
Cisco Carrier Ethernet Management

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1 Executive Summary

1.1 Preface

The target audience for this white paper is network management engineers involved in developing solutions for managing service provider Carrier Ethernet networks. It is helpful to have familiarity with how Ethernet works and Ethernet OA&M [1], and products such as Cisco Active Network Abstraction (ANA) and Cisco IP Solution Center (ISC).

1.2 Introduction

The main objectives of this white paper are to:

- Introduce Cisco solutions that are available for managing Carrier Ethernet networks.
- Help readers determine the best solution based on their organization's size, requirements, and budget. To accommodate different needs, two types of solutions are proposed: the "Jump-Start Solution" and the "Complete Solution." More details are provided later in the paper.
- Describe a full lifecycle services approach available through Cisco Advanced Services for service providers.

2 Historical Overview

Currently ISC is used to support Cisco's Metro Ethernet customers. Moving forward with Carrier Ethernet, a new management solution is proposed based on Cisco ANA. This solution will support service providers who wish to deploy Carrier Ethernet services on the Cisco 7600 Series Routers with the new-generation Ethernet Switch 20 gigabits per slot (E20) cards and Ethernet Switch 40 gigabits per slot (E40) cards.

2.1 Business Needs

Many Cisco customers are converting their older access technology to Carrier Ethernet, and need a network management solution to manage the Gigabit Ethernet cards. Especially, there is an immediate need to configure the E20 and E40 Gigabit Ethernet cards in the Cisco 7600 Series Router platform for the aggregation layer. Cisco is proposing a two-part solution for managing the Carrier Ethernet network:

- **Jump-Start Solution:** In this solution, Cisco ANA, using predefined scripts that are tested in Cisco labs, will be used to configure the Carrier Ethernet cards. This solution configures Carrier Ethernet cards for Cisco 7600 Series network elements, and addresses the resource management layer of the fulfillment vertical defined in TMF [2].
- **Complete Solution:** The complete solution covers the service layer and resource management layer of the fulfillment vertical in TMF [2]. This will use partner products for the service management layer, which will in turn use the activation scripts created as part of the Jump-Start Solution.

The Cisco ANA Carrier Ethernet Assurance Manager, which is a plug-in module for Cisco ANA, will provide discovery and monitoring of Carrier Ethernet services. The assurance manager operates independently of the activation component and neither depends on the other to operate.

2.2 Target Market

Residential customers want voice, video, and broadband Internet access, and they are also finding appeal in other services such as video on demand (VoD), pay-per-view, gaming, voice over IP (VoIP), instant messaging, and sending photos over the Internet. Ethernet is central to delivering this wide range of services for two reasons: It is an efficient protocol that works well with other transport and service technologies, and it provides for a very wide range of bandwidth capabilities.

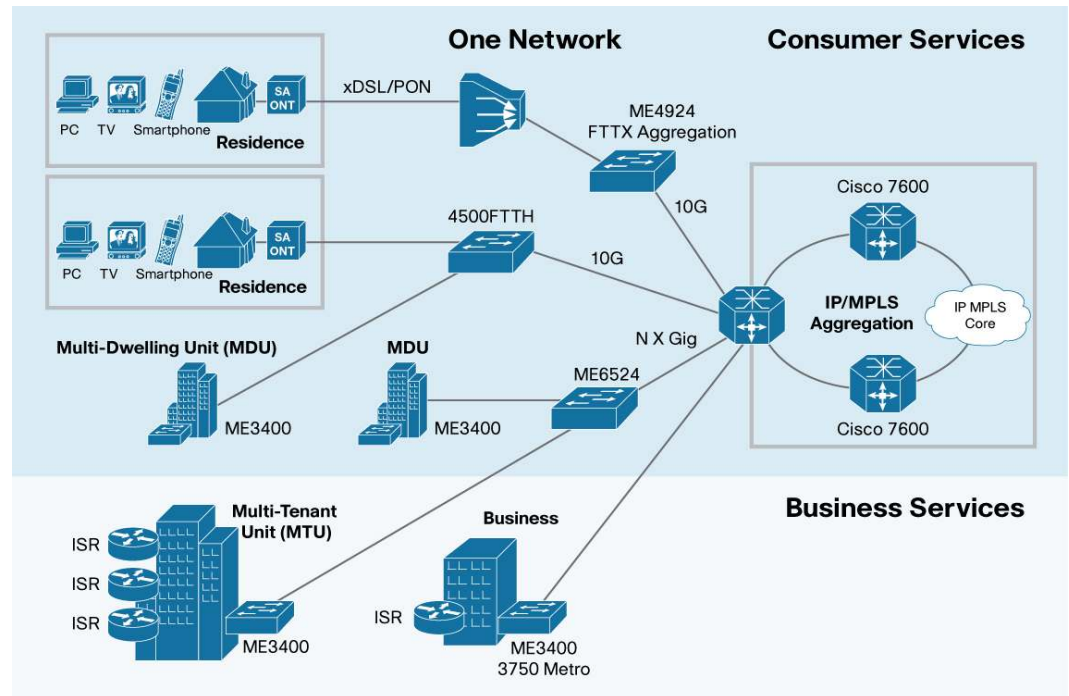
Many service providers are accelerating the conversion from older leased-line data services such as ATM, Frame Relay, and TDM networks to the next-generation Layer 2 and Layer 3 IP VPN. Many service providers consider Carrier Ethernet as the most important competitive edge, and plan to invest heavily in Carrier Ethernet to provide Ethernet connectivity for businesses and residences. The Heavy Reading survey [3] indicates that competition will increase in the next few years and there will be a higher demand for Carrier Ethernet services. The market demand is fueled by the explosion of residential and business broadband services and the need for higher bandwidth.

