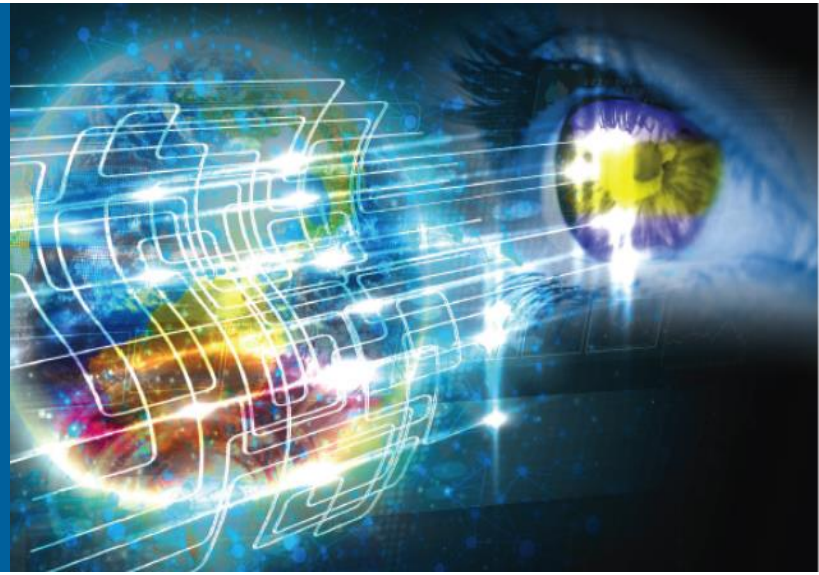
SYSTEMS THINKING AND "CRIME ON THE URBAN EDGE"



SAME Midwest Small Business Expo 2017

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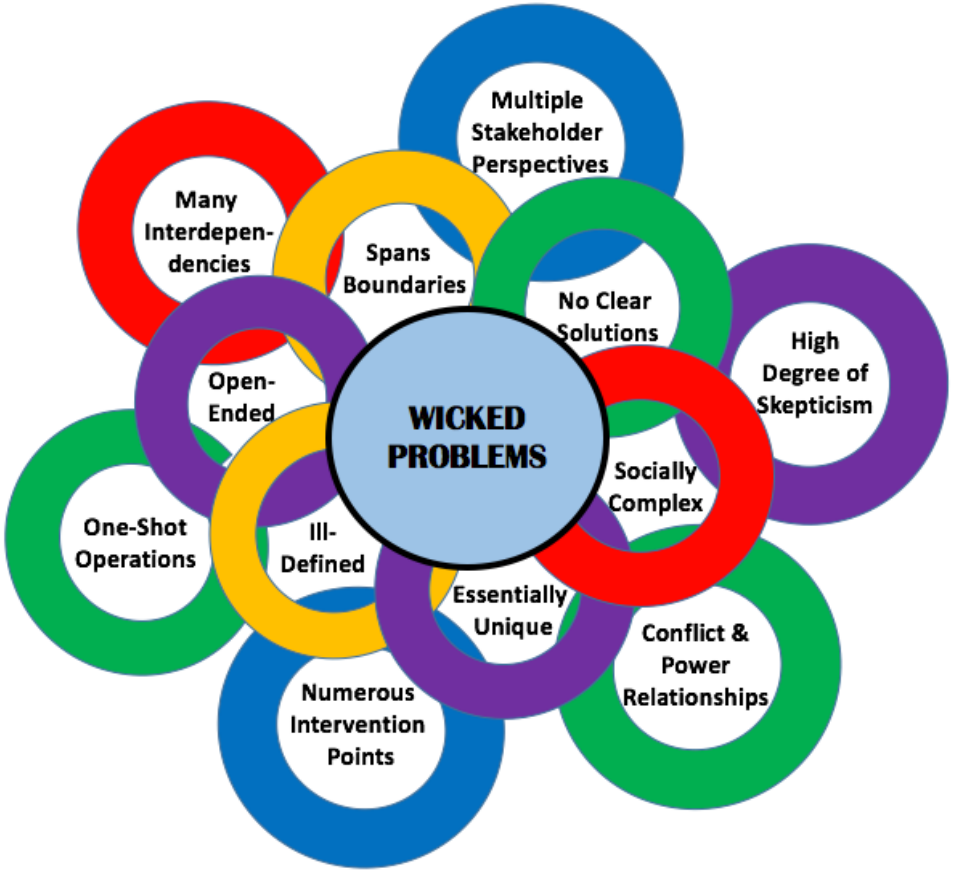
COMPLEXITY

Complexity is a term used to characterize something with:

- Many parts
- Many interdependencies between parts
- A property of emergence where the whole is greater than the sum of the parts

Complex Problems are social planning problems that are open-ended, contradictory, and have many stakeholders.

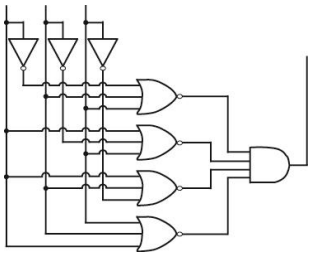
- This class of problems is sometimes called "**Wicked Problems***" or "Tangled Problems" or "Messy Problems"



[1] Rittel, H.J., Webber, M., 1973. Dilemmas in a general theory of planning. Policy Sciences 4, 155-169.

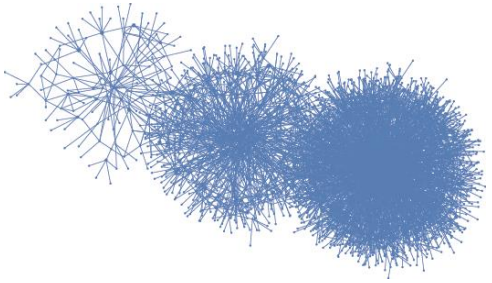
COMPLICATED VS WICKED PROBLEM?

- "Complicated (Tame) Problems



- Originate from isolated causes that are clearly identifiable and fall within distinct bureaucratic categories
- Can be dissected into isolated chunks addressed, and pieced back together;
- Consequences are generally proportionate to their causes (for every input, there is a proportionate output);
- Fixtures can be put in place for permanent solutions.

- Complex (Wicked) Problems

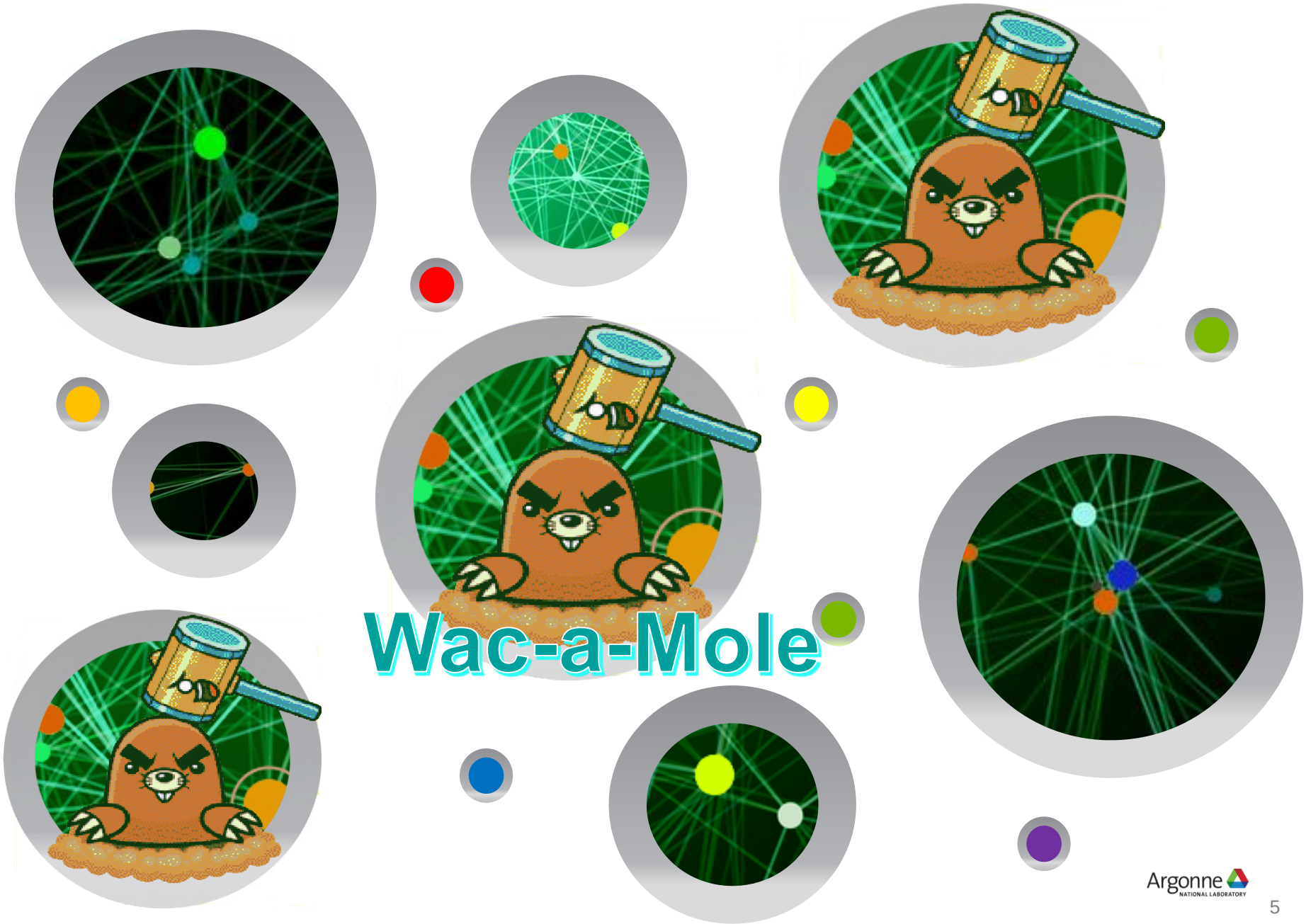


- Result from concurrent interactions among multiple systems of events, and they erode the customary boundaries that differentiate bureaucratic concepts and missions;
- Cannot be broken apart and solved piece-by-piece. They must be understood and addressed as a system;
- Do not automatically stabilize, but intrinsically unravel into chaos if not systemically managed;
- Cannot be permanently solved. Instead, they morph into new problems as a result of interventions to deal with them."

