

**ECHELON 4**



# Policy-Based Command & Control

## In Federated Systems

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OASD/NII



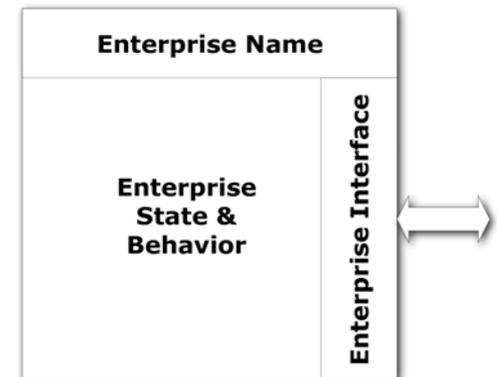
# Outline



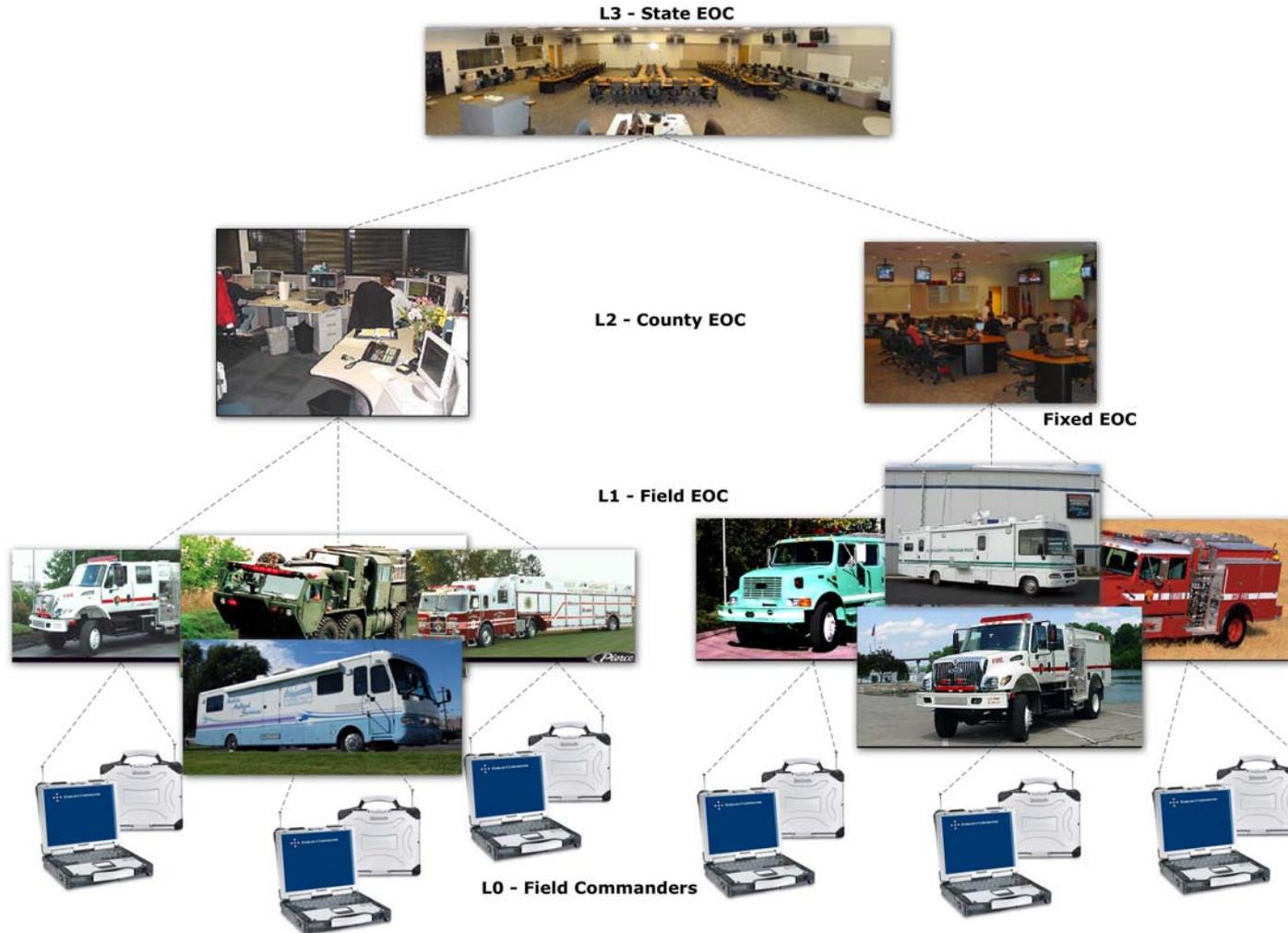
- Thesis
- Federated C2 Systems
- C2 Space - Policy Domains
- C2 Actors
- C2 Services
- C2 Timing - Completion Time Requirements



