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Metro Ethernet (Networking Technology)



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Synopsis

The definitive guide to enterprise and carrier metro Ethernet applicationsEasy to read and understand, following the style of the best-selling Internet Routing ArchitecturesUnderstand emerging metro Ethernet services such as point-to-point packet-leased line services and multipoint-to-multipoint VPLSLearn to scale your Ethernet LAN beyond the enterprise wall and across a geographically dispersed virtual private campusUnderstand the drivers and the challenges that carriers face in transforming the metro to address data servicesUnderstand the different metro deployment models using SONET/SDH, next-generation SONET/SDH, Ethernet over SONET/SDH (EOS), virtual concatenation, Generic Framing Protocol (GFP), and Resilient Packet Ring (RPR).Examine the VPLS model and how MPLS can extend an L2 service across the MAN and the WANLearn about the characteristics of a GMPLS architectureMetro networks have emerged as an area of growth for the networking industry and represent a major shift in how data services are offered to businesses and residential customers. This is not only a technology shift but also a shift in the operational and business models that will allow incumbent carriers to transform the metro to offer enhanced data services.Ethernet has been the technology of choice for the enterprise and is now emerging as the access interface of choice for delivering data services in the metro. Emerging metro Ethernet services include packet-leased line services and virtual private LAN service (VPLS). These services are delivered over a wide mix of metro transport technologies such as SONET/SDH, next-generation SONET/SDH, Ethernet/WDM, and Resilient Packet Ring. With the simplicity, flexibility, and cost effectiveness of Ethernet networks comes the challenge of scaling Ethernet Layer 2 (L2) services over metro and WAN deployments. Metro Ethernet looks at the deployment of metro data services from a holistic view. It gives a description of the current metro, which is based on TDM technology, and discusses the drivers and the challenges to be faced in transforming the metro to address data services.Metro Ethernet discusses the mix of transport technologies deployed in the metro and the migration strategies that metro operators will adopt in moving from today’s SONET/SDH network to an all-Ethernet network. You’ll learn about the VPLS model and how you can use MPLS to extend an L2 service across the MAN and the WAN. You’ll explore traffic engineering and how you can use RSVP TE to increase the reliability and availability of the metro service. Finally, you will examine an emerging MPLS technology called Generalized MPLS (GMPLS) and how it is used to facilitate the operation and deployment of metro networks. GMPLS presents a major shift in the operation and configuration of transport networks and will tremendously influence the future deployments of metro and WAN networks.This book is part of the Networking Technology Series from Cisco Press(r), which offers networking professionals valuable information

for constructing efficient networks, understanding new technologies, and building successful careers.

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Customer Reviews

The definitive guide to Enterprise and Carrier Metro Ethernet applications* Discover the latest developments in metro networking, Ethernet, and MPLS services and what they can do for your organization* Learn from the easy-to-read format that enables networking professionals of all levels to understand the concepts* Gain from the experience of industry innovator and best-selling Cisco Press author, Sam Halabi, author of Internet Routing ArchitecturesMetro networks will emerge as the next area of growth for the networking industry and will represent a major shift in how data services are offered to businesses and residential customers. The metro has always been a challenging environment for delivering data services because it has been built to handle the stringent reliability and availability needs for voice. Carriers will have to go through fundamental shifts to equip the metro for next-generation data services demanded by enterprise customers and consumers. This is not only a technology shift, but also a shift in the operational and business model that will allow the incumbent carriers to transform the metro to offer enhanced data services.Metro Ethernet from Cisco Press looks at the deployment of metro data services from a holistic view. It describes the current metro, which is based on TDM technology, and discusses the drivers and challenges carriers will face in transforming the metro to address data services.Metro Ethernet

discusses the adoption of metro Ethernet services and how that has led carriers to the delivery of metro data services. With a changing mix of transport technologies, the book then examines current and emerging trends, and delves into the role of virtual private networks (VPN), virtual private local area networks (VLAN), virtual private LAN services (VPLS), traffic engineering, and MPLS and Generalized MPLS (GMPLS).

Sam Halabi is an industry veteran with more than 18 years of experience in the development, sales, and marketing of data networking equipment and services to the worldwide enterprise and service provider markets. As an executive vice president of marketing and business development, Mr. Halabi was instrumental in leading the development and marketing of emerging business and consumer applications such as enterprise and carrier metro Ethernet services, residential Ethernet, corporate data center applications, content distribution services, and enterprise security. Mr. Halabi held multiple leadership positions at Cisco Systems in the field of network engineering and marketing. While at Cisco, Mr. Halabi wrote the first Cisco Internet routing book, Internet Routing Architectures, a best seller in the U.S. and international markets. Mr. Halabi served on the board of directors of the Optical Internetworking Forum (OIF) and the MPLS Forum. He holds a master’s degree in computer science from San Jose State University.

