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Implementing Enterprise Strategy
using Architectural Processes

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An overview of the use of Enterprise Architecture at Sandia
Presented to Yucca Mountain leadership

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
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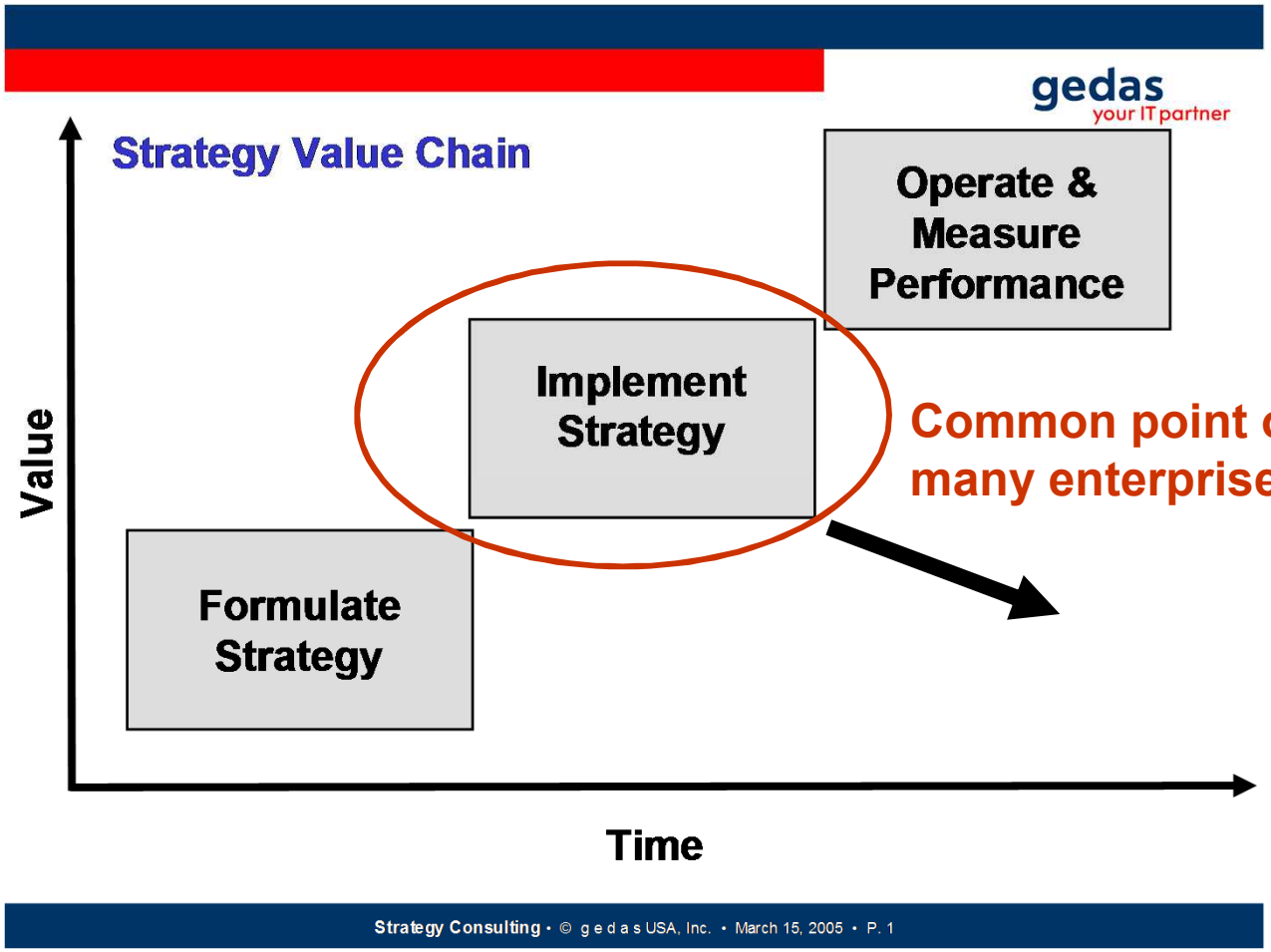
Outline

- Introduction
- Purpose, Process, Payoff
- Overview of the problem and issues
- The concept of enterprise architecture
- The process of architecting
- The benefit of architecting
- Sandia implementations
- Final words

PURPOSE

Acknowledge the Pitfall!



The Evidence is Compelling

Organizations are not good at implementing change.
1991-2000, 49 Studies, 43,000+ organizations

Culture Change—19% Success Rate
Business Expansion—20%
Reengineering/BPI—30%
Mergers/Acquisitions—33%
New Technology—40%
Restructuring—46%
New Strategic Direction—58%

M. E. Smith, ISPI, 2002

The Sources of Failure

- **Wicked problems** (Conklin & Weil)
  - No definitive problem statement, broad disagreement on what the problem is
  - A search for solutions that is open ended, competing stakeholders frame the problem to lobby for a solution specific to their interests
  - The problem-solving process is complicated by continual changes in resources, constraints, ground rules
  - Stakeholders that come and go, change their minds, fail to communicate
- **Business units loosely tied by ineffective understanding and uncommon purpose—whole is not even the sum of its parts**
- **Organization and socio-cultural factors (e.g., funding model, reward system, leadership, process, etc.)**

Old Business Approaches are Inadequate!

Back to Fundamentals With A New Approach

As the *infrastructure matures*, the companies that succeed will not be those that reflexively pursue innovation…but rather those that are pragmatic in planning and competent in execution.

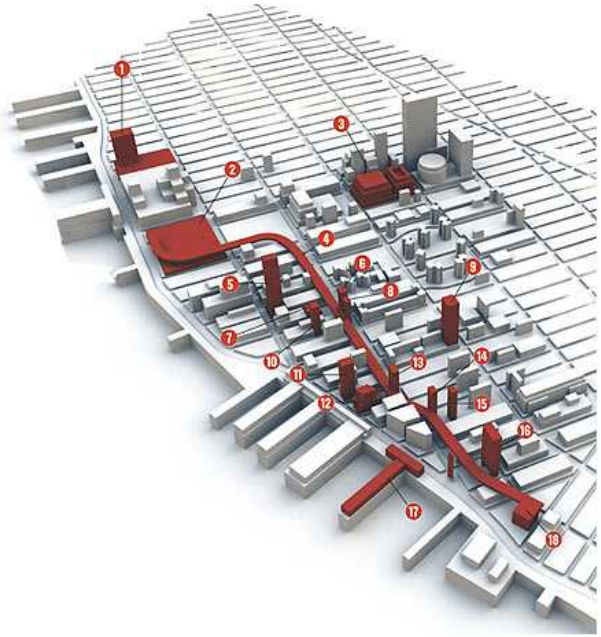
—Nicholas Carr, *Does IT Matter?*

Urban Planning as a Metaphor

Well Planned and Managed Communities

Public, Zoning, Code, Planner, Developer, Builder, Transport, Commission, Plans, Waste, etc.