The Jump-Start Solution will appeal to large Tier 1 service providers because it allows Cisco specific activation scripts to be integrated into their existing provisioning systems. Smaller providers who need a complete solution from Cisco can also benefit from the combined Cisco and partner solution.

3. Solution/Technology

3.1 Carrier Ethernet Network

Figure 1 shows the topology of a converged Carrier Ethernet network. The Cisco design with its Carrier Ethernet transport provides a flexible platform for both consumer and business services. On the consumer side, the example shows xDSL and Fiber-to-the-Home (FTTH) access to single-family residences or multidwelling units. For businesses and business-oriented multitenant units, direct fiber connections to the Cisco ME 3400 Series and Cisco Catalyst® 3750 Metro Series are used. The Cisco Catalyst 4500 Series Switch and Cisco ME 4924 Ethernet Access Switch support the consumer applications for FTTH Ethernet as well as for xDSL and Passive Optical Network (PON) aggregation. The Scientific Atlanta Optical Network Terminal (ONT) provides an in-home termination device for consumer services.

Figure 1. Cisco Design for Carrier Ethernet

The Cisco IP NGN architecture for Carrier Ethernet includes the Cisco 7600 Series Routers, Cisco ME 3400 Series Ethernet Access Switches, Cisco ME 6500 Series Aggregation Switches, Cisco Catalyst 6500 Series Switches, Cisco Catalyst 3750 Metro Series Switches, and Cisco 1841, 2800, and 3800 Series Integrated Services Routers. Optical switches include the Cisco ONS 15310, ONS 15454, and ONS 1531 MA platforms. The following products complement the Carrier Ethernet line:

- The Cisco ME 3400 Series Ethernet Access Switch, which is the key platform for business services over Carrier Ethernet. Built for service providers, these multilayer customer-located switches allow you to deploy Ethernet-to-the-home (ETTH) triple-play services and Ethernet-to-the-business (ETTB) VPN services.
- Cisco Catalyst 4900 Series Switches with the Cisco ME 4924 Ethernet Access Switch with 10-Gbps access aggregation capacity for xDSL or PON deployments.
- The Cisco Catalyst 3750 Metro Series Switches are multilayer switches that bring greater intelligence for Metro Ethernet access, facilitating the delivery of more differentiated Metro Ethernet services. The switches feature bidirectional hierarchical QoS and traffic shaping, intelligent 802.1Q tunneling, VLAN translation, Multiprotocol Label Switching (MPLS), Ethernet over MPLS (EoMPLS), and Hierarchical Virtual Private LAN Service (H-VPLS) support, and redundant AC or DC power.

3.2 Carrier Ethernet OAM Overview

Cisco supports end-to-end operations, administration, and maintenance (OAM) capabilities for Carrier Ethernet. The Cisco Integrated Services Router now has Ethernet interfaces that extend standards-based OAM capabilities all the way to the customer premises. Using OAM that spans the Cisco 7600 Series Router, Cisco ME 3400 Series Ethernet Access Switches, Cisco Catalyst 3750 Metro Series Switches, and Cisco Integrated Services Router, managed services providers can configure, monitor, and test equipment remotely from the network operations center (NOC).

