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Linux Bootloaders on System z
Current & Future Implementations

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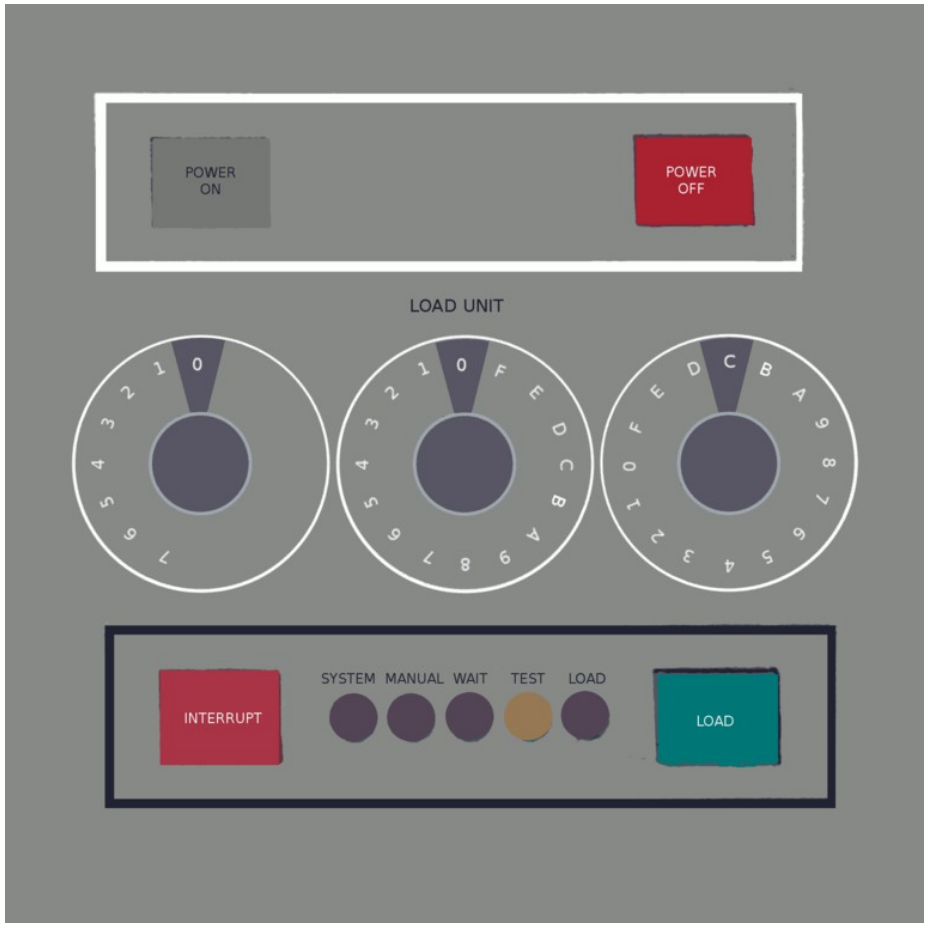
Agenda

- Boot Process on System Z
  - Initial Program Load (IPL)
  - zIPL and limitations
  - Grub 2 function
  - Grub 2 s390 implementation

IPL Process

Initial Program Load (IPL)

- Formalized with System 360
  - Set the dials, push the button
- Initiated from CP console for z/VM or HMC
- 1 PSW and 2 CCW loaded from
  - That's enough to load a Command Program



IPL Process for Linux on System Z

Linux Initial Program Load (zIPL)

- Linux Bootloader for System Z
- Configured with /etc/zipl.conf
- Bootloader written using /sbin/zipl

zIPL Configuration file (/etc/zipl.conf)

```
[defaultboot]
defaultmenu = menu

[SLES11_SP3]
    image = /boot/image-3.0.76-0.11-default
    target = /boot/zipl
    ramdisk = /boot/initrd-3.0.76-0.11-default,0x2000000
    parameters = "root=/dev/dasda2 hvc_iucv=8 TERM=dumb resume=/dev/dasda1"

:menu
    default = 1
    prompt = 1
    target = /boot/zipl
    timeout = 10
    1 = SLES11_SP3
```

zIPL Operation

- Multi-stage operation
  - Stage 0 – 24 bytes – 2 CCWs to load and TIC to Stage1
  - Stage 1 – 104 byte channel program to load Stage 1b
  - Stage 1b – 1k channel program to load Stage 2
  - Stage 2 – 8k maximum menu and kernel loader
  - Stage 3 – Kernel parameter parser and execution

ZIPL Limitations - Devices

- Limited device capabilities
  - Restricted to specific Channel I/O device types
    - DASD
    - SCSI
    - Tape
  - Boot from the Network? Nope.
  - Device-mapper tends to be finicky

zIPL Limitations – File Systems

- Limited file system support
  - Only ext2, ext3
  - Btrfs and XFS not supported

