

Jacktrip Server: Setup, Independent Channel Mixing, Integrated Launch

TJGigs crawls.dillies0c@icloud.com

Background, Environment & System Requirements (from actual experience)

- To achieve imperceptible latency and clean as possible audio while jamming online you should follow the following tips. The goal is to feel like you are all in the same recording studio with everyone wearing headphones and having control of their own group mix.
- These tips apply to any software used for online jamming not just Jacktrip. I used and experimented with Jacktrip, Jamkazam, Jamulus, SoundJack and Sonobus as client and setting up my own servers where possible. I also tested using remote servers (subscription, common use, SW inherent). Except for Jamkazam, and running my own Jacktrip server I was never able to achieve acceptable consistent 25ms or less latency even in LA with my FIOS 100/100 and bandmates upgrading their cable ISP plans.
- Jamkazam is the best commercial solution so far with its dynamic P2P/ARS Hub latency optimization and numerous improvements over the past year. Depending on your environment latency of 25ms or less can be achieved. That's the minimum requirement for me and my bandmates with an ideal target around 20ms. At times we even got around 16ms.
- Running my own Jacktrip server I've achieved the same or better latency, cleaner sound, more stability, individual multi-channel mixing for each Jacktrip participant (like Jamkazam) and at no subscription costs. After determining a way to do local mixing, and automating the launch process for non-tech-savvy participants I switched to using Jacktrip and running my own low latency Jacktrip server exclusively.
- The Jacktrip server (-S) does not need to be on a separate dedicated computer. That is how I started and it was total overkill with no benefit. It actually increased complexity, administration, points of failure, and latency. I ending up running the server on my laptop (i5) instead. The Jacktrip server host also does not need to run an extra virtual client for themselves in order to participate in their Jacktrip session (also has negative benefit). The server host just uses the Jacktrip server as a client as well and to implement local multi-channel mixing for all session participants (client/server).
- I play several standing sessions a week with my bandmates using the Jacktrip server/client configurations, mixing solutions and other information in this document. I'm the Jacktrip server admin, host, drummer and an IT guy.

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Tips for Imperceptible Latency

- Mid to low 20ms or less latency. (Achieved running own Jacktrip server and with Jamkazam)
- Low latency HW audio interface. Ideally 5ms or less.
- Optimize computer for performance. Stop background tasks not needed during online jamming such as software updates, virus scan and maintenance tasks. Select high performance CPU utilization mode. Make sure firewall is not causing problems.
- Physical distance between participants. My bandmates are mostly within 20 miles but the bass player is 70 miles away and we still lock in no problem.
- Wired Internet.
- Fast ISP upload speed. Ideally 20mbps or greater. Cable internet providers (e.g., Spectrum) have notoriously slow upload speed. You may have to upgrade your plan to at least get above 10mbps. FAQs/blogs stating you do not need more than 2-3mbps upload do not square with the actual experience of my bandmates. There is a notable improvement difference in latency, sound and jitter having the faster 10mbps or more upload speed.
- Search online for latency and audio interface whitepapers. Jacktrip and Jamkazam support sites have lots of good documentation on best gear, performance optimization and latency

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Router config for Jacktrip server admin (-S)

Networked Computer / Device	Applications & Ports Forwarded	Status
<input checked="" type="checkbox"/> StudioComputer 192.168.1.219	JackTrip UDP Any -> 61002 - 61010 TCP Any -> 4464 UDP Any -> 4464	Active

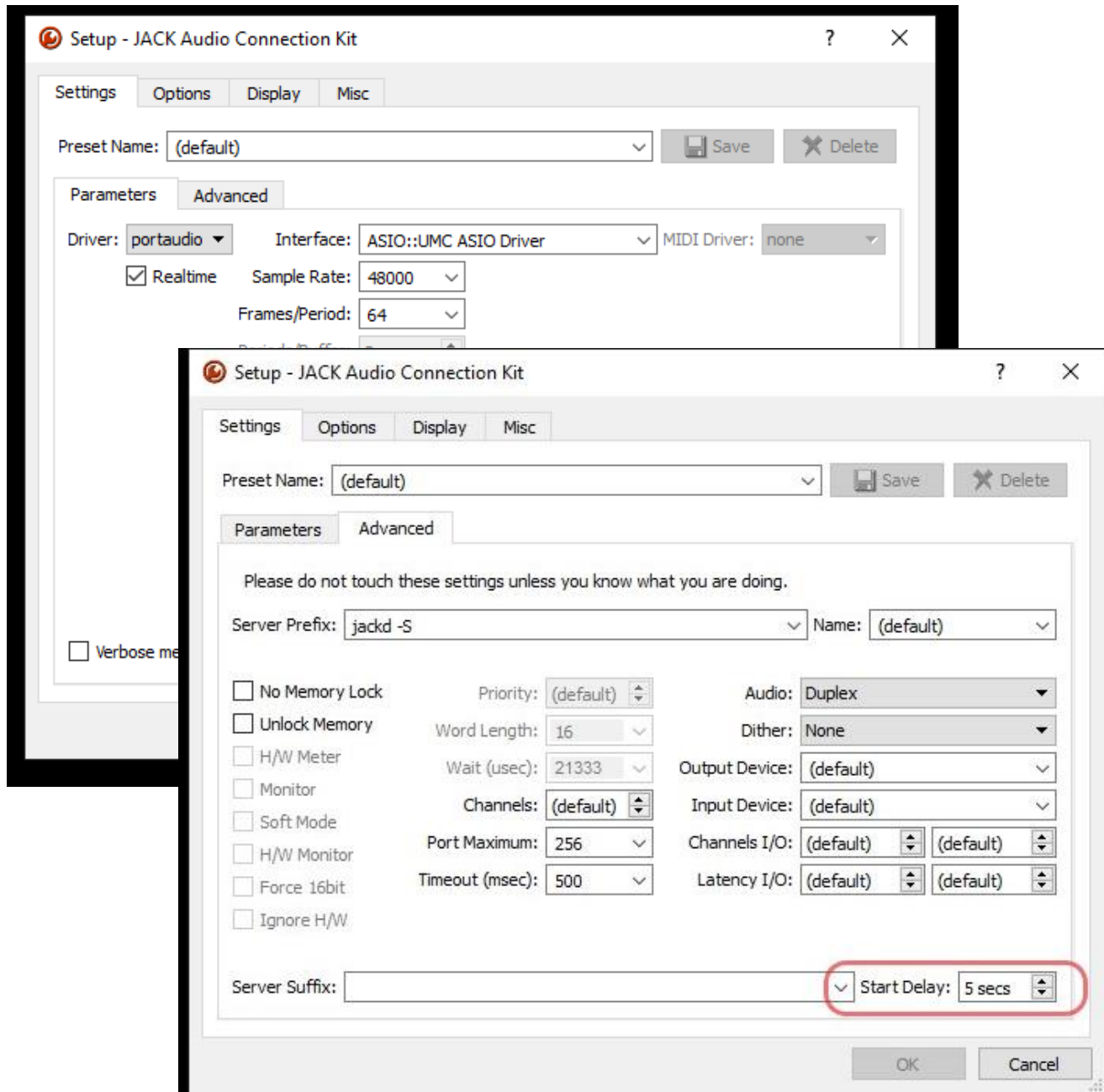
- If client (-C or -c) has connection issues after verifying local setup, firewall, command lines, SW config etc. then apply same port forwarding rules on their router.
- If using Port offset mode with defined ports for each participant (-c, -s) add UDP increments as needed starting from 4464