Business Units, Policy, Stds, Portfolio, Process Owner, Program Manager, Governance, Technologies, etc.



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“Enterprise Architecture”

Useful Parallels between Urban Planning and EA

Urban Planning		Enterprise Architecture
General Contractor		Business Process / IT Project Manager
Construction Tools		Development Tools
Planners		Enterprise Architecture
Building Inspection		Reviews & Verifications
Building Architect		Project Architect
Standard Parts/ Hardware Store		Core Asset / (Reuse) Repository
Utilities / Infrastructure		Core Services/ Middleware/Infrastructure
Subdivision/ Community		System-of-Systems

Enterprise Architecture

EA is the art and science of capturing, designing, and making explicit, an enterprise's operating framework. It includes:

PURPOSE, GOALS, CONCERNS, STRATEGIES, POLICIES, PROCESSES, APPLICATIONS, DATA, EVENTS, CYCLES, NORMS, VALUES, RULES, SPONSORS, CUSTOMERS, CONSTRAINTS, ETC.

The goal of EA is to ensure that decision-making within the enterprise is based on explicit knowledge about the enterprise.

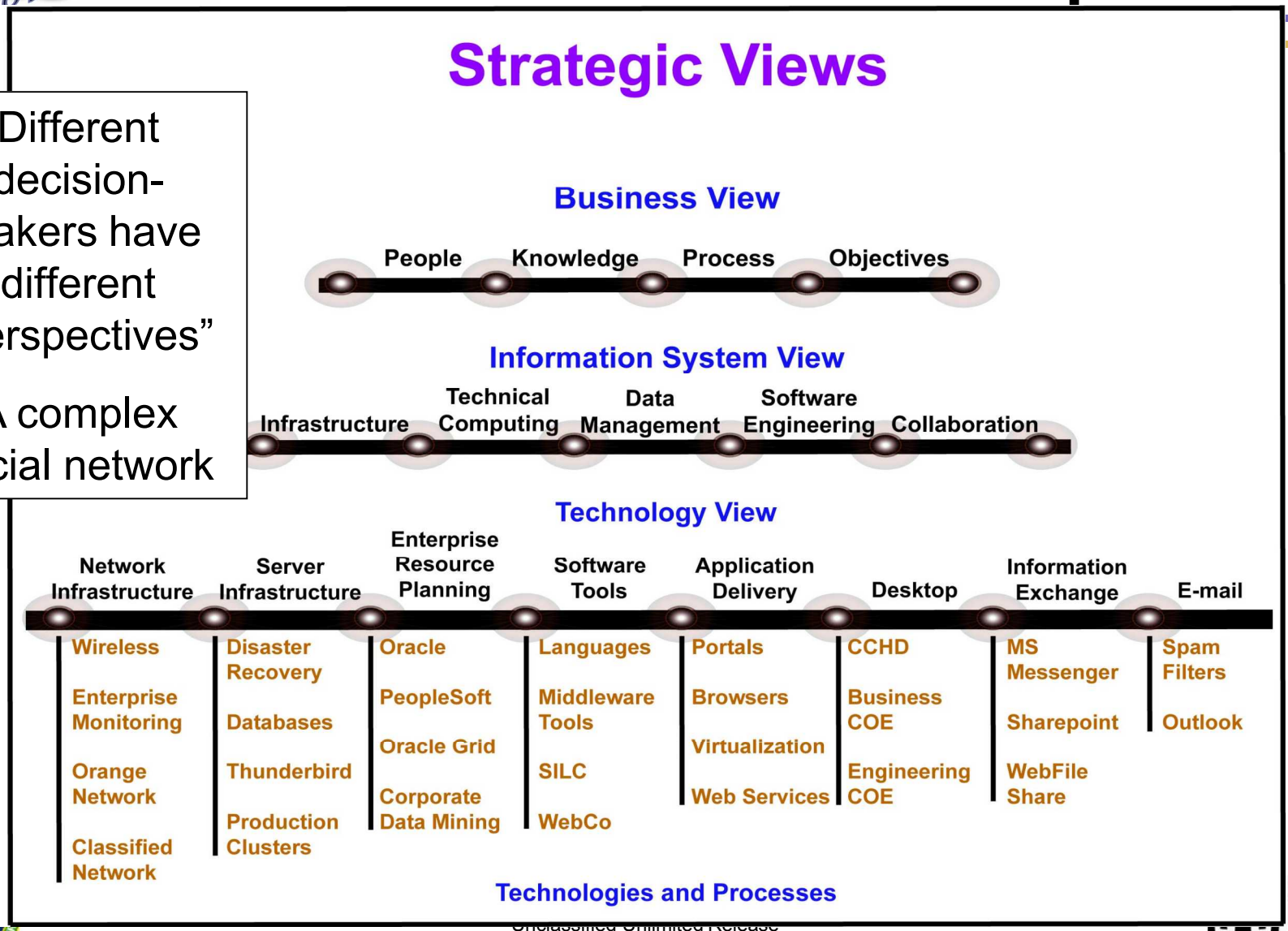
Principles:

- It's about the business—scoped appropriately
- Simple as possible, but no simpler
- EA is an enabling discipline, nothing more nor less
- Agility is expected
- EA is not IT, but EA covers IT

Multiple Views of the Architecture of an Enterprise

Different decision-makers have different "perspectives"

