Cisco Prime Solutions for Carrier Ethernet 2.0

Accelerate and Monetize New Services with Automated Service Delivery and Assurance

What You Will Learn

The latest generation of Carrier Ethernet provides new capabilities to optimize and manage the performance of Ethernet-based services. For service providers, it means possibilities to expand new markets and to deliver new types and classes of standardized services to align with customers’ changing needs. But the updated standard also potentially adds new layers of complexity in provisioning and managing Carrier Ethernet services. The Cisco Prime™ portfolio of products provides the capabilities you need to simplify the management of more sophisticated Ethernet offerings, accelerate service deployments, and capitalize on the potential of Carrier Ethernet 2.0.

Benefits of Carrier Ethernet 2.0

The original Carrier Ethernet specifications (Carrier Ethernet 1.0), created by the Metro Ethernet Forum (MEF), sought to standardize Ethernet services with the goal of providing a universal, cost-effective access technology. Today, Carrier Ethernet has become the dominant last-mile access medium for enterprise, mobile, and consumer-facing network services. Infonetics Research forecasts that the Carrier Ethernet market will reach $39 billion by 2017 and include more than 95 million ports worldwide.

Carrier Ethernet 1.0 was designed for service delivery over a single provider’s network. A certified service must meet MEF-defined requirements for scalability, reliability, quality of service (QoS), and service management. Now, with Carrier Ethernet 2.0, MEF has added more classes of services, new management capabilities, and the ability to manage Ethernet services over interconnected multiprovider networks. By standardizing metrics for attributes like bandwidth, resiliency, and service multiplexing, Carrier Ethernet 2.0 allows service providers to offer a broader range of services under service-level agreements (SLAs). It also allows customers to compare Ethernet offerings among different providers. Together, these capabilities can empower you to:

- Open up new market opportunities with the ability to expand your service offerings across regions where you do not have a network footprint
- Accelerate service deployments with a better framework to manage and provision Ethernet services end to end, even across multiple network providers
- Respond more effectively to your customers’ needs with the ability to offer standardized service types that meet a broad range of application requirements under SLAs
- Assure uniform service characteristics across multiple transport providers, so you can support more services under SLAs and manage multiprovider networks cost-effectively
Overview of Carrier Ethernet 2.0

Carrier Ethernet 2.0 enables you to define multiple classes of Ethernet services, with each class defining attributes for frame delay, frame delay variation and range, and other metrics. These classes of service (CoS) are in turn organized into various tiers for local, regional, national, and international services. So you have the tools to establish more fine-grained SLAs to support multiple types of applications and meet different customer needs.

The second major innovation in the updated standard is the ability to interconnect managed Ethernet services across multiple service provider networks. Along these lines, Carrier Ethernet 2.0 adds a new service type to existing E-Line, E-LAN, and E-Tree topologies called E-Access. E-Access facilitates a standardized Ethernet service exchange, so providers can buy and sell wholesale Carrier Ethernet services from each other, substantially expanding the market and scope of their offerings. So for example, you could sell a managed global video service to multi-national enterprise customers, and purchase E-Access services from local network operators to extend the service to regions where you do not have your own network footprint.

Finally, Carrier Ethernet 2.0 adds a suite of new fault management and performance monitoring capabilities for Carrier Ethernet services. These capabilities empower you to deliver profitable new services and SLAs, but they also represent a potential source of operational complexity.

In 2013, MEF began certifying end-to-end services and equipment under the expanded Carrier Ethernet 2.0 standard. This certification has quickly become an important business requirement for many enterprise customers, who now demand Carrier Ethernet 2.0 certification for the services and equipment they deploy.

Carrier Ethernet Management Challenges

Modern operators support a broad range of services - voice, video, data - using a variety of multivendor network equipment, systems, and tools. But too many operators rely on separate management systems for their various subscriber access domains. The need to swivel between each “siloed” system adds complexity and increases operational costs. It also impedes your ability to deploy and deliver new services to respond quickly to customer and market changes, ultimately making you less competitive. And this complexity will only grow as you introduce new classes of Carrier Ethernet services and new performance tiers across interconnected transport networks.

