Transforming the Enterprise Using a Systems Approach

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INCOSE Symposium
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Topics

- **What is an Enterprise?**

- **What does an Enterprise do?**

- **How does the Enterprise do this?**

- **How can SE help the Enterprise improve?**

What is an Enterprise?

- **A bold, new business venture**

- **Everything required to accomplish a large, complex undertaking**

Organizations Participating in an Enterprise
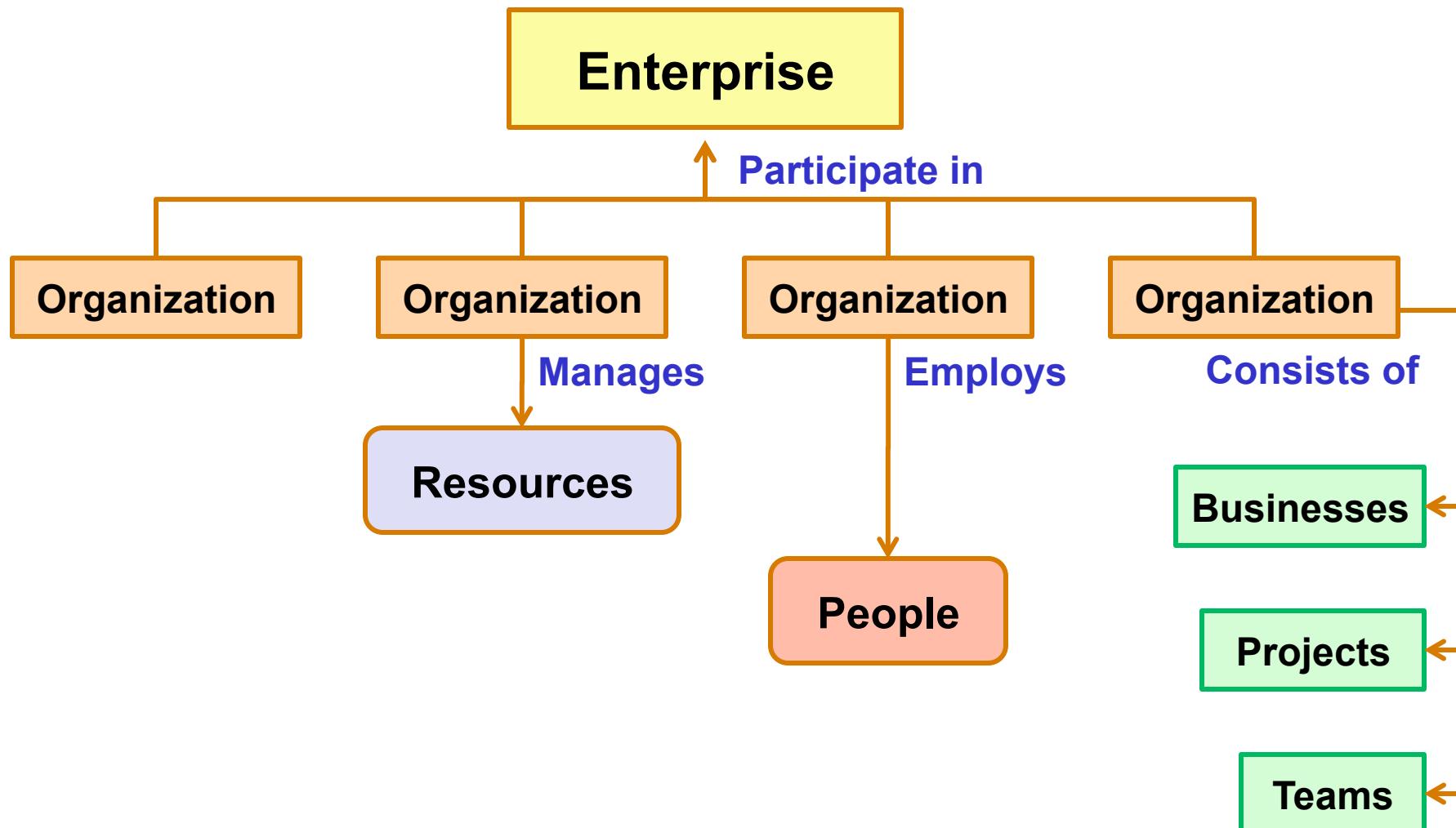
Example Enterprise –
Air Transportation
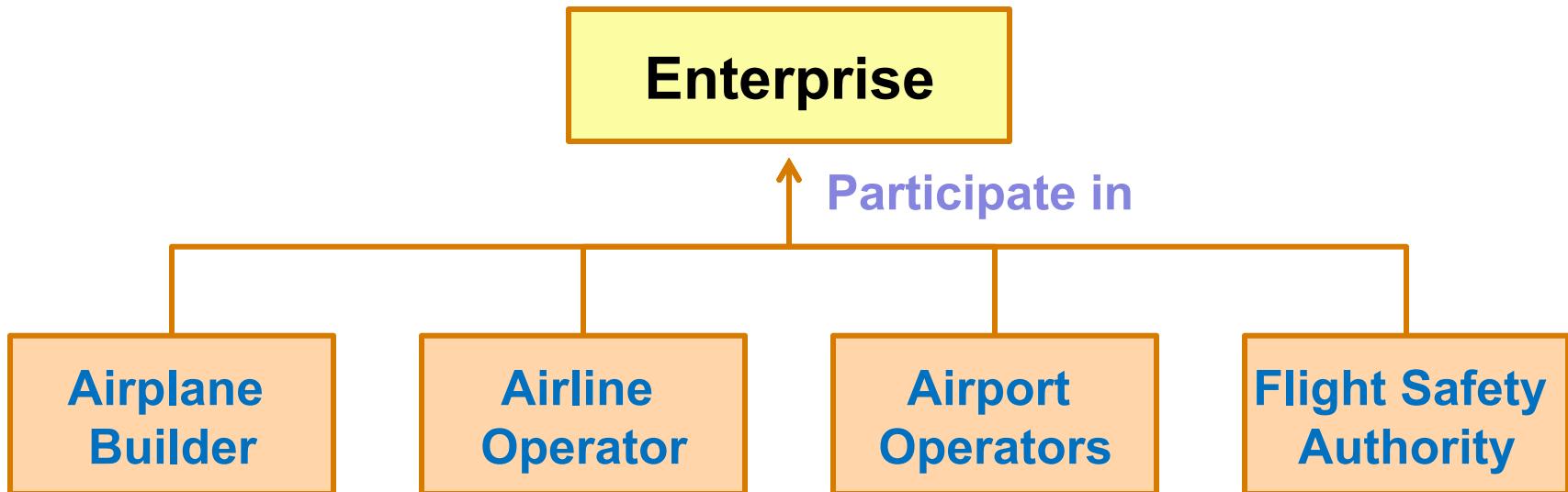
Organizational Complexity

Managing Resources

Enterprise

Participate in

Organization — Organization — Organization — Organization

Manages

Consists of

Resources

Knowledge | People | Other Assets

- **Explicit Knowledge**
  - **Books & Papers**
  - **Training Material, etc…**
- **Implicit Knowledge**
  - **Lessons Learned**
  - **Mental Models, etc…**

Businesses

Projects

Teams

People & Other Assets

Enterprise

Participate in

Organization   **Organization**   **Organization**   **Organization**

Manages   *Consists of*

Resources

Knowledge   **People**   **Other Assets**

- **Managers & Executives**
- **Engineers & Technicians**
- **Business & Support Staff**
- **Facilities & Infrastructure**
- **Operations & Maintenance**

- **Financial Capital & Credits**
- **Equipment, Raw Materials & Finished Goods**
- **Facilities, Land & Leases**
- **Intellectual Property, Patents & Trade Secrets**
- *Reputation & Goodwill !!*

Businesses

Projects

Teams

Consumption & Production
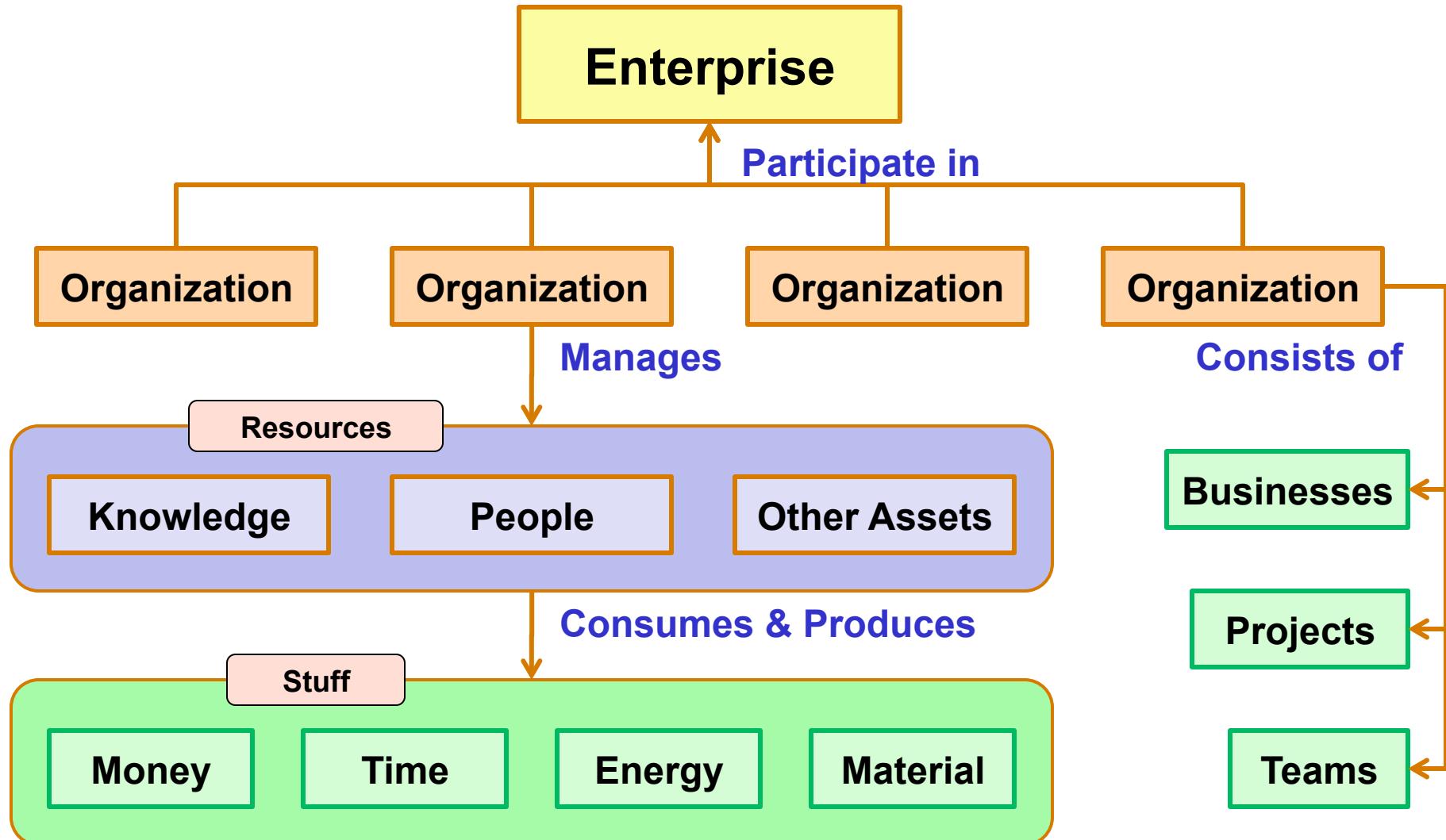
Enterprise Management → Planning, Organization, Assessment & Control

Enterprise

Participate in

Organization   **Organization**   **Organization**   **Organization**

Manages   *Consists of*

Resources

Knowledge   **People**   **Other Assets**

Consumes & Produces

Businesses

Stuff

Money   **Time**   **Energy**   **Material**

Projects

Teams

Creating Value

Enterprise → **Creates** → **Value**

Participate in

Organization · **Organization** · **Organization** · **Organization**

Manages

Consists of

Resources
- **Knowledge**
- **People**
- **Other Assets**

Consumes & Produces

Stuff
- **Money**
- **Time**
- **Energy**
- **Material**

- **Businesses**
- **Projects**
- **Teams**

What Does an Enterprise Do?

