

The economics of testbed federation

The case of Planetlab

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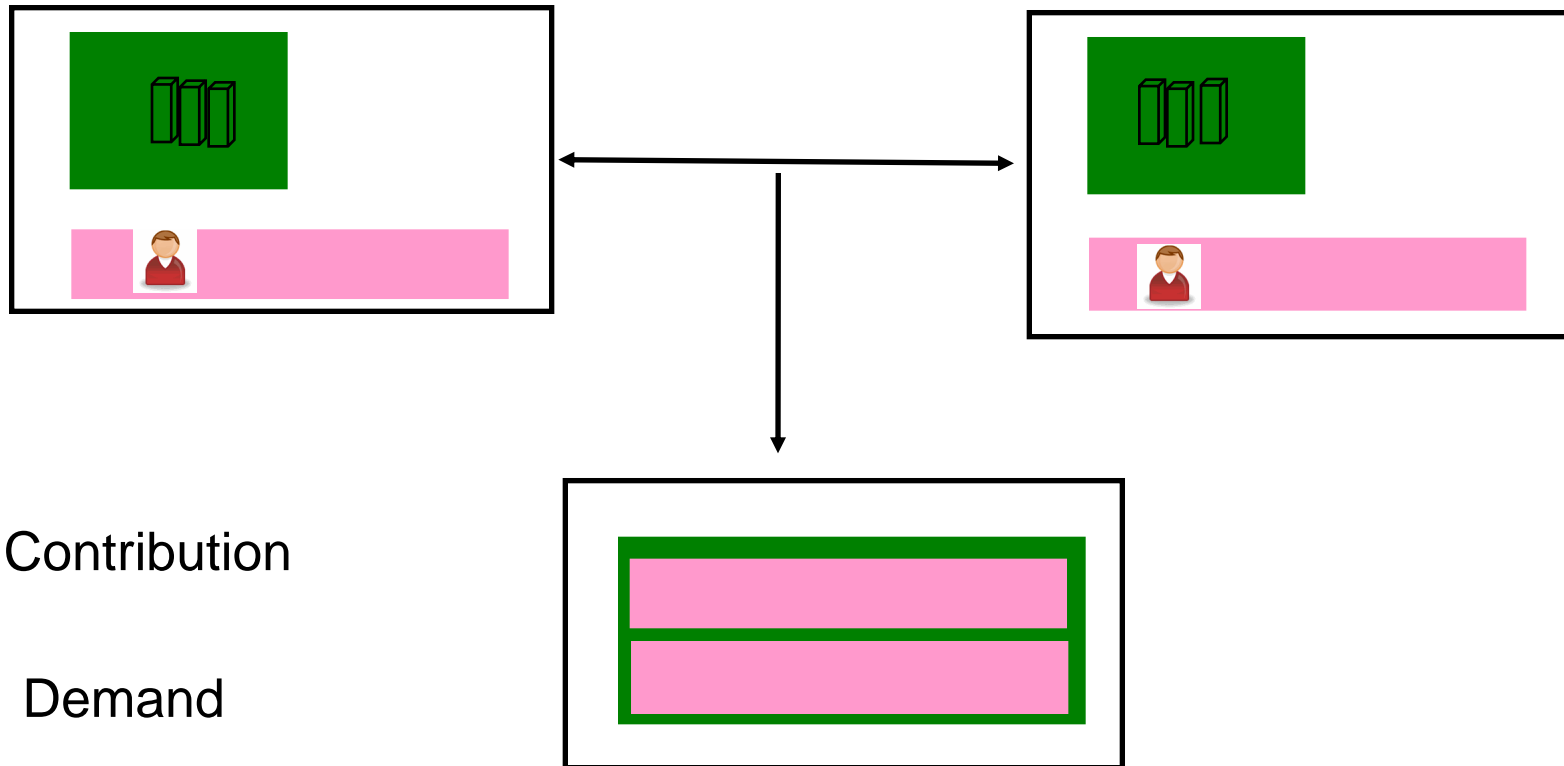
(joint work with Serge Fdida, Timur Friedman, and Jon Crowcroft)