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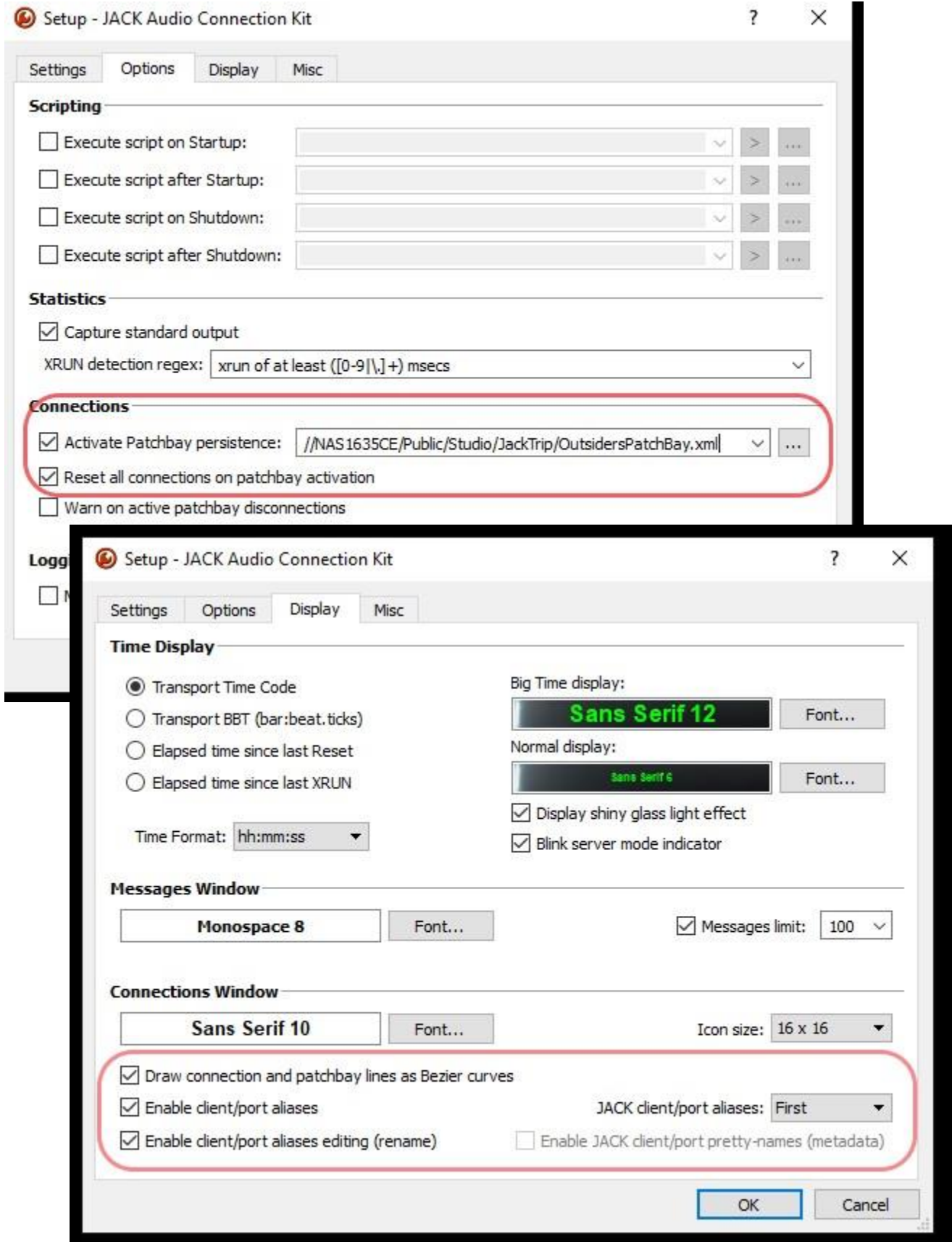
Qjackctl Initial Setup

- Take all defaults except for changes specified or highlighted in red.
- All clients have same settings as server except where related to their specific interface. Sample Rate, Frames must be the same regardless of interface.
- Portaudio for windows, Coreaudio for Mac. Use defaults on advanced tab. It is best to use your own hardware interface ASIO Driver if you have a low latency gear instead of ASIO4ALL.
- Mixing involves defining identical channels, nodes and aliases, a master server patchbay xml, individual client patchbay xml (XMLs are different). The persistent patchbay file will be set after it has been created from existing connections (see mixing setup steps).



