

# DICE Interdomain Control Plane

John Vollbrecht, Internet2

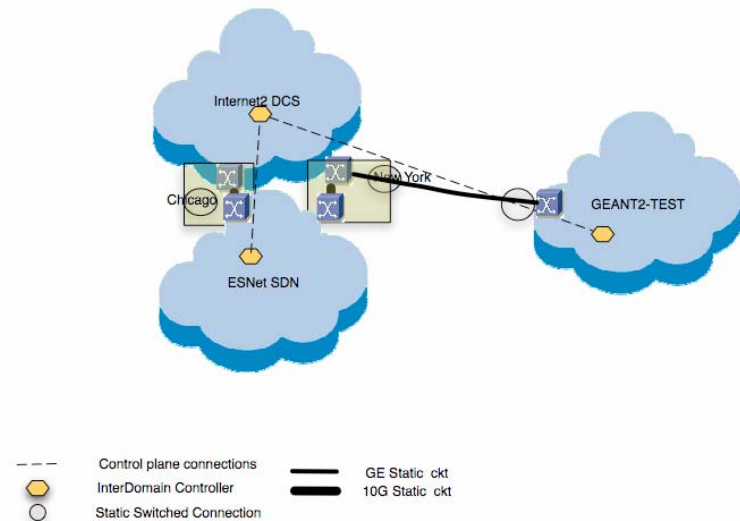
Afrodite Sevasti, GRNET

Radek Krzywania, PSNC

GLIF - Sept 2007

# Planned infrastructure

- Between ESnet I2/  
GEANT
  - Regionals, Labs and  
Campuses in US
  - National Nets in  
Europe
- Operational demos  
at November SC07



# Interdomain protocol development

- Initial development by GEANT, ESNet, and Internet2
  - Collaborative development of protocol
  - Meetings in DICE control plane group
    - Development of common schemas for exchanging information
    - Collaborate with perfSONAR topology work
- Interoperation testing in process
- Demo of control plane inter-operation at SC07

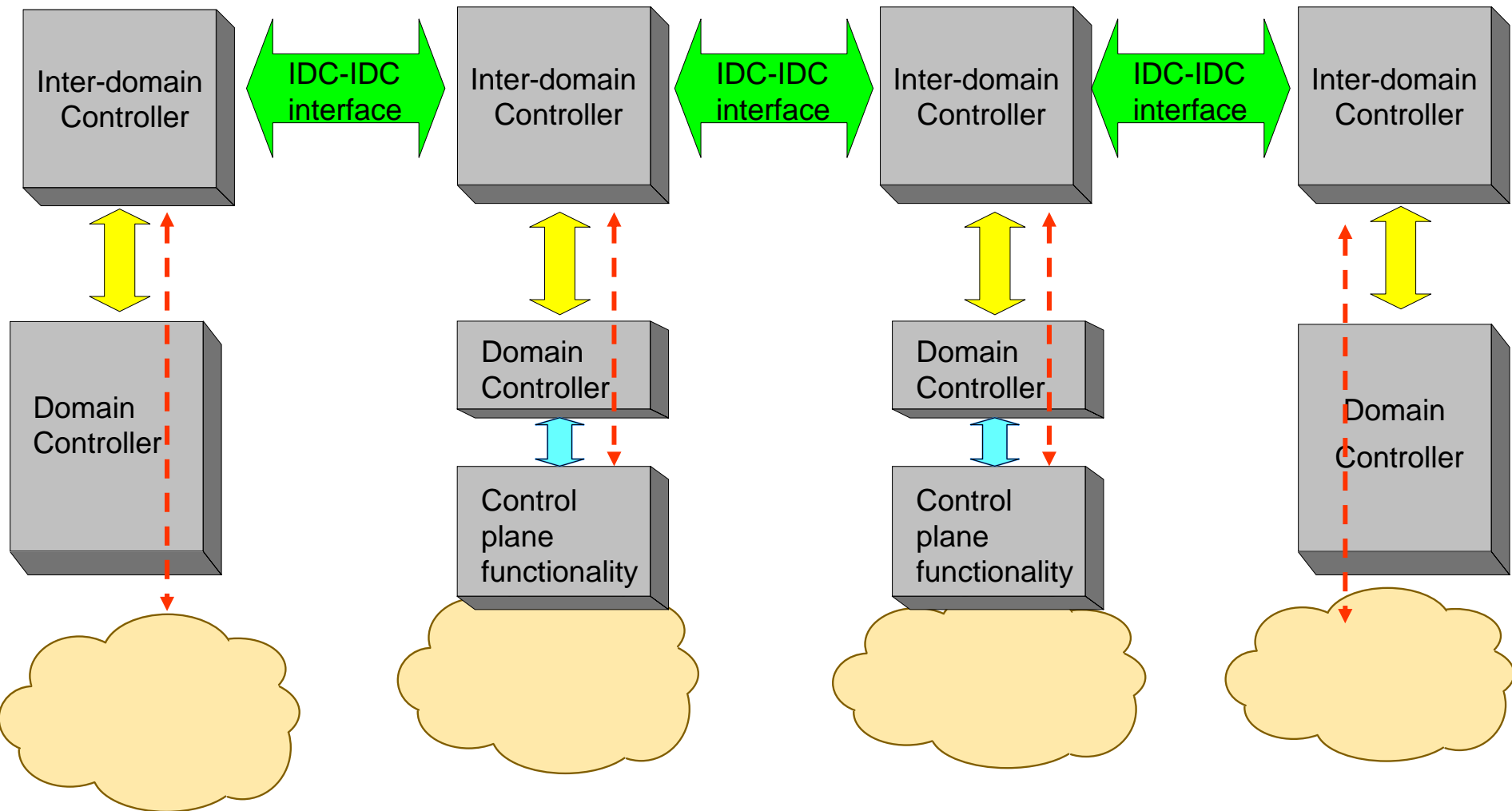
# Multidomain Control Protocol functional requirements

