Finding the best way to use Linux in Long Term

LTSI Project status update

Long Term Support Initiative

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at Open Source Summit North America

Who am I

Tsugikazu Shibata

Stepped away from previous company in May

So, Not a LF Board member and other representatives now

Still very much interested in Linux and Open Source and then joined..

Linux Foundation and

Open Invention Network

Linux : What ?

- Linux is one of the most successful Open Source project
- Continue growing in 28 years ; expanding adoption for new area;
  - IT enterprise, Cloud, Networking, Android, Embedded, IoT and many others
- Developing and releasing under GPLv2

Developed by the community

- Participating ~1700 developer, ~230 companies every releases
- Growing yearly 1.5Mlines of code, 4000 files increased
- Again, 28 Years of history
- Maintainers have great skill to manage the subsystem and professional knowledge of its area of technologies

Status of Latest Linux Kernel

- Latest released Kernel : 5.2
  - Released: July 7, 2018
  - Lines of code : 26,552,127
  - Files : 64,553
  - Developed period: 63 days from 5.1
- Current Stable Kernel: 5.2.9
- Current development kernel: 5.3-rc5

Kernel release cycle

- Release cycle: 63 ~ 70 days, 5~6 releases/year
- This will help us for own development/upstreaming plan

Version	Release	Rel. span
4.4	2016-01-10	68
4.5	2016-03-14	64
4.6	2016-05-15	63
4.7	2016-07-24	70
4.8	2016-10-02	70
4.9	2016-12-11	70
4.10	2017-02-19	60
4.11	2017-04-30	80
4.12	2017-07-02	63
4.13	2017-09-03	63

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Version	Release	Rel. span
4.14	2017-11-12	70
4.15	2018-01-28	77
4.16	2018-04-01	63
4.17	2018-06-03	63
4.18	2018-08-12	70
4.19	2018-10-22	71
4.20	2018-12-23	62
5.0	2019-03-03	70
5.1	2019-05-05	63
5.2	2019-07-07	63

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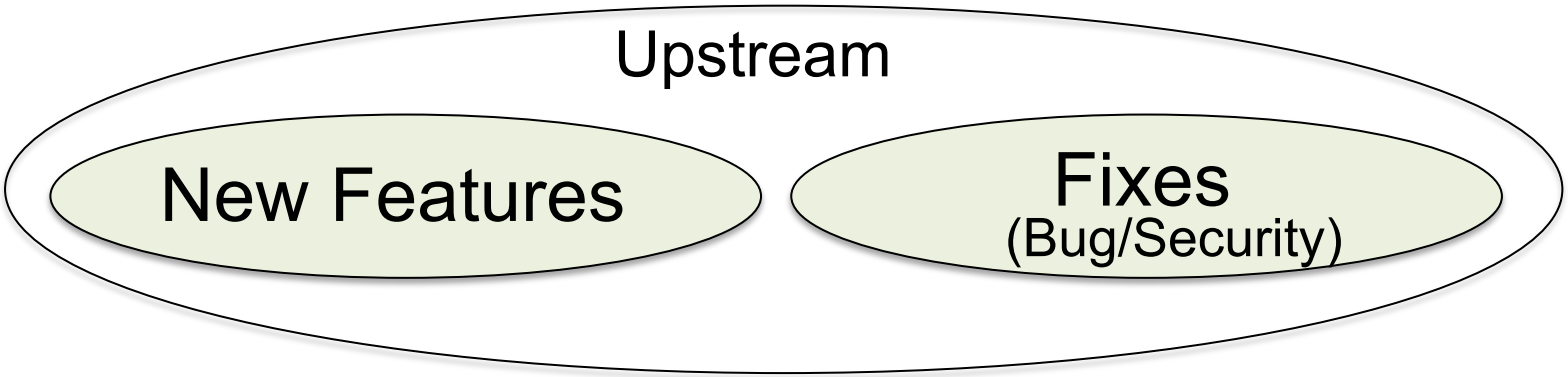
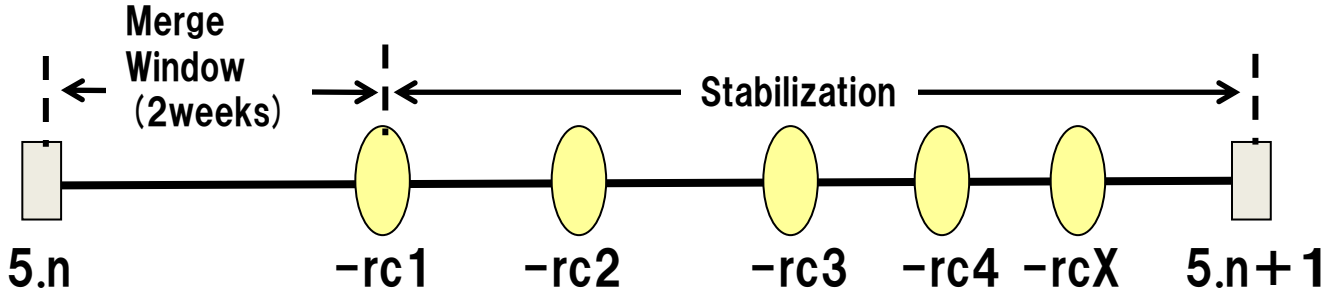
Linux development policy

