INSTRUMENTATION TECHNOLOGIES

LIBERA

Overview and ongoing developments for the Libera Operating Systems

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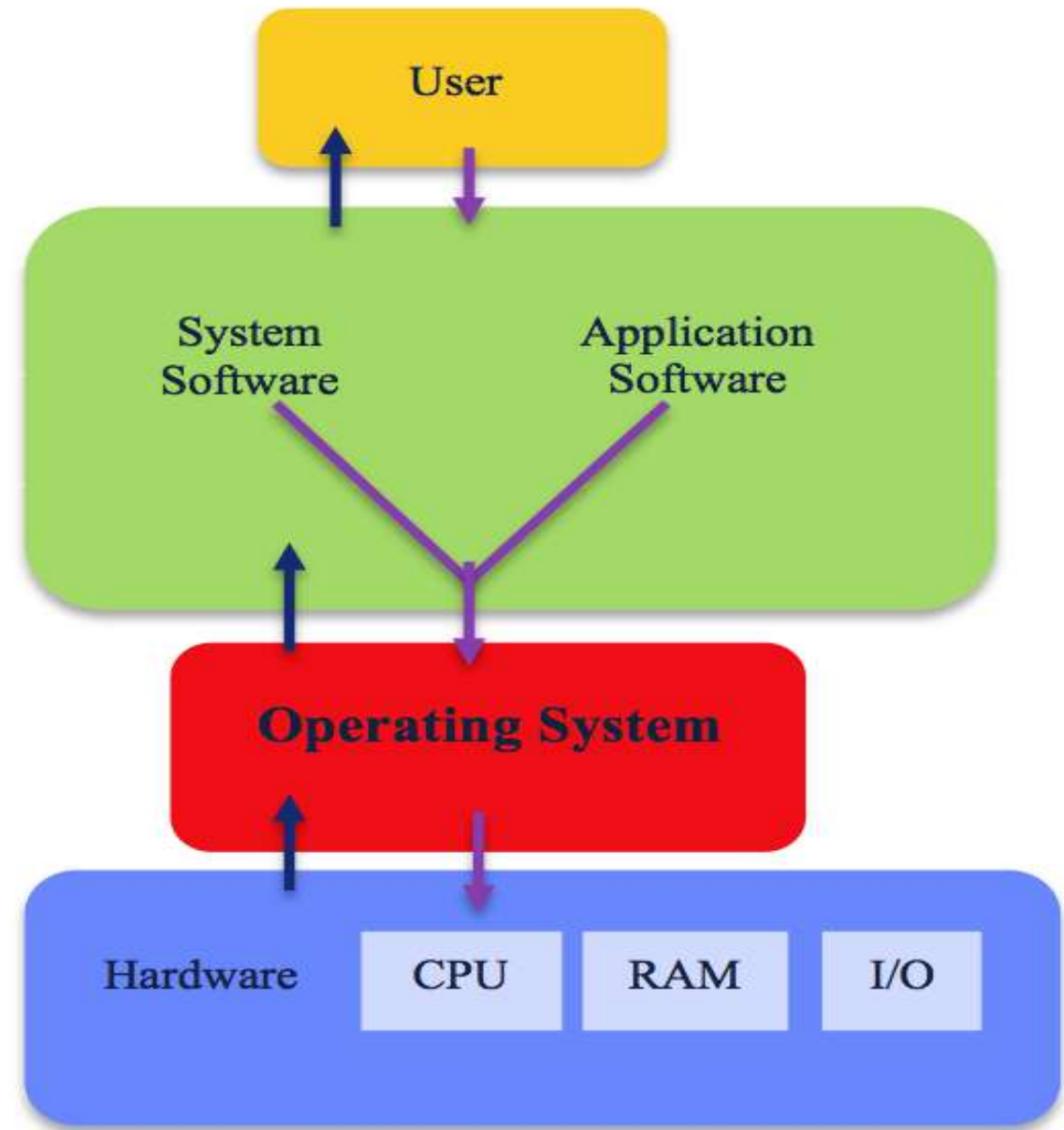
