Squeezebox Touch Toolbox (2011)

by Klaus Schulz

Introduction

Probably you come by 'cause you're owning a little audio streaming device called Logitech Squeezebox Touch (SBT)...

Yep. That's the place. You found it...

10 minutes of intensive reading and 20 minutes of work (max) will hopefully get you there. I'm pretty sure the exercise will turn out to be worth the effort...

Squeezebox Touch

The Squeezebox Touch has been and still is a very successful audio product. It’s 1. a high quality product and 2. rather fairly priced. Even professional journalists, reviewers and manufacturers use the device in private.

Why is that?

At the time of writing there are not that many high quality audio streaming devices around.

Many people look for replacing a noisy PC. Who wants to have such a PC monster in the living room!?!?

The Logitech streaming ecosystem is a rock-solid well-tested and highly flexible streaming environment. It is well maintained – and all that free of charge.

With an iOS or any other Android device at hand the whole family will be able to manage Daddies holy audio system without touching it.

The SBT price/performance ratio will be hard to beat by the competition.

Not to forget. There’s a huge community contributing quite some enhancements and support.

Why Touch Toolbox?

Pretty much every product out there comes with space for improvement. The SBT has that much of it that I thought it’d be worth to start a little project around it.

The result of the project I called Touch Toolbox.

This Toolbox offers a set of recommendations that might improve the performance of your device and your perceived audio performance. You’ll learn how to configure your SBT stup accordingly and most important how to introduce and handle the Touch Toolbox.

Of course there are many other ways and solutions to improve your streaming solution. This will be one out of many. For the SBT there are not that many though.

Let’s hope this effort for the exercise is not gonna be wasted on either side..

I'm pretty optimistic the majority of systems will respond with a worthwhile sound quality improvement.

Of course you should have a reasonable audio chain in place. The better the downstream equipment (amp and speakers), the more you'll notice the changes.

The quality of DAC you're using will obviously directly impact the level of improvement you'll experience.

Top Quality DAC manufacturer try to fight the transport associated problems since years. Some do better than others and usually ask serious money for doing so. Still 99.9% fail on isolating the DA stage from upstream associated distortions. You'll hear what I mean.

The Toolbox is meant for those who care about best possible soundquality supplied by a given audio-system or device and are open to try this and that.

Even mid-/lo-fi systems will benefit. If it matters to you is a different question. Applying the Toolbox to an SBT in the kitchen, I'd say is waste of time. ;)

Once more. I'm not aware of any other source providing a similar toolset that you find over here.

Please also consider. All modifications, including HW and network mods, and my advise make "my package". If you strip the scope down, you won't experience its full potential.

However. Even applying just some of the modifications should make a noticeable difference. But keep in mind, certain -- sometimes very little – bottlenecks in the chain will limit your overall system resolution.

And I'd like to point out:

My toolbox is not some kind of "illegal" hack. It's rather the other way around.

Logitech (the Squeezebox company section) allows the community to participate in enhancing their product line. It’s a Linux system and you simply access it via ssh.

Enjoy.

II. Modification Philosophy

The overall philosophy follows simply the “less is more” principle.

The idea is to reduce as many bottlenecks, distractions and inefficiencies as possible and put the focus on the key task, to stream digital audio from a to b.

What factors beyond the actual audio device do impact the perceived sound quality ?

1. Power
2. Noise
3. EMI/RFI
4. Temperature
5. Vibrations
6. Audio material
7. Processing/calculation errors

Highly dynamic and non-linear load conditions - not necessarily the absolute CPU load - quality of software drivers, the base operating system, parameter configurations, power fluctuations and instability, RFI/EMI, clock interference and inter-modulations, common mode noise and many more sources, inside a computer - the Touch can be considered a mini computer - impact the physical conditions such as timing or the shape of a single (physical) bit and the quality of the entire bit stream.
It's very tricky to get all these variables under control.

Some of these distortions directly interfere with the electronics on the receiver side (e.g. your external DAC).

It actually doesn't matter if you run analog or if you stay 100% digital all the way to the SPDIF output - everything is affected!

