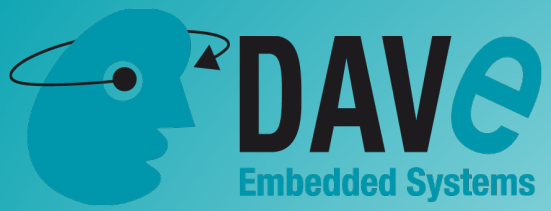

Linux Day 2014
Sviluppare con Linux Embedded

RELATORE: Andrea Scian
andrea.scian@dave.eu

DATA: 25 Ottobre 2014

Chi vi parla

Biografia

Perito informatico all'ITIS Kennedy (PN, 1998)
Laureto in Ingegneria Informatica a Padova (2003)
Tesi sull'utilizzo di Java nel mondo Linux Embedded (ARM7, 16MB RAM, 4MB NOR Flash)
Sviluppo software per Linux (e non solo) Embedded (e non solo) dal 2003

Ora responsabile degli sviluppi software e responsabile IT c/o DAVE Embedded System
Appassionato del mondo Linux e FLOSS
Socio PNLUG

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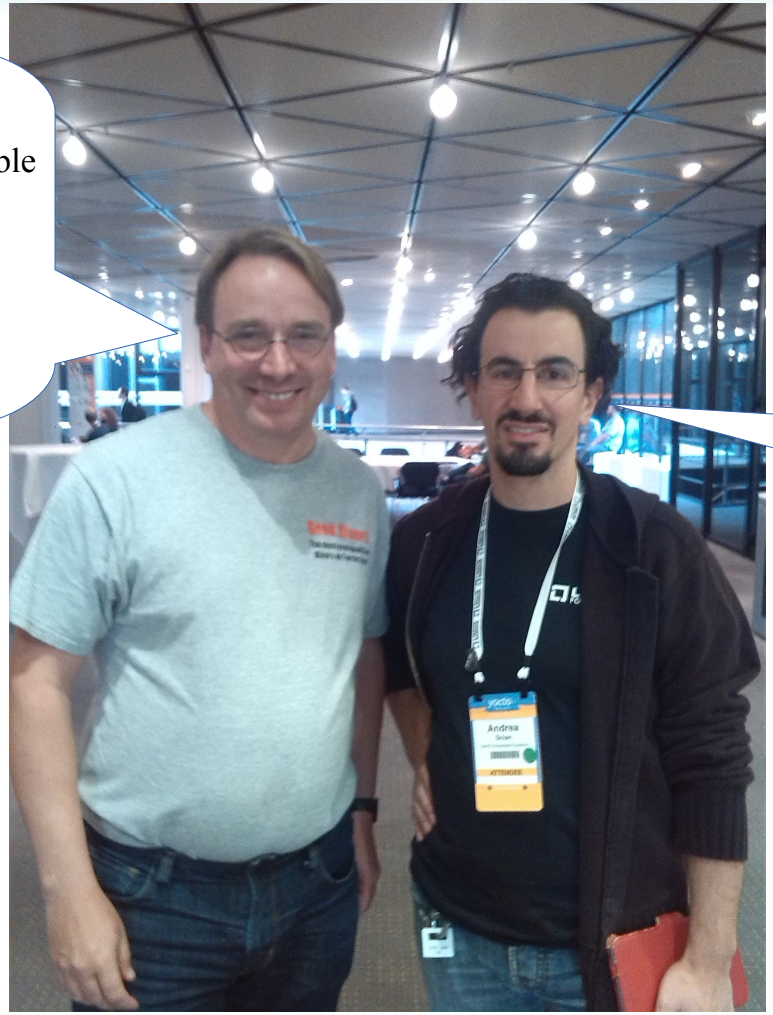
Con un certo tipo di conoscenze...

I still really despise the absolute incredible sh*t that is non-discoverable buses, and I hope that ARM SoC hardware designers all die in some incredibly painful accident.



I totally agree with you, Linus (I'm a software guy)

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Keyword

Realtime

Terminal Emulator

i.MX6

Root file system

Linux Embedded

JTAG

TFTP

Bridged Network

CortexA9-MPCore

Cross-Toolchain

GIT

SSH/SFTP

GDB

AMP

Yocto

Virtual Machine

NFS

Eclipse IDE

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Agenda

- Linux Embedded
  - Cos'e'?
  - Componenti Software (target e sistema di sviluppo)
- Yocto Project
  - Breve introduzione e build/debug applicativo userspace

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Sistema Embedded: cos'e'?

- General purpose vs embedded
- Ha un compito predefinito gia' durante la progettazione
- SOC non x86
- Consumi, dimensioni, costo, range temperatura, immunita' ai disturbi, durata, reperibilita'....

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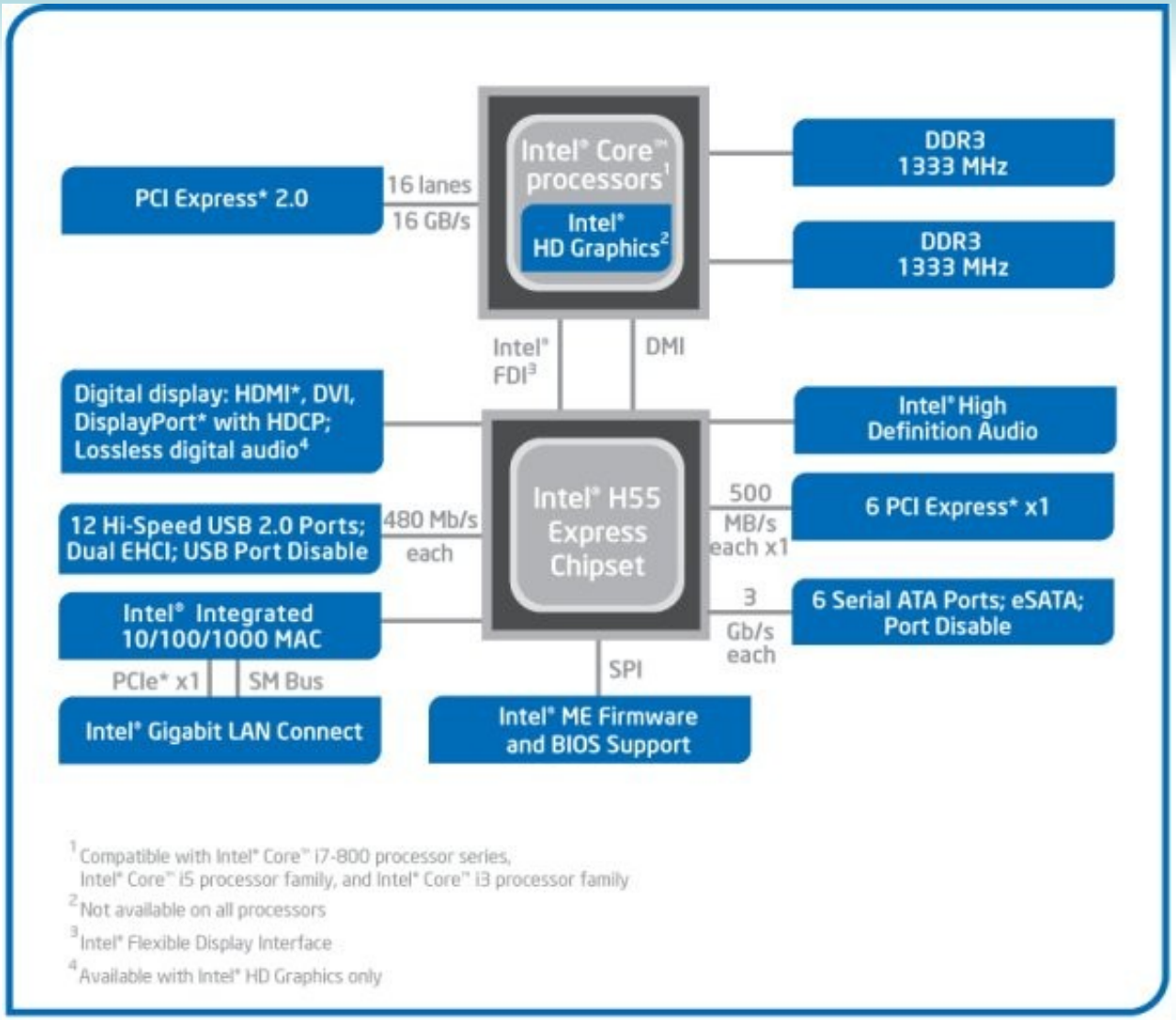
Cosa NON e' un SOC



