International Roaming Access Protocols (IRAP) Framework

An overview for the Broadband Working Group of the Communications Futures Program, MIT

by

Intel Corporation

Dan Dahle

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Agenda

- Roaming Vision
- IP Services
- IRAP
Roaming Vision

Services Access
- Fleet Mgmt
- Commerce
- Voice Services
- CRM
- Video Svcs
- VPN
- Location Info
- E-Mail
- SMS & MMS
- Internet

Network Access
- Public WLAN Hotspots
- Residential WLAN
- Enterprise LAN / WLAN Networks
- Personal Profiles & Preferences
- Context

Device Access
- 2.5G / 3.0G Networks
- Residential WLAN
- Enterprise LAN / WLAN Networks

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Agenda

• Roaming Vision
• IP Services
• IRAP
Enables New Service Opportunities

- Bring Internet growth to wireless services

Universal IP Connectivity
All IP Svcs Require IP Connection

Steps 3, 4, 5, ...

Step 1
Universal IP Connectivity

Step 2
“Enhanced service” authorization & provisioning

NGN svcs: Voice, IMS (3GPP, TISPAN, ITU, etc.)

UMA or SIP voice

3GPP R7

IPSEC, VPN, etc.

Client

Association

Access network

Roaming Agmt

Svc Provider

Services Support Discovery
No IP Connection → No IP Svcs

Step 1
Universal IP Connectivity
Services Support Discovery

Step 2
“Enhanced service” authorization & provisioning

3GPP R7
IPSEC, VPN, etc.
UMA or SIP voice
NGN svcs: Voice, IMS (3GPP, TISPAN, ITU, etc.)

Steps
3, 4, 5, ...

Client
Association
Access network
Roaming Agmt
Svc Provider

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Agenda

- Roaming Vision
- IP Services
- IRAP
Need for standard interfaces

Clients

Access Network

Home operators

Billing/Clearing

1. Network Access
2. Authentication & Authorization
3. Accounting Data

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WLAN Standards and Forums

**Standards**
- **ITU**
- **IEEE:** Wireless, Security, QoS foundation
- **IETF:** common AAA protocols
- **3GPP:** Promoting use of IETF, IEEE standards
- **3GPP2**
- **GSMA:** consistent usage and deployment models
- **Wi-Fi Alliance:** Overall Wi-Fi focus, client – AP interaction
- **IPDR:** settlement format for billing exchange

**Interop**
- **Testing**
Roaming Architecture & Protocols

Access Network (hot spot)

Access Controller

Home Network

RADIUS AAA Server / gateway

EAP Methods (e.g. EAP-SIM, EAP-MSCHAPv2)

PEAP / TTLS

EAP

WPA*

802.1X

PMKv2

802.11

802.16e

802.3 / IP

Provisioning and Authentication over PEAP or TTLS

Mutual Authentication & over-the-air Encryption

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IRAP Roaming Interfaces

• Develop industry-standard Interface Profiles
  1. Wireless Station to Access Network – Roaming user login
  2. Access Network to Home Service Provider authentication system
     – Roaming user authentication
  3. Access Network to billing system
     – Session accounting for One Bill Roaming
  4. Access Network to Home Service Provider operations subsystem
     – services support discovery & customer support services

IRAP = International Roaming Access Protocols
IRAP Supports Service Providers

- Better customer identification and support than anonymous scratch cards
- Better support for roaming customers at independent roaming partner hotspots
- Various billing models supported
  - subscription, one-time, prepaid, time-based, etc.
- One stop spec for all types of deployment
  - harmonized for WISP, 3GPP/GSMA and 3GPP2/CDG
- Lower cost and time for roaming interconnects
- Lower maintenance costs for supporting multiple roaming partners
IRAP Supports Customers

• Safer login
  • over the air encryption
  • connected network verification

• Simpler login
  • Roaming login same as in home network

• Seamless experience
  • enabled with automated login using security
IRAP Program Outline

Done

PWLAN Arch

Interworking Study

IDA / Intel operator testbeds

Architecture Validation

In Process

Detailed Interfaces

IRAP Interfaces

Test program

Test specs, Test ecosystem

Deployment

Summits, Trials, Pilots, Interop

ETS TISPAN work

- Use existing standards
  - Industry feedback: “We have enough WLAN standards. Don’t define more, make the ones we have work.”
- End to end solution
  - Unique aspect is the end to end approach – crosses multiple standards bodies and unifies the otherwise fragmented landscape.
IRAP Status

