



# **Global Interconnect Implementation Guide**

**Implementing Standardized Ethernet Interconnects for  
Carrier Ethernet Services**

**March 2010**

## Contents

Abstract.....	3
1 Introduction .....	4
2 Carrier Ethernet Services.....	4
2.1 Carrier Ethernet Services.....	4
3 Service Certification – Simplifying Qualification.....	5
4 Standardized Ethernet Interconnects Extend Carrier Ethernet Services.....	6
4.1 Common Considerations.....	6
5 Key Players in Standardized Ethernet Interconnects.....	7
Service Providers and Operators.....	7
Service Provider and Operator Roles: Buyers and Sellers.....	7
6 Implementing Standardized Ethernet Interconnects .....	7
6.1 Standardized Bilateral Connections .....	8
6.2 Connection via a Carrier Ethernet Exchange .....	9
7 Qualification Phase .....	10
7.1 Locating potential partners and the services they provide .....	10
7.2 Meeting general Interconnect specifications.....	11
7.3 Do they meet detailed specifications per service type? .....	11
8 Additional Implementation Considerations .....	11
8.1 Contracting .....	11
8.2 Ordering Carrier Ethernet Services .....	12
8.3 Provisioning Carrier Ethernet Services.....	12
8.4 Billing.....	13
8.5 Assurance.....	14
9 Related Standards .....	14
10 Glossary .....	15
11 Summary .....	15

## **Abstract**

*The goal of this document is to outline the activities needed for Service Providers to implement the interconnection of autonomous Carrier Ethernet networks to enable standardized and streamlined delivery of MEF-certified Carrier Ethernet services with global end-to-end Class of Service, management and protection.*

*Readers are introduced to the various implementation phases of Qualifying, Contracting, Ordering, Provisioning, Billing, and Assuring for Ethernet interconnections. Guidelines are provided to assist parties implementing the Ethernet interconnect at each phase.*

*With the ability to quickly and easily establish interconnections and the services that ride on them, Carrier Ethernet Service Providers realize revenue faster, at the same time as expanding their Ethernet portfolios.*

## 1 Introduction

Since 2001 when the MEF was formed, Carrier Ethernet services and networks have grown from almost zero to annual service revenues of \$17B in 2009.

The next phase in the work of the MEF is to accelerate the deployment of Carrier Ethernet services over multiple Carrier Ethernet networks belonging to more than one operator or service provider. There are a range of elements in this work, including new technical specifications, certification, implementation of the necessary connections as well as business and operational processes.

This document is the MEF's first high level perspective for service providers that are starting to implement standardized Ethernet interconnects to support Carrier Ethernet service. It introduces the prerequisites and phases to be expected in completing interconnect transactions and deploying services through those interconnects. This first overview is not intended to be a step by step manual, as every service provider has their own requirements, however it does address how to qualify interconnect partners. For completeness, brief descriptions of areas out of scope for the MEF (Contracts, Orders, Provisioning, Billing, Assurance) are included.

## 2 Carrier Ethernet Services

The Global Interconnect phase of Carrier Ethernet exists solely to fulfil the promise of worldwide ubiquitous availability of carrier-class Ethernet networks and services. It is therefore worthwhile to provide a brief review of MEF Carrier Ethernet services themselves.

### 2.1 Carrier Ethernet Services

Since the definition, implementation and certification of MEF standardized Carrier Ethernet services, deployment has grown at a very rapid rate. Carrier Ethernet services adoption has been driven by cost savings, simplicity, service differentiation and unlimited flexibility of **E-Line** (Ethernet Private Line and Ethernet Virtual Private Line), **E-LAN** and **E-Tree** services that deliver IP, MPLS and converged data applications to all manner of users independent of physical transport.

The MEF has specified a range of Carrier Ethernet services that fulfill the needs of different markets and applications, and these are summarized in Table 1:

Service Type	Port-Based (All-to-One Bundling)	VLAN-Based (Service Multiplexed)
<b>E-Line</b> (Point-to-Point EVC)	<b>Ethernet Private Line (EPL)</b>	<b>Ethernet Virtual Private Line (EVPL)</b>
<b>E-LAN</b> (multipoint-to-multipoint EVC)	<b>Ethernet Private LAN (EP-LAN)</b>	<b>Ethernet Virtual Private LAN (EVP-LAN)</b>
<b>E-Tree</b> (rooted multipoint EVC)	<b>Ethernet Private Tree (EP-Tree)</b>	<b>Ethernet Virtual Private Tree (EVP-Tree)</b>

Table 1: MEF Carrier Ethernet services

The schematic in Figure 1 shows an example of a Carrier Ethernet service - in this case an EVPL Service.

