Carrier Ethernet Services Delivery

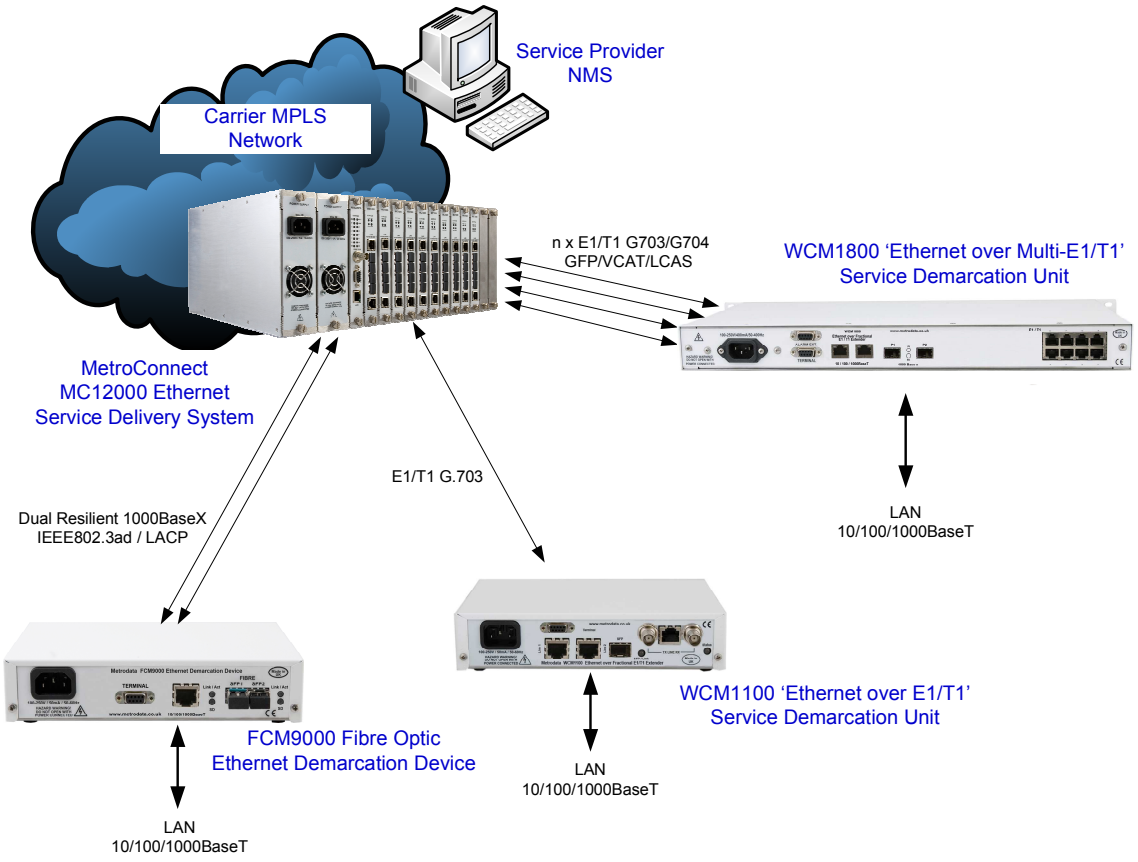
Application Note: MetroConnect Service Delivery and CPE Management

The MetroConnect Ethernet Service Delivery platform, in combination with the Metrodata family CPE Demarcation Devices, enables a Telecoms Service Provider to offer Ethernet services over a range of Network Transport architectures.

For 'Ethernet over Fibre' applications, the MC12000 system offers a high density of 10/100/1000BaseT and Gigabit Ethernet Fibre connectivity via SFP connectors for maximum flexibility. As a CPE Demarcation Device, the FCM9000 inter-works with the MC12000, offering 10/100/1000BaseT connectivity. Either single or dual resilient fibre links can be deployed between Service Provider and Customer premises.

Similarly, in combination with the MC12000, the Metrodata WCM CPE family offers Ethernet service delivery via single or multiple E1 or T1 links. Within the full WCM range, Ethernet Service bandwidths are offered corresponding to delivery via a range of PDH or SDH services. PDH offerings range from a single fractional E1/T1 up to a maximum of 16x E1/T1 or 4x E3/DS3 'bonded' links. For SDH, a single STM1/OC3 link is offered. Details of the entire MetroConnect / WCM range can be found at www.metrodata.co.uk

The diagram below illustrates a number of deployment variations:



In these applications, a MetroConnect system located at the Telecoms Service Provider's premise connects to the Provider's MPLS Network Switch infrastructure, providing interface 'grooming' to support the appropriate 'last-mile' infrastructure for Ethernet Service Delivery. MetroConnect offers a highly efficient use of valuable rack space. For example, up to 24 dual-redundant fibre links for customer Ethernet Service delivery are offered within the 4U MetroConnect system chassis, allowing the Provider's switches to be optimised for port density, typically needing only standard high-density copper ports, rather than a variety of copper and fibre ports.

