THE IMPORTANCE OF OSS IN PLANNING CLASS OF SERVICE FOR ETHERNET NETWORKS

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CONTENTS

1. THE KEY TO MONETIZING AND DIFFERENTIATING ETHERNET SERVICES

It's one thing keeping your customers happy by providing high-speed connectivity with new technologies like Ethernet, but how do you, as a service provider, guarantee benefit from the investment your business has made? Or, put another way, how exactly can you guarantee and increase revenues, and avoid becoming an ultrafast, but dumb, pipe? One method is to apply Class of Service (CoS) management to Ethernet service, such as mobile backhaul, so this valuable resource can be differentiated, controlled and regulated according to your rules – applying your rules allows you to protect and increase your revenues.

The only way to manage this and differentiate a service over Ethernet is by adopting a closed-loop planning and fulfillment Operational Support System (OSS). The OSS in this case focuses on the CoS within the network at the point when it is designed and built. This white paper describes the components required in the OSS to achieve this.

2. WHY ETHERNET?

2.1 The Market Drivers

Ethernet is the success story of the late 2000s. It is the preferred access strategy of an increasing number of fixed-line and mobile service providers across the globe from existing incumbents to start-up rivals. Worldwide service provider revenue for Ethernet services grew 36% sequentially in 2008 to $16.9 billion, and is forecast to nearly double to $33 billion by 2013 (Source: Infonetics). Service provider investment in Carrier Ethernet continues to defy the economic downturn and outpace overall telecom capital expenditure investments. By 2013 the Carrier Ethernet Equipment market is predicted to reach $34 billion (Source: Infonetics).

There are a number of good reasons for this. Firstly, Ethernet has a lower total cost of ownership, from initial equipment cost to setup, through to management and maintenance. Ethernet switches do not have the complexity of many traditional TDM products. As a consequence, the cost per port of an Ethernet switch is far less than an equivalent TDM port cost. In North America, the monthly cost for 100Mbps Ethernet is about $50 per megabyte, but that monthly cost increases to about $180 per megabyte when using DS3s or SONET.

Secondly, the service offerings from a Carrier Ethernet network allow for services to be defined with specific Class of Service (CoS) requirements based on some commonly accepted measures. This work has been driven by the Metro Ethernet Forum (MEF) and permits an exact Service Level Agreement (SLA) to be defined at the point that the service is delivered. This SLA covers aspects such as the speed and availability of the connection. These SLAs are defined at the customer interface with the network, which is also known as the User to Network Interface (UNI). In order for SLAs to be reliably offered and monitored it is necessary to plan CoS into the underlying network when it is built.

This is great news for the customer. They can order an Ethernet-based service in the knowledge that its performance at the point they experience it is pre-defined by the service provider. It sets their service expectation and forms the basis for a contract between them and the provider. The customer service expectation can thus be set.

3. THE ETHERNET CHALLENGE

But what are the drawbacks of using this technology?

The trouble is that the service that the customer receives at the UNI is impacted by the complete end-to-end circuit from the UNI to the core network. What is more, the customer has a quantitative measure of their performance expectation in their allocated SLA. If their experienced performance falls outside these bounds they may demand compensation. Or worse, they may decide to move to another supplier.

The way to avoid this is to manage the service, their expectations and resource capacity in the end-to-end network so that customer services never reach a point where a defined underlying Class of Service (CoS) is violated.

Service Providers need to assign a different Class of Service to the network for each type of service they offer. For example, applications that require a constant data rate and are ultimately measured by their ability to 'keep up' in real-time, like video and VoIP, are assigned highest priority. Data applications, like email and web browsing, often take lower priority.

4. MANAGING ETHERNET USING OSS

4.1 The Imperative for OSS

Ethernet is used by many service providers to provide different combinations of Ethernet connectivity and enable many new IP services.

Figure 1 and *2* below illustrate some examples of the main architectures that can deliver a service over Ethernet.

They show different IP access connections, each of which could be transported over Ethernet. They range from a simple Ethernet over copper or coax connection through to DSL of the sort seen in many medium- and high-density residential areas, and finally to Fiber, WiMAX and Wireless.

It is not impossible to imagine a service provider having some or all of these types as their physical connectivity for Ethernet services. The key point here is that while the service delivered appears to be the same at the UNI to each consumer, the method for provisioning the access technology differs greatly. Yet the customer expectation must be met equally, regardless of the access technology being used. The Operational Support System must provide critical functionality in order to ensure this is to be done.

