Communications for Vehicle Safety

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Programme

- Overview of the CEN programme
- Some info on CEN DSRC
- Overview of the ISO programme
- Overview of WG16 – Wide Area Communications

- And tomorrow – CALM!

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Standardisation – an overview

General	Electro	Comm.	IT
ISO	IEC	ITU	ISO JTC1 IEC INFORMATION TECHNOLOGY STANDARDS JTC1
CEN	CENELEC	ETSI	CEN CENELEC ETSI ICTSB
NS	NEK	pt	NTS

CEN TC/278

Road Transport and Traffic Telematics

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CEN TC278 - Road Transport and Traffic Telematics

WG	CEN TC278 RTTT	Nation	Convenor
1	Electronic Fee Collection	NL	H. Stoelhorst
2	Freight and Fleet Management	F	Rennesson
3	Public Transport	F	Franchineau
4	Traffic & Traveller Information	GB	P. Burton
5	Traffic Control	GB	T. Sullivan
6	Parking Management	F	J.P.de Borgo
7	Geographic Road Database	D	W. Zechnall
8	Road data/elaboration, storage, distrib.	NL	H. de Winter
9	Dedicated Short Range Communication	D	C.Rokitanski
10	Man-machine Interfaces	D	C. Heinrich
11	Subsystem/Intersystem Interfaces	GB	
12	Automatic Vehicle and Equipment ID	N	K.Evensen
13	Architecture and Terminology	GB	R.Williams
14	After-theft Systems for Vehicle Recovery	F	J.P.Paschal

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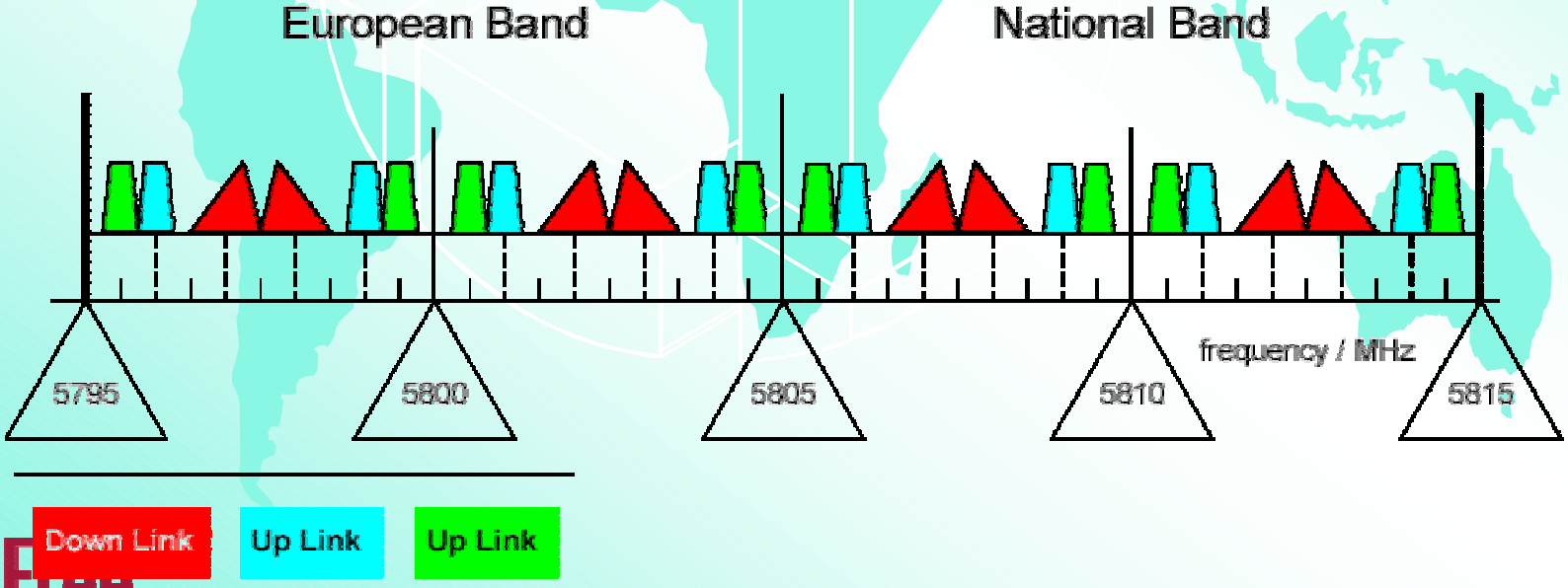
What is DSRC?

- Dedicated Short Range Communication
- Dedicated = Developed for ITS
- Short-Range = 1 – 40 meters, typ 8-10 m
  - 2W EIRP ASK downlink (roadside – vehicle)
  - 50mW DPSK reflected uplink (veh – roadside)
  - Passive mixing reflector – no RF generated in vehicle



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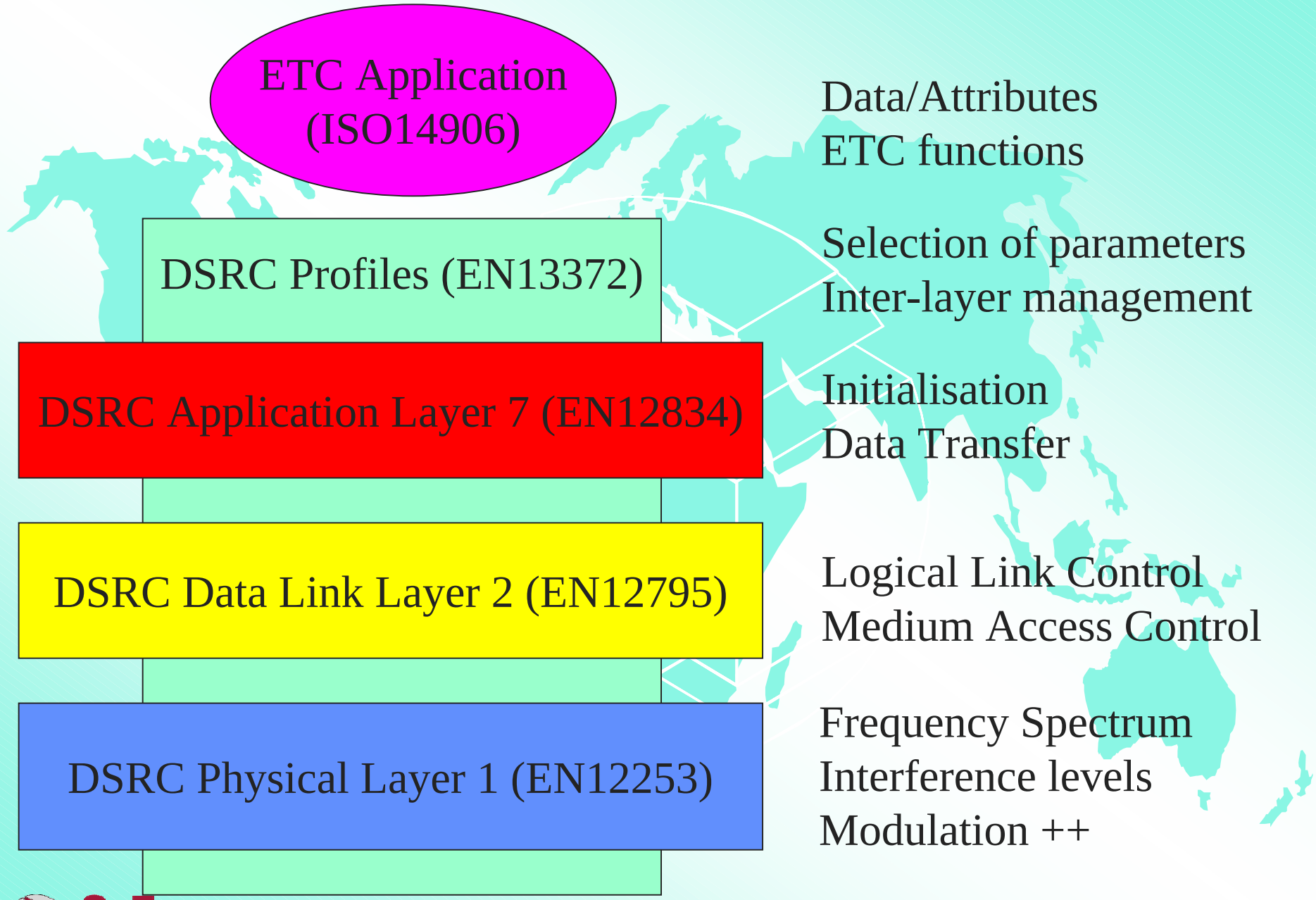
ETC Application
(ISO14906)
DSRC Profiles (EN13372)
DSRC Application Layer 7 (EN12834)
DSRC Data Link Layer 2 (EN12795)
DSRC Physical Layer 1 (EN12253)
Data/Attributes
ETC functions
Selection of parameters
Inter-layer management
Initialisation
Data Transfer
Logical Link Control
Medium Access Control
Frequency Spectrum
Interference levels
Modulation ++

