Technical Performance Risk Management for Large Scale Programs

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Technical Performance Risk Management

- **The Challenge**
  - Development of large scale systems and system of systems often face considerable cost and schedule challenges. Technical performance risk is one of the most common drivers behind those challenges due to the potential of perturbation to the upfront architecture and design as well as the backend verification and validation efforts.
- **The Context**
  - Technical performance issues can often be ambiguous, under-defined, or unknown until later stages of the system development life cycle where the functional product has a greater degree of maturity.
  - This dynamic has a higher degree of risk in large scale multi-iteration or Agile development based programs due to end-to-end product maturity occurring late in the development and integration life cycle.
    - New mission needs, such as greater cybersecurity and autonomy, serve to further complicate these technical performance issues

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The Approach

- Not all technical performance is created equal
  - Up Front
    - Negotiate TPMs and Performance Verification Criteria: Must Have, Want to Have, Nice to Have
    - Manage customer, stakeholder, and leadership expectations
  - In Phase
    - Apply rigorous performance management at critical phases
- Establish technical performance as part of the culture
  - 'Bake it in' to your Systems Engineering technical baseline
    - Integrate Performance throughout all levels of the Systems Engineering 'V'
  - Manage the risk at all levels and maximize your flexibility
  - Model it, Measure it, and Analyze it

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Not all technical performance is created equal

- Performance, defined in absolutes, drives cost and schedule risk into a program
  - "Work Smarter Not Harder" – Work with your customers to categorize performance needs: Must Have, Want to Have, Nice to Have
    - Drive 'Must Have' performance into all levels of the technical baseline thru the SE 'V'
    - Mitigate risk of 'Want to Have' and 'Nice to Have' by negotiating sell off of lower category performance - Worst case sell off, 95% sell off, confidence intervals, sample sizes, acceptable or alternate verification methods
- "Tell me, I will forget. Show me, I will remember. Involve me, I will understand"
  - Drive customer & stakeholder engagement, involve them in your performance plans, risks, and mitigations, manage their expectations though the collaboration, communication, integrity, and trust built by your actions
- Apply rigorous performance management methodology at critical phases
  - Performance Requirements & Implementation
  - Performance Design
  - Performance Integration, Test, and Verification

Establish technical performance as part of the culture

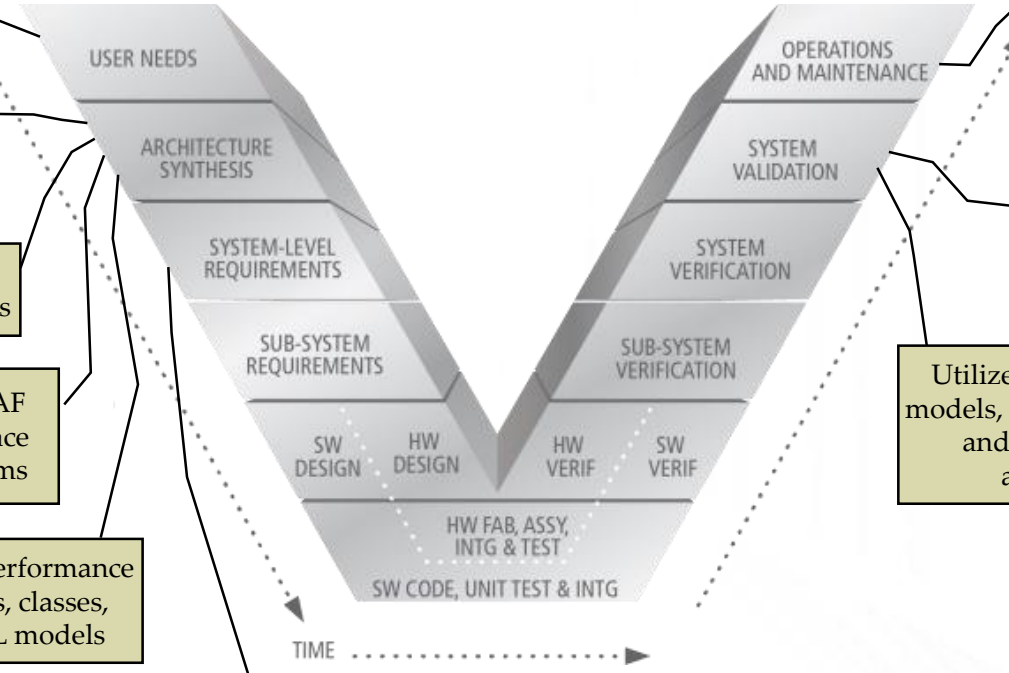
Context & Definition of Mission Critical Performance in the ConOps/OpsCon

Capture KPP/KSA/TPM in the DoDAF metamodel relationships. SV-1 → SV-6 → OV-3

Overlay performance in DoDAF OV-5 Operational Activity use cases

Capture performance in the DoDAF OV-6c, SV-10c, SvcV-10c event trace or SYSML/UML sequence diagrams