FIGURE 1: ALTERNATE TECHNOLOGY COMBINATIONS FOR DELIVERING AN ETHERNET SERVICE

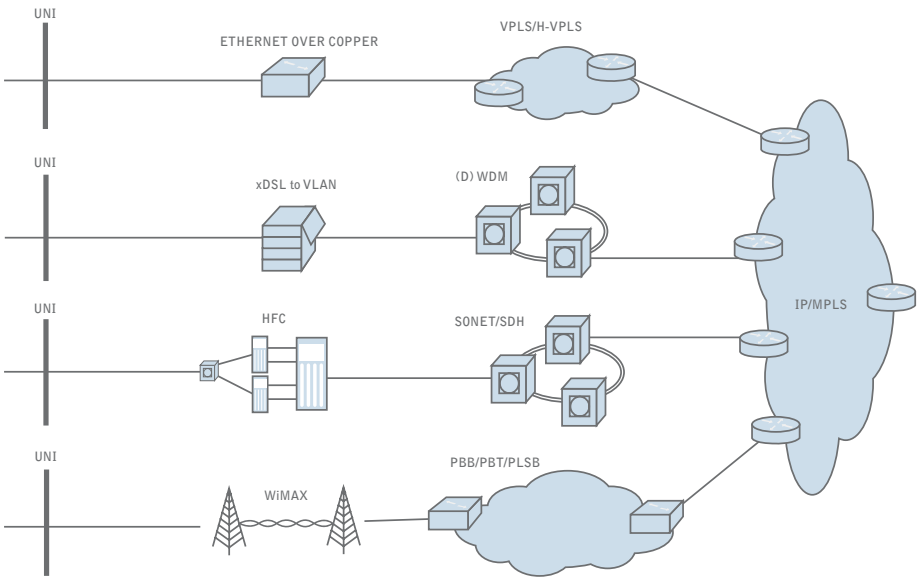
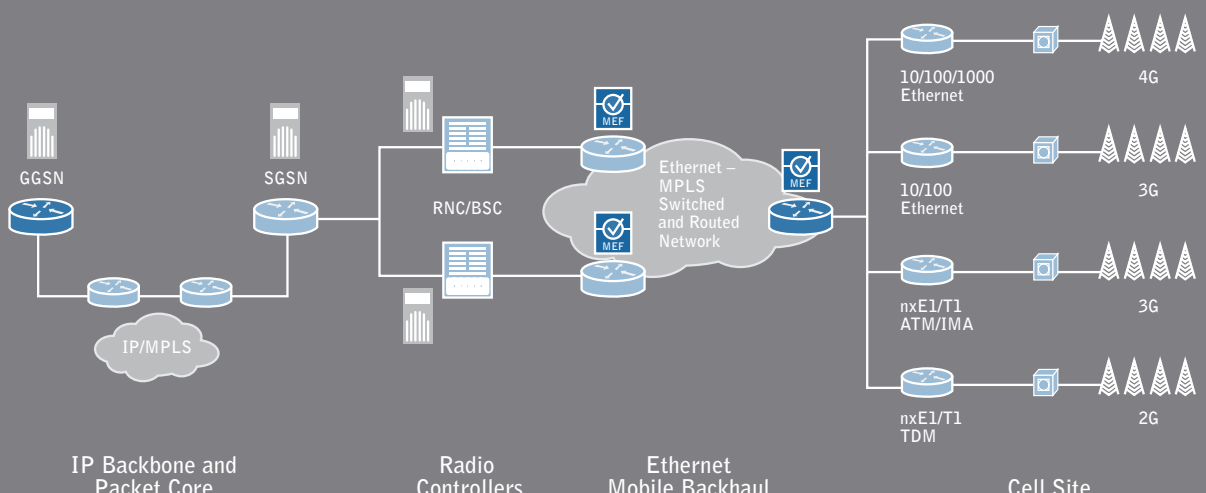


FIGURE 2: ETHERNET SERVICE AS USED IN MOBILE NETWORKS



5. PROVISIONING AND MANAGING CARRIER ETHERNET

5.1 Challenges

Carrier Ethernet presents four key challenges not encountered previously by operators using TDM technologies:

- An inability to 100% assure performance of sites and emulated traditional technologies over Ethernet
- The need to guarantee the same end-to-end quality as seen with traditional TDM
- The necessity to right-size Ethernet backhaul infrastructures as data traffic explodes
- The requirement to manage the complexities associated with Class of Service and MPLS traffic engineering

5. PROVISIONING AND MANAGING CARRIER ETHERNET (CONT.)

5.2 Meeting the Challenges

OSS must deliver the following capabilities in order to meet these challenges:

> Inbuilt Class of Service planning and design capability
> Admission Control
> Holistic approach to plan, build and provision process
> One service design across multiple technologies
> Managing and offering differentiated services
> Right size and plan

5.2.1 Inbuilt Class of Service planning and design capability

When a service is delivered using Carrier Ethernet, there are two important factors that must be taken into account. Firstly, each service must be delivered according to its SLA from the UNI to the network head end. Secondly, the delivery of that service must not cause the SLA of any other service to be violated both in the access and core network. Managing Ethernet services according to these rules requires an OSS solution that has inbuilt Class of Service (CoS) planning and design capability, and the ability to understand the complete end-to-end network.