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Standardisation of DSRC

- DSRC started in 1993 in CEN TC278/WG9
- A set of four CEN standards approved period 1997-1999:
  - ENV 12253 – DSRC Physical Layer
  - ENV 12795 – DSRC Link Layer
  - ENV 12834 – DSRC Application Layer
  - ENV 13372 – DSRC Profiles
- ETSI produced EN 300 674 for Type Approval/Conformance Testing

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Status

- CEN DSRC standards have provided 6 years of stability
- Two standards are approved EN
- Two standards will be voted before Christmas

Oslo AutoPASS plaza

Portugal DSRC plaza

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Interoperability

- Tests have been performed all over the world, both commercially and as part of EU R&D:
  - China
  - Brazil
- Real multi-vendor operation in at least:
  - Australia
  - Switzerland
  - France

DSRC system in China

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DSRC Applications

- Road Pricing
- Priority in intersections for public transport & emergency veh. Safety
- Metro safety communication
- Electronic license plate
- Access Control
- Fleet control
- Park&Ride

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Experience on radio performance

- **Experience shows: The best possible microwave performance is needed.**
- **In real life, microwaves behave contrary to lab-tests and computer models. Reflections, multipathing and effects like skin ducting often lead to counter-intuitive behavior of the system. These effects are stronger in a city environment than in a controlled motorway-tolling situation.**

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The future of DSRC

- **CEN DSRC has proven its:**
  - **use in urban environments,**
  - **applicability in many ITS applications,**
  - **suitability for interoperability,**
  - **high performance and good security.**

- **To learn more:**
  Dr. Fischer's DSRC textbook –
  http://www.esf-gmbh.de/esf/index.htm

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ETSI
ERM TG37
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ETSI ERM TG37

- A new Topic Group dedicated to ITS communication
- Very good relation to CALM
- Chairman is Bob Williams

- TG37 will look at:
  - Spectrum matters 5-6 GHz for Europe
  - Cellular convergence standards
  - Testing and formal protocol verification

- Please see www.etsi.org ERM forum

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ISO TC/204

Intelligent Transport Systems

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Scope of TC204

- **Provide standards for information, control and communications systems in surface transport including:-**
  - **Intermodal and multimodal traveler and freight services (Road,rail,maritime).**
  - **Driver, Traveler and Traffic information.**
  - **Road Traffic management.**
  - **Public - and Commercial / Freight- transport.**
  - **Emergency and hazard management.**

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Responsibilities and Secretariat

- Systems and infrastructure –interaction aspects of ITS.
- Coordination of ISO work program in the field of ITS.
- Coordination with other international standards organizations.
- New Secretariat at ITS-America - contact Najarian@itsa.org
- Two Plenary Mtgs per Year since launch in March 1993

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Overview TC/204

- Around 25 voting members
- Around 25 observing members
- Around 10 liaisons (JTC1, TC22, CEN, IEEE etc.)
- Complex communication involves many actors, and need stable a (formal) platform
- Challenge: A full ISO standard usually takes two years for formal process

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Objectives of TC204 include:-

- ITS architectures, terminology & data registrars.
- Protocols and methods for communications between traffic-control & emergency-call centers, as well as to & from vehicles .
- Automatic vehicle & equipment identification.
- Interoperability of Location-Based information.
- Characteristics & performance of ITS-related vehicle-to-infrastructure and inter-vehicle communications, for driver assistance & guidance.
- International, multimodal end-to-end people & freight transport.

Structure of TC/204

[WG4, 10,14,15,16 of interest to comms.]

ISO/TC204 Intelligent Transport Systems		
WG1	Architecture	R.K. Williams – U.K.
WG3	TICS Database Technology	M. Shibata - Japan
WG4	Automatic Vehicle Identification (CEN WG12)	K. Evensen - Norway
WG5	Fee & Toll Collection (CEN WG1)	H. Stoelhorst – Netherlands
WG6	General Fleet Management	Merged with WG7
WG7	General Fleet Management & Commercial/Freight	R. Sabounghi - Canada
WG8	Public Transport/Emergency	A. Kiepper – U.S.A.
WG9	Integrated Transport Information, Management & Control	D. Clowes – U.K.
WG10	Traveler Information Systems	P. Burton – U.K.
WG11	Route Guidance & Navigation Systems	Convenor TBD
WG14	Vehicle/Roadway Warning & Control Systems	K. Yamada - Japan
WG15	Dedicated Short Range Communications (CEN WG9)	C. Rokitansky - Germany
WG16	Wide Area Communications/Protocols & Interfaces	R. Shields – U.S.A.

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WG14 Standardization Items

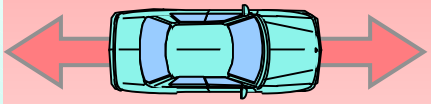
Warning

Assist

Forward Vehicle Collision Warning System
(FVCWS)

Adaptive Cruise Control Systems
(ACC)

Extended Range Backing Aid Systems
(ERBA)

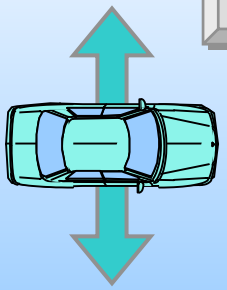


Enhanced Adaptive Cruise Control Systems (EACC)

Forward Collision Avoidance Assistance Systems
(FCAAS)

Traffic Impediment Warning System
(TIWS)

Maneuvering Aid for Low Speed Operation
(MALSO)



Side Obstacle Warning Systems
(SOWS)

Lane Departure Warning Systems
(LDWS)

Finished

Under development

Starting development

WG15 - DSRC

- Convenor Dr. Carl-Herbert Rokitansky
- Only one active work item now: ISO 15628
  - Similar to CEN L7 draft, but extended to cover other DSRC lower layers
  - Japan has done a lot of work on this
- No plans for further work items at this time

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ISO TC/204 WG16
Wide Area Comms

