

Advanced Platform Services on JGN2plus

DCN Deployment & NOC Collaboration Tool

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Outline

I. DCN Brief Review

- DCN Multi-domain Control Plane
- Global Dynamic Circuit
- Example of DCN Utility
- Benefits of Using DCN

2. Expansion of DCN connection to APAN region

- How to Connect to DCN?
- Installation of Control Plane Software

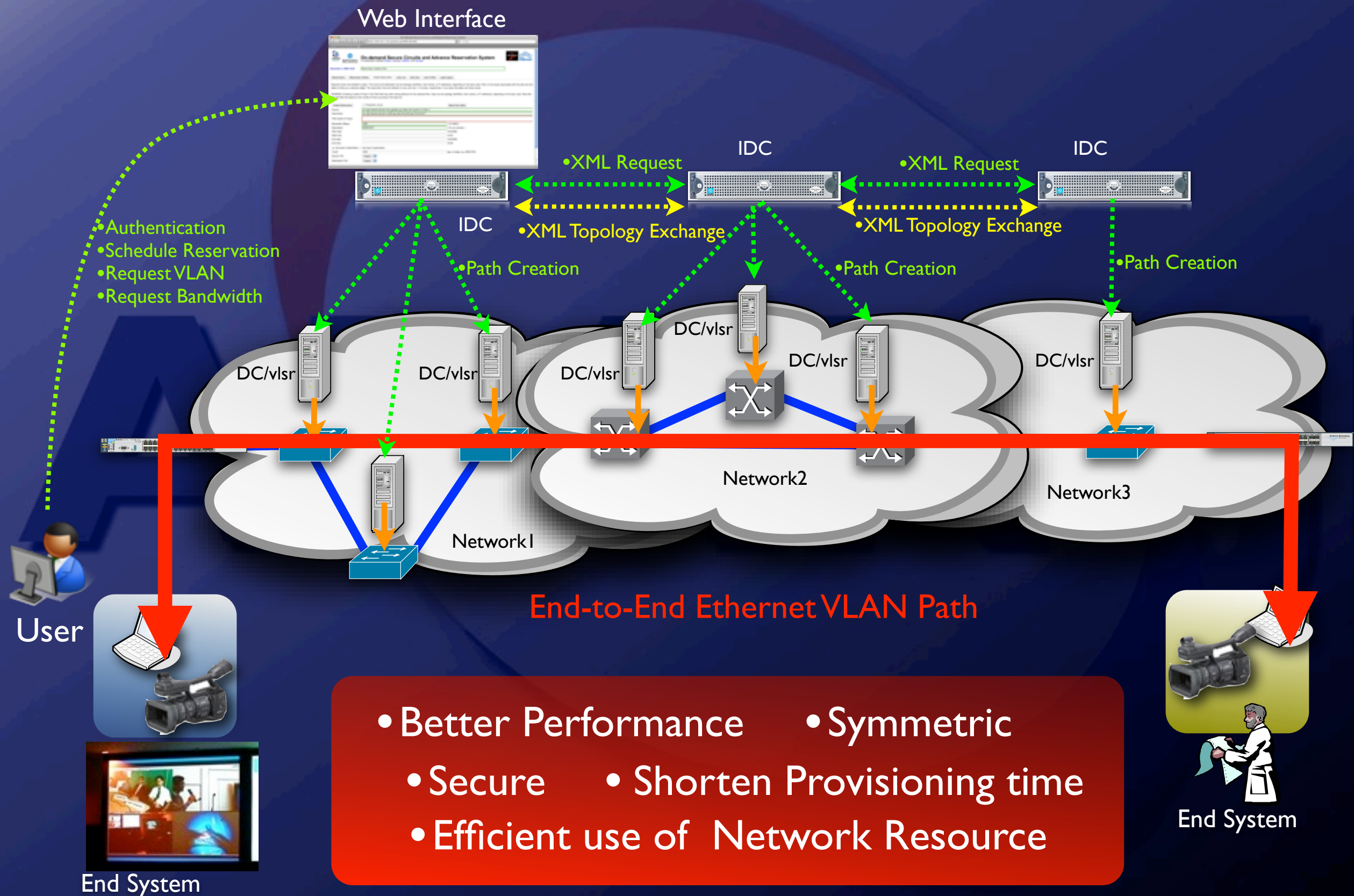
3. Issues and Advices on Development of Data Plane

- Efficient Construction of Layer2 Network
- Taking Care of Network Performance
- Challenges in Multi-domain DCN Operation

4. NOC Collaboration Tool for Multi/Inter-domain R&E network

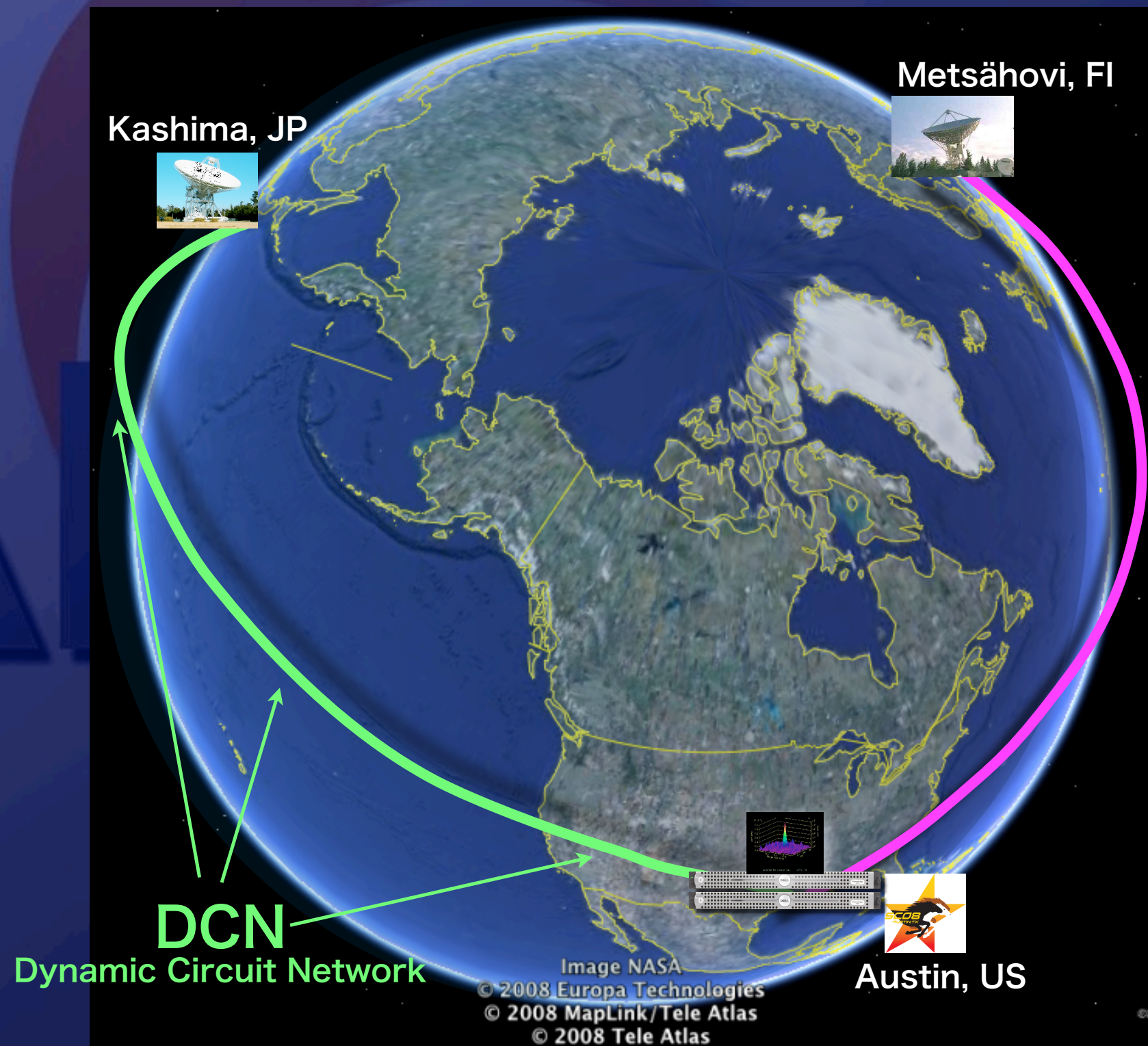
- Information-sharing Tool Review
- Next Steps by APAN Sydney Meeting

