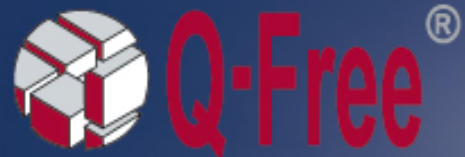


ITS Telecommunications - BREST 2005



CALM Architecture and Network

Knut.Evensen@Q-Free.com



What is CALM?

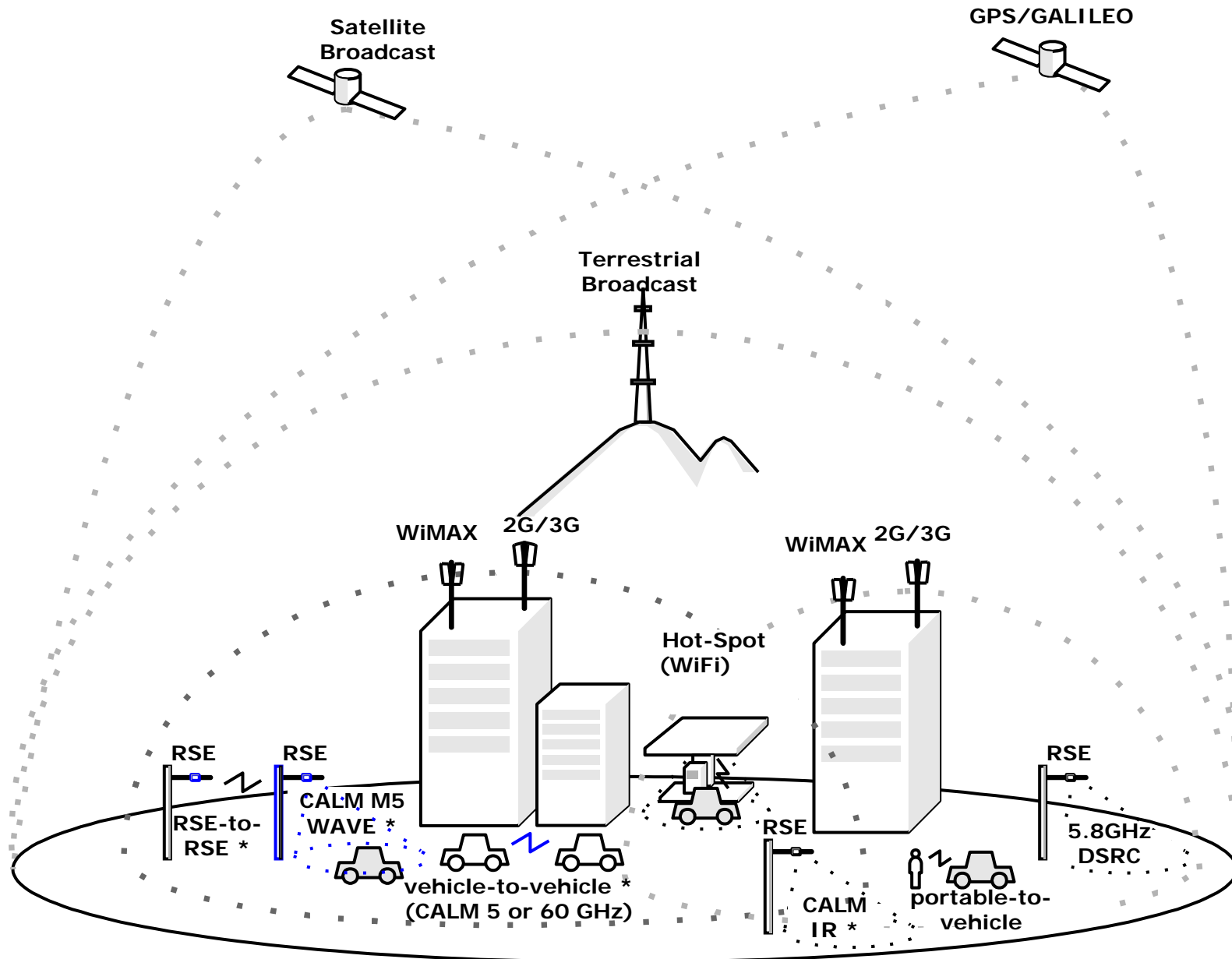


CALM - Overall

- Continuous **A**ir interface for **L**ong and **M**edium distance
- ISO TC204/WG16 – Wide Area Communications
- Support user transparent continuous communications
- CALM is the first *open* way to combine GPRS with vehicle-optimized WLAN technology.
 - NOT a complicated collection of new, unproven radio technologies



CALM Communication Scenarios



CALM Applications

- Support of Internet services
- Support of traditional ITS apps – media independent through DSRC L7
- New generation of applications:
 - Major push in safety – Vehicle Safety Communication
 - New commercial applications made possible by high data rate & long range.



Services defined for 5 GHz medium - 1

CVO - Tractor-Trailer Interface
CVO - Rollover Warning
CVO - Electronic Border Clearance
CVO - Weigh Station Bypass Clearance
CVO - CVO Fleet Management
CVO - Onboard Safety Data Transfer
CVO - Tractor-Trailer Matching
CVO - Transit Vehicle Data Transfer
CVO - Vehicle Safety Inspection
CVO - Drivers Daily Log
OTHER SERVICES - Probe Data Collection
OTHER SERVICES - Access Control
OTHER SERVICES – Vehicle Manufacturer Info
PAYMENTS - Toll Collection
PAYMENTS - ITS Service Payment
PAYMENTS - Other ePayments
PAYMENTS - Rental Car Processing
PAYMENTS - Parking Payment
PAYMENTS - Food Payment
PAYMENTS - Fuel Payment
SAFETY - Vehicle-to-vehicle Data Transfer
SAFETY – Highway-Rail Intersection Warning

Traffic Information - Audio Transfer - Streaming
Traffic Information - Map Updates
Traffic Information - Mobile Internet
Traffic Information - Traffic Data
Traffic Information - Traveller Information
Traffic Information - Vehicle Registration (EVI)
Traffic Information - Transit Vehicle Priority
Traffic Information - Diagnostic Data Transfer
Traffic Information - Video Transfer - Block
Traffic Information - Audio Transfer - Block
Traffic Information - Video Transfer - Streaming
Traffic Information - Repair Service Record
Traffic Information - Vehicle Software Updates
**VSC - OBU-to-OBU - Approaching Emergency Vehicle
Warning**
VSC - OBU-to-RSU - Emergency Vehicle Signal Pre-emption
**VSC - OBU-to-RSU - Intersection Emergency Vehicle
Approaching**
**VSC - RSU to OBU - Emergency Scene Data
Networking**
**VSC - OBU-to-OBU - Emergency Scene Data
Networking**
VSC - OBU-to-OBU - Cooperative Collision Warning



