

Zylin AS

Nios Linux MMU

2010

Øyvind Harboe, General Manager, Zylin AS



Zylin AS

- Established 1.1.2002
- Primary business: embedded consultancy
- 2010 : 5 employees
- Currently customers in Stavanger, Oslo, USA, France, Germany
- Products: ZY1000 JTAG debugger
- Wholly owned by employees
- Robust customer base and profitable since day 1



Nios Linux MMU

- uCLinux has been around for a while
- Linux with MMU is “regular linux”
- Nios Linux MMU is still a fork
- Some applications require MMU
 - Memory fragmentation / protection?
 - Compatibility? fork support.
 - Migration?
 - Regulations?
 - Competition?



What do you need to learn?

- Git. If you are going to do serious Linux development, then you have to learn about DVCS.
- Develop under Linux, Quartus works fine under Linux(we're using Ubuntu 9.10).
- Windows is not a usable environment for Linux embedded development



What do you need?

- Linux needs megabytes of ram & flash, i.e. DRAM
- High bandwidth internet connection and a modern development PC
- Linux development regularly deals with 100's of thousands of files and gigabytes of repositories
- Tried with 32 bit x86 Ubuntu 9.10, other combinations should probably work as well.
- GCC Nios MMU binaries for 64 bit hosts?



Which Linux MMU for Nios?

- There are different branches / distributions, including commercial and open source efforts
- Fork of uClinux on nioswiki
<http://www.nioswiki.com/linux>



Quickstart

- Perhaps resetting expectations is a good place to start... this takes time. Set aside a few days to avoid frustration and disappointment.
- http://www.nioswiki.com/Linux/Linux_Quick_Start
- Rebuild Nios w/MMU(option in SOPC)



Essential steps

- Try with eval kit first
- Build FPGA w/Linux support for your FPGA. This requires both hardware and software knowledge
- Build Linux + test
- Best case: software engineer is trained sufficiently to do test cycles using SOPC + Linux build procedure



FPGA w/MMU

- Create Nios w/MMU and tightly coupled memory for TLB
- Generate headers based on FPGA memory map
- http://www.nioswiki.com/Linux/Creating_a_Nios_II_Design_with_an_MMU



custom_fpga.h

- If you get errors, modify custom_fpga.h to handle differences in SOPC names
- #define IGOR_MAC_BASE OEM_BASE
- #define UART0_BASE UART_0_BASE
- etc.



Building

- Make menuconfig
- Remember to configur w/custom_fpga via kernel settings
- Disable unused devices, e.g. TSE MAC
- Make



Altera Nios MMU

```
oyvind@titan: ~  
File Edit View Terminal Tabs Help  
oyvind@titan: ~/wo... x oyvind@titan: ~/nio... x oyvind@titan: ~ x oyvind@titan: ~/wo... x  
Linux/Nios II-MMU  
init_bootmem_node(?,0x4d7, 0x0, 0x4000)  
free_bootmem(0x4d7000, 0x3b29000)  
reserve_bootmem(0x4d7000, 0x800)  
Built 1 zonelists in Zone order, mobility grouping on. Total pages: 16256  
Kernel command line:  
NR_IRQS:32  
PID hash table entries: 256 (order: 8, 1024 bytes)  
Dentry cache hash table entries: 8192 (order: 3, 32768 bytes)  
Inode-cache hash table entries: 4096 (order: 2, 16384 bytes)  
We have 16384 pages of RAM  
Memory available: 59944k/4954k RAM, 0k/0k ROM (1743k kernel code, 3210k data)  
Calibrating delay loop... 49.45 BogoMIPS (lpj=247296)  
Mount-cache hash table entries: 512  
net_namespace: 296 bytes  
NET: Registered protocol family 16  
init_BSP(): registering device resources  
bio: create slab <bio-0> at 0  
NET: Registered protocol family 2  
IP route cache hash table entries: 1024 (order: 0, 4096 bytes)  
TCP established hash table entries: 2048 (order: 2, 16384 bytes)  
TCP bind hash table entries: 2048 (order: 1, 8192 bytes)  
TCP: Hash tables configured (established 2048 bind 2048)  
TCP reno registered  
NET: Registered protocol family 1  
msgmni has been set to 117  
io scheduler noop registered  
io scheduler anticipatory registered  
io scheduler deadline registered
```

User space debugging

- No JTAG debugger currently
- Enable TCP/IP networking
- Make menuconfig - gdbserver (old)
-
- `gdbserver localhost:9999 /bin/dhccpd`
-
- <http://www.nioswiki.com/OperatingSystems/UClinux/DebugApps>



OpenCores ethernac

- Altera TSE MAC is perhaps more mainstream
- make menuconfig
- ifconfig eth0 10.0.0.137 netmask 255.255.255.0
up
- passwd root
- ftp performance figures on ~NEEK
- 3770069 bytes sent in 1.63 secs (2257.5 kB/s)
- 3770069 bytes received in 1.69 secs (2177.9 kB/s)



Bootloader and remote update

- One FPGA bit file for bootloader and another for uClinux
- Requires Remote System Update capable bootloader
- No obvious choices
- Nios2ecos bootloader?



Is Linux easy?

- Could be...
- Check that drivers are available for your peripherals
- Linux is easier when it works, but what about when it doesn't?
- Do you need the latest version of Linux?
- Track branch when making modifications?
- Contribute back patches?



Zylin AS

Embedded services

2010

Øyvind Harboe, General Manager, Zylin AS

