PTXdist Application Note

Kernel Driver Development

Since kernel 2.4 the kernel build environment supports building kernel modules out-of-tree. This feature isn't only for convenience, it also simplifies and accelerates the development. There is no need for `make` to walk through the whole kernel tree to re-compile one driver source file only. This application note describes how to integrate driver development into PTXdist's build environment.

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We can use this feature for our own kernel driver development within PTXdist. This will simplify and automate the required steps to transfer the new module to our target for test purposes.

Preparations

To start development of a module we create a folder anywhere we like. Mostly we are using a subfolder in our own active project:

```
project$ mkdir -p local_src/module-template
```

To simplify a quick start PTXdist comes with two templates to be used to start a kernel driver development. We are copying these two files into our local directory:

```
project$ cp <ptxdist-installdir>/rules/templates/kernel/Makefile
     local_src/module-template/
project$ cp <ptxdist-installdir>/rules/templates/kernel/*.c
     local_src/module-template/
```

Note: Replace <ptxdist-installdir> with the path to your PTXdist installation.

That's all for our kernel driver development starting point.

Adding Build Support

In this step we integrate the new driver into PTXdist's build environment.

To do so, we change to the `rules/` directory in our active project and call `ptxdist` to create a new rule for us:

```
project$ cd rules/
project/rules$ ptxdist newpacket kernel_driver
```

This command will ask us some questions about the new rules file. We should answer them like this:

```
ptxdist: enter packet name.......: module-template
ptxdist: enter version number....: 0.1
ptxdist: enter URL of basedir....: file://$(PTXDIST_WORKSPACE)/local_src
ptxdist: enter packet author.....: Juergen Beisert
ptxdist: enter suffix............:
```

Note: The only important thing here is the URL of the basedir. It must start with `file://` to tell PTXdist's build environment this is not an archive to handle.
The `$(PTXDIST_WORKSPACE)` ensures to use always the base path to the active project. If the project will be move around in the filesystem, this avoids manipulations in the path.
We only enter `local_src` as a part of the path. The template assumes the source directory uses the same name as the packet name. If we are using different names we have to edit the `module-template.make` file manually. This command will create the file `rules/module-template.make` in the active project.
Note: If we are using the same names as mentioned here we do not have to change anything in these files.

> ⚠ There is a small but important difference when using `file://` or `file:///` to define the basedir. `file://` is used as a path in the current project directory, while `file:///` defines an absolute path.

Extending the Menu

To let PTXdist be aware of this new rule, we also need a file to extend its menu. It's also available as a template, so we can simply copy it:

```
project/rules$ cd ..
project$ cp <ptxdist-installdir>/rules/templates/kernel/*.in rules/
```

In the last step of integration we have to extend PTXdist's `Kconfig` to make our new menu extension visible. Prior to this step we must check if there is already a file called `Kconfig` in our active project. If not, we can copy a generic one:

```
project$ cp <ptxdist-installdir>/rules/templates/kernel/Kconfig .
```

If there is already a `Kconfig` present, we must extend this file to include the new `module-template.in` file into the project's menu. Add this command at the bottom of `Kconfig`:

```
source "workspace/rules/module-template.in"
```

For further details about menu extension please refer application note "Extending the Menu".

After it's done, we start PTXdist to check if it's now aware of our new driver.

```
project$ ptxdist menuconfig
```

See at the bottom of the menu list for the new entry. If it's present, ensure it's checked and leave the menu with saving the new configuration.

Note: At this point of time we always must save the configuration. Even if we do not change anything in the current menu settings! With our previous menu extension we change something in the internals of PTXdist. To make them valid we must save the configuration at least once.

Building the Driver

Now we are ready to start the build.

```
project$ ptxdist go
```

Important: The packet name, the directory name and the source file name must be equal (`module-template` in this example). Otherwise some modifications are required.

In case of trouble

- PTXdist is going to build the out-of-tree module before attempting to build the kernel.

  The out-of-tree module depends on an already built kernel. So this dependency must be present in the menu extension file. Add a
  ```
  select KERNEL
  ```
  into the menu entry that controls the out-of-tree module build.

- PTXdistdoes not find the driver sources.

  Maybe there is a typo in the settings so PTXdist searches for an invalid path. Open the `rules/module-template.make` rule file and check macro `MODULE_TEMPLATE` for a valid directory name. The `MODULE_TEMPLATE_URL` macro combines the basic path and driver's source directory and will be used to gain access to driver's directory. Check if this path is a valid one. Note: If you are using different names and paths than shown above, also the rule file and the macros are using different names.

Additional questions?

Below is a list of locations where you can get help in case of trouble. For questions how to do something special with PTXdist or general questions about Linux in the embedded world, try these.

Mailing Lists

About PTXdist in particular

This is an English language public mailing list for questions about PTXdist. See

> http://www.pengutronix.de/mailinglists/index_en.html

how to subscribe to this list. If you want to search through the mailing list archive, visit

> http://www.mail-archive.com/

and search for the list *ptxdist*.

About embedded Linux in general

This is a German language public mailing list for general questions about Linux in embedded environments. See

> http://www.pengutronix.de/mailinglists/index_de.html

how to subscribe to this list. Note: You also can send mails in English.

News Groups

About Linux in embedded environments

This is an English newsgroup for general questions about Linux in embedded environments.

comp.os.linux.embedded

About general Unix/Linux questions

This is a German newsgroup for general questions about Unix/Linux programming.

de.comp.os.unix.programming

Chat/IRC

About PTXdist in particular

irc.freenode.net:6667

Create a connection to the **irc.freenode.net:6667** server and enter the chatroom **#ptxdist**. This is an English room to answer questions about PTXdist. Best time to meet somebody there is at European daytime.

Miscellaneous

Online Linux Kernel Cross Reference

A powerful online cross reference.

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http://lxr.linux.no/blurb.html

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U-Boot manual (partially)

Manual how to survive in an embedded environment and how to use the U-Boot on target's side

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http://www.denx.de/wiki/DULG

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Commercial Support

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