www.codethink.co.uk

THE LINUX FOUNDATION PROJECTS

CIVIL INFRASTRUCTURE PLATFORM

Maintaining a Linux Kernel for **13** Years? You Must be Kidding Me. We Need at Least **30**!

Ben Hutchings / Agustín Benito Bethencourt

ELCE, Prague, 24th October 2017

CodeThink Providing Genius.

The speakers:

CIVIL INFRASTRUCTURE PLATFORM

- Ben Hutchings
  - Kernel developer at Codethink Ltd.
  - CIP kernel maintainer (4.4)
  - Debian and stable (3.2 and 3.16) kernel maintainer
- Agustín Benito Bethencourt
  - Principal Consultant at Codethink Ltd.
  - Codethink representative at CIP. Check http://www.toscalix.com

Codethink Providing Genius.

Who are Codethink?

- Provide software engineering & consultancy services.
- Expert in Linux and Open Source software.
- Focus on embedded. Strong in automotive.
- UK Headquarters, serving clients in EU, US and Asia.
- Founded in 2007. Independent and unbiased.
- Membership: CIP (founder member), OIN (2010), AGL (2015), GENIVI (2012)...

C.I.P.: a Linux Foundation Initiative

Provide a super long-term maintained industrial-grade embedded Linux platform.

Platinum Members

HITACHI
Inspire the Next

SIEMENS

RENESAS

TOSHIBA

Silver Members

Codethink

Plat' Home
There, we are. Internet of Things

Talking points

CIVIL INFRASTRUCTURE PLATFORM

1. Maintenance/support: the current picture.
2. Kernel maintenance strategies for industrial grade.
3. Limits to the maintenance lifetime.
4. How can CIP achieve a longer lifetime?

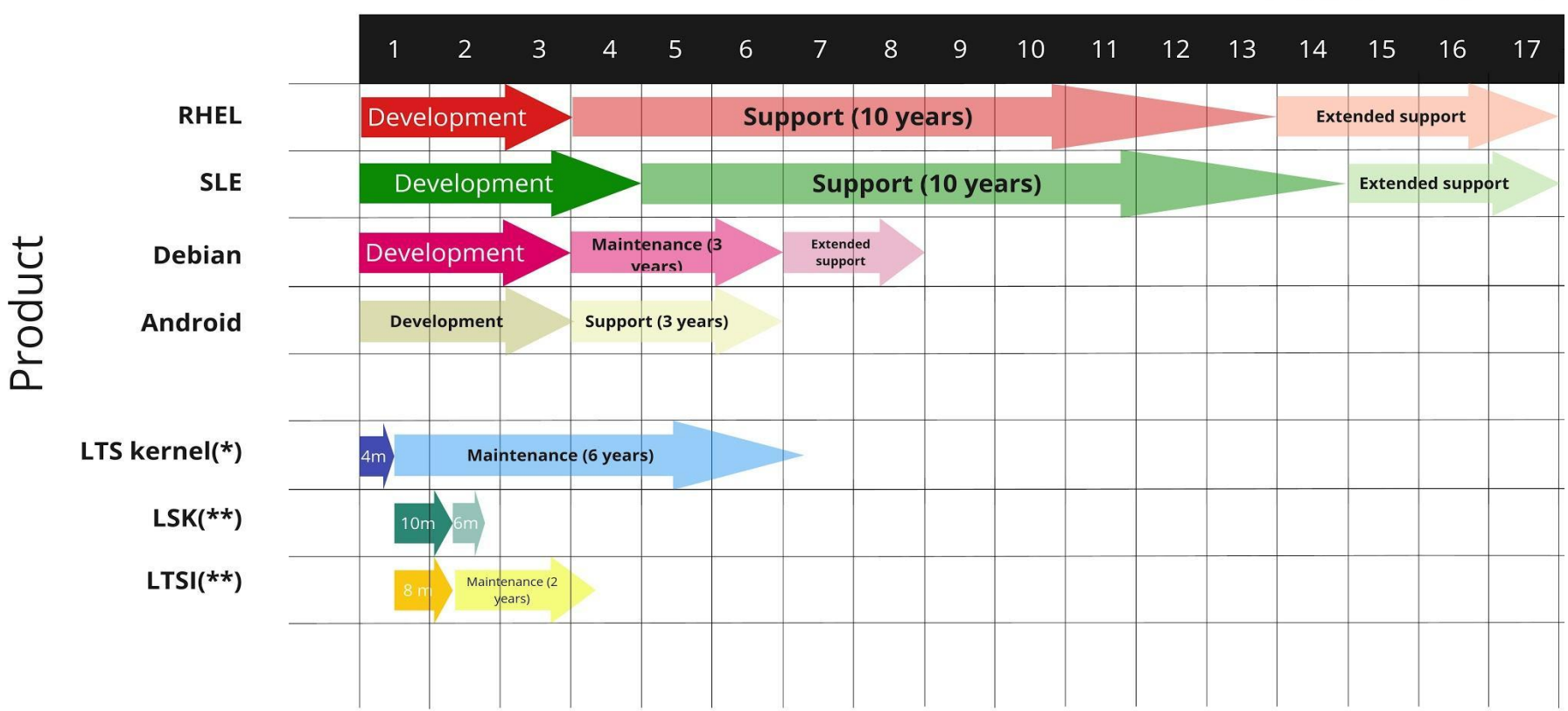
CodeThink Providing Genius.

