



Cisco Crosswork Network Automation

Introduction

Communication Service Providers (CSPs) are at an inflexion point. Digitization and virtualization continue to disrupt the way services are configured and delivered. The exponential growth in traffic only adds to the complexity of network operations. CSPs looking to reinvent themselves must deliver services that are relevant, immersive, and customizable, with minimal friction. Automation is a key pillar of this transformation and CSPs must be able to use on-box and off-box data to gain real-time, actionable insights. They have to rethink how to best operate their networks in order to:

- Simplify operations to gain speed, agility, and efficiency
- Deliver relevant and customized services that address consumer needs
- Support tremendous scale and resiliency

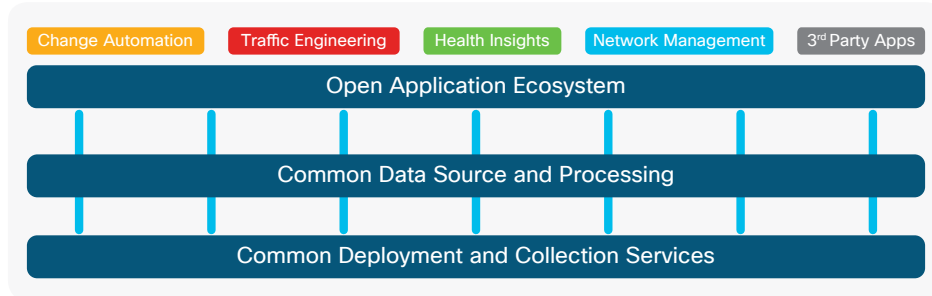
Service providers have to look into a different approach and architecture to transform their operations into a faster, more agile, less complex, and highly cost-effective service delivery environment. Software-Defined Networking (SDN), Network Function Virtualization (NFV), automation, and analytics all play important roles. The challenge is how to bring these critical elements together to create a scalable, efficient, multivendor environment.

Cisco Crosswork Network Automation is the solution for addressing these challenges, it provides a framework for transforming the current mode of operations and delivers the efficiencies and scale achieved by web operators to service providers. Cisco Crosswork Network Automation addresses the business challenges that service providers face as they seek to transform their operations. Cisco Crosswork Network Automation provides:

- A modular application ecosystem with open APIs to accelerate application and service development
- Common, best-in-class infrastructure software functions to improve time to market
- A multivendor collection and deployment service that is scalable, agile, and flexible

Cisco Crosswork Network Automation is an operations framework to transform service provider network engineering and operating functions. The solution is modular, customizable to the context of each deployment scenario and network environment.

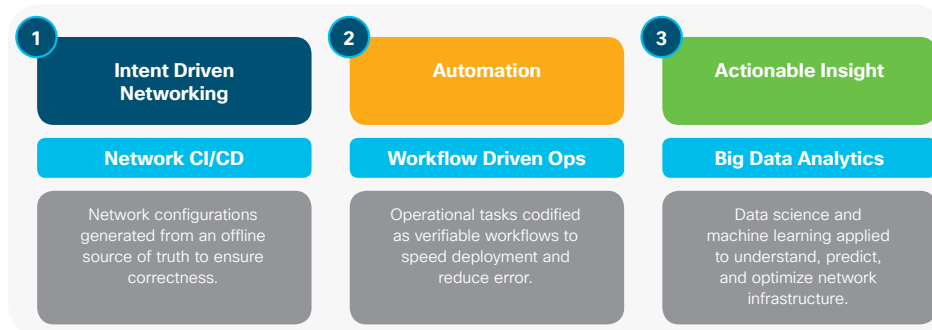
Figure 1. Cisco Crosswork Network Automation framework



