LINUX FOUNDATION
COLLABORATIVE PROJECTS

CIVIL INFRASTRUCTURE PLATFORM

CIP Kernel Team Activities to Accomplish Super Long Term Support

SZ Lin (林上智) @ Moxa Inc.
Masashi Kudo @ Cybertrust Japan

June 29th , 2020

About US

- **SZ Lin (林上智)** <sz.lin@moxa.com>
  - Working for Moxa Inc.
  - CIP Technical Steering Committee Member
  - OpenChain Project Governing Board Member
  - Debian Developer

- **Masashi Kudo** <masashi.kudo@miraclelinux.com>
  - Working for Cybertrust Japan Co., Ltd.
  - Acted as OpenDaylight (LF Networking) Ambassador
  - CIP Kernel Team Chair

CIVIL INFRASTRUCTURE PLATFORM

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What is CIP?

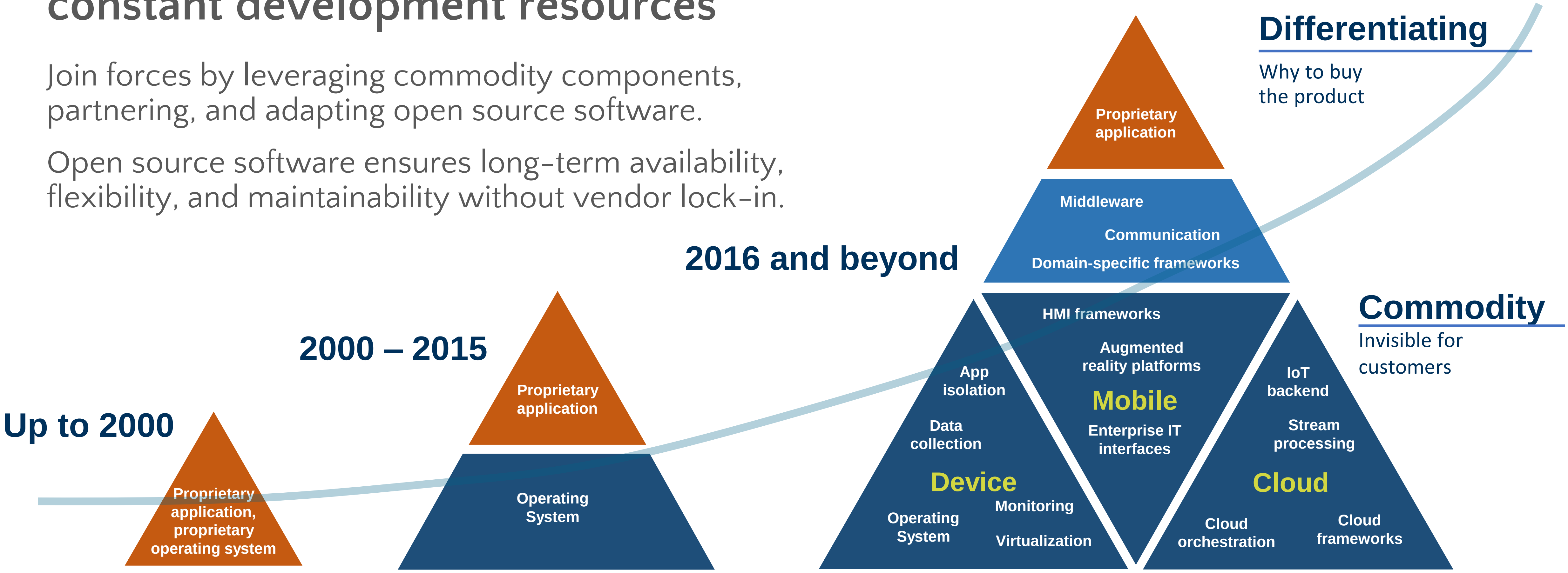
Image: http://zdnet1.cbsistatic.com/hub/i/r/2016/02/29/10863f77-89b2-40c0-9d8c-dbaa5feb65be/resize/770xauto/490141cef9bddc0db66b492698b53a50/pc

Speed and efficiency: focus on differentiating parts

Handling increasing complexity with constant development resources

Join forces by leveraging commodity components, partnering, and adapting open source software.

Open source software ensures long-term availability, flexibility, and maintainability without vendor lock-in.



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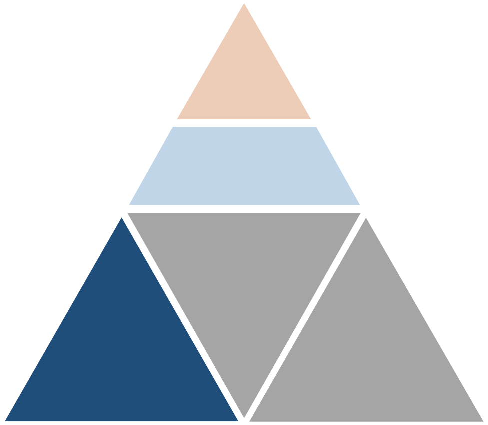
Facts and Issues: Silo Development

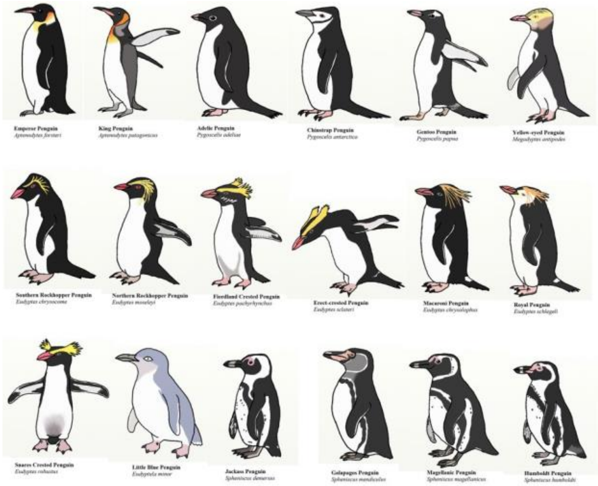
Facts

- Millions or trillions Industrial devices, including smart devices
- Similar software components (e.g. Linux)
- Industrial IoT requirements
  - Security
  - Sustainability
  - Industrial-gradeness



Issues

- A lot of products have to meet industrial requirements
- Same development and maintenance efforts spent by many companies or even business units
- **No common solution** for base building blocks



picture taken from Pinterest
https://www.pinterest.de/pin/554646510344033382/

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CIP is the Solution

Establishing an

Open Source Base Layer

of industrial-grade software to enable the use and implementation of software building blocks for Civil Infrastructure Systems

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What is “Open Source Base Layer (OSBL)”?

system-specific middleware and applications

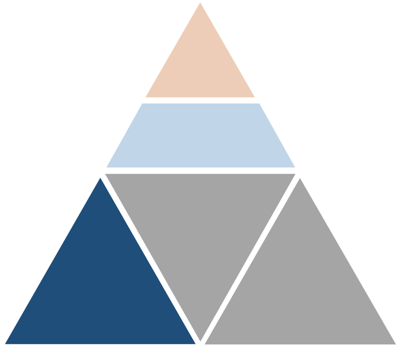
additional packages
(hundreds)

CIP Core packages
(tens)

CIP SLTS kernel
(10+ years maintenance, based on LTS kernels)

OSBL

scope of
a typical Linux
distribution



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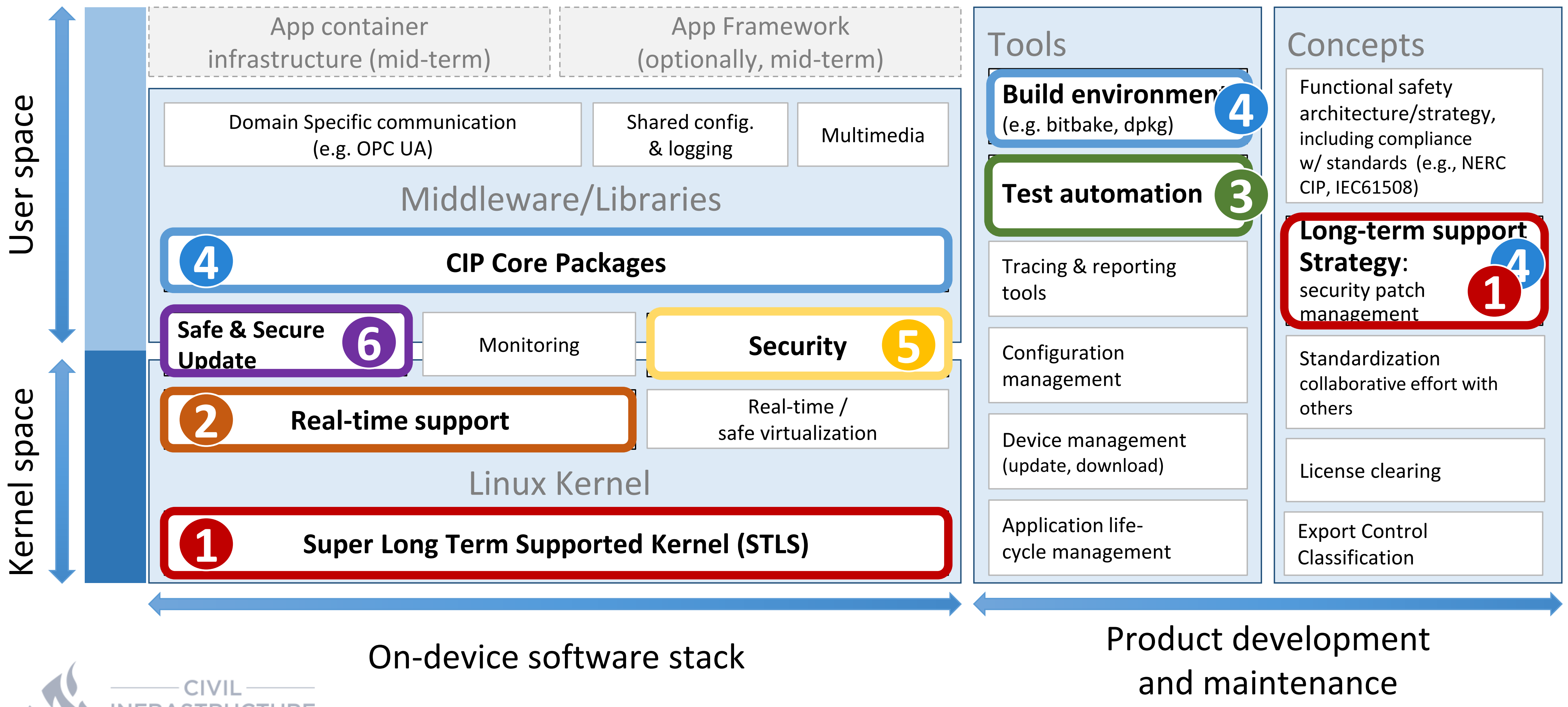
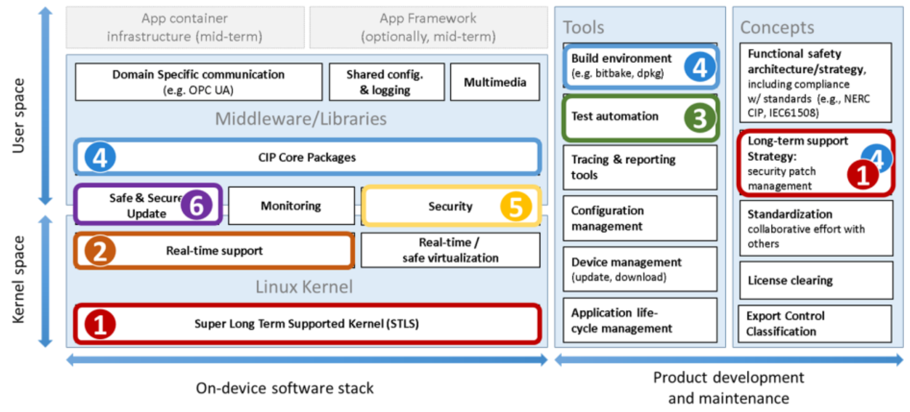
CIP Civil Infrastructure Platform Project (https://www.cip-project.org/) **SLTS** Super Long Term Support

Scope of activities



CIVIL INFRASTRUCTURE PLATFORM

CIP governance structure and projects



Governing Board (GB)

Technical Steering Committee (TSC)

(*): Workgroup

	1 SLTS kernel	2 Real-time	3 Testing	4 CIP Core	5 Security WG(*)	6 Software update WG(*)
Security	✔		✔	✔	✔	✔
Sustainability	✔		✔	✔		✔
Industrial grade	✔	✔	✔	✔	✔	✔

CIP Projects and its scopes

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The backbone of CIP are the member companies

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RENESAS, SIEMENS, TOSHIBA, Codethink, cybertrust, HITACHI Inspire the Next, MOXA, Plat'Home There, we are. Internet of Things

