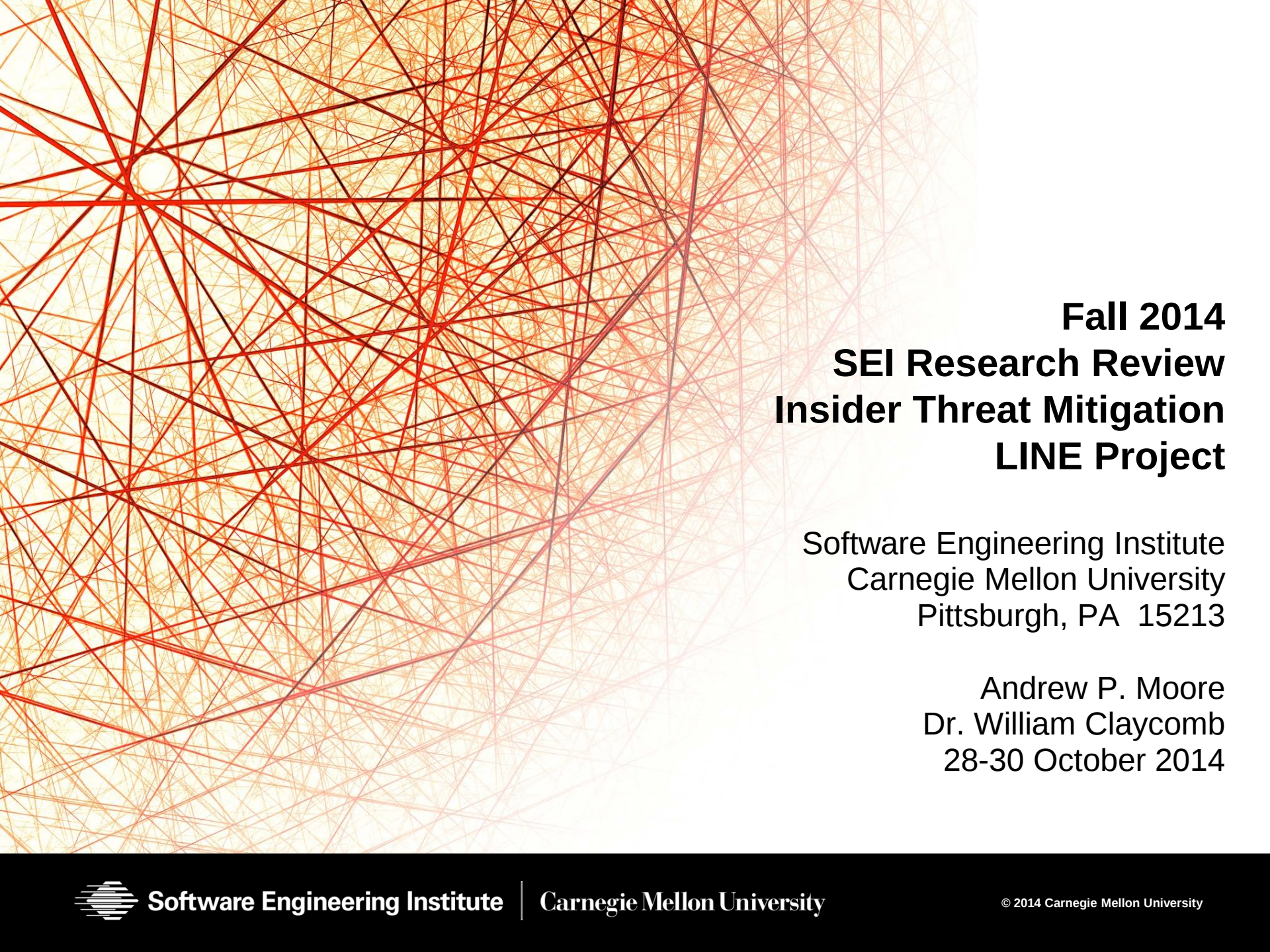




Fall 2014 SEI Research Review Insider Threat Mitigation LINE Project

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

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Dr. William Claycomb
28-30 October 2014



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Team

SEI team members

- Dr. Bill Claycomb (Co-PI)
- Andy Moore (Co-PI)
- Dr. Jason Clark
- Matt Collins
- Dr. Jen Cowley
- Bill Novak
- Dr. Bronwyn Woods

Engaged Stakeholders

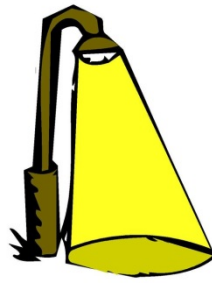
- Two engaged USG partners
 - data and piloting

