



# Architecture Analysis Technique Development

September 13 – 15, 2011

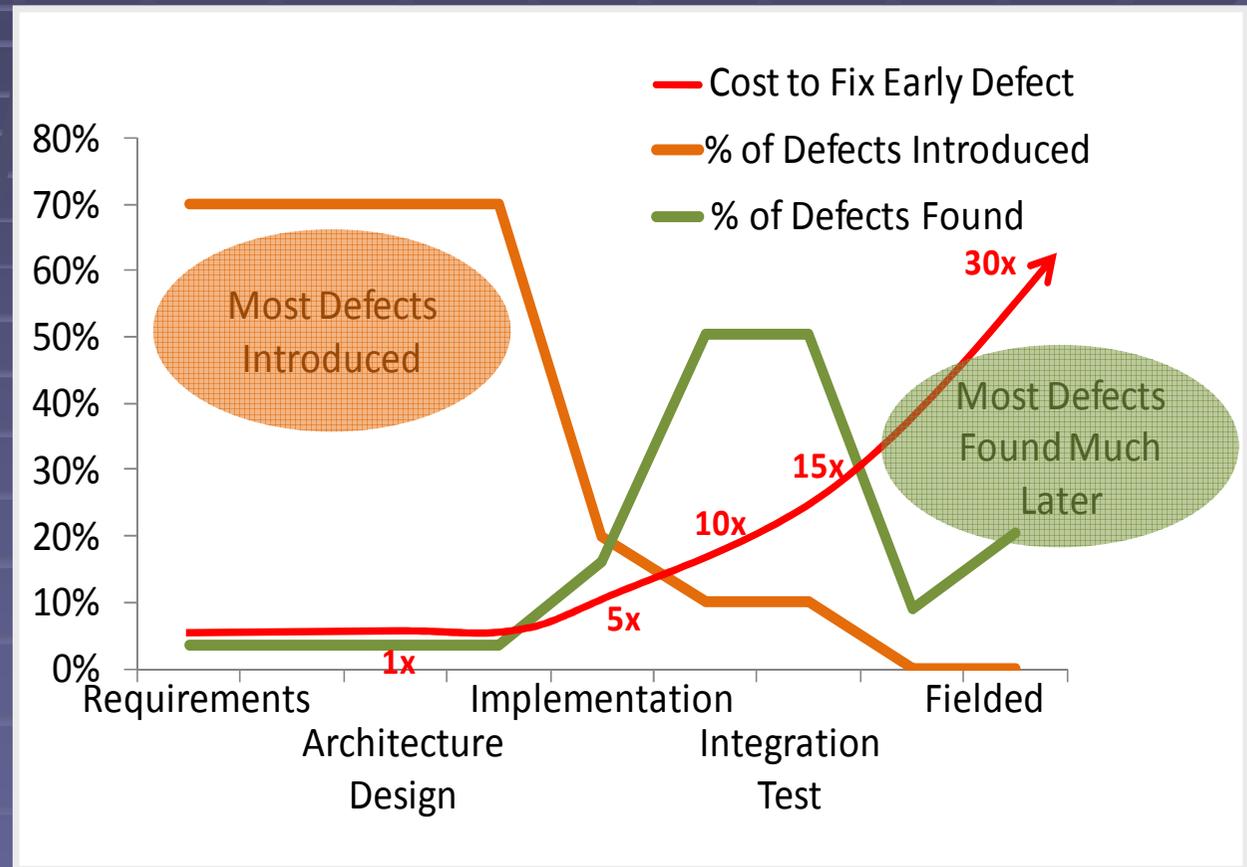
Don Ohi, L-3 Communications  
Heath Haga, L-3 Communications  
Jim Dabney, L-3 Communications

# Overview

- Architecture IV&V
- Specification completeness
- Stakeholder analysis
- Key driving requirements
- Technical budgets analysis
- Scenario analysis
- Next steps

