

# Red Hat Enterprise Linux 9 for Accelerator Controls

Linux Future committee #07

2023-01-16

<https://indico.cern.ch/event/1229565/>

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On behalf of the BE-CSS teams

# Introduction aka the end of CentOS Linux



## Introduction

Why ?  
What ?  
Purpose Scope Objective Review

## Proposed solutions

Recap of possible choices from Linux Future committee  
Centos Stream  
RHEL

## Status and on going work

Adoption status  
Technical console  
Servers  
Timeline

## Summary

RHEL 9  
Next steps

# Glossary

In the context of this presentation

RHEL : Red Hat Enterprise Linux

EL : Derivative which are “binary compatible”. Rocky Linux, AlmaLinux, etc...

CC7 : CERN CentOS 7 (EOL 2024-06)

CentOS : CentOS Stream

# Why ?

- CC7 lifecycle ends during the RUN

# Why ?

- CC7 lifecycle ends during the RUN
- Support missing for newer Hardware that can be purchased in 2021/2022
  - Desktop 2021/2022 from CERN store : CC7 not supported
  - Server 2021/2022 : limited CC7 support, no support for newer CPU features

# What ?

- Back-ends
  - Technical Consoles (~ 800 units scattered across CERN sites running Java / Python / Web and commercial applications)
  - Servers (~ 576 in the CCR)
  - Openstack Virtual Machines provided by IT (~800 in Meyrin datacentre)

# Summary from Purpose Scope Objective

- Participate actively in the Linux Future Committee
- Evaluate in particular the CentOS Stream and Red Hat Enterprise Linux options in terms of
  - Functionality, Support model, Cost
  - Compatibility with the CERN Accelerator schedule
  - Compatibility with third-party and commercial software
- Propose the best strategy in terms of OS distribution and deployment roadmap during RUN3 and LS3
- Get endorsement from the ATS CTTB (<https://indico.cern.ch/event/1146867/>)
- Get endorsement from the ATS-IT TC
- Coordinate the support (IT) and operational deployment (BE-CSS sysadmin days)

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# Proposed Solution



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Few words about Front-ends  
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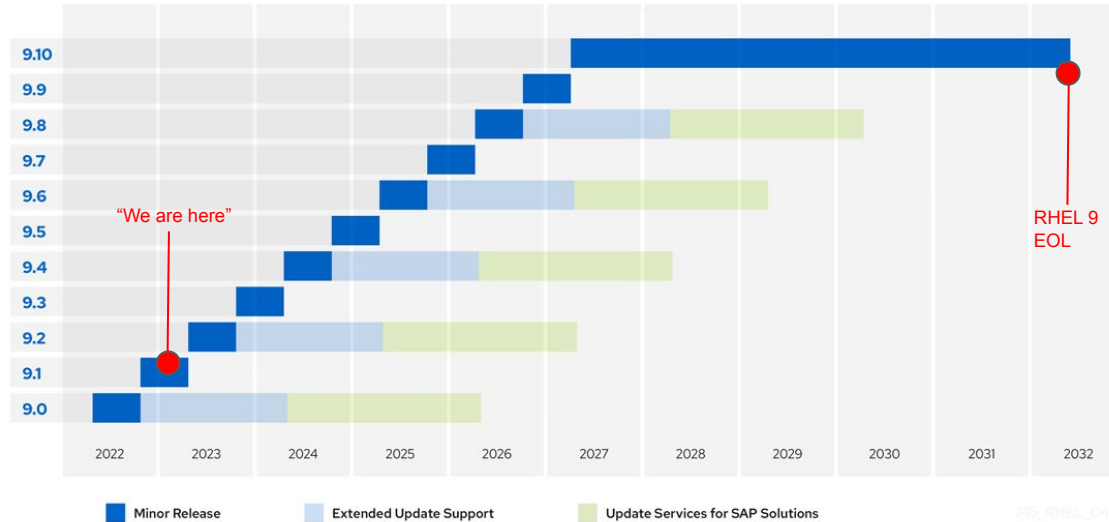
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# Red Hat Enterprise Linux 8 / 9

