InterCloud Exchange: piattaforme neutrali di comunicazione tra sistemi di Cloud Computing

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Cloud Computing: essential features (1)

Virtualization: decoupling between hardware resources and application software

Elasticity: dynamic resource allocation as function of the specific application needs

Multi-tenancy: different applications may safely share hardware resources, thus resulting in better resource utilization

Cloud Computing: essential features (2)

Aggregation and centralization of hardware resources (offer)

Aggregation of applications (demand)

Taking advantage of economies of scale in order to reduce the amount of physical resources needed to run a specific set of applications

InterCloud eXchange : Cloud Computing

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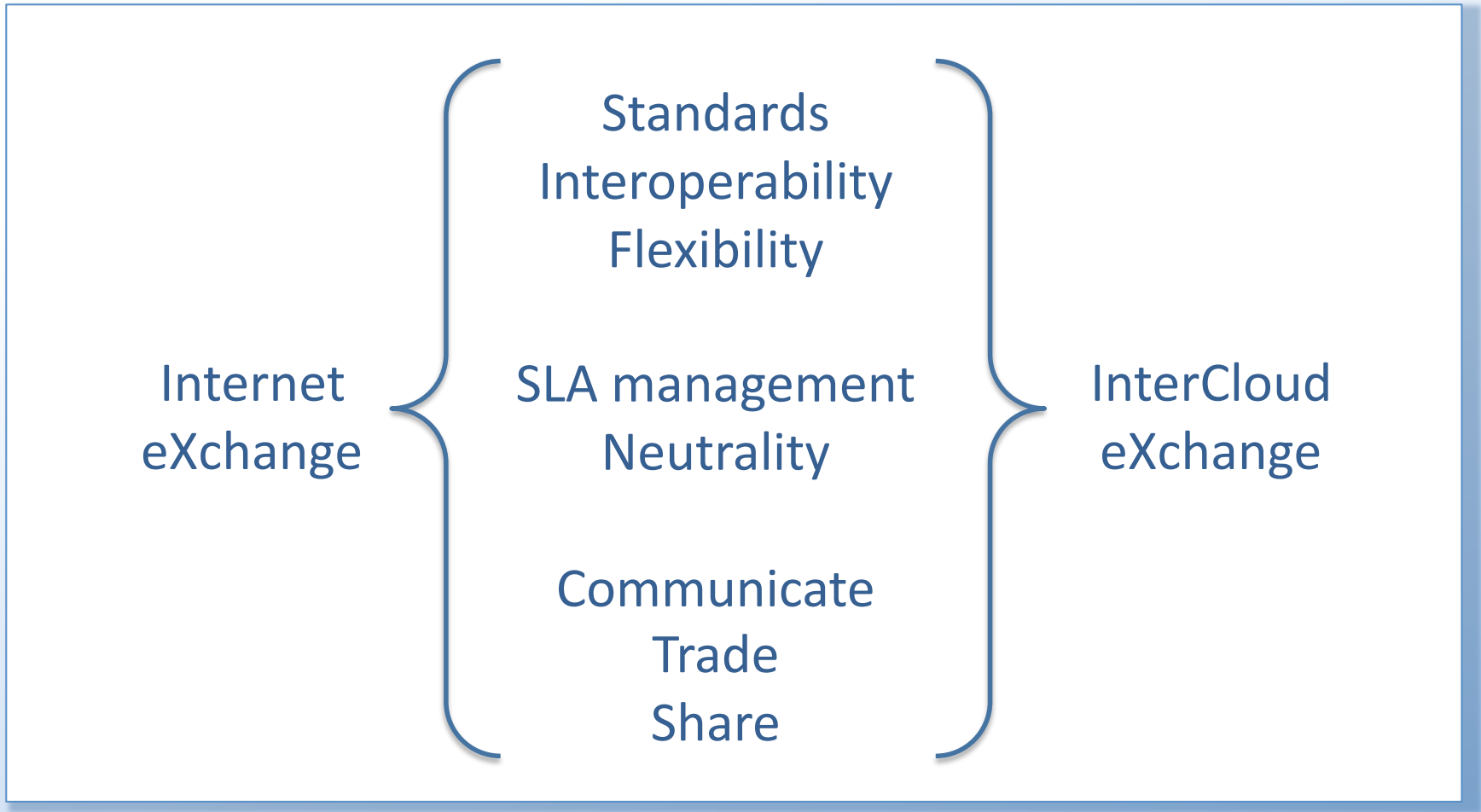
Internet eXchange : Internet



InterNet and InterCloud: framing the issues

	Internet eXchange	InterCloud eXchange
Flexibility	• Increase peering is just a command entry, increase bandwidth is just buying a Ethernet port. Route servers reduce the “any to any” matrix	• Ability to access resources from different clouds as transparently as possible
Neutrality		
Interoperability		
SLA management		
Exchange		
Trade		

InterNet and InterCloud: framing the issues

- Flexibility
- **Neutrality**
- Interoperability
- SLA management
- Exchange
- Trade

Internet eXchange

- Ix's are neutral organisation (in Europe) working on ethernet connection without any IP domain control

InterCloud eXchange

- For each application, every provider is accessible with the same policies

InterNet and InterCloud: framing the issues

- Flexibility
- Neutrality
- **Interoperability**
- SLA management
- Exchange
- Trade

Internet eXchange	InterCloud eXchange
• BGP4 protocol	• Applications, platform and services needs to be accessible through uniform interfaces. • High level protocols are arising to formalize requests.