- Upstream is only the place to accept the patches
  - Reviewed by skilled maintainer
  - Tested with other proposals to confirm without conflicts
  - Well coordinated development process for over thousands of developers



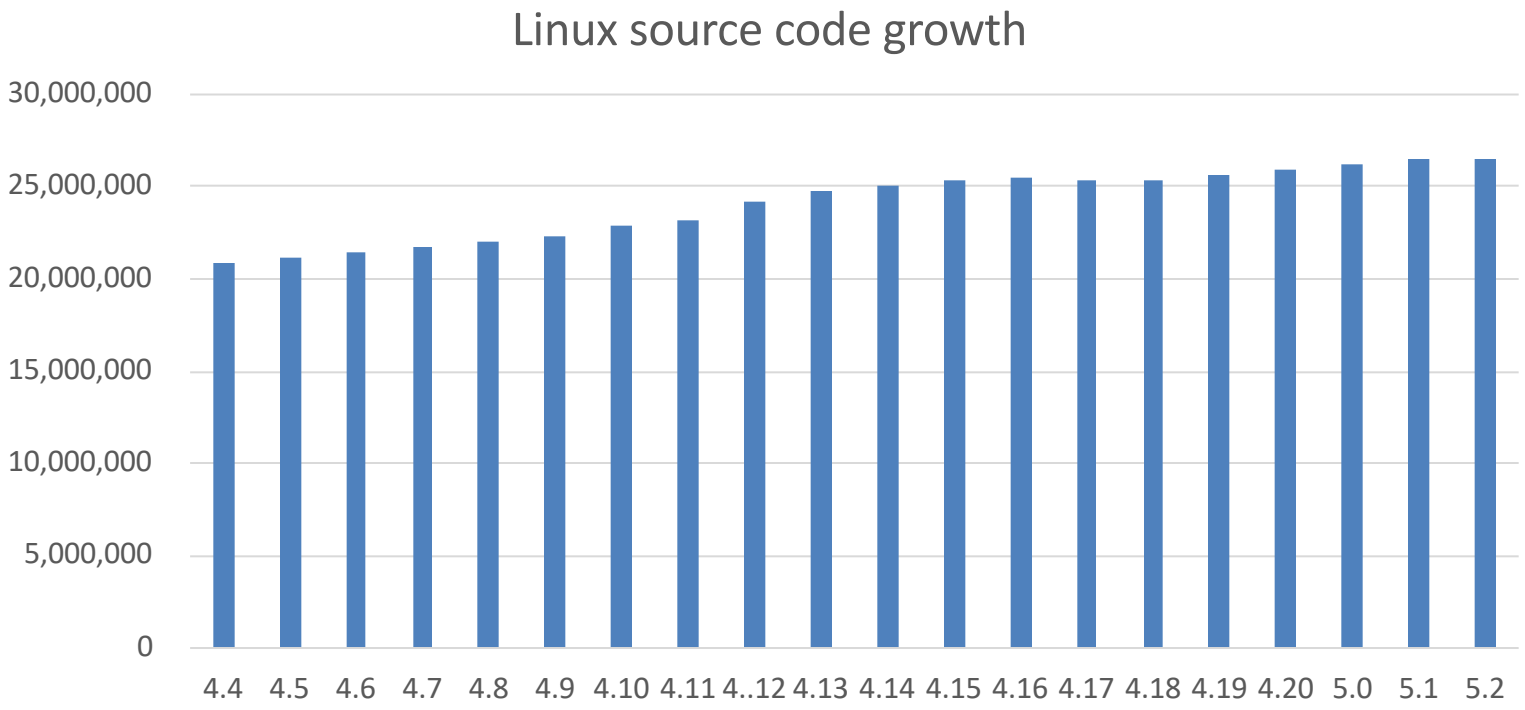
Linux Development process

- Just after the release of 5.n, two weeks of merge window will be opened for proposal of new features
- After 2 weeks of merge window, -rc1 will be released and the stabilization will be started
- 5.n+1 will be released when it becomes reasonably stable by some of -rcX released

