

Embedded Kernel Back-Porting

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Simon Horman <simon@horms.net>
Horms Solutions Ltd.

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- Motivation
- Strategy
- Mechanism
- Example

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...or required features

Adding Features to an Old Kernel

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- Add in-house implementation directly to the old kernel
 - Perhaps the most obvious option
 - Optimal for lack of code reuse
- Backport implementation from mainline kernel
 - Mainline implementation may need to be made first
 - More opportunity for code reuse
 - More opportunity to leverage existing, open solution

- Backport small isolated components
- Full backport of targeted components;
- Selected backport of dependencies from other subsystems

- Individual drivers or subsystems

Backport Small Isolated Components

- Individual drivers or subsystems
- For a new board
 - Clock
 - SoC
 - Board
 - Serial driver
 - Then, SMP and other drivers

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Full Backport of Targeted Components

- Can we assume that most changes made mainline are either bug fixes or enhancements *and* that testing will show up any regressions?
- If so, it would appear to make sense to make a full backport of a component from mainline.
 - Backport all patches
 - Reduces the scope for conflicts

Selective Backport of Dependencies

- Constrains the overall scope of the backport

- Obtain List of Target-Files
- Mine Patches from Git
- Apply Patches
- Conflict Resolution Strategies
- If at First a Backport Fails

Obtain List of Target-Files

- Obtain a list of files that are directly related to the component to be backported
 - Be aware that files are added, removed and renamed over time
 - Find all file names used between the source and target kernel versions
 - Ask people who know the code for guidance
 - Kconfig and Makefiles are often too hot to be useful

- Use git to obtain a short-list of patches

```
git log --oneline v3.0..v3.4 -- fileA fileB ...
```

Apply and Manage Patches

- `git cherry-pick -xs` + `git rebase -i`, `quilt`, ...

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- `git cherry-pick -xs + git rebase -i, quilt, ...`
- It is useful to:
 - Note the commit id of the patch in mainline
 - Note any conflicts
 - Sign off the patch, presumably you will distribute it to

Sample Changelog

commit 37e7a4e1eddd663a2c5fddaabf80598f204fea62

Author: Paul Gortmaker <paul.gortmaker@windriver.com>

Date: Sun Jul 31 16:17:29 2011 -0400

arm: Add export.h to ARM specific files as required.

These files all make use of one of the EXPORT_SYMBOL variants or the THIS_MODULE macro. So they will need <linux/export.h>

Signed-off-by: Paul Gortmaker <paul.gortmaker@windriver.com>
(cherry picked from commit dc28094b905a872f8884f1f1c48ca86b3b78583a)

Conflicts:

arch/arm/common/it8152.c

Signed-off-by: Simon Horman <horms@verge.net.au>

Conflict Resolution Strategies

- Drop the patch
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 - Is this a tree-wide patch with only a small portion in scope?
- Manually resolve conflict
 - Is this hot file? Kconfig, Makefile, ...
- Add dependency
 - Is some new infrastructure or helper-function required?

- Incremental Backports
 - Are there a large number of patches?
 - Backport to an intermediate kernel version.
 - Backport from 3.4 to 3.0, then 2.6.35;
 - Backport from 3.4 to 3.3, then 3.3, to 3.2;...
 - Can be time consuming

If at First a Backport Fails: Small Steps

- Incremental Backports
 - Are there a large number of patches?
 - Backport to an intermediate kernel version.
 - Backport from 3.4 to 3.0, then 2.6.35;
 - Backport from 3.4 to 3.3, then 3.3, to 3.2;...
 - Can be time consuming
- Bisection
 - Useful in conjunction with incremental backports
 - Can be very time consuming

If at First a Backport Fails: Change Scope

- Increase Scope
 - Does a dependency need to be satisfied by adding backport of another component?

If at First a Backport Fails: Change Scope

- Increase Scope
 - Does a dependency need to be satisfied by adding backport of another component?
- Decrease Scope
 - Are there too many unnecessary changes.
 - Could dependencies be provided by a selective backport instead of a full backport?

If at First a Backport Fails: Seek Advice

- As for guidance from someone familiar with the mainline code

Example

Backport of CMT timer driver from 3.4 to 3.0

- Simple real-world example

- `include/linux/sh_timer.h`
- `include/linux/sh_cmt.h`
- `drivers/clocksource/sh_cmt.c`

Patch Short-List

```
$ git log --oneline --no-merges v3.0..v3.4 -- \
    include/linux/sh_timer.h include/linux/sh_cmt.h \
    drivers/clocksource/sh_cmt.c
615a445 PM / shmobile: Make CMT driver use pm_genpd_dev_always_on()
7deeab5 drivers/clocksource: Add module.h to those who were using it
    implicitly
3f7e5e2 clocksource: sh_cmt: wait for CMCNT on init V2
```

Apply Patches

```
$ git checkout v3.0 -b 3.0/cmt
Switched to a new branch '3.0/cmt'
$ git cp -xs 615a445 7deeab5 3f7e5e2
[3.0/cmt.tmp ab672c8] clocksource: sh_cmt: wait for CMCNT on init V2
Author: Magnus Damm <damm@opensource.se>
1 file changed, 32 insertions(+), 2 deletions(-)
[3.0/cmt.tmp 32fae08] drivers/clocksource: Add module.h to those who
were using it implicitly
Author: Paul Gortmaker <paul.gortmaker@windriver.com>
3 files changed, 3 insertions(+)
[3.0/cmt.tmp 68f65b2] PM / shmobile: Make CMT driver use
pm_genpd_dev_always_on()
Author: Rafael J. Wysocki <rjw@sisk.pl>
1 file changed, 4 insertions(+)
```

Preliminary Backport Complete

Now to test and submit to LTSI for others to enjoy

Questions?