InterNet and InterCloud: framing the issues

- Flexibility
- Neutrality
- Interoperability
- **SLA management**
- Exchange
- Trade

Internet eXchange

- Easy to identify the service boundaries and define performance and reliability figures for the domain of interest

InterCloud eXchange

- Complex and variable system of providers and users of services
- Brokering tools are useful to actively balance demand and offer to guarantee the required SLA at higher levels of service

InterNet and InterCloud: framing the issues

- Flexibility
- Neutrality
- Interoperability
- SLA management
- **Exchange**
- Trade

Internet eXchange	InterCloud eXchange
• Peering	• Providers exchange resources among each other effectively pooling together part of their infrastructure

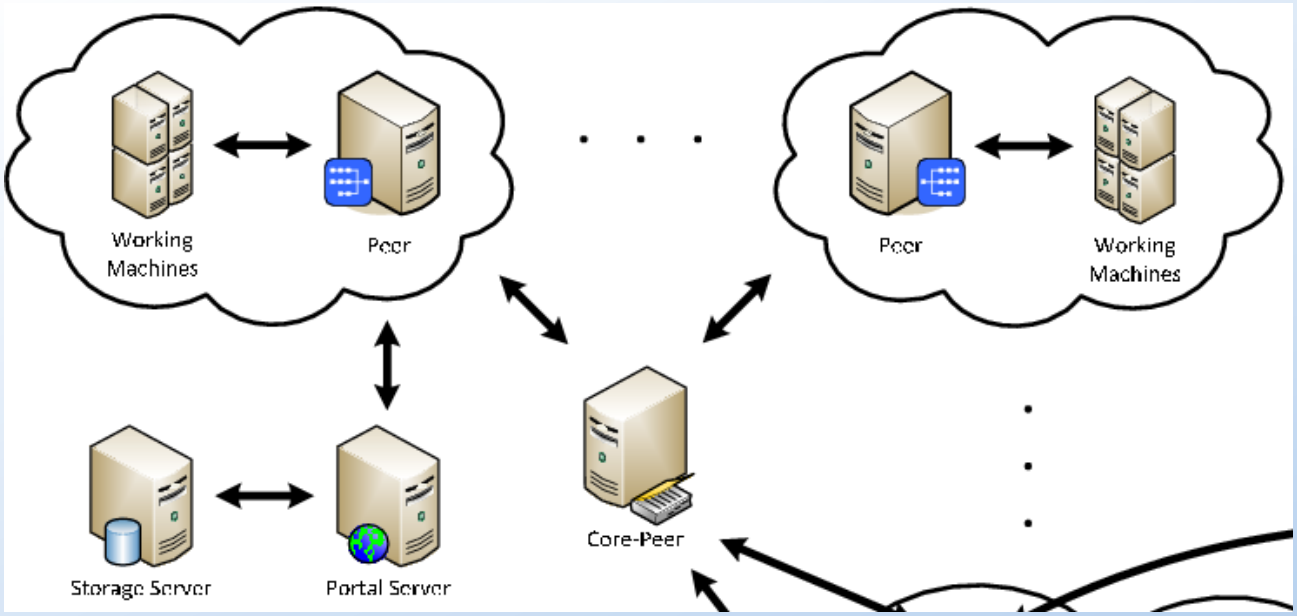
InterNet and InterCloud: framing the issues

- Flexibility
- Neutrality
- Interoperability
- SLA management
- Exchange
- Trade

Internet eXchange	InterCloud eXchange
• Transit (someone sells, someone buys)	• ICXs aggregate offer and demand of computing resources creating an opportunity for brokering services

ShareGrid

- ShareGrid is distributed computing platform based on a peer-to-peer federation of resources, in which each user:
  - Provides his/her own resources to other users
  - Can use resources provided by other users to run his/her own applications



