

PHILIPS

MythTV on Nexperia



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Philips Semiconductors
CTO/ST&A

Advanced Systems Labs

- Focussed on Cross Platform Communications
 - Connecting home, mobile and automotive
 - Building the interoperability network on PS platforms
 - Prototyping the “Connected Consumer” on top of the latest Nexperia solutions
 - We will deliver our results incrementally through prototyped systems based on Linux

MythTV on Nexperia

- MythTV
 - What & Why
 - Functionality
 - Features & Functions
 - Components
- Open Source
 - Way of working
 - Why Open Source on Nexperia
- MythTV on Nexperia
 - Architecture
 - Modifications
 - Compilation
 - Toolchain
- Results & Conclusion

MythTV – What & why

- Media Center on LinuxPC
- "MythTV is a GPL licensed suite of programs that allow you to build the mythical home media convergence box on your own using Open Source software and operating systems" (Isaac Richards, 2002)
- Convergence PC and CE worlds
 - TV related info available on the internet
 - Program guide information
 - Internet Movie Database
 - PC hardware suited for A/V applications
 - Large hard disks to store recordings
 - Tuners available in PC's

MythTV – Functionality

- MediaCenter applications:
 - Personal Video Recorder
 - Hard disk
 - Time shift
 - User interaction via Remote control
 - Networked / distributed application
 - View anywhere in network
 - Photo album



EPG

WWW

Home network

MythTV – Main menu: Focus on PVR



MythTV – Electronic Program Guide



Enterprise

10:04 pm

"Cogenitor"
Recording Once

The Enterprise crew encounters an alien species that relies on a third gender for its mating ritual.

| | Wed | 8:00 pm | 8:30 pm | 9:00 pm | 9:30 pm |
|--|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------|-----------------------------|---------|
| | 73 TRAV | Top Ten Predators Up Close (Special) | | World Poker Tour (Travel) > | |
| |  3 WKYC | America's Most Talented Kid (Reality) | | The West Wing (Drama) | |
| |  4 WUAB | Enterprise (SciFi)  | | The Twilight Zone (SciFi) | |
| | 5 WEWS | My Wife and Kids () | George Lopez () | The Bachelor (Reality) | |
| |  6 DISN | Rip Girls (Drama) | | | |

MythTV – Playback Recordings Menu

Select a recording to view:

That '70s Show

The Agency

All Programs

CSI: Miami

Frank Herbert's Children of D...

Still Standing

| | | |
|------------------------------------|------|----------|
| The Agency - "Spy Finance" | 4/12 | 10:00 pm |
| That '70s Show - "No Quarter" | 4/2 | 8:00 pm |
| Frank Herbert's Children of D... | 3/19 | 1:00 am |
| Frank Herbert's Children of D... | 3/18 | 1:00 am |
| Frank Herbert's Children of D... | 3/17 | 1:00 am |
| CSI: Miami - "Dispo Day" | 3/10 | 10:00 pm |
| Still Standing - "Still Excelling" | 3/10 | 9:30 pm |
| That '70s Show - "Your Tim... | 1/29 | 8:00 pm |
| CSI: Miami - "Ashes to Ashes" | 1/13 | 10:00 pm |

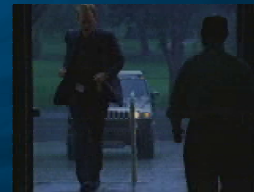
The Agency

"Spy Finance"

Airdate: Sat Apr 12, 10:00 pm - 11:00 pm

Channel: 7


Description: Gage and Quinn must deal with an organized crime leader involved with an al-Qaida cell.



MythTV – Features & Functions

- Distributed architecture (Client / Server)
- Supports MPEG2
 - Analog source: tuner / encoder card
 - Digital source: DVB-S or DVB-T
- Use Internet for EPG
- Use DVB program information (EIT) for EPG
- Supports plug-ins, for example:
 - MythGallery photo album
 - MythWeather weather forecast from the Internet
- PC application
- Based on Linux
- Most processing done by the Pentium, but:
 - Support for MPEG2 decode hardware accelerators
 - Can also run on a slow PC
- Source code available

MythTV on Nexperia

- The Advanced Systems Lab has already demonstrated similar functionality on Nexperia
- MythTV is typical for a future CE application the Nexperia home chips are intended for
- My challenge: 
- Either it works
 - Opportunities...
- Or not
 - Feedback results to the business

