Proposal for Automated GOLE Pilot

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Defining automated GOLE Pilot

- Pilot is an operational project to bring automated provisioning to some GLIF exchange points
- Expect participants to make a [small] subset of GOLE resources available for a minimum of a year
- Pilot includes analyzing and deploying software for automating switching
- This includes finding applications that can use the pilot resources

Pilot Project Proposed Phases

Phase 1 [by spring GLIF]

Evaluate pilot requirements

- resources at Exchange points
- Automation software to use
- Policy requirements
- Potential users
- Connectivity to and between GOLES

Phase 2 [by next fall GLIF]

Implement

- Implement hardware and software at participating sites
- Connect to participating networks and debug
- Run demos over connection that use GOLES

Phase 3

Evaluate and report on pilot – determine next steps

[To be revised by project team]

Automated GOLE Pilot Goals

- Gain experience and understanding of how to support (the absence of) GOLE policy
- Get operational experience with automated switching software
- Provide input to standards work defining interface to switching – NSI-wg at OGF
- Learn to interface to existing networks providing end to end automated connections
- Do this with applications that demonstrate the power of this capability

Limited Automated GOLE Pilot

- Pilot proposal is for L2 only. If successful follow-on with other layers
- Pilot will protect "static" exchange resources from automating software
- Pilot will have web page to allow connections between GOLE ports and
- Pilot will connect to automated networks at both the transport and control level allowing e2e connections that include GOLE's and multiple networks
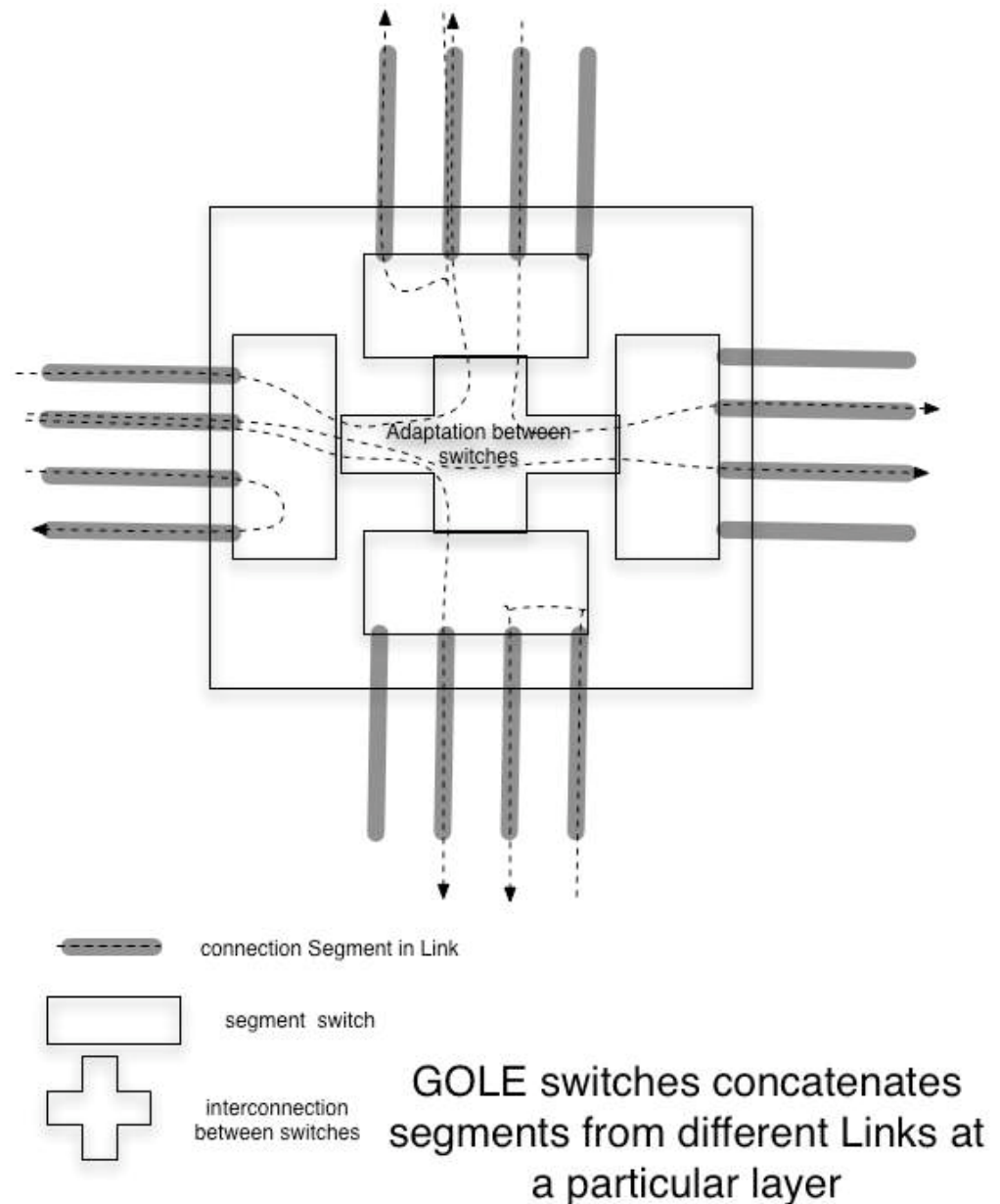
IDEAL GOLE