DCN Multi-domain Control Plane

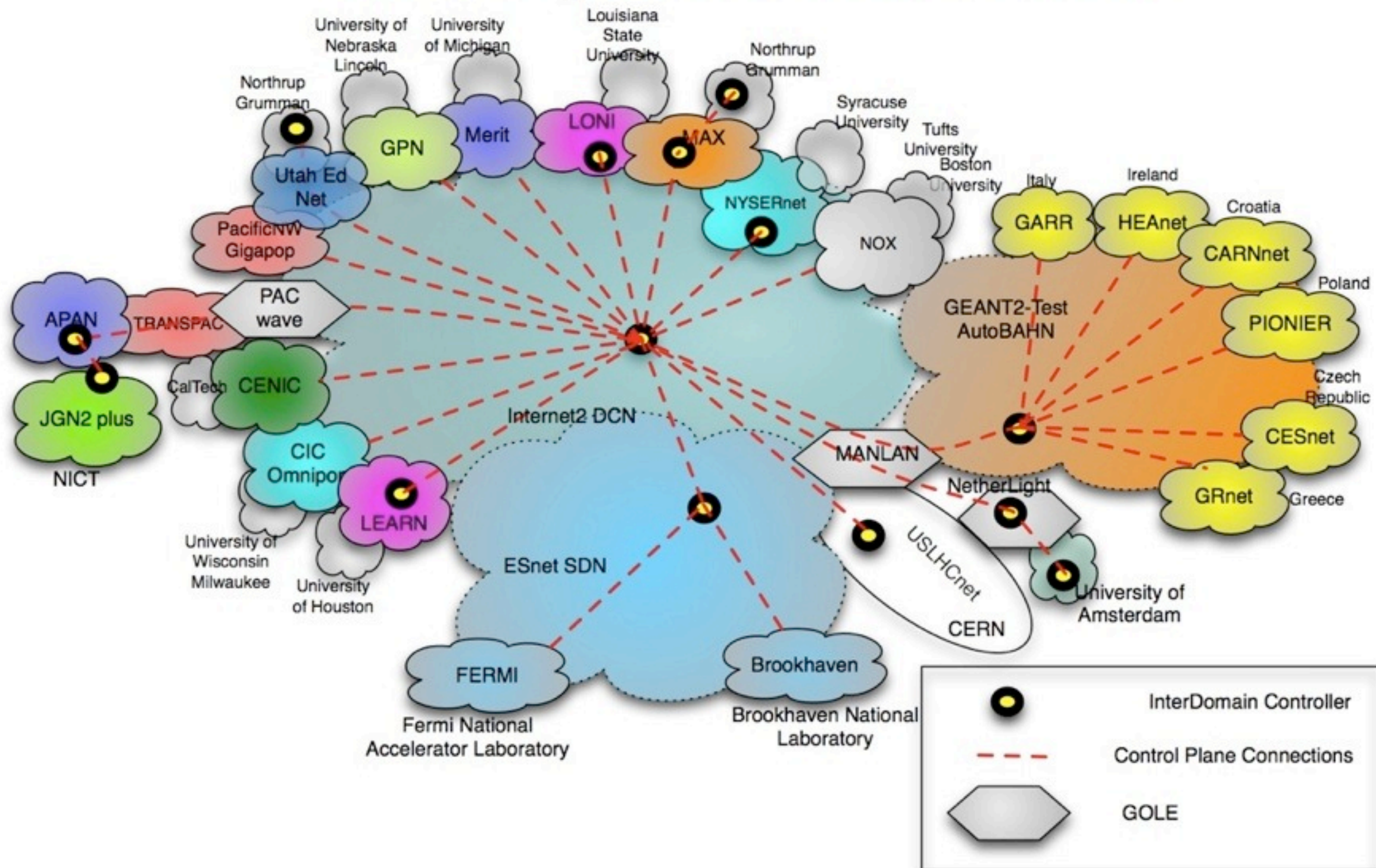


Example of DCN Utility

NICT e-VLBI Correlation over DCN at SC08



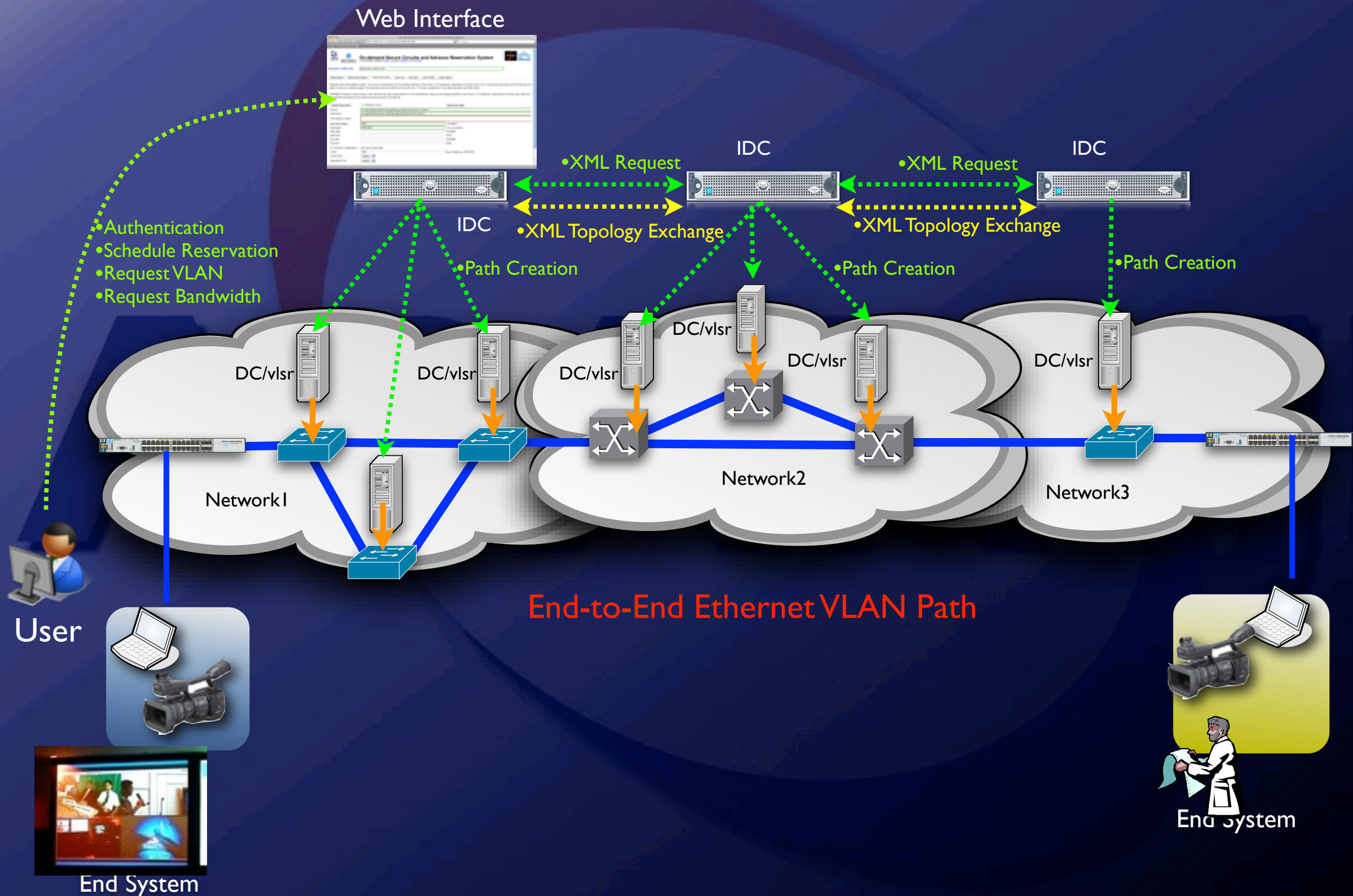
Global Dynamic Circuit Network



Benefits of Using DCN

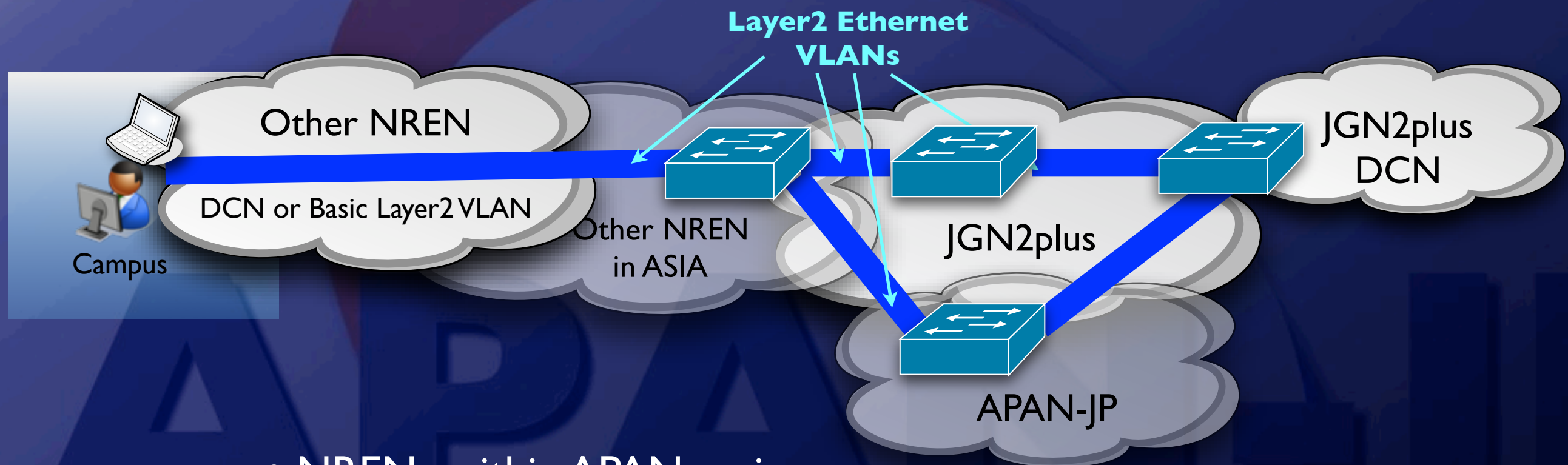
- Enable user to create on demand end-to-end L2 VLAN path
 - Researchers/campus network operators can provision VLAN path through Web Interface by themselves
 - Save significant network provisioning time
 - Possible use for interactive real-time application, events over the network
 - Provides speedy implementation of research activities and experiments
- Reduce the burden of multi-domain network coordination
 - No need to coordinate the path among multiple networks in each use case
 - Facilitate the smooth implementation of international collaboration researchs
- Schedule management of finite network resources
 - IDC reservation scheduler prevents the network performance degradation by cross-traffic collision
 - Especially effective in stationary and huge data transmission
- Improvement of network performance in US section
 - Internet2 DCN controls the Layer I level and provides dedicate circuit secured the bandwidth
 - Avoids a negative impact of cross-traffic in the shared-network-specific
- Users and application can use “DCN web service API” to request circuits
 - DCN API can be used into your applications or scripts
 - DCN API enables users to develop the original client software appropriate for own application
 - Realization of integrated client software cooperate with DCN and application

How to connect to DCN?



