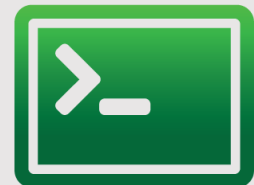


Getting Started with GENI - Part 2

GENI Engineering Conference 17
Madison, WI



Design/Setup



Execute



Finish

In Part 1 You Learned to...

- Log into the **GENI** Portal

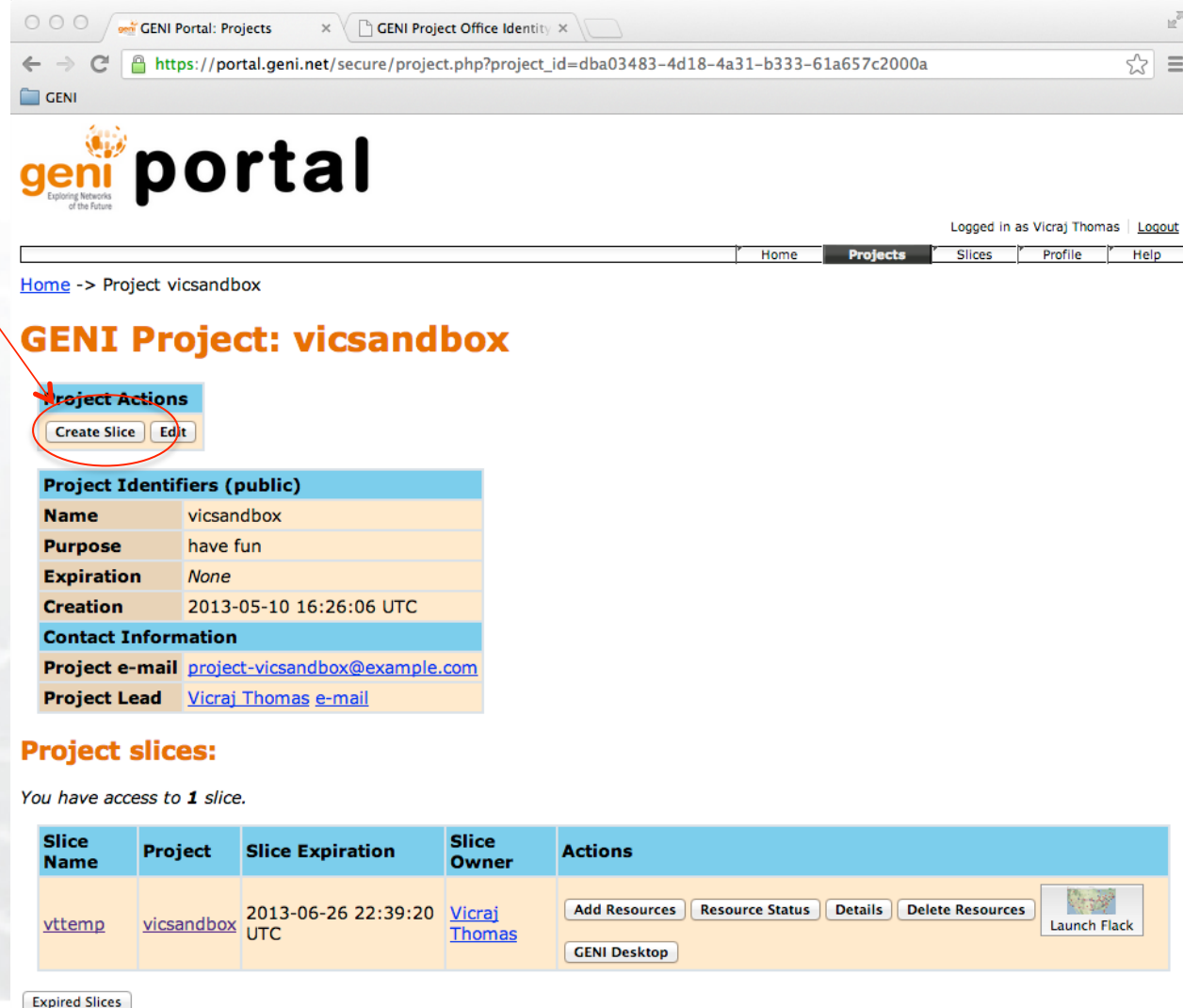


The screenshot shows a web browser window with the URL `https://portal.geni.net/eds/?entityID=https%3A%2F%2Fpanther.gpolab.bbn.com%2Fshibboleth&return=https%3A%2F%2Fporta...`. The page content includes:

- A header bar with the **GENI** logo.
- A prompt: "Please sign in using your account at one of our partners:"
- A red-bordered box containing:
 - The text "Use a suggested selection:"
 - The **geni** logo and "GENI Project Office" link.
 - The text "Or enter your college, university, or organization's name" above a text input field.
 - Buttons for "Continue" and "Get Help".
 - A link: "Allow me to pick from a list".
- Links for "Can't login via any of the above organizations? Request a login from the GPO" and "Need help? Contact GENI Help".
- A footer bar with "Web Design by Free Templates Online".
- A footer note: "GENI is sponsored by the  National Science Foundation".

In Part 1 You Learned to...

- Log into the GENI Portal
- Create a **slice**



GENI Portal: Projects | GENI Project Office Identity

https://portal.geni.net/secure/project.php?project_id=dba03483-4d18-4a31-b333-61a657c2000a

GENI

geni portal

Logged in as Vicraj Thomas | Logout

Home | **Projects** | Slices | Profile | Help

Home -> Project vicsandbox

GENI Project: vicsandbox

Project Actions

Create Slice | Edit

Project Identifiers (public)

Name	vicsandbox
Purpose	have fun
Expiration	None
Creation	2013-05-10 16:26:06 UTC

Contact Information

Project e-mail project-vicsandbox@example.com

Project Lead [Vicraj Thomas e-mail](#)

Project slices:

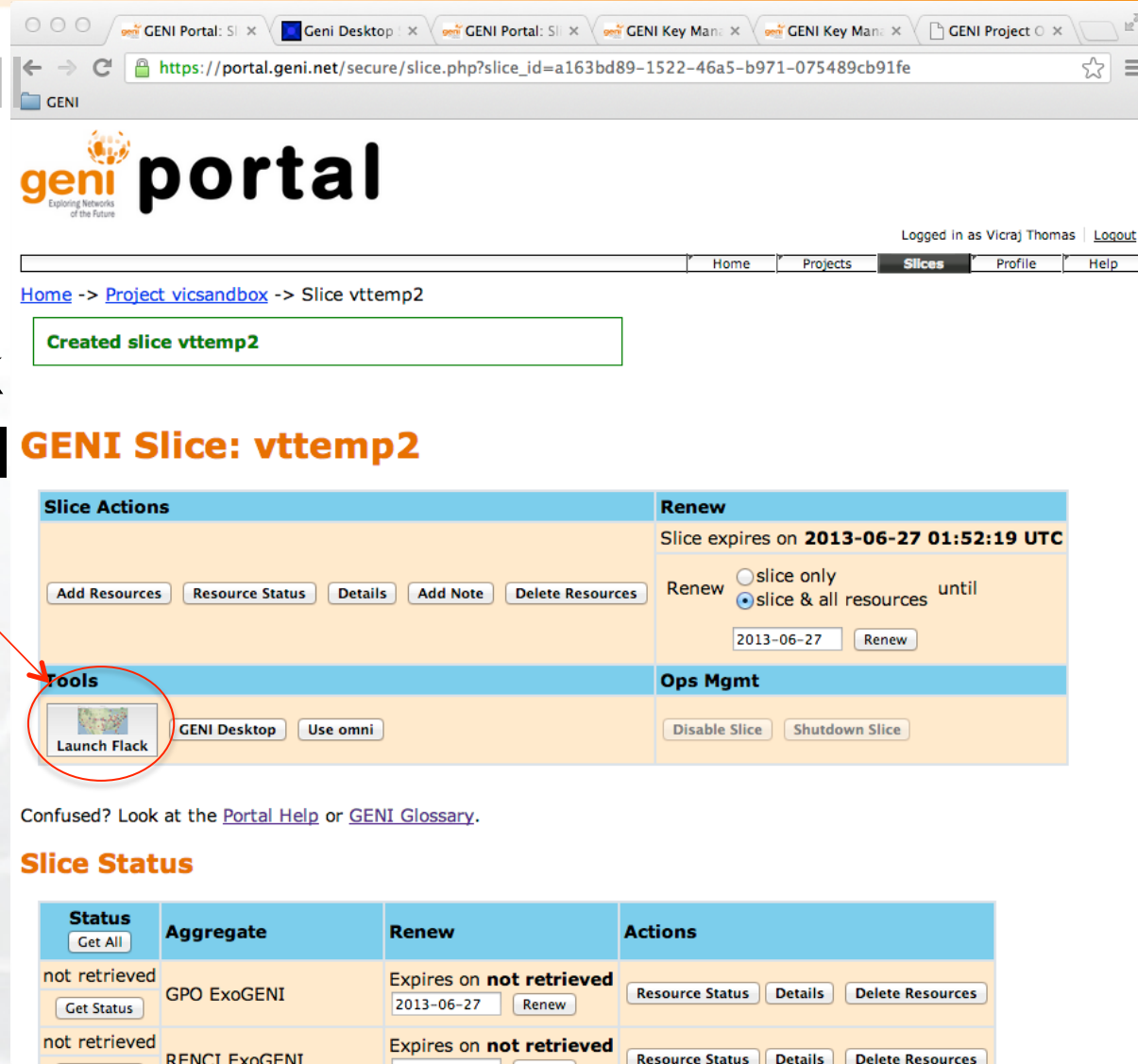
You have access to **1** slice.

Slice Name	Project	Slice Expiration	Slice Owner	Actions
vttemp	vicsandbox	2013-06-26 22:39:20 UTC	Vicraj Thomas	Add Resources Resource Status Details Delete Resources Launch Flask GENI Desktop

Expired Slices

In Part 1 You Learned to...

- Log into the GENI Portal
- Create a slice
- Launch the Flack experimenter tool



The screenshot shows the GENI Portal interface. At the top, the browser address bar displays the URL: `https://portal.geni.net/secure/slice.php?slice_id=a163bd89-1522-46a5-b971-075489cb91fe`. The page header includes the GENI logo and the text "portal". A navigation menu shows "Home", "Projects", "Slices", "Profile", and "Help". The user is logged in as "Vicraj Thomas".

A green box displays the message: "Created slice vttemp2". Below this, the page title is "GENI Slice: vttemp2".

The main content area is divided into several sections:

- Slice Actions:** Contains buttons for "Add Resources", "Resource Status", "Details", "Add Note", and "Delete Resources".
- Renew:** Shows the slice expiration date: "Slice expires on 2013-06-27 01:52:19 UTC". It includes a "Renew" section with radio buttons for "slice only" and "slice & all resources", and a date selector set to "2013-06-27".
- Tools:** Contains a "Launch Flack" button (highlighted with a red circle and arrow), "GENI Desktop", and "Use omni".
- Ops Mgmt:** Contains buttons for "Disable Slice" and "Shutdown Slice".

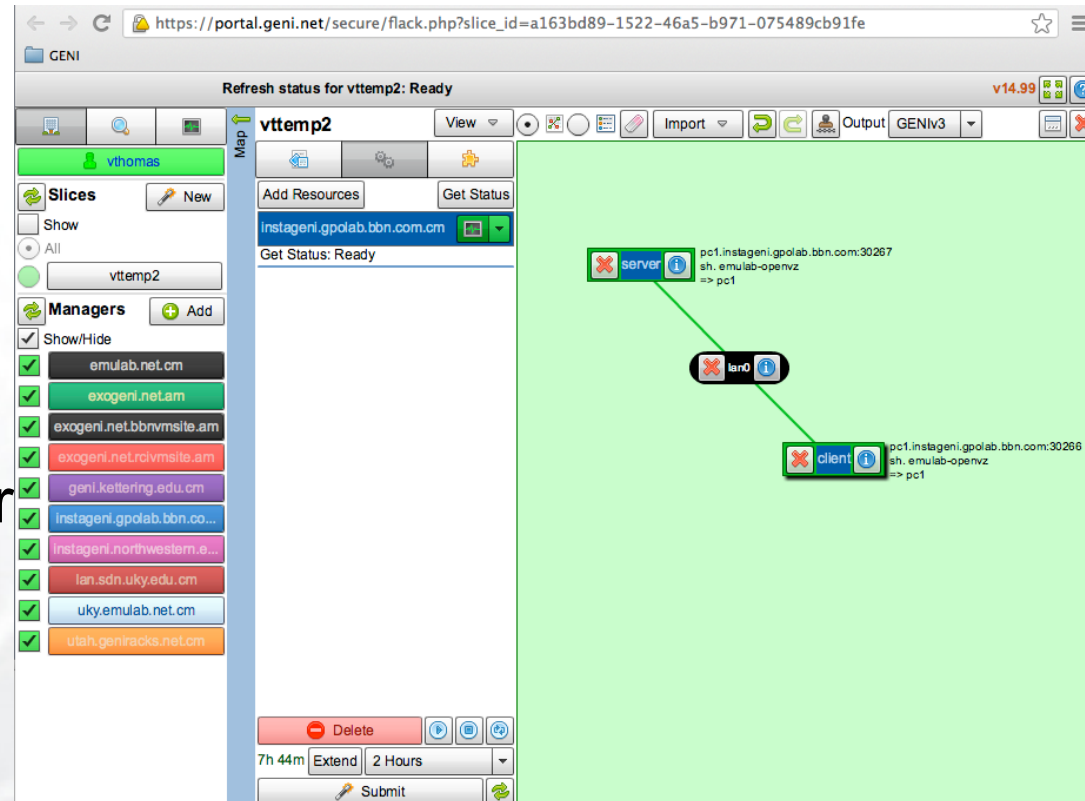
At the bottom, there is a "Slice Status" table:

Status	Aggregate	Renew	Actions
not retrieved Get All Get Status	GPO ExoGENI	Expires on not retrieved 2013-06-27 Renew	Resource Status Details Delete Resources
not retrieved	RENCI ExoGENI	Expires on not retrieved	Resource Status Details Delete Resources

Confused? Look at the [Portal Help](#) or [GENI Glossary](#).

In Part 1 You Learned to...

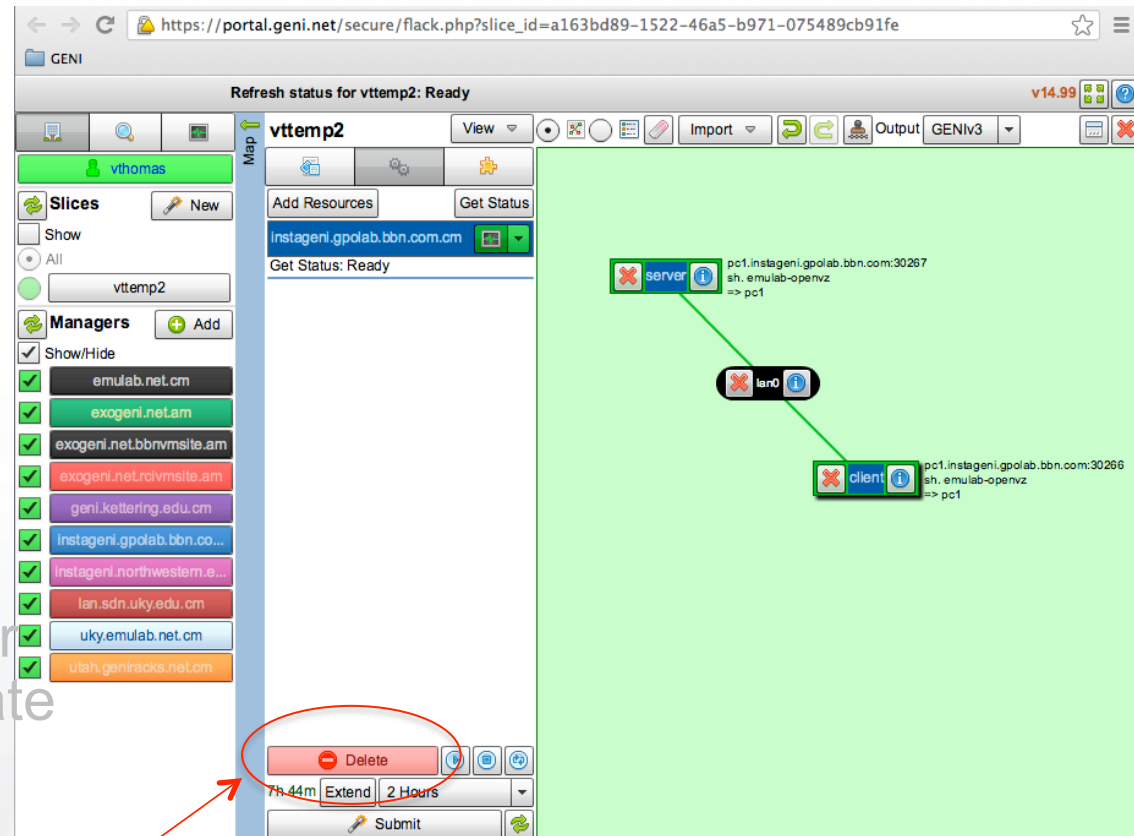
- Log into the GENI Portal
- Create a slice
- Launch the Flack experimenter tool
- Set up a simple experiment
 - Add **resources** to your slice from an **aggregate**
 - Use the resources in your slice