Intel® H55 Express Chipset Platform Block Diagram

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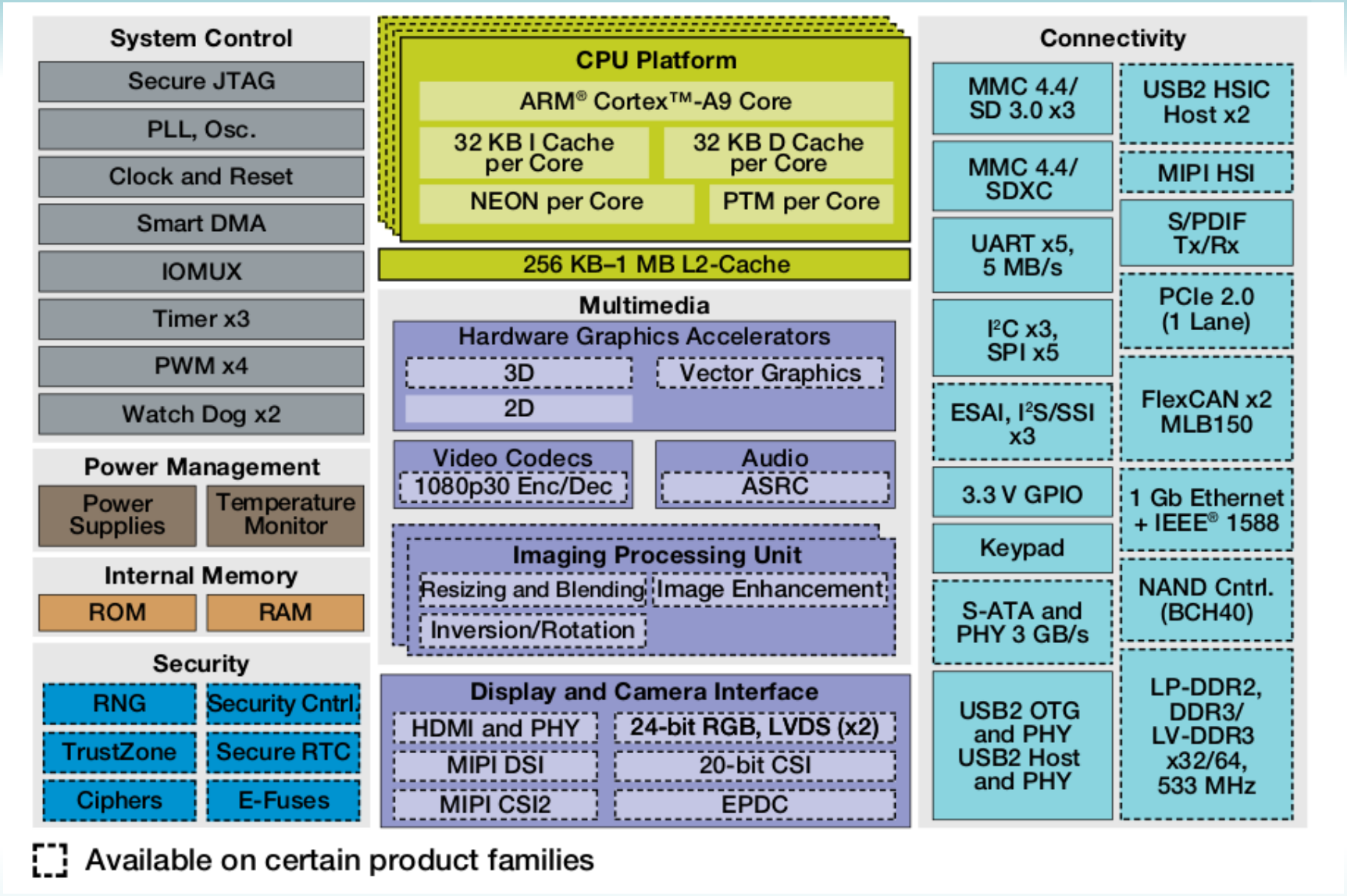
Cosa e' un SOC



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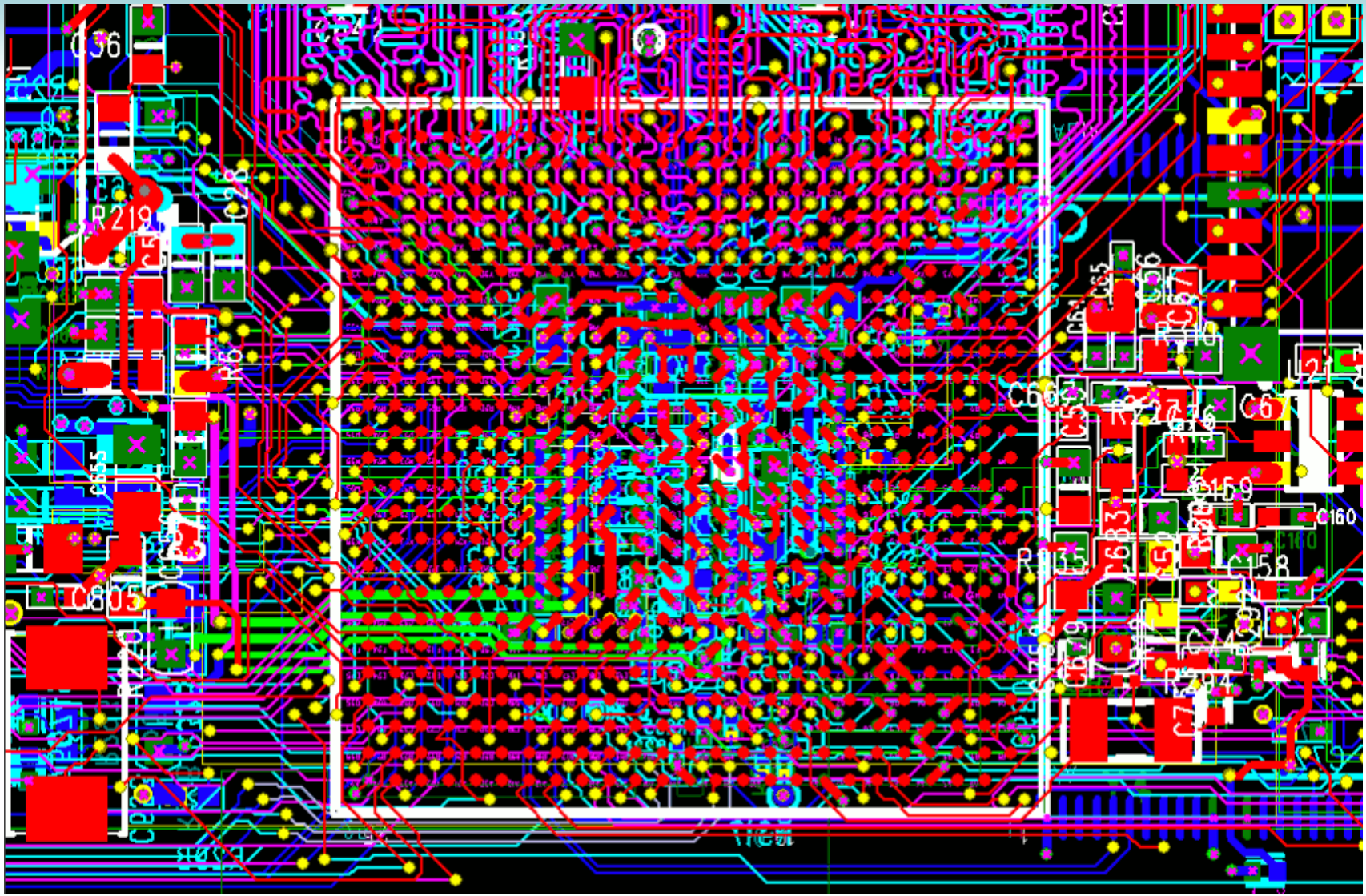
624 BGA



