

# VST System Link



**Cubase • SX**



**PC**  
VERSION

 **steinberg**

# Introduction

VST System Link is a network system for digital audio that allows you to have several computers working together in one large system. Unlike conventional networks it does not require Ethernet cards, hubs, or CAT-5 cables; instead it uses the kind of digital audio hardware and cables you probably already possess in your studio.

VST System Link has been designed to be simple to set up and operate, yet give enormous flexibility and performance gains in use. It is capable of linking computers in a “ring” network (the System Link signal is passed from one machine to the next, and eventually returns to the first machine). VST System Link can send its networking signal over any type of digital audio cable, including S/PDIF, ADAT, TDIF, or AES, as long as each computer in the system is equipped with a suitable ASIO compatible audio interface.

So, why would you want to link up two or more computers? Well, the added computer power gives you vast possibilities:

- Dedicate one computer to running VST instruments while recording audio tracks on another.
- If you need lots of audio tracks, you may simply add tracks on another computer.
- You could have one computer serve as a “virtual effect rack”, running CPU-intensive send effect plug-ins only.
- Since you can use VST System Link to connect different VST System Link applications on different platforms, you can take advantage of effect plug-ins and VST instruments that are specific to certain programs or platforms.

This chapter describes how to set up and use VST System Link in Cubase SX.

# Preparations

## Requirements

The following equipment is required for VST System Link operation:

- Two or more computers.  
These can be of the same type or use different operating systems – it doesn't matter. For example, you can link an Intel-based PC to an Apple Macintosh without problems.
- Each computer must have audio hardware with specific ASIO drivers, installed and working.
- The audio hardware must have digital inputs and outputs.  
Of course, to be able to connect the computers the digital connections must be compatible (i.e. the same digital formats and connection types must be available).
- At least one digital audio cable for each computer in the network.
- A VST System Link host application installed on each computer.  
As of this writing, VST System Link is implemented for Cubase SX, Nuendo 1.6 and Cubase 5.1 (System Link version). Any VST System Link applications can connect to each other.

Additionally, we recommend that you use a KVM switchbox:

### Using a KVM switchbox

If you want to set up a multi-computer network, or even a small network in a limited space, it's a good idea to invest in a KVM (Keyboard, Video, Mouse) switchbox. With one of these switchers you can use the same keyboard, monitor, and mouse to control each computer in the system, and switch between computers very rapidly. KVM switchers are not too expensive, and very easy to setup and operate. If you decide not to go this route, the network will function just the same, but you may end up doing a lot of jumping from one machine to the other while setting up!

## Making connections

Below, we will assume that you are connecting two computers.

Should you have more than two computers, it's still best to start with two and add the others one by one once the system is working – this makes troubleshooting easier if you run into problems. For two computers, you will need two digital audio cables, one in each direction:

1. Connect a digital audio cable from the digital output of Computer 1 to the digital input of Computer 2.
  2. Connect the other cable from the digital output of Computer 2 into the digital input of Computer 1.
- If a card has more than one set of inputs and outputs, choose whichever one that suits you – for simplicity usually the first set is best.

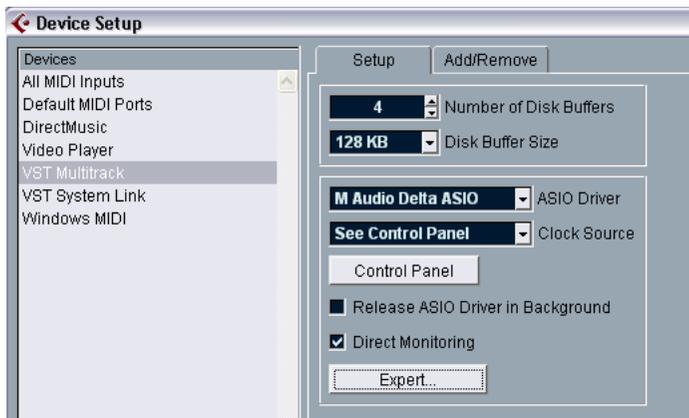
## Setting up clock sync

Before you proceed you need to make sure that the clock signals on your ASIO cards are synchronized correctly. This is essential when cabling any kind of digital audio system, not just VST System Link.

