getting started with the Yocto Project and systemd

ESE3005

Yocto Project

- backed by a number of large tech corporations and individuals, in order to expedite getting embedded Linux systems working!
- hardware companies like IBM and TI have a vested interest in getting IoT hardware systems working (so they can sell their chips!)
- getting a Linux OS working for a newly designed embedded system is not a simple matter (there is no off-the-shelf distribution like Beagleboard Debian or Raspbian!)
- although there are several embedded OS "generic" operating systems available, notably: Android, Angstrom, OpenWrt;

Yocto Project Cont'd

- Yocto is not the only embedded Linux Build System:
  - Baserock
  - Buildroot
  - OpenEmbedded
- What is hard about a custom Linux distribution?
  - Bootloader
  - Kernel
  - Device Drivers
  - Life Cycle Management
  - Application Software Management
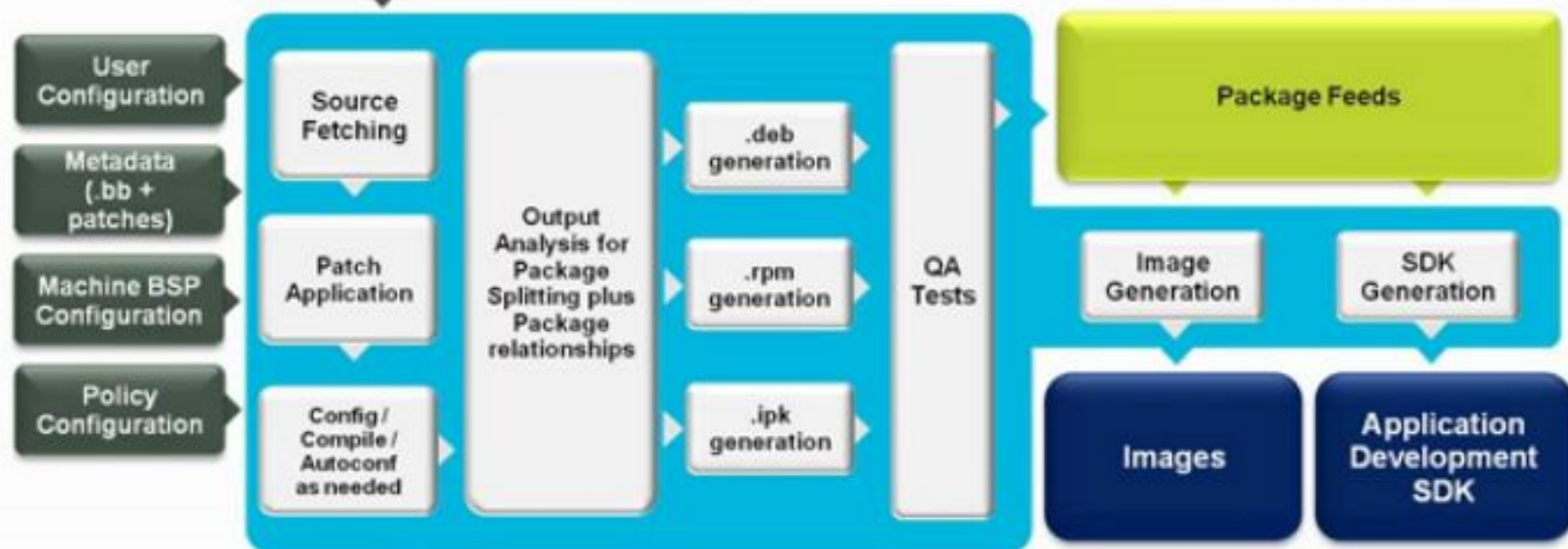
Yocto: fetch, extract, patch, configure, build...

