SuperComm2004 interoperability test demo report

Part I : OIF OUNI/E-NNI　Interoperability Demo

2004/11/02

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OIFとは

- **Optical Internetworking Forum**
  - **1998年に設立**
  - **IPネットワークとフォトニックネットワークの間の物理的および論理的インタフェイスの仕様策定を行い，マルチベンダ環境での相互運用可能な製品とサービスの開発および広報活動による市場開拓を行うことを目的としている。**
  - **約180組織が参加**
  - **2000年1月より overlay model に基づいた、IP router と OXC 間の制御プロトコル(UNI)をGMPLSを流用して制定するプロジェクトをスタート。**
  - **現在、UNI (1.0R2, 2.0), E-NNI (1.0) を制定し、SuperComm 2004 において、World Wide UNI/E-NNI Interop. Demo を実施。**

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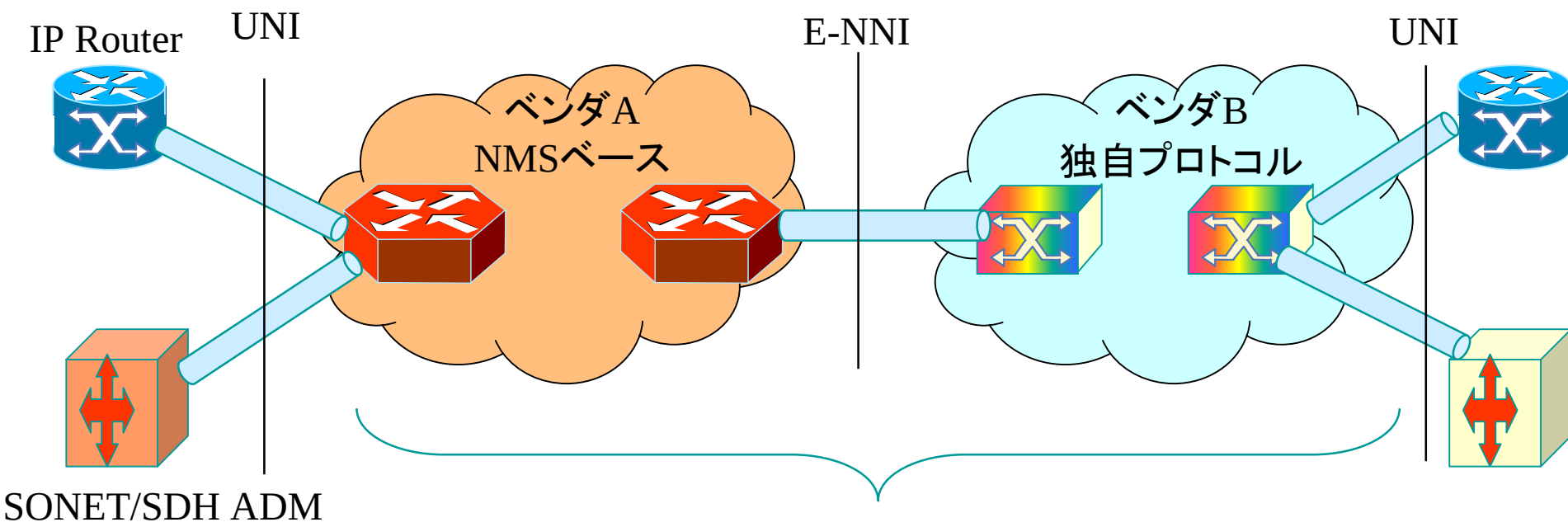
OIFの参照ネットワーク

- **UNI は、TDM, LSC に対して定義しているが、TDMの実装が大多数である。**
  - **UNI の IF 速度 < キャリア網内 IF 速度 (ex. OC3 vs. OC192)**



SuperComm Demo 参加組織

- **15 Vendors**
  - ADVA
  - Alcatel
  - Avici Systems
  - CIENA Corp.
  - Cisco Systems
  - Fujitsu
  - Lucent Technologies
  - Mahi Networks
  - Marconi
  - NEC
  - Nortel Networks
  - Siemens
  - Sycamore Networks
  - Tellabs
  - Turin Networks
- **7 Carriers in 3 continents**

