Policy-Based Command & Control

In Federated Systems

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Outline

- Thesis
- Federated C2 Systems
- C2 Space - Policy Domains
- C2 Actors
- C2 Services
- C2 Timing - Completion Time Requirements

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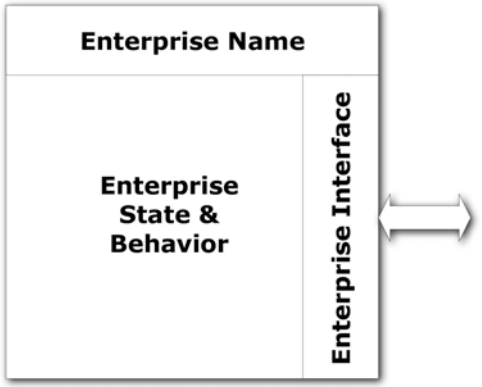
Thesis

- Effective governance of large-scale federated enterprise systems requires policy-based "inter-" and "intra-enterprise" C2
- Effective enterprise C2 (EC2) in federated (collaborative, interoperable, interactive) enterprise systems requires higher degrees of automation (tools) of traditional social and *ad hoc* C2 activities
- Automation of *ad hoc* C2 activities requires a more formal EC2 model and associated set of tools (services)
- Key EC2 services include *policy-based*
  - *Situation Assessment*
  - *Plan Generation*
  - *Plan Execution*



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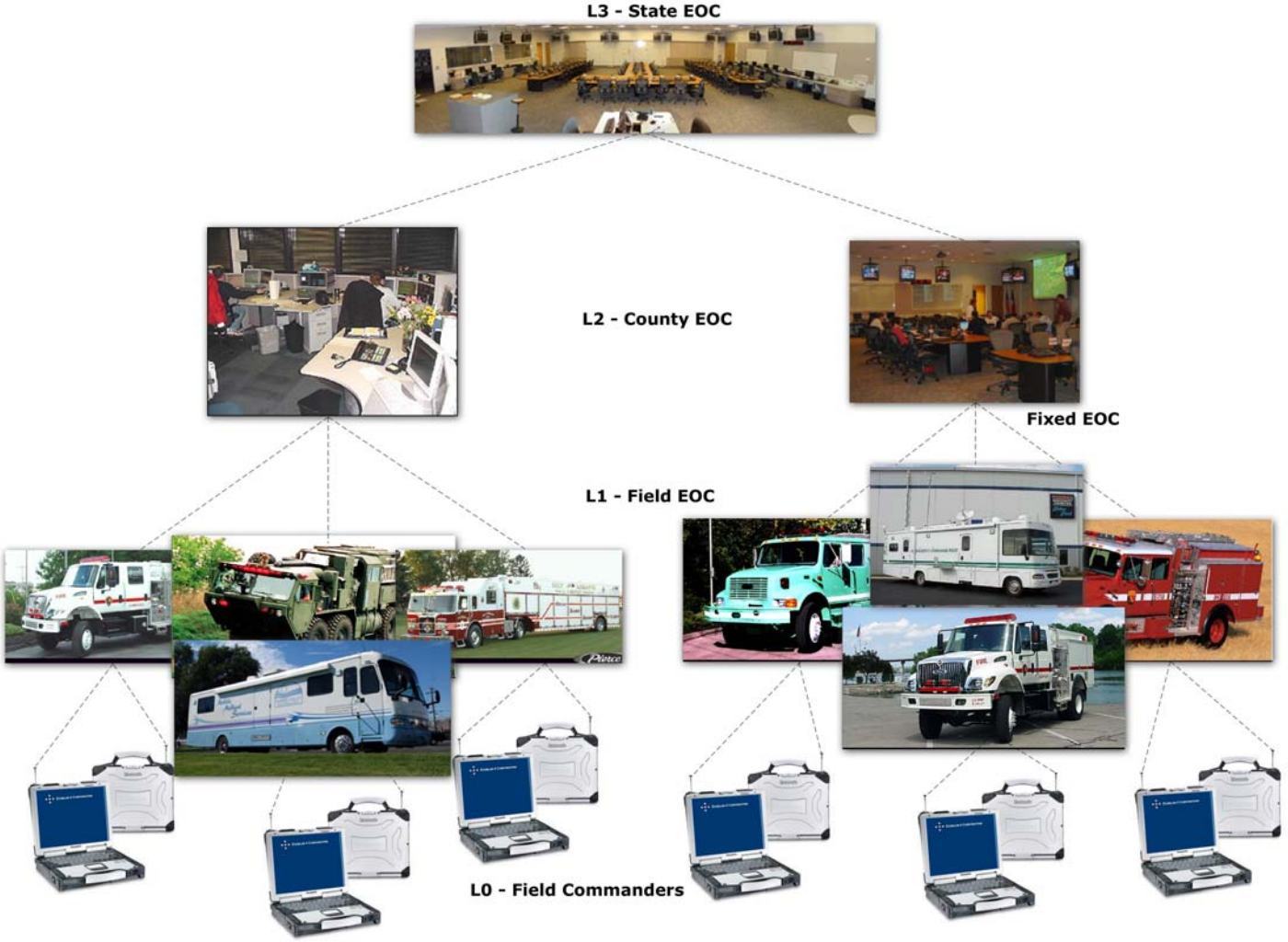
Ex. Civilian C2 Enclaves



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Ex. DoD C2 Enclaves

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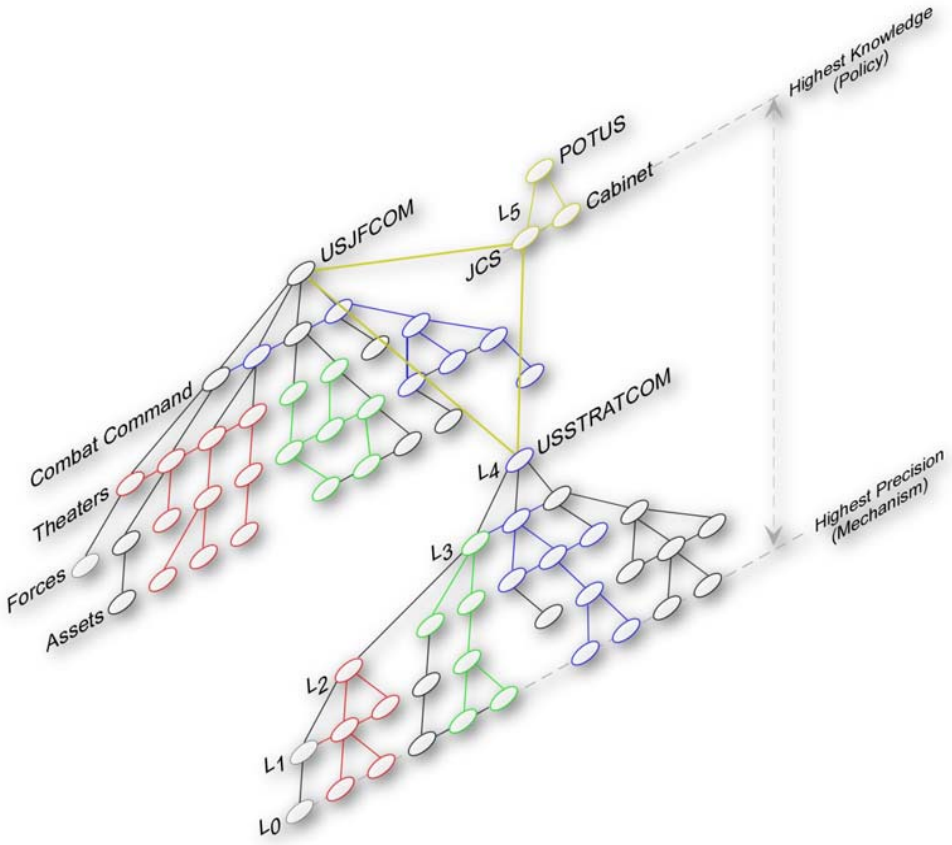
C2 Space: Federated Policy Domains



