White Paper

Automating the Delivery of Advanced Customer Experiences: Cisco Prime Architecture

What You Will Learn

Today's service providers face growing competition and more demanding service requirements than ever before. This paper discusses how the architecture of Cisco Prime, an end-to-end next-generation management application suite, helps service providers:

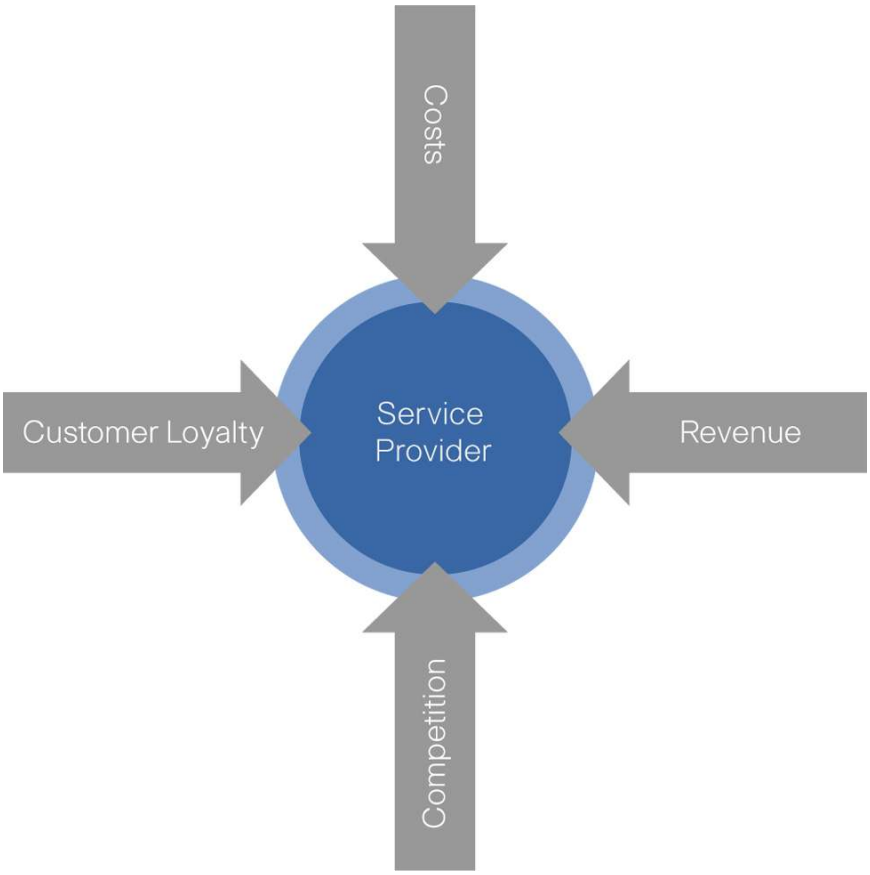
- Reduce capital and operational costs
- Enhance operational efficiency
- Grow revenues
- Realize more value from technology investments

Introduction

As businesses and consumers become more dependent on network-enabled services, the value of the service provider network has never been greater. But this complex and evolving marketplace also presents significant challenges. Between new "over-the-top" players riding on service provider infrastructures and fierce competition from other carriers in saturated markets, today's service providers face mounting pressure to increase customer loyalty, attract new customers, and grow (or at least protect) average revenue per user (ARPU), (Figure 1).

Staying competitive means making significant capital expenditures (CAPEX) to boost network capacity, intelligence, and availability. This also means more complexity - more network services, specialized functional teams, and dedicated tools and applications to support the growing array of services - all of which drive higher operational costs (OPEX). Too often, the difficulty of integrating new services within the service provider environment also means long delays between when network investments are made and when they begin delivering a return-on-investment.

Figure 1. Service Provider Challenges



For modern service providers, the key to success is to deliver more value in the business and consumer services ecosystem. Service providers must transform from basic providers of network access to full-scale “experience providers” capable of delivering a broad suite of advanced network services and compelling and differentiated user experiences.

To accomplish this, service providers need novel strategies to design and deliver new customized services more quickly, while reducing the cost of the entire service lifecycle: from design, to fulfillment, through assurance, analysis and optimization. Cisco can help service providers address all of these issues with Cisco Prime.

