IEEE GLOBECOM Design and Developers Forum

Service Management For ITS Using WAVE (1609) Networking

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Honolulu, HI
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Objectives of this Presentation

ITS Service Management Design Using WAVE Standards

-- ITS Models (ETSI, DOT,VII Use Cases, IEEE WAVE)

-- WAVE Standards – Architecture (1609.0) Security (1609.2), Networking (1609.3)

-- A Closer Look at the WAVE Approach – 2009 Modifications, WAVE nomenclature

Show real-world examples

-- SAE 2757 DSRC Messaging

-- VII/IntelliDrive Proof of Concept

-- Vehicle Public Key Infrastructure

-- Identity Management Models for Service Management

Organizing Framework for Security Architecture

-- How to reduce Complexity for ITS Service Management Design

-- How to Provide Repeatable Processes using the WAVE Approach

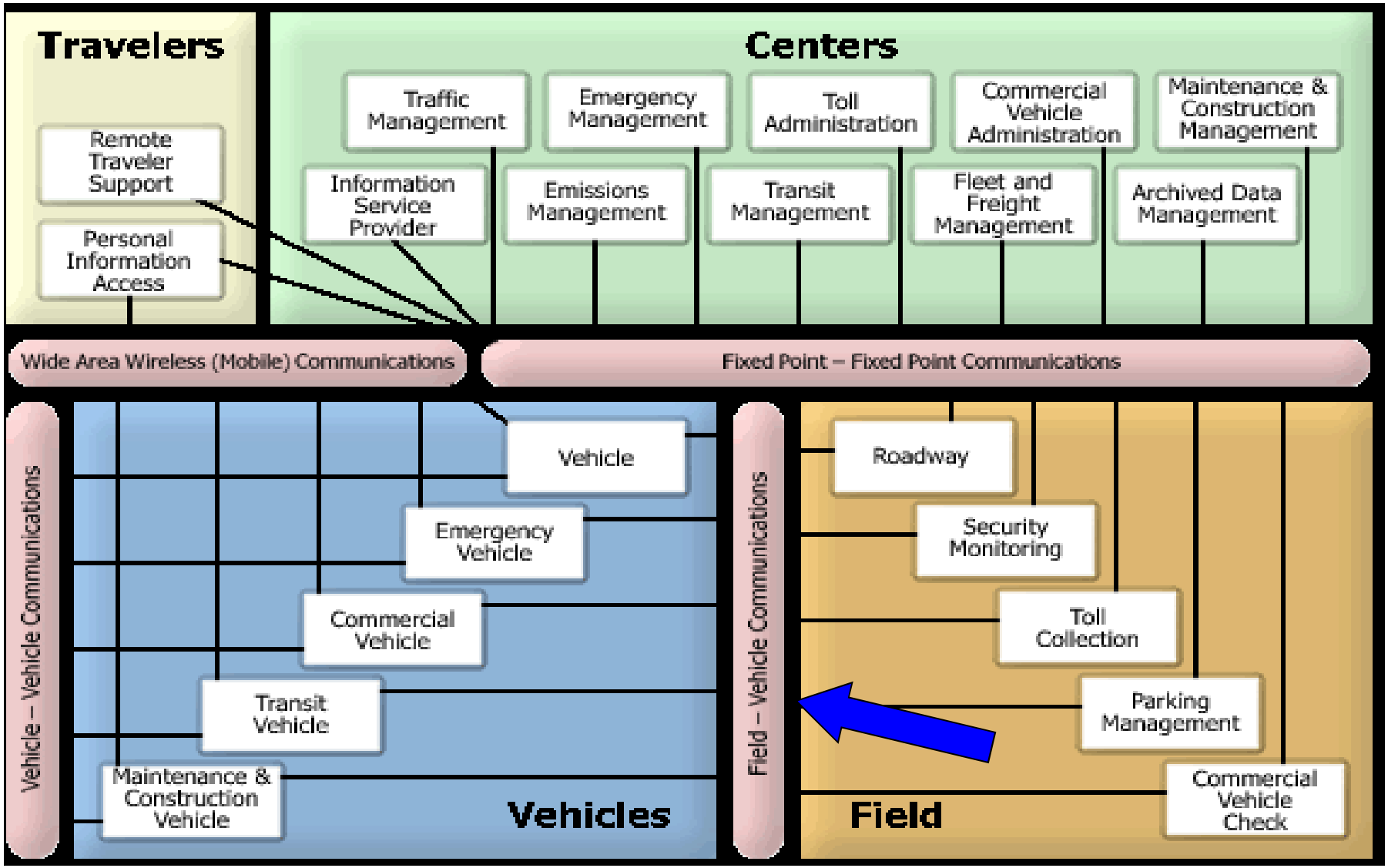
Future Work

ETSI ITS Automotive Networking Model –

http://www.etsi.org/WebSite/document/Technologies/ETSI-ITS.jpg

Introduction – USDOT ITS National Architecture

http://www.iteris.com/itsarch/html/entity/paents.htm



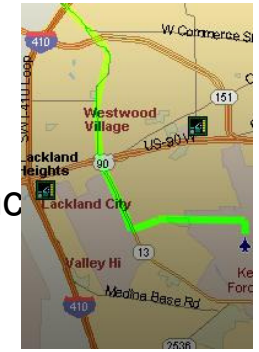
Introduction – ITS Use Cases Services and Applications

- **Traveler Information**
  - Travel Times, Incident Alerts,
  - Road Closures, Work Zones

- **In Vehicle Signage**
  - Local Signage (School Zones, Stop Signs)
  - Highway Next Exit Services

- **Navigation**
  - Off Board Navigation
  - Reroute Information

- **Traffic Management**
  - Ramp Metering
  - Signal Timing Optimization
  - Corridor Management Planning Assistanc
  - Corridor Management Load Balancing
  - Pothole Maintenance



- **Weather Information**
  - Traveler Notification (Icy Bridge Warning)
  - Improved Weather Observing
  - Winter Maintenance

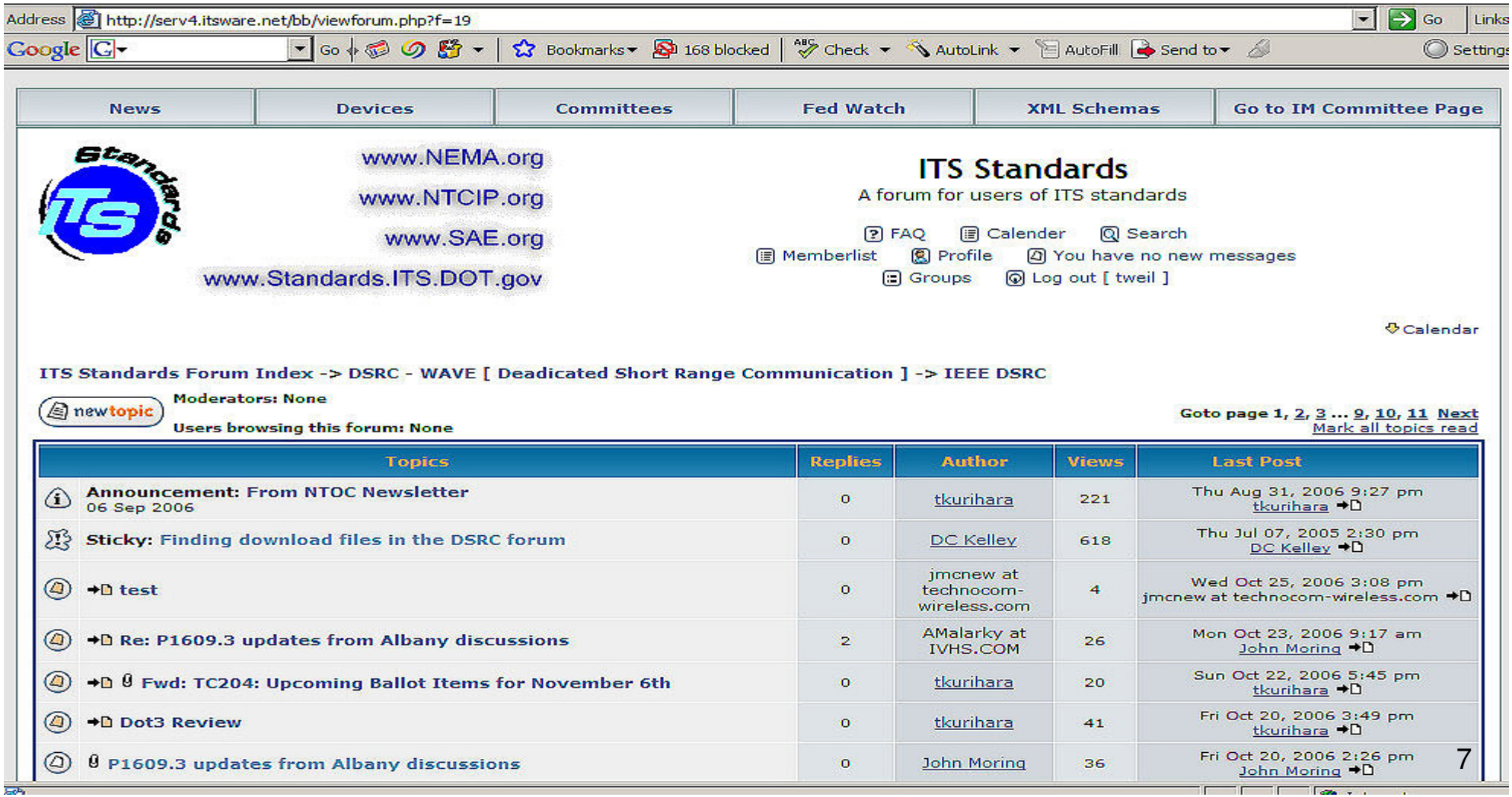
- **Safety**
  - Emergency Electronic Brake Light
  - Traffic Signal Violation Warning
  - Stop Sign Violation Warning
  - Curve Speed Warning

- **Electronic Payment**
  - Parking
  - Toll Roads
  - Gasoline

IEEE Standards Association Publications (WAVE) -

- IEEE P802.11p, Draft Amendment to STANDARD FOR Information technology—Telecommunications and information exchange between systems—LAN/MAN Specific Requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Wireless Access in Vehicular Environments (WAVE).
- IEEE Std 1609.0-2006 ™, IEEE Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE)—Architecture.
- IEEE Std 1609.1-2006 ™, IEEE Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE)—Resource Manager.
- IEEE Std 1609.2-2006™, IEEE Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE)—Security Services for Applications and Management Messages.
- IEEE Std 1609.3-2007™,, IEEE Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE)—Networking Services.
- IEEE Std 1609.4-2006™,, IEEE Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE)—Multi-Channel Operation.
- IEEE Std 1609.11-2006™,, IEEE Draft Standard for Wireless Access in Vehicular Environments (WAVE)—Over-the-Air Data Exchange Protocol for Intelligent Transportation Systems (ITS) - Electronic Payment Service

ITS Standards Forum (DSRC Working Group) – http://serv4.itsware.net/bb/index.php



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www.SAE.org
www.Standards.ITS.DOT.gov

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newtopic **Moderators: None**

Users browsing this forum: None

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Topics	Replies	Author	Views	Last Post
Announcement: From NTOC Newsletter 06 Sep 2006	0	tkurihara	221	Thu Aug 31, 2006 9:27 pm tkurihara
Sticky: Finding download files in the DSRC forum	0	DC Kelley	618	Thu Jul 07, 2005 2:30 pm DC Kelley
test	0	jmcnew at technocom-wireless.com	4	Wed Oct 25, 2006 3:08 pm jmcnew at technocom-wireless.com
Re: P1609.3 updates from Albany discussions	2	AMalarky at IVHS.COM	26	Mon Oct 23, 2006 9:17 am John Moring
Fwd: TC204: Upcoming Ballot Items for November 6th	0	tkurihara	20	Sun Oct 22, 2006 5:45 pm tkurihara
Dot3 Review	0	tkurihara	41	Fri Oct 20, 2006 3:49 pm tkurihara
P1609.3 updates from Albany discussions	0	John Moring	36	Fri Oct 20, 2006 2:26 pm John Moring

