



Declaration of Ethernet – technology issues

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Key Messages

- Ethernet services should not be regulated
 - Ethernet is not a bottleneck service and there is no market failure
- Draft amendment is too broad
 - Inconsistent scope
 - Disincentive for investment in emerging technologies
 - Need well directed regulation
 - Need market specific regulation
- Competition analysis and full market inquiries are required to show that regulation of Ethernet is in LTIE



Terms in the Draft Service Description



OSI Layers

- Released in 1977 as a guideline, not a technical standard
 - <http://www.buzzle.com/articles/osi-model-explained.html>
- Ambiguous and open to interpretation with advances in technology
- Blurred distinction between transport layers (1-4)
 - SDH as an implemented network technology (EoSDH) is both Layer 1 and Layer 2 as it also has Ethernet capabilities. Technology evolution will continue to create similar ambiguities in the future
 - MPLS is considered Layer 2.5!
- Layer 2 is very broad category: may include EoMPLS, EoVPLS, EoATM, EoFrame Relay, EoSDH

Network Interfaces and Designated Rates



Specify the physical media Interface as 10Mb/s, 100Mb/s, 1000Mb/s

- Advantages to access seekers because simpler than regulating subscriber line rates
- Effectively controls all rates sold
- Includes all Ethernet interface overheads eg inter-frame gap
- Ethernet physical interfaces defined by IEEE 802.3 standards
 - Refer to: <http://www.ieee802.org/3/>



Permanent Basis Telstra View

- Guaranteed rates
- Nailed up circuits/Clear Channel
- CIR=PIR

Is this consistent with ACCC meaning by permanent in the context of Ethernet?



Exemptions

- Currently based on SDH transmission not Ethernet
 - too few compared to the eligible routes and ESAs
- More exemption locations are eligible for Ethernet
- Current exemptions based on Tail and IEN services which do not apply in Ethernet
 - Tail Ethernet services should be exempt
- Draft declaration in its current form should exempt all retail Ethernet services and Ethernet over Fibre (switched Ethernet)
 - they are fully competitive



Potential Ethernet Technologies caught by draft declaration

Ethernet Technologies Potentially To Be Regulated



- Ethernet over current technologies
 - 1) SDH,
 - 2) Ethernet over fibre (switched Ethernet)
 - 3) Ethernet over ATM, Frame Relay, SHDSL, DOCSIS3
 - Many competitors already own fibre and sell Ethernet services, particularly Ethernet over fibre which are not exempt
- New Ethernet products MPLS and VPLS
 - Disincentive for investment and product innovation
 - Risk of regulatory error in picking technologies

Ethernet over SDH



- A telecommunications provider will utilise their existing SDH infrastructure (where NGSDH is installed), but provide an Ethernet interface to a customer in the form of a 10/100 or Gigabit Ethernet connection, instead of a traditional PDH or SDH interface
- Once the Ethernet frame has been received from the customer, the EoSDH Node encapsulates the customer Ethernet frame via Generic Frame Procedure (GFP) into an SDH container which is then carried through the SDH core. At the far end, the reversal takes place with the Ethernet frame de-encapsulated from the SDH container and a raw Ethernet frame is forwarded to the customer.
- EoSDH Ethernet Private Line (EPL's) are Point-to-point Ethernet services between two customer's sites. An EPL service is a non-shared service, in which each Carrier Ethernet (CE) is connected via a non-shared Ethernet link User Network Interface (UNI) to Provider Equipment (PE), and the PE's are connected to each other via a dedicated non-shared SDH Tunnel
- EPL uses a point-to-point EVC between two UNIs and provides a high degree of transparency for Service Frames between the UNIs it interconnects.

Difference between EoSDH circuit and EoFibre (L2 switched Ethernet)



EoSDH differs from traditional bridged Layer 2 services in the way different customer services are segregated within the network.

An EoFibre bridged Layer 2 service consists of a single, shared Ethernet domain. Each customer purchases access to that shared domain, differentiating their traffic from other customers' traffic by use of 802.1q VLAN tags. The VLAN tag in the context of this type of service is used to provide customer service segregation.

