

TF-NGN meeting

# **GÉANT2 Update**

**14<sup>th</sup> April, 2005**  
**Zürich, Switzerland**

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# Outline

- GÉANT 2 Status
  - Connectivity tender
  - Equipment tender
  - Topology considerations
  - Cross border fibre
- POP designs
  - POPs with dark fibre
  - POPs without dark fibre

# GÉANT2 Status

## Status of tenders

- Connectivity tender
  - Preferred suppliers and backup suppliers selected for most routed
  - Currently in final round of negotiations
  - Signing of contracts expected by early May
- Equipment tender
  - Lab tests have been performed at the labs of three selected vendors
  - Negotiations with vendors are ongoing
  - Decision expected by the end of April
  - Signing of contracts expected by early May

# Topology Considerations

- Topology has a dependency on offers
  - Limited number of fibre routes offered
- Consider resilience
  - Two diverse routes out of each country, where possible
  - Avoid, if possible, unnecessary concentration of capacity
- Consider Performance
  - Minimise delay by avoiding unnecessary long routes
- Topology is close to finalisation
  - But... cannot be disclosed publicly yet
  - NRENs are involved via workshop held in Amsterdam

## Input from Architecture Workshop (Amsterdam)

- Dual diverse services rather than protected services  
(2 diversely routed lightpaths rather than mesh based restoration)
  - Amount of capacity unaltered from initial topology (1+1 restoration already included in calculations)
  - More capacity on some peripheral routes, shifting the break-even analysis to include more DF routes
- Some connections may benefit in the future from Cross Border Fibre

## Cross Border Fibre

- Leverage dark fibre from NRENs
  - in regions where is difficult or expensive to acquire dark fibre
  - to provide route diversity
- Provision wavelengths between GÉANT2 POPs over dark fibre of adjacent NRENs
  - example: Germany-Poland
- Still some operational issues to solve
  - SLAs, responsibilities, interconnections
  - trial period

# GN2 POP designs

## POP designs

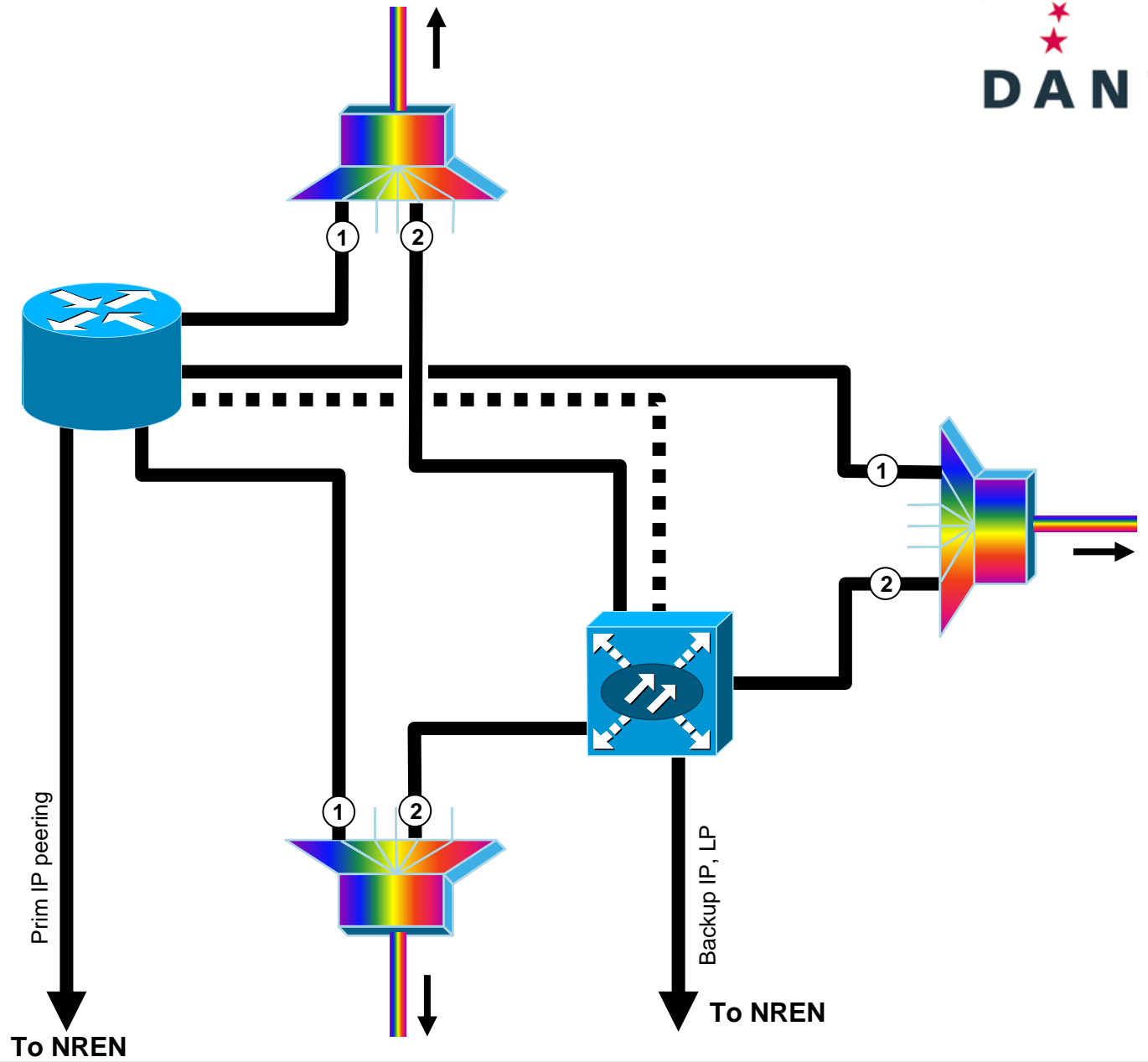
- A number of typical GN2 POP scenarios have been identified
- POPs where dark fibre and possibly managed wavelengths are available
  1. DWDM terminals, switch and router
  2. OADM and switch
- POPs where only managed wavelengths are available
  3. Switch and router
  4. Router only

