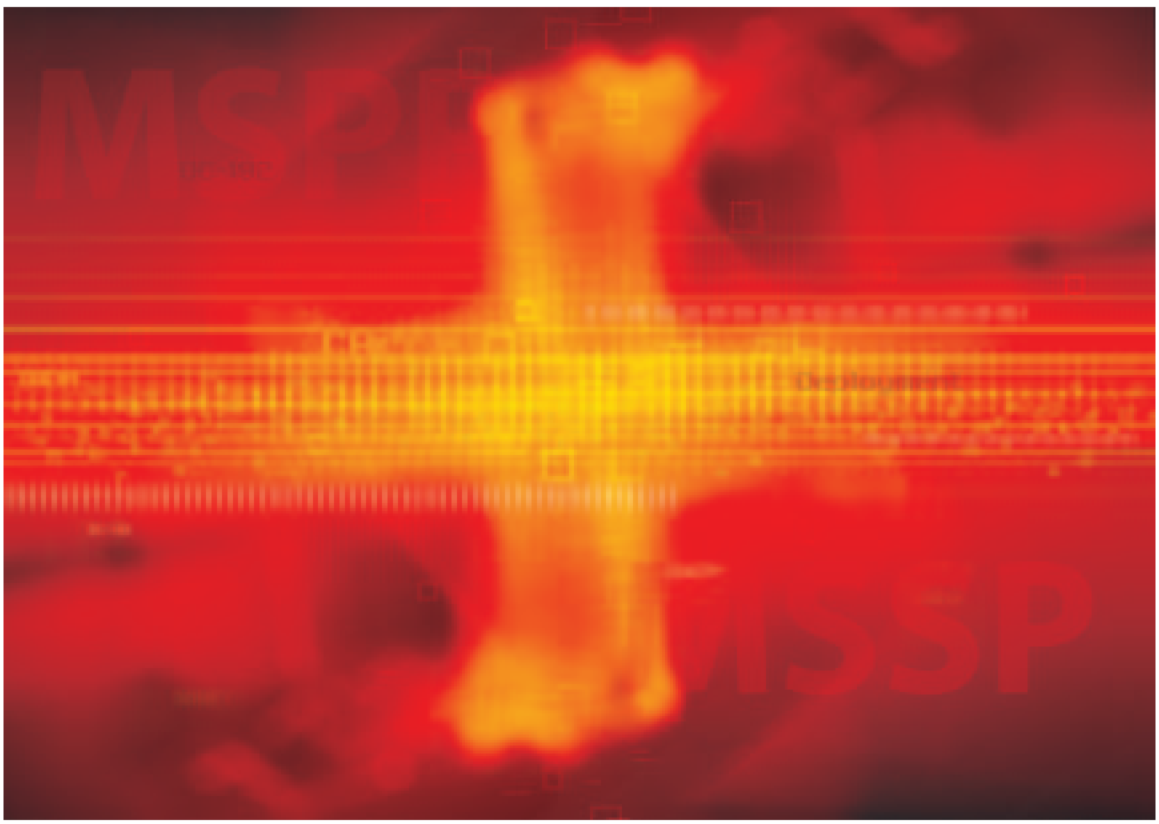
THE POSSIBILITIES ARE INFINITE

MSPP, MSTP and MSSP Network Elements

What's the Difference and Do We Need All of this Terminology?



Introduction

Carriers have successfully deployed legacy SONET NEs in North America for the past 15 years. The market segmentation for these SONET ADM devices was fairly simple and easy to understand: devices were ADMs with the ability to drop a mix of legacy electrical and optical TDM circuits, mainly DSx and OC-n signals. The differentiation among the various platforms from an individual vendor was based on the OC-n rate of the high-speed interface with a specific set of service interfaces.

The emergence of the next-generation SONET market has blurred the situation. We were first faced with the term MSPP. Most individuals interpreted this market segment as a mere acronym for a next-generation SONET NE.

Now, in the spirit of crafting a new market niche, we have seen the emergence of additional market segments: MSTP and MSSP.