For an EoSDH service, there is no requirement to segregate different customers' services using VLAN tags, since the segregation is performed at the transmission level and network resources are not shared at Layer 2. For Point-to-Point services the customer is free to use their own 802.1q VLAN tagging, or any other tagging mechanism, with no constraints imposed by the provider. This service is considered to be more transparent than for traditional switched services, since each customer can operate with no functional, performance or scaling impacts from other services within the same network

Characteristics of EoSDH vs L2 E switching



| Point to Point EoSDH | Ethernet over Fibre (switched Ethernet) |
|---|---|
| Circuit-switched technologies | Store-and-forward switching or cut-through switching |
| Hardware MAC addresses unaware | Physical addressing (MAC addressing) |
| VLAN unaware | LAN switching (packet switching) including MAC filtering and spanning tree protocol |
| Fixed Virtual container size (VC-12, VC-3 or VC-4) mapped to Ethernet PHY | Data packet queuing or scheduling |
| Service bandwidth governed by the VC size, (CIR = PIR) | Quality of Service (QoS) control, bandwidth contention, (CIR + PIR) |
| Service positioning: backhaul services, bandwidth guaranteed, carrier grade Ethernet, high availability | Service positioning: service contention, low availability |



Emerging Ethernet services in development

Issues impacting Carrier Ethernet's success in emerging products



Issues still under-developed and not yet in place

1. Standards compatibility

- Vendor alignment to technical standards
- Resolve interoperability challenges in multi-vendor networks

2. Ethernet Operations & Maintenance (OAM) toolset

- Link OAM tools eg. 802.3ah
- Service OAM tools eg. 802.3ag, Y.1731

3. Interconnections

- Develop standardised External Network to Network Interface (ENNI)








Risks to Ethernet Product Innovation

- Regulatory overreach may disincentivise product development
 - An adequate return on investment must be possible
 - Risks still need to be taken
- Regulation of emerging Ethernet technologies may distort investment choices
 - Unregulated services become more attractive
 - Unintended consequences when the technology still in development
- Risks around co-ordination between multi-vendors
 - Timely commercialisation at risk




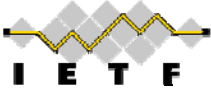

Ethernet Standards Summary



| Standards Body | Ethernet Services | Architecture/Control | Ethernet OAM | Ethernet Interfaces |
|--|--|--|--|---|
|   | - | <ul style="list-style-type: none"> • 802.3 – MAC • 802.3ar – Congestion Management • 802.1D/Q – Bridges/VLAN • 802.17 - RPR • 802.1ad – Provider Bridges • .1ah – Provider Backbone Bridges • .1ak – Multiple Registration Protocol • .1aj – Two Port MAC Relay • .1AE/af – MAC / Key Security • .1aq – Shortest Path Bridging | <ul style="list-style-type: none"> • 802.3ah – EFM OAM • 802.1ag – CFM • 802.1AB - Discovery • 802.1ap – VLAN MIB | <ul style="list-style-type: none"> • 802.3 – PHYs • 802.3as - Frame Expansion |
|  | <ul style="list-style-type: none"> • MEF 10.1 – Service Attributes • MEF 3 – Circuit Emulation • MEF 6.1 – Service Definition • MEF 8 – PDH Emulation • MEF 9 – Test Suites • MEF 14 – Test Suites • Services Phase 2 | <ul style="list-style-type: none"> • MEF 4 – Generic Architecture • MEF 2 – Protection Req & Framework • MEF 11 – UNI Req & Framework • MEF 12 – Layer Architecture • MEF 20 – UNI Type 2 | <ul style="list-style-type: none"> • MEF 7– EMS-NMS Info Model • MEF 15– NE Management Req • MEF 17 – Service OAM Requirements & Framework • Service OAM Protocol– Ph. 1 • Performance Monitoring | <ul style="list-style-type: none"> • MEF 13 - UNI Type 1 • MEF 16 – ELM1 • E-NNI |
|  | <ul style="list-style-type: none"> • G.8011 – Services Framewrk • G.8011.1 – EPL Service • G.8011.2 – EVPL Service • G.asm – Service Mgmt Arch • G.smc – Service Mgmt Chnl | <ul style="list-style-type: none"> • G.8010 – Layer Architecture • G.8021 – Equipment model • G.8010v2 – Layer Architecture • G.8021v2 – Equipment model • Y.17ethmpls - ETH-MPLS Interwork | <ul style="list-style-type: none"> • Y.1730 – Ethernet OAM Req • Y.1731 – OAM Mechanisms • G.8031 – Protection • Y.17ethqps – QoS • Y.ethperf - Performance | <ul style="list-style-type: none"> • G.8012 – UNI/NNI • G.8012v2 – UNI/NNI |
|  | - | - | <ul style="list-style-type: none"> • TMF814 – EMS to NMS Model | - |

