International Roaming Access Protocols (IRAP) Framework

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

by

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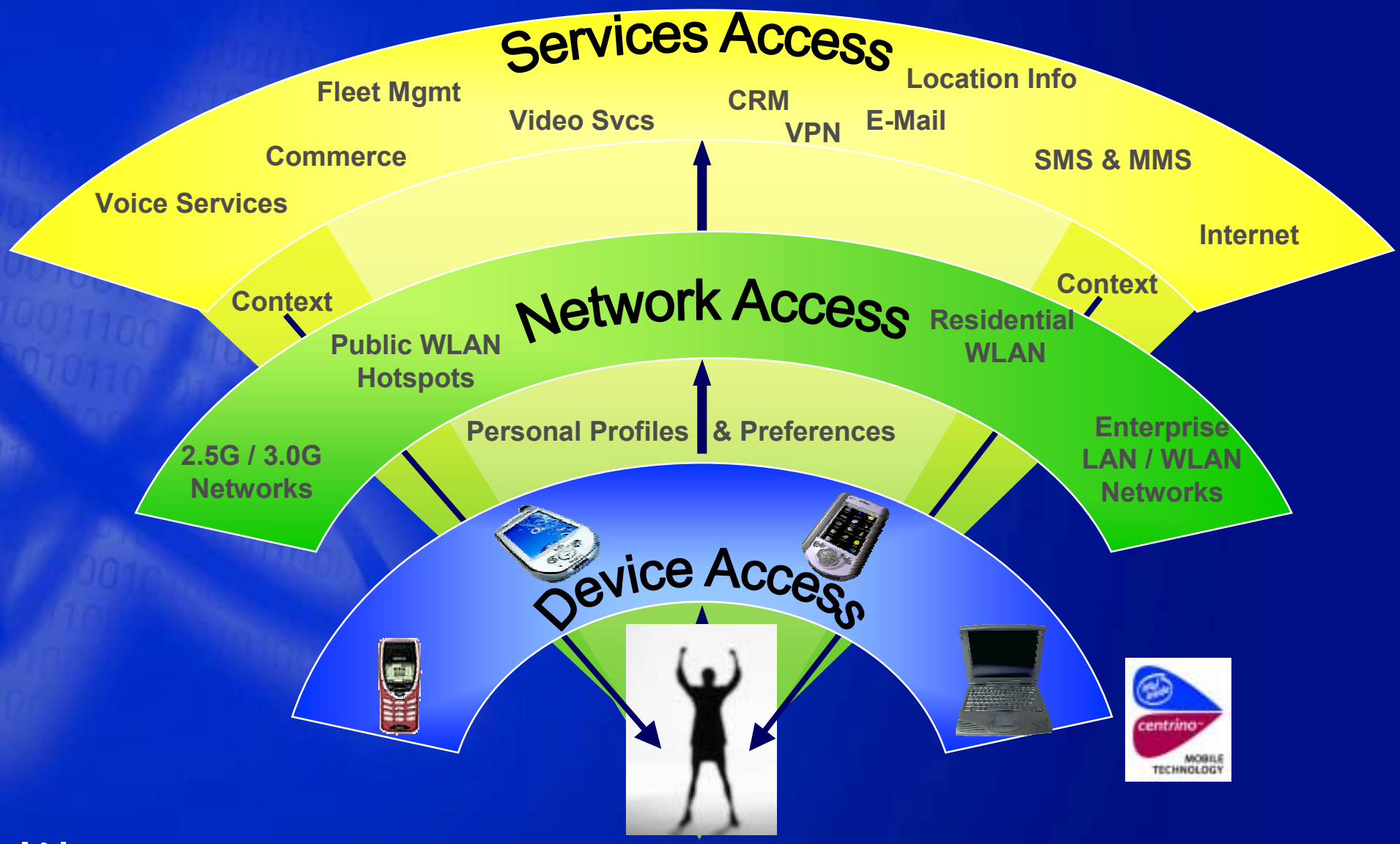
25 January 2005

