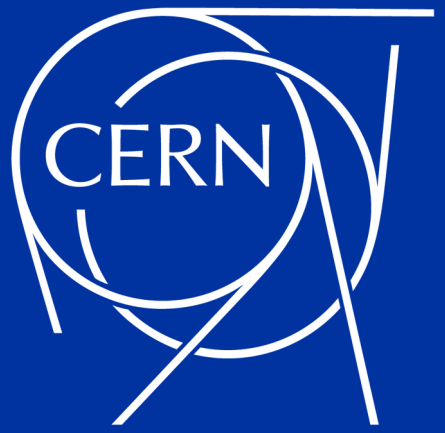


Selection Of Linux Distribution For Front-End Computers and System-on-Chip in CERN-ATS

Federico Vaga

2023-05-24

Who am I?

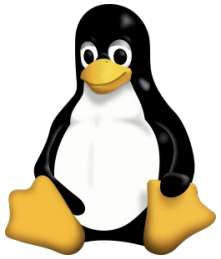
- **I work in CERN BE-CEM-EDL**
- **I’m a Software Engineer, specialised in:**
  - Low-Level Software
  - Linux kernel development
  - Linux systems

Disclaimer

This is an on-going project

From Last SoC Working Group Meeting

How Does The Next OS Boot?



DRA
CUT

GRUB → Linux → Init RAM disk → Distribution

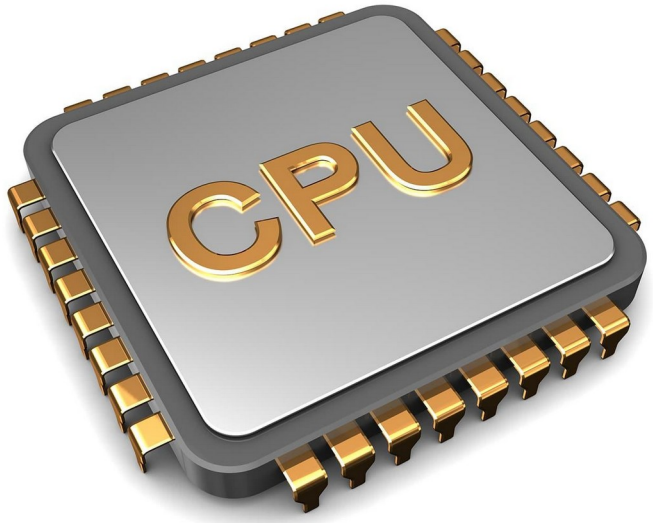
www.gnu.org/software/grub

www.kernel.org

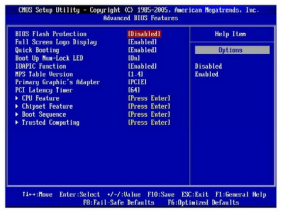
github.com/dracutdevs/dracut

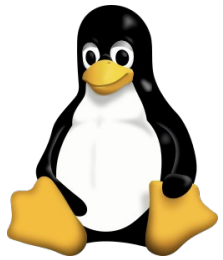
almalinux.org

www.debian.org



Network RAM Booting: Industrial PC





DRA
CUT

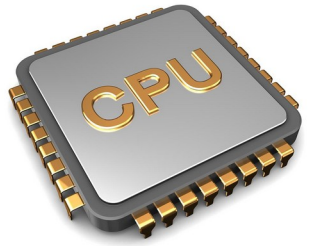
BIOS
EFI Firmware

GRUB

Linux

Init RAM
disk

Distribution



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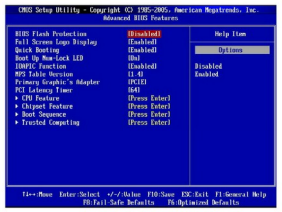

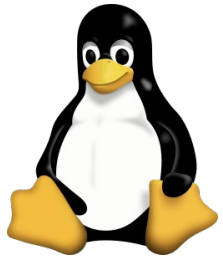

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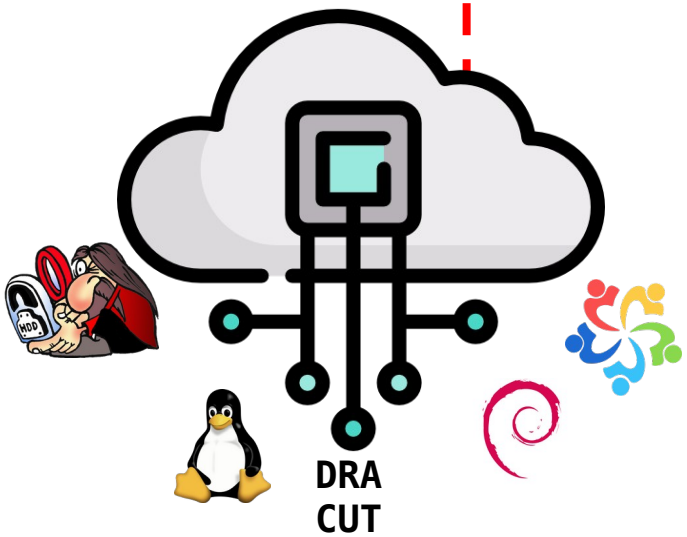

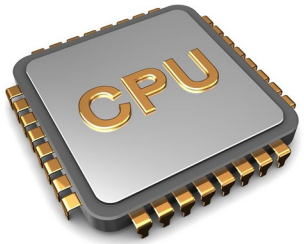

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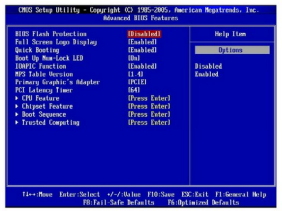

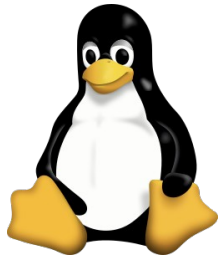

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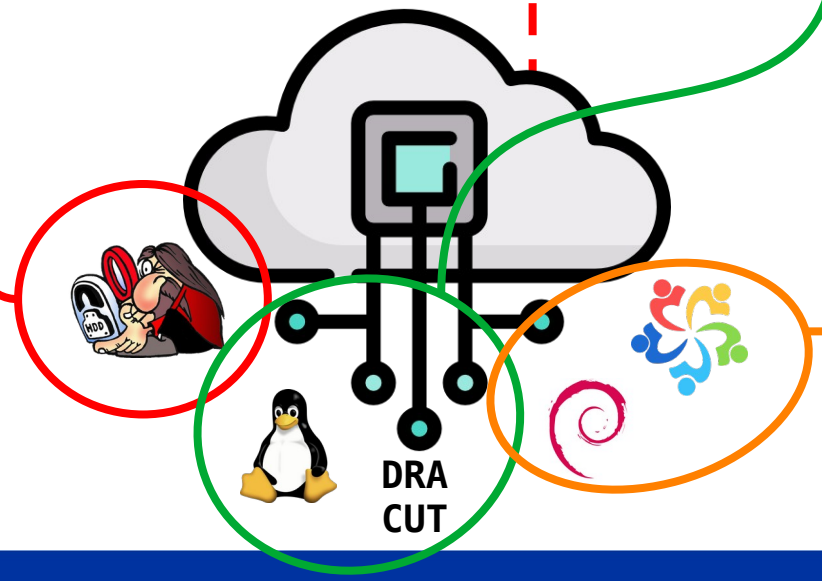
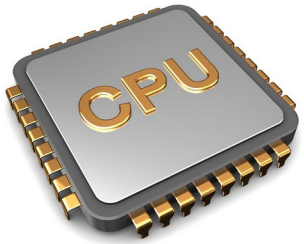
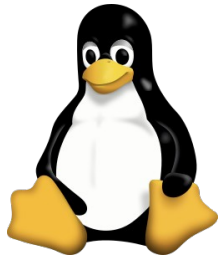


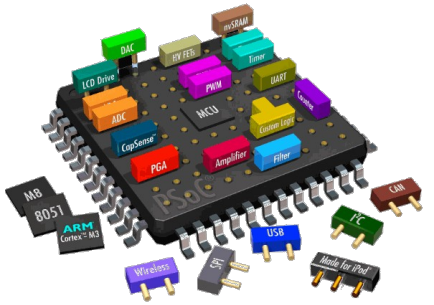


Network RAM Booting: System-on-Chip



DRA
CUT

FSBL and friends → U-Boot → GRUB → Linux → Init RAM disk → Distribution



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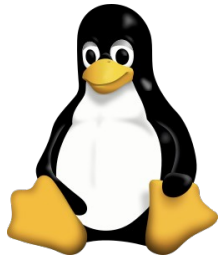

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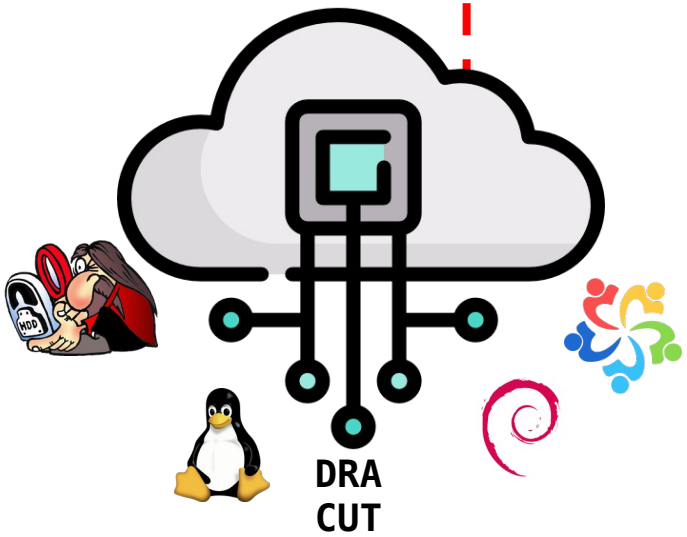

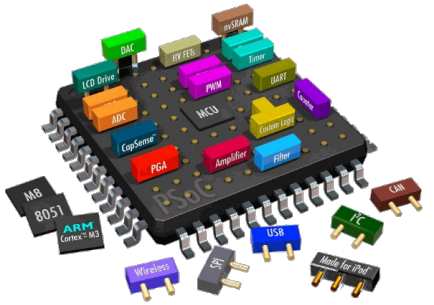

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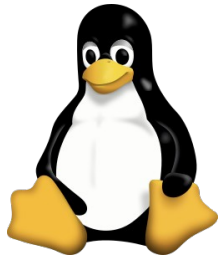
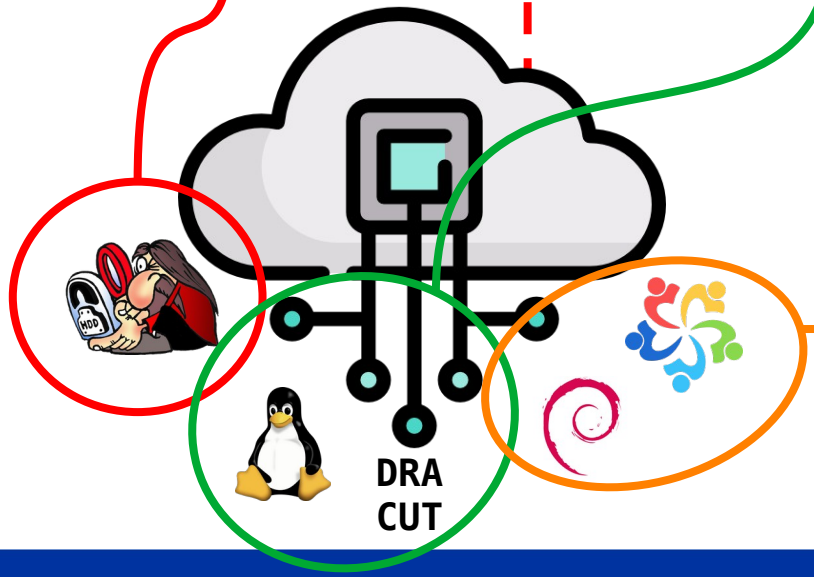
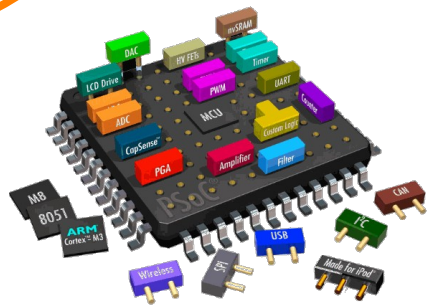


DRA
CUT

FSBL and friends → U-Boot → GRUB → Linux → Init RAM disk → Distribution





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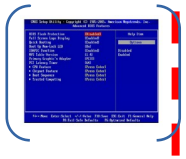
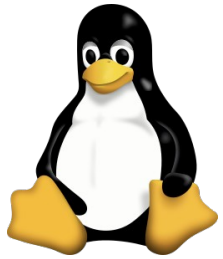
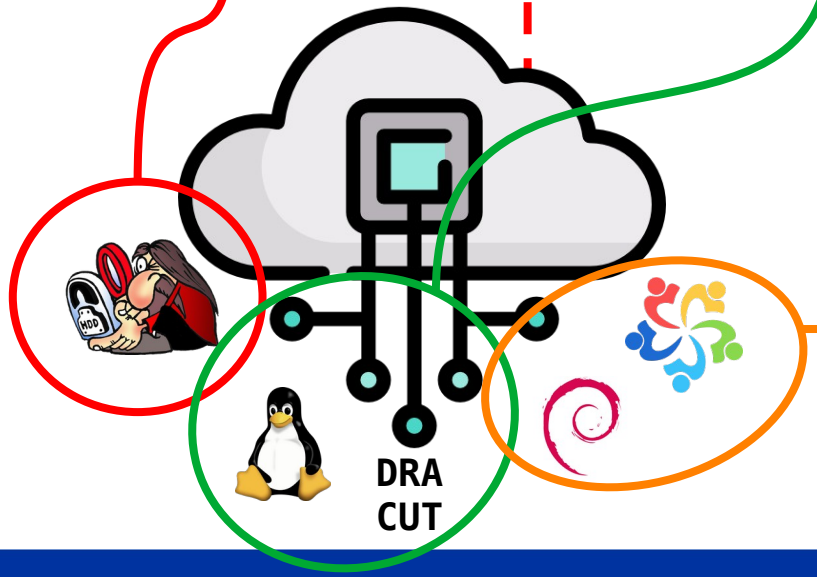
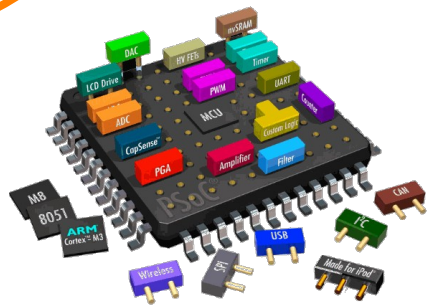




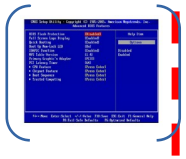
DRA
CUT

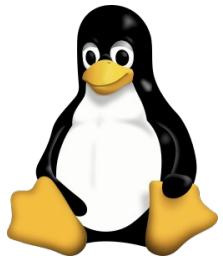
FSBL and friends → U-Boot → GRUB → Linux → Init RAM disk → Distribution





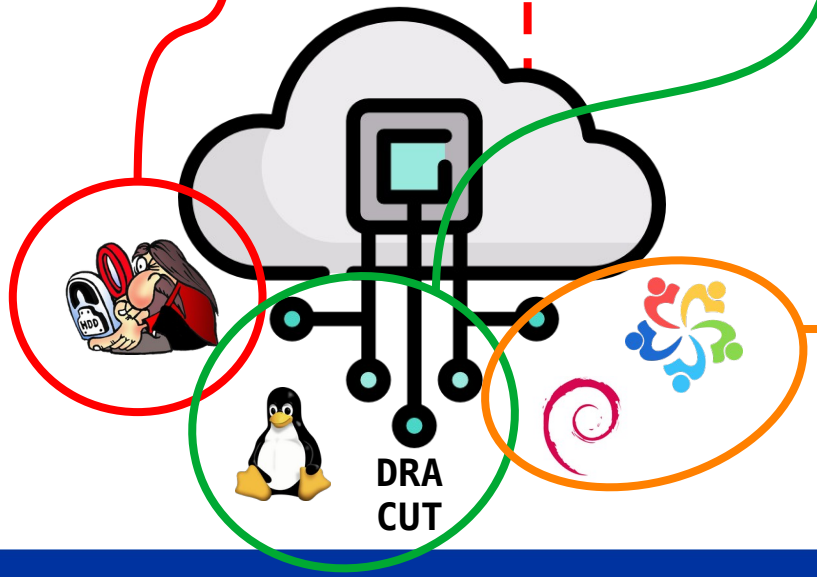
Network RAM Booting: System-on-Chip

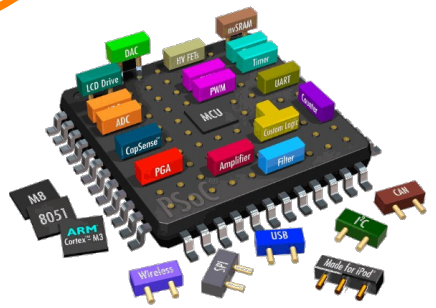




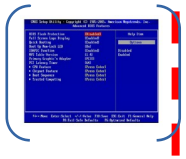
DRA
CUT

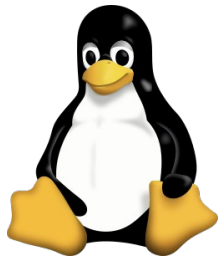
FSBL and friends → Barebox → GRUB → Linux → Init RAM disk → Distribution