- An enterprise is *accountable* to the degree it operates in an authority, command or asset chain hierarchy
- An enterprise is *federated* to the degree it operates in a *policy domain* with other enterprises
- An enterprise is able to *collaborate* to the degree the policy domain supports *interoperability*

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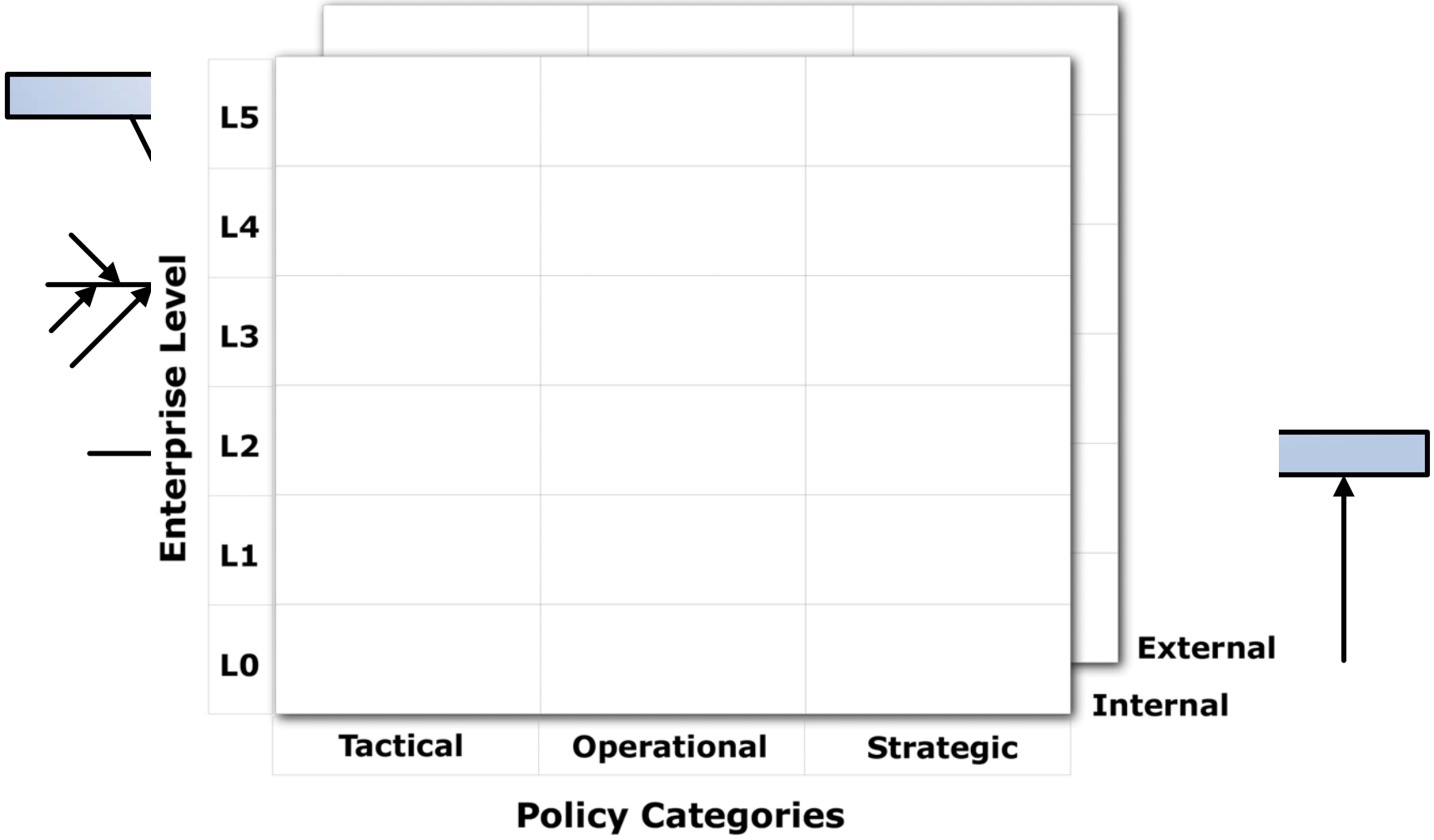
Policy Frameworks



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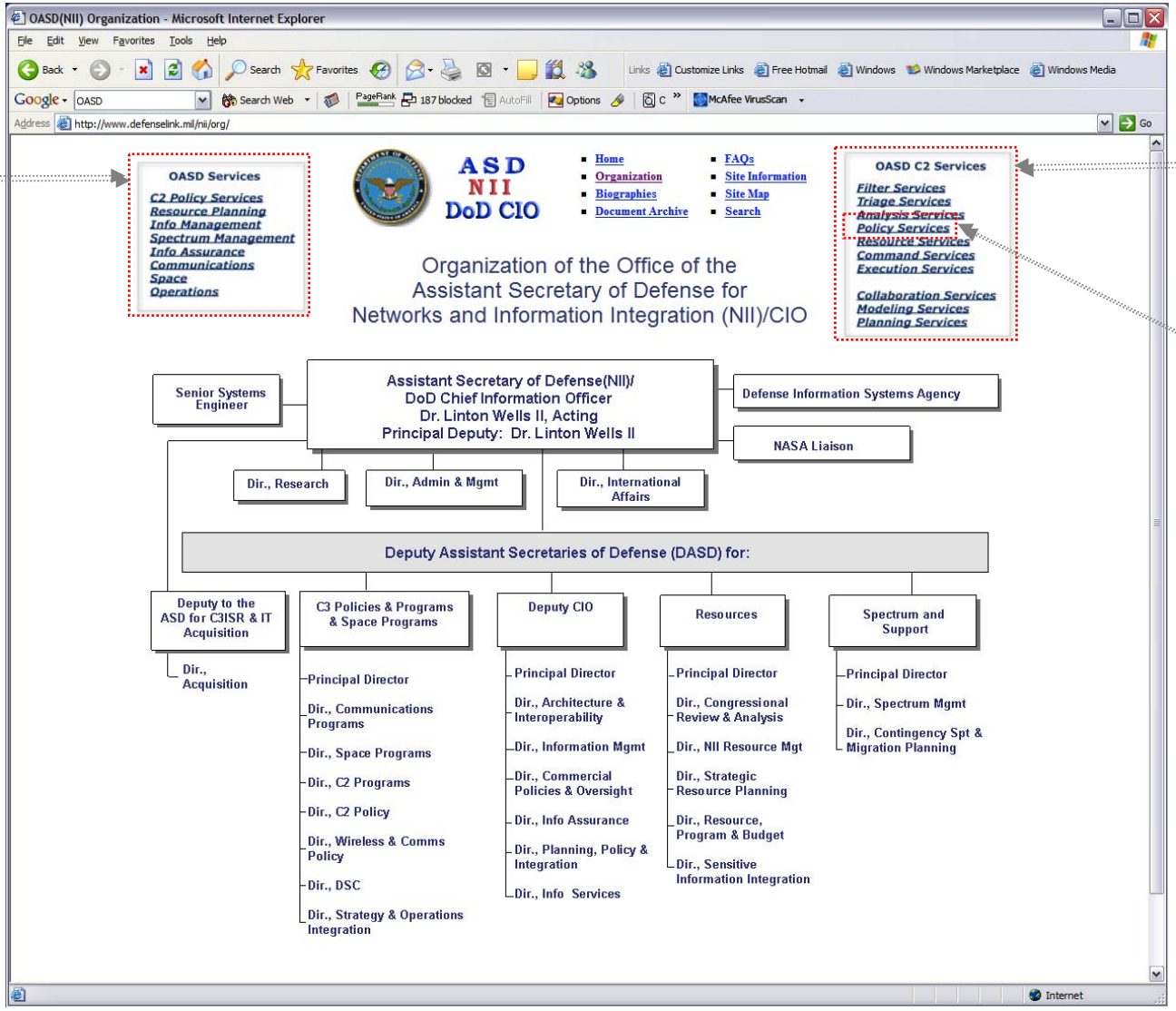
Joint C2 Strategy