# Impact of Architecture Phase IV&V

- Architectural issues are a leading source for integration problems
- Without systematic upfront analysis these problems are costly to repair
- Application of complexity, safety and dependability analysis enables addressing the issues early on
- Architectural decisions impact what is required of the software
- Improved architecture specifications reduce software risk and increase IV&V's ability to validate and verify the software

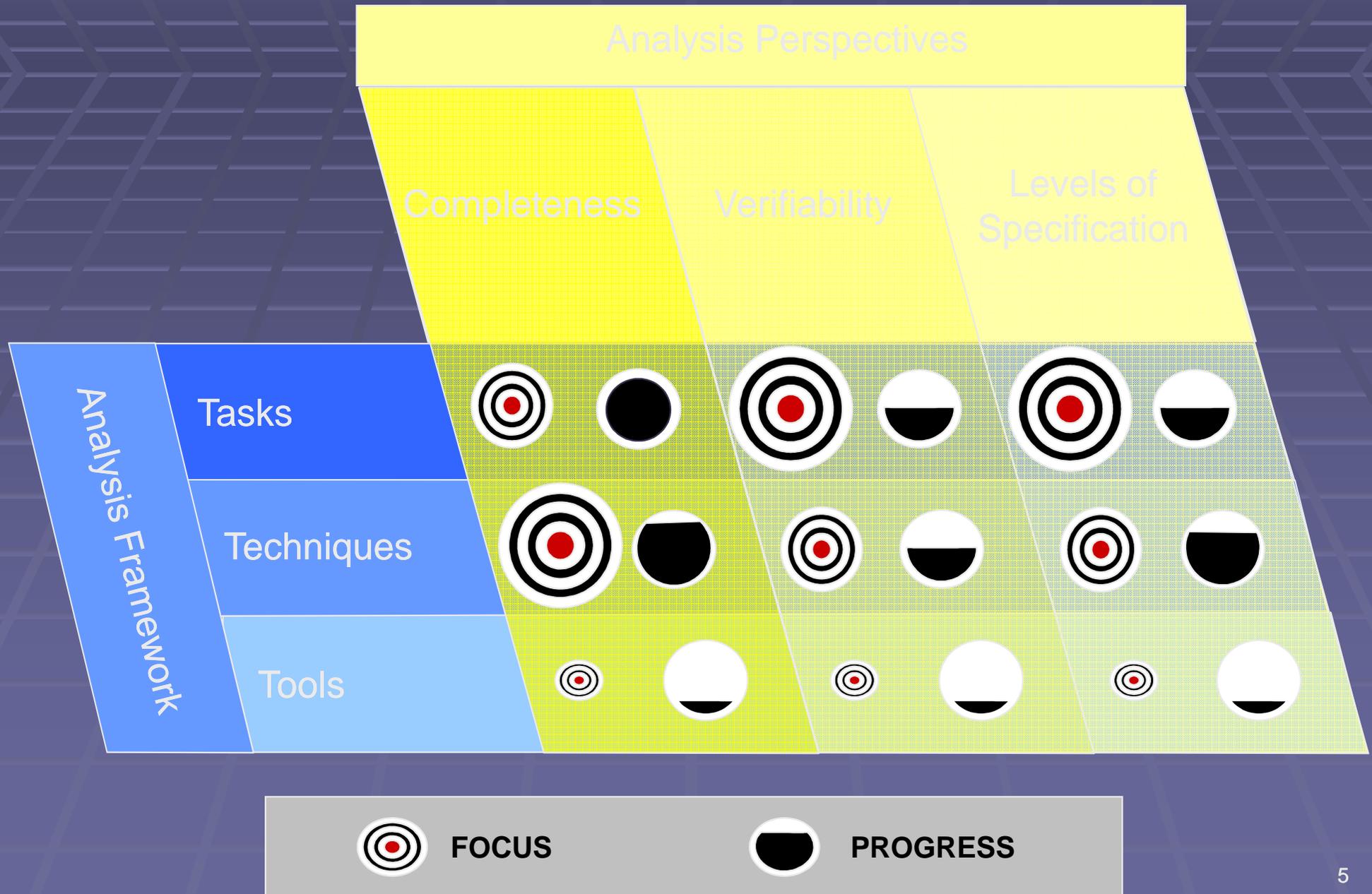


Source: NIST Planning report 02-3, "The Economic Impacts of Inadequate Infrastructure for Software Testing", May 2002.

