LONG TERM
SUPPORT INITIATIVE

LTSI Project update

Long Term Support Initiative

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Embedded Linux Conference Europe

Hilton Prague

agenda

LONG TERM SUPPORT INITIATIVE

- Kernel statistics and process
- History of LTSI and learned in 6 years
- Further steps for maintaining kernel long term

Who am I

- Tsugikazu SHIBATA, NEC
- Founder and project lead of LTSI
- LTS/LTSI Advocate

- Board member of Linux Foundation
- Involved with Linux community since 2.4

Linux = Open Source project

- Linux is one of the most successful Open Source project
- Continue growing in 26 years ; expanding adoption for new area;
  - IT enterprise, Cloud, Network, Smart Phone, Robotics, Embedded, IoT and many others
- Developing and delivering under GPLv2

Developed by the community

- Participating ~1700 developer, ~230 companies every releases
- Growing yearly 1.5Mlines of code, 4000 files increased
- 26 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 : 4.13
  - Released: Sep 3rd , 2017
  - Lines of code : 24,767,008 (+596,148)
  - Files : 60,543 (+737)
  - Developed period: 63 days from 4.12
- Current Stable Kernel: 4.13.9
- Current development kernel: 4.14-rc5

Kernel release cycle

- Release cycle: 65 ~ 70 days, 5~6 releases/year

	Version	Release	Rel. span
5	3.19	2015-2-9	64
	4.0	2015-4-12	62
	4.1	2015-6-22	71
	4.2	2015-8-30	69
	4.3	2015-11-2	64
6	4.4	2016-1-10	68
	4.5	2016-3-14	64
	4.6	2016-5-15	63
	4.7	2016-7-24	70
	4.8	2016-10-2	70

	Version	Release	Rel. span
	4.9	2016-12-11	70
5	4.10	2017-02-09	60
	4.11	2017-04-30	80
	4.12	2017-07-02	63
	4.13	2017-09-03	63
	4.14	2017-??	

Linux development policy

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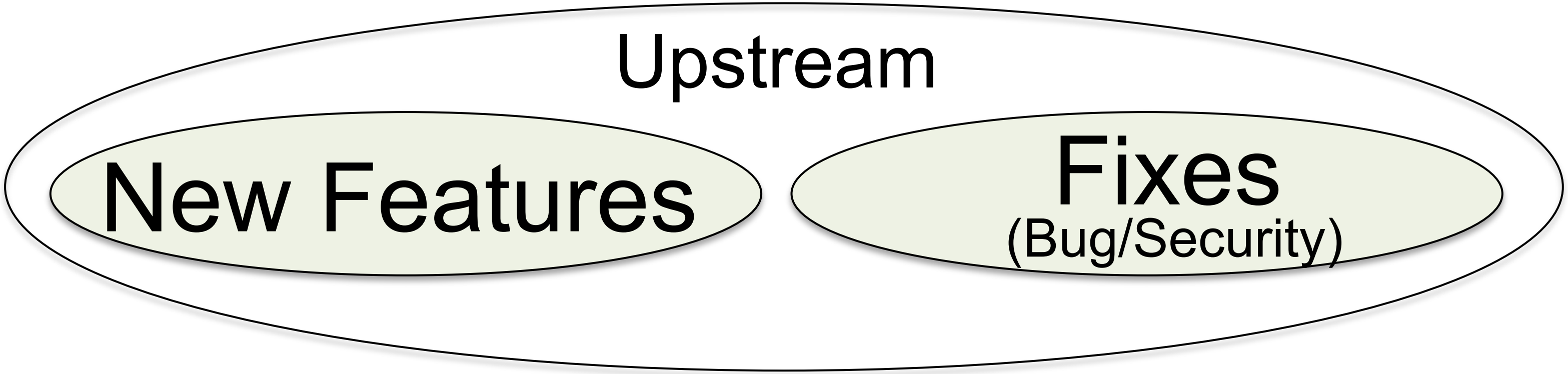
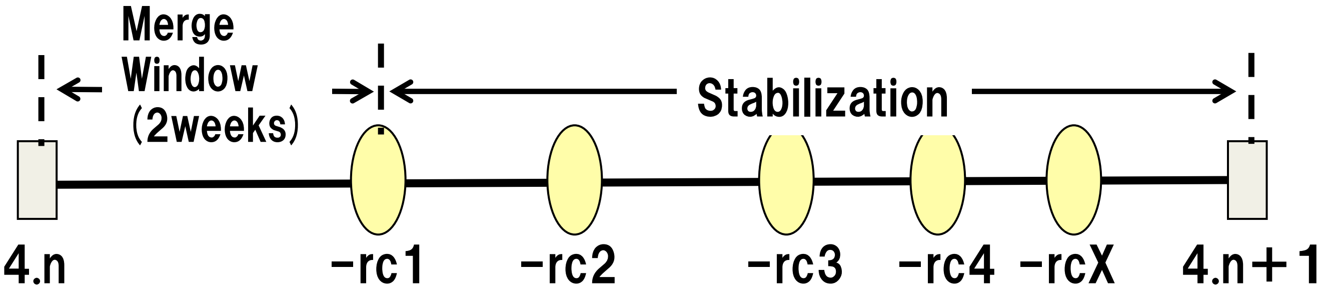
- Upstream is only the place to accept the patches
  - Reviewed by skilled maintainer
  - Tested with other proposals to confirm no conflicts
  - Well coordinated development process for over thousands of developers



