

**Draft**

# Use of an Executable Workflow Model to Evaluate C2 Processes

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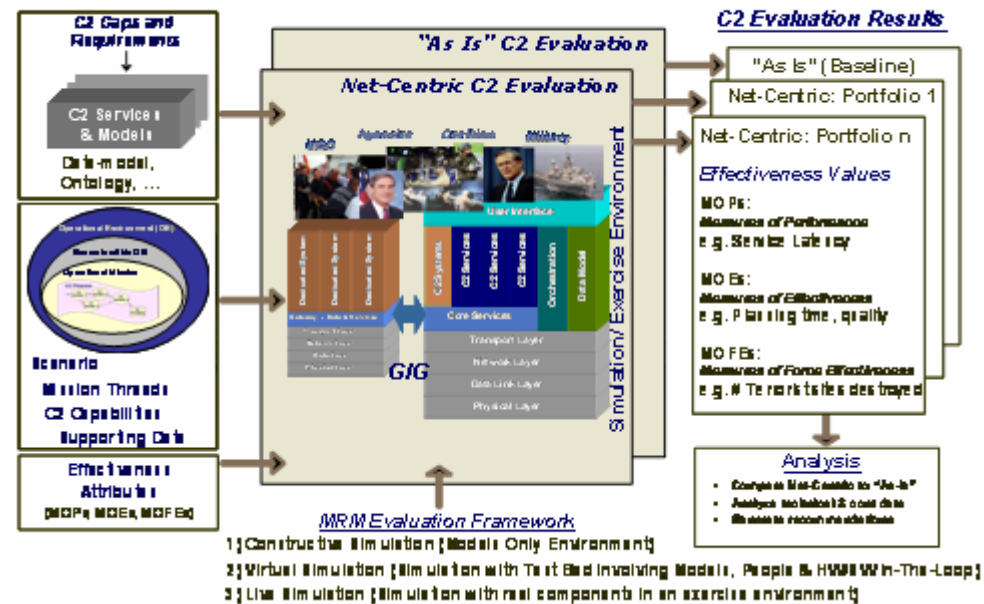
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# C2 Evaluation - Critical Challenges & Need

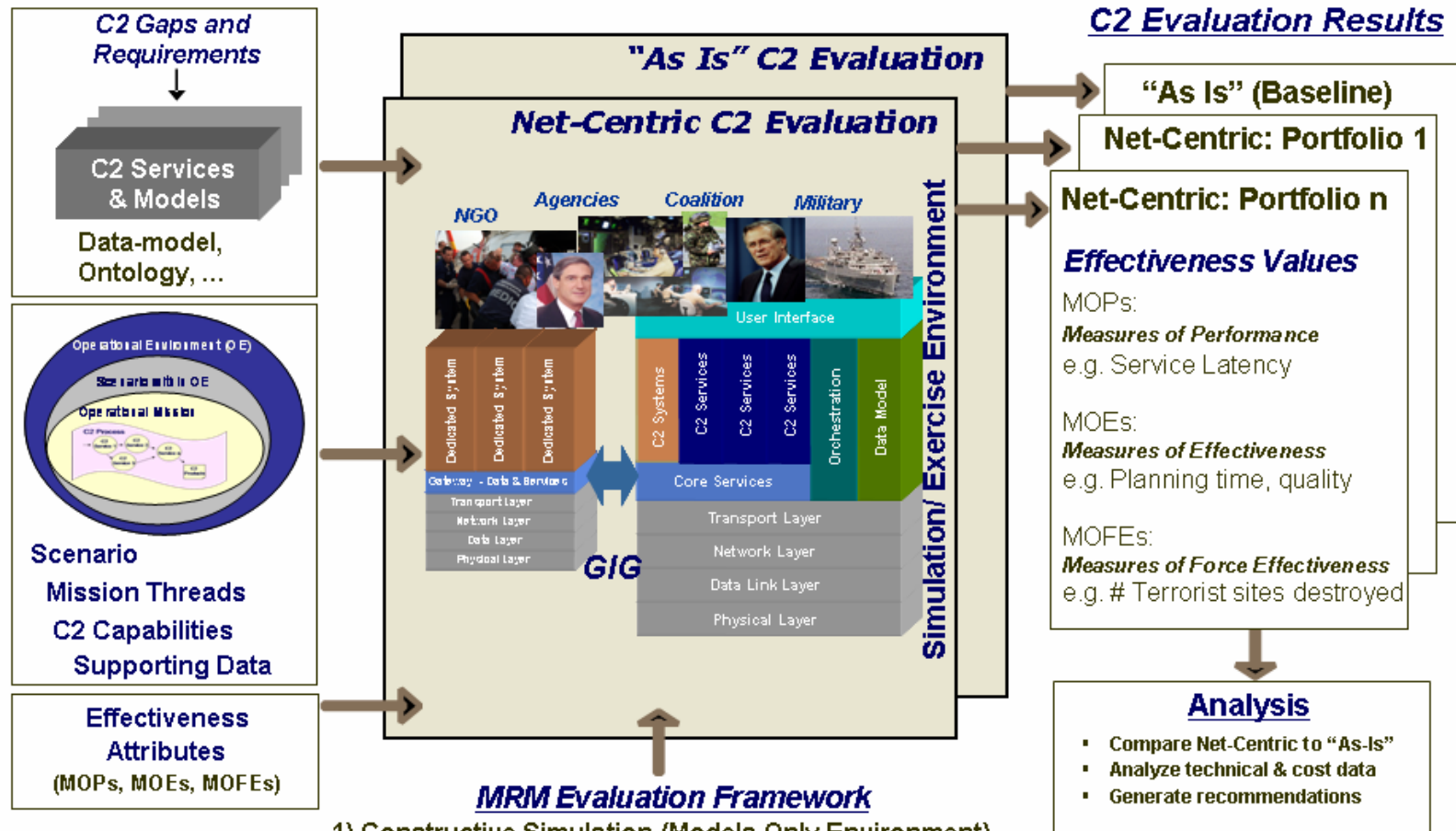
## Critical Challenges:

- 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



# Multi-resolution Modeling Evaluation Framework

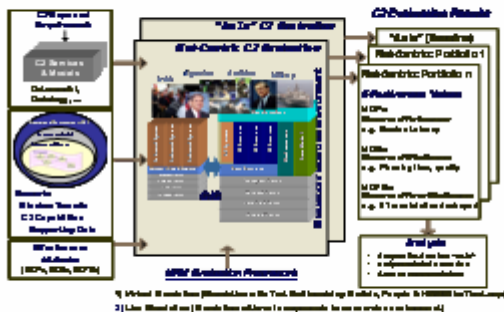


## MRM Evaluation Framework

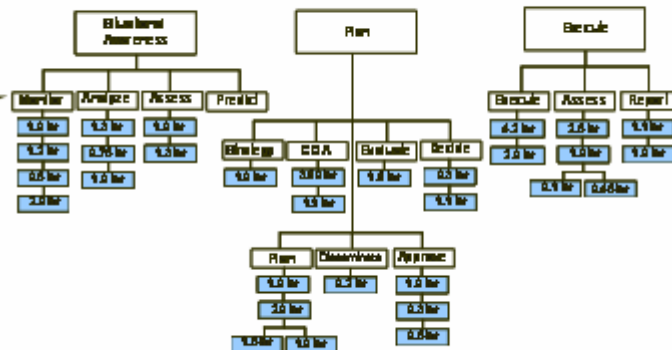
- 1) Constructive Simulation (Models Only Environment)
- 2) Virtual Simulation (Simulation with Test Bed involving Models, People & HW/SW In-The-Loop)
- 3) Live Simulation (Simulation with real components in an exercise environment)

# Net-centric C2 Evaluation: Key Elements

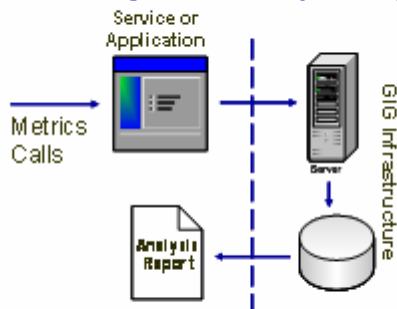
## Multi-resolution Modeling Evaluation Framework



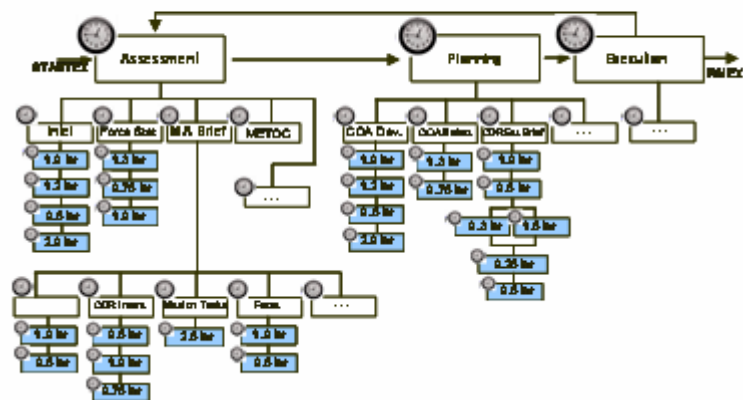
## Process Decomposition & Assessment



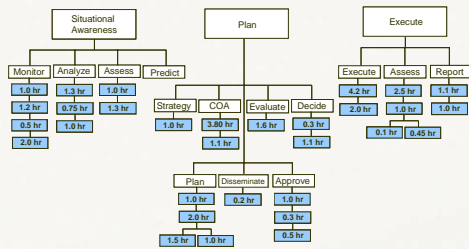
## Service-based Data Collection, Analysis, & Reporting



## Mission-specific Workflow Evaluation



## Process Decomposition & Assessment



# Process Decomposition & Assessment

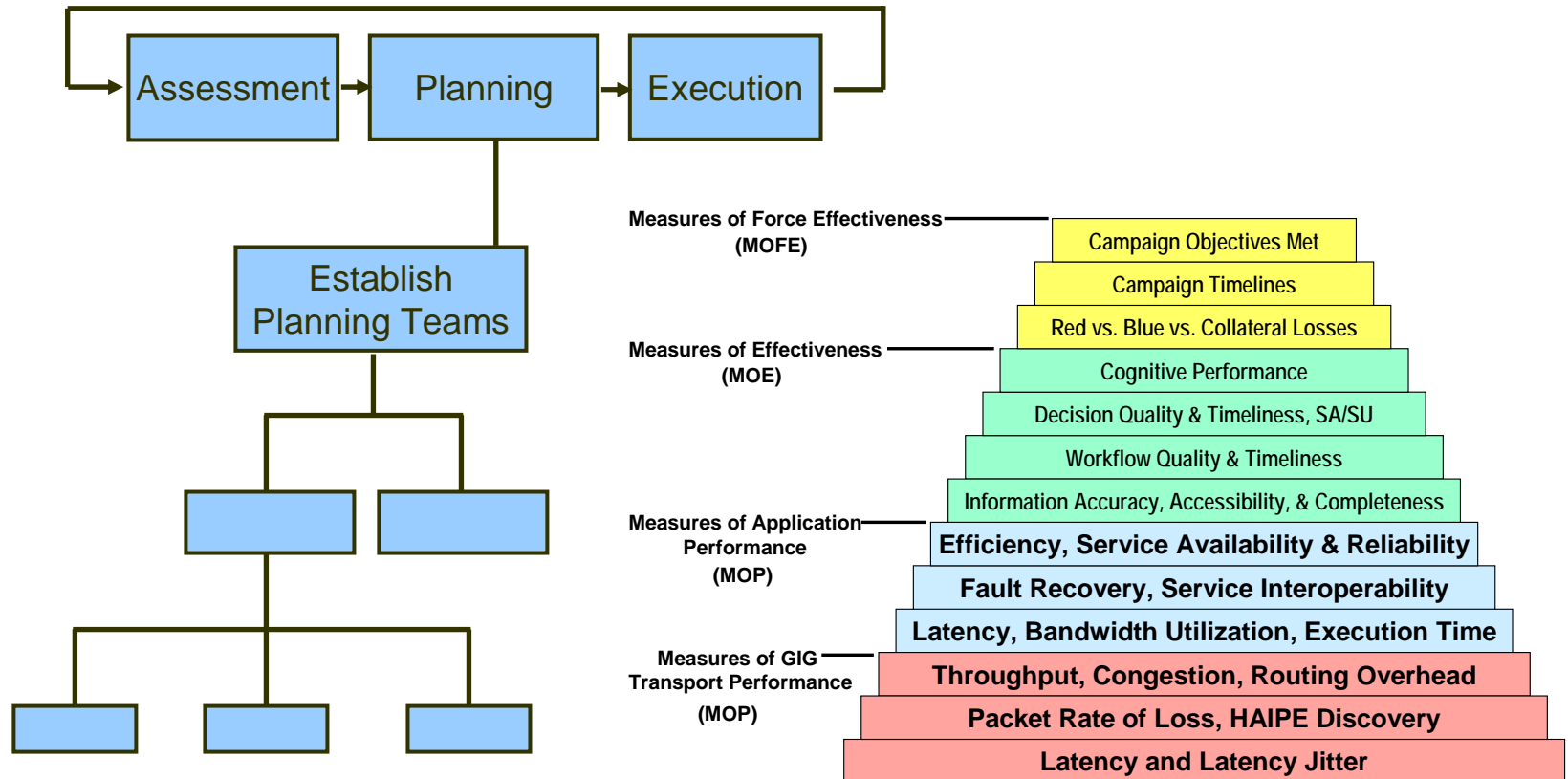
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# C<sup>2</sup> Process Decomposition