• Phase 3 and beyond

• Links attach to GOLES

• Links carry segments which can connect to segments from other links

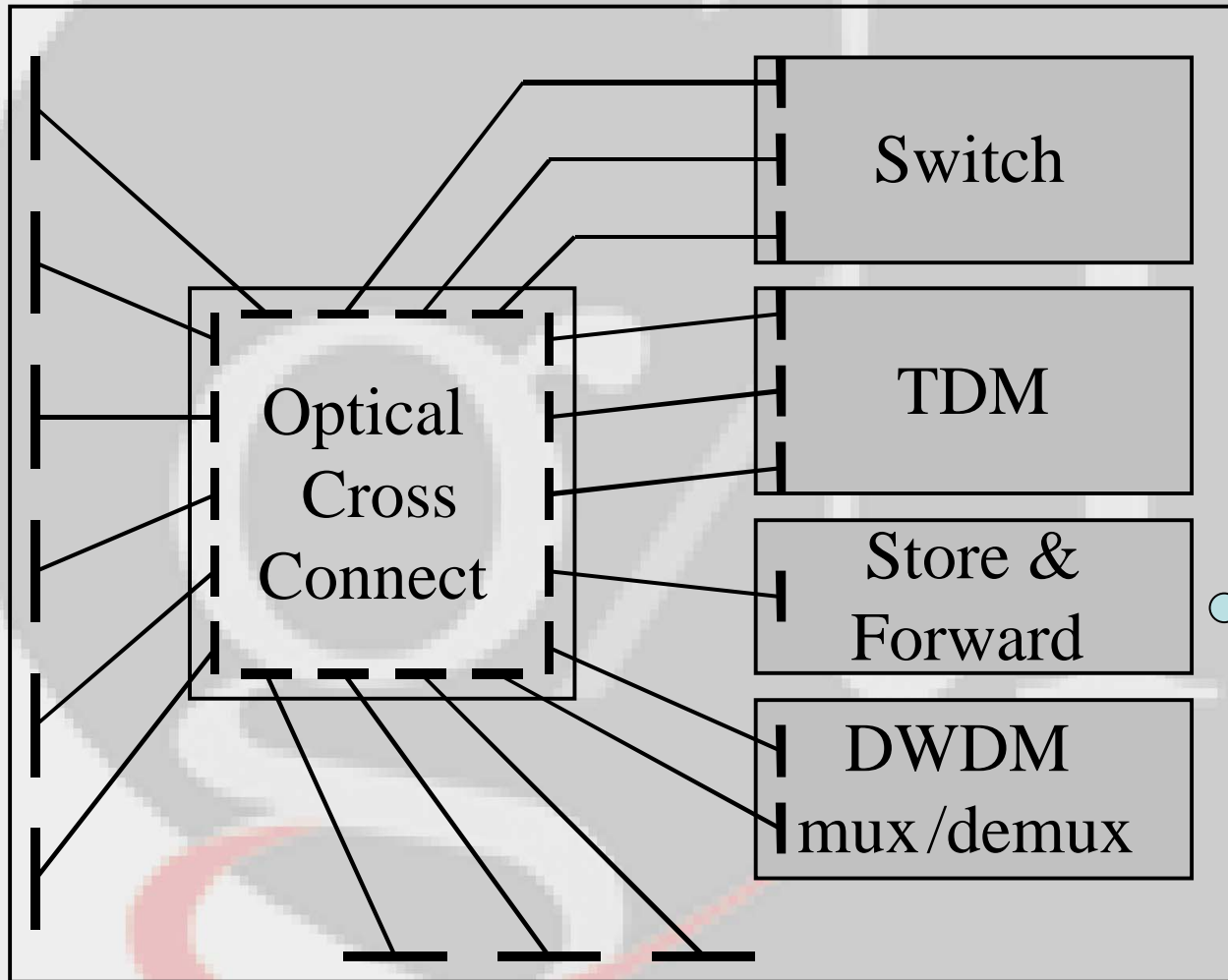• GOLEs work at a "layer"

