Application of a Network Perspective to DoD Weapon System Acquisition: An Exploratory Study

Major Ryan D. Mantz (author)
Dr. Nancy C. Roberts (presenter)

Reference

- Mantz, R.

 http://theses.nps.navy.mil/06Dec_Mantz.pdf

Research Question

- To what extent can the weapon systems acquisition process by characterized as a network?

What is a network?

- A network is a set of actors connected by a set of ties (Borgatti and Foster, 2003, p. 992).

- A network is persistent relationships among actors (Knoke and Kuklinski, 1991; Marsden and Lin, 1982).

- A network is a stable pattern of social relations between interdependent actors which takes shape around policy problems and/or programs (Kickert, Klijn, and Koppenjan,1997, p. 6).
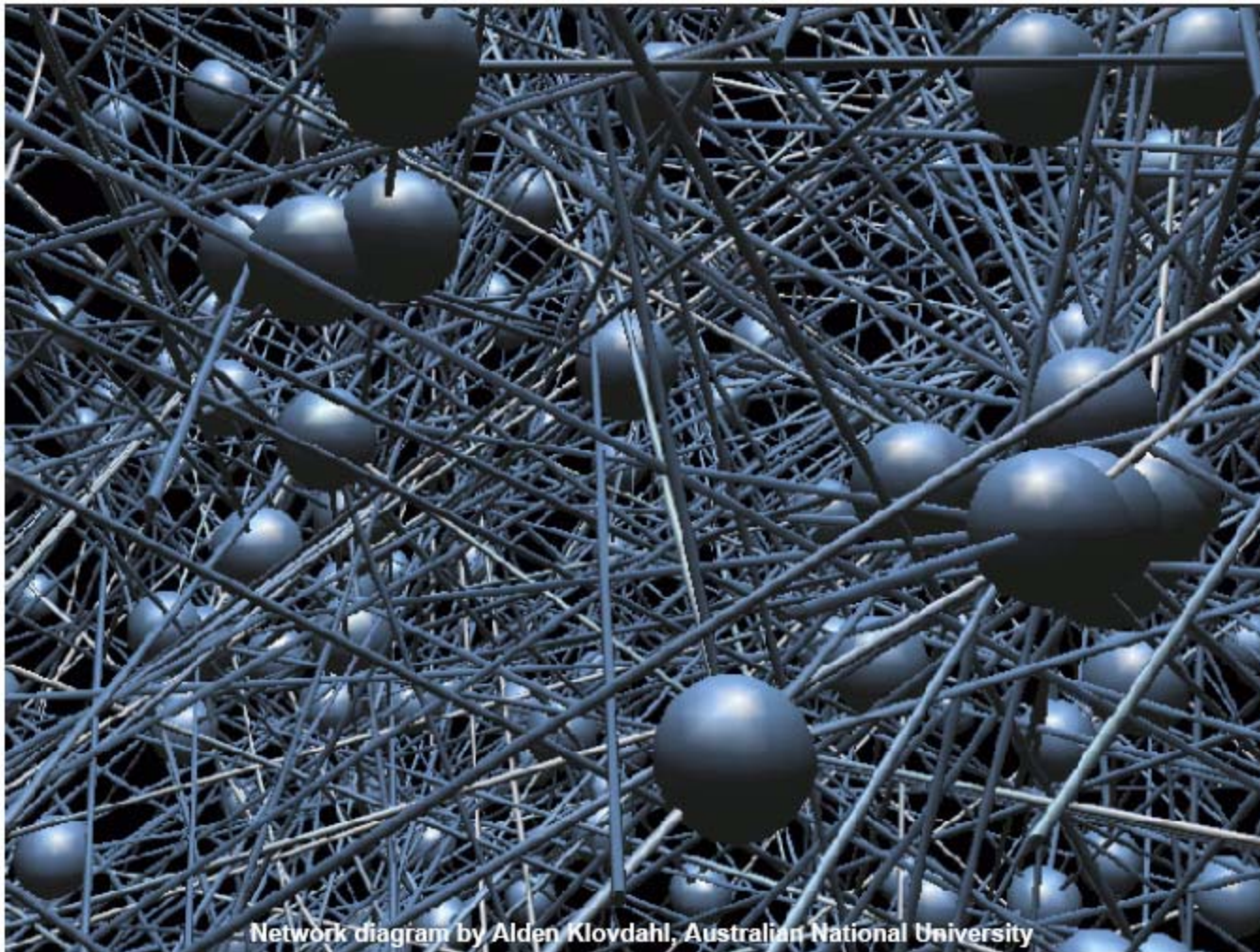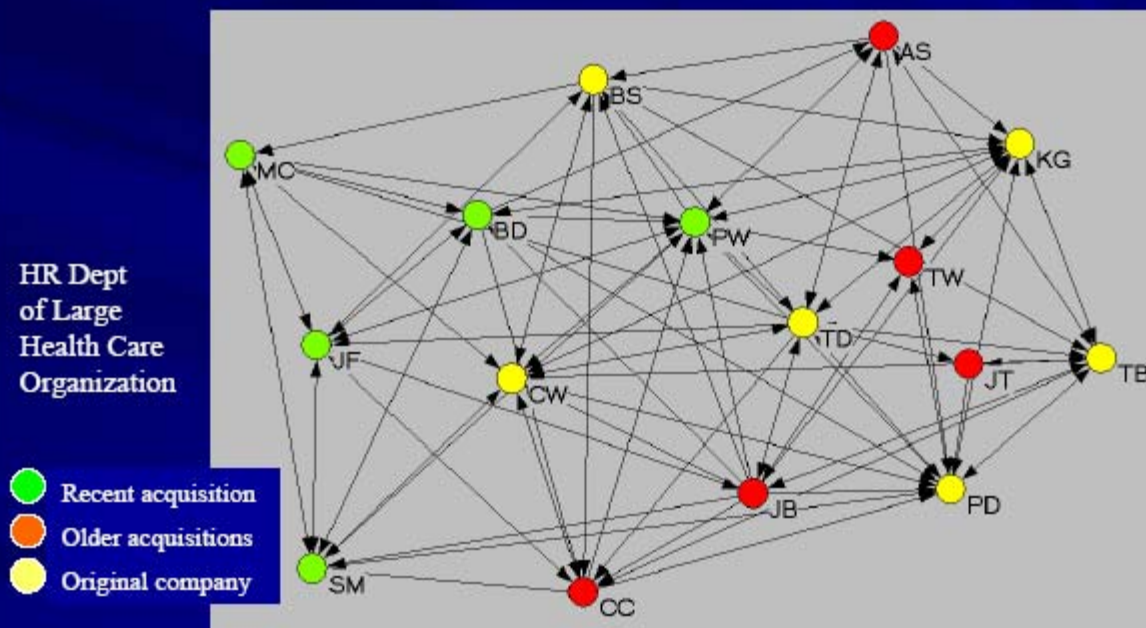
Network diagram by Alden Klovdahl, Australian National University

