Upstreaming 101

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Introduction

- This presentation is focused on upstreaming the Linux code
- What means upstreaming ?
- The Linux kernel development cycle
- The Linux kernel code organization
- Contributions
- Writing one patch
- Writing several patches
- Conclusion
- Introducing Upstreaming 201

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What is upstreaming ?

- Bring your private changes to the mainstream kernel
- Be prepared to:
  - restart from scratch
  - change your approach
  - be part of the OSS community
- No deadline, no schedule, no obligation to take a patch
  - Linux is evolution, best proposed solution wins
  - Consensus is the key

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Why upstream ?

- The Linux kernel has one rule: no regression
  - The community won't break your code
- The submitted code will be reviewed in detail
  - Better quality
- The community will give support
  - Better knowledge
- Stop porting out of tree code to newer kernel
  - Save money and effort

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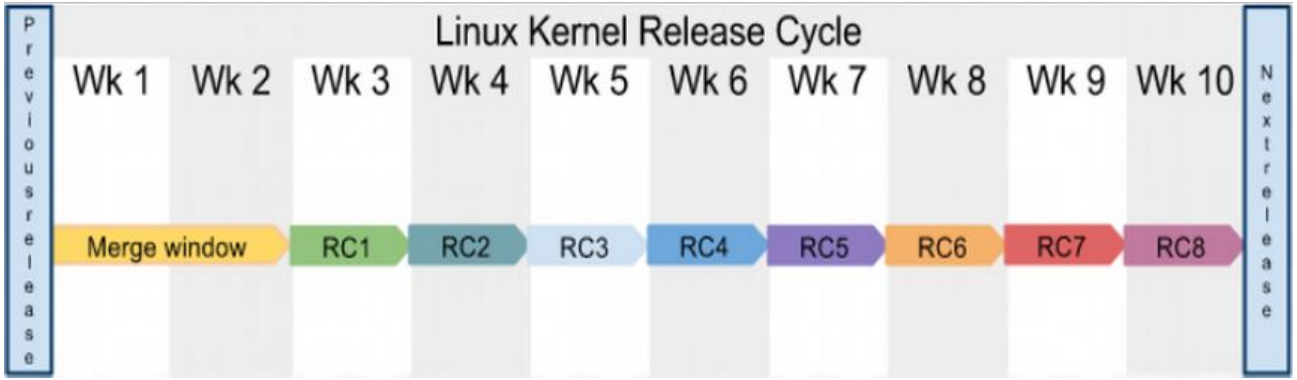
The Linux kernel development cycle

1. Iterative release candidates: v4.10-rcX, up to -rc8
   - Usually every Sunday
2. New release: v4.10
3. Merge window
4. New release candidate: v4.11-rc1
5. … and so on



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The Linux kernel development cycle

- A new release every 3 months
- When to send patches?
  - Fixes: anytime
  - New code and cleanup: depend on the maintainer
- How long is the merge window?
  - The merge window lasts two weeks
- How to know if the merge window is happening?
  - As soon as there is a new release
- How to know if the merge window is finished?
  - As soon as there is a -rc1

The Linux kernel development cycle

- Automatic with a RSS feed:
  - https://www.kernel.org/feeds/kdist.xml
- Manually by polling:
  - https://www.kernel.org/

Protocol	Location
HTTP	https://www.kernel.org/pub/
GIT	https://git.kernel.org/
RSYNC	rsync://rsync.kernel.org/pub/

Latest Stable Kernel: 4.9.10

mainline:	4.10-rc8	2017-02-12	[tar.xz]	[pgp]	[patch]		[view diff]	[browse]
stable:	4.9.10	2017-02-14	[tar.xz]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse] [changelog]
longterm:	4.4.49	2017-02-14	[tar.xz]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse] [changelog]
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linux-next:	next-20170216	2017-02-16						[browse]

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Linux-next : catching the issues early

- Linux-next integrates all the different trees
  - Kudos to Stephen Rothwell
- Image of the future Linux release ahead of the schedule
- Testing with this tree allows to catch the bugs before they hit mainline

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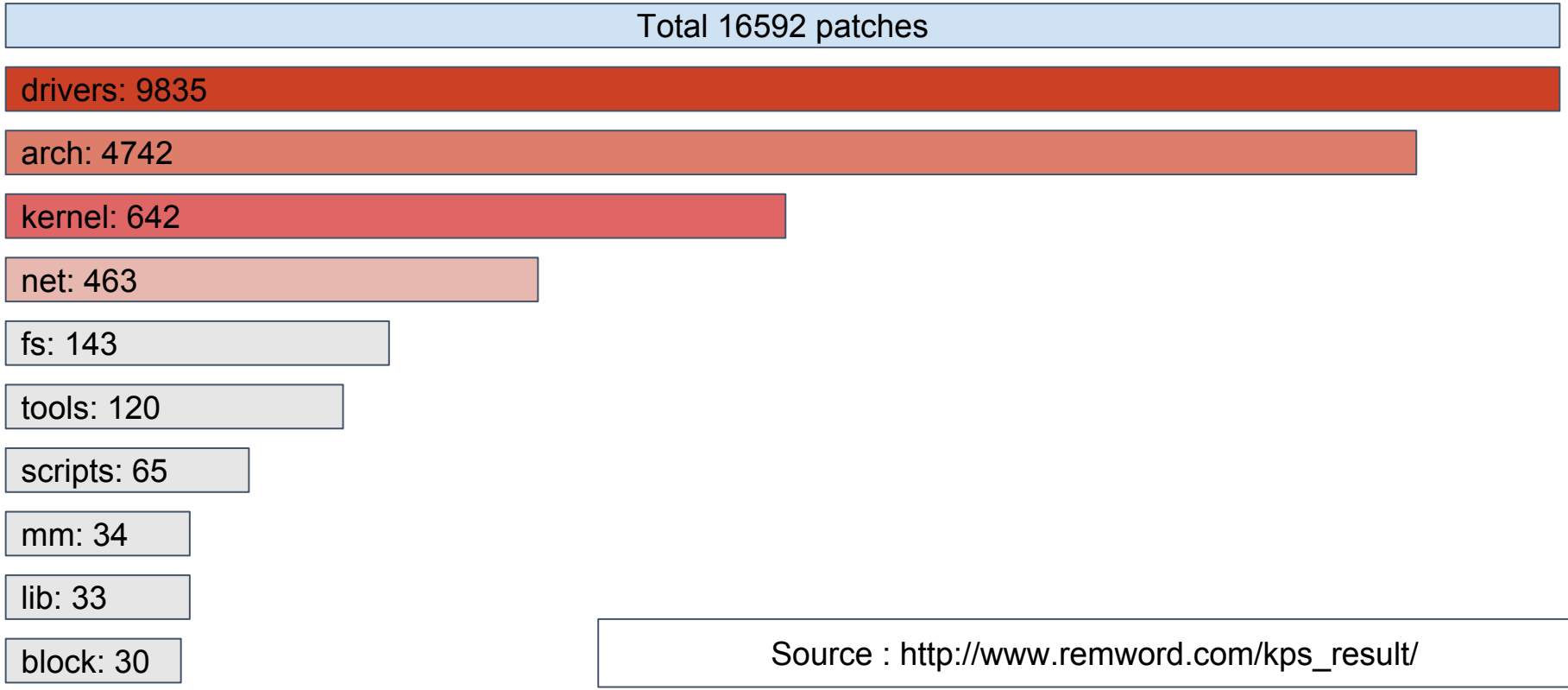
How to start contributing ?