Examples

    1) Link = Fiber

      segment = wave

    2) Link = fiber bundle

      segment = fiber

    3) Link = Ethernet

      segment = VLAN

    4) Link = SONET

      segment = STS1

Adaptation between switches

━━━ connection Segment in Link

▭ segment switch

✚ interconnection between switches

GOLE switches concatenates segments from different Links at a particular layer

Optical Exchange as Black Box

Optical Exchange

Switch

TDM

Store & Forward

DWDM mux /demux

Optical Cross Connect

TeraByte Email Service

Ref: gridnets paper by Freek Dijkstra, Cees de Laat

IDEAL L2 GOLE

Also Phase 3
L2 GOLE – Links carry VLANs

Technology of link may be different
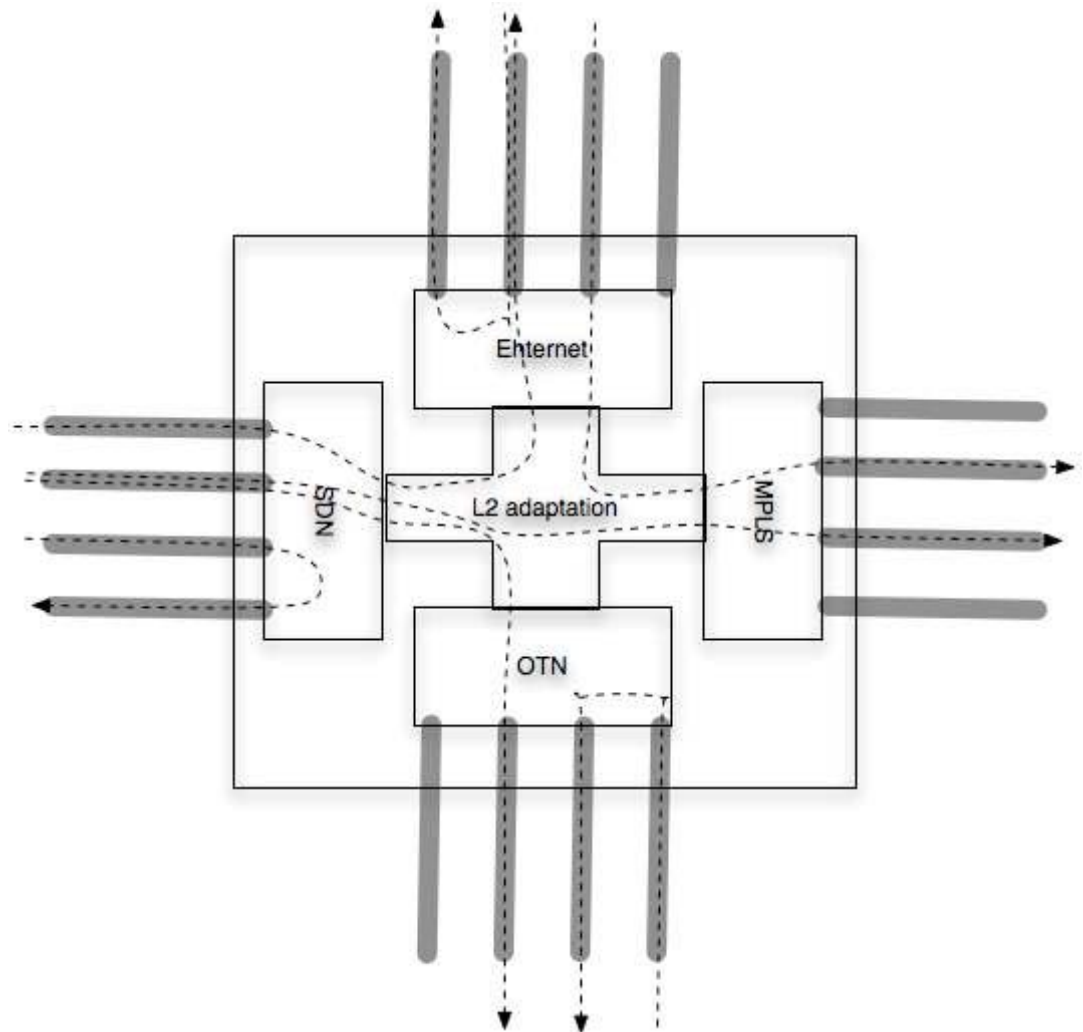VLAN/ Ethernet
VLAN/ MPLS
VLAN/ OTN
VLAN/ SONET
Switching between ports on same trunk type simple

