



D u k e S y s t e m s

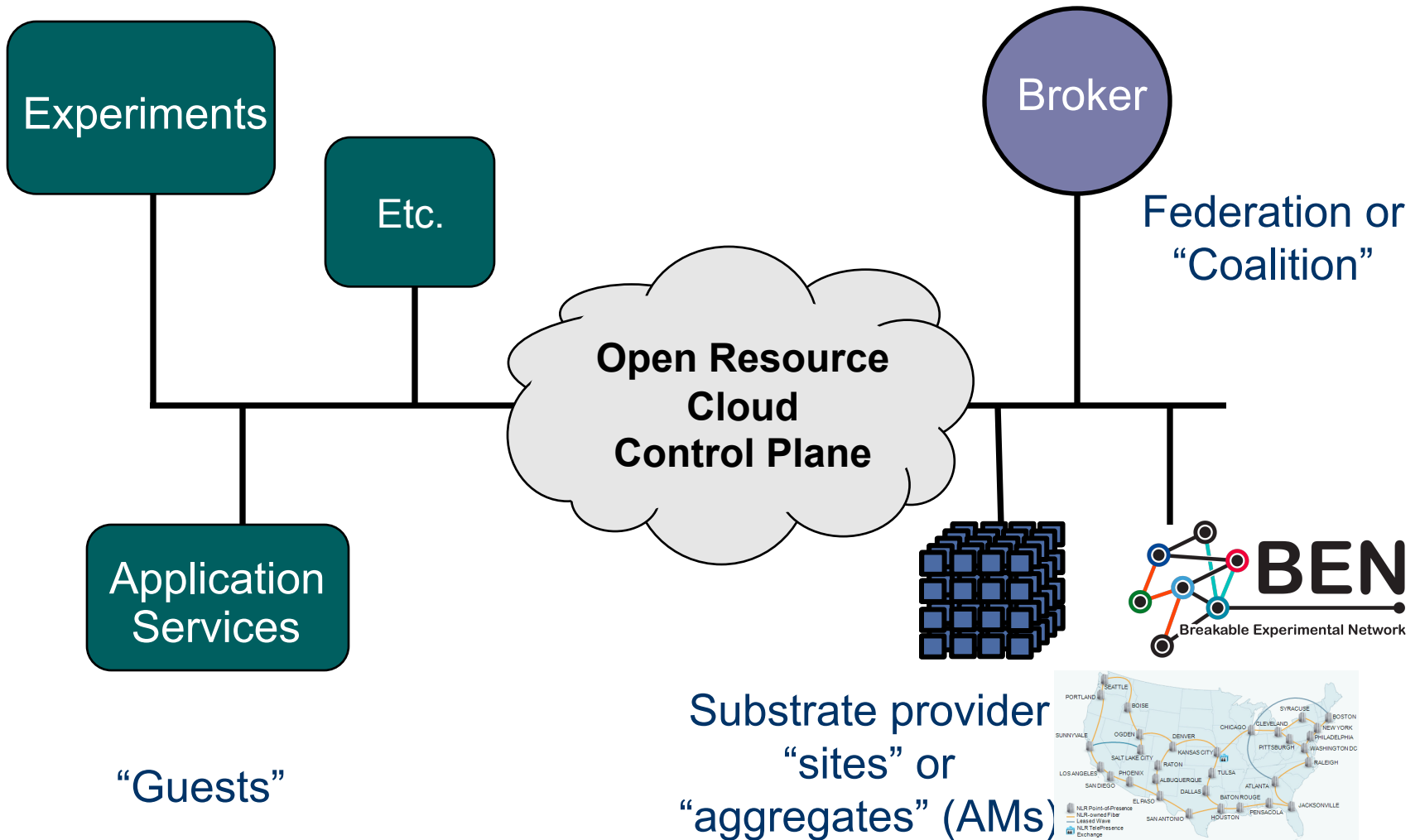
ORCA/BEN and Cluster D Demo GEC7

**Jeff Chase
Duke University
and “GENI Cluster D”**

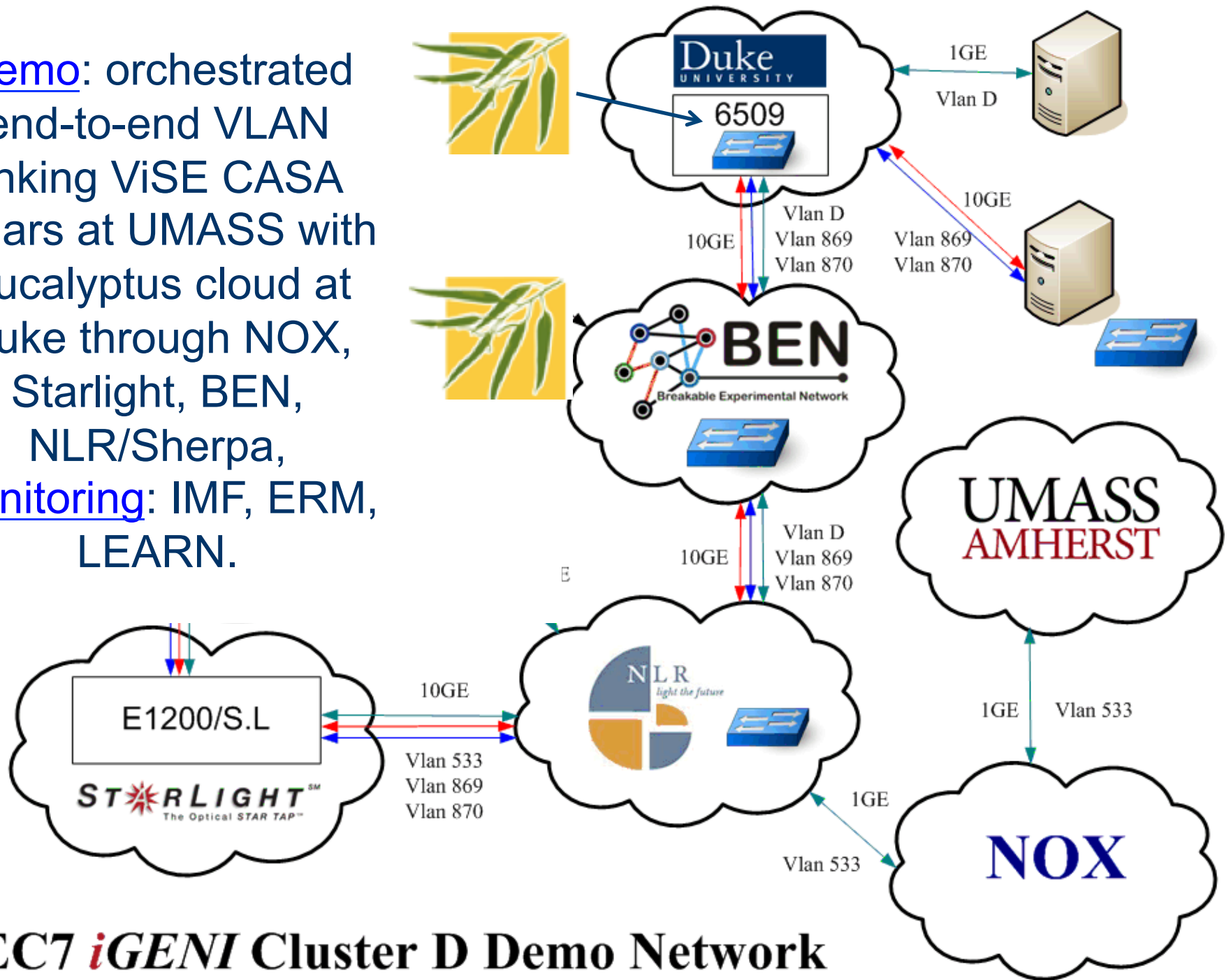
ORCA



© whale-images.com



Demo: orchestrated end-to-end VLAN linking ViSE CASA radars at UMASS with Eucalyptus cloud at Duke through NOX, Starlight, BEN, NLR/Sherpa, Monitoring: IMF, ERM, LEARN.



GEC7 *iGENI* Cluster D Demo Network



EUCALYPTUS IS PRIVATE CLOUD[®]

NASA uses Eucalyptus. No need to be a rocket scientist.
Easily transform your machines into a private cloud.

Getting started with Eucalyptus is as simple as...

1 Download
Eucalyptus 1.6.2

2 Read Featured
Whitepaper*

3 Sign Up for
Proof of Concept

*Featured Whitepaper: Intel[®] Cloud Builder Guide to Cloud Design and Deployment on Intel[®] Platforms

Featured Quote about Eucalyptus...

"The exciting thing on the horizon for us is you've got this Eucalyptus open standard for Cloud Computing, because once you get a standard that's developed across industry, then I move up and make more of the IT stack a commodity."

