Network Science and Engineering Update

Computing Community Consortium

7 July 2008

Ellen Zegura

NetSE ("Net-see")

- Path forward for GENI Science Council
- Gets us out of the "justify the facility" or "cart before the horse" box
- NetSE Council succeeds GENI Council, for all interpretations of "succeeds"
- GENI Project Office (GPO) continues to harden designs for shared experimental facilities

NetSE Council

Mission: 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, Google

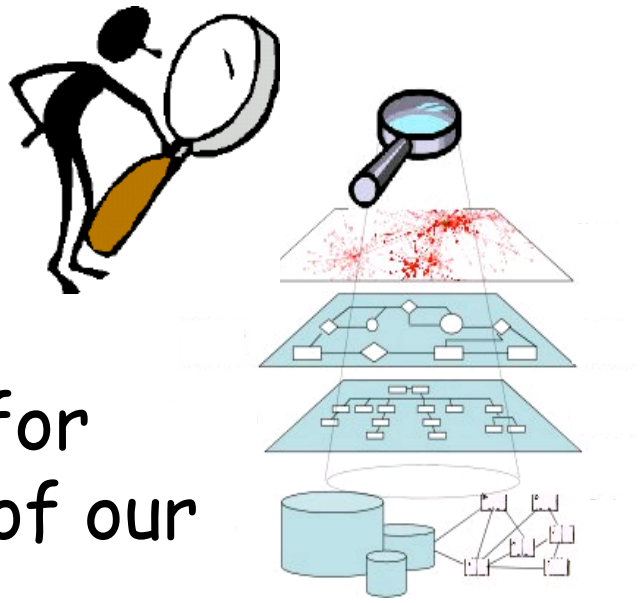
Additions pending – workshop leaders, other enthusiasts

Timeline

- June-Sept 2008 – elaborate the space
  - workshops (3)
  - meetings (2)
- Oct 2008
  - draft research agenda completed
  - incl. recommendations on how to advance agenda
- Nov 2008
  - collect feedback (from few then many)
- December 2008
  - finalize research agenda

Technical context

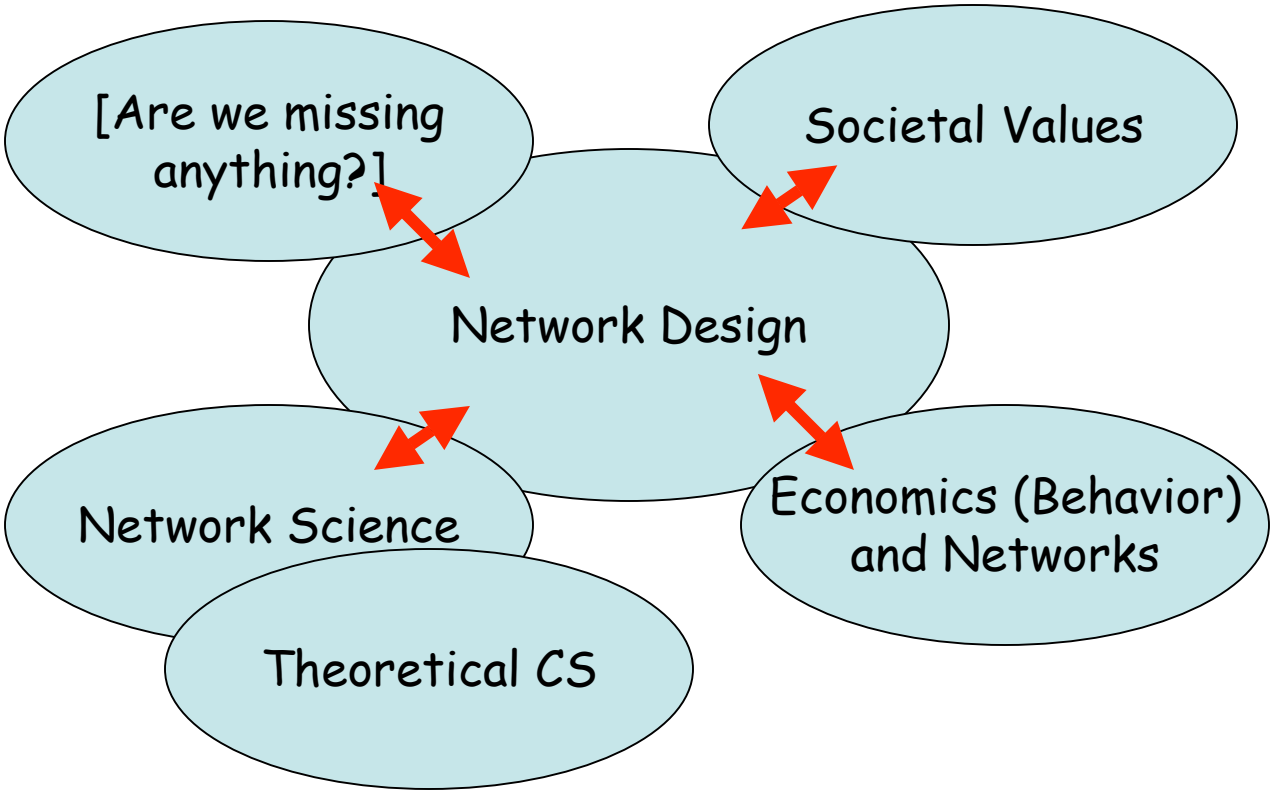
Fundamental Question: Is there a science for understanding the complexity of our networks such that we can engineer them to have adaptable behavior?