Switching between ports on different trunk types requires adaptation

Hardware to support this is not generally available at this point

Ownership of resources

- **Legal Owner:**
  - Organization that legally owns a resource.
  - A legal owner may sell the right to economically use the resource.
- **Economic Owner:**
  - Acquires economic resource usage right a from legal resource owner.
  - A contract details terms by which a resource may be used.
  - Economic owners may outsource resource management to an Administrative Owner by means of a service level agreement.
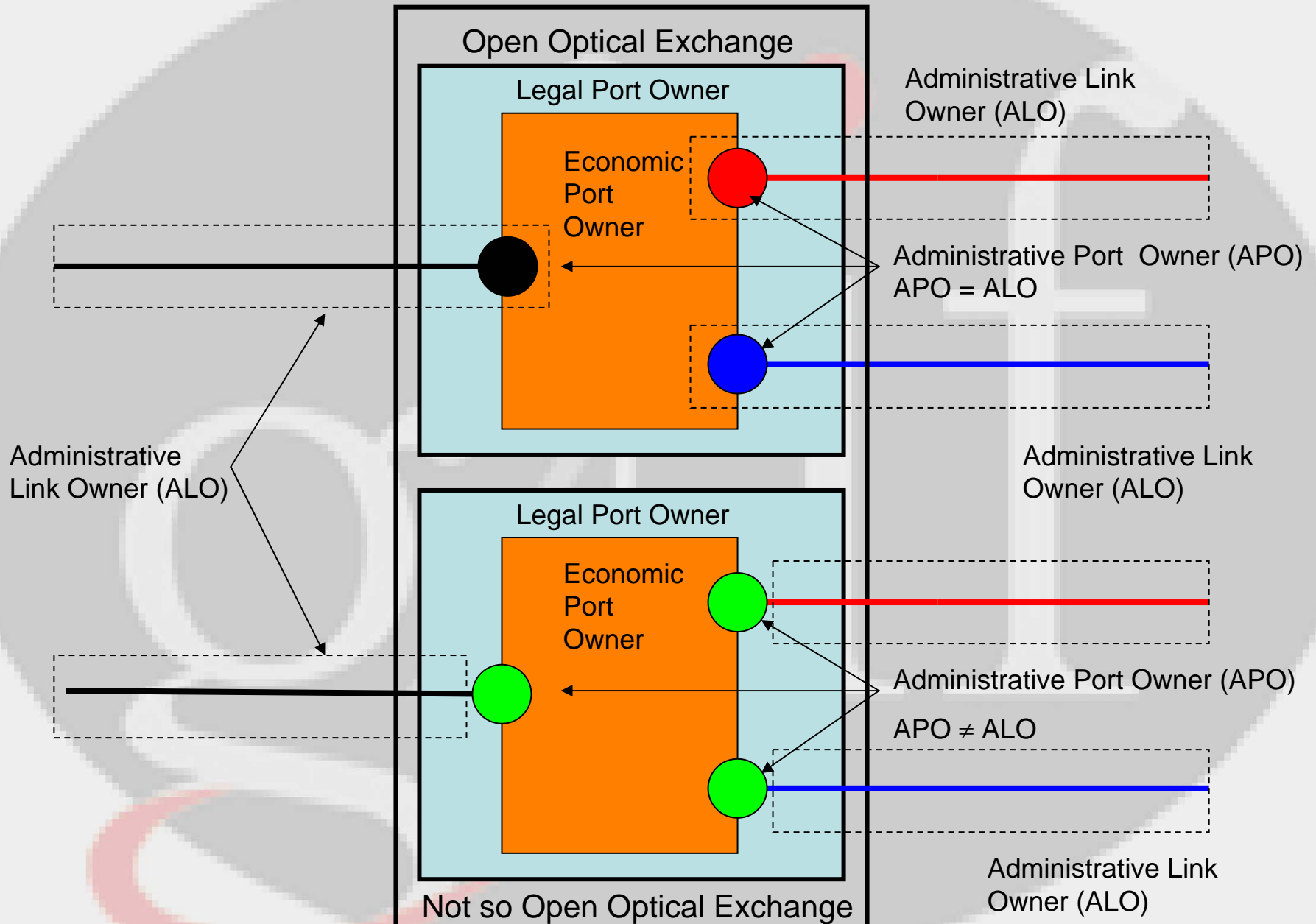- **Administrative Owner:**