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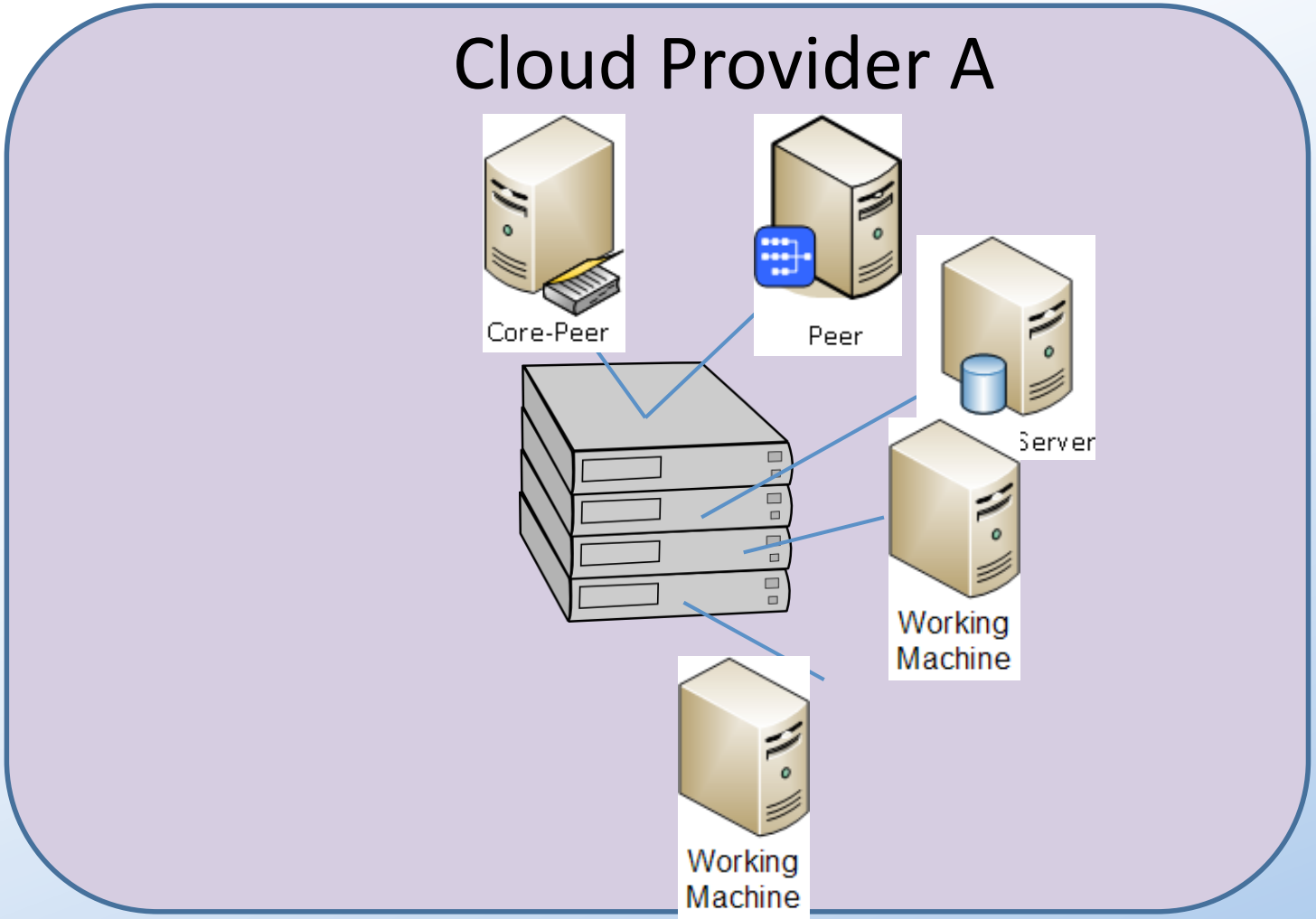
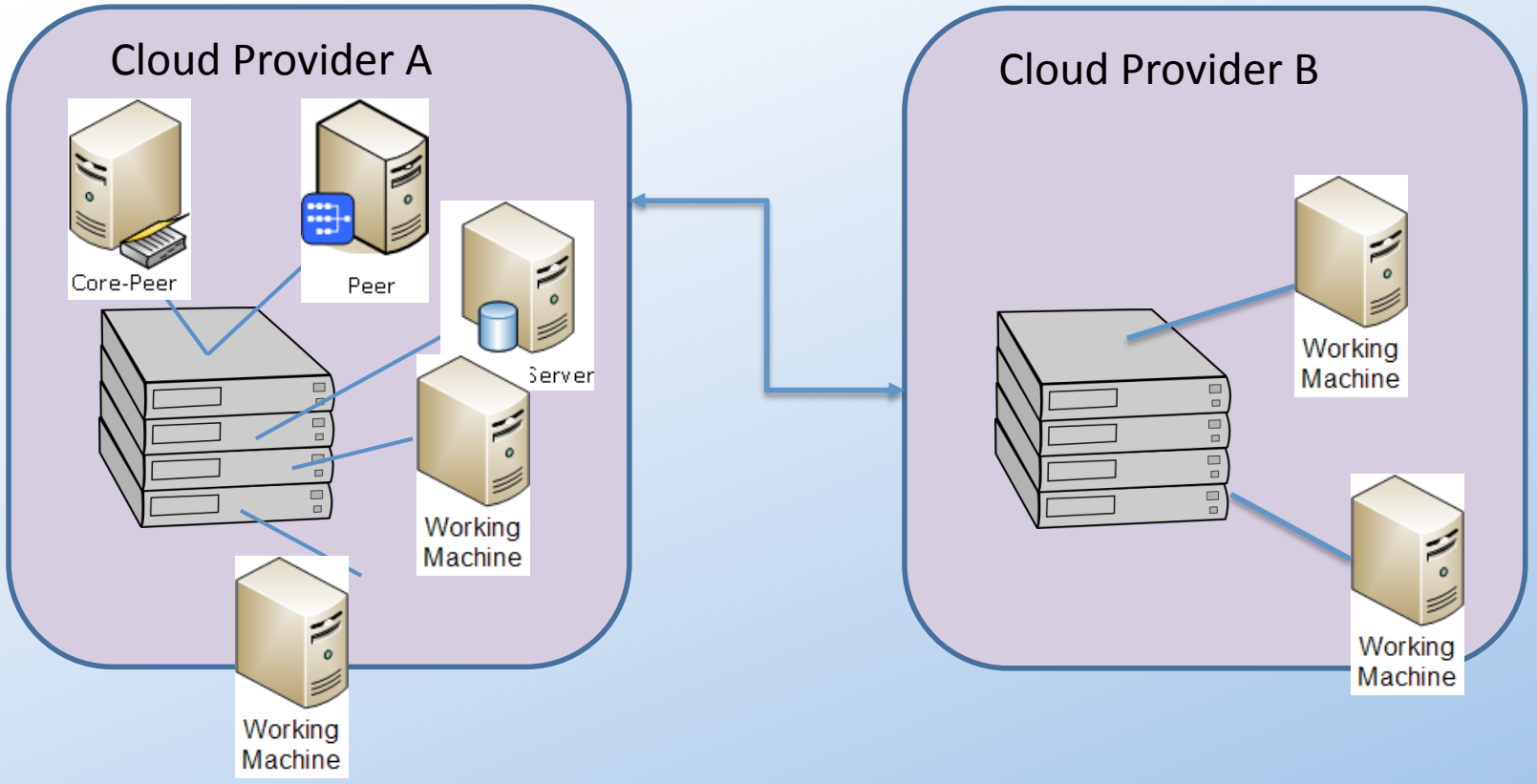
ShareGrid “in the Cloud” (Paas)



