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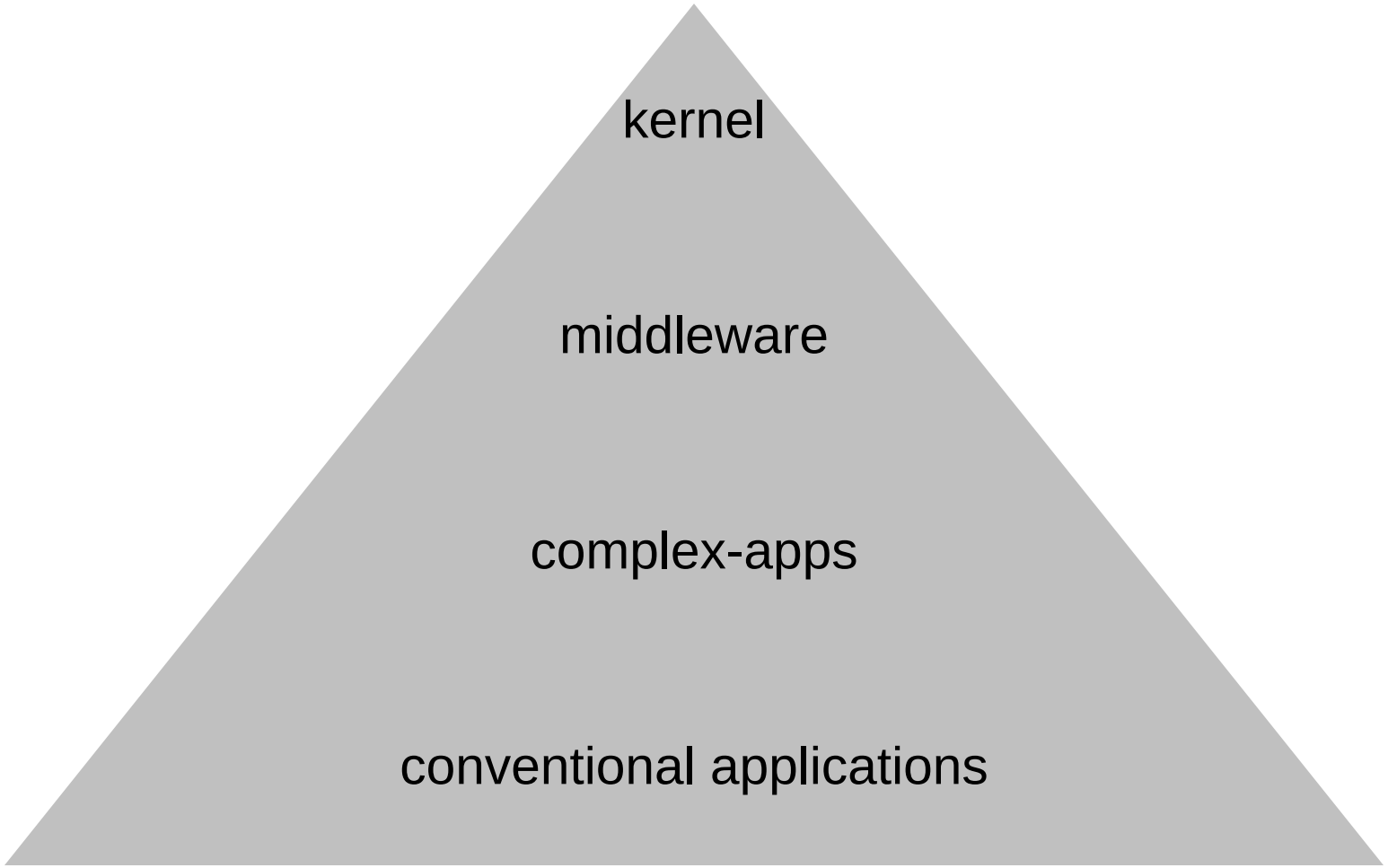
Session 1228

Events and Threads

HPETS 2002
Tuesday, October 8, 2002
11:15 – 12:30
Room 125

Types of Software Components

- compilers, linkers, simple sequential transformations
- real-time applications
- network applications
- middleware (e.g. RMS, network tool kits, real-time toolkits)
- run time libraries
- device drivers and related processes (e.g. XQP)
- operating system kernels



Why Events and Threads?

