

NetSE Council

~~GSC Update~~

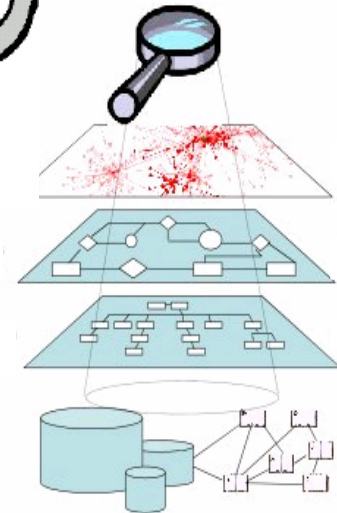
GENI Engineering Conference

4 March 2008

Ellen Zegura

# Challenge to the Community

Fundamental Question: Is there a **science** for understanding the complexity of our **networks** such that we can **engineer** them to have predictable behavior?



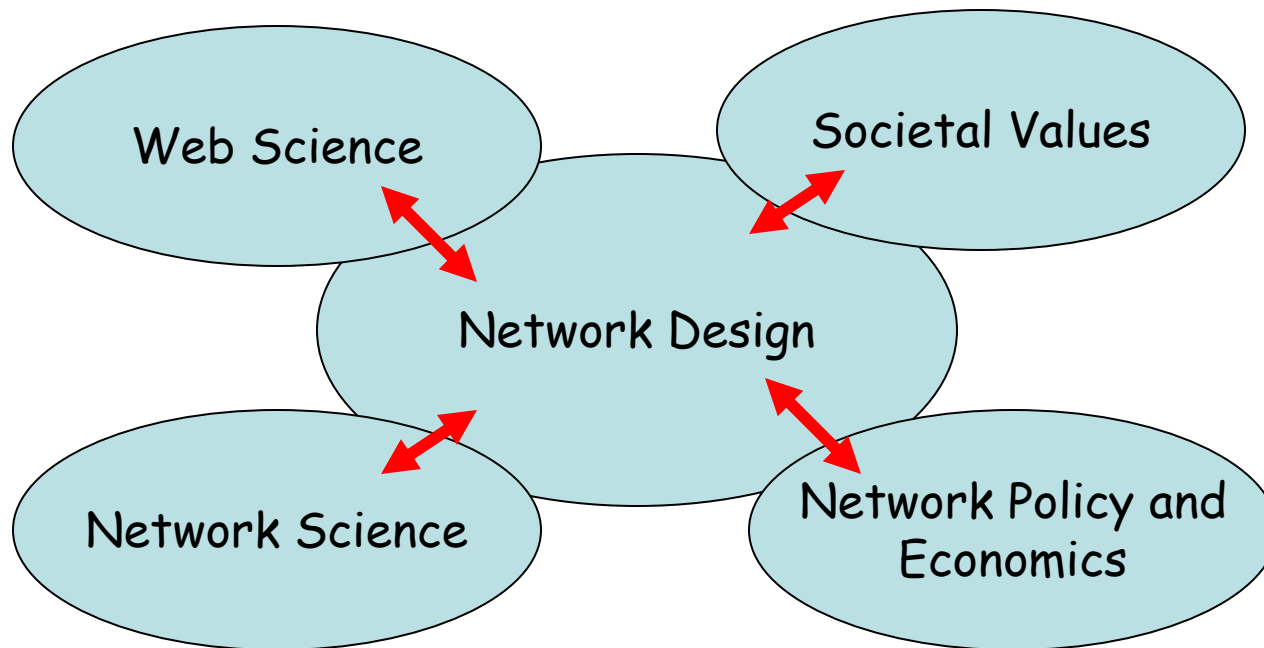
**Call to Arms:** To develop a compelling research agenda for the science and engineering of our evolving, complex networks.