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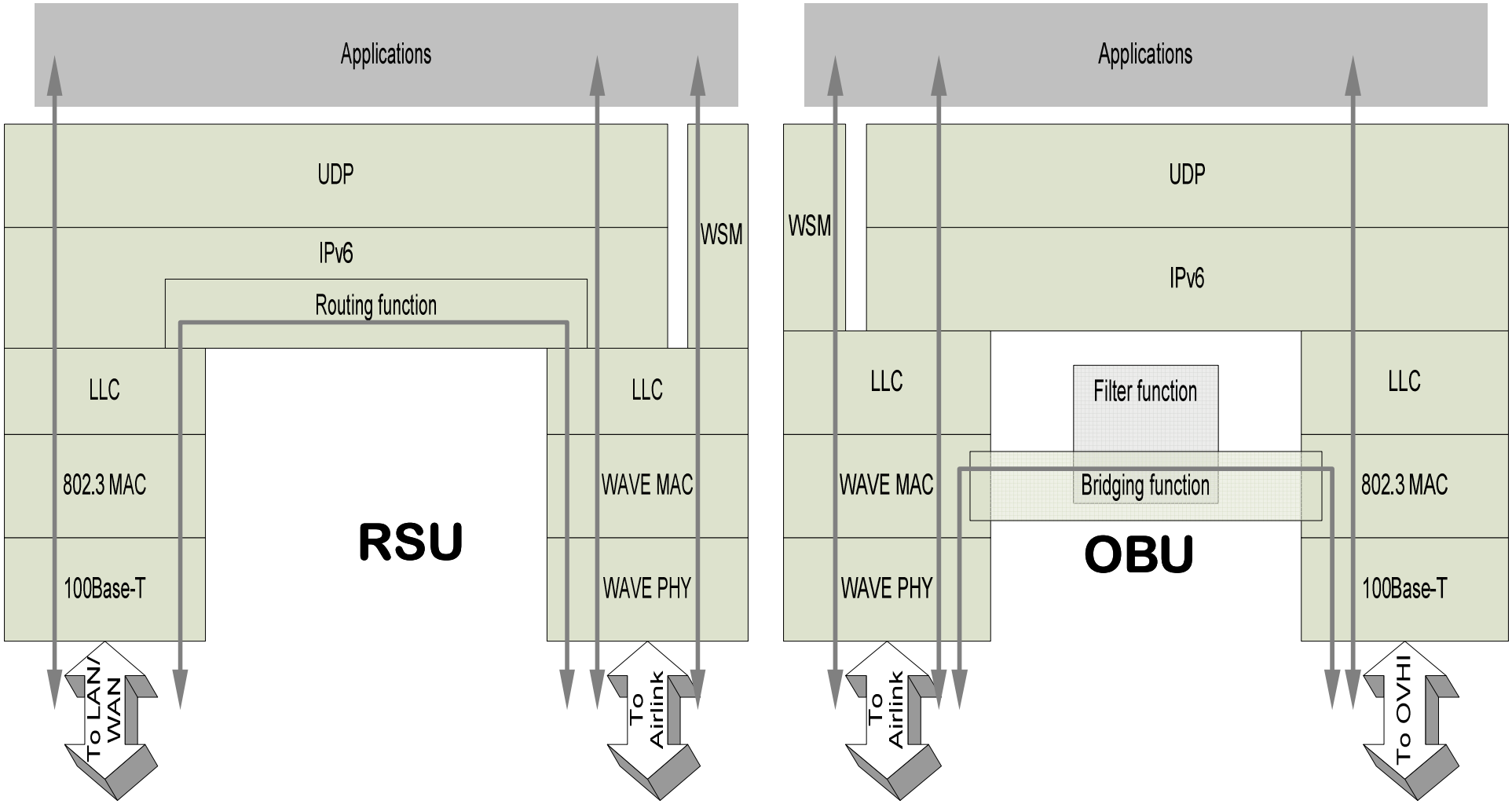
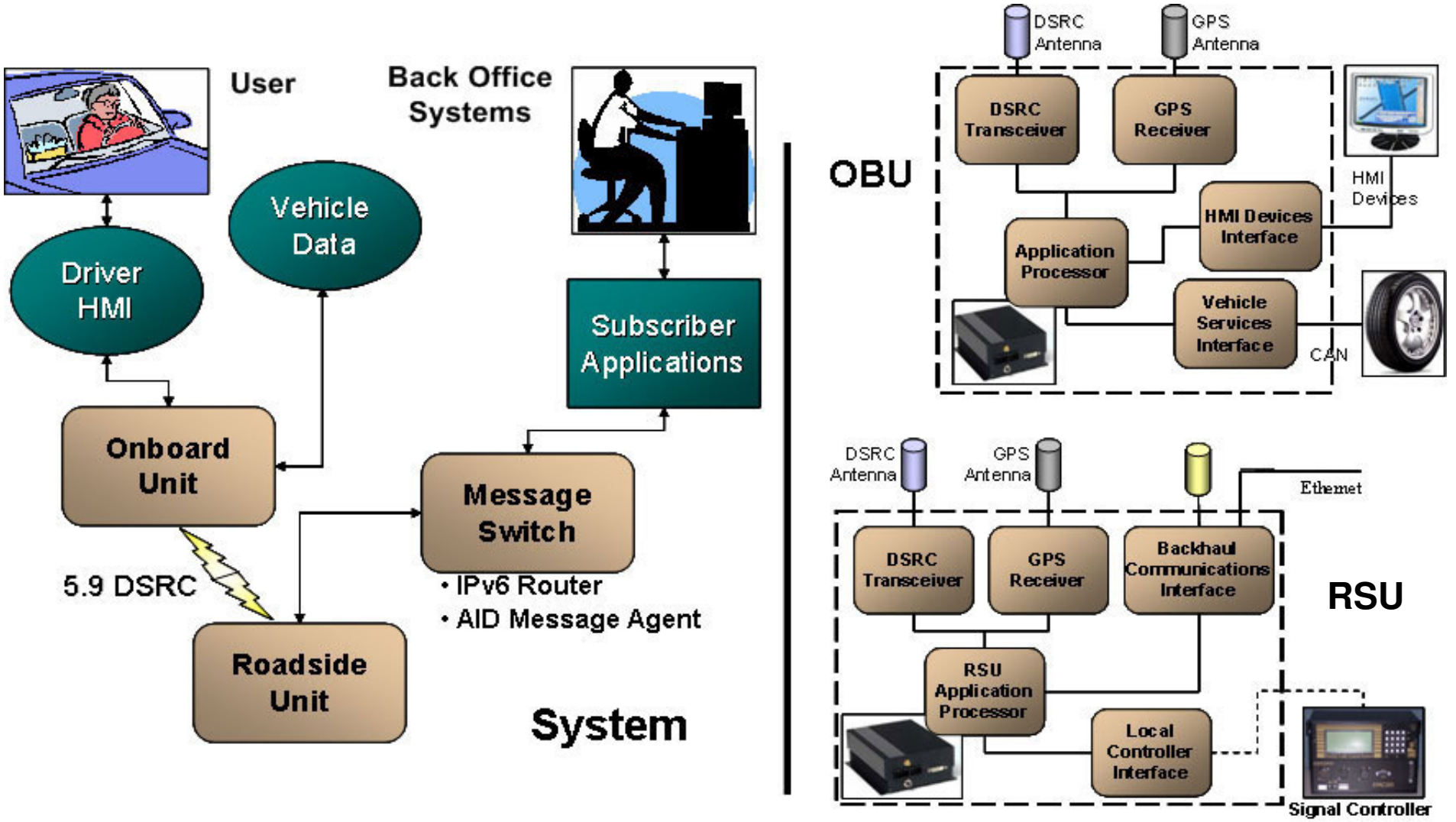
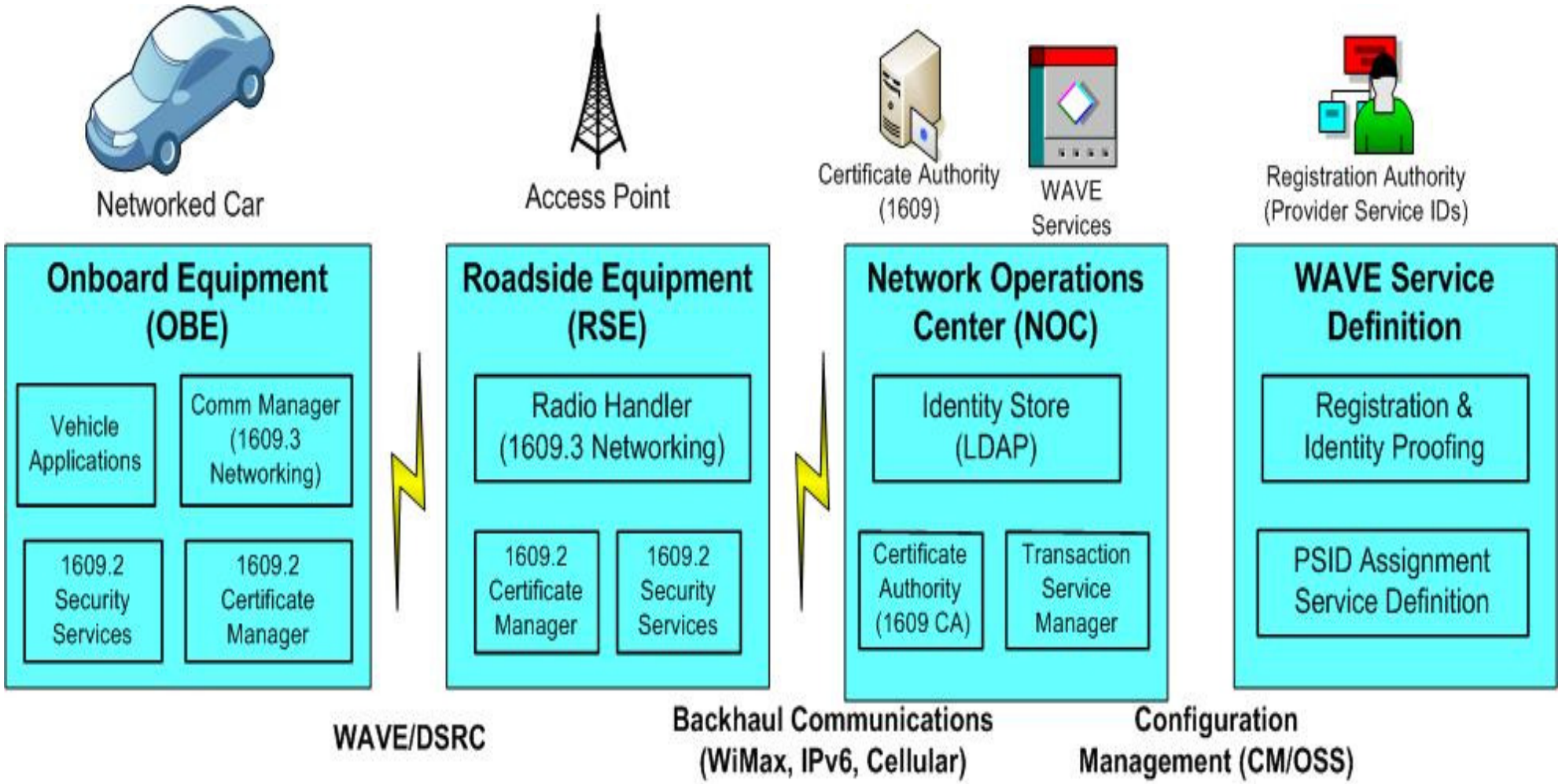
RSU and OBU Protocol Stacks (1609.3 Model – 2005)



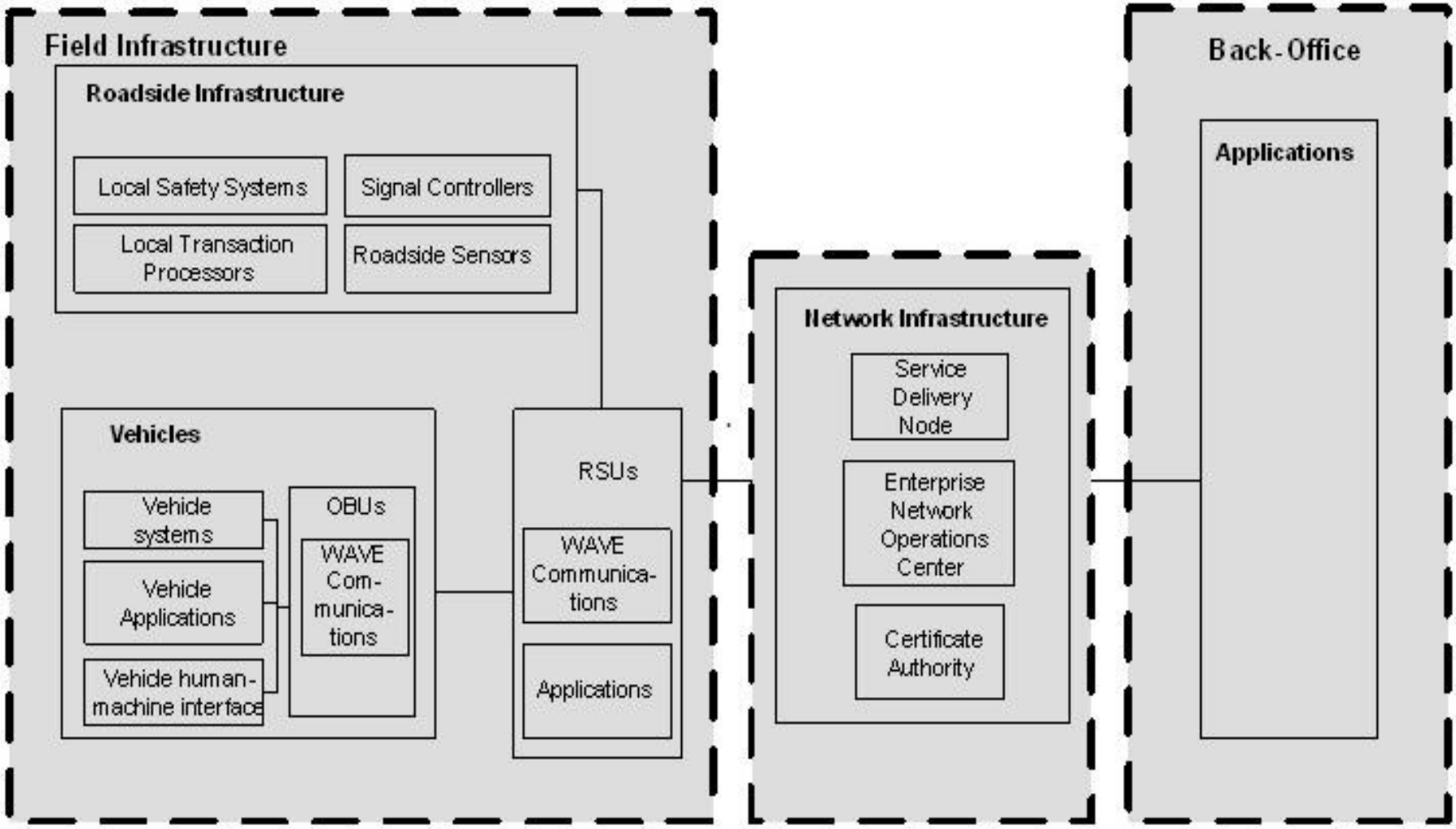
Prototype of DSRC Architecture and Components (OmniAir)



ITS Service Management Model (IntelliDrive Example)



ITS Architecture using WAVE (1609.0) – Example of an operational system implemented using WAVE devices



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Evolution of the IEEE 1609 Standards (2009) –

- **IntelliDrive Reports** on Vehicle Infrastructure Integration (VII) Proof of Concept tests
  - **VII POC Technical Description Vehicle Report** (DSRC Communications, OBE Software Services, Network Services Enabler Subsystem), Application Manager
  - **VII POC Technical Description Infrastructure Report** (DSRC Communications, Radio Handler, 1609.2 Security Libraries)

- **WAVE Protocol Enhancements**
  - 1609.0 WAVE Architecture, 1609.11 Electronic Payments, 802.11p amendments
  - Vendor Specific Action Frame (802.11p) - OID and Content Description Enhancements
  - 802.11p Sponsor Ballots (10/2009-6/2010)
  - WAVE Sponsor Ballots (3/2010-10/2010)

- **1609.3 Modifications (impact on Service Management)**
  - Service Management Model moved to 1609.0
  - Sending and Receiving unsigned WSAs (allow use of timing without signature verification)
  - Defined Security SAP to WME

- **1609.2 Modifications**
  - Alignment with changes in WAVE Networking Standard (1609.3)
  - Scope/Purpose Restatement
  - SAPS for sending and receiving secured messages and WSAs
  - Application Security Profiles (how applications call the MIB)
  - Anonymity and Privacy Guidelines

IntelliDrive/VII Final Reports – DSRC and Proof of Concept Tests

http://www.intellidriveusa.org/library/rept-dsrc-poc.php

- Final Report: Vehicle Infrastructure Integration Proof of Concept Executive Summary — Vehicle - VII Consortium. May 2009.

