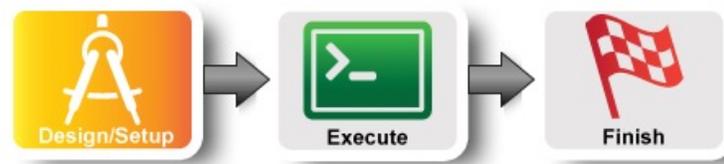


Lab One: Understanding the AM API Through a Simple Experiment

http://groups.geni.net/geni/wiki/GENIExperimenter/Tutorials/GettingStarted_PartII_ccn/Procedure/Setup
version 20140614

Understanding the AM API using Content Centric Networking



1. Design the Experiment

- a. In today's experiment you will use resources at the aggregate listed on the worksheet. If you don't have a worksheet use *Clemson InstaGENI* (aka *instageni.clemson.edu*)

2. Establish the Environment

2.1 Pre-work: Ensure SSH keys are setup

Verify that you have at least one public key associated with your account. To do that, after you login to the portal check under your Profile, under the *SSH keys* tab. If you do not have SSH keys associated yet, please follow the instructions on that tab of the Portal.

2.2 Configure Omni

- a. Login to the [GENI Portal](#)
- b. Click on the `Profile` tab` link on the top of your screen. Then click on the `Configure omni` tab under `PROFILE`.



Figure 2-1 Click on the *Configure omni* tab under *Profile*.

- c. Click on the `Download your omni data` button under step 2.

Option 1: Automatic omni configuration

To configure omni, use the `omni-configure` script distributed with omni as described below.

1. In order to use omni or other command line tools you will need to generate an SSL certificate.

[Generate an SSL certificate](#)

2. Download your customized omni configuration data and save it in the default location (`~/Downloads/omni-bundle.zip`):

[Download your omni data](#)

3. Generate an omni_config by running the following command in a terminal:

```
omni-configure
```

Figure 2-2 *Download your omni data* under step 2.

- d. If this is the first time you try to access your GENI certificate you will have to generate one. Click on the `generate a certificate` link.



Figure 2-3 Click on *Generate a certificate*.

- e. Unless you really understand how SSL certificates work, choose the simple option. Click on the `Generate Combined Certificate and Key File` button and then click on `Close`. You will be taken back to the download page with the warning. Reload the page to enable the download button.

GENI Certificate Management

In order to use some GENI tools (like `omni`) you need a signed SSL user certificate.

There are two options for creating this:

1. Have it generated for you. This is the easiest option. **If in doubt, use this option.**
2. Have the SSL certificate generated for you based on a private key you keep locally. This is the most secure

Simple Option: Have the SSL certificate generated for you

If in doubt, use this option.

An SSL certificate always has a corresponding SSL private key. This option will generate one file which contains different from your SSH private key.)

Remember, in order to use this, you will need to have the downloaded combination certificate/private key file.

Figure 2-4 Click on *Generate Combined Certificate and Key File*.

- f. If you are a member of more than one project, select which project you would like to be the default one for running experiments in GENI. You can always change the project that is used by the ``-r`` command line option of `Omni`. Then click on ``Download your omni data``.

DOWNLOAD OMNI CONFIGURATION DATA

Use the omni configuration data downloaded from this page, to automatically [configure omni](#).

Choose a default project to use with omni:

Figure 2-5 Click on *Download your omni data*.

- g. The bundle will be saved at `~/Downloads/omni-bundle.zip`
h. Open a terminal window and type:

```
omni-configure
```

The cert and key files you need will be installed in the appropriate folders.

3. Obtain Resources

3.1 Create a slice

Create a slice using `omni` and the slice name of your choice. From now on that slice name will be referred to as `SLICENAME`.

```
$ omni createslice SLICENAME
```

3.2. Load a simple topology in Flack

For this exercise, we will edit an existing RSpec file. Start by loading this predefined topology into Flack.

- a. In the Portal, launch Flack for this slice.
b. From the **Import** menu (see figure), select the **Import from the web** item.

