

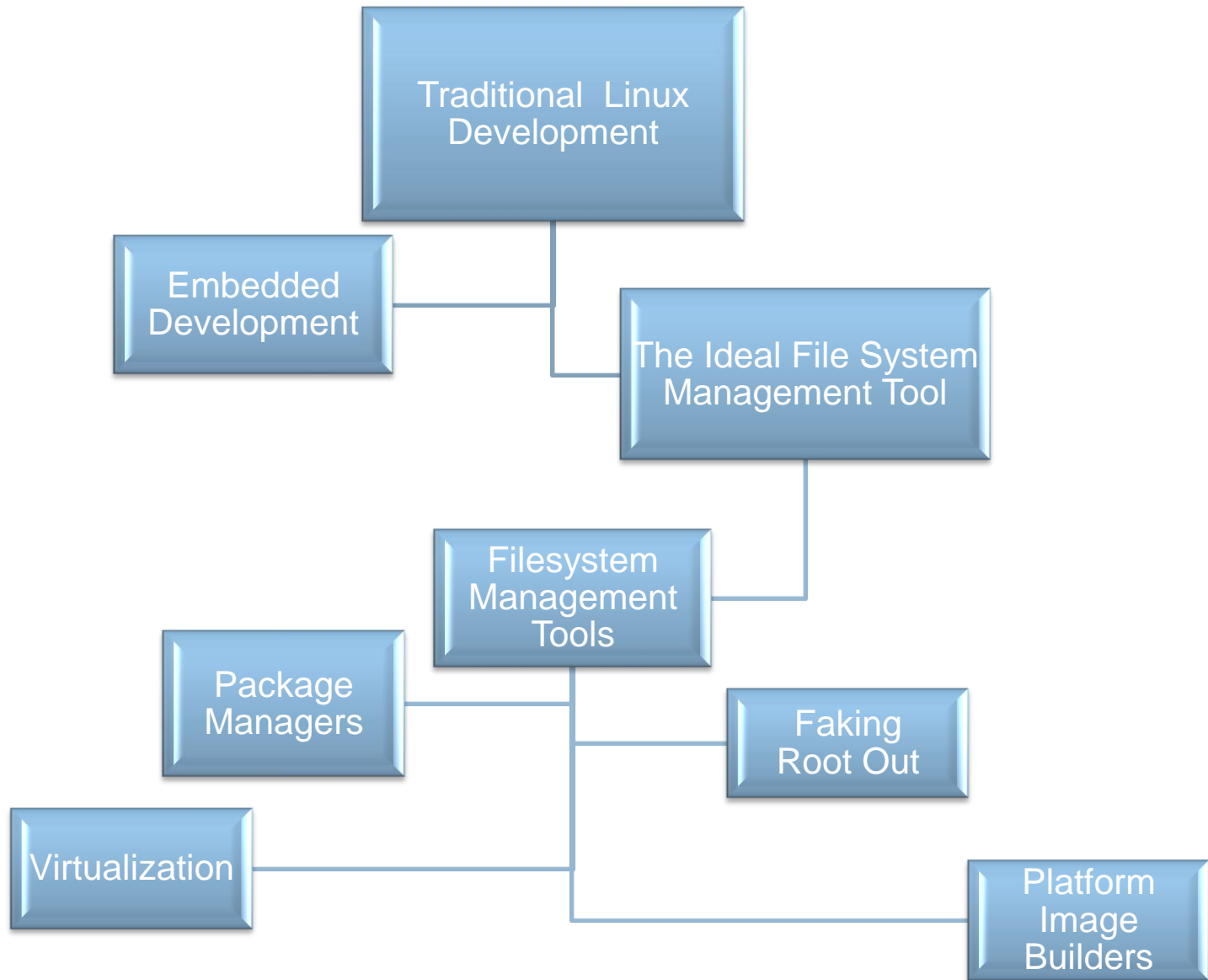


# **Tooling for Success: Embedded Linux File System Management**

**Presenter: Troy Kitch**

**Session Code: AE205**

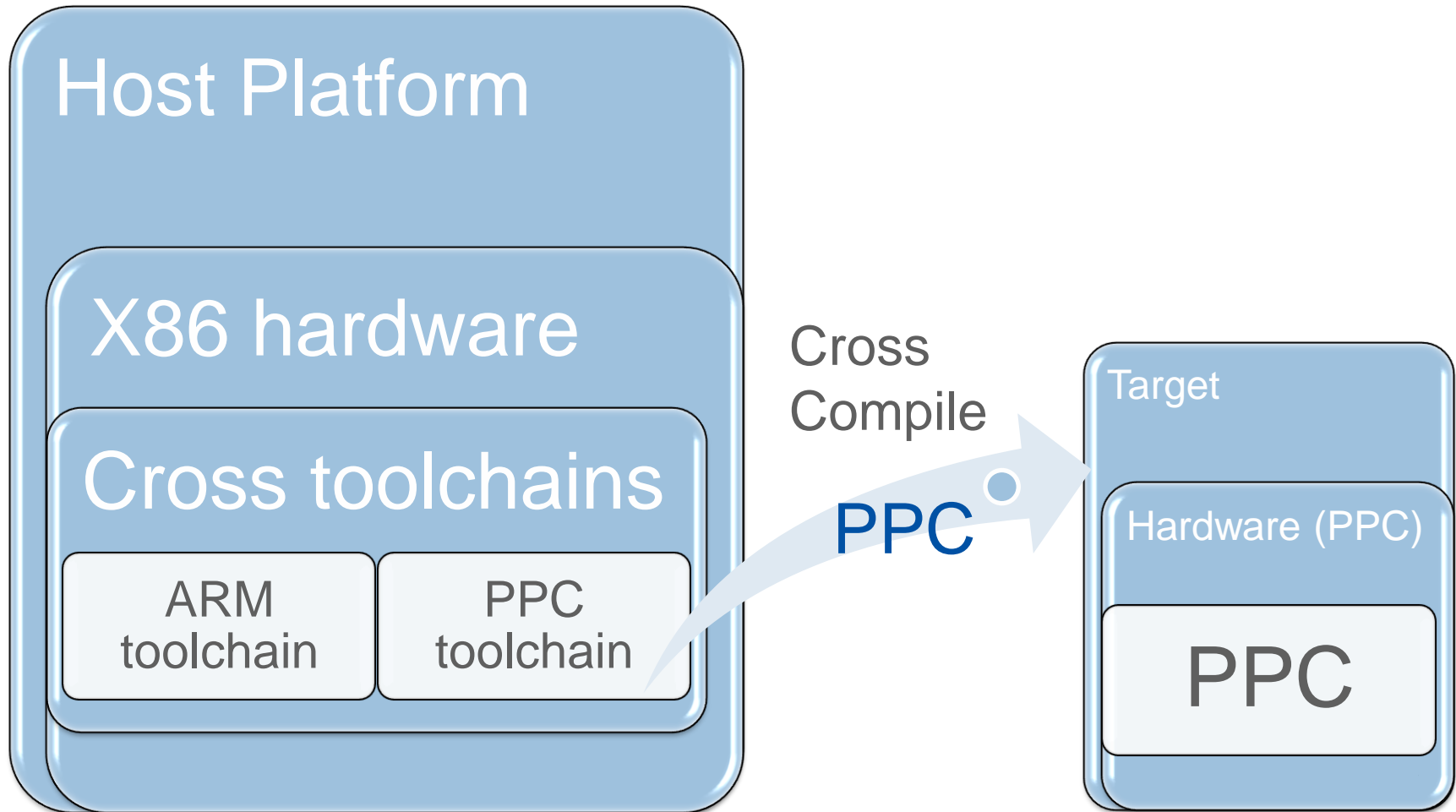
**Track: Enabling Technologies Market Segment:  
Development Tools**



Host Platform (x86)

Target (x86)

X86 toolchain



- **DWIM Button**
- **Easy selection and configuration**
- **Find and resolves package/file dependencies**
- **Optimize file system(s) for your given device**
- **Create multiple types of file systems**
- **Do all this without requiring root privilege**