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Linux Embedded

- Embedded Linux: utilizzo di Linux in sistemi embedded
  - Vantaggi: qualita', riuso del software, community, controllo (OSS)
  - Svantaggi: OS complesso, setup ambiente di sviluppo, mancanza di uniformita'

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Componenti Software

- ROM (fuso nel SOC)
- Bootloader (U-Boot)
  - Inizializzazione di base (DDRx, PLL, GPIO)
  - Preleva il kernel (NOR/NAND/TFTP) e gli cede il controllo
- Kernel (vendor dependent)
  - Scheduler, gestione memoria, device drivers ecc
- Filesystem
  - Contiene tutti gli applicativi/file di configurazione ecc
  - NON è possibile farne a meno!
  - Ramdisk, NOR/NAND, SSD, HDD
  - Ext2-3-4, JFFS2/UBIFS, F2FS, ROMFS, NFS

Componenti Software (devel)

- Text Editor
- (Cross) Toolchain
- Debugger
  - Gdb/Gdbserver, JTAG
- IDE (Eclipse)
- Sistema di build (DIY, Buildroot, Yocto, Android)
- Ethernet/Seriale
- **TFTPD, NFSD**, [Samba, SSH]
- **Linux based workstation**

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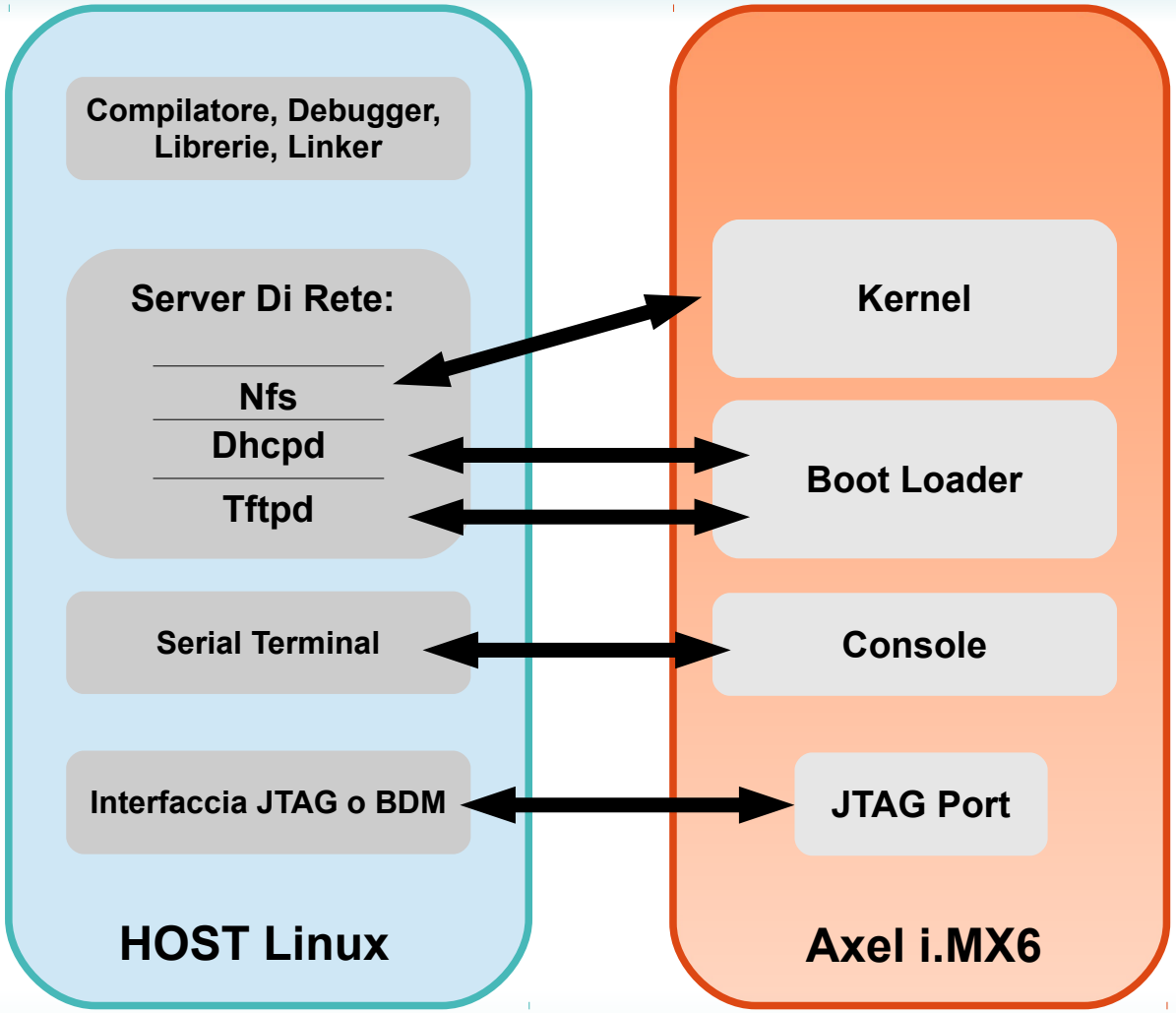
Ambiente di sviluppo tipico



Set up del sistema di sviluppo

- Una lunga lista di attività necessarie prima di poter essere operativi...

Installare la distribuzione Linux raccomandata dal silicon vendor (per non incorrere in problemi di compatibilità)

Installare tutti i pacchetti software richiesti (tool, utility, librerie, ...)

Installare la cross-toolchain

Installare e configurare i servizi di rete (tftp, dhcp, NFS, ..)

Scaricare i tree dei sorgenti

Configurare le variabili di ambiente

....

- ... che richiede tempo, competenze e risorse.

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DVDK - DAVE Virtual Development Kit

- Cos'è?
  - VM Virtual Box con il development kit pre-installato
  - Setup mimino (networking)
  - Utilizzo da Windows/OSX/Linux (indipendenza dalla distribuzione/setup)
  - Obiettivo: minimizzare gli sforzi del cliente per il setup dell'ambiente di sviluppo
- Git preconfigurato per aggiornamenti → trasferimenti in rete ridotti

