

# Optical Internetworking Forum

## World Interoperability Tests and Demonstrations

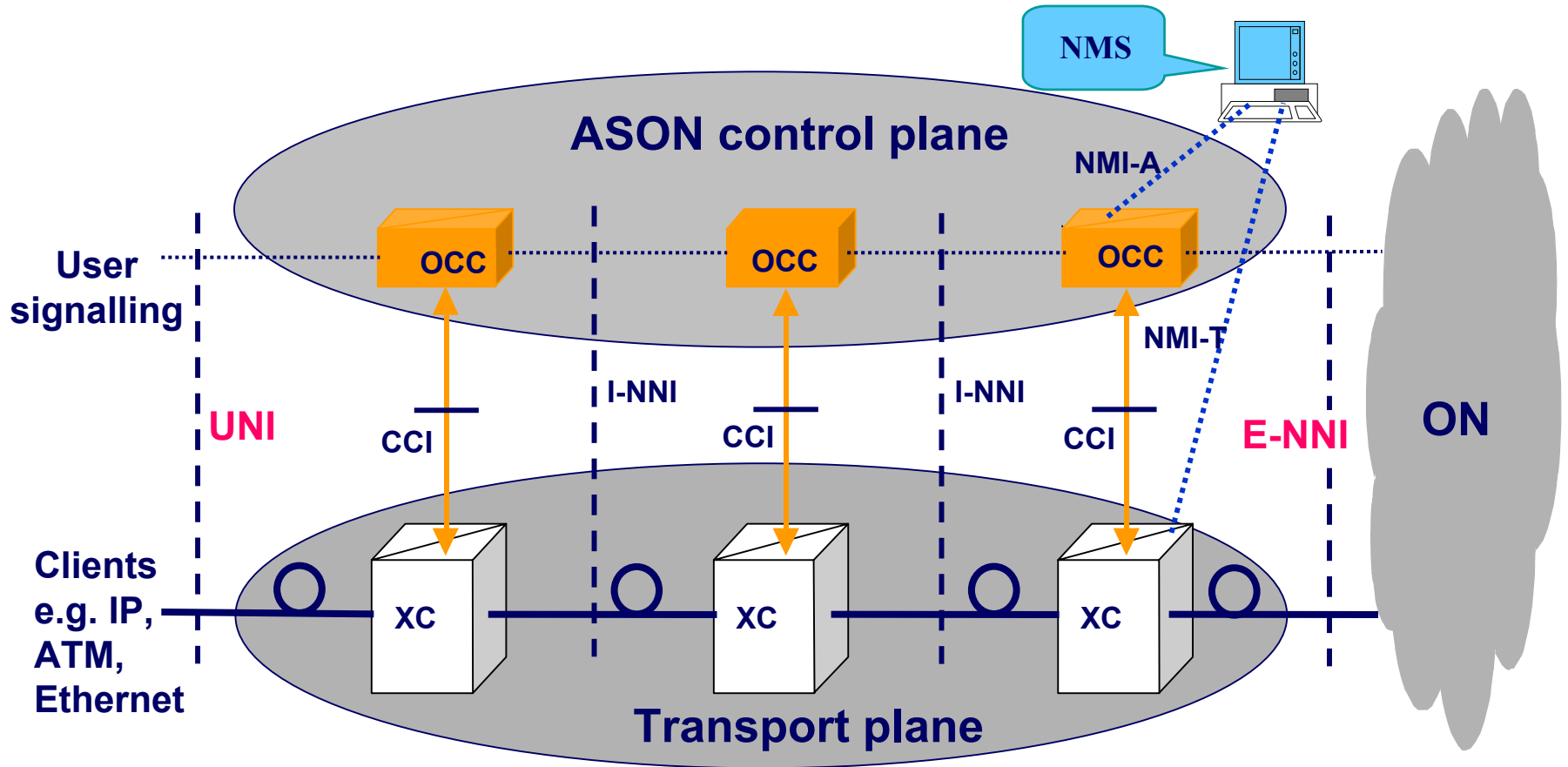
**Hans-Martin Foisel**  
**T-Systems/Deutsche Telekom**  
**OIF Carrier WG Chair**

# Optical Internetworking Forum - OIF

- ◆ Launched in April 1998 to foster development of low-cost scaleable internet using optical technology
- ◆ The only industry group bringing together professionals from the data and optical communities
- ◆ Open forum: 120+ member companies
  - Carriers
  - Component and systems vendors
  - Testing and software companies
- ◆ Mission: To foster the development and deployment of **interoperable products and services** for data switching and routing using optical networking technologies
- ◆ OIF website: [www.oiforum.com](http://www.oiforum.com)