- Establish a commonly defined protocol at the inter-domain level
  - Web-services based
  - GMPLS is not used for inter-domain operations
- Intra-domain functionality is left open to the different implementations
- Authentication based on X.509 certificates

# Basic architecture

- Inter-domain functionality provided by the Inter Domain Controller (IDC)
- Interoperability at the inter-domain level is ensured by IDC-to-IDC communications
- IDC may be used to create “federations” of networks
- An IDC represents a particular network
- Initial IDC federations allow users to pilot applications
- IDCs may interoperate with GOLEs and GRID services in the future

# Provisioning Multidomain Control Plane

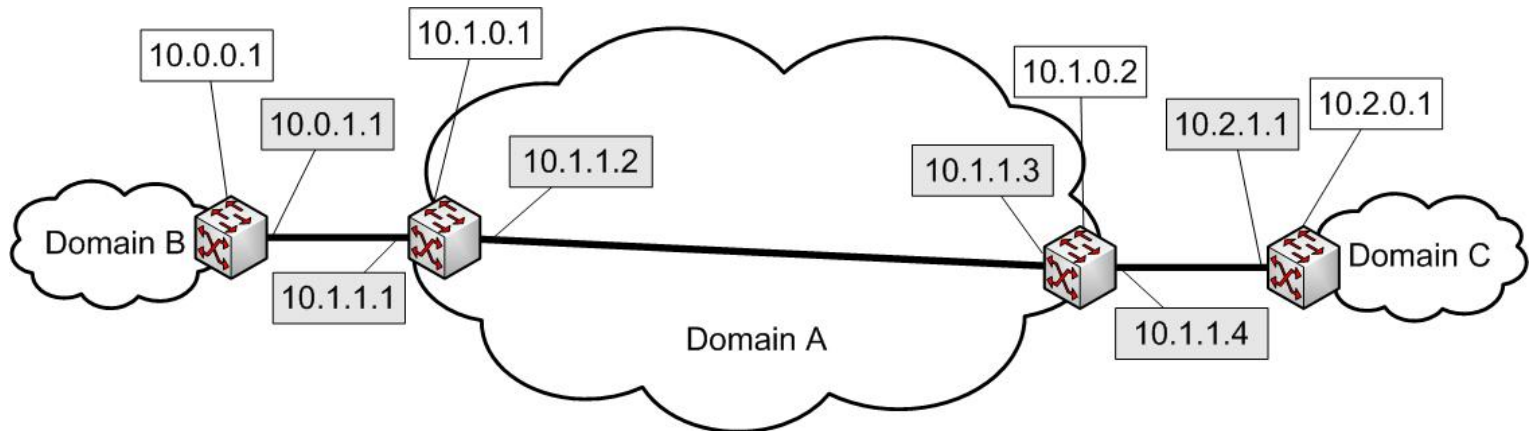
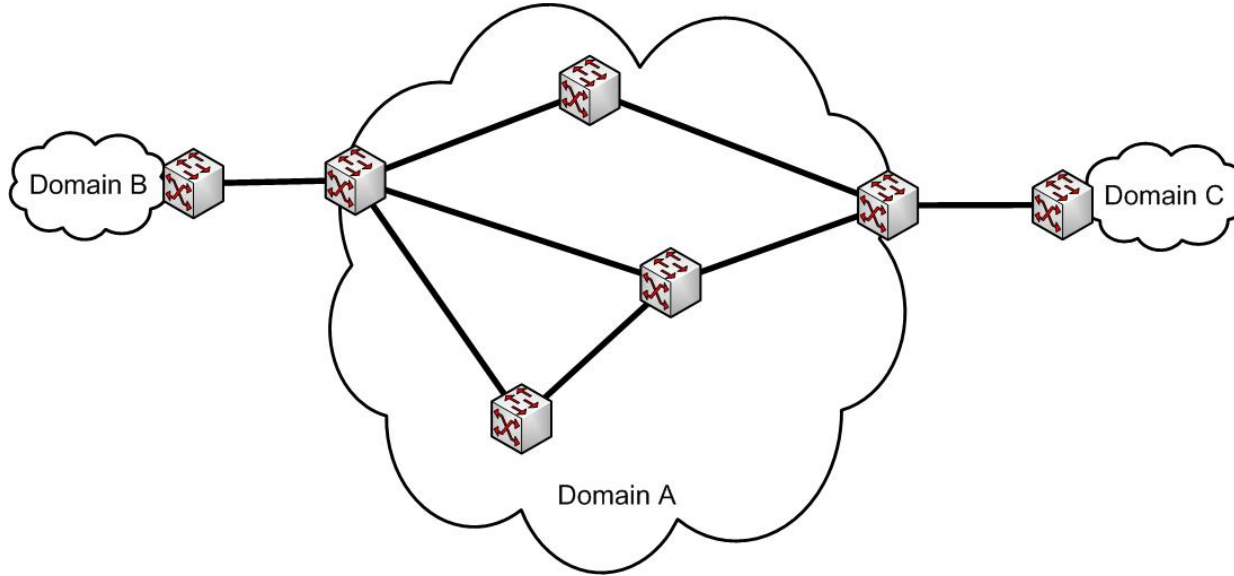