  FHWA-JPO-09-003. The executive summary is intended for executives and managers of organizations interested in the deployment of IntelliDriveSM. This report summarizes a program of work resulting from a Cooperative Agreement between USDOT and the VII Consortium to develop and test a Proof of Concept VII system based on DSRC wireless communication between an infrastructure and mobile terminals. It supports applications for improvement in safety and mobility and enables other commercial applications. Key findings and recommendations for further work are presented.

- Final Report: Proof of Concept Results of Findings Summary—Vehicle - VII Consortium. May 2009. FHWA-JPO-09-043.

  This final report describes the objectives and the approach to the testing of the VII Proof of Concept system. Summaries of the vehicle-related test results and findings for both the major system functions and the applications designed for the system.

- Final Report: Proof of Concept Technical Description—Vehicle* - VII Consortium. May 2009. FHWA-JPO-09-017.

- This report provides the technical description of the VII system developed for the Cooperative Agreement VII Program between the USDOT and the VII Consortium. The basic architectural elements are summarized, and detailed descriptions of the hardware and software systems are provided, along with the descriptions of the applications used to assess the system performance and operation.

- Final Report: Proof of Concept Executive Summary—Infrastructure - Booz Allen Hamilton. Feb. 2009.

  This document provides an overview of the key infrastructure-related findings and recommendations from the POC testing. This volume is intended for executives and managers of organizations interested in the deployment of IntelliDriveSM.

- Final Report: Proof-of-Concept Technical Description—Infrastructure - Booz Allen Hamilton. Feb. 2009.

  This report describes the overall approach undertaken to prove the infrastructure-related VII concepts through a structured testing program. It describes the overall experimental design used in proving the VII concept by providing an overview of the system architecture and design of systems, subsystems, and components, as well as the public sector applications developed to prove some of the system concepts. This volume is intended for engineering managers and practicing engineers interested in the design and development of IntelliDriveSM systems and applications

IEEE 1609 Standards Working Group

(*http://vii.path.berkeley.edu/1609_wave)*

Welcome to the IEEE 1609 Working Group Public Site

The IEEE 1609 Family of Standards for Wireless Access in Vehicular Environments (WAVE) define an architecture and a complementary, standardized set of services and interfaces that collectively enable secure vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) wireless communications. Together these standards are designed to provide the foundation for a broad range of applications in the transportation environment, including vehicle safety, automated tolling, enhanced navigation, traffic management and many others. This web site is primarily for the convenience of the members of the IEEE 1609 Working Group who are developing and maintaining these standards, and includes open minutes and public presentations from their meetings. References to the presentations are given in the minutes. Materials are currently available from the following meetings:

- April 29-May 1, 2008, Los Angeles, California
  - Presentations
  - Minutes
  - Agenda
- August 26-27, 2008, Richmond, California
  - Presentations
  - Minutes
  - Agenda
- October 14-15, 2008, Albany, New York
  - Presentations
  - Minutes
  - Agenda

For more information about these standards and how they may be purchased, see the following reference:

- Fact Sheet about the IEEE 1609 Family of Standards for Wireless Access in Vehicular Environments
  US Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems (ITS) Standards Program

Other information of interest to those participating in IEEE 1609 development includes:

- Selected Presentations from the "M5" Workshop
  Chicago, USA, September 2008
- CALM web site
  includes minutes from the M5 Workshop posted in the publicly available area "Chicago Workshop" along with all the presentations.
- Panel presentations on the commercialization of DSRC/WAVE
  WiVec, Calgary, Alberta, Canada, September 2008

Draft revisions and other materials for members only can be found at the password protected "members only" site:

- DSRC Messaging Standards
  IEEE Vehicular Technology Society (VTS), Intelligent Transportation Systems

Site hosted by California PATH UC Berkeley

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Maintained by Susan Dickey
Last modified: August 31, 2008

1609.0 Purpose and Scope

- **WAVE Objectives** (System Components and Connectivity, Protocol Architecture, Interfaces, Channel Types, Communication Services, Device Roles, Priorities, Channel Coordination)
- **Relevant Standards** (National ITS Architecture, ASTM and FCC, IEEE WAVE Standards, IETF)
- **WAVE Systems Operation** (Communications Without a Service, Communications With a Service*, Time Synchronization and Channel Coordination, Addresses and Identifiers in WAVE**, Distribution System (DS) Portal at Roadside Unit, IPv6 Neighbor Cache)
- **Security Considerations - TBD** (Certificate Management, Encryption of User Traffic, Signature and Validation of User Management Traffic, Anonymity)
- **Annex** – Example System Configuration (WAVE Architecture)

* **Addresses and Identifiers –** (MAC Address, IPv6 Address, Protocols and Ports, Application Identification Using PSID and PSC)

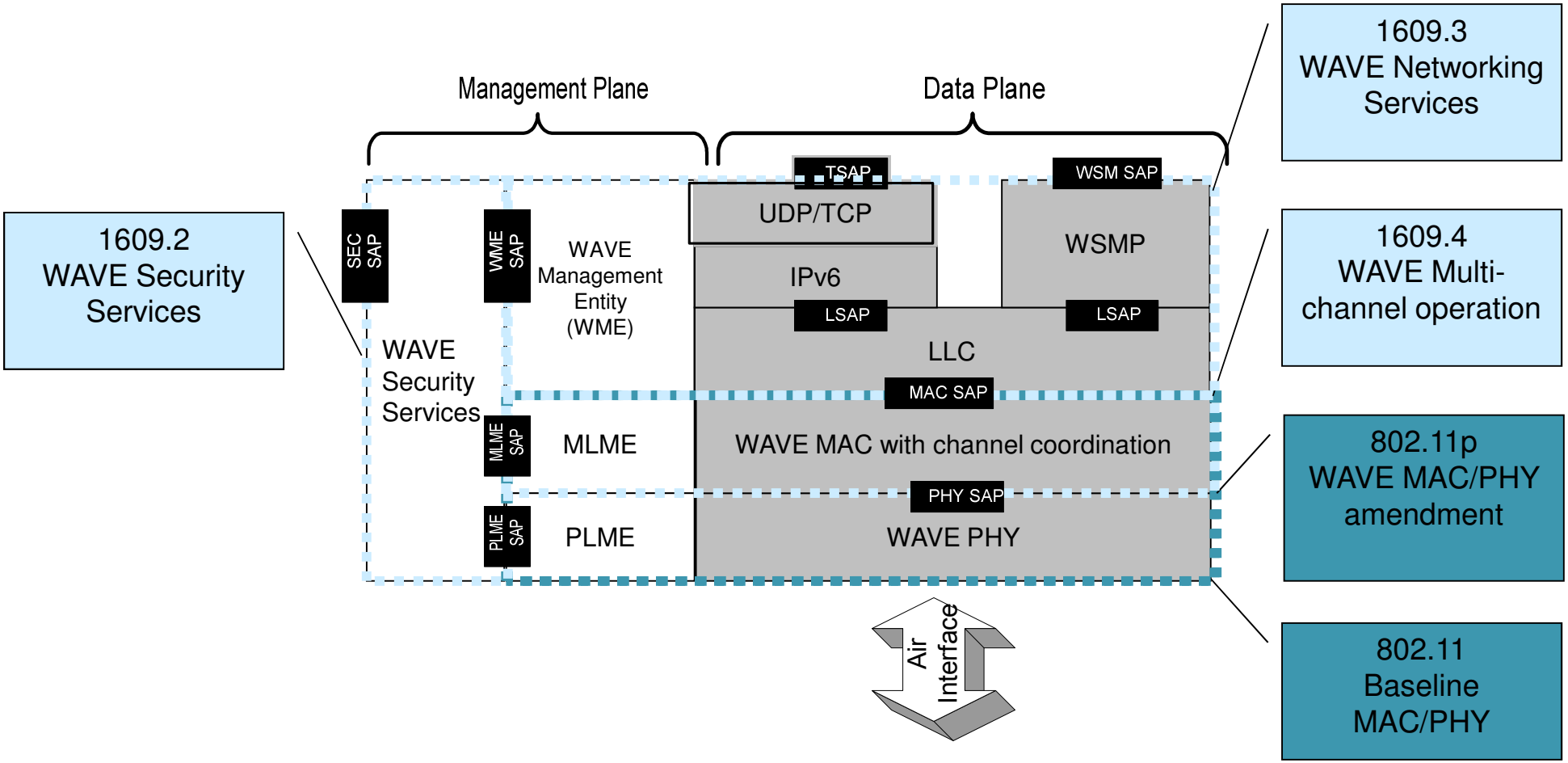
** **Communications With a Service –** (WAVE Service Advertisement, Service Initiation, Service Channel Communications, Service Termination, Adding and Subtracting Applications from an Advertisement

1609.3 Purpose and Scope

- **Data Plane Services** (LLC, IPv6, UDP, Other IP Protocols, WAVE Short Messages - WSMP)
- **Management Plane Services** (Service Requests and Channel Usage Assignment, Automatic Message Generation, Management Data Delivery on Receipt, WSA Monitoring, IPv6 Configuration)
- **Service Primitives** (WAVE Short Message Protocol SAP, WAVE Management Entity SAP, WAVE LSAP, MLME and MLMEX DAP, Security SAP)
- **Over the Air Formats** (WAVE Service Advertisement, WAVE Short Message, WSM Encoding)
- **Annexes** – WME MIB Table, ASN.1 Encoding of the WME MIB, Bibliography and Definitions, Protocol Implementation Conformance (PICS) proforma, Service Usage Examples)
- **Service Usage Examples (Annex E) –** (Provider Service Request, User Service Request with Automatic Channel Assignment, User Service Request with Notification, MIB Monitoring of User Service Request, Multi-Channel Operation)

1609.0 Protocol Model, Updated, with Standards and Access Points

The air interface allows WAVE devices to communicate with each other over the wireless medium. Interfaces between protocol components are accomplished via services access points (SAPs). SAPs are specified in the appropriate standard and are illustrated below. SAPs describe information exchanged, but do not specify the interface implementation. SAPs are comprised of "primitives," each of which is a logical message structure, generally containing a set of data elements for accomplishing a particular function.



Networking and Service Managements Features addressed in the IEEE Standards (1609.0/.3)

Features of 1609.0 and 1609.3	Purpose
WAVE Services (1609.0)	A capability, provided by an application, that makes use of WAVE communication facilities. Services are classifed as Persistent or Non-Persistent
WAVE Management Entity (WME)	A set of management functions required to provide WAVE Networking Services.
WAVE Service Advertisement (WSA)	A data structure containing information that announces the availability of a service. A VSA is composed of such structures
WAVE Short Message Protocl (WSMP)	A protocol for rapid, reliable exchange of messages in a rapidly-varying RF environment where low-latency is also an important objective.
ProviderServiceInfo (MIB Entry)	• WSA-Type ProviderServiceIdentifier Service Priority • ProviderServiceContext Regulatory Class ChannelSelection • Repeat Rate IP Service IPv6 Address • ServicePort Provider MAC AddressServiceStatus
Provider Service Table (PST)	A collection of data describing the applications that are registered with and available though a WAVE device, with supporting channel information.
Provider Service ID (PSID)	A number that identifies ***a service provided by an application***.
Provider Service Context (PSC)	A field associated with a PSID containing supplementary information related to the service. The format of the PSC is PSID dependent.
Control Channel/Service Channel (CCH/SCH)	CCH - A radio channel used for exchange of management frames and WAVE Short Messages. . SCH - Secondary channels used for application specific information exchanges.