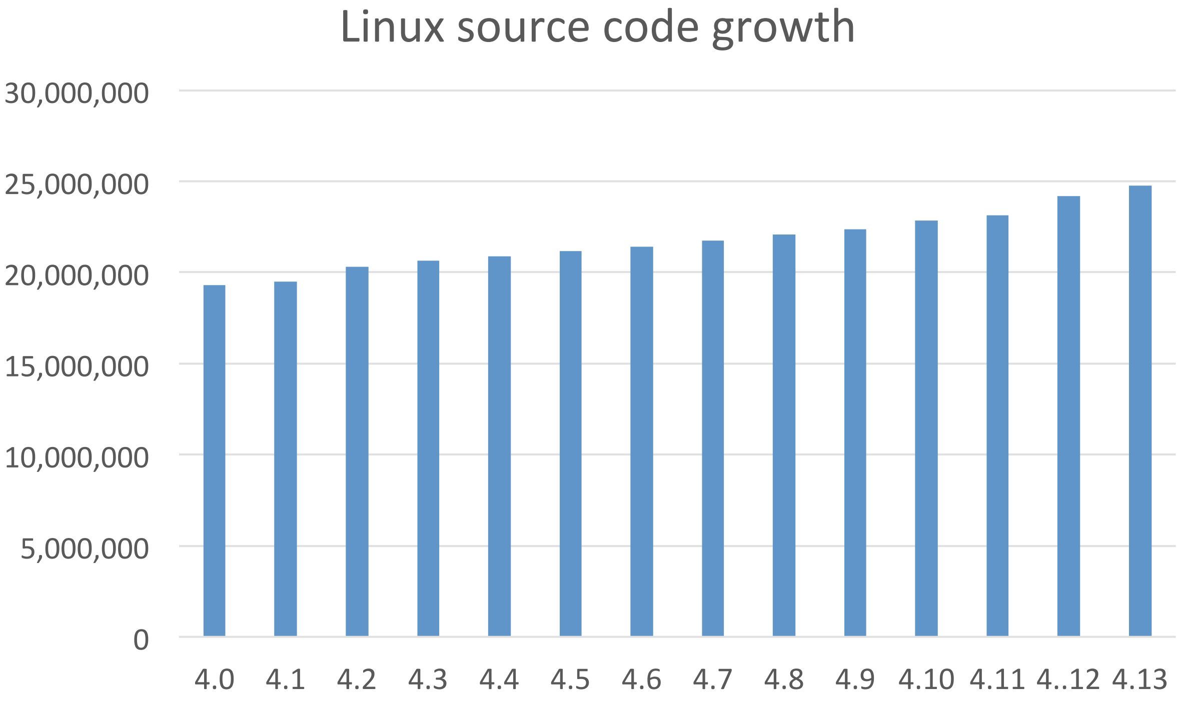
Linux Development process

- Just after the release of 4.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
- 4.n+1 will be released when it becomes reasonably stable by some of -rcX released