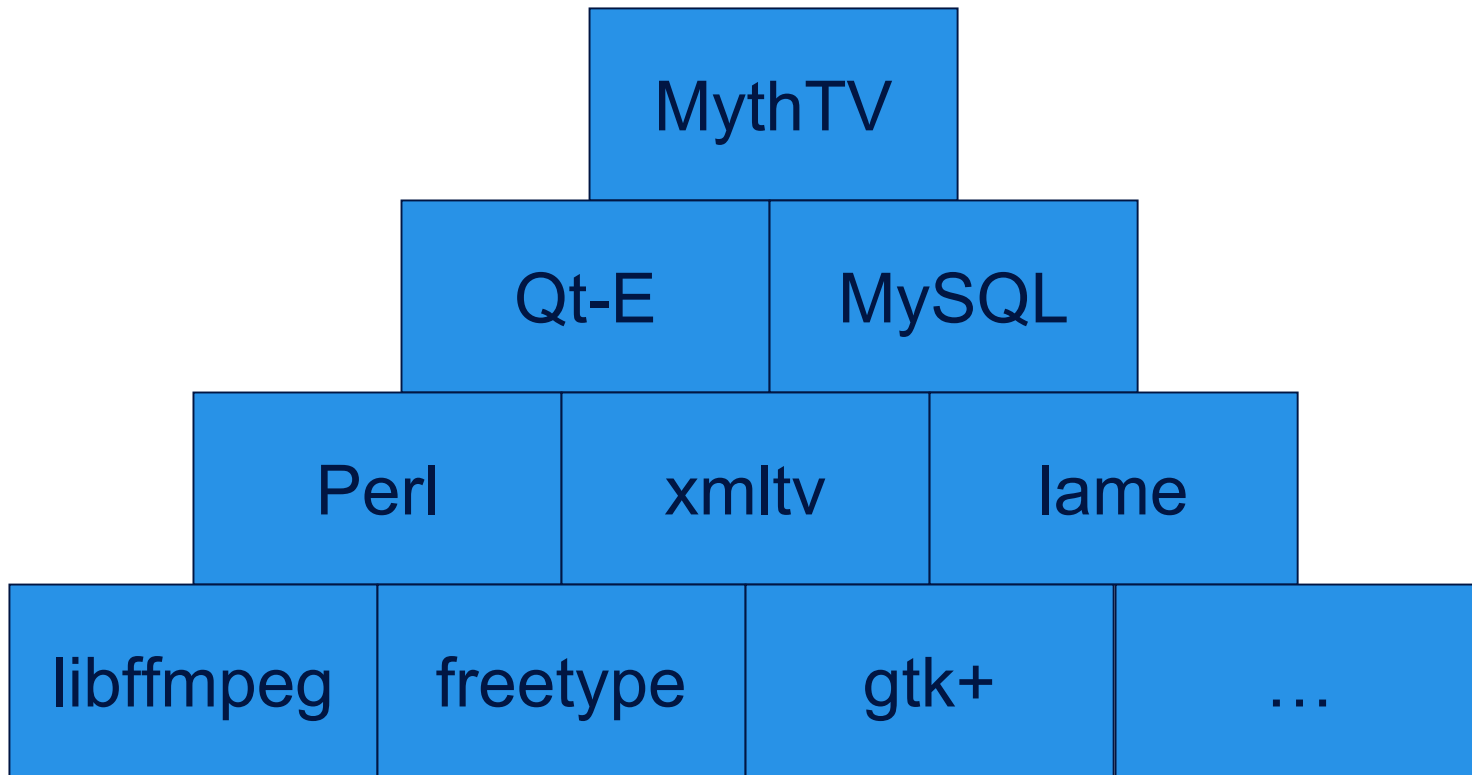
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Way of working

- Open source
 - MythTV is now an Internet-based collaborative effort
 - Many contribute to the project, based on their need and / or expertise
 - Based on Linux
 - Source code available via dedicated website
 - Lots of re-use:
 - Built "on top of" existing open source packages
 - GPL license

MythTV - Components



... and many more ... (pango, netpbm, atk, zlib, glib, gettext, gnupg, pkgconfig, automake, autoconfig, fontconfig, etc.)

