IaaS level control mechanisms to alter user behavior for energy efficient academic clouds

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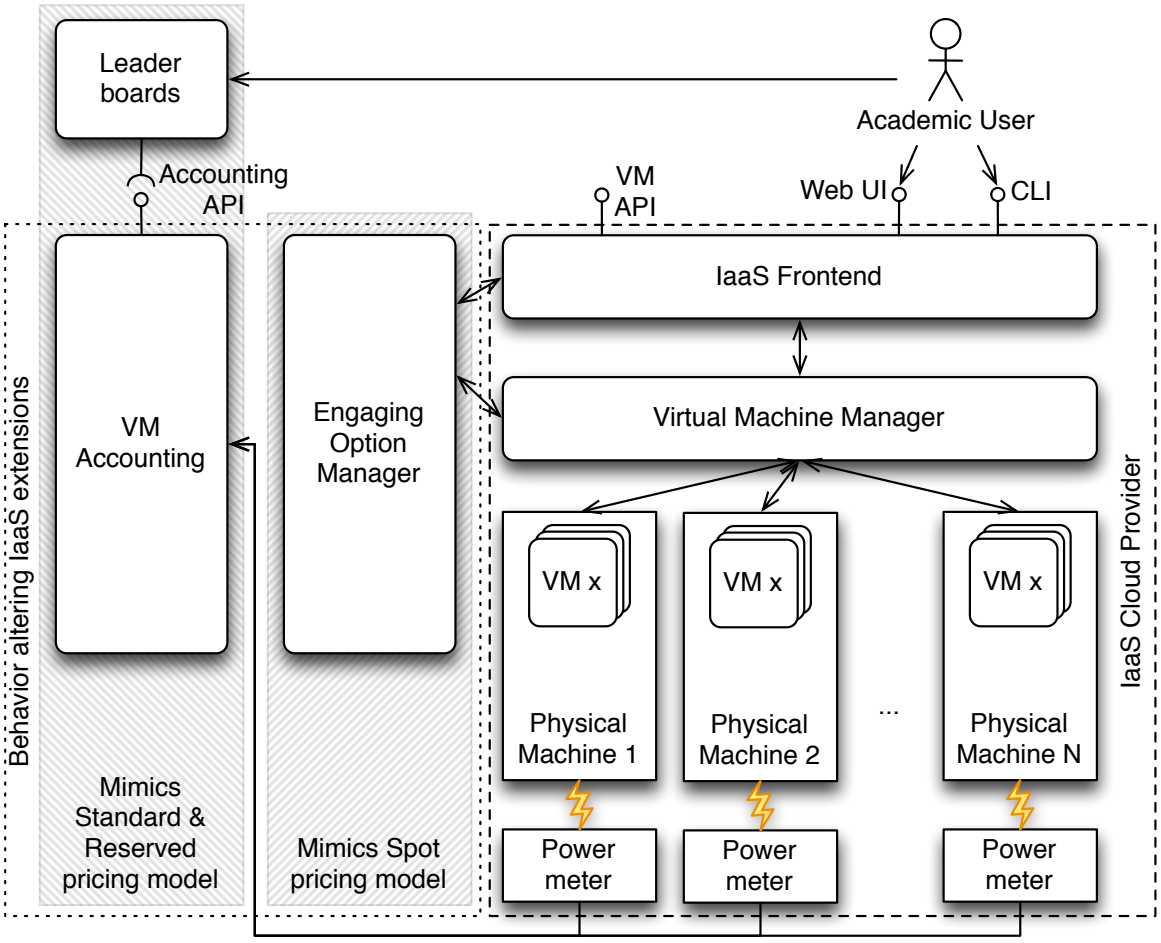
A collaborative work between MTA SZTAKI and the University of Innsbruck

Academic vs. Commercial IaaS users

- Academic users
  - Unnaturally and unnecessarily long infrastructure leases
  - Preference for resources with the highest performance without giving too much consideration on other properties
- Commercial users
  - delay the instantiation until absolute necessity
  - ensure continuous use
  - terminate VMs early considering billing periods
  - compromise between price and performance

Proposed architecture



(i) availability of energy readings, (ii) application of energy aware virtual machine placement, and (iii) leader board publicity.

Leader boards

- Account for runtime VM consumption

$