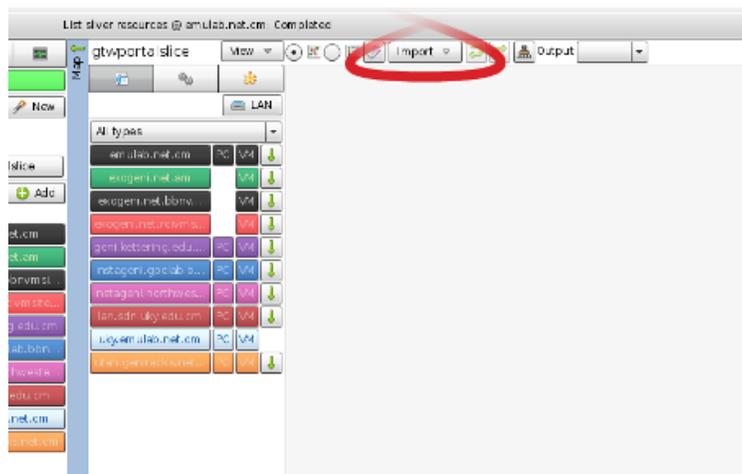


Figure 3-1 Import an RSpec into Flack.

- c. Enter the URL for the RSpec:
`http://www.gpolab.bbn.com/experiment-support/ccnx/ccn_precip_openvz_gcc20.xml`
then click **OK**.
d. When Flack pops up a message asking you to pick a manager to use click **OK** and then select the manager listed

on your worksheet from the list. After you click **Accept**, and a network topology should appear on the canvas.



Because this RSpec file contains a generic description of resources and does not specify any particular aggregate manager, Flack will pop up a message asking you to specify an aggregate to use:
There were resources detected without a manager selected, please select which manager you would like to use.

3.3. Modify the RSpec to automatically install and execute CCNX software

For this experiment, we need to install the following software on the nodes:

- The CCNX software (ccnx-0.6.1-F15-x64.tar.gz)
- Scripts that set up the CCNX software (ccnx-setup.tar.gz)
- Scripts used to pull atmospheric precipitation data using the CCNX protocol (ccnx-atmos-F15-x64.tar.gz)

When the nodes start up, we need the following scripts to be executed:

- Script that sets up the node (node-setup)
- Script that sets up the ccnx protocol (ccnx-setup)
- Script that setup up ccnx protocol routes (add-precip-routes)

We automate the installation and running of the software using install and execute scripts in the RSpec.

- a. Click on the the *i* button on the **collab node** (see figure) to manipulate details of the node configuration.



When you open the node information, you should see options like those in the figure.

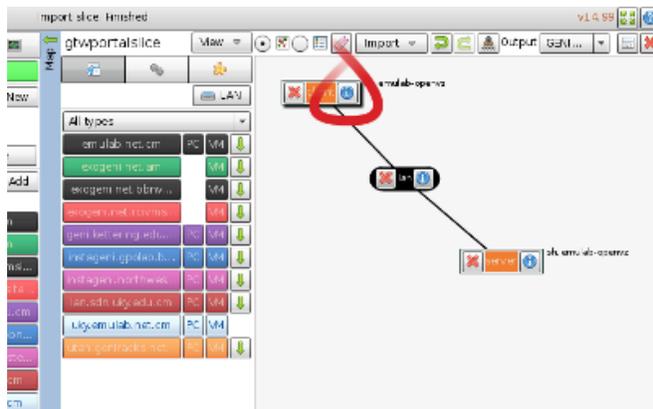


Figure 3-2 Edit the nodes

- b. The way we will request installation of the proper software and execution of our experiment is to add *install* and *execute* services.

