# URBAN RAIL EXPECTATIONS FOR FUTURE COMMUNICATION SYSTEMS

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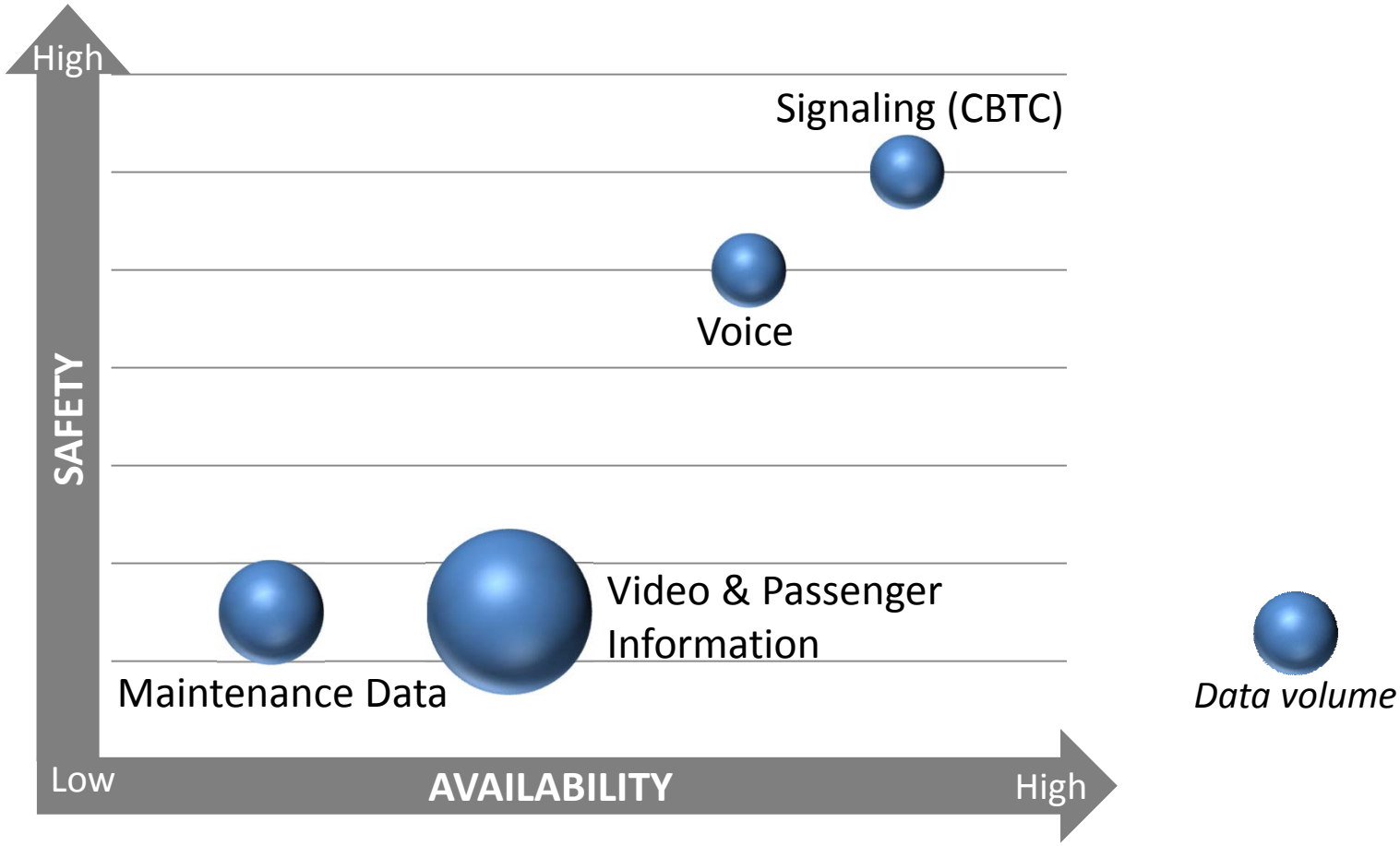
*convergence benefits with regional and long distance rail*

