IMS Solution for FMC

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- FMC (Fixed & Mobile Convergence) & IMS
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FMC (Fixed & Mobile Convergence) & IMS
Convergence Vision

Convergence: Communication, Broadcasting, Service, Web etc.

- **Service Convergence**: Seamless services for the same user over different access networks and different devices.
- **Network Convergence**: Unified core network, multiple access networks.
- **Device Convergence**: Multi-Band/Multi-Mode/Multi-Media Device.
Requirements for Convergence

**Customer Needs**

- **Service:**
  - Personalization
  - Instant
  - Multimedia

- **Infra:**
  - Mobile Device
  - Always Best Connect
  - High speed data

**Network Requirements**

- **Network Capabilities:**
  - Unified Core Network
  - Single sign on/Single Bill
  - Secure, QoS
  - Service Continuity
  - Customer awareness

- **Access Capabilities:**
  - High speed mobility
  - All-IP
  - Broadband
  - Always On

**Converged Service**

- **Service Continuity**
  - One-phone, WiFi, WiMAX/Cellular, UMA

- **Multimedia Communication**
  - PTT, Video Conferencing, VoIP/video
  - Telephony, SMS/MMS, Sharing (Image, Video)

- **Telephony + Broadcasting**
  - IPTV + Telephony / QPS / Mobile TPS

- **Broadband (Wireline, Wireless)**
  - FTTH / WiFi, M-WiMax
FMC Network Architecture

**Application Server**
- Enabler (PS/IM/DMS)
- PTA
- TAS
- VCC
- Other AS

**IMS Core**
- HSS
- SCIM
- CG
- SBC-SP
- IMS-ALG
- CSCF
- AGCF
- MRFC
- MGCF
- IBCF
- SPDF
- PCRF

**Resource and Admission Control Subsystem**
- C-BGF
- IMS-AG
- MRFP
- MGW
- I-BGF

**IP Transport**
- IP Bearer
- TDM Bearer

**Other IP Network**
- PS (Policy Server)
- BRAS
- A-RAS
- GGSN/PDSN/ACR

**Signaling**
- (SIP)
- (Diameter)
- (MEGACO)
- (ISUP)

**Networks**
- Cable
- Broadband (xDSL)
- WiFi
- WCDMA/CDMA/WiBro
- Narrowband
- POTS Phone
- Cable
- WiFi
- Broadband (xDSL)
- WCDMA/CDMA/WiBro
- Narrowband
- POTS Phone

**Signaling (SIP)**
- (Diameter)
- (MEGACO)
- (ISUP)
Features of IMS (1/2)

- **Session Control**
  - Perform session registration and session setup through register, reg’ event package, invite message
  - Control Application Server by using ISC interface at S-CSCF

- **QoS control**
  - Provide QoS along with Services
  - Network based VoIP
  - Rich Multimedia Services is provided, based Packet Switch, under the guarantee of QoS
    - Real-time and non real-time, communication services
    - Between peers, or in a client-server configuration

- **Charging**
  - Provide variable charging mechanism (Online/Offline charging, Flow Based Charging, etc.)
Features of IMS (2/2)

- **Mobility Management**
  - Support Mobility / Nomadicity
    - Service mobility independent of User and Terminal Location

- **Security**
  - Authentication/Authorization for providing services
  - Protection of unauthorized peer-to-peer traffic or rogue RTP

- **Inter-working with other networks (Legacy)**
  - Independent Configuration with variable Access Network
    - CDMA, WCDMA, Wibro, WLAN, etc.
    - Interworking between same operator network and different operator network for providing services
Standardization

- IMS standard has been adopted by mobile communication industry first
- Broadband and Cable industries are in the process of adoption
  - Wireless communication Standard body: 3GPP, 3GPP2
  - Wireline communication Standard body: ETSI / TISPAN / ITU-T
  - Cable Standard body: CableLabs
- Interoperability between IMS and Non-IMS Network: MSF
  - Enlarging Focus Area: FMC, Guaranteed NGN Service & Architecture

