

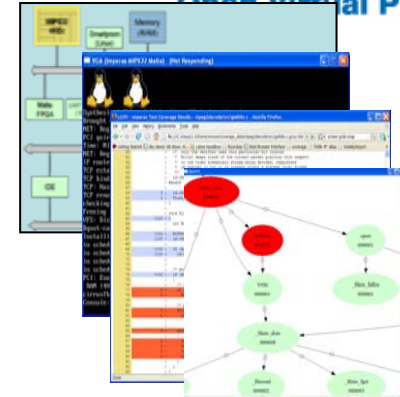


# **Software Development using Virtual Platforms**

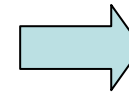
**Simon Davidmann**  
**Imperas CEO**  
**OVP founder**

DAC VP09 Workshop, 29 July 2009

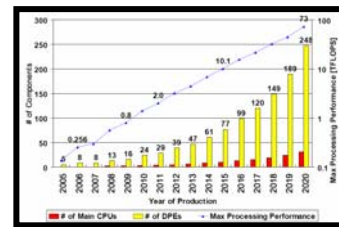
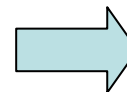
# New Tools and Methodology Needed for Embedded Software Development



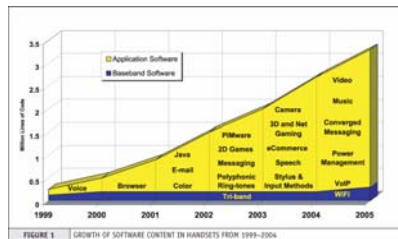
Adoption of new tools to produce higher quality embedded software