- Code review
  - Cleanups
  - Trivial fixes
  - Potential issue
- Compilation test coverage
  - Cross compile and fix errors / warnings
  - Use rare compilation option (eg. headers_check, sparse, …)
- Communicate
  - Dig into mailing lists to help people
  - Review patches
- Test linux-next
  - Boot and fix bugs
  - Report compilation warnings
- Debug
  - https://**bug**zilla.**kernel**.**org**

Linaro contribution for 4.9



Source : http://www.remword.com/kps_result/

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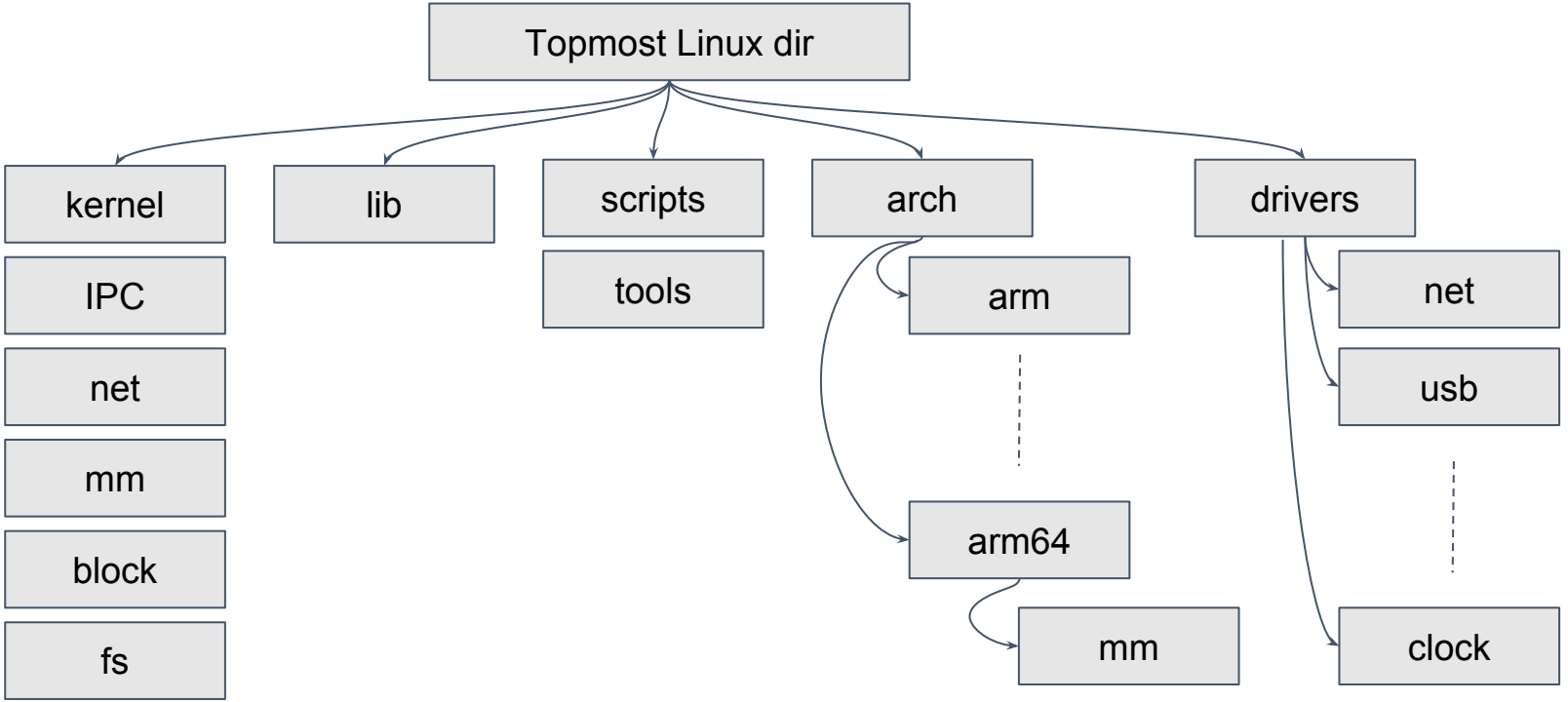
Linux code organization

- Huge number of files, more than 40,000

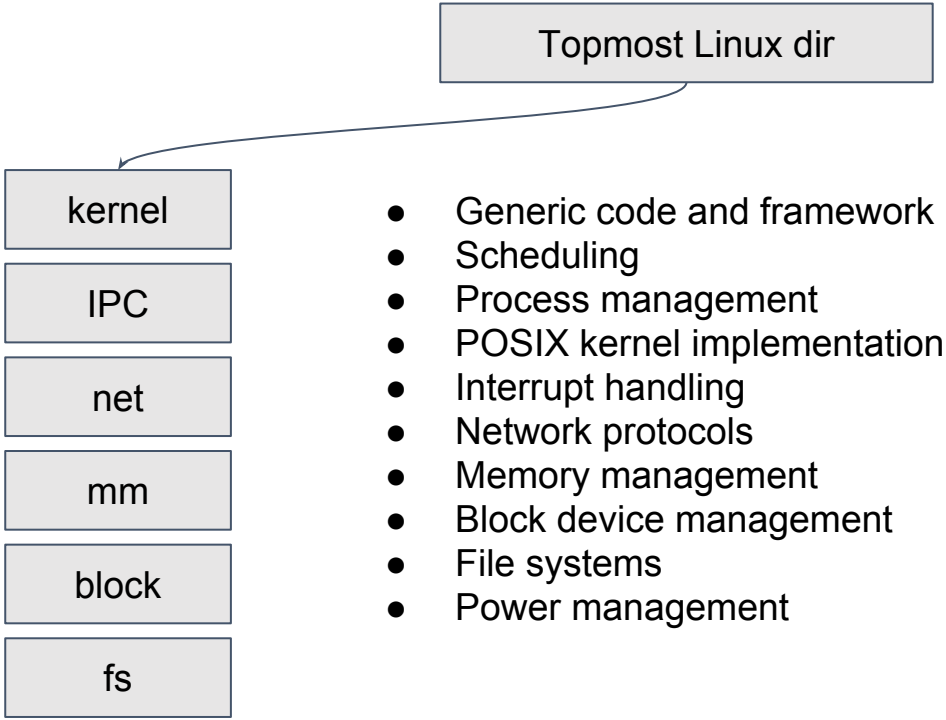
- Organized in subsystems

- Posix implementation
- Architecture specific
- Frameworks
- Drivers
- Network stack

