Key technologies in IMS

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Course Objectives:

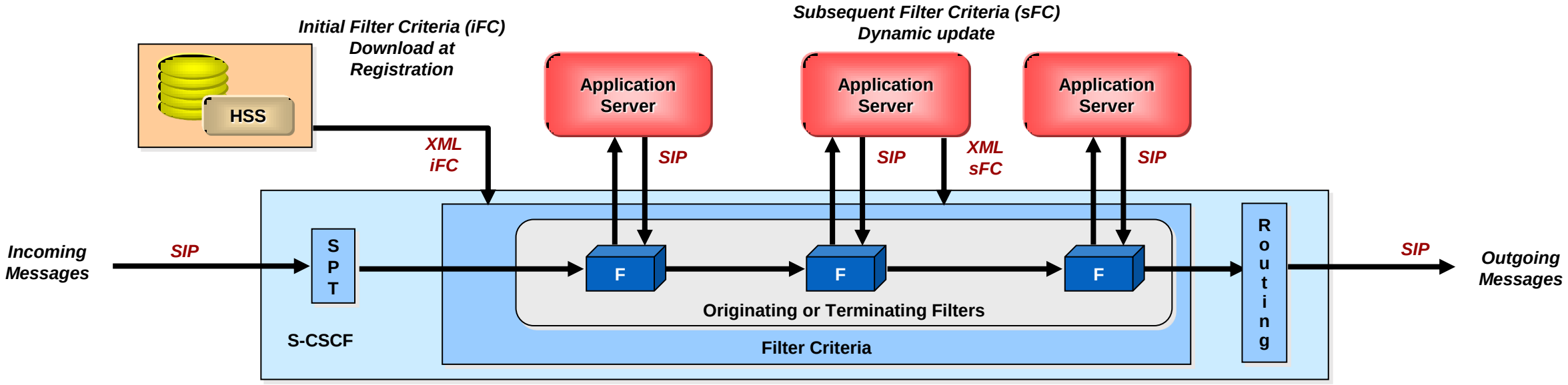
To learn the key technologies in IMS, including the service model, the numbering mechanisms, the network architecture, the interworking architecture, the authentication and charging etc.

Agenda

- IMS service model
- Numbering in IMS
- Network architecture of IMS
- IMS interworking with other networks
- Authentication and Charging in IMS

IMS Service Model

- S-CSCF uses iFC to involve AS(s) to provide services
  - Forwards messages to each AS in the order indicated by the Filter Criteria
  - Order based on priority of each AS associated iFC
- After last AS contacted, message is routed towards intended destination
- AS can decide to continue or disengage in subsequent messaging
  - Record-Route/Route inclusion



IMS Service Trigger Principles

S-CSCF uses Initial Filter Criteria to involve AS(s) as needed to provide services and features

IMS defines Service Point Triggers (SPTs) - points in the SIP signaling on which Initial Filter Criteria can be set:

- Any initial known or unknown SIP method (e.g. REGISTER, INVITE, SUBSCRIBE, MESSAGE)
- Presence or absence of any header
- Content of any header
- Direction of the request with respect to the served user

  Terminating or Originating Party
- Session description information (i.e. SDP).

