

Optical Backbone of KREONET

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leehr@kreonet2.net

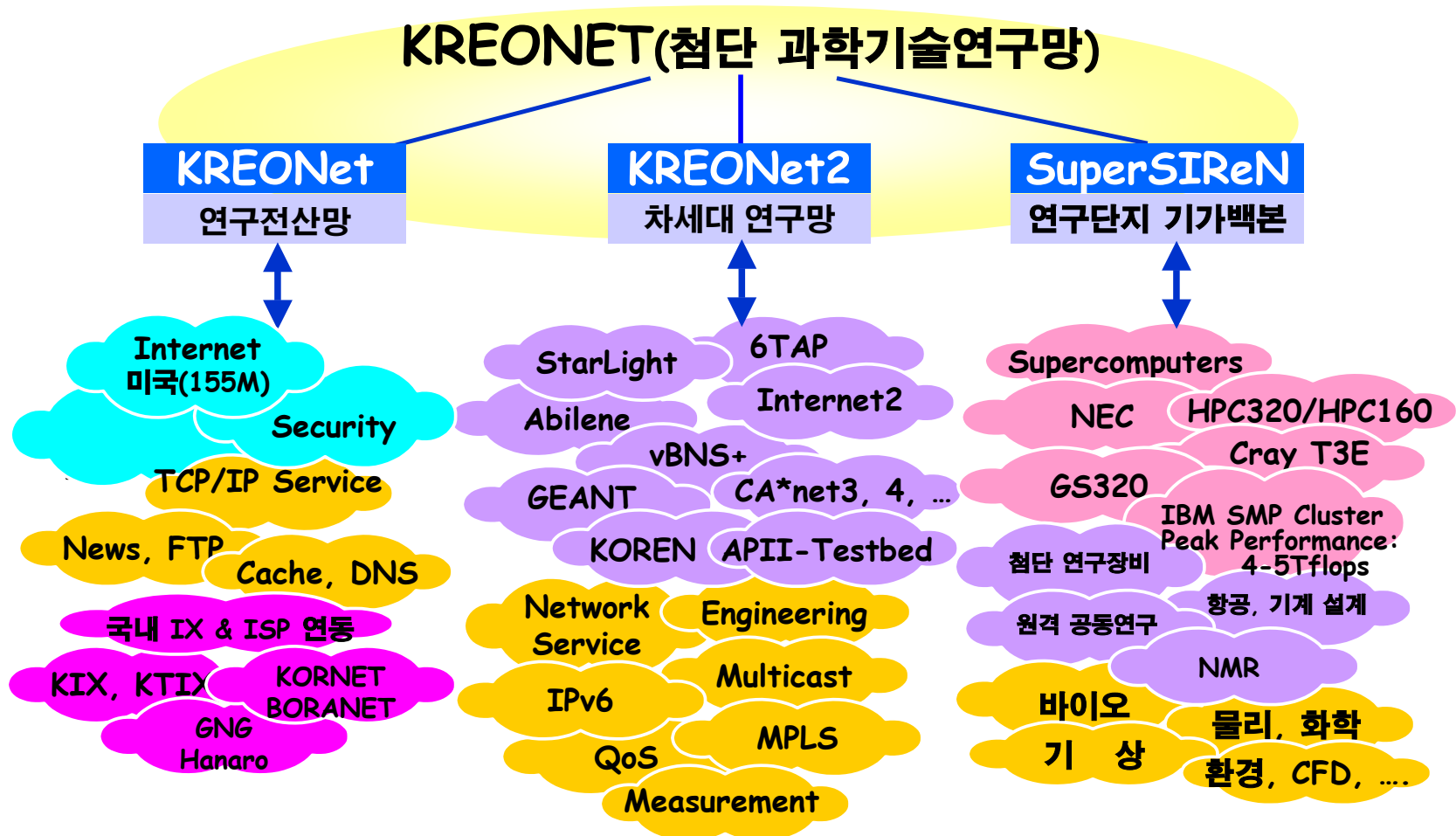
Lee Hyeak Ro

Korea Institute of Science Technology
Information

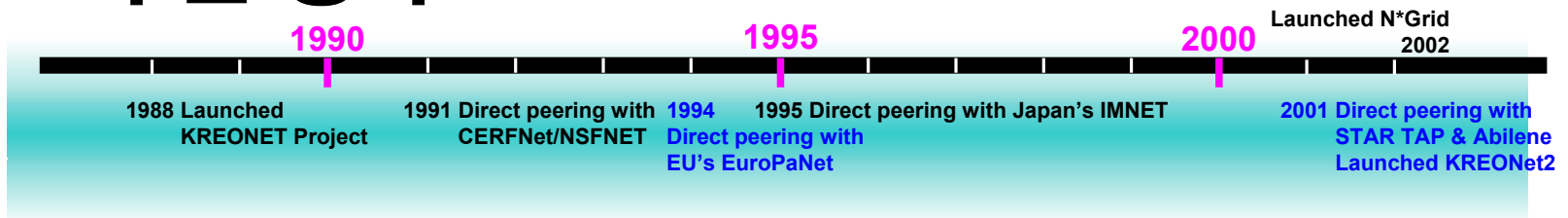
Content

- I. What is KREONET ?
- II. Optical network construct objects
- III. Optical KREONET backbone status
- IV. Optical network benefits
- V. Example of the Light path
- VI. International R&D network Trends
- VII. Conclusions

What is KREONET ?



추진 경과

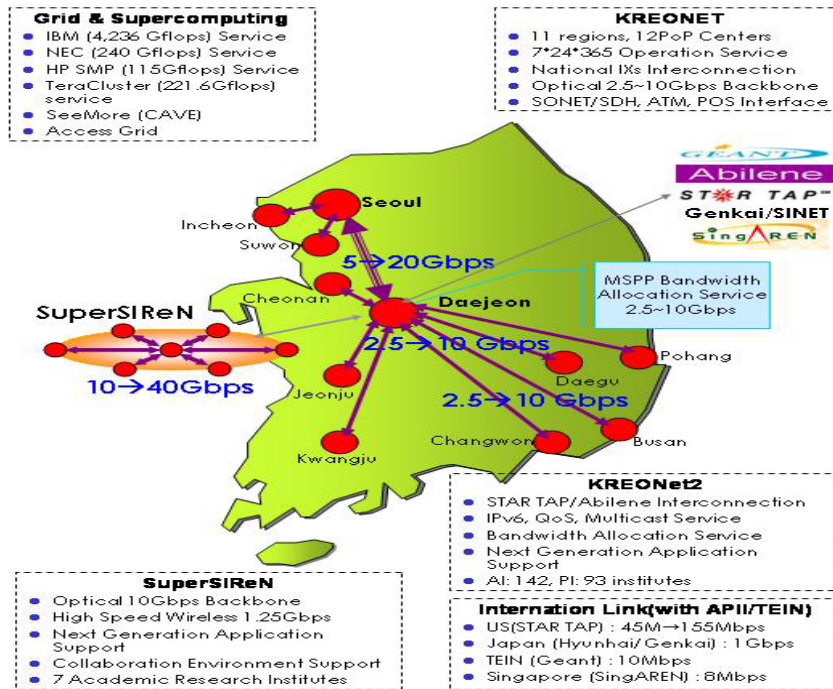


- ◇ 1988 : KREONet+ 연구전산망 서비스 실시(국내 최초 TCP/IP 인터넷 운영)
- ◇ 2000. 05 : KREONet2(차세대연구망) 구축 STARTAP(45M), KOREN(155M)
- ◇ 2000. 05 : KREONET(초고속연구망) KREONet, KREONet2, GRID NOC 운영
- ◇ 2002. 06 : KREONET 증장기 발전 계획 수립 및 기가 백본 추진
- ◇ 2003. 04 : 12개 지역망센터 기가백본 구축 완료 (5Gbps~2.5Gbps)
- ◇ 2003. 04 : 연구단지 SuperSiReN 10Gbps 연구백본 구축(KAIST외 6기관)
- ◇ 2003. 06 : 국내외 R&D 연구망 증속 서비스 시작
 - 서울 · 대전(5Gbps), 대구, 부산, 광주 지역 및 기타지역(2.5Gbps)
 - STARTAP(45Mbps -> 155Mbps), KOREN(155Mbps -> 1Gbps)
- ◇ 2004. 08 : 한-미 APII Testbed/KREONET2 1.2Gbps 연동
- ◇ 2004. 08 : 한-중 APII Testbed/KREONET2 310Mbps 연동

KREONET 백본 현황(2/5)

가입기관 내역

연 구 소	교육 기관	정부 공공	산 업 체	기 타	합 계
47	50	16	57	40	210



백 본

- ✓ 서울-대전 10Gbps x 2=20Gbps
- ✓ 기타 지역 2.5Gbps~10Gbps

국내·외 R&D 네트워크 연동

- ✓ KOREN : 1Gbps
- ✓ STAR TAP: 1.2Gbps
- ✓ SuperSireN : 10Gbps(KAIST외 5개 기관)
- ✓ APII Testbed, KIX, 6TAP(IPv6 Network)