In-Vehicle Signage DSRC Setup – SAE J2757 POC Message Set

WSM's broadcast from RSE to OBE's

UNSIGNED PSID's

- 0x02100001 Conditions Advisories: Traffic Delays & Status
- 0x02110001 Conditions Advisories: Weather Conditions
- 0x02120001 Convenience Advisories: Roadside Services
- 0x02130001 Convenience Advisories: Food Services
- 0x02140001 Convenience Advisories: Vehicle Services
- 0x02150001 Convenience Advisories: Lodging Services

SIGNED PSID's

- 0x02020001 Safety Advisories: Roadway Condition
- 0x02030001 Safety Advisories: Civil Emergency
- 0x02040001 Safety Advisories: Cautions
- 0x02010001 Safety Advisories: Road Incident

Message Priorities (SAE DSRC Message Framework Subcommittee DRAFT October 2008)

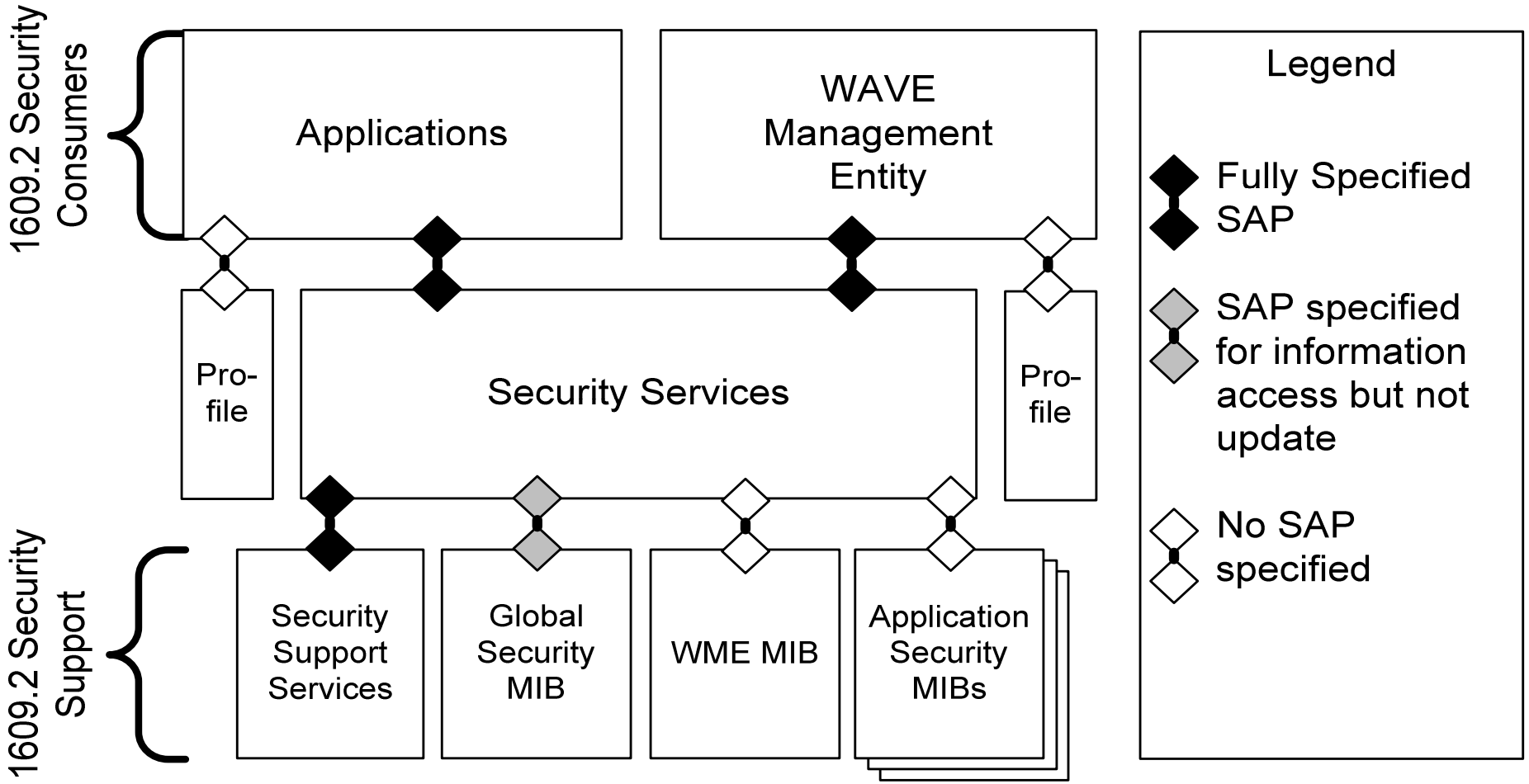
SAE DSRC Message Set & Priorities

Importance Level from USA FCC Policy	Description (When to apply a specific urgency level)	Description (When to apply a specific urgency level)
1 = Safety of Life Applies to those Messages and Message Sets associated with societal and/or safety impact related to human life.	Emergency Impact mitigation and injury avoidance/mitigation	Urgent warning of impending local situation
	Emergency Potential-event impact and/or injury mitigation and avoidance	Situation-based status information of uninvolved local interest
	Urgent Warning Events (Event Flags)	Intersection and vehicle safety status information
2 = Public Safety (Safety not in 1) Applies to Road Side Units (RSU) and On-Board Units (OBUs) operated by state or local governmental entities presumptively engaged in public safety priority communications. (Includes Mobility and Traffic Management Features)	Urgent public safety downloads (Intersection Information)	Semi-urgent public safety data and application enabler
	Public safety data transactions, exchanges	Important Traffic Management status information enabler
	Public safety geospatial context information	Important Announcement of WAVE Services
	Public safety RTCM GPS correction information	Non-urgent Traffic Management Foundational Data
	Semi-urgent public safety link establishment	
3 = Non-Priority Communications (Not in 1 or 2) Applies to Fleet Management, Traveler Information Services and Private Systems.	Urgent, private and commercial electronic transactions	Important, private and commercial electronic transactions
	Semi-Urgent, private mobility data and electronic transactions	Background, private mobility data downloads and upgrades

AuthN/AuthZ Features addressed in the IEEE 1609 Standards

Identity Management Features of 1609.2/1609.3	Purpose
Classes of Digital Certificates	There are **classes of certificates** identified by the ***'subject_type'*** field which describes what kind of entity owns the certificate. It is used to determine the scope of the certificate and the means of identifying the signer
Securing Transactions	Transactions are exchanges in which multiple messages are sent by one or both peers. Transactions are initiated when a user receives a Provider Service Table (PST) as advertised by a WSA
Securing Messages Structures	A secure message type is a published 1609.2 data structure with these options - ***unsecured message***, ***signed message*** or ***signed WSM***.
Bootstrapping Trust	All WAVE equipment are provisioned with a public key that can be used to validate root certificate updates. ***OBEs*** can generate their own key pairs.
Signed Messages	**ECDSA** signed messages provides authentication for WAVE multicast messages.
Encrypting Message Structures	The ***EncryptedMessage*** type is a subtype of the ***SecuredMessage*** type. A WAVE certificate contains one or two keys for either encryption, verification or both functions.
Provider Service ID (PSID)	**A** number that identifies a service provided by an application and announced in the WAVE Service Announcement (WSA) PSID – signed or unsigned frame
Certificate Requests	Device provisioning with certificates use either 'push' or 'pull' model. 'Pull Model' is supported with a CSR message type in 1609.2.
Certificate Revocation Lists	1609.2 defines a CRL type. The 'Security Manager' annex describes the CRL functionality on a 1609 device (i.e. OBE)
Anonymity	Broadcast transmissions from a vehicle operated by a private citizen should not leak information that can be used to identify that vehicle to unauthorized recipients.

1609.2 Security Subsystem Diagram



1609.2 - Example Application Profile (WME)

Sending and receiving secured messages - Application security profiles

An application within the 1609 system shall maintain a security profile. This profile shall have two parts, the secure messaging profile and the security management profile.

For each registered PSID and priority

- *Use1609Dot2* – True
- *SignMessages* – True.
- *SetGenerationTime* – True
- *UseGenerationTime* – True.
- *ExternalGenerationTime* – False
- *SetExpiryTime* – True
- *UseExpiryTime* – True
- *ExternalExpiryTime* – False
- *SetGenerationLocation* – True
- *UseGenerationLocation* – True
- *ExternalGenerationLocation* – False
- *SignerIdentifierType* – Adaptive
- *SignerInfoCertChainLength* – Adaptive
- *EncryptMessages* – No
- *RequireEncryptedMessages* – No
- *DetectReplay* – No
- *MessageValidityPeriod* – Adaptive, with default 5 s
- *MessageValidityDistance* – Adaptive, with default 500m
- *GenerationTimeConfidenceMultiplier* – Adaptive, with default 1.
- *GenerationLocationHorizontalConfidenceMultiplier* – Adaptive, with default 1
- *AcceptableSignerTypes* – WSA Signer
- *RequiredCRLFreshness* – Adaptive, with default 1 year

Security Management profile:

- *SigningKeyAlgorithm* – ECDSA-256
- *EncryptionAlgorithm* – None.

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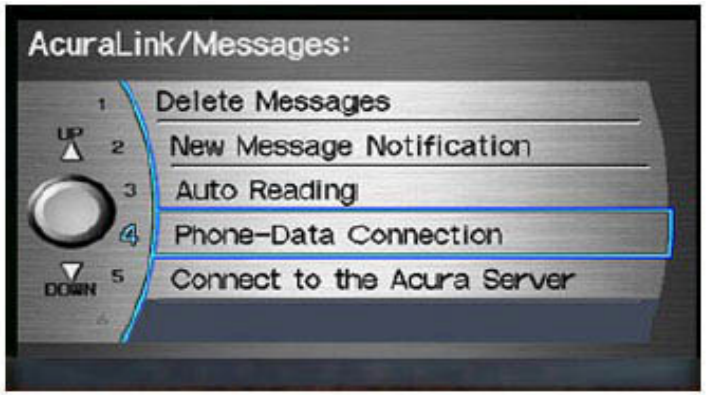
ITS Security and Privacy – Data You Can Trust