- 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*



# Ex. Civilian C2 Enclaves



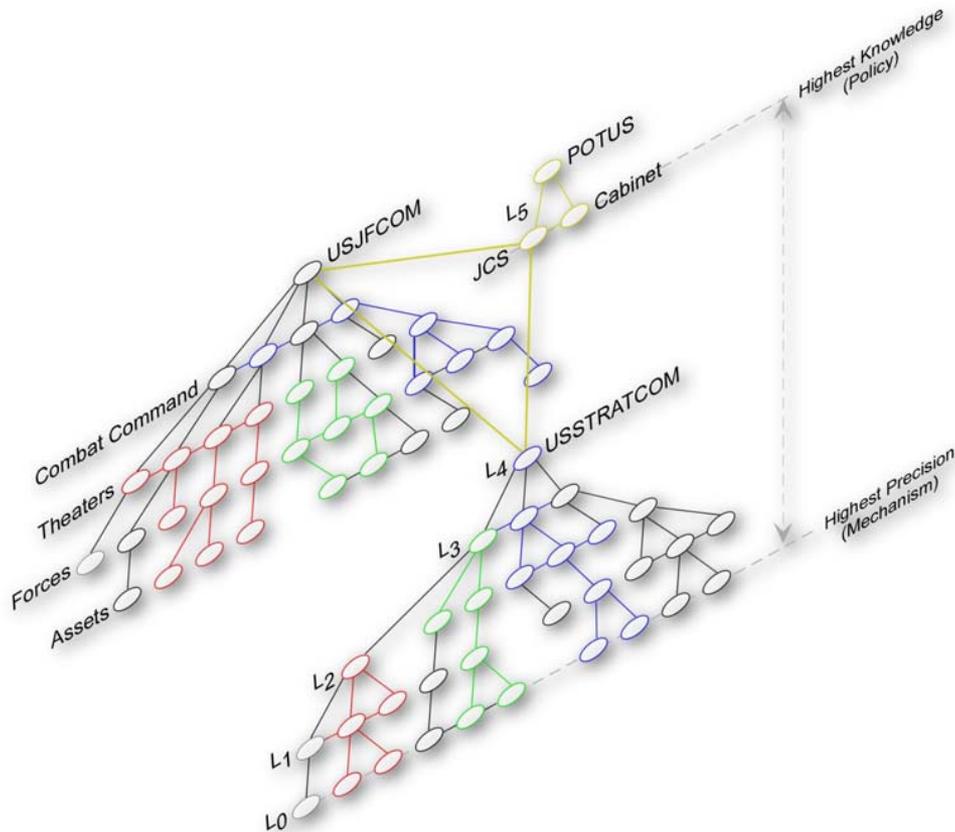


# Ex. DoD C2 Enclaves

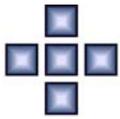




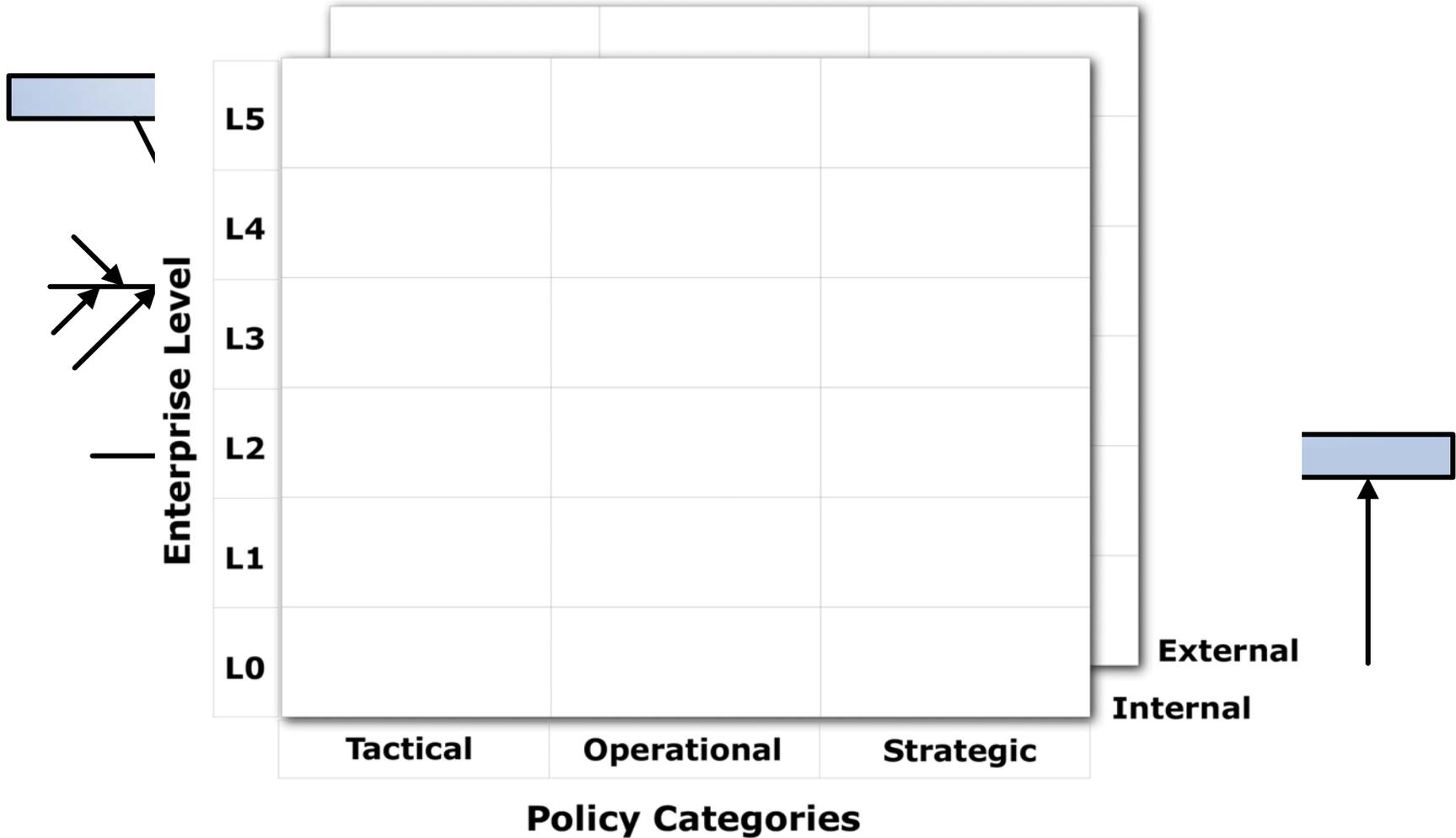
# C2 Space: Federated Policy Domains



- 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*



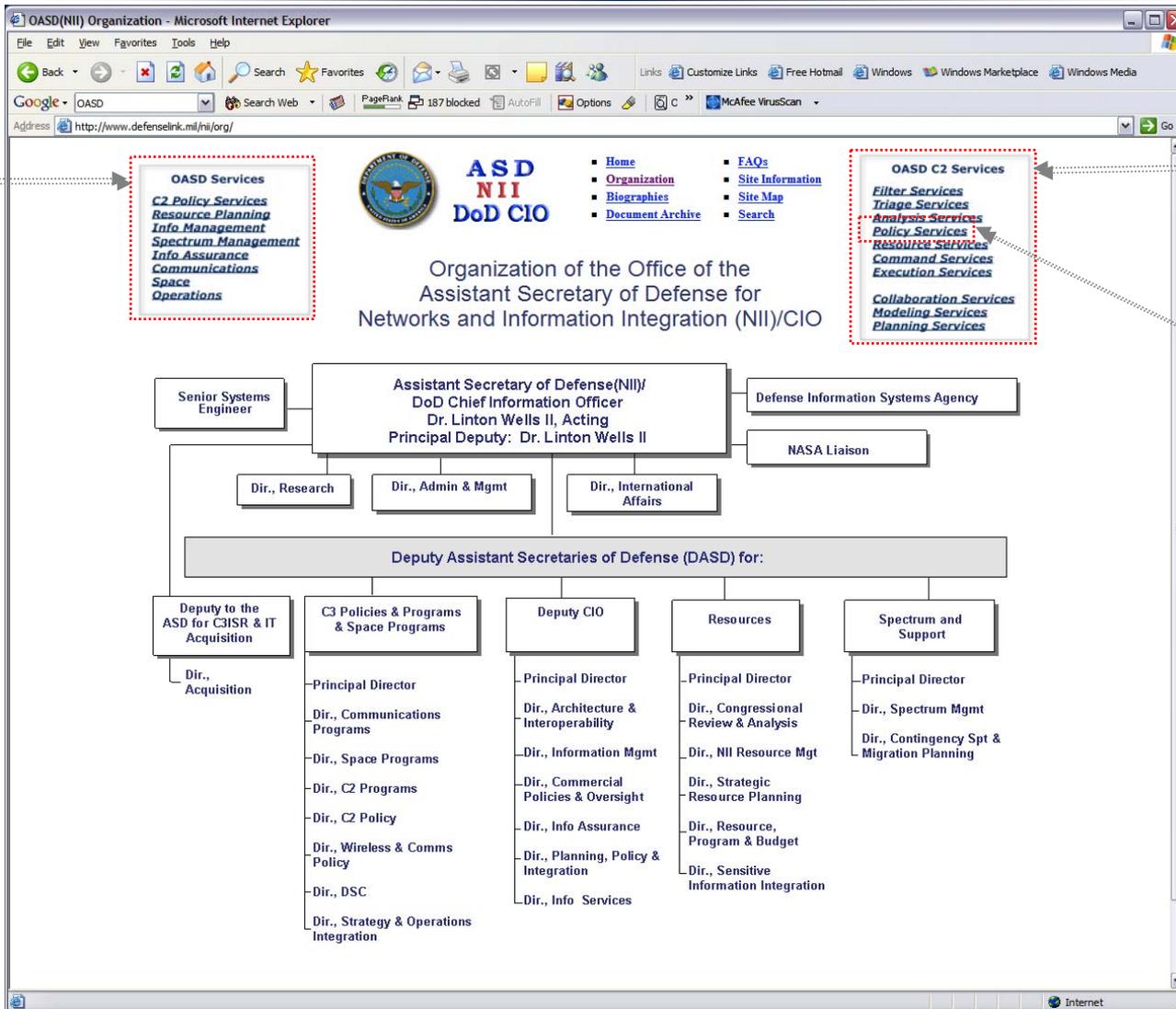
# Policy Frameworks



# Policy Services Concept



**OASD Services Offerings**



The screenshot shows the OASD(NII) Organization website in Microsoft Internet Explorer. The page title is "OASD(NII) Organization - Microsoft Internet Explorer". The address bar shows "http://www.defenselink.mil/nii/org/". The page content includes a navigation menu with links for Home, Organization, Biographies, Document Archive, FAQs, Site Information, Site Map, and Search. The main heading is "Organization of the Office of the Assistant Secretary of Defense for Networks and Information Integration (NII)/CIO". Below this is an organizational chart.

