

Transition to DevOps with Cisco UCS and Cisco HyperFlex Platforms

To meet business demands, IT organizations are adopting DevOps methodologies and automating more processes. Cisco Unified Computing System™ (Cisco UCS®) management provides automation and an effective framework for making the transition.



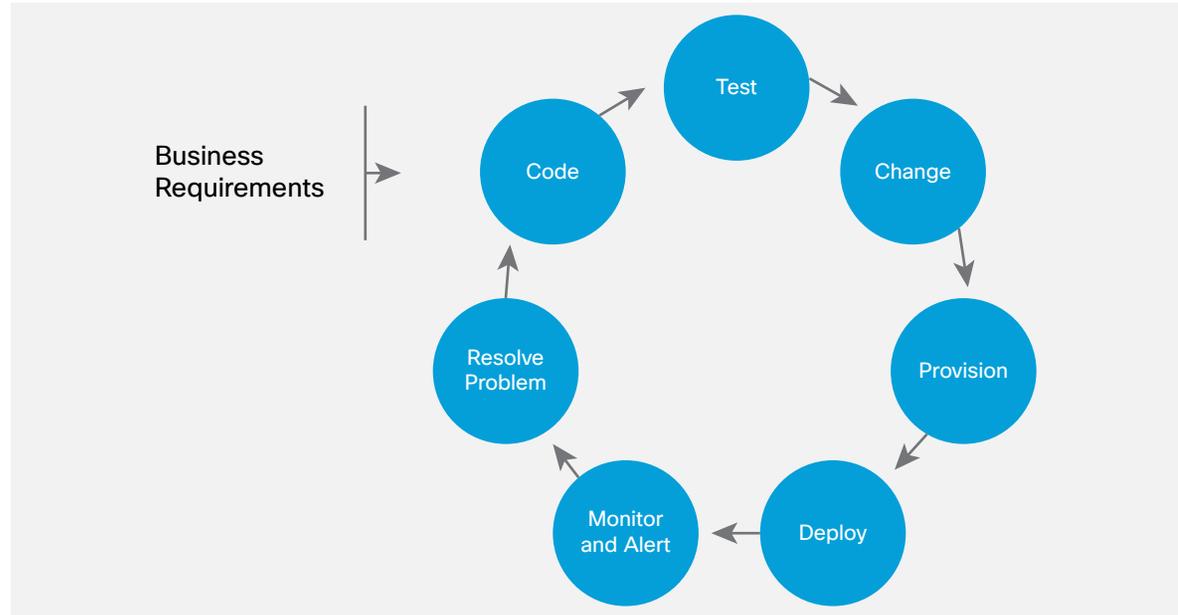
Highlights

- Use your investment in existing infrastructure, tools, and processes, so you can transition to DevOps cost effectively at your own pace.
- Roll out new applications and business services faster and more efficiently.
- Reduce total cost of ownership (TCO) by automating many routine tasks, improving resource utilization, and proactively preventing manual errors.
- Efficiently adopt new technologies, such as hyperconverged infrastructure and containers.

Overview

To achieve greater competitive advantage through deployment of new business services, enterprises need to move applications more quickly through the various phases of the software development lifecycle (Figure 1). Traditional applications that run your business, such as enterprise resource planning (ERP), collaboration applications and databases, were developed to run in an environment in which updates were made only every several months. But new applications, such as the [Internet of Things \(IoT\)](#), mobile, and cloud-native applications that provide personalized customer experiences and generate new revenue streams, operate in an environment in which change is continuous.

Figure 1. Phases of the Software Development Lifecycle (SDLC)



As a result, an increasing number of organizations are adopting [DevOps](#) methodologies. DevOps is part of a growing movement toward processes and methods that facilitate greater communication and collaboration among development, quality assurance (QA), and IT operations. It facilitates continuous delivery by automating the software delivery and infrastructure change processes, reducing inefficiency throughout the SDLC. According to a recent survey¹, 81 percent of enterprises have implemented DevOps in some form: by business units or divisions (31 percent), by projects or teams (29 percent), or across the entire company (21 percent).

The [continuous delivery](#) approach in DevOps requires continuous deployment and [management of infrastructure as code](#) (IaC). Industry analyst Gartner notes in its [definition of DevOps](#) that DevOps implementations utilize technology—especially automation tools that can leverage an increasingly programmable and dynamic infrastructure from a lifecycle perspective.

