



DICE Development Steps Detailed Checklist

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1 Introduction

Over time the information and resources available from TCAT has grown significantly, and the info is not all in one place of course. To save some leg-work, this document gives a checklist of development steps where TCAT provides resources or time-saving information.

2 Checklist

Not necessarily in order:

- ☐ Locate Documentation and other Resources
- ☐ Get an EVM
- ☐ Get the Firmware Development Environment
- ☐ Take care of Licensing
- ☐ Get access to source code, binaries, developer documentation
- ☐ Get Subversion Access
- ☐ Register for Forum Access

Search the forums first before contacting TCAT, there's a lot of info there.

- ☐ Get your email addresses signed up for our Newsletter
- ☐ Hardware design
- ☐ Develop Firmware
- ☐ Get a compatible JTAG interface
- ☐ Get a 1394 OUI from the IEEE
- ☐ Send information to TCAT for customized Drivers
- ☐ Send information to TCAT for customized Control Panel
- ☐ Get set up for Driver Signing (optional)
- ☐ Develop Host Software
- ☐ Test against TCAT driver Release, submit feedback as needed
- ☐ Create Factory Load and Test

3 Details

3.1 Resources

The TCAT Website is <http://www.tctechnologies.tc>

The TCAT Forums are here: <http://www.tctechnologies.tc/forum/>

The TCAT Subversion Repository is here: <https://dev.tctechnologies.tc/tcat/>

3.2 TCAT Website

You can find the following resources on the TCAT website:

- DICEII, Jr, Mini User Guides, from the main page
- EVM, go to Support->Design
 - The page has links to the Hardware Guide, Schematics, Design Files, and the Firmware Update Guide
- Firmware and Host Software, go to Support->Software
 - The Firmware Development Environment can be downloaded from there. It's also known as the Firmware SDK. Note that the firmware and software sources are not included in the Firmware Developer Environment. Sources are made available via the Subversion sever.

Read the Installation Guide **before** Installing the tools

- Firmware CLI Reference
 - A reference of the commands available on the serial interface
- Latest PAL (Platform Abstraction Layer)
 - The PAL is used for cross-platform driver interfacing, giving a common C++ API for Host utilities and applications. Developers may access driver API's directly, but this is not supported by TCAT.
 - The PAL documentation is built from tags within the source code, and latest is published on the website with each new release in the subversion repository.
- Latest Firmware and Driver Binaries
 - Firmware and Drivers that work with the DICE EVM.

3.3 Get an EVM

On the Website go to Support->Design for all of the info.

The DICE EVM002 Evaluation Board works with all of the DICE chips. Microboards (daughter cards) are available for each variant of the chip.

TCAT also provides a number of UI expander boards which gives the developer a chance to work with the usual hardware UI elements, such as encoders, VU's, switches, LED's, etc.

Contact sales@tctechnologies.tc for ordering.

Choose a driver model

The firmware can be configured to work with a number of Host driver models, such as TCAT's DiceDriver model, or AV/C Audio and Music, or peer-to-peer (i.e. async control, but no streaming to/from Host).

Prebuilt firmware binaries are available for evaluators to try out each of the driver model options.

Linux

The EVM (plus a growing number of retail DICE-based products) is supported in the FFADO Linux Audio project. The EVM can be used to evaluate the state-of-the-art with Linux 1394 Audio. You can find a walk-through for configuring a Linux distribution on our forums, including adding support for your own device. Of course the best source of information is at the FFADO web site <http://www.ffado.org/> and the web at large.

3.4 Get the Firmware Development Environment

On the website, go to Support->Software

Windows cross-development is supported. The Firmware Development Environment is available as a free download. Please read the Installation Guide first, it has important pre-installation information for developers. The download installs the cross-development tools, including the Cygwin Linux emulation environment, the GNUARM tool-chain (gcc compiler, gdb debugger, Insight GUI for gdb, and support libraries) and a Windows version of Emacs for those just have to have it. The Firmware SDK does not require a license so evaluators can see what's included.