Simple Answers

Who you ask for answers to straightforward questions.

HR Dept of Large Health Care Organization

Recent acquisition
Older acquisitions
Original company

Cross, R., Borgatti, S.P., & Parker, A. 2001. Beyond Answers: Dimensions of the Advice Network. *Social Networks* 23(3): 215–235
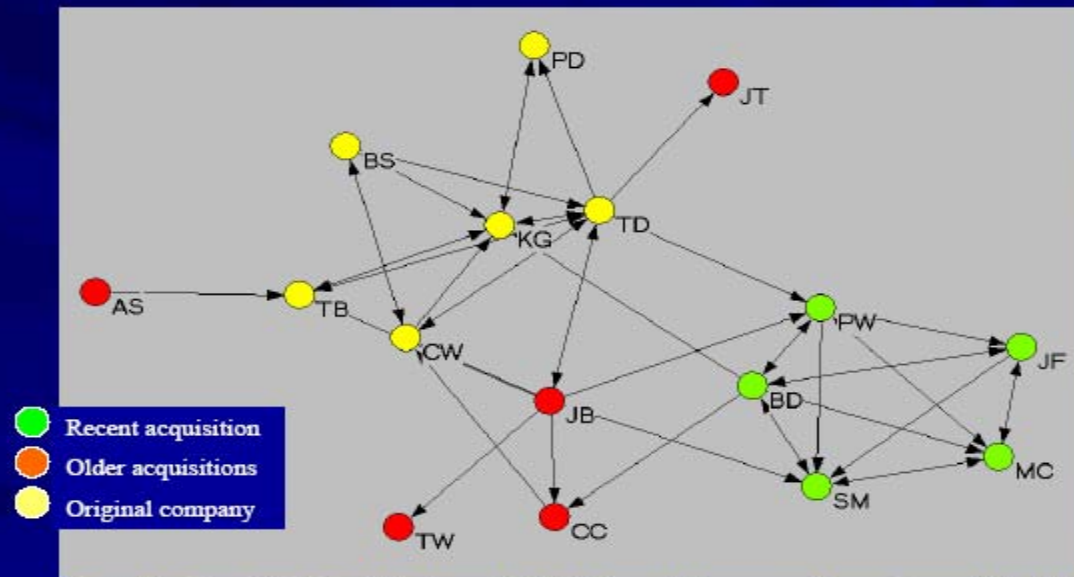
Presentation @ National Academy of Sciences