Mike Krieger, Army Deputy CIO from On The FrontLines, "Shaping Government Clouds", Winter 2010

- **Open source and supported**
- **Runs at 1000s of sites w/ Xen, KVM, etc.**
- **Amazon/EC2 compatible ("standard")**
- **Bring power of Eucalyptus/EC2 clouds into GENI**
- **Bring power of GENI to the Cloud**

AM Interface to Substrate Providers



“GET”

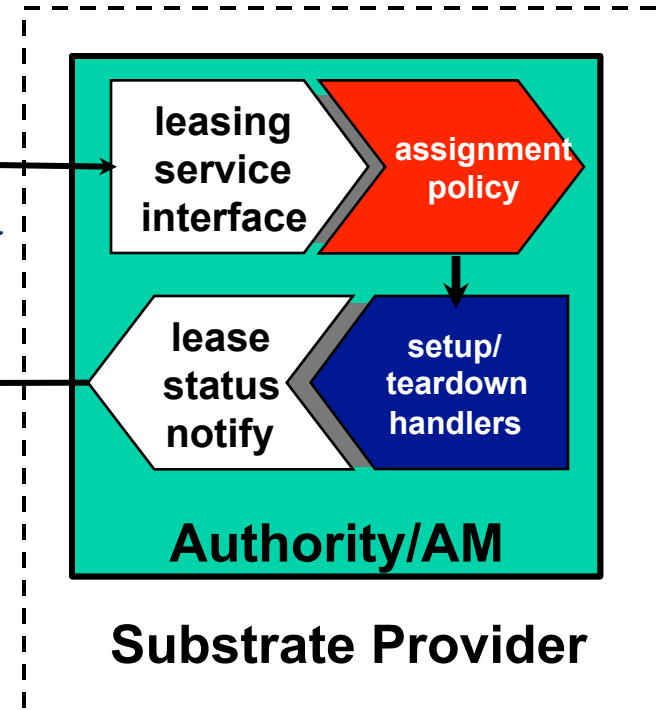
Configuration
properties

image.id,public.key



Unit
properties

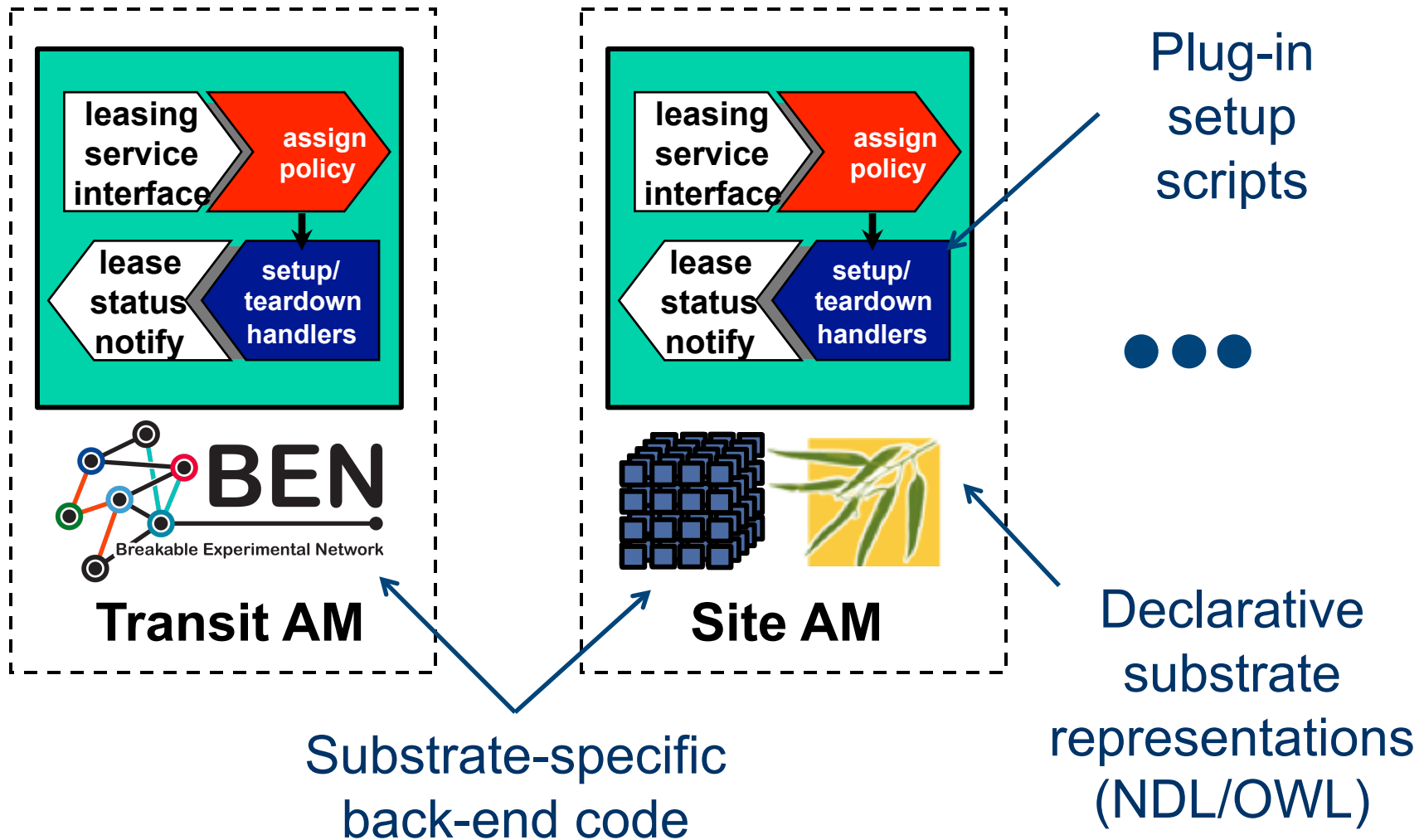
host.ip,host.key



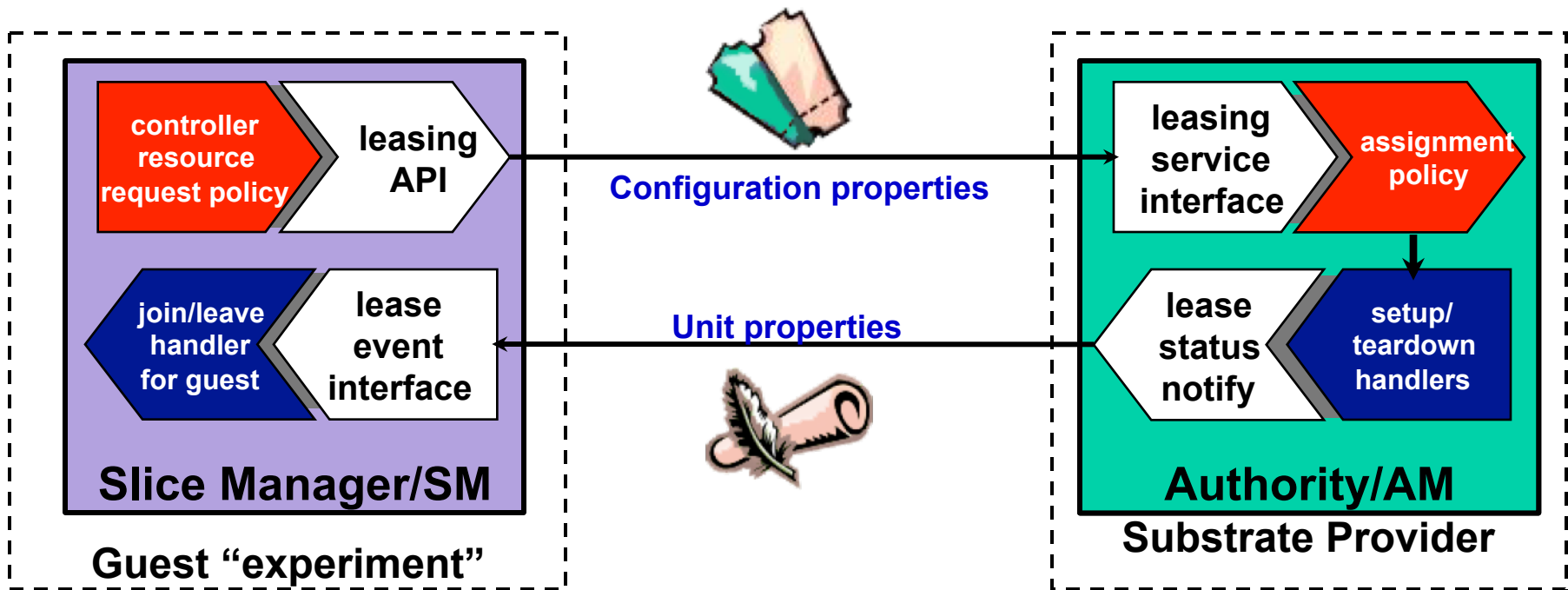
```
<lease>
  <issuer>site ABC public key</issuer>
  <signed_part>
    <holder>guest's public key</holder>
    <rset> resource description </rset>
    <start_time> ... </start_time>
    <end_time> ... </end_time>
    <sn> unique ID at Site </sn>
  </signed_part>
  <signature>site ABC</signature>
</lease>
```

AMs issue lease contracts
for sliver/slice instances.