Services defined for 5 GHz medium - 2

VSC - RSU to OBU - Map Downloads and Updates
VSC - RSU to OBU - Enhanced Route Guidance and Navigation
VSC - RSU to OBU - GPS Corrections
VSC - RSU to OBU - Adaptive Headlight Aiming
VSC - RSU to OBU - Adaptive Drivetrain Management
VSC - RSU to OBU - Merge Assistant
VSC - RSU to OBU - Sign Information (warning assistance)
VSC - RSU to OBU - Point-of-Interest Notification
VSC - RSU to OBU - Curve Speed Warning
VSC - RSU to OBU - Highway/Rail Collision Warning
VSC - RSU to OBU - Animal Crossing Zone Information
VSC - RSU to OBU - Low Bridge Warning
VSC - RSU to OBU - Work Zone Warning
VSC - RSU to OBU - Stop Sign Warning
VSC - RSU to OBU - Keep Clear' Warning
VSC - RSU to OBU - Wrong-way Driver Warning
VSC - RSU to OBU - Left Turn Assistant
VSC - RSU to OBU - Infrastructure Intersection Collision Warning
VSC - RSU to OBU - Pedestrian Crossing Information
VSC - RSU to OBU - Pedestrian/Children Warning
VSC - RSU to OBU - School Zone Warning
VSC - RSU to OBU - Stop Sign Movement Assistance
VSC - RSU to OBU - Traffic Signal Warning
VSC - RSU to OBU - Low Parking Structure Warning

VSC - OBU-to-OBU - Pre-crash Sensing
VSC - OBU-to-OBU - Intersection Collision Warning
VSC - OBU-to-OBU - Enhanced Differential GPS Corrections
VSC - OBU-to-OBU - Highway/Rail Collision Warning
VSC - OBU-to-OBU - Vehicle-based Road Condition Warning
VSC - OBU-to-OBU - Road Feature Notification
VSC - OBU-to-OBU - Curve Speed Warning
VSC - OBU-to-OBU - Visibility Enhancer
VSC - OBU-to-OBU - Electronic Brake Lights
VSC - OBU-to-OBU - Hybrid Intersection Collision Warning
VSC - OBU-to-OBU - Instant (Problem) Messaging
VSC - OBU-to-OBU - Blind Merge Warning
VSC - OBU-to-OBU - Post-Crash Warning
VSC - OBU-to-OBU - Merge Assistant
VSC - OBU-to-OBU - Lane Change Assistant
VSC - OBU-to-OBU - Left Turn Assistant
VSC - OBU-to-OBU - Stop Sign Movement Assistant
VSC - OBU-to-OBU - Cooperative Glare Reduction
VSC - OBU-to-OBU - Blind Spot Warning
VSC - OBU-to-OBU - Platooning
VSC - OBU-to-OBU - Cooperative Adaptive Cruise Control
VSC - OBU-to-RSU - Infrastructure-based Traffic Probes
VSC - OBU-to-RSU - SOS Services
VSC - OBU-to-RSU - Post-Crash Warning
VSC - OBU-to-RSU - Just-in-Time Repair Notification
VSC - OBU-to-RSU - Intelligent On-ramp Metering
VSC - OBU-to-RSU - Intelligent Traffic Lights
VSC - OBU-to-RSU - Blind Merge Warning



TC204/WG16 Co-operation

- IEEE 802.11p and P1609 – Wireless Access in Vehicular Environments (WAVE)
- Co-operation agreement with WG16
- ETSI ERM TG37 – 2G/3G standards, spectrum and test standards,...
- IETF – Internet Network Mobility (NEMO)
- ITU-R WP 8A – Global radio standards
- USA projects: VSCC and VII
- Japan projects: CALM Proof-Of-Concept,...
- Europe projects: C2C-CC, CVIS, SafeSpot,...





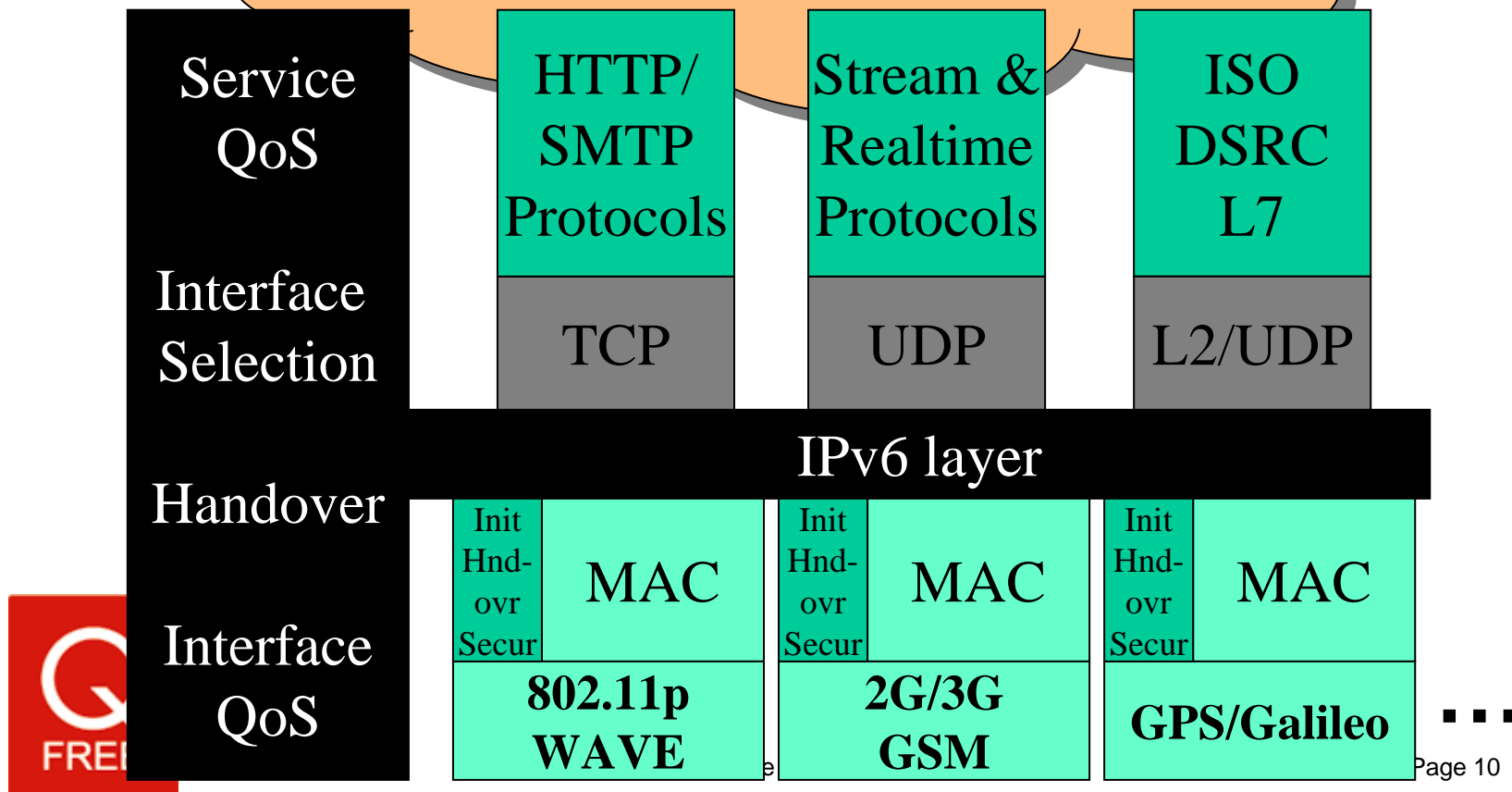
What is CALM?

