

Standards for Cooperative ITS: A Proof of Concept

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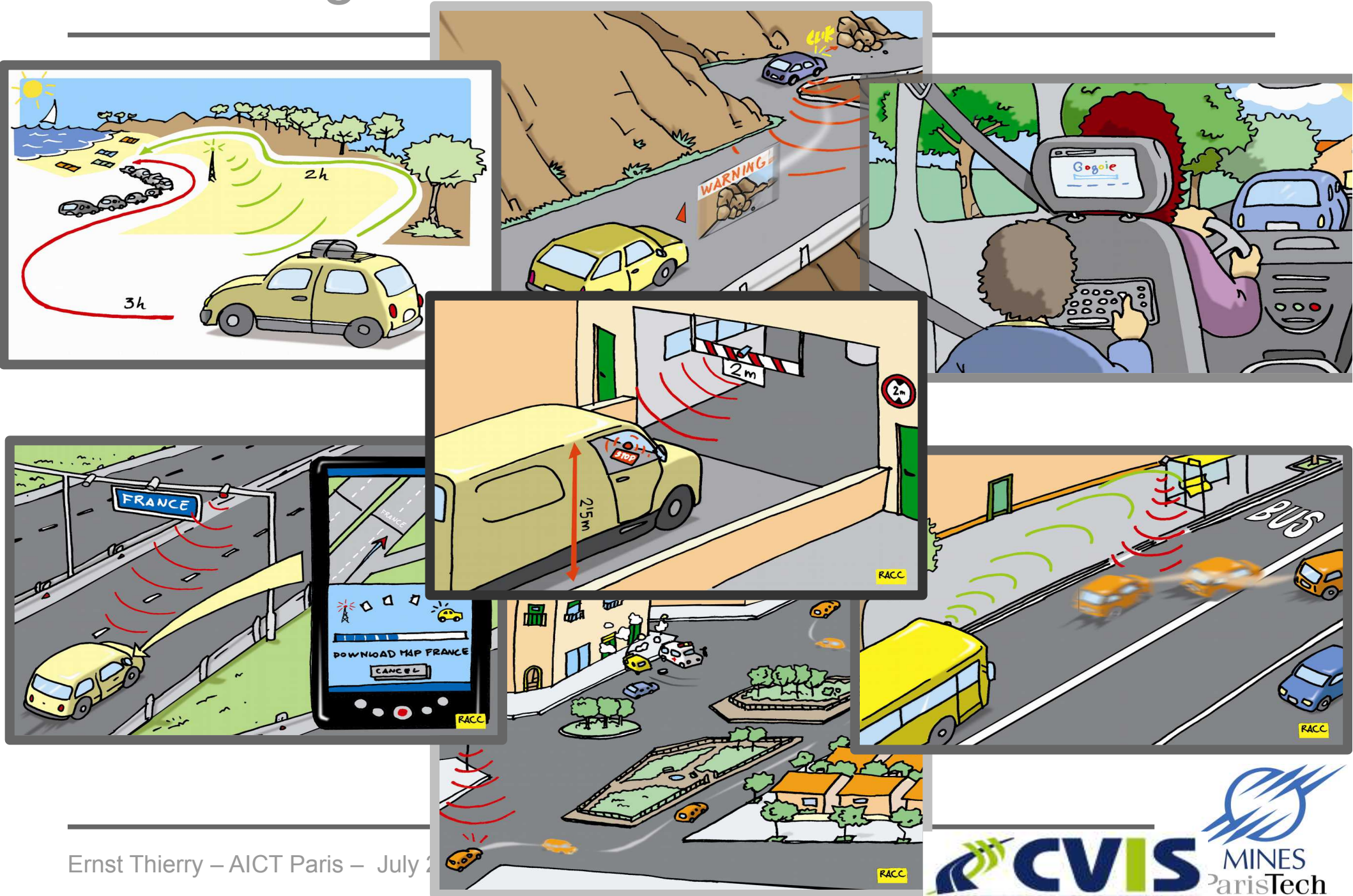
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ITS : Usages