Agenda

- Roaming Vision
- IP Services
- IRAP

Roaming Vision



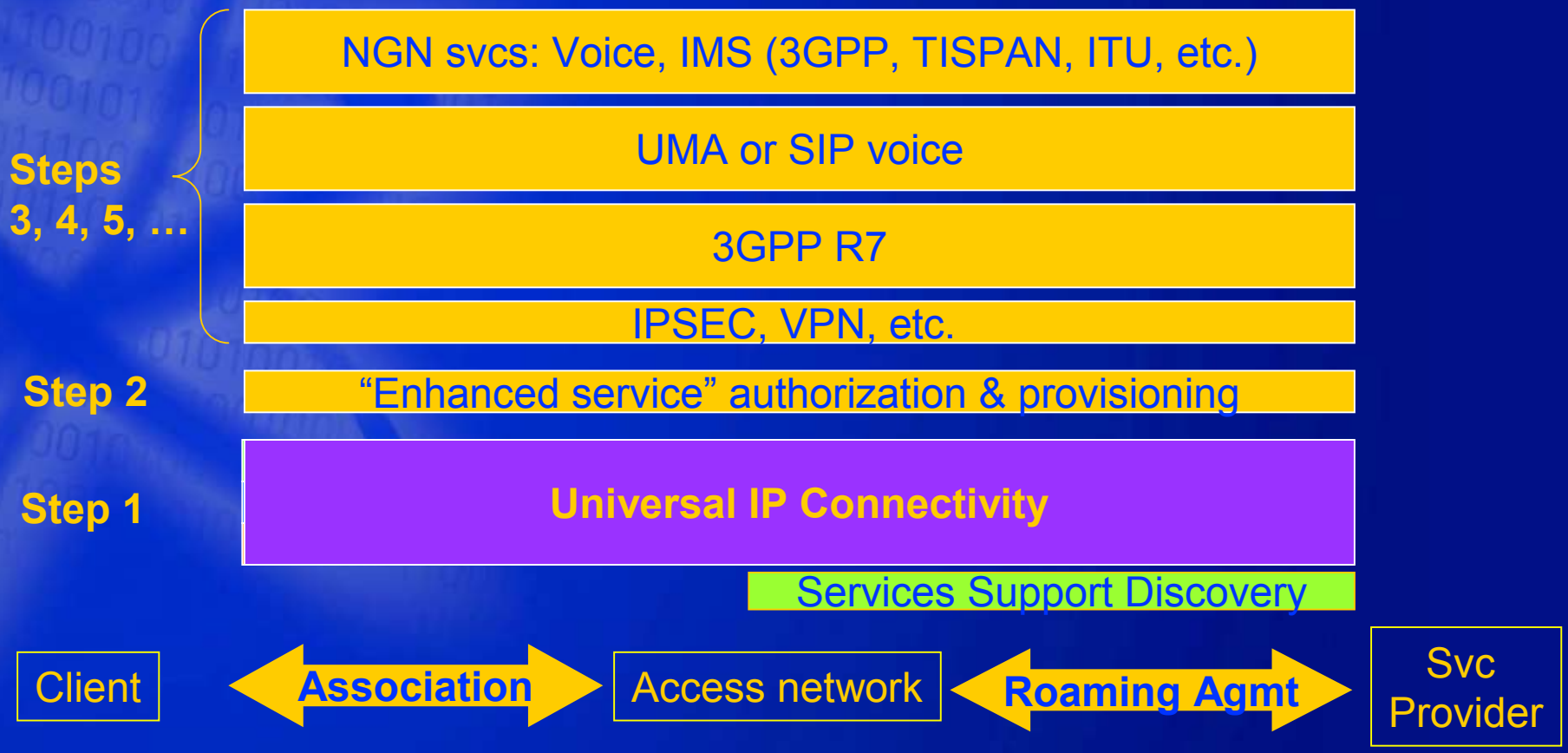
Agenda

- Roaming Vision
- IP Services
- IRAP

Enables New Service Opportunities

- Bring Internet growth to wireless services

All IP Svcs Require IP Connection



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No IP Connection → No IP Svcs