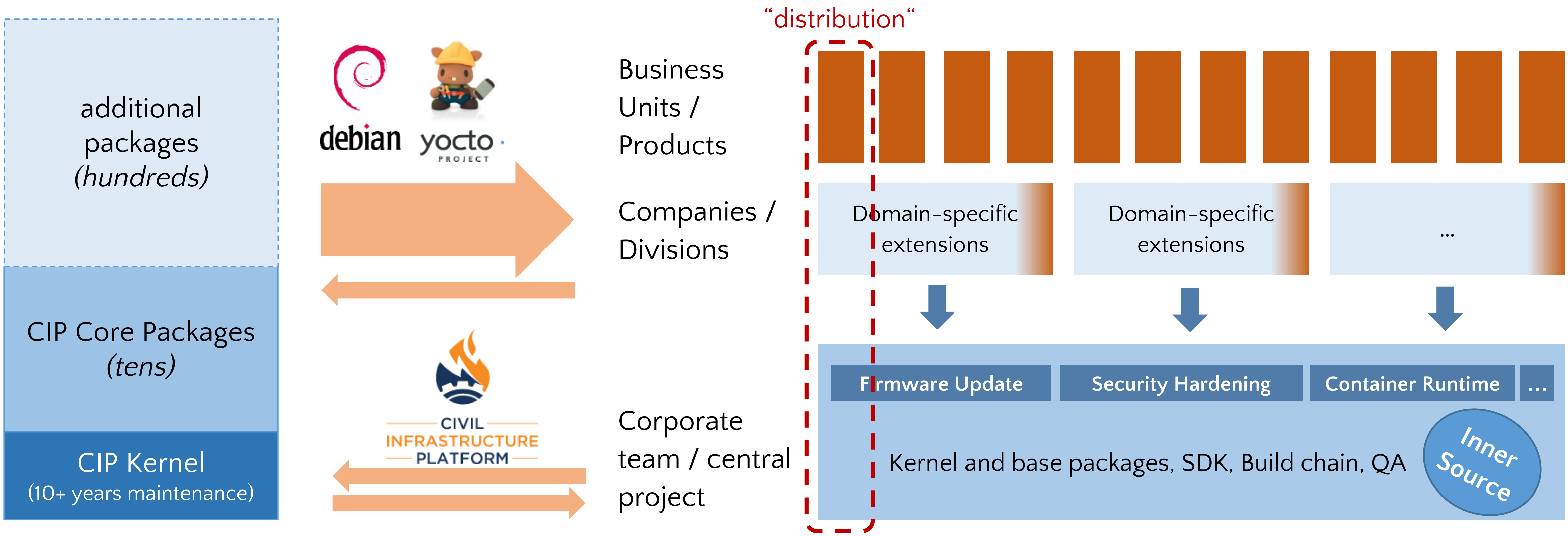
Budget ¥ € £ $ → Developers, maintainers

Optional: funding of selected projects

Contribution & usage / integration

Open Source Projects (Upstream work): Real-Time LINUX, debian, Reproducible Builds, EDGEX FOUNDRY

Mapping CIP into the company



Up to 70% effort reduction achievable for OSS license clearing and vulnerability monitoring, kernel and package maintenance, application adaptation and testing for an individual product.

OSS Open Source Software **QA** quality ssurance **SDK** software development kit

Upstream First

CIP Kernel Team

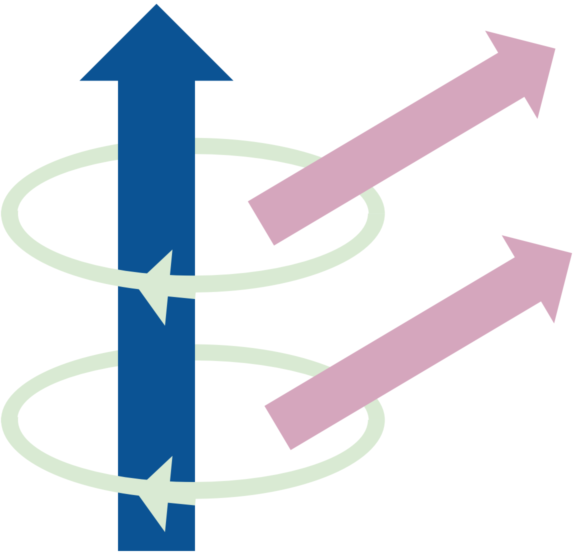
- **Primary Goal**
  - Provide CIP SLTS kernels with ten+ years maintenance period **by fixing versions** to fulfill the required level of reliability, sustainability, and security

- **Team Members**
  - Masashi Kudo – **Chairperson**
  - Nobuhiro Iwamatsu – **Kernel Maintainer**
  - Pavel Machek – **Kernel Maintainer**
  - Ben Hutchings – **Kernel Mentor**
  - SZ Lin – **Kernel Developer**
  - Chen-Yu Tsai – **Kernel Developer**

Development Models

“Own Community” Model

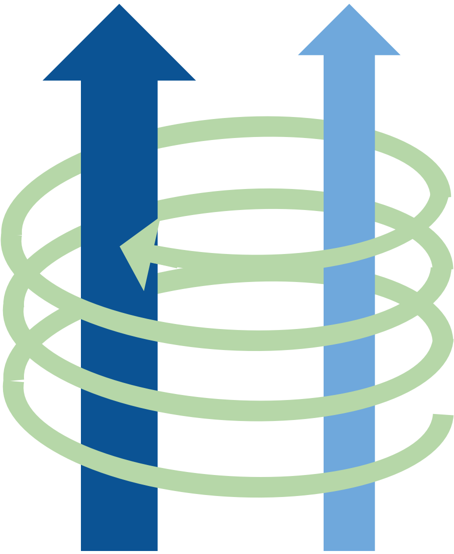
The project branches its base from upstream and evolves by its own.



Upstream **Project**

“Upstream First” Model

The project only allows patch commits if those patches are already in the upstream.



Upstream **Project**

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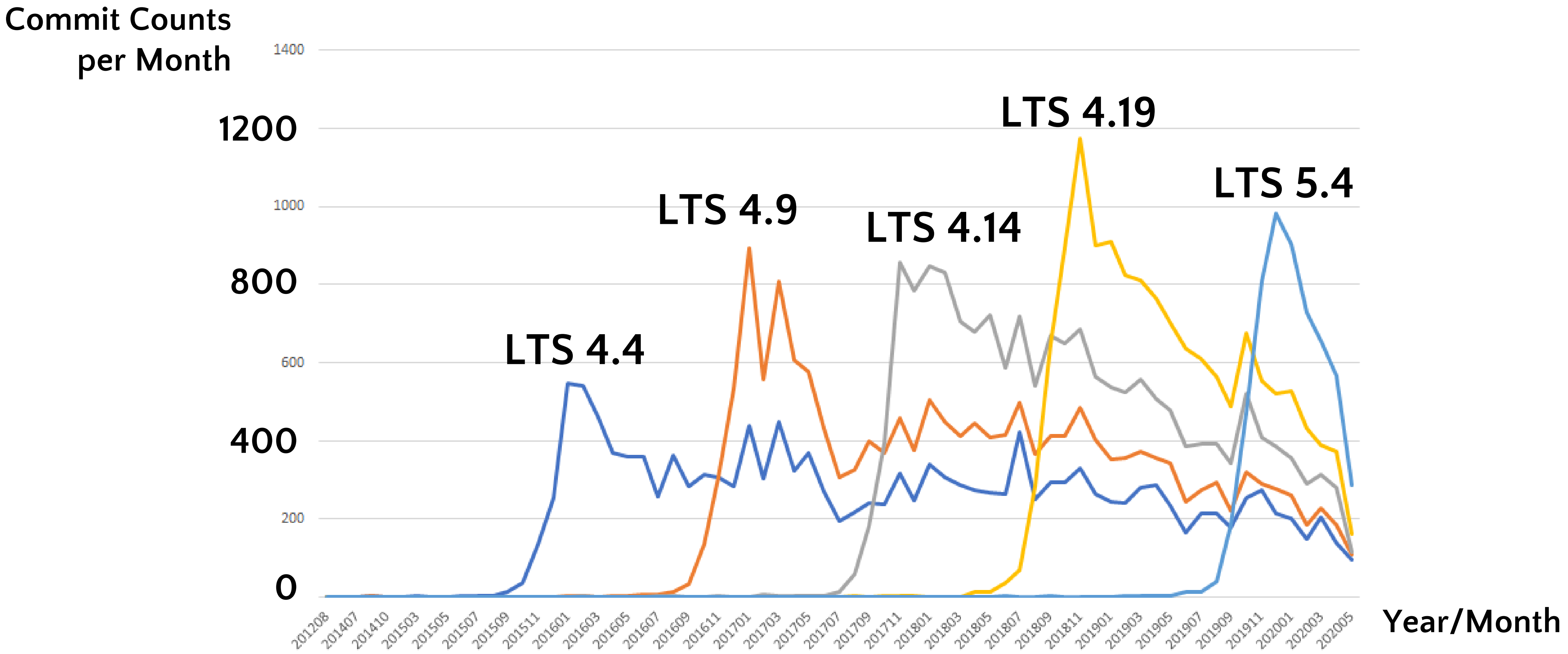
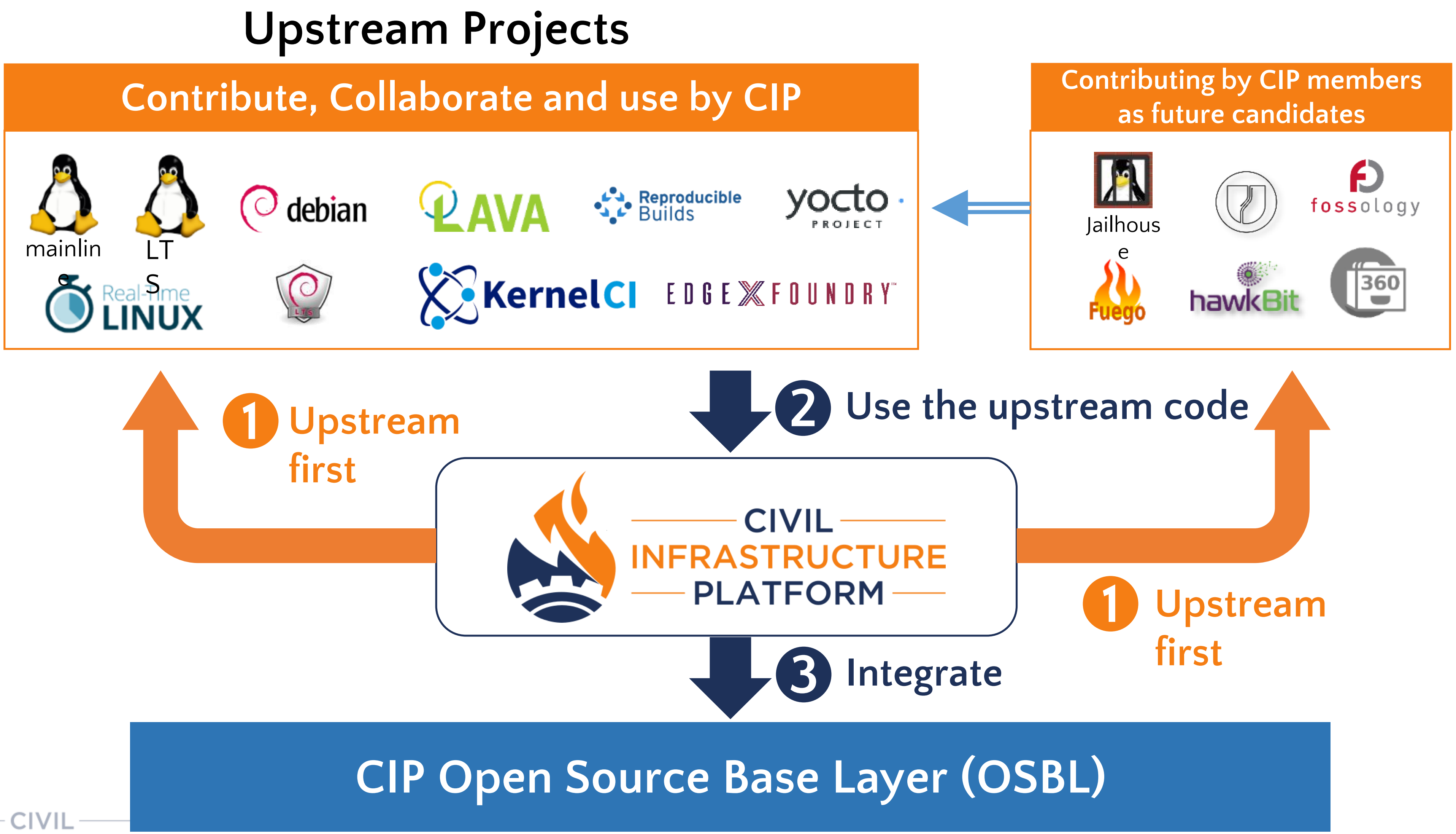
Commit Counts per LTS