ISPs간 연동

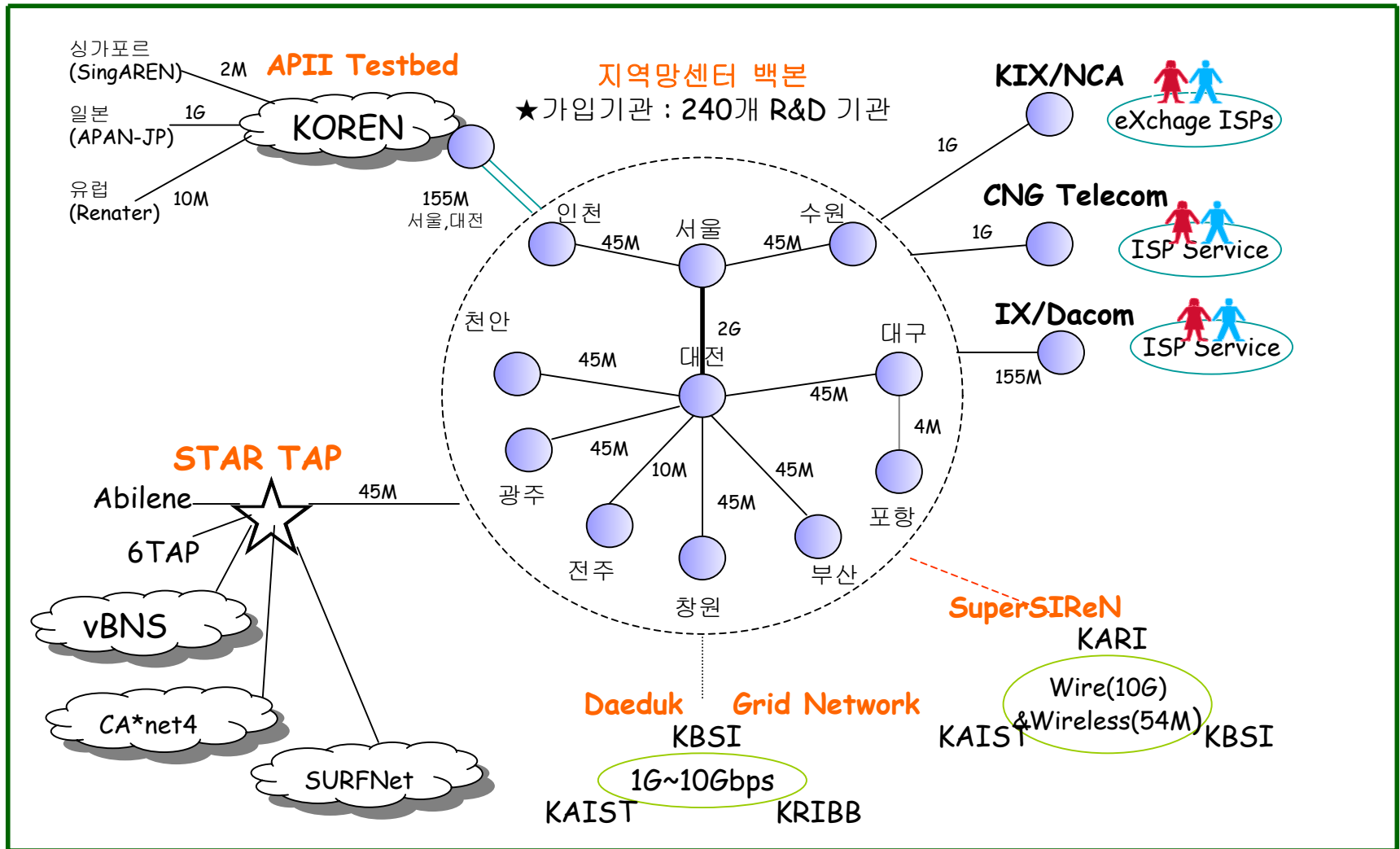
- ✓ KIX : 2Gbps
- ✓ Commercial Networks
 - KT : 1Gbps
 - Dacom : 1Gbps
 - Enterprise network : 1Gbps

Optical network construct objects

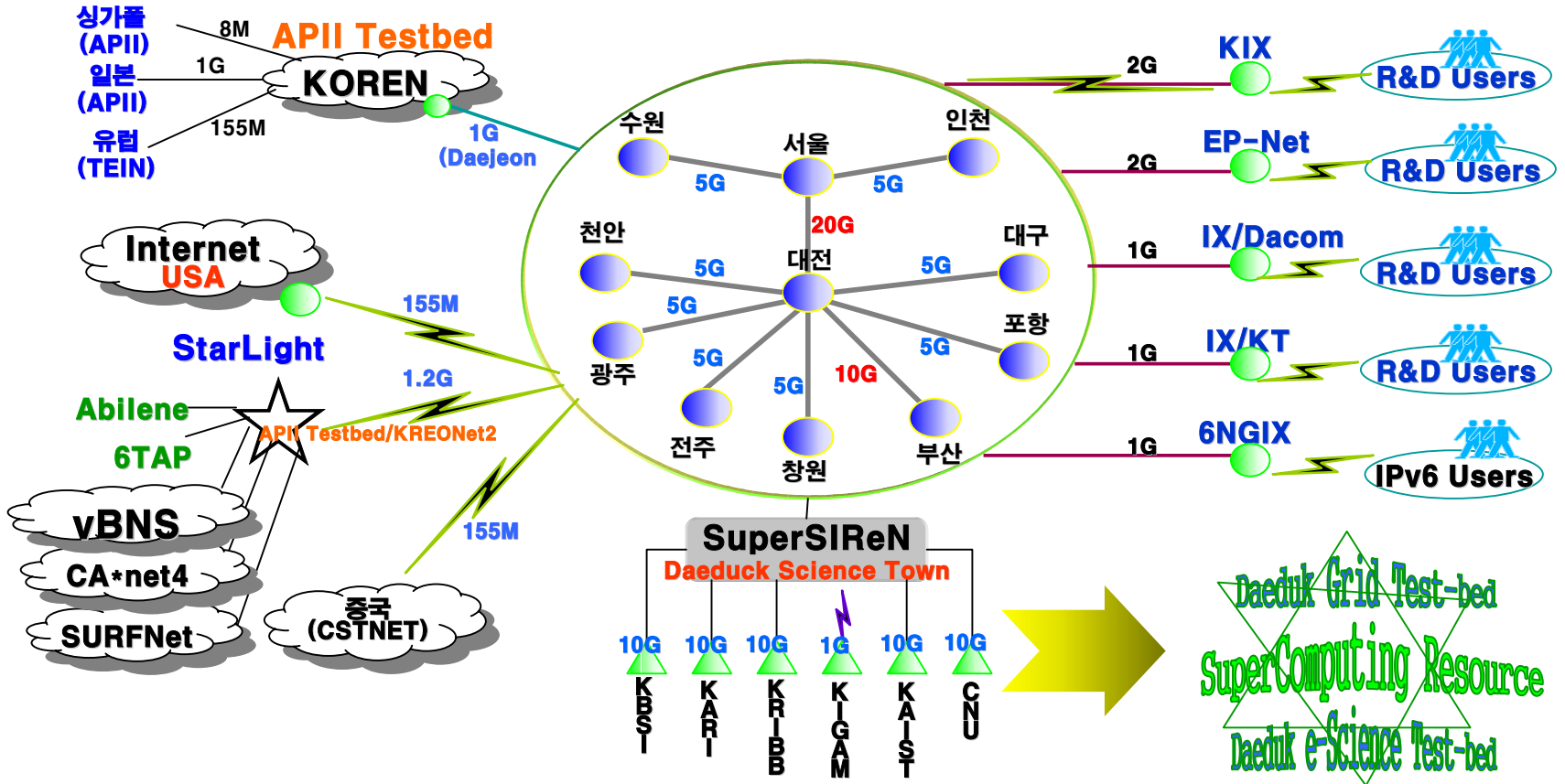
- ◆ 사용자 트래픽 증가로 인한 백본 증속 필요
 - 전용선, ATM, Metro, Giga급 요구
- ◆ 서비스를 위한 시험망 Testbed가 많이 요구됨
 - Voip, Ipv6, Testbed, etc
- ◆ 국제적 R&D 응용을 지원하기 위해 동등한 환경 제공필요
 - 네트워크구조, 지원기술, 요구사항 충족 등
- ◆ 기술이 Leased line에서 optical 계열으로 변화됨
 - 모뎀, DUS, CSU MUX, Metro, Gigabit Ethernet, MSPP, WDM, DWDM, Etc.
- ◆ KREONET 중장기 발전계획 수립(2002)

Optical KREONET backbone status (before)

2003.3.31



Optical KREONET backbone status (after)