Connecting to DCN -I-

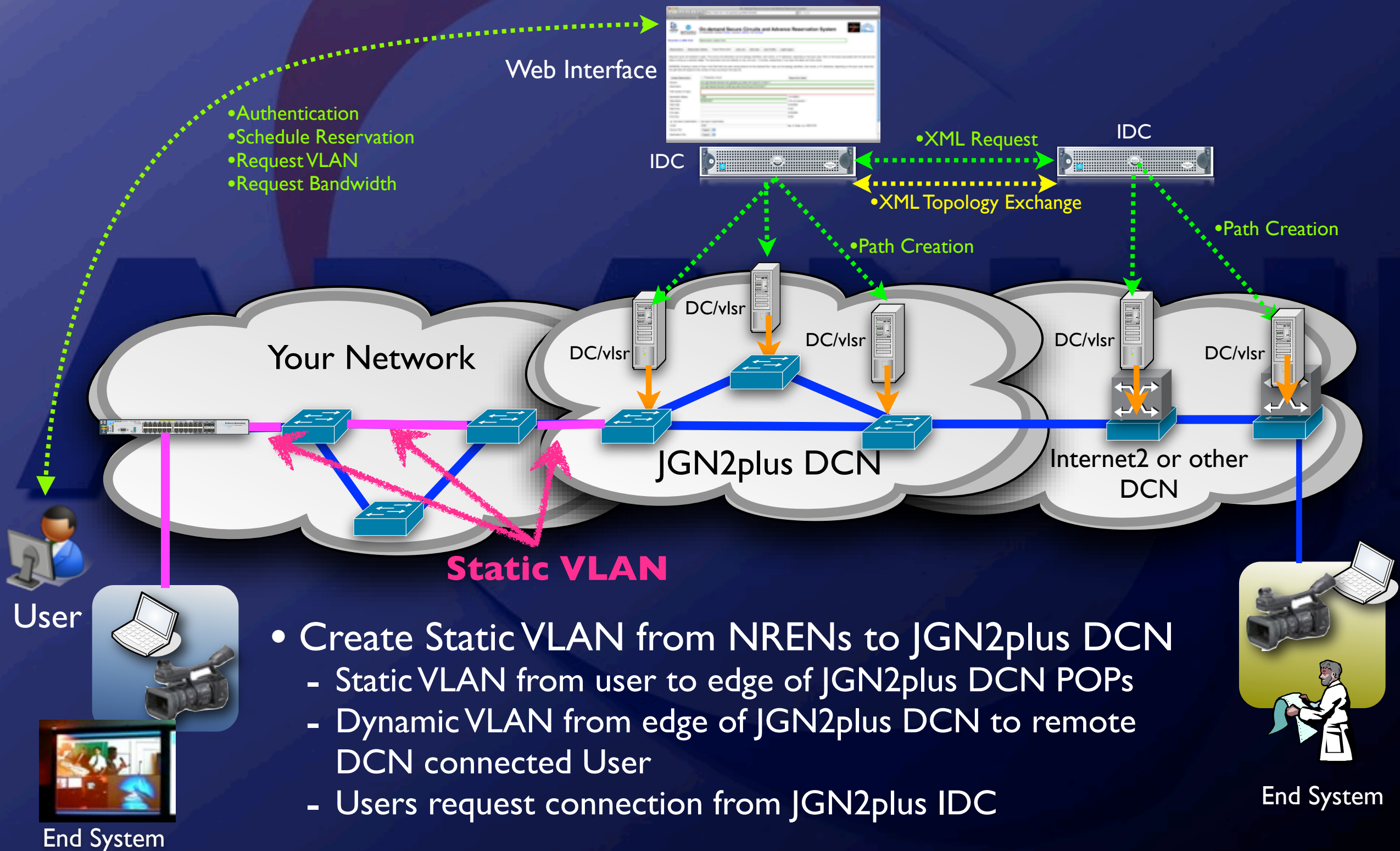
Physical Connection from National networks interconnect



- NRENs within APAN region,
 - Physical Link to JGN2plus DCN POPs
 - Tokyo/Otemachi, Kyusyu, Kashima, Tsukuba POPs
 - Layer2 connection via APAN-JP
 - Link should be Layer2 ethernet supporting VLANs
- Universities and campuses in each NRENs,
 - Physical Link to NRENs POPs
 - Typical connection is Ethernet VLANs