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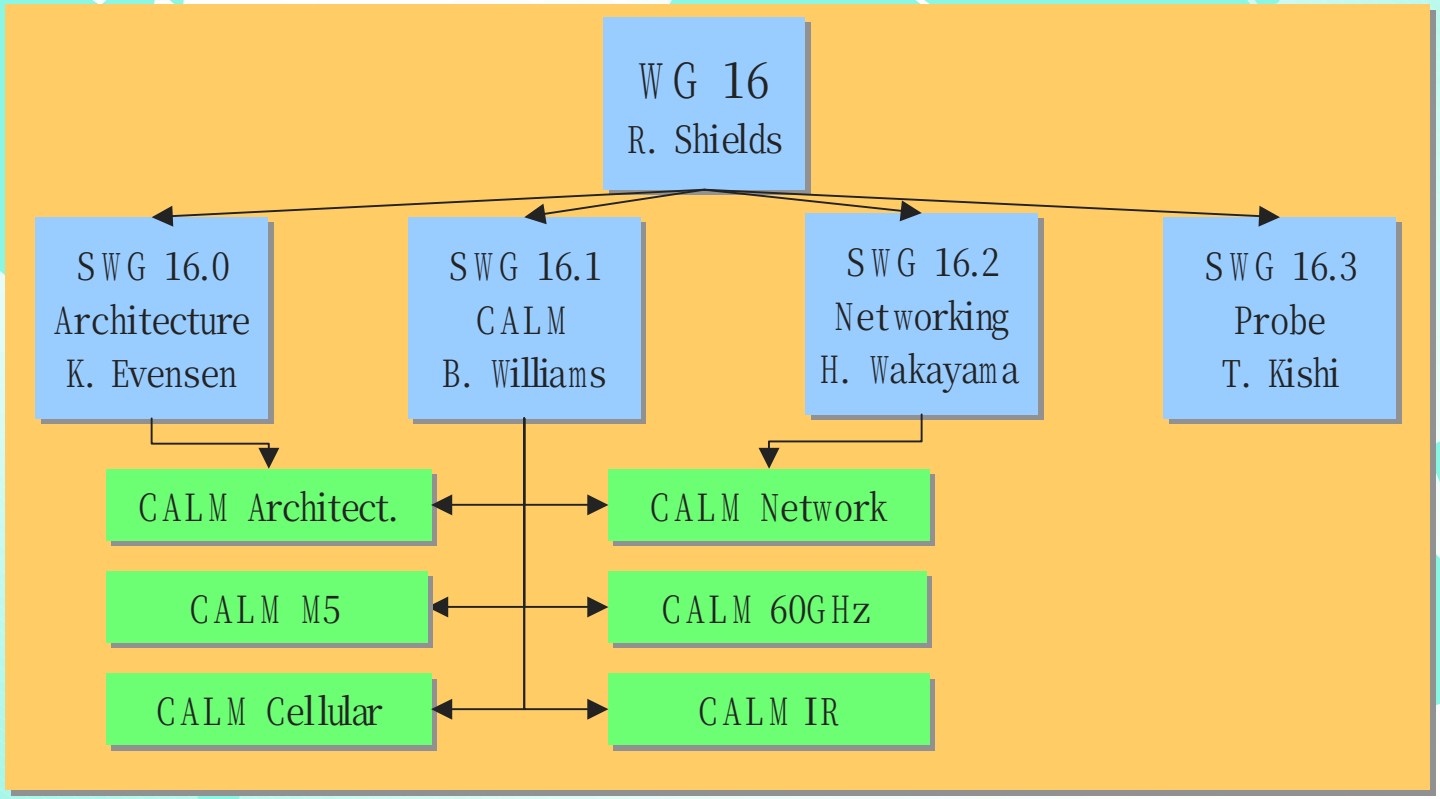
ISO TC204 WG16
Wide Area Communication



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SWG 16.0
Architecture and Outreach

- **First task**
  - **Draft the Architecture standard (NP 21217)**
  - **Status: First draft to be submitted in Vienna plenary October 2003**
- **Second task**
  - **Outreach – to present CALM and its possible services**

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SWG 16.1 – CALM

- **Specifications for 4 key media:**
  - **2G, 3G Cellular (PWI 21212, 21213)**
    - → **Building on existing ETSI and ITU standards**
  - **IR (NP 21214)**
    - → **Air interface using Infrared systems at 850 nm**
    - → **Building on existing standards (e.g. IrDA)**
  - **M5 (NP 21215)**
    - → **Air interface using 5GHz systems**
    - → **Working closely with IEEE 802.11, ASTM, and other efforts**
  - **MM (NP 21216)**
    - → **Air interface at 60-70 GHz Millimeter Wave**

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SWG 16.2 – Networking

- **Scope**
  - Roaming and handover at the network layer, providing continuity of application connectivity
- **PWI 21210**
  - Routing and Media Switching based on IPv6
  - CALM system Management Entity (CME)
  - Network Management Entity (NME)
  - Directory Services
  - Initialization and Convergence Layer
- **Status**
  - PWI 21210 in progress
  - PWI for lower layer SAPs approved June 03

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SWG 16.3 – Probe Data

- **Vehicle Probe Data for Wide Area Communication**
  - **Reference architecture for probe vehicle systems and probe data**
  - **Basic data framework for defining probe data elements and probe data messages**
  - **Definition of core data elements**
  - **Definition of basic data elements**
- **Status**
  - **PWI 22837: "Configuration of Vehicle Probe Data for Wide Area Communications"**
  - **NP ballot requested June 2003**

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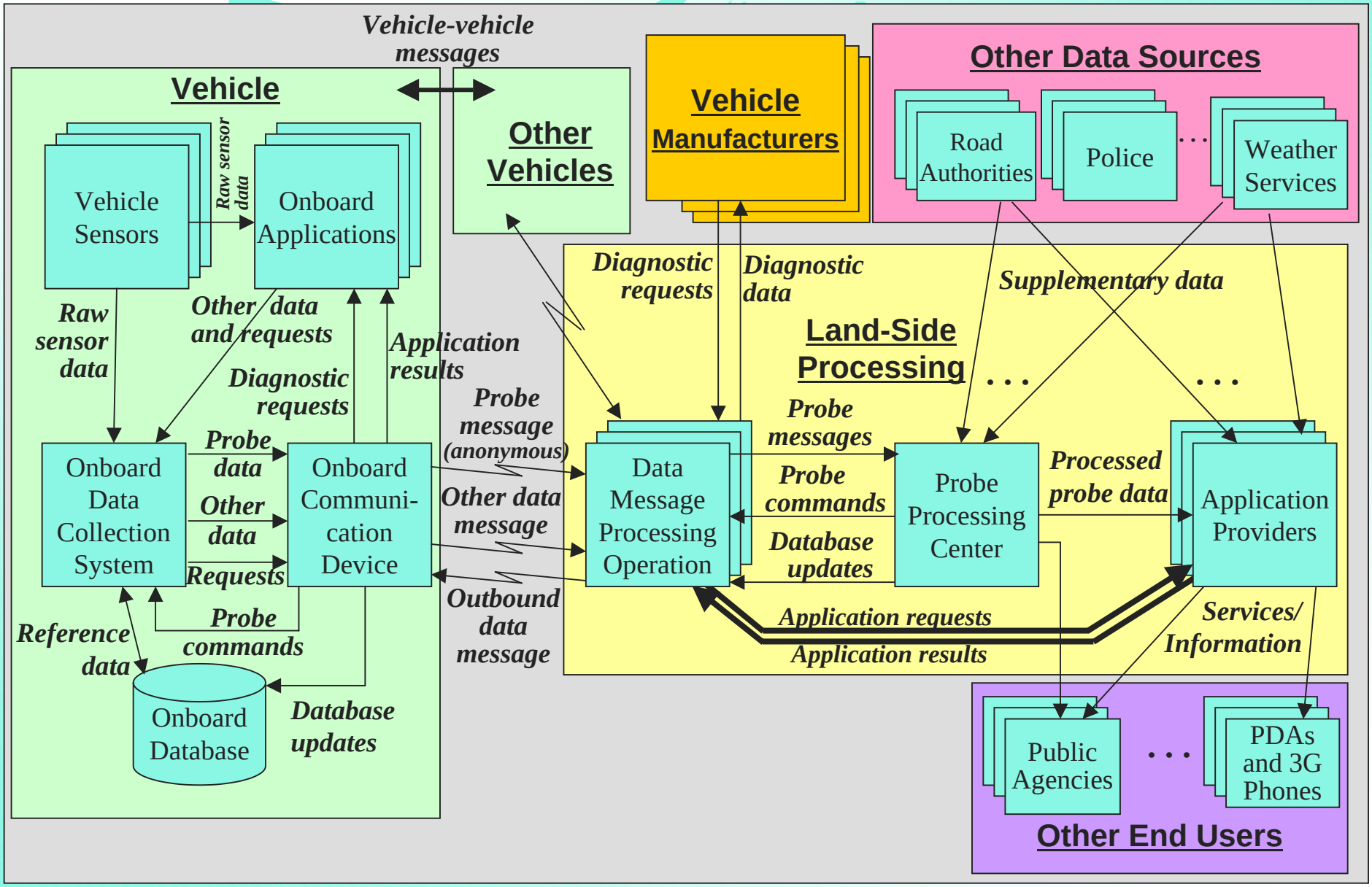
Draft 2003-05-06

Probe Data Context Model




CALM
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CALM - Overall

- **Continuous Air interface for Long and Medium distance**

- **Support continuous communications**
- **Support master/slave and peer-peer modes**
- **Support user transparent networking**
- **Support handover spanning multiple media, media providers and beacons**

- **Very ambitious timescale – ISO test-case for fast development**

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CALM Applications

- Support of Internet services – invisible handover –(mostly) media independent
- Support of traditional ITS apps – media independent through DSRC L7
- New generation of applications:
  - Major push in safety – Vehicle Safety Comm. Consortium (8 car mfg) defines more than 50 distinct applications – funded by US DoT.
  - New commercial applications made possible by high data rate & long range.