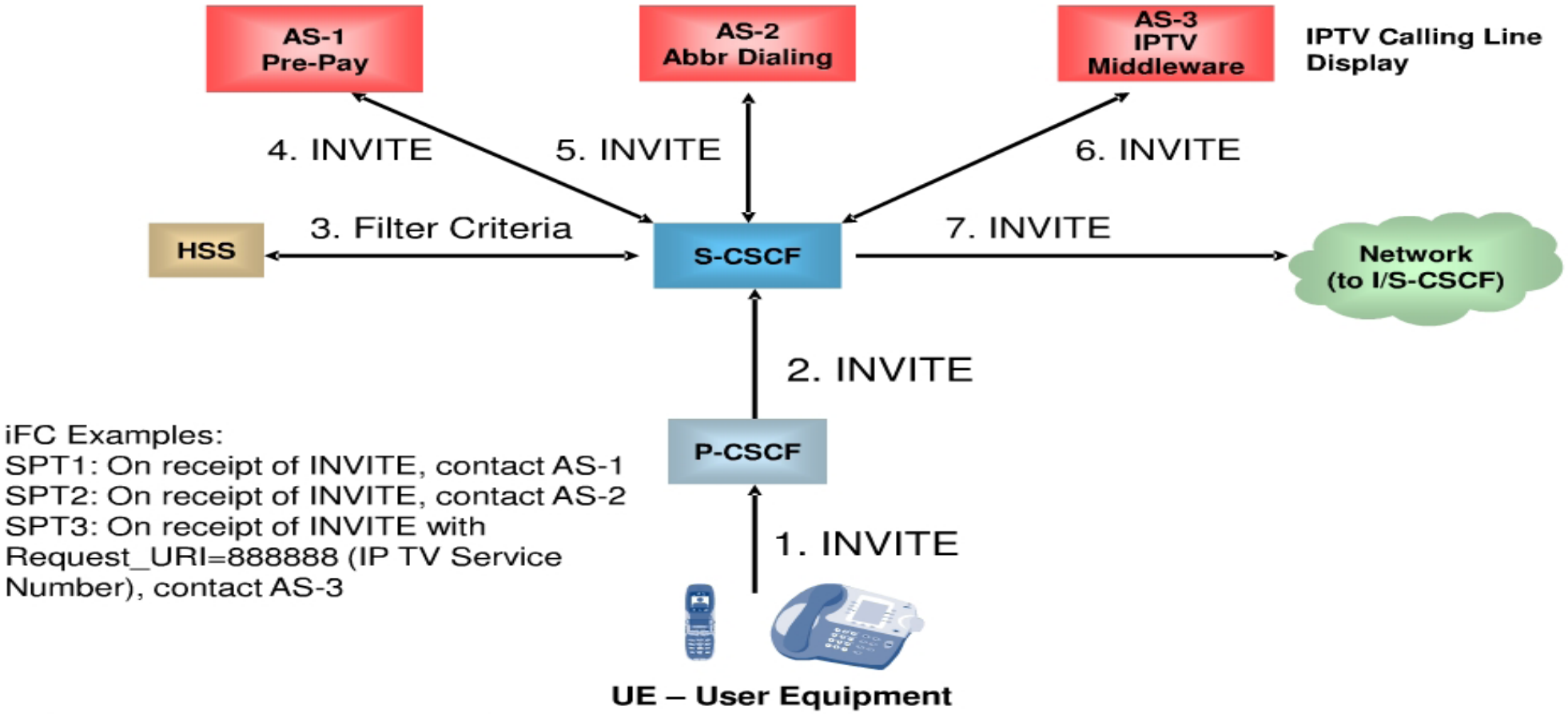
Filter Criteria Contents

Each Initial Filter Criteria includes the following information:

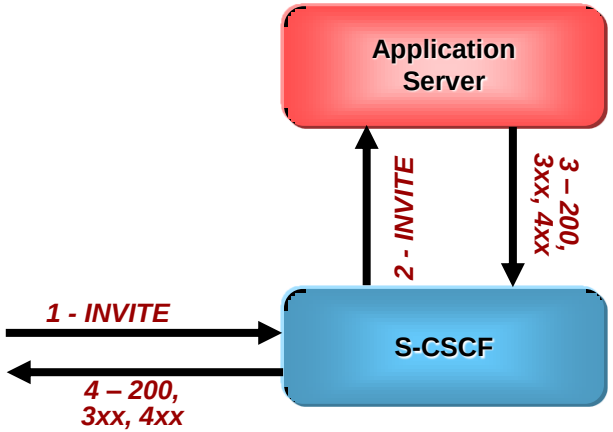
- SPT(s), where multiple SPTs may be linked with logical expressions (e.g. AND, OR, NOT, etc)
- Address of AS to be contacted
- Priority of initial filter criteria
- Default handling when AS cannot be reached
  - Continue with lower priority initial filter criteria
  - Abandon request and release
- Optional Service Information for the message body
- Optional Service Trigger (shortcut to trigger service logic in AS)

Data representation from HSS Collective to S-CSCF is XML

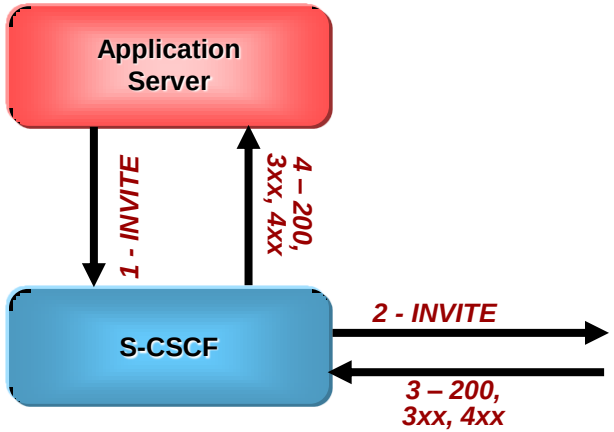
Example of S-CSCF Using Filter Criteria



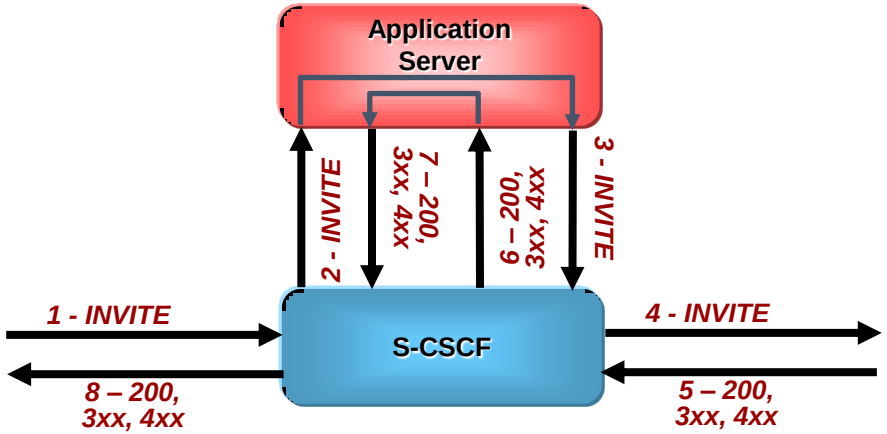
IMS AS Service Model



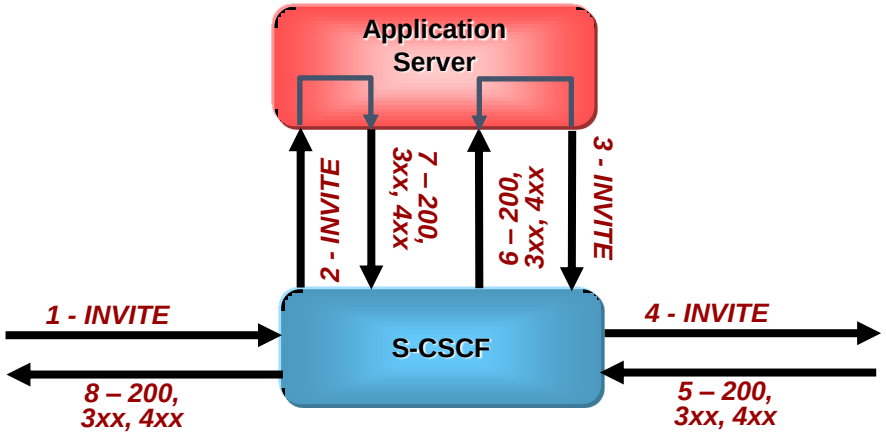
Model 1: Application Server acting as terminating UA