Linux Source Code Growth

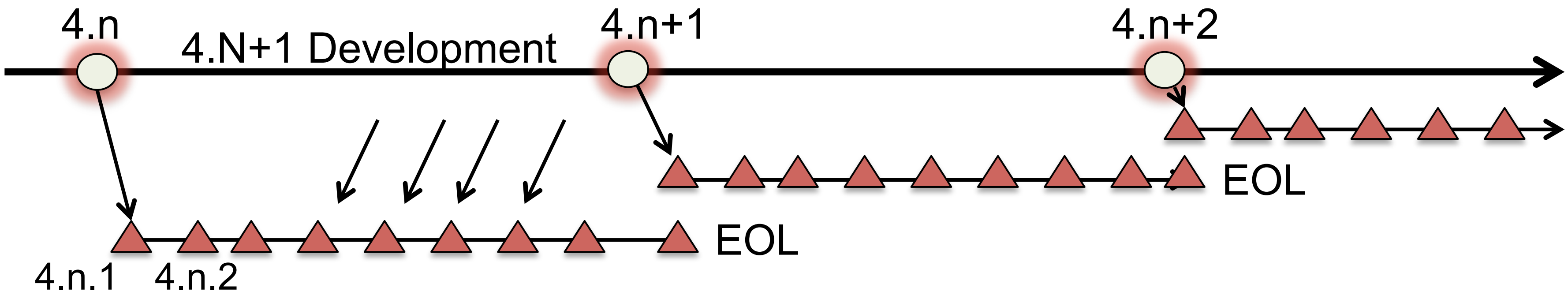
- Increasing 0.3ML/Version, 1.5ML/year



Rapid Release cycle of Linux

- Yearly more than 5 times of chance to marge the code into upstream.
  - Other project maybe 6 month release cycle that is 2 times/year
- Lot's of chance to merge new code into upstream
- So many choice to use for newer products and need deeper knowledge to pick right version

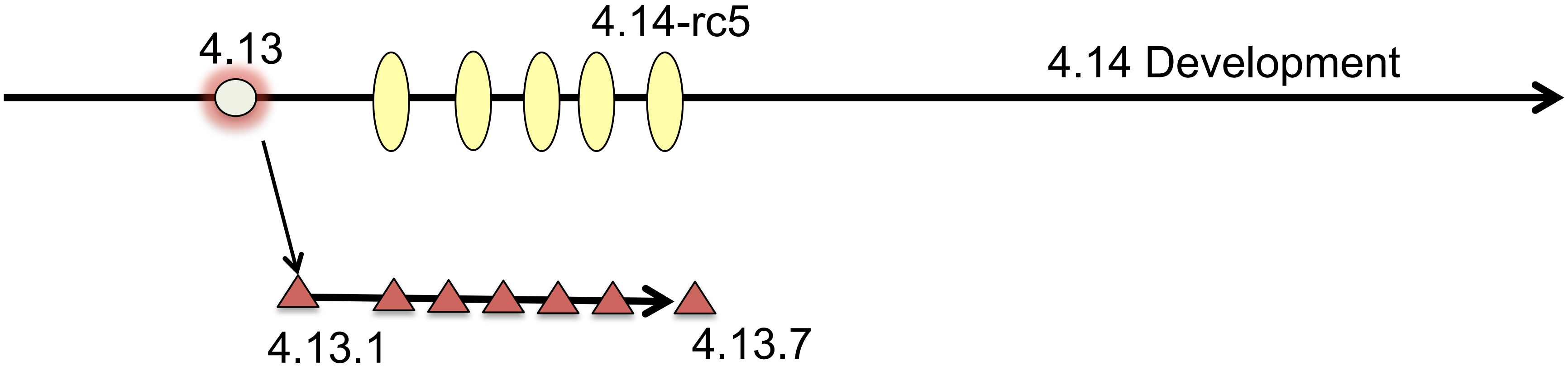
Stable kernel release



- Recommended branch for users who want the most recent stable kernel
- 3 part version like 4.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

Status of Latest Linux Kernel Again

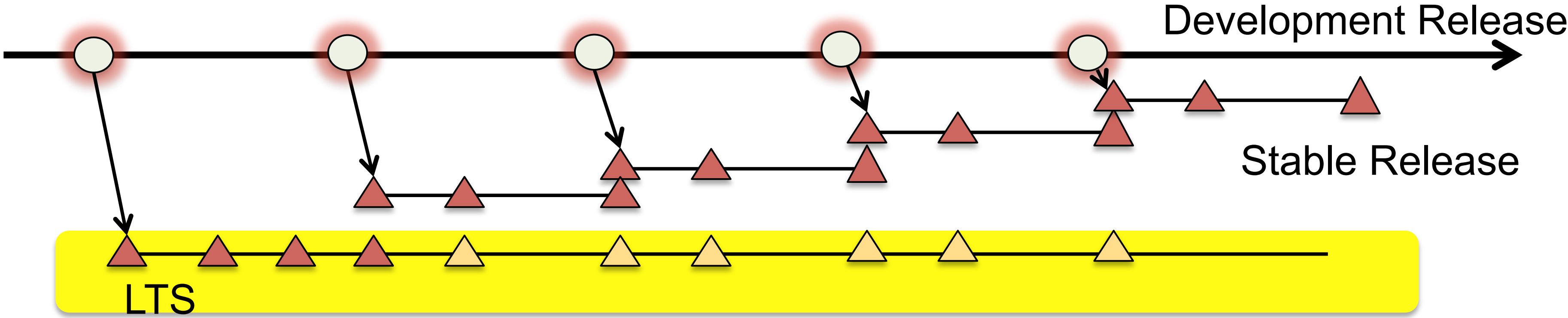
- Latest released Kernel : 4.13
- Current Stable Kernel : 4.13.7
- Current development kernel : 4.14-rc5



