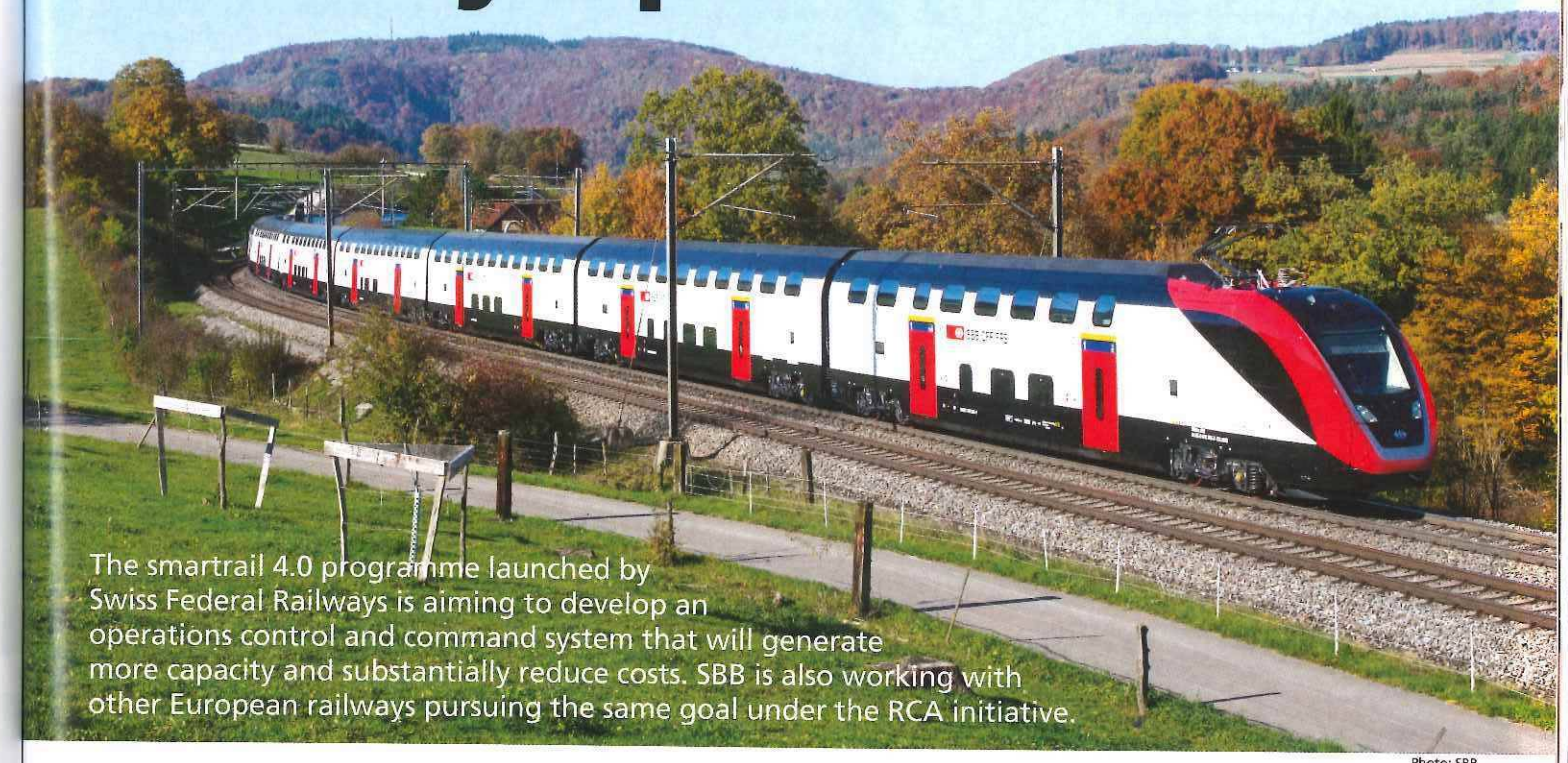
Rethinking the **heart** of **railway operations**



The smartrail 4.0 programme launched by Swiss Federal Railways is aiming to develop an operations control and command system that will generate more capacity and substantially reduce costs. SBB is also working with other European railways pursuing the same goal under the RCA initiative.

Photo: SBB

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Looking at the pace of technological change in other transport modes, it is clear that railway systems need urgently to evolve, if rail is to remain relevant in the longer term. This evolution must not be restricted to customer-facing apps, but needs to embrace the very core of railway operations.

