Executable Architecture of Net Enabled Operations: State Machine of Federated Nodes

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Outline

• Introduction
  – Background
  – TPED vs TPPU
• Conceptual basis
  – OV-1
  – PRC
• Implementation in COREsim

• Decision Logic
  – Extensions beyond OPCEN SM
  – Node-specific logic (Producer, Consumer, Discovery, External, Repository)
• Input Data Files
• Way Ahead
Background

• Goal: develop capability-engineering analysis tools to support the building, demonstration, and analysis of executable architectures.

• OPCEN State Machine
How Task, Process, Exploit and Disseminate (TPED) Handles Jobs

Queue

Task >

Process >

Exploit >

Disseminate >

Select Highest Priority Job

Utility of Product

1 → 2 → 3 → 4
Scale Free OV-1 for SMOFN

- **Product**
  - Discover
  - Produce
  - Repository

- **Queries**
  - Discover

- **Responses**
  - Produce
  - Portal

- **Questions**
  - Portal

- **Action**
  - Consume

- **External Sources**

- **Effect**
  - Portal

- **Activity**

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Producer-Repository-Consumer (PRC) Model
SMOFN Execution

- Flowchart represents a moment in time
- Decision logic executes entirely for one time step
- Time steps forward, logic repeats, accounts for changes in job states
What SMOFN Accounts For

• Data-driven simulation:
  – Uses files to build customized job workflows and configure any combination of nodes without affecting the business logic.

• Accounts for the following overhead activities:
  – Tracking consumer perception of product utility as it accrues and decays;
  – Consolidation of products into higher-level aggregated products; and
  – Triggering new jobs where needed whenever relevant data becomes available.
What SMOFN Does That OPCEN SM Couldn’t Do

• Nodes other than Producer
  – Discovery threads
  – Interaction between nodes
• More flexibility in job steps
  – Unlimited number
  – Step names
What the Producer Does

• Only node in OPCEN SM
• Converts raw data into analyzed products
• Progress is tracked step by step
• Job state accounts for
  – Utility accrued / decayed
  – Operators involved
  – Time spent / left
What the Repository Does

- Transfers information between nodes according to OV-1
What the Consumer Does

- Receives Products from Repository
- May generate Questions some time after receiving each Product
What the Discoverer Does

- Jobs defined similar to Producer
- Jobs start when Questions received
- Three possible results
  - All required data found
  - Some required data found
  - No required data found
- Found data triggers new analysis job at Producer
- Missing data triggers Query to External Sources
What the External Sources Do

• Logic similar to Consumer
• Receives Queries from Repository
• Generates Responses some time after receiving each Query
Data Files

- Describe general characteristics of each thread
- Describe each step within thread
- Describe OPCEN configuration
- Describe product delivery
C2 Modeling Path

Current C2 Practices

Capture Practices As Executable Threads

C2 Processes Articulated

C2 Process Analysis & Improvement

Capabilities Definition Knowledge

Convert Threads To SMOFN Format

SMOFN Model

Expanded SMOFN Model

Option to Enhance Execution Capability

Future CF C2 Operational Architecture
Work in progress

- Customization of SMOFN is underway to make data files representative of new Canadian Forces Command structure
  - OPCEN config
  - Job threads (reporting & response process, daily brief)
- Data remains outside model until runtime – model itself remains unclassified
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