SLTS Kernel Maintenance and Patches Management

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Super Long Term Support Kernel Workgroup

- The first action taken by the CIP project is to select and maintain Linux kernels for very long time (10+ years).
- Applying the PREEMPT_RT patch to CIP Kernel, then maintaining as CIP-RT.

<table>
<thead>
<tr>
<th>SLTS kernel</th>
<th>Real-time</th>
<th>Testing</th>
<th>CIP Core</th>
<th>Security WG(*)</th>
<th>Software update WG</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
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<td>✔</td>
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</tr>
</tbody>
</table>

(*): Workgroup

- Industrial grade
- Sustainability
- Security

CIP Projects and its scopes
Policy and Progress
## Current LTS Versions (Retrieved 22\textsuperscript{nd}, Oct 2019)

<table>
<thead>
<tr>
<th>Version</th>
<th>Maintainer</th>
<th>Released</th>
<th>Projected EOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.4</td>
<td>Greg Kroah-Hartman &amp; Sasha Levin</td>
<td>2019-XX-XX</td>
<td>Dec, 2021</td>
</tr>
<tr>
<td>4.14</td>
<td>Greg Kroah-Hartman &amp; Sasha Levin</td>
<td>2017-11-12</td>
<td>Jan, 2024</td>
</tr>
<tr>
<td>4.9</td>
<td>Greg Kroah-Hartman &amp; Sasha Levin</td>
<td>2016-12-11</td>
<td>Jan, 2023</td>
</tr>
<tr>
<td>4.4</td>
<td>Greg Kroah-Hartman &amp; Sasha Levin</td>
<td>2016-01-10</td>
<td>Feb, 2022</td>
</tr>
<tr>
<td>3.16</td>
<td>Ben Hutchings</td>
<td>2014-08-03</td>
<td>Apr, 2020</td>
</tr>
</tbody>
</table>
CIP SLTS Kernel Development (Upstream First Development)

• Goal
  • Providing CIP kernels with more than 10 years maintenance period
    • Super Long Time Stable kernel

• Status
  • LTS review process participation
  • CIP SLTS kernels release
    • 4.4.196-cip38
    • 4.19.78-cip12
  • CIP kernel CVE tracker
  • CIP kernel failed patches tracker
Introduction to CIP Kernel Team Member

• Chairperson
  • SZ Lin (林上智)

• Maintainer
  • Nobuhiro Iwamatsu
  • Pavel Machek

• Mentor
  • Ben Hutchings
## Current SLTS Versions (Retrieved 22nd, Oct 2019)

<table>
<thead>
<tr>
<th>Version</th>
<th>Maintainer</th>
<th>First Release</th>
<th>Latest Release</th>
<th>Projected EOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4</td>
<td>Nobuhiro Iwamatsu &amp; Pavel Machek</td>
<td>2017-01-17 • v4.4.42-cip1</td>
<td>2019-10-12 • v4.4.196-cip38</td>
<td>2027+</td>
</tr>
<tr>
<td>4.4-rt</td>
<td>Pavel Machek</td>
<td>2017-11-16 • v4.4.75-cip6-rt1</td>
<td>2019-10-02 • v4.4.190-cip36-rt25</td>
<td>2027+</td>
</tr>
</tbody>
</table>
CIP SLTS Kernel Development

Maintenance Policy
• [https://wiki.linuxfoundation.org/civilinfrastructureplatform/cipkernelmaintenance](https://wiki.linuxfoundation.org/civilinfrastructureplatform/cipkernelmaintenance)
• Follow the stable kernel development rule as the basis
• Validation will be done by CIP test infrastructure and/or members
• Feature backports are acceptable
  • All features has to be in upstream kernel before backport to CIP kernel
  • CIP has “Upstream first” policy
• The CIP Project uses the Linux Foundation Developer Certificate of Origin (DCO)
CIP SLTS Kernel Development