ITS: Vision

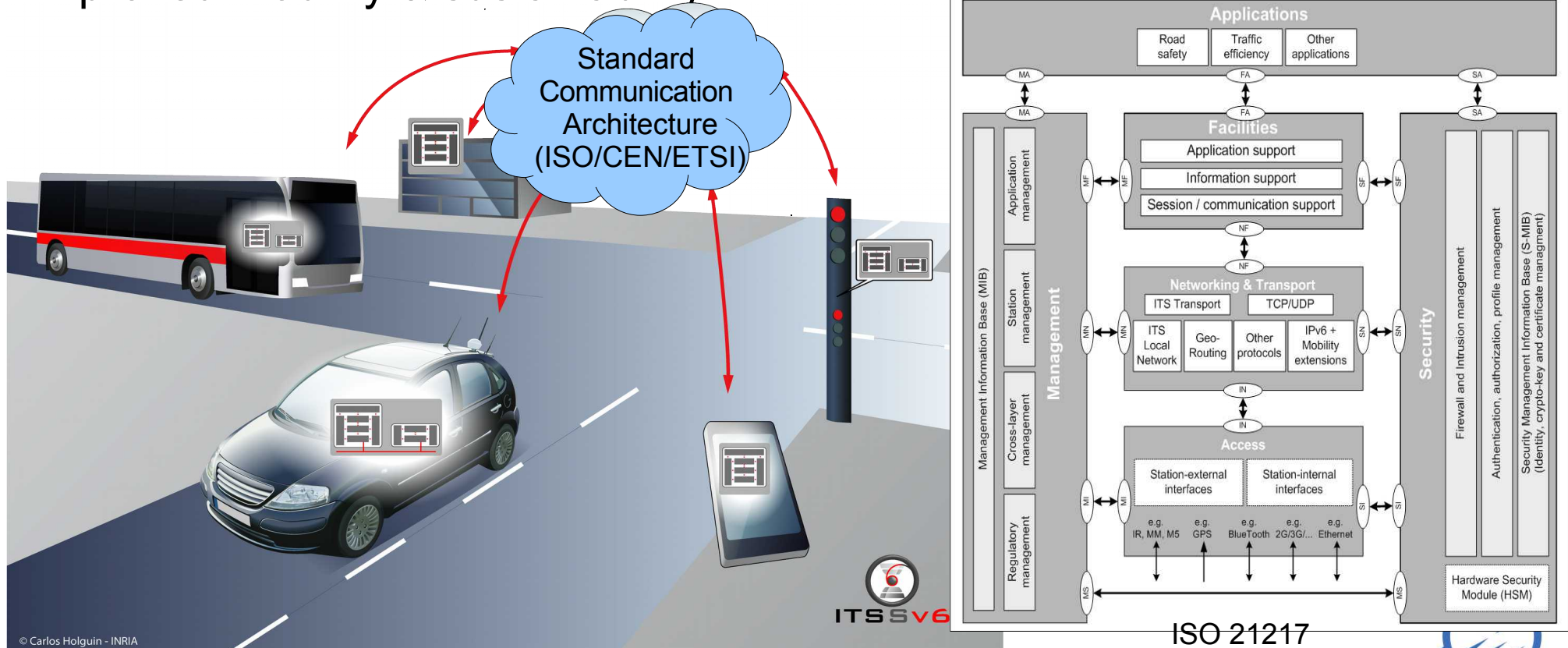
- Communicating ITS station

- ITS station diversity (vehicle, roadside, central, personal)
- Communication scenario diversity (V2V, V2R, V2C, R2C, R2P, ...)
- Communication media diversity (WiFi, DSRC, 3G, Satellite, ...)
- Application diversity (road safety, traffic efficiency, comfort/mobility)



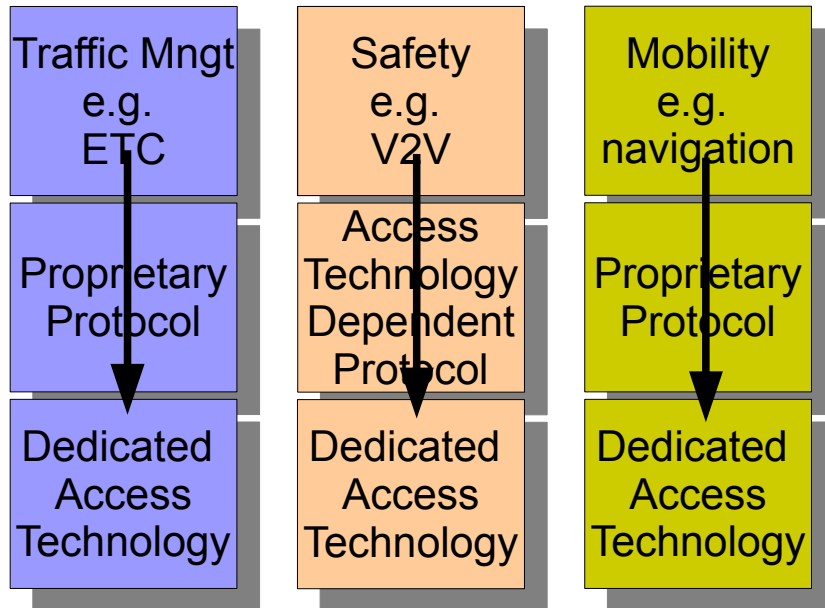
Cooperative ITS

Cooperative ITS (C-ITS) are Intelligent Transport Systems (ITS) where vehicles, roadside equipment, traffic control centers, nomadic devices, etc. cooperate, based on a common communication architecture (the **ITS Station Reference Architecture** standardized by ISO, CEN & ETSI) to provide road users with better road safety, traffic efficiency, comfort, improved mobility & sustainability.

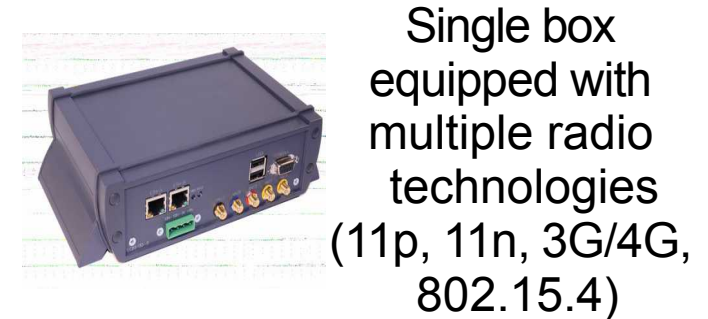
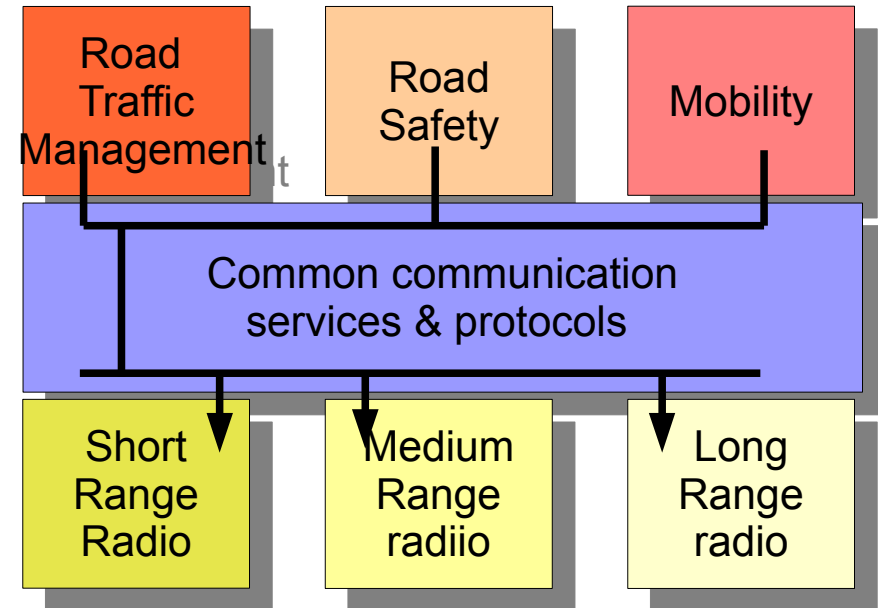