Technically!



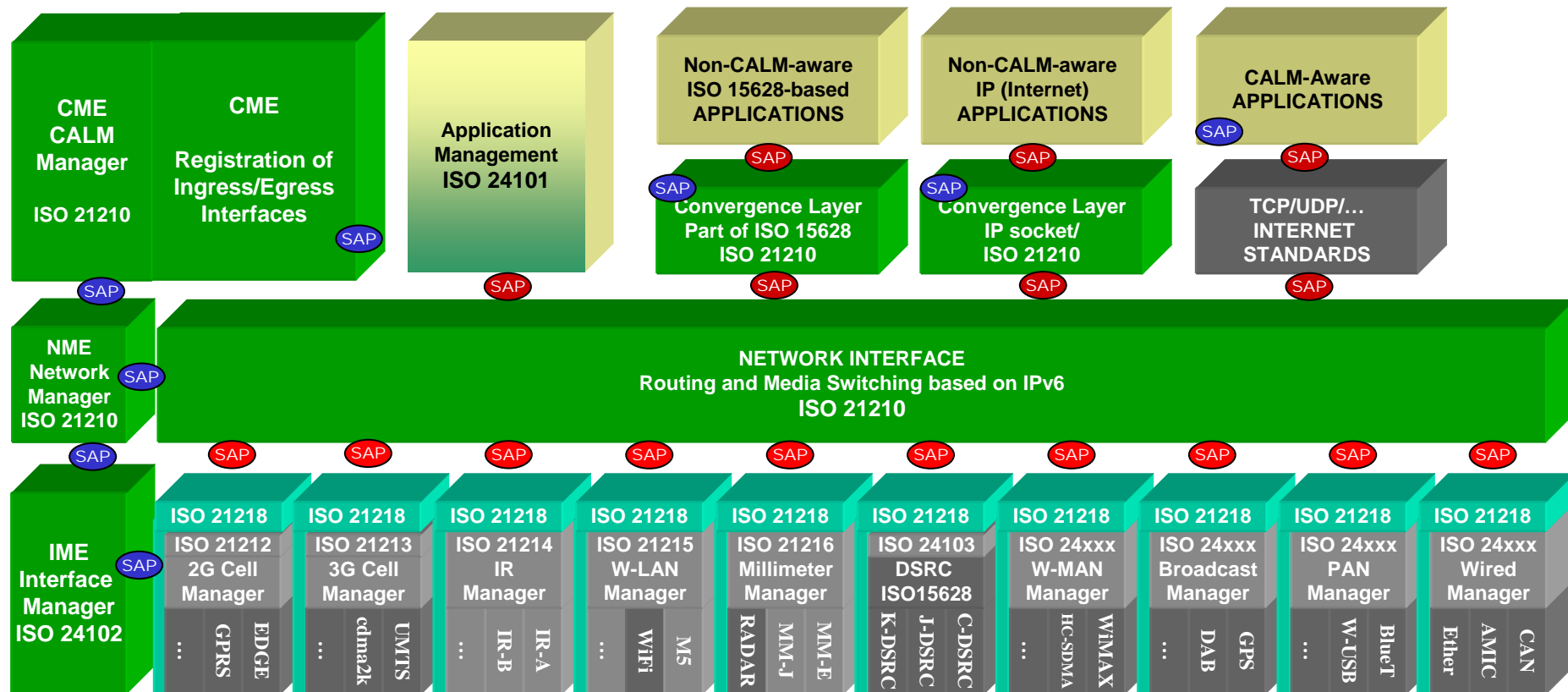
CALM *classic* architecture

ISO TC204 ITS APPLICATIONS



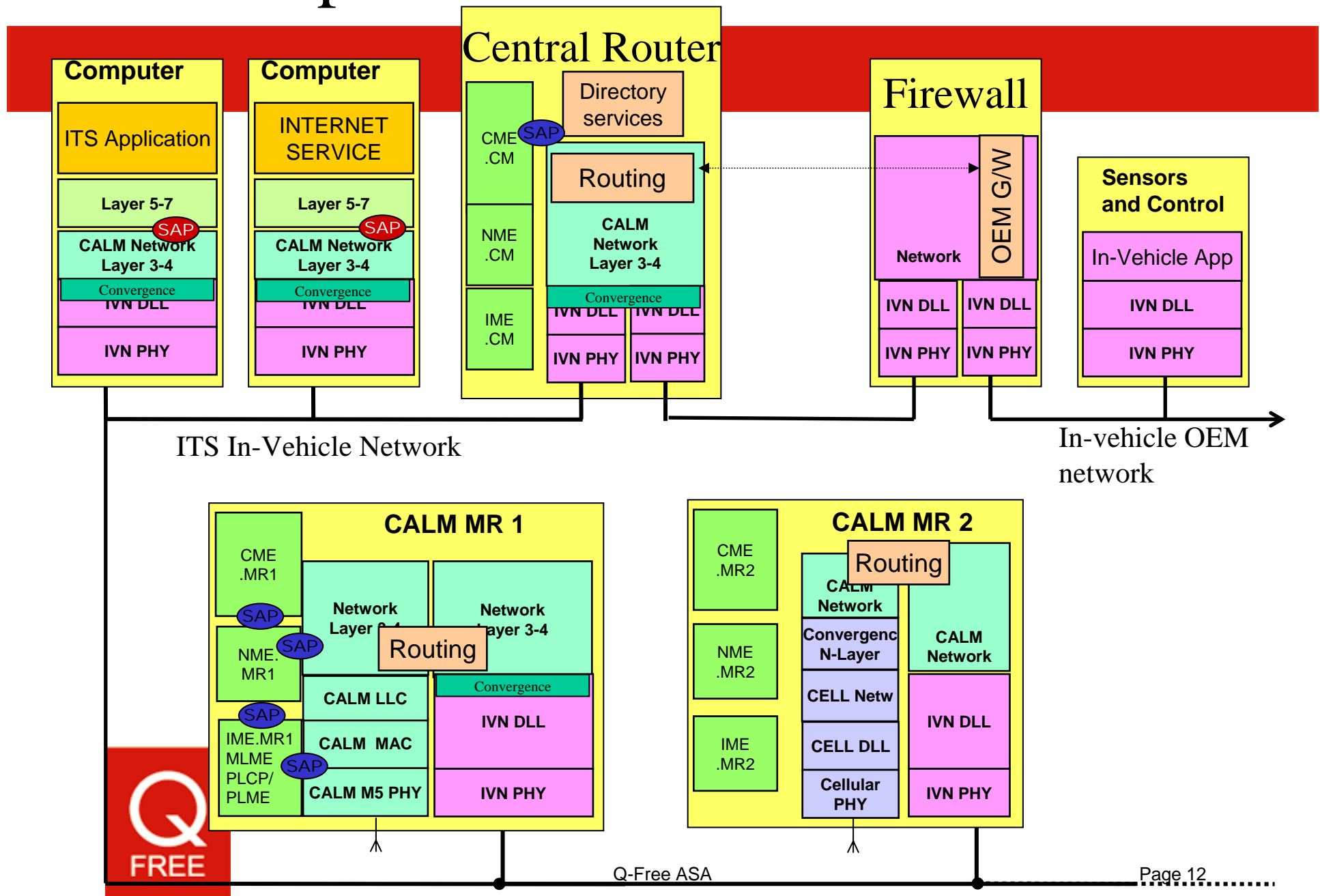
CALM System Architecture (21217)

(Rev. Geneva)