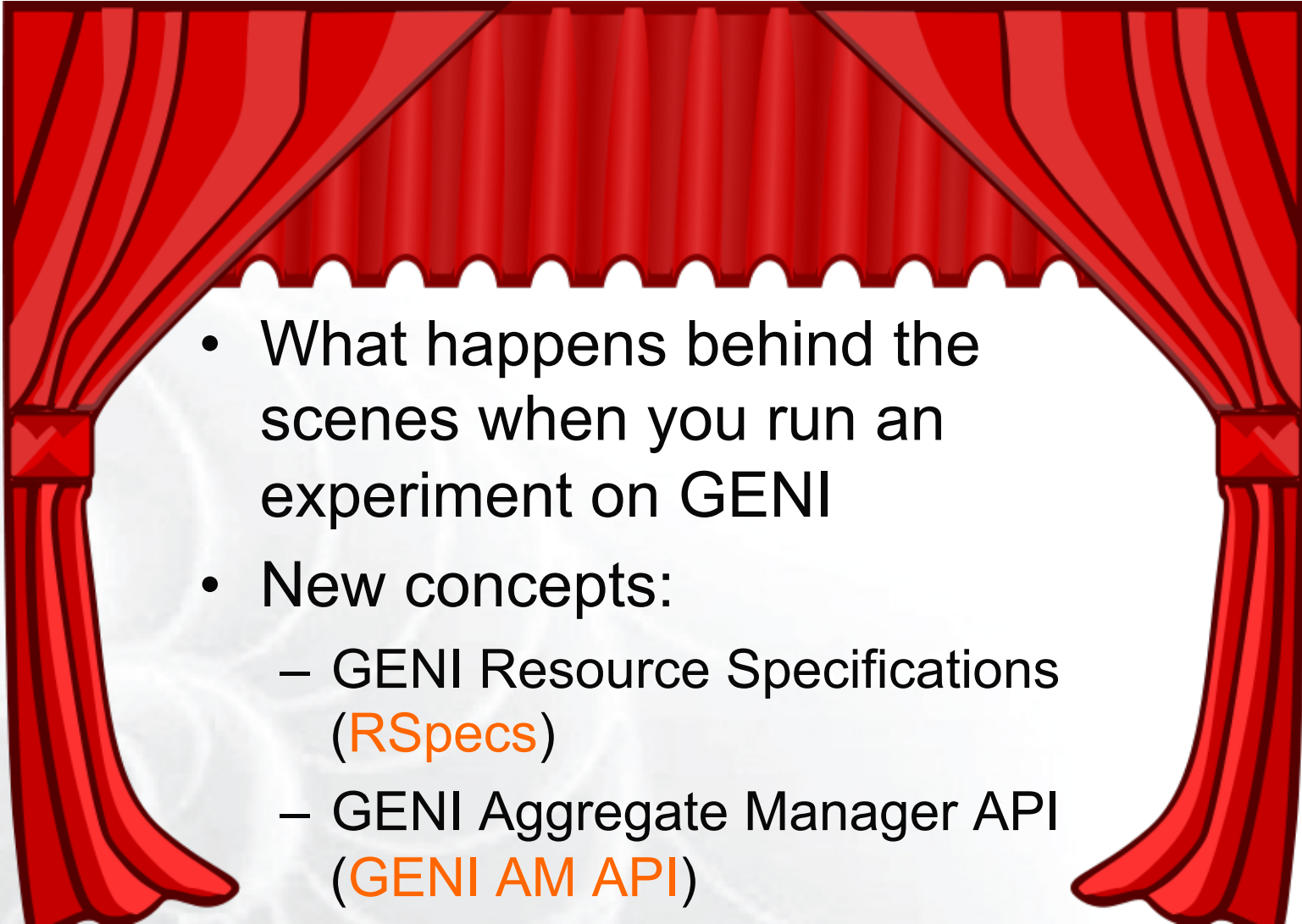
The screenshot shows the GENI portal interface for a slice named 'vttemp2'. The browser address bar shows the URL: https://portal.geni.net/secure/flack.php?slice_id=a163bd89-1522-46a5-b971-075489cb91fe. The interface includes a 'Refresh status for vttemp2: Ready' message and a 'v14.99' version indicator. On the left, there is a 'Slices' section with a 'New' button and a 'Show' checkbox, and a 'Managers' section with an 'Add' button and a 'Show/Hide' checkbox. Below these are several manager entries, each with a checkmark and a name: emulab.net.cm, exogeni.net.am, exogeni.net.bbrvmsite.am, exogeni.net.rcivmsite.am, geni.kettering.edu.cm, instageni.gpolab.bbn.co..., instageni.northwestern.e..., lan.sdn.uky.edu.cm, uky.emulab.net.cm, and ulah.geniracks.net.cm. The main area shows the slice 'vttemp2' with a 'View' dropdown, 'Add Resources', and 'Get Status' buttons. Below these are two resource entries: 'instageni.gpolab.bbn.com.cm' and 'Get Status: Ready'. On the right, a network diagram shows a 'server' node connected to a 'client' node via a 'lan0' link. The server node is labeled 'pc1.instageni.gpolab.bbn.com:30267 sh.emulab-openvz => pc1' and the client node is labeled 'pc1.instageni.gpolab.bbn.com:30266 sh.emulab-openvz => pc1'. At the bottom, there is a 'Delete' button, a timer showing '7h 44m', an 'Extend' button, a '2 Hours' dropdown, and a 'Submit' button.

In Part 1 You Learned to...

- Log into the GENI Portal
- Create a slice
- Launch the Flack experimenter tool
- Set up a simple experiment
 - Add resources to your slice from an aggregate
 - Use the resources in your slice
- **Delete resources in your slice**



In Part 2 You will Learn...

- 
- What happens behind the scenes when you run an experiment on GENI
 - New concepts:
 - GENI Resource Specifications (**RSpecs**)
 - GENI Aggregate Manager API (**GENI AM API**)

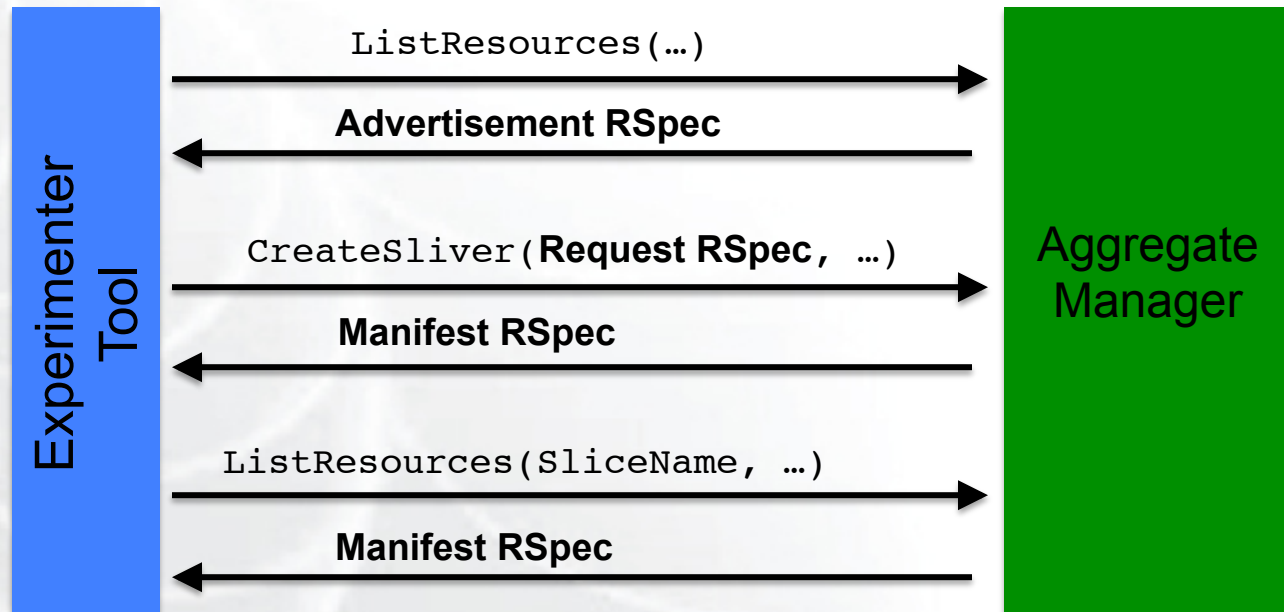
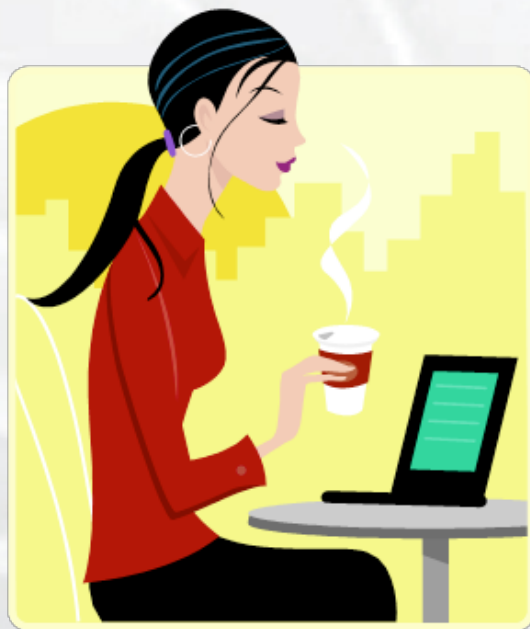
- RSpecs are XML documents that describe resources
 - VMs, links, etc.

