RT-126: Demonstration and Analysis Tool for Agile SE Management (DATASEM)
• **Tasks:**
  - SERC proposes to develop the Demonstration and Analysis Tool for Agile SE Management (DATASEM)
  - A flexible modeling and simulation capability to:
    - advance the understanding of the KSSN (Kanban Schedule System Network) value-based approach,
    - investigate optional mechanisms for implementation, and
    - provide support for organizations that are interested in piloting the concept
  - Animation and experimentation to support decision-making

• **Team Members:**
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All work that consume efforts (resource + time) from SPs are viewed as Tasks; Dev Task is Value-added Task, may or may not be subtask of one or more Aggregation Nodes; All kinds of Activities do not directly add value, but necessary or helpful to effectively perform value-added Tasks.
An **Agent** can be confronted with **Tasks of various type** simultaneously. The agent has to decide "who to do what" and allocate resources to the tasks or assign tasks to other agents, according to its own **Governance Strategy**.
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Conceptual Modelling

DATASEM Modeler

DATASEM Simulator

Experiments Analysis

Future Works

Work Item Dependencies

Hierarchy

C1

C2

R1

R2

R3

T1

T2

T3

Causality

1. Requests Resolution

T1 may creates Res. T1

becomes prerequisite of

2. Analysis

R1 creates

creates

activates

T1

T2

T3

Ana. R1-1

Ana. R1-2

3. Impacts

T1

T2

T3

may reduce progress of

T1

T2
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Eclipse Xtext

Domain Specific Language (DSL)

Features:

- Develop Organizational / WIN / Governance Models in DATASEM DSL
- Syntax helper
- Enables random variables / distributions
- Generate XML format input file for Simulator Program
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DATASEM Simulator
Repast Modeling Toolkit
Agent-based Modeling and Simulation (ABMS)
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Service Provider: My Team

Resources: Skills:

Manager ▲ { [Analysis: Efficiency = 100%] }
Developer 1 ▲ { [Java: Efficiency = 100%] }
Developer 2 ▲ { [Python: Efficiency = 100%] }
Developer 3 ▲ { [SQL: Efficiency = 100%] }

T_SQL, T_Python, T_Java

Analysis Needs Requirement

Activates Fulfilled by

Management: 5
Java Programming: 20
SQL Programming: 10
Python Programming: 15
Service Provider Agent Behavior

1. Requests Handling
   - Requests Q
   - Accept
   - Outsource
2. Make Assignments
   - Assign
3. Allocate Resources
   - Backlog Q
4. Advance Tasks Progress
   - Advance
5. Trigger Changes
   - WLS Stochastic Changes Conditions
6. Completion Handling
   - Complete
7. Disburse Handling
   - Release (all/partial) subtasks of target Aggr-Node
   - Clear suspension of target Dev Task

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![Diagram showing System-of-Systems Engineering: 140, IT Development: 527, SE Electrical: 210, SE IT: 180, Electrical Eng: 366, Mechanical Eng: 368. Diagram also shows a network of teams (Elec Team, Mech Team, IT Team) with different skill levels, and a flow of work items and requests between the teams.]
When Task 01 reaches a new maturity level, it may propagate change to Task 02/03/05 by reducing their progress by 10%, with 20% chance for each (all independent).
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New Aircraft Development
PX-49, Dev-Proj
 Decomposes
AOCWS, Int-Proj

Operation System Integration
Systems Integration, OpeCap

SoS-level Capabilities
System-level Functional / Operational Capabilities
Decomposes
Precedency

DATASEM Simulator
Electronics, FunCap
Aero-Dynamics, FunCap
PowerSys, FunCap
Infra-Structure, FunCap
WeaponSys, OpeCap

Flight Control
Engines
Protocols
Air Conditioning
Engine aux
Database
CA

Cabling
Avionics
Transmission

JAT
Op-Plat
MAAP
MAA
Testing I
FCC
Testing II

SOA

Required Skills & Efforts
Impacts Dependencies

Life Cycle Model
Tasks

Future Works
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DATASEM Simulator
Total Workload
- Sum of (nominal efforts * progress) of all WIs on the agent at each time step

Active Workload
- Sum of (nominal efforts * progress) of in-progress WIs on the agent at each time step

Resource Utilization Rate
- (Number of Busy Resources / Number of Total Resources) of the agent at each time step

Workload Imbalance
- The coefficient of variation of the agents’ resource utilization rates at each time step.
Value Delivered

Number of WIs in the Simulation Context

Rework occurrence

Bottleneck occurrence
  – When an agent has available resource(s) but cannot start backlogged WIs due to precedence constraints

Change Propagation occurrence

Work Efficiency
  – Service Efficiency is defined as \( \frac{Nominal Efforts}{Cycle Time} \) when finished, where \( Cycle Time \) is calculated as sum of actual efforts spent on this WI
The experiments compares agents’ performance by changing two aspects of their strategy configuration:

**Work Assignment**
- Neutral random
- Balanced Assignment

**Work Prioritization**
- FIFO (no prioritization)
- RPW (rated precedency weighting)

...and compares under 3 levels of:
- Rework Risk
- Technical Bottleneck Probability
- Impacts Severity

For each model: 

2x2x3 = 12 scenario configurations, 
50 replications of each
Development Organization Model
Aerospace & Defense Projects Model

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Conceptual Modelling
• Need to work together more with stakeholders
• Need feedbacks from SE practitioners
• Need “real” use cases

DATASEM Modeler
• Web interface
• Simplify modeling language
• More flexible processes / strategies / behaviors configuration

DATASEM Simulator
• Improve statistical analysis features
• Incorporate more governance strategies
• Improve simulation of stochastic events and human behaviors
References

Thank you
Questions?