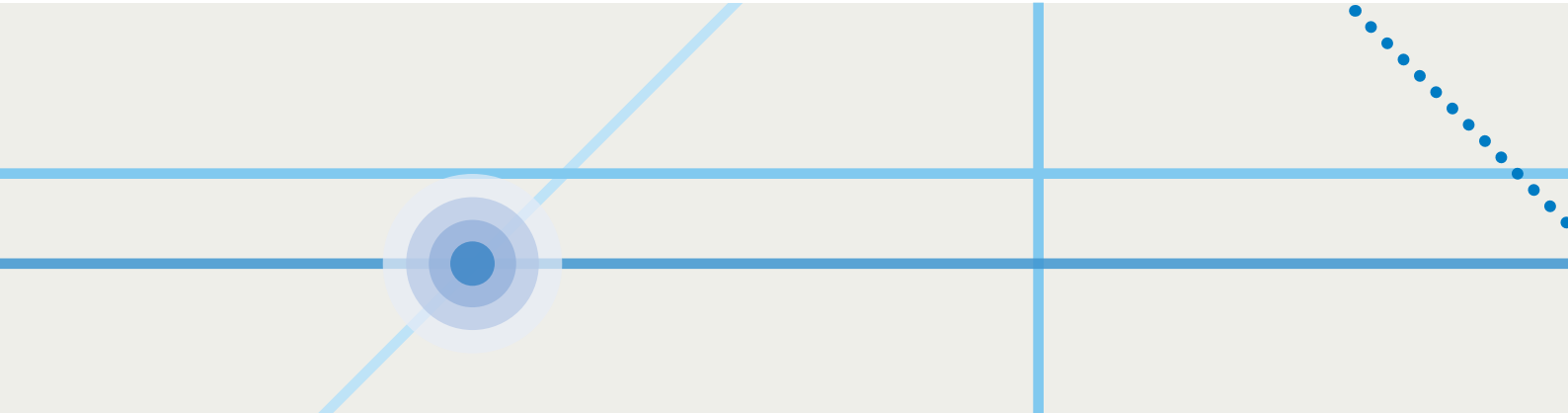


Modern ICT architectures



In many places, the IT and communication architecture of public transport vehicles still comprises silo-like building blocks, i.e. each business application uses its own computers, switches, routers, modems, SIM cards and antennas. This poses numerous challenges:

- Different life cycles of the proprietary systems, which are usually permanently linked to the hardware. This means that new functions cannot simply be added via a software update, instead necessitating expensive hardware and installation costs.
- For compatibility reasons, the same hardware type must be installed in all vehicles, which means that old hardware has to be installed in new vehicles.
- Systems do not communicate with one another, thereby complicating or preventing operators' digitisation efforts.

As a result, many public transport companies are heavily reliant on their ICT* suppliers and accept subsequently high costs. That does not have to be the case.