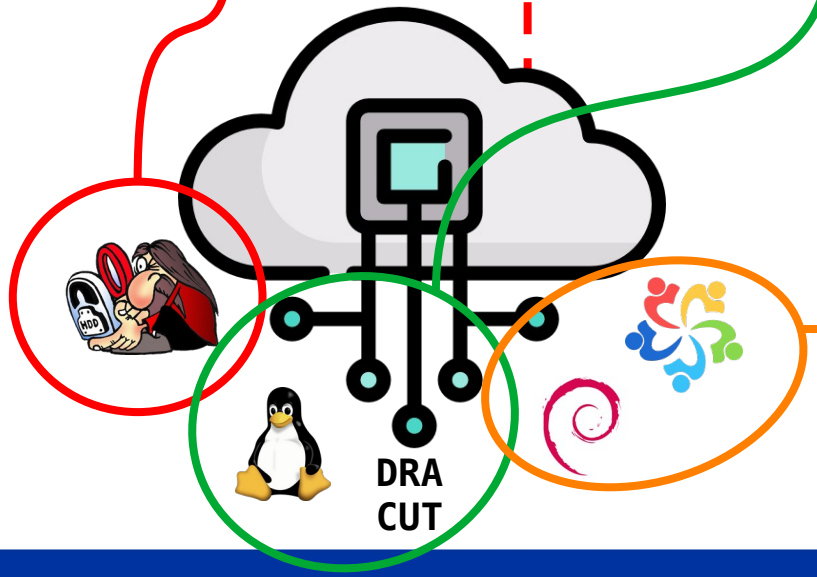
Network RAM Booting: System-on-Chip

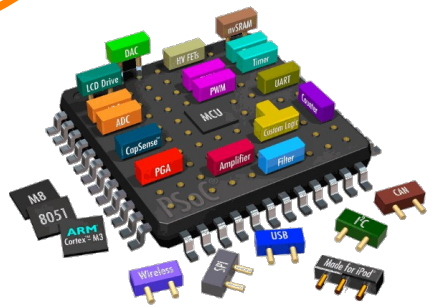




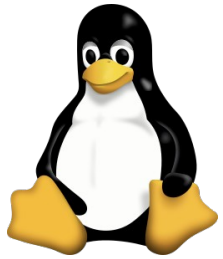
DRA
CUT

FSBL and friends → coreboot → GRUB → Linux → Init RAM disk → Distribution



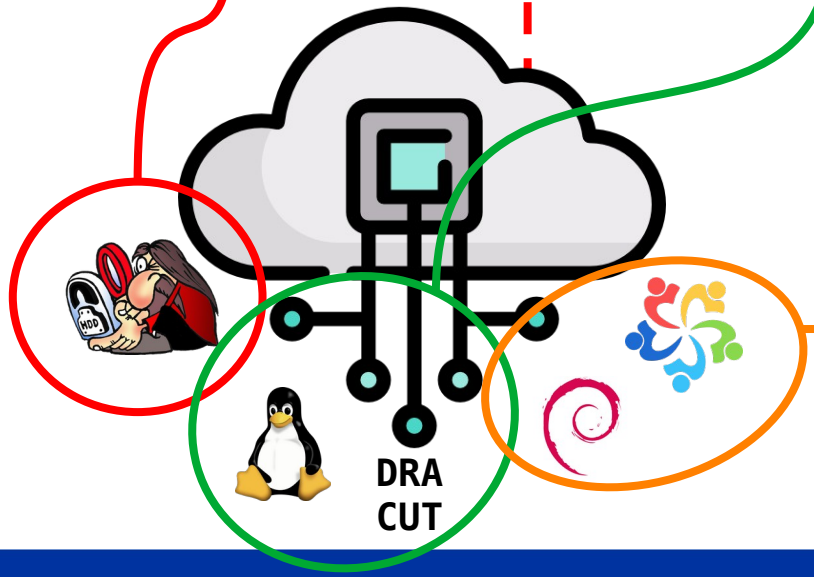


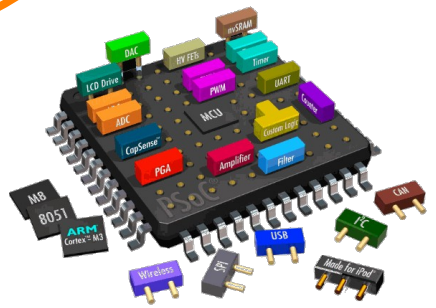
Network RAM Booting: System-on-Chip



DRA
CUT

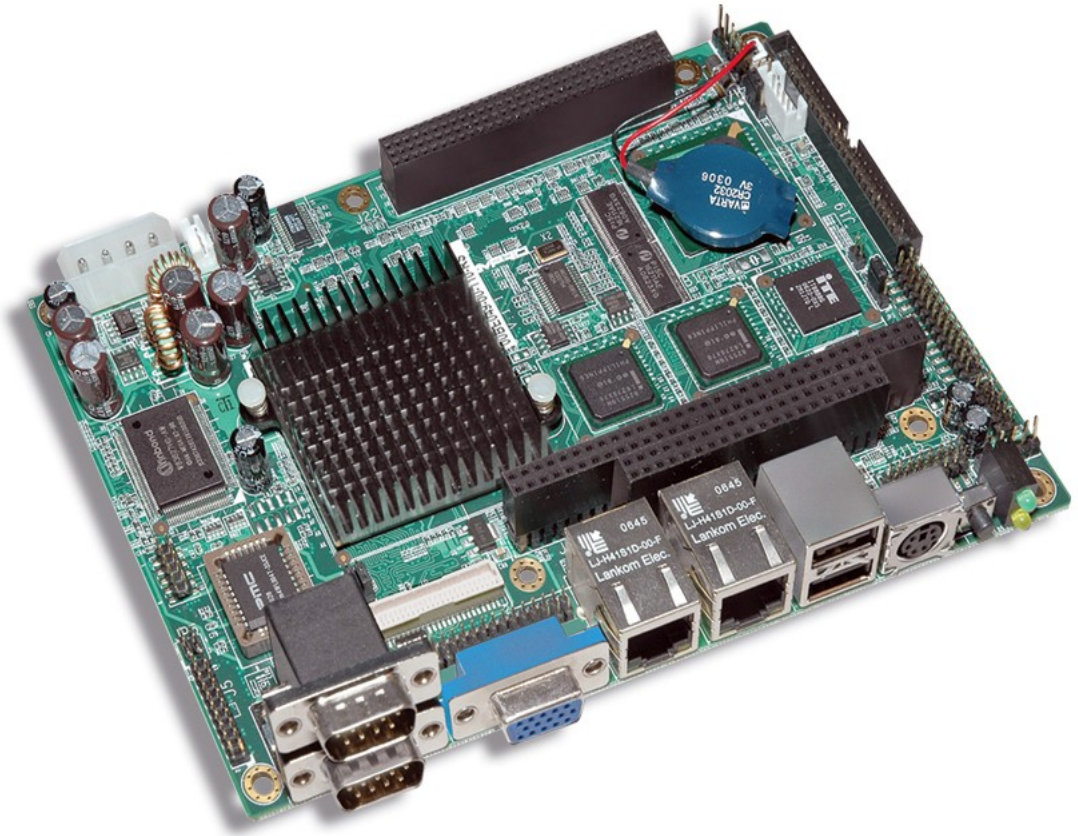
FSBL and friends → coreboot → Boot EFI → GRUB → Linux → Init RAM disk → Distribution



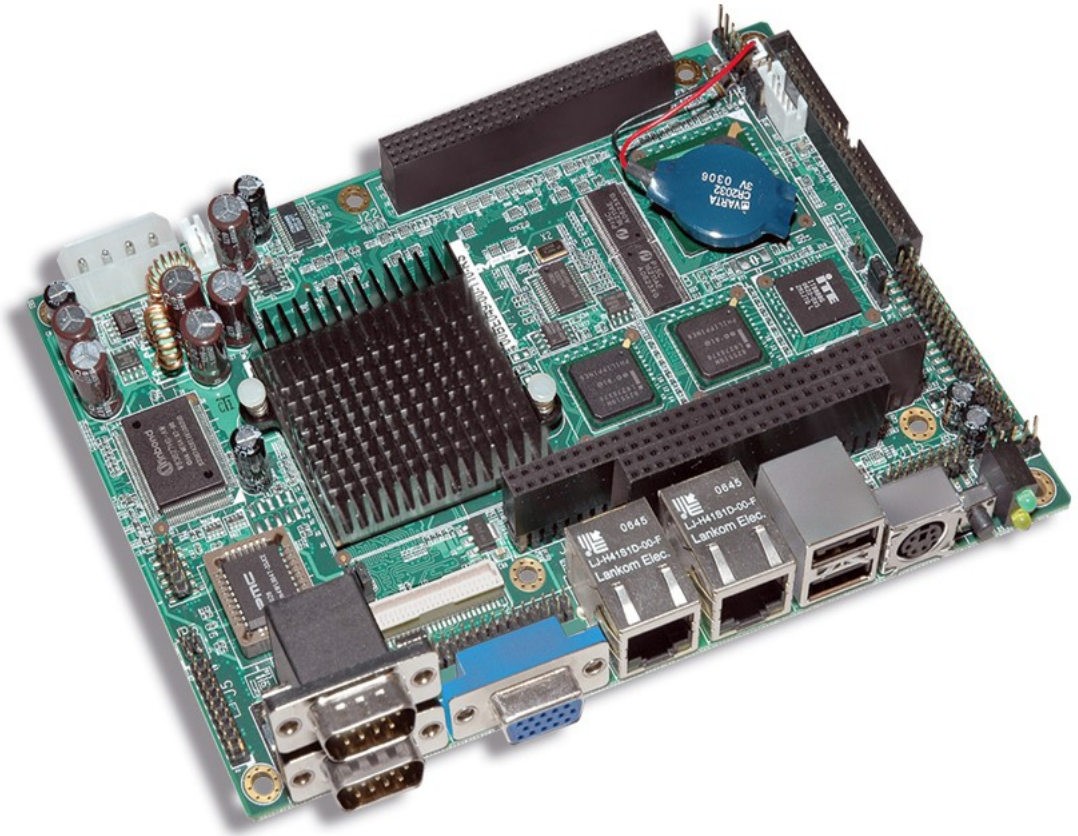


Back On Topic: OS Selection Process

Embedded Systems



Embedded Systems



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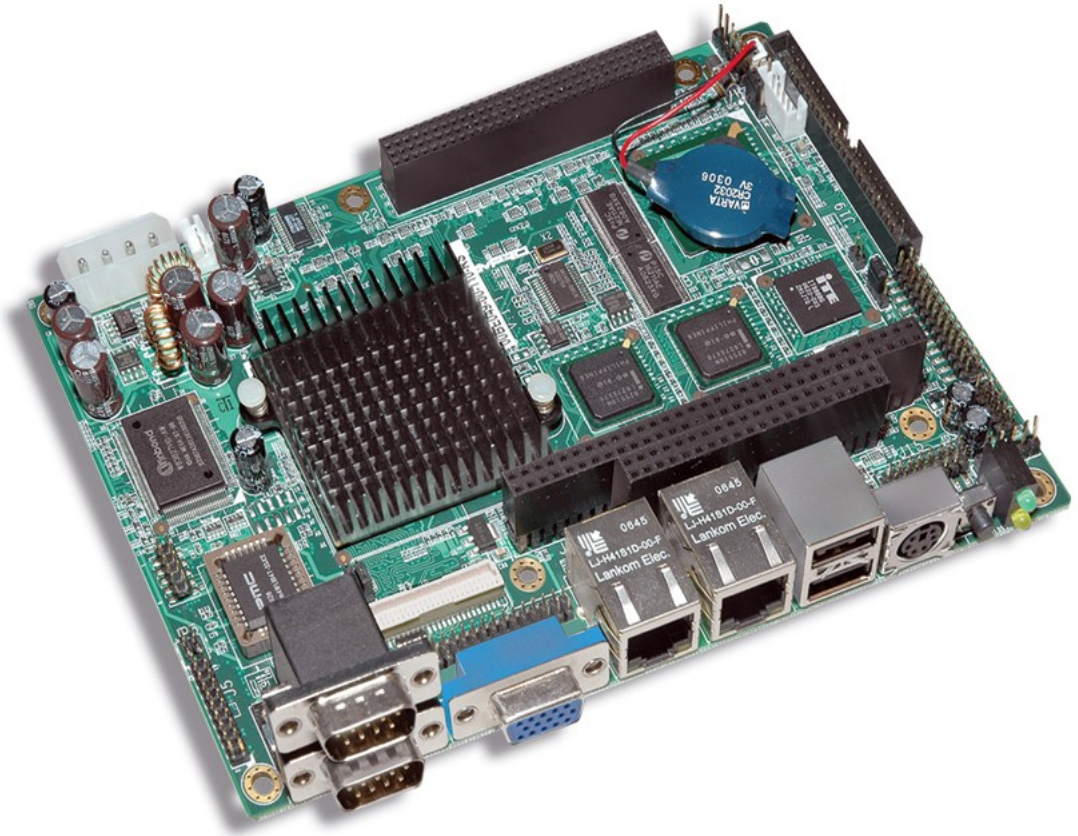

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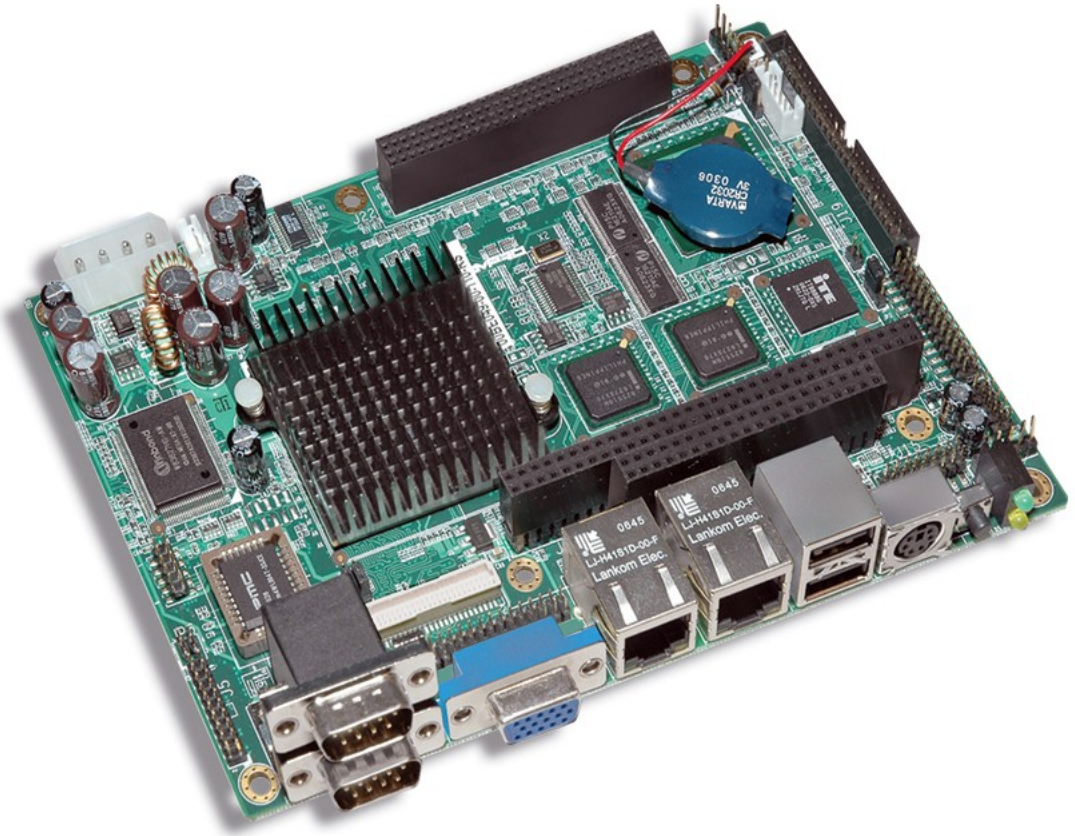


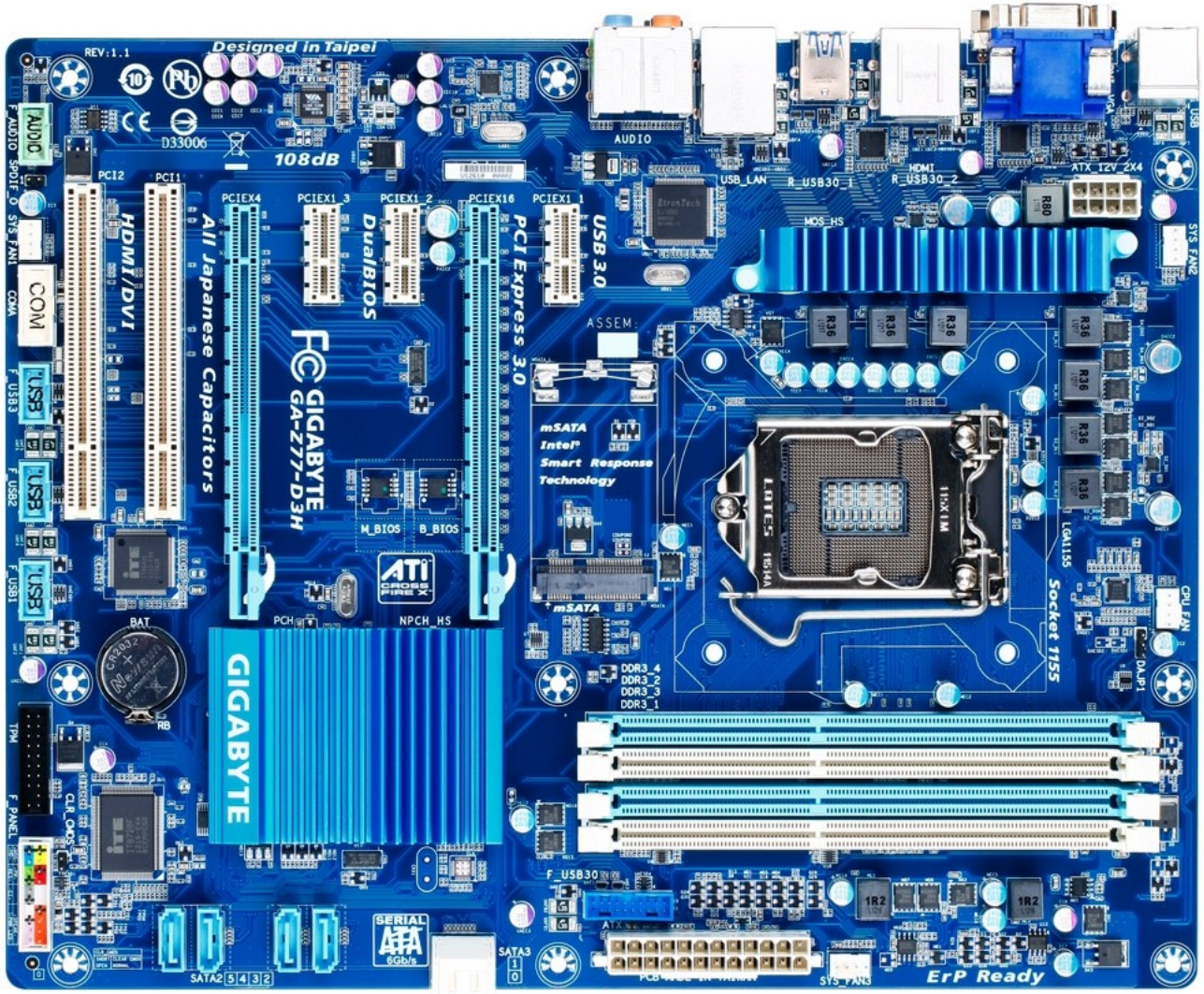
yocto PROJECT

Definition

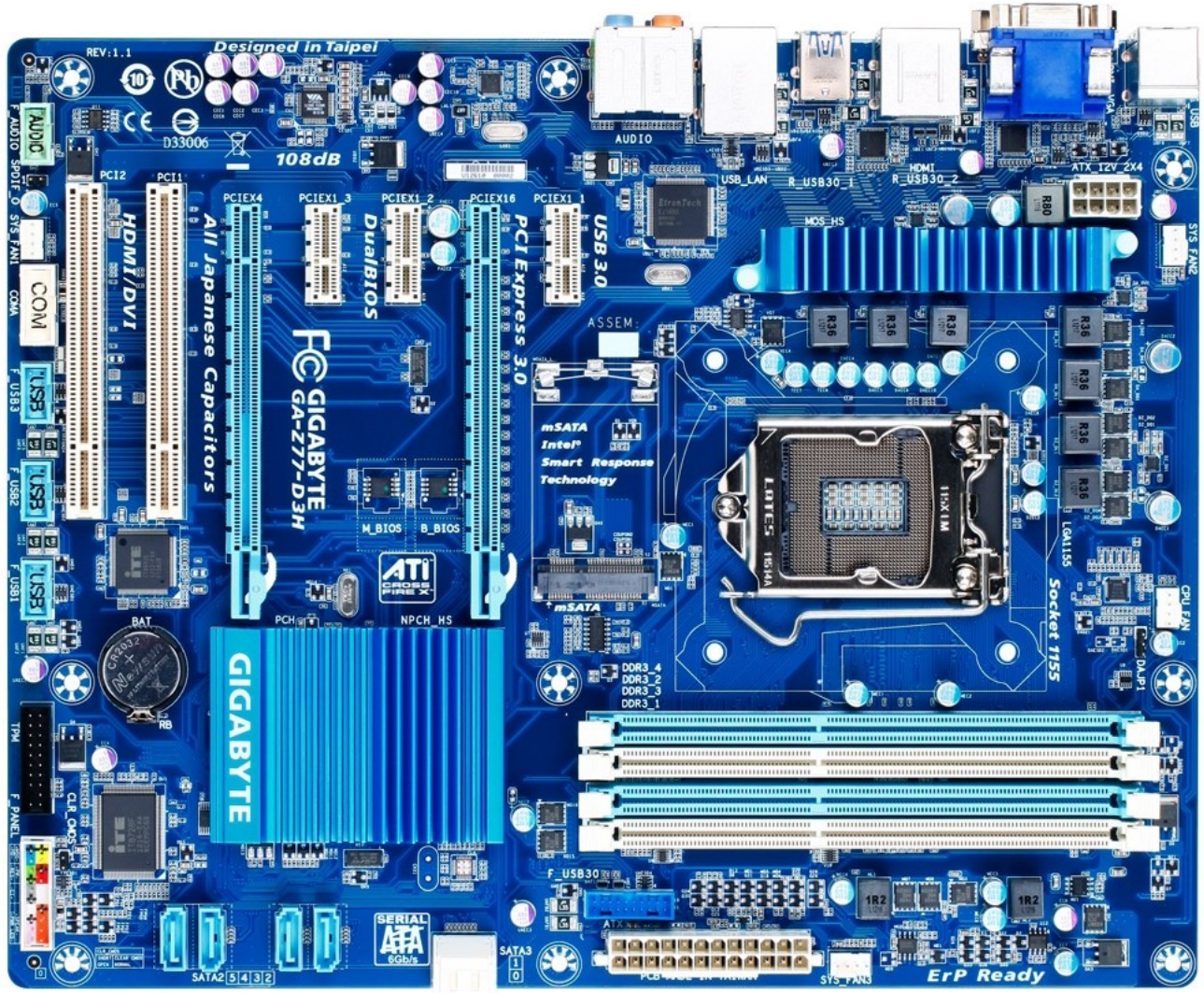
embedded system

A combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a dedicated function. In some cases, embedded systems are part of a larger system or product.

Embedded Systems ?