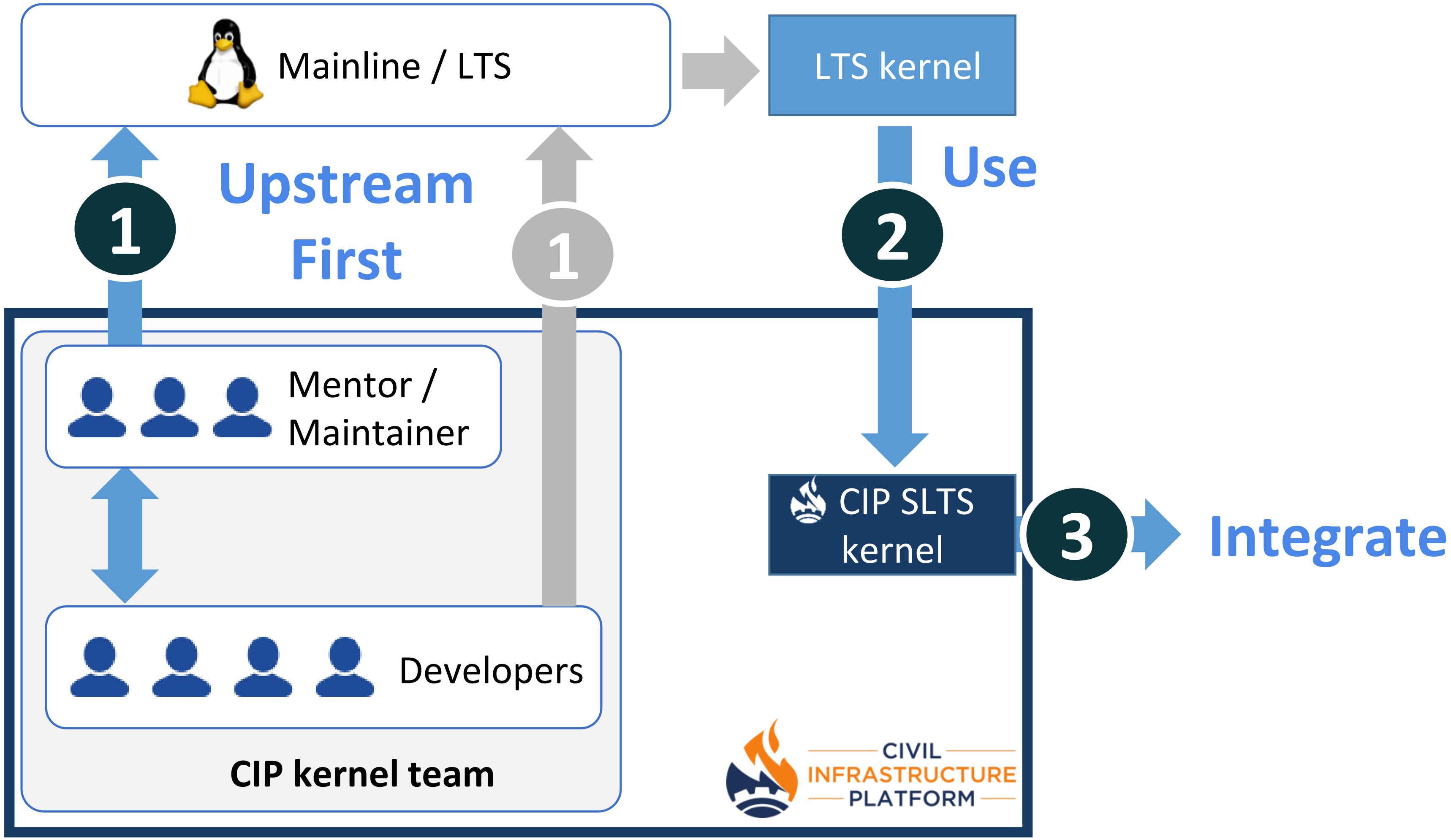


Note: If a patch has an original patch, the date of the patch is that of the original one.

Collaborative development with other OSS projects



CIP SLTS kernel development



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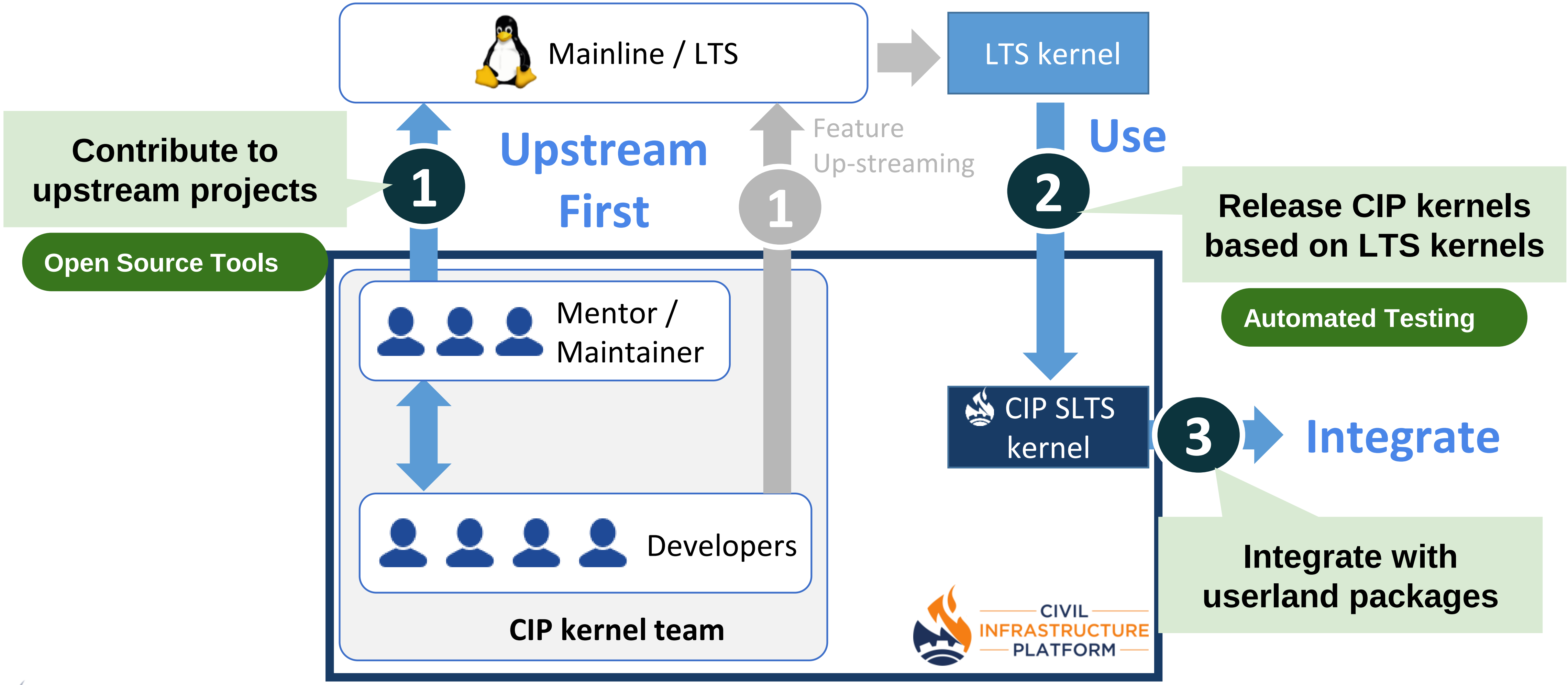
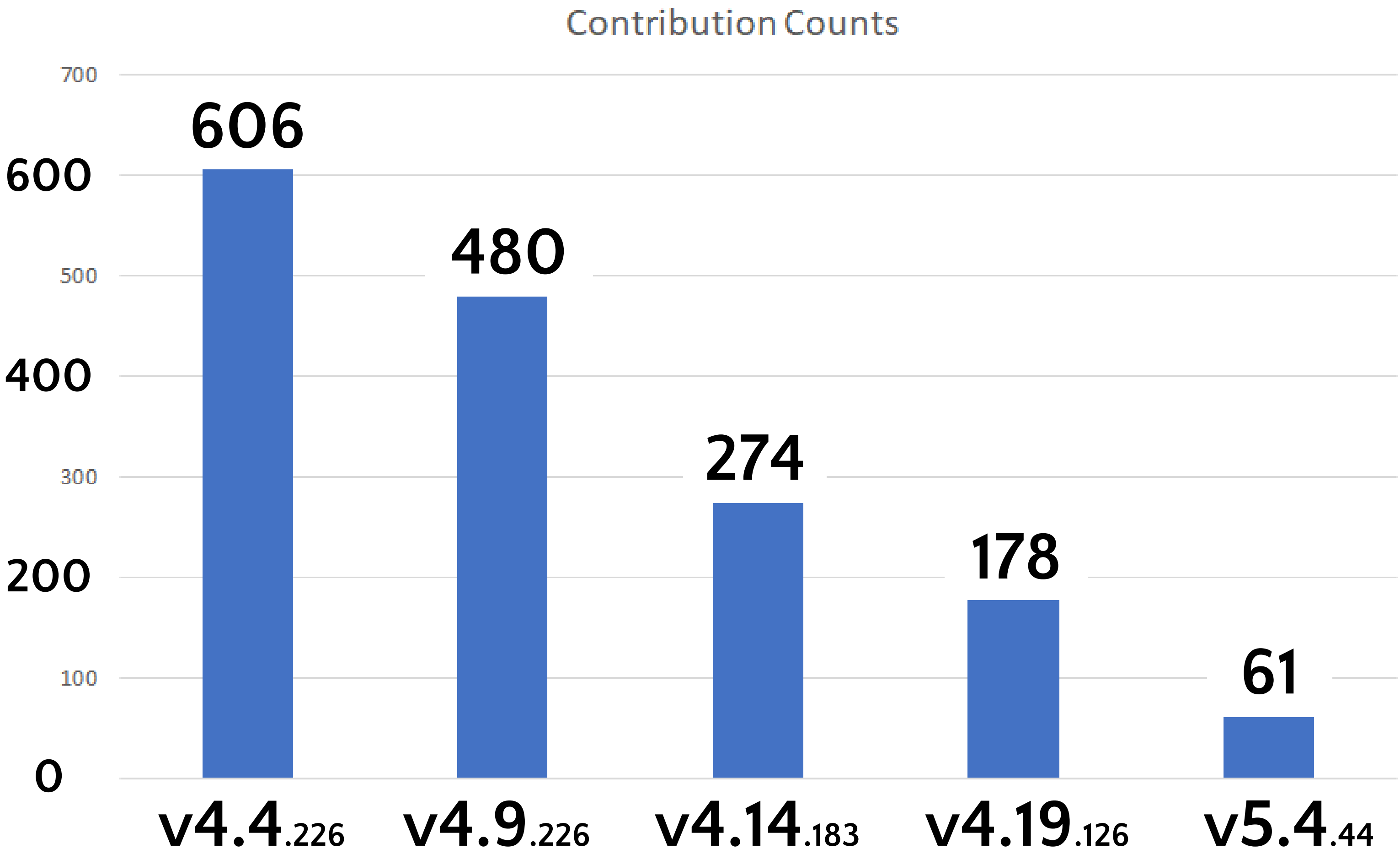
CIP SLTS kernel development



1 Contributions – Statistics



as of June 7, 2020

1 Contributions – Details

as of June 7, 2020

	v4.4.226	v4.9.226	v4.14.183	v4.19.126	v5.4.44	TOTAL
Suggested-by:	1	1	1	2	1	**6**
Reported-by:	44	35	29	16	6	**130**
Signed-off-by:	429	319	137	74	24	**983**
Debugged-by:	1	1				**2**
Author:	78	81	53	33	14	**259**
Acked-by:	26	29	33	43	11	**142**
Reviewed-by:	2	4	9	6	3	**24**
Tested-by:	4	4	6	3		**17**
Cc:	103	96	70	49	23	**341**
TOTAL / LTS	**606**	**480**	**274**	**178**	**61**	**1599**

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Note: There could be multiple contributions by a same personnel in one commit. such duplicates are eliminated in total numbers. Therefore, the summation of each item may not equal to “Total”.