The myth that "0s are 0s and 1s are 1s -- it's all digital, do not care about it " is simply said wrong and misleading.

It's not about just digital 1s or 0s actually. The data receiver must be able to read a certain analog voltage and need to declare it a 1 or 0. Since timing and shape of that bit and its distortion are continuously changing and usually far far away from being ideal, the receiver will see all but a clean rectangular evenly separated noise-free signal.

In the majority of cases the situation is that bad that a receiver is not able to recover respectively refresh that incoming bit-stream properly.

If people are talking about bit-perfection or bit-transparency, it won't tell you anything about the actual sound quality. Bit perfection just says that the value of a bit (or sample) arrived as it was sent - as a 1 or 0 - but it doesn't say at what time resp. in what condition it arrived (or even it's reflection arrived) and if and how the receiving end is able to cope with that condition. And that's a key issue.

The vast majority of audio interfaces resp. DACs out there are just not able to properly cope with quality issues on the incoming bit stream respectively connection.

This is not only applicable just to the Squeezebox btw. It's also valid for any other Transport (e.g. PC or MAC based). Most of them cause pretty serious trouble – from an audiophile perspective.

Since 2006 I'm actively looking into that subject btw.. From Windows I switched to Linux in 2007. Since the beginning I haven't seen any DAC, which wouldn't respond to changes done on the upstream and/or transport side.

I really hope that some day somebody comes up with a DAC that's immune against incoming distortions on its inputs.

That would finally make so called audiophile High-End transports, PC based audiophile SW players, PC optimizations and also my Toolbox contribution more or less obsolete and might save us all a lot of money.

Lots of talk so far. Almost done.

III. Scope of work

Just modifying the Touch firmware with the Toolbox wouldn't be sufficient.
You should notice quite a change. However. To squeeze the last bit out of
your network streaming solution, you should have a look at your entire environment. There are a lot more factors that can impact your audio experience.

You'd basically need to address following areas:

1. Logitech Media Server setup (formerly known as Squeezebox Server)
2. Squeezebox base setup
3. Touch Toolbox setup
4. Server and network setup

All these areas can impact your sound experience. Some more and some less.

The software related optimizations follow the good old "less is more" approach.
By shutting down this or that feature or by doing some parameter optimizations the load gets reduced respectively harmonized. A bumpy off-road road becomes freeway.
Even a very simple thing such as shutting down the monitor will cause serious power savings and power fluctuations on the Touch, which in turn will stabilize the audio performance by causing less trouble.

My measures won't solve the issues completely, that would require a completely different approach, but I'm personally more then happy with the achieved result.

This document covers the Toolbox part. I strongly recommend to read the blog to get the other areas settled.

Touch Toolbox 3.0

The feature list:

- improved installation process
- full integration of all mods into just one tool
- help function

- process/task priority tuning (NEW)
- networking parameter tuning (NEW)
- networking configuration related adjustments (NEW)
- kernel parameter adjustments (updated)
- screen on/off during operations (no more reboot required) (NEW)
- infrared on/off (NEW)
- exclusive audio routing (no more asound.conf) (NEW)
- the daemon killer (you'll love that one) (NEW)
- volume lock at 100 % (for testing purposes) (NEW)
- disabling samba network server

TT 3.0 has been tested on systems running up to LMS and SBT FW 7.7.0

Lets get (finally) started.

IV. Touch Toolbox - Modifications and Setup

1 Copyright & Disclaimer

I put quite some time and effort into the project. The toolbox for sure has quite some intellectual and monetary value. That's why the tools respectively solution I provide are restricted to private and non-commercial use only.

I do claim a copyright for my overall solution respectively the intellectual property behind it!!

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The information you'll find may be changed or updated without notice. I may also apply improvements and/or changes to the programs at any time without notice.

For those who are going to apply the tools and modifications, please:

Please read the carefully DISCLAIMER before you start the journey. I do anticipate your acceptance of it. Keep in mind -- Everything you do with the toolbox or you do by following my advise , you 100% do at your own risk. Don't blame me if you smoke anything. I try my best to avoid any problems.