The Basics: Cisco Crosswork Network Automation

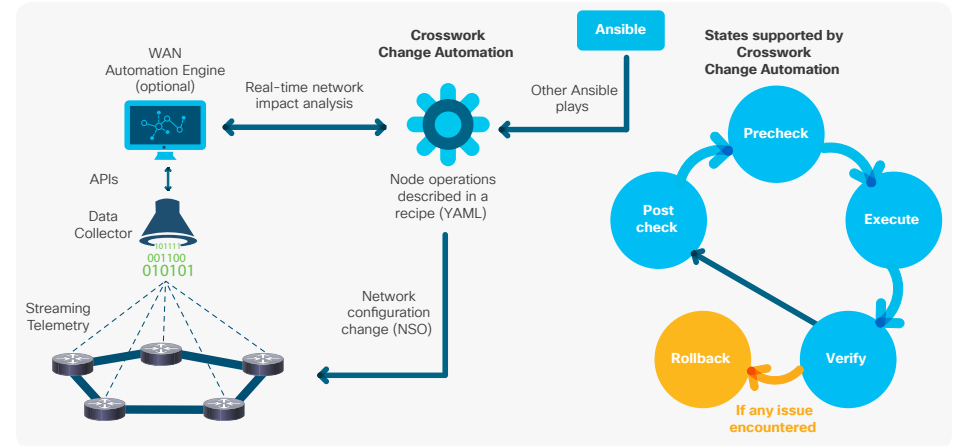
Cisco Crosswork Network Automation is a solution framework for network service providers who seek to transform their approach to operations and re-tool to handle mass-scale networks with increased agility and predictability. The platform automates and transforms operations, using telemetry, data analytics, and machine learning (see Figure 2).

Figure 2. Intent Driven Networking



The initial release of Cisco Crosswork Network Automation will include the entire software platform as well as two of the most requested applications running on it: Cisco Crosswork Change Automation Engine, which provides closed-loop workflow automation, and Cisco Crosswork Health Monitoring, which provides machine learning-based smart remediation. (See Figure 3)

Figure 3. Cisco Crosswork Change Automation: Codify your workflows



A primary task in day-to-day network operations is managing the hundreds or thousands of changes in the network. These changes represent the process of maintaining and updating a network for continuity of network service. Today's manual and slow processes do not scale as rapidly and as extensively to meet the growing demands.

Cisco Crosswork Change Automation application automates the implementation of network changes such as:

- Change in network device configurations
- Change in service configurations
- Maintenance window work orders

Cisco Crosswork Change Automation captures the intent of network changes that network professionals want to implement and translates them into actionable items. An intent can be described by a series of tasks following a specific order. A sequence of tasks is commonly referred to as a Method Of Procedure (MOP).

Cisco Crosswork Change Automation application captures the user intent of network changes as MOP into a machine-readable workflow.

With Cisco Crosswork Network Automation you can transform the following operational tasks, reducing time and cost while increasing network utilization, uptime, and reliability:

- Activation (device, network, and service activation)
- Assurance (device and network assurance)
- Closed-loop workflow-defined operations
- Single source of truth for devices, topology, and network state
- Self-service KPI customization and monitoring
- Machine learning-based event management
 - Smart network remediation
 - Creation of smart thresholds for KPIs

Cisco Crosswork Network Automation is an innovation in network operations, control, and automation, building upon Cisco's world-class networking expertise, along with innovations in analytics, DevOps, and machine learning.

Some examples of Cisco Crosswork Network Automation use cases describing what to expect from operations transformation include:

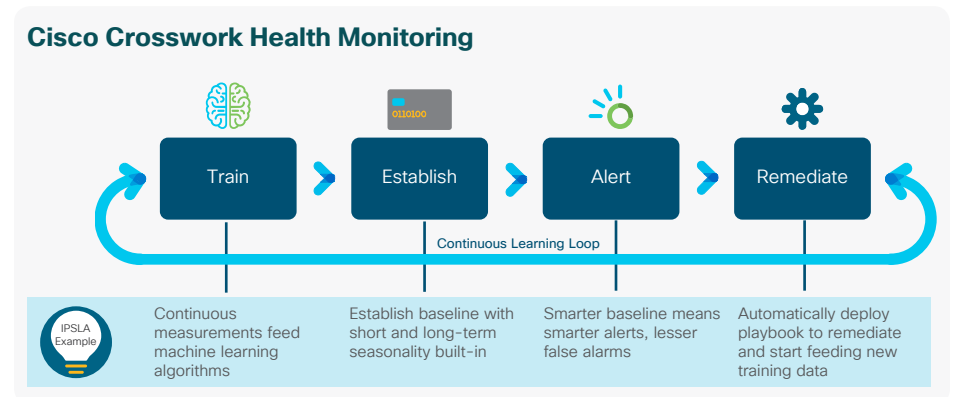
- **Network configuration as a code:** Cisco Crosswork Network Automation toolset enables operators to treat network configuration like software code. New configurations get developed and deployed with modern techniques that now allow a version control system, automated testing, simulation testing, and a peer review process.
- **Self-service monitoring:** Cisco Crosswork Network Automation continually self-monitors the preselected key performance indicators related to a service or network and notifies of any breach.
- **Machine learning-based event management:** Cisco Crosswork Network Automation correlation engine correlates current events with similar events in the past and suggests remediation. It also has the ability to actuate the document called "Play". This process simplifies software provisioning, configuration management, and application deployment.

The process of automating the network change begins with a MOP definition by the user in a human-readable format. You, as the user, can then translate the MOP definition into a set of plays in the following ways:

- **Standard plays:** Choose and use plays from a prebuilt library that match your requirements
- **Custom plays:**
 - Build your own custom plays
 - Utilize Cisco Advanced Services to build custom plays
 - Utilize partner services to build custom plays

In addition to predefined standard MOPs, Cisco Crosswork Network Automation is integrated with Cisco Network Services Orchestrator to provide end-to-end device configuration and network service provisioning capability. (See Figure 4)

Figure 4. Cisco Crosswork Health Monitoring: The learning cycle



Monitoring and making sense of the collected data are big challenges in service provider networks because of:

- Too much information: selecting streaming telemetry paths sensibly
- Pertinent information not collected: cannot determine root cause of a network issue without reproducibility
- Inability to make sense of streaming telemetry: what to look for, what metrics to monitor
- Inability to generate and correlate alerts from telemetry data in near real time
- Difficulty to predict and prevent software or hardware failures in the network
- Challenges in automating network assurance with automated detection and remediation of errors

Cisco Crosswork Health Monitoring application, running inside Cisco Crosswork Network Automation, addresses these challenges. Cisco Crosswork Health Monitoring provides smart monitoring, analytics, and remediation. It is also designed to work with the huge amount of data that is available from the network but could not be managed so far by existing systems and technologies. Cisco Crosswork Health Monitoring provides the following capabilities to address these challenges:

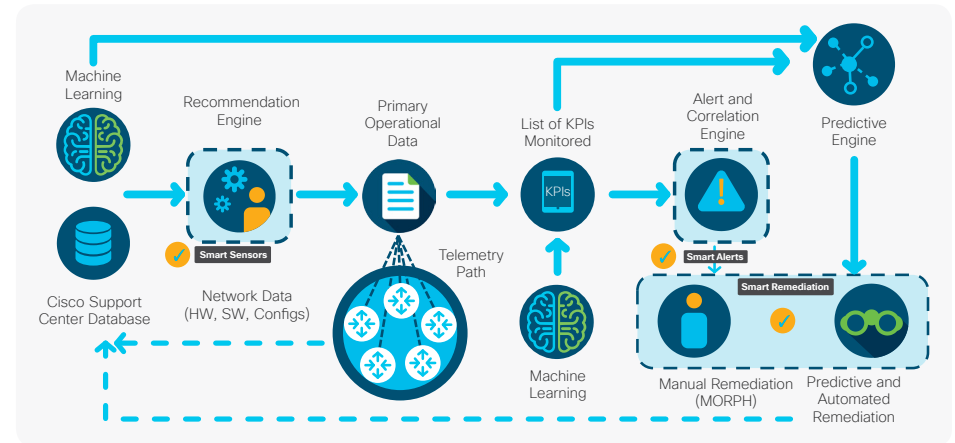
- Intelligent telemetry sensor recommendations based on platform software and hardware features
- Crosswork sensor recommendations based on troubleshooting history: derive telemetry paths from Cisco databases
- KPI definition and threshold cross alerting based on defined monitoring policies
- Machine learning recommendations based on troubleshooting history to remediate errors with manual/automated deployment capabilities

