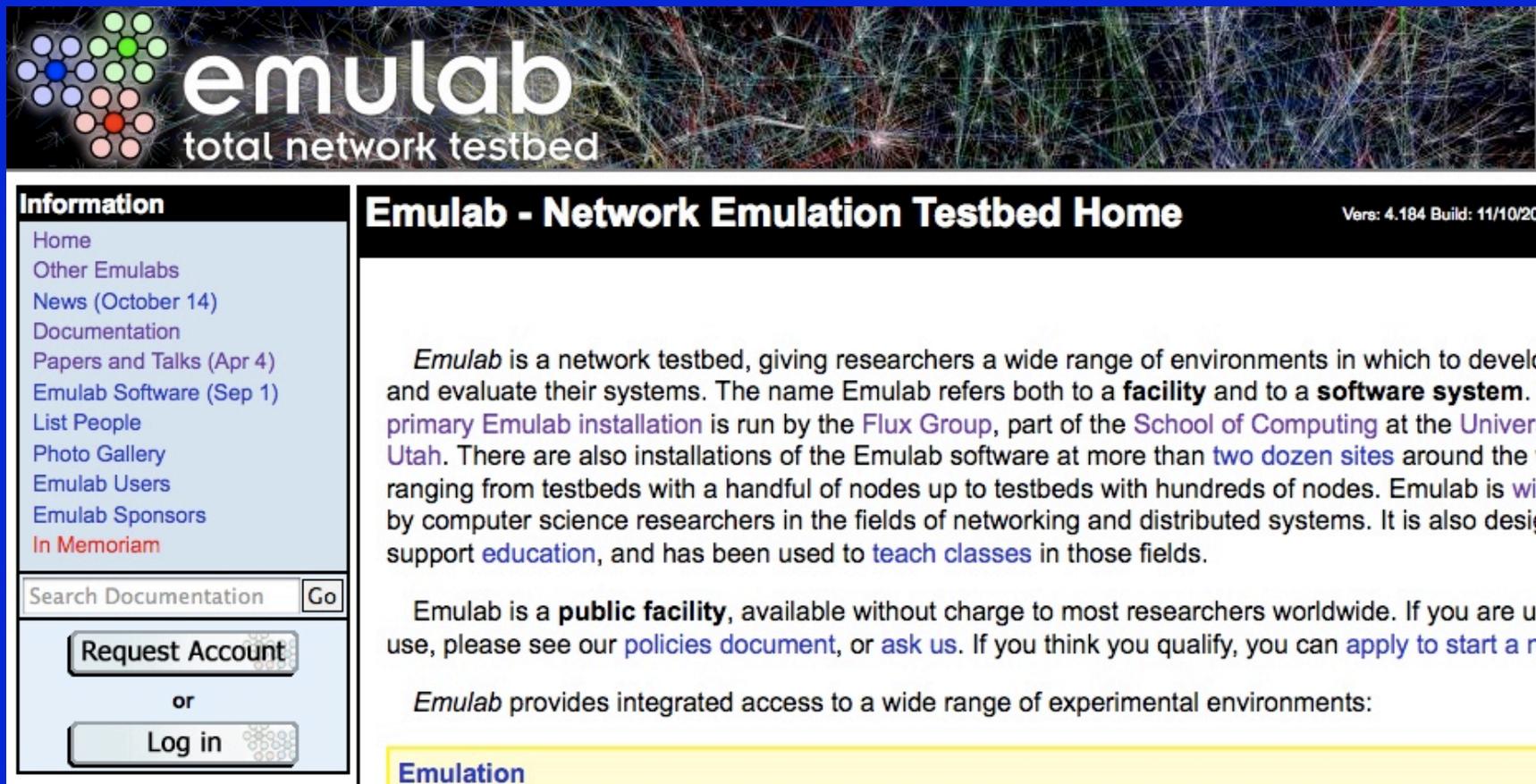


# Overview

- **Sign up at Emulab**
- **Create an SSL certificate to use ProtoGENI**
- **Overview of test scripts**
- **Create and destroy slices/slivers**
- **Setting up to use the Flash client**
- **Flash client demo**