# ITU-T ASON Architecture – G.8080

## Control Plane Interfaces: UNI, NNI

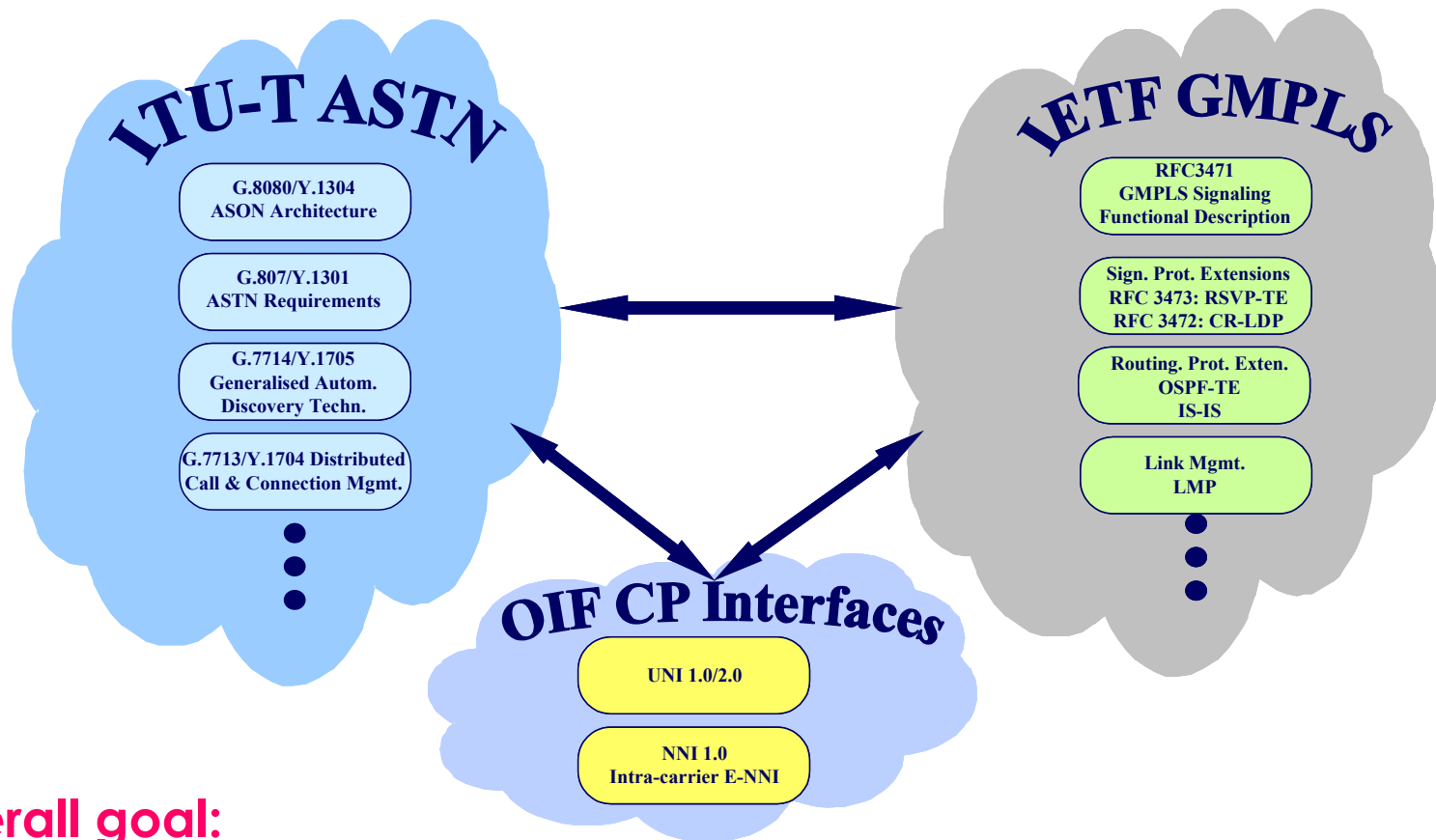


OCC: Optical Connection Controller  
 CCI: Connection Control Interface  
 NMI: Network Management Interface  
 NMS: Network Management System

I-NNI: Internal Network-Network Interface  
 E-NNI: External Network-Network Interface  
 UNI: User Network Interface

# ASON/GMPLS Standards Bodies & Forums

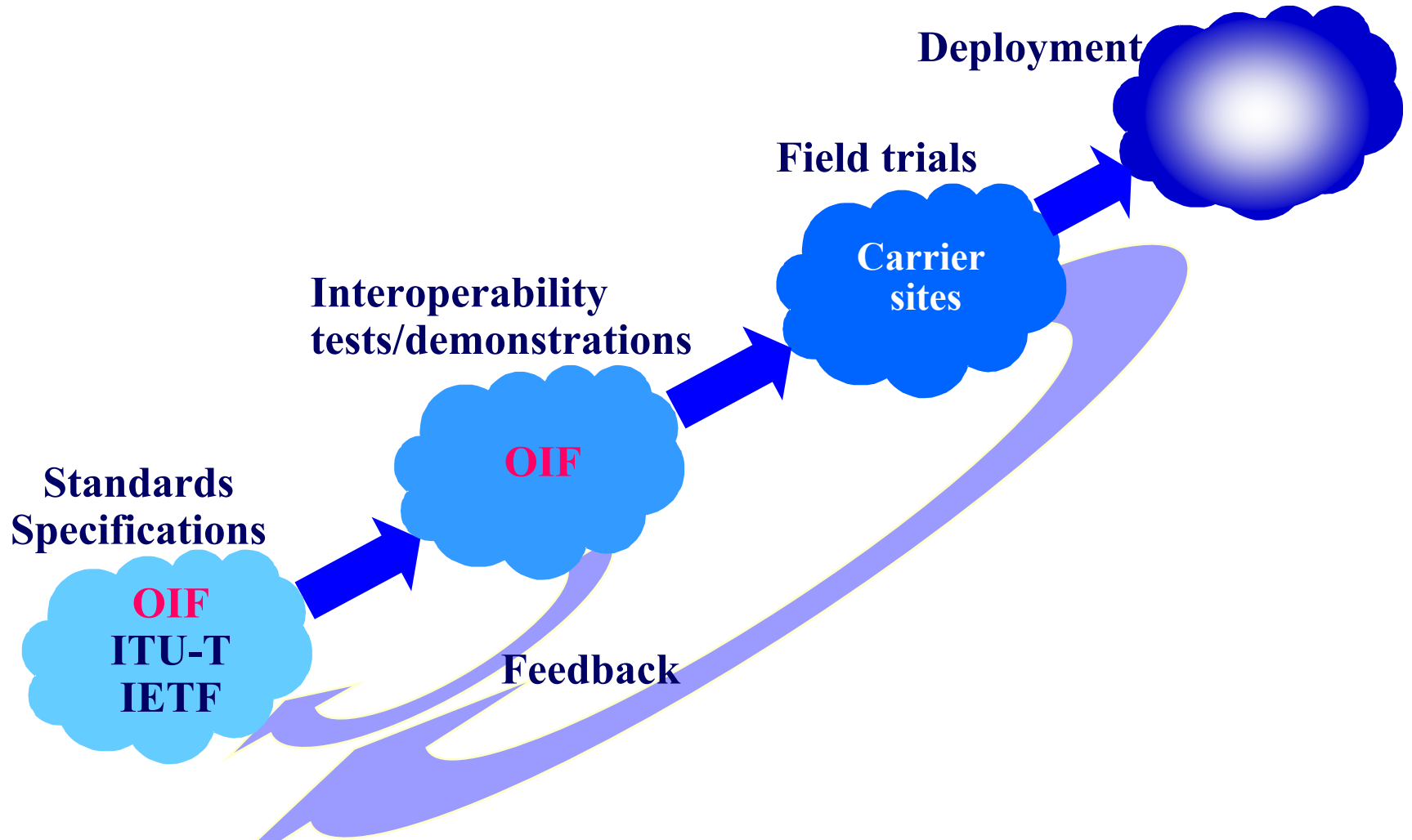
## Organisations Involved in Specifying fast Configurable TN