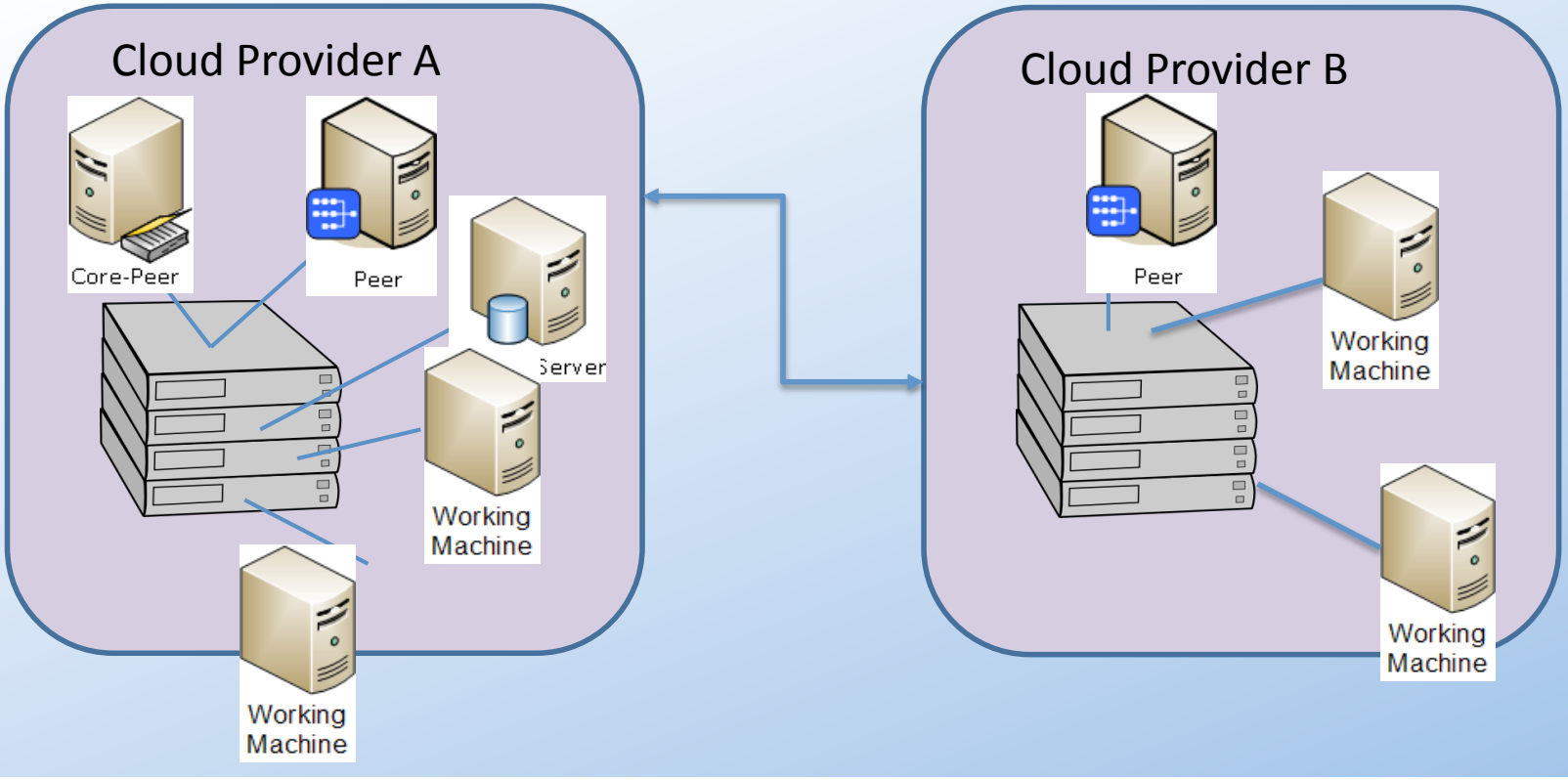
ShareGrid PaaS & Federated Clouds

- Spawning of new virtual Working Machines on the resources of provider B gives rise to the need of:
  - communicating with the reference Peer
  - accessing the Storage Server



