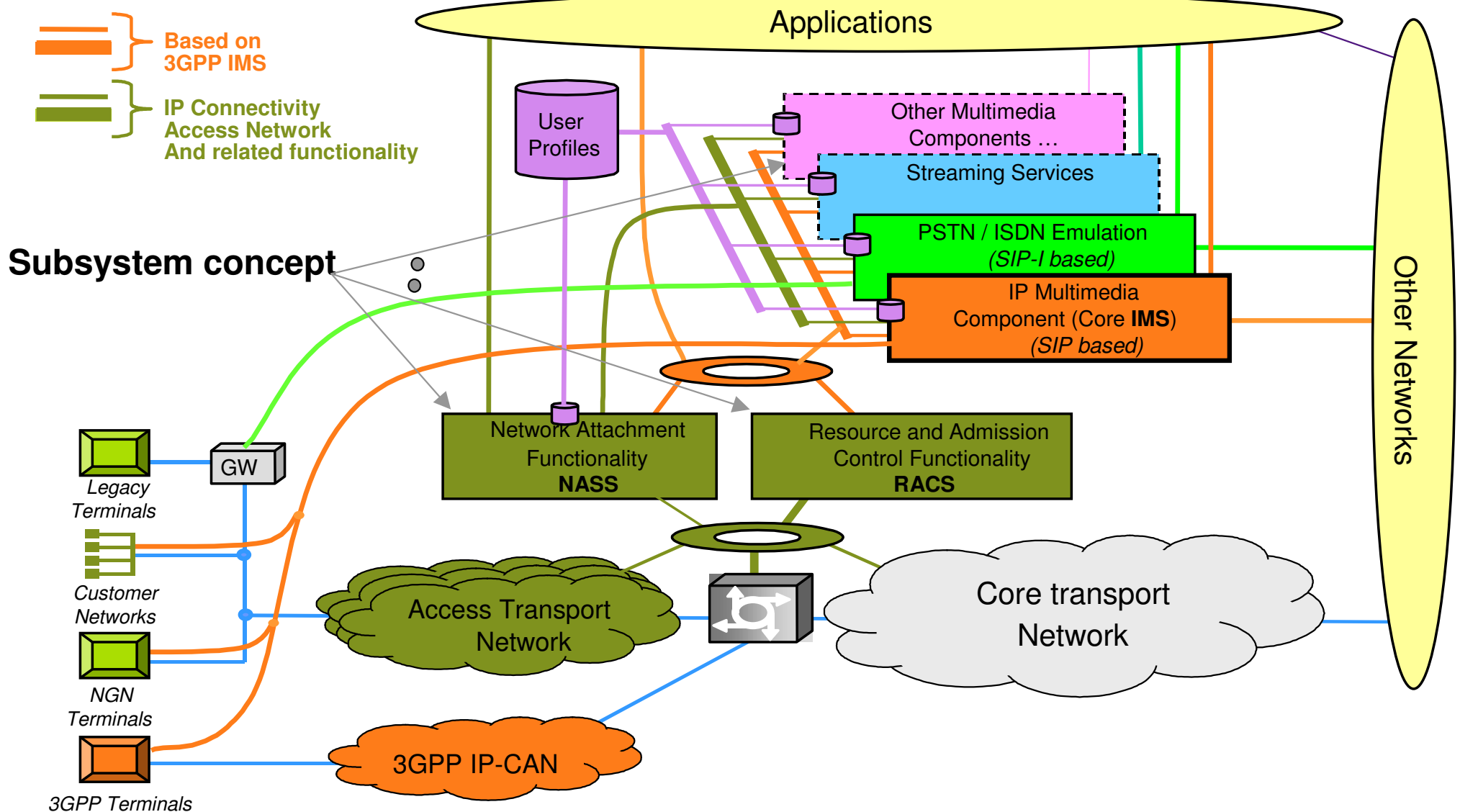
Telecommunication and **I**nternet converged **S**ervices and **P**rotocols for **A**dvanced **N**etworking
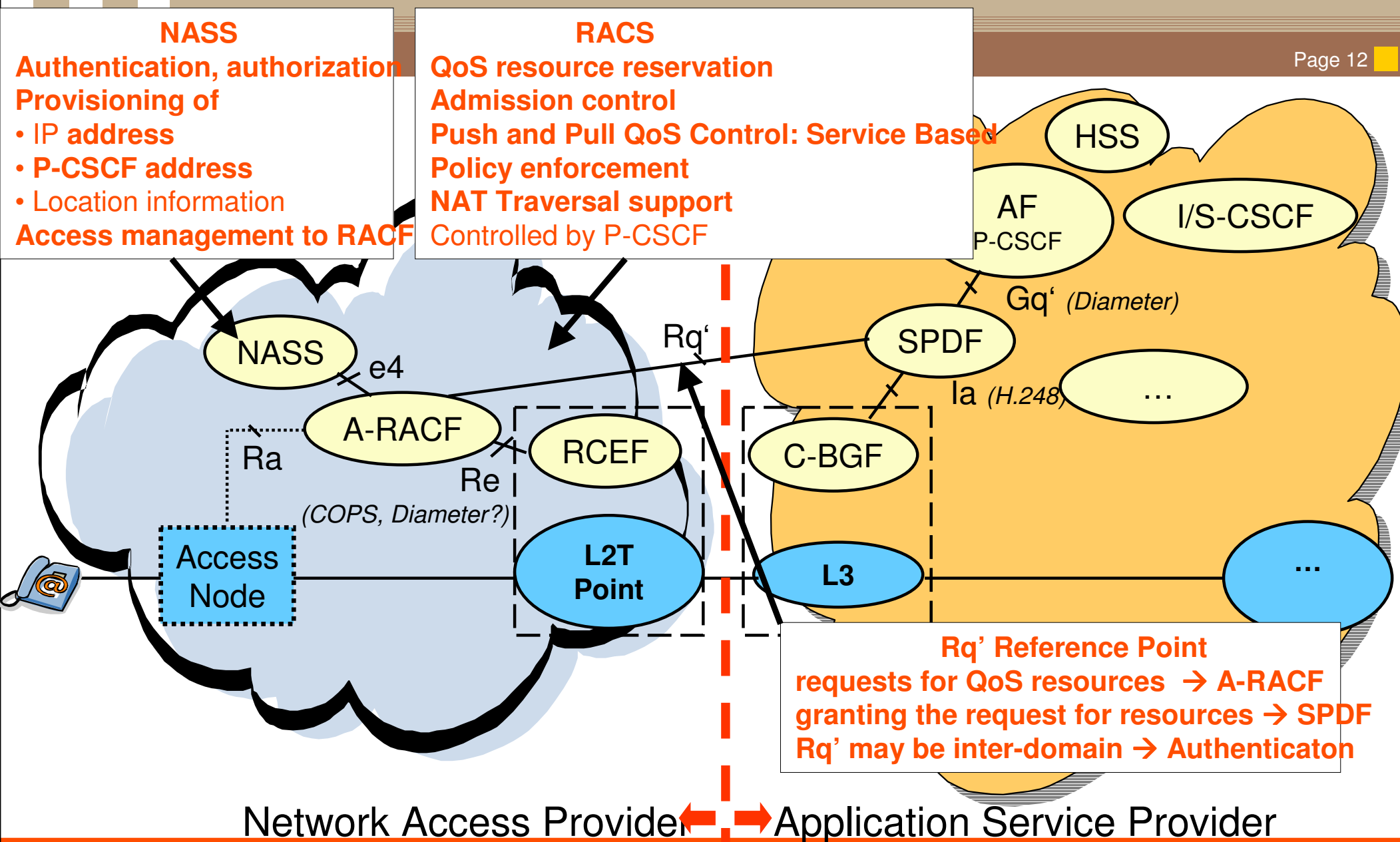
Complement the architecture with other subsystems

