Systems of Systems Evaluations using SCRAM

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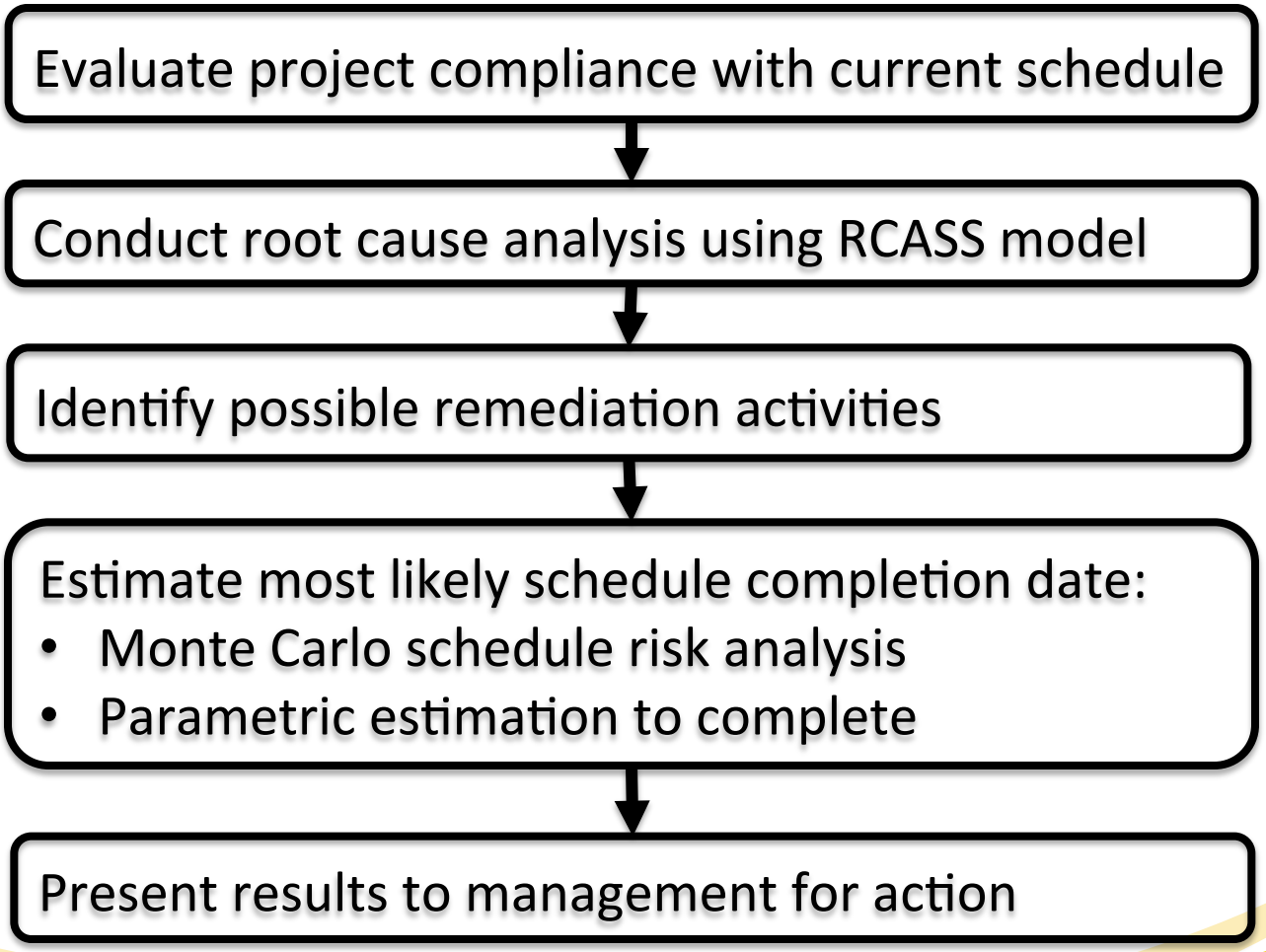
scram™
SCHEDULE COMPLIANCE RISK ASSESSMENT METHODOLOGY

SoS Evaluations Overview

- Based on Schedule Compliance Risk Assessment Methodology (SCRAM)
  - Developed by the Australian DMO
- Elaborated to support evaluation of SoS capabilities
- Strives to answer questions such as
  - What is the probability that a given SoS capability will be available by a certain date?
  - What is the most probable date SoS capability will be available?
  - What are the risks associated with this probability?

