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Cgroups and Enterprise Users

Linux Plumbers 2023

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Linux Kernel Development

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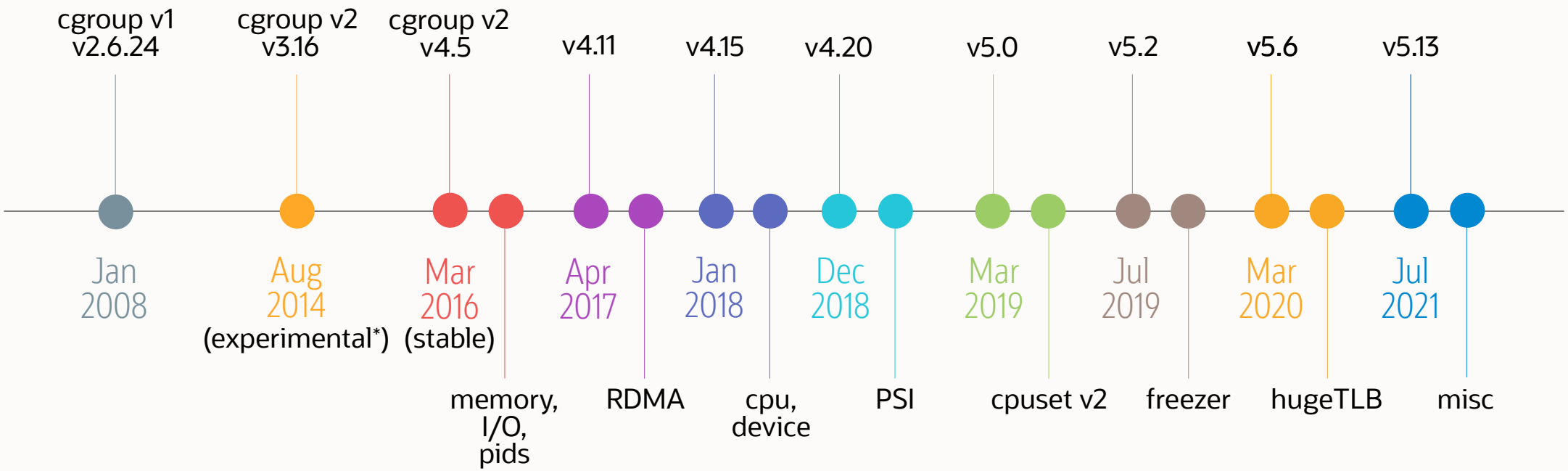
Kernel cgroup