Model 2: Application Server acting as originating UA



Model 3: Application Server acting as a SIP proxy



Model 4: Application Server performing third party call control (B2BUA)

Model 5: A SIP leg is passed through the S-CSCF without Application Server involvement

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- IMS interworking with other networks
- Accouting in IMS

IMS User Identities: IMPU

- IMS User public identity
  - Every IMS user shall have one or more Public User Identities. The Public User Identity/identities are used by any user for requesting communications to other users. For example, this might be included on a business card.
  - The Public User Identity/identities shall take the form of a SIP URI or the “tel:”-URI format.(user name@domain)
  - Both telecom numbering and Internet naming schemes can be used to address users depending on the Public User identities that the users have.
  - An ISIM application shall securely store at least one Public User Identity
  - It shall be possible to register globally (i.e. through one single UE request) a user that has more than one public identity via a mechanism within the IMS(e.g. by using an Implicit Registration Set). This shall not preclude the user from registering individually some of his/her public identities if needed.
  - Public User Identities may be used to identify the user's information within the HSS (for example during mobile terminated session set-up).

IMS User Identities: IMPI

- IMS User pravite identity:Every IMS user shall have one or more Private User Identities. The private identity is assigned by the home network operator, and used, for example, for Registration, Authorisation, Administration, and Accounting purposes. This identity shall take the form of a Network Access Identifier (NAI). It is possible for a representation of the IMSI to be contained within the NAI for the private identity.
  - The Private User Identity is not used for routing of SIP messages.
  - The Private User Identity shall be contained in all Registration requests, (including Re-registration and De-registration requests) passed from the UE to the home network.
  - An ISIM application shall securely store one Private User Identity. It shall not be possible for the UE to modify the Private User Identity information stored on the ISIM application.
  - The Private User Identity is a unique global identity defined by the Home Network Operator, which may be used within the home network to identify the user's subscription (e.g. IM service capability) from a network perspective. The Private User Identity identifies the subscription, not the user.
  - The Private User Identity shall be permanently allocated to a user's subscription (it is not a dynamic identity), and is valid for the duration of the user's subscription with the home network.
  - The Private User Identity is used to identify the user's information stored within the HSS.
  - The Private User Identity may be present in charging records based on operator policies.
  - The Private User Identity is authenticated only during registration of the user, (including re-registration and de-registration).
  - The HSS needs to store the Private User Identity.