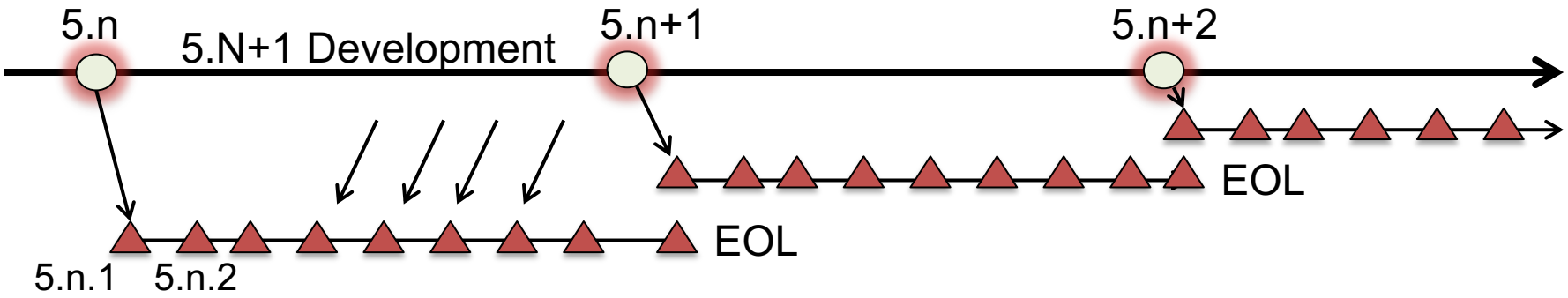


Linux Source Code Growth

- Increasing 0.3ML/Version, 1.5ML/year



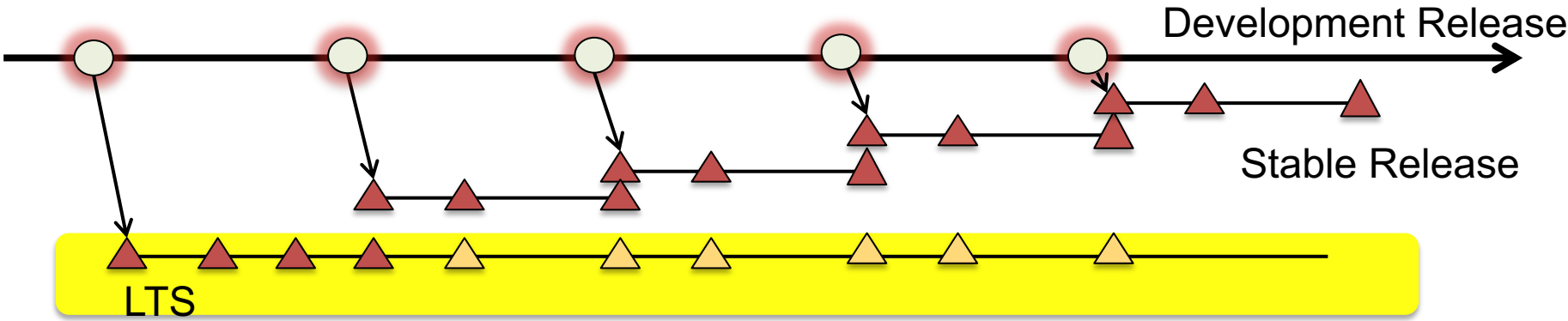
Stable kernel release



- Recommended branch for users who want the most recent stable kernel
- 3 part version like 5.n.m
- Contain small and critical fixes for security problems or significant regressions discovered in a latest development version
- Becomes “End Of Life” when next stable kernel were released