3GPP R5 (HSDPA)
IMS basic architecture

3GPP R6 (HSPA)
Service standard

3GPP R7 (HSPA+)
Interworking with other networks

3GPP R8
Fixed-Mobile Convergence

Adoption of IMS standard

- 3GPP (3rd Generation Partnership Project)
- ETSI (European Telecommunications Standards Institute)
- MSF (Multi Service Forum)
- TISPAN (Telecoms & Internet converged Services & Protocols for Advanced Networks)
- HSDPA (High Speed Downlink Packet Access)
Service Continuity
Service Continuity Concept

- Provides seamless service between Heterogeneous Networks
  - Voice Call Continuity
    - Provides handover between CS domain and IMS domain
    - Provides Domain Selection for terminating VCC user
  - Single Radio Voice Call Continuity
    - Provides handover mechanism from LTE (Long Term Evolution) domain to 3GPP/3GPP2 CS domain using Single Radio
  - IMS Centralized Service
    - Provides IMS services to users by utilizing CS bearer independently of access network
  - Multimedia Service Continuity
    - Provides domain transfer/selection of multimedia services
Voice Call Continuity (1/2)

- Provides capabilities to transfer voice calls between the CS domain and the IMS

- Provides VoIP service in WiFi/WiBro at low price

- Increases user convenience by providing telephony service continuity beyond IMS coverage

Multi-mode/One Phone/One Number
# Voice Call Continuity (2/2)

**VCC in the Market and SDOs**

<table>
<thead>
<tr>
<th>Needs</th>
<th>Standardization</th>
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| - Need of IMS based WiMax/WiFi service control | - 3GPP VCC Standardization  
  - Stage 1: TR 23.806, TS22.101, TS22.228  
  - Stage 2: TS23.228, TS23.206  
  - Stage 3: TS24.228, TS24.206 |
| - Need of single Number based CS-IMS call control | |
| - Need of voice call origination/termination control outside of WiMAX/WiFi (IMS) coverage | |

**Capabilities and Benefits**

- Provide voice service outbound of WiMAX/WiFi coverage through mobile communication system
- Seamless voice handover between WiMAX/WiFi - CS Domains
- Reduce CAPEX/OPEX
- Support international roaming with mobile network

- 3GPP2 VCC Standardization  
  - X.P0042-001, “Voice Call continuity between IMS and Circuit Switched Systems – Stage 2”  
  - X.P0042-003-0_v0.2 SMS Interoperability Stage-2 3
- CableLabs (PacketCable)  
  - PacketCable 2.0 Cellular Integration, PKT-cellular-D01

3GPP VC Standardization
- Stage 1: TR 23.806, TS22.101, TS22.228
- Stage 2: TS23.228, TS23.206
- Stage 3: TS24.228, TS24.206

3GPP2 VC Standardization
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CableLabs (PacketCable)
- PacketCable 2.0 Cellular Integration, PKT-cellular-D01
Single Radio VCC

- Provides Voice Call Continuity between IMS over PS and CS when the UE is capable of transmitting/receiving on only one of those access networks at a given time.

- **Scope**
  - SRVCC from E-UTRAN access to 3GPP2 1xCS access
  - SRVCC from E-UTRAN access to 3GPP UTRAN/GERAN CS accesses for voice calls that are anchored in the IMS

- **Standardization(Rel.8, 2008/04/30)**
  - 3GPP System Architecture Evolution Specification - Evolved Packet System (non RAN aspects)
    - Single Radio Voice Call Continuity for 3GPP
    - Voice Call Continuity for CDMA2000 1X
      - 80%, (2007/06/25 ~ 2007/06/13)
    - SAE impacts on IMS (e.g. Local Break Out aspects)
      - 40%, (2007/01/02 ~ 2008/09/15)
MME/E-UTRAN should support tunneling mechanism for sending CS signal message to 3GPP2 CS domain