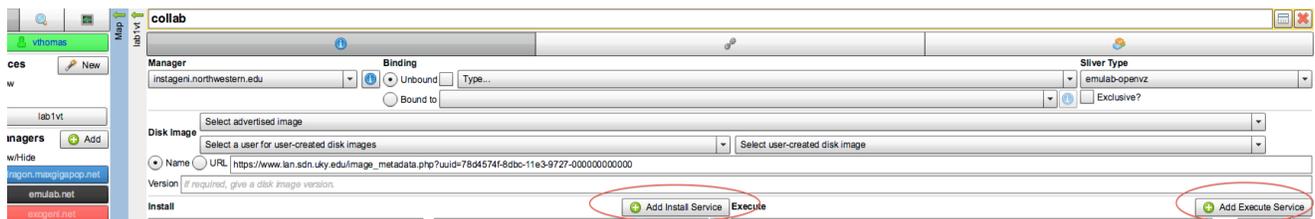


Figure 3-3 Specify the install and execute scripts

- c. First, select "+ Add Install Service" as shown. In the box the Install box enter (cut-and-paste):
`http://www.gpolab.bbn.com/experiment-support/ccnx/ccnx-0.6.1-F15-x64.tar.gz`
and enter
/
in the box next to it (labeled 'in').

Now, select "+ Add Install Service" again. This time add:

`http://groups.geni.net/geni/wiki/GENIExperimenter/Tutorials/GettingStarted_PartII_ccn/Procedure/Setup`

<http://www.gpolab.bbn.com/experiment-support/ccnx/ccnx-atmos-F15-x64.tar.gz>
 and enter
 /
 in the box next to it (labeled 'in').

Similarly, add a third install service:

<http://www.gpolab.bbn.com/experiment-support/ccnx/ccnx-setup.tar.gz>
 and enter
 /tmp
 in the box next to it (labeled 'in'). **Note the different install directory this time.**

d. In a similar manner, use the "+ Add Execute Service" button to add three execute services on this node:

```

cd /tmp/ccnx-setup && ./node-setup
cd /tmp/ccnx-setup && ./add-precip-routes rsrchr
cd /tmp/ccnx-setup && ./ccnx-setup router 4
  
```



Be very careful when entering this information -- these commands will not be executed yet, so it will be some time before you will see any relevant error messages if there is a mistake here.

e. Once both the *install* and *execute* services are specified, click **Apply**.

f. You *DO NOT* have to specify install and execute scripts for the other nodes as they have already been done for you. You can check this by clicking on the *i* button next to the icons for these nodes.

3.4. Add GEMINI extensions

This assignment has the option of instrumenting the experiment and viewing graphs of traffic on links using the GENI Desktop. To prepare for this option, you need to turn on GEMINI extensions. Do this by

- Select the tab in the middle panel of Flack with the 'gear' icon
- Check the box "Use GEMINI Extensions"

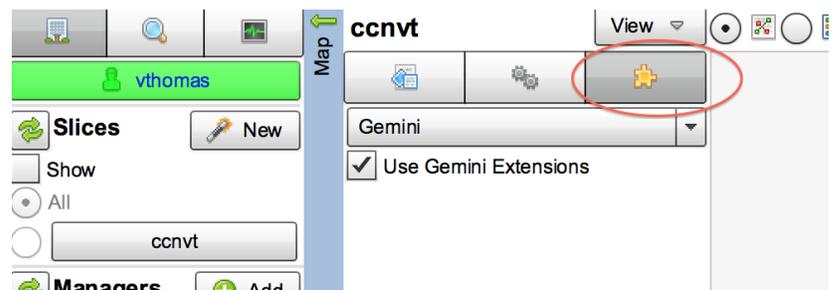


Figure 3-4 Add GEMINI Extensions

3.5. Export the modified request RSpec

Now we will pull back some of the covers and inspect exactly what Flack has been doing for us when preparing the RSpecs for the experiments we design. Each node and link has a corresponding element in the RSpec, and the details of the component configuration (such as the install and execute services we requested above) are specified with attributes, or sometimes child elements, within those portions of the document.