Policy Services Concept

OASD Services Offerings



C2 Support Services

C2 Policy Services

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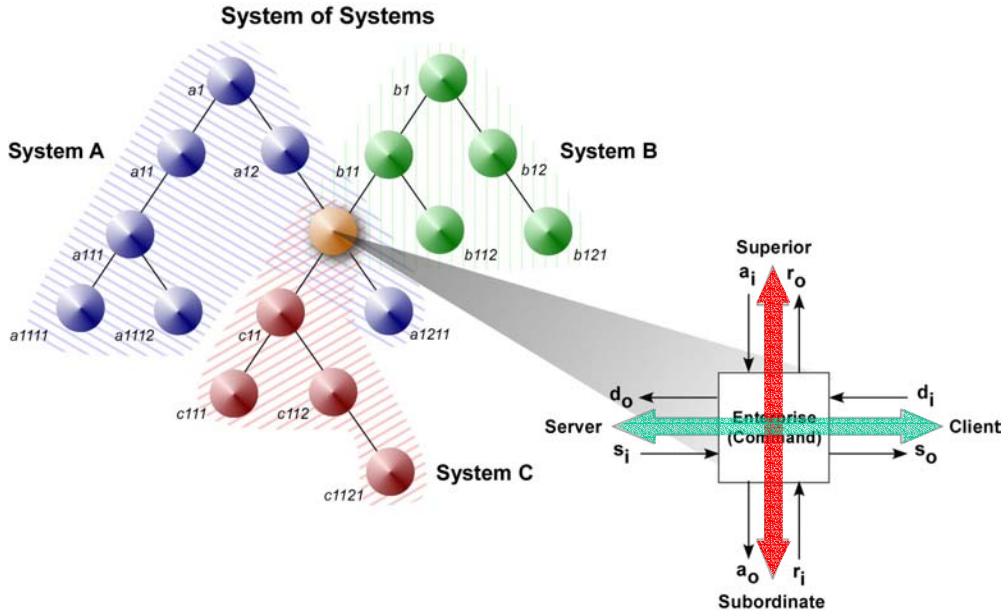
Federated C2 Systems



- Federation members are
  - Uniquely Identifiable
  - Self Directed (Semi-Autonomous)
  - Freely Associative, and
  - Mutually Interdependent

- A given enterprise may participate in multiple federations (systems of systems)
- Each federated entity is considered a *command*, or *value production unit*
- A command is a four port object operating in a lattice or mesh interconnected by a
  - Command Axis (superior-subordinate)
  - Service Axis (client-server)

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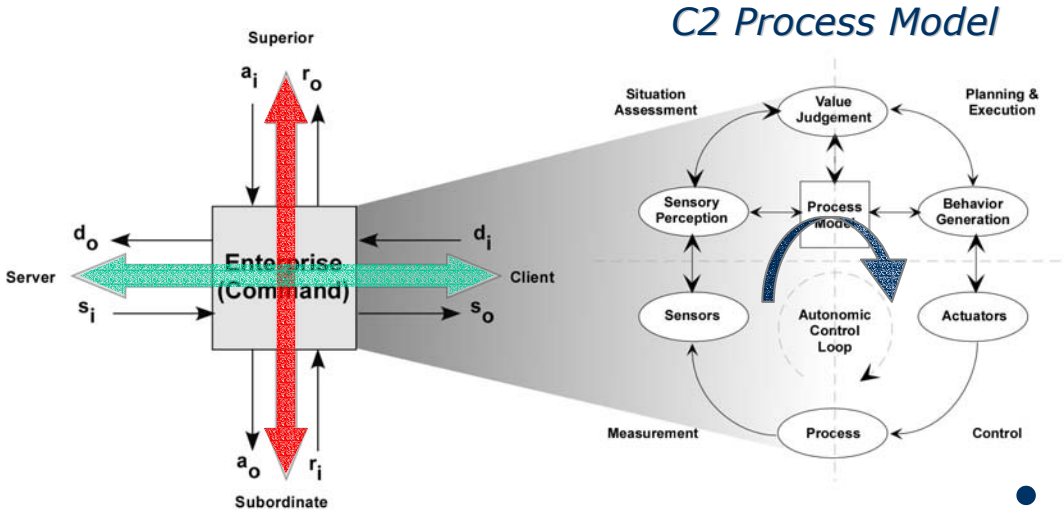
The Processes of EC2



- Federated enterprise management has two simultaneous objectives:
  - Maintaining command chain commitments (viability, homeostasis)
  - Maintaining supply chain commitments (service level agreements)
- Automation of core processes (autonomic controls) is a proven means of improving performance (yield, quality, etc.)

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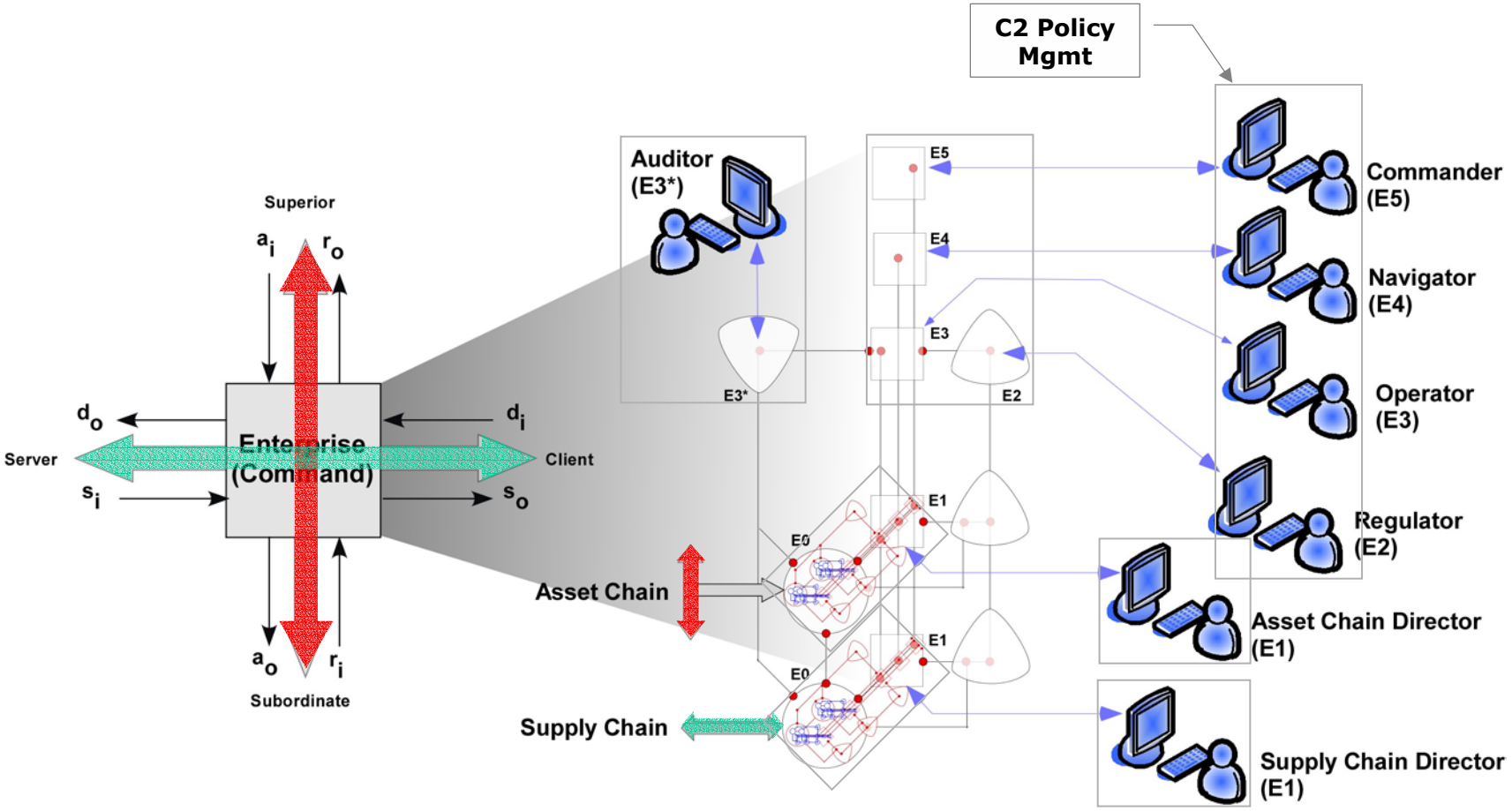
The Principal EC2 Actors



