Wednesday, October 28, 2026, 4:30 PM, Gardner Room

Building OpenVMS Applications for Troubleshooting and Accountability

2026 OpenVMS Bootcamp
Portsmouth Sheraton
Portsmouth, New Hampshire USA

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Agenda –

- 0300L, Holiday weekend: Production Failure
- Alterative: Product Failure at Customer Site
- What does one need for troubleshooting?
- Solution: Facilitate Evidence Preservation
- Some problems are obvious; others not so much

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References

- VSI OpenVMS System Management Manual
- VSI OpenVMS System Service Reference Manual: A–GETUAI
- VSI OpenVMS System Service Reference Manual: GETUTC–Z
- VSI OpenVMS DCL Dictionary: N–Z
- VSI OpenVMS RTL Library (LIB$) Manual
- VSI OpenVMS Debugger Manual

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Introduction

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Debugging Never Ends; It Blends into Troubleshooting

- Interactive debugging not feasible for production
- More sophisticated approaches assist debugging
- Troubleshooting production/field problems
- Low-cost
- Long-term economies
- Up-front cost canard

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Modifying Production Images

- Management reluctance
- Fork hazard
- Haphazard – Entropy

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Working Forward

- Temporary bespoke changes – bad
- Configuration – parameters; logical names
- Thought out in advance

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Costs

- Judicious validity checks do not impair performance
- Ad-hoc debugging traps are expensive
- Pre-arranged troubleshooting aids
- Original construction v rennovation
- Entry/Exit gates; Signatures

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Conditional Traces

- Global parameter bitmask
- Defined during program initialization
- Can be changed during execution –
  via timed logical name polling;
  command interfaces, e.g., mailboxes; commons
- active not reactive
- Thought out in advance

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History – Trace Tables

- Classic; date back over 50 years
- Memory used to be a limit; no more
- Simple to implement see example
- Example: Last 10 requests

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Internal Fault Detection

- Entry gates – Validity; Conditional Trace
- Wrapped within IF block
- Standard subroutine/function boilerplate
- Centralized Enable/Disable control; parameter
- Signature check on data structures

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Failure Reporting

- Failures are inevitable
- Standard reporting when fault is detected
- Formatted dump of all data structures
  (see Formatting Extensions presentation)
- Applications dump via LIB$SIGNAL
- Include date/time; Image; Process ID; $GETJPI

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Application Dumps

- Goal: Formatted trace/dump with .DMP file backstop
- Connect data with DUMP file
- SET PROCESS/DUMP[=NOW]/ID=xx
- ANALYZE/PROCESS_DUMP <filename>

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Build Artifacts

- Compile with FULL listings (including assembly code)
- /DEBUG whether Optimizing or not
- LINK with both maps and symbol tables
- Automate artifact generation
- Storage is relative inexpensive compared to downtime

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Application Bug Checks

- Internal integrity checks
  See: Building Applications for Trouleshooting and Accountability
- Formatted dumps of data structures
  see: DEBUG Formatting Extensions
- Specify user exception handlers
- Include: Image; ToY; Process ID; Nodename; and other relevant data for correlation
- Final step: Use LIB$SIGNAL to signal SS$_IMGDMP

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Traces

- Not ad hoc; thought out in advance
- Can be formulaic – Entry/Exit gates
- Specific to function – corruption, e.g., bad index/pointer
- Global trace status long/quadword
- Always guarded by a conditional

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Global Trace Control

- Define categories of traces
- Define macros in a separate file
- Mask and bit # definitions; consider enum
- Pragmas and compiler built-ins for performance
- At initialization – config file; parameter
- Post initialization: logical name; command interface; in-stream

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Global Trace Control – Sample Code

```
long somefunction(structure *Pointer){

#ifdef TraceIncluded

     If  (Trace_Enabled(Trace_A)) [[unlikely]] {
          // Produce trace output
          ...
          }
     …
     }
#endif
```


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Tracing – Instance

- Entry/Exit gate
- Critical points in code, e.g., critical data structure changes

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Reasons for a BugCheck/Trace Point

- NULL pointer on entry
- Invalid data structure on entry
- “Impossible” condition (unsurvivable)
- Fatal -> BugCheck; Recoverable -> Trace

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Bug Check Checklist

- Unexpected NULL pointers
- Out of range parameters
- Data structure invalidity
- Logical contradictions, e.g., assert failures

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OpenVMS DEBUG In Production

- Production runs without human intervention
- OpenVMS DEBUG can be invoked hands-free
- DEBUG logical names: DBG$INIT, DBG$INPUT, DBG$OUTPUT
- Conditional Breakpoints,
  e.g., SET BREAK brkpt WHEN (condition)
- EXAMINE
- CALL external formatting routine, see DEBUG Formatting Routines session

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Example: SAMPLEDEBUG.C

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SAMPLEDEBUG.DBG

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SAMPLEDEBUG.COM

- Compiles with DEBUG symbol tables
- Links with DEBUG enabled
- Can use SET IMAGE post-LINK, but tricky

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Execute SAMPLEDEBUG_RUN.COM

- No human intervention

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SAMPLEDEBUG_RUN.COM output redirected

- Separate DEBUG log file

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Summary

- Advance preparation speeds troubleshooting
- Ad-hoc approaches risk error
- Tracing/Internal validation can be enabled in advance
- Performance impact is generally negligible

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Questions?

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Session Notes & Materials:
http://www.rlgsc.com/openvms-bootcamp/2026/index.html

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