RSpec for a virtual machine with one interface:

```
<?xml version="1.0" encoding="UTF-8"?>
<rspec type="request" xsi:schemaLocation="http://www.geni.net/
resources/rspec/3 ... xmlns="http://www.geni.net/resources/rspec/3">
  <node client_id="server" component_manager_id="urn:publicid:IDN
+instageni.gpolab.bbn.com+authority+cm">
    <sliver_type name="emulab-opensvz"/>
    <interface client_id="server:if0"> </interface>
  </node>
</rspec>
```

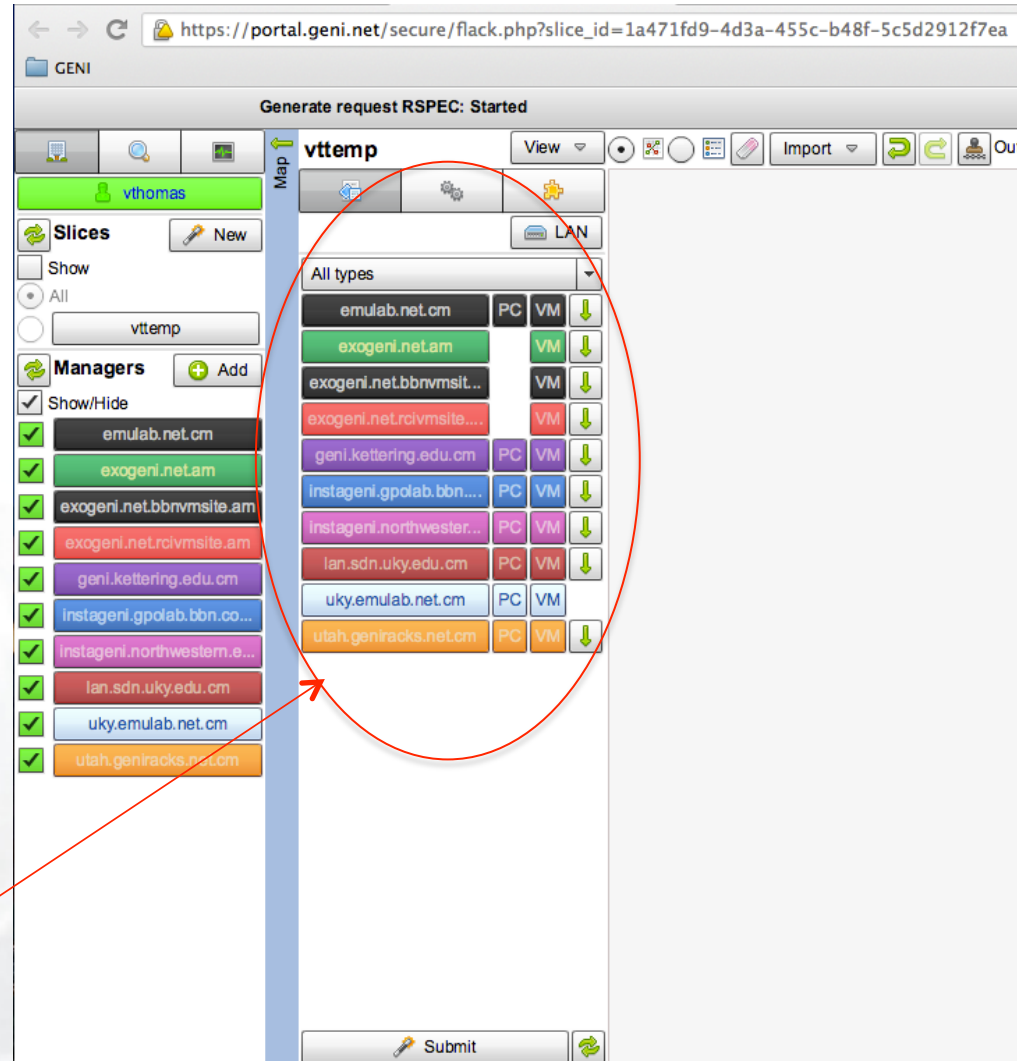

- RSpec documents are exchanged by experimenter tools (e.g. Flack) and aggregates
 - Aggregates use RSpecs to describe what they have – **Advertisement RSpecs**
 - Experimenters use RSpecs to describe the resources they want – **Request RSpecs**
 - Aggregates use RSpecs to describe the resources allocated to an experimenter – **Manifest RSpecs**

- Experimenter tools and aggregates talk to each other using the GENI Aggregate Manager API (**GENI AM API**)



Putting it all Together...

- Flack calls **ListResources** on all aggregates it knows about
- Aggregates send back **advertisement RSpecs**
- Flack uses information in the advertisements to populate its palette of resources

