Use of an Executable Workflow Model to Evaluate C2 Processes

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C2 Evaluation - Critical Challenges & Need

Critical Challenges:

- Evaluating command & control (C2)
- Evaluating the impact of net-centricity on force effectiveness
- Decision makers require quantitative methods and metrics for measuring the extent to which:
  - Net-centricity improve C2 and related applications
  - The GIG infrastructure and Core Services effectively and efficiently support C2 and related applications
Multi-resolution Modeling Evaluation Framework

C2 Evaluation Results

"As Is" (Baseline)
Net-Centric: Portfolio 1
Net-Centric: Portfolio n

Effectiveness Values

MOPs: Measures of Performance
  e.g. Service Latency

MOEs: Measures of Effectiveness
  e.g. Planning time, quality

MOFEs: Measures of Force Effectiveness
  e.g. # Terrorist sites destroyed

Analysis

- Compare Net-Centric to "As-Is"
- Analyze technical & cost data
- Generate recommendations

MRM Evaluation Framework

1) Constructive Simulation (Models Only Environment)
2) Virtual Simulation (Simulation with Test Bed involving Models, People & HWSW In-The-Loop)
3) Live Simulation (Simulation with real components in an exercise environment)
Net-centric C2 Evaluation: Key Elements

Multi-resolution Modeling Evaluation Framework

Process Decomposition & Assessment

Service-based Data Collection, Analysis, & Reporting

Mission-specific Workflow Evaluation
Process Decomposition & Assessment
Define detailed measures and metrics to measure and evaluate the quality and execution time of COA Development tasks at the MOE and MOP levels.
Mission Area/Functional Capabilities Map

USSTRATCOM Example

Mission Area Domain Mapping

Organizational Mission Areas

Mission Area 1
Mission Area 2
Mission Area 3
Mission Area 4
Mission Area 5

Global Strike
Global Integrated Missile Defense
Global Support for Space-based OPS
Global ISR
Global C2
Global Information & Network OPS
Global Deterrence
Globally Combating WMD

Functional Capabilities

Capability 1
Capability 2
Capability 3
Capability 4
Capability 5
Capability 6
Decompose High-level Mission Area

Functional Capabilities
- Global Strike
- Global Integrated Missile Defense
- Global Support for Space-based OPS
- Global ISR
- Global C2
- Global Information & Network OPS
- Global Deterrence
- Globally Combating WMD

USSTRATCOM Mission Areas

Decompose Mission Area into High-level Processes

High-level Global Strike Processes
- Adaptive Planning
- Crisis Action Planning
- Execution
Decompose Global Strike Processes into Functional Capabilities

Adaptive Planning (DP)
- DP Trigger
  - Develop Guidance
    - Target Development
      - Effects-based Analysis
        - Develop GS Support Document
          - Critical Situation Trigger

Crisis Action Planning (CAP)
- Critical Situation Trigger
  - Develop Guidance
    - JFCC GSI Planning
    - JFCC ISR Planning
    - JFCC Strategic Planning
      - Integration
        - Brief CDR STRATCOM/Select Plan
          - Brief SECDEF/POTUS

Execution
- SECDEF/POTUS Approval and/or Execution Order
  - Pre-Strike
  - Strike
  - Post-Strike
Map Global Strike Capabilities to Programs of Record & Web Services

- Crisis Action Planning (CAP)
  - Critical Situation Trigger
  - Develop Guidance
- JFCC SGS Planning
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Detailed Capability Decomposition

Current Systems/Infrastructure
- TBMCS/SIPRNET
- GCCS/SIPRNET
- GCSS/SIPRNET
- IWS/SIPRNET

Net-centric ISE

GIG UDDI Directory
- Web Service 1
- Web Service 2
- Web Service 3
- Web Service 4
- Web Service 5
- Web Service 6
- Web Service n
Mission-specific Workflow Evaluation
Create & Characterize a Workflow Pattern based on the Global Strike Process Decomposition

STARTEX → Assessment → Planning → Execution → FINEX

- **Intel**: 1.0 hr, 1.2 hr, 0.5 hr, 2.0 hr
- **Force Stat**: 1.3 hr, 0.75 hr, 1.0 hr
- **MA Brief**: 1.2 hr, 0.75 hr, 1.3 hr
- **METOC**: ...
- **HQ Tasking**: 1.0 hr, 0.5 hr
- **CDR Intent**: 0.5 hr, 1.0 hr
- **Mission Tasks**: 2.5 hr, 1.0 hr, 0.75 hr
- **Facts**: 0.5 hr, 1.0 hr, 0.5 hr
- **COA Dev.**: 1.0 hr, 1.2 hr, 0.5 hr, 0.3 hr, 2.0 hr
- **COA Select**: 1.3 hr, 0.75 hr, 0.5 hr, 1.0 hr, 0.5 hr
- **CDR Est. Brief**: 1.0 hr, 1.5 hr, 0.25 hr, 0.25 hr, 0.5 hr

Notional times to complete sub-workflow elements.
Create an Executable Model of the Workflow Pattern

- Assessment
  - Intel
    - 1.0 hr
    - 1.2 hr
    - 0.5 hr
    - 2.0 hr
  - Force Stat
    - 1.3 hr
    - 0.75 hr
    - 1.0 hr
  - MA Brief
  - METOC

- Planning
  - COA Dev.
    - 1.0 hr
    - 1.2 hr
    - 0.75 hr
    - 2.0 hr
  - COA Select
    - 1.3 hr
  - CDR Est. Brief
    - 1.0 hr
    - 0.3 hr
  - ...

- Execution
  - ...

Model's Knowledgebase
GOC-CE: Portal-based Visualization of the Global Strike TSP Workflow

TSP Knowledge Wall site pulls status information maintained in other TSP workspaces.

The Knowledge Wall provides the CDR a quick view of GS TSP process status.
Evaluate Execution of Mission-specific Workflow Pattern

Visualize Model’s Execution Status Via the GOG-CE

Model’s Knowledgebase
Service-based Data Collection, Analysis, & Reporting
Service-based Data Collection, Analysis & Reporting

- Develop a set of “analysis services (AS)” that will facilitate automated data collection and detailed analysis of “core” and “vendor-developed services and applications

- Calls to those services can be incorporated into “core” and “vendor-developed” services at design time

- Incorporation could be achieved via manual or smart-agent assisted insertion

- Execution of the AS is controlled via runtime configuration settings

- Gathered metrics and analytic results are managed within the GIG infrastructure for each core and vendor-developed service to be analyzed

- Used to identify and analyze service-level faults
During the TSP mission assessment phase, the workflow model identifies a temporal overflow exception associated with INTEL image acquisition (IIA).

The web service software responsible for that task exceeded its planned execution time budget by 25%.

The question to be answered: is there a problem with the software or did some external factor contribute to/cause that problem?
Example Value-Add Use Case (cont.)

- A probe from an envisioned NCES diagnostic software service was used to analyze the IAA web service
- That analysis showed
  - The web service software was not at fault
  - The performance issue was due to a failure of the software to establish a secure socket connection to the network, i.e. a network problem
  - The software error messages should be augmented for better diagnostic clarity
Value of Model-driven Workflow Evaluation Approach

- Employs a disciplined, system engineering process
- Quantifies workflow shortfalls
- Identifies areas for capability improvements
- Provides focus for future capabilities development and helps shape acquisition decisions