A complex social network

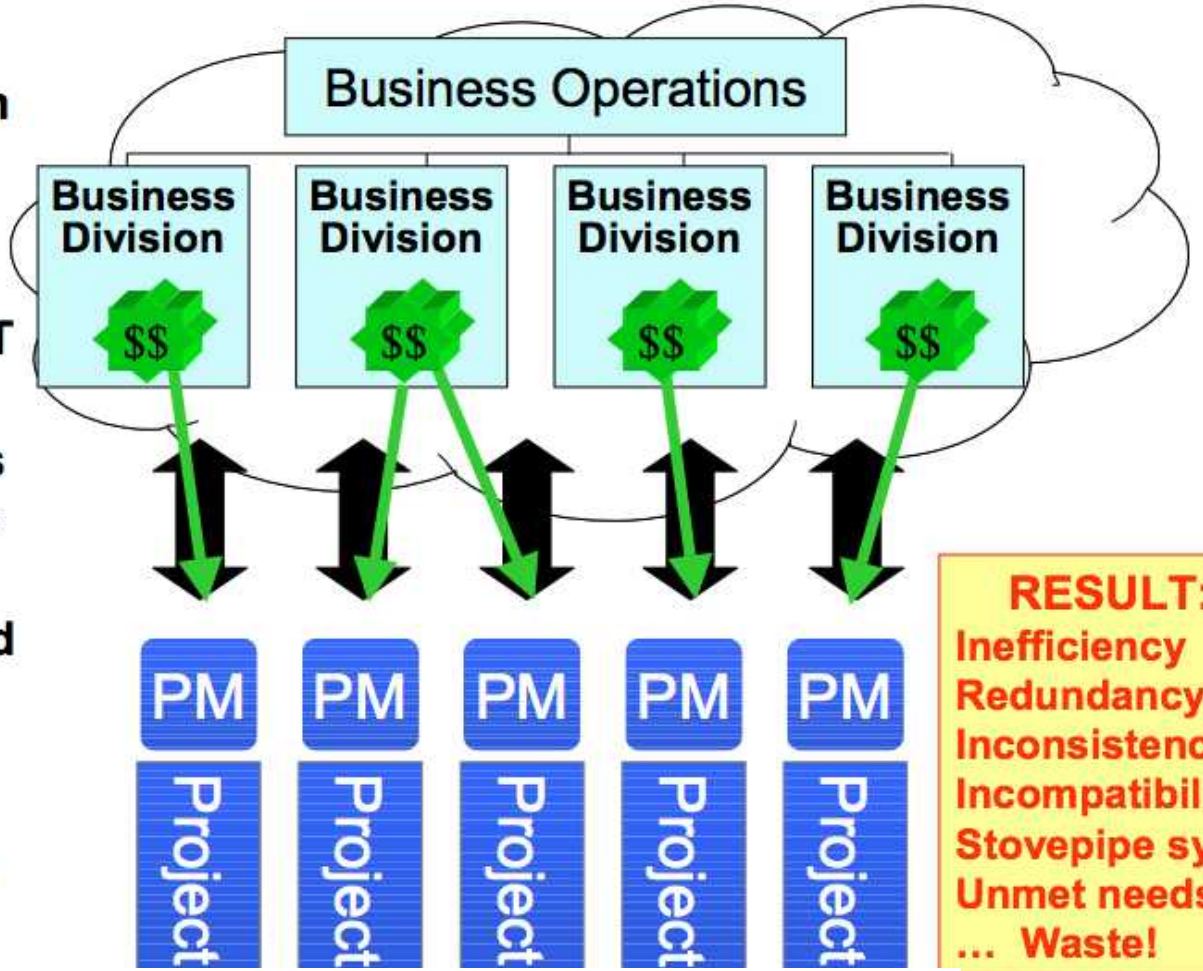


Why Do You Need an EA?

Multiple views can lead to sub-optimization; Follow the $

MITRE

- IT initiatives often justified on their own merits
- Autonomous management of IT budgets
- Interface to SMEs and operations is project driven
- Projects managed individually
- Contracts *and* development is based on system life cycle



RESULT:
Inefficiency
Redundancy
Inconsistency
Incompatibility
Stovepipe systems
Unmet needs
… Waste!

Architecture Happened Here

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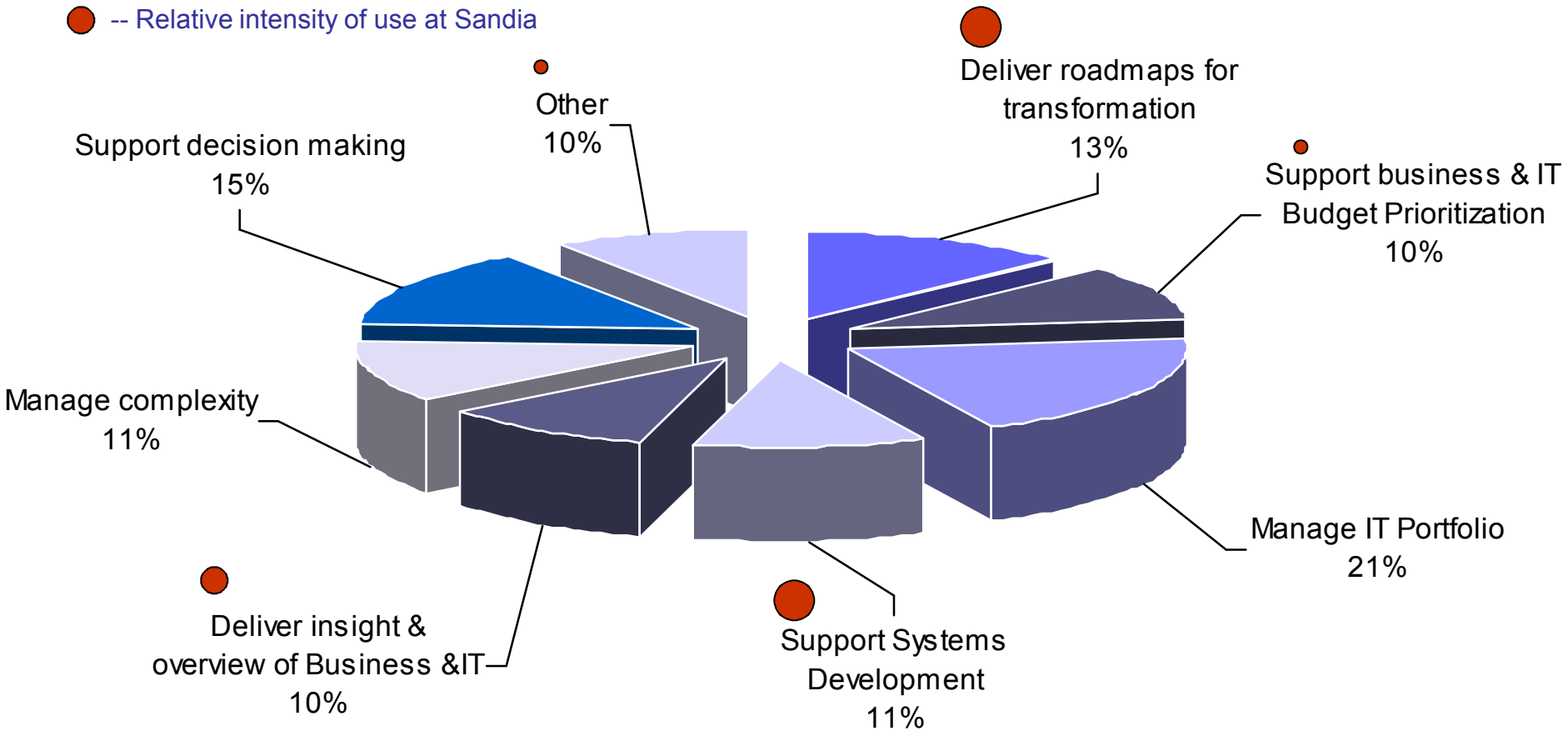
How Companies use Architecture to Achieve Business Strategy