Grub 2 on System Z

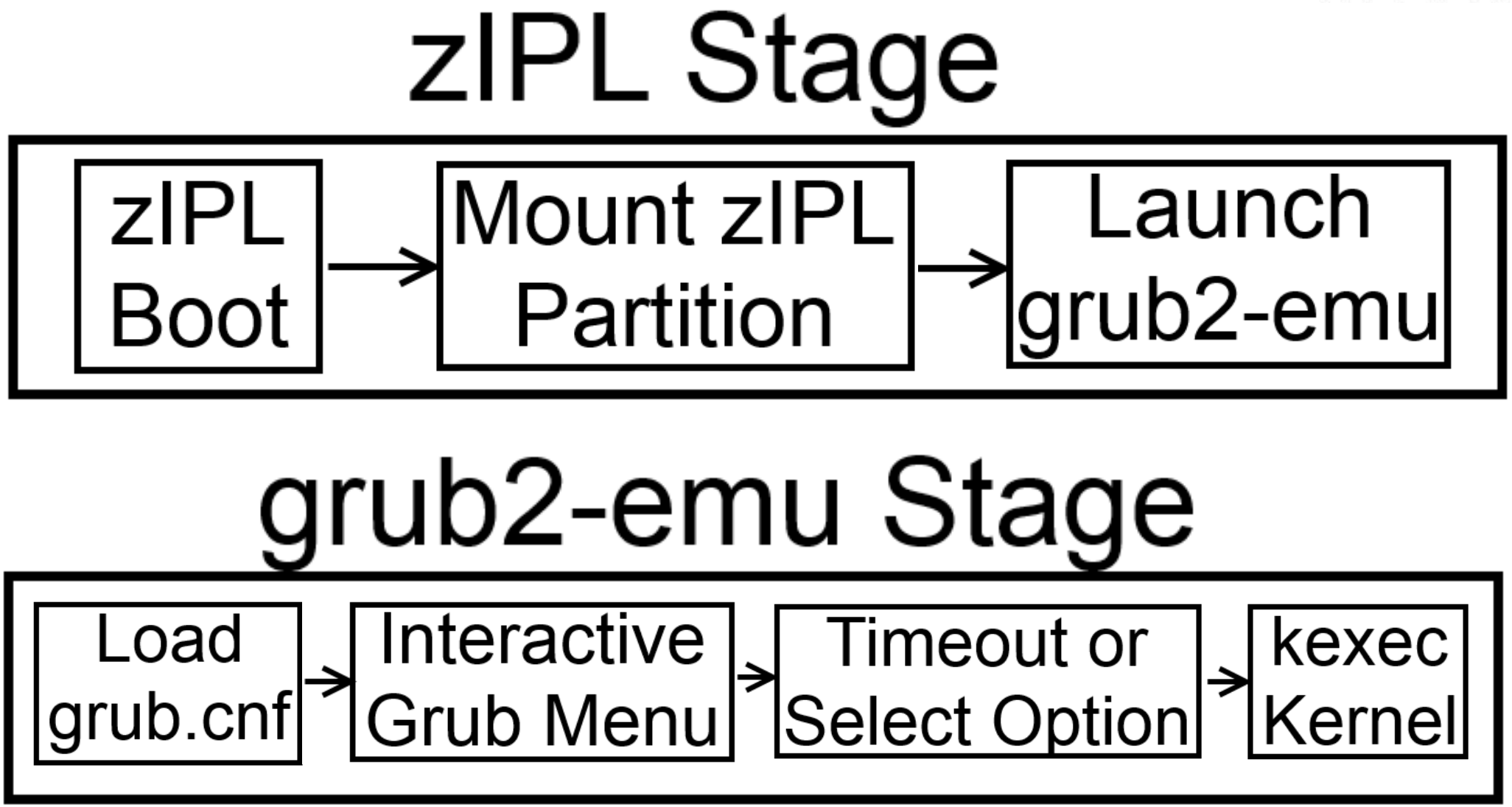
Challenges of Grub 2 on System Z

- Large Binary Size
  - 1.3MB cannot be easily loaded via CCW
- Unique System Z Drivers
  - DASD, zFCP, QETH all should be cleanly implemented
  - Maintenance a major factor
- Unique Display Configuration
  - Both 3270 and 3215 need to be supported
-

Solution : grub2-emu

- User-mode grub2
  - Relatively little modification necessary
- Requires a linux kernel to be booted
  - All supported s390 drivers available
  - udev resolves devices
  - Still uses zIPL, but in a “Stage 4” role
- Full filesystem support
  - BTRFS snapshots
  - Unusual device-mapper configurations
- Two stage boot

Grub 2 boot process



How to boot another kernel?

- kexec
  - Kernel-supported reboot
  - Safe shutdown and restart of devices
- Implementation of kexec in Grub 2
  - New feature for grub2-emu
  - Options for kernel and initrd are used and verified
  - Only available to root user

Configuration : grub2

- Special grub2 boot partition
  - Normally mounted to /boot/zipl
- Contains grub2 kernel and initrd
- Contains grub2 config file
  - Allows for dynamic configuration
  - No more need to run zipl when kernel configuration changes

Demonstration

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