Cooperative ITS: New paradigm

Current ITS solutions



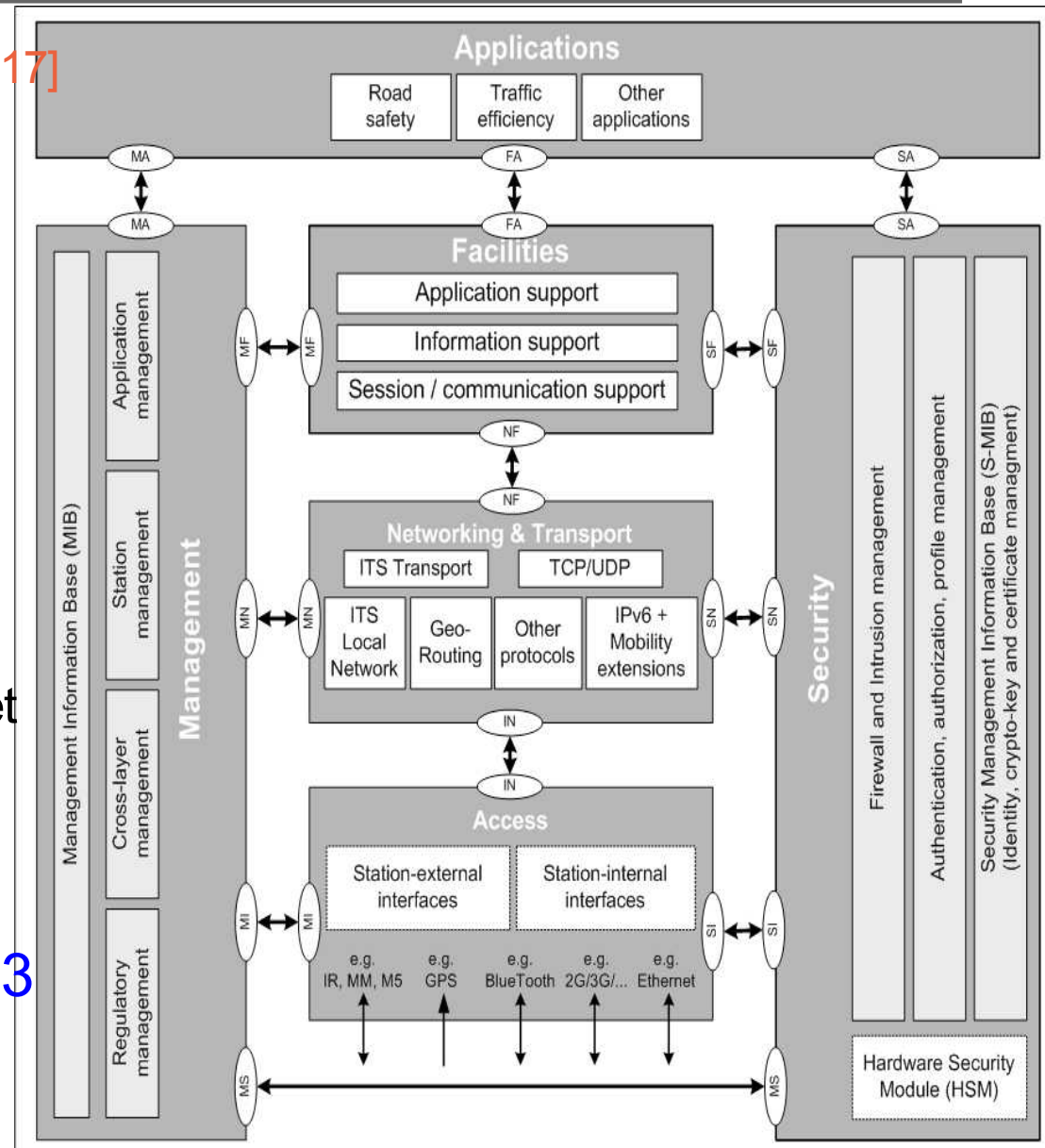
Cooperative ITS solutions



=> Need for a **generic** communication system, **standardized** and adapted to **all ITS usages**

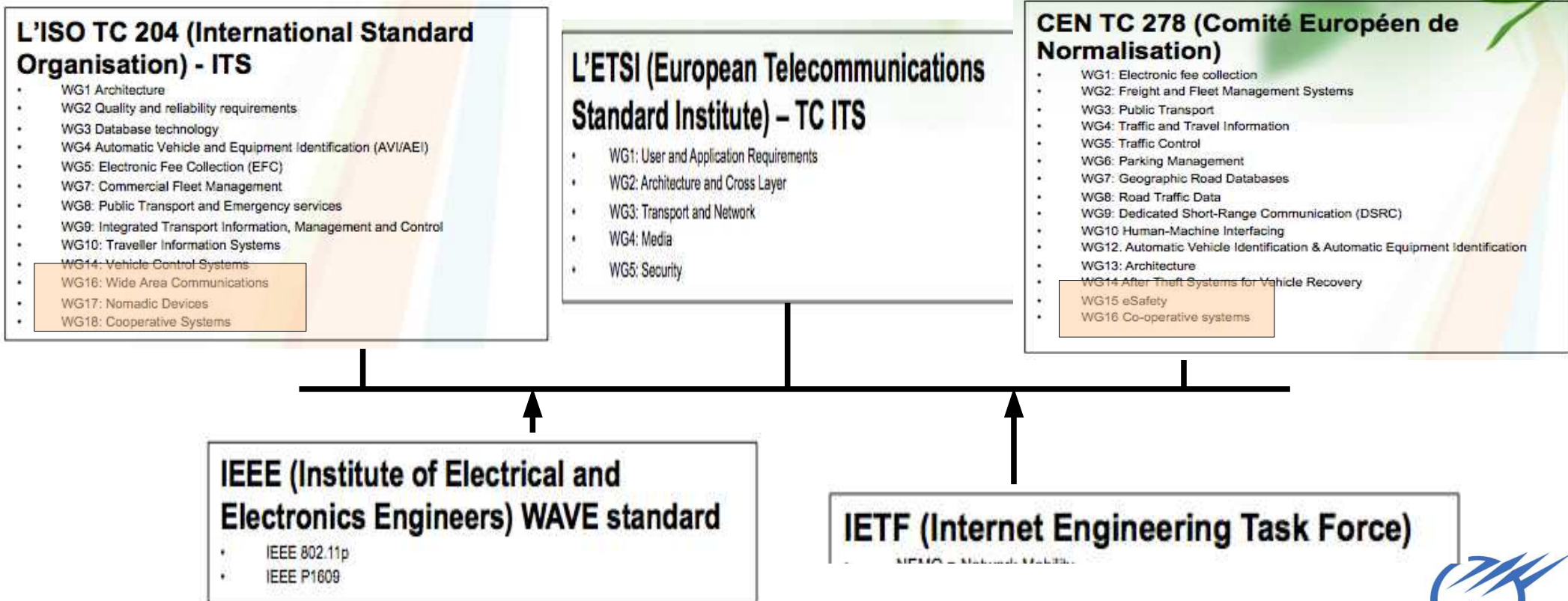
Cooperative ITS: ITS Station Architecture

