Introduction to OpenVMS AST Programming

Monday, September 25, 2017

2017 OpenVMS Bootcamp
Westford Regency Conference Center
Westford, Massachusetts

Agenda –

- **This session will teach you how to use OpenVMS ASTs**
- **The rules presented here ARE stricter than many of the rules presented in the OpenVMS manuals.**
- **These rules are designed to ensure correct, efficient applications**

Introduction

Basics

- **Synchronization logically equivalent to IPL level synchronization in the VMS Executive WITHIN a single process.**
- **High Efficiency**
- **Fewer limits than Event Flags**

When Should You Use ASTs?

Realtime Applications
Control
Transaction Processing
Monitoring
Network Applications
Time related applications

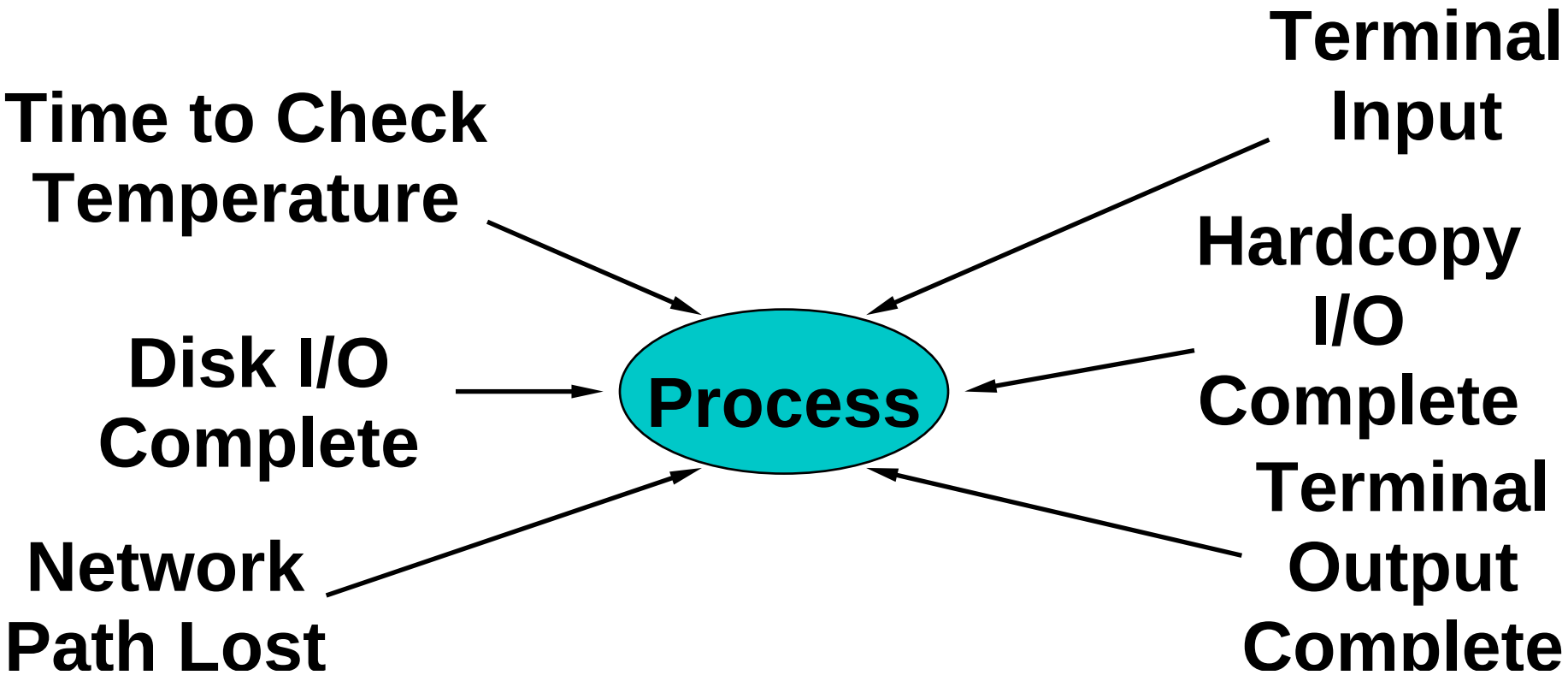
General AST Concepts

- **Non-interruptable by other ASTs at same or lesser Access Modes.**
- **FIFO Execution.**
- **AST Entry is via an asynchronous(!), simulated, CALLS instruction.**