# Getting Started

- Visit the website at [www.emulab.net](http://www.emulab.net)



**Information**

- [Home](#)
- [Other Emulabs](#)
- [News \(October 14\)](#)
- [Documentation](#)
- [Papers and Talks \(Apr 4\)](#)
- [Emulab Software \(Sep 1\)](#)
- [List People](#)
- [Photo Gallery](#)
- [Emulab Users](#)
- [Emulab Sponsors](#)
- [In Memoriam](#)

Search Documentation

or

## Emulab - Network Emulation Testbed Home

Vers: 4.184 Build: 11/10/20

*Emulab* is a network testbed, giving researchers a wide range of environments in which to develop and evaluate their systems. The name Emulab refers both to a **facility** and to a **software system**. The primary Emulab installation is run by the Flux Group, part of the School of Computing at the University of Utah. There are also installations of the Emulab software at more than two dozen sites around the world, ranging from testbeds with a handful of nodes up to testbeds with hundreds of nodes. Emulab is widely used by computer science researchers in the fields of networking and distributed systems. It is also designed to support education, and has been used to teach classes in those fields.

Emulab is a **public facility**, available without charge to most researchers worldwide. If you are unable to use, please see our [policies document](#), or [ask us](#). If you think you qualify, you can [apply to start a new account](#).

*Emulab* provides integrated access to a wide range of experimental environments:

### Emulation

Fields marked with \* are required.

*Username (alphanumeric, lowercase):	<input type="text" value="leebee"/>																
*Full Name (first and last):	<input type="text" value="Leigh B Stoller"/>																
*WikiName:	<input type="text" value="LeighBStoller"/>																
*Job Title/Position:	<input type="text" value="Comic"/>																
*Institutional Affiliation:	Name <input type="text" value="University of Utah"/>																
	Abbreviation: <input type="text" value="UofU"/> (e.g. MIT)																
Home Page URL:	<input type="text" value="http://www.flux.utah.edu/~stoller"/>																
*Email Address[1]:	<input type="text" value="leebee@flux.utah.edu"/>																
*Postal Address:	<table border="1"><tr><td>Line 1</td><td colspan="3"><input type="text" value="555 NW 55th Street"/></td></tr><tr><td>Line 2</td><td colspan="3"><input type="text"/></td></tr><tr><td>City</td><td><input type="text" value="Somewhere in Oregon"/></td><td>State/Province</td><td><input type="text" value="OR"/></td></tr><tr><td>ZIP/Postal Code</td><td><input type="text" value="55555"/></td><td>Country</td><td><input type="text" value="USA"/></td></tr></table>	Line 1	<input type="text" value="555 NW 55th Street"/>			Line 2	<input type="text"/>			City	<input type="text" value="Somewhere in Oregon"/>	State/Province	<input type="text" value="OR"/>	ZIP/Postal Code	<input type="text" value="55555"/>	Country	<input type="text" value="USA"/>
Line 1	<input type="text" value="555 NW 55th Street"/>																
Line 2	<input type="text"/>																
City	<input type="text" value="Somewhere in Oregon"/>	State/Province	<input type="text" value="OR"/>														
ZIP/Postal Code	<input type="text" value="55555"/>	Country	<input type="text" value="USA"/>														
*Phone #:	<input type="text" value="555-555-5555"/>																
Upload your SSH Pub Key[2]: (1K max)	<input type="text" value="/Users/stoller/.ssh/id_dsa.pub"/> <input type="button" value="Browse..."/>																
*Password[1]:	<input type="password" value="....."/>																
*Retype Password:	<input type="password" value="....."/>																
*Project Name:	<input type="text" value="ProtoGeni"/>																
Group Name: (Leave blank unless you <i>know</i> the group name)	<input type="text"/>																
<input type="button" value="Submit"/>																	