Out-of-tree drivers

• In general, all out-of-tree drivers are unsupported by CIP

• Users can use CIP kernel with out-of-tree drivers
  • If a bug is found in such a modified kernel, users will first demonstrate that it exists in the CIP kernel source release in order for the CIP maintainers to act on it.
CIP SLTS Kernel Development

Mainline

4.4

4.19

Stable 4.4.y

EOL

CIP SLTS (linux-4.4.y-cip)

Backported patches

Maintained by Iwamatsu and Pavel

Feature backports

Stable 4.19.y

EOL

CIP SLTS (linux-4.19.y-cip)

CIP SLTS (linux-4.4.y-cip)

CIP SLTS (linux-4.19.y-cip)
## CIP SLTS Kernel Release Policy

<table>
<thead>
<tr>
<th>Release regularly</th>
<th>Release on demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release <strong>4.19 twice a month</strong> and <strong>4.4 once a month</strong> (Effective June, 2019)</td>
<td>It depends on critical bug/ security fix</td>
</tr>
<tr>
<td>• Kernel 4.19</td>
<td></td>
</tr>
<tr>
<td>• second and fourth Fridays of the month</td>
<td></td>
</tr>
<tr>
<td>• Kernel 4.4</td>
<td></td>
</tr>
<tr>
<td>• second Friday of the month</td>
<td></td>
</tr>
<tr>
<td>Release <strong>4.19-rt once a month</strong> and <strong>4.4-rt once every two months</strong> (Effective Nov, 2019)</td>
<td>Ditto</td>
</tr>
</tbody>
</table>

**Note:** Difficult to estimate actual release date because of number of patches depends on each stable release
CIP Kernel and Real-time Kernel Release Statistics

- **v4.4-cip**
- **v4.4-cip-rt**
- **v4.19-cip**
- **v4.19-cip-rt**

<table>
<thead>
<tr>
<th>Year</th>
<th>v4.4-cip</th>
<th>v4.4-cip-rt</th>
<th>v4.19-cip</th>
<th>v4.19-cip-rt</th>
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<tbody>
<tr>
<td>2017</td>
<td>15</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2018</td>
<td>14</td>
<td>17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2019</td>
<td>9</td>
<td>5</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>(Retrieved 27th, Oct)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>25</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>(Retrieved 27th, Oct)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total estimated in 2019</td>
<td>42</td>
<td>26</td>
<td>16</td>
<td>5</td>
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</tbody>
</table>

Retrieved 27th, Oct

Total estimated in 2019
Patches Review
CIP maintains two LTS-based kernels, 4.4.y and 4.19.y.
We are reviewing patches for these kernels and patches that have been requested for feature backports.
Patch Review

- There are two LTS patch review targets.
  - Already released
    - 4.19.y: Pavel Machek
    - 4.4.y: Me
  - Develop and review on linux-stable@vger.kernel.org.
- We both review and manage the results at repository[0].
- Also, commits with problems are reported to upstream or linux-stable.

[0]: https://gitlab.com/cip-project/cip-kernel/lts-commit-list
Patch Review

- Patch reviews are basically based on stable kernel rules.
  Documentation/stable_kernel_rules.txt
- I carefully check the following:
  - Are there similar bugs elsewhere in similar code?
  - Are new bugs added to the newly code?
  - Is there a memory leak?
  - Is there any other good implementation?
  - Is the commit message correct?
  - Are there other related patches?
A review of stable patches includes checking for missing related patches.
Patch Review

in 4.4.y:

commit cc475966e5f704f36ccc74575640e743fec248ad
Author: David Ahern <dsahern@gmail.com>
Date: Wed May 1 18:18:42 2019 -0700

neighbor: Call __ipv4_neigh_lookup_noref in neigh_xmit

[ Upstream commit 4b2a2bfeb3f056461a90bd621e8bd7d03fa47f60 ]

Commit cd9ff4de0107 changed the key for IFF_POINTOPOINT devices to INADDR_ANY but neigh_xmit which is used for MPLS encapsulations was not updated to use the altered key. The result is that every packet Tx does a lookup on the gateway address which does not find an entry, a new one is created only to find the existing one in the table right before the insert since arp_constructor was updated to reset the primary key. This is seen in the allocs and destroys counters:
ip -s -4 ntable show | head -10 | grep alloc

which increase for each packet showing the unnecessary overhead.

