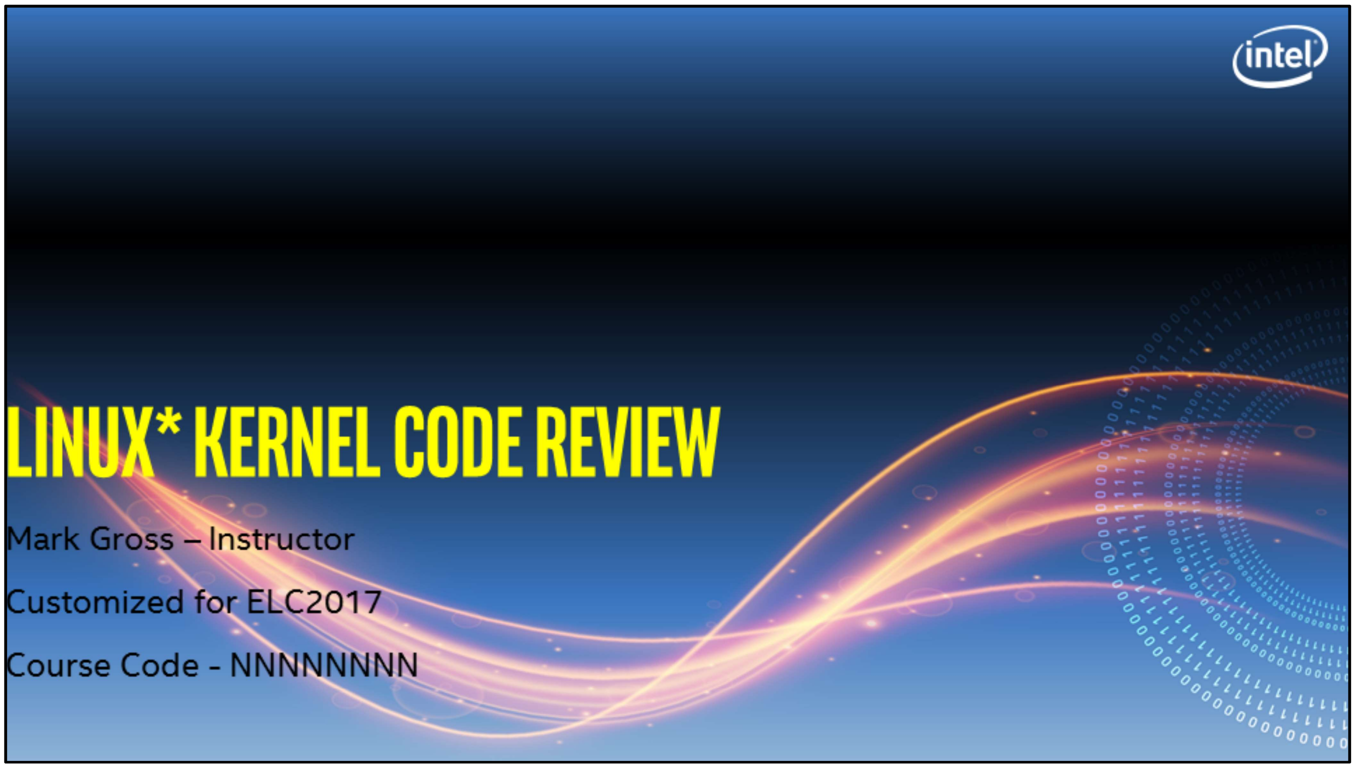
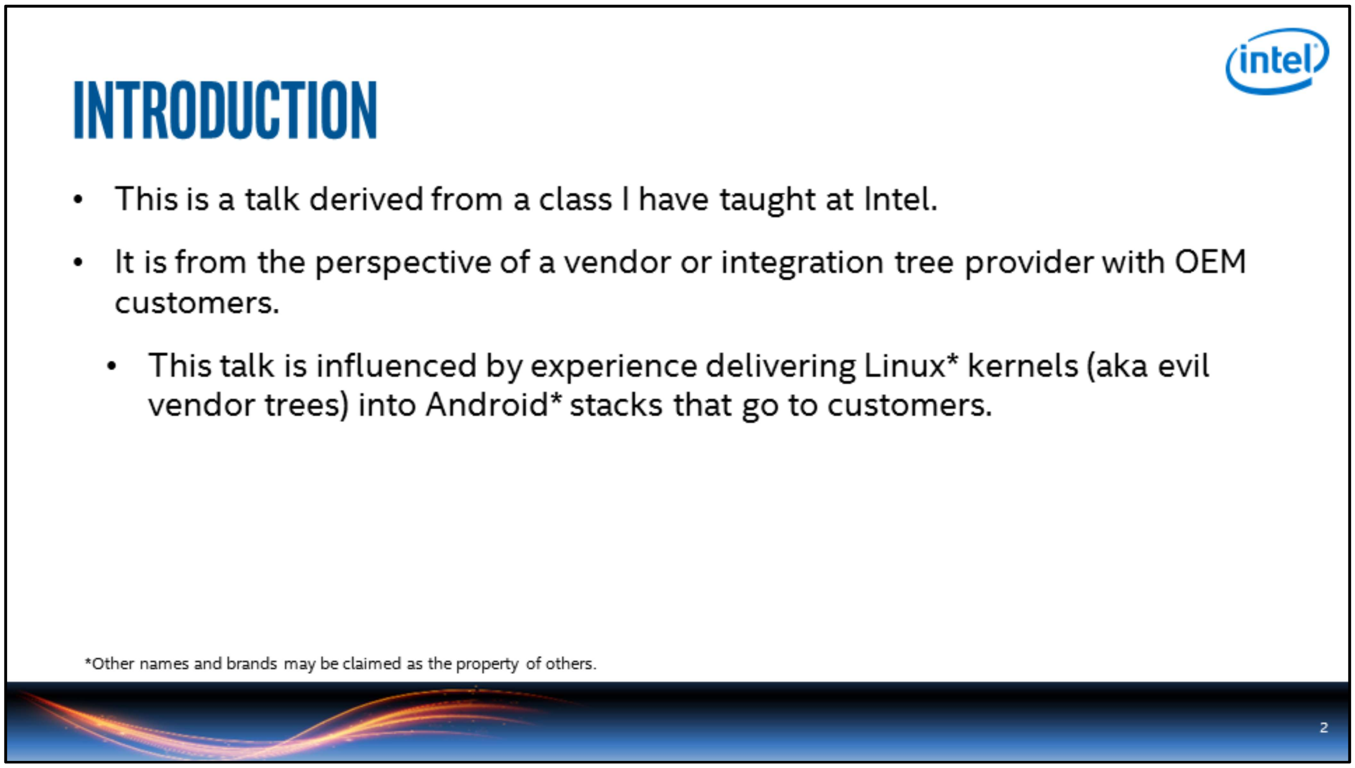


LINUX* KERNEL CODE REVIEW

Mark Gross – Instructor

Customized for ELC2017

Course Code - NNNNNNNN



INTRODUCTION

- This is a talk derived from a class I have taught at Intel.
- It is from the perspective of a vendor or integration tree provider with OEM customers.
  - This talk is influenced by experience delivering Linux* kernels (aka evil vendor trees) into Android* stacks that go to customers.

*Other names and brands may be claimed as the property of others.

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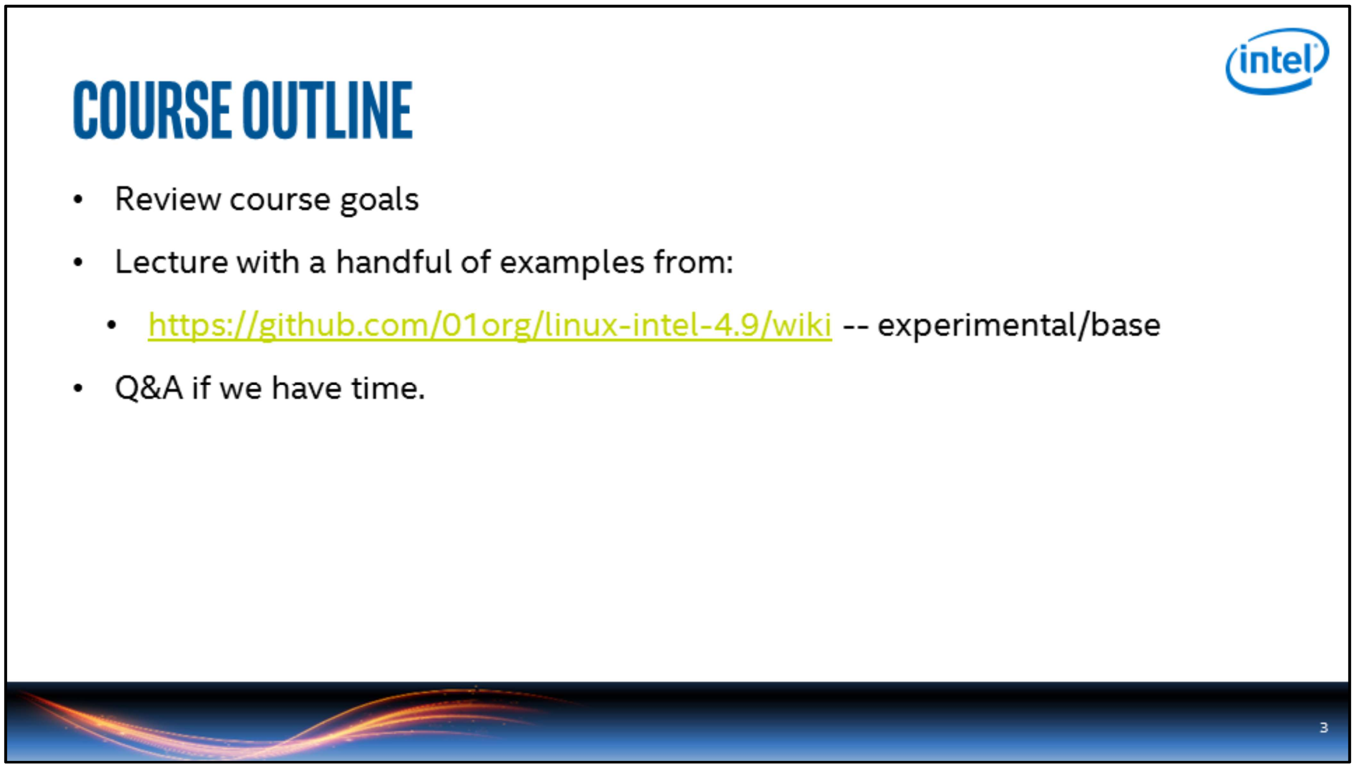
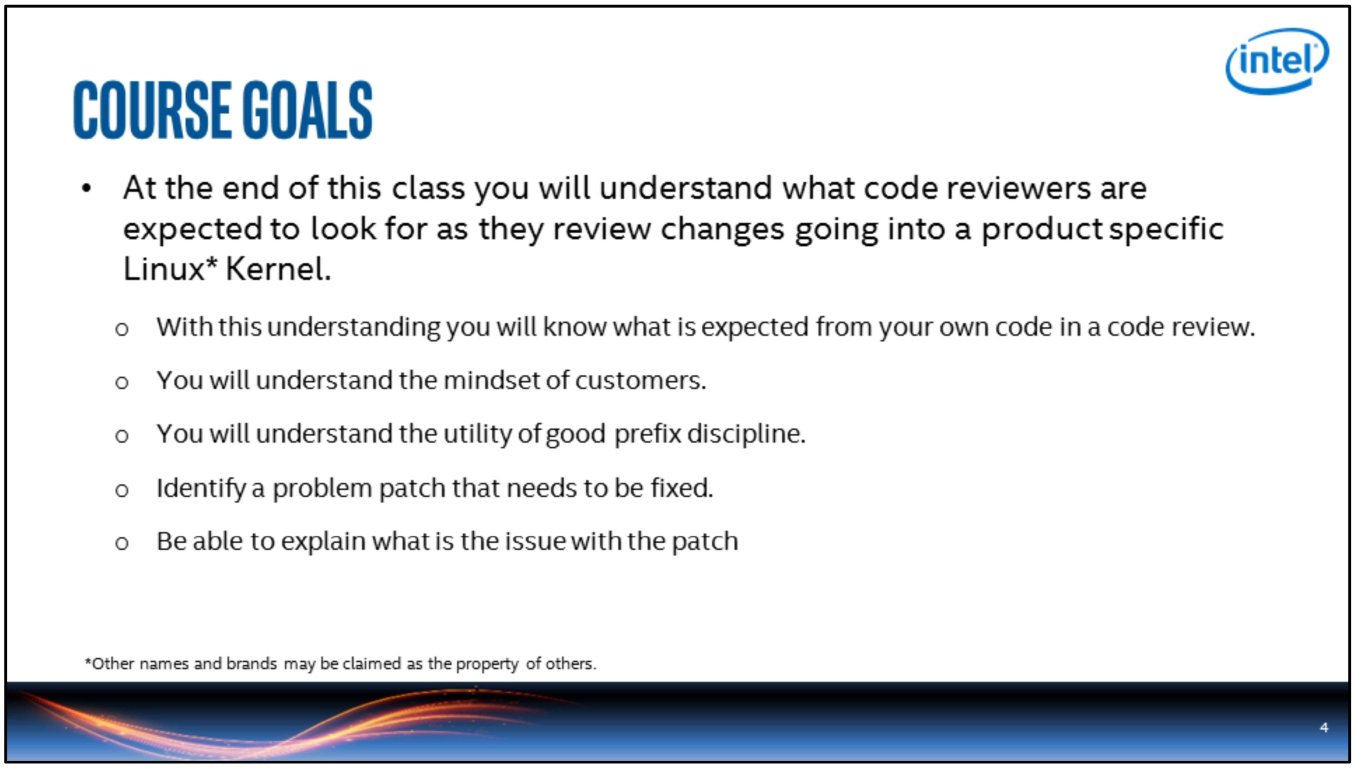


COURSE OUTLINE

- Review course goals
- Lecture with a handful of examples from:
  - https://github.com/01org/linux-intel-4.9/wiki -- experimental/base
- Q&A if we have time.