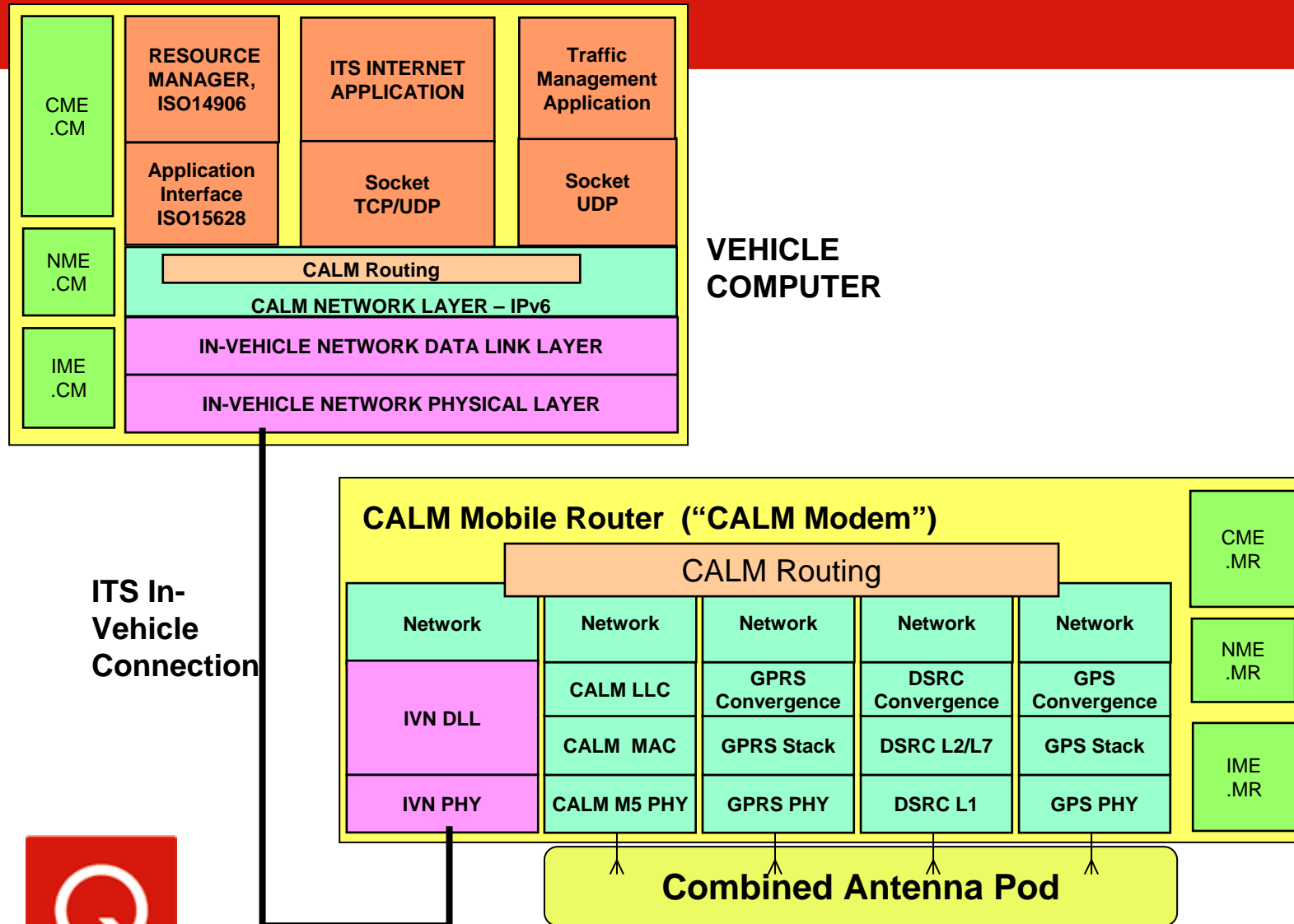


SAP **Data SAP**
 SAP **Management SAP**

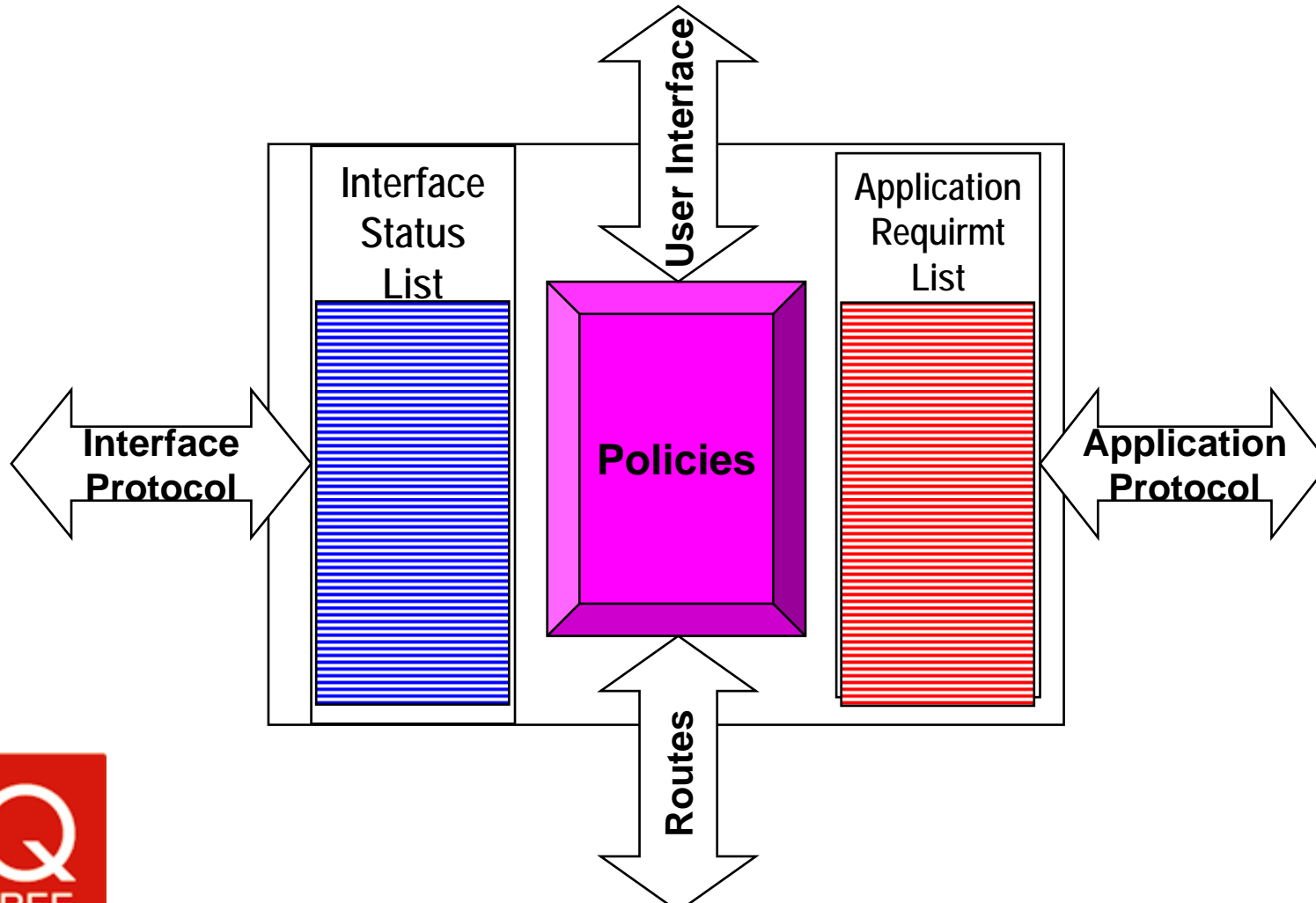
Example: Full Vehicle Architecture



Example – Early Vehicle Architecture



CALM Manager



