Intel® Edge Insights for Industrial Software

DELL™ POWEREDGE™ XR SERVERS WITH 4TH GENERATION
INTEL® XEON® SCALABLE PROCESSORS ENABLE
INDUSTRIAL 4.0 TRANSFORMATION

Smart Factory Solutions | Worker Safety | PCB Defect Detection

SCALERS AI

| Delivering to the Industrial 4.0 Vision with AI at the Edge

The Fourth Industrial Revolution, often referred to as Industrial 4.0 is a paradigm shift in the manufacturing sector powered by edge computing, AI, and robotics. Perhaps better characterized as software defined manufacturing that unlocks the potential to rapidly adjust manufacturing to consumers ever evolving tastes and enterprise demand shifts, reduce costs, improve sustainability, and enhance worker safety. To accelerate this transformation Intel® and Dell™ have invested in delivering hardware and software targeted for the Industrial 4.0 revolution.

Intel® Edge Insights for Industrial Software package provides a modern microservices architecture with the building blocks to run AI on video and time series data, ingest sensor data, and scale out at the edge.

Dell™ PowerEdge™ XR platforms complement this software with a rugged compact form factor that meets the temperature range, reliability, and power envelope requirements of industrial settings. Equipped with the latest 4th Gen Intel® Xeon® Scalable Processors they offer dramatic improvement in the AI required to drive 4.0 Industrial innovation augmented with the general purpose processing to run new and legacy applications.

Intel® Edge Insights for Industrial Software with Dell™ PowerEdge™ XR5610 Server supports 40 simultaneous streams running AI worker safety at 488 Images / Sec

| 1.6x Gen on Gen Performance Improvement Using Intel® Deep Learning Boost & Intel® OpenVINO™

Delivering on the promise of Industrial 4.0 requires industrial grade solutions that fast track modern AI use cases. With Intel® Edge Insights for Industrial Software and Dell™ PowerEdge™ XR Servers with 4th Gen Intel® Xeon® Scalable Processors manufacturers have the foundation required to accelerate Industrial 4.0 transformation.

- Steen Graham, CEO at Scalers AI™

How AI at the Edge Transforms Quality Inspection in Manufacturing

AI at the network edge is revolutionizing quality inspection in manufacturing by enabling real-time analysis of production data. By integrating artificial intelligence capabilities into edge devices on the factory floor, manufacturers can perform in-process inspections and detect defects as they occur. This allows for immediate corrective action to be taken, reducing the need for time-consuming and expensive post-production inspections. The low latency and high processing power of AI at the network edge also enables advanced techniques such as computer vision and machine learning to be applied to the inspection process, leading to more accurate and efficient quality control.

By leveraging AI at the network edge, manufacturers can improve their overall quality, increase production efficiency, enhance worker safety, and stay ahead of the competition in an increasingly digitalized world.

CASE STUDY

PCB Defect Inspection & Worker Safety

Printed Circuit Boards are used to mechanically support and connect electronic components using conductive pathways, tracks or traces. PCBs are commonly used in electronic devices and products, including computers, smartphones, and televisions.

Common defects in PCB manufacturing include soldering defects, component placement or missing component errors, copper trace damage, and short & open circuits. The rework, scrap, and downtime due to defects in PCB's cost the electronic industry billions of dollars a year.