  Asia
  - China Telecom
  - KDDI Labs
  - NTT

  Europe
  - Deutsche Telekom
  - Telecom Italia

  North America
  - AT&T
  - Verizon

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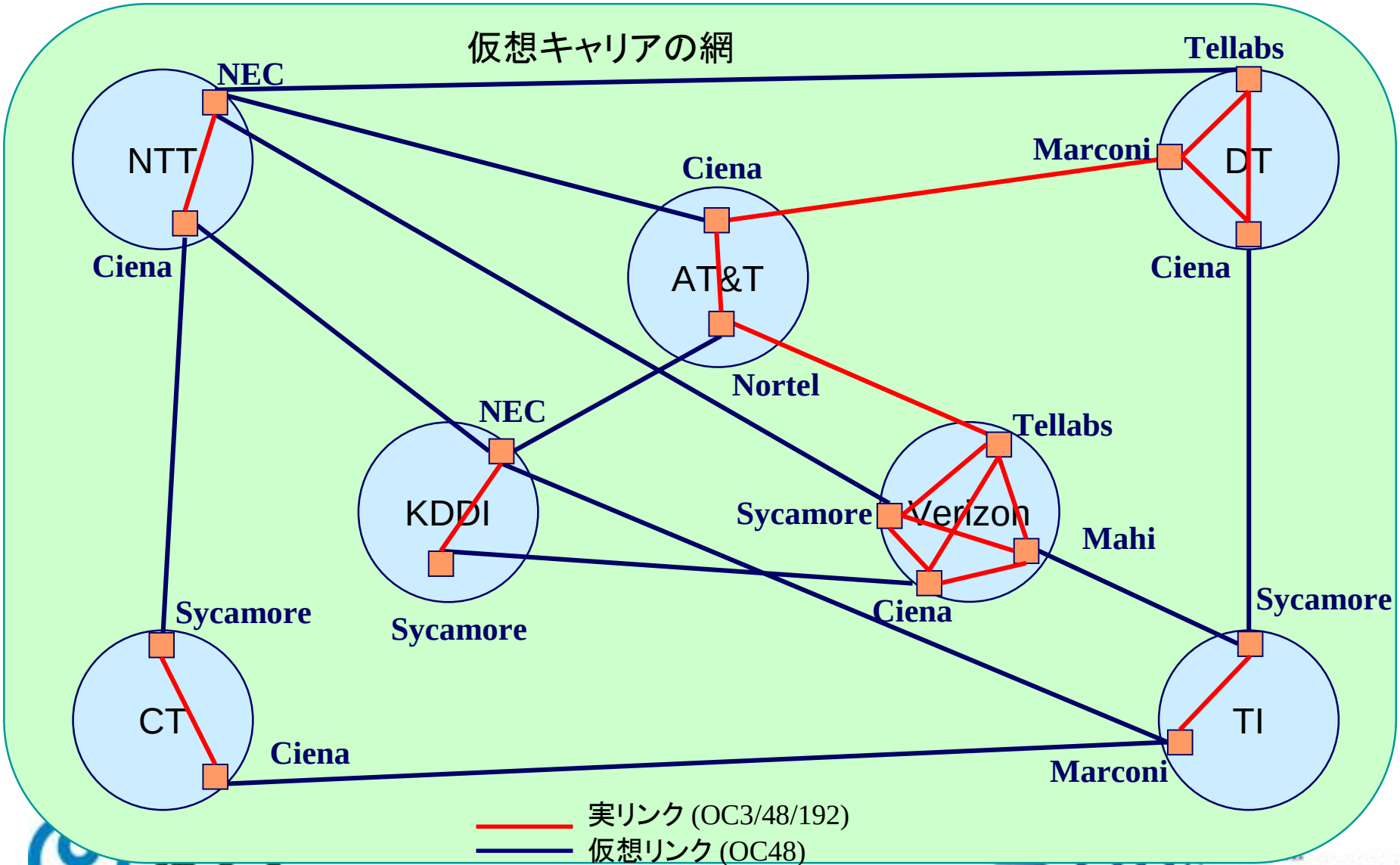
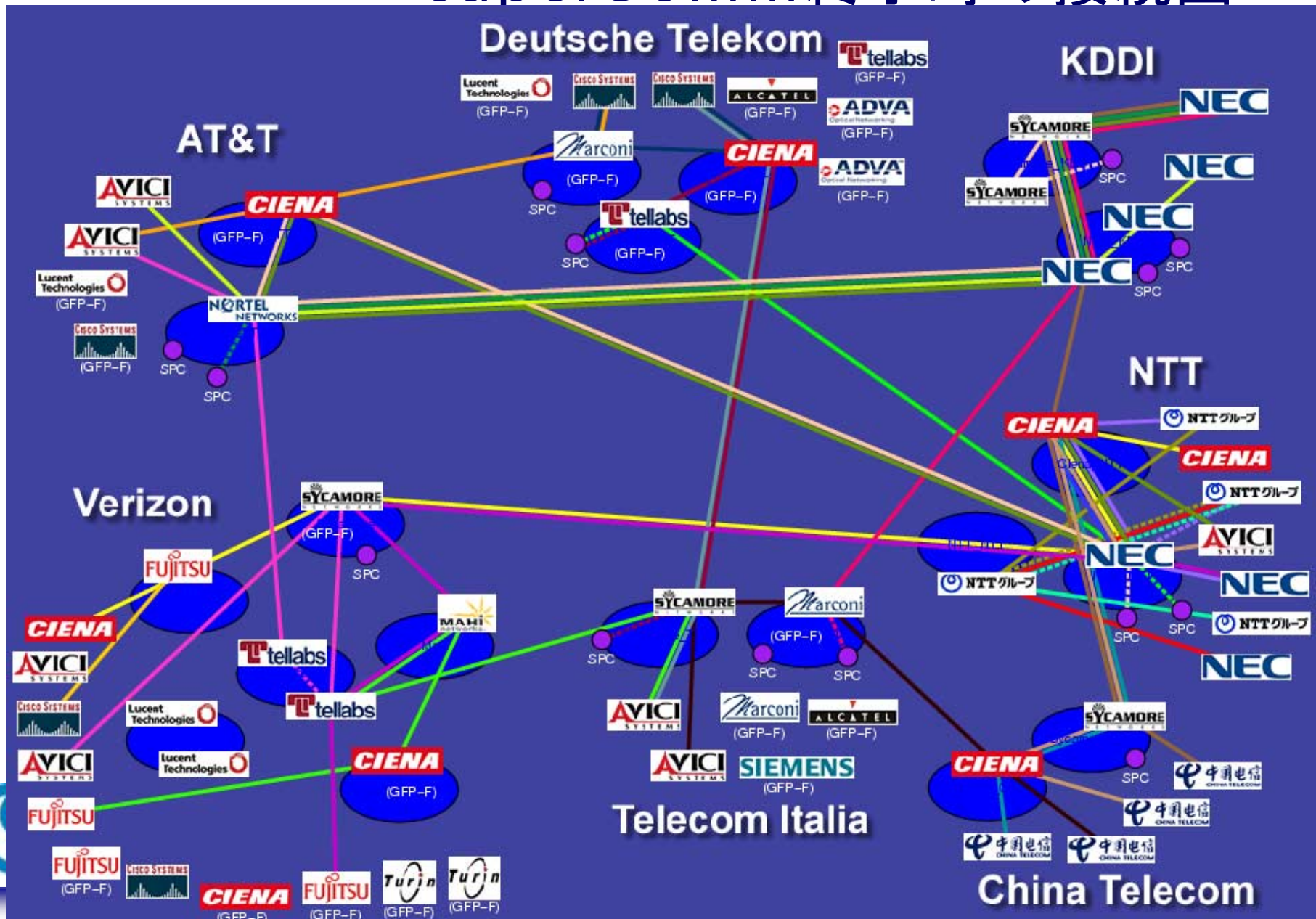
Inter-lab interconnections