# 1. POP with dark fibre

DWDM terminal, switch, router

- DWDM terminal for each dark fibre
- Routers are interconnected directly via the transmission system
- Backup IP can be backhauled via switch
  - NREN peers with two different GÉANT routers
- Switch to access (protected) lightpath services

# DWDM terminals, switch, router

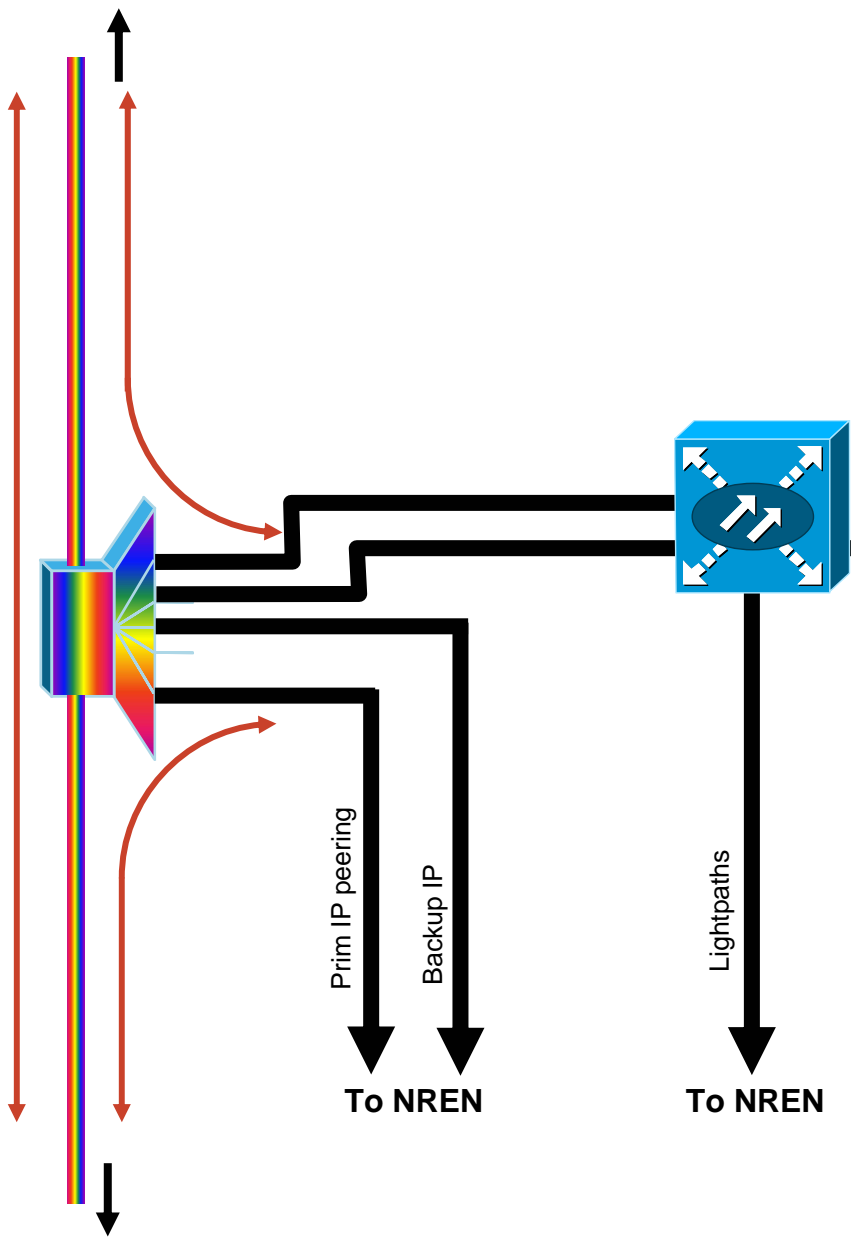


## 2. POP with dark fibre

OADM, Switch

- Primary and backup IP directly connected to the OADM
  - diverse routes
- Lightpath access via the switch
- OADM is a two-way system
  - Three-way POPs require an additional DWDM terminal (i.e. dropped wavelengths must be regenerated)
- OADM is not a single point of failure
  - Passive optical multiplexers
  - Redundant power supplies
  - No impact on traffic when management connection is lost

