



# MINIX 3 on ARM FOSDEM 2014





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<http://wiki.minix3.org/DevelopersGuide/MinixOnARM>



# MINIX history the 80's

- 1987 Mini-UNIX is included in OSDI
- Usenet comp.os.minix



# MINIX history the 90's

- 1991 Linus's announces Linux on comp.os.minix
- “I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu”
- 1992 386BSD is released
- MINIX remains tool with a vision



# MINIX history the 00's

- 2005 MINIX 3 “Usable as a serious system on resource-limited and embedded computers”
- 2008 ERC grant: Research on Really Reliable and Secure Systems Software



# MINIX history

- Licensing and governance changed over time

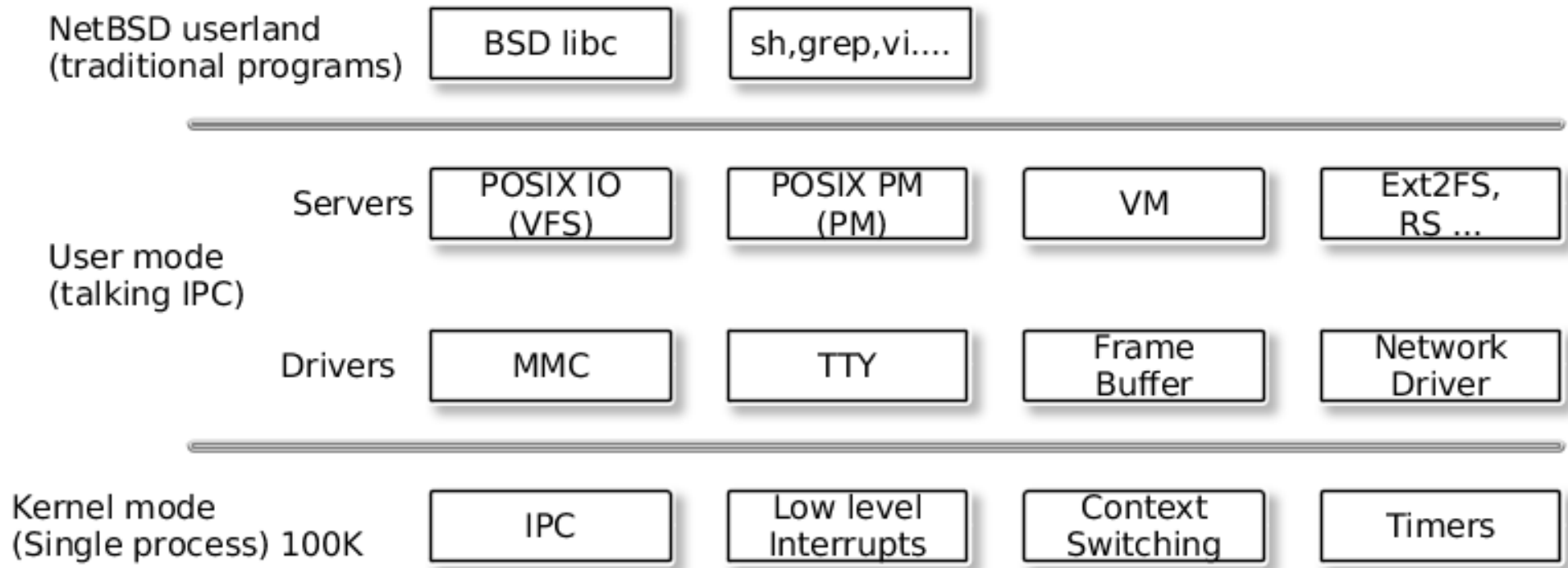


# MINIX 3.2.0 2012

- Clang is the default compiler
- Transparent recovery from block device driver crashes in file systems, data stores...
- NetBSD libc, headers
- ELF file format



# MINIX 3.2.0







# MINIX 3 features

- Reliability features
- Ease of code development
- Single build system, self contained