Linux kernel code organization

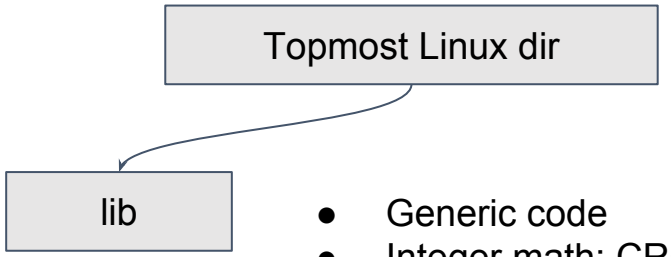


Linux kernel code organization



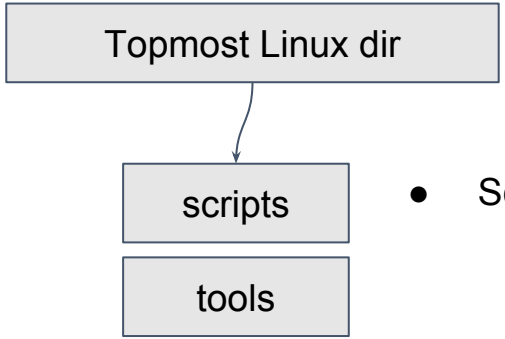
- Generic code and framework
- Scheduling
- Process management
- POSIX kernel implementation
- Interrupt handling
- Network protocols
- Memory management
- Block device management
- File systems
- Power management

Linux kernel code organization



- Generic code
- Integer math: CRC, div
- List manipulation, red-black tree
- String manipulation
- … a lot of useful functions

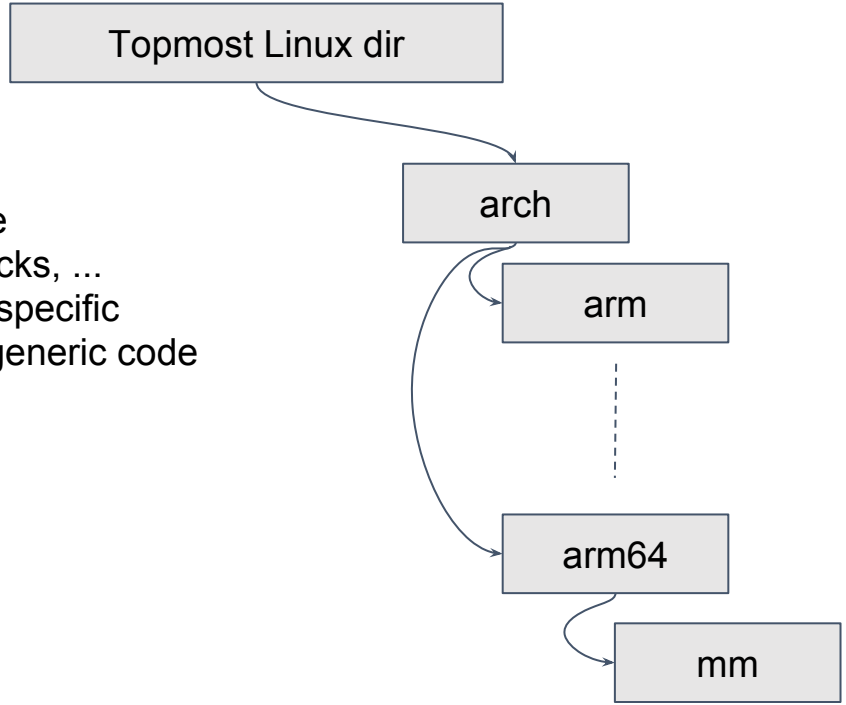
Linux kernel code organization



- Scripts to help making Linux better
  - Patch checking, header check
  - Kernel symbol size comparison
  - ...
- Userspace tools with a dependency on the kernel sources

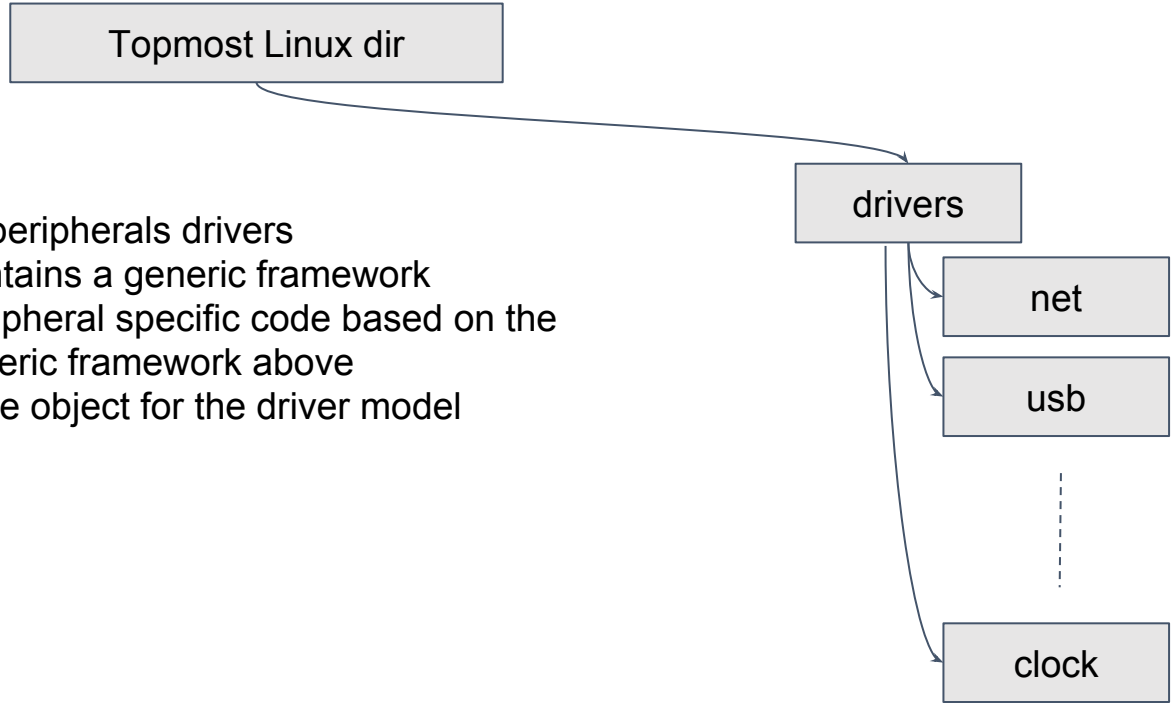
Linux kernel code organization

- Architecture specific code
- Memory management, locks, ...
- Everything which is arch specific
- Fills the gaps left by the generic code



Linux kernel code organization

- All peripherals drivers
- Contains a generic framework
- Peripheral specific code based on the generic framework above
- Base object for the driver model



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What is a maintainer ?