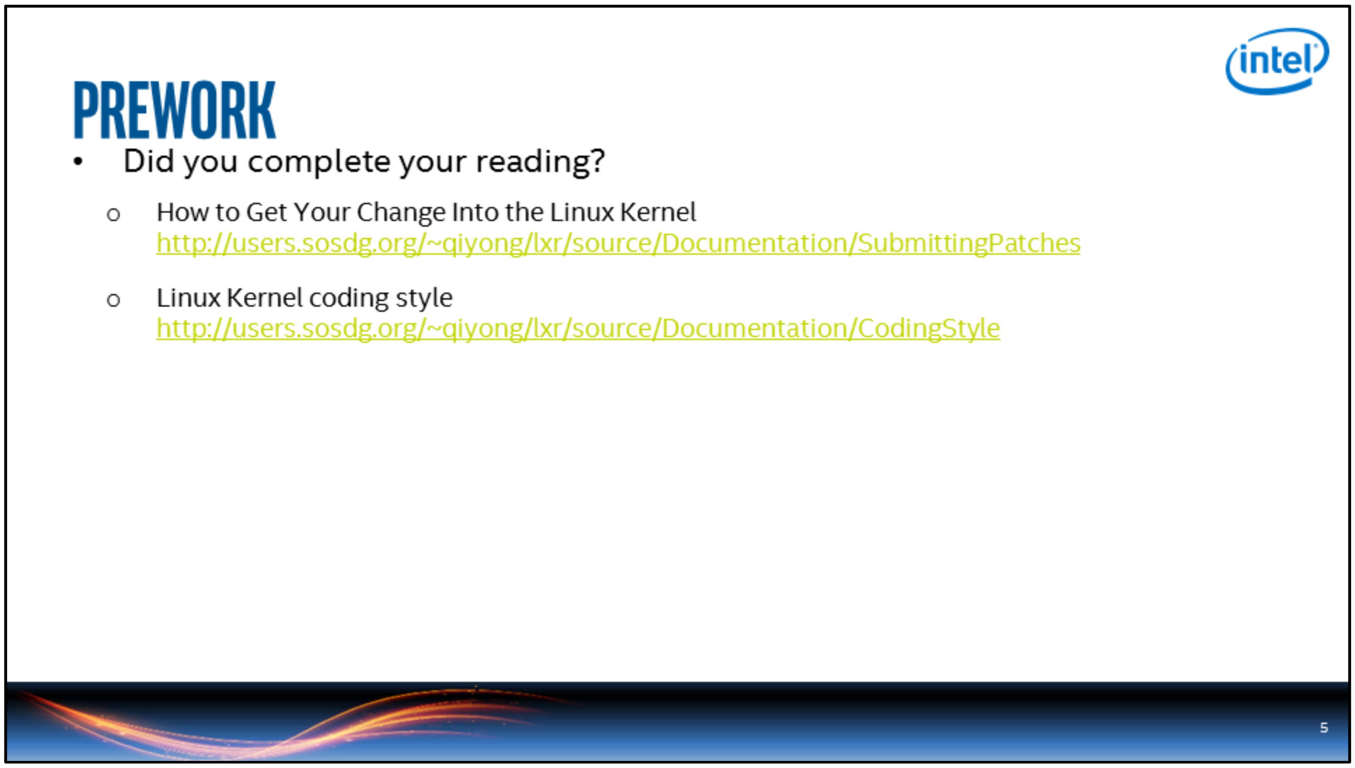
The examples are a bit tame. I wanted to limit my examples to publicly accessible code.



COURSE GOALS

- At the end of this class you will understand what code reviewers are expected to look for as they review changes going into a product specific Linux* Kernel.
  - With this understanding you will know what is expected from your own code in a code review.
  - You will understand the mindset of customers.
  - You will understand the utility of good prefix discipline.
  - Identify a problem patch that needs to be fixed.
  - Be able to explain what is the issue with the patch

*Other names and brands may be claimed as the property of others.



PREWORK

- Did you complete your reading?
  - How to Get Your Change Into the Linux Kernel
    http://users.sosdg.org/~qiyong/lxr/source/Documentation/SubmittingPatches
  - Linux Kernel coding style
    http://users.sosdg.org/~qiyong/lxr/source/Documentation/CodingStyle

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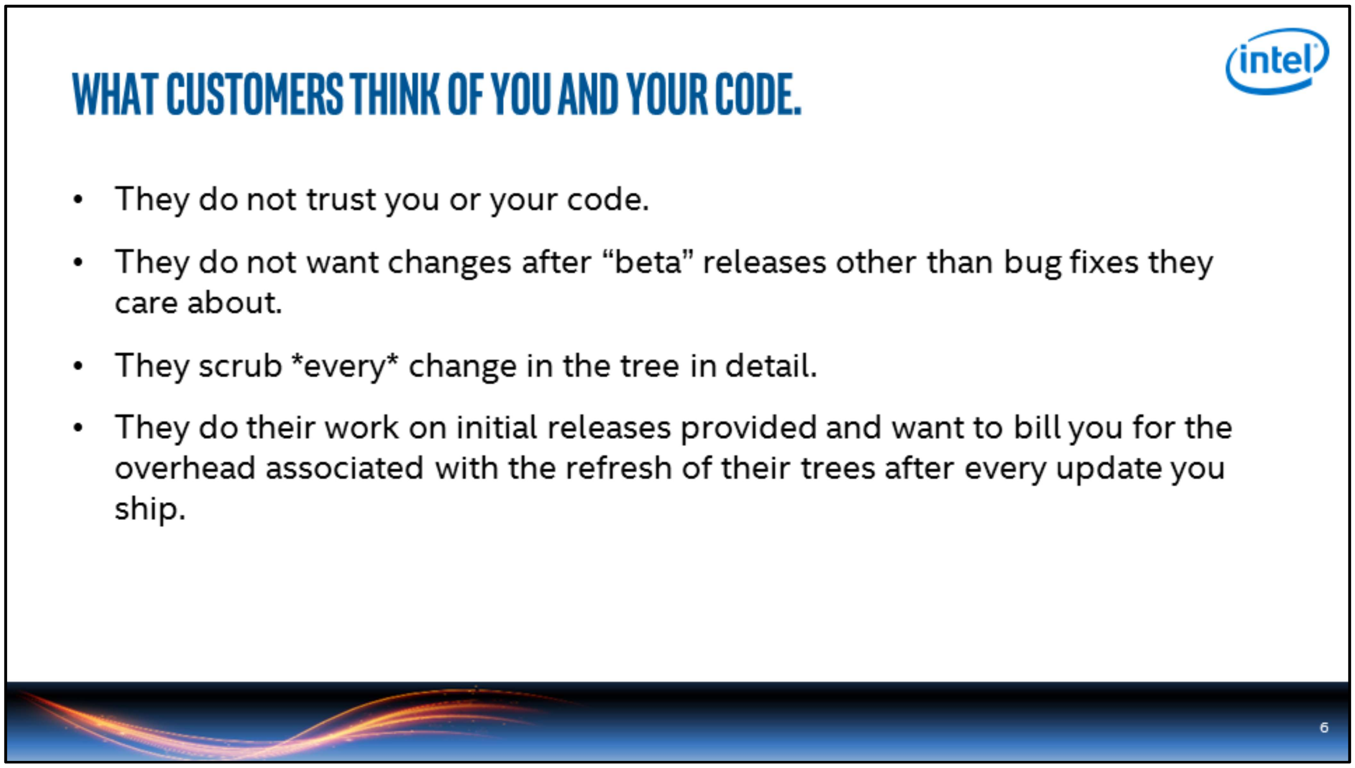

WHAT CUSTOMERS THINK OF YOU AND YOUR CODE.

- They do not trust you or your code.
- They do not want changes after “beta” releases other than bug fixes they care about.
- They scrub *every* change in the tree in detail.
- They do their work on initial releases provided and want to bill you for the overhead associated with the refresh of their trees after every update you ship.

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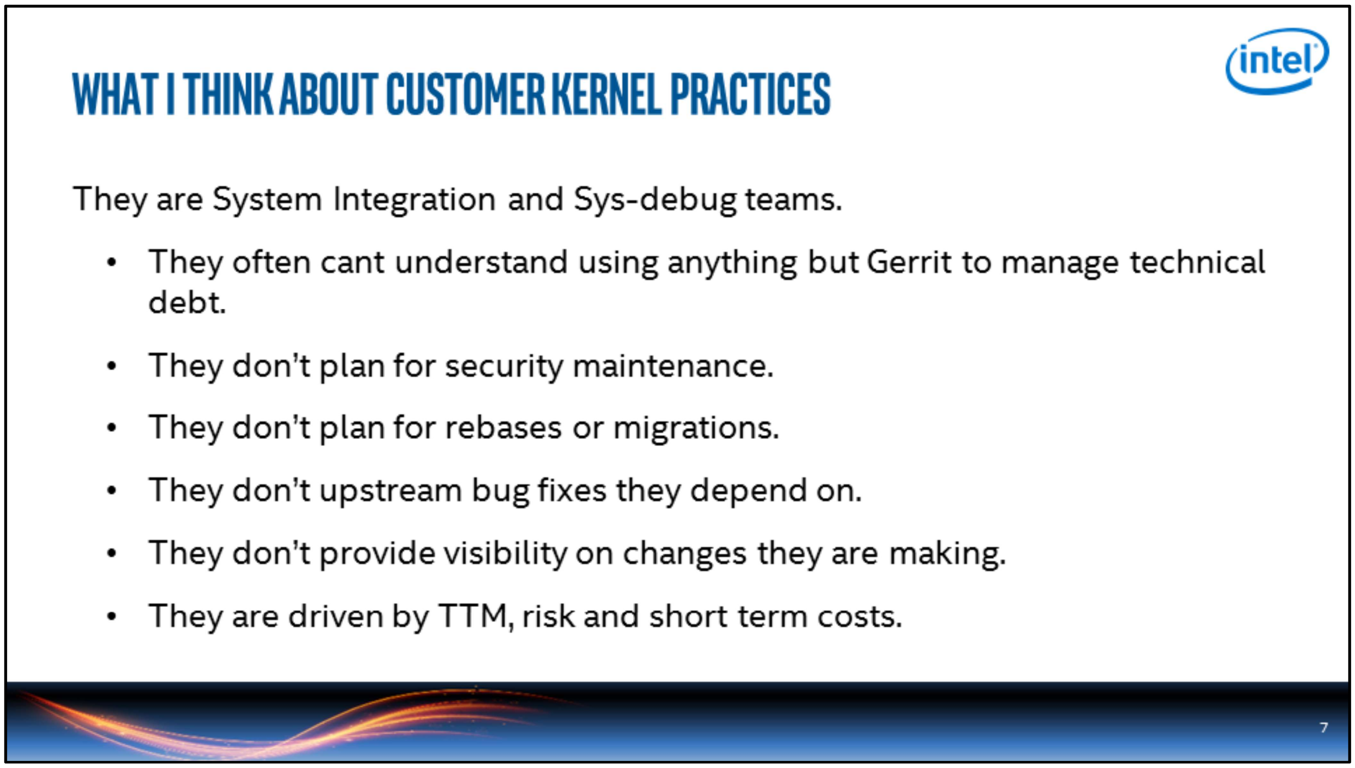

WHAT I THINK ABOUT CUSTOMER KERNEL PRACTICES

They are System Integration and Sys-debug teams.

- They often cant understand using anything but Gerrit to manage technical debt.
- They don't plan for security maintenance.
- They don't plan for rebases or migrations.
- They don't upstream bug fixes they depend on.
- They don't provide visibility on changes they are making.
- They are driven by TTM, risk and short term costs.