Move to Virtual Platforms for Software development



Multicore Proliferation



Software Complexity Explosion

# Virtual Platforms Types

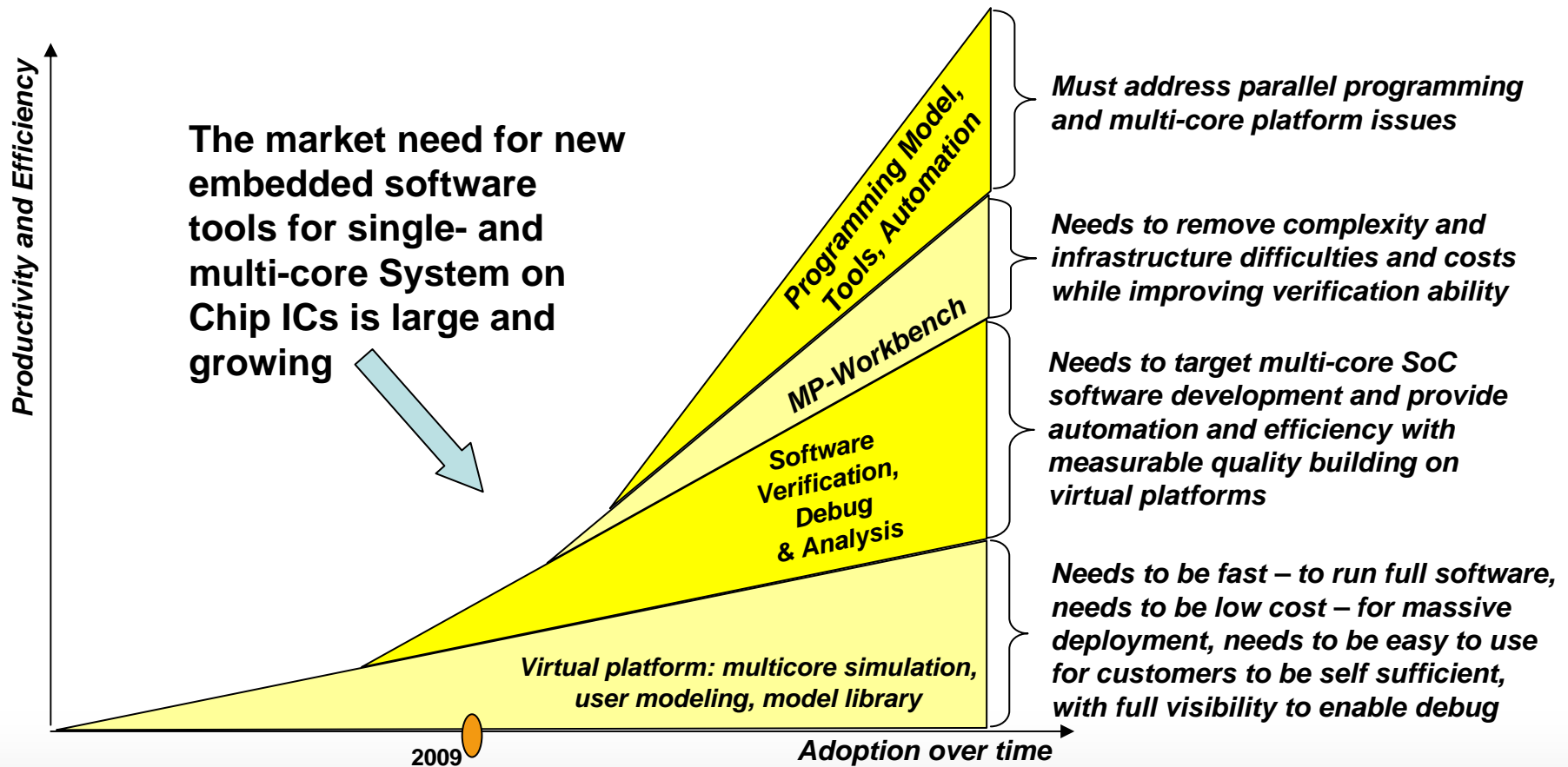


- Hardware Virtual Platforms
  - Timing / Cycle accurate
  - Used for architecture performance analysis, drivers, firmware
  - Models are very complex, slow, time consuming to build
  - SystemC etc
  - Main value is same performance as RTL, no Verilog license cost...
  
- Software Virtual Platforms
  - Instruction accurate
  - Used for OS, applications
  - Can be very fast, programmers views
  - Model only what is needed in peripherals
  - Complete system environment

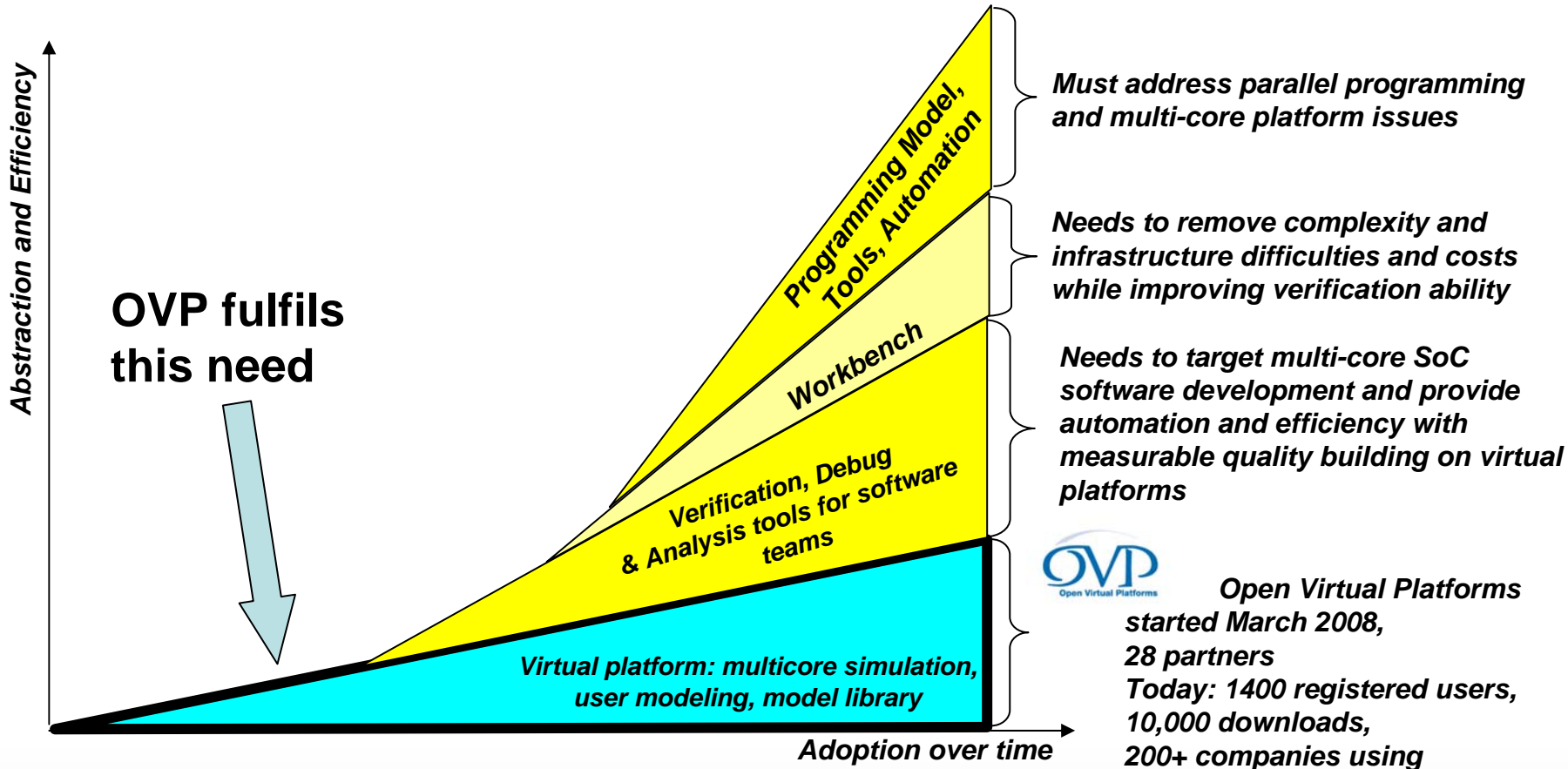
# New SoC Embedded Software Development market