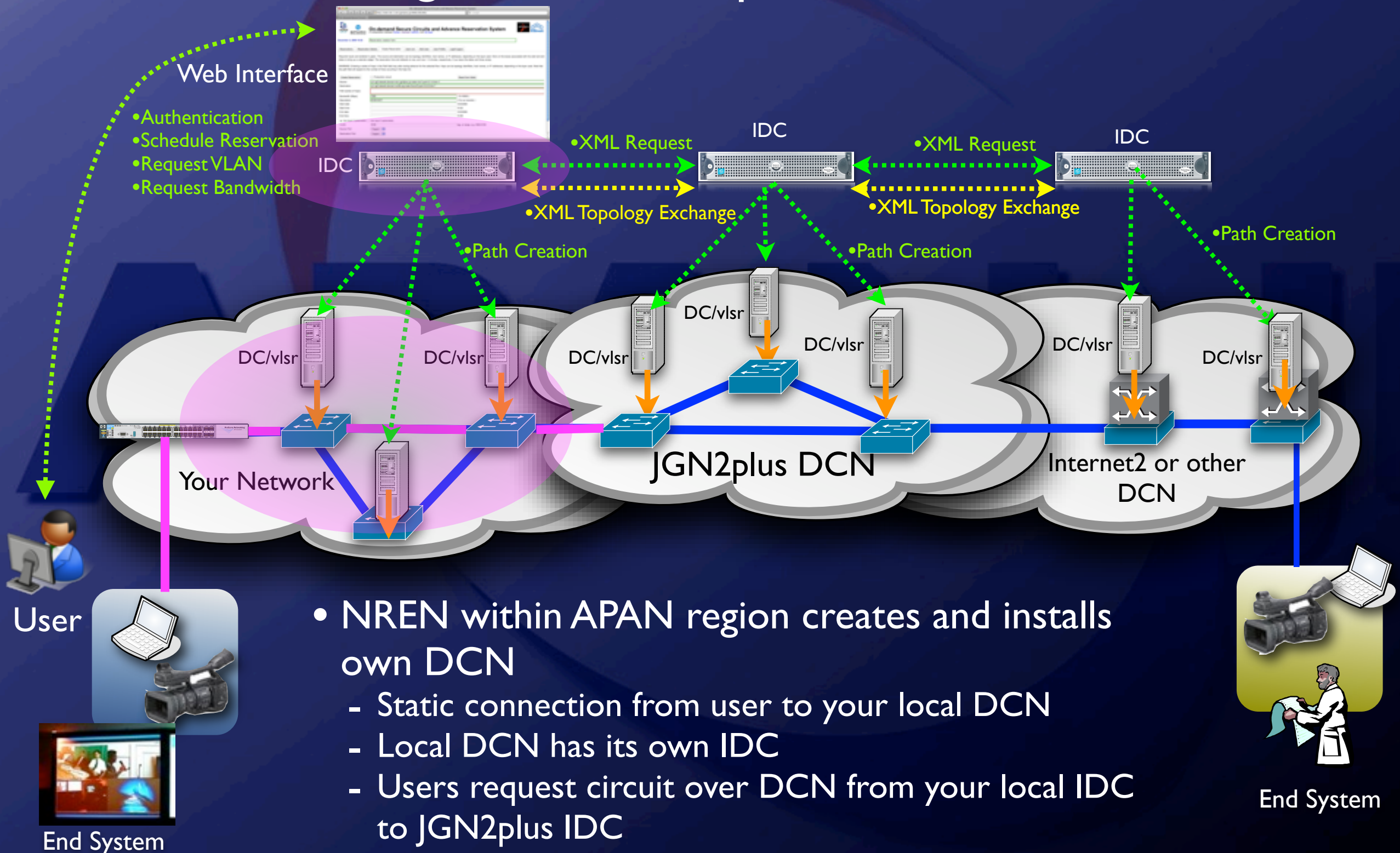
Connecting to DCN -2-

Linking to DCN - Option I: Static VLAN -

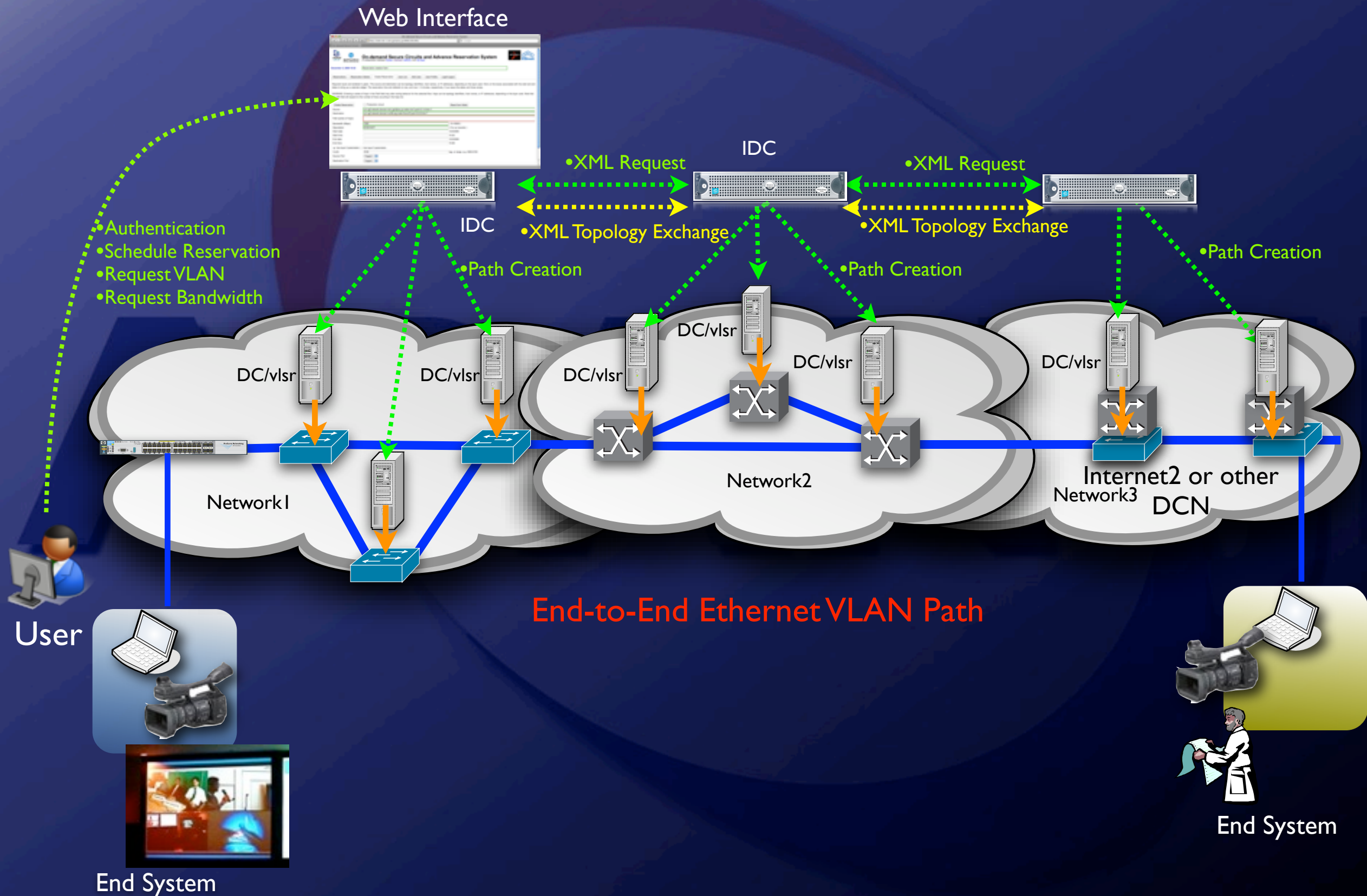


Connecting to DCN -3-

Linking to DCN - Option2: Own DCN-



Installation of Control Plane Software





Control Plane Software -I-

Domain Controller

DC(Domain Controller)

- **DRAGON**(Dynamic Resource Allocation via Gmpls Optiacl Network)

- Open source implementation of GMPLS maintained by MAX, USC ISI EAST, and George Mason University

- **VLSR (Virtual Label Switched Router)**

- Zebra PC based control plane software
- Provides GMPLS protocol support for devices which do not support GMPLS
- OSPF-TE, RSVP-TE
- Provision the Ethernet Switch and SONET/SDH Switch
- Switch setting method: SNMP, CLI, TLI, other script
- Provisioning request via CLI, XML

- **System Requirements for Installation**

- **DRAGON System**

- Linux BOX
- RedHat Enterprise Base (Kernel version 2.4.2 or later)
- Software Requirements

- DRAGON Software package (VLSR, NARB, RCE, ASTB)
- Dependence-package (SSH, GNU Compiles, Net-SNMP, libxml2, zlib-1.2.3)