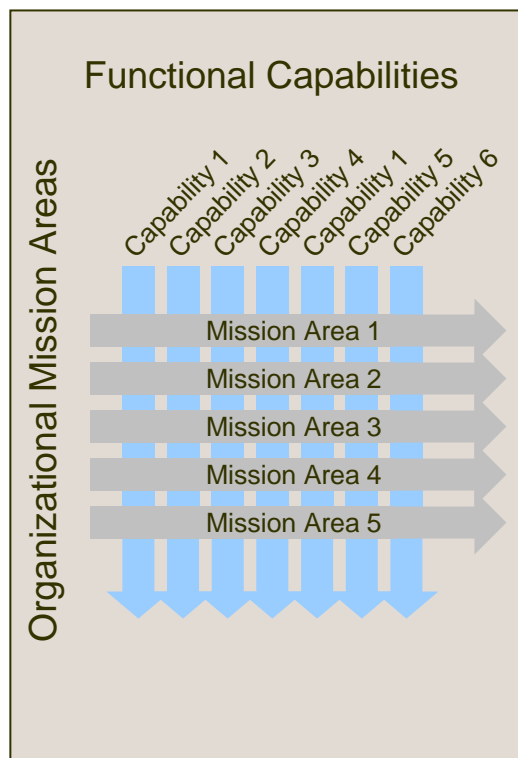
*Serves as the basis for measuring end-to-end performance*

## Example: Global Strike Mission End-to-End C<sup>2</sup> Process



Define detailed measures and metrics to measure and evaluate the quality and execution time of COA Development tasks at the MOE and MOP levels

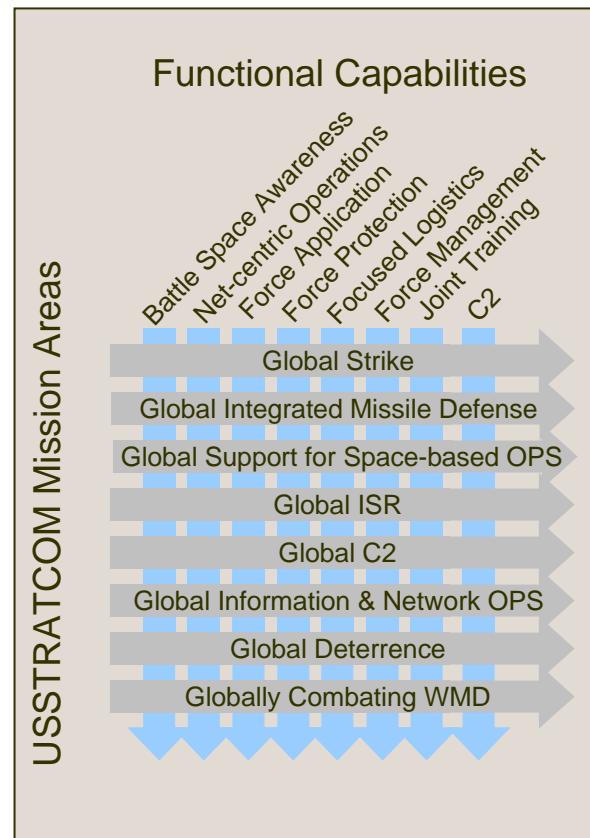
# Mission Area/Functional Capabilities Map



