Wholesale

EPIPE Connectivity Services

power to you

VTCW018 - I 08/13

In an "always on" hyperconnected world choosing the right networking technology is now more important than ever. Around the world businesses of all sizes are increasingly adopting Carrier Ethernet services for their wide area networking requirements due to its cost effectiveness, superior performance, reliability and highly scalable low latency bandwidth.

Traditional LAN Ethernet has evolved to become Carrier Ethernet with the addition of "Carrier Class" service management and reliability capabilities making it the technology of choice for the wide area whilst still retaining the plug and play simplicity that Ethernet is renowned for.

EPIPE is one of our Carrier Ethernet products. It offers a selection of Ethernet connectivity services that are based on the Metro Ethernet Forum (MEF) E-Line and E-Access generic service types. Each individual service instance commands resources that are reserved within our Synchronous Digital Hierachy (SDH) transport core making it the perfect choice for delivering mission critical applications with stringent uptime, performance and security requirements.

EPIPE Overview

Whether you need high speed access from an in country POP to end user premises, backhaul between POP's or DataCentres or backhaul from a POP to an International Cable Station, EPIPE provides a cost effective and flexible connectivity solution backed with industry leading SLA's.

EPIPE services provide symmetrical bandwidth in speeds ranging from 2Mbit/s to 10Gbit/s and support both point to point and point to multipoint (aggregation) connectivity topologies.

The services are available for connecting end-points within and between eight major New Zealand cities (including Auckland, Wellington and Christchurch) on our own terrestrial fibre based network. Transport between cities is provided on our protected SDH core network which stretches from Whangarei in the North Island to Invercargill in the South Island.

Single mode fibre cable[1] is used in the "first mile" to attach each service endpoint to the SDH network edge. A Network Interface Device (NID) is deployed at each endpoint providing intelligent demarcation. The NID terminates the fibre cable access link and presents a User Network Interface (UNI) or External Network to Network Interface (E-NNI) port that end user equipment is attached to. UNI speeds of 100Mbit/s, 1Gbit/s and 10Gbit/s and E-NNI speeds of 1Gbit/s and 10Gbit/s are supported.

Where additional robustness is required, optional automatic or customer-managed protection capability via redundant fibre optic access cables can be engineered to provide higher availability[2].

End to end service connectivity is realised by Ethernet Virtual Connections (EVC's) or Operator Virtual Connections (OVC's) that are configured across elements within our network. The EVC/OVC is a service container that associates the UNI/E-NNI ports at each end and securely isolates traffic for that service instance from service instances of other customers as it crosses the network. With EPIPE, each service instance is assigned to a dedicated circuit path within the SDH Transport core whose bandwidth is not shared with any other customer service instance.

All new or reconfigured services are tested after provisioning but prior to handover. Testing ensures service configuration is correct and that all services carried by the network meet their SLA objectives. RFC2544 and Y.156sam test methodologies are used with results captured in a "Birth Certificate" that is stored on-line and available to customers for future reference.

EPIPE uses IEEE 802.1ag/ITU Y.1731 Connectivity Fault Management (CFM) protocol based tools to administer the network. These Ethernet Service Operations, Administration and Maintenance (OAM) protocols facilitate pro-active monitoring, rapid diagnosis, isolation and resolution of faults.

By default, each EPIPE service instance is configured to have measurements of SLA performance parameters Frame Loss, Delay, Delay Variation and Availability carried out between NID's at set intervals. Measurements occur in-service across the EVC/OVC using synthetic OAM traffic. Results are collected from NID's and used to produce comprehensive SLA reports which are available for customers via an online reporting portal.

Using EPIPE Services

The EPIPE product implements two generic MEF service types which can support two connection topologies (each with a set of attributes and parameters that may have configurable options) giving you the freedom to choose the most appropriate service and configuration for your specific application.

Figure 1 shows the EPIPE EPL (E-Line service type, point to point topology) being used by a Carrier in a backhaul application for linking two edge routers located in Carrier POP sites in different cities. This Ethernet Private Line service is port based with a single service EVC configured with 2Gbit/s bandwidth between dedicated 10Gbit/s UNI's on the NID's at each POP.

The EPL service is highly transparent accepting untagged, single or multiple tagged frames and preserving any VLAN ID's or CoS values present.