Communication Scenarios

- CALM defines 5 communication scenarios:

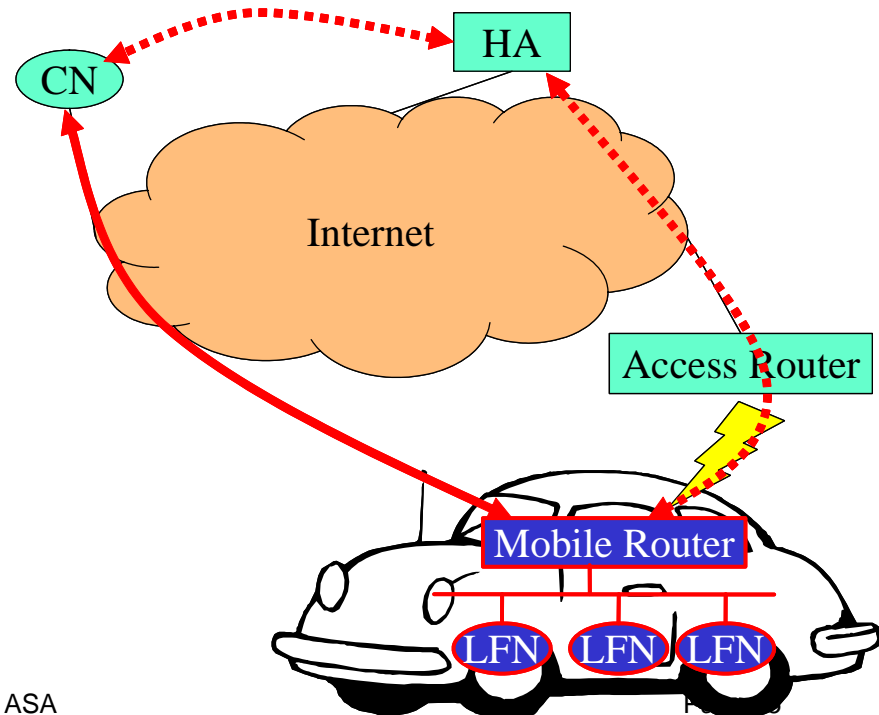
0 – V2I Non-IPv6 communications

1 – V2I/V2V Local IPv6

2 – V2I MIPv6

3 – V2I NEMO

4 – V2V Non-IPv6





What is CALM M5?