- Resource and Admission Control Subsystem (RACS)
- Network Attachment Subsystem (NASS)
- PSTN/ISDN Emulation Subsystem (PES)
- other Multimedia Subsystems (VoD streaming,..)

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NGN Architecture Model

Based on
3GPP IMS

IP Connectivity
Access Network
And related functionality

Applications

User Profiles

Other Multimedia Components …

Streaming Services

PSTN / ISDN Emulation
(SIP-I based)

IP Multimedia Component (Core **IMS**)
(SIP based)

Subsystem concept

Other Networks

Network Attachment Functionality
NASS

Resource and Admission Control Functionality
RACS

Legacy Terminals

GW

Customer Networks

NGN Terminals

Access Transport Network

Core transport Network

3GPP Terminals

3GPP IP-CAN

TISPAN RACS Architecture

NASS
Authentication, authorization
Provisioning of
• IP **address**
• **P-CSCF address**
• Location information
Access management to RACF

RACS
QoS resource reservation
Admission control
Push and Pull QoS Control: Service Based
Policy enforcement
NAT Traversal support
Controlled by P-CSCF

HSS

AF
P-CSCF

I/S-CSCF

Gq' *(Diameter)*

NASS

e4

Rq'

SPDF

Ia *(H.248)*

…

A-RACF

RCEF

C-BGF

Ra

Re
(COPS, Diameter?)

Access
Node

**L2T
Point**

L3

…

Rq' Reference Point
requests for QoS resources → A-RACF
granting the request for resources → SPDF
Rq' may be inter-domain → Authenticaton

Network Access Provider   Application Service Provider

RACF Resource and Admission Control Function
SPDF Service-based Policy Decision Function
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C-BGF Core Border Gateway Function
RCEF Resource Control Enforcement
Function

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Fixed Mobile Convergence Network Evolution
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3GPP IMS network/service architecture

ETSI/TISPAN network architecture

Mobility and use case scenarios
- ■ **Mobility Terms and Definitions**
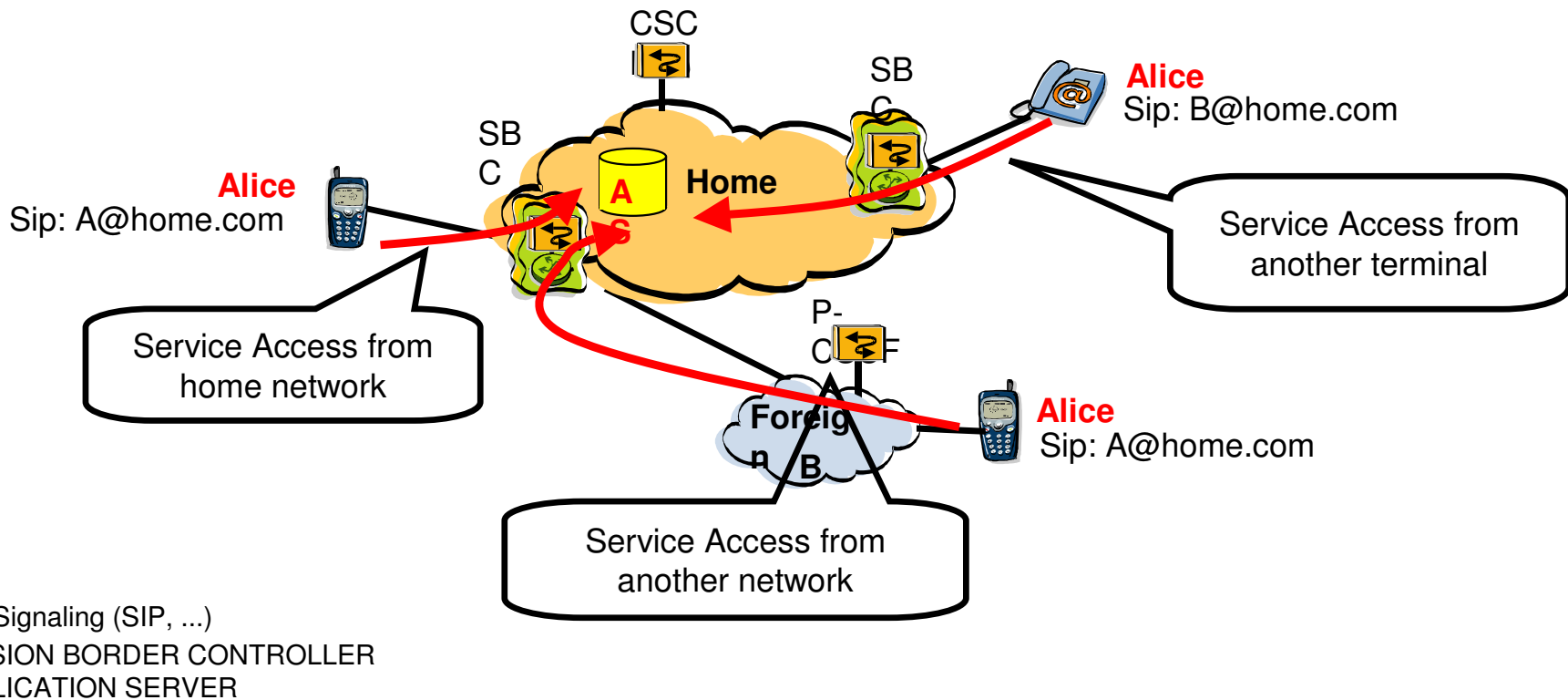 - • **Five Main Mobility Types**
  - • **Specific Mobility Terms**