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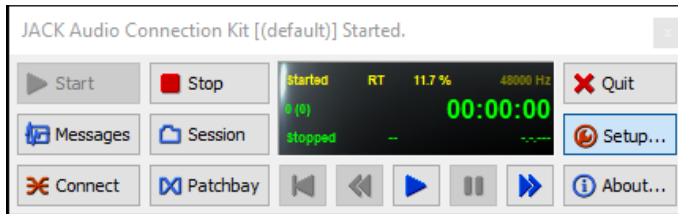
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Qjackctl “Connect” and “Patchbay” Initial Setup for Mixing



-  1-Piano
-  2-Guitar
-  3-Bass
-  4-Drums

- 1) Standardize a master channel map for all instruments and participants in your Jacktrip sessions. There will be 1 standardized channel for each **-n** value on the Jacktrip command line.

In this configuration we have 4 instruments **-n4** so the master channel map will be defined as above. Prefixed numbers are used to control how qjackctl “Connect” window sorts aliased receive and send channels.

Server-side patching between client participant channels enables individual and independent client and server mixing by utilizing extra virtual channels from any Jack Router capable Win DAW (e.g. Voicemeter) and Mac aggregate audio device (combines physical and virtual channels e.g Blackhole) paired with a Mac DAW. Server and client aliased connections will be configured after you establish an initial Jacktrip session.

- 2) Jacktrip command line parameters

- **-P5** Turn off Jacktrip automatic routing.
- **-n** Specify total number of channels you need with 1 channel per instrument. All source stereo signals and chat mics per participant will be combined into mono sends channels.
- If no local mixing is desired use **-p2** on the server and **-n1** on server/client for a “bandstand mix” where each client adjusts their send level based on feedback from others.

Server

- `jacktrip -S -n4 -z -p5 -D -a4 -J test -K JackTripHub -bufstrategy 1 -q16 -r1`

Client

- `jacktrip -C 47.144.999.99 -n4 -z -D -a4 -O io -f o:c(2) -J TestName -K TestName -bufstrategy 1 -q16 -r1`

Note -j,-k not really needed. -f (optional) does not work on mac terminal

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- 3) Configure “Connect” window as appropriate for the server and clients once you initiate the first full server connected session with all participating clients.
 - Disconnect all automatic connections if there are any. If connections continue to reappear go to the “Patchbay” window to deactivate the active patchbay.
 - Overtyping all nodes names (IP addresses) on the server with the participant’s name.
 - Overtyping all send and receives channels on each node with the standardized channel map and aliases. Client participants can overtype their send and receive channels any time even if a server connection has not been established.
 - If your DAW (Win Jack Router capable or Mac aggregate device) is loaded then qjackctl will display the virtual channels. You should overtype send nodes with the same master channel map. If your DAW is not already loaded you can make these changes later without an active session connection.
- 4) All qjackctl config changes (including aliases) are applied to qjackctl defaults when you close qjackctl. Reply YES to the save dialog when you close qjackctl after making changes.
- 5) The following 2 pictures illustrate the “connect” configuration for the server and a client.

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Server "Connect" (drummer as host) with Standardized Channel Map and Aliases

Connections - JACK Audio Connection Kit

The screenshot displays the JACK Audio Connection Kit interface, showing the configuration for a server (drummer as host). The interface is divided into two main panels: "Readable Clients / Output Ports" on the left and "Writable Clients / Input Ports" on the right. The "Audio" tab is selected, and the "MIDI" tab is also visible.

Readable Clients / Output Ports:

- Jimmy
 - 1-Piano
 - 2-Guitar
 - 3-Bass
 - 4-Drums
- Joao
 - 1-Piano
 - 2-Guitar
 - 3-Bass
 - 4-Drums
- Matt
 - 1-Piano
 - 2-Guitar
 - 3-Bass
 - 4-Drums
- portaudio
 - ASIO::UMC ASIO Driver:out1Mic
 - ASIO::UMC ASIO Driver:out2Mic2
 - ASIO::UMC ASIO Driver:out3Drums
 - ASIO::UMC ASIO Driver:out4Drums
 - ASIO::UMC ASIO Driver:out5
 - ASIO::UMC ASIO Driver:out6
 - ASIO::UMC ASIO Driver:out7CP88
 - ASIO::UMC ASIO Driver:out8CP88
 - ASIO::UMC ASIO Driver:out9
 - ASIO::UMC ASIO Driver:out10
- voicemeeter8
 - out1-MixLeft
 - out2-MixRight
 - out3-Mix2Left
 - out4-Mix2Right
 - out5
 - out6
 - out7
 - out8

Writable Clients / Input Ports:

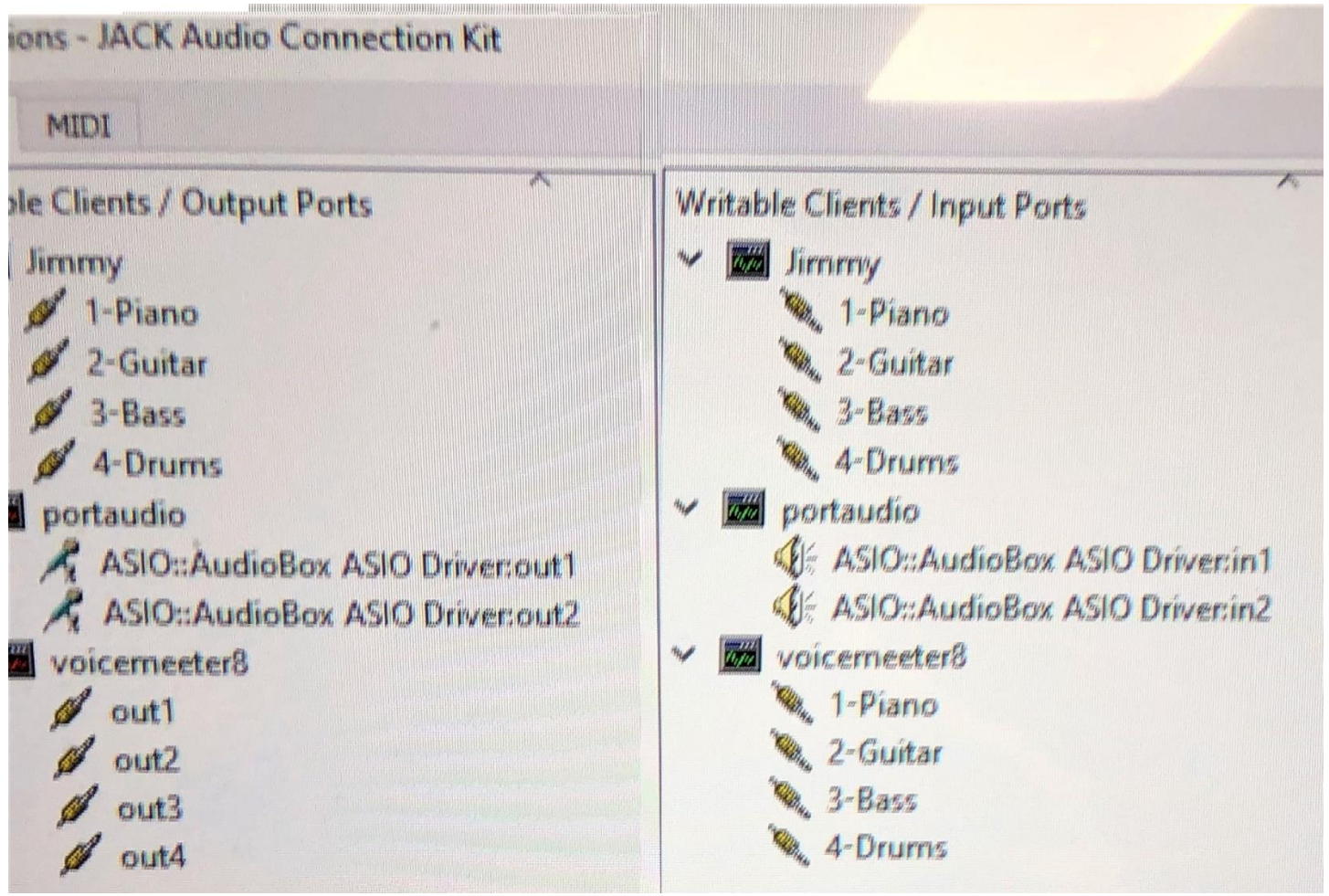
- Jimmy
 - 1-Piano
 - 2-Guitar
 - 3-Bass
 - 4-Drums
- Joao
 - 1-Piano
 - 2-Guitar
 - 3-Bass
 - 4-Drums
- Matt
 - 1-Piano
 - 2-Guitar
 - 3-Bass
 - 4-Drums
- portaudio
 - ASIO::UMC ASIO Driver:in1-HP1Left
 - ASIO::UMC ASIO Driver:in2-HP1Right
 - ASIO::UMC ASIO Driver:in3-HP2Left
 - ASIO::UMC ASIO Driver:in4-HP2Right
 - ASIO::UMC ASIO Driver:in5
 - ASIO::UMC ASIO Driver:in6
 - ASIO::UMC ASIO Driver:in7
 - ASIO::UMC ASIO Driver:in8
 - ASIO::UMC ASIO Driver:in9
 - ASIO::UMC ASIO Driver:in10
 - ASIO::UMC ASIO Driver:in11
 - ASIO::UMC ASIO Driver:in12
- voicemeeter8
 - in1-Piano
 - in2-Guitar
 - in3-Bass
 - in4-Drums
 - in5-GuitarMix2
 - in6-BassMix2
 - in7
 - in8

At the bottom of the interface, there are buttons for "Connect", "Disconnect", "Disconnect All", "Expand All", and "Refresh".

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Client "Connect" (Guitar player) with Standardized Channel Map and Aliases



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6) Create all server and client channel mappings on the “Connect” window

Concepts

- Each participant (server/client) will only ever send 1 mono channel to Jacktrip. This channel could be an aggregate of several source channels from the participant’s physical interface such as separate left and right signals and/or a chat mic
- Each participant (server/client) will monitor/mix their own instrument locally. They will not get a loopback of their own channel from the server.

Server

- For each participant connect (send) their associated instrument channel under “Readable Clients” to all other participant’s corresponding same named instrument channel under “Writable Clients”.
- Also connect each participant’s associated instrument channel under “Readable Clients” to the server’s own corresponding same named instrument channel under “Writable Clients” defined for your Win DAW (Jack Router capable) or Mac aggregate device.
- Do not connect Client’s own instrument back to themselves (a loopback) This is not needed because each client will monitor/mix their instrument locally. Doing so will create extra send data overhead that could impact overall session performance.
- For the server’s own instrument connect (send) the appropriate physical channels from your interface under “Readable Clients” to the single correlated instrument channel to all other participants under “Writable Clients”.
- For the server’s own instrument connect the appropriate physical channels from your interface under “Readable Clients” to the single correlated instrument channel under “Writable Clients” defined for your Win DAW (Jack Router capable) or Mac aggregate device.
- Route the master mix under “Readable Clients” of your Win DAW (Jack Router capable) or Mac aggregate device to the appropriate physical output channels (“Writable Clients”) on your interface.