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UPMC Univ Paris 06



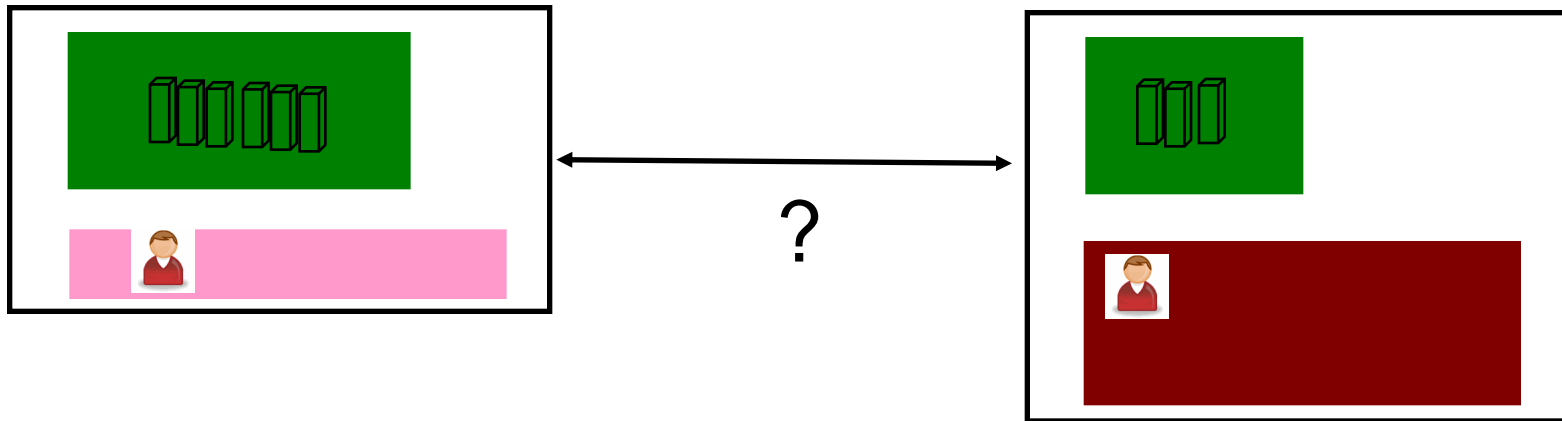
Federation abstraction



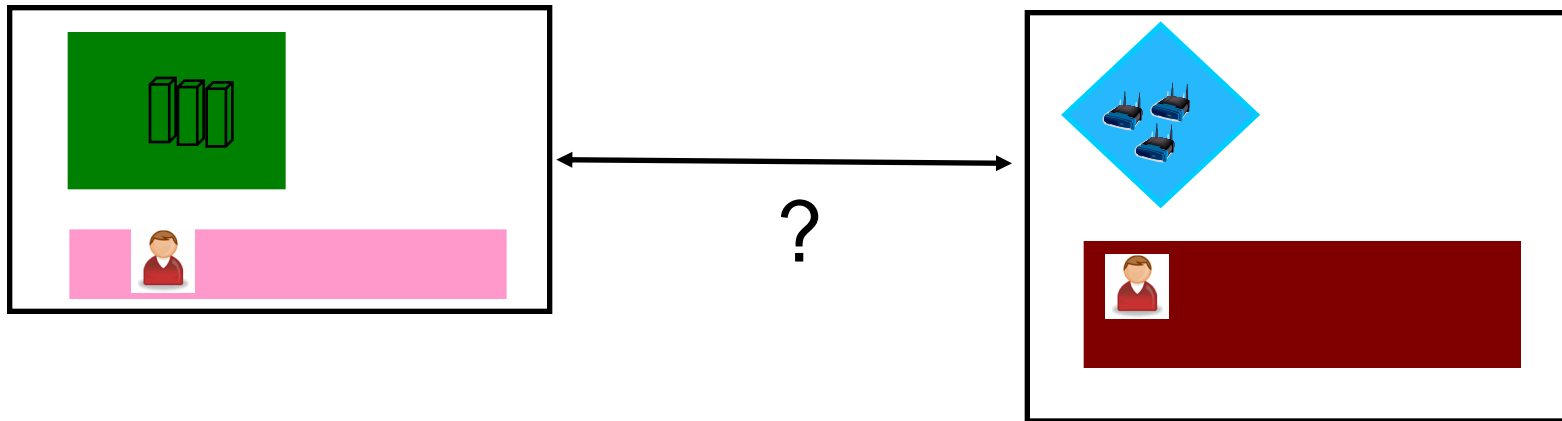
 Contribution

 Demand

Asymmetry



Heterogeneity

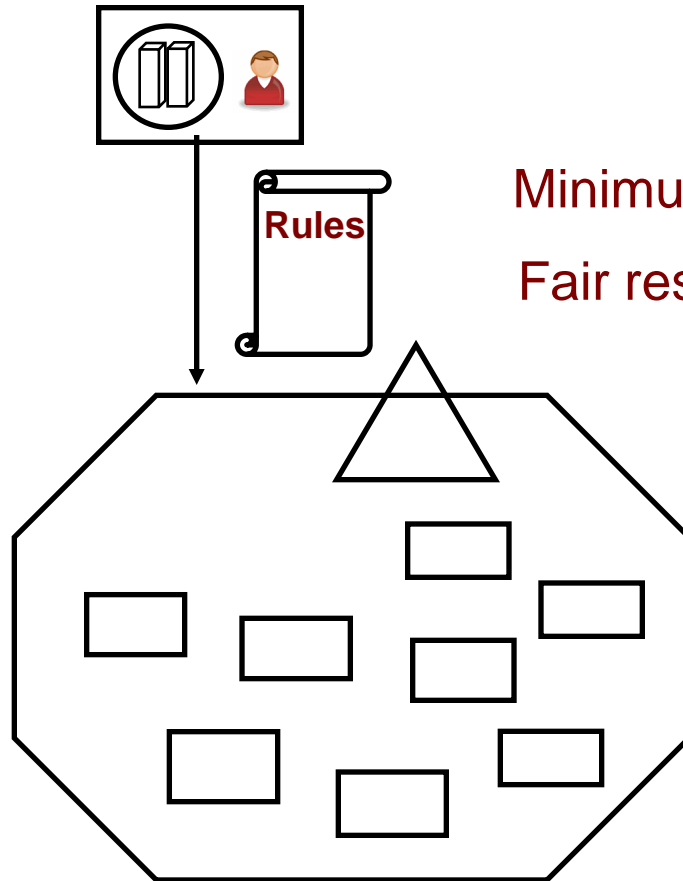


Our objective

- **Design resource management policies**
 - Encourage contributions and participation
 - Keep independence but achieve scale and diversity