US DSRC (WAVE)

- WAVE is IEEE 802.11p
Wireless Access for Vehicles
- as required by US DoT/VSCC/VII/...
- WAVE is optimised for US channel plan
- WAVE protocols are optimised for current single-radio technology.
- No GSM or other technology is included.

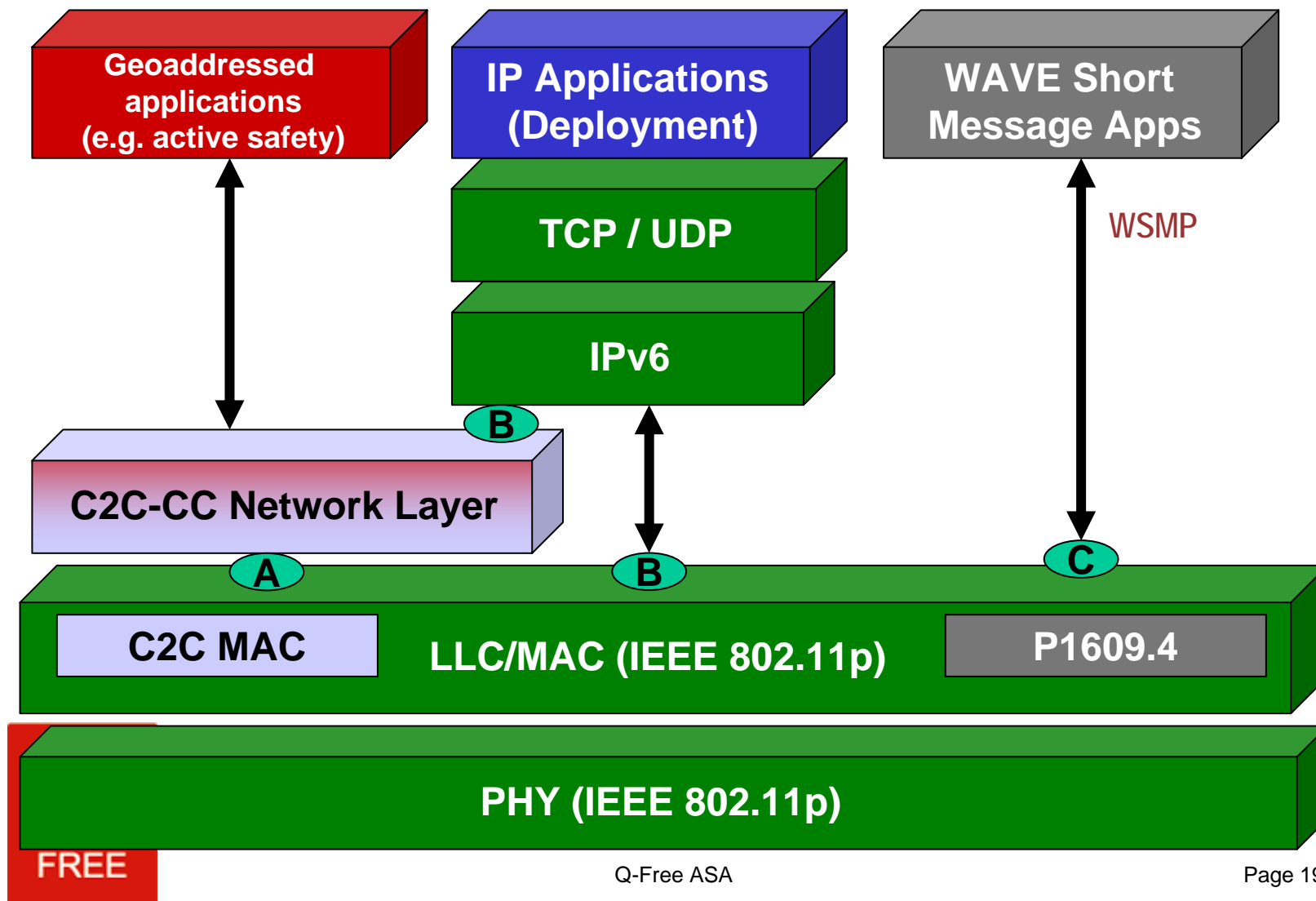


CALM M5

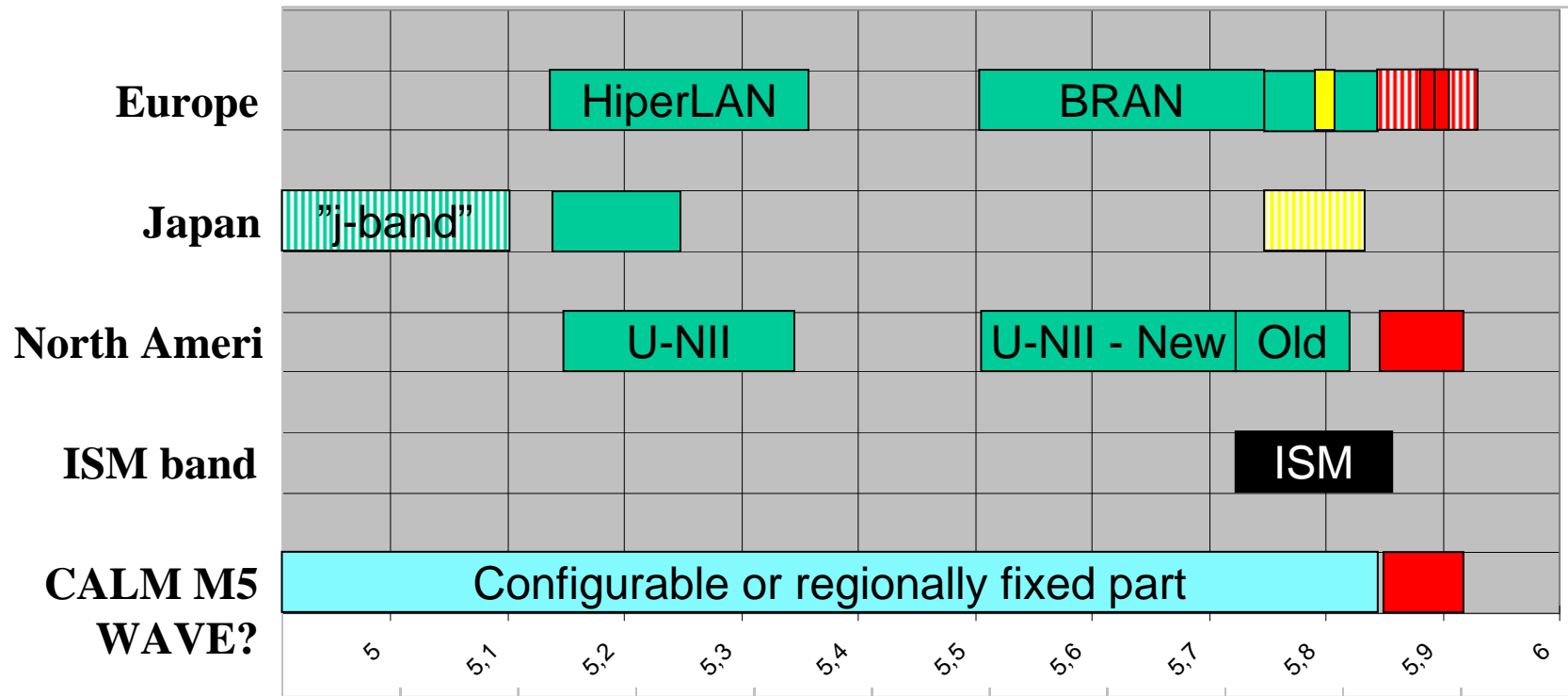
- CALM M5 incorporate WAVE and adds:
 - Global (European) 5 GHz spectrum
 - Regulatory domain (border) management
 - Directivity and EMC control
 - CEN DSRC co-operation
 - Multiple radio/interface/antenna management
 - GPRS/UMTS network interconnectivity



CALM M5: C2C-CC & WAVE



5 GHz Spectrum (not exact!)



Dedicated ITS (DSRC)

**Requested : Global
ITS Safety allocation 5.85-5.925**





What is happening in Europe?



ETSI ERM TG37