LTS: Long Term Stable Kernel

LONG TERM SUPPORT INITIATIVE

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



Why LTS?

LONG TERM SUPPORT INITIATIVE

- Only the tree get fixes from the community
- In the real use case, tested/confirmed kernel is important, less important for new features
- Fixes will be released # of times and should be applied frequently, Security/Bug fixes are being more important
- Bugs found in LTS should be reported and fixed in upstream

Current LTS versions

Version	Maintainer	Released	Projected EOL	Years
4.9	Greg Kroah-Hartman	2016-12-11	Jan, 2019	2
4.4	Greg Kroah-Hartman	2016-01-10	Feb, 2022	6
4.1	Sasha Levin	2015-06-21	May, 2018	3
3.16	Ben Hutchings	2014-08-03	Apr, 2020	6
3.10	Willy Tarreau	2013-06-30	Oct, 2017	4
3.2	Ben Hutchings	2012-01-04	May, 2018	6

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

LTS includes large number of fixes

LONG TERM SUPPORT INITIATIVE

- 600 – 700 fixes included in a Stable release
- LTS include several thousands of fixes

As of 2017/10/15

Version FROM-TO		#Commits
3.2	**3.2.94**	**8105**
3.3	3.3.8	698
3.4	**3.4.113**	**5929**
3.5	3.5.7	816
3.6	3.6.11	757
3.7	3.7.10	718
3.8	3.8.13	996
3.9	3.9.11	746
3.10	**3.10.107**	**6564**
3.11	3.11.10	677

Version FROM-TO		#commits
3.12	**3.12.70**	**7342**
3.13	3.13.11	903
3.14	**3.14.79**	**4977**
3.15	3.15.10	703
3.16	**3.16.49**	**7278**
3.17	3.17.8	884
3.18	**3.18.75**	**5281**
3.19	3.19.8	873
4.0	4.0.9	757
4.1	**4.1.44**	**4629**

Version FROM-TO		#commits
4.2	4.2.8	903
4.3	4.3.6	618
4.4	**4.4.92**	**5619**
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	**4.9.56**	**4838**
4.10	4.10.17	1136
4.11	4.11.12	984

Version FROM-TO		#commits
4.12	4.12.14	837
4.13	4.13.7	509

LTS
EOLed LTS
Stable

# of Yearly fixes in LTS

- LTS include 1 ~ 3 thousands of fixes every year
- Continue to apply these patches are very important for the security viewpoint

As of 2017/10/15

Version	Maintainer	Released	Years maintained	Total Commits	Fixes/year
4.9	Greg Kroah-Hartman	2016-12-11	0.8	4038	4038
4.4	Greg Kroah-Hartman	2016-01-10	1.8	5619	3176.0
4.1	Sasha Levin	2015-06-21	2.3	4629	1989.3
3.16	Ben Hutchings	2014-08-03	3.2	7278	2266.2
3.10	Willy Tarreau	2013-06-30	4.3	6564	1523.8
3.2	Ben Hutchings	2012-01-04	5.8	8105	1397.5

LTSI Status

What is LTSI

- Open Source community to create and maintain LTSI kernel tree for long term
  - Based on LTS, All the LTS patches are applicable
  - Add another chance to include further patches on top of LTS, That is LTSI tree
  - Industry party to share best practice and help companies to use Linux for long term

LTSI includes LTS

LTSI

- □ Be able to add required features on top of LTS
- □ Share status, info, problem among industry people
- □ Huge testing by contributors
- □ Auto test frame-work
- □ Provide help developer for upstream

LTS

- □ Release 1 version / year, Maintain 2 years
- □ Frequently and large number of bug /security fixes

