

Console Yourself

Sarah Ewen & Lionel Lemarié SCEE Technology Group





This talk...

- Brief overview of PlayStation 2 architecture
 - Basic knowledge for development
- Linux for PlayStation 2
 - What is it, how does it work
- Development using the Linux kit
- Comparison with the professional devkit
- Performance
- The direct access "SPS2" module

But first...

- Who are we?
 - Sarah Ewen
 - Lionel Lemarié





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PlayStation 2

What were the design goals of the PlayStation 2?



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PlayStation 2: Goals of hardware

- Floating point performance
 - Essential for realistic 3D graphics
- High bandwidth
 - Maximise throughput
- Low level
 - More flexibility for developers
 - Feedback from PlayStation



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So how does the PlayStation 2 meet these goals?

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Main components



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The Emotion Engine (EE)



EE: 128-bit Emotion Engine VU0/VU1: Vector Units FPU: Floating Point Unit

GS: Graphic Synthesiser **DMA**: Direct memory access **IPU**: Image processing Unit

Introducing the Linux Kit

Why release Linux for PlayStation 2? What's in the kit? How does it work?

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Introducing the Linux kit



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What it is

- Keyboard & Mouse
- 40 GB HDD
- 10/100 Mbit NIC
- Monitor cable
- 2xDVD set
 - Linux
 - Manuals
 - EULA



What it is not

- Professional development environment
 - EULA agreement
 - Runtime Environment
- Desktop computer
 - Close, but not out of the box
 - Takes familiarity with Linux



Linux

- Distro based on Kondara Linux
 - Based on Red Hat 6.2
- Usual software packages
 Disc 2
- Supports VESA, PAL, NTSC
- Useful PS2Linux tools
 - setcrtmode
 - mcformat



Linux kit - Software



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Runtime Environment

- Provides access to:
 - DVD drive
 - Memory cards
 - .. any IO device via IOP
- Consequences
 - Can only read PS2 discs in drive
 - Cannot open game saves on memory card...

Development

What are my options using the Linux kit?

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Linux kit - development

Higher level:

- PS2GL
- Mesa
- SDL port
- **PS2** Approach:
 - Libps2dev
 - Bundled with examples and some documentation
 - /usr/doc/PlayStation2
 - Additionally
 - ps2stuff & SPS2 projects available on playstation2-linux.com

Linux kit - development

- Access to the Vector Units
 - Unaffected by Linux
 - Write applications in C/C++ and assembly
- Development environment
 - Libraries to access devices under Linux
 - A vu0math library
 - Your favourite text editor
 - A cross compiler
 - Principals are the same as native PS2
 - Limited debugging capability

A comparison

Linux kit vs professional development hardware: What's the difference?

- Hardware
- Software
- Development
- Tools
- Libraries
- Docs & support



Hardware

T10000:

- Expanded PS2
 - 128M main memory
 - 8M IOP memory
- Host-PC
- Controlled via network only
 - No direct access to either the PS2 or the host-PC

PS2 Linux:

- Standard PS2
 - 32M main memory
 - 2M IOP memory
- HDD
- Network adapter
- Can be used directly using a keyboard and mouse







Software

T10000:

- Host-PC controls PS2 hardware
 - PS2 hardware resources unrestricted
 - Thin kernel
 - manages I/O
 - debugging features
 - IOP exposed to developers

- PS2 runs Linux
 - PS2 hardware exposed through devices
 - Nodirect IOP access or SPU2 access to protect "MagicGate"
 - Linux eats memory and CPU time

Development

T10000:

- Cross development
 - compilation of code done on users PC
 - downloaded to PS2 via host-PC interface
 - debugger runs on users
 PC, talks to host-PC over network, which then talks
 to PS2 hardware

- Direct development
 - compilation of code done on Linux kit itself
 - debugger runs on PS2 Linux, taking up extra resources

Tools

T10000:

- Supplied with custom toolchain
 - GCC based compiler
 - EE and IOP debuggers
 - All tools know about PS2 hardware
- Several commercial development packages

 Fully visual IDE's etc.

