

Always comprehensively and consistently informed

Communication systems in AVLC

A modern operations control system handles a large number of functions and processes using several radio systems at the same time. But it is the comprehensive integration of all communication systems that makes AVLC a consistent operations management system with high availability for dealing with the various tasks.



Depending on the requirements of the transport operator, the AVLC operates with either a private radio system (PMR), public mobile radio via GSM/2G/3G/4G or a combination of both. Private radio systems refer to either analogue radio systems or digital trunked radio systems (e.g. TETRA, TETRAPOL), which are generally called PMR radio systems (Professional Mobile Radio).

Especially when it comes to integrating regional routes where some of the vehicles move out of the coverage range of the PMR radio system, or in situations where DPI signs can only be addressed using public mobile radio or LAN/WAN, the AVLC has to support several communication media at the same time.

To warrant communication on the whole route network, the vehicles are equipped with both PMR radio and public mobile radio, working in hybrid mode. The vehicle automatically selects the available radio system working on the basis of a stipulated priority.

Economic use of radio systems in “Agile Hybrid”

While company-owned PMR systems provide maximum availability and redundancy for transmitting important operational information, public mobile radio via 3G/4G and 5G offers the necessary bandwidth for data-intensive applications.

ebblo’s “Agile Hybrid” communication system offers the possibility of specifically prioritising the radio system for data radio and voice radio actions, or assigning a fixed radio system. This ensures that the available radio systems are put to economic use with maximum availability at the same time.

Intelligent use of the communication services

Precise vehicle locating is of central significance for operations management. This information not only gives the driver and dispatcher a current overview of timetable adherence by the vehicles but is also crucial for computing and visualising the real-time arrival and departure times on the stop signs and also for transfer information for the passengers in the vehicle. In terms of speed and availability, this communication makes highest demands of the radio system.

When transmitting text messages to the drivers or stop DPI signs, reliable, complete transmission of the information is more important than transfer speed. The dispatcher must be able to rely on the fact that the information has arrived and been understood. Such information therefore requires acknowledgement, is repeated in the event of errors and reported to the dispatcher.

Voice and data communication in the ITCS



Data supply

LAN



In the control centre

WLAN IEEE 802.11

Operational data

- Vehicle timetable data
- Audio files of stop announcements
- Ticketing data
- Statistical data
- Software updates for on-board computers

PMR radio system and/or public mobile radio GSM/2G/3G/4G

Real-time communication

- Vehicle locating
- Instructions and driver messages
- Request-to-talk, priority call and emergency call by drivers
- Passenger information and connection assurance
- Voice connections and announcements

Operating data

- Operating data at stops or vehicles outside the depot (only possible via public mobile communications)