Fixed Mobile Convergence

Session Mobility - service provisioning in a heterogeneous Access Network environment

Conclusion
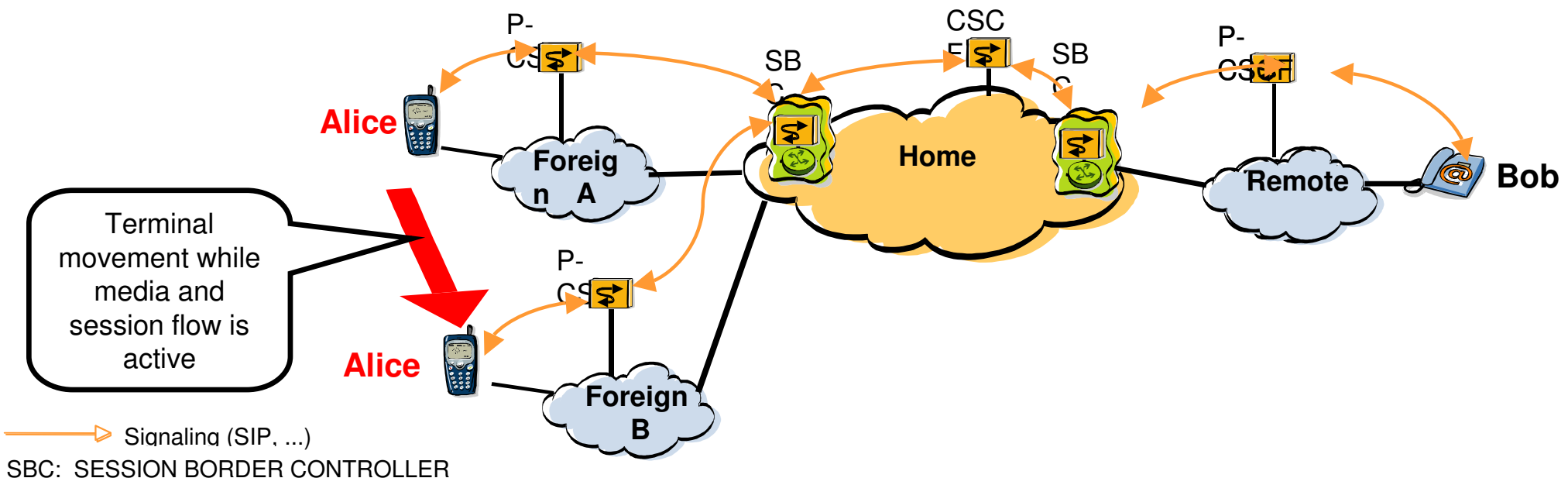
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Service Mobility

*"Service Mobility refers to the ability of a user to **use** the particular (subscribed) **service irrespective of the location** of the user and the terminal that is used for that purpose."* (**ITU-T**, ETSI, 3GPP)
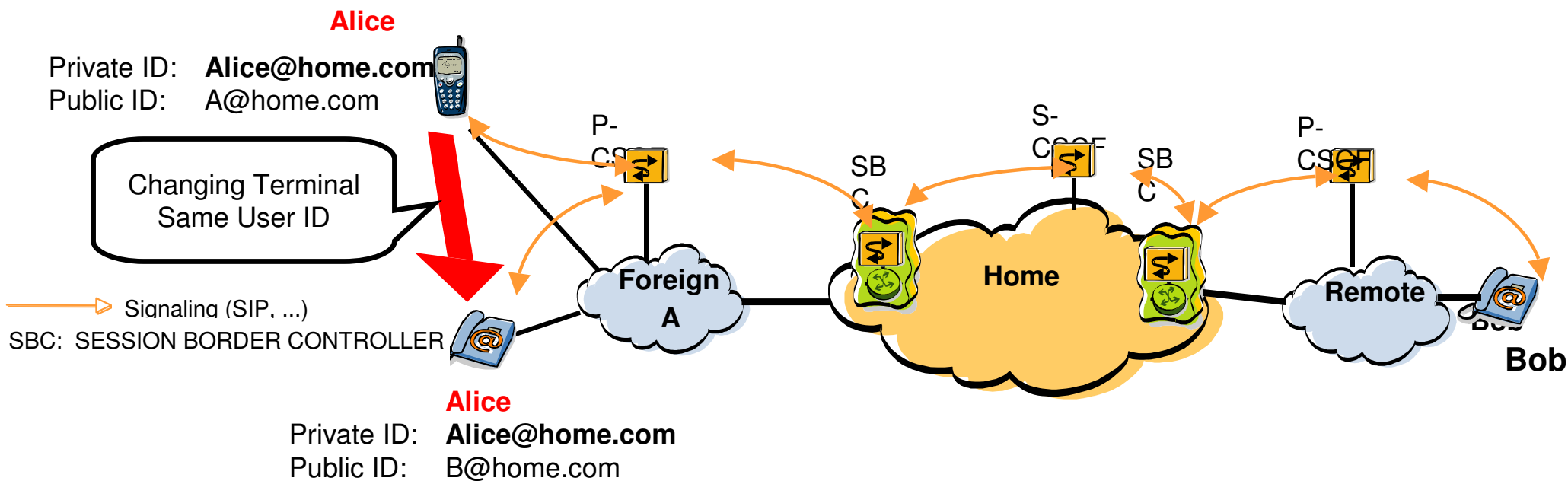
CSC

SBC

SBC

Alice
Sip: A@home.com

A
AS
Home

Alice
Sip: B@home.com

Service Access from another terminal

Service Access from home network

P-CSCF

Foreign

A
B

Alice
Sip: A@home.com

Service Access from another network

→ Signaling (SIP, ...)

SBC: SESSION BORDER CONTROLLER
AS: APPLICATION SERVER

Terminal Mobility

*"Terminal mobility refers to the ability of a **terminal** to **access** telecommunication **services from different locations** and **while in motion**. Terminal mobility is also concerned with a mobile terminal that is changing its point of attachment to the network." (**ITU-T**, ETSI, 3GPP)*

Terminal movement while media and session flow is active

Alice

Alice

Foreign A

Foreign B

Home

Remote

Bob

P-CSCF

CSCF

P-CSCF

P-CSCF

SBC

SBC

Signaling (SIP, ...)