- **ITS Station Architecture [ISO 21217]** supporting a diversity of:
 - **ITS stations** (vehicle, roadside, central, personal)
 - **Access technologies** (802.11p, 2G/3G, 802.11n)
 - **Applications / Use cases** (road safety, traffic efficiency, mobility/comfort)
 - **Communication protocols**: Internet Protocol (IPv6) and non-IP (ETSI GeoNetworking / ISO FNTP)
- **EC ITS Directive & Standardization Mandate M/453**
 - 65+ standards developed by ETSI/CEN/ISO (2009-2014)



Cooperative ITS: Standards (ITS Station)

Standardization effort initiated within **ISO TC204 WG16 (CALM)** [2001], completed by European Projects (CVIS, SafeSpot, Coopers, GeoNet, COMeSafety, DriveC2X, FOTsis, ITSSv6, PRESERVE) [2006-2013], **ETSI TC ITS / CEN TC 278 / ISO TC 204 (WGs 16, 17 & 18)** [since 2010]



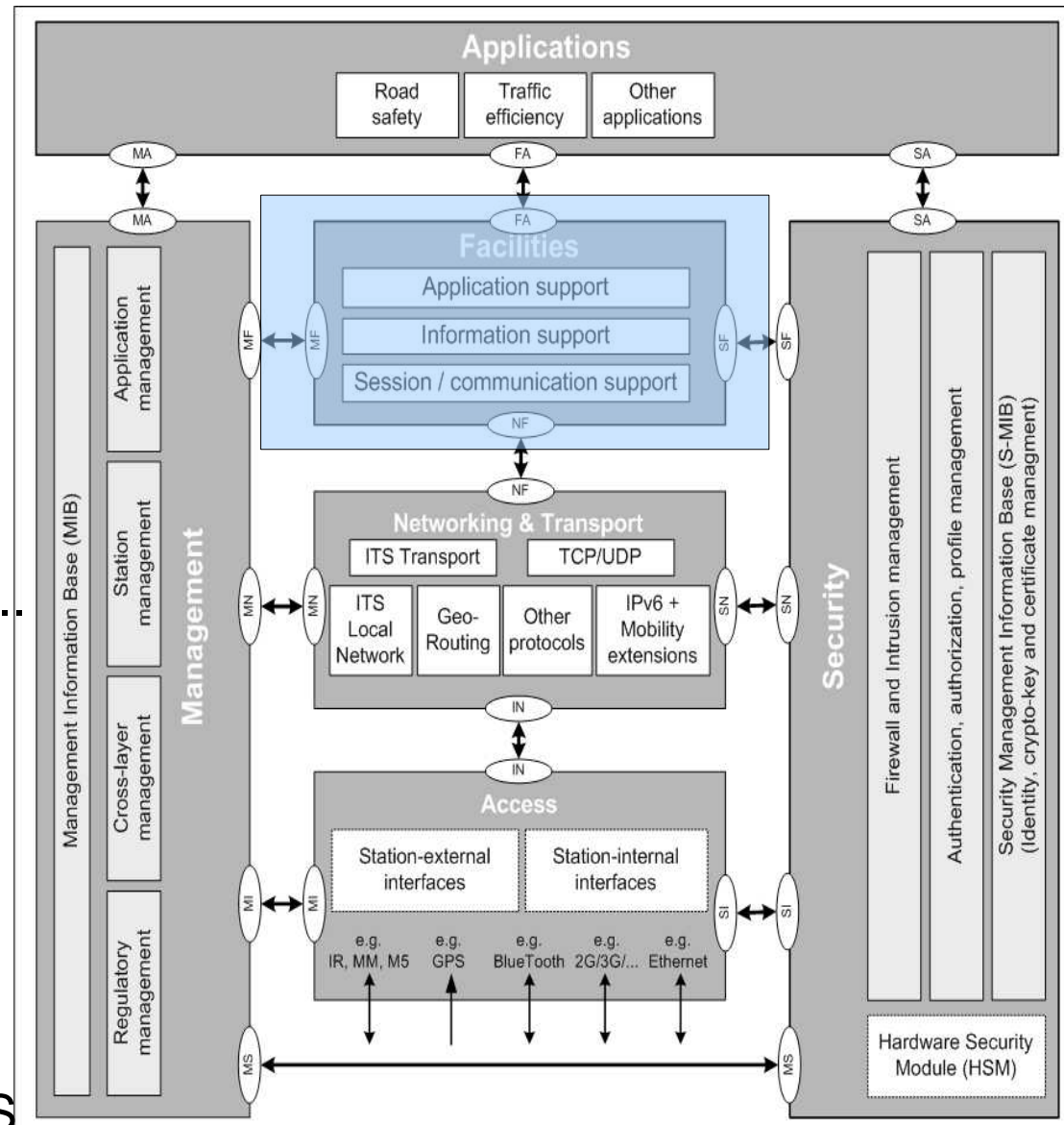
Facilities Communication Support Functions

Generic ITS-S facilities functions facilitating the exchange of data between ITS stations [ISO 17429]

- Communication profile selection
- Publication / subscription to the reception of a given content
- Time stamping of messages
- Security: encryption, authentication...