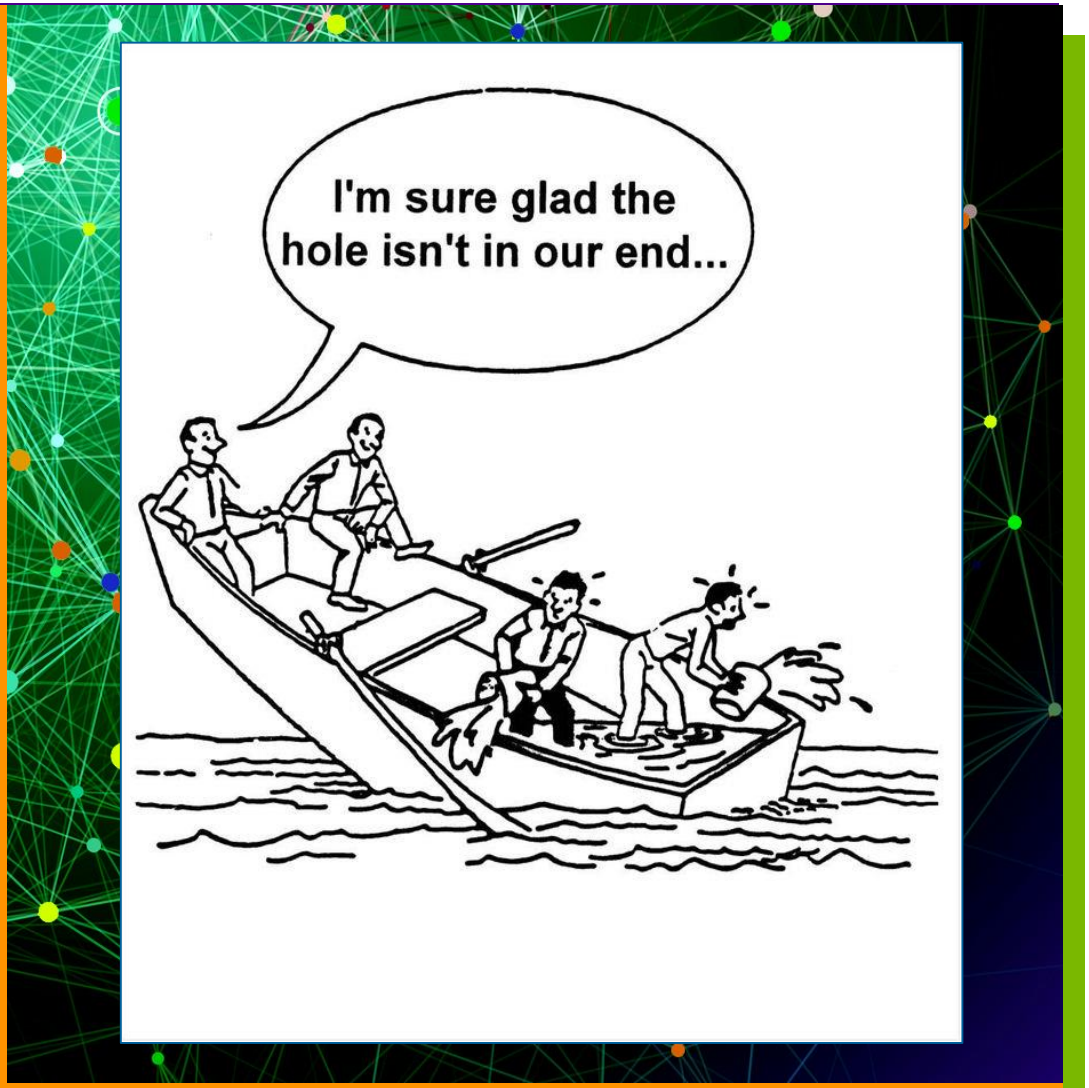
Fuerth and Faber, 2012

Stove-piped Organizations Meet the Wicked Problem

WICKED PROBLEM VIEWED DOWN PIPES



WE NEED SYSTEM THINKERS



Systems thinking, in contrast, focuses on how the thing being studied interacts with the other constituents of the system—a set of elements that interact to produce behavior—of which it is a part.

Influence – Not Control **Anticipation – Not Prediction**

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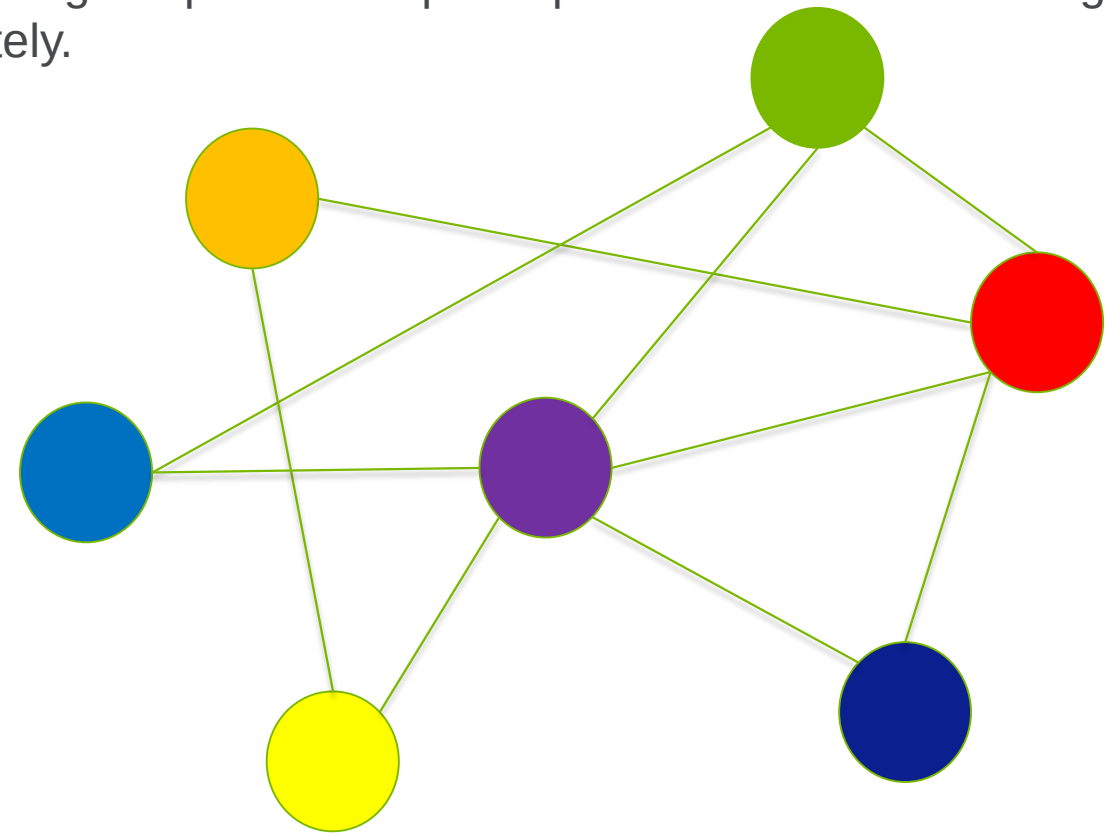
WHAT IS SYSTEMS THINKING?

A System is set of connected elements organized in such a way as to form a complex whole with emergent properties

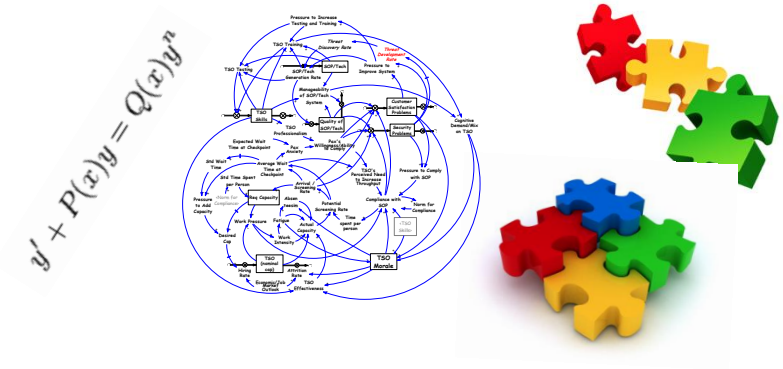
Systems Thinking (or Systems Science) is an interdisciplinary field that focuses on the interactions and interdependencies of elements of systems, allowing us to tackle difficult complex problems that cannot be solved simply by breaking the problems up into parts and then addressing each part separately.



HARD AND SOFT SYSTEMS THINKING

Hard Systems (Quantitative)

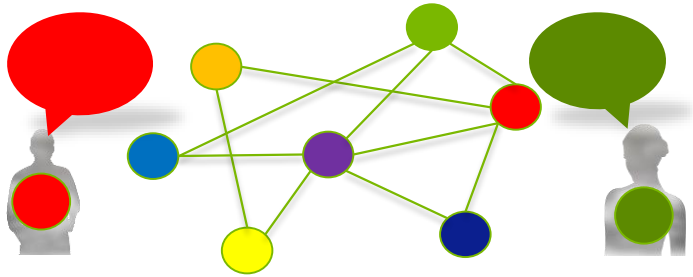
- Deterministic and mechanistic
- Assumes problems are well-defined and clearly bounded
- Reliant of the judgment of "experts"
- Scientific approach to problem-solving
- Seeks to find the optimal solution



HISTORICAL DIVIDE

Soft Systems (Qualitative)

- Holistic, bigger-picture and diversity of perspectives
- Human Factors Important
- Common understanding (not consensus) among stakeholders
- Explores the boundaries of inclusion and exclusion
- Seeks better understanding and collective learning rather than an objective "solution"



Example Hard System Approaches:

- **System dynamics**
- **Systems analysis**
- **Systems engineering**
- **Physical infrastructure models**
- **Integrated environmental assessments**
- **Complex Adaptive Systems Modeling**

Example Soft Systems Approaches:

- **Participatory Problem Structuring**
- **Critical Systems Heuristics**
- **Distinctions, Systems, Relationships and Perceptions (DSRP)**
- **Second Order Cybernetics**
- **Anticipatory Systems**
- **Systemic Intervention**

PROBLEM STRUCTURING METHODS

- Useful for wicked problems because they are "appropriate for situations characterized by multiple actors, differing perspectives, partially conflicting interests, significant intangibles and perplexing uncertainties.
- Strive to achieve a common understanding (not consensus) of a problem
- Acceptance of people's differences, and an agreement on some accommodations, or next steps forward, that can be taken
- Systemic Problem Structuring:
  - Finds ways to explore the boundaries of inclusion and exclusion (Ulrich, 1983)
  - Collaborative process for evaluation, involving the researcher and selected stakeholders, looking at the context, purposes, methods, and outcomes of an intervention (Midgley et al., 2013)

CRIME ON THE URBAN EDGE

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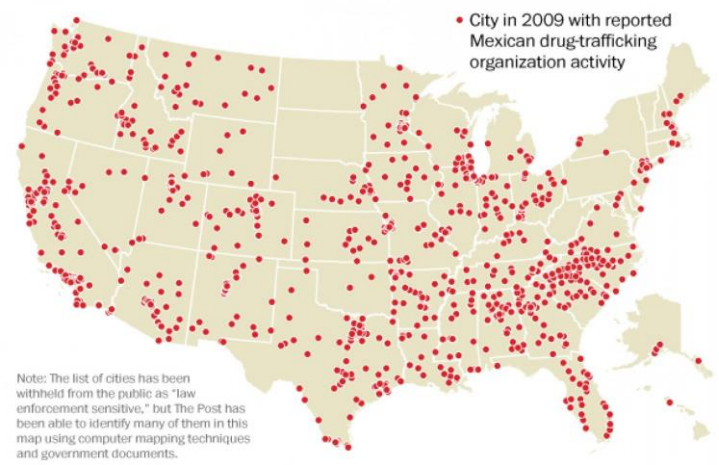
CRIME ON THE URBAN EDGE (CUE)

Convergence of TOC and U.S. Urban Gangs and Crime

- U.S. gangs play roles as enforcers during the cross-border trans-shipments and as proxies for the cartels on the street.
  - Street level sales, street enforcers, conducting kidnappings, and collecting the proceeds from sales.
- As TOC becomes more sophisticated, expanding influence in major U.S. cities is feared for all types of illicit trafficking
- Dynamics of the U.S. “Demand-side” impacts TOC behavior