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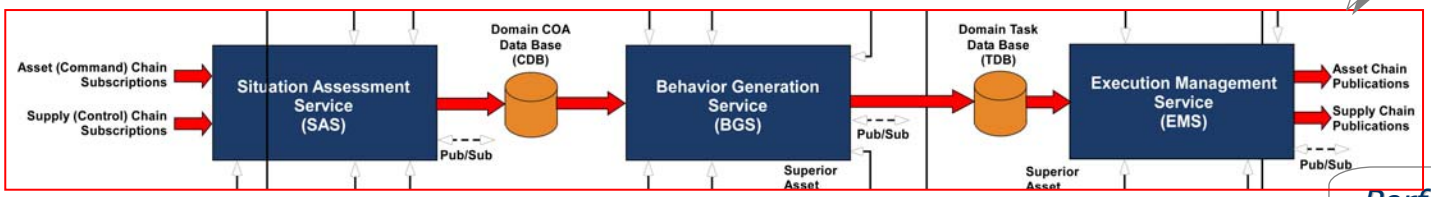
EC2 Enclave Applications



Visual Commons

Model Manager

Policy Manager

Core C2 Services

Performance Manager

Resource Manager

Scenario (Plan) Manager

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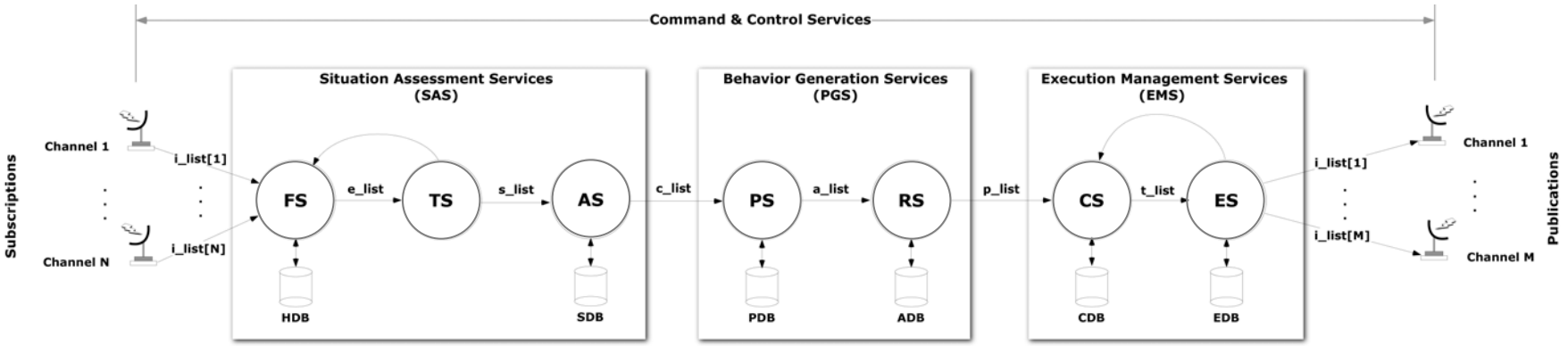
Core C2 Services



SID	SERVICE Function
FS	Filter Service (Subscription Management)
TS	Triage Service (Event Detection, Correlation & Prioritization)
AS	Analysis Service (Situation Detection & Response Proposals)
PS	Policy Service (Condition Detection & Risk Assessment)
RS	Resource Service (Asset Management & Allocation)
CS	Command Service (Plan Sequencing & Authorization)
ES	Execution Service (Plan Execution, Coordination & Abort)

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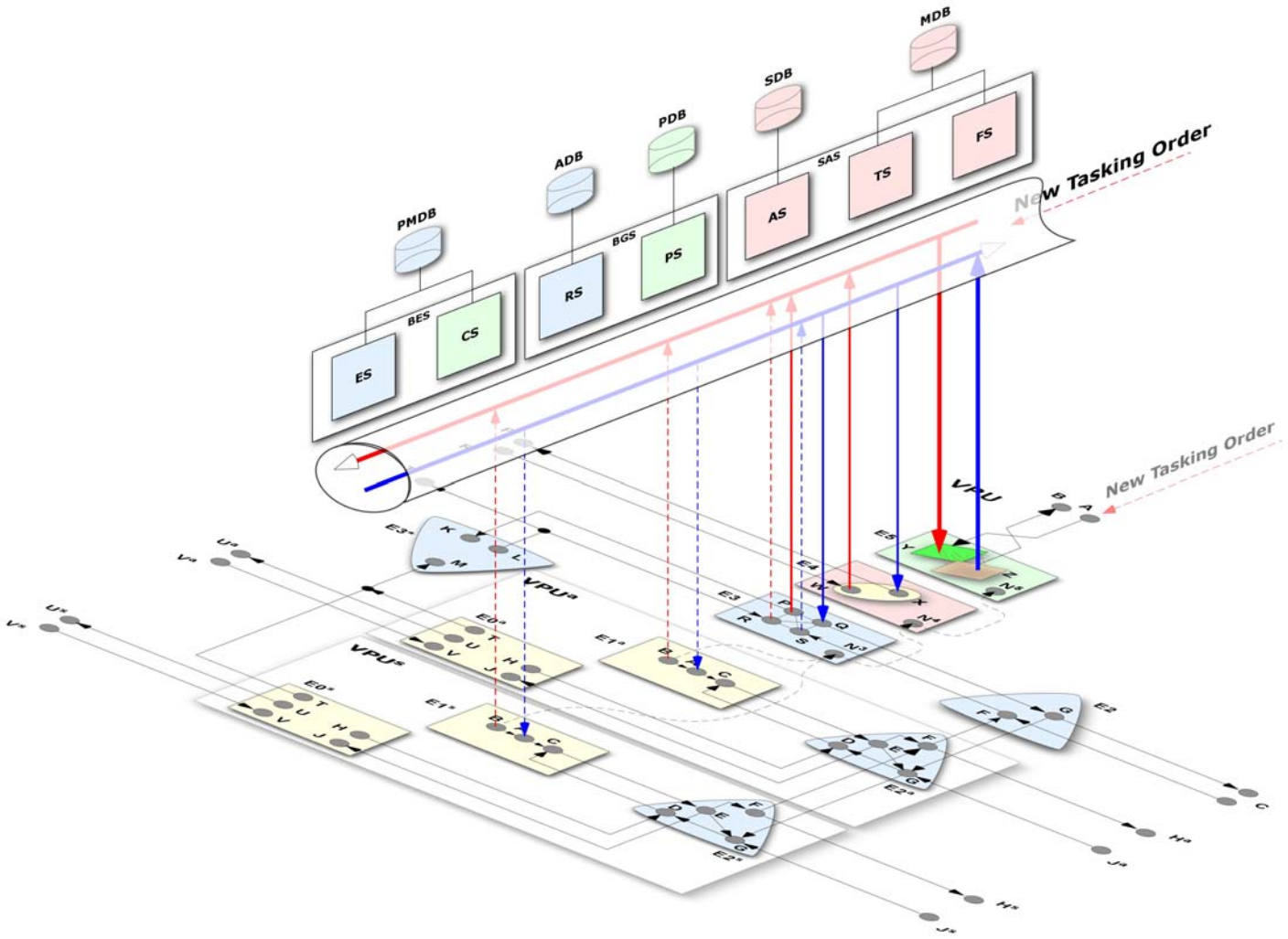
Command Axis Flows