Steps 3, 4, 5, …

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

Step 2

- "Enhanced service" authorization & provisioning

Step 1

- **Universal IP Connectivity**

Services Support Discovery

Client ⟷ **Association** ⟷ Access network ⟷ **Roaming Agmt** ⟷ Svc Provider

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- IP Services
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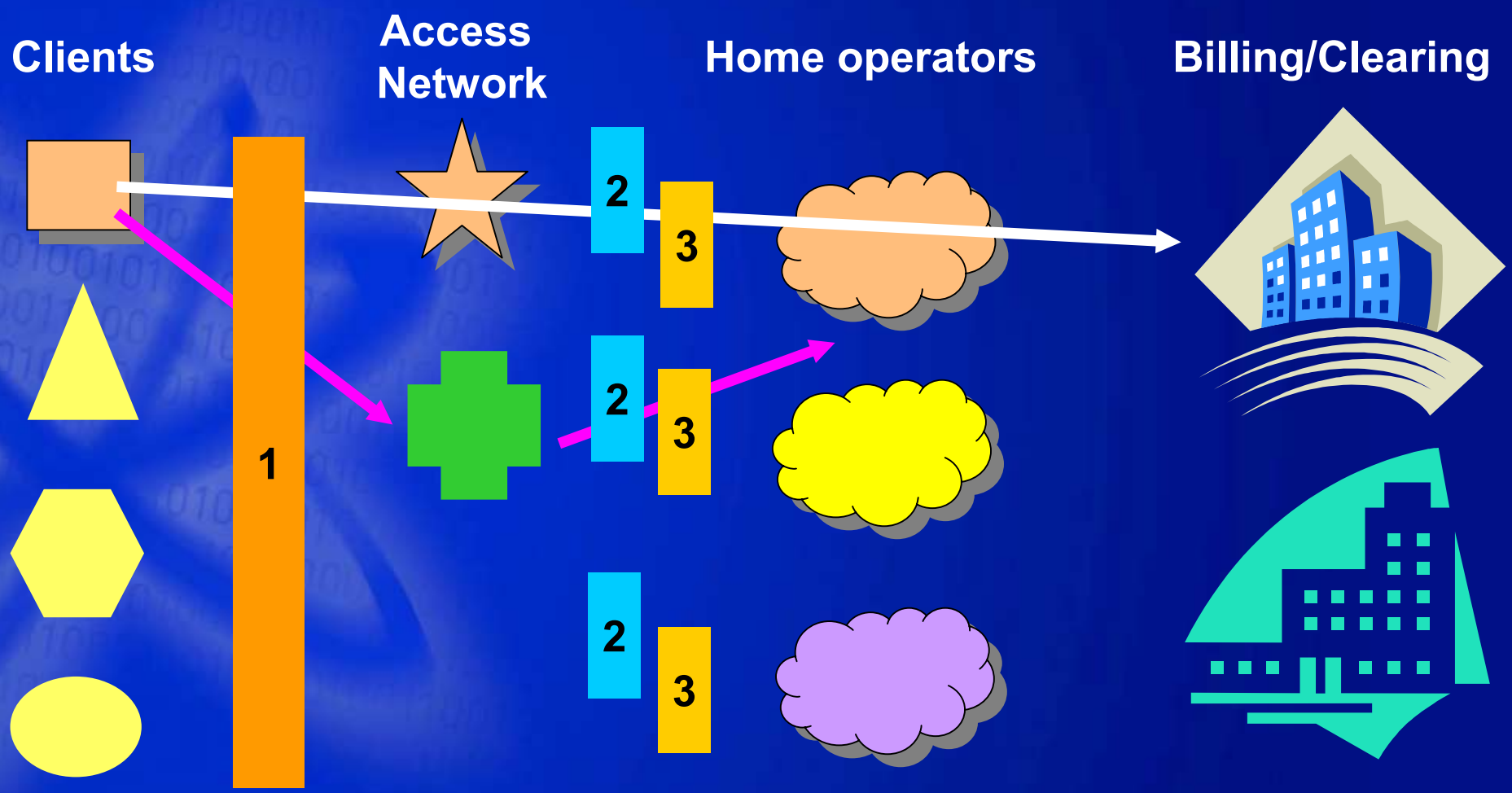
Need for standard interfaces



