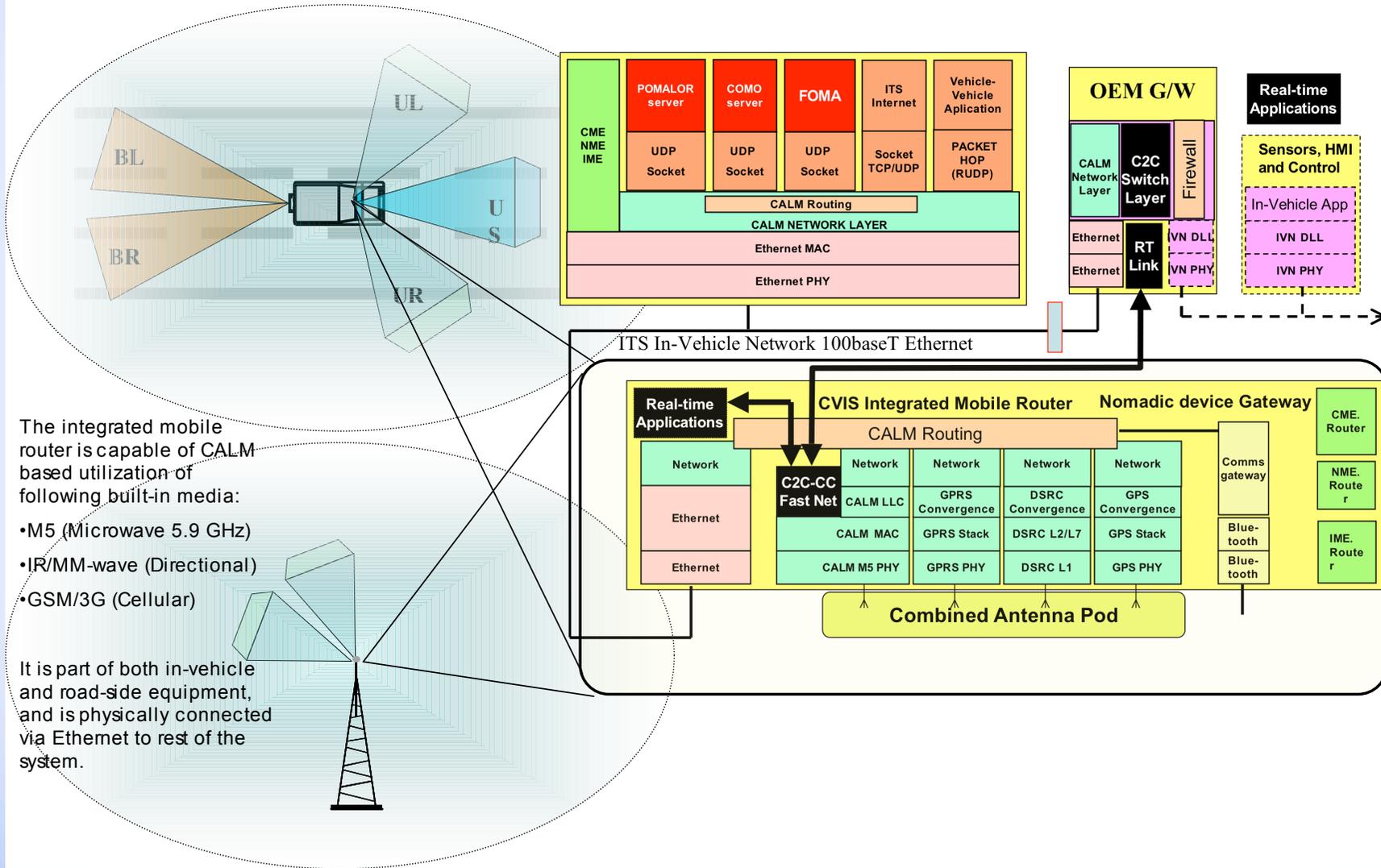


CALM/CVIS Router

Integration of multiple radio technologies into 'CALM Router' of vehicles and road-side infrastructure