- outside events not controllable
- multiple tasks
- CPU utilization high; response latency
- need to operate "behind the scenes"

Different Threading Categories

- non-threaded
- non-preemptorially threaded
- collegial preemption
- involuntary preemption

Why Preemption?

- only a single reason – response latency
- other reasons are specious
- preemption has a high cost
- need to operate "behind the scenes"

Let’s look at some basics

- Process Types
- Trade-offs
- Protection Models
- Threading Hazards

Process Types

- Heavyweight
- Lightweight
- Featherweight

Heavyweight Processes

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

Lightweight Processes

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

Featherweight Processes

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

Threading Hazards

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

Synchronization

- if non-premptive – no locking
- if collegial-preemptive – active thread is presumptive lock
- if involuntary – explicit locking mandatory

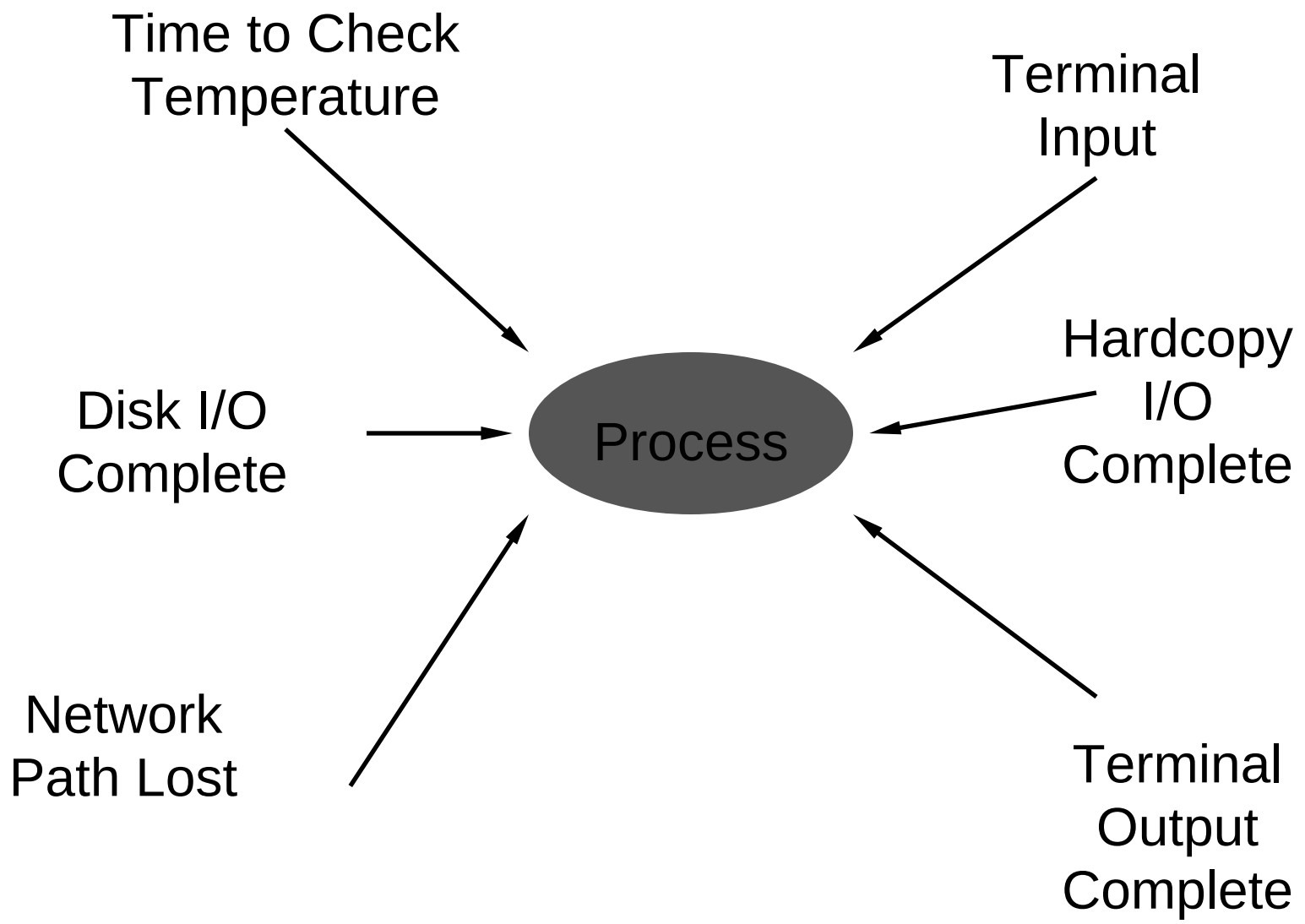
Threading Implementation Basics

- preemption model
- priority model
- debugging
- application suitability

OpenVMS ASTs – Basics

- FIFO within Access Mode
- Non-preemptable within an Access Mode
- ’Featherweight’
- AST Entry is via an asynchronous(!), simulated, CALLS instruction

Typical Event Driven Computer Application



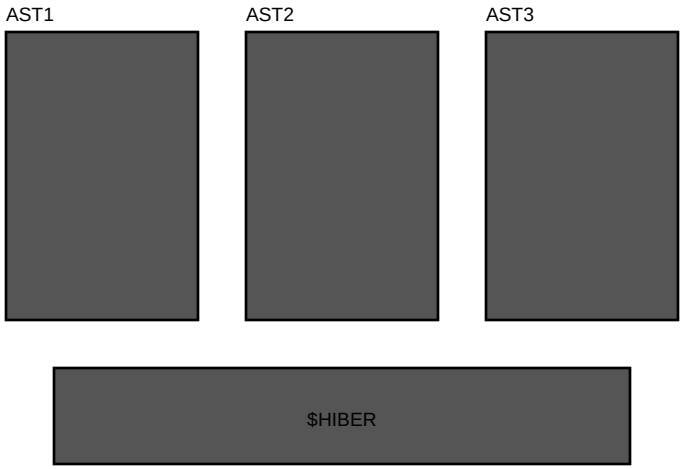
Common Root —

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

Tricks to Getting It Right

Do ALL Processing in ASTs

Avoid Performing Processing at AST level and normal Process level.



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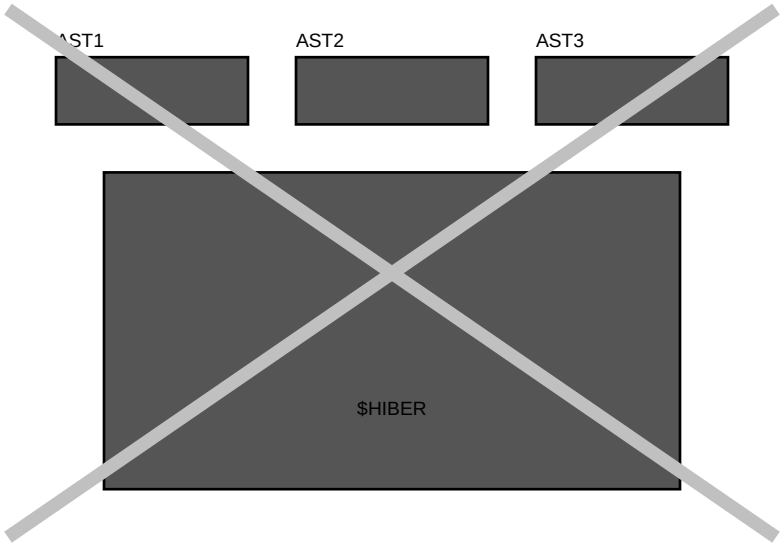