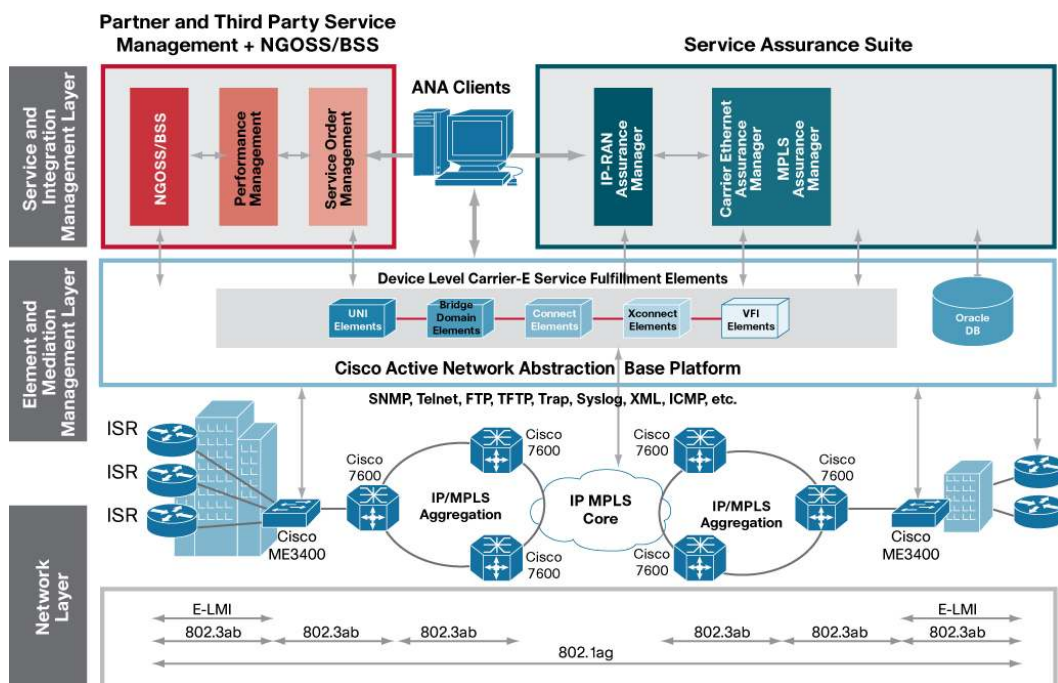
The management protocols include IEEE 802.1ag for service verification, IEEE 802.3ah for link-layer troubleshooting, and the Metro Ethernet Forum (MEF) Ethernet-Local Management Interface (E-LMI) for service status and auto provisioning of customer premises equipment.

Without Ethernet OAM capabilities in a system, the NOC operator is working with very minimal information available to troubleshoot any connectivity problem. The Cisco ANA-based network management system/element management system (NMS/EMS) simplifies OAM monitoring and troubleshooting. When a problem occurs in the transport network, the Carrier Ethernet management system will receive messages from the devices and raise alarms accordingly. Management systems play an important role in configuring OAM functionality consistently across all devices in the network and for automating the monitoring and troubleshooting of network faults. Unlike MPLS OAM where mechanisms such as Label Switch Path (LSP) ping and trace work without any configuration, the mechanisms provided by 802.1ag require configuration before being functional. If you issue an 802.1ag ping or link trace in a network that has not been configured, you will not receive any response.

3.3 Carrier Ethernet Management Solution

Figure 2 shows the end-to-end network management solution for Carrier Ethernet. This solution addresses configuration management for Carrier Ethernet services, discovery of the network, and monitoring of the Carrier Ethernet. The configuration management of Carrier Ethernet services is addressed by the Cisco ANA-based Carrier Ethernet management system activation elements shown in the middle layer of Figure 2. The discovery and monitoring of the Carrier Ethernet is done by the Carrier Ethernet Assurance Manager shown on the top layer of Figure 2.

Figure 2. End-to-End Architectural View of Carrier Ethernet Management Solution



3.3.1 Carrier Ethernet Configuration Management

The configuration management is accomplished by the Cisco ANA-based Carrier Ethernet management system. The intent of the Jump-Start Solution is to develop standard Carrier Ethernet services using ANA command builder scripts. It is generally expected that there will be additional customization required based on the business requirements, and Cisco CA will assist the customers in the customization and implementation of the ANA command builder scripts. These scripts generate Cisco IOS® Software CLI to configure Cisco devices to turn on Carrier Ethernet-based service components, such as E-Line, E-LAN, Local Connect, H-VPLS, etc. The service provider can then provision these service components to activate end-customer-facing services such as Business E-Line, Business E-LAN, Residential Internet Access, etc.