Back to business.

2 Prerequisites

What we'll do is following. First we will download and store a tar-archive (it's similar to zip under Windows) consisting of all stuff you need to modify the box.

You can always revert your Touch back to the original settings respectively firmware status, by just doing a factory reset . You'd just push the tiny reset button on the back, right above the power plug for a bit >5s. As soon as you get off that button, the Touch will tell you about the restore being in progress. It's that easy to get back to factory settings.

There is IMO no risk that you mess anything up on the software side. I restored my box a numerous times and never experienced a problem.

Below instructions work mainly under Linux and Microsoft.

1. If you was running version 1.0 or 2.0 of my Toolbox or any other mods you MUST run a factory reset of the Touch first. We need a clean base. Push the little black button on the back for more than 5s.

2. Update to latest firmware e.g. 7.6.1. as supplied with the Logitech Media Server. I do have 7.7.0 beta working fine.

3. Initial setup of Touch via touchscreen done and

check if audio playback is working. (see chapter 2.)

4. Make sure SSH access is enabled on the Touch (see chapter 2.)

5. On Windows systems download WinScp and Putty and install them.

We need at least WinScp to transfer files from a Windows platform to the

Touch via SSH and to run some commands locally on the Touch.

The SB Touch is running an embedded Linux with realtime kernel btw.

On Linux and OSX systems, we can do a simple ssh/scp from a terminal

window.

You might have to install ssh on your Linux systems: Ubuntu/Debian/Mint run: sudo apt-get install openssh-server openssh-client

On OSX you've got all you need installed.

6. Player IP address of your Touch

To figure out the IP address of your Touch you open your Squeezebox Server Settings/Player

Important:

The IP address of your Touch might change everytime you reboot the device. If possible make sure that you get this address fixed. More recent routers will allow you to "reserve" an IP address based on recognized MAC addresses. You need to login to your router first. Usually you'll find all active clients listed under a kind of network settings menu. There you'll be able to reserve an IP

address for your Touch. (There's no need to work with good old static IPs anymore). If you're already at it do the same for your server.

You'll also need that IP reservation for doing remote controlling the toolbox later on, with e.g. iSSH.

3 Download Toolbox

Download the Toolbox and save it on your PC.

Current version: TT3.0 build:11/02/11

Version 1: Touch Toolbox 3.0 with Wireless LAN deactivated
Version 2: Touch Toolbox 3.0 with Wireless LAN activated

4 Accessing the Touch (Windows)

Start WinScp.

1. Enter the Touch IP address in the "Hostname" field.
2. As user you enter "root", as password you enter "1234"
3. As protocol you select "SCP"
4. Press "Login" and confirm the pop-up (ssh key generation) with yes.

Now you should get logged in.

You might want to save that connection, since you need to login several time during the process.

Note: Ignore the WinSCP error messagess - just click OK.

5 Copy the toolbox (Windows)

Once WinScp logs in to the Touch as user root, you'll see the local and the remote directory structure side by side in the explorer style file manager.

The remote directory on te right is "/root" and it is usually empty.

On the PC side change to the directory where you've stored your downloaded touchtoolbox file.

On the Squeezebox Touch side you stay where you are.

Now Drag and Drop the touchtoolbox3.0 file into the default (/root) directory .

6 Unpack the tar-archive (Windows)

Open a Putty terminal (the two-terminals icon) within WinScp - enter:

password:1234
(the user root is selected automatically)

A terminal window opens. When logging in you end up at the target directory "/root"

To see if you file is there type below command and push <enter> afterwards:

ls

(If the file is not listed something went wrong with the copy in WinScp, try to check the source/target directories)

If the file is listed, you type:

tar xvf to*

(You can use the asterisks instead of typing the full toolbox name)

The archive gets unpacked now. All files are distributed to the target directories with correct permissions.

7 Initialize the Toolbox

Just type in the terminal commandline:

tt -i

The toolbox will now get initialized. The system will reboot immediately afterwards.