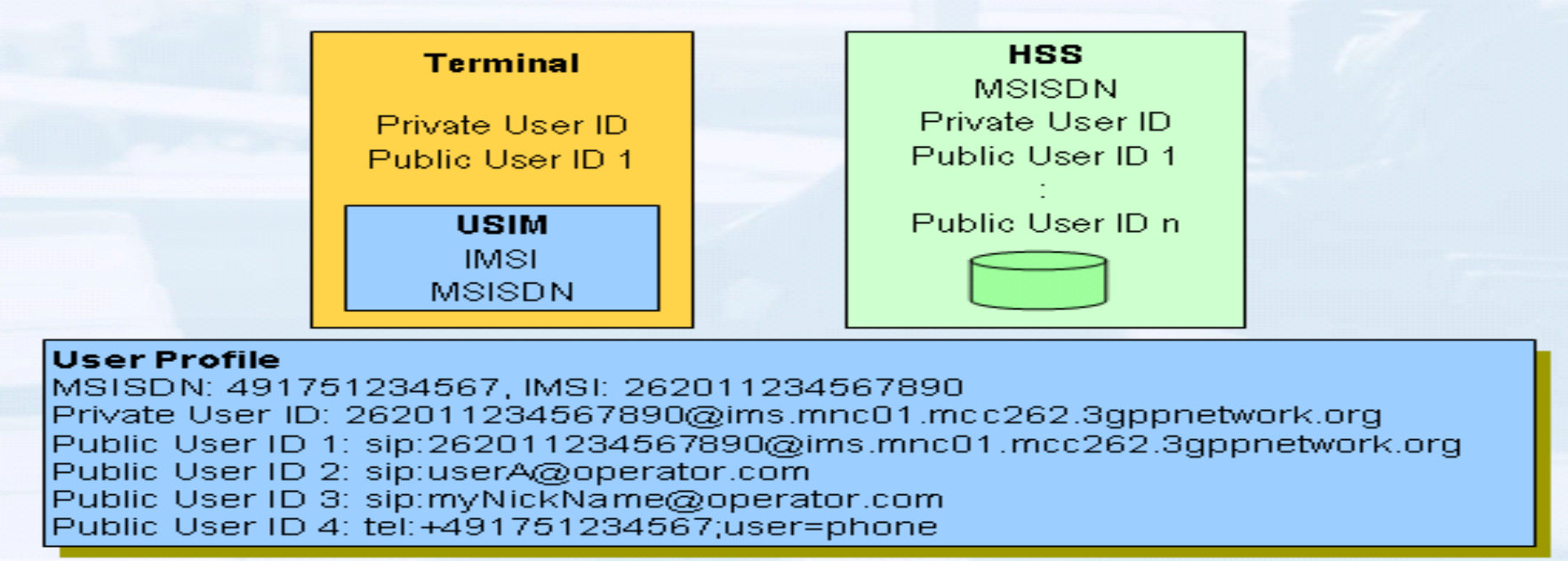
The network element Identities

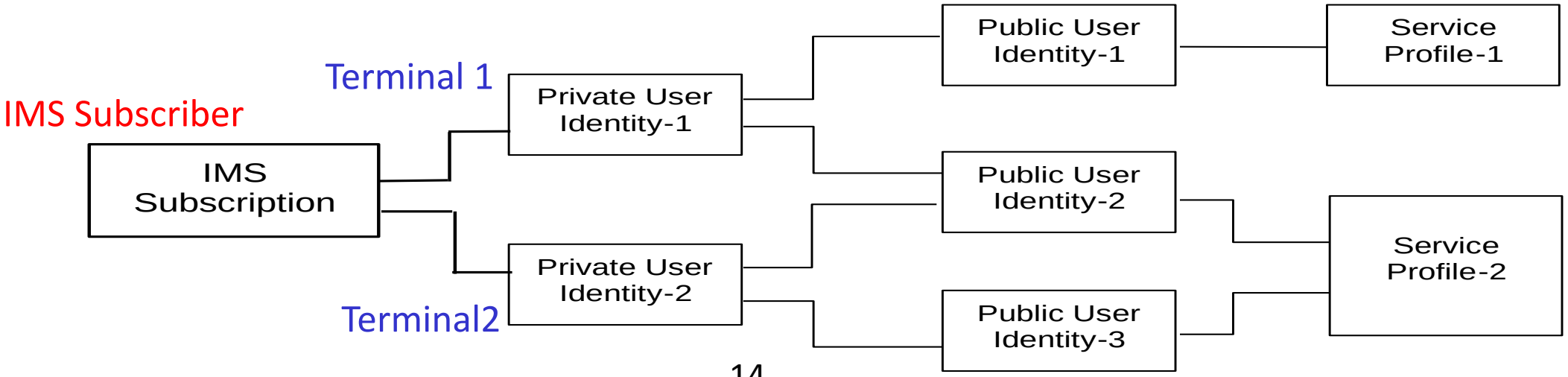
- The CSCF, BGCF and MGCF nodes shall be identifiable using a valid SIP URI (Host Domain Name or Network Address) on those interfaces supporting the SIP protocol, (e.g. Gm, Mw, Mm, and Mg).
- These SIP URIs would be used when identifying these nodes in header fields of SIP messages. However this does not require that these URIs will be globally published in DNS.

Domain concept

- The usage of domain in IMS
  - used in the IMPI/IMPU of IMS users
    - Use SIP URI for the IMPI/IMPU of IMS users
    - example：+861058552000@ctcims.cn、+8613301160000@bj.ctcims.cn 、 bob@ctcims.cn、mike@ctbri.com.cn（enterprise domain name）
  - Routing
    - IMS Routing according to the domain of IMS like internet service, and no longer use E.164 number