**Overall goal:**

**Complete one interoperable, harmonized set of ASON/GMPLS standards and specification to foster the deployment of control plane enabled networks**

# Control Plane Evolution Path From Standards to Deployment



# OIF World Interoperability Tests 2004

## Interoperability areas

### Most efficient data over SDH transport:

Ethernet-over-SDH/SONET adaptation, based on ITU-T Rec.:

- ◆ G.7041: Generic framing procedure (GFP)
- ◆ G.707: Network Node Interface for SDH; virtual concatenation (VCAT)
- ◆ G.7042: Link capacity adjustment scheme (LCAS)

### Fast connection provisioning, initiated by clients:

Switched connections setup by using UNI 1.0 R2 based on OIF IA:

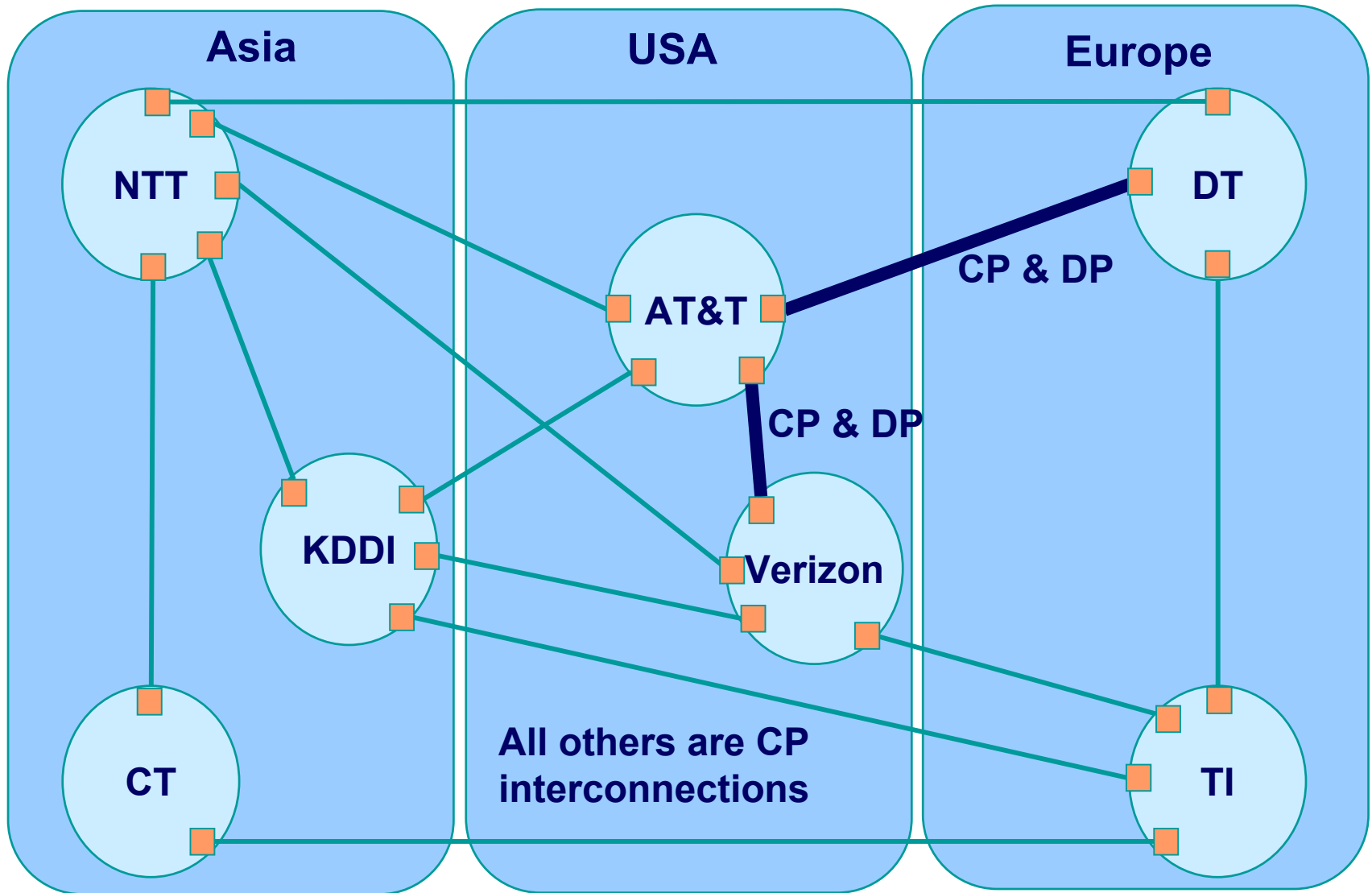
- ◆ 2003.248.05: UNI 1.0 signaling specification, R2
- ◆ 2003.249.09: RSVP extensions for UNI 1.0 signalling, R2

### Fast multi-domain connection provisioning:

Soft permanent and switched connection setup over multiple network domains by using E-NNI signalling and routing, based on:

- ◆ 2003.179.08/IA: OIF intra-carrier E-NNI signalling specification
- ◆ 2003.259.02/Draft: Specification for intra-carrier E-NNI routing using OSPF

