



Hewlett Packard
Enterprise

Smart Auto Manufacturing

Ushering in the new era of IoT Edge computing

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Solution overview

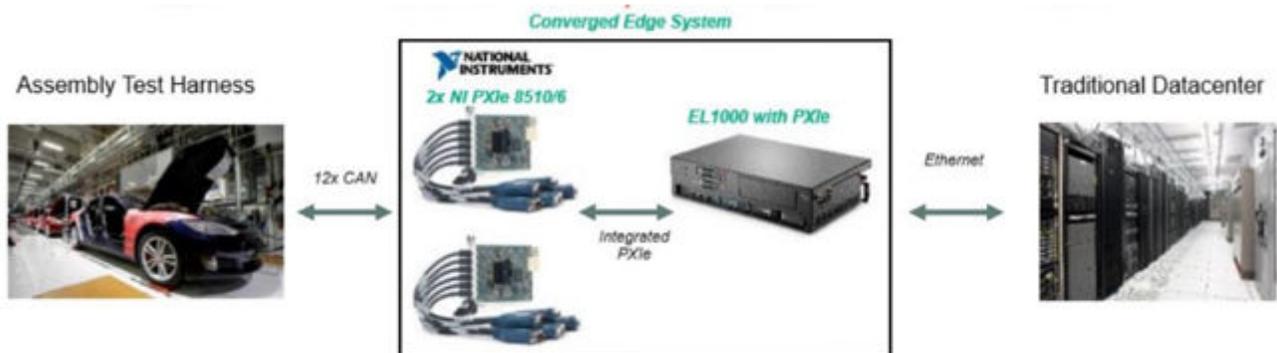
Automotive manufacturers today use multiple PC-based PXI test and measurement systems for factory in-line automated testing and engineering development. This implementation is a hassle to maintain, as most of the updates are performed manually via USB keys (a.k.a. sneaker net) and aren't easy to track. There were issues with installing OS and software on PCs, managing the systems, and applying firmware updates. Ultimately, this process is also wrought with human error, and takes a lot of expensive human capital to deploy and maintain. Automotive manufacturers still using this existing model of factory testing can benefit from this new solution using Edgeline systems.

Real World Example: Large Auto Manufacturer



One popular auto manufacturing company saw the need to consolidate the separate hardware components (networking, CANBUS, and compute) into a single system. To solve this problem, HPE proposed a solution using the convergence of datacenter-class compute power, iLO remote management, and integrated PXI data capture/control aspects. The HPE Edgeline systems are a superior platform for factory automated testing and engineering development, combining OT (Operational Technology) and IT (Information Technology). Merged with the NI PXIe 8510/6 which has (6) CANbus connections, they are now enabled to monitor and test units under assembly with an automated, managed compute environment. This all-in-one converged system is out on the edge, in this case the manufacturing floor, and is the same system that developers would be using in the lab for testing their deployment software. This is useful to have a convergence of the developer team with the same machines on the factory floor.

This example has the HPE EL1000, ProLiant m710x Moonshot Server cartridge, and NI PXIe 8510 used to perform automotive integration testing on a car door via CANbus communication with the car's control system. NI LabVIEW is used as the data acquisition and control program to automate the testing process. An EL4000 system can be used as well, offering more redundancy and compute power, depending on the need. With the EL4000, we are given the option to consolidate different factory functions into 4 cartridges at the same location. 1-2 m710x cartridges could be used for auto testing, while the other two could be used for factory process management. During operation, the auto manufacturer can test all system components including the car door's window, mirror, lights, and audio mechanisms through CANbus messages sent from NI LabVIEW running on HPE Edgeline to the vehicle under test (VUT). This process ensures real-time system integrity on the factory line while the vehicles are being built.



Communication between the LabVIEW test program running on Edgeline and the VUT occurs through a sequence of CAN messages, and translation of CAN to 12VDC operations at the vehicle level. The combination of an Edgeline system with a vehicle communication system is direct, simple, and very efficient in communicating, controlling, and testing a vehicle system. This solution has revolutionized the way that this automobile manufacturing company runs its factory floor, and introduces the convergence of OT and IT, allowing for future development in a more streamlined manner.

Edge computing using HPE Converged Edge Systems

Driving business decisions based on real-time data can be accelerated through edge computing and data analysis. HPE has created unique systems, purpose-built for the edge, which converge real-time data acquisition, enterprise-class computing, and remote manageability needed for data analysis at the IoT edge. HPE Edgeline systems are low-power consuming, rugged-ized platforms with multiple network connectivity and data acquisition options to aggregate and analyze data for industrial systems. HPE Edgeline systems can be sized to meet the demands of IoT-created data by customizing the type of chassis, number of compute-servers, CPU cores, memory, and local storage for each modular compute-server within the chassis.