- Older approach was to use prototypes, breadboards, FPGA, previous generation – this fails to satisfy for next generation complexity



# Virtual Platforms (OVP) are the foundation for the next generation of [embedded] software development environments – especially for multicore



# What is in OVP?



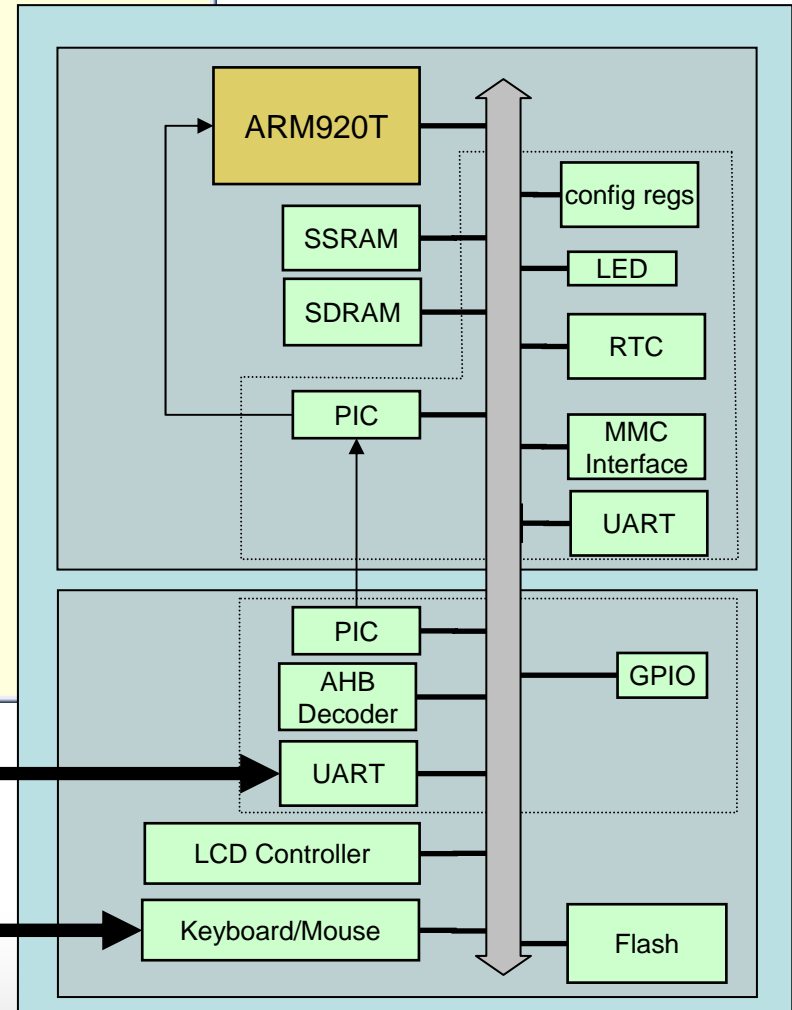
- **Modeling APIs**
  - Publishing of C OVP APIs for Processor, Peripheral, and Platform modeling
  - Documentation & header files
- **Open Source library of models**
  - C source of models written to C OVP APIs
  - Processor models of ARM, ARC, MIPS, OpenRisc OR1K, x86, ...
  - Peripheral models of standard embedded devices
  - Example embedded platforms in C, C++, SystemC, TLM2.0
    - Including full platforms that boot operating systems like Linux, Nucleus
- **OVP reference simulator, free for non-commercial use**
  - Runs processor models fast, 500 MIPS typical
  - Interfaces to GDB via RSP/socket
  - MP Capable, scalable and very efficient
  - Can encapsulate existing processor models (ISS)
  - Callable with C/C++/SystemC wrapper
- **Website community/portal**
- **Ecosystem growing for model and tool developers and users**