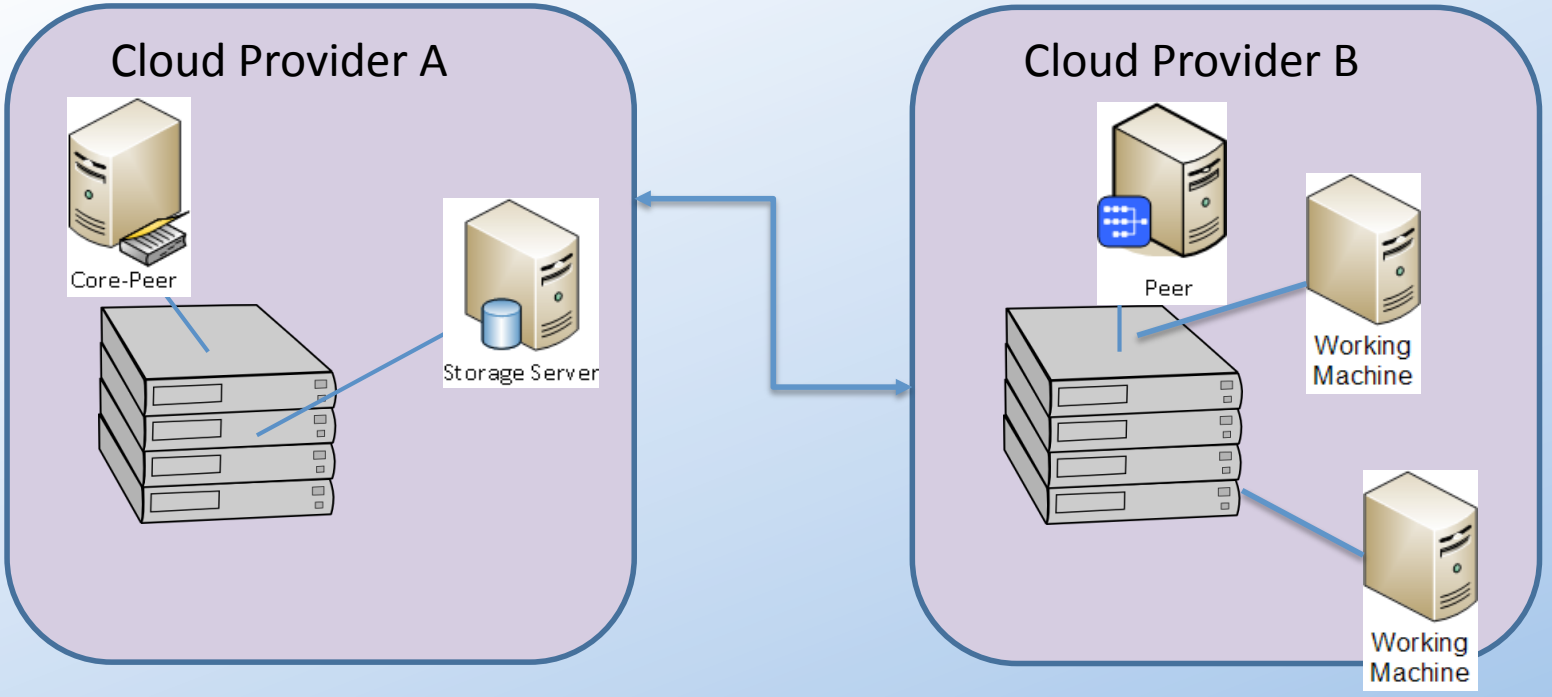
ShareGrid PaaS & Federated Clouds

- Spawning of a whole new “site” on the resources of provider B gives rise to the need of providing
  - communication between the new Peer and the Core Peer
  - storage access to all the new Working Machines



ShareGrid PaaS & Federated Clouds

- Migration of individual Working Machines or of whole "sites" on resources of provided B gives rise to the need of managing already active sessions (client-peer, core peer-peer, peer-worker, worker-storage server)