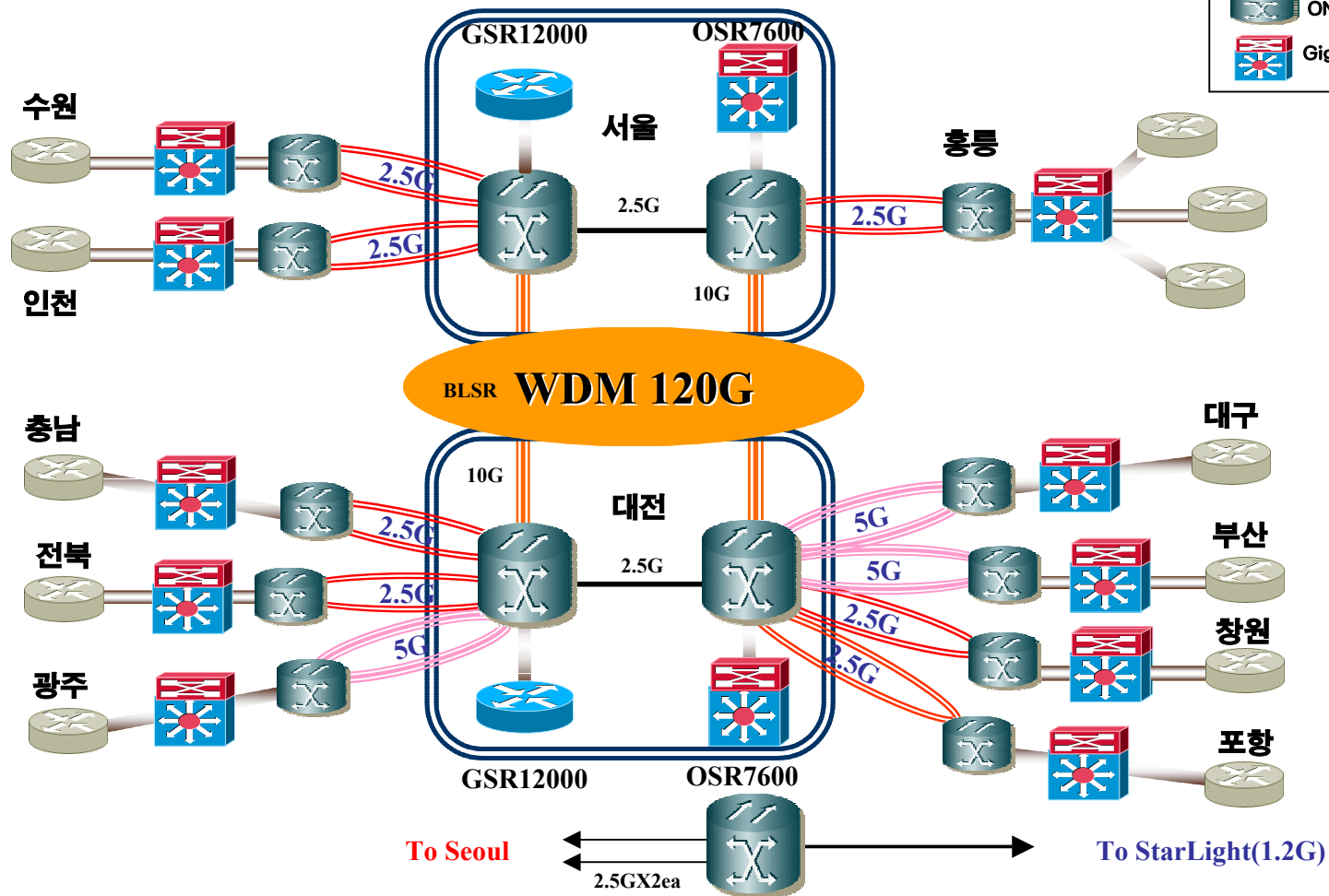


What's the benefits of optical network?

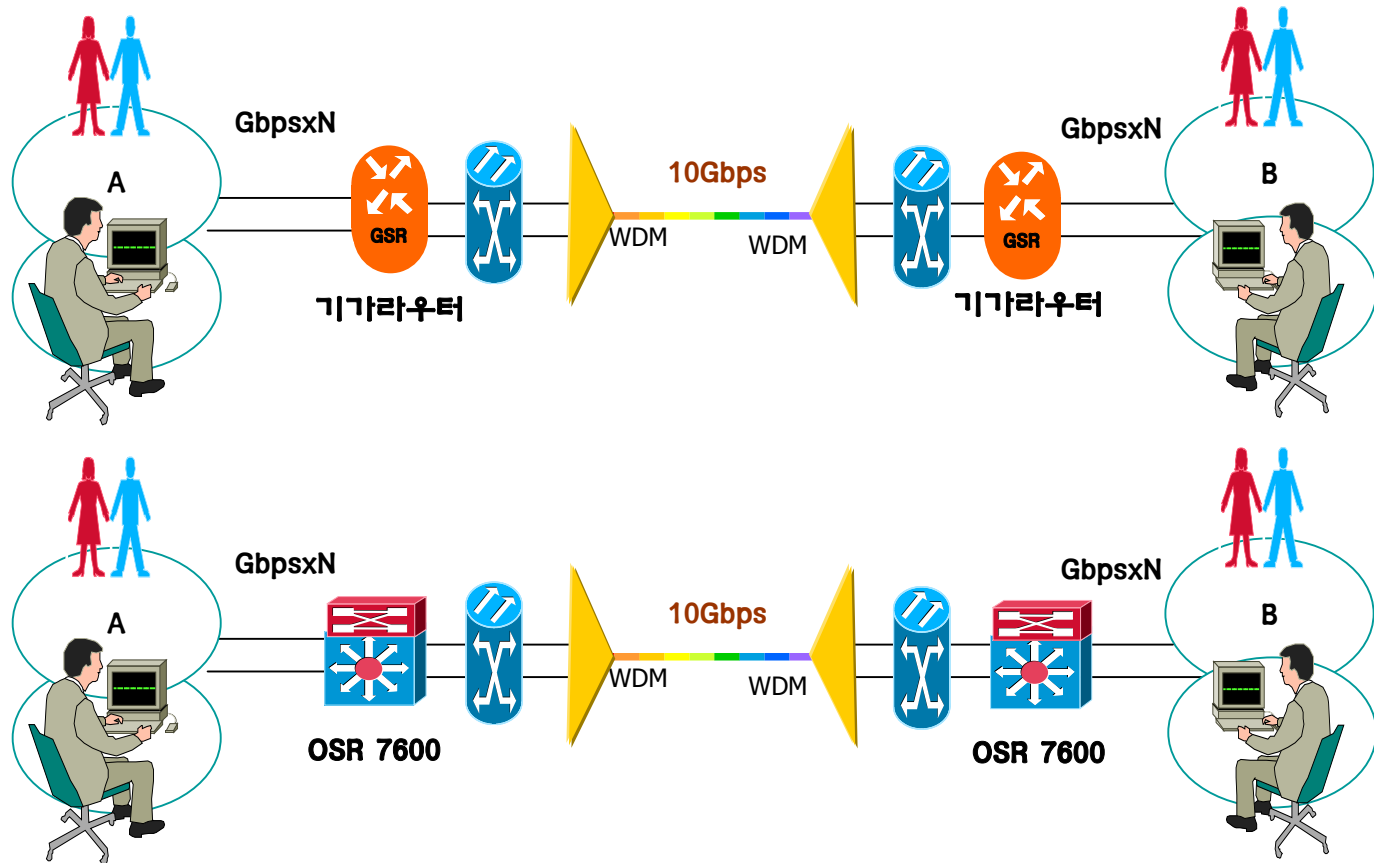
- ◆ 시험 및 Testbed 지원을 위해 **고속 회선과 안정성 보장된 자원의 가변적 제공 가능**
 - Light Path 기반의 **자유로운 Circuit 생성 가능(Mouse to Mouse)**
 - 다양한 네트워크 시험 환경제공(IPv6, Grid, Performance Test, Etc)
- ◆ 국내·외 공동 협업 연구 지원 가능
 - End to End 품질이 보장된 전용망 지원 가능
 - 다양한 규격의 Bandwidth 제공
- ◆ 국내·외 공동 협업 연구 대체 가능
 - 세계 연구망들은 Light Path 기반으로 이미 전환되고 있음
- ◆ 통신 사업자 변경 대체에 유연함