1 Network Access
2 Authentication & Authorization
3 Accounting Data

WLAN Standards and Forums

Standards → ← Interop

Protocols

ITU

IEEE:
Wireless, Security, QoS foundation

IETF:
common AAA protocols

Domain Solutions

3GPP2

3GPP:
Promoting use of IETF, IEEE standards

Forums

GSMA:
consistent usage and deployment models

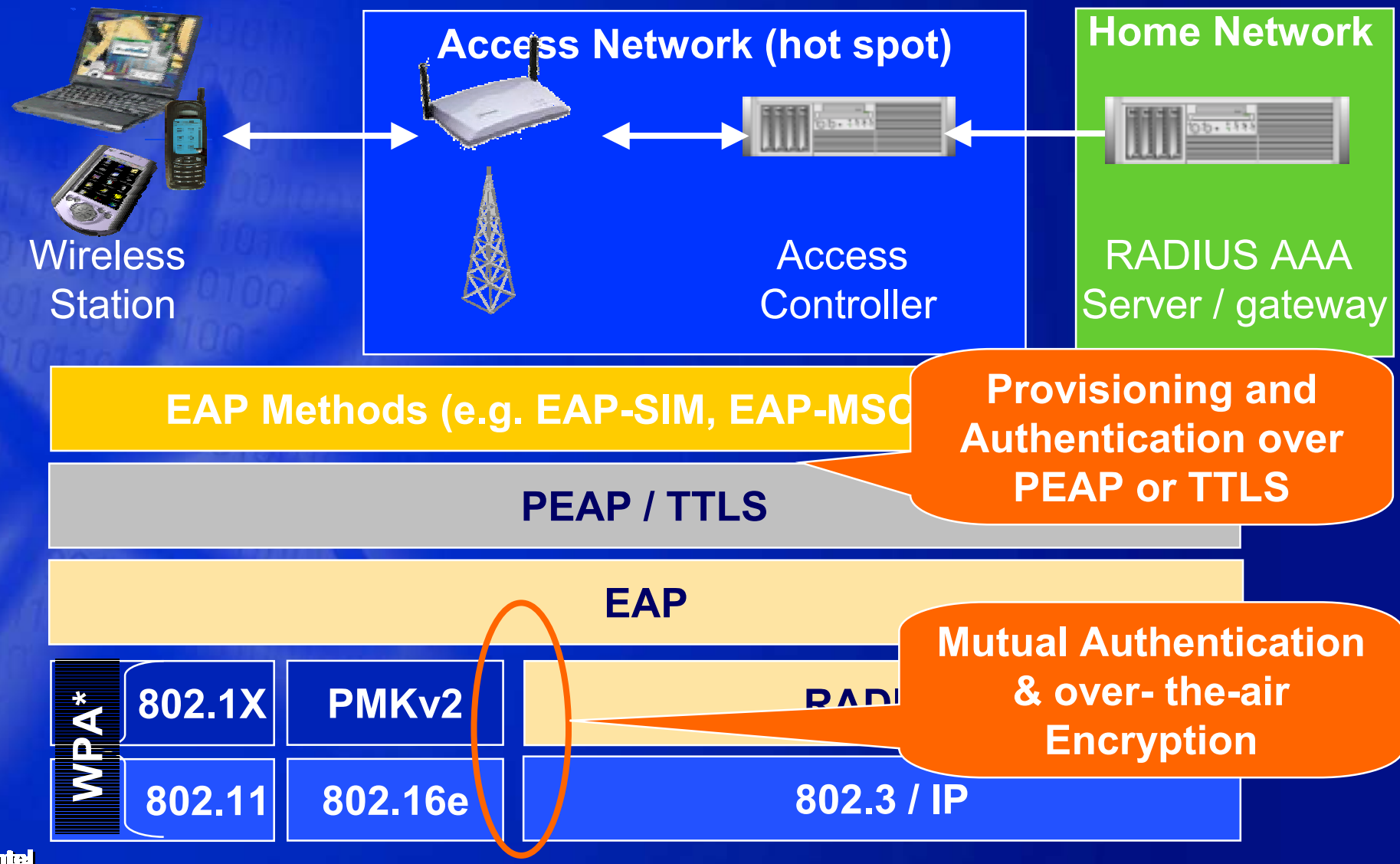
Wi-Fi Alliance:
Overall Wi-Fi focus, client – AP interaction

IPDR:
settlement format for billing exchange

Testing

IRAP

Roaming Architecture & Protocols



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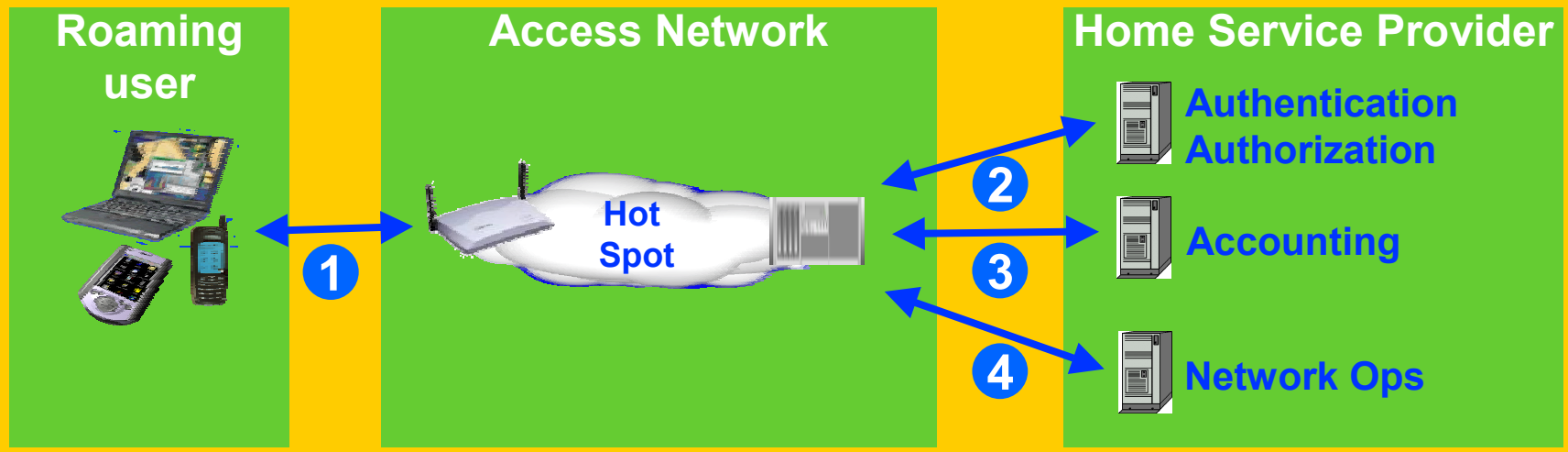
IRAP Roaming Interfaces