Collaborators

- CMU-CS (FY14-15)
 - Prof. Kathleen Carley
 - Neal Altman (staff)
 - Jeff Reminga (staff)
 - Geoff Morgan (student)
 - Matt Benigni (student)
- UC-Davis (FY15)
 - Prof. Sean Peisert
 - Julie B. Ard (student)



Project Framing



Objective: Develop scientifically and operationally validated insider threat indicators

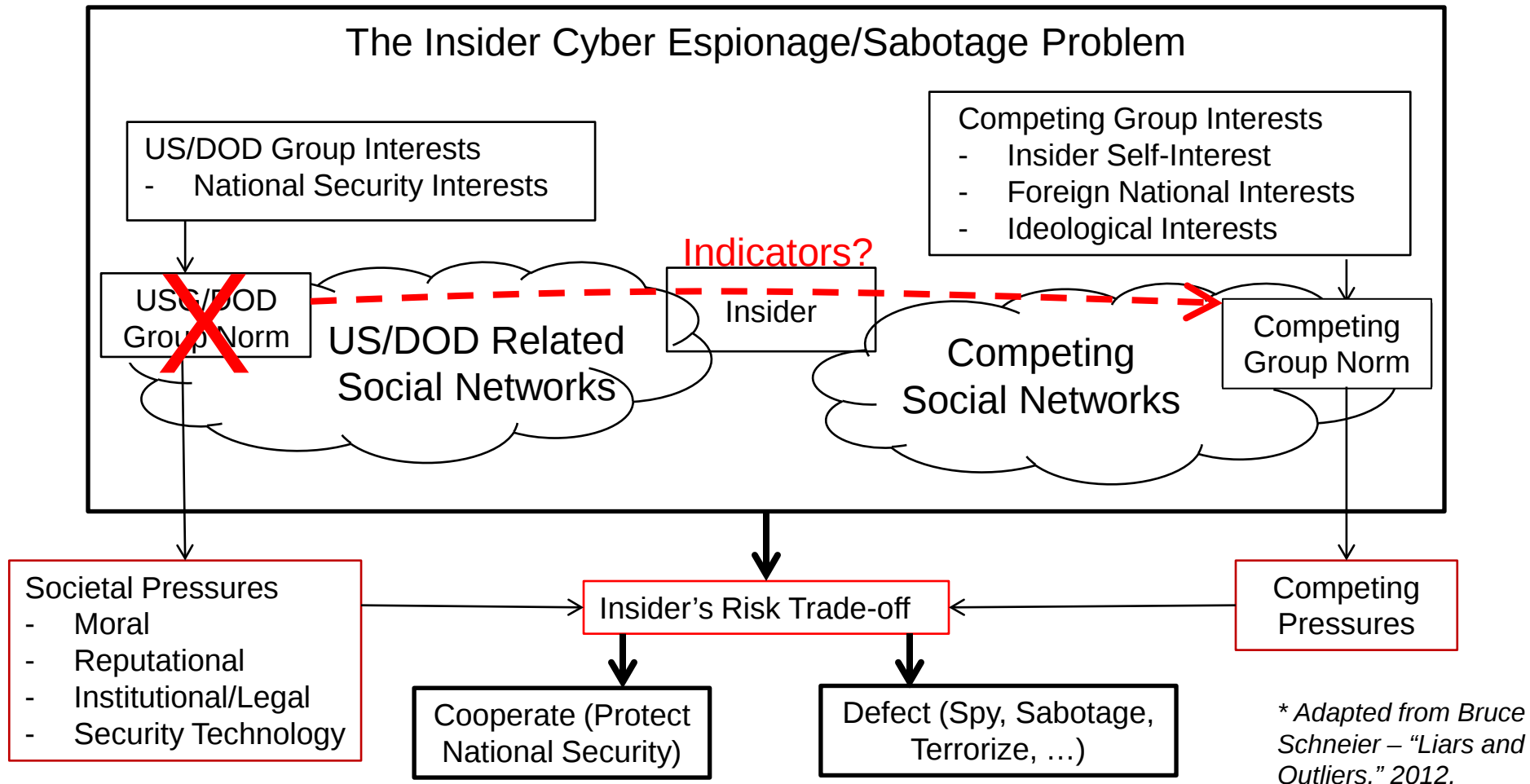
- **Need:** DoD/Gov't agencies, contractors struggling to build mandated Insider Threat Programs, per Executive Order 13587
- **Challenges:**
 - Attacks are costly but relatively infrequent
 - Malicious and benign behaviors difficult to distinguish