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Problem Reformulation

Who you see to help you think through issues

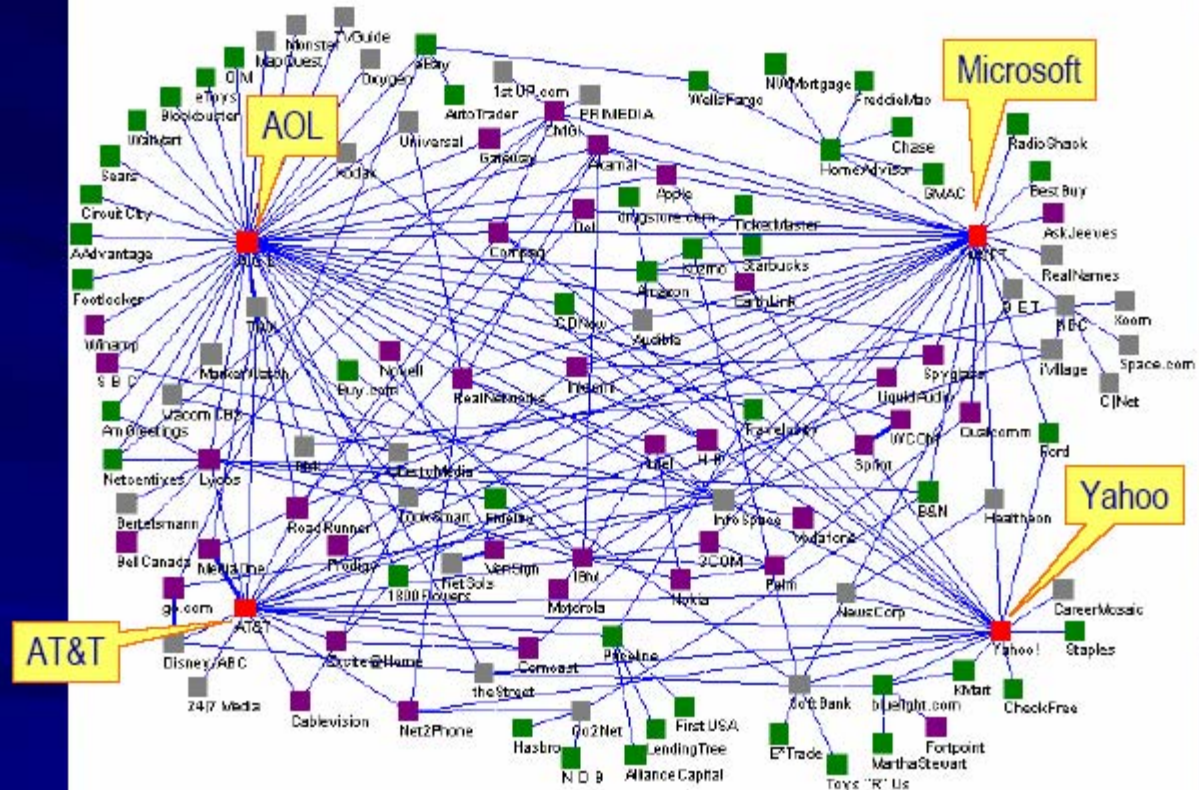Recent acquisition
Older acquisitions
Original company

Cross, R., Borgatti, S.P., & Parker, A. 2001. Beyond Answers: Dimensions of the Advice Network. *Social Networks* 23(3): 215-235