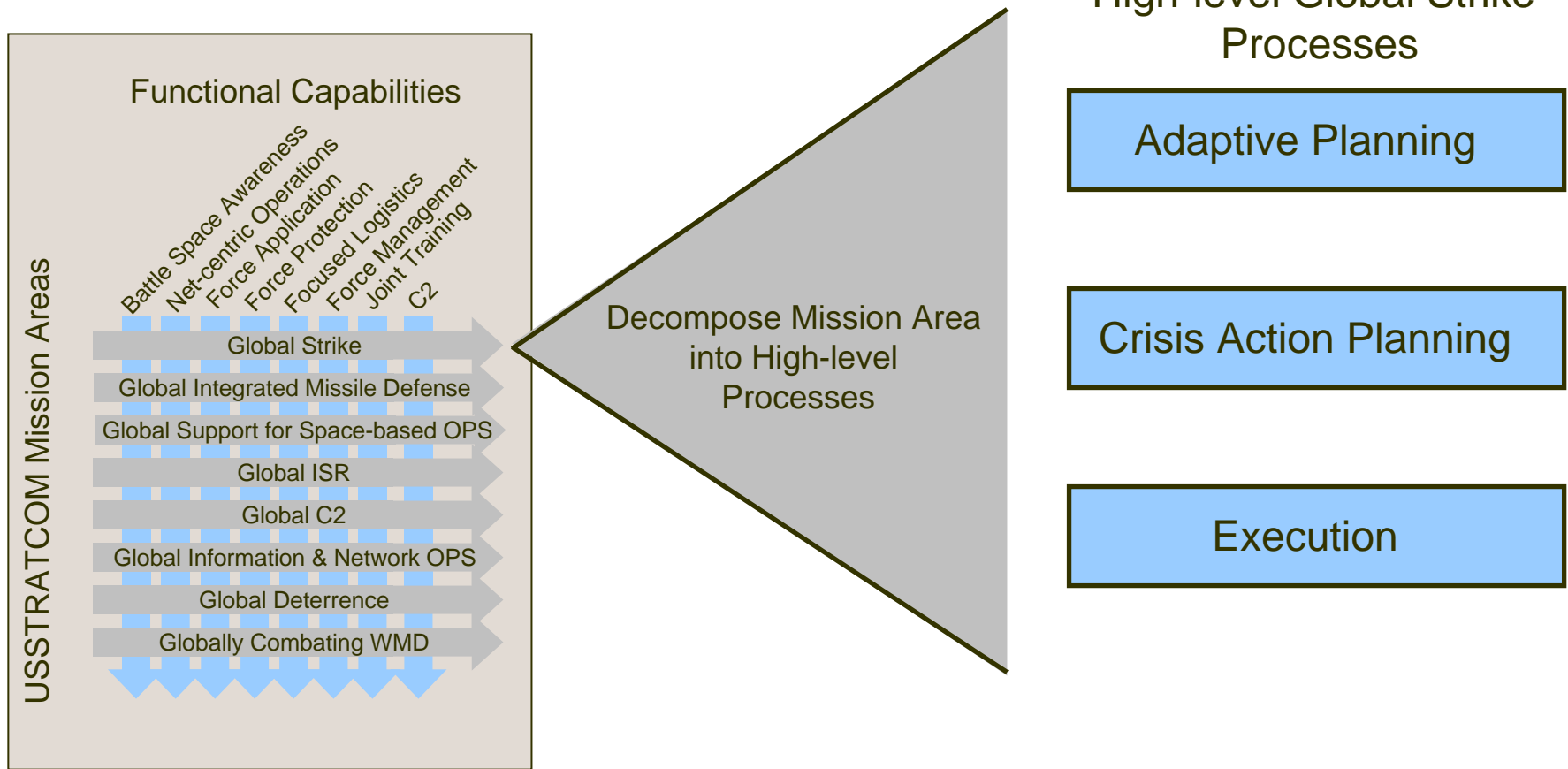
Mission Area  
Domain Mapping

A large, hollow black arrow points from the left diagram to the right diagram, signifying the application of the mapping process to a specific example.