FY14 Focus: Dynamic analysis of *social networks* of convicted *spies*
BUT Insiders are not top actors – changes in relationships are key

- **Hypothesis:** Over time, insider social networks exhibit weakening of internal connections, AND the strengthening of external connections to adversaries
- **Data:** ~140 insider espionage incidents – from court records, media reports
- **Data Analysis method:** Measure connection strength over time between insider and family/coworkers/adversaries (ORA toolset)
- **Connection strength measures:** communication frequency, reciprocity, time spent, volume, affect, truthfulness (in order of ease/integrity of measurement)



Context for Understanding Insider Behavior *



Preliminary Observations from Incident Data

Broadly specified social networks of ~140 insider spies

- Showed increasing reliance on electronic means of illicit transfer/comms

Elaborated the time series of two incidents

- John Walker (and Walker spy ring)
- Private Bradley Manning (Wikileaks)

Hypothesis supported but situation more complex than framed

- Internal connections may weaken or strengthen over time
- Insider starts connecting more individuals over time (*betweenness* measure)
- Decrease in ratio of internal connections to external connections
- Excluding ring members, networks grow larger but less densely connecting

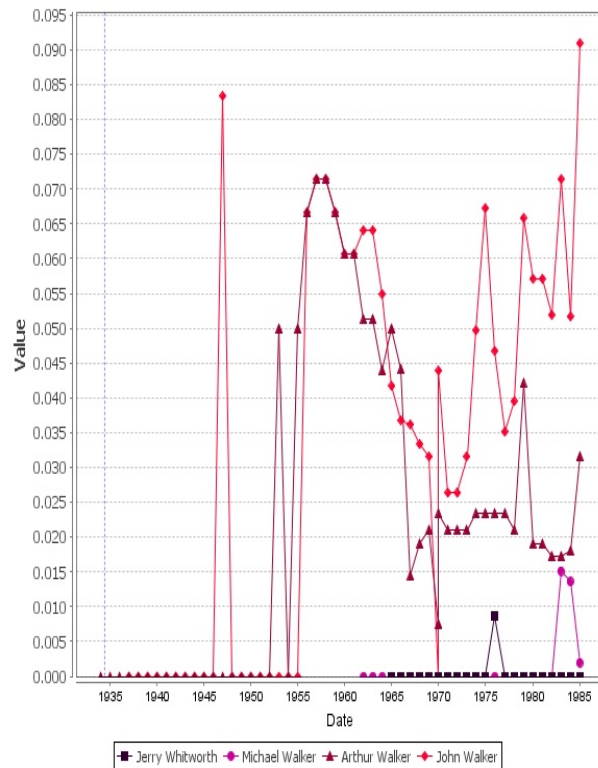
Gain confidence in significance as we compare findings with baseline



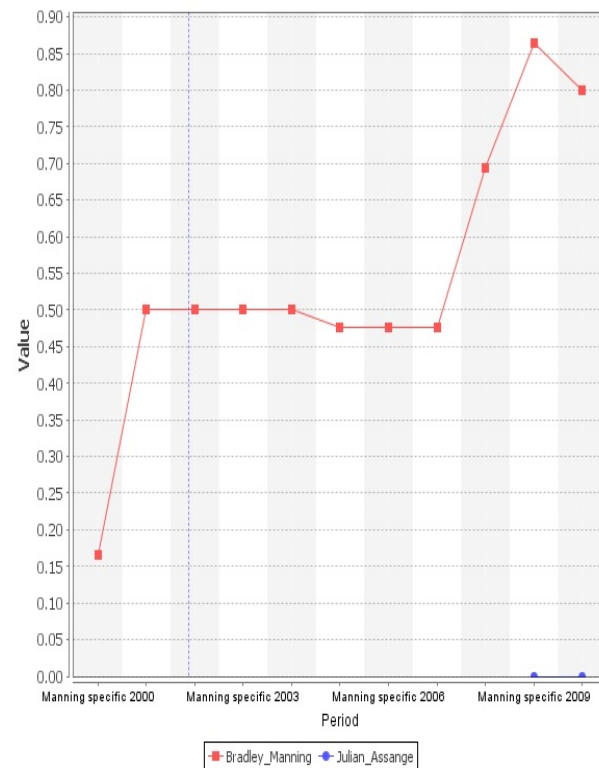
Increasing betweenness during spy activities – insider starts connecting more individuals

Come to poster session to see detailed results and talk with analysts!