- **Where are you getting your source from?**
- **How is it “wrapped” for delivery?**
- **What will the file system be used for?**
- **How will you optimize for a particular target?**
  
- **Your choices make a difference:**
  - Package manager
  - Faking root out
  - Virtualization
  - Platform image builder

- **Developing on your desktop**
  - Download package
  - Unpack (tar.gz)
  - Configure
  - Make
  - Make install
- **The further you get away, the tougher things get**
- **Problems occur**
  - Overwrite files
  - Dependencies unclear
  - You can screw up your system

# Package Managers



- **Install, uninstall, query, verify and update packages**
  - Locally, remotely
- **Includes metadata to manage it all**
- **Standard; available on most Linux systems**
- **Easy to automate**
- **Packages can be cryptographically verified**

`<name>-<version>-<release>.<arch>.rpm`

`busybox-1.2.2.1-2.0.0.P4080.rpm`

- **Command line, no graphical option**
- **Limited ability to prune files**
  - Documentation
  - Unused utilities
- **“Dependency Hell”**
  - Lack of consistency in naming and content
  - Does not solve package dependencies
- **Requires other command line tools to assist**
  - Yellowdog Updater (yum)
  - Advanced Packaging Tool (apt)
- **Root privilege required for**
  - Upgrades and installs
  - Modifying the RPM database

# Faking Root Out

- **Creates a virtual “/” file system tree within a directory on the host system, providing**
  - Fake “/” environment
  - Redefines standard functions within host system libraries
  - Changes the utilities that reference files
  - Captures privileged information about files
  - Does not require root privilege to create them
- **Can be used with standard utilities without requiring special tooling**

- Cannot solve dependencies
- Cannot execute code, for a different architecture than the host, within the target directory

```
$ whoami
joost
$ fakeroot /bin/bash
# whoami
root
# mknod hda3 b 3 1
# ls -ld hda3
brw-r--r--  1 root    root      3,   1 Jul  2 22:58 hda3
# chown joost:root hda3
# ls -ld hda3
brw-r--r--  1 joost   root      3,   1 Jul  2 22:58 hda3
# ls -ld /
drwxr-xr-x 20 root    root     1024 Jun 17 21:50 /
# chown joost:users /
# chmod a+w /
# ls -ld /
drwxrwxrwx 20 joost   users    1024 Jun 17 21:50 /
# exit
$ ls -ld /
drwxr-xr-x 20 root    root     1024 Jun 17 21:50 //
$ ls -ld hda3
-rw-r--r--  1 joost   users      0 Jul  2 22:58 hda3
```