# URBAN RAIL RADIO USAGE

## *Communications performances cartography*



# URBAN RAIL RADIO USAGE

## *Urban Rail communications Networks*

| **Signalling - CBTC (Communication Based Train Control)** | **Voice (driver and/or passenger emergency communication)** | **Video + Passenger Adress & Information** | **Maintenance Data** |
|---|---|---|---|
| Adapted WIFI (either on a dedicated frequency 5.9GHz or ISM band) | Analog or tetra Network | Standard WIFI network (on ISM band) | Standard WIFI network (on ISM band) |

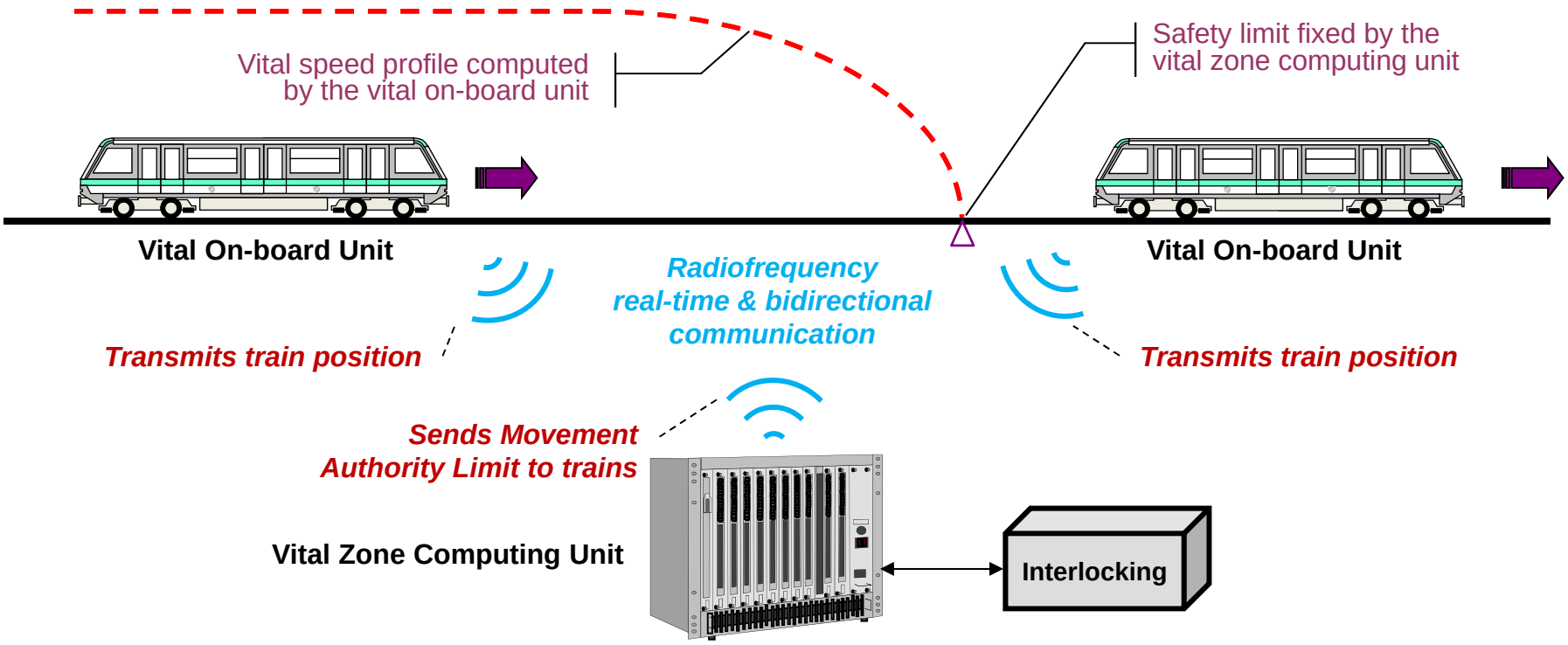
Functions adressed mainly trough dedicated communication networks