**OASD Services Offerings:**

- C2 Policy Services
- Resource Planning
- Info Management
- Spectrum Management
- Info Assurance
- Communications
- Space
- Operations

**OASD C2 Services:**

- Filter Services
- Triage Services
- Analysis Services
- Policy Services
- Resource Services
- Command Services
- Execution Services
- Collaboration Services
- Modeling Services
- Planning Services

**Organizational Chart:**

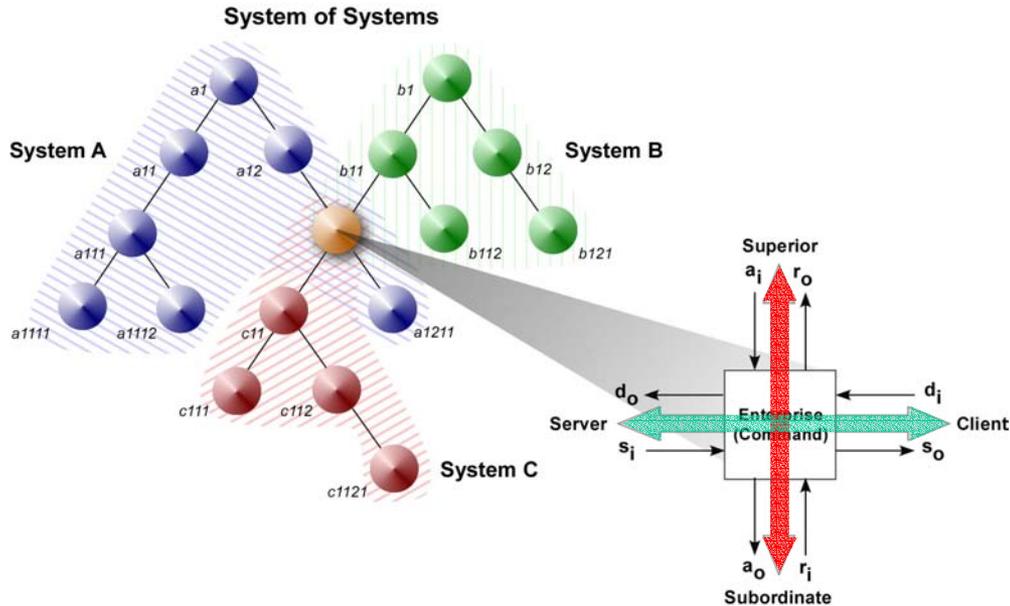
- Assistant Secretary of Defense(NII)/ DoD Chief Information Officer  
Dr. Linton Wells II, Acting  
Principal Deputy: Dr. Linton Wells II
  - Senior Systems Engineer
  - Defense Information Systems Agency
  - NASA Liaison
  - Dir., Research
  - Dir., Admin & Mgmt
  - Dir., International Affairs
- Deputy Assistant Secretaries of Defense (DASD) for:
  - Deputy to the ASD for C3ISR & IT Acquisition
    - Dir., Acquisition
  - C3 Policies & Programs & Space Programs
    - Principal Director
    - Dir., Communications Programs
    - Dir., Space Programs
    - Dir., C2 Programs
    - Dir., C2 Policy
    - Dir., Wireless & Comms Policy
    - Dir., DSC
    - Dir., Strategy & Operations Integration
  - Deputy CIO
    - Principal Director
    - Dir., Architecture & Interoperability
    - Dir., Information Mgmt
    - Dir., Commercial Policies & Oversight
    - Dir., Info Assurance
    - Dir., Planning, Policy & Integration
    - Dir., Info Services
  - Resources
    - Principal Director
    - Dir., Congressional Review & Analysis
    - Dir., NII Resource Mgt
    - Dir., Strategic Resource Planning
    - Dir., Resource, Program & Budget
    - Dir., Sensitive Information Integration
  - Spectrum and Support
    - Principal Director
    - Dir., Spectrum Mgmt
    - Dir., Contingency Spt & Migration Planning

**C2 Support Services**

**C2 Policy Services**



# Federated C2 Systems

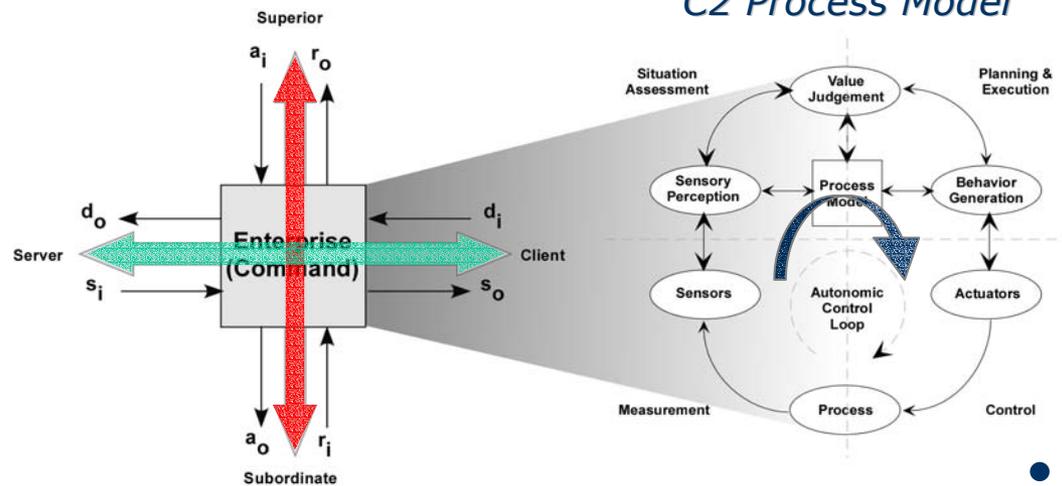


- Federation members are
  - Uniquely Identifiable
  - Self Directed (Semi-Autonomous)
  - Freely Associative, and
  - Mutually Interdependent

- 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)



