

# systemd, the wave of the future

## Try not to get drowned by it

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# Agenda

- What is systemd?
- What problem is systemd trying to fix? I.e., what was wrong with SysV init?
- systemd concepts
- Sample service unit files
- Backward compatibility
- I just got comfortable with SysV init. How do I do similar tasks with systemd?
- Questions?
- Additional material
  - Terminology, additional concepts
  - Links to (*lots*) more information

# What is systemd?

- The new system startup and service manager for Linux, replacing the “old” SysV init.
- According to the developers, systemd "provides aggressive parallelization capabilities, uses socket and D-Bus activation for starting services, offers on-demand starting of daemons, keeps track of processes using Linux cgroups, supports snapshotting and restoring of the system state, maintains mount and automount points and implements an elaborate transactional dependency-based service control logic."
  - It also promotes run-on sentences and excessive fervor in its adherents.
- It is intended to be compatible with SysV and LSB init scripts (but there have been some problems due to different design philosophies)
- Pretty much everything about it is different, which means a significant learning curve

# What is systemd?

- A few things to keep in mind for both SLES12 and RHEL 7
  - A lot of things are different, just in the system startup area.
    - systemd versus SysV init
    - dracut versus mkinitrd
    - grub2 (Grand Unified Bootloader)
    - Plymouth (Graphical Boot Animation and Logger)
  - Trying to figure what you're seeing on the console belongs to which piece will be a new “learning experience (ouch).”
  - I'm not going to get into all that here. Talking about systemd alone could fill multiple session slots.
  - udev is now part of systemd. The RPM name is still just “udev” but the source comes from systemd.

# What was wrong with SysV init?

- Depending on who you talk to, nothing or everything.
- There *are* a number of areas that could use improvement
  - It's slow
  - It's hard to parallelize
  - The concept of runlevels is rather coarse
  - Linux Standard Base (LSB) dependencies only do part of what most system administrators need
  - No automatic restart of services (outside of /etc/inittab)
  - No unified logging
  - No unified resource limit handling
  - Creating your own init scripts can be problematic

# systemd concepts

- systemd introduces a lot of new concepts and terminology
  - Services are not started via scripts, but “unit files.”
  - Service starts, stops, and messages associated with those are logged in a journal, accessible via the “journalctl” command.
- systemd replaces the traditional init process
  - Comes with a bunch of helper services
  - Uses the DBus protocol
- You'll be typing the “systemctl” command a *lot*.
  - It's the primary way you interact with systemd.
  - You'll probably want to create an alias for it, such as “sc”.

# systemd concepts

- One-stop shopping for boot, shutdown and power management
  - integrated logging
  - unified command line tools for almost everything
  - automatic restart of services
  - cgroups and security compartments for everything
  - multi-seat hosts
  - handling of ACPI power management events

# systemd concepts

- Unit files describe targets (i.e. synchronization points) and services (what used to be init scripts)
  - Much of what the LSB standard used is modeled in unit files
  - Plus a few more, for instance with LSB you could never say “my service needs to be started before kdm”
- Runlevels are replaced by targets
  - Runlevel 0: poweroff.target
  - Runlevel 1: rescue.target
  - Runlevels 2-4: multi-user.target
  - Runlevel 5: graphical.target
  - Runlevel 6: reboot.target

# Sample service unit file: sshd.service

## /usr/lib/systemd/system/sshd.service

```
# This is a comment!
```

```
[Unit]
```

```
Description=OpenSSH Daemon
```

```
After=network.target
```

```
[Service]
```

```
EnvironmentFile=/etc/sysconfig/ssh
```

```
ExecStartPre=/usr/sbin/sshd-gen-keys-start
```

```
ExecStart=/usr/sbin/sshd -D $SSHD_OPTS
```

```
ExecReload=/bin/kill -HUP $MAINPID
```

```
KillMode=process
```

```
Restart=always
```

```
[Install]
```

```
WantedBy=multi-user.target
```

```
LSB Analogs/Equivalents
```

```
[Unit]
```

```
# Description: ...
```

```
# Required-Start: $network
```

```
[Service]
```

```
# <- All of these used to be
```

```
# <- coded in the init script
```

```
# <-
```

```
# <-
```

```
# <-
```

```
Automated Restart: didn't exist previously
```

```
[Install]
```

```
# Default-Start: 3 5
```