¹ “2016 State of the Cloud Report,” <https://www.rightscale.com/lp/state-of-the-cloud>, pages 23–24

Main Features

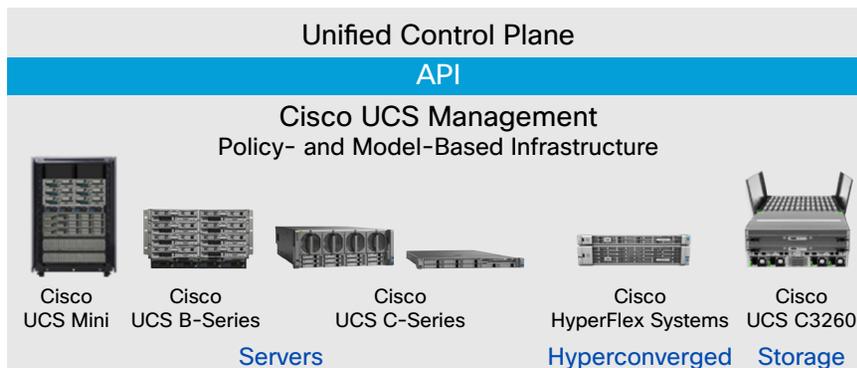
The Cisco® solution offers a number of important features.

Infrastructure as Code

By abstracting all hardware configuration and identity information and transforming it into software-defined infrastructure (SDI) or, even better, policy-based infrastructure, you can begin to manage infrastructure as code (IaC). By describing your infrastructure as code, you can more easily define the desired state of the infrastructure and what you want to do with the infrastructure. As a result, IaC can serve as a fundamental building block for a continuous-delivery pipeline.

Cisco UCS was designed from the beginning to manage infrastructure as code. It can help your organization transition to DevOps. We offer proven management software and a mature partner ecosystem that provides a consistent and holistic operations management framework. Cisco UCS is policy- and model-based infrastructure with a unified control plane through the API. This management framework supports a variety of infrastructure solutions, including Cisco UCS B-Series Blade Servers and C-Series Rack Servers, C3260 Storage servers, and Cisco UCS Mini. It also supports Cisco hyperconverged infrastructure, through the Cisco HyperFlex™ platform. These components form solutions that make the process of implementing greater automation and DevOps methodologies less disruptive and more secure (Figure 2).

Figure 2. Cisco UCS Management Framework Provides Programmatic Control of All Infrastructure Resources



Implementing our SDI strategy since the introduction of Cisco UCS in 2009. The Cisco UCS management framework offers four main areas of innovation that treat the infrastructure as code. These four areas provide the foundation for automation of infrastructure management by making the infrastructure programmable. These include:

- **Software object model:** Hardware is not configured manually in Cisco UCS. Instead, every identity and configuration setting of every device in the system is defined in software through service profiles.
- **API centricity:** A unified system control plane is made accessible through a fully documented and open API.
- **Virtual interface card (VIC):** All network and SAN adapters are software defined, yet they present themselves to bare-metal OSs or hypervisors as physical devices.
- **Storage profiles:** Storage profiles provide flexibility in defining the number of storage disks, roles, use of the disks, and other storage parameters. They also encapsulate the storage requirements for one or more service profiles.

Cisco UCS management software delivers efficient automation capabilities and role-based access to help you effectively administer and manage a wide range of infrastructure locally and remotely. This tightly integrated management solution offers a model-based foundation that helps simplify and automate the everyday processes of provisioning, updating, monitoring, and managing compute, local storage, storage connections, and network resources. It provides the framework for efficient implementation of DevOps across the Cisco UCS and Cisco HyperFlex portfolios. Cisco UCS management accelerates IT service rollouts and actively helps prevent error-induced downtime.

An essential aspect of automated management is encapsulation of the best practices of your server, virtualization, storage, and network experts as policies and templates, which Cisco UCS calls service profiles. Service profiles let you consistently repeat, test, share, and promote configurations across your entire environment. In combination with the open API in Cisco UCS, they provide a common language for provisioning and configuring the infrastructure across the various types of devices.

The combination of true SDI and best practices defined in service profiles helps ensure that routine tasks are implemented consistently and correctly to reduce risk. Our customers are achieving significant efficiencies and cost savings using service profiles with their existing Cisco UCS blade and rack systems. We have extended this same management framework to our hyperconverged infrastructure with the Cisco HyperFlex platform.

Unified API for Complete Control

The API in Cisco UCS management provides a unified control plane. It is a programmatic interface to all components in the products in the Cisco UCS and Cisco HyperFlex portfolios. The API accepts XML documents through HTTP or HTTPS. Developers can use any programming language to generate XML documents that contain the API methods. It can present physical and logical resources in the same way that virtual and public cloud resources are presented.