# Rising to the Challenge

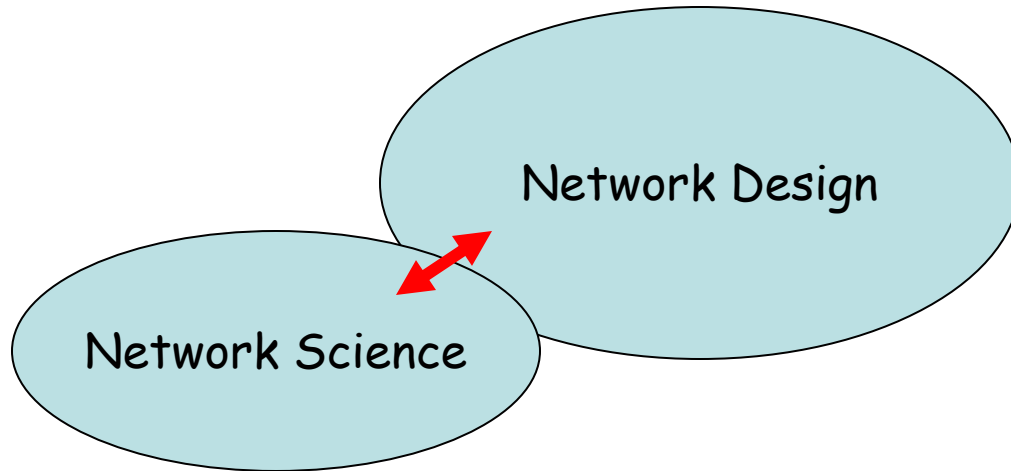
1. Understand and organize intellectual space (high level scope, structure)
  - strawman in a few slides
2. Bring together researchers to discuss and articulate parts of agenda
  - workshops late Spring, ...
3. Synthesize discussions into coherent vision with recommendations
4. [But what about GENI?]

# NetSE Intellectual Space

Goal: Networks with predictable behavior  
(better networks)



# Articulating Agenda I

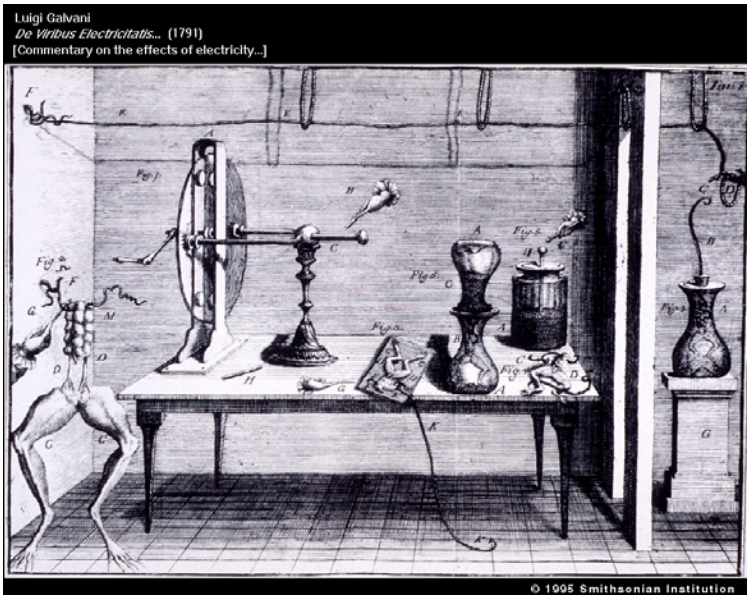


- Workshop on Science of Network Design
- Co-chairs:
  - John Doyle, CalTech
  - John Wroclawski, ISI

# Food for Thought

(courtesy John Wroclawski)

Electricity: 1800...

