URBAN RAIL EXPECTATIONS FOR FUTURE COMMUNICATION SYSTEMS

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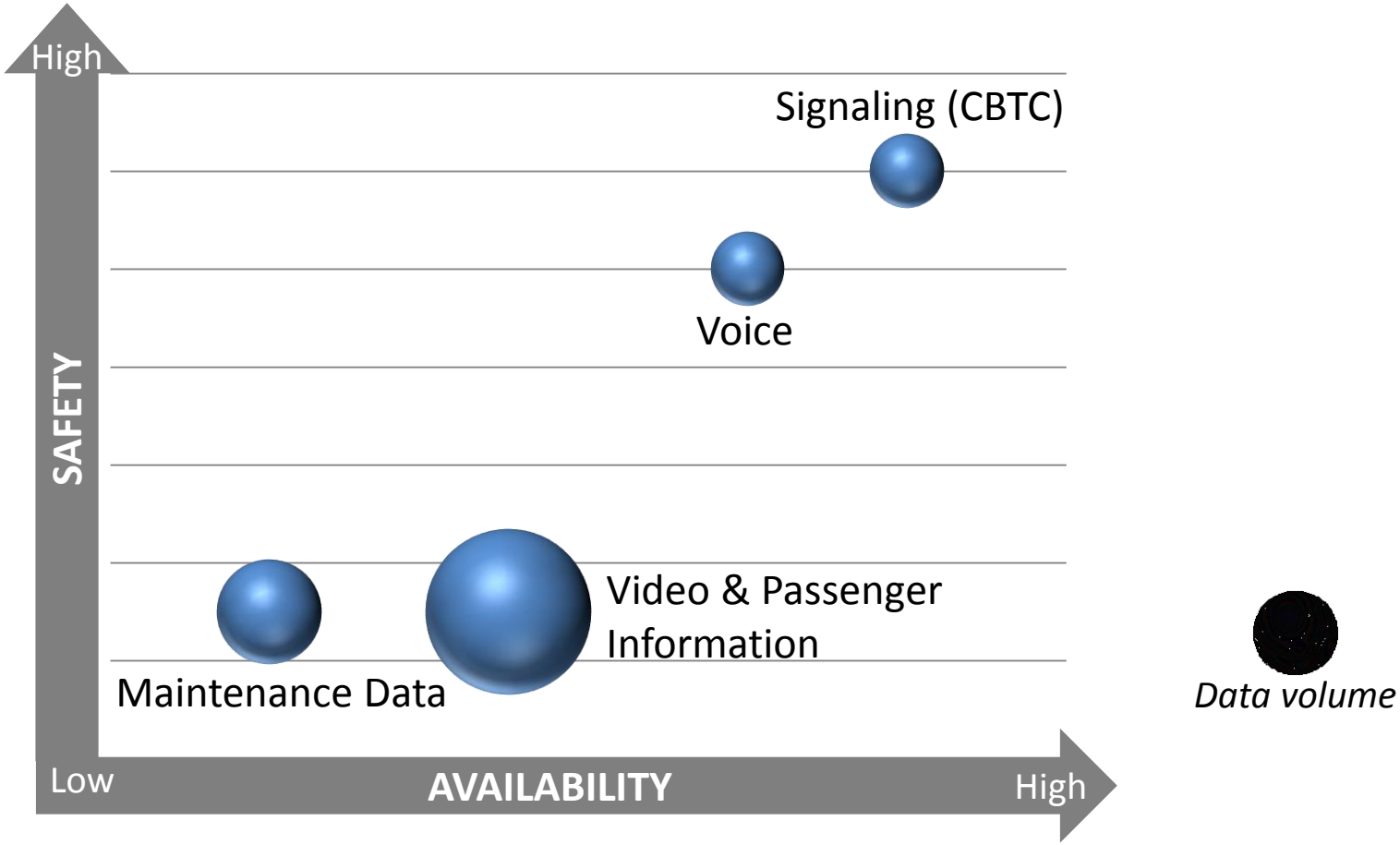
CONVERGENCE BENEFITS