Stereotype & characterize critical performance as part of the functions, interfaces, classes, and operations in SYSML & UML models



Deliver performance as a Product to O&M architecture, models, tools, instrumentation, & docs to operate & maintain long term

Validate the ConOps/Opscon Mission Critical Performance Achieves Operational Suitability

Utilize the performance architecture, models, Performance Development Plan, and performance verification to achieve system validation

Utilize requirements & architecture to define & decompose the Performance Development Plan. Manage performance cost, schedule, & expectation risk thru collaboration and the programs risk management framework

Drive 'Must Have' Performance into the Technical Baseline & the Program Culture

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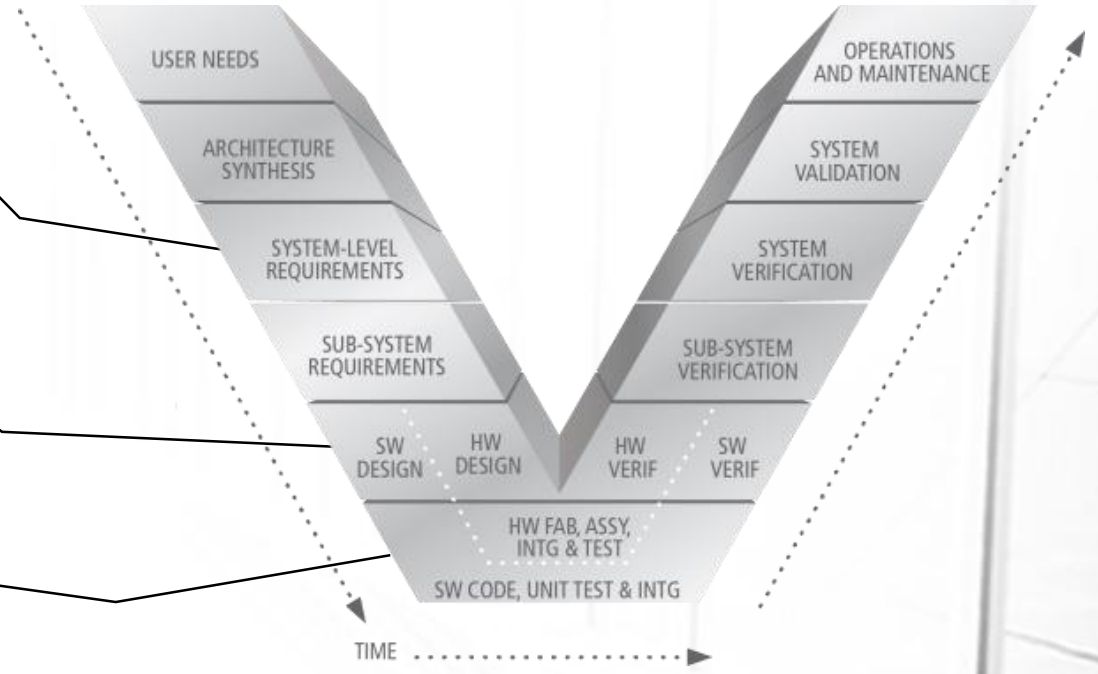
Performance Requirements and Implementation

- Performance Boundaries need to be crisp, clear and verifiable:
  - Latency: last bit in last bit out vs. first bit in first bit out, etc
  - Infrastructure: CPU/MEM, LAN/WAN, Storage -> Loading Condition, Virtual Environment, Nominal vs. Worst Case, etc
  - Accuracy and Error: Truth source, Filter criteria, statistical sell off points
- Agreed upon assumptions need to be clearly documented and periodically reviewed