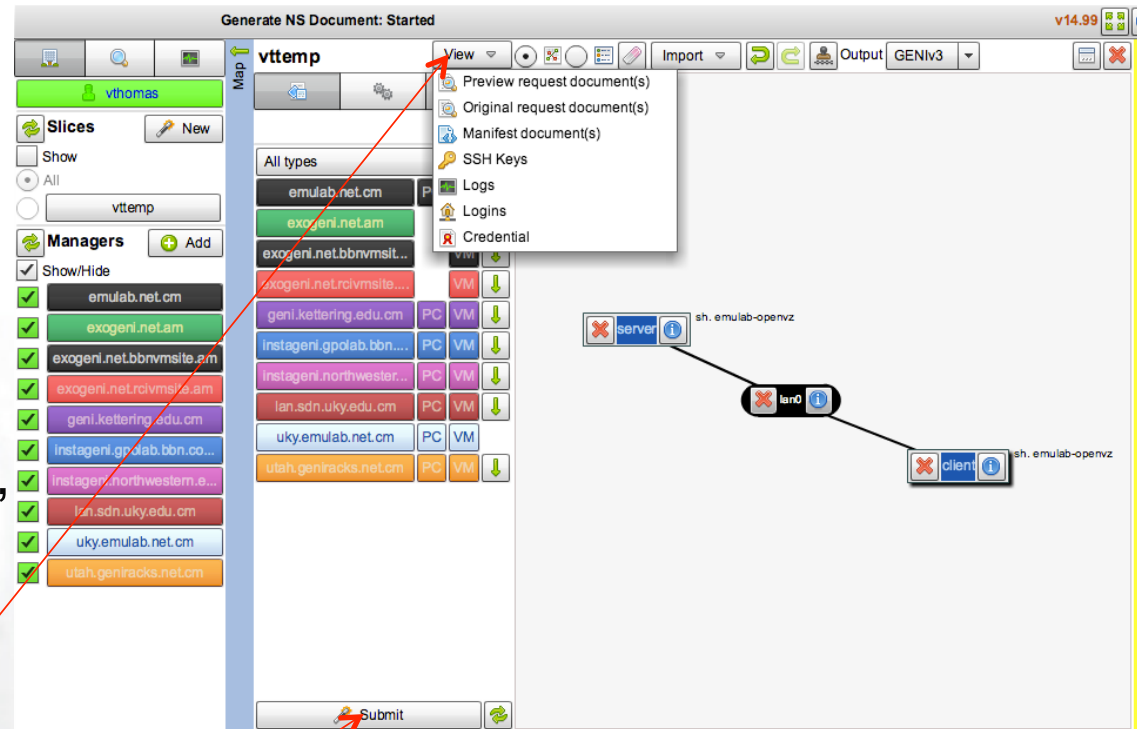


The screenshot shows the GENI portal interface for a slice named 'vtemp'. The interface includes a navigation bar, a search bar, and a 'Map' button. The main content area displays a list of resources under the heading 'All types'. A red circle highlights this list, and a red arrow points from the text 'populate its palette of resources' in the slide to the highlighted area.

Resource Name	Type 1	Type 2	Direction
emulab.net.cm	PC	VM	↓
exogeni.net.am	VM		↓
exogeni.net.bbrvmsit...	VM		↓
exogeni.net.rcivmsite...	VM		↓
geni.kettering.edu.cm	PC	VM	↓
instageni.gpolab.bbn...	PC	VM	↓
instageni.northwester...	PC	VM	↓
lan.sdn.uky.edu.cm	PC	VM	↓
uky.emulab.net.cm	PC	VM	
utah.geniracks.net.cm	PC	VM	↓

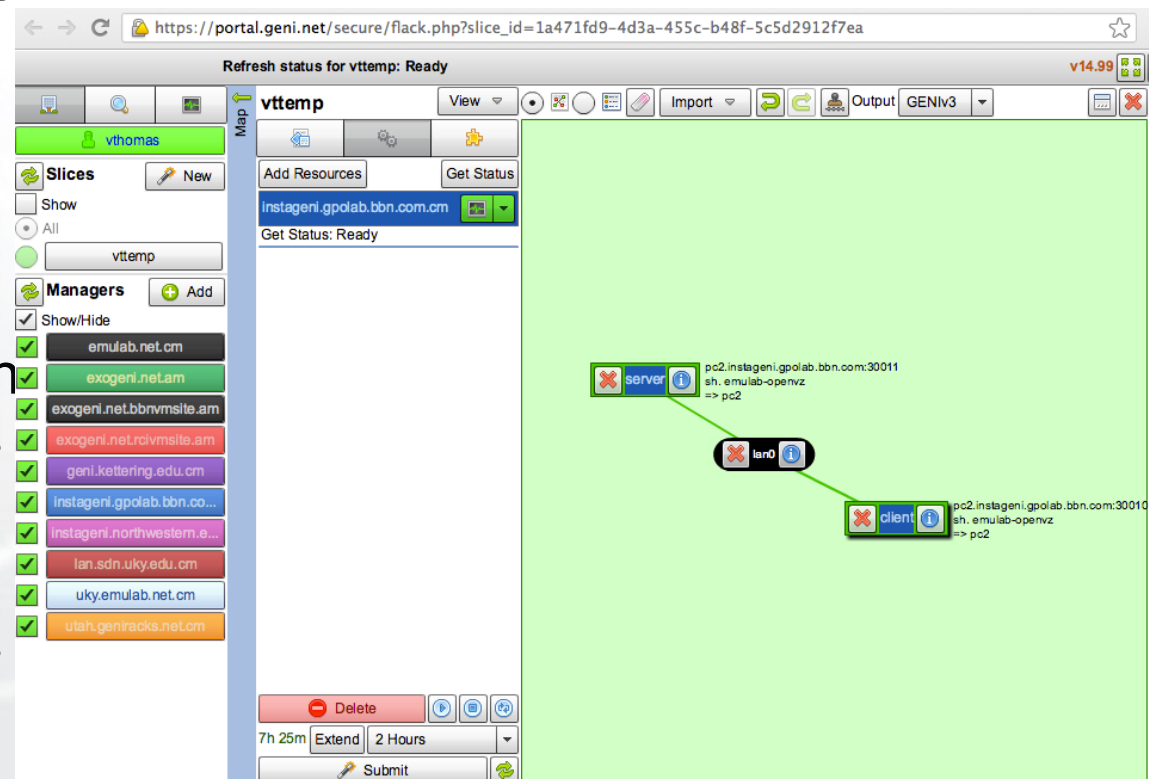
Putting it all Together...

- When you drag and drop resources on to the Flack canvas, it creates **request RSpecs** for these resources
 - To view the request Rspec click on “View” and select “Preview request documents”
- When you click “Submit”, Flack makes **createSliver** calls on the aggregates



Putting it all Together...

- Flack periodically calls `sliverStatus` on the aggregates to check on the status of your request
- When `sliverStatus` shows:
 - Resources have been allocated, Flack turns its canvas yellow
 - Resources are ready to use, Flack turns its canvas green