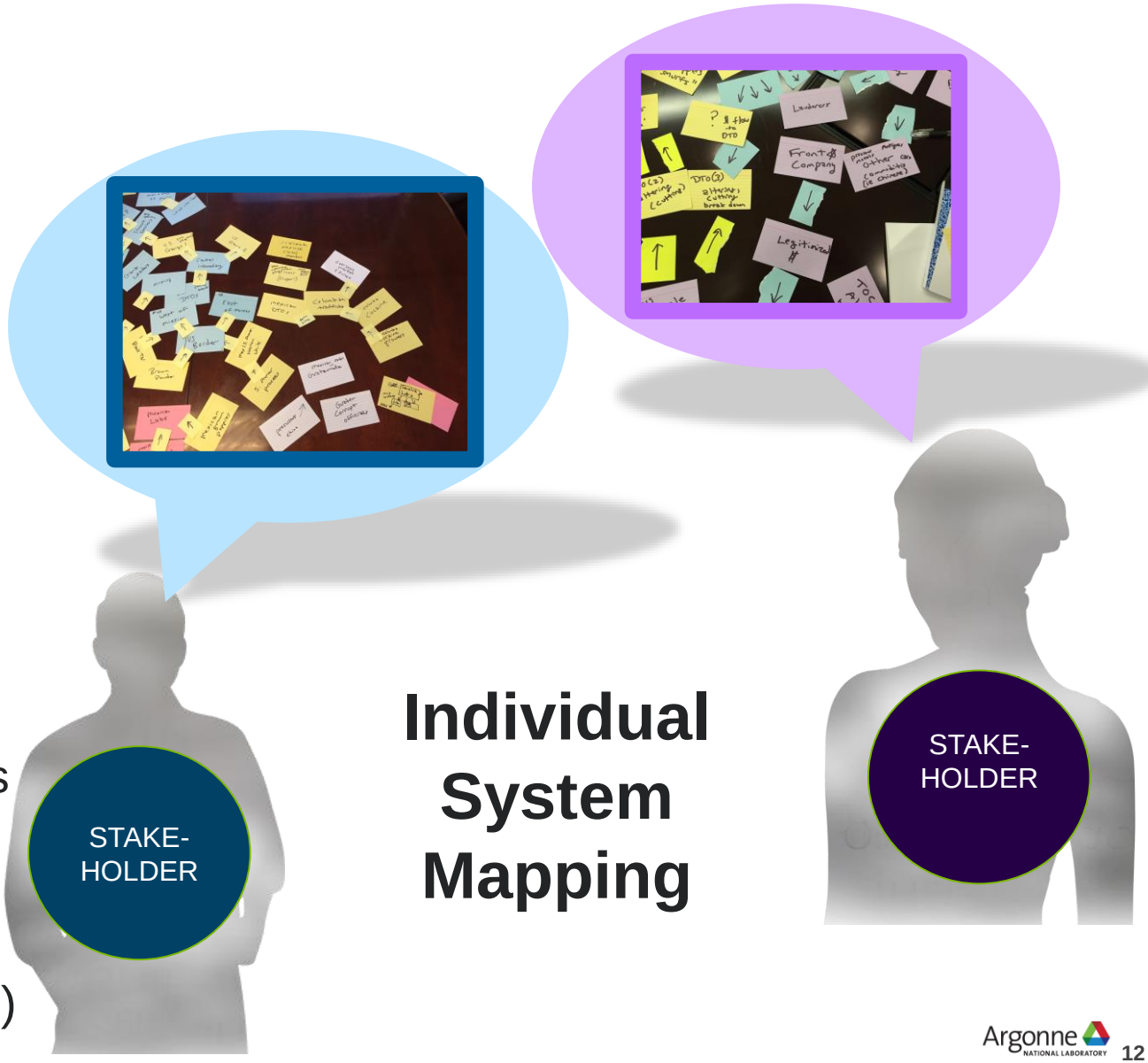


TOC/Urban Gang Convergence

Study Focus on Chicago

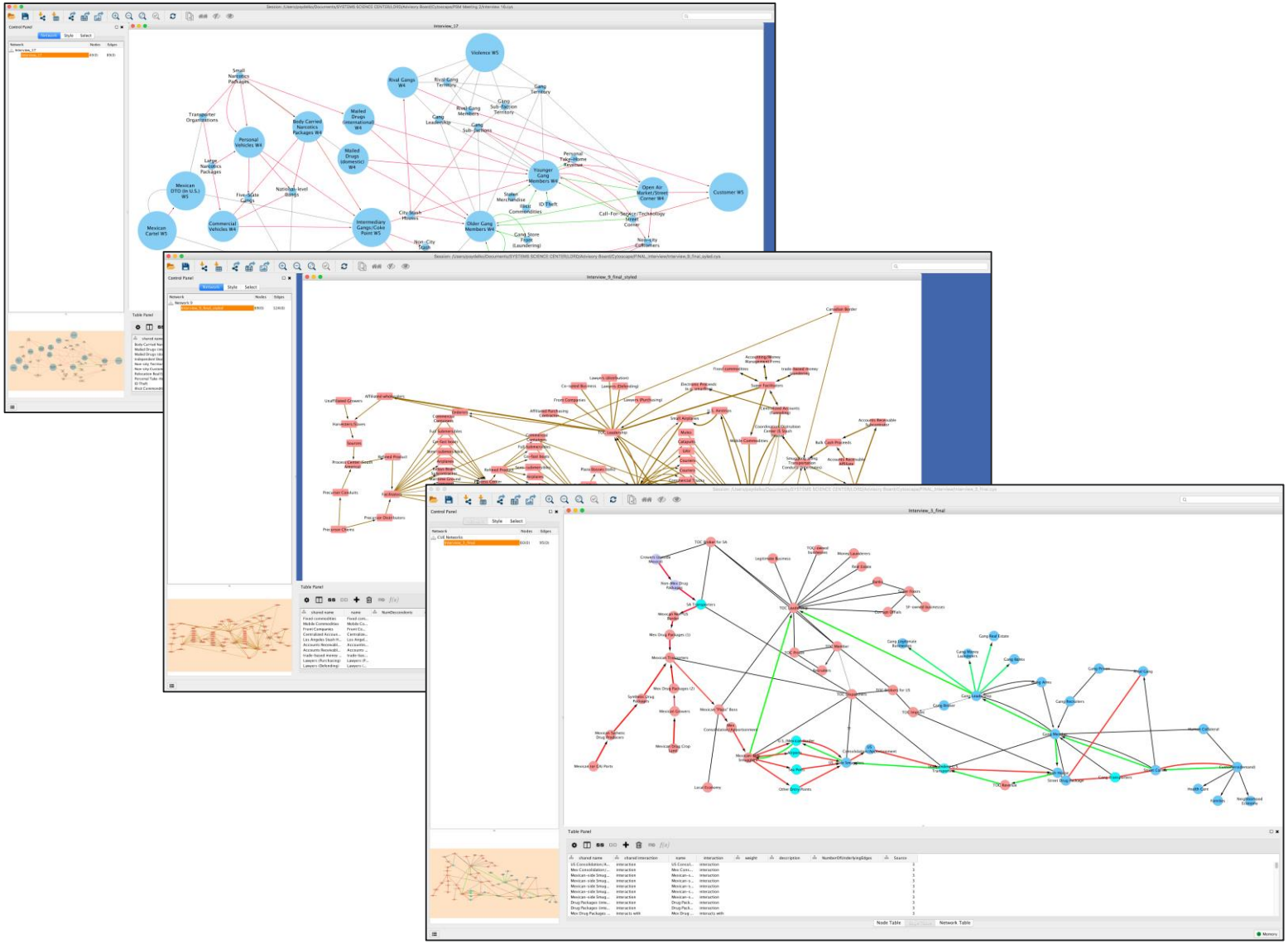
SYSTEMIC PROBLEM STRUCTURING WITH EACH STAKEHOLDER INDIVIDUALLY

- Respect the diversity of perspectives
- Bring in different contexts to the problem
- Encourage stakeholders to be explicit about interdependencies
- Allow stakeholders to reflect their values and what they think is most important (weights)