SuperComm終了時の接続図



C-Plane 網の構築

- **IPsec over internet**
  - **NTT lab (武蔵野)からの RTT (traceroute で測定)**
    - **KDDI研究所　　14ms (上福岡)**
    - **AT&T　　186ms (East Coast)**
    - **Verizon　　197ms (East Coast)**
    - **DT　　312ms (Berlin)**
    - **CT　　503ms (北京)**
  - **朝9時～10時にパケット落ちが発生との報告有**
    - **RSVP パケット (Raw IP) は再送されない。。。。**
    - **Ack パケット(?)が落ちると、最悪は reboot !!!**
- **Chicago 9:00, Tokyo 23:00, Berlin 16:00**
  - **事前ネゴシエーションが大変**

Problems

- 基本的な、Interoperability は確保
- LSP (call) 設定の可視化に難有
  - Ethereal でプロトコル追跡は辛い
  - 可視化ツールは、実際に反映されて見えるようになるまで時間がかかる
- Router Alert Option の立ったRSVPパケットは事故の元
  - GMPLS では、Router Alert Option は基本的に使用しない
- システムの安定性は、まだまだ
  - ほとんどのシステムのコードはβ版
  - 使えないから、使わないから、熟成されないといった悪循環
  - 遠隔操作で対応できるベンダもあるが、技術者がつきっきりで対応することが必要なベンダも多数
    - 時差のある環境での、大規模デモはつらい
    - NOC から、統合制御できないと。。。。

Supercomm 2004 interoperability test demo report
Part II: ISOCORE IP-Optical Pavilion

November 2, 2004

Kohei Shiomoto

NTT Network Service Systems Laboratories

Isocore's Position in the Industry

- **Offers interactive platform for service providers and vendors community**
- **Performs technology validation and technology feasibility for future network deployments**
- **State-of-the art facility in the Washington DC area (Northern Virginia) with live peering with multiple carriers who are associated with Isocore**
- **Live operationally-oriented test services verifying the stability and maturity of services on any high-end router**
- **Isocore consulting helps large enterprise/Government and carrier networks migrate to the next generation network**
- **Performs Interoperability and Interworking services for cross technology and between multiple devices**
- **PIL is group member of ISOCORE as well as sister site. Professor. Naoaki Yamanaka (Keio Univ.), is Executive director for Asia Pacific of ISOOCRE.**

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ISOCORE IP-Optical Pavilion Overview

- **Demonstrate the state of next generation networking technologies for IP and Optical networks**
  - **Optical transport to showcase GMPLS-enabled core**
  - **IP multi-service network to showcase MPLS enabled applications on top of redundant core**
- **IP-Optical Integration defined**
  - **Integrating multiple-layered networks through a common control plane**
  - **Simplification of Topology and Service Discovery**
  - **Enabling automated resource provisioning of transport and data planes**
- **Automated setup of circuits in the transport layer using GMPLS using routing thus forming the intelligent optical core**
- **Allowing the usage of circuits at the IP layer**
- **Enabling MPLS/IP based multi-services on top of the dynamically provisioned GMPLS links**
- **Participants**
  - **Vendors**
    - **ADC, APC, Alcatel, Avici Systems, Chiaro, Ciena, Cisco Systems, Data Connection, Fujitsu, Juniper Networks, Marconi, NEC, NTT, Quarry Technologies, Redback Networks, and Sycamore Networks**
  - **Test equipment manufactures**
    - **Ixia and Spirent**

