This documents what we're learning about using AuLab (for Mac computers only) to connect 2 or more computers for telematic music making.

(so far by Mark Dresser and Michael Dessen)

Sections of this document:

How to get AULab

AULab is for Mac computers running OSX. It's a small application that is part of the Developers Toolkit which may already be on your computer (check the top level of your hard drive for a "Developers Tools" folder). If not, you can download it free here:

For Mac OS X.5, Leopard, download version 2 of AULab at www.elevio.ucsd.edu/sw
Click on the link that says: AU_Lab_Leopard.sit
After un-stuffing it (using Stuffit) drag it into the application folder.

Also from the same page, download:
mda-au-1.0.1.dmg
This is for test tones.
After downloading it, mda must dragged into this folder on your computer:
hardisk/library/audio/plugins/components

For Mac OS X.4, Tiger, download version 1 of AULab at http://trevor.ucsd.edu/aunetjam.html
Scroll down to the very bottom of the page and click the link that says "AULab"

After un-stuffing it (using Stuffit) drag it into the application folder.
On the bottom of that same page, also click on "MDA Plugins" to download the plugins that contains a test tone.
After downloading it, mda must dragged into this folder on your computer:
hardisk/library/audio/plugins/components

Essential terms and concepts

1. Generator tracks vs. Input/Output tracks
An INPUT in AULab is used for bringing sound into your computer from the space that you're in. The INPUT tracks are NOT what you use for the sounds that the other musicians are sending you. Those sounds need to come into AULab on a GENERATOR track. This seems counter-intuitive because you would normally think of a generator track as something you'd use to generate sound, but in this case it's the opposite: The GENERATOR tracks in AULab are what you use to RECEIVE sound from the remote sites.

Note also that an OUTPUT track in AULab is not necessarily what you'd use to send sound out to the other site(s). You could do it that way if you want, but in many cases it is better to use a Bus for sending your local sounds out to the other sites. That way you can reserve the Output strip for the master Output of everything (local and remote) mixed together, which would go to your PA system or headphones. (More on busses and mixing below.)

2. AUNetSend and AUNetReceive.
These are the plugins for sending and receiving.
The *AUNetSend* plugin could theoretically go on any track that has sound on it, and that sound would be sent out on the port indicated in the corresponding AUNetSend plugin window.
The *AUNetReceive* plugin gets created (as one of 2 options you choose) when you create a "GENERATOR" track. This plugin has a window (double click the AUNetRecive icon at the top of the track to see the window) where you will select the IP and Port numbers that you're receiving on that particular track. It's a good idea to name these according to what you intend to receive on each, especially if you have more than one.

3. A note about Busses
Audio busses within AULab are important for mixing. This will be covered below, but one thing we discovered is that by default, all busses you create will automatically be routed to the main Output 1. This is often NOT what you want, especially if you are using the bus to create a submix to send to the remote location, but don't want that submix to interfere with your own in-house PA mix. So in order to make a bus a dead end so that it does NOT go to the main output, you click on the tiny number "1" (assuming you only have 1 output track) that is at the top left of the track fader on that bus. It goes grey and then the bus signal is no longer sent to that output track.

4. About ports
In order to send and receive you need to specify port numbers. Having open ports are often the problem if you have connection problem. Some Internet Service Providers (such as the ones that

provide you with internet service at home) may have blocked the ports needed by the program to connect. This may be impossible to get around. Also, the UC Irvine campus is has blocked ports, so if you're on that campus you need to submit a work order to have one opened up for a specific computer and time period (and it takes a few days to get this done). UCSD uses a different system (firewall but all ports open) so there have been no problems there, and so far no problems with UCB either. But depending on your location/institution/ISP this is very likely to be the culprit if you can't connect. Become good friends with your systems administrator and IT staff.

5. Protocol and chat
It's important to have a text chat (gmail chat, iChat, or Skype) to keep communicating by text when things aren't working or there is a lot going on in the audio.