**DWDM terminal, OADM,  
Switch, Router**



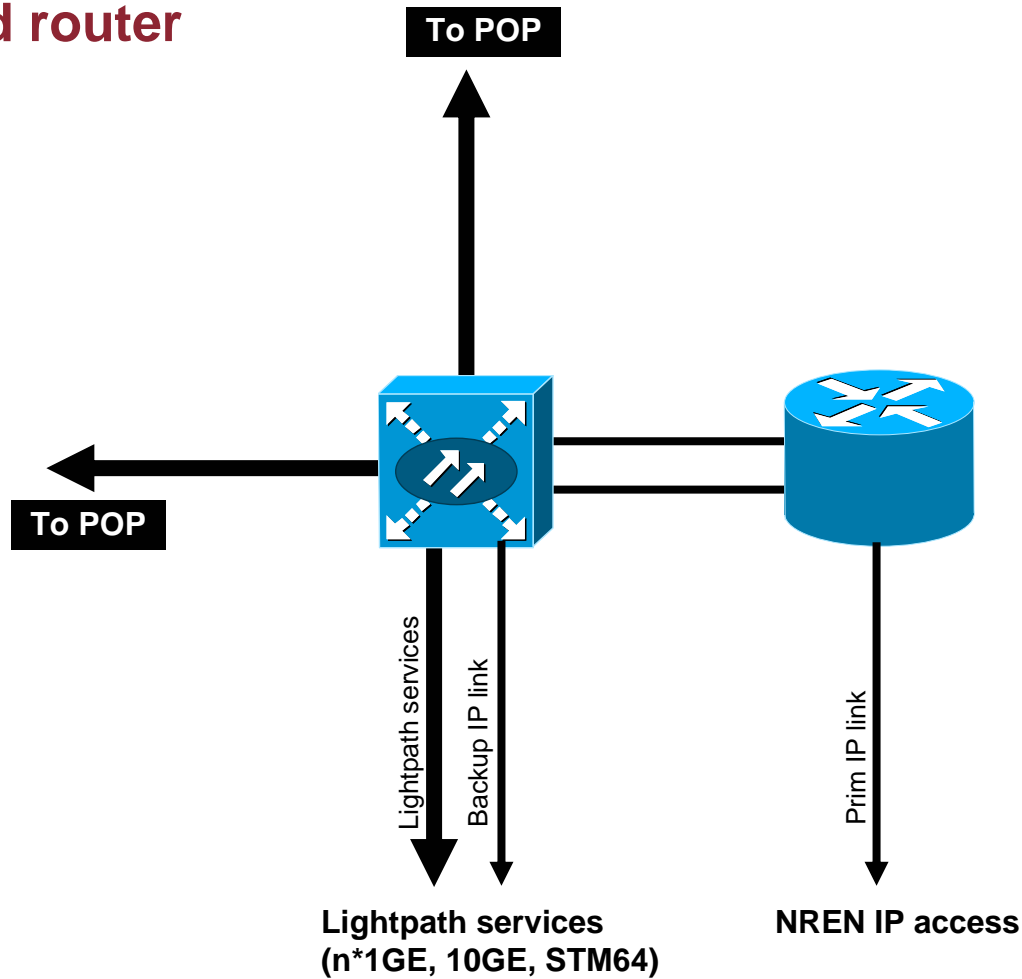
# 3. POP with managed wavelengths

Switch and router



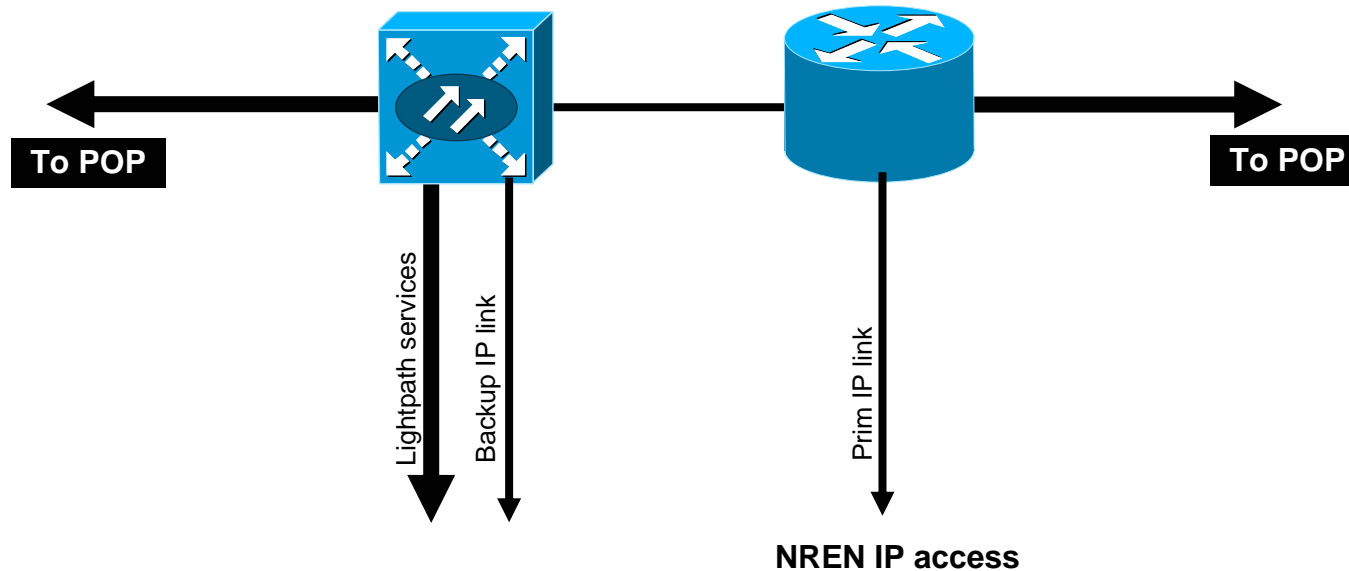
- Two managed 10G wavelengths to neighbouring POPs
  - 7.5G IP connections
  - Other capacity dedicated to lightpaths
- IP backup can be backhauled
- Two options
  - Both wavelength are connected to the switch
  - One wavelength to the switch and one to the router
- Issues
  - Single point of failure for IP services (switch)
