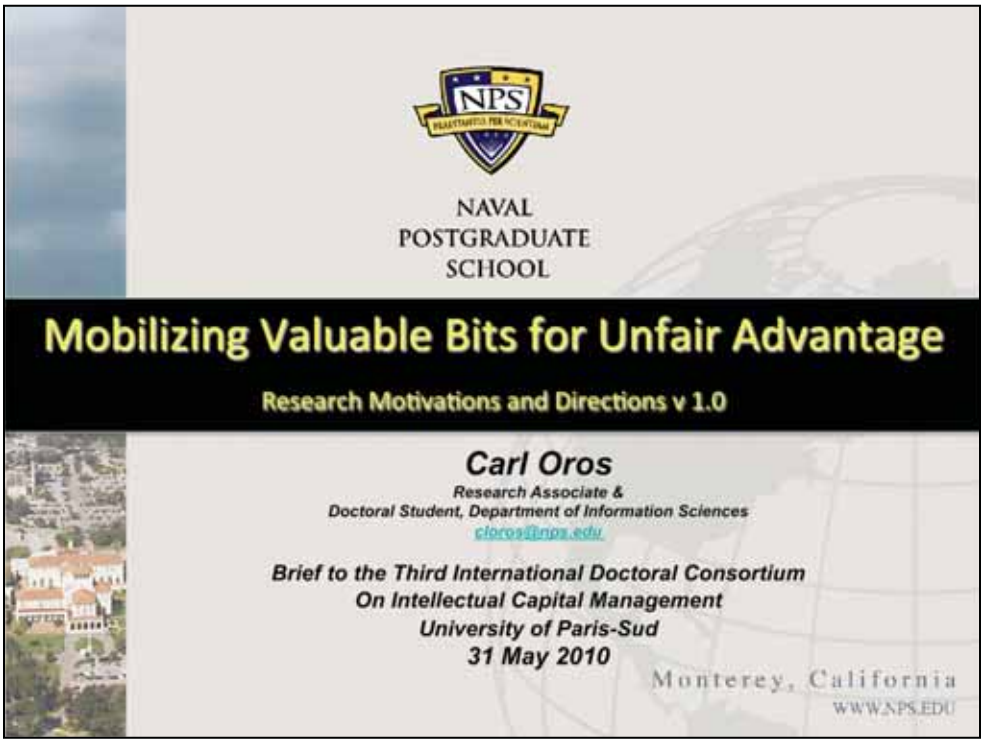
NPS
NAVAL
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Mobilizing Valuable Bits for Unfair Advantage
Research Motivations and Directions v 1.0
Carl Oros
Research Associate &
Doctoral Student, Department of Information Sciences
coros@nps.edu
Brief to the Third International Doctoral Consortium
On Intellectual Capital Management
University of Paris-Sud
31 May 2010
Monterey, California
WWW.NPS.EDU

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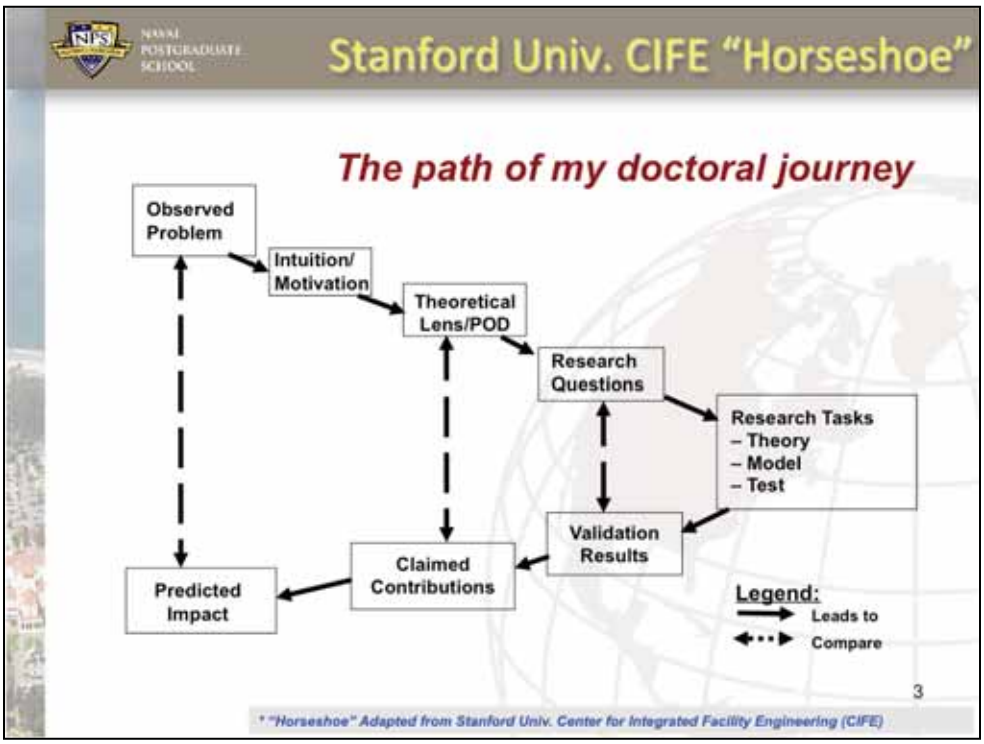
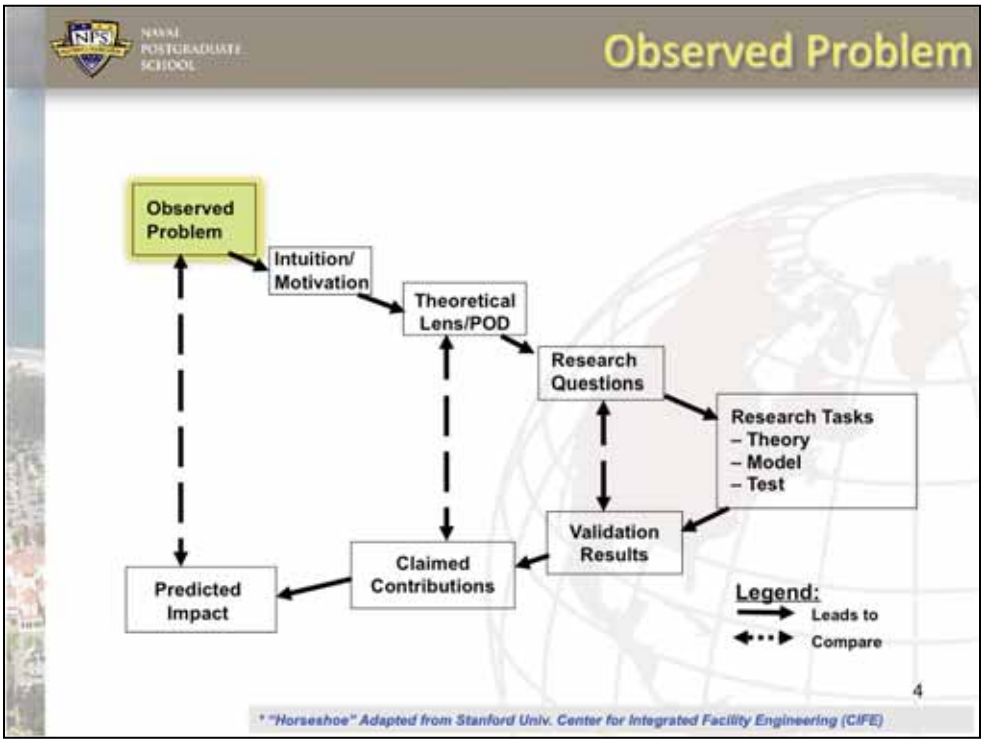
Research Space