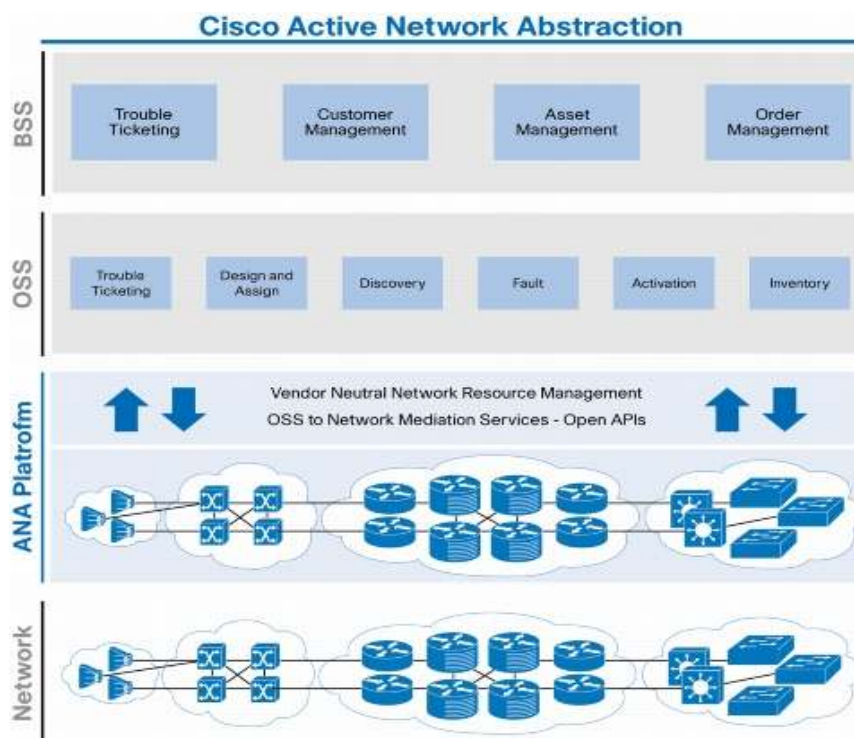
3.3.1.1 Jump-Start Solution

Figure 3 shows the Cisco ANA architecture. The system architecture of the Jump-Start Solution is based upon the Cisco ANA platform.

3.3.1.2 Cisco ANA

Cisco ANA is a resource management platform that serves as an active mediation layer between the operations support system/business support system (OSS/BSS) and network layers. It provides a set of easy-to-use applications and well-defined APIs for OSSs. Cisco ANA enables service providers to efficiently respond to the constant market demand for new, reliable, and more complex services, while hiding the complexity of large, multivendor, mixed technology networks.

Figure 3. Cisco ANA Architecture



Cisco ANA can manage diverse network environments. It offers an integrated process for network modeling, intelligent fault analysis, and a highly flexible network configuration and activation engine. This enables fully correlated management of global networks that need to support millions of subscribers and customers.

Cisco ANA is a network management system that provides a fully integrated, service-oriented offering including:

- Multivendor network element support (physical components that can be managed through an IP address)
- Mixed technologies (IP, Ethernet, and so on)
- Multiple functions (network discovery, fault, activation, and configuration)
- Standards-based northbound interfaces that provide integration with assorted OSS and BSS applications

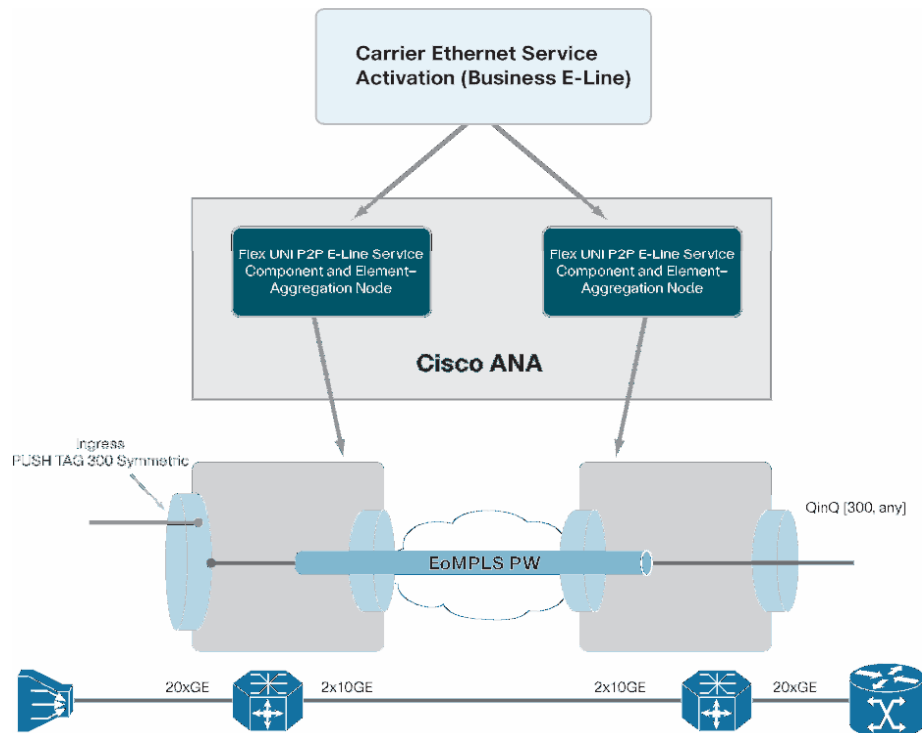
Based on a patented architecture of distributed autonomous virtual network elements (VNEs), Cisco ANA enables integration management for multivendor, multitechnology network environments, while at the same time scaling according to network growth and evolution.

Cisco ANA hides the complexity of large, multivendor, mixed technology networks while allowing you to continually modify your network in response to the constant market demand for new, reliable, and more sophisticated services. The user interface provides a normalized view of network elements and the network, masking differences and nuances of diverse network element types and vendors. This makes it easier to view the status, control the configuration, and manage the state of the network and intranetwork element operations.