- Outcome of Linux Future Committee in 2021 : provide CERN site wide license for RHEL :
  - License scheme at CERN valid until 2029
  - Similar install process and Virtual Machine creation as previous distribution
- Supported by all commercial providers since many years (*labview*, matlab, WinCC OA)
- Additional software repositories available early after release (EPEL, rpmfusion)
- CentOS Stream 9 for early validation
- Decision to go with RHEL9 vs RHEL8 because X11 stack was still shipped (Be warned RHEL9 is the last RHEL with X11 - Wayland is coming soon...)

# And the winner is... RHEL 9

RHEL 9 Planning Guide<sup>viii</sup>



<https://linux.web.cern.ch/rhel/>

# Status and on going work

**PREDICTING THE SUCCESS OR FAILURE OF A NEW PRODUCT**  
BASED ON WHAT ENGINEERS AND PROGRAMMERS ARE SAYING ABOUT IT

IF THEY SAY...	IT MEANS...
"IT DOESN'T DO ANYTHING NEW"	THE PRODUCT WILL BE A GIGANTIC SUCCESS.
"WHY WOULD ANYONE WANT THAT?"	
"REALLY EXCITING"	THE PRODUCT WILL BE A FLOP. YEARS LATER, ITS IDEAS WILL SHOW UP IN SOMETHING SUCCESSFUL.
"I'VE ALREADY PREORDERED ONE."	
"WAIT, ARE YOU TALKING ABOUT <UNFAMILIAR PERSON'S NAME>'S NEW PROJECT?"	THE PRODUCT COULD BE A SCAM AND MAY RESULT IN ARRESTS OR LAWSUITS.
"I WOULD NEVER PUT <COMPANY> IN CHARGE OF MANAGING MY <WHATEVER>."	WITHIN FIVE YEARS, THEY WILL.

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# RHEL 9.0 - adoption status

- Jumping from CC7 to RHEL9 (No production on el8)
- Standard installation of RHEL at CERN since years, even simplified because no license request needed anymore. Managed repository like CentOS in Ansible with snapshot support.
- Lot of work to rebuild software with the help of the community (EPEL, rpmfusion) for software not provided by Red Hat : mplayer, vlc, xfce, etc..
- Maintaining compatibility with software deployed on our infrastructure for Technical Console on both CC7 and RHEL 9.
- Our driver was to make RHEL9 behave like CC7 for Technical Consoles Users

# RHEL 9.0 - timeline

- RHEL 9 released on 2022-06 and evaluation started :
  - 2022-07 : Technical Console with Ansible running RHEL 9, followed by a lot of testing
  - 2022-08 : Containerized WinCC OA UI Proof of concept, proprietary X11 app in a container
  - 2022-09 : First **test** console in CCC migrated from CS8 -> RHEL9
  - 2022-10 : First **test** RHEL 9 server installed for WinCC OA team
  - 2023-01 : 7 Consoles in CCC in production, 10 servers in CC5, dozen of VMs.
- ~ 2 FTE over 3 months (Ansible dev + RHEL fixes) + Application expert time when issue popup (however, we already started to redo Ansible architecture with CS8 which saved a lot of time + CentOS Stream 9 allowed us to validate that RHEL9 would be viable for the Sector)