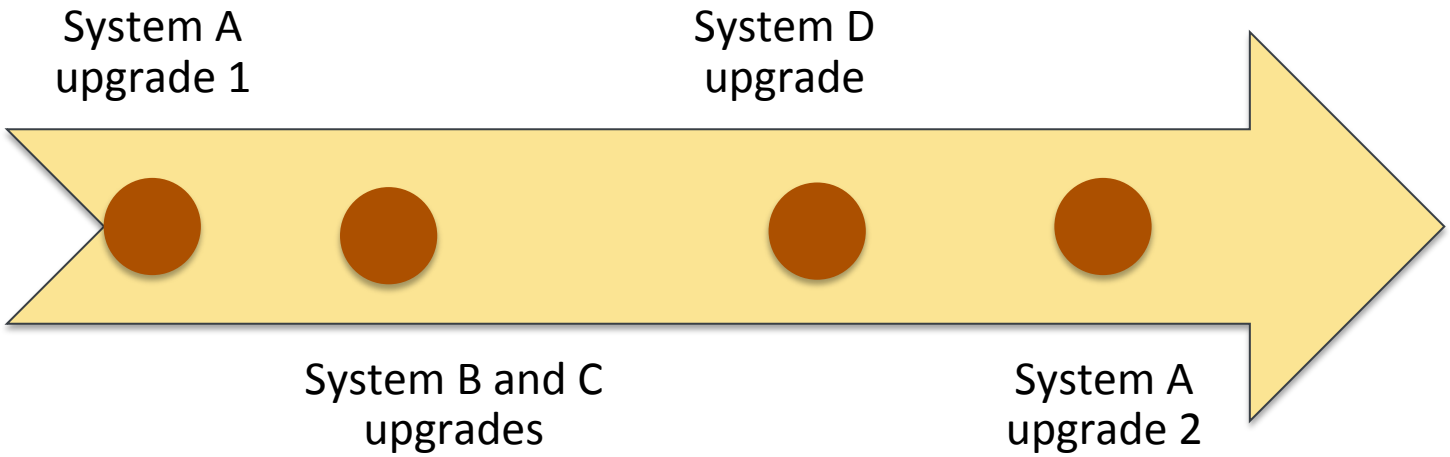
SCRAM Flow of Activities



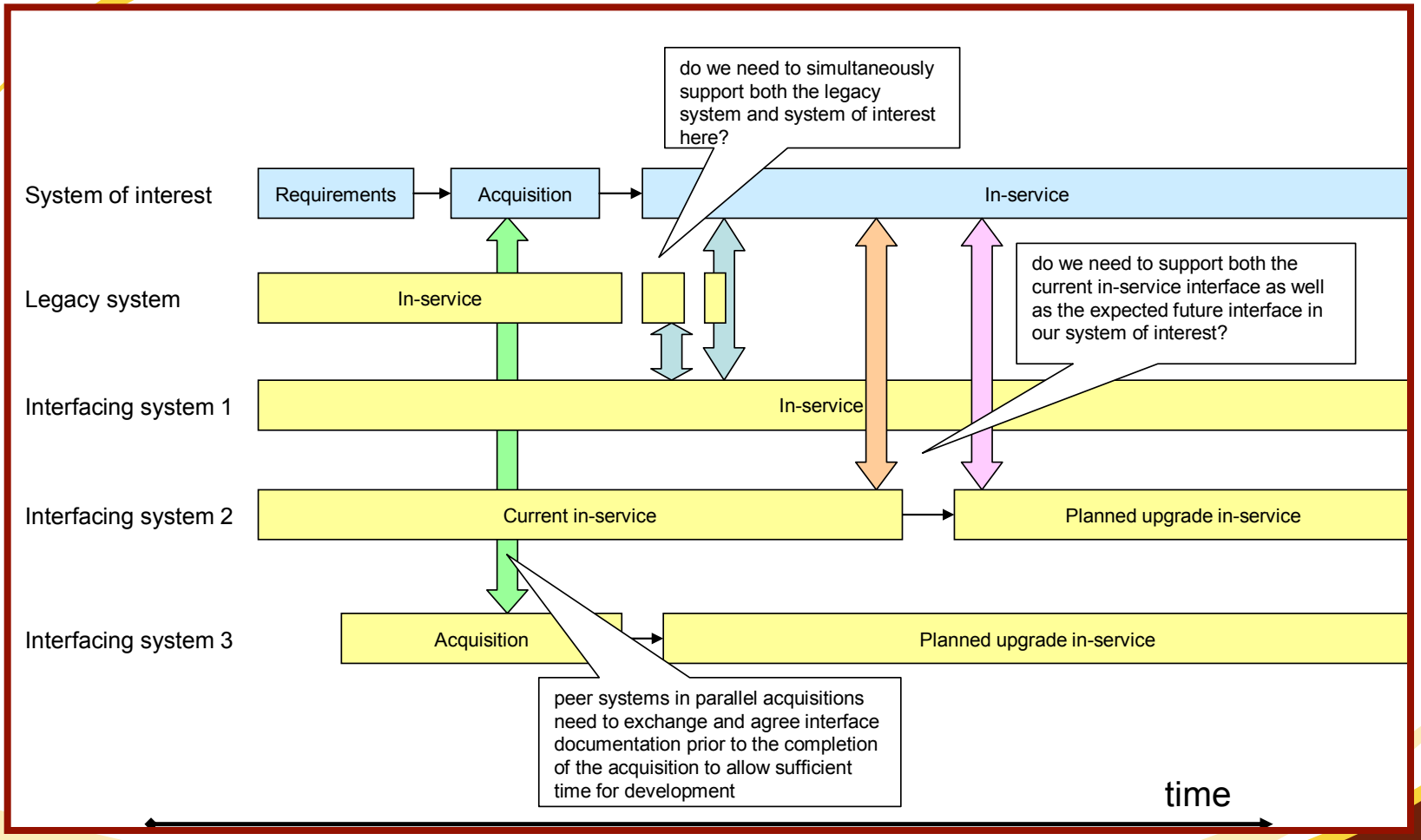
SoS Considerations With SCRAM

- Relationships between SoS stakeholders and constituent systems
- Constituent system robustness and flexibility
- Level of SoS architecture maturity
- Asynchronous incremental constituent system evolution
- Tracking SoS capability schedules
- Monte Carlo simulations for SoS