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CALM -IETF

- A very good liaison to the Internet Engineering Task Force has been set up
- Main support from experts at Keio university T. ERNST /K. UEHARA
- CALM concept is forwarded to IETF to make various groups aware of mobility requirements
- IETF NEMO (Network Mobility) group is closely following CALM. Will be the contact point to IETF

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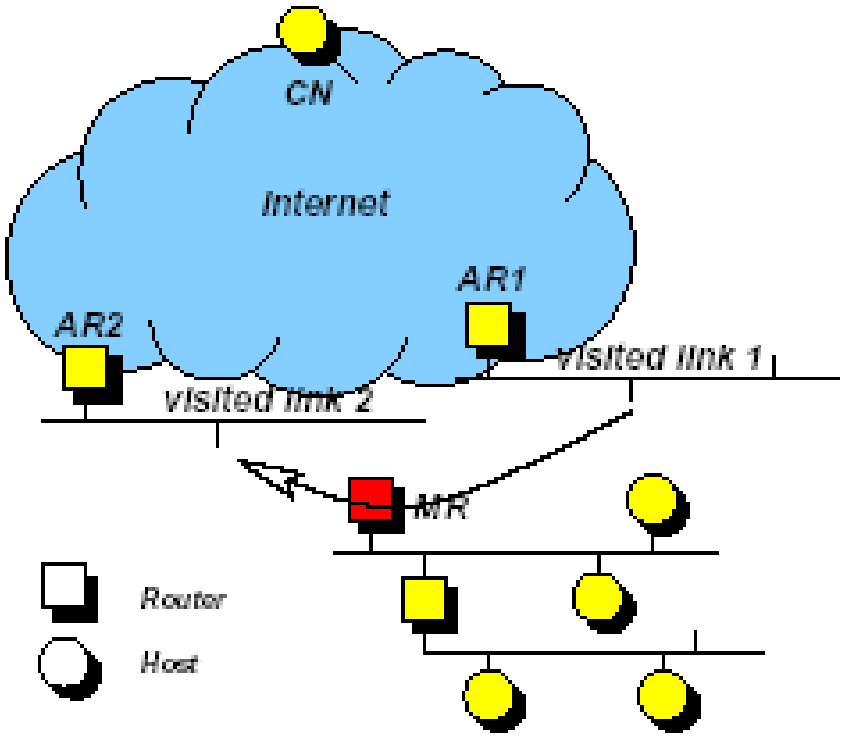
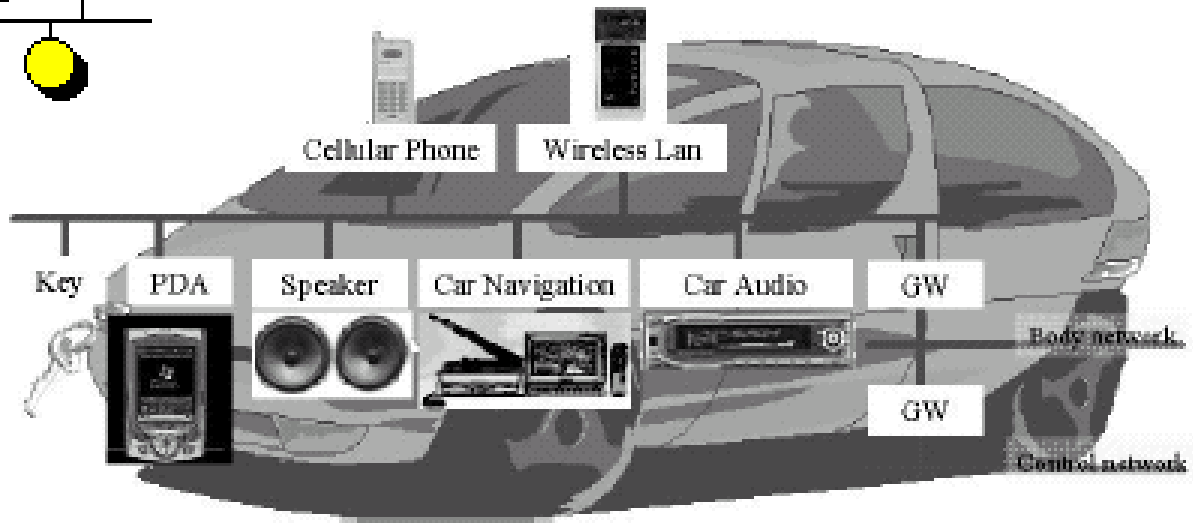
NEMO Concept