2 Use – Current SLTS Versions

Version	Maintainer	First Release	Projected EOL
4.19	Nobuhiro Iwamatsu & Pavel Machek	2019-01-11 • v4.19.13-cip1	2029-01
4.19-rt	Pavel Machek	2019-01-11 • v4.19.13-cip1-rt1	2029-01
4.4	Nobuhiro Iwamatsu & Pavel Machek	2017-01-17 • v4.4.42-cip1	2027-01
4.4-rt	Pavel Machek	2017-11-16 • v4.4.75-cip6-rt1	2027-01

2 Use – CIP Kernel Release Process

1. Review stable patches – status tracked in Gitlab [1]
    - Mark the review and the name of the worker under the commit.
    - **Start to review stable kernel patches in rc stage**
2. Review patch from CIP members via cip-dev [2]
    - Update the status of the commit in patchwork
3. Start testing
4. Tag release candidate
5. Ack by other maintainers
6. Release and send the news to cip-dev

```
# Stable Kernel Patches Review Status
Please list your name and review result below the patch item

  * UR:  Under Review
  * ACK: Acknowledge (if the patch is accepted)
  * TBB: To be backported (if other patches should be also backported)
  * NAK: Negative acknowledge (if the patch is rejected, please list the reason)
  * IGN: Patch was not reviewed as it is out of scope for CIP project


## v4.4.184
  - 72d1ee93e931 Linux 4.4.184
  - 46c7b5d6f2a5 tcp: refine memory limit test in tcp_fragment()
```

[1] https://gitlab.com/cip-project/cip-kernel/lts-commit-list

[2] https://patchwork.kernel.org/project/cip-dev/list/

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2 Use – CIP SLTS Kernel Release Policy

Release regularly	Release on demand
SLTS 4.19: twice a month **SLTS 4.4**: once a month	Depends on criticality of bug / security fixes
SLTS 4.19-rt: once a month **SLTS 4.4-rt**: once every two months	Ditto

Note: Difficult to estimate actual release date because of number of patches depends on each stable release

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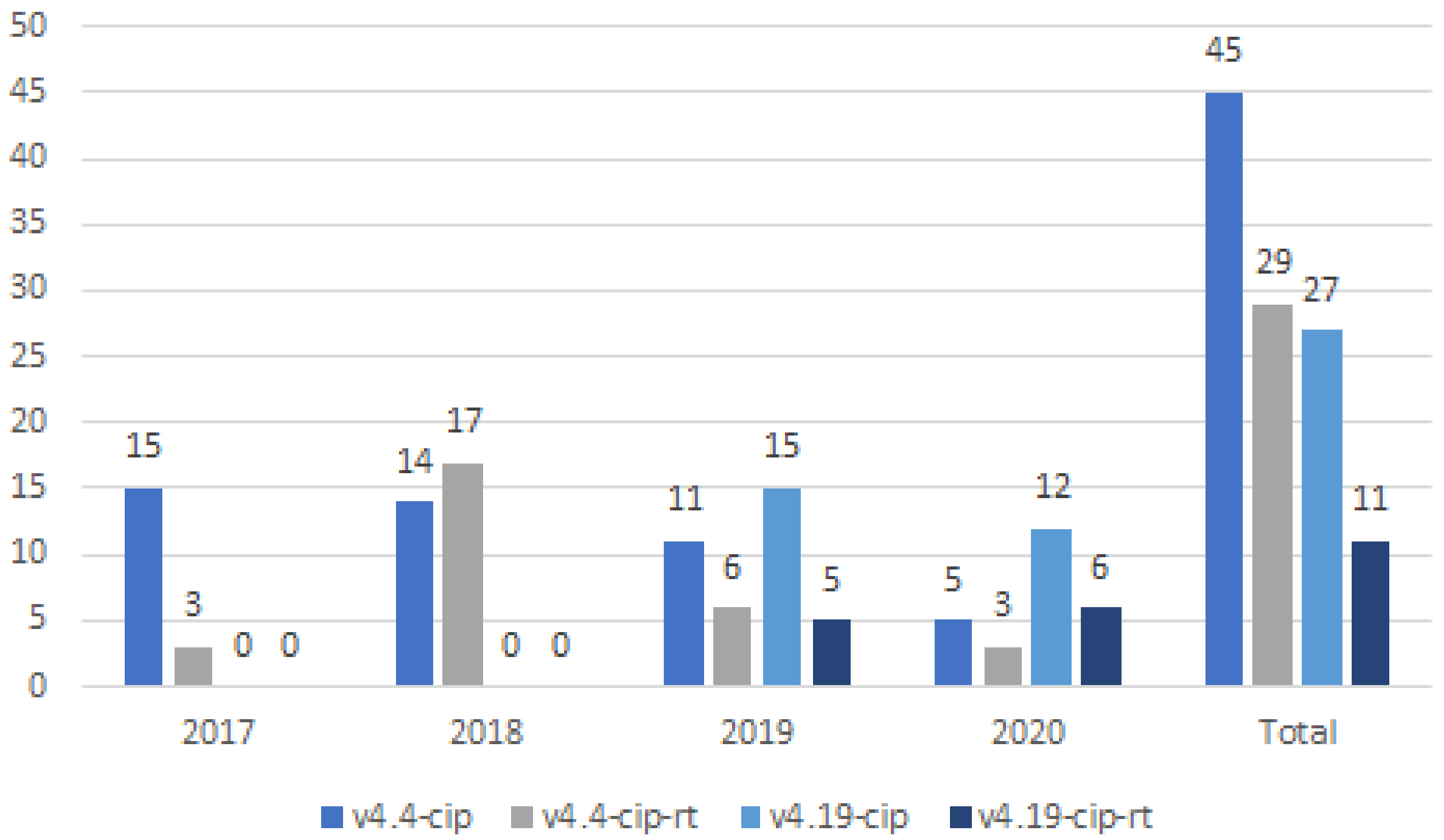
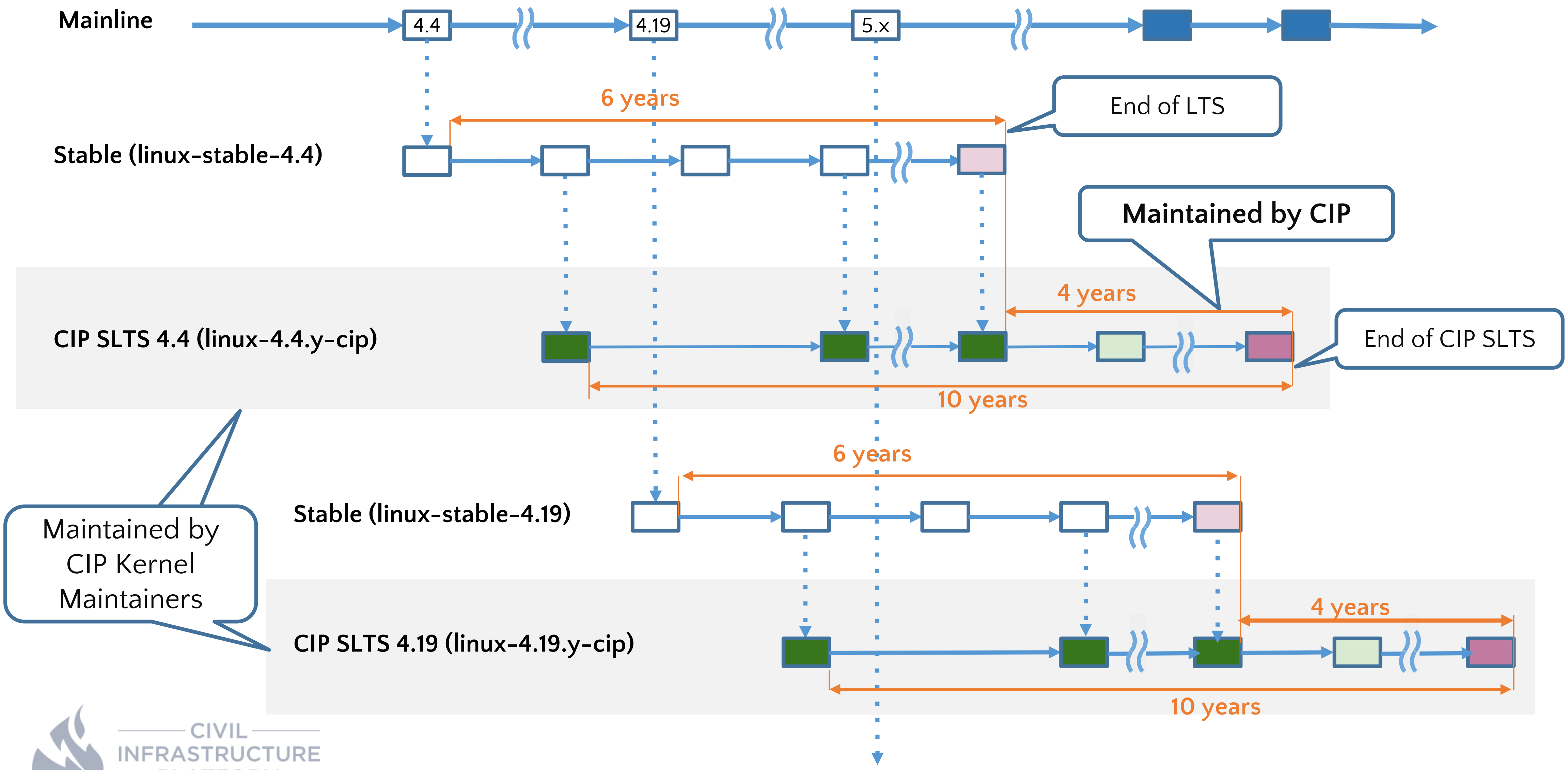
Use – CIP SLTS Kernel Release Statistics



as of June 7, 2020

2 Use – CIP SLTS Kernel Releases



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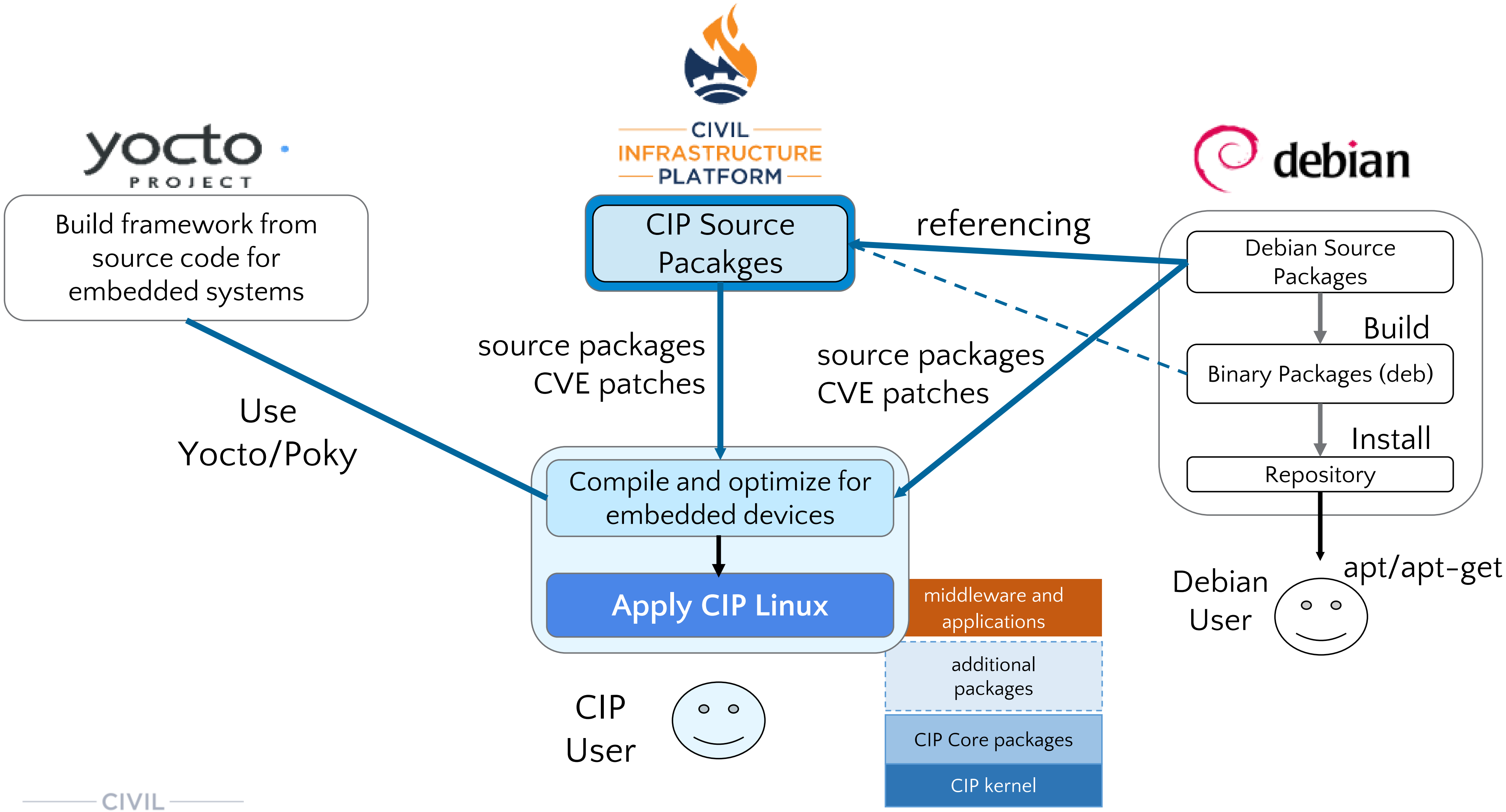
3 Integrate