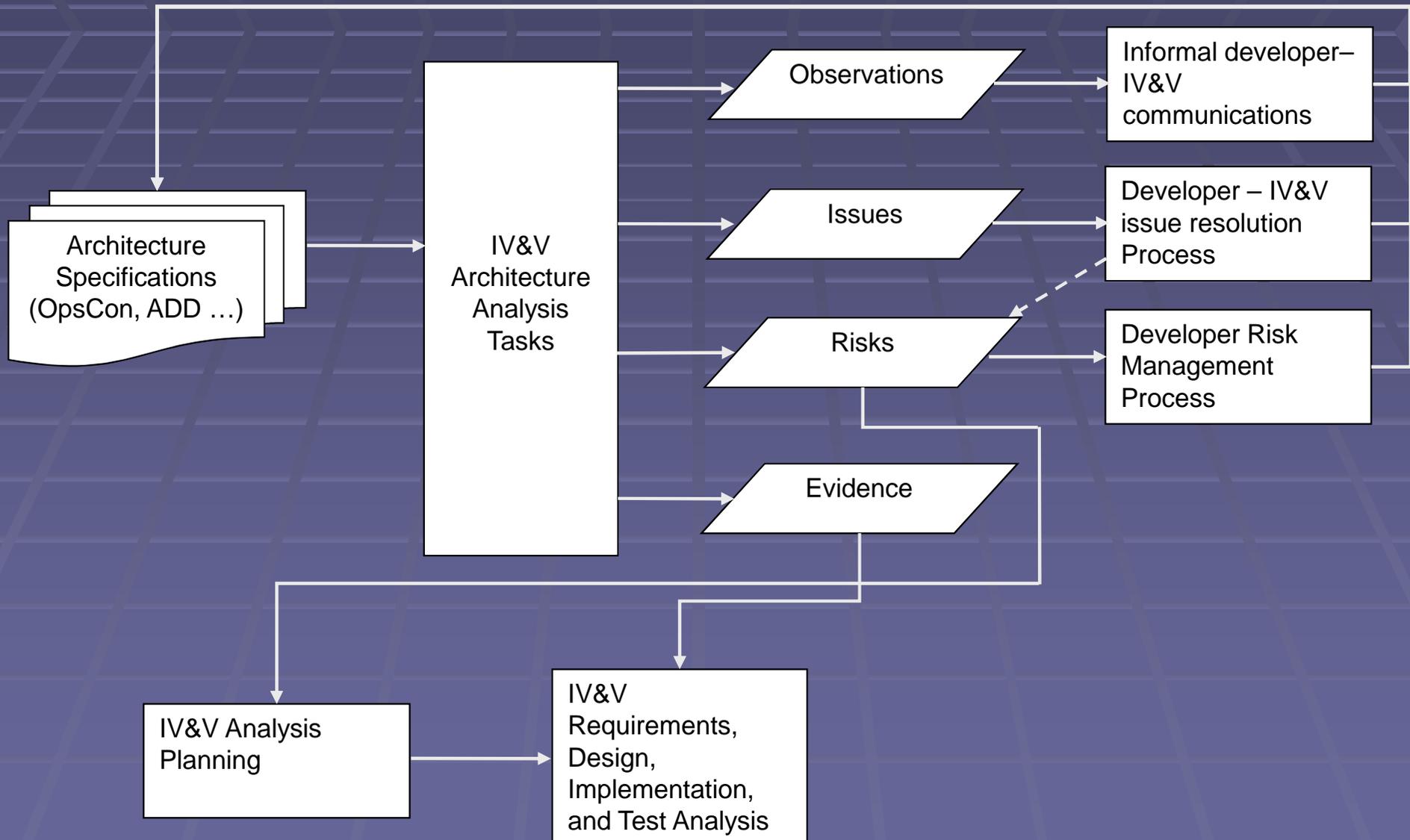
# Objectives

- Adequately specified
- Complies with requirements
- Feasible

# Architecture Analysis Research Elements



# Architecture Analysis Context



# IV&V Architecture Analysis Tasks

## Completeness

Specification completeness

Functional Capability Mapping

Dependency mapping analysis

Technical budgets analysis

Top-level requirements mapping

Scenario development

Fault management and redundancy analysis

## Verifiability

Reuse Analysis

Interface requirements traceability analysis

Key driving requirements validation

## Levels of Specification

Levels of specification identification

Stakeholder analysis

Evolvability analysis

Comparison to lower level architecture specifications

# Task Phasing

**Concept  
Review**

**SRR**

**SDR**

**PDR**

**CDR**

**Stakeholder analysis**

**Specification  
Completeness SDR**