- **Challenging aspects**
 - Heterogeneous resources, users, testbeds
 - Research communities, industry
 - Politics
- **The upcoming Planetlab federation is a great opportunity for practical and theoretical research on policy design**

Resource management

Regulation vs. markets



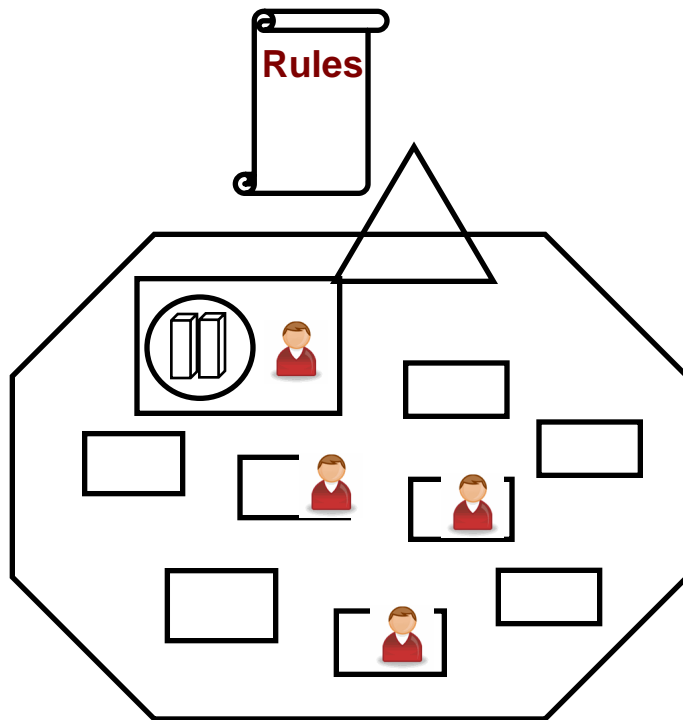
Minimum contribution to join (e.g. 2 nodes)

Fair resource allocation

Distributed testbed (e.g. planetlab)