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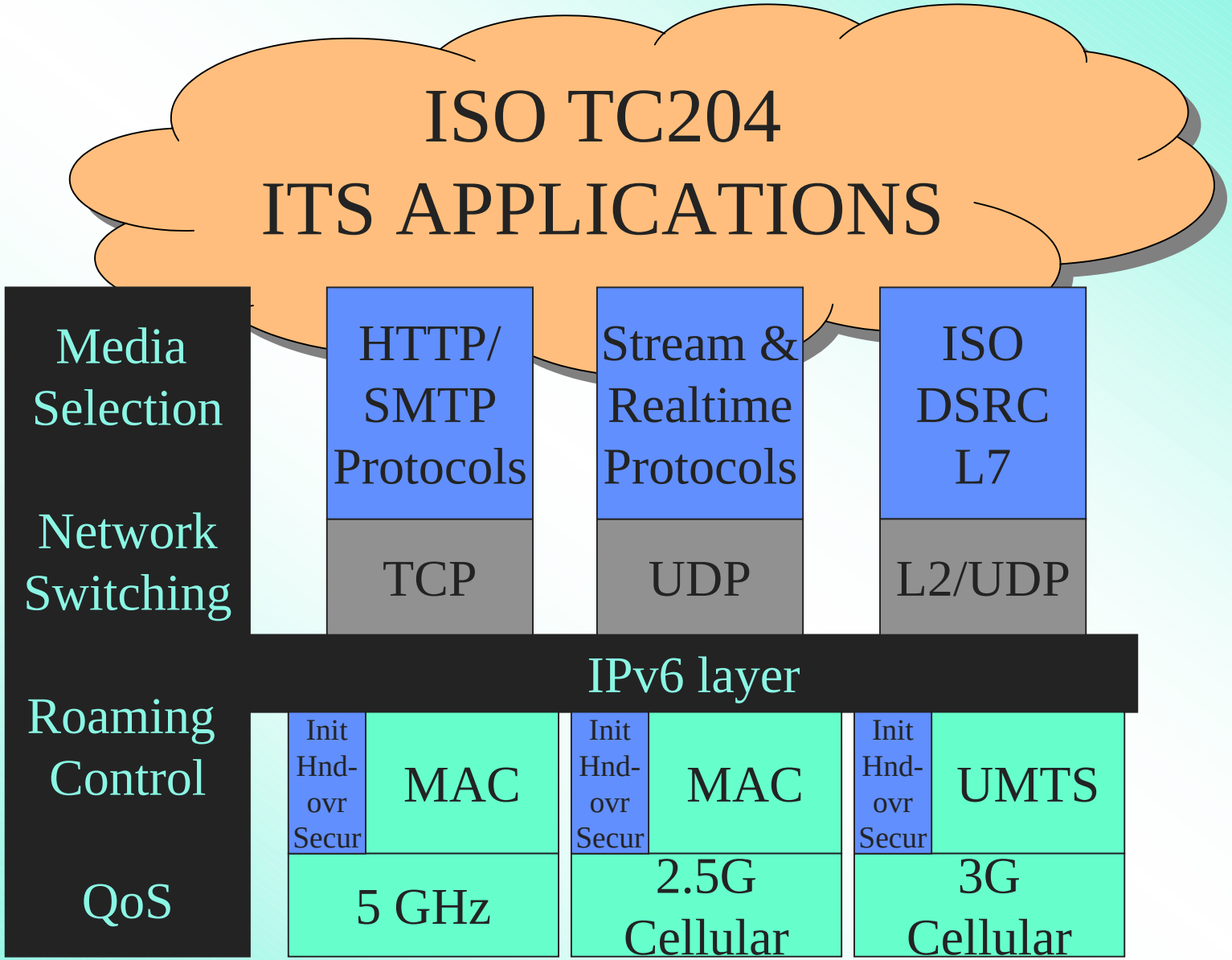
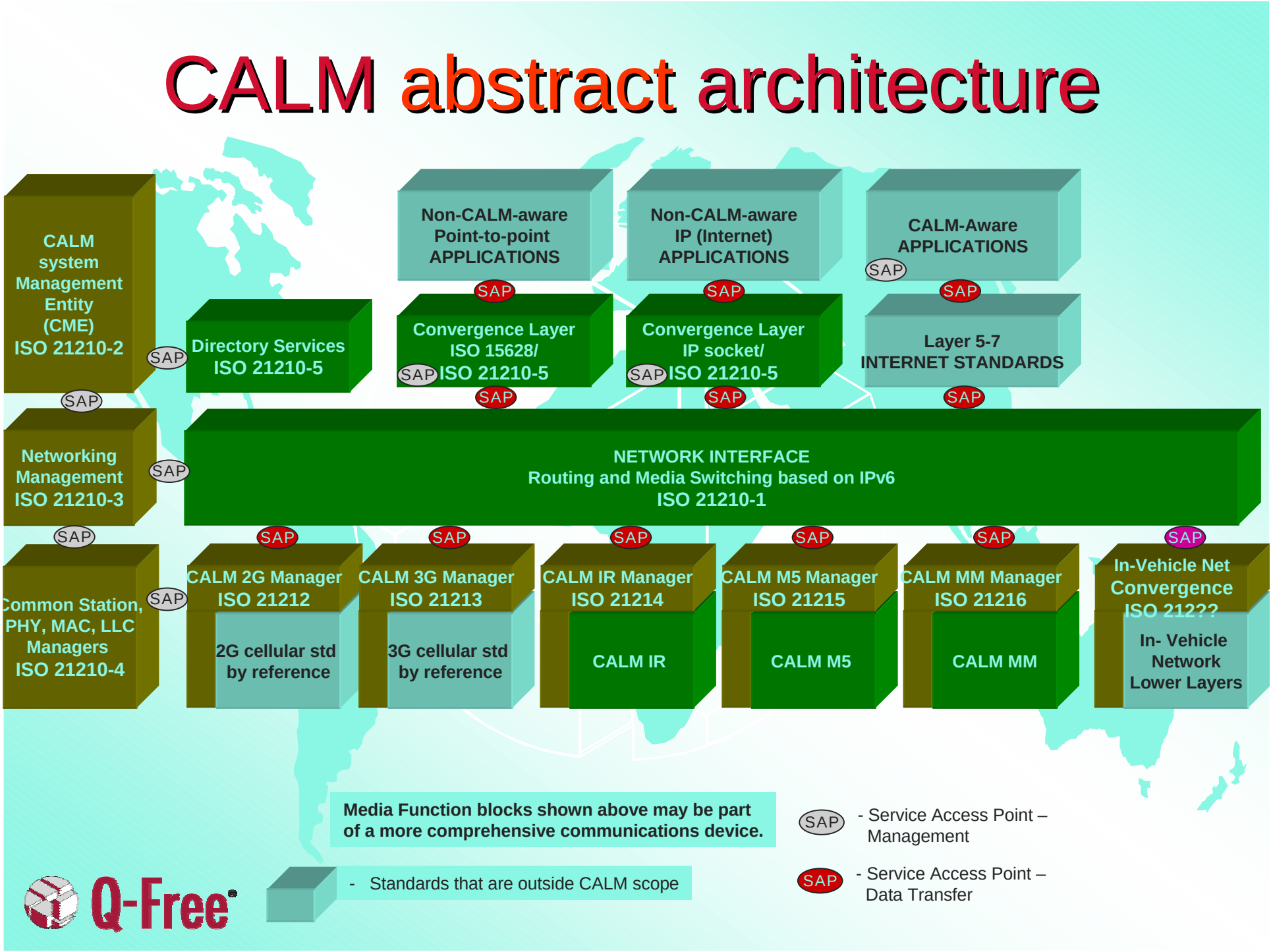
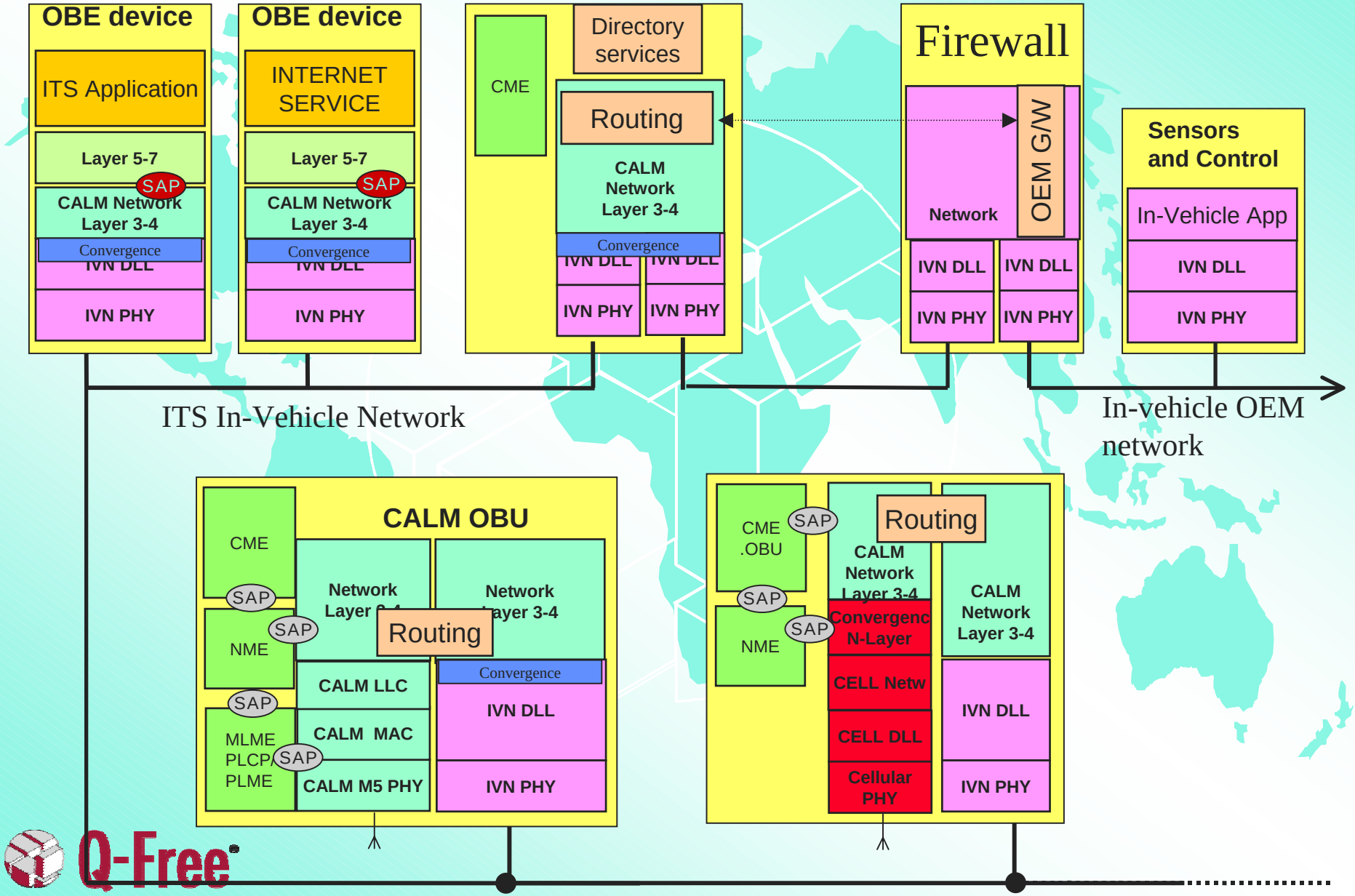
CALM *classic* architecture