That is why SBB has launched a programme to develop and implement a substantially improved 'production system' for operating the national railway network. All major players in Switzerland have joined the smartrail 4.0 initiative, while at the European level more than 10 railways are pursuing the same goal through the RCA initiative — looking to develop a so-called Reference CCS Architecture. CCS stands for Command, Control & Signalling.

In 2017 Switzerland achieved the goal of equipping its national network with ETCS. Selected routes have been fitted with Level 2, while the rest of the network has been equipped with Level 1 Limited Supervision, a development proposed by Switzerland and then integrated in the European standard. L1LS allows the migration of vehicles to ETCS while being faster and cheaper to install than Full Supervision. smartrail 4.0 is looking to build on this experience in shaping the next generation of operations planning and control technologies.

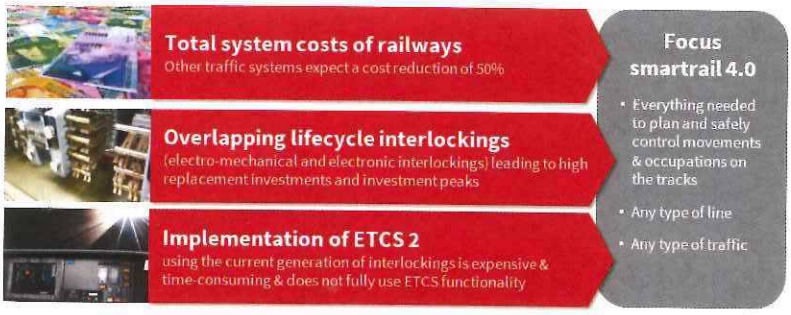

Fig 1. smartrail 4.0 is looking to develop a clear system architecture with well-defined interfaces that will support all aspects of the railway, operation and production processes.

SBB's FV-Dosto double-deck EMUs entered regular service on Basel – Zürich – St Gallen inter-regional services with the December timetable change.

SBB was among the first railways in the world to install ETCS Level 2, launching a pilot project between Luzern and Olten in 2002-03. A commercialised version of Level 2 was subsequently installed on the new Mattstetten – Rothrist line and in the Lötschberg and Gotthard base tunnels; more recently it has been rolled out on other main lines. But while preparing for further implementation of Level 2 as a replacement for life-expired signalling, SBB realised that the business case looked disappointing. There were no cost savings, no additional capacity, only marginal safety gains and more complexity. These problems did not stem from shortcomings with ETCS *per se*, but from how ETCS had been implemented.

Cost undermines competitiveness

As command and control systems are a major cost and capacity driver for the railway, this poor business case clearly undermines rail's competitiveness versus other modes of transport. Given this analysis, smartrail 4.0 was launched in late 2016 to design and evaluate a more attractive alternative.

smartrail 4.0 is now a common project for all four major railways in Switzerland: SBB, BLS, Südostbahn and Rhätische Bahn, plus the Swiss

Table II. Goals and supporting mechanisms for smartrail 4.0

Goal	Supporting mechanisms
Cost	Reduction of trackside assets by up to 70% (made possible by new localisation technology and by relying fully on digital communication channels) Automation of planning, controlling and warning processes Energy savings through ATO
Capacity	Shorter headways with moving block, higher-resolution of localisation Geometric interlocking allows the physically available capacity to be used Less driving variance with ATO, more precise plan execution Continuous, automated, region-wide timetable optimisation Using capacity bands, instead of slots to generate more optimisation opportunities
Safety	Fully protecting movements while shunting Automatically localising and warning track workers
Reliability	Reducing the number of trackside assets Providing a digital fall-back mechanism on a separate channel
Migration	The architecture includes several 'switch-over' mechanisms to support an industrialised rollout and efficient testing Data-driven safety logic (based on safe topology acquisition) reduces the manual steps in interlocking projects

requirements. A project team is therefore already in the process of examining and redesigning the organisational and procedural aspects of the railway production processes. The effects on job profiles are being worked out in greater depth and developments are being shared internally in a fully transparent way. Feedback and concerns from employees have been and are being recorded in more than 100 workshop sessions.

