3G-WLAN Interworking

Jouni Korhonen

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What it is all about?

- An ongoing standardization work item in 3GPP

- Interworking between 3GPP systems and Wireless Local Area Networks (WLANs)

- The term 3GPP -WLAN interworking refers to the utilisation of resources and access to services within the 3GPP system by the WLAN UE and user respectively

- The intent of 3GPP-WLAN Interworking is to extend 3GPP services and functionality to the WLAN access environment

- The WLAN effectively becomes a complementary radio access technology to the 3GPP system

- Enabling any of these interworking cases may result in modifications or additions in 3GPP systems, in WLANs or both

- The 3GPP WLAN is assumed to provide bearer services for connecting a 3GPP subscriber via WLAN to IP based services compatible with those offered via PS domain

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Aperitif and Basic Vocabulary....

- PLMN
  - Public Land Mobile Network, either @Home (HPLMN) or @Visited (VPLMN)
- Scenarios
  - Scenario 2 -> Basic WLAN service with 3G AAA backend
  - Scenario 3 -> Adds 3G Packet Switched (PS) Services e.g. IMS
  - Scenario 4 -> Service continuity during handover between 3G and WLAN
  - Scenario 5 -> Seamless Handover between 3G and WLAN
- W-APN
  - Wireless-APN, similar to GPRS APN but for WLAN access
- Working Stages
  - Stage 1 -> service description from a service-user's point of view
  - Stage 2 -> logical analysis, breaking the problem down into functional elements and the information flows amongst them
  - Stage 3 -> concrete implementation of the protocols between physical elements
- Releases
  - 3GPP releases of the whole system on periodical phases

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Fundamentals and the Basic Architecture

- Two models: Roaming and non-Roaming

- In 3GPP-WLAN interworking, 3GPP system functionalities can be used either through a WLAN or independently of any WLAN (i.e. using 3GPP access)

- In the case of 3GPP system functionalities accessed via a WLAN, the interworking between 3GPP system and WLAN may include:
  - Enabling usage of 3GPP system functionalities between mobile terminals and 3GPP systems via the WLAN (e.g. providing SIP calls)
  - Utilising 3GPP system functionalities to complement the functionalities available in the WLAN (e.g. providing charging means, authentication, authorization, and accounting functions)

- Moreover, in order to ensure transition between the WLAN access and the 3GPP access, the interworking between the systems may include
  - Creation of mechanisms for selecting and switching between the WLAN and 3GPP access systems -> Seamless Mobility & Vertical Handovers

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Key Networking Components

- Packet Data Gateway (PDG)
  - 3GPP PS based services (appear the first time in Scenario 3) are accessed via a Packet Data Gateway
  - "GGSN"-like functionality i.e. charging data generation, IP address management, tunnel endpoint, QoS handling, service based local PEP, etc...

- Wireless Access Gateway (WAG)
  - A gateway via which the data to/from the WLAN AN shall be routed via a PLMN through a selected PDG in order to provide a WLAN UE with 3G PS based services (appears the first time in scenario 3)
  - Charging data generation, routing enforcement, etc…

- 3GPP AAA Server/Proxy
  - All AAA related tasks, and relaying when needed

- HSS/HLR
  - Located within the 3GPP subscriber's Home Network
  - Contains required authentication and subscription data to access the WLAN-IW service

- OCS/CCF/CGw
 - Charging data collection, accounting, online charging, etc

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WLAN user profile

- Should be stored in HSS
- In case of HLRs, the user profile may be in 3GPP AAA Server
- The profile contains:
    1. **IMSI** - *User identification.*
    2. **MSISDN** *(optional) – User identification, for example used for charging purposes*
    3. **Operator determined barring of 3GPP-WLAN interworking subscription**
    4. **Operator determined barring of 3GPP WLAN tunneling** – *This allows operator to disable all W-APNs at one time. If there is a conflict between this item and the "access allowed" flag of any W-APN, the most restrictive will prevail.*
    5. **Maximum session duration** *(optional) – Used for re-authentication purposes. If this field is not used, the WLAN AN will apply default time intervals.*
    6. **Charging mode** (pre-paid, post-paid, both) and accounting server identifier(s) for every charging mode – *Charging mode to be applied and, for every case, the charging node where the accounting information is to be reported.*
    7. **List of authorized W-APNs** *(optional) – List of W-APNs for which the user will have services available. These W-APNs may correspond to services in the home network or in the visited network. Each W-APN shall have a flag indicating whether access is allowed in visited PLMNs or in the home PLMN.*
    8. **Local access allowed** – *Indicates if the user is allowed to have direct access to external IP networks, e.g. Internet, from the WLAN Access Network.*
       If this parameter should be further split down to specific services that are allowed or not from the WLAN AN is FFS.
    9. **Roaming allowed** – *Indicates if the user is allowed to use 3GPP-WLAN Interworking in an WLAN AN that have no direct connection to the home PLMN.*