The intent of this paper is to first acknowledge these terms by describing them and positioning them against each other. Next, we will revisit the terms' unique characteristic to offer some simplification in this overcrowded market segmentation.

Defining the Market Segments

The MSPP is the oldest of the next-generation SONET NE market segment and supports the following:

- DS1 to OC-192 support
- No fixed high-speed interface; users can deploy this device at any OC-n rate
- Unrestricted STS-1 and VT1.5 switch fabrics for grooming and small DCS applications
- SONET mapping for a wide range of data interfaces such as Ethernet, Fibre Channel and DVB-ASI video
- GFP mapping of data services

The term MSPP has received broad support and was widely adopted by the carriers, the analyst community and equipment vendors. The term is now generally associated with the next-generation SONET market segment, although the actual word SONET is not part of the acronym definition.

The MSTP is really a new twist on the MSPP. MSTP is basically an MSPP plus integrated DWDM capabilities. Typical DWDM additions include transponders, optical amplifiers, passive DWDM couplers and OADM devices to drop selected wavelengths at a site.

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For your convenience, a list of acronyms can be found at the end of this document.

This category raises the following fundamental question: Should DWDM services be incorporated into the MSTP in the first place? This paper will address this question after defining the last market category.

The MSSP acronym is used to represent platforms offering similar services as the MSPP but on a larger scale. The MSPP switch fabric is typically in the sub-100 Gbps capacity while the MSSP resides in the 300 Gbps range as a minimum. The question then becomes: do we need this category in the first place?

To use an analogy with the legacy SONET market, we did not create a new market segment with the emergence of the OC-192 NEs or the larger ADM segment. Therefore, why create a new segment to represent the largest devices? Actual value might exist in having separate market segments, which will be discussed later in this paper.

Does MSPP + DWDM = MSTP Makes Sense?

Carriers have always expressed concern about the same traditional issues: cost, space and power savings. While integrating DWDM directly into the MSTP might initially seem like a good decision based on these three traditional requirements, the reality is often quite the opposite.

The issue involves the slot count of the MSPP. Most MSPPs have an average of 12 slots available for interface units. In most cases, a typical MSPP deployed in a typical location will quickly run out of available slots. At that point, carriers need to obtain denser interface units from suppliers to reduce the consumption rate of the available slot count.

Directly integrating the DWDM functionality into the MSPP is not practical. This integration will only increase the slot consumption within the MSPP.

For example, suppose a carrier deploys a typical MSPP with 12 interface card slots and requires the node to interconnect as an OC-192 device for an interoffice application. The pair of OC-192 units consumes two of the 12 interface slots within the device. Let's suppose that the device requires two types of protected interfaces, OC-48 and DS3, dropping from the OC-192 ring. This process will require another four interface card slots. At that point, the carrier is left with six available interface card slots.

Now, if they require DWDM at the site, a DCM unit along with an amplifier and a passive coupler for a single side of the OC-192 ring is needed. Thus, the integration of the DWDM functionality directly on the device will require another three slots. Although this process is technically possible, it leaves the device with only three available slots and very little room for future growth.

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Interface	MSPP or DWDM	Slots Required	Slots Remaining
OC-192	MSPP	2	10
DS3	MSPP	2	8
OC-48	MSPP	2	6
Passive Coupler	DWDM	1	5
Amplifier	DWDM	1	4
DCM Module	DWDM	1	3

Table 1: Typical MSTP Deployment Requirement Example

Another issue is the STS-1 and VT1.5 switch fabric consumption. MSPP and MSTP devices are centered on large switch fabrics typically dropping 10G of capacity to every interface card. Any DWDM integration into the MSTP will forgo the use of this switch fabric in the slots where the DWDM units are located.

In other words, in the example described above, the user would forgo the use of 30G of useful grooming capacity in the three slots where the amplifier, DCM and passive coupler are located. Considering that the largest cost of an MSTP is the switch fabric, this loss of switch fabric capacity is clearly a waste of the carrier's CAPEX.