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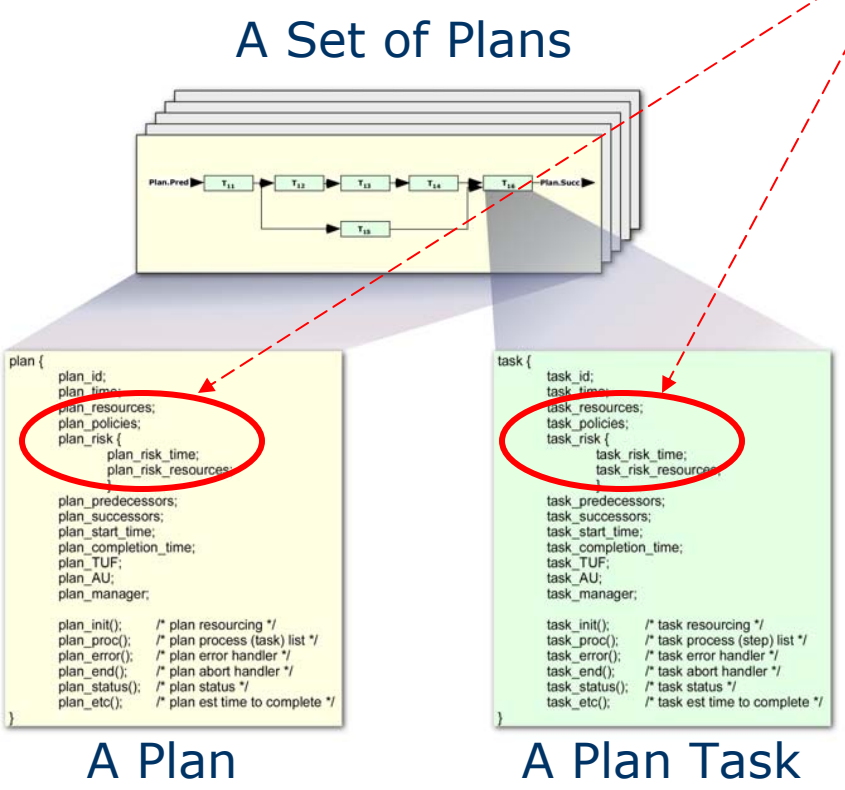
Policy-Guided Tasking Orders



- Plans (tasking orders) comprise *policy-constrained* task steps
- Policies are defined by rules and measures of risk related to rule violations
- A plan's *value* to an enterprise is a function of its *effects* and *completion-time* semantics
- => A task's *value* to a plan is a function if its *effects* and *completion-time* semantics

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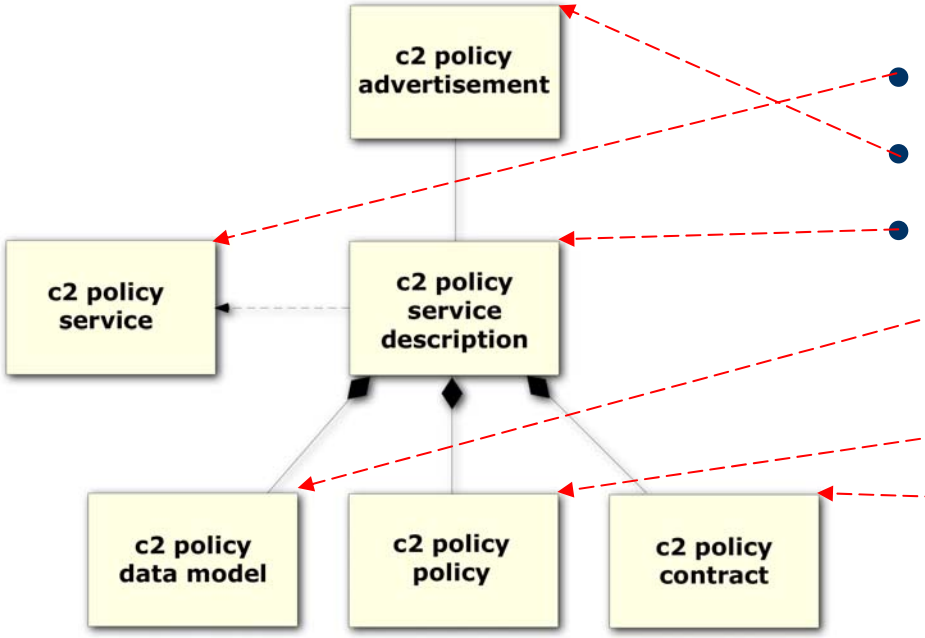
Policy Service Reference Model

Within a Service Oriented Architecture (SOA)
a "policy service" is defined by six specifications:



- Policy Service
- Policy Service Advertisement
- Policy Service Description
  - Policy Service Data Model (Policy Template)
  - Policy Service Use Policy
  - Policy Service Contract

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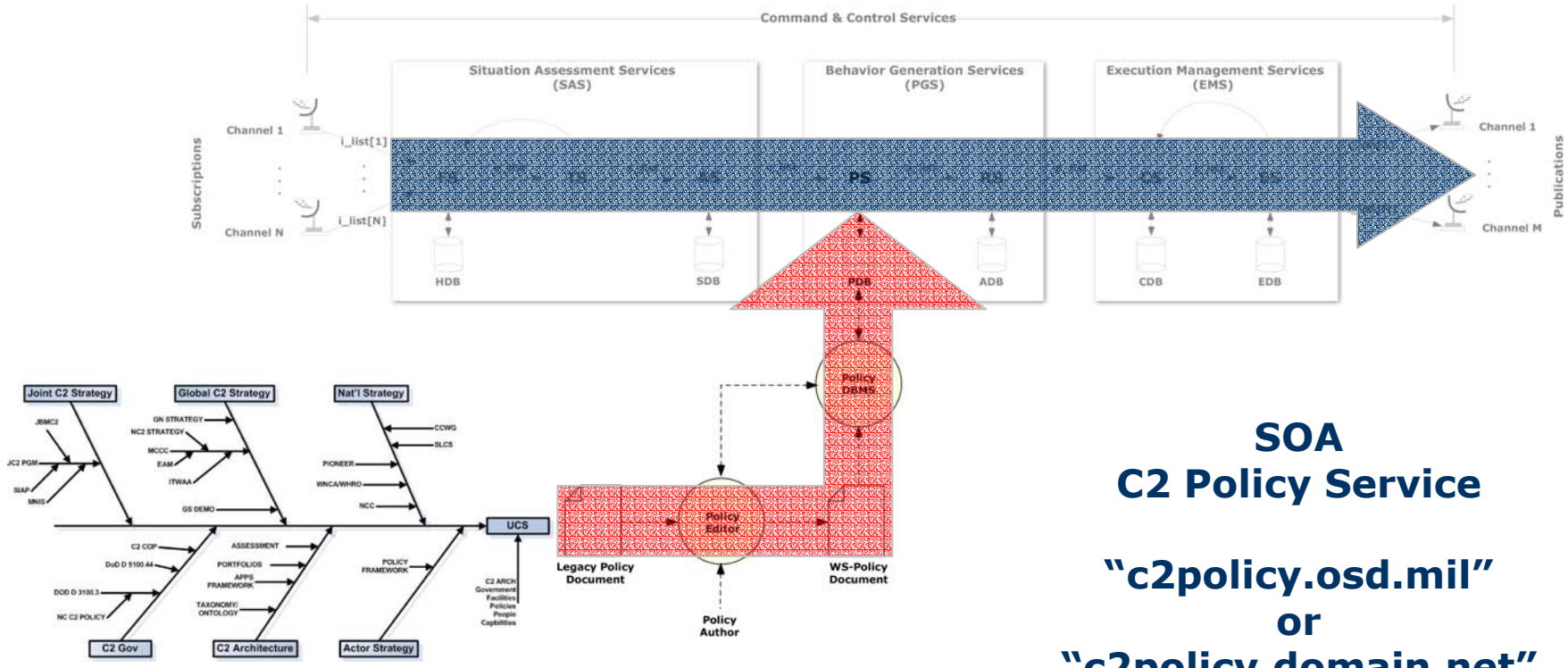
Federated C2 Policy Management