- Interface specs @ 1.0 (intfc 1-3 stable, 4 @ 60%)
- Test specs @ 1.0 for intfc 1-3
- 17 Jan – ETSI TISPAN#5
- 7 Feb – ETSI hosted IRAP test pilot
- 14 Feb – IRAP at 3GSM in the Intel Connect Café
Summary

• Industry needs global WLAN interoperability specs & testing methodologies

• IRAP program goals:
  • Well-defined architectural blueprint for PWLANs, allows for migration to safer, simpler authentication
  • A standards-based set of interfaces to facilitate global roaming and interoperability
  • A complete validation package

• Enables future seamless IP service models

• Start with 802.1X/WPA today
For more information

• Documentation and Information on Intel roaming programs
  • [http://www.intel.com/technology/roaming](http://www.intel.com/technology/roaming)
  • For more information on Intel R&D [http://www.intel.com/technology](http://www.intel.com/technology)

• Direct link to IRAP documentation and information
  • [http://www.irap.nl](http://www.irap.nl)

• GSMA IR61 (“InterOperator Handbook”)

• Wi-Fi Alliance “WPA Deployment Guide for Public Access”
  • [http://www.wi-fi.org/OpenSection/MediaResources.asp?TID=5](http://www.wi-fi.org/OpenSection/MediaResources.asp?TID=5)
Backup
Achieving "Seamless Roaming"

- Consistent sign-on for different wireless networks
- Mutual authentication using multiple wireless devices
- Multi-credential support within & across roaming alliances
- Security consistent with Enterprise WLAN policies
- Consolidated bill for wireless usage
- Achieving "Seamless Roaming"
Serve Your Customers Anywhere

Internet

Home Service Provider

Network Access Authorization

Operator owned Access Network

Access Network Association

Local Hotspot / Access Network

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The issue at hand

- Fragmentation in the PWLAN ecosystem
  - Rapid deployment of PWLAN hotspots and equipment
  - Variety of deployment strategies could result in fragmented and incompatible implementations
    - Many choices exist within the standards
  - Increases the cost and complexity of supporting global PWLAN roaming between operators

Need to enable safer, simpler, standards-based methods of network access
Universal IP Connectivity Goals

- Define common interoperable interfaces or profiles between network entities
- Reduce fragmentation by early alignment with existing and emerging standards
- Facilitate operator / vendor adoption of the interfaces
- Better security and roaming enables more advanced services
- Scope: AAA interworking for Universal IP Connectivity
Architectural Tenets

• Usability
  • Common login process
  • Simplified client provisioning
  • Seamless roaming experience

• Security
  • Mutual authentication to protect user & network
  • Multiple client credential types, e.g. password, SIM, certificates
  • Secure tunnels for back-end authentication
  • Support VPN for remote enterprise access

• Scalability / Extensibility
  • Accommodate various wireless topologies
  • Ability to share infrastructure safely
  • Support advanced services efficiently
  • Common accounting data
Trust Model for WLAN

- Mobile Client doesn’t trust Foreign WLAN to provide safe service
- Foreign WLAN doesn’t trust Mobile Client to pay its bill

- Mobile Client trusts Home WLAN to provide safe service
- Home WLAN trusts the Mobile Client to pay its bill

- Foreign WLAN and Home WLAN trust each other to pay Mobile Client charges
- Foreign WLAN and Home WLAN trust each other to bill only for legitimate activity

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## Trust Model: Cellular ≠ Wi-Fi

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<th>Trust Model: Cellular ≠ Wi-Fi</th>
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<tbody>
<tr>
<td>You will be prosecuted if you operate an unlicensed transmitter in a cellular band</td>
<td>Anyone can legally deploy a Wi-Fi access point (unlicensed band)</td>
</tr>
<tr>
<td>Erecting and operating a cellular tower costs significant $$$s</td>
<td>You can deploy and operate a Wi-Fi access point for &lt; $100</td>
</tr>
<tr>
<td>Cellular base stations and towers occupy fixed locations</td>
<td>A rouge AP is transportable anywhere</td>
</tr>
<tr>
<td>The cellular operator owns all the equipment, in physically secure sites</td>
<td>Wi-Fi equipment is owned by a mix of carriers, hot spot providers, enterprises, and individuals in sites with varying security levels</td>
</tr>
<tr>
<td>There are only a small number of Cellular operators world-wide</td>
<td>The number of access point operators is legion</td>
</tr>
<tr>
<td>Session keys can only be used within the cellular network itself, where their use can be audited</td>
<td>Session keys can be transported to (rogue) APs that are not auditable</td>
</tr>
<tr>
<td>Except for special cases, the only thing worth stealing in a cellular network is service, and there are easier ways to accomplish this than cryptanalysis</td>
<td>The IPR on computer hard drives is more valuable than the WLAN communication itself</td>
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802.1X Overview