My research is situated at the confluence of organizations, technology, and the environment. Specifically, can this information technology space be informed & architected such that semantically relevant (valued) timely bits are communicated as the norm?


NAVAL POSTGRADUATE SCHOOL
Stanford Univ. CIFE "Horseshoe"
The path of my doctoral journey
Observed Problem
Intuition/ Motivation
Theoretical Lens/POD
Research Questions
Research Tasks
– Theory
– Model
– Test
Validation Results
Claimed Contributions
Predicted Impact
Legend:
Leads to
Compare
3
* "Horseshoe" Adapted from Stanford Univ. Center for Integrated Facility Engineering (CIFE)


NAVAL POSTGRADUATE SCHOOL
Observed Problem
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Theoretical Lens/POD
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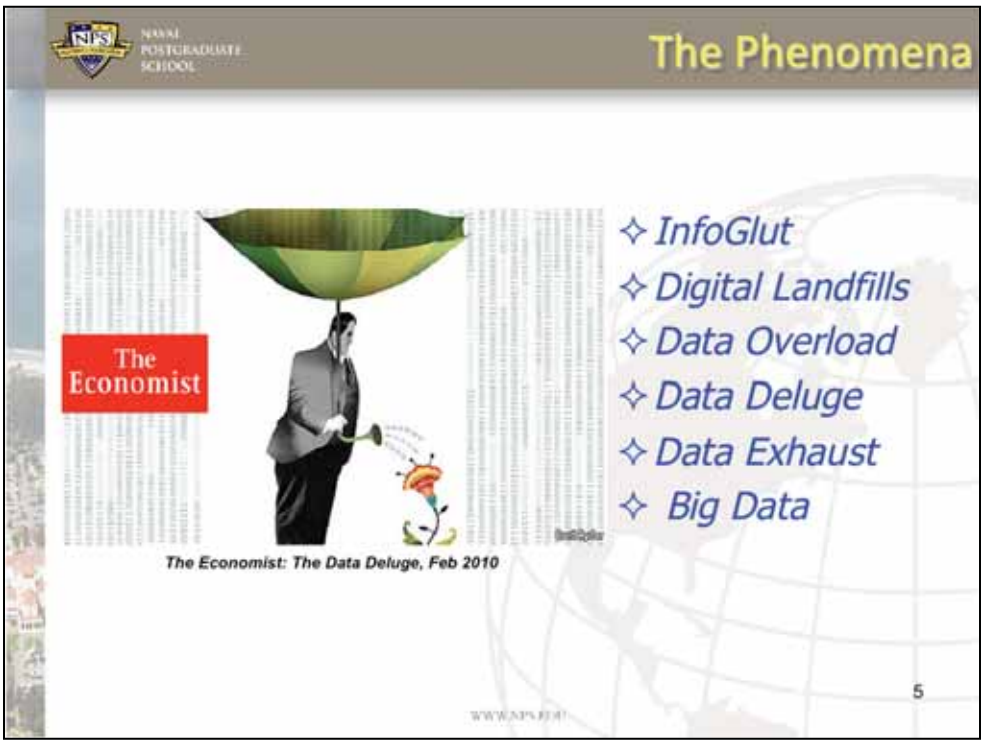
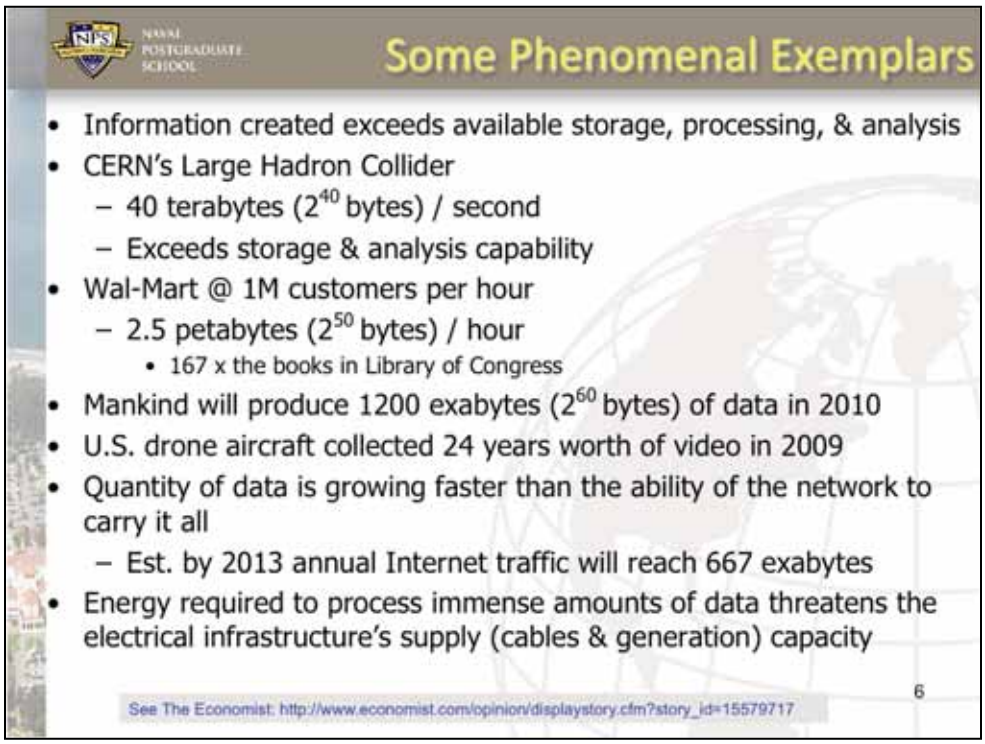