Privacy

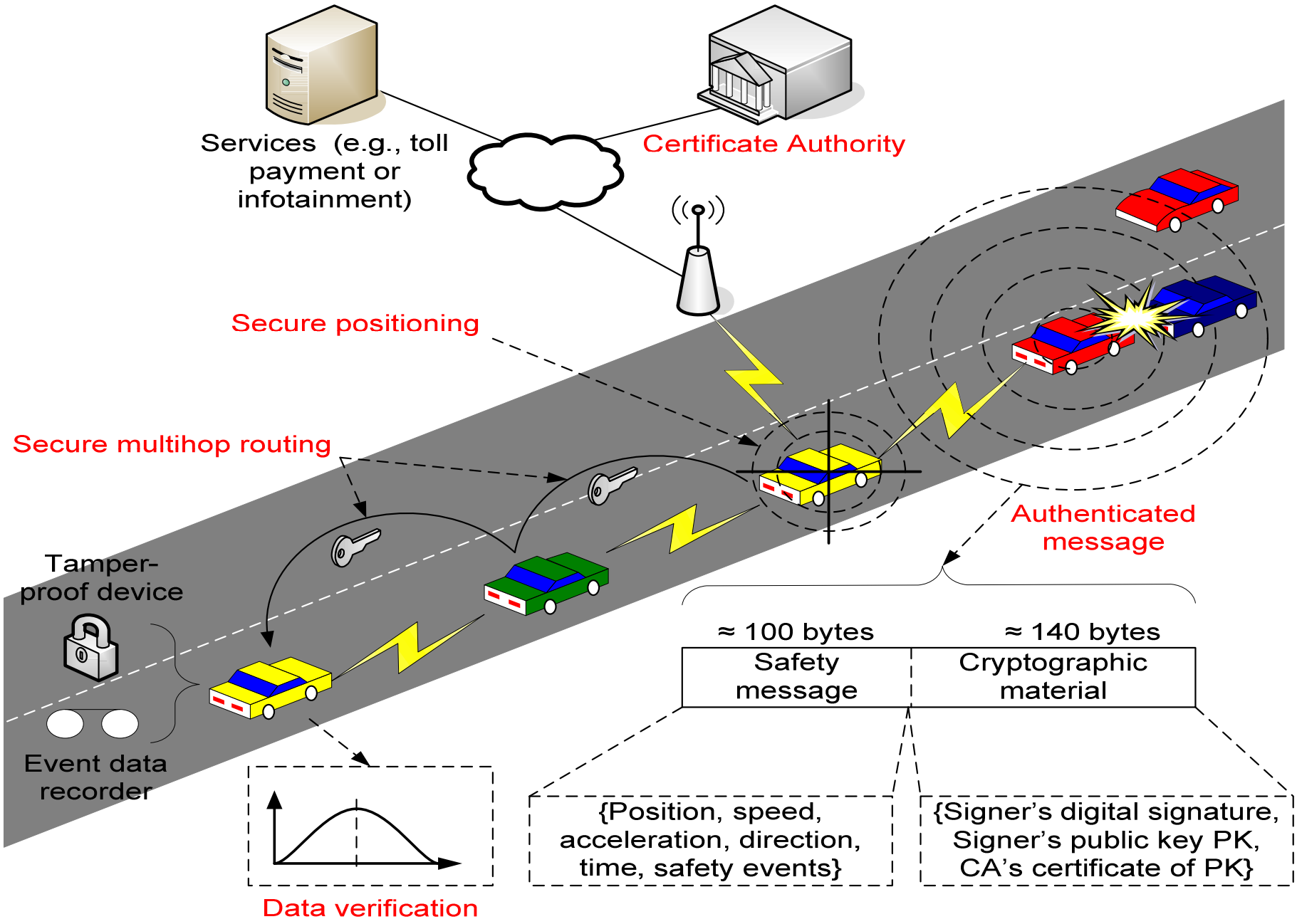


Confidentiality

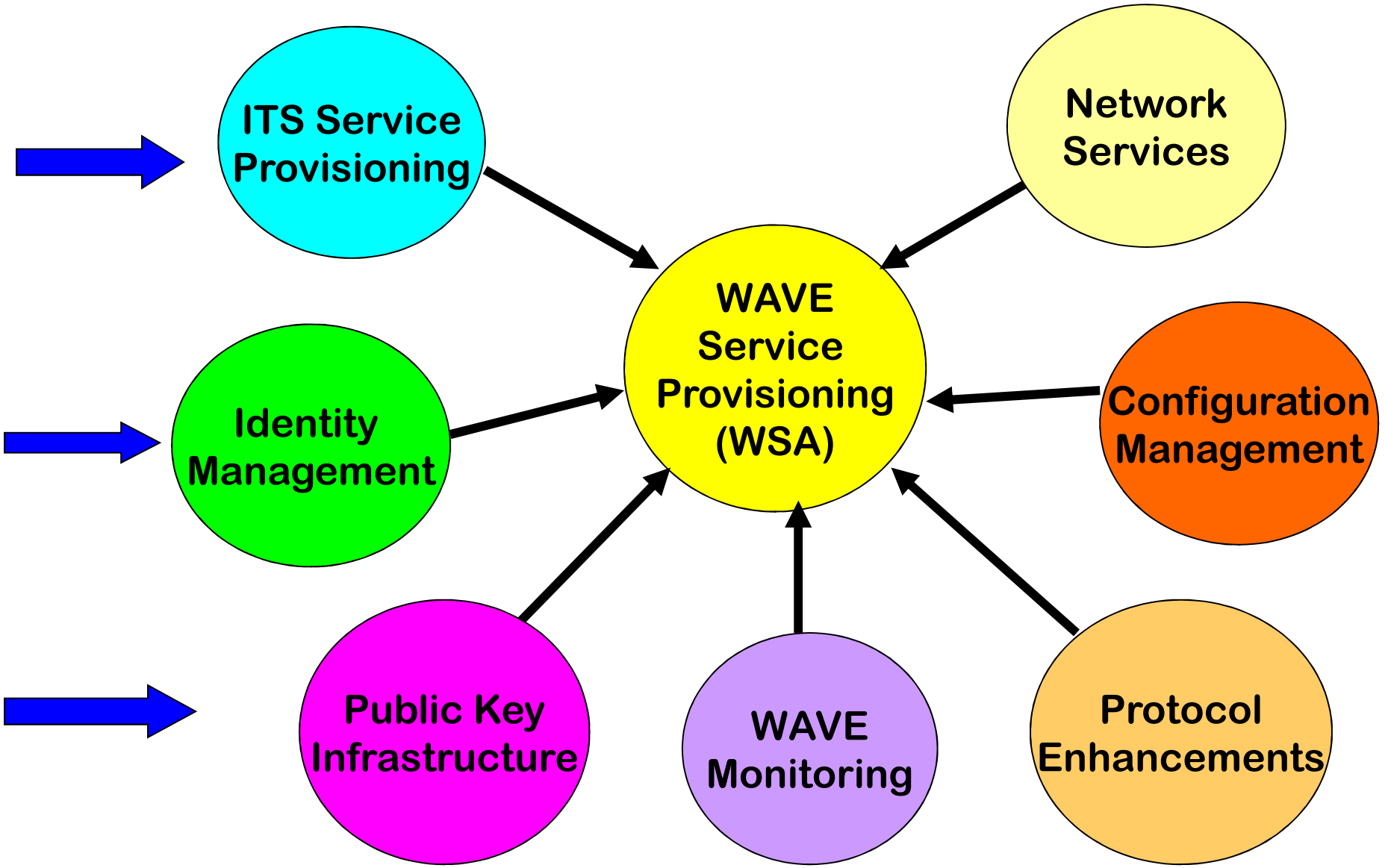
Availability

Integrity

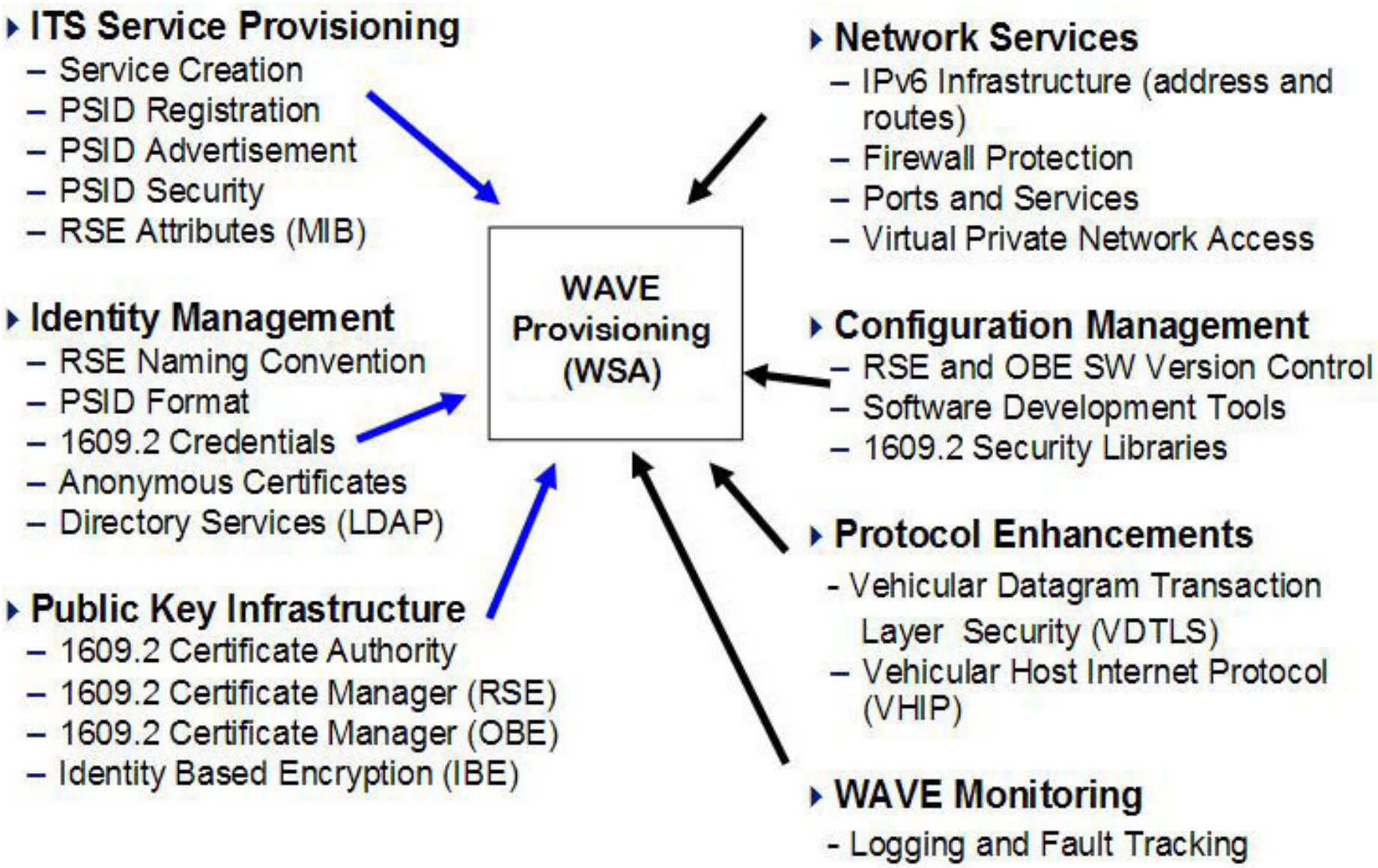
Security Architecture (EPFL – VPKI)



WAVE Architecture Integration – Component Services (1609.2/1609.3)



WAVE Architecture Integration – Component Services (1609.2/1609.3)



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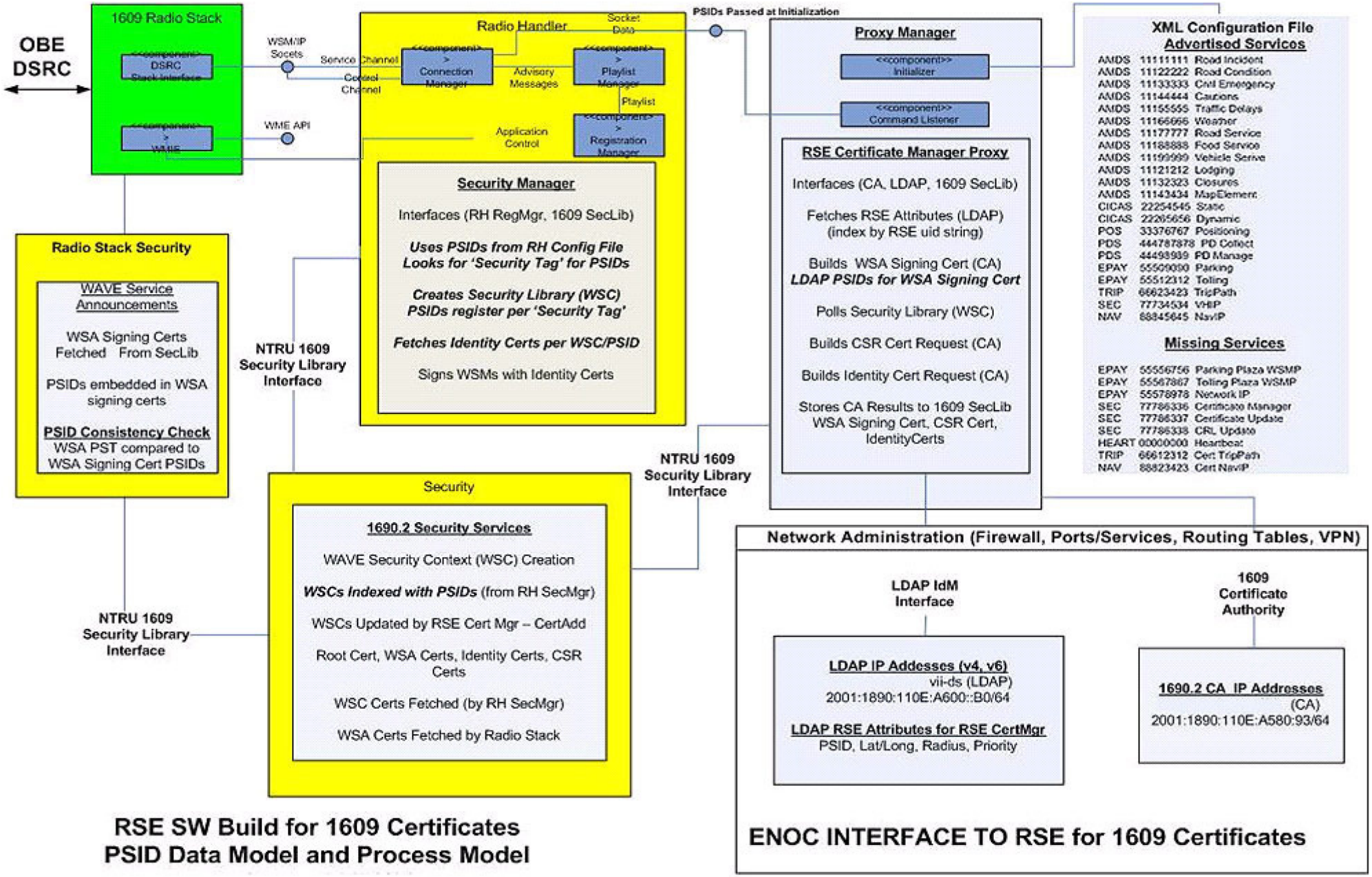
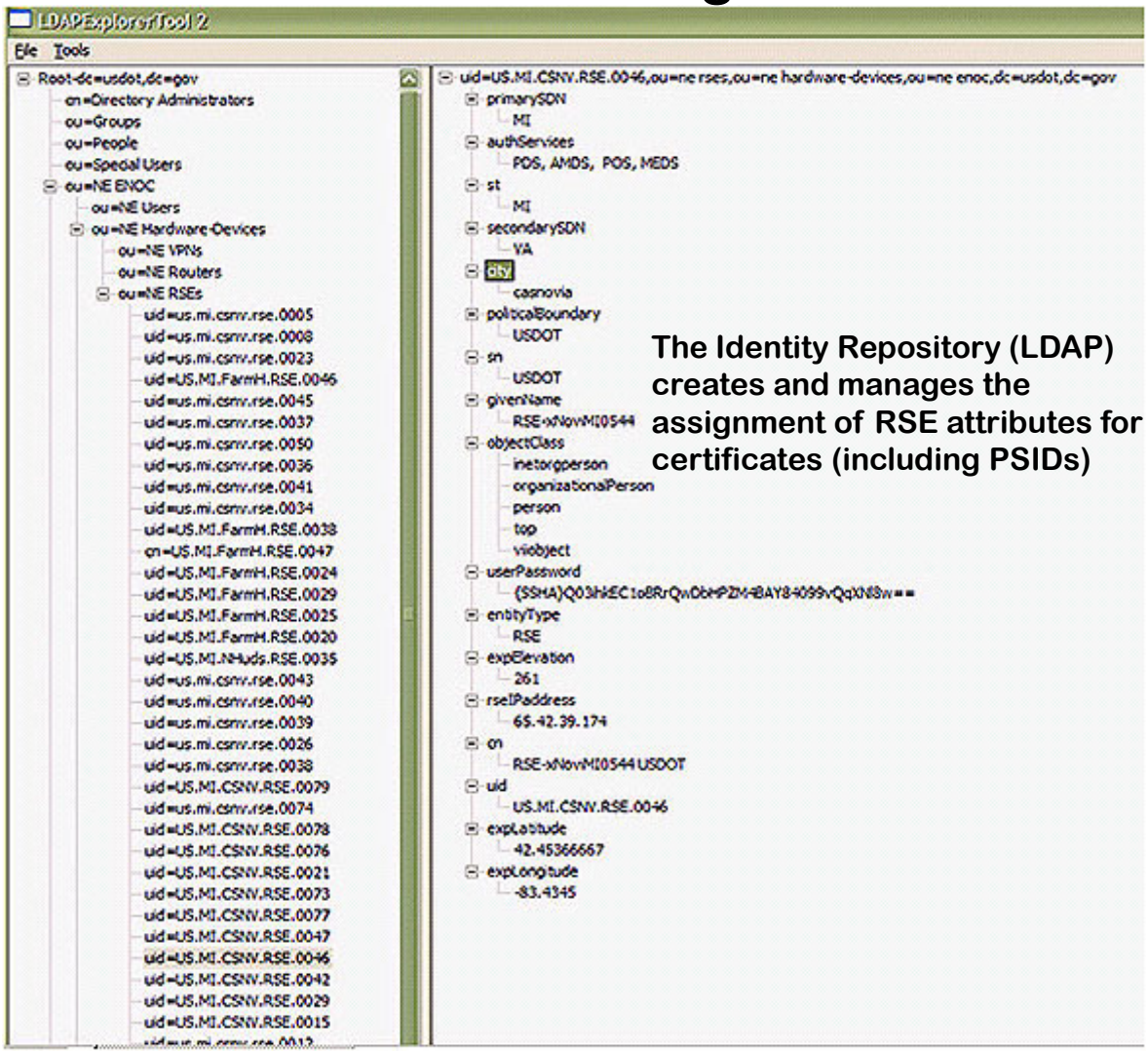
WAVE Architecture Integration (Network and Security Services)



ITS Service Provisioning – 1 of 2



The Identity Repository (LDAP) creates and manages the assignment of RSE attributes for certificates (including PSIDs)