5.2.2 Admission Control

Carrier Ethernet requires a subtle refocusing of existing strategies to take in a changed grouping of activities and parameters.

Carrier Ethernet introduces a new OSS component in the form of Admission Control. Admission Control in the OSS acts as the control point and arbiter for new (and planned) Ethernet services. It controls the decision as to whether a particular scenario is possible and permitted against pre-defined rules. The OSS also performs the service creation across a single-technology domain and in this mode acts as a multi-vendor aggregation controller. The Admission Control is responsible for maintaining the connection and computation of the network CoS so a specific SLA can be met.

Vendor EMS and NMS generally only provide a single domain view for a single technology, and generally have a restricted view of the end customer services. In order to fully manage the end-to-end customer service(s), an OSS is required to provide functions that span these differing technology domains. The OSS in this case must include the planning and optimization of the network to meet the underlying CoS requirements.

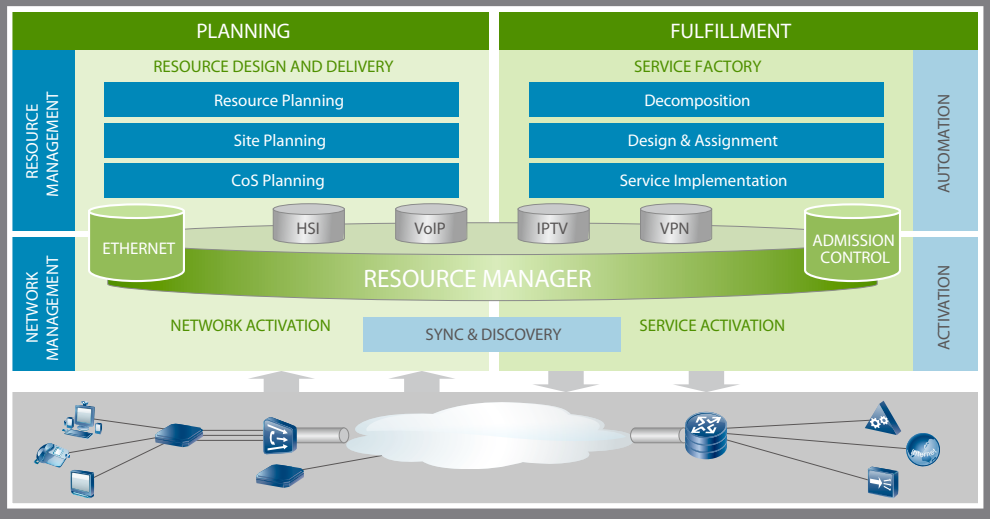
5.2.3 Holistic approach to plan, build and provision process

The ideal and complete OSS solution supports the plan, build, and provisioning process as summarized in *Figure 3*.

In the plan, build and provisioning process of Carrier Ethernet services, the following components are required:

> Service Decomposition
> Resource Management
> Activation
> Synchronization
> CoS Capacity Planning and Trending

FIGURE 3: THE IDEAL PLANNING AND FULFILLMENT SOLUTION



5. PROVISIONING AND MANAGING CARRIER ETHERNET (CONT.)

5.2.3 Holistic approach to plan, build and provision process (cont.)

Service Decomposition
A Service Decomposition or Service Factory function is responsible for processing customer orders and decomposing the order into the constituent legs from the UNI to the service provider access point. This process works in conjunction with the Resource Management function to ensure that the decomposition process takes into account the network technology being used to deliver the service and the available network CoS. It may also want to look into the future and see what network resources are either becoming available or planned.

Resource Management
A Resource Management function performs the design and build for each individual customer service. It does the physical and logical selection and models all the additional parameters for the service, adhering to the designed and available CoS parameters. It then interacts and mediates between the Activation function to turn the design into an active customer service. The Resource Management function is also used independently to plan and build future core network, rollout and expansion as required.