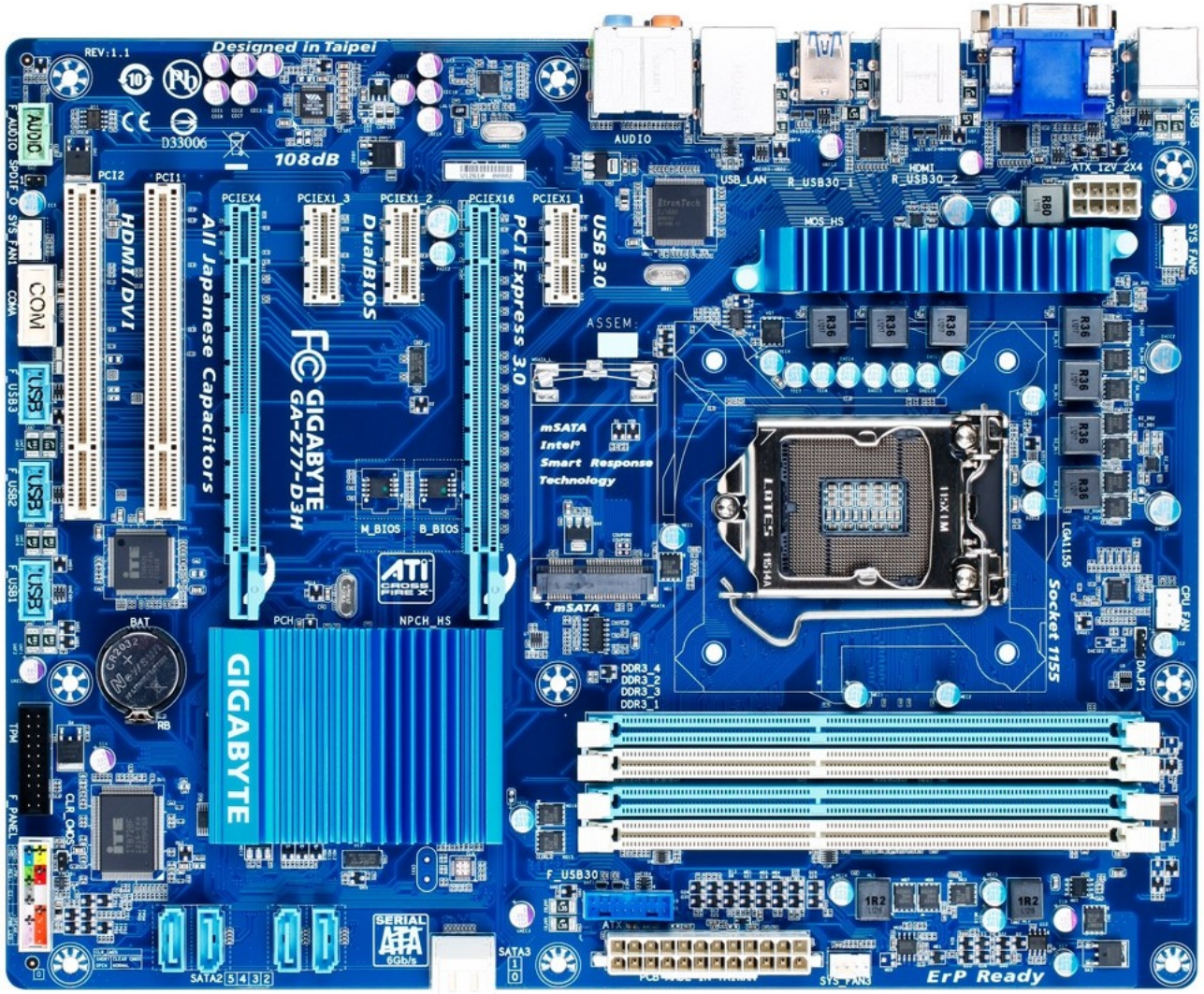


Embedded Systems ?



Embedded Systems ?

CAN Bus



Embedded Systems ?

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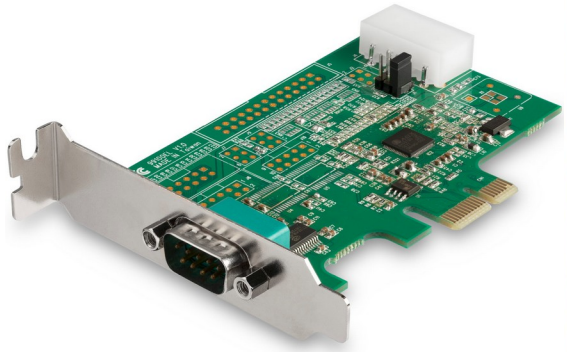
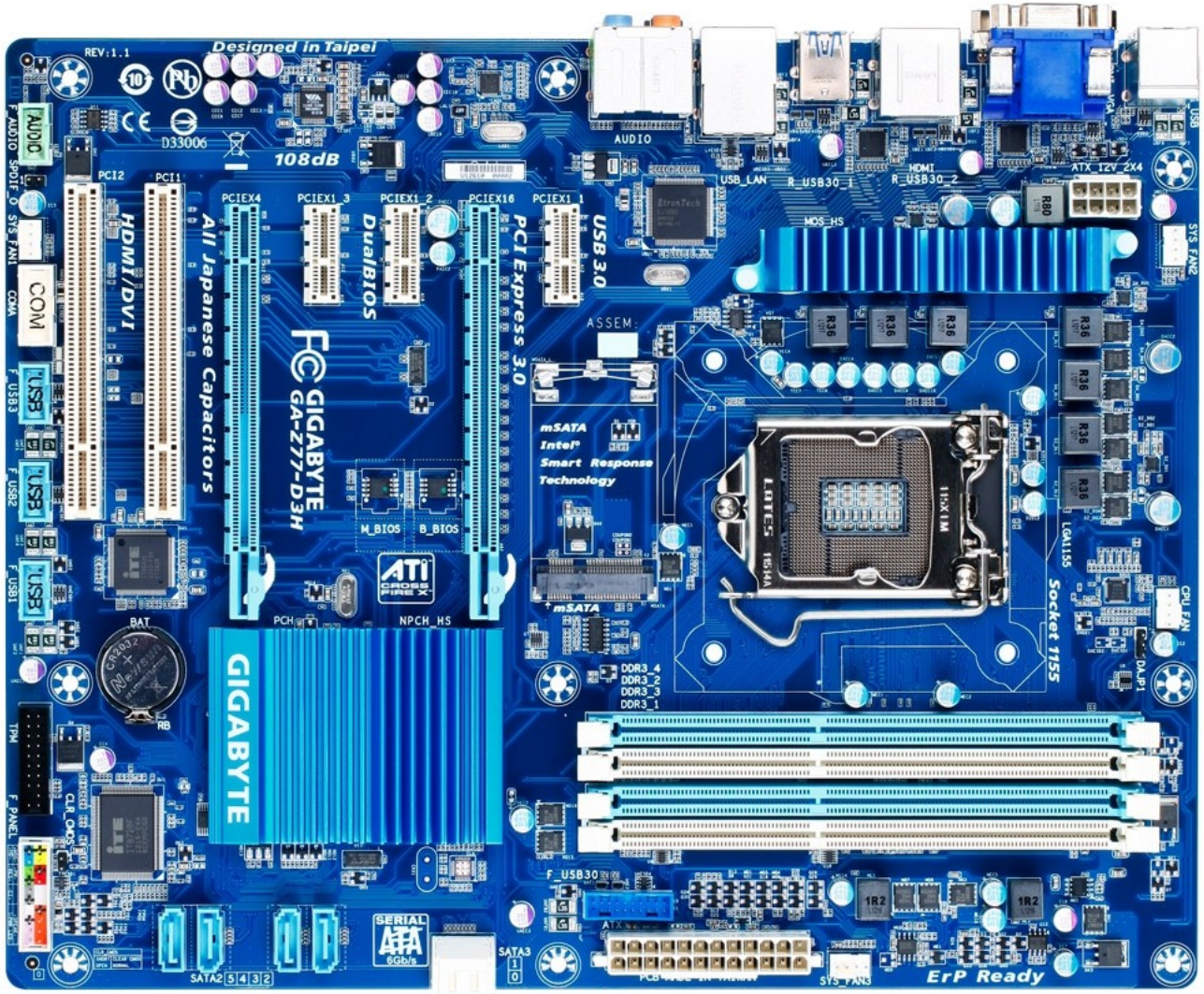


Serial Bus



Embedded Systems ?

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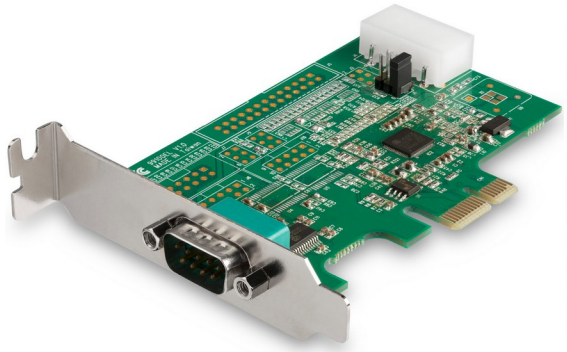
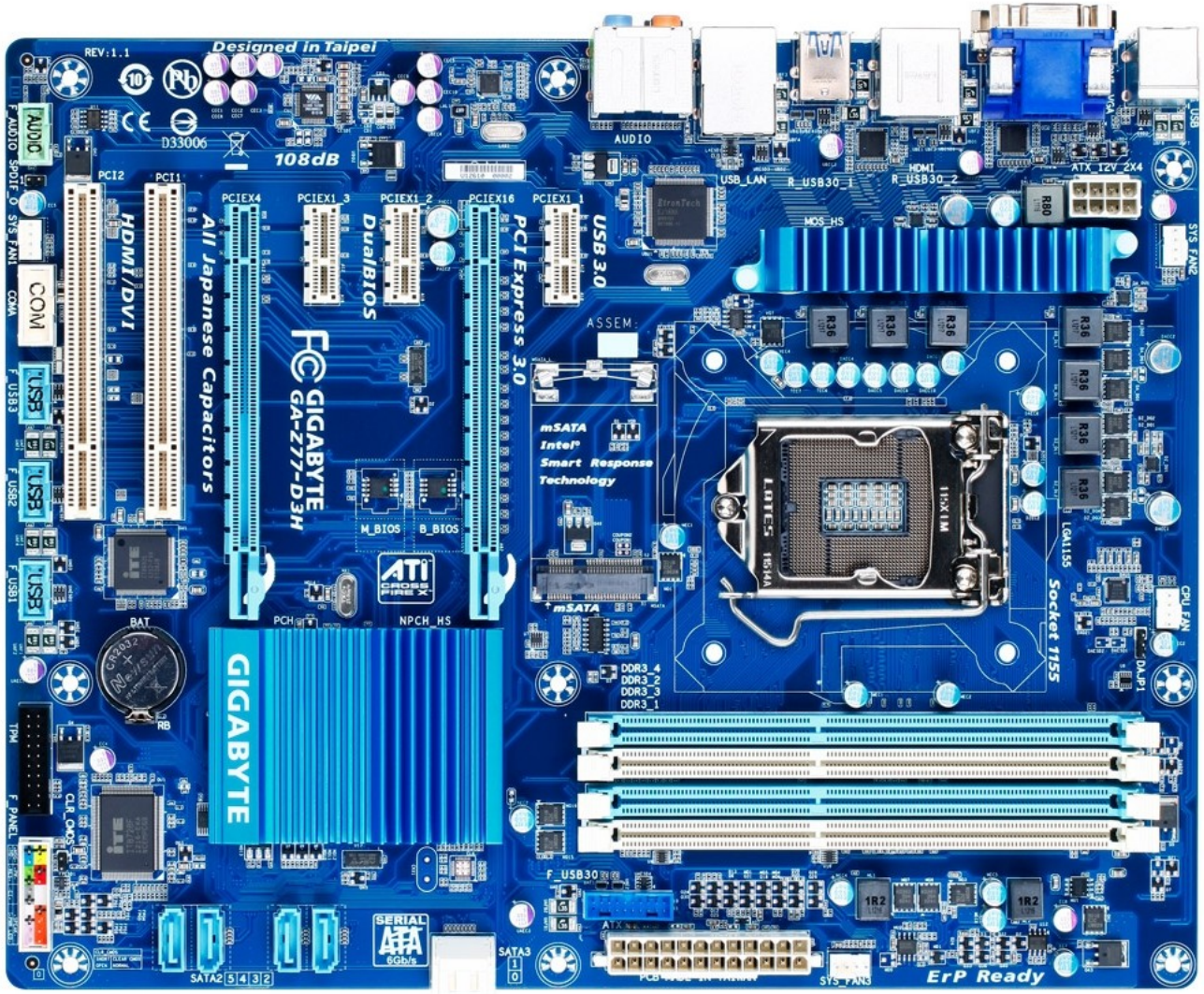


Serial Bus

Digital IO



Embedded Systems ?

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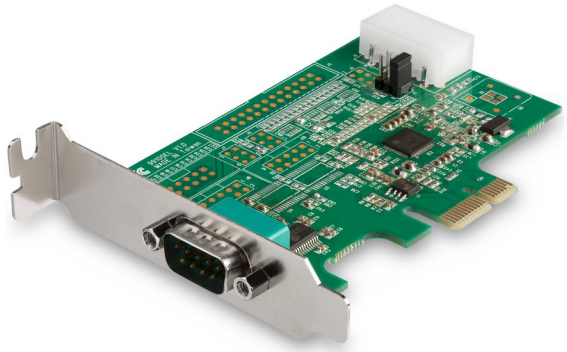
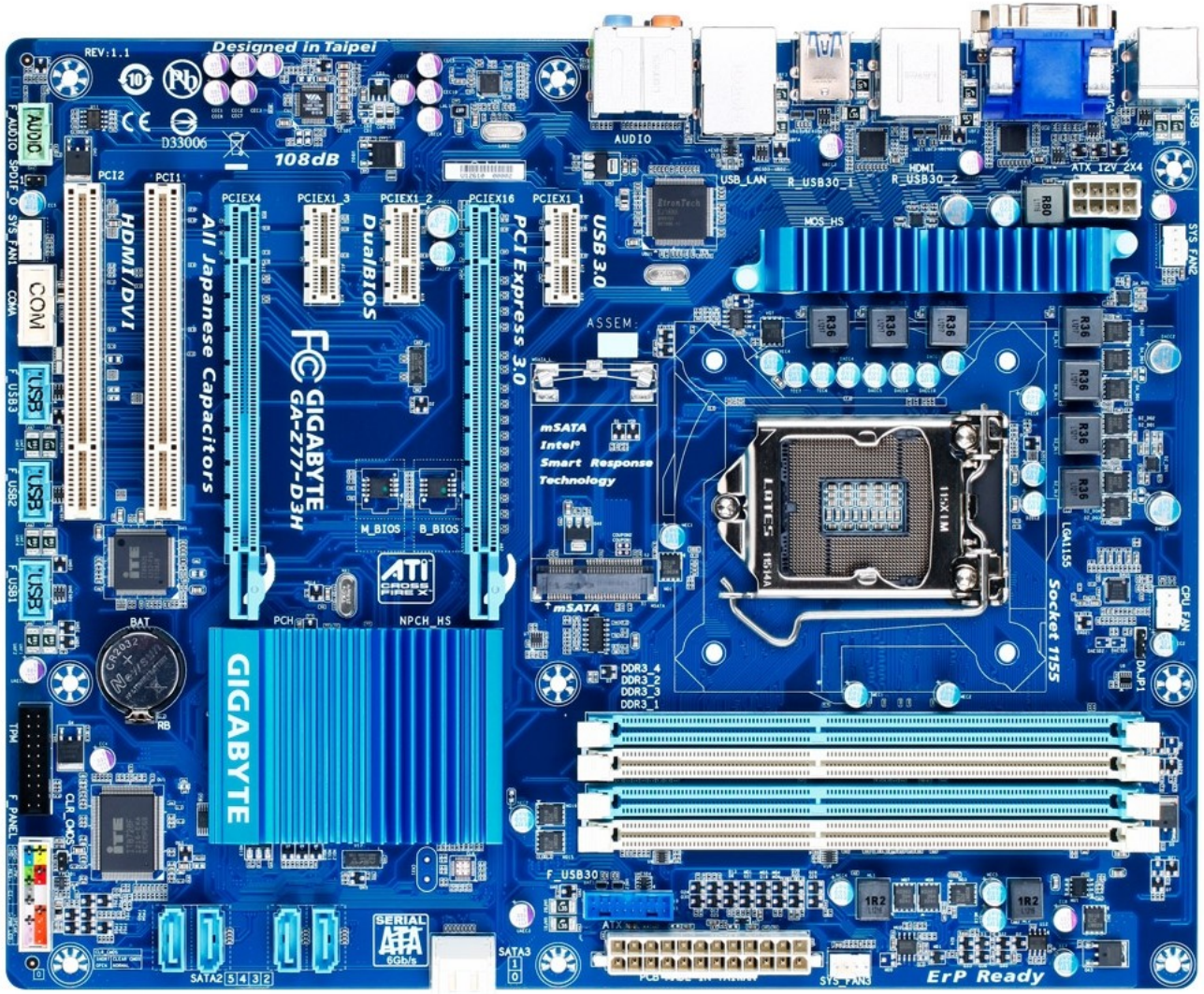


Serial Bus

Digital IO

Custom Card



Embedded Systems ?

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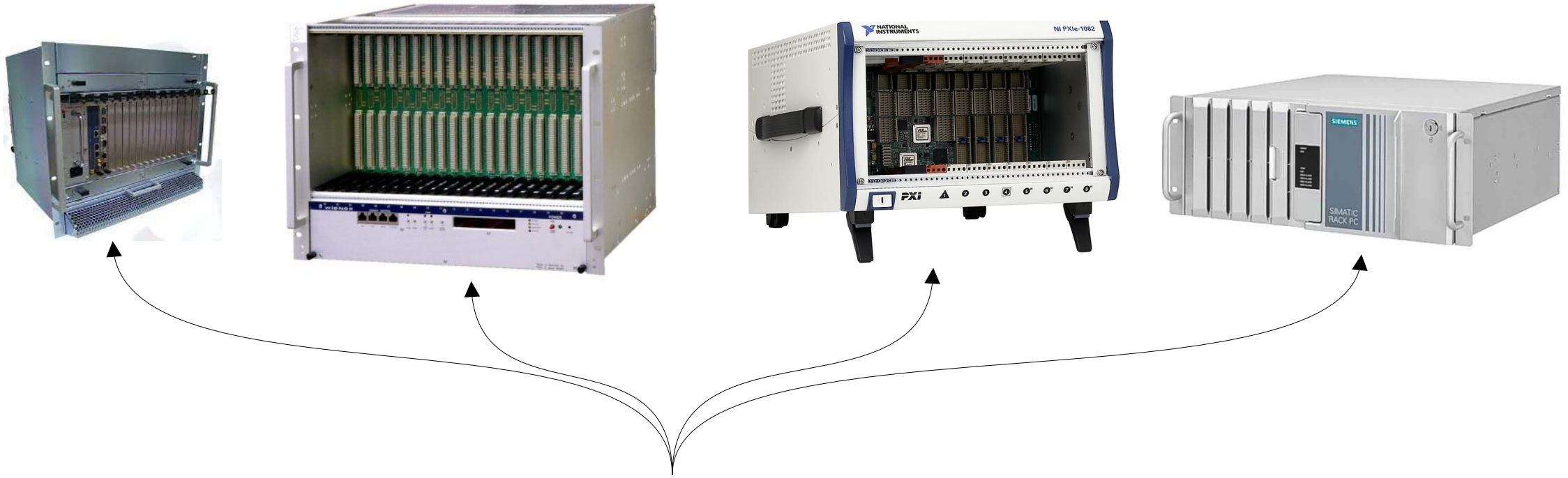
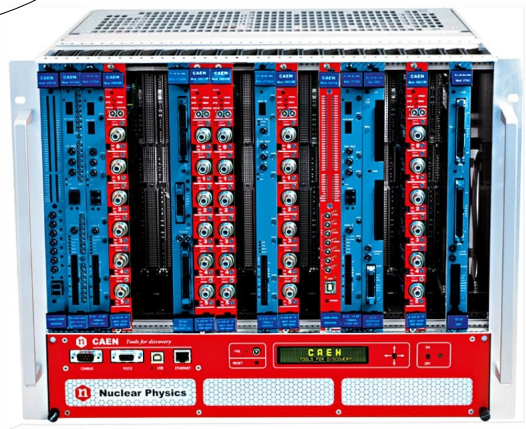


General Purpose platforms

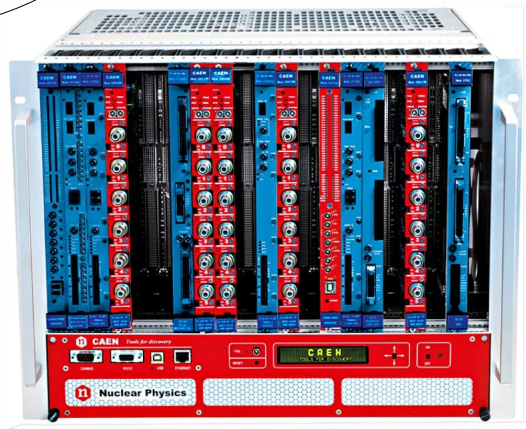
Embedded Systems ?