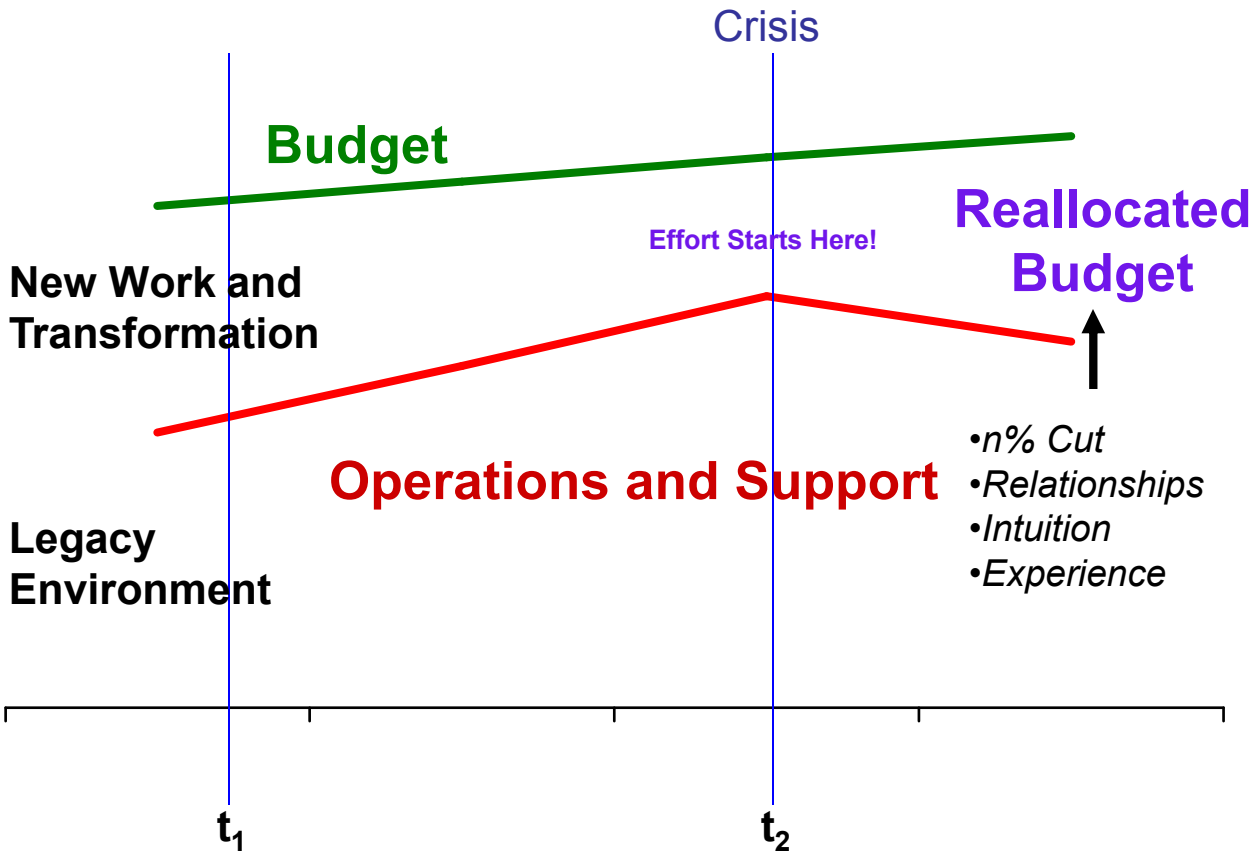


The EA Approach

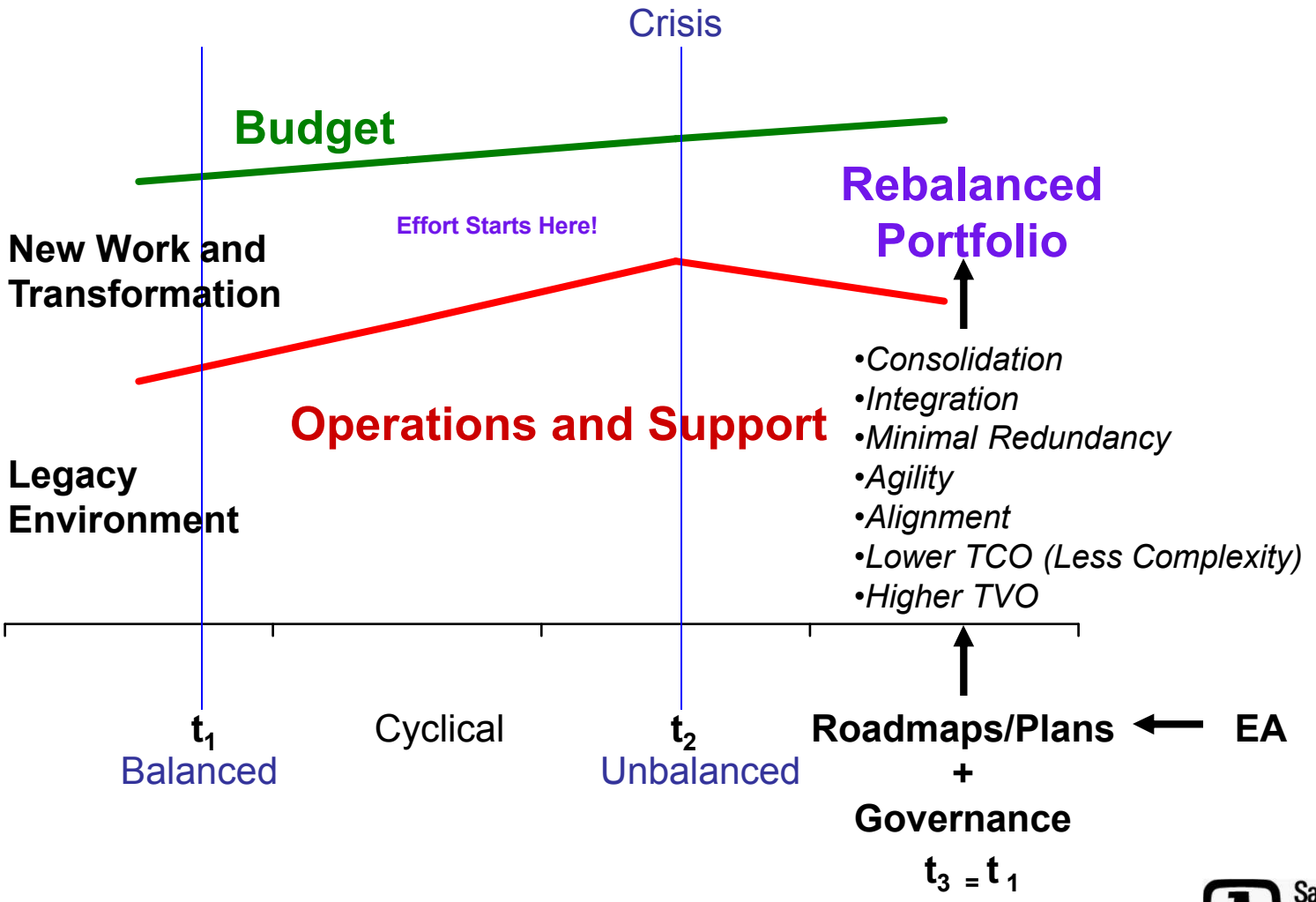
Using Trained Architects

- Stakeholder concerns are the drivers to identify candidate value-adding models
- Models are built to depict the as-is and to-be states of the enterprise (Business and IT)
- Analysis of the models identifies problems with alignment and lack of integration
- Requirements for Business and IT change are derived based on the model analysis
- A Roadmap or Plan for reaching the to-be state is developed from prioritized requirements
- Timeframe to achieve to-be state is weeks to months to years depending on the scope of your enterprise, urgency to change, barriers to change, and iteration

