



Simultaneous Multi-Threading

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Unit Objectives

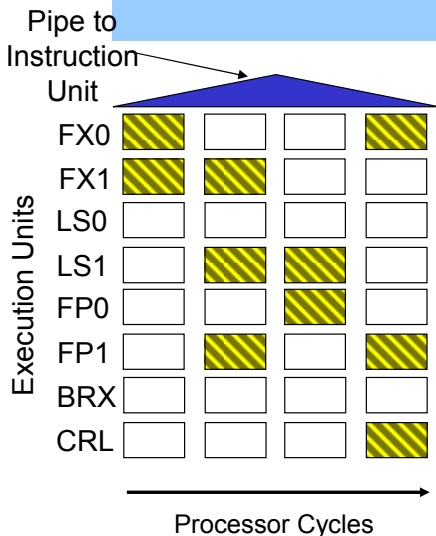
After completing this unit, you should be able to:

- Describe the simultaneous multi-threading concept and its effect on performance monitoring and tuning
- View logical processors
- Use `smtctl` to enable/disable simultaneous multi-threading and view simultaneous multi-threading statistics
- Describe the function of the new PURR statistics
- Describe the impact of simultaneous multi-threading on tools such as `vmstat`, `iostat`, `sar`, and `topas`

What is Multi-Threading?

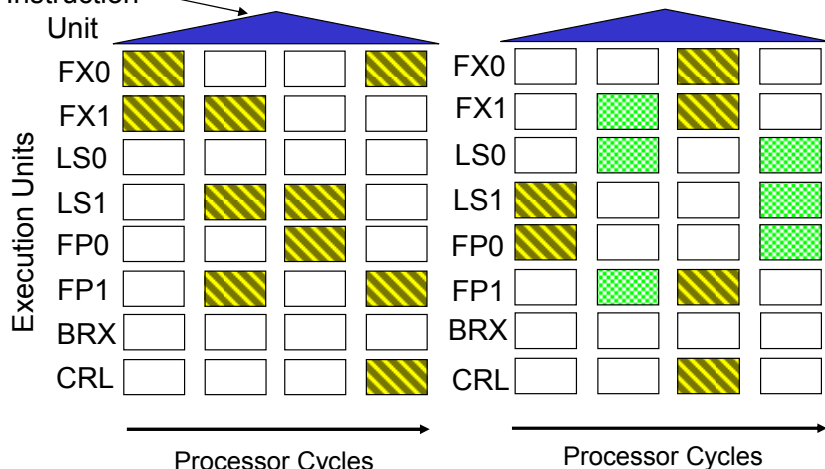
No multi-threading (Single-threaded)

Execution units in a processor are dedicated to a single instruction stream



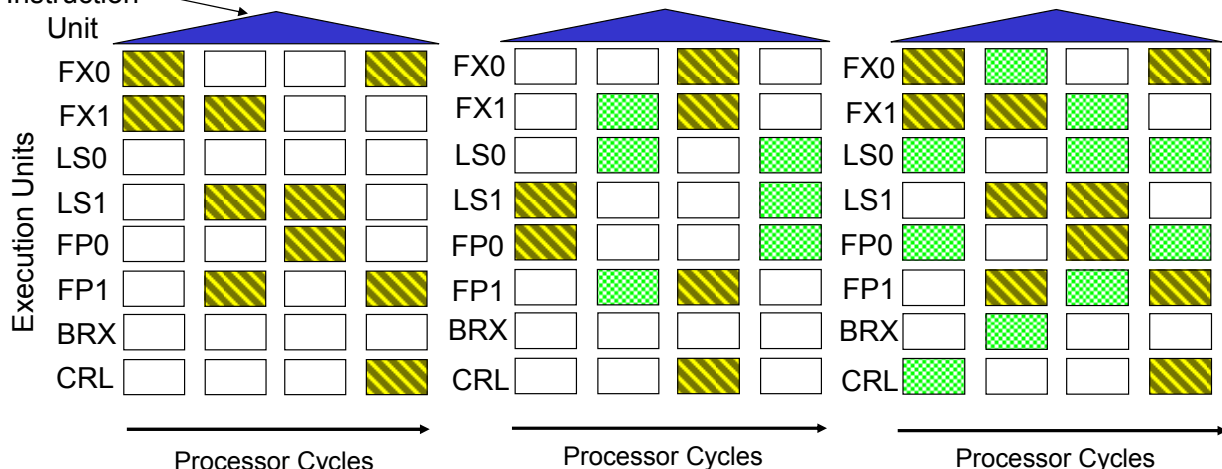
Fine- and coarse-grain multi-threading

Execution units can be made available to more than one instruction stream during different cycles



