Midscale infrastructure investments to support computing research: CCC white paper process to gather community input

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Background:

- **goal**: solicit community input on midscale infrastructure requirements
  - options discussed, not taken: CISE-AC only, decadal studies (e.g., Astronomy), NAS study, NSF-sponsored workshop

- **white paper process**
  - solicited through CCC, advertised via CCC blog, mailing lists
    - “The Computing Community Consortium is seeking community input to better understand the potential needs and payoff for additional investments in mid-scale infrastructure for computing research ... “
    - [http://www.cccblog.org/2013/03/20/call-for-white-papers-on-mid-scale-infrastructure-investments-for-computing-research](http://www.cccblog.org/2013/03/20/call-for-white-papers-on-mid-scale-infrastructure-investments-for-computing-research)
  - 10 white papers, including inputs from many impactful MI activities (Emulab, FutureGrid, GENI, Openflow, Planetlab), experimental systems researchers
A common vision:

Is there a need for midscale infrastructure? Yes!!

“A nationwide, multi-tiered system (national/regional R&E backbones, data centers, campuses) that is sliced, deeply programmable, virtualized, and federated so that research experiments can run `end to end’ across the full suite of infrastructure.”

- multi-tiered system (national/regional R&E backbones, data centers, campuses): core/edge networking, computation, clouds
- sliced, virtualized: one (logically shared) physical infrastructure
- programmable: platform for innovation
- federated: organic growth, skin-in-the-game business model
Observations (1):

- accessible to different researcher communities at different levels in architecture
  - *IaaS*: infrastructure as a service, down to bare machine
  - *PaaS*: experimental platforms (e.g., end-end networked cloud platform) as a service
  - *SaaS*: application software (SaaS)

- building bottom up vs. top-down: *converging* to similar place
  - architectural, control differences

- importance of clear, consistent architecture of testbed design, control, management

- open software: OpenFlow, OpenStack
Observations (2):

- **edge networks:**
  - WiMax, mostly via existing GENI sites (wireless ubiquity a challenge)
  - measurement of wireless, cable access nets

- **limited input from:**
  - cyberphysical systems: one paper only
  - security
  - optical (some)

- **sustainable business models often addressed:**
  - NSF, campus co-investment, working with industry
  - investment timescales
  - interaction with industry
Observations (3): other visions

- education value noted in several white papers
- a couple of other, more tightly focused whitepapers:
  - edge network: measurement observatory
  - BGP routing
Summary:

- valuable, thoughtful input reflecting deep experience, articulating midscale infrastructure value
- multiply-articulated MI vision: nationwide, multi-tiered system .. sliced, deeply programmable, virtualized, and federated
  - many common views on how to get there, but some differences as well (architecture, control, management)
- next steps: what’s valuable to NSF?
  - broadening community input (CPS, security)
  - sustainability, review & evaluation processes
  - control/architecture/management approaches
  - whitepapers ideas out to broad audience?