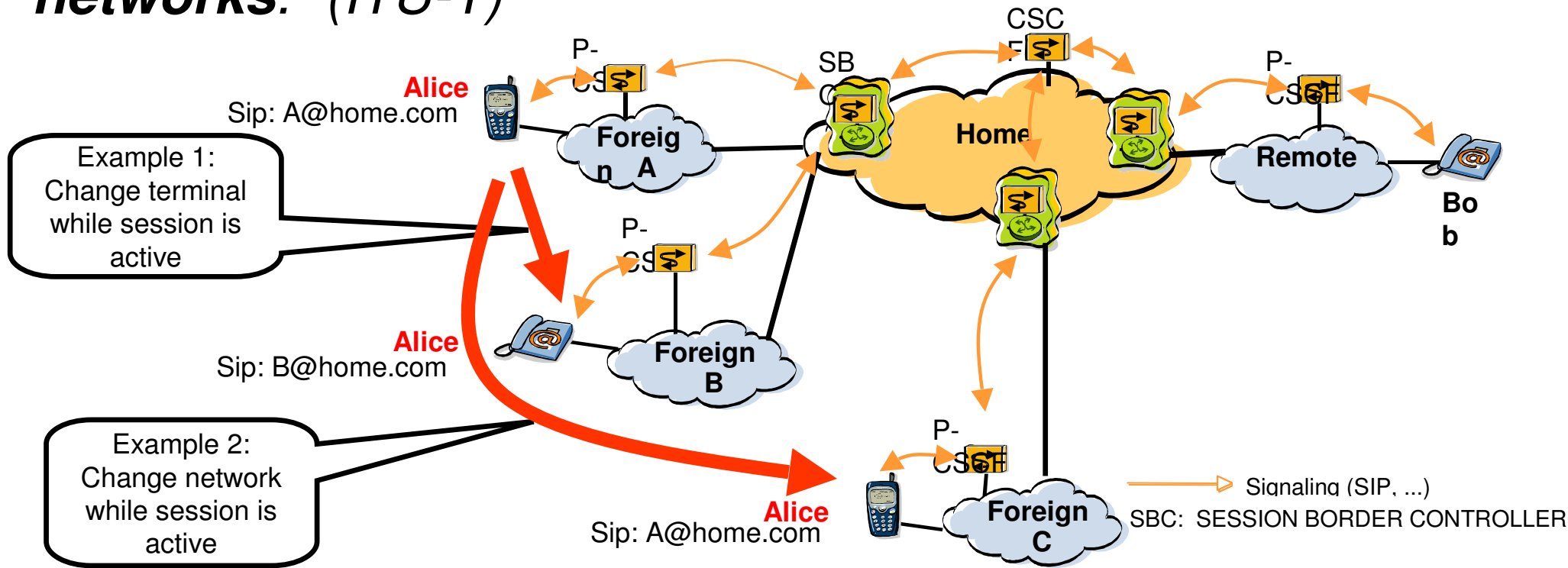SBC: SESSION BORDER CONTROLLER

Personal Mobility

*"This is mobility for those scenarios where the **user changes the terminal** used for network access at different locations. The ability of a user to access telecommunication services at any terminal on the basis of a **personal identifier**." (**ETSI**, ITU-T, 3GPP)*

Alice

Private ID: **Alice@home.com**
Public ID: A@home.com

Changing Terminal
Same User ID

P-CSCF

S-CSCF

SBC

SBC

P-CSCF

Foreign A

Home

Remote

Bob

Signaling (SIP, ...)

SBC: SESSION BORDER CONTROLLER

Alice

Private ID: **Alice@home.com**
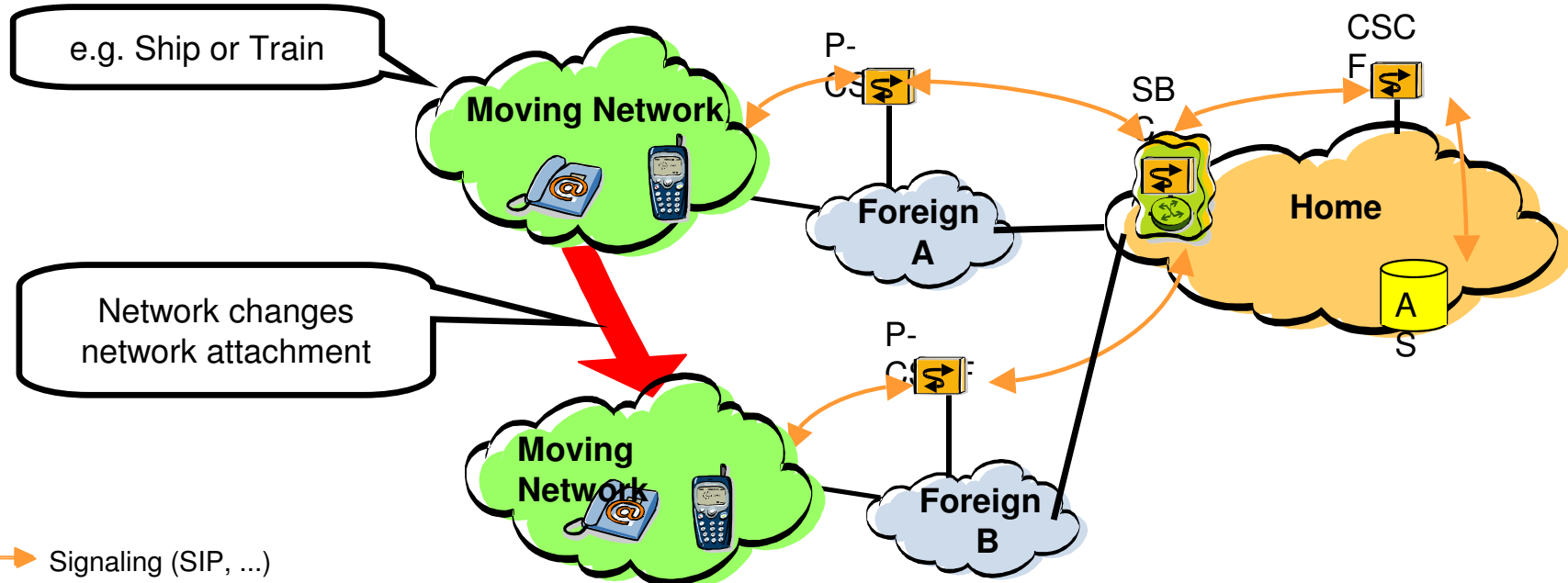Public ID: B@home.com

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Session Mobility

*"Session mobility is the ability of the mobile user to maintain sessions while **changing** between **terminal** devices and **moving across** various **access** and core **networks**." (ITU-T)*

Alice
Sip: A@home.com

Example 1:
Change terminal while session is active

Alice
Sip: B@home.com

Example 2:
Change network while session is active

Alice
Sip: A@home.com

P-CSC

CSC

SB

P-CSC

Foreign A

Home

Remote

Bob

P-CSC

Foreign B

P-CSC

Foreign C

Signaling (SIP, ...)