History of LTSI

- Established 2011, in ELCE Prague
  - 6 yeas now!
  - Started for stable Kernel for Android
    - Every Android release was used different kernel
    - Android 3.0 Ice cream Sandwich was used Linux 3.0
    - Number of different tree need to be integrated
  - Discussed about the shape of LTS
    - 2 Years term and release every year
    - Maintaining 2 LTS kernels is reasonable for both companies and maintainer

History of LTSI

LONG TERM SUPPORT INITIATIVE

- Maintained by Greg Kroah-Hartman , Fellow of Linux Foundation as same as LTS
- Released yearly basis; 3.0, 3.4, 3.10, 3.14, 4.1, 4.9
- Integrated by Yocto Project (2012, May)
  - Yocto is about 60% or more share of Embedded products
- Have had workshop/session to share information and discuss issue among industry
- Have many of use cases : AGL …

Learned in 6 Years

The value of LTS/LTSI were :

1. LTS and LTSI is only a choice for the products
2. Upstream First policy
3. Security and Bug fixes are being more important in Embedded space

1. LTS and LTSI is only a choice

LONG TERM SUPPORT INITIATIVE

- For Long-term usage, LTS/LTSI is just fit
- LTS provides 2-3K of patches in a year
  - If the work should be done by a company, the company needs specific resources
- Now, all the Android device using LTS
  - LTS is default choice even for the other use case
- There is more longer term requirements
  - CIP, AGL and Android

2. Upstream First policy

- Changing kernel for the “product first” makes problem for long term use
  - Large number of fixes may NOT applicable in the future
  - Huge discussion happened before kernel summit 2016
- That’s why companies’ developers need participate Linux kernel community
- Initial hurdle may high but important for long term use
- LTSI is keeping upstream first policy

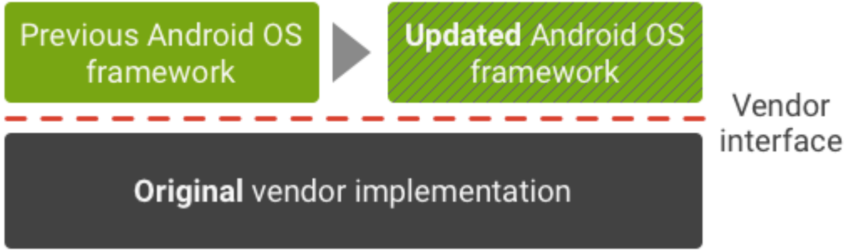
3. Security / Bug fixes are being more important

- Now fixing security problem is mandatory requirement
- To apply community provided security fixes, base code should be same as upstream. Otherwise Immediate patch release will not possible
  - In-house patches must as small as possible

Further steps for maintaining kernel long term

Case of Project Treble for Android

- Isolate Android OS and hardware specific code
  - Under the Vendor Specific Binder (/dev/vndbinder), all the vendor specific kernel code will run
  - VTS/CTS can test its interface
  - By this change, silicon specific patches and LTS patches can be applied separately
  - That makes Android software does NOT depend on Hardware


Previous Android OS framework
Updated Android OS framework
Vendor interface
Original vendor implementation

Live Patching

- Feature for live patching the kernel code was merged in Linux 4.0
  - Result of kgraft of SUSE and kpatch of RedHat
  - Most CVE can be safely to apply
  - X86 is primary architecture
- By using Live patching, some super important patch can be applied without down time