# Topology of the OIF Worldwide Test Bed



# OIF World Interoperability Tests 2004

## Participants

### Carriers

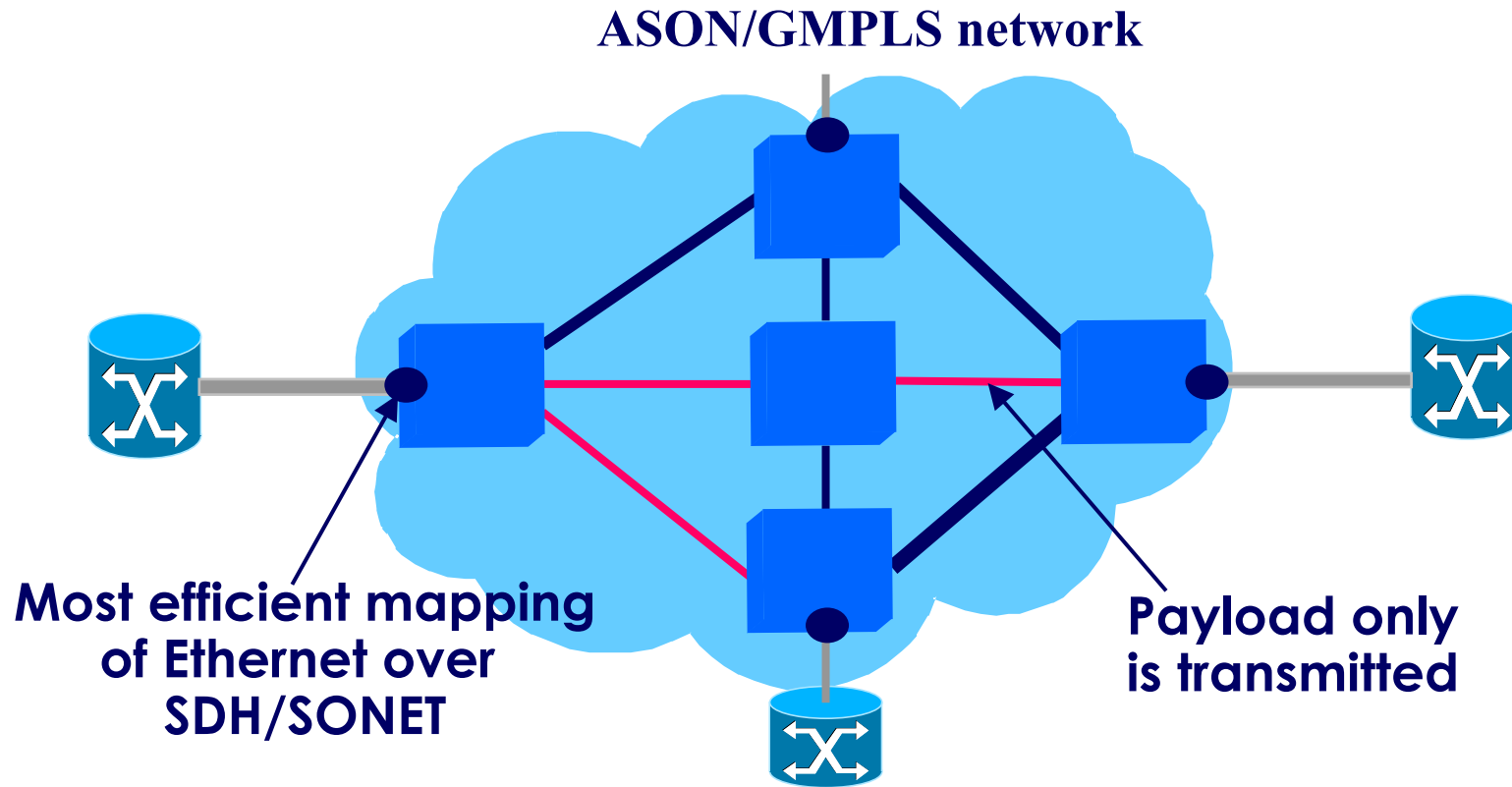
- ◆ **North America:** AT&T, Verizon
- ◆ **Asia:** China Telecom, KDDI, NTT
- ◆ **Europe:** Telecom Italia, Deutsche Telekom

### Vendors

- ◆ **Transport network elements:**
  - Alcatel, ADVA, CIENA, Cisco, Fujitsu, Lucent, Marconi, NEC, Nortel, Siemens, Sycamore, Tellabs, Turin Networks, Mahi Networks
- ◆ **Client network elements:**
  - Avici, Cisco, Tellabs

# Reference Network for Ethernet over SDH/SONET Adaptation Interoperability Tests

Based on ITU-T Standards



# OIF World Interoperability Tests 2004

## Tests for Ethernet Adaptation: GFP-F, VCAT, LCAS

#	Test cases
1	Partial bandwidth (B), FE over STS-1/VC-3
2	Full B, FE over STS-1-2v/VC-3-2v
3	Full B, GE over STS-1-21v/VC-3-21v
4	Partial B, GE over STS-1-3v/VC-3-3v
5	Partial B, FE over STS-1-Xv/VC-3-Xv, LCAS
6	Partial B, GE over STS-1-Xv/VC-3-Xv, LCAS
7	Full B, FE over STS-3c/VC-4
8	Full B, GE over STS-3c-7v/VC-4-7v
9	Partial B, GE over STS-3c-1v/VC-4-1v
10	Partial B, GE over STS-3c-Xv/VC-4-Xv, LCAS



# OIF World Interoperability Tests 2004

## Tests for Ethernet Adaptation over SDH/SONET

### Participating carrier labs:

- ◆ **North America:** AT&T, Verizon
- ◆ **Europe:** Telecom Italia, Deutsche Telekom

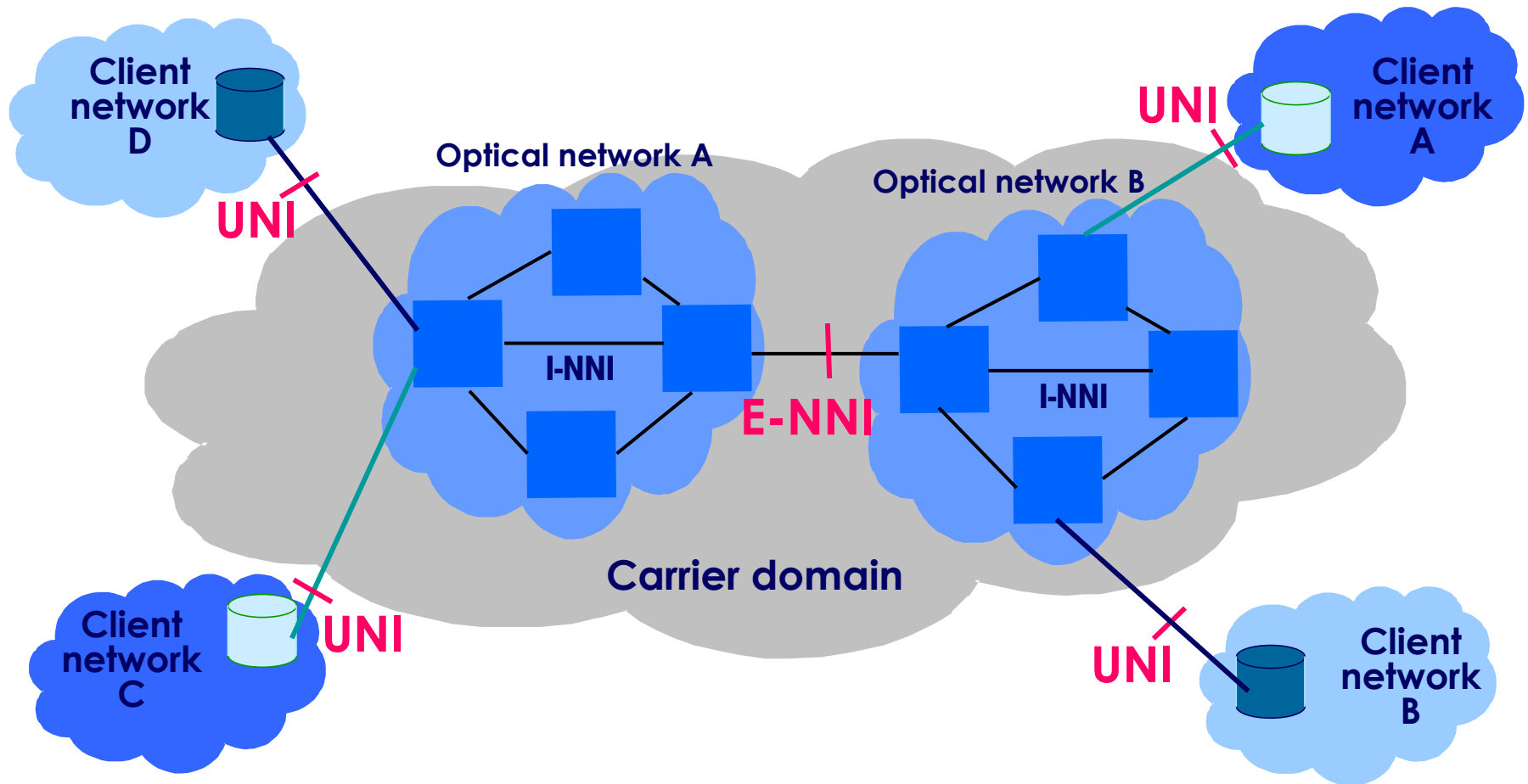
**Local tests:** Were carried out first, covering mostly a subset of the test list