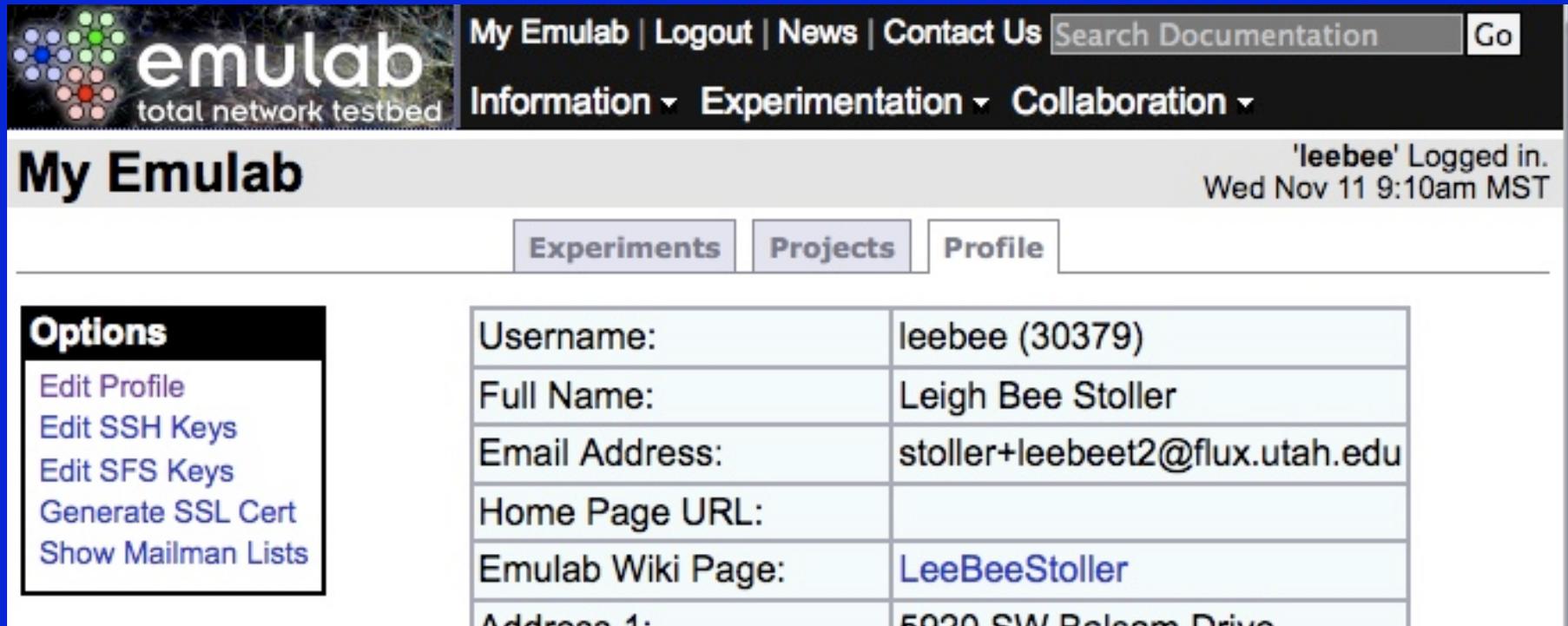
# Join an Existing Project

- **Click on Join Existing Project**
- **Be sure to pick a good password**
- **Upload an ssh public key so that you can log into your nodes**
- **No shared accounts!**

# Verify Your Account

- **Wait for email message from Emulab that has your verification token**
- **Allow all email from @emulab and @flux.utah.edu through spam blockers**
- **Click on the link in the email message and login to Emulab.**
- **Verification happens automatically.**

# My Emulab



The screenshot shows the My Emulab web interface. At the top left is the emulab logo with the tagline "total network testbed". To the right are navigation links: "My Emulab | Logout | News | Contact Us", a search box for "Search Documentation" with a "Go" button, and a menu with "Information", "Experimentation", and "Collaboration". Below this is a header bar with "My Emulab" on the left and "'leebee' Logged in. Wed Nov 11 9:10am MST" on the right. A secondary navigation bar contains "Experiments", "Projects", and "Profile" tabs, with "Profile" being the active tab. On the left side, there is an "Options" box with links: "Edit Profile", "Edit SSH Keys", "Edit SFS Keys", "Generate SSL Cert", and "Show Mailman Lists". On the right, a table displays user profile information.