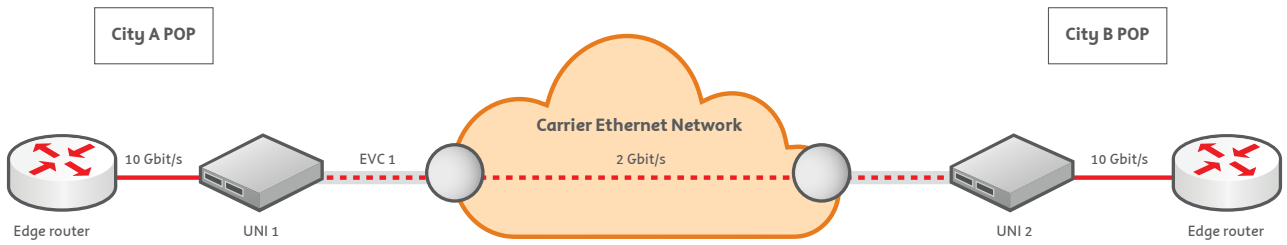

Figure 1
EPIPE Ethernet Private Line

Figure 2 shows the EPIPE EVPL (E-Line service type, point to multipoint topology) being used by a Service Provider delivering a Managed WAN offering to an enterprise customer. In this application three EPIPE point to point services (10Mbit/s EVC's) are being used in a "hub and spoke" WAN arrangement linking 100Mbit/s UNI's connected to managed routers at the enterprise branch offices to a 1Gbit/s UNI connected to a hub router at the Head Office.

Unlike port based EPL's, Ethernet Virtual Private Lines are VLAN based and don't require a dedicated port per EVC each end which, as shown, allows services to be multiplexed (aggregated) onto a single UNI at the Head Office.

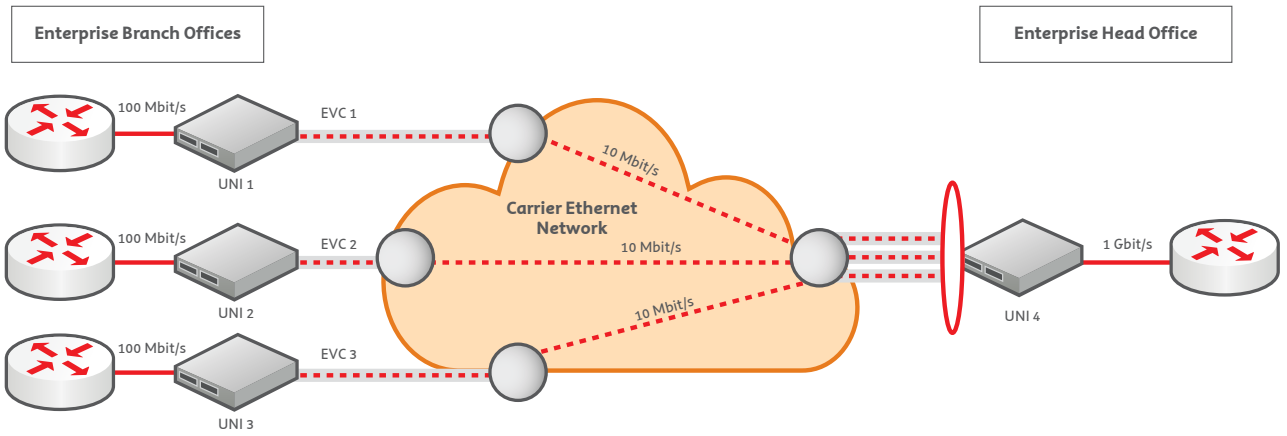

Figure 2
EPIPE Ethernet Virtual Private Line

Figure 3 shows the EPIPE Access EPL (E-Access service type, point to point topology) being used by a Global Carrier to deliver an international EPL service to a multi-national customer. In this application an access EPL with a 10Mbit/s OVC is being used to provide a local loop connection. This links a 100Mbit/s UNI connected to a router at the end user NZ site back to the Global Carriers NZ POP. The access service is a "wholesale input" that is being combined with the Global Carriers own network and facilities to deliver an international EPL service into New Zealand.

The EPIPE Access EPL service interconnects a dedicated UNI and an E-NNI. It provides a high degree of transparency such that Service Frames are delivered unchanged at the E-NNI with the addition of an S-VLAN tag and the E-NNI Frames are delivered unchanged at the UNI except for the removal of the S-VLAN tag.