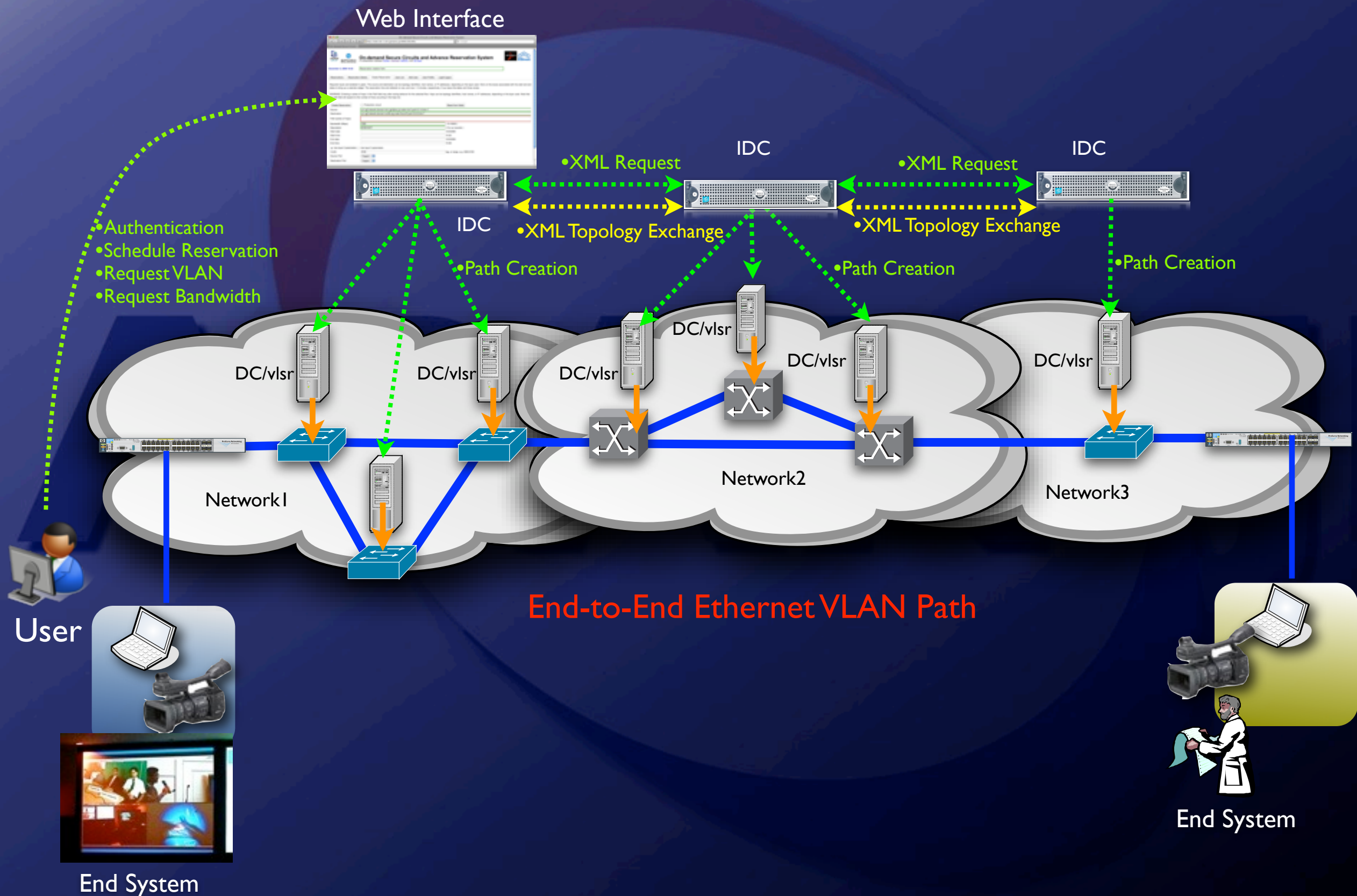


JGN2plus and APAN-JP hardware

- HP ProLiant DL360 G5
- Intel Xeon X5260 3.33GHz DualCore
- DDR2-667 2GB * 2
- SAS146GB*2 (RAID1)
- 10/100/1000 base-T * 2



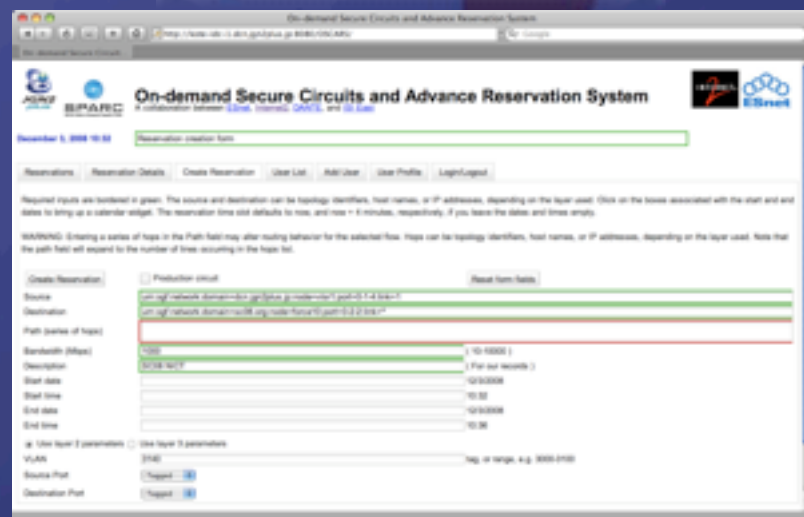
Installation of Control Plane Software



Control Plane Software -2-

Inter-Domain Controller

IDC(Inter-domain Controller)



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• OSCARS

- Open source project maintained by Internet2 and ESnet
- Accept circuit requests from users
- Use IDC protocol which consist of web services as a messaging among Inter-domain
- Web User Interface function for users
- Book-ahead and manage the scheduling of circuits

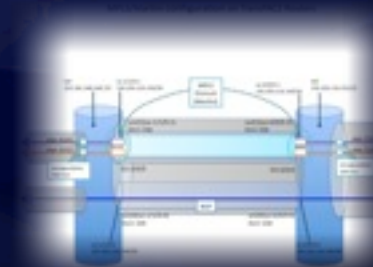
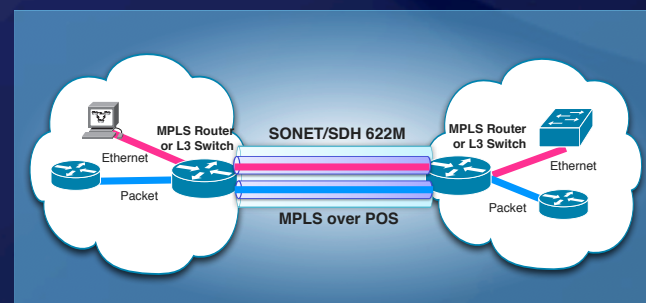
- System Requirements for Installation

