

Technology Brief

Provider Backbone Transport

Achieving true carrier-grade Ethernet

Introduction

For years now, Ethernet has been the dominant networking protocol in the Local Area Network (LAN). It's simple to use, extremely cost effective and offers plenty of bandwidth.

But within Metro Area Networks (MANs), Ethernet is just not quite delivering on the same promise. Yes, it has all the potential, but delivering switched Ethernet services in the MAN – particularly to deliver the collaborative, multimedia functionality that enterprises now demand, along with the required Quality of Service (QoS) – has not been possible until now.

That's because, originally, Ethernet was not designed for use in the MAN where reliability, manageability and scalability are much harder to control.

Flooding and learning

To understand why this is the case, we need to take a closer look at how Ethernet works. The primary function of an Ethernet switch is to forward data to its intended destination in the network – a simple enough task when the switch knows where a given address resides in the network. But when a switch receives data destined for an unknown destination, its only option is

to copy the data to all of its outgoing ports. This process is known as 'flooding'. Eventually, the intended destination will be reached via one of the ports, and a reply will be returned. This reply is used by each switch to note which specific port corresponds to the destination. This is the 'learning' process.

This approach works fine in small networks, but as networks get bigger and more complex – in the MAN, for instance – the flooding and learning processes generate considerable network congestion and can create security concerns.

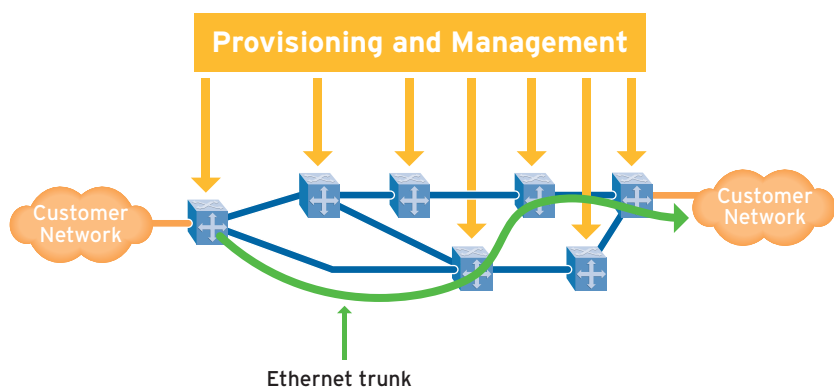
In addition, the learning process is only reliable where there is one, and only one, path towards a given destination.

To eliminate the possibility of multiple paths, Spanning Tree Protocol is used to selectively disable switch ports and thus block one or more of the redundant physical paths. This leaves a lot of expensive network assets sitting idle. Spanning Tree Protocol can also find a new route between two nodes in the network when one fails, creating a simplistic protection mechanism but while spanning tree is converging on the best alternate path, service is interrupted across the network.

Life outside the LAN

The problem with Spanning Tree Protocol is that it's simply too slow at protection switching. In the LAN, routes can take tens of seconds to be re-established. If you then extend into

Figure 1: Example of a configured Ethernet trunk



the MAN, convergence can take even longer. These long restoration times will not support today's voice, video and other real-time services that are quickly converging on the burgeoning Metro Ethernet network.

Spanning Tree Protocol also compounds the congestion problem by turning off the very links which could be used to move traffic off the most heavily laden links. Spanning Tree Protocol was designed for the tree topology that naturally exists in the LAN, not the complex mesh topology that exists in the MAN.

Finally, because the network controls the path that data takes across the network, it's difficult to predict network performance and to provide guaranteed QoS.

Ethernet cost points are still very attractive to carriers. So what's needed is a way to deliver guaranteed, deterministic services over Ethernet infrastructure on a wider scale; a way to ensure reliability, management and

scalability – to carrier-grade levels – in order to deliver the multimedia services that enterprises demand. And, come to that, service providers need a way to take advantage of the operational and cost efficiencies that carrier Ethernet can generate in the MAN.

Making the carrier grade

Provider Backbone Transport (PBT) simplifies conventional Ethernet by using explicit configuration of switches instead of the traditional flooding and learning techniques outlined above. Suddenly Spanning Tree Protocol and all the associated constraints and problems simply disappear. The switch still behaves largely as with traditional Ethernet: forwarding data to its intended destination. All that has changed is the forwarding information is no longer learned by the switches, but provided directly by the management plane, resulting in a prescribed, pre-determined path through the network and totally predictable network behaviour under all circumstances (as shown in Figure 1).

PBT therefore avoids the congestion problems caused by network flooding, which would otherwise be needed for the learning process. Protection routes can be provisioned across the network to provide backup in the event of failure, switching the traffic across in a mere 50 milliseconds; that's true carrier-grade reliability. What's more PBT can offer dedicated, point-to-point connections alongside traditional Ethernet, with no complex and expensive network overlay technologies, so the service can be up and running quickly, with nominal outlay.

Nortel is supporting PBT as it makes its way through the ITU, IEEE and other standards groups. So for the first time, scalable, carrier-grade Ethernet in the MAN can become a far more manageable, cost-effective and realistic proposition.

For more information on the Provider Backbone Transport, visit www.nortel.com/pbt

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