Example: Standard Problem, Old Approach



Example: Standard Problem, Architecture Approach



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PROCESS

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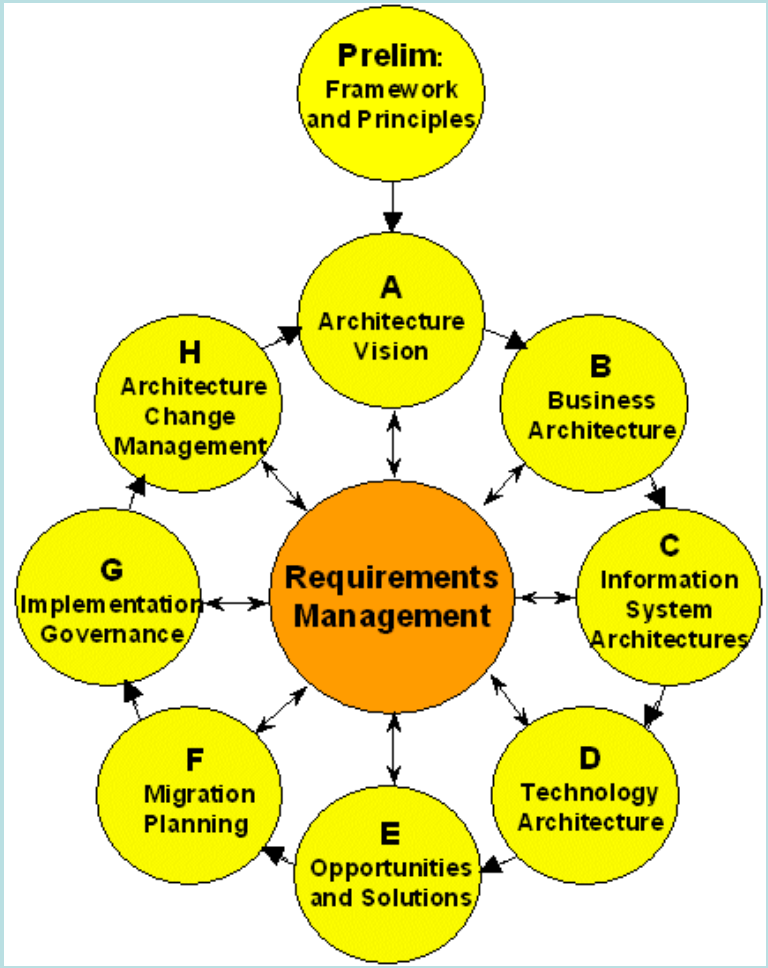
Laying Out Your Plan

The Open Group Architecture Framework (TOGAF):



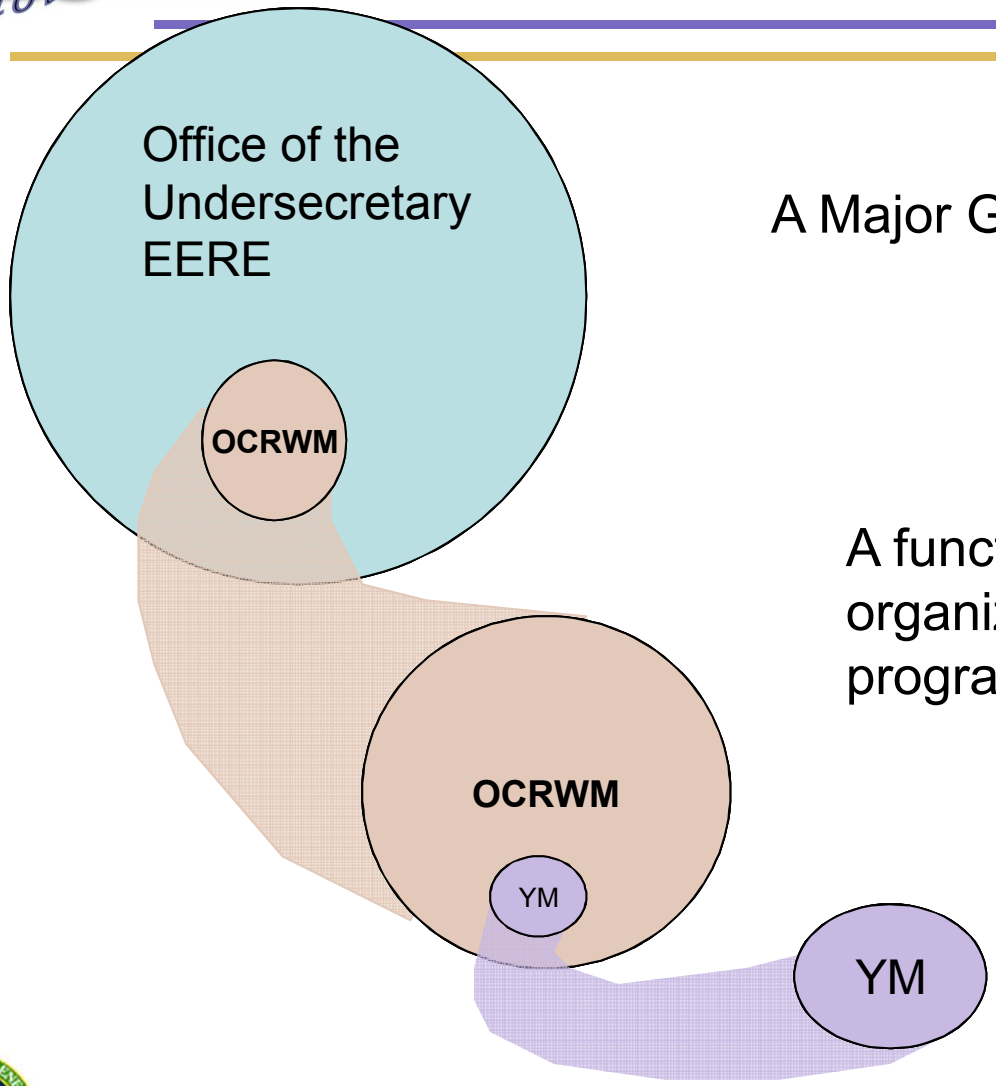
- TOGAF forms the basis of Sandia's enterprise architecture plan
- supplemented by
  - IEEE 1471-2000
  - OMG Model Driven Architecture
  - Zachman Framework for Enterprise Architecture

Using Driving Principles

(adapted from TOGAF)

- Maximize Benefit to the Enterprise
- Information Management is Everybody's Business
- Business Continuity
- Common Use Applications
- Compliance with Law
- IT Responsibility
- Protection of Intellectual Property
- Data is an Asset
- Data is Shared
- Data is Accessible
- Data Trustee
- Common Vocabulary and Data Definitions
- Data Security
- Technology Independence
- Ease-of-Use
- Requirements-Based Change
- Responsive Change Management
- Control Technical Diversity
- Interoperability