HPE Edgeline EL1000 Converged Edge System

A single HPE Converged Edge System EL1000 chassis with an HPE ProLiant m710x server cartridge was tested in this solution to provide the data acquisition, monitoring, visualization, and control capabilities. The HPE ProLiant m710x server cartridge is a modular server that can be sized accordingly with memory and local storage space required for maximum performance of the monitoring solution. The HPE ProLiant m710x server cartridge also has a built-in GPU with the Intel Iris Pro Graphics P580 for HD and 3D quality data visualization. Up to 64GB memory may be required for advanced data analysis and visualization. Up to 8TB of local NVMe SSD storage is available for historical data storage. The HPE ProLiant m510 server cartridge is also available if additional memory, of up to 128GB, and CPU cores, up to 16 Intel Broadwell-D cores, are required for data analysis applications.

The HPE Edgeline chassis is versatile in its ability to operate in a wide range of environments, and can be installed in multiple locations through rack and wall-mount options. HPE Edgeline EL1000 and EL4000 enables enterprise-class remote manageability through HPE Integrated Lights-Out technology which is embedded directly on the HPE ProLiant server cartridges.

For more information about HPE Edgeline EL1000, see <https://www.hpe.com/us/en/product-catalog/servers/edgeline-systems/pip.hpe-edgeline-el1000-converged-iot-system.1008670396.html> .



Figure 1: HPE Edgeline EL1000 Converged Edge System

The HPE EL1000 with an HPE ProLiant m710x server cartridge was configured with the following specifications when using a PXI/PXIeCANbus enabled device:

Qty	Description	HPE Part Number
1	HPE EL1000PXI System	847555-B21
1	HPE 500W Flex Slot Platinum Hot Plug Power Supply Kit	720478-B21
1	HPE Edgeline EL1000 Rack Rail Kit	866690-B21
1	HPE ProLiant m710x 1P E3-1585Lv5 CPU Configure-to-order Server Cartridge	833105-B21
2-4	HPE Moonshot 16GB DDR4 DIMM	863953-B21
1	HPE Moonshot 240GB M.2 SATA 2242 Solid State Device	866844-B21
0-4	HPE Moonshot 1024GB M.2 NVMe 2280 Solid State Device	862163-B21
1	HPE m710x Front I/O Cable Kit	867893-B21

HPE Edgeline EL4000 Converged Edge System

An HPE Converged Edge System EL4000 chassis with up to four HPE ProLiant m710x server cartridges or up to four HPE ProLiant m510 server cartridges should be considered if scaling out the monitoring solution across a large number of data acquisition systems or for configuring redundancy. The HPE EL4000 operates in the same manner as the HPE EL1000 with the exception that it hosts up to four HPE ProLiant server cartridges per chassis as well as having redundant power options.



Figure 2: HPE Edgeline EL4000 Converged Edge System

The HPE EL4000 with PXI/PXIe and up to four HPE ProLiant m710x server cartridges for maximum performance and availability:

Qty	Description	HPE Part Number
1	HPE EL4000 PXI System	847536-B21
2	HPE 800W Flex Slot Platinum Hot Plug Power Supply Kit	720479-B21
1	HPE Edgeline EL4000 Short Rack Rail Kit	868575-B21
4	HPE ProLiant m710x 1P E3-1585Lv5 CPU Configure-to-order Server Cartridge	833105-B21

Table Continued

16	HPE Moonshot 16GB DDR4 DIMM	863953-B21
4	HPE Moonshot 240GB M.2 SATA 2242 Solid State Device	866844-B21
16	HPE Moonshot 1024GB M.2 NVMe 2280 Solid State Device	862163-B21
4	HPE m710x Front I/O Cable Kit	867893-B21

Remote management using HPE Integrated Lights-Out (iLO) Server Management

As data acquisition and analysis systems are deployed to the edge, the need for remote access and management becomes critical for maintaining and operating of the solutions. HPE Edgeline Converged Edge Systems provide best in-class remote management to accompany their enterprise-class edge compute, and real-time data acquisition capabilities.

Hewlett Packard Enterprise has included enterprise-class remote management capabilities through HPE Integrated Lights-Out (iLO) Server Management technology which is embedded into HPE ProLiant m710x and m510 server cartridges. HPE iLO provides server health, reliability, management and performance tracking anytime, anywhere. With iLO, we have the ability to perform a wide range of activities on a HPE server from any remote location such as resetting the server, powering up the server, or mounting remote physical CD/DVD drives or images. In addition, iLO offers full command line interface support and has the ability to access the server's Integrated Management Log (IML).

HPE iLO automatically monitors, controls, and can even issue alerts based on system health of the server. HPE Integrated Lights-Out is accessible from any web browser, SSH client, or from the iLO Mobile App. HPE iLO technology enables remote management not only through health monitoring, but also through provisioning, firmware updates, virtual media connectivity, operating system installation, integrated remote console, and access to BIOS settings. HPE iLO is also Redfish compliant through the Redfish API and RESTful communication protocol.