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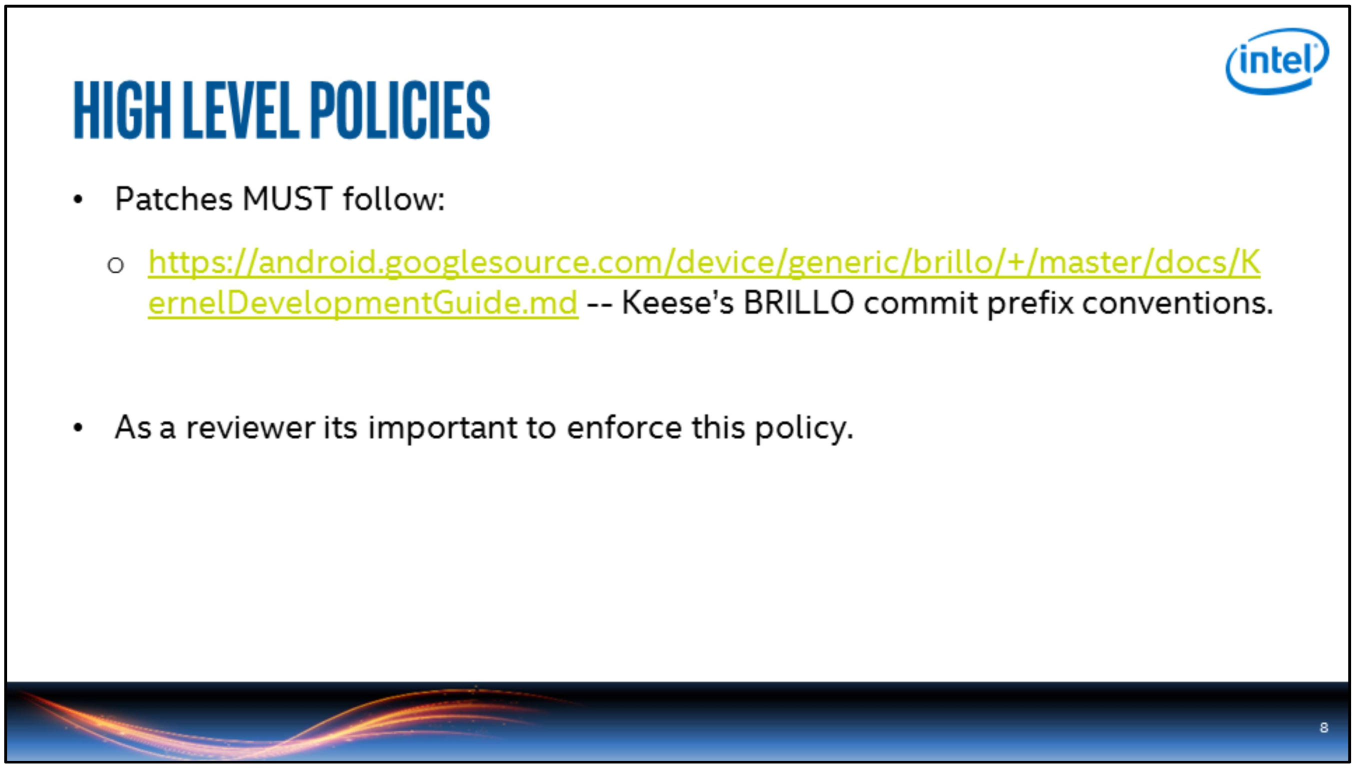

HIGH LEVEL POLICIES

- Patches MUST follow:
  - https://android.googlesource.com/device/generic/brillo/+/master/docs/KernelDevelopmentGuide.md -- Keese's BRILLO commit prefix conventions.
- As a reviewer its important to enforce this policy.

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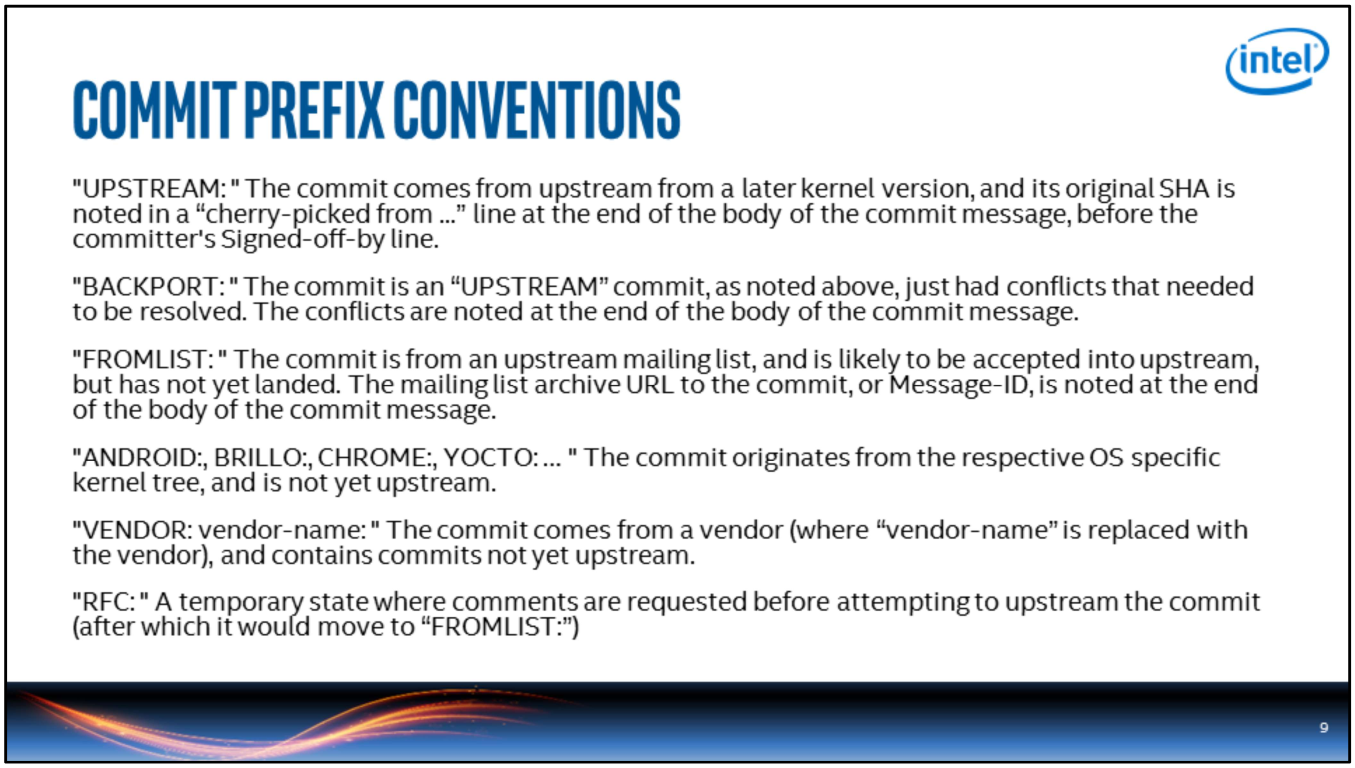


COMMIT PREFIX CONVENTIONS

"UPSTREAM: " The commit comes from upstream from a later kernel version, and its original SHA is noted in a “cherry-picked from ...” line at the end of the body of the commit message, before the committer's Signed-off-by line.

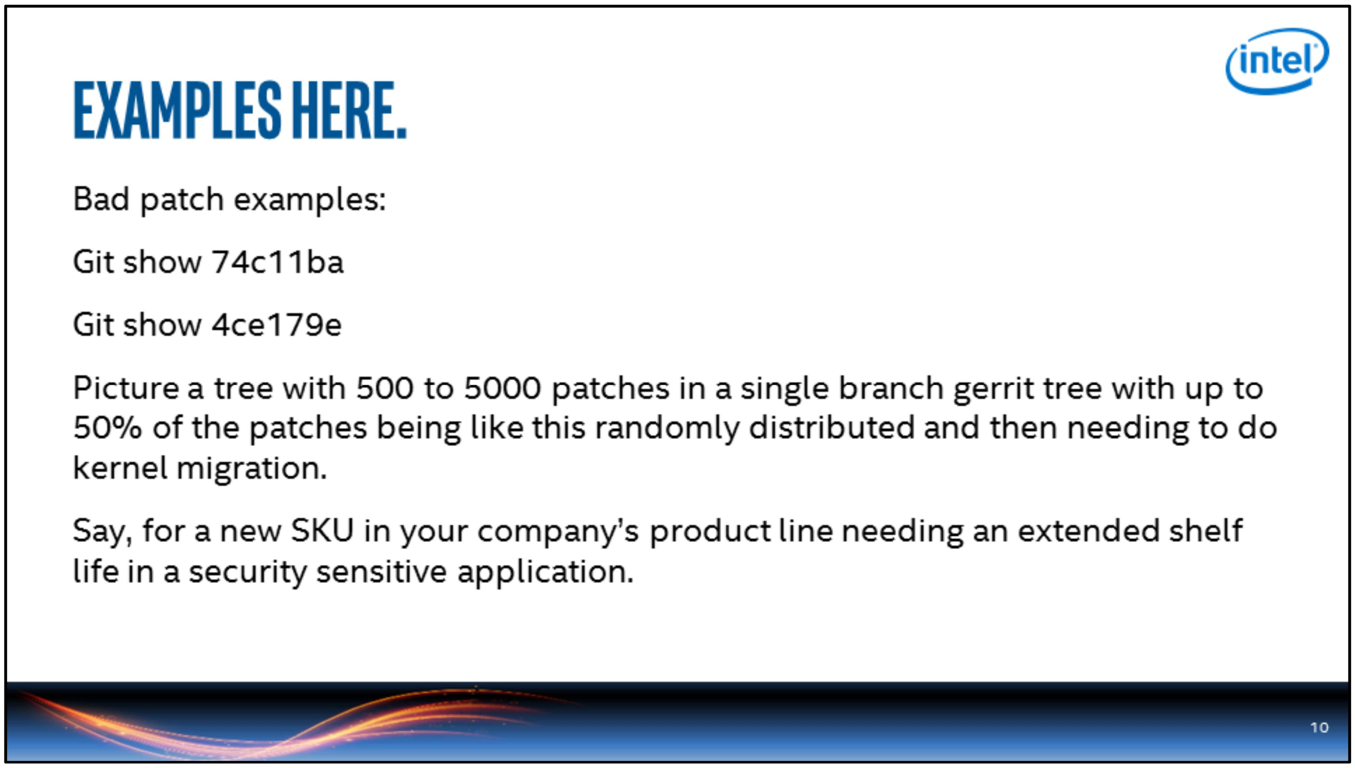
"BACKPORT: " The commit is an “UPSTREAM” commit, as noted above, just had conflicts that needed to be resolved. The conflicts are noted at the end of the body of the commit message.

"FROMLIST: " The commit is from an upstream mailing list, and is likely to be accepted into upstream, but has not yet landed. The mailing list archive URL to the commit, or Message-ID, is noted at the end of the body of the commit message.

"ANDROID:, BRILLO:, CHROME:, YOCTO: ... " The commit originates from the respective OS specific kernel tree, and is not yet upstream.

"VENDOR: vendor-name: " The commit comes from a vendor (where “vendor-name” is replaced with the vendor), and contains commits not yet upstream.

"RFC: " A temporary state where comments are requested before attempting to upstream the commit (after which it would move to “FROMLIST:”)



EXAMPLES HERE.

Bad patch examples:

Git show 74c11ba

Git show 4ce179e

Picture a tree with 500 to 5000 patches in a single branch gerrit tree with up to 50% of the patches being like this randomly distributed and then needing to do kernel migration.

Say, for a new SKU in your company's product line needing an extended shelf life in a security sensitive application.

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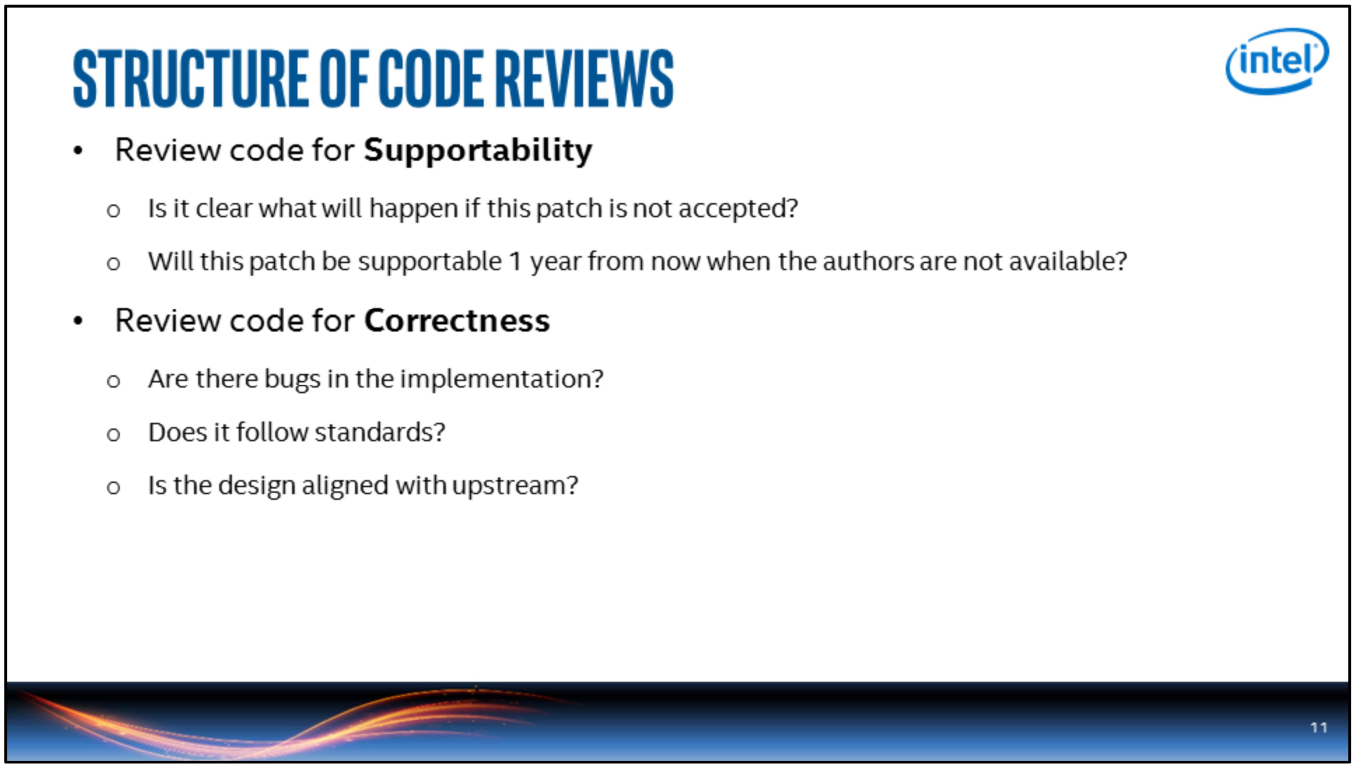
STRUCTURE OF CODE REVIEWS

- Review code for **Supportability**
  - Is it clear what will happen if this patch is not accepted?
  - Will this patch be supportable 1 year from now when the authors are not available?
- Review code for **Correctness**
  - Are there bugs in the implementation?
  - Does it follow standards?
  - Is the design aligned with upstream?