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Non Roaming Reference Model
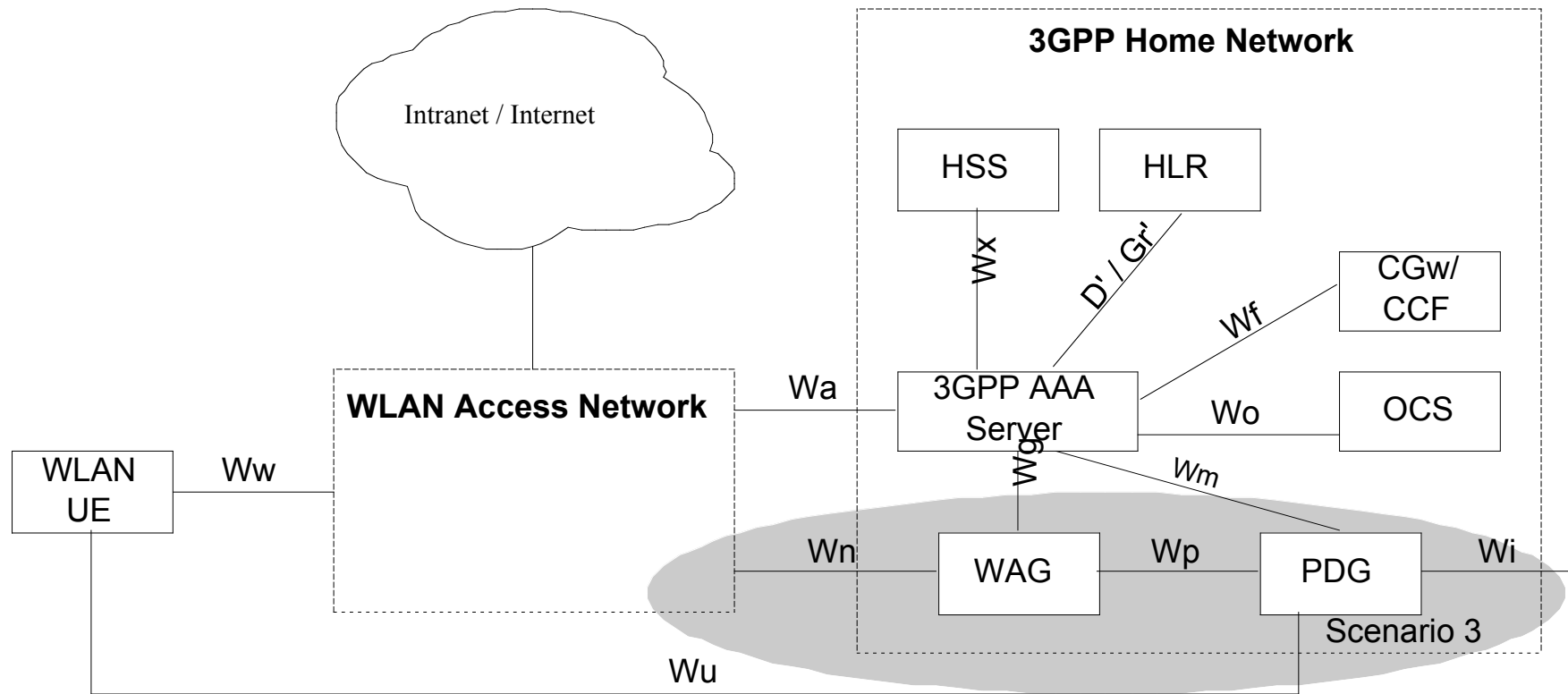