This an excellent book to get the best knowledge of how Metro Ethernet topology is configured which includes DWDM, ADM, GPLS, MPLS and much more.....great reference and as expected, well written.

Sam Halabi did it again.This is a rare and very informative book on Metro Ethernet developments.It has very clear explanation on all the subjects.I particularly like the VPLS section.One thing tough,the HVPLS section needs to have more coverage on real world scenario.

This book is very very old. out of date

Sam Halabi’s book is described on the cover as "the definitive guide to enterprise and carrier metro Ethernet applications". As you would expect from the author of the justly-celebrated "Internet Routing Architectures", Halabi does a superb job.Chapter 1 reviews traditional TDM ways of getting to the customer. With traditional SDH/SONET-based transmission, carriers pay a high price in operational complexity, cost and provisioning delay. Ethernet’s advantages include fast

provisioning, fine-grained bandwidth granularity (inherent in packet technologies) and a scalability from kbps to Gbps. The customer also expects a lower cost service, although carrier pricing remains volatile, partially from fear of cannibalising their existing connectivity revenues.Chapter 2 looks at metro Ethernet technologies. Carriers with already deployed SONET/SDH networks naturally consider how to use them efficiently to carry Ethernet. The problem of mapping continuously-scalable packet flows into the lumpy SONET/SDH bandwidth hierarchy is well-described. Generic Framing Procedure (GFP) is becoming an increasingly popular adaptation layer between Ethernet (and other packet protocols such as PPP, Fiber Channel, FICON/ESCON) and SDH/SONET, implemented via the evolution of SONET/SDH devices into Multi-Service Provisioning Platforms (MSPPs). The bandwidth mismatches are addressed via Virtual Concatenation (VCAT) and Link Capacity Adjustment Scheme (LCAS).Ethernet-over-SONET/SDH as just described is a pure transport mechanism. To create an Ethernet analogue of add-drop multiplexing and to support traffic aggregation, L2 switching functionality needs to be added to the basic SDH/SONET box. (This is a well-worn path for transmission vendors - the same model was proposed for ATM). Different customers' Ethernet streams need to be identifiable, and carrier VLAN tagging is a possibility, although MPLS provides a more scalable solution, discussed later.In L2 switching in ring topologies, bandwidth fairness and efficient protection switching is difficult to achieve. The new "Resilient Packet Ring" (RPR) MAC protocol was developed to address these issues, and RPR can be run over GFP, and therefore supported in SONET/SDH devices which understand the RPR protocol. Of course, one can dispense with SONET/SDH equipment altogether (especially if you are a new operator and never installed it). Halabi briefly touches on the deployment and management of Gigabit Ethernet switches with direct interconnect.Chapter 3 is devoted to metro Ethernet services. After a brisk tutorial on L2 switching, MAC learning, flooding, broadcast/multicast, VLANs and spanning tree protocol, Halabi gets down to the services. The Metro Ethernet Forum has defined two Ethernet service types: Ethernet Line Service (ELS) and Ethernet LAN service (E-LAN). Point-to-point vs. multipoint-to-multipoint, or transport vs. transport-and-switching if you prefer. ELS issues include traffic and performance management, class-of-service, VLAN support. Additional issues for E-LAN services focus on mechanisms for customer-separation, address-management and scalability.Halabi identifies a number of issues along the way: with the VLAN tag length restricting operators to 4,096 customer-id values, operational services cannot scale; Ethernet does not have the kind of embedded OA&M facilities which allow carrier services such as SONET/SDH to be monitored and provisioned; the spanning tree protocol for loop-prevention does not scale and is inefficient; VPN configuration is hard to