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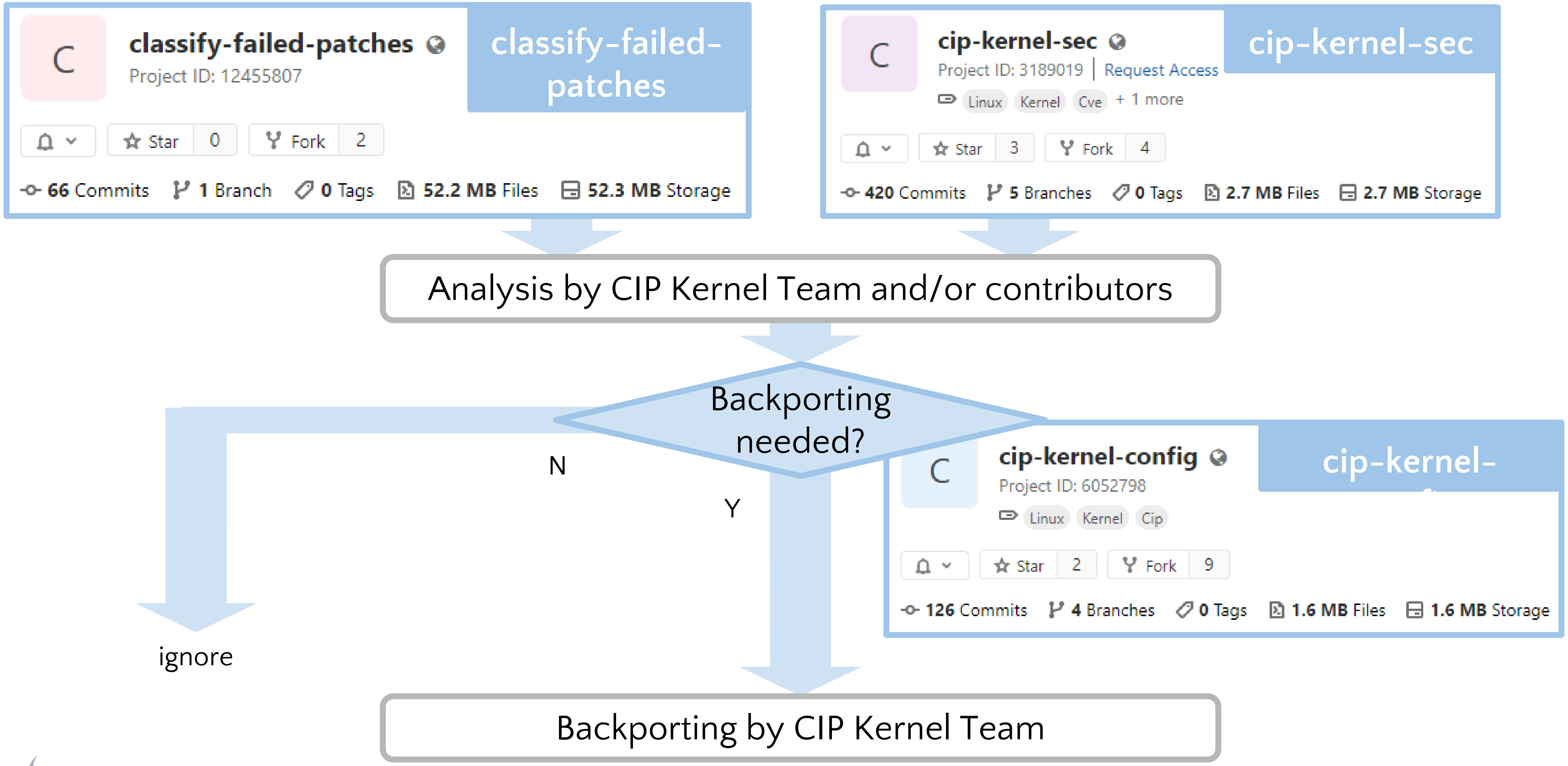
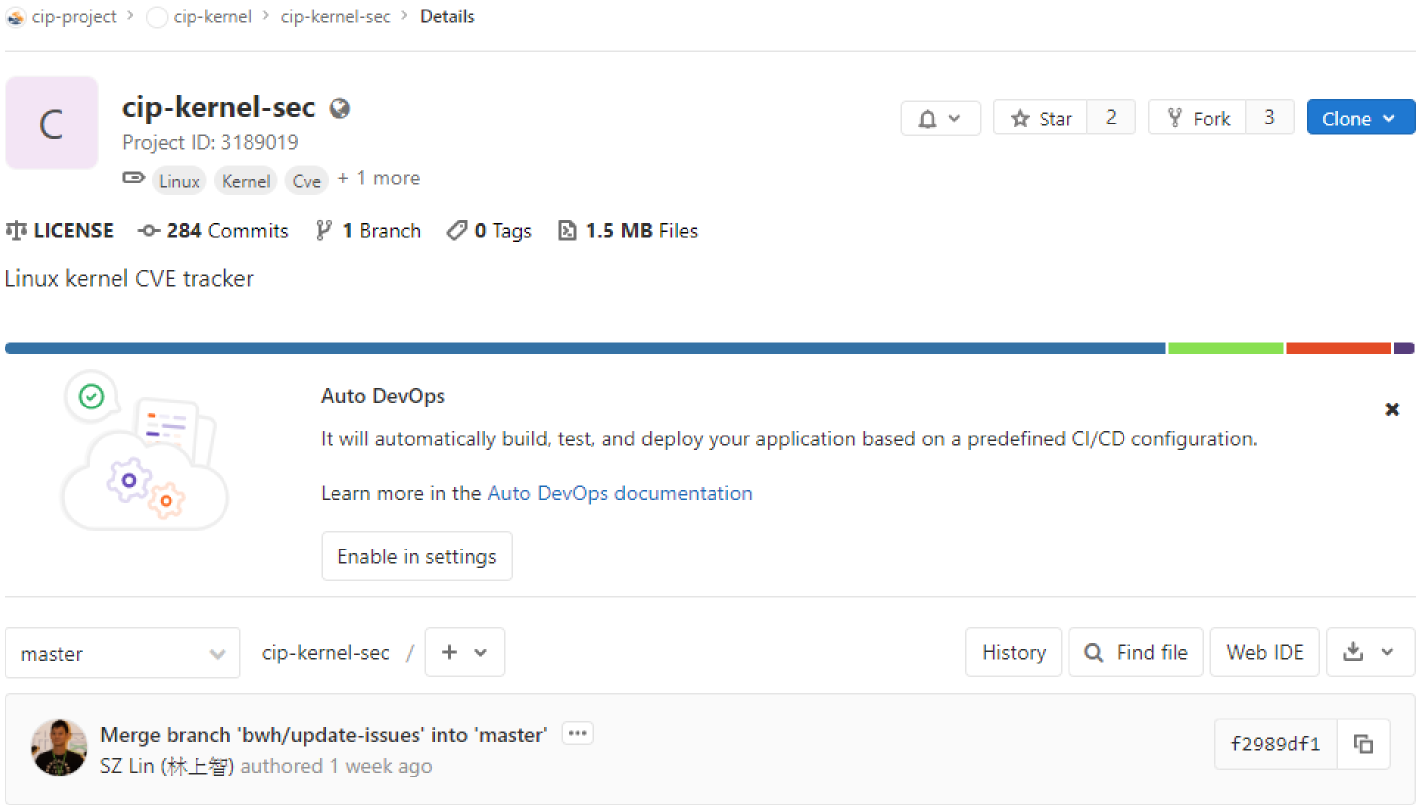
CIP
Open Source
Tools

Open Source Tools for Backporting Process



cip-kernel-sec

- Tracks the status of security issues, identified by CVE ID, in mainline, stable, and other configured branches.



cip-kernel-sec

Mainline/LTS

ubuntu

debian

Gather CVE Information for Kernel

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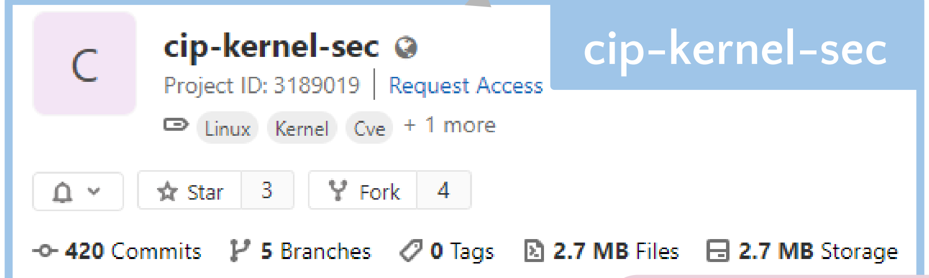
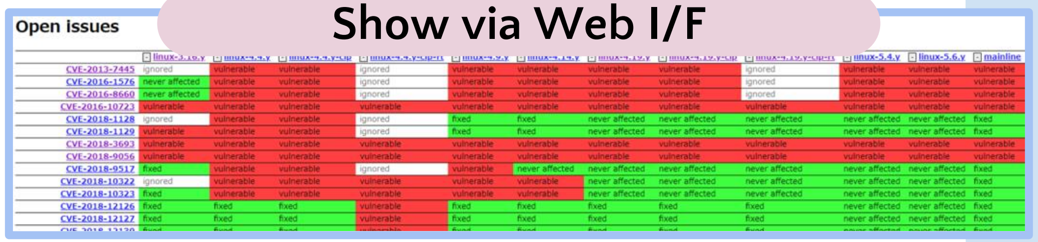
cip-kernel-sec

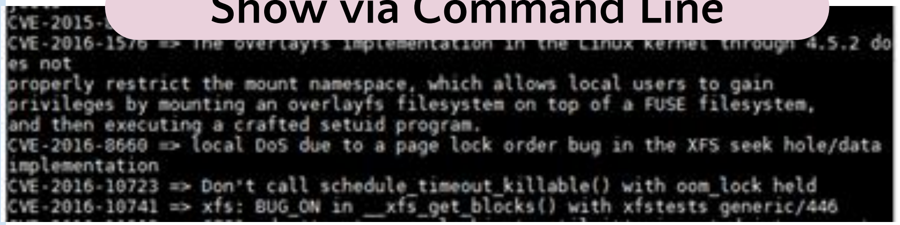


Show via Web I/F



Webview

Show via Command Line



Command line view

Backporting by CIP Kernel Team

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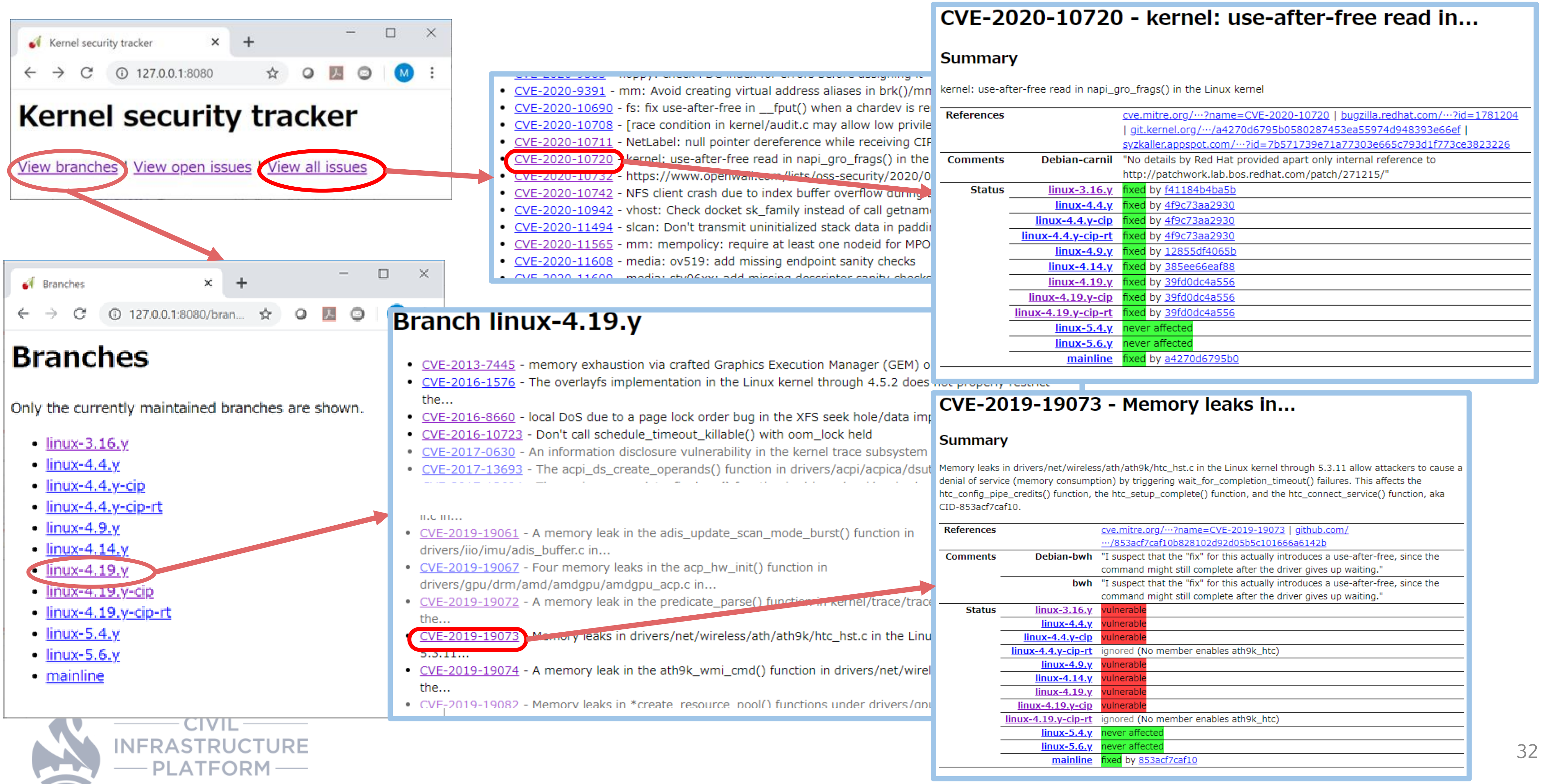
cip-kernel-sec Webview



Kernel security tracker

127.0.0.1:8080

Kernel security tracker

View branches | View open issues | View all issues

Branches

127.0.0.1:8080/bran...