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- ❑ **All digital audio cables by definition always carry a clock signal as well as audio signals, so you don't need to use a special Word Clock input and output for this (although you may find that you get a slightly more stable audio system if you do, especially when using multiple computers).**
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The Clock Mode or Sync Mode is set up in the audio hardware's ASIO Control Panel. In Cubase SX, you proceed as follows:

1. Pull down the Devices menu and open the Device Setup dialog.
2. Select the VST Multitrack device and make sure the Setup tab is selected to the right.



3. Click the Control Panel button.  
The ASIO Control Panel appears.
4. Open the ASIO Control Panel on the other computer as well.  
If you are using another VST System Link host application on that computer, check its documentation for details on how to open the ASIO Control Panel. Hint: in Steinberg's Nuendo 1.6, the procedure is the same as in Cubase SX. In Cubase 5.1, you pull down the Options menu, select System from the Audio Setup menu and click the Control Panel button in the Audio System Setup dialog that appears.

5. Now, you need to make sure that one audio card (and only one!) is set to be the Clock Master, and all the other cards must be set to listen for the clock signal coming from the Clock Master i.e. they must be Clock Slaves.

The naming and procedure for this differs depending on the audio hardware – consult its documentation if required. If you are using Steinberg Nuendo ASIO hardware, all cards default to the “AutoSync” setting – in this case you must set one of the cards (and only one) to “Master” in the Clock Mode section of the Control Panel.

- Typically, the ASIO Control Panel for an audio card contains some indication of whether the card receives a proper sync signal or not, and the sample rate of that signal.

This is a good indication that you have connected the cards and set up clock sync properly. Check your audio hardware’s documentation for details.

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- ❑ **It’s very important that one and only one card is the clock master, otherwise the network cannot function correctly. Once you have set this up, all the other cards in the network will take their clock signal from this card automatically.**
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The only exception to this procedure is if you are using an external clock – which could be from a digital mixing desk or special Word Clock synchronizer for example. If so, you must then leave all your ASIO cards in Clock Slave or AutoSync mode, and make sure that each of them is listening for the signal coming from the synchronizer, usually passed through your ADAT cables or Word Clock connectors in a daisy chain fashion.

## Minimizing the latency

The general definition of latency is the amount of time it takes any system to respond to whatever messages are sent to it. For example, if your system's latency is high and you play VST instruments in real time, you will get a noticeable delay between when you press a key and when you hear the sound of the VST instrument. Nowadays, most ASIO-compatible audio cards are capable of operating with very low latencies. Also, all VST applications are designed to compensate for latency during playback, making the playback timing tight.

However, the latency time of a VST System Link network is the total latency of all the ASIO cards in the system added together. Therefore it's extra important to minimize the latency times for each computer in the network.

- **The latency does *not* affect the synchronization – it's always perfectly in time. But, it can affect the time it takes to send and receive MIDI and audio signals, or make the system seem sluggish.**

To adjust the latency of a system, you typically adjust the size of the buffers in the ASIO Control Panel – the lower the buffer size, the lower the latency. Generally speaking it's best to keep to fairly low latencies (buffer sizes) if your system can handle it – about 12 ms or less is usually a good idea.

## Setting up your software

Now it's time to set up your programs. The procedures below describe how to set things up in Cubase SX; if you are using another program on the other computer, please refer to its documentation.

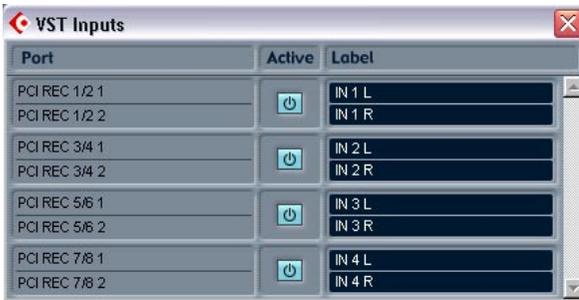
### Setting the sample rate

The projects in both programs must be set to use the same sample rate. Select "Project Setup..." from the Project menu and make sure the sample rate is the same in both systems.