3.3.1.3 Carrier Ethernet Service Activation

Figure 4 shows a Carrier Ethernet service activation model. In order to activate customer-facing services such as Business E-Line service, a service provider needs to take the command builder scripts, available as part of the Jump-Start Solution, and deploy those scripts either through Cisco ANA's Network Vision GUI or through Cisco ANA's Web-services-based northbound interface. The network operator/administrator has to select the devices that need to be configured to activate the service, and then deploy the right set of scripts. The process of deploying these scripts can be automated by using a CRM/OSS with a workflow engine that integrates with Cisco ANA through the Cisco ANA ISDK (northbound interface)⁴.

For example, in order to activate Business E-Line service, a service provider would select the aggregation node and deploy the Flex-UNI E-Line service component, and similarly the provider would pick the Flex-UNI E-Line service component on the remote aggregation node and deploy. The service component is nothing but a command builder script. Upon successful deployment, the network is now prepared to carry business E-Line traffic from one site to the other.

Figure 4. Carrier Ethernet Service Activation Model

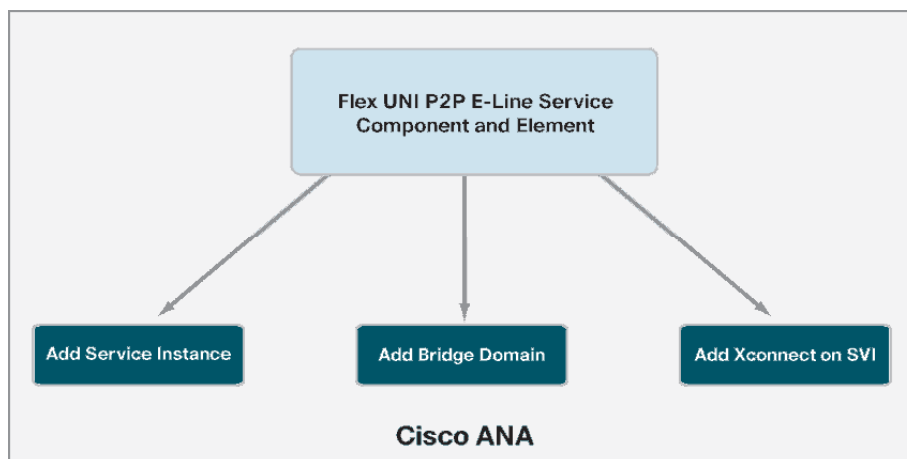
The following service components will be available as part of the Jump-Start Solution:

1. Configure point to point E-Line
2. Remove point to point E-Line
3. Configure point to multipoint E-Line
4. Remove point to multipoint E-Line
5. Configure E-LAN
6. Remove E-LAN
7. Configure Local Connect
8. Remove Local Connect
9. Configure H-VPLS spoke
10. Add Neighbor with no-split horizon
11. Remove H-VPLS spoke
12. Remove neighbor
13. Create Class Map and add to Policy Map
14. Add Policy Map to Service Instance
15. Add Policy Map to interface
16. Modify Policy Map
17. Remove Policy Map from Service Instance
18. Remove Policy Map from interface
19. Configure Standard-UNI-based E-Line
20. Configure standard-UNI-based E-LAN

21. Add allowed VLAN to interface
22. Remove standard-UNI-based E-Line
23. Remove standard-UNI-based E-LAN

Figure 5 shows a service activation scripting model. The scripts are designed to be modular and the service components rely on utility scripts. The purpose of breaking down scripts in such a manner is to allow service providers to create their own service components, in order to deploy Carrier Ethernet services customized to their environments.

Figure 5. Service Activation Scripting Model



The following utility scripts will be available as part of the Jump-Start Solution:

1. Add Service Instance to interface
2. Remove Service Instance on interface
3. Add Bridge Domain
4. Remove Bridge Domain
5. Add xconnect on Service Instance
6. Remove xconnect on Service Instance
7. Add xconnect on VLAN interface
8. Remove xconnect on VLAN interface
9. Add xconnect to VFI
10. Remove xconnect to VFI
11. Create VFI
12. Remove VFI
13. Delete Bridge Domain
14. Add Local Connect
15. Add Switchport access
16. Add Switchport trunk
17. Activate interface
18. Shut down interface

3.3.1.4 Cisco ANA Integration Software Development Kit

The Cisco ANA platform provides an Integration Software Development Kit (ISDK) that allows customers to integrate Cisco ANA into their OSS and BSS. It offers an integrated process for network modeling, intelligent fault analysis, and a highly flexible network configuration and activation engine. More details on the integration are provided in the Cisco ANA ISDK [4].

Service providers deploying the Jump-Start Solution can utilize the Cisco ANA ISDK to integrate their CRM/OSSs with the Jump-Start Solution system.