Branches

Only the currently maintained branches are shown.

- linux-3.16.y
- linux-4.4.y
- linux-4.4.y-cip
- linux-4.4.y-cip-rt
- linux-4.9.y
- linux-4.14.y
- linux-4.19.y
- linux-4.19.y-cip
- linux-4.19.y-cip-rt
- linux-5.4.y
- linux-5.6.y
- mainline

- CVE-2020-9391 - mm: Avoid creating virtual address aliases in brk()/mm
- CVE-2020-10690 - fs: fix use-after-free in __fput() when a chardev is re
- CVE-2020-10708 - [race condition in kernel/audit.c may allow low privile
- CVE-2020-10711 - NetLabel: null pointer dereference while receiving CIP
- CVE-2020-10720 - kernel: use-after-free read in napi_gro_frags() in the
- CVE-2020-10732 - https://www.openwall.com/lists/oss-security/2020/0
- CVE-2020-10742 - NFS client crash due to index buffer overflow during
- CVE-2020-10942 - vhost: Check docket sk_family instead of call getnam
- CVE-2020-11494 - slcan: Don't transmit uninitialized stack data in paddi
- CVE-2020-11565 - mm: mempolicy: require at least one nodeid for MPO
- CVE-2020-11608 - media: ov519: add missing endpoint sanity checks

Branch linux-4.19.y

- CVE-2013-7445 - memory exhaustion via crafted Graphics Execution Manager (GEM) o
- CVE-2016-1576 - The overlayfs implementation in the Linux kernel through 4.5.2 does not properly restrict the...
- CVE-2016-8660 - local DoS due to a page lock order bug in the XFS seek hole/data imp
- CVE-2016-10723 - Don't call schedule_timeout_killable() with oom_lock held
- CVE-2017-0630 - An information disclosure vulnerability in the kernel trace subsystem
- CVE-2017-13693 - The acpi_ds_create_operands() function in drivers/acpi/acpica/dsut
- CVE-2019-19061 - A memory leak in the adis_update_scan_mode_burst() function in drivers/iio/imu/adis_buffer.c in...
- CVE-2019-19067 - Four memory leaks in the acp_hw_init() function in drivers/gpu/drm/amd/amdgpu/amdgpu_acp.c in...
- CVE-2019-19072 - A memory leak in the predicate_parse() function in kernel/trace/trace the...
- CVE-2019-19073 - Memory leaks in drivers/net/wireless/ath/ath9k/htc_hst.c in the Linu 5.3.11...
- CVE-2019-19074 - A memory leak in the ath9k_wmi_cmd() function in drivers/net/wirel the...

CVE-2020-10720 - kernel: use-after-free read in...

Summary

kernel: use-after-free read in napi_gro_frags() in the Linux kernel

References		cve.mitre.org/…?name=CVE-2020-10720 | bugzilla.redhat.com/…?id=1781204 | git.kernel.org/…/a4270d6795b0580287453ea55974d948393e66ef | syzkaller.appspot.com/…?id=7b571739e71a77303e665c793d1f773ce3823226
Comments	Debian-carnil	"No details by Red Hat provided apart only internal reference to http://patchwork.lab.bos.redhat.com/patch/271215/"
Status	linux-3.16.y	fixed by f41184b4ba5b
	linux-4.4.y	fixed by 4f9c73aa2930
	linux-4.4.y-cip	fixed by 4f9c73aa2930
	linux-4.4.y-cip-rt	fixed by 4f9c73aa2930
	linux-4.9.y	fixed by 12855df4065b
	linux-4.14.y	fixed by 385ee66eaf88
	linux-4.19.y	fixed by 39fd0dc4a556
	linux-4.19.y-cip	fixed by 39fd0dc4a556
	linux-4.19.y-cip-rt	fixed by 39fd0dc4a556
	linux-5.4.y	never affected
	linux-5.6.y	never affected
	mainline	fixed by a4270d6795b0

CVE-2019-19073 - Memory leaks in...

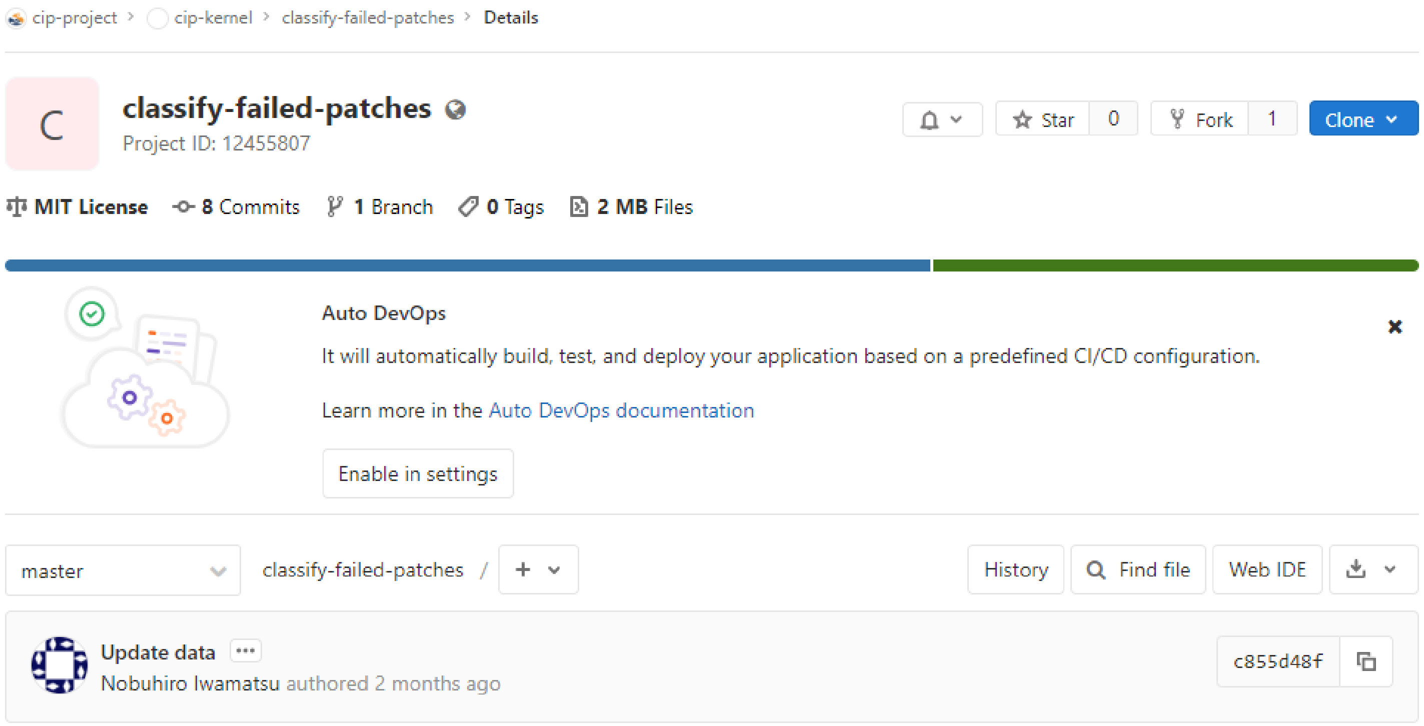
Summary

Memory leaks in drivers/net/wireless/ath/ath9k/htc_hst.c in the Linux kernel through 5.3.11 allow attackers to cause a denial of service (memory consumption) by triggering wait_for_completion_timeout() failures. This affects the htc_config_pipe_credits() function, the htc_setup_complete() function, and the htc_connect_service() function, aka CID-853acf7caf10.

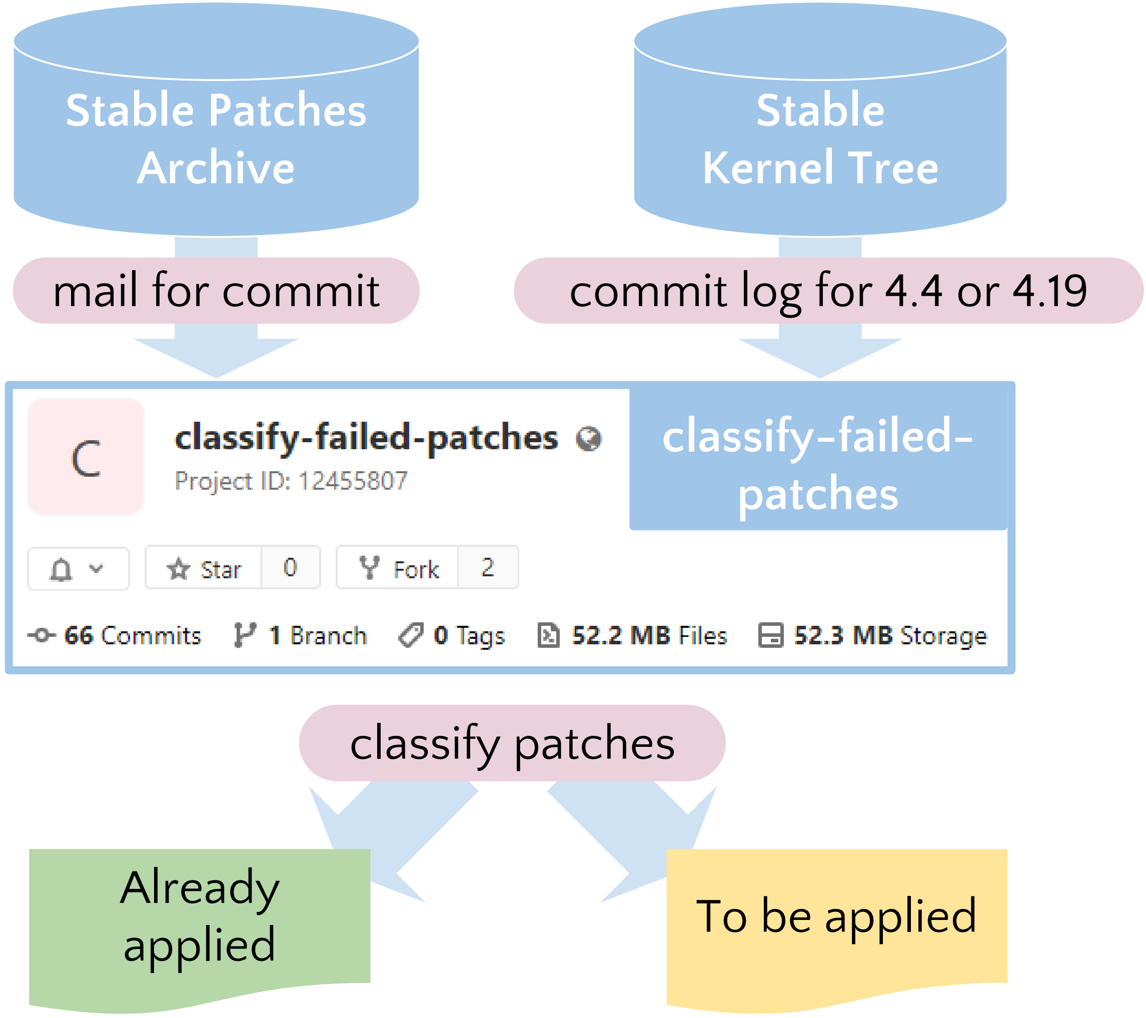
References		cve.mitre.org/…?name=CVE-2019-19073 | github.com/…/853acf7caf10b828102d92d05b5c101666a6142b
Comments	Debian-bwh	"I suspect that the "fix" for this actually introduces a use-after-free, since the command might still complete after the driver gives up waiting."
	bwh	"I suspect that the "fix" for this actually introduces a use-after-free, since the command might still complete after the driver gives up waiting."
Status	linux-3.16.y	vulnerable
	linux-4.4.y	vulnerable
	linux-4.4.y-cip	vulnerable
	linux-4.4.y-cip-rt	ignored (No member enables ath9k_htc)
	linux-4.9.y	vulnerable
	linux-4.14.y	vulnerable
	linux-4.19.y	vulnerable
	linux-4.19.y-cip	vulnerable
	linux-4.19.y-cip-rt	ignored (No member enables ath9k_htc)
	linux-5.4.y	never affected
	linux-5.6.y	never affected
	mainline	fixed by 853acf7caf10

classify-failed-patches

- This project tracks the status of failed patches, and classifies patches into “applied” and “ToApply” types.