### Setting up inputs and outputs

1. Open the VST Inputs window from the Devices menu.
2. Activate the inputs you want to use by clicking the buttons in the Active column.

To make it simple you will probably want to enable all inputs available in the cable you are using. For example, if you are using an ADAT connection this would mean clicking on the first four buttons (i.e. activate the first eight inputs).



3. Close the VST Inputs window and open the VST Outputs window from the Devices menu.



4. Enable the output buses you need.  
Usually these should match up to the input buses you enabled above. In our ADAT example, this would mean the first four stereo outputs.
  5. Repeat the steps above for all computers in the network.
- **Note that at least one computer in your network needs to have more than one physical set of audio outputs, so that you can hear what's coming out of it!**

For example, if your audio card has a stereo analog out and an ADAT connector, you can use the ADAT connector for networking and the analog outs for monitoring. Make sure that the bus setup in your VST application reflects which set of outputs is doing which operation.

Once we've done this we have a set of inputs and outputs that can carry both our network commands and audio signals from one computer to another. At this point, it may be a good idea to test that everything is set up properly:

## Streaming digital audio between applications

1. Set things up so that Computer 1 plays back some audio.  
You could for example import an audio file and play this back in Cycle mode.
2. In the Mixer, make sure the playing audio channel is routed to one of the digital outputs you have set up for the VST System Link connection.
3. In Computer 2, select the corresponding digital input for an audio channel and activate monitoring for the channel.  
The audio being played back should now “appear” in the program running on Computer 2. You should see the input level meters moving, and hear the audio.
4. Reverse this procedure so that Computer 2 plays back and Computer 1 “listens”.

Now you have verified that the digital connection works as it should.

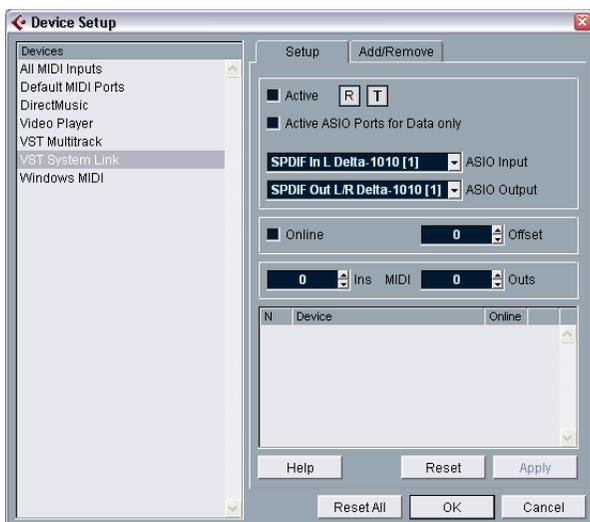
## Activating VST System Link

After setting up the inputs and outputs, you now need to define which input/output should carry the actual VST System Link information.

The System Link networking signal is carried on only one bit of one channel. This means that if you have an ADAT based system which normally carries eight channels of 24-bit audio, once you activate VST System Link you will have seven channels of 24-bit audio and one channel of 23-bit audio (the least significant bit of this last channel is what we will use for networking). In practice this makes no discernible difference to the audio quality, since you will still have around 138dB headroom on this channel.

To set things up we need to open the VST System Link panel:

1. Open the Device Setup dialog on the Devices menu.
2. Select the VST System Link device and make sure the Setup tab is selected to the right.



3. Use the ASIO Input and ASIO Output pop-up menus to define which channel should be the networking channel (and thus become a 23-bit audio channel, in our example).  
Quite often you will be able to just leave these pop-ups the way they are.
4. Click the Active checkbox at the top of the panel.
5. Repeat the steps above for every computer on the network.

As the computers are made active, you should see the small T (Transmit) and R (Receive) lights flashing on each active computer, and the name of each computer should appear in the list at the bottom of the pane. Each computer is assigned a random number – don't worry about this, it's just so the network knows internally which one is which.