3.3.2 Carrier Ethernet Service Assurance Management

The Cisco ANA Carrier Ethernet Assurance Manager component of the management solution simplifies OAM monitoring and troubleshooting. When a problem occurs in the transport network, Cisco ANA will receive messages from the devices, correlate alarms, find the root cause, and raise alarms accordingly. Additionally the impact of alarms on services in the network will be calculated and displayed.

With a converged, next-generation IP/MPLS network based on Ethernet technology, which is capable of delivering both business and consumer services, service providers are finding it more and more difficult to effectively assure the availability of services because they are often unable to:

- Maintain an accurate inventory of the physical and logical resources of the entire network that delivers services
- Correctly associate services with logical and physical resources across a multilayer, multiservice network
- Isolate faults in any layer that impacts customer service, in a timely fashion
- Analyze the impact of network resource problems on virtual services with an end-to-end recursive look

3.3.2.1 Carrier Ethernet Service Assurance Value Proposition

Cisco ANA, when used with the optional Assurance Management Solution, enables a high-fidelity, end-to-end network and service model that provides synergy among different layers in the network and is capable of effectively assuring the availability of both consumer and business services by the following means:

- End-to-end service discovery
- Comprehensive, real-time physical and logical inventory
- End-to-end network fault detection and isolation
- Rich customer service impact analysis, taking into account any network-layer faults
- Smooth integration capability with any third-party OSS/BSS applications using industry-standard northbound interfaces

3.3.2.2 Carrier Ethernet Service Discovery

Discovery process:

1. Initiate the service discovery by selecting the desired devices.
2. Assign the appropriate role to each of the devices and submit this as part of the discovery request.
3. The discovery request will be merged with the devices that were selected in previous requests to invoke discovery with a superset.

4. Stitch the discovered UNIs to customer sites through the GUI/northbound interface.

The workflow for Carrier Ethernet discovery consists of four sub-discoveries:

1. Access domain discovery
2. Attachment circuit discovery
3. Network VLAN discovery (relies on access domain discovery)
4. Service UNI discovery (relies on access circuit and network VLAN discovery)

Discovery is supported on an end-to-end basis and the following service attributes based on the MEF model are included:

- EVC attributes
- UNI attributes
- EVC flow point attributes

Business services:

- Ethernet point-to-point (E-Line) services over traditional VLAN-based Metro Ethernet networks as well as new EVC infrastructure
- Ethernet multipoint (E-LAN) services over traditional VLAN-based Metro Ethernet networks as well as new EVC infrastructure

Residential services:

- Internet access
- Broadcast, VoD, and IPTV

3.3.2.3 Bridge Domain/Spanning-Tree-Specific Features

- EVC topology and Spanning Tree Protocol topology visualization
- Spanning Tree Protocol impact analysis per network VLAN
- Support for Per-VLAN Spanning Tree (PVST) and Multiple Spanning Tree Protocol (MSTP)
- Support for DC Flow based on Spanning Tree Protocol port status
- GUI auto-fresh for updates on access domain/network VLAN in Spanning Tree Protocol impact analysis (IA) drawer navigation area
- Topology change notification

3.3.2.4 Supported Device- and Service-Level Fault Analysis

- Includes EVC faults and customer impact analysis
- Provides the basic capability to receive/parse failure conditions from the device/network and will generate alarm/ticket
- Gives the user the ability to view impacted service entities through ticket browser
- User can manually clear the alarm, if needed
- Carrier AM enhances this functionality for Carrier-Ethernet-specific alarms
- Determines which customers, customer sites, VPLS, provider-edge devices, customer-edge devices, and VLANs are affected by each fault
- Updates the alarm/ticket with the calculated affected Carrier Ethernet service entities

- Gives the user the ability to view impacted Layer 2 services and service entities through IA Topology view
- Supported faults:
 - Link down
 - Port/interface down
 - Device unreachable
 - Pseudowire down
 - Card out
 - VPLS instance down

3.3.2.5 E-OAM Specific Features

- Connectivity Fault Management (CFM) is an end-to-end, per-service-instance Ethernet layer OAM protocol
 - End to end => provider edge (PE) to PE or customer edge (CE) to CE
 - Per service instance => per VLAN
 - Proactive connectivity monitoring, fault verification, and fault isolation
- Inventory discovery
 - Bridge-brain MAC address
 - CFM domains and maintenance levels
 - Maintenance endpoints (MEPs) and Maintenance Intermediate Points (MIPs)
 - Service IDs and associated VLAN
- Fault support
 - Processing of continuity check and cross-check traps
 - Correlation of MEP Down alarms to single ticket
 - Correlation of MEP Down alarm to root cause ticket
 - Configuration scripts
- CFM network configuration scripts
- CFM service configuration scripts

Impact analysis

- Carrier Ethernet service impact analysis based on CFM alarm
- Determine impacted customer, customer site, UNI, and EVC based on MEP Down alarm

3.3.2.6 Service Path Trace

Supported traces

- Point-to-point VLAN path trace
- VLAN trace for both S-VLAN (outer tag) and CE-VLAN (inner tags)
- Path trace across EoMPLS
- Path traces across VPLS
- Path traces across combination of Carrier Ethernet technologies including Pseudowire Emulation Edge to Edge (PWE3) and MPLS Traffic Engineering (TE) tunnels
- Multipoint VLAN path trace through broadcast option

3.3.2.7 Northbound Interface

The northbound interface is based on Web services: Web Services Description Language (WSDL), Simple Object Access Protocol (SOAP), and Web Services Distributed Management (WSDM). Send XML over HTTP in a format that is defined in the WSDL file intended for interface to customer OSSs.