** ICT = Information and Communications Technology*

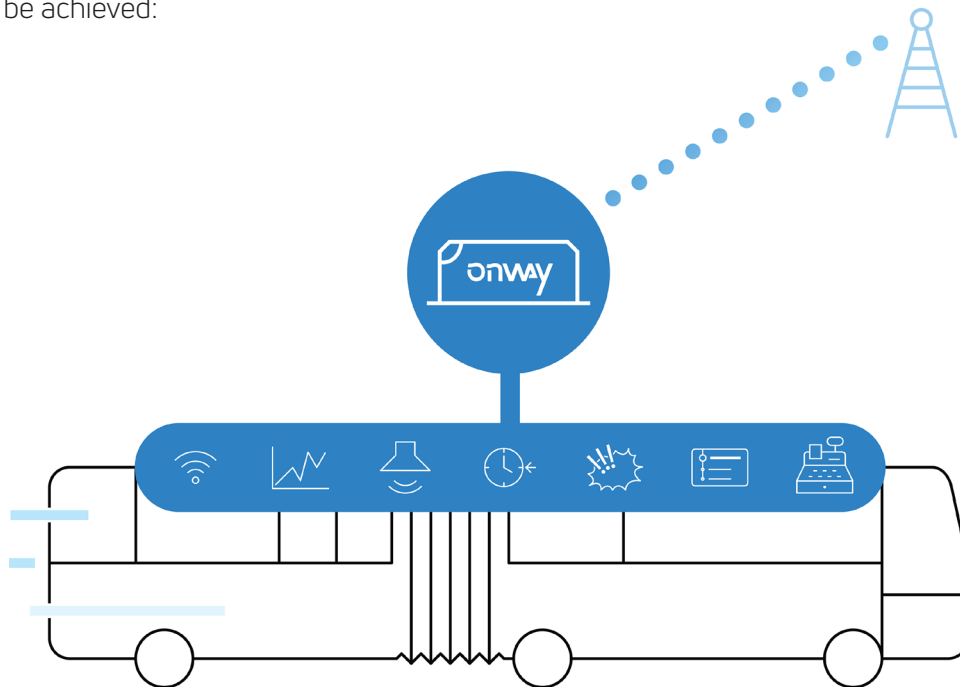
Large corporate and cloud environments

If we compare this initial situation with modern ICT architectures in large corporate and cloud environments, some significant differences become apparent:

- Separating hardware and software has been a valid principle in the stationary environment for many years. Only in this way is it possible to manage the life cycle of various components independently. Software is updated whenever there are important security patches or new releases. Hardware is updated as soon as it is amortised.
- Different hardware generations can be operated in parallel because it is completely irrelevant for applications on which hardware they run.

- Standardised interfaces enable solutions from different manufacturers to communicate with each other.
- Central management applications control and monitor both hardware and applications.

If these basic principles are applied to public transport, the following modern ICT vehicle architecture can be achieved:



- Wherever possible, software solutions that can be virtualised are procured so that they can run on standard hardware and a standard hypervisor. Together they form a **mobile data centre** for all applications.
- Intelligent network functions – such as routers, firewalls and proxies – are also operated in a virtualised manner on standard hardware today. This means that vehicles no longer need their own routers since they are also integrated into the mobile data centre.
- Given that the hardware and software are separated, newly procured vehicles are always equipped with up-to-date modern standard hardware and thus have the longest possible operating life. Older hardware that no longer meets the requirements of new applications is replaced as part of life-cycle management.
- All peripherals such as screens, sensors, cameras, etc., are connected via a shared Ethernet infrastructure.
- Solutions must be able to be administered from the cloud, whereby «cloud» can of course also mean a company's own data centre. It is important that no manual configuration is required at any time on devices in the vehicle itself.

Operational responsibility

The biggest changes when transitioning to a modern ICT vehicle architecture are not of a technical nature, but lie in the shift of operational responsibility. While in the past each supplier was solely responsible for their own subsystem, this new set-up requires different hardware and software suppliers to coordinate their efforts due to the interfaces and technical dependencies. Only the operator can manage this coordination effort, which inevitably means that they are bound to assume joint responsibility for operating the entire solution.

As such, forging ahead with digitisation efforts unavoidably leads to public transport operators assuming a system integration role and responsibility over an increasingly heterogeneous ICT landscape. This encompasses a variety of tasks:

- The overall architecture, consisting of mobile and stationary systems, must be determined.
- Decisions must be made and guidelines must be established for the use of cloud solutions.
- The basic technical requirements for all systems (e.g. compliance with standards such as VDV, ITxPT, etc.) must be defined.
- A vast array of security standards and guidelines must be defined.
- A central cross-manufacturer management system must be evaluated and put into operation.
- Suppliers must adapt their solution to the new infrastructure (or replace it as soon as possible).
- Operating new ICT architecture must be actively moderated on a continual basis, thereby ensuring that mutual dependencies do not lead to disruptions.

These different and new tasks require in-depth IT knowledge and many years of operational experience. However, this experience is not sufficiently available everywhere. At onway, we have been developing and operating modern ICT architectures for over 15 years, both in the stationary environment and for a wide range of public transport companies. We would therefore be delighted to support you with this transformation.

Our services

- Analysing and optimising existing mobile and stationary ICT landscapes
- Drawing up a catalogue of requirements to modernise existing ICT environments
- Developing a modern ICT vehicle architecture based on defined requirements
- Devising and supporting tenders for implementation
- Engineering support for implementation