XML Configuration File

Advertised Services

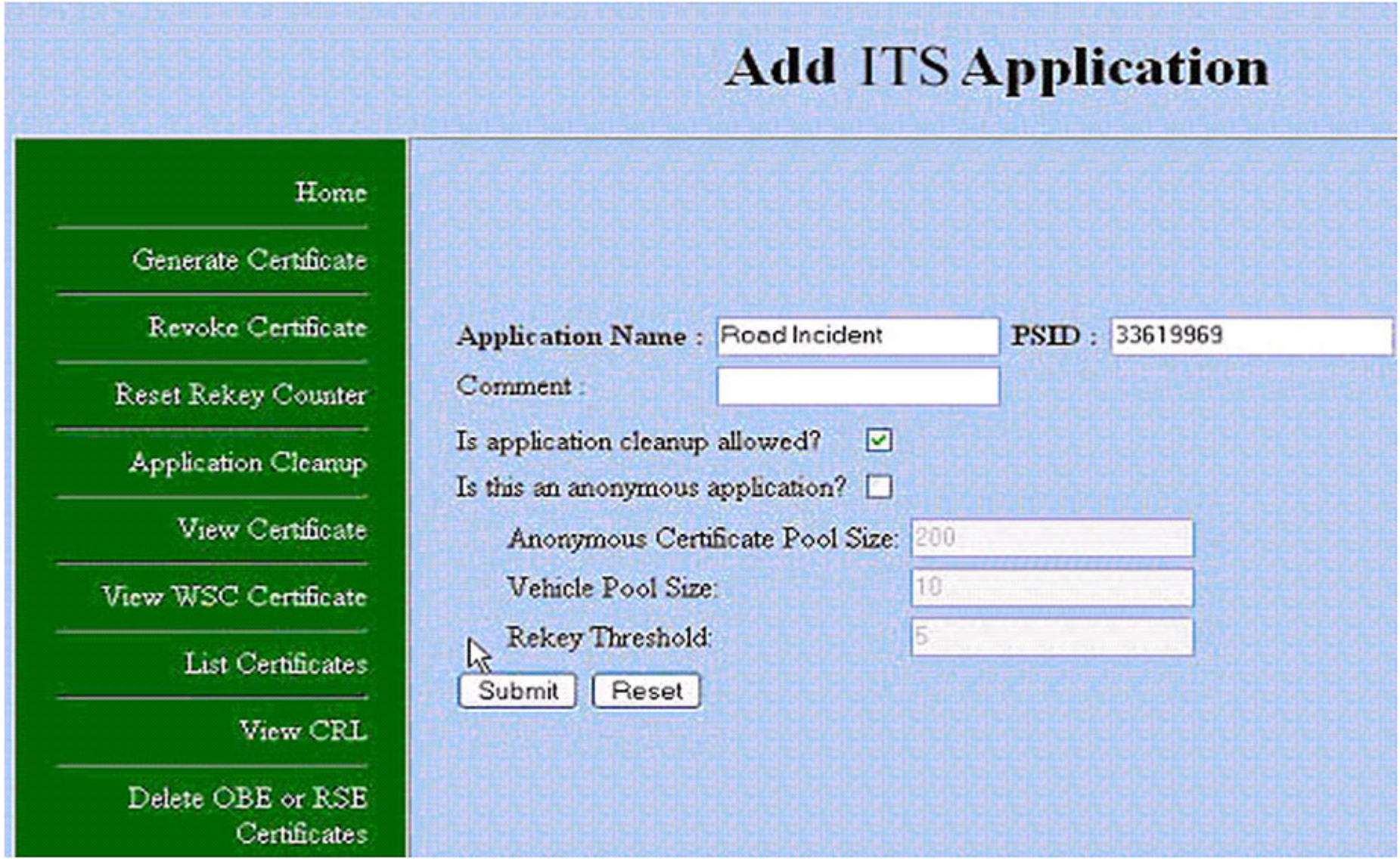
AMDS	11111111	Road Incident
AMDS	11122222	Road Condition
AMDS	11133333	Civil Emergency
AMDS	11144444	Cautions
AMDS	11155555	Traffic Delays
AMDS	11166666	Weather
AMDS	11177777	Road Service
AMDS	11188888	Food Service
AMDS	11199999	Vehicle Servic
AMDS	11121212	Lodging
AMDS	11132323	Closures
AMDS	11143434	MapElement
CICAS	22254545	Static
CICAS	22265656	Dynamic
POS	33376767	Positioning
PDS	444787878	PD Collect
PDS	44498989	PD Manage
EPAY	55509090	Parking
EPAY	55512312	Tolling
TRIP	66623423	TripPath
SEC	77734534	VHIP
NAV	88845645	NavIP

Missing Services

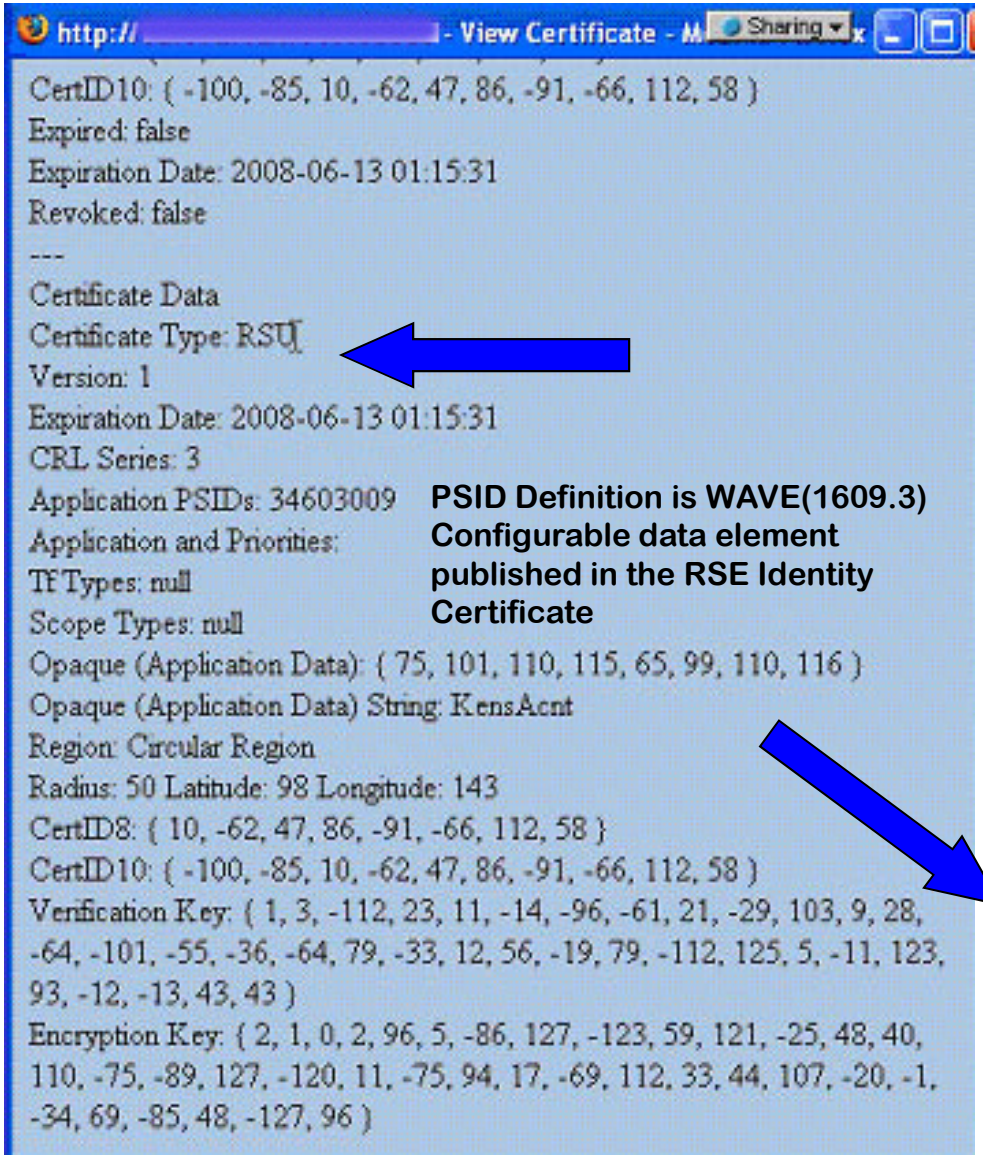
EPAY	55556756	Parking Plaza WSMP
EPAY	55567867	Tolling Plaza WSMP
EPAY	55578978	Network IP
SEC	77786336	Certificate Manager
SEC	77786337	Certificate Update
SEC	77786338	CRL Update
HEART	00000000	Heartbeat
TRIP	66612312	Cert TripPath
NAV	88823423	Cert NavIP

11111111,11122222,11133333,11144444,11155555,11166666,11177777,11188888,11199999,11121212,11123232,11143434,22254545,22265656,33376767,444787878,44498989,55509090,55512312,66623423,77734534,88845645,55556756,55567867,55578978,77786336,77786337,77786338,00000000,66612312,88823423 ← PSID Provisioning String

ITS Service Provisioning – 2 of 2



ITS Identity Management (PSID Creation) – 1 of 2



PSID Definition is WAVE(1609.3) Configurable data element published in the RSE Identity Certificate

Certificate Id	Certificate Type	PSID	OBE/RSE Identifier	Revoked	Pool Index
2999	CSR	34603009	us.mi.csnv.rse.0005	N	N/A
3000	RSU Identifying	34603009	us.mi.csnv.rse.0005	N	N/A
2998	CSR	83886337	us.mi.csnv.rse.0005	N	N/A

PSID					Service Series	Service Category	POC Applications
App Series/ Subseries		Not Used	Reserved	Iteration			
01	xx	xx	x	x	Safety		
01	02	00	0	0		Vehicle to Vehicle Safety Services	Used in WSA to Advertise Vehicle to Vehicle Services and for Certificates (not used in POC, and possibly never used)
01	02	00	0	1			Heartbeat Message WSM and Certs
01	03	00	0	0		Positioning Services	Used in WSA to Advertise Positioning Services and for Certificates (not used in POC)
01	03	00	0	1			HANDGPS Network Corrections WSM and Certs
02	01	00	0	0		Advisory Services: Road Incident	Used in WSA to Advertise Road Incident Advisory Services and for Certificates (not used in POC)
02	01	00	0	1			Road Incident Advisory WSMs and certs
02 01 00 02 to 02 01 FF FF						Unused Road Incident	
02	02	00	0	0		Advisory Services: Roadway Condition	Used in WSA to Advertise Roadway Condition Advisory Services and for Certificates (not used in POC)
02	02	00	0	1			Roadway Condition Advisory WSMs and certs
02 02 00 02 to 02 02 FF FF						Unused Roadway Condition	
02	03	00	0	0		Advisory Services: Civil Emergency	Used in WSA to Advertise Civil Emergency Advisory Services and for Certificates (not used in POC)
02	03	00	0	1			Civil Emergency Advisory WSMs and certs

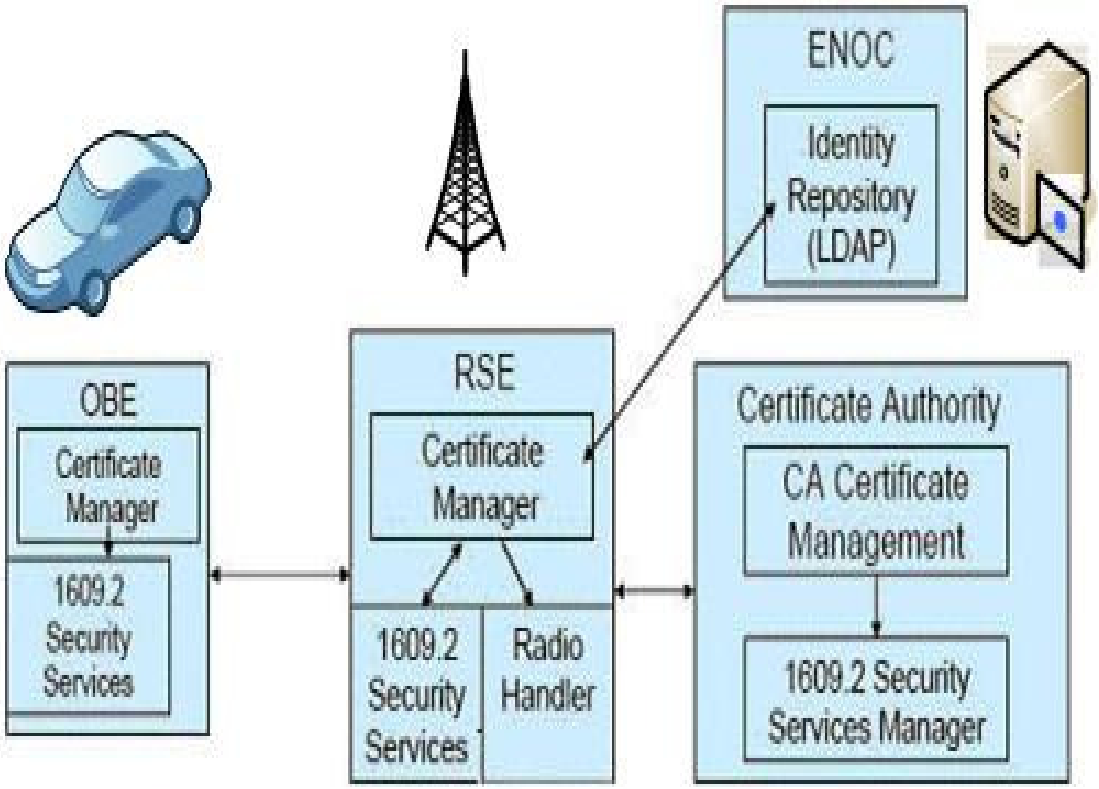
ITS Identity Management (PSID Creation) – 2 of 2

Certificate Information

Database Data
Certificate ID: 3020
CertificateType: CSR
PSID: { 2, 22, 0, 1 }
PSID numeric: 34996225
Application Data: { 82, 69, 80, 76, 65, 67, 69, 95, 77, 69 }
CertID8: { -4, -19, 8, 98, -123, 125, -55, -74 }
CertID10: { -95, 124, -4, -19, 8, 98, -123, 125, -55, -74 }
Expired: false
Expiration Date: 2008-06-14 03:29:30
Revoked: false