SOA
C2 Policy Service

"c2policy.osd.mil"
or
"c2policy.domain.net"
...

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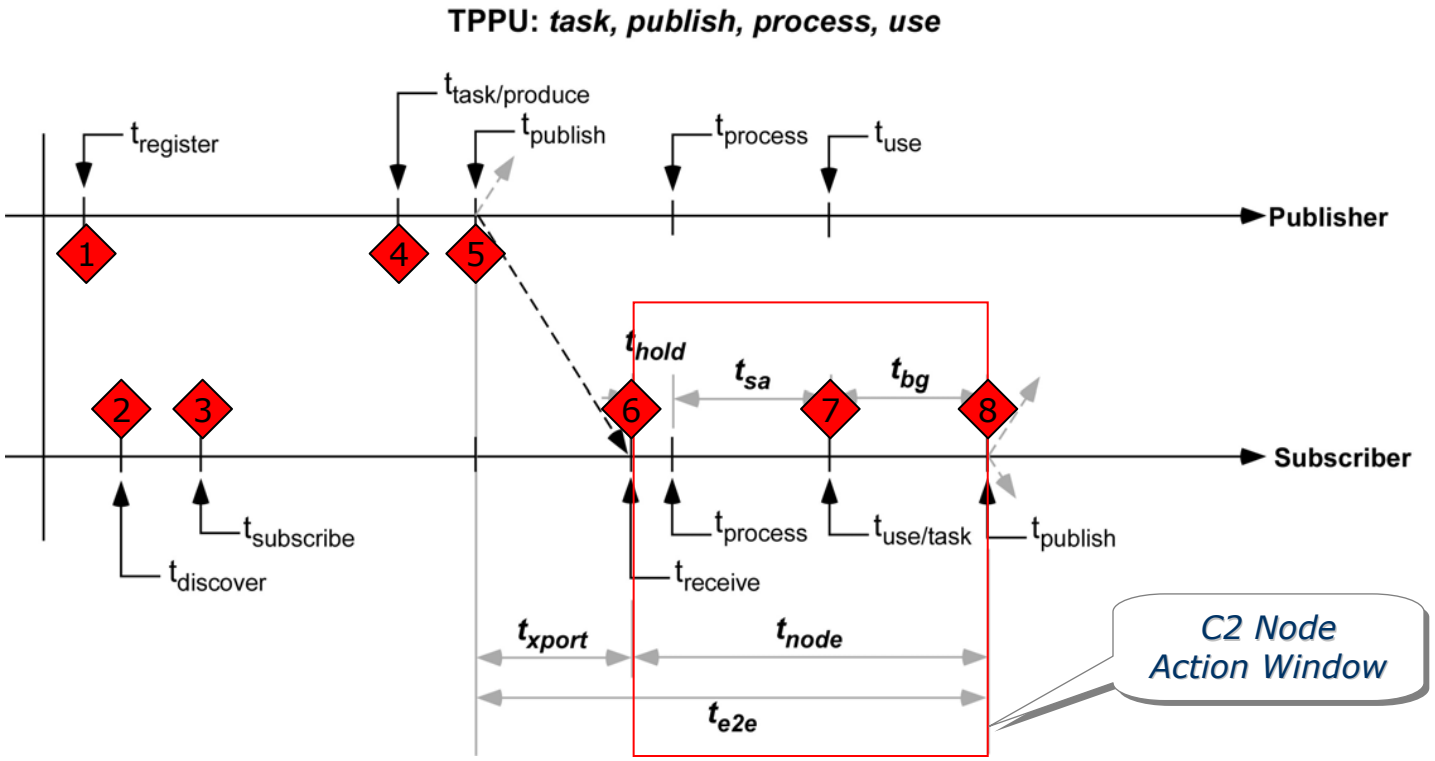
Policies Govern Timeliness



- Real-time => Meeting completion time requirements
- Grid-based => IP connected with publish-subscribe services

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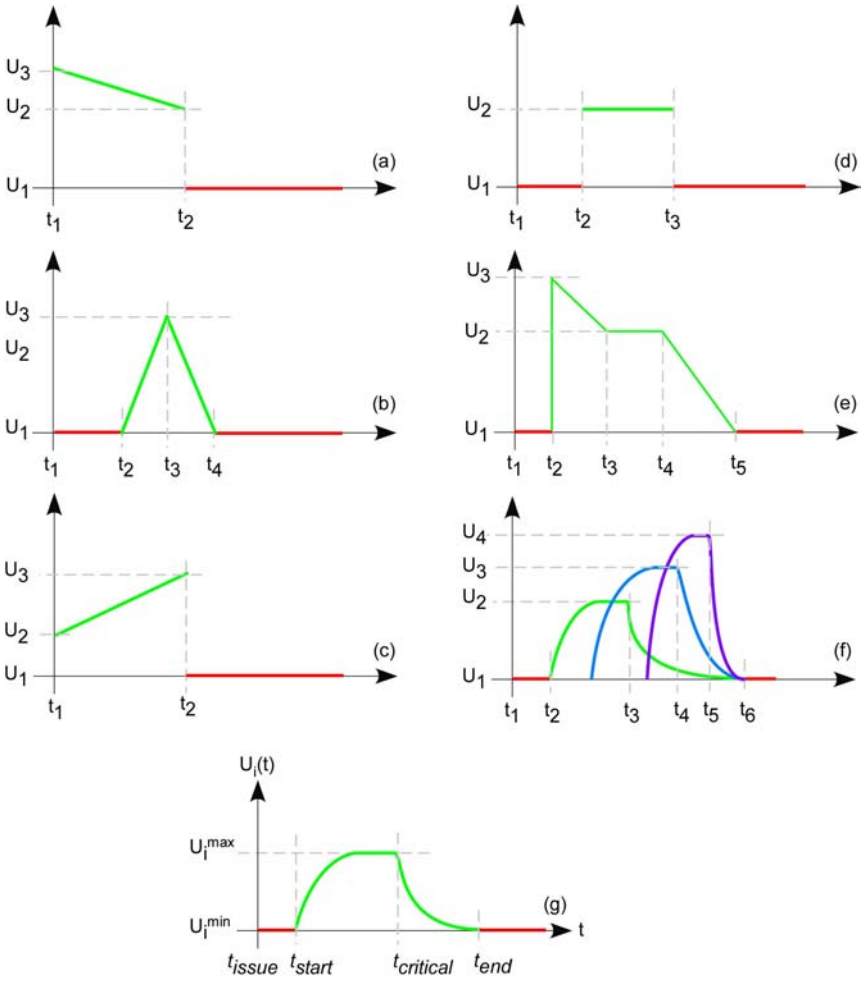
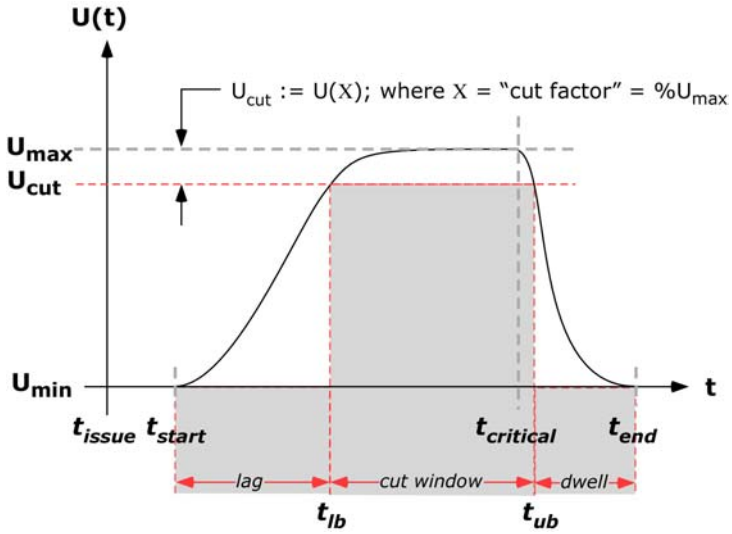
C2 Service Time