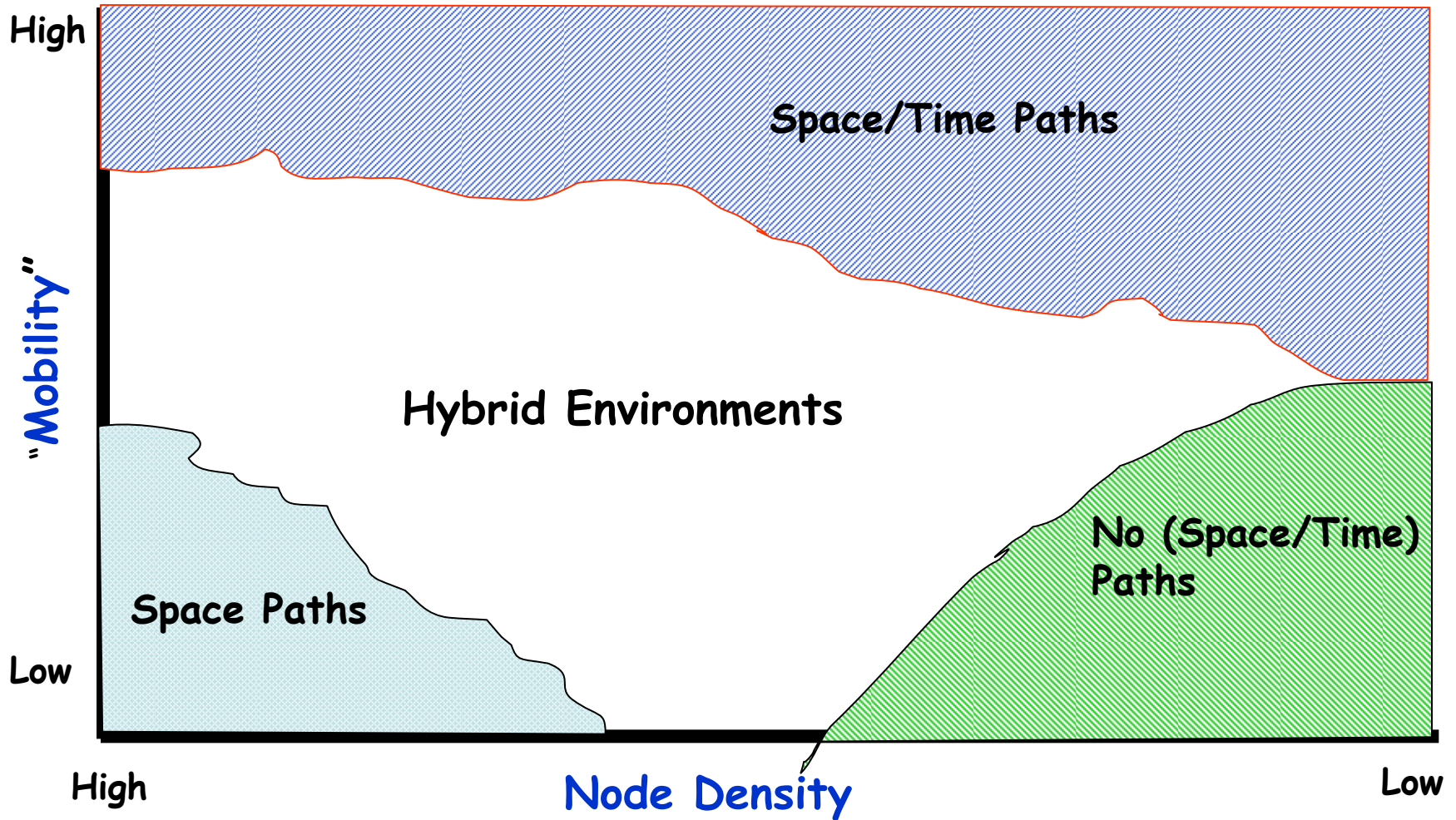


Electricity: Today...