Presentation @ National Academy of Sciences

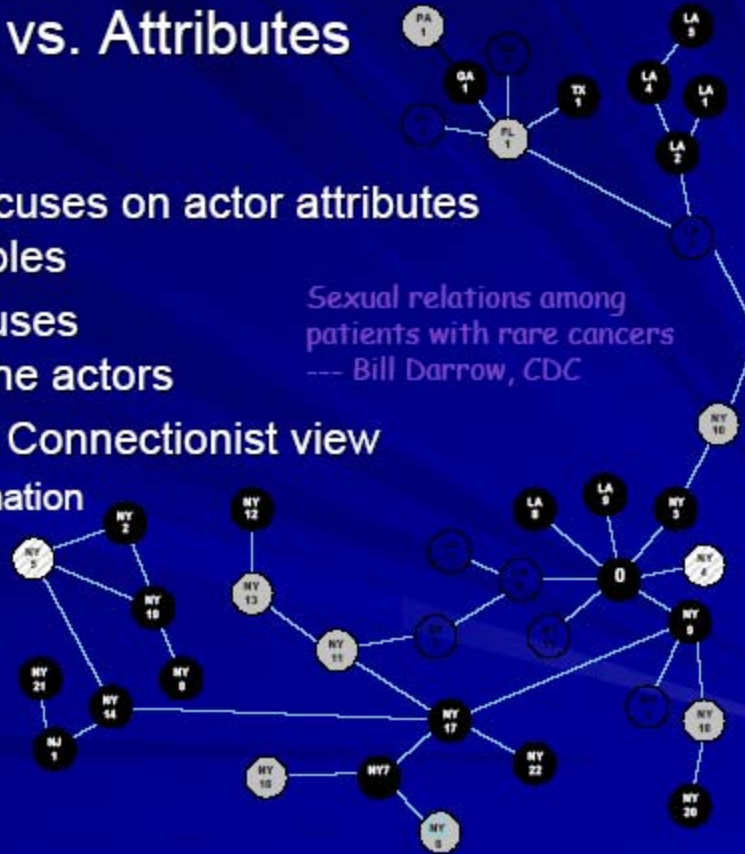© 2005 Steve Borgatti

What is unique about a network?

- Relationship is the unit of analysis.

- Structure of network is an important determinant of behavior—provides opportunities and constraints for individual social actors.

Program Networks—
the Focus of this Study.

Program Networks in the Acquisition Phases and Milestones for Weapon Systems: (Department of Defense, 5000.1, 2003)
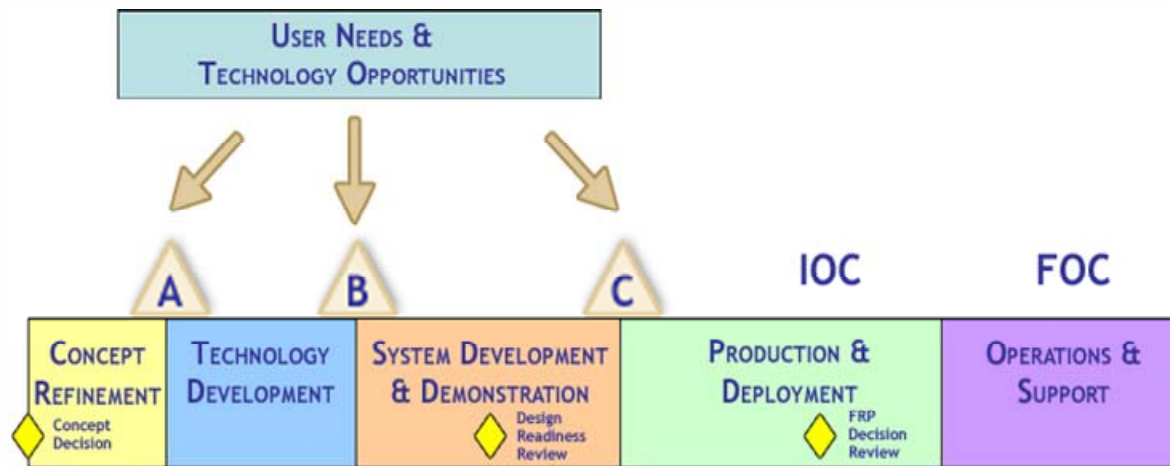
Research Design: Phase I

- The Assistant Secretary of the Air Force (Acquisition Integration), SAF/AQX, formed the Acquisition Process Action Team (APAT) in Spring 2005 to describe the set of processes Air Force weapon systems were using to accomplish their missions. The goals were to baseline the acquisition processes and form a common language and basis of measurement across the stakeholders in the acquisition process. The group focused mainly on the defense acquisition system itself and its interactions with JCIDS and PPBE.

- Lt. Col. Michael Paul and Major Ryan Mantz, SAF/AQXA, led the APAT effort. A group of consultants from the Center for Reengineering and Enabling Technologies (CRET) provided the methodology and manpower to support the data-gathering effort. Mr. Mike Wilhelm, CRET, was instrumental in managing the effort.

- In order to assess the interactions within weapon system acquisition, the APAT used an enterprise process-model approach. A process model offers a look across the many disciplines within weapon system acquisition to understand what behaviors the team is using to solve the problem.