CIVIL INFRASTRUCTURE PLATFORM

Maintenance/support: the current picture

Codethink Providing Genius.

Embedded, Mobile, Enterprise (aprox.)



(*) Assuming 2m on -next and 2m on mainline
(**) "On top" of the (LTS) Linux Kernel

CIP products

CIVIL INFRASTRUCTURE PLATFORM

Railway Control System

- 3 – 5 years development time
- 2 – 4 years customer specific extensions
- 1 year initial safety certifications / authorization
- 3 – 6 months safety certifications / authorization for follow-up releases (depending on amount of changes)
- 25 – 50 years product lifetime

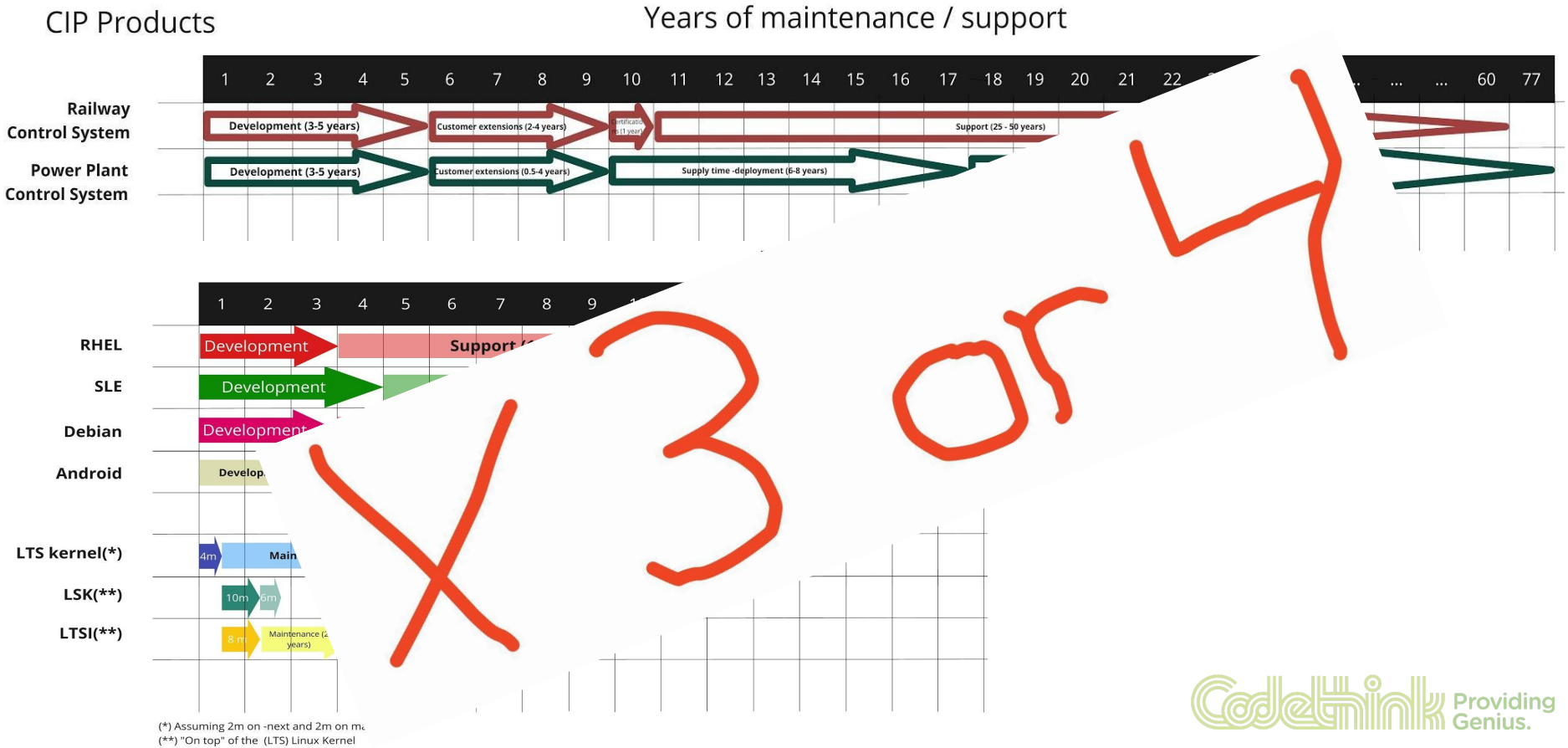
CIP products

Power Plant Control System