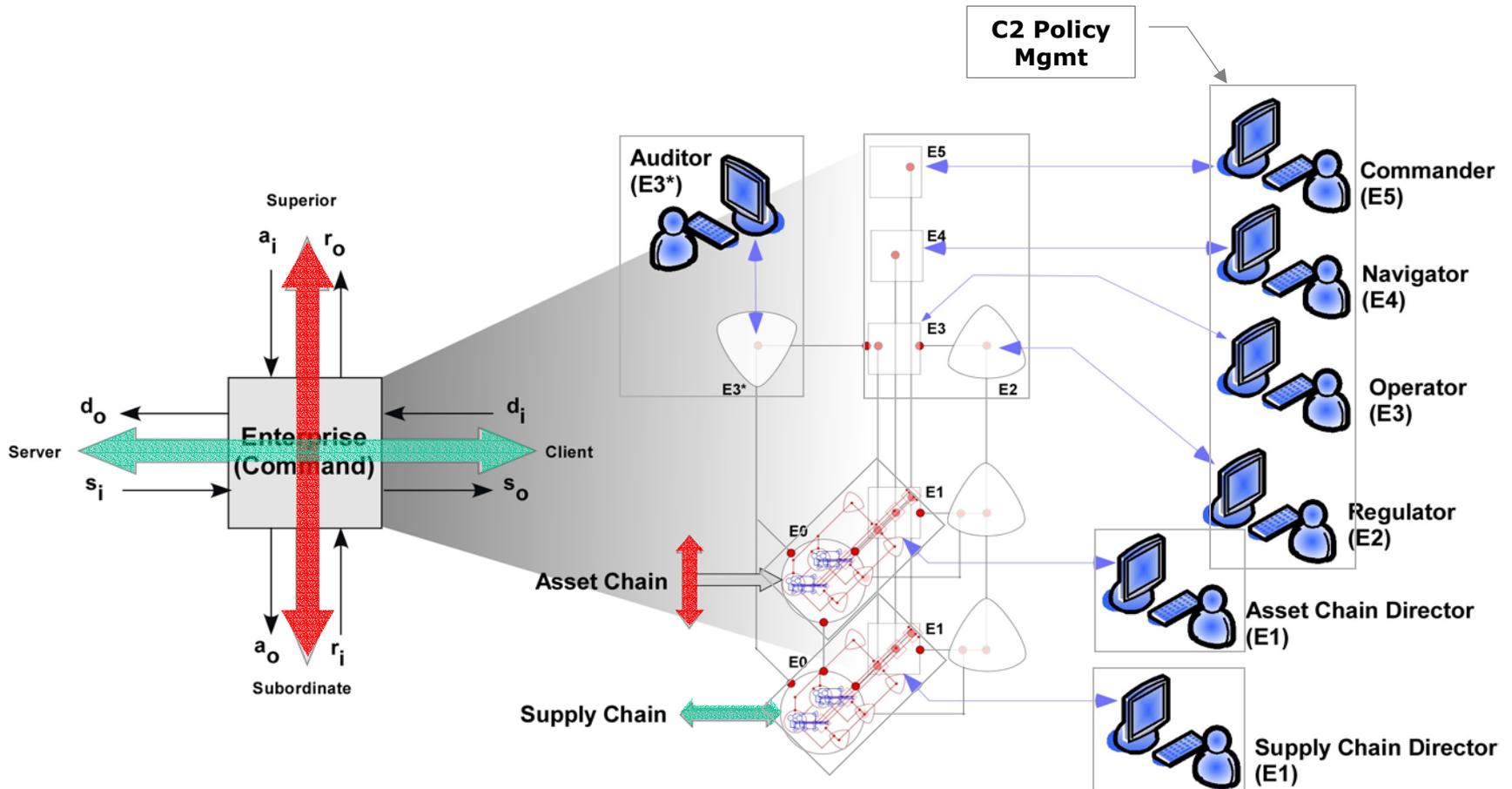
# The Processes of EC2



- 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.)