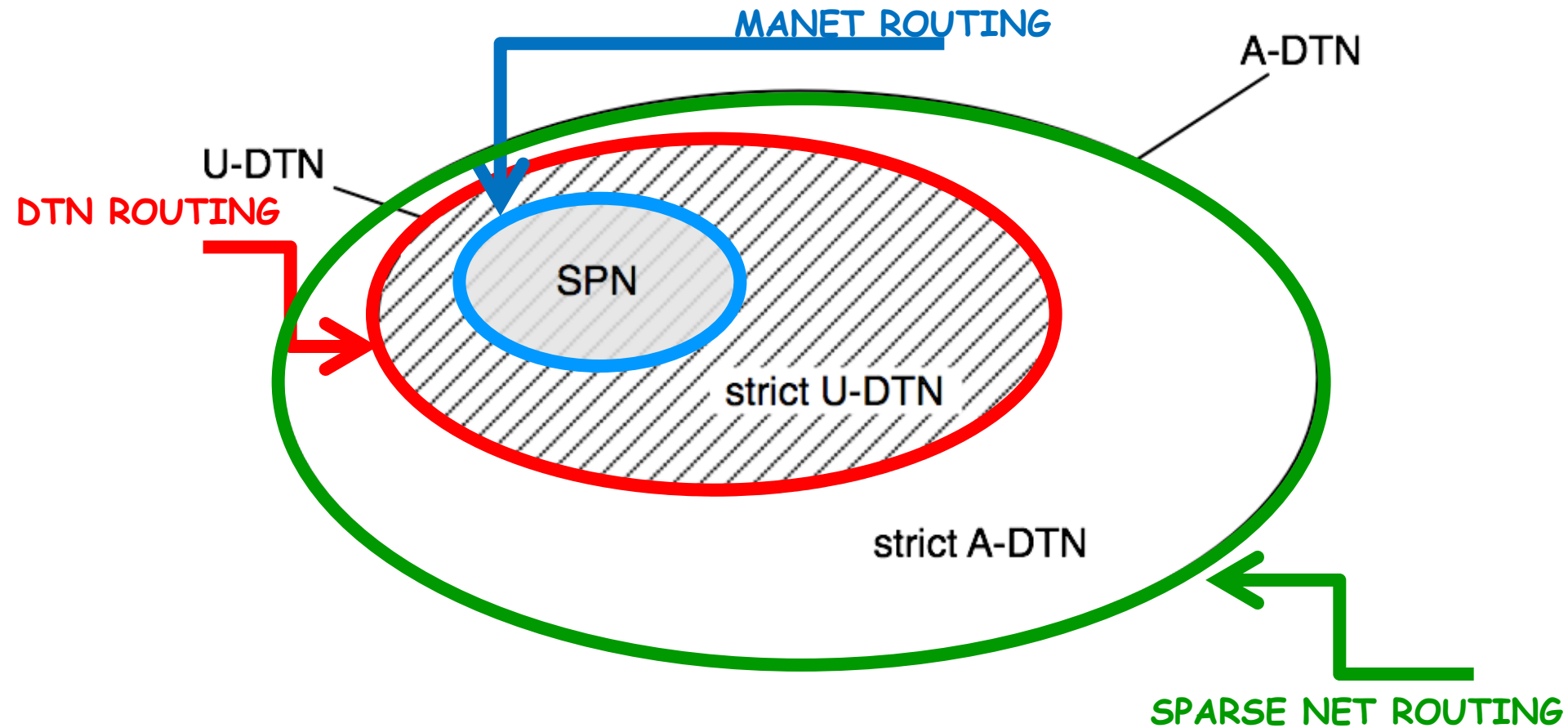
$$\oint \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0}$$
$$\oint \vec{B} \cdot d\vec{A} = 0$$
$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$$
$$\oint \vec{B} \cdot d\vec{s} = \mu_0 i + \frac{1}{c^2} \frac{\partial}{\partial t} \int \vec{E} \cdot d\vec{A}$$

What are the analogies...  
... for Network Architecture and Design?