    - If you used the E.164 number, it should be translate to the domain style, and then the call could be continued
  - Locating the home network of users
    - According to the domain name, the network could find the home network of users, such as registered to the home HSS and finding the called I-CSCF when called.

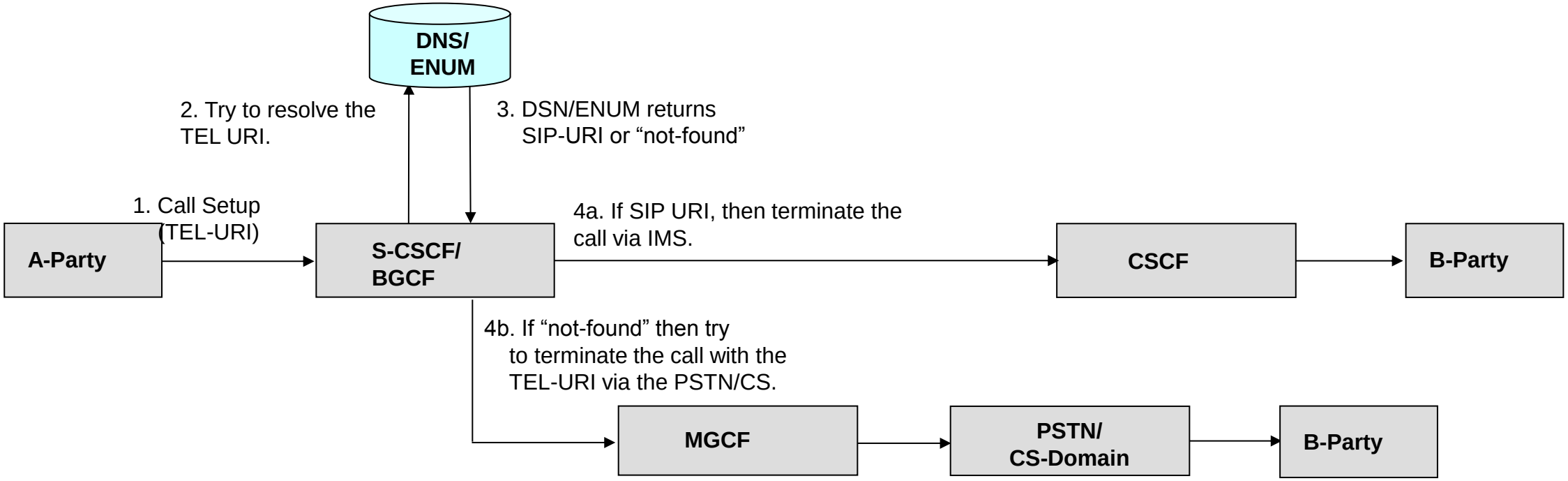
The relationship between IMPI & IMPU





DNS/ENUM: E.164 to SIP-URI resolution

- The S-CSCF shall support the ability to translate the E.164 address contained in a Request-URI in the non-SIP URI Tel: URI format to a SIP routable SIP URI using an ENUM DNS translation mechanism with the format.
- If this translation fails, then the session may be routed to the PSTN or appropriate notification shall be sent to the mobile, depending on network operator configuration.