  - Protection for IP and lightpath services (diverse routes)

## Switch and router



- Switch is single point of failure for IP services
- Protected lightpath services

## Switch and router



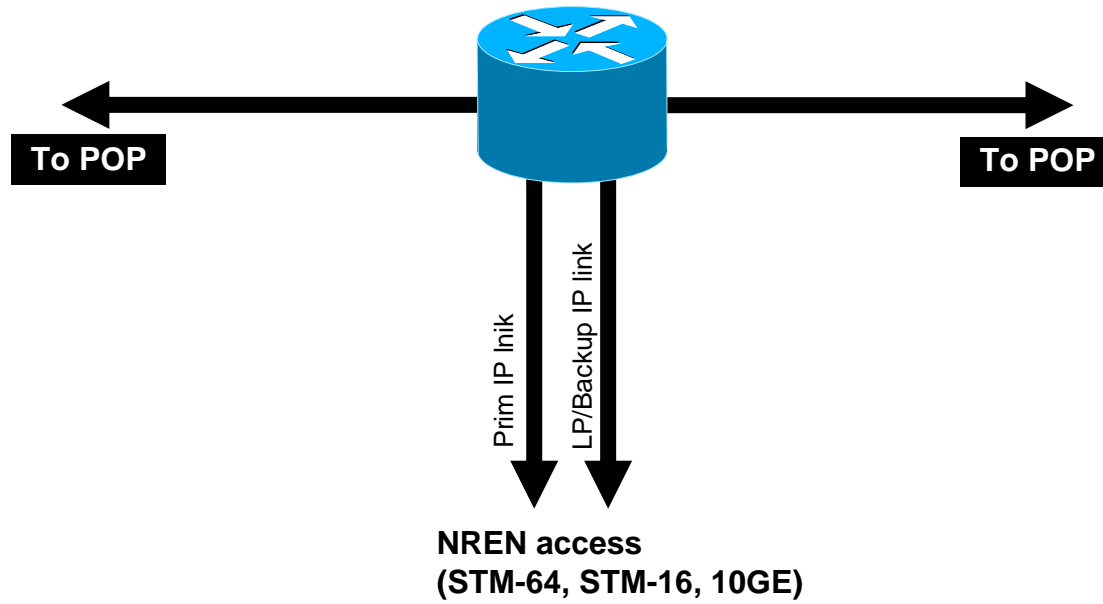
- No single point of failure for IP services
- Lightpath services are unprotected
- Capacity may not be optimally used

## 4. POP with managed wavelengths

Router only

- This is the current POP design
- No backhauling of backup IP
- Lightpaths
  - Via IP router using MPLS based L2VPNs

