Standardization activities within Intelligent Transport Systems (ITS)

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Intelligent Transport Systems

- ITS encompass a broad range of wireless and wire-line communication based on information, control and electronics technologies
- Integrated in vehicles and infrastructure, these technologies e.g., help monitor and manage traffic flows, provide alternate routes, save lives, decrease air pollution etc.

IEEE – America

- Institute of Electrical and Electronics Engineers
- Celebrating 125 years
- Non-profit organization (365 000 members)
- Electrical and computer sciences, engineering and related disciplines
- HQ in America
- 802.11 (WLAN), 802.3 (Ethernet), 802.16 (WMAN), 802.15.4 (WPAN) etc.

ISO – Worldwide

- International Organization for Standardization
- Funded 1947
- Network of national standards institutes
  - Swedish Standards Institute (SIS) in Sweden
- HQ in Geneva
- E.g., agriculture and construction, mechanical engineering to medical devices and IT etc.

ETSI – Europe

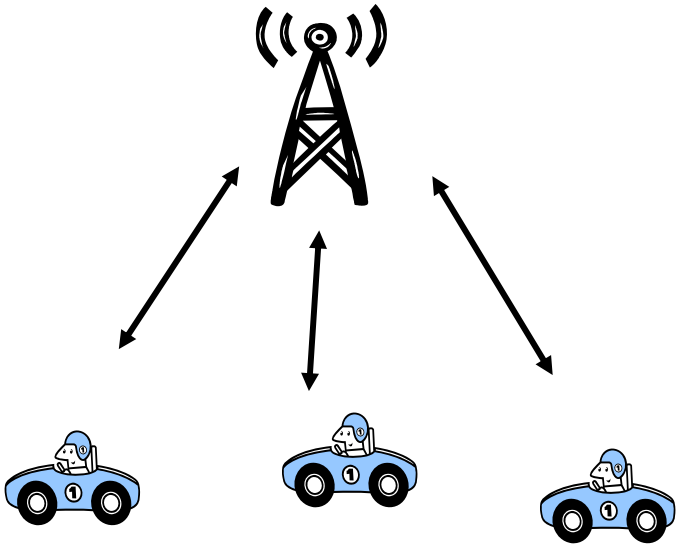
- European Telecommunications Standards Institute
- Created in 1988
- HQ in Sophia-Antipolis, France
- Standards for Information and Communications Technologies (ICT)
- 766 ETSI members (companies, institutes, universities etc.)
- E.g., GSM, 3GPP, HiperLAN

CEN and CENELEC - Europe

- CEN – European committee for standardization
  - E.g., air and space, healthcare, cooling, heating, mechanical engineering, security and defense etc.
  - EN (European standards)
- CENELEC – European committee for electrotechnical standardization
  - Electrotechnical domain

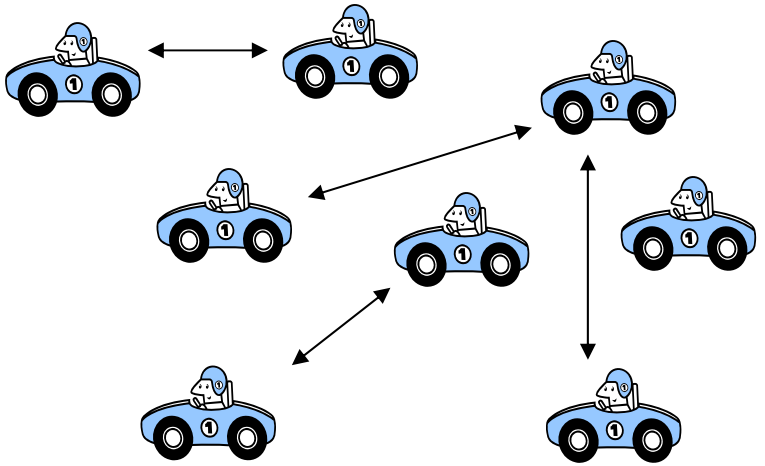
Network topologies

Vehicle-to-infrastructure (V2I)



Centralized with an access point, base station or roadside unit.

Direct vehicle-to-vehicle (V2V)



Ad hoc no central entity.