CALM abstract architecture



CALM Vehicle Architecture 1



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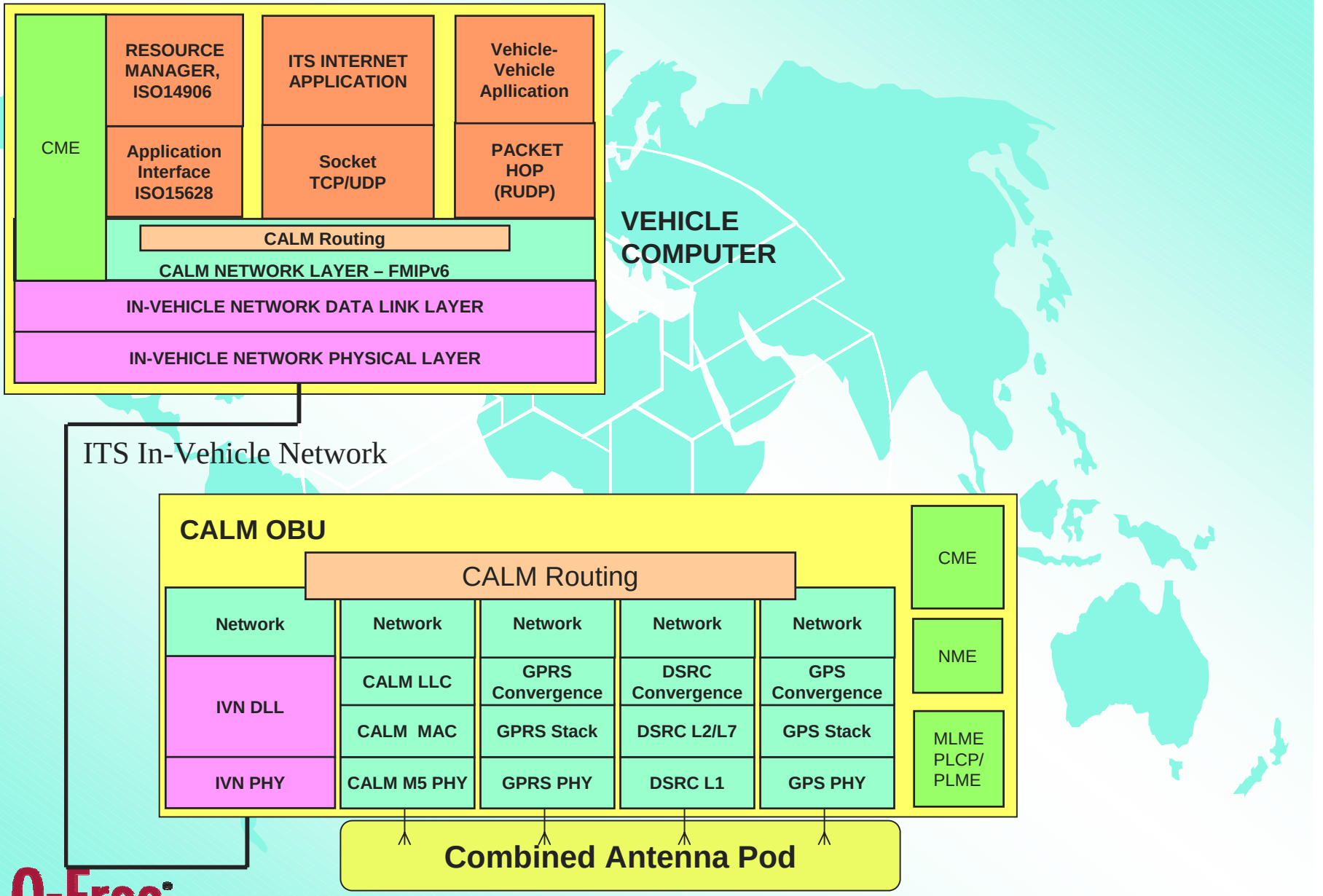
Implementation Architecture - Example



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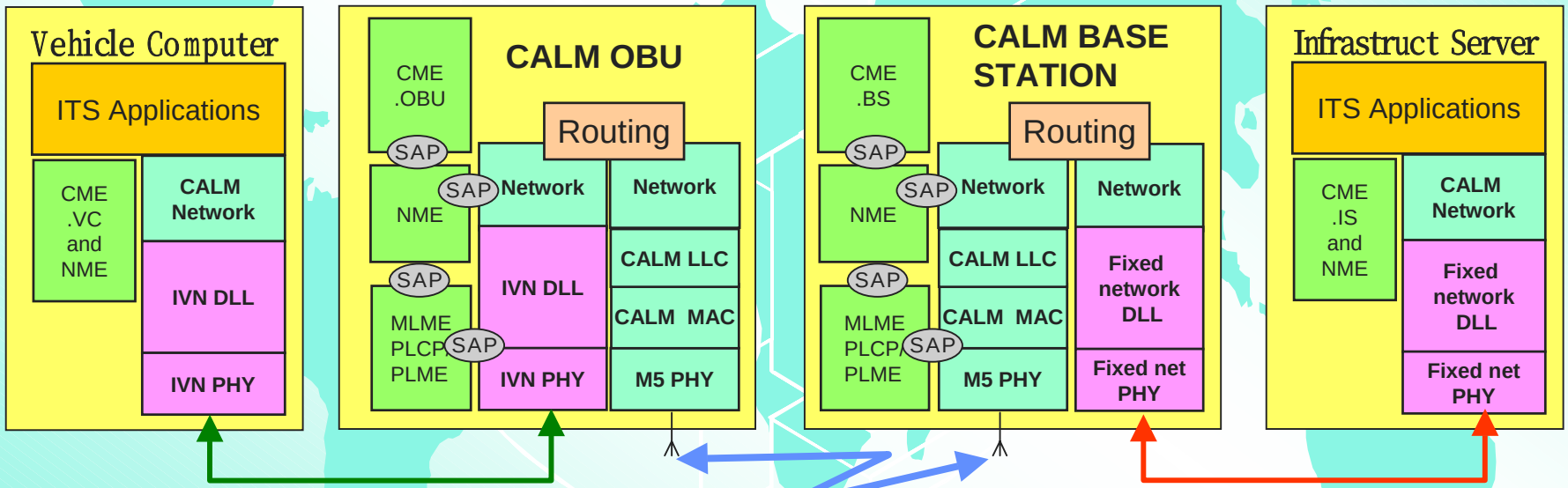
Vehicle - Infrastructure