1xCS IWS (Interworking Solution Function) should be added
- To be a signaling tunneling end point towards the MME for receiving/sending encapsulated 3GPP2 1xCS signaling messages to/from the UE
- To emulate a 1xRTT BSS towards the 1xRTT MSC
Single Radio VCC for 3GPP2 (2/2)

SRVCC Network Diagram from LTE to 3GPP2 CS

1xCS SRVCC UE

E-UTRAN

MME

1xCS IWS

1xRTT MSC

EUTRAN/EPS tunnelling

S102 tunnelling

1xCS signalling messages tunneled across EUTRAN / EPS

1xCS signalling messages tunneled inside S102 protocol

Registration and Authorization if needed

Towards VLR/HLR

CS Call setup procedures

Call terminated at VCC AS

VCC AS STARTS
VCC Domain Transfer PROCEDURES

A1 messages

Originating Side

Target Side
MSC server should be enhanced for SRVCC
   - Interworking LTE signaling message with CS signaling message

MME should support
   - Performing the PS bearer splitting function by separating the voice PS bearer from the non-voice PS bearers
   - Initiating the SRVCC handover procedure for handover of the voice component to the target cell

HSS should send SRVCC VDN and MSISDN to MME during E-UTRAN attach procedure
Single Radio VCC for 3GPP (2/2)

SRVCC network diagram from LTE to 3GPP2 CS
IMS Centralized Service (1/4)

- Provides communication services such that all services, and service control, are based on IMS mechanisms and enablers. It enables IMS services when using CS access for the media bearer.

Consideration

- SCC AS should be added
  - Interworking and control Service Control Signaling path with CS bearer signaling
  - Provide Domain Selection, with ICS UE (when needed)
  - Support USSD transport
- MSC server should support SIP interface with CSCF and control not only CS-MGW, but also IMS-MGW.
Service Control Signaling Path established via IP-CAN

- CS Bearer Control Signaling Path established via CS network
- SCC AS correlates Service Control Signaling and CS Bearer Control Signaling and presents session to IMS
- Bidirectional Speech Media established via CS and IMS network
IMS Centralized Service (3/4)

- Service Control Signaling Path established via CS network

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IMS Centralized Service (4/4)

**Service consistency**

- **Core Network**
  - ICS enhanced CS MSC
  - Legacy (or ICS enhanced) CS MSC

- **Access Network**
  - Legacy UE
  - ICS UE
  - SAE

- **IMS Centralized Services Provided to User**
  - CS Voice
  - CS Voice
  - CS Voice
  - CS Voice
  - VoIP
  - VoIP
  - QoS VoIP
  - QoS VoIP

- **Data Services**
  - Partial MMTEL SS
  - Full MMTEL SS
  - Hi Speed Data
  - Hi Speed Data
  - Hi Speed Data
  - Hi Speed Data

- **IP Services**
  - Rich IP Services
  - Rich IP Services
  - Rich IP Services
  - Real Time Services (Gaming)

**Common Device Client provides Consistent User View**
**Service Capabilities Grow with Access Capabilities**
Multimedia Service Continuity (1/4)

- Supports the continuity of multimedia services refers to the capability of continuing ongoing communication sessions with multiple media across different access networks or across different UEs.

**MMSC AS**
- Extend existing functional capabilities from the VCC Application
- Anchor all multimedia sessions
- Enable network initiated multimedia session transfer by updating and providing session transfer policies stored in the UE
- Provide multimedia session splitting/merging functionalities
Multimedia Service Continuity (2/4)

- PS – PS Session Continuity

- PS-PS session continuity in conjunction with PS-CS continuity

※ To support Service Continuity between CS and PS of bidirectional speech media in IMS sessions, ICS AS shall be used for the CS leg
Multimedia Service Continuity (3/4)

- Mobility of media components of a session between different terminals under the control of the same user
  - Transfer media components to different UEs
  - Retrieve media components from different UEs
  - Add new media components to different UEs
  - Remove media components from different UEs
Mobility of media components of a session between different terminals under the control of the same user using keep control mode and release control mode

- Transfer media components to different UEs with the selection of “keep control” mode
- Transfer media components to different UEs with the selection of “release control” mode
IMS QoS
IMS based QoS (1/2)

Why IMS based QoS?
- Pakcet network can not guarantee proper Service QoS per each services.
- Each service/subscriber has different requirements of bandwidth, delay, etc
- Some mechanism are required that identify the QoS requirement of service and enforce the QoS requirement.

