

# Industrial and Office Networks Convergence

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The concept of Industry 4.0 (I4.0) or, more generally, Smart Production (SP), is transforming radically the industrial chain of value. Building on Information and Communication Technologies, I4.0 boosts interoperability of machines and achieves seamless integration with the Internet and the manufacturing and production processes.

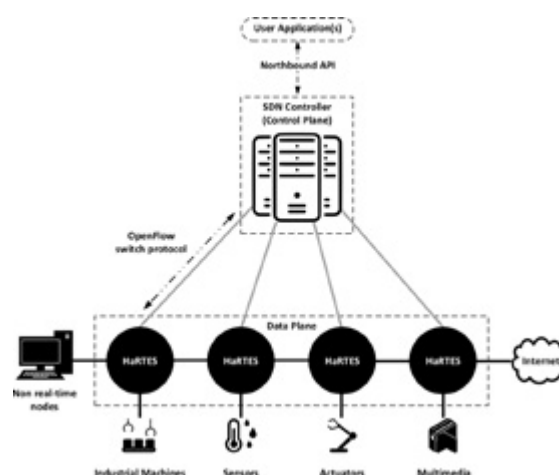
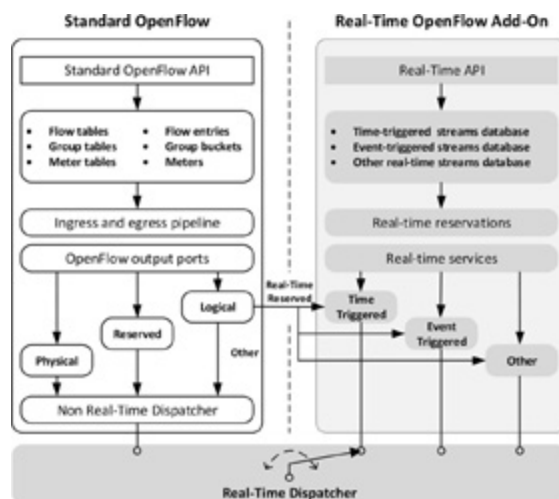
Networks are a core component of I4.0/SP systems, interconnecting all entities, both physical and virtual, such as products, manufacturing systems, management, logistics and business models. Designing networks for these scenarios is particularly challenging because they cross domains that often exhibit conflicting communication requirements, from cost and throughput typically valued at the management level to determinism and reliability that are often prime performance criteria in the shop floor.

Software-Defined Networking (SDN) is a disruptive network management paradigm that emerged on campus networks but was soon considered for use at industrial level. However, due to its roots, SDN protocols, e.g. OpenFlow (OF), do not support deterministic real-time services, thus hampering its adoption on I4.0/SP systems, at least for the lower layers. This problem is addressed by the METRICS project, proposing an OF extension to allow specifying and managing real-time communication services while keeping compatibility with the original standard.

The real-time services are accessed via a dedicated API that extends the standard one, being transparent to standard OF nodes. Supported real-time communication services include the transmission of synchronous and asynchronous real-time message streams. The extended API allows the dynamic creation, modification and elimination of real-time reservations. The framework also

includes an admission control module to ensure that all accepted reservations are feasible.

METRICS also addresses the development of a bridge (data plane) capable of segregating standard OF and real-time traffic, providing dedicated scheduling and dispatching services for each of these traffic types.



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