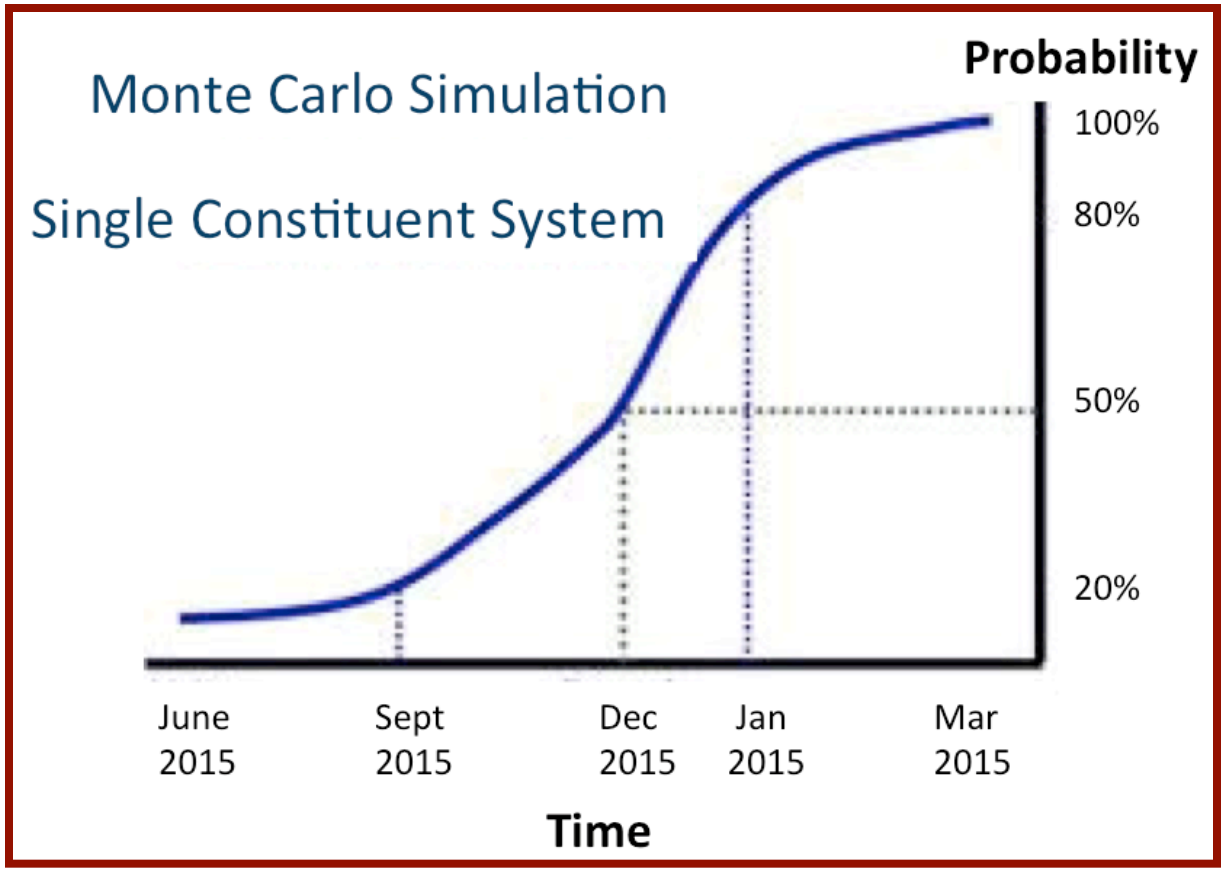
SoS Constituent System Upgrades Over Time