# Router only



**Questions...**

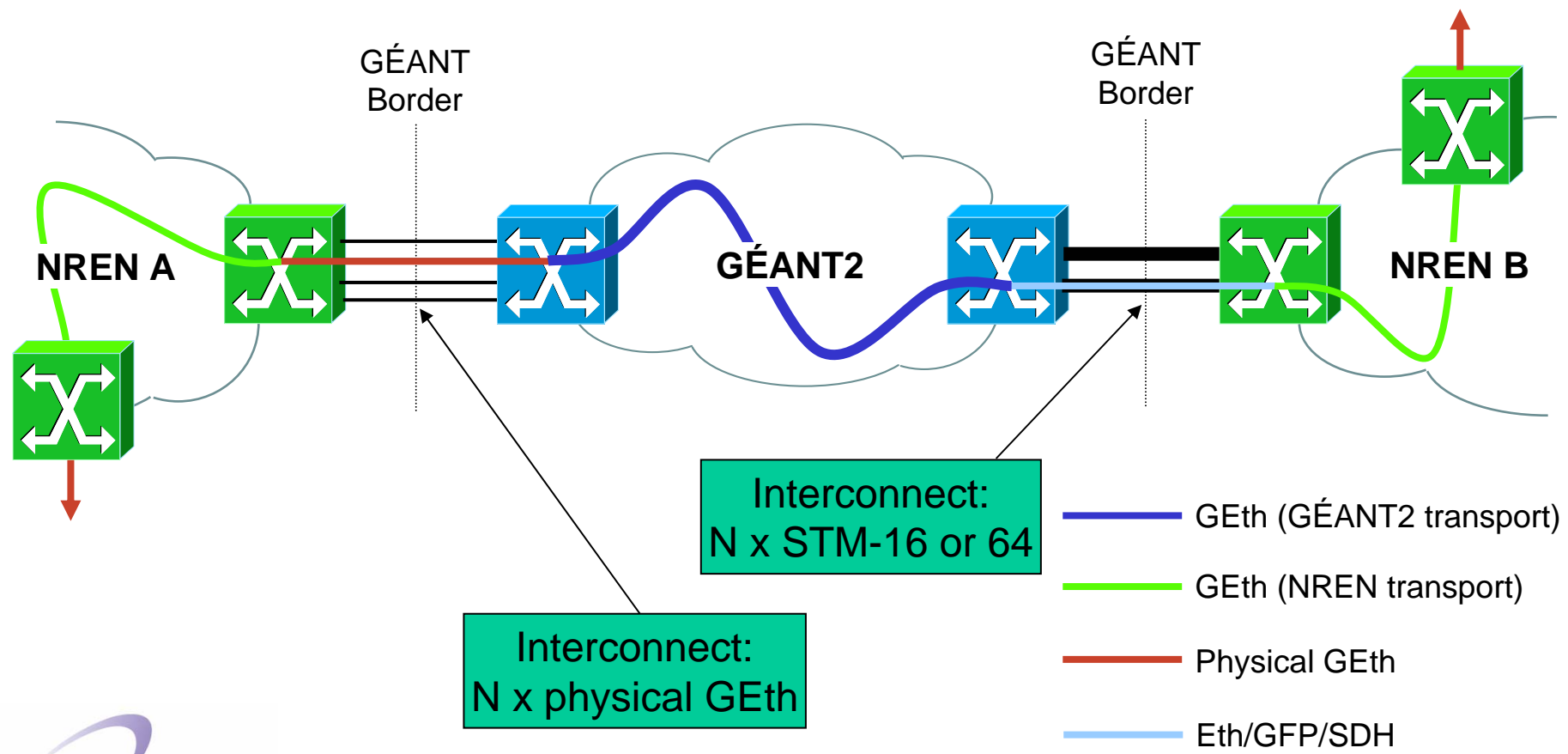
# Benchmark Service Scenarios

# GÉANT2 Internals

- Most important point is to support the services requested and the access types requested
- Ethernet flows identified by VCGs internally
- Focussing on SDH in the backbone
- Other points to consider:
  - Protection and restoration mechanisms
  - Network management and monitoring
  - Control plane developments, with a multi-domain view