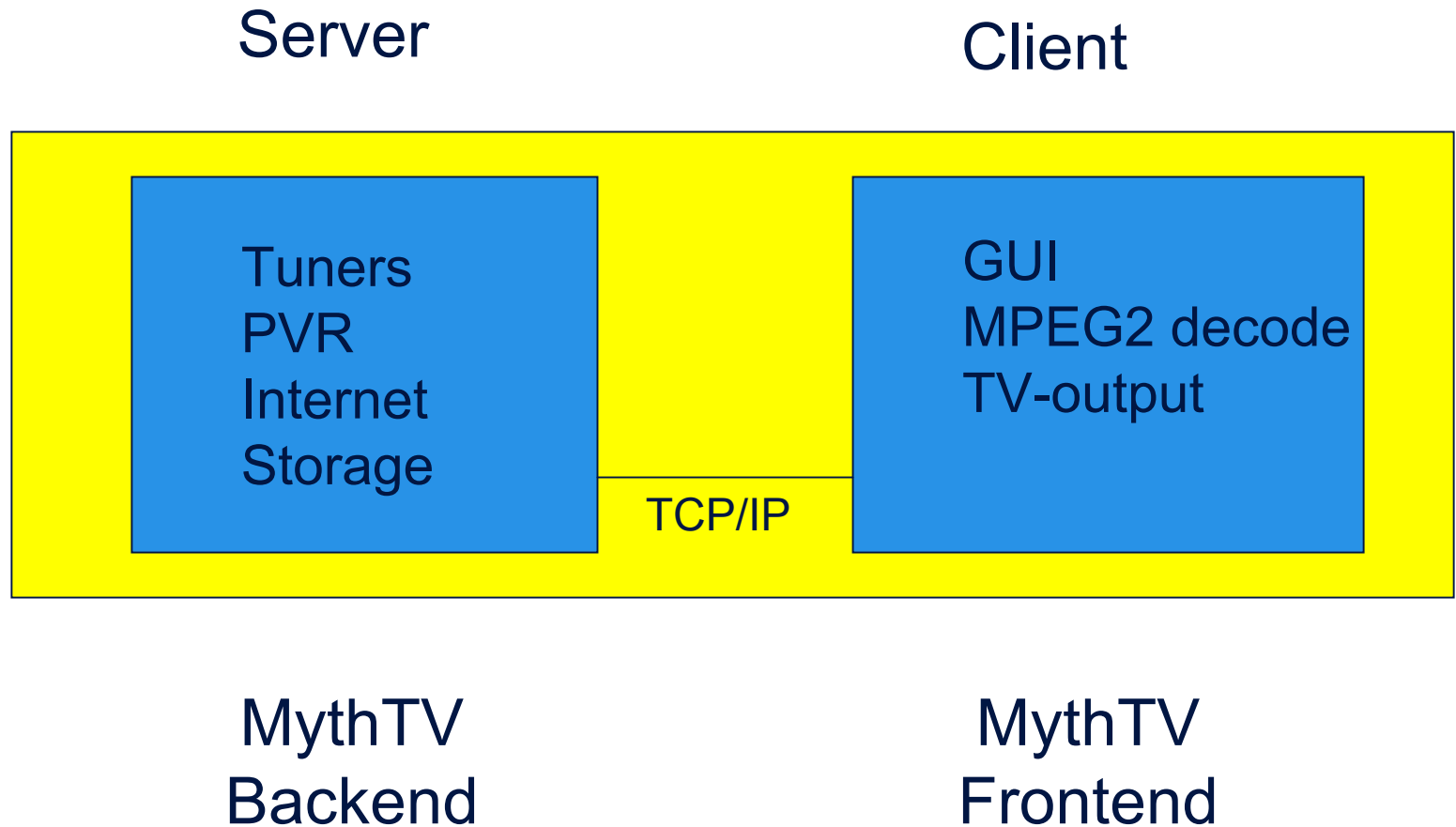
Why Open Source on Nexperia

- Very much open source software available
- PS cannot write all possible software themselves
- Even if we could it takes time.....and costs money...
- With open source software we can:
 - Test feasibility of our platforms for these applications
 - Demonstrate product ideas
 - Show to ISV's the capabilities of our platforms
- For products we can:
 - Write the software ourselves
 - Buy software of ISV's
 - Sort out the IPR issues and use open source software

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MythTV – Client/Server or Frontend/Backend ?



