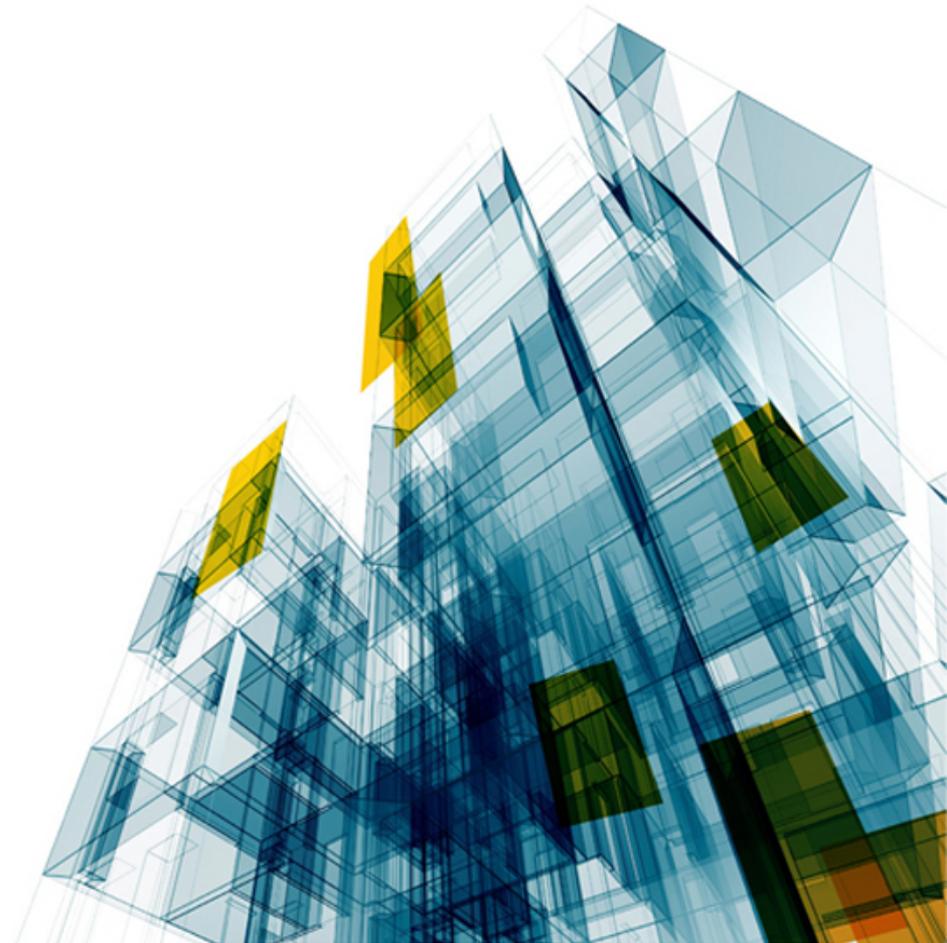




# Research Infrastructure for SARnet

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Winter 2015



Temps passé en reconnaissance n'est jamais perdu.

-Napoleon Bonaparte



# Preparatory Milestones

**~ 2001 Ciena established a research network OmniNet in Chicago at Northwestern University**

**~2008 CANARIE connected Ciena Ottawa research labs to Starlight.**

**June 4<sup>th</sup> 2010 Ciena designs “the Flight Cees” a portable Optical transmission demo platform.**

**October 18<sup>th</sup> 2010: Ciena-CANARIE link upgraded to 100G,**

**January 2013: Collaboration agreement signed with University of Amsterdam**

**June 1<sup>st</sup> 2013 Ciena and Internet 2 signed MOU called the “Research on demand network” to create a persistent service on a dedicated wave.**

**June 3<sup>rd</sup> , 2013: Ciena lead participant in ANA-100 research network**

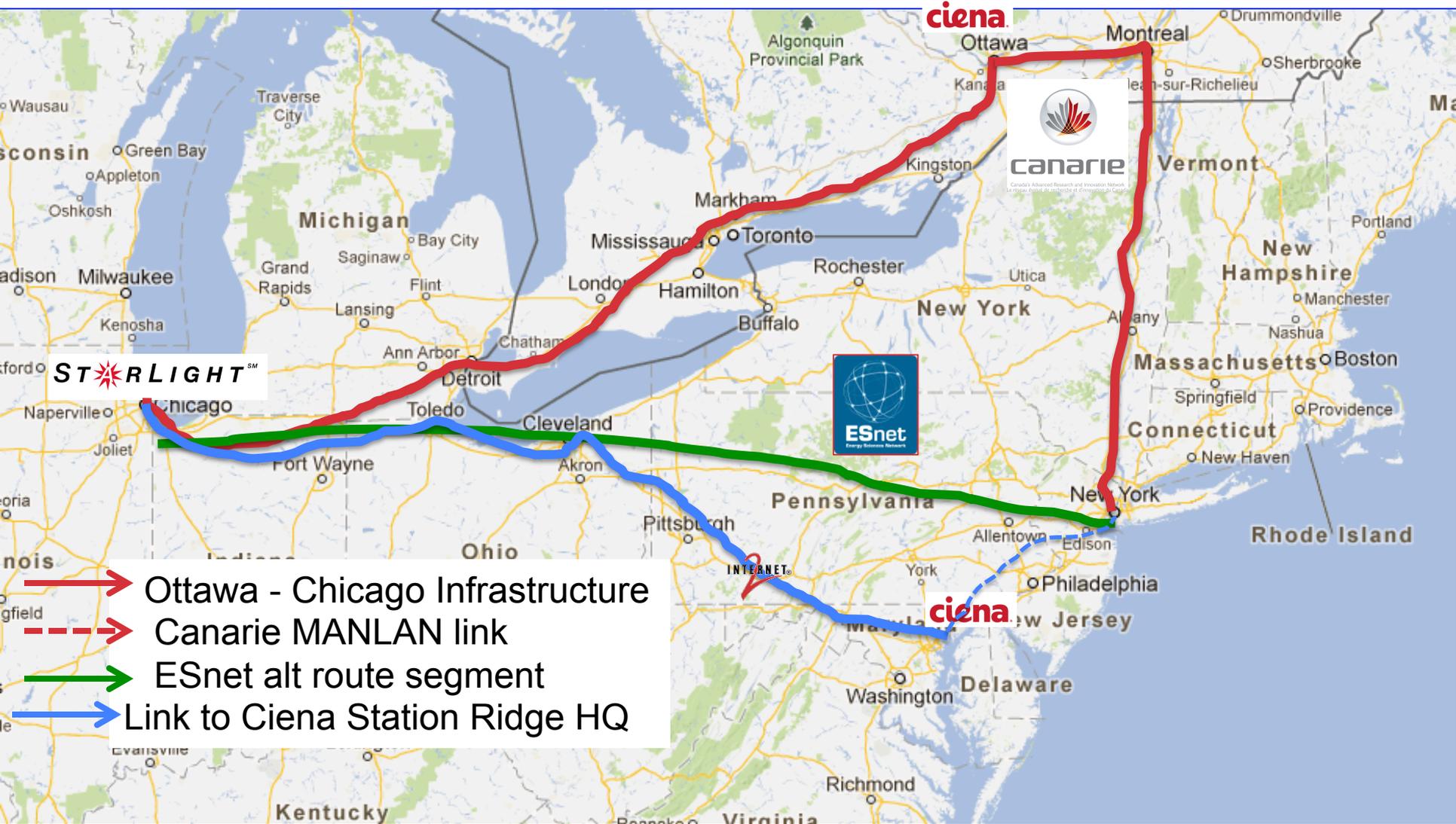
**July 2013, Ciena signed an IRU to extend Internet 2 in to Hanover HQ**

**September 2014: REANZ GLIF trans Pacific 100G demo link.**

**January 2015 Ciena signs SARnet research project agreement**

**March 25<sup>th</sup> 2015: Ciena announces GENI involvement**

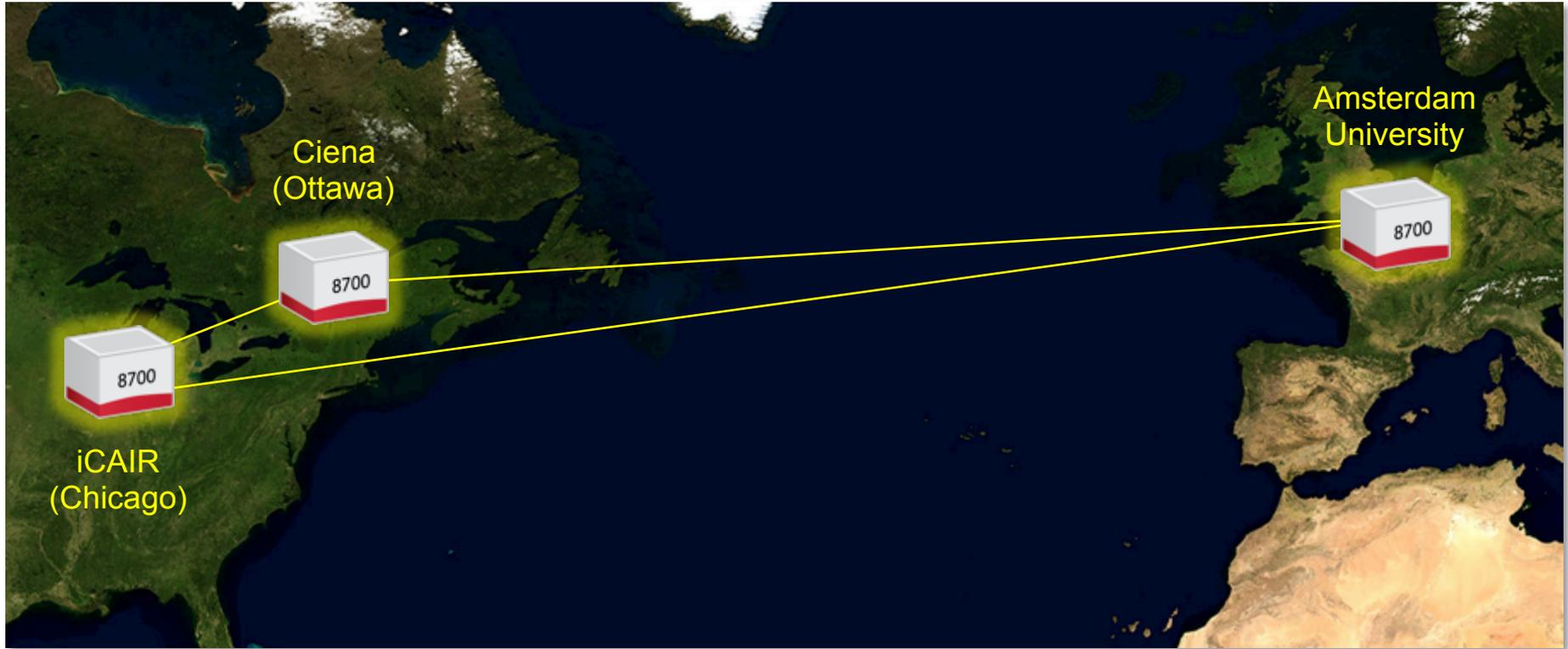
# Ciena's CENI topology



- Ottawa - Chicago Infrastructure
- - - → Canarie MANLAN link
- ESnet alt route segment
- Link to Ciena Station Ridge HQ

# CENI, International extension to University of Amsterdam

Research Triangle Project. Operation Spring of 2015



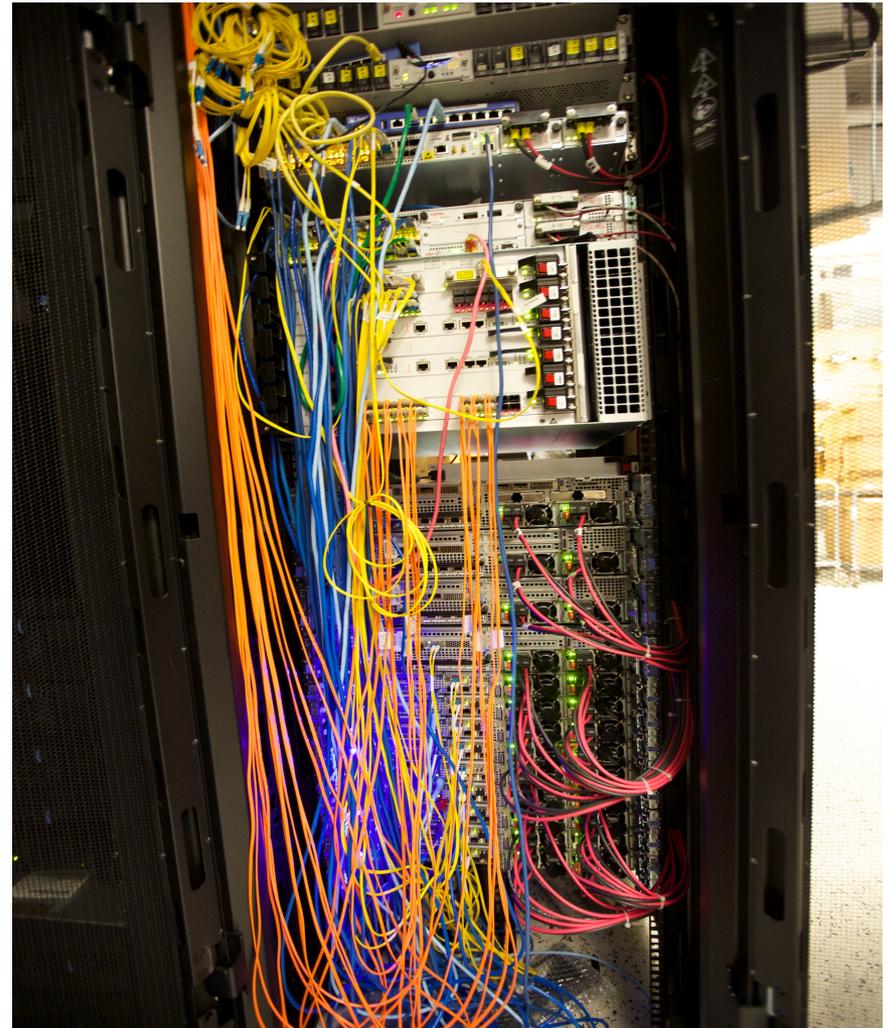
National Science Foundations ExoGENI racks, installed at UvA (Amsterdam), Northwestern University (Chicago) and Ciena's labs (Ottawa), are connected via a high performance 100G research network and trans-Atlantic network facilities using the Ciena 8700 Packetwave platform. This equipment configuration is used to create a computational and storage test bed used in collaborative demonstrations.

# Modified exoGENI hardware configuration

Undertaken in collaboration with University partners, RENCI, iCAIR at Northwestern University, and SNE at University of Amsterdam

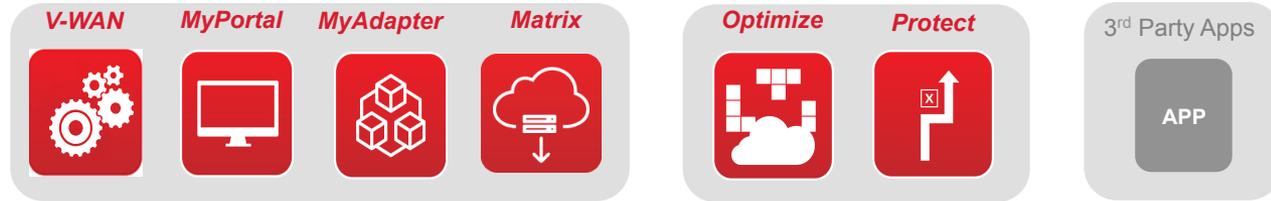


Multi-100GE DWDM SDN  
enabled 2Tb/s switching fabric

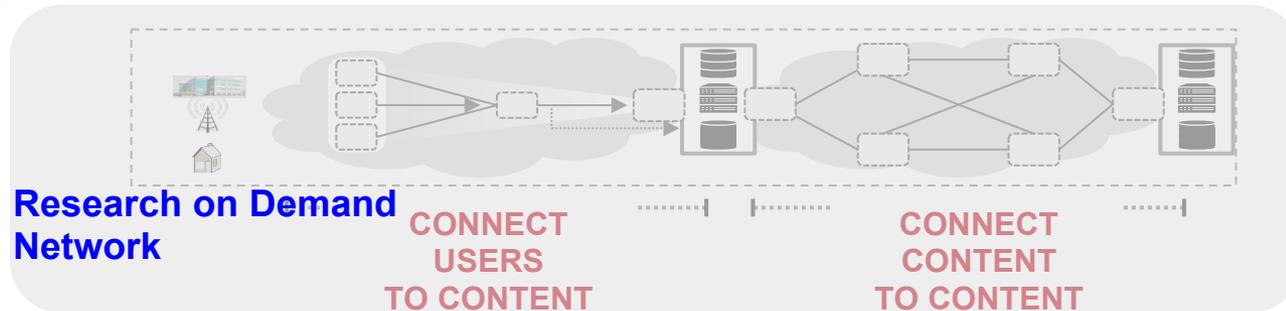


# Exploring / Validating Software Solutions

Verification On-Demand Network Applications



CENI  
SDN Visualization  
exoGENI,  
Collaboration  
Multi-Layer,  
Multi-Domain  
SARnet vehicle



# Ciena SARnet exoGeni

## Rack elevation & components

### Ciena 3940 Service Delivery switch

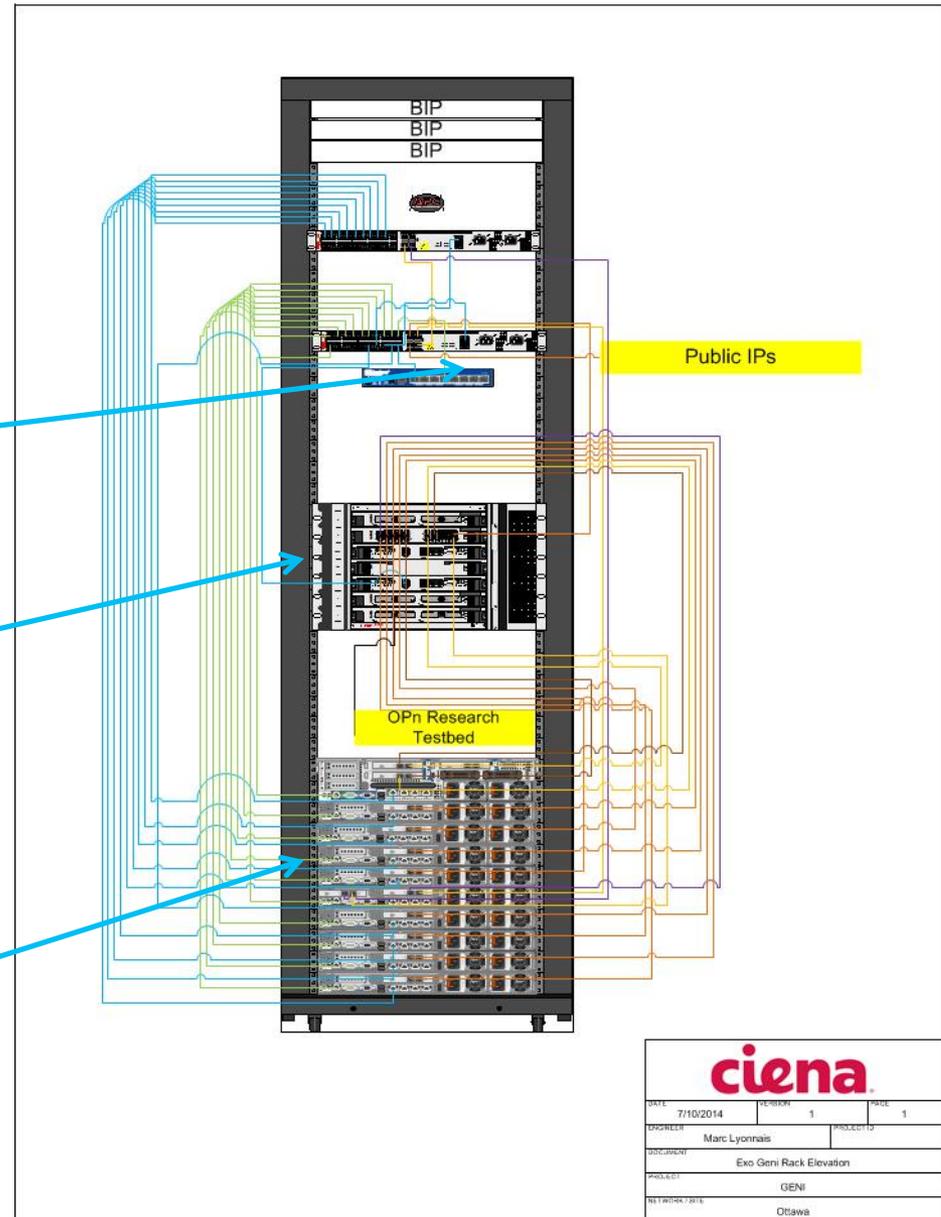
Ethernet aggregation platform. high-capacity switching fabric with 24 Gigabit Ethernet (GbE) ports efficient packaging design provides both SFP and RJ-45 connectors

### Ciena Packetwave 8700

Ethernet over DWDM, multi-Tb L2 switching Platform. Incorporates WL3 @ 200+Gbps

#### 10 Dell Servers

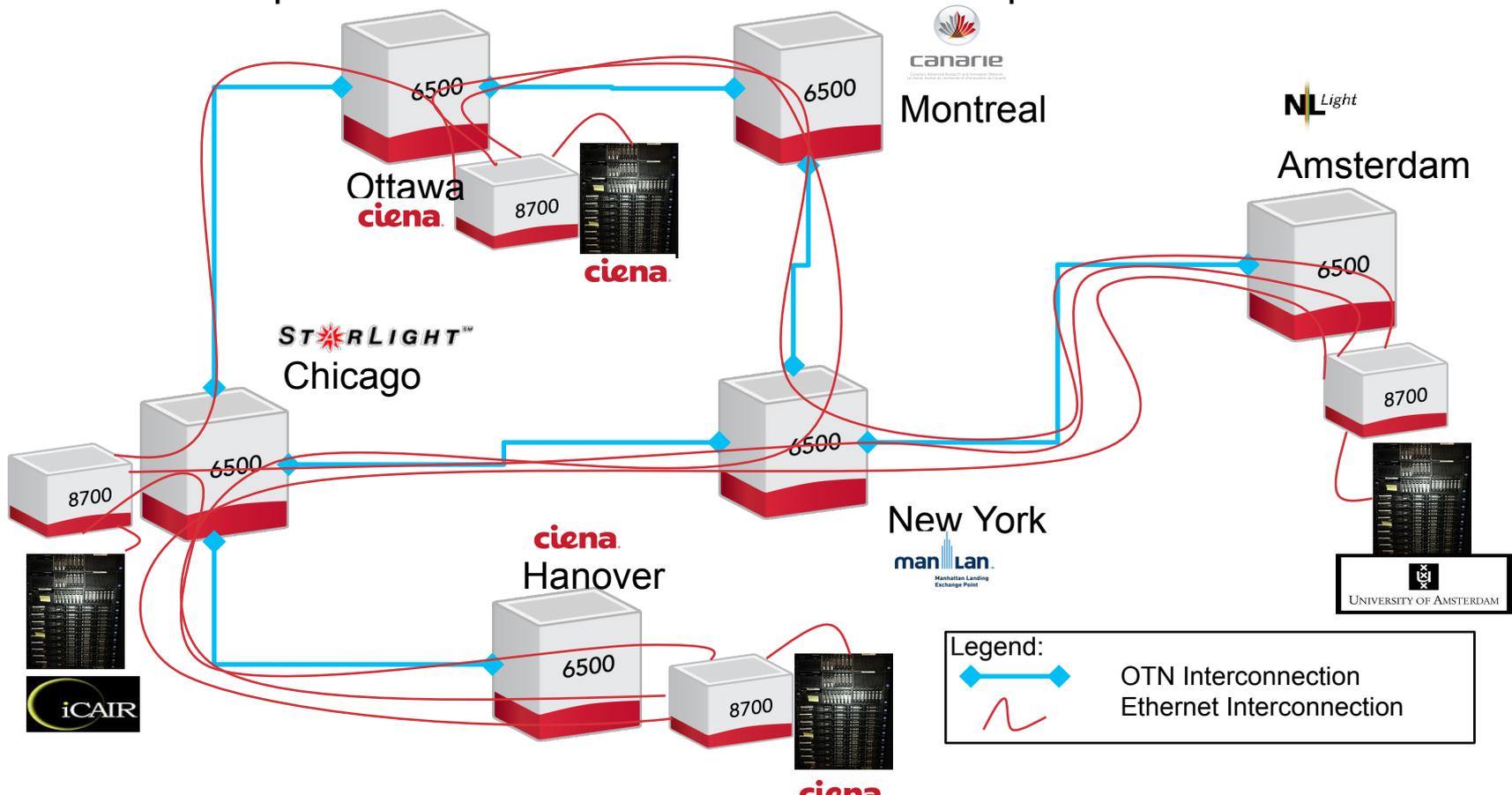
- 180 Physical Cores -> approx. 330 Virtual Core Machines Running Linux RedHAT 6.0
- Up to ~ 80 VMs (using 4 Cores each.)
- 608 GB of Physical RAM -> approx. 1.2TB VRAM
- 6 TB of HD-> more than 12TB Virtual Disk Capacity



# Ciena Environment for Network Innovation (CENI)

(with full credit to our colleagues at NSF GENI)

Collaboration with Internet2, CANARIE, Starlight and SURFnet created a “research on demand” testbed, now enhanced with exoGENI racks as a resource for computer communications research and experimentation.



## Network Infrastructure for SARnet.



Thank you



# Starlight 8700 Packetwave Node

## Network End-Point Flows