Economist: http://www.economist.com/opinion/displaystory.cfm?story_id=15579717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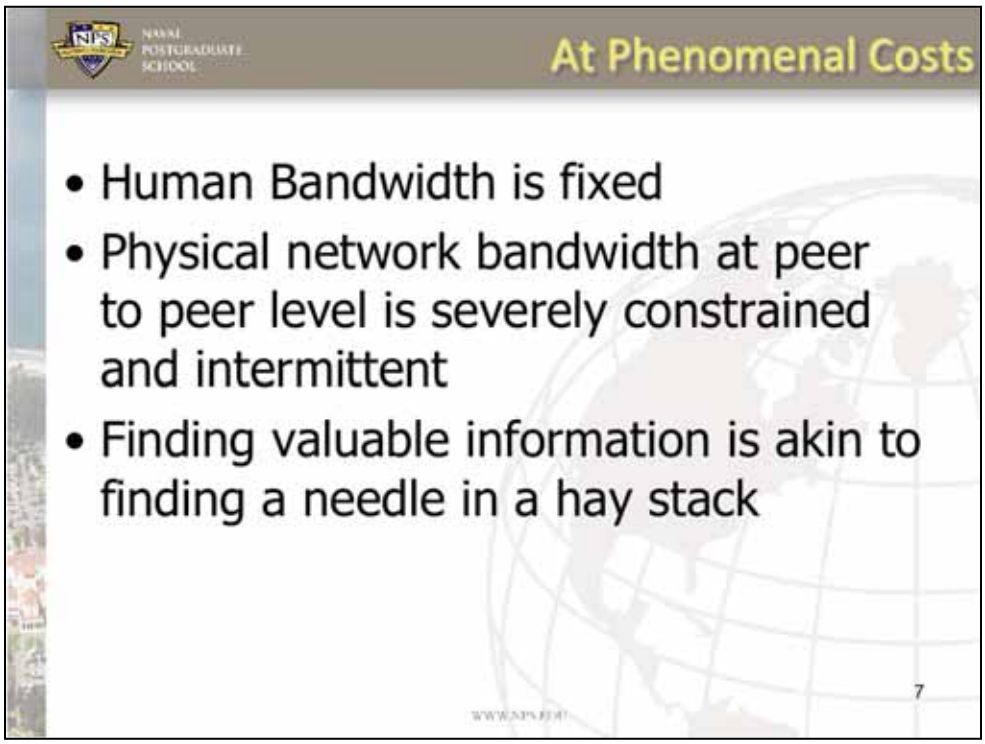
Some Phenomenal Exemplars
• Information created exceeds available storage, processing, & analysis
• CERN's Large Hadron Collider
– 40 terabytes (2^{40} bytes) / second
– Exceeds storage & analysis capability
• Wal-Mart @ 1M customers per hour
– 2.5 petabytes (2^{50} bytes) / hour
• 167 x the books in Library of Congress
• Mankind will produce 1200 exabytes (2^{60} bytes) of data in 2010
• U.S. drone aircraft collected 24 years worth of video in 2009
• Quantity of data is growing faster than the ability of the network to carry it all
– Est. by 2013 annual Internet traffic will reach 667 exabytes
• Energy required to process immense amounts of data threatens the electrical infrastructure's supply (cables & generation) capacity
6
See The Economist: http://www.economist.com/opinion/displaystory.cfm?story_id=15579717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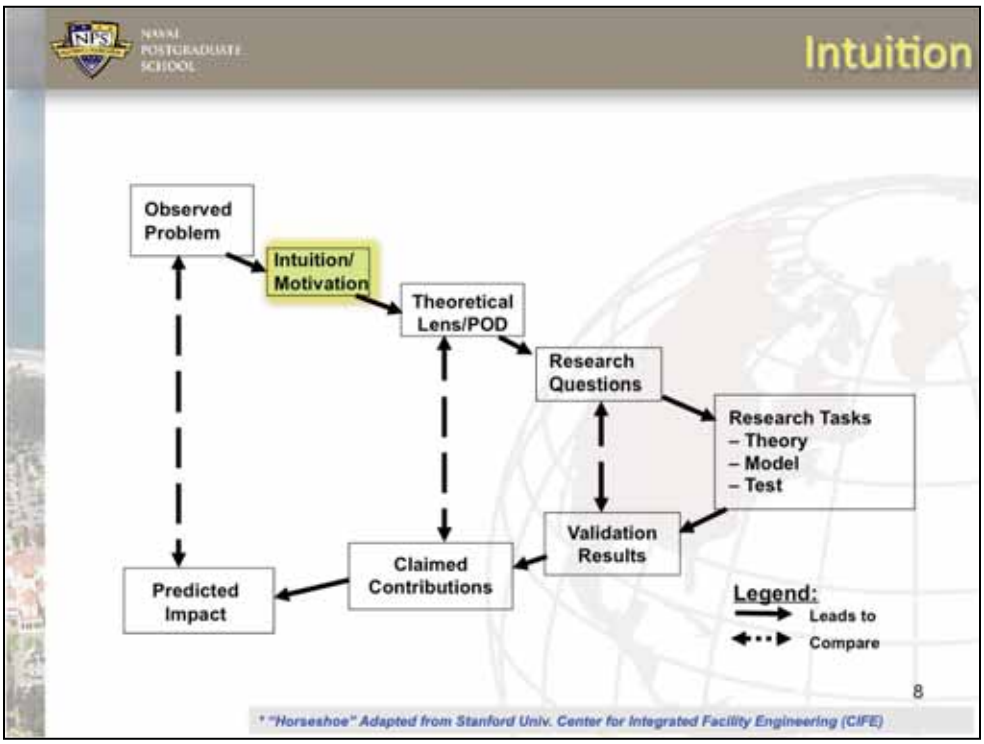
At Phenomenal Costs
• Human Bandwidth is fixed
• Physical network bandwidth at peer to peer level is severely constrained and intermittent
• Finding valuable information is akin to finding a needle in a hay stack
7