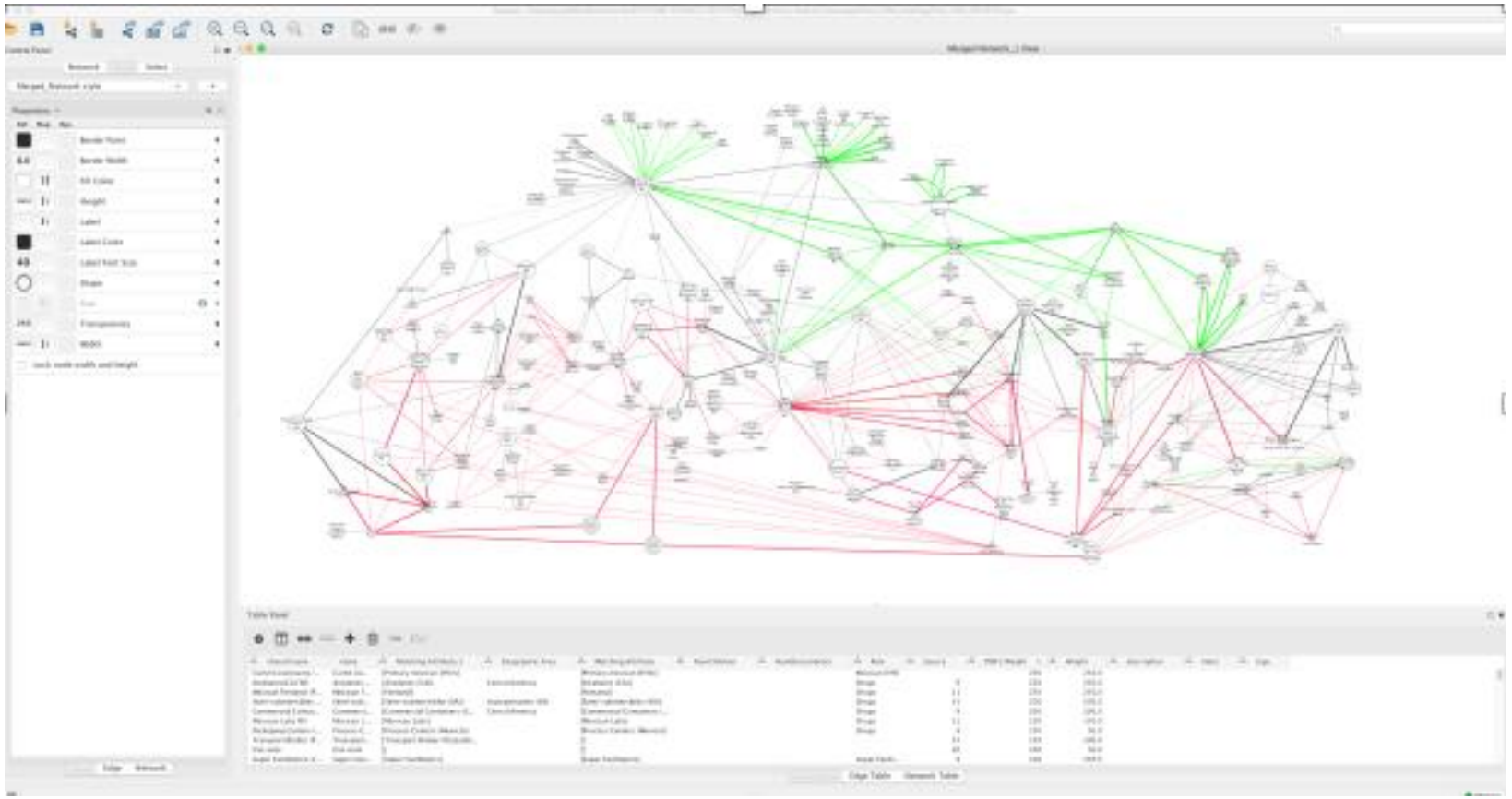


Individual System Mapping

MERGING INDIVIDUAL SYSTEM MAPS

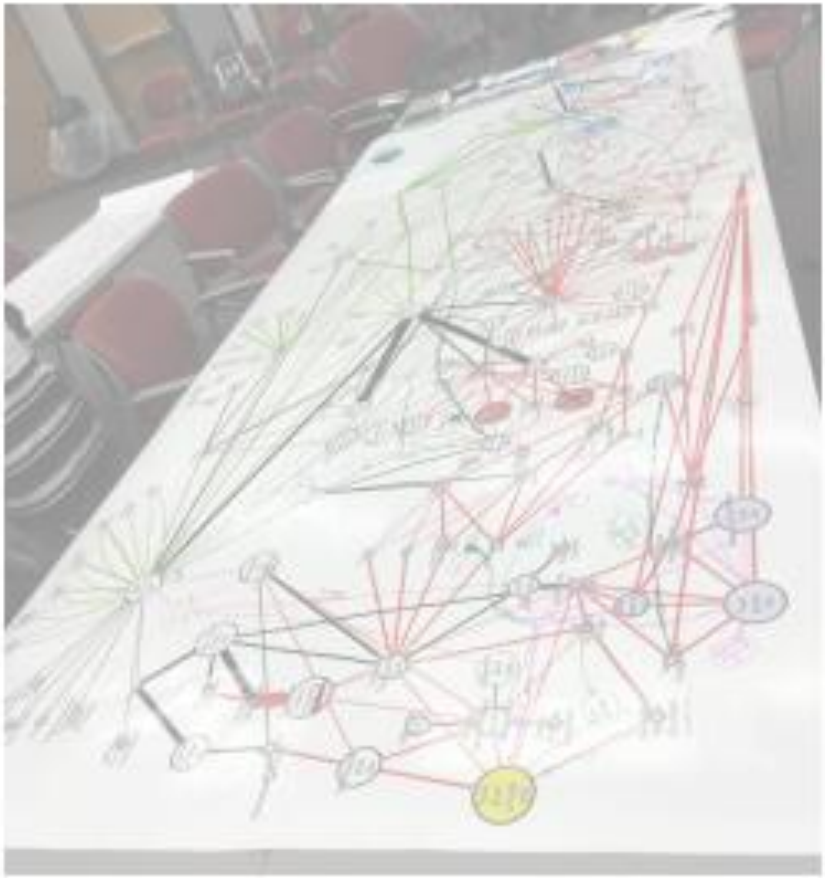


FINAL “COMMON” SYSTEM MAP

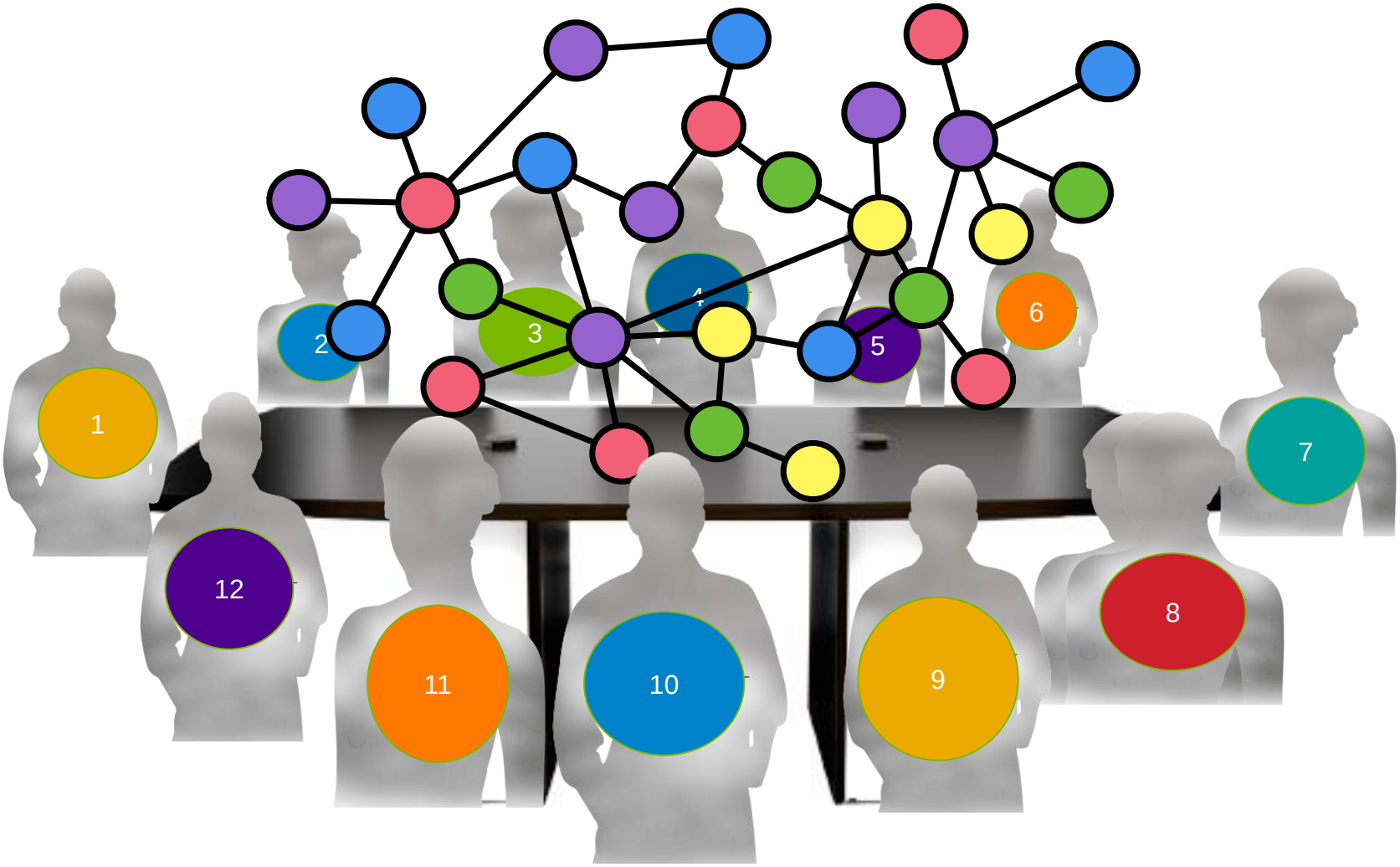


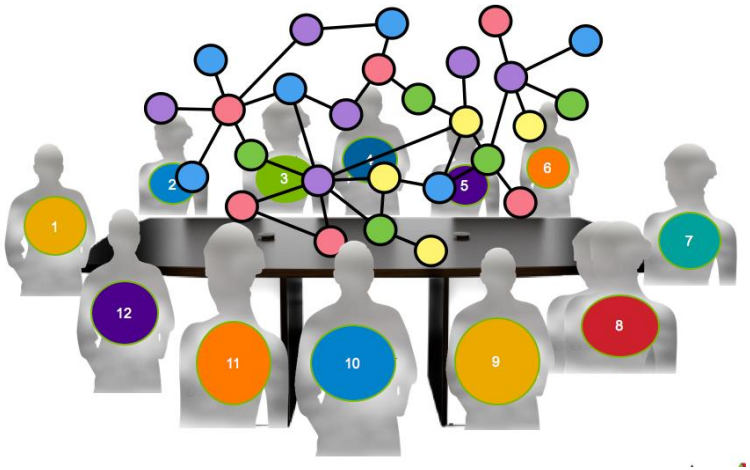
GROUP PROBLEM STRUCTURING

- Two group sessions
- Reconciled semantic differences
- Made elements and interdependencies (links) explicit
- Added more nodes/links
- Conducted Boundary Critique
  - Discuss and decide on what should be taken out
  - Discuss and decide on weights



SO WE'VE STRUCTURED OUR PROBLEM….



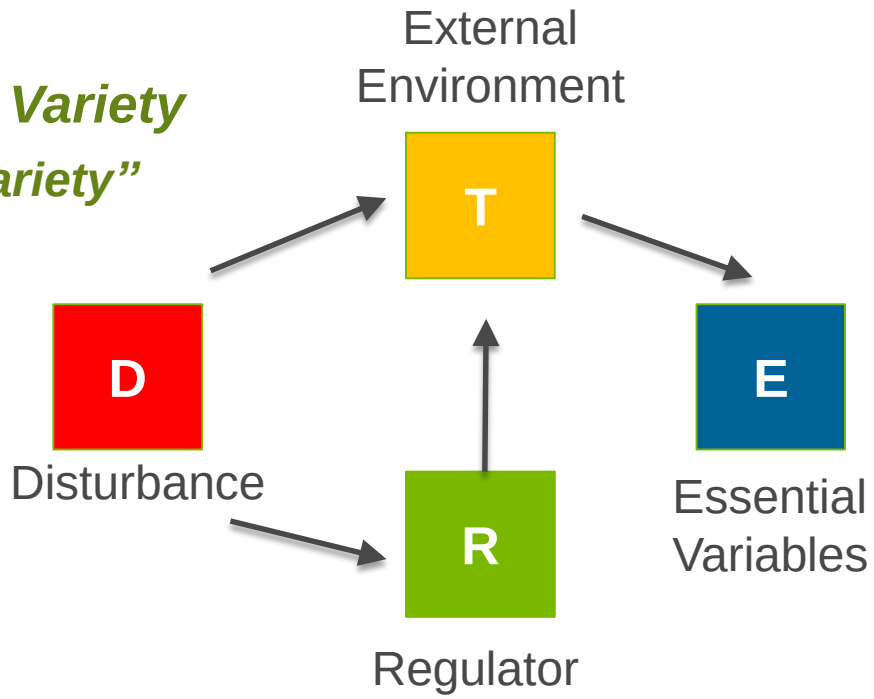


Systemic Organizational Design

DESIGNING SYSTEMIC ORGANIZATIONS

Ashby's Law of Requisite Variety

"Only variety can destroy variety"



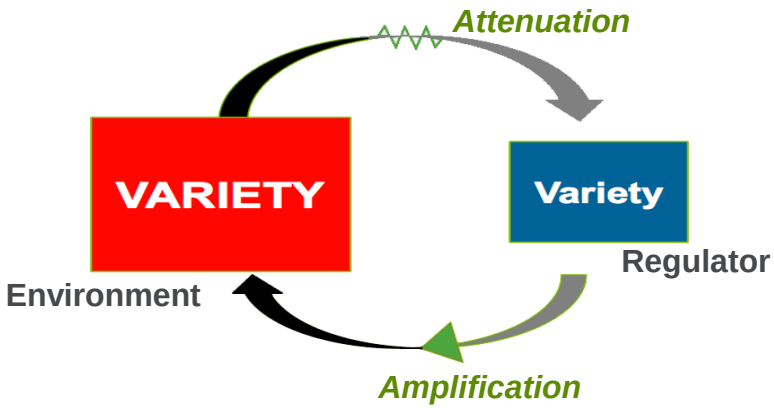
- Biologically based- species regulate the variety (disturbances) into the gene patterns to ensure their survival
- D –T – E transmission must be regulated in order for the organization (organism) to remain viable within a changing environment
- Regulator (R) must directly reduce the variety in their environment (T) in order to stay in a homeostatic state.

