Introduction to Inter-standard Roaming

Bill Dahnke
Project Director, International Roaming
Andrew Hunter
Technical Director, International Roaming

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Introduction
CDMA/GSM Inter-standard Roaming

Inter-standard roaming has been available for years...

- Required rental or purchase of GSM handset from CDMA operator
- GSM & CDMA billing is typically integrated
- Call forwarding from CDMA handset to GSM handset is typical
- Many operators offer this service

... But now it can be improved with a dual-mode GSM/CDMA handset

- China Unicom, Verizon, others
Dual-Mode Phone Market Update

China Unicom
  • Full launch: August 2004

Verizon Wireless
  • Soft launch: June 2004
  • Full launch: September 2004

Other Carriers
  • Pelephone: 4Q 2004
  • Many other carriers are interested
MOTOROLA
Verizon: A840
China Unicom: A860

Hardware
- Display
  - 2.2 inch 260K TFT color screen
  - 4096 STN color display on the cover screen
- Camera phone
  - 1.2M pixel with memory stick
- 64 poly
- Voice dial, speaker phone
- Thickness 24.5mm

Function
- Supports “U-max” Unicom service
- BREW
SAMSUNG
Verizon: A790
China Unicom: W109

Hardware
- Display
  - 2.2 inch 260K TFT color screen
  - 260K TFT color display on the cover screen
- CMOS VGA Camera phone 300K
- 64 poly
- Thickness
  - 24.5mm

Function
- Supports Unicom “U-max” service
- BREW
LG
China Unicom: W800

Hardware
- Display
  - 2.0 inch 260K TFT color screen
  - 65K TFT color display on the cover screen
- CCD VGA Camera phone 300K pixel
- 64 poly
- Thickness
  - 22.9mm

Function
- Supports Unicom “U-max” service
- UNIJA
Multimode Handset Evolution

Current handsets have high prices – ~US$500

- Low volume
- High tier
- Mainly for international business travelers

Future cost reduction factors

- Amortization of NRE costs by existing vendors
- Availability of quad-band RF CMOS chipsets
- Migration to smaller die size

Key Requirements

- Demand from operators for a low-cost multimode handset
- Volumes are important – combine orders?
Inter-standard Roaming
Building Blocks
Roaming Solution Building Blocks

J-STD-038-B

Handset/Subscription Transportability
  • Multi-mode multi-band handset
    – Multi-mode ASICs
  • R-UIM Cards

Operational Plane Interconnectivity
  • MAP Interconnectivity
    – Authentication and Authorization
    – Service Transparency

Business Interconnectivity
  • Billing Plane Interactions
  • Roaming agreements
**The Key Standard: J-STD-038-B**

Published standard for bi-directional GSM↔CDMA roaming

Implemented in products today and deployed in carriers’ networks

Based on an Inter-standard Inter-working Function - IIF (aka Mobility Gateway)
- Network entity that performs MAP inter-working
- An SCP/HLR-like network platform
- Multiple vendors currently supply J-STD-038-B IIFs
- IIF only addresses MAP and network domain – not billing

Describes a model with 1 home HLR subscription and 1 IIF linked auxiliary subscription
- Can be single or dual handset model
- One HLR subscription and one auxiliary IIF subscription
  - Single bill
  - Single number
  - Translated services

User experience is governed by the serving network
- GSM-MAP service experience in GSM network
- ANSI-41 service experience in CDMA network
J-STD-038B Roaming

Service core network:
- Standard GSM core network
- Standard IS-41 core network

Convergent network element:
- IIF convergence behind IS-41 switch
- IIF as built today
  - Perform MIN/IMSI mapping
  - Perform visited network authentication
  - Perform MAP, profile & SMS translation

Core Network
- Standard IS41 Core network

Radio infrastructure:
- Standard CDMA2000 1X radio infrastructure

Standard or Convergent handsets
- Standard CDMA handsets
- Convergent MMMB handsets
Business Impacts

Inter-standard roaming:

**ALWAYS** introduces a new network element, e.g., IIF, AuC

**ALWAYS** some changes to front-end administrative procedures
- Subscriber management
- Customer care
- Provisioning system interfaces
- Billing system for account management
- OA&M for Network elements

**ALWAYS** modifies customer care systems
- Provisioning system
- Billing system
- Mediation device
  - communicate with new IIF/AuC
Outbound Roaming: Into a GSM Network
The Multi-Mode, Multi-Band Handset (MMMB Handset)
Issues in a Multiple Technology Environment

System Selection & Preferences
- Technology and System preferences
- Search and reselection criteria
- Manual or Automatic mode

Combined User Interface appearances
- Recent Call Lists
- SMS presentation
- Plus Code Dialing

Provisioning
- Distribution models
- CDMA data for non CDMA operators
- GSM data for non GSM Operators

Network Operational & Billing Plane Deployment
- Subscription models
  - Single Number Dual Subscriptions Linked
- Billing models and corresponding CDR flow
- Service Transparency
  - Supplementary Services, SMS, MMS, Data, Prepaid
Provisioning Scenarios

Single-slot Handset
- Use GSM SIM, CDMA parameters provisioned in NV memory
  - Verizon Wireless method for implementing outbound roaming to Europe
  - Bundle multimode handset w/ a GSM SIM from Vodafone
- Use a dual-provisioned RUIM (USIM)
  - The USIM has twin directory structures – one for GSM and one for CDMA provisioning
  - No provisioning in NV memory
  - China Unicom method for its exiting GSM users, i.e. replace their GSM SIMs w/ a USIM