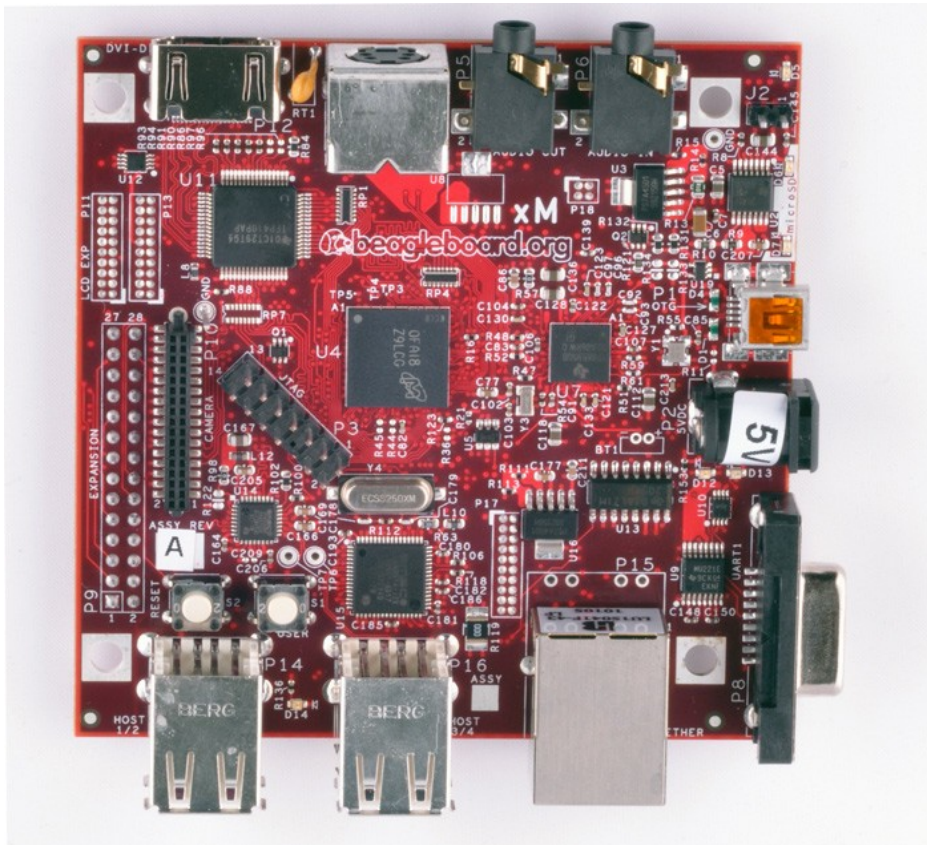


# MINIX 3 on ARM

- Features are a good fit for embedded hardware
- 2014 will not be the year of MINIX 3 on the desktop
- Commercialization/Growth