Goal
- Support service/service data flow level QoS differentiation
- Guarantee a minimum QoS for a session
- Prevent network resource from exclusively possessed by few sessions
- Increase the resource utilization

Principles
- End-to-end Service QoS negotiation
  - E2E Service QoS requirements are negotiated via SIP/SDP Signaling
- Service Based Policy
  - Policy Server makes a QoS decision based on negotiated service QoS requirements, operator’s policy rules and subscription profile
IMS based QoS (2/2)

- Policy based QoS control
  - Policy server indicates to the PCEF how to control the IP-CAN bearer

- QoS differentiation
  - Subscriber
  - Service (e.g. multimedia chatting)
  - Service data flow (e.g. text chatting window, video or audio of multimedia chatting)

- Guarantee a minimum QoS for a session
  - Depend on a dynamic policy decision and resource status of IP edge
  - Policy decision is made based on session description parameters at the service time

- Prevent network resource from exclusively possessed by few sessions

- Increase the resource utilization
3GPP PCC Architecture (Rel. 7)

- **Policy and Charging Control**
  - Complete harmonization and merger of the policy control and flow based charging architecture and procedures
    - Flow Based Charging, including charging control and online credit control
    - Policy Control (e.g. gating control, QoS control, etc)
    - PCC (FBC as basis)
  - Support Subscriber / service / service data flow based QoS and charging differentiation
  - Support for end-user subscription differentiation
  - Support general policy control aspects to the policy/charging control

- **Main Feature**
  - Policy Control (QoS, Gating)
  - Charging Control
  - Event trigger
  - Subscription profile Repository
3GPP PCC Architecture (Rel.7)

AF : Application Function (e.g. P-CSCF of IMS)
SPR : Subscriber Profile Repository
PCC : Policy and Charging Control
PCRF : Policy & Charging Rules Function
PCEF : Policy & Charging Enforcement Function
OFCS : Offline Charging System
OCS : Online Charging System
3GPP EPC QoS Architecture (Rel. 8)

3GPP TR 29.804 3GPP System Architecture Evolution
- Architecture (non-roaming, roaming)
- PCC roaming architecture for home-routed traffic
- PCC roaming architecture for LBO with AF in the H-PLMN
- PCC roaming architecture with AF in the V-PLMN
- Definitions of Functional Entities
- Diameter Routing Agent: select PCRF
- EPC-specific QoS AVPs, etc.

3GPP TS 23.401
- CN Architecture for 3GPP
- Rx+, S9, S7 interface

3GPP TS 23.402
- CN Architecture for non-3GPP
- Rx+, S9, S7, S7a/b/c interface

*EPC: Evolved Packet Core
*LBO: Local Breakout
WiMAX PCC Architecture (NWG Rel.1.5)

- **Non-roaming scenario**

- **Phase 1 (Feb. 2008)** – under V&V stage
  - Architecture (non-roaming, roaming), Definitions of Functional Entities, Stage 2 call flows, WiMAX QoS AVPs, etc.

- **Phase 2 (June. 2008) - plan**
  - Bearer binding, Stage 3 call flows, offline/online charging details, C-PCEF details, etc.