Worker safety is paramount in industrial setting and AI allows us to determine if workers are wearing protective equipment to ensure their safety.
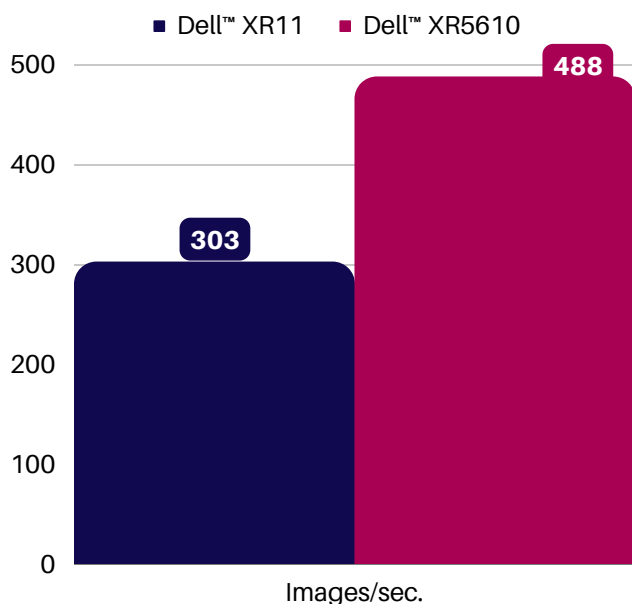
In this solution we are running both PCB defect detection and worker safety protective equipment detection using Intel® Edge Insights for Industrial Software and Dell™ PowerEdge™ XR Servers with 4th Gen Intel® Xeon® Scalable Processors.
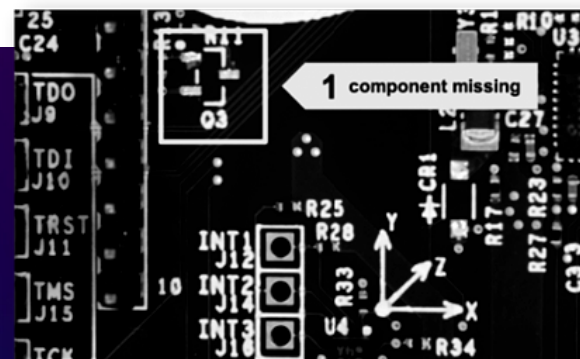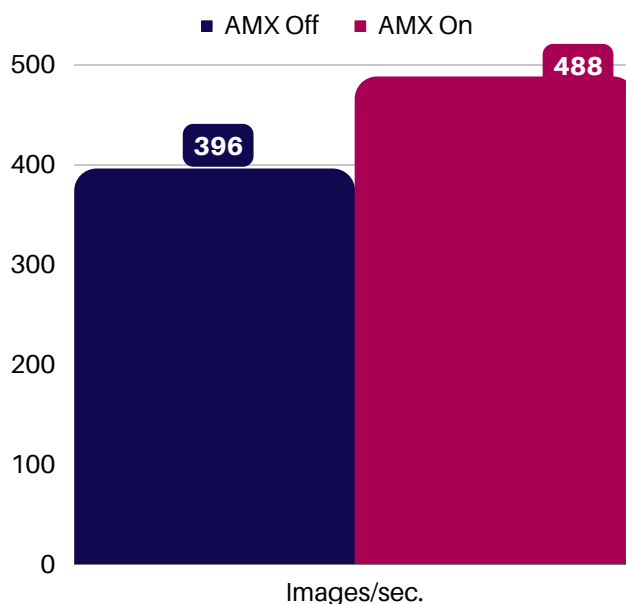
| Dell™ PowerEdge™ XR11 & XR5610 Performance Insights running a Worker Safety Use Case

Inference, Video Decode & Application Logic

Inference, Video Decode & Application Logic

Legend (left chart): ■ Dell™ XR11   ■ Dell™ XR5610

Left chart values: 303, 488

X-axis label: Images/sec.

Legend (right chart): ■ AMX Off   ■ AMX On

Right chart values: 396, 488

X-axis label: Images/sec.

Dell™ PowerEdge™ XR5610

| Product Inspection with Dell™ PowerEdge™ XR5610

Dell™ PowerEdge™ systems are designed to process and analyze large amounts of data in real-time, making them ideal for use in product inspection scenarios. It is now possible to deploy state of the art computer vision applications leveraging AI models for object detection, defect classification and complex analytics and visualization. In addition, these systems are powerful enough to support rapid customization through the use of techniques such as transfer learning at the edge.

Product inspection often takes place in hazardous environments with dust, and extreme temperatures, shock. Dell™ PowerEdge™ systems rugged form factory is perfectly suited to address these challenges.

To learn more about how to create custom defect models using transfer learning review the linked white paper that details transfer learning techniques and showcases the development of a custom model for impeller defect detection.

