



Amazon Uses Copia to Connect 500+ PLCs and Cut PLC-Driven Downtime by 80%

Amazon also expects to improve high severity response time by 25%.

The Problem

Amazon fulfillment has a wide range of material handling equipment and work cells using multiple PLC manufacturers. Buildings and work cells that shared the same original design often would have code changed over time by local controls technicians, which caused variability throughout the network and lacked appropriate feedback mechanisms to design and development teams. Collaboration and file backups were done manually that allowed co-development, and maintaining the latest backups was enforced only through an honor system. Amazon reviewed various internal and external solutions and selected Copia Automation as its pilot software, based on its flexibility with various PLC manufacturers and its ability to allow customers to self-host on their own AWS servers.

High-severity issue resolution time is expected to improve by 25 percent or more by having proper change history and file backups

The Implementation

In 2023, Amazon engineers collaborating with Copia Automation completed a proof-of-concept (PoC) of automatic backups of automation software at three warehouses. The backups included PLCs and configuration files for equipment, such as safety scanners. During the PoC, Amazon's business and design needs were verified, security and performance of the solution were tested, and Copia Automation's functionality was customized to be integrated with Amazon's workflow. After successful completion of the PoC, Amazon extended Copia Automation's solution to 10 more warehouses, with over 500 PLCs to back-up code daily and provide smart reporting of changes. Copia Automation supported

the Amazon team in being able to host agent and conversion servers on internal instances of [Amazon Elastic Compute Cloud](#) (Amazon EC2)—which provides secure and resizable compute capacity for virtually any workload—where Amazon had full control of approved traffic flow to PLCs. Alerts are generated over email and Slack, and network-level dashboards were created by connecting databases to [AWS QuickSight](#)—which provides unified business intelligence at hyperscale—for flexible reporting.

Solution Architecture and Best Practices

The Copia solution is deployed in Amazon’s own AWS account. In this type of deployment model, Amazon is responsible for managing and configuring its own infrastructure needed to run Copia’s software. The typical architecture is shown in Figure 1. The primary software application (App Server) is run on [Amazon Elastic Kubernetes Services](#) (Amazon EKS). It uses [Amazon Elastic Block Storage](#) (Amazon EBS) as the storage layer for storing Git repositories. The metadata needed to run the application is stored in an [Amazon Relational Database Service](#) (Amazon RDS) database while [Amazon Simple Storage Service](#) (Amazon S3) is used for storing backups. On the factory side, Copia software can be installed on Agent Servers running Vendor-specific software for Integrated Development Environment (IDE) and connectivity. The Agent software works in conjunction with the vendor software to connect with PLCs and other devices. The agent software connects to the App Server over HTTPS. [Amazon Route 53](#) is used to resolve the DNS, and Application Load Balancer ([Amazon Elastic Load Balancer](#)) serves as the end point for receiving and distributing the traffic to the appropriate App Server pods. Shop floor users or vendors can access the application through a web interface. A Conversion Server Instance on Amazon EC2 is used by Copia to translate PLC programs from vendor proprietary language to a common intermediate format for display on the web.

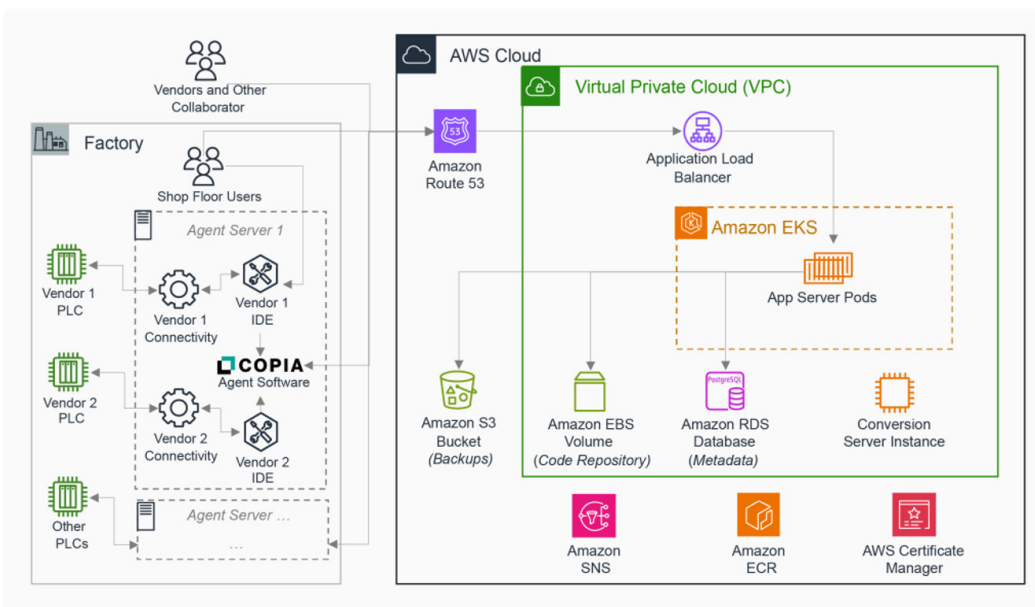


Figure 1: Solution Architecture for Copia Deployment

The Amazon EKS cluster is configured to be horizontally scalable. Connectivity between the Factory and the AWS cloud over [AWS Direct Connect](#) (or [AWS Site-to-Site VPN](#)) keeps all the traffic private and encrypted. This architecture allows Amazon to privately store their code repositories and enable a centralized source management practice for their Automation code. It enables Amazon to standardize code management and code collaboration practice both internally and externally (with vendors).

Benefits

Amazon expects to reduce unexpected downtime from unapproved controls changes by 80 percent and significantly improve scalability of known code improvements that should be propagated across the entire network. High-severity issue resolution time is expected to improve by 25 percent or more by having proper change history and file backups and by reducing the time of downloading and sending files with internal or external original equipment manufacturer (OEM) customer support. External OEM vendors can be provided read-only access to support troubleshooting, and they can be given full access if they are supporting implementation of new equipment.

Conclusions

Manufacturing enterprises need a durable and remotely accessible solution for managing their PLC and Robot program versions. Copia offers toolsets to store such automation code, render the programs in a web portal to visually understand the differences between versions, and provides systematic workflows for code reviews and code merges. This solution helps manufacturers manage disaster recovery, code rollbacks, and remote collaboration with vendors or experts. Because the code repositories are to be accessed via the cloud, a strong security and code integrity protocols can be implemented: access to the code can be implemented as per company roles and policies; supervisory controls monitor, trace, approve or reject, or alert appropriately whenever code is accessed; and the code is encrypted at rest and in transit. Amazon deployed automation at 13 warehouses, connected about 500 PLCs to back-up to the AWS cloud, and expects to reduce 80% of unexpected downtime due to PLC code errors.

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