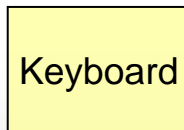
# OVPsim booting Nucleus on ARM Integrator / ARM920



```
graham@lnx16:~/workspaceArmlIntegrator <3>
Task 5 Event Detections:      22
RX Buffer:
*****
                Nucleus PLUS 2.2 Demonstration
                Build Timestamp - Jul 18 2009/02:18:52
*****
Task 0 Time:                  24
Timer Interrupts:            2400
Task 1 Messages Sent:        9503395
Task 2 Messages Received:    9503339
Task 2 Invalid Messages:     0
Task 3/4 Resource Owner:     Task 4
Task 5 Event Detections:     23
RX Buffer:
```



Easy to run



telnet localhost 9999



# OVPsim booting Linux on ARM Integrator / ARM926

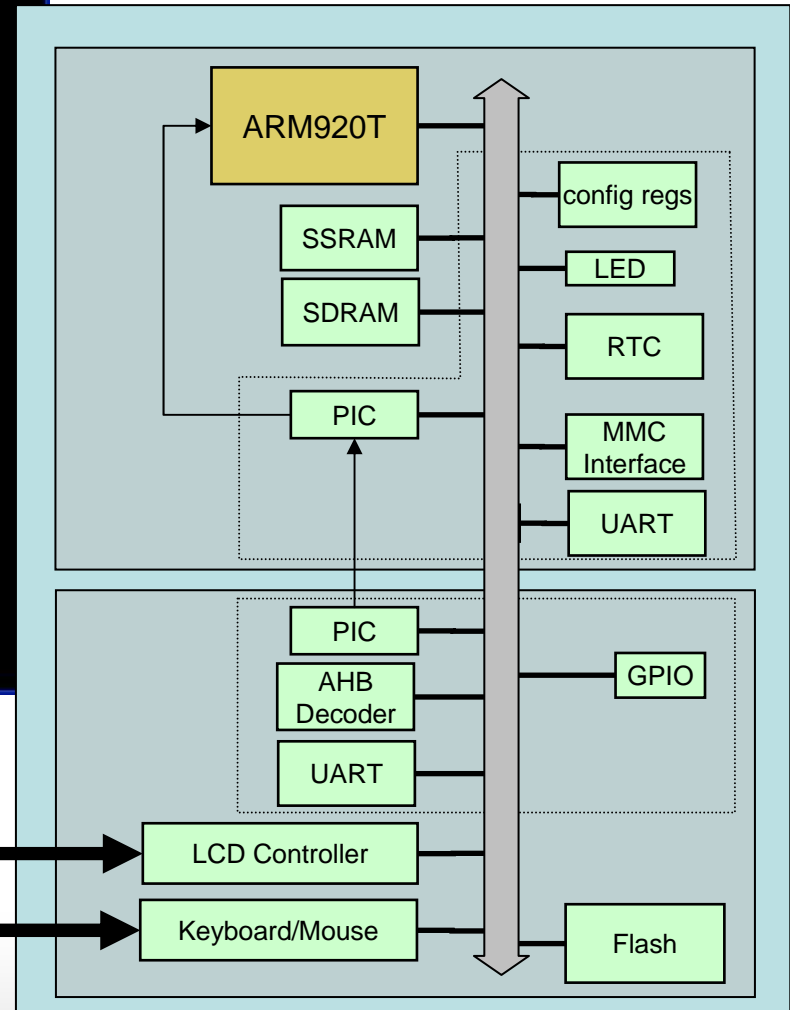


```
PL110 LCD
mb:16: ttyAMA0 at MMIO 0x16000000 (irq = 1) is a AMBA/PL011
mb:17: ttyAMA1 at MMIO 0x17000000 (irq = 2) is a AMBA/PL011
RAMDISK driver initialized: 16 RAM disks of 8192K size 1024 blocksize
loop: loaded (max 8 devices)
nbd: registered device at major 43
smc91x: not found (-19).
mice: PS/2 mouse device common for all mice
input: AT Raw Set 2 keyboard as /class/input/input0
input: ImExPS/2 Generic Explorer Mouse as /class/input/input1
IPv4 over IPv4 tunneling driver
GRE over IPv4 tunneling driver
TCP bic registered
NET: Registered protocol family 1
NET: Registered protocol family 17
802.1Q VLAN Support v1.8 Ben Greear <greearb@candelatech.com>
All bugs added by David S. Miller <davem@redhat.com>
UFP support v0.3: not present

This root FS contains most basic linux utilities (implemented with busybox)
and the Lynx web browser.

Kernel config is available through /proc/config.gz

Log in as root with no password.
imperas login:
```