Roaming Reference Model
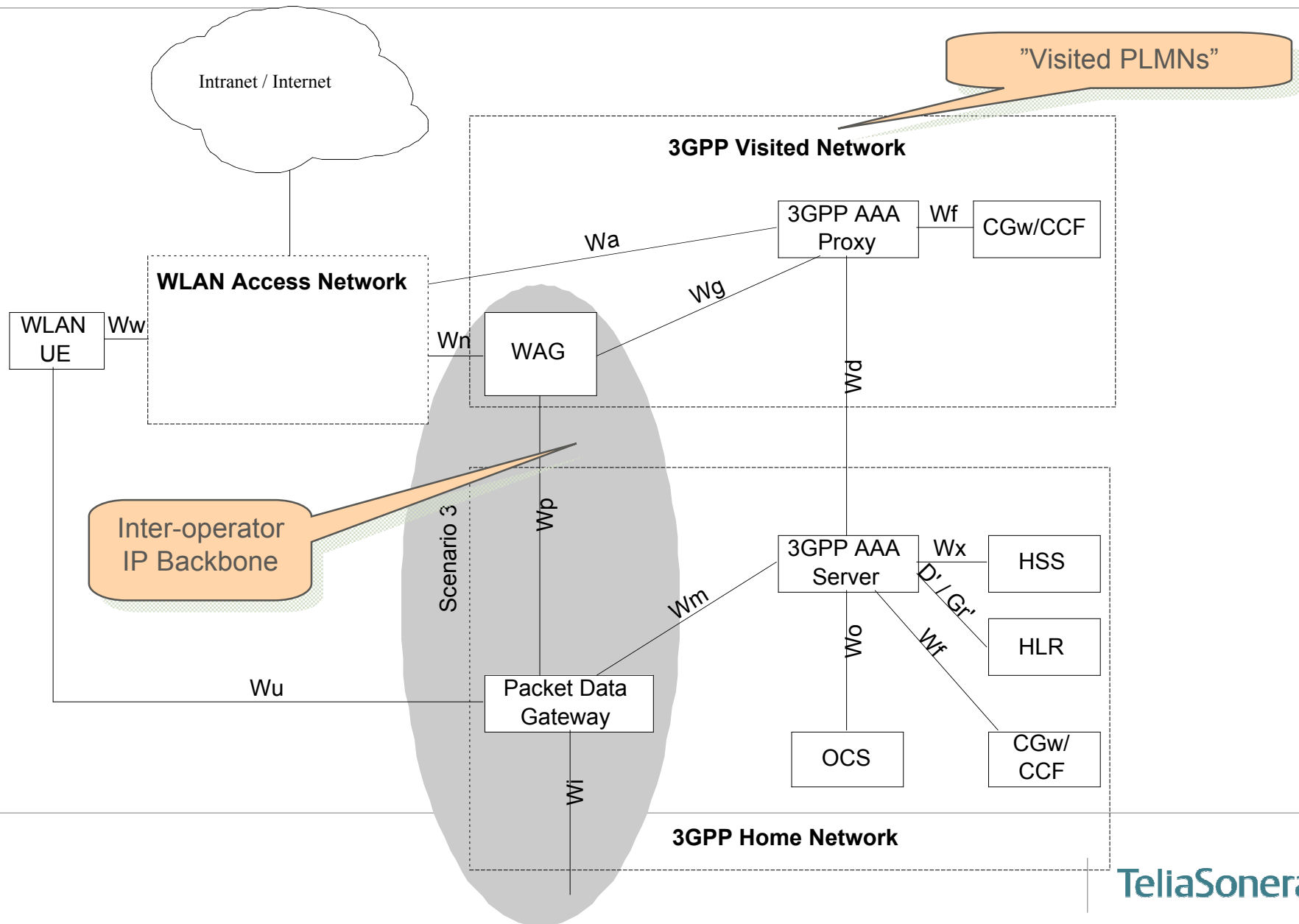
Network Selection and Advertisement

