Connecting Workers with Data and Insights at the Edge

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Written by: Jonathan Lang, Research Manager, IT/OT Convergence Strategies

Introduction

Digital Transformation for Workers at the Edge

The manufacturing and industrial edge is where products are made, moved, delivered, and serviced. It can be a factory floor, a warehouse, a power grid, a refinery, a service center, or a call center. "Edge" workers in these environments include assembly line, operations, maintenance and repair, and field services.

This IDC Technology Spotlight explores how new technologies such as augmented reality (AR) and edge compute are enabling new use cases that hold the promise of increasing edge worker productivity and safety, optimizing operations, and improving the quality of product and service delivery.

For machine assets and products, connectivity has long driven improvements in efficiency, performance, and productivity. Recent technology developments provide greater capabilities to monitor and control plant floor equipment, products, and even the production processes themselves, providing new data sources from a variety of operations areas that didn’t exist before.

With the onset of more pervasive wireless connectivity and location-based services, a broader set of use cases has emerged to enable digital transformation (DX) that provides edge workers with just-in-time access to the information and subject matter expertise they need to more effectively and safely perform their functions in increasingly complex production environments. In fact, IDC’s 2019 Global IoT Decision Maker Survey found that 61.8% of manufacturers have deployed people-centric solutions — more than any other solution — as part of their Internet of Things (IoT) initiatives.

AT A GLANCE

KEY STATS

» 61.8% of manufacturers have deployed people-centric solutions as part of their Internet of Things initiatives.
» 51.7% of industrial enterprises have implemented augmented reality or are planning to implement augmented reality within 24 months.
One key innovation that has contributed to these gains is augmented reality — a technology that aims to enhance the user experience by visually placing data or digital objects into the user's field of vision (e.g., via a tablet or wearables). Enabled by mobile devices and wearables with access to pervasive, industrial, and wireless infrastructure, early adopters in manufacturing are recognizing the business value and integrating AR into their DX strategies. According to IDC's 2019 Talent Management Survey, 51.7% of industrial enterprises have implemented AR or are planning to implement AR within 24 months. AR technology is helping solve the following key challenges that industrial enterprises face today:

» Addressing the skills gap (As workers with deep domain knowledge of operations technology [OT] prepare to retire, digitizing knowledge critical to operations is a key component of a knowledge management strategy.)

» Increasing product complexity and shorter batch runs require line workers to master multiple assembly configurations

» Providing relevant and timely insights to all workers engaged in a process or a workflow to minimize or eliminate single points of failure

» Improving maintenance and repair cycles to increase uptime

Companies can pursue multiple parallel paths to move toward a digitally transformed edge workforce: the connected plant engineer, the assembly-line worker, the connected field worker, and the connected maintenance worker. For example, providing connected line workers with real-time assembly instructions and production specifications can improve worker productivity, factory throughput, and product quality. Using wearables to connect field and maintenance workers with remote expertise and guided work instructions can improve first-time fix rates and mean time to repair, leading to an increase in asset uptime and utilization. While these different types of workers have very divergent responsibilities, ensuring they have access to the right information at the right time — within the context of their physical work environment — allows them to be more productive and work more safely.

The solution needed for establishing a connected worker platform can be as simple as a cloud-based software-as-a-service subscription or a more robust hybrid on-premises solution that can be scaled from a single location to multiple locations. Even in hard-to-reach or remote locations that may have poor wide area network connectivity, these edge-to-cloud solutions provide enterprise-grade compute and real-time analytics at the edge and thus reduce the volume of data that needs to be transmitted across the wide area network.

**Key Capabilities of the Connected Edge Worker and Enabling Technologies**

The key to digitally enabling the edge worker is to match the speed of data and insights to the business needs of the enterprise.

» Enabling edge workers to connect with remote experts to diagnose and resolve production issues can reduce downtime, making assembly lines more productive.

» Enabling line workers to access real-time step-by-step guided assembly instructions and other information critical to operations via their connected wearable or handheld device and overlaid digitally onto the actual product and work surface improves product quality and throughput and reduces rework.