Keyboard / Mouse

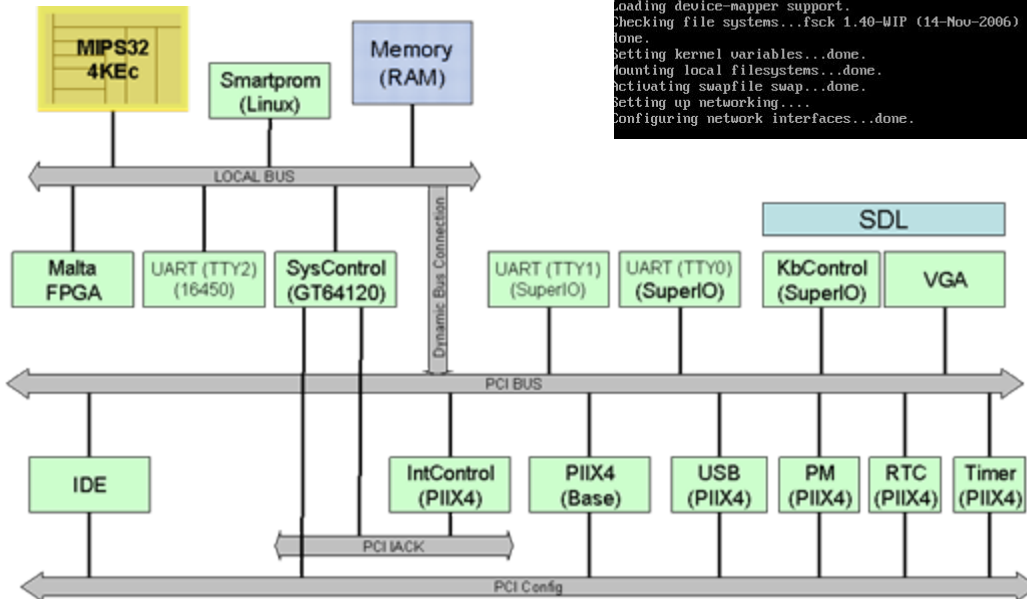
Boot Linux

# OVPsim MIPS Linux platform



```

TIT: version 2.86 booting
Starting the hotplug events dispatcher: udevd.
Synthesizing the initial hotplug events...done.
Waiting for /dev to be fully populated...done.
Activating swap...Adding 112412k swap on /dev/hda5. Priority:-1 extents:1 across:
:112412k
done.
Checking root file system...fsck 1.40-WIP (14-Nov-2006)
/dev/hda1: clean, 20204/116480 files, 121133/232934 blocks
done.
EXT3 FS on hda1, internal journal
Setting the system clock...
select() to /dev/rtc to wait for clock tick timed out
Cleaning up ifupdown...
Loading kernel modules...FATAL: Could not load /lib/modules/2.6.23.11/modules.d
p: No such file or directory
Loading device-mapper support.
Checking file systems...fsck 1.40-WIP (14-Nov-2006)
done.
Setting kernel variables...done.
Mounting local filesystems...done.
Activating swapfile swap...done.
Setting up networking...
Configuring network interfaces...done.
    
```



0xFFFFFFFF	Controller
0x1fd00000	Flash
0x1fc00000	Controller
0x1f100000	FPGA
	UART
	FPGA
0x1f000000	
0x1e400000	Flash
0x1e000000	
0x1be00000	Controller
	PCI IO
0x18000000	PCI Memory
0x08000000	Memory
0x00000000	SmartProm

- Boot Linux on Windows PC...
- Easy to run: platform .exe vmlinux

# OVPsim Heterogeneous Platform ARM Nucleus / MIPS Linux



```

graham@lnx16:~/workspacArmlntegrator <3>

Task 5 Event Detections:      22

RX Buffer:

-----
Nucleus PLUS 2.2 Demonstration
Build Timestamp - Jul 18 2009/02:18:52
-----

Task 0 Time:                  24
Timer Interrupts:             2400

Task 1 Messages Sent:         9503395
Task 2 Messages Received:     9503339
Task 2 Invalid Messages:      0

Task 3/4 Resource Owner:     Task 4

Task 5 Event Detections:      23

RX Buffer:
    
```