- essentially, you use various configuration files and special script files called "recipes" to direct the build system in how to construct your Linux image
- the image is then "flashed" on your embedded system
  - in this unit, we'll be emulating the embedded system, so you won't have to worry about flashing a physical device!
- the Yocto's BitBake program then runs, based on the configuration files and recipes goes through a repetitive process involving the same steps:
  - fetch (from many different sources on the Internet)
  - extract (un-zipping, un-archiving)
  - patch (updating the source code)
  - configure (configuring the build)
  - build (compiling, linking)
  - install (placing the program in the right directories, etc.)
  - package (creating the archive or image)

systemd

- originally developed by Lennart Poettering and Kay Sievers, two software engineers working at RedHat
- a software suite consisting of various system components
    - some components work as a "glue" between applications and the kernel
    - the *system and service manager*
- the predecessor to the systemd startup and service manager is System V init (sometimes called "SysV")
    - drawback of SysV is the slow boot process:
        - SysV waits for one task to complete, before starting the next
        - whereas systemd starts up services in parallel, this was one of systemd's primary initial aims

systemd cont'd

- What are services? Examples include:
  - webservers (Apache server)
  - ssh (secure shell), interfacing kernel and /bin/bash
  - uart communication management
  - low-level hardware control (graphics, sound, etc.)
- core components:
  - *systemd*: the start-up and service manager itself
  - *systemctl*: a command used to probe *systemd*
  - *systemd-analyze*: system state information, including boot-up performance
  - other components also provide login management, journal logging, device management, and more
- systemd has been criticized for taking on too many functions, diverting from its original mission; nevertheless, this has not slowed its widespread adoption by various Linux distributions

typing the *systemctl* command at the Linux prompt yields:


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                                                                    takis@Bernard: ~                                          Q  ≡   _  □  ✕