classify-failed-patches



classify-failed-patches

Applied patches

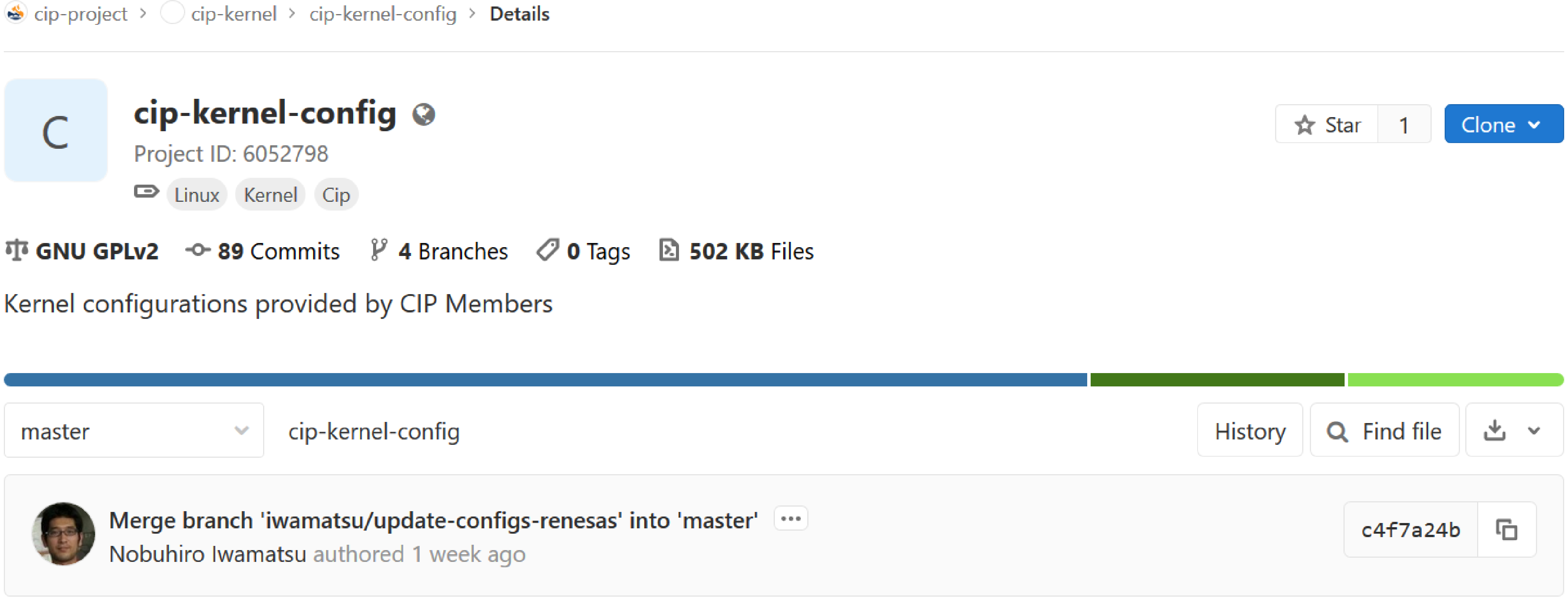
```
[APPLIED] arm64: Disable unhandled signal log messages by default
        56b57bd20f5bcdd353eacf7b7c41ee18ffe0c963 arm64: Disable unhandled signal log messages by default
[APPLIED] ARC: hide unused function unw_hdr_alloc
        4d28512bfca84456b6f65e6800c003cf0810480b ARC: hide unused function unw_hdr_alloc
[APPLIED] btrfs: Ensure replaced device doesn't have pending chunk allocation
        986543fcf50c8a3681be44cac42dc498fe25ab34 btrfs: Ensure replaced device doesn't have pending chunk allocation
[APPLIED] btrfs: Ensure replaced device doesn't have pending chunk allocation
        986543fcf50c8a3681be44cac42dc498fe25ab34 btrfs: Ensure replaced device doesn't have pending chunk allocation
[APPLIED] btrfs: Ensure replaced device doesn't have pending chunk allocation
        986543fcf50c8a3681be44cac42dc498fe25ab34 btrfs: Ensure replaced device doesn't have pending chunk allocation
[APPLIED] btrfs: Ensure replaced device doesn't have pending chunk allocation
        986543fcf50c8a3681be44cac42dc498fe25ab34 btrfs: Ensure replaced device doesn't have pending chunk allocation
```

To be Applied Patches

```
[TOAPPLY] inet: update the IP ID generation algorithm to patch 355b98553789b646ed97ad801a619ff898471b92 standards.
[TOAPPLY] scsi: ufs: Fix RX_TERMINATION_FORCE_ENABLE define value
[TOAPPLY] inet: update the IP ID generation algorithm to patch 355b98553789b646ed97ad801a619ff898471b92 standards.
[TOAPPLY] IB/hfi1: Failed to drain send queue when QP is put into error state
[TOAPPLY] arm64: mm: Ensure tail of unaligned initrd is reserved
[TOAPPLY] fs/proc/task_mmu.c: fix uninitalized variable warning
[TOAPPLY] tpm: Fix the type of the return value in calc_tpm2_event_size()
[TOAPPLY] block: bio_map_user_iov should not be limited to BIO_MAX_PAGES
[TOAPPLY] clk: ingenic/jz4725b: Fix parent of pixel clock
[TOAPPLY] i2c-piix4: Add Hygon Dhyana SMBus support
[TOAPPLY] TTY: serial_core, add ->install
```

cip-kernel-config

- Necessity of backporting is determined to be fixed base on kernel configurations provided by CIP members



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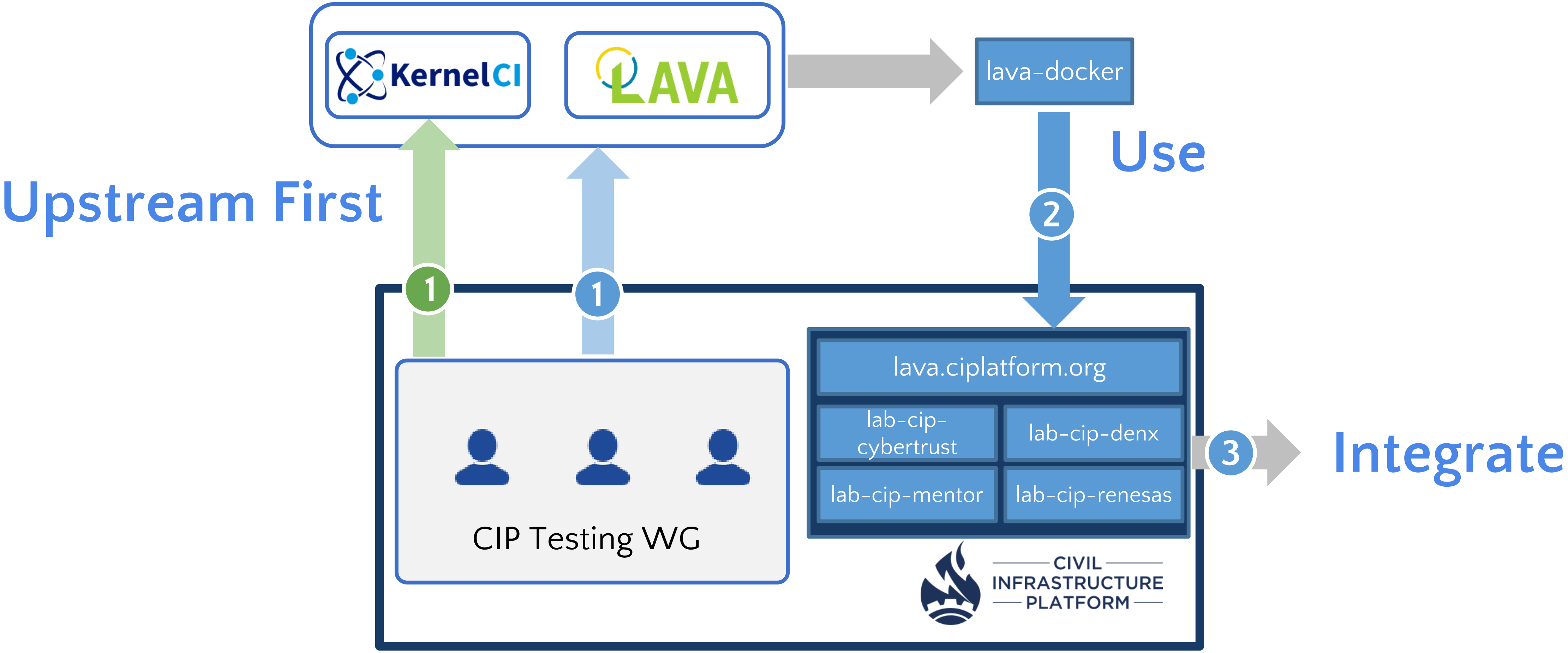
CIP Automated Testing

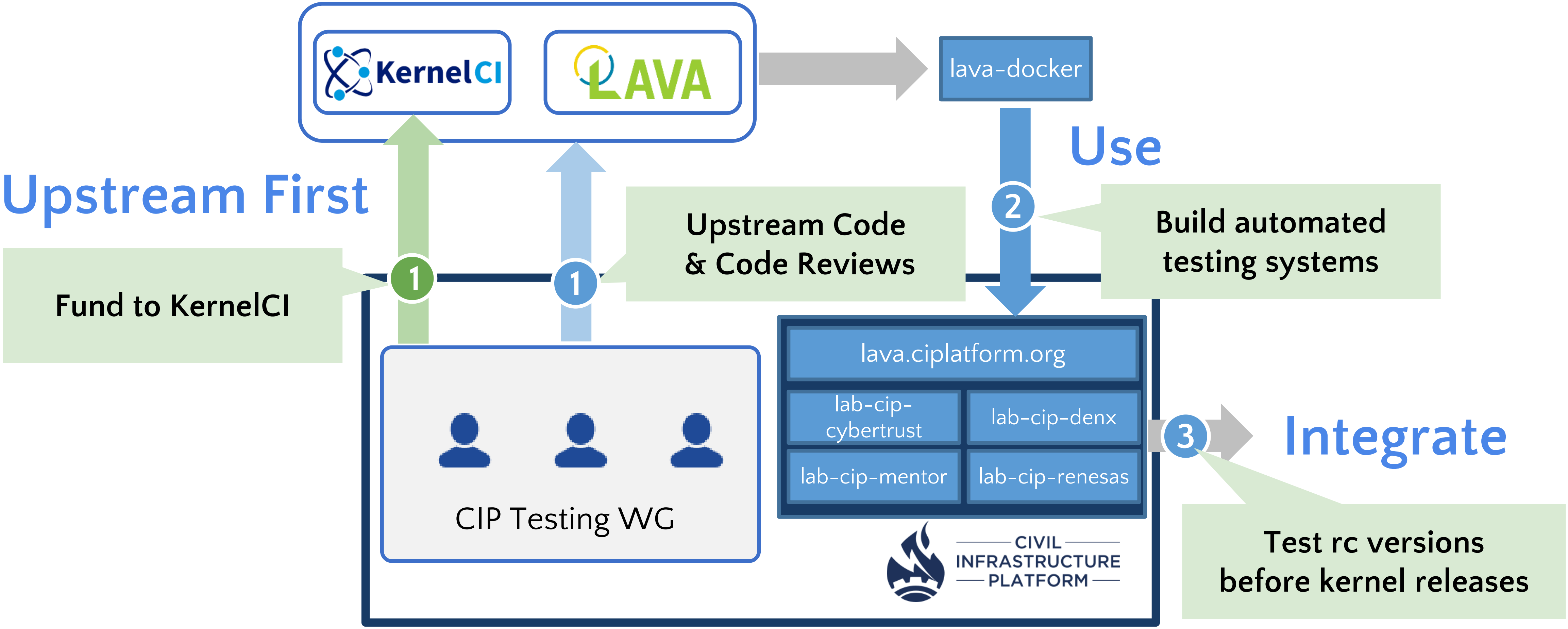
CIP Testing Goals

- **Centralized control / distributed testing**
  - CIP developers who are distributed over the world should be able to test CIP reference platforms which are hosted at 4 labs located in Europe, India and Japan.
- **Automated testing with Continuous Integration (CI)**
  - Sustain periodical and long-term kernel releases cost-effectively
- **Support all CIP reference platforms**
  - There are currently 7 different reference platforms