- 2G/3G standards, eCall, Testing standards,...
- European frequency selection
- System Reference Document (SRD) in three parts:
 - pan-European - 2*10MHz bandwidth
 - National allocations - 4*10MHz
 - Mobile use of unlicensed 5 GHz bands
- Request in 4.9-6.0 GHz band, but likely 5.9 GHz band.
- Process involves several steps with ETSI – CEPT – national authorities.

-first indications on 5GHz frequencies early 2006?



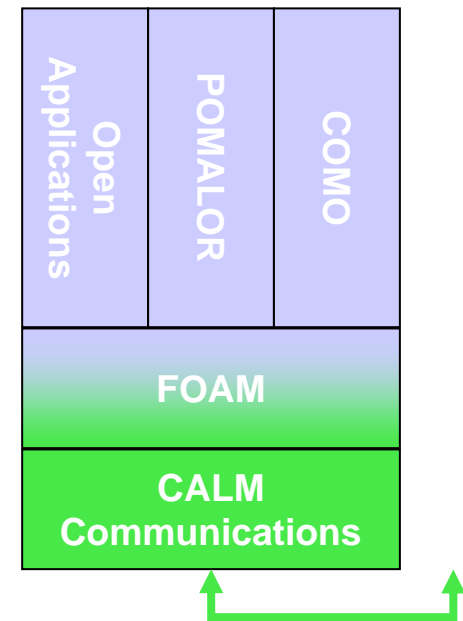
CVIS - Overall

- **C**ooperative **V**ehicle - **I**nfrastructure **S**ystems
- Proposal for eSafety Integrated Project
- Consortium lead by ERTICO, 2006-2010
- Significant budget for CALM prototyping and standardisation support
- Co-operation with SafeSpot via EUCAR
- Car manufacturers are involved in technology
- Most developments will be **open source**