- Contains both
  - WLAN access network selection
  - PLMN network selection
- Two modes: Automatic and manual
- Network Access Identifier (NAI) has an important role in:
  - User authentication
  - Network authentication
  - AAA routing
  - NAI decoration will be needed in roaming cases
- WLAN access network selection is technology dependant
  - Some SSID based mess anyway...
  - Users & operator might have "preferred" lists of access networks
- (Visited) PLMN network selection and advertisement should be WLAN technology agnostic
  - Based on EAP-methods...

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VPLMN and Access Network Selection
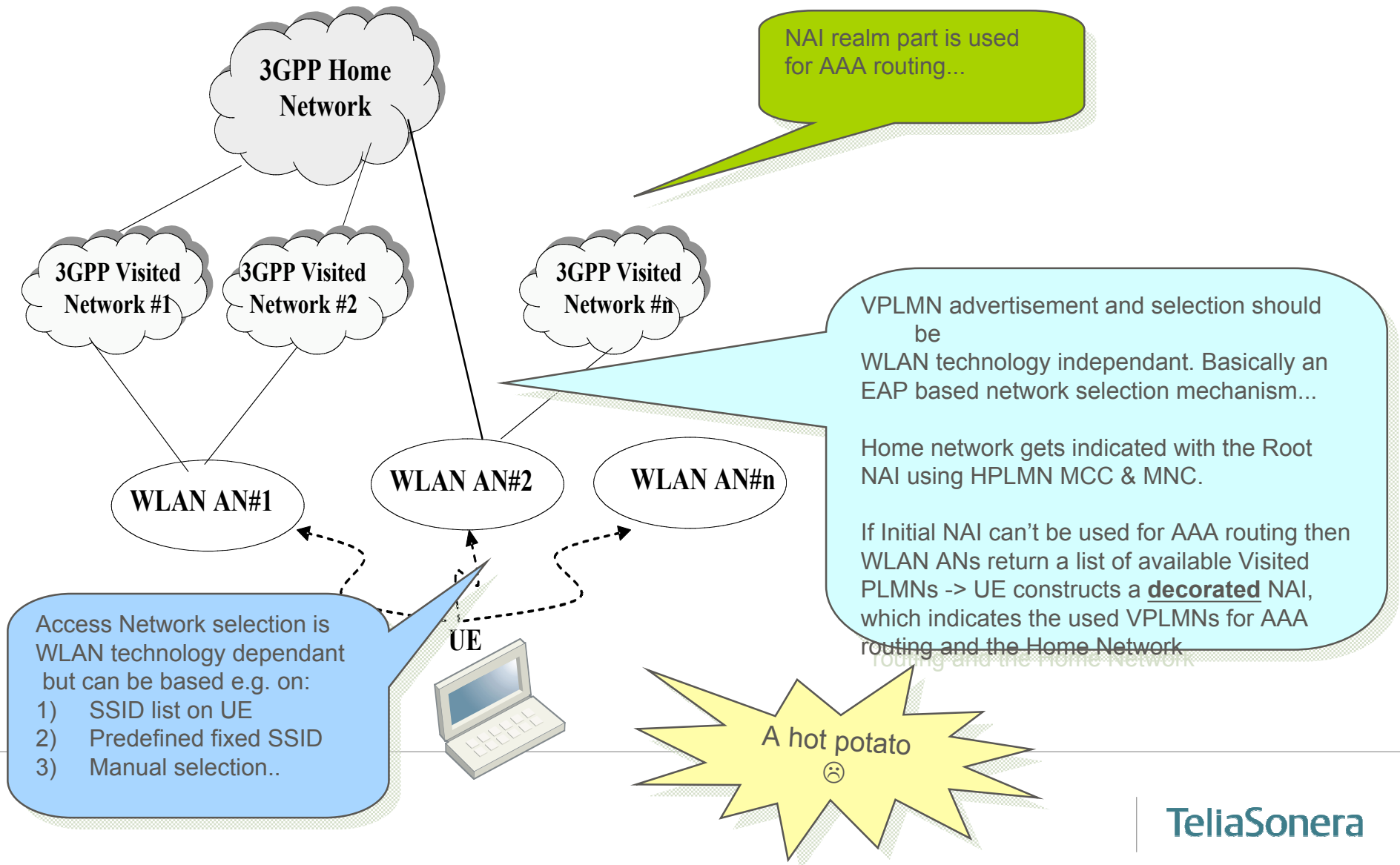
WLAN PLMN Selection Procedure