- Responsible of a part of the Linux kernel code
- Ensure the code complies with some rules:
  - Coding style
  - Consistency
  - Consensus
  - Technically relevant
- A maintainer is a gatekeeper

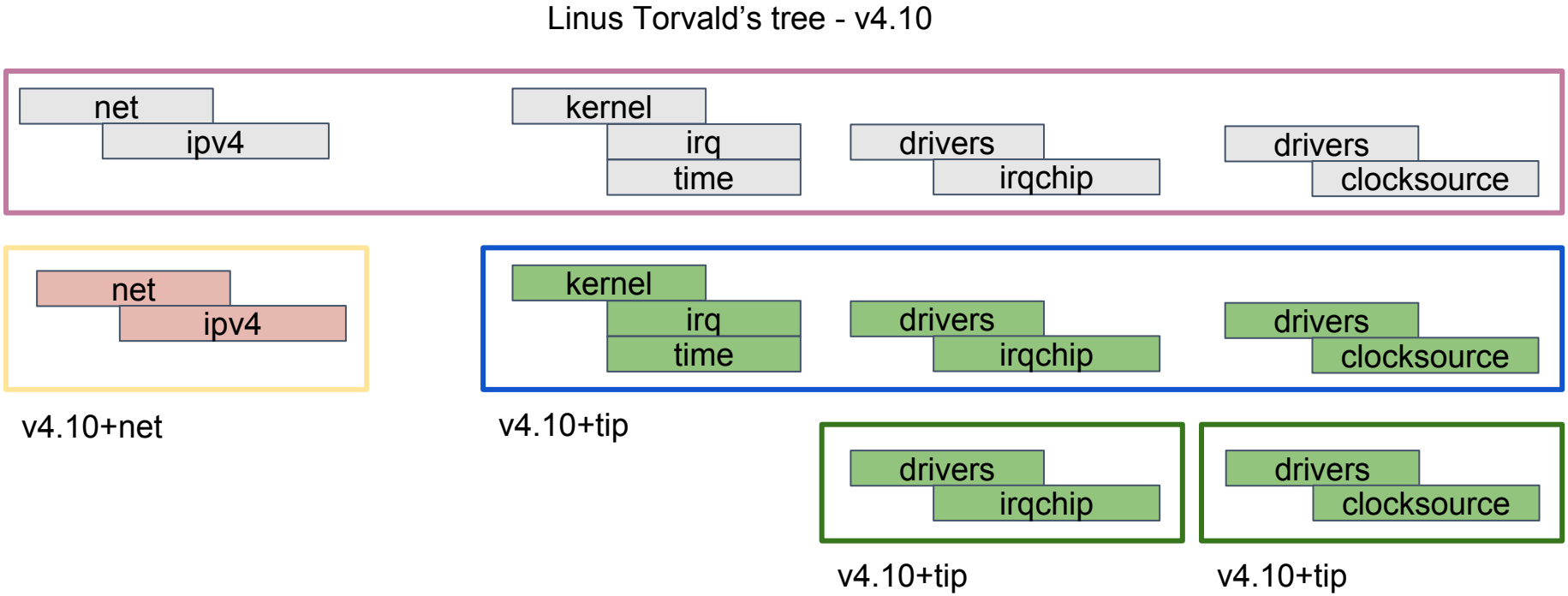
Maintainership

- Each directory falls under the umbrella of a maintainer
- Each maintainer has its own tree
- Each proposed change must stick to the relevant tree

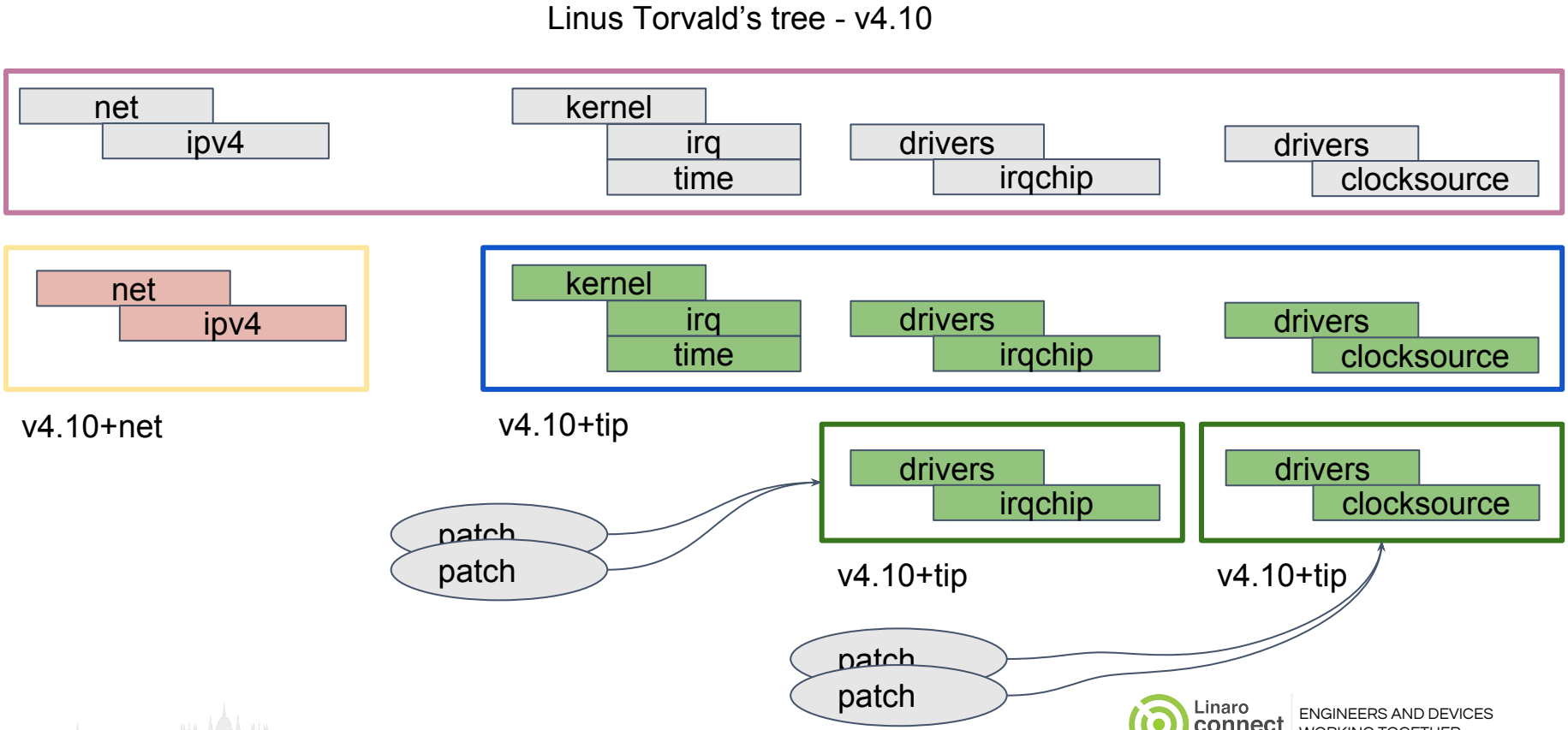
- After a kernel release, all the maintainers' tree are merged together : it is the merge window
- Topmost maintainer is Linus Torvalds