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Client

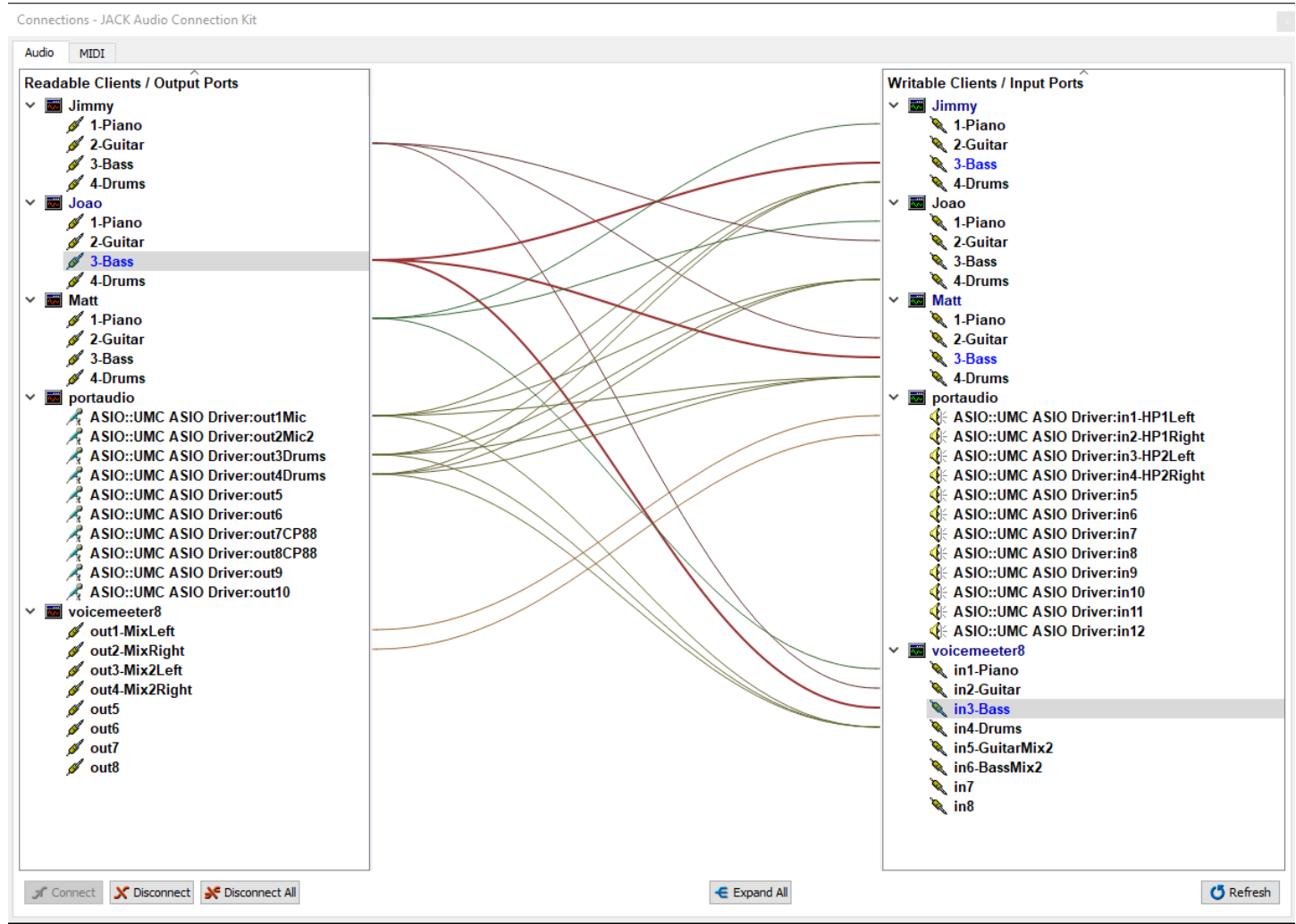
- For each instrument channel (except the channel defined for your own instrument) connect the channel under “Readable Clients” to the corresponding same named instrument channel under “Writable Clients” defined for your Win DAW (Jack Router capable) or Mac aggregate device.
- Connect (send) the appropriate physical channels from your interface under “Readable Clients” to your own single correlated instrument channel under “Writable Clients”. This is your instrument sent to Jacktrip
- Connect the appropriate physical channels from your interface under “Readable Clients” to your own single correlated instrument channel under “Writable Clients” defined for your Win DAW (Jack Router capable) or Mac aggregate device.
- Route the master mix under “Readable Clients” of your Win DAW (Jack Router capable) or Mac aggregate device to the appropriate physical output channels (“Writable Clients”) of your interface.

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7) The following 2 pictures illustrate completed server and client connection patching using a standard channel map and aliases.

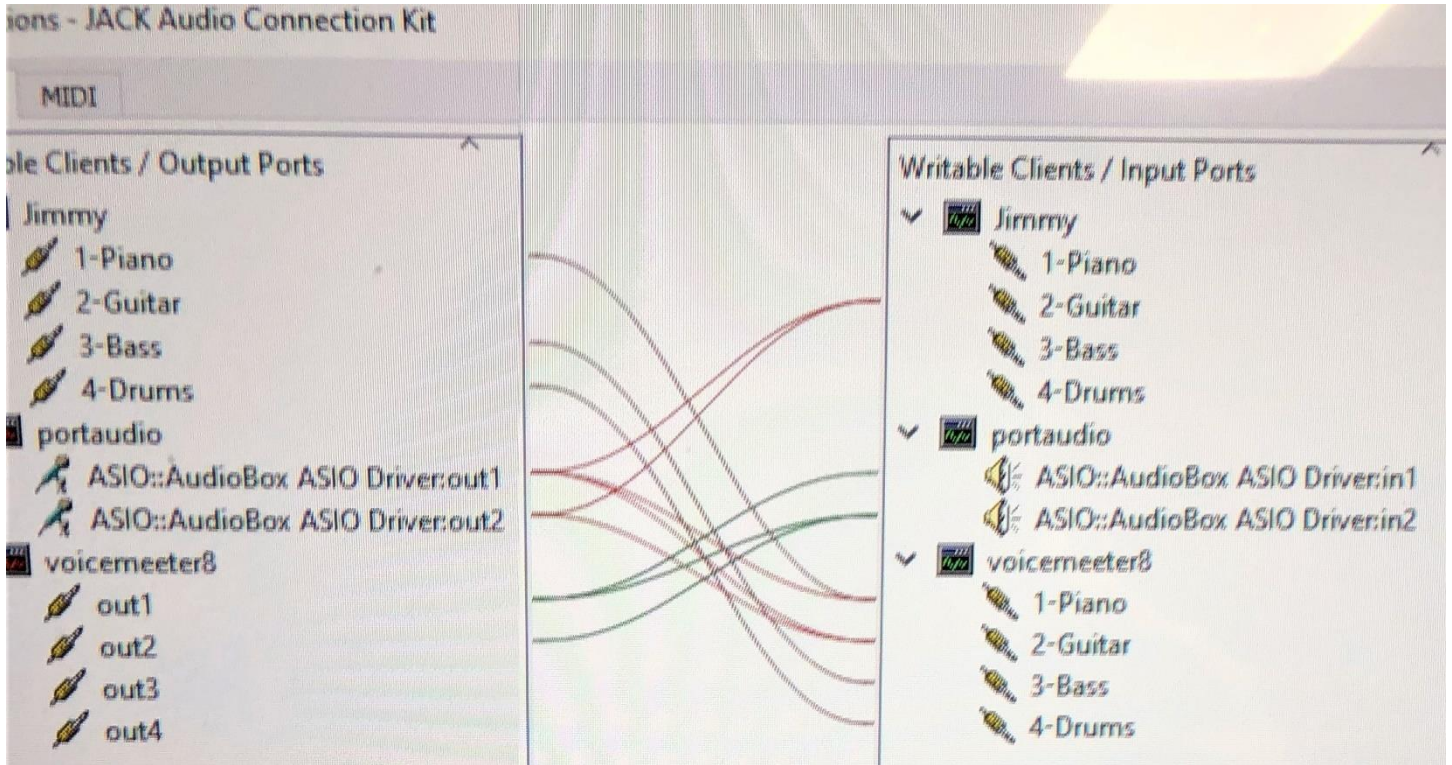
Server (Drums - server host) Patching using Standard Channel Map and Aliases