# Virtualization

## Host Platform (x86)

Power

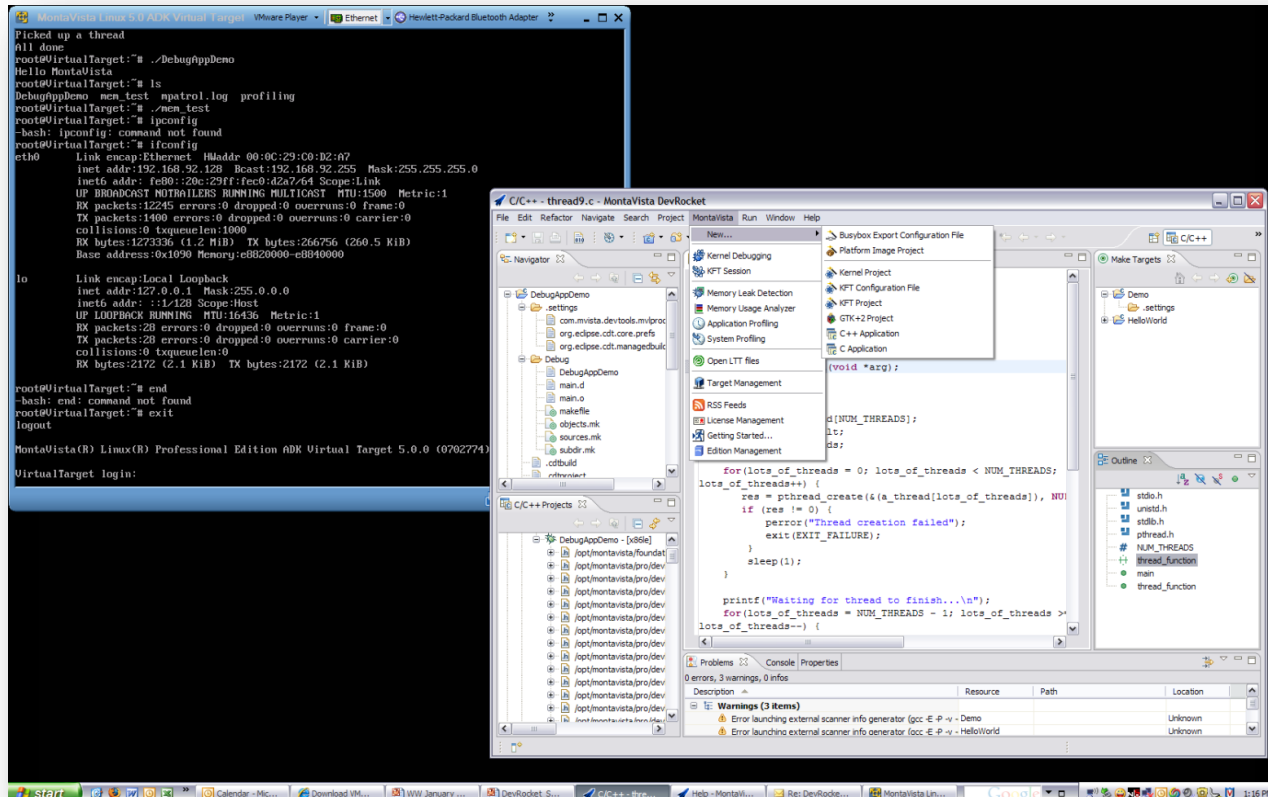
Memory

Processor

## Virtual Target (PPC)

“Guest” File System

- Faster than developing on the target itself, but adds further complexity
- Slows processor power relative to cross development
- Package dependency isn't solved





# Platform Image Builder

- **LTIB (Linux Target Image Builder)**

- Open Source (GPL) and Command Line
- Doesn't require root privilege
- Runs on Linux systems (some ppc)

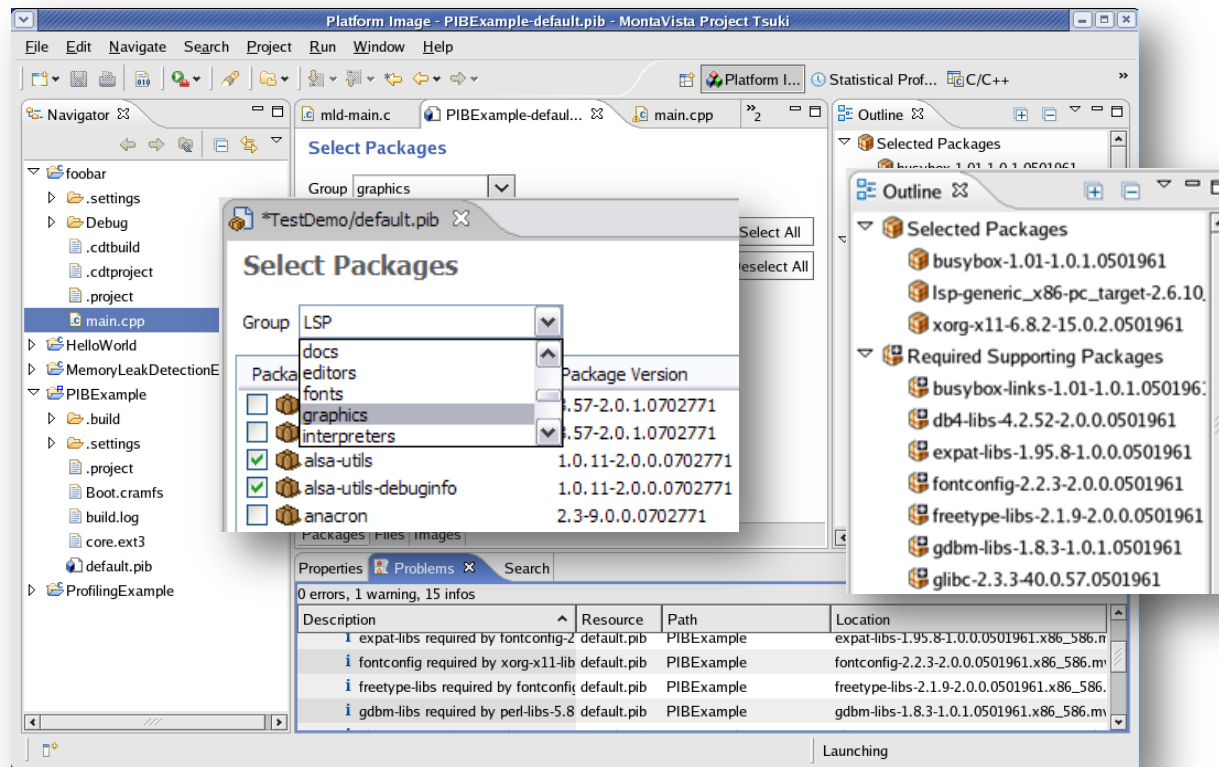
```
[*] remove man pages etc from the target image
[*] remove the /boot directory
[*] remove the /usr/src/ directory
[*] remove the /usr/include directory
() remove these directories
() remove these files[*] remove the static libraries
[*] strip any remaining binaries or libraries in the target image
```