- All maintainers are listed in the MAINTAINERS file

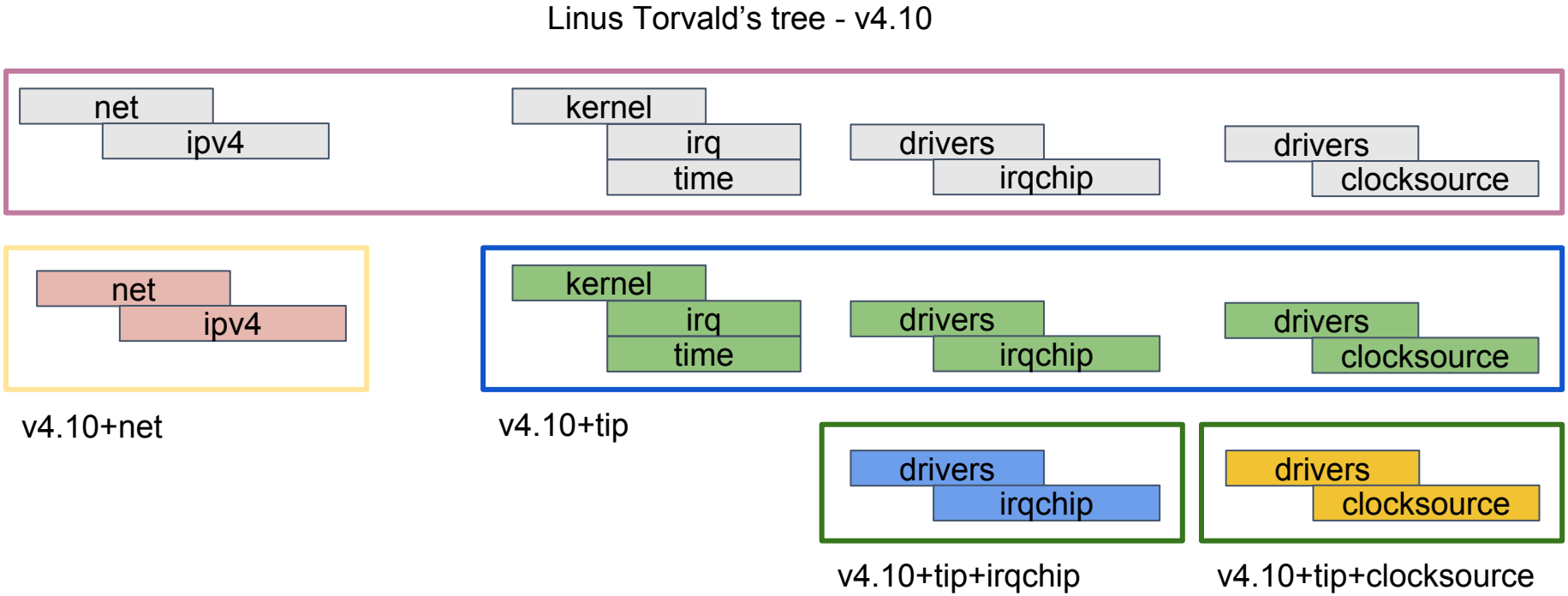
Example of a merge process



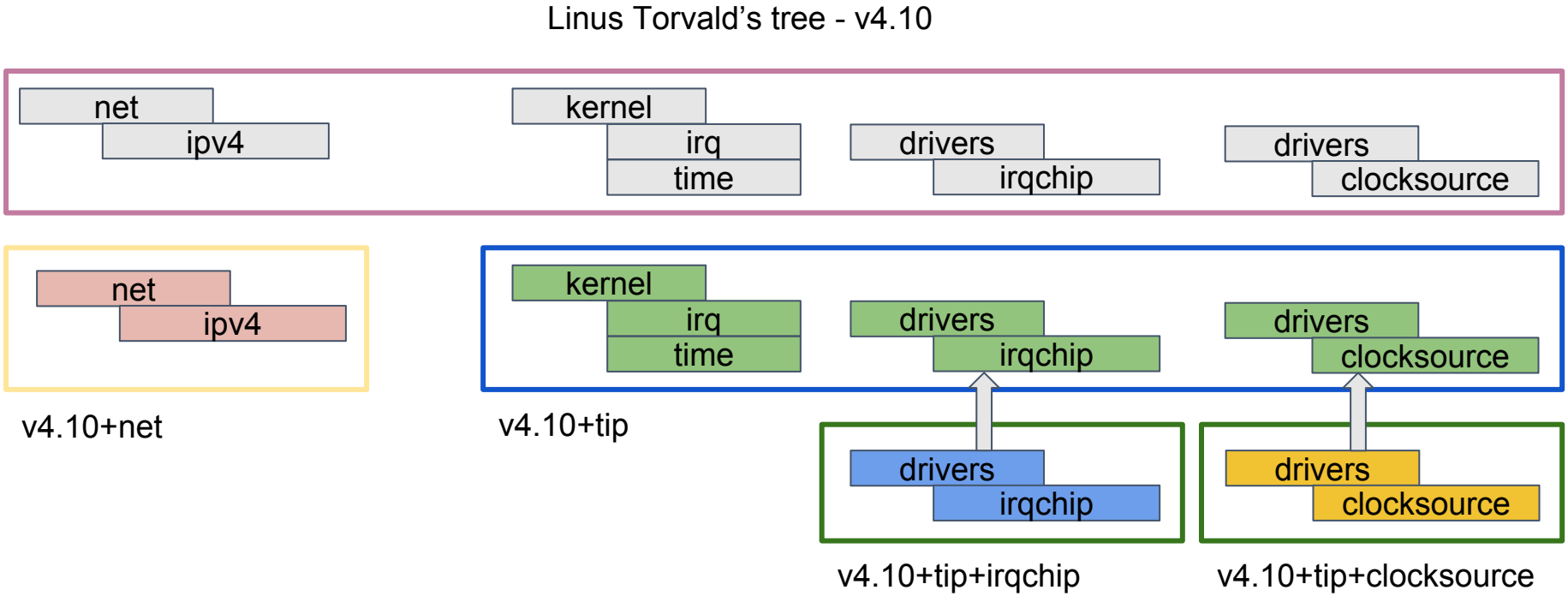