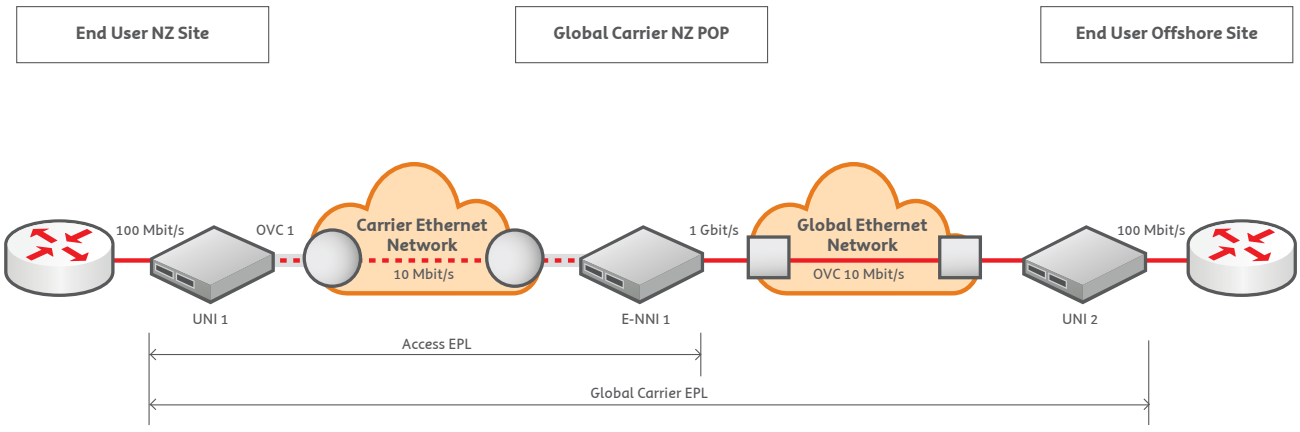

Figure 3
EPIPE Access EPL

EPIPE Business Benefits

- Use of **Fully reserved resources** in the SDH transport core per service instance ensures security and highly deterministic performance that cannot be affected by other network users traffic flows.
- **Scalable bandwidth and granular speed increments** for Ethernet and Operator Virtual Connections (EVC/OVC's) mean you will only pay for the bandwidth you actually need. Bandwidth is able to be rapidly adjusted up or down should circumstances change.
- **Service Multiplexing support** permits multiple EVC's or OVC's to be aggregated onto a single high speed (up to 10Gbit/s) UNI or E-NNI . Delivering each service instance on a single port as opposed to multiple discrete ports allows terminal equipment to be optimised with potential cost savings due to reduced port counts, cabling, rack space and power consumption. Adding or removing instances can also be performed remotely saving costs of site attendance to perform physical jumpering.
- Our **extensive New Zealand coverage** means you can quickly expand your network footprint and potential market without major capital expenditure and without the operational overhead of dealing with multiple suppliers.
- We provide a **choice of access availability options** to suit the importance and priority of the site (e.g. protect against potential service outages due to cable cuts by using dual diverse cable routes to the end user premise)
- Our **implementation of Connectivity Fault Management (CFM) technology** enables us to pro-actively monitor your services, automatically raise trouble tickets should connectivity be impacted, and rapidly isolate and diagnose problems to facilitate fastest fault resolution. EPIPE services will transparently pass Service OAM frames allowing diagnosis of end user Maintenance Domains.
- Service turn up "**Birth Certificates**" issued following RFC2455 or Y.156sam commissioning testing provide high confidence that a new service will "work first time" and demonstrate that the service has been configured correctly and meets the performance parameters specified in the Service Level Agreement.
- Comprehensive **Service Performance SLA reporting** enabled through SNMP based statistics collection from NID's coupled with ongoing Ethernet OAM based in-service performance measurements allows unprecedented visibility of service status and performance.

Interacting with Us – what to expect

We understand the need for reassurance and certainty when transitioning to a new supplier or deploying a new service. Underlying all our offerings are four vital principles: value, trust, technology and service.

Our people

We offer a skilled and experienced team of communications consultants who can provide in depth advice on Carrier Ethernet architecture and service attributes and help you to identify a solution that best meets your needs. Expert technical and operational support is available once a service has been provisioned and activated.

Our network

We own and operate one of the largest fixed and mobile networks in New Zealand. Developed over 20 years the network includes over 6000km of fibre optic cable extending from Whangarei to Invercargill. Our Carrier Ethernet services are available in the places where your business needs it.

Getting connected

Use our building list and mapping tools or talk to our client liason team to confirm connected buildings and new site feasibilities and quotes. You can order EPIPE services using our all in one order form. Provisioning lead times will depend on whether intact network facilities are in place at all sites or if new facilities are needed to be constructed

at some locations. You'll find indicative lead times in our Operations Manual, available on request from your Service Manager. Our install co-ordination team will confirm delivery dates shortly after order placement and oversee install and provisioning activities of internal teams through to handover. A dedicated account support consultant is available to assist you with any queries around ordering, amending or cancelling services, getting credentials for online tools (e.g. reporting portal) and billing.

Charging principles

EPIPE uses zone based pricing for the recurring charges for both point-to-point and point-to-multipoint service topoplogies. Our pricing takes into account UNI/E-NNI line speeds, first mile media types and resiliency options and EVC/OVC bandwidths, giving you a comprehensive range of options. A minimum term of 12 months applies to each EPIPE service. Non-recurring and recurring charges may be eligible for fixed term discounts. We'll bill your services monthly, itemising the installation charges and recurring charges.

Operations and Maintenance

Our customer help premium support helpdesk is your primary point of contact for fault reporting. Through the helpdesk, we will provide you with a 24x7 fault logging facility, investigate and manage faults through to resolution, update you on progress with fault resolution and escalate any unresolved faults to an appropriate manager.

For more information

To find out more, contact your Vodafone Wholesale account manager.

1. At sites where fibre cable is not available a digital microwave radio based first mile access link may be possible subject to feasibility.
2. Provision of higher availability access link options to a specific site may not always be possible. Where diverse access facilities do not exist construction of new facilities is subject to feasibility.