# Example: Understanding

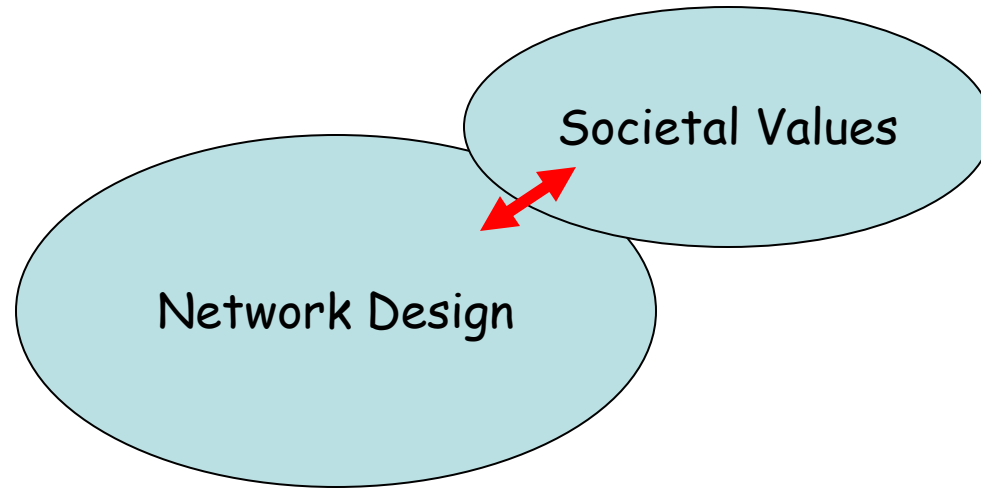


# Implications for Routing





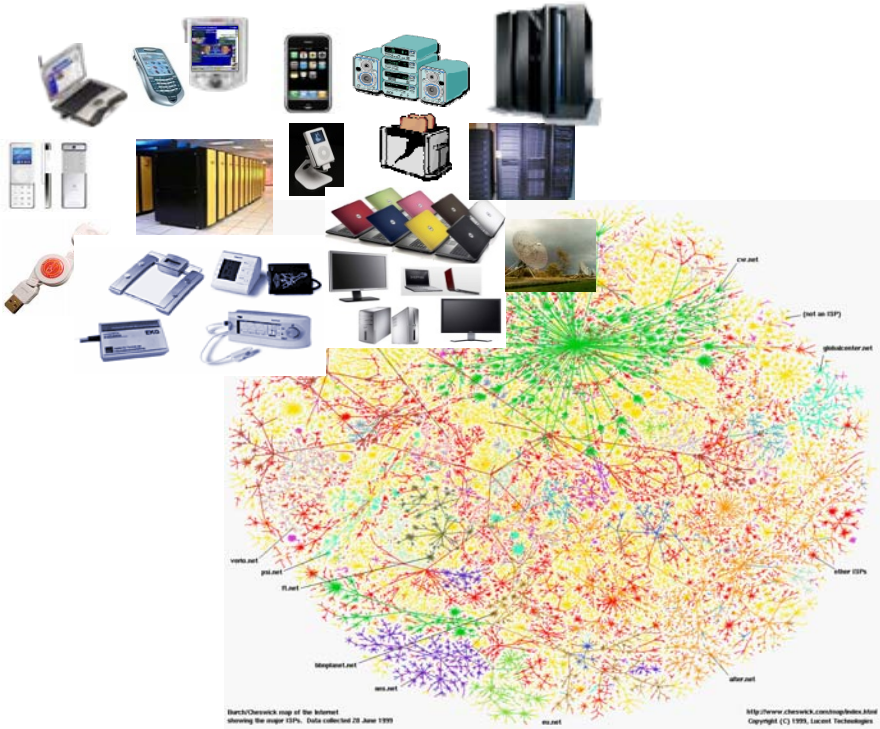
# Articulating Agenda II



- Workshop on Network Design and Societal Values
- Co-chairs:
  - Helen Nissenbaum, NYU
  - David Clark, MIT