Consider deploying a new E-Line or E-LAN service, with its many more variations and QoS and Ethernet operations, administration, and maintenance (OAM) requirements. Having to switch between different systems for each phase of the service lifecycle - much less having to address each device in the network one by one to design or troubleshoot a service - would render these services virtually impossible.

Customers spanning different business cases are imposing stricter requirements on service providers:

- **Mobile backhaul**: Mobile backhaul is the quintessential example of transport with multiprovider characteristics. The services have to be the same - not just from an SLA perspective, but also from the perspective of provisioning and time to market. Carrier Ethernet management to make mobile backhaul services look uniform across multiple transport providers is essential.

- **Business services**: More and more business service providers are requiring Carrier Ethernet 2.0 certification from their vendors because their own end customers are demanding it. In this context, service providers need service assurance that helps meet the SLA and the expected characteristics and performance. Regardless of the provider from which the customer purchases a particular service, the service will have the same look and feel.
● **Wholesale services**: Similar to mobile backhaul, services are provided across multiple infrastructures. Here the same business demands - the need for efficiency and uniform service definitions and characteristics for end customers - are driving the requirements for Carrier Ethernet management.

**Cisco Prime Solutions**

To address the challenges that service providers with traditional management tools are facing, and to meet the new requirements that customers are demanding, Cisco Prime solutions for Carrier Ethernet include [Cisco Prime Carrier Management](#) and [Cisco Prime Fulfillment Multivendor Service Orchestration (MVSO)](#).

Cisco Prime Carrier Management provides a single, powerful interface to simplify and automate the management, provisioning, and assurance of all network services across your environment, including new Carrier Ethernet 2.0 services. It accelerates your ability to monetize Carrier Ethernet 2.0 by automating fulfillment and assurance processes end to end. It provides a workflow and resources framework to unify existing siloed infrastructures to create and support a full range of IP-based applications and services. And, along with Cisco Prime Fulfillment MVSO, it enables cross-domain, multivendor management to facilitate faster deployments of new content-rich, differentiated services that increase revenues.

As the most comprehensive end-to-end network management solution in the industry, Cisco Prime Carrier Management gives you a holistic view of your entire network. So you can understand exactly what is happening - from Ethernet access to the Multiprotocol Label Switching (MPLS) core, from mobile backhaul through the data center - without having to manually piece together information from multiple management tools. With these capabilities, you gain the agility to accelerate deployment timelines from days to minutes, monetize new on-demand service offerings, and assure a superior customer experience.

Cisco Prime Fulfillment MVSO extends these capabilities to multivendor networks. It lets you bring the simplicity and automation of Cisco Prime provisioning tools to networks that include Alcatel-Lucent devices.

**Cisco Prime Carrier Management**

Cisco Prime Carrier Management addresses every aspect of the service lifecycle - from accurate real-time inventory and resource management through service design, provisioning, assurance, and analysis. It integrates those lifecycle components within a single framework, where all elements work in concert and present a single, powerful interface to the user. And it gives you unified visibility across your entire network - from subscriber access to the MPLS or packet core and the data center. It efficiently provisions and assures a wide range of new Carrier Ethernet 2.0 services with their associated quality of service and Ethernet OAM requirements.

**Resource Management**

Accurate inventory is the foundation of service design, provisioning, and assurance. New technologies and services increase the complexity of the network, making effective inventory management even more important. Without a clear understanding of the network, including topology, services, and available resources and bandwidth, you can't activate and fulfill traditional services. To deliver more complex Carrier Ethernet 2.0 services, having accurate and reliable inventory is even more important.