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Client (Guitar Player) patching using Standard Channel Map and Aliases

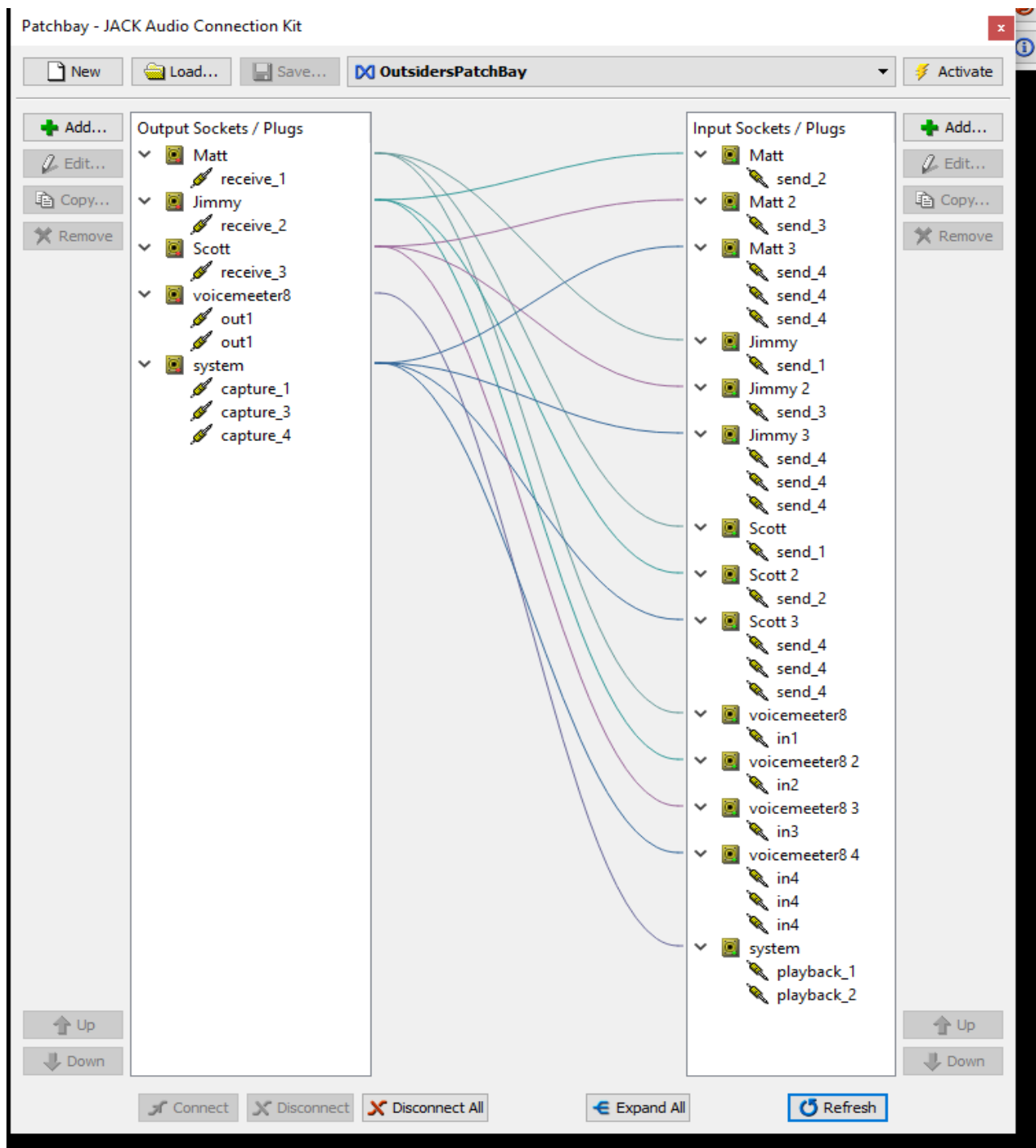


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8) Create server/client Patchbay xml

- Once all connection channel mapping is completed then the Jacktrip server host and all clients should use “Patchbay” window to create a new Patchbay xml based on current connections.
- Select this file as the “Activate Patchbay Persistence” value on the qjackctl options tab.