Variety Attenuators:

- Not simply to reduce the amplitude, but select and discard aspects of the signals which are relevant.

Variety Amplifiers:

- Amplify variety to increase our power over our environment



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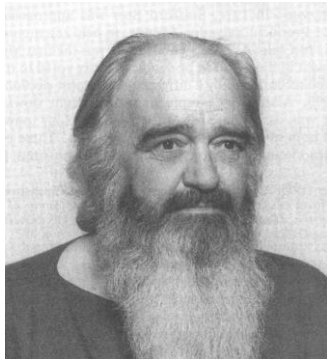
VIABLE SYSTEM MODEL (VSM)
2ND ORDER CYBERNETICS



- *Viable system: a system that maintains its identity while maintaining a co-evolutionary –but still balanced - relationship with their niche*

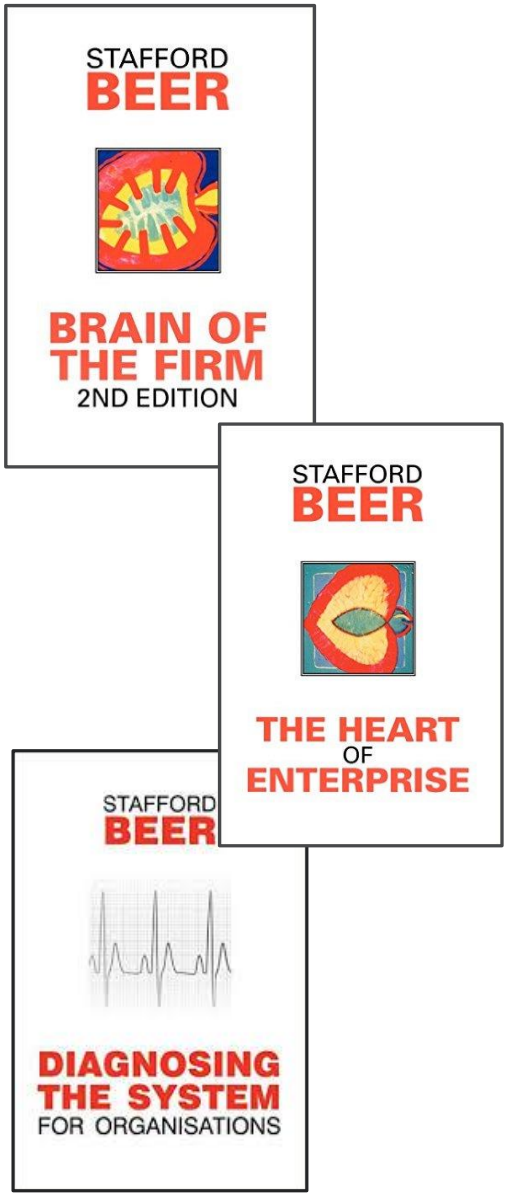
  Espinosa, A., Harnden, R., & Walker, J. 2007. Beyond hierarchy: a complexity management perspective. *Kybernetes*, 36(3/4): 333-347.

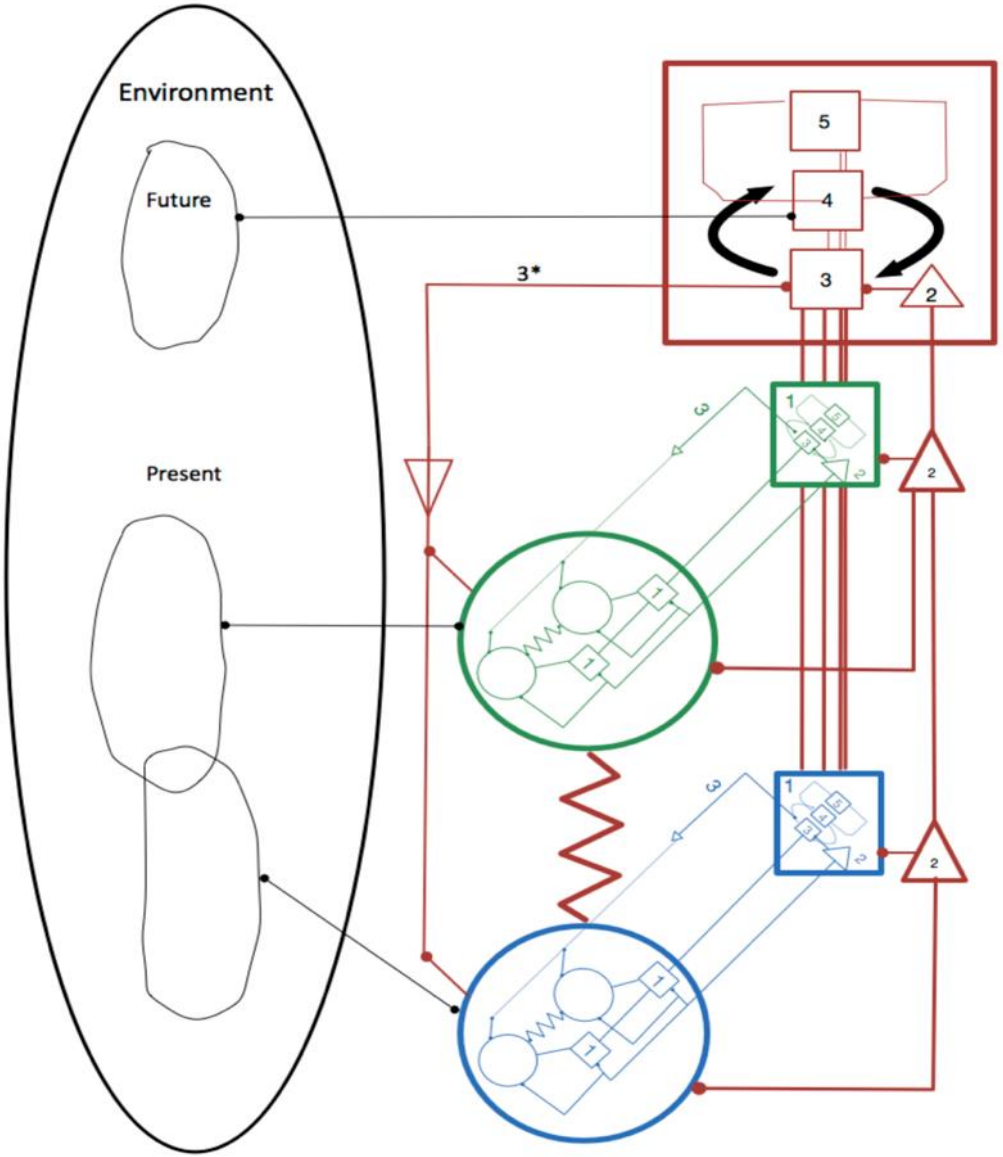
Builds on Ashby's Law

- **Stafford Beer's Viable System Model (VSM)** is an organizational representation of the elements and interactions considered essential for any system to be viable or autonomous.
  - Organized and operates in a manner such as to survive in its changing environment.
  - Adaptability is one of the prime features of systems that survive

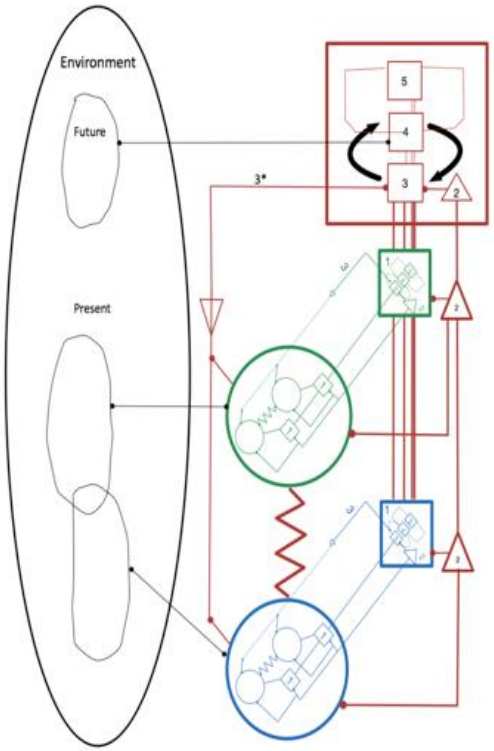
- *In order to design and maintain a viable organization capable of tackling the complexity of a wicked problem, the organization must be closely attuned to it's environment and dynamically adjust to disruptions to it*
- Beer, S. 1985. *Diagnosing the system for organisations*: John Wiley and Sons, Chichester.

DIAGRAM OF THE VSM





THE FIVE SUBSYSTEMS OF THE VSM



- **System 1 (S1)**: The operations of the organization where the production of products or services happens. It is a viable organization itself.
- **System 2 (S2)**: Deals with the day-to-day operations, providing shared languages, protocols, procedures, and information. It is also involved in providing conflict resolution when discord exists between S1s.
- **System 3 (S3)**: Responsible for regulatory issues such as resource distribution, accountability, and legal. S3 also ensures all parts are running in the best interest of the whole organization.
- **System 3* (S3*):** The auditing system used by S3 to monitor the activities of S1s. It can probe the details of the operations, but does not take over or micromanage the S1s.
- **System 4 (S4):** Responsible for understanding the changing outside environment in which the organization is embedded. It is concerned with facilitating adaptation of the organization.
- **System 5 (S5)**: Defines the ethos and purpose of the organization and an identity for the collection of systems. Assures balance between what might be and what is happening now.

NOT HIERARCHICAL

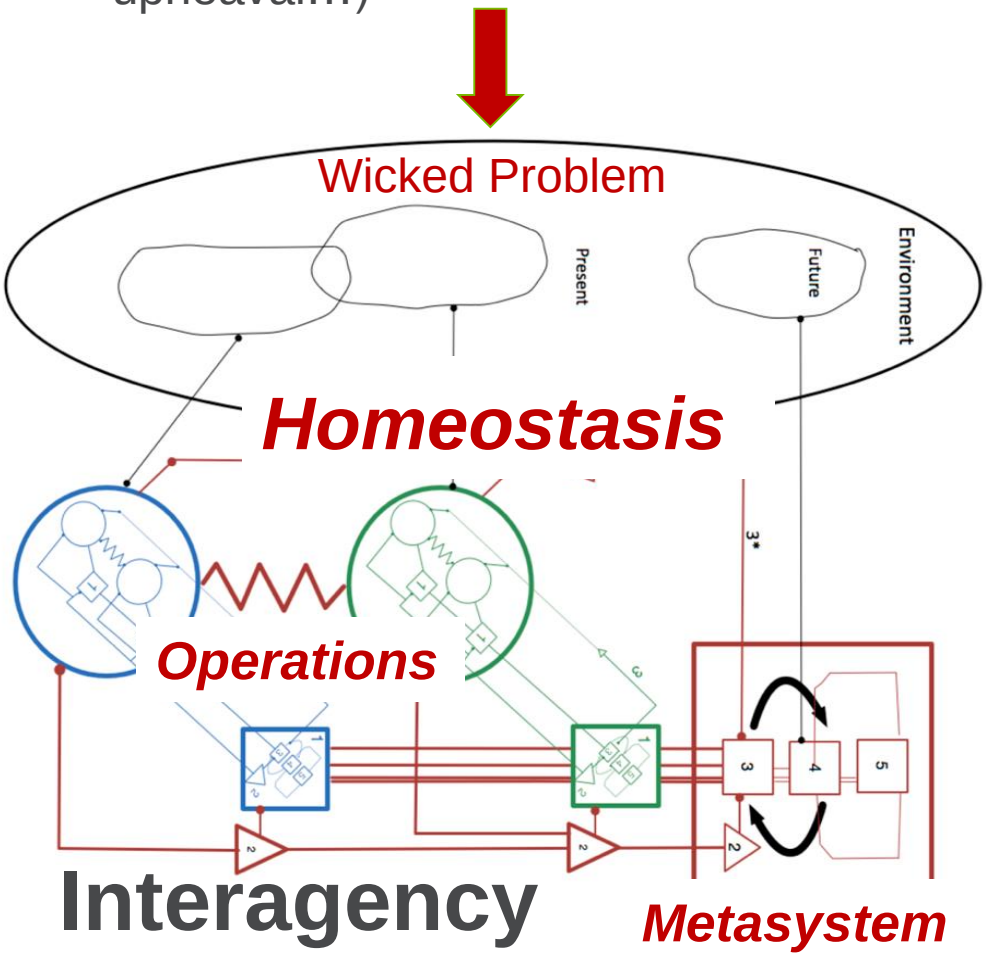
Self-Organization

- Continuously re-create themselves while being recognizably the same
- Maintain identity despite pressures from the environment