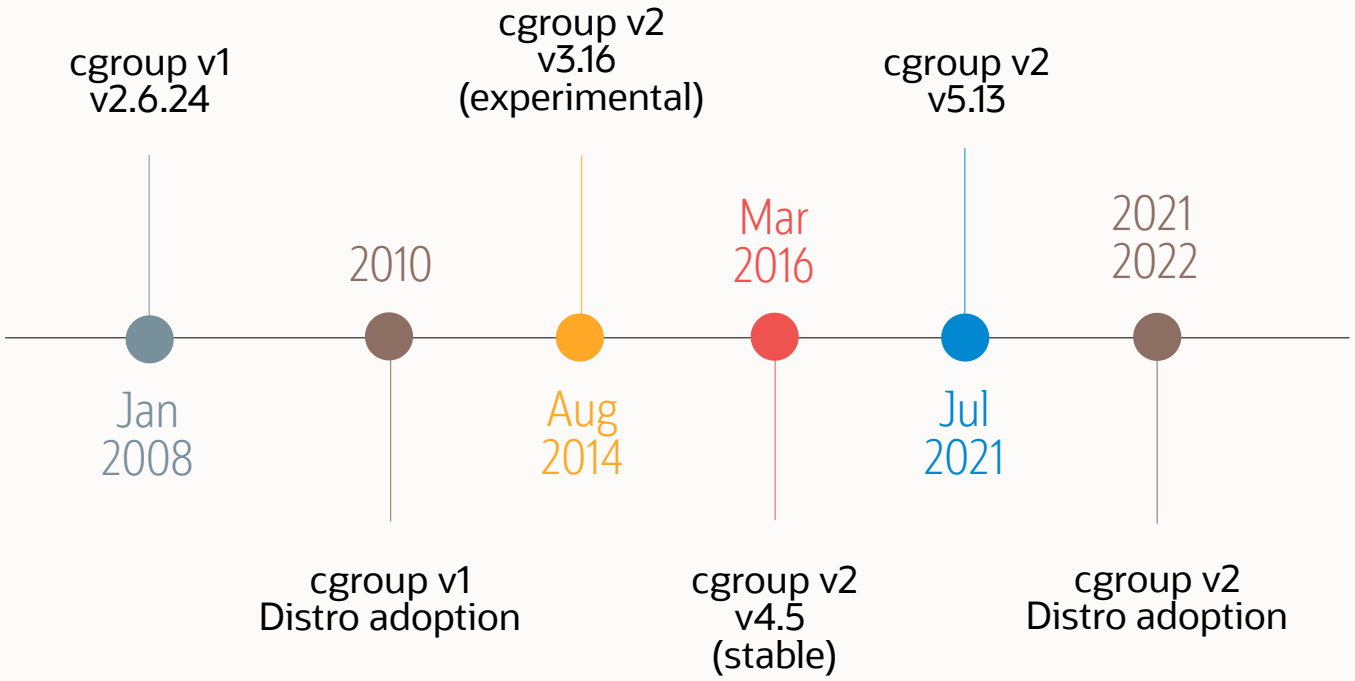
Upstream releases



*mount -t cgroup -o __DEVEL__sane_behavior cgroup <mount-point>

Enterprises cgroup

Upstream vs Distribution Adoption



Enterprise Distributions

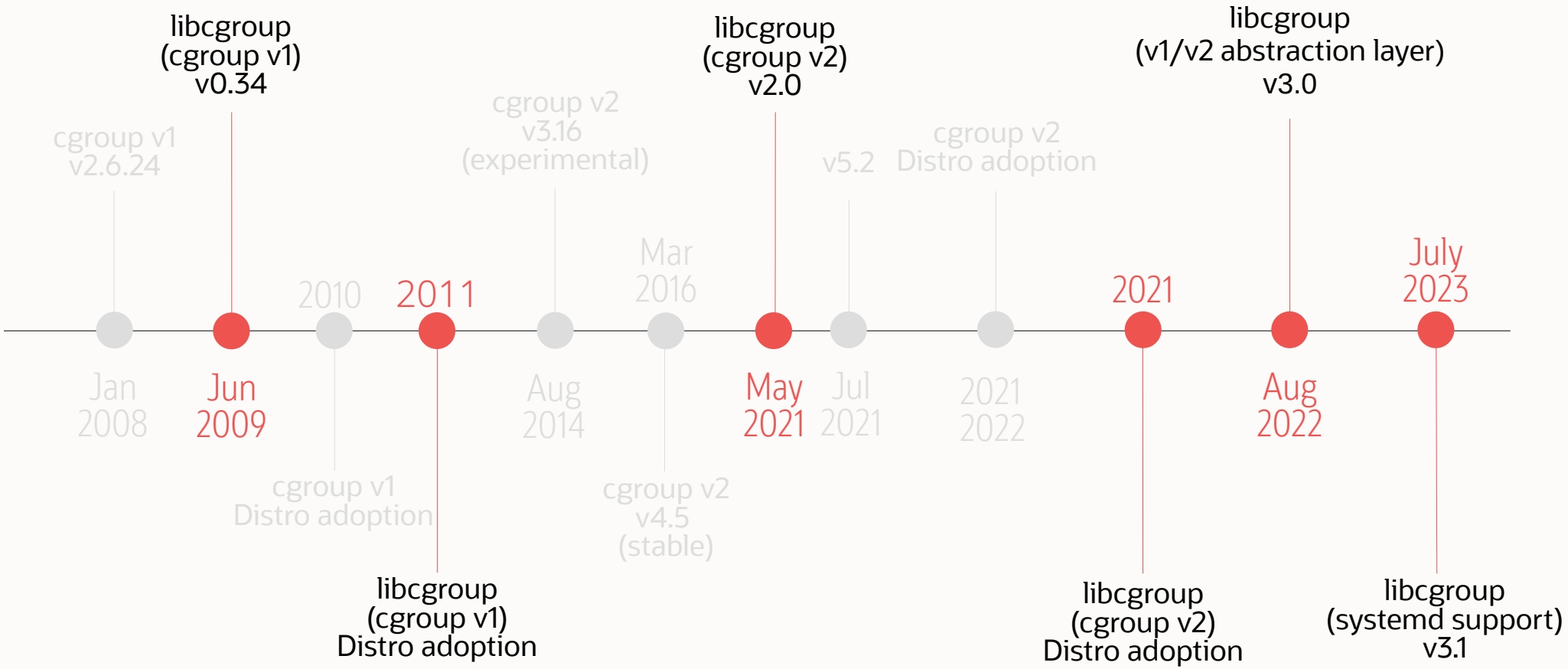
- LTS of 10 years or more