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Patchbay XML

You may need to tweak the xml because the qjackctl “create patchbay from current connections” logic sometimes adds extra unneeded or incorrectly aligned connections. Once any manual xml tweaks are made the connections will render properly on the “Connect” window.

```
patchbay version="0.3.13.10" name="OutsidersPatchBay">
<output-sockets>
<socket exclusive="off" client="Matt" type="jack-audio" name="Matt">
<plug>receive_1</plug>
</socket>
<socket exclusive="off" client="Jimmy" type="jack-audio" name="Jimmy">
<plug>receive_2</plug>
</socket>
<socket exclusive="off" client="Scott" type="jack-audio" name="Scott">
<plug>receive_3</plug>
</socket>
<socket exclusive="off" client="voicemeeter8" type="jack-audio" name="voicemeeter8">
<plug>out1</plug>
<plug>out1</plug>
</socket>
<socket exclusive="off" client="system" type="jack-audio" name="system">
<plug>capture_1</plug>
<plug>capture_3</plug>
<plug>capture_4</plug>
</socket>
</output-sockets>
<input-sockets>
<socket exclusive="off" client="Matt" type="jack-audio" name="Matt">
<plug>send_2</plug>
</socket>
<socket exclusive="off" client="Matt" type="jack-audio" name="Matt 2">
<plug>send_3</plug>
</socket>
<socket exclusive="off" client="Matt" type="jack-audio" name="Matt 3">
<plug>send_4</plug>
<plug>send_4</plug>
<plug>send_4</plug>
</socket>
<socket exclusive="off" client="Jimmy" type="jack-audio" name="Jimmy">
<plug>send_1</plug>
</socket>
<socket exclusive="off" client="Jimmy" type="jack-audio" name="Jimmy 2">
<plug>send_3</plug>
</socket>
<socket exclusive="off" client="Jimmy" type="jack-audio" name="Jimmy 3">
<plug>send_4</plug>
<plug>send_4</plug>
<plug>send_4</plug>
</socket>
<socket exclusive="off" client="Scott" type="jack-audio" name="Scott">
<plug>send_1</plug>
</socket>
<socket exclusive="off" client="Scott" type="jack-audio" name="Scott 2">
<plug>send_2</plug>
</socket>
<socket exclusive="off" client="Scott" type="jack-audio" name="Scott 3">
```

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```
<plug>send_4</plug>
<plug>send_4</plug>
<plug>send_4</plug>
</socket>
<socket exclusive="off" client="voicemeeter8" type="jack-audio" name="voicemeeter8">
<plug>in1</plug>
</socket>
<socket exclusive="off" client="voicemeeter8" type="jack-audio" name="voicemeeter8 2">
<plug>in2</plug>
</socket>
<socket exclusive="off" client="voicemeeter8" type="jack-audio" name="voicemeeter8 3">
<plug>in3</plug>
</socket>
<socket exclusive="off" client="voicemeeter8" type="jack-audio" name="voicemeeter8 4">
<plug>in4</plug>
<plug>in4</plug>
<plug>in4</plug>
</socket>
<socket exclusive="off" client="system" type="jack-audio" name="system">
<plug>playback_1</plug>
<plug>playback_2</plug>
</socket>
</input-sockets>
<slots/>
<cables>
< cable output="Matt" input="Jimmy" type="jack-audio"/>
< cable output="Matt" input="Scott" type="jack-audio"/>
< cable output="Matt" input="voicemeeter8" type="jack-audio"/>
< cable output="Jimmy" input="voicemeeter8 2" type="jack-audio"/>
< cable output="Jimmy" input="Matt" type="jack-audio"/>
< cable output="Jimmy" input="Scott 2" type="jack-audio"/>
< cable output="Scott" input="Matt 2" type="jack-audio"/>
< cable output="Scott" input="Jimmy 2" type="jack-audio"/>
< cable output="Scott" input="voicemeeter8 3" type="jack-audio"/>
< cable output="voicemeeter8" input="system" type="jack-audio"/>
< cable output="system" input="Jimmy 3" type="jack-audio"/>
< cable output="system" input="Scott 3" type="jack-audio"/>
< cable output="system" input="Matt 3" type="jack-audio"/>
< cable output="system" input="voicemeeter8 4" type="jack-audio"/>
</cables>
</patchbay>
```


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Integrated Jacktrip Launch (win)

1. start jackd with parameters. (match qjackctl audio device configuration)
2. start Jacktrip with parameters
3. start a jack router capable DAW with its predefined defaults and on startup configuration.
4. start qjackctl with its predefined defaults, aliases and batchbay. qjackctl is aware that jackd already started so it does not try to restart the server.

“timeout” provides time for a process to complete prior to executing the next process

Server Script

```
@@echo off
c:
cd \Program Files (x86)\Jack\
echo -----
echo STARTED 1) JACKD
start /min jackd -S -dportaudio -d"ASIO::UMC ASIO Driver" -r48000 -p64
timeout 4 /nobreak
echo -----
echo STARTING 2) JACKTRIP
start jacktrip -S -n4 -z -p5 -D -a4 -J test -K JackTripHub --bufstrategy 1 -q16 -r1
timeout 5 /nobreak
echo -----
echo STARTING 3) VOICEMEETER (or another jack router DAW)
start /min "" "C:\Program Files (x86)\VB\Voicemeeter\voicemeeter8.exe"
timeout 15 /nobreak
echo -----
echo STARTING 4) qJACKCTL
echo -----
start "" "C:\Program Files (x86)\Jack\qjackctl.exe"
```

Note: For client scripts (-C) adjust the Jacktrip command parameters as appropriate and update DAW as needed.

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Startup Sequence

```
JackdHub
'\\NAS1635CE\Public\Studio\JackTrip'
CMD.EXE was started with the above path as the current directory.
UNC paths are not supported. Defaulting to Windows directory.
-----
STARTED 1) JACKD

Waiting for 0 seconds, press CTRL+C to quit ...
-----
STARTING 2) JACKTRIP

Waiting for 0 seconds, press CTRL+C to quit ...
-----
STARTING 3) VOICEMEETER

Waiting for 0 seconds, press CTRL+C to quit ...
-----
STARTING 4) qJACKCTL

Press
```

```
JackHub
'\\NAS1635CE\Public\Studio\JackTrip'
CMD.EXE was started with the above path as the current directory.
UNC paths are not supported. Defaulting to Windows directory.