NAVAL POSTGRADUATE SCHOOL
Intuition
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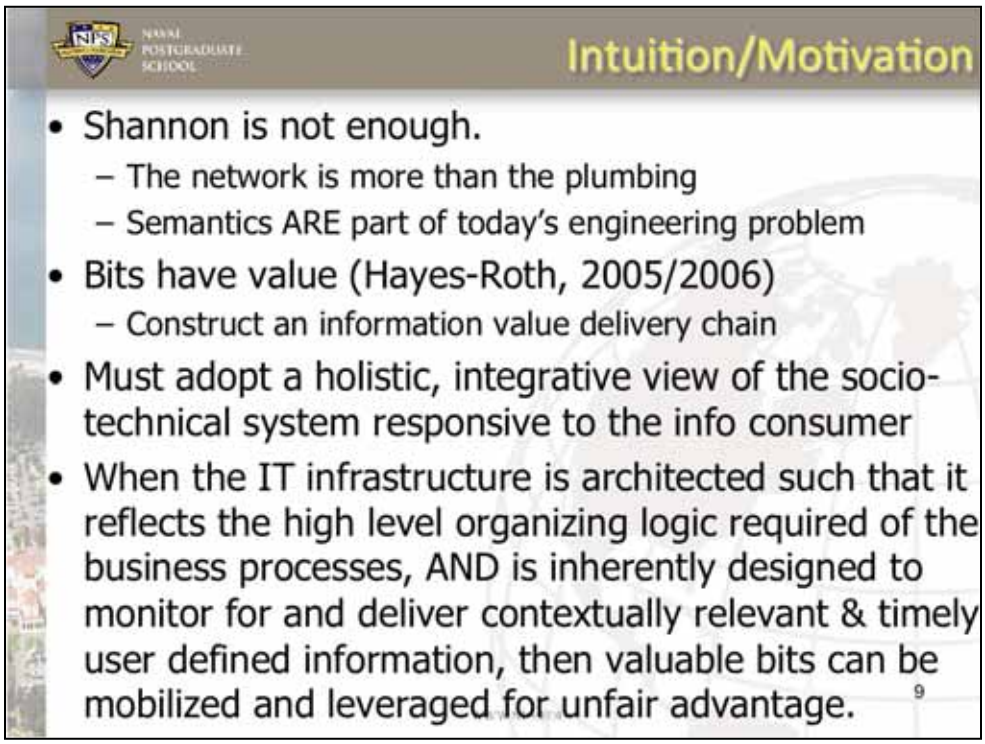


Architecture:

IEEE STD 1471-2000: **Systems and Software engineering-Recommended practice for architectural description of software-intensive systems**

-The fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding their evolution

-Software intensive system: Any system where software contributes essential influences to the design, construction, deployment, and evolution of the system as a whole.

Enterprise Architecture:

Ross, et. al, "Enterprise Architecture as a Strategy

"High level, organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company's ***operating model***

Long term view of processes, systems, & technologies so individual projects can build capabilities, vice fulfill immediate needs

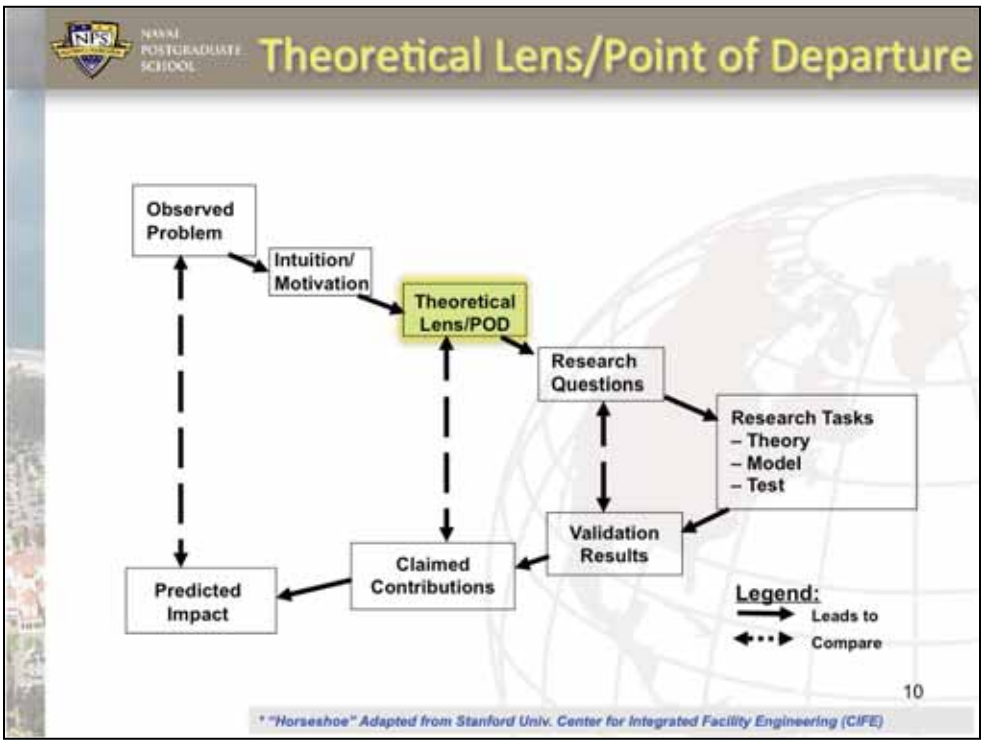
Key to effective EA is to identify the

Processes
Data
Technologies
Customer Interfaces

… that take the operating model from vision to reality"

Daniel Minoli, "Enterprise Architecture A to Z

"A blueprint for the optimal target-conformant placement of resources in the IT environment for the ultimate support of the business function."


