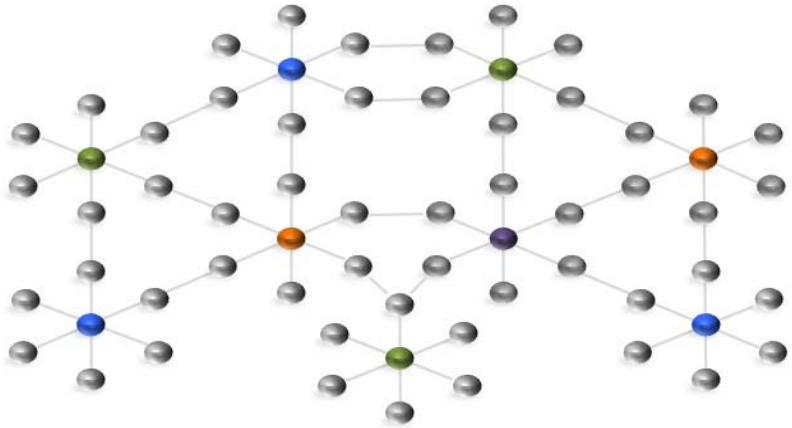
Acquisition in a World of Joint Capabilities:

Complex Contagion



Research Goals

1. Identify the extent to which exposure to upstream program performance affects downstream programs

1. Identify the extent to which interdependent activities experience turbulence over time

1. Identify hazard and survival rates relating to Program Performance

Better Understanding of Costs of Interdependencies

Improved Cost, Schedule, Performance Estimates

Key Terms

Acquisition as a Complex System

- A relational property among three or more **interdependent** entities

- that demands adaptation and adjustment when state changes occur in any one of the entities

DAG - Chapter 4 was written employing 24 different organizations and 149 participants

Key Terms

Interdependency is defined as dependence on an external source for:

- data,
- money,
- staff,
- facilities, or
- requirements

beyond the normal acquisition workflow

Key Terms

Interdependency Research is Fragmented & Contradicting:

- lead to cost and schedule growth due to adaptation requirements

- result in cost savings, improved response rates, greater capabilities

Complex Behavior

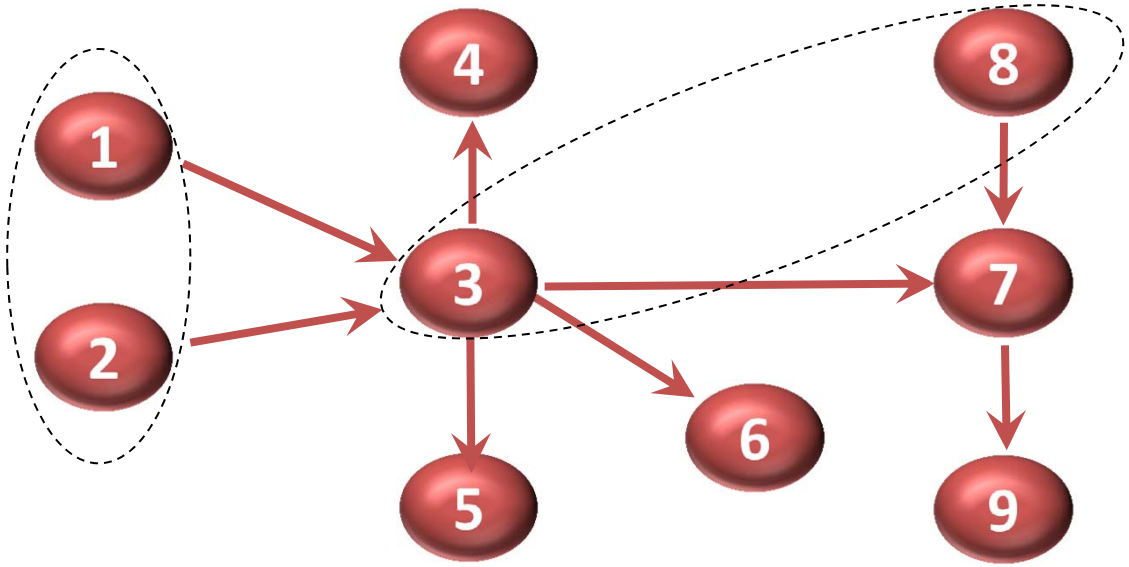
- Nonlinear
- Emergent
- Self-organization
- Adaptive Capacity
- Collective Behavior
- Contagion