- **Example:** Within DT tests 8. – 10. were carried out, based on GE interfaces and VC-4 switching granularity

**Global tests:** Were carried out between the labs of Verizon, AT&T and Deutsche Telekom

**All participants passed these world wide interoperability tests, show clearly that actual, standard compliant implementations are really interoperable, even on global scale**

# Reference Network for Control Plane Interfaces (UNI, E-NNI) Interoperability Tests Based on OIF Implementation Agreements



# OIF World Interoperability Tests 2004

## Tests for Control Plane Interfaces: UNI, E-NNI

#	Test case	UNI-C	UNI-N	E-NNI
1	Basic routing functionality	-	-	X
2	Routing functionality for virtual links	-	-	X
3	Connection initiated by UNI	X	X	-
4	Dual-domain connection initiated by EMS	-	-	X
5	Dual-domain connection initiated by UNI	X	X	X
6	Multi-domain connection initiated by UNI	X	X	X



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# Example of Local Tests Network

## Deutsche Telekom Lab in Berlin



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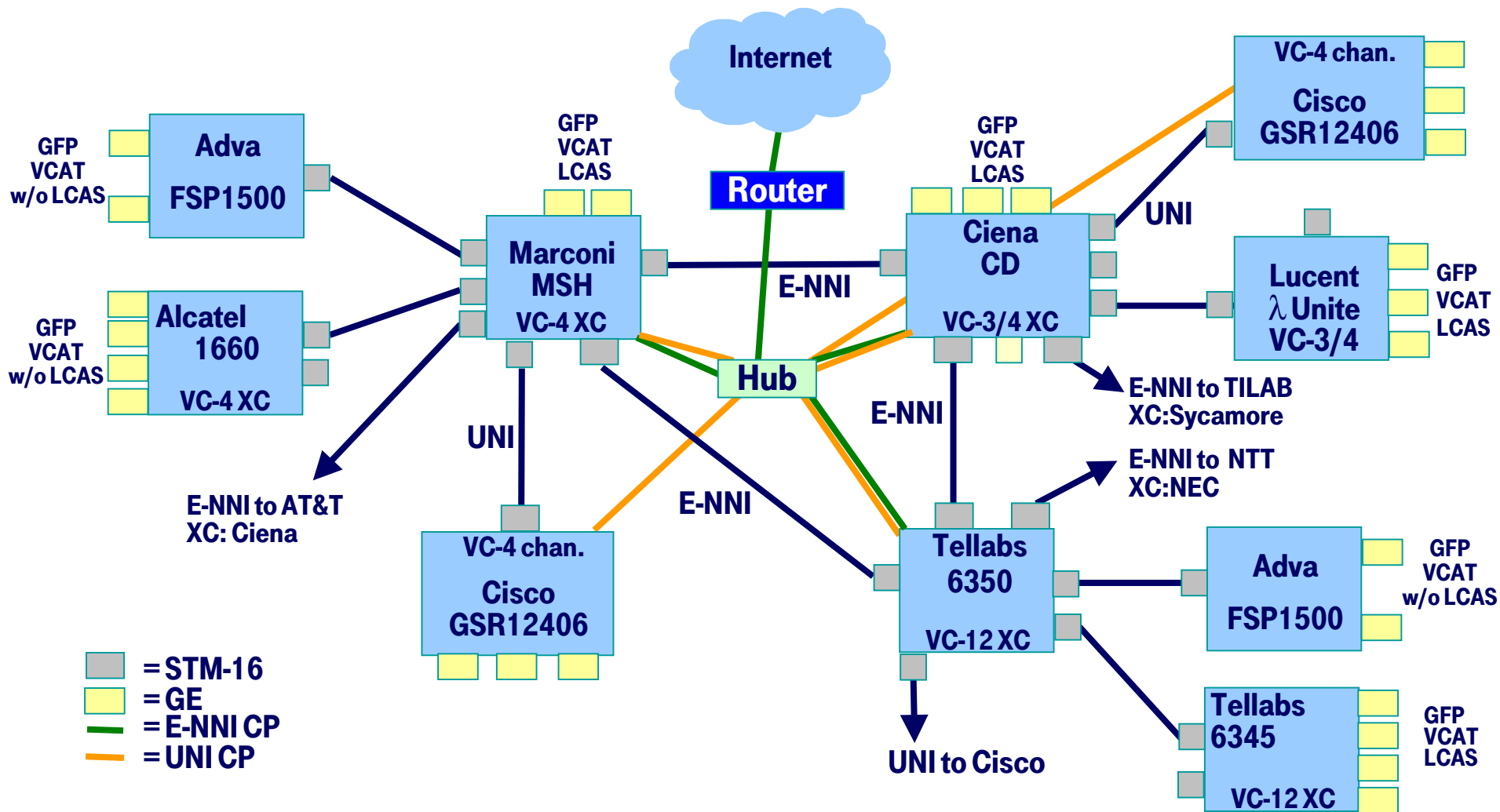
# OIF World Interoperability Tests 2004