Example of a merge process



Example of a merge process



Example of a merge process - step 1



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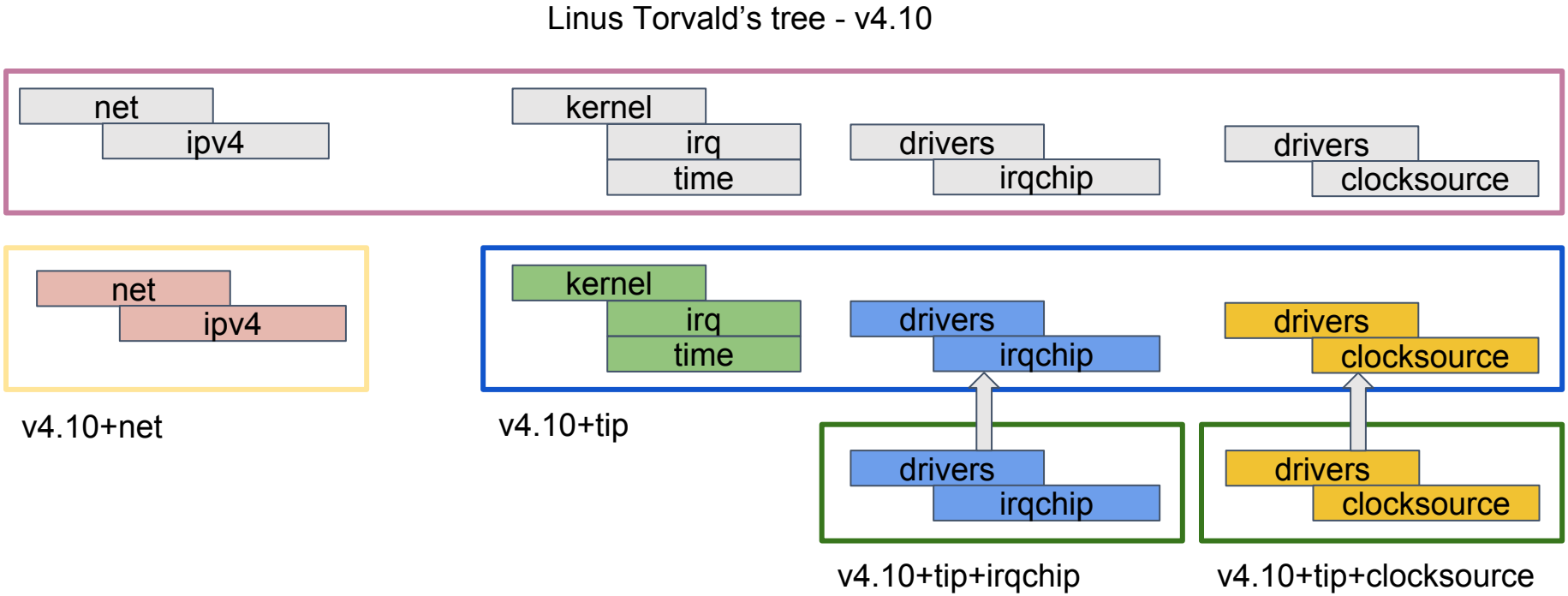