CIP Testing Team

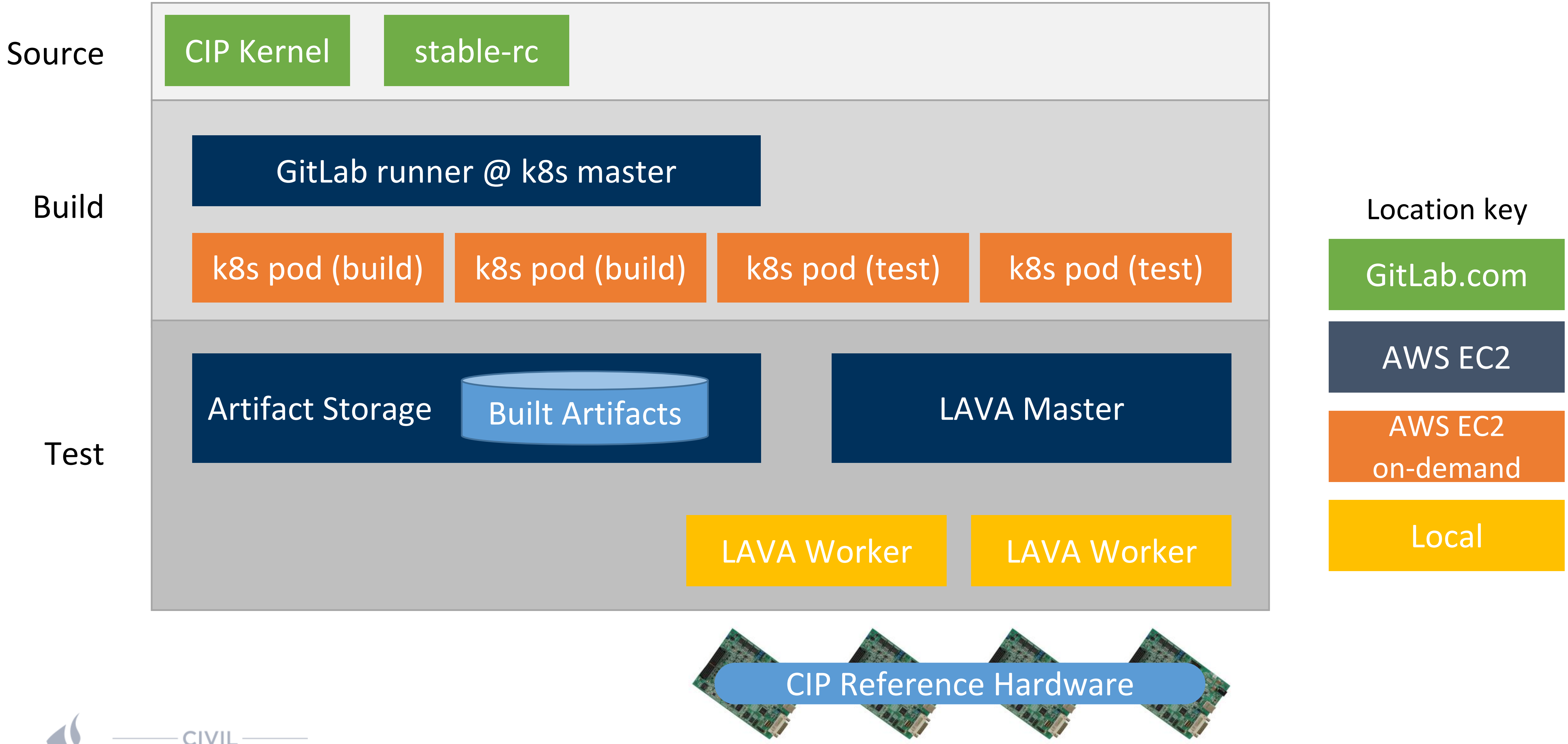


CIP Testing Team



CIVIL INFRASTRUCTURE PLATFORM

Testing Architecture Overview



CIP Reference Boards

CIP Reference Boards		Supported Kernels			
Platform	**Architecture**	**SLTS v4.4**	**SLTS v4.4-rt**	**SLTS v4.19**	**SLTS v4.19-rt**
AM335x Beaglebone Black	Armv7	Y	Y[1]	Y	Y[1]
Cyclone V DE0-Nano-SoC Development Kit	Armv7	N	N	Y	Y[1]
QEMU	x86_64	Y	Y[1]	Y	Y[1]
RZ/G1M iWave Qseven Development Kit	Armv7	Y	Y[1,2]	Y	Y[1,2]
RZ/G2M HopeRun HiHope	Armv8	N	N	Y	Y[1,2]
SIMATIC IPC227E	x86-64	N	N	Y	Y[1]
OpenBlocks IoT VX2	x86-64	N	N	Y	Y[1]

CIP Reference Board Candidate		Supported Kernels			
Platform	**Architecture**	**SLTS v4.4**	**SLTS v4.4-rt**	**SLTS v4.19**	**SLTS v4.19-rt**
Zynq UltraScale+ MPSoC ZCU102 Evaluation Kit	Armv8	N	N	Y	Y[1]

[1] Tested with standard Kernel configuration (non-RT)
[2] Tested with Real-Time enabled Kernel configuration

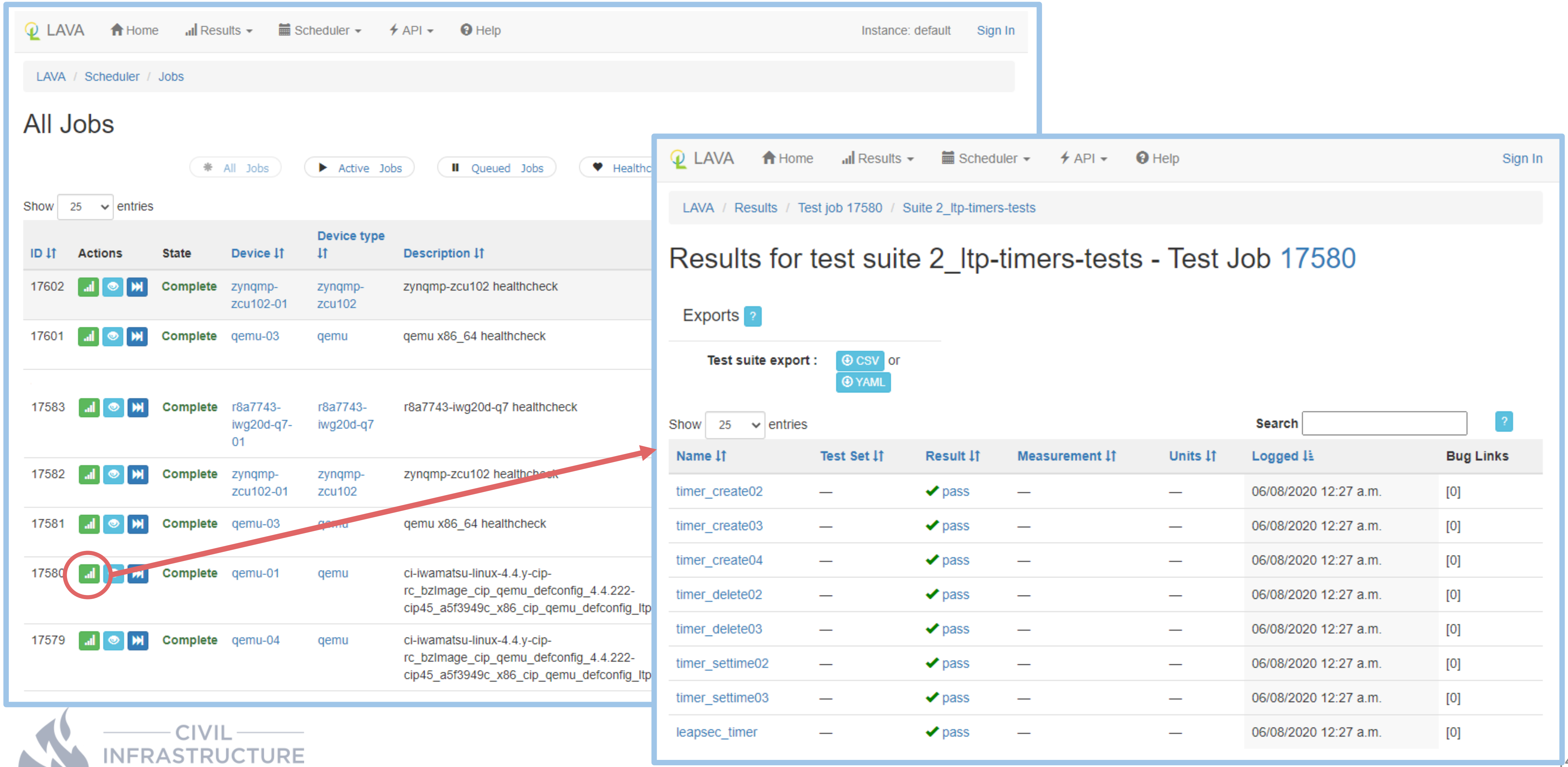
CIVIL INFRASTRUCTURE PLATFORM

Automated Testing

- Currently CIP is running the following tests:
  - Boot test
    - uname -a
  - Spectre/Meltdown checker
  - LTP
    - ltp-cve-tests, ltp-dio-tests, ltp-fs-tests, ltp-ipc-tests, ltp-math-tests, ltp-open-posix-tests, ltp-sched-tests, ltp-syscalls-tests and ltp-timers-tests
  - Cyclictest+Hackbench
    - This test measures event latency in the Linux Kernel, with hackbench running in the background to stress the system.

- In Development:
  - Kselftest

LAVA Results



Collaboration with KernelCI

- kernelci.org is now a Linux Foundation project, sponsored by Baylibre, **CIP**, Collabra, Foundries.io, Google, Microsoft and Redhat: https://foundation.kernelci.org/
- CIP are collaborating with KernelCI to improve the range of tests supported by KernelCI, starting with LTP
- Further collaboration is being discussed between CIP and KernelCI

CIVIL INFRASTRUCTURE PLATFORM

KernelCI

Summary

Summary

- CIP Kernel Team follows "Upstream First" principle, and contributes to upstream.
- CIP open source tools are developed to facilitate the contribution activities.
- By taking advantage of kernel LTS, the team steadily releases CIP SLTS kernels, and aims to maintain them for 10 years or more.
- To reduce CIP SLTS kernel release cost, the team is closely working with CIP testing team to build automated testing systems.

Please join us to sustain Civil Infrastructure together !

Weekly Regular Online Meeting

- CIP IRC weekly meeting – Every Thursday UTC (GMT) 09:00

US-West	US-East	UK	DE	TW	JP
02:00	05:00	10:00	11:00	17:00	18:00

- Channel:
  * irc:chat.freenode.net:6667/cip

- The meeting is used to share status among CIP developers (Kernel Team, Test Team, SW Update WG, Security WG)

CIVIL INFRASTRUCTURE PLATFORM

CIP Kernel Workgroup Repository

- **CIP Linux kernel & real-time kernel**
  - https://git.kernel.org/pub/scm/linux/kernel/git/cip/linux-cip.git
- **CIP Linux kernel CVE tracker**
  - https://gitlab.com/cip-project/cip-kernel/cip-kernel-sec
- **CIP Linux kernel failed patches tracker**
  - https://gitlab.com/cip-project/cip-kernel/classify-failed-patches

Contact Information and Resources

To get the latest information, please contact:

- CIP Mailing List: cip-dev@lists.cip-project.org

Other resources

- Twitter: @cip_project
- CIP Web Site: https://www.cip-project.org
- CIP News: https://www.cip-project.org/news/in-the-news
- CIP Wiki: https://wiki.linuxfoundation.org/civilinfrastructureplatform/
- CIP Source Code
  - CIP repositories hosted at kernel.org: https://git.kernel.org/pub/scm/linux/kernel/git/cip/
  - CIP GitLab: https://gitlab.com/cip-project

Thank You