Resource management

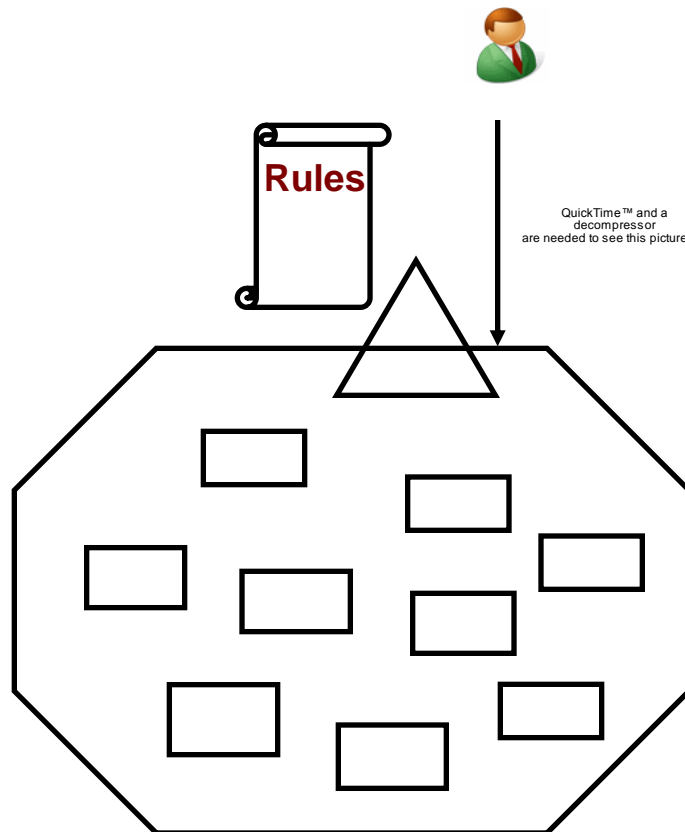
Regulation vs. markets



Distributed testbed (e.g. planetlab)

Resource management

Regulation vs. markets

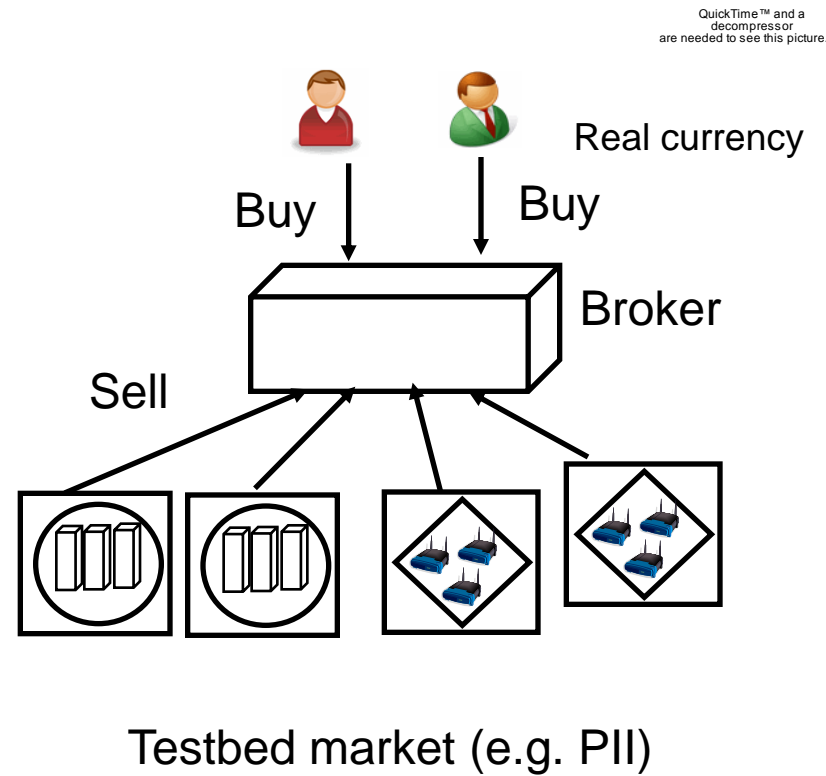
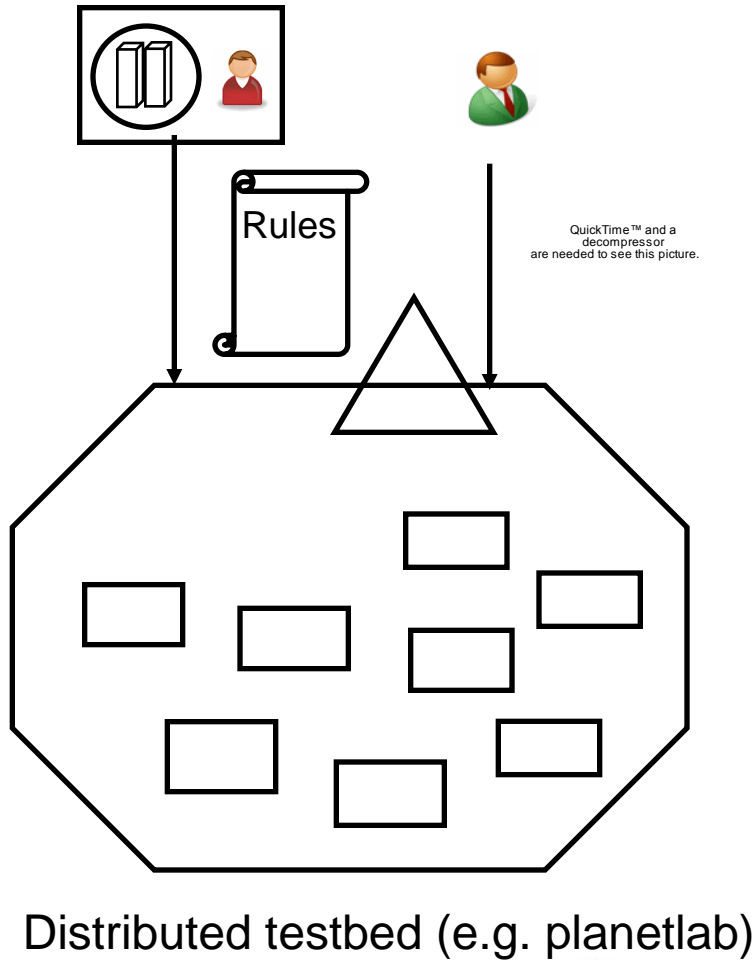