# The Principal EC2 Actors





# EC2 Enclave Applications

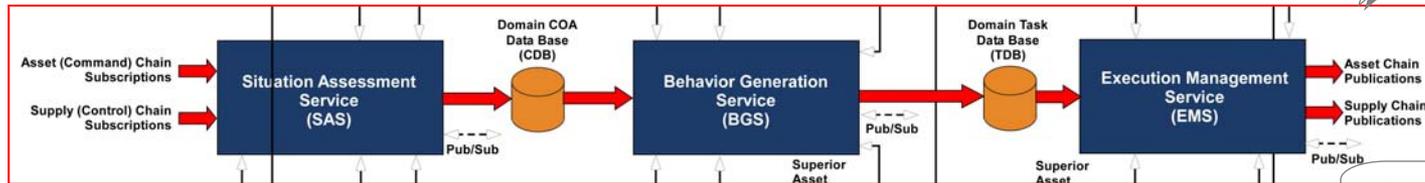


*Visual Commons*

*Model Manager*

*Policy Manager*

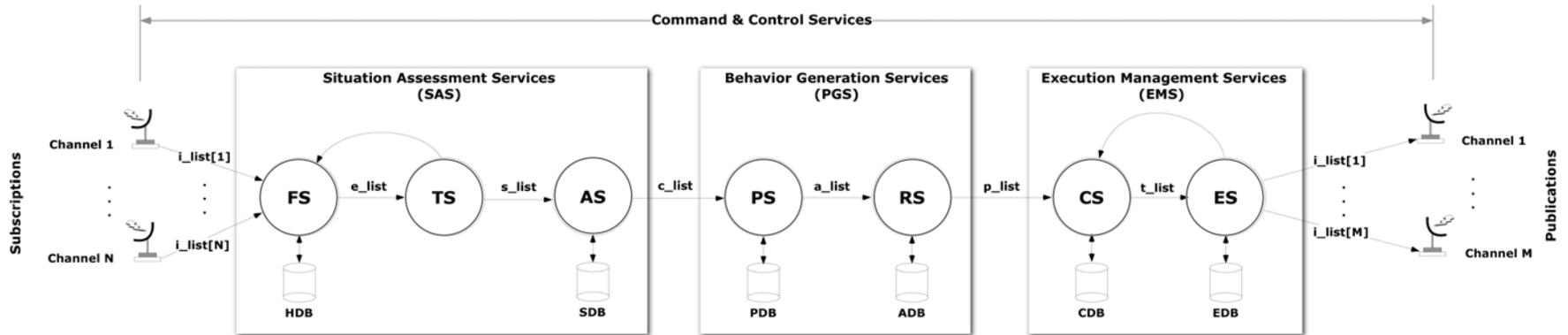
*Core C2 Services*



*Performance Manager*

*Scenario (Plan) Manager*

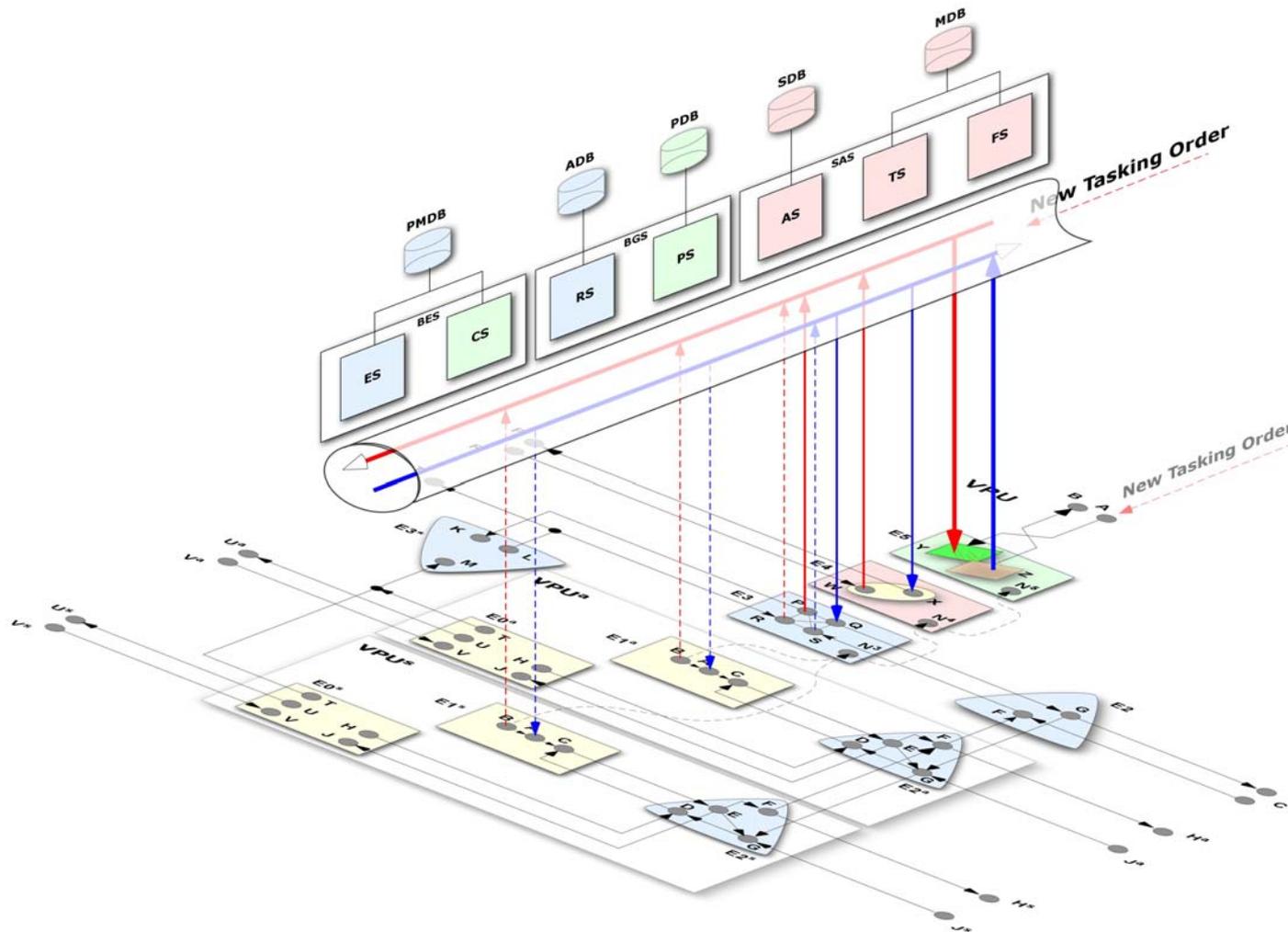
*Resource Manager*

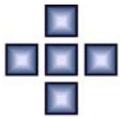


SID	SERVICE Function
FS	Filter Service (Subscription Management)
TS	Triage Service (Event Detection, Correlation & Prioritization)
AS	Analysis Service (Situation Detection & Response Proposals)
PS	Policy Service (Condition Detection & Risk Assessment)
RS	Resource Service (Asset Management & Allocation)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



# Command Axis Flows

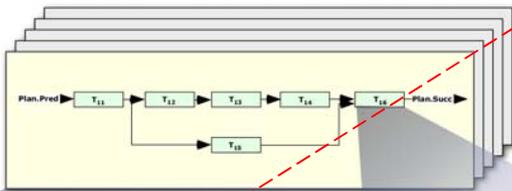




# Policy-Guided Tasking Orders



A Set of Plans



```

plan {
  plan_id;
  plan_time;
  plan_resources;
  plan_policies;
  plan_risk {
    plan_risk_time;
    plan_risk_resources;
  }

  plan_predecessors;
  plan_successors;
  plan_start_time;
  plan_completion_time;
  plan_TUF;
  plan_AU;
  plan_manager;

  plan_init(); /* plan resourcing */
  plan_proc(); /* plan process (task) list */
  plan_error(); /* plan error handler */
  plan_end(); /* plan abort handler */
  plan_status(); /* plan status */
  plan_etc(); /* plan est time to complete */
}
  
```

A Plan

```

task {
  task_id;
  task_time;
  task_resources;
  task_policies;
  task_risk {
    task_risk_time;
    task_risk_resources;
  }

  task_predecessors;
  task_successors;
  task_start_time;
  task_completion_time;
  task_TUF;
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  task_manager;

  task_init(); /* task resourcing */
  task_proc(); /* task process (step) list */
  task_error(); /* task error handler */
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  task_status(); /* task status */
  task_etc(); /* task est time to complete */
}
  
```

A Plan Task

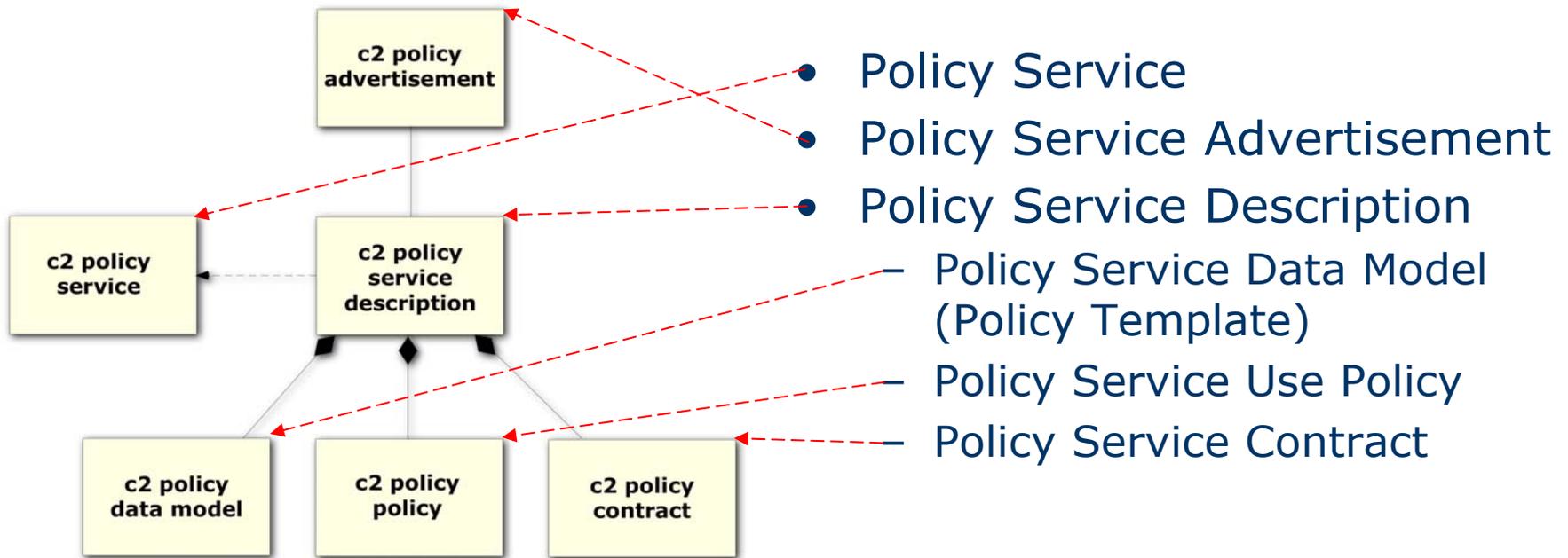
- Plans (tasking orders) comprise *policy-constrained* task steps
- Policies are defined by rules and measures of risk related to rule violations
- A plan's *value* to an enterprise is a function of its *effects* and *completion-time* semantics
- => A task's *value* to a plan is a function of its *effects*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