SBC: SESSION BORDER CONTROLLER

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Network Mobility

*"The ability of a **network**, where a set **of fixed or mobile nodes** are networked each other, to **change**, as a unit, its **point of attachment** to the corresponding network upon the network's movement itself." (ITU-T)*

e.g. Ship or Train

Moving Network

Network changes network attachment

Moving Network

Foreign A

Foreign B

P-CSCF

SBC

CSCF

Home

AS

Signaling (SIP, ...)

SBC: SESSION BORDER CONTROLLER
AS: APPLICATION SERVER

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Mobility and use case scenarios

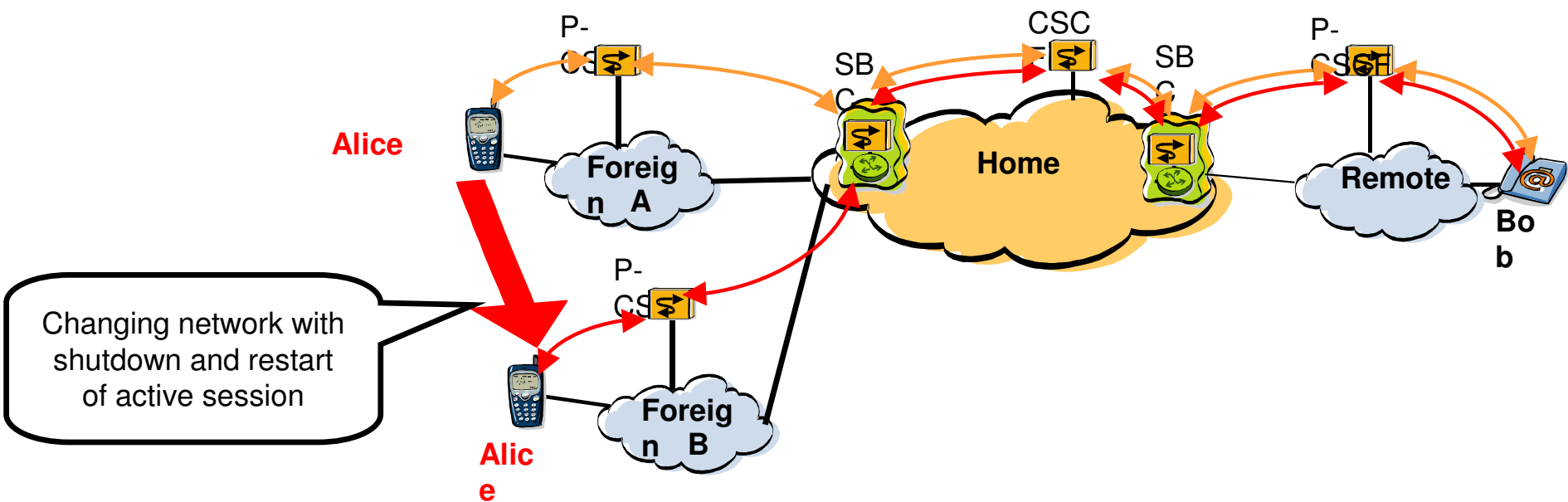- **Mobility Terms and Definitions**
  - **Five Main Mobility Types**
  - **Specific Mobility Terms**

Fixed Mobile Convergence

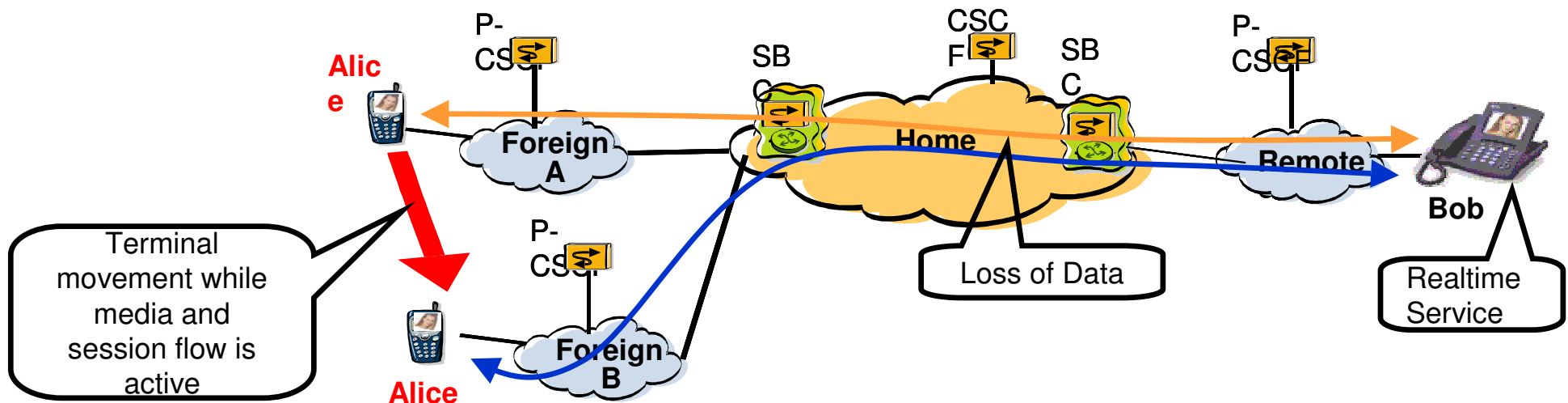**Session Mobility - service provisioning in a heterogeneous Access Network environment**

Conclusion

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Discrete Mobility

Nomadism

P-CSC

CSC

SB C

SB C

P-CSC

Alice

Foreign A

Home

Remote

Bo b

Changing network with shutdown and restart of active session

P-CSC

Foreign B

Alic e

→ Signaling (SIP, ...) Session 1
→ Signaling (SIP, ...) Session 2

SBC: SESSION BORDER CONTROLLER

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Continuous Mobility

Continuous Mobility	Loss of Data
Handover	Limited; Real-time services can still be continued
Seamless Handover	Minimal; Handover is not perceptible to user

Media Path 1
Media Path 2
SBC: SESSION BORDER CONTROLLER

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Fixed Mobile Convergence

Identification of four areas for Fixed Mobile Convergence

- Commercial convergence
- Device convergence
- Network convergence
- **Service convergence**

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Fixed Mobile Convergence

Commercial convergence

The marketing and administration personnel of both the fixed and mobile departments are pooled together.