Cisco Prime Architecture

The key to meeting today’s business and operational challenges lays in shifting from a network or device management model to service management lifecycle - focusing on the end-to-end service experience, instead of just a collection of network elements. Cisco Prime addresses the complete “experience lifecycle” from service design through fulfillment, assurance, analysis, and optimization (Figure 2). The Cisco Prime architecture is a pre-integrated management application suite, incorporating a self-populating common inventory model, based on industry standards. The Cisco Prime data model abstracts network devices and services to provide powerful experience management capabilities, and extends coverage from the service provider core network to the customer premises.

Figure 2. Example of Cisco Prime Experience Lifecycle Management for IP Services

The Cisco Prime architecture provides a comprehensive management solution to automate the design, fulfillment, assurance, and ongoing management of advanced network services such as video, mobility, and managed cloud services over IP networks. It enables repeatable, policy-driven service provisioning processes within standardized workflows and templates, allowing even support personnel without specialized networking knowledge to easily provision, modify, diagnose, and repair complex services. Ultimately, it helps service providers provision services more quickly and consistently, at a lower cost.

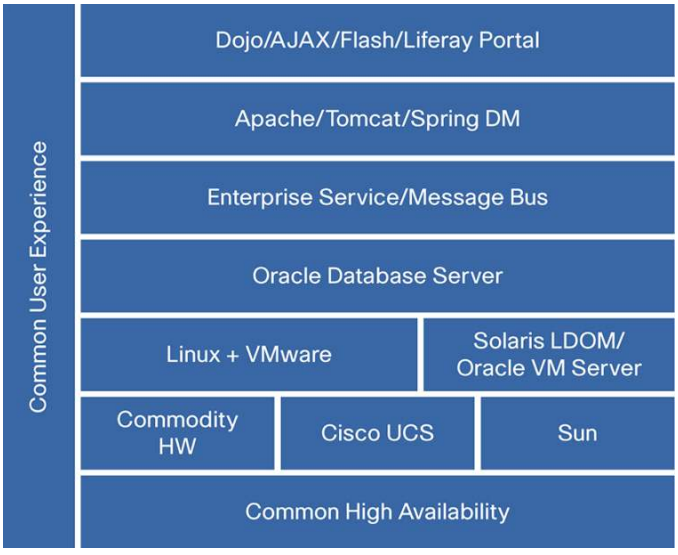
Cisco Prime delivers these capabilities through a set of integrated “suites” that align with major service provider-enabled customer experiences, such as Cisco Prime for IP Next-Generation Network (NGN) or Cisco Prime for Hosted Collaboration. Together, these suites and the overall management framework help service providers reduce costs, streamline operations, and radically reduce complexity in their networks.

The Cisco Prime architecture is designed to help service providers:

- **Accelerate time-to-revenue.** The Cisco Prime architecture can shave weeks off of deployment times through concepts such as pre-integration, automated service deployment, and converged management views of the entire service provider network. The architecture also provides “day zero” support for Cisco hardware and architectural solution blueprints, and integrated delivery with common components and standards-based open interfaces. Ultimately, it allows service providers to design and deliver new customer experiences more quickly, and with less risk.

- **Improve operational efficiency.** As service providers adopt new technologies to roll out differentiated services, they become more reliant on highly skilled, dedicated resources for fulfillment, maintenance, and quality. Maintaining these disparate management approaches is extremely costly, and makes service offerings inherently difficult to scale. Alternatively, the Cisco Prime architecture delivers visibility of the entire network - as well as workflows for fulfillment, assurance, and diagnostics. Cisco Prime can extend this comprehensive visibility across segmented functional groups. Or, for groups that maintain a functional demarcation (e.g., between fulfillment and assurance operations), the architecture easily allows for the appropriate enforcement of safeguards through role-based access control. In either case, the Cisco Prime architecture enables a shared, holistic understanding of the network. With the ability to visualize all inventory and services on the network and the topographical relationships between them through a single interface, service providers can deliver higher-quality services with fewer errors, at a lower cost.
- **Dramatically lower total cost of ownership.** The Cisco Prime Architecture is designed to help service providers reduce the costs of delivering quality customer experiences. It provides:
  - Reduced training costs for end users through a common user experience, and reduced administrative costs through a common set of management tools.
  - Service automation, allowing lower-level support personnel to perform “zero touch” provisioning, modifying, and repair functions
  - Embedded Oracle database option for all components, allowing users to manage the database through the related component, without requiring advanced database administration training. Embedded databases include self-maintenance and routine management scripts out-of-the-box, and are ultimately manageable through the Cisco Prime interface
  - Common technology stack for all components based on widely used and open-source components and software, as well as Cisco reusable technologies. (Figure 3.)
  - Support for both Cisco Unified Computing System (UCS) and off-the-shelf commodity hardware