  - Technically implements the terms of a service level agreement
  - Signals requests to other AO's and handles responses.
  - Collects accounting information.
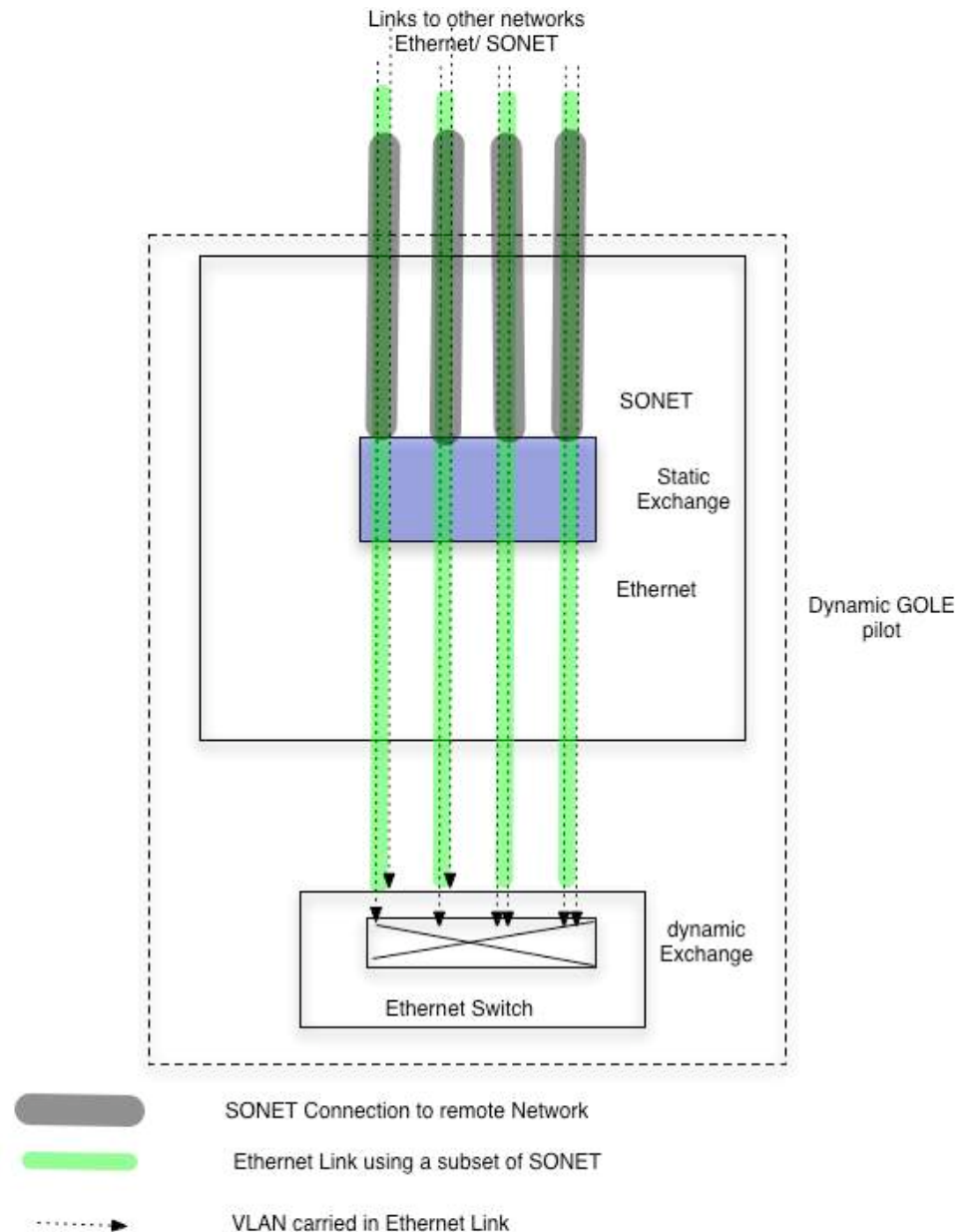- **Relationship between owners:**
  - Legal, economic and administrative owners may or may not be independent organizations.
  - Economic owners may acquire resources from different legal owners.
  - Administrative owners may serve different economic owners.
  - Economic owners may establish contracts with other economic owners to create more elaborate services. Technical details are delegated and implemented by Administrative Owners.