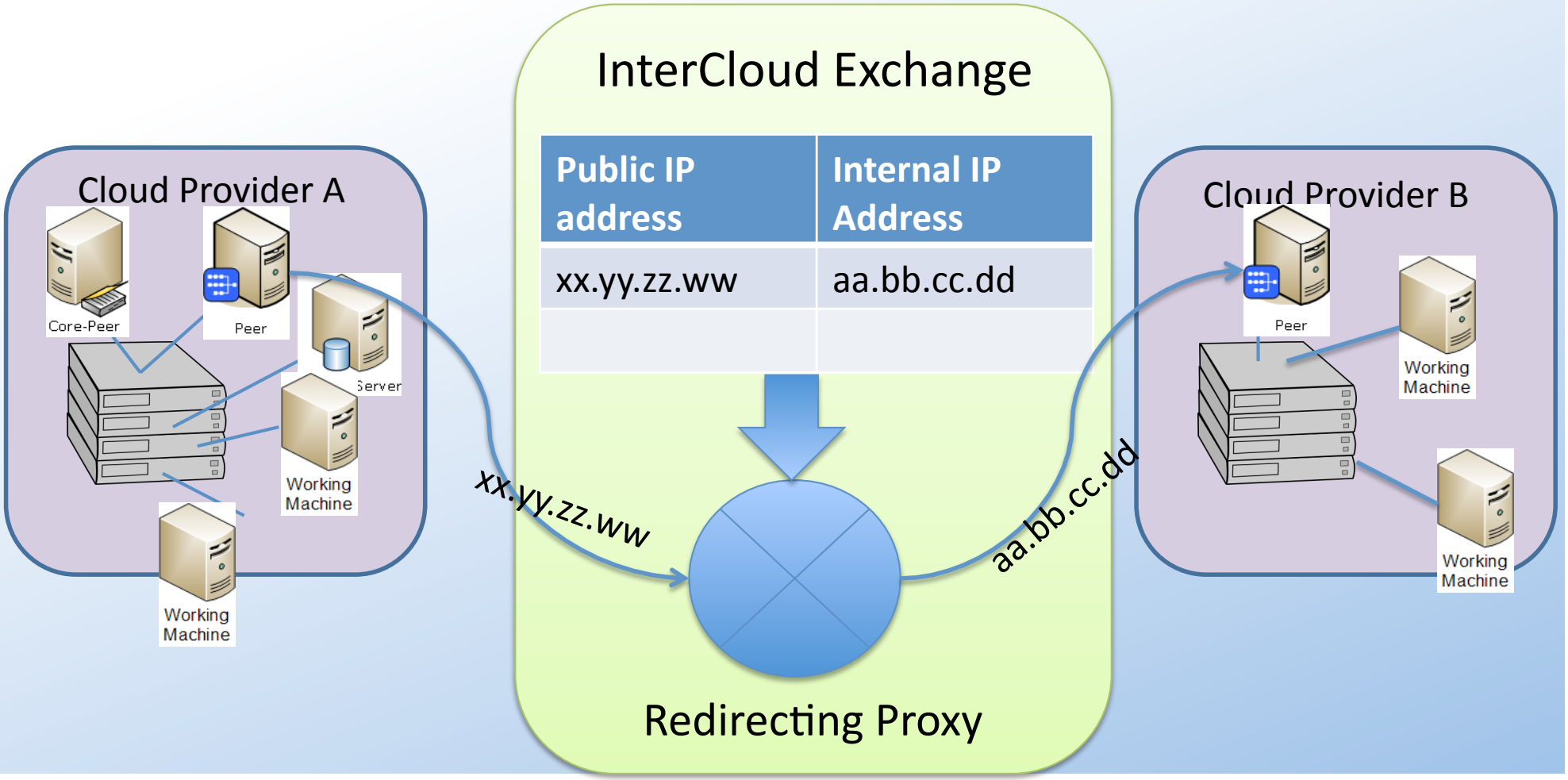


InterCloud Exchange e Federated Clouds

- There is the general need of providing open mechanisms supporting:
  - Brokering of physical resources belonging to different Cloud Providers
  - Policy reconciliation among different Cloud Providers
  - Transparent addressing between different tiers of the same applications running on different Cloud Providers
  - Efficient communication among application tiers running on different Cloud Providers
  - Transparent access to storage resources

