



Calhoun: The NPS Institutional Archive
DSpace Repository

Reports and Technical Reports

Faculty and Researchers' Publications

2011-05-11

Acquisition Risks in a World of Joint Capabilities

Kravchuk, Robet; Owen, Graham; Brown, Mary Maureen

Monterey, California. Naval Postgraduate School

<http://hdl.handle.net/10945/33663>

This publication is a work of the U.S. Government as defined in Title 17, United States Code, Section 101. Copyright protection is not available for this work in the United States.

Downloaded from NPS Archive: Calhoun



Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community. Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943

<http://www.nps.edu/library>



Defense Acquisition in Transition 8th Annual Symposium

Acquisition Risks in a World of Joint Capabilities

Mary Maureen Brown
University of North Carolina at Charlotte

Robert Kravchuk
University of North Carolina at Charlotte

Graham Owen
University of North Carolina at Charlotte



This material is based upon work supported by the Naval Postgraduate School Acquisition Research Program under Grant No. N00244-11-1-0019

Despite the most intense management efforts of the best-trained, best-qualified acquisition professionals; despite vigorous acquisition reform, oversight, and scrutiny, *cost over runs and schedule delays of technological developments remains unacceptably high.*

examines the funding and data interdependencies that exist among MDAPs to determine if it problems may be due to the interdependent nature of joint capabilities.

Join Capabilities and Network Centric Warfare

is an emerging theory of war based on the concepts of nonlinearity, complexity, and chaos. It is less deterministic and more emergent; it has less focus on the physical than the behavioral;

and it has less focus on things than on relationships

Complexity and Joint Capabilities



Nonlinear interaction

Combat forces composed of a large number of nonlinearly interacting parts

Decentralized Control

There is no master “oracle” dictating the actions of each and every combatant

Self-Organization

Local action, which often appears “chaotic,” induces long-range order

Non-equilibrium Order

Military conflicts, by their nature, proceed far from equilibrium. Correlation of local effects is key

Adaptation

Combat forces must continually adapt and coevolve in a changing environment

Collectivist Dynamics

There is a continual feedback between the behavior of combatants and the command structure

- Incomplete Information
- Incomplete Payoff Structures
- Inability to Isolate Cause and Effect
- Unknown Response Options
- Multiple and Conflicting Representations of Environmental Variety
- Perturbations
- Multiple Constraints



Cost Overruns

Schedule Delays

Feature Shortfalls

Applied Research :: 2011

- Identify and characterize the nature of MDAP interdependencies.
- Test to see if performance breaches (specifically, feature changes, cost overruns, and budget shortfalls) correlate with any of the interdependency characteristics.
- Isolate the extent to which acquisition performance breaches (i.e. per unit cost growth, schedule delays, and feature shortfalls) in an upstream program cascade to downstream interdependent MDAP programs.
- Compute overall annual MDAP network metrics of complexity dating back to 2005 to see how they might relate to the total acquisition spending.