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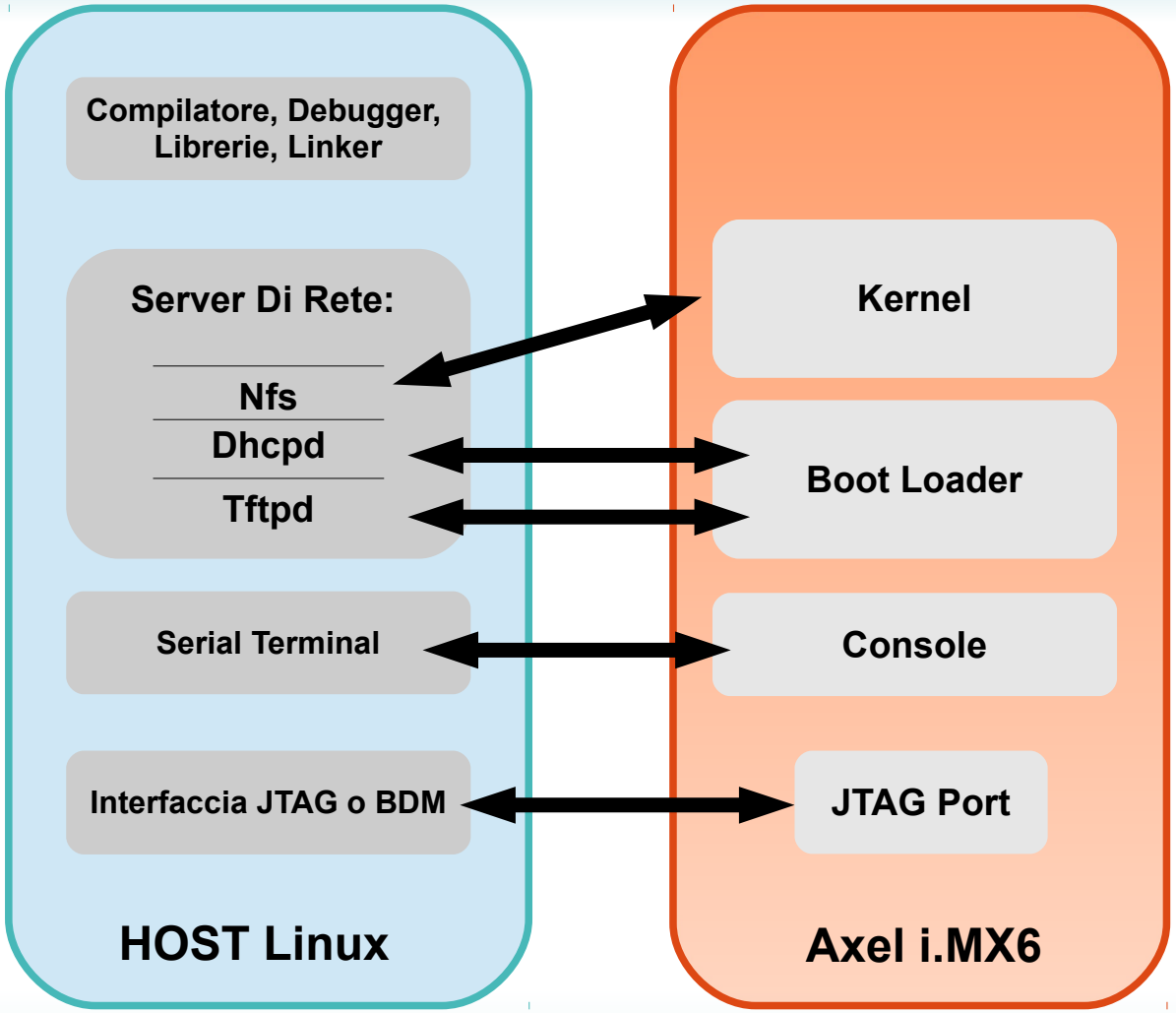
Senza DVDK



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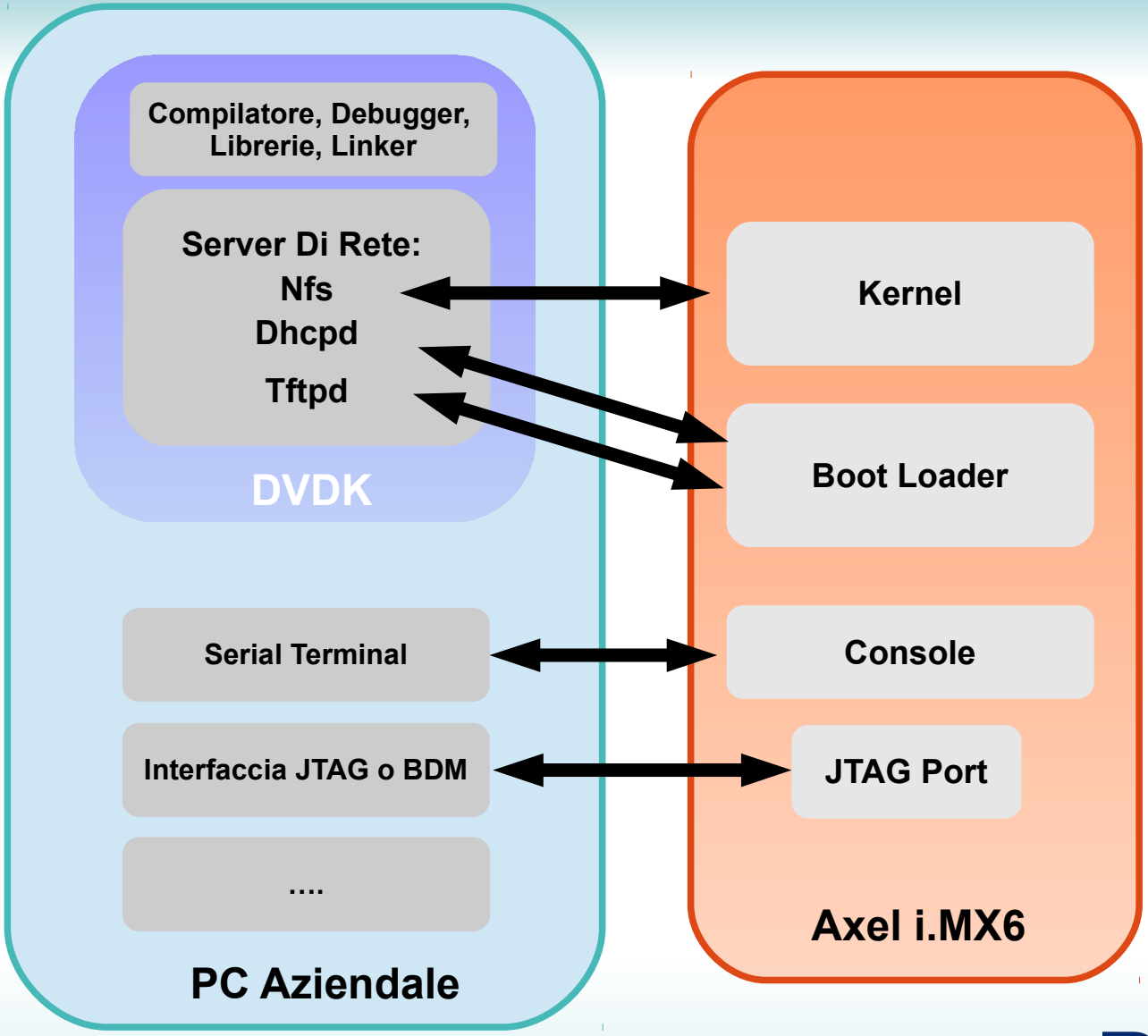
Ambiente di sviluppo DVDK