## Interop Test Partners at DT's Lab in Berlin

<b>Vendor</b>	<b>Network function</b>
<b>Ciena</b>	<b>UNI(N) 1.0R2, E-NNI, GFP-F</b>
<b>Tellabs</b>	<b>UNI(N) 1.0R2, E-NNI, GFP-F</b>
<b>Marconi</b>	<b>UNI(N) 1.0R2, E-NNI, GFP-F</b>
<b>Cisco</b>	<b>UNI(C) 1.0R2</b>
<b>Alcatel</b>	<b>GFP-F</b>
<b>Lucent</b>	<b>GFP-F</b>
<b>ADVA</b>	<b>GFP-F</b>

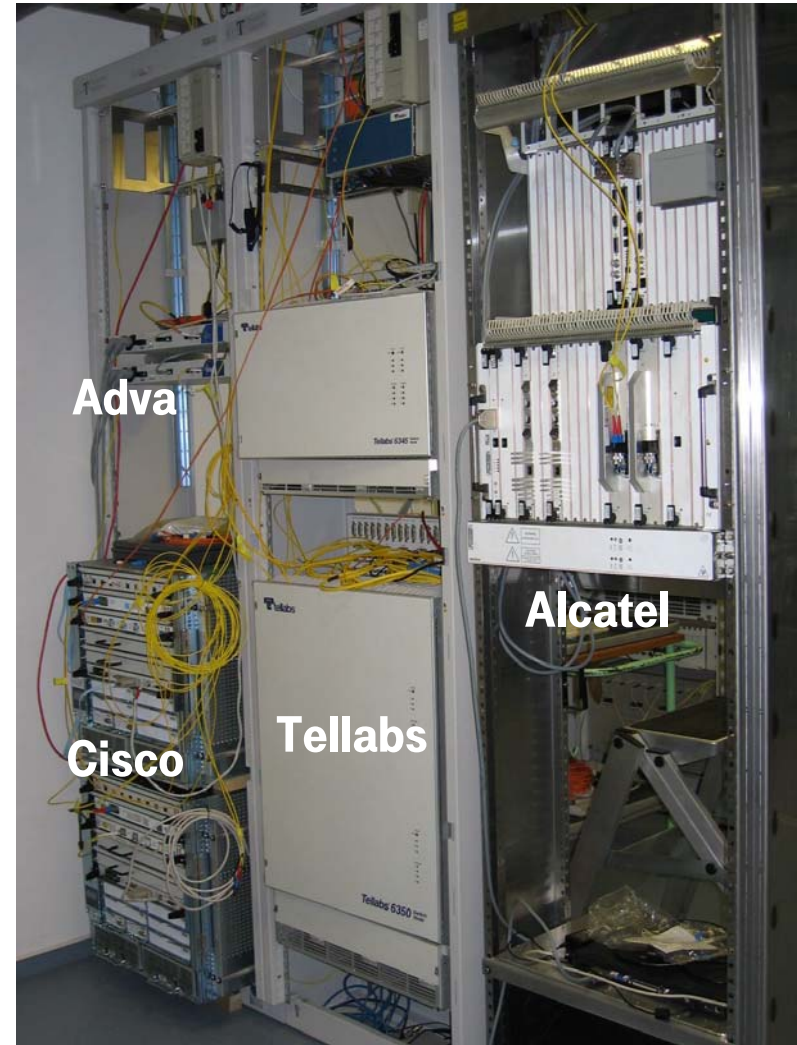
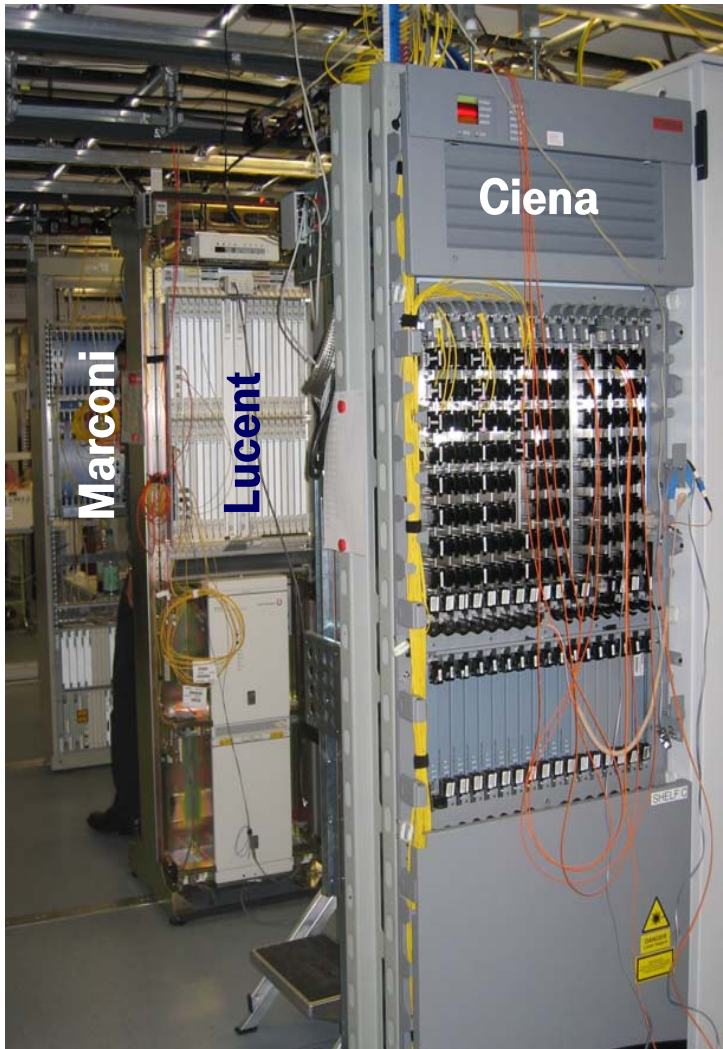
# OIF World Interoperability Tests 2004