Benefits

- Transmit messages using any available protocol stack (agnostic to access technologies and network protocol)
- Future proof / inter-operability between existing systems and C-ITS



ITS station entities (non exhaustive)

LDM: Local Dynamic Map

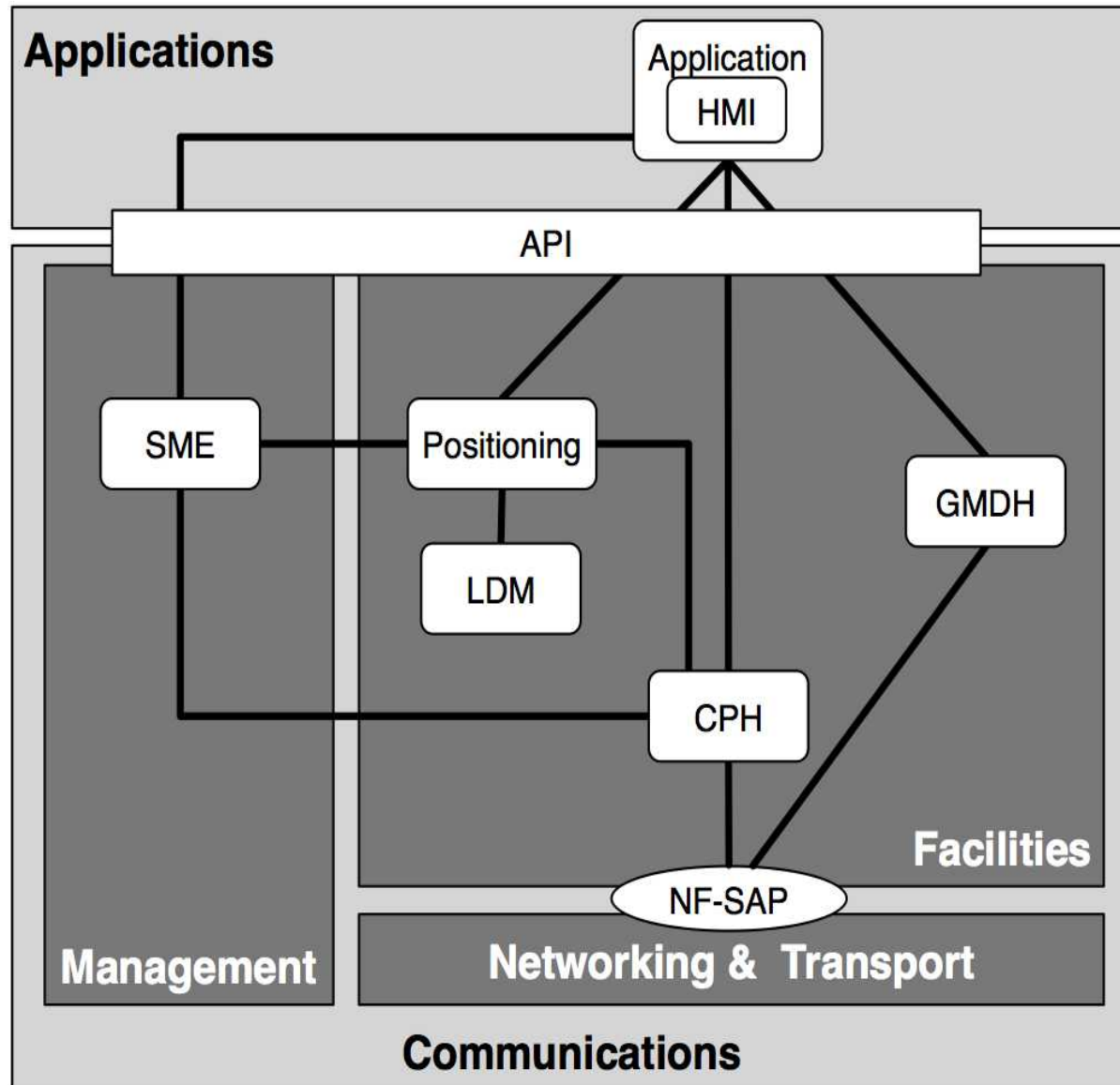
- Database recording various information (map, position of various objects, ...)