The Nexperia pnx8550

- Is called "Programmable Source Decoder"...
- Designed for Digital TV
 - MIPS for GUI and control
 - Hardware for:
 - MPEG2 decode
 - Image improvement
 - TriMedia's for:
 - AV streaming
 - Software codecs
 -
- The Question:
 - Can pnx8550 also run "tomorrow's software" i.e. MythTV?

MythTV - Map to Nexperia - backend (server)

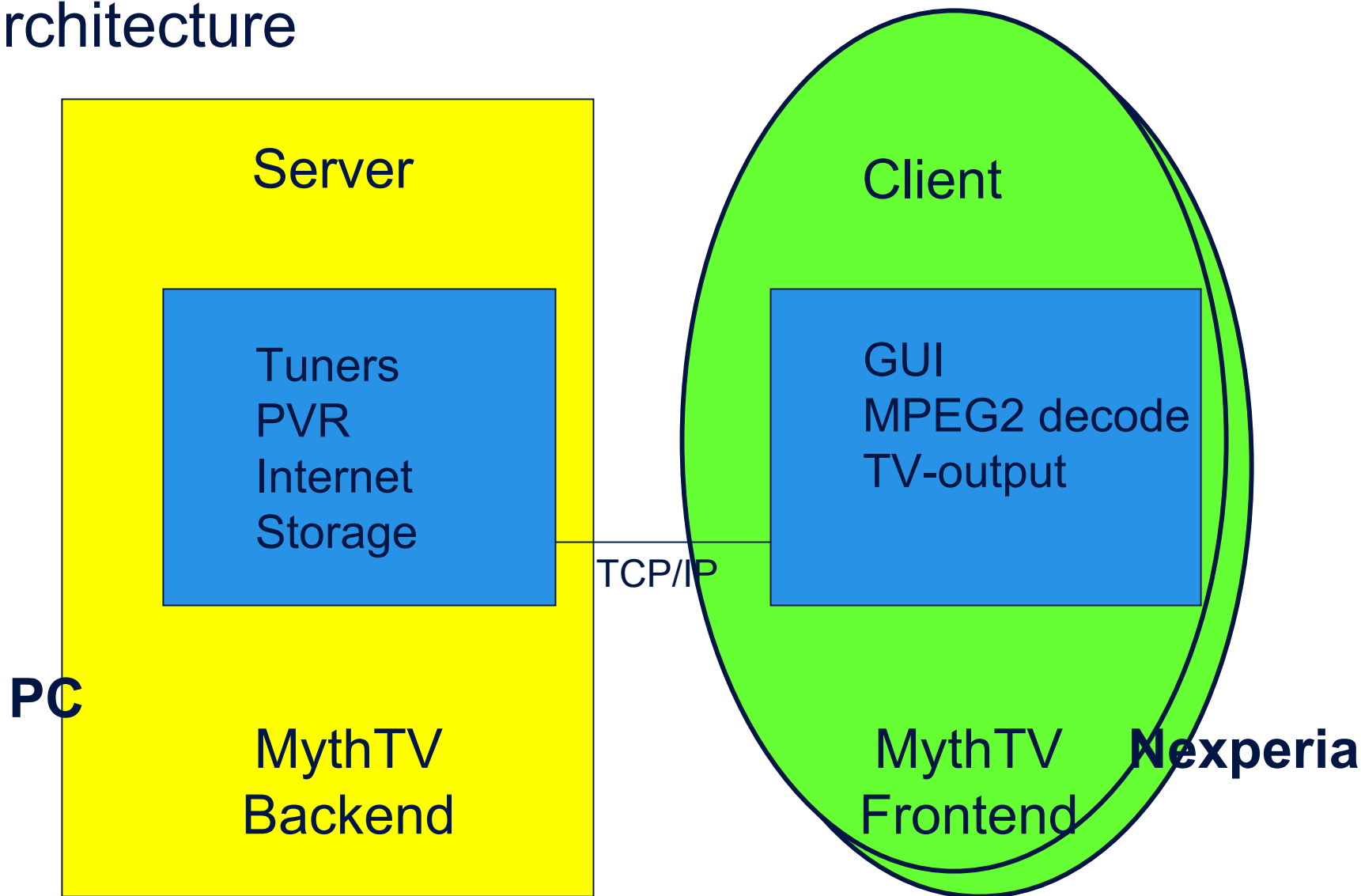
- MythTV-backend ("server"):
 - Needs only "general purpose" computing
 - To store programs on hard disk
 - Transmit programs on the network
 - Uses tuners that produce MPEG2:
 - Analog tuner cards with MPEG2 hardware encoders
 - DVB-T or DVB-S is already MPEG2
 - MPEG2 section filtering supported in hardware
 - Unused "chip real-estate":
 - MPEG2 audio/video decoding not used
 - Image enhancement functions not used
 - TriMedia's not used