# RHEL 9.0 - 6 months after release

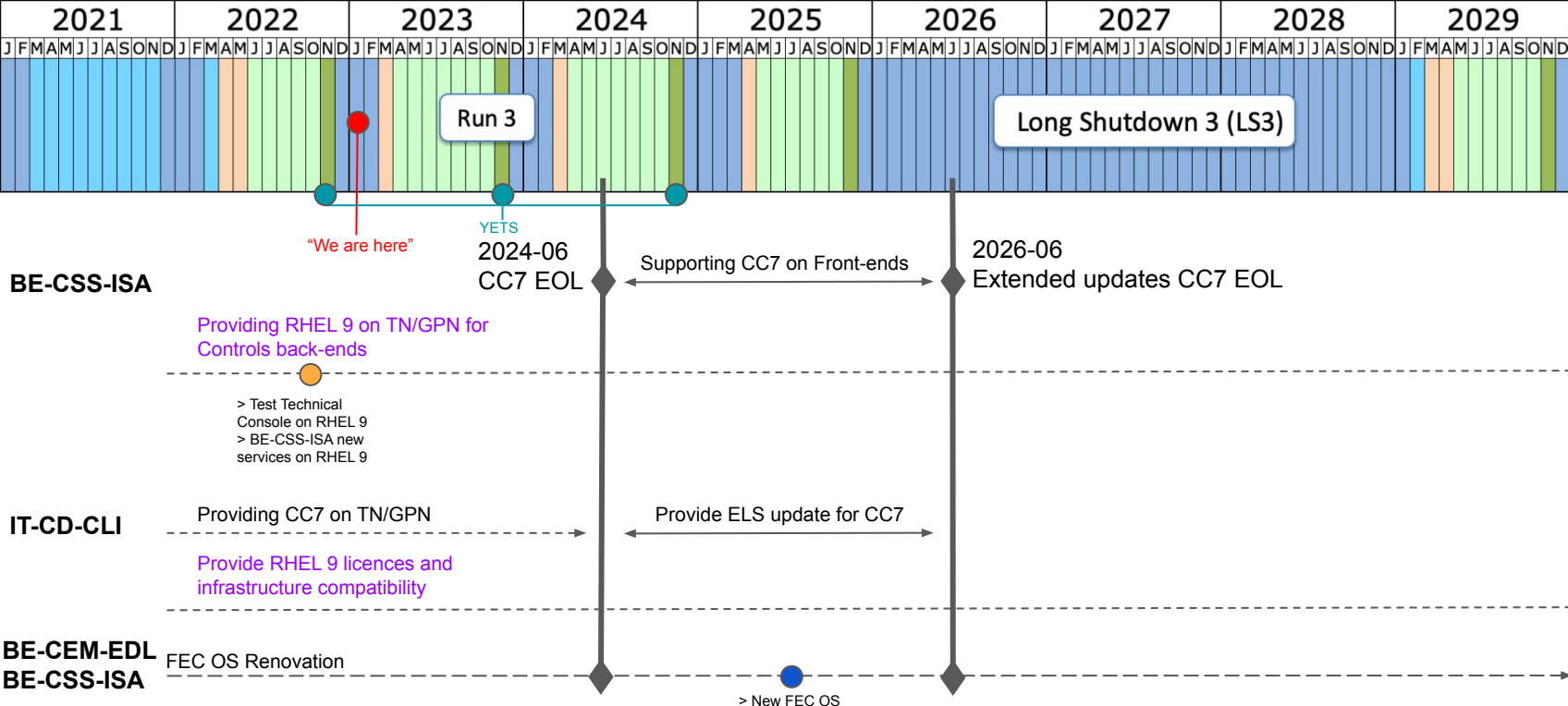
- Java: packaging azul jdk (zulu) instead of openjdk 1.8.0\_352 / **1.11.0\_17** / 1.17.0\_5
- Packages still not available in EPEL :
  - `xorg-x11-apps` (xclock, xcutsel, etc...)
  - `xdotool`
  - `xorg-x11-drv-intel` (needed for Intel CPU ~~42th~~ and 13th generation)
- `mplayer` 1.5.1 still missing from rpmsfusion
- Oracle clients 21.7.0.0.0-1.el8 (no issue so far)
- Launcher for WinCC OA UI X11 app within a CC7 containers
  - 3.16 only supported on CC7 (3.19 is coming for RHEL9)
  - Support for sudo / multiple users on same machine
  - Transparent for the end user
  - Try to make it generic for X11 apps compatibility after CC7 EoL and Wayland migration