# Sample service unit file: cron.service

## /usr/lib/systemd/system/cron.service

```
# This is a comment!
```

```
[Unit]
```

```
Description=Command Scheduler
```

```
After=ybind.service nscd.service network.target
```

```
After=postfix.service sendmail.service exim.service
```

```
[Service]
```

```
ExecStart=/usr/sbin/cron -n
```

```
Restart=on-abort
```

```
[Install]
```

```
WantedBy=multi-user.target
```

# Backward compatibility

- The systemd developers don't seem to believe in it.
- SUSE does, however
  - insserv, chkconfig and /sbin/service will still be supported
  - Old style commands (calling “rcfoobar”) will be redirected to systemctl automatically
  - LSB compatibility for targets like \$network are still available
  - And of course init scripts are still supported
    - But you may find that you actually prefer unit files.

# How do I do the things I used to do?

- First, make sure you have the systemd-sysvinit RPM installed. (It should be installed by default.)
  - This provides symbolic links for halt, telinit, reboot, runlevel, etc.
  - This will allow you to continue using the old commands while learning the new ones.
- Changing run levels
  - Old: `telinit 1`  
`telinit S`  
`telinit 3`
  - New: `systemctl isolate runlevel1.target`  
`systemctl isolate rescue.target`  
`systemctl isolate default`

# How do I do the things I used to do?

- Check the default runlevel
  - Old: Use YaST, or examine `/etc/inittab`
  - New: `systemctl get-default`
- Set/change the default runlevel
  - Old: Use YaST, or edit `/etc/inittab`
  - New: `systemctl set-default multi-user.target`
- Enabling/disabling a service
  - Old: `chkconfig <name> on`  
`chkconfig <name> off`  
`insserv [-r]`
  - New: `systemctl enable <name>.service`  
`systemctl disable <name>.service`

# How do I do the things I used to do?

- Starting/stopping a service
  - Old: `rc<name> start`  
`rc<name> stop`  
`/etc/init.d/<name> start`  
`/etc/init.d/<name> stop`  
`service <name> start`  
`service <name> stop`
  - New: `systemctl start <name>.service`  
`systemctl stop <name>.service`

To kill all the processes in the cgroup of a service:  
`systemctl kill <name>.service`

# How do I do the things I used to do?

- Check the status of a service
  - Old: `rc<name> status`  
`/etc/init.d/<name> status`  
`service <name> status`
  - New: `systemctl status <name>.service`  
To check the status of *all* services  
`systemctl`
- Re-read /etc/inittab
  - Old: `telinit q`  
`telinit Q`
  - New: `systemctl daemon-reload`  
`systemctl reload "*"`

# How do I do the things I used to do?

- Re-spawn/re-execute init
  - Old: `telinit u`  
`telinit U`
  - New: `systemctl daemon-reexec`
- Show the running process “tree”
  - Old: `pstree` (part of the `psmisc` package)
  - New: `systemd-cgls`

# How do I do the things I used to do?

- Shutting down
  - Old: `halt`  
`shutdown -h`  
`telinit 0`
  - New: `systemctl halt`
- Rebooting
  - Old: `reboot`  
`shutdown -r`  
`telinit 6`
  - New: `systemctl reboot`

# File locations

- RPM-provided unit files  
`/usr/lib/systemd/system`
- User overrides to unit files  
`/etc/systemd/system/`  
`/etc/systemd/system/<name>.service.d`
- `/etc/systemd/system.conf`  
At the moment, all defaults (as comments)
- `/etc/systemd/user.conf`  
At the moment, all defaults (as comments)
- Don't bother looking for `/etc/inittab`. It doesn't exist any longer.