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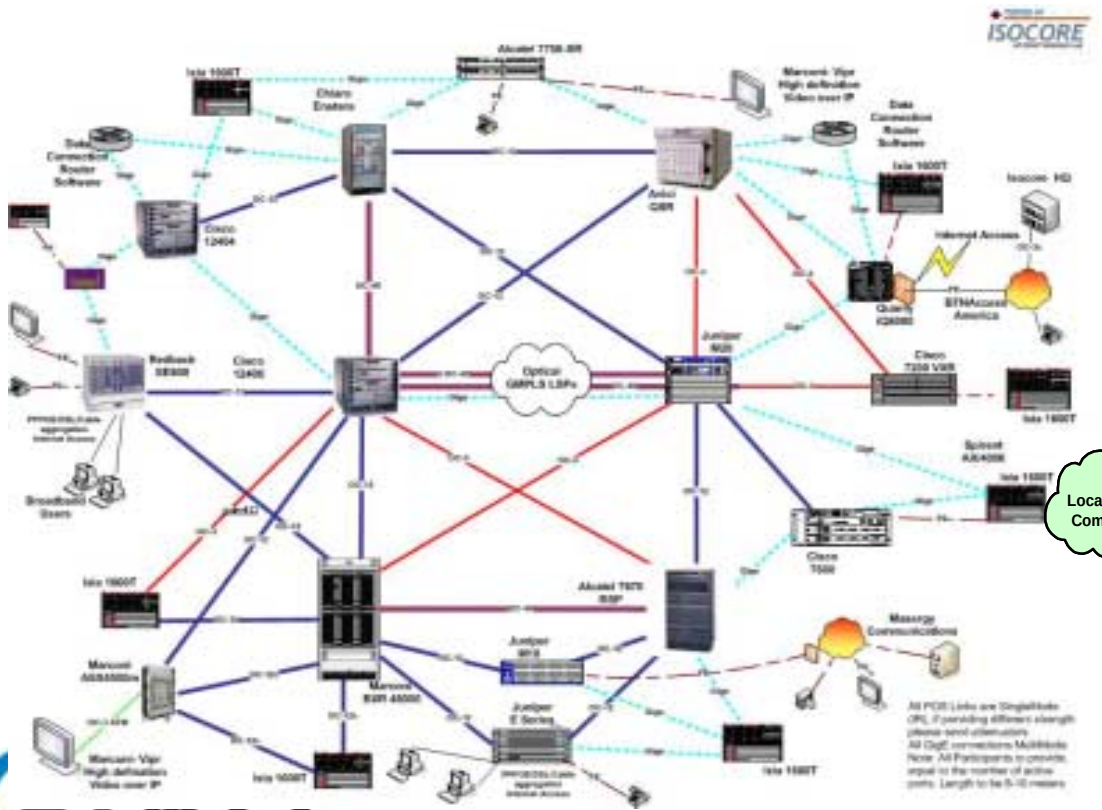