Username:	leebee (30379)
Full Name:	Leigh Bee Stoller
Email Address:	stoller+leebeet2@flux.utah.edu
Home Page URL:	
Emulab Wiki Page:	LeeBeeStoller
Address 1:	5920 SW Balsam Drive

- Click on My Emulab if you do not see this page

# Create an SSL Cert

- Click on Generate SSL Certificate

PassPhrase[2]:	<input type="text"/>
Confirm PassPhrase:	<input type="text"/>
Emulab Password[3]:	<input type="text"/>
<input type="button" value="Create SSL Cert"/>	

- Click on Generate SSL Certificate
- Pick a good PassPhrase!
- Confirm with your Emulab password

# Download Certificate

- Click on the download link
- Copy the file to your `~/.ssl` directory (create it if it does not exist)
- Set permissions appropriately
- Optionally, create a file to hold your passphrase to avoid entering repeatedly

```
echo XXX > ~/.ssl/password
```

# Download Test Scripts

<http://www.emulab.net/downloads/protogeni-tests.tar.gz>

- **Unpack the tarball someplace**
- **Make sure python and M2crypto installed**
- **Run discover.py to make sure everything is working okay**
- **Default Slice Authority and Component Manager is where your Emulab account is (determined from SSL certificate)**

# Register a Slice

- A slice is a protogeni wide container for a group of resources
- The result is a credential that gives you permission to allocate resources at any of the Component Managers
- Pick a pithy name, run registerslice.py

```
registerslice.py -n myslice
```

# Create a Sliver

- A sliver is a container for resources at a single Component Manager
- Create an RSpec to describe the resources you want
- The result is a credential that allows you to control the sliver
- Example RSpec on next slide

```
createsliver.py -n myslice myrspec.xml
```

# Example RSpec

```
<rspec xmlns="http://protogeni.net/resources/rspec/0.1">
  <node virtual_id="geni1"
        virtualization_type="emulab-vnode"
        exclusive="1">
    <interface virtual_id="virt0"/>
  </node>
  <node virtual_id="geni2"
        virtualization_type="emulab-vnode"
        exclusive="1">
    <interface virtual_id="virt0"/>
  </node>
  <link virtual_id="link0">
    <interface_ref virtual_interface_id="virt0"
                  virtual_node_id="geni1"/>
    <interface_ref virtual_interface_id="virt0"
                  virtual_node_id="geni2"/>
  </link>
</rspec>
```

# RSpec Details

```
<node virtual_id="geni1"  
  virtualization_type="emulab-vnode"  
  exclusive="1">  
  <interface virtual_id="virt0"/>  
</node>
```

- **Requesting a wildcard node. Interface is also wildcarded**
- **Use “component\_urn=” to choose specific node from advertisement**
- **Node is exclusive use, not a vnode on a shared node**

# RSpec Details

```
<link virtual_id="link0">  
  <interface_ref virtual_interface_id="virt0"  
    virtual_node_id="geni1"/>  
  <interface_ref virtual_interface_id="virt0"  
    virtual_node_id="geni2"/>  
</link>
```

- **Link between “geni1” and “geni2”**
- **Uses the interfaces named in the node spec**

# Discovering Resources

- **What resources are available for RSpec?**
- **Use Discover (resources) to download advertisements from CMs**
- **Advertisements describe each node and link in detail**

```
discover.py > advert.xml
```

# Start the Sliver

- The resources in your sliver have not been initialized yet
- You have to “start” the sliver, which reboots the nodes and creates VLANs

```
startsliver.py -n myslice
```

# Wait for “ready”

- After “start” must wait for nodes to come “ready”
- ie: nodes have to finish rebooting
- Returns a structure immediately, so need to poll (but not too fast)

```
sliverstatus.py -n myslice
```

# Sliver Status

```
{
  'status' : 'notready',
  'details':
  {
    'de98acb3-773e-102b-8eb4-001143e453fe': 'notready',
    'de9945e9-773e-102b-8eb4-001143e453fe': 'notready'
  }
  'detailsNew':
  {
    'urn:publicid:IDN+emulab.net+sliver+pc160': 'notready',
    'urn:publicid:IDN+emulab.net+sliver+pc98': ' notready'
  },
}
```

