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ABSTRACT: This is a copy of the presentation made at the OIF meeting in Tampa, Florida on 1/31/2001 related to Contribution OIF2001.067 on "Proposal to form a Project on Architectures and Signaling for Configurable All-Optical Networks." At the meeting, no formal motion was made to form a project. This is currently planned for the next OIF meeting after some fine-tuning. Meanwhile, contributions in this area are solicited.

Proposal to form a "Project" on Architectures and Signaling for Configurable All-Optical Networks

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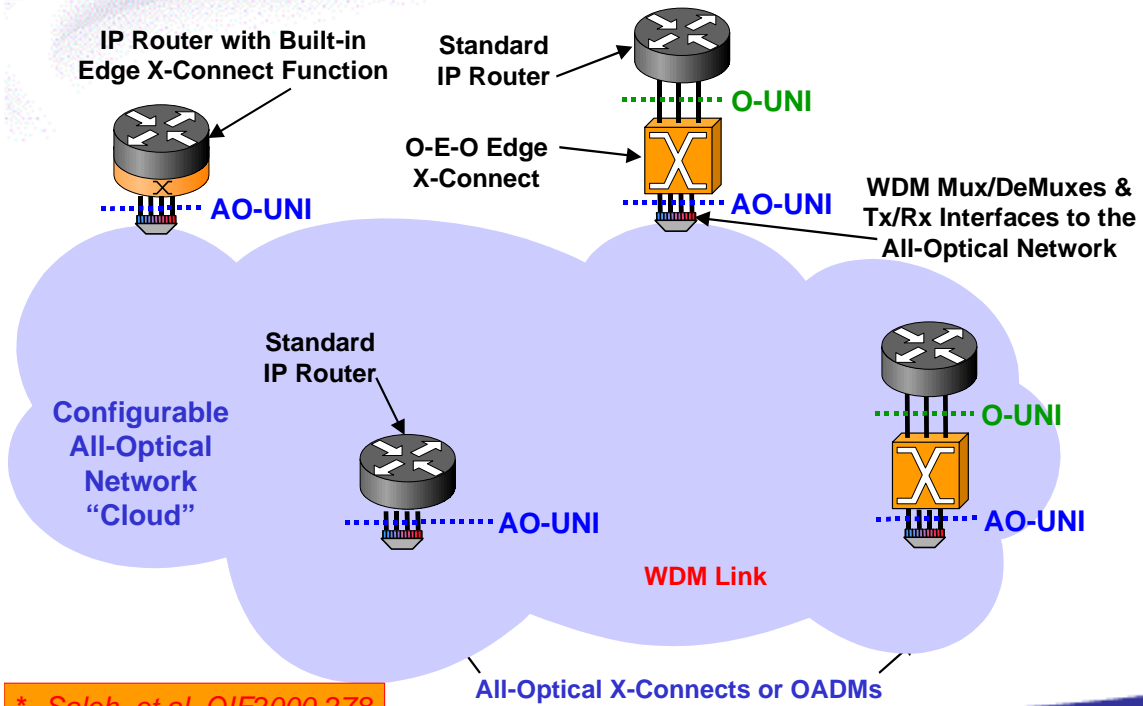
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Abstract / Motivation

Long-reach optics and configurable all-optical networks provide economic benefits for carriers in terms of both capital and operating expenses by significantly reducing the amount of equipment required in the network. Such networks are currently entering the marketplace, and there is a desire in the OIF and other standards organizations to generalize their respective architectural models to include all-optical networks. This contribution is a proposal for initiating a new project in the OIF to address the specific features of all-optical networks as they relate to signaling for automatic provisioning and restoration of optical paths. Since an all-optical network naturally forms a domain, another important aspect of this project relates to the more general problem of establishing connections across multi-domain networks.

