

# Linux: Reducing the cost of upstream development to encourage collaboration

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# Summary

- 1 Introduction
- 2 Upstream issues
- 3 Forked kernels' issues
- 4 Pros of upstream development
- 5 Making testing cheaper

# Introduction

## Linux is everywhere

- Most of the servers/networking equipments;
- 80% of smartphones (Android) and 65% of tablets;
- Entertainment systems (at home, cars, planes, ...);
- Majority of IoT devices.

## World domination?

- No, because all products use outdated kernels!
- Most products actually use forked kernels...

# Introduction

## Is that a problem?

Yes, it lowers collaboration and leads to:

- Less features: All features do not get upstreamed/backported;
- Poorer Quality/Security: Less eyes per tree, fixes duplicated.

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Why upstream is no good for vendors?

# Upstream from a vendor's perspective

## Objectives of making a product

Get it as good as possible, and as quickly as possible

## Challenges with upstream

- Linux development not product-oriented:
  - Releases not in sync with products;
  - Conflicting objectives: upstream wants generic solutions
- Code sharing between drivers mandated: AMD's DAL/DC;
- Stable user ABIs, no user-visible regressions;
- ⇒ Increased dev. cost and Time-To-Market (TTM)

## Forked kernel?

- Full control over the code;
- None of the above challenges!

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# Issues with forked kernel

## What should be done when the next product comes?

- Re-use the previous product's kernel?  $\Rightarrow$  technical debt;
- Rebase changes: can amount to a full re-implementation.

## Challenges with forked kernels

- You don't get to shape the future of Linux:
  - Out-of-tree code is not supported;
  - Risk that internal changes break your features and userspace;
- Maintenance?
  - Automotive products need 10+ years of maintenance;
  - Linux Long-Term Support (LTS) maintained for 2 years;
  - LTS releases only get fixes, no new features;
  - Rebasing generates no revenue.



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# Pros of upstream development

## Nice features of upstream development

- Non-regression of the user ABI makes updates easy;
- Never need to rebase: Others improve Linux and your code;

## Problem: Testing isn't free!

- Unless constantly tested, a feature gets accidentally broken;
- Without continuous testing, updating isn't free!

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# How to make testing cheaper?

## Reducing manual testing to 0

- Pre-merge testing is the best way to prevent regressions;
- Linux accepts about 8 changes per hour, in average;
- ⇒ all testing needs to be automated!

## Problems with automated testing

- The full product needs to be tested;
- Requires system-level testing;
- ⇒ Need for better HW-assisted test suites!

# How to make testing cheaper?

## Example of full product testing: Project trebble

- Android 8 de-couples the UI from the vendor-provided system;
- The vendor interface is fully unit tested;
- ⇒ could be used for continuous integration!

## What can we do on our side?

- Lead by example: provide regression free graphics!

# How to provide regression-free graphics?

## Many dependencies

- Improve the coverage of Open Source test suites to test:
  - all graphic-related features of the kernel;
  - all drivers.
- Validation HW:
  - Chamelium everywhere for testing DP/HDMI/VGA and sound
- CI platform:
  - running the relevant test suites on all drivers;
  - decentralized so as everyone can add platforms;
  - developed and maintained by everyone;
  - Controller instance hosted on fd.o?