- If you wish, you can double click on the name in bold (which is the name of the computer you're currently working on) and set it to whatever other name you wish.  
This name will appear in the System Link window of every computer on the network.
- **If you don't see the name of each computer appearing once you have made it active, you may have to check your settings.**  
Go through the procedure above again and make sure that all ASIO cards are listening to the digital clock signals correctly, and that each computer has the correct inputs and outputs assigned to the System Link network.

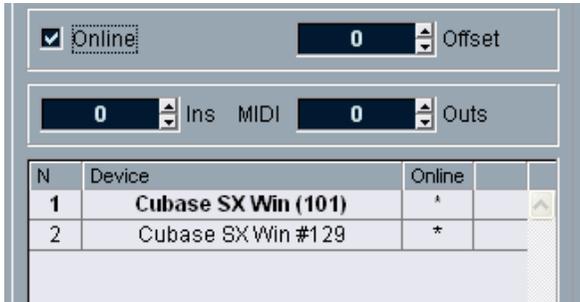
## Putting the network online

After each computer's name you will see whether it is Online or not. When a computer is Online, that means it receives transport and time-code signals, and its sequencer application can be started and stopped by remote control. If it is Off-line it can only be started from its own keyboard – it is effectively an independent machine, although it is still on the network.

- **Note that any computer can control any and all of the others – VST System Link is a peer to peer network and there is no absolute “Master” computer.**  
However, most users do like to think of one machine as the Master (in a one person / two computer network, this would be the machine you actually sit behind most of the time).

For now, let's put all computers Online:

1. Activate the Online checkbox in the VST System Link panel for all computers.



2. Check that the system is working by pressing Play on one computer – all computers should start almost instantly and play perfectly in time, with sample accurate precision.

- The Offset setting to the right allows you to adjust whether one machine will play back slightly ahead or behind the rest. This is normally not needed, but occasionally with some hardware you may find that the lock is a few samples out. In that case you can adjust the lock with the Offset value. For now, leave it set to 0 – it will most likely be what you want.

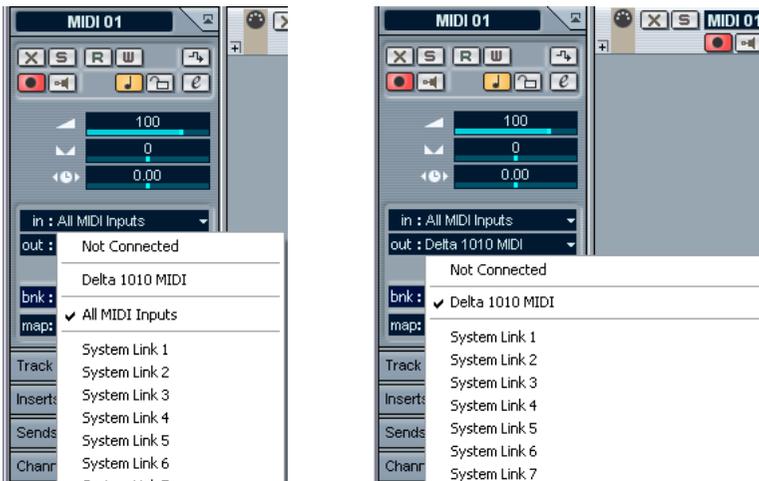
VST System Link sends and understands all transport commands, so you can play, stop, fast forward, rewind etc. the entire network from one computer without a problem – try it! If you jump to a locator point on one machine, all other machines will also instantly jump to that locator point.

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- ❑ **Don't forget to make sure that all computers have their tempos set to the same value, otherwise your synchronization will be seriously skewed.**
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## Using MIDI

As well as supplying transport and sync control, VST System Link also supplies up to 16 MIDI ports, each with 16 channels. You set this up as follows:

1. Use the MIDI Ins and Outs value boxes to specify the number of MIDI ports you need.  
The default value is 2 MIDI In and 2 MIDI Out ports.
2. Create a MIDI track in the Project window and open the Inspector (top section).
3. If you now pull down the “in” or “out” pop-ups, you will find the specified System Link ports added to the list of MIDI Inputs and Outputs.