# Status

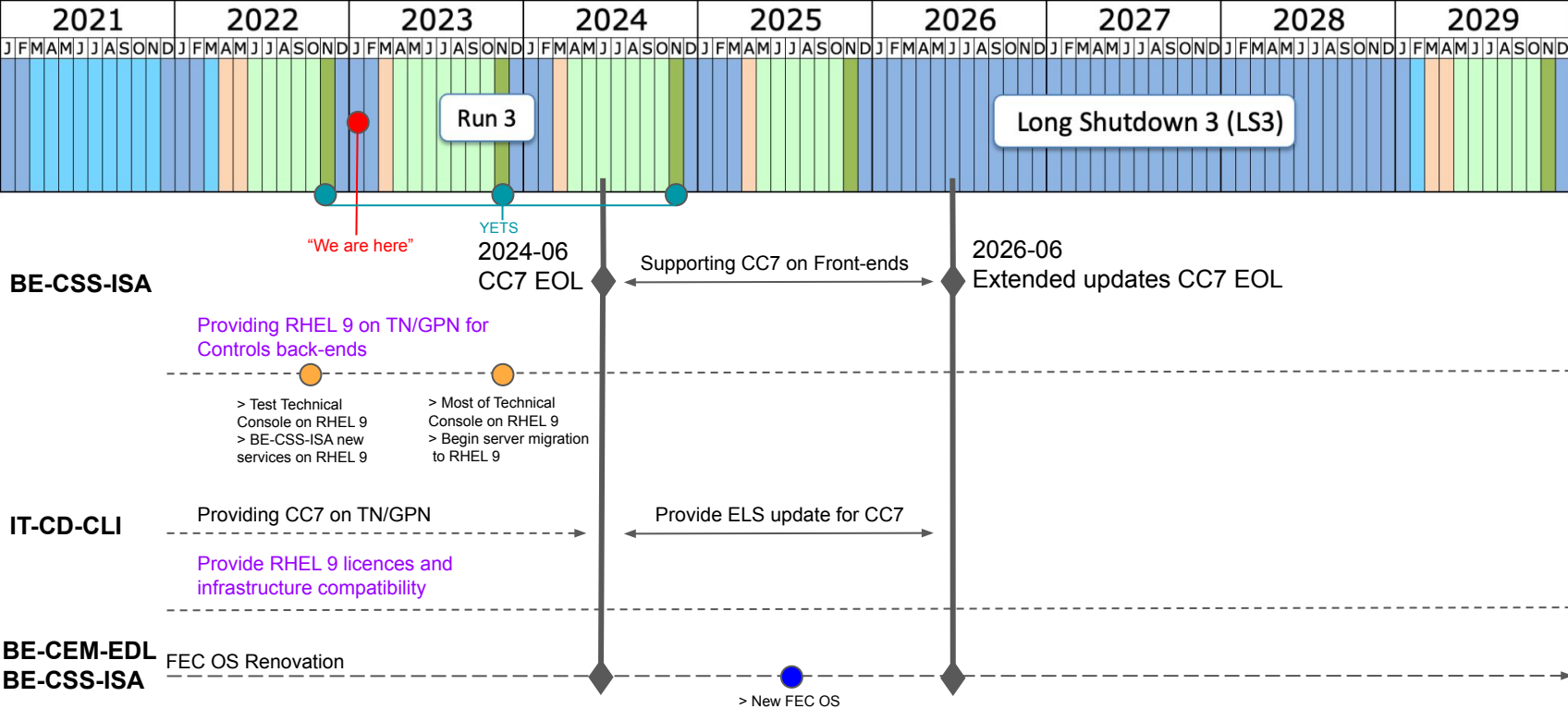
- ★ Technical Console ✓
- ★ Servers ✓
- ★ Virtual Private Console (Openstack) ✓
- ★ Containers ?
  - Strategy is based on podman since the last 2 years - no issue, no daemon, big community now (Gitlab runner support, X11 apps encapsulation, built for RHEL, etc...). Our Container framework is based on pure systemd + CDDB database for service description (lumens).
  - Redistribution is one of the challenge and Almalinux container preferred option at this time with the recent IT announcement (still under review, final decision by Q2 2023)
  - UBI 9 is not discarded and no major problem arose in the early tests, but having less redistribution concerns is always better
- ★ RHEL 9.1 validation starting now - released too late to jump directly to it.
  - In 2023 Wayland evaluation for Technical consoles use cases