General Purpose platforms



Embedded Systems !

General Purpose platforms



Embedded System

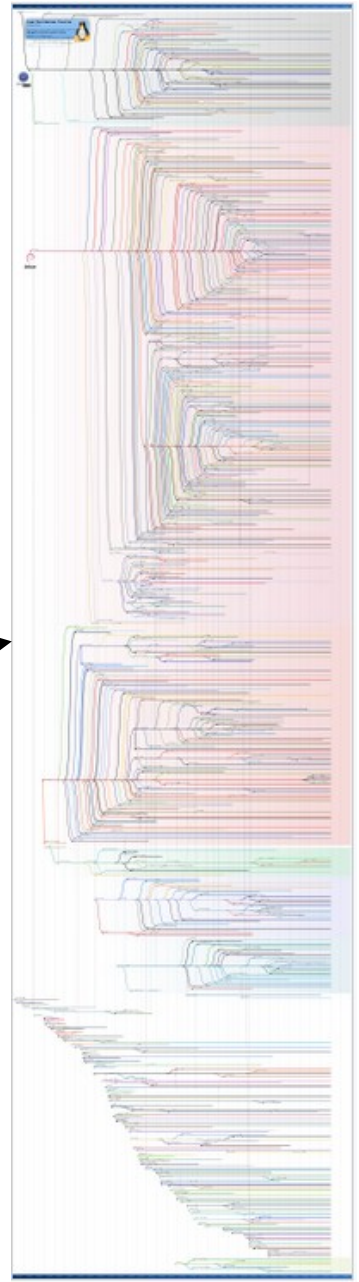
The Next Operating System

For FEC and SoC

Linux Distributions Panorama

DistroWatch.com
Put the fun back into computing. Use Linux, BSD.

Wikimedia picture



Linux Distributions Panorama

- **There are hundreds of them.**

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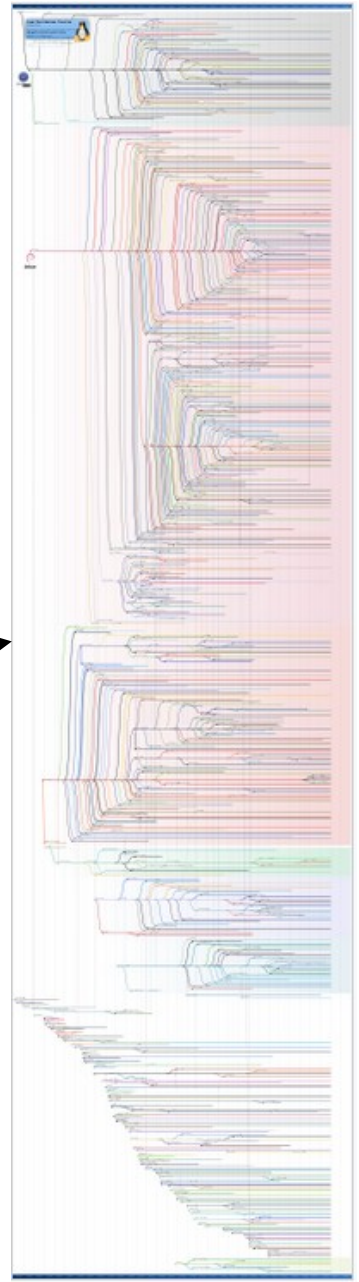

Linux Distributions Panorama

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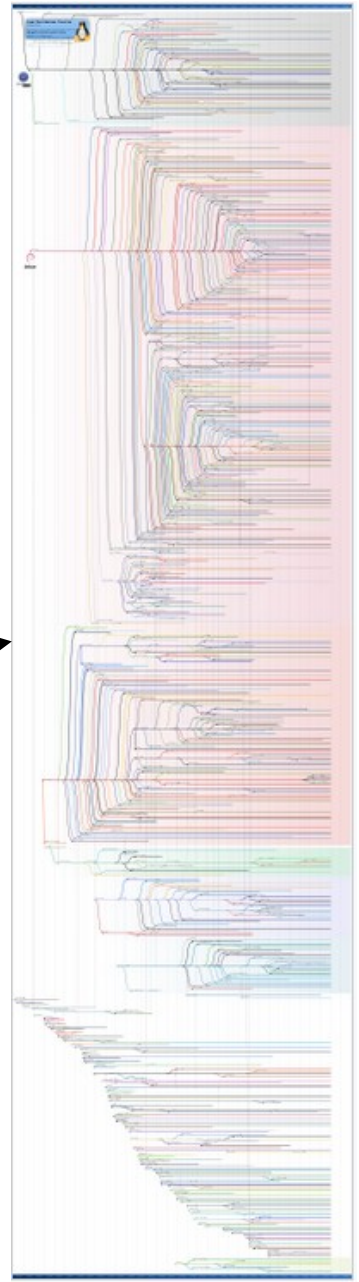
  - Each software follows its own governance and development life-cycle
  - May add patches

DistroWatch.com
Put the fun back into computing. Use Linux, BSD.

Wikimedia picture



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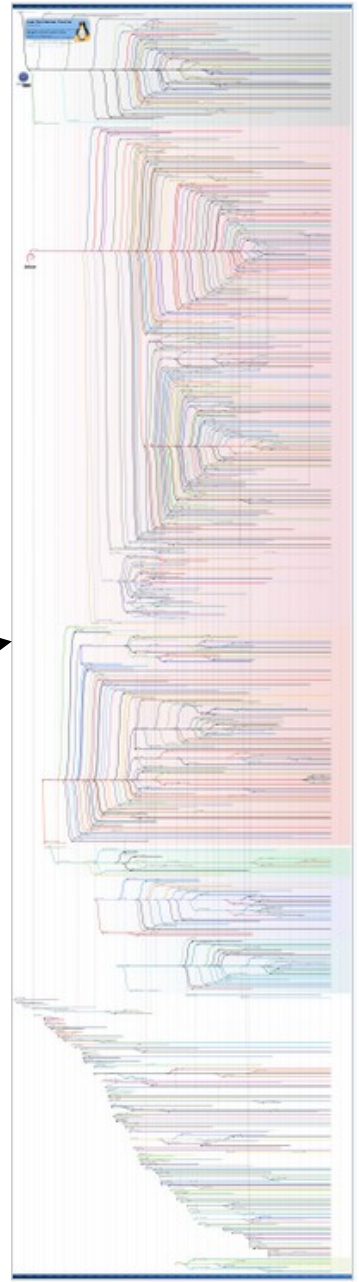

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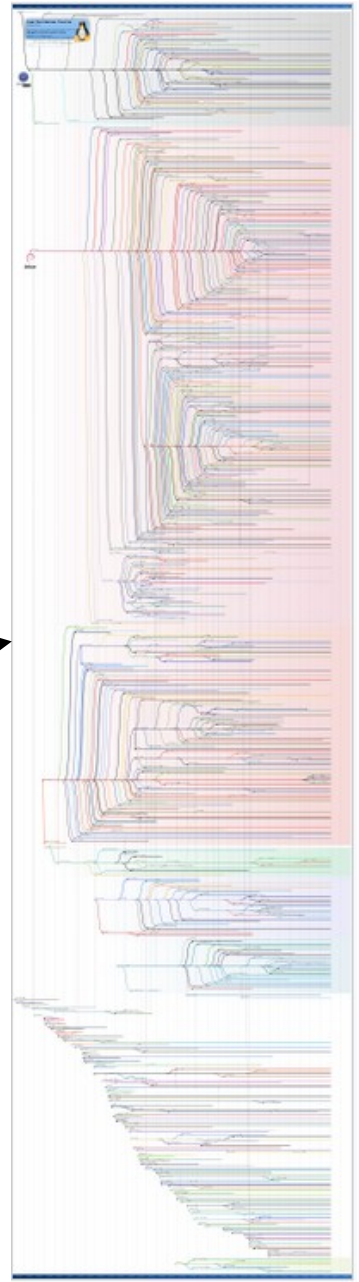

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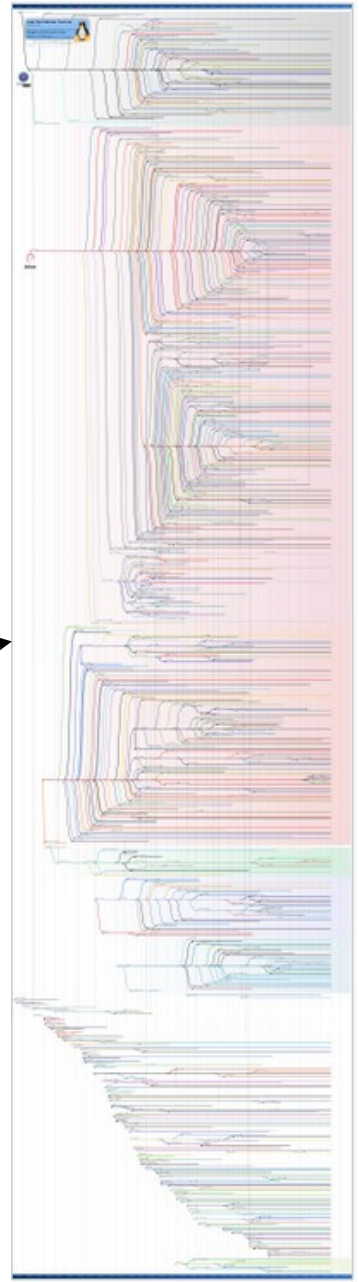

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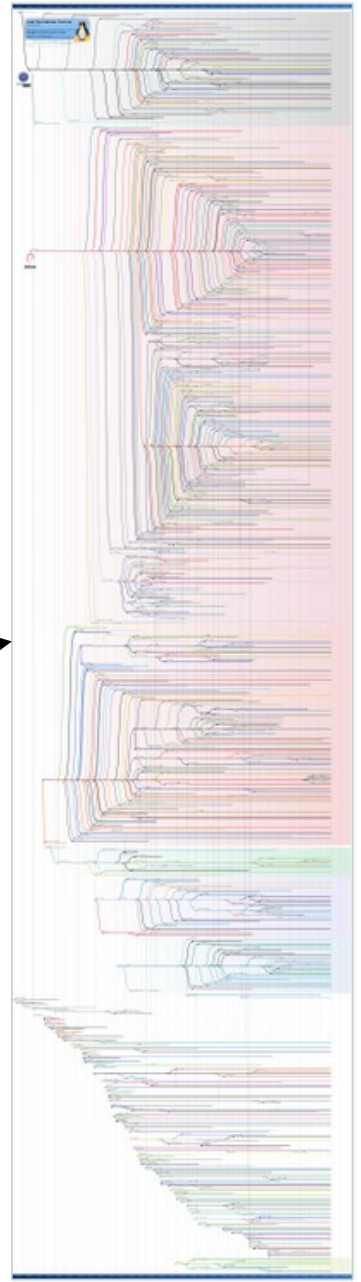

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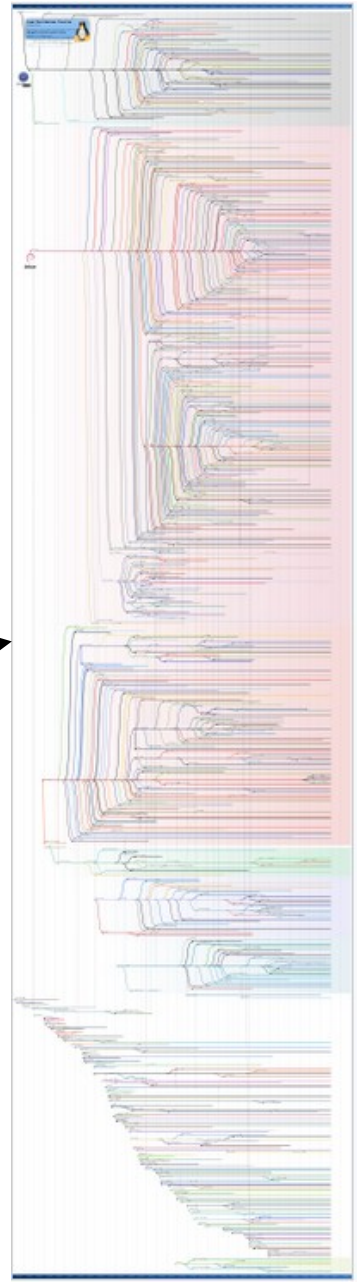

Does this matter? YES!

It Matters Because It Affects:

- governance priorities;
- community or company size;
- software availability, version, building, and configuration;
- supported architectures;
- the development life-cycle;
- the upgrade policy;
- the delivered support level;
- its maintenance;
- its long-term existence.

A Few Examples

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I’m not responsible for your choice


Cloud
Computing


BuildRoot
Making Embedded Linux Easy
CIVIL
INFRASTRUCTURE
PLATFORM
Cloud
Computing
yocto
PROJECT
Red Hat
Enterprise Linux
debian
GNU/Linux


PCSPECIALIST
XFX
PCSPECIALIST
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PCSPECIALIST
XFX
COOLER MASTER


BuildRoot
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yocto
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Red Hat
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SteamOS


Windows 11
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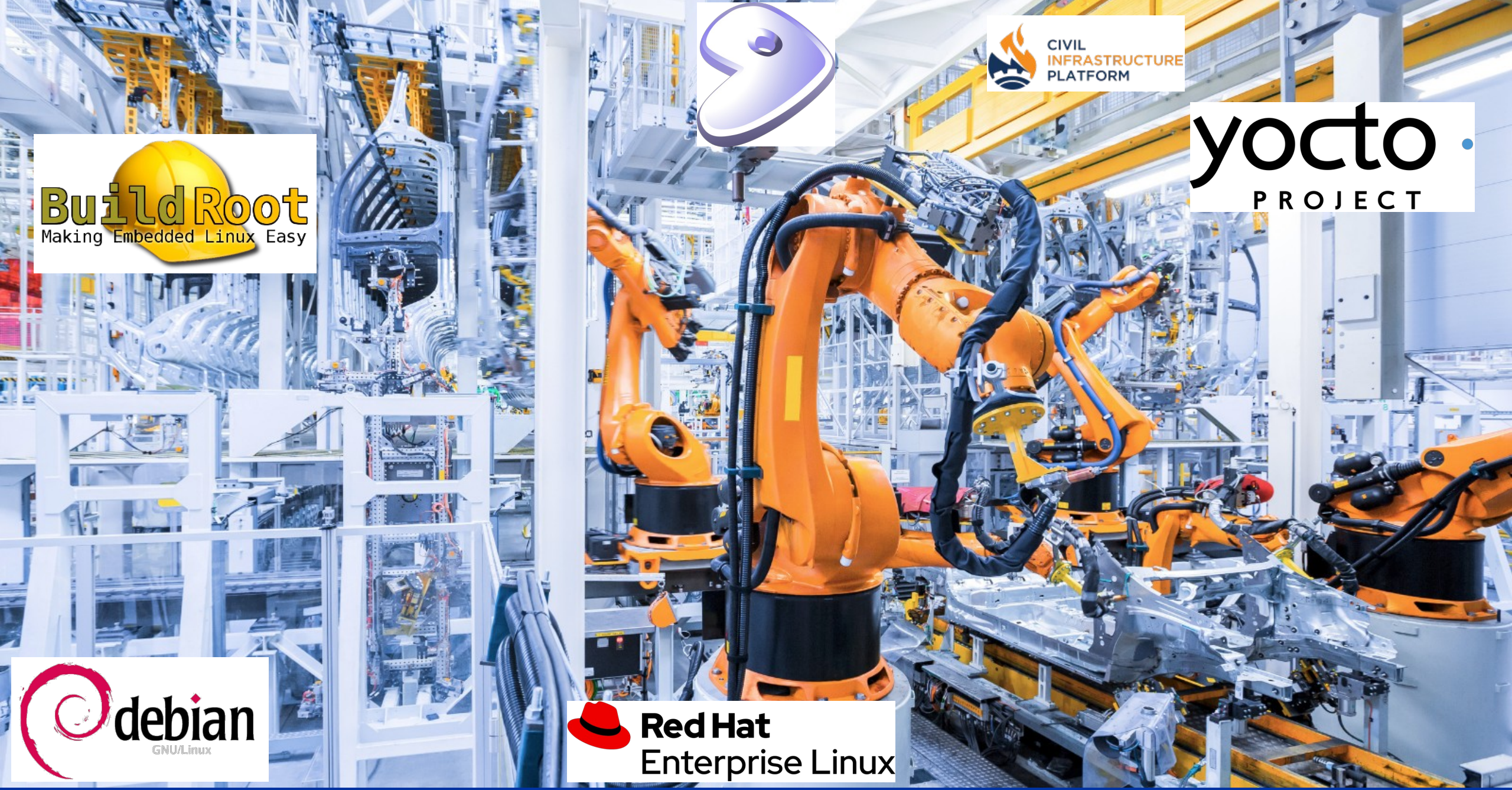
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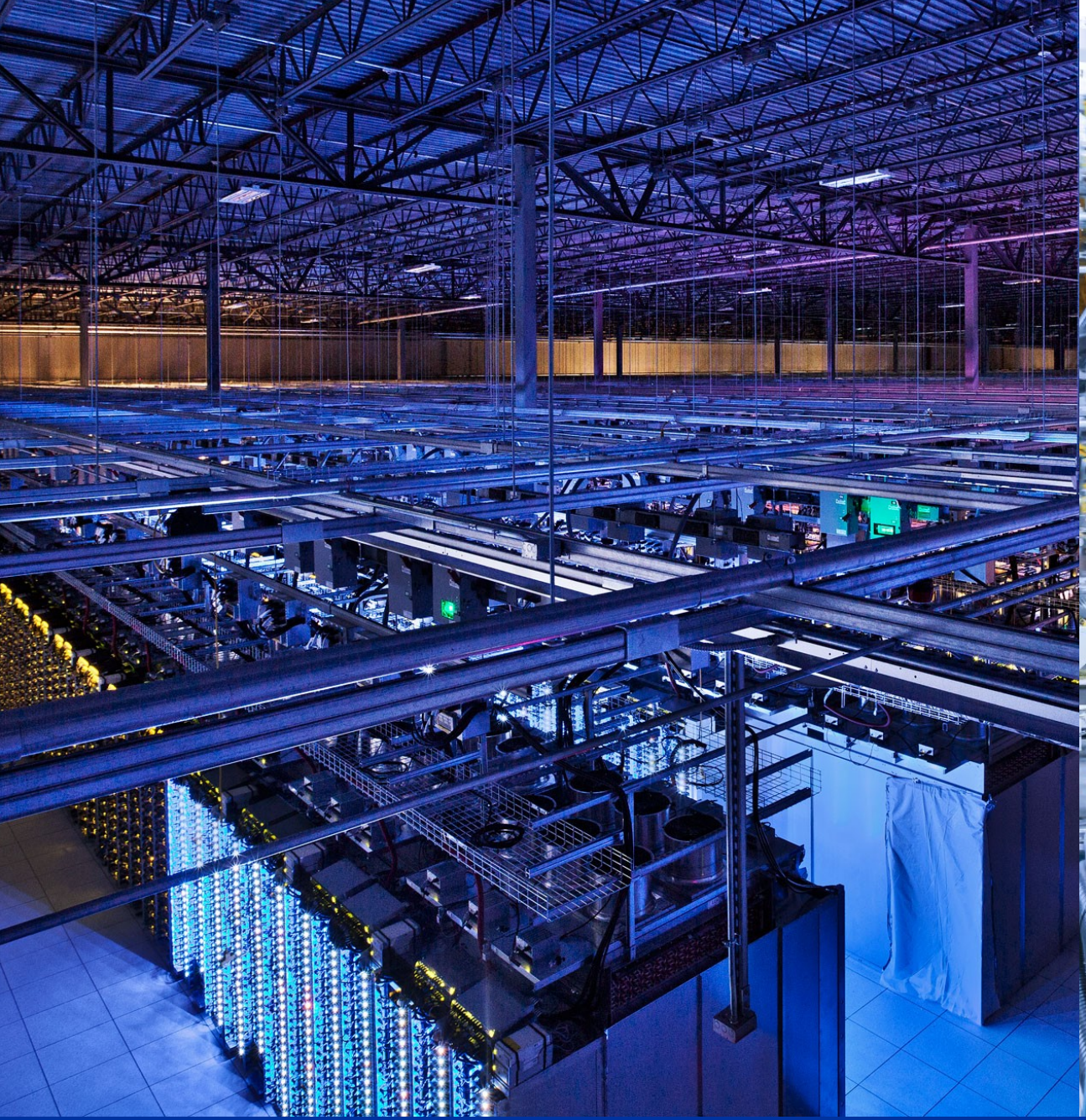