• OSCARS System

- Linux BOX
- RedHat Enterprise (Kernel version 2.4.2 or later)
- OSCARS Package Software
- Third-Party Library and Package Requirements
 - OSCARS Package Software
 - MySQL5.0 / JDK5.0 / Tomcat 5.5 / Axis2 1.4.1/ Rampart 1.4.1/ Ant 1.7
- SMTP(sendmail) for e-mail notification of circuit activity
- NTP source

Efficient Construction of Layer2 Network

- Hybrid or Coexistence with IP production Network
 - Only Japan, Korea, and Thailand are currently providing Layer2 backbone services in APAN region
 - It is a fact that most NREN networks are built up with Layer3 and transport research traffic with IP packets
 - There are barriers:
 - A few carriers can provide wide-area ethernet service in Asia
 - Difficulty in Layer2 network operation
 - In principle, DCN needs point-to-point Layer2 VLAN connection
 - MPLS/L2VPN function is a good solution to provide Layer2 VLAN connection on backbone router
 - Cost-effective:
 - There is no need to procure ethernet infrastructure besides current IP infrastructure
 - If your router supports MPLS, you don't need purchase ethernet backbone switch
 - Operation side:
 - Solid performance in APAN-JP/TransPAC2/CERNET/UniNet, etc.
 - Since router has larger interface queue buffer than switch, MPLS brings the expected performance
 - Multi vendor Interoperability problem remains an issue

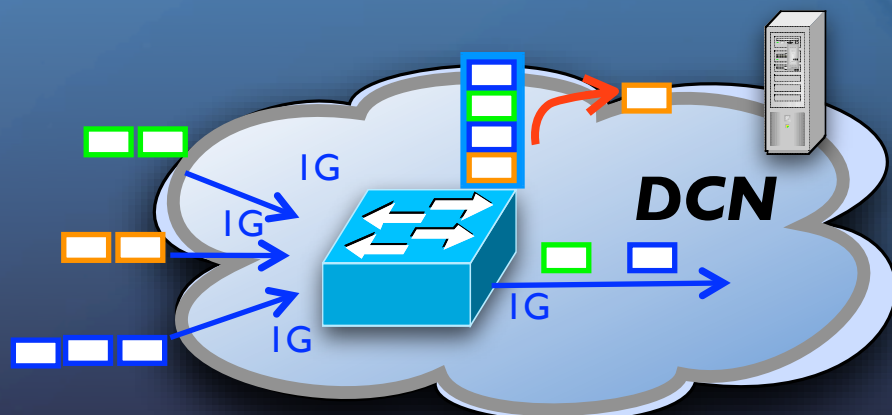


Take care of Network Performance

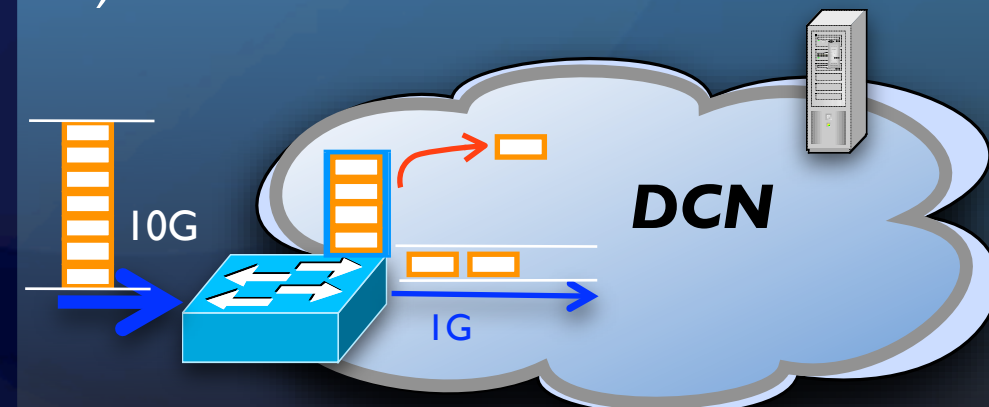
- Performance of Data Plane Network

- Even though we use DCN technology, it is difficult to create bandwidth guaranteed E2E circuits on APAN region
- Since DCN is partially shared network, it should be considered **long-distance Layer-2 shared network**
- To my knowledge, it is very difficult to provide better performance over long-distance Layer-2 network rather than Layer-3 network
- Capability of Layer-2 switch
 - Buffer size of interface queue
 - Wire rate
 - VLAN-based QoS
- Though DCN system specified the bandwidth exceeding manually-set XML topology cannot be reserved by user basically, it is expected to design data plane network without such bottleneck as “Saturation Point (a)” and “Bandwidth Conversion Point”
 - $n \times \text{IG} \Rightarrow \text{IG}$ ✗
 - $10\text{G} \Rightarrow \text{IG}$ ✗ $\text{GigE} \Rightarrow \text{SONET OC12}(622\text{M}) \Rightarrow \text{✗}$

a) Saturation Point



b) Bandwidth Conversion Point



Challenges in Multi-domain DCN Operation

- Difficulty of Trouble-shooting of Multi-domain DCN
 - NOC for DCN has not been deployed even in US and Euro, Global Dynamic Circuit is operated based on DCN control plane engineers and software developers community
 - In this situation, the DCN end-to-end path creation between JP-US becomes failure
 - No problem on JGN2plus control plane and data plane
 - Contact the US DCN developer and then the problem was finally resolved
 - There are absolutely no operational information for DCN like usual Internet2 IP network
 - Pause to realize importance of “operational information”
- Multi-domain operation for multi-domain DCN Circuit
 - Network monitoring tools and systems for multi-domain environment is indispensable to DCN operation
 - DCN path is created over existing multi-admin/multi-domain infrastructures, so we would need more various operational information beside current operation data
 - Operational status of underlying data plane network --Circuit, equipment over end-to-end/multi-domain network
 - DCN-specific event status on IDC and DC software
 - Usage / Number of DCN circuits
 - User accounts for authentication
 - Solutions:
 1. Development of perfSONAR-driven operation tool for multi-domain DCN
 2. Improvement of DCN control plane softwares
 3. Need more stronger collaboration among R&E NOCs

NOC Collaboration Tool

Proposal of Integrated “Web based tool” that can share those kind of information among NOCs

- Essential Requirements

- Link to NOC own web page of each asian REN/NRENs
- NOC information for understanding the network situation and research projects
- Collaborative research project lists/Detailed application lists
- Calendering of experiment and event schedule
- Documentation management
- Authentication for NOC and Network admin

