**SLOTH: Let the Hardware Do the Work!**

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SOSP 2009, WiP Session
Confessions of a Slothful

Wanja Hofer

Sloth: Let the Hardware Do the Work! (SOSP-WiP 2009)
How It All Began...

- Building embedded OSes as used in automotive industry
- Prevalent OS standard: OSEK OS
  - Event-triggered, priority-driven real-time system
Let the Hardware Do the Work!

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SLOTH: Let the Hardware Do the Work! (SOSP-WiP 2009)
SLOTH: Threads as Interrupts

- Idea: Let interrupt subsystem do the scheduling and dispatching work
- New: All threads are interrupt handlers and have interrupt priorities
- New: `setReady(thread)` is implemented as an IRQ
SLOTH: Design and Example

IRQ Source
Thread A
prio=1
request

IRQ Source
Thread B
prio=2
request

IRQ Source
Thread C
prio=3
request

IRQ Arbitration Unit

CPU
curprio=X

IRQ Vector Table

threadA()
threadB()
threadC()
Sloth: Design and Example

- Thread A: prio=1 request
- Thread B: prio=2 request
- Thread C: prio=3 request

IRQ Source

Interrupt Request

CPU

curprio=1

IRQ Vector Table

threadA()

threadB()

threadC()
A diagram illustrating the process of handling interrupts in SLOTH. The diagram shows three threads (Thread A, Thread B, Thread C) with different priority levels (prio=1, prio=2, prio=3) and their corresponding interrupt requests. The interrupts are handled by an interrupt arbitration unit, which forwards the requests to the CPU based on the current priority. The CPU then selects the appropriate thread from the IRQ vector table to handle the interrupt (threadA(), threadB(), threadC()).
Sloth: Design and Example

**IRQ Source**
- **Thread A**
  - `prio=1`
  - `request`
- **Thread B**
  - `prio=2`
  - `request`
- **Thread C**
  - `prio=3`
  - `request`

**IRQ Arbitration Unit**

**CPU**
- `curprio=3`

**IRQ Vector Table**
- `threadA()`
- `threadB()`
- `threadC()`
SLOTH: Design and Example

**IRQ Source**
- **Thread A**
  - prio=1
  - request
- **Thread B**
  - prio=2
  - request
- **Thread C**
  - prio=3
  - request

**IRQ Arbitration Unit**

**CPU**
- curprio=3

**IRQ Vector Table**
- threadA()
- threadB()
- threadC()
**SLOTH: Design and Example**

- **prio=1** : IRQ Source Thread A
- **prio=2** : IRQ Source Thread B
- **prio=3** : IRQ Source Thread C

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**IRQ Arbitration Unit**

**CPU**

- curprio=3

**IRQ Vector Table**

- threadA()
- threadB()
- threadC()
**SLOTH: Design and Example**

- **Thread A**: 
  - `prio=1` request
  - IRQ Source

- **Thread B**: 
  - `prio=2` request
  - IRQ Source

- **Thread C**: 
  - `prio=3` request
  - IRQ Source

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**_IRQ Arbi-tration Unit**

- **CPU**
  - `curprio=2`

- **IRQ Vector Table**
  - `threadA()`
  - `threadB()`
  - `threadC()`

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**SLOTH: Design and Example**

**IRQ Source**
- Thread A: prio=1, request
- Thread B: prio=2, request
- Thread C: prio=3, request

**IRQ Arbitration Unit**

**CPU**
- curprio=1

**IRQ Vector Table**
- threadA()
- threadB()
- threadC()
Sloth: Advantages

- Simple
- Small
- Fast (2–20x)
- Cool
SLOTH: One of the Seven Deadly Sins

David Fincher, Se7en (1995)
**Sloth: One of the Seven Deadly Sins**


Nicolas le Rouge, *Le Grant Kalendrier Des Bergiers* (1496)
1. Talk to me!