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Our Operating Systems Options

Our Operating Systems Options

Higher Control
Higher Maintenance

Lower Control
Lower Maintenance

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Lower Control
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Higher Control
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linux from scratch

yocto PROJECT

PTX DIST

BuildRoot
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archlinux

SUSE

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ubuntu

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yocto PROJECT

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The control we need - The maintenance we can afford

CIVIL INFRASTRUCTURE PLATFORM

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ubuntu

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The best fit CIVIL INFRASTRUCTURE PLATFORM

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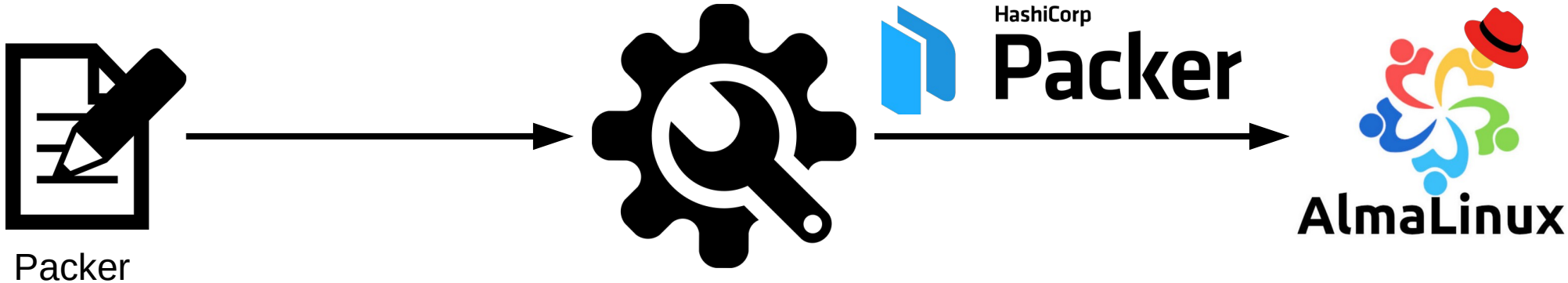
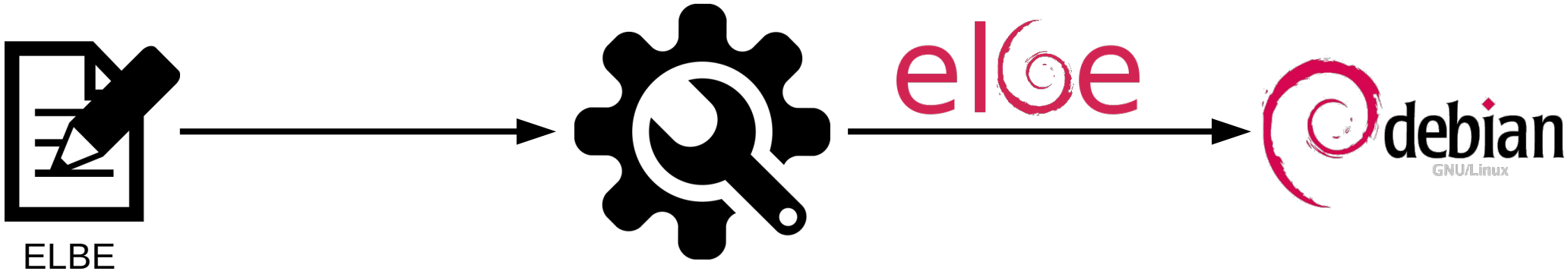
Building Processes



Packer
HCL Configuration file
Custom Scripts



ELBE
XML Configuration File

packer.io almalinux.org
elbe-rfs.org debian.org

First Choice: RHEL Family

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It Is Good To Follow Recommendations

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Someone else is offering good services to you

Evolution Of Our First Choice Preference

(7)

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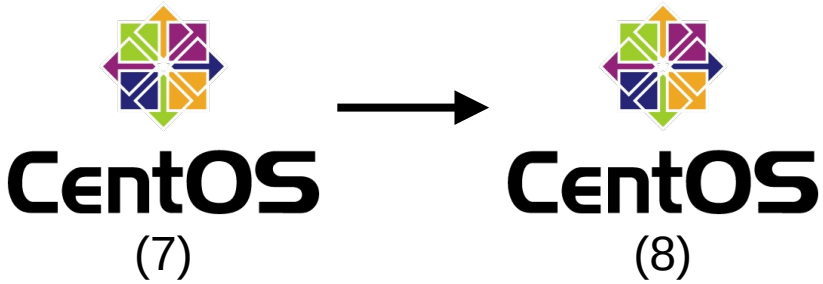

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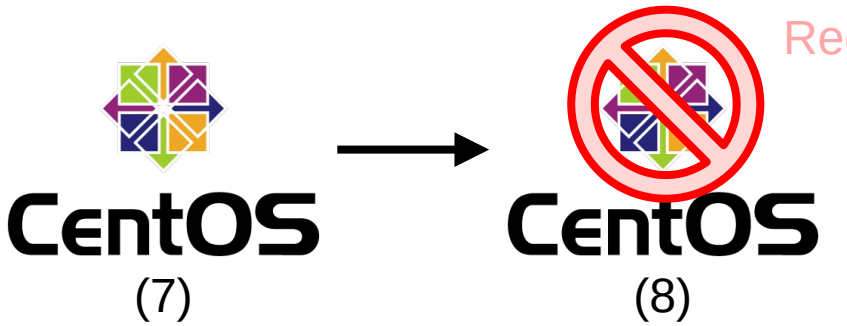

Red Hat killed the project

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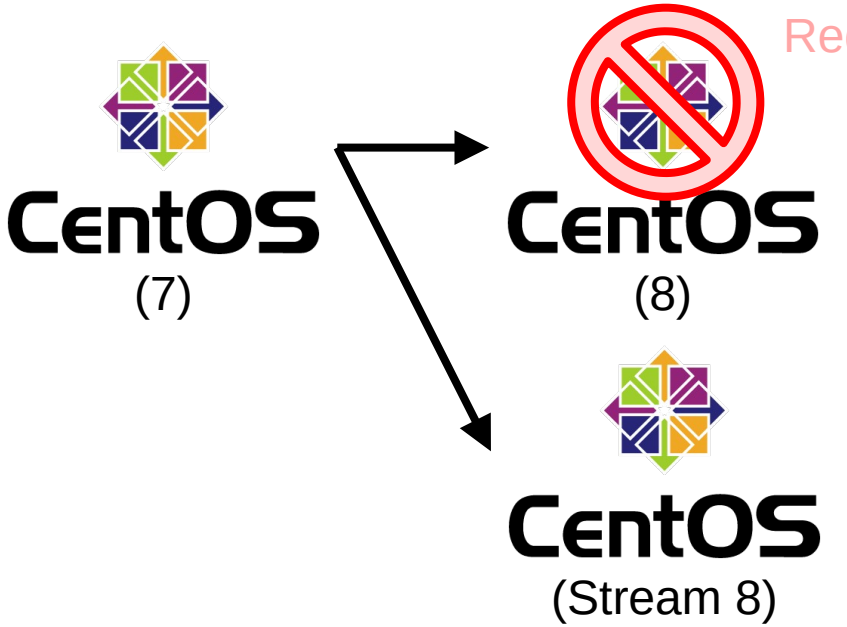

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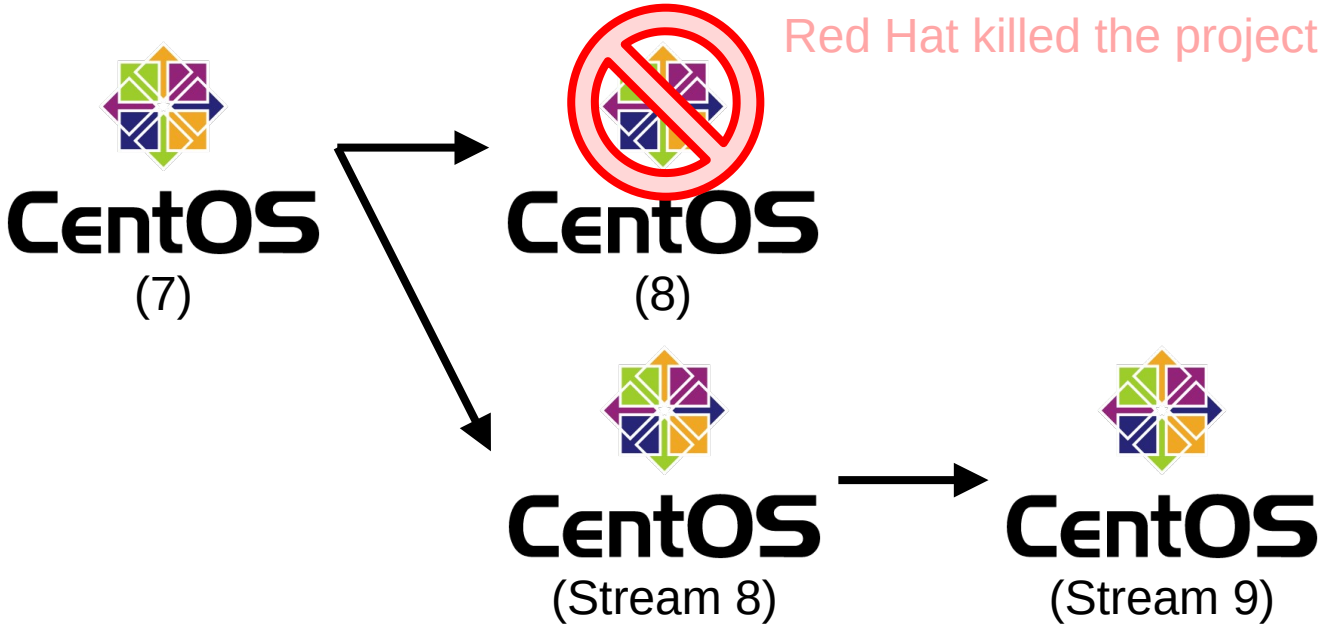

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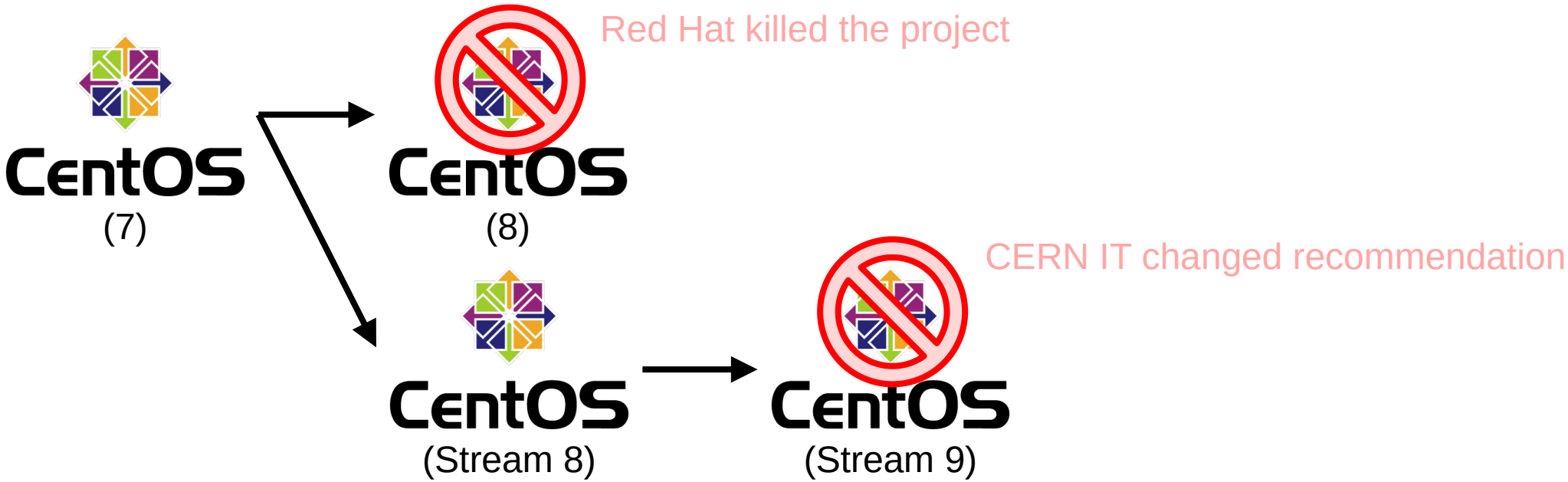

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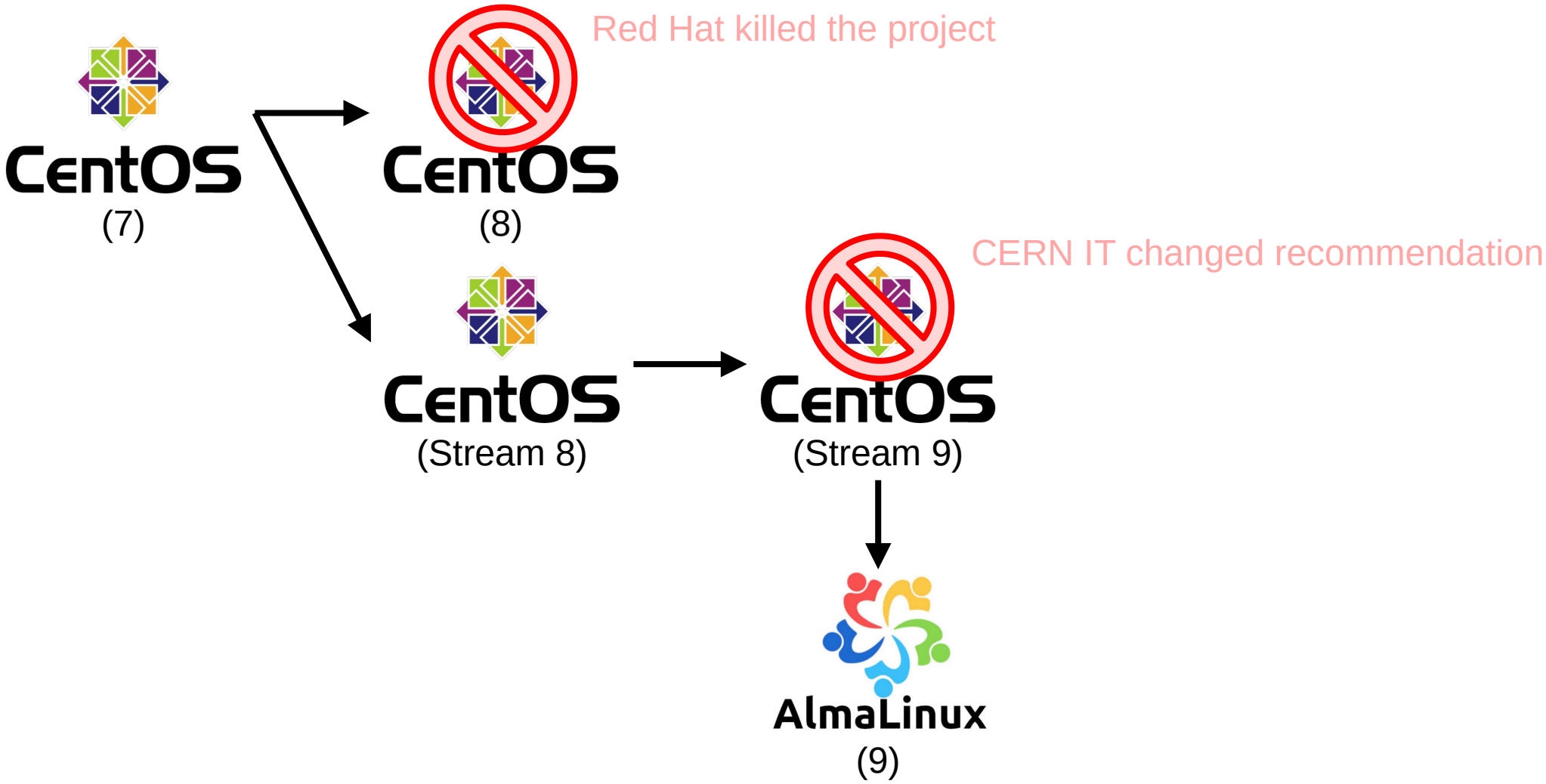

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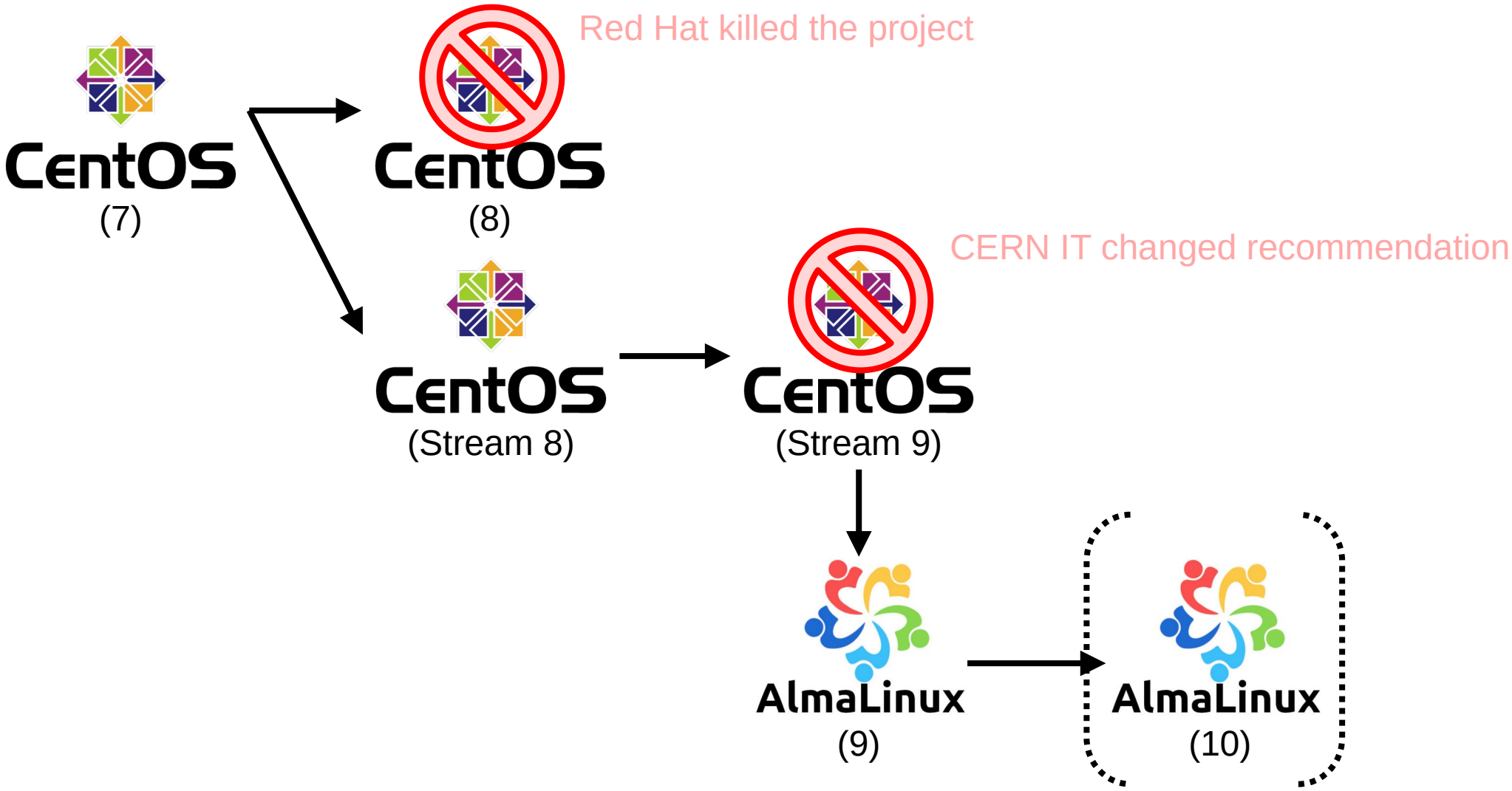
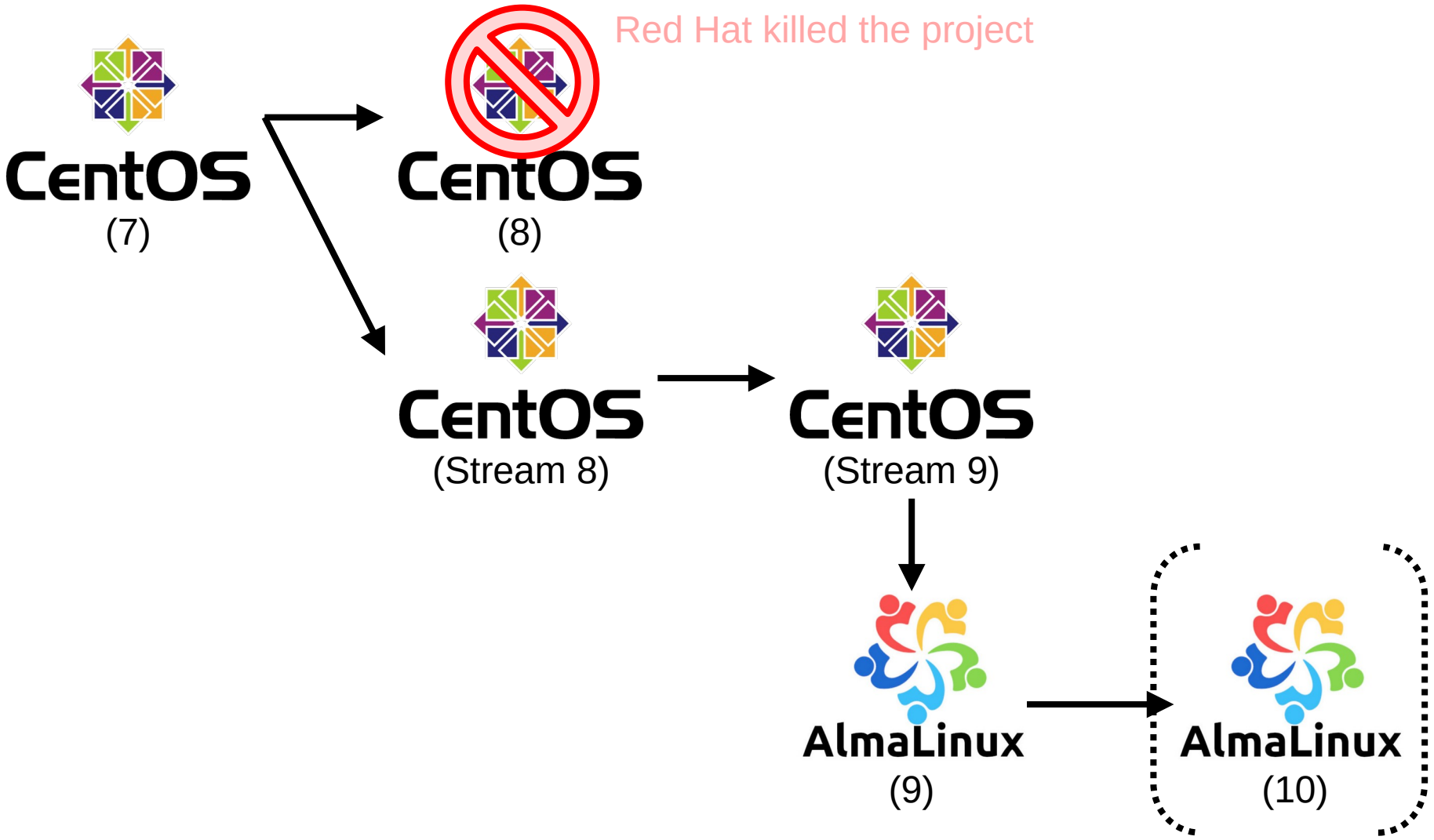