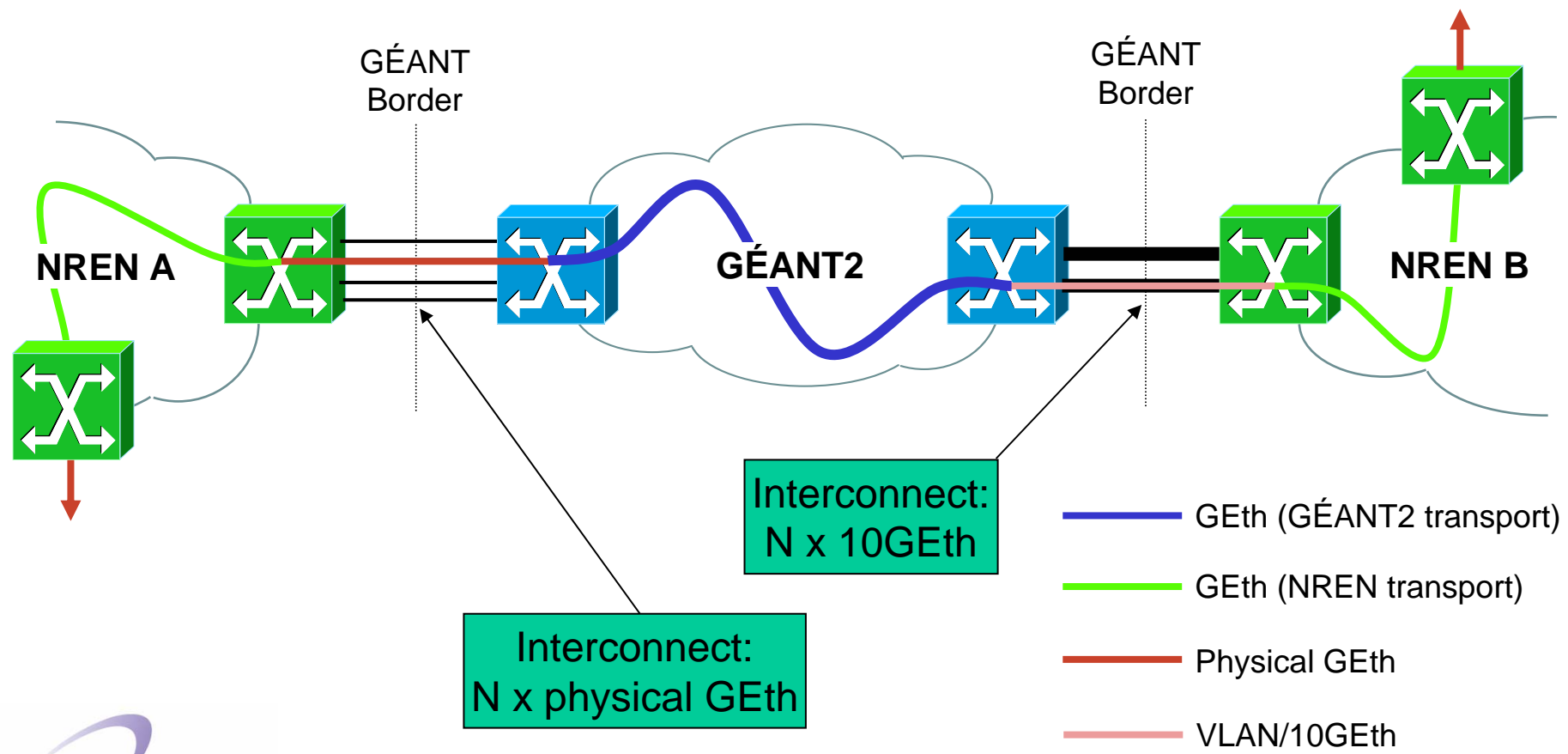
# Scenario 1: P2P GEth

(GÉANT borders: physical GEth – STM-16 or 64)