→ Nexperia pnx8550 not optimal for MythTV-backend

MythTV - Map to Nexperia - frontend (client)

- MythTV-frontend ("client"):
 - Requirements similar to Digital TV or STB:
 - Run the Graphical User Interface
 - MPEG2 audio/video decoding
 - Image enhancement
 - Difference is:
 - Ethernet connection instead of a tuner
- ➔ Nexperia pnx8550 well suited for MythTV-frontend

MythTV on Nexperia – Client / server architecture



MythTV on Nexperia – Modifications

- Modifying MythTV:
 - Problem:
 - MPEG2 audio/video decoding on TriMedia
- Solution:
 - Philips Research knows a lot about MythTV
 - Use of LinuxPC with TM1300 "Kenobi" card
 - Use of "Luddite" gives identical software development environment
 - Philips Research added "Kenobi" driver to MythTV

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MythTV on Nexperia – Compilation

- Starting conditions:
 - Linux distribution available
 - Typical "embedded" distribution: very limited number of open source packages
 - Cross-compilation development environment
- The work:
 - Compile all required open source packages:
 - MythTV, MySQL, Qt-Embedded, pango, gtk+, lame, netpbm, xmltv, atk, zlib, glib, gettext, gnupg, pkgconfig, automake, autoconfig, freetype, fontconfig,

Cross-compilation blues

Problem: open-source software not written for cross-compilation

Example of automatic configuration:

The “configure” script wants to find out the size of an “int”

This is done by:

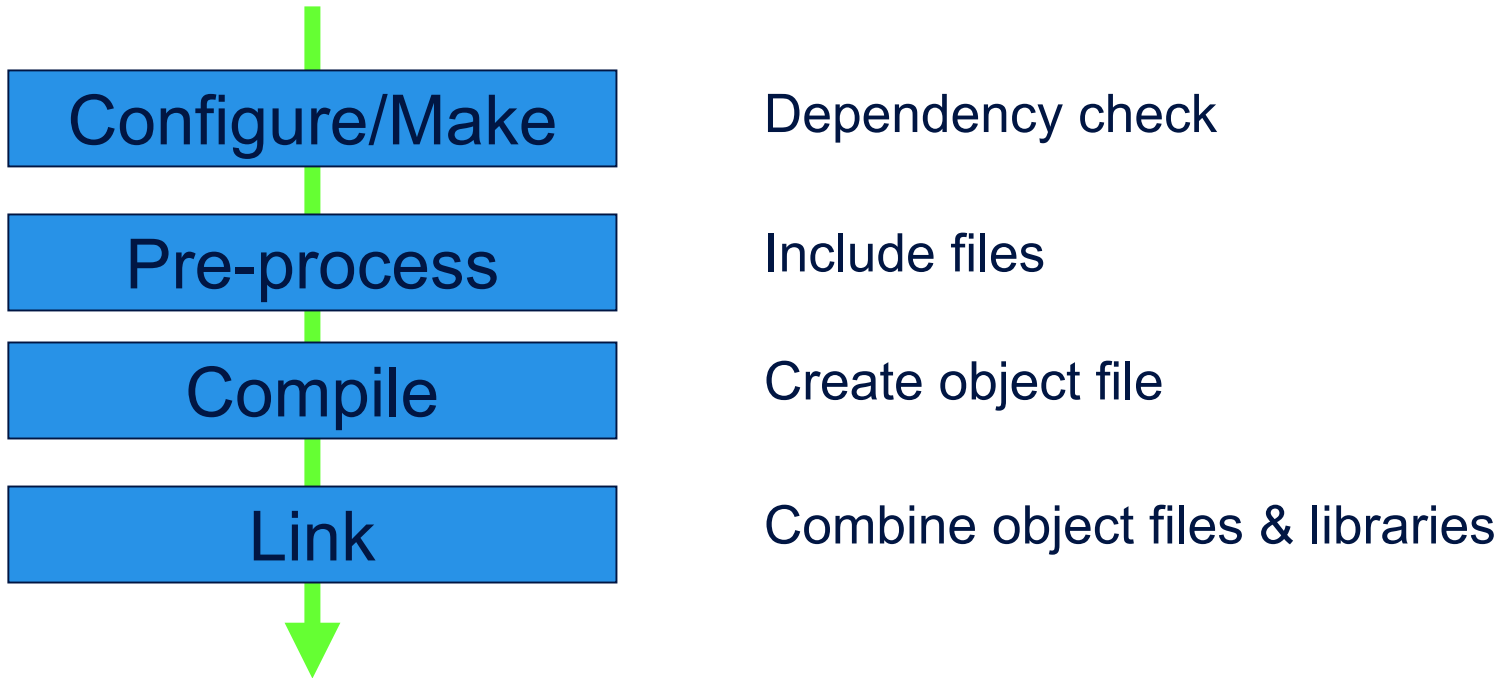
- Creating small “C” program that prints out the size of an “int”
- Compiling this program
- Running this program
- Use the output of the program in the rest of the script