Cisco Prime Carrier Management makes it much easier to design Carrier Ethernet 2.0 services. It automatically discovers all network elements, and imports asset information for all hardware, software, and infrastructure in the network. It goes beyond physical devices to capture your logical inventory - encompassing all device configuration data such as label-switching tables, tunnels, protocols, and so on.
This way, Cisco Prime Carrier Management can model the entire logical topology of the network, identifying the relationship between configurations and physical and logical constructs. And it presents all of this information graphically in the user interface, in a way that even operators who aren’t Cisco IOS® Software or command-line interface (CLI) experts can understand. So you can focus your more expert operational resources on more complex tasks, reduce your overall service design and provisioning costs, and accelerate delivery of new services.

**Cisco Prime Carrier Management Inventory in Action**

Let’s explore how an operator would use Cisco Prime Carrier Management inventory capabilities for a basic Carrier Ethernet 2.0 E-Line service. Figure 1 shows an operator bringing up the logical inventory for a point-to-point pseudowire. The system shows the local interface defined on the device, and presents all the information about the service in a simple, graphical format.

**Figure 1. E-Line Logical Inventory**

Operators can also view all QoS parameters and classes of service reported in the system - an essential capability to support new classes of E-Line services (Figure 2).

**Figure 2. Ethernet Classes of Service**
With the logical inventory, Cisco Prime Carrier Management ascertains the full “device genome”: all Layer 1 through Layer 3 protocol stacks, routing information, and termination points to interfaces used by all devices. And it uses this to create a full logical topology of the network, so the operator can understand the connections and packet flows involved in the planned E-Line service (Figure 3). The operator can now drill down to any device associated with the E-Line service to understand the interconnections and dependencies associated with it.

Figure 3. Logical Topology

This deep modeling of inventory and resource management makes designing the new E-Line service much easier. And it provides the foundation upon which the rest of the E-Line service lifecycle (or any other service lifecycle) is built.

**Simplified Service Provisioning**

Once you have an accurate picture of the resources currently available in the network, you can start designing a new service. Cisco Prime Carrier Management provides workflows and templates for modeling every aspect of the service. It draws on defined resource pools and customizable service policies depending on the service and customer, with the ability to select attributes defined by the user or by the resources available in the network. For example, you could create a service model that allows a user to define some parameters of a service (for example, name, interfaces) while other attributes (pseudowire ID, tunnel ID) are automatically assigned from the resource pool, and still others (for example, protection for a protected pseudowire) are defined by default. Scheduling allows you to define services at one point in the process for deployment at another.

You can provision tiered classes of Carrier Ethernet services (for example, “Gold,” “Silver,” “Bronze”) that are defined and supported “out of the box,” and define customized policies for different users provisioning the service. The system automatically checks configurations against network inventory and topology to assure that device configurations match service intent.

As with inventory management, operators need not have knowledge of the Cisco CLI to provision a service. They can point and click on a graphical map of the network, select the type of service they want to provision from a list of predefined service models, and schedule the service for automatic fulfillment. Together, these capabilities enable you to deploy the full range of IP and Carrier Ethernet services faster, more easily, and at a lower cost.
Cisco Prime Carrier Management Service Provisioning in Action

Let’s walk through the service design and provisioning process for a new E-Line service. Provisioning starts with a service request, in which the user provides all the important parameters to define the new E-Line service. First, the user selects the service type from a list of predefined models for all of the various services that can be provisioned. These models draw on policy and resource pools that the operator has defined (Figure 4).

Figure 4. Creating a Service Request

For the E-Line service, Cisco Prime Carrier Management provides “out of the box” service models that are already defined with attributes for standardized Carrier Ethernet 2.0 E-Line services. A graphical wizard walks the operator through each step of defining appropriate parameters. So the operator can associate the new E-Line service with Ethernet OAM, for example, and define the service entirely through the GUI (Figure 5).