Optical KREONET backbone status

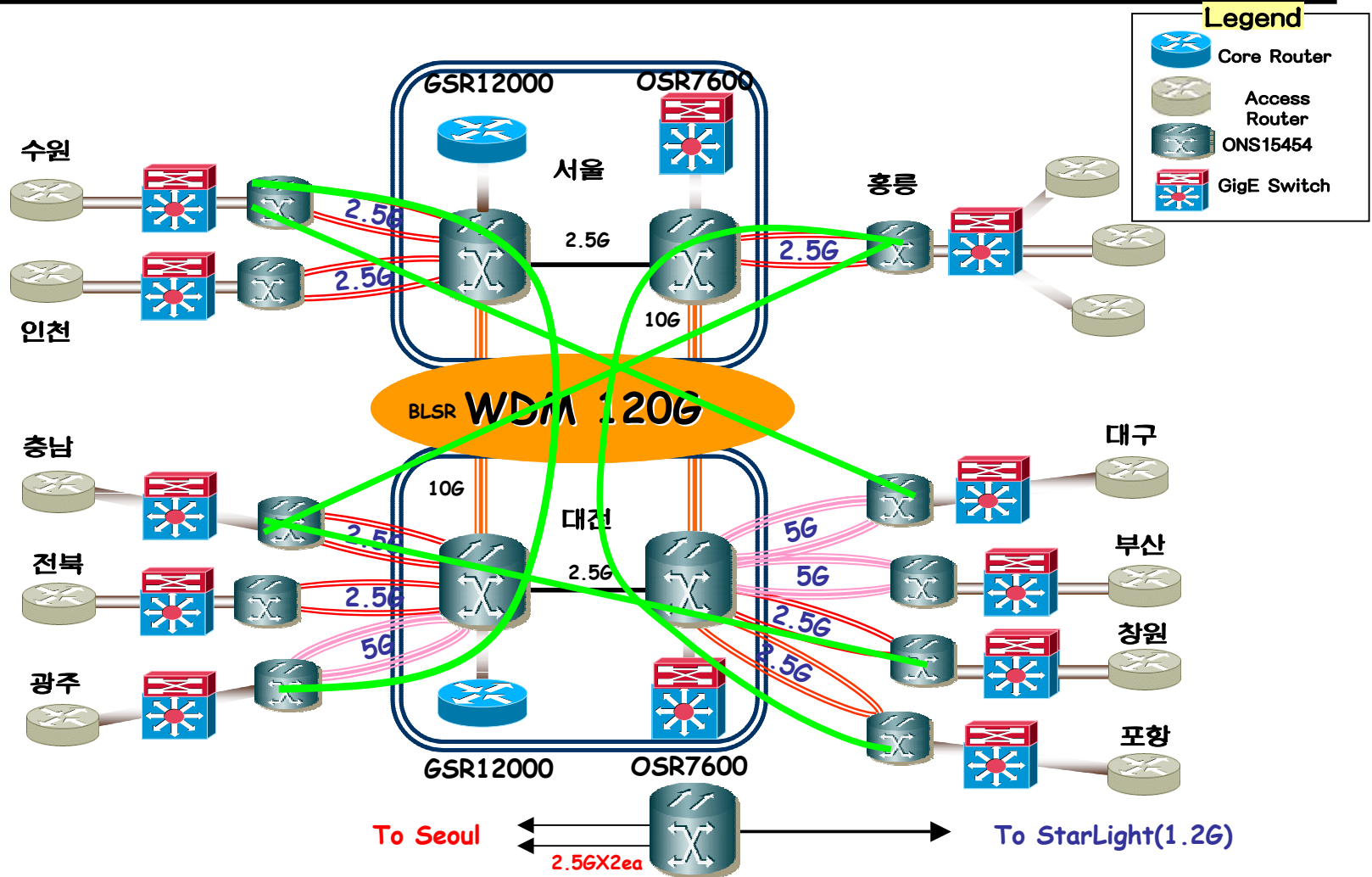
Legend



Optical KREONET backbone status



Optical KREONET backbone status

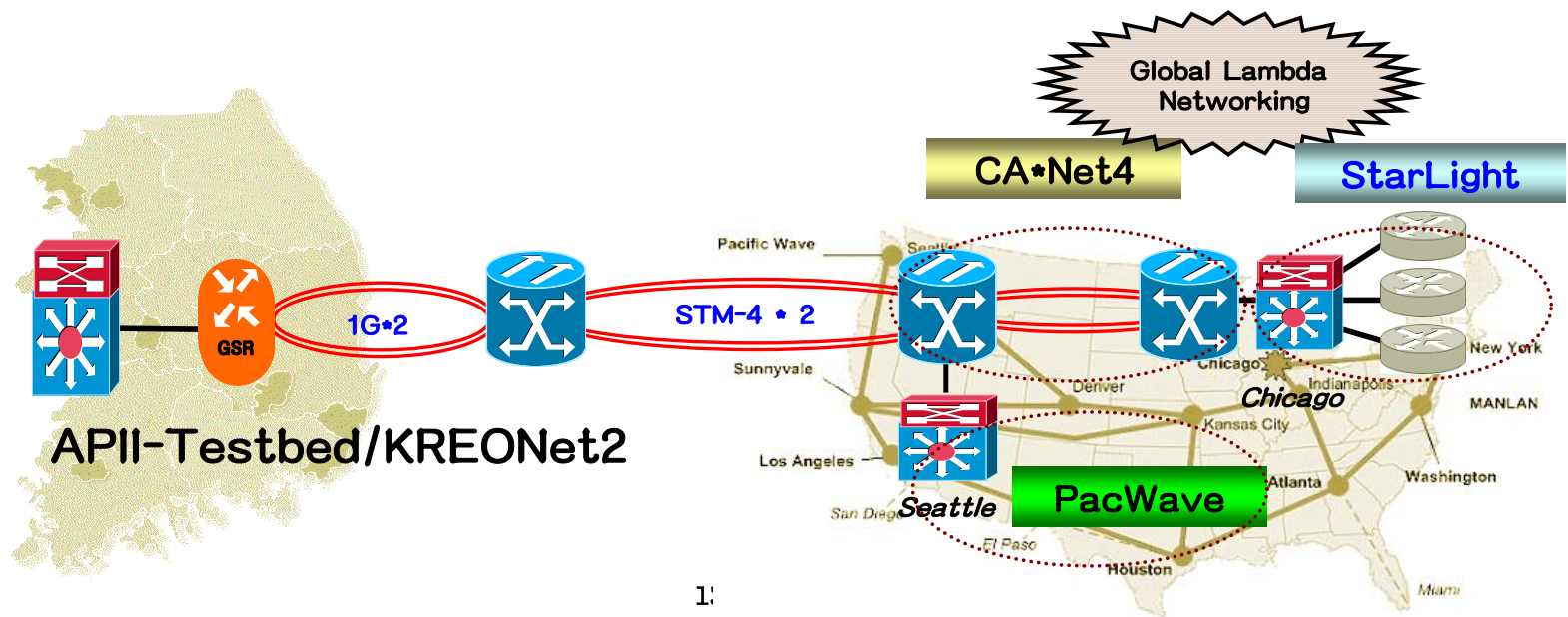


Optical KREONET backbone status

KR-US/CA Trans Pacific

■ Participation in Global-scale Lambda Networking

- Two STM-4 circuits (1.2G) : KR-CA-US
 - PacWave and StarLight (via CA*net4 lightpath)
- Joining Global-scale lambda Grid networking



How to make optical circuits(1/2)

■ NMS를 통해 가능

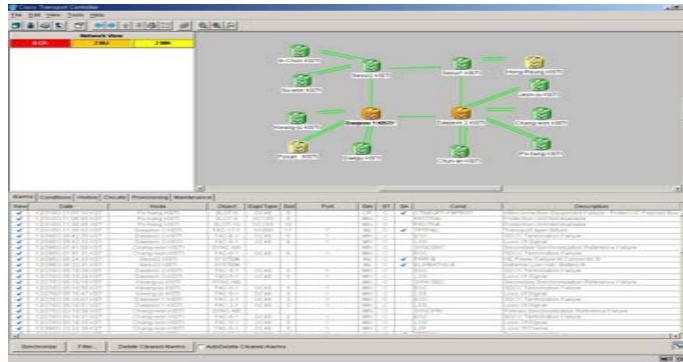
- CTC(Cisco Transport Controller) 지원
- GUI 환경을 통한 Mouse Click

■ KT 24시간 연중 지원

- CTM(Cisco Transport Management) 지원
- 12개 지역망센터 MSPP 15 대

How to make optical circuits(2/2)

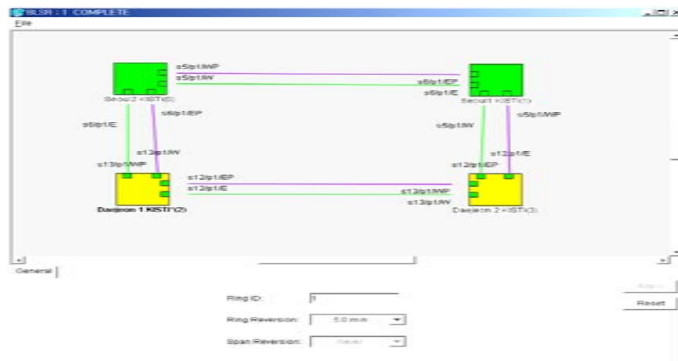
Lambda Allocation



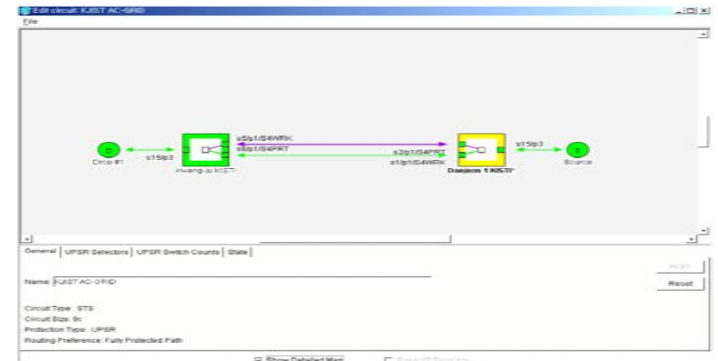
Lambda Allocation system (1)