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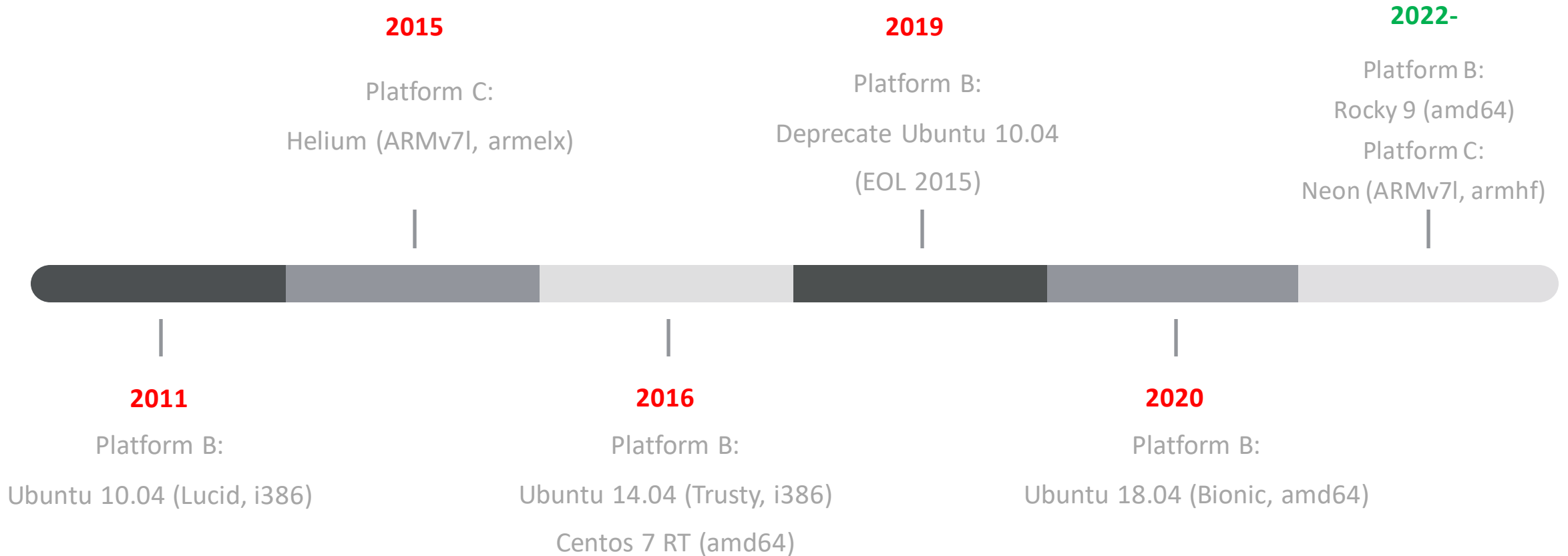- Ongoing developments for the Libera Operating Systems