**Specification  
Completeness PDR**

**Specification  
Completeness CDR**

**Levels of Specification  
Identification**

**Scenario Analysis**

**Key Driving Requirements Validation**

**Top-level Requirements Mapping**

**Fault Management and Redundancy Analysis**

**Technical Budgets Analysis**

**Reuse Analysis**

**Functional Capability Mapping**

**Dependency Mapping Analysis**

**Evolvability Analysis**

**Interface Requirements Traceability  
Analysis**

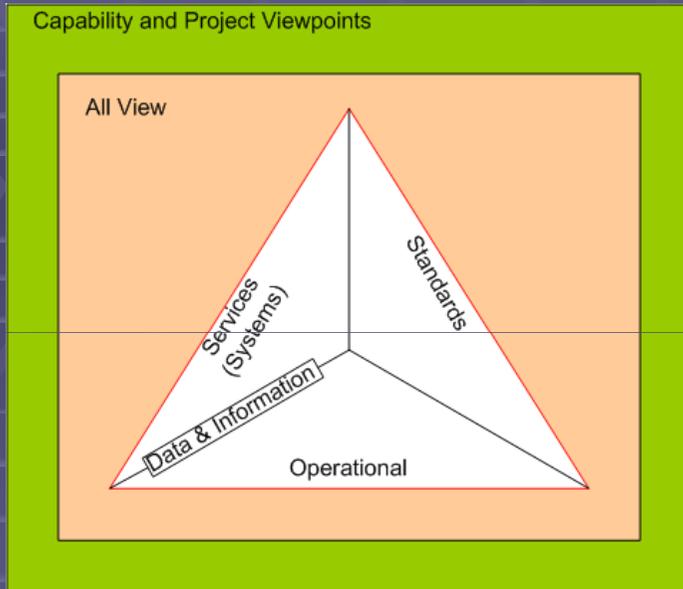
**Comparison to Lower Level Architecture  
Specifications**

# Specification Completeness

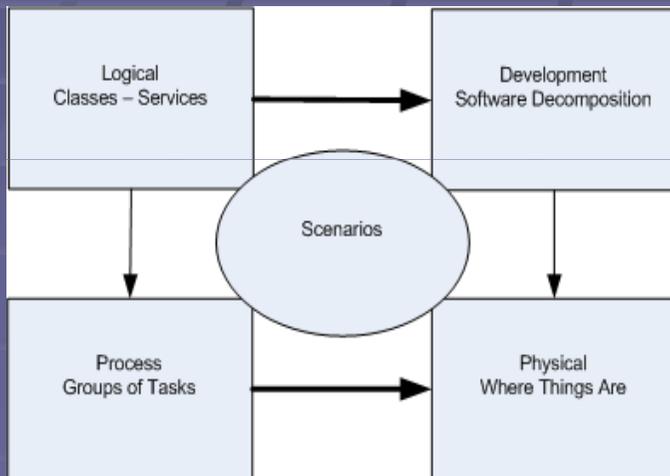
- Assess tailoring
  - Identify architecture specification
  - Analyze tailoring
  - Tailoring guidelines per lifecycle phase
- Assess viewpoint representation
  - Breadth
  - Depth

