



Advanced Programmable Networks: A Demonstration of Software Defined Networks, OpenFlow, and Current GENI Capabilities

For the Advanced Programmable Networks Team: Northwestern University, National Center for High Performance Computing, Communications Research Center, SARA, University of Amsterdam, GENI, NLR, StarLight Consortium, Metropolitan Research and Education Network, GLIF

GLIF



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- Programmable Networks = Instant New and Enhanced Services vs Legacy Multi-Year Schedule of Design, Development, and Deployment
 - Joint Project With Many Partners: iCAIR, iGENI, SARA, GENI, NCHC, CRC, StarLight, MREN, NLR, etc
 - iGENI Optimizes Programmable Dynamic Private Networks Consisting of Highly Distributed Resources

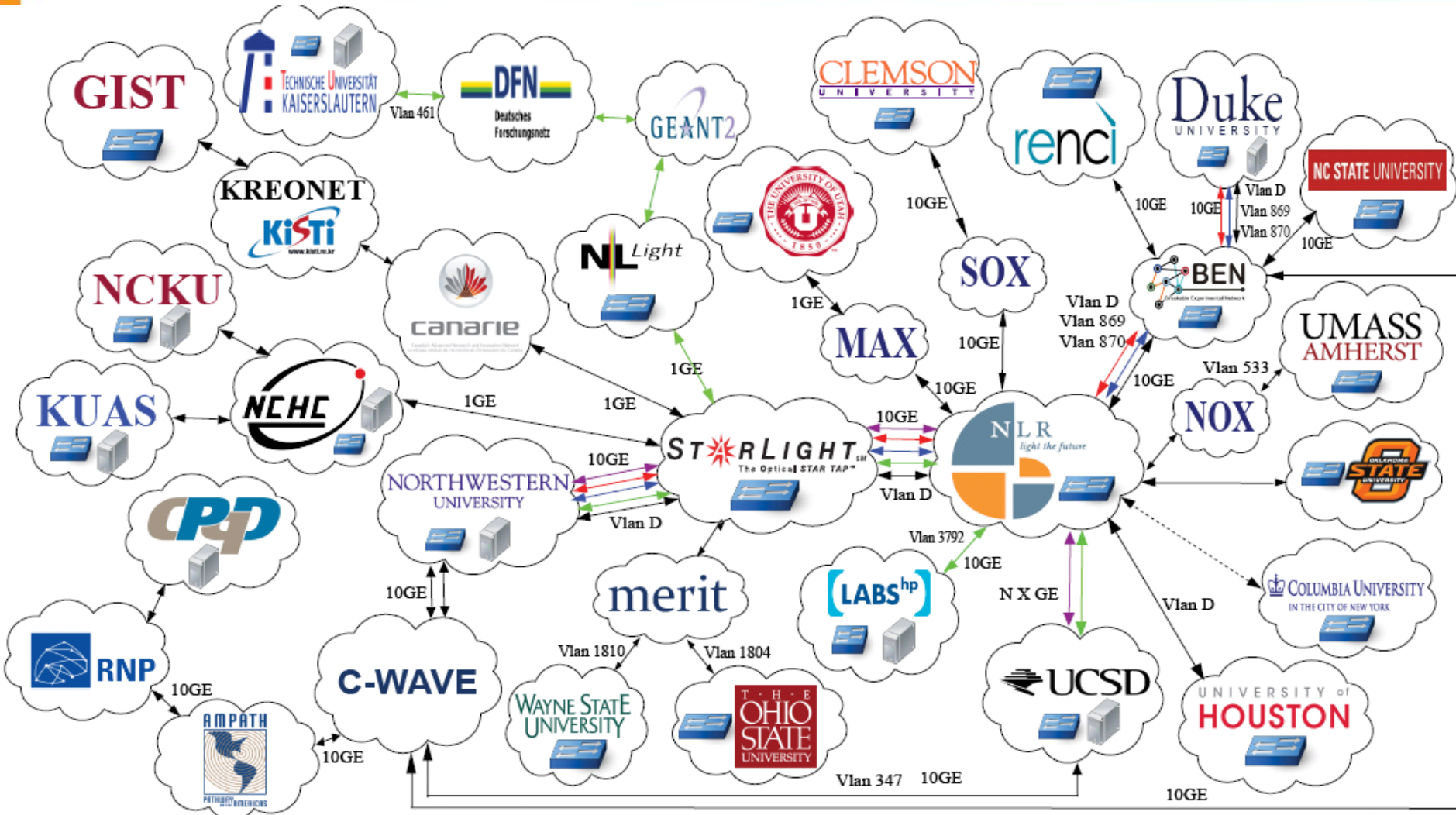
- 1 Year To Define Service
- 1 Year To Define Architecture
- 1 Year To Define Technology
- 1 Year To Deploy
- N Years of Static Unchanged Implementation
- Minimal Enhancements
- Minimal Opportunities for Service Upgrades

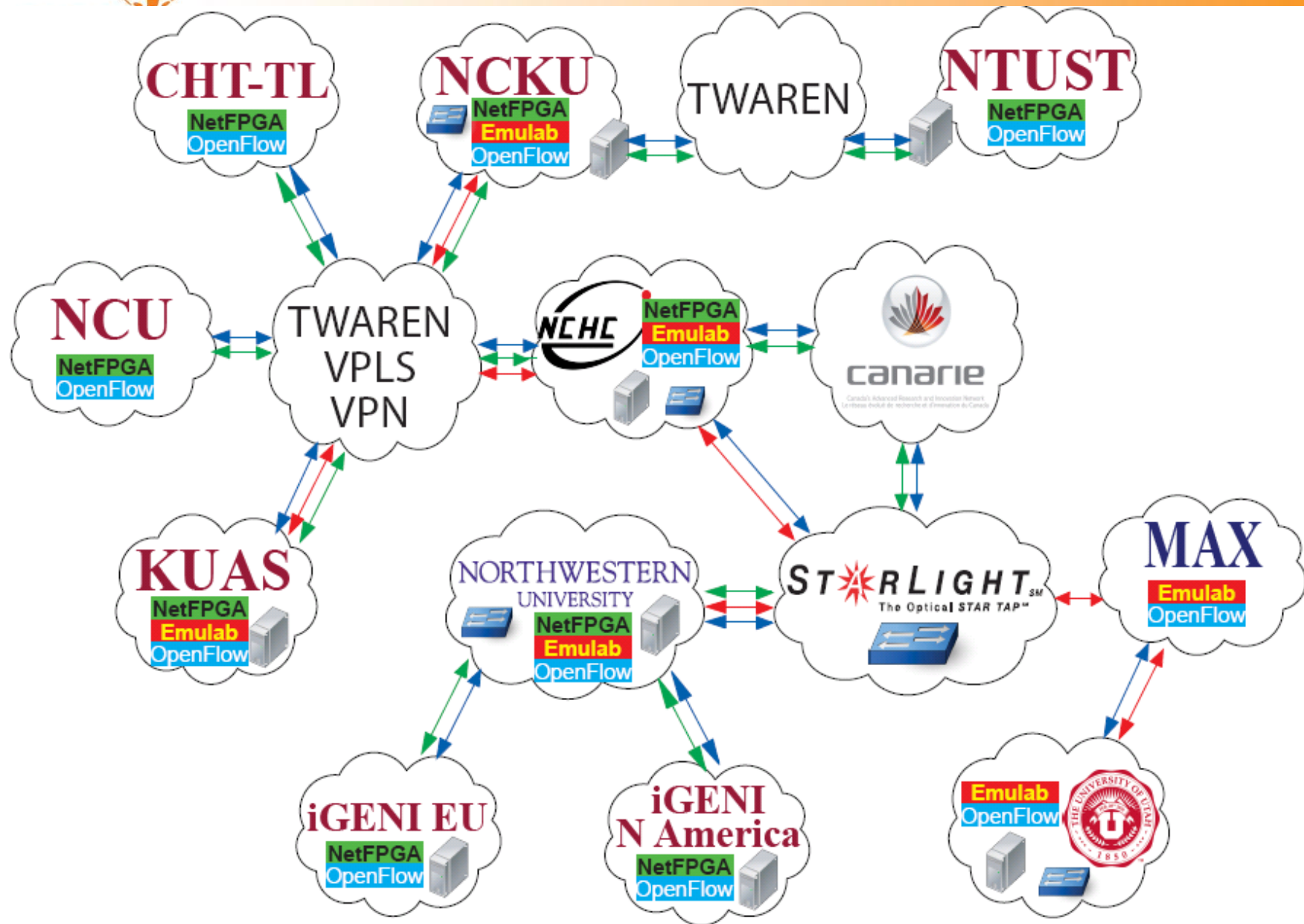
- Advanced =
 - Dynamic vs Static
 - Highly Customizable, Including At Edge
 - High Level of Abstractions, Including APIs
 - Flexible Middleware Processes That Can Be Dynamically Provisioned
 - Highly Distributed Processes vs Centralized Command and Control
 - Etc
- Programmable =
 - All Resource Elements As Objects
 - Discoverable/Integrateable
 - Programmability Extending To Hardware Components
 - Rich Semantics for Resource Discovery and Integration

- Use Case: Ad Hoc Specialized Networks
- Legacy Approach: Try To Find a Provider To Create a New Communications Service (!)
- APN Approach: Create Private Network (Ref: TransCloud)
 - Private Optical Fiber/Lambdas/L2 VLANs
 - All Control Planes
 - All Management Planes
- Leverage
 - IaaS/NaaS
 - PaaS
 - SaaS
 - OaaS
 - XaaS
- More Leverage
 - Dynamic Clouds Closely Integrated With Dynamic Networks (Ref TransCloud, Note Demo At GEC10)

- Ad Hoc Specialized Networks Can Lead To:
 - Personal Global Networks
 - Individualized Communication Services
 - Historic Note Progression From Monolithic To Individualized
 - Personal Computer vs Mainframe
 - Smart Phone vs Personal Computer
 - Intelligent Device vs Smart Phone
 - Etc.

GCDnet + iGENI Partner Resources

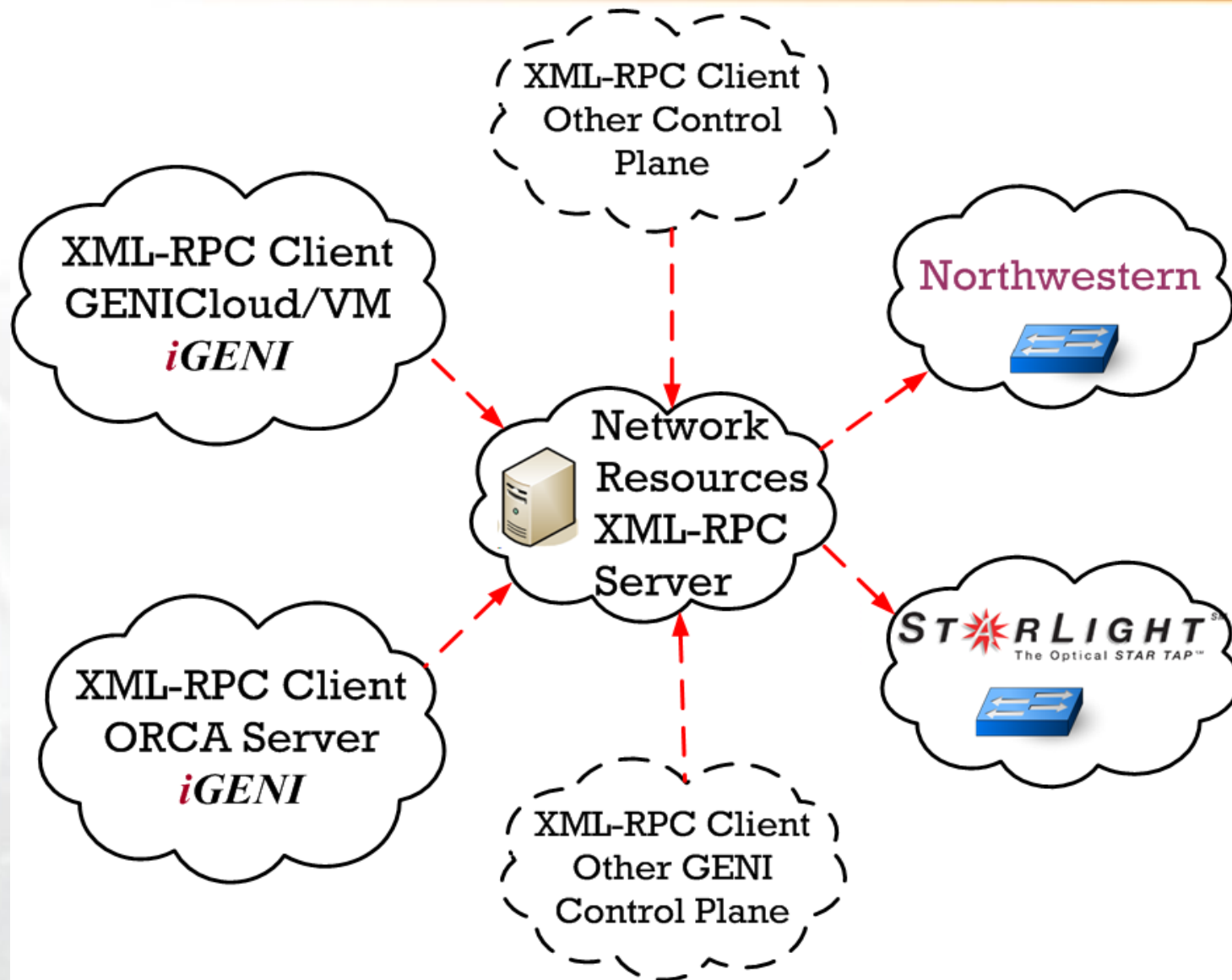




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Demo

(International Center for Advanced Internet Research,
Northwestern Univ, SARA, NCHC and CRC)



- 1) Current State - Partial Mesh of Paths
- 2) In Response To Dynamic Change In Requirements, Selection and Implementation of Alternative Paths Directly Via XML-RPC Client Control Over Dynamic Paths
- 3) Personnel Client Direct Control Over Switches With Embed XML-RPC Server.
- 4) Vlans/Flows Control Implementation
- 5) Possible In Band or Out of Band Control
- 6) XML-RPC API For Control Plane Frameworks Or Apps Integration.

- Objective: Advanced Programmable Networks
- Highly Customizable, With Individual Direct Control
- High Level APIs, Signaling, Via Client or API
- A Highly Programmable Environment
- Any Resource Can Be Integrated Into the Environment (Extensible)
- Abstraction Of Control Frameworks + Rich Set of Underlying Primitives

- **Thanks!**
- **Questions?**