Optical Exchange Stakeholders

Open Optical Exchange

Legal Port Owner

Economic
Port
Owner

Administrative Link
Owner (ALO)

Administrative Port Owner (APO)
APO = ALO

Administrative
Link Owner (ALO)

Legal Port Owner

Economic
Port
Owner

Administrative Link
Owner (ALO)

Administrative Port Owner (APO)

APO $\neq$ ALO

Not so Open Optical Exchange
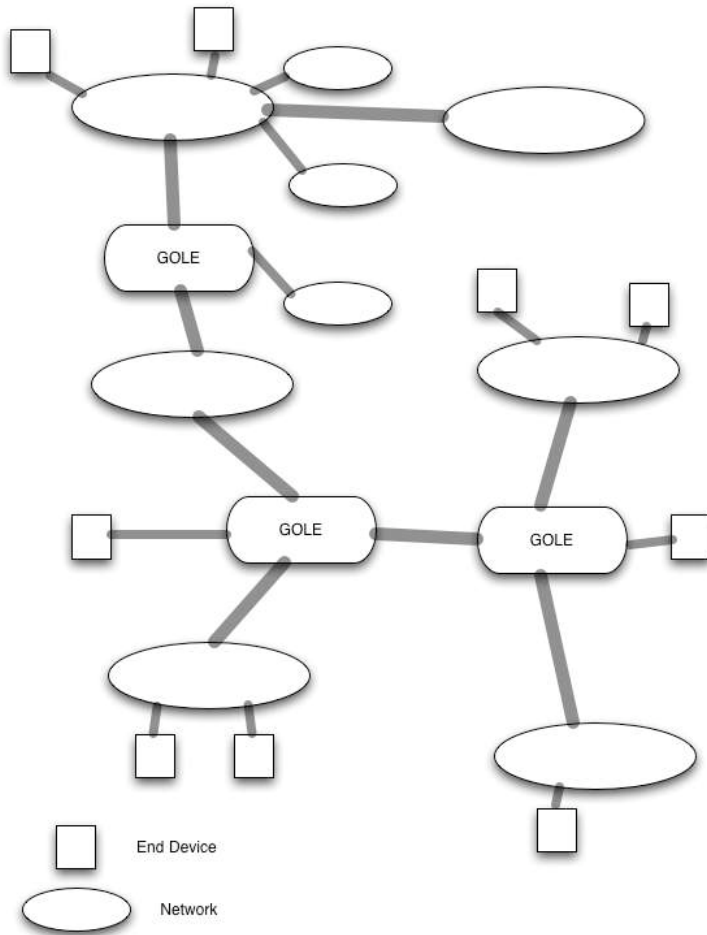
Administrative Link
Owner (ALO)

Proposed Pilot GOLE

- Pilot protects operational switch by moving switching to isolated location
- A separate ethernet switch is used for switching
- A static ethernet is created from remote site to GOLE ethernet switch
- Static ethernets carry VLANs

To be switched to VLANs from other static ethernets

- Requires extra ports on SONET switch
- Requires ethernet switch

- **Other configurations are possible**

Links to other networks
Ethernet/ SONET

SONET

Static Exchange

Ethernet

Dynamic GOLE pilot

dynamic Exchange

Ethernet Switch

SONET Connection to remote Network

Ethernet Link using a subset of SONET

VLAN carried in Ethernet Link

GOLE's in Automated connection infrastructure

- GOLES can be used as hub for networks
- To interconnect between geographical areas
- To connect directly to end users
- Pilot will allow exploration of different approaches
- NML-wg

Automated Connection Software

- Software to create and destroy automated connections exists in a number of ways
  - IDC from DICE community (ESNET, Internet2, GEANT)
  - G-Lambda
  - ARGIA
  - Phosphorus
  - HARMONY
  - Open_DRAC
- FENIUS software being developed in GLIF GNI-wg allows many to interoperate
- Pilot will determine what is required for software to be "pilot" compatible

Steps

- Identify participants
- Identify chair(s)
- set up call
- goto slide 3 to start phase 1
- For doc see http://ext.delaat.net/dgole