Describing Your Architecture: Identifying and Bounding Your Enterprise



A Major Government Entity

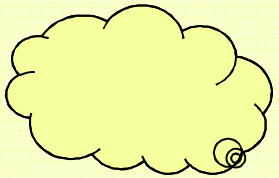
A functional, cross-organizational group or program within EERE

A site implementation within OCRWM

Describing Your Architecture: Establishing Enterprise Targets

Know the Customer

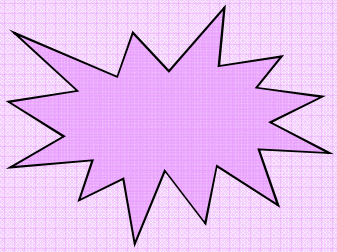
An enterprise survives primarily because in one way or another it provides value to its customers



- Motivations and processes of the customer
- Interactions with the enterprise
- Rules and modes of engagement
- Customer value perception

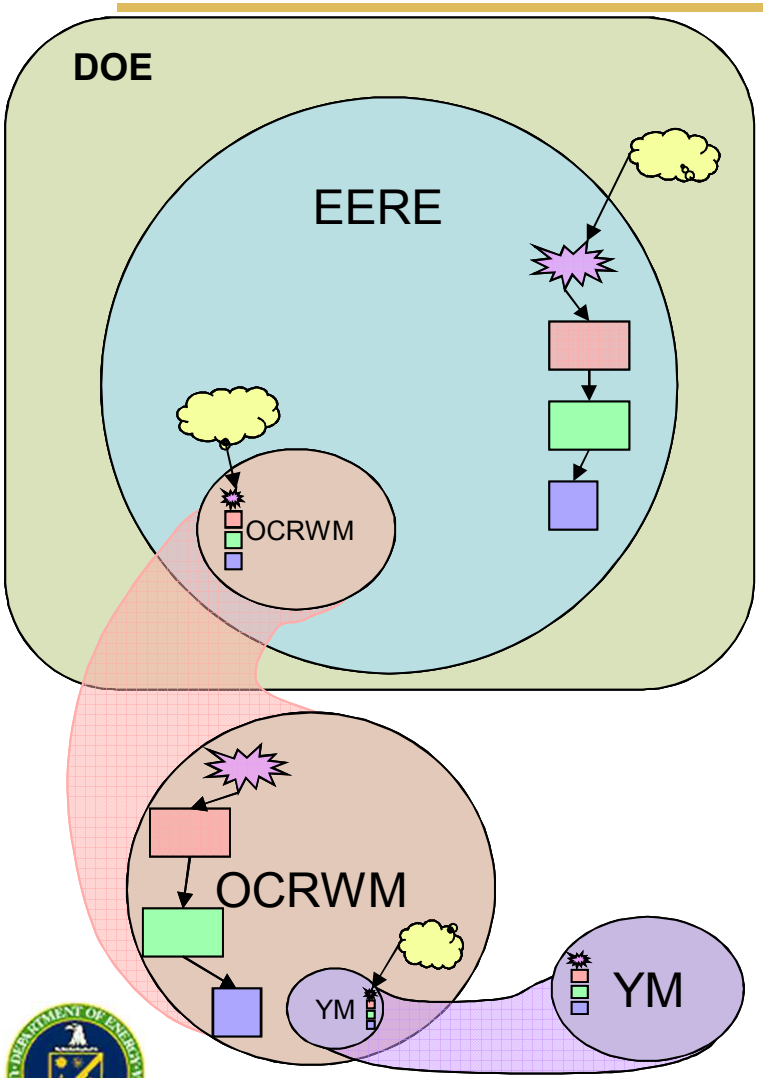
Strategic Intent of the Enterprise

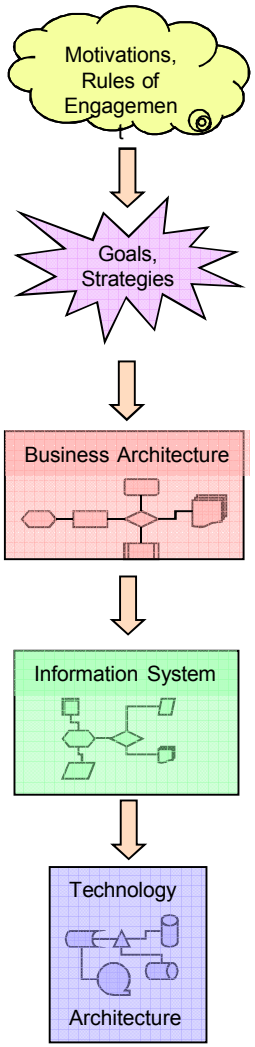
•How does understanding of the customer contribute to enterprise motivations?



- Value proposition to customer
- Vision, goals
- Mission, strategies
- Principles, policies
- External influences & pressures

Describing Your Architecture: Mapping Existing Alignment & Integration





- **Customers' Motivations, Rules of Engagement** shape Enterprise's goals/strategies/policies
- **Enterprise's Goals, Strategies, Policies** shape business architecture
- **Business Architecture** shapes information systems
- **Information Systems Architecture** shapes technology architecture
- **Technology Architecture**

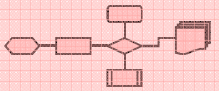
Describing Your Future: Creating Future Alignment & Integration

Given

- **knowledge of the customer,**
- **enterprise's motivations and intents,**

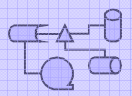
define an *optimal enterprise structure*
(the architecture of the enterprise)

Business Architecture: fundamental organization of work (people, processes, work products, facilities) that enables motivations and intents



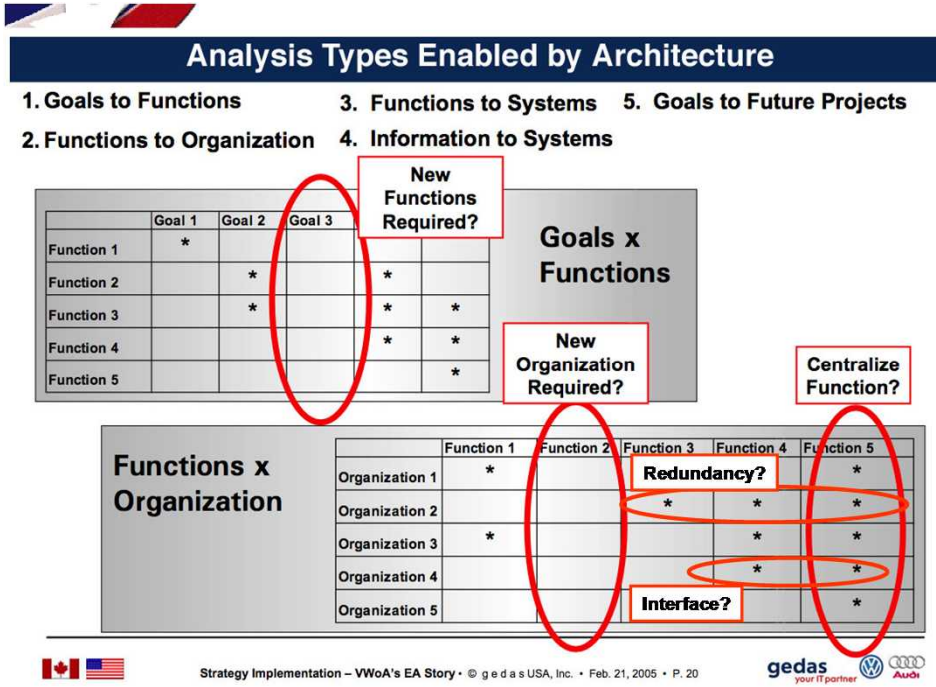
Information Systems Architecture: fundamental organization of applications and data that enable work of the enterprise