Challenges Within Red Hat Enterprise Linux Family



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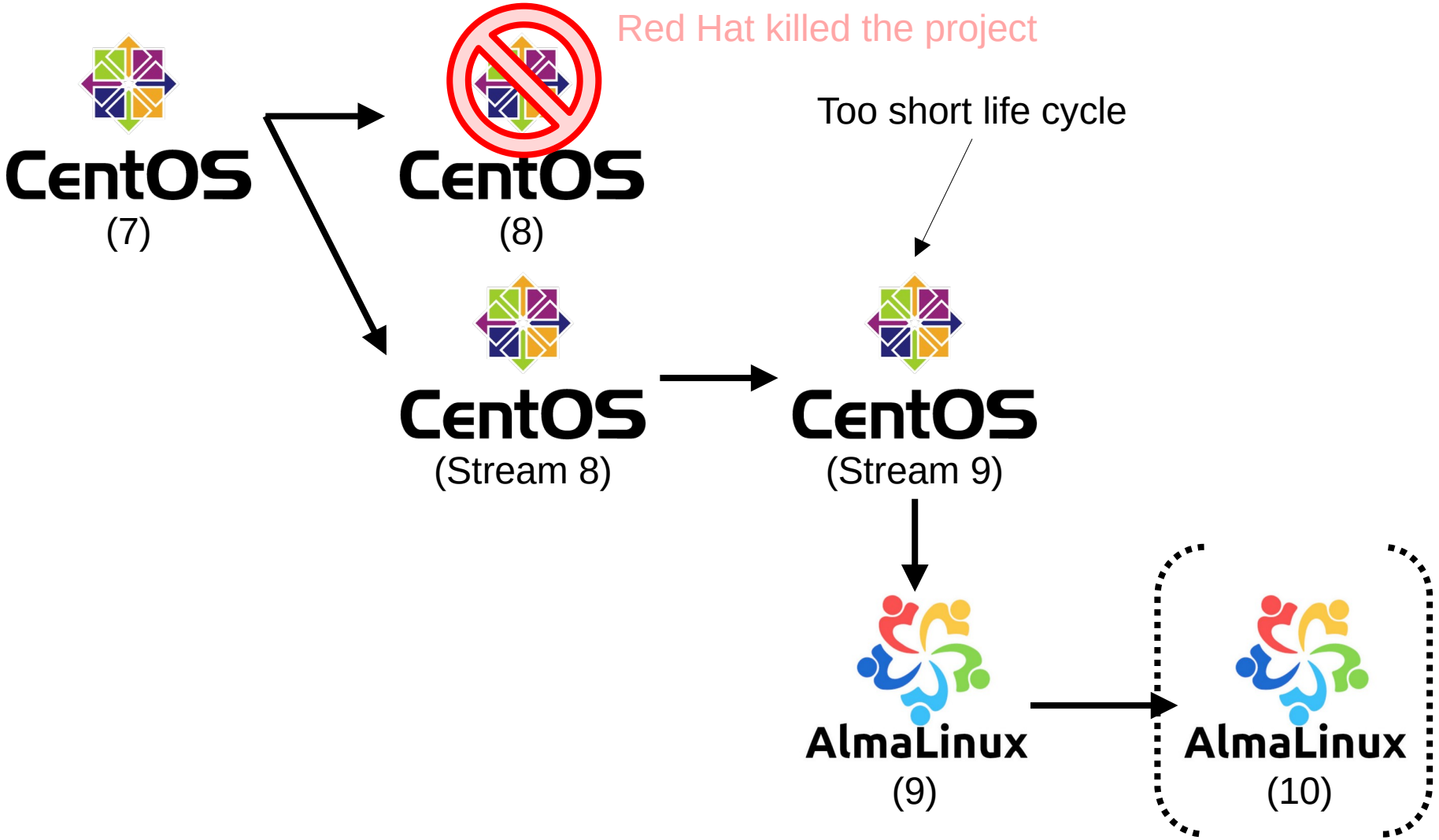

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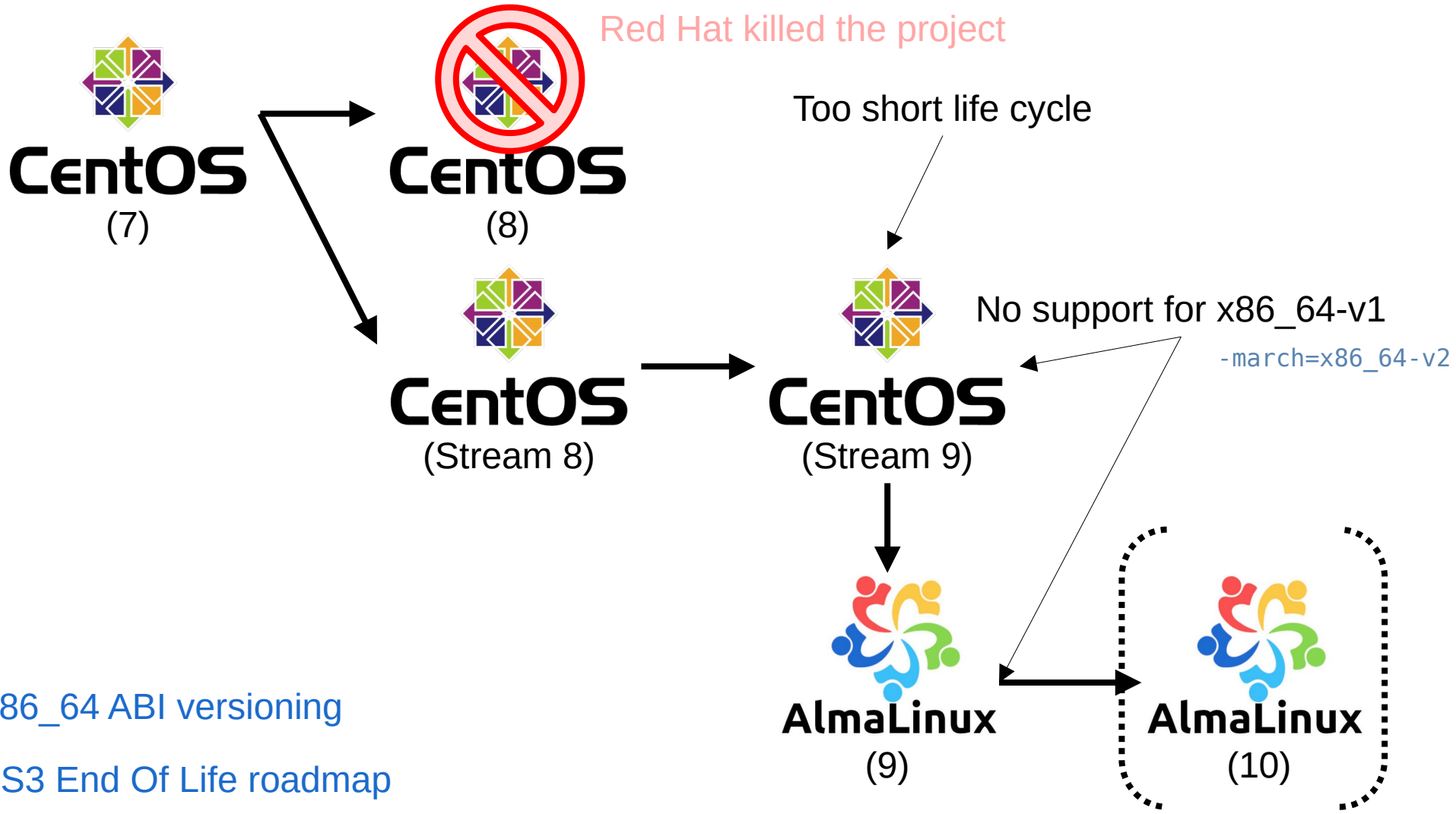

x86_64 ABI versioning

LS3 End Of Life roadmap

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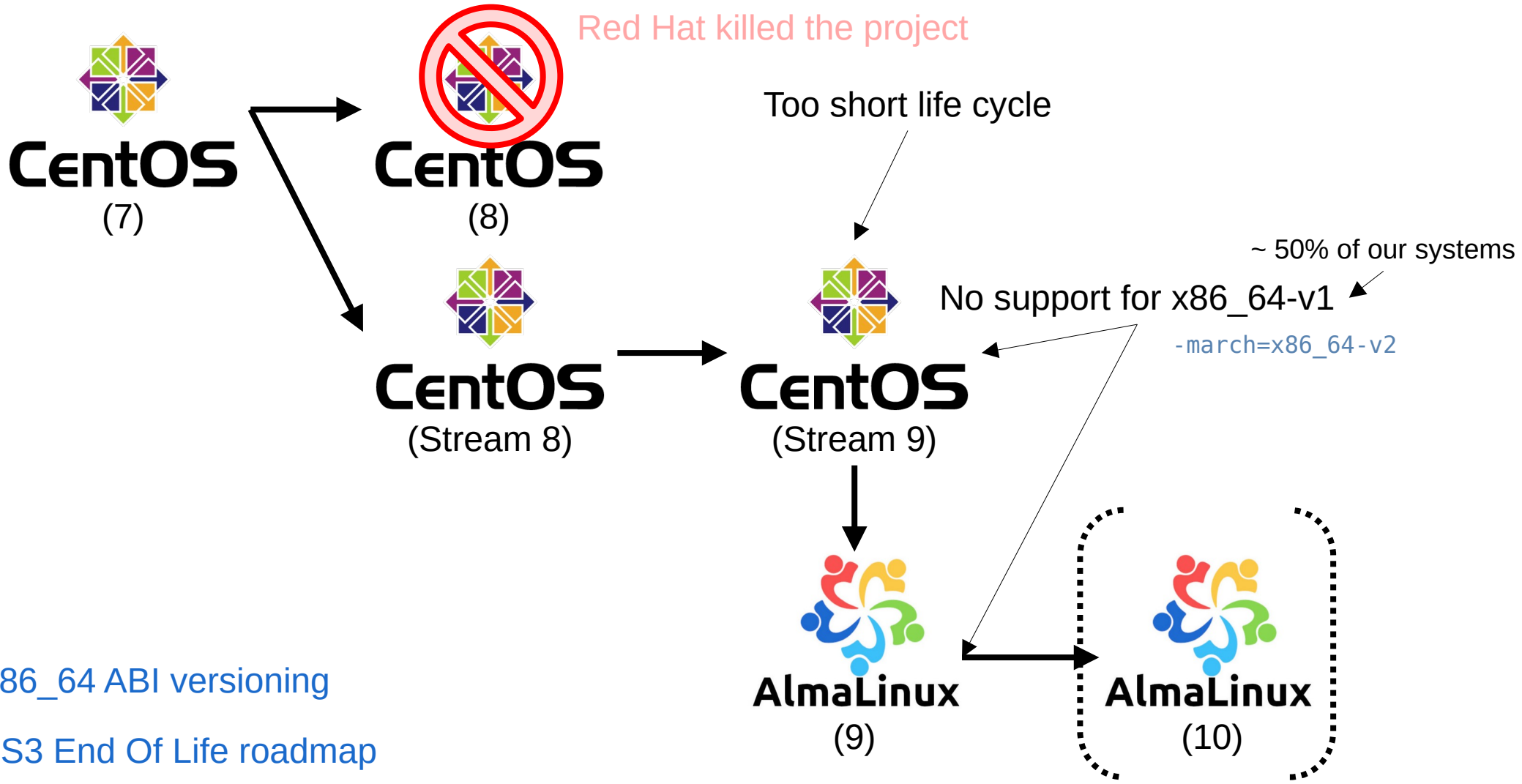

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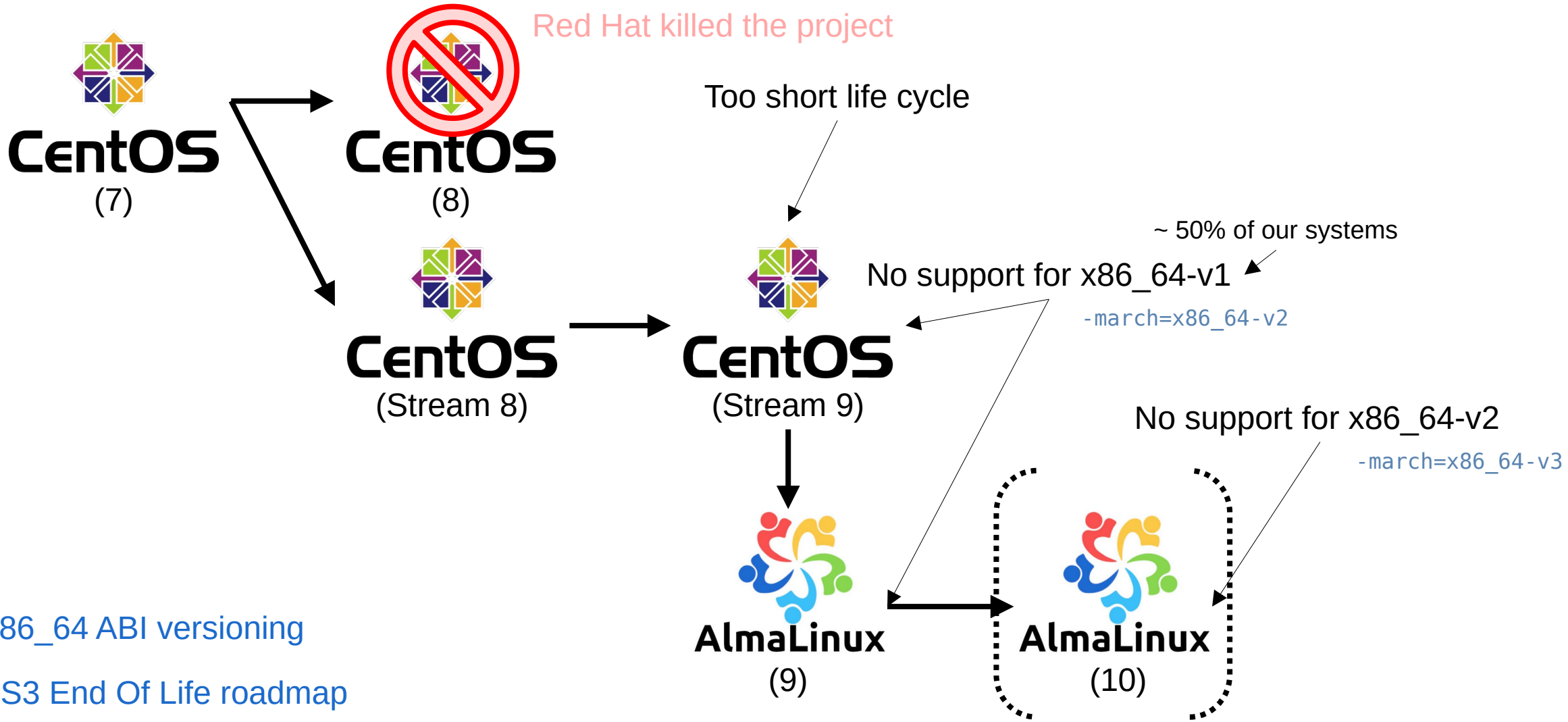

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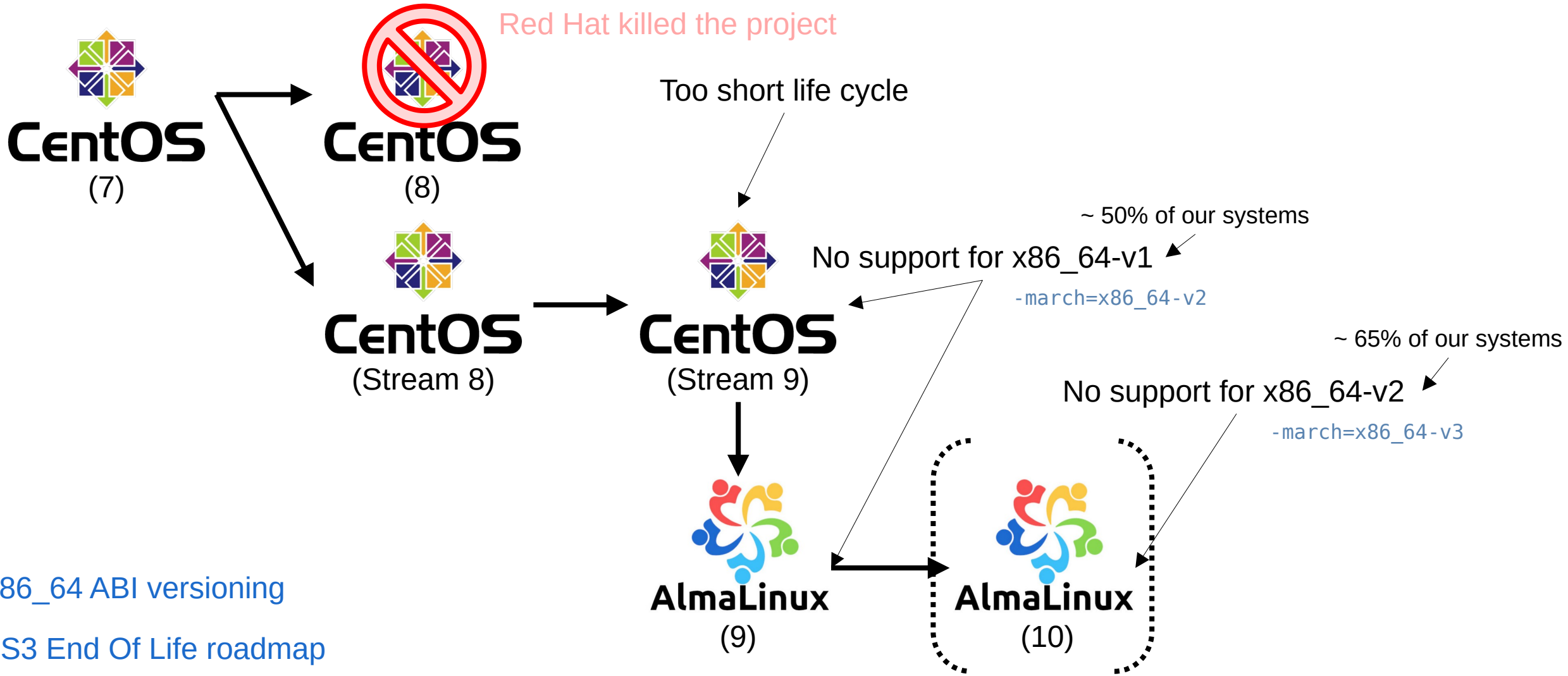