# Login

- **Login into your nodes with ssh**
- **No passwords, public key only**
- **Use sudo to do “root” things (configure interfaces, install software, etc.)**
- **Write papers, get famous, send us money**

## More on ssh keys

- Your ssh keys are given to the CM in the `RedeemTicket()` method
- For convenience, you can request them in a bundle; see `lookupuser.py`
- `createsliver.py` does this for you
- Upload additional public keys via the Emulab web interface

# Renew your Sliver

- Slivers time out after a short time
- Renew them so they are not expired
- Argument is number of minutes
- Can also put expiration time in request RSpec

```
renewsliver.py -n myslice 600
```

# Delete your Sliver

- **Slivers eventually timeout**
- **But remember to delete them anyway**
- **Then unregister your slice name**

```
deletesliver.py -n myslice
```

```
unregisterslice.py -n myslice
```

# Using other CMs

- **Use `listcomponents.py` to get list of CMs**

```
listcomponents.py
```

<https://www.emulab.net/protogeni/xmlrpc/cm>

<https://www.uky.emulab.net/protogeni/xmlrpc/cm>

<https://www.schooner.wail.wisc.edu/protogeni/xmlrpc/cm>

<https://www.pgeni.gpolab.bbn.com/protogeni/xmlrpc/cm>

<https://boss.uml.emulab.net/protogeni/xmlrpc/cm>

<https://boss.cmcl.cs.cmu.edu/protogeni/xmlrpc/cm>

<https://myboss.jonlab.geni.emulab.net/protogeni/xmlrpc/cm>

<https://myboss.myelab.testbed.emulab.net/protogeni/xmlrpc/cm>

# Using other CMs, cont.

- **All scripts take an option to specify CM**

-m <https://www.emulab.net/protogeni/xmlrpc/cm>

- **Not all CMs have usable nodes**
- **Use `discover.py` to get advertisement**

# Flash Client Setup

- Need to load SSL certificate into your browser
- Browsers use the pkcs12 format
- Click on the Download SSL Cert link.