The source code is available separately, see below.

3.5 Licensing

Search the TCAT Forums for more information about Licensing.

When the mutual NDA is in place, the vendor will have access to TCAT supplied source code, and access to the developer area in the TCAT forums. Additional licenses are required for vendors who wish to distribute firmware based on our sources and another for vendors who wish to redistribute our driver binaries and Host software based on our sources.

Vendors who wish to use our Host examples that are based on the JUCE library should see the TCAT Forum topics related to licensing.

Also, contact info@tctechnologies.tc for more information about the TCAT license.

3.6 Get Subversion Access

Once you have a License agreement in place, let us know when you're ready to look at the sources, and we will create a login for you. To see how our repository is used, you can find a how-to in the public area of the repository. Look for TCAT_repos_how_to.pdf here:

<https://dev.tctechnologies.tc/tcat/tags/release/public/latest/docs/>

3.7 Register for Forum Access

You can search our forums without registering; however you will not be able to see the developer area. To get access to the developer content, please register in the forums and then send an email to support@tctechnologies.tc telling us the user name you picked, and who you are so we can look up your License agreement. We usually grant access within a day or so.

3.8 Sign up for the Newsletter

Whenever we have a new subversion release, or if some important developer related info needs to go out, we send an email Newsletter.

It's a good idea to get all of the necessary people in your company on our Newsletter distribution list. It doesn't contain any ads or fluff, it's purely developer info.

3.9 Hardware design, on the website go to Support->Design

EVM Design files are available here. At your option, TCAT also can do a schematic and layout review of your design to verify interfacing to the DICE and to watch out for some considerations regarding routing around the 1394 PHY.

TCAT also provides hardware Design Services under contract.

3.10 Firmware Development

The *Firmware Development Environment User Guide* (in the Programs menu folder if the firmware tools are installed, and in the documents area in the subversion repository) goes into a lot of detail about the tools and source code.

There are a number of firmware project templates that are good starting points for products in your subversion tag in /firmware/project/template and the scripts used for creating from template are in /firmware/project.

TCAT also provides firmware Development Services under contract.

3.11 JTAG Debugging and Hardware Bring-up

The firmware has built-in support for serial debugging and flash updating via the CLI serial port. However, for new board bring-up you will have to load the firmware via JTAG at least once (assuming that the flash is not preprogrammed before assembly).

There are a lot of options for JTAG interface hardware. For details on using JTAG for bring-up and debugging, there is a lot of good information in the TCAT Forums, and you can look at the *Firmware Development Environment User Guide* and for those who want to use OpenOCD, you can look at DICE_OOCD_JTAG.pdf

https://dev.tctechnologies.tc/tcat/tags/release/public/latest/docs/firmware/DICE_OOCD_JTAG.pdf

During bring-up it is sometimes necessary to troubleshoot a new circuit board. We provide a utility that runs in on-chip RAM, which allows testing of the memory interfaces to the chip, and only requires proper lock, power and JTAG connections. You can look for in_ram_test in the *Firmware Development Environment User Guide*.

3.12 Get a 1394 OUI (Organizationally Unique Identifier)

Every shipping 1394 device must have a Worldwide Unique ID. The WWUID is a 64-bit number made up of your 24-bit company_id (the OUI) and the rest of the bits are assigned by you the vendor. TCAT has recommendations for allocating these bits, which can be found in the firmware. You can look in the *Firmware Development Environment User Guide* and in the firmware file targetVendorDefs.h.

The company_id is the same id that Ethernet Mac vendors use.

You can get an OUI here: <http://standards.ieee.org/regauth/oui/forms/>

In the firmware and other documentation, the `company_id` is the same thing as the `vendor_id`. Also the WWUID is also known as EUI64. To confuse things even more, the WWUID is sometimes called a GUID, which is incorrect but it's usually obvious what is meant by the context.

3.13 Send information to TCAT for customized Drivers

When you first begin using the repository you will work from a generic tag, which has source code and drivers with TCAT vendor information.