- STA 802.1X blocks port for data traffic
- AP 802.1X blocks port for data traffic
- 802.1X/EAP-Request Identity
- 802.1X/EAP-Response Identity (EAP type specific)
- EAP type specific mutual authentication
- Derive Pairwise Master Key (PMK)
- 802.1X/EAP-SUCCESS
- RADIUS Access Request/Identity
- Derive Pairwise Master Key (PMK)
- RADIUS Accept (with PMK)
- RADIUS
Need for WLAN Security

• Expect enterprise users to drive most of the early revenues for public WLAN usage
  • Improved security solutions will impact deployment decision for 90% of executives**

• User concerns
  • Authentication
    • Can user credentials be stolen?
  • Data privacy
    • Can wireless traffic be decrypted?
    • Can data be intercepted?
  • Network “goodness”
    • Are users connected to valid networks?

** Source: Jupiter Research, executive surveys, 2003

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Public Access and VPNs

- Ability to secure traffic with a VPN connection is "necessary but not sufficient"
  - VPNs do not secure the authentication process
  - Users may not want to connect back to the corporate network
  - Users may still connect to the internet if the VPN server happens to be unreachable
**Interoperable Interfaces**

- **Interface definition**: specification of a set of protocols and associated behavior through which two components of a network system interact.

- Well-designed interfaces foster both interoperation and innovation:
  - Interfaces should be designed with end-to-end system operation in mind.
  - Innovation occurs within components and subsystems.

- **Interface requirements**:
  - Standards-based.
  - Concrete and testable for conformance verification.
  - Coexistence with legacy solutions, provide migration path.
Intel/IDA Program

• Intel and Singapore Infocom Development Authority hosting trials test bed

• Operators include China Mobile, MobileOne, SingTel, StarHub and PCCW

• Validation test bed vendors include CISCO, Dan Net, iPASS, Microsoft, Funk Software, Transat, Gemtek Systems, Huawei Technologies, Radiator and ANTLabs.

Intel Quickens Race To Expand Range Of Wireless World

... the chip maker said five Asian telecommunications companies were joining its collaboration ... China Mobile Ltd. in China; MobileOne Ltd., Singapore Telecommunications Ltd. and StarHub Pte. Ltd. in Singapore; and PCCW Ltd. in Hong Kong.

The Asian Wall Street Journal, 16 September 2003

* Other names and brands may be claimed as the property of others.
Intel Contributions: Roaming Specifications

• Industry standards work
  • IEEE – .11e chair, .11i editor, 802.21 editor, ...
  • IETF – AAA, EAP
  • 3GPP – SA2, SA3, CN4
  • 3GPP2 – WLAN Interworking
  • ETSI – TISPAN

• Industry Forum work
  • GSMA – WLAN Task Group, e-Commerce, ...
  • WiFi Alliance – board member, Ease of Use chair, Public Access editor, etc.
Deployment

• Completed Trials in Singapore

• Industry influence
  • Wi-Fi Alliance, 3GPP, 3GPP2, IETF RADEXT and GEOPriv WGs, GSMA IREG, ETSI TISPAN

• IRAP Supporters

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<th>AntLabs</th>
<th>Boingo Wireless</th>
<th>CETECOM</th>
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<tr>
<td>Cisco</td>
<td>HuaWei</td>
<td>iCELL Network</td>
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<td>Intel</td>
<td>iPass</td>
<td>MACH DanNet</td>
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<td>Microsoft</td>
<td>RoamPoint</td>
<td>SingTel</td>
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<td>SwissCom Ltd</td>
<td>Telia HomeRun</td>
<td>TeliaSonera</td>
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<td>Telus Mobility</td>
<td>The Cloud</td>
<td>T-Systems</td>
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