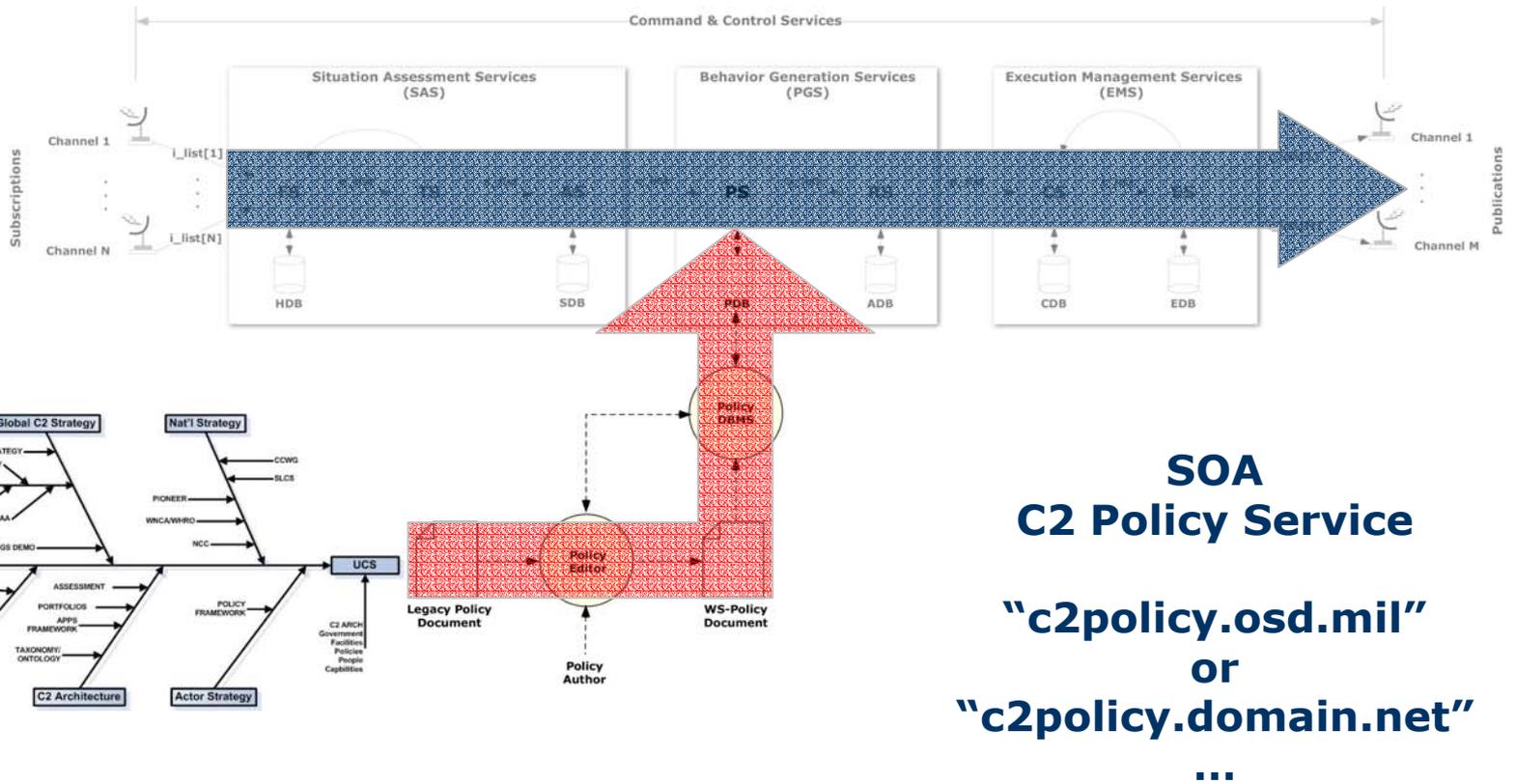


# Policy Service Reference Model



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



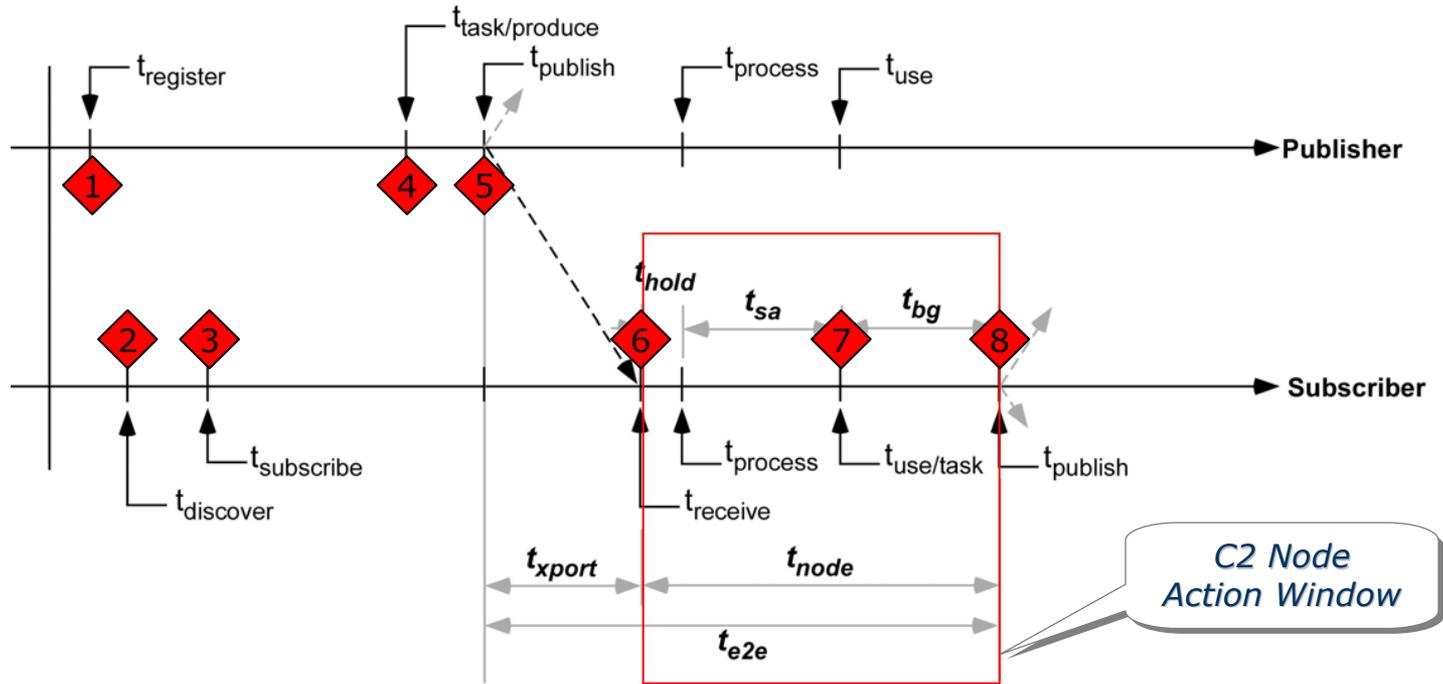




# Policies Govern Timeliness



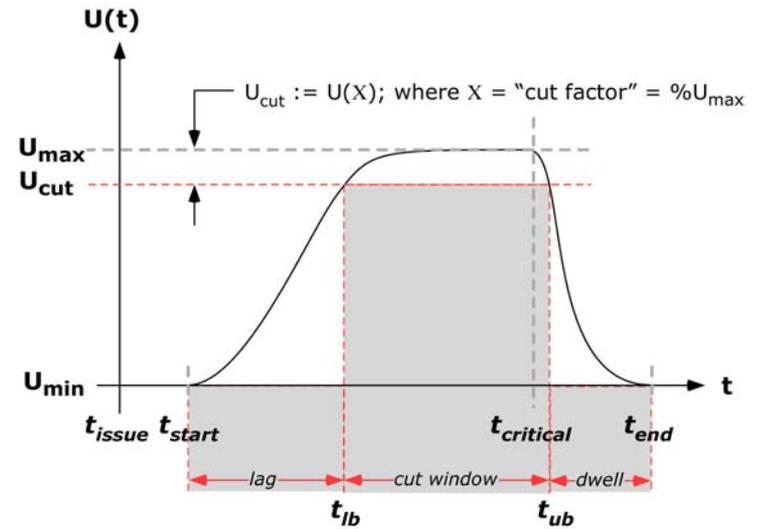
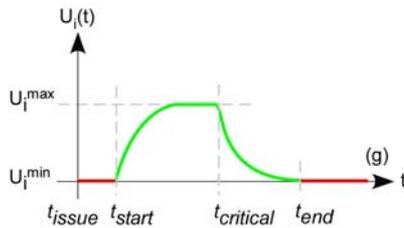
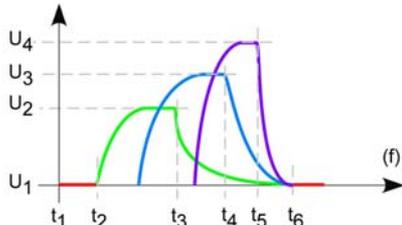
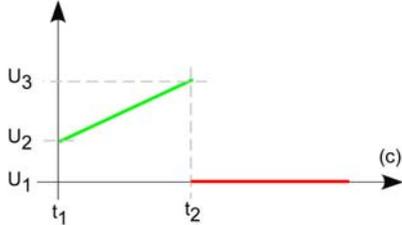
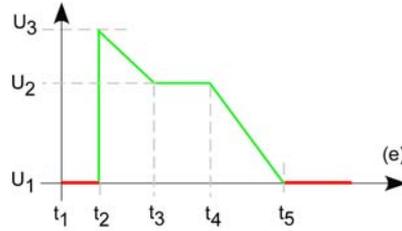
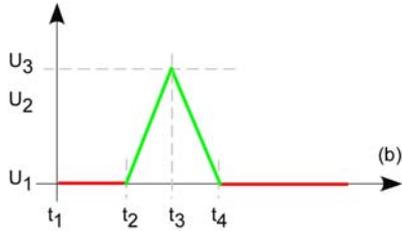
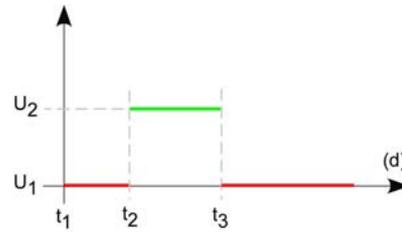
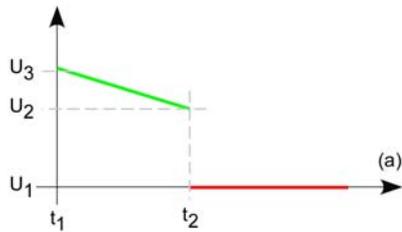
TPPU: *task, publish, process, use*



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



# C2 Service Time

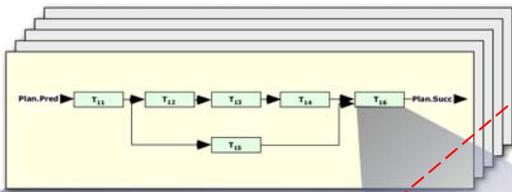




# Completion-Time Semantics



A Set of Plans



```

plan {
  plan_id;
  plan_time;
  plan_resources;