6. How to find your IP address:
http://www.ip-adress.com/

Basic setup for 2 locations

To set up the AULab Document:
(these instructions are for version 2 but should be similar for version 1)

Launching the program brings up a Document Configuration Assistant (unless you double clicked a previously created document)
Under Output configuration:
Select "stereo" from the dropdown menu, and create 1 stereo output track on channels 1 and 2
Click "next..."
Under Input configuration:
Depending on what you want to send in (from your interface), select the stereo or mono channels you wish. If you're using the built in microphone, select 1 stereo input track
Click "next..."
Under Audio Device:
Select the interface you want to use. If you don't have an external audio interface, you may not be able to input sound from your space because in some cases AULab does not support the built in microphone.
click "Done"
It should then open a document with an Output 1 track, and however many inputs you chose. Name and save the document somewhere.

A simple setup using one stereo input
Let's assume you're using an external audio interface and set up a single, stereo input track on channels 1 and 2.
In this case you should see a track called "Audio 1," which is for the input from your interface, and a track called "Output 1," which is your main output (to your interface, which should be connected to either speakers or headphones). Try the following:

1. Test your input/output: Make some noise into your mic and see if it appears on the Audio 1 track. If not, check your interface levels, make sure your interface is selected in AULab (in the Studio window, under the Window menu, under Device). If you see levels on the Audio 1 track then they should also appear on the Master and you should hear it through your PA or headphones.

2. To test SENDING: On your audio input track, under Sends, create a bus and set the track (in that same menu) to pre-fader, so that you can separate your mixes (more on this below under mixing). You should then see a Bus track appear and, on the Audio 1 track, you'll see a tiny horizontal meter/slider near the Bus menu. You can use that to drag the level of the bus send for that track.

Then, on the Bus track itself, under Effects, select the MDA menu then select TestTone. In the test tone window adjust it however you like - we usually set the On/Off time to 1 second each to create a pulsing test tone.

You should hear the test tone (which should be coming through your Output 1 track, since by default the bus you created should send to Output 1 and you haven't changed that, right?).

If you don't hear anything, check the bottom of the AULab window to see if the Audio Engine is running and if not, click it to start it.

Then, just below the spot on the Audio 1 track where you created the test tone, select a new blank effects menu to add another effect on that track below the test tone, and this time select under the Apple submenu, the plugin AUNetSend. When you do this, it opens a window where you indicate the port you want to send on. The default is 52800. Once you do that, tell the person in the remote site your IP address (find it here) and the port number you selected, and then they should hear everything on that bus. To increase/decrease the level of your mic for them, you can drag the little horizontal bus send slider on the Audio 1 track.

3. To test RECEIVING: To receive from the remote site, you create a Generator track (under the Edit menu, select "Add Audio Unit Generator..."). In the dropdown menu in the first window that comes up, select AUNetReceive (which is not the default). If you "show audio unit details" it will open up a dialog where you can name the track.

It then creates the track and opens up a window for the AUNetReceive settings (which you can also open later, if it gets closed, by double clicking the AuNet icon at the top of that track). If you see a menu with nothing on it, or just AUNetSend, click the "+" sign at the bottom to open up a window where you can add a remote host. This is where you put the IP address and port of the remote site you want to receive from on that particular generator. [Note that you can have multiple generators to simultaneously receive from many different people, which is why there is a menu... More on that later.]

Under "display name," type in a name based on the person you're receiving from, and under "Host name and port," type in their IP address followed by a colon and then the port number. For example:

132.239.234.238:52800
Leave the password field blank. Click OK...

You'll then return to the AUNetREceive window for that particular generator, where you select the name of the host you want to receive from, and click Connect. If all goes well you'll connect to their signal and it will appear on that generator track.

Coming soon...

Multi-channel send/receive

We've done some work with this but need to document and test it more.

3 or more sites w/ host

We're still working on this, and you can also consult Trevor's page to see how he did it: http://trevor.ucsd.edu/aunetjam.html

Mixing/routing issues

We need to write up a tech document for the main routing and mixing plans at each site for our Oct. 25 concert. Soon...