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

NetSE Intellectual Space (not to scale)

Goal: Networks with adaptable behavior ("better networks")



Workshops

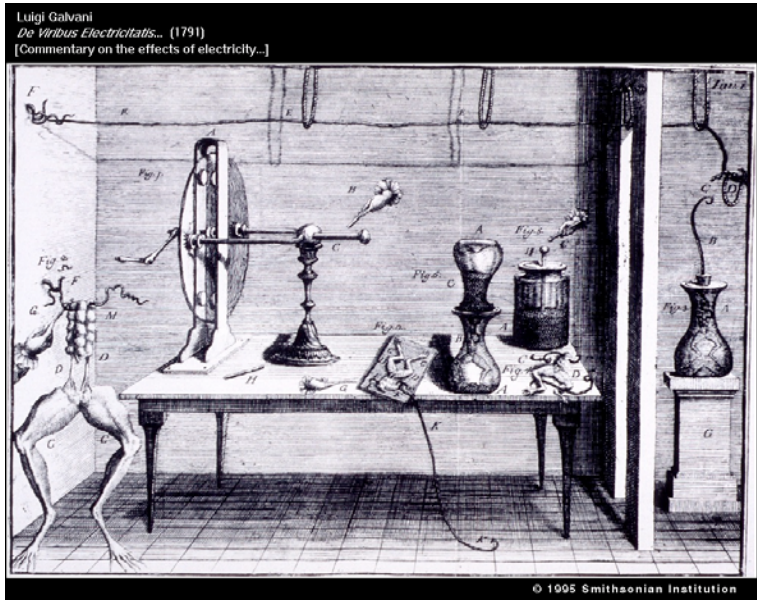
- Science of Network Design
  - John Doyle, CalTech/NSF
  - John Wroclawski, ISI
  - July 29 and 30, southern CA
- Behavior, Computation and Networks
  - Mike Kearns, U Penn
  - Colin Camerer, CalTech
  - July 31 and August 1, La Jolla
- Network Design and Societal Values
  - David Clark, MIT
  - Helen Nissenbaum, NYU
  - September 24-26, Washington DC

Meetings

- Smaller than workshops
- Extract/expand on more well trod areas
- Theory and Network Design
  - John Byers (BU), Joan Feigenbaum (Yale), Ellen Zegura (GT)
  - June 11, Boston
- Network Engineering and Network Design
  - TBD, e.g., Nick Feamster (GT), Amin Vahdat (UCSD), David Andersen (CMU), Mike Dahlin (UT Austin), Jen Rexford (Princeton)
  - Likely with SIGCOMM (August)

Food for Thought
(courtesy John Wroclawski)