## USSTRATCOM Example

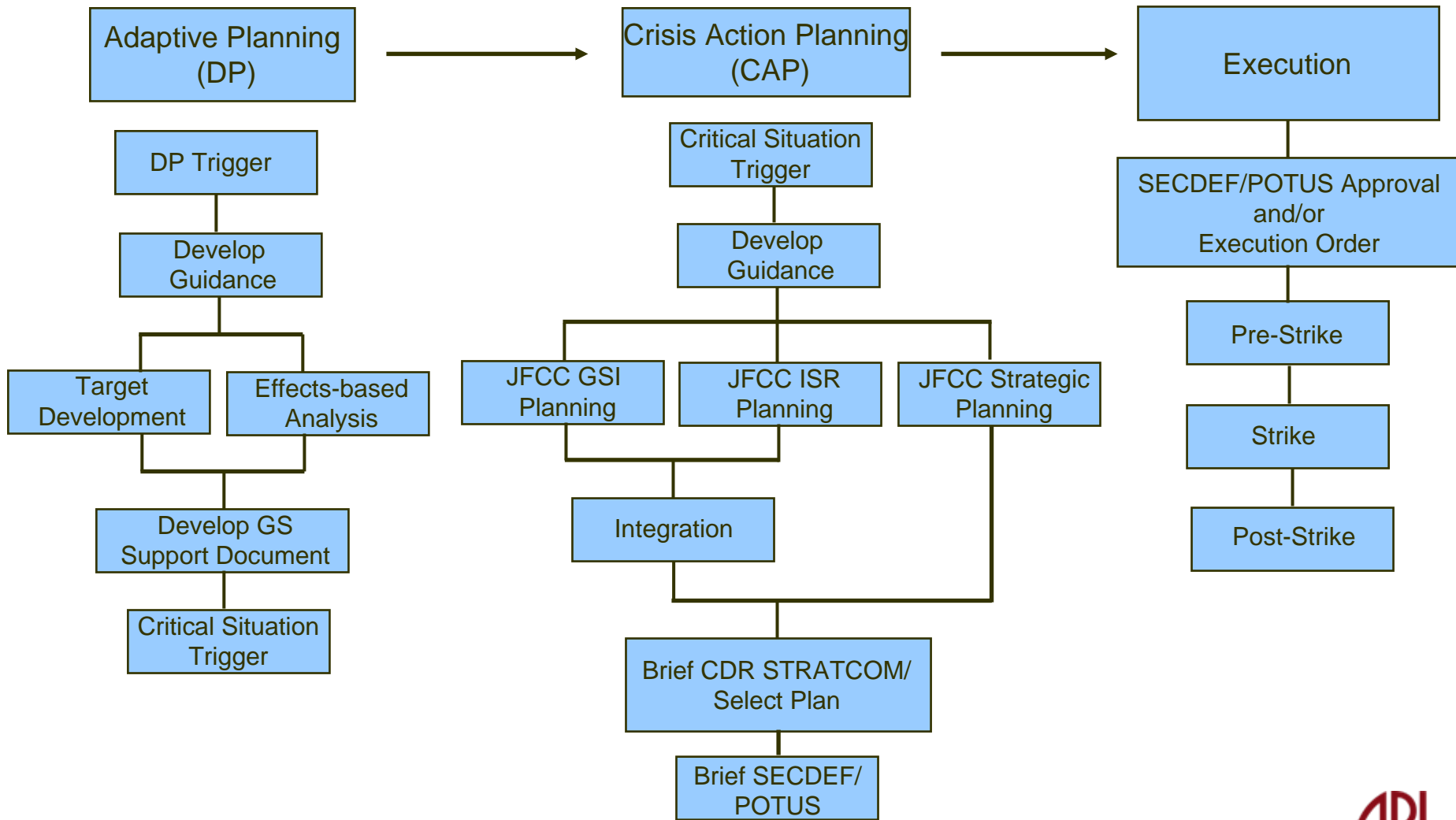


# Decompose High-level Mission Area

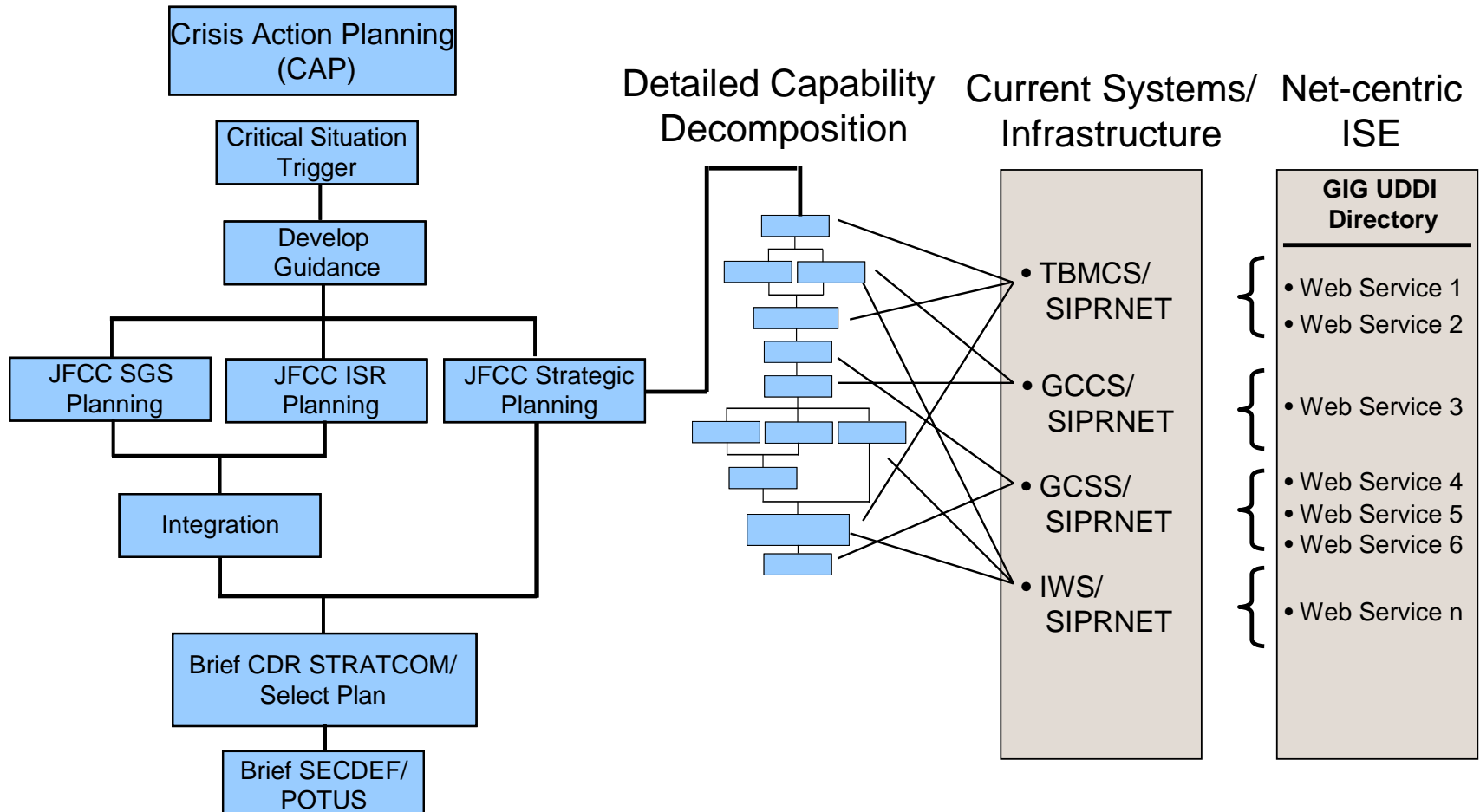




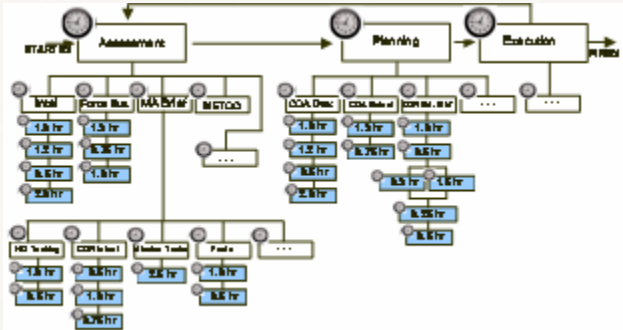
# Decompose Global Strike Processes into Functional Capabilities