Figure 3. The Cisco Prime Architecture Common Technology Stack



- **Easily support multi-vendor environments.** To support heterogeneous network devices, as well as the variety of operations (OSS) and billing systems (BSS) service providers use, multi-vendor support is a key requirement of any management solution. The Cisco Prime architecture uses a common data model, based on open industry standards, and exposes a common set of northbound APIs across the entire suite to simplify integration with OSS/BSS systems. Cisco Prime applications support Cisco hardware "out-of-the-box," helping service providers achieve rapid-time-to-value. Cisco Prime applications also support non-Cisco devices, eliminating the need for separate element managers for each type of device.
- **Maintain optimal hardware flexibility.** Cisco Prime components are flexible enough to take advantage of either off-the-shelf commodity hardware or high-performance systems specialized for the most stringent service provider environments. For more demanding environments, service providers can use a fully integrated, benchmark-setting solution running on the Cisco Unified Computing System (UCS), run Cisco Prime suites fully virtualized, or run a dedicated Cisco Prime suite pre-installed on Cisco UCS as a hardware appliance.
- **Adopt an overall management solution in a phased, incremental manner**. While the Cisco Prime architecture allows service providers to address all domains within a single framework, it does not require them to do so. Service providers can adopt Cisco Prime solutions economically in phases, running standalone domain managers (such as Cisco Prime Network for the IP network or Cisco Prime Optical for the optical domain), and implement a converged solution in the future. Service providers that are cost conscious can start with the most critical tasks such as turn-up and network fulfillment. Over time, as their business grows and demand for automation increases, Cisco Prime components can be installed to support more of the complete experience lifecycle. Organizations can also migrate their existing management products to the equivalent Cisco Prime component. In this manner, organizations can better control deployment risk, budget, and timelines.

In addition to these benefits, the Cisco Prime Architecture helps service providers accelerate ROI on the management architecture and maximize revenue. The following sections detail these industry-leading capabilities.

Accelerating Return-on-Investment

The Cisco Prime architecture is designed from the ground up to reduce the time needed to install and configure an overall management solution for the service provider network, and allow service providers to quickly reap the benefits of end-to-end management. Typically, service providers must shoulder expensive, lengthy, and risky upfront service engagements to stitch together multiple element managers during setup. Instead, Cisco Prime applications have been pre-integrated for many of the common phases of the "Experience Lifecycle," and include comprehensive workflows which span and support experience design, fulfillment, assurance, and analysis.

This "out-of-the-box" pre-integration enables "day-zero" support for both Cisco hardware and Cisco Business Architectural solution blueprints. That means service providers can introduce new, "cutting-edge" services found in Cisco hardware (such as Multi-Protocol Label Switching Transport Profile, or MPLS-TP), using Cisco management software that was tested and certified together with the hardware as an integrated Cisco solution from the initial release.

The Cisco Prime architecture is also designed to address complex operational challenges such as pre-population of end-to-end inventory in management systems and cross-domain fault management and troubleshooting. It provides a unified, consistent, and end-to-end view of network services, as well as cohesive workflows for common tasks that extend across multiple domains. As a result, service providers can more rapidly correlate, diagnose, and remediate faults that span multiple domains - which today can take days or weeks to repair.

Consider, for example, the Cisco Prime suite for IPNGN, an end-to-end solution for managing next-generation packet/IP and transport networks. This pre-integrated management solution enables:

- **Automatic discovery,** allowing network engineers to easily find and map both IP/packet and optical network devices from Cisco and other infrastructure providers, from the access layer through aggregation to the core network
- **Intelligent fulfillment,** with automated, A-Z provisioning of services such as Carrier Ethernet services, L2/L3 VPNs, MPLS-TP tunnels, and L1 circuits based on real-time inventory and resource information direct from topological maps
- **Comprehensive configuration management** to automate the validation of changes to network elements and restore configurations to the desired state
- **Automated service assurance** powered by diagnostic workflows to help operators rapidly detect and isolate network faults
- **Network visibility,** providing the user with complete visibility across IP and optical domains, and over legacy TDM network infrastructure and new dense wavelength division multiplexing (DWDM) devices and circuits

All of these capabilities help operators to deploy new services more quickly and efficiently, and accelerate time-to-revenue of new customer experiences.

Optimizing Revenue

The Cisco Prime architecture provides a powerful platform to help service providers deliver new services more quickly and accurately, with superior quality. By differentiating their offerings from the competition and assuring a higher level of performance, scalability, flexibility, and availability, service providers can more effectively differentiate their services and increase customer loyalty and average revenue per user.