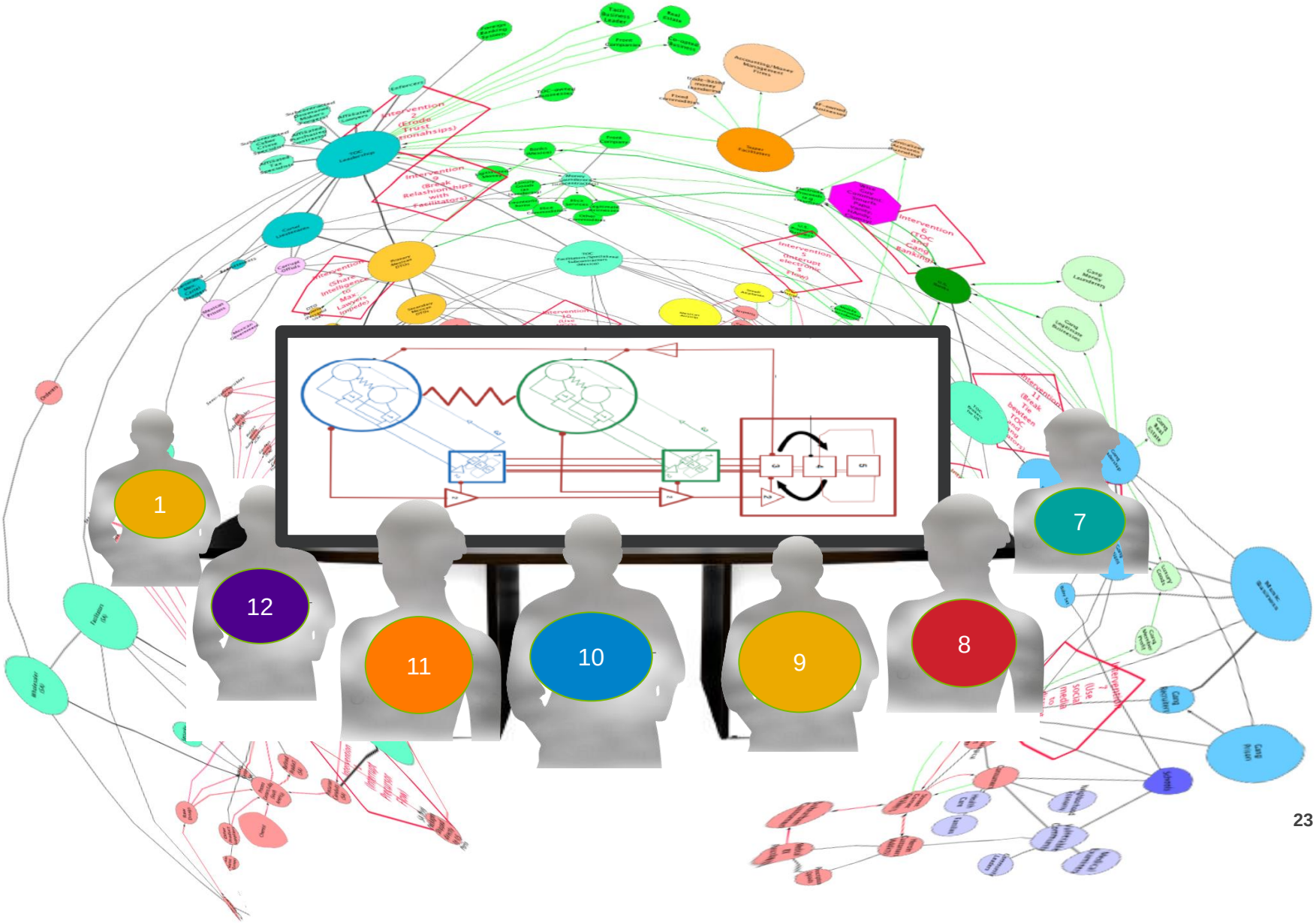
Not Hierarchical

- Management can be seen as support for operations (not controllers)
- Resource Bargain between management and operations

Other external disturbances (I.e. economic shocks, political upheaval…)



DESIGNING THE CUE VIABLE SYSTEM



SYSTEM 5: CREATE AN IDENTITY AND ETHOS

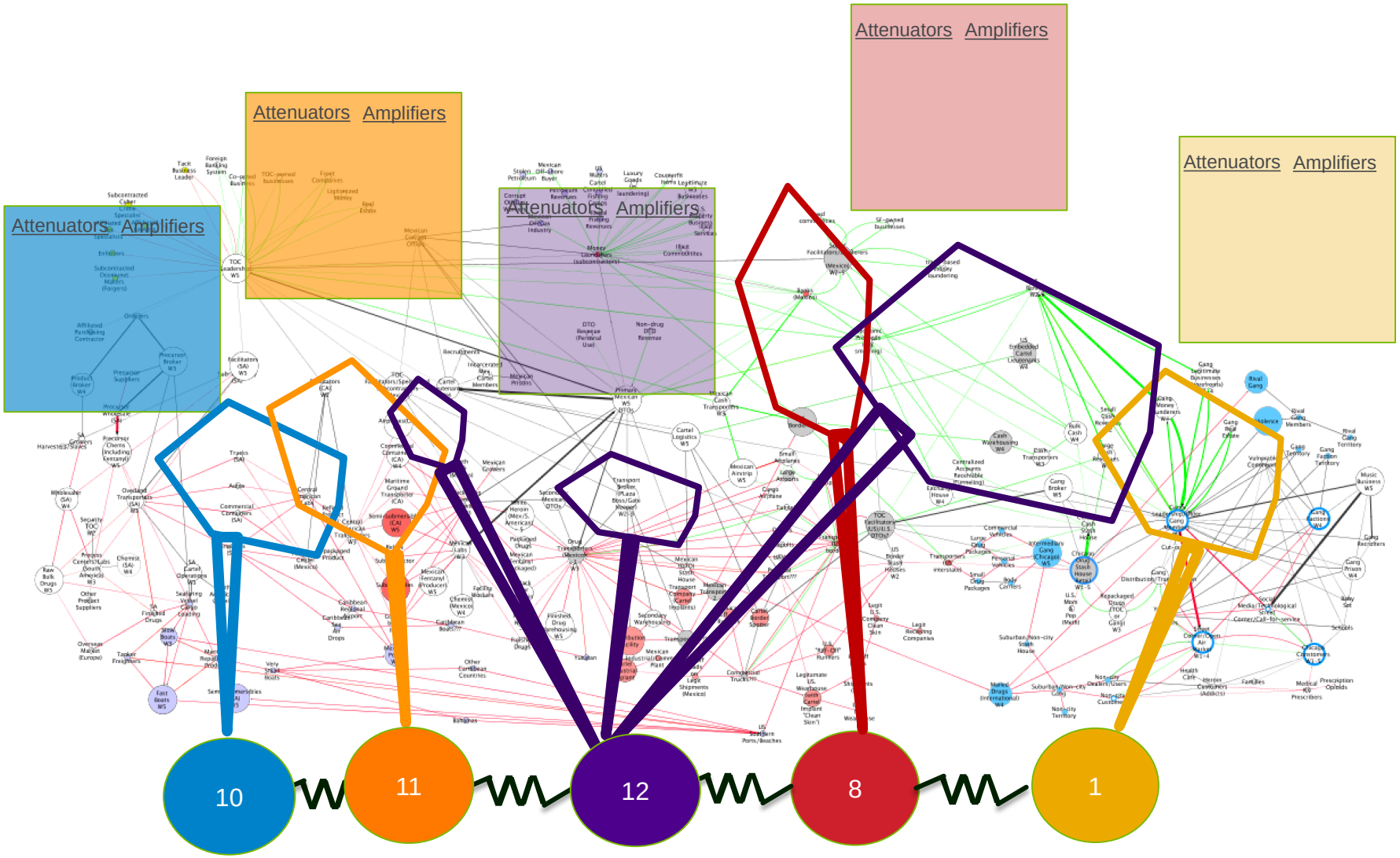
- What would you like to call this interagency entity?
- What might be the purpose of this Interagency?
- What might be a set of values for it?

System 5
Identity
Ethos
Policy

BlueNet

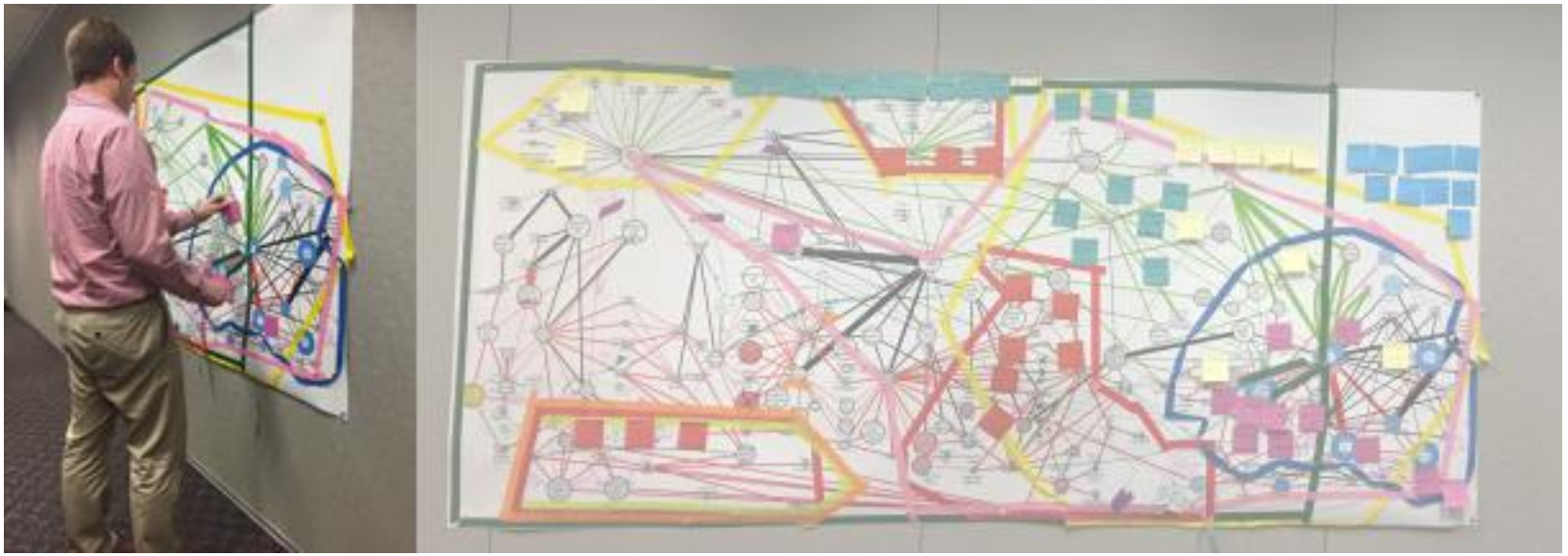
BlueNet is an elite law enforcement squad that spans across and unifies the agencies dedicated to countering illicit drug trafficking organizations that threaten our communities, impacts the health of our citizens, and poses a real national security threat to the nation. Joining forces and leveraging from our collective knowledge, experience, and resources, BlueNet will unravel the complexities of drug trafficking operations while protecting personal rights. We pledge to relentlessly counter their illicit activities from source to street corner.