## Run Platform

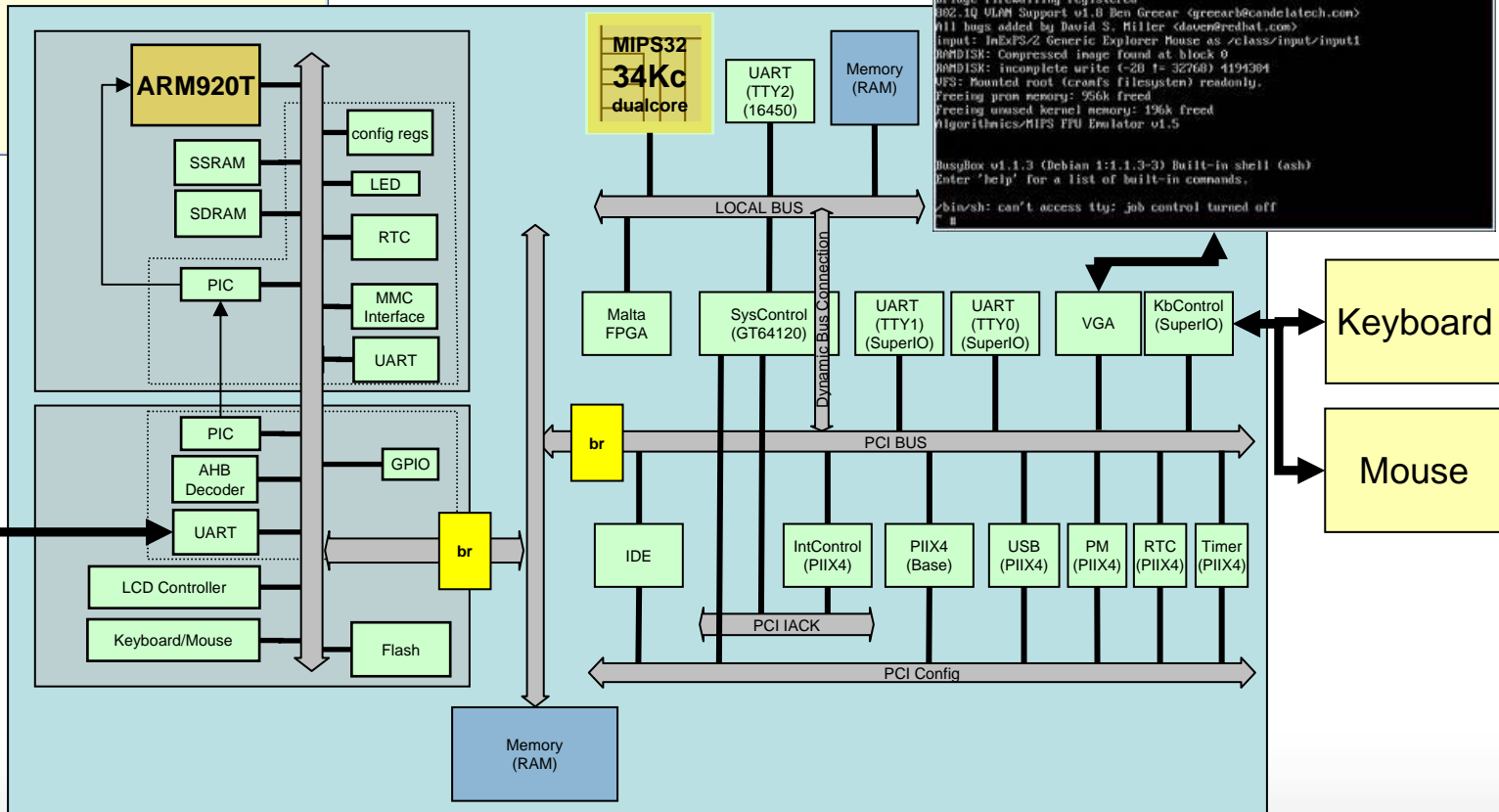
```

VGA (Imperas MIPS32 Malta)

serio: i8042 KBD port at 0x60,0x64 irq 1
serio: i8042 AUX port at 0x60,0x64 irq 12
nice: PS/2 mouse device common for all nice
input: AT Raw Set 2 keyboard as /class/input/input0
TCP cubic registered
NET: Registered protocol family 1
NET: Registered protocol family 17
NET: Registered protocol family 15
Bridge firewalling registered
BR2: IQ U/LAN Support v1.8 Ben Greear <greearb@candelatech.com>
All bugs added by David S. Miller <davem@redhat.com>