Figure 5. Defining Service Parameters
Figure 6 highlights the catalog of policies included with the E-Line service model that can be applied to the service. These policy associations can be customized depending on the user, so that users with deeper domain knowledge can access more complex policies, while less advanced users choose from more basic policies. Users who do have more advanced networking knowledge can review the configuration of each device associated with the service.

**Figure 6.** Managing Policies Associated with Service Types

Once the new E-Line service is scheduled, Cisco Prime Carrier Management handles all of the resource allocation automatically to deploy the new service. Operators can also use the same dashboard to view all scheduled service requests, and conduct regular configuration audits to check whether the deployed service actually matches the service intent (Figure 7).

**Figure 7.** Scheduling Tasks and Audits
All of these capabilities allow users - even those with more basic networking expertise - to provision E-Line and other Carrier Ethernet 2.0 services faster and with fewer errors.

**Comprehensive Service Assurance and Monitoring**

As the next phase in the service lifecycle, Cisco Prime Carrier Management provides a broad range of essential service assurance capabilities. Drawing once again on inventory and resource management building blocks, the system lets you visualize and troubleshoot services across Layers 1, 2, and 3 of the network to enable essential fault management and alarm capabilities.

These troubleshooting and assurance tools are based on two core capabilities. The first is Cisco Prime Carrier Management’s ability to collect device and service configuration information from across the network, present it in a simplified GUI, and relate it to a specific service. The second is the system’s ability to provide guided troubleshooting, a centralized view of all alarms, and tools to reduce the number of duplicate alarms. Effectively, Cisco Prime Carrier Management makes sure that whatever service assurance or troubleshooting task an operator is performing, all of the relevant information - and only the relevant information - is readily accessible within a single view.

Together, these capabilities make it much easier to view and troubleshoot a service, allowing users to see exactly where a problem is in the path of a service and how the problem is affecting it. Compared to the traditional processes - where users must address each physical device one by one, and map that information to a specific service - it radically reduces operational efforts and mean time to repair.

**Cisco Prime Carrier Management Service Assurance in Action**

Let’s look at some of the tools an operator can use to assure Carrier Ethernet 2.0 services. Figure 8 highlights the E-LAN service visualization. This is a very complex service, and to troubleshoot it, the operator needs to be able to investigate all of the endpoints in the network that touch the service. This would be an enormously arduous task if operators had to go device by device to find information. With its unique modeling capabilities, Cisco Prime Carrier Management can display a single view representing all of the logical relationships between all of the building blocks of the service - even if they reside on different physical devices.

**Figure 8.  E-LAN Service Visualization**
On top of this view, Cisco Prime Carrier Ethernet displays any service alarms related to any endpoint in the visualization. So users can immediately identify issues affecting the service, and quickly drill down to the appropriate endpoint to investigate.

Figures 9 and 10 highlight another useful troubleshooting tool, the service overlay representation. As shown in Figure 9, the user can select any type of service - say an E-Line pseudowire - to be overlaid on the network topology.

**Figure 9.** View Devices and Links That Are Part of a Service

As Figure 10 shows, Cisco Prime Carrier Management displays the members of the service in color, while other endpoints in the network are grayed out. The representation includes alarm status, icons showing working and protected paths, ports in blocking or forwarding state, and other information.

**Figure 10.** Service Overlay
Troubleshooting and Alarm Reduction

Troubleshooting a service typically starts by receiving a notification of a threshold-crossing alarm (TCA) from the main alarm dashboard. Users can set performance triggers that generate alarms when a service’s parameters cross user-defined thresholds. The centralized dashboard presents a simple, easy-to-understand snapshot of all events coming from different sources across the network (Figure 11).

Figure 11. Centralized Alarm Dashboard

Of course, in a complex network, it can be easy for operators to get flooded with alarms from devices across the network. From the perspective of assuring the service - which is why the operator wants event notifications in the first place - many of these alarms are duplicates. Cisco Prime Carrier Management uses two types of alarm reduction capabilities to enable users to quickly identify the root cause of a problem.