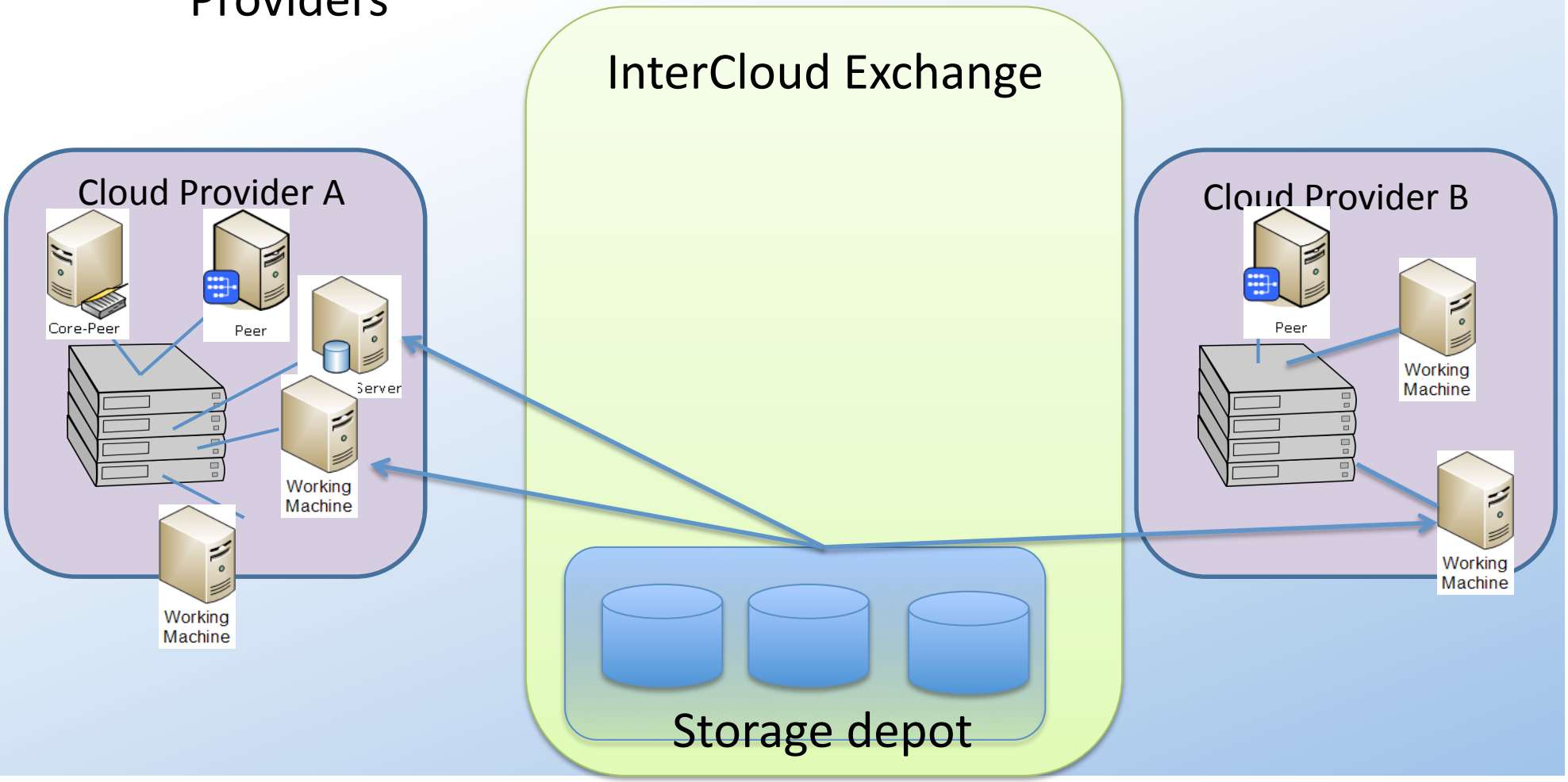
InterCloud Exchange: address proxy

- Redirecting Proxy to provide transparent addressing
- Need of proxying mechanisms able to handle active sessions when migration is performed



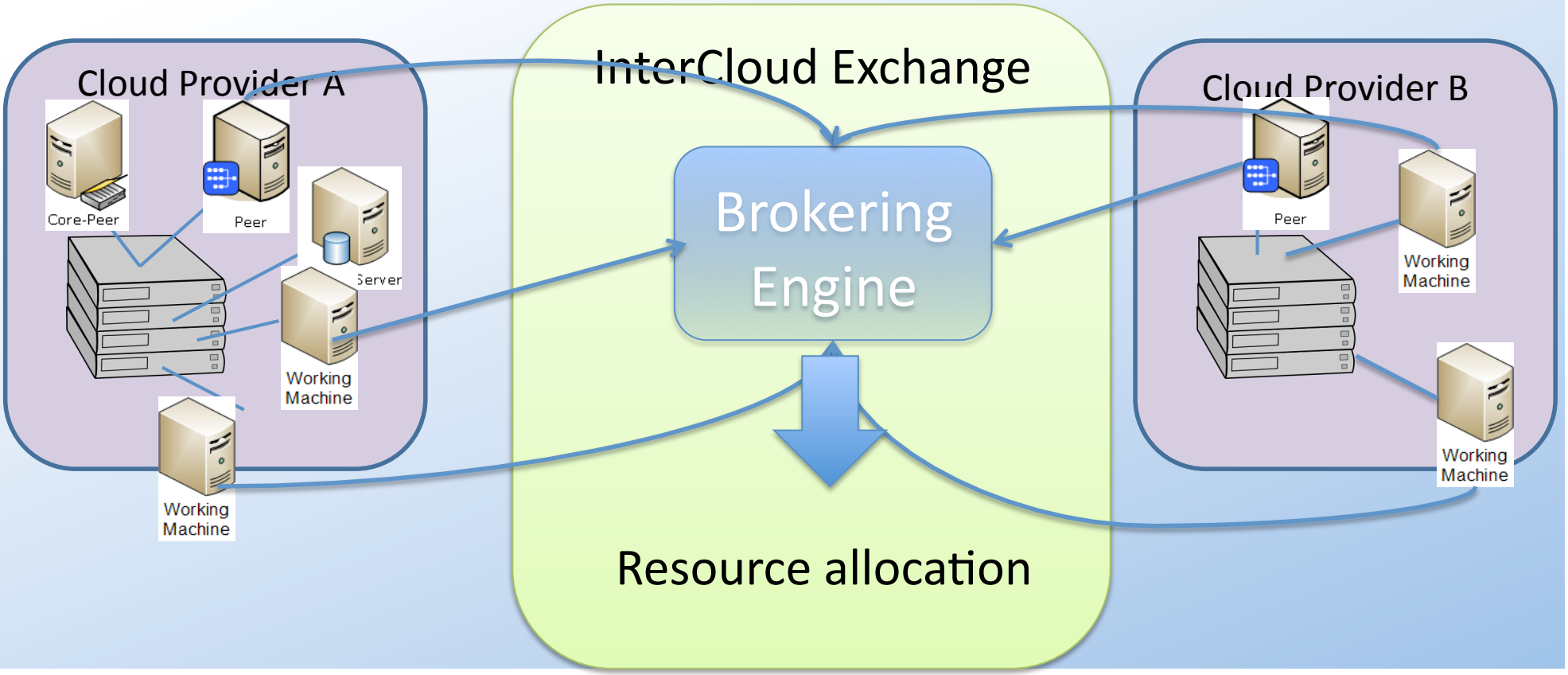
InterCloud Exchange: storage depots

- Virtualized storage infrastructures placed in the Internet Exchange premises and accessible in an efficient and transparent way from the resources of all the involved Cloud Providers