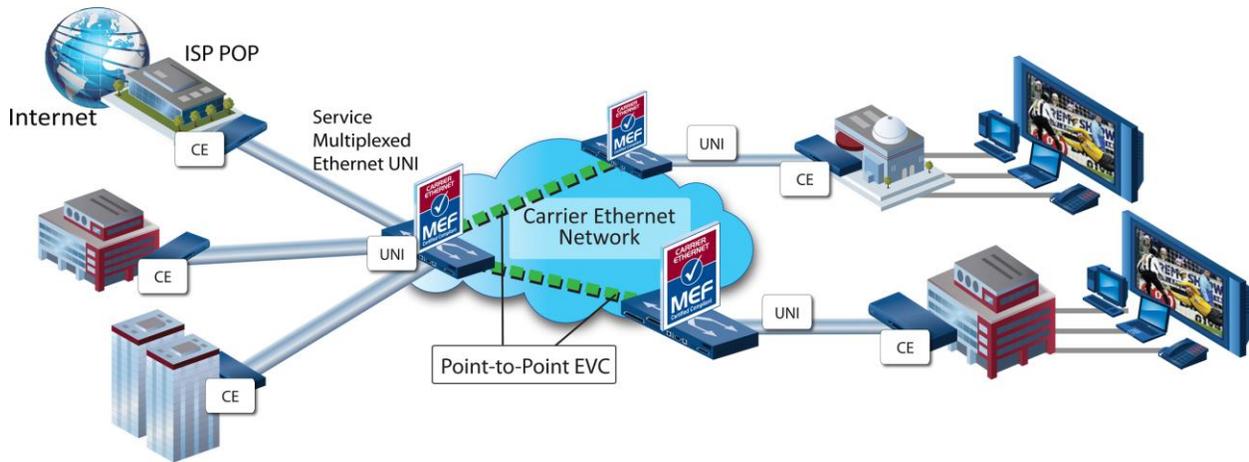


Figure 1: Example EVPL Carrier Ethernet Service

More detailed information on the types and advantages of Carrier Ethernet services can be found at [www.metroethernetforum.org/services](http://www.metroethernetforum.org/services)

### 3 Service Certification – Simplifying Qualification

Having defined Carrier Ethernet services, and supporting specifications, in 2005, the MEF introduced the Certification Program so that both vendors and service providers could have their compliance of their product and service offerings with the relevant MEF specifications validated. This program has brought an internationally accepted standard and trusted baseline for implementation of both Carrier Ethernet services and the products on which they are based.



The MEF certification program remains a key and active element of the MEF's work.

Over one hundred companies and over 700 products and services have now been certified for MEF UNI compliance. Above all, certification brings confidence and significantly reduces time and cost of deployment. The importance of certification to Global Interconnect is that it significantly reduces the due diligence that service providers need to carry out on operator partners in preparation for the implementation of a standardized Ethernet interconnect between them.

More detailed information on MEF Certification can be found at [www.metroethernetforum.org/certification](http://www.metroethernetforum.org/certification)

## 4 Standardized Ethernet Interconnects Extend Carrier Ethernet Services

Driven by its acceptance in the metro and a wide variety of access networks, connectivity has reached out beyond the boundaries of each service provider's domain. However, interconnection, management and business implementation has been done individually and on an ad-hoc basis often on top of legacy implementations. Until now, the extraordinary success of Carrier Ethernet Services has taken place largely on islands of connectivity, within individual service provider networks.

This effort can now be standardized and normalized by implementation of the Global Interconnection specifications that simplify and bring scalable delivery of Carrier Ethernet services across all services providers worldwide. In summary, the MEF Global Interconnect program exists to enable standardized and streamlined delivery of MEF-certified Carrier Ethernet services to scale both locally and globally.