Theoretical Lens/Point of Departure
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Theoretical Lens/POD
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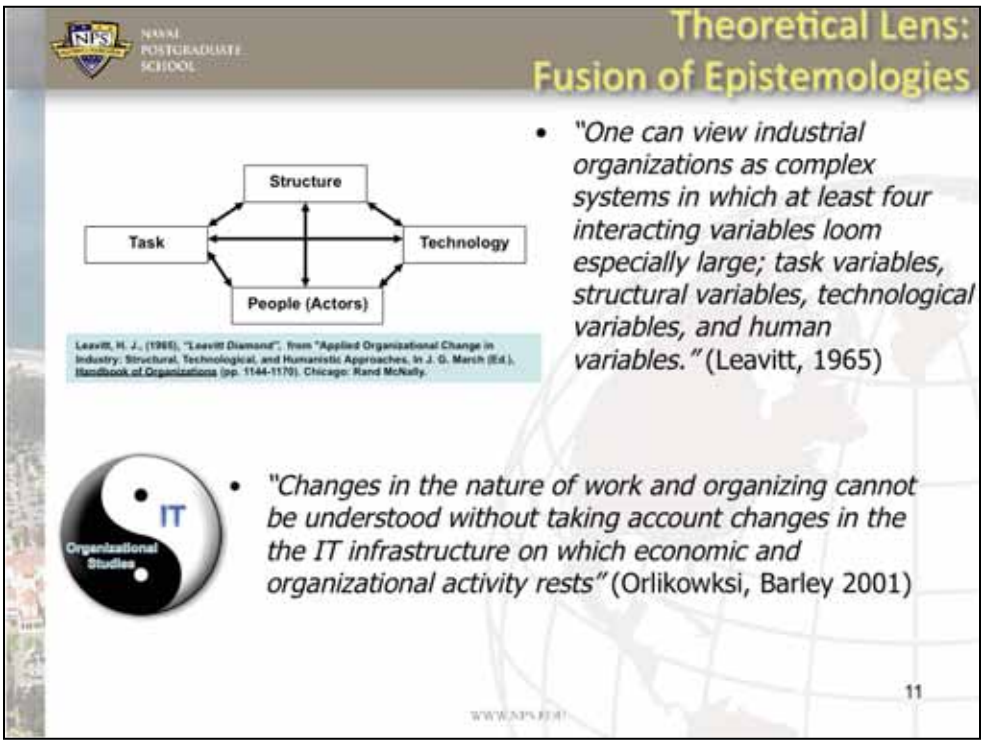


Leavitt, H. J., (1965), *"Leavitt Diamond",* from "Applied Organizational Change in Industry: Structural, Technological, and Humanistic Approaches, In J. G. March (Ed.), Handbook of Organizations (pp. 1144-1170). Chicago: Rand McNally.

"Task: Production of goods and services, including large numbers of different but operationally meaningful subtasks.

Actors: people, but acts executed by people at some time or place need not remain exclusively in the human domain.

Technology: direct problem solving inventions like work measurement techniques or computers or drill presses. Includes machines and programs [software?]

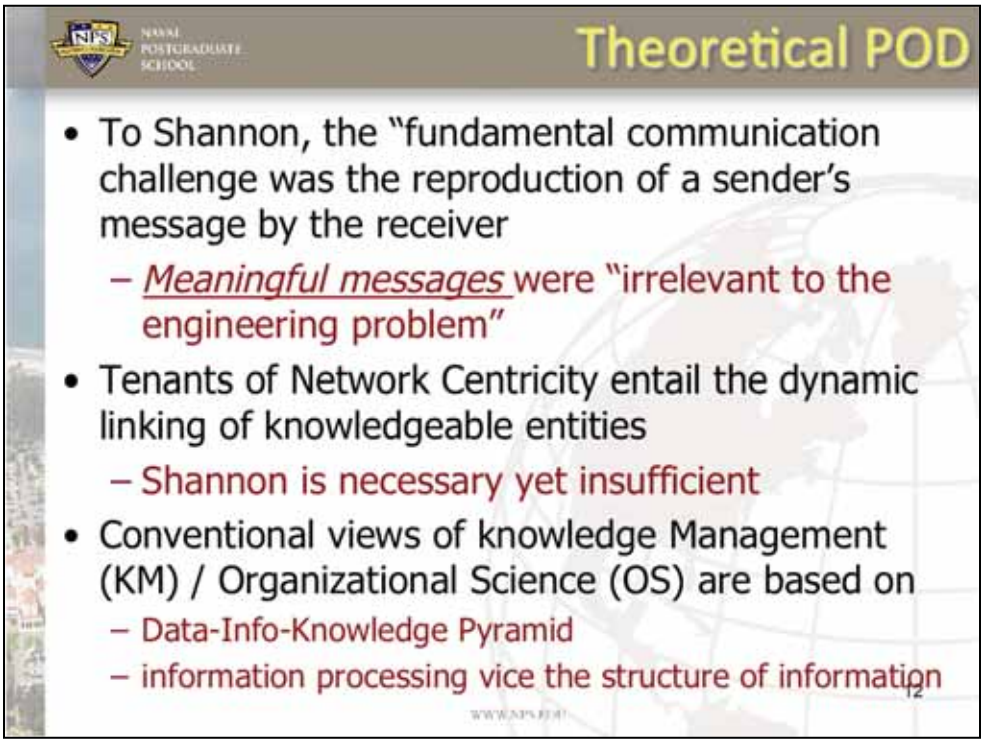
Structure: System of communication, systems of authority, and systems of work flow.

Highly interdependent…change in anyone usually results in compensatory (or retaliatory) change in others."