This allows you to route MIDI tracks to VST instruments running on another computer, as described in the application examples (see [page 640](#)).

## The “Active ASIO Ports for Data only” setting

If you are sending huge amounts of MIDI data at once, there is a small possibility that you might run out of bandwidth on your VST System Link network. This will manifest itself by notes “choking” or timing becoming erratic.

If this happens, you can devote more bandwidth to MIDI by selecting Active ASIO Ports for Data only in the VST System Link Setup panel. When this is active, the VST System Link information will be sent on the entire channel instead of just one bit. This gives you 16 times the bandwidth you had before, more than enough for all the MIDI you could ever hope to use. The downside is that you can no longer use this ASIO channel for audio transfer (do not connect it to a speaker!), thus leaving you only 7 channels of audio in our ADAT cable example. Depending on how you work this might be a reasonable compromise.

## Hearing the network audio

If you are using an external mixing desk, hearing your audio really isn't an issue – just plug the outputs of each computer into the desired channels on the external mixing desk, press Play on one of the computers, and you're good to go.

However, many people prefer to mix internally inside the computer and just use a desk for monitoring (or maybe not use any external mixer at all). In this case you'll need to select one computer to be your “main mix computer” and send the audio from your other computers into this.

In the following example, we assume you are using two computers, with Computer 1 as your main mix computer and Computer 2 running two additional audio tracks, a reverb plug-in and a VST instrument plug-in with stereo outputs.

1. First you want to set things up so that you can listen to the audio playback from Computer 1.  
In other words, you need an unused set of outputs, e.g. an analog stereo output, connected to your monitoring equipment.
2. Go to Computer 2 and assign each of the two audio tracks to a separate VST System Link output bus.  
For example, assign the audio tracks to Bus 1 and 2.

3. Assign the output of the reverb to another bus (e.g. Bus 3).  
This is done using the output routing pop-up menu in the VST Send Effects window.
4. Assign the VST instrument stereo channel to yet another bus (e.g. Bus 4).
5. Go back to Computer 1 and add four new stereo audio tracks.  
These should be routed to the bus you use for listening, e.g. to the analog stereo outputs.
6. Use the Input pop-up menus in the Mixer to select the four VST System Link buses (one for each track).
7. Activate monitoring for the four tracks.

If you now start playback, the audio from Computer 2 will be sent “live” to the new tracks on Computer 1, allowing you to hear them together with any tracks you play back on Computer 1.

### Adding more tracks

OK, but if you have more audio tracks than you have VST System Link buses (physical outputs)? Then you just use the VST Outputs window on Computer 2 as a small submixer: Assign several audio tracks to the same Output bus and then set the fader in the VST Output window to make sure you are sending the right level to your main mix computer.

Note also that if your audio cards have multiple sets of input and output connections you can link up e.g. multiple ADAT cables and send audio via any of the buses on any of the cables.

### Internal mixing and latency

One problem with mixing inside the computer is the latency issue we mentioned earlier. The VST engine always compensates for record latencies, but if you are monitoring through Computer 1 you will hear a processing delay while you listen to signals coming from your other computers (*not* on your recording!). If your audio card in Computer 1 supports ASIO Direct Monitoring you should definitely turn this on – you’ll find the setting in the VST Multitrack Device Setup panel (see [page 31](#)). Most modern ASIO cards support this function. If yours doesn’t you may want to change the Offset value in the VST System Link Setup panel to compensate for any latency issues.

## Setting up a larger network

This is not much more difficult than a two computer network. The main thing to remember is that VST System Link is a daisy chain system. In other words, the output of Computer 1 goes to the input of Computer 2, the output of Computer 2 goes to the input of Computer 3, and so on around the chain. The output of the last computer in the chain must always go back into the input of Computer 1, to complete the ring.

Once you've done this, this transmission of all the transport, sync, and MIDI information to the whole network is handled pretty much automatically. However, where you may run into confusion in a large network is in the transmission of audio signals back to a central mix computer.