Lambda Allocation system (2)



Configuring Seoul-Daejeon Ring



Lambda Allocation Example

Optical feature advantage and disadvantage

◆ 장 점

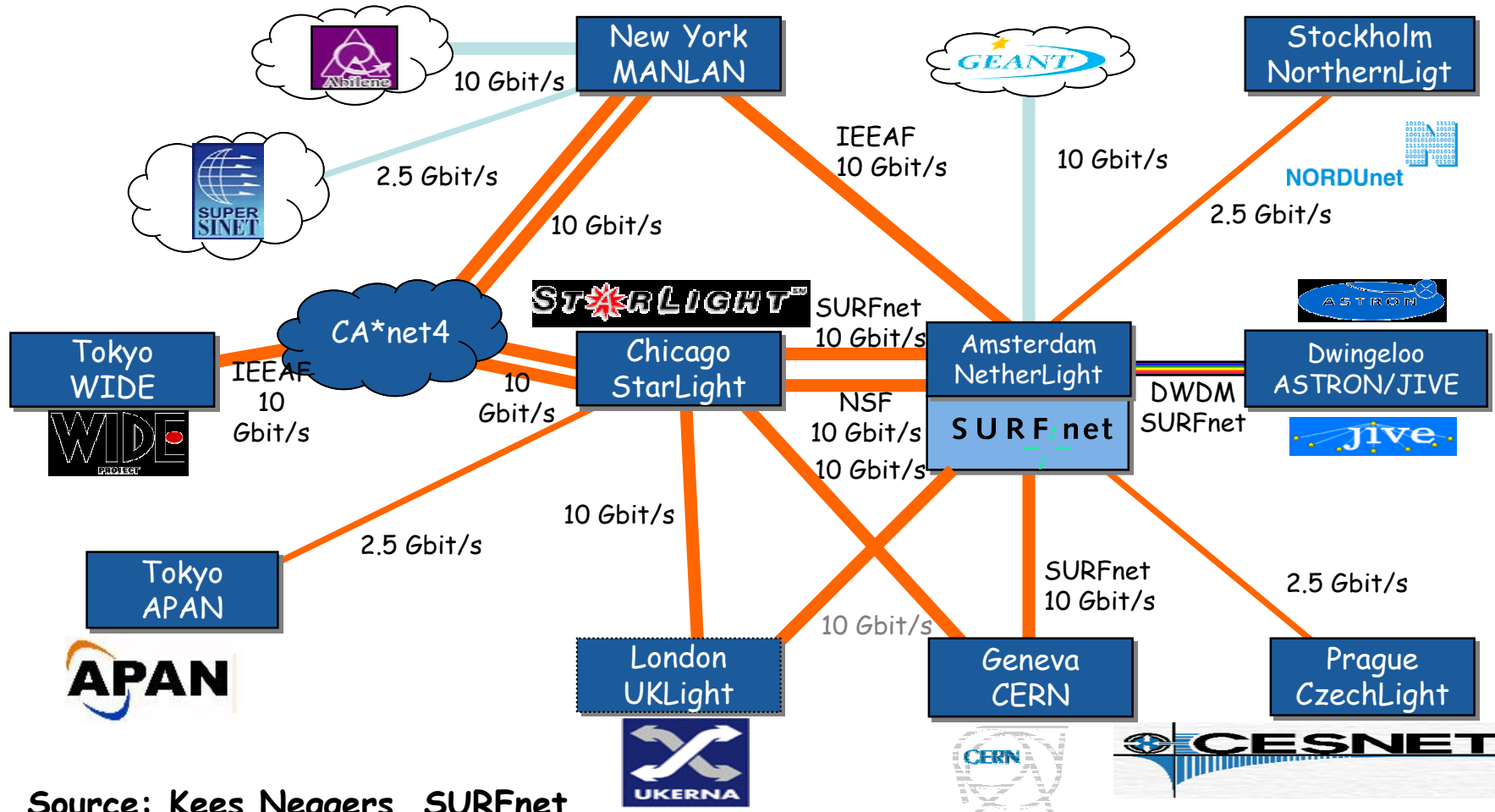
- Circuits의 신규, 철수, 변경이 신속하게 이루어짐
- 사업자 Level의 망 안정성 확보
- 네트워크의 Local/Remote 영역이 없음
- LAN, WAN, MAN 등의 다양한 솔루션 지원과 운영이 간단

◆ 단 점

- 초기 구축비가 고가이며, 주로 대용량의 백본에서 용이
- 장애시 유지보수품 수급이 늦으며, 관련 엔지니어가 적다.

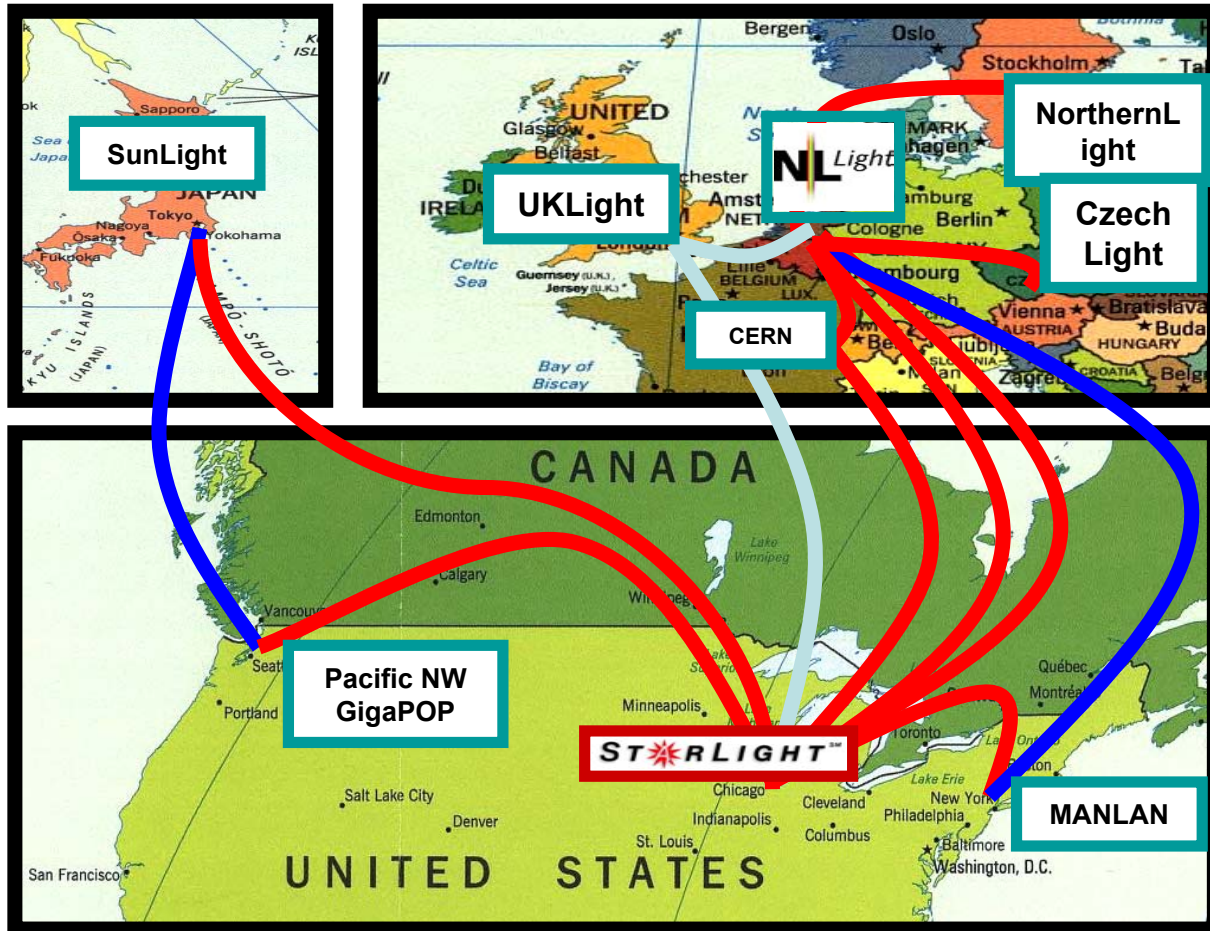
International R&D network Trends

Global Participation: GLIF



Source: Kees Neggers, SURFnet

International R&D network Trends (TransLight Int'l Lambdas)