4 Acceleration of Carrier Ethernet Success with Cisco Advanced Services

Companies work toward achieving network-related business goals—lowering the total cost of network ownership, improving business agility, speeding access to applications and services, and increasing availability—throughout the lifecycle of the network. Cisco Advanced Services take a unique Lifecycle Services approach, with six distinct phases in its model: prepare, plan, design, implement, operate, and optimize (Figure 6). A lifecycle approach orchestrates the alignment of business and technical requirements at every phase.

Figure 6. Cisco Lifecycle Services Model



4.1 Prepare, Plan, Design, Implement, Operate, and Optimize Services

Prepare Phase

In the prepare phase of the network lifecycle, a company establishes business requirements and a corresponding technology vision. The company develops a technology strategy and identifies the technologies that can best support its growth plans. After the financial and business value of migrating to a particular advanced technology solution has been assessed, the company establishes a high-level, conceptual architecture of the proposed system and validates features and functionality documented in the high-level design through proof-of-concept testing.

Plan Phase

In the plan phase of the network lifecycle, a company assesses its network to determine if the existing system infrastructure, sites, and operational environment are able to support its proposed system. Typically, Current State Architecture (CSA) and Target State Architecture (TSA) are created. A project plan is created to help manage the tasks, risk, problems, responsibilities, critical milestones, and resources required to execute the plan. The project plan aligns with the scope, cost, and resource parameters established in the original business requirements.

Design Phase

During the design phase of the network lifecycle, a company develops a comprehensive detailed design that meets current business and technical requirements and incorporates specifications to support availability, reliability, security, scalability, and performance. Where applicable, customization is done to meet the organization's requirements and to enable integration with the existing network infrastructure. A variety of plans is developed during the design phase to guide activities such as configuring and testing connectivity, deploying and commissioning the proposed system, migrating network services, demonstrating network functionality, and validating network operation.

Implement Phase

In the implement phase, a company works to integrate devices without disrupting the existing network or creating points of vulnerability. The company might stage and test the proposed system before deploying it. After identifying and resolving any system implementation problems, the company installs, configures, and integrates system components and installs, configures, tests, and commissions the operations and network management system. Once network services have been migrated, the company validates that its operational network is working as intended, validates system operations, and works to close gaps in staff skills.

Operate Phase

Network operations represent a large part of a company's IT budget. An organization spends substantial time in this phase, living with the technology in the company's environment. The company manages and resolves problems reported by the network and by the customers to ensure all services are running smoothly and customer satisfaction is maintained through proper service-level agreements (SLAs). Throughout the operate phase, a company maintains the ongoing health of its system, proactively monitoring and managing it to maximize its performance, capacity, availability, reliability, and security.