- Supplied with GCC
 - Not fully "PS2"
 - Ports to other platforms possible for cross compilation

Libraries

T10000: Has several low-level libraries GS DMAC VUO And some higher level ones Mpeg **Network**

- Has device interfaces to some features
 - VU/VIF
 - GS expand
- Has some "helper" libraries to get you going
 LibPS2Dev

Docs and Support

T10000:

- Full hardware manuals
 Except IOP
 - But including SPU
 - Printed and PDF
- Many additional documents on
 - professional webs
 - professional website
- Private newsgroups and email support

- Full hardware manuals
 - Except IO Processor, sound chip
 - PDF only
- Public website
 - Public projects
 - Discussion forums
- Limited direct support
 - Sarah, Adam
 - Tech group staff in their own time

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Legal Documents	
Rules & Policies	great time!
Public Forum Rules	(0 Comments)
Privacy Policy	Linux kit at Consumer Electronics Show, Australia, 13-16 June Linux for Playstation 2 Community - sarahe - 2002-Jun-13 11:40
Terms of Service	
	I've just heard that the Linux kit will be on display at Sony's huge 324 sqm stand at the Consumer Electronics Show in Sydney.
Site Statistics	We're stand 69 in the Hordern Pavillion - "our man in Australia" Bill Dixon will be there to answer your questions and demo the kit.
Hosted Projects: 38 Registered Users: 8,362	The show's website is: http://www.ceshow.com.au/
SuperUser Site Administration Main entry Project admin Sony Admin Site	(1 Comment) European orders: your contact details, Public holidays Linux for Playstation 2 Community - sarahe - 2002-May-31 18:02 Interactive Ideas have now e-mailed every person who has been affected by their credit card bank refusing to verify address details.

Performance

What level of performance can be achieved on the Linux kit? What affects it?

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Performance

- Linux architecture not designed for PS2
- Large CPU overhead
- Kernel is not cache friendly
 - Does not use ScratchPad memory
 - Does not use Vector Units
- Software rendering is far from optimal
- But you have access to all unused resources

Performance

- Pretty good performance is achievable
- One of the samples displays 560k polys at 60fps
 - That's 33.6M polys/sec
 - Theoretical max is 35
- Aided by SPS2 module:
 - "Direct Access Environment"

SPS2: Direct Access Environment

Developed by PS2Linux developer community

- 1. What is it?
- 2. Why use it?
- 3. How do I use it?
- 4. Are there disadvantages?

What is SPS2?

- Kernel module loaded at runtime
- Gives direct access to the hardware
- Has been used to create samples requiring lots of processing power
- Linux friendly

Advantages

- Required for DMA transfers
 - Guarantee to have unswappable/unmovable memory
 - Only 4kb continuous memory is guarantied
 - Physical address of memory
 - You fill the buffers using Linux virtual addresses and sends the data using physical addresses
 - Direct access to the hardware registers
 - EE
 - GS

More advantages

- DMA packet checker
 - Set of functions for debugging purposes
 - Helps prevent crashes
 - Easy to crash the system
- Very good documentation
- Samples to illustrate usage
- Currently being developed and improved
- The module can be installed/uninstalled at runtime
 - No need to recompile the kernel
 - No memory is reserved
 - No need to even reboot

How to use SPS2

- Load the kernel at runtime
 - Scripts are provided to make it easy
- Use the library provided
 - Just a set of headers to include
 - System calls are taken care of
- Build DMA packets the same way you'd do on a DevKit
 - Use memory allocated by the module
 - Build small 4kb chunks linked in a chain
- Use macros to set the DMA registers
 - Macros are assembly code writing directly to the registers

Disadvantages

- Potential security issue
 - No safeguards
- Trade off between security and speed
 - You can have one or the other
 - But not both

SPS2 project framework

- Written by members of the community

 Professional developers
- Takes cares of display initialisation
- Deals with DMA packet building
- Provides a solid base for your code
- Samples of advanced techniques used in a game
 - Mskpath3
 - Bump mapping
 - Interlock

Nearly there...



• AGDC talks are nearly over!

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Conclusion

- Linux kit provides
 - Hardware Manuals
 - Access to PS2 at a low level
 - VCL
- Everything you learn through the Linux kit is of value on professional development tool

 SPS2 even makes your code more portable
- Amateur developer community is growing
 - playstation2-linux.com
 - Sourceforge approach to helping developers

Contact

- Exhibition on level 3: Booth #9
- On the web:

http://playstation2-linux.com http://au.playstation.com or nz.playstation.com http://www.technology.scee.net



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