### 4.1 Common Considerations

The successful deployment of standardized Carrier Ethernet interconnects also depends on understanding the following aspects of the Carrier Ethernet networks of the Buyer and the Seller respectively:-

- Support for Carrier Ethernet services
- Link protection to be used on the ENNI
- Class of Service within each Carrier Ethernet network
- Class of Service alignment between the Carrier Ethernet networks
- End-to-end service OAM
- Control protocol handling

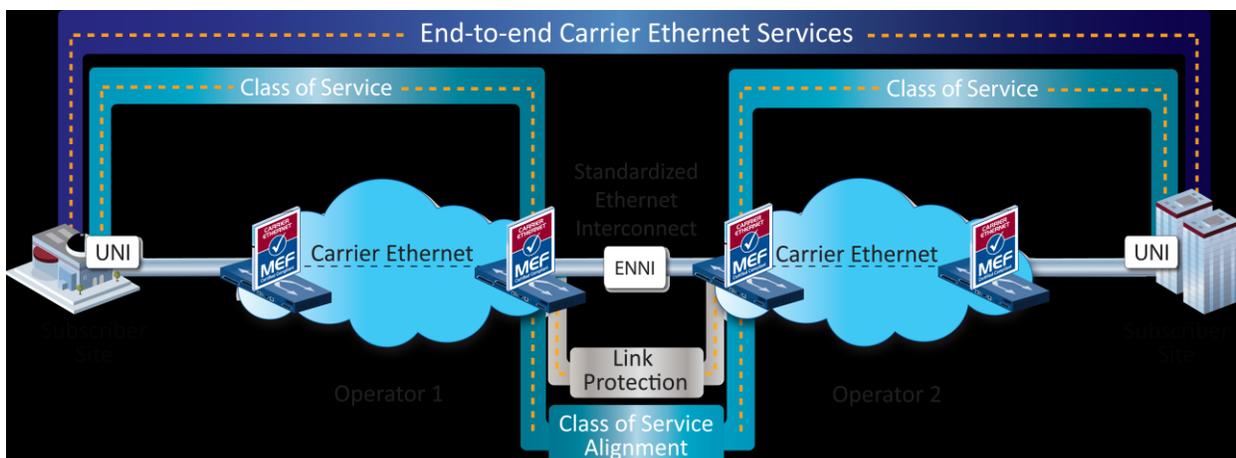


Figure 5: End-to End Service Connection

## 5 Key Players in Standardized Ethernet Interconnects

Two entities are involved in the negotiation and implementation of the standardized Ethernet interconnects of Carrier Ethernet networks. In order to explain the implementation of an interconnect, we refer to those two business entities as Service Providers and Operators.

### Service Providers and Operators

The entity delivering or providing a Carrier Ethernet service to the end customer is referred to as the 'Service Provider'. The Service Provider has the ultimate responsibility in the eyes of the end customer for the quality of the end to end Carrier Ethernet service between sites. The Service Provider also bills the end customer.

Often, the Service Provider does not have all customer sites on its own network, and therefore requires access to Carrier Ethernet networks controlled by other companies. The owners and operators of these additional Carrier Ethernet networks are referred to as 'Operators'. The Operator may either provide the access connection to the customer site or be a transit provider.

### Service Provider and Operator Roles: Buyers and Sellers

When implementing a standardized Ethernet interconnect, the Service Provider may need to buy Ethernet connectivity through another company's Carrier Ethernet network to reach customer sites not on the Service Provider's network. In this case, the Service Provider is referred to as the 'Buyer', and the other company is the 'Seller'. The Seller, who provides a portion of the overall connectivity, is typically an Operator. In some cases, a single company may serve both as a Buyer and a Seller, to their respective vertical markets.

## 6 Implementing Standardized Ethernet Interconnects

When preparing to implement a standardized Ethernet interconnect, the process should be divided into the following phases: Qualify, Contract, Order, Provision, Bill, and Assure.

Each phase has a number of considerations to be discussed between the Buyer and Seller, along with decisions to be made about how to conduct business. In some cases, the MEF Global Interconnect group has created tools to assist the Buyers and Sellers. In other cases, it has been left to each Service Provider or Operator to establish the most suitable practices. Interconnects can involve facilities within a metro, a region, a country, or worldwide.

The simplest arrangement of interconnects is between two providers, but can involve multiple Operators as shown in Figure 2.