# Map Global Strike Capabilities to Programs of Record & Web Services



## Mission-specific Workflow Evaluation

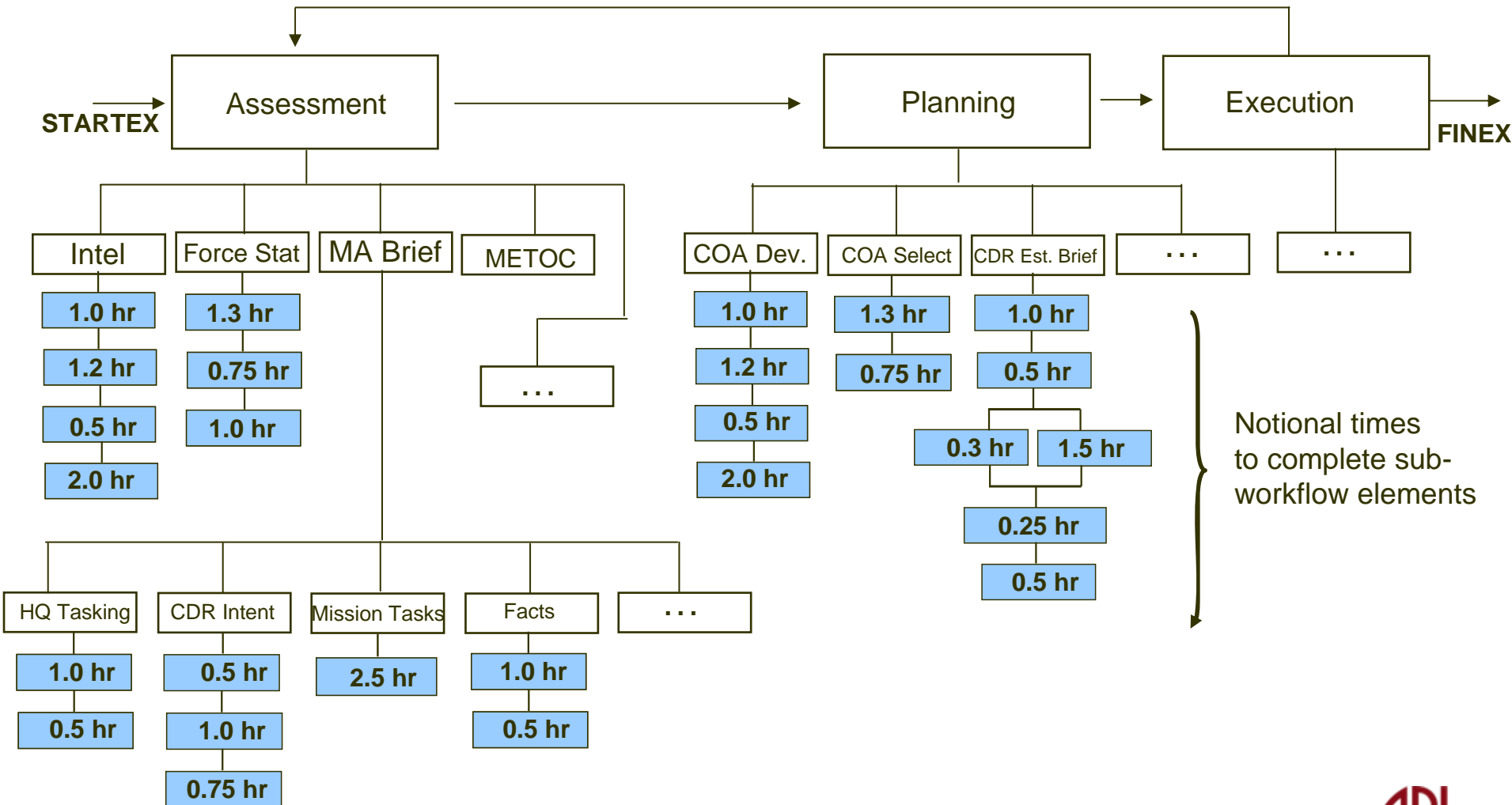


# Mission-specific Workflow Evaluation

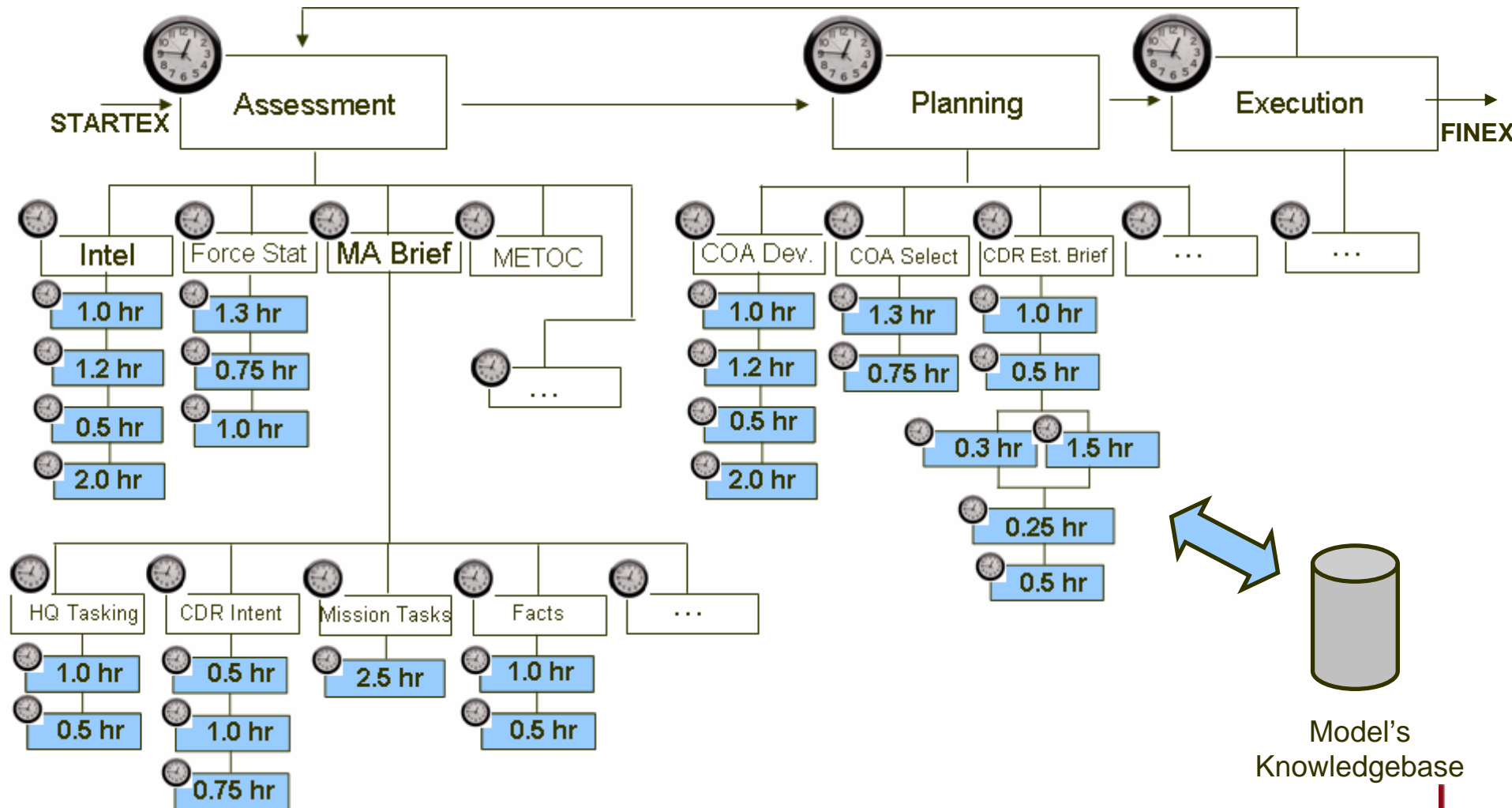
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# Create & Characterize a Workflow Pattern based on the Global Strike Process Decomposition



# Create an Executable Model of the Workflow Pattern



# 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

The screenshot shows the 'Global Lightning 06 - TSP Knowledge Wall' interface. It features two main task lists at the top: 'Assessment' and 'Planning'. Below these is a 'Workspace Hierarchy' diagram.

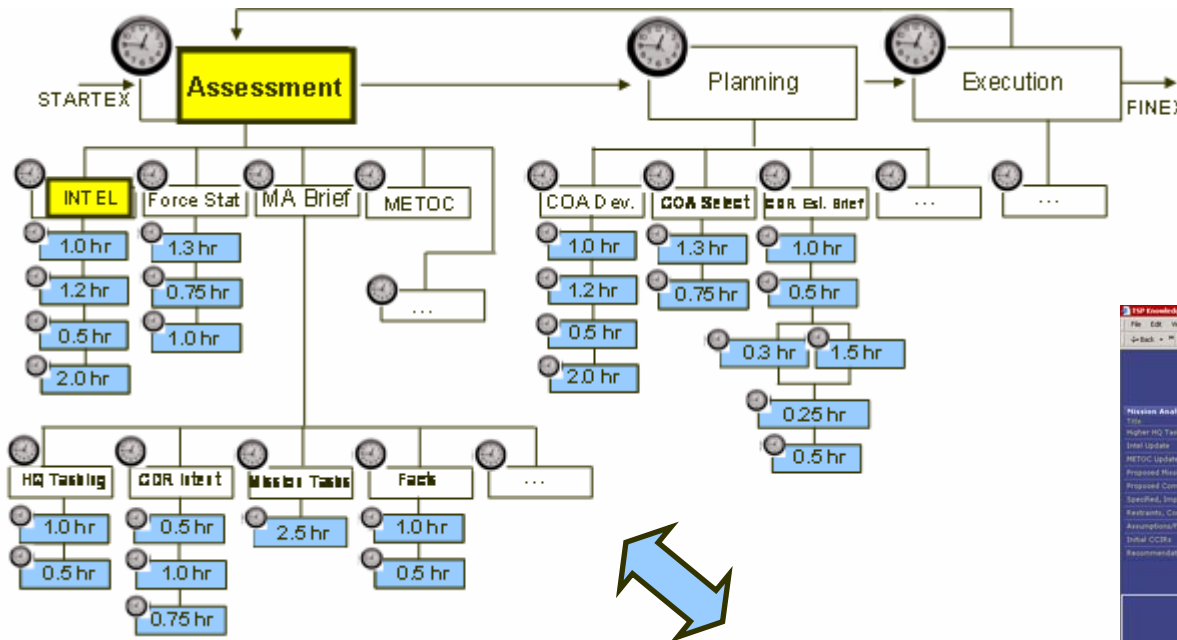
Assessment		COA Development Tasks		CDR Estimate Tasks	
Title	Complete	Title	Completed	Title	Complete
Higher HQ Tasking	Yes	Higher HQ Tasking	Yes	Higher HQ Tasking	Yes
Intel Update	Yes	Mission Statement	Yes	Mission Statement	Yes
METOC Update	Yes	Commander's Intent	No	Commander's Intent	No
Proposed Mission Statement	Yes	Intel Update	No	Battle Space Evaluation Updates	No
Proposed Commander's Intent	Yes	METOC Update	No	COA Summary	No
Specified, Implied, and Essential Tasks	No	Battlespace Evaluation	No	Collateral Damage Estimates	No
Restraints, Constraints, Considerations	No	COA's	No	Potential Enemy Response	No
Assumptions/Facts	No	GCC Inputs	No	Risk Assessment	No
Initial CCIRs	No	Recommendations	No	GCC Inputs	No
Recommendations	No			COA Comparison	No
				Recommendations	No