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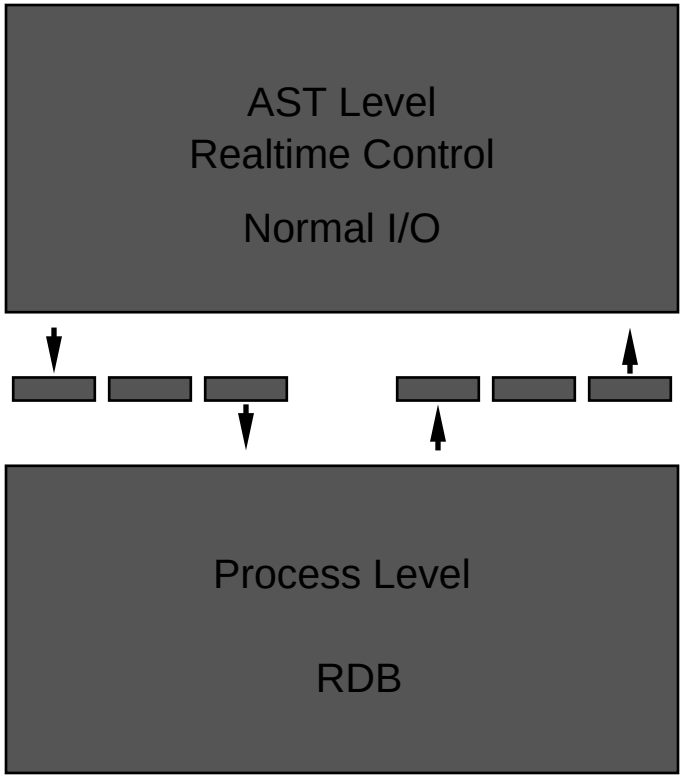
Tricks to Getting It Right

Use Work, Answer, and Free Queues to communicate.



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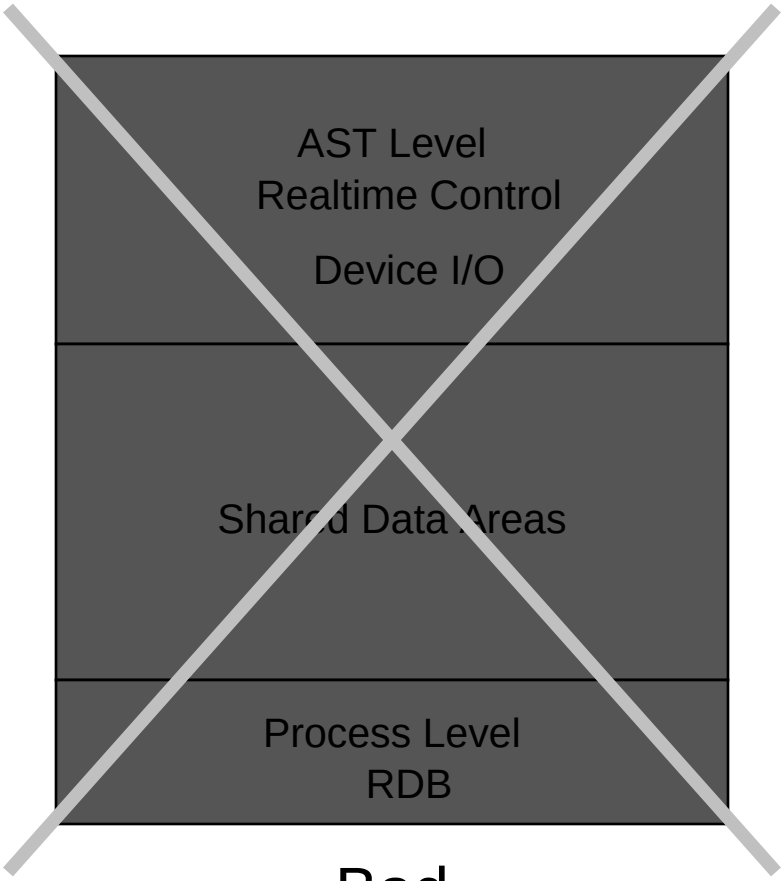

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Don’t Borrow Trouble — Avoid Problems

- Kill bugs before they occur
- Increasing levels of preemption is expensive
- Analysis is cheap; debugging is expensive
- Testing is difficult, expensive, and not reassuring
- Preemption only needed to deal with latency
- DO NOT inhibit ASTs
- Use serialization where needed to simplify

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Session Notes & Materials:
http://www.rlgsc.com/hpets/2002/index.html

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Questions?