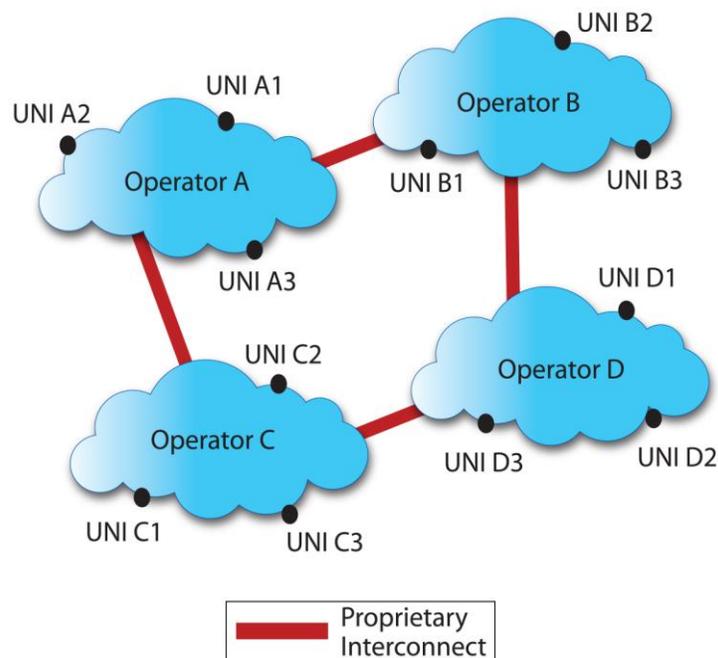


Figure 2: Ad-hoc Interconnects between multiple Operators

Currently operators that need to interconnect their Carrier Ethernet networks, shown as blue clouds in Figure 2, face interconnect challenges. While each Carrier Ethernet network may operate flawlessly by itself, as an operator tries to span other Carrier Ethernet networks, they find that features and functionality are implemented differently to service their end-user customers and to implement differentiated, value-added services. Also, they may be unsure as to which Carrier Ethernet networks are available to reach a specific area. Proprietary and customized features which started out as profitable become complex and unmanageable. Negotiations between Operators to verify each other's Carrier Ethernet functionality and operational capabilities may become cumbersome and awkward, since a potential partnership is balanced against revealing too much network information to a competitor.

The interconnect arrangement between Operator A and Operator B may be entirely different from that which Operator A must negotiate with Operator C.

The MEF has envisaged two types of practical interconnect: bilateral connections at local or remote connection points and Carrier Ethernet Exchanges where many service providers connect. Both are important.

## 6.1 Standardized Bilateral Connections

This is greatly simplified with a standardized Ethernet interconnect, as shown in Figure 3. With such an interconnect, Operator A can streamline their interconnect negotiations and operations, helping to cost effectively scale up deployment of Carrier Ethernet services with Operator B, C, and D. By partnering with other operators as a Buyer, Operator A can provide a wider range of services to their enterprise customers and reach new markets at a lower cost compared to the cost of deploying additional facilities themselves.

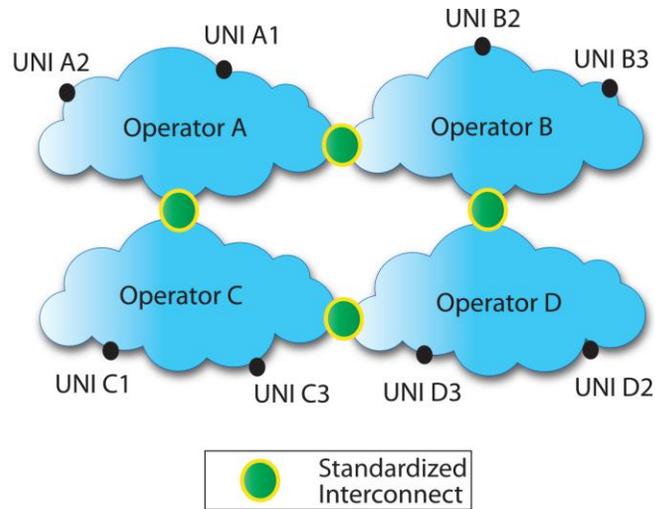
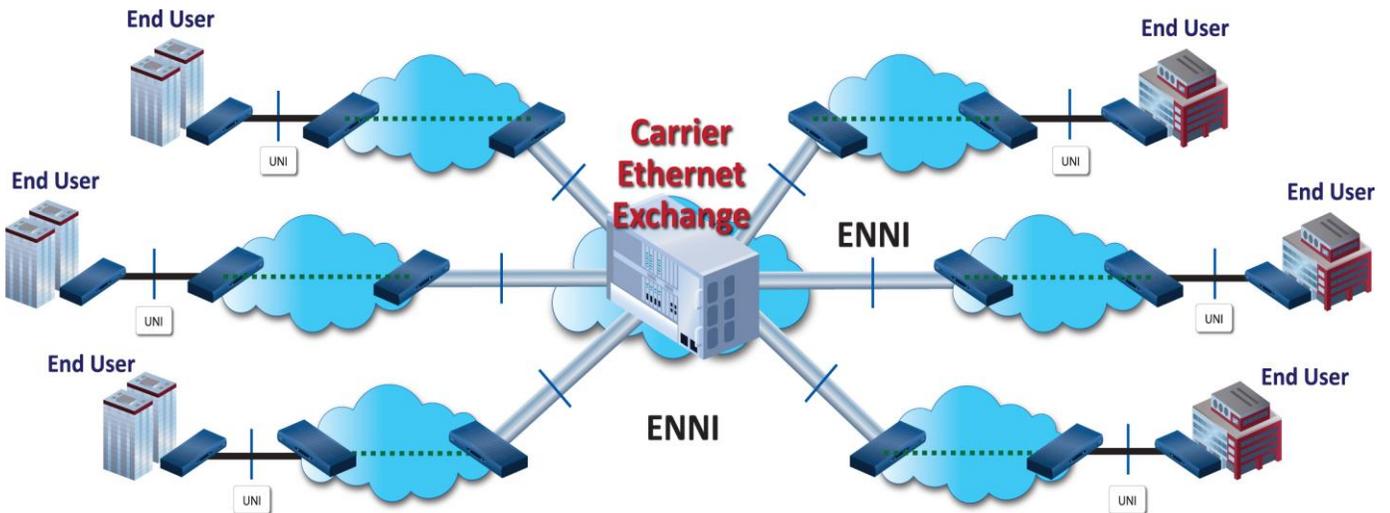


