New Opportunities in Wireless Network Evolution

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Wireless Network Evolution

- Access
  - High speed
  - Multi-services

- Core network
  - All IP infrastructure
    - IMS core to replace existing mobile service core
  - Large variety of services
    - MMS, Video Chat, Mobile TV, Digital Video Broadcasting (DVB), Voice, Data, Streaming services

- Ultimate goal
  - Single device, anytime, anywhere and anything
Wireless Network Evolution

- An ambitious target
  - Lead and dominate next generation network (NGN)
- Starting from Fix mobile convergence (FMC)
  - Home/personal base station (Femto) – the cut in point
The Reality

- Existing network infrastructure
  - Large investment
  - Lots of reusable functional entities
  - Mature service platforms
- Existing subscribers
  - Long ramp up curve to adopt new services
  - Satisfied with the current services
  - Existing access terminals
- For a certain long period of time
  - Existing and new network infrastructures will co-exist
  - Services provided in existing network infrastructure need to be accessible to new comers
The Needs

- Convergence functions that can bridge the new and existing network infrastructures
- Not a simple adaptor
  - Long term value in new network infrastructure
  - Unique and essential functionalities
Mobile Network Status -- CDMA
Mobile Network Status -- GSM
Common Future: All IP Core
While migrating to AIP core …

- IP Subsystem (IMS) core serves all signaling and service control purposes
  - Call/session signaling
  - Mobility management
  - Registration/Location services
  - AAA services
  - Multi-media service delivery
  - Media path control
  - Interworking
  - Breakout control
  - Service feature control
IMS Core: Key Components
IMS Core: Major Protocols

- SIP Signaling
- H.248 Media Control
- DIAMETER: AAA, Service/Location management
Existing Reusable Network Elements

- Database elements
  - HLR/VLR ➔ HSS
  - EIR
  - Subscriber Profile
  - Network Policy Rules
- MSC
  - Backward compatibility
  - Handin/handout control
- Protocols
  - MAP / ANSI.41
A New Element: Convergence Server

- Bridging IMS core and traditional mobile core
  - Signaling interworking SIP ↔ MAP / ANSI.41
  - Service interworking: call/session, SMS etc.
  - Mobility interworking: IMS and mobile cores
- Mobility management in IMS core
- Location management in IMS core
- Feature service enabling in IMS core
- Access control in IMS core (AAA)
Position of Convergence Server

HLR – Home Location Registry:
- SS7 GSM MAP/D (VLR to HLR)

SMSC – Short Message Service IW/Gateway MSC
- SS7 MAP/Gd interface (SGSN to SMSC)
- SS7 MAP/E interface (MSC to SMSC)

MSS – Media Switching Centers
- SS7 GSM MAP/E (MSC to MSC handover)

PDG – Packet Data Gateway
- Wu – IPSec Tunnel (AP to PDG)
- Wm – RADIUS/Diameter
  AAA (PDG to AAA)
  AAA Server
  Wx Diameter (AAA to HSS)
  Convergence Server
  Sh – Diameter (Conv Svr to HSS)
  ISC – SIP interface (Conv Svr to S-CSCF)

AAA Server

Mobile Core Network (SS7)

MAP-D

MAP-E Gd

G.703 Voice

MAP-E

ISUPv3 M3UA

IMS Core

X-CSCF

MGCF

MGW

IP PS Data Network

IP Packet Core Network

AN

Convergence Server

HSS /Presence

SIP

RTP

Gi / Gn

Mg

Mn

Cx

Wm / RADIUS

Wu’
An Immediate Application: Femto Access control

- Femto cell
  - Home/personal base station
  - Same handset air interface
  - Backhaul wireless traffic via home broadband (cable/DSL)
- Targeted issues
  - Coverage
  - Air link congestion
- Benefit to subscriber
  - Low rate plan
  - Multi-media service to home
  - Single device for everything
Femto Architectural Approaches

- **3GPP2**
  - SIP/IMS base solution
  - Future facing solution

- **3GPP**
  - Existing protocols over IP Sec tunnel
  - Leverage existing investment
  - Will move to IMS core based solution eventually
  - Temporary solution for IMS: Iu/SIP adapter
3GPP2 Identified Convergence Server Element (1xRTT)

Legend:
TAS – Telephony Application Server
SMSC – Short Message Service Center
MFIF – MAP-Femto Interworking Function
PSTN – Public/Private Switched Telephone Network

PDE – Position Determining Entity
MPC – Mobile Positioning Center
PSAP – Public Safety Answering Point
3GPP2 Identified Convergence Server Element (HRPD 1x Packet)
Convergence Server: Major Functions

1xFemto IMS Network

ANSI-41 Network
Convergence Server: Major functions

- Acting as a VLR, performs SIP subscriber registration and location tracking
- Supports IMS-MSC call interworking
- Supports IMS-MSC messaging interworking
- Performs IMS supplementary service control and interworking with mobile core
- Provides SLF function in IMS core
- Anchors IMS calls for handoff support
- Performs IMS – MSC roaming services
- Provides IMS subscriber AAA functions
- Supports OSA, WIN, CAMEL etc. service building logics
Convergence Server: Potential expansions

- Supports full CSCF functions
- Support SS7 signaling gateway functions
- Supporting MEGACO functions and acting as eMSC
Convergence Server: HW Architecture

- No customized hardware needs
- Pure software solutions, works on
  - standard ATCA chassis and general server modules
  - Standard Blade Server system and server modules
Convergence Server: SW Architecture