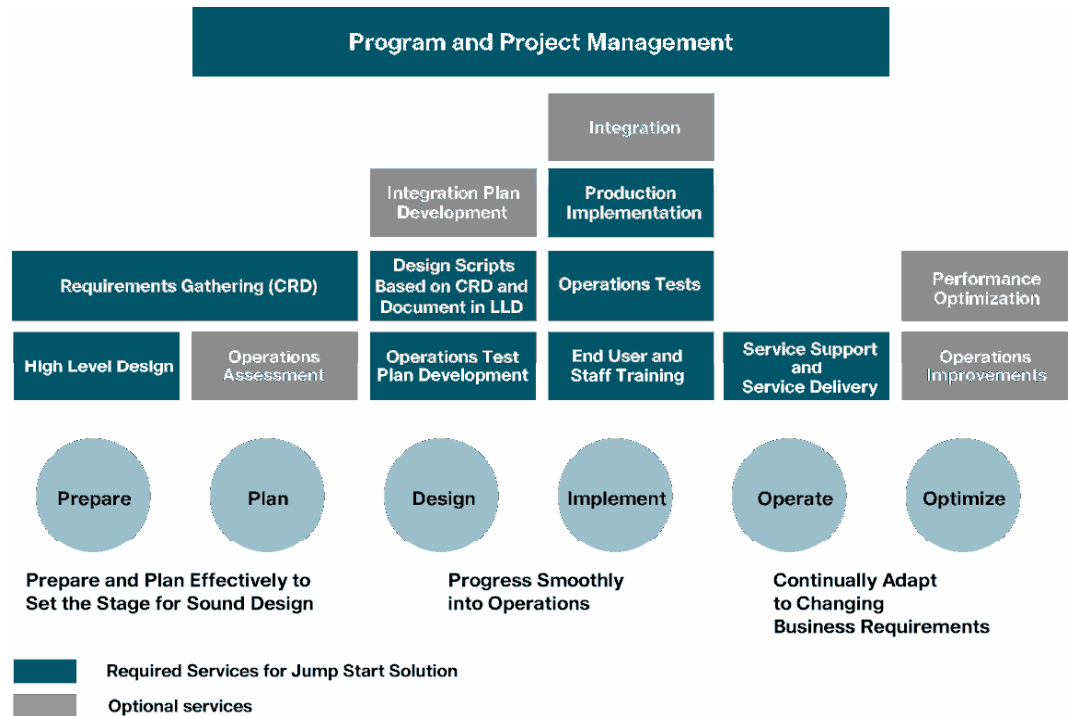
Optimize Phase

The paramount goal of the optimize phase is achievement of operational excellence through ongoing efforts to improve the performance and functionality of the system. A company tries to ensure that its operational system is meeting the objectives and requirements established in the company's business case and works to improve system performance and security. Management practices are enhanced by improving network deployability and operational efficiencies through a network management system that automates, integrates, and simplifies management processes and tools. Business requirements are regularly updated and checked against the network's technology strategy, performance, and operations. The network must be adaptable and prepared to cope with these new or changing requirements. As it is changed to support new business requirements or to enhance performance, the network re-enters the prepare phase of its lifecycle.

4.2 Services Stacks for Carrier Ethernet

Figure 7 shows the Cisco Advanced Services' Service Stacks for Carrier Ethernet services in each lifecycle phase. The following sections describe the services performed during each phase. These services may be performed by Cisco, a Cisco partner, or by the customer.

Figure 7. Service Stacks for Carrier Ethernet Management Solution



4.2.1 Prepare and Plan Phases

In these phases, Cisco Advanced Services works with the customer and prepares the following documents:

- Customer Requirements Document (CRD)
- High-Level Design Document (HLD)

The CRD determines what Carrier Ethernet services are offered and what scripts need to be used or developed. The HLD provides a conceptual architecture based on business and technical requirements and creates the foundation for low-level design. High-level design can help the customer to reduce rework during the design phase by identifying and validating required technologies and features early in the solution lifecycle.

4.2.2 Design Phase

In this phase Cisco Advanced Services does the following:

- Designs the Carrier Ethernet scripts required based on the CRD
- Documents the Carrier Ethernet scripts in a Low-Level Design Document
- Develops a test plan, which will be used during the implementation

The design of the solution (configuration scripts) is based on the network management processes and tools that are defined in the CRD and HLD. This helps improve productivity of operations staff by automating high-demand, repeatable tasks for Carrier Ethernet service and reducing manual provisioning and activation.

4.2.3 Implement Phase

In this phase, Cisco Advanced Services performs the following tasks:

- Implements the Carrier Ethernet scripts on customer systems and equipment
- Performs the tests based on the test plan developed in the design phase
- Provides customer training through transfer of information

4.2.4 Operate Phase

In this phase, Cisco Advanced Services provides post-delivery support. This is explained in more detail in the next section.

4.2.5 Optimize Phase

In this phase, Cisco Advanced Service helps the customer to optimize the systems based on operations improvements such as adding workflow to the provisioning operations, or adding new services based on business needs. In addition, Cisco Advanced Services can review the operations and make recommendations related to improving performance.

4.3 Post-Delivery Support

Post-delivery support, also referred to as Day 2 support, is essential for ensuring that the systems are working properly and the SLAs are maintained. This is included in the Operate and Optimize phases of the Lifecycle Services model. Both of these phases help maintain the systems and solutions in good working order so that they provide an effective environment for the operation of the network. The support provided by the Cisco Technical Assistance Center (TAC) organization for both network equipment and for NMSs such as CiscoWorks is sufficient where single applications are concerned. However, in a solution-based approach, where several Cisco and partner systems are involved, the Lifecycle Services model provides the appropriate support.

The Lifecycle Services model provides 24-hour coverage and is staffed by people who are knowledgeable in the Carrier Ethernet solution and all the associated individual products that make up the solution. The customer contacts the Cisco TAC and calls are routed to a designated team specializing on the Carrier Ethernet Solution. This team will assist in the diagnosis of the issue and root cause determination. Once the root cause is established, the issue is handed to the appropriate support organization for rectification. The rectification of the issue will be performed by one of a number of teams, the Cisco product support team, the TAC Carrier Ethernet specialist team or appropriate other teams involved in supporting Carrier Ethernet.

5 Conclusion

The Carrier Ethernet Management solution enables providers to reliably activate and assure Carrier Ethernet services. The proposed solution builds upon Cisco' Carrier Ethernet portfolio to support both business and residential triple-play services.

For more information about the Cisco Carrier Ethernet solution, please contact your local Cisco account manager.

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