- **The Enterprise uses available Resources to accomplish its Goals & Objectives**

- **These Resources consist of:**
    - People, Policies, Practices & Platforms
    - Money, Energy, Time & Material
   - Equipment, Facilities, Infrastructure & Systems

# Individual Competence & Organizational Capability
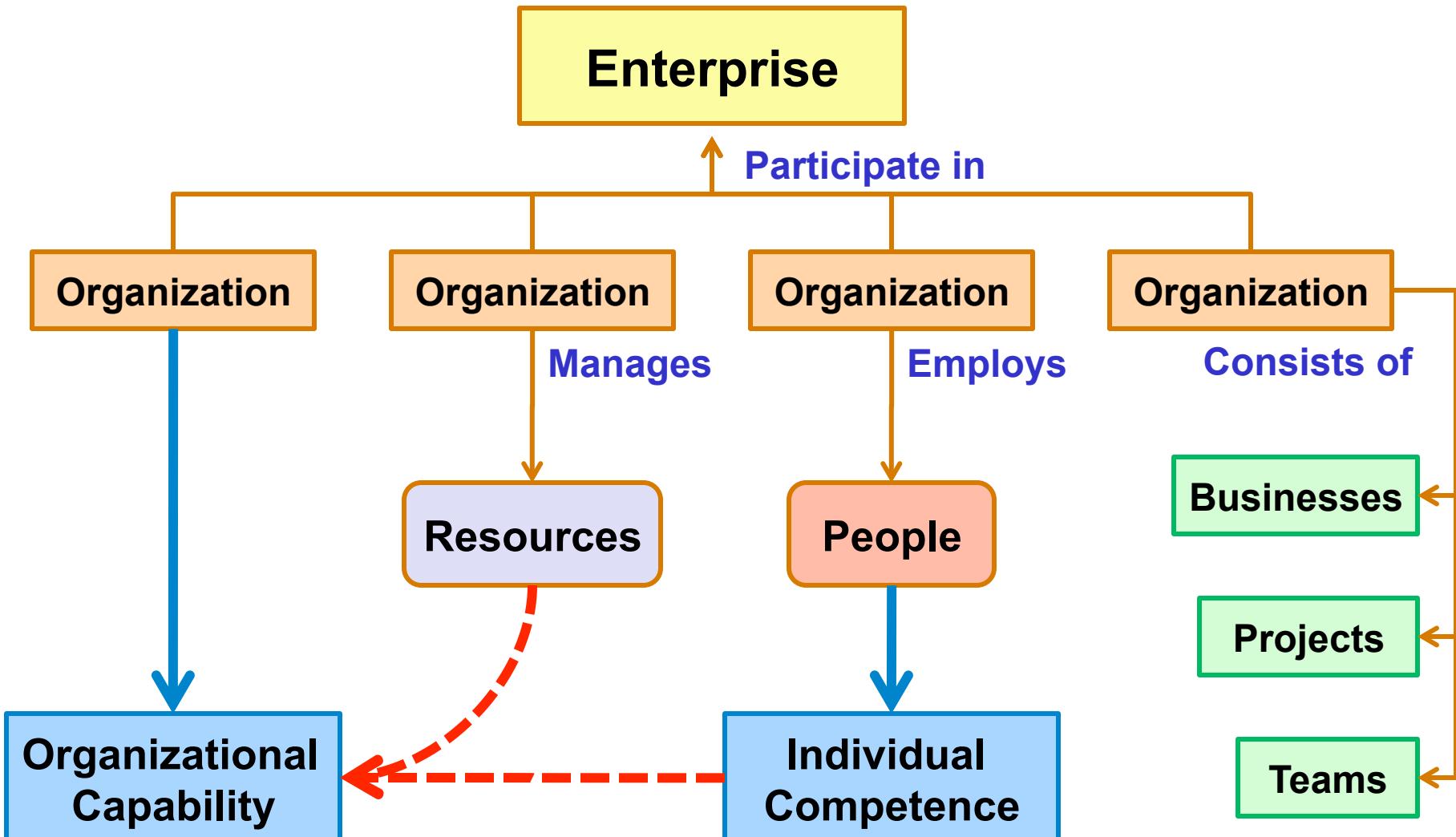
System & Operational Capabilities
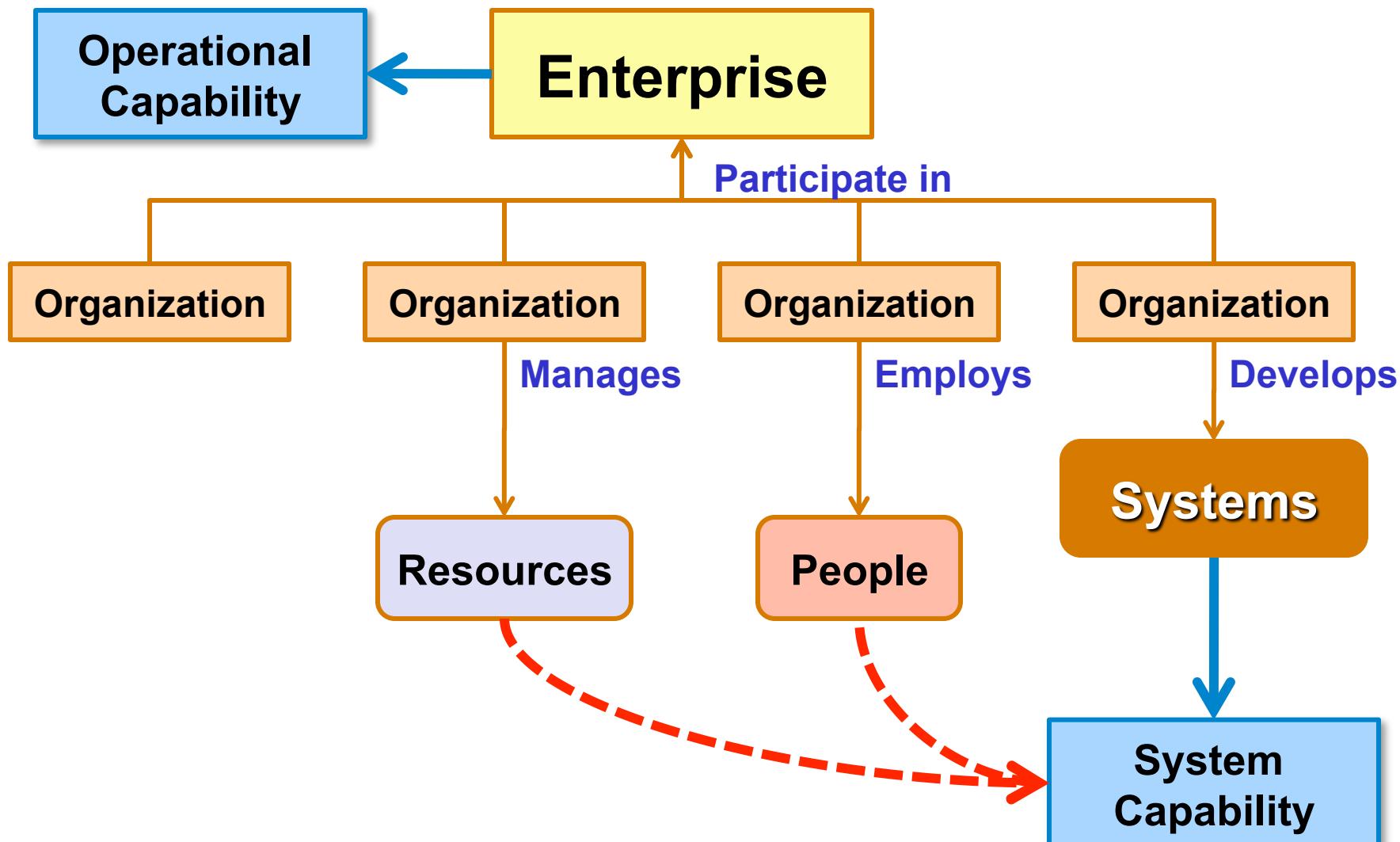
3 Types of Capability

Systems vs. Enterprises

DRIVERS → **Enterprise** → OUTCOMES

INPUTS → **System** → OUTPUTS
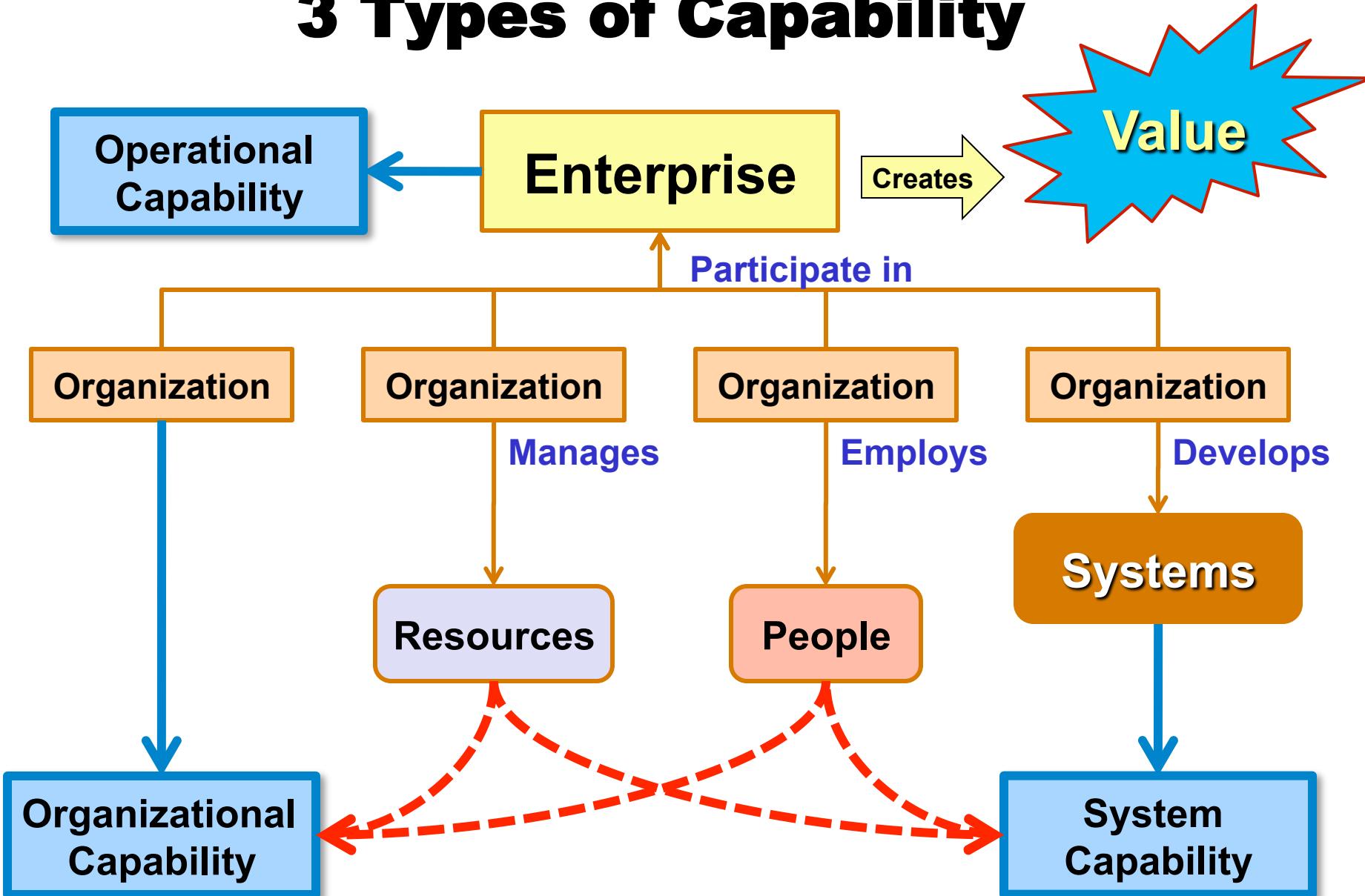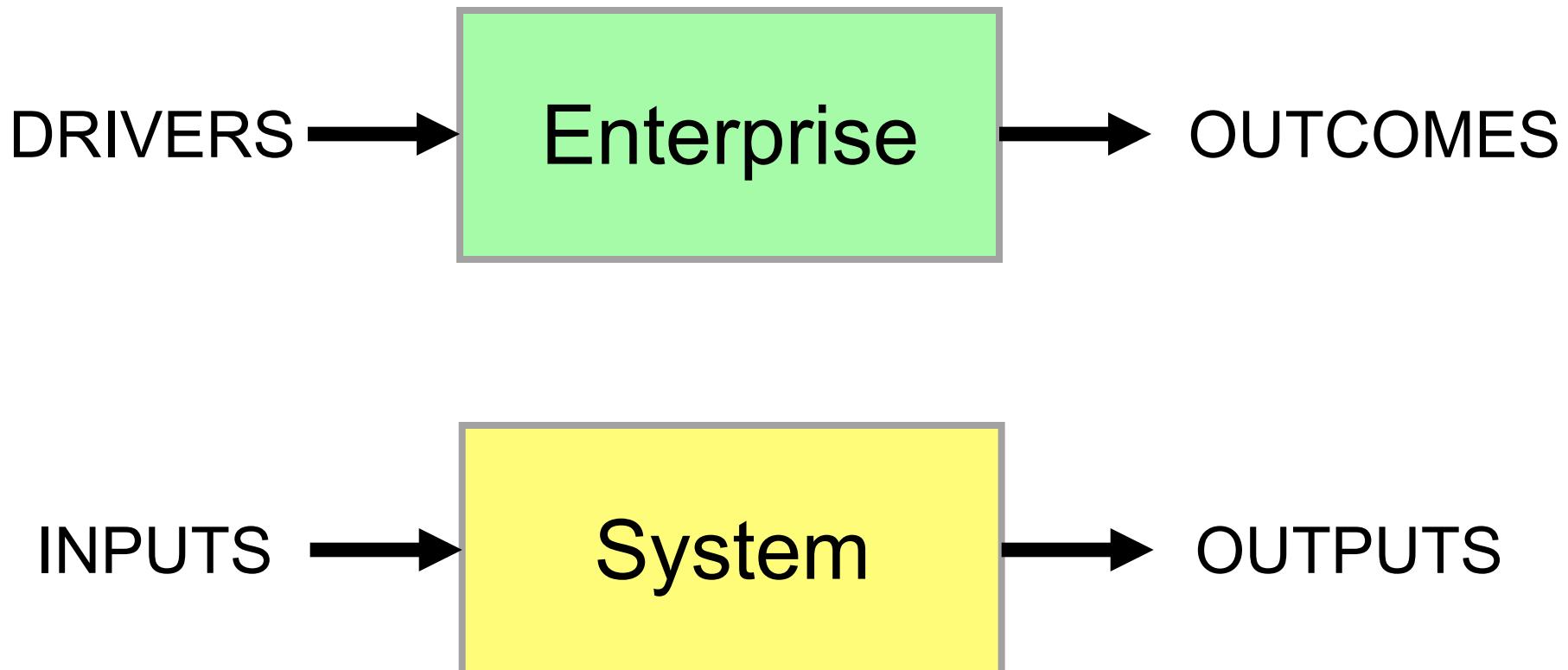
System Architecture is Like Blueprints for a Building
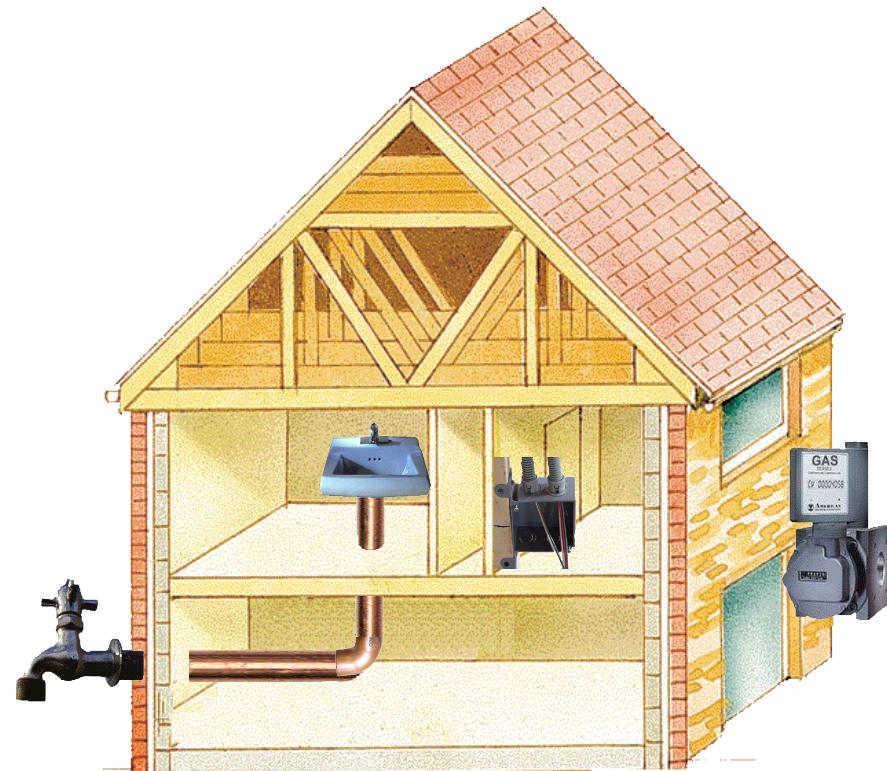
Enterprise Architecture is Like Urban Planning
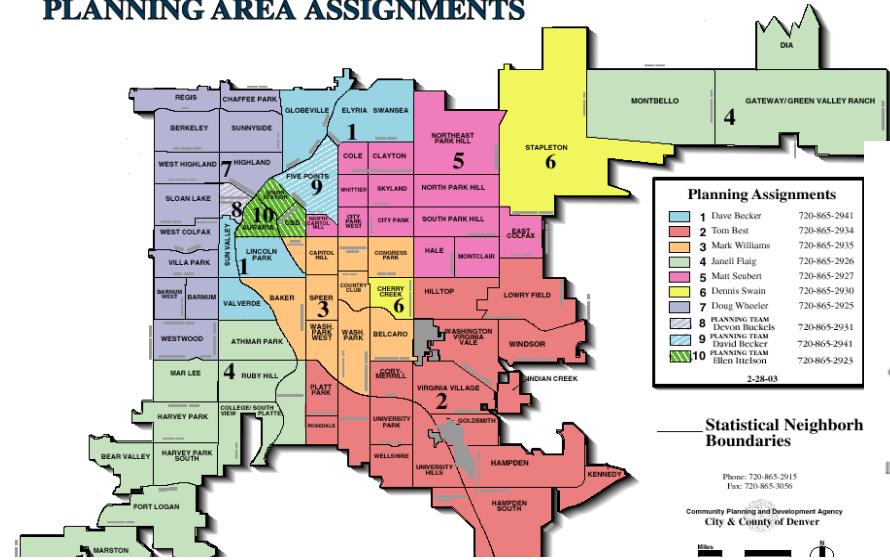
An Enterprise Performs Missions, Each with their Own Objectives