- 3 – 5 years development time
- 0.5 – 4 years customer specific extensions
- 6 - 8 years supply time.
- 15 years hardware maintenance after latest shipment
- 20 – 60 years product lifetime

CIP products vs other industries

CIVIL INFRASTRUCTURE PLATFORM



Codethink Providing Genius.

CIVIL INFRASTRUCTURE PLATFORM

Codethink, are you sure you want to get into this? Really?

Codethink Providing Genius.

CIVIL INFRASTRUCTURE PLATFORM

Kernel maintenance strategies for industrial grade.

CodeThink Providing Genius.

Strategy 1

CIVIL INFRASTRUCTURE PLATFORM

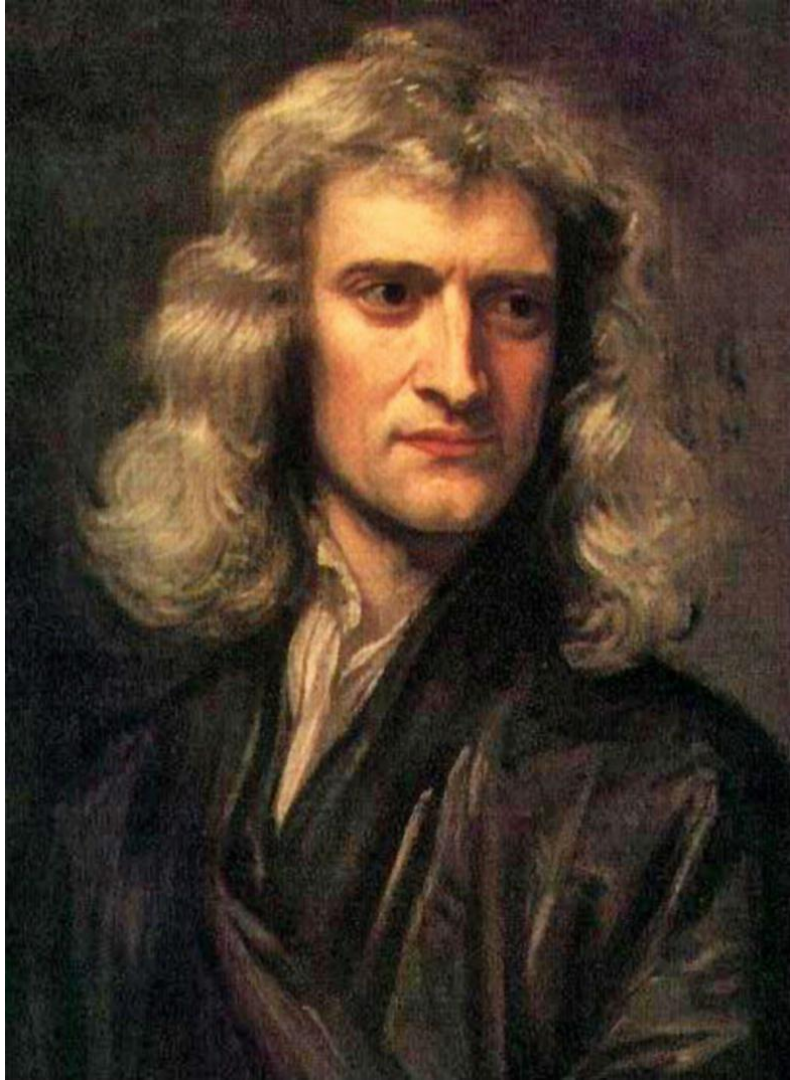
Update!

CodeThink Providing Genius.