- 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

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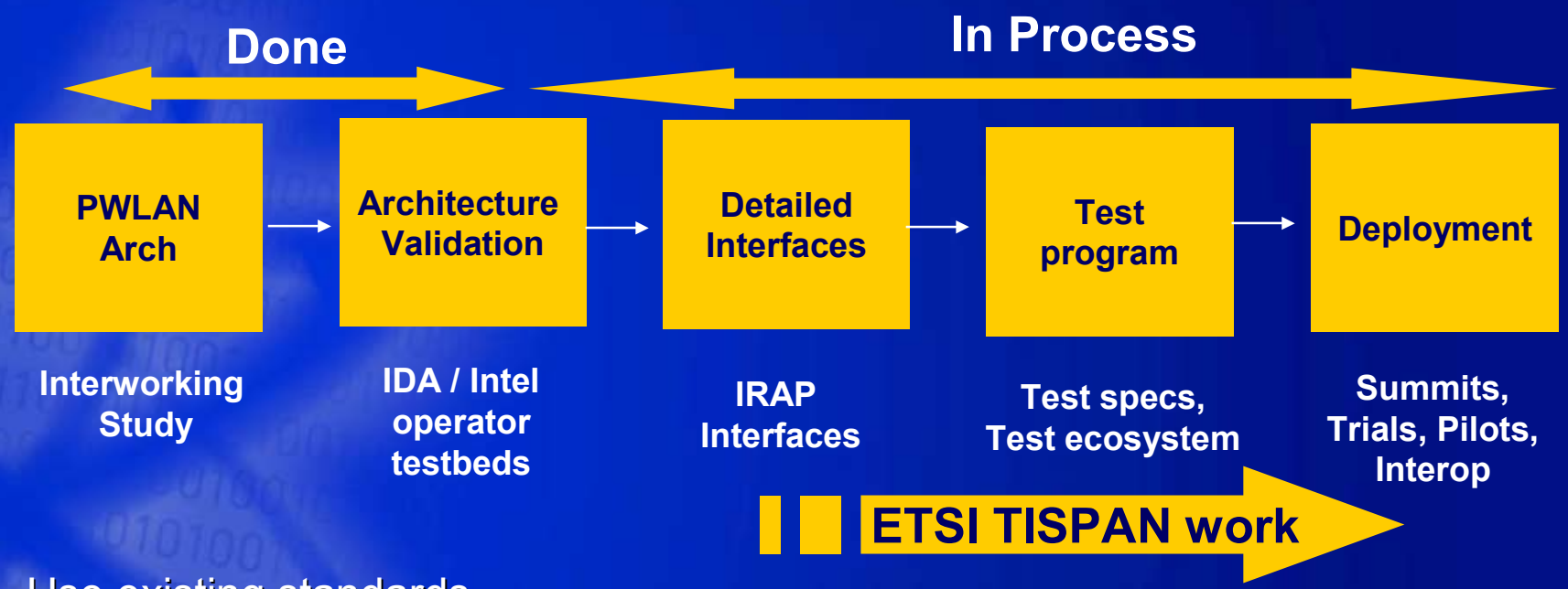
IRAP Supports Service Providers