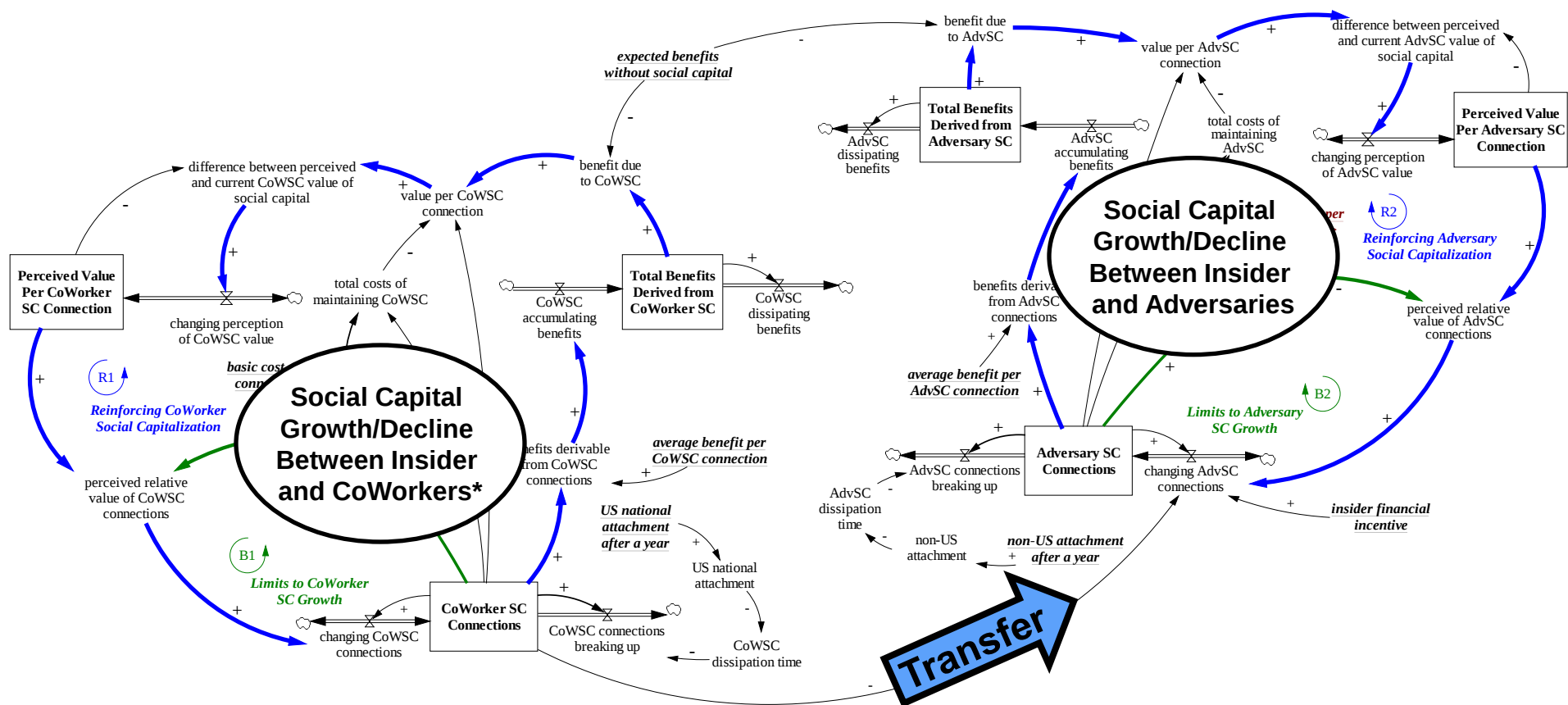
Walker Case



Manning Case



Theory Building: Social Capital Growth/Transfer



* Adapted from Dudley's "The Dynamic Structure of Social Capital: How Interpersonal Connections Create Communitywide Benefits," 22nd Conf. of the System Dynamics Society, 2004.



New Work with UC-Davis in FY15

Sociotechnical network (STN) = social network + info flow network

Key Ideas

- Combine analysis of information flow networks with social network analysis
 - earlier detection with lower false positive rates
- Focus not on insider access rights
 - but movement and trajectory of info flow

Compare baseline document flows with actuals (Gemini tool)*

- Identify document (expected) workflows as baseline (up front)
- Compare actual document flows with expected; identify anomalies (real time)
- Requires comparing **documents to documents** and **flows to flows**
- *Proposed Measures*
 - **Document Similarity** : hashing, plagiarism detection, keyword matching
 - **Flow Similarity** : graph matching algorithms – eg, using GED measures

* Ard, et.al., “Information Behaving Badly,” NSPW ‘13



Plans

Scientific and Operational Validation

Method \ Data Set	CERT Incident DB (Open Src)	SEI Emails (Anonymized)	Enron Emails (Public)	Partner Data (Operational)
Insider Social Net Analysis	FY14	FY14/15	FY14/15	FY15
Info Flow Net Analysis	FY15	FY15	FY15	FY15/16