Once you have an OUI, and have determined your product line naming and device information, you can send us your modified version of the file `tcat_dice_myproduct.h`, which is in the repository in the top-level `/interface` directory. This file specifies your vendor id, vendor strings, product names, etc. Also, at your option, you can customize the MIDI product and port names for each device supported by your driver. For details, you can read this document in your subversion tag: `/docs/developer/host/MIDI_Name_Customization.pdf`

We keep this file in a private customer branch and our build system creates a custom private tag for you. The tag will have drivers that are built for your vendor info and are ready to distribute to your customers (after QA at your company of course). You then switch from the generic tag to your custom tag and continue as usual.

3.14 Send information to TCAT for customized Control Panel

TCAT provides a Control Panel application as part of the driver installers, for Mac OSX and Windows. You can choose to customize the Control Panel in a lot of ways, such as color scheme, vendor strings and logo, which features are visible to end-users, and the some default behaviors. To customize the Control Panel, you can make changes to a companion XML file, which is read each time the Control Panel is launched. For vendors who don't wish to write their own control panel, this makes a good option and since you are not recompiling it for your use, then you can use it under our existing JUCE license (see licensing above). For details on the customizable XML file, see the document *CPL_Overview_and_Customization.pdf*, which is in your repository tag in `/docs/developer/host/`

Once you have made the customizations, you can send us the modified `cpl.defs` file and it will be included in your custom driver installers.

3.15 Driver Signing

Windows Vista 64-bit requires signed drivers, and TCAT provides signed drivers and installers for you. However, we sign them with our own certificate, so end-users will see our vendor information if they are asked to confirm things during installation or otherwise examine the driver files.

If you want to sign the drivers and installers yourself, we provide all of the parts and pieces needed for this in your tag, as well as a script to rebuild the installers. Then all

you need is a signing certificate for your company and to read this document in your subversion tag: /docs/developer/host/Driver_Signing.pdf

3.16 Develop Host Software

Most applications will interact with DICE devices through the PAL C++ API, which abstracts driver ioctl's and platform differences for Mac OSX and Windows. It also makes it easy to write firmware loader utilities, etc. The PAL sources are located in your tag in /host/pal. The sources are commented with doxygen tags, so the documentation is always up to date with each release. We keep the latest doxygen-generated doc's online in your subversion tag in /docs/public/pal/html/index.html

Also note that in the Control Panel Application, there is an event/listener layer, which also does not assume a specific GUI framework. This later takes care of notifications from the driver and handles device instance and reference counting, and can save a lot of time for developers who need this in their own control panels or other applications.

All of our GUI examples are written with the JUCE API, and the dice command-line tool is a good starting point for developers who want to write command-line applications.

The /host tree contains scripts that build all of the examples and libraries for all of the supported operating systems and variants. The XCode and Visual Studio projects are included as well.

You can also find a lot of information and how-to's in our forums regarding the host sources.

TCAT also provides Host Software Development Services under contract.

3.17 Test against TCAT driver Release, submit feedback as needed

TCAT does a great deal of automated and manual testing of the drivers, and it is still essential for you to test the drivers as well and to send us feedback when you discover an issue. The current driver release will be in your subversion tag in /binary/drv

For driver issues, you can send an email to support@tctechnologies.tc or to the engineers that you've already been working with at TCAT.

3.18 Create Factory Load and Test

For production, manufacturers usually create a flash image with the boot loader, application image, setup file, and other files. The image is preprogrammed into flash

parts before assembly. The setup file contains a serial number (which is also part of the required WWUID), which is set to a unique number during the hardware test.

For manufacturers who wish to exercise, test and configure the device via 1394 during production they can put together a Host application fairly quickly using the PAL and the dice tool as starting points.

The PAL is in your subversion tag in /host/pal, and the 'dice' command-line tool is in /host/tools/dice

You can also check the TCAT Forum scripts for volume production related discussions. Some people have posted some host-side scripts that do a lot of common production tasks.