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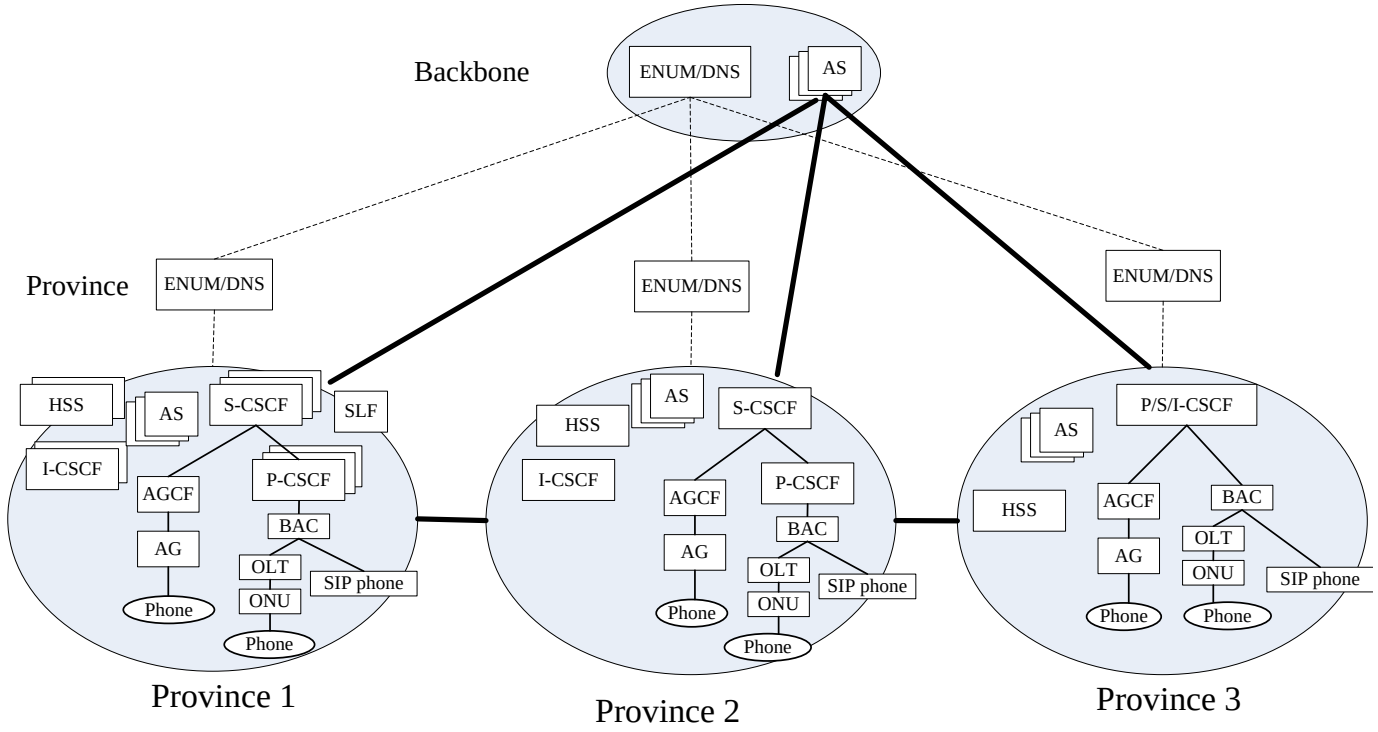
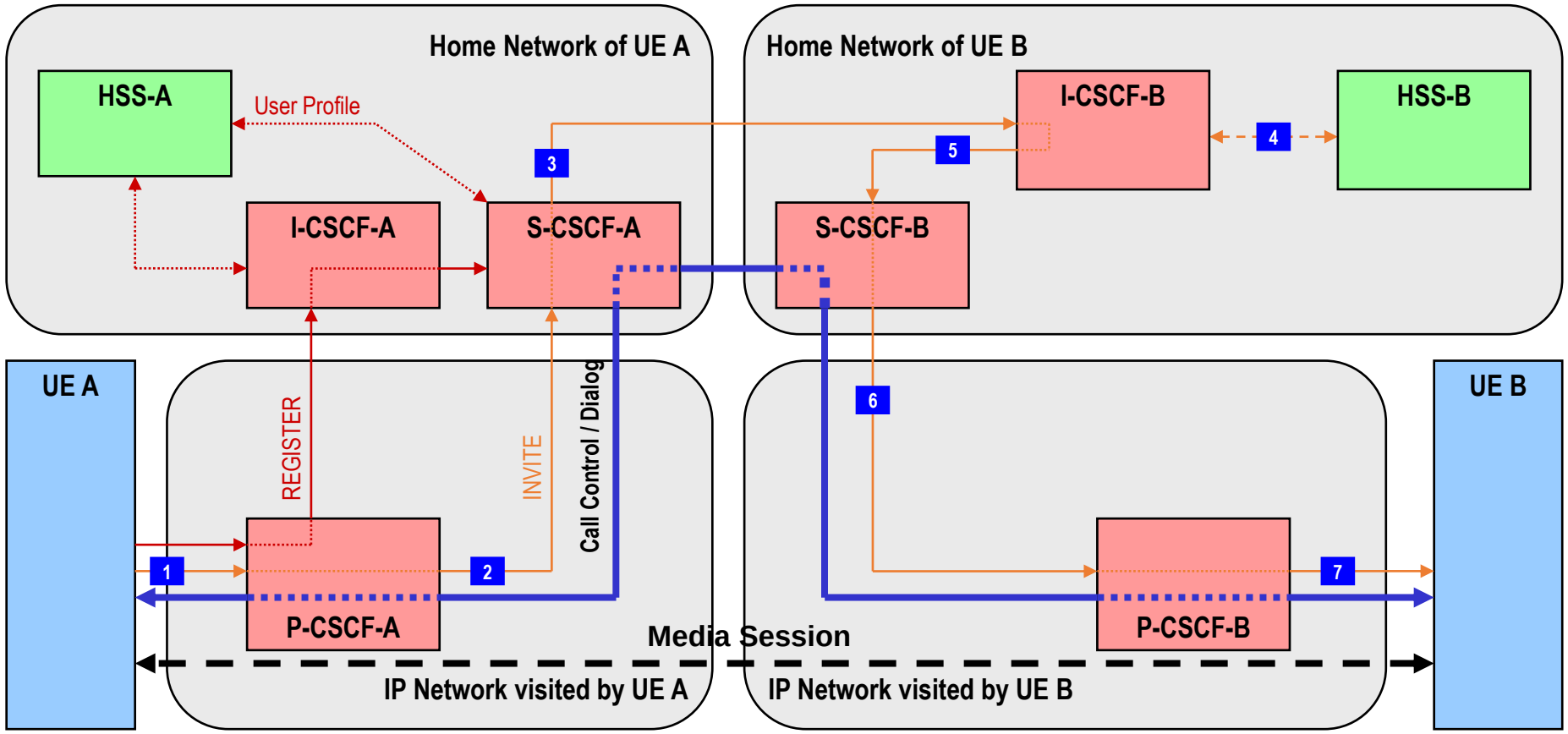
The architecture design of IMS network