Typical Event Driven Computer

- **Printing**
- **Terminal Management**
- **Process Control**

Typical Event Driven Computer Applications



Common Root —

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

Generating and Processing ASTs

- **Asynchronous System Services**
  - **$QIO**
  - **$ENQ**
- **Record Management Services**
- **Timer Services ($TIMER)**
- **Declare AST Service ($DCLAST)**
- **Mailboxes**
- **Unsolicited I/O Events**
- **Library events**

Speaking More Generally

- **Synchronous System Services (e.g., $FAO)**
- **Asynchronous System Services (e.g., $QIO)**
  - **Descriptions include AST, ASTPRM, and IOSB**
  - **Derivatives thereof**

Programming Benefits

- **Event Flags are limited**
  - **64 Local Event Flags**
  - **64 Common Event Flags (remappable)**
- **No limit on ASTs. AST limits enforced by**
  - **ASTLIM (from SYSUAF)**
  - **System Resources**
- **Capable of supporting multiple, alternative sequences without polling or increases in complexity**

Keep Programs Simple

Best main program for AST based application is extremely simple.

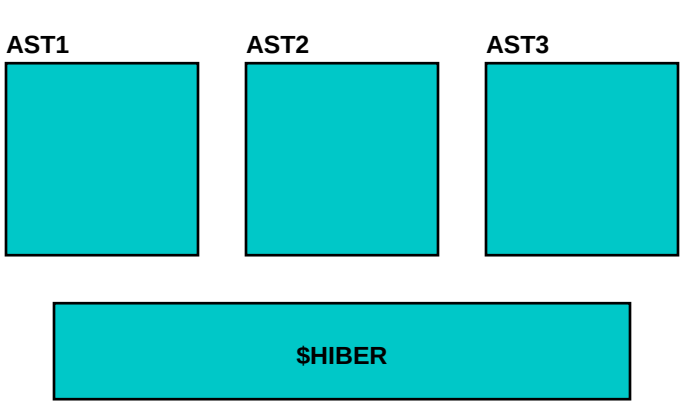
```
PARAMETER NO = 0
CALL INIT
EXIT_FLAG = NO
DO WHILE EXIT_FLAG .EQ. NO
    CALL SYS$HIBER()
    END DO
```

Keep Programs Simple

- **Get in — GET OUT!**
- **Never use System Service WAIT forms**
- **Use Event Flag EFN$_EFC**
- **Keep Logic simple**

Tricks to Getting It Right

Do ALL Processing in ASTs.
Avoid Performing Processing at AST level and normal Process level.



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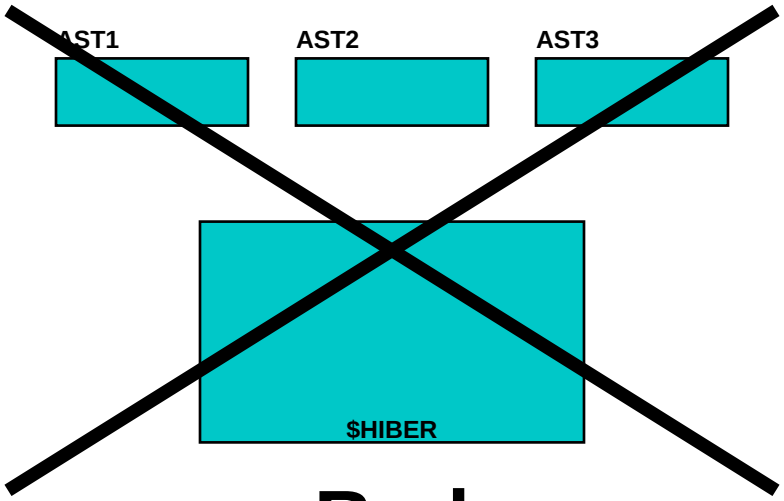