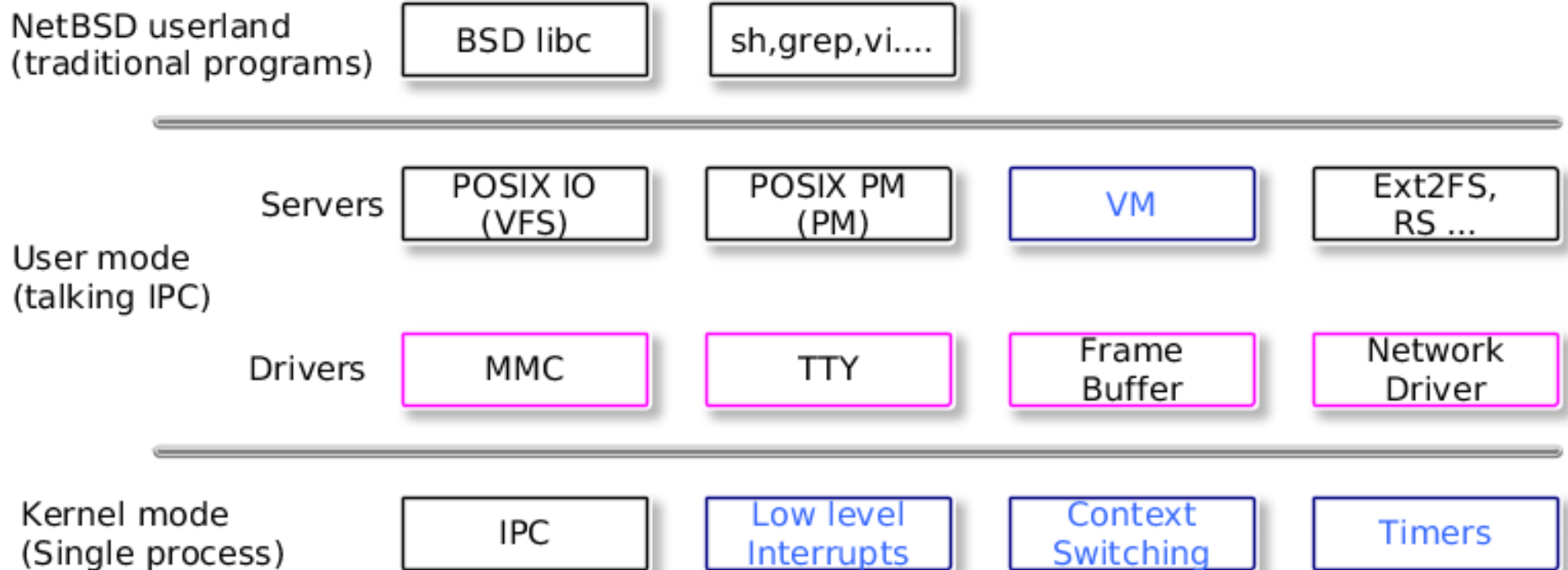
# MINIX 3 BeagleBoard-Xm



- DM37XX
- Cortex-A8/armv7
- 512M



# MINIX 3 Porting





# MINIX 3 Tasks ahead

```
push {r1}
    0x8020001c    0c209fe5
ldr r2, [pc, #12] ; 0xffffffff80200030
; => 0xf04239ec
    0x80200020    12ff2fe1
bx r2
    --> 0x80200024    feffffea
b 0x80200024
    0x80200028    00502080
eorhi r5, r0, r0
    0x8020002c    041043f0
undefined instruction 0xf0431004
    0x80200030    ec3942f0
undefined instruction 0xf04239ec
    0x80200034    f0472de9
push {r4, r5, r6, r7, r8, r9, sl, lr}
    0x80200038    0050a0e1
mov r5, r0
    0x8020003c    0100a0e1
mov r0, r1
[0x80200000]>
```

```
j/arm/bb/src/../../obj.evbearm-el/tooldir.L
inux-3.11.0-15-generic-x86_64/lib/libgmp
.a
libtool: install: chmod 644 /home/keesj/
arm/bb/src/../../obj.evbearm-el/tooldir.Lin
ux-3.11.0-15-generic-x86_64/lib/libgmp.a
libtool: install: ranlib /home/keesj/arm
/bb/src/../../obj.evbearm-el/tooldir.Linux-
3.11.0-15-generic-x86_64/lib/libgmp.a
```

```
        (*saved_lr < (vir_bytes) mems
et_fault);

        if((is_nested || iskernelp(pr))
&&
        catch_pagefaults && (in_
physcopy || in_memset)) {
            if (is_nested) {
```

[0] 0: bash\*

57,1-8 22%  
"sylvarna" 10:16 22-Jan-14



# MINIX 3 Tasks ahead

- Cross compilation
- Build system
- Kernel & VM
- Drivers





# MINIX 3 Cross compilation

- Cross compilation
- Adding flexibility
- Headers etc
- Build order





# MINIX 3 Kernel

- Kernel
- Startup
- Interrupt
- Context switching
- Timers

ansic:	3036 (81.29%)
asm:	699 (18.71%)





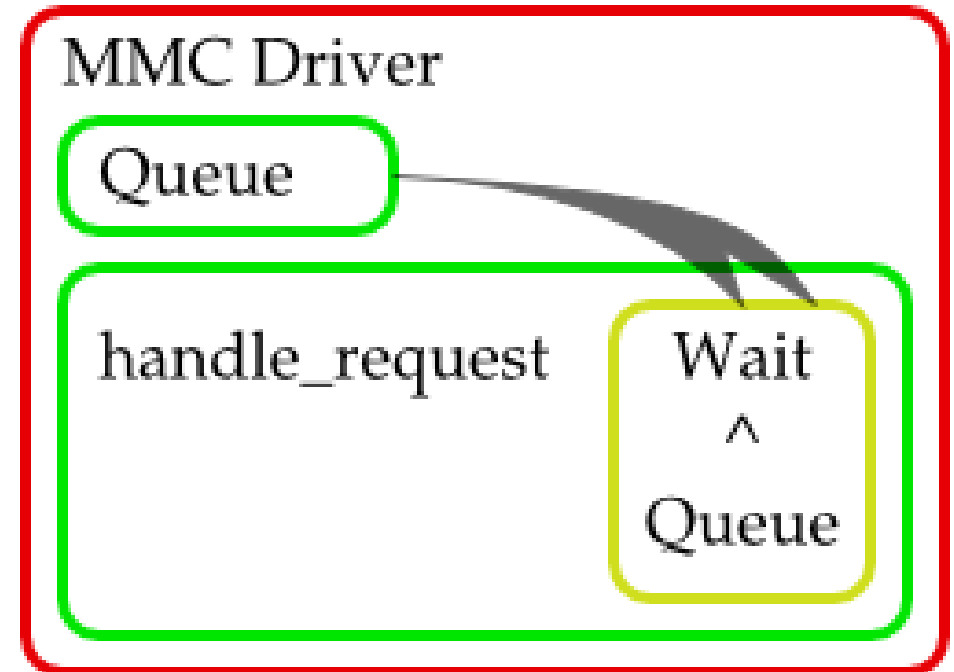
# MINIX 3 VM

- Map regions to table entries
- Caching, separate I and d-cache
- TODO: using ASID...