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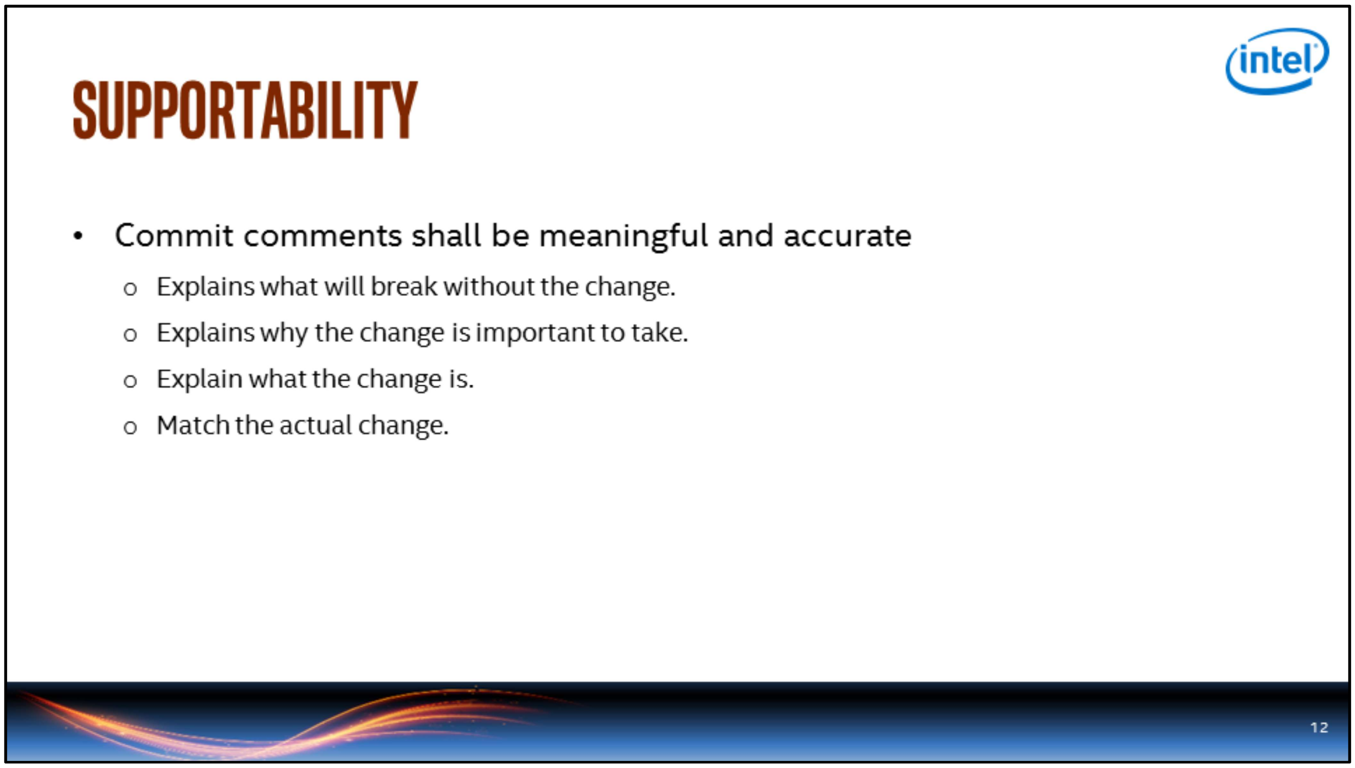
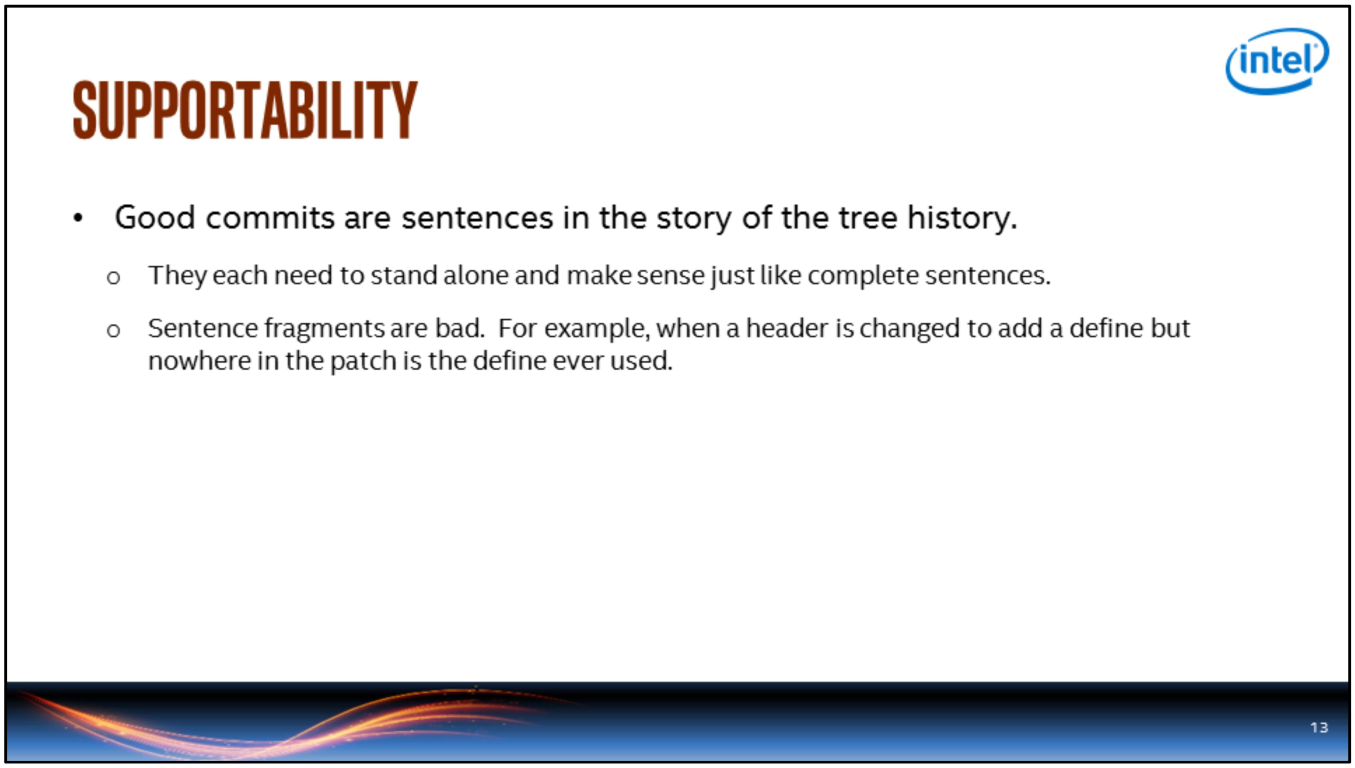
Can someone, capable of reading C-code and knowing a little about kernel programming, make progress debugging issues with any of the patches without calling for support?



SUPPORTABILITY

- Commit comments shall be meaningful and accurate
  - Explains what will break without the change.
  - Explains why the change is important to take.
  - Explain what the change is.
  - Match the actual change.



SUPPORTABILITY

- Good commits are sentences in the story of the tree history.
  - They each need to stand alone and make sense just like complete sentences.
  - Sentence fragments are bad. For example, when a header is changed to add a define but nowhere in the patch is the define ever used.

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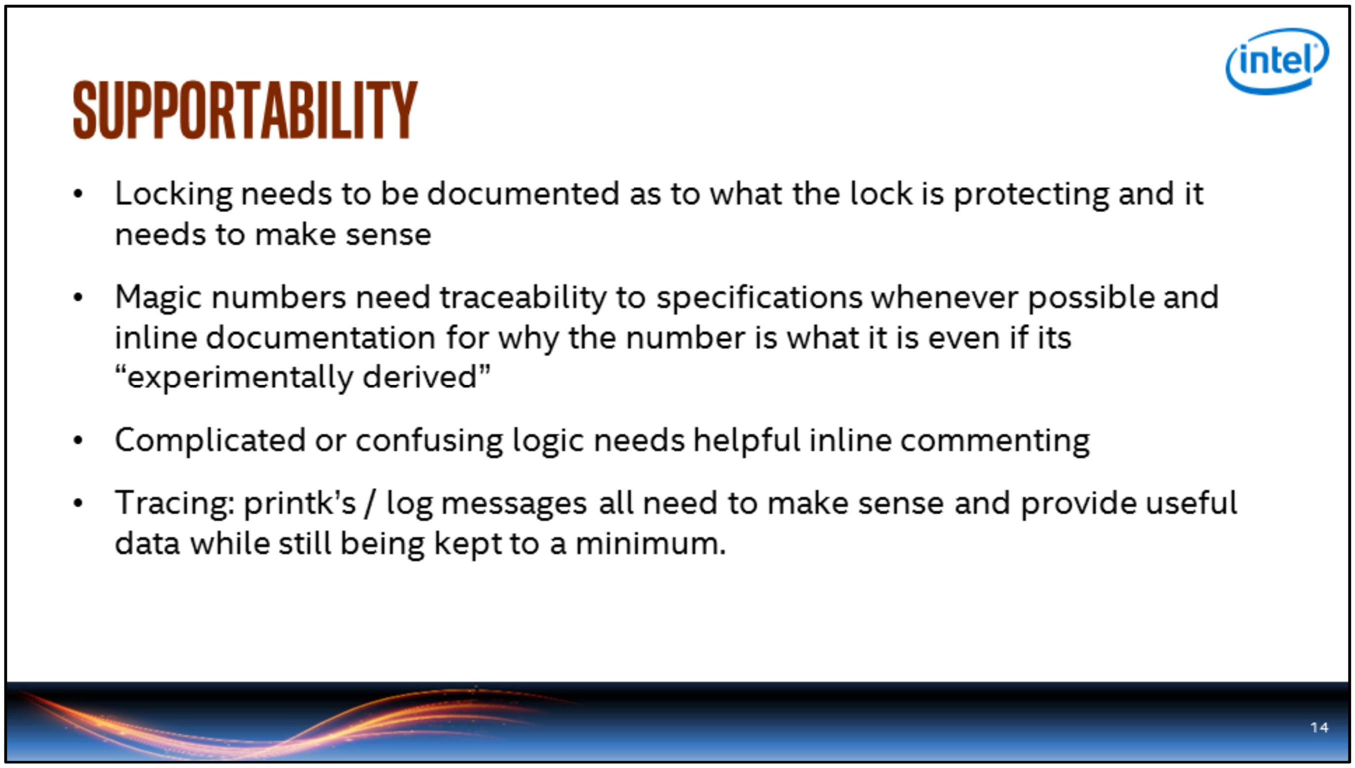
Many times incomplete or fragment commits result form porting patches forward.



SUPPORTABILITY

- Locking needs to be documented as to what the lock is protecting and it needs to make sense
- Magic numbers need traceability to specifications whenever possible and inline documentation for why the number is what it is even if its “experimentally derived”
- Complicated or confusing logic needs helpful inline commenting
- Tracing: printk’s / log messages all need to make sense and provide useful data while still being kept to a minimum.