Key Terms

Complex Contagion –phenomenon in networks where multiple sources of exposure affect a change in the program's performance state.

Exposure Rates
Susceptibility Rates
Mean time in Growth

Thresholds
Survival Rates
Mean Time to Growth



Methods

Examined 2 MDAP Networks

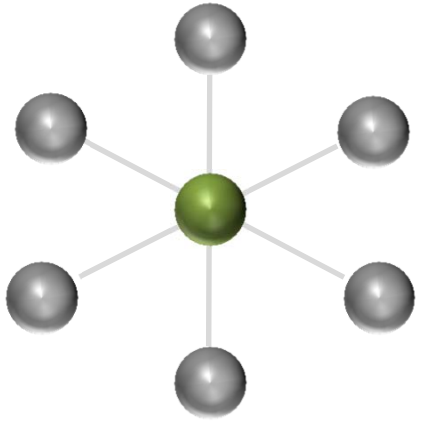
Shared Funding Sources

Funding Networks were established through the track-to-budget field of the SAR. Any given program element (R Doc)funds multiple MDAPS

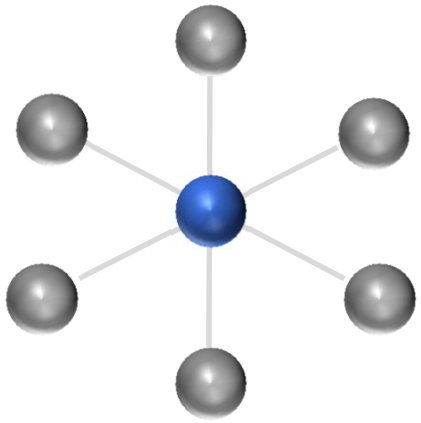
Data Networks

established through a 2009 call to program managers to identify their critical interdependencies.