The first is based on the system’s deep physical technology and topology modeling. By discovering the resources across different devices and the connections between them, Cisco Prime Carrier Management groups and presents alarms based on domain. It groups related events into single alarms, and uses modeling to reduce duplicate alarms based on the cause of the problem - whether the issue is localized to an individual network element or affecting the larger service topology (Figure 12).

Figure 12. Grouping Alarms Associated with the Same Event
For duplicate alarms that cannot be reduced based on topology modeling, Cisco Prime Carrier Management provides an additional layer of rules-based alarm grouping and reduction. Topology-based and rule-based alarm reduction complement each other, reducing the number of events and alarms that operators must troubleshoot and allowing them to zero in on the effective root cause faster.

**Service Analysis and Reporting**

In addition to extensive service assurance tools, Cisco Prime Carrier Management provides you with extensive analytics capabilities. For performance monitoring, for example, the system provides granular analytics and reporting for all service components, from the infrastructure up to the service itself. This includes predefined real-time reports that are essential to support new Carrier Ethernet 2.0 services, with their expanded classes of service and more service types to monitor.

You can generate performance reports encompassing Ethernet interfaces, flow points, and virtual containers; Layer 2 and MPLS VPNs; class-based QoS; and Ethernet OAM (Figure 13). The degree of insight provided by this level of monitoring improves multiple areas of your business operations, including capacity planning, resource management, troubleshooting, and SLA and service-level management.

**Figure 13.** Multitechnology Performance Monitoring

Cisco Prime Carrier Management reports are both customizable and extensible (Figure 14). Operators can adjust report layout and granularity, and create user-defined views of a service. (For more details, see the white paper on [User-Defined Network Performance Views](#).) The system also supports dynamic loading of new reports, extensions to existing reports, and reports on new devices, including non-Cisco equipment. All of this gives operators the flexibility to generate custom reports to suit their specific business and operational requirements.
Figure 14. Customizable, Extensible QoS and IP SLA Reporting

You can also configure TCAs, for example, if a class of service exceeds capacity or latency in a service gets too high. Thresholds can be set for groups of devices or individual network elements, and categorized into different, customizable alarm areas.

Simplicity and Automation for Carrier Ethernet 2.0 Services
Cisco Prime Carrier Management provides all of these capabilities - inventory, resource management, provisioning, and service assurance - as part of a complete, integrated suite. And it provides simplified workflows and easy-to-use graphical interfaces to address every phase in the lifecycle of Carrier Ethernet 2.0 services. The result is that even less-specialized operators can easily perform all of the essential tasks involved in service design and provisioning, without having extensive knowledge of Cisco or CLI. So you can bring new Carrier Ethernet 2.0 services to market faster, with higher quality and fewer issues, while lowering operational costs.

Cisco Prime Carrier Management also provides comprehensive use cases to address most of the major business cases for new Carrier Ethernet 2.0 services. This includes:

- **Cisco Prime for Mobility**, for highly scalable, cost-effective management of next-generation mobile networks and mobile backhaul services
- **Cisco Prime for Evolved Programmable Networks**, to simplify new business and wholesale Carrier Ethernet 2.0 services

Cisco Prime Fulfillment Multivendor Service Orchestration
Many service providers operate their multivendor networks using network elements from different vendors. Too often, this results in a kind of network management sprawl, where you have to use multiple proprietary management systems, each of which must be integrated with operational support systems and business support systems (OSSs/BSSs). This need to swivel between network management silos to fulfill service requests results in redundant efforts, human errors, and more overall complexity - all of which increases operational costs and slows service deployments.
Cisco Prime Fulfillment MVSO makes it easy to insert Cisco equipment into an Alcatel-Lucent network as it orchestrates and provisions Carrier Ethernet services across your heterogeneous network. So you can take advantage of Cisco Prime Carrier Management capabilities to simplify and monetize new Carrier Ethernet 2.0 service delivery, while preserving your existing Alcatel-Lucent network and management investment. For a detailed discussion of the solution, see the white paper Accelerate and Simplify Service Design, Creation, and Delivery in Cisco and Alcatel-Lucent Networks. The following section focuses on its applications for Carrier Ethernet services.