Fix by having neigh_xmit use __ipv4_neigh_lookup_noref for NEIGH_ARP_TABLE.

Fixes: cd9ff4de0107 ("ipv4: Make neigh lookup keys for loopback/point-to-point devices be INADDR_ANY")
A patch to fix commit 4b2a2bfeb3f0 is included in the linus tree, but it is not yet applied in the 4.4.y tree.

in linus/master:

commit 9b3040a6aafd7898ece7fc7efc9ca71e42aa8069
Author: David Ahern <dsahern@gmail.com>
Date: Sun May 5 11:16:20 2019 -0700

ipv4: Define __ipv4_neigh_lookup_noref when CONFIG_INET is disabled

Define __ipv4_neigh_lookup_noref to return NULL when CONFIG_INET is disabled.

Fixes: 4b2a2bfeb3f0 ("neighbor: Call __ipv4_neigh_lookup_noref in neigh_xmit")
Patch Review

in linus/master:

commit 9b3040a6aafdf7898ece7fc7efcbca71e42aa8069
Author: David Ahern <dsahern@gmail.com>
Date: Sun May 5 11:16:20 2019 -0700

ipv4: Define __ipv4_neigh_lookup_noref when CONFIG_INET is disabled

Define __ipv4_neigh_lookup_noref to return NULL when CONFIG_INET is disabled.

Fixes: 4b2a2bfebf3f0 ("neighbor: Call __ipv4_neigh_lookup_noref in neigh_xmit")

in 4.4.y:

commit 647f72b0d75c9faeecc36b88fc051339e73008435
Author: David Ahern <dsahern@gmail.com>
Date: Sun May 5 11:16:20 2019 -0700

ipv4: Define __ipv4_neigh_lookup_noref when CONFIG_INET is disabled

commit 9b3040a6aafdf7898ece7fc7efcbca71e42aa8069 upstream.

Define __ipv4_neigh_lookup_noref to return NULL when CONFIG_INET is disabled.

Fixes: 4b2a2bfebf3f0 ("neighbor: Call __ipv4_neigh_lookup_noref in neigh_xmit")
Kernel Maintenance

- Again
  - CIP maintains kernels based on 4.4.y 4.19.y.
  - We do not include out of tree code, and all kernel modifications must be included in Upstream.
- Release
  - We are releasing 4.19.y on Fridays in the 2nd and 4th weeks, 4.4.y on Fridays in 4th weeks every month.
  - It depends on critical bug / security fix.
Kernel Maintenance

Testing and release

- Compile kernel tests for our reference board.
- Run the boot test, LTP, and kselftest using the created kernel image to confirm that there are no regression problems.
Kernel Maintenance

- At first, the local environment is checked for problems, but finally Gitlab and LAVA managed by CIP are used for kernel compiling and testing.
- Chris Paterson will talk about this later.
Kernel Maintenance