input: InExPS/2 Generic Explorer Mouse as /class/input/input1
DRM/DRM: Compressed image found at block 0
DRM/DRM: incomplete write (-28 != 32768) 4194384
JFS: Mounted root (cramfs filesystem) readonly.
Freeing init memory: 956k freed
Freeing unused kernel memory: 196k freed
Algorithmics/MIPS TPU Emulator v1.5

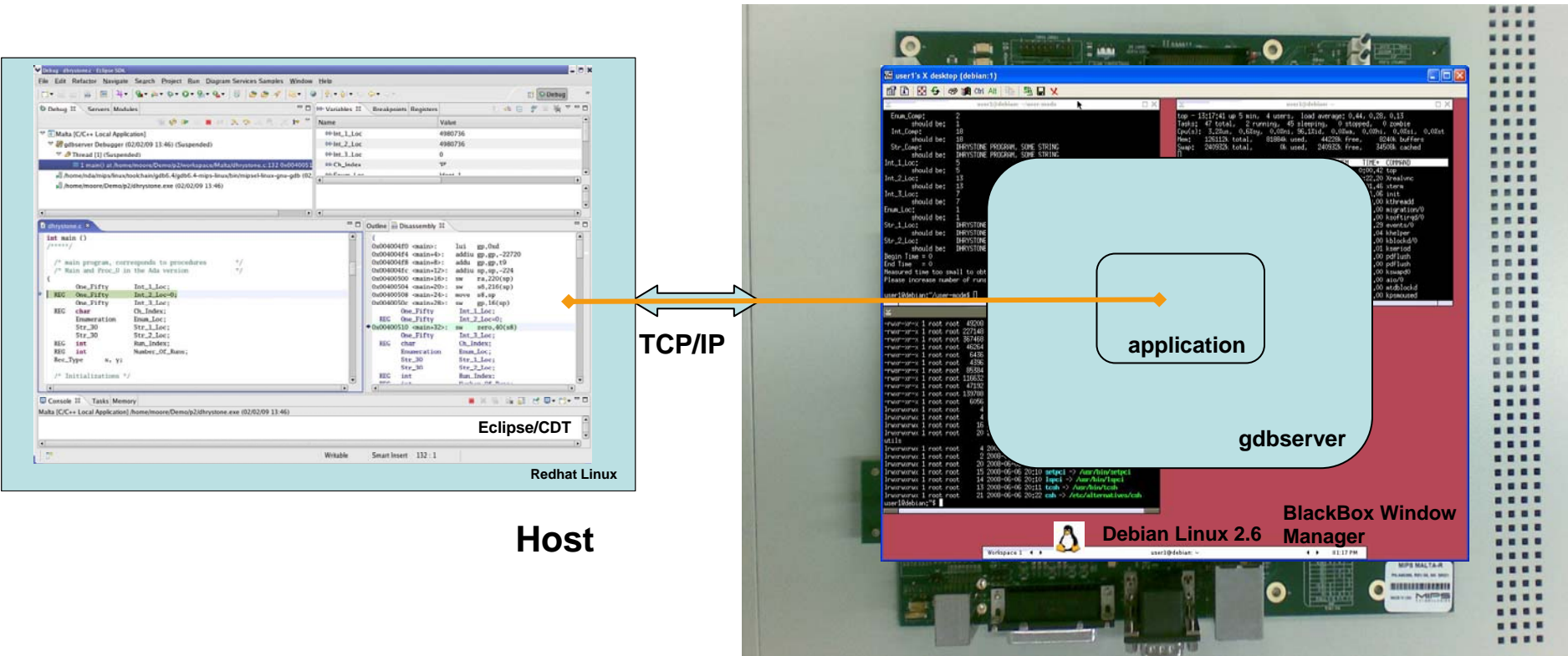
BusyBox v1.1.3 (Debian 1:1.1.3-3) Built-in shell (ash)
Enter 'help' for a list of built-in commands.

~/bin/sh: can't access tty: job control turned off
#
    
```