Theory Building

- Ground System Dynamics Model in insider threat risk measures based on sociotechnical net properties

Transition

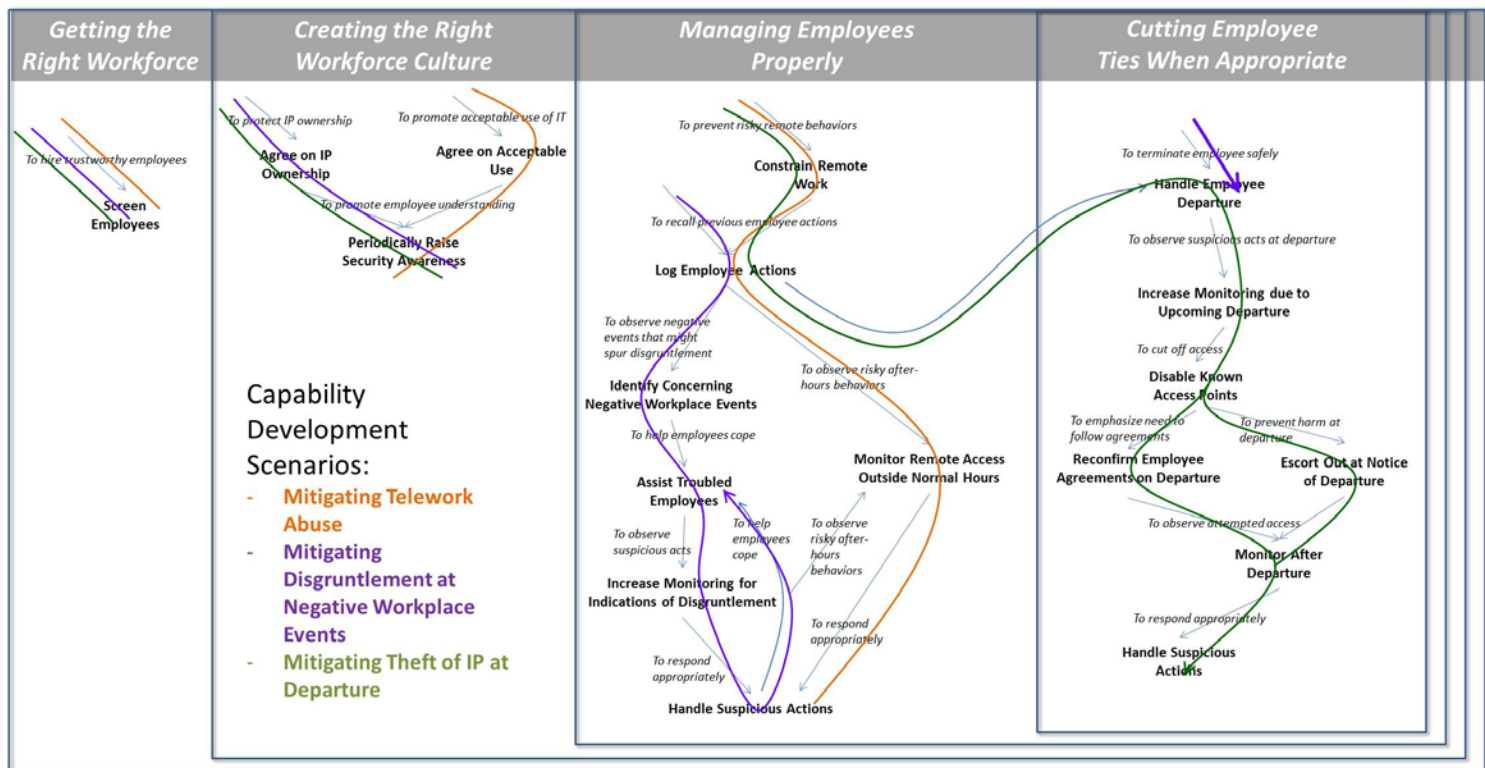
- Developing Special Issue of Journal “Computational and Mathematical Organization Theory” based on Insider Threat ModSim Workshop (7/2014)
- Apply approaches in projects to develop DOD insider threat architectures



Publications – Pattern Language as a Transition Vehicle

Research results will continue to ground insider threat mitigation patterns

- 24 patterns identified, 6 analyzed, with 7 ACM/IEEE papers published
- Threat models published in book: *CERT Guide to Insider Threats* (2012)
- *Pattern-Based Design of Insider Threat Programs*: Forthcoming



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