Cisco Crosswork Health Monitoring uses collected data at massive scale; mining the rich Cisco Defect and Enhancement Tracking system (CDET) and Technical Assistance Center databases for selecting the most relevant and effective telemetry paths.

Cisco Crosswork Health Monitoring uses statistical methods to provide baseline thresholds for sensor data in real-time, accounting for customer network conditions. As a result, Cisco Crosswork Health Monitoring improves data fidelity and reduces noise levels for applications seeking meaningful triggers.

With machine learning, Cisco Crosswork Health Monitoring can recommend remediation in case of a threshold breach. And Cisco Crosswork Health Monitoring can trigger Cisco Crosswork Change Automation to deploy the recommended remediation to provide self-healing capabilities. (See Figure 5)

Figure 5. Cisco Crosswork Health Monitoring: Make your data actionable



Primary value drivers

- **Smart sensors:** Cisco Crosswork Health Monitoring relies on its vast support database and device configuration to create a recommendation engine that uses supervised machine learning algorithms to come up with sensors relevant to that device. Why is this meaningful? It unburdens the customer from having to manually create KPIs of relevance. Cisco Crosswork Health Monitoring recommendation engine recommends KPIs of relevance for the device and starts monitoring them.
- **Smart alerts:** After relevant KPIs are monitored, Cisco Crosswork Health Monitoring allows the creation of thresholds (manual or based on unsupervised machine learning that can detect short- and long-term trends, including seasonality). The anomaly detection algorithms can detect changing baselines and thus generate smart alerts, significantly reducing the noise that otherwise occurs in most provider network alarms.
- **Smart remediation:** What's the point of a smart alert if there isn't a remedy? This is where tie-ins with Cisco Crosswork Change Automation create significant value. After an alert is generated, you have the option of deploying an appropriate Cisco Crosswork Change Automation playbook to remediate. **Future iterations of Cisco Crosswork Network Automation running Cisco Crosswork Health Monitoring will mine its database of defects to be then capable of automatically predicting and deploying changes before any problems can occur.**

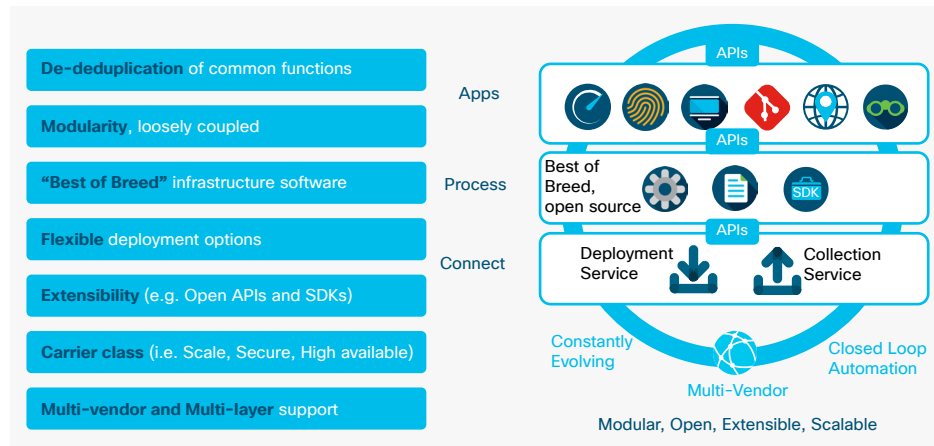
Cisco Crosswork Network Automation architecture

Cisco Crosswork Network Automation is based on the vision to use a common, shared infrastructure and a foundation of services for joint use by applications. This way a set of common functions can be provided as a service toward domain-specific applications as opposed to a product-by-product approach. This common-shared approach provides higher flexibility and scalability at a lower cost to address the needs of mass scale networking.