Enterprise

Mission

System

Systems are Used to Perform these Missions

Operational Capabilities ➜ System Functions

Users → Missions → Capabilities → Tasks → System Functions → Systems → System Elements

Value

Cost =
Time + Money
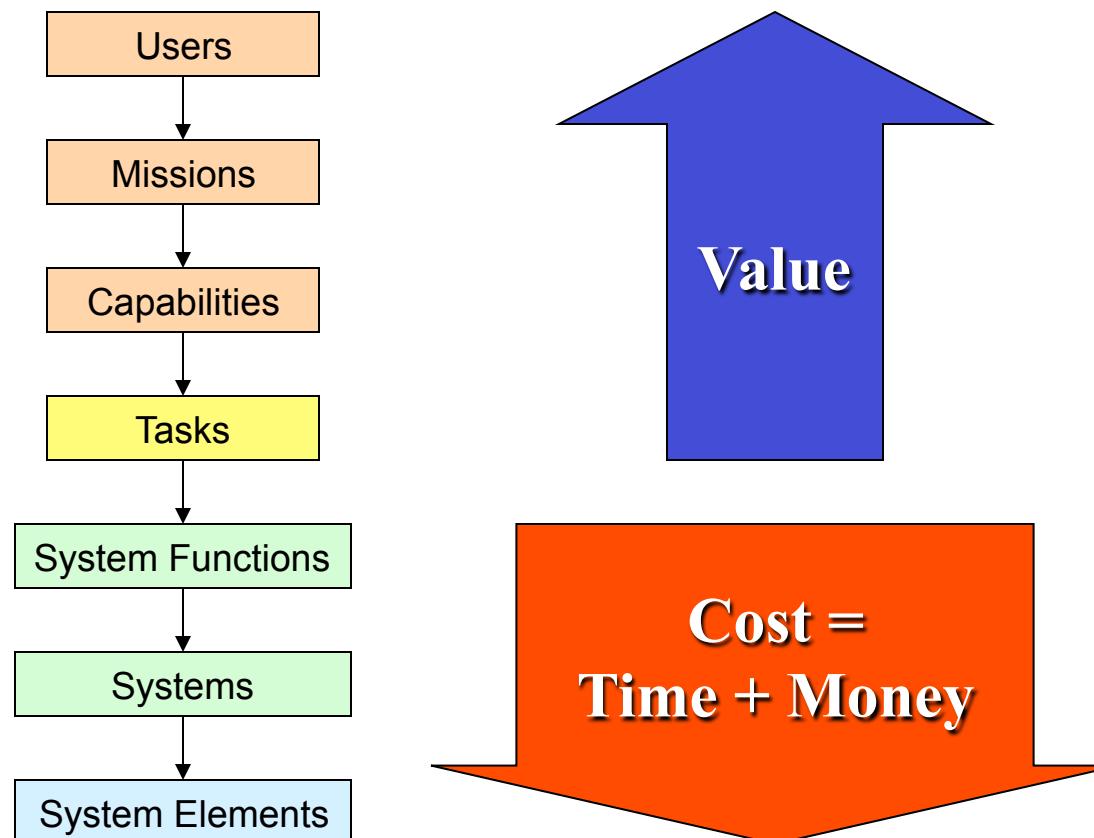
The "Value Chain"
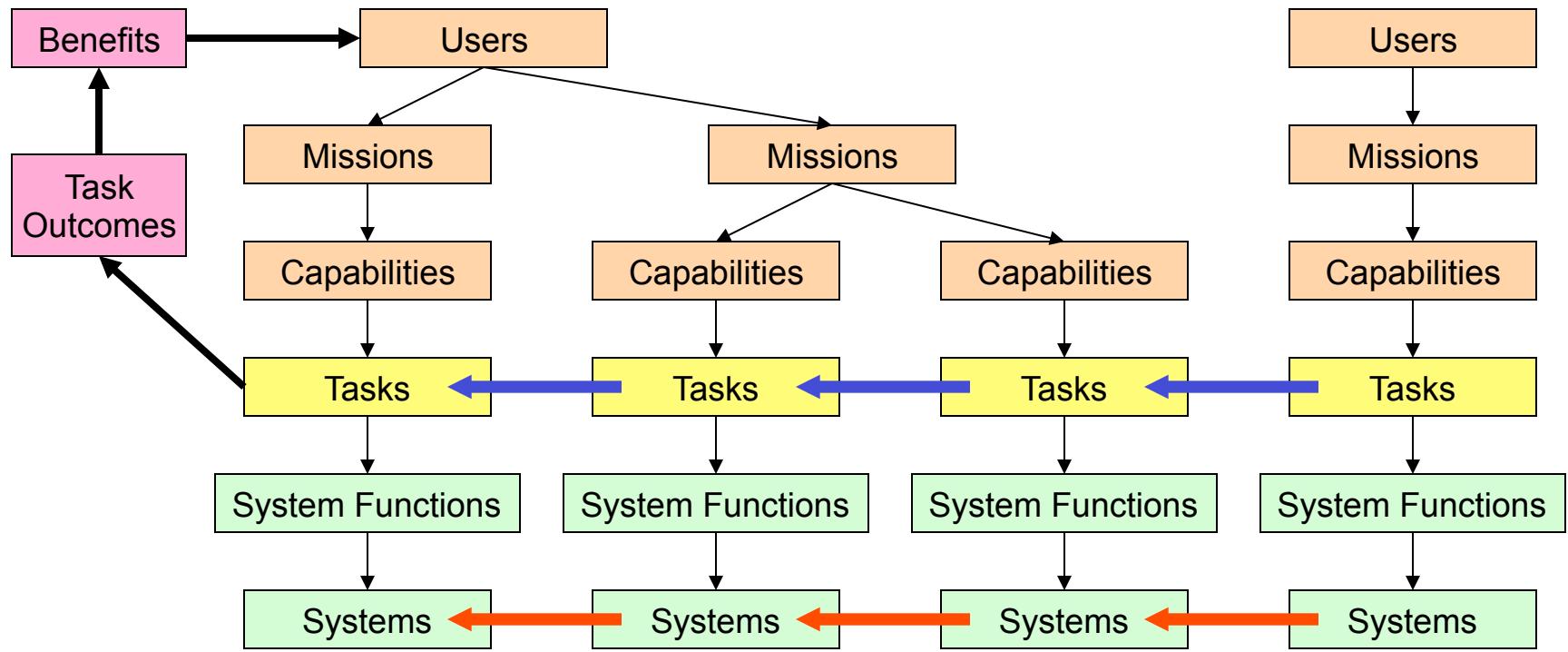
Each System By Itself Has <u>No</u> Value ! !

…and All that Other "Messy" Stuff
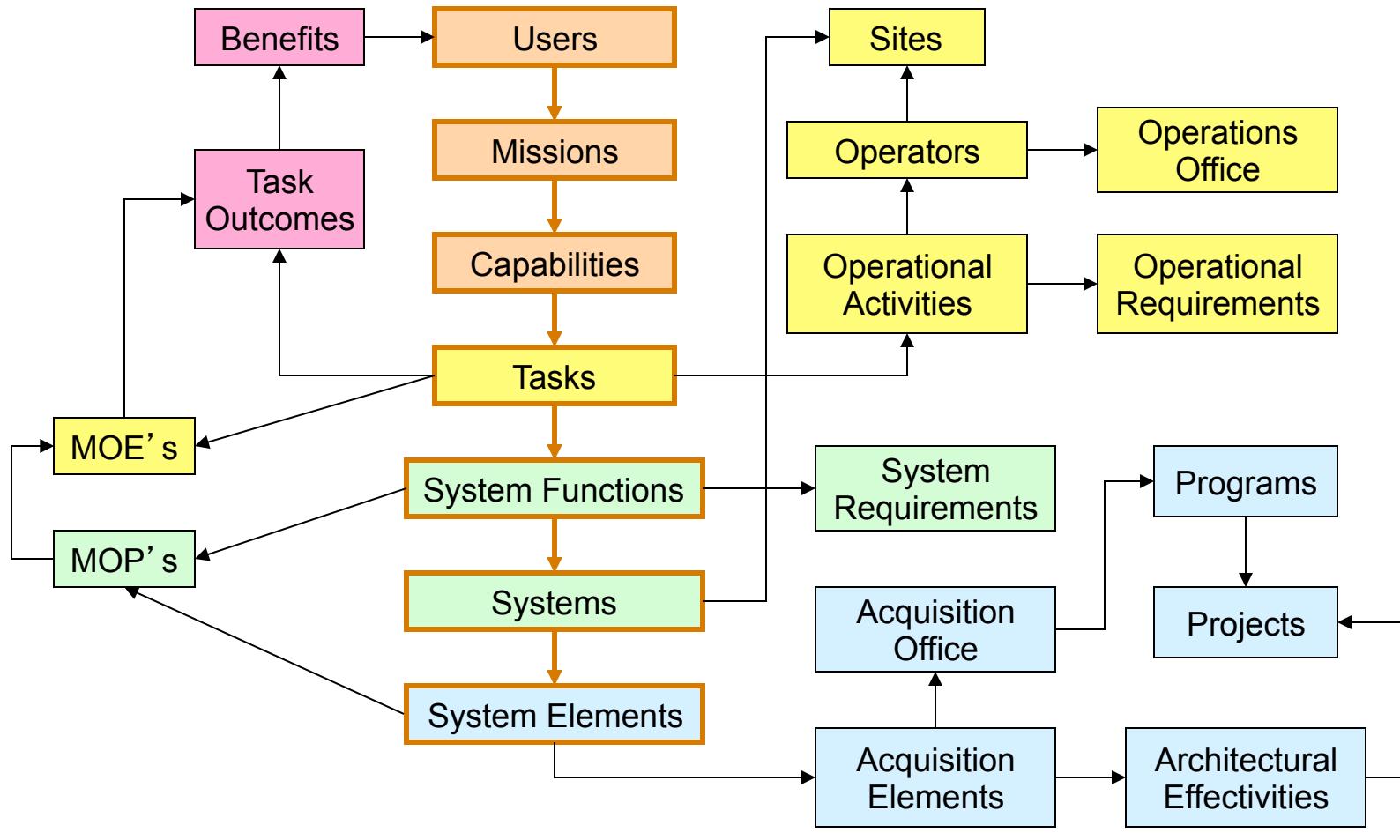
Architecture Modeling & Analysis