- Wiki based Software

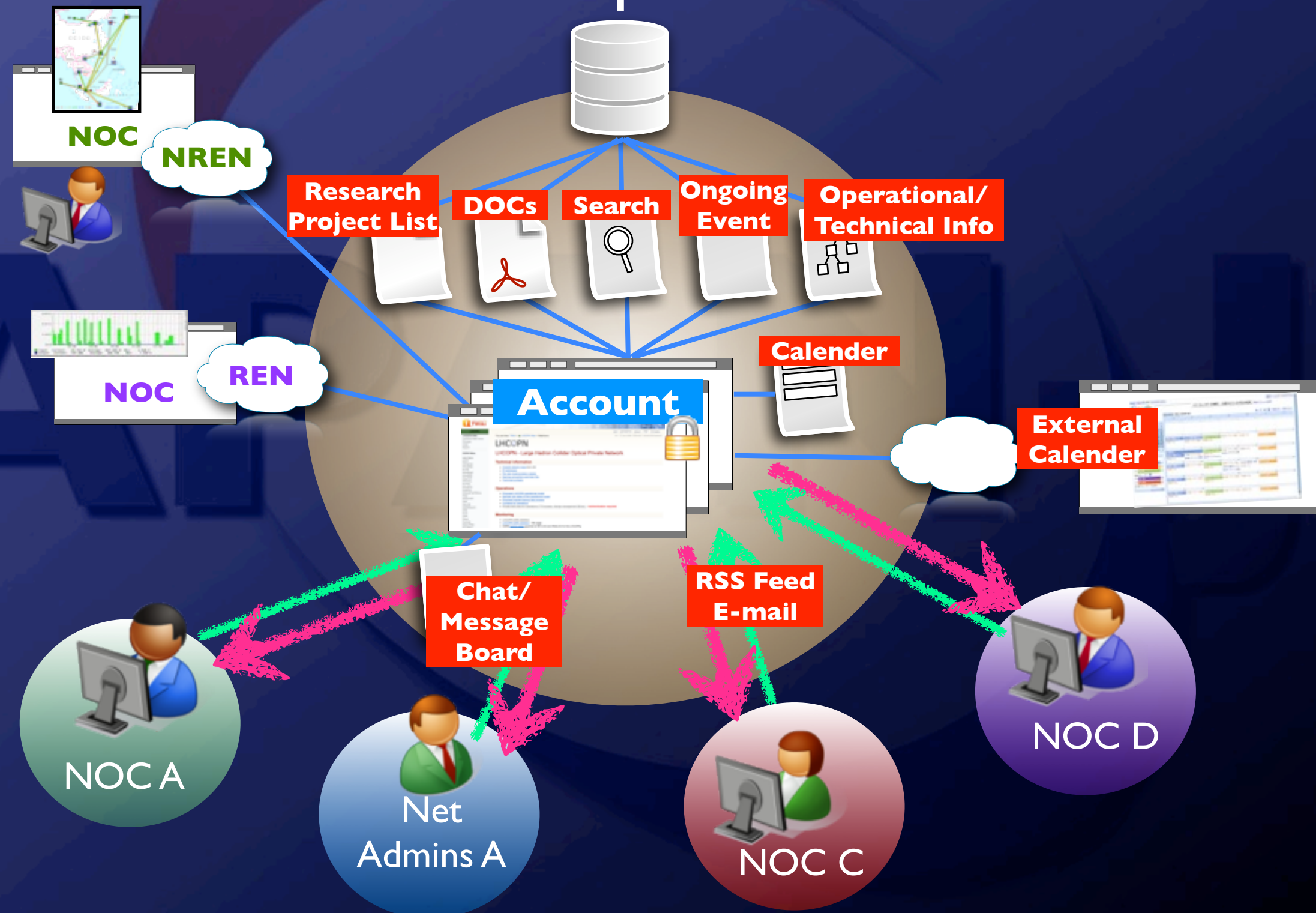
- APAN-JP NOC Proposed “Atlassian Confluence”(Enterprise wiki/Blog/CMS) at last APAN meeting
- Plug-in system makes it easy to customize and extend Confluence to suit our NOC needs
- It is used in Internet2, KEK(Japan), Accenture, Sun mirosystems, U.C. Berkeley

- Management

- Public web NOC and Network admin with Authentication
- APAN-JP NOC install tool and compile content responsibly

Information-sharing Tool

- Blueprint -





Information for NOC

Routing Information Research Project Iperf server

NOC contact point Experiment Schedule

Traceroute Network Topology Measurement Data

IP addresses BGP neighbor Equipment

Network Resource VLAN ID MTU size Network Usage

Bandwidth Trouble-Ticket

Documentation Researchers



Next Steps by APAN Sydney

1. As a first step, APAN-JP NOC collects each NOC's contact point
 - Your 24 x 7 NOC mailing list & phone number
 - Photos of operators
 - Your NOC manager's cell phone number
 - Your organization or NOC operation web page
2. Create an account and initial page of all APAN NOCs on Atlassian Confluence
 - Post your portrait picture :-)
 - For creating your NOC's own personal space
 - For learning features of wiki basics
3. Discuss on Discussion threads of Atlassian Confluence
 - Call for cooperation from NOCs
 - Brainstorming about what information do we need for further collaboration
 - Assemble necessary information
4. Design and create a framework of collaboration tool
 - Consolidate information and enhancing the content
 - Start the trial operation

Conclusions

- DCN overview
 - Creates on demand end-to-end L2 VLAN path between devices connected to DCN
 - Reduce the burden of multi-domain network coordination and provides speedy implementation of research activities and experiment
 - leads to the promotion of the international collaboration on R&E networks
- Expansion of DCN on APAN region
 - NRENs needs physical data connection, and control plane access to DCN
 - MAY have control plane connection
 - NRENs can create local DCN using available open source control plane software
- Issues and advices for data plane deployment
 - MPLS/L2VPN is a good solution to make layer2 connection over APAN network
 - Care about capability of Layer-2 switch
- Collaborated network operation
 - Multi-domain operation will be more important in DCN operation
 - Operation technology approach: Utilization and deployment of perfSONAR
 - NOC collaboration approach: Wiki based Information Sharing Tool

Reference URL

- DCN Software Suite
<https://wiki.internet2.edu/confluence/display/DCNSS/Home>

- OSCARS
<http://www.es.net/oscars/>

- OSCARS Web Services Specification
<https://wiki.internet2.edu/confluence/display/CPD/OSCARS+Web+Service+Definition>

- DRAGON
<http://dragon.maxgigapop.net/twiki/bin/view/DRAGON/WebHome>

- DCN Working Group Wiki
<https://spaces.internet2.edu/display/DCN/Home>

- Test IDC Guid
<https://wiki.internet2.edu/confluence/display/DCNSS/Internet2%2Fs+Test+IDC>

- perfSONAR
<http://www.perfsonar.net/>

- SC08
<http://sc08.supercomputing.org/>

- Atlassian Confluence
<http://www.atlassian.com/software/confluence/>

If you want to see actual DCN path creation, please contact me. I will show DCN demonstration!