# MINIX 3 Drivers

- Very simple model
- One driver started per controller (1:1)
- Library reuse
- Missing bus drivers/protocols





# MINIX 3.2.1 2013

- MINIX 3.2.1 (BeagleBoard-xM)(Serial/MMC and Framebuffer, GPIO)
- Off to discover the world



# MINIX 3.2.1 sales pitch

- BSD licensed
- Small
- Reliability
- Best of both worlds



# EW demo



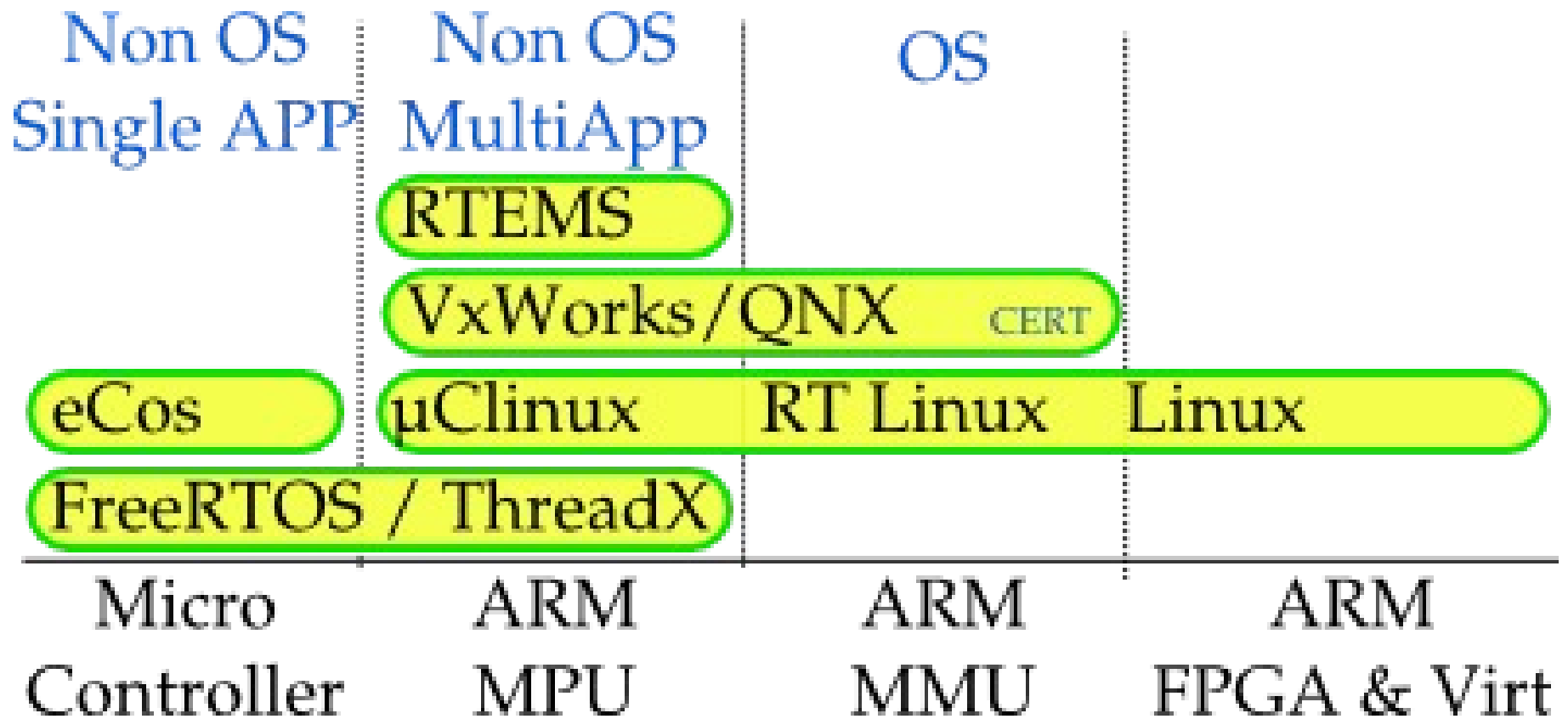
# EW demo



Andy Tanenbaum at Embedded World 2013



# EW Eco system





# MINIX 3 current goals

- Work on the reliability features integrate the rest of the functionality
- Increase community involvement





# MINIX 3 ARM Status

```
git clone git.minix3.org/minix ; .cd src ;  
/releasetoots/arm_release.sh
```



# MINIX 3 ARM Status

	MMC	Framebuffer	Networking	usb
BeagleBoard	😊	😊		
BeagleBone	😊		😊	WIP



# MINIX 3 on ARM Future

- NetBSD type alignment
- More clang , live update, mmap
- Towards a volunteer based organization



# MINIX 3 on ARM future

Support more Ti hardware (including PRU)  
AllWinner (Olimex LIME)



# Q & A

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Thomas, Thomas Cort