- From the *View* menu (see figure), select the **Preview request document(s)** item. This will bring up a window showing the current RSpec -- please take a moment to inspect it. The XML elements under the "flack" namespace were added for Flack's internal use (containing information about the canvas layout, editing history, etc.), and are ignored by aggregate managers. The `` and `` elements contain the specification for the components we will request, and if you look closely, you will be able to see the install and execute service elements you added earlier.

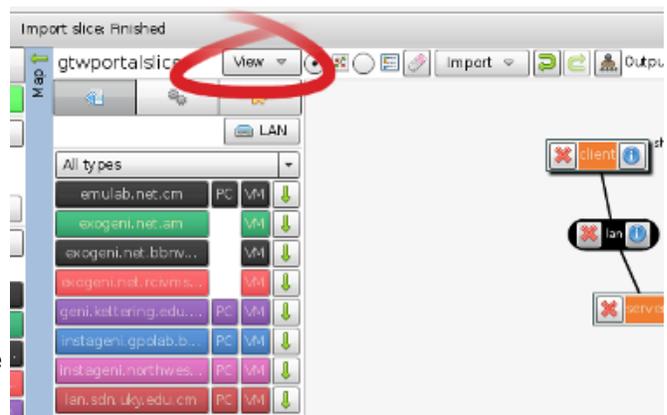


Figure 3-5 View and save the final request RSpec

- a. Use the **Save to file** button (in the upper left) to a local copy of your RSpec with the name `lab1_rspec.xml`. We'll use this in the next step to demonstrate how other client tools also use RSpec files to communicate requests to aggregate managers.

3.6. Instantiate the new experiment using Omni

For this step, we'll change the approach a bit and switch to a new client tool, the command line Omni client.

From a terminal, please enter the command:

```
$ omni -a AM_NICKNAME createsliver SLICENAME RSPEC_FILE
```

where `AM_NICKNAME` is the nickname for your assigned aggregate manager and `SLICENAME` is the name of the slice you created earlier (both of these are given on your worksheet). `RSPEC_FILE` should be replaced with the filename of the RSpec you saved in step 4.

If all is well, Omni should give you a number of informational messages, such as:

```
INFO:omni:Loading config file /home/geni/.gcf/omni_config
```

It should quickly proceed to the point where it makes the request to the remote manager:

```
INFO:omni:Creating sliver(s) from rspec file /home/geni/Downloads/experiments.rspec for slice ..
```

This step can sometimes be time-consuming, so please be patient. If it succeeds, within a couple of minutes Omni should report:

```
INFO:omni: Completed createsliver:
```

and your resource reservation is complete!

Introduction

Next: Execute

Attachments

- [EditRspecCollabCropped.png](#) (327.7 KB) - added by [vthomas@bbn.com](#) 6 hours ago.
- [addGeminiExtensionsCropped.png](#) (69.4 KB) - added by [vthomas@bbn.com](#) 6 hours ago.

Understanding the AM API using Content Centric Networking



4 Wait for resources to be ready

You can tell whether your nodes are *ready* by using a script built on omni called `readyToLogin`.

- a. Please use the command:

```
readyToLogin -a AM_NICKNAME SLICENAME
```

where (as before) `AM_NICKNAME` and `SLICENAME` are your aggregate manager nickname and your slice name (both found on your worksheet).

- b. If it reports that the sliver is not yet ready (for example, it might say that the status is "changing"), then wait a minute or two and try again. Once everything is complete, `readyToLogin` will give output that should look something like this:

```
...
rschr's geni_status is: ready (am_status:ready)
User example logs in to rschr using:
  ssh -p 32768 -i /Users/example/.ssh/geni_key_portal example@pcl.utah.geniracks.net
User example logs in to collar using:
  ssh -p 32769 -i /Users/example/.ssh/geni_key_portal example@pcl.utah.geniracks.net
...
```

5 Trying out the CCN protocol

The `install` and `execute` services requested in our RSpec have already started, and nodes in our experiment should be running the CCN (Content Centric Networking) protocol. Our experiment consists of:

- A data source (node `dsrc1` that holds precipitation data from the US National Oceanic and Atmospheric Administration (NOAA).
- A researcher node `rschr` that gets data from the data source
- A collaborator node `collab` that gets data from the researcher

Key features of the CCN protocol include:

- Data is accessed by name. In our case we use a program called `client` to get precipitation data by date range (e.g. precipitation between 1901/01/01 and 1901/01/02).
- All nodes cache data for a certain period of time. When a node receives a request for data, it checks its local cache. If the data is in its cache, it returns that data. Otherwise, it forwards it on to its neighbor.