European lambdas to US

- 10Gb Amsterdam—Chicago
- 10Gb London—Chicago
- 10Gb CERN — Chicago

Canadian lambdas to US

- 10Gb Chicago—Canada-NYC
- 10Gb Chicago—Canada-Seattle

US lambda to Europe

- 5Gb Chicago—Amsterdam

US/Japan lambda

- 2.5Gb Chicago—Tokyo

European lambdas

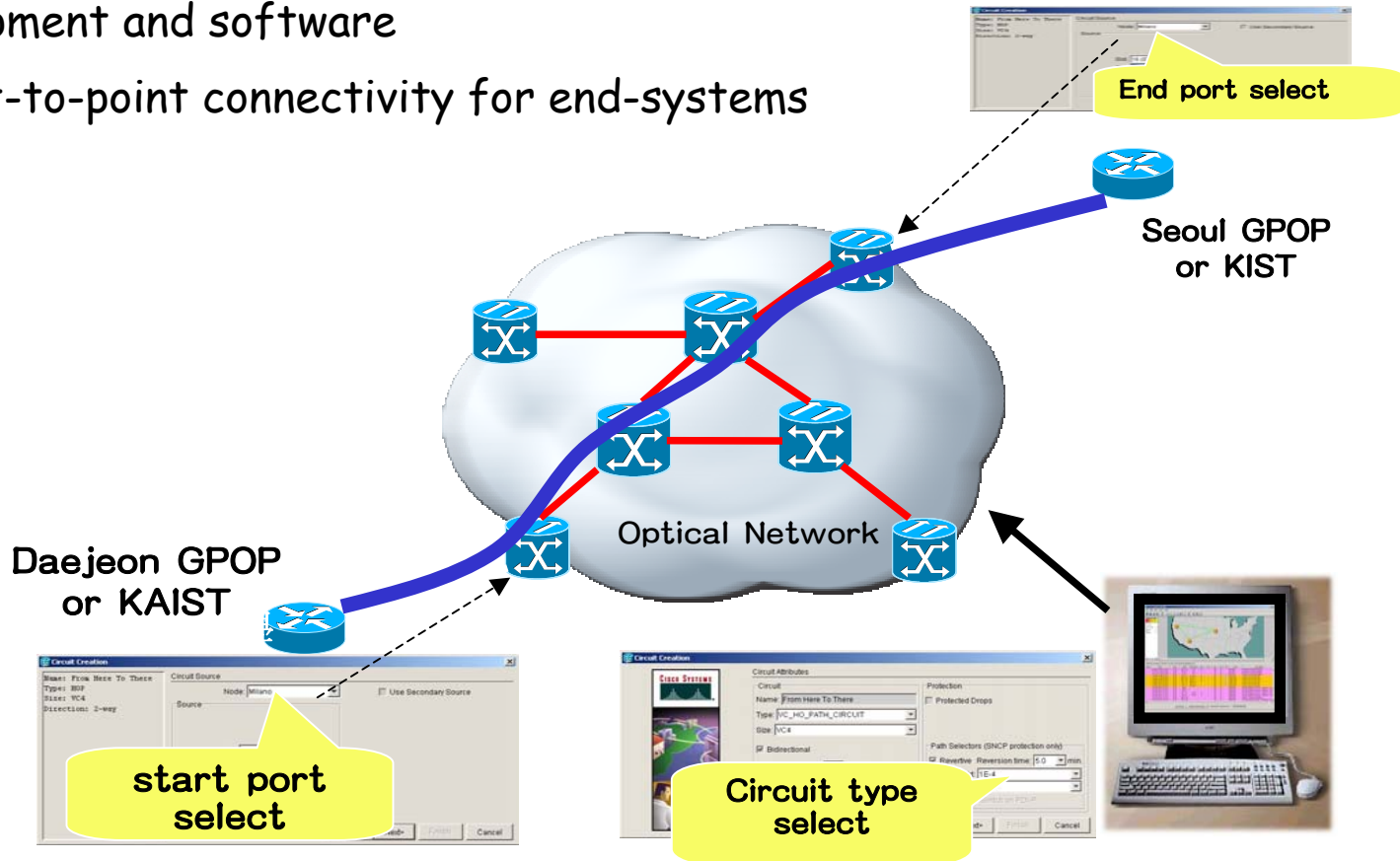
- 10Gb Amsterdam—CERN
- 2.5Gb Prague—Amsterdam
- 2.5Gb Stockholm—Amsterdam
- 10Gb London—Amsterdam

IEEAF lambdas (blue)

- 10Gb NYC—Amsterdam
- 10Gb Seattle—Tokyo

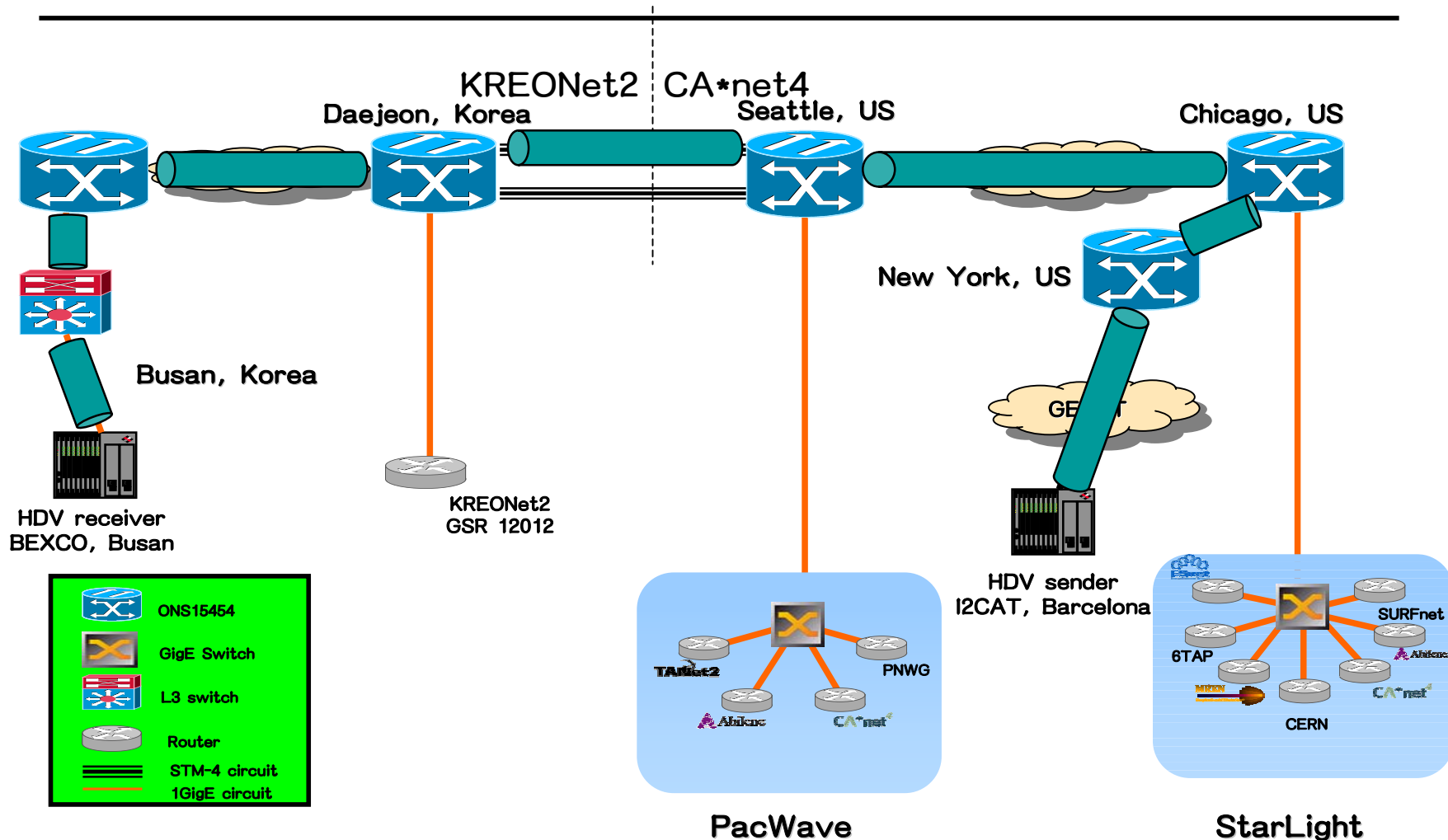
International R&D network Trends (PTP Lightpath provisioning)

- Manage & control the light path through equipment and software
- Point-to-point connectivity for end-systems



International R&D network Trends(1/2)

(International Lightpath Provisioning for HDV Streaming)



International R&D network Trends(2/2)

(International lightpath provisioning for HDTV demo)