This approach allows developers to automatically provision and adjust their infrastructure to meet their application requirements. An API call can initiate changes to attributes of one or more objects, including chassis, servers, adapters, drives, policies, and other configurable components. The Cisco UCS Manager Developer API toolkit includes Cisco UCS [PowerTool](#) and [Microsoft Windows PowerShell](#) modules and a [Python software development kit \(SDK\)](#) along with the Cisco [UCS Platform Emulator](#).

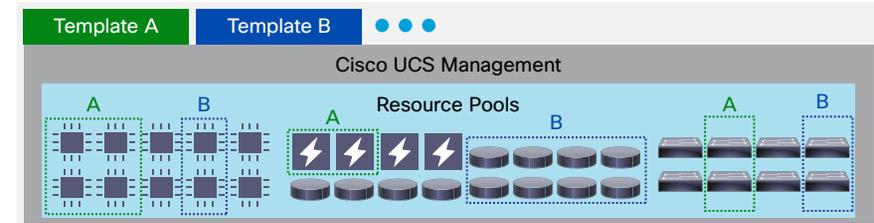
IAC and DevOps

Infrastructure as code is a prerequisite for common DevOps best practices such as version control, code review, and continuous delivery, to help ensure fast and reliable deployments. It provides standard ways of provisioning and configuring infrastructure in a programmatic manner. With IAC, infrastructure resources can be composed in a consistent way based on the demands of the application. Cisco UCS offers service profiles and a fully open and documented API to implement this approach.

By managing infrastructure as code, you can deploy applications more quickly by rapidly composing the infrastructure you need consistently and predictably. Figure 3 shows how templates allocate

the resources from a centralized infrastructure resource pool in Cisco UCS management software. Resource elements are provisioned and configured to uniquely support each application and workload.

Figure 3. Templates Allocate Resources from Centralized Infrastructure Resource Pools in Cisco UCS Management



Transitioning to DevOps: Addressing the Top Time-Consumers

DevOps is not limited to quickly provisioning applications and infrastructure. Organizations transitioning from their traditional environments to DevOps need to automate and implement continuous improvement of all phases of the SDLC. A survey by IDC² identifies the portion of time that IT administrative and operations staff spend on different activities:

- Provisioning, patching, and configuration: 21 percent
- Monitoring, troubleshooting, and fixing problems: 16 percent

To address the broader requirements for implementing DevOps and continuous deployment, you need a holistic approach. Cisco UCS management tools are integrated with a broad partner ecosystem that we've developed over the past seven years. We've worked with more than a dozen independent software vendors (ISVs) to integrate monitoring and analysis, deployment and configuration, and service orchestration tools.

These solutions help address the top time-consumers in the SDLC by extending and enhancing the capabilities of partner tools. Integrating these tools helps significantly reduce the time required for daily activities and makes configuration, provisioning, operations, and analysis more efficient.

² "IDC Converged Systems Survey", December, 2015.

DevOps Benefits from Partner Integrations: Puppet and Cisco UCS Management Tools

One of the leading tools for DevOps configuration management is [Puppet Enterprise](#). Cisco UCS management integration with Puppet is a good example of how we address the time-consuming activities that slow application deployment and support. Puppet Enterprise's extensible plug-in architecture and powerful declarative language provides a flexible, easy-to-use platform that seamlessly integrates the unique capabilities of the [Cisco UCS and Cisco Nexus® solutions](#). The Puppet [Razor module](#) is used for bare-metal provisioning. Razor's open-source heritage makes it highly customizable and superior to solutions that use the more cumbersome menu-based approaches of typical Preboot Execution Environment (PXE)-based systems.

Here are a few highlights of the solution:

- Configuration and server role assignment with Cisco UCS service profiles
 - Service profiles provide identity for the infrastructure. The infrastructure elements are stateless, and the network, storage, and server profiles create the identity for each of these elements through Cisco UCS Manager. The Cisco UCS platform's combination of model-based architecture and service profiles enables safe, fast automation.
 - For additional customization, the Cisco UCS [Python SDK](#) on GitHub provides a comprehensive set of [Python SDK sample code](#) to help you automate infrastructure as code with Cisco UCS.
- Rapid provisioning with Razor
 - Razor provides a robust set of programmatic interfaces for provisioning, including fine control of the target OS (Red Hat Linux, Microsoft Windows, etc.) and target workload (the server's role). Cisco UCS service profiles allow immediate, flexible definition of the intended server role, which is passed automatically to Razor.
 - Razor transparently integrates with Puppet Enterprise, and provisioned nodes are immediately brought under management.
- Monitoring with Puppet Enterprise
 - Puppet Enterprise can install and manage all aspects of a target workload with information passed from Cisco UCS service profiles. This capability allows immediate definition of a target OS and workload, which are automatically provisioned and brought into the desired state by Puppet Enterprise.
 - Puppet Enterprise's robust set of modules support a wide range of managed workloads across all major OS, virtual machine, and containerized environments.