UNIT                                                                   LOAD    ACTIVE      SUB        DESCRIPTION
proc-sys-fs-binfmt_misc.automount                                     loaded  active      waiting    Arbitrary Executable File Formats File System Automount Poin>
dev-fuse.device                                                       loaded  activating  tentative  /dev/fuse
sys-bus-pci-drivers-nvidia.device                                     loaded  active      plugged    /sys/bus/pci/drivers/nvidia
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.0-usb1-1\x2d3-1\x2d3:1.0-sound-card1.device  loaded  active  plugged  Audio Adapter (Unitek Y-247A)
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.0-usb1-1\x2d4-1\x2d4:1.2-sound-card3.device  loaded  active  plugged  HD Pro Webcam C920
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata1-host0-target0:0:0-0:0:0:0-block-sda-sda1.device  loaded  active  plugged  WDC_WD1003FZEX-00MK2A0 1
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata1-host0-target0:0:0-0:0:0:0-block-sda-sda2.device  loaded  active  plugged  WDC_WD1003FZEX-00MK2A0 2
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata1-host0-target0:0:0-0:0:0:0-block-sda-sda5.device  loaded  active  plugged  WDC_WD1003FZEX-00MK2A0 5
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata1-host0-target0:0:0-0:0:0:0-block-sda-sda6.device  loaded  active  plugged  WDC_WD1003FZEX-00MK2A0 6
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata1-host0-target0:0:0-0:0:0:0-block-sda-sda7.device  loaded  active  plugged  WDC_WD1003FZEX-00MK2A0 7
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata1-host0-target0:0:0-0:0:0:0-block-sda.device  loaded  active  plugged  WDC_WD1003FZEX-00MK2A0
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata2-host1-target1:0:0-1:0:0:0-block-sdb-sdb1.device  loaded  active  plugged  INTEL_SSDSC2BP240G4 1
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata2-host1-target1:0:0-1:0:0:0-block-sdb-sdb2.device  loaded  active  plugged  INTEL_SSDSC2BP240G4 2
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata2-host1-target1:0:0-1:0:0:0-block-sdb-sdb5.device  loaded  active  plugged  INTEL_SSDSC2BP240G4 5
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.1-ata2-host1-target1:0:0-1:0:0:0-block-sdb.device  loaded  active  plugged  INTEL_SSDSC2BP240G4
sys-devices-pci0000:00-0000:00:01.3-0000:03:00.2-0000:1d:07.0-0000:25:00.0-net-enp37s0.device  loaded  active  plugged  RTL8111/8168/8411 PCI Express Gigabit Ethernet Controller (M>
sys-devices-pci0000:00-0000:00:08.1-0000:26:00.1-sound-card0.device  loaded  active  plugged  GK106 HDMI Audio Controller
sys-devices-pci0000:00-0000:00:08.1-0000:28:00.3-sound-card2.device  loaded  active  plugged  Family 17h (Models 00h-0fh) HD Audio Controller
sys-devices-platform-serial8250-tty-ttyS1.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS1
sys-devices-platform-serial8250-tty-ttyS10.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS10
sys-devices-platform-serial8250-tty-ttyS11.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS11
sys-devices-platform-serial8250-tty-ttyS12.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS12
sys-devices-platform-serial8250-tty-ttyS13.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS13
sys-devices-platform-serial8250-tty-ttyS14.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS14
sys-devices-platform-serial8250-tty-ttyS15.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS15
sys-devices-platform-serial8250-tty-ttyS16.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS16
sys-devices-platform-serial8250-tty-ttyS17.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS17
sys-devices-platform-serial8250-tty-ttyS18.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS18
sys-devices-platform-serial8250-tty-ttyS19.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS19
sys-devices-platform-serial8250-tty-ttyS2.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS2
sys-devices-platform-serial8250-tty-ttyS20.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS20
sys-devices-platform-serial8250-tty-ttyS21.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS21
sys-devices-platform-serial8250-tty-ttyS22.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS22
sys-devices-platform-serial8250-tty-ttyS23.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS23
sys-devices-platform-serial8250-tty-ttyS24.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS24
sys-devices-platform-serial8250-tty-ttyS25.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS25
sys-devices-platform-serial8250-tty-ttyS26.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS26
sys-devices-platform-serial8250-tty-ttyS27.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS27
sys-devices-platform-serial8250-tty-ttyS28.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS28
sys-devices-platform-serial8250-tty-ttyS29.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS29
sys-devices-platform-serial8250-tty-ttyS3.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS3
sys-devices-platform-serial8250-tty-ttyS30.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS30
sys-devices-platform-serial8250-tty-ttyS31.device                     loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS31
sys-devices-platform-serial8250-tty-ttyS4.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS4
sys-devices-platform-serial8250-tty-ttyS5.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS5
sys-devices-platform-serial8250-tty-ttyS6.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS6
sys-devices-platform-serial8250-tty-ttyS7.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS7
sys-devices-platform-serial8250-tty-ttyS8.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS8
sys-devices-platform-serial8250-tty-ttyS9.device                      loaded  active  plugged  /sys/devices/platform/serial8250/tty/ttyS9
sys-devices-pnp0-00:04-tty-ttyS0.device                               loaded  active  plugged  /sys/devices/pnp0/00:04/tty/ttyS0
sys-devices-virtual-block-loop0.device                                loaded  active  plugged  /sys/devices/virtual/block/loop0
sys-devices-virtual-block-loop1.device                                loaded  active  plugged  /sys/devices/virtual/block/loop1
sys-devices-virtual-block-loop10.device                               loaded  active  plugged  /sys/devices/virtual/block/loop10
sys-devices-virtual-block-loop11.device                               loaded  active  plugged  /sys/devices/virtual/block/loop11
sys-devices-virtual-block-loop12.device                               loaded  active  plugged  /sys/devices/virtual/block/loop12
sys-devices-virtual-block-loop13.device                               loaded  active  plugged  /sys/devices/virtual/block/loop13
sys-devices-virtual-block-loop14.device                               loaded  active  plugged  /sys/devices/virtual/block/loop14
sys-devices-virtual-block-loop2.device                                loaded  active  plugged  /sys/devices/virtual/block/loop2
sys-devices-virtual-block-loop3.device                                loaded  active  plugged  /sys/devices/virtual/block/loop3
sys-devices-virtual-block-loop4.device                                loaded  active  plugged  /sys/devices/virtual/block/loop4
sys-devices-virtual-block-loop5.device                                loaded  active  plugged  /sys/devices/virtual/block/loop5
sys-devices-virtual-block-loop6.device                                loaded  active  plugged  /sys/devices/virtual/block/loop6
lines 1-63
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