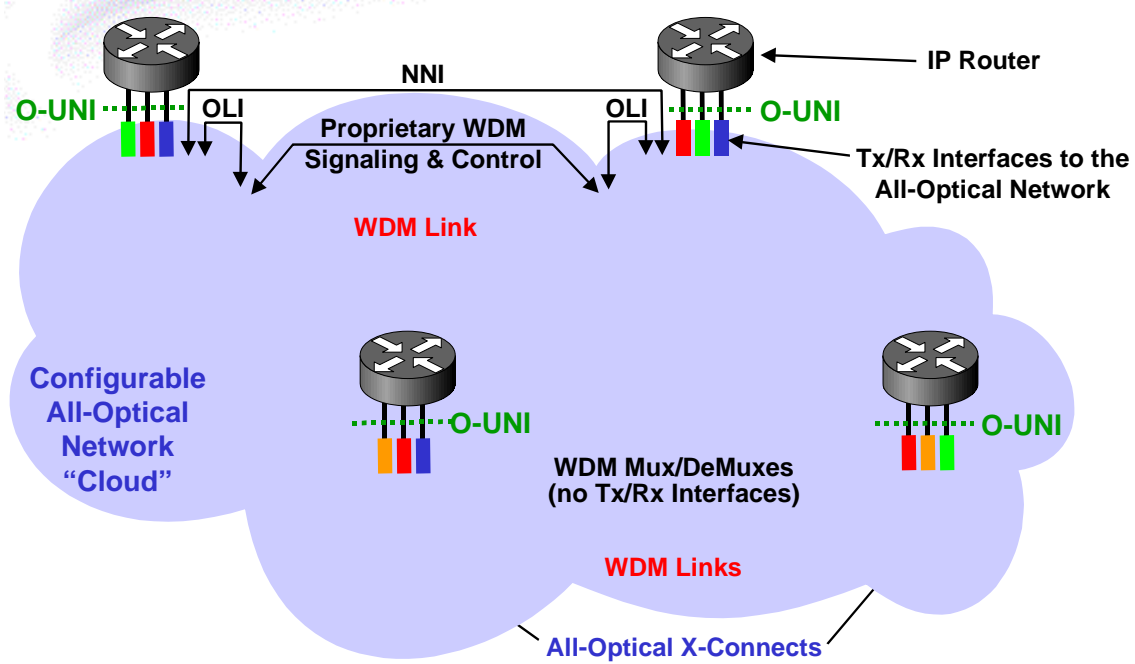# High-Level Reference Model for the Current UNI

IP Router *

Optical UNI (**O-UNI**)

O-UNI

WDM Point-to-Point Link

Core O-E-O X-Connect with Full- or Sub-λ Granularity

O-E-O WDM Tx/Rx Interfaces

O-UNI
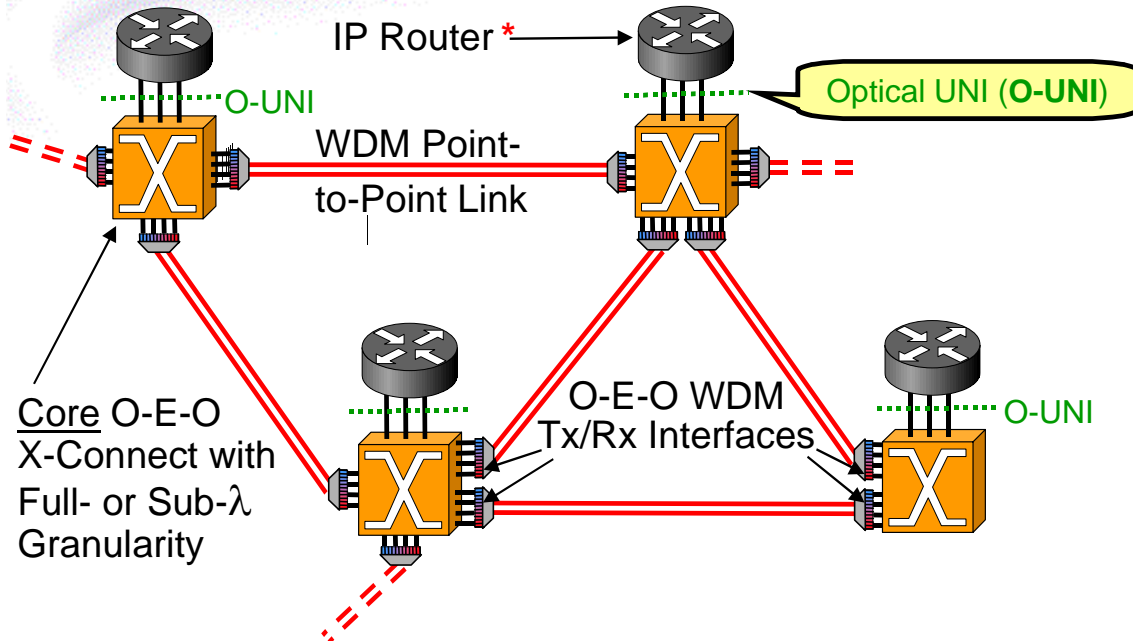
* *Can also be ATM switch, SONET/SDH multiplexer, etc.*

All-Optical Network Reference Model 1*

IP Router with Built-in Edge X-Connect Function

Standard IP Router

O-E-O Edge X-Connect

O-UNI

AO-UNI

AO-UNI

WDM Mux/DeMuxes & Tx/Rx Interfaces to the All-Optical Network

Standard IP Router

Configurable All-Optical Network "Cloud"

AO-UNI

O-UNI

AO-UNI

WDM Link

All-Optical X-Connects or OADMs

* *Saleh, et al, OIF2000.278*

All-Optical Network Reference Model 2*

NNI

IP Router

O-UNI   OLI

OLI   O-UNI

Proprietary WDM Signaling & Control

Tx/Rx Interfaces to the All-Optical Network

WDM Link

Configurable All-Optical Network "Cloud"

O-UNI

O-UNI

WDM Mux/DeMuxes (no Tx/Rx Interfaces)