Technology Architecture: fundamental organization of communications, platform and software infrastructures that enable information systems



Means to Analyze Alignment and Integration

Generic Analysis Types



IT Dependency Matrix

	IT DEPENDENCY	Business Applications: EBOM	IMS	LLCE	ROA	SSDMS
Infrastructure Software	Cold Fusion	X				
	DCE/Kerberos	X	X	X	X	X
	IIS Web Server					X
Database Management Systems	Oracle	X			X	X
	Sybase			X		
	DB2		X			
Machines	ds09sainf			X		
	sahp137	X		X		
	sahp860		X	X	X	X
Networks	SCN	X	X	X	X	X
	SRN			X		
	SON					

integrated information services

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Actions taken: Consolidation, Staffing Plan, Organization Design

Issues: DBMSs, Machine SLA (many apps on one)

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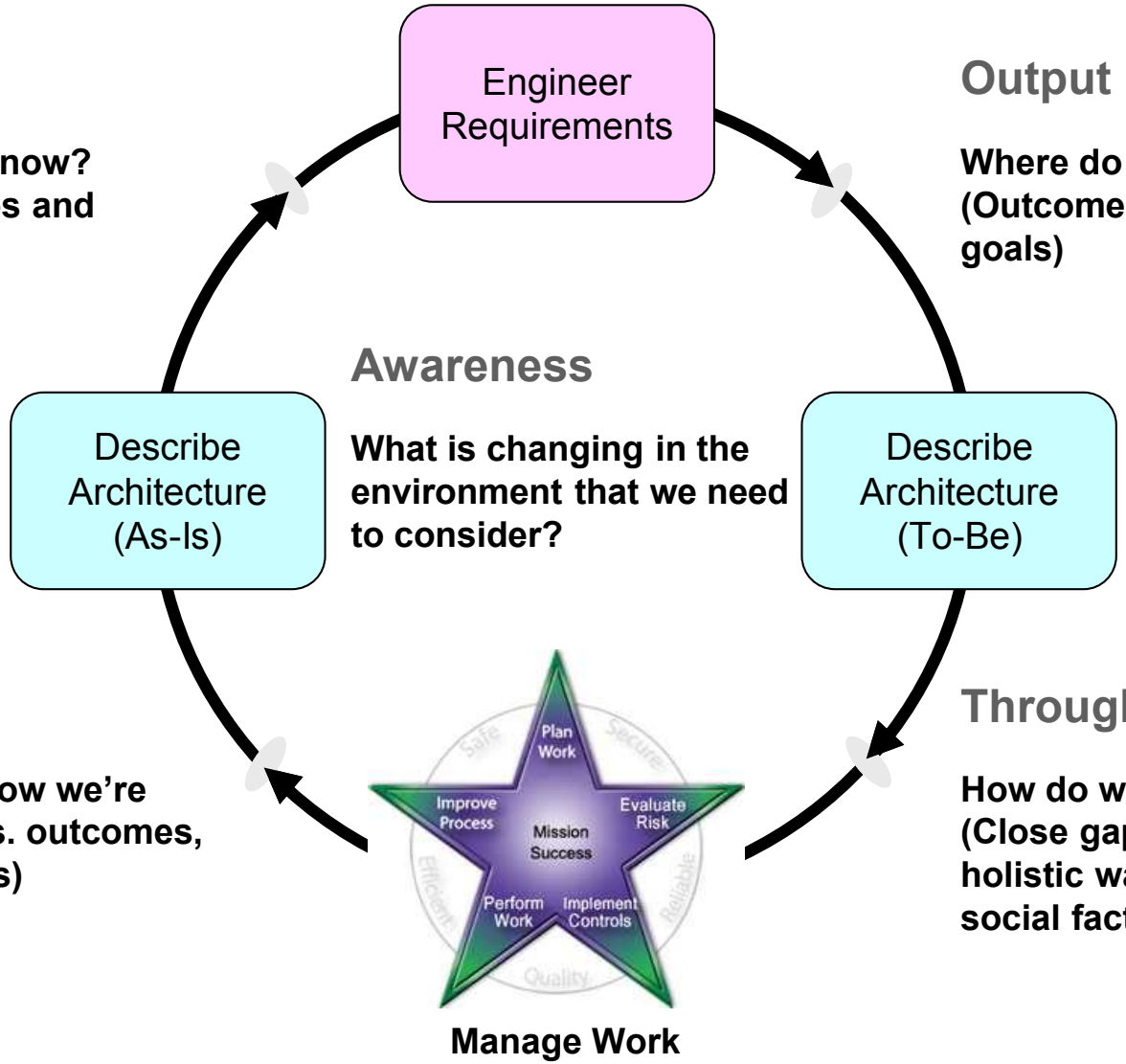
Means to Enable Planning

Specific to Organizational Transformation

Goals related to Vision

Elements of Change	Broad Mission Impact	Enabling Customer Agility	Enabling Customer Performance	Culture of High-Caliber People	Agile Organization	High Reliability Solutions	Cost Effective Solutions
PEOPLE / SKILLS type, level, mix	X	X	X	X	X	X	X
PROCESSES E2E, RUP	X	X	X	X	X	X	X
ROLES & RESPONSIBILITIES enable processes, clarify cross line organizational interactions		X		X	X		X
LINE ORGANIZATION STRUCTURE focus on disciplines and skills needed to enable processes	X	X	X	X	X	X	X
VIRTUAL STRUCTURES enable initiatives, projects, and focus on areas beyond the scope of line organizations	X	X	X		X	X	X
PORTFOLIO mix, growth in HS&D and DS&A, maintain NW	X	X	X	X			

Change Builds Iteratively – Address the Urgent in the Context of the Whole!



Input

Where are we now? (Today's issues and problems)

Output

Where do we want to be? (Outcomes, purpose, goals)

Awareness

What is changing in the environment that we need to consider?