KREONet2, KISTI, Korea

CA*net4, CANARIE, Canada

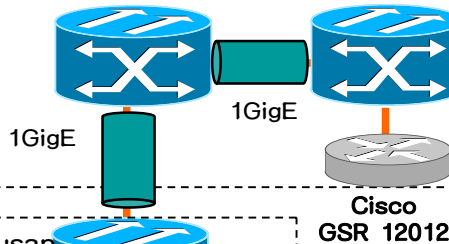
GEANT, Europe

Daejeon PoP

Daejeon
Cisco ONS #2

Daejeon
Cisco ONS #1

APII/KREONet2



Busan PoP

Busan
ONS

Cisco
7609

Cisco
7513

Cisco
7505

IEEE 802.D
bridging

45M HSSI

Cisco
7505

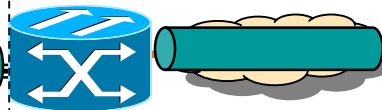
100M FE

KISDI Booth, BEXCO, Busan

HDTV receiver
BEXCO, Busan

Seattle, US

New York, US



New York, US

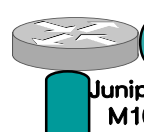
Juniper
M160



RedIRIS, Spain

Barcelona, ES

Madrid, ES



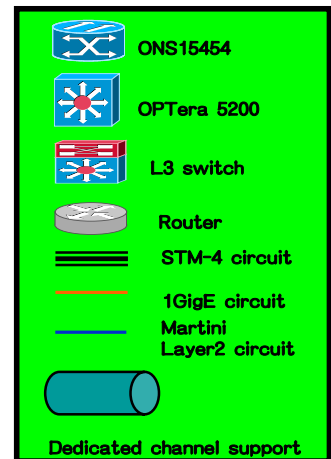
Anella-Cientifica

UPC, Spain



1GigE

HDTV sender
I2CAT, Barcelona



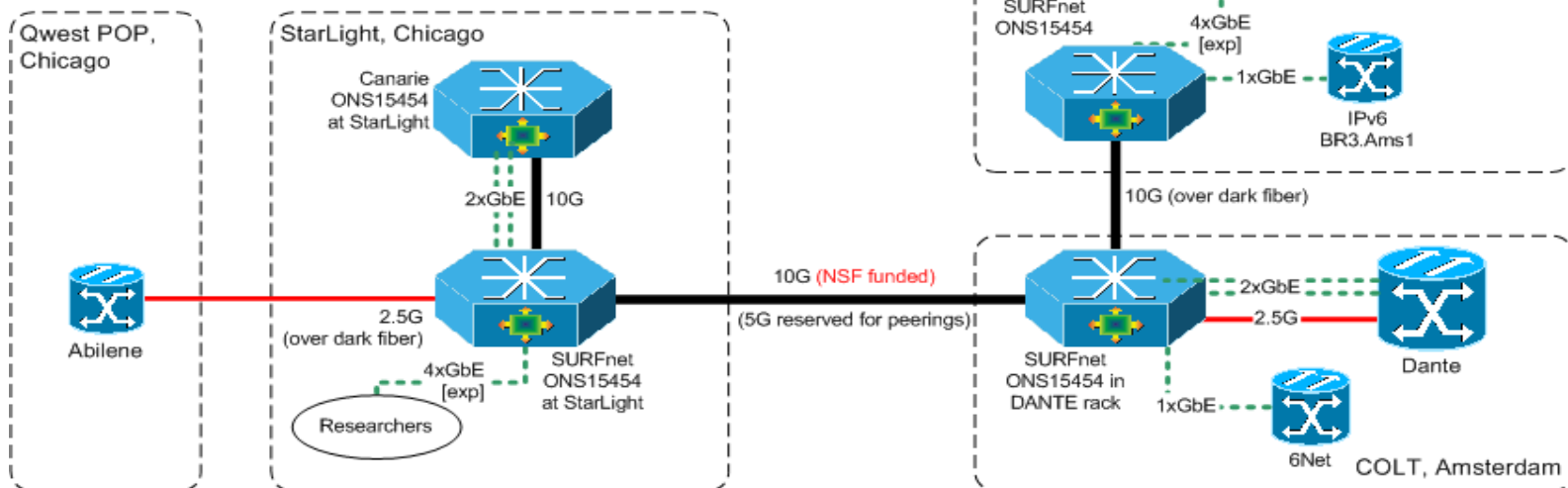
International R&D network Trends (NSF funded 10G lambda US-EU)

SURFnet

NSF-funded 10G lambda Chicago-Amsterdam

Peering bandwidths:

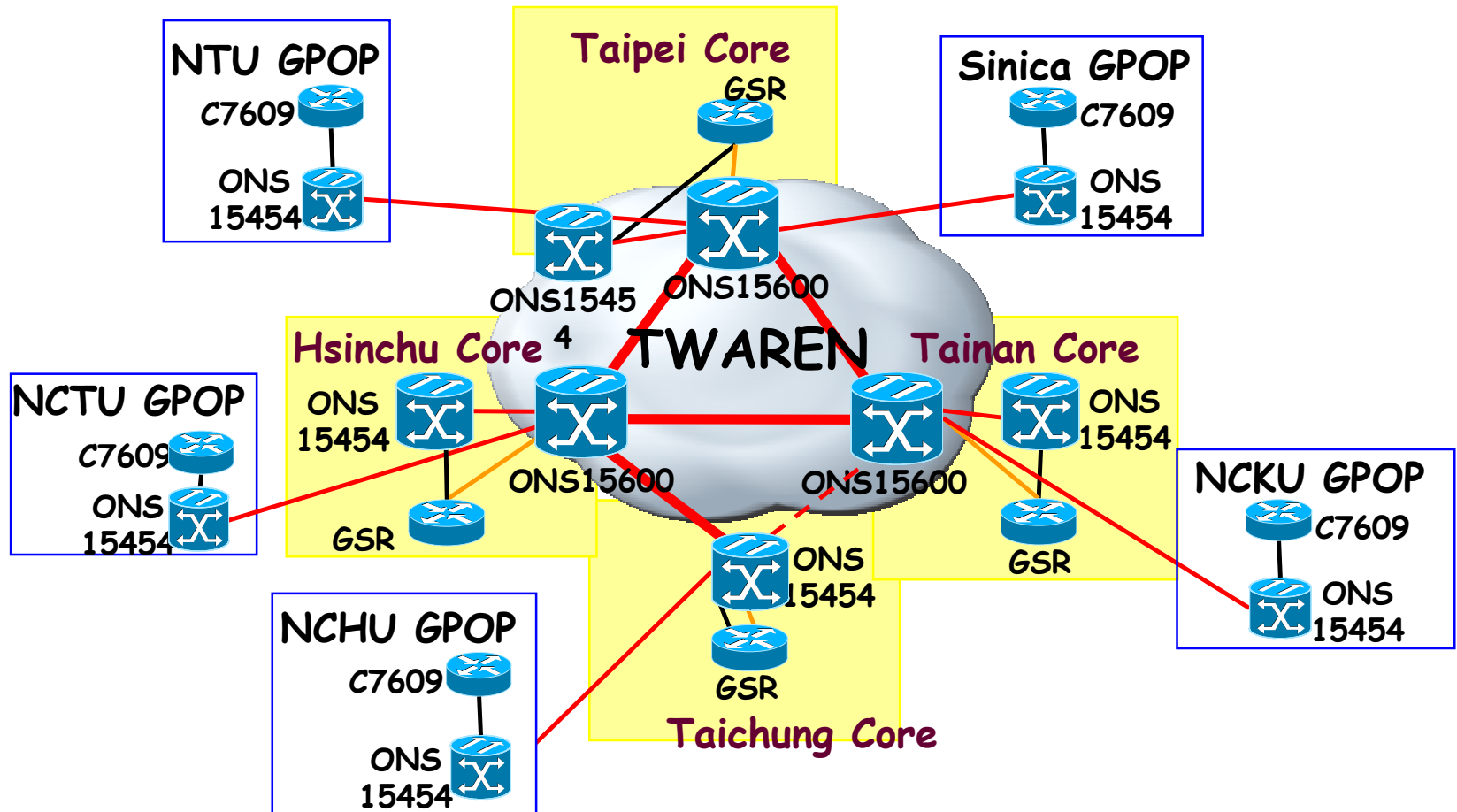
GEANT - Abilene	1 x 2.5Gb/s	(mapped to 1 x STS-48)
GEANT - CA*net 4	2 x 1Gb/s	(mapped to 2 x STS-24)