Enterprise Customers

- Applications runs on multiple distros/release
- Long term Application support
- Need to support cgroup v1/v2

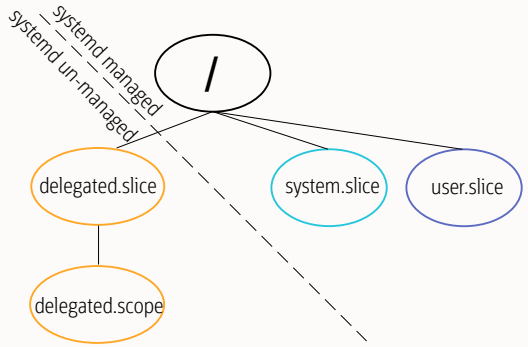
Libcgroup Releases

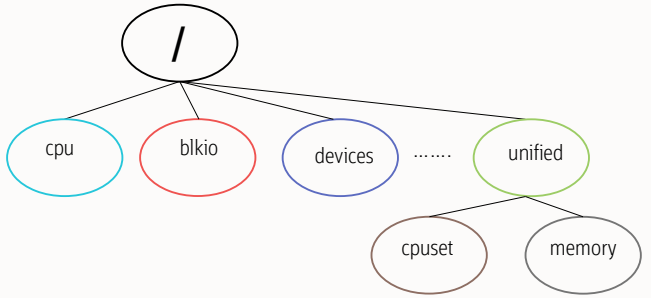
Upstream vs Distribution adoption vs libcgroup release