- Another important aspect of a process model is to describe the relationship between the steps and other actors. In essence, the process model is a look at the interdependencies within the acquisition system. Each step in the process is described in terms of inputs, outputs, triggers, and mechanisms. A source of those characteristics is also described. This allows the model to describe interaction with other steps in the process.

Research Design: Phase II

- **Exploratory Study Question:**
  To what extent can the weapon systems acquisition process be characterized as a network?

- **Begin with descriptions of activities, relations, and interdependencies identified in Phase I APAT data.**

- **Transform descriptions into relational data sets (binary, symmetric) and enter them into matrices by relational type—e.g. Concept Refinement Network. (Data are available in Appendices).**

- **Data Analysis: UCINET software; degree centrality measures.**

If a network, we should find at least three elements:

- **Multiple, independent social actors** from government, non-government, and private agencies pursue their separate goals. Within government, there is no single actor and no unifying goal. (Scharpf, 1978).

- At the same time social actors **create relations and interdependencies** among one another as they **exchange resources, capital, personnel and knowledge** to accomplish their individual objectives in addressing some policy, program, or issue (Jones, Hesterly & Borgatti, 1997; Klijn,1997; Powell, 1990).

- Through their **repeated interactions,** they **begin to collaborate**, develop **lasting relationships**, and ultimately come to understand who they can **trust** and who they cannot trust (Klijn ,1997; Jones, Hesterly and Borgatti,1997).

Results:

- **Yes, there are multiple, independent actors who form around a project in the APAT Data (Matrices in Appendix B).**

Matrix Format

	(2) MAJCOM Requirements	(3) PEO	(4) Program Office	(5) Milestone Decision Authority (MDA)	(6) Congress	(7) AFMC/LG
(2) MAJCOM Requirements	0	0	1	1	0	1
(3) PEO	0	0	1	1	1	0
(4) Program Office	1	1	0	1	0	1
(5) Milestone Decision Authority	1	1	1	0	1	0
(6) Congress	0	1	0	1	0	0
(7) AFMC/LG	1	0	1	0	0	0
(8) MAJCOM LG	1	0	1	0	0	1
(9) OSD (AT&L)	0	1	0	1	1	1
(10) Contractor	1	1	1	0	1	1
(11) Sub Contractor	0	0	1	0	1	0
(12) Vendor	0	0	0	0	0	0
(13) MAJCOM Budget	1	1	1	0	0	1
(14) SAF/AQX	0	1	1	0	0	0
(15) SAF/FM	0	0	0	0	0	0
(16) AF/XP	0	0	0	0	0	0
(17) OSD(C)	0	0	0	0	1	0
(18) Center Contracting (PK)	0	0	1	0	0	0
(19) Center FM	0	0	1	0	0	0

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Results

- **Yes, there are at least three relationships and interdependencies that exist within the three phases of the weapons acquisition process in the APAT data:**

    – **"Concept Refine" relations and interdependencies.**

    – **"Technology Development Planning/Milestone" relations and interdependencies**