Enterprise Architecture

Mission Architecture

System Architecture

Overlapping Architecture Models
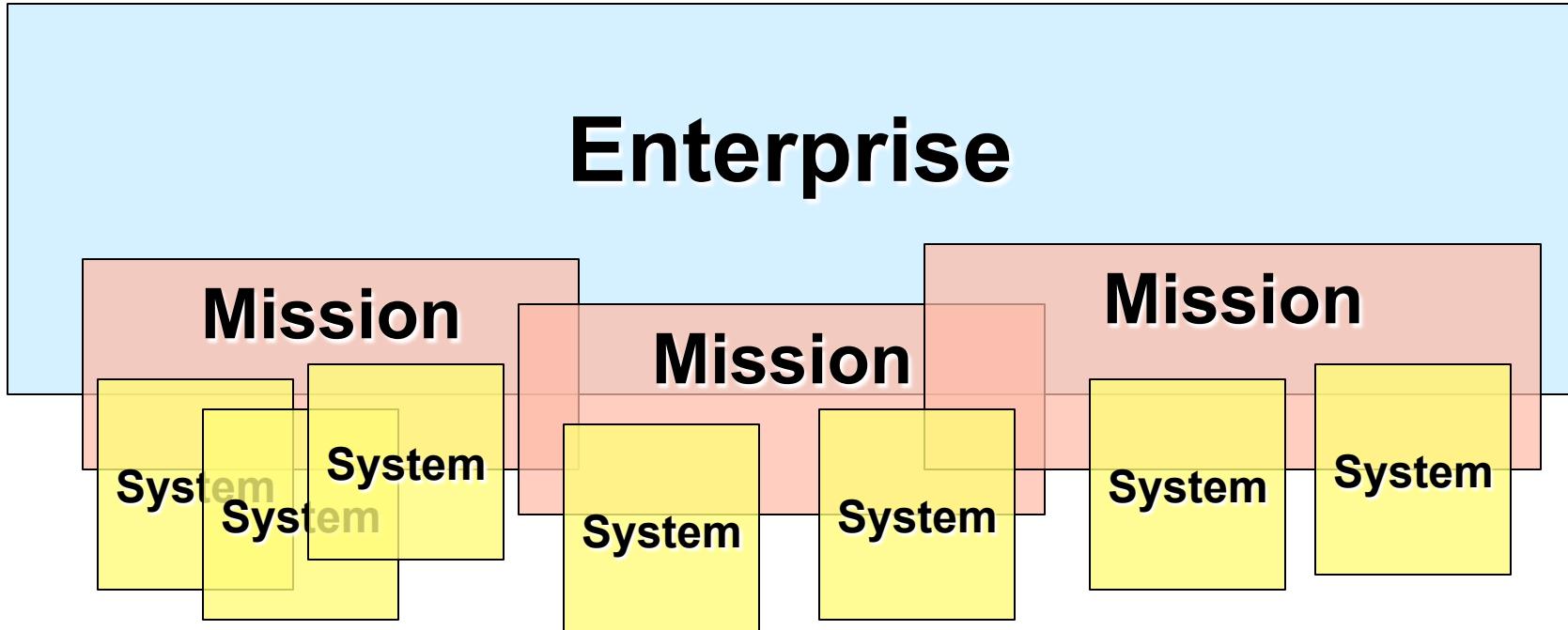
"System" Architecture Deals with Requirements & Design
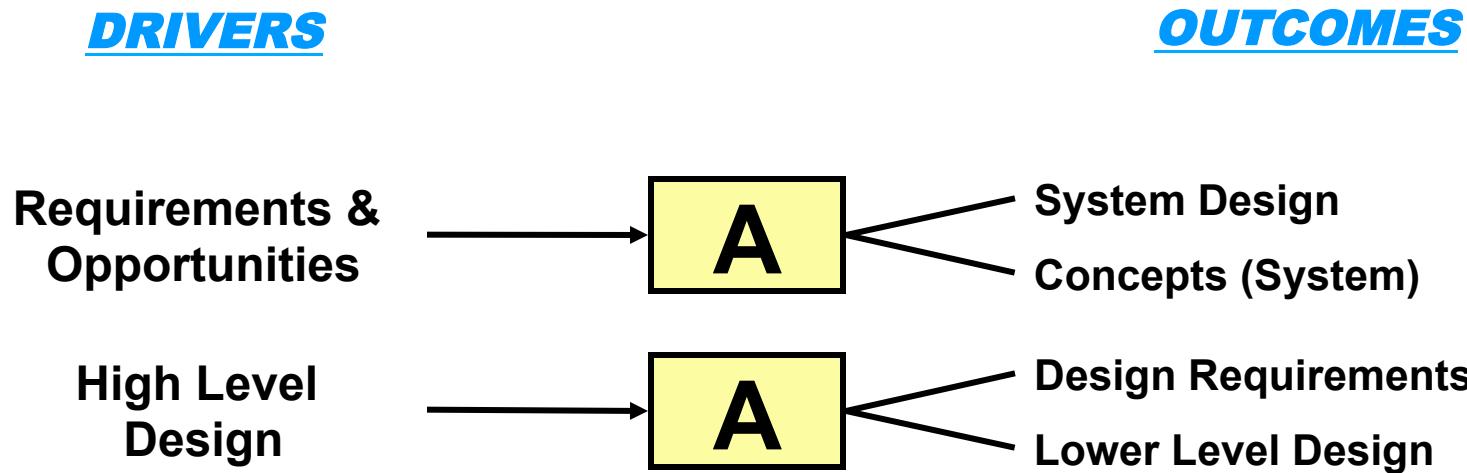
DRIVERS   **OUTCOMES**

Requirements & Opportunities → **A** → **System Design**
                                              Concepts (System)

High Level Design → **A** → **Design Requirements**
                                Lower Level Design

The most common use of architecture (for developers). A means for transforming <u>requirements</u> into design, and high-level design into lower-level design.

Where do Requirements Come From ??
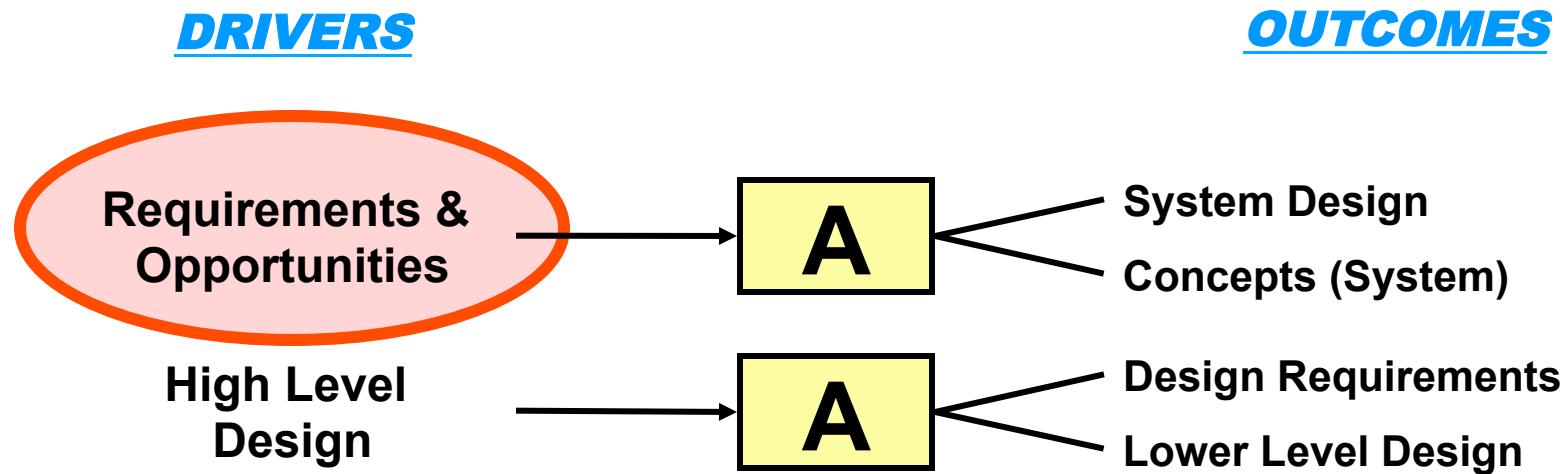
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Mission Level

Enterprise Architecture

Mission Architecture

System Architecture
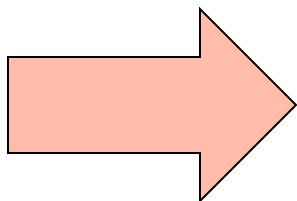
"Mission" Architecture Deals with Capabilities & Operating Concepts
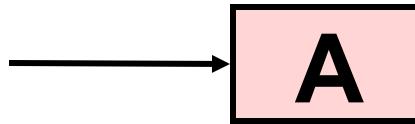
Enterprise Level
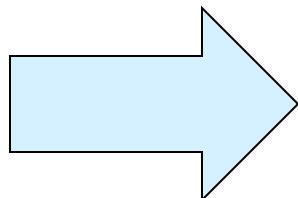
Enterprise Architecture

Mission Architecture

**System Architecture**

Enterprise Architecture Deals with "Getting to the Future" & the "Big Picture"

Enterprise Vision & Objectives → **A** — **Business Plans / Strategies**
                                              Concepts (Business & Mission)

Business Plans & Mission Needs → **A** — **Missions & Scenarios**
                                              Effects & Capabilities
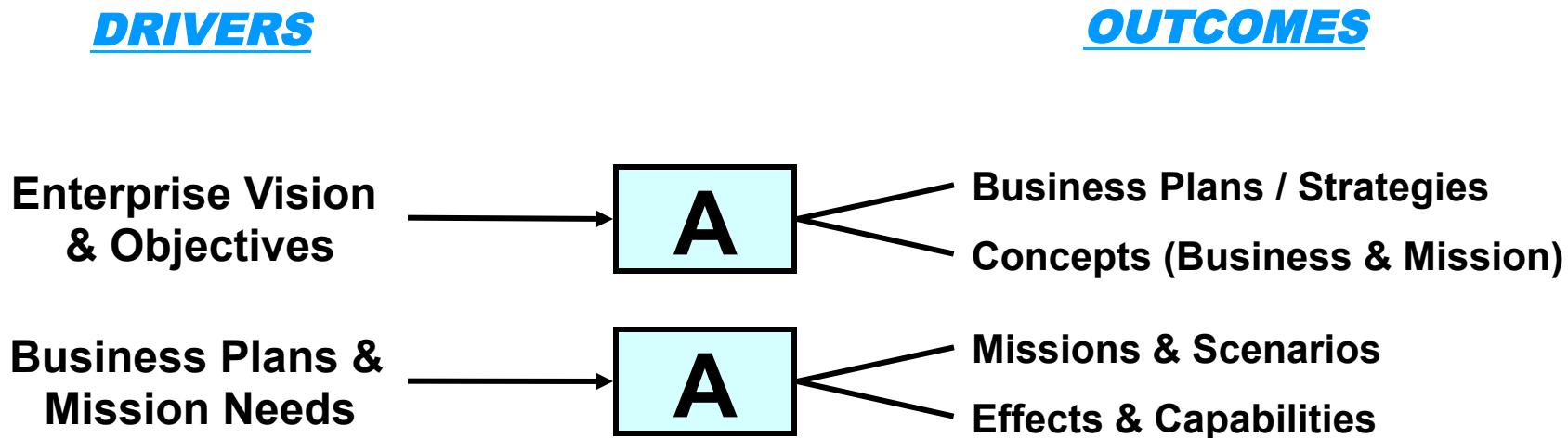
A growing use of architecture (for enterprises).
A means for transforming <u>enterprise objectives</u> into business plans and mission needs.

Various Architecting Situations
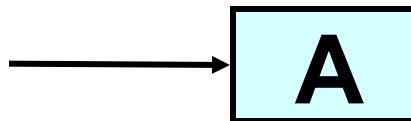
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Business Plans & Mission Needs → **A**
- **Missions & Scenarios**
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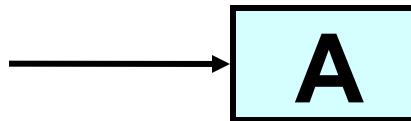
Mission Effects & Scenarios → **A**
- **Capabilities**
- **Concepts (Operational)**
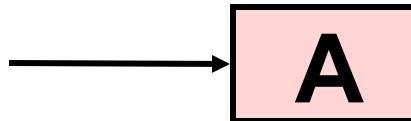
Capabilities & Operational Concepts → **A**
- **Functional & Performance Reqts**
- **Concepts (Enabling)**
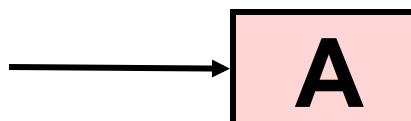
Requirements & Opportunities → **A**
- **System Design**
- **Concepts (System)**
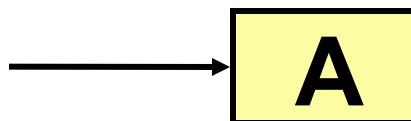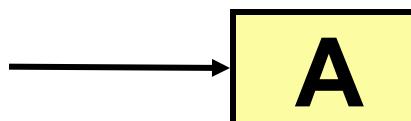
High Level Design → **A**
- **Design Requirements**
- **Lower Level Design**

Outcomes Become Drivers for Next Level Down

DRIVERS

OUTCOMES

Enterprise Vision & Objectives → **A** → Business Plans / Strategies — Concepts (Business & Mission)

Business Plans & Mission Needs → **A** → Missions & Scenarios — Effects & Capabilities

Mission Effects & Scenarios → **A** → Capabilities — Concepts (Operational)

Capabilities & Operational Concepts → **A** → Functional & Performance Reqts — Concepts (Enabling)

Requirements & Opportunities → **A** → System Design — Concepts (System)