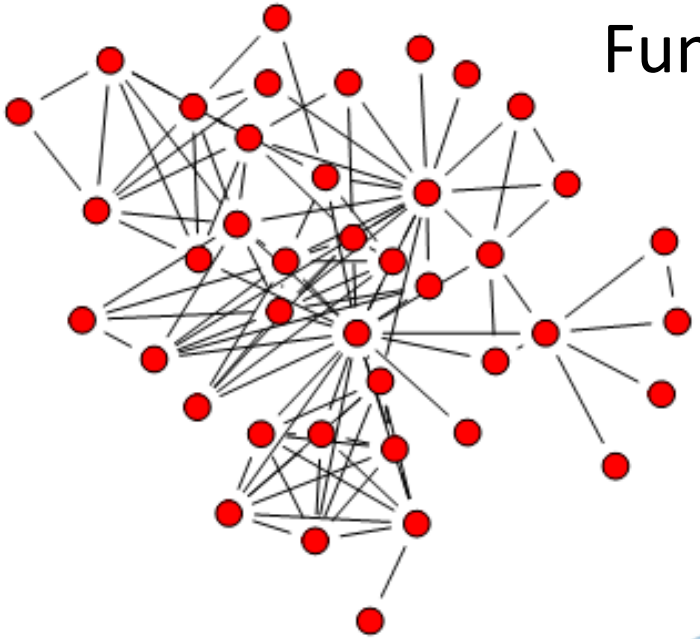
Funding Networks



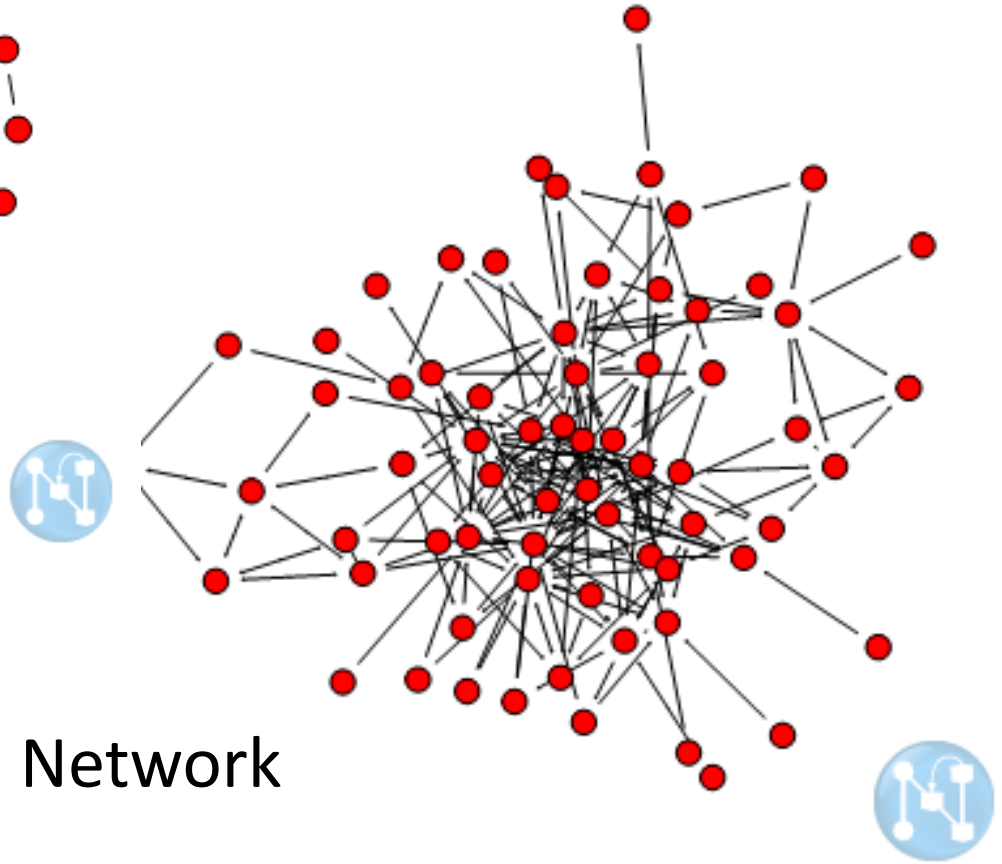
Data Networks



Methods



Funding Network 2012



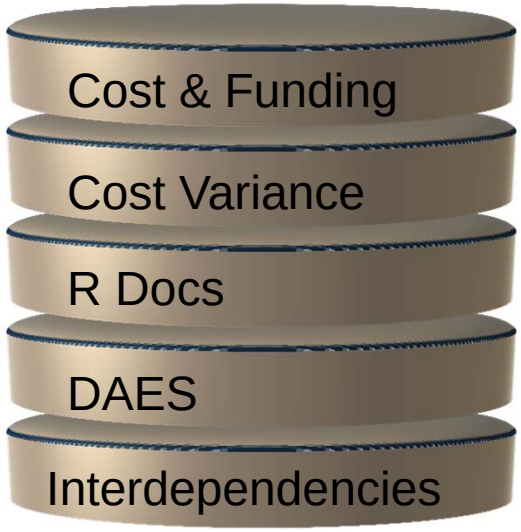
Data Network

Methods

1. Examined performance over the 2005 - 2012 time period
   - Funding network connections vary over time
   - Data network connections stable over time