CEN DSRC

- Dedicated Short-Range Communications
- Approved standards
  - EN 12253, (PHY) EN 12795 (DL), EN 12834 (APP)
- Refers to application specific standard
  - Electronic Toll Collection (ETC), freight fleet management, traffic traveller information, parking management, automatic vehicle identification
- Centralized controller
  - hot spot communication
- No support for direct ad hoc vehicle-to-vehicle communication
- 10 MHz at 5.795-5.805 GHz (250-500 kbps)
- Öresund's BroBizz

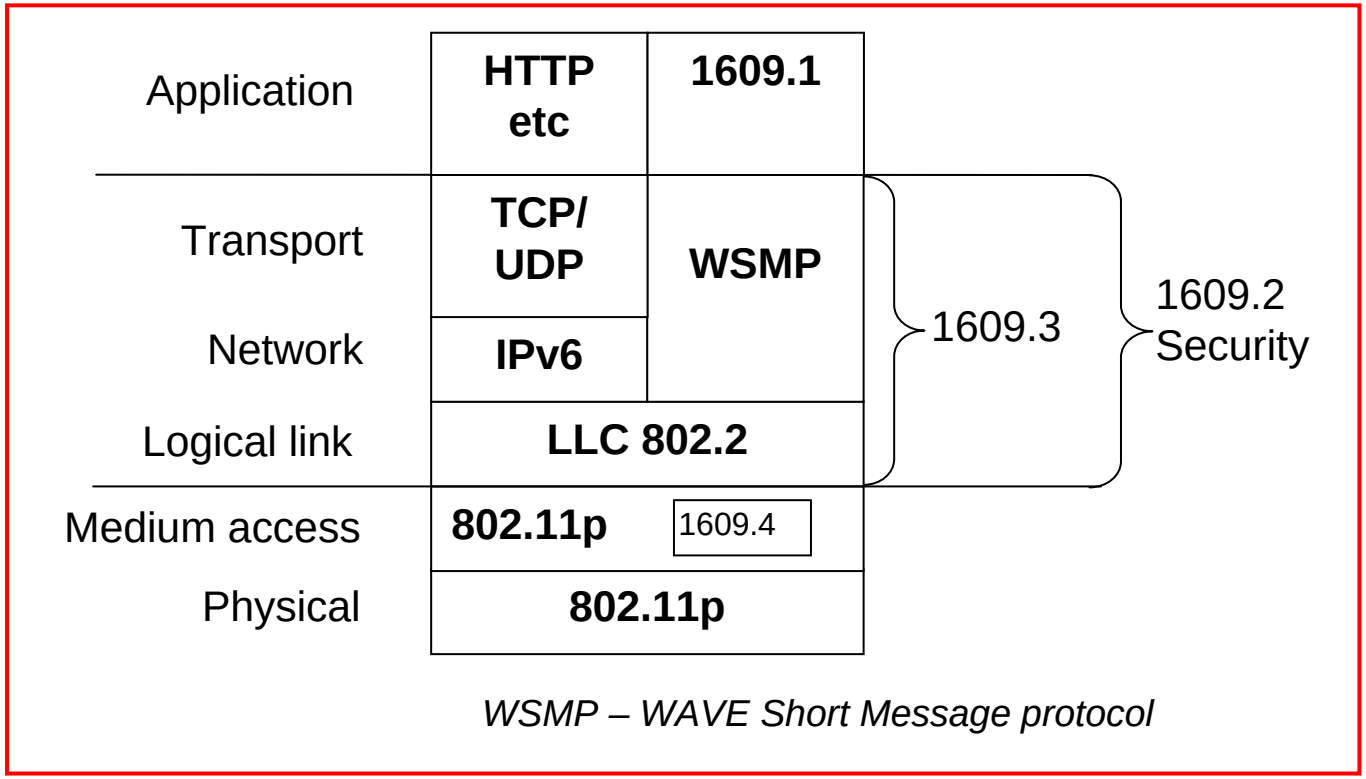
SS-EN 12834 Application layer
SS-EN 12795 Data link layer
SS-EN 12253 Physical layer

IEEE 802.11p

- Developing a vehicular communication standard based on the IEEE 802.11 wireless local area network (WLAN)
- Ad hoc direct vehicle-to-vehicle communications
- Physical layer and medium access control
- Draft stage
  - Probably official standard in June 2010
- Part of the WAVE initiative also from IEEE