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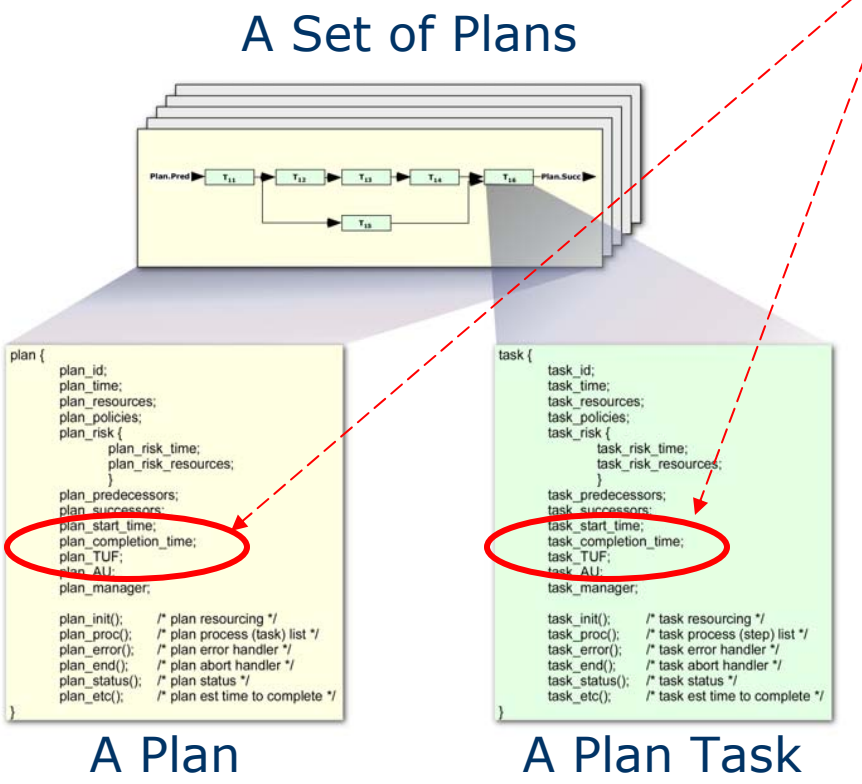
Completion-Time Semantics



- Plans (tasking orders) have completion time requirements
- A plan's value (utility) to an enterprise is dependent on its completion
- A plan's completion is dependent on its ability to obtain resources
- Effective (timely) resource management is a critical EC2 management objective

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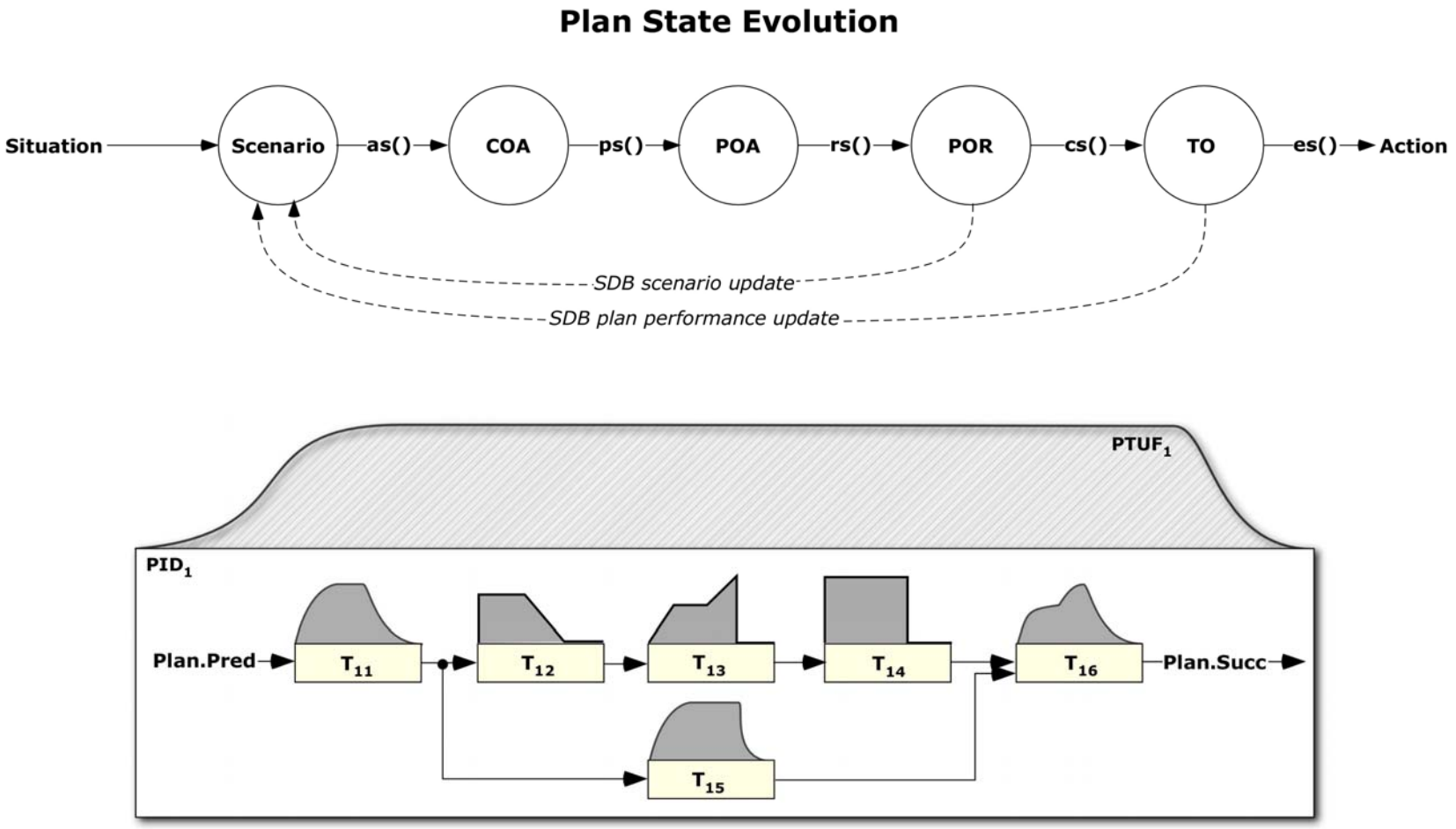
C2: The Evolution of Plans