GMDH: Generic Message Distribution Handler

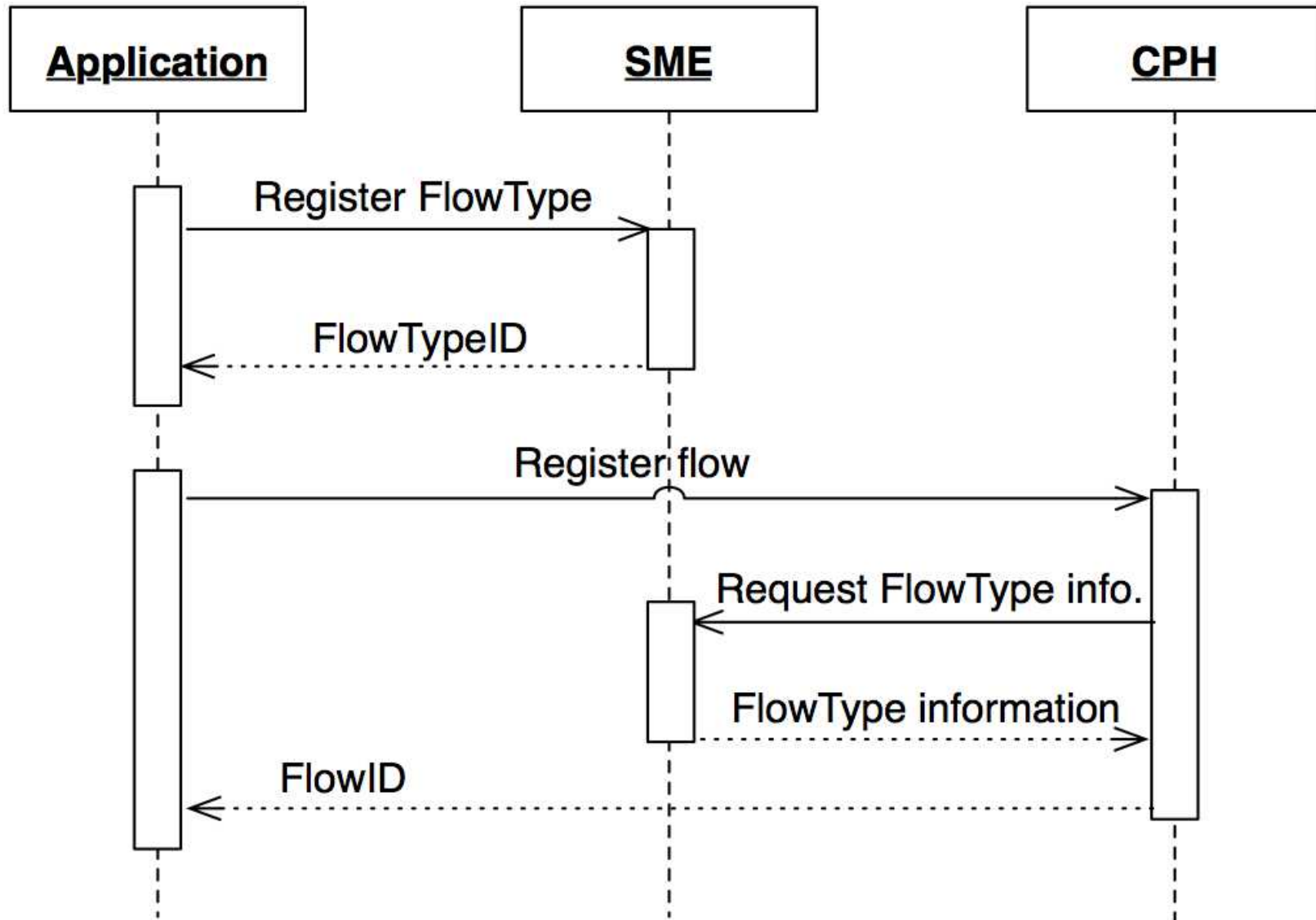
- Publication / Subscribe mechanism

CPH: Communication Profile Handler

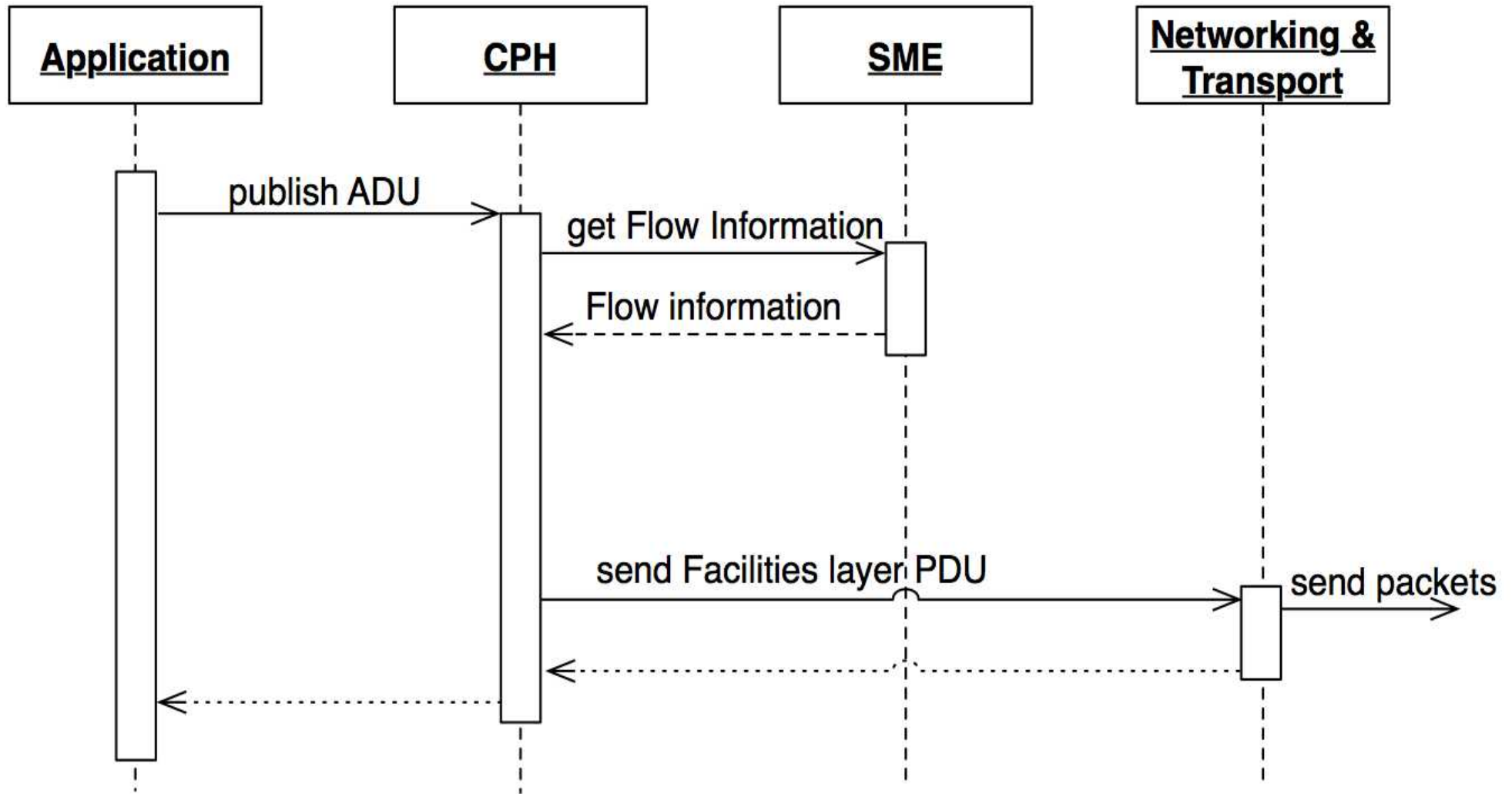
- In charge of selection of the protocol stack