If you have lots of hardware inputs and outputs on your ASIO cards you don't need to send audio via the chain at all, but can transmit it directly to the master mix computer via one or more of its other hardware inputs. For example, if you have a Nuendo Digiset interface or 9652 card on Computer 1 you could use ADAT cable 1 for networking, ADAT cable 2 as a direct audio input from Computer 2, and ADAT cable 3 as a direct audio input from Computer 3.

You can also transmit audio via the ring system if you don't have enough hardware I/Os for direct audio transmission. For example, in a four computer scenario you could send audio from Computer 2 into a channel in the mixer in Computer 3, and from there to a channel in the mixer in Computer 4, and from there back to the master mixer in Computer 1. This can certainly be tricky to set up, so generally it is recommended that if you want to set up a complex network, you should make sure to use ASIO cards with at least three separate digital I/Os.

# Application examples

## Using one computer for VST instruments

In this example, you are using one computer as your main record and playback machine, and want to use another computer as a virtual synth rack.

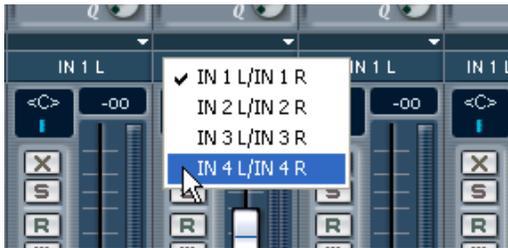
1. Record a MIDI track into Computer 1.
2. Once you have finished recording, route the MIDI output of that track to System Link MIDI port 1.
3. Now go to Computer 2, open up the VST Instrument rack and assign an instrument to the first slot in the rack.
4. Create a new MIDI track in the Project Window of Computer 2, and assign the MIDI output of the track to go to the VST Instrument you selected earlier.
5. Assign the MIDI input of the track to be VST System Link port 1.  
Now, the MIDI track on Computer 1 is routed to the MIDI track on Computer 2, which in turn is routed to the VST Instrument.
6. Now activate monitoring for the MIDI track on Computer 2, so that it will listen and respond to any MIDI commands coming in.  
In Cubase SX, you would click the monitor button in the Track list or Inspector.
7. Press play on Computer 1.  
It will now send the MIDI information on the track to the VST Instrument loaded on Computer 2.

Even with a slow computer you should be able to stack a whole bunch of extra VST Instruments this way, expanding your sound palette considerably. Don't forget that VST System Link MIDI is also sample accurate, and thus has *much* tighter timing than any hardware MIDI interface ever invented!

## Creating a virtual effect rack

The effect sends for an audio channel in Cubase SX can either be routed to an effect (in the VST Send Effects rack) or to any activated Group or Output bus. This allows you to use a separate computer as a “virtual effect rack”, by setting things up in the following way:

1. Go to Computer 2 (the machine you will use as effect rack) and add a new stereo audio track.
2. Add the desired effect as an insert effect for the track.  
Let's say you add a high-quality reverb plug-in.
3. Open the Mixer and select one of the VST System Link buses as input for the audio track.  
You want to use a separate System Link bus, which will only be used for this purpose.



4. Activate monitoring for the track.
5. Now, go back to Computer 1 and select a track to which you want to add some reverb.
6. Bring up the effect sends for the track, in the Mixer or Inspector.
7. Pull down the send routing pop-up menu for one of the sends, and select the System Link bus assigned to the reverb in step 3.
8. Use the send slider/knob to adjust the amount of effect as usual.

The signal will be sent to the track on Computer 2 and processed through its insert effect, without using any processor power on Computer 1.

You can repeat the steps above to add more effects to the “virtual effect rack”. The number of effects available this way is only limited by the number of ports used in the VST System Link connection (and of course by the performance of Computer 2, but given that it won’t have to handle any recording or playback, you should be able to use quite a lot of effects).

## **Getting extra audio tracks**

All computers on a VST System Link network are locked with sample accuracy. Therefore, if you find that the hard drive on one computer isn’t fast enough to run as many audio tracks as you need, you could record new track on one of the other computers instead. This would create a “virtual RAID system”, with several disks all operating together. All tracks will remain locked together just as tightly as if they were all running on the same machine. This means that you effectively have an unlimited track count! Need another 100 tracks? Just add another computer.