



# Decentralization

---

Internet Innovations Workshop

June 20, 2007



# Working Group Charter

---

Decentralization of services is a disruptive force that promotes innovation, new markets, and end-user value, often while displacing the economics of traditional service providers. Hence, decentralization faces serious challenges for provider adoption.

As an innovation platform GENI encourages the introduction of decentralized services. The concern, though, remains as to how such services can be different on GENI, allowing traditional operators to offer competitive services and thus adopt decentralization architectures.

This track will examine emerging usage models based on decentralization, debate the challenges of decentralization on current business models and network architectures, and develop requirements for GENI to transition to a future Internet capable of supporting decentralized services broadly for commerce and social benefit.



# Framing Questions

---

- Is there a way to create incentives for providers to adopt decentralization or is it time for a new “breed” of providers?
- End-to-end decentralized services continue to run at a high level and to exhibit an oblivious behavior to the underlying network. Is this enough or should it be changed?
- How would a decentralized architecture look like? And who would “own” the different pieces?
- What does GENI bring to decentralization that is different from today’s testbeds and platforms?



# Market models of decentralized coordination

---

- Grand Challenge:
  - Develop models based on **economic markets** for decentralized decision-making resulting in “social” optima.
- Experiments Required:
  - Systems based on either shared **social value functions** or on individual **competition** can be considered. Designing and validating fair **auction methods** is notoriously hard.
- Industry/Academic Relationship:
  - Markets require infrastructure in the analogs of **privacy**, **property** and **prices** on which to build experiments.



# Participation Template

---

- Grand Challenge:
  - provide a suitable business model for decentralized services
- Experiments Required:
  - run a pilot network to check whether the business model works or not.
- Industry/Academic Relationship:
  - Academy investigates new decentralized services with suitable business model in close collaboration with Industry.

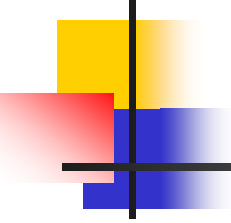


# Participation Template

---

- **Grand Challenge:**
  - Enable seamless decentralization: machines are often interconnected on the lower levels but applications sit on top oblivious and often do not share data
- **Experiments Required:**
  - Implement a cross-layer model for decentralization: can virtualization be the answer (machines will team up and act as one slice sharing resources and application-specific environments)
- **Industry/Academic Relationship:**

# Decentralization Challenges: Laundry List

- 
- Several central points
  - Trust
  - Location of control
  - Distributed coordination
    - Adaptability
    - Resources (sharing, and management)
    - Access control
  - Definition of goals
  - Complexity (consistency)
  - Transparency and co-existence with centralized systems
  - Monitoring (scaling)
  - Layers of decentralization
  - Dynamics from mobile nodes
  - Categories:
    - Management
    - Control (usually centralized and most challenging to decentralize)
    - Data plane
  - Decentralization GENI control & responsibility (managing nodes and accountability)
    - Management : complexity, policy, discovery
    - Control model with the presence of constraints :
      - trust
      - Coordination
      - goals
      - state detection
      - Timing
      - feedback
    - maximizing use of resources (negative interactions)



# Decentralization Report-Out

---

Internet Innovations Workshop

June 20, 2007



# Decentralization Grand Challenges

---

## ■ Grand Challenges:

- Decentralization GENI control & responsibility (managing nodes and accountability)
- Management : complexity, policy, discovery, naming
- Control model with the presence of constraints: (trust, Coordination, goals, state detection, Timing, feedback)
- Maximizing use of resources (negative interactions)



# Decentralization Grand Challenges

---

## ■ Experiments Required:

- Decentralized GENI control & management
- Decentralized network access (the use of GENI through services)
- Decentralizing classical applications (i.e. IM, calendar)
- Decentralized service composition (aggregation, and cooperation)
- Market based approach for resources combination
- Data collection decentralization (automated assimilation of data to become knowledge)
- p2p-type of experiment
- Decentralized storage, backup and archiving



# Decentralization Grand Challenges

---

- **Industry/Academic Relationship:**
  - Academia leading in decentralization in industry-like environments
  - Jointly defining usage models with business value
  - Industry providing test-case application(s) to be re-shaped
  - Active contribution to GENI from industry with resources and data