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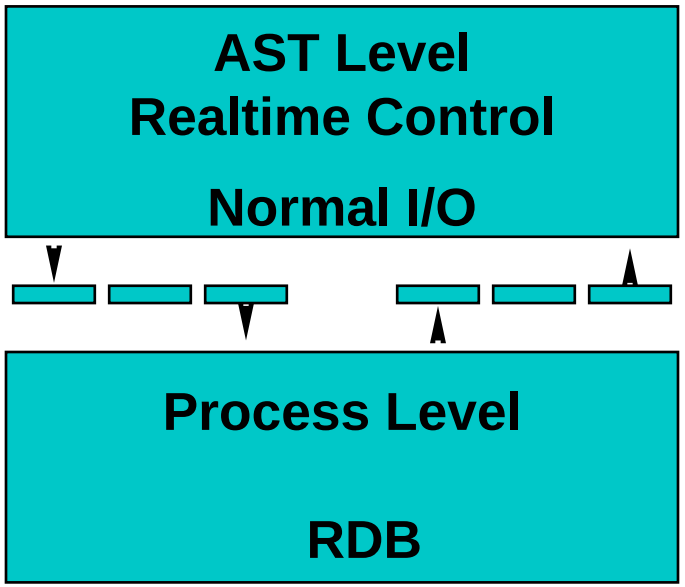
Tricks to Getting It Right

Some packages (e.g. RDB) expect to be used only from normal level, NOT AST level.

Tricks to Getting It Right

Use Work, Answer, and Free Queues to communicate.



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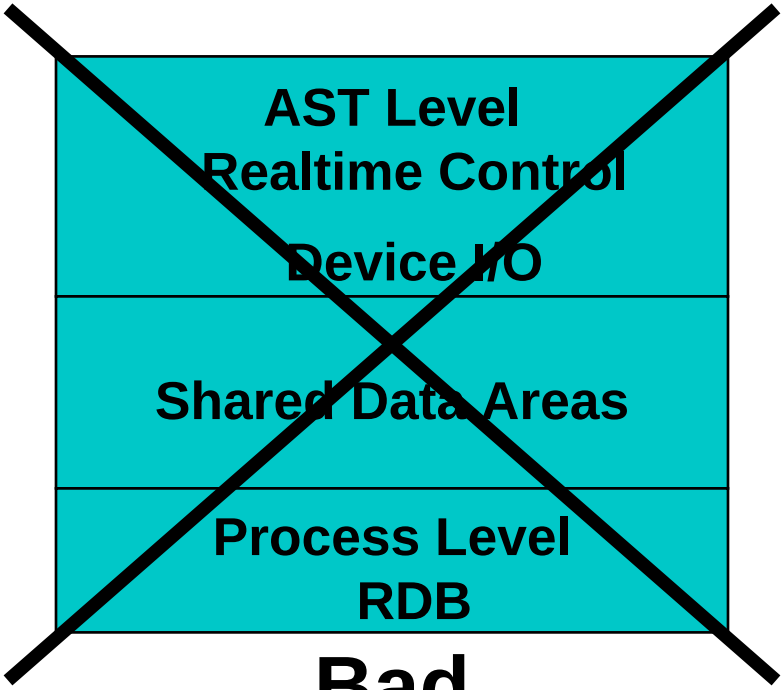

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Communications Between AST Level and Process Level

- **Use Queues, Insert/Remove Queue or LIB$ routines (for HLLs)**
- **Be careful of queue overflows, handle overflows gracefully**
- **Remember to ALWAYS issue $WAKE call!**

Communications Between Process Level and AST Level

- **Use queues, Insert/Remove Queue or LIB$ routines (HLLs)**
- **Use $DCLAST service to switch to AST level**
- **Allow ASTs to be processed in the order they are generated, DO NOT process multiple items at a time!**