Information flow between entities



Information flow between entities

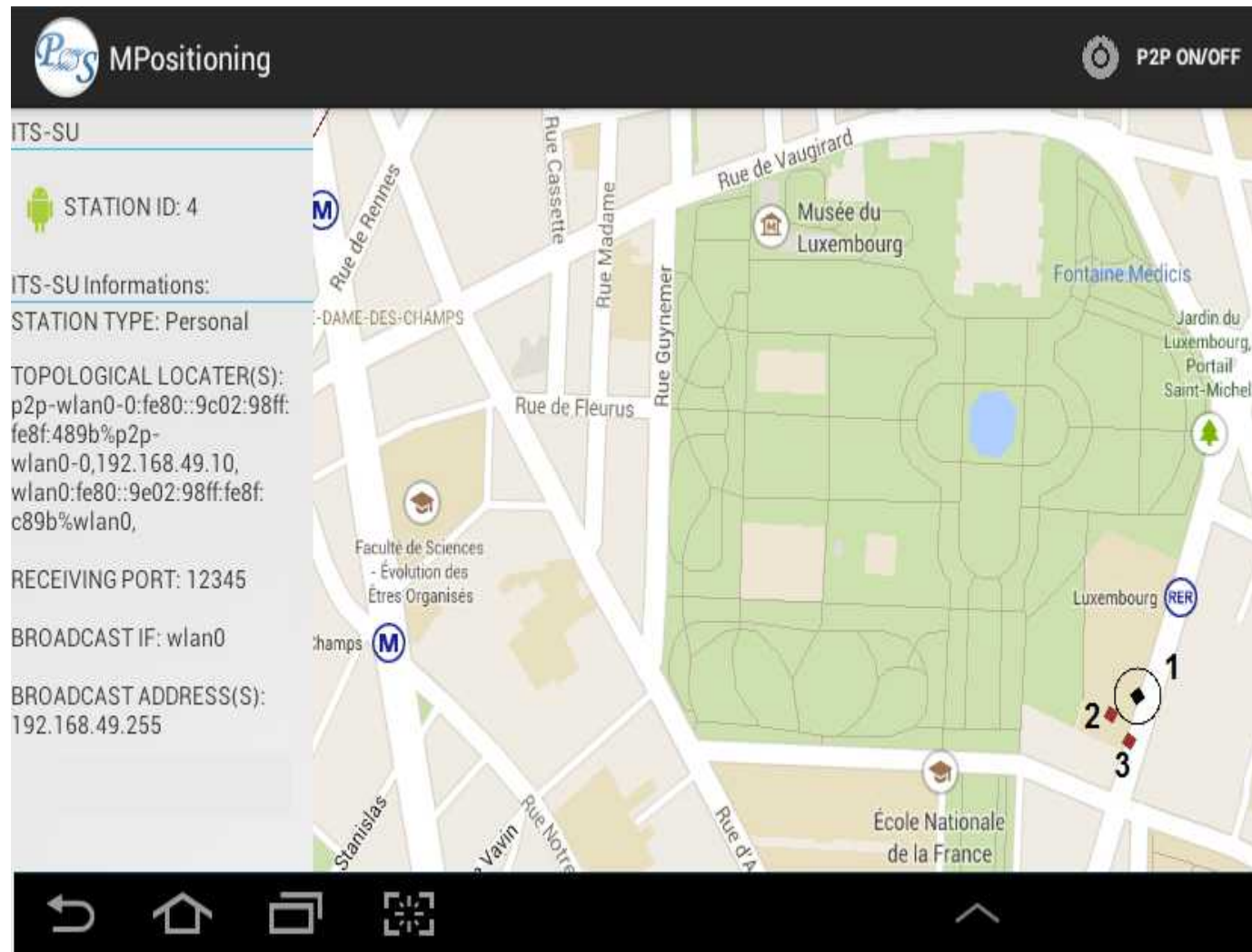
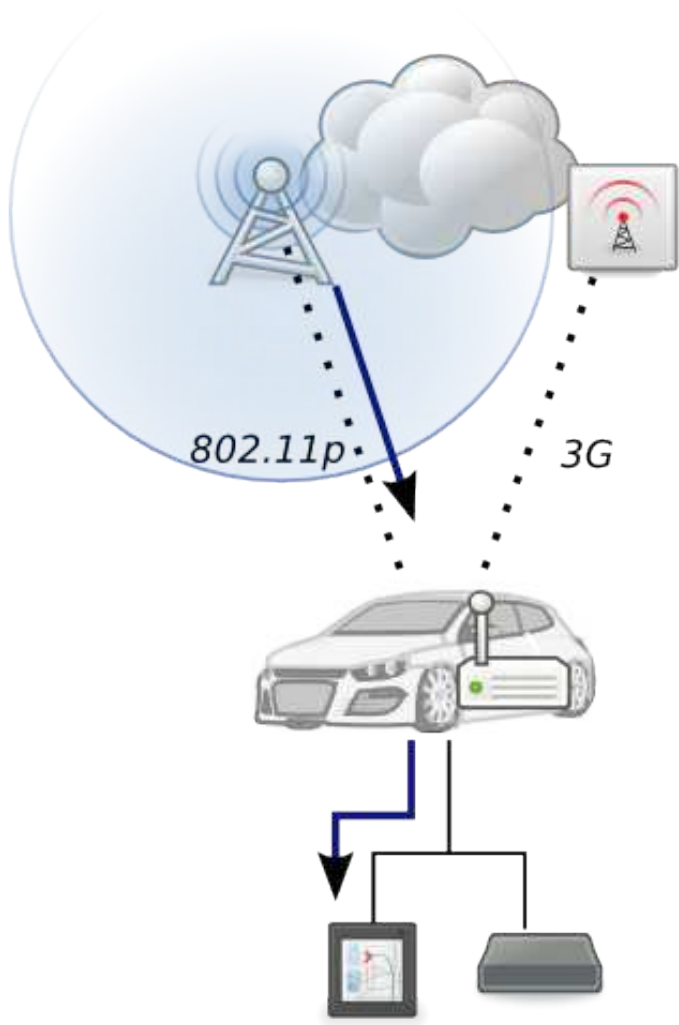