- **Re-Used**
  - PCRF, SPR
  - Rx, Gx interface

- **New**
  - PDF
  - PCC-R3-P/OC/OFC interface

*PCC: Policy and Charging Control*
PacketCable 2.0 QoS Architecture

- Define Architecture and Functional Entities, etc.
- PAM
  - Determine the QoS resources needed for a session using SDP
  - Manage the QoS resources allocated for a session
- pkt-qos-1 interface
  - XML / SOAP

3GPP Harmonization

- PCRF
  - Merging the AM (Application Manager) and PS (Policy Server)
- pkt-qos-1 interface
  - Rx (Diameter)
IMS Charging
IMS Charging

Why IMS based Charging?

- User requests guaranteed QoS as enough as he pay.
- Operator wants to charge a fee as enough as user’s usage.
- Different services require different charging rules.
- User/Operator wants to get one bill for telecommunication service that includes transport, core and service level fees.

IMS based Charging

- IMS supports both online and offline charging.
- IMS NEs (e.g. CSCF, MGCF, AS, MRF, IP edge) generate the charging event information.
- CDF (Charging Data Function) and OCS (Online Charging Server) generate the CDRs (Charging Data Records) for offline and online charging.
- CDF/OCS or Billing Domain correlate the CDRs received from multiple IMS NEs based on icid (IMS Charging ID).
IMS Charging Architecture (Offline)

- IMS Charging Correlation
  - Based on unique ICID (IMS Charging Identifier), Charging correlation will be performed for session, bearer and service/event charging

![Diagram of IMS Charging Architecture](image)
IMS Charging Architecture (Online)

- **IMS Charging Correlation**
  - Based on unique ICID (IMS Charging Identifier), Charging correlation will be performed for session, bearer and service/event charging.

**Billing Domain**
- Correlated CDRs
- IMS based Integrated Online Charging Server (OCS)
- Session Information
- Charging event Information
- IMS-GWF
- PCRF
- P-CSCF
- S-CSCF
- AS
- Service & Event Charging
- Session & Event Charging
- Charging rules (Online)
- Bearer Charging
- IP Edge
- MRF
Benefits of IMS Based Charging

- IMS charging provides not only session based charging but also event based and service based charging.
- IMS charging provides the unified charging data that associate the Service & Event, Session and Bearer level charging information.
- IMS charging provides the easy charging architecture for integrated charging for multi-session and multi-services.
- IMS charging provides the different charging rules per each service on the basis of policy control architecture with the help of PCRF.
- CDR structures will not be changed with introduction of new services.
GRUU (Globally Routable User Agent URIs)
Globally Routable User Agent URIs

- **GRUU (Globally Routable User Agent URIs)**
  - Identify a unique combination of Public User Identity and UE instance
  - Prevent SIP request from forking to another registered UE of the same Public User Identity

- **Necessity of GRUUs**
  - User can get multiple UEs of the same public User IDs
  - It is difficult to identify the proper UE among these UEs during Call Transfer, CS to IMS handover

- **Two Types of GRUUs**
  - **Public GRUUs**
    - pub-gruu="sip:callee@example.com;gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6"
    - reveal the Public User Identity of the user and are very long lived

  - **Temporary GRUUs**
    - temp-gruu="sip:tgruu.7hs==jd7vznzga5w7fajsc7-ajd6fabz0f8g5@example.com:gr"
    - contain a URI that do not reveal the Public User Identity of the user
    - valid until the contact is explicitly de-registered or the current registration expires
IMS Subscription & ID

Public User Identity : Service Profile = 1:1 or N : 1

Implicitly Registered ID Set

Implicitly Registered ID Set 1

Implicitly Registered ID Set 2

Implicitly Registered ID Set 3

Service Profile 1

Service Profile 2

Service Profile 3

Service Profile 4
Relationship of PUIs, GRUUs and UEs
IMS Vision for FMC
IMS Vision for FMC

Anytime, anywhere access
to converged services with any device

Converged Services

Service Continuity
Seamless services for the same user over different access networks and different devices

QoS/Charging/Single Sign On

Unified core network, multiple access networks

Network Convergence

Device Convergence
Multi-Band/Multi-Mode/Multi-Media Device

VCC/SRVCC, ICS, MMSC

Private ID/Public ID, GRUU
Thank you!