Interdependency Dimensions & Data

Resource

- ✓ Financial
- ✓ Data
- ✓ Authority
- Labor
- Information

Direction

- Pooled
- ✓ Sequential
- Reciprocal

Characteristics

- ✓ Joint
- ✓ Stage
- ✓ Turnover
- ✓ Development Estimate

DAES

RDOCs

Damir

SAR



NAVAL
POSTGRADUATE
SCHOOL

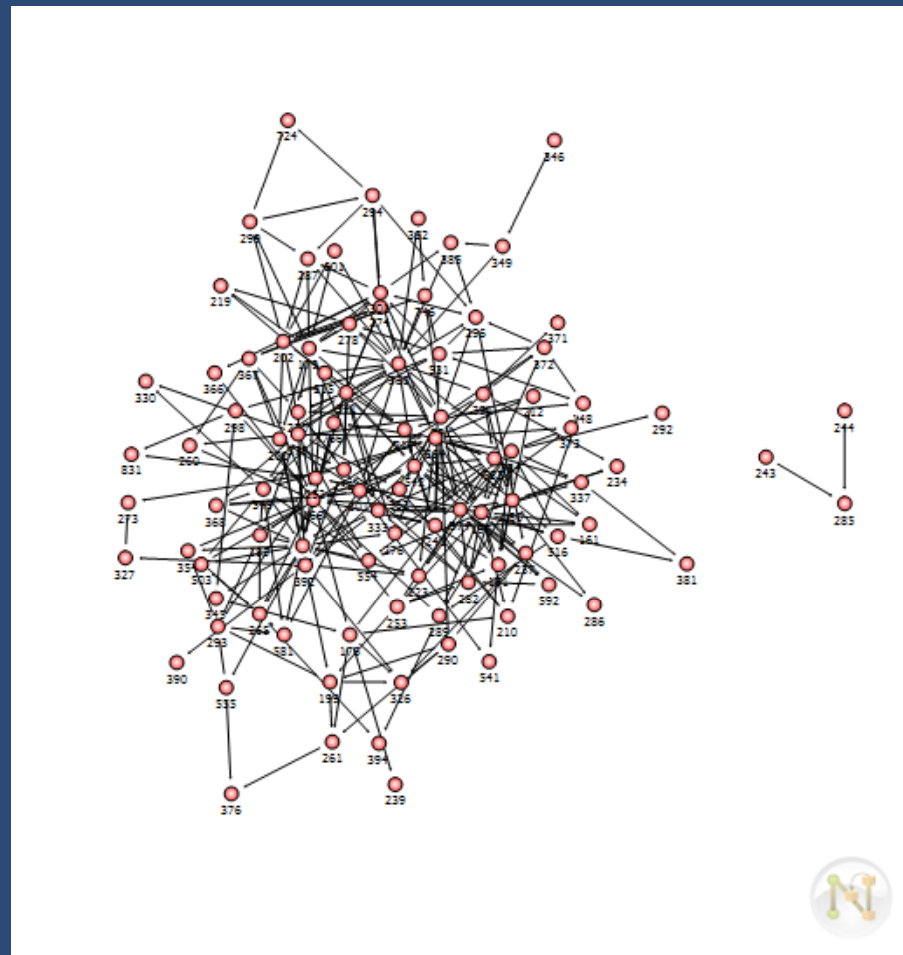
Data Interdependencies

Growing Interdependencies and Growing Complexity

97 Nodes

353 Links

18% Density





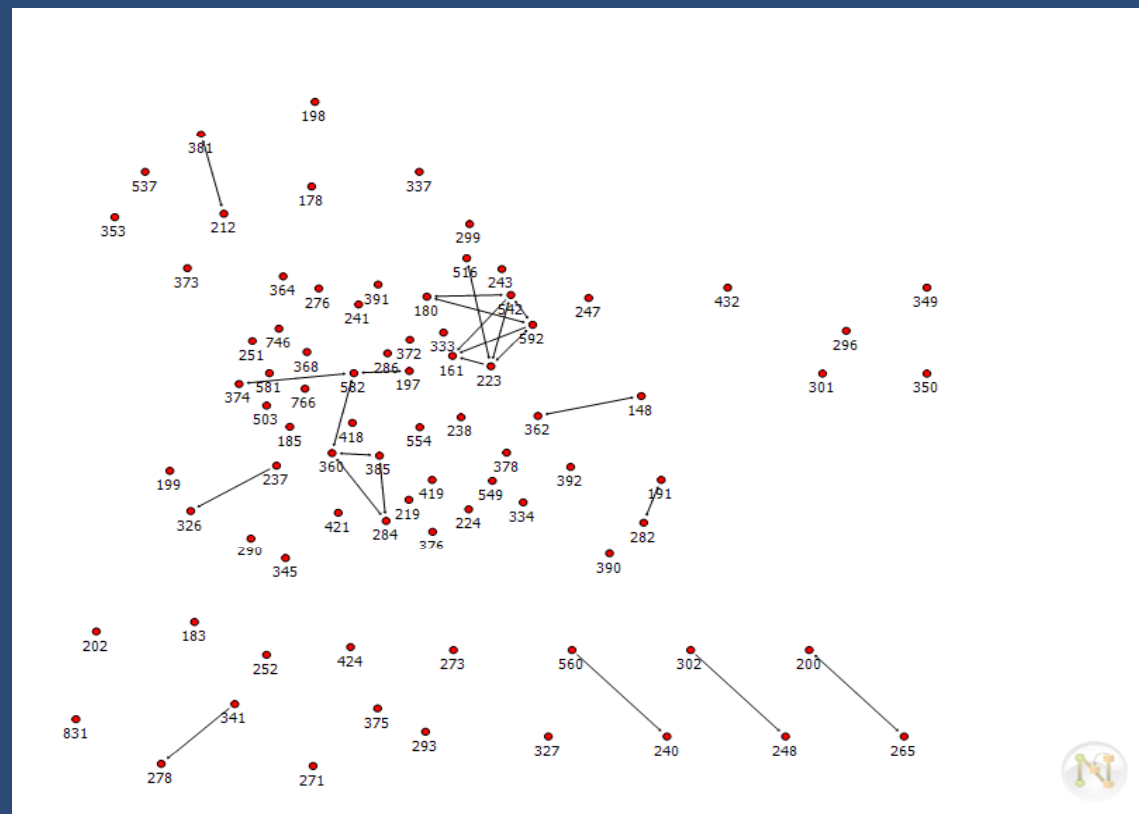