GigaPort

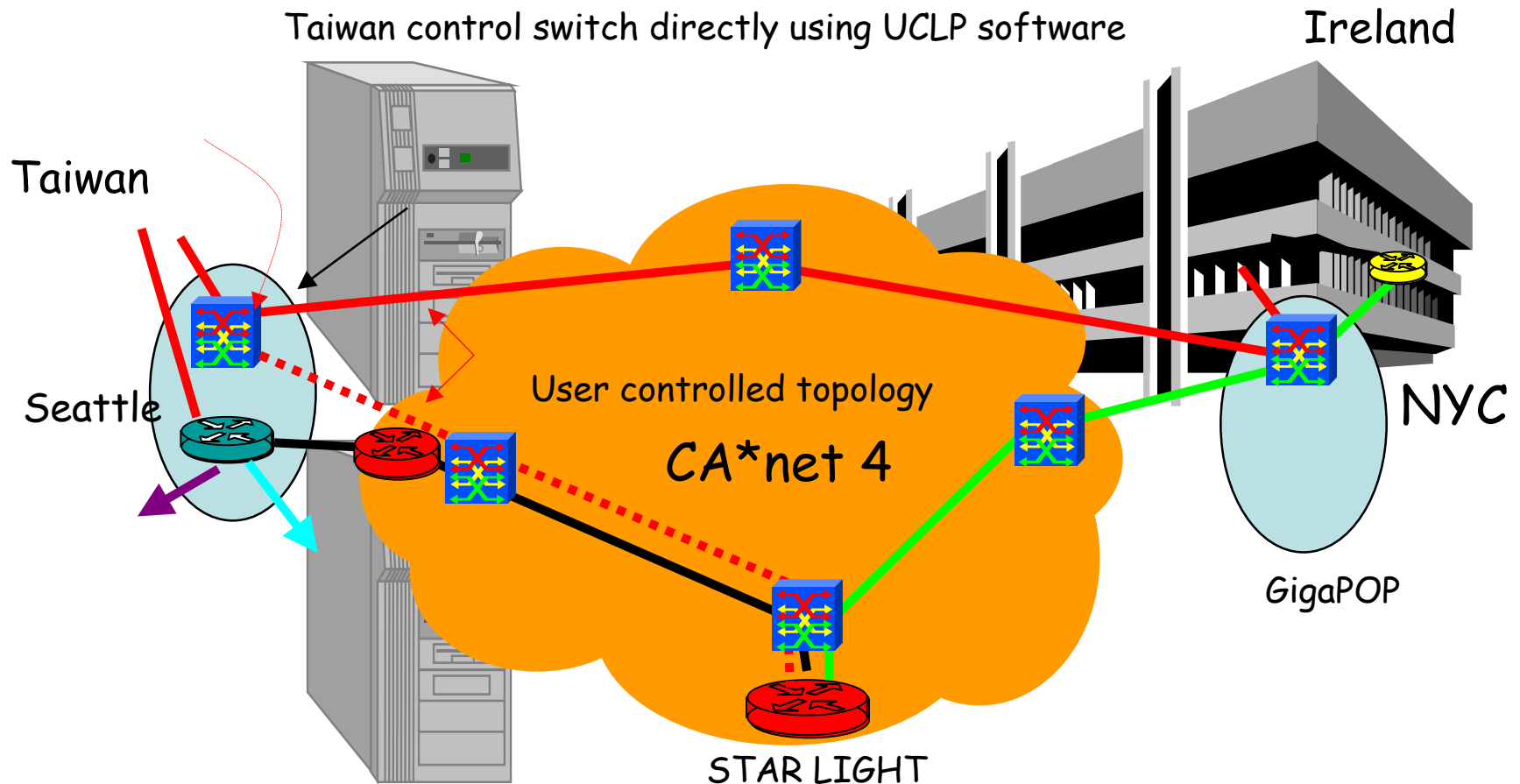
International R&D network Trends

TWAREN Optical Networking(domestic architecture)



International R&D network Trends

Taiwan Ireland



International R&D network Trends

KREONET WDM & MSPP



WDM 120Gbps(40Gbps x 3)

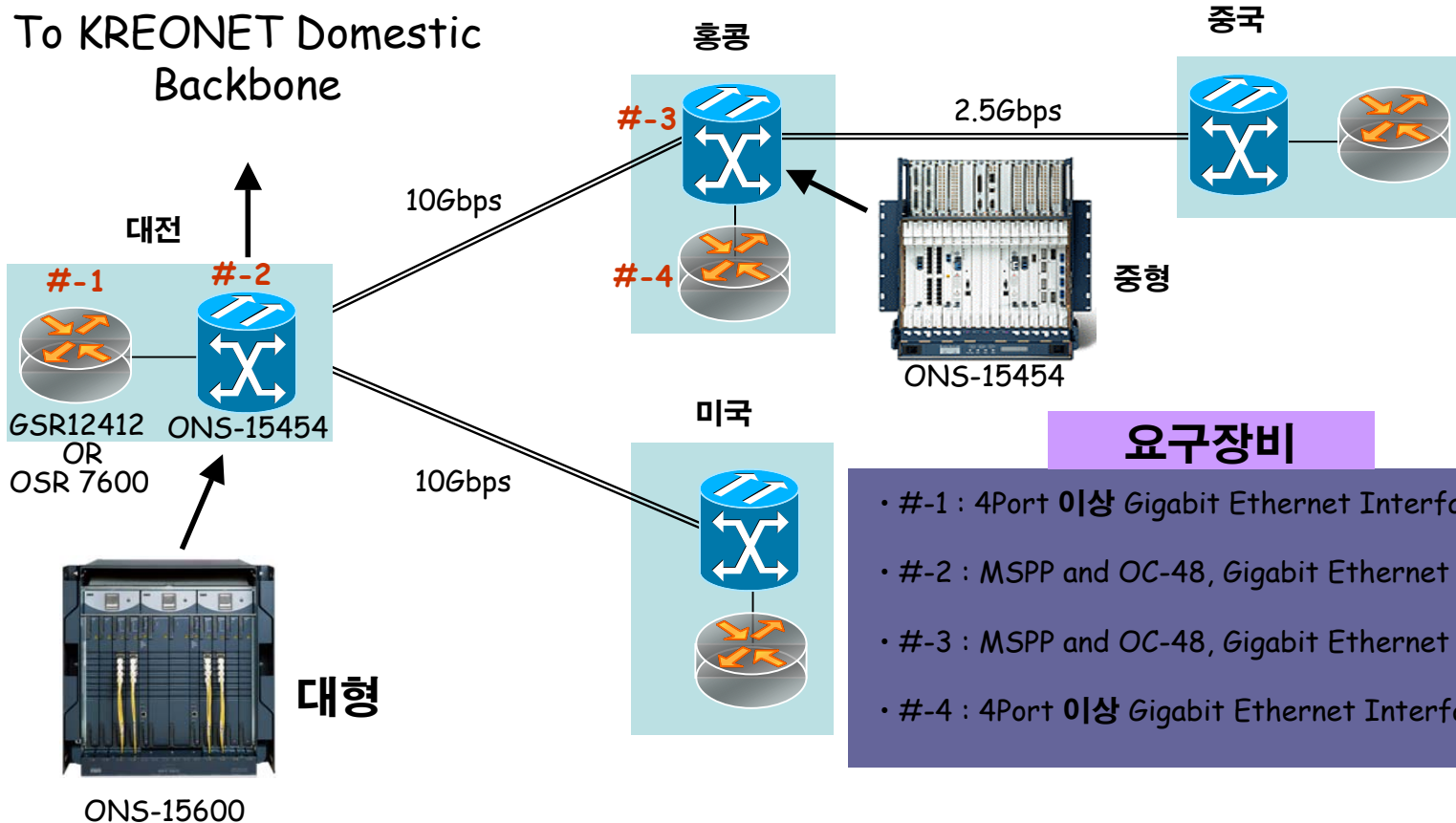


MSPP 120Gbps(40Gbps x 3)

International R&D network Trends

GLORIAD NETOWRK TOPOLOGY PLAN

To KREONET Domestic Backbone



요구장비

- #1 : 4Port 이상 Gigabit Ethernet Interface
- #2 : MSPP and OC-48, Gigabit Ethernet Include
- #3 : MSPP and OC-48, Gigabit Ethernet Include
- #4 : 4Port 이상 Gigabit Ethernet Interface

Conclusions

- ◆ 안정성이 보장된 자유로운 Cross Connecting 기술 등으로 시험 망 구성과 사용자 지원이 효과적
- ◆ 국제수준의 연구망들은 백본 고도화시 Lambda Based Light Path 서비스를 추진하고 있음
- ◆ 이러한 Light Path기반으로 다양한 과학기술 및 첨단 응용연구들이 추진됨(HEP, ITER, Bio, Climate, HDV, Etc,,,...)
- ◆ 국내 R&D 커뮤니티 에서도 Korea Light 기반의 R&D 응용 서비스 추진을 위해 활동(NCA, KAIST, KISTI, KOREN,,,,,,)

SONET/SDH 디지털 신호 계위

SDH 신호	SONET 신호	전송 속도
	STS-1	51.840 Mbps
STM-1	STS-3	155.520 Mbps
STM-4	STS-12	622.080 Mbps
	STS-24	1244.160 Mbps
STM-16	STS-48	2488.320 Mbps