Device convergence

One device for access to services via different network technologies:

- Multiple Physical Layer interfaces, e.g.,
    - CDMA2000, WCDMA, GSM, WLAN, WiMAX, mesh ad-hoc, fixed broadband xDSL, Cable DOCSIS, etc.
- Device performs functions that previously required several devices
    - voice calls, internet access, video, gaming, navigation, etc.

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Fixed Mobile Convergence

Network convergence

Migration of heterogeneous physical and logical network elements into one single (IP based) infrastructure:

- Converged access aggregation network of the wireline and wireless/mobile access technologies with control of QoS management, resource & mobility management (RMM), etc.

- Sharing of resources: AAAC, security, common OAM, OoS, mobility management

- Alignment of network load and bandwidth management

- Emphasis on operator's cost efficiency

Fixed Mobile Convergence

Service convergence

Homogeneous delivery of service features independent of the access networks, network technologies and end user terminals

- Usability of services must be independent of the current access point and terminals
    - Service mobility: any service is accessible from any location, any access network (technology and operator) and any terminal
    - Multitude of services (person to person, person to content/service, content to person and service to service)
    - Enables the delivery of user-centric ubiquitous services
- Media handling, session control,…

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FMC: Service Convergence
Service Requirements

- Full **mobility support** (service, session, terminal, personal and network mobility)
- **Single authentication and authorization** for all services and network technologies
- **Single and unique user identity** for all services, and all network technologies and terminals
- **Presence and preference** across service and network technology
- "Always best connected" (broker/location based services, location optimized mobility, ..)
- In General: Services shall be access network and -technology agnostic
- But: Service parameters may vary depending on access networks/ technologies/ terminals
  - Network based service adaptation at MRF …
- Network, terminal or AS based adaptation functions required
  - Achieving interconnection of per se incompatible applications/services
- Billing and accounting concepts for session mobility

Challenges
➔ **FMC across multiple administrative domains/operators**
➔ **FMC scalability**

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Fixed Mobile Convergence

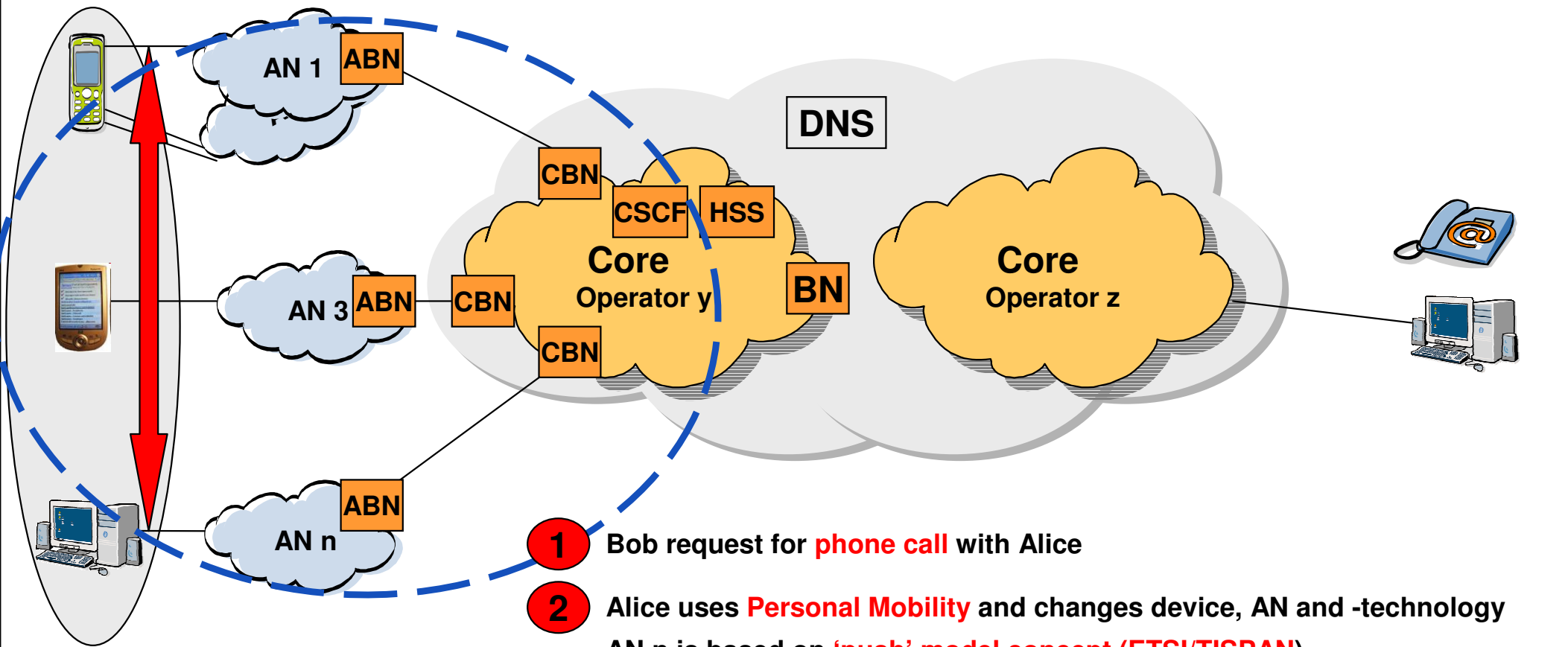**Session Mobility - service provisioning in a heterogeneous Access Network environment**