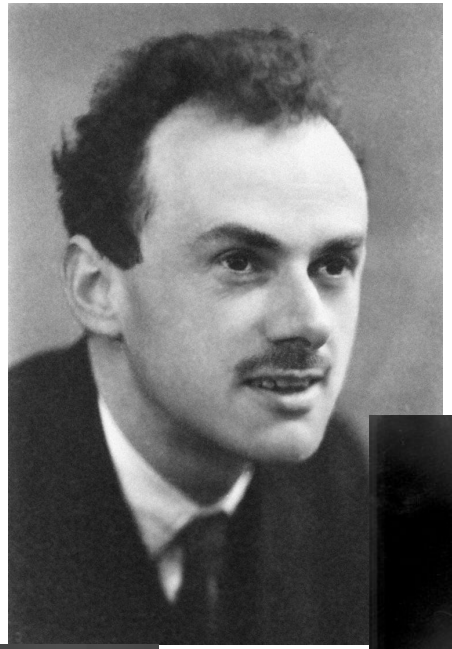
Strategy 2

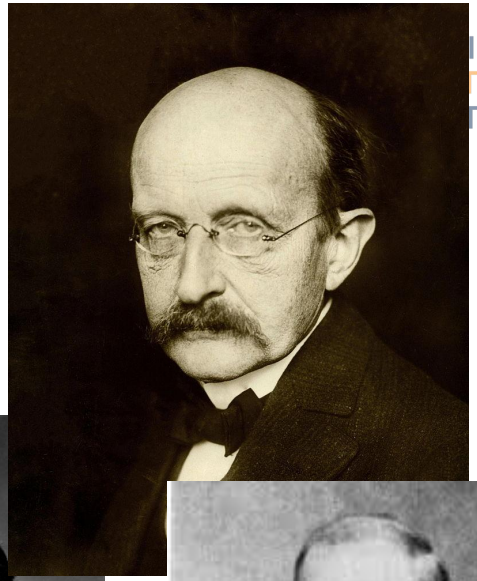
Extend current process:

SSSSS… LTS



Strategy 3





© Wikipedia

CIVIL INFRASTRUCTURE PLATFORM

Limits to the maintenance lifetime

CodeThink Providing Genius.

Limits to lifetime - 2038

- Linux represents “wall-clock” time as number of seconds since 1970.
- With 32-bit signed values, maximum possible time is in 2038.
- On 32-bit architectures, time types in uAPI and many internal APIs are 32-bit.
- On all architectures, time types in some internal APIs and filesystem formats are 32-bit.
- Needs changes in kernel, libc, other libraries, some applications.
  - Kernel and GNU libc changes in progress.
- Probably not backport-able.

Limits to lifetime - hardware

CIVIL INFRASTRUCTURE PLATFORM

- Support lifetime of most CPUs and SoCs is much less than 30 years
- Only most recent CIP kernel branch receives hardware support backports
- Some long-lived systems might require replacement of the Linux-based component - both hardware and kernel

Limits to lifetime - software

- Kernel internal APIs and their implementations change over time, sometimes dramatically
- Bug fixes may depend on those interface or implementation changes
- Backporting bug fixes from mainline to an older branch therefore becomes more difficult over time

CIVIL
INFRASTRUCTURE
PLATFORM

How can CIP achieve a longer lifetime?

CodeThink Providing Genius.

A longer lifetime - scope

CIVIL INFRASTRUCTURE PLATFORM

- Scope of maintenance is based on needs of members
- Most architectures, drivers, filesystems, etc. are not used and their bugs can be ignored
- Greatly reduces effort to backport and review fixes when a branch is only maintained by CIP

A longer lifetime - fewer fixes needed

CIVIL INFRASTRUCTURE PLATFORM

- Most important bugs are found and fixed quickly
- Number of bugs in a stable branch reduces over time, so does rate of fixes
- Difficulty of backporting fixes is counterbalanced by lower rate of fixes to handle
- Obscure bugs without security impact may not need fixing

A longer lifetime - collaboration

CIVIL INFRASTRUCTURE PLATFORM

- CIP won’t be a vendor providing support to customers
- Members’ developers will take over maintenance, addressing own needs but sharing the work
- Lifetime of each kernel branch will be determined by the interest and capability of members

CIVIL INFRASTRUCTURE PLATFORM

Thanks.

Questions?

CodeThink Providing Genius.

Maintaining a Linux Kernel for **13** Years? You Must be Kidding Me. We Need at Least **30**!

Event: ELCE
Schedule: 24th October 2017

Ben Hutchings / Agustín Benito Bethencourt
Kernel Developer / Principal Consultant
Codethink Ltd

www.codethink.co.uk