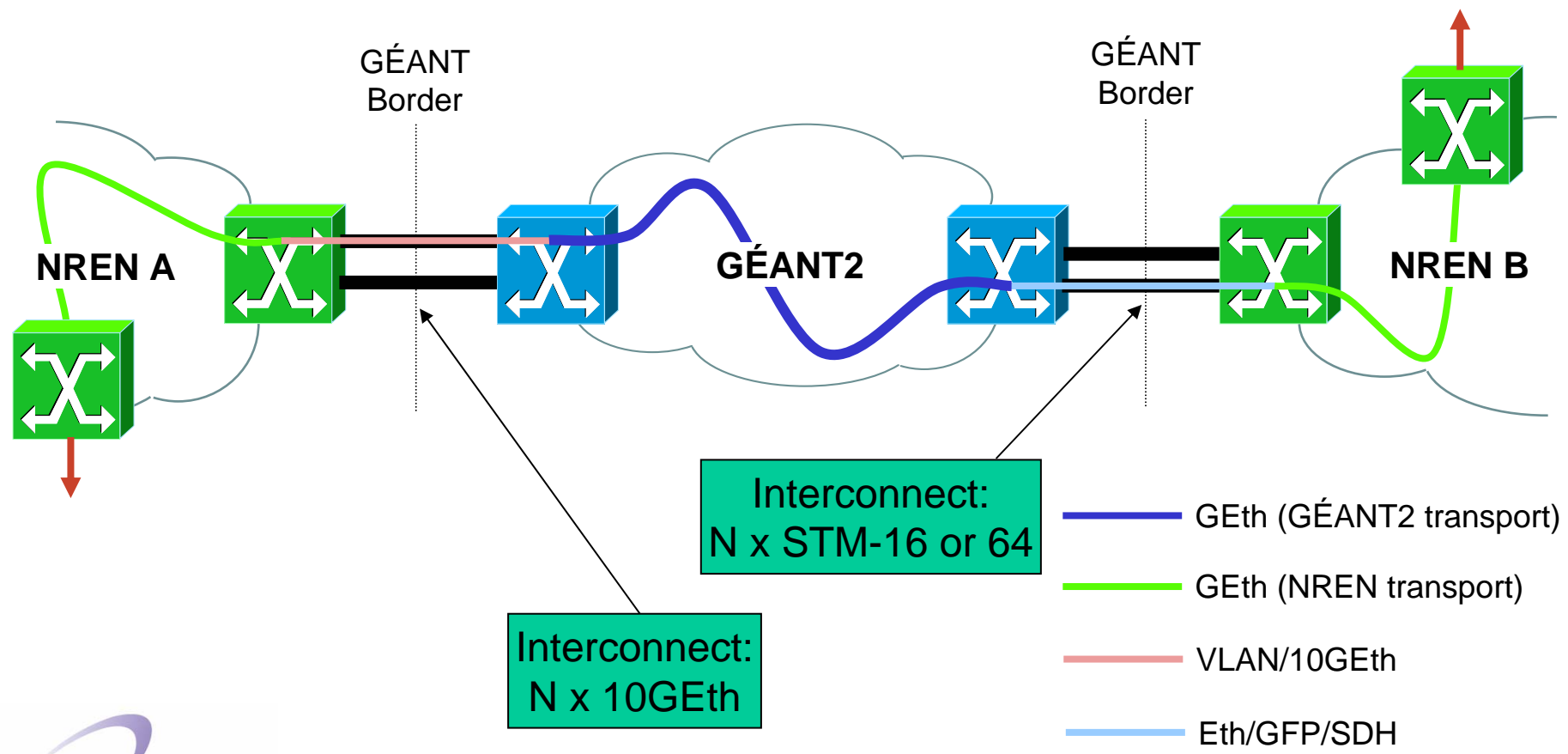
# Scenario 2: P2P GEth

(GÉANT borders: physical GEth – physical 10GEth)



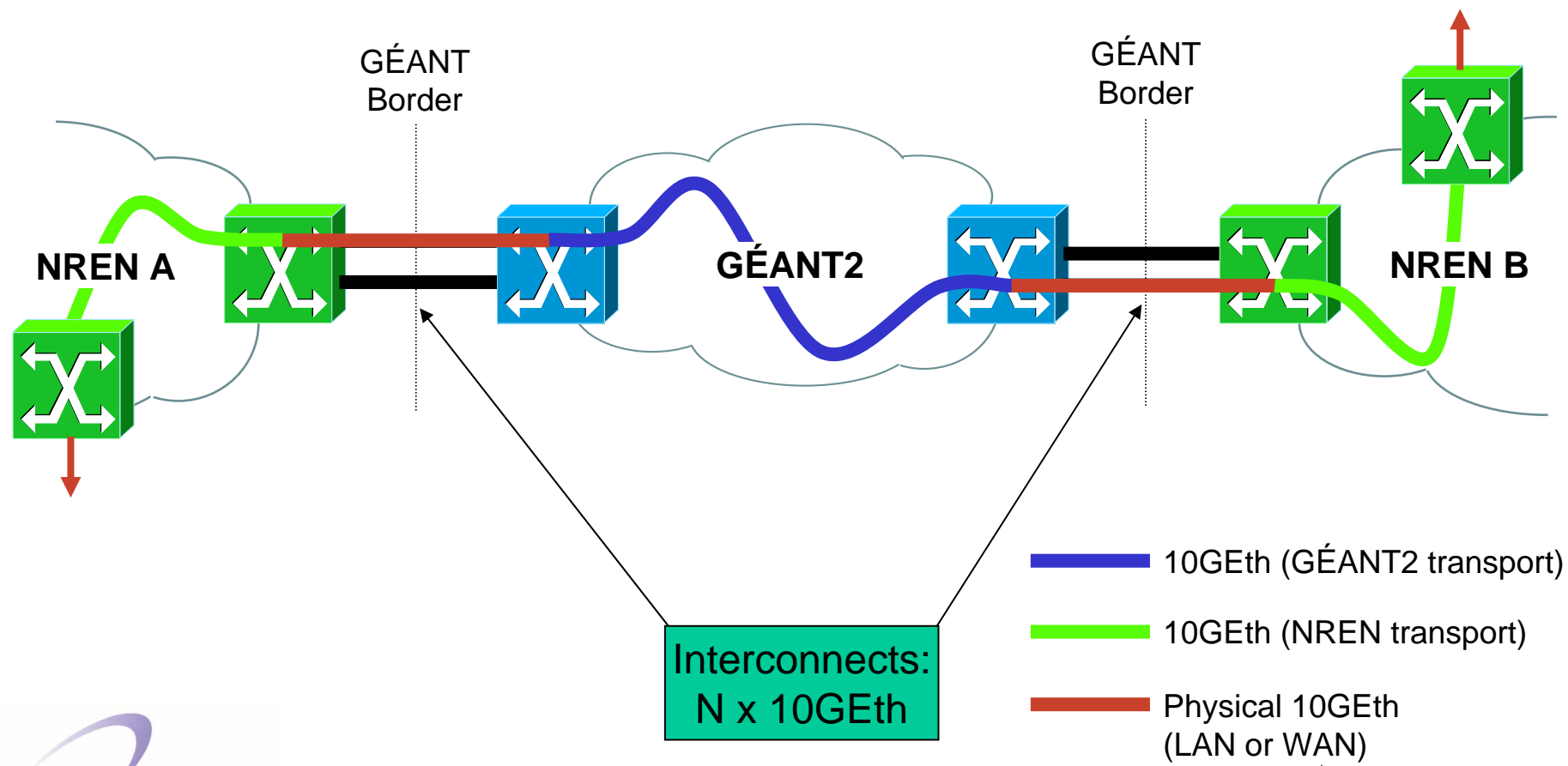
# Scenario 3: P2P GEth

(GÉANT borders: physical 10GEth – STM-16 or 64)