High Level Design → **A** → Design Requirements — Lower Level Design

Driving the Enterprise to Achieve Maximum Value for Stakeholders

DRIVERS → **Enterprise** → **OUTCOMES**

INPUTS → System → OUTPUTS
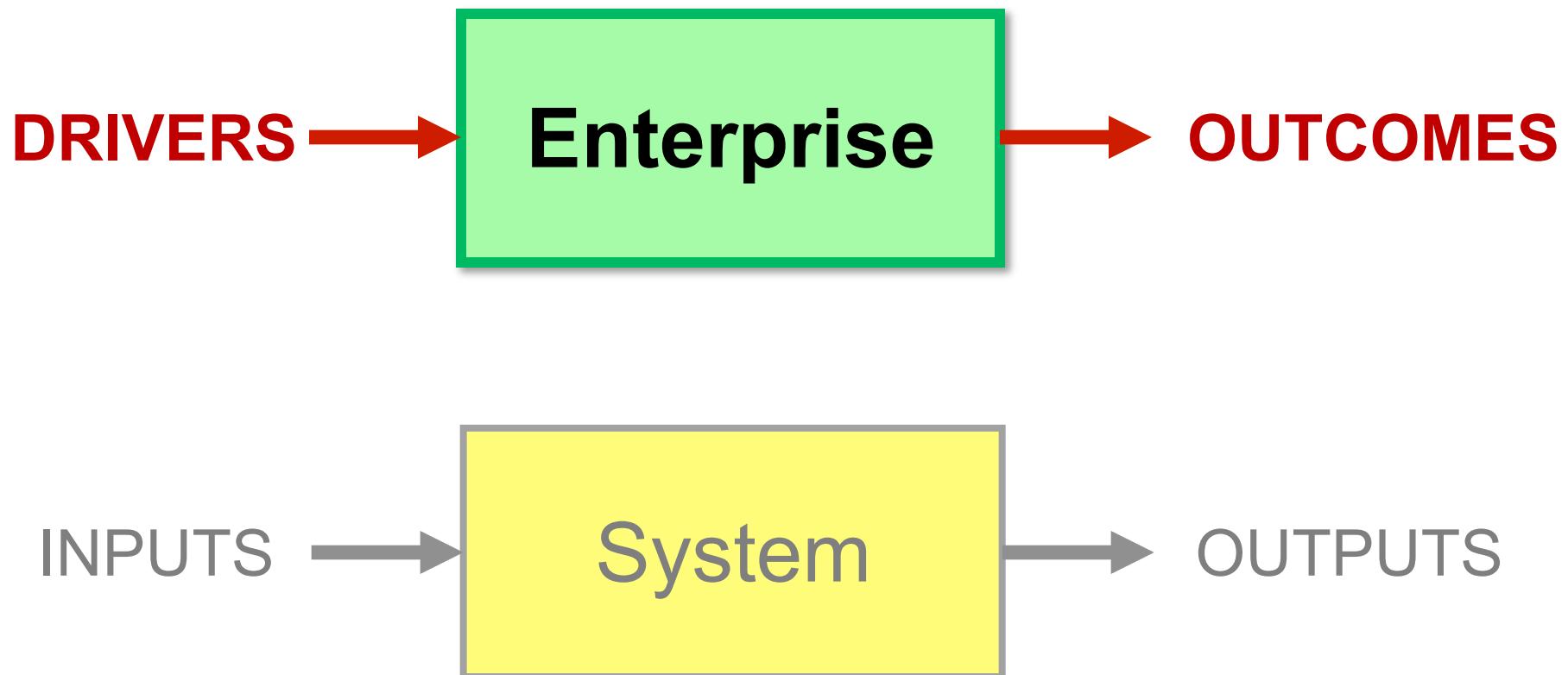
Enterprise State Changes are Achieved Through Work Process Activities

Drivers
- Demand
- Competition
- Laws
- Regulations
- People
- Technology
- Investment
- Revenues

Enterprise State

Work Processes

Outcomes
- Products
- Services
- Revenues
- Earnings
- Share Price
- Market Share
- Jobs
- Innovation
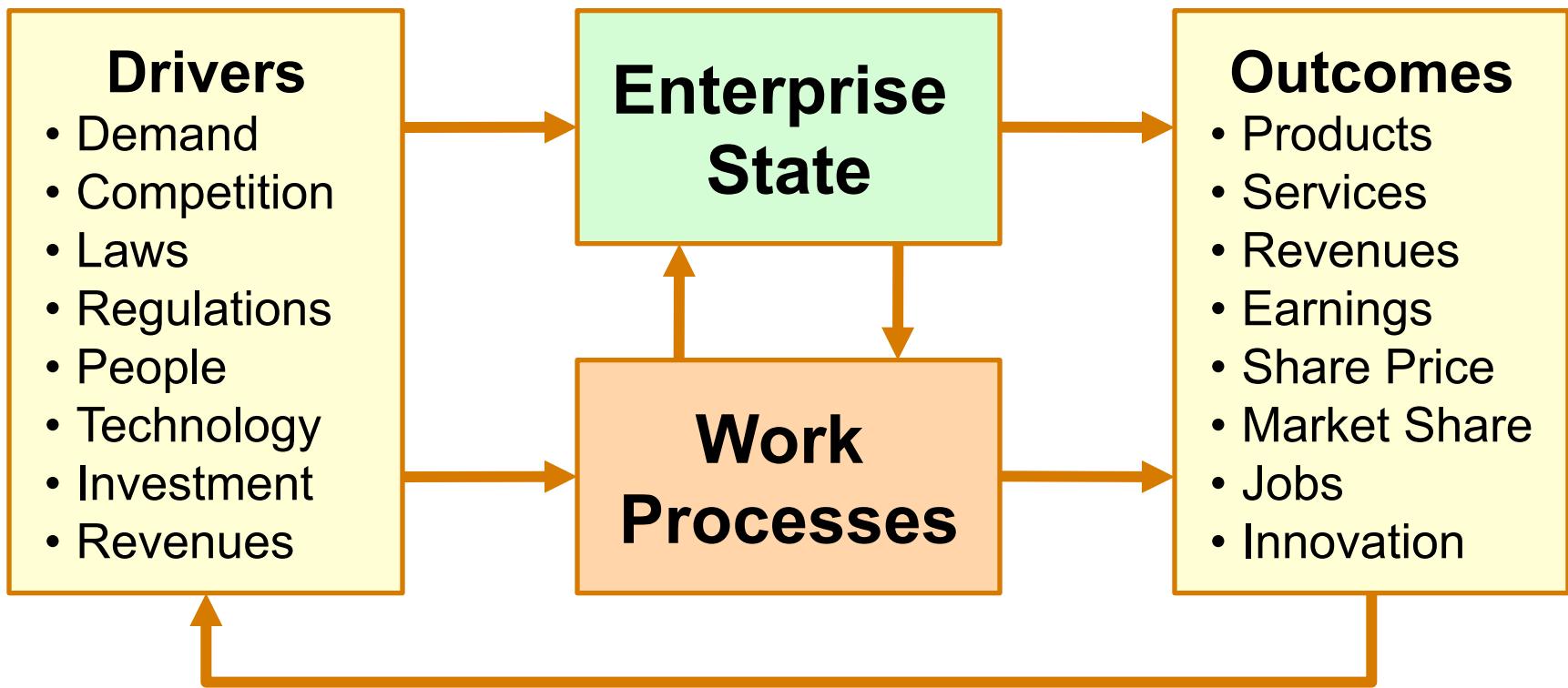
Two Types of Architecture

Enterprise Architectures

utilize these →

Solution Architectures

- **Strategic Goals**
- **Capabilities**
- **Segments**
- **Mission Threads**

- **System Solutions**
  - Hardware
  - Software
  - People
- **Non-System Solutions**
  - Process
  - Policy
  - Education & Training
  - Organizations
  - Facilities

Enterprise Systems Engineering & Management
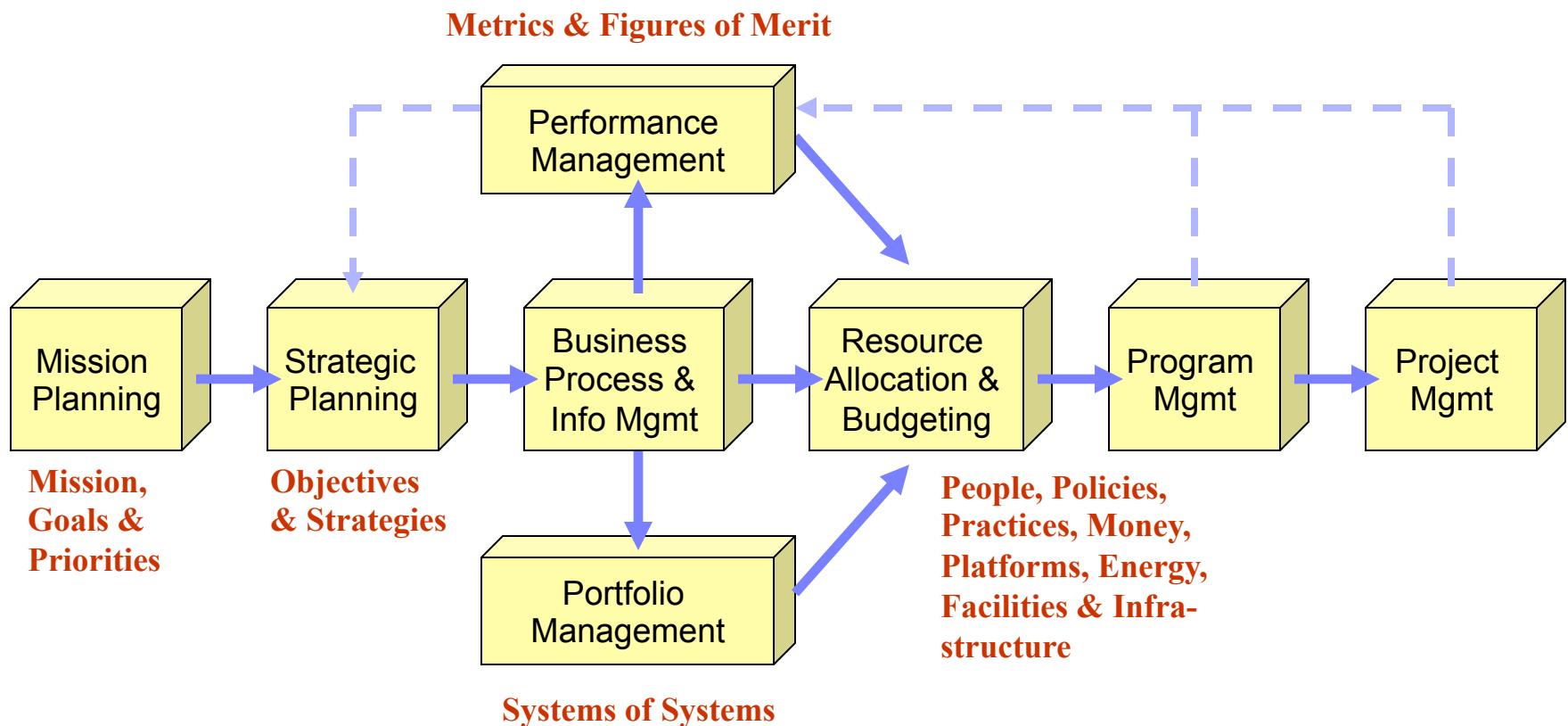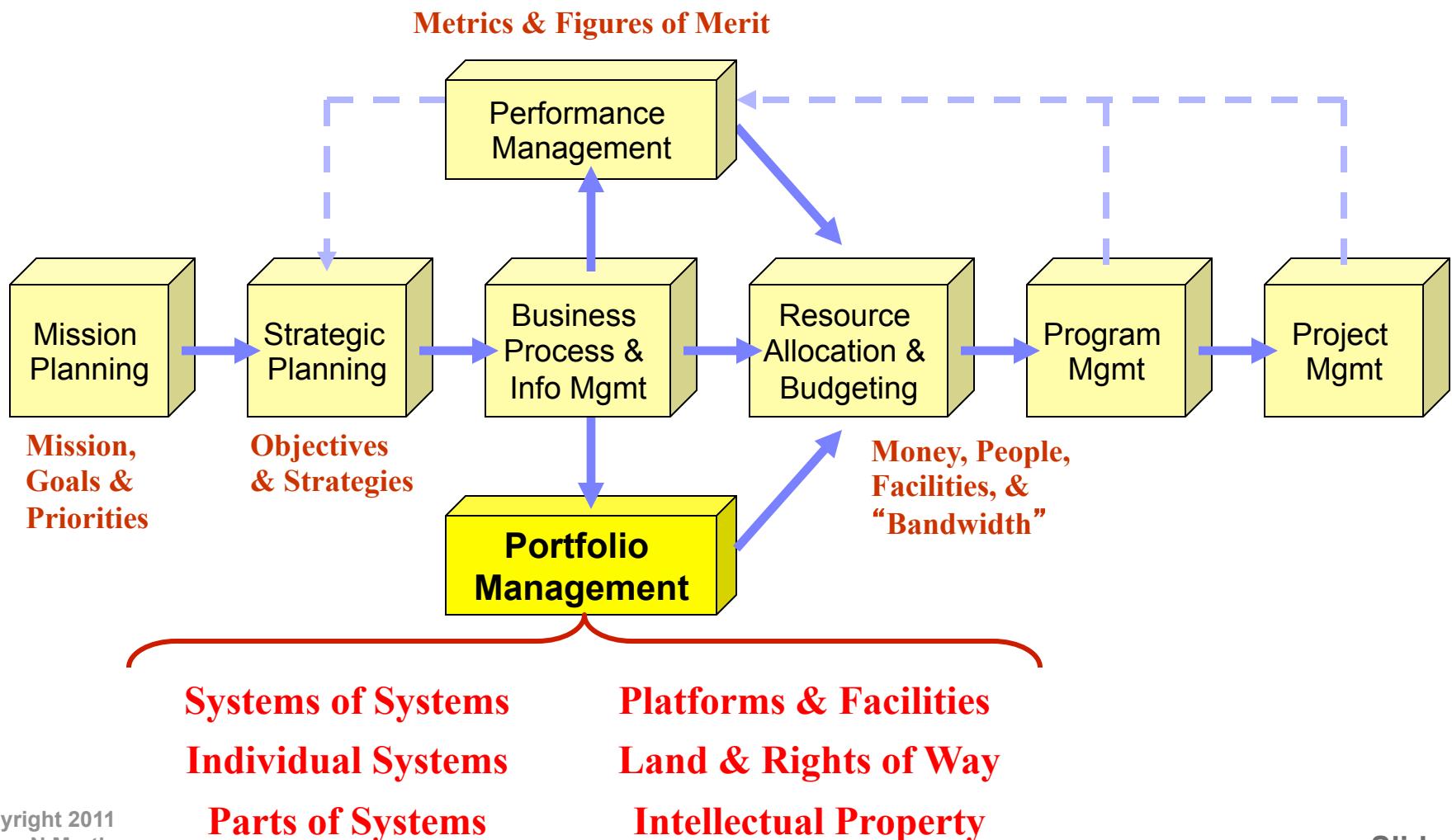
Enterprise SE vs Product SE