Key Ethernet OAM Standards



| Standards Body | Ethernet OAM |
|---|--|
|  | <p>802.3ah – Ethernet in the First Mile</p> <p>802.1ag – Connectivity Fault Management</p> |
|  | <p>MEF 7 – EMS-NMS Info Model</p> <p>MEF 13 – UNI-Type 1</p> <p>MEF 15 – NE Management Req</p> <p>MEF 17 – OAM Requirements & Framework</p> <p>MEF 16 – Ethernet Local Mgmt Interface (E-LMI)</p> <p>MEF 20 – UNI-Type 2</p> <p>Service OAM – Performance Monitoring Implementation Agreement</p> <p>Service OAM – Fault Management Implementation Agreement</p> <p>NID Specifications</p> |
|  | <p>Y.1730 – Ethernet OAM Req</p> <p>Y.1731 – Service OAM Performance Monitoring</p> <p>G.8031 – Ethernet Protection</p> <p>Y.17ethqos – QoS</p> |
|  | <p>RFC-2544 – Benchmarking Method for Ntwk Interconnect Dev</p> <p>RFC-2819 – Remote Monitoring (RMON Etherstats)</p> |
|  | <p>TMF814 – EMS to NMS Model (Corba)</p> <p>TMF854 – EMS to NMS (Web services - MTOSI)</p> |

A view on technology maturity



| | Standard | Name | Organisation | | |
|----------|---------------------------------|-----------------------|--------------|--------|---------------|
| | | | IEEE | ITU-T | IETF |
| Ethernet | 802.3 | Ethernet II | 1983 | | |
| | 802.3u | Fast Ethernet | 1995 | | |
| | 802.3z | Gig Ethernet | 1998 | | |
| OAM | 802,1ag | Service OAM | Sep-07 | | |
| | Y.1371 | Service OAM | | Feb-08 | |
| | 802.3ah | EFM | Jun-04 | | |
| | RFC 3031 | MPLS | | | Jan-01 |
| | RFC 4761 | VPLS (BGP) | | | Jan-07 |
| | RFC 4762 | VPLS (LDP) | | | Jan-07 |
| | RFC 3985 (Architecture) | PWE3* | | | Mar-05 |
| | RFC 5654 (Requirements Only) | MPLS-TP | | | TBA (Q4 2010) |
| | RFC 5654 (Requirements Only) | OAM MPLS-TP | | | TBA (Q4 2010) |
| | G.707/8/9 | SDH | | 1988 | |
| | None Specified | EoS ^{SDH} ** | | | |
| | G.7042 | LCAS | | Feb-02 | |
| | G.7041 | GFP | | Oct-01 | |
| | G.709 | OTN | | Mar-03 | |

*The PWE3 terminology is used to describe the technical procedure for the emulation of a native service over a packet switched network (PSN). The native service may be ATM, frame relay, Ethernet, low-rate TDM, or SONET/SDH

**EoS^{SDH} refers to a set of protocols (GFP and LCAS) which allow Ethernet traffic to be carried over SDH networks in an efficient and flexible way .



Market Inquiries and Competitive Analysis

Well Directed and Market Specific Regulation

- Are SDH and Ethernet sold in different markets
- Different Ethernet markets exist
- Assess each market for level of competition
- Regulate only locations where competition is low
- Different levels of regulation may apply to different product markets
- Regulation must support LTIE and not be a disincentive for investment

Regulation of Ethernet by OFCOM



- Business Connectivity Market Review 2008
 - Ofcom conducted detailed market analysis considering competition, maturity of markets, ubiquity and level of BT's dominance by geography and bandwidth. Different levels of regulation for different markets.
 - Ofcom approach involved a survey of end users; analysis of relative prices and usage trends; characteristics of the services.
 - Price cap controls for wholesale low bandwidth (≤ 1 Gbps) Ethernet Products (Ethernet Backhaul Direct, Bulk Transport Link, Ethernet Access Direct)
- Regulation reduced in 2009 due to replicability
 - BT's retail low bandwidth digital leased lines can now be replicated by its competitors so regulation changed from price cap to price floor.