GPRS/UMTS

IAB Workshop
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Outline

• Introduction to 3GPP

• GPRS/UMTS Architecture
  • GPRS/UMTS Introduction
  • GPRS Architecture
  • UMTS Packet Architecture
  • GPRS/UMTS Protocols

• Combined GSM and M-IP mobility handling in UMTS IP CN
  • Introduction
  • Step 1
  • Step 2
  • Step 3

• Overview to UMTS Release 2000 All-IP Option
Introduction to 3GPP (1/5)

- Participation
  - Organizational Partners
    - ARIB
    - CWTS
    - ETSI
    - T1
    - TTA
    - TTC
  - Market Representation Partners
    - Global Mobile Suppliers Association - GSA
    - GSM Association
    - UMTS Forum
    - Universal Wireless Communications Consortium (UWCC)
    - IPv6 Forum
  - Individual Members
    - Companies
  - Observers, Guests
Introduction to 3GPP
(2/5)
Introduction to 3GPP (3/5)

- **TSG CN (Core Network)**
  - WG1 (MM/CC/SM) (Iu)
  - WG2 (MAP/GTP/CAMEL)
  - WG3 (Interworking with external networks)

- **TSG RAN**
  - WG1 (Radio Layer 1)
  - WG2 (Radio Layer 2 and Radio Layer 3 RR)
  - WG3 (Iub, Iur, Iu, UTRAN O&M requirements)
  - WG4 (R. performance, protocol aspects)
  - AHG1 (Ad-hoc group on ITU (internal) co-ordination)

- **TSG SA**
  - WG1 (Services)
  - WG2 (Architecture)
  - WG3 (Security)
  - WG4 (Codec)
  - WG5 (Telecom Management)
Introduction to 3GPP (4/5)

- TSG T
  - WG1 (Mobile Terminal Conformance testing)
  - WG2 (Terminal Services & Capabilities)
  - WG3 (USIM)
Introduction to 3GPP (5/5)

- Technical Work Done in WGs
- Meetings
  - As Necessary
  - Decision through Consensus or Voting
  - Most of the Work Done in Meetings
- Deliverables
  - Technical Reports/Technical Specifications
  - Approval by Consensus or Vote
  - Change Control When Sufficiently Stable
- Inter-WG Coordination
  - In TSGs
  - Information Exchange through Liaison Statements
- Standards
  - Releases
GPRS/UMTS Architecture
GPRS/UMTS Release 99 Architecture

Signalling and Data Transfer Interface

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Signalling Interface
UMTS Architecture / WCDMA

- Serving GPRS Support Node (SGSN)
- Gateway GPRS Support Node (GGSN)
- Inter-PLMN Backbone network
- Border Gateway (BG)
- Intra-PLMN backbone network (IP based)
- GPRS INFRASTRUCTURE
- GPRS INFRASTRUCTURE
- Data network (Internet)
- PSTN
- SMS-GMSC
- Corporate 1 Server
- Corporate 2 Server
- Local area network
- Local area network
- HLR/AuC
- MAP-F
- SS7 Network
- EIR
- Gd
- Gr
- Gi.IP
- Uu
- Iu
- Gp
- Gn
- Gs
- Gn
- Gd
- Gr
- i.IP
- Firewall
- Router
The R99 Architecture
Entities

- The Serving GPRS Support Node (SGSN)
  - Mobility Management
  - Authentication
  - Gathers Charging Information

- Gateway GPRS Support Node (GGSN)
  - Gateway between UMTS Core Network and external networks
  - Address allocation for MS
  - Gathers Charging Information
  - Filtering

- Base Station Subsystem (BSS) / Radio Network Subsystem (RNS)
  - BSS
    - BSC
    - BTS
  - RNS
    - RNC
    - Node-B
PDP Context

- Packet Data Protocol (PDP) Context
  - Session
  - Logical Tunnel between MS and GGSN
  - Anchored GGSN for Session
  - Multiple PDP Contexts
    - Per Mobile
    - Per PDP Address

- PDP Context Activities
  - Activation
  - Modification
  - Deactivation
R99 Interfaces and Protocols
Routing Example

case 1

case 2

case 3
GPRS Network from the Internet

HOST 155.222.33.55

GPRS SUBNETWORK

SUBNETWORK 155.222.33.XXX

"Router"

SUBNETWORK 191.200.44.XXX

Corporate 1

Router

Local area network

HOST 191.200.44.21

Data network (Internet)