These three arguments show that the direct integration of DWDM within the MSTP can lead to negative consequences in terms of cost, space and power:

- Rapid consumption of MSTP slots will push the premature deployment of a second collocated MSTP. The collocation of this second MSTP contributes to eliminate any possible space advantages through the inclusion of DWDM functionality into the MSTP.
- The collocation of a second MSTP will increase power usage. In a way, power is always tracking space consumption in a central office.
- The cost benefits of the MSTP are also negated by the underutilization of the STS-1 and VT1.5 switch fabric for the slots where the DWDM units are located. Again, the single largest cost of the MSTP is the switch fabric and deploying DWDM units in the interface slots lead to an underutilization of this precious resource.

The Better Alternative to the MSTP

A better approach is to leave the SONET transport functionality and the STS-1 and VT1.5 switch fabric usage to the MSPP and deploy DWDM functionality in a separate collocated shelf as an adjunct to the MSPP. However, in order to be effective, the DWDM functionality must focus on the following specific applications and criteria:

- Target the application space as a fiber relief, amplification and DCM compensation shelf providing specialized DWDM services to the MSPP.
- Utilize a small shelf to ensure that the collocation of an MSPP with this specialized DWDM system is physically smaller than two collocated MSTPs.
- Optimize the price around the application space so the addition of the DWDM service shelf does not drastically change the cost equation of the MSPP.
- Integrate the software of the two shelves so the MSPP and the complementary DWDM system can be managed as a single entity.

In summary, leave the MSPP to perform SONET transmission without any loss of interface slots and provide a cost effective small DWDM service shelf with a few slots to complement the MSPP where DWDM is required.

This approach is superior and in the end, leads to better space, cost and power usage when compared to an architecture which attempts to perform everything in a single platform.

What About the MSSP?

The term MSSP has emerged in recent years to denote large MSPP systems, which have switching and grooming capacity of at least 300 Gbps. One noticeable difference is that most MSSPs do not provide granularity down to the DS1 level, and many of them are actually pure optical systems in terms of available interface units.

MSSPs are clearly filling a different market segment when compared to the MSPP. MSSPs represent CO-based systems in large office locations, which are used to groom a large number of access rings and interconnect directly to the various IXC networks interconnecting at that particular site.

A network planner must really understand the differences between the MSPP and MSSP when deciding on a deployment strategy. He must also choose which device should be deployed at every site within the network. Typically, this decision comes down to answering the following question: When faced with a given initial capacity requirement, do I start with an MSPP or do I go directly to an MSSP assuming a rapid capacity growth in that office?

This question might seem relatively simple but in reality it is not. Most often, the initial deployment cost of an MSSP lies in about $100K of initial capital expense for the purchase of the system's management complex. The MSSP requires an extensive management complex, which is proportional to the size of the device, but this management complex comes at a cost.

Considering all the different deployment and capacity growth scenarios, you find that the following possibilities can actually occur:

- Traffic demand is initially low, the carrier deploys an MSPP and the traffic demand remains low, leaving unused MSPP capacity. In this scenario, the network planner made the right deployment decision.
- Traffic demand is initially low, the carrier deploys an MSPP and the traffic demand increases much faster than anticipated, creating a situation where either a second MSPP or an MSSP is required. The network planner made the wrong product deployment decision, and the deployment of an MSSP on day one would have proved more economical.
- Traffic demand is initially moderate but a strong growth is predicted at a given location. The carrier deploys an MSSP and traffic demand meets the forecast demand. In this scenario, the network planner made the right decision.
- Traffic demand is initially moderate but a strong growth is predicted at a given location. The carrier deploys an MSSP but the forecast traffic growth never materializes. The network planner made the wrong decision and it leads to an over investment at that location.

As we can see from these scenarios, a very real possibility exists where the carrier will not have the ability to right size the investment against the forecasted bandwidth demand.

Deciding on a device for small centers such as rural areas in less populated states is relatively simple. Most of these locations will be equipped with an MSPP unless they happen to be at an important IXC connection point, where a large number of IXC rings interconnects.

The decision becomes increasingly difficult when dealing with medium-sized COs. These are smaller centers that do not justify an MSSP today, but they are large high-tech locations where the capacity demand will likely increase, and the use of an MSSP will eventually be justified.