# Questions?

# Terminology

- Unit file - Encodes information about things such as a service, socket, device, mount, automount, target, snapshot, etc.
- Target - A unit configuration file whose name ends in ".target" encodes information about a target unit of systemd, which is used for grouping units and as well-known synchronization points during start-up.
- Slice - A concept for hierarchially managing resources of a group of processes.
- Seat - The set of hardware available at one work place (graphics card, keyboard, mouse, usb devices)
  - This doesn't seem to be relevant to System z

# Terminology

- Session - A session is created once a user is logged on, using a specific seat
  - Only one session can be active per seat
  - Default seat (for Linux consoles) is seat0
  - Hardware is assigned to seats
    - This replaces ConsoleKit

# Additional concepts

- Cgroups (control groups) for *everything*
  - systemd puts each service and each session into a separate cgroup
    - Sessions also get assigned an audit ID matching their cgroup ID
  - You can restrict these cgroups in all the ways the kernel supports
    - IO bandwidth, memory or CPU consumption, etc

# Additional concepts

- Improve Security for Everything
  - Restrict services and sessions using namespaces
    - Linux kernel namespaces are the technology underlying Linux containers
    - blacklist directories
    - require private /tmp directory
    - whitelist devices to which access is granted
  - Specify user/group to run as
  - Assign Linux kernel capabilities (CAP\_FOOBAR)
  - Set ulimit values

# Additional concepts

- Overriding defaults for a service
  - With SysV init, if you want to do anything more advanced that enable/disable a service, you need to edit the init script
    - Obviously this doesn't go well with package updates
- systemd supports this
  - To modify settings for <name>.service
    - Create /etc/systemd/system/<name>.service.d
    - Create a file named mysettings.conf in there:

```
[Service]
InaccessibleDirectories=/precious
MemoryLimit=1G
```
    - Only the settings you want to add/override need to be in the file

# Additional concepts

- Session handling
  - List all sessions  
`loginctl [list-sessions]`
  - Show session details  
`loginctl session-status <session-number>`
  - Forcefully terminate a session  
`loginctl kill-session|kill-user|terminateseat <name>`
- See how your configuration differs from the vendor defaults
  - `systemd-delta`
- Analyze boot times and bottlenecks
  - `systemd-analyze`

# Additional information

- `systemd` in SUSE® Linux Enterprise 12 white paper  
[www.novell.com/docrep/2015/01/systemd\\_in\\_suse\\_linux\\_enterprise\\_12\\_white\\_paper.pdf](http://www.novell.com/docrep/2015/01/systemd_in_suse_linux_enterprise_12_white_paper.pdf)
- [www.suse.com/documentation/sles-12/book\\_sle\\_admin/data/cha\\_systemd.html](http://www.suse.com/documentation/sles-12/book_sle_admin/data/cha_systemd.html)
- [www.suse.com/documentation/sles-12/pdfdoc/book\\_sle\\_admin/book\\_sle\\_admin.pdf](http://www.suse.com/documentation/sles-12/pdfdoc/book_sle_admin/book_sle_admin.pdf)
- The various man pages on an installed system.
  - They're pretty verbose, but as do most man pages, they tend to assume some background you may or may not have. See below for where to find that background.
- <http://www.freedesktop.org/wiki/Software/systemd/>

# Additional information

- [www.freedesktop.org/wiki/Software/systemd/](http://www.freedesktop.org/wiki/Software/systemd/)
- <http://freedesktop.org/wiki/Software/systemd/Debugging/www.linux.com/learn/tutorials/788613-understanding-and-using-systemd>
- <http://0pointer.de/blog/projects/systemd.html>
- <http://0pointer.de/blog/projects/systemd-update.html>
- <http://0pointer.de/blog/projects/systemd-update-2.html>
- <http://0pointer.de/blog/projects/systemd-update-3.html>
- <http://en.wikipedia.org/wiki/Systemd>
- <http://0pointer.de/blog/projects/>
- <http://0pointer.de/blog/>



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