- 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



- 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

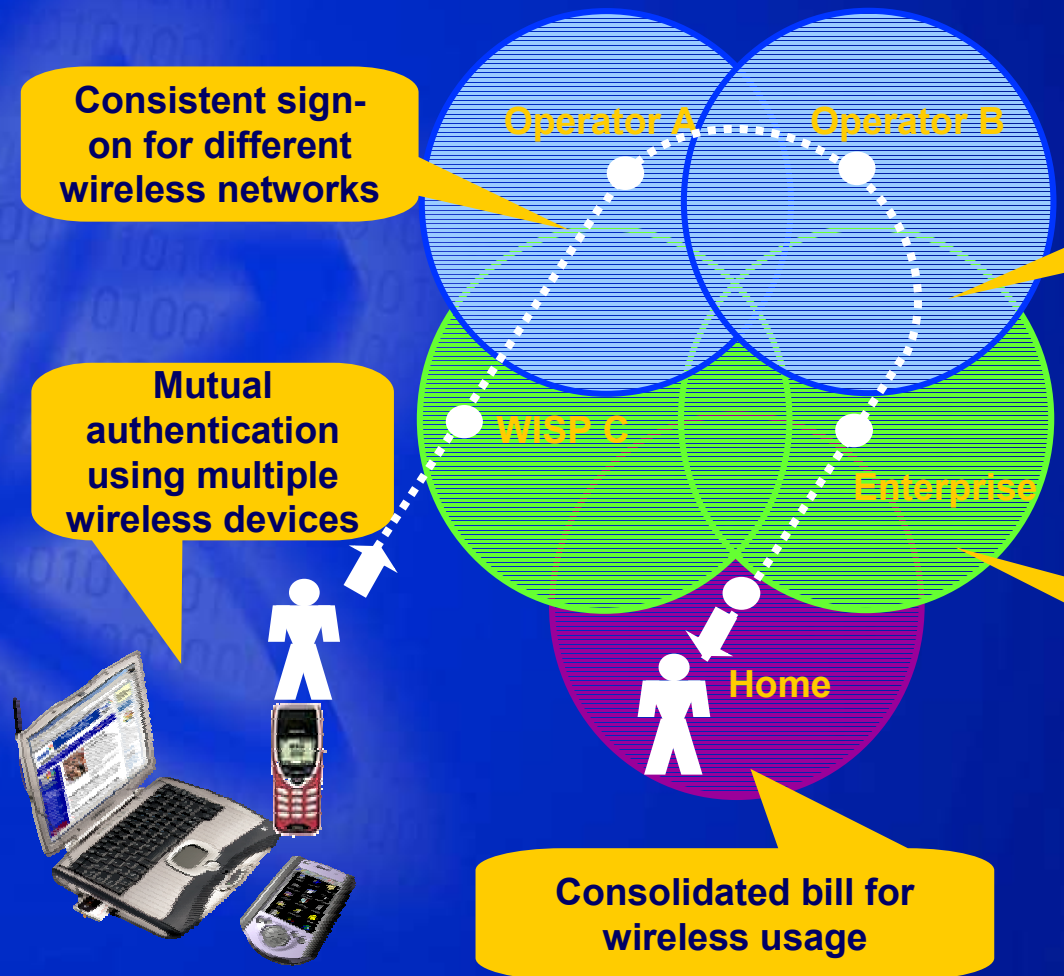
- Industry needs global WLAN interoperability specs & testing methodologies
- IRAP program goals:
  - Well-defined architectural blueprint for PWLANs, allows for migration to safer, simpler authentication
  - A standards-based set of interfaces to facilitate global roaming and interoperability
  - A 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
  - Direct link to Wireless LAN End to End Guidelines http://www.intel.com/labs/roaming/download/WLAN_E2E_Guide.pdf
  - For more information on Intel R&D http://www.intel.com/technology
- Direct link to IRAP documentation and information
  - http://www.irap.nl
- GSMA IR61 ("InterOperator Handbook")
  - http://www.gsmworld.com/documents/index.shtml
- Wi-Fi Alliance "WPA Deployment Guide for Public Access"
  - http://www.wi-fi.org/OpenSection/MediaResources.asp?TID=5

Backup

Achieving "Seamless Roaming"