    – **"System Development and Demonstration" relations and interdependencies**

Concept Refinement Relations and Interdependencies
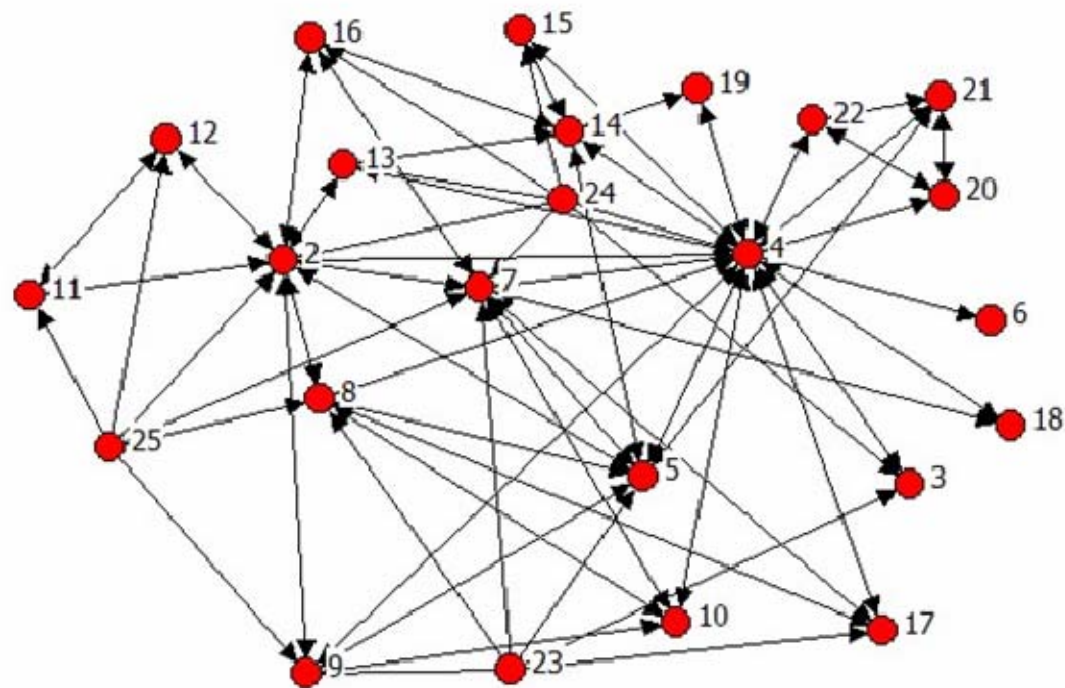
Technology Development Planning/Milestone Relations and Interdependencies
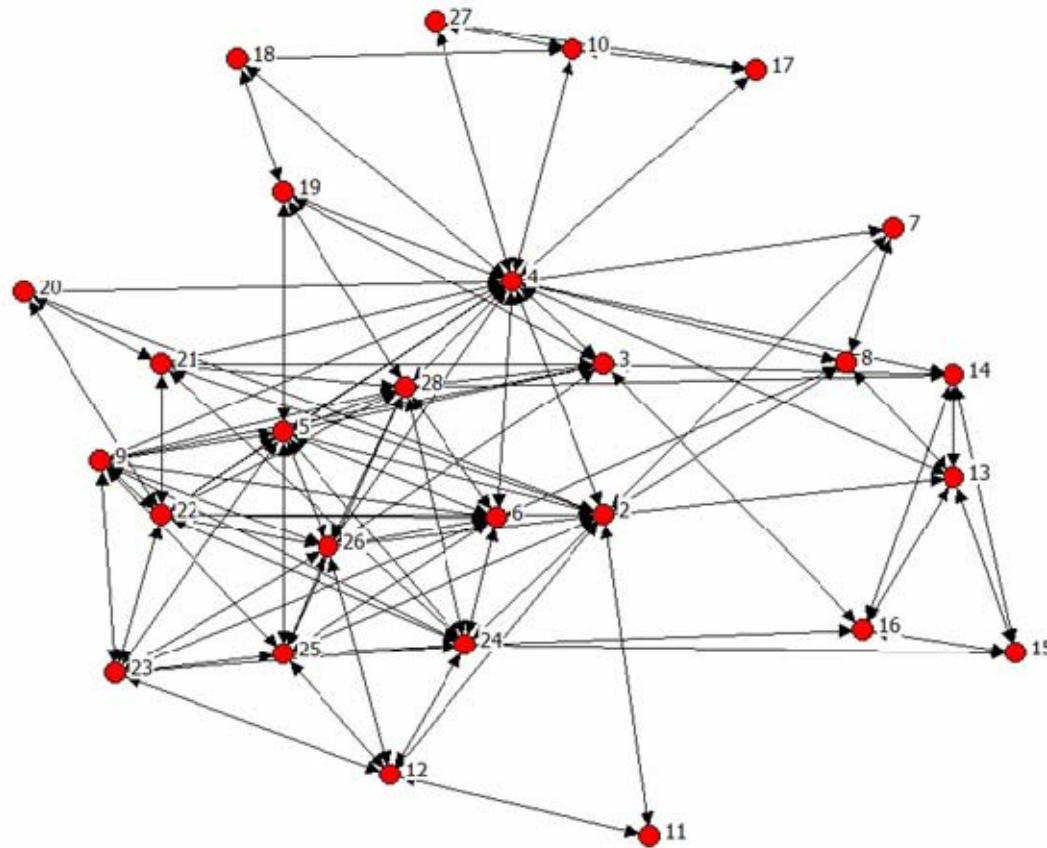
System Development and Demonstration Relations Interdependencies

Results

- **Yes, there are lasting, stable, relationships among social actors among the APAT data.**