NAVAL
POSTGRADUATE
SCHOOL

Funding Networks

Fiscal Year 2004

39 Links

4% Density





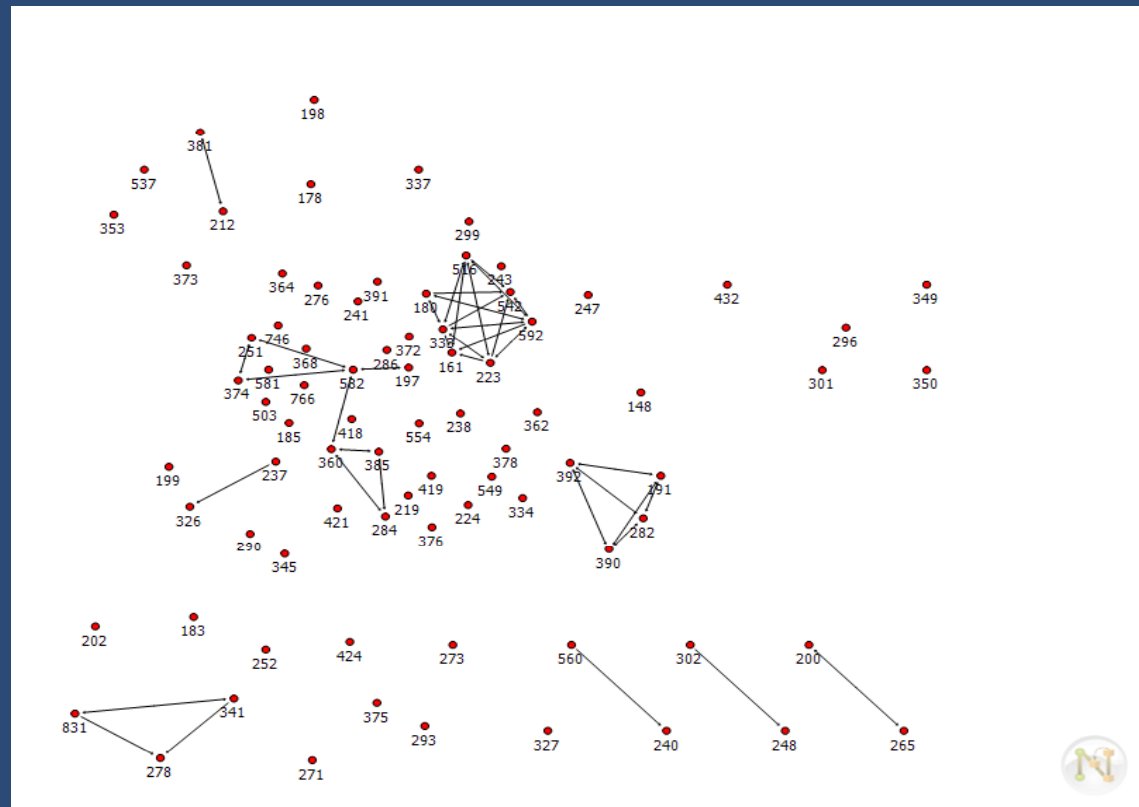
NAVAL
POSTGRADUATE
SCHOOL

Funding Networks

Fiscal Year 2005

64 Links

5% Density