Proof of concept implementation

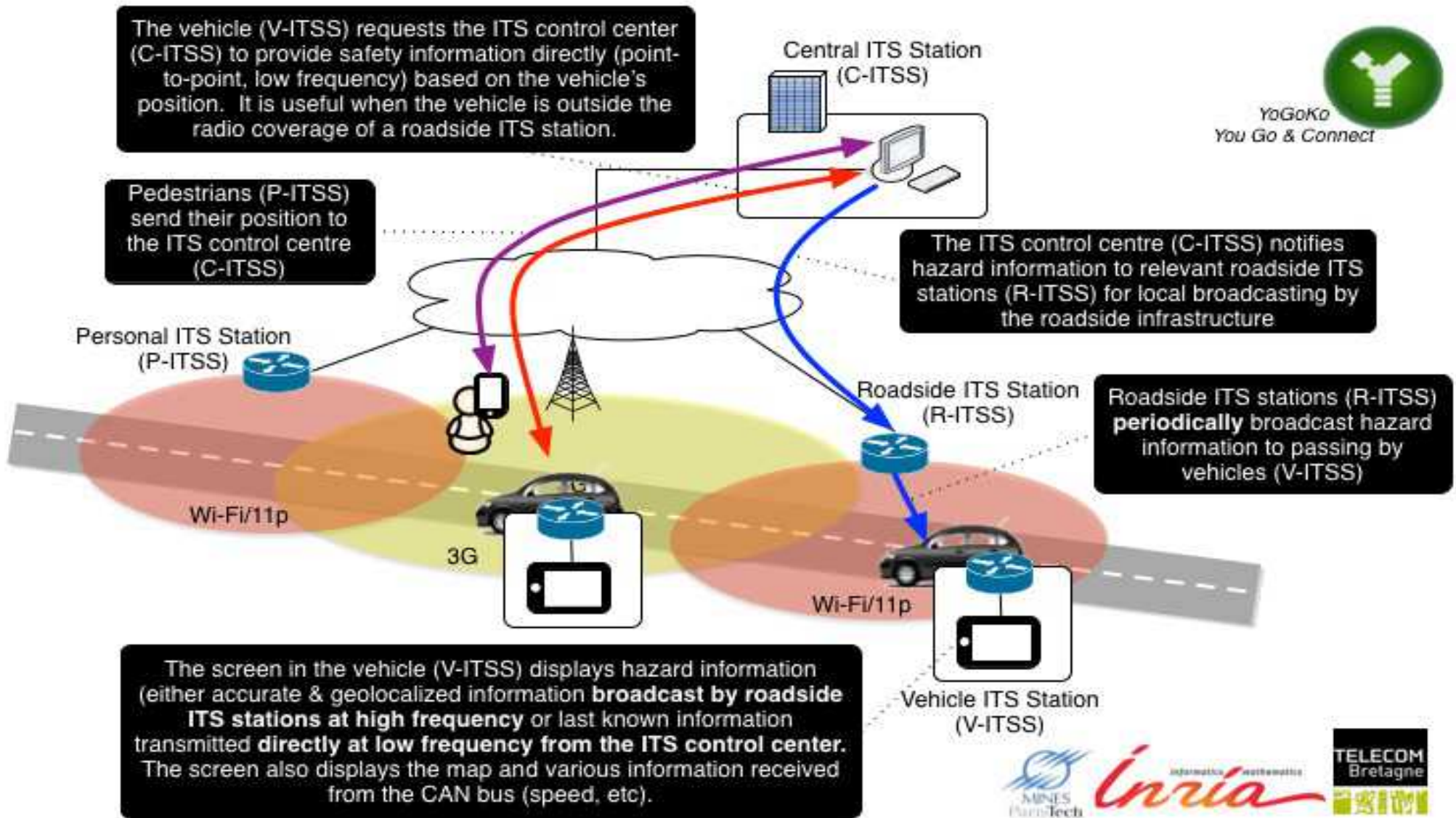
- Developed distributed middleware and API
 - Client on smart phone: user interface (Android)
 - Server on in-vehicle router (communication box)
- Developed example use case: detection of pedestrians on the road
 - Road maintenance employees working on the road equipped with smart phone
 - Smart phone connected to in-vehicle router (WiFi direct)
 - In-vehicle router broadcast position of employees (vehicular WiFi i.e. 802.11p)
 - Approaching vehicles detect employees on the road

Proof of concept implementation

Application user interface on Android



Proof of concept: Public demo



Cooperative ITS Standards: Conclusions

- Deployment of cooperative ITS based on the **ITS station reference architecture** [ISO 21217] and related standards [ISO 17423] [ISO 17419] [ISO 17429] [ISO 24102.6]
- Middleware (ITS station facilities layer)
 - To develop media-agnostic applications
 - To provide common services to applications
 - To ensure interoperability
 - To decrease complexity of application
- Proof of concept implementation
 - Position sharing use case on Android
 - Any other use case can be contemplated

Cooperative ITS: Key standards

- ISO 21217 / EN 302 665: ITS Station Architecture **published**
- ISO 21210 IPv6 networking **published**
- ISO 24102.6 Flow and Path Management **work in progress**
- ISO 17429: Profiles for exchange between ITS stations **work in progress**
- ISO 17423: ITS application requirements and objectives for selection of communication profiles **under ballot**

Cooperative ITS : Links

- <http://ec.europa.eu/digital-agenda/en/news/progress-and-findings-harmonisation-eu-us-security-and-communications-standards-field>

EU-US ITS harmonization

- <http://its-standards.eu> Cooperative ITS Standards
- <http://www.itssv6.eu> ITSSv6 : IPv6 ITS Station Stack
- <http://www.scoref.fr> SCORE@F : Système COopératif Routier Expérimental Français
- <http://www.fotsis.com> FOTsis European Project (road operators)
- <http://www.cvisproject.org> CVIS : Cooperative Vehicle-Infrastructure Systems
- <http://www.amsterdamgroup.eu> Amsterdam Group



Don't hesitate to contact me for more information about Cooperative ITS standards

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