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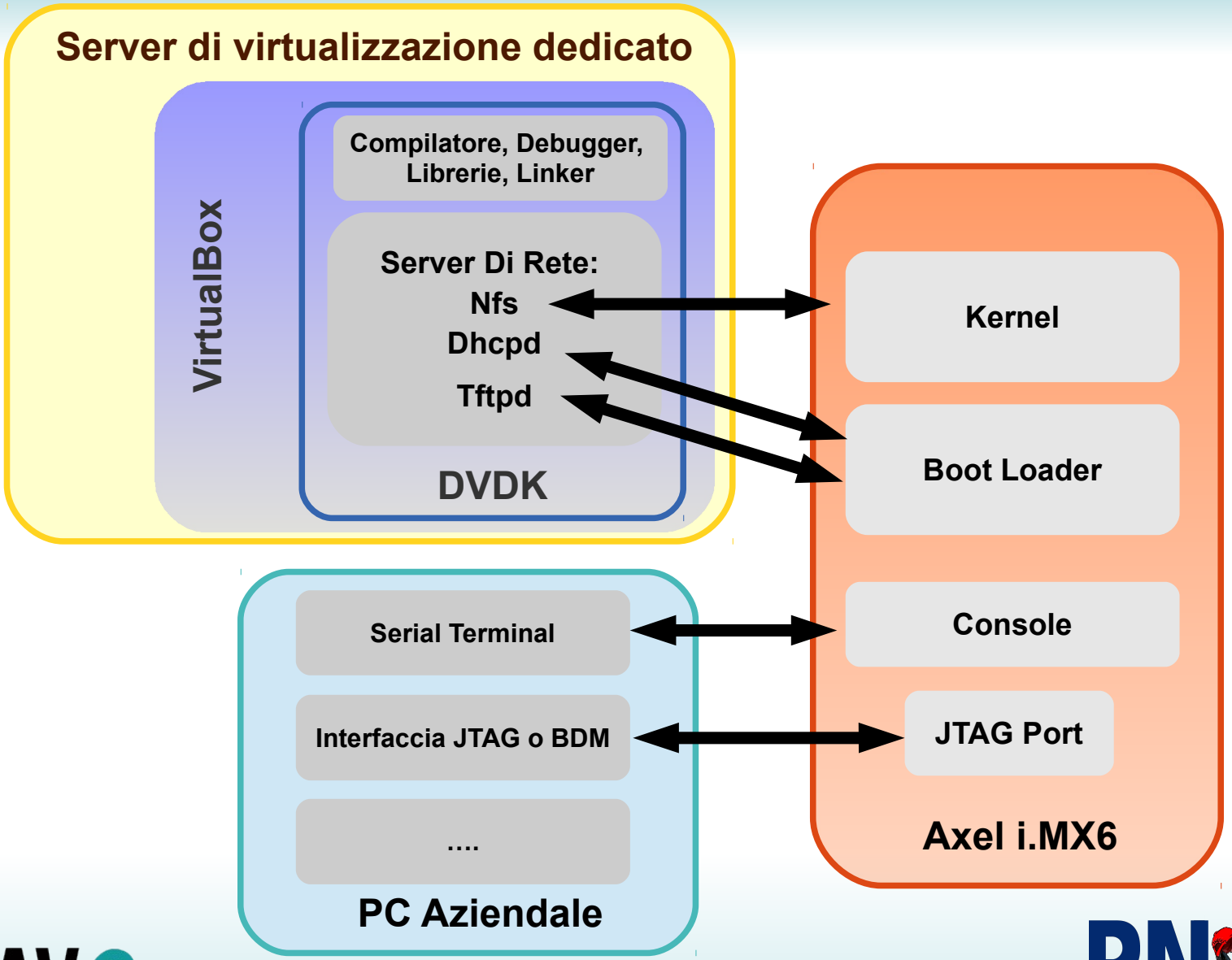
Ambiente di sviluppo DVDK (avanzato)



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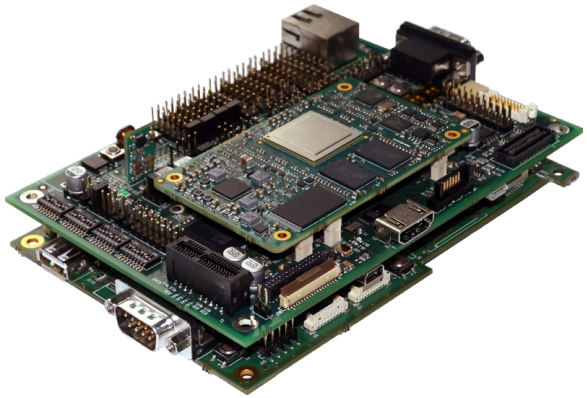
DVDK Live Demo

- *"Installazione"*
- Configurazione di Rete
- Build kernel
- Boot della board via TFTP + NFS



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DVDK Live Demo: Networking

- DVDK (server tftp+nfs)
  - 192.168.0.78/24
  - Non e' possibile usare il NAT → Bridge
- AxelUltra (client)
  - 192.168.0.77/24
  - Kernel axel/xelk/1.1.0/uImage
  - RFS /home/dvdk/xelk/rfs/yocto
  - Bootcmd: run net_nfs

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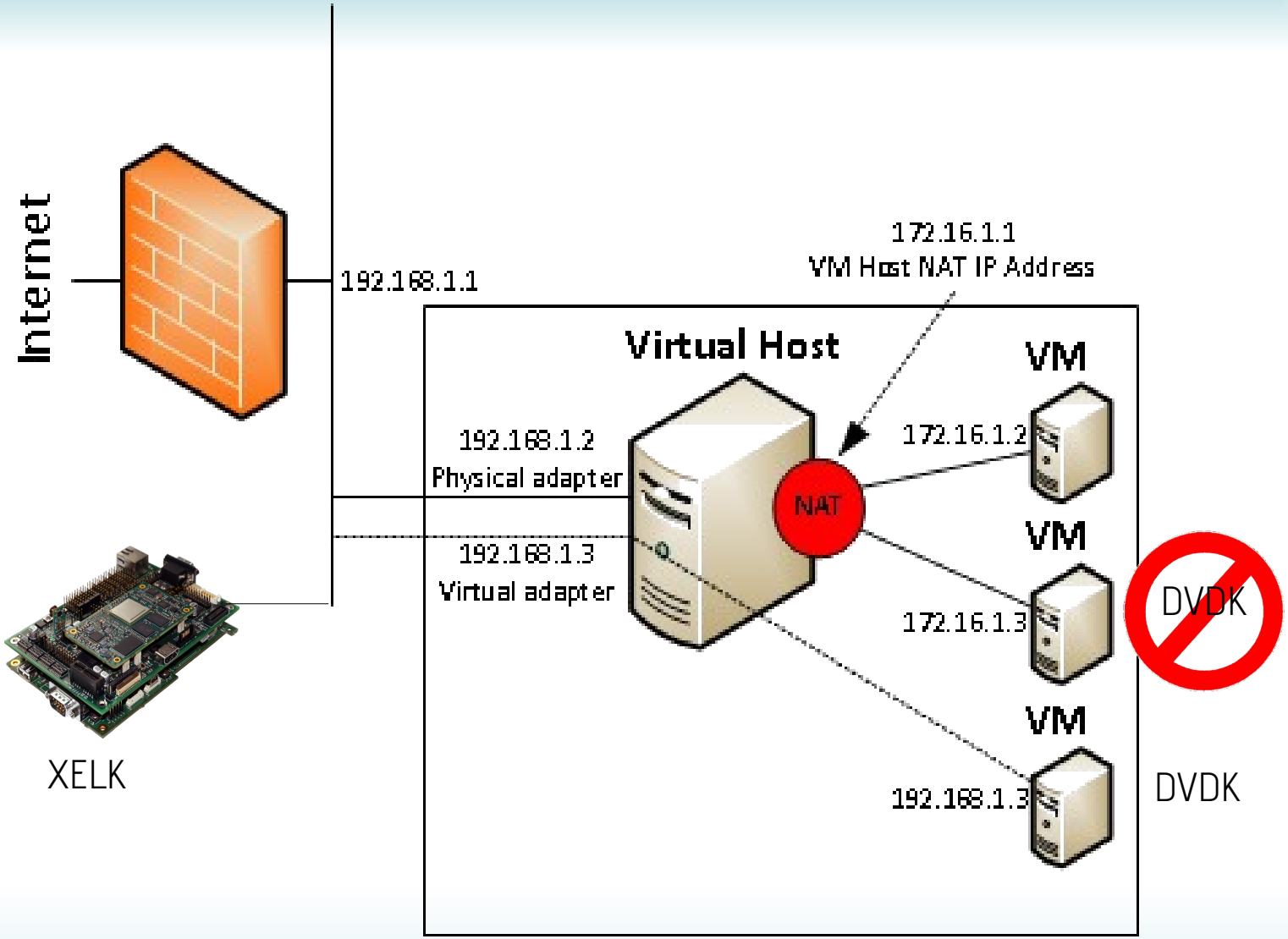
NAT vs Bridge