Enterprise SE

Product SE

Metrics & Figures of Merit

Performance Management

Mission Planning

Strategic Planning

Business Process & Info Mgmt

Resource Allocation & Budgeting

Program Mgmt

Project Mgmt

Mission, Goals & Priorities

Objectives & Strategies

Money, People, Facilities, & "Bandwidth"

Portfolio Management

Systems of Systems

Platforms & Facilities

Individual Systems

Land & Rights of Way

Parts of Systems

Intellectual Property

Slide 39

Achieving the Proper Balance Using Enterprise SE

- **Compromise & Trade-offs**
  - Balance between Complexity & Order
  - Balance between Effectiveness & Efficiency
  - Balance between Enterprise Goals & Project Objectives
- **Balancing Stakeholder Concerns**
  - Predictability & Robustness
  - Performance & Stability
  - Security & Ease of Use
  - Cost & Schedule

Business & SE Process Areas

Enterprise Management

Vision
Goals
Conflict Mgt
Roles & Resp

Program Management

Reqts Dev & Mgmt
Risk Mgmt
Config Mgmt
Tech Project Plng
Quality Assurance
System Safety
Integ Logistics Spt

Restructure The Enterprise

Design Implement Transition

Diagnostics

Integrated Test

Enterprise Assessment

Traditional Business Process Areas

Traditional Systems Engineering Process Areas

Adding Enterprise SE Process Areas

Traditional Business Process Areas

Enterprise Management

Vision
Goals
Conflict Mgt
Roles & Resp

Enterprise SE
Strategic Technical Plan
Enterprise Architecture
Cap. Planning Analysis
Technology Planning

Reqts Dev & Mgmt
Risk Mgmt
Config Mgmt
Tech Project Plng
Quality Assurance
System Safety
Integ Logistics Spt

Restructure The Enterprise

Process Improvement (CMMI)

Design Implement Transition

Diagnostics

Evaluation & Assessment

Integrated Test

Enterprise Assessment

Traditional Systems Engineering Process Areas

Enterprise-Level SE Processes

❖ **Strategic Technical Planning**

❖ **Enterprise Architecture**

❖ **Capabilities-Based Planning Analysis**

❖ **Technology Planning**

❖ **Enterprise Evaluation and Assessment**

Enterprise Systems Engineering
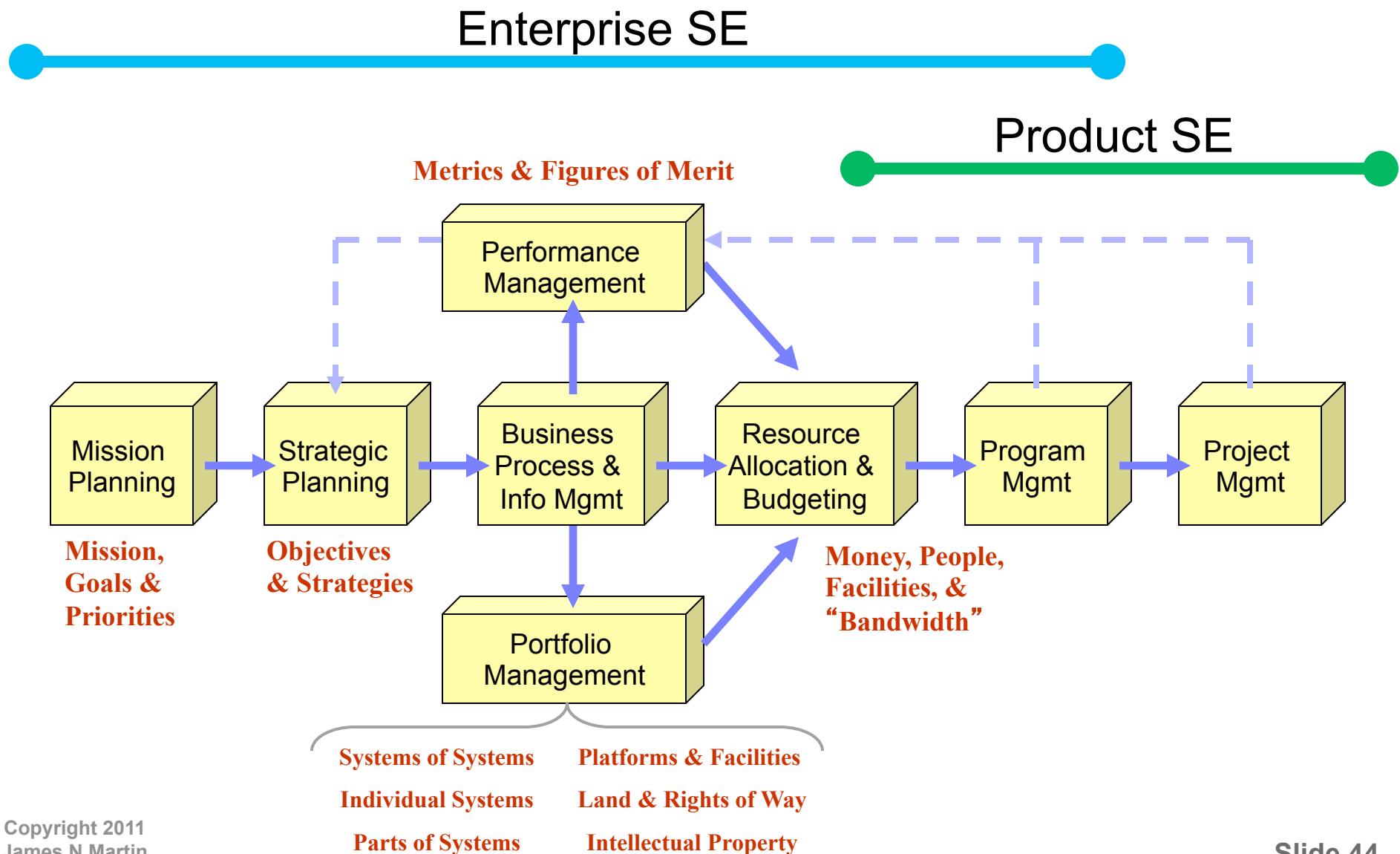
Enterprise SE

Product SE

Metrics & Figures of Merit

Performance Management

Mission Planning

Strategic Planning

Business Process & Info Mgmt

Resource Allocation & Budgeting

Program Mgmt

Project Mgmt

Mission, Goals & Priorities

Objectives & Strategies

Money, People, Facilities, & "Bandwidth"

Portfolio Management

Systems of Systems

Platforms & Facilities

Individual Systems

Land & Rights of Way

Parts of Systems

Intellectual Property

Slide 44

Conclusions

- **Enterprise SE is different from Product SE**
  - Deals with less tangible "things"
  - Different Knowledge & Skills
  - Different Tools & Methods
  - Traditional SE processes are not sufficient for Enterprise-level SE

- **Enterprise SE Practices**
  - An emerging discipline
  - Needs expansion of Processes & Standards
  - Needs training & development of People & Teams
  - Needs understanding from Enterprise Managers that SE has something useful to contribute

# BACKUP

Child Enterprises

Parent Enterprise

Enterprise A

- Mission Planning
- Strategic Planning
- Business Process & Info Mgmt
- Performance Management
- Portfolio Management