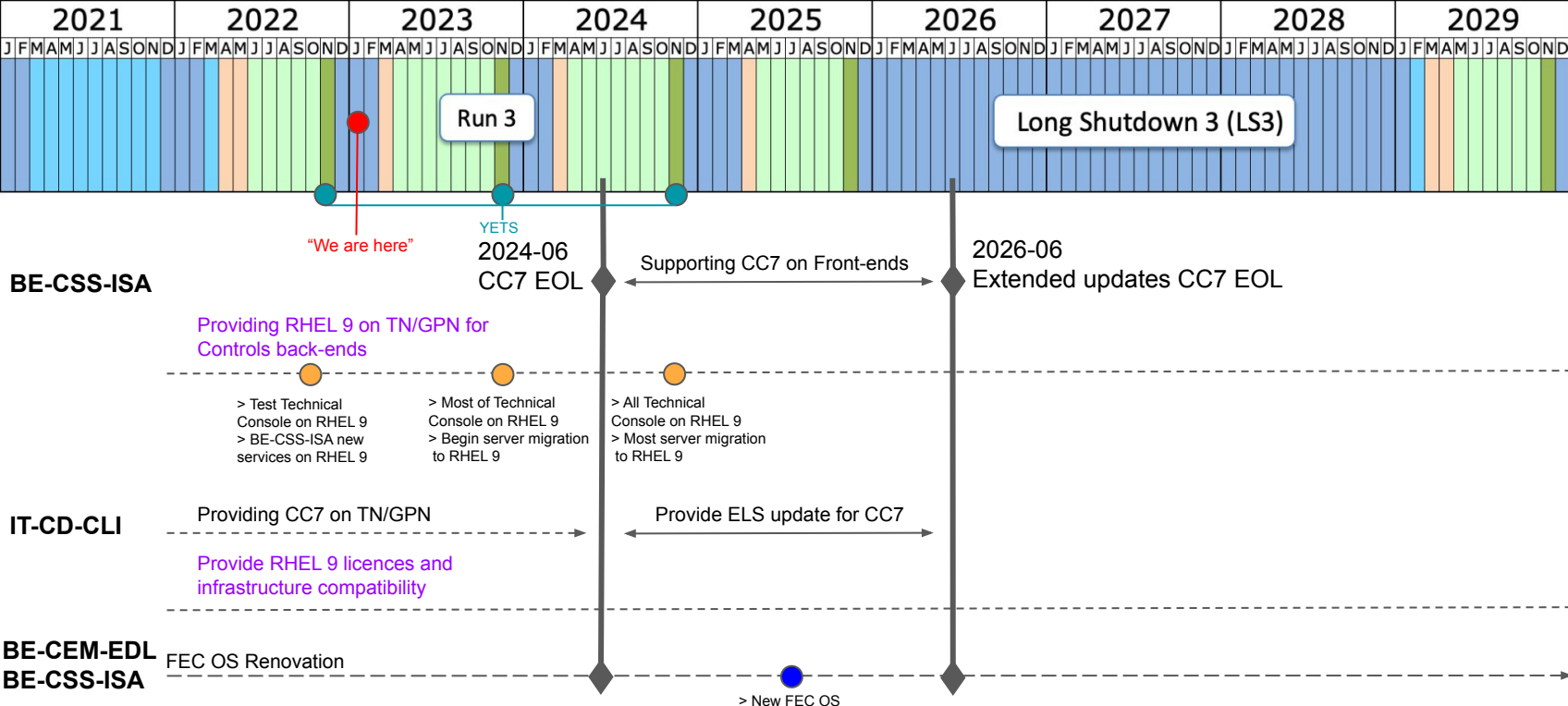
# Timeline



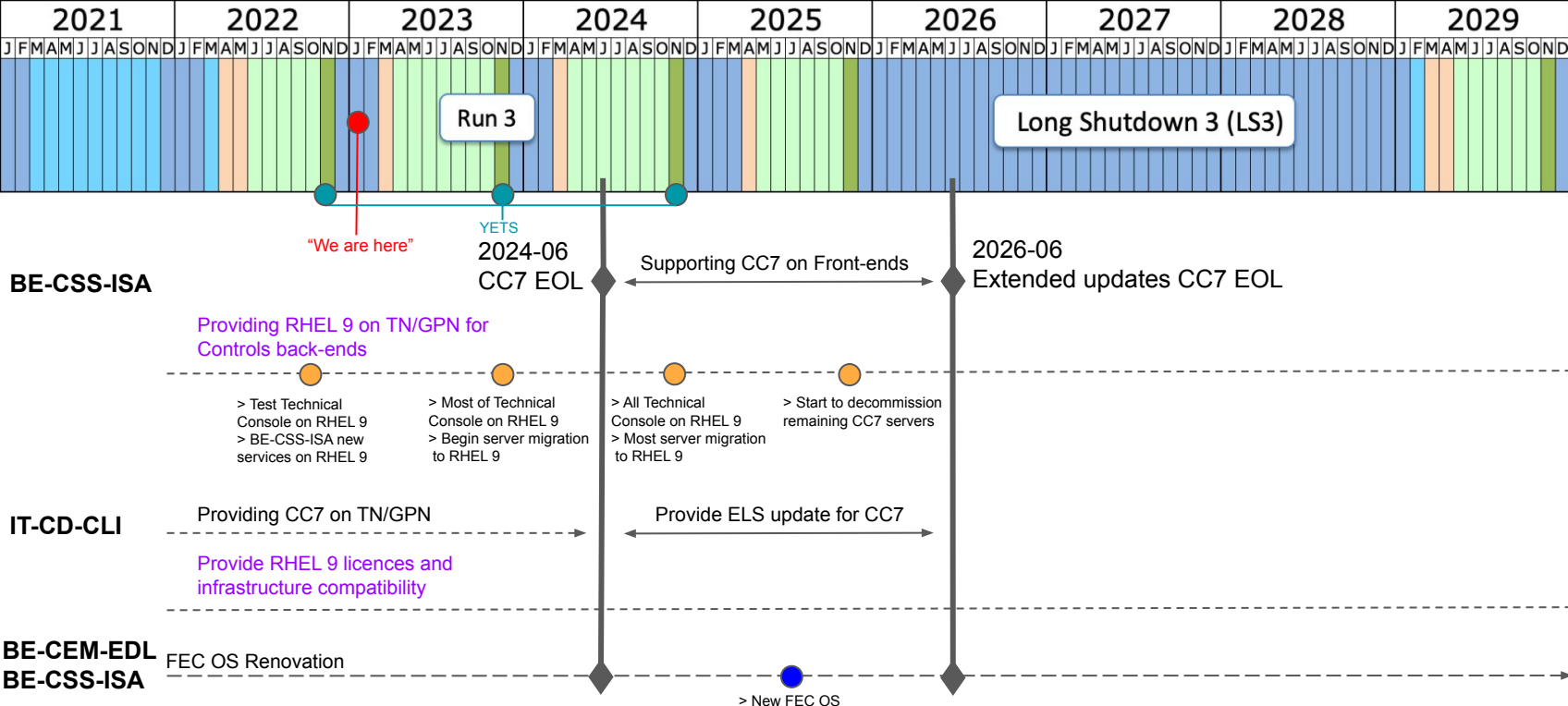
# Timeline



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# Timeline



## Summary

We believe this resolves all remaining questions on this topic. No further research is needed.

### References

1. ...
2. ...
3. ...
4. ...

JUST ONCE, I WANT TO SEE A RESEARCH PAPER WITH THE GUTS TO END THIS WAY.