Conclusion

Personal Mobility
Single Operator, multiple AN, multiple Terminals

User Alice

User Bob

AN 1 ABN

DNS

CBN

CSCF HSS

Core
Operator y

BN

Core
Operator z

AN 3 ABN CBN

CBN

ABN

AN n

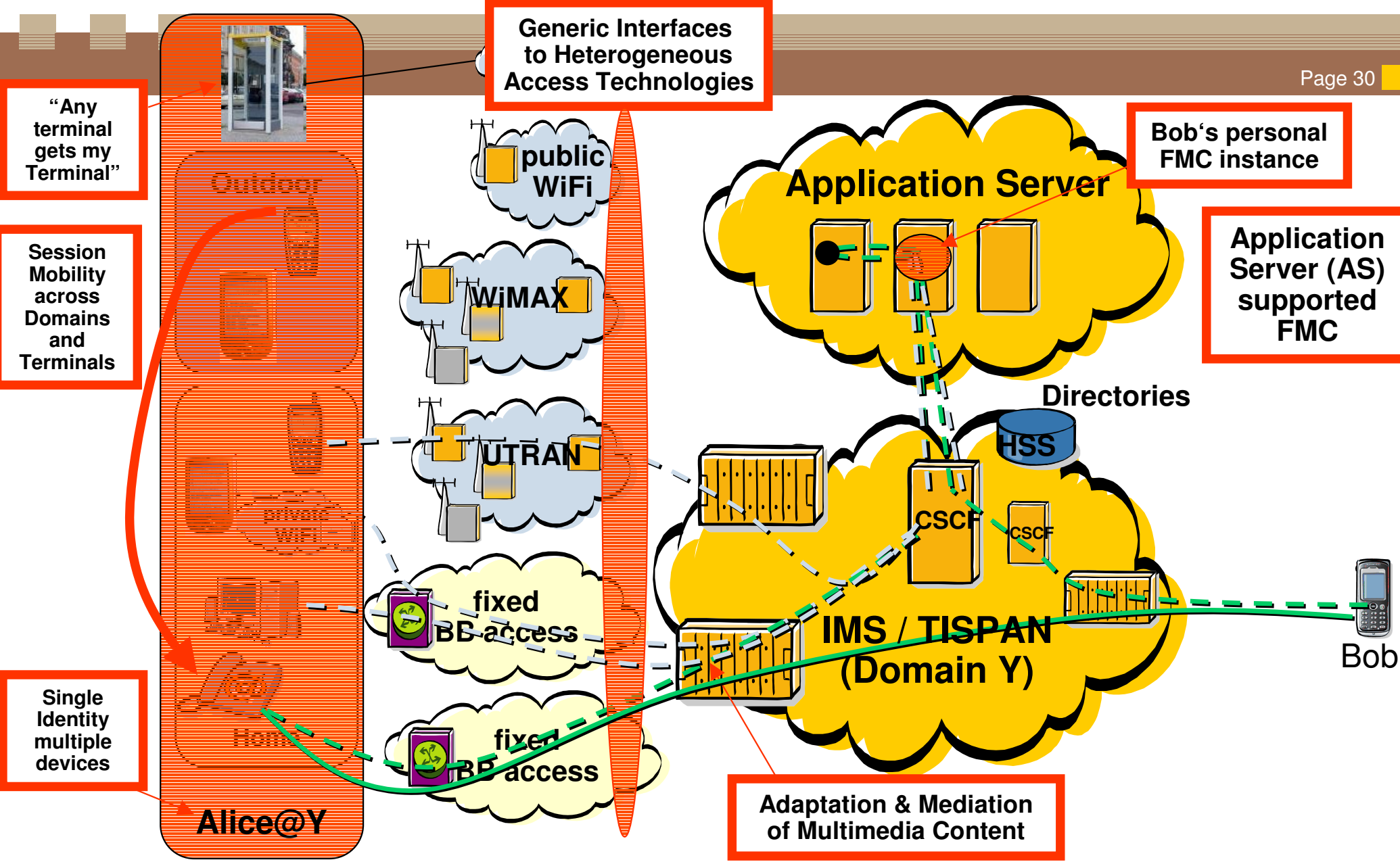**1** Bob request for phone call with Alice

2 Alice uses Personal Mobility and changes device, AN and -technology

AN n is based on 'push' model concept (ETSI/TISPAN)

All services parameters are provided by the IMS core network

➡ Requires SIP signaling, involving IMS core functions as CSCF, MRF

Unique identity:
    Alice@y

CBN: Core Border Node   **ABN: Access Border Node**

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FMC solution based on Application Server

Generic Interfaces to Heterogeneous Access Technologies

"Any terminal gets my Terminal"

Session Mobility across Domains and Terminals

Single Identity multiple devices

Bob's personal FMC instance

Application Server (AS) supported FMC

public WiFi

WiMAX

UTRAN

fixed BB-access

fixed BB-access

Alice@Y

Application Server

Directories

HSS

CSCF

CSCF

IMS / TISPAN (Domain Y)

Bob

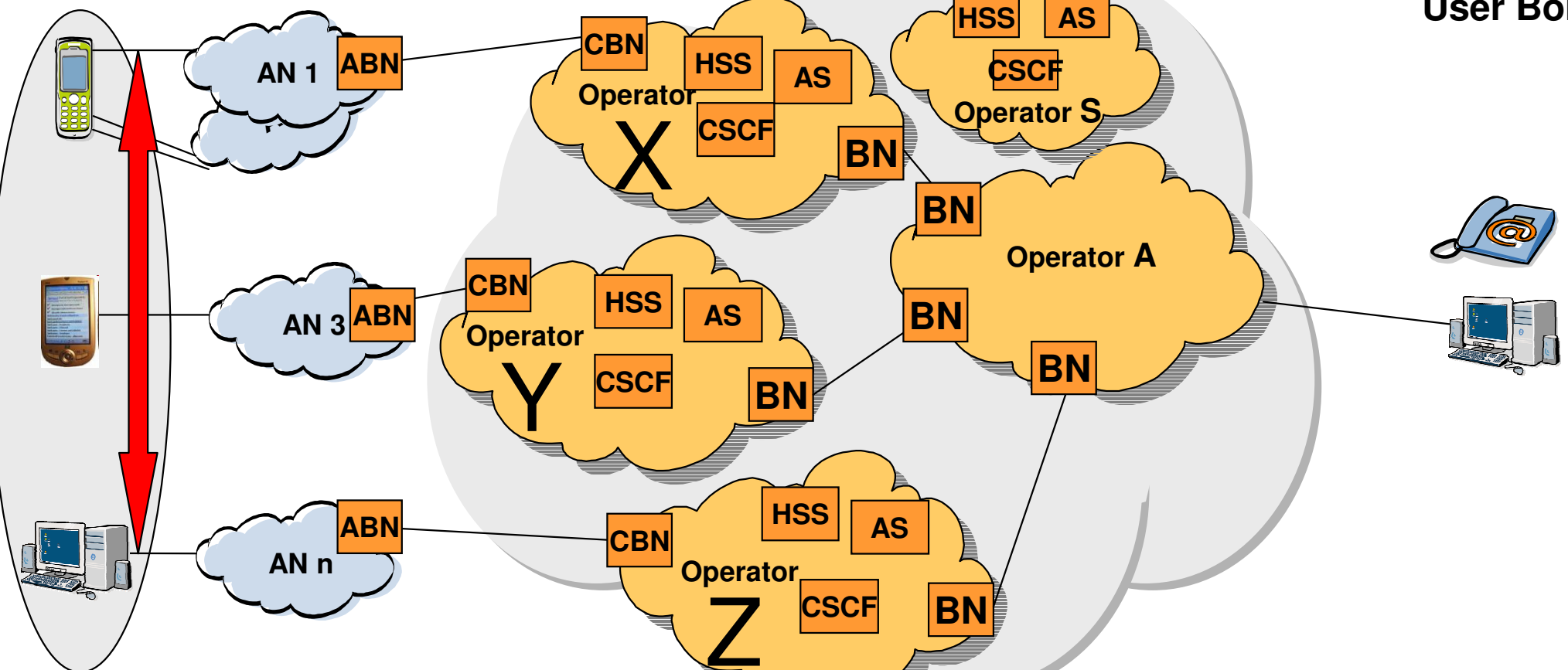**Adaptation & Mediation of Multimedia Content**