Entree fee for industrial customers

Distributed testbed (e.g. planetlab)

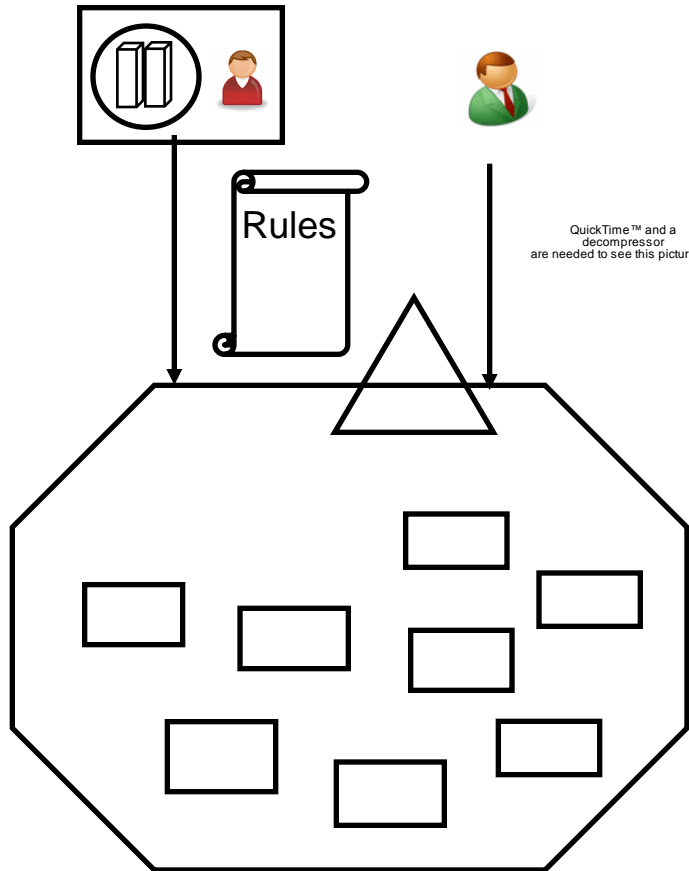
Resource management

Regulation vs. **markets**

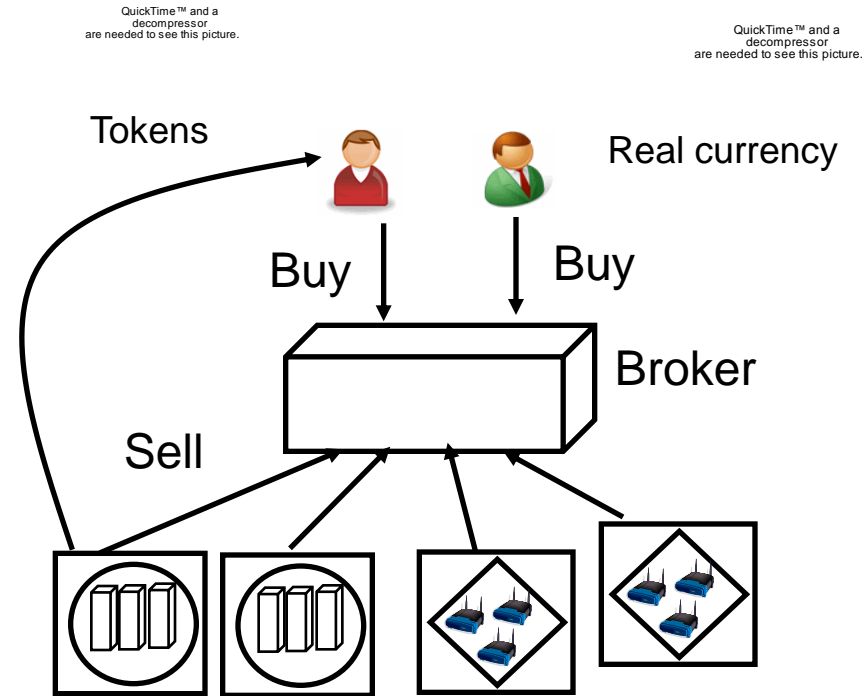


Resource management

Regulation vs. **markets**



Distributed testbed (e.g. planetlab)

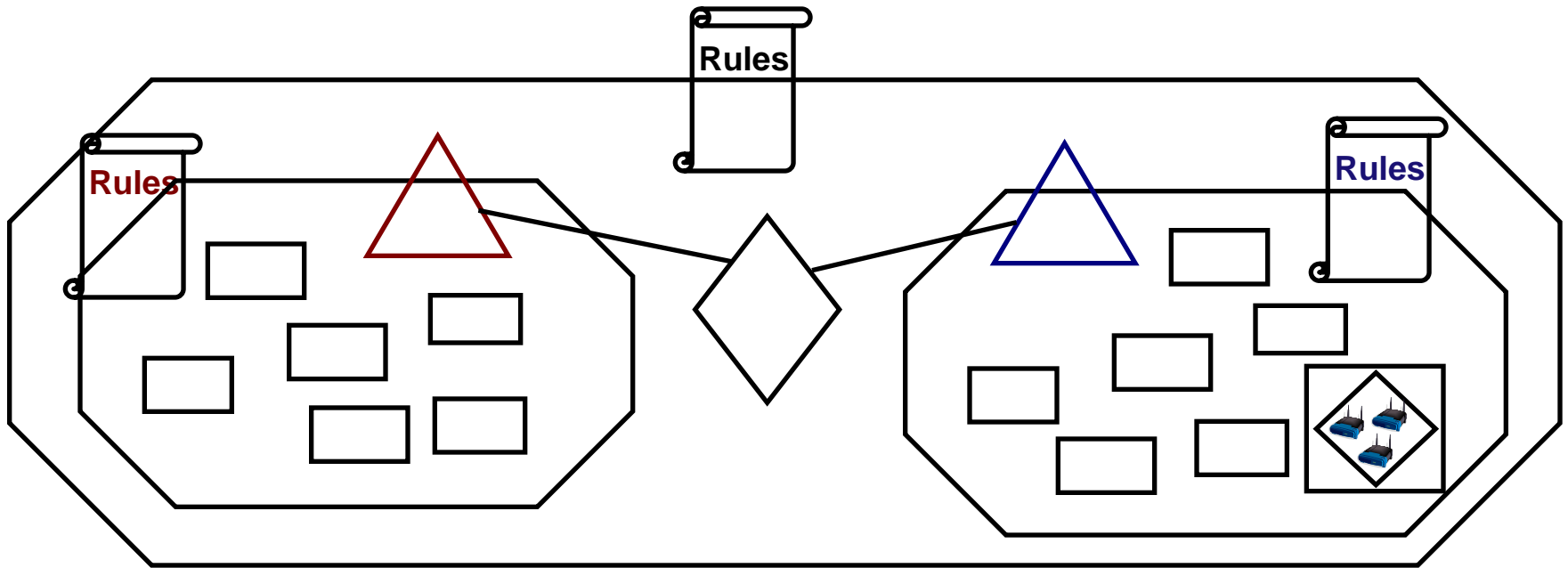


Testbed market (e.g. PII)

The case of planetlab

- It follows the public good model ... and it works
- Currently in the process of “top-down” federation (devolution)
 - Central Planetlab is splitting into independent *authorities* based on geographical location (onelab/europe, japan)
- Benefits
 - less administration burden, empower communities
- Main principles
 - good will and trust, a common public good accessible to all
- But there is room for improvement + federation-related issues