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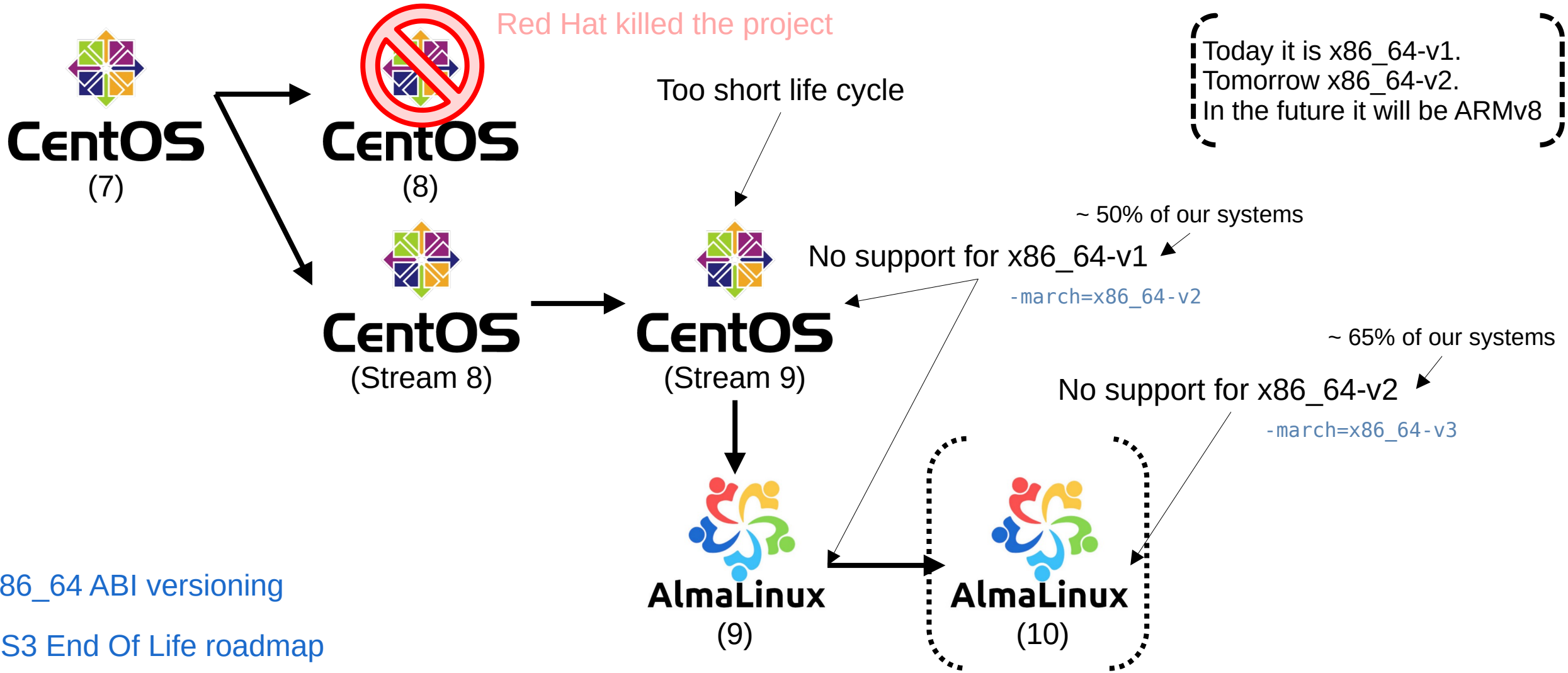

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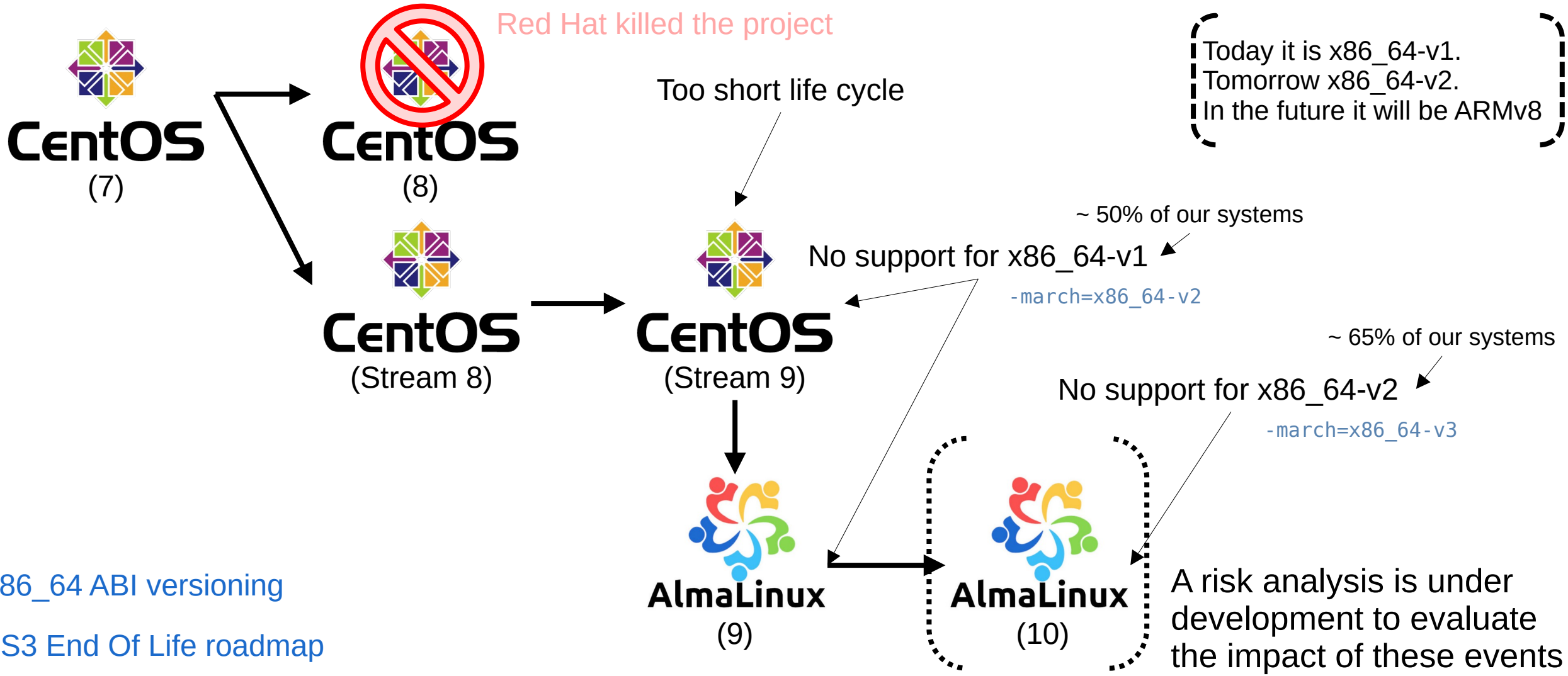

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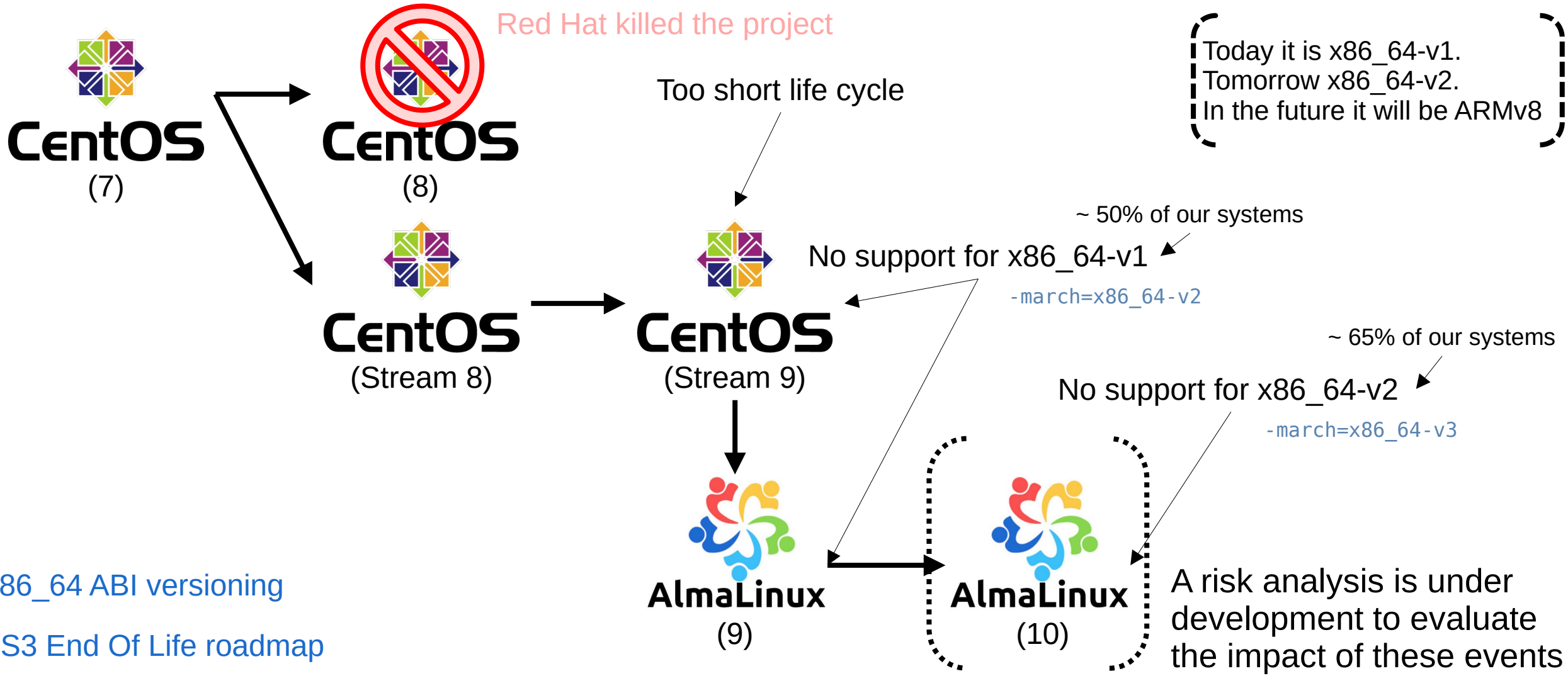

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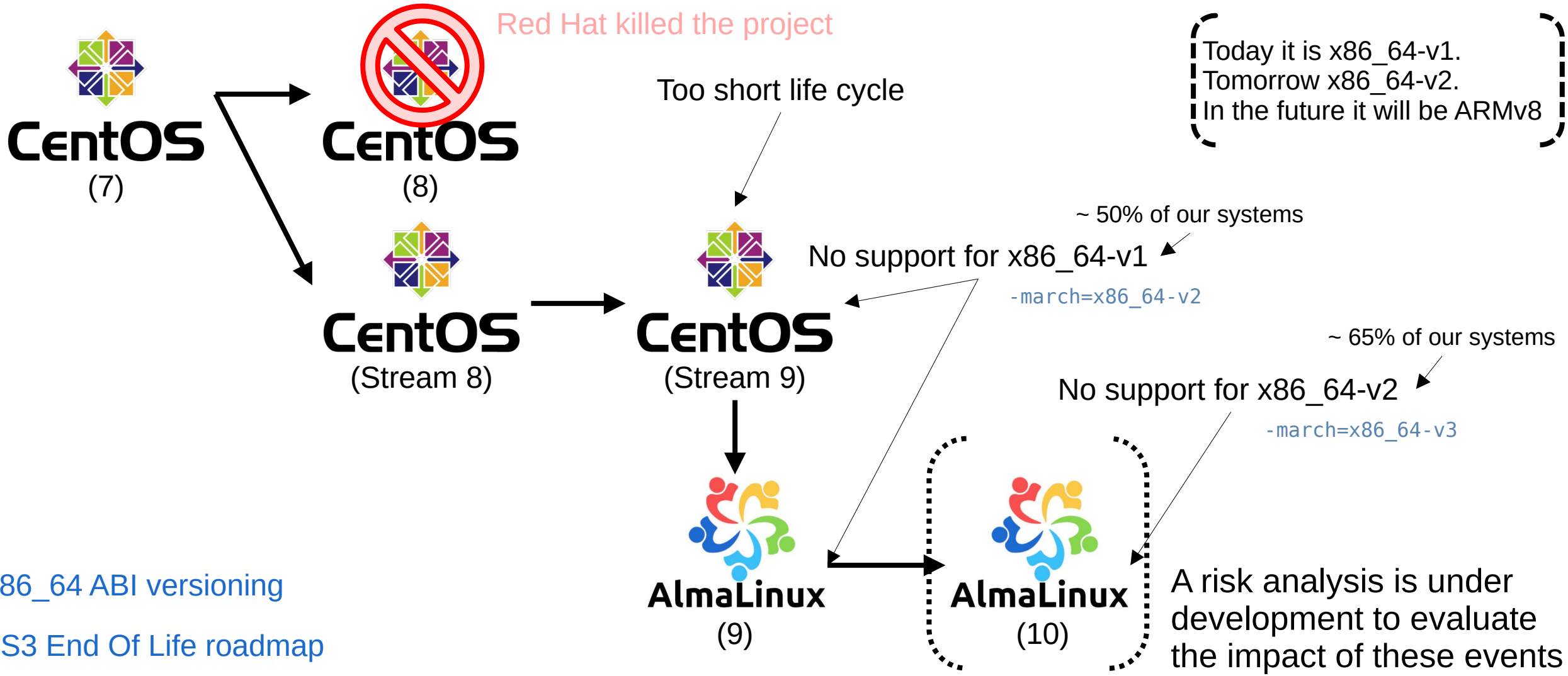

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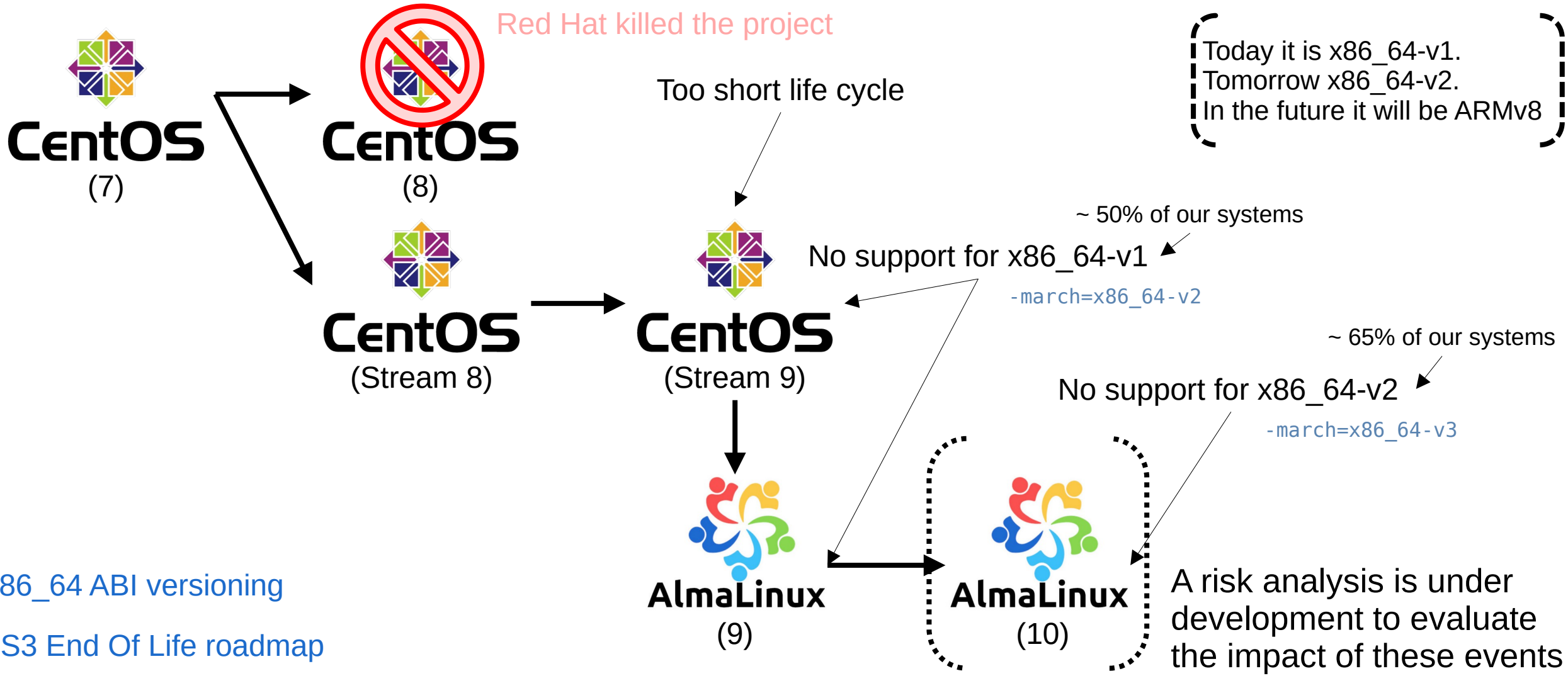

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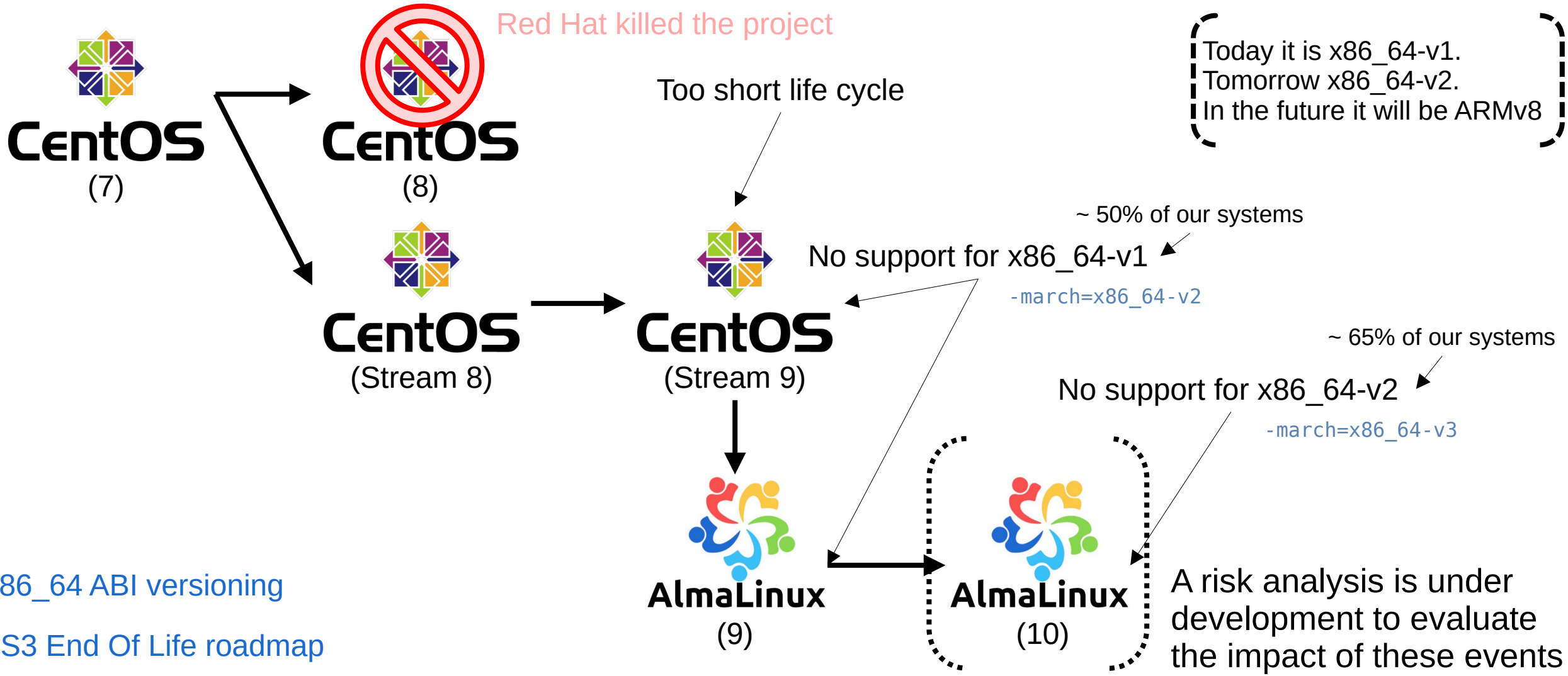