Consistent sign-on for different wireless networks

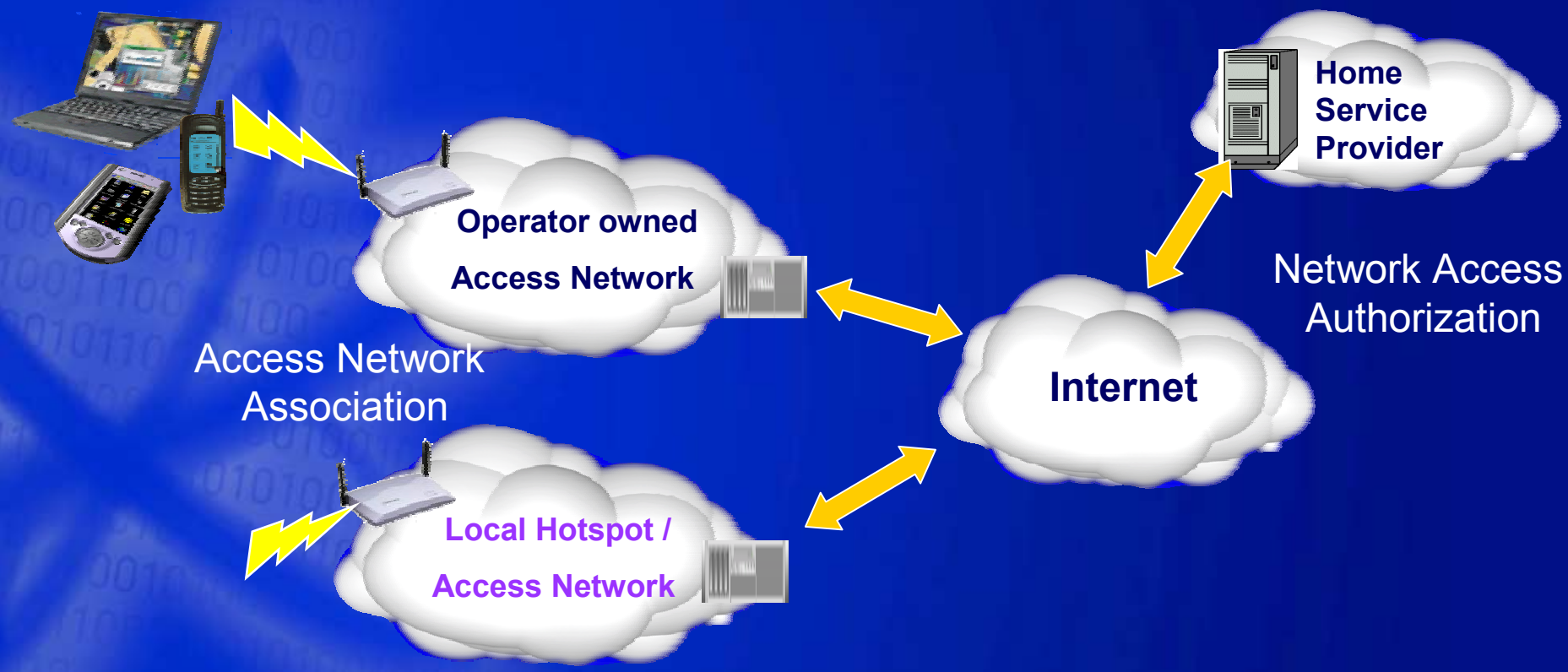
Multi-credential support within & across roaming alliances

Mutual authentication using multiple wireless devices

Security consistent with Enterprise WLAN policies

Consolidated bill for wireless usage

Serve Your Customers Anywhere



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

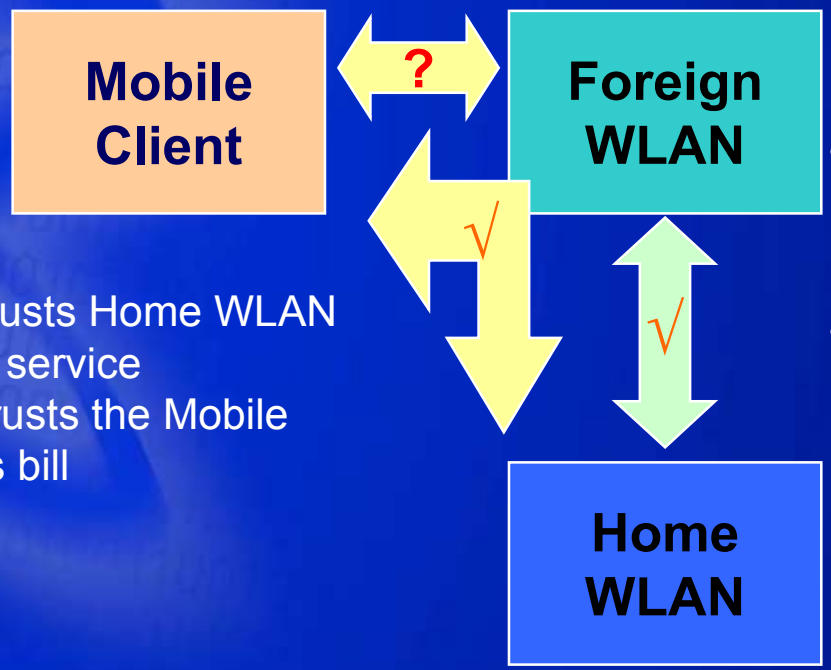
- Define common interoperable interfaces or profiles between network entities
- Reduce fragmentation by early alignment with existing and emerging standards
- Facilitate operator / vendor adoption of the interfaces
- Better security and roaming enables more advanced services
- Scope: AAA interworking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