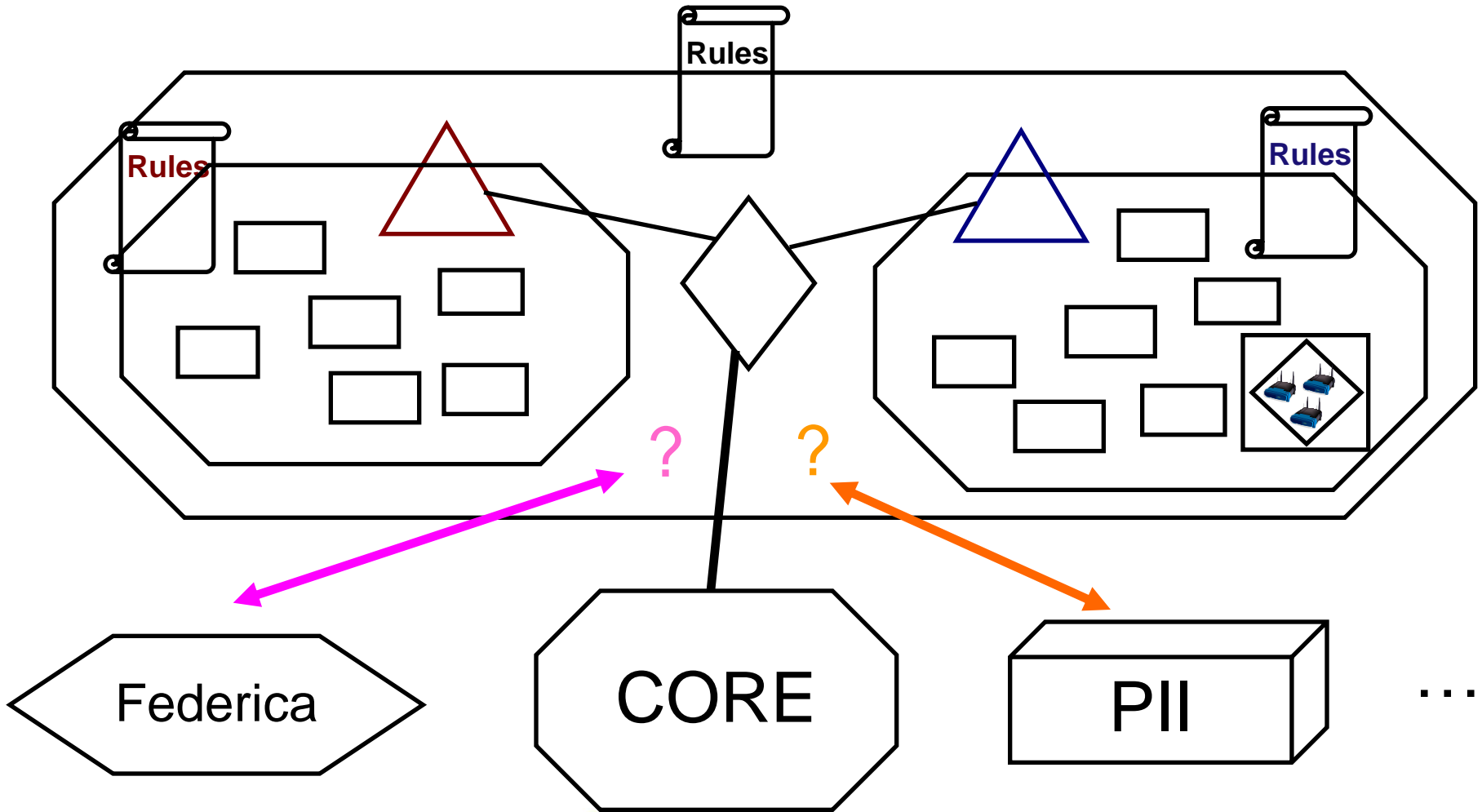
Planetlab/Onelab federation



The main principles of our approach

- **Service differentiation based on *effective contribution***
 - Reward **reliability** and/or punish unreliability
 - Reward **diversity** (e.g. wireless testbeds)
 - Also use them as a “reward” themselves
 - Different slice profiles (understand the users)
- **Redefine the notion of **fairness****
 - Fairness in time (long-term), protect “light” users
- **Compatibility of local policies with global “constitution”**
- **Incremental approach ...**

More challenging federation scenarios



Testbed federation economics

- **Public good approach (federalism)**
 - Local vs. global public good provision
 - Tax competition
- **Market approach (ISP interconnection)**
 - Transit vs. peering vs. paid peering
 - Hidden information
- **Hybrid approach** might be needed
- Both practical and theoretical interesting research issues arise
- Should also take into account political aspects ...