WAVE incl. 802.11p

WAVE = Wireless Access in Vehicular Environment



1609.0 WAVE Architecture

1609.5 WAVE Communications Manager started during spring 2008.

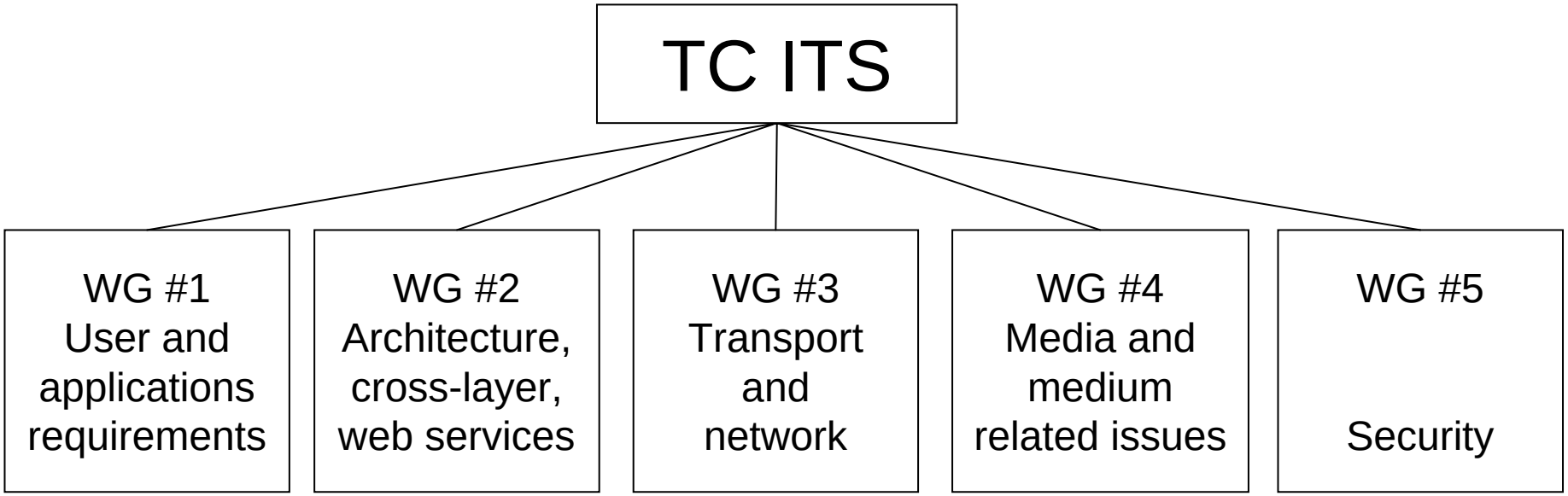
WAVE = IEEE 802.11p, 1609.0, 1609.1, 1609.2, 1609.3, 1609.4 and 1609.5

IEEE 802.11p con't

- Specially designed for 75 MHz band dedicated for ITS applications
  - 5.850-5.925 GHz Intelligent Transportation Systems Radio Service (ITS-RS)
- 1 control channel and 6 service channels
- 10 MHz channels
- 1.5, 3, 4.5, 6, 9, 12, 15, 18 Mbps
- No support for access point functionality

ETSI TC ITS

- Technical Committee (TC) on ITS formed in December 2007



ETSI G5

- WG #4 making a profile of IEEE 802.11p suited for the 30 MHz frequency band allocated in Europe
  - 5.875 – 5.905 GHz Safety related applications of Intelligent Transport Systems (ITS) “Cooperative Systems”
  - 1 control channel and 2 service channels
- The profile’s working name is G5
- Physical layer and medium access control
- ETSI G5 will probably be approved already in Oct-Nov 2009 (WG #4)

ISO TC 204 ITS

- WG #1 Architecture
- WG #3 TICS Database Technology
- WG #4 Automatic vehicle and eq. identification
- WG #5 Fee and toll collection
- WG #7 General fleet management and commercial freight
- WG #8 Public Transport – Emergency
- WG #9 Integrated transport information, management, control,
- WG #10 Traveler information system
- WG #11 Route guidance and navigation systems
- WG #14 Vehicle-roadway warning and control systems
- WG #15 DSRC for TICS applications
- WG #16 Wide area communications – Protocols and Interfaces
- WG #17 Nomadic and portable devices for ITS services