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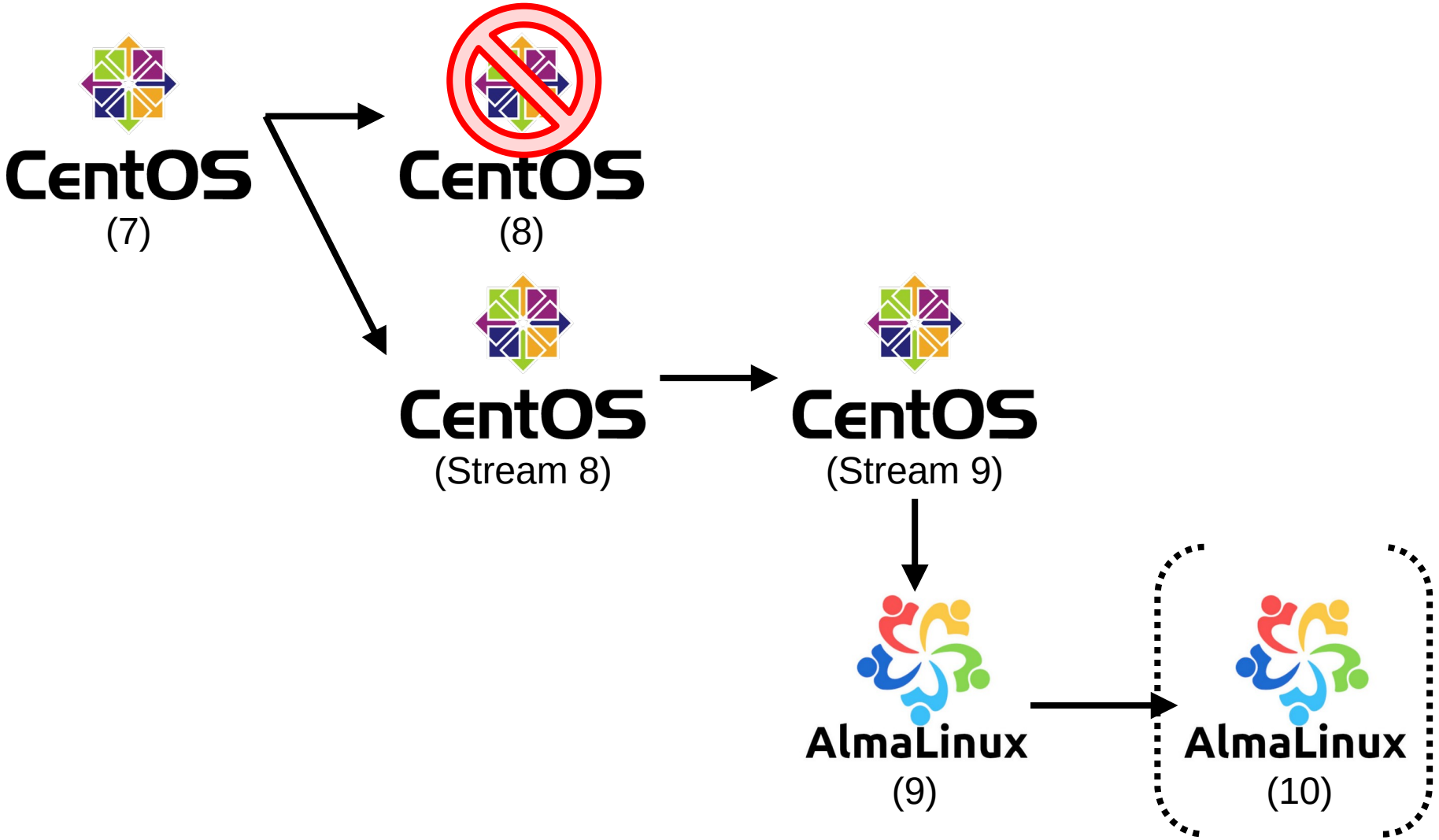
A Possible Scenario: Promote The Second Choice



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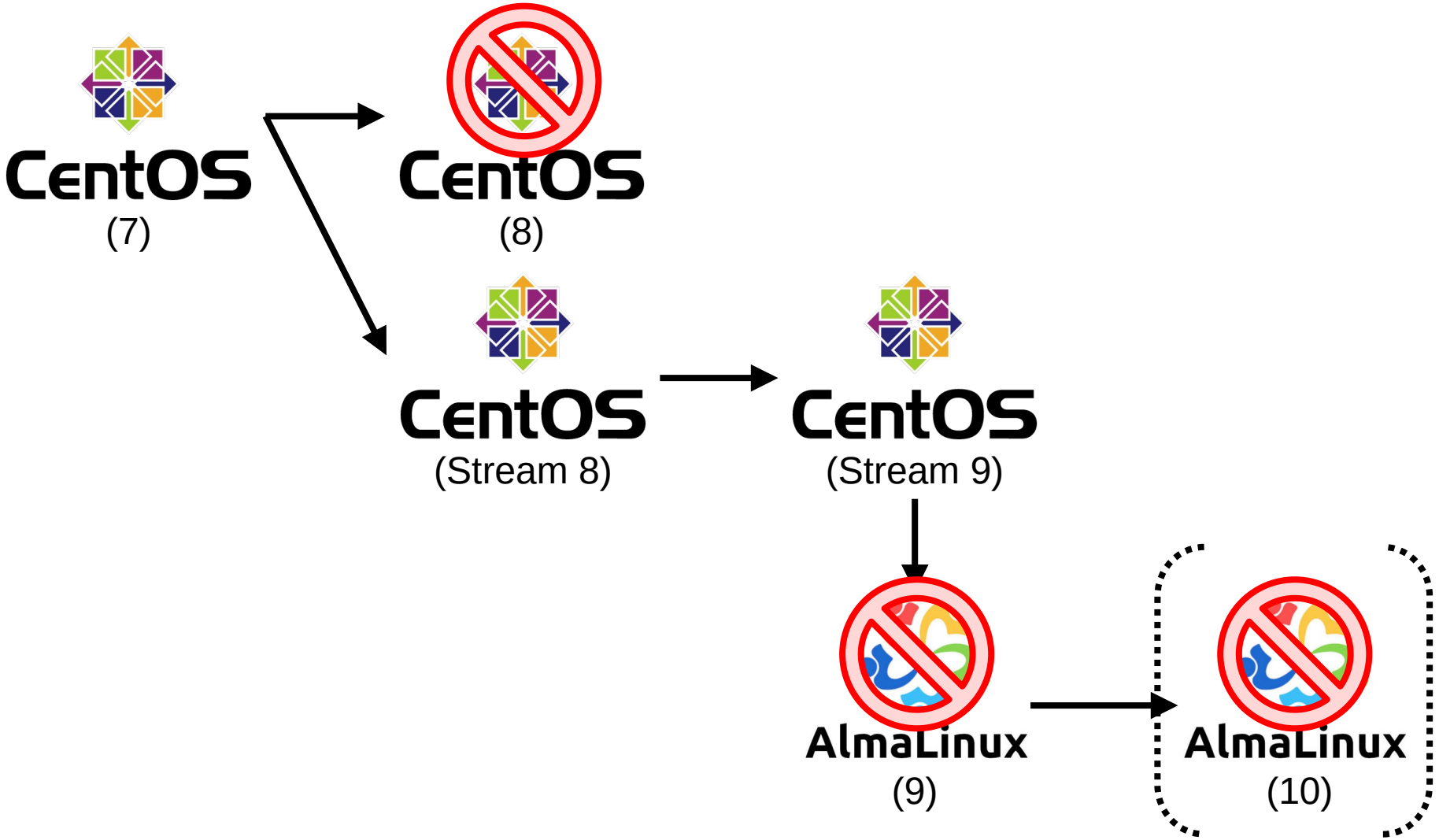

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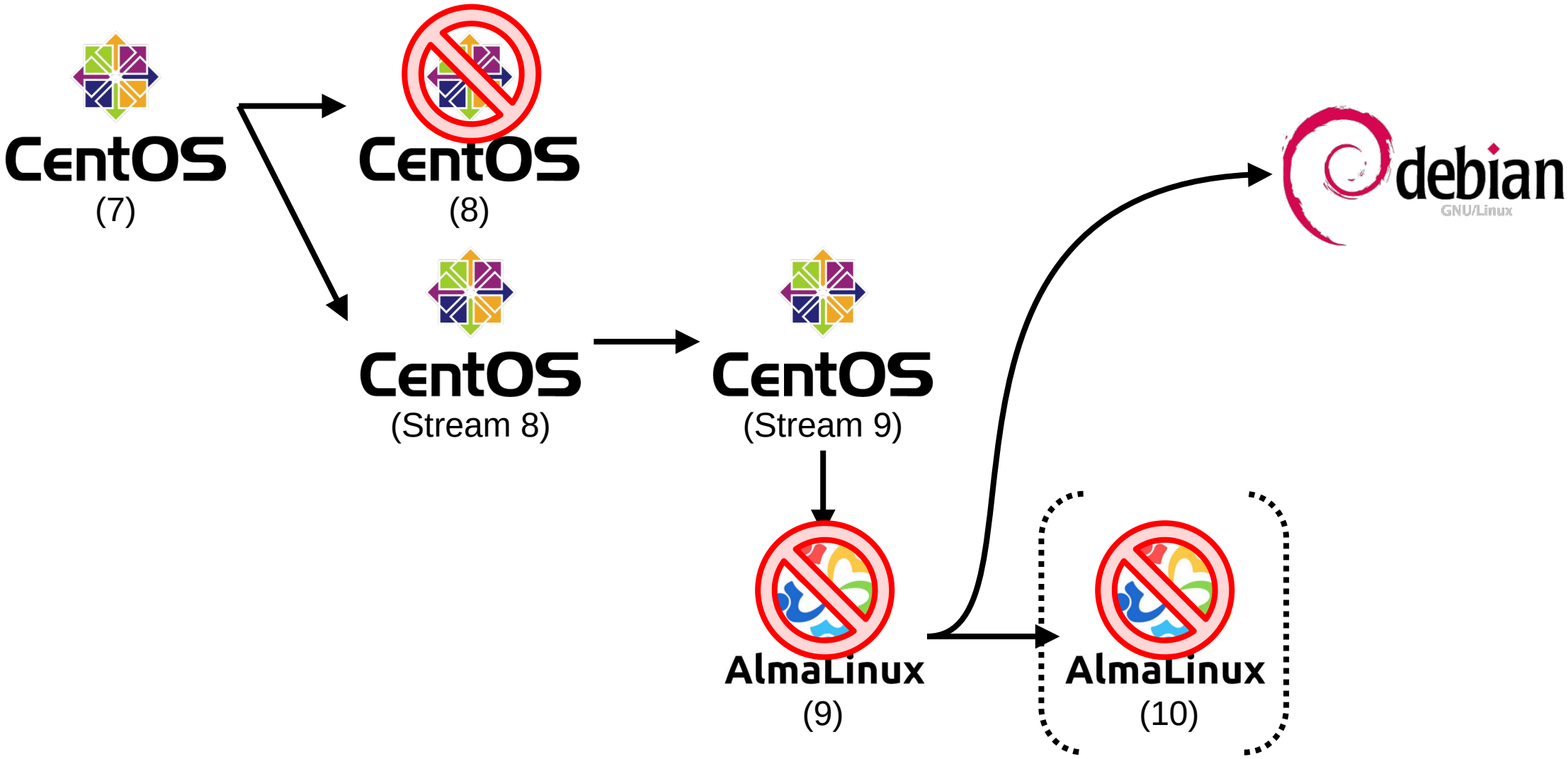

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  - Money and people must be put at work to compensate the compiler flag `-march=x86_64-v2`

Conclusions

- **Because we speak about embedded systems**
  - Not servers, nor service oriented applications.
- **Because we develop custom hardware and dedicated drivers/tools**
  - Hence, we want finer control over these systems.
- **Because RHEL Family of distributions aims at “server farms” and workstations**
  - aarch64 support is not there because of embedded systems, but because aarch64 is entering in “server farms”
- **Because historically we could never benefit from Red Hat support line**
  - At least not directly, we benefit from Red Hat work in terms of distribution maintenance
- **Because we can’t rely on Red Hat support if we modify packages**
  - We want control over the Linux kernel, therefore we will provide our own build from vanilla sources
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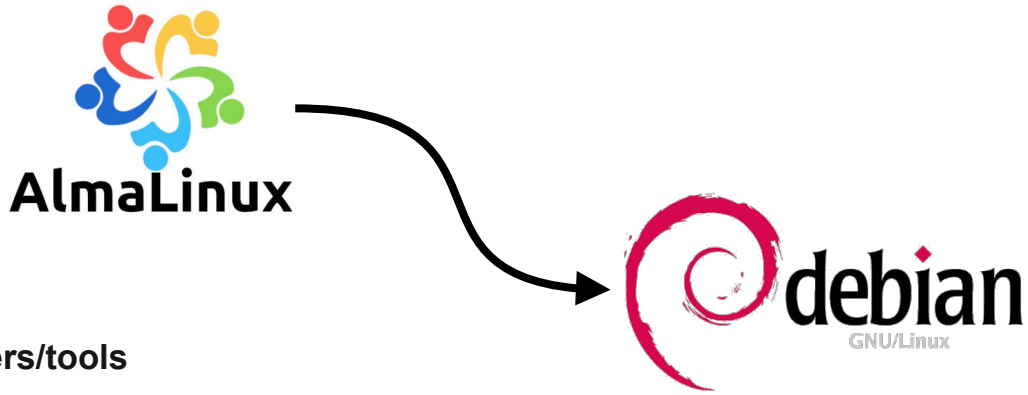
  - it is easy for us to switch between RHEL Family and Debian

Conclusions



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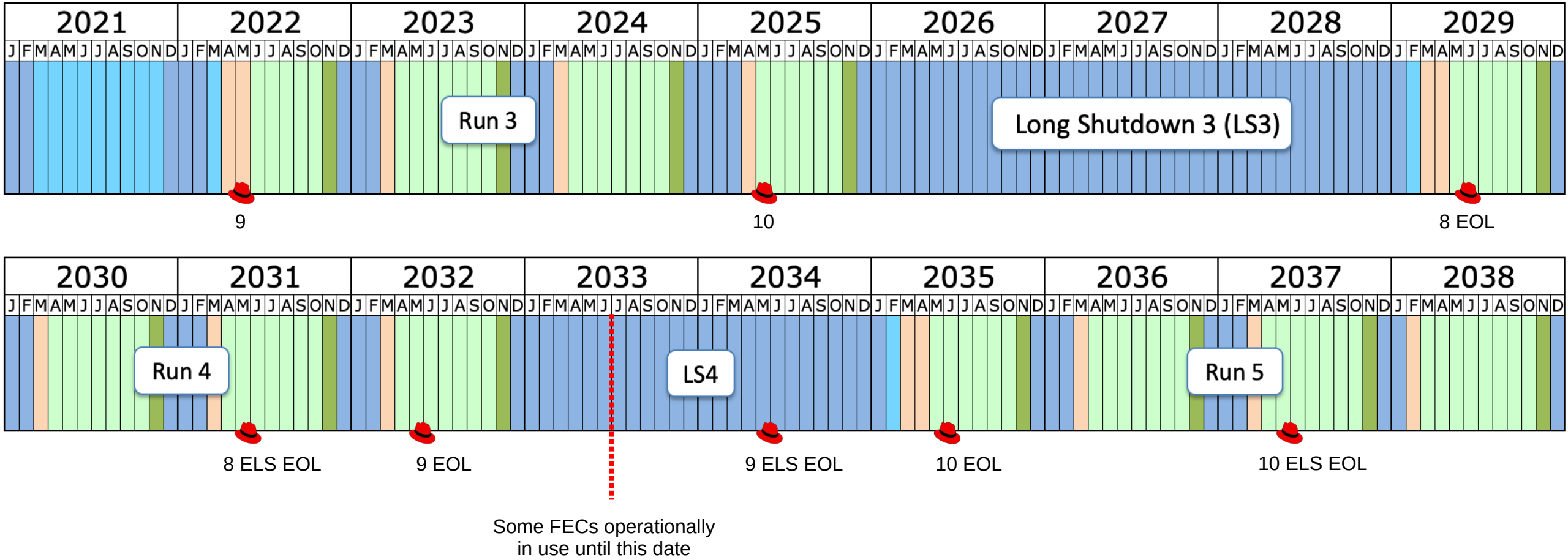
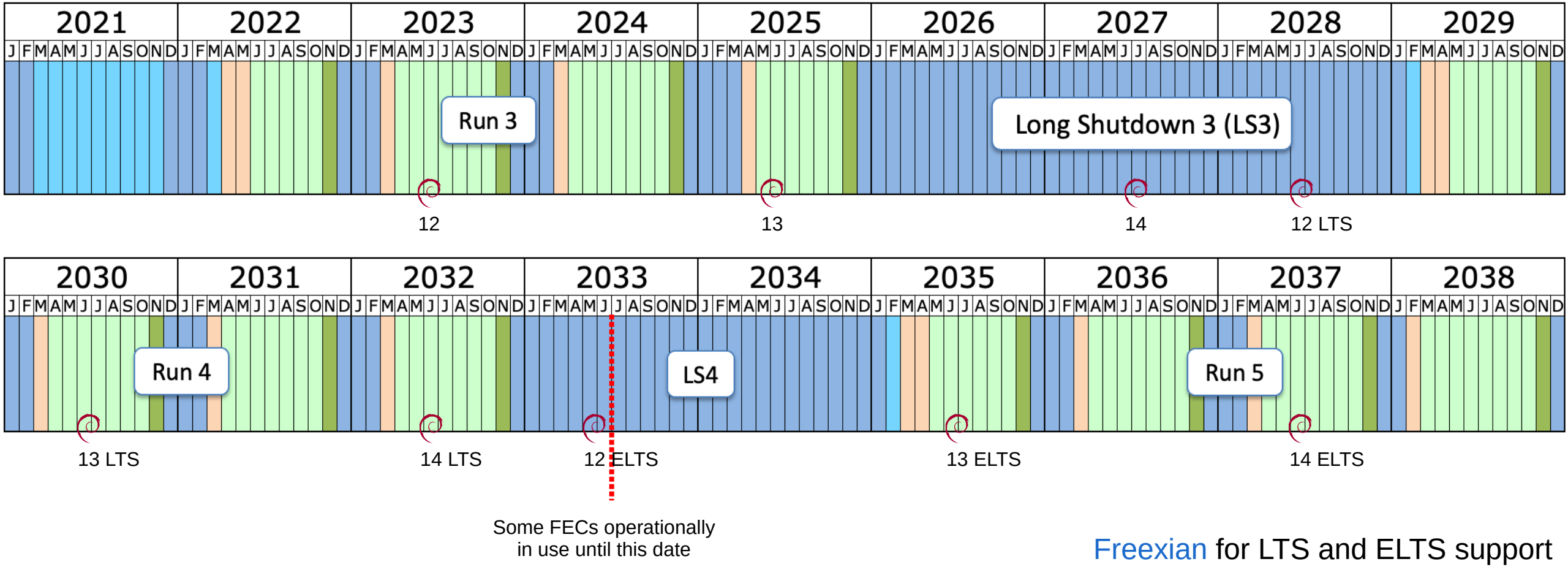
- **Because we have an exit strategy**
  - it is easy for us to switch between RHEL Family and Debian
- **We are considering selecting Debian as our first choice, we would like to start a collaboration with CERN IT**
  - For both Industrial PCs and SoC systems (today Zynq UltraScale+)

BACKUP SLIDES

FEC OS Renovation Schedule: Red Hat Enterprise Linux



FEC OS Renovation Schedule: Debian



Freexian for LTS and ELTS support