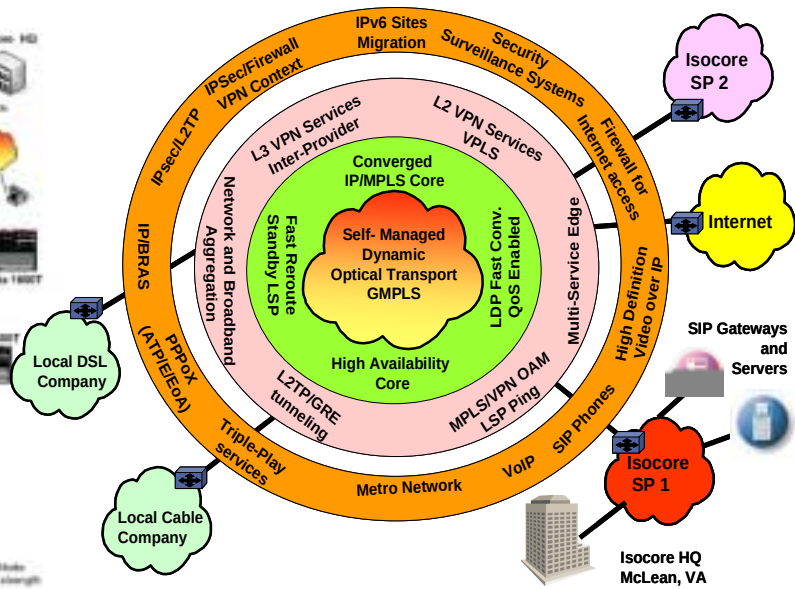
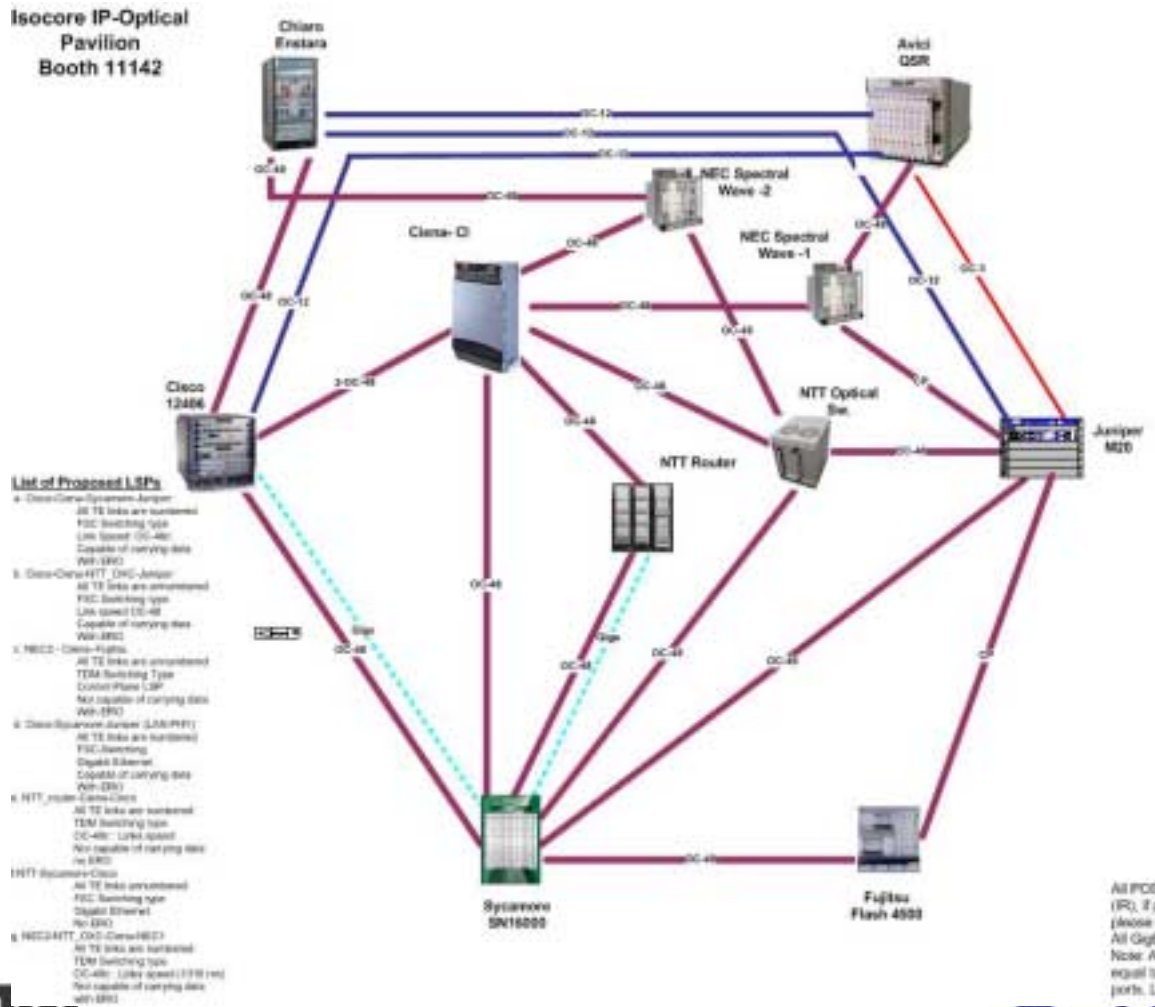
IP/MPLS Network topology & showcase concept