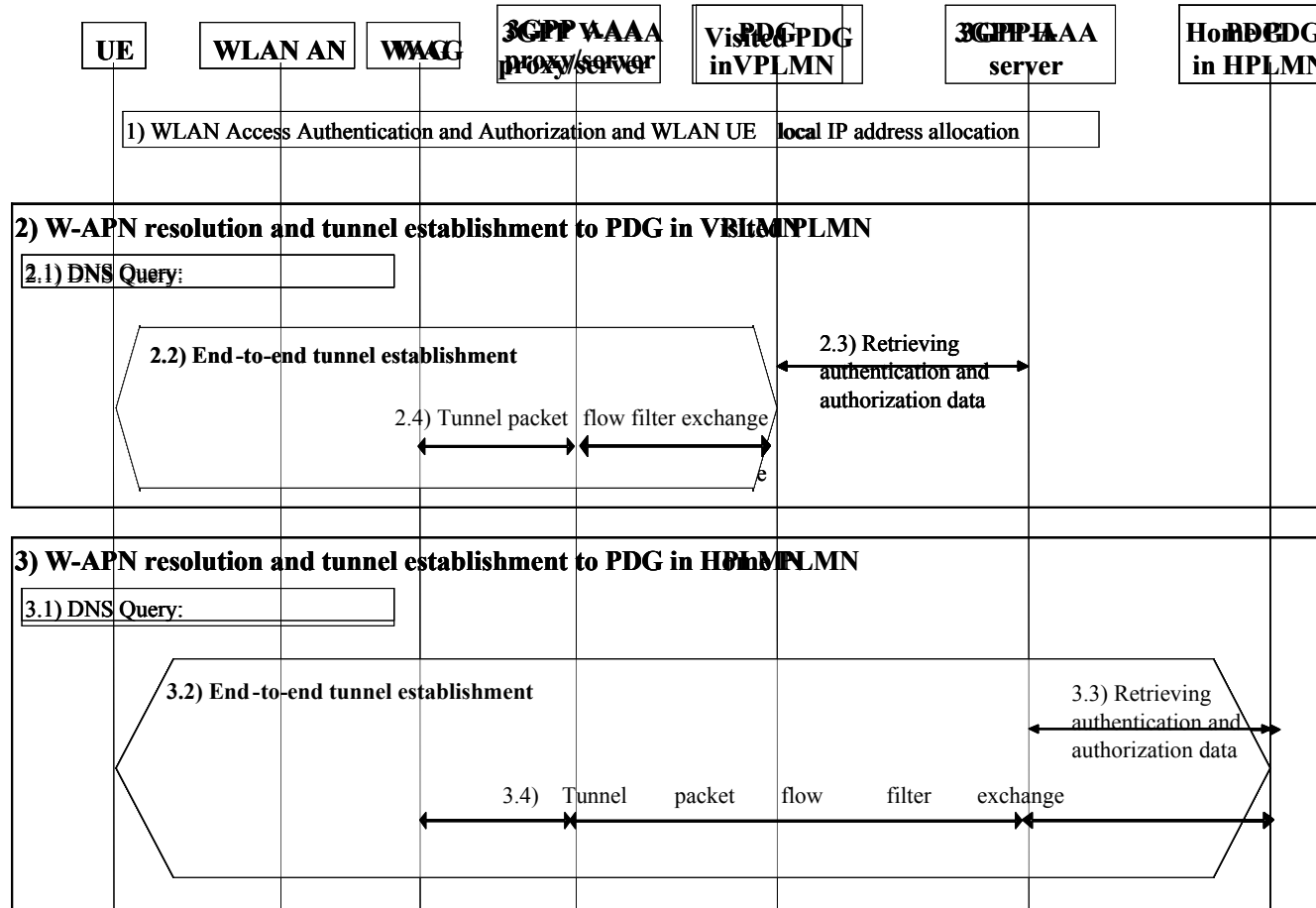TeliaSonera
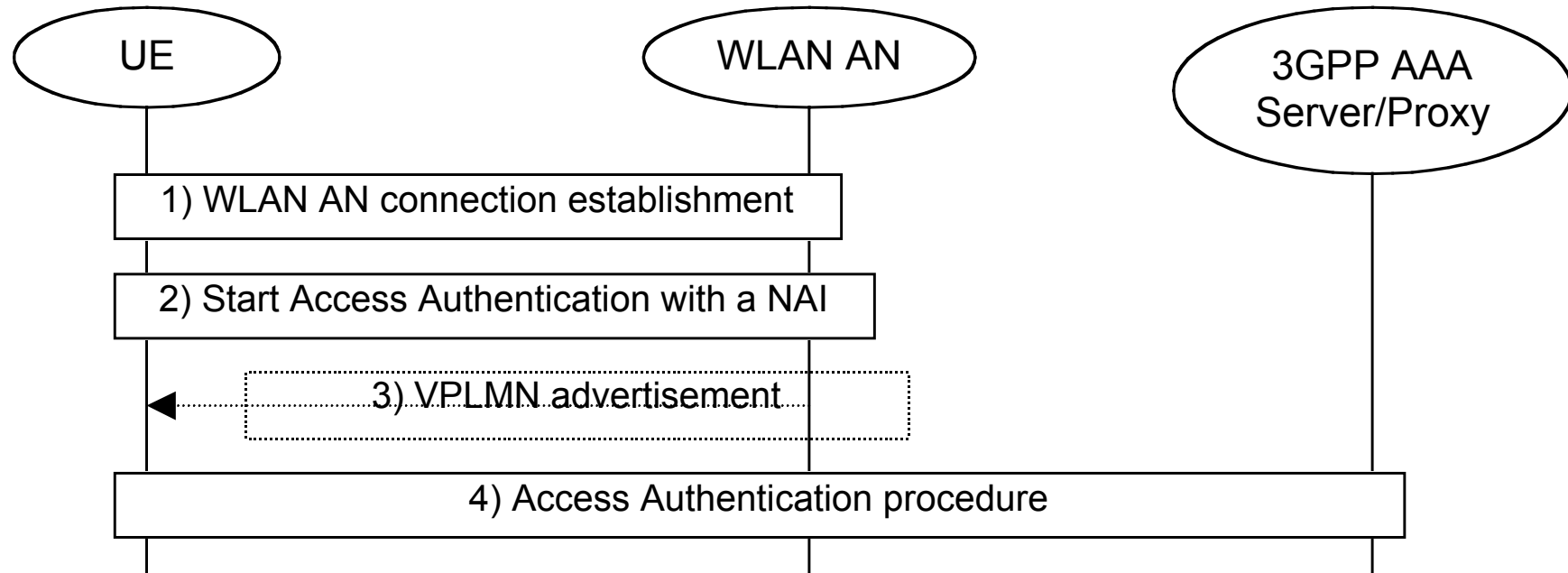
User Identities & Roaming NAI – Example