- ENUM/DNS Server have two level, one is the root ENUM/DNS, the second level is the province ENUM/DNS .
- The AS have two levels, the AS in province only provides service for this province, the globe AS provides service for all the domain.
- Other network elements(e.g. CSCF,HSS,AGCF,MGCG ect.) reside in the province.



IMS Routing



- Signaling routing：UE A -> P-CSCF-A -> S-CSCF-A ->I-CSCF-B ->S-CSCF-B ->P-CSCF-B->UE B
- Media session：UE A-> IP Network-A->IP Network- B->UE B

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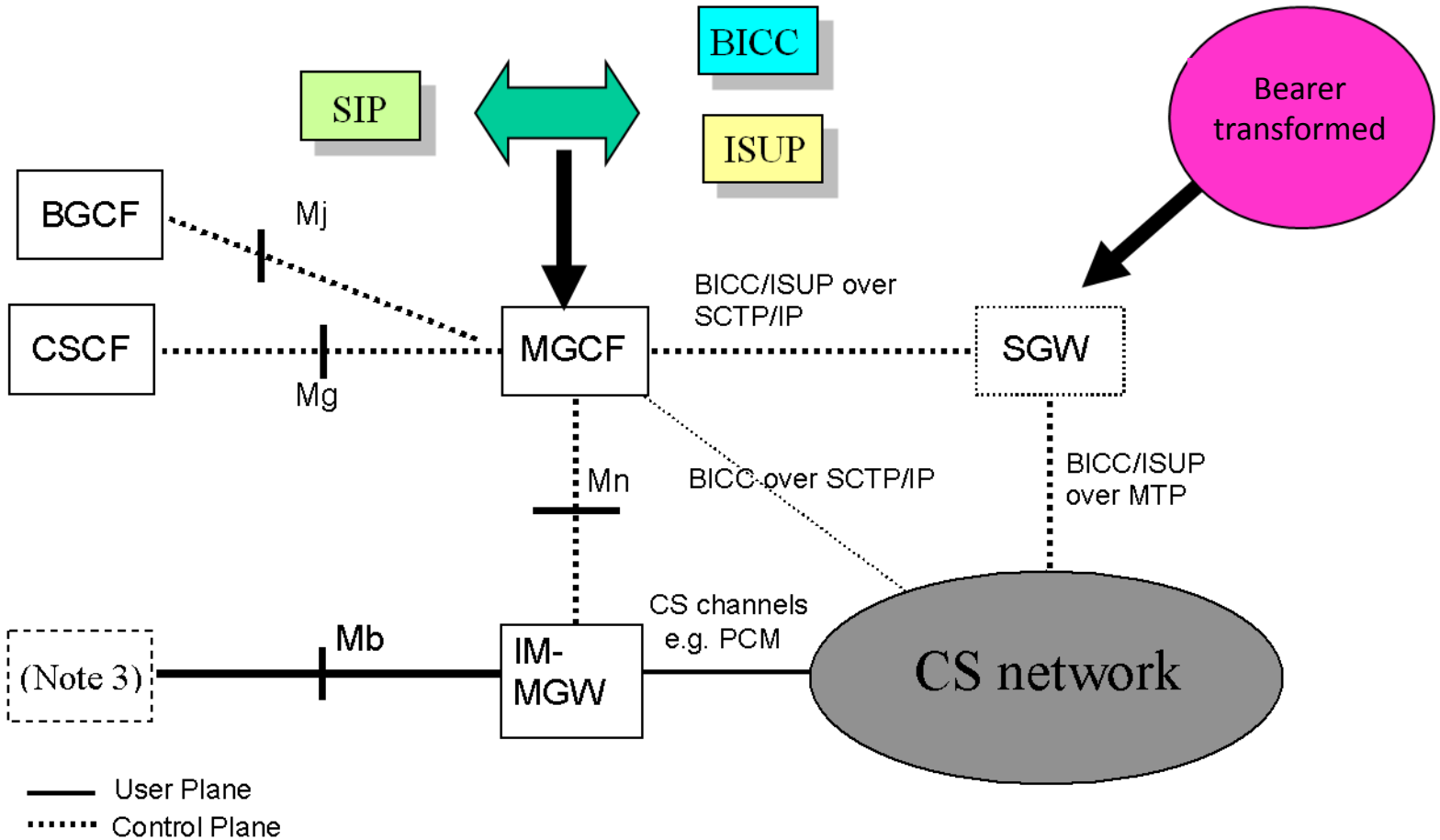
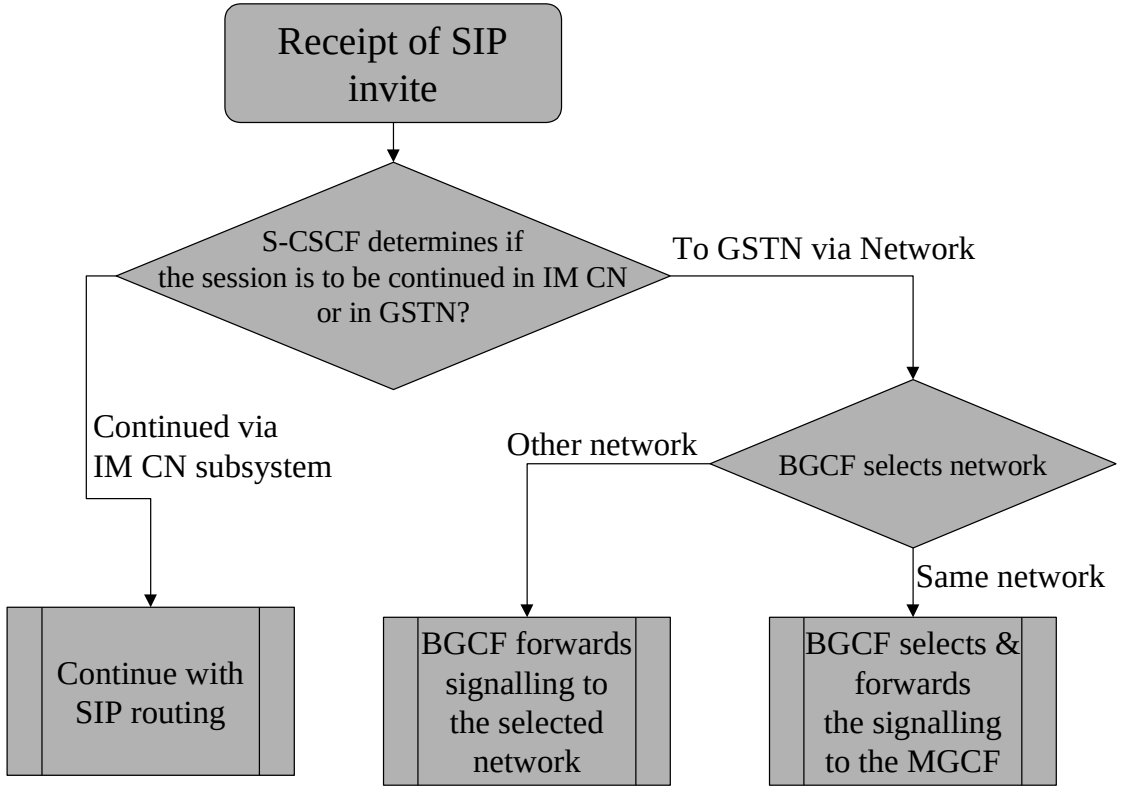
IMS interworking architecture with CS



IMS interworking procedure with CS

- The S-CSCF, possibly in conjunction with an Application Server, shall determine that the session should be forwarded to the PSTN. The S-CSCF will forward the Invite information flow to the BGCF in the same network.
- The BGCF selects the network in which the interworking should occur, and the selection of the interworking network is based on local policy.
- If the BGCF determines that the interworking should occur in the same network, then the BGCF selects the MGCF which will perform the interworking, otherwise the BGCF forward the invite information flow to the BGCF in the selected network.
- The MGCF will perform the interworking to the PSTN and control the MG for the media conversions.



