Networking Grand Challenges

NSF Future Directions
Workshop
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What is a grand challenge?

A grand challenge is ...

- sound bite (for higher ups)
- technical meat (for peers)
Grand challenge: providing new services

- ubiquitous telepresence
- sensored universe
- virtualized environments
  - naming, management
- adding resilience

Grand challenge: providing new services

- market based mechanisms
- support for overlays: design principles
  - competing overlays
  - overlaid overlays
  - competing control loops
- networks as large heterogeneous complex systems
  - modeling, control, design (control plane)
- resilience in the absence of knowledge of faults
- security/robustness
- performance limits (information theory)
  - compute/communicate/sensing tradeoff under power constraints, multi-layer considerations
- redesigning the Internet (what would we do now)
Grand challenges

- providing new services using overlays
  - market based mechanisms for providing rich sets of services
  - how to support overlays: design principles
    - competing with each other
    - on top of each other
  - network support for virtualized environments (naming, mgnt)
- resilience in the absence of knowledge of faults
- networks as large heterogeneous complex systems
  - modeling, control, design (control plane)
- network information theory
  - compute/communicate/sensing tradeoff under power constraints, multi-layer considerations
- catchall
  - redesigning the Internet (what would we have do now)
  - security/robustness

Grand challenge definitions

- **Classical HPPC definition:**
  "Grand Challenges are fundamental problems in science and engineering with potentially broad social, political, economic, and scientific impact that can be advanced by applying high performance computing resources."

  Here, one could replace "by applying high performance computing resources" with by fundamental networking research.

- **Definition used in Panel description:**
  "As a fundamental problem with broad economic and scientific impact that is currently considered intractable, and whose solution can be advanced by fundamental research, this panel attempts to articulate grand challenge problems in computer networking."

  Difference to HPPC definition: Grand challenge is not the application area, but a currently unsolved and presumably unsolvable problem in networking.