Router

Local area network

HOST 131.44.15.3

SUBNETWORK 131.44.15.XXX

Corporate 2
R99 Interfaces and Protocols
GSM User Plane

Application
- IP, etc.
- SNDCP
- LLC
- RLC
- MAC
- GSM RF

MS

BSS

SGSN

GGSN

GTP-U

UDP

IP

L2

L1

GTP-U

UDP

IP

L2

L1

Relay

SNDCP

GTP-U

LLC

UDP

IP

Network Service

Network Service

L1bis

L1

GB

Gn

Gi
R99 Interfaces and Protocols
UMTS User Plane

Application
E.g., IP, PPP, OSP
PDCP
RLC
MAC
L1

Relay
PDCP
RLC
MAC
L1

Relay
PDCP
RLC
MAC
L1

Relay
GTP-U
UDP/IP
AAL5
ATM

Relay
GTP-U
UDP/IP
AAL5
L2
ATM
L1

Relay
GTP-U
UDP/IP
AAL5
L2
ATM
L1

Relay
GTP-U
UDP/IP
E.g., IP, PPP, OSP

3G-SGSN
3G-GGSN

MS
Uu
UTRAN
Iu-PS

3G-SGSN
3G-GGSN

GTP-U
UDP/IP
L2
L1

GTP-U
UDP/IP
E.g., IP, PPP, OSP

GTP-U
UDP/IP
L2
L1

GTP-U
UDP/IP
E.g., IP, PPP, OSP
Mobile IP in UMTS
3GPP TSG- SA WG2 Mobile IP Ad Hoc
Mobile IP in UMTS
A Staged Approach

- Step 1: Offering Mobile IP service
  - UMTS Release 99
- Step 2: Intermediate GPRS-Mobile IP system
- Step 3: Using Mobile IP for Intra System Mobility
Mobile IP in UMTS
Step 1

- UTRAN
- RNS
- Iu
- MAP
- HLR etc.
- SGSN
- GGSN
- HA
- FA
- BG
- R
- Internet

BG: Border Gateway
R: Router
HA: Home Agent
FA: Foreign Agent
Mobile IP in UMTS
Step 1 (Cont.)

• Changes
  • FA functions at GGSN
  • Mobile IP in the mobile if needed

• Does not change
  • GSM MAP, VLR and HLR
  • Network architecture
  • No changes to the MS
Mobile IP in UMTS
Step 2

- BG  Border Gateway
- R    Router
- HA   Home Agent
- FA   Foreign Agent

Diagram showing the Mobile IP in UMTS network with various nodes and connections.
Mobile IP in UMTS
Step 2 (cont.)

• Changes to Step 1
  • GGSN/FA can be changed during a session if more suitable available

• Applicability
  • Maybe in Release 2000
Mobile IP in UMTS
Step 3
Mobile IP in UMTS
Step 3 (the reality)
Mobile IP in UMTS
Step 3 (Cont.)

• Changed from Step 1 & Step 2
  • GTP only on control plane (almost)
  • No SGSN + GGSN -> IGSN
  • Mobile IP based Macro Mobility Management
  • MS has to be changed to support Mobile IP

• Problems
  • Interworking with pre-Step 3 networks
  • Support for non-M-IP mobiles
  • etc.

• Applicability
  • Not defined

More Mobile IP Integration
Release 2000 All-IP Architecture
Release 2000 Architecture

• Includes All-IP Architecture Option

• GPRS as basis
  • Includes GPRS Core Network
  • Home Subscriber Server (HSS) instead of HLR

• New Entities - Voice over IP infrastructure
  • Call State Control Function (CSCF)
  • Media Gateway Control Function (MGCF)
  • Media Gateway Function (MGW)
  • etc.

• New Interfaces

• New Protocols
R00 All-IP Reference Architecture

- Alternative Access Network
- Signalling and Data Transfer Interface
- Signalling Interface
- Applications & Services *)
- Legacy mobile signaling Network
- Multimedia IP Networks
- Applications & Services *)
- PSTN/Legacy/External

*) those elements are duplicated for figure layout purpose only, they belong to the same logical element in the reference model.
All-IP System Level Architecture

CSCF  Call State Control Function
HSS   Home Subscriber Server
MGCF  Media Gateway Control Function
MGW   Media Gateway

MRF   Multimedia Resource Function
RAS   Remote Access Server (DSLAM, head end…)
RSGW  Roaming Signaling Gateway
TSGW  Transport Signaling Gate
R00 All-IP Reference Architecture

Legacy Mobile Signaling Networks

Transport Layer

External IP Networks

PSTN/External CS Networks

WLAN, DSL, Cable, etc.

OSA, VHE, etc.

Service Layer

Application Layer
R00 New Protocols (?)

- Protocol between CSCF and Mobile or IP Phone:
  - H.323 or SIP

- CSCF- MRF: Mr
  - H.248/Megaco

- CSCF- MGW: Mc
  - H.248/Megaco

- CSCF- HSS: Cx
  - IP based Interface

- CSCF- CSCF: Mw
  - Bear Independent Control Protocol (BICC) or SIP?

- CSCF- Legacy Mobile Network: Ms
  - IP based signaling - The same as Mw

- CSCF- Applications/Services:
  - Difference: Camel over IP (Sigtran)

- Real-time IP transport:
  - RTP/UDP/IP
Thank You!

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