Snowbird Talk

• Context and Background for the Talk
• Concerns for the Research Community
• Specific Challenges
  – Cognitive Systems, Information Management, Networking Focus
• Conclusions
Context for the Talk

• Evolution of Information Technology (personal experience)
  – Computing - Early IBM with console programming, IBM 704/709/7090, calculators have more power than room-sized machines back then
  – Memory – Carry GB on keyring (<$1K) vs. $M for a MB in 1970s which also was room sized. Million to one reduction in cost (plus size and power reductions)
  – Software – batch and overnight delivery to interactive, real-time, and symbolic – design/development still a major limitation and bottleneck
  – Networking – 300 bps dial-up, 50 Kbps ARPANET, 1.5/45 Mbps NSFNET, Giga/Tera
DARPA Experience

• In 1960s, every development was new, no industrial base, no serious constraints
• In 1980s, transfer of ideas to industry emerged, transfer from industry to defense was the goal
• By 2000, was getting increasingly near-term, demonstration/delivery/transfer oriented
• Industry coupled vs. Contrarian
• Breaking out of the mold – getting there
• Can participate in addressing infrastructure concerns – no longer take the lead
Current Observations

• Infrastructure investments of the past are getting in the way of real innovation
• Mindset that we can’t do big infrastructure any more – so focus on smaller scale efforts
• Everything needs to use DNS and/or the Web
• Reminiscent of the telco infrastructure situation before the ARPANET, NSFNET and Internet
Crisis for the Community

• Wonderful way we used to do business is in jeopardy of being held hostage to legacy investments – marginalizing ourselves

• Used to be industry that held us hostage, but now it is the research establishment itself

• Need to find new ways of doing business, of working together, of collaborating
Unintended Consequences

• PITAC funding enabled NSF, overloaded
  NSF – too many proposals

• PITAC funding for DARPA produced no
  net new money – reduced flexibility, added
  constraints

• Hard to quantify the effects, measure added
  progress
Bureaucratic Overload

• Program managers barely had time to read proposals (too many), time spent in managing review committees

• Short Term Stints
  – Heavy on Administration
  – Resulting eagerness to return to academia/industry

• Loss of memory of what came before

• Duplication of efforts over time, reinvention

• Needs to rethink public service to make it more attractive – CRA, ACM, IEEE, etc. can help
Opportunity

• Dot Com bubble hurt, may also help
• Problem with PITAC was how to retain best researchers in light of commercial (money) opportunities that were abundant
• Now academic and government opportunities should be much more attractive
• How to leverage – make this a priority
• Create the intellectual and organizational capital for the future.
The role of the Research Community

• Research Community help in planning and running government initiatives
• Make public service a goal for best researchers at some point in their career
• Think out of the box
• Allow for false starts, failure
• Encourage publication of negative results where significant
Cognitive Systems

• Today’s systems are generally very brittle
• CS Properties – reactive, perceptive, reflective
• Knows about itself, external world
• Acts on its knowledge + built in functions
• Metaknowledge includes:
  – Knows about its design, design goals, constraints
  – Can tell when its performance is affected
  – Can tell about external variations about quiescent
  – Can plan and react accordingly, with & w/o help
System Issues

• How to build such systems?
• What are the architectural principles, common standards, reusable functions
• How to characterize/measure system cognition? (other than qualitatively)
• How can individual systems learn to cooperate/collaborate with others
Cognitive System Targets

• Each target for cognition has its own concerns, ontologies – what is sharable?
• Each application may choose to express itself differently! – How to communicate?
• Examples: Networks, User Interfaces, functional applications
• How to avoid each group separately researching cognitive functionality?
Appreciating Information Management

• Sounds pretty mundane and administrative
  – like logistics, and maintenance

• Critical to many of the advanced capabilities we seek in the future

• Trusting your information to “electrons, photons and Networks”
  – It can get lost in the thicket of invisibility and technology evolution
Handling Abstraction

• What is the Internet?
  – Not the collection of networks, routers, computers, switches, lines
  – Conceptual Architecture for global connectivity
  – And, increasingly, a global information system

• What is a Book?
  – Not the “paper and ink”
  – Logical structuring of a literary work
  – An example of a digital object
Understanding Patent & Copyright in Network Context

• Building bridges to Legal Establishment
• Copyright Rights in Works
• Different Legal Systems around the world
• Distinguishing Mass and Energy
• Patents in Systems and Methods
• Legal alternatives to enable progress
• Finding workable compromises
“Google-like” Systems

• Deals with openly accessible information
• Can’t access protected information
• IP concerns often leave critical information off the net
• Places fundamental limitations in spanning the public and private information worlds
• Encryption and Persistence also at odds
Identifier & Resolution Systems

- Multiple identifier systems will continue to exist, be separately administered
- There needs to be a common trusted resolution mechanism
- Needs Government Imprimatur to achieve
- Similar set of issues as Internet in 1970s
- Handle System on Internet since 1994 in public interest – software downloadable.net
Networking

• Principal challenges:
  – Scaling for Growth, meaningful applications
  – Workstations at speed – chicken and egg
  – High speed local access – last mile
  – Don’t be constrained by ITU, ISO, IETF, W3C, ICANN, etc.

• Emerging Role for Wireless everywhere
  – Emphasizes mobility, security, and power
  – Copyright concerns will grow – 802.11b
Conclusions

• Move beyond “Business as usual” – reinvent the means of conducting research to adapt to current needs!
• Insure real innovation is enabled – wherever!
• Both Government and Research Community need to break out of the mold – don’t stay locked in
• Think out of the box – process and proposal
Conclusions

• Let industry do what industry does best – short term developmental projects – be vigilant to get ahead and stay ahead of the power curve

• Pursue unique opportunities
  – Leverage the Dot Com fallout
  – Meld research and advanced applications in national interest post 9/11 – requires care – glad to see NSF taking a lead here

• Encourage the best technical minds to undertake public service for a part of their career; reduce bureaucratic limitations on them wherever possible