  plan_policies;
  plan_risk {
    plan_risk_time;
    plan_risk_resources;
  }
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  plan_successors;
  plan_start_time;
  plan_completion_time;
  plan_TUF;
  plan_AU;
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  plan_error(); /* plan error handler */
  plan_end(); /* plan abort handler */
  plan_status(); /* plan status */
  plan_etc(); /* plan est time to complete */
}

```

A Plan

```

task {
  task_id;
  task_time;
  task_resources;
  task_policies;
  task_risk {
    task_risk_time;
    task_risk_resources;
  }
  task_predecessors;
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  task_etc(); /* task est time to complete */
}

```

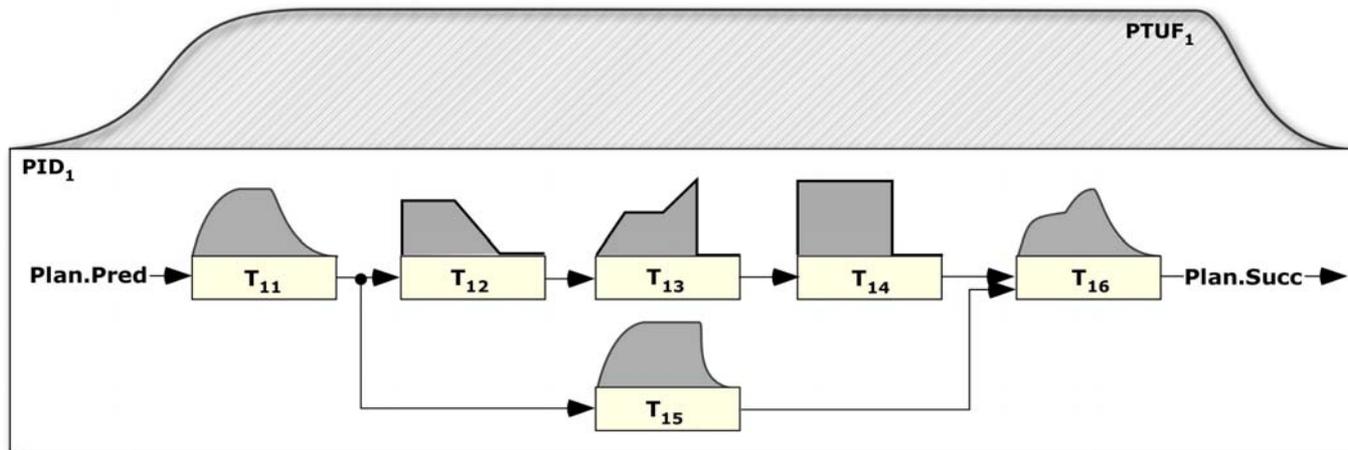
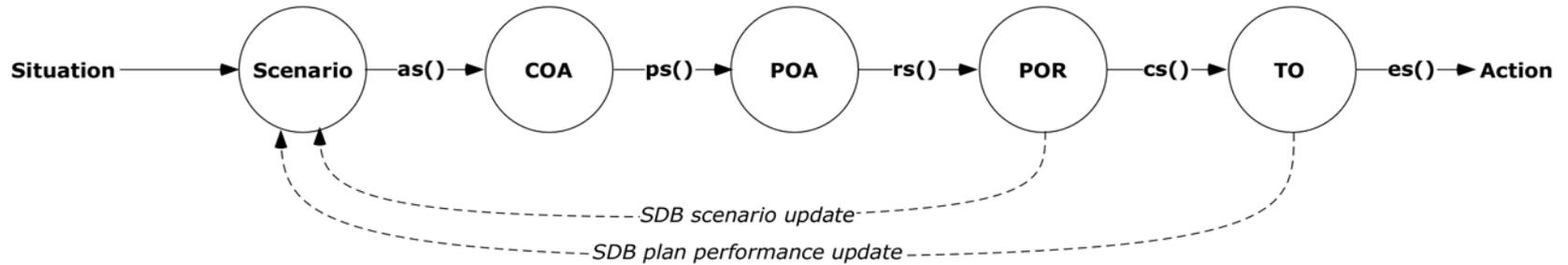
A Plan Task