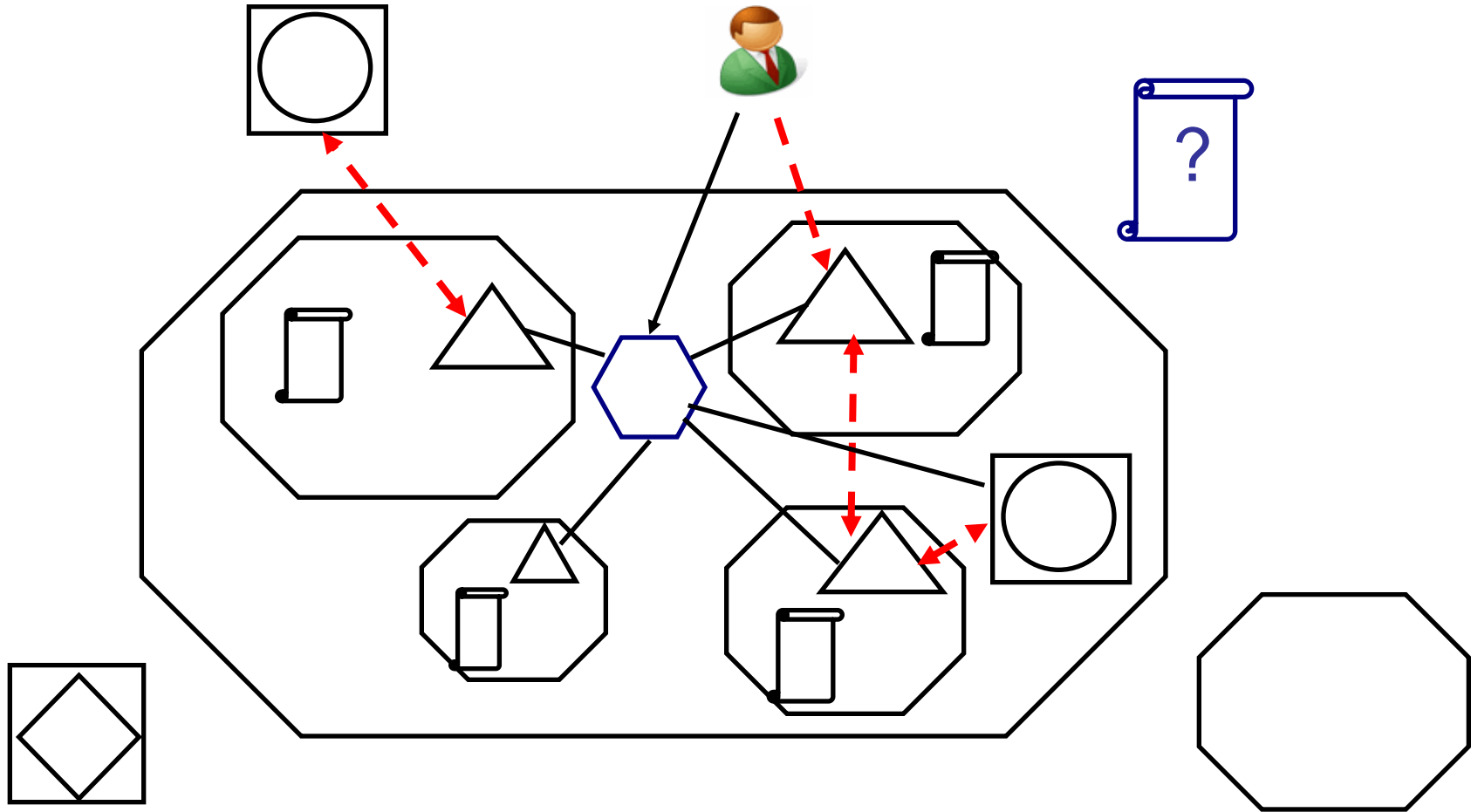
Thank you for your attention!



Market-based approach

- **Benefits**
 - Self-tuning (resource value depends on demand), efficient
- **Challenging problems**
 - Complexity
 - Harms community spirit
 - Needs security and trustworthy accounting
 - Underprovision (contribution depends on demand)
- **Extra problems for virtual currency**
 - Inflation/deflation (problematic under heterogeneity)
 - Need regulation!

Federation?



Practical but also theoretical perspective

- **More difficult than standard network economic problems**
 - Heterogeneity: different types of resources, different time scales, different types of users, different types of relationships,
 - constraints (politics), ...
- **But easier than**

Public good approach (regulation)

- **Big investments from governments. But still contributions from universities and organization will be needed. Need incentives for investing on infrastructure and administration**
- **We need improvements to ameliorate the experience of the planetlab environment, increase reliability, and contributions**
- **Challenges**
 - “Unique” resources?
 - Asymmetric relationships (small stand-alone testbeds, external customers)?
 - Profit sharing?