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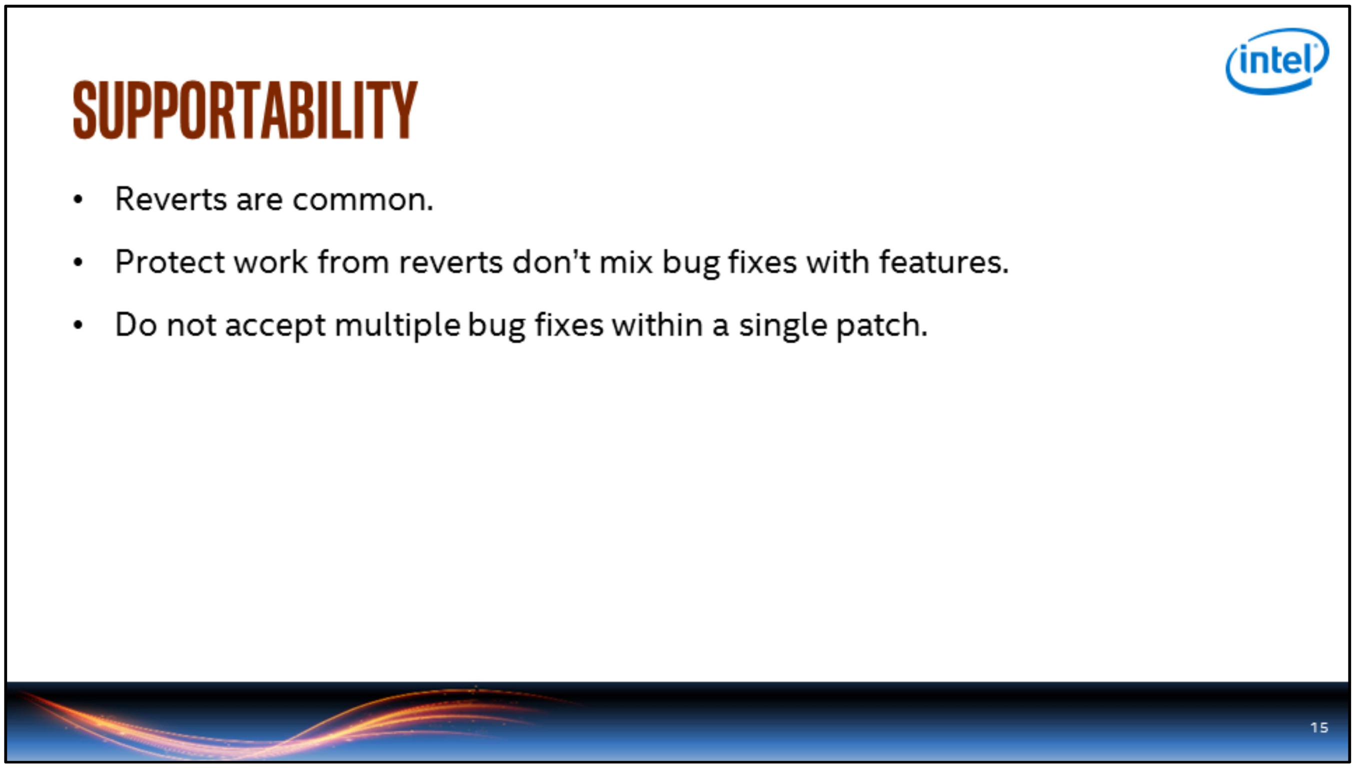
Delay loops are a problematic use of magic numbers and need special attention.
Every log message is a potential support call that costs money. We need to make them count!



SUPPORTABILITY

- Reverts are common.
- Protect work from reverts don't mix bug fixes with features.
- Do not accept multiple bug fixes within a single patch.

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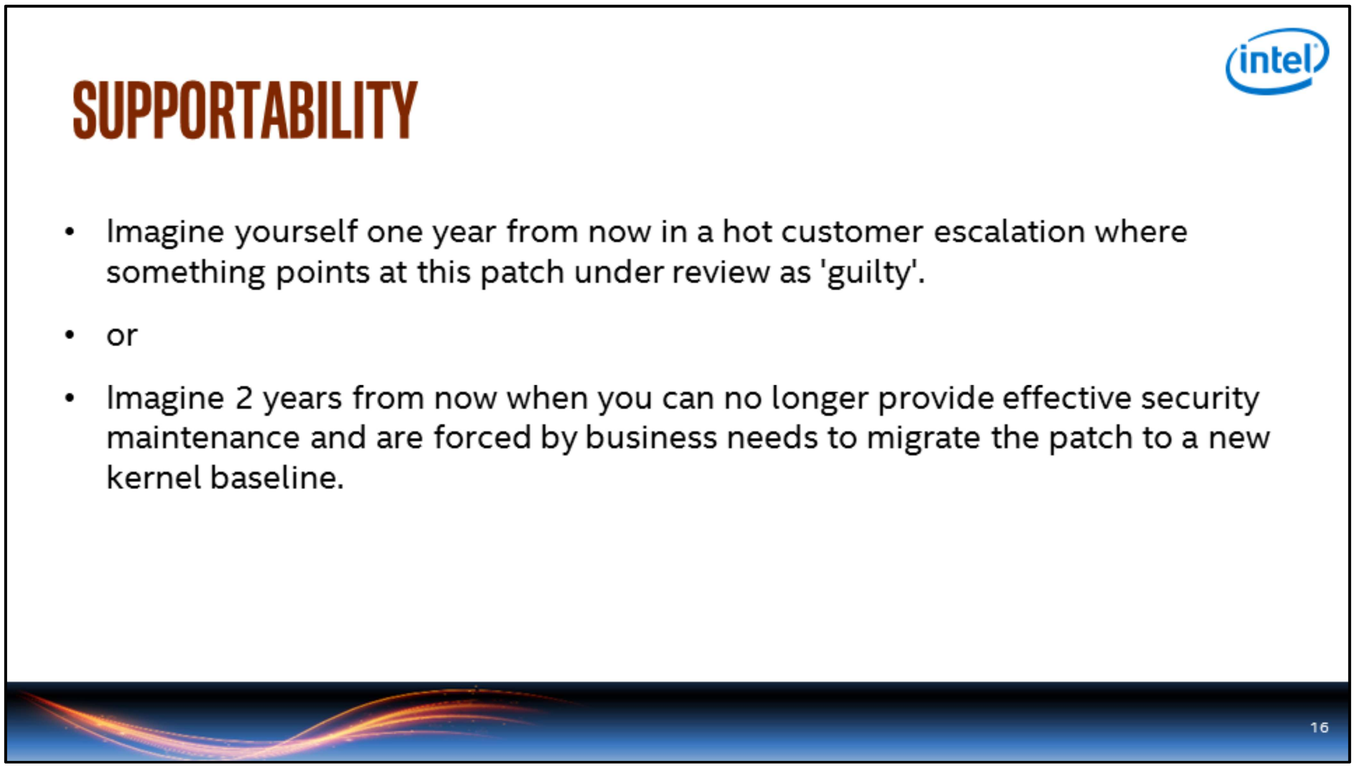
Nobody likes being forced between accepting a regression and a needed feature. Don't be that guy.



SUPPORTABILITY

- Imagine yourself one year from now in a hot customer escalation where something points at this patch under review as 'guilty'.
- or
- Imagine 2 years from now when you can no longer provide effective security maintenance and are forced by business needs to migrate the patch to a new kernel baseline.

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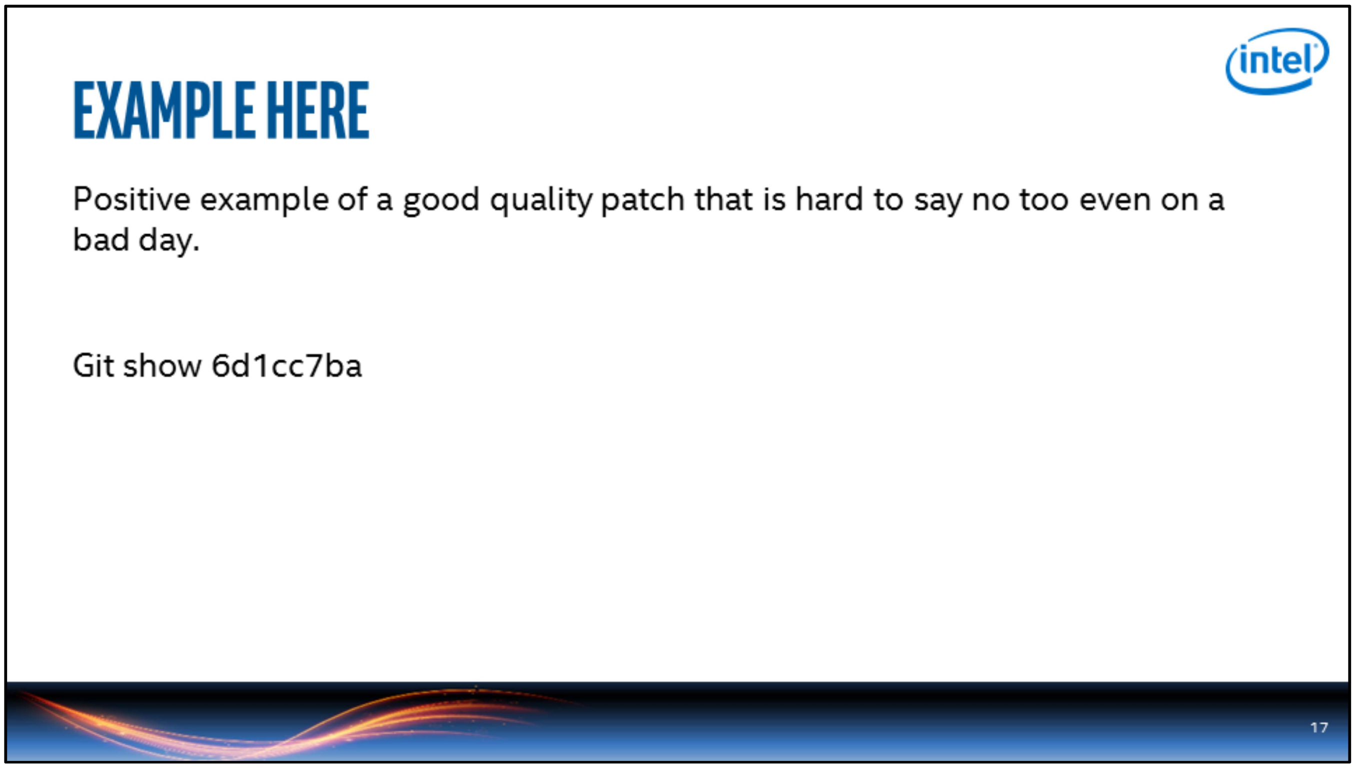
- Is the description/code/comments clear enough to then figure out what this patch is about?
- If needed, can I then keep the goodness in it even if I need to redo some of it?



EXAMPLE HERE

Positive example of a good quality patch that is hard to say no too even on a bad day.

Git show 6d1cc7ba

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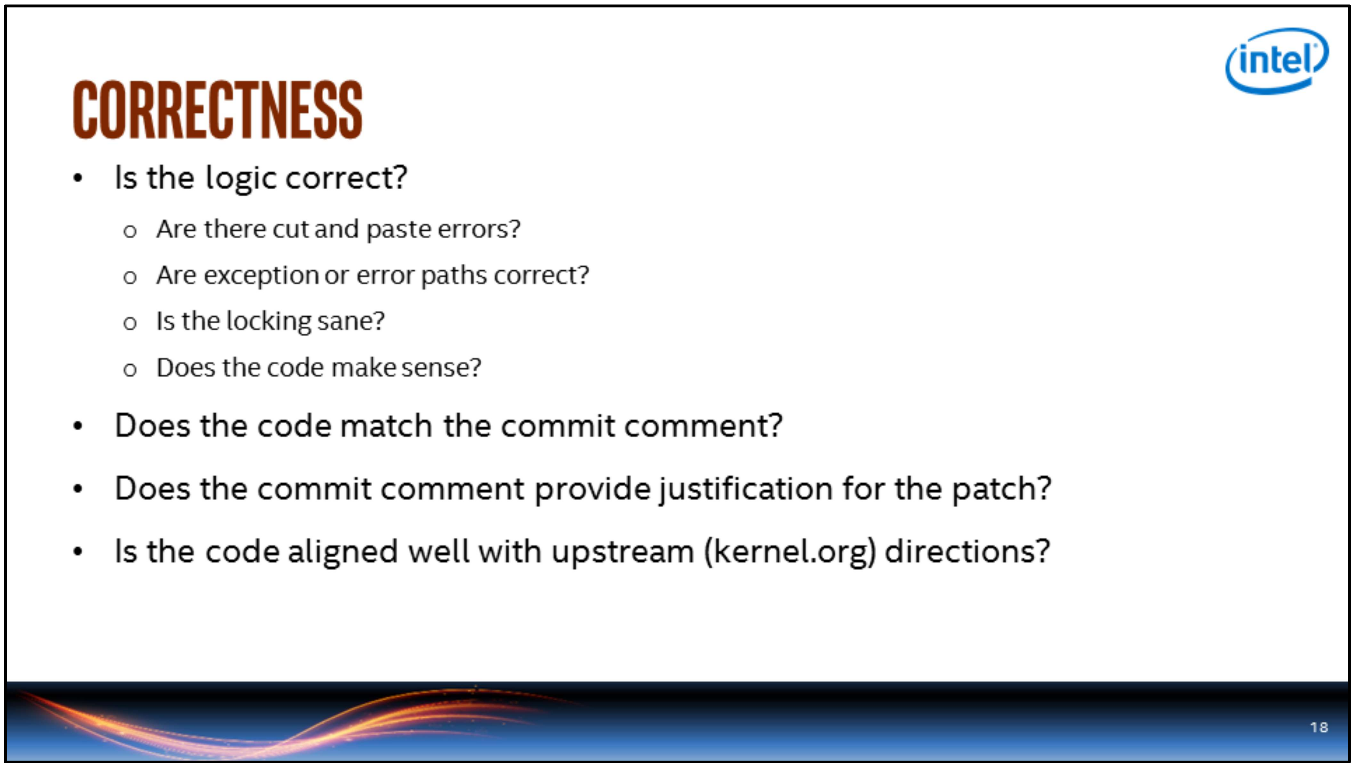

CORRECTNESS

- Is the logic correct?
  - Are there cut and paste errors?
  - Are exception or error paths correct?
  - Is the locking sane?
  - Does the code make sense?
- Does the code match the commit comment?
- Does the commit comment provide justification for the patch?
- Is the code aligned well with upstream (kernel.org) directions?