**Workspace Hierarchy**

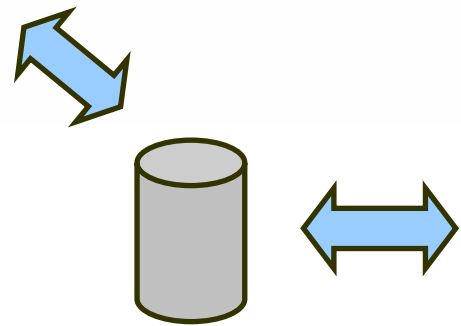
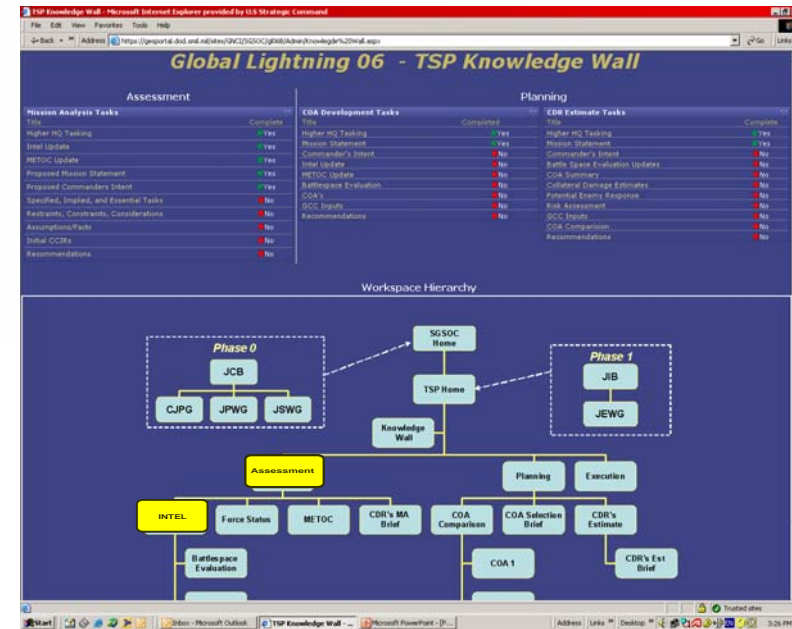
```

    graph TD
        TSPHome[TSP Home] --> SGSOCHome[SGSOC Home]
        TSPHome --> KnowledgeWall[Knowledge Wall]
        KnowledgeWall --> Assessment[Assessment]
        KnowledgeWall --> Planning[Planning]
        KnowledgeWall --> Execution[Execution]
        
        Assessment --> Intel[Intel]
        Assessment --> ForceStatus[Force Status]
        Assessment --> METOC[METOC]
        Assessment --> CDRMA[CDR's MA Brief]
        
        Intel --> Battlespace[Battlespace Evaluation]
        
        Planning --> COAComparison[COA Comparison]
        Planning --> COASelection[COA Selection Brief]
        Planning --> CDRsEstimate[CDR's Estimate]
        
        COAComparison --> COA1[COA 1]
        CDRsEstimate --> CDRsEstBrief[CDR's Est Brief]
        
        subgraph Phase0 [Phase 0]
            JCB[JCB]
            CJPG[CJPG]
            JPWG[JPWG]
            JSWG[JSWG]
        end
        
        subgraph Phase1 [Phase 1]
            JIB[JIB]
            JEWG[JEWG]
        end
    
```

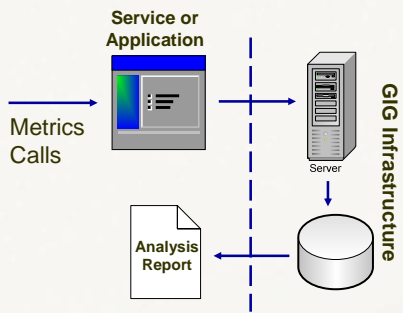
# Evaluate Execution of Mission-specific Workflow Pattern



Visualize Model's Execution Status Via the GOG-CE



Model's Knowledgebase



# Service-based Data Collection, Analysis, & Reporting

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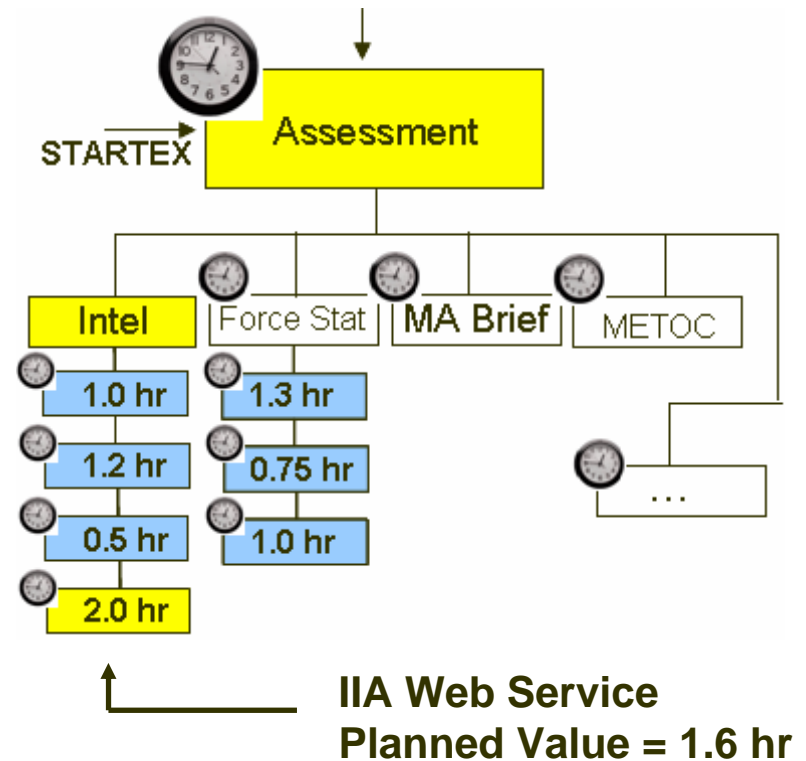


# Service-based Data Collection, Analysis & Reporting

- **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**

# Example Value-Add Use Case

- 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