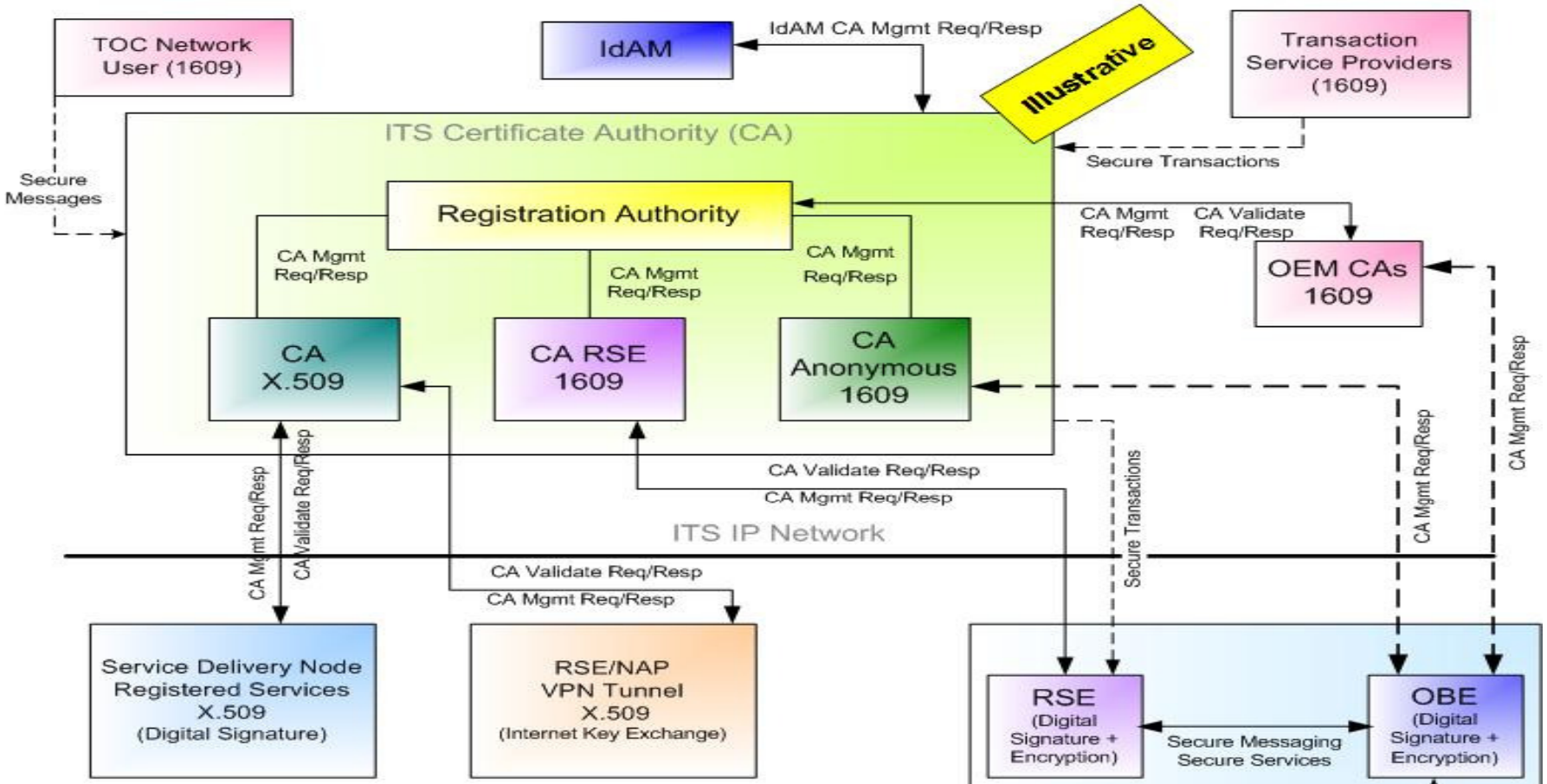
Certificate Data
Certificate Type: CSR_SIGNER
Version: 1
Expiration Date: 2008-06-14 03:29:30
CRL Series: 2
Application PSIDs: 34668545, 33619969, 16842753, 34799617, 33751041, 83886337, 34930689, 35061761, 50266112, 16777217, 50331649, 34603009, 67108865, 34734081, 33685505, 17039361, 34865153, 33816577, 67371009, 34996225
Application and Priorities:
Tf Types: RSU
Scope Types: RSU
Opaque (Application Data): { 82, 69, 80, 76, 65, 67, 69, 95, 77, 69 }
Opaque (Application Data) String: REPLACE_ME
Region: Circular Region
Radius: 5 Latitude: 82 Longitude: 42
CertID8: { -4, -19, 8, 98, -123, 125, -55, -74 }
CertID10: { -95, 124, -4, -19, 8, 98, -123, 125, -55, -74 }
Verification Key: { 1, 3, -78, -51, -26, 50, 87, -91, 67, 9, -124, -67, -43, 14, -9, 19, 27, -37, 44, -78, -122, 11, 87, 48, 107, 53, -50, 22, 2, 52, -84, -84, -83, -30 }
Encryption Key: null

A Certificate Signing Request (CSR) is used to request RSE Identity Certificates



The RSE Certificate Manager provides management of the certificates within an RSE required to secure the communications of Identifying applications over the WAVE radio access network. The RSE Certificate Manager communicates with the Certificate Authority to acquire and replace certificates and to process certificate revocations .

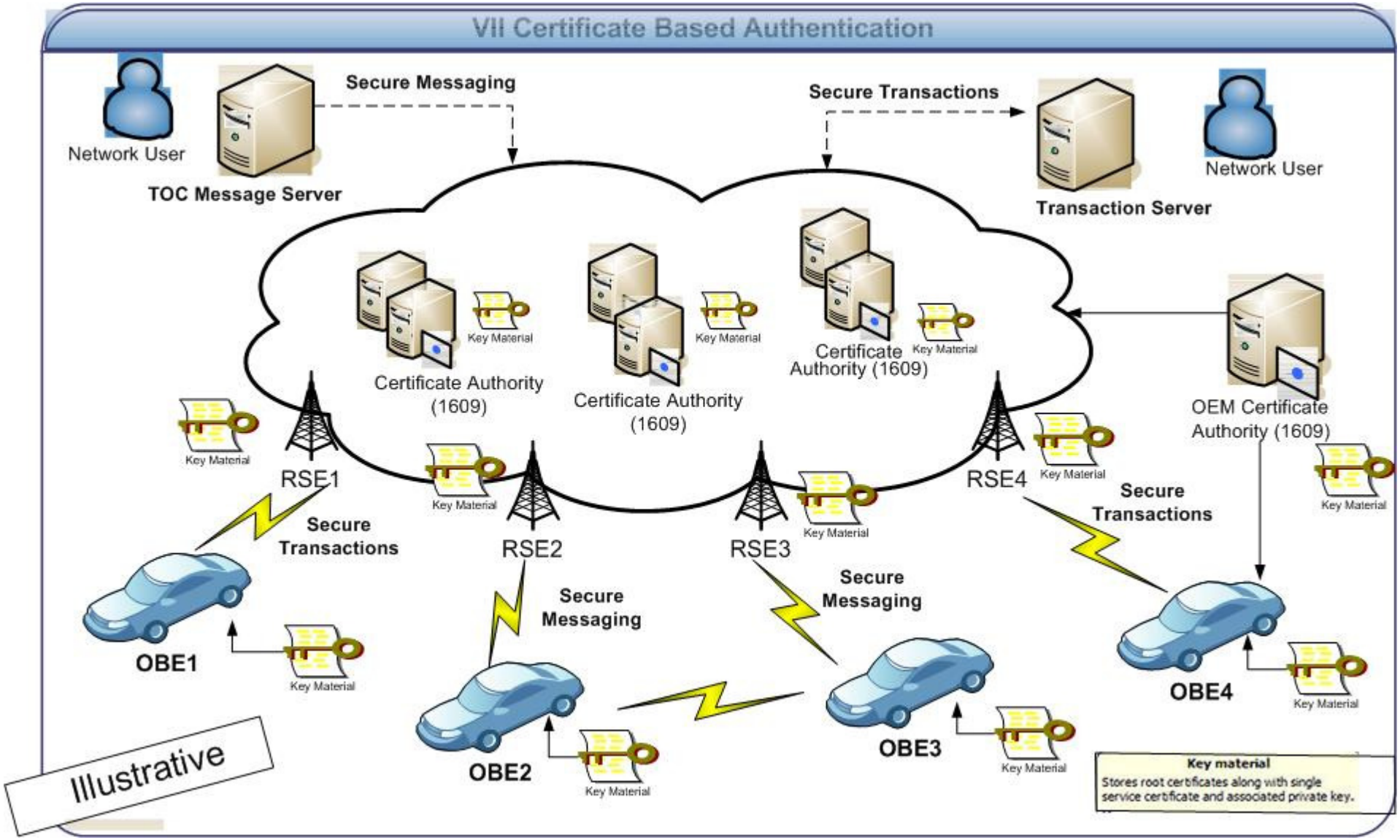
Public Key Infrastructure - Certificate Authority Architecture



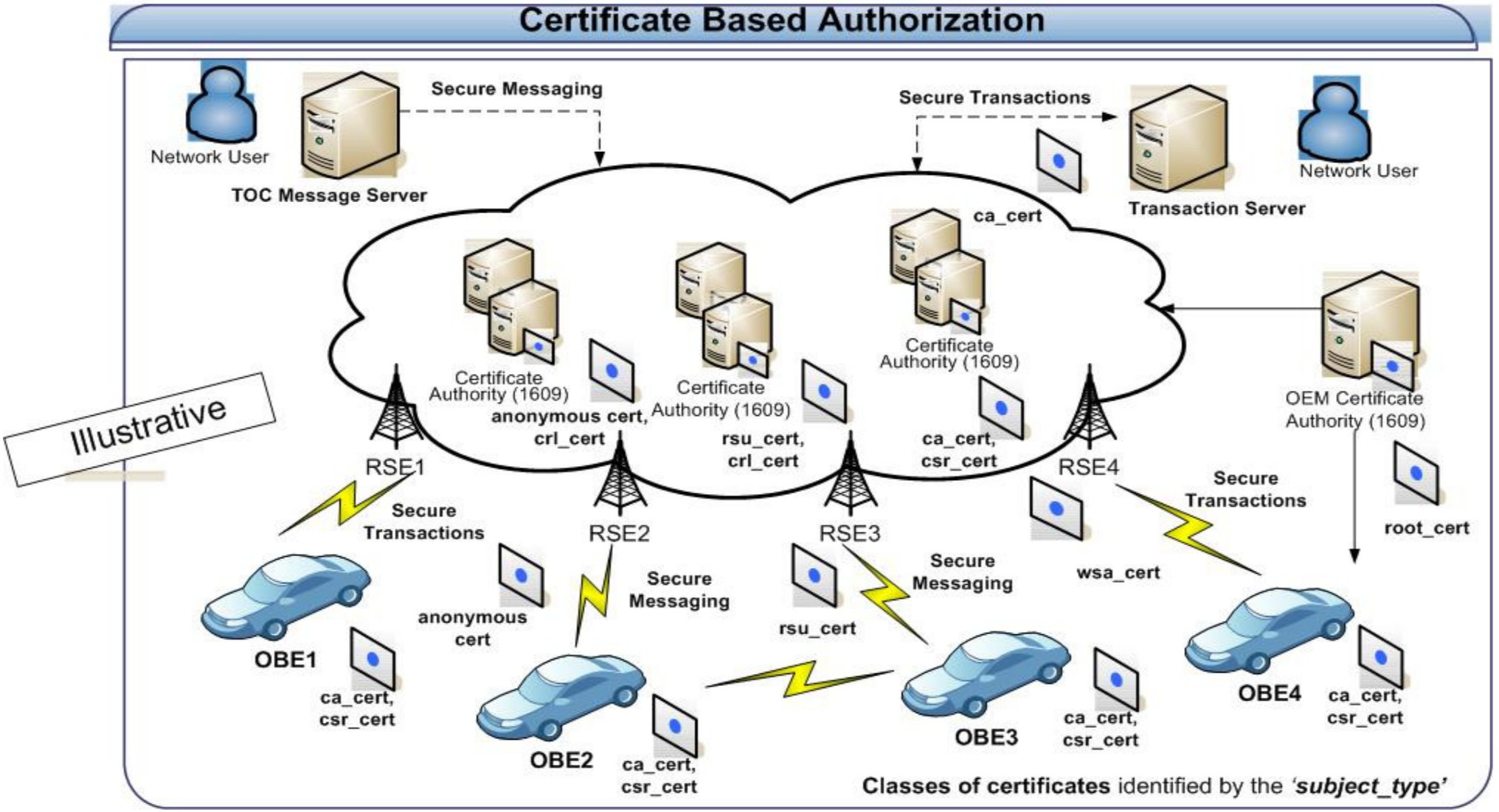
Transaction Service Provider – , Network Users that send and receive information to or from other Network Users, Vehicles or Public Service Vehicles using facilities provided by the ITS System. Example: State DOT Transportation Traffic Management Center.