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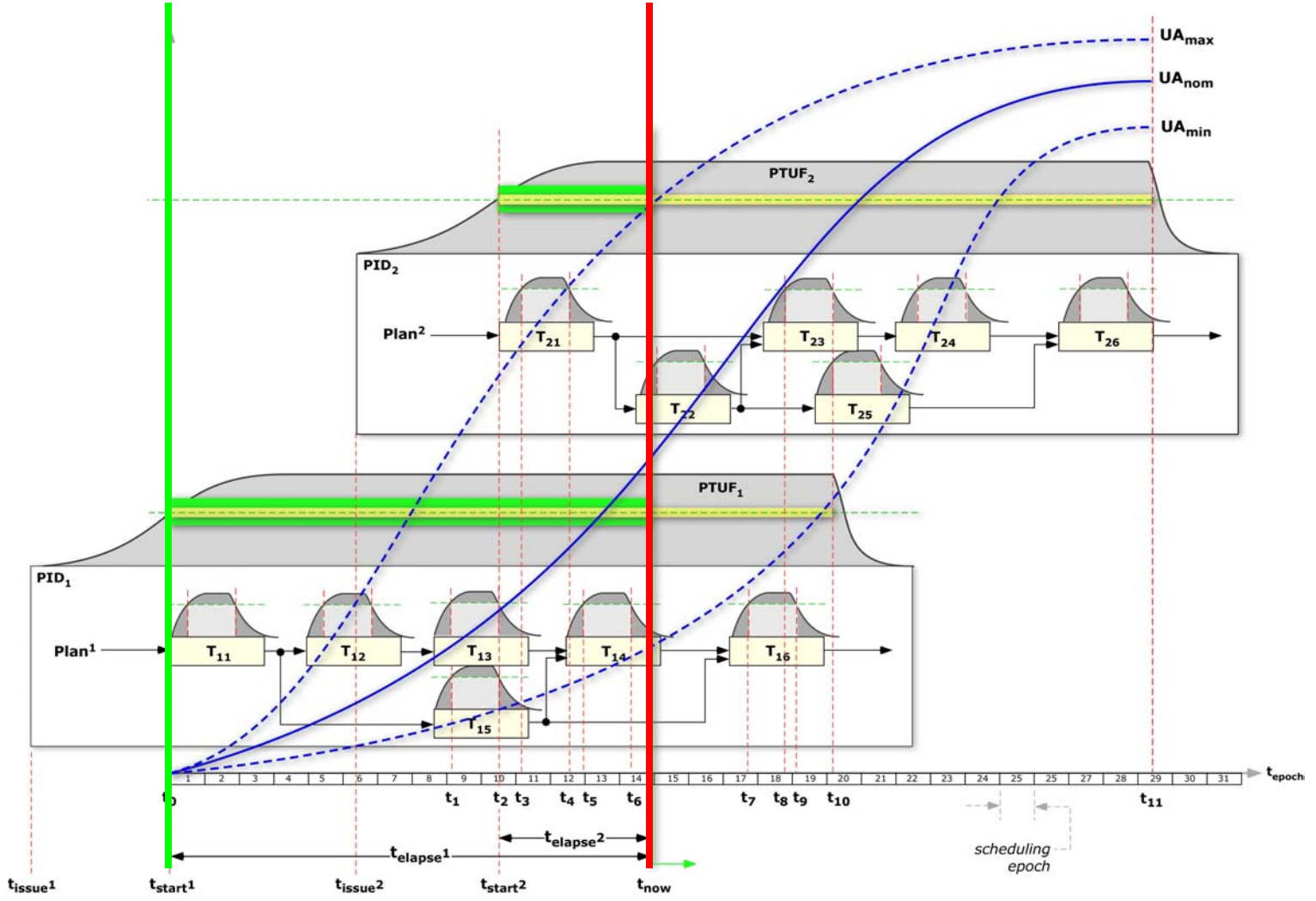
Utility Accrual Model



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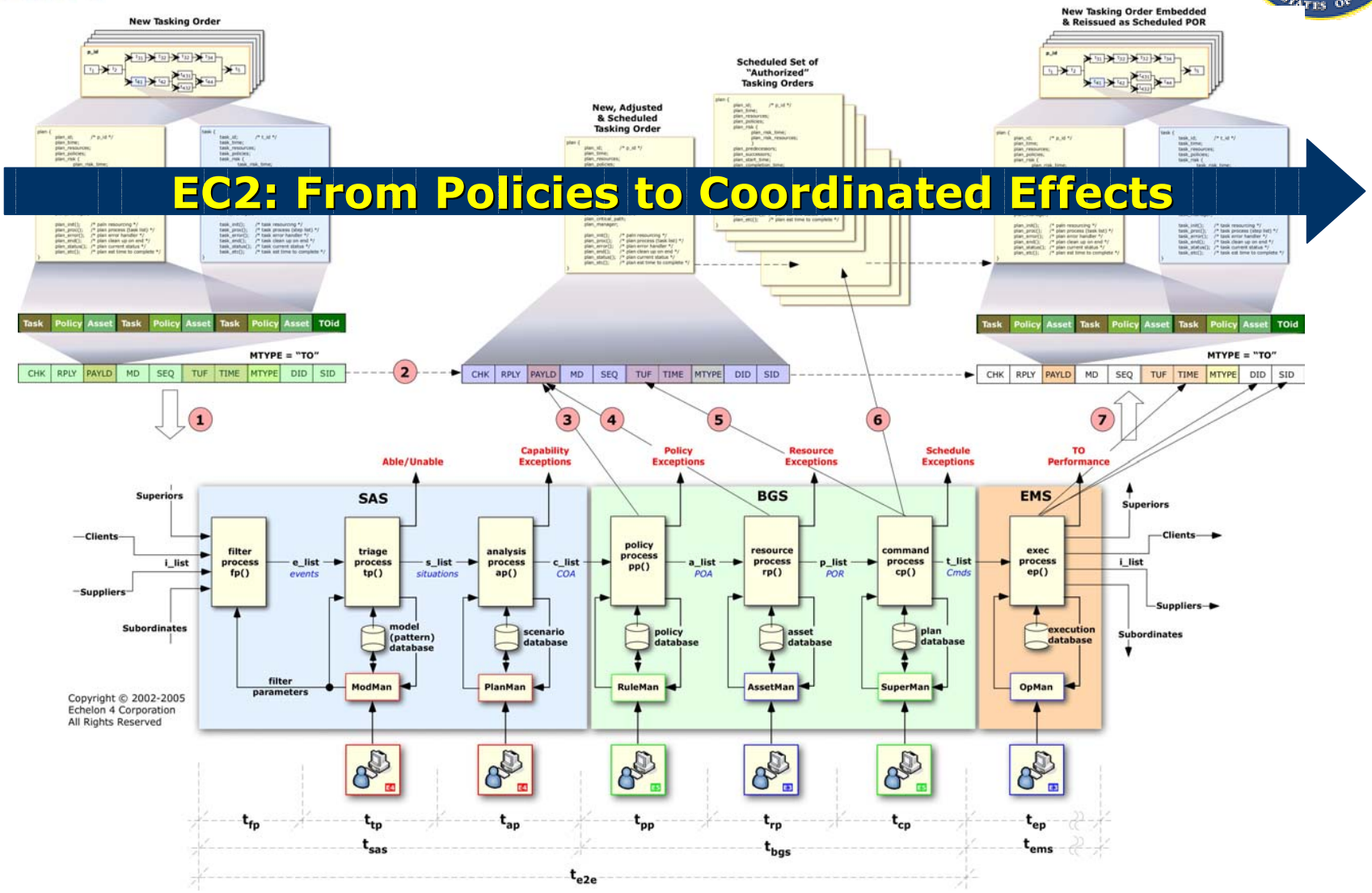
In Summary…



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Thank You.

Are there any questions?

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