Optical – GMPLS Network



Brief Overview of the IP-Optical Network Status – GMPLS Optical Network

- **Optical Dynamic GMPLS LSPs established using OC-48 Links**
- **Isocore Internetworking Lab devised a multi-layered network topology encompassing all kind of devices in the OTN (Optical Transport Network)**
  - **FSC, L2SC, TDM, LSC**
- **LSP paths spanning across multi-layered network were defined**
- **LSPs established in the optical domain are used as forwarding adjacencies in the IP domain**
- **G-LSPs are setup across multiple type of Physical interfaces including OC-48, GigE, and OC-12**

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Findings (Summary)

- **Control plane**
  - **Native ethernet or IP tunnel (GRE, IP in IP, etc)**
  - **Associated/Non-associated topology**
- **Addressing**
  - **Numbered/unnumbered TE link**
  - **Numbered C-plane**
  - **Router ID (SHOULD be loopback addres)**
- **RSVP-TE**
  - **ERO/RRO**
  - **HOP**
  - **Label**
  - **Router Alert Option**
- **OSPF-TE**
  - **Router Address TLV (=Router ID) SHOULD be routable, i.e., loop-back address**
  - **Link TLV**
- **See also <draft-shiomoto-control-plane-architecture>**

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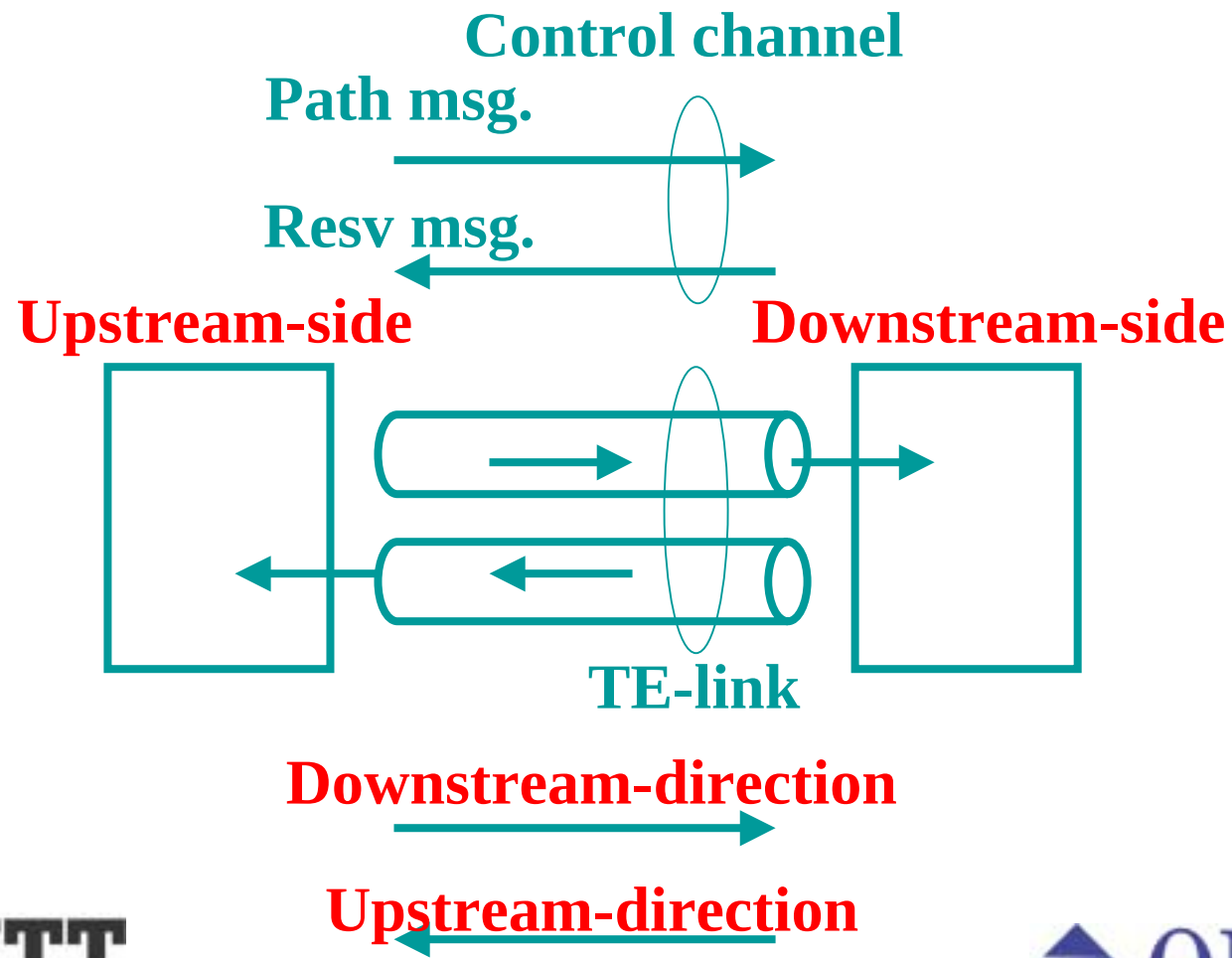
Findings (RSVP)

- ERO
  - Numbered/unnumbered
    - MUST accept numbered TE-link
    - MUST accept unnumbered TE-link (RFC3477)
    - MUST accept numbered and unnumbered TE-link in the same message
  - Upstream/downstream-side
    - SHOULD send the upstream-side Id of the TE-link
    - MUST accept either upstream-side or downstream-side Id of the TE-link
- RRO
  - See ERO
- HOP
  - Loop-back address/interface address
    - Next/Previous Hop Address
      - SHOULD be the Loop-back address of the sender.
      - MAY be the interface address of the sender, from which the RSVP message is sent out.
    - Interface_ID (type 1: IPv4)
      - See Next/Previous Hop Address
    - Interface_ID (type 3:IF_index)
    - Interface_ID (type 4:Component IF downstream)
    - Interface_ID (type 5:Component IF upstream)
      - For IP address, see Next/Previous Hop Address
- Label