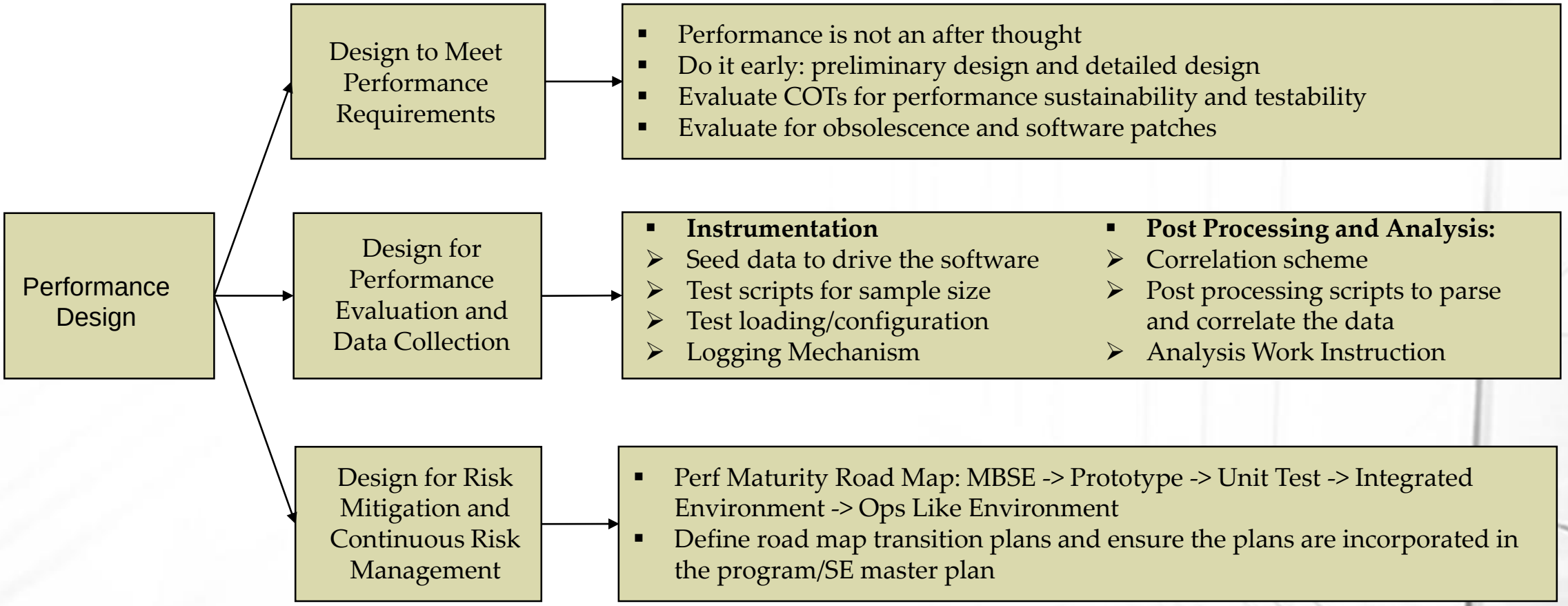
- See Next Slide

- Performance issues are hard to fix. Use DevOps, Agile, Scrum methodology to shorten the Observe, Orient, Decide, Act (OODA) loop
- As the system matures, periodic performance regression tests will be desirable to continuous monitor the system performance -> Automation is necessary to achieve performance monitoring.



Not well defined or managed perf requirements = significant cost/schedule impact

Performance Design



Design for Off-Nominal Conditions

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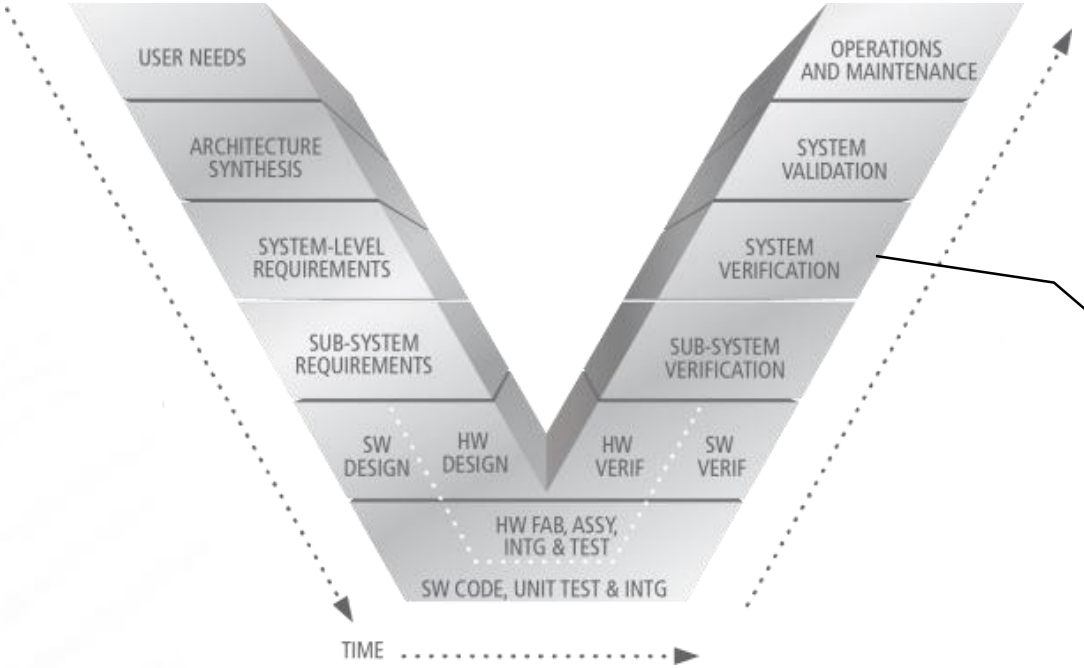
Performance Integration, Test and Verification



- Sum of the lower level performance estimations is not always smaller or equal to the high level performance. Sometimes 1 + 1 = 11. Manage both low level performance and high level performance.
- Be aware of the interdependencies and assumptions.
- Performance verification test should be a check box. System/subsystem/CI performance issues need to be detected, investigated and resolved early to reduce cost/schedule risks.
- Tooling/instrumentations need to be qualified and managed with change configuration management for formal performance qualification test
- IA and Cyber security will have performance impact

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Thank you!

Q & A

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