Yocto

- Cos'è?
  - **"It's not an embedded Linux distribution – it creates a custom one for you"**
  - Build system derivato da OpenEmbedded
  - Insieme di tool, script, configurazioni per creare una distribuzione Linux Embedded
  - Differenza tra realizzazione distribuzione e applicativi

yocto PROJECT

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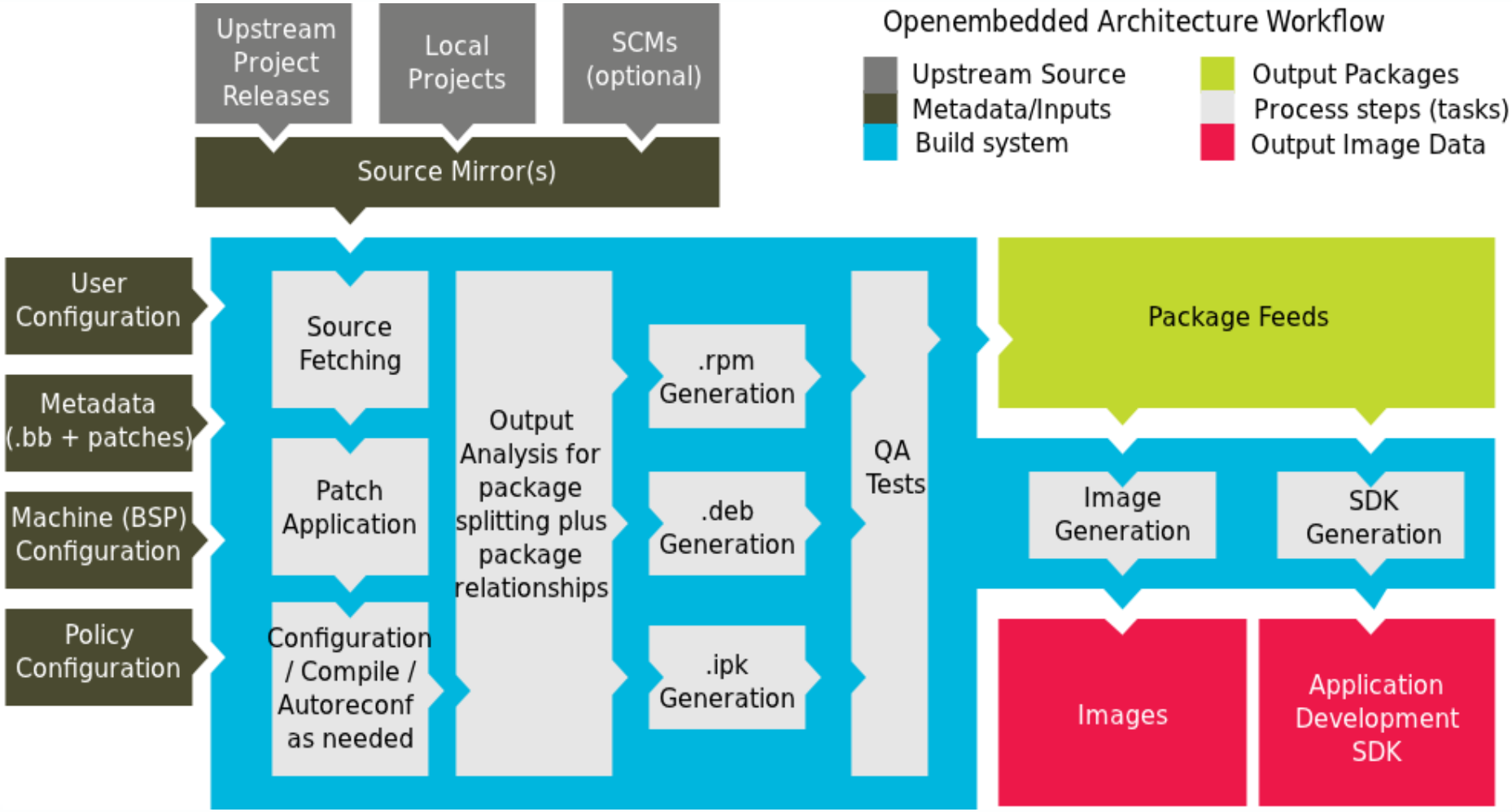
Yocto - Overview



Yocto: pro e contro

- Vantaggi
  - Community forte, Progetto universale
  - Packaging
  - **Eclipse/ADT**
  - **Layers**
- Svantaggi
  - Tempo/size di build (BSP, 30-100GiB)
  - Curva di apprendimento (customizzazione BSP)

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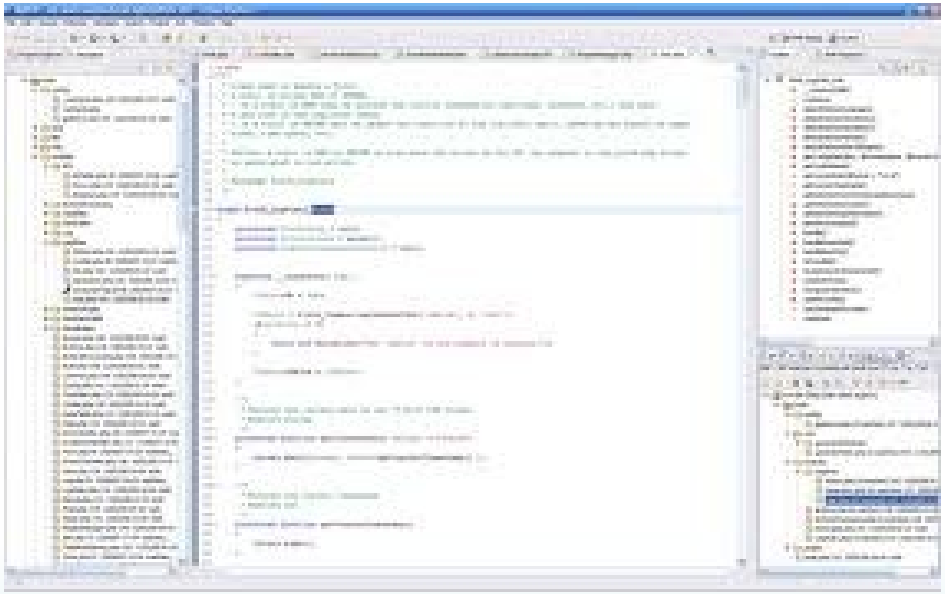
Yocto Live Demo

- Realizzazione applicativo HelloWorld
- Utilizzo Eclipse + Yocto ADT Plugin
- Build con autotools
- Debug remoto
  - SFTP, SSH, GDB/GDBServer