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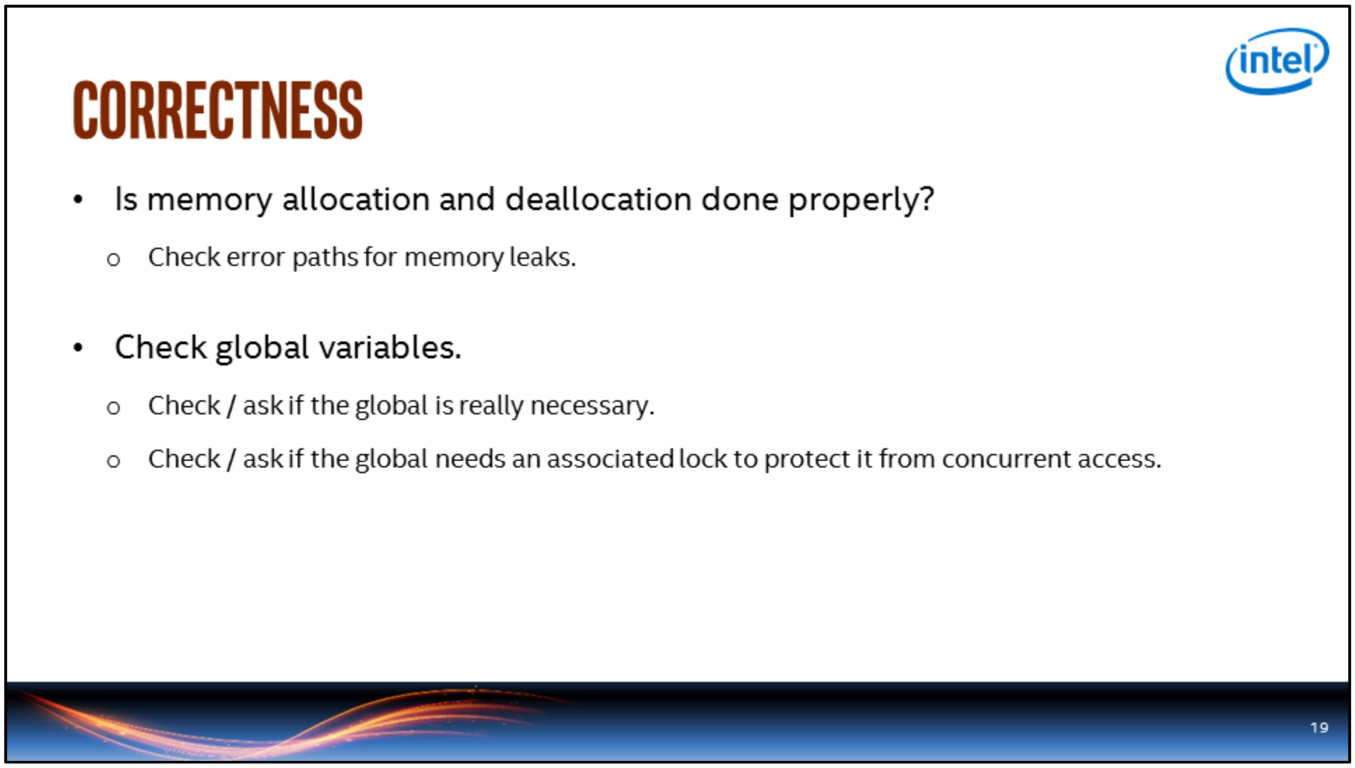
Does it explain what will break if the patch is not accepted?
alarmtimer_suspend CONFIG_RTC_CLASS example.



CORRECTNESS

- Is memory allocation and deallocation done properly?
  - Check error paths for memory leaks.
- Check global variables.
  - Check / ask if the global is really necessary.
  - Check / ask if the global needs an associated lock to protect it from concurrent access.

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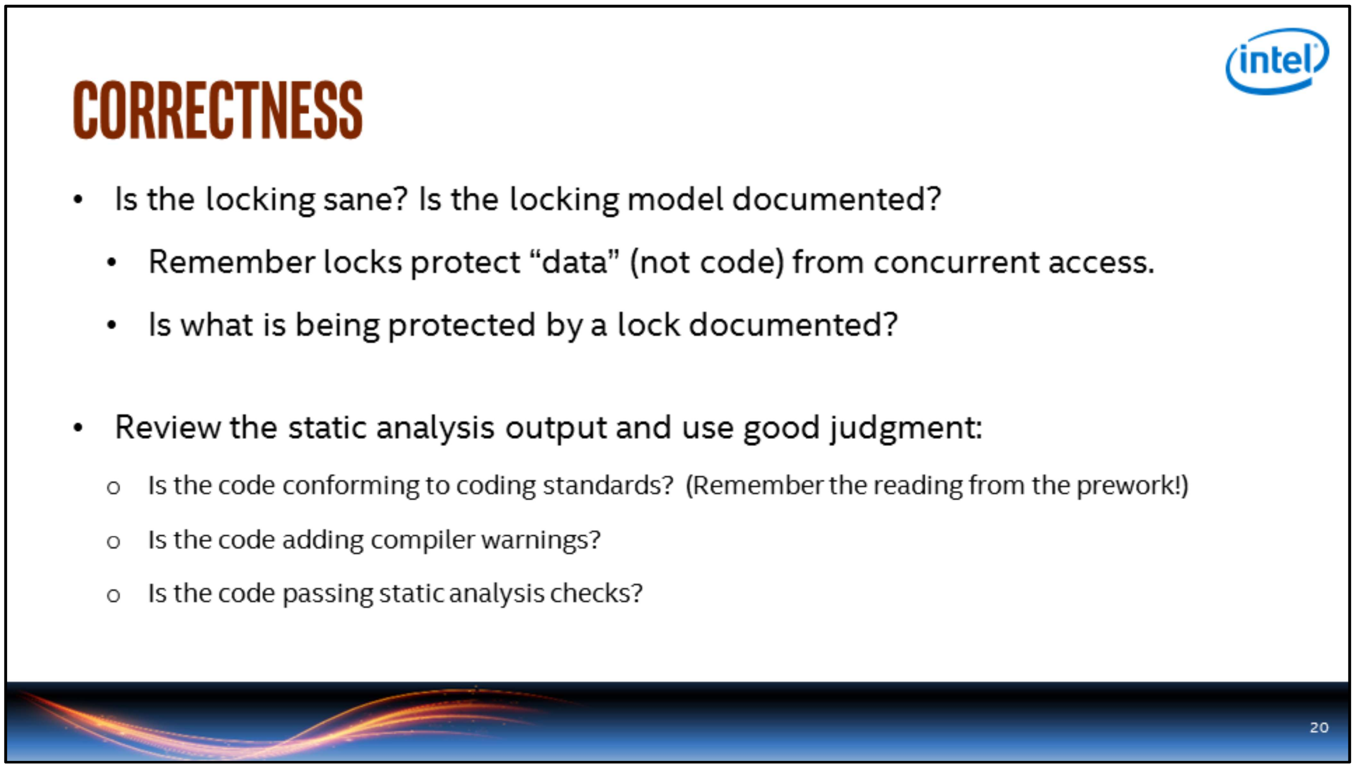
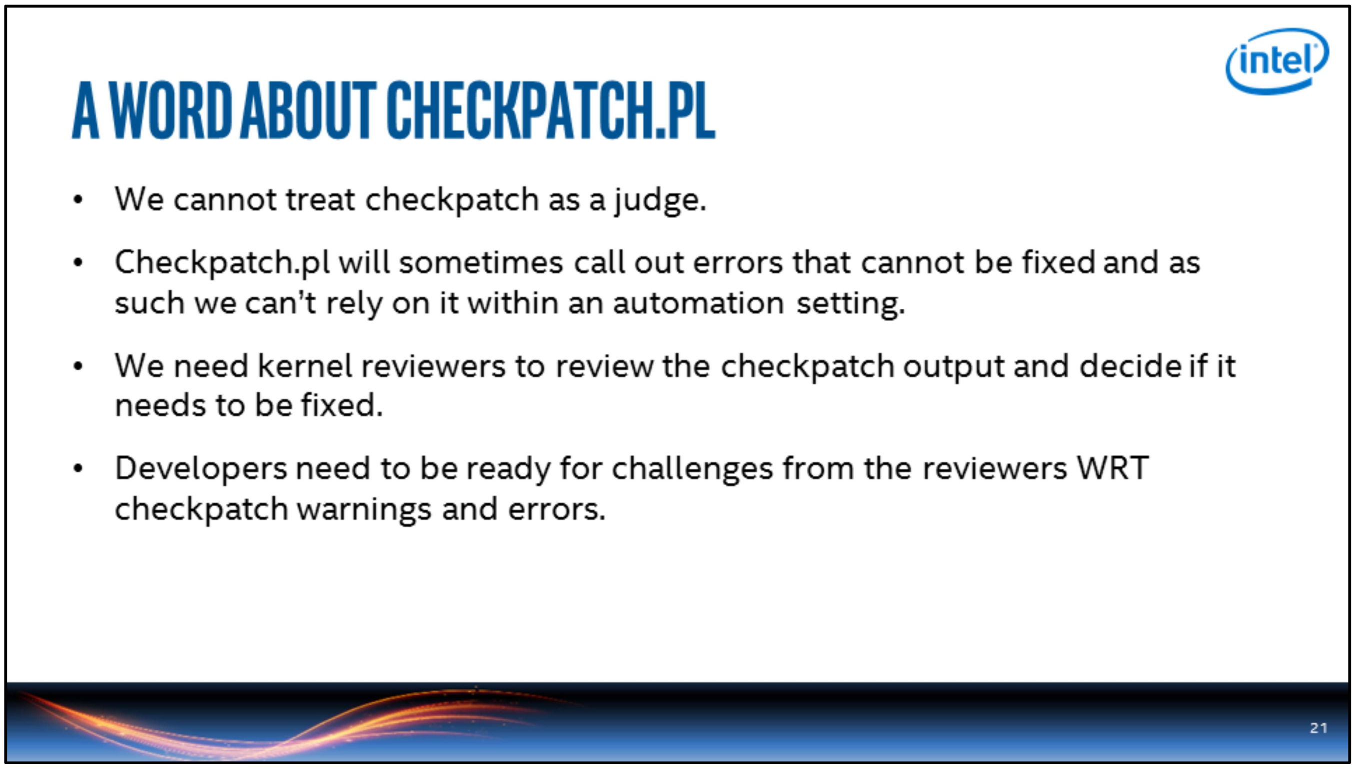


CORRECTNESS

- Is the locking sane? Is the locking model documented?
  - Remember locks protect “data” (not code) from concurrent access.
  - Is what is being protected by a lock documented?
- Review the static analysis output and use good judgment:
  - Is the code conforming to coding standards? (Remember the reading from the prework!)
  - Is the code adding compiler warnings?
  - Is the code passing static analysis checks?



A WORD ABOUT CHECKPATCH.PL

- We cannot treat checkpatch as a judge.
- Checkpatch.pl will sometimes call out errors that cannot be fixed and as such we can't rely on it within an automation setting.
- We need kernel reviewers to review the checkpatch output and decide if it needs to be fixed.
- Developers need to be ready for challenges from the reviewers WRT checkpatch warnings and errors.

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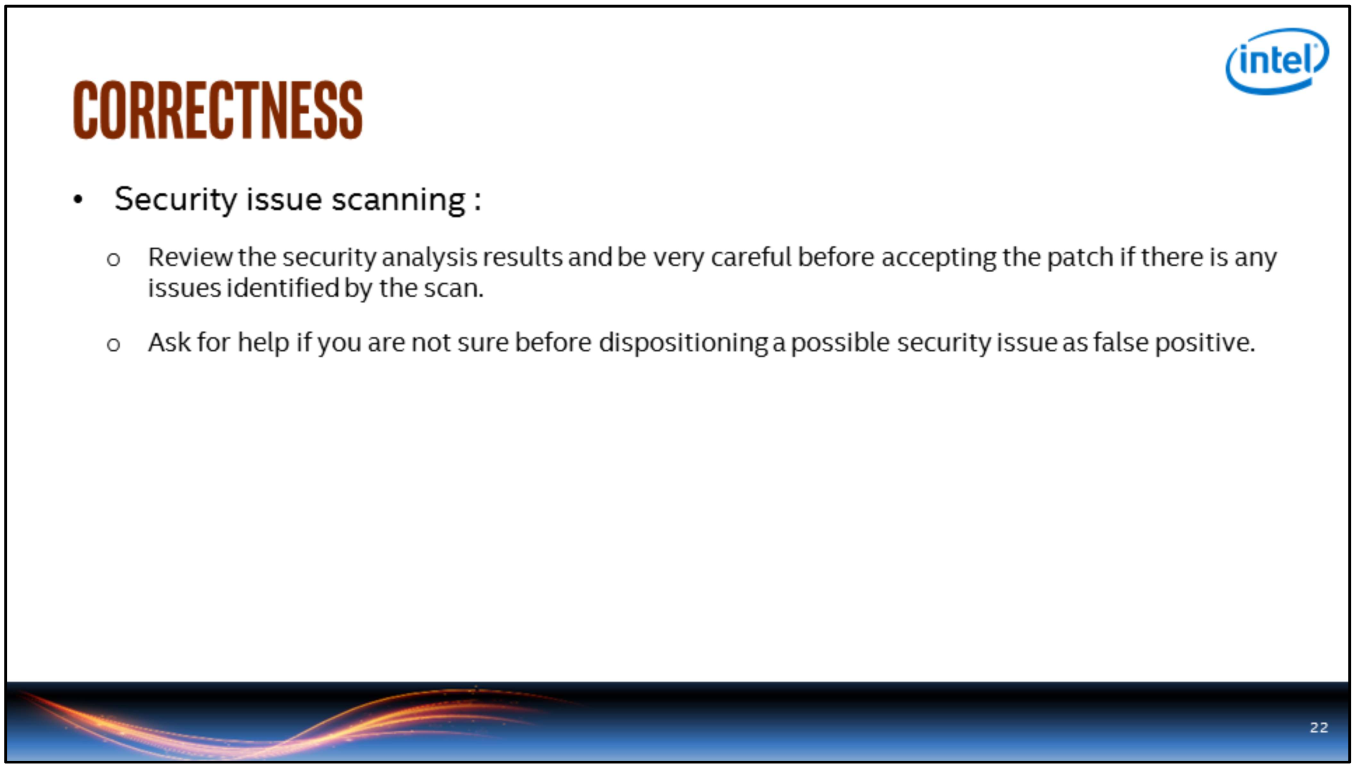

CORRECTNESS

- Security issue scanning :
    - Review the security analysis results and be very careful before accepting the patch if there is any issues identified by the scan.
    - Ask for help if you are not sure before dispositioning a possible security issue as false positive.