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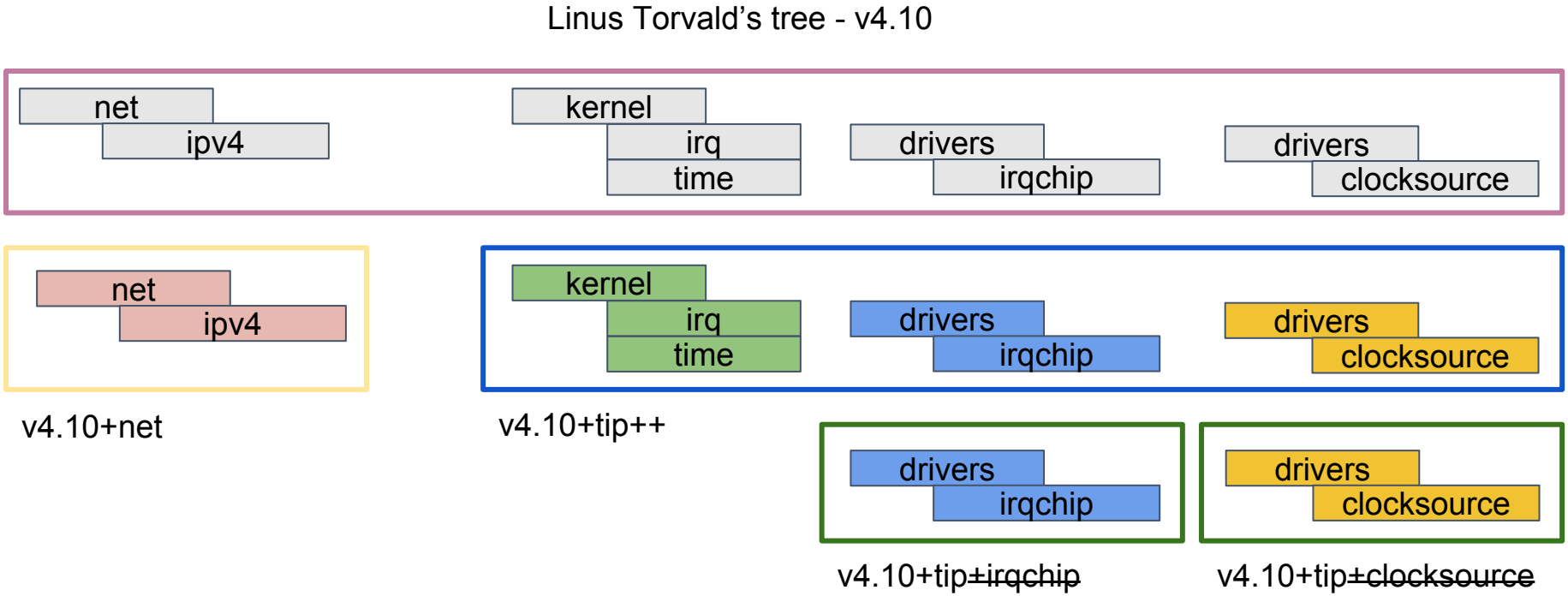
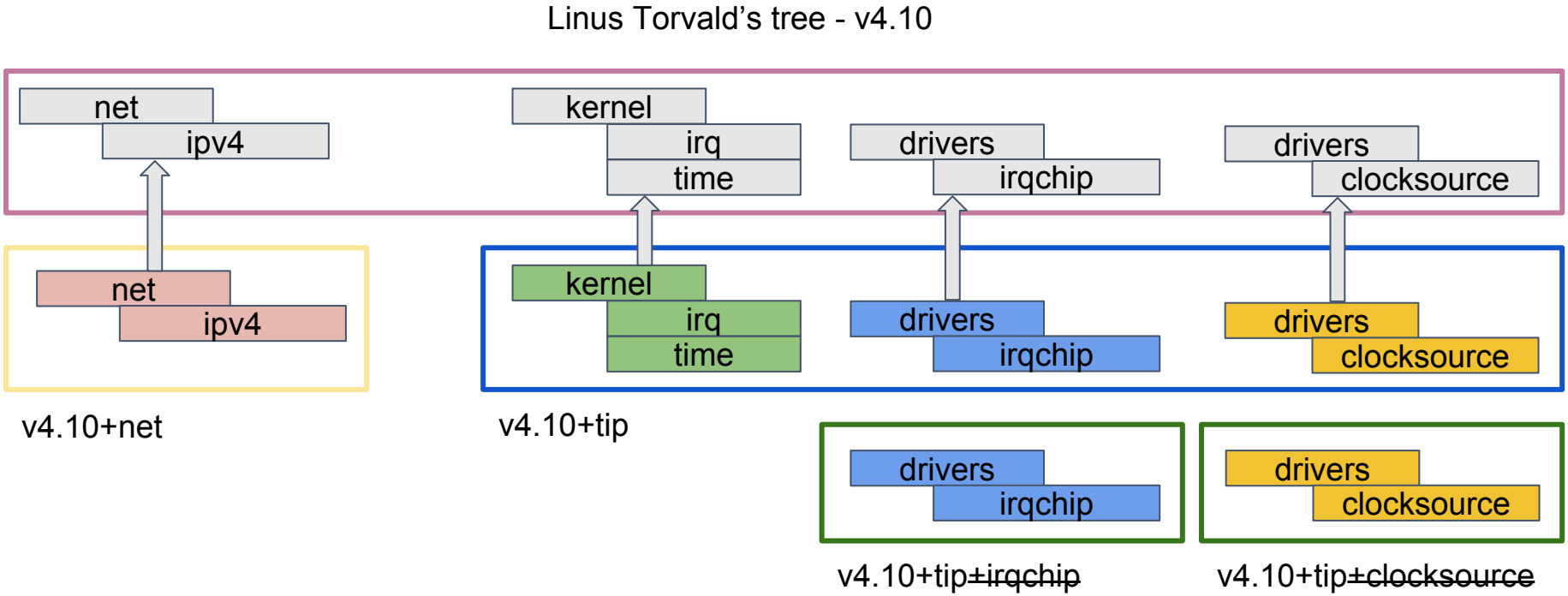
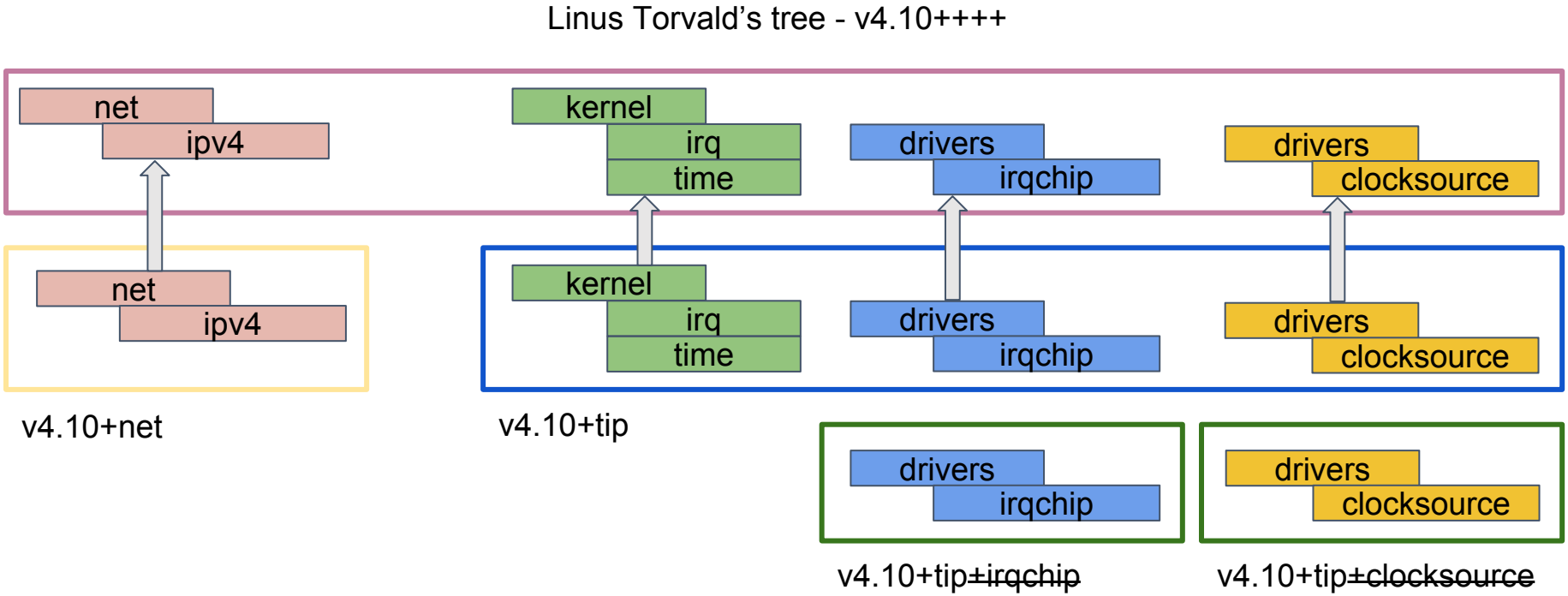