Simultaneous multi-threading POWER5

Execution units are simultaneously available to two instruction streams during the same cycle



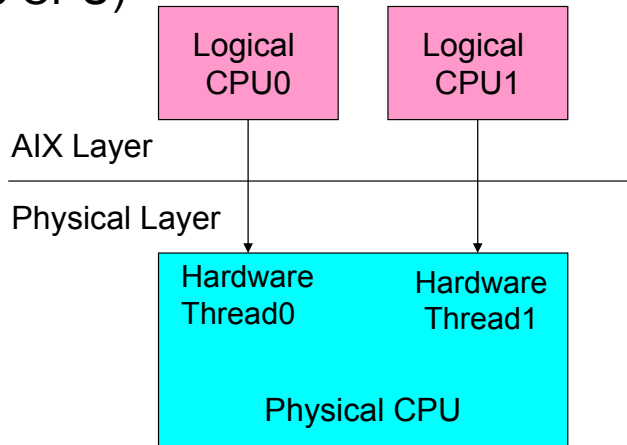
Instruction Stream 1



Instruction Stream 2

What is Simultaneous Multi-Threading?

- Two hardware threads can run on one physical processor at the same time
- One processor appears as two logical processors to the operating system
- Simultaneous multi-threading is a means of converting thread-level parallelism (multiple CPUs) to instruction-level parallelism (same CPU)



When to Use Simultaneous Multi-Threading

- Simultaneous multi-threading may be beneficial if:
 - The two threads are similar in execution needs and CPU utilization is topping out
 - There is random data access (where you must wait for data to be loaded into cache)
 - The overall throughput is more important than the throughput of an individual thread
- Simultaneous multi-threading may not be beneficial if:
 - One thread is slower, which could slow down both threads running on the processor
 - Both threads use same execution units
- Where simultaneous multi-threading is not beneficial, POWER5 systems supports single-threaded execution mode:
 - Automatically by *snoozing*
 - Manually by disabling simultaneous multi-threading

Viewing Processor and Attribute Information

- List processors with the `lsdev` command:
 - `lsdev` lists physical or virtual processors:

```
# lsdev -Cc processor
proc0 Available 00-00 Processor
proc2 Available 00-02 Processor
```

- List processor attributes with the `lsattr` command:

```
# lsattr -E1 proc0
frequency 1656000000 Processor Speed False
smt_enabled true Processor SMT enabled False
smt_threads 2 Processor SMT threads False
state enable Processor state False
type PowerPC_POWER5 Processor type False
```

- List logical processors with the `bindprocessor` command:

```
# bindprocessor -q
The available processors are: 0 1 2 3
```

Turning On/Off Simultaneous Multi-Threading

- Use the `smtctl` command or SMIT to enable/disable or see status:
 - `smtctl [-m off | on [-w boot | now]]`
 - SMIT fastpath: `smitty smt`
- To turn simultaneous multi-threading off dynamically (for now):

```
# smtctl -m off -w now
smtctl: SMT is now disabled.
# bindprocessor -q
The available processors are: 0
```
- To turn simultaneous multi-threading on dynamically (now and reboot):

```
# smtctl -m on (defaults to both)
smtctl: SMT is now enabled.
# bosboot -a
# bindprocessor -q
The available processors are: 0 1
```

Viewing smtctl Settings

smtctl

This system is SMT capable.

SMT is currently enabled.

SMT boot mode is set to enabled.

SMT threads are bound to the same physical processor.

proc0 has 2 SMT threads.

Bind processor 0 is bound with proc0

Bind processor 1 is bound with proc0

proc2 has 2 SMT threads.

Bind processor 2 is bound with proc2

Bind processor 3 is bound with proc2