# Basic Initial implementation principles

- Asynchronous topology updates
  - Commonly agreed schema
- Path computation as first phase of request satisfaction
  - Results in an unconfirmed loose path hop
- Reserve resources and determine technical resource parameters along the unconfirmed loose path hop
  - Distributed fashion of reservations
  - Results in a confirmed loose path hop
- Signaling separate from authorizing paths and scheduling

Domain specific implementation of each feature

# Topology abstraction





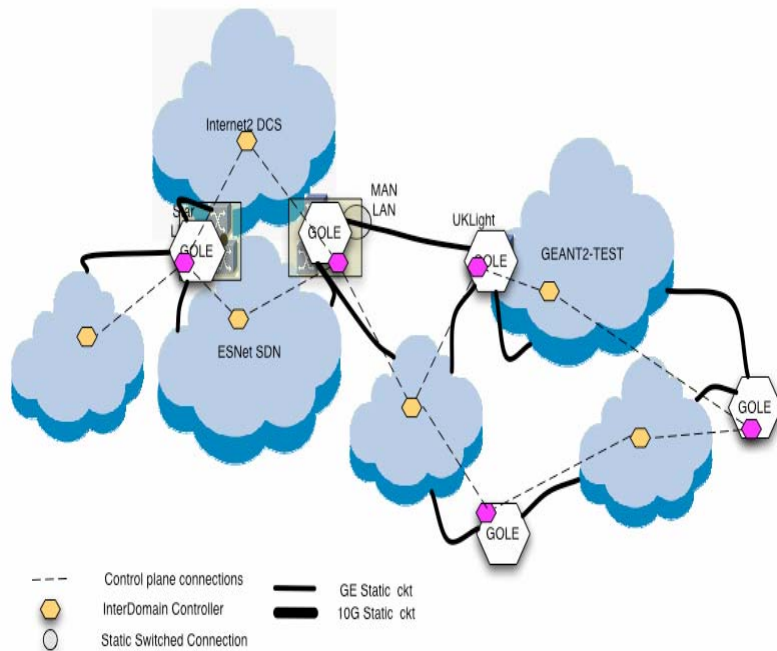
# Requirements of an IDC

- Honor the inter-domain (IDC to IDC) interface
  - Advertise an abstracted topology
  - Accept, process and hand over upstream reservation requests
- Implement intra-domain functionality
  - Routing and path computation
  - Resource reservation
  - Signaling