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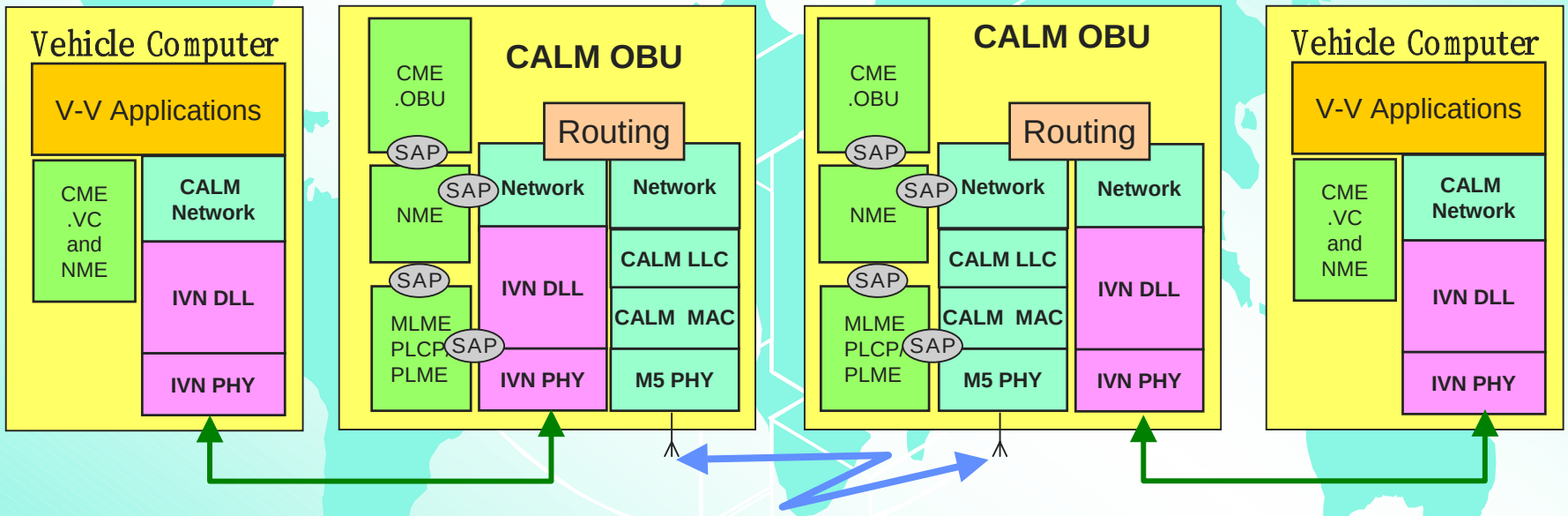
Vehicle - Vehicle



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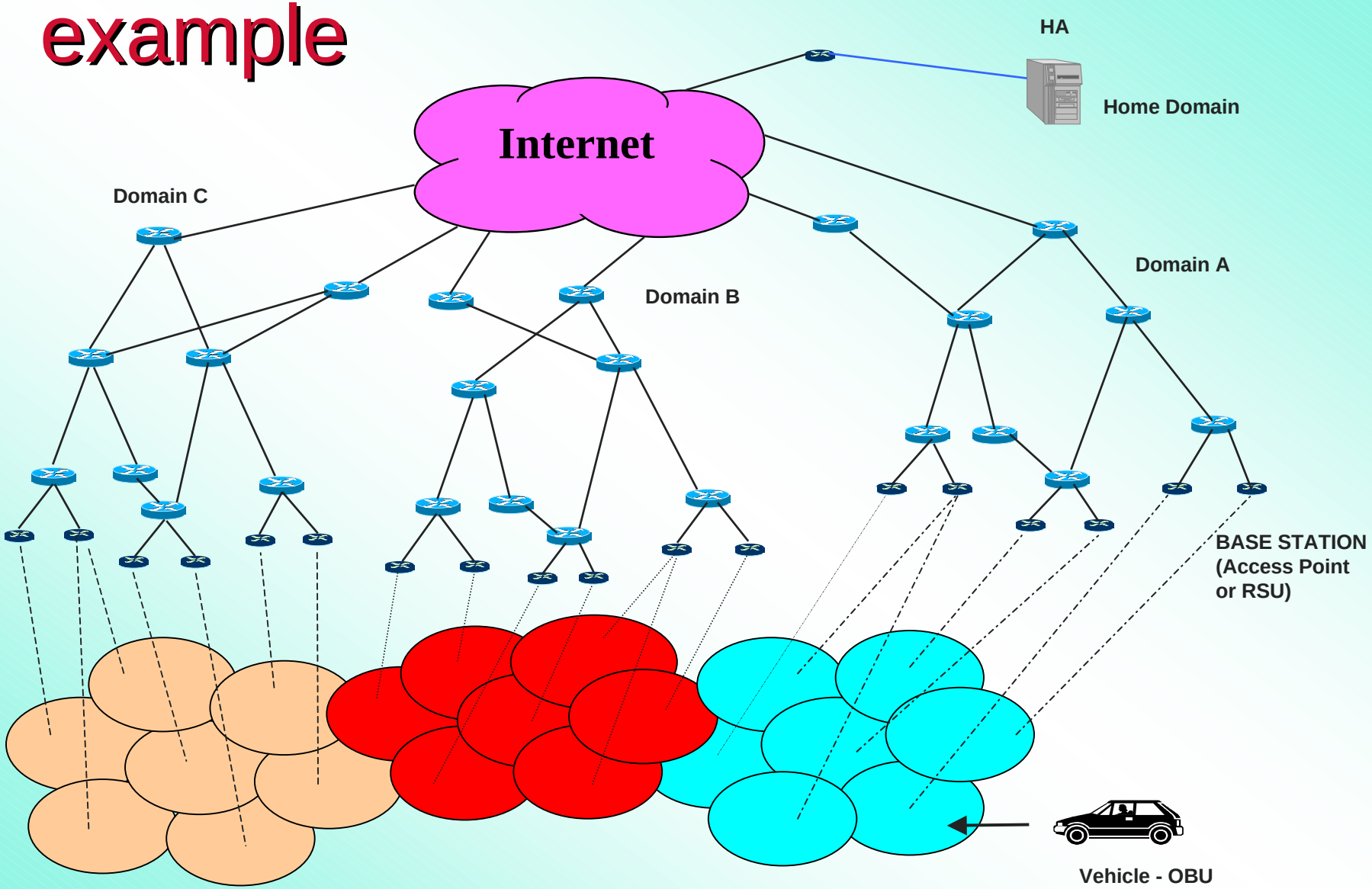
Infrastructure Architecture - example




CALM M5
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Why the 5 GHz spectrum?

- This is the same basic standard as the US ASTM – car unit for global market!
- Radio based – can partly penetrate walls and “bend around corners”
- Based on 802.11 W-LAN standards:
  - Many suppliers – no single source problem
  - Low cost due to competition, high volume and no expensive or proprietary components
  - High reliability due to proven performance and mature developments of 802.11
- High performance from day one:
  - 6-54 Mbit/s data rate
  - 80-1000 meters communication distance

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Why 5 GHz – cont.

- 802.11 standards are optimised for both:
  - ad-hoc (vehicle-vehicle) as well as
  - central communication (vehicle-infrastructure)
- Many channels are globally available – physically separated and non-interfering :
  - Dedicated channels for emergency and safety applications to avoid contention and interference
  - Other channels for less critical Internet access and information downloads
  - A group of vehicles in a “moving network” can share one channel, and pass another moving network without any disruption.

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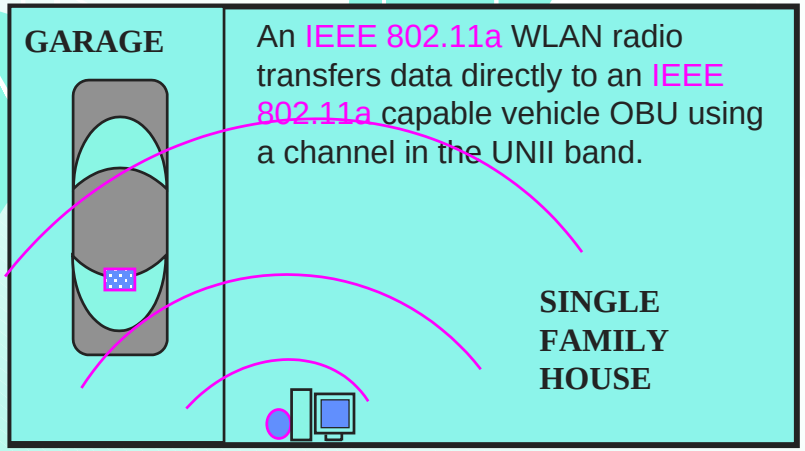
Why 5 GHz – cont

- The vehicle can commiunicate with normal IEEE 802.11a access points – your vehicle can access your normal home W-LAN – even through the walls.