Orlikowski:

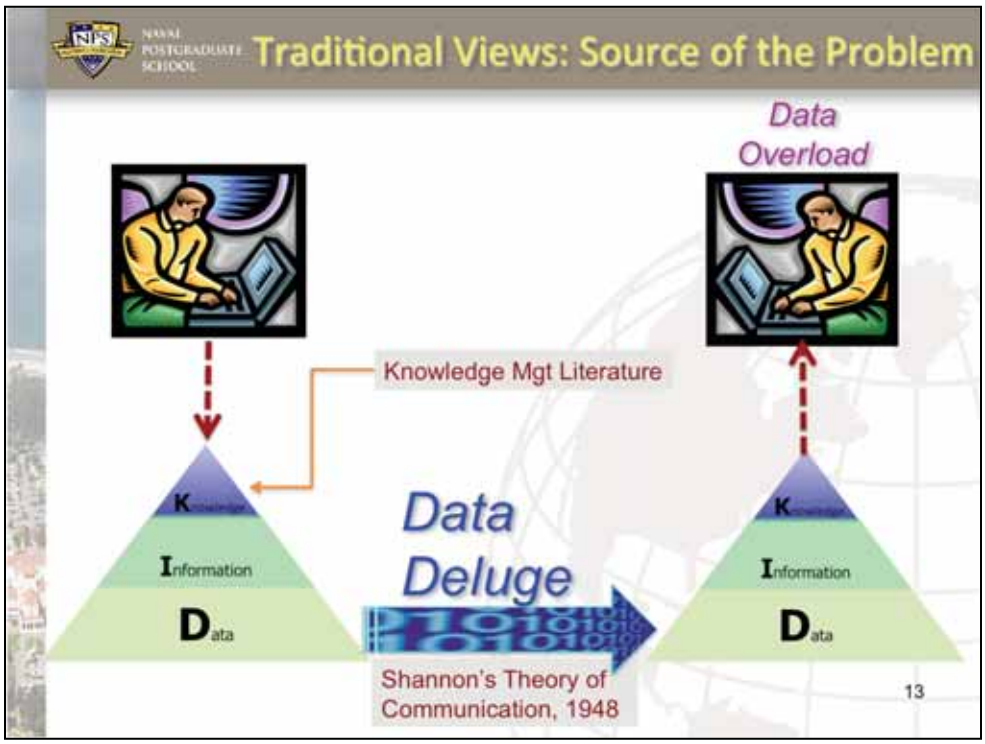
Wanda J. Orlikowski and Stephen R. Barley,* Technology and Institutions: What Can Research on Information Technology and Research on Organizations Learn from Each Other? *Volume 25, Issue 2, June 2001, pp. 145-165

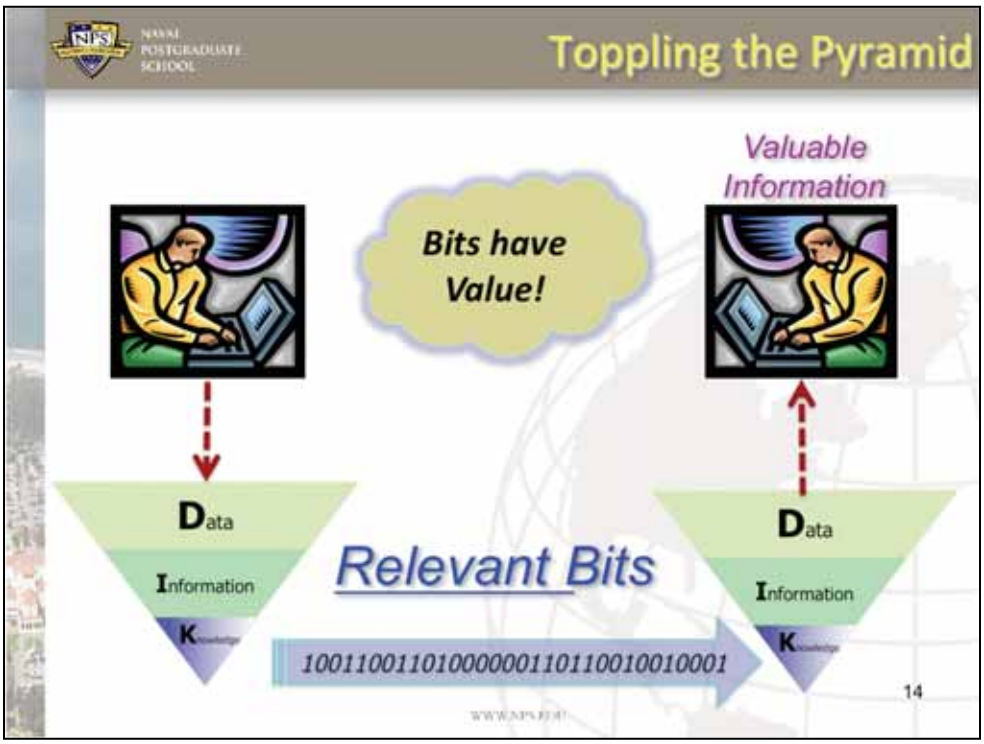
"Techno-social structure that increasingly pervade our lives."



See:

Claude E. Shannon, *A Mathematical Theory of Communication, The Bell System Technical Journal, Vol. 27, pp. 379–423, 623–656, July, October, 1948.*


Traditional Views: Source of the Problem
Data Overload
Knowledge Mgt Literature
K
Information
Data
Data Deluge
K
Information
Data
Shannon's Theory of Communication, 1948
13