- **Combines utilities we've discussed**
  - Fakeroot
  - Builds RPM packages and assembles them into an image
  - Support RAMDISK and JFFS2 flash image creation
- **Add/prune packages and files**
- **Used as non-root**

```
[*] apptrk binary package for powerpc
[ ] autoconf
[ ] automake
[*] Include C library
(base_libs) C library package
[ ] Include libc locale files ?
[ ] Include header files from toolchain ?
[ ] Include static libc libraries ?
[ ] alsa-lib
[ ] alsa-utils
[ ] bash
[ ] bind
[ ] binutils
[ ] bison
[*] boa
[ ] bonnie++
[*] busybox
(busybox.config) busybox preconfig filename
[ ] Configure busybox at build time
[ ] bzip2
```

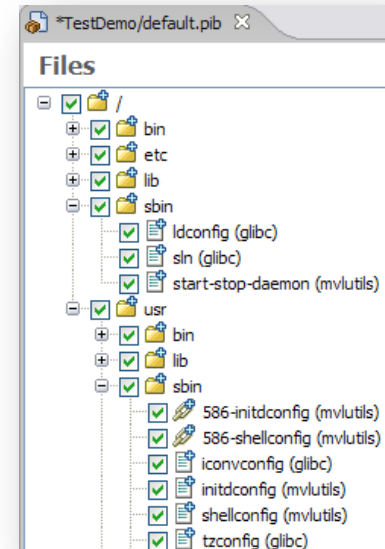
- **Platform Image Builder**

- Windows and Linux host, Eclipse plug-in
- Build and optimize runtime file systems
- Specialized for adding/pruning Linux packages