FMC Architecture based on IMS Core and Application Server

Fixed Mobile Convergence
Multi Operator, multiple AN, multiple Terminals

User Alice

User Bob

AN 1 · ABN

CBN · Operator **X** · HSS · AS · CSCF · BN

HSS · AS · CSCF · Operator S · BN

AN 3 · ABN · CBN · Operator **Y** · HSS · AS · CSCF · BN

BN · Operator A · BN · BN

AN n · ABN · CBN · Operator **Z** · HSS · AS · CSCF · BN

Unique identity?
Alice@<which domain?>

➔ **Which is Alice's home S-CSCF?**
➔ **What about the HSS entries?**
➔ **Who provides the Application Services?**
➔ **Unique identity?**
➔ **What about common presence?**

Real World Scenario

More "real-world" scenarios comprise:

■ **Multiple operators**

- for Access Networks
- for Application Service Providers
- ..

■ **FMC for users with service contracts to multiple providers**

- Mobility across the user's contracts
- Single identity
- Single and homogeneous presence and preference
- Billing and accounting
- Authentication and authorization

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Conclusion

IMS/TISPAN architecture is currently a good nucleus for

- End-to-end multimedia and QoS enabled conversational services
- Different mobility scenarios (service, terminal, personal, session)
  - Seamless session mobility is not solved, yet
- Heterogeneous access networks

Fixed Mobile Convergence in a multi operator scenario

- Rising a lot of questions and unsolved issues
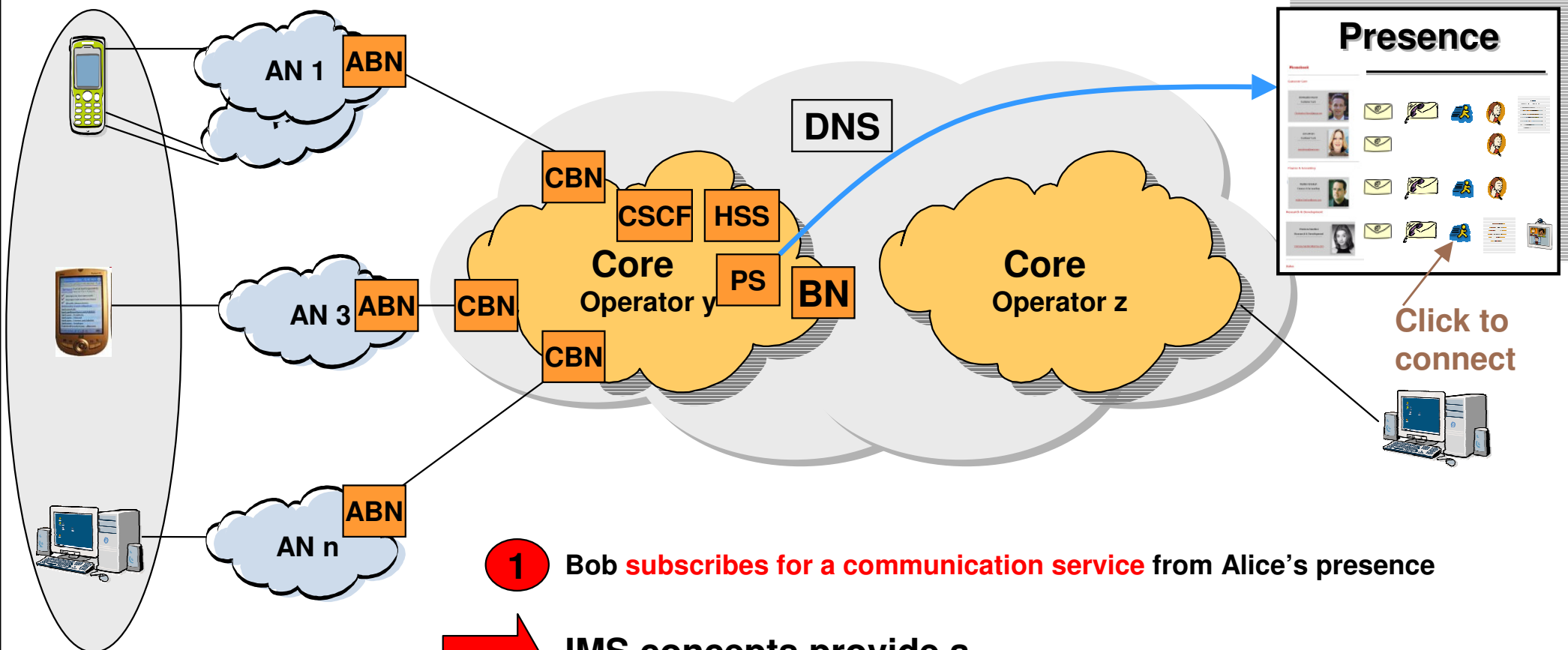- Requires further details studies

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End of Presentation

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Personal Mobility
Single Operator, multiple AN, multiple Terminals

User Alice

User Bob

Presence

AN 1 — ABN

CBN

CSCF   HSS

Core
Operator y

PS   BN

Core
Operator z

DNS

AN 3 — ABN — CBN

CBN

AN n — ABN

Click to connect

Unique identity:
Alice@y

1 Bob subscribes for a communication service from Alice's presence

➡ IMS concepts provide a
homogeneous service solution across
all domains, terminals and application

CBN: Core Border Node   **ABN: Access Border Node**

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