For more information on HPE iLO technology, see <https://www.hpe.com/us/en/servers/integrated-lights-out-ilo.html>.

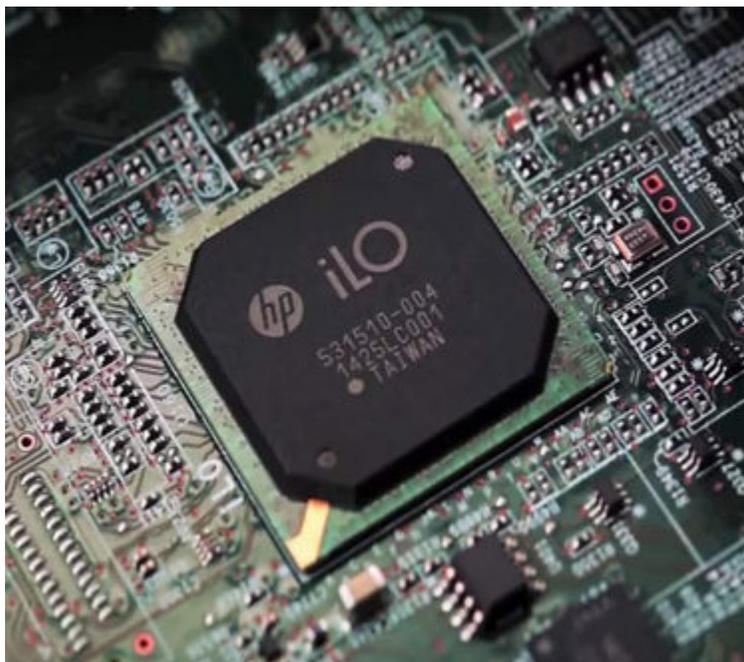


Figure 3: HPE Integrated Lights-Out (iLO) Server Management

Data analysis using NI

Connected sensors require a data acquisition device for acquisition and conversion of analog to digital data. The analog-to-digital conversion occurs on controller modules connected to each sensor input and then presented upstream for interfacing with data acquisition software. Data acquisition software, for example National Instruments LabVIEW, is used in the solution as the foundation to acquire data and interface with the FPGA within the data acquisition device.

Data acquisition systems from National Instruments come in many different forms based on how data will be acquired and converted for upstream analysis systems. Many different sensors can be used to measure analog data depending on the type of data to be measured, for example temperature, voltage, pressure, vibration, etc. In this case we are using a serial CANbus port and the ODBII.

Direct PXI/PXIe

The recommended approach to connect and control test systems is found using the HPE Edgeline Converged Edge Systems with integrated PXI/PXIe1 slots in order to directly connect sensors such as CANbus or Xnet communications. In this case, data acquisition is performed directly on the HPE Edgeline Converged Edge System using a variety of PXI/PXIe modules depending on the data being measured. In the case of the smart auto manufacturing, the PXIe-8510 module from National Instruments would be installed in the Edgeline chassis. This option provides real-time data acquisition, also referred to as direct data ingest, condition monitoring, and system control all in real-time and converged into the same edge-compute system.



Figure 4: PXIe-8510, 2 or 6-Port PXI Vehicle Multiprotocol Interface Module

Referenced PXIe-8510 configuration:

Qty	Description	NI Part Number
2	PXIe-8510, 2-Port Hardware-Selectable NI-XNET Interface	784121-01
2	TRC-8542, NI-XNET CAN HS/FD Transceiver Cable, 18 in.	783699-02
2	TRC-8546, NI-XNET LIN Transceiver Cable, 18 in.	783702-02

NI LabVIEW

NI LabVIEW system design software is a graphical programming platform which simplifies the process of visualizing, creating, and coding of data acquisition, monitoring, and visualization solutions. LabVIEW includes all the drivers and interfaces required to quickly and easily access data collected from National Instruments data acquisition systems. For this solution, NI LabVIEW and required components were installed on HPE Edgeline Converged Edge Systems in order to acquire data from either remote data acquisition systems or directly from sensors. (National Instruments, n.d.)

The following LabVIEW software and drivers were installed on the HPE ProLiant m710x server cartridge running in the HPE Edgeline EL1000 Converged Edge System:

Software	Usage
NI LabVIEW Professional Development	Platform for data acquisition, measurement, and control
NI TestStand Full Development System	Supporting Platform for LabVIEW Professional

Conclusion

HPE Edgeline Converged Edge Systems have the ability to transform your factory floor. Our converged systems integrate unprecedented edge compute, data capture and control, datacenter-class security, device and systems management, as well as large storage capacity to provide heavy-duty analytics and insights to the edge. This will enable auto manufacturing companies to make real-time decisions and add value to their operational processes to result in better business outcomes. The Edgeline EL1000 also prevents cloud lock-in by not having to send data back to the cloud or data center. It addresses latency, bandwidth, cost, security, duplication, corruption, and compliance issues, enabling three critical components of savings and success—time, money, and time to action.

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