## Detailed Network Topology in DT's Lab in Berlin



# OIF World Interoperability Tests 2004

## Berlin Atrium Lab View





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**WORLD  
INTEROPERABILITY  
DEMO**

**SUPERCOMM 2004**

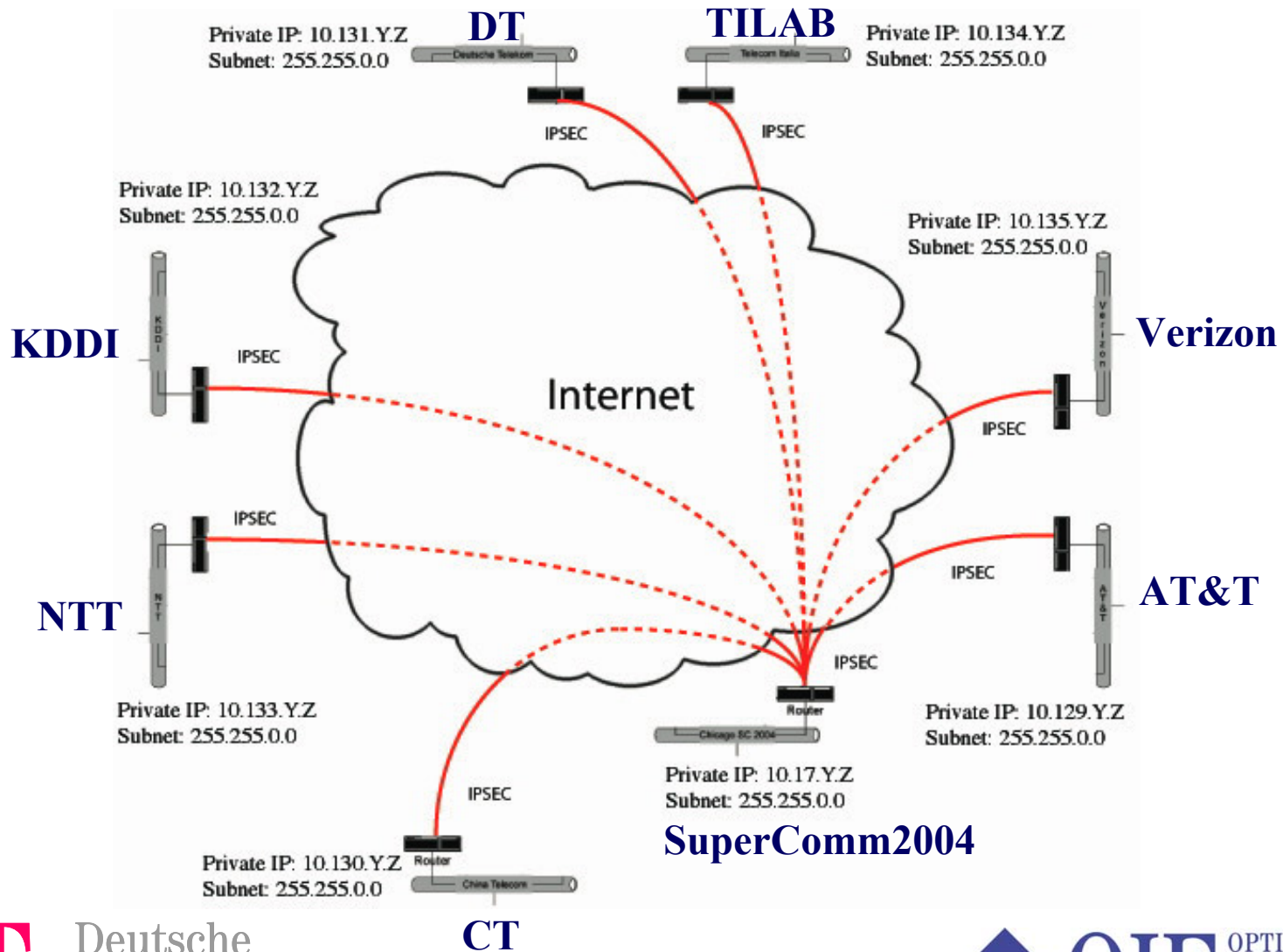
**Chicago**

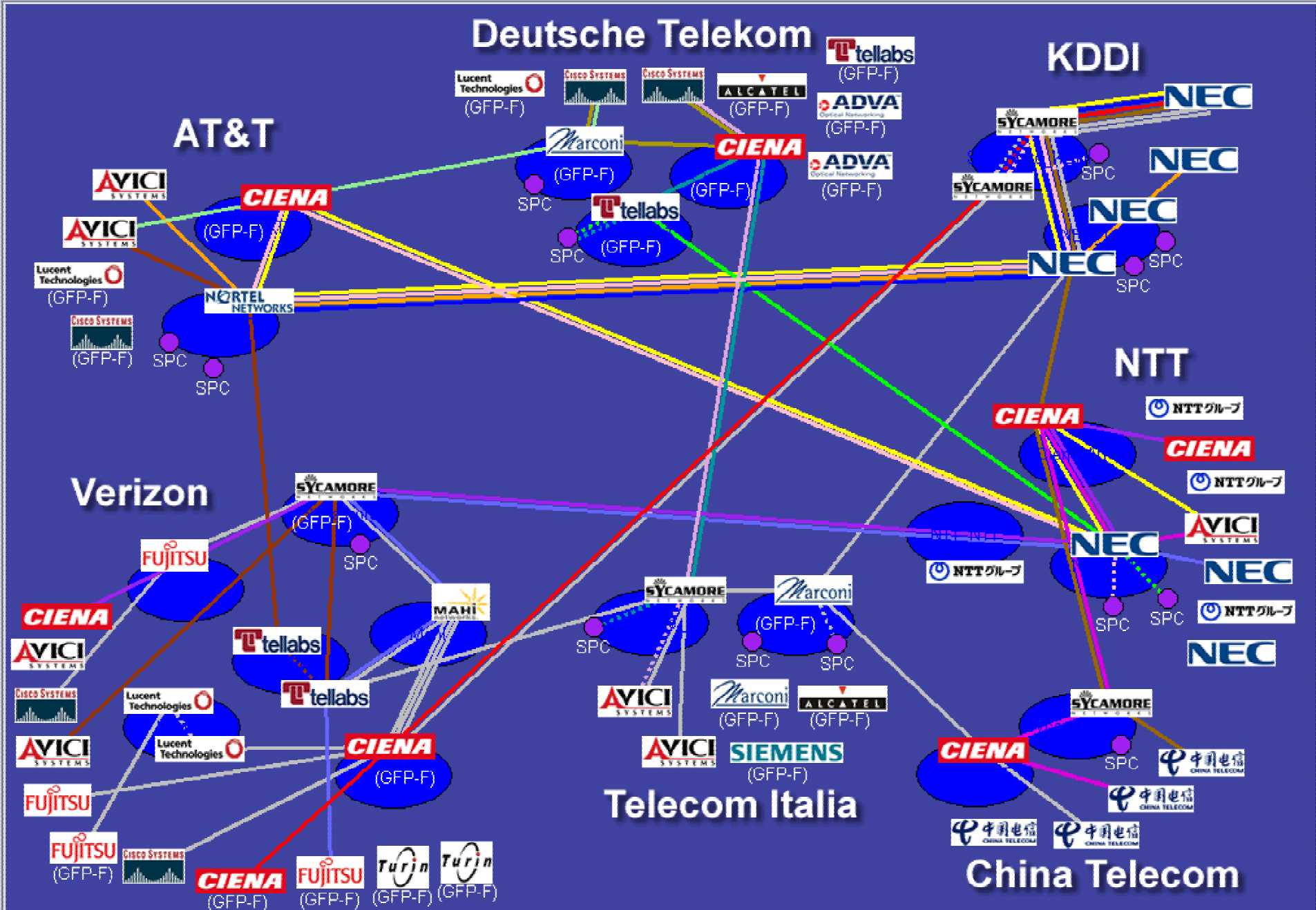
[http://www.oiforum.com/public/supercomm\\_2004.html](http://www.oiforum.com/public/supercomm_2004.html)

