Convergence of IT and OT

Management of a company in the food industry needed real-time visibility into the manufacturing process. Evaluating the requirements to capture and report the data, the plant became aware the existing engineering network used throughout the manufacturing area was not able to meet the objectives management desired. The existing network infrastructure had been pieced together over the years without design, or thought, of the type of data necessary to provide the visibility management was seeking.

The company had been very proactive in utilizing the best available technologies to automate their processes over the years. A project in 2009 consolidated three independent kitchens, implementing 60 units of Rockwell Automation's FactoryTalkBatch resulting in increased capacity, reduced unit costs and improved consistencies. In 2011, another kitchen was expanded to with 34 units of FactoryTalkBatch, again improving consistency and reducing costs.

Despite the addition of numerous servers to support the automation, the network infrastructure lacked the robustness and speed required to efficiently handle the increased amounts of network traffic, resulting in increasingly frequent server lockups and network losses. Servers were aging and disparate versions of software were making maintenance difficult and security a challenge. Furthermore, the plant had no dedicated local IT management for the system. The manufacturing engineers did not have the experience or training to deal with the management of data, servers, and networks and the off-premise IT personnel did not have a full understanding of the production requirements.

With managements objectives in mind, the decision was made to redesign and implement a new network infrastructure to more effectively support and deliver the plants current and future needs. The upgrade involved network redesign, configuration, and component supply. ECS followed the Cisco/Rockwell Automation Design and Implementation Guide for a Converged Plantwide Ethernet Architecture.

ECS provided the design of the network, with drawings, and both specified and provided the major components e.g., IDF cabinets, switches, etc. ECS configured the hardware components and supported the startup and migration to the new network. Such an upgrade was clearly a daunting project. The replacement of the new network would have to be deployed without affecting production. It might be likened to performing open heart

surgery on the plant production. ECS proposed that the project be executed in two phases:

Phase I: Upgrade the servers and software versions.

Phase II: Upgrade the plant-wide manufacturing network.

To improve reliability, it was necessary to replace the servers with high availability, redundant, physical servers together with replacement of software versions. Overall the performance would be enhanced by increasing storage server speed (CPU and memory), network speed and providing accessibility to packaging and utilities. Within Phase I, ECS replaced seven stand-alone tower servers in one kitchen with redundant physical servers, redundant power supplies. The servers were sized for plant-wide data.

The tasks performed by ECS regarding the network design, the installation, and the start-up and commissioning of the upgrade included the following:

1. Design of a new plant wide managed Ethernet infrastructure to support the existing engineering network.
2. Provision of drawings of the network architecture, illustrating the interconnections between network components (switches) and connected equipment (PLCs, computers, etc.)
3. Determination of actual locations for new equipment based on best practices for routing and distances.
4. Provision of a document describing the migration plan, with the responsibilities of the various parties involved. Exact directions were developed for the company's wiring vendor to install the correct fiber and Ethernet runs to the equipment and cabinets as required.
5. All network cabinets were connected with 10 GD connections.
6. Each cabinet was protected from surges and brownout conditions by Uninterruptible power supplies.

ECS provided a migration plan for the installation, with drawings illustrating the location of the existing connected equipment and the new IDF enclosures. ECS specified the type of media (fiber or copper) and the manufacturer's part number or equivalent of the part numbers for the cables. ECS also specified each connection point at the IDS switches and the connected equivalent.

The strategy for upgrading the network proposed by ECS involved implementation of a Redundant Star Topology rather than a Ring arrangement. The Topology provided quicker convergence times, was easier to expand (when necessary and with less intrusion) and offered significantly less risk of cut fibers. There is no single point of failure if the central point uses redundant hardware. A negative aspect to the Redundant Star Topology is that all traffic passes through a single point between segments.

For startup and commissioning, ECS configured switches to the required settings to replace existing equipment. To minimize downtime ECS provided support to migrate

existing connected equipment from the current engineering network to the new engineering network. In total, ECS provided five new IDF enclosures located in strategic arears of the plant with new Cisco level 2 and 3 managed switches.

With the completion, the uptime and availability were improved, server lockups were reduced to zero occurrence, the speed of data storage and retrieval improved for the process kitchen. The system became more flexible and more data was collected allowing new reports for management and the operation to be generated. OEE has been implemented on the network.

To bring management visibility into a process, a solid network architecture and infrastructure is essential.