Ethernet Service Delivery over Fibre

The MetroConnect range includes the chassis-based FCC9000 module, and the stand alone customer site demarcation device, the FCM9000. The FCC9000 module provides support for delivery of two separate Ethernet services. Within the Service Provider premises, the Provider's switching infrastructure is interfaced via high density copper connection supporting 1000BaseT. Customer connections are delivered over fibre, either single or dual resilient circuits utilising a pair of fibres supporting IEEE802.3ad Link Aggregation and LACP control. With a 1000BaseX fibre connection, a customer may be provided with a full 1000BaseT service.

Ethernet Service Delivery over Single E1/T1 Links

The MetroConnect range includes the chassis based WCC1100 module, and the customer site demarcation device, WCM1100. The WCC1100 module supports a single Ethernet service. The local connection to the carrier switch utilises a high density copper connection supporting 1000BaseT. The “last mile” is delivered over a PDH E1/T1 circuit. The WCM1100 will support unframed circuits to give maximum capacity, however framed and fractional rates are also available. The WCM1100 supports both simple HDLC encapsulation or alternatively GFP encapsulation.

The customer Ethernet service port may be supplied via copper (10/100/1000BaseT) or fibre (1000BaseX). Since there is a low speed uplink, the WCM1100 supports priority queuing using IP DSCP or IEEE802.3p priority schemes. Where prioritisation is enabled, high priority traffic, such as Voice, can be given guaranteed bandwidth, whilst lower priority internet browser traffic will have lower priority. Large queues enable the buffering of lower priority traffic such that packets will only get dropped as a last resort when the average capacity is exceeded.

Ethernet Service Delivery over Multiple E1/T1 Links

In many cases the costs of switching from an E1/T1 based infrastructure to a fibre based network, coupled with the limited bandwidth of a single E1/T1 link, gives rise to the potential use of circuit 'bonding', whereby multiple E1/T1 circuits may be combined to provide a higher service delivery bandwidth.

The MetroConnect Product range includes the chassis based WCC1800 module, which provides a single Ethernet service over up to 8 E1/T1 circuits, with the local

connection to the Service Provider's switch infrastructure utilising high density copper connections. In this case, the CPE service demarcation unit is the WCM1800. The WCC/WCM1800 units support “last mile” delivery over up to 8 E1/T1 circuits. Bonding is provided through the used of VCAT (Virtual concatenation), and resilience is ensured through the use of LCAS, (Link Capacity Adjustment Scheme). Encapsulation utilises GFP (Generic Framing Procedure) which provides a deterministic bandwidth scheme. LCAS ensures that the service delivery will continue even if a link fails, and similarly allows for seamless addition of additional circuits when a customer demands more bandwidth.

The customer Ethernet service port may be again supplied via copper, (10/100/1000BaseT) or fibre (1000BaseX). Since there is a low speed uplink (8 x E1 offers approximately 16Mbps), the WCM1800 supports priority queuing, using IP DSCP or IEEE802.3p priority schemes, similarly to the single-link WCM1100 product.

Service Delivery

MetroConnect allows the provision of Ethernet services at 'layer 2', thereby greatly simplifying network design. To allow network partitions to be provisioned, VLANs are supported and may be transported in a trunk mode, in which tagged frames pass transparently. Alternatively, for multi-port devices such as WCM1100, different ports may be assigned to different VLANs. For point to point MEF E-Line services, the MetroConnect may add the required “QinQ” S-Tags to identify the individual customer services.

The maximum Ethernet packet size supported is 10kbytes, which allows for maximum efficiency when using Gigabit Ethernet links. For lower speed connections, the MTU may be reduced as desired to a minimum of 1518/1522 bytes.

For customers wishing to ensure resilience through the use of multiple network paths, RSTP 'Spanning Tree' support will ensure that loops are prevented.

Management

It is essential that all elements of a service delivery network may be managed, and MetroConnect embraces this principle. One of the key themes for management of the MetroConnect is “zero touch” installation for the CPE demarcation units. Through “zero touch”, the demarcation devices are simply physically installed and connected. All configuration functions are performed from the Provider's Management Station(s).

One elements of “zero touch management” is auto-discovery. When a device is installed, it will activate IEEE802.3ah Link OAM. It will then listen for status requests from the MetroConnect Manager. During this auto-discovery phase, the device type and capabilities are retrieve. Metrodata makes use of the Organisation-specific Extension capabilities of Link-level OAM to enable a management channel to be established. Once this channel has been established, the MetroConnect Manager acts as an IP proxy to effectively enable remote device management via TELNET or SNMP.

The use of OAM for the management channel also gives the advantage of traffic isolation, since no management traffic will be visible to the customer and similarly the customer will have no access to the management sub-systems.

To further enhance the management offerings, simple password management may be upgraded through the use of TACACS, and enhanced security through SSH based encryption.

In general, the management of Metrodata products can be considered in two phases, configuration and monitoring. Configuration is normally achieved through the use of a simple, menu driven user interface available through TELNET or using a web browser and HTTP services. Once a device is configured, it then enters the monitoring phase where alarms, events and statistics are gathered using SNMP. Additionally, the demarcation devices may generate TRAP indications to signal problems to the Management System.

The MetroConnect offers extensive performance monitoring facilities as well as in-service and out-of-service test facilities. Where problems are discovered, OAM level loopback tests may be used to determine the status of links exhibiting problems. These OAM level loops may operate at an “in-service” level where they are not traffic affecting, or as “out of service” tests where the traffic flows are disrupted during tests.