scale.Chapter 4: "hybrid L2 and L3 IP/MPLS networks" unveils the solution. In a nutshell it is to adapt Ethernet to MPLS at the network edge, and use the power of BGP/MPLS VPN technology to scale the service. Halabi starts by reviewing standard L3 VPNs, both IP tunnels (GRE, not IPsec) and BGP/MPLS rfc 2547.He then notes that Ethernet can be carried over MPLS via the IETF Pseudowire standard - this is fine for Ethernet Line Services. An E-LAN service such as Virtual Private LAN Service requires more work from the CE/PE devices, however. Specifically, the CEs think they are talking to an Ethernet switch on their link to the PE. The PE needs the additional functionality of a VLAN switch, and maps a specific MPLS label to each VLAN on a per-customer basis. This "broadcast domain" identification inner label is then augmented by an outer traffic-engineering label to forward traffic to the correct destination PE across the Service Provider network. Halabi describes in detail the mechanisms, which are similar to rfc 2547 VPNs at L3.In practice there are still scaling issues, and the concept of "Decoupled Transparent LAN Service" is introduced. This creates an additional customer-premises PE which specialises in L2 MAC address management and customer segmentation, while the network POP PE can specialise in L3 MPLS tunnel and connectivity management. Given the detailed technical treatment, this is one of the harder chapters in the book. However, this is the last chapter actually devoted to Ethernet.With Chapter 5, we enter part II of the book, which is more focused on traffic engineering and GMPLS. This chapter is a fast review of MPLS for traffic engineering of IP networks. Chapter 6 extends this discussion to cover the details of RSVP-TE for LSP establishment, specifically for fast-reroute. In Chapter 7 and the final Chapter 8, we see how MPLS (specifically GMPLS) can be used as a generalised control plane for virtual circuit management in the SONET/SDH and the optical layers.The Internet is awash with white papers on all aspects of metro Ethernet. This book was published, by Cisco Press, in September 2003 so it’s hot off the press. But sections still appear to be slightly dated in what is an incredibly fast-moving area.Why buy it? Because Halabi knows what he’s talking about, and gets down into the detail of how everything works with great intellectual clarity. Although it can be hard to see the wood from the trees in this book, it is the ideal "in one place" reference for both services and technologies for carrier Ethernet. I consider chapters 5-8 as an MPLS bonus, as they actually have nothing specifically to do with carrier Ethernet.

I recently read the book titled "Metro Ethernet", authored by the legendary Sam Halabi. ISBN: 158705096X. Let me be the first to say that this title lives up to Mr. Halabi’s high standards for delivering top quality information. Sam Halabi does an excellent job of taking away the smoke and mirrors of the often misunderstood world of Metro Ethernet. This book explains, in superb detail,

every way to skin the Metro Ethernet cat. The author does it in a way that helps to give the reader a complete understanding of a particular application of Metro Ethernet without dropping the reader off the deep-end of this hybrid technology. The book is organized very well. The author has taken a crawl, walk, run approach to the layout of this book. The introduction alone gives the reader a great road map of the book, so the reader can pinpoint a given topic, rather quickly. In the past I've had to rely heavily on the Index to provide pointers to a given topic, but the Introduction of this book is a great reference. Along with the Authors previous book, "Internet Routing", the author waste little ink. Each topic is clear, concise and to the point. He's taken a lot of information from several sources and compiled the information in an easy to understand text. The illustrations help out a lot with capturing the complexity of the many different Metro Ethernet Architectures. One thing I liked about the book is that the Author gives the reader insight or background as to why a certain application of Metro Ethernet was designed and where it is likely to be applied. This book is best suited for Telco carrier personnel or Enterprise personnel at any level. Companies that are looking for different strategies for their Metro Area Networking requirements will find this title very useful. For Enterprise Customers, this book is a great place to start prior to calling in a consultant or discussing services offered by a service provider. Consultants will likely find this title very valuable to understand the complexities and furthermore gain the ability to transform the complex lingo into something palatable for a non-technical audience/customer. Telco support personnel would benefit a great deal by understanding what their existing offers are or perhaps alternatives to their current offerings. The book is well rounded for a large target audience. A general understanding of the technologies discussed in this book is not really necessary, because the characteristics of the technologies discussed in the book are not implemented in the traditional sense. It does help to have an understanding of the technologies to be able to contrast the difference in the applications of Metro Ethernet. There is a great deal of information that covers the use of MPLS in conjunction with Metro Ethernet. The sections covering MPLS get a little more technical and may lose some individuals that are not technically savvy, however the concepts are clearly stated. There is another title that covers information about Metro Ethernet technology offered by Cisco Press titled "Cisco Self-Study: Building Cisco Metro Optical Networks (METRO)" by Dave Warren, Dennis Hartmann. Since Metro Ethernet is one of many technologies covered in this title, it doesn't have as much to offer on the subject of Metro Ethernet as the title "Metro Ethernet" by Sam Halabi. The chapters in the title "Cisco Self-Study: Building Cisco Metro Optical Networks (METRO)" covering Metro Ethernet, focuses more on implementation details and the configuration of Metro Ethernet in Cisco equipment. If your looking for detailed information about Metro Ethernet, I would recommend the book "Metro

Ethernet" by Sam Halabi. This is one reader that is thankful Sam Halabi chose to write another book.

This is a fantastic overview if this is your first contact with the metro ethernet. However, it may be not enough for techies willing to find an in depth description of the protocols involved. Moreover, it forgets some outstanding proposals in Layer 2 point-to-point transport over MPLS networks, like the ones from Kireeti Kompella, even though it comprises Kompella's BGP approach to VPLS. In a nutshell, if you don't know almost anything about metro ethernet, this is a 'must have' book.

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