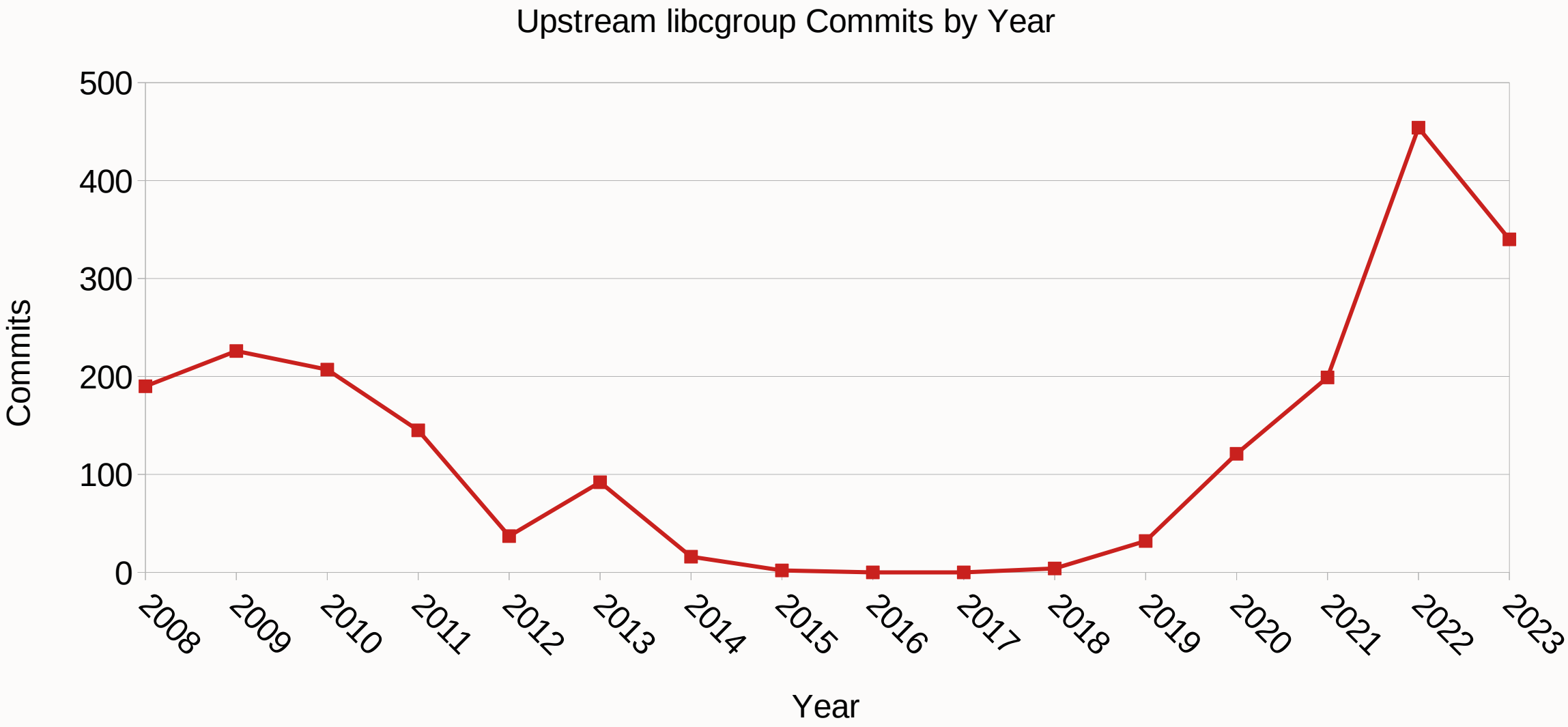
Why/When to Use libcgroup

- Programmatic management of delegated scopes
- CLI management of delegated scopes
- Complex cgroup hierarchies
- Different hierarchies across v1 controllers
- Different hierarchies across v1 and unified controllers
- Threaded cgroups
- Transient cgroups
- Cgroup settings not managed by systemd, e.g. cpusets
- Support for Python bindings