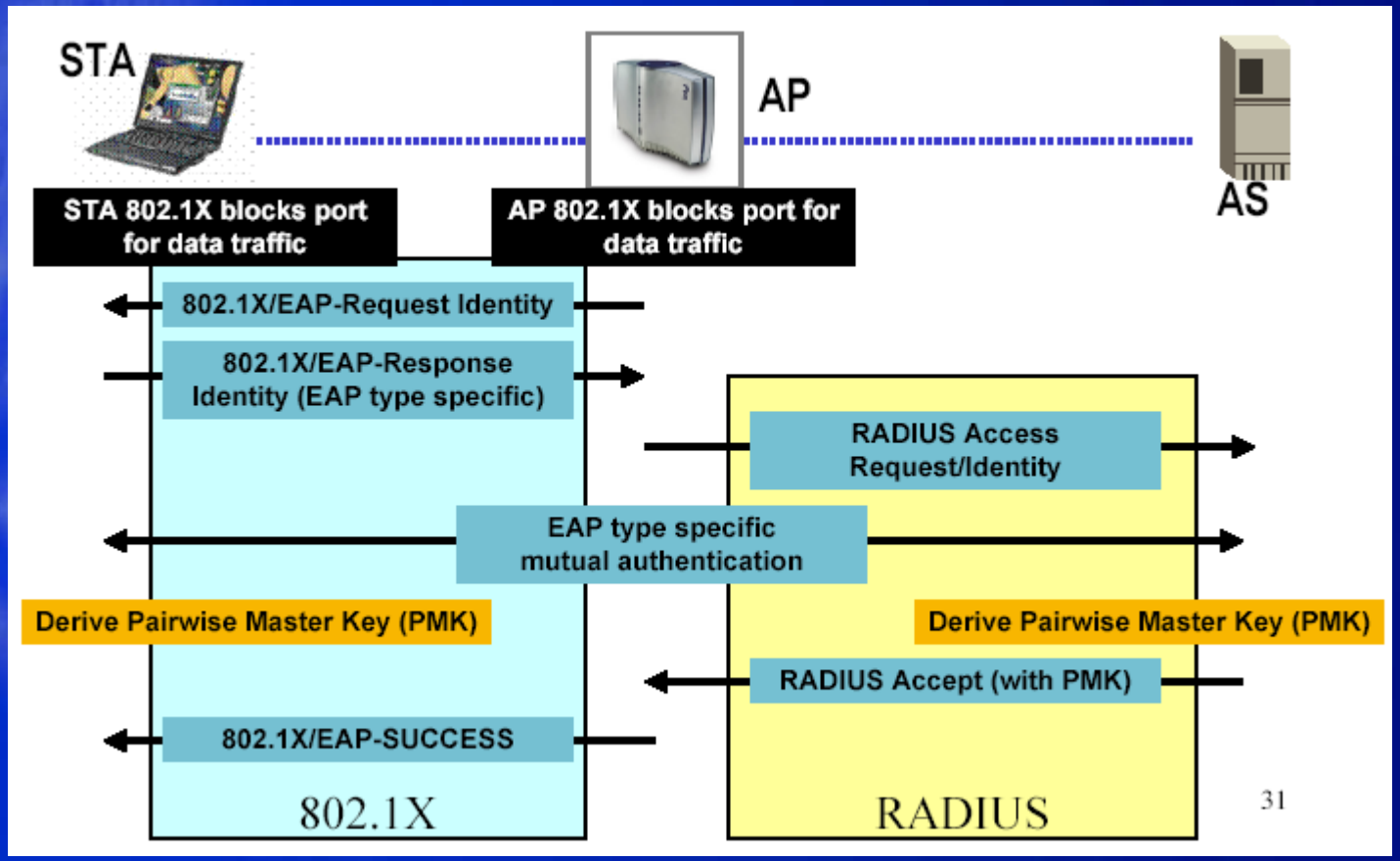
- Mobile Client trusts Home WLAN to provide safe service
- Home WLAN trusts the Mobile Client to pay its bill

- 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

Trust Model: Cellular ≠ Wi-Fi

You will be prosecuted if you operate an unlicensed transmitter in a cellular band	Anyone can legally deploy a Wi-Fi access point (unlicensed band)
Erecting and operating a cellular tower costs significant $$$s	You can deploy and operate a Wi-Fi access point for < $100
Cellular base stations and towers occupy fixed locations	A rouge AP is transportable anywhere
The cellular operator owns all the equipment, in physically secure sites	Wi-Fi equipment is owned by a mix of carriers, hot spot providers, enterprises, and individuals in sites with varying security levels
There are only a small number of Cellular operators world-wide	The number of access point operators is legion
Session keys can only be used within the cellular network itself, where their use can be audited	Session keys can be transported to (rogue) APs that are not auditable
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	The IPR on computer hard drives is more valuable than the WLAN communication itself

802.1X Overview



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

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

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

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