# DICE Interdomain Dynamic Circuit Protocol

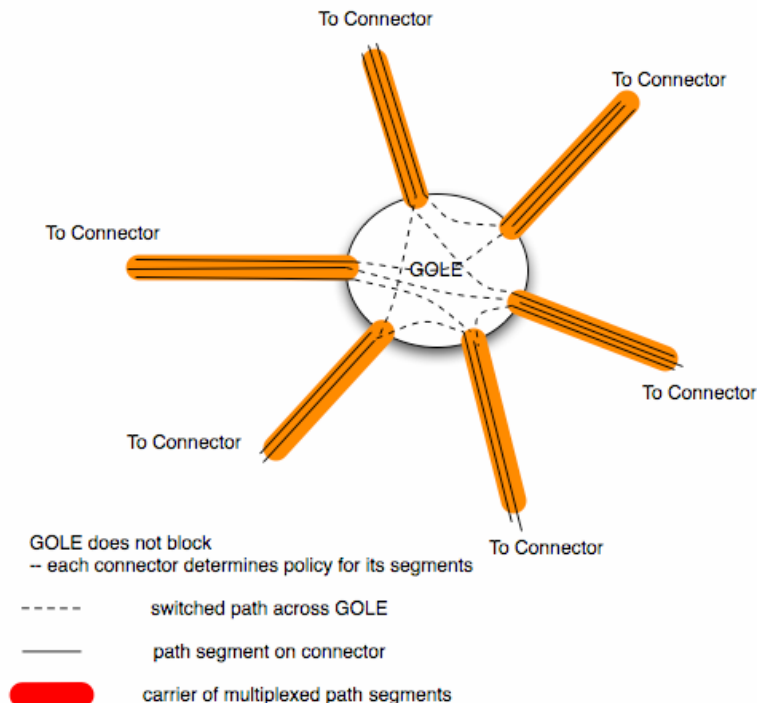
- Topology
  - Keeps map of interdomain topology
  - Does interdomain path computation
- Scheduling and Reservation
  - Reserves resources in all domains
  - Maintains schedule
  - May initiate signaling to create circuit on schedule
- Signaling
  - Signals to set up the data plane
  - Recognize path failure
  - Path teardown
  - Path maintenance

# Adding GLIF GOLES to dynamic circuits



- Exchange with other networks
- Compare to IP Exchange Points
- Control protocol at Exchange points
  - DICE control protocol
  - Probably policy neutral
- Develop Exchange Point Protocol jointly?

# Policy Neutral Dynamic Circuit GOLE



- Connectors carry units of connectivity
- Units switched between connectors
- Units may be Ethernet VLANs, SONET VCGs, Waves, Fibers, MPLS ?
- Both connectors must approve - no other policy

# User interface to control plane

- Basically a subset of Interdomain interface
- Request is for connection between two end points
  - May allow net to find path or
  - May provide a “domain” path
- Request reserves circuit for specified time period
- Circuit setup may be initiated by user or by network

# IDC Protocol - Topology

- IDCs share ‘abstracted’ topology with trusted peers
- Initial implementation - share with neighbors
- Other approaches - central collector, VO management
  - Issues - what is abstracted topology
    - how to describe TE capabilities in Abstract
- Path computation from topology
  - Initially done at ingress IDC
  - Longer term may have remote computation
    - Application specific PCE

# IDC Protocol - Reservation and Authorization

- Successful Interdomain request requires successful return from each domain in the requested circuit
- Reservation
  - reservation immediate or in future
  - Method of reservation domain specific
  - Some implementations may only allow immediate
- Authorization done by each domain
  - Domain policy may include limits by requesting domain, time of day, total resources allowed to requestor
  - Request may include attributes, including user-id or group-id signed by trusted authority
  - Authorization may include requirement for resources outside dynamic circuit capabilities

# IDC Protocol -Signaling

- Signalling between domains done with WS for initial implementation
- Design leaves open the idea of using RSVP for signalling
- This is a topic for further study
  - Timing of signalling
  - Authorization of calls to be signalled
  - Detecting and signalling path errors
  - Path refresh messages between domains
  - A basic question - what does signalling mean when done between domains with possibly abstracted topology views.