Enterprise X
- Resource Allocation & Budgeting
- Program Mgmt
- Project Mgmt

Enterprise Y
- Resource Allocation & Budgeting
- Program Mgmt
- Project Mgmt

Enterprise Z
- Resource Allocation & Budgeting
- Program Mgmt
- Project Mgmt

Child Enterprises

Parent Enterprise

Slide 48
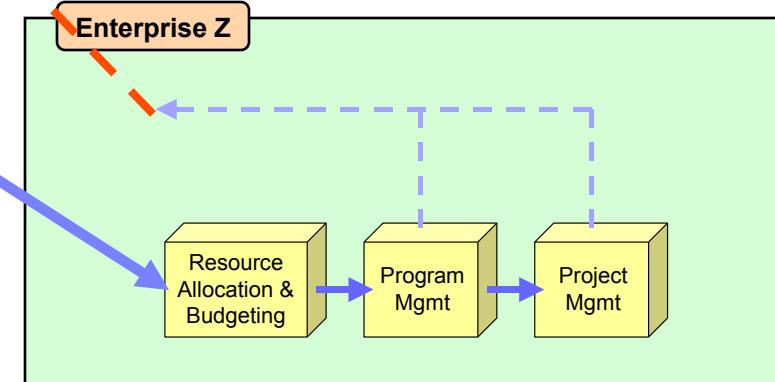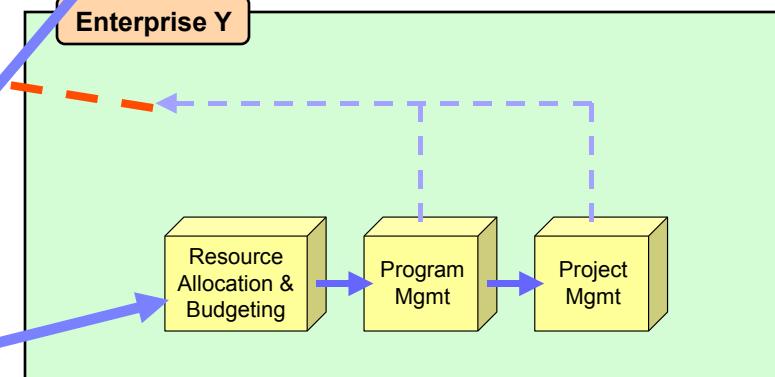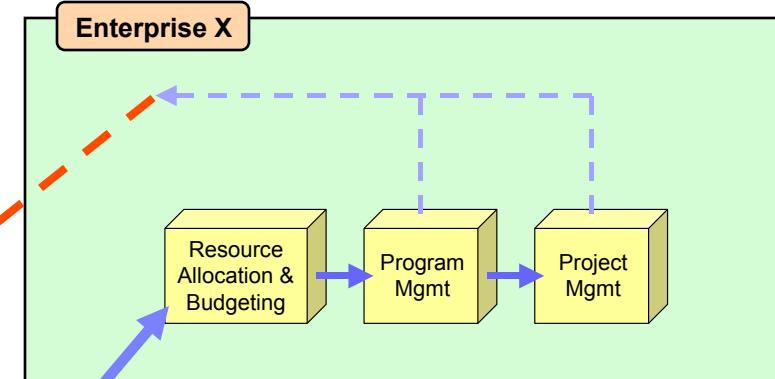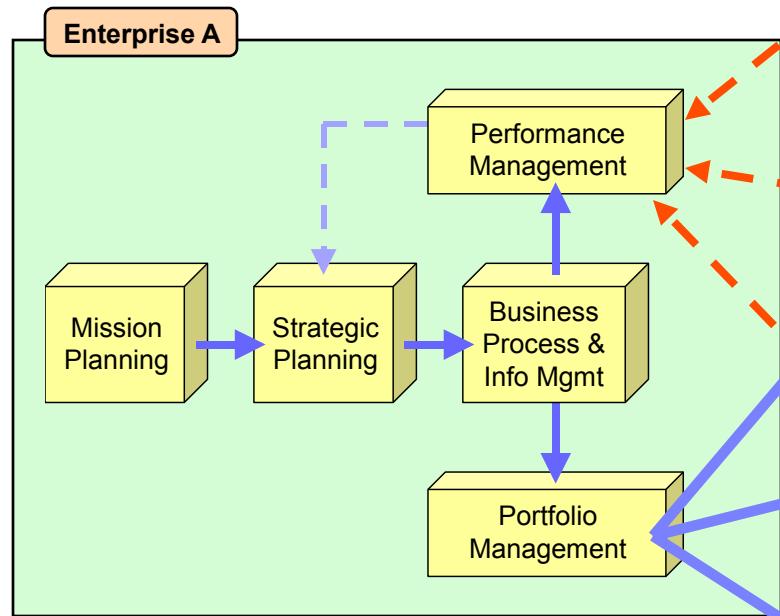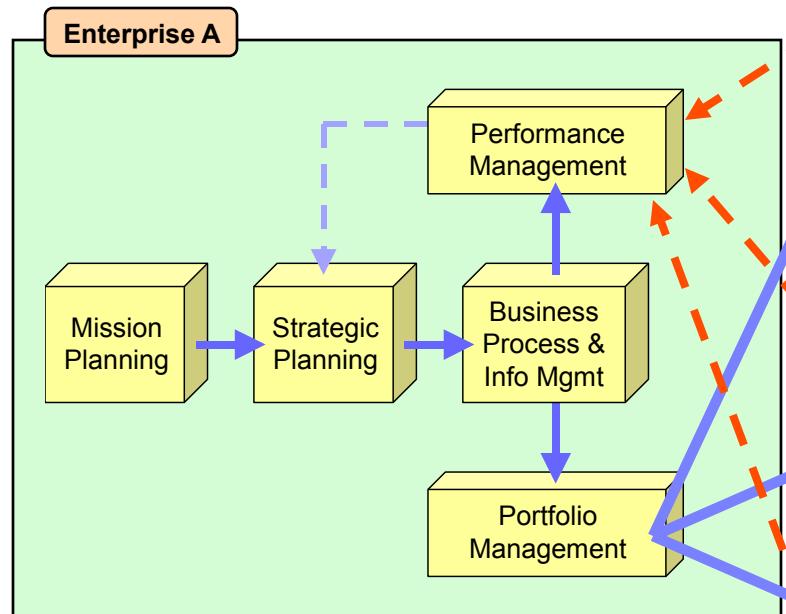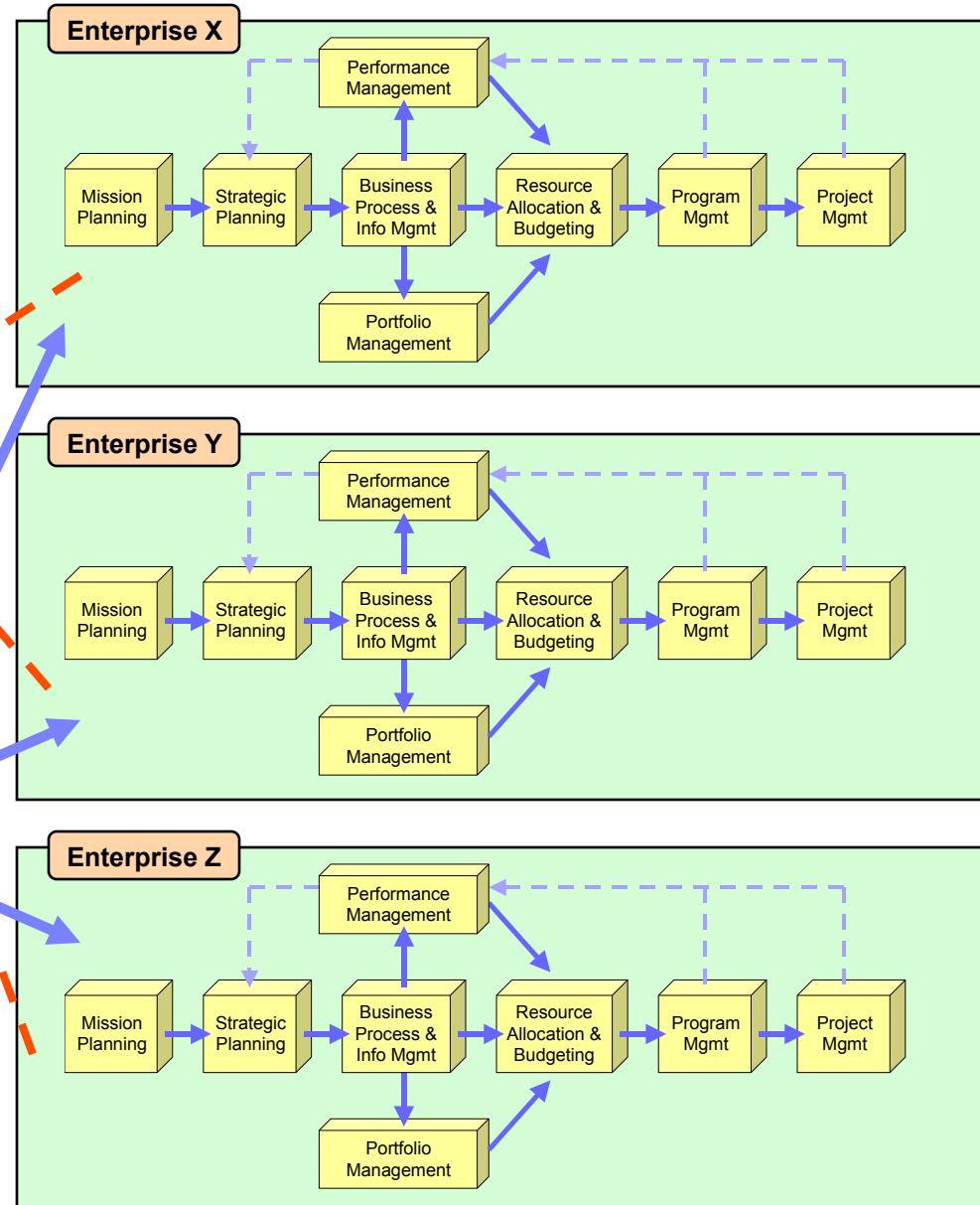
Enterprise Governance as an Enabler to Manage Progress & Control Changes
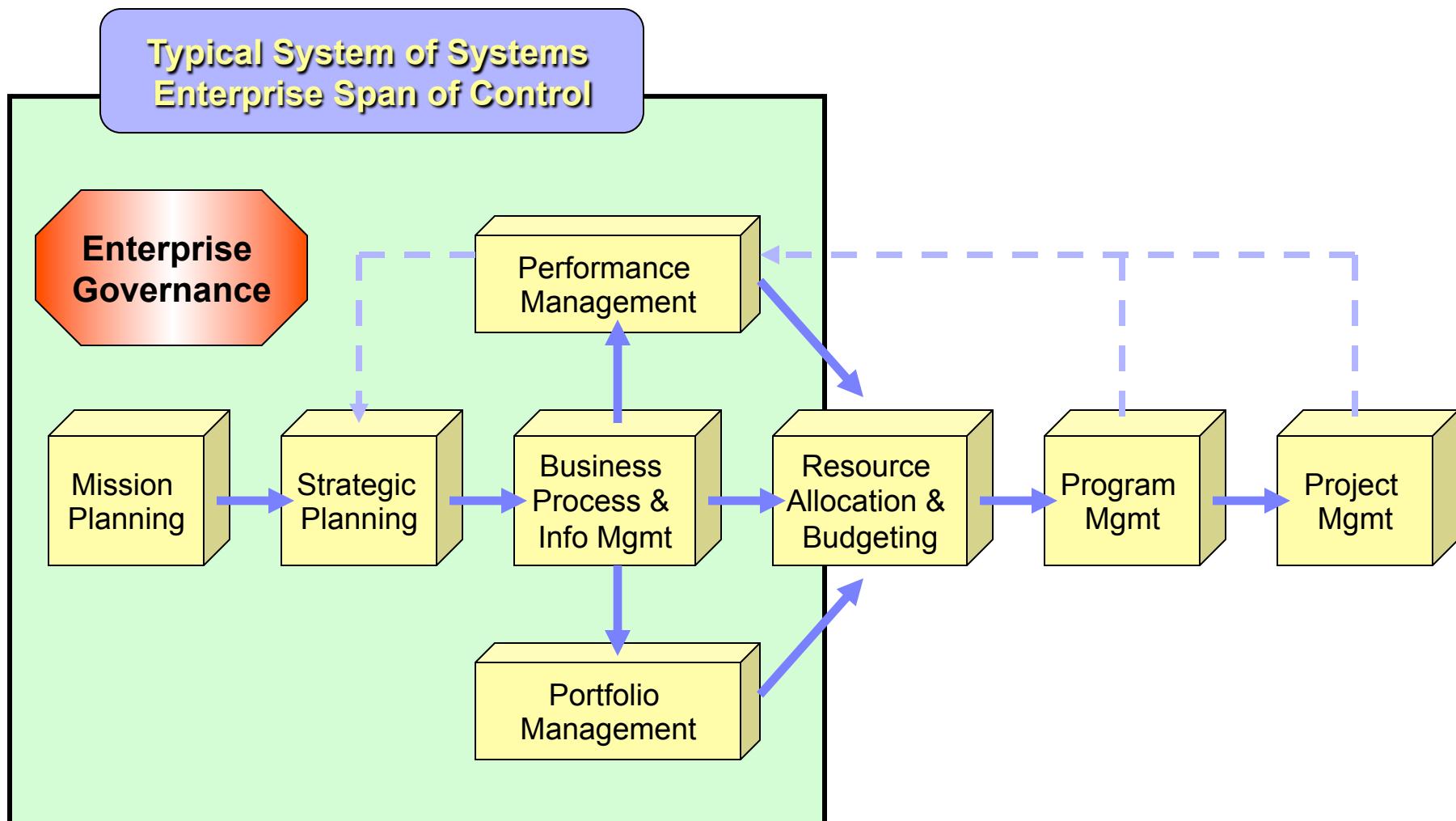
Enterprise Architecture
Can Facilitate Understanding of
# Inter-Relationships & Consequences
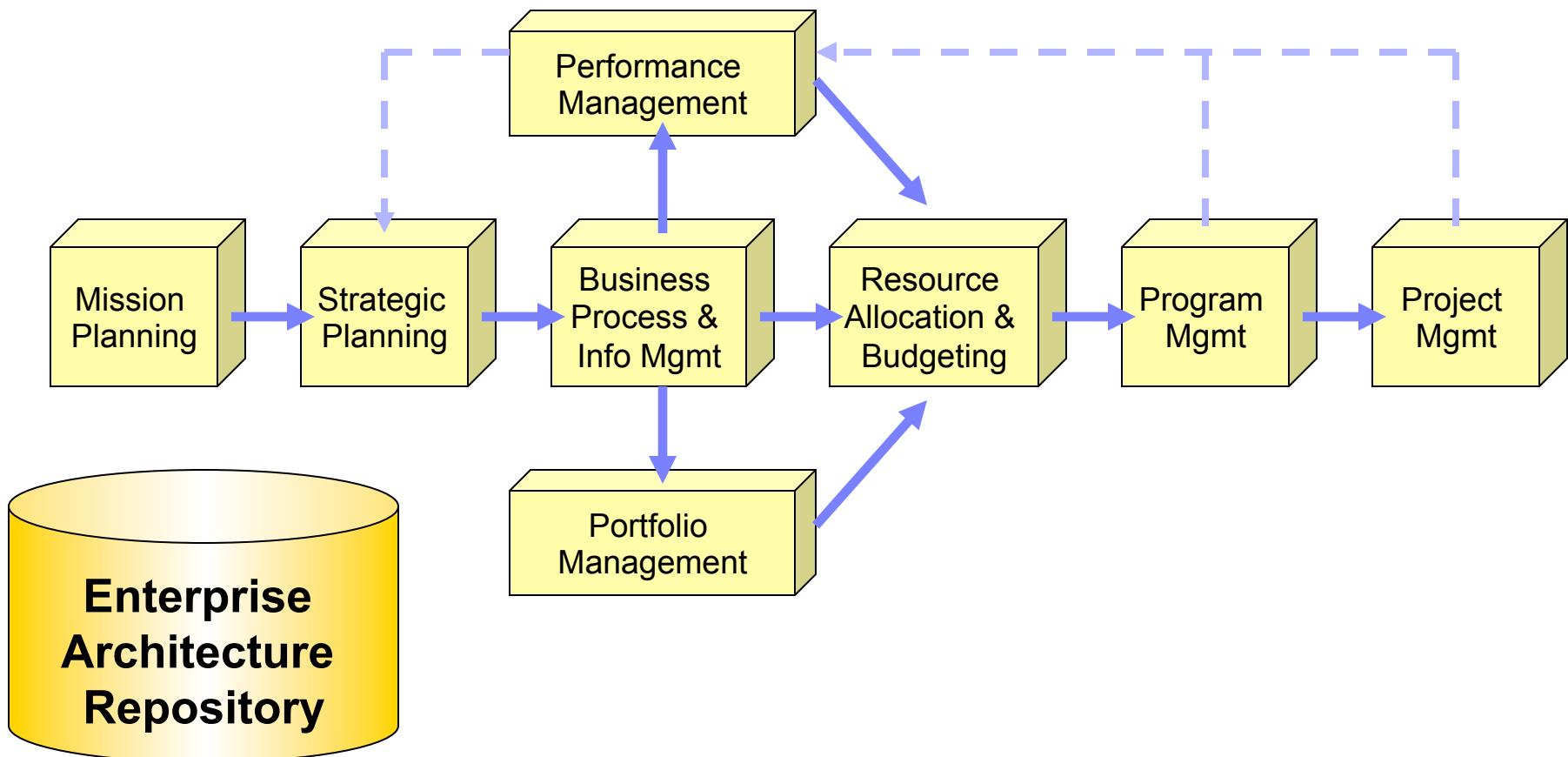
Executive Concerns & SE Enablers

| Executive Concerns	SE Enablers
Identifying ends, means, and scope and candidate changes	System complexity analysis to compare "as is" and "to be" enterprises
Evaluating changes in terms of process behaviors and performance	Organizational simulation of process flows and relationships
Assessing economics in terms of investments, operating costs, and returns	Economic modeling in terms of cash flows, volatility, and options
Defining the new enterprise in terms of processes and their integration	Enterprise architecting in terms of workflow, processes, and levels of maturity
Designing a strategy to change the culture for selected changes	Organizational and cultural change via leadership, vision, strategy, and incentives
Developing transformation action plans in terms of what, when, and who	Implementation planning in terms of tasks, schedule, people, and information