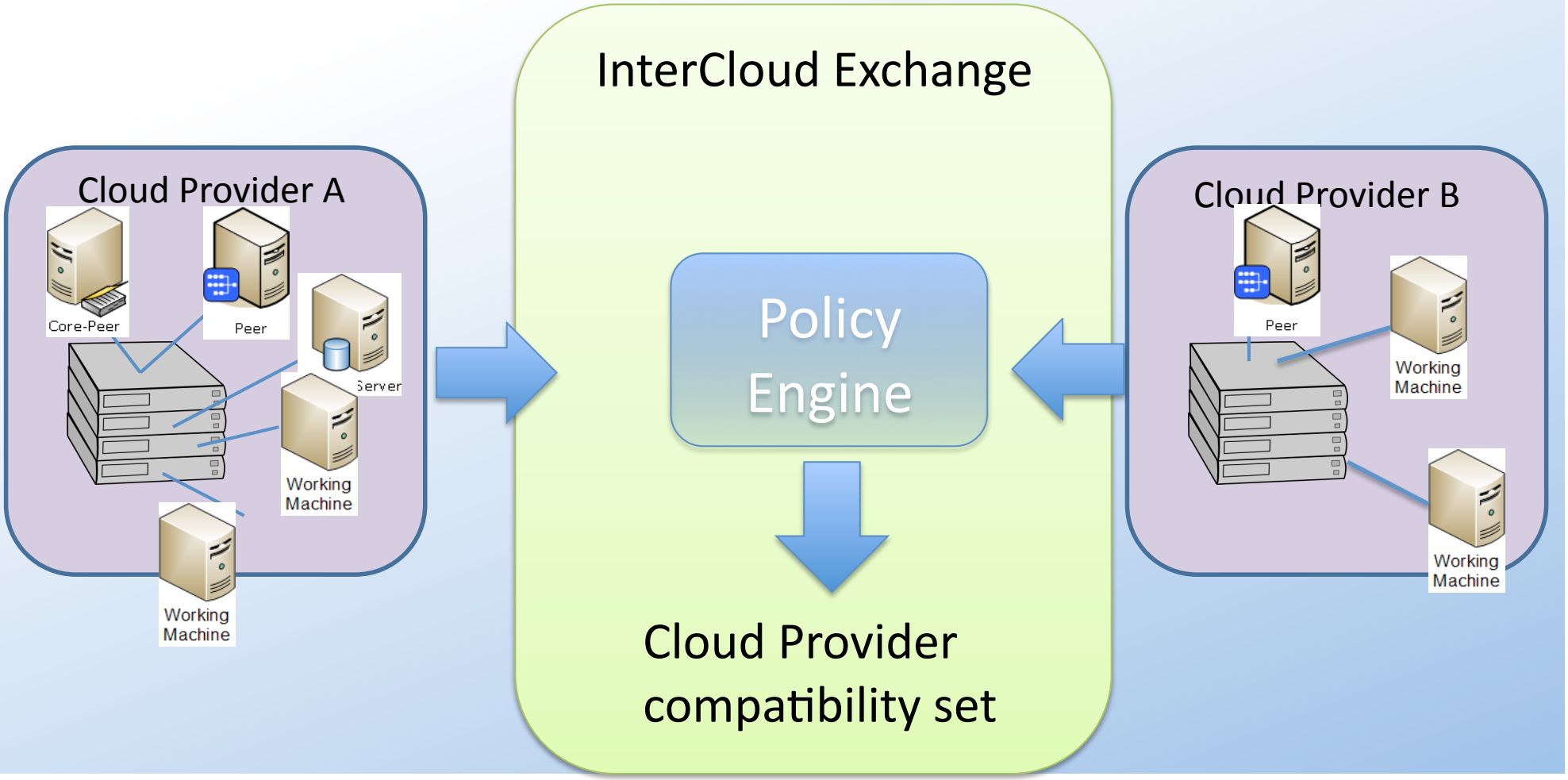
InterCloud Exchange: resource brokering

- The Internet Exchange is the place where all the information concerning the global resource state of all the involved Cloud Providers naturally converge
- Better brokering policies can be devised



InterCloud Exchange: policy reconciliation

- Different Cloud Provides may adopt different resource access policies
- The Policy Engine identifies compatible and incompatible policies in order to identify Cloud Providers that share similar policies



Conclusions

- Federations of Cloud Infrastructures will be increasingly common in the future
- InterCloud Exchanges represent Neutral Access Points where InterCloud traffic can be properly handled
- Work is in progress to provide the mechanisms and policies required to implement the InterCloud Exchange functionalities