Proposal for Deployment of International Multi-Layer Network

- TransPAC2 Update -

Jin Tanaka
APAN-JP/KDDI/NICT
tanaka@kddnet.ad.jp

Network Engineering Workshop
APAN26 New Zealand Meeting
7th Aug. 2008
Need for Multi-Layer/Hybrid Network

- R&E application has been diversified into multiple types in recent years.
- But, Layer3 routing technology has been not changed.
- Would you say that current Layer3 routing is best technology for applications?
- In such situation, international lower-layer network such as GLIF has emerged.
- In addition, the emergence of DCN heighten the need for lower-layer network over multi-domains.
- Using multi-Layer network technology could help us design a network suitable for each application.
Optical - Ethernet - Packet
Multi-Layer

IP

Ethernet

10G LAN-PHY
10G WAN-PHY
1G PHY

HDLC/PPP

GFP (Generic Framing Procedure)

SONET/SDH

Optical Fiber
Multi-Layer/Hybrid Network

- Internet2 (US), GEANT2 (EU), KOREN (KR), SINET3 (JP), and other R&E networks, has introduced multi-Layer network and has started operation.
- Provide flexible networks to meet user demand.
- Aim to provide communication capability that is service-oriented: DCN, bandwidth on demand.
- But there is no R&E network providing international fully multi-Layered connection with Japan.
APAN-JP L2/L3 network over JGN2plus/APII/TransPAC2
## Options of International Low-Layer Connection

- Most “popular” international circuit is SONET/SDH
- Create the Multi-layer/Hybrid Network over SONET/SDH circuit

<table>
<thead>
<tr>
<th>Layer-1 switch with SONET/SDH</th>
<th>MPLS over POS</th>
<th>10G WAN-PHY</th>
</tr>
</thead>
<tbody>
<tr>
<td>• It’s effective in high-speed circuits over OC-12, OC48</td>
<td>• Provide ethernet connectivity by L2VPN/MPLS function on edge router</td>
<td>• OC-192 SONET circuit provide ethernet connection by 10GigE-WANPHY</td>
</tr>
<tr>
<td>• Appearance of a MSPP (Multi-service Provisioning Platform) equipment and GFP mapping technology enable us to translate SONET/SDH to ethernet more effectivity</td>
<td>• It’s effective in low-speed circuits</td>
<td>• Set up L2/L3 multi-layer network on the 10GigE-WANPHY</td>
</tr>
<tr>
<td>• Dedicated circuit</td>
<td>• Depend on methods of router vender - Juniper CCC/Martini/Kompella or Cisco Martini</td>
<td>• Available switch is limited</td>
</tr>
<tr>
<td>• Tough to obtain specific circuit</td>
<td>• Shared Link</td>
<td>• Shared Link</td>
</tr>
<tr>
<td>• CERNET/CSTNET</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Layer-1 switch with SONET/SDH
- It’s effective in high-speed circuits over OC-12, OC48
- Appearance of a MSPP (Multi-service Provisioning Platform) equipment and GFP mapping technology enable us to translate SONET/SDH to ethernet more effectivity
- Dedicated circuit
- Tough to obtain specific circuit
- CERNET/CSTNET

### MPLS over POS
- Provide ethernet connectivity by L2VPN/MPLS function on edge router
- It’s effective in low-speed circuits
- Depend on methods of router vender - Juniper CCC/Martini/Kompella or Cisco Martini
- Shared Link

### 10G WAN-PHY
- OC-192 SONET circuit provide ethernet connection by 10GigE-WANPHY
- Set up L2/L3 multi-layer network on the 10GigE-WANPHY
- Available switch is limited
- Shared Link
SONET/SDH circuit must be subdivided to VC3 (50M) - VC4 (155M) units for providing dedicated bandwidth guaranteed circuit service.

Or, utilize a “Clear Channel” technology which enable to transmit H1/H2 byte in a SONET line over head.

You have to request such a circuit specification to an international circuit carrier - Do not Concatenate! We concatenate the circuit ourselves by VCAT (Virtual Concatenation)!

Provide the GigE lightpath under SONET/SDH via VCAT & GFP mapping on MSPP.

It might be a good method for reducing the cost due to expensive POS Router Interface.

It seems that still have difficulty operating such a particular circuit and providing from international carrier in Asian region.
Inter-domain/AS L2VPN/MPLS
- Effectivity -

- Provide point-to-point ethernet connection over LSP which is made by MPLS technology on IP/Layer-3 network
- A good solution for APAN region, there are few high-speed circuit such as OC-48 or OC-192
- Juniper, Cisco, and other vendors is supporting L2VPN/MPLS (Kompella/Martini/CCC)
- Set up MPLS connection statically out of consideration of dynamic routing/protection
  - Routing among multi-domain is carried out by IDC (inter-domain controller)s of DCN over L2VPN/MPLS path
- Get results of the interoperability of inter-domain MPLS over inter-AS
- Challenge to hard operation and accumulate the operation know-how
Current Status and Future Possibility

• Ethernet connection with Layer-1 switch with SONET/SDH
  - CERNET
  - CSTNET
  - TEIN2-HK

• Ethernet connection with 10G WAN-PHY
  - KOREN

• MPLS over POS
  - TransPAC2
  - APAN-TW
  - TEIN2-POPs
  - ASTI

Network are complete for the DCN connection
Coming Soon!!
Suggestion
Summary

- Multi-layer/Hybrid networks are intended to provide a flexible mix of IP routed service and “lower layer services”. And it can respond quickly to user/application requirements and requests to access both the IP routed and/or lower layer services.
  - Deterministic network performance, dedicated network resources, guaranteed network capacity, freedom to use protocols other than (congestion control friendly) TCP, privacy/security

- If we can deploy the “innovative” DCN service over lower layer network, we can establish user on-demand international path. It leads to the promotion of the international collaboration on R&E networks.

- This will require the international Inter-domain multi-layer networking. Though there are various options to make Inter-domain multi-layer network, it is still heavily dependent on specification of circuit provided international carrier.

- L2VPN/MPLS is a good solution to make multi-layer connection over current APAN network which has many low-speed circuits.

- APAN-JP/TransPAC2 will becomes one model, and progress the operation knowhow of L2VPN/MPLS between Inter-domain/inter-AS to APAN network.
Thank You!

For DCN connection with APAN-JP
Ask the APAN-JP NOC
ops"at"jp.apan.net