WS-Agreement Based Resource Negotiation in AgentScape

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1. Problem
- Distributed resources and services
  - Workstations/computational resources.
  - Web services/databases.
- Resources are managed:
  - Individually (e.g. workstation owners).
  - Organizational levels (e.g. SysAdmins).
- Make resources available to applications:
  - Sharing idle resources with outside parties.
  - Enforcing usage policies (e.g. load balancing jobs).
- Access needs to be regulated:
  - Prevent configuration ‘hassle’
  - Define simple usage/access policies.
  - Ensure enforcement of policies
  - Retain autonomy of indiv. providers.

2. Approach
- Two-tiered negotiation model.
- Resource providers are organized into Virtual Organizations (VOs).
- VOs are represented by Mediators.
- Consumers negotiate with mediators.
- Mediators in turn negotiate with resource providers within the VO.
- Negotiation policies can be specified:
  - At individual providers.
  - At the mediator (organization level).
- Negotiation is document-based:
  - Based on WS-Agreement specification.
  - Templates guide the negotiation process.
  - During negotiations, agreement documents are exchanged and manipulated.

3. Model
- Workstation users define individual and fine-grained policies for resources
- System Administrators define overall access and usage policies
- Applications have specific resource requirements

4. Protocol
- Advertisement phase
  - Mediator collects and merges provider advertisements into combined advertisement.
- Request phase
  - Consumer selects combined advertisement and creates agreement request.
  - Mediator translates request into one or more provider agreement requests.
- Offer phase
  - Mediator collects and selects provider offers, and creates combined offer.
- Acceptance phase
  - Consumer selects best offer from combined offers, and notifies mediator of acceptance. Other offers are rejected.

5. Case: Distributed Resource Management (AgentScape)
- In AgentScape, agents negotiate for resource access prior to migration.
- Agents select the location with the best offer, and move to this location to perform their tasks.
- Resources available: CPU-time, Communication, Webservice access, ...

6. Case: Distributed Energy Management
- Energy providers form groups, enabling energy resources to be combined.
- Consumers negotiate with provider groups for the combined energy resources
- Virtual Energy Provider Organization
- Wind generator
- Diesel generator
- Solar array