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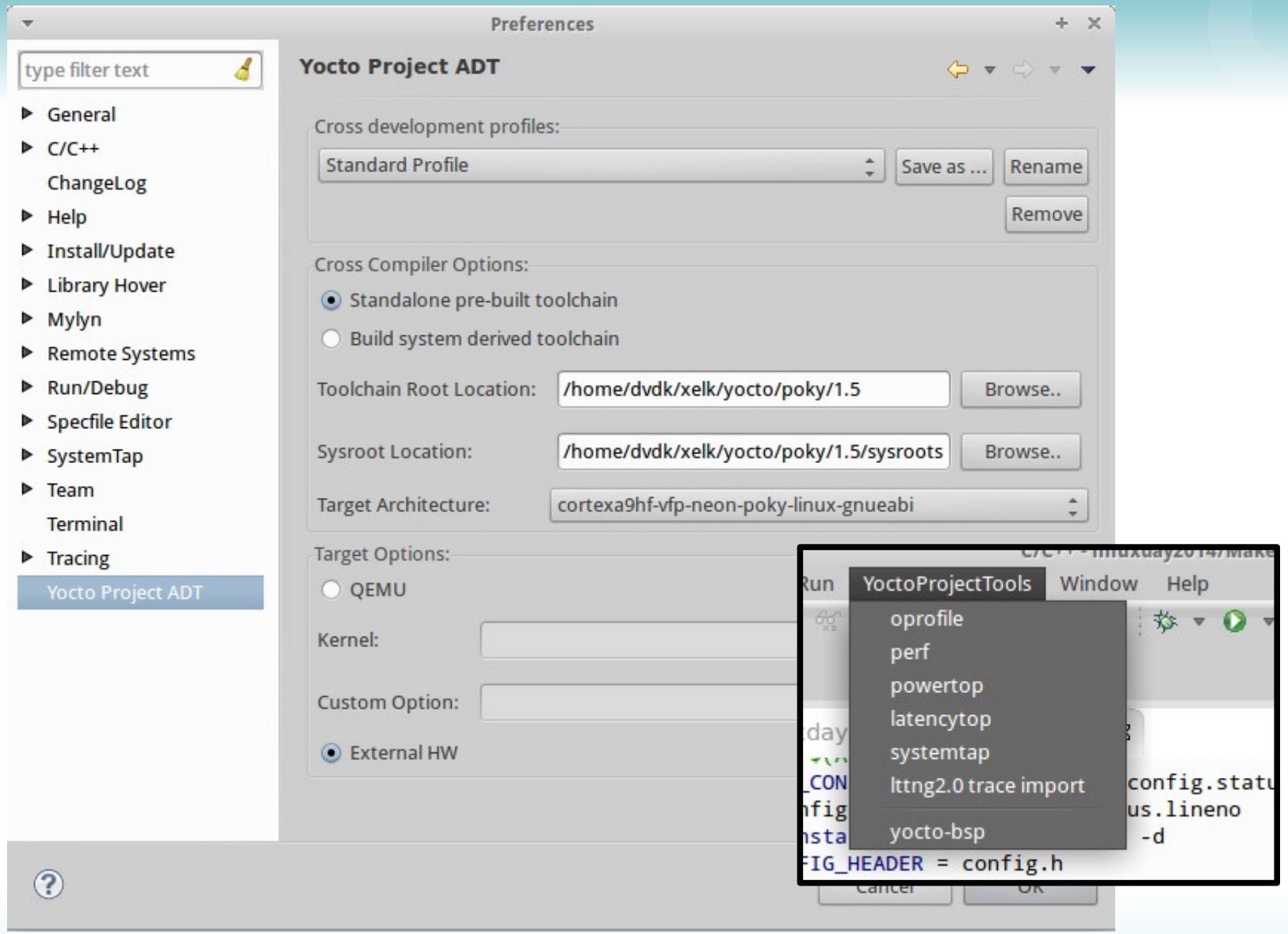
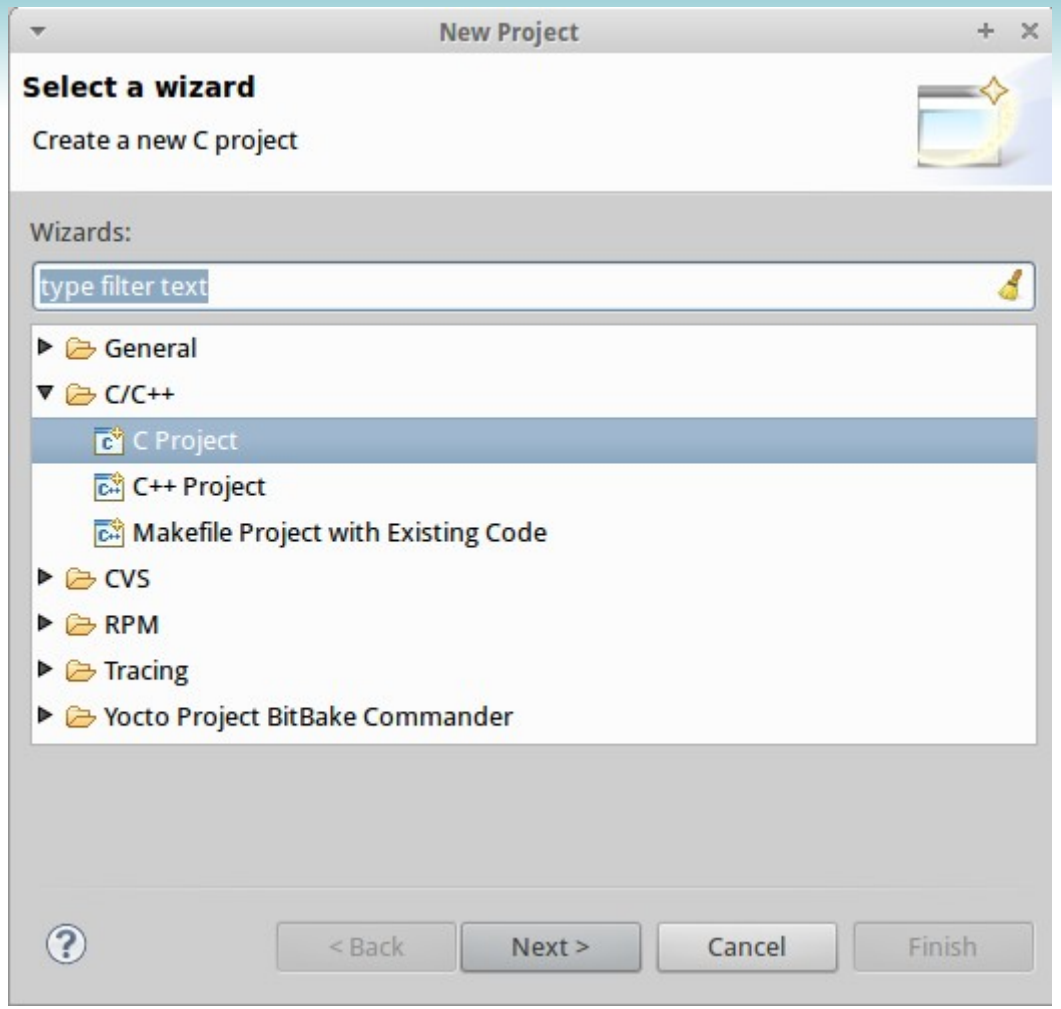
Yocto ADT


Preferences
type filter text
General
C/C++
ChangeLog
Help
Install/Update
Library Hover
Mylyn
Remote Systems
Run/Debug
Specfile Editor
SystemTap
Team
Terminal
Tracing
Yocto Project ADT
Yocto Project ADT
Cross development profiles:
Standard Profile
Save as ...
Rename
Remove
Cross Compiler Options:
Standalone pre-built toolchain
Build system derived toolchain
Toolchain Root Location:
/home/dvdk/xelk/yocto/poky/1.5
Browse..
Sysroot Location:
/home/dvdk/xelk/yocto/poky/1.5/sysroots
Browse..
Target Architecture:
cortexa9hf-vfp-neon-poky-linux-gnueabi
Target Options:
QEMU
Kernel:
Custom Option:
External HW
Run
YoctoProjectTools
Window
Help
oprofile
perf
powertop
latencytop
systemtap
lttng2.0 trace import
yocto-bsp
FIG_HEADER = config.h