Streamlining Service Delivery over Cisco and Alcatel-Lucent Networks
Cisco Prime Fulfillment MVSO orchestrates end-to-end Ethernet service delivery across Cisco Prime provisioning tools and the Alcatel-Lucent Service Aware Manager (SAM), and integrates those services with your existing OSS architecture without disrupting existing processes and operations. The solution simplifies service design, creation, and delivery, allowing you to provision Carrier Ethernet services across a multivendor network with a single service request. You can fulfill services using your existing OSS/BSS, or provision them manually using the solution’s intuitive GUI. Drawing on the provisioning mechanisms provided by each vendor’s management system, the solution automates fulfillment end to end without requiring additional effort from administrators.

Cisco Prime Fulfillment MVSO provides predefined and pretested service components for creating and modifying Carrier Ethernet services. You can use reusable technology building blocks and workflows for common services - for example, a preassembled MEF-certified E-Line service over a multivendor network - and tailor them to your unique business rules. It also includes prebuilt adapters for accessing both Cisco devices and Alcatel-Lucent SAM, enabling you to provision new Carrier Ethernet services quickly and consistently.

To zoom in, Cisco Prime Fulfillment MVSO begins by performing network discovery, including the physical equipment and its logical configurations, and converting that information into a vendor-neutral model that depicts existing services. The solution - unlike provisioning systems using offline inventory systems that can quickly become inaccurate - automatically detects any discrepancies, reducing many of the errors commonly associated with multivendor service fulfillment. And it uses a standards-based northbound API to allow you to easily integrate it with your existing order entry and other OSS components.

Using the Cisco Prime Fulfillment MVSO Order Manager GUI, an operator selects the customer and service type (for example, a new E-Line service) from a list of predefined service options, and specifies the endpoints for both Cisco and Alcatel-Lucent devices. Once the order is entered into the system, it creates and fulfills the service automatically, including selecting the appropriate physical and logical path end to end.

Cisco Prime Fulfillment MVSO also streamlines troubleshooting over a multivendor network. For any service deployed, it provides comprehensive information about all physical and logical resources used in the service, in a consistent, vendor-neutral model. By associating the services running and resources consumed over a link with a specific customer, it lets you quickly identify the customers and SLAs affected by an issue.

Together, these capabilities accelerate service fulfillment over multivendor networks, reduce operational costs and complexity, and make it much easier to deploy new revenue-generating Carrier Ethernet services.
Conclusion

Carrier Ethernet 2.0 holds the potential to open new markets, deliver new service types, and generate more revenue from your network and Ethernet investments. But to realize these benefits, you need network management and provisioning tools that can accommodate the more complex performance tiers and network interconnects associated with new Ethernet applications, and provide a holistic view of your network.

Cisco Prime solutions provide the advanced capabilities you need to simplify and automate Ethernet service delivery and assurance end to end. They empower you to:

- **Dramatically reduce mean time to repair**, a key factor in sustaining customer loyalty and improving SLAs
- **Deploy new services faster** with a point-and-click graphical interface to design, fulfill, assure, and analyze services
- **Simplify network provisioning and troubleshooting** by empowering less specialized administrators to perform service lifecycle tasks with an intuitive GUI, instead of CLI
- **Differentiate services in a crowded marketplace** with the ability to easily define and support a broad range of Carrier Ethernet services at multiple performance tiers to meet customer needs
- **Reduce total cost of ownership** by managing the entire network - across all network layers and service domains - through a unified interface
- **Monetize new service types and multiprovider applications** under Carrier Ethernet 2.0

For More Information


Or, contact Cisco by emailing ask-prime-sp@cisco.com.