Drawing on a common data model and tools to manage the entire experience lifecycle, the Cisco Prime architecture unlocks the full potential of Cisco hardware and architectural solutions. Providers can use the automated tools and workflows described above to simplify the provisioning of advanced services and reduce errors. Cisco Prime solutions also help operators detect issues, diagnose and rapidly fix root causes, and support the entire event lifecycle. Cisco Prime Performance Manager product collects important service metrics such as bandwidth, latency, and jitter, and proactively notifies operators of pending faults or problematic trends. Together, these capabilities allow service providers to deliver outstanding quality, exceed service-level agreements (SLAs), and better differentiate their offerings.

The Cisco Prime architecture also provides maximum scalability for even the largest Tier-1 providers. Each domain manager and lifecycle management application supports distributed, scalable deployment. Major elements of the solution, such as the service bus and common data model, are also based on components that can be clustered, load-balanced, and scaled as needed - rather than relying on rigid, monolithic systems. The Cisco Prime architecture is also designed to be highly extensible, allowing service providers to readily adapt to changing requirements and modify functionality. Using common design tools, operators can customize workflows, application logic, and device communication algorithms to suit their needs.

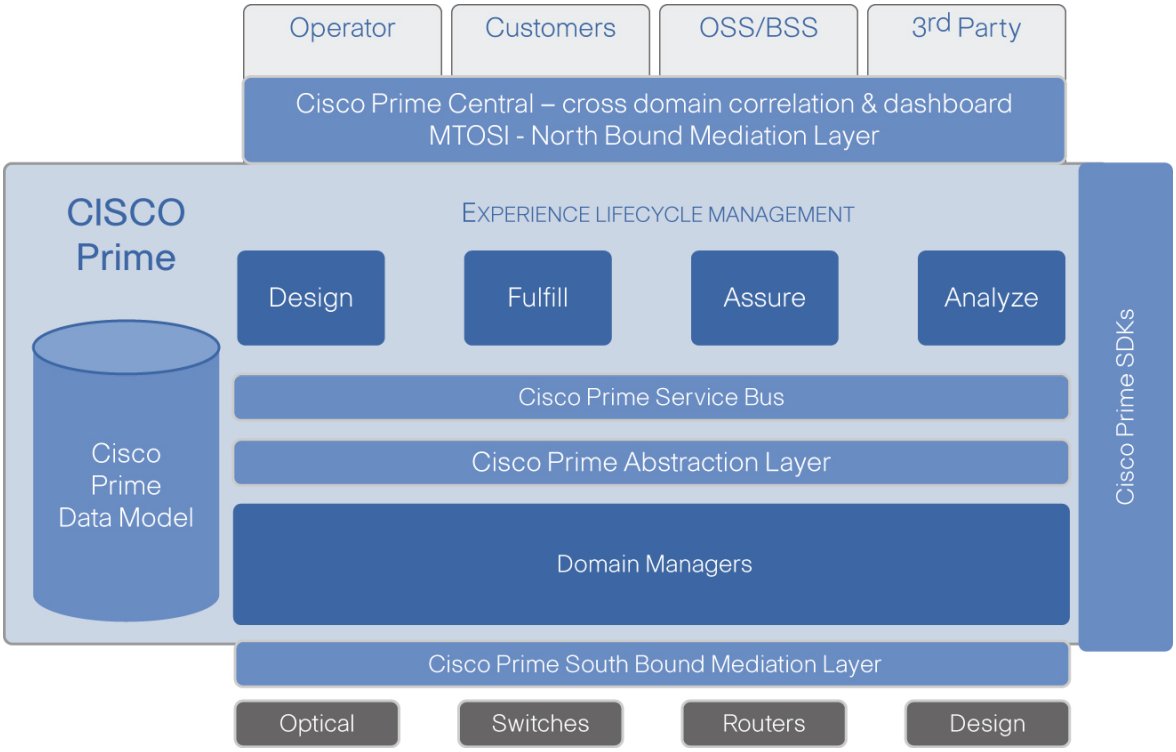
Finally, the Cisco Prime architecture allows service providers to deliver the highly reliable, uninterrupted services their customers expect. Cisco Prime solutions can be deployed to meet even the most demanding high-availability requirements. This includes both localized high-availability failover, as well as options for geographic disaster recovery and offloading.

Together, all of these capabilities enable a more nimble and responsive network environment, superior quality of customer experiences, and the ability to clearly differentiate services in an increasingly competitive field.