Evaluating SoS Schedules



Monte Carlo Simulations for SoS

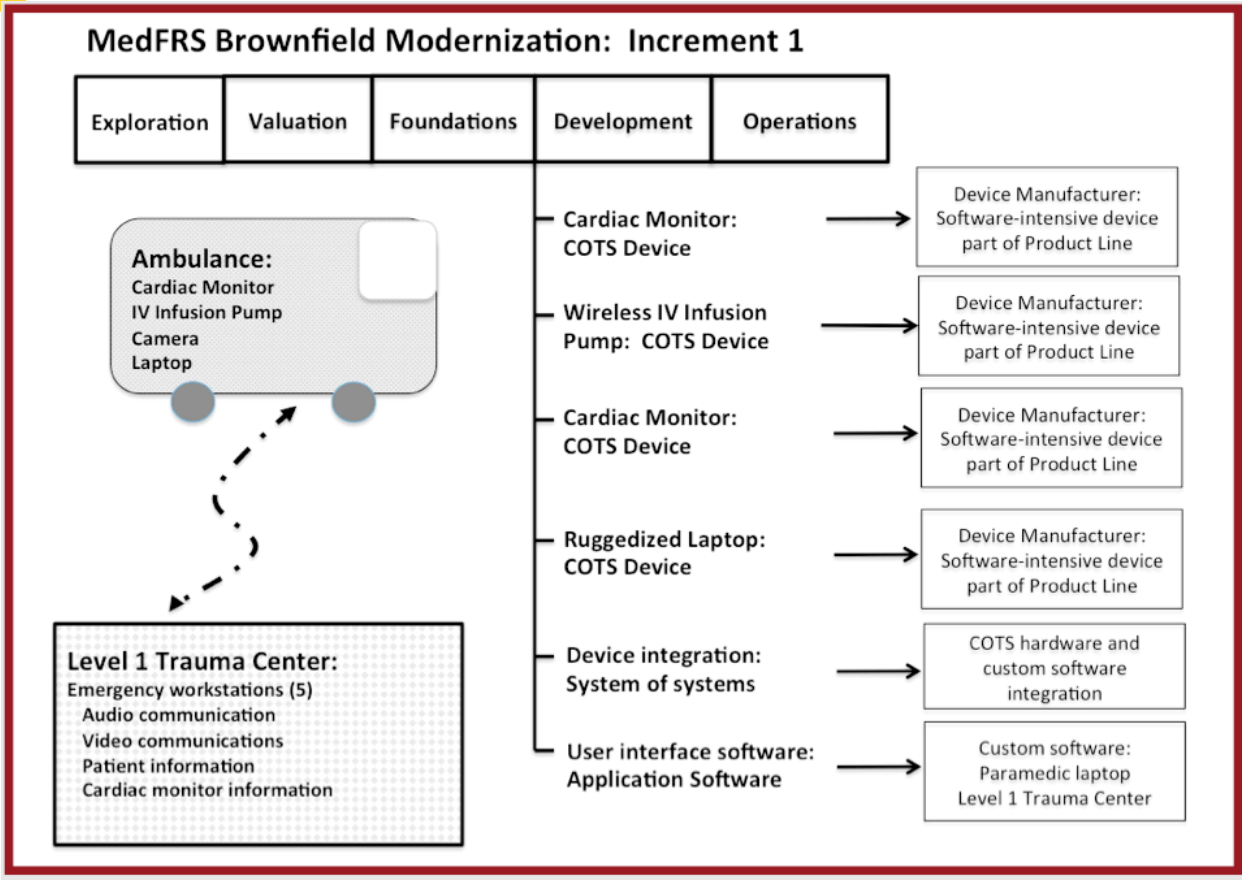


$$P(SoS) = P(cs_1) * P(cs_2) * P(cs_3) * \ldots * P(cs_n)$$

Common SoS Problems Affecting Schedule

- Lack of attention to CS organizational and technical issues
- Inability to track progress of SoS capability development
- Understanding CS limitations (e.g., CS priorities vs. SoS priorities, interoperability, fragile systems that are difficult to change)
- Immature technology or tech refresh coordination issues, especially those that may impact interoperability between systems
- Lack of planning for data/database conversions required for system upgrades
- Deployments using “all or nothing” approach rather than incremental rollout of capability parts
- Lack of integration and test planning/execution at the SoS level
- Impacts related to any required SoS level safety or security certifications

SCRAM for MedFRS Example



Medical First Responder SoS to provide continuous patient care from point of response to hospital/trauma care center

MedFRS SCRAM Analysis

- Desired MedFRS SoS capability
  - Incorporation of an Electronic Health Record (EHR) on MedFRS first responder platform that is compatible with four regional hospitals
- Issues
  - Want new capability within 6 months
  - Interoperability Issues: Four regional hospitals/three different EHR COTS system
  - Power and space issues on the first responder platforms
  - New national healthcare EHR standard may impact existing EHR systems
  - Compatibility with other EHR systems not a high priority for hospitals
  - Assumption that future versions of EHR systems will be interoperable "out of the box"

MedFRS SCRAM Analysis *(continued)*

- SCRAM evaluation
  - Two options evaluated:
    - One team to implement software required to be interoperable with multiple EHR systems
    - Two teams work in parallel to provide necessary interoperability
  - Results of Monte Carlo simulations using 3-point estimates
    - 90% probability that two-team approach will result in desired capability with six months
    - 50% probability that one-team approach will result in desired capability within six months
    - Most probably schedule for one-team approach: 9 months

Conclusions and Future Work

- SoS master scheduling much more challenging compared to single system scheduling
- SCRAM must focus on both single system and SoS-level issues
- Process works well for directed and acknowledged SoS—more work needed for collaborative SoS
- DMO SCRAM program developing materials to better support SoS capability SCRAMs (expected date: late 2015)