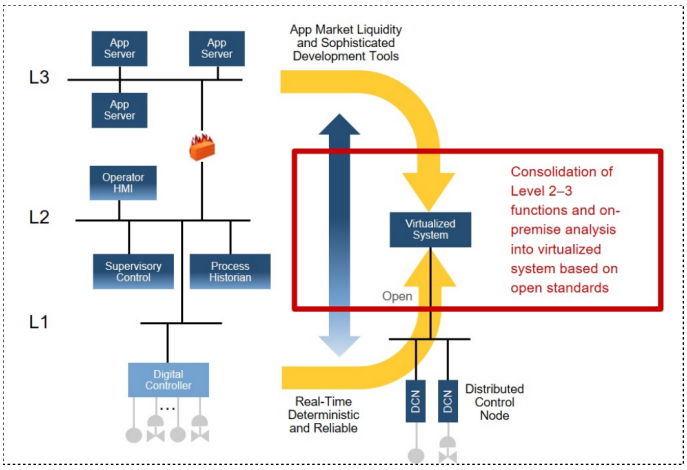
Industrial control applications

The industrial control systems used to drive production equipment in factories and plants are a formidable barrier to modernization and flexibility; many of those in use today were installed more than 20 years ago and are now becoming outdated, presenting major business challenges. While this infrastructure has provided a stable platform for control systems for many years, it lacks flexibility, requires costly manual maintenance, and does not easily allow process information to be exported and analyzed. Virtualization overcomes the limitations of legacy control systems infrastructure and provides the foundation for the Industrial Internet of Things (IIoT): control functions that were previously deployed across the network as dedicated hardware appliances can be virtualized and consolidated onto commercial off-the-shelf (COTS) servers, which not only leverages the most advanced silicon technology but also reduces capital expenditure, lowers operating costs, and maximizes efficiency for a variety of industrial sectors, including energy, health-care, and manufacturing.

The scope of transformation

The first step of any industrial virtualization process is the identification of which domains can be effectively virtualized; some domains that require ultra-low latency for example may require dedicated hardware to provide strict deadline accuracy, and thus would not be compatible with the inherent resource sharing approach introduced by virtualization. In general, the most effective strategy is the virtualization of L2 and L3 layers of industrial control systems (source: ExxonMobil):



This approach leaves to physical platforms only the small number of L1 control systems that require hard real-time or strict latency properties, while consolidating the remaining infrastructure into a single Edge cloud platform that provides flexibility and hardware independence.

The advantages

Cost savings: Consolidation increases server utilization, reduces power consumption and facilitates the normal maintenance operations.
Hardware flexibility: NodeWeaver heterogeneous hardware support allows for platform refresh by simply swapping the oldest hardware nodes and replacing them with newer generations, with no downtime and no expensive local IT support.
Efficient use of physical resources: Space can be limited in industrial plants, and many facilities do not have dedicated computer rooms or proper enclosures. Thanks to its dynamic optimizer, NodeWeaver can run even on the smallest system-on-a-chip platform.
Easier capacity provisioning: managing virtual machines, assigning them tasks and testing and upgrading are much simpler tasks than managing and provisioning physical servers, and can be performed at scale in parallel thanks to automation tools and without the need for local IT personnel.

Handling direct connections

Some control systems require a direct connection to a production system using a dedicated connector and protocol, like MODBUS or RS485; in this case a simple serial-to-Ethernet (or industrial Ethernet, to guarantee packet latency times) can be introduced to transform local physical connections into virtual network links that can be transported to any other place in the plant, with copper or fiber connections to make the link reliable even in environments with significant electrical disturbances.