Implementing DevOps Through Tools Integration

Cisco's robust and mature ecosystem along with the customization tools reduce risk and disruption by allowing IT teams to use existing management tools and processes as they incorporate new technologies and DevOps methodologies. By integrating the tools that support the development and test phases of the SDLC with Cisco UCS management and third-party operations tools, you can automate the entire application lifecycle. This approach supports the continuous improvement and improved communication that are essential to the DevOps methodology. Most organizations currently use VMware vCenter, Microsoft System Center, and other tools in their daily operations. They don't plan to implement new tools just to adopt DevOps, and they shouldn't have to. Table 1 offers some examples of how you can use existing tools and supplement them with new tools and integrations to implement DevOps using Cisco UCS integrations.

Table 1. Examples of Tools Integration to Enhance DevOps Methodology³

Steps in SDLC	Tools Integrated	Explanation of Use Case and Benefits
Provision, deploy, monitor/alert, and analyze	Cisco UCS Manager, VMware vSphere Auto Deploy with Cisco UCS service profiles, Cisco UCS Management Pack for VMware vRealize Operations, Cisco UCS Content Pack for vRealize Log Insight, and Log Insight with vRealize Operations	Users can continue to work from their familiar VMware consoles as they provision and deploy virtual resources, monitor and analyze problems. You can establish Cisco UCS service profiles in vSphere, deploy bare-metal servers, and then deploy the hypervisor with a single click. vRealize Operations provides in-depth monitoring of all Cisco UCS systems, and Log Insight provides analytics for unstructured data and log management to provide operational intelligence for rapid root-cause analysis and problem resolution.
Provision, deploy, monitor/alert, and analyze	Puppet Enterprise, Puppet Razor module, and Cisco UCS Manager	Puppet Razor provisions the servers using service profiles from Cisco UCS Manager. Puppet Enterprise installs and manages all aspects of a target workload with information passed up from Cisco UCS service profiles. The nodes are configured and managed in Puppet Enterprise. The health of the resources can be monitored in Puppet Enterprise with alerts sent to other monitoring tools.
Provision and deploy	Chef Server, Chef Knife plug-in for vSphere, VMware vSphere Cisco UCS Manager plug-in for vSphere, and Cisco UCS Manager	Users can provision and manage virtual machines on Cisco UCS from Chef Server. The Chef's Knife plug-in for vSphere lets users provision, list, clone, and delete virtual machines managed with vCenter. It lists data stores, resource pools, and clusters and allows users to implement commands on running virtual machines. Chef Server users can customize attributes such as virtual CPUs (vCPUs), virtual RAM (VRAM), and IP addresses. The Cisco UCS Manager plug-in adds the capability to provision servers from firmware with policy-based provisioning and configuration-drift protection. It also enables critical vSphere capabilities, such as VMware vSphere vMotion, Distributed Resource Scheduler (DRS), High Availability (HA), and Fault Tolerance (FT).
Monitor/alert, resolve problems, code, and test changes	Cisco UCS Manager, Cisco UCS Integration Pack for Microsoft System Center, System Center Operations Manager, System Center DevOps Management Packs, and Microsoft Visual Studio Team Foundation Server (TFS)	Cisco UCS Manager generates an alert in Microsoft System Center when an error occurs. The System Center DevOps management pack enables alert attachments and integrations with Visual Studio. Operations Manager in System Center can collect root-cause data in IntelliTrace format. The detailed information from Cisco UCS Manager is forwarded to the developer. Developers get the TFS work item with the IntelliTrace snapshot, so they can analyze the problem. They track and fix the problem in Visual Studio and then change the status in Operations Manager, so the alert can be closed. Developers can use their own familiar work environment to view and track problems, and the solution facilitates greater automation and interaction between development and operations processes.

³ Note: Integrated solutions are based on information provided by each ISV. Cisco has only tested portions of each solution.

Making the Transition to DevOps Easier

Cisco UCS management is also integrated with Cisco UCS tools, such as Cisco UCS Performance Manager, for monitoring and analysis, and with Cisco UCS Director for orchestration across Cisco and third-party hardware. In addition, the open and extensible XML API for Cisco UCS management provides the capability to develop custom integrations using [PowerTool and PowerShell modules](#) and the [Python SDK](#) as mentioned earlier.