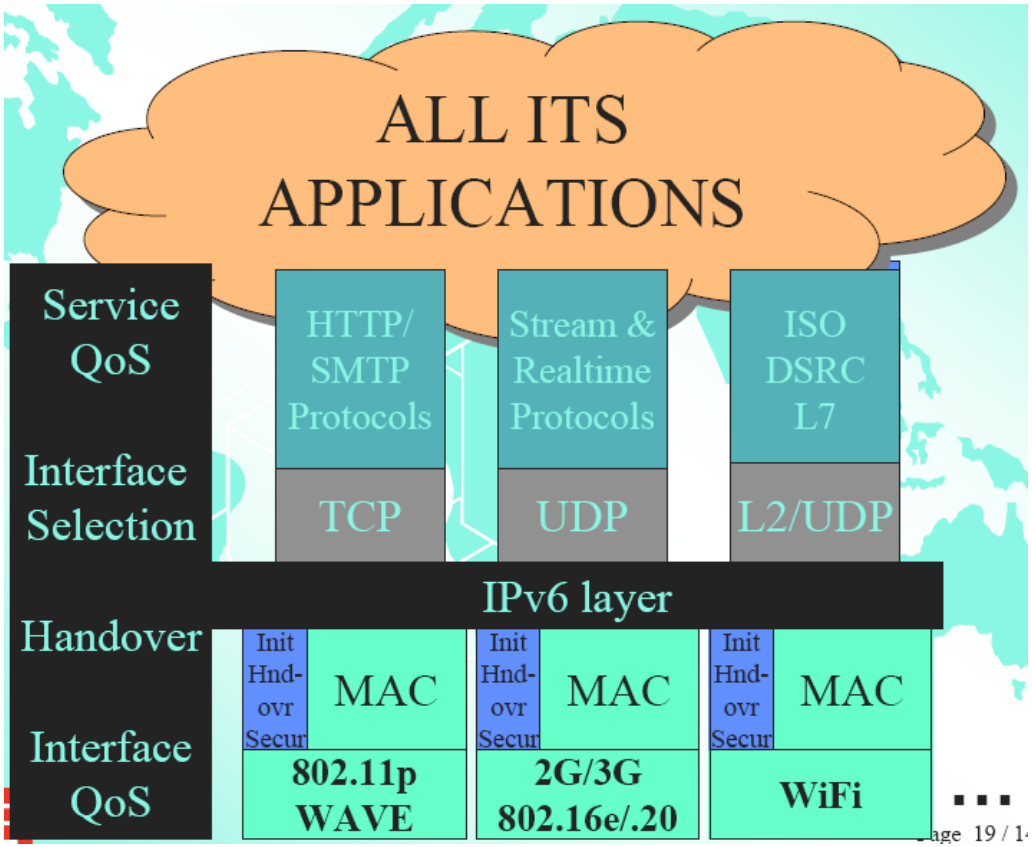
ISO TC 204 WG #16

- WG #16 Wide area communications – Protocols and Interfaces
  - Consists of 8 subworking groups
  - SWG 16.1 Architecture, SWG 16.1 Media, SWG 16.2 Networking, SWG 16.3 Probe data, SWG 16.4 Application management, SWG 16.5 Emergency communications, SWG 16.6 Non-IP networking, SWG 16.7 Security and lawful intercept
- Developing a framework called Continuous Communications for Land Mobiles (CALM)
  - Born as a concept in 2000