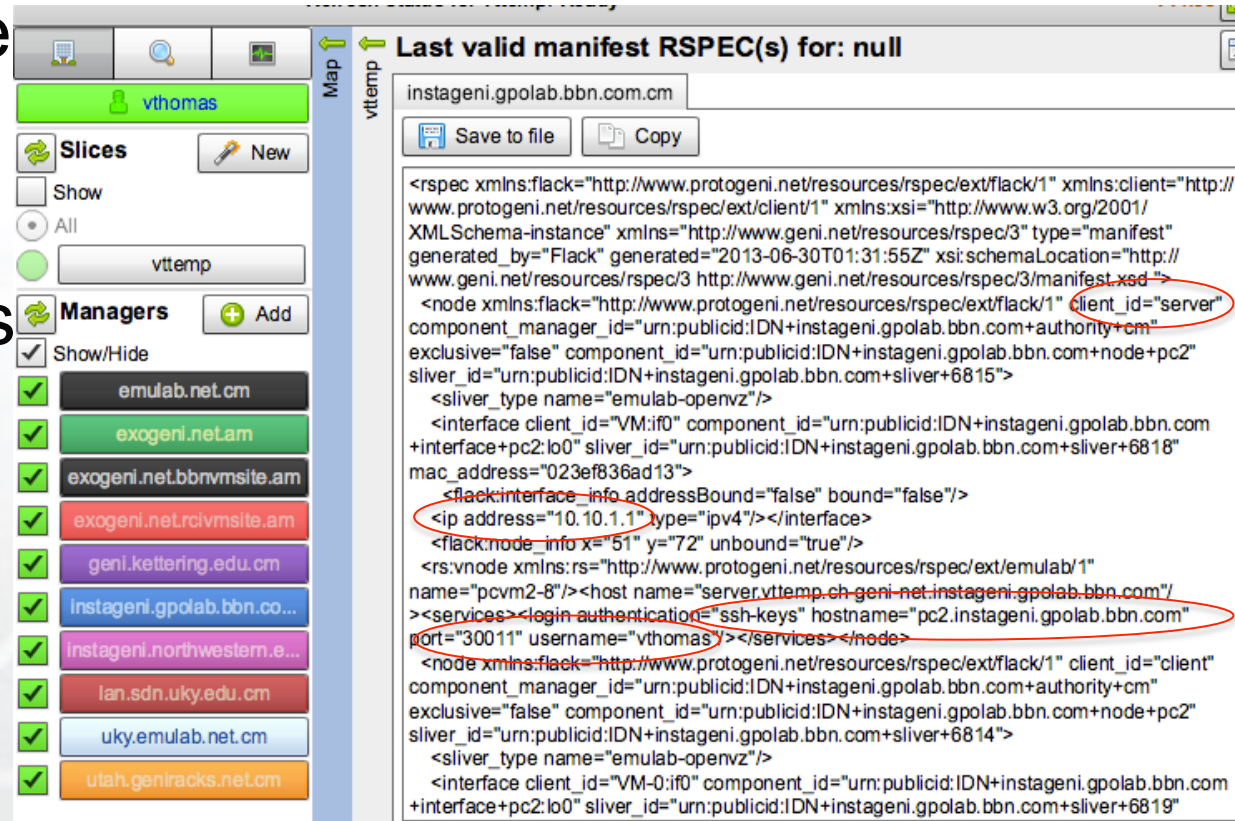
The screenshot shows the GENI portal interface for a virtual network named 'vtemp'. The browser address bar shows the URL: `https://portal.geni.net/secure/flack.php?slice_id=1a471fd9-4d3a-455c-b48f-5c5d2912f7ea`. The interface includes a sidebar with 'Slices' and 'Managers' sections, a main canvas displaying a network topology, and a bottom control panel.

The network topology in the canvas shows a 'server' node connected to an 'lan0' node, which is connected to a 'client' node. The nodes are labeled with their IP addresses and hostnames, such as `pc2.instageni.gpolab.bbn.com:30011` and `sh.emulab-openvz => pc2`.

The bottom control panel includes a 'Delete' button, a timer set to '7h 25m', an 'Extend' button, a '2 Hours' dropdown menu, and a 'Submit' button.

Putting it all Together...

- listResources with a slice name returns a **manifest RSpec**
- Manifest includes names and ports used to ssh into VMs
 - Flack uses this information to help you log into your resources



Last valid manifest RSPEC(s) for: null

instageni.gpolab.bbn.com.cm

Save to file Copy

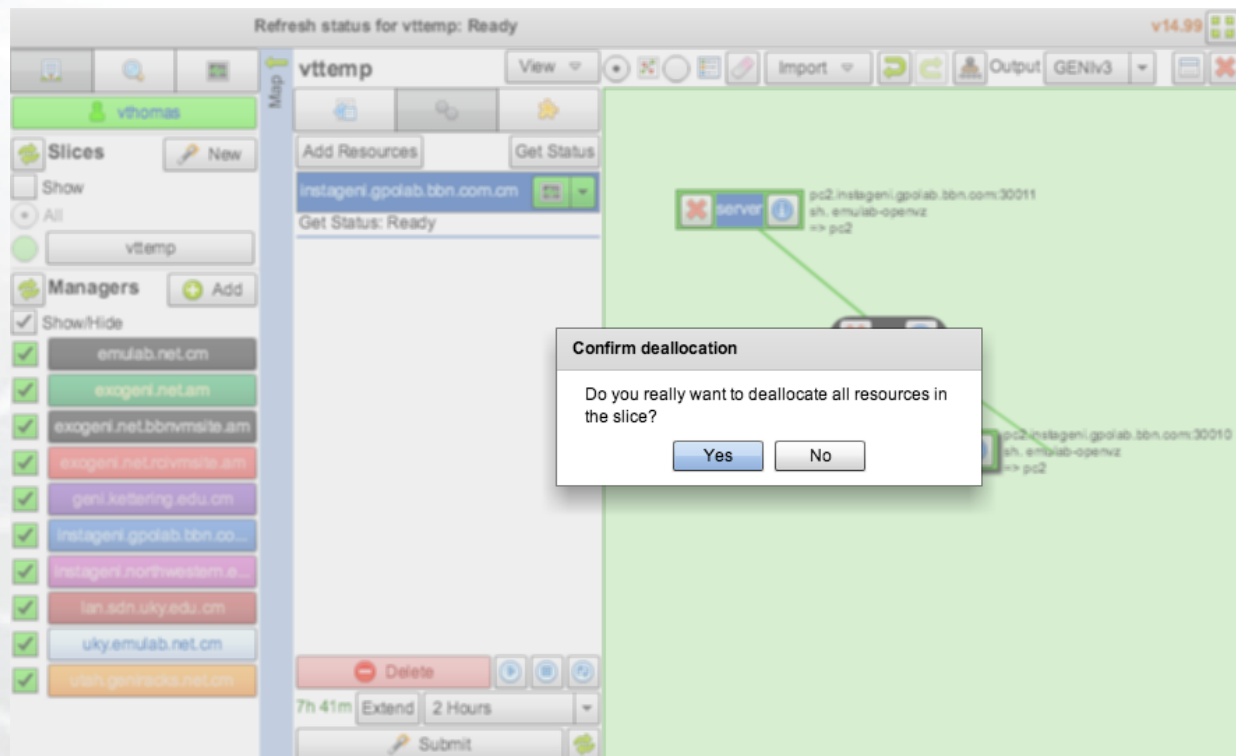
```

<rspec xmlns:flack="http://www.protogeni.net/resources/rspec/ext/flack/1" xmlns:client="http://www.protogeni.net/resources/rspec/ext/client/1" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.geni.net/resources/rspec/3" type="manifest" generated_by="Flack" generated="2013-06-30T01:31:55Z" xsi:schemaLocation="http://www.geni.net/resources/rspec/3 http://www.geni.net/resources/rspec/3/manifest.xsd">
  <node xmlns:flack="http://www.protogeni.net/resources/rspec/ext/flack/1" client_id="server" component_manager_id="urn:publicid:IDN+instageni.gpolab.bbn.com+authority+cm" exclusive="false" component_id="urn:publicid:IDN+instageni.gpolab.bbn.com+node+pc2" sliver_id="urn:publicid:IDN+instageni.gpolab.bbn.com+sliver+6815">
    <sliver_type name="emulab-openvz"/>
    <interface client_id="VM:i0" component_id="urn:publicid:IDN+instageni.gpolab.bbn.com+interface+pc2:lo0" sliver_id="urn:publicid:IDN+instageni.gpolab.bbn.com+sliver+6818" mac_address="023ef836ad13">
      <flack:interface_info addressBound="false" bound="false"/>
      <ip address="10.10.1.1" type="ipv4"/></interface>
      <flack:node_info x="51" y="72" unbound="true"/>
    <rs:vnode xmlns:rs="http://www.protogeni.net/resources/rspec/ext/emulab/1" name="pcvm2-8"/><host name="server.vttemp.ch.geni.net.instageni.gpolab.bbn.com"/><services><login_authentication ssh-keys hostname="pc2.instageni.gpolab.bbn.com" port="30011" username="vthomas"/></services></node>
    <node xmlns:flack="http://www.protogeni.net/resources/rspec/ext/flack/1" client_id="client" component_manager_id="urn:publicid:IDN+instageni.gpolab.bbn.com+authority+cm" exclusive="false" component_id="urn:publicid:IDN+instageni.gpolab.bbn.com+node+pc2" sliver_id="urn:publicid:IDN+instageni.gpolab.bbn.com+sliver+6814">
      <sliver_type name="emulab-openvz"/>
      <interface client_id="VM-0:i0" component_id="urn:publicid:IDN+instageni.gpolab.bbn.com+interface+pc2:lo0" sliver_id="urn:publicid:IDN+instageni.gpolab.bbn.com+sliver+6819">