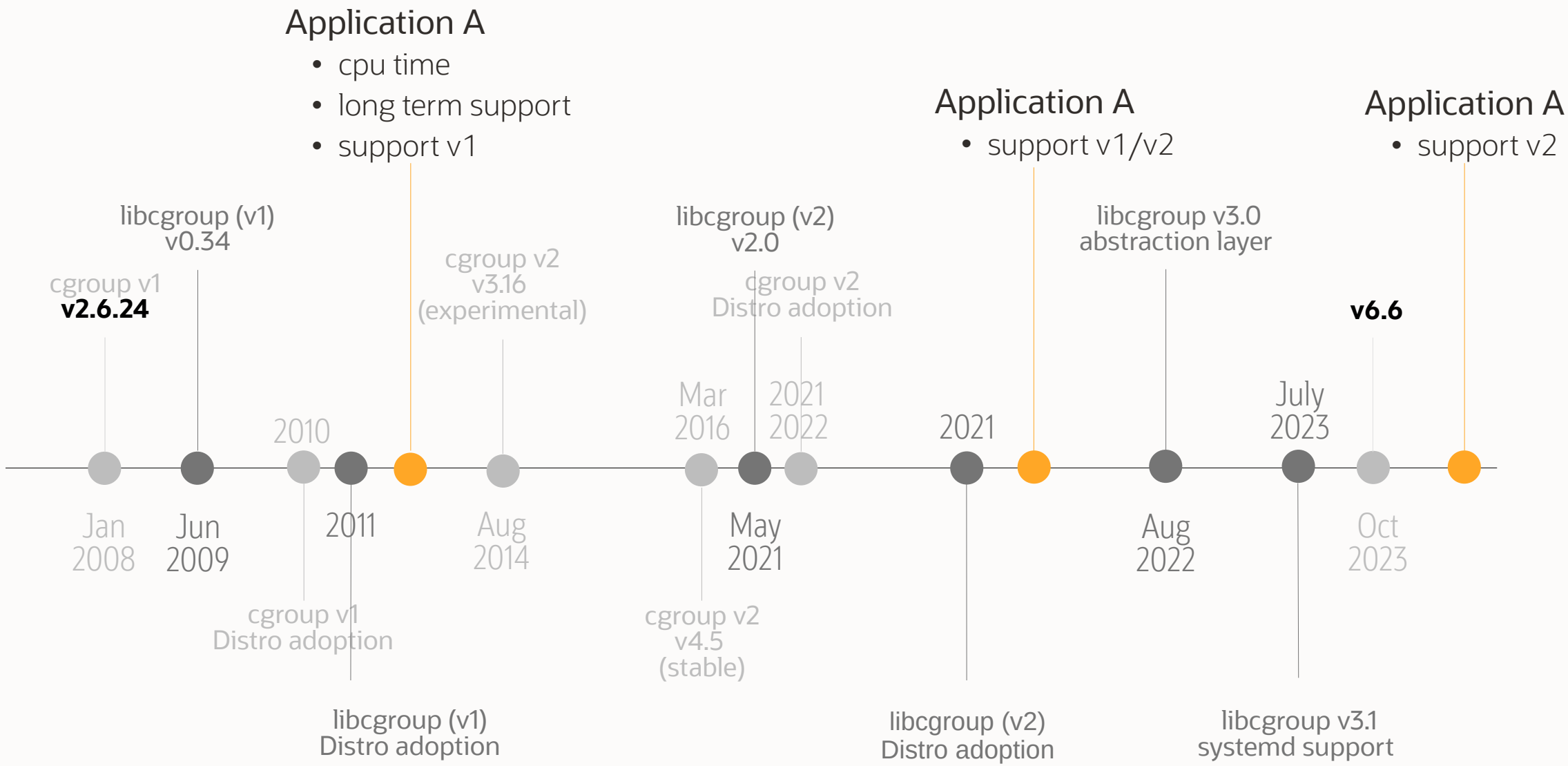




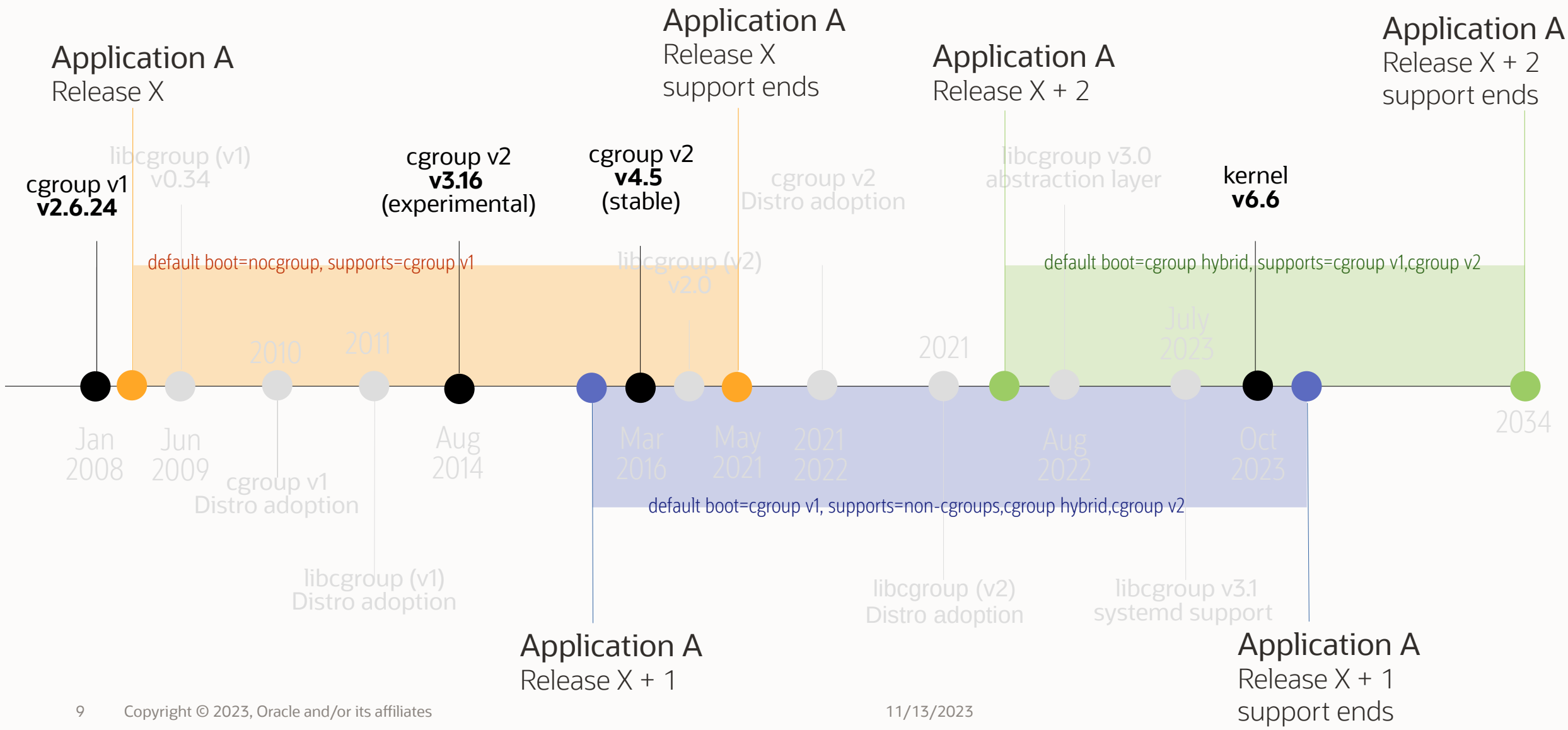
Upstream libcgroup Activity



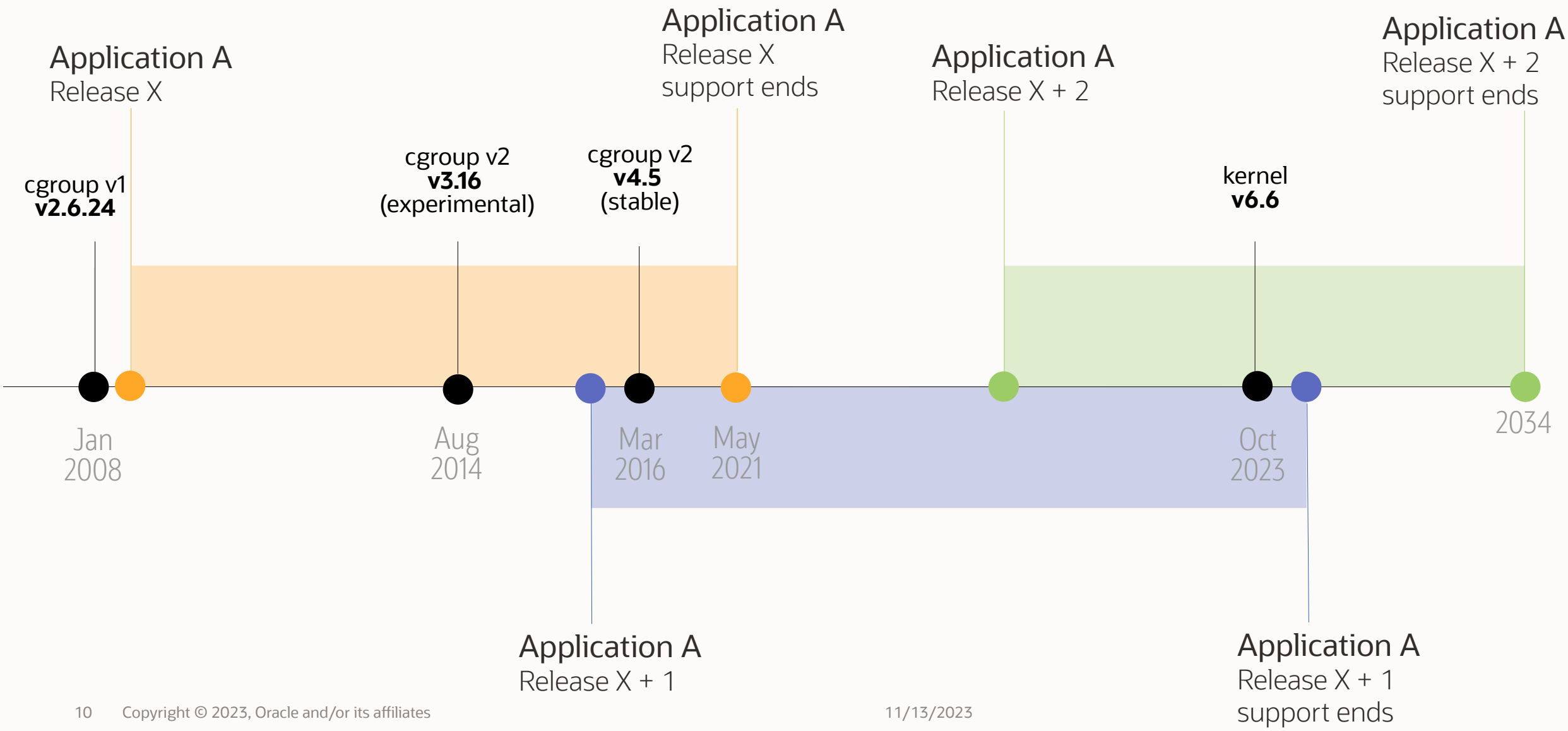
Enterprises Application Example



Enterprise Application Life Cycle



Enterprise Application Life Cycle



Challenges for Enterprise Users

Exclusive cpusets and root cgroup

- v2 - a process in the root cgroup cannot access a child cgroup's exclusive cpuset cpus
- v1 - root cgroup entirely ignores child cgroup's exclusive cpusets