# Frameworks

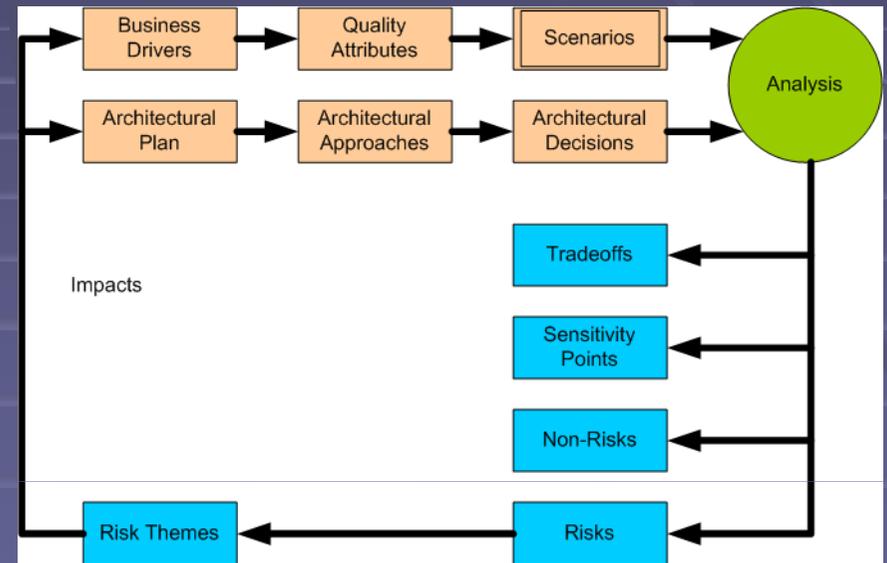
## DoDAF 2.0



4 + 1



## ATAM



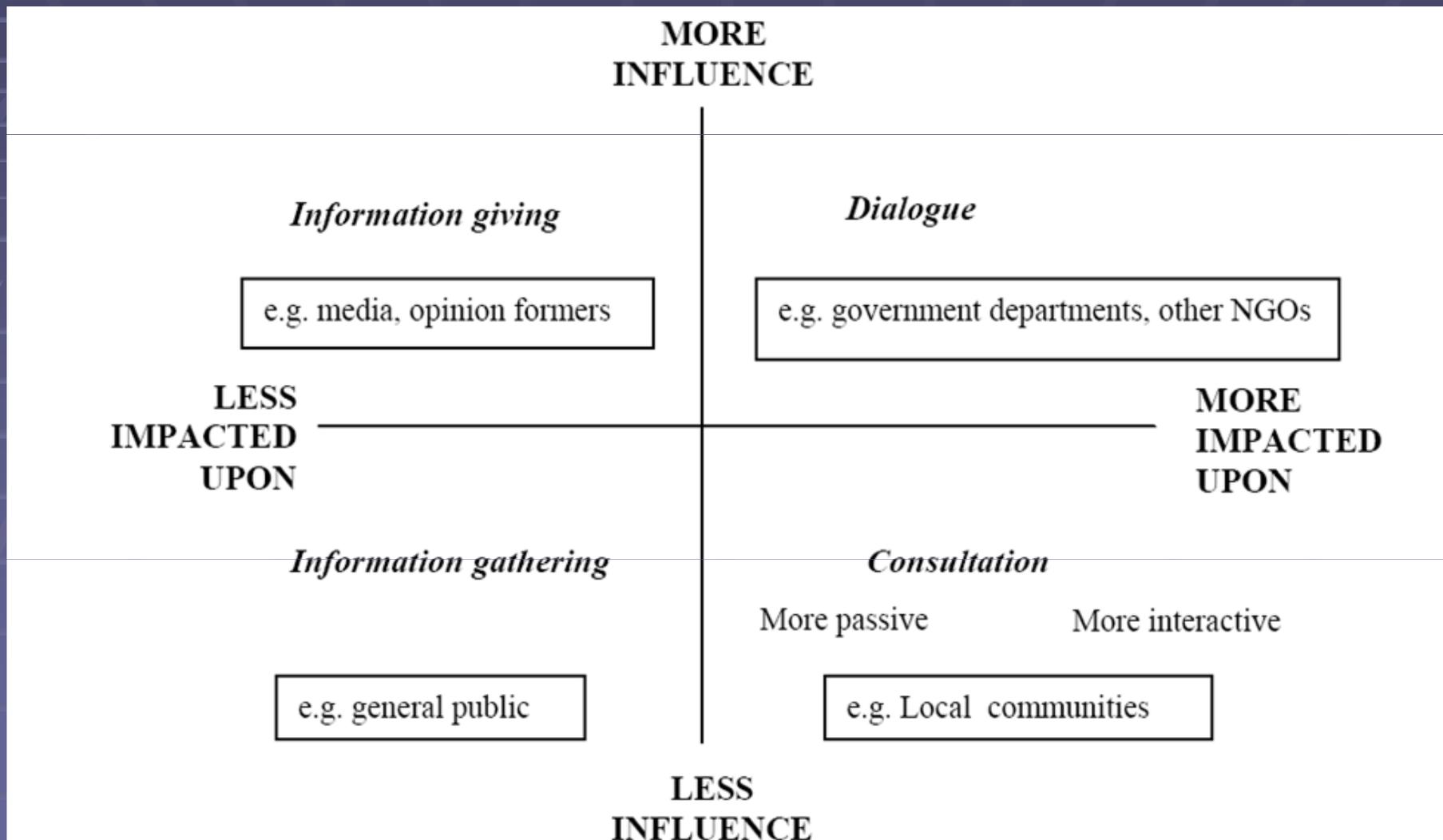
Evaluation

Representation

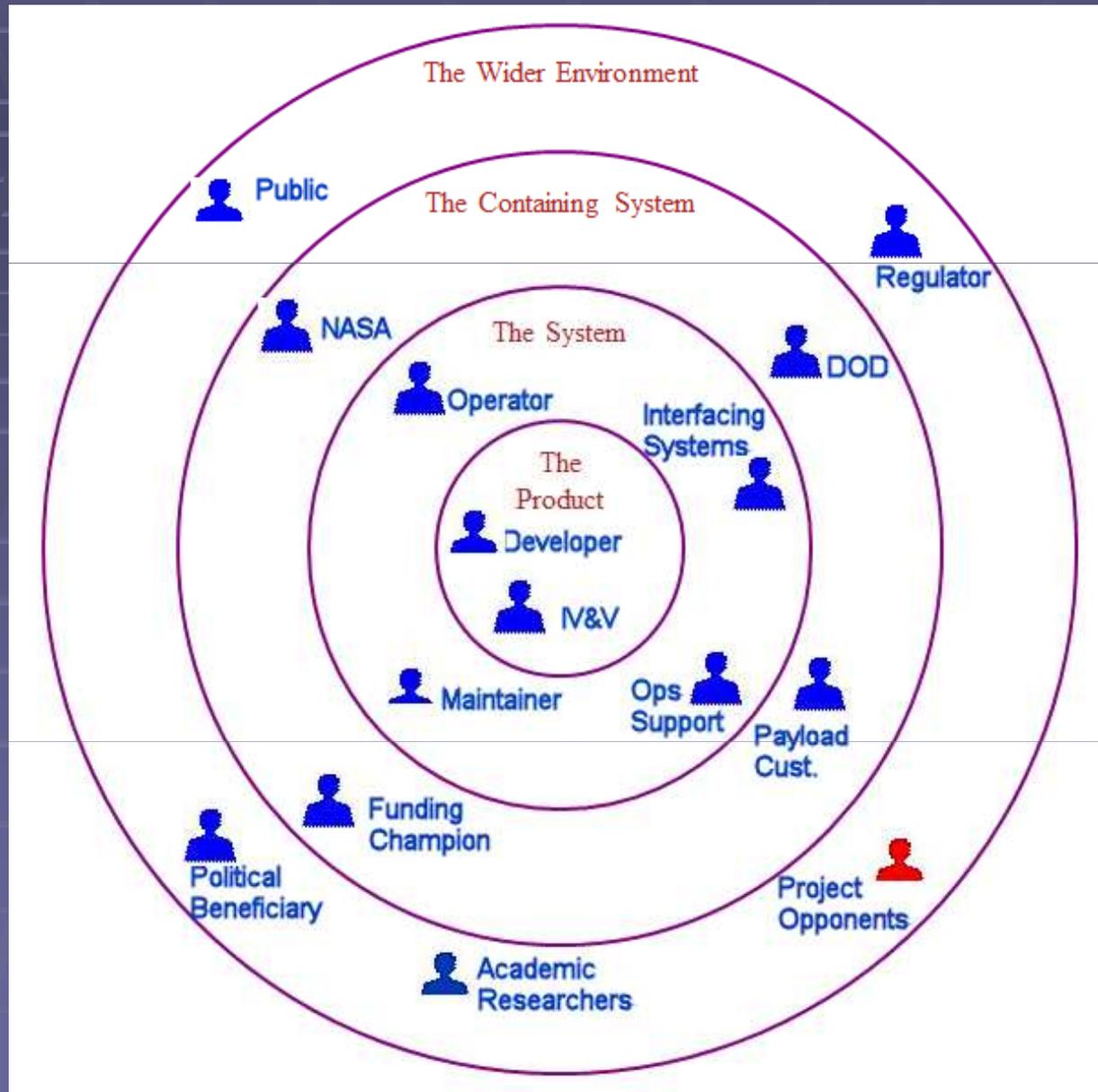
# Stakeholder Analysis

- Basis for any systems engineering activity
- Drives other IV&V (and systems engineering) tasks
- Key elements
  - Identify stakeholders
  - Assess power, influence, interest
  - For key stakeholders
    - Concerns
    - Priorities
    - Risks

# Influence Diagram



# Onion Diagram



# Participation Matrix

<b>Participation Type</b>	<b>Inform</b>	<b>Consult</b>	<b>Partner</b>	<b>Control</b>
<b>Stage</b>				
<b>Needs Assessment</b>				
<b>Planning</b>				
<b>Implement</b>				
<b>Monitoring &amp; Evaluation</b>				