> ▷ https://infohub.delltechnologies.com/section-assets/smart-factory-defect-detection-poweredge-xr-intel-xeon-4th-gen
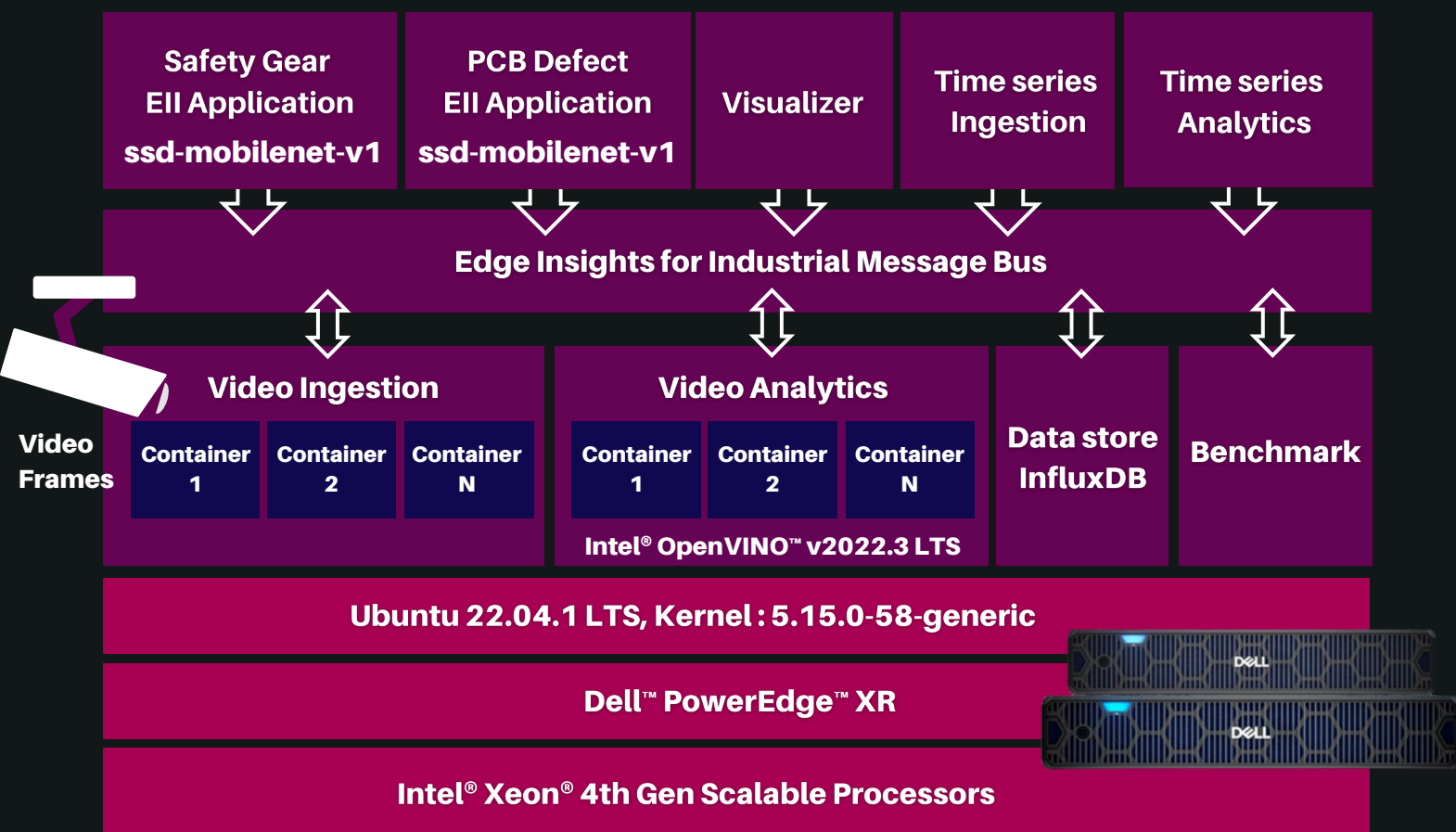
Solution Architecture