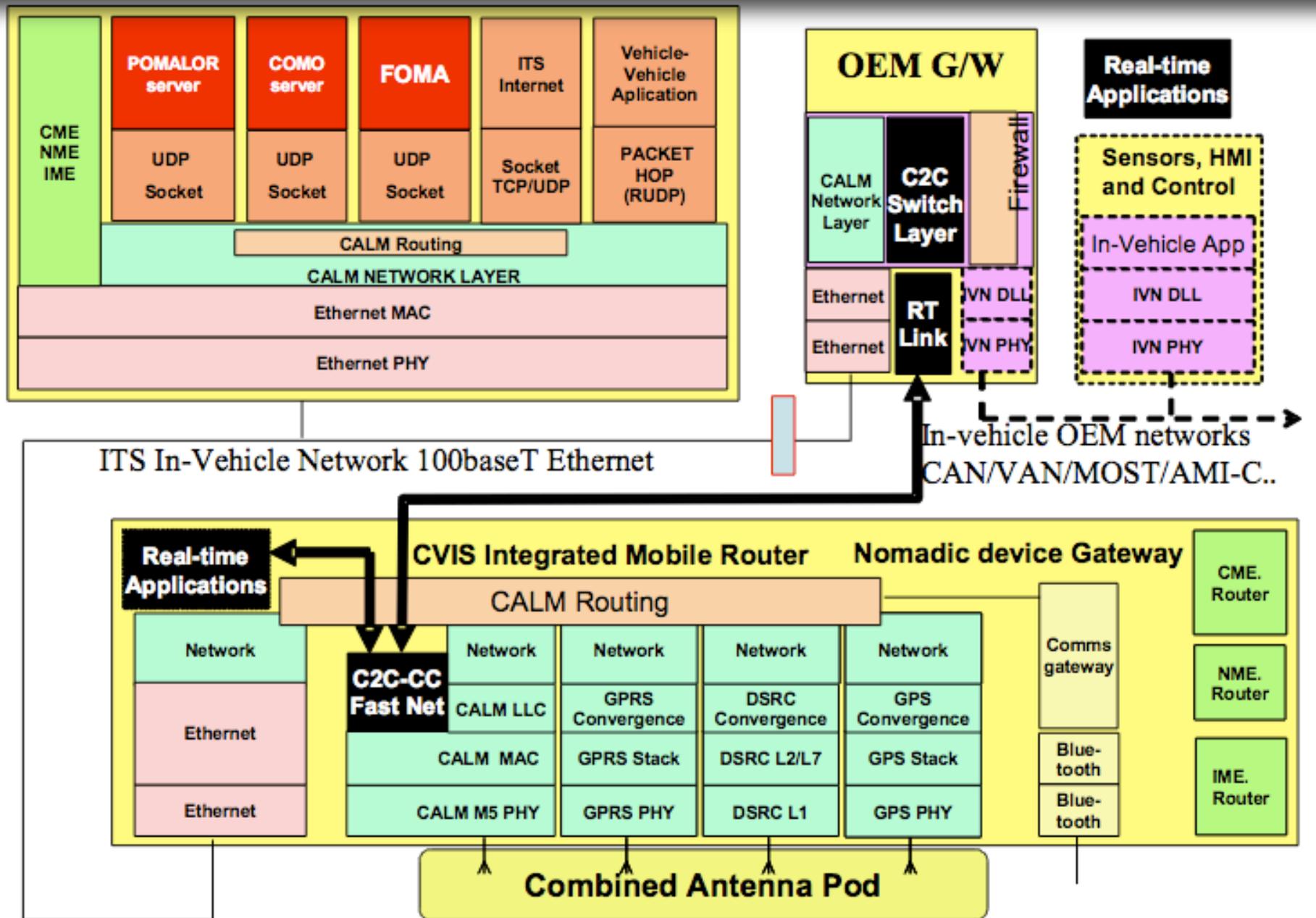
The integrated mobile router is capable of CALM based utilization of following built-in media:

- M5 (Microwave 5.9 GHz)
- IR/MM-wave (Directional)
- GSM/3G (Cellular)

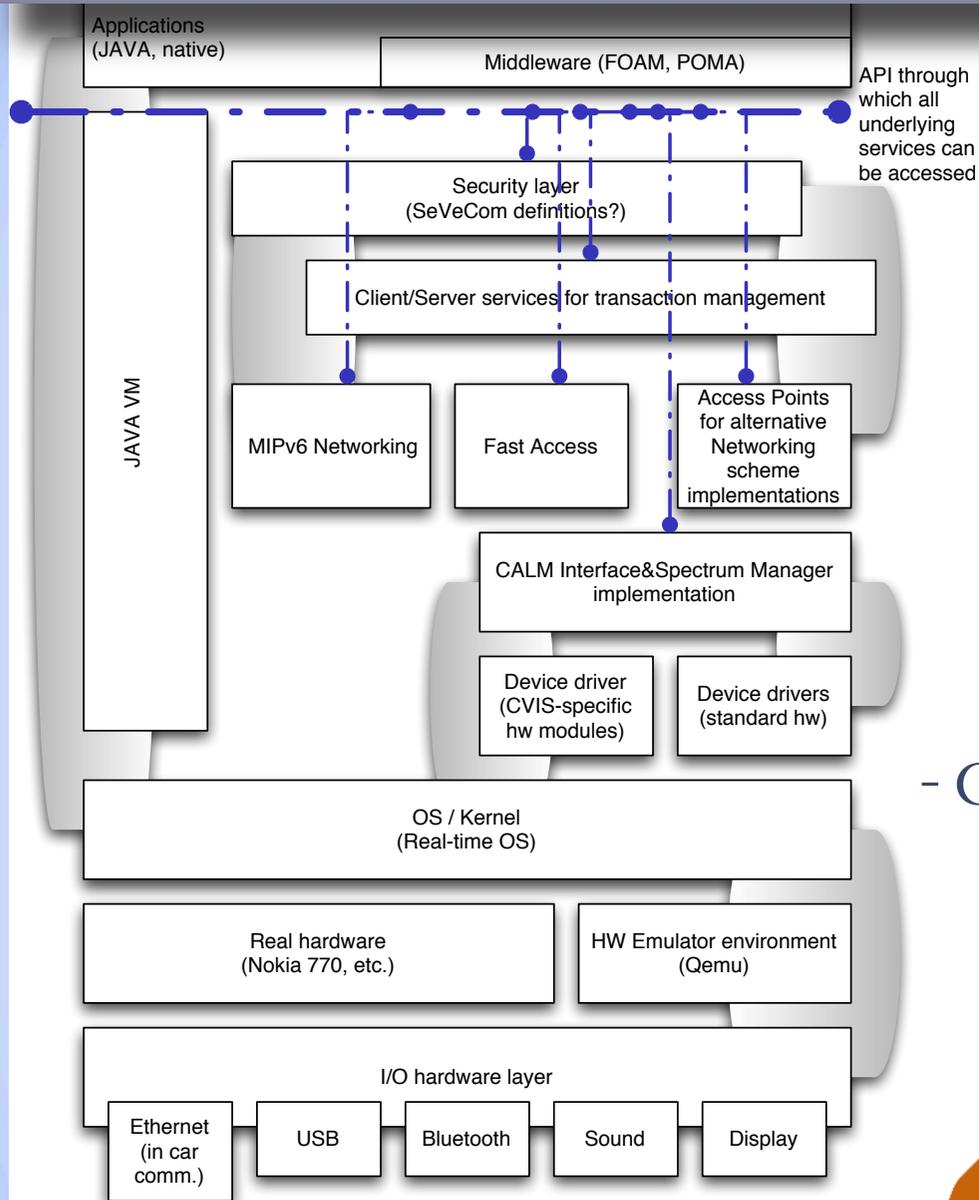
It is part of both in-vehicle and road-side equipment, and is physically connected via Ethernet to rest of the system.