Transportation Operations Center (TOC) Network User – Advisory Providers that publish information to the ITS System. Example: a weather alerts provider, that issues warnings regarding weather events

Illustrative mapping of 1609.2 Authentication Scenarios



Illustrative Mapping of 1609.2 Authorization Scenarios



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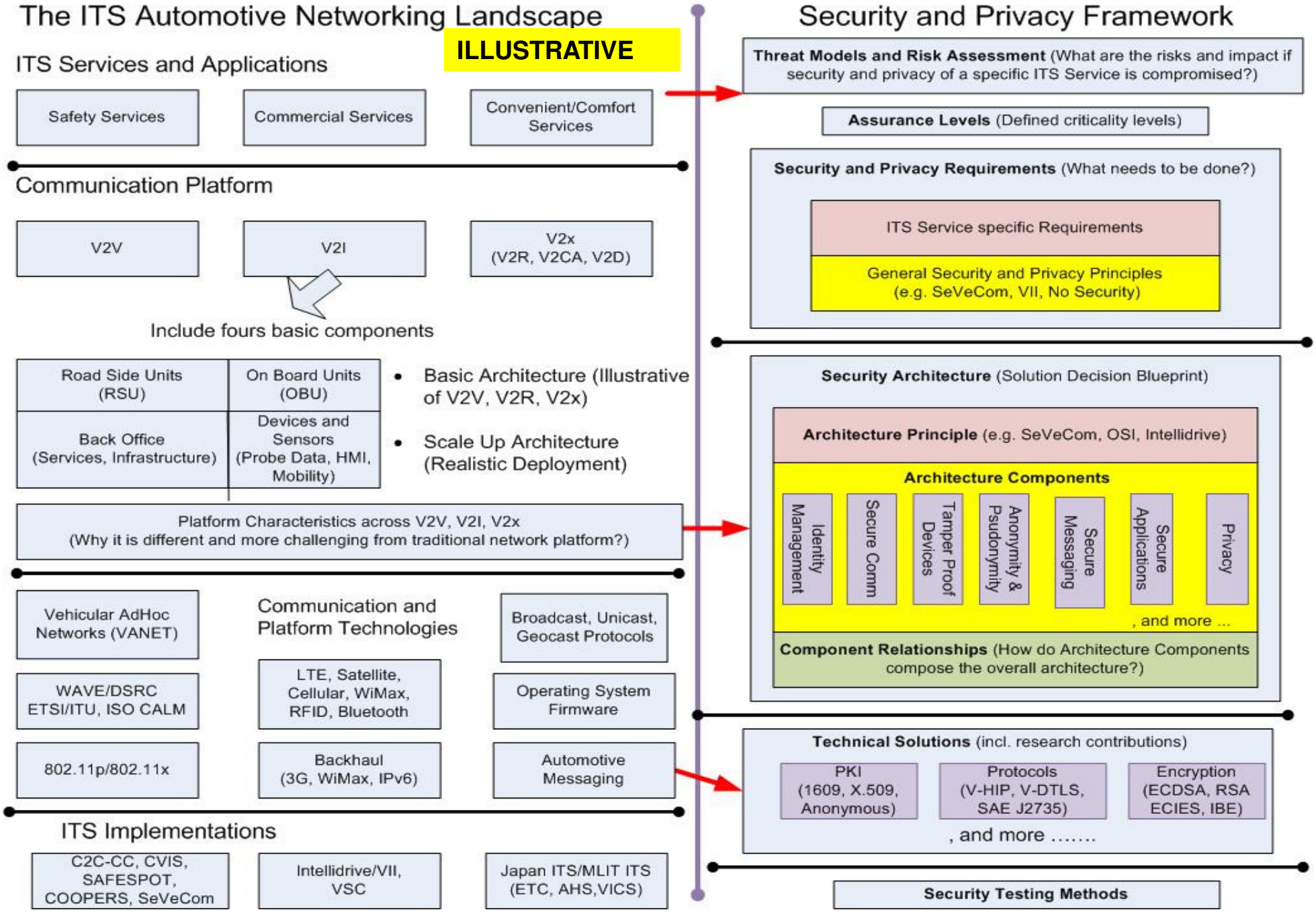
The ITS Automotive Networking Landscape
ILLUSTRATIVE
ITS Services and Applications
Safety Services
Commercial Services
Convenient/Comfort Services
Communication Platform
V2V
V2I
V2x (V2R, V2CA, V2D)
Include fours basic components
Road Side Units (RSU)
On Board Units (OBU)
Back Office (Services, Infrastructure)
Devices and Sensors (Probe Data, HMI, Mobility)
• Basic Architecture (Illustrative of V2V, V2R, V2x)
• Scale Up Architecture (Realistic Deployment)
Platform Characteristics across V2V, V2I, V2x
(Why it is different and more challenging from traditional network platform?)
Vehicular AdHoc Networks (VANET)
WAVE/DSRC ETSI/ITU, ISO CALM
802.11p/802.11x
Communication and Platform Technologies
LTE, Satellite, Cellular, WiMax, RFID, Bluetooth
Backhaul (3G, WiMax, IPv6)
Broadcast, Unicast, Geocast Protocols
Operating System Firmware
Automotive Messaging
ITS Implementations
C2C-CC, CVIS, SAFESPOT, COOPERS, SeVeCom
Intellidrive/VII, VSC
Japan ITS/MLIT ITS (ETC, AHS,VICS)
Security and Privacy Framework
Threat Models and Risk Assessment (What are the risks and impact if security and privacy of a specific ITS Service is compromised?)
Assurance Levels (Defined criticality levels)
Security and Privacy Requirements (What needs to be done?)
ITS Service specific Requirements
General Security and Privacy Principles (e.g. SeVeCom, VII, No Security)
Security Architecture (Solution Decision Blueprint)
Architecture Principle (e.g. SeVeCom, OSI, Intellidrive)
Architecture Components
Identity Management
Secure Comm
Tamper Proof Devices
Anonymity & Psudonymity
Secure Messaging
Secure Applications
Privacy
, and more ...
Component Relationships (How do Architecture Components compose the overall architecture?)
Technical Solutions (incl. research contributions)
PKI (1609, X.509, Anonymous)
Protocols (V-HIP, V-DTLS, SAE J2735)
Encryption (ECDSA, RSA ECIES, IBE)
, and more .....
Security Testing Methods

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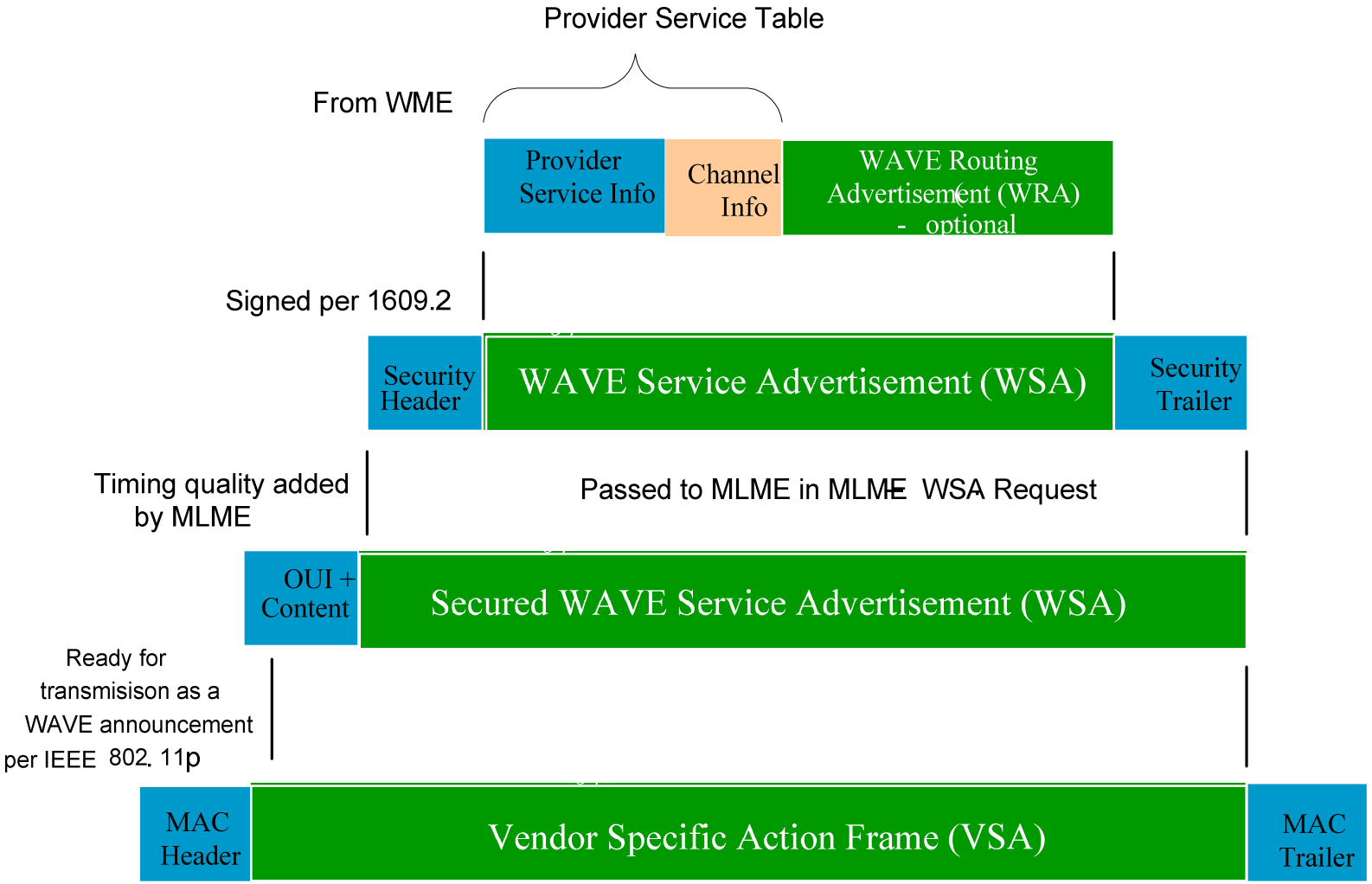
Thank you for joining us!

For JDBiggs and Associates
Identity and Access Management Practice –

WAVE Networking Services – Secure WAVE Service Advertisement (1609.0)

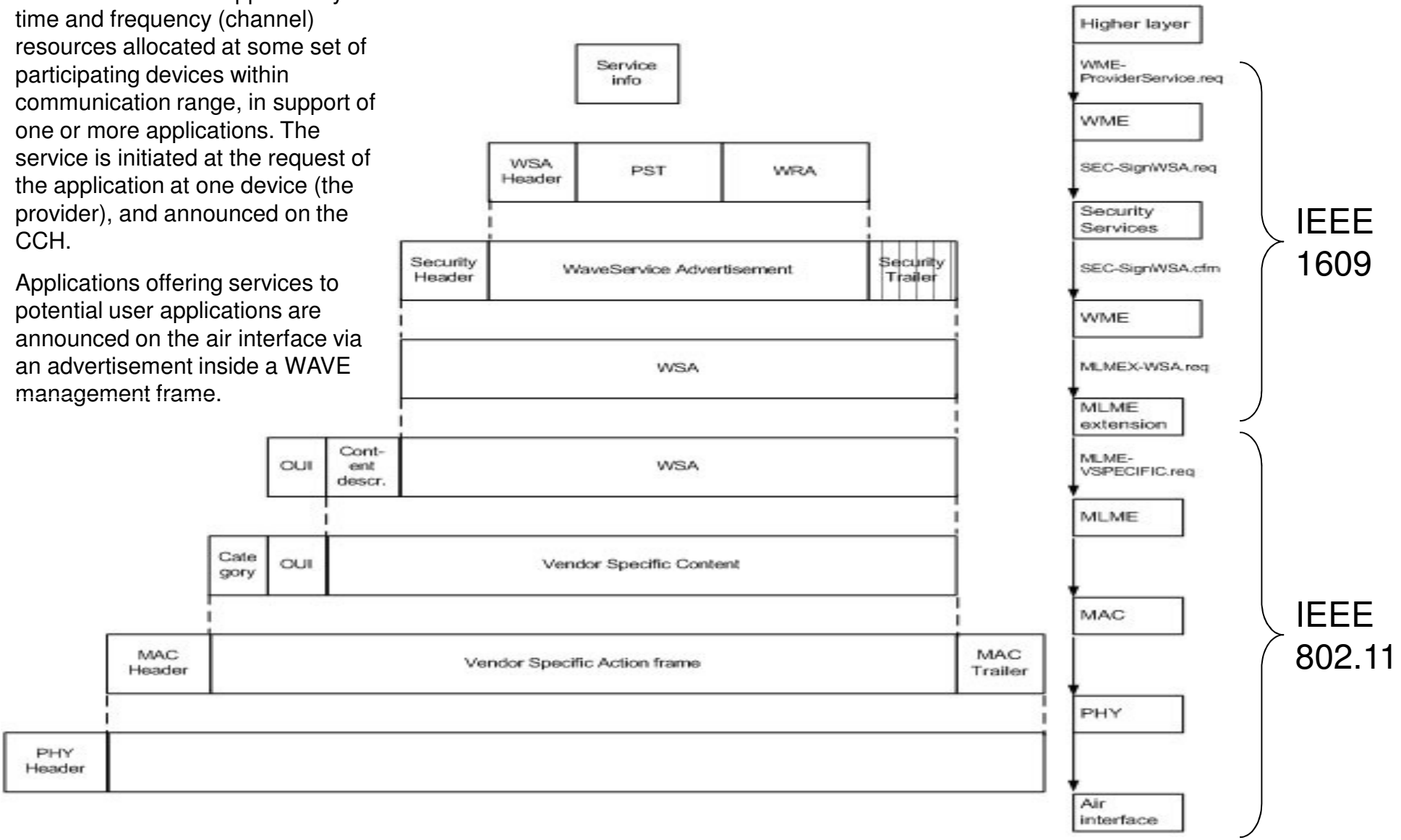
The WME generates a WAVE Service Advertisement, which will be transmitted to potential service users. The WME collects the application information describing the services being offered, previously registered in its MIB, and channel characteristics, also from the MIB, and inserts them into the WAVE Service Advertisement as a Provider Service Table (PST). In addition, if the service is IP-oriented the IP network configuration information (WRA) from the MIB is included.



WAVE Advertisement – Communication with a service (1609.0)

A WAVE service is supported by time and frequency (channel) resources allocated at some set of participating devices within communication range, in support of one or more applications. The service is initiated at the request of the application at one device (the provider), and announced on the CCH.

Applications offering services to potential user applications are announced on the air interface via an advertisement inside a WAVE management frame.



WAVE Networking Services – WAVE Service Advertisement (new format)

Streamlines message. Makes more consistent use of WAVE Element IDs and Extension (optional) fields.