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**Automated train operation:
3 processes towards an intelligent railway backbone**

1. One of the main benefits of automation will be to create an exchange of information between different modes, and in particular between the individual vehicles, the public transport network and the railway system (both regional and intercity). As UIC is benefiting from a consultative statute for the UN, we are committed to bring our technical expertise and the network of our members to help this vision to become rapidly a reality. Participating to numerous initiatives and UN events, within the UNECE, the CESAP and many other bodies, UIC endeavour to propose new ideas for promoting the SDG's objectives and modal shift to railway, in particular for freight.

In this respect, we advocate multimodality in order to create a seamless transport network, that would be more and more efficient and less carbon-intensive. For providing the expected level of service the railways system must become more intelligent in using better its native network advantages (predictability, safety, control, resilience...). Indeed, where road vehicle will need to be autonomous (ie: to react to a moving and unpredictable environment), rail and urban transport evolve in a predictable environment and then can be automatized, or remotely controlled more easily.

2. Implementing sustainable transport would only be possible in breaking the silos between railways and public transports. Multimodality is the key for promoting the use of railway as mass transit and for transforming the concept of transport as a service into a reality. It is only if the capacity of the rail system and its interconnexion capabilities achieves a quantum leap that the SDGs objectives would be met.

UIC fosters a digital approach through its digital platform and looks for a hybrid approach between telecommunications and rail signalling. Indeed, the issue for the railway integrated network is to promote an intelligent network management where automation shall be developed at the system level. It is therefore essential to rethink the modelling of the system and to be able to design the new standards that will be the basis for specifying the innovative services of tomorrow via the UIC International Railway Solutions (IRS).

The UIC proposes to define three key processes that would allow to develop sound interfaces definition and system management capabilities: **Network Productivity, Safety/Security and Services to the end user**. Definition of these processes should rely on careful SWOT analysis that will rely on life cycle management: digitalisation is a transverse process that will continue to bring disruptive innovations. It is therefore vital to avoid solutions that engage the system for long periods of time, without offering interfaces definitions that will allow to upgrade only the fast-evolving parts of the system.

3. Concentrating to key processes and well-defined deliverable should allow to meet those ambitious expectations.

- A. **Network Productivity:** this process is intended to define new ways of managing the rail Network based on a digital approach. Here 'Network' includes the principle elements that are using the shared system, infrastructure and rolling stock. The core of this evolution is the signalling & Telecommunication system that should be able to contribute to the increase of capacity and flexibility of the Network, paving the way for new services.

UIC is currently leading the specification and the corresponding process for standardisation of the **Future Railway Mobile Communication System (FRMCS)**. FRMCS will allow to bridge the different data flows and application that are necessary for managing the network and its interfaces (ie: internal rail management on board and at infrastructure level as well as smooth interfaces with public networks).

The benefits of FRMCS would only be instrumental if the sector has the possibility to develop a common vision of a what should be a common **railway modelling system**. To this end, UIC is developing **RailTopoModel (RTM)**, a logical object model based on class diagrams that sets out to standardise the representation of railway infrastructure-related data.

Furthermore, RTM would allow to improve Asset management, from the early definition and design to the end of life cycle. It will allow to differentiate subsystems by their respective life cycles in order to anticipate the ever-shorter life cycles of the modern digital component. Then, sound and early definition of interfaces should be translated into IRS in order to deliver faster and less costly implementation of new technologies.

- B. **Safety and Security:** in the digital age in which we live, safety and security will be more and more integrated. As the safety of railway operations will depend increasingly on automation and digital processes, cyber security should be considered at the system modelling level: operation, resilience and safety/security should be assessed based on RTM modelling, that would allow to create digital twins based on common patterns, where the intelligence of the network management could be deployed.

UIC is developing a top down approach of Cyber Security that reassembles safety and security. At the same time, the operational role of UIC would be key to anticipate the threats to system architecture and the organisational and the technical solutions to cope with the system impact brought about by ATO.

- C. **Services to the end user:** the result of the above developments should be the possibility to evolve toward mobility as a service, including the last mile(s). Railway will become the backbone of land mobility only if quality management throughout the entire transport chain is improved. This is especially true for the intermodal interfaces in the passenger stations and freight hubs.

UIC products such as MERITS would be the enablers for a unique European approach for virtual ticketing and transportation contracts. For the freight sector UIC undertakes development of digitalisation and innovative collaboration with other modes.

In a nutshell those three processes complement each other: FRMCS and RTM playing the role of kernel for innovation that enables the vital data exchanges along the Network. The evolving framework of standardised documents, with the IRSs at the heart, can be utilised as a supporting mechanism for accelerating operational deliverables.