- 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

# C2: The Evolution of Plans

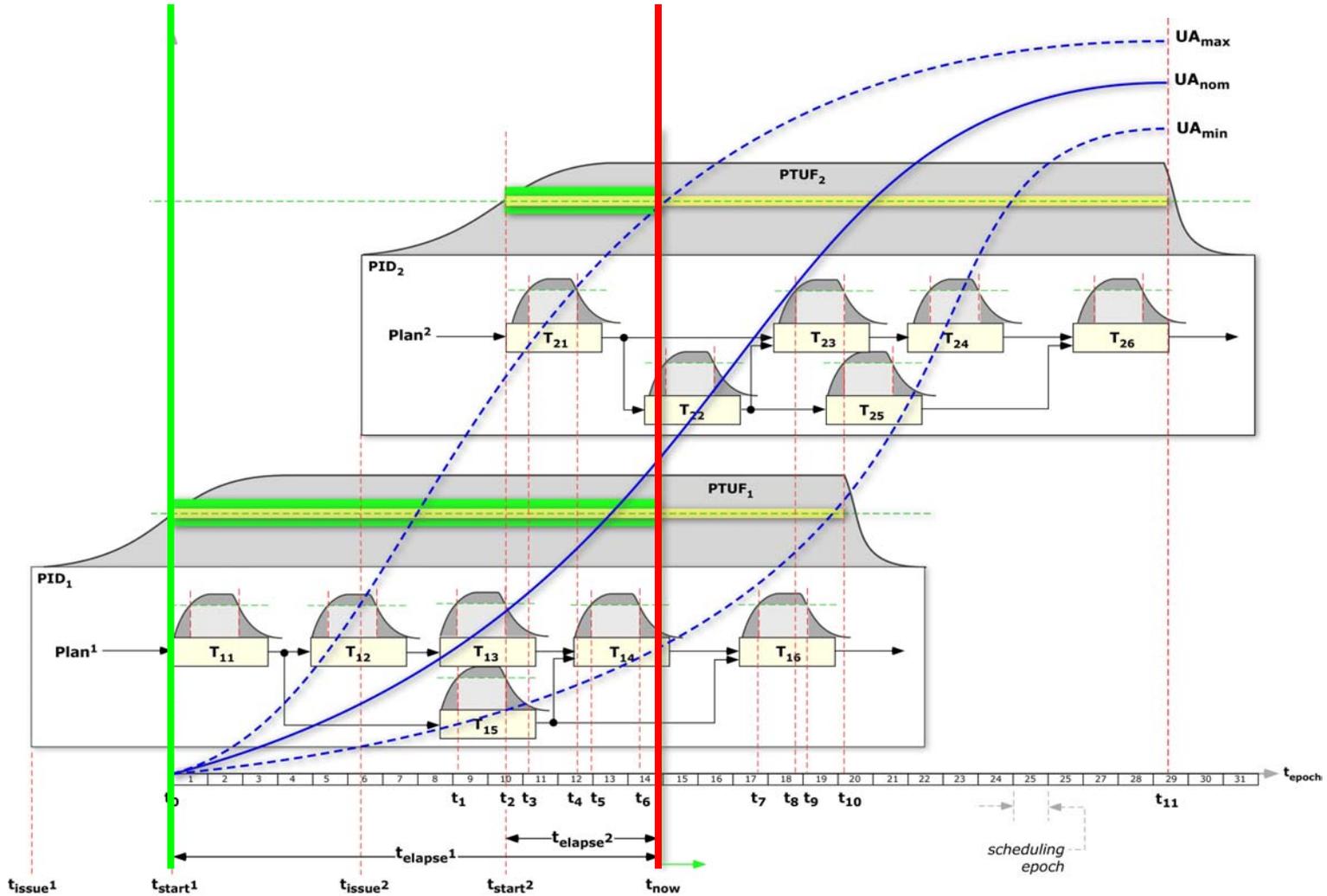


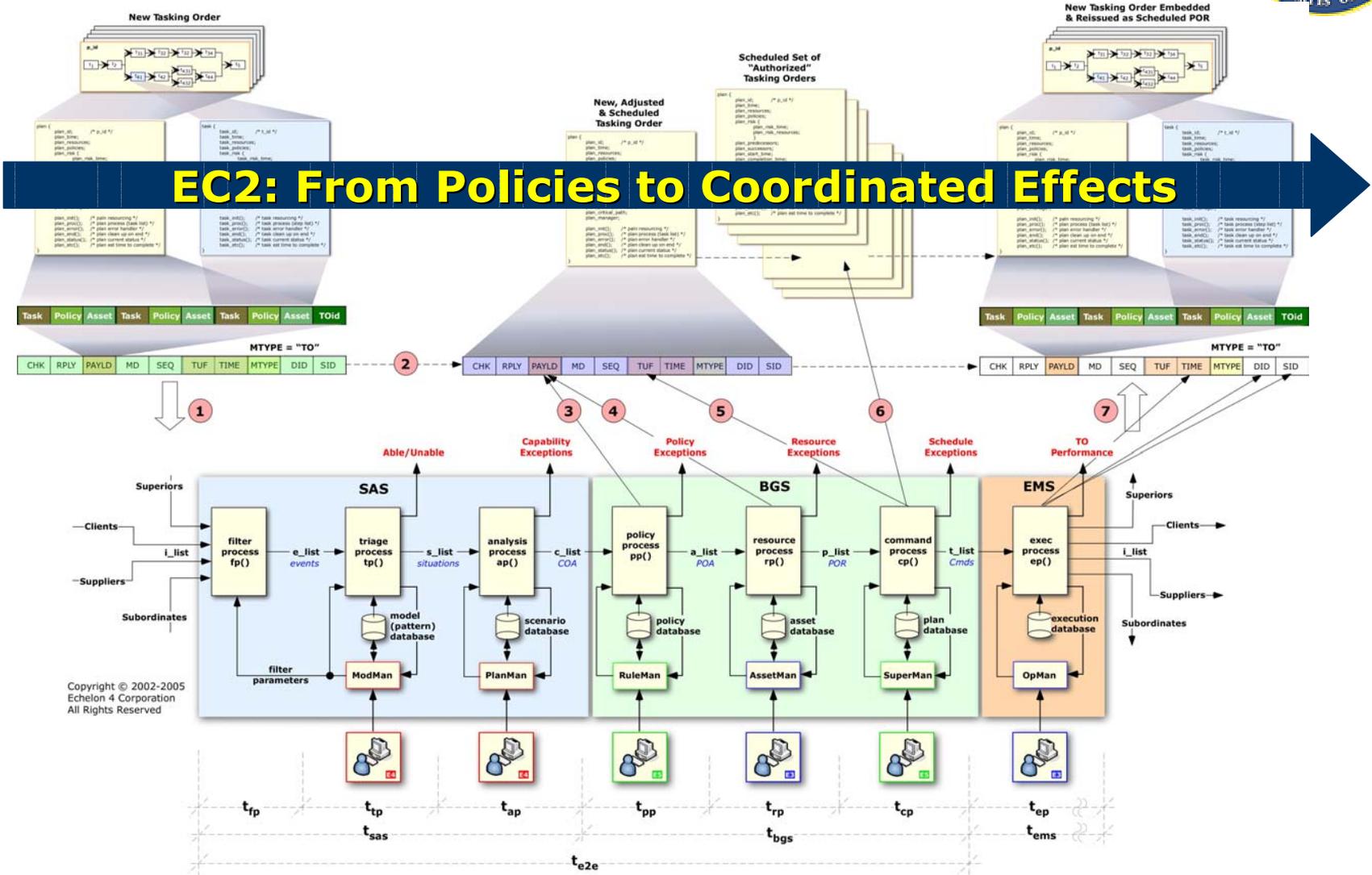
## Plan State Evolution

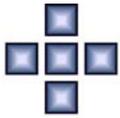




# Utility Accrual Model







**Thank You.**

**Are there any questions?**