# Scenario 4: P2P 10GEth

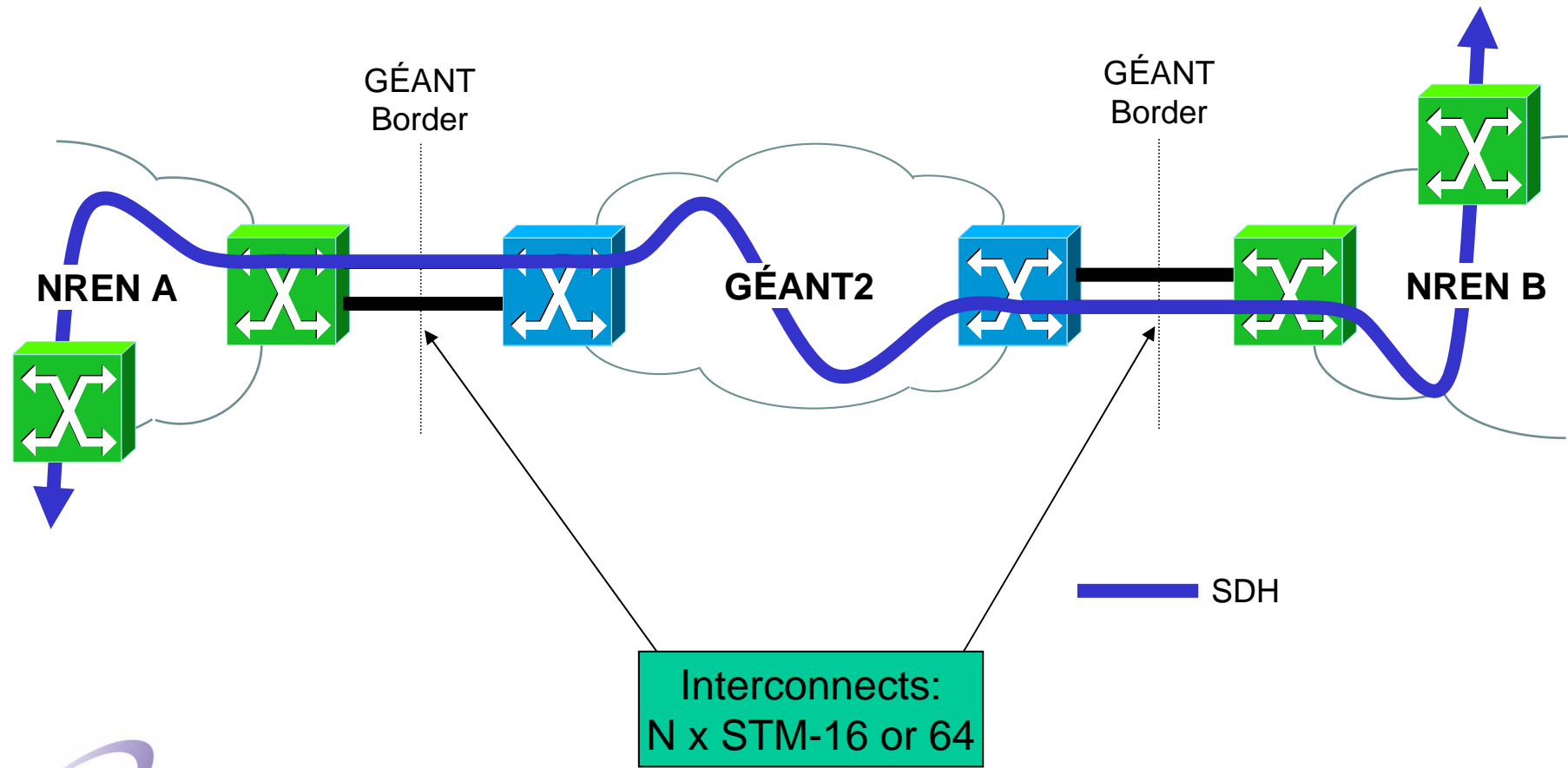
(GÉANT borders: physical 10GEth – physical 10GEth)



Implies underlying SDH  $\lambda$  

# Scenario 5: P2P STM-n

(GÉANT borders: STM-16/64 – STM-16/64)



# Details

	Serv.	NREN A Access	NREN B Access	Bee	Chicken	Cow	Dog	Duck	Snail
1	GE	NxGE	NxSDH	YES	YES	Limitation and ready Q2/05	YES	YES	Requires Additional SDH OXC
2	GE	NxGE	Nx10GE	YES	In 2005	Requires Additional Equipment	Interim Solution Until 2006	Dec 05	YES
3	GE	Nx10GE	NxSDH	YES	In 2005	Requires Additional Equipment	Interim Solution Until 2006	Dec 05	Requires Additional SDH OXC
4	10GE	Nx10GE	Nx10GE	YES	March 2005	YES	Interim Solution Until 2006	Dec 05	YES
5	STM	SDH	SDH	YES	YES	YES	YES	YES	NO