C:\Windows>:

C:\Windows>cd \Program Files (x86)\Jack\

C:\Program Files (x86)\Jack>rem jacktrip -S -z -n 4 --clientname JACKSERVER -q 32 -r 100

C:\Program Files (x86)\Jack>jacktrip -S -n4 -z -p5 -D -a4 -J test -K remote --bufstrategy 1 -q16 -r1
mThreadPool default maxThreadCount = 8
mThreadPool maxThreadCount set to 128
JackTrip HUB SERVER: UDP Base Port set to 61002
Setting buffers to zero when underrun...
-----
JackTrip HUB SERVER: Waiting for client connections...
JackTrip HUB SERVER: Hub auto audio patch setting = 5 (no auto patching)
=====
```

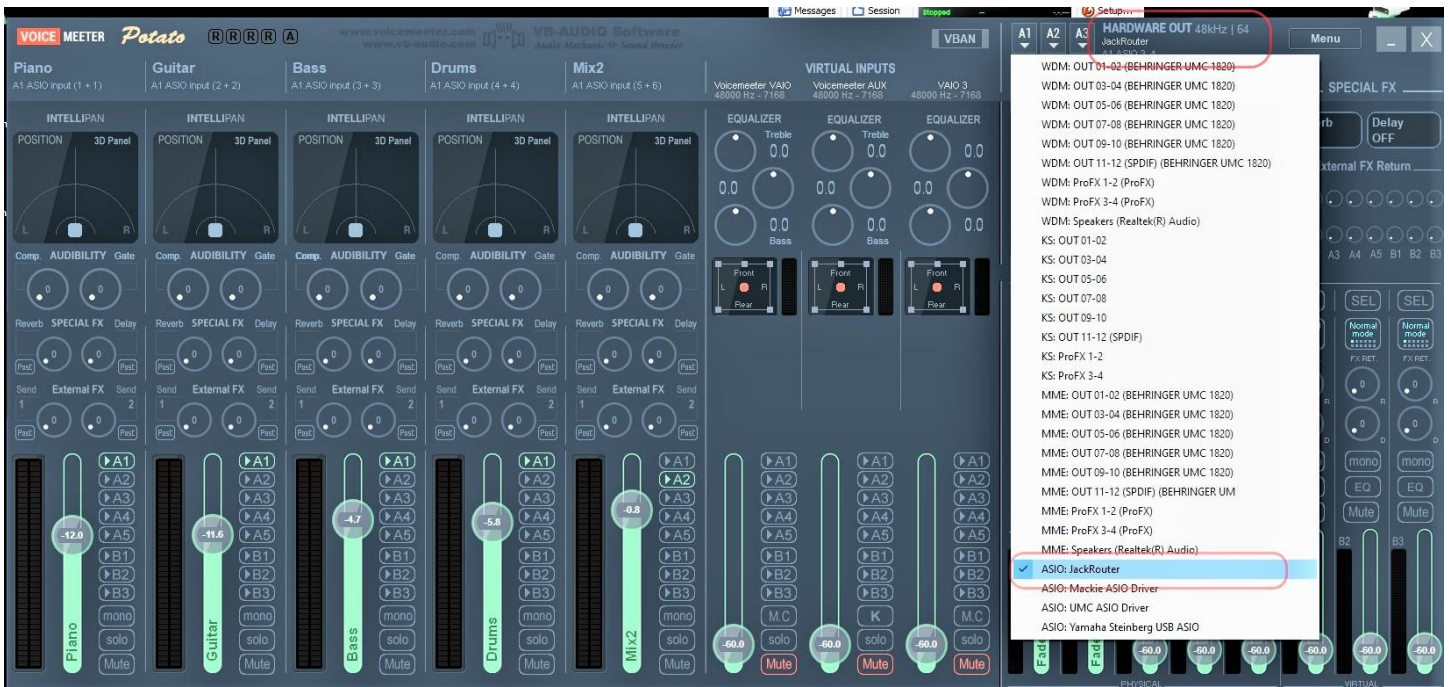
The image shows a DAW interface with several tracks: Piano, Guitar, Bass, Drums, and Mix2. Each track has a 3D panel for position and various knobs for volume, pan, and effects. A JACK Audio Connection Kit control panel is overlaid on the bottom right, displaying the status 'JACK Audio Connection Kit [(default)] Started.' The panel includes buttons for Start, Stop, Messages, Session, Connect, Patchbay, and About... It also shows a status indicator 'started RT 11.7% 48000 Hz' and a timer '00:00:00'. A 'Quit' button is also present.

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Jack Router DAW - Voicemeter example

Voicemeter provides for the creation of extra virtual channel in Jacktrip that can be individually routed into discreet mixing functions. The mixed channels are then sent by qjackttl to physical interface outputs like headphones, speakers, recording etc.



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The screenshot displays the Voicemeeter Potato interface. At the top, five channels are labeled: Piano (A1 ASIO input (1 + 1)), Guitar (A1 ASIO input (2 + 2)), Bass (A1 ASIO input (3 + 3)), Drums (A1 ASIO input (4 + 4)), and Mix2 (A1 ASIO input (5 + 6)). A red box highlights these channel labels and the 'INTELLIPAN' buttons below them.

The 'System settings / Options...' window is open, showing 'System Settings / Information' for 'Voicemeeter Version: 3.0.1.4'. It lists physical inputs (IN1-5) and outputs (OUT A1-A5). A red box highlights the 'OUT A1 Main Device' section, which is set to 'ASIO: JackRouter'. Below this, a 'PATCH ASIO Inputs to Strips' section shows a grid of input assignments: IN 1 (1), IN 2 (2), IN 3 (3), IN 4 (4), and IN 5 (5, 6). Another red box highlights the 'PATCH BUS TO A1 ASIO Outputs' section, where OUT A2 is set to 3 and 4.

On the right side of the settings window, various parameters are listed: Buffering MME (1024), Buffering WDM (512), Buffering KS (512), Buffering ASIO (Default), ASIO SR (Default), Monitoring Synchro Delay, External FX PATCH, and Virtual ASIO Type (Float32LSB). Preferred Main SampleRate is 44100 Hz and WDM Input Exclusive Mode is No.

At the bottom, a yellow-bordered window shows the audio routing diagram. On the left, the 'portaudio' and 'voicemeeter8' devices are listed. On the right, the 'portaudio' and 'voicemeeter8' devices are listed with their respective inputs and outputs. Red boxes highlight the 'voicemeeter8' outputs (out1-MixLeft, out2-MixRight, out3-Mix2Left, out4-Mix2Right) and the 'portaudio' inputs (in1-Piano, in2-Guitar, in3-Bass, in4-Drums, in5-GuitarMix2, in6-BassMix2). Lines connect the outputs on the left to the inputs on the right, showing the routing path.