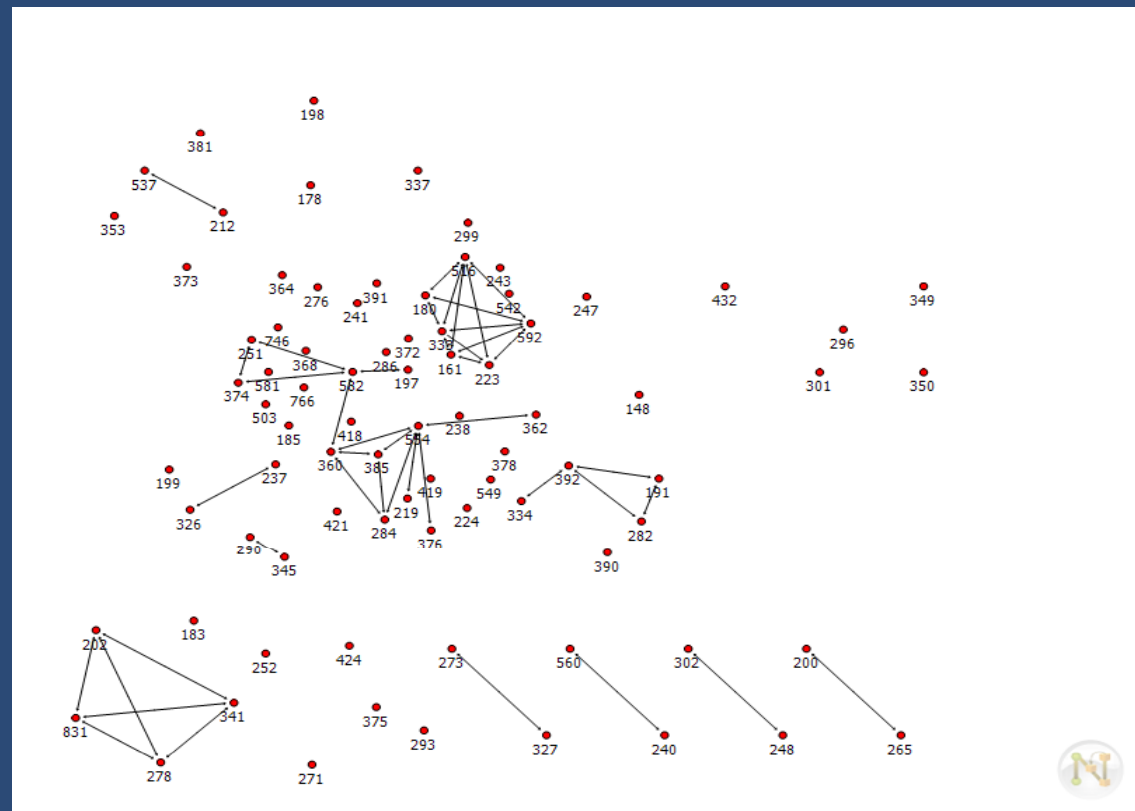
NAVAL
POSTGRADUATE
SCHOOL

Funding Networks

Fiscal Year 2006

87 Links

6% Density



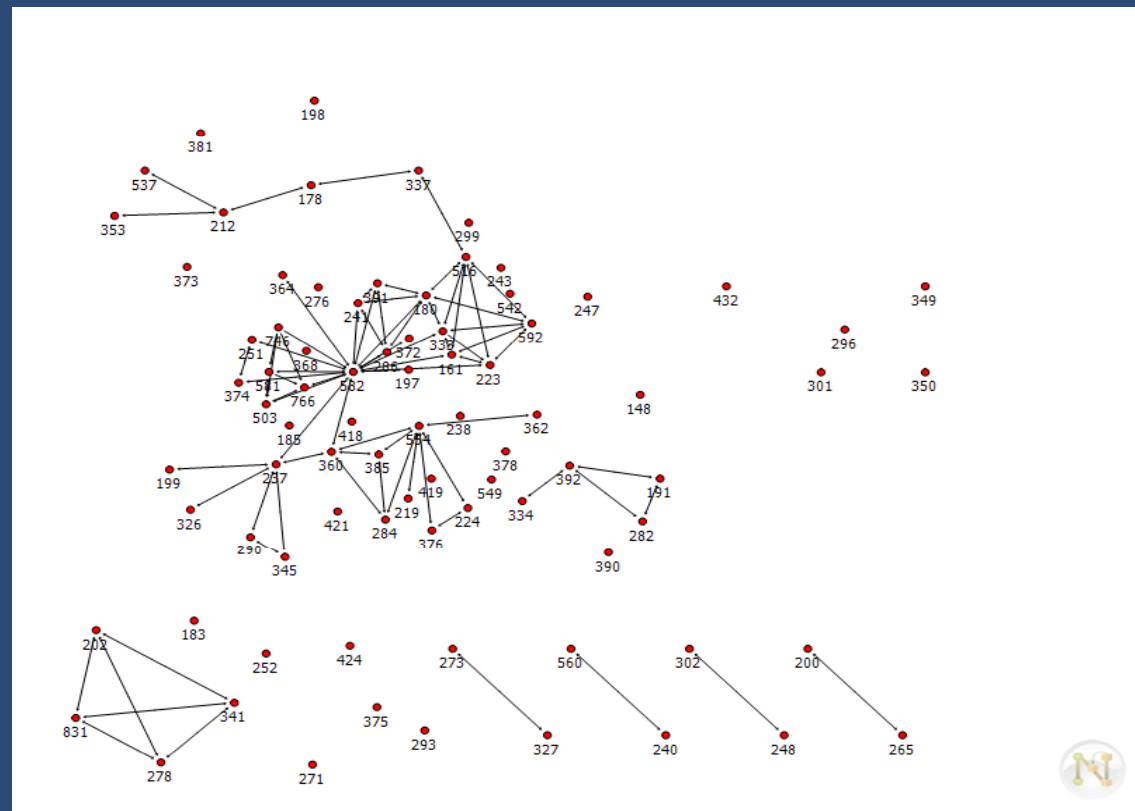


Funding Networks

Fiscal Year 2007

152 Links

19% Density



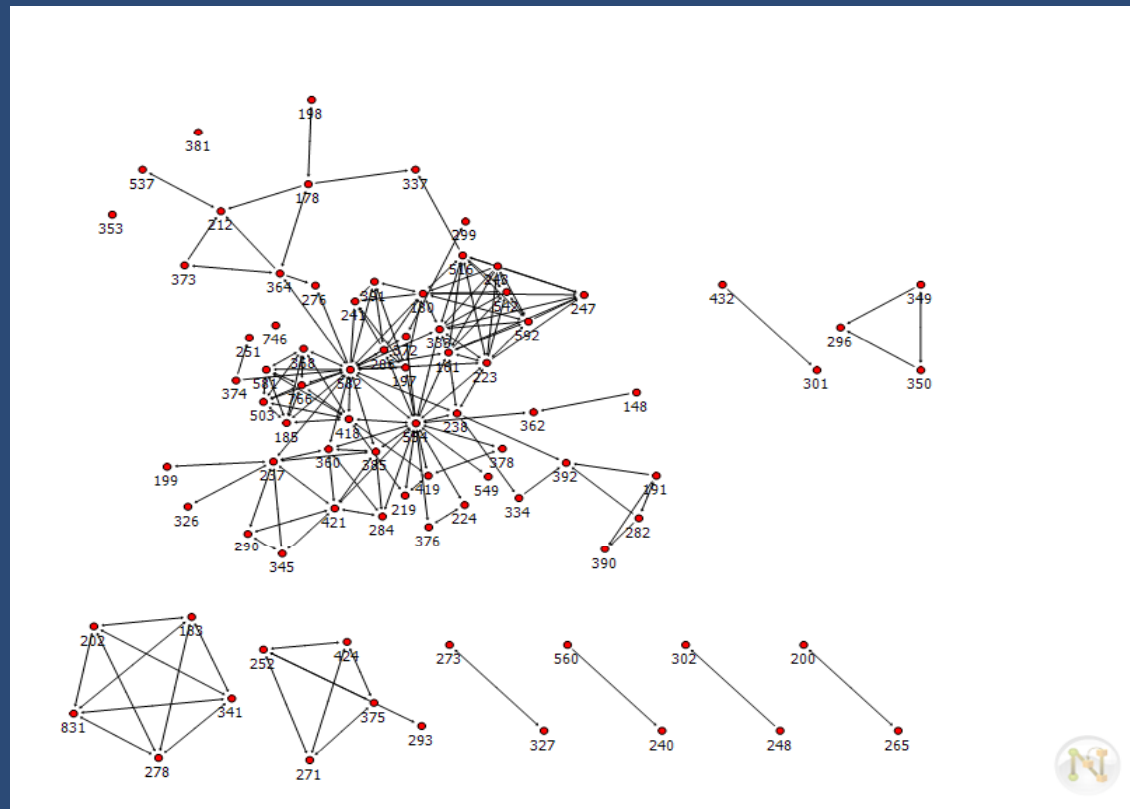