Activation
An Activation function supports the provisioning of the network components. It uses inputs from the previous functions to configure the devices and ports that will support the customer service and should also be able to reinstate initial configuration (rollback) of those devices in the case that there is an error in service provisioning.

Synchronization
A further desirable function is Synchronization – it plays a key role in supporting the Resource Management function by validating the 'as-built' network model. Without an up-to-date model of the network, it is incredibly difficult to accurately design new services. Ensuring the accuracy of that data is vital to cost-efficient operations.

CoS Capacity Planning and Trending
CoS Capacity Planning and Trending are used to maintain the 'service-ready' health of the network, ensuring capacity is available just in time and in the correct locations. Trending monitors the usage in the network as services are added and helps prevent over-utilization and CoS capacity conflicts of the network resources. Optimization is useful as a means of ensuring that the best use is being made of a network. Multiple service additions and removals may leave the allocation of resource in the network in an uneven state. Optimization addresses this by calculating the best way to place all the services across the network. These components form a coherent management capability for service placement and update based on current network knowledge.

5. PROVISIONING AND MANAGING CARRIER ETHERNET (CONT.)

5.2.4 One Service Design Across Multiple Technologies

The OSS must seamlessly work with mixed multi-technology Ethernet service placement. What exactly does this mean? Consider the connection access and aggregation network illustrated in *Figure 4* below.

The customer simply orders a service at the customer location. This will be from a defined set of services offered by the service provider from their product catalog and will correspond to a service model template in the Service Decomposition system. The OSS must now decide whether this requested level of service, including CoS, can be supported.

For instance, as an example, suppose that the order specifies a UNI with a guaranteed maximum data rate and physical diversity to ensure service continuity.

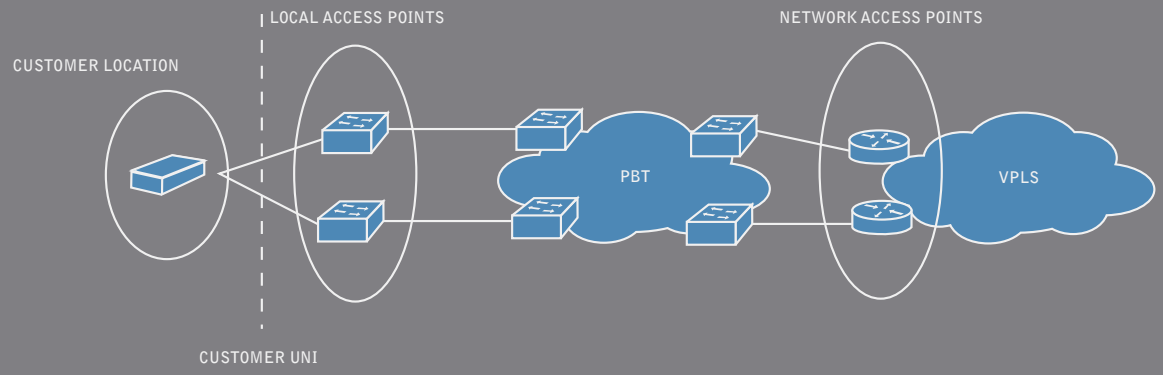
The Resource Management function must locate two physically diverse local access points that the customer service can terminate on. It then has to find two network access points on the edge of the network where the service terminates before entering the core data network. It must then work with the Admission Control to ensure that there are two viable and physically disjoint connections across the data network that can support the requested level of service. Only once this is done, can the creation of the service be scheduled through the Activation function. Note that also during this complete-end-to end fulfillment exercise, and at all decision points, the required CoS criteria must also be met.

Should any aspect of this service not be deliverable in the design phase, the service provider can decide what course of action to take. For instance, they could inform the customer that the service request is not supportable, or implement a 'just-in-time' planning cycle where capacity or transmission parameters are adjusted. Another alternative mitigation process might include determining the services that are supportable at that location and immediately offering a similar higher or lower grade service to the customer.

Delivering the service at the UNI requires an extensive analysis of the aggregate network to deliver the required service to the required CoS. Without an OSS solution even the most basic Ethernet services with a simple SLA and CoS requirement is difficult to place across multi-technology network segments.

By using an OSS with a full end-to-end service view for the above complex scenarios, the service provider is able to manage their network through OSS Admission Control to ensure that new services do not disrupt or invalidate any existing services.