We verify this caching behavior by:

- Logging into the researcher node and using the `client` program to get precipitation data for a certain date range. The client displays how long it took to get the data.
- Retrieving the same data again and noting how we get it much faster since it comes out of a cache.
- Requesting data for different date range and see how long it took to retrieve the data.
- Requesting the data again and noting it is retrieved much faster.

If you have time, you can repeat the above steps on the collaborator node.

Note: There is an [optional part](#) to this exercise that uses the GENI Desktop to visualize traffic on the links in our network. There you can visualize which data requests went all the way to the data source (node `dsrc1`) and which data requests were fulfilled from a node's cache.

5.1 Run the CCN application

1. Log into the node `rsrchr` using the `ssh` command returned by `readyToLogin`.
2. Once you are logged in, ask for precipitation data from 1 Jan 1902 to 2 Jan 1902:

```
$ /opt/ccnx-atmos/client.py
Start Date in YYYY/MM/DD? 1902/01/01
End Date in YYYY/MM/DD? 1902/01/02
```

3. You should see output that looks like:

```
Asking for /ndn/colostate.edu/netsec/pr_1902/01/01/00, Saving to pr_1902_01_01.
Time for pr_1902_01_01.tmp.nc 1.09802699089=
Asking for /ndn/colostate.edu/netsec/pr_1902/01/02/00, Saving to pr_1902_01_02.
Time for pr_1902_01_02.tmp.nc 4.65998315811=
Joining files..
Concat + write time 0.0735998153687
Wrote to pr_1902_1_1_1902_1_2.nc
```

Note that it took about 1.1 and 4.7 seconds respectively to retrieve data for Jan 1 and Jan 2

4. Run the client again and request the same data. This time your output should look like:

```
Asking for /ndn/colostate.edu/netsec/pr_1902/01/01/00, Saving to pr_1902_01_01.
Time for pr_1902_01_01.tmp.nc 0.0423700809479=
Asking for /ndn/colostate.edu/netsec/pr_1902/01/02/00, Saving to pr_1902_01_02.
Time for pr_1902_01_02.tmp.nc 0.0388598442078=
Joining files..
Concat + write time 0.0237510204315
Wrote to pr_1902_1_1_1902_1_2.nc
```

Notice how much faster the data was retrieved this time.

5. If time permits, log into the collaborator node `collab` and run queries from there. (Pick dates in 1901 or 1902.) Notice different data retrieval times depending on whether the data came from the datasource, the cache at `rsrchr`, or the local cache.

5.2 (Optional) Visualize experiment data flows

To use the GENI Desktop to visualize the data flows in your network, continue with the instructions [here](#).

Setup

Next: Finish

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7 Cleaning up

As in previous tutorials, it is always good practice to clean up slivers right away so that resources can be released and reused by other experimenters. While other tools (such as Flack and the GENI Portal) can also be used to clean up, no matter which software was used to establish the sliver in the first place, for this example we will demonstrate the clean up procedure using Omni.

The command to use is:

```
omni -a AM_NICKNAME deletesliver SLICENAME
```

where once again `AM_NICKNAME` is the aggregate manager nickname and `SLICENAME` is the name of your slice (both found on your worksheet).

A minute or so later, Omni should respond with:

```
INFO:omni: Completed deletesliver:
```

and some details of exactly what was deleted.

8. Archive Experiment

Congratulations! You have completed the exercise.

Introduction