- We also manage the -rebase branch.
  - This is to separate the commits we captured from the LTS commits for clarity.
  - It is also used for patch maintenance and management.

```bash
$ git log --decorate --oneline --graph linux-4.4.y-cip
* 83bce8ee46df (tag: v4.4.196-cip38) CIP: Bump version suffix
| * a2cbf3a26dc8 Merge tag 'v4.4.196' into linux-4.4.y-cip
|/
| * c61ebb668f2c (tag: v4.4.196) Linux 4.4.196
| * 2e486f58901d NFC: fix attrs checks in netlink interface
<br>
* 27e2b1835861e ALSA: hda - Fix potential endless loop at app
| * ac80b90d814 gitlab-ci: Run tests on RZ/G1C iwg23s platform
| * a5f1c42146af gitlab-ci: Always store job artifacts
| * 5253596c2e6b gitlab-ci: Increase test timeout to 60 minutes
| * 2d85c7070029 (tag: v4.4.192-cip37) CIP: Bump version suffix
| * a88eb4f69a03 Merge tag 'v4.4.192' into linux-4.4.y-cip
<br>
| /
| * 882f8791e141 (tag: v4.4.192)
```

```bash
$ git log --decorate --oneline --graph linux-4.4.y-cip-rebase
* eb744d702d93 (tag: v4.4.196-cip38-rebase) CIP: Bump version suffix
| * ae3fb68390e0 gitlab-ci: Run tests on RZ/G1C iwg23s platform
| * 34b0a906b19a gitlab-ci: Always store job artifacts
| * 4af2f171a5c gitlab-ci: Increase test timeout to 60 minutes
| * 458ab9722770 CIP: Bump version suffix to -cip37 after merge from st
| * f5a80f24e5c4 ARM: dts: iwg23s-sbc: Enable HS-USB
| * 76efac95424 ARM: dts: r8a77470: Add HSUSB device nodes
| * ca75f91b47fd dt-bindings: usb: renesas_usbhs: Add support for r8a7
| * 9bc64505191 dt-bindings: usb: renesas_usbhs: Add support for r8a7
| * 41604073912f ARM: dts: iwg23s-sbc: Enable USB USB2.0 Host
| * 249ef90d680e ARM: dts: iwg23s-sbc: Enable USB Phy[01]
| * ac0e68e8030f ARM: shmobile: Enable USB [E]HCI HCD PLATFOR
| * e7af62b1ffe8 ARM: shmobile: Enable PHY_RCAR_GEN3_USB2 in sh
| * 9584390a673e ARM: dts: r8a77470: Add USB2.0 Host (EHCI/OHCI) d
<br>
```
Documented Rules

a) It or an equivalent fix must already exist in Linus’ tree (upstream).

b) It must be obviously correct and tested.

c) It must fix a real bug that bothers people (not a, "This could be a problem..." type thing).

d) It must fix a problem that causes a build error (...), an oops, a hang, data corruption, a real security issue, or some "oh, that’s not good" issue. In short, something critical.

e) It cannot contain any "trivial" fixes in it (spelling changes, whitespace cleanups, etc).
Real Rules

a) It or an equivalent fix must already exist in Linus’ tree (upstream).

[b) It must not be obviously broken]
People actually follow the rules
- mostly
Auto-picked patches do not
Other Players

SuSE

- [x] https://kernel.suse.com/
- [ ] 4.4 but not 4.19
Kinds of Patches

Crashes, bad errors
Run time WARN_ON()
Confusing printk messages
Compile time warnings
Regular Meeting
Weekly Regular Online Meeting

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

<table>
<thead>
<tr>
<th>US-West</th>
<th>US-East</th>
<th>UK</th>
<th>DE</th>
<th>TW</th>
<th>JP</th>
</tr>
</thead>
<tbody>
<tr>
<td>02:00</td>
<td>05:00</td>
<td>09:00</td>
<td>10:00</td>
<td>17:00</td>
<td>18:00</td>
</tr>
</tbody>
</table>

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

• The meeting will take 30 min although it can be extended to an hour if it makes sense and those involved in the topics can stay. Otherwise, the topic will be taken offline or in the next meeting.
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
Join us
CIP for sustainable Smart Cities with Open Source Software
Question?
Thank you
References

• How to make Smart Cities stay smart with Open Source Projects, OSS-J 2019, Yoshitake Kobayashi

• The Activity of the Security Working Group in the CIP Project, OSS-J 2019, Takehisa Katayama

• Debian and Yocto Project based Long-term Maintenance Approaches for Embedded Products, ELCE 2019, Jan Kiszka and Kazuhiro Hayashi