FIGURE 4: EXAMPLE OF CONNECTION ACCESS AND AGGREGATION NETWORK



5. PROVISIONING AND MANAGING CARRIER ETHERNET (CONT.)

5.2.5 Managing and Offering Differentiated Services

It is usual that the Resource Management function maintains a model of the capacity of each link in the network and how it is being consumed in the logical layers that it supports. Maintaining a model of the expected bandwidth usage and CoS of the network means that a service provider can determine whether a new session can be supported across the network. This logic to perform CoS and SLA-based Admission Control is provided by the OSS.

This starts to make more sense when you consider that many service providers separate their Layer 2 provisioning from their Layer 3 provisioning functions, especially for residential customers. Most end customers really do not care how their broadband or Voice over IP (VoIP) connection is being delivered, as long as it works. So the Layer 2 provisioning department will usually create Ethernet trunks over which multiple Layer 3 services may be provisioned. One can think of an Ethernet trunk that has been provisioned with a CoS profile to support 1,000 simultaneous VoIP trunks. It is then up to the Layer 3 department to police the number of VoIP customers they choose to route over that connection. But the OSS system using CoS planning capabilities can share data across physical departmental boundaries and be configured to indicate to other departments when the trunk is reaching certain thresholds. This data sharing is one of the main functions of Admission Control when performed in the OSS.

Ethernet is the bedrock of many new data services offerings; getting the quality right is critical to the revenue-generating services riding on them. And the ability to offer high-value and differentiated connectivity for services such as Video on Demand (VoD), VoIP or IP Television (IPTV) is critical to service providers' future revenues.

5.2.6 Right Size and Plan

Historically in many industries, like manufacturing and retail, it has been demonstrated that being able to right size and plan your supply chain is critical to being successful and profitable. The same transformation is now happening in the telecommunication sector. Failing to plan and operating in silos is no longer an option.

Planning and trending is a mechanism that should be employed at both a physical and logical level, with the objective that provisioning service admission control failures should never arise. Trending helps to predict the expected capacity usage over time based on the actual allocation and currently availability of resources in the network through the 'now and next' models held in the Resource Manager.

Rather than waiting for a static capacity threshold to be reached during service design, a trending engine will give advance warning that new services will no longer be able to be accommodated in a given time frame. It does this by extrapolating the current capacity take-up trends based on real customer order information to produce a timeline for capacity exhaustion. This permits the service provider to determine in advance when a network upgrade is required.

This can be applied either to physical infrastructure such as the number of DSL ports in a cabinet or to the logical CoS capacity usage within a traffic trunk.

6. BENEFITS

Arguably the greatest motivation for implementing the described approach to OSS is to meet the specific challenges associated with provisioning and managing Ethernet services, as described above.

But another major motivation for introducing an OSS approach as described in this white paper is that it directly helps a service provider control Capital Expenditure (CAPEX) on new network equipment. By managing the placement of service across the network, it is possible to control service and placement onto the network according to the available resource on the network. Optimization of the services once placed also permits the best use of the network resources according to a defined best use policy. Further, trending analysis allows the service provider to predict when capital purchases of new devices will be required to support the current service take-up rate. Understanding this permits devices to be purchased in a more controlled manner that best suits the service provider.

Of course, the key benefit of this OSS approach is that it helps to guarantee the customer a defined service level, and this means that service providers can reduce churn arising from poor service delivery. Moreover, the service provider is better equipped to roll out high-value services such as VoD, VoIP and IPTV faster, reducing time to revenue.

Finally, but perhaps most compelling, an OSS system is not restricted to calculating connections that support a simple UNI. The Metro Ethernet Forum (MEF) is progressing with a number of Network to Network Interface (NNI) specifications that will place even greater requirements on the understanding a service provider has on the usage of their network. These NNIs frequently span complex infrastructure from the NNI. The NNIs frequently have much harsher SLAs as they are offered either to other service providers or to corporate customers with exacting needs and strict penalty contracts for SLA violations. As these mature, the need for a suitable OSS that understands network CoS escalates.

7. CONCLUSION

In conclusion, Ethernet services offer significant benefits to the end customer and financial benefits to a service provider. It is possible to specify the expected level of service that a customer will receive over the lifetime of an Ethernet service and the point at which that service will be delivered. This provides an enormous advantage to the end-user, but in order to do this, the service provider must ensure they are able to build a network that is CoS aware.

The only way to ensure this is through the deployment of an OSS solution that defines a CoS model which can then be used to plan, trend and optimize network resources. The OSS provides Admission Control that is driven by CoS parameters and available resource capacity.

If you are thinking of running an Ethernet network and wanting to differentiate Ethernet services, then new challenges must be met. Only an OSS that can address those challenges will enable service providers to reap the full promise of Ethernet.

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