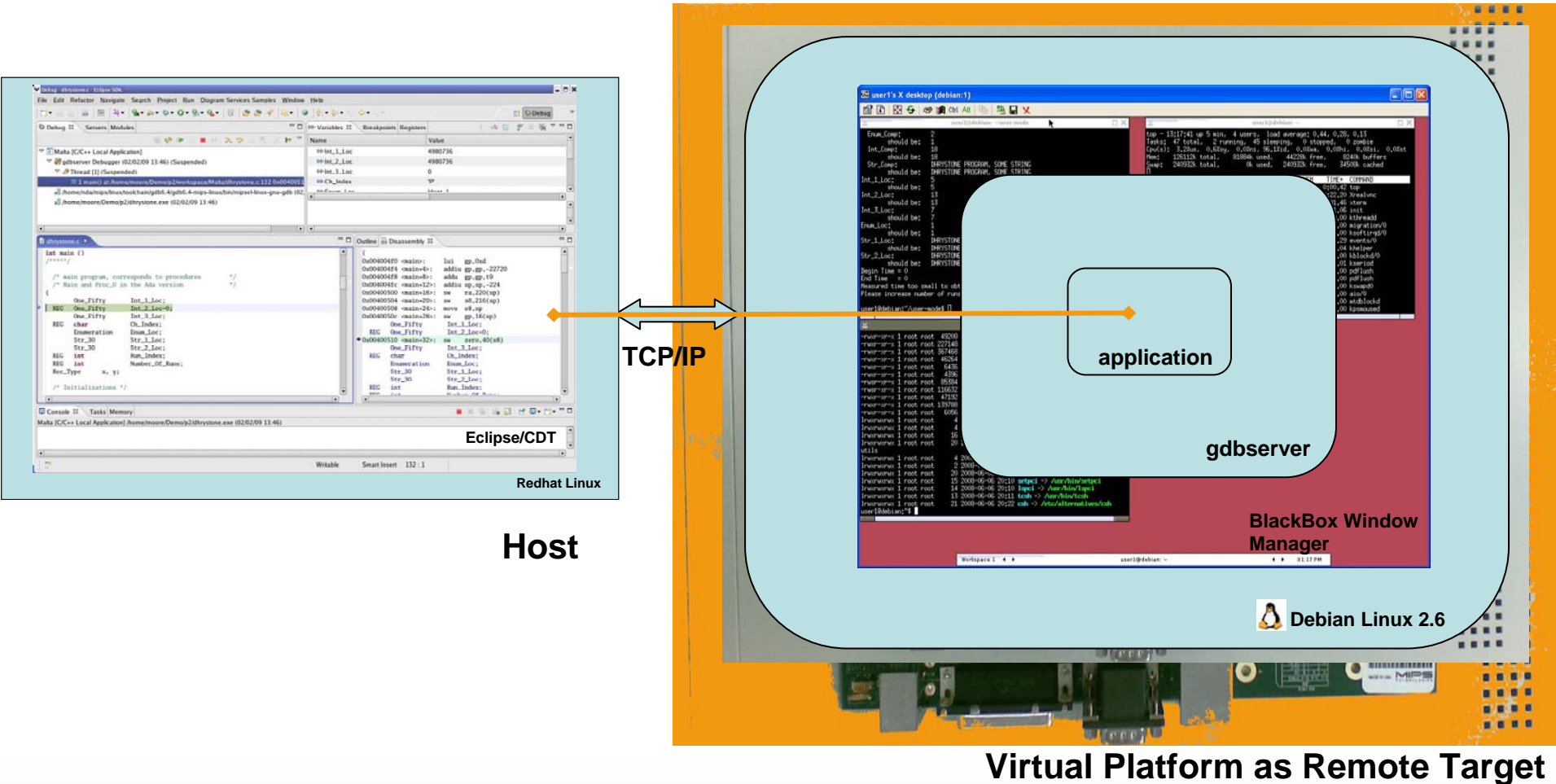
telnet localhost 9999

# Software debug on prototype: Run gdbserver on target and Eclipse on host to debug application on target



Remote Target

# Using a Virtual Platform from OVP provides exactly the same environment



# Demo: Developing Software on Virtual Platforms



- Virtual Platforms are replacing hardware prototypes for software development
  - It's a new world, with familiar tools
  - Virtual Platforms provide significant benefits
  - Software development uses standard tools
    - Eclipse, GDB, gdbserver

## Benefits of Virtual Platforms for software development

Easier to deploy, more reliable, deterministic

Often much faster

Easier to use for regression testing, improving quality

Available much sooner (developing SoC takes 2 years of delay...)

With OVP, the models are free, fast, and easy to use...



- Thank you
  
- For more information visit [www.OVPworld.org](http://www.OVPworld.org)