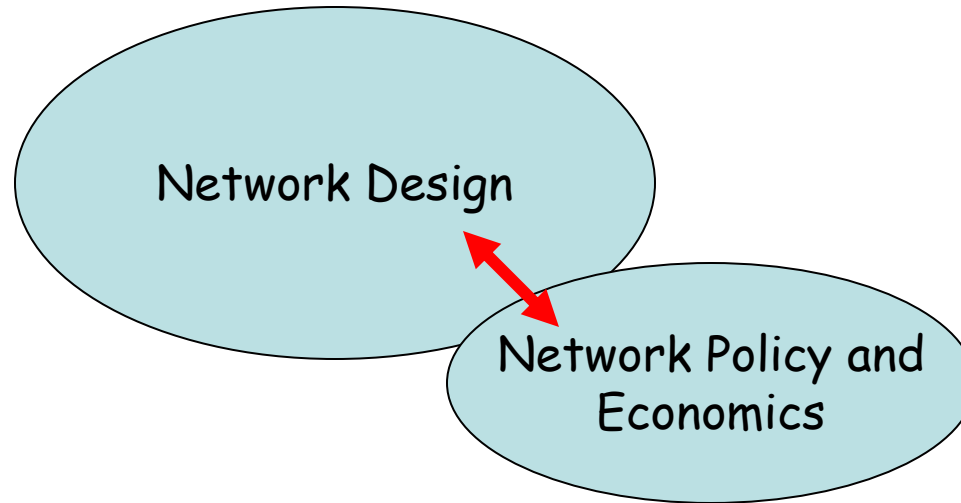
# Food for Thought

- (Where) does the current Internet embed assumptions of plenty?



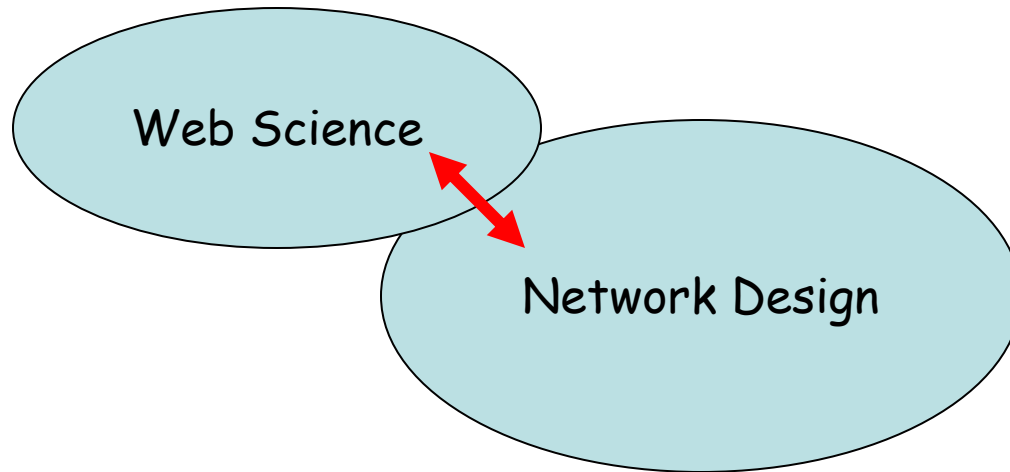
Does TCP work here? (Hint: no!)

# Articulating Agenda III



- Workshop in network economics,...
- Discussions with Mike Kearns, UPenn,...
- Food for thought: See Shane Greenstein talk yesterday!

# Articulating Agenda IV



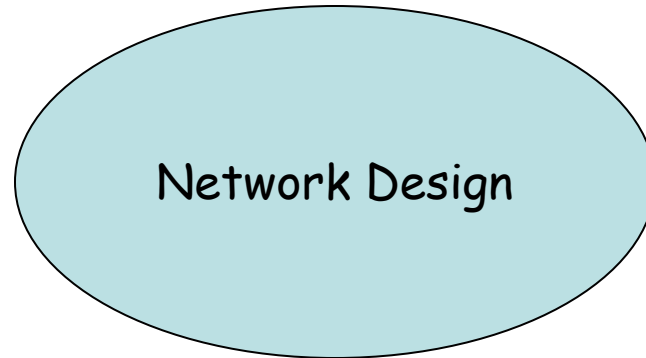
- Workshop in web science,...
- Co-chairs:
  - Jim Hendler, RPI
  - TBD

# Food for Thought

(courtesy of Jim Hendler)

- Network adaptivity is not just to what is happening in network
  - But what is happening in the **real world**
    - political, economic, social
      - Example: slashdot effect
  - These can change any level of network dynamics

# Back to the Beginning



- Good progress under GENI auspices, with emphasis on architecture
- See Dave Clark Research Plan
- What more? You tell me...