```


Putting it all Together...

- When you deleted your resources, Flack called **deleteSliver** on the aggregates



- Reinforce understanding of the new concepts by:
 - Viewing and editing RSpec documents
 - Making the AM API calls ourselves using the **Omni experimenter tool**

- Repeat the experiment from Part 1 by loading an RSpec into Flack
 - Instead of drawing the topology ourselves (saves time)
- Edit the RSpec using Flack but don't "submit"
- Save the request RSpec generated by Flack into a file
- Use Omni to make GENI AM API calls to send the request RSpec, check status of resources, etc.

- `listresources`: Get an advertisement rspec listing the resources at an aggregate
- `createsliver`: Request resources from an aggregate
- `sliverstatus`: Get status of resources allocated to a slice at an aggregate
- `deletesliver`: Delete resources allocated to a slice by an aggregate

For a complete list of GENI AM API calls see:
http://groups.geni.net/geni/wiki/GAPI_AM_API

- A command line experimenter tool
- Useful for making AM API calls on aggregates
- Written in and scriptable from Python
- **Works with aggregates that implement the GENI AM API**
 - ProtoGENI, PlanetLab, OpenFlow, InstaGENI, ExoGENI

```
$ omni.py createsliver aliceslice myRSpec.xml
INFO:omni:Loading config file omni_config
INFO:omni:Using control framework pgeni
INFO:omni:Slice urn:publicid:IDN+pgeni.gpolab.
        expires within 1 day on 2011-07-07
INFO:omni:Creating sliver(s) from rspec file
INFO:omni:Writing result of createsliver for
INFO:omni:Writing to 'aliceslice-manifest-rspe
INFO:omni: -----
INFO:omni: Completed createsliver:

Options as run:
                aggregate: https://www.emulab.
                framework: pgeni
                native: True

Args: createsliver aliceslice myRSpec.xml

Result Summary: Slice urn:publicid:IDN+pgeni
Reserved resources on https://www.emulab.net/p
Saved createsliver results to aliceslice-man
INFO:omni: =====
```

<http://trac.gpolab.bbn.com/gcf/wiki/Omni>

- `omni.py -a aggregatename listresources`
- `omni.py -a aggregatename createsliver slicename requestRSpec`
- `omni.py -a aggregatename sliverstatus slicename`
- `omni.py -a aggregatename listresources slicename`
- `omni.py -a aggregatename deletesliver slicename`

- A useful utility (distributed with Omni):
`readyToLogin.py`
 - Gives you the ssh commands you need to log into your nodes
 - `readyToLogin.py` parses the output of `sliverStatus` to determine the hostname, portname and username for the ssh commands

- Omni reads a configuration file `omni_config` to:
 - Get usernames for accounts to be created on compute resources
 - Find locations of ssl certs and ssh key files
 - ssl certs are used to secure communication between Omni and the aggregates
 - ssh key pairs are used log into compute resources
 - Find standard nicknames for aggregates
 - E.g. you can refer to the InstaGENI rack at BBN as `ig-bbn` instead of `https://boss.instageni.gpolab.bbn.com:12369/protogeni/xmlrpc/am/2.0`

Creating an Omni Config File

1. Download the GENI bundle from the GENI Portal
2. Run the script `omni-configure.py`
 - Distributed with Omni
 - Already installed on your virtual machine

Download omni bundle

Instructions:

1. Choose a project below as your default omni project.
2. Click "Download omni bundle"
3. Run "`omni-configure.py -f portal <location of bundle>`"

Choose project as omni default: NSDI13

Download omni bundle

Cancel

```
geni@NSDI13-Tutorials:~$>
```

```
omni-configure.py -f portal
```

Watch Instructor do the Exercise

- By the end of this tutorial you should:
 - Feel comfortable running simple experiments on GENI
 - Have a basic understanding of how GENI works
- Later tutorials may skip some of these basic steps to focus on new material
 - You may be given an RSpec to use rather than have you create one
 - You may use slices that have already been created and resources added to them

If you need help completing the exercise stop by the:

- Experimenter Drop-In session at 4pm tomorrow, or
- The Experimenter Tutoring session at 1.30pm on Tuesday

For a description of the GENI concepts you have learned, see:

<http://groups.geni.net/geni/wiki/GENIConcepts>

- You should have a printout with detailed instructions
- Online instructions:

http://groups.geni.net/geni/wiki/GEC17Agenda/GettingStartedWithGENI_II/Procedure