Figure 3: Standardized Ethernet Interconnects

## 6.2 Connection via a Carrier Ethernet Exchange

The introduction of Carrier Ethernet exchanges increases scalability and efficiency. These exchanges implement MEF ENNI to enable Carrier Ethernet interconnection at strategic points and enable multiple virtual connections over a single physical connection. Exchanges present an MEF ENNI interface to connected service providers and act as MEF Operator Virtual Connection (OVC) providers that simplify connections, provisioning and create additional service availability.



Example of 6 service providers buying and selling services via a Carrier Ethernet Exchange

Figure 4: Interconnect via a Carrier Ethernet exchange

## 7 Qualification Phase

There are many Service Providers and Operators around the world, selling various flavors of Ethernet. Some are carrier grade, others are not. Some are MEF certified, others are not. As with any service and technology, there are many details that must be explored before the interconnection is made.

The first thing for a Buyer to do is to determine potential partners (Sellers) and narrow down the list based on specific services, capabilities, and geographic reach.

### 7.1 Locating potential partners and the services they provide

The Global Service Directory, available on the MEF member site<sup>1</sup>, is a starting point for Buyers to view potential Sellers and their self-reported offerings and availability. Keep in mind that you may need to work with several Sellers to achieve the footprint that you are seeking.

When speaking with a potential Seller, be sure that they are geared up to sell their service to a wholesale customer, which the Buyer is considered in this scenario.

The screenshot shows the MEF Global Services Directory website. At the top left is the MEF logo. The header banner reads "ACCELERATING THE ADOPTION OF CARRIER ETHERNET". Below the banner is a search bar and a "Search" button. The main content area is titled "MEF Global Services Directory" and features a world map. To the right of the map is a section titled "About the GSD" which explains the directory's purpose and provides contact information for service providers. Below the map are "Global Summaries" filters, including a dropdown menu for "AboveNet" and radio buttons for "Show all services for selected service provider" and "Show all locations for selected service provider". A "Show Global List" button is also present. A legend of terms used in the GSD is provided at the bottom right.

Figure 6: MEF Global Services Directory

<sup>1</sup> For more information, refer to [www.metroethernetforum/global-interconnect](http://www.metroethernetforum/global-interconnect)

## 7.2 Meeting general Interconnect specifications

Once the list of potential Seller partners is identified, the next step is to develop a greater understanding of the offerings that are available.

This can be done with the Buyer requesting that the Seller complete the **MEF Interconnect Questionnaire**, available on the MEF member site. As explained in the Questionnaire, the initial pass is to arrive at a high level understanding of the Seller's offerings by focusing on the key questions (i.e., not expanding every section on every tab within the spreadsheet). Based on these replies, the potential Seller partner list may be narrowed down to the few Sellers with which to continue into detailed discussions.