# URBAN RAIL RADIO FOR CBTC

## *Communication Based Train Control Systems*

### The new market standard for signaling systems

- The radio ensures train safe-movement control



# URBAN SPECIFIC CONSTRAINTS

## *Impacts on communication architecture #1/2*

- Real-time performance
  - 35 seconds dynamic headway (gap between trains)
  - Depends on:
    - Train traction & braking characteristics (Rolling Stock issue)
    - Vital computers calculation time cycles (CBTC issue)
    - **Radio communication performance (Communication system issue)**
- Safety
  - Integrity of data related to environmental conditions and localization
  - service availability (avoid passengers evacuation if possible)
- Security
  - Fulfill EN 50159 (Closed communication network)
  - National cybersecurity requirements (Vital Important System)

# URBAN SPECIFIC CONSTRAINTS

## *Impacts on communication architecture #2/2*

- High level of availability
  - Way side and on board radio redundancy
  - Availability of the air gap: rather dedicated than open frequency band
- Life span
  - Related to frequency band allocation and technology
  - To be compliant with CBTC system : 30/40 years (probably far too ambitious?)
- Quality of service
  - Operation in tunnels (obstruction from other trains)
  - or urban dense areas (electromagnetic interferences)

# NEAR FUTURE ISSUES

## *European actions to secure urban transport communication needs*

### Protect 5.9GHz frequency band

- UITP initiative (together with UNIFE) : the Spectrum User Group
  - ETSI action TR 103442 : Sharing protocol with ITS and CBTC in 5.9GHz band
    - To allow high priority of the frequency band to CBTC
    - Pending decision to the ECC (European Communication Committee)
  - Revision of ECC Decision (08)01 proposed by WGFM
    - To include Urban CBTC as co-owner of the 5,9 GHz band (together with future « smart roads & cars »)

### Think about systems optimisation

- To merge all services on a same communication system
  - Initiated with MODCOM (MODURBAN)
  - And took over by S²R-IP2 (UNIFE)

# NEAR FUTURE ISSUES

## *New applications for CBTC*

### Suburban/regional railway

- Not only tunnel/dense areas crossings, but also using regional network branches
  - serving long distance zones,
  - with few trains per hour.
- Urban model for radio transmission is technically compatible but:
  - Not optimized in terms of number of trackside access points
  - Oversized in terms of performances
    - Compared to ERTMS / ETCS requirements

# LONG TERM EVOLUTION (LTE)

## *The new LTE technology*

### Originally developped to support 4G/5G networks

- Heavily promoted for railway applications by the major telecom manufacturers (Huawei, ZTE, Nokia, Ericsson,...)
- Already deployed on some metro lines in china (Urumqi, Chongqing, Changaï L6,...)
  - Using a dedicated frequency band 1,8GHz, allocated to urban rail by the Chinese government
- Most probabelly: will be supported by the railway industry:
  - S²R-IP2 will promote the LTE technology
  - Leading railway industry to give up proprietary radio development

# LONG TERM EVOLUTION (LTE)

## *LTE over Urban rail: a model still to be addressed*

**LTE will certainly address urban rail technical needs:**

- Based on ethernet IP standard
  - supports IoT (Internet of Things)
  - **Fully adresses CBTC requirements**
    (field test already done by some metro operators and CBTC providers with telecom manufacturers in Europe)
- But with specifics
  - Personal Mobile Radio (PMR) needs of operators :
    - group calls, localisation on grid, etc.
  - Symmetrical tuning (Upload AND download)

**But operation needs to be addressed**

- PMR: not yet specified : Lessons from GSM-R experience?
- Opportunity or threat to bear on functions on a same link
  - Namely CBTC and Radio / Video on GOA2 and GOA4 lines

# LONG TERM EVOLUTION (LTE)

## *LTE over Urban rail: a model still to be addressed*

**its use case is to be questioned:**

- Dedicated bandwith? Using which statutory support?
- Third-party operated? Or proprietary infrastructure? With which lifespan?
- Multimodal infrastructure? Or a dedicated network per modes or per line?
- What life cycle consideration (maintenance, evolution of needs: video, migration, cybersecurity, etc…)?

**Urban rail needs to define its global environment constraints rather than being overimposed by the telecommunication industry.**