Capacity gambling might become very risky with the potential for serious consequences:

- The MSPP is too small and you require a new CAPEX investment to collocate an MSSP.
  You spend twice the CAPEX for two collocated nodes consuming more power and space than required.
- The MSSP remains too large due to an over-optimistic traffic growth assumption. The carrier spent needless CAPEX for a system that is too large and underutilized.

The second possibility is probably familiar territory for carriers who have dramatically overbuilt their network during the bubble years and are just recovering from unproductive asset inventory within their network infrastructure.

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A Better Approach?

Carriers are carefully looking for solutions to better control their CAPEX. One of the simplest approaches is to properly utilize the dollars invested in the network.

Carriers can deploy solutions that will scale from the size of an MSPP into an MSSP. This process requires that a sub-100 Gbps MSPP can be upgraded in-service into a larger device in the 300 Gbps range, while still retaining all the MSPP feature set. This approach provides the following fundamental advantages:

- Removes most of the uncertainty related to the choice of equipment when deploying a new device. The carrier has the ability to start small and still keep all options open for upgrading to a larger device.
- Allows the carrier to couple the required capital spending to the actual revenue generated by the increase in traffic demand. This tight coupling of revenue and expenses is critical in today's environment.

This solution is possible if the MSPP is initially designed to be upgraded to an MSSP. In most cases, this migration requires the following:

- Multiple STS and VT1.5 switch fabric sizes for the MSPP. In most cases, it includes switch fabrics below 100 Gbps for the MSPP configuration and in the 300 Gbps range for the MSSP configuration.
- Reuse of the same interface cards for every configuration, which is critical to ensure that the MSPP can be upgraded to an MSSP in the same chassis, while providing service to the existing customers. Interface cards with more density can be offered at a premium in the MSSP configuration but the interface cards supported in the MSPP configuration should be supported in the MSSP configuration.
- The MSSP configuration should be upgradable to support more interface card slots when compared to the MSPP configuration. This process normally requires support for a tributary or expansion shelf, which can be collocated with the initial MSPP configuration. This expansion shelf is normally installed when upgrading from the MSPP to the MSSP configuration.

Summary

The North American next-generation SONET market has recently seen some new market segmentation terminology to try to position various products in a unique market niche. The most common ones are MSPP, MSTP and MSSP. This whitepaper differentiates between these various terms , which can be summarized as follows:

- The market surrounding the legitimacy of the MSPP is in general agreement. Most equipment vendors, carriers and analysts are now commonly using this term.
- No strong requirement exists for the MSTP. An MSPP is mostly described with integrated DWDM functionality, and one could also argue that the definition of an MSPP could include integrated DWDM functionality.
- The MSSP category represents a product segment that, due to its size, supports a fundamental difference against the MSPP and value does exist in differentiating the MSSP from the MSPP.

In terms of cost and real-estate use, leaving the DWDM functionality outside of the MSPP and using a small, cost-effective collocated DWDM solution to provide the specialized DWDM services for the MSPP is more advisable. This process leaves all the interface slots and switch fabric capacity of the MSPP available to provide revenue-generating services to the carrier's customers.

On the MSSP, one of the difficulties brought forward by the co-existence of the MSPP and MSSP is the deployment decision between the two platforms: What do you deploy where? The answer might lie in the availability of MSPP solutions, which scale to the size of the MSSP. This approach provides the easiest answer to this question by removing the question altogether.

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Acronym	Descriptor
ADM	Add/Drop Multiplexer
CAPEX	Capital Expenditure
CO	Central Office
DCM	Dispersion Compensation Module
DVB-ASI	Digital Video Broadcast-Asynchronous Serial Interface
DWDM	Dense Wavelength Division Multiplexing
GFP	Generic Framing Procedure
IXC	Interexchange Carrier
MSPP	MultiService Provisioning Platform
MSSP	MultiService Switching Platform
MSTP	Multi-Service Transport Platform
NE	Network Element
OADM	Optical Add/Drop Multiplexer
SONET	Synchronous Optical Network
TDM	Time Division Multiplexing