See

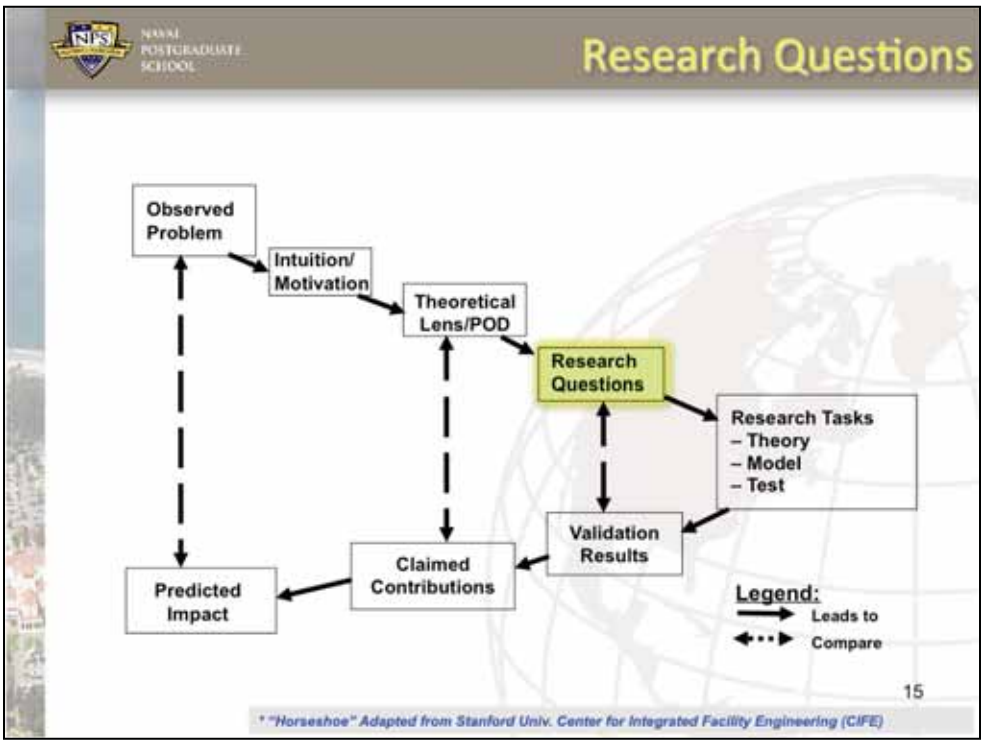
Ilkka Tuomi. ***Journal of Management Information Systems. Armonk: Winter 1999/2000. Vol. 16, Iss. 3; pg. 103, 15 pgs***

Hayes-Roth, F. (2006).
Model-Based Communication Networks and VIRT: Orders of Magnitude Better for Information Superiority. MILCOM 2006, Washington, DC, IEEE.

Hayes-Roth, F. (2005).
Model-based Communication Networks and VIRT: Filtering Information by Value to Improve Collaborative Decision-Making. 10th International Command and Control Research and Technology Symposium: The Future of C2, McLean, VA, US Department of Defense, Command and Control Research Program (CCRP

Hayes-Roth, F. (2006).
Valued Information at the Right Time (VIRT): Why less volume is more value in hastily formed networks, NPS Cebrowski Institute.

Hayes-Roth, F. (2006).
Two Theories of Process Design for Information Superiority: Smart Pull vs. Smart Push. 2006 Command and Control Research and Technology Symposium, San Diego, CA, US Department of Defense, Command and Control Research Program


NAVAL POSTGRADUATE SCHOOL
Research Questions
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* "Horseshoe" Adapted from Stanford Univ. Center for Integrated Facility Engineering (CIFE)

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Mobilizing Valuable Bits

- Can we leverage technological advances in computer processing and software to transmit valuable *needles of knowledge* vice search through mountainous, digital "haystacks"?

-If so, via what methodology?
-What architectural approach?

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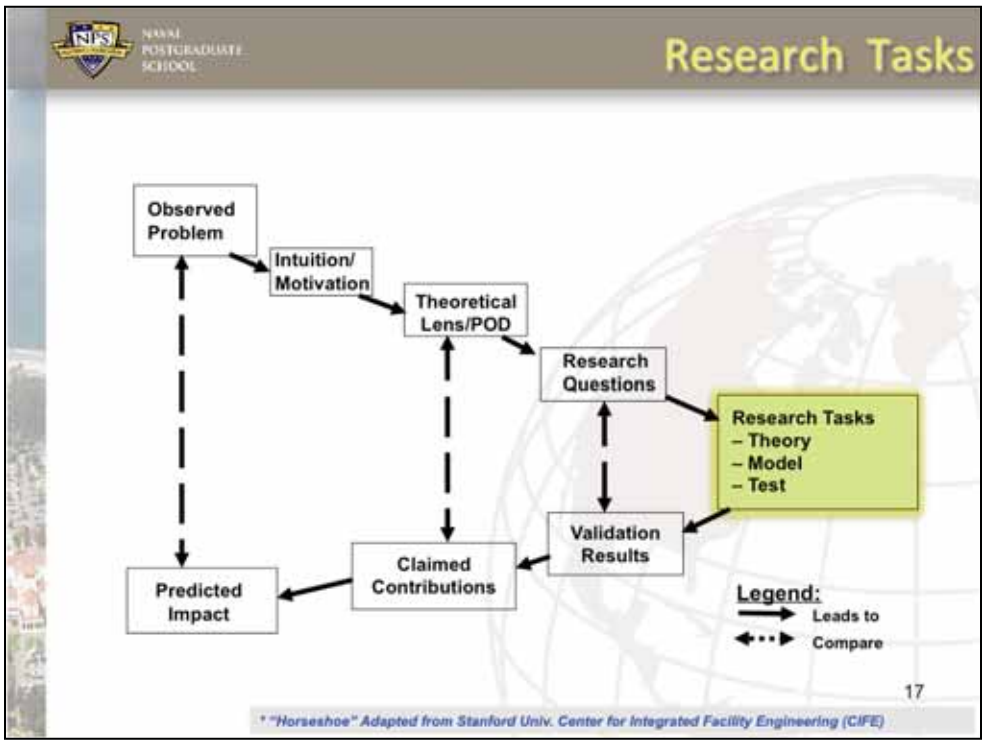
NAVAL POSTGRADUATE SCHOOL
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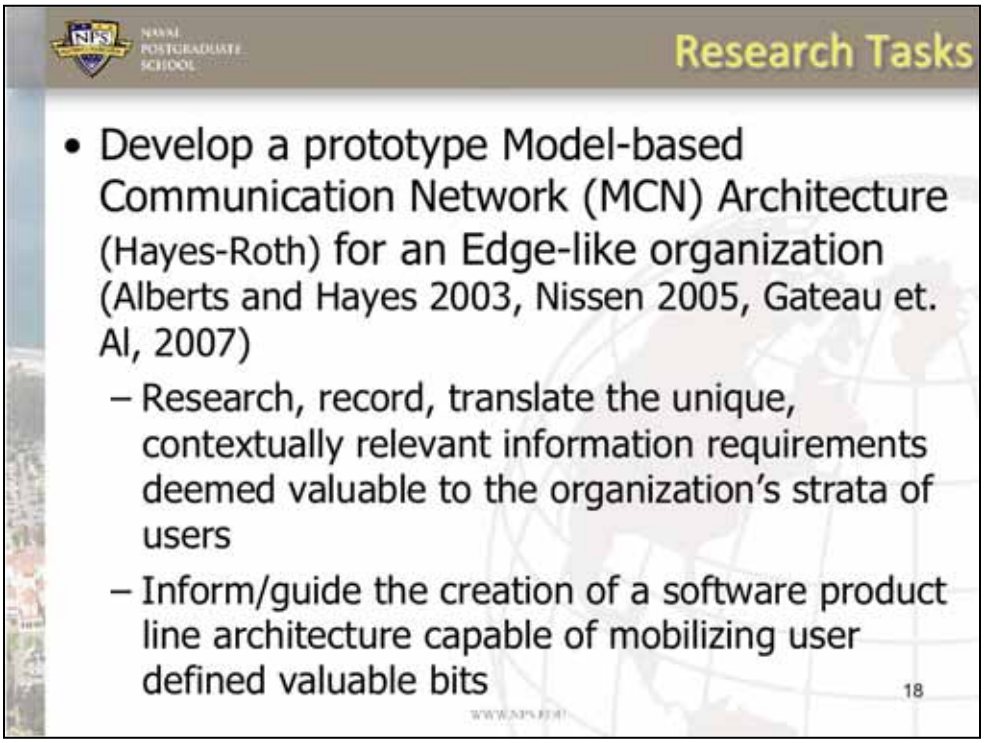