This fails horribly!!

Other cross-compilation problems:

- Use of header files and libraries from your LinuxPC
 - Also Linux, but slightly different...
- Use of native PC tools (cc, ar, ld, strip etc) instead of the cross-compilation tools

Compilation Overview



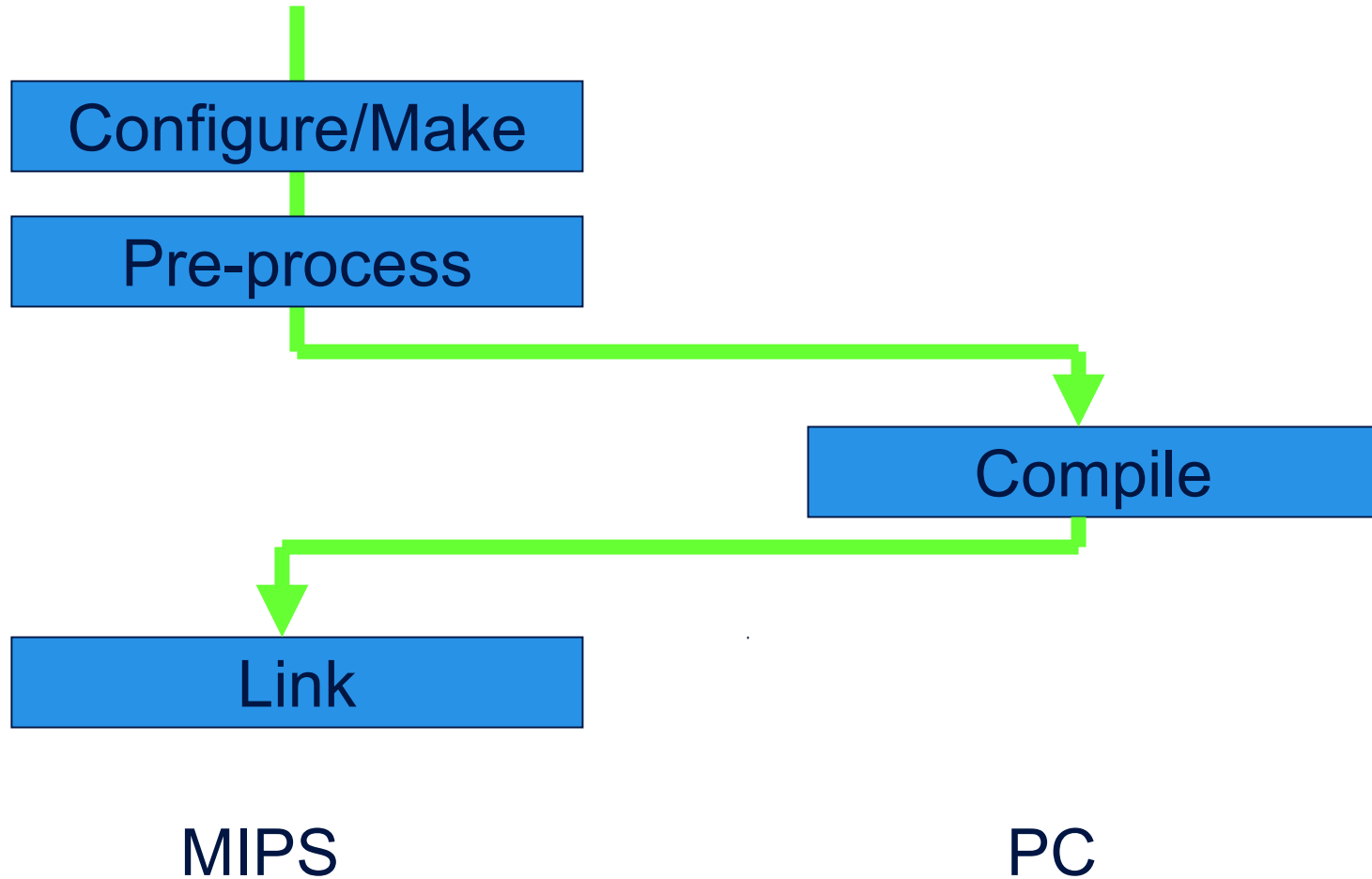
Linux on PC: Native compilation on X86PC for X86PC (fast)