Dual-slot Handset
- GSM SIM in one slot, CDMA R-UIM in the other slot
  - No provisioning in the memory
  - China Unicom solution to attract GSM users from other carriers, i.e. the GSM users retain their existing SIMs and receive a new CDMA R-UIM from China Unicom
Operational Interconnectivity
Service in a Visited Network

System Access

Registration
- Accessing the service profile to enable service authorization
  - Obtaining and mapping the profile, authorizing access

Authentication
- Exchanging coded verification messages
  - Verifying the authentication messages using right keys

System Use

Origination Services
- Call Origination
- SMS Origination
- Data Service Access

Delivery Services
- Call Termination
- SMS Termination
- Data Call Termination
Mobility Gateway – Interstandard Interworking Function (IIF)

Mobility Gateways – (IIF)
• Dedicated Interworking entity between IS41 & GSM
• Emulates both HLR and VLR and has feature inter-working
• Separate handsets or a single multimode handset using R-UIM cards
• The implementation available and in use today

IMSI/MIN mapping
• What identity does a visiting handset have?
• Where is the mapping performed?

MAP Interconnectivity
• Signaling protocol conversion
• MAP protocol conversion

Network Translation Tables
• MIN to HLR translations
• Global Title Translation
• MSC Translation tables
The IIF

Inter-working Functions

ANSI-41 Network

ANSI-41 VLR

ANSI-41 HLR

ANSI-41 AC

IIF

GSM Network

GSM VLR

GSM HLR

GSM AuC

ANSI-41

VLR

HLR
The IIF Requires Planning….

Requires:
• GSM VLR Number (E.164)
• GSM MSC Number (E.164)
• GSM point code

Address the GSM HLR(s) using:
• HLR’s destination point code
• HLR’s E.164 global title address
• Subscriber’s IMSI as E.212 global title address
• Subscriber’s IMSI converted to E.214 global title address

Requires:
• IS41 MSCID
• IS41 addressable point code

Addresses IS41 MSC using:
• point code in initial message from IS-41 system
Billing
Minimizing Business Impacts
• reduces cost
• speeds deployment

Introducing a new network element, e.g., An AuC

Front-end administrative procedures
• Subscriber management
• Customer care
• Provisioning system interfaces
• Billing system for account management
• OA&M for Network elements

Minimise modification of customer care systems
• Provisioning system – RUIM knowledge and tracking
• Billing system – CIBER or TAP – one end needs to change
• Mediation device – communicate with new AuC
Billing Considerations

Formats
- Exchanging information between Operator Billing Systems
- TAP or CIBER

Exchange Mechanisms
- Clearing House
- Point-to-Point

Procedures
- Roaming Agreements
- Pricing
- Time constraints
  - Risk minimization
- In effect, many aspects addressed in the GSM MoU
  - IREG, TADIG
Clearing & Settlement

CIBERnet Clearing Accounts

GSM Clearing Accounts

Roaming Charges Incurred

Funds Transfer

Roaming Revenue Earned

IS41 Network A Billing

CIBER-in

IS41 Network B Billing

CIBER-in

IS41 Network C Billing

CIBER-in

CIBER-out

Roaming Revenue Earned

CIBER-out

TAP-out

GSM Network 1 Billing

TAP-out

GSM Network 2 Billing

TAP-out

GSM Network 3 Billing

Inter-Technology Clearing

IMSI A

TAP-in

IMSI B

IMSI C

Funds Transfer
Managing Subscribers in the Roaming Environment

Creating Initial Subscriber Data
• Mapping MINs to IMSIs
• “Permanent” subscriber records in GSM AuthC
  – MIN, Akey, ESN
• “Roaming” subscriber records
  – Created as valid roamers enter IS-41 systems
  – Deleted when the roamers leave the IS-41 systems

Ensuring Subscriber Management
• Modifying profiles while roaming
• Withdrawing service access while roaming
Building a Solution
Ways to Implement Inter-Standard Roaming

J-STD-038-B level of service transparency, basic voice services, SMS

Third Party Solutions Providers
• Verisign, Syniverse Uniroam services
• Interworking & Interconnection
  – e.g. Offering both Operational and Billing Plane interworking
• Costs, recurring and non-recurring

Direct Carrier-to-carrier Relationship
• Signaling Interconnect & translation
  – Translation as needed between SS7 variants (ANSI/ITU/China)
  – Own IIF systems – MAP inter-working
• In-house billing – TAP or CIBER conversion/exchange
• Costs – purchase, maintenance, staffing
Technology solutions are available to support roaming
  • Various levels of service transparency
  • Various levels of risk exposure

Recent Developments make it easier
  • RUIM technology
  • RUIM Handsets
  • Multi-mode Multi Band Handsets

IIFs are the best cost/benefit solution right now
  • Platform vendors: Accuris, Ericsson, Logica, Synacom, Covansys, etc…
  • IIF service providers: Syniverse, Verisign, IMC, etc…

Network technology advances are on the horizon
  • Soft-switching, new HLRs
  • Still have some time-to-market issues or don’t deliver a complete solution
  • May not be ready for prime-time commercial deployment
Thank You