Stakeholder impact

The co-operation principles in smartrail 4.0 are based on two observations. Firstly, the rail sector has suffered in the past from technological fragmentation and a lack of standardisation. In many cases, technological progress cannot reach railways efficiently as long as the markets for the suppliers remain small and fragmented. Secondly, the main competition for railway operators is not other railway companies, but other modes of transport. This is even more obviously true for the infrastructure managers, who are the main focus of smartrail 4.0 and RCA.

We believe that substantial progress will not be possible without close co-operation. smartrail 4.0 tries to live up to this need for co-operation by openly sharing what we have learned and the concepts we have developed. We have already published dozens of documents on the project website at www.smartrail40.ch and will continue to do so. And we are actively supporting the RCA initiative as the major platform for working together.

Fig 3. Three phases for development and implementation of smartrail 4.0 have been identified.

We have already agreed several bilateral co-operation programmes with other European railways such as DB, ÖBB and SNCF, addressing specific topics such as localisation, TMS and line capacity. Working with the supply industry, we regularly organise industry days and specific innovation workshops so that we can learn about the technological options that are or may become available, and ensure that this knowledge is fed into the development work within the industry. This process also includes participation in numerous cross-industry forums and programmes such as Shift2Rail, UIC, EUG and Eulynx.

Pan-European initiative

The RCA initiative in particular offers a real opportunity for Europe's railways to shape their own future. Within the framework of the Ertms Users Group and Eulynx, a programme of international co-operation was launched in August 2018. Members of the two organisations include ADIF, BaneNOR, CFL, DB Netze, Infrabel, Network Rail, ProRail, RFI, SBB, SNCF, SZ, Trafikverket and Väylä.

Members of both organisations have joined forces under the RCA initiative to define a harmonised architecture for the future railway CCS. As with smartrail 4.0, the main goal is to substantially improve the ratio of performance against total cost of ownership — which includes initial procurement and life-cycle costs, as well as direct and indirect costs — in comparison with the way today's systems are procured and implemented.

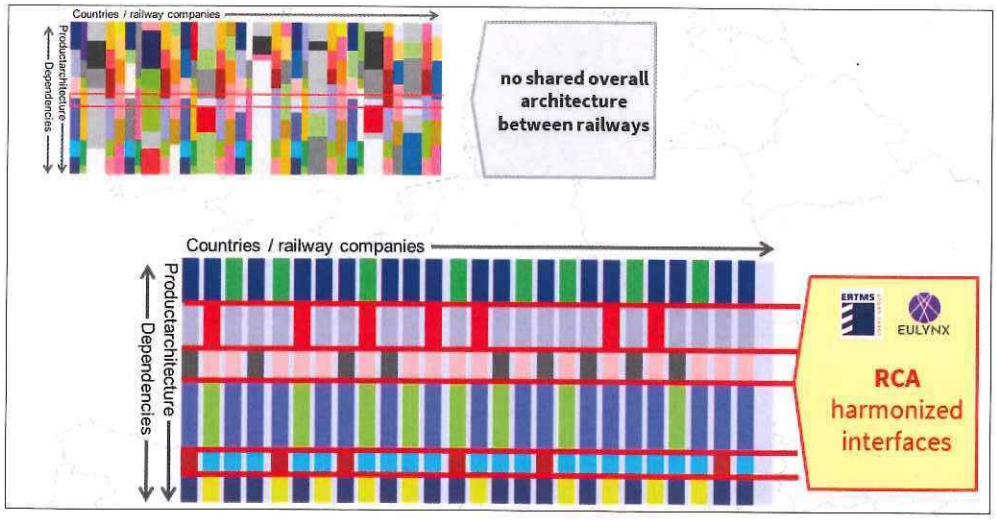

Fig 4. Although ETCS and interoperability have begun to change the overall picture, there is still a lack of common standards for command and control systems across Europe.

Fig 4 illustrates today's lack of standards for CCS systems, except perhaps in the area of interoperability. In a bid to reduce the current fragmentation, RCA is looking to define harmonised interfaces between many more of these important components.

smartrail 4.0 is well aligned with the goals and the architecture of RCA. Harmonising the architecture over several countries would increase the potential market size for key components and should lead to the emergence of better solutions. Additionally, a shared approach increases the opportunities for infrastructure managers to work together, and will help to ensure greater political support.

An 'alpha' version of the architecture was published last month to seek initial feedback from the wider rail sector and other stakeholders. Readers seeking more information about RCA are invited to visit the websites of the Ertms Users Group or Eulynx or to contact the author at bernhard.rytz@sbb.ch. ■

References

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