Funding Networks

Fiscal Year 2009

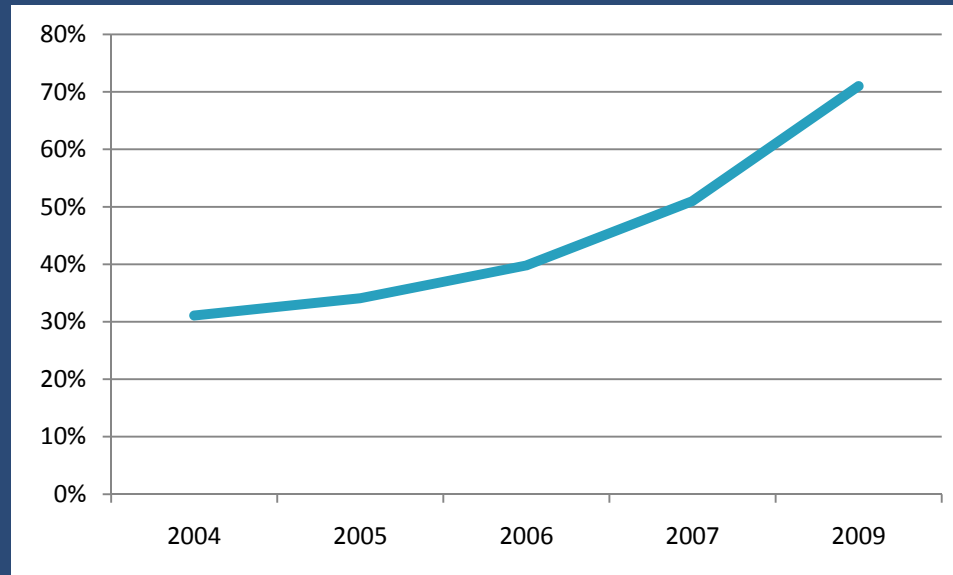
291 Links

23% Density



Funding Interdependencies

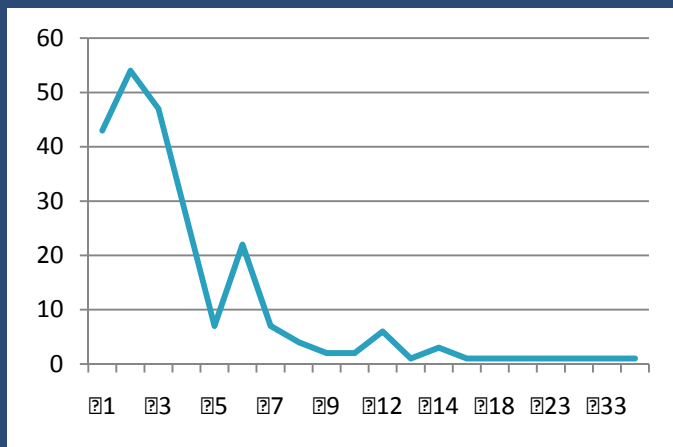
Percent of MDAPs that Share a Funding Account