- The authentication to the network is based on EAP methods
  - Both EAP-SIM and EAP-AKA
- User identity, visited & home network information is packaged into NAI
  - Username part is a permanent user indentity (IMSI) or (IMSI based) pseudonym/Temporary Indentity
  - Realm part is an IMSI deriverded "domain name" for the home network
  - Visited network added to NAI -> decorated NAIs
- Required "data" is or will be stored into (U)SIM.. or in some cases to UE memory
- Examples:
  - Root NAIs:
    - "0<IMSI>@wlan.mnc<MNC>.mcc<MCC>.3gppnetwork.org", for EAP AKA authentication
    - "1<IMSI>@wlan.mnc<MNC>.mcc<MCC>.3gppnetwork.org", for EAP SIM authentication
  - And a decoreated roaming NAI for SIM authentication:
    - wlan.mnc<MNC>.mcc<MCC>.3gppnetwork.org![01]<IMSI>@<MNC>.<MCC>
    - wlan.mnc015.mcc234.3gppnetwork.org!1234150999999999@071.610

Visited network   IMSI (SIM profile)   Home network

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Tunnel Establishement and Service Authorization

- The WLAN UE can connect to different IP networks, including the Internet, an operator's IP network or an external IP network such as a corporate IP network

- Current working assumption is that an end-2-end tunnel gets established between the WLAN UE and the PDG (pointed by the W-APN)
  - Tunneling and W-APNs are not part of Scenario 2 functionality!
  - UE initiates the tunnel establishement

- Preferred IP networks/services are indicated with requested W-APNs

- A W-APN is indicated by the WLAN UE in the tunnel establishment procedure between the WLAN UE and the PDG
  - It should be possible to several tunnels open simultaneously…
  - Desired service & network is reached via W-APN resolution (DNS query), which ultimately selects the PDG providing requested service & network