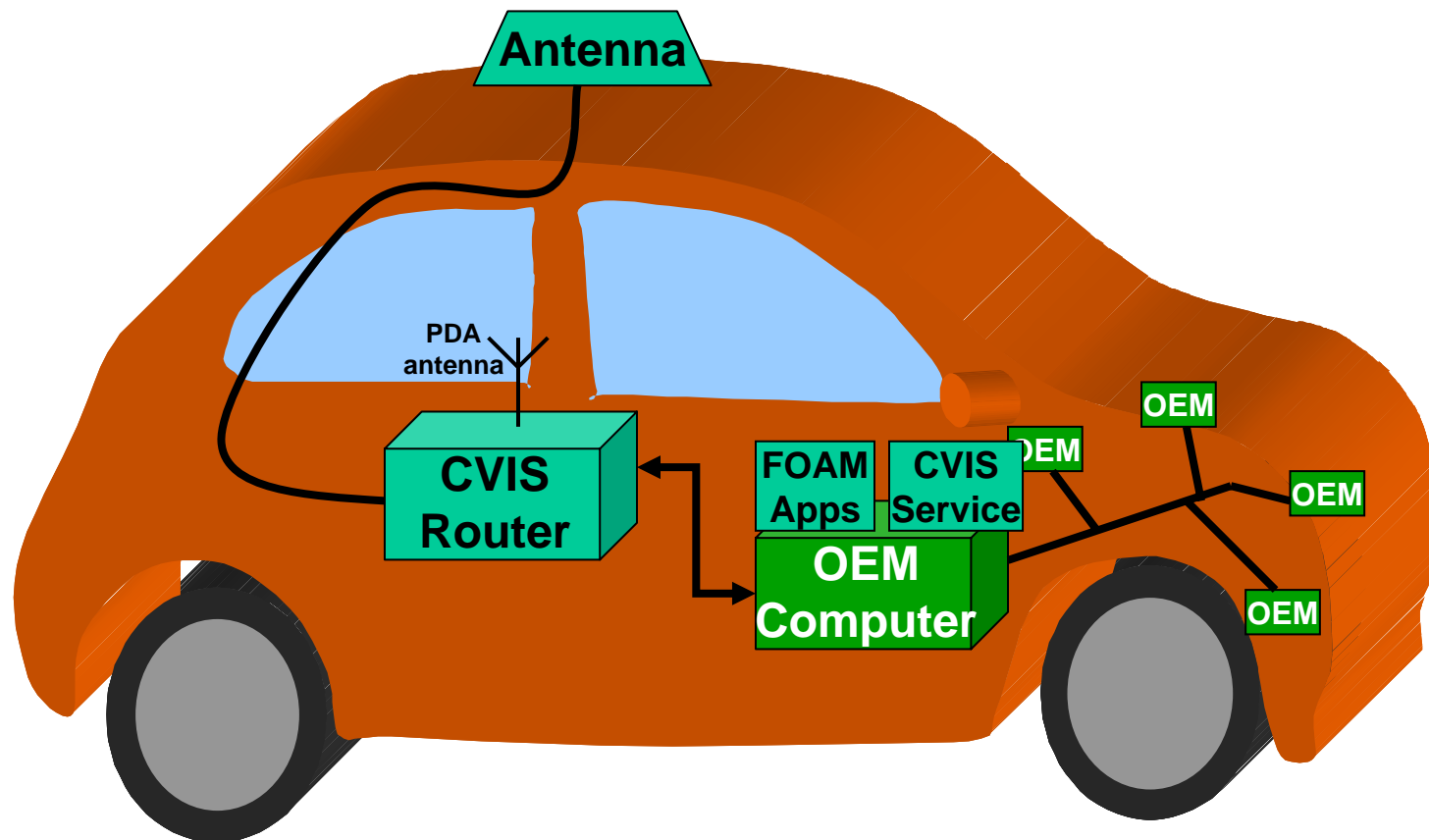


CVIS Core Tech services

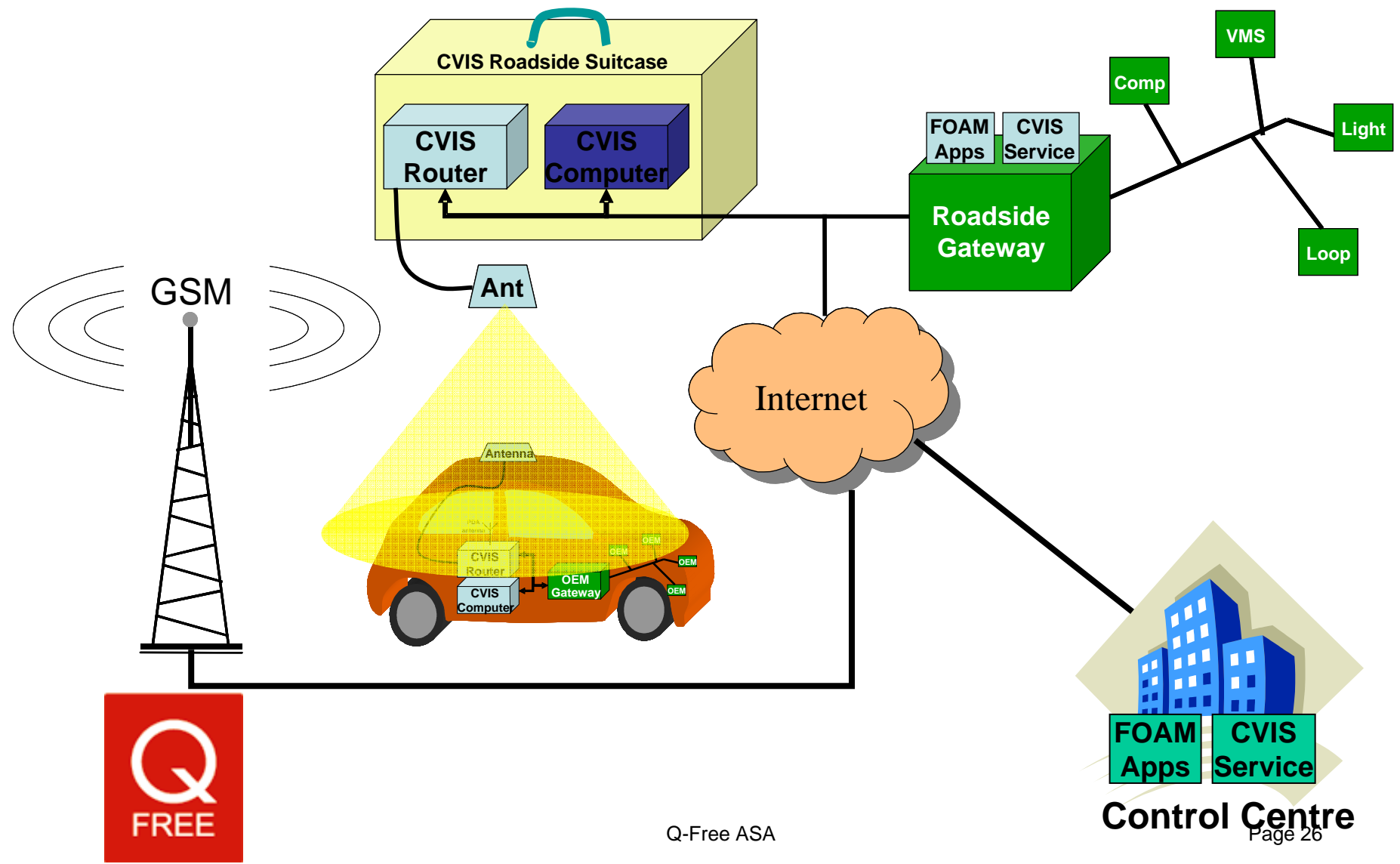
- CVIS will provide four **Enabling Services**
 - **CALM**: Standard seamless wireless communications with Internet access
 - **POMALOR**: Positioning, map services and location referencing
 - **COMO**: Cooperative Monitoring. Vehicle and Infrastructure standard data sets for local or central fusion
 - **FOAM**: GST extension – open end2end framework linking in-vehicle systems, roadside infrastructure and back-end infrastructure



CVIS Deployment configuration



CVIS Scenario



Conclusion

- Multiple networked communication will be integrated in vehicles - **Timescale ?**
- Standards are obviously needed
- **avoid proprietary solutions**
- **CALM** is the ISO and ETSI answer –
Several drafts available
Please contribute to this work!