Initialization

Do as much initialization as possible from AST level to reduce risk of race conditions.

```
SUBROUTINE INIT
X = SYS$DCLAST(INITAST, PARM)
END

SUBROUTINE INITAST(PARM)
     :
     :
END
```

Good

```
SUBROUTINE INIT
     :
     :
END
```

Bad

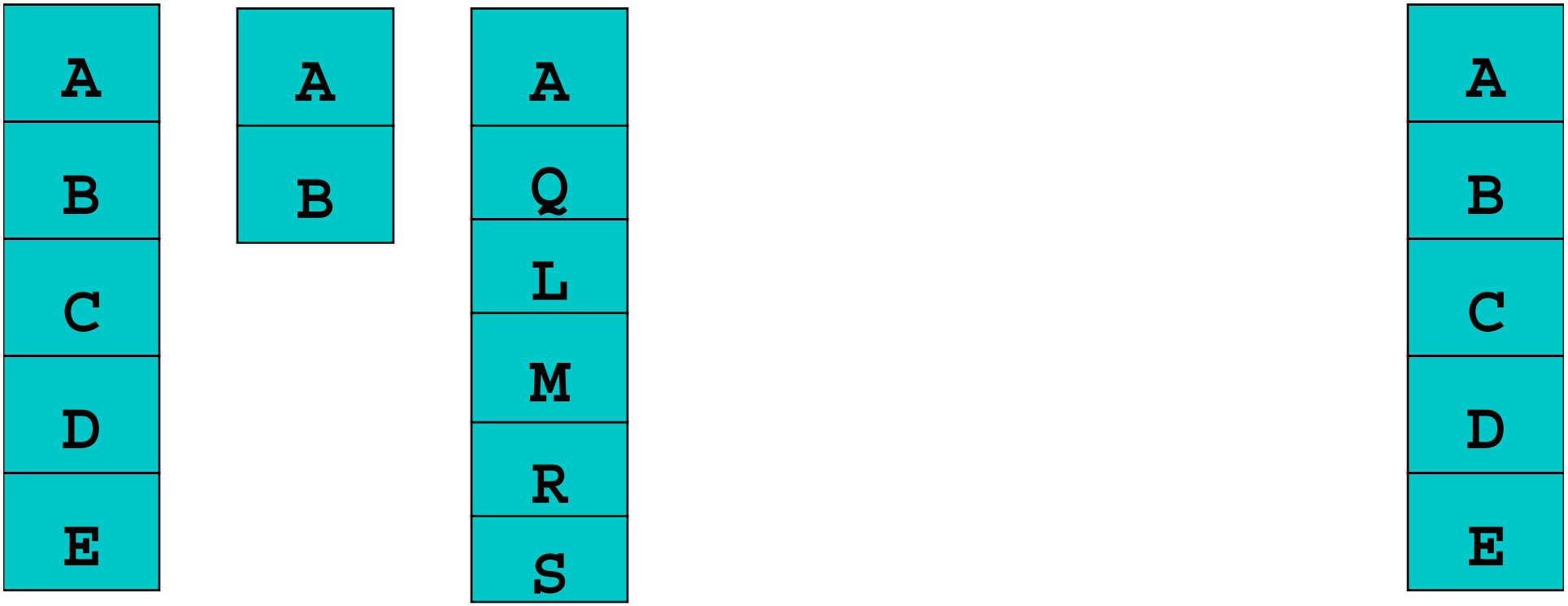
Avoid Problems

- **Kill bugs before they occur**
- **DO NOT inhibit ASTs. Use $DCLAST to avoid interruptions.**

“Out of scope” Variables

Stack locations are used by different modules over time. ASTs should NOT use stack-based for persistent uses (e.g., IOSB, buffers)

“Out of scope” Variables (cont’d)



Questions?

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Session Notes & Materials:
http://www.rlgsc.com/openvms-bootcamp/2017/index.html