WDM Links

All-Optical X-Connects

* *Drake, et al, OIF2000.254 and Chiu, et al, OIF2000.251*

Optical Bypass, Optical Reach and Regeneration
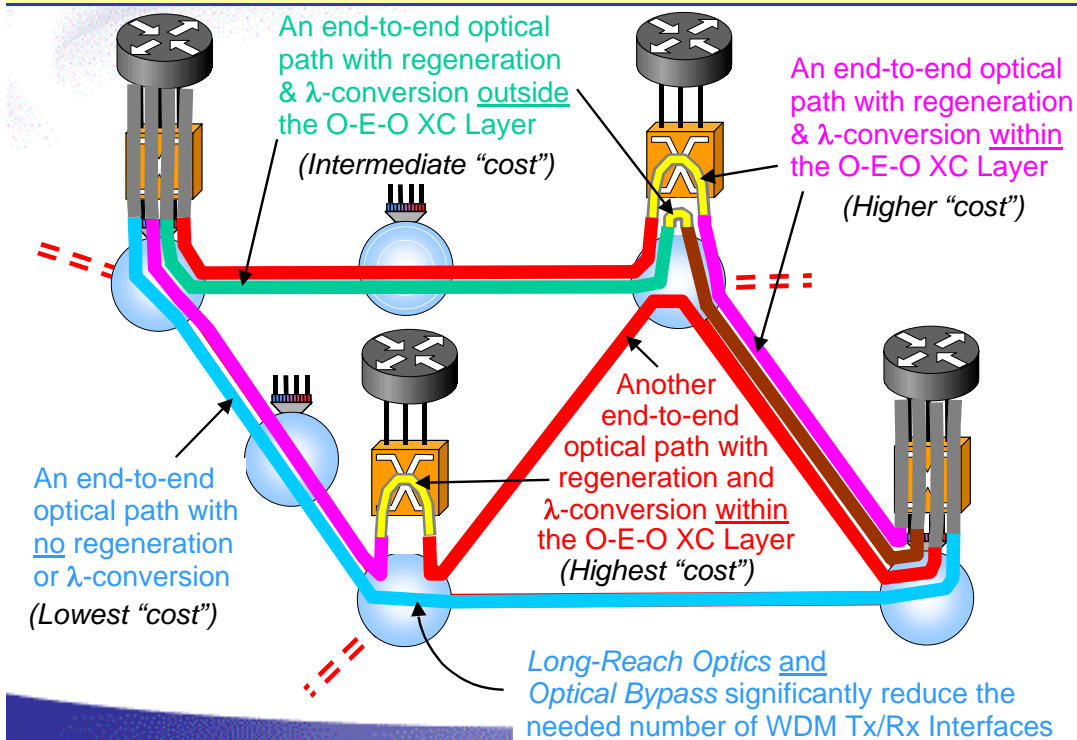
An end-to-end optical path with regeneration & λ-conversion <u>outside</u> the O-E-O XC Layer
(Intermediate "cost")

An end-to-end optical path with regeneration & λ-conversion <u>within</u> the O-E-O XC Layer
(Higher "cost")

Another end-to-end optical path with regeneration and λ-conversion <u>within</u> the O-E-O XC Layer
(Highest "cost")

An end-to-end optical path with <u>no</u> regeneration or λ-conversion
(Lowest "cost")

Long-Reach Optics <u>and</u> Optical Bypass significantly reduce the needed number of WDM Tx/Rx Interfaces

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Some Benefits of a Configurable All-Optical Layer

- **In addition to saving WDM Tx/Rx Interfaces because of optical bypass, as indicated in the previous slide, ...**

- **A configurable All-Optical Layer, in effect, allows the sharing of cross-connect ports at the O-E-O layer, thus requiring smaller cross-connects, which enhances the scalability of the network**

- **An All-Optical Layer can more naturally provide useful optical services like optical *Multicasting* and *Waveband* X-Connection**

Forming an All-Optical "Project" within the OIF ?

- **Agree on one or more suitable reference models for a configurable all-optical network layer, *including:***
  - *Point-to-point links or rings with long-reach optics and configurable OADMs*
  - *All-optical mesh networks*

- **Develop all-optical extensions to UNI 1.0 (e.g., AO-UNI, UNI 2.0 ?)**
  - *Formalizing signaling to/from an all-optical layer for connection setup, etc.*
  - *Considering regeneration needs for paths longer than the optical reach*
  - *Including non-SONET/SDH services, e.g., GbE, 10G-E, OCh, etc.*
  - *Adding optical multicasting and waveband cross-connection applications*
  - *Assuring that the all-optical aspects are not lost among other UNI 2.0 tasks*

- **Consider hierarchical, two-tier networks, e.g., with the all-optical layer acting as an "express-highway" layer**

- **Treat the all-optical cloud as a domain in a multi-domain network**
  - *Assuring that the all-optical multi-domain aspects are not lost*