- Tunnel may be terminated either to VPLMN or HPLMN

WLAN UE-Initiated tunnel establishment

UE | WLAN AN | WAG | 3GPP AAA proxy/server | Visited PDG in VPLMN | 3GPP AAA server | Home PDG in HPLMN

1) WLAN Access Authentication and Authorization and WLAN UE local IP address allocation

2) W-APN resolution and tunnel establishment to PDG in VPLMN

2.1) DNS Query:

2.2) End-to-end tunnel establishment

2.3) Retrieving authentication and authorization data

2.4) Tunnel packet flow filter exchange

3) W-APN resolution and tunnel establishment to PDG in HPLMN

3.1) DNS Query:

3.2) End-to-end tunnel establishment

3.3) Retrieving authentication and authorization data

3.4) Tunnel packet flow filter exchange

General IP/Routing/DNS Related Issues

- RADIUS/DIAMETER
    - The AAA protocol of choice is DIAMETER, except...
    - The WLAN AN defacto AAA protocol is RADIUS
    - RADIUS-DIAMETER interworking must be taken into account
    - ...some people want to push RADIUS even further...

- DNS usage
    - Use of .3gppnetwork.org might cause some implementation difficulties
    - Public and "private" DNS hierarchies..

- Routing in general -> WLAN AN, Inter-operator IP Backbone and external networks
    - Some well known challenges are expected – when selectiong VPLMNs and routing via Inter-operator IP Backbone
    - Several IPs – transport IP layer and tunneled remote IPs

- Mobility & tunneling
    - Mobile IP? MOBIKE like? Something else?
    - Per tunnel/user charging and policy enforcement
    - Scenario 3 working assumption is IPSec + IKEv2

- Co-existense of Scenarios 2 and Scenarios 3 within the same PLMN is a challenge!!

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Release-6 Schedule for 3G-WLAN Interworking

- Stage-1: Requirements
  - 3GPP SA WG1, started ~2001
  - TR 22.934: defines the **6 scenarios** for I-WLAN
  - (GSMA increased interest 2003/2004)
- Stage-2: Architecture
  - 3GPP SA WG2, started ~2002
  - Scenarios 1-3
  - TS 23.234, approved March -04 by TSG SA
  - TS 23.234 frozen september –04
- Stage-3: Protocols etc
  - SA3, SA5, CN1, CN4, … - & dependence on stage-2!
  - To be completed by the end of 2004
- Scenarios 4-5 are Release-7 work items
  - Starting 2H 2004 and continues…

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Summary

- 3GPP-WLAN Interworking is to extend 3G services and functionality to the WLAN access environment

    – e.g. SMS, IMS and voice services…

- Reuses 3G AAA functionality and 3G ideology

    – (U)SIM has an important role

    – WLAN won't be that "easy & cheap" anymore

    – Roaming awareness!

- Architecture has been made rather complex

    – standardization has delayed

- Handovers and Seamless Handovers will come but don't hold your breath for it

- A lot of work still ahead when it comes to IP, routing and protocol level implementation level details

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References – Short List

- B. Aboba, " The Network Access Identifier", RFC2486bis
- F. Adrangi, " RADIUS Attributes Extension", draft-adrangi-radius-attributes-extension-00.txt, work in progress
- F. Adrangi, " Mediating Network Discovery and Selection", draft-adrangi-eap-network-Discovery-and-Selection-01.txt, work in progress
- H. Haverinen, "EAP SIM Authentication", draft-haverinen-pppext-eap-sim-13.txt, work in progress
- J. Arkko, "EAP AKA Authentication", draft-arkko-pppext-eap-aka-12.txt, work in progress
- 3GPP, "3GPP TS 23.234 v6.0.0", 3GPP system to Wireless Local Area Network (WLAN) Interworking, System Description (Release 6)
- 3GPP, "3GPP TS 33.234 V1.0.0", 3G Security, Interworking Security (Release 6)
- 3GPP, "3GPP TS 24.234 V1.4.1", UE to Network protocols, Stage 3 (Release 6)
- H. Tschofenig, " Carrying Location Information within RADIUS", draft-tschofenig-geopriv-location-information-00.txt, work in progress
- J. Arkko, "Network Discovery and Selection Problem", draft-ietf-eap-netsel-problem-00.txt, work in progress

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End of Presentation