In-vehicle and road-side implementation

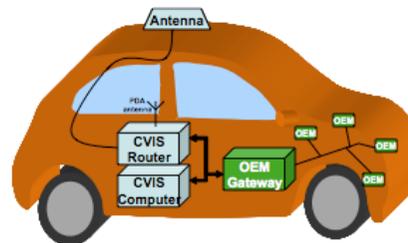


CALM/CVIS Router - modules



CALM/CVIS router

- hardware support for USB, Ethernet, Bluetooth, etc.
- realtime BSD kernel
- package manager
- Mobile IPv6 networking
- Layer3 and Layer2 level routing
- CALM protocol implementation
- CALM interface and spectrum manager
- Geo-Routing support
- Client-Server architecture
- Security layer (SeVeCom)
- JAVA virtual machine
- Fast access I/O



The five communication media types

1. Infrared light CALM IR

Its predecessor is used in several Asian countries and in the German Truck-tolling. This novel successor is currently being standardised at ISO TC204 WG16, document CD 21214. This technology especially supports localised directed communication, e.g. between subsequent vehicles and lane-selective transmission.

2. Microwaves CALM M5

The full set of this novel functionality is currently being standardised at ISO TC204 WG16, document CD 21215. A sub-set is developed at IEEE. The IEEE 802.11p standard is the mobile version of the known series of WLAN standards IEEE 802.11a, b, g. This technology especially supports localised omnidirectional communication and localised broadcast communication. A variant of this technology is considered by the European car industry in e.g. C2C-CC.

3. Millimetre waves CALM MM

This novel functionality is currently being standardised at ISO TC204 WG16, document CD 21216. This technology especially supports localised directed communication. Different physical propagation properties as compared with CALM IR makes CALM MM complementing CALM IR for safety related applications, where different simultaneous communication paths are required.

4. Cellular technology CALM 2G/3G

The inclusion of this functionality into the CALM network is currently being standardised at ISO TC204 WG16, documents CD 21212 / CD 21213. This technology especially supports wide-area communication. It uses existing ETSI standards but needs an adaptation layer.

5. Microwaves CEN DSRC

This functionality is specified in the European standards EN 12253, EN 12795, EN 13372 and the International standard ISO 15628. Currently it is used mainly for payment systems and access control in battery powered stand-alone systems glued to the windscreen. Integration into the CVIS communications platform is important. The technological / scientific challenge is to achieve harmless co-existence of DSRC and CALM M5.



Protocol functionalities

1. Mobile IPv6 routing functionality

This novel functionality currently is standardised at IETF in co-operation with ISO TC204 WG16. It allows access to a mobile client based on a home agent. State-of-the-art IP addressing is included in CVIS as well.

2. Geographically mapped IPv6 addressing

This novel functionality performs proper IP address mapping based on the geographical location.

3. Fast location addressing

This novel functionality is standardised at ISO TC204 WG16. It uses the geographical location as addresses for communication.

4. Real-time data exchange

This novel functionality is standardised at ISO TC204 WG16. It allows for extremely fast communications of mostly very short messages by avoiding protocol overhead.

5. CALM management CME / NME

This novel functionality is standardised at ISO TC204 WG16. It is responsible for managing bindings between various applications and various communications media based on the requirements of applications and the capabilities / cost / availability of media.

6. CALM interface management IME

This novel functionality is standardised at ISO TC204 WG16. It allows real-time control of communications media parameters, such as e.g. frequency, power, directivity, data rate, ... etc, in order to comply with applicative needs and regional regulatory requirements, e.g. spectrum management.