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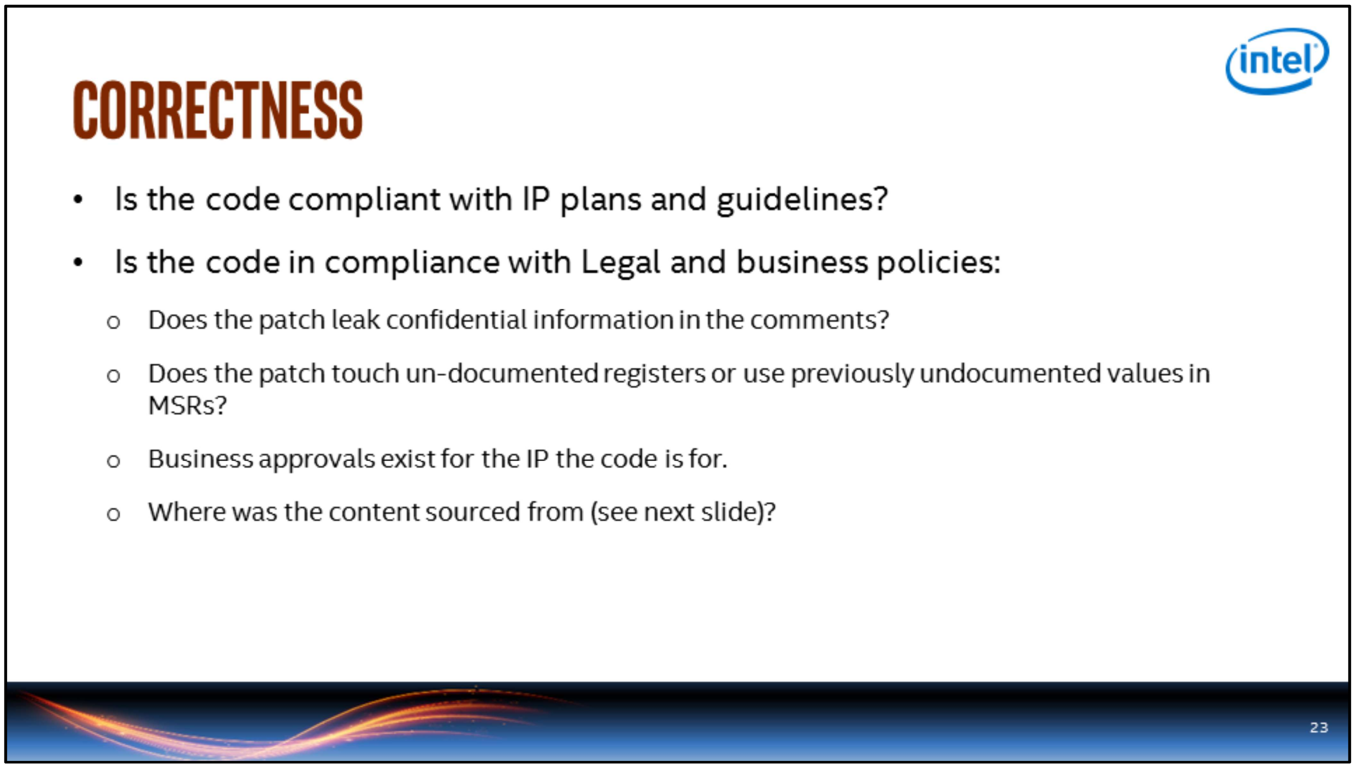

CORRECTNESS

- Is the code compliant with IP plans and guidelines?
- Is the code in compliance with Legal and business policies:
  - Does the patch leak confidential information in the comments?
  - Does the patch touch un-documented registers or use previously undocumented values in MSRs?
  - Business approvals exist for the IP the code is for.
  - Where was the content sourced from (see next slide)?

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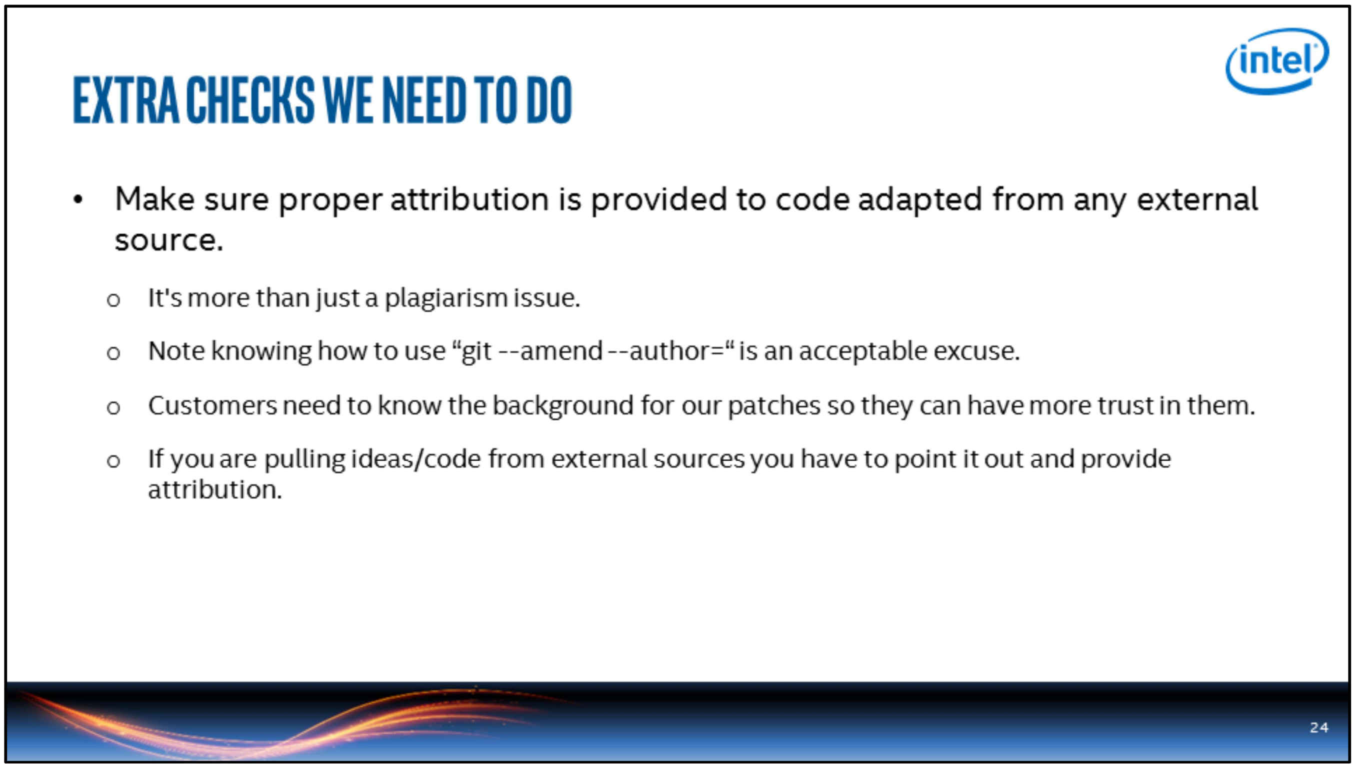
- Does it leak new IP information by its implementation?
- Is that IP information approved for publishing under GPLv2?



EXTRA CHECKS WE NEED TO DO

- Make sure proper attribution is provided to code adapted from any external source.
  - It's more than just a plagiarism issue.
  - Note knowing how to use “git --amend --author=“ is an acceptable excuse.
  - Customers need to know the background for our patches so they can have more trust in them.
  - If you are pulling ideas/code from external sources you have to point it out and provide attribution.

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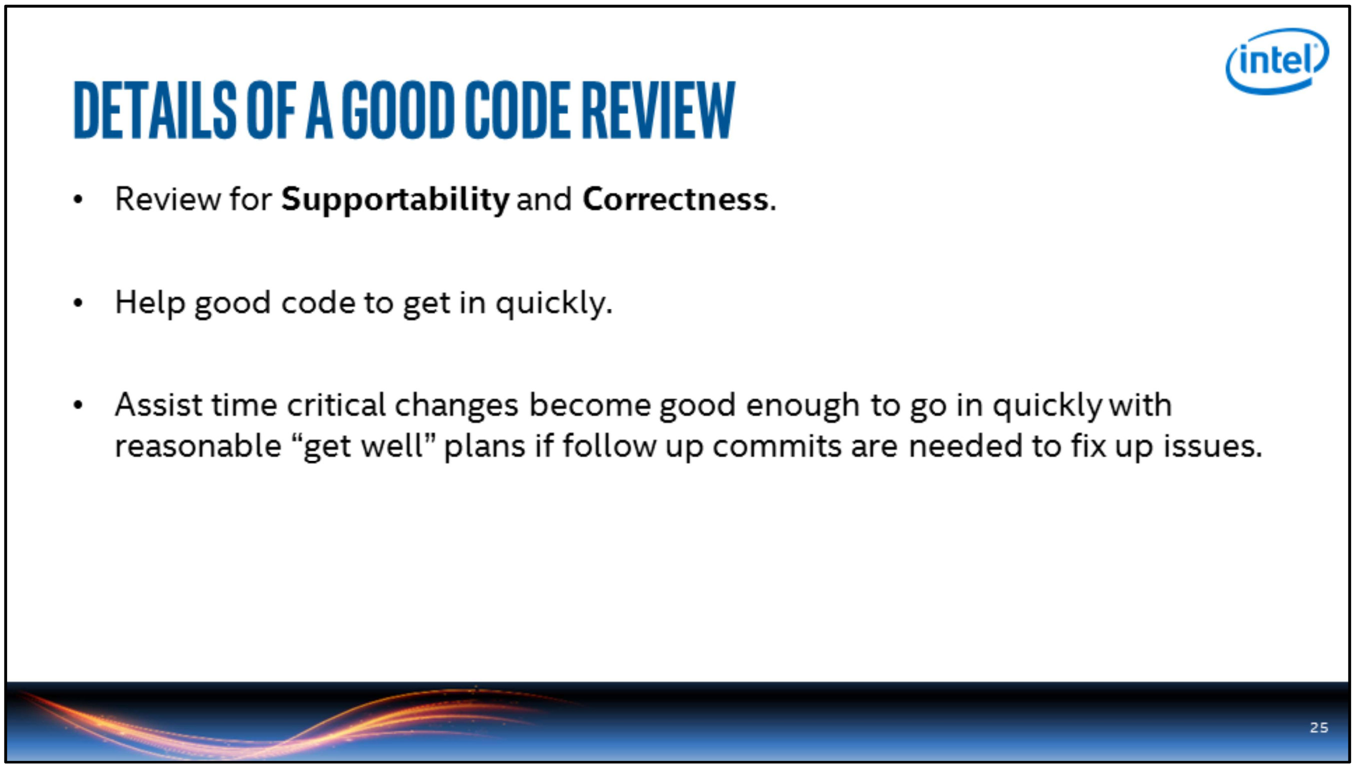
- Its an easy mistake to do when you are in a hurry.
- Providing background on patch origins provides credibility via herd mentality.
- It’s important to have a good perception of yourself and your employer in the open source community.



DETAILS OF A GOOD CODE REVIEW

- Review for **Supportability** and **Correctness**.
- Help good code to get in quickly.
- Assist time critical changes become good enough to go in quickly with reasonable "get well" plans if follow up commits are needed to fix up issues.