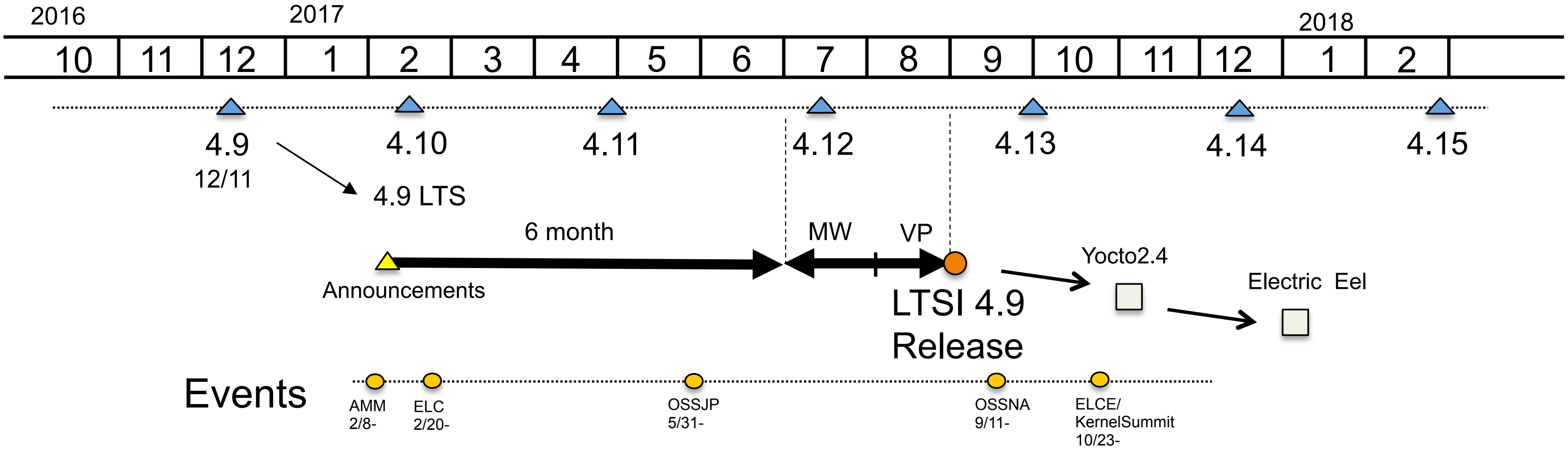
Kernel update mechanism

- CoreOS and ChromeOS have feature to update kernel.
  - There is 2 different partition. A is current working one and during working on A, new kernel will be down loaded into B and then boot from B.
  - Google is providing basic code called “Omaha”
  - Different commercial implementation is available
  - This will easier to upgrade kernel and also easy to roll back to previous kernel

Container based OS

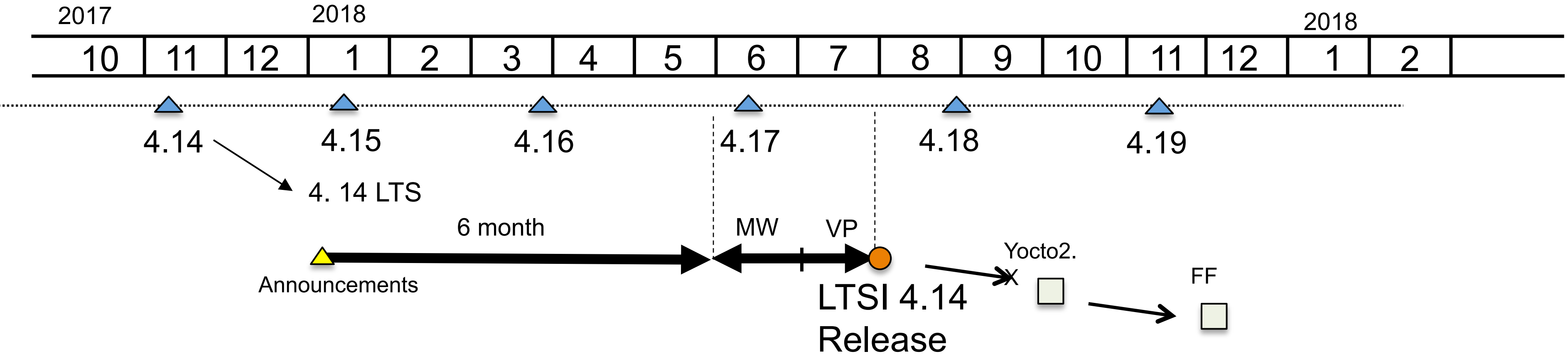
- For Embedded space, Container will be able to used as packaging technology
  - Be able to ignore problem of Libraries and Language processor version
- Building Container OS is different
  - OS is just providing service for container
  - Basic OS should include minimum packages
  - Apps supports should be in Container

LTSI 2017 Development plan



Announce	Merge Window Open	Merge window Close	Release
2/8 or 20	End of June	End of July	End of August

LTSI 2018 Development plan



You will be able to have chance to add new patches on top of 4.14 LTS in Merge Window next May

Conclusion

LONG TERM SUPPORT INITIATIVE

- LTSI was started to fill the gap between community and industry but still there is the gap
  - We will continue our activity to discuss both side to better align each other
- Upstream first policy is important for Open Source
- Why don’t you join LTSI?
  - By joining LTSI, you will be able to share best practice
  - Be able to get information for stable kernel

THANK YOU

You can participate LTSI

- Follow on Twitter account:

  @LinuxLTSI

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LTSI stands for Long-Term Support Initiative. A group of CE Working Group of the Linux Foundation to provide Long-Term and stable Linux for Industry

- 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