Reference model for signaling terminology



After Supercomm 2004

- **MPLS 2004 public demo (www.mpls2004.com)**
  - **Date: October 20, 2004**
  - **Items:**
    - **MPLS to GMPLS migration strategies**
    - **Constraint shortest path (CSPF) algorithms**
    - **Dynamic GMPLS label switch paths**
    - **GMPLS-OIF UNI interworking**
  - **Vendors:**
    - **Alcatel, Avici Systems, Chiaro Networks, Cisco Systems, Ciena, Extreme Networks, Fujitsu, Foundry Networks, Ixia, Juniper Networks, Marconi, Movaz Networks, MRV Communications, Navtel Communications, NTT, Quarry Technologies, Redback Networks, Spirent Communications, Sycamore Networks and Tellabs**
- **iPOP2005 showcase**
  - **Date: February 21-22, 2005**

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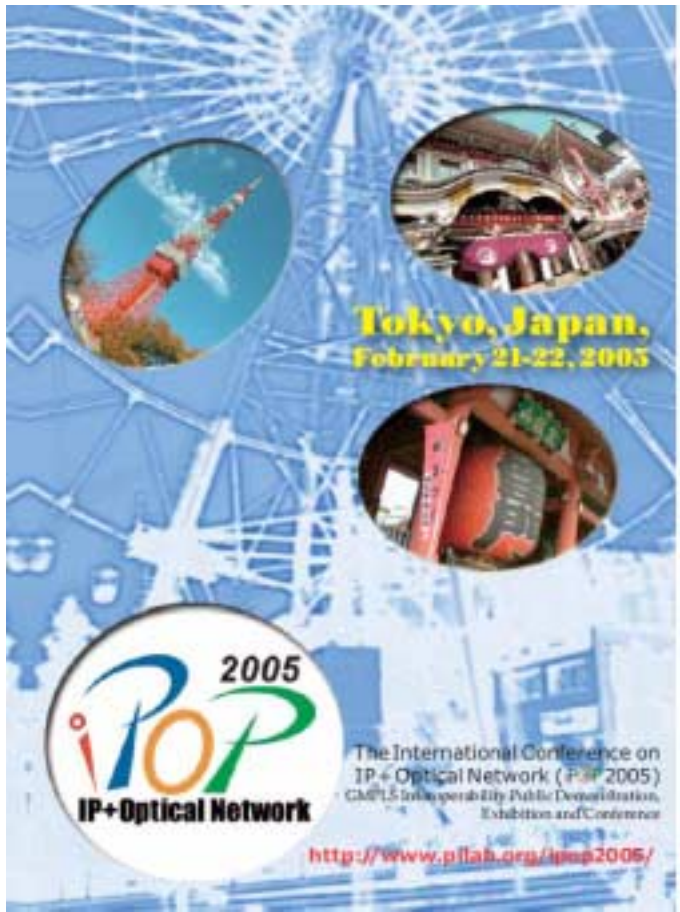
iPOP2005
International Conference on IP + Optical Network
http://www.pilab.org/ipop2005/

- **Date: February 21-22, 2005**
- **Venue: Tokyo Fashion Town (TFT) Hall, Tokyo, Japan**
- **Sponsors: PIL(Photonic Internet Lab), ISOCORE, and PIF (Photonic Internet Forum)**
- **CALL FOR PRESENTATINOS**
  - **Technical area: Field trial report, operators requirements, international standards, inter-operability experiment, new services, multi-region/multi-layer, P&R, Protocol design, experiment, theory, implementation, and operational experiences are solicited.**
  - **Submission Deadline is November 15 (EXTENDED)**
- **CALL FOR SHOWCASE EXIBITOR PROPOSALS**
  - **Showcase inter operability demonstration for the leading-edge technologies**
    - **Technical area (TBD): multi-region/multi-layer network, P&R, Layer-one VPN, etc.**
- **Audience: over 200 attendees, network operators, service providers, and equipment vendors are anticipated**



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INTERNETWORKING FORUM