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Scope of CALM M5

- The standard:
  - shall use microwaves in the 5 GHz band as the transmission medium between (moving or stationary) vehicles and a roadside communications-infrastructure or other (moving or stationary) vehicles;
  - shall minimise harmful interference with standardised regional radio unit in this spectrum, e.g. no harmful cross-interference with regional DSRC standards;

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Scope of CALM M5

- **The Standard:**
  - **shall support vehicle speeds to a minimum of 200km/h;**
  - **shall define or reference environmental parameters relevant to link operation;**
  - **shall support latencies and communication delays in the order of milliseconds;**
  - **shall be adaptable to regional/national regulatory parameters;**
  - **may support other regional/national parameters as applicable.**

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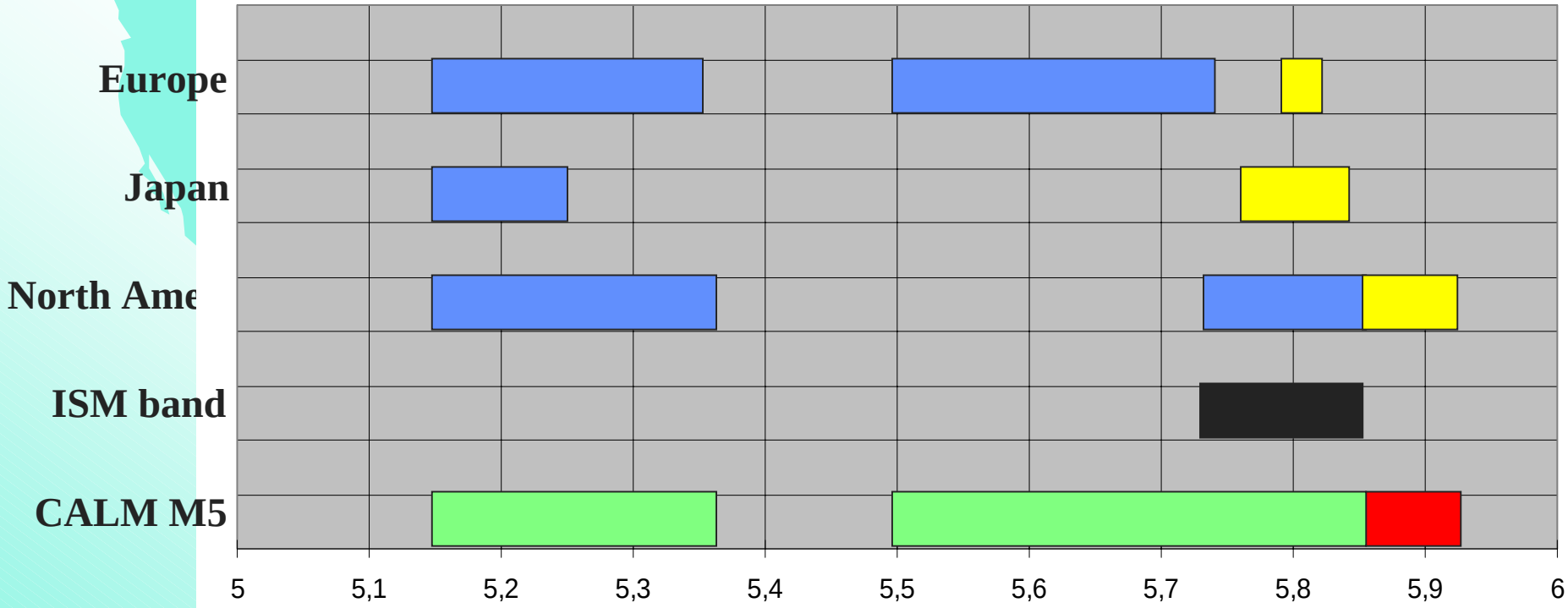
5 GHz Band Spectrum



Unlicen. W-LAN

Dedicated ITS (DSRC)

Partly available regionally: ISM + shared unlicenced

Requested from ITU: Global ITS Safety allocation 5.85-5.925

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Spectrum M5

- For global use, the OBUs shall:
  - Be capable of operating within the range of 5.15 GHz to 5.925 GHz
  - Support both 10 and 20 MHz channels
  - Support accurate transmit power control
- RSUs will operate on the regionally allocated frequencies.

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Global M5 spectrum config.

- The mobile unit (OBU) shall be configurable when moving between regulatory areas
- The OBU shall not start operation until an authorised source (e.g. fixed, licensed RSU) has provided profile information.
- Profiles may be autonomously initiated if the OBU can ascertain its position.

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M5 Access Methods

- National regulatory bodies can place limitations on channel utilisation and maximum channel usage on a per channel basis, and the unit shall be configurable / programmable to operate within these limitations.

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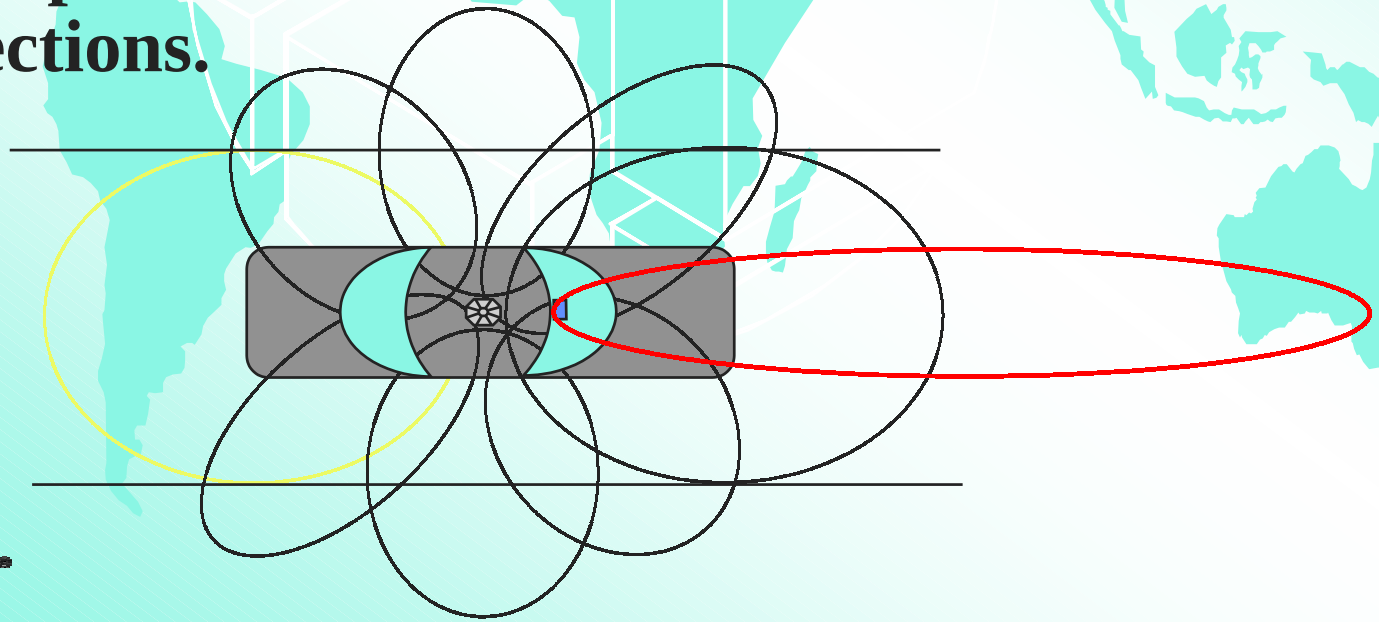
M5 Directivity

- CALM M5 include omni-directional as well as directive patterns.
- The standard allow control of multi-sector directed antenna elements.
- The standard allow simultaneous operation on multiple channels in the same or different directions.



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Conclusion

- CALM M5 - likely candidate for the next high-volume ITS communication medium
- The public safety applications requires global spectrum allocations
- Participation in finalizing CALM is wanted – in particular from Europe.
- Information exchange between VSC and CALM (M5) is needed

This VSC conference is a good initiative!

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