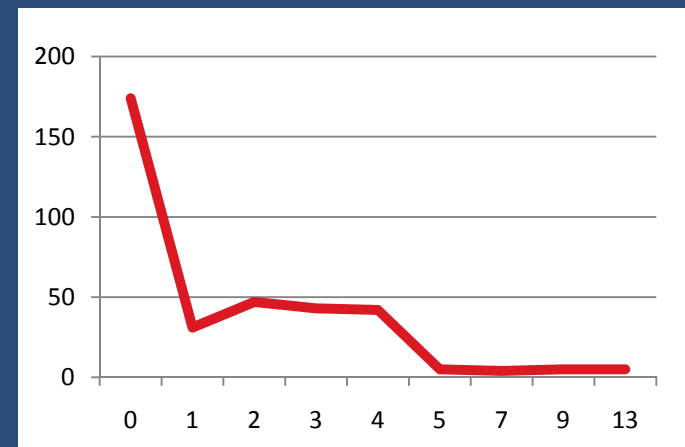
Scale Free Networks

Number of MDAPs



Number of Funding Links

Number of MDAPs

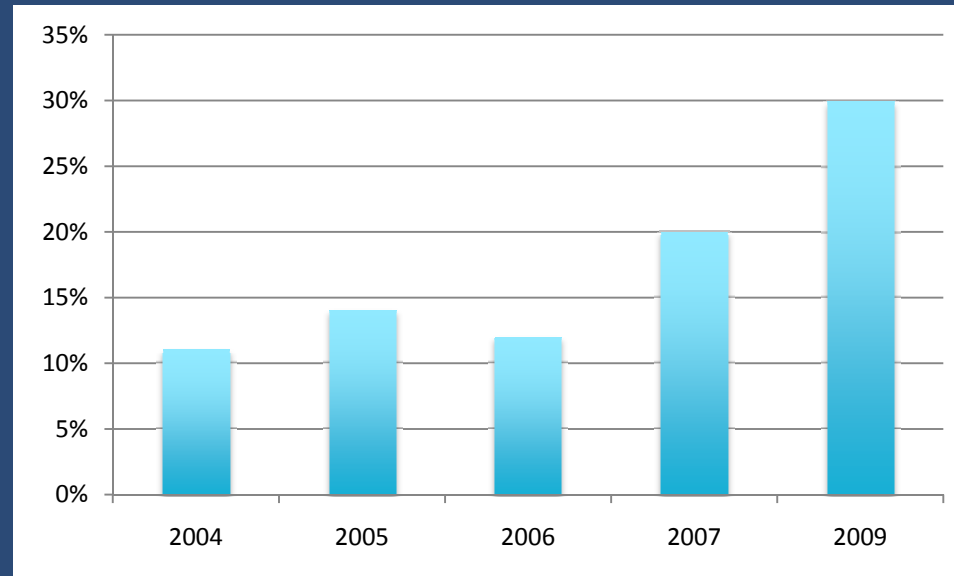


Number of Data Links



Data & Funding Interdependencies

Percent of MDAPs that Share Both Data & Funding Interdependencies



Regression Models

Data Links →
Schedule Cost Variance

Data and Funding Links →
APB Performance Breaches

Joint Status →
Pct Growth from Baseline

Summary of Regression Findings*						
	Pct Growth From Baseline	RDT&E PAUC Pct Growth	APB Perf Breaches	Schedule Cost Variance	Estimation Cost Variance	Engineering Cost Variance
Number of Program Elements						
Total Number of Signatures				-		
Number of Data Links				+		
Joint Status	+					
Both Data and Funding Links		-	+			
Funding Links Only	-					
*Controlling for Development Estimate, Turnover, Stage						

First & Second Order Cascades

Summary of First Order Cascades

+ = Positive Cascade
 - = Negative Cascade
 x = Positive Cascade for MDAPs that experience Greater than 13% Growth
 z = Negative Cascade for MDAPs that experience Greater than 13% Growth

Year	Pct Growth From Baseline	RDT&E PAUC Pct Growth	APB Perf Breaches	Schedule Cost Variance	Estimation Cost Variance	Engineering Cost Variance
Funding Interdependencies						
2005						
2006	+			+		
2007	+	+	+ x	x		
2009	+	+ x	-	-	-	-
Data Interdependencies						
2006	x	x		-		- z
2007	x	x	+			+
2009	x	x	+	-	- z	- z
Both Data and Funding Interdependencies						
2006					-	+
2007			-			
2009	x	x			+	

Second Order:

PAUC Pct Growth

>13 PAUC Pct Growth

>13 Pct Growth From Baseline

1. *Growth in Complexity*

2. *Data & Funding Networks are Scale Free*

3. *Regressions*

Data Links → Schedule Cost Variance

Data and Funding Links → APB Performance Breaches

4. *Cascades*

Data Links

RDT&E PAUC Pct Growth

APB Perf Breaches

Engineering Cost Variance

Funding Links

RDT&E PAUC Pct Growth

Pct Growth From Baseline

5. *Tipping Point*

Pct PAUC Growth

Pct Growth From Baseline

- ✓ Incorporate 2010 Data
- ✓ Test the Influence of Dyadic Analysis as a Measurement Tool
- ✓ Test the Influence of Structural Equation Modeling as a Measurement Tool