Session
AD019

Threads vs. Events

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Introduction

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In recent years, Threads have been the rage.

Like most fads, Threads have strengths and weaknesses which must be considered when planning software development.

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NOTES

Thread Model:

A process contains multiple threads: Each thread may computable or blocked at any instant in time.

Examples:

DECthreads, Windows NT

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Event Model:

A process consists of the processing of a series of events. At any instant in time, a single event is being processed.

Examples:

OpenVMS AST, X-Windows

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Threads vs. Events – A Comparison

- ***Mathematically Equivalent***
- ***Significant Complexity Difference***
- ***Which is better?***

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Threading:

If no interactions, simple application implementation.

If there are interactions between threads, then the interactions require locking and other mechanisms to prevent subtle programming errors from causing failures.

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Events:

Each event is treated as an independent transaction by the program. Pre-emption is not permitted, so there are no locks or synchronization required to access data structures during the processing of a single event.

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Process Types

- ***Heavyweight***
- ***Lightweight***
- ***Featherweight***

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Heavyweight Processes

- ***Separate Register Set***
- ***Separate Stack***
- ***Separately Dispatchable***
- ***Separate Address Space***
- ***Expensive Creation***

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Lightweight

- ***Separate Register Set***
- ***Separate Stack***
- ***Separately Dispatchable***
- ***Preemptable***
- ***Low resource consumption***

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Featherweight

- ***Shared Register Set***
- ***Shared (nested) Stack***
- ***Separate Address Space***
- ***Extremely inexpensive Creation***
- ***No preemption***
- ***Implicit synchronization***
- ***Extremely inexpensive***

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When Threads/Events?

Use threads only when there a payoff.

Pre-emption only pays when CPU saturation occurs.

Hierarchy of Effort

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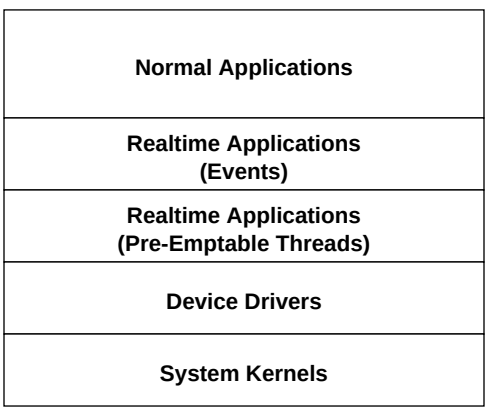
Hierarchy of Effort



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Threading Hazards

- ***synchronization***
- ***complexity***
- ***proper tool?***
- ***debugging***
- ***data structure locking***

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Threading Implementation Basics

- ***preemption model***
- ***priority model***
- ***debugging***
- ***application suitability***

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Events (Non-Preemptible Threads)

- ***FIFO***
- ***Non-preemptable***
- ***'Featherweight'***

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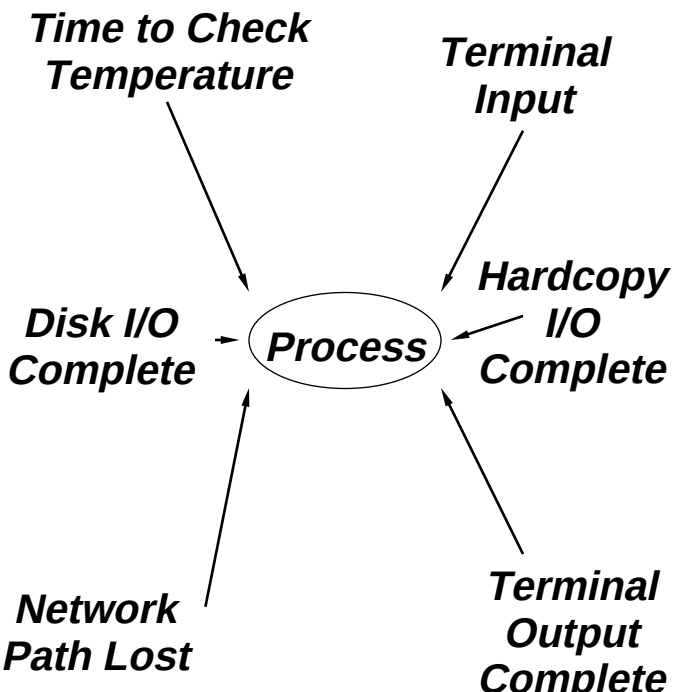
Typical Event Driven Computer Application



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Event Processing —

- ***External events control program***
- ***Programs need to be efficient***
- ***External event sequence is not under program control***
- ***No Dispatch Routine***

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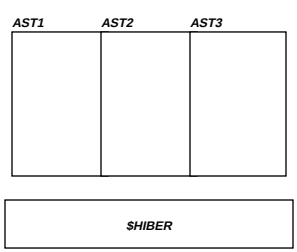
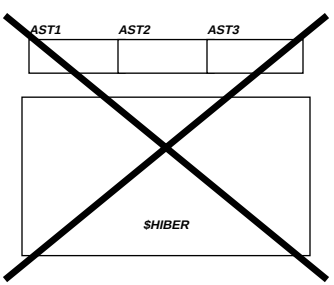
Tricks to Getting It Right

Do ALL Processing in as Events



Good



Bad

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Avoid Problems

- ***Kill bugs before they occur***
- ***DO NOT inhibit Events.***

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Summary:

The minimum needed level of complexity is desireable. If your application is not operating in a CPU saturated environment, then the performance benefits of pre-emptible threads are illusory at best, and represent a significant increase in the complexity of your application over the functionally equivalent application using events.

Questions?

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