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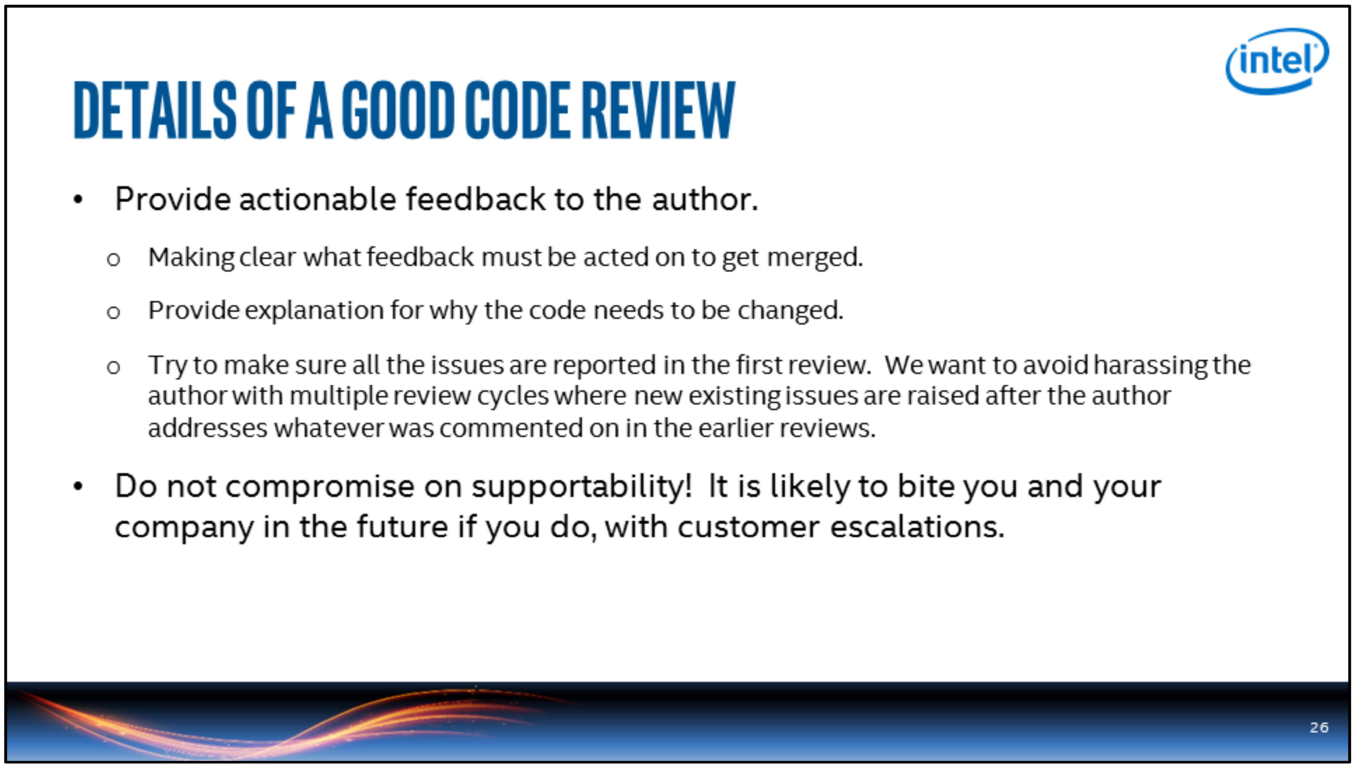
Help rewrite problematic commit comments or code if needed.



DETAILS OF A GOOD CODE REVIEW

- Provide actionable feedback to the author.
  - Making clear what feedback must be acted on to get merged.
  - Provide explanation for why the code needs to be changed.
  - Try to make sure all the issues are reported in the first review. We want to avoid harassing the author with multiple review cycles where new existing issues are raised after the author addresses whatever was commented on in the earlier reviews.
- Do not compromise on supportability! It is likely to bite you and your company in the future if you do, with customer escalations.

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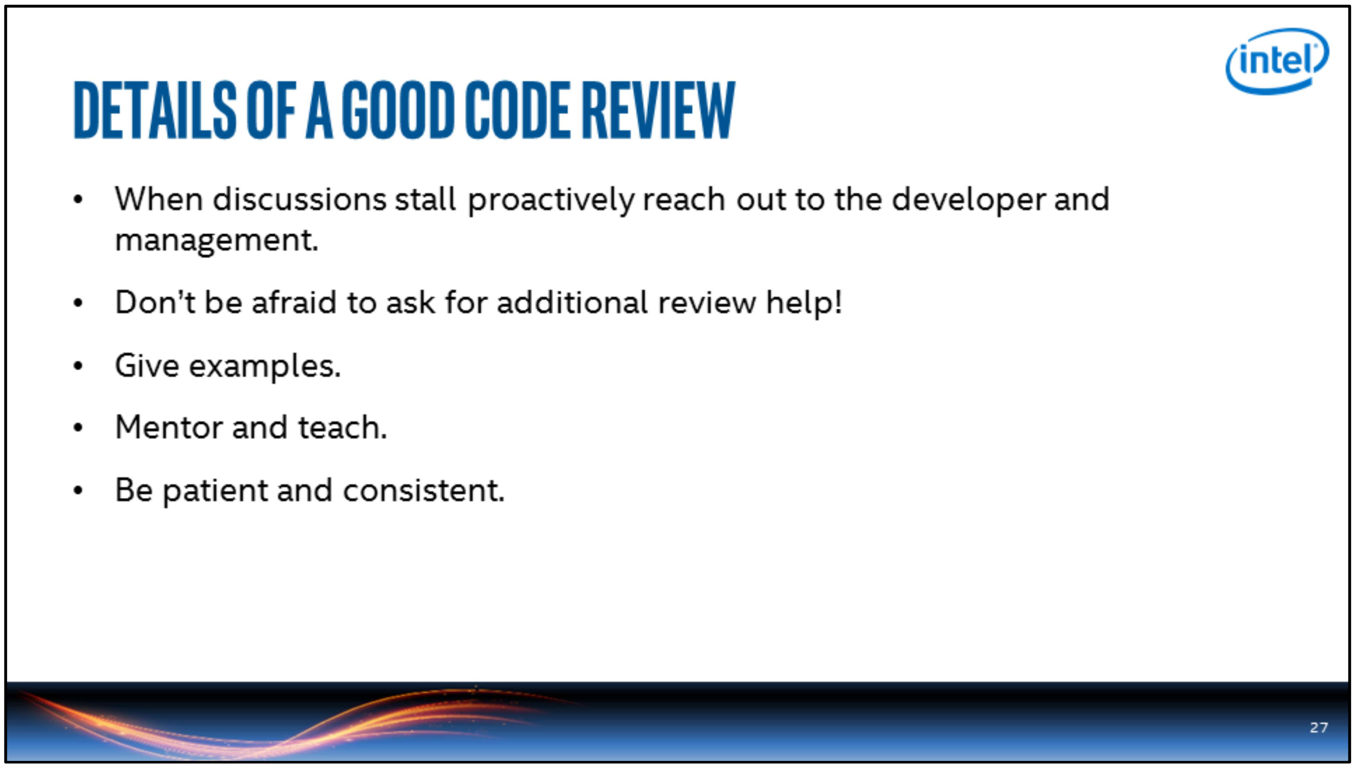
Note: mistakes happen but, we want to avoid a “bring me a rock” situation.



DETAILS OF A GOOD CODE REVIEW

- When discussions stall proactively reach out to the developer and management.
- Don't be afraid to ask for additional review help!
- Give examples.
- Mentor and teach.
- Be patient and consistent.

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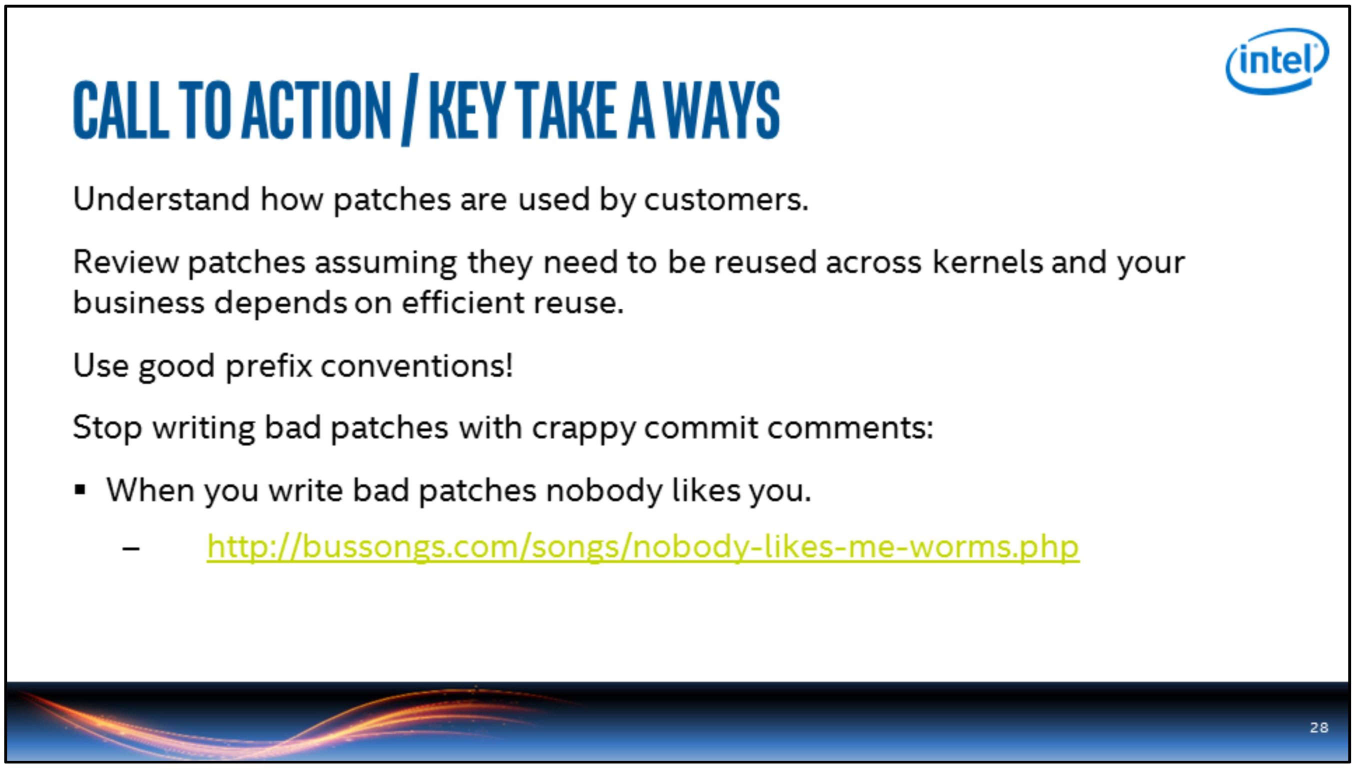
- Many companies have experts you can ask for help from. Use them when you are unsure as a reviewer.
- Take notes and learn from the experience! Don't miss out on the opportunity for you to grow yourself technically!



CALL TO ACTION / KEY TAKE A WAYS

Understand how patches are used by customers.

Review patches assuming they need to be reused across kernels and your business depends on efficient reuse.

Use good prefix conventions!

Stop writing bad patches with crappy commit comments:

- When you write bad patches nobody likes you.
  - http://bussongs.com/songs/nobody-likes-me-worms.php

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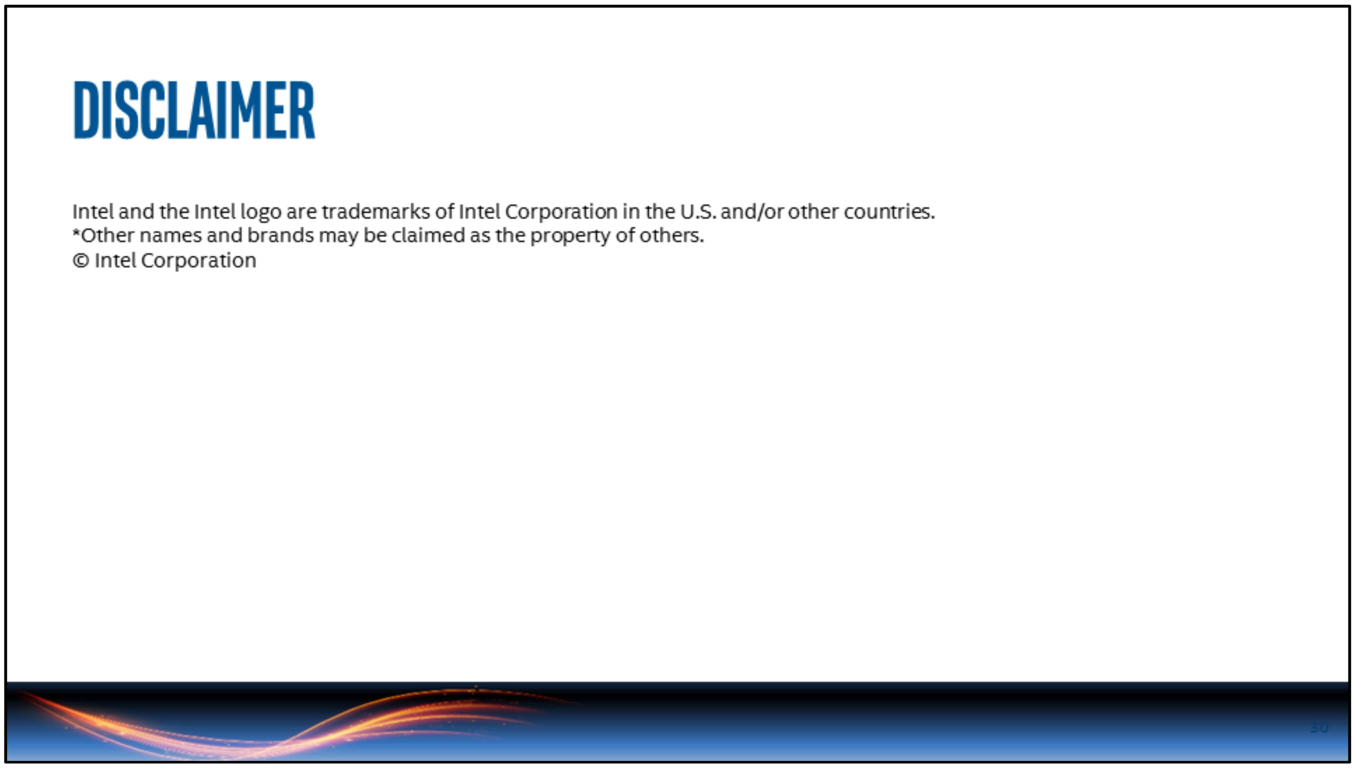
THANK YOU! --- QUESTIONS?



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