Building Blocks of the Cisco Prime Architecture

The Cisco Prime architecture delivers all of the benefits described above through a flexible, end-to-end framework of integrated Cisco Prime suites. Figure 4 provides an overview of these suites and of the Cisco Prime architecture as a whole.

Figure 4. Cisco Prime Architecture Overview



Let's explore each component of the architecture illustrated here in detail.

- **Cisco Prime Data Model.** At the core of the architecture, Cisco Prime provides a common data model across the end-to-end infrastructure under management and the entire experience lifecycle, from service design through provisioning and all aspects of management and optimization. By providing a common set of APIs for every element of the solution - instead of requiring service providers to integrate each element with support, billing, and other existing systems separately - Cisco Prime dramatically simplifies integrations. The Cisco Prime data model is based on the Multi-Technology Operations Systems Interface (MTOSI) 2.0 industry standard from the TeleManagement Forum (TMF) and is populated from Cisco Element (Domain) Managers.
- **Cisco Prime Service Bus.** The service bus coordinates activity among Lifecycle Managers (i.e., among elements controlling design, fulfillment, assurance, and analysis), and between lifecycle and domain managers. It provides a redundant, highly scalable framework with the ability to mediate messages, and embedded Prime Framework Services such as the scheduler, locator service, persistence, etc.

- **Cisco Prime Abstraction Layer.** This component removes the complexity of managing a wide variety of interfaces by abstracting the information into the Cisco Prime Data Model. The abstraction layer mediates information stored in the Cisco Prime Data Model and makes it available to all Cisco Prime Suite components and interfaces, and is also based on MTOSI 2.0 compliant messages.
- **Cisco Domain Managers.** Domain managers (or element managers) provide basic fault, configuration, accounting, performance, security (FCAPS) functionality for each specific technology domain. Examples include the Prime Network domain manager for IP/packet services and Prime Optical for optical transport.
- **Cisco Prime Southbound Mediation Interfaces (SBI).** The Cisco Prime SBI layer provides a common, mediated interface to communicate with any Cisco device. Each domain manager uses this element to abstract the intricacies of device communication via different protocols (i.e., SNMP, CLI, XML, CORBA, etc.) using standard interfaces. The SBI also includes a workflow engine that can be customized with graphical, drag-and-drop design tools. These tools simplify domain management in the field and help service providers customize and extend the network model without having to wait for new Cisco Prime software releases. Additionally, since the SBI is developed in close collaboration with the Cisco hardware business unit, it is designed from the ground up to optimize the interaction between Cisco devices and Cisco Prime.
- **Cisco Prime Northbound Interfaces (NBI).** These interfaces allow for direct access to lifecycle and domain managers by both Cisco Prime Central and third-party products such as OSS systems. They are standards-based and available in a number of formats, web services, and native XML, and can be further customized in the field. The NBI is also designed for maximum security, employing transport encryption and requiring authenticated access.
- **Cisco Prime Software Development Kits (SDK).** These SDKs provide service providers with maximum flexibility to customize the solution and easily integrate it into their environment. They include APIs and documentation for access to domain managers along with lifecycle managers for both northbound and southbound interfaces.
- **Cisco Prime Central.** Cisco Prime Central serves as both an operator and a management portal. It is the component of the Cisco Prime architecture that provides users with a single view of all inventory managed by the various domain managers, simplifying the management and provisioning of services across the end-to-end network infrastructure. It provides a common user experience with integrated operator workflows for each element of the experience lifecycle, single authenticated sign-on (SSO), and user management services with Role-Based Access Control (RBAC). It also provides an optional administrative interface for all products included in the suite that addresses common management tasks.
- **Cisco Prime Lifecycle Managers (Design, Fulfill, Assure, Analyze).** These applications provide end-to-end experience lifecycle management services across all technology domains. The lifecycle managers coordinate with each other through the Cisco Prime Service Bus, and rely on the common Cisco Prime Data Model for shared device and service context. Examples include Prime Fulfillment and Prime Performance Manager.

Conclusion

As consumers and businesses use more network-based applications and services, the demands on the service provider network will only continue to grow. These trends pose significant challenges, but they also offer tremendous opportunity. Service providers that are prepared for the next generation of experience delivery - that are able to meet the demands of a new wave of video applications, connected devices, and cloud-based services - stand to compete and thrive in tomorrow's network services marketplace. By helping service providers to automate service provisioning, converge inefficient functional silos, and deliver superior quality and availability, the Cisco Prime architecture provides a powerful platform to differentiate offerings and deliver more compelling and profitable services.

For more information about the Cisco Prime architecture, visit: http://www.cisco.com/go/prime.

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