Yocto ADT



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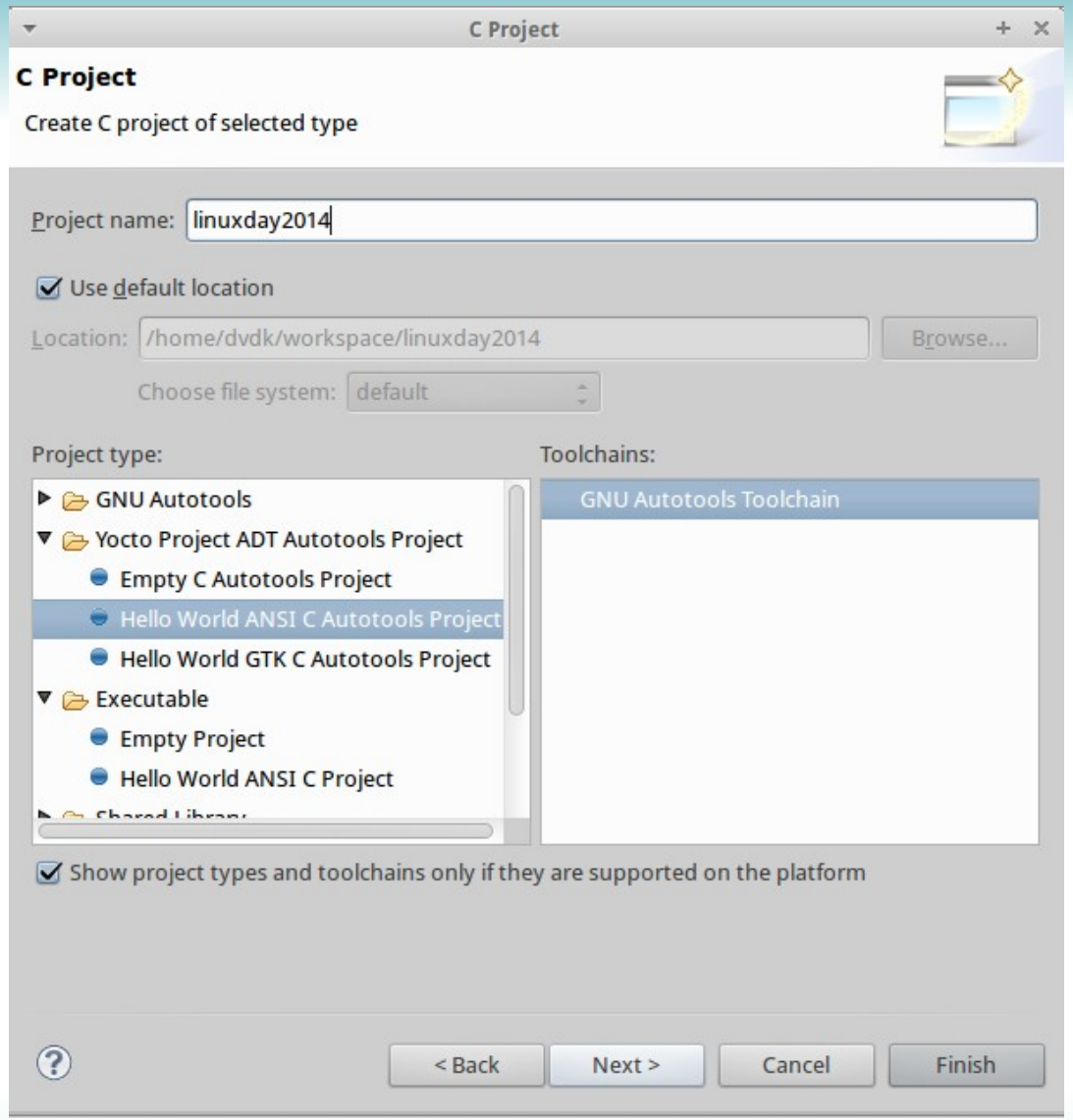
Yocto ADT



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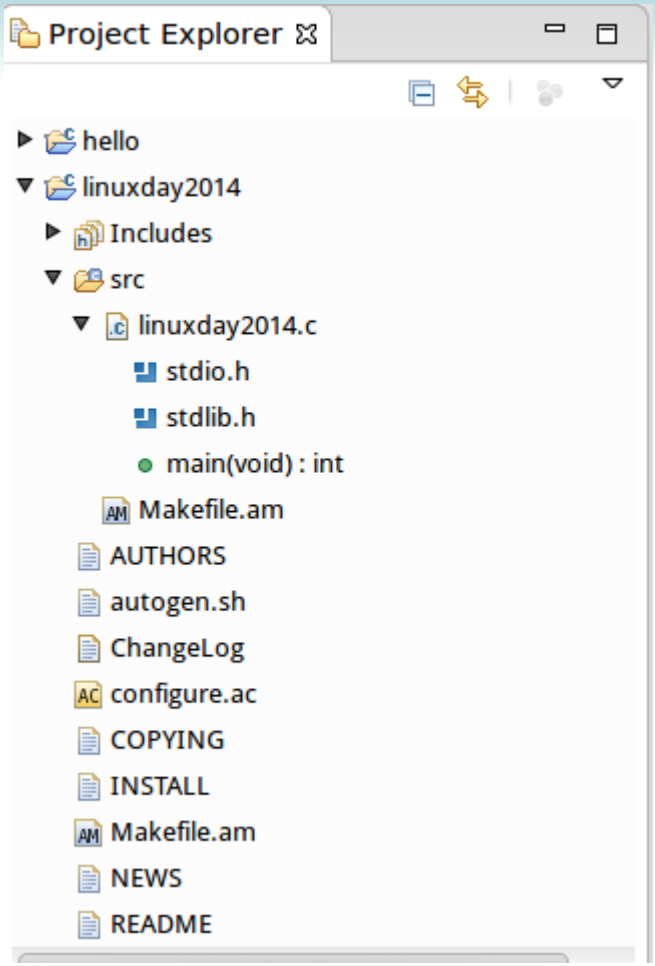

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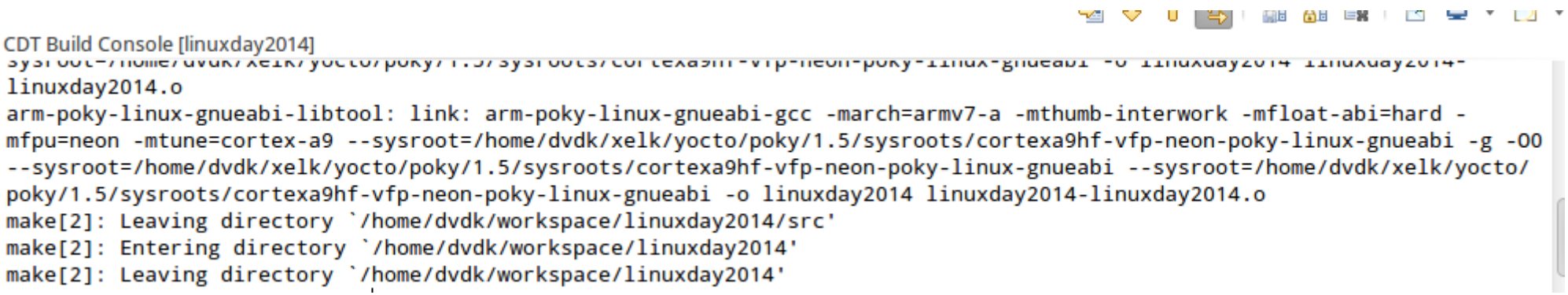
Yocto ADT



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Yocto Live Demo – Creazione Progetto

- New Project → C Project
- Yocto ADT Autotools Project → HelloWorld
- Reconfigure
- Build

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Yocto Live Demo – Debug Configuration

- Debug Config
- C/C++ Remote Application → New Configuration
- Connection → New SSH
  - ipaddress target
- Configurare Cross-GDB
- Configurare Remote Absolute File Path
- RUN!
  - Download via SFTP, debug via GDBServer

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References

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- http://elinux.org
- http://lwn.net (if you're not subscriber, please do so!)
- Building Embedded Linux Systems, By Karim Yaghmour, O'Reilly Media

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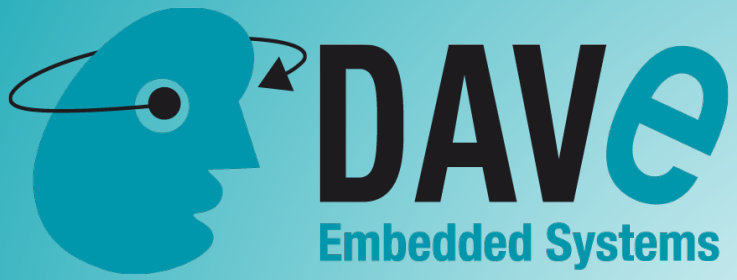

Sviluppare con Linux Embedded

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Ass. Culturale Informatina Pordenone Linux User Group PN LUG

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