SYSTEM 1 AND LOCAL ENVIRONMENTS

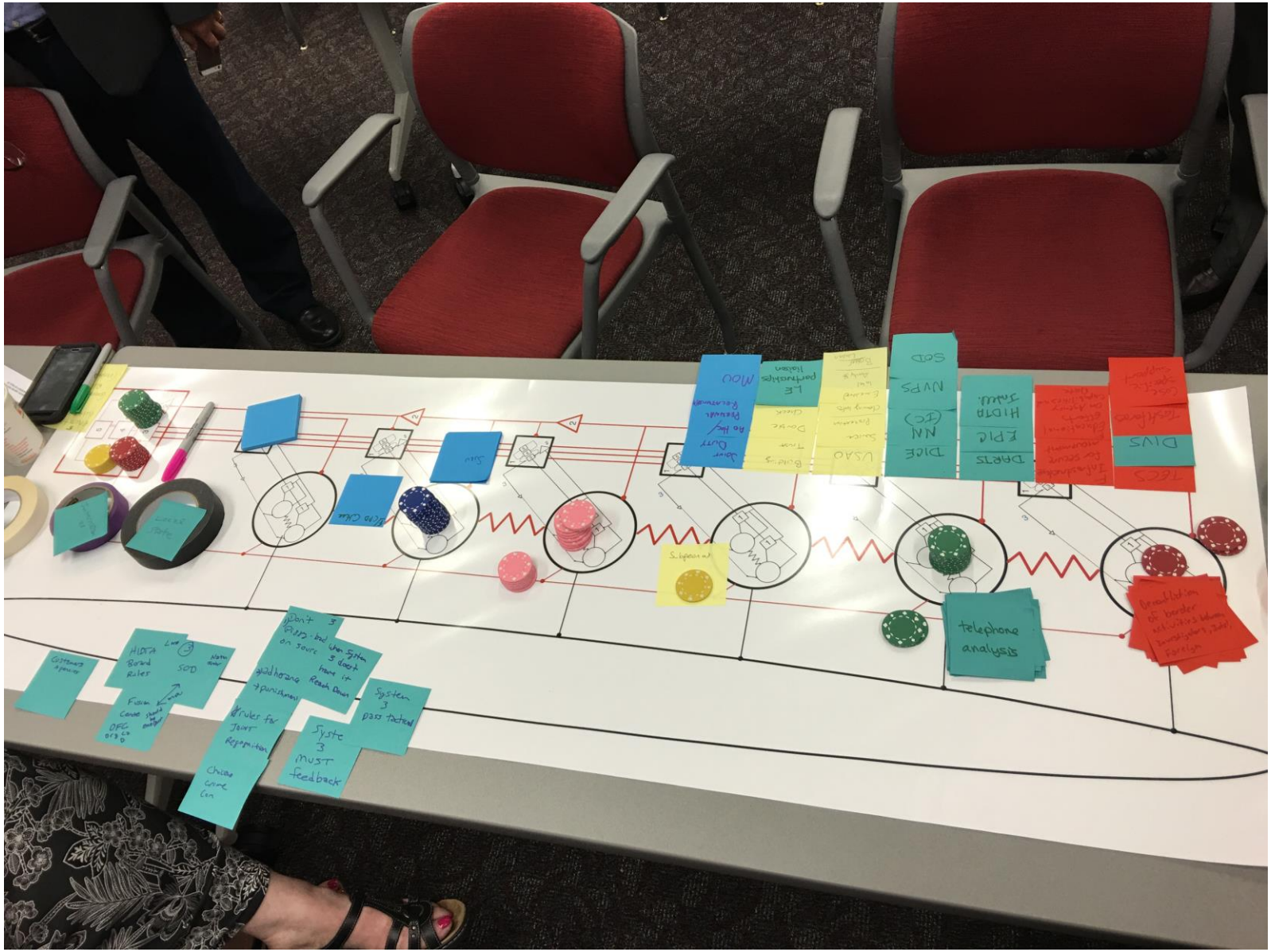


All System 1s both influence the environment and are influenced by it

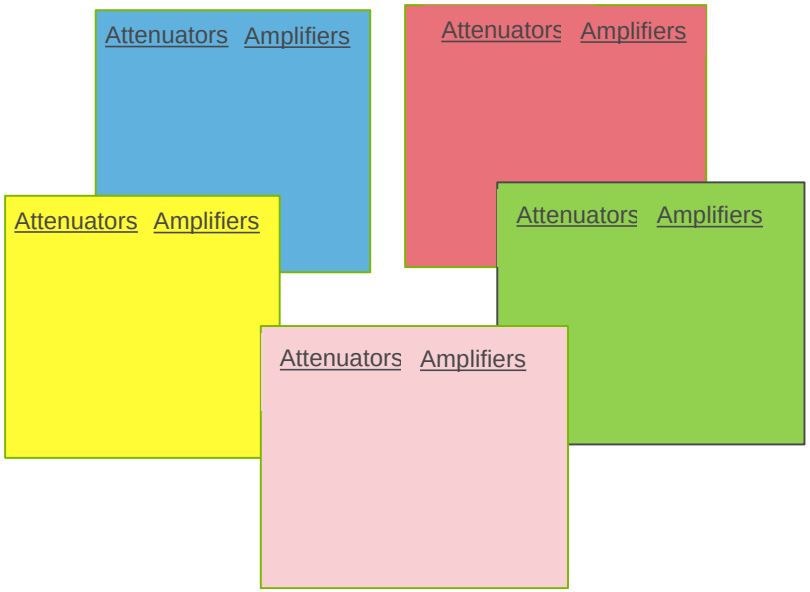
SYSTEM 1 AND LOCAL ENVIRONMENTS



VSM "BOARD"



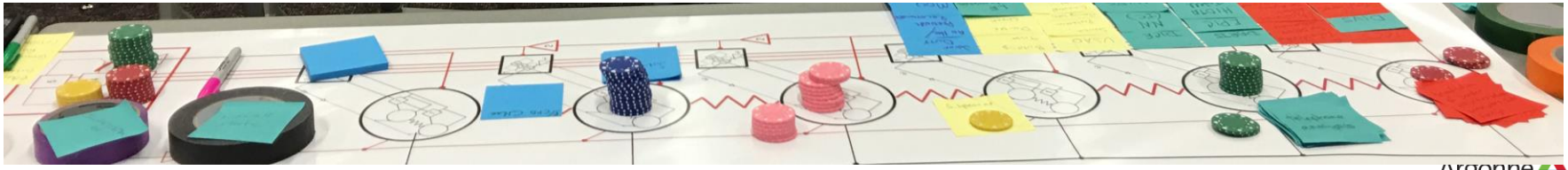
CHANNELS: WHAT'S COLLECTED? WHAT CAN BE SHARED?



Stakeholders receive a token (poker chip) for each piece of information about the environment that they are collecting

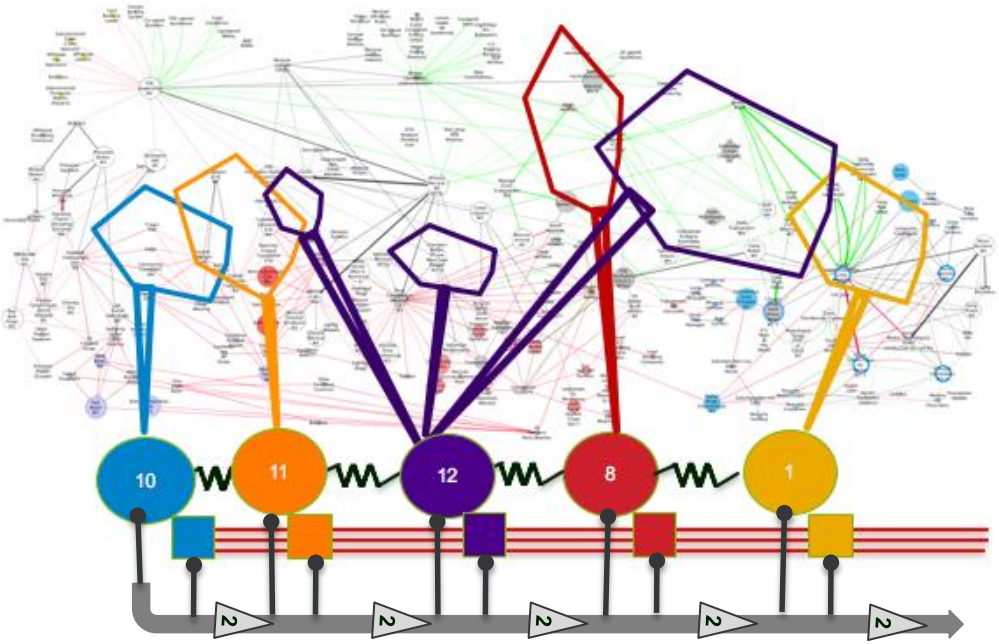
Stakeholders separate shareable from un-shareable

- **Move shareable into channels**
- **Discuss why some information is not shareable**



SYSTEM 2

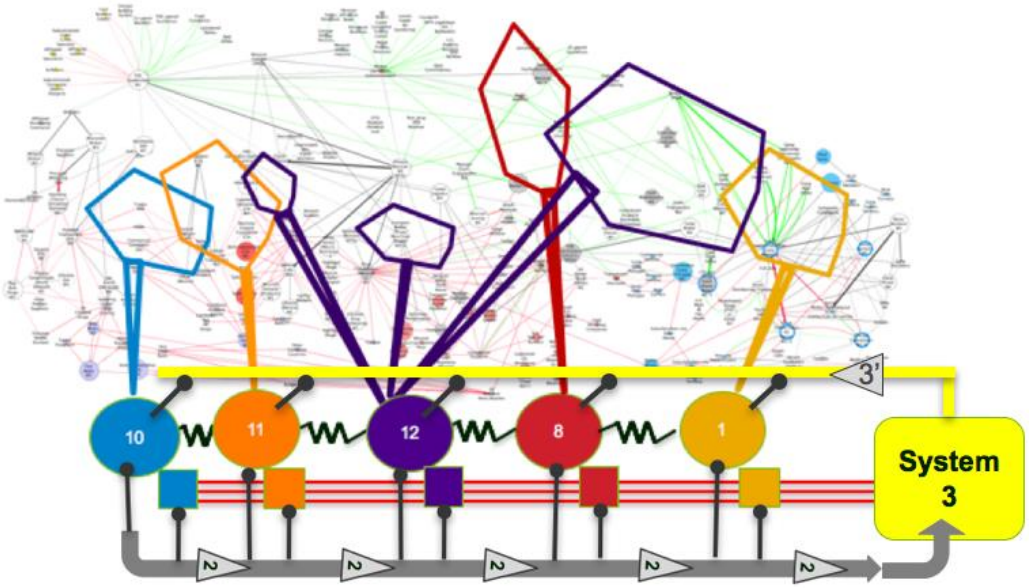
- Coordinates the S1s
- Deals with the day-to-day operations and is involved in providing cohesion
- Coordination is often accomplished through processes that are mutually agreed upon among S1s
- Could include mechanisms that overcome un-sharable information
- Provides conflict resolution when discord exists between them
- Bring in “senior management” only when disagreements cannot be resolved



- What are current mechanisms for joint activities and what could be improved?
- What conflicts have arisen?
- How are conflicts resolved?