Results

Table 8. Core Network during Early Acquisition Phases

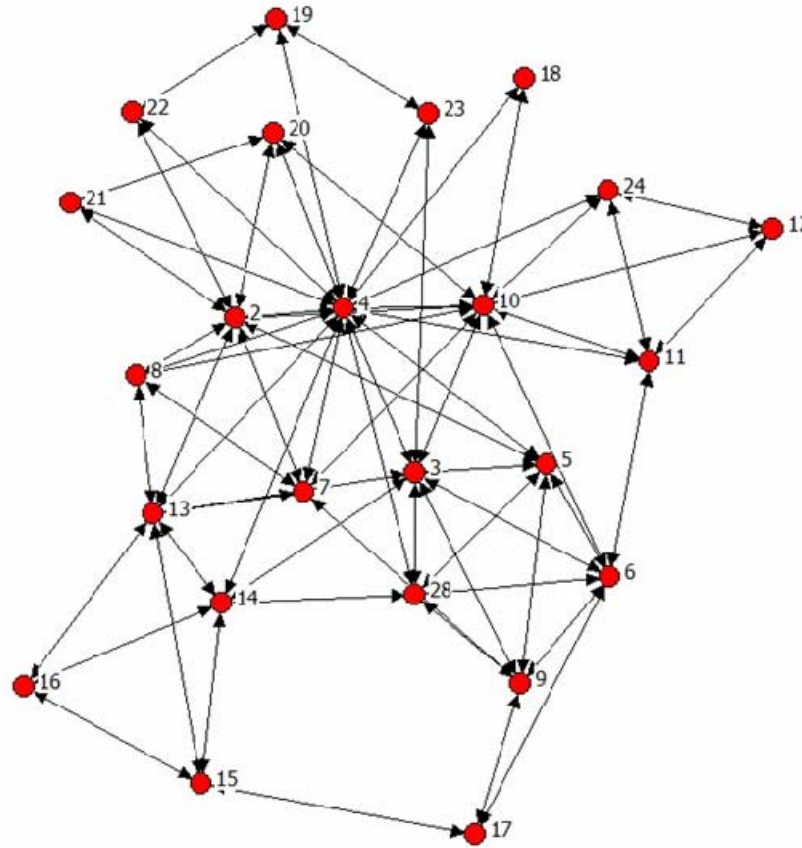|	(2) MAJCOM Requirements	(3) Program Office	(4) Milestone Decision Authority	(5) Contractor	(6) MAJCOM Budget	(7) SAF/AQX	(8) Service Acq Exec (SAF/AQ	(9) SAF/FM	(10) AF/XP	(11) Center Contracting
(2) MAJCOM Requirements	0	1	1	0	1	0	0	0	0	0
(3) Program Office	1	0	1	1	1	1	1	0	0	1
(4) Milestone Decision Authority (MDA)	1	1	0	0	0	0	0	0	0	0
(5) Contractor	0	1	0	0	0	0	0	0	0	1
(6) MAJCOM Budget	1	1	0	0	0	1	0	1	0	0
(7) SAF/AQX	0	1	0	0	1	0	1	0	1	0
(8) Service Acq Exec (SAF/AQ)	0	1	0	0	0	1	0	0	0	0
(9) SAF/FM	0	0	0	0	1	0	0	0	0	0
(10) AF/XP	0	0	0	0	0	1	0	0	0	0
(11) Center Contracting	0	1	0	1	0	0	0	0	0	0

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Lasting, stable relationships among social actors

Figure 16.   Acquisition Core Network
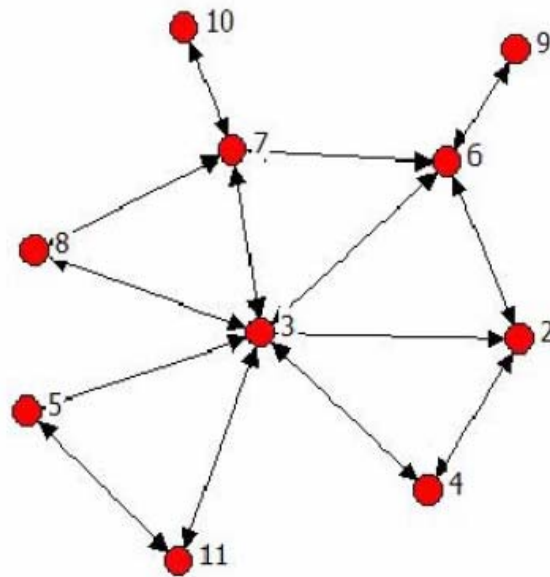
Conclusions:

- This analysis of APAT data has led to the conclusion that weapon system acquisition can be conceptualized as a network:
  - Multiple independent social actors
  - Key activities within Concept Refinement, Technology Development, and System Development and Demonstration Phases reveal relationships and interdependencies among social actors who are involved in the controls, inputs, activities, and outputs of each subsystem.
  - Interdependencies evolved into long and stable relationships among independent actors over time.