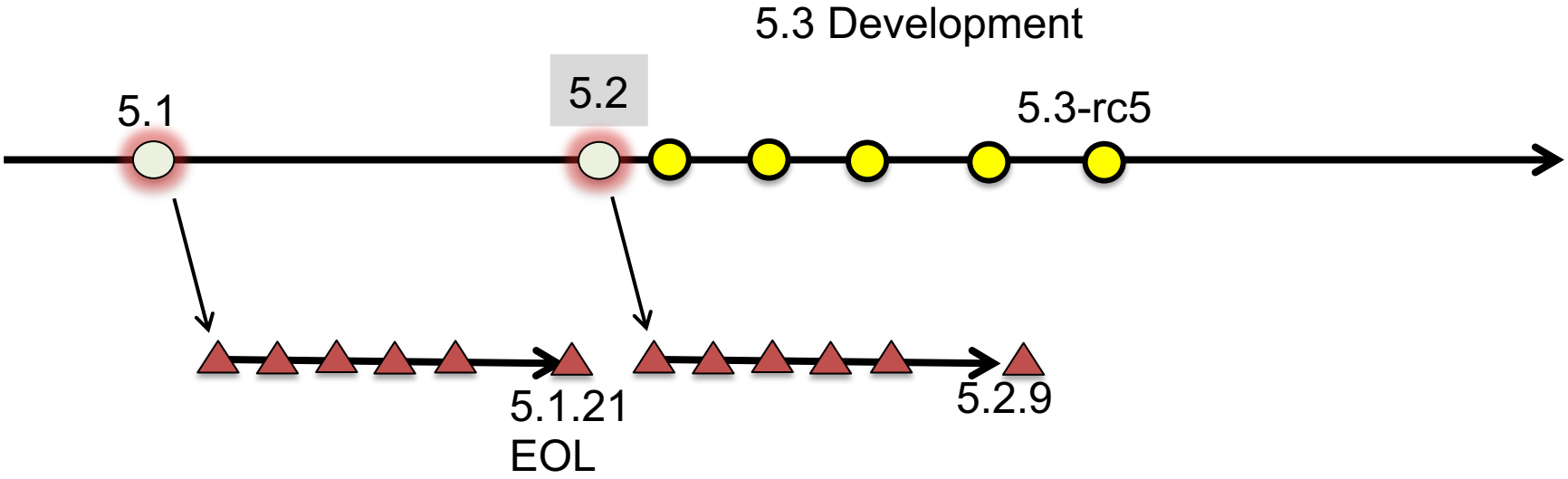
LTS: Long Term Stable Kernel

- Kernel tree continue to back port bug and Security fixes for more long term
- Extended maintenance period for stable kernel
- Pick one version per year and maintain 2 years
- Some version was committed to 6 years



Latest status of Linux Kernel Again

- Latest released Kernel : 5.2
- Current Stable Kernel: 5.2.9
- Current development kernel: 5.3-rc5



Why LTS?