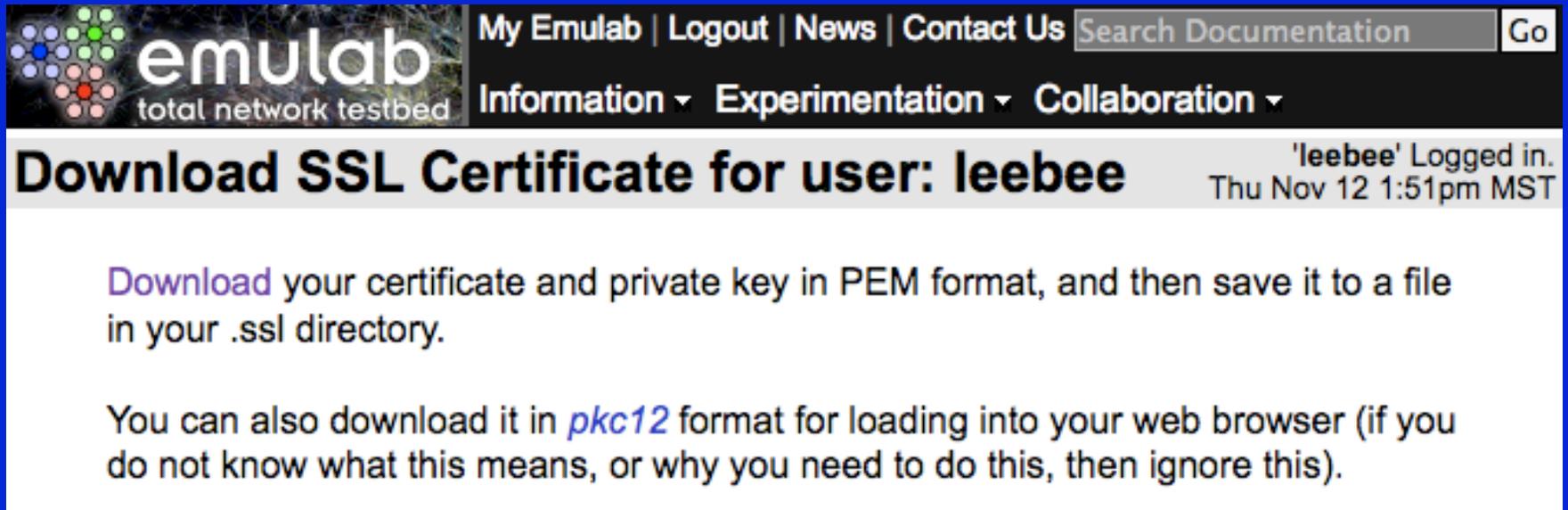


The screenshot shows the My Emulab user interface. At the top, there is a navigation bar with the emulab logo (total network testbed) and links for My Emulab, Logout, News, Contact Us, and a search box for Documentation. Below this is a secondary navigation bar with Information, Experimentation, and Collaboration menus. The main content area is titled 'My Emulab' and shows the user 'leebee' is logged in on Thursday, November 12, 2009, at 1:42pm MST. There are three tabs: Experiments, Projects, and Profile, with Profile selected. On the left, there is an 'Options' sidebar with links: Edit Profile, Edit SSH Keys, Edit SFS Keys, Generate SSL Cert, Download your SSL Cert, and Show Mailman Lists. On the right, there is a profile information table.

Username:	leebee (30379)
Full Name:	Leigh Bee Stoller
Email Address:	stoller+leebeet2@flux.utah.edu
Home Page URL:	
Emulab Wiki Page:	<a href="#">LeeBeeStoller</a>

# Download PKCS12

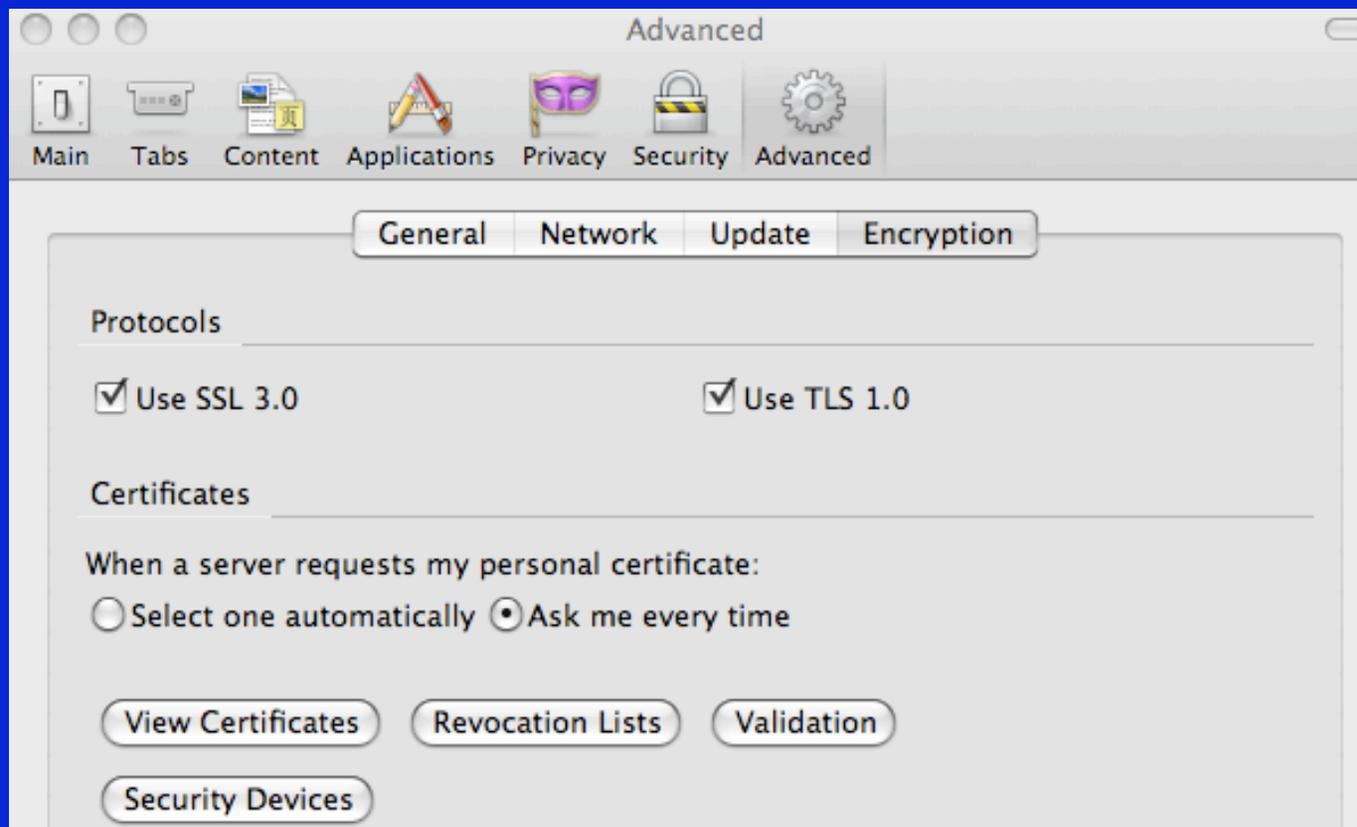
- Click on the pkcs12 link and save to file