Enterprise Entities
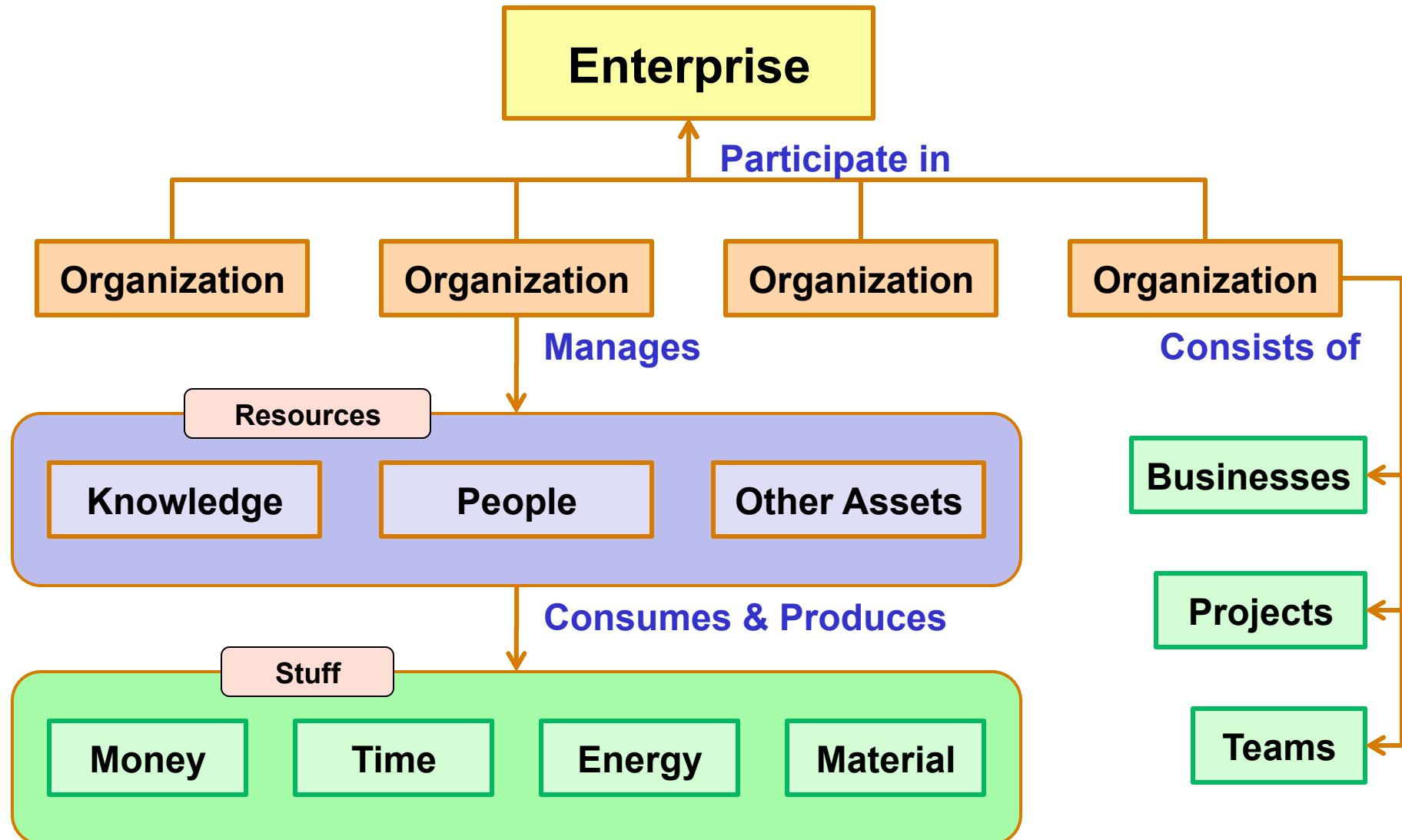
Different Groupings and Patterns Revealed at Different Scales

Scales	Groupings	Patterns	Descriptions
Enterprise Systems Engineering	Enterprise & Sub-enterprise		**Broad Descriptions** Net-centric Capabilities-based Evolutionary Developm... Emergent Behavior
System of Systems Engineering	Tens of System of Systems (Mission Strings)		**Mission Descriptions** Mission Capabilities-ba... Composition of Sys...
System Engineering	Hundreds of Independent Systems		**Functional Description** Detailed Specifications Detailed Requirements

Capabilities ↑ Constraints ↓

Functionality ↑ Constraints ↓

Relationships between an Enterprise and SoS's
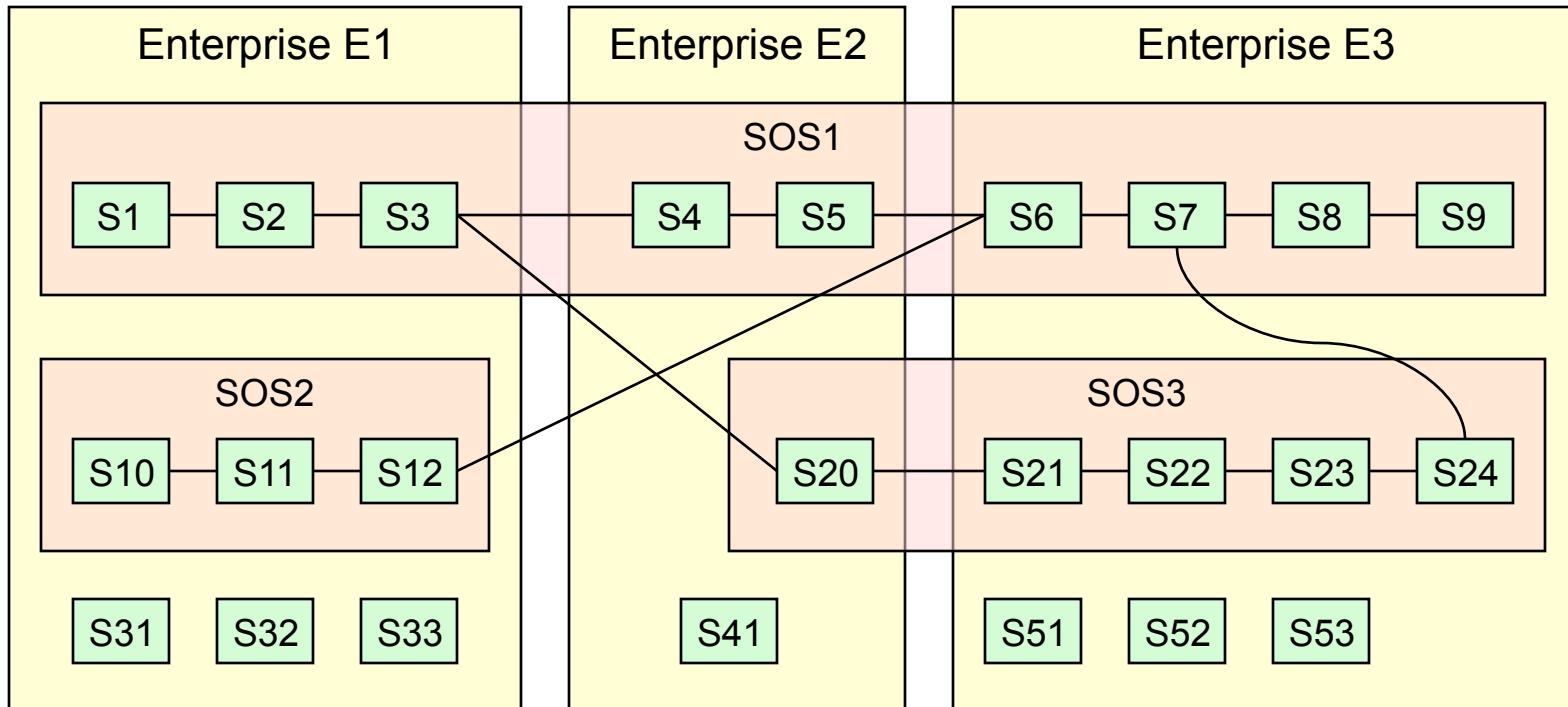
Context for Enterprise Transformation
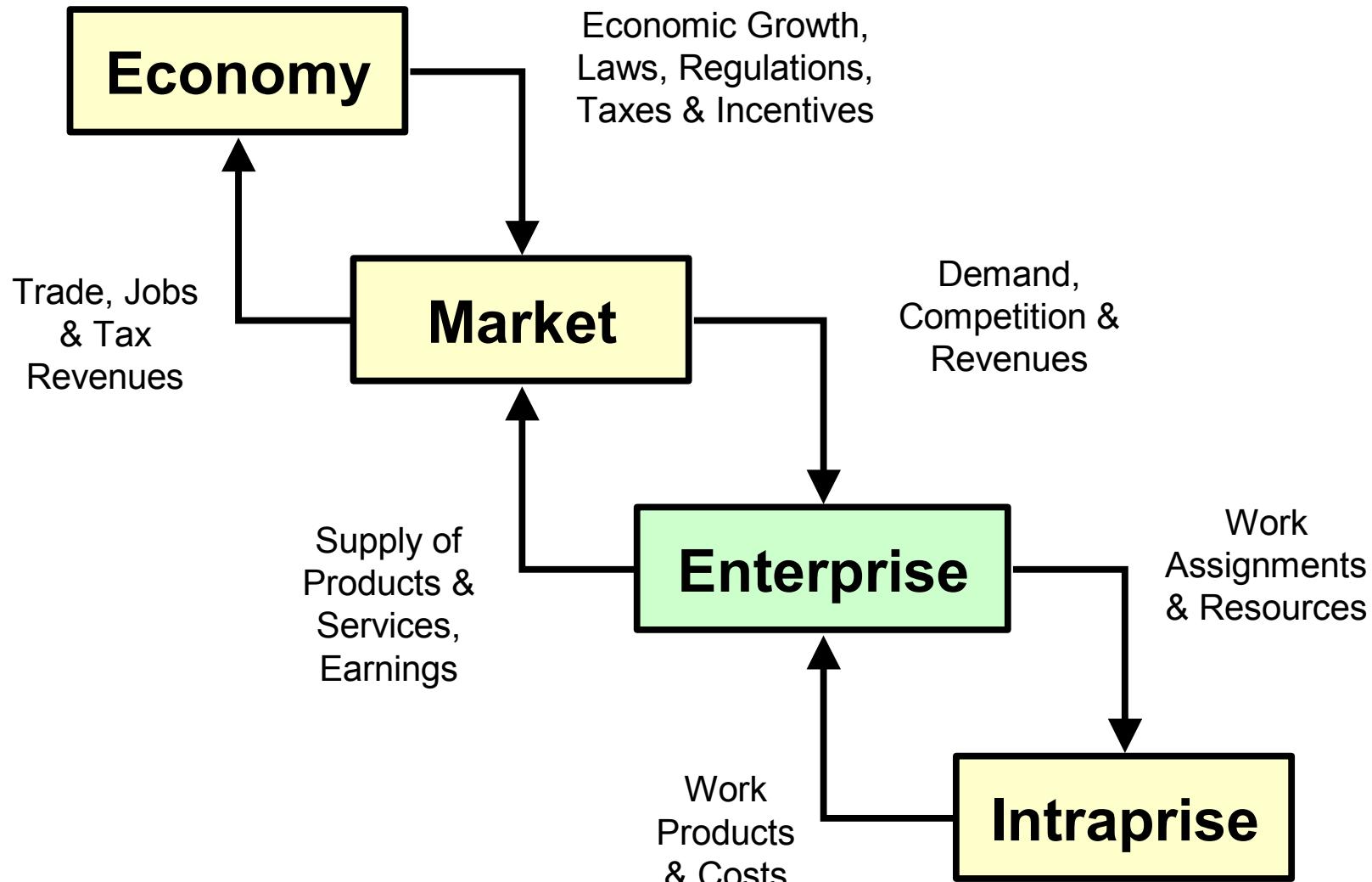
Risk & Opportunity at the Enterprise Scale versus the Systems Scale
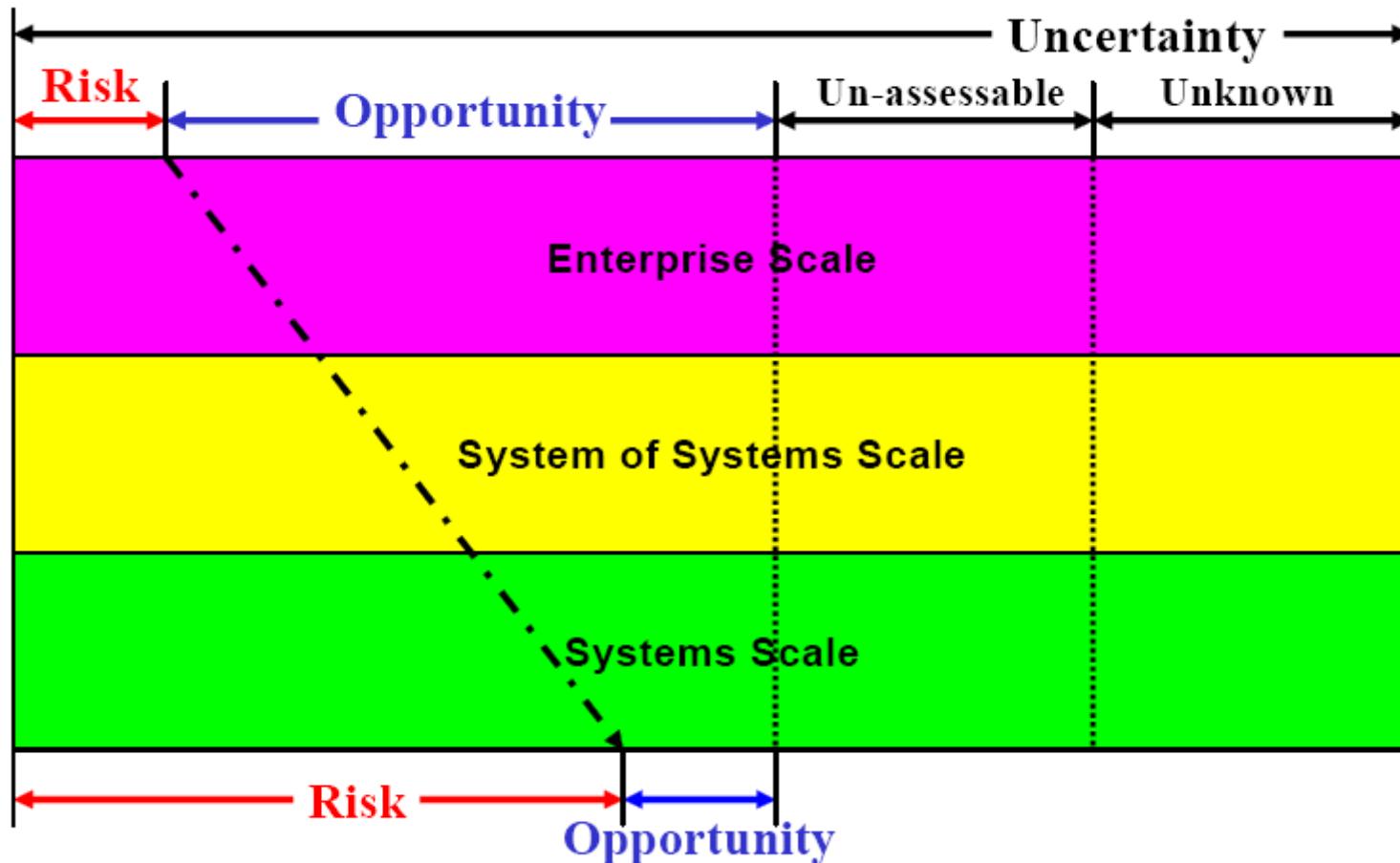
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