Exclusive cpusets and child cgroups

- v6.6 - parent cgroups set as root can exclusively allocate all cpus to their children
- v5.15 - parent cgroups must keep at least 1 cpu available to themselves

cpu controller and root cgroup

- Given the default cpu.shares/cpu.weight, one process in the root cgroup has equal weight to a child cgroup
- Inconsistent spawning of processes in the root cgroup vs a child cgroup like system.slice

Single writer rule

- systemd owns the root cgroup and its children in the root cgroup
- A delegated cgroup (company.slice/app.scope) is the only approved method for a user-managed cgroup
- Generally more strictly enforced on cgroup v2 and newer versions of systemd
- This rule didn’t exist during early cgroup adoption

libcgroup features to assist moving from cgroup v1 to v2

Abstraction layer support

- Maps v1 controller settings to v2 controller settings and vice versa

```
cgxset -1 -r cpu.shares=512 <cgroup>

cgroup_convert_cgroup(out_cgroup, out_version,
                in_cgroup, in_version);
```

- Not all mappings are available, especially multiline controller settings.

Systemd delegation support

- Allow creation of systemd slice and scope (transient) programatically and tools to support them

```
cgcreate -S -c
-gcpu,memory:libcgroup.slice/database.scope

cgroup_create_scope2(cgroup, ignore_ownership,
                  cgroup_systemd_scope_opts);
```

Abstraction layer support cgconfig.conf

- /etc/cgconfig.conf will automap v1 settings to v2 settings

```
group foo {
     cpu {
          cpu.shares=512;
     }
}
```

Systemd delegation support cgconfig.conf

- /etc/cgconfig.conf will automap v1 settings to v2 settings

```
systemd {
     slice = database.slice;
     scope = db.scope;
     setdefault = yes;
}
```

Discussion Topics

- Re-adoption of libcgroup into distros
- Are there upcoming features (cgroups, systemd, etc.) that could break assumptions made by these legacy applications?
- Are there upcoming features that may be of interest to these legacy applications?
- Strategies for applications that must support cgroup v1/v2, new and old systemd versions, and a wide range of kernel versions
  - See inconsistencies slide from earlier
- Ways to increase “proper” usage of cgroups – single writer rule, no-inner-node processes, etc.
- Ways to discourage improper usage of cgroups

Thank You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Backup Slides

cgroup v2

Controllers	Kernel Version		libcgroup Release
memory, I/O, pids controllers	- v4.5	(Mar 2016)	
rdma controller	- v4.11	(Apr 2017)	
cpu controller	- v4.15	(Jan 2018)	
block I/O latency controller	- v4.19	(Oct 2018)	
Pressure Stall Information	- v4.20	(Dec 2018)	
cpuset v2	- v5.0	(Mar 2019)	
freezer	- v5.2	(Jul 2019)	
Kernel Release	- v5.5	(Jan 2020)	libcgroup v0.42
hugetlb	- v5.6	(Mar 2020)	
Kernel Release	- v5.12	(Apr 2020)	libcgroup v2.0
misc	- v5.13	(Jun 2021)	
Kernel Release	- v5.17	(Mar 2022)	libcgroup v2.0.1
Kernel Release	- v5.18	(May 2022)	libcgroup v2.0.2
Kernel Release	- v5.19	(Jul 2022)	libcgroup v3.0
Kernel Release	-v6.2	(Feb 2023)	libcgroup v2.0.3

cgroup adoption

Distribution	Release Version	Release Date	libcgroup version
Oracle Linux	9	Jun 2022	3.0
RedHat Enterprise Linux	9	May 2022	N/A
SuSE Linux Enterprise Server			
Ubuntu Server	21.10	Oct 2021	2.0.2.2