» Enabling technical support specialists to connect to customer environments to diagnose and resolve product issues reduces the number of customer site visits by service technicians.
As the volume, variety, and velocity of data continue to increase, organizations need a technology that allows them to collect data generated at the edge, analyze the data in near real time, and deliver the insight directly to the edge workers and their devices. AR is quickly proving to be the edge technology of choice to establish this connection to workers, delivering the following key capabilities:

» Two-way video streaming so remote experts can see what the edge worker sees and more effectively collaborate with the edge worker to work through issues together

» Audio for collaboration but also for helping diagnose unusual sounds being emitted from the asset

» Content overlay (asset telemetry, specifications, schematics, and work instructions overlaid atop the asset image or displayed on the worker’s connected device)

» Streaming data (streaming real-time asset or product performance and operational data from IoT and connected products)

» Enterprise system connections (view and edit transactional data such as work orders, asset history, and spares inventory)

» Quality and compliance standards in enterprise systems

» Access to training and other knowledge management systems

AR technology, particularly the video content needed to deliver work instructions and remote expertise, requires significant bandwidth communicating at low latency reliably. For many remote locations, wide area connectivity is a challenge. Relying on the cloud for data aggregation and processing greatly inhibits delivering the necessary real-time insights to the edge worker. A hybrid edge-to-cloud approach allows businesses to optimize and scale the solution economically. AR use cases typically leverage an edge AR platform responsible for sourcing and orchestrating content that interacts with the worker. An intelligent edge infrastructure is needed to host the platform and establish and maintain the platform’s connection to all the data and insights required to construct and deliver a compelling AR experience.

As Figure 1 shows, edge computing is a priority for connecting operations and data, including enabling edge workers. Edge computing enables the reliable and secure movement of large amounts of data from silos to a central aggregation point for processing. It can also natively select all the data to move to the cloud. An edge platform can act independently from the cloud when the connections fail or data sovereignty issues arise, ensuring continuity. These capabilities are all core to supporting the edge worker with AR.
The investment in edge computing is being driven by the increasing amount and variety of data being generated on the plant floor by equipment, tools, cameras, and other operations technologies. Edge compute provides the ability to put distributed, datacenter-grade compute and intelligence closer to the data sources and the workers who need to consume the information and insights.

It also supports the analysis of the video feed for automated monitoring and diagnosis of asset and product issues in customer deployments. IDC estimates that by 2024, over 50% of work orders on product and production assets will be prescriptive in nature versus time based, requiring more agile methods of orchestrating those work orders. This significantly shifts the work of edge-based workers from rigid schedules and processes to more dynamic operations based on product or asset usage and performance. All this dynamic behavior and analysis needs to be orchestrated at the edge.
Benefits

Augmented reality and other connected worker technologies offer the potential for:

- Gains in productivity and worker efficiency
- Reduced impact from a retiring skilled workforce
- Improved production quality
- Increased asset uptime with guided service and maintenance instructions
- Reduced time to diagnose and resolve production and product support issues
- Reduced time and travel costs associated with service technician site visits

These gains can be realized only if the AR experiences can be reliably delivered and scaled. Edge infrastructure delivers several key benefits to enable the connected worker edge device:

- **Video streaming.** Buffering and transmitting video to remote experts in areas of low bandwidth
- **Content retrieval and management.** Acquiring and synchronizing content and data coming from the cloud and operations systems
- **Computer vision.** Processing novel video and images not pre-installed on the AR device
- **Predictive and prescriptive analytics.** Analyzing real-time and historical data at the edge to diagnose and predict failure and proactively notify local and remote support resources so they can respond in a timely and appropriate manner
- **Logic control.** Ensuring activities conducted by the edge worker have built-in safety and logic controls, enabling connected assets to react to worker activities (e.g., enabling a worker to advance the assembly line by verifying that a task is complete)
- **Network management.** Ensuring continuous connectivity to resources by modulating and prioritizing bandwidth needs to ensure edge worker connectivity
Key Trends
Some of the trends in manufacturing operations and field service that are driving the adoption of AR technology are as follows:

» Increased customization at the point of manufacture, leading to smaller batch runs and multiple product configurations and the need to maintain consistent tolerances for each batch run

» Advances in workplace mobility and connectivity expanding across the factory floor with Wi-Fi, 5G, and other forms of connectivity

» The blurring of OT and IT environments and the digitization of machine assets and processes made possible by the IoT and analytics

» Deployment of hybrid cloud platforms that extend access to data sources and using IT datacenter-class management of these platforms, from edge to cloud

» Prevalence of edge devices being implemented across plant operations

» Video analytics as a core enabler of use cases for quality assurance and other operational processes

» Use of edge devices to support intermittent communications to central system

Considering HPE
Hewlett Packard Enterprise is a global edge-to-cloud platform-as-a-service technology company that provides technology to help organizations create smarter operations, make better business decisions, and ignite innovation. HPE helps manufacturing and industrial organizations improve worker productivity and safety, factory throughput, and product quality. HPE works with its partner ecosystem to deploy AR-based connected worker solutions that can be easily integrated into existing workflows with minimal disruption.