Debian Linux Operating System

Linux Kernel
- Process Manager
- Memory Mgmt
- Network Interface
- File System

Debian Packages
- FTP
- Telnet
- SSL
- NTP
- HA
- Firewall
- SSH

Platform/Device Specific
- Platform Interface
- Platform Monitors
- Ethernet Drivers
- T1/E1 Drivers

Applications
- RTP
- Diameter
- SIP AS
- ASC
- SCC
- SBC
- SMF
- MSC
- VRE
- CAC
- CA
- Trap Alarm
- Event Log
- CFC
- CLI
- SNMP Master Agent

Management
- Apache Tomcat 5.0.28
- Embedded Web Mgmt. Application
- SOAP 1.1/1.2 via Apache Axis 1.3
- EPIC Adaptation
- CLI
- CLI Session

Chassis Operation System (COS)
- Control Plane
- Service Plane
- Platform Interface
- Platform Monitors
- Ethernet Drivers
- T1/E1 Drivers

Chassis Operation System (COS) System Service

Shelf Manager (SHM)

Web
- SOAP Clients
- SOAP Clients
- CLI Sessions
Convergence Server: SW Architecture

- SNMP
- CLI
- Web Server

SS7
  - VLR/HLR
  - MAP
  - ANSI.41
  - TCAP SCCP
  - MTP1/2/3

SIP AS
  - VLRC
  - SSPC

CAC
  - GCC
  - ASC
  - SMC
  - SSC

CMON
  - DNC
  - CFC

SHM
  - COS
  - ICC
  - EVL
  - TAM
  - CFC

OS Adaptation Layer
  - OS (Linux & Debian Packages)
Convergence Server: Service Plane

- OS Adaptation Layer (OSA)
- Shelf Manager (SHM)
- Chassis Operation System (COS)
- Inter Component Communications (ICC)
- Event Log Service (EVS)
- Trap and Alarm Management (TAM)
- Configuration File Control (CFC)
Convergence Server: Control Plane

Service management
- Messages
- Active Calls
- Active Subscribers

CAC
- WIN/CAMEL Service Control
- Call Admission Control
- Resource Management
- Congestion Control
- Load Balancing Control

CDR
- Rf/Ro Interface
- CDR management

SIP AS
- Registrar
- Call Control
- Message Control
- SIP B2BUA
- GCC
- SMC
- ASC
- SSC

SS7 (MAP/ANSI.41)
- Application
  - VLR
- Protocol
  - MAP
- Protocol
  - ANSI41

Service Delivery
- TCAP
- SCCP

Transportation
- MTP3
- MTP2
- Adax Driver
- M3UA
- SCTP
- IP
Convergence Server: Control Plane

- Signaling Stack Control (SSC)
  - SIP SSC, SS7 SSC
- Access Signaling Control (ASC)
  - ASCi & ASCe
- General Call Control (GCC)
- Call Admission Control (CAC)
- Short Message Control (SMC)
- Visitor Location Registrar Control (VLRC)
- Subscriber Service proxy Control (SSPC)
- Call Detail Record (CDR)
- Domain Name Control (DNC)
- Other Misc. Component (e.g. Service management)
Convergence Server: Management Plane

- MIB/SNMP
- CLI
- SOAP
- Web
- Generic Management Framework (GMF)
Backup Slides
Mobile Network Status -- CDMA
IMS Core
Convergence Server: Call Control

WIN/CAMEL
Supplementary Service
Call admission

CAC

GCC

ASCi

SSCi

Network 1 (e.g. Femto Cell / Gateway)

ASCe

SSCe

Network 2 (e.g. xCSCF/MGCF)
Convergence Server: COS
Convergence Server: ICC
Convergence Server: Inter Component Interfaces
Convergence Server: Call Setup

1. NET_SETUP(SIP:INVITE)
4. CONN_IND
5. REG_CMD
7. REG_RPY
6. External Call
Control
Query & Reply

13. NET_SETUP (SIP:INVITE)
4a. NET_PROC(SIP:100)
13a. NET_PROC(SIP:100)
14. NET_ALERT(SIP:180)
18. NET_CONN(SIP:200)
19a. NET_CONN_ACK(SIP:ACK)
28. NET_INFO
(SIP:INFO/MESSAGE)

1. NET_SETUP(SIP:INVITE)
4a. NET_PROC(SIP:100)
17. NET_ALERT(SIP:180)
21. NET_CONN(SIP:200)
22. NET_CONN_ACK
24. NET_INFO
(SIP:INFO/MESSAGE)

Resource pool

External Call
Control
Intelligence

CAC

GCC

ASCI

ASCE

Network 1

Network 2
Convergence Server: Registration

Registration procedure

Deregistration

SIP:REGISTER

SIP:200OK

SIP:MESSAGE

REGNOT

SIP:MESSAGE

Registration request

Registration response

AUTHREQ

authreq

REGNOT

regnot

SIP:REGISTER

SIP:200OK

SIP:MESSAGE

P/I/S-CSCF

MS / FEMTO

HLR / AC
Convergence Server: Call Originating

Successful SIP Registration
Convergence Server: Call Terminating
Convergence Server: SMS Originating

Successful SIP Registration

- SIPMESSAGE (CM_SERVICE_REQ)
- SIPMESSAGE (CM_SERVICE_RSP)
- SIPMESSAGE (SMD.REQ)
- SIPMESSAGE (SMD.RESP)
- SIPMESSAGE (SMD.ACKNAK)
- SIPMESSAGE (SMD.RESP)
Convergence Server: SMS Terminating