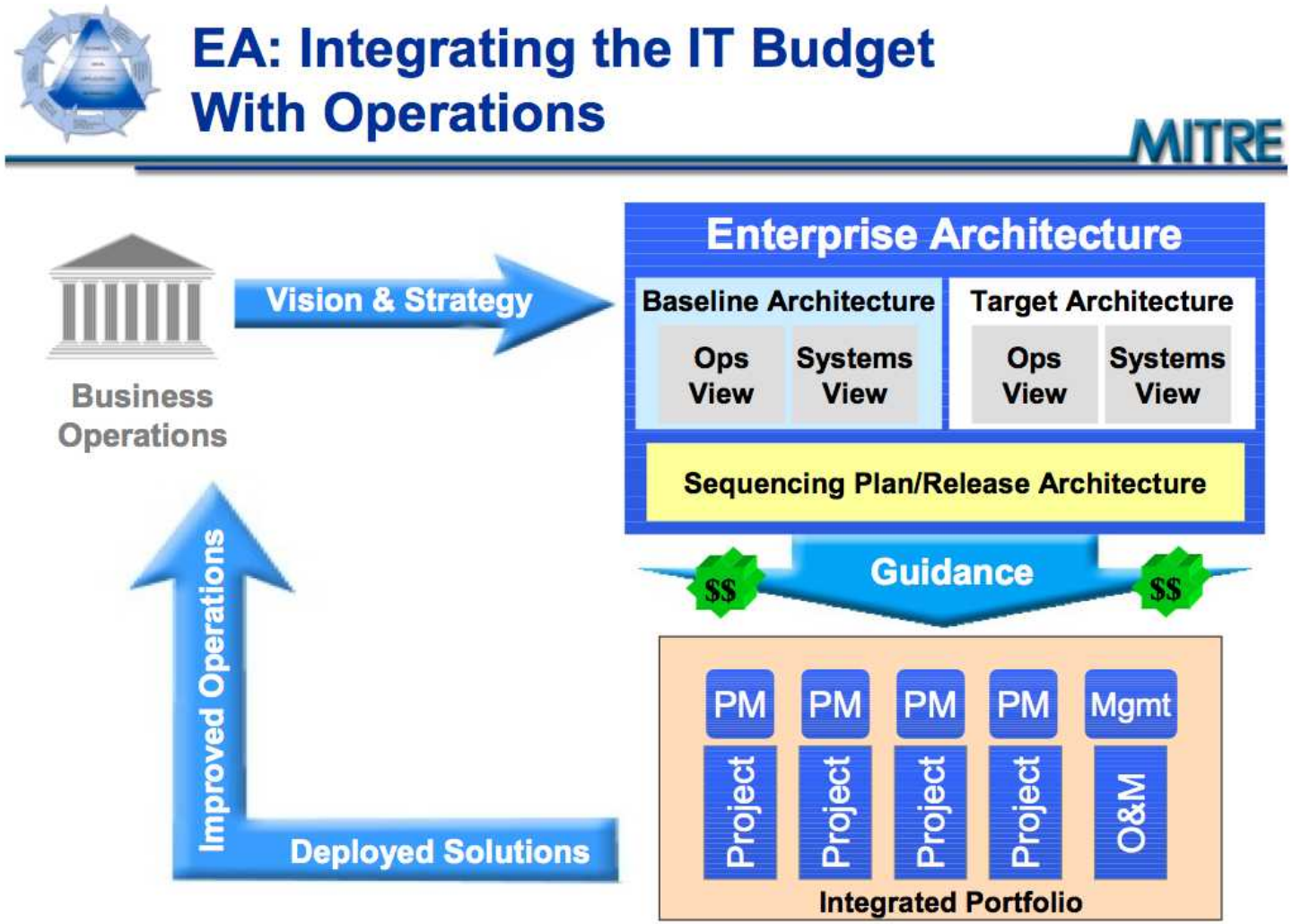
Feedback

How do we know we're there? (V/V vs. outcomes, purpose, goals)

Throughput

How do we get there? (Close gap in a complete holistic way; Address social factors)

Make it Real: Allocate Money to Follow the Architecture



Use Integrated Work Processes

as used by Sandia CIO (1 is in place, most are in development):

Core	**1. Strategic Planning**	Define enterprise vision, goals, strategies
	2. Portfolio Management	Existing solutions; programs & projects
Governance	**3. Fulfill Customer Requests**	Broker solutions, assure integration
	4. Solution Life Cycle Support	Continual care and feeding of solutions
Enabling	**5. Architecture Road-mapping**	Describe baseline, requirements, target, effective transition sequence
	6. Bus. Cont. & Disaster Rec.	Minimize impact of disastrous or unforeseen events
	7. Enterprise Configuration & Change Management	Structured inventory of enterprise content

Leverage Industry Models

As Applicable and Tailored

- Capability Maturity Model Integrated (CMMI)—Software engineering and information services process management (We are assessed at SW-CMM L3 and plan to seek CMMI L4 in FY08)
- Rational and Enterprise Unified Process (R/EUP)—Software and systems engineering methods
- ISO 9001—Organizing framework for Sandia's management system and transformation activity
- Hammer Process Engineering—Business process design, description, and management
- Control Objectives for Information and Related Technology (COBIT)—Measures, indicators, processes, best practices to facilitate IT governance

Leverage Industry Models

As Applicable and Tailored

- Information Technology Infrastructure Library (ITIL)—IT service management best practices
- The Open Group Architecture Framework (TOGAF)—Architecture process and method
- Zachman Enterprise Architecture—Classification scheme for Architecture content
- Carnegie-Mellon Software Engineering Institute (SEI)—Software architecture certification and methods
- International Council on Systems Engineering (INCOSE)—Systems engineering body of knowledge
- IEEE 1471-2000—Best practice for Architecture descriptions

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Achieve Results

EA Team Engagements

Sandia Strategies

- Provide leadership to transform the NW Stockpile and NWC
  - *Product Realization Integrated Digital Environment (PRIDE) Enterprise Architecture*
- Maximize National Security contributions
  - *IT Architectures for Various Mission Programs and Projects*
- Achieve Operational Excellence and deliver Innovative Science and Engineering
  - *Integrated Laboratory Management System*
  - *Process Efficiency and Effectiveness*
  - *Organization and Program Transformations*
  - CIO Vision: Information Mastery
    - *Roadmap (refer to earlier Integrated Work Processes)*
    - *IT Valuation*

Achieve Results

"Pragmatic in Planning and Competent in Execution"

Vision

Sandia is the provider of innovative, science-based, systems-engineering solutions to our Nation's most challenging national security problems.

Highest Goal

Become the laboratory the U.S. turns to first for innovative, science-based, systems-engineering solutions to the most challenging problems that threaten peace and freedom for our nation and the globe.

Conclusion

Enterprise Architecture enables one to plan for and manage cause and effect, to apply systems and critical thinking to design a whole that is greater than the sum of its parts.

It facilitates implementing strategy to focus change on the vital few and right assets to achieve vision and goals.

Final Thoughts

It is my impression that no one really likes the new. We are afraid of it. It is not as Dostoyevsky put it that "taking a new step, uttering a new word is what people fear most." Even in slight things the experience of the new is rarely without some stirring of foreboding. … We are usually told that revolutions are set in motion to realize radical changes. Actually it is drastic change that sets the stage for revolution.

The Ordeal of Change
Eric Hoffer

The creature that survives is not the smartest or the strongest but the one most adaptable to change.

Darwin