## 7.3 Do they meet detailed specifications per service type?

Once the second level of filtering has been completed, the MEF Interconnect Questionnaire can be expanded by section (row) into additional, more detailed technical questions regarding the various aspects of the Seller's offerings. This information may be completed for one or more of the MEF Ethernet service types (e.g., EPL, EVPL), based on the level of interest of the Buyer.

It is anticipated that once a Seller completes the detailed portion of the Questionnaire, meetings will be held between the Buyer and Sellers to review the responses and clarify open questions.

The objective of the Questionnaire is to streamline discussion and the provisioning of documentation that removes misunderstandings that could prevent technical incompatibility between the Buyer and Seller at the time the interconnect is installed and carrying end user customer traffic.

Ultimately, the Seller's solution will be able to support the service definition, features, Service Level Agreements (SLAs), speeds, etc. – that are being offered to the end user customer by the Buyer, once it is part of the end-to-end transport solution.

## 8 Additional Implementation Considerations

*Beyond the Qualification phase, there are five additional implementation phases outlined in the remainder of this section. These phases are out of scope of the MEF's work. However, for the benefit of those new to this topic, we present some high level concepts and considerations that should be taken into account by service providers and operators when implementing Global Interconnect.*

### 8.1 Contracting

After qualification of a partner, the next step in the process of implementing a standardized Ethernet interconnect is to finalize a contract between the Buyer and Seller.

A typical contract will contain these general areas:

- General terms and conditions, including confidentiality, payment terms, dispute resolution and jurisdiction, duration and cause for termination. It should be noted that the question of jurisdiction and location of the ENNI may often be closely interrelated.
- SLA penalties with credits to be provided in the event of under-performance of the service's SLAs. SLAs of the services will also be specified with parameters including MTTR, availability etc.
- Service descriptions with an annex containing the feature/functions of the Buyer/Seller's network.
- Quote to Cash Processes/Responsibilities will often be provided in a high-level annexe covering items such as:
  - Obtaining quotes for services (Buyer requesting quotes from Seller)
  - Submitting orders
  - Implementing orders, including order status, escalation, test and turn-up
  - Submitting trouble tickets, network monitoring, etc.
  - Billing, including invoicing, billing account number capabilities, etc.

## **8.2 Ordering Carrier Ethernet Services**

Once the qualification and contracting phases of the implementation of a standardized Ethernet interconnect are completed, the ordering phase for Carrier Ethernet services can begin.

Ideally, the Service Provider acts as the single point of contact towards the end user customer and is fully responsible for ordering all the elements of the Carrier Ethernet service including customer located equipment - even though several Carrier Ethernet networks may be used to build up a specific circuit for this end-user customer.

Information obtained from each Seller during the qualification phase should be reused as much as possible in order to ease and streamline the ordering process.

It is also recommended to be familiar with the whole of the team involved in the ordering process in each Seller company, as well as what materials they require in order to expedite the ordering process. Examples include: forms required; Purchase Order (PO) number; acceptable order channels such as e-mail, fax, online, etc.

Another factor that should be taken into account when building an ordering process is the potential involvement of interconnect services from carrier hotels and/or data centers, and their respective processes.

## **8.3 Provisioning Carrier Ethernet Services**

Provisioning enables the Buyer to keep track of provisioning activities from one or more Sellers, specifying timeliness for testing and turn-up. From the Seller's side, provisioning enables collaboration with the Buyer on the testing and turn-up. It includes aspects of manual versus automatic provisioning, logical and physical provisioning and equipment installation.

Essential for successful collaboration on provisioning is the identification of the primary contacts on both side of the interconnect for SLA monitoring and accountability purposes.

Provisioning, as with service assurance, is a very major part of the implementation process and is heavily reliant on very extensive legacy and proprietary processes and software in each of the service providers and operators.

## **8.4 Billing**

To allow a strong relationship to develop between service providers and operators, it is important that some thought is given by the those Buyers and Sellers to billing when they agree to set up a Global Interconnect based service. The contract that is drawn up between the partners should allow a clear billing and payments relationship to be set up. Within this document we do not seek to define the details of the commercial relationship, but instead suggest some common approaches which will form the foundations of a strong commercial relationship.

### **8.4.1 Invoicing Periods**

The period that a charge refers to relates to the commercial terms agreed between Buyer and Seller.