# Key Driving Requirements

- High-level (user) requirements which define mission success
- Flow from stakeholder analysis
- Sources
  - Generic based on mission type
  - Ops concepts/capabilities (CV-1, CV-4, CV-6)
  - Business case, vision

# Attributes

- Requirement – succinct statement
- Stakeholder
- Success criteria
- Relevant scenarios
- Quality measures
- Priorities
- Risks
- Dependencies
- Verification
- Relevant artifacts
- How satisfied
- Issues

# Technical Budgets

- Flows such as data streams, fluids, energy
- Physical characteristics such as weight, volume, moment of inertia
- Operational factors such as workload, risk
- Budget management mechanisms
  - Authority – who's responsible
  - Tracking
  - Identification procedures
- Technical budget levels of specification
  - Operational (logical) level
  - Systems (services, physical)

# Technical Budget Assessment

- Identify budgets managed / should be managed
- Evaluate consistency
- Evaluate feasibility
- Evaluate testability

# Scenario Analysis

- Scenario completeness
  - Flows from stakeholder and key driving requirements analysis
  - Nominal scenarios
  - Maintenance and update scenarios
  - Abort and degraded system scenarios
- Scenario correctness
  - Analytical (decision tree, event tree, activity network diagram)
  - Simulation

# Next Steps

- Test & refine methods on ongoing IV&V project
- Define additional analysis techniques
  - Levels of specification
  - Fault management & redundancy analysis
  - Mapping tasks
  - Safety analysis
- Develop tools