ISO CALM

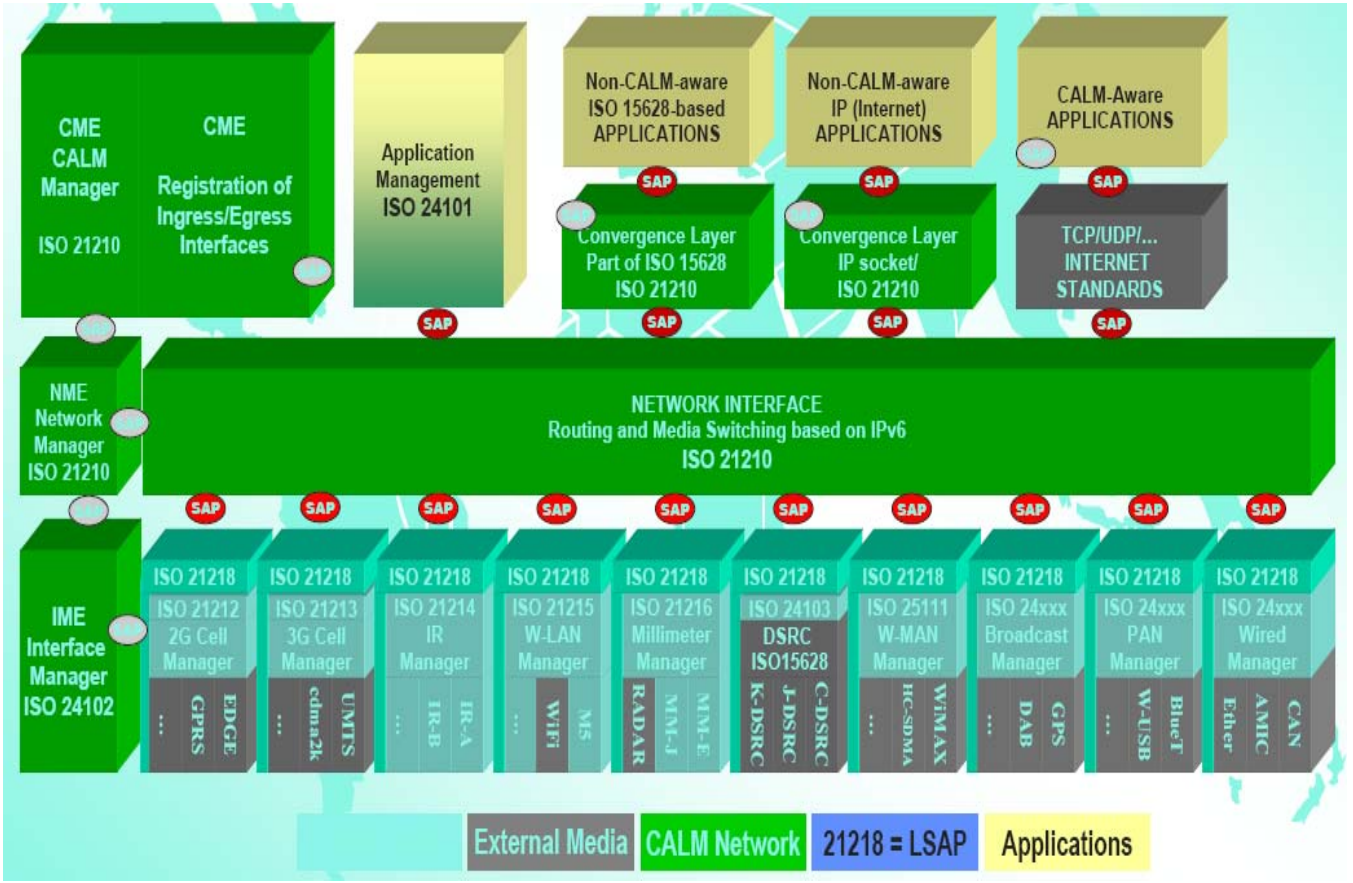
- Framework for heterogeneous packet-switched communication in mobile environments
- The framework supports user transparent continuous communications across various interfaces and communication media such 802.11p, 802.11, 802.15, 802.16e, 802.20, 2G/3G/4G cellular systems and national systems
- “Standardized set of air interface protocols and parameters for medium and long range, high speed ITS communication using one or several media”
- Supporting three communication modes
  - Vehicle-infrastructure
  - Infrastructure-infrastructure
  - Vehicle-vehicle
- 33 open working documents within CALM – already published or in its draft stage