Example of a merge process - step 2



Example of a merge process - step 2



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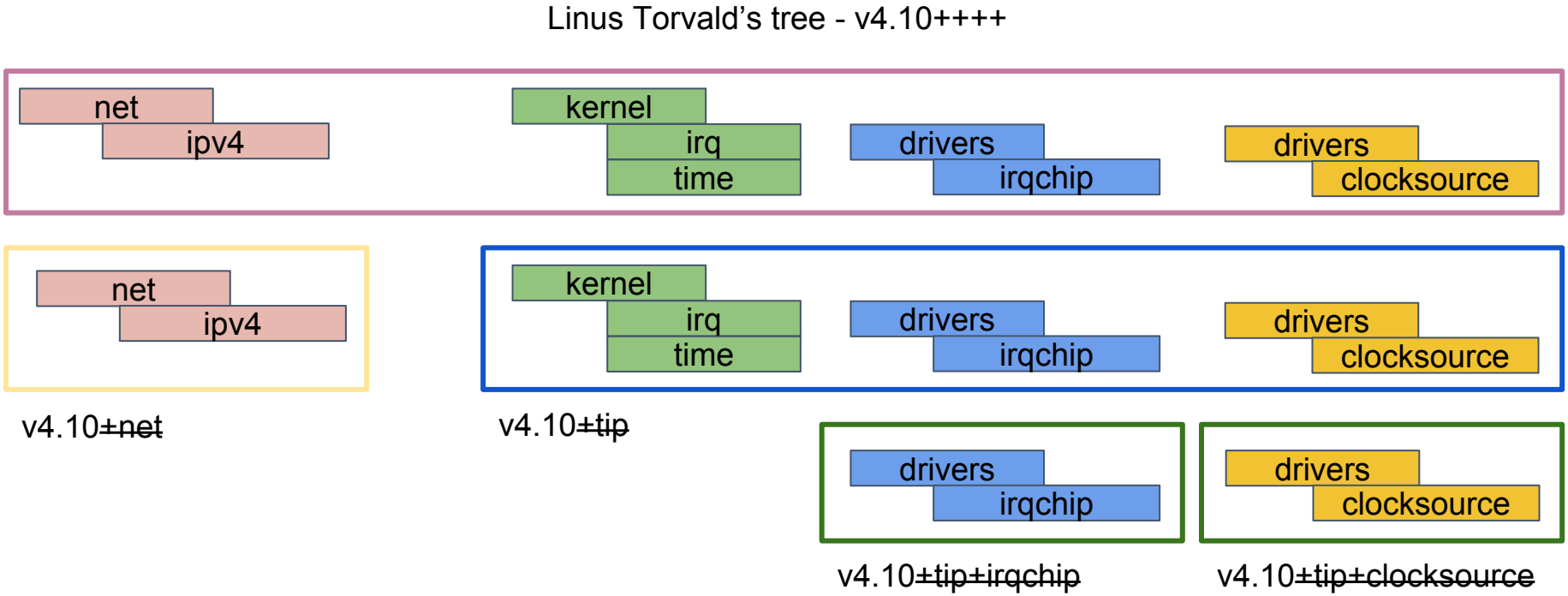
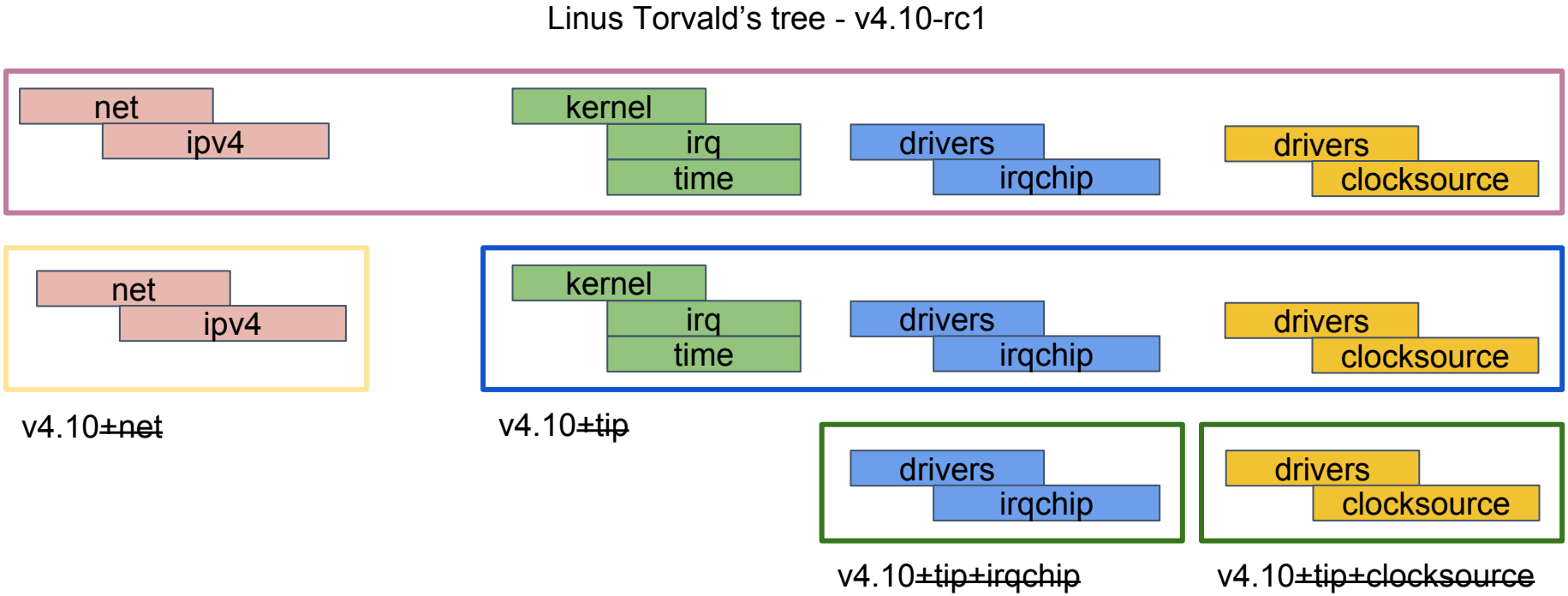


Example of a merge process - step 3



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Communication

- All development communication through the mailing lists
  - Important mailing lists for Linaro: lkml@, lakml@
  - MAINTAINERS file gives the subsystem <-> mailing list
  - http://vger.kernel.org/vger-lists.html
- Public discussion, no point-to-point
  - Reply-all always
- Opensource events: Linux Plumbers Conference, Embedded Linux Conference, Linaro Connect

Where to begin ?

- Send a simple contribution
  - But don't flood with too trivial patches
    - Read trivial@kernel.org rules

- One example with a checkpatch script
  - Run it in a directory where you will be working in the future
    - Eg. drivers/acpi
  - Target one ERROR spotted by checkpatch
  - Beware of false positives

```
for i in $(ls drivers/acpi/utils.c); do
        ./scripts/checkpatch -f $i
done
```

A simple contribution

- Compile, test first and then commit
  - Even if the change is trivial
- Write a nice description:
  - Why and what
  - One simple sentence prefixed with the subsystem name ...
  - … followed by a more detailed description

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A simple contribution

- Read the Digital Certificate of Origin:
  - Documentation/process/submitting-patches.rst
- Make sure you fully understand what that means
  - You are legally responsible of your changes
- When committing, add your Signed-off-by
- Don’t send more than 2 trivial changes

A simple contribution

- A list of examples:
  - https://goo.gl/q7NqcZ : Fixing checkpatch errors
  - https://goo.gl/JCn2y : Fixing missing kfree
  - https://goo.gl/ASrbOU : Remove unused parameter
  - https://goo.gl/uiktEV : Remove pointless code

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A more complex contribution

- Split the changes into several patches
- Bring the changes step by step, incremental changes
- Make sure the changes are git-bisect safe
  - Not following this rule will hurt your karma in the community
- Set the scene by cleaning up the place before sending a complex contribution

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A more complex contribution

- Some examples:
  - Changing the loopback to be multi-instantiated:
    - https://goo.gl/q6w1Ay : Change the static variable to a pointer
    - https://goo.gl/tdNth4 : Dynamically allocate the loopback
  - A cleanup to catch clocksource initialization error
    - https://lkml.org/lkml/2016/6/16/781
  - A very complex change for CPU hotplug:
    - https://goo.gl/c2NpDY : A long description of the changes

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Before going to Upstreaming 201

Be sure you have the right mindset

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Be altruist

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Be polite

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Be patient

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Be humble

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Be factual

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Always take into account the comments

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Before going to Upstreaming 201

- Read all the documentation Documentation/process/*:
  - Coding style rules
  - Give all the details introduced in this presentation
  - Digital Certificate of Origin

- More material at:
  - https://kernelnewbies.org

Before going to Upstreaming 201

- Ready to send patches for review ?
  - No … I'm scared of what they'll think of my code
- Be sure you have the right mindset:
  - Be altruist
  - Be polite
  - Be patient
  - Be humble
  - Always take into account the comments
    - You can disagree, stick to technical reasons
  - Comments can be harsh, stay polite and factual
    - Stick to technical reasons
  - Don't be afraid, increase self confidence
    - Read the kernel documentation
    - Be altruist to encourage yourself to have a positive attitude

Thank You

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BUD17 keynotes and videos on: connect.linaro.org