**T** Deutsche  
Telekom

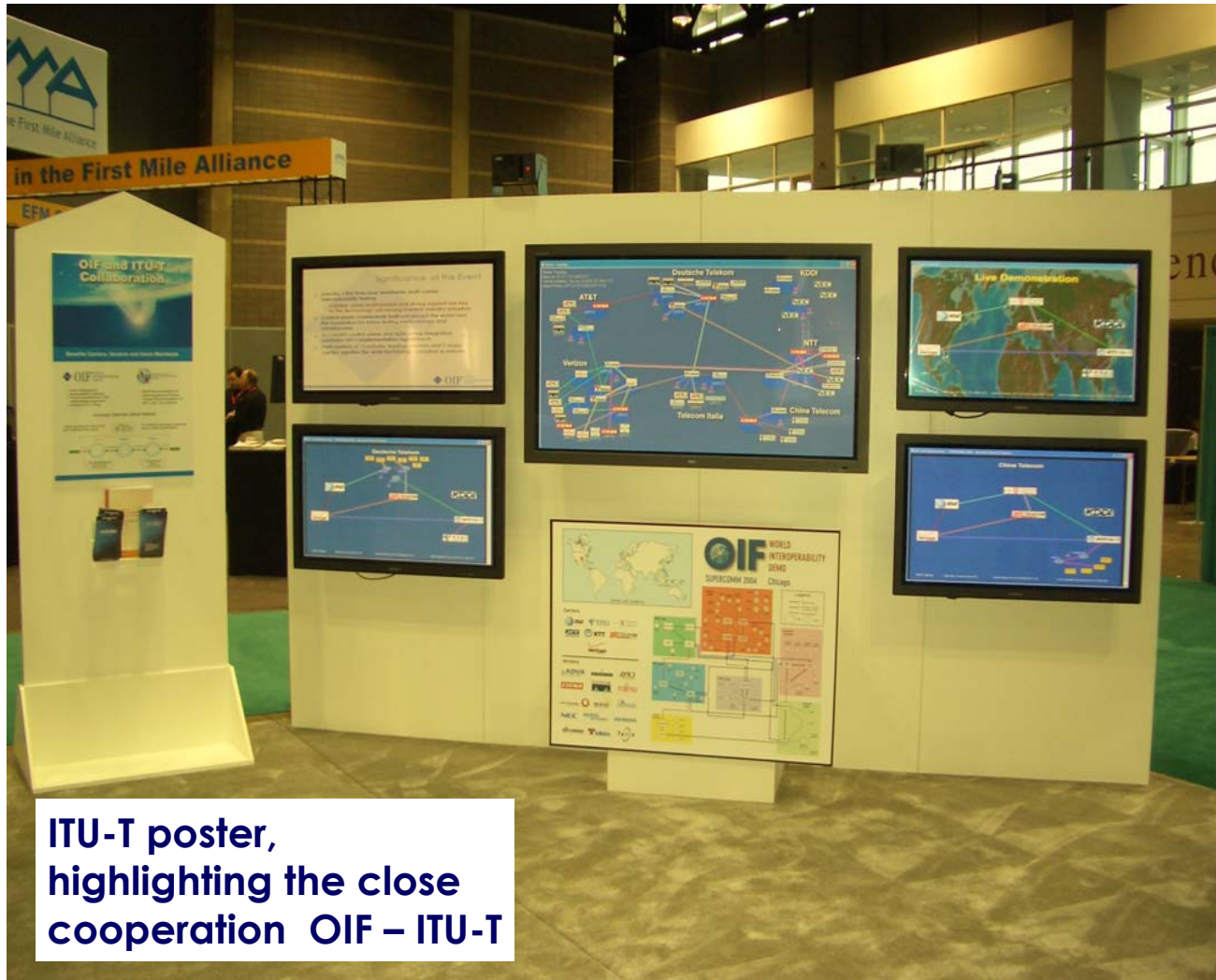
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# OIF SuperComm Booth Interconnections Signaling Network for Test Network Topology Display





# OIF SuperComm Booth Test Network Topology Displays



ITU-T poster,  
highlighting the close  
cooperation OIF – ITU-T



Deutsche  
Telekom



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# OIF World Interoperability Tests 2004 Summary

- ◆ **All participants successfully carried out these world wide interoperability tests!!!**
- ◆ **This joint effort of vendors and carriers, covering activity areas of the ITU-T, IETF and OIF, manifest globally the strong request for an interoperable, harmonized set of ASON/GMPLS standards and specifications.**

# OIF World Interoperability Tests 2004 Acknowledgements

**These results are based on a joint effort of all OIF interoperability test partners, vendors and carriers, support teams, colleagues and the OIF staff**



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