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- RHEL 9 is a good choice until the end of RUN3:
  - Modern distribution for current run with industry support
  - RHEL 9 will cover the entire run
  - Allow to purchase and use modern hardware
  - No lock in ; for RHEL 10 we can move to Almalinux in the light of recent development in IT
- Next Steps:
  - Follow up with IT through SNOW on diverse topics (Oracle client validation, ~~Openafs for RHEL, EOS fuse~~)
  - ATS sector is very interested in the IT Strategy if alignment on e19 is possible. What do we do with users Desktop that want a similar setup ? We have hundreds of those. How do we convene a message that end-users are encouraged to use version 9 (PoC to provide a locmap module to get the ACC desktop (xfce / lightdm / widgets)). End-users are not service managers or computer literate. Is Almalinux 9 (with limited support) the best choice ?
  - Strategy for next RUN ? With industrial PCs, multiple arches (amr64, RiscV?) and SoC likely a CERN wide discussion should happen before 2025-2027.

# A reminder about the Future of Front-ends...

CTTB #16 (<https://indico.cern.ch/event/1146862>)

Aka Industrial PCs

FEC OS Renovation

Joint BE-CSS and

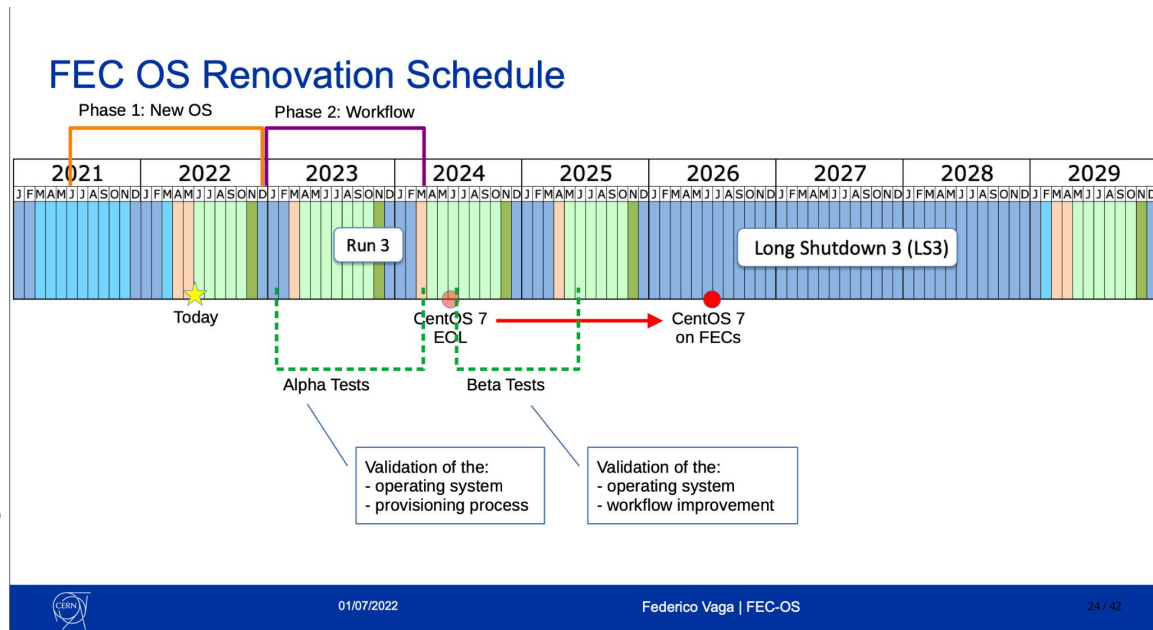
BE-CEM project

lead by Federico Vaga

\*One challenge is the old cpus limited to x86\_64 v2

Not supported by RHEL  $\geq 9$

<https://en.wikipedia.org/wiki/X86-64> (Microarchitecture levels)