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)

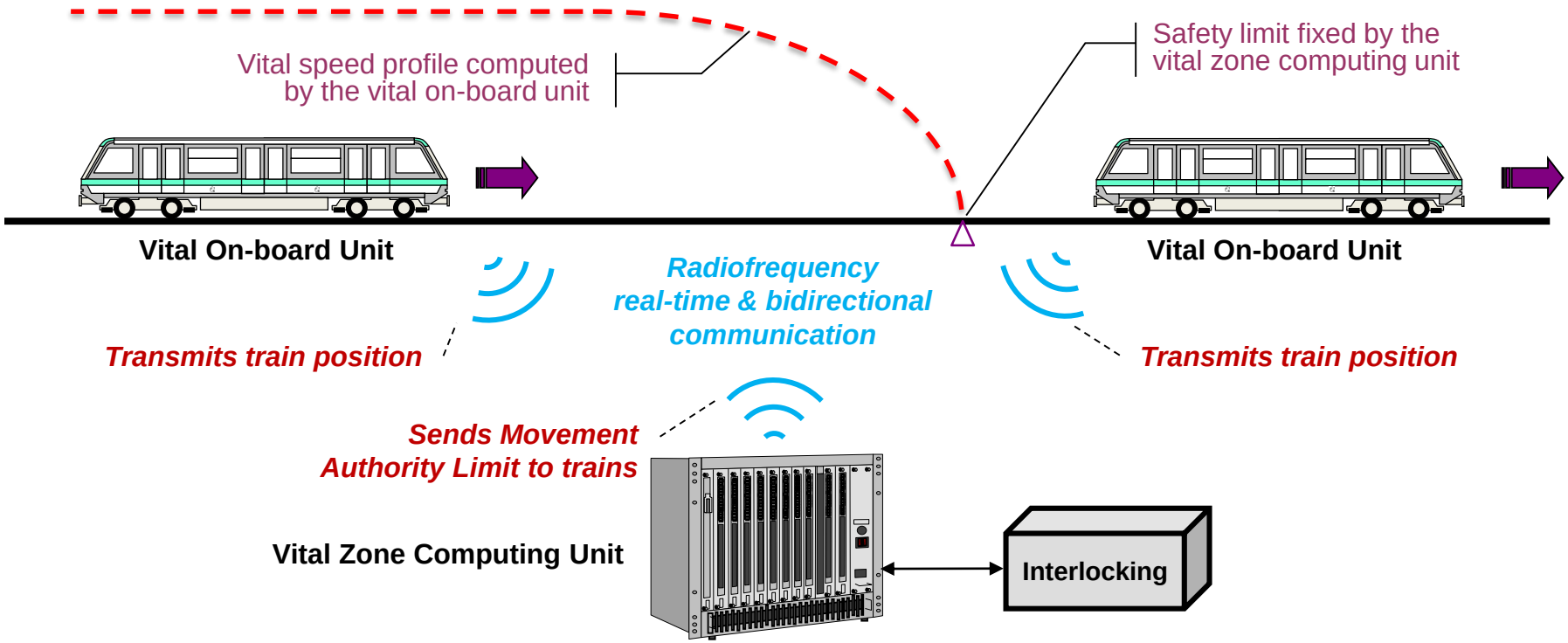
Functions adressed mainly trough dedicated communication networks

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 TS 103 518: Sharing conditions between ITS and CBTC in 5.9GHz band
    - To allow high priority to CBTC
    - Pending decision to the ECC (European Communication Committee)
  - Revision of ECC Decision (08)01 proposed by WGFM
    - To include Urban Rail 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 3G/4G networks

- Heavily promoted for railway applications by the major telecom manufacturers
- 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 : 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…)?
- Multivector usage to increase availability performance?

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