It is important to the integrity of the chain of operators that a reasonable approach is taken by operators in the chain to invoicing periods. For example if a Seller only offers yearly in advance and the Buyer's customer will only buy on a monthly in arrears basis, a cash flow issue will be apparent and the commercial position strained.

### **8.4.2 Neutrality**

Operators should consider the principle of sale and purchase under the same terms to drive equality into the relationship with other carriers. However it is recognized that this is somewhat of an ideal.

### **8.4.3 Reporting – Invoice Supporting Material**

A Buyer should reasonably expect an invoice presented by a Seller to be clear and supported by reports and material (such as a circuit inventory) to substantiate the charges reflected by the invoice.

Local legal requirements will drive the structure and tax treatment of the invoice, for example, if VAT is included or not.

#### 8.4.4 Payment

Consideration should be given within the commercial relationship to the currency in which settlement must be made and also to the credit terms offered.

Local laws differ regarding the treatment of late payment penalties and it should be clear within the commercial contract what late payment penalties are in effect and how payment disputes are handled under local laws.

#### 8.5 Assurance

Assurance includes aspects of transparency of a Seller's network to monitoring by the Buyer to ensure a complete picture of the end-to-end connection, trouble tickets, SLAs and integrated OAM mechanisms.

Service assurance, as with service provisioning, is a very major part of the implementation process and is heavily reliant on very extensive legacy and proprietary processes and software in each of the service providers and operators.

### 9 Related Standards

It is recommended that Service Providers and Operators regularly refer to the latest MEF specifications and certifications when developing offerings that will be based on standardized Ethernet interconnects.

Currently, the following are the relevant technical specifications for all aspects of standardized Ethernet interconnects:

- External Network Network Interface Phase I (ENNI) (MEF 26)
- Ethernet Services at the UNI (6.1)
- Traffic Management Phase I (10.1.1)
- UNI Type 2 (MEF 20)
- UNI Type 2 Link OAM (MEF 21)
- Carrier Ethernet Class of Service Implementation Agreement (MEF 23)
- UNI Type 2 E-LMI (MEF 24)

There are other specifications currently being developed. These include:

- ENNI Tunnel Amendment
- Service OAM Performance Management
- Service OAM Fault Management
- EMS-NMS Information Model
- NID Specification
- OVC Service description and level specification

More detailed information on relevant specifications can be found at [www.metroethernetforum.org/global-interconnect](http://www.metroethernetforum.org/global-interconnect).

The updated status of the MEF's specifications work can be found on the Technical Dashboard on the MEF site at [www.metroethernetforum.org/technical\\_dashboard](http://www.metroethernetforum.org/technical_dashboard).

## 10 Glossary

For the convenience of the reader, an updated glossary of terms used in this document can be found online at [www.metroethernetforum.org/glossary](http://www.metroethernetforum.org/glossary).

## 11 Summary

Standardized Ethernet interconnects are essential for the scalable growth of Carrier Ethernet services around the globe. In contrast to ad-hoc or non-standardized interconnects, they enable end to end Carrier Ethernet E-Line and E-LAN services such as EVP, EVPL and EVP-LAN over multiple Carrier Ethernet networks while maintaining Class of Service, management and protection.

To implement standardized Ethernet interconnects, Buyers and Sellers of the interconnects need to ensure that they are ready to deliver MEF certified Carrier Ethernet services, and implement MEF 26-compliant ENNIs. The Buyers and Sellers must then create and maintain all the internal processes required for managing the Qualification, Contracting, Ordering, Provisioning, Billing and Assurance phases of the implementation of a standardized Ethernet interconnect.

The standardization and streamlining of the implementation of interconnects will ensure the continued rapid growth of Carrier Ethernet services to a larger market of end users, and increased revenues for certified Service Providers and Operators of Carrier Ethernet networks and services.

## **Acknowledgements**

The MEF thanks the following member companies for their contribution to this document

Michelle Waggener (Verizon)  
Mark Fishburn (CENX)  
Bill Johnson (Orange Business Services)  
Michael Boehlert (Ancotel)  
Andy McEwan (Virgin Media)  
Charleen Hird (Alcatel-Lucent)  
Phil Tilley (Alcatel-Lucent)  
Fred Ellefson (Adva)  
Mannix O'Connor (Hitachi)

More information and updates on  
Global Interconnect  
can be found at  
[www.metroethernetforum.org](http://www.metroethernetforum.org)