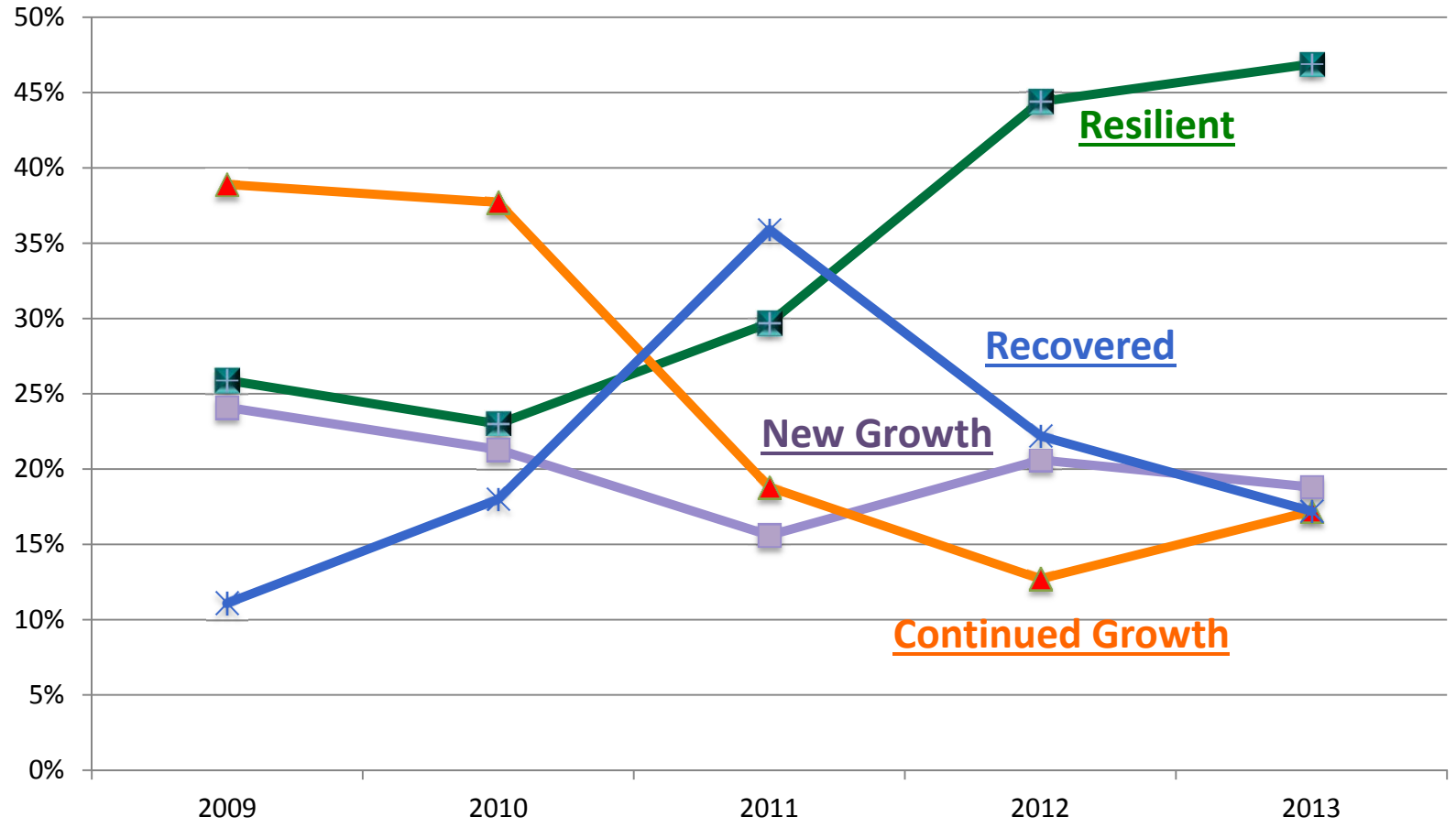
2. Measures
   - PAUC cost growth
   - Cost Variance
   - Number of Connections
   - Exposure rates