CALM concept



Source: Knut Evensen, Q-free

ISO CALM Architecture



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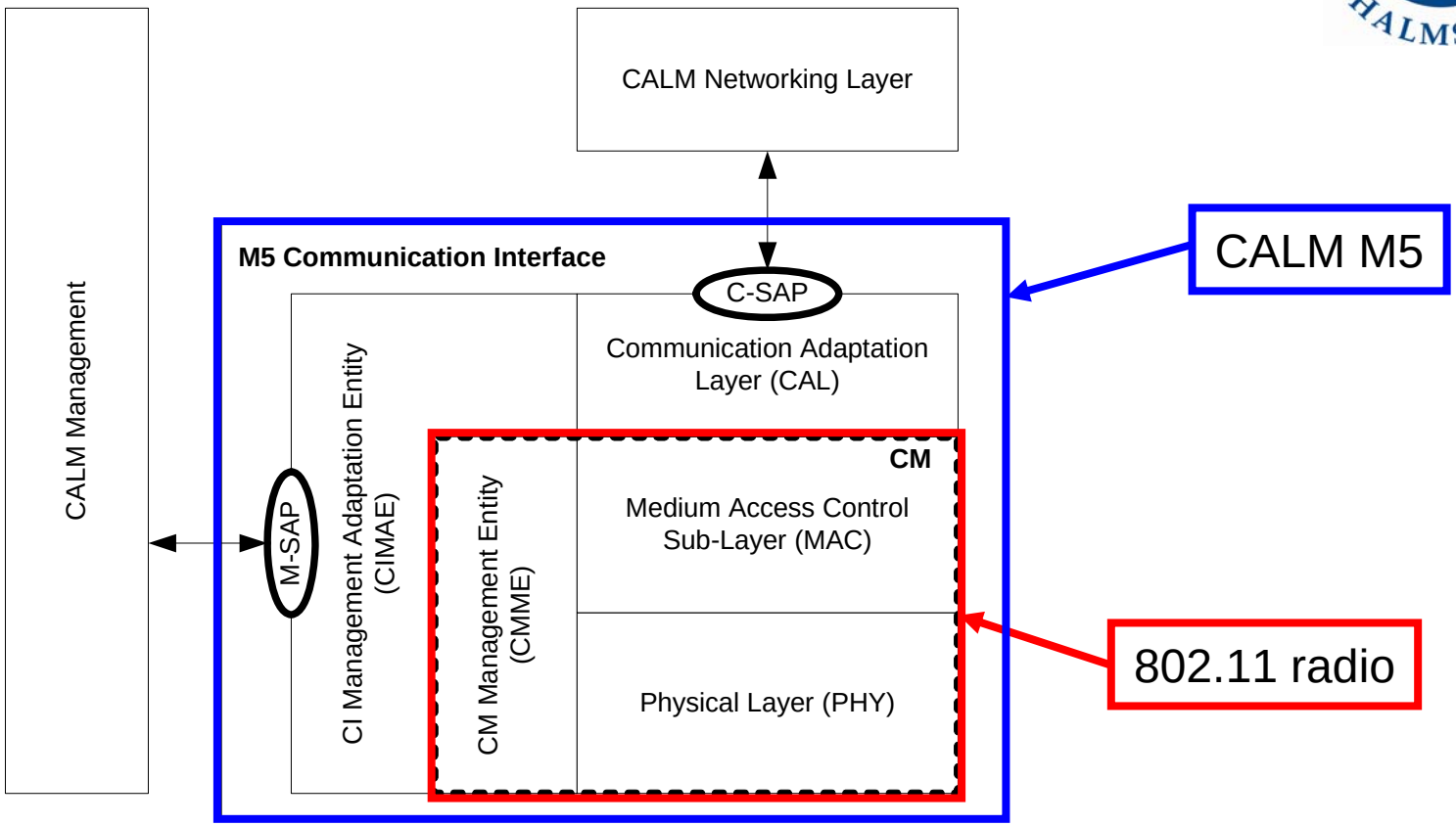
ISO CALM M5


CALM Networking Layer
CALM Management
M5 Communication Interface
C-SAP
Communication Adaptation Layer (CAL)
CM
Medium Access Control Sub-Layer (MAC)
Physical Layer (PHY)
M-SAP
CI Management Adaptation Entity (CIMAE)
CM Management Entity (CMME)
CALM M5
802.11 radio

ISO CALM M5

- M5 – Microwave communications for 5.8-5.9 GHz
- ISO 21215 draft
- Based on the IEEE 802.11p
- Communications adaptation layer
- Ballot in June 2010

Summary

- Only one standard supporting direct ad hoc vehicle-to-vehicle communications
  - IEEE 802.11p
- IEEE 802.11p is the basis for the work within ETSI (G5), ISO (CALM M5) and also in Japan
- ISO CALM is a framework for using already existing wireless carriers to solve different applications' requirements
- ETSI TC ITS will propose a solution for the vehicular environment including almost all layers, i.e., a whole protocol stack excluding the applications
- IEEE also proposes a total solution called WAVE including 802.11p, 1609.0, 1609.1, 1609.2, 1609.3, 1609.4, and 1609.5
- There are liaisons between the different organizations – IEEE, ISO and ETSI
- For the ITS sector the different wireless carriers provide different opportunities for a diverse set of applications and one standard does not exclude another one (e.g., 802.11p vs. 3G)

Thank you for your attention!

Questions?

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