The Cisco UCS XML API programmer’s guide provides an overview of Cisco UCS, the Cisco UCS management information model, and the XML API, and it contains numerous API examples. You can easily extend your existing tools and processes to support hyperconverged infrastructure as well as the rest of the Cisco UCS product portfolio.

The Cisco [UCS Platform Emulator](#) supports the use of Cisco UCS Manager and the Cisco UCS API without requiring physical hardware. The emulator significantly shortens the development cycle for applications that are based on the Cisco UCS API. You can create and test programs using only the emulator installed on a laptop. The emulator presents a controlled environment for the following:

- Emulation of large-scale environments
- Changes in the hardware inventory (device discovery)
- Firmware upgrade testing
- Troubleshooting real Cisco UCS problems

Adopting Containers and Cisco UCS

The benefits of containerization are real: improved resource utilization, predictable application deployment, and an agile environment for delivering applications at the speed businesses need to be competitive. The tools required to manage and deploy container technology are in the early stages. For developers and operators, deployment of large-scale containers is not as commercially advanced as solutions using virtual machine-based infrastructure. Even though application composition frameworks such as Docker Compose and Kubernetes pod definition are adequate for defining applications, they don’t address application infrastructure initiation and operational requirements.

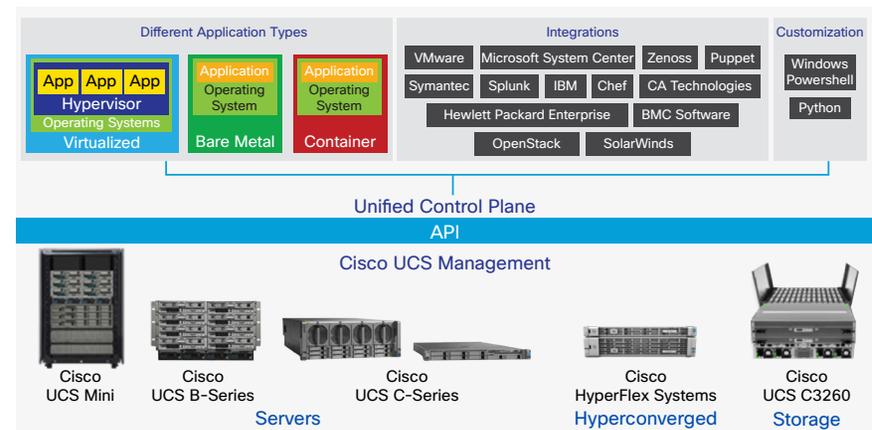


Cisco is addressing this gap by sponsoring an open-source project called [Contiv](#). This project provides the framework for an operator to define operational policies for infrastructure with containerized applications. It addresses the capability to specify network, computing, and storage policies for applications. It also offers an implementation for the enforcement of policies. Contiv consists of three components: [Contiv Network](#), [Contiv Storage](#), and [Contiv Cluster](#). Cisco acquired ContainerX and will be implementing a broader strategy to help organizations adopt containers.

Why Cisco?

The Cisco UCS approach to DevOps provides significant advantages. Cisco offers an evolutionary approach based on the innovation and management framework we first established over 7 years ago. More than 52,000 customers worldwide have deployed Cisco UCS and Cisco HyperFlex systems. IT organizations can implement DevOps gradually using proven, mature software and hardware in a manner that makes sense to them without risk and disruption. We allow you to transition efficiently by providing support for virtualized, bare-metal, and containerized environments while preserving your investment in existing systems, tools, and processes (Figure 4).

Figure 4. Unified Management Framework for Transitioning to DevOps and New Technologies



Cisco offers a holistic approach to DevOps that builds on a broad partner ecosystem. The Cisco UCS management framework integrates with operations management, configuration, and orchestration tools from more than a dozen ISVs. It also integrates with other Cisco management software, including Cisco UCS Director and Cisco UCS Performance Manager. These solutions are extended to other development and test platforms. Users can use consoles and environments that are already familiar to them as well as new DevOps tools, such as Puppet. In addition, developers can create custom integrations using the open and extensible API in Cisco UCS management software and the Cisco UCS Manager Developer API toolkit. With these integrated solutions, your organization can implement continuous improvement of the entire SDLC across the entire Cisco UCS product portfolio as well as the Cisco HyperFlex platform.

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Next Steps

For more information about Cisco UCS tools and integrations to facilitate DevOps methodologies, go to the Cisco [UCS DevNet webpage](#).