Electricity: 1800…



Electricity: Today…

$$\oint \vec{E} \cdot d\vec{A} = \frac{q}{\varepsilon_0}$$

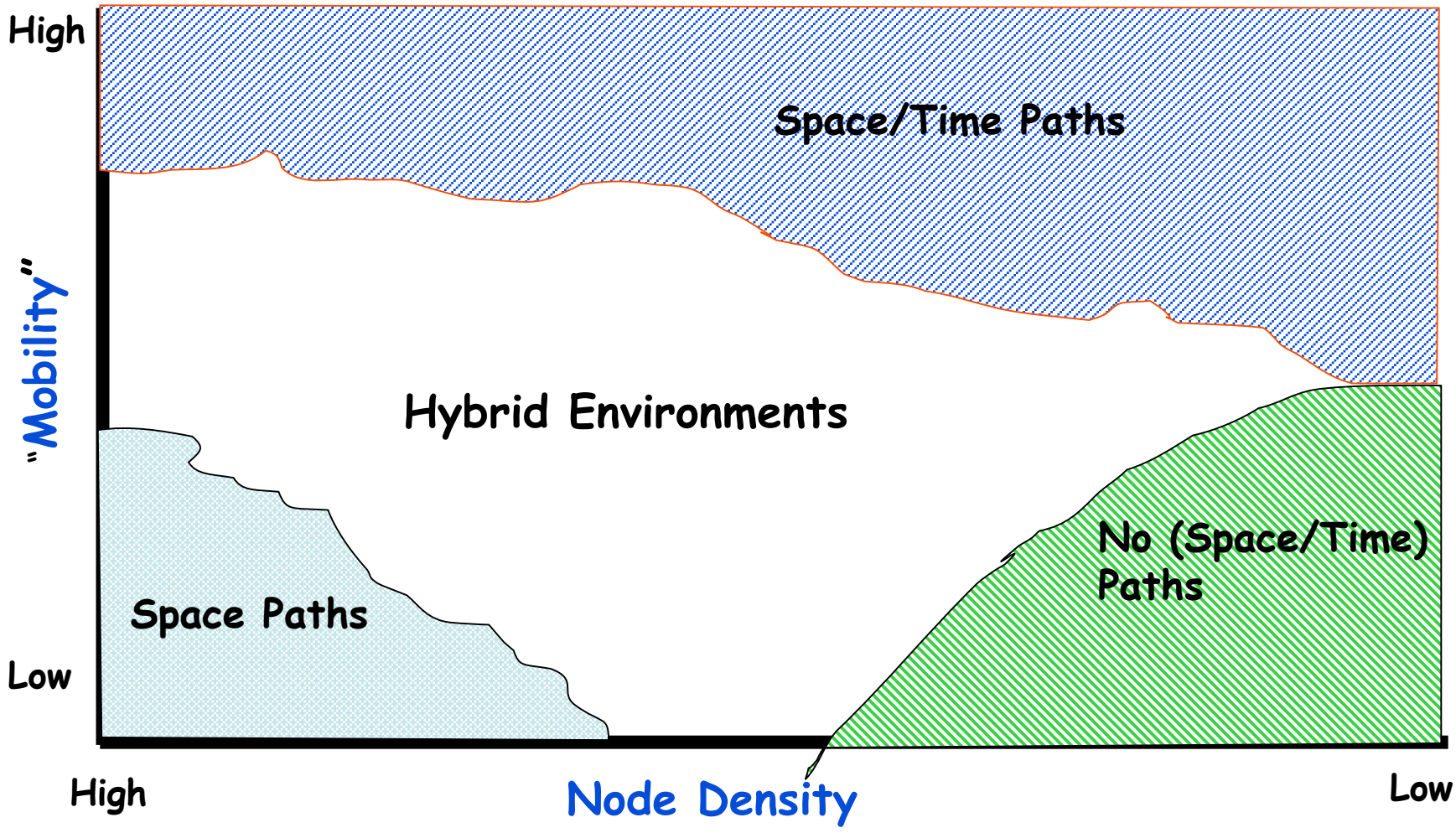
$$\oint \vec{B} \cdot d\vec{A} = 0$$

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$$

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

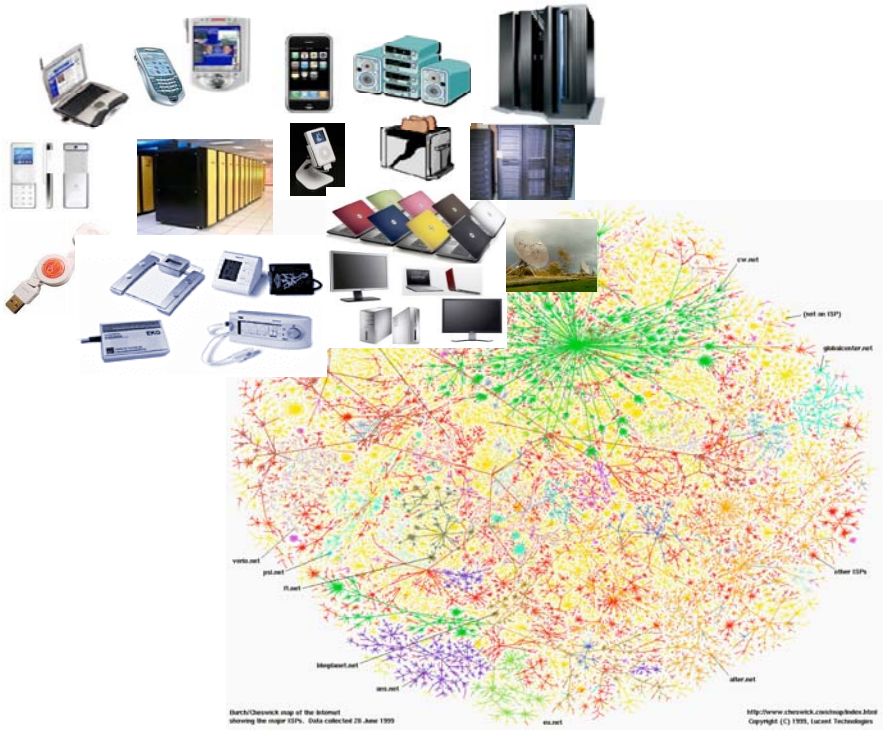
What are the analogies…
… for Network Architecture and Design?

Example: Understanding



Food for Thought

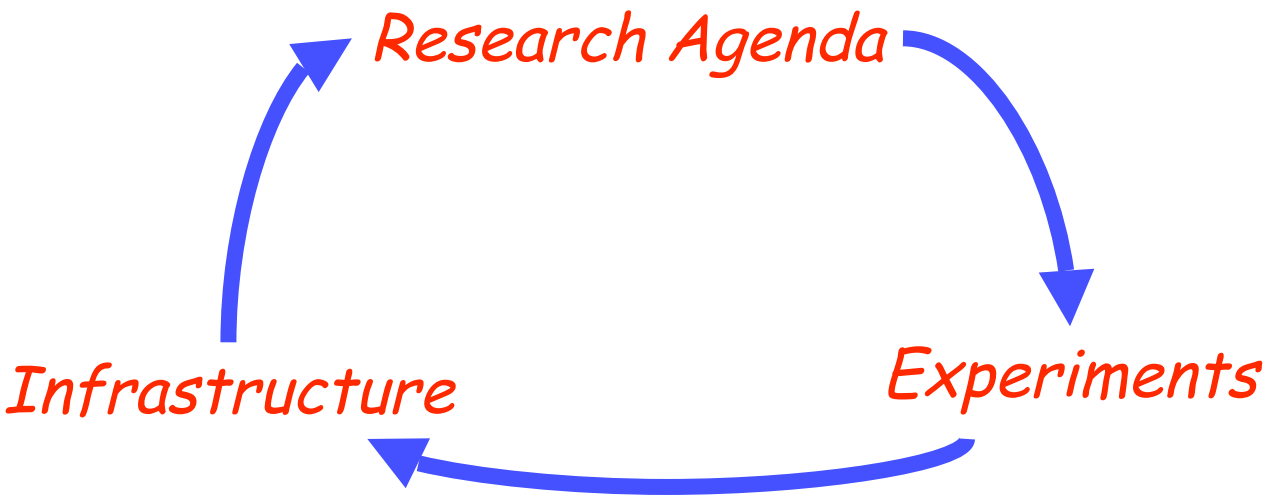
- (Where) does the current Internet embed assumptions of plenty?



Does TCP work here? (Hint: no!)

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

Likely scenario

- Agenda effort identifies 1 or more (probably more) facilities that would be useful in advancing research
- Members of a facility requirements group are "spies" at each workshop to help extract requirements
- Some of prototyping work funded currently by GPO is useful in future facilities

How can you help

- Already are: Many, many thanks to Ed and Susan for their involvement. It has made a BIG difference
- Spread the word that NetSE replaces GENI
- Spread the word to relevant parts of communities around Network Design

Lessons (so far!)

- Leadership and vision
  - Ed: "elevator pitch worked too well"
  - refinement: must have elevator pitch that works for experts
- Cart before horse
- Right-sizing
- Who's driving
- Communication

Questions/Discussion