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What is an Operating System?

- An **interface** between users and hardware

- **Manages** the software and hardware on the computer

- Provide **isolation** and **protection** (allocate different parts of memory to different applications so that applications don't overwrite other memory locations)

- Handles **resource management**:
    - Process management (CPU scheduling),
    - Memory management,
    - Device management,
    - File management

- Other **important functions**:
    - Security (prevents unauthorized access),
    - Control over system performance (balance between service request and response from the system),
    - Error detections (dump, tracing, error messages),
    - etc.

Operating systems make sure each program gets what it needs.

History of Libera Operating Systems

2015

Platform C:

Helium (ARMv7l, armelx)

2019

Platform B:

Deprecate Ubuntu 10.04

(EOL 2015)

2022-

Platform B:

Rocky 9 (amd64)

Platform C:

Neon (ARMv7l, armhf)

2011

Platform B:

Ubuntu 10.04 (Lucid, i386)

2016

Platform B:

Ubuntu 14.04 (Trusty, i386)

Centos 7 RT (amd64)

2020

Platform B:

Ubuntu 18.04 (Bionic, amd64)

Types of Libera Operating Sytems

Libera Operating Systems are grouped in two categories:
- **Platform B** – Libera Brilliance+, LLRF, Libera Hadron, etc.
- **Platform C** – Libera Photon, BLM, Libera Sparks, Libera Digit, etc.

Operating Systems for Platform B

Platform B (pictures on right-side):
- 2U 19'' chassis
- Inter-Connection Board (ICB) with CPU and OS
- ICB provides control actions to all AMC modules
- Intel CPUs, storage on μSD memory card (old: 4GB Flash), etc.

Operating systems:
- Official Ubuntu LTS releases: 14.04, 18.04
- **Replaced** omniORB 4.2.3 with 4.2.4 on Ubuntu 18.04 OS image – memory leak in omniORB library
- CentOS 7 with real-time kernel patch (Ingo Molnar) - GSI
- **Support Network Boot:** CentOS 7 (GSI), *Libera Ubuntu 18.04* (ANL)
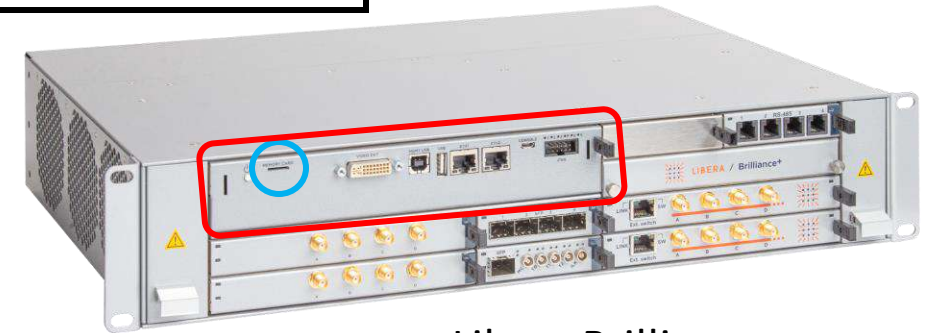
Libera Brilliance+

Libera LLRF digital processor

Types of Libera Operating Sytems

Operating System for Platform C

Platform C (pictures on right side):
- Based on Zynq 7000 SoC platform (7020, 7035)
- ARM®-based 32-bit processor
- μSD memory card with custom build OS

Operating System:
- Releases: Helium 1.0 (2016), Lithium 1.2 (2022), *Neon 1.4 (2023-)*
- Architecture: armelx (*without* hardware FPU[1])
- Operating System based on:
  - Buildroot (2015.02)
  - BusyBox (1.23.1)
  - GNU C libraries
- Root file system on RAM ⟹ **robust Operating System**
- Add support for Si569 VCXO (alternative for Si571)
- **Support Network Boot –** requires TFTP, NFS and DHCP server

[1] *Floating-Point Unit*

Libera BLM

Libera Photon

Libera Digit 500

Ongoing developments for the Libera Operating Systems

Migration to Rocky 9 Operating System

- Requested by GSI customer
- Migration from CentOS 7 to Rocky 9 OS
- Port Libera BASE to Rocky OS
- Port missing libraries to Rocky OS required by Libera software
- Porting applications:
    - Libera Hadron
    - Libera Single Pass H (LSPH)
    - Libera LLRF for p-Linac

Ongoing developments for the Libera Operating Systems

Neon operating system – What is new?