In the depot



In the vehicle

Short-range radio

- Traffic light preemption
- Clearing of displays
- Voice radio



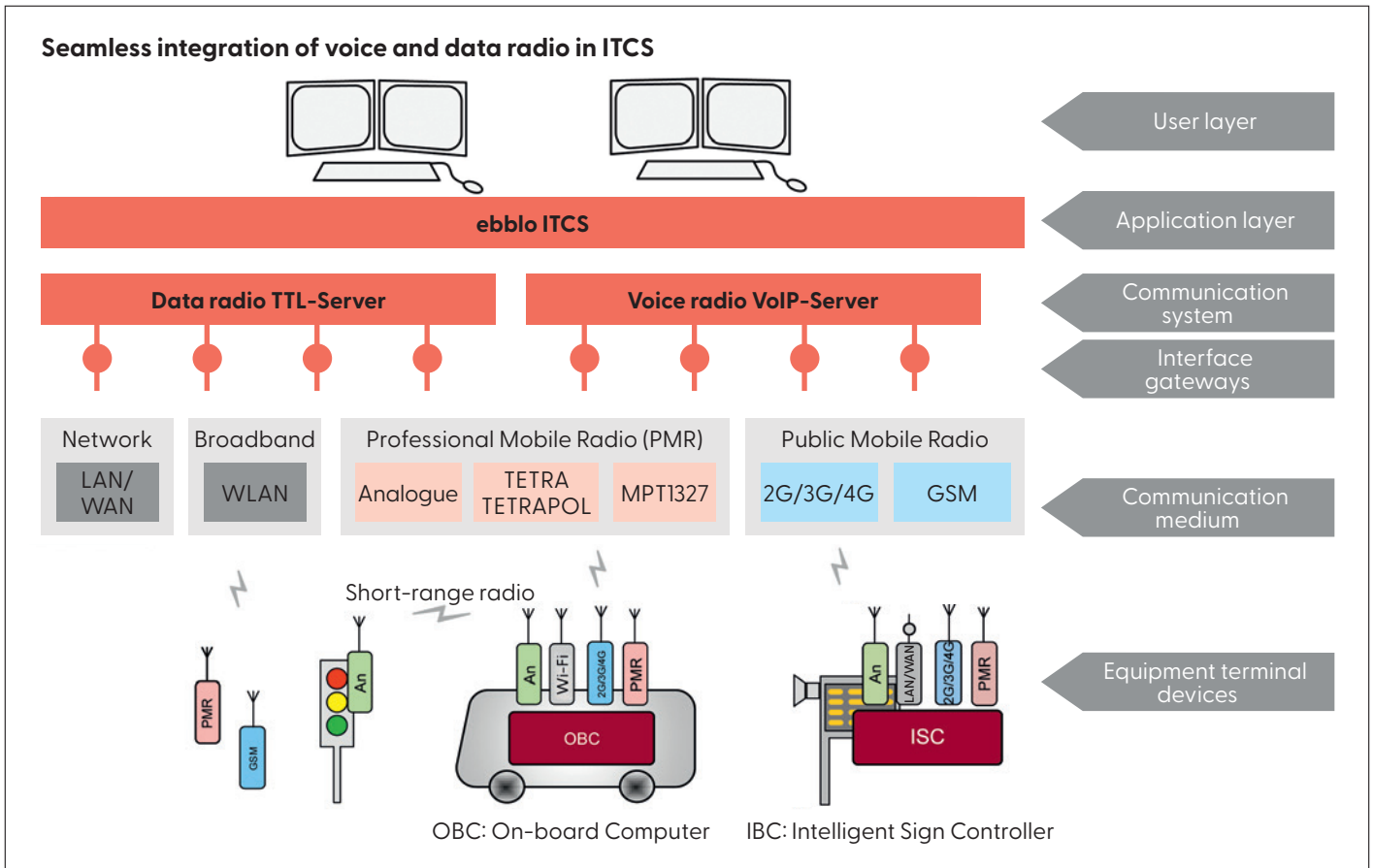
On the street

Broadband transmission of mass data

When transmitting operating data such as timetables, software updates or statistics and analysis data, the available bandwidth is what counts as these data can be very large in volume and must be transmitted in a short period of time. The best medium for this kind of communication is the depot's Wi-Fi. Transmissions of operating data while the vehicle is moving can also use the public mobile radio network via 2G, 3G or 4G. The generally low bandwidth available in a PMR radio system means it has only very limited suitability for the transmission of operating data.

Secure transmission of sensitive data

Secure data transmission is of ever growing significance when using IP-based radio systems such as public mobile radio or Wi-Fi. There must not be any tapping or manipulation of sensitive operating data while these are being transferred through the air. As a result, encryption and authentication services are used such as VPN or encryption based on AES. Here ebblo offers tailor-made solutions for the individual customer, based on corresponding IT standards.



LIO with TTL and VoIP server with interfaces to various communication media

Traffic light preemption

Even in heavy traffic, traffic light preemption minimises journey times and ensures reliable timetable adherence for the transport operator. It also helps to reduce operating costs because block optimisation means that fewer vehicles are needed for the same level of performance. ebblo offers a comprehensive solution where buses and trams communicate directly with the junction controller via data radio. This is triggered by the data supply, based on logical location with GPS, with the possibility of complementary use of TLP based on loops or beacons. This function takes place during the trip and demands highly reliable transmission of the messages. To this end, analogue radio modems are used in the short range to transfer the messages from the on-board computer to the station controllers at the stops.

Integrating voice and data radio

The radio systems are integrated in ebblo's AVLC communication system and controlled by it accordingly to permit data and voice communication via different radio systems without needing any intervention from the dispatcher or driver. Data radio is controlled by the Transparent Transport Layer, the TTL server. It controls and monitors the various radio systems and ensures that data communication between control centre, vehicles and stop signs is handled with the necessary priority and required security.

The voice connections are controlled by the VoIP server, which has interfaces to the various radio systems, the wired networks (LAN) or the telephone network. It routes the voice connection between the dispatcher and the



mobile radio subscriber via the corresponding radio system. The dispatcher does not have to worry about which radio system can be used to reach the radio subscriber. The radio subscribers are selected directly from the AVLC dialogues; this also applies to connecting the call. The radio system used to reach a subscriber is selected automatically by the communication system. This also works when the subscribers of a group are in different radio systems.

Thanks to the VoIP server, the dispatchers know that:

- they will reach the necessary call partners swiftly even if different communication networks are being used.
- they can integrate other subscribers quickly and easily in an existing call.
- they can forward connections easily to the corresponding point.
- they can intervene in on-going calls by listening in, connecting themselves in to the call or even terminating the call if necessary.
- important calls can be recorded at short notice and listened to again to know how to proceed.

The consistent architecture of ebblo's AVLC facilitates optimum availability of the advantages presented by the various radio systems:

- Profitability thanks to flexible use of the integrated radio systems
- Autonomous availability thanks to integration via a PMR system
- Flexible integration of regional routes via public mobile radio
- High availability thanks to redundant use of two radio systems in hybrid mode
- Large bandwidth for applications with high data volume using the public mobile radio network
- Secure transmission of sensitive data

Supported radio systems

For voice and data communication, ebblo supports the following radio systems in different configurations:

- Analogue radio
- DMR
- TETRA to various manufacturers
- TETRAPOL
- Public mobile radio via GSM, 2G, 3G, 4G

The solution is implemented either as a stand-alone radio system or combined with public mobile radio. The interfaces to the PMR radio systems depend on the specific manufacturer and are developed on request.

Planning a new radio system and AVLC migration

Detailed advance planning is necessary for the successful introduction of a new radio system and smooth migration of the AVLC in on-going operations. This presumes intensive cooperation between the radio system supplier, ebblo as AVLC supplier and the customer.

ebblo has implemented numerous migration projects and acquired a wealth of experience in integrating different radio systems. We offer diverse solutions and services covering all aspects of AVLC, together with comprehensive integration solutions for communication systems. The main focus is on high availability, performance capability and secure data transfer.

We gladly help our customers with radio network planning to safeguard coverage in the operating area, ascertaining the functional requirements for the control system and computing the necessary radio capacity for voice and data radio.

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