Using a mix of IT and OT, a connected worker solution can be as simple as a cloud-based subscription-as-a-service solution or an on-premises edge-to-cloud solution that resides behind a firewall to offer increased security, lower latency, and near-real-time analytics and processing. HPE helps its customers navigate from proof of concept to full-scale deployment, ensuring the most efficient and cost-effective outcomes while addressing the unique needs of workers at its customers’ facilities.

With a broad range of computing, networking, and storage solutions, HPE can help deliver seamless experiences from the edge to the datacenter. For edge computing, HPE Edgeline Converged Edge Systems, featuring Intel second-generation Xeon Scalable Processors, are built for rugged environments and designed for power-efficient operations. HPE Edgeline offers datacenter-grade computing power, storage, and near-real-time analytics for the manufacturing and industrial edge (e.g., the factory floor, the refinery, the power grid, or a freighter) — and the ability to integrate operations and IT data from a variety of sources into a single dashboard view. This single-pane-of-glass view is designed to enable visibility across industrial machine assets and production processes, helping optimize operations, reduce maintenance costs, and improve worker productivity.
**Customer Use Cases**

HPE offers the following use cases as examples of customer success:

» A process manufacturer of hazardous chemicals has reportedly achieved a 75% reduction in the time needed to identify asset risks in its plant, where a single spark can cause an explosion and put lives at risk. Workers now retrieve documentation digitally and obtain 3D rotational views of assets and risk-based inspection graphs to warn of impending issues. New workers are trained on production processes using a connected worker solution to orient them to workflows and allow them to experience the environment prior to setting foot on the plant floor.

» Nontechnical workers in large retail distribution centers can diagnose and repair critical IT components vital to ensuring in-store inventory levels are met by using mobile devices and wearables to connect to HPE technical support. According to HPE, the number of site visits by HPE technical staff was reduced from 54 to 1 during a five-month pilot.

» A large-format digital printing press manufacturer is reportedly able to diagnose issues twice as fast and reduce resolution times by as much as 70% in its technical support centers. Using HPE Visual Remote Guidance (VRG), the support technician remotely connects with the customer, who dons AR-based wearables to allow the technician to see what the customer sees, diagnose the issue, and visually guide the customer through fixing the problem — all without the time and expense of dispatching a support engineer onsite.

» A large enterprise remodeling its locations is saving travel time and dollars, according to HPE, using HPE VRG for project status inspections. Construction workers can don the wearables or use a tablet to walk remotely located project managers through the renovation sites to monitor progress.

**Challenges**

Even with the convergence of technologies, organizations must overcome the following challenges:

» There are organizational silos and distinctly different approaches to talent acquisition, business processes, and technology support.

» Integration between data sources for each system is difficult and continuous.

» An integrated solution typically involves working with a network of technology partners, often adding unforeseen cost and complexity.

These challenges are not insurmountable, but they will require manufacturing companies to take a deep and hard look at their organizations and potentially reengineer them to ensure successful adoption of these technologies.
Conclusion

Connected worker technologies can help manufacturing and industrial organizations realize gains in worker productivity and safety, product quality, and operational efficiency while reducing time and costs associated with maintenance and repair. The emergence of augmented reality as a powerful tool to empower the connected worker and flexible delivery options provides companies with choices based on their business and operational needs. Many companies choose to start small with a cloud-first approach for relative ease of setup and faster time to evaluate results, with a longer-term strategy of rolling out a hybrid on-premises solution with the ability to integrate various plant floor operations technologies.

Compounded by the widespread adoption of the cloud and IoT, distributed edge infrastructure is proving itself to be the architecture of choice to accelerate smart manufacturing initiatives and to boost worker productivity.

About the Analyst

Jonathan Lang, Research Manager, IT/OT Convergence Strategies

Jonathan Lang is Research Manager for IDC Manufacturing Insights responsible for the IT/OT Convergence Strategies practice. Mr. Lang’s research focuses on digital transformation strategies in environments where operations technologies are deployed, including manufacturing, utilities, oil and gas, and healthcare provider settings.
MESSAGE FROM THE SPONSOR

For additional resources on deploying connected worker solutions, readers may also be interested in:

» The Intelligent Factory (video)
» Reinventing Product Support using Remote Visual Guidance (case study)
» The Refinery of the Future (video)
» Edge Compute Family Guide (Product Guide)