Cisco Crosswork Network Automation is a vendor- and layer-independent solution being built on microservices and containerized, guaranteeing performance, scalability, and high availability. Cisco Crosswork Network Automation is built on primary open-source and standard components that have been proven effective in the service provider, Over The Top (OTT) and web apps environments. Cisco Crosswork Network Automation is flexible enough to run custom-built applications with readily available open APIs and a Software Development Kit (SDK).

Primary tenets for the Cisco Crosswork Network Automation architecture are shown in Figure 6.

Figure 6. Cisco Crosswork Network Automation architecture key tenets



The architecture is divided into three functional layers:

- **Open Application Ecosystem layer:** Proprietary or open applications that address specific use case or solve specific operations problems.
- **Common Data source and Processing layer:** Necessary common functions to aggregate, distribute, analyze, and store data based on best-in-class Cisco and open-source software.
- **Common Deployment and Collection Service:** Multivendor network element configuration deployment and network data acquisition for operational, event, and flow data:
 - **SDKs and APIs:** Published and documented part of the infrastructure to aid application development and simplify integration with other OSS and BSS systems.

Business outcome

Service providers want to evolve into a cost-effective service delivery environment and make their operations more agile, predictable, and efficient. Cisco Crosswork Network Automation provides a cost-effective, multivendor, modular, and scalable ecosystem for service providers to achieve their operational transformation goal. Cisco Crosswork Network Automation has an open and scalable framework to help service providers transform their network operations and service delivery capability. Each of the three modules of Cisco Crosswork Network Automation provides distinct business value to the service provider.

The open application ecosystem provides a common pool of applications developed by the community for faster deployment of new services. Open APIs will help CSPs avoid vendor lock-in. The ecosystem provides applications such as real-time monitoring and optimization applications to improve utilization of network resources through the use of closed-loop real-time network monitoring and optimization capabilities. It also provides closed-loop workflow automation applications to help in the automation of work orders for making changes to the network and services. Applications, such as these, supplied through the open application ecosystem, have positive business effects:

- Reduce long-term network infrastructure CapEx by 30 to 40 percent by closely monitoring and optimizing network resources

- Reduce the number of development errors by up to 40 percent
- Reduce the number of FTEs dedicated to capacity monitoring and planning by up to 20 to 30 percent through the use of auto-remediation and self-healing

The **data source and processing layer** provides common functions to aggregate, distribute, analyze, and store data based on best-in-class Cisco and open-source software. These functions include functions from the open-source community to speed up the development of new applications and services. This module provides a single set of data and inventory for all applications for both internal and partner developers. By making common software functions readily available in the platform, service providers can:

- Reduce development cost and time to market by 20 to 30 percent
- Reduce errors by providing data integrity by creating a single source of truth for all data and inventory

The **common collection and deployment layer** is another part of Cisco Crosswork Network Automation that provides a robust and scalable automation platform.

It provides multivendor network element configuration deployment and network data acquisition for operational, event, and flow data. By creating a common module for all devices and applications, this module:

- Reduces integration cost
- Creates a highly scalable infrastructure
- Reduces hardware and facilities cost
- Reduces network telemetry traffic

Cisco Crosswork Network Automation enables operational transformation of the service provider by providing a highly scalable and efficient operations automation framework while making it easier for service providers to develop new automated operations with minimal development time and cost.