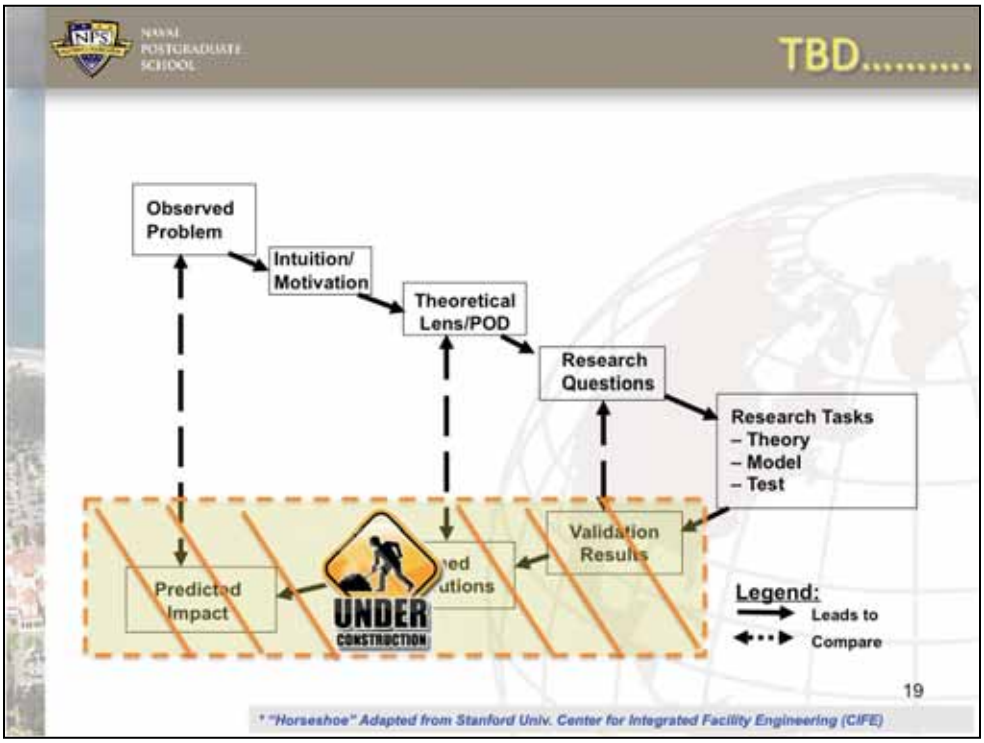
Edge Organization

Alberts, D.S. and Hayes, R.E., 2003. *Power to the Edge CCRP.*

Nissen, M.E. 2005a. Hypothesis Testing of Edge Organizations: Specifying Computational C2 Models for Experimentation. *Proceedings International Command & Control Research Symposium. McLean, VA.*

Nissen, M.E., 2005b. "A Computational Approach to Diagnosing Misfits, Inducing Requirements, and Delineating Transformations for Edge Organizations," Proceedings International Command and Control Research and Technology Symposium, McLean, VA , June 2005

James B. Gateau, Tara A. Leweling, John P. Looney, Dr. Mark E. Nissen, "Hypothesis Testing of Edge Organizations: Modeling the C2 Organization Design Space, 12th ICCRTS Adapting C2 to the 21st Century, Nwport, RI, June 2007.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TBD.....
Observed Problem
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Theoretical Lens/POD
Research Questions
Research Tasks
– Theory
– Model
– Test
Validation Results
Predicted Impact
UNDER CONSTRUCTION
Legend:
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* "Horseshoe" Adapted from Stanford Univ. Center for Integrated Facility Engineering (CIFE)

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Questions
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Resources/Publications
• Oros, C.L. and Nissen, M.E., "Designing Complex organizations Computationally," Handbook of Research on Complex Dynamic Process Management: Techniques for Adaptability in Turbulent Environments, ISBN: 978-1-60566-669-3; 689 pp; July 2009.
• Oros, LtCol, C. L., USMC, "Enabling Adaptive C2 via Semantic Communication and Smart Push", Critical Issues in C4I, AFCEA-George Mason University C4I Symposium, George Mason University, Fairfax, Virginia Campus, May 2008
• Oros, LtCol Carl L., USMC, "Enabling Adaptive C2 via Semantic Communication and Smart Push", C2 for Complex Endeavors, 13th International Command & Control Research and Technology Symposium (ICCRTS),Track 2, Networks & Networking, #125, Seattle, WA, June 2008. Slides
• Oros, Maj Carl L., USMC, "Proposed Architecture for a Helicopter Information Awareness Module (I-AM)", 10th International Command & Control Research and Technology Symposium (ICCRTS), Track 3, Experimentation, # 374, McLean, VA, June, 2005. Slides
• Dr. Rick Hayes-Roth: http://faculty.nps.edu/fahayesr/
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