NOTE: All mods are ON with TT3.0..
Screen is Off.
buffer is at lowest value 3400.
WLan is off.
Digital output only is on.
Infrared off.

For those of you who can live with those settings, hopefully the majority, will be pretty much set after tt -i.

Others have to turn the features off which they can't make use of.

For a better understanding you might want o have a look at this little tutorial:

Windows users can proceed to 9 from here. You might want to read Note 3 in below chapter.

8 Linux/OSX (commandline)

1. Open a terminal: CTRL-ALT-T (Linux) ; App "Terminal" under OSX

2. Check the login access and accept ssh key:

   ssh root@Your-Touch-IP-Address

   Password: 1234

   ##Accept the ssh key

   exit

3. Copy the file:

   I assume that your downloaded file resides in /Users/your-user-id/Download for OSX

and /home/your-user-id/Download for Linux.

Let's go:

OSX:

cd /Users/your-user-id/Download

Linux:

cd /home/your-user-id/Download

To find out if your file is there type:

ls

If it is there copy it over to the Touch:

scp touchtoolbox3.0-LAN.tar root@Your-Touch-IP-Address:/

or

scp touchtoolbox3.0-WLAN.tar root@Your-Touch-IP-Address:/

(e.g. scp touchtoolbox3.0-LAN.tar root@192.168.0.105:/)

If the file wasn't at the respective "Download" directory you need to find the place where you put it! ;)

4. Now login into the Touch and unpack the archive:

ssh root@Your-Touch-IP-Address

Password: 1234

cd /

tar xvf touchtoolbox3.0-LAN.tar

or

tar xvf touchtoolbox3.0-WLAN.tar

5. Initialize the Toolbox:

tt -i

That's about it. You're done for the moment. The system will reboot and the default modifications

and parameter settings should be in place and activated.

You'll always run the toolbox commands in the same manner under Linux or OSX:

1. Open Terminal

2. ssh root@Your-Touch-IP-Address

Password: 1234

3. replace-this-with-the-toolbox-command

4. exit or close terminal

Note1: The modified files or the toolbox might get removed or overwritten during Logitech

upgrades. That'll lead to inconsistencies and the toolbox will not work

properly - if at all - anymore.

You need to do a factory reset and run the whole upgrade procedure again if this happens.

Note2: tt -i installs already a full set of modifications! You might have to adjust it to your situation.

Note3:

Just in case your Touch hangs up during the upgrade process while booting - this happened to me once or twice. Just DO A POWER RESET by unplugging the power cable!! After this everything should be working fine.

This won't happen during operation later on!!!!

Toolbox commands

a. HELP

Let's give it a try. Again we need to be on the Touch command line in WinSCP (CTRL-T) or via ssh on Linux.

Just type:

tt -h

That's how it looks on the Touch:

b. STATUS

Now you should see all commands available - like above.

tt -s

Now you should see the status after initialization, like this:

Wasn't that difficult. ;)

Note:

For sure you'll experience in the printout of tt -s something like shown in the printout above: "Unknown HZ value! (94) Assume 100."

Don't worry!!!

That's a Logitech respectively Linux kernel bug and not my fault. It's been fixed on newer kernels since a long long time.

c. BUFFER SIZE Tuning

With this modification you will resize the Alsa buffer. It's the buffer from

the Linux soundlayer to your device and NOT the streaming buffer on the ethernet receiver.

Just type:

tt -b 4000

The system will now reboot.

You can choose values between 3400us and 50000us. 20000 is the Touch default setting. Most of the people seem to made it work at a 4000 setting.

Run tt -s to see if your change is active.

Advise:

If you experience crackling sound (XRUNS=buffer underruns) while playing music, your buffer setting is too low.

In this case, increase the value by a couple of 100 us to e.g. 4400 or even higher until the sound stops crackling. You might have to run several loops to figure out the lowest value for your environment.

If 4000 does not work for you, you might checkup your environment, server or network for high-load conditions. I'm running 3400 and 24/96 without XRUNS.

d. OUTPUT ROUTING

By default all outputs run in parallel. With this modification you will disable either the analog or the digital output.