- The lead acquisition organizations/program manager appears to be a central figure who has the greatest number of relationships and is most central to the network measured in terms of degree of centrality. Despite the program manager's lack of a high-level authority position within a hierarchical model, network analysis reveals that the program manager has the greatest number of contacts and interactions within the network.

- Additionally, there appears to be a core group of social actors who have a persistent set of relationships during the early, critical stages of the acquisition process. While the program manager is well-placed within this core group, there are other important actors who deal with budgets and have sustained relationships over time. Understanding the structure of this group and their relationships with the rest of the network will be important in helping the acquisition community develop strategies to govern the network and influence changes for improved network performance and outcomes.

Implications for acquisition research

- A network view of acquisition allows an analyst to examine outcomes and management strategies in a new way. Rather than focusing on individual or organizational accountability, the focus shifts to understanding how the network as a whole functions to create greater value.

- Based on the APAT data, the Lead Acquisition Organization/Program Manager is the most central actor within the acquisition process measured in terms of degree centrality. Furthermore, this actor has the greatest range of relationships, brokering information from the warfighter, budget community, technology community, and contractor. This places the Program Manager in a very important position in the network. However, not all program managers perform equally. Some may be unable to develop their networks. Other managers may have perfectly adequate networks, but unable to understand the nuances and subtleties of network governance.

- Further, an understanding of the network allows an analysis of second-order effects due to changes in the network. In other words, a network view of acquisition would allow individual participants to understand how their outcomes and the network's outcomes would be affected by the continuing change in policy, resources, and players in the acquisition system.

Next steps:
Validate the APAT model?

- The data gathered in the APAT model were intended to serve as a framework to understand the current acquisition process as it applies to a majority of programs. The scope of the data-gathering process limited the ability to focus on all interactions.

- Activities such as milestone decisions were described as an exercise in document writing. Those involved in the APAT effort recognized that the documents generated for a milestone decision were actually the culmination of a set of interactions to gather data and develop a strategy for a particular portion of the acquisition program. For this effort, the official who approved the document and the program office WIPT were assumed to be the only participants. This is, in fact, probably not true. Participants might include other organizations, depending on the subject matter of the program and local procedures.

- Therefore, **the model serves as a good first step to begin to explore certain interactions within the acquisition system. If a certain set of interactions or a set of actors are of interest, gathering more detailed data would be valuable to further the understanding of the network and to validate the model.**

Next steps:
Use network framework to assess program success?

- The data-gathering effort for the APAT model was not prescriptive. While the sponsors of the effort were interested in recognizing areas for improvement, the model was meant to describe the current process. There are reasons for the patterns of relationships established in the model, but there also may be improved ways of interacting.

- **Indeed, the network model, once validated, could be utilized as a framework to assess program success. Those who control acquisition policy or who participate in acquisition programs likely would be interested in studying how the networks of these programs of interest differ from the norm**.

- *DoD Directive 5000.1* gives the program manager and milestone decision authority flexibility to decide what the correct set of activities and relationships should be for a particular acquisition program. **Studying network models of similar programs might enable decision-makers to tailor their efforts and focus resources on valuable relationships. Alternatively, acquisition strategies could be modeled to discover if information flows efficiently and effectively given several scenarios for organizing a program.**

Next steps:
Use network framework to simulate and validate changes to the acquisition system?

- Improving consistency of the system has spawned a number of changes—some of which are initially declared successful, only to be later discredited for their "unintended consequences." An example is the initiative to give the contractor Total System Performance Responsibility. This initiative gave the contractor more flexibility and responsibility for the performance of the acquisition program. Unfortunately, the effects of this change were probably not studied using a network analysis. Without a network perspective, the decision-makers were unable to understand the relational dynamics involved in the acquisition process.

- A number of changes to the acquisition system are being considered today. JCIDS mandates that programs have been have a Net-ready Key Performance Parameter (Chairman of the Joint Chiefs of Staff, 2005). This attempt to build a communication system by mandating interoperability from those who will utilize the system is much like the chicken and the egg conundrum. First, the architecture of the network must have some definition. Those who are developing a network and the users of the network must collaborate to solve this problem. Clearly, a network analysis to identify who is involved and how they are collaborating would be more beneficial than mandating a change and hoping that those actors in the network would comply.