Embedded: Cross-compilation on X86PC for MIPS (fast)

Linux on MIPS: Native compilation on MIPS for MIPS (slow)



Compilation with "distcc"



Compilation for MIPS with “distcc”

Requires:

- Capability to run native compiler on MIPS
- Identical native and cross compilers:
 - compiler version
 - libc version
 - binutils version
 - Generated from the same source

Result:

- Can compile anything on MIPS that compiles on PC
- Without Makefile modifications!
- A bit slower than native on PC
- Much faster than native on MIPS

MythTV on Nexperia – Toolchain Troubles

Problem: using the Qt-Embedded shared library

- All applications linked against the Qt-Embedded shared library do crash with a “segmentation fault”.

Investigation showed:

- Problem is related to number of functions in library
- Problem reproducible with “hello world” application
- Problem depends on version of toolchain used to build the shared library!
- Toolchain is built from packages gcc, libc and binutils
- Toolchain built with binutils-2.14 is OK
- Toolchain built with binutils-2.15 fails

Toolchain Troubles (2)

How to get this fixed: three approaches

1. Do It Yourself:

- I did try (but it was too difficult for me...)

2. Vendor Support

- “We do not support the pnx8525, only the pnx8550”
- “We do not support the pnx8550, not validated yet”
- “It has to be reproduced on a MIPS Malta 4Kec”

3. Report this to the Open Source

- http://sourceware.org/bugzilla/show_bug.cgi?id=660
- Never heard anything....

My workaround:

- One toolchain compiles Qt-Embedded (but not the rest)
- Another toolchain compiles the rest

Toolchain Troubles (3)

Conclusions:

1. Bugs in MIPS toolchains do not get fixed by themselves
2. For problems like this you need either:
 - Support from third parties, or:
 - Build the competence yourself
3. Vendor Support:
 - Get support for the chip you actually use...

Results & Conclusion (1)

MythTV-Frontend (client) runs on Nexperia!!

- Demonstrated at CRE 2005:
 - Live TV (incoming MPEG2 via Ethernet)
 - Play TV from hard disk recording
 - MythTV photo album application
- Can play MPEG2-HD streams
 - From MythTV-backend on PC
 - From MythTV-backend on the same box
- Shown at CES 2006 in the Philips CE “Home Gateway” demo
- Subjective performance:
 - TV and GUI performs OK
 - UI not much slower than with low-end VIA X86
 - Switching from UI to TV takes a long time

Results & Conclusion (2)

- Photo album JPEG decoding very slow on MIPS
 - better in hardware or on TriMedia!
- MythTV-Frontend needs 64MByte main memory
- Linux virtual memory makes it possible to run it:
 - On pnx8550 with only 48 MByte for Linux/MIPS
- Would like to have at least 128MByte for Linux/MIPS to run MythTV and the MythTV plug-ins

Acknowledgements

- Frank van Tuijl & Ad Denissen, PRLE
- "Open Media Center" development team, PRLE
- Peter Kourzanov, PRLE
- Tim Everett, AppTech

DEMO

...yesterday afternoon...