The screenshot shows the Emulab website interface. At the top left is the Emulab logo with the tagline 'total network testbed'. To the right of the logo are navigation links: 'My Emulab | Logout | News | Contact Us'. Further right is a search bar with the text 'Search Documentation' and a 'Go' button. Below these links are three dropdown menus: 'Information', 'Experimentation', and 'Collaboration'. The main heading of the page is 'Download SSL Certificate for user: leebee'. In the top right corner of the page content, it says ''leebee' Logged in. Thu Nov 12 1:51pm MST'. The main text of the page reads: 'Download your certificate and private key in PEM format, and then save it to a file in your .ssl directory.' Below this, it says: 'You can also download it in *pkc12* format for loading into your web browser (if you do not know what this means, or why you need to do this, then ignore this).'

# Import PKCS12

- Go to Firefox Preferences, Advanced, Encryption, and click on View Certificates



# Import PKCS12

- Go to Your Certificates and click Import
- Type the password you gave earlier



# Preload Security Exceptions

- <https://boss.uml.emulab.net/protogeni/xmlrpc>



## This Connection is Untrusted

You have asked Firefox to connect securely to `boss.uml.emulab.net`, but we can't confirm that your connection is secure.

Normally, when you try to connect securely, sites will present trusted identification to prove that you are going to the right place. However, this site's identity can't be verified.

### What Should I Do?

If you usually connect to this site without problems, this error could mean that someone is trying to impersonate the site, and you shouldn't continue.

Get me out of here!

- ▶ **Technical Details**
- ▶ **I Understand the Risks**



## This Connection is Untrusted

---

You have asked Firefox to connect securely to **boss.uml.emulab.net**, but we can't confirm that your connection is secure.

Normally, when you try to connect securely, sites will present trusted identification to prove that you are going to the right place. However, this site's identity can't be verified.

### What Should I Do?

If you usually connect to this site without problems, this error could mean that someone is trying to impersonate the site, and you shouldn't continue.

Get me out of here!

▶ **Technical Details**

▼ **I Understand the Risks**

If you understand what's going on, you can tell Firefox to start trusting this site's identification. **Even if you trust the site, this error could mean that someone is tampering with your connection.**

Don't add an exception unless you know there's a good reason why this site doesn't use trusted identification.

Add Exception...



You are about to override how Firefox identifies this site.  
Legitimate banks, stores, and other public sites will not ask you to do this.

### Server

Location:

[Get Certificate](#)

### Certificate Status

This site attempts to identify itself with invalid information.

[View...](#)

#### Unknown Identity

Certificate is not trusted, because it hasn't been verified by a recognized authority.

Permanently store this exception

[Confirm Security Exception](#)

[Cancel](#)

# Preload, done



## Secure Connection Failed

---

An error occurred during a connection to boss.uml.emulab.net.

SSL peer was unable to negotiate an acceptable set of security parameters.

(Error code: ssl\_error\_handshake\_failure\_alert)

---

- The page you are trying to view can not be shown because the authenticity of the received data could not be verified.
- Please contact the web site owners to inform them of this problem. Alternatively, use the command found in the help menu to report this broken site.

Try Again