# Synthesizing Discussion: NetSE Council

Mission (work in progress): The primary mission of the Network Science and Engineering (NetSE) Council is to articulate a compelling research agenda for Network Science and Engineering, including inter-related theoretical, experimental and societal aspects.

- Ellen Zegura, chair
- Tom Anderson, Washington
- Hari Balakrishnan, MIT
- Joe Berthold, Ciena
- Charlie Catlett, Argonne
- Mike Dahlin, UT Austin
- Chip Elliot - GPO (ex-officio)
- Joan Feigenbaum, Yale
- Stephanie Forrest, UNM
- Roscoe Giles, Boston Univ
- Jim Hendler, RPI
- Michael Kearns, UPenn
- Ed Lazowska, Washington
- Peter Lee, CMU
- Helen Nissenbaum, NYU
- Larry Peterson, Princeton
- Jennifer Rexford, Princeton
- Stefan Savage, UCSD
- Scott Shenker, ICSI/Berkeley
- Alfred Spector, IBM (ret.)

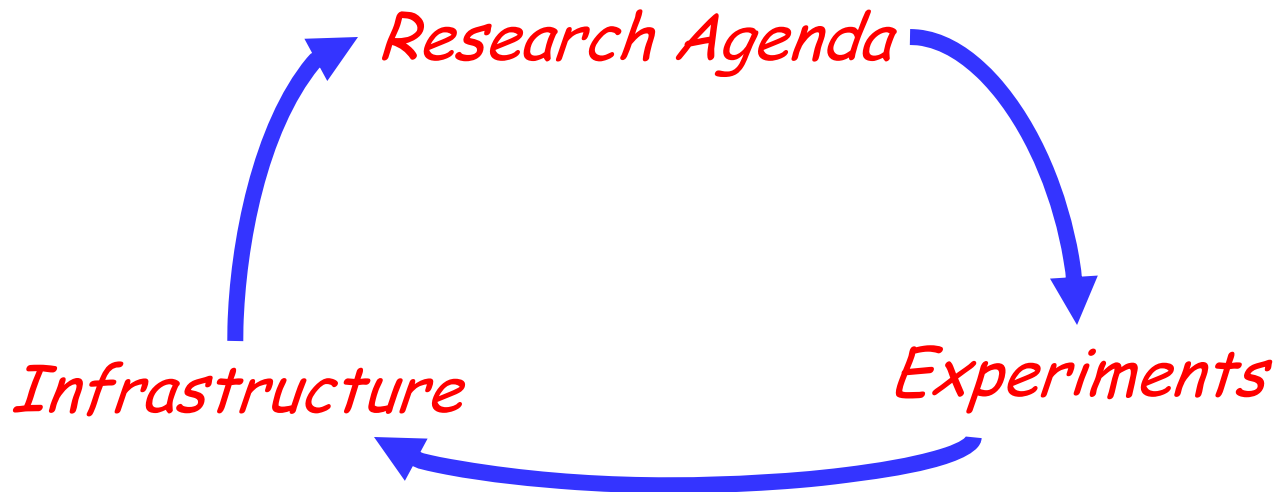
# Draft Timeline

- Late Spring 2008 - workshops
- Early Summer 2008 - meeting of writing group
  - initial reports from each workshop
  - discussion of pieces missing or in need of attention
  - discussion of cross-over issues between reports
  - integration discussion
- Summer 2008 - integration
- August 2008
  - post draft for public comment



# What about GENI?

Virtuous cycle of agenda setting, demands for experimentation, identification of infrastructure needs, building, learning, building, learning, ...



Sometimes one part gets a little ahead...that's ok  
Research enterprise is incredibly robust

# Challenge to the Community

Question: *Is there a science for understanding the complexity of our networks such that we can engineer them to have predictable behavior?*

**Call to Arms:** To develop a compelling **research agenda** for the science and engineering of our evolving, complex networks.

NSF (and the world) is **listening**.  
Let's work together to **speak with  
vision and clarity**.

# Backup Slides