- Only the tree provide fixes from the community
- In the real use case, tested/confirmed kernel is important, less important for new features
- Security/Bug Fixes will be released frequently until End Of Life
- LTS will be released around November/ December time frame, easier for planning

Current LTS versions

Version	Maintainer	Released	Projected EOL	Years
4.19	Greg Kroah-Hartman	2018-10-22	Dec, 2020	2
4.14	Greg Kroah-Hartman	2017-11-12	Jan, 2024	6
4.9	Greg Kroah-Hartman	2016-12-11	Jan, 2023	6
4.4	Greg Kroah-Hartman	2016-01-10	Feb, 2022	6
3.16	Ben Hutchings	2014-08-03	Apr, 2020	6

https://www.kernel.org/category/releases.html

Actual use case of LTS

OS/Products	Linux Kernel Version
Android *1	4.4, 4.9, 4.14
Chrome Book *2	4.4, 4.14
Windows Subsystem for Linux 2 *3	4.19
Raspbian (July 2019) *4	4.19
Amazon Linux	4.14, 4.19

*1 https://source.android.com/devices/architecture/kernel/releases
*2 https://www.chromium.org/chromium-os/developer-information-for-chrome-os-devices
*3 https://devblogs.microsoft.com/commandline/announcing-wsl-2/
*3 https://github.com/microsoft/WSL2-Linux-Kernel/
*4 https://www.raspberrypi.org/downloads/raspbian/

LTS includes large number of fixes

LTS
EOLed LTS
Stable

- 600 – 1000 fixes included in a Stable release
- LTS include 10 thousands of fixes

As of 2019/7/16

Version FROM-TO		#commits
3.12	**3.12.74**	**7746**
3.13	3.13.11	903
3.14	**3.14.79**	**4977**
3.15	3.15.10	703
3.16	**3.16.70**	**10970**
3.17	3.17.8	884
3.18	**3.18.140**	**8577**
3.19	3.19.8	873
4.0	4.0.9	757
4.1	**4.1.52**	**6695**

Version FROM-TO		#commits
4.2	4.2.8	903
4.3	4.3.6	618
4.4	**4.4.185**	**12170**
4.5	4.5.7	973
4.6	4.6.7	705
4.7	4.7.10	912
4.8	4.8.17	1102
4.9	**4.9.185**	**13010**
4.10	4.10.17	1136
4.11	4.11.12	984

Version FROM-TO		#commits
4.12	4.12.14	837
4.13	4.13.16	883
4.14	**4.14.133**	**11654**
4.15	4.15.18	1616
4.16	4.16.18	1749
4.17	4.17.19	1642
4.18	4.18.20	2456
4.19	**4.19.58**	**5848**
4.20	4.20.17	1807
5.0	5.0.21	2387

Version FROM-TO		#commits
5.1	5.1.16	1613

of Yearly fixes in LTS

- LTS include thousands of fixes every year
- Continue to apply these patches are very important for the security viewpoint

As of 2019/7/15

Version	Maintainer	Released	Years maintained	Total Commits	Fixes/year
4.19	Grrg Kroah-Hartman	2018-10-22	0.7	5848	7000
4.14	Greg Kroah-Hartman	2017-11-12	1.6	11654	7066
4.9	Greg Kroah-Hartman	2016-12-11	2.6	13010	5063
4.4	Greg Kroah-Hartman	2016-01-10	3.5	12170	3487
3.16	Ben Hutchings	2014-08-03	4.9	10970	2226

How to handle such huge patches?