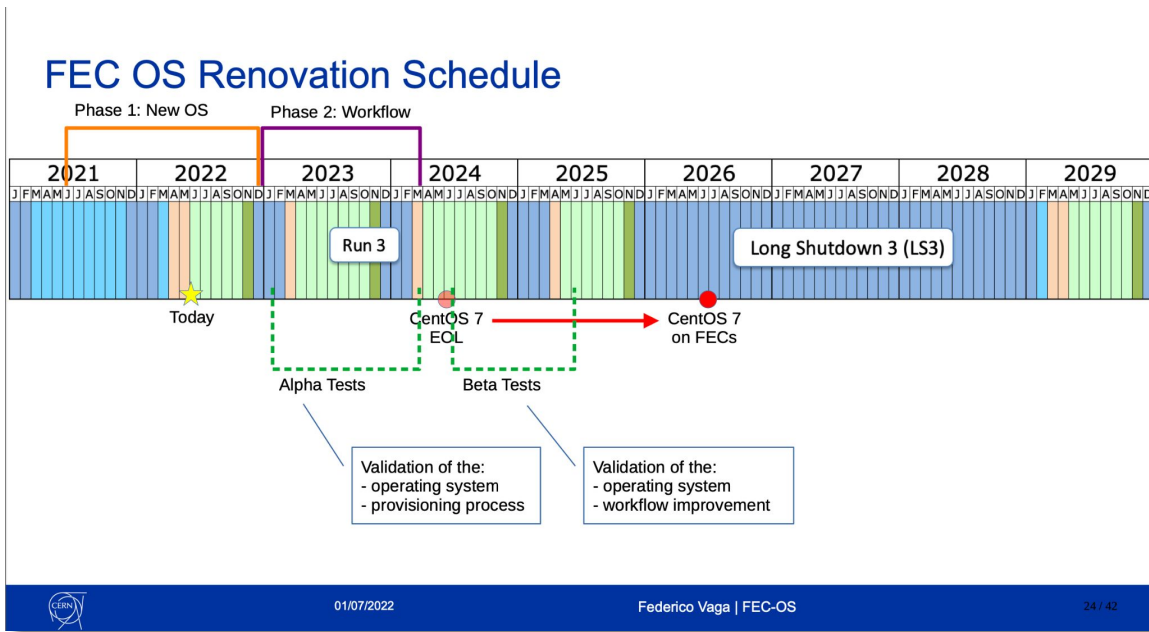


# A reminder about the Future of Front-ends...

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CPU microarchitecture levels		
Level	CPU features	Example instruction
x86-64 (also x86-64-v1) (baseline: all x86-64 CPUs)	CMOV	cmov
	CX8	cmpxchg8b
	FPU	fild
	FXSR	fxsave
	MMX	emms
	OSFXSR	fxsave
	SCE	syscall
	SSE	cvtss2si
	SSE2	cvtpl2pd
	SSE4_1	blendpd
x86-64-v2 (circa 2009: <b>Nehalem and Jaguar</b> ) Also: • <b>Atom Silvermont</b> (2013) • <b>VIA Nano and Eden "C"</b> (2015)	CMPXCHG16B	cmpxchg16b
	LAHF-SAHF	lahf
	POPCNT	popcnt
	SSE3	addsubpd
	SSE4_2	pcmpestri
	SSSE3	phaddq
	AVX	vzeroall
	AVX2	vpermd
	BMI1	andn
	BMI2	bzhi
x86-64-v3 (circa 2015: <b>Haswell and Excavator</b> ) Also: • <b>Atom Gracemont</b> (2021) • <b>QEMU Emulation</b> (as of version 7.2) <sup>[42][43]</sup>	F16C	vcvtpd2ps
	FMA	vfmadd132pd
	LZCNT	lzcnt
	MOVBE	movbe
	OSXSAVE	xgetbv
	AVX512F	kmovw
	AVX512BW	vdbpsadbw
	AVX512CD	vplzcntd
	AVX512DQ	vpnullq
	AVX512VL	n/a
x86-64-v4 (AVX-512's general-purpose subset)		

CTTB #16 (<https://indico.cern.ch/event/1146862>)



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