# Authentication

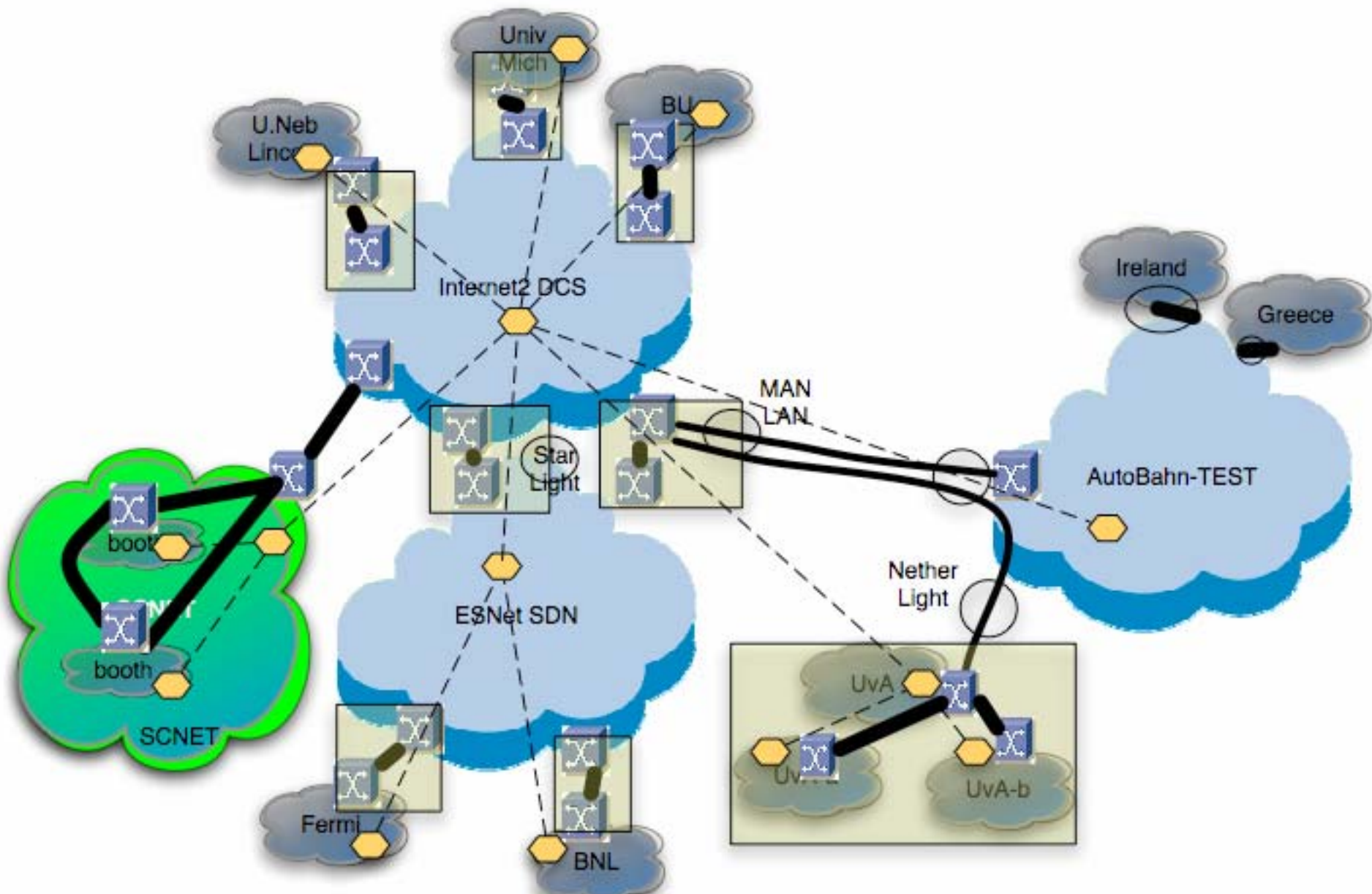
- Initial implementation uses WS authentication. Each domain authenticates to the next, no ete authentication
- Looking to add more
  - Authentication of user
  - Authentication of other IDCs
  - Authentication of other services interfacing with IDCs...
  - (more to come)

# Additional research

- Tokens
- Vos
- GRIDs
- Exchange Point protocols and operation
  - Difference between exchange point and interoperation between networks

# Questions

- [John Vollbrecht jrv@internet2.edu](mailto:jrv@internet2.edu)
- Afarodite Sevasti [sevasti@grnet.gr](mailto:sevasti@grnet.gr)



- Control plane connections
- ⬡ InterDomain Controller
- Static Switched Connection
- GE Static ckt
- 10G Static ckt

**SC07 Proposed Dynamic Circuit Infrastructure**