- Testing kernels for every LTS is actually hard
  - Use Automated test
  - Use common test suites and share the results
  - Make consensus of common tests and develop it
  - KernelCI will be one of the solution

Recommended Steps for the future

- Expect next LTS version and release time, put own patches into upstream until then
- Choose the planned LTS kernel for your products/Services
- Create the process to apply all the patches including security fixes

What is the next LTS version?

What is the next LTS version?

5.4

If everything is going fine…

What is happening around the kernel

1. CPU Vulnerabilities
2. HarmonyOS , Fuchsia and Linux

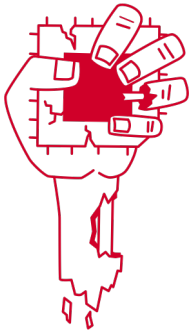
Topic1: Major CPU Vulnerabilities

Vulnerability	Variant	Public Name/Label	Announced
Specter	1	Bounds Check Bypass(BCB)	2018/1
Specter	2	Branch Target Injection(BTI)	2018/1
Meltdown	3	Rogue Data Cache Load(RDCL)	2018/1
Specter-NG	3a	Rogue System Register Read(RSRR)	2018/5
Specter-NG	4	Speculative Store Bypass(SSB)	2018/5
Specter-NG	5	Lazy FP State Restore	2018/6

Vulnerability	Public Name/Label	Announced
Foreshadow	L1 Terminal Fault (L1TF)	2018/8
Foreshadow-NG	L1 Terminal Fault (L1TF)	2018/8

MDS: Major CPU Vulnerabilities

Vulnerability	Public Name/Label	Announced
ZombieLoad	Microarchitectural Fill Buffer Data Sampling (MFBDS)	2019/5
RIDL	Microarchitectural Data Sampling Uncacheable Memory (MLPDS/MDSUM)	2019/5
Fallout	Microarchitectural Store Buffer Data Sampling (MFBDS)	2019/5



Impacts of CPU Vulnerabilities

- CPU : Intel, AMD, ARMs
- CPU Architecture: Generations, 32/64 Bits
- Operating system: Linux, Android, Commercial OS, Cloud OS
- Others: Virtualization environments, Web Browser, Microcode
- Software versions (Old one have no work arounds)
- BIOS configuration required
- Performance degradations need to be considered

- Should we expect further problem in the future?

Regular Kernel Updates

- CPU vulnerabilities problem tell us
  - Issue is happing everywhere even in CPU
  - Security problem is #1 priority to be fixed immediately
  - We must sync with LTS, no patch provided for non LTS
  - Cherry picking patches are being difficult to fix completely
    - Number of further fixes will come later
- Applying ALL the LTS patches is the best way, not cherry picking

Topic 2: Fuchsia, HarmonyOS and Linux

- Fuchsia: microkernel based on zircon, expected to be used for next-gen embedded devices in 5 years
- HarmonyOS: microkernel, safer/secure, deterministic Latency Engine.., available in 2020?

How newer technologies come closer to Linux?

- Open Source:
  - Community actively contributing code into upstream with diverse developers
  - Open and transparent development model
  - Security and bug fixing with trusted and timely fashion
  - Long term support by the community

Key pieces of managing Open Source in long term

- Long term community
  - Community continue to provide bug fixes in long term
  - May have organization to support its activities
- Security
  - Provide security fixes with trusted process
  - Continuous updates with less downtime
  - Responds to many different risk
- Compliance
  - Compliance process for the Product/Service
  - Cooperate compliance : Internal standard
  - Supply chain compliance : Open Chain

THANK YOU

You can participate LTSI

- Follow on Twitter :

  @LinuxLTSI

- Web:

  http://ltsi.linuxfoundation.org

- Mailing list:

  https://lists.linuxfoundation.org/mailman/listinfo/ltsi-dev

- Git tree :

  http://git.linuxfoundation.org/?p=ltsi-ernel.git;a=summary