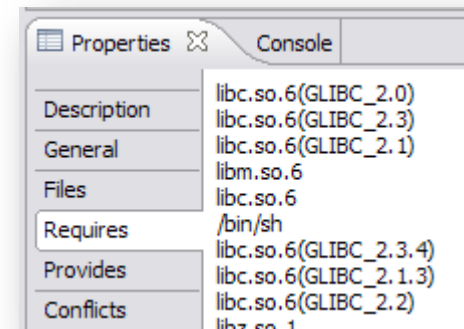
- **Prune directories and files**

- Keep what you want
- Delete what you don't

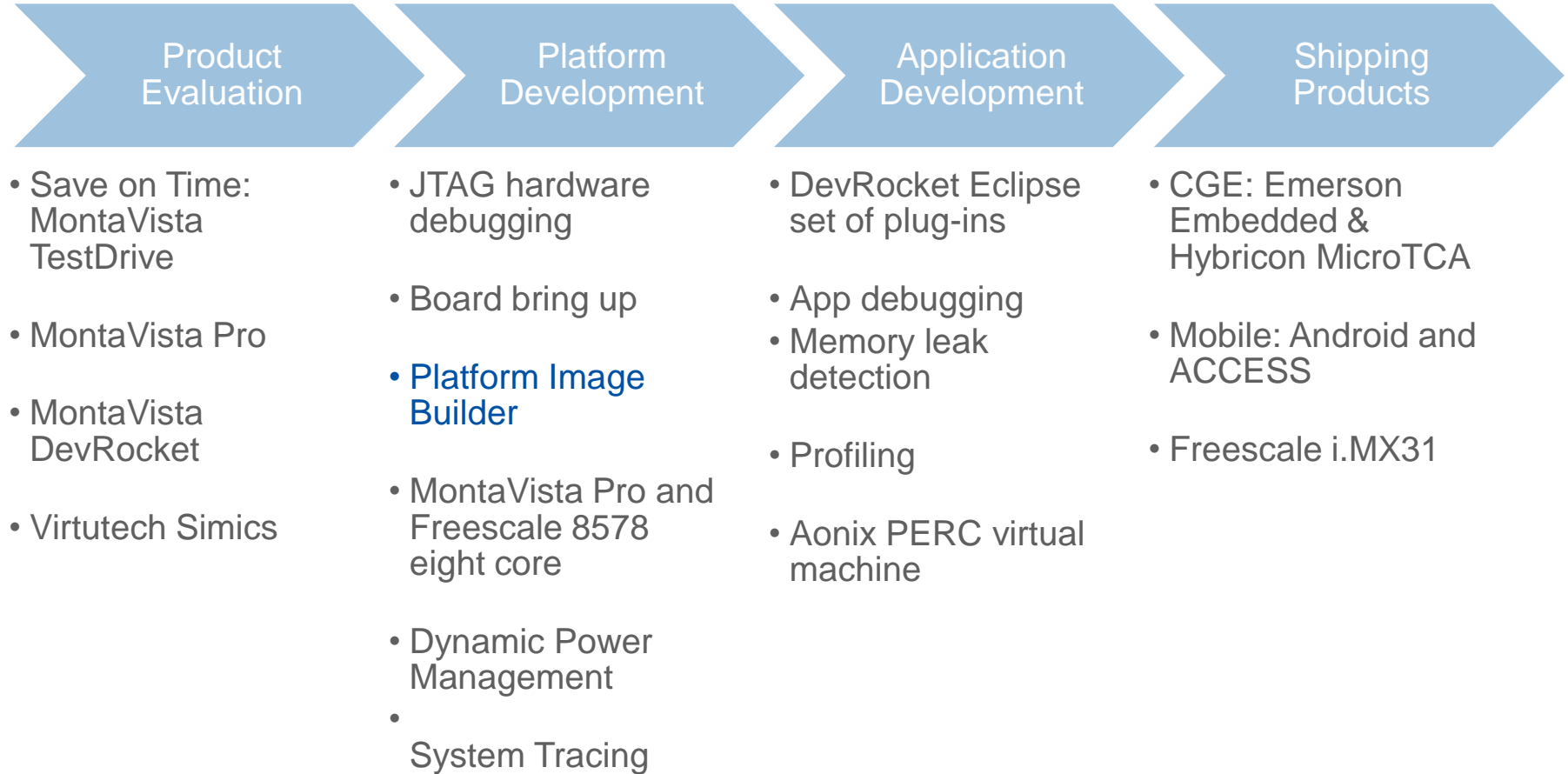


- **Detailed package information**

- Files included
- Required packages
- Conflicts



## • Embedded Linux lifecycle development



- **Reducing Boot Time - Techniques for Fast Booting**
  - Who: Chris Hallinan, MontaVista FAE and author of *Embedded Linux Primer*
  - When: Wednesday @ 10:45 AM
  - Where: RC Ballroom Salon II (AE206)
- **Save Valuable Battery Life with Linux® Power Management**
  - Who: Brad Dixon, MontaVista FAE
  - When: Wednesday 5:00 PM
  - Where: Tuscany A (AM201)



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