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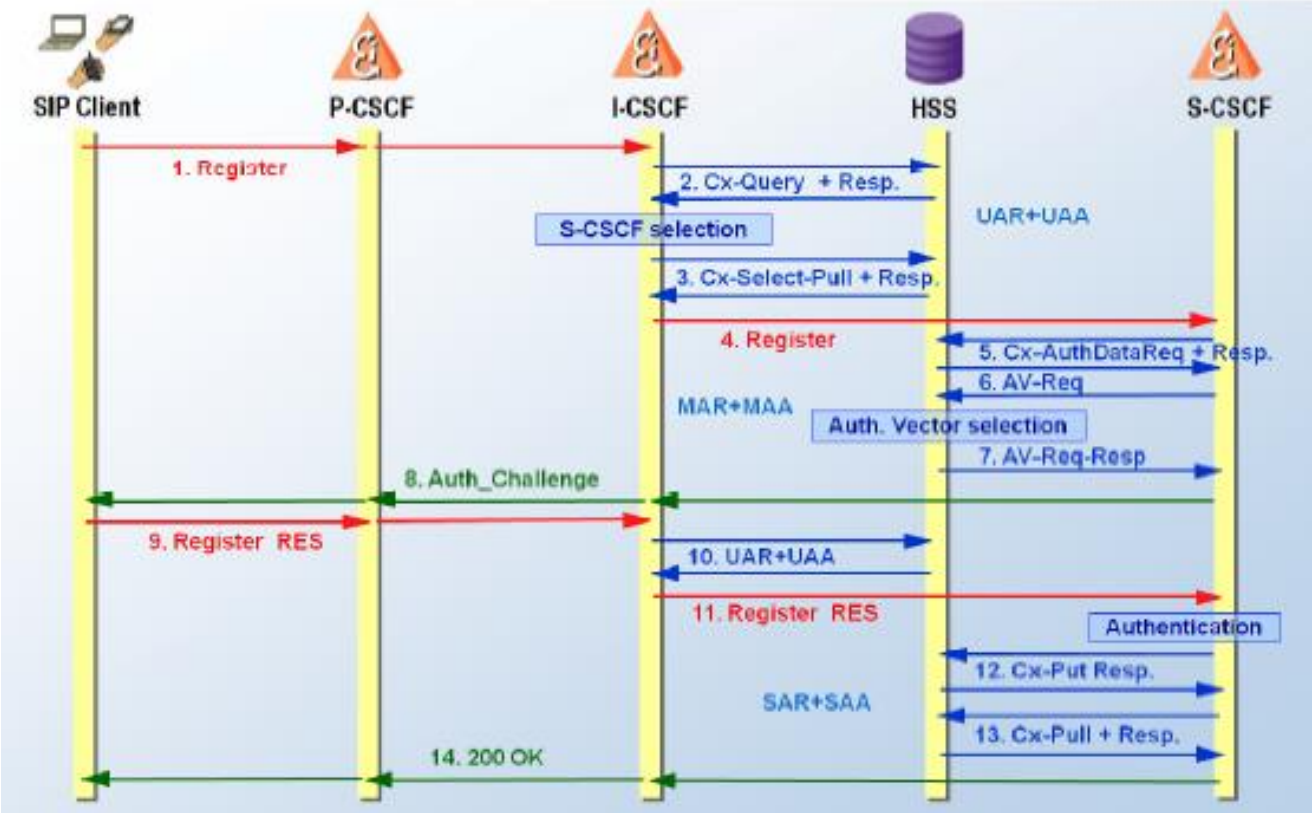
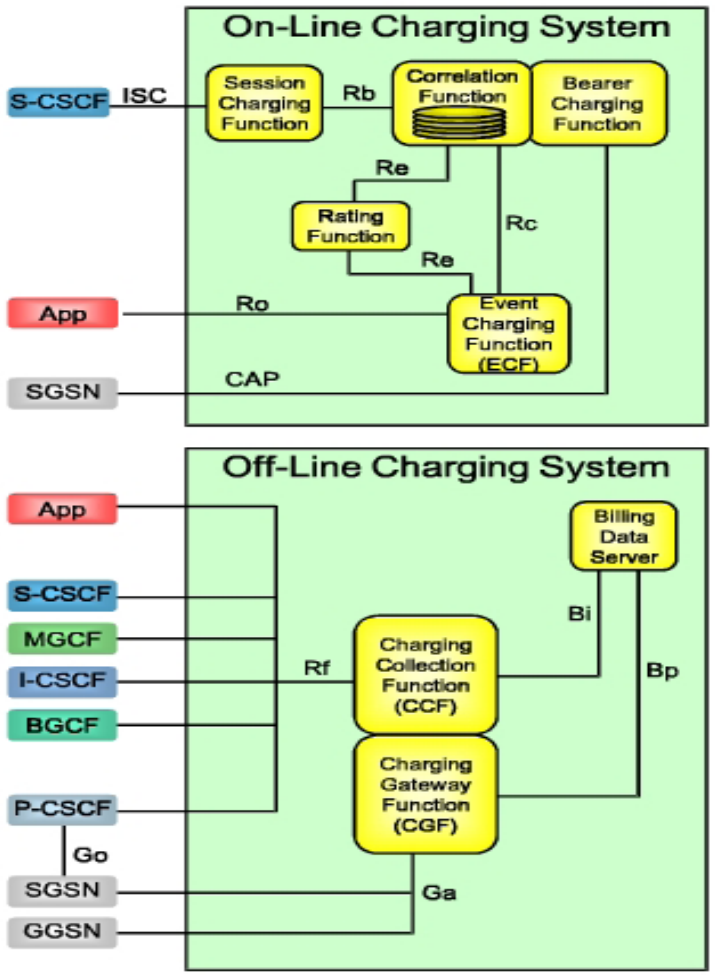
Registration and Authentication

- IMS AKA, Http Digest， and CAVE AKA could be used in the registration flow for the user authentication.
  - IMS AKA authentication use ISIM card
  - Http Digest authentication will need the user name and password
  - CAVE AKA used for CDMA terminal, and the HSS should be connected with HLR in 2G network.



Charging Entities in IMS



Off-line Charging (Rf Interface)

- Does not affect in real-time the service rendered
- Used by P/I/S-CSCF, BGCF, MGCF & AS

On-line Charging (Ro Interface)

- Charging can affect, in real-time, the service rendered
- Direct interaction from session/service control
- Used by S-CSCF, & AS

Diameter protocol used for Rf and Ro

Charging Collection Function (CCF)

- Collects session charging information from IMS nodes to construct and format CDRs.
- Provides intermediate data storage buffering
- Provides mechanism to transfer charging information to the operator's billing system

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