And you'll turn off the Alsa "plugin" output mode - which is the 2nd best choice in terms of SQ..

With this mod we go straight to the "hardware=hw".

And for the Linux experts: With TT30 we even got rid of asound.conf

You'll also be able to define a single output for a 24bit USB DAC.

NOTE: There are radio stations sampled with less than 44.1khz. Those radio

stations will cause the so called "Chipmunk" effect.

At this point you need to set your priorities!!! If those radio stations are

important to you, you need to skip this modification.

By now you should know the game how to access the Touch. On the command-line you enter:

1. for activating the digital output only, type:

tt -o 0

2. for analog out only

tt -o 1

The system will reboot automatically after that modification. Run tt -s to see if the change is active.

Note: USB DACS

I tried for quite some time to get USB DACs going. The toolbox is pretty much prepared to get those going.

Unfortunately the majority of DACs (USB Class 2) will not function properly. Logitech is using a very old USB Audio driver which could be the reason.

You'll experience buffer problems (XRUNS).

USB Audio Class 1 DACS with 24bit support might work.

I'll get a device isochronous device for testing soon. If I make it work I'll update the Toolbox.

e. WLAN ON/OFF

With this modification you will disable the Wlan, which is IMO a must!!!!

(Please have a look at the HW/network section for a feasible HYBRID solution for those of you who must go wireless!)

All WLAN related processes (incl. wpa encryption) will no longer be started at boot time.

From commandline run:

tt -w

The system will reboot automatically. To reactivate Wlan run the same command again.

Run tt -s to see if the change is active.

f. DISPLAY ON/OFF

With this modification you will disable the screen on the fly.

This will have a bigger impact then just applying the screen-off screensaver.

Run from the Touch commandline :

tt -x

That's about it. To reactivate the display run tt -x again.

To switch the display off at boot, in case you don't want use the screen at all, you can make that modification permanent, by typing

tt -d

The system will reboot automatically. Afterwards the screen stays dark after boot.

To disable that permanent display off mod, just run the command tt -d

again.

g. Restore

To restore the original status just run:

tt -r

after the reboot yopu're back at inital status. You can start over with tt -i

h. INFRARED RECEIVER ON/OFF

You can turn off your infrared receiver with

tt -ir

You'll get it back on by running the same command again.

i. VOLLOCK (experimental)

This modifications locks the volume control at 100%. Though I do it slightly different then Logitech (see function lock volume under player settings) is doing it.

Why experimental?? No idea why this mod does what it does. ;)

Just give it a try and let me know what you experience:

tt - v

WARNING:

Some people might have their amps directly connected to the DAC or to the Touch analog output without having an external volume control in the path.

These people who exclusively use the software volume control of the Squeezebox will smoke their speakers if they use this function!!! So pleeaase - stay away from this mod.

Other folks who do have an external volume control in place, pleeaase

turn your external volume control down before you apply this function first.

So folks. You better know what you're doing.

f. THE DAEMON KILLER MOD

If you're done with everything else you should run this one. The cream on the cake mod. This mod kills pretty much all (system related) background daemons (that's how background processes are called in Linux land) on the Touch.

It goes that far that even remote access daemons are killed. The side effect -- you'll get locked out!!! No more access to the box until you "reboot" the machine.

Just run:

tt -k

You need to do a power reset (unplug the cable and plug it back in) or you push very short (in any case less than 3s !!) the black button on the back right above the power connector.

The box reboots into the "normal" TT3.0 state.

You need to rerun tt -k every time you reboot or better power-up the system

I can't make it a permanent setting for obvious reasons.

There is NOOO factory reset needed to get back to normal!!!

Congratulations. That'll be it. Now you're set - at least on the Touch software side.

V. Wrap Up

Now you're hopefully set. Some of you will experience more, some will experience less and even some will report no improvements by applying the Toolbox. Some might even claim they must have bad ears. ;)

All systems are different, all people are different.

I hope that most of you will experience and enjoy a new sound experience...

Enjoy.

\Klaus a.k.a soundcheck