3. Unit of Analyses
   - Network Level
   - MDAP level



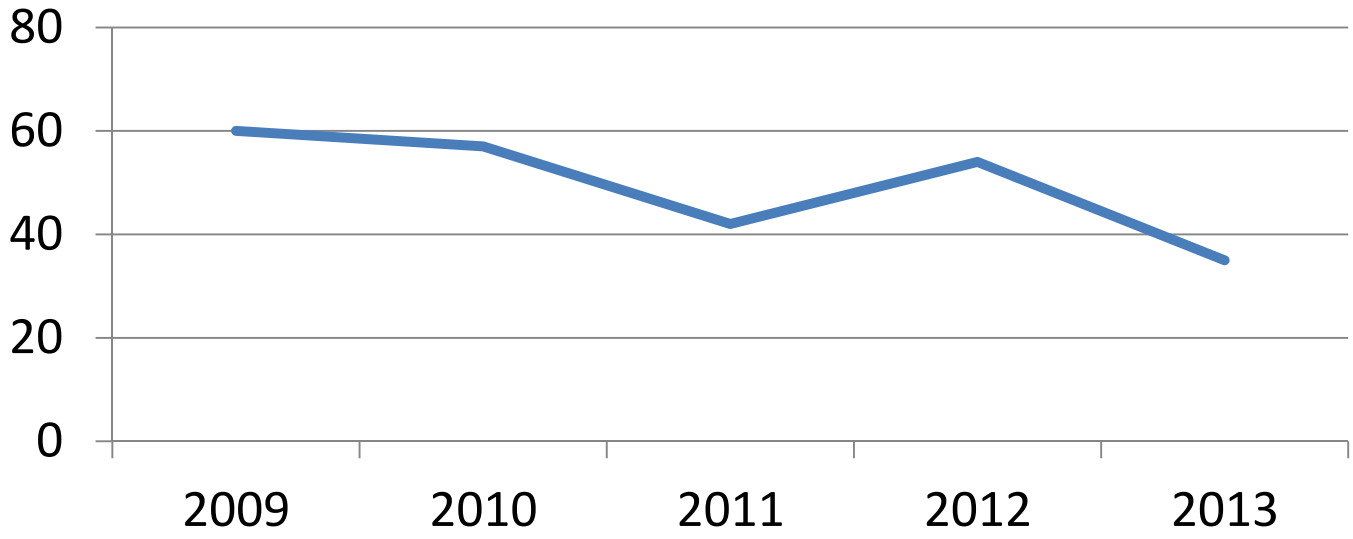
Descriptives

Average Percent of programs in growth at any point in time = 40%



Descriptives

- Average Annual PAUC Growth Rate = 8%
- Average Recovery Rate = 2.4 years
- Funding Network average number of partners = 4
- Data Network average number of partners = 5.6



Average Exposure Rate for Both Networks (Pct Partners Growth):

Snapshot Findings

Significant Network Level Findings

(Exponential Random Graph Modeling)

Funding Network:

- Increasing complexity over the years
  - Preferential attachment
- Preference for forming cohesive, interlocking relationships

Data Network:

- Preferential Attachment
- Is ***four times more likely to exchange data*** with partners than would normally be expected of a network of this size
  - A preference for tight closed relationships

Snapshot Findings

Contagion Results

(Generalized Linear Models Maximum Likelihood Estimation)

Funding Network:

- Exposure did not provide predictive capabilities
- Number of Partners did

Data Network:

- Contagion was apparent and statistically significant

Future Efforts

1. Continue to Monitor MDAPs
2. Expand to Include Contracts Network
3. Expand to Include MAIS
4. Expand to Include other Federal Agencies
5. Capture and Test Different Measures:

   Recovery Rates, Threshold Rates, etc