SYSTEM 3: CONTROL AND INTERNAL STABILITY

- Very close relationship with S2 but provides a broader profile
- Maintains the holistic interagency situational awareness (information flows through channels to S3 and then back to S1s again)
- Responsible for the internal stability and homeostasis
- Has the responsibility to monitor the activities of S1s through auditing procedures (S3*)
  - "Rules" for this Interagency must be agreed upon, accepted, and understood by System 1s



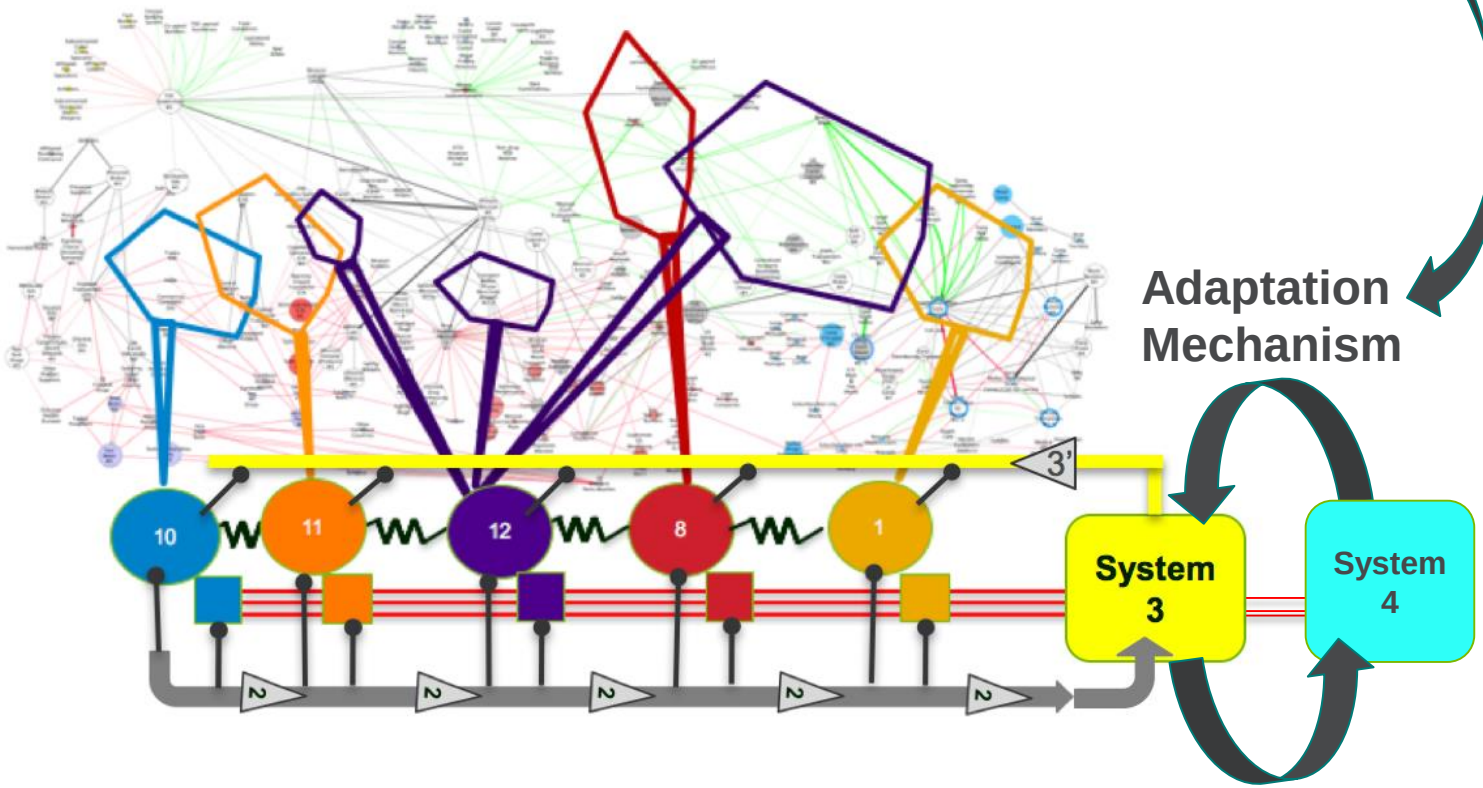
- What if joint budgets were allocated to S3 to provide resources to S1s?
- What resources might be shared amongst the S1s?
- How can S3 have a common holistic situational awareness?
- What might be some agreed-upon rules

SYSTEM 4: ANTICIPATION AND ADAPTATION

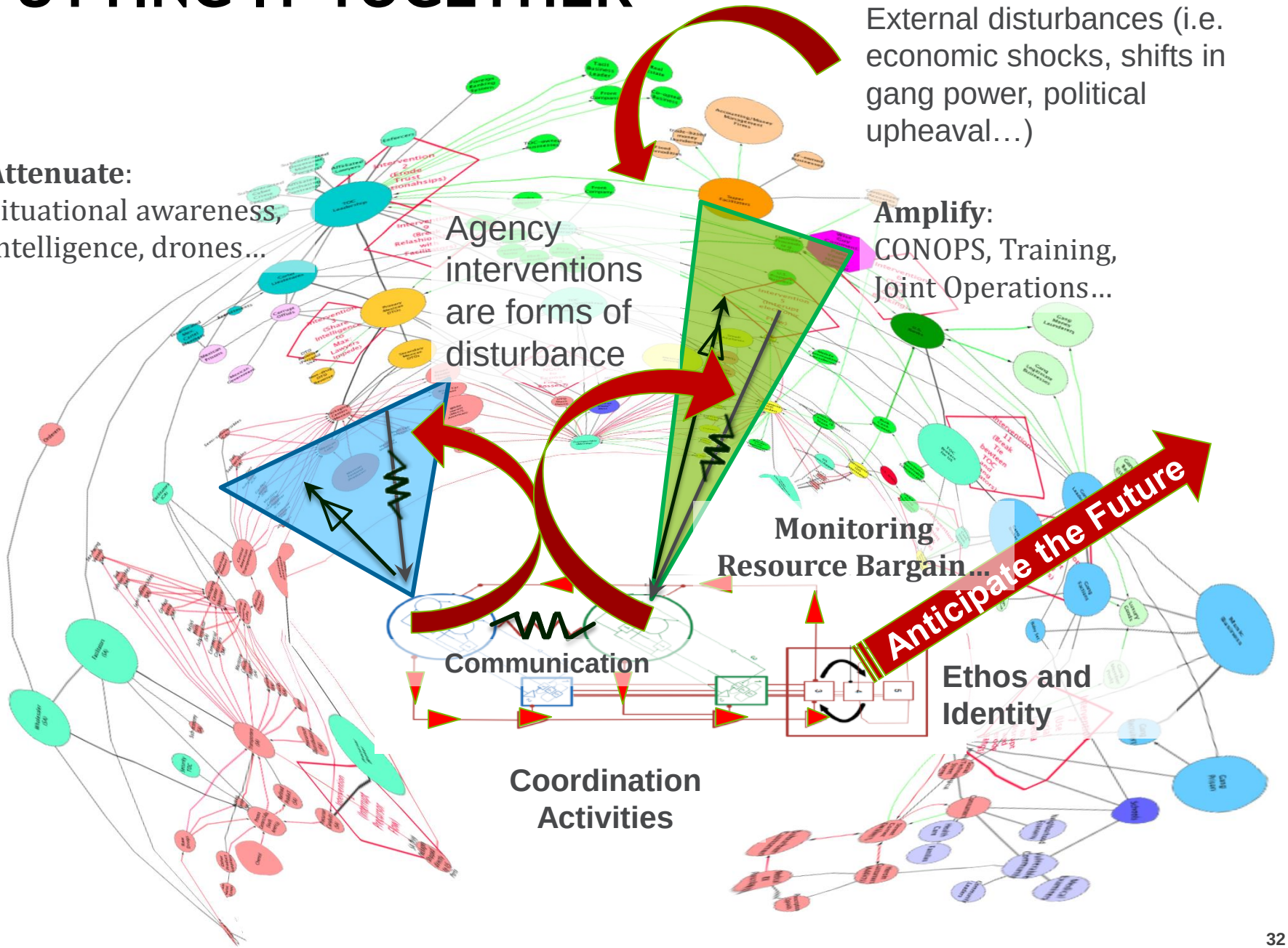
- What are current methods for anticipating the future?
- Are those projections shared?
- Might there be a centralized anticipation role?
- Who might play this role?
- What are possible new methods or technologies?
- How does the organization meet future needs?

Future Environment

Adaptation Mechanism



PUTTING IT TOGETHER



SYSTEMS SCIENCE CENTER

Making connections: systems solutions to complex problems

SYSTEMS SCIENCE ALWAYS STARTS WITH "WHAT IS THE PROBLEM?"

COMPLEX PROBLEMS ARE ILL-DEFINED, OPEN ENDED, HIGHLY INTERDEPENDENT AND HAVE MANY STAKEHOLDERS

- Complex problems are emergent, where the whole is greater than the sum of the parts
- Complex problems must be structured, diagnosed, and bounded by considering all stakeholder perspectives
- Complex problems require untangling physical, social, economic, and technological interrelationships

INTERDISCIPLINARY TEAM OF RESEARCHERS

CONNECTING WITH COLLABORATIVE PARTNERS

- Systems Scientists
- Natural Scientists
- Social Scientists
- Systems Engineers
- Operations Researchers
- Data Scientists/Analysts
- Decision Scientists
- Physical Scientists
- Computer Scientists
- Visualization Developers

OUR MISSION

- INCREASE UNDERSTANDING OF COMPLEX SYSTEM DYNAMICS AND BEHAVIOR
- PROVIDE THE ABILITY TO ANTICIPATE FUTURE CONDITIONS
- SUPPORT DECISION MAKING IN COMPLETE ENVIRONMENT

ADVANCING SYSTEMS SCIENCE AND TECHNOLOGY

- Interoperability Architectures
- Advanced Visualization
- Physical Systems Modeling
- Network Modeling
- Economic/Market Modeling
- Data Analytics (Big Data)
- System Dynamics
- Logistics and Supply Chain Modeling
- Agent-based Modeling
- High Performance Computing

DELIVERING SYSTEMS SOLUTIONS FOR DIVERSE COMPLEX PROBLEMS

- Energy Security
- Crime Systems
- Cyber Security
- Environmental Security
- WMD Threats
- Disease Spread
- Critical Materials
- Supply Chains
- Infrastructure
- Security

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QUESTIONS?

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