Helium OS
• Release 1.2
• armelx (without hardware FPU)
• Buildroot **2015.02**
• BusyBox 1.23.1
• GCC 4.7.3 (release in 2013)
• Xilinx Linux Kernel 3.15

| Neon OS |
|---|
| • Release 1.4 |
| • armhf (with hardware FPU) |
| • Buildroot **2022.02.6** |
| • BusyBox 1.35.0 |
| • GCC 10.4.0 (release in 2022) |
| • Xilinx Linux Kernel 5.4 LTS (EOL 2025) + **security patches** |
| • **Increase performance** by 200% in floating point calculation (with hardware FPU) |
| • Enable users to modify Linux system's configurations |
| • Add support for Epson VG7050 VCXO |
| • Other enhancements |

Conclusion

- On Platform B we introduce new Ubuntu LTS OS every 2-4 years

- Add support for CentOS 7 RT (GSI customer) and support for Network Boot

- On Ubuntu 18.04 OS was replaced omniORB library due to memory leak

- OS for Platform C is compact and robust, support Network Boot

- Migration from CentOS 7 to Rocky 9 OS
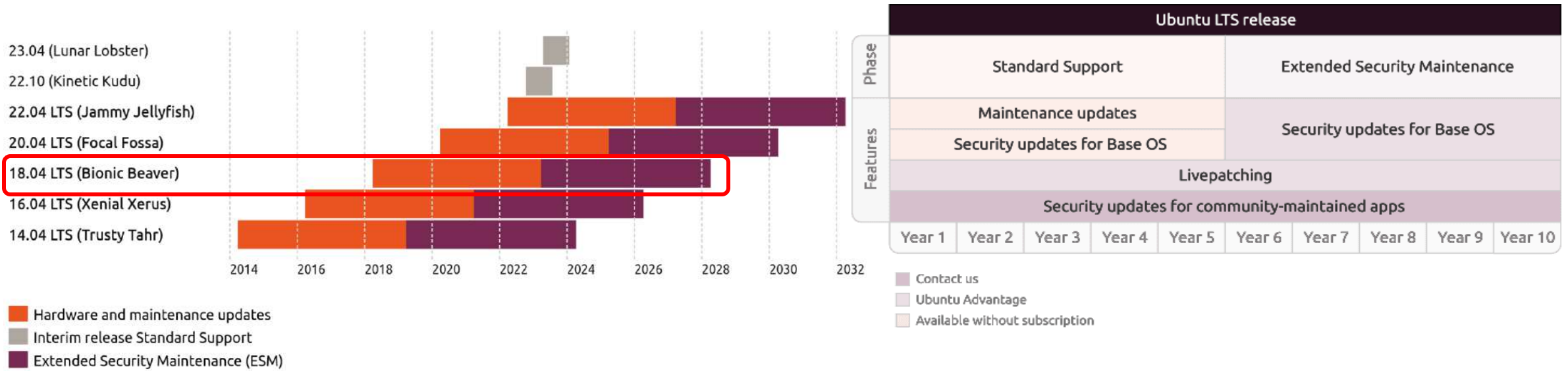
- Introduce new OS on Platform C – Neon (1.4)

Thanks for your attention!

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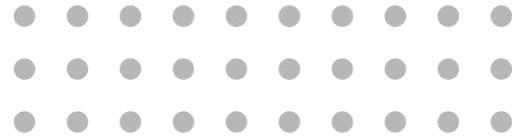
Source: https://ubuntu.com/about/release-cycle (May 2023)

Longterm release kernels

Version	Maintainer	Released	Projected EOL
6.1	Greg Kroah-Hartman & Sasha Levin	2022-12-11	Dec, 2026
5.15	Greg Kroah-Hartman & Sasha Levin	2021-10-31	Oct, 2026
5.10	Greg Kroah-Hartman & Sasha Levin	2020-12-13	Dec, 2026
5.4	Greg Kroah-Hartman & Sasha Levin	2019-11-24	Dec, 2025
4.19	Greg Kroah-Hartman & Sasha Levin	2018-10-22	Dec, 2024
4.14	Greg Kroah-Hartman & Sasha Levin	2017-11-12	Jan, 2024

Source: https://www.kernel.org/category/releases.html (May 2023)