Intel® Edge Insights for Industrial Software is middleware optimized for industrial data analytics at the edge, providing real-time processing, analysis, and visualization. The software manages sensor integration, time series data ingestion, video capture, and optimized AI inference, and is scalable and flexible for deployment in various environments. The application layer includes worker safety and PCB defect detection AI models that can be quantized into int8 format for improved performance.
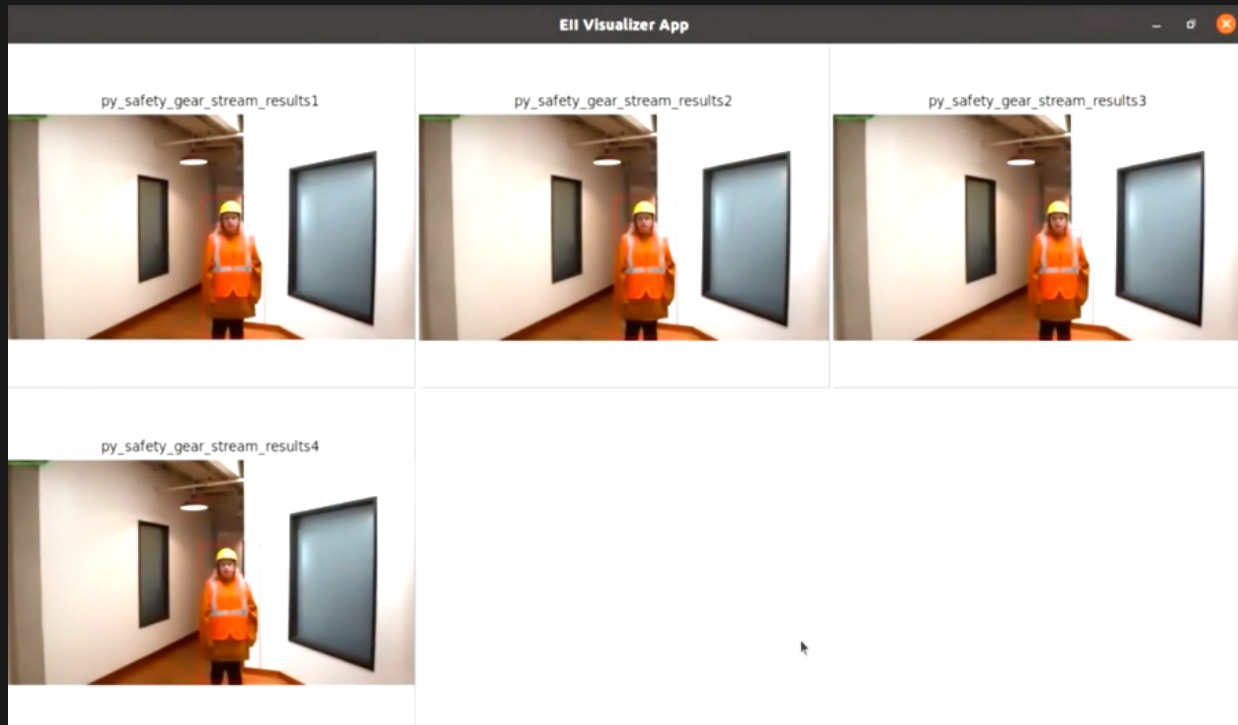
Complementing the scalable software, the hardware layer uses Dell™ PowerEdge™ XR Servers with 4th Gen Intel® Xeon® Scalable Processors. The servers have up to four sockets, a rugged form factor with a wide temperature range, and rich I/O ideal for edge computing.

Intel® Edge Insights for Industrial Software scales horizontally across multiple nodes using a distributed architecture, which can deploy in different environments and scale to cloud or edge nodes in manufacturing. Manufacturers can add nodes to the solution as their needs grow, allowing for a flexible and agile infrastructure.
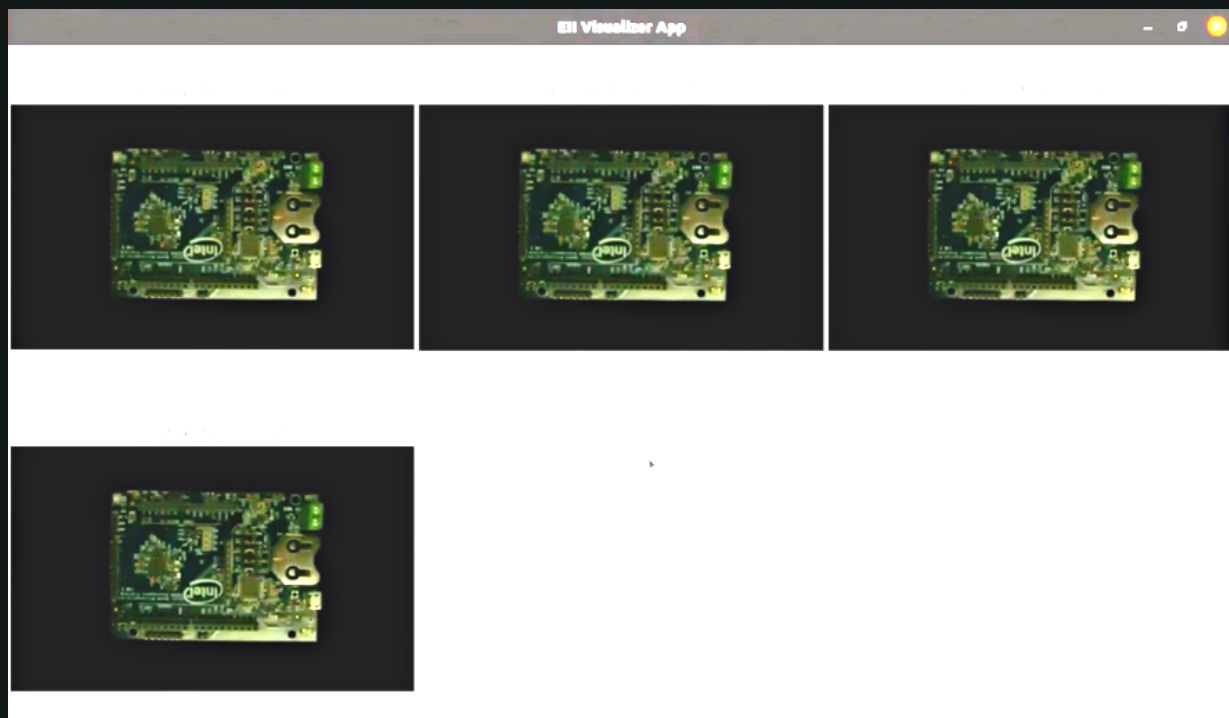
The solution enables processing of data closer to the source, allowing for real-time decision-making, reduced latency, and increased efficiency. Intel® Edge Insights for Industrial Software is a powerful solution for industrial data analytics at the edge, providing a way to make informed decisions based on insights gleaned from data.

Safety Gear EII Application ssd-mobilenet-v1	PCB Defect EII Application ssd-mobilenet-v1	Visualizer	Time series Ingestion	Time series Analytics

Edge Insights for Industrial Message Bus

Video Frames

Video Ingestion			Video Analytics			Data store InfluxDB	Benchmark
Container 1	Container 2	Container N	Container 1	Container 2	Container N		

Intel® OpenVINO™ v2022.3 LTS

Ubuntu 22.04.1 LTS, Kernel : 5.15.0-58-generic

Dell™ PowerEdge™ XR

Intel® Xeon® 4th Gen Scalable Processors

DASHBOARDS

Worker Safety Demo Output

PCB Defect Detection Demo Output

Conclusion

Dell™ PowerEdge™ XR5610 servers, equipped with 4th Gen Intel® Xeon® Scalable Processors are well suited to handle edge AI applications with both AI inference and training at the edge. The rugged form factor (MIL-STD, NEBS tested), extended temp (-5 to 55C), and Dell™ XR portfolio scalability to 4 sockets enables compute to be deployed in rugged environments closer to the point of data creation allowing for **near-real-time insights**.

These industry specific solutions can run remote with workloads previously thought to require cloud resources such as Transfer Learning or retaining the model, making it possible to do this at the edge, **faster**, and **more secure.**

Intel® Edge Insights for Industrial Software offers compelling complementary value by providing a middleware stack purpose-built to drive Industrial 4.0 innovation by ingesting sensor data, capturing video, analyzing time series data, and running optimized AI in an architecture that scales out at the edge or to the cloud.

About Scalers AI™

Scalers AI™ specializes in creating end-to-end artificial intelligence (AI) solutions for a wide range of industries, including retail, smart cities, manufacturing, and healthcare. The company is dedicated to helping organizations leverage the power of AI for their digital transformation. Scalers AI™ has a team of experienced AI developers and data scientists who are skilled in creating custom AI solutions for a variety of use cases, including predictive analytics, chatbots, image and speech recognition, and natural language processing. As a full stack AI solutions company with solutions ranging from the cloud to the edge, our customers often need versatile common off the shelf (COTS) hardware that works well across a range of workloads. Additionally, we also need advanced visualization libraries including the ability to render video in modern web application architectures.

Dell™ XR portfolio includes 2U dual socket Dell™ XR7620 and 2U sled-based XR8000 along with 1U Single Socket Dell™ XR5610, offering flexibility and scalability with highly configurable options for CPU, memory and I/O needed for Edge and Telecom applications.

APPENDIX

Our Solution Testing Methodology

- The workload and test cases were designed to maximize CPU utilization, ensuring that it was at least 90% throughout the scenario.
- Two Dell™ servers with different CPU models were used in the testing: Dell™ PowerEdge™ XR11 with single socket Ice Lake CPUs and Dell™ PowerEdge™ XR5610 with single Socket 4th Gen Intel® Xeon® Scalable Processors CPUs.
- The testing was done using Intel® Edge Insights for Industrial Software, and system performance was monitored with Linux System tools.
- The AI model used in the testing was SSD-Mobile-net-v1 and computation was in int8 format.
- Intel® Edge Insights for Industrial Software was configured to provision 40 ingestion services each serving 1080p video at 30 images per second.
- Intel® Edge Insights for Industrial Software was configured to process 40 video analytics services each using built-in udf (User Defined Function) based configuration for inference and collecting output images per second.

Performance varies by use case, model, application, hardware & software configurations, the quality of the resolution of the input data, and other factors. This performance testing is intended for informational purposes and not intended to be a guarantee of actual performance of an AI application.