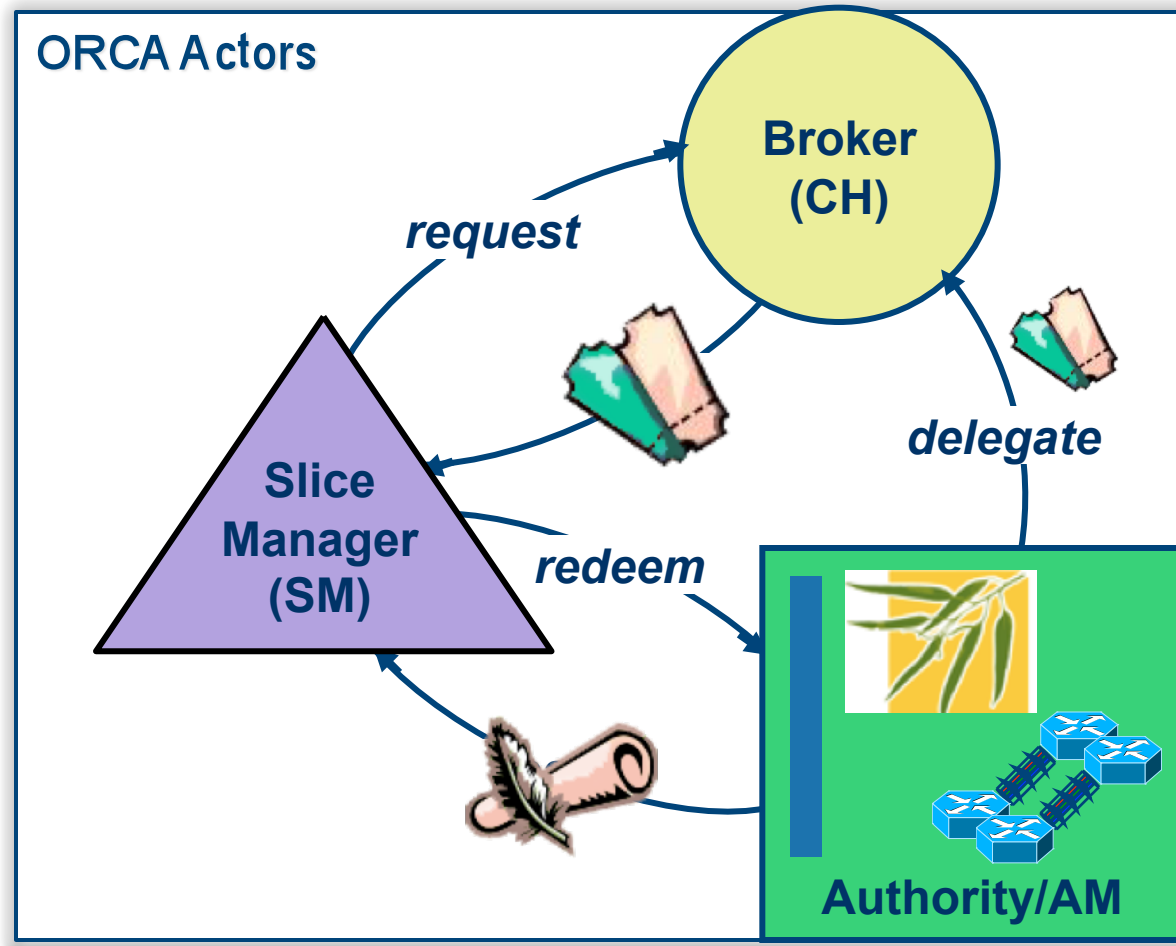
A Coalition of Substrate Providers



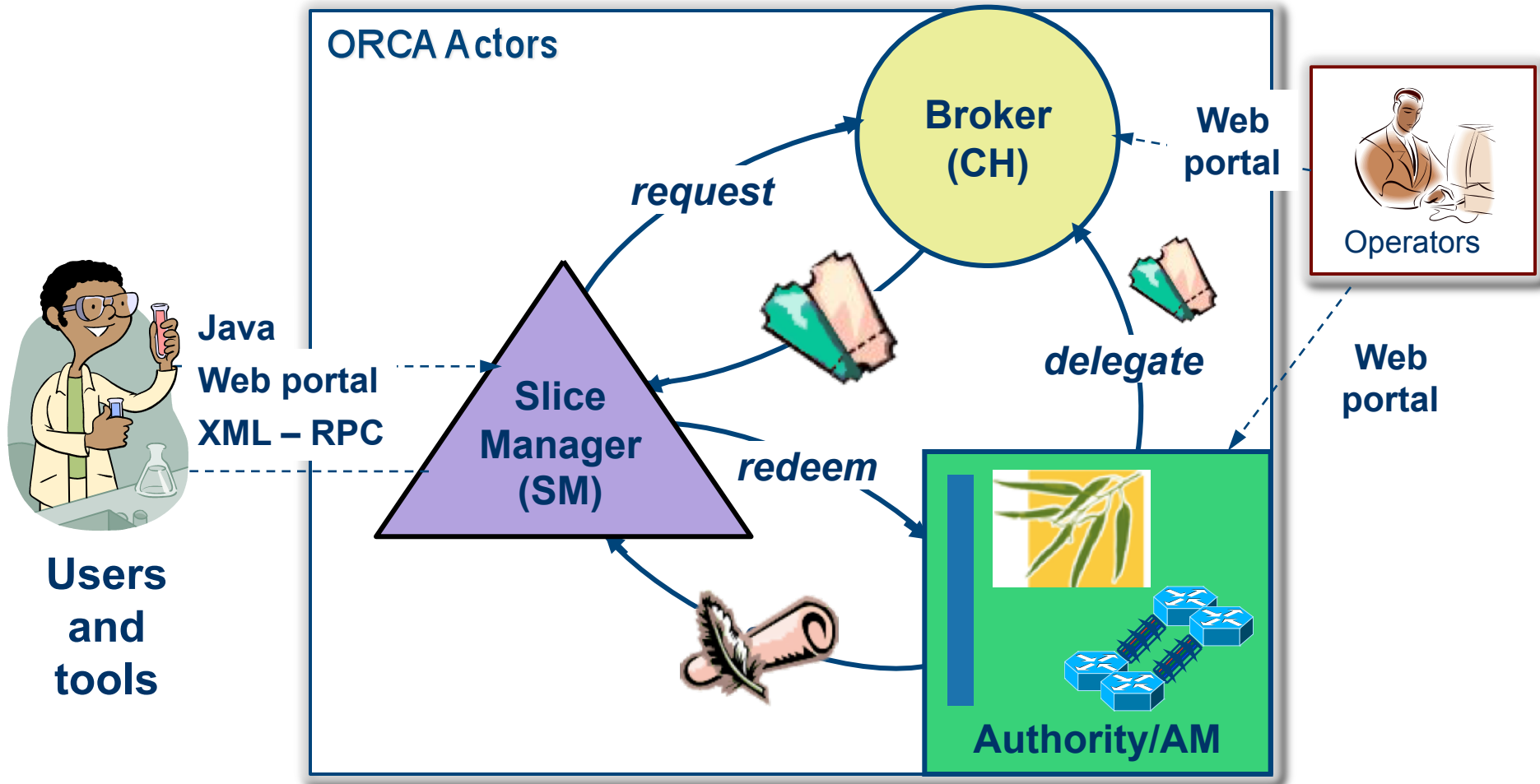
Slice Manager (SM) Service



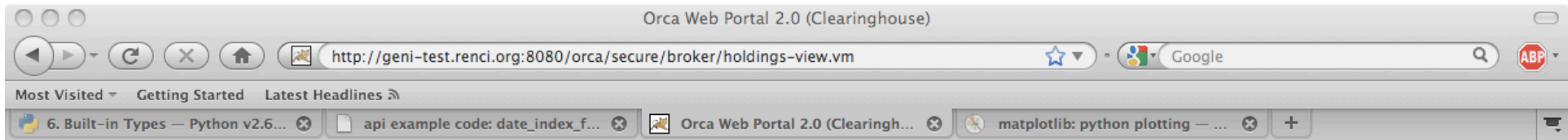
ORCA Servers (Actor) Roles



ORCA Servers (Actor) Roles



For GENI the ORCA SMs run as hosted services.



Orca Admin Logout

ORCA

home user **broker** site admin About Contact Us

Current Selections
» slice: none

Inventory
» View Inventory
» View Inventory Slices
» Create Inventory Slice
» Claim Resources

Clients
» View Clients
» Register Client

Ticketed Slices
» View Slices
» Create Slice
» View Reservations

Brokers
» Current Broker
» View Brokers

Inventory

Select: All None Action:

No	Slice	Type	Units [R]	Units [A]	Start	End	Broker	Site	State		
<input type="checkbox"/>	1	broker	DUKE NET VLAN	4	4	03/15/2010 16:15	04/01/2010 16:55	duke-net-site	duke-net-site	Ticketed	manage
<input type="checkbox"/>	2	broker	BEN VLAN	100	100	03/15/2010 16:15	04/01/2010 16:55	ben-site	ben-site	Ticketed	manage
<input type="checkbox"/>	3	broker	NLR VLAN	100	100	03/15/2010 16:15	04/01/2010 16:55	nlr-site	nlr-site	Ticketed	manage
<input type="checkbox"/>	4	broker	Starlight VLAN	10	10	03/15/2010 16:15	04/01/2010 16:55	starlight-site	starlight-site	Ticketed	manage
<input type="checkbox"/>	5	broker	Eucalyptus Virtual Machine (DUKE)	10	10	03/15/2010 16:14	04/01/2010 16:54	duke-vm-site	duke-vm-site	Ticketed	manage
<input type="checkbox"/>	6	broker	ViSE Testbed	1	1	03/14/2010 14:56	03/31/2010 15:36	vise-site	vise-site	Ticketed	manage
<input type="checkbox"/>	7	broker	Eucalyptus Virtual Machine (RENCI)	10	10	03/15/2010 16:22	04/01/2010 17:02	renci-vm-site	renci-vm-site	Ticketed	manage
<input type="checkbox"/>	8	broker	RENCI NET VLAN	10	10	03/15/2010 16:22	04/01/2010 17:02	renci-net-site	renci-net-site	Ticketed	manage

Select: All None Action:

Done

Operator portal interface to RENCi Clearinghouse (CH), listing AMs with substrate registered for brokering.



ORCA

Current Selections

- » actor: nlr-site
- » slice: none

Inventory

- » View Inventory
- » View Resource Pools
- » Add Resource Pool
- » View Exported Resources
- » Export Resources

Policy

- » Manage

Brokers

- » View Brokers
- » Register Broker

Client Slices

- » View Slices
- » Create Slice
- » View Reservations
- » View Slivers

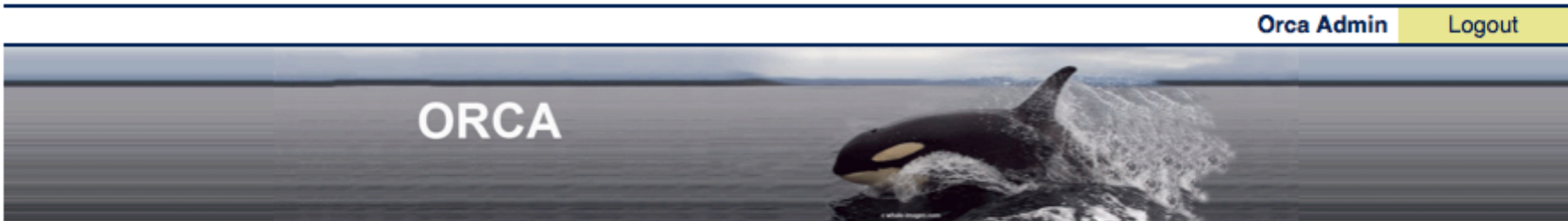
Providers

- » Site Authorities

Sites

No	Name	Policy	Description	
<input type="checkbox"/>	1	starlight-site	Starlight site authority	select
<input type="checkbox"/>	2	ben-site	BEN site authority	select
<input type="checkbox"/>	3	nlr-site	NLR site authority	select
<input type="checkbox"/>	4	duke-net-site	DUKE NET site authority	select

Operator portal interface to AMs managed by this operator (RENCI).



- Current Selections**
- » actor: nlr-site
 - » slice: none
- Inventory**
- » View Inventory
 - » View Resource Pools
 - » Add Resource Pool
 - » View Exported Resources
 - » Export Resources
- Policy**
- » Manage
- Brokers**
- » View Brokers
 - » Register Broker
- Client Slices**
- » View Slices
 - » Create Slice
 - » View Reservations
 - » View Slivers
- Providers**
- » Site Authorities

Manage Resource Pool

Name NLR VLAN

GUID 784e7375-800a-4f58-a9a9-8d5f370506b3

Description no description

Resource Type nlr.vlan

Resource Properties Show

Inventory

Add Select: All None

No Name Control IP

Add Remove

Tickets

No	Units	Start	End	
<input type="checkbox"/> 1	100	01/30/2010 00:00	01/30/2011 00:00	manage

**Operator portal interface to a Resource Pool:
NLR/Sherpa VLAN tags.**



ORCA

Current Selections

» slice: service

Slices

» View Slices

» Create Slice

Reservations

» View Slice Reservations

» Create Reservation

» View All Reservations

Slice Controllers

» View Controllers

» Start Controller

My Account

» Current Actor

» Actors

» Settings

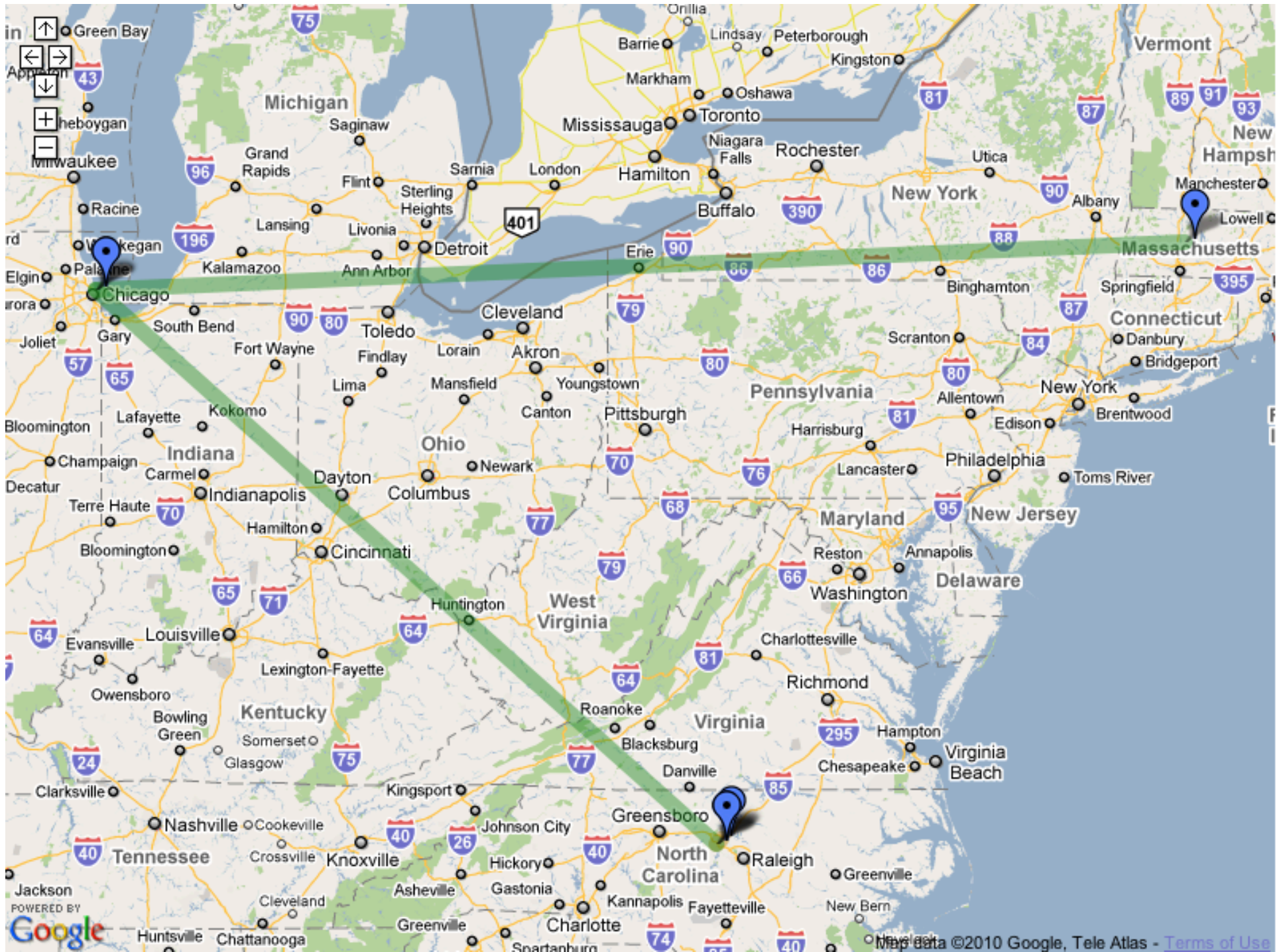
View Slices

Select: All None Action: Select an action

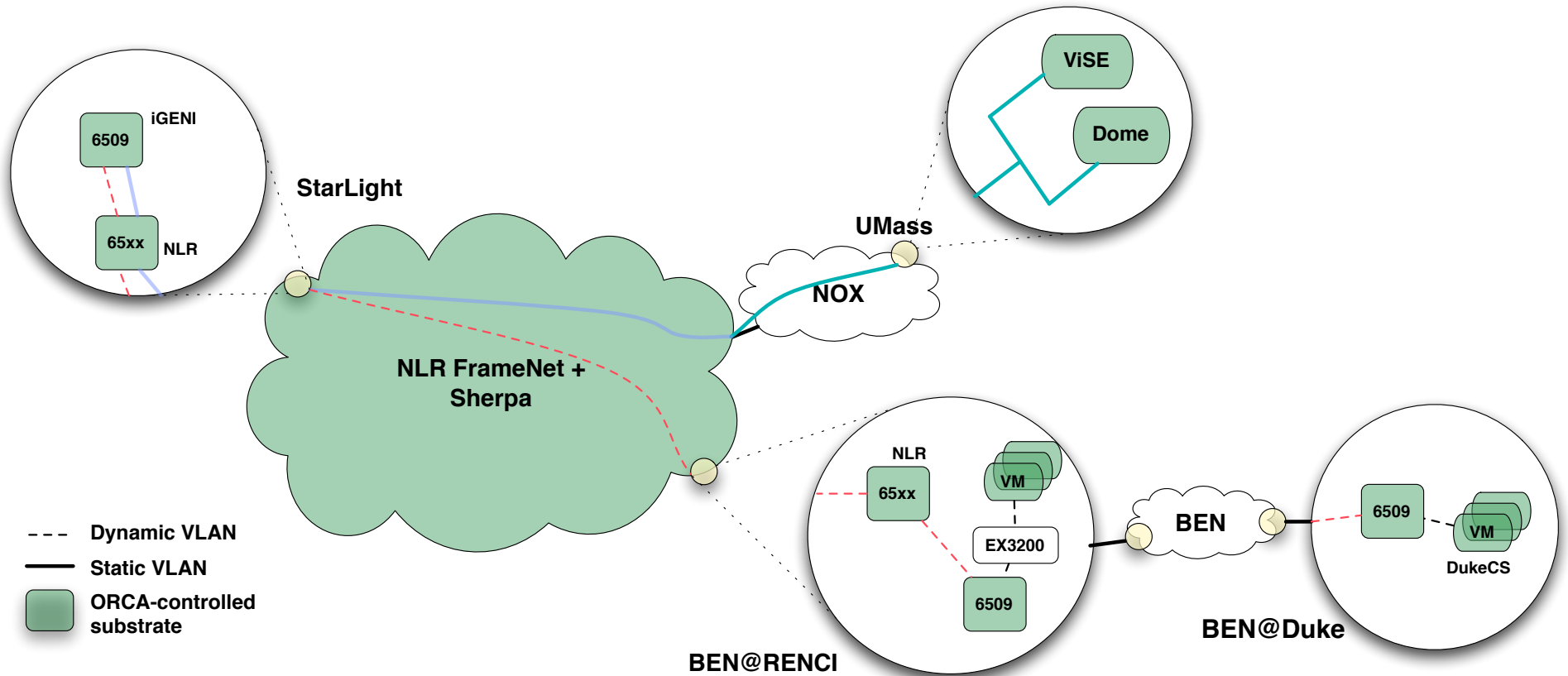
No	Name	GUID	Description	
<input type="checkbox"/>	1 service	5a9a95db-5f42-4334-907e-334cdef9ee84	no description	manage
<input type="checkbox"/>	2 ben	10553e14-db1c-4ba3-a575-7841366454fc	no description	manage

Select: All None Action: Select an action

User portal interface: view slices.



The Demo Slice



Elements of a Slice

Current Selections

» slice: **ben** [manage]

Slices

» View Slices

» Create Slice

Reservations

» View Slice Reservations

» Create Reservation

» View All Reservations

Slice Controllers

» View Controllers

» Start Controller

My Account

» Current Actor

» Actors

» Settings

Manage Slice

» Slice: **ben** Action: ganglia

GUID: 10553e14-db1c-4ba3-a575-7841366454fc

Owner: service (af7b4558-23e7-11df-bf65-000c29b1c193)

Description: no description

Request Properties: Show

Configuration Properties: Show

Local Properties: Show

» Reservations:

Select: All None Action:

No	Slice	Type	Units [R]	Units [A]	Start	End	Broker	Site	State	
<input type="checkbox"/>	1	ben	ViSE Testbed	1	1	03/15/2010 16:31	03/16/2010 16:31	broker	visite-site	Closedmanage
<input type="checkbox"/>	2	ben	BEN VLAN	1	1	03/15/2010 16:51	03/16/2010 16:51	broker	ben-site	Closedmanage
<input type="checkbox"/>	3	ben	RENCI NET VLAN	1	1	03/15/2010 16:51	03/16/2010 16:51	broker	renci-net-site	Closedmanage
<input type="checkbox"/>	4	ben	DUKE NET VLAN	1	1	03/15/2010 16:31	03/16/2010 16:31	broker	duke-net-site	Closedmanage
<input type="checkbox"/>	5	ben	Starlight VLAN	1	1	03/15/2010 16:56	03/16/2010 16:56	broker	starlight-site	Closedmanage
<input type="checkbox"/>	6	ben	Eucalyptus Virtual Machine (DUKE)	1	1	03/15/2010 16:31	03/16/2010 16:31	broker	duke-vm-site	Closedmanage
<input type="checkbox"/>	7	ben	Eucalyptus Virtual Machine (DUKE)	1	1	03/15/2010 16:56	03/16/2010 16:56	broker	duke-vm-site	Closedmanage
<input type="checkbox"/>	8	ben	NLR VLAN	1	1	03/15/2010 16:31	03/16/2010 16:31	broker	nlr-site	Closedmanage
<input type="checkbox"/>	9	ben	DUKE NET VLAN	1	1	03/15/2010 16:56	03/16/2010 16:56	broker	duke-net-site	Closedmanage
<input type="checkbox"/>	10	ben	BEN VLAN	1	1	03/15/2010 16:56	03/16/2010 16:56	broker	ben-site	Closedmanage
<input type="checkbox"/>	11	ben	Starlight VLAN	1	1	03/15/2010 16:31	03/16/2010 16:31	broker	starlight-site	Closedmanage
<input type="checkbox"/>	12	ben	NLR VLAN	1	1	03/15/2010 16:56	03/16/2010 16:56	broker	nlr-site	Closedmanage
<input type="checkbox"/>	13	ben	DUKE NET VLAN	1	1	03/15/2010 16:51	03/16/2010 16:51	broker	duke-net-site	Closedmanage
<input type="checkbox"/>	14	ben	Eucalyptus Virtual Machine (RENCI)	1	1	03/15/2010 16:51	03/16/2010 16:51	broker	renci-vm-site	Closedmanage
<input type="checkbox"/>	15	ben	BEN VLAN	1	1	03/15/2010 16:31	03/16/2010 16:31	broker	ben-site	Closedmanage
<input type="checkbox"/>	16	ben	ViSE Testbed	1	1	03/15/2010 16:56	03/16/2010 16:56	broker	visite-site	Closedmanage
<input type="checkbox"/>	17	ben	Eucalyptus Virtual Machine (DUKE)	1	1	03/15/2010 16:51	03/16/2010 16:51	broker	duke-vm-site	Closedmanage

Select: All None Action:



Current Selections

» slice: ben [manage]

Slices

» View Slices

» Create Slice

Reservations

» View Slice Reservations

» Create Reservation

» View All Reservations

Slice Controllers

» View Controllers

» Start Controller

My Account

» Current Actor

» Actors

» Settings

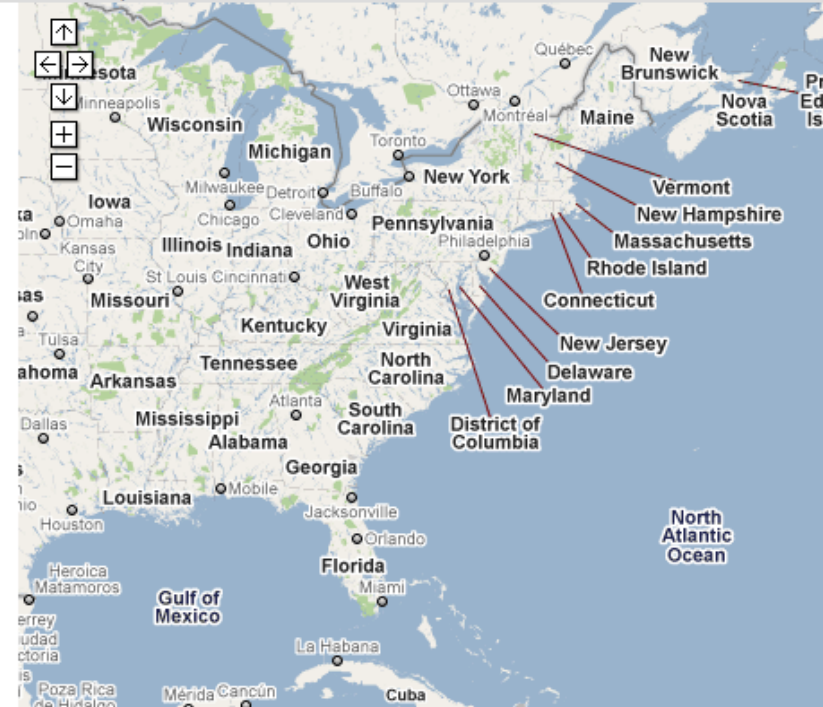
Request Resources

Resource Selection

Lease Start: 03/16/2010 14:44

Lease End: 03/17/2010 14:44

Resource Map



Current Selections

» slice: ben [manage]

Slices

» View Slices

» Create Slice

Reservations

» View Slice Reservations

» Create Reservation

» View All Reservations

Slice Controllers

» View Controllers

» Start Controller

My Account

» Current Actor

» Actors

» Settings

Request Resources

Resource Selection

Lease Start: 03/16/2010 14:44

Lease End: 03/17/2010 14:44

Resource Map



[Query NDL-OWL Store](#) [Cancel Selection](#) [Check Request](#) [Submit Request](#)

ORCA



home

user

broker

site

admin

About

Contact Us

Current Selections

» slice: ben [manage]

Slices

- » View Slices
- » Create Slice

Reservations

- » View Slice Reservations
- » Create Reservation
- » View All Reservations

Slice Controllers

- » View Controllers
- » Start Controller

My Account

- » Current Actor
- » Actors
- » Settings

Request Resources

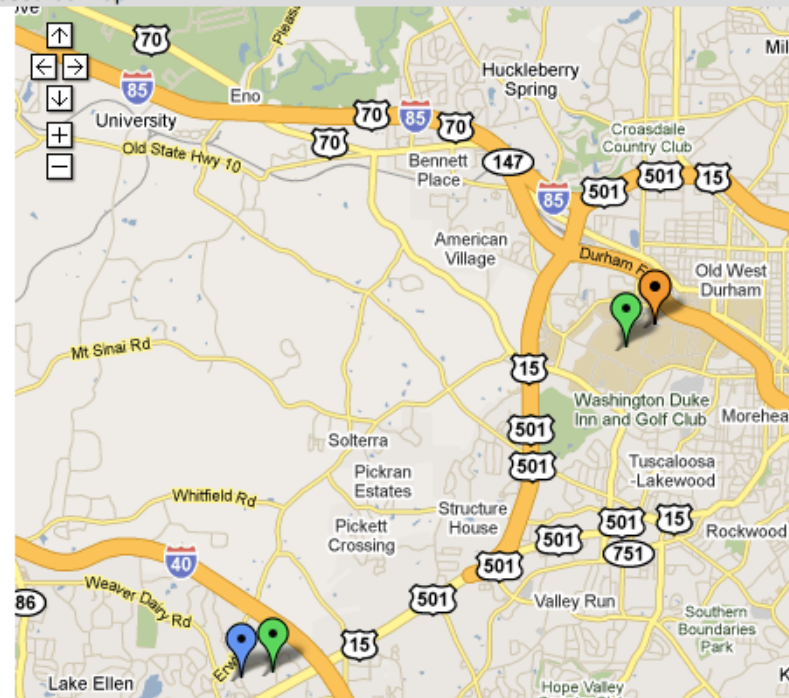
Resource Selection

Lease Start: 03/16/2010 14:44

Lease End: 03/17/2010 14:44

Resource Provider	Resource Type	Units
RenciEuca Renci/Euca	Resource ServerCloud	16
DukeCSEuca	Resource	16
Duke/Euca	ServerCloud	

Resource Map



Current Selections

» slice: ben [manage]

Slices

» View Slices

» Create Slice

Reservations

» View Slice Reservations

» Create Reservation

» View All Reservations

Slice Controllers

» View Controllers

» Start Controller

My Account

» Current Actor

» Actors

» Settings

Request Resources

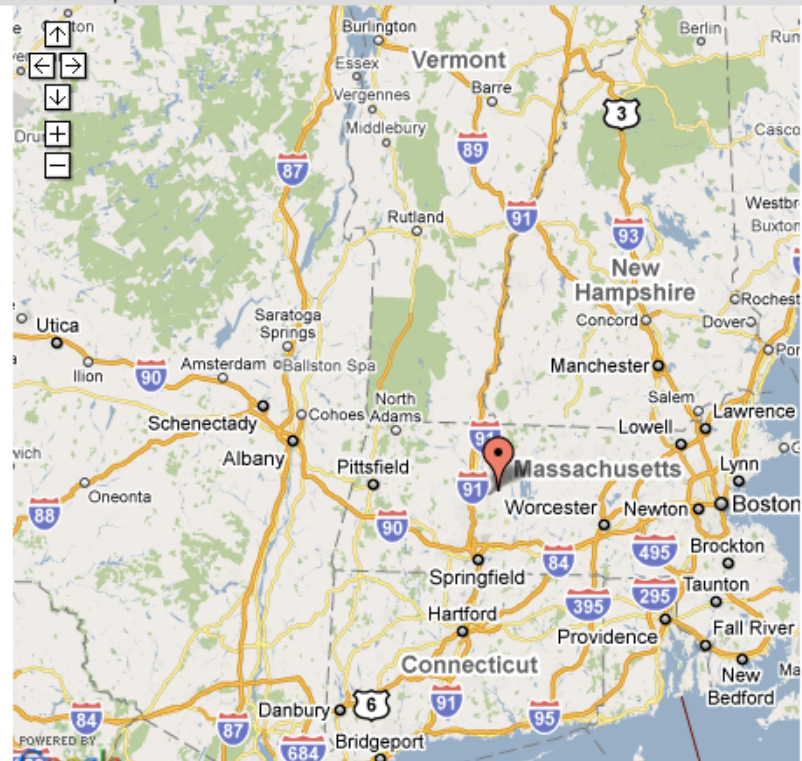
Resource Selection

Lease Start: 03/16/2010 14:44

Lease End: 03/17/2010 14:44

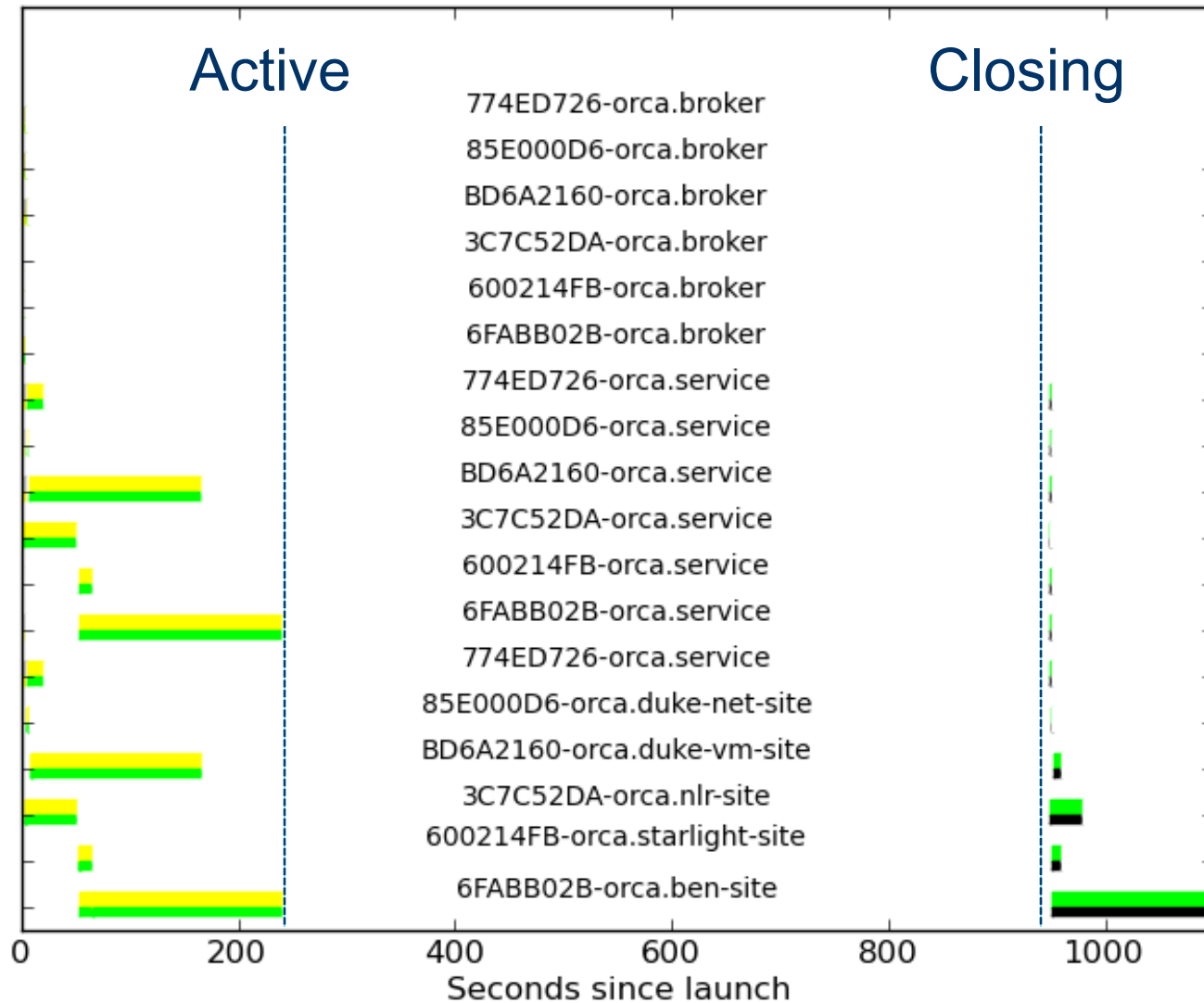
Resource Provider	Resource Type	Units
UMass UMass/Visc /Testbed	Resource Testbed	1
RenciEuca Renci/Euca	Resource ServerCloud	16
DukeCSEuca	Resource ServerCloud	16
Duke/Euca	Resource ServerCloud	16

Resource Map

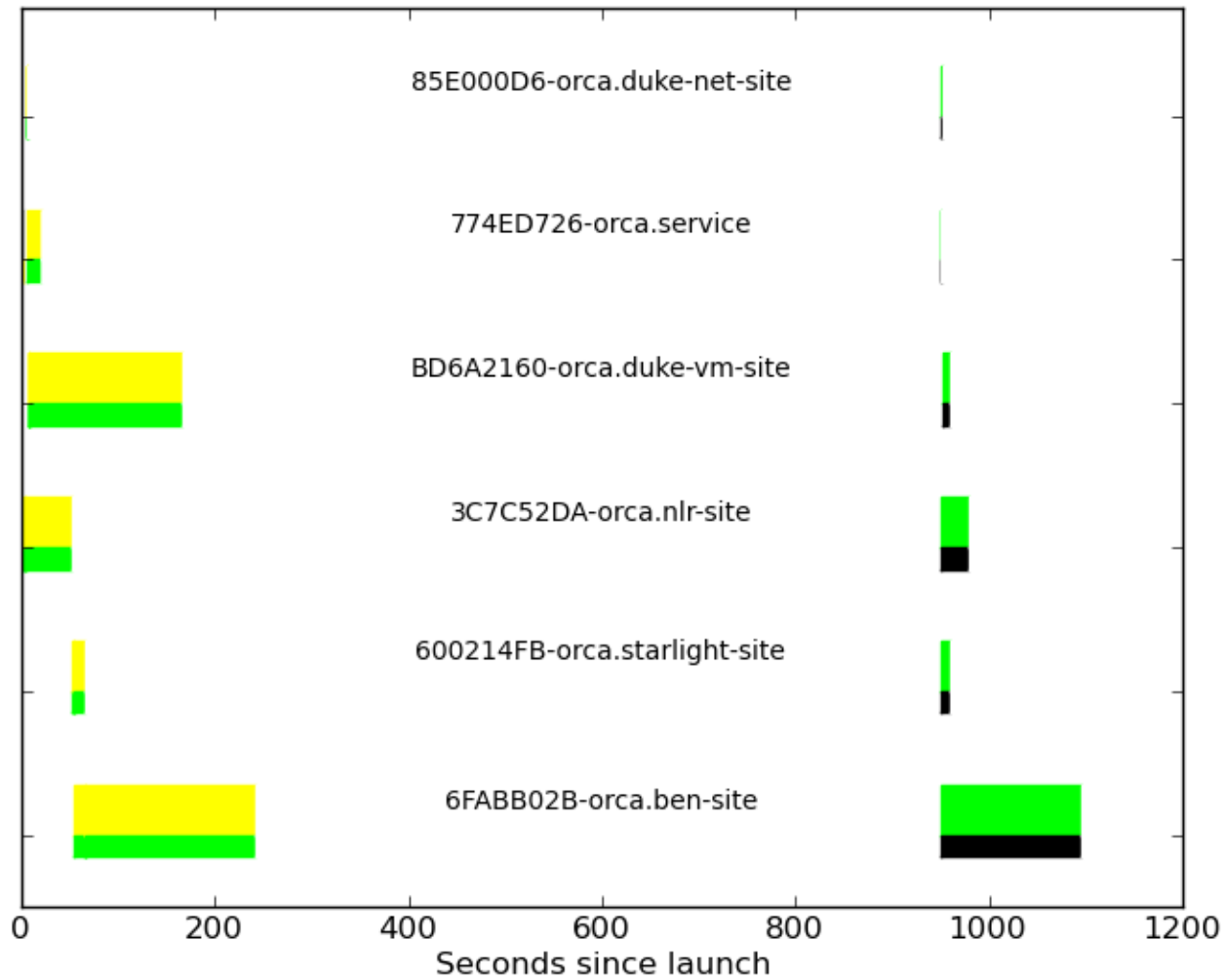


Query NDL-OWL Store Cancel Selection Check Request Submit Request

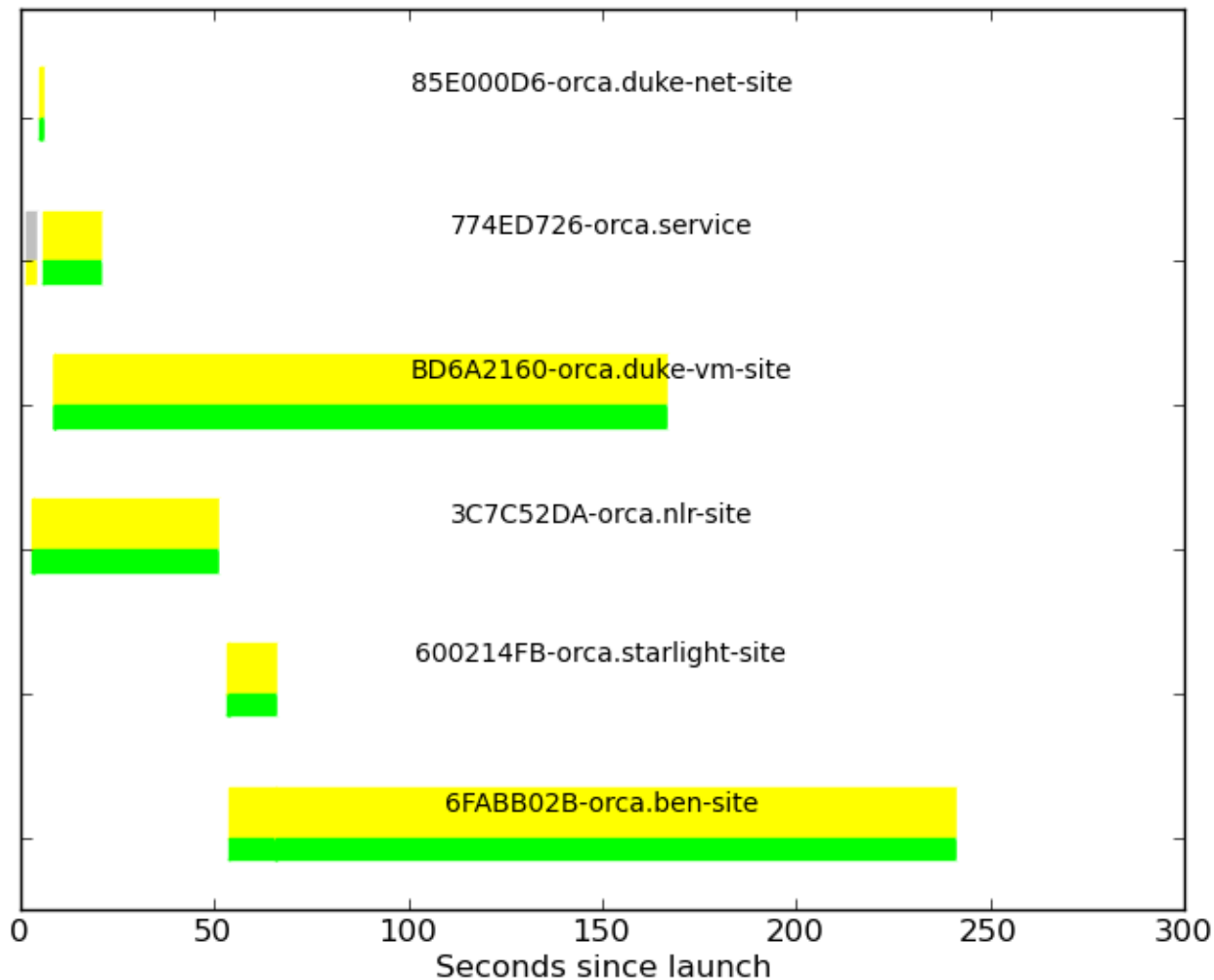
Lease activity (from logs)



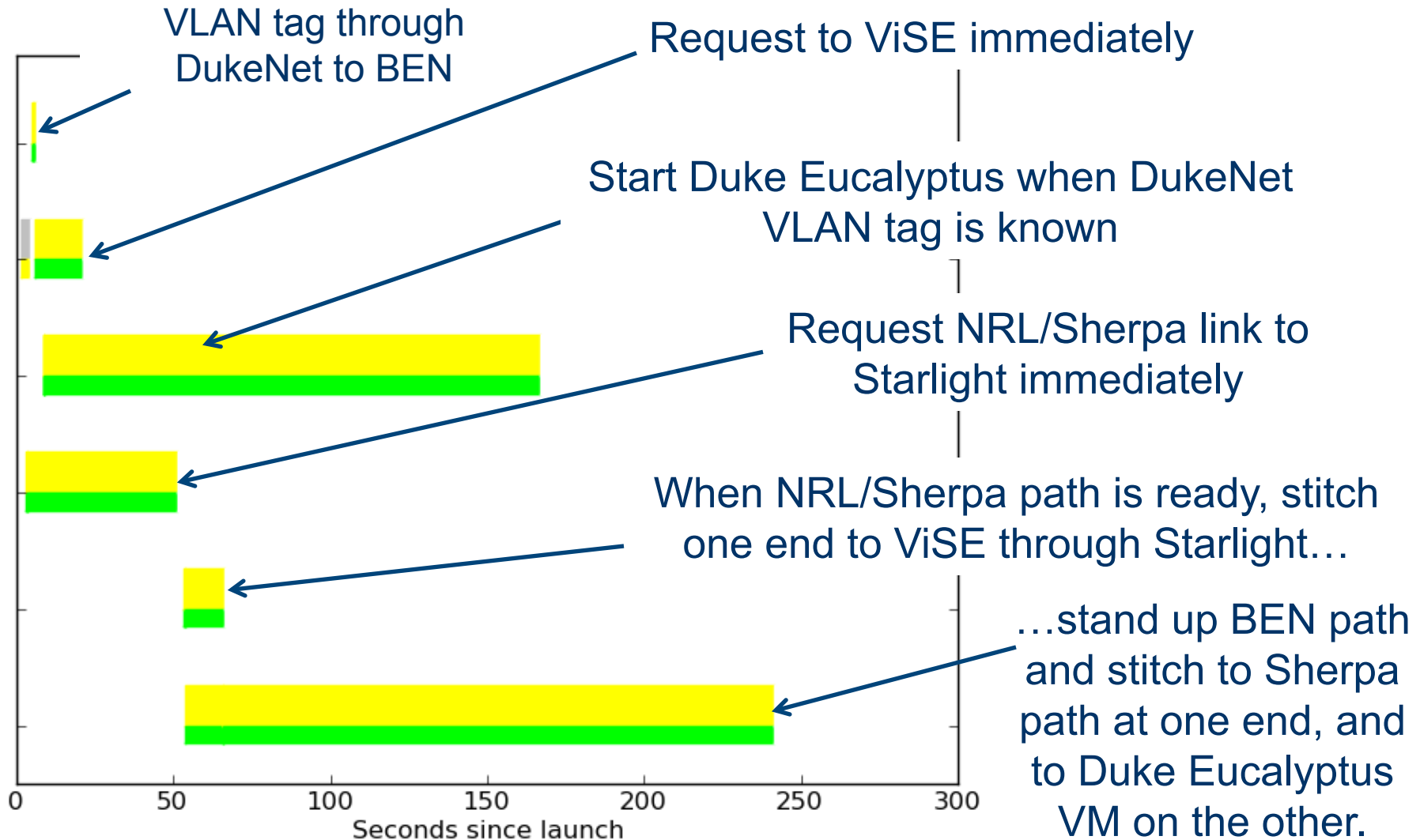
A Closer Look

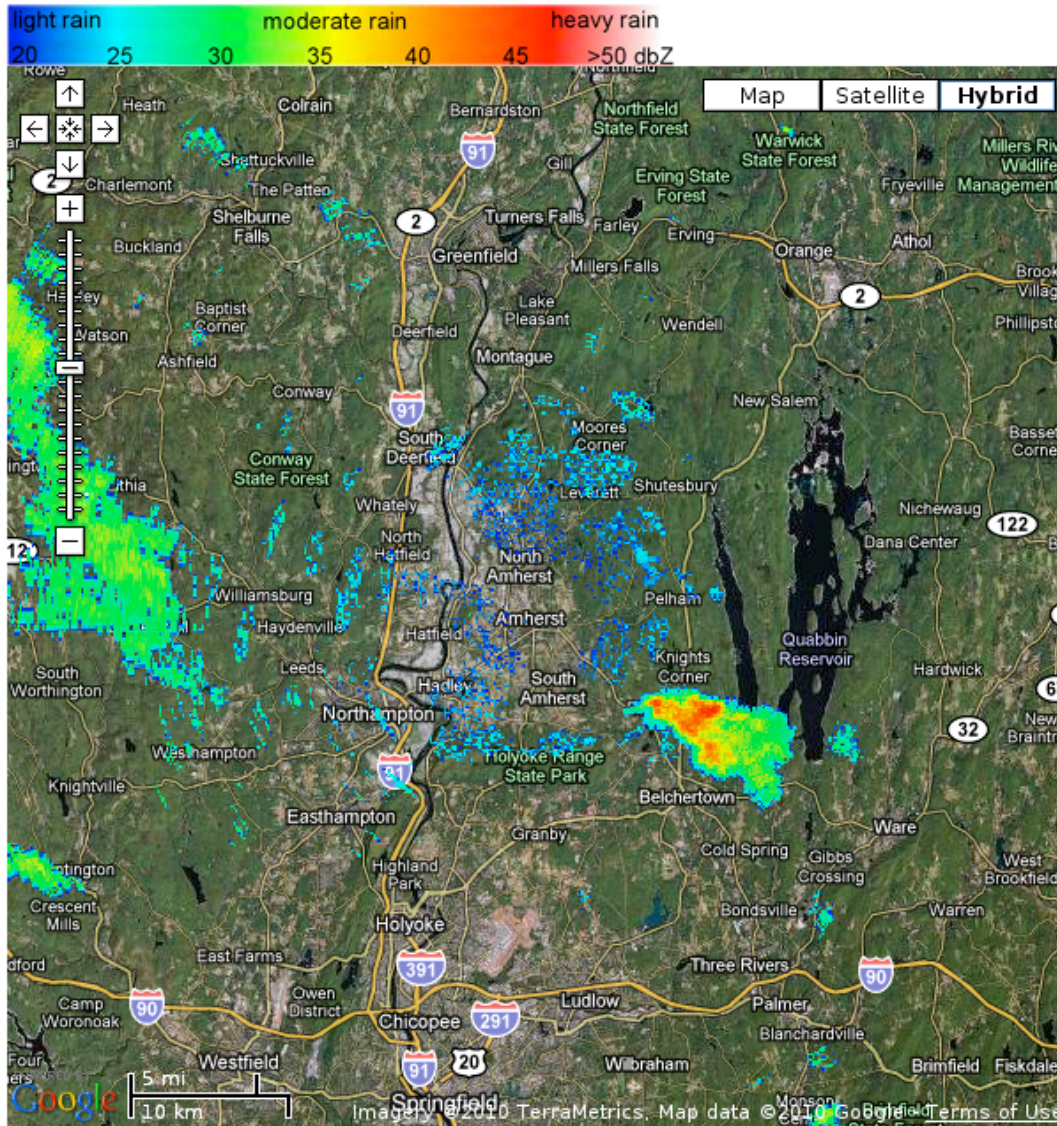


A Closer Look: Instantiation



A Closer Look: Instantiation





Load/Reset Animation

Pause	Next	Previous
Faster	Slower	
1 Frames Per Second		

06/15/2009
18:46:48pm UTC

NDL-OWL

```
<!--Polatis-Renci-->
<ndl:Device rdf:about="#Polatis-Renci">
  <rdfs:label>Polatis-Renci</rdfs:label>
  <ndl:locatedAt rdf:resource="#Renci"/>
  <ndl:hasInterface rdf:resource="#Polatis-Renci:f1"/>
  <ndl:hasInterface rdf:resource="#Polatis-Renci:f17"/>
  <ndl:hasInterface rdf:resource="#Polatis-Renci:f2"/>
  <ndl:hasInterface rdf:resource="#Polatis-Renci:f18"/>
</ndl:Device>

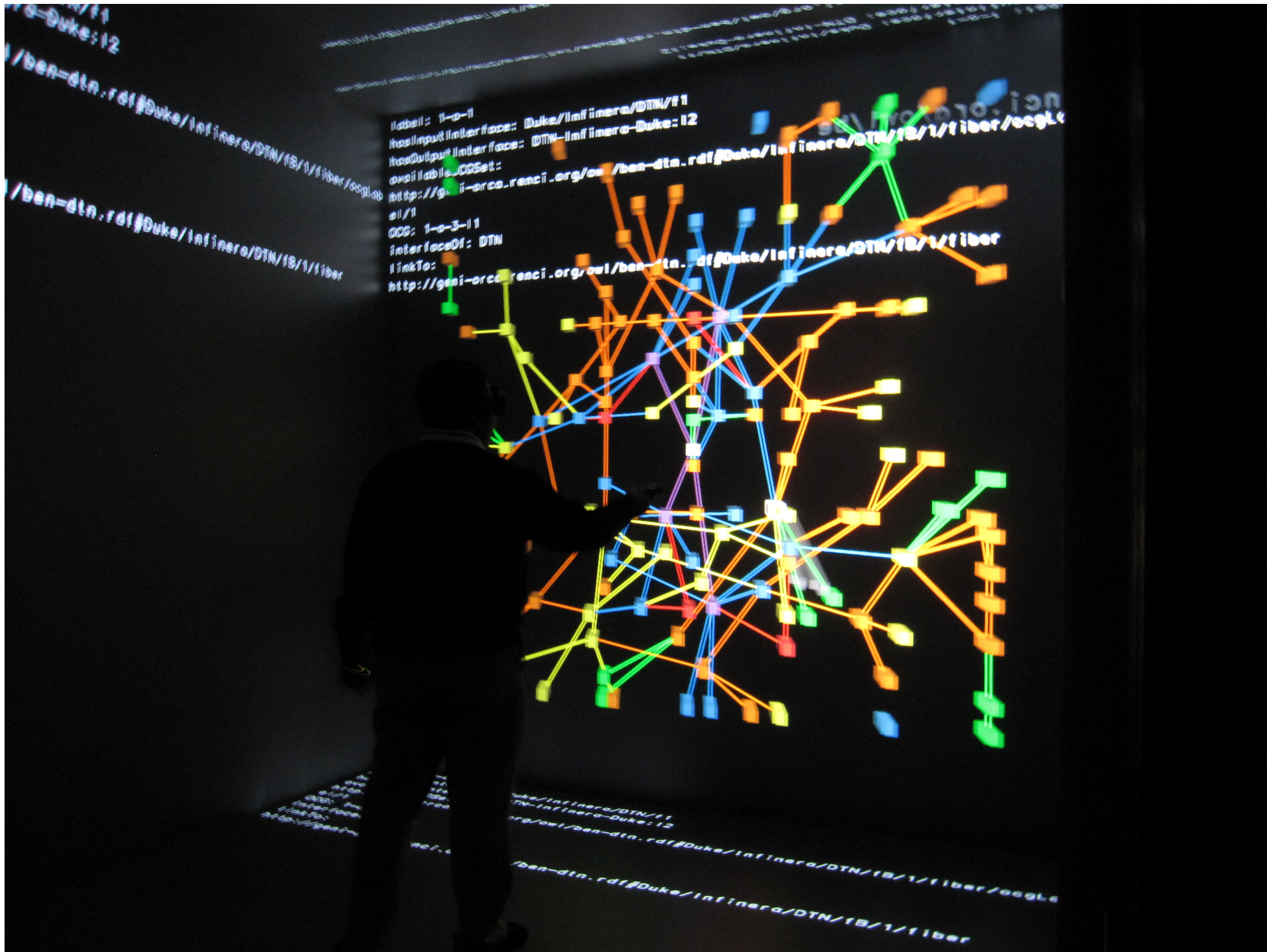
<!--Polatis-Renci:f1-->
<ndl:Interface rdf:about="#Polatis-Renci:f1">
<rdfs:type rdf:resource="http://.../ndl/wdm#FiberNetworkElement"/>
  <rdfs:label>Polatis-Renci:f1</rdfs:label>
  <ndl:connectedTo rdf:resource="#Polatis-Duke:f1"/>
</ndl:Interface>
```

```
label: 1-g-1  
hasInputInterface: Duke/Infimera/DTN/11  
hasOutputInterface: DTN-Infimera-Duke: 12  
availableCCSet:  
http://geni-orca.rnci.org/ow/ben-dtn.rdf#Duke/Infimera/DTN/1B/1/fiber/ocgLe  
e1/1  
CCS: 1-g-3-11  
interfaceOf: DTN  
linkTo:  
http://geni-orca.rnci.org/ow/ben-dtn.rdf#Duke/Infimera/DTN/1B/1/fiber
```

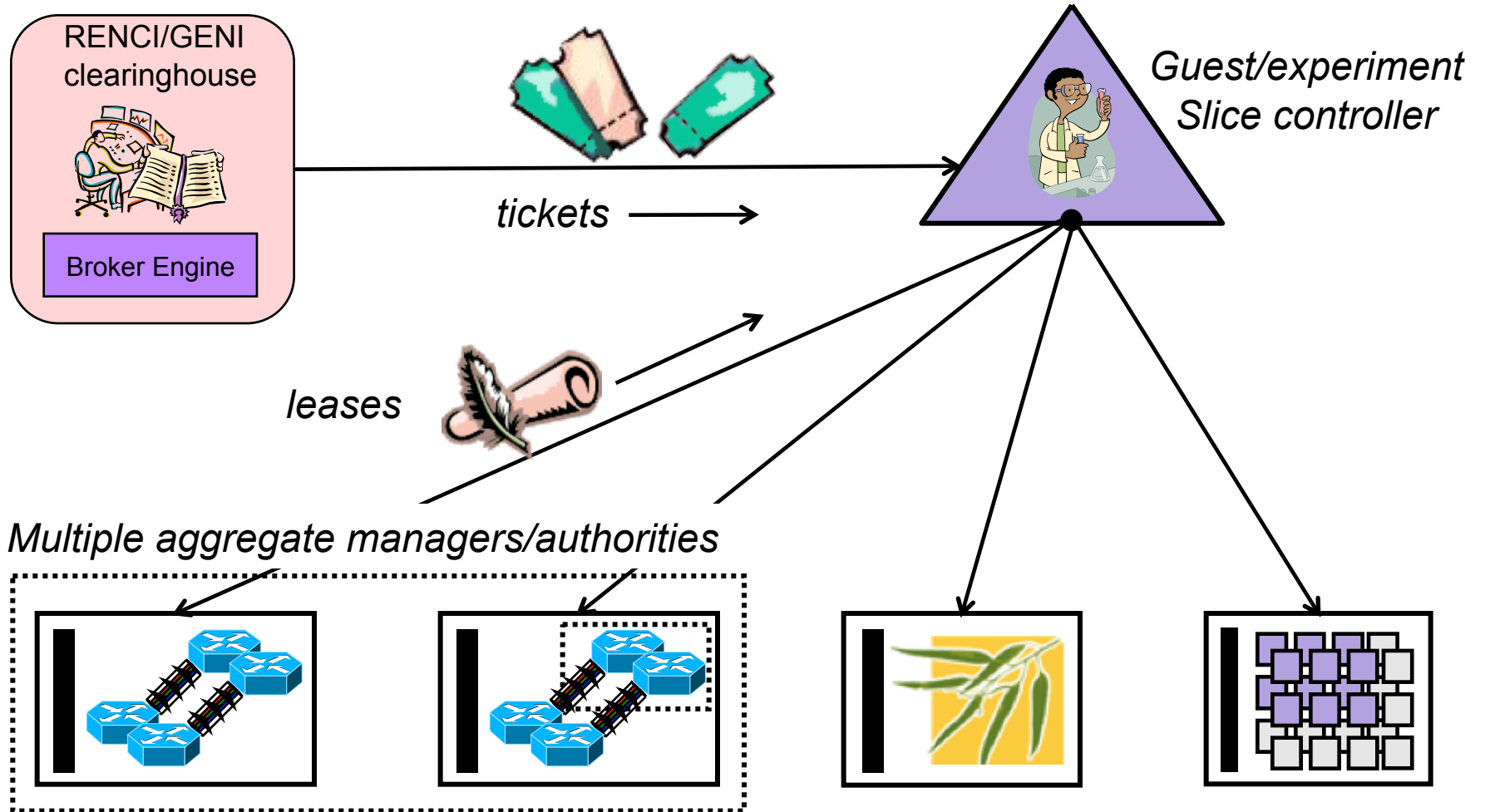
1-g-1
Duke: 12

/ben-dtn.rdf#Duke/Infimera/DTN/1B/1/fiber/ocgLe
/ben-dtn.rdf#Duke/Infimera/DTN/1B/1/fiber

...
Duke/Infimera/DTN/11
DTN-Infimera-Duke: 12
...
...
/ben-dtn.rdf#Duke/Infimera/DTN/1B/1/fiber/ocgLe
/ben-dtn.rdf#Duke/Infimera/DTN/1B/1/fiber

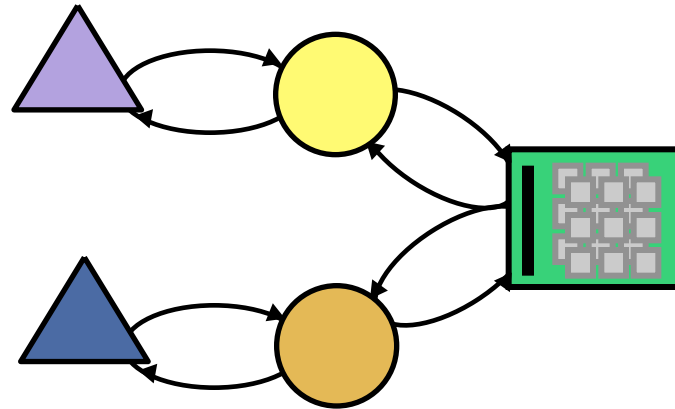


Stitching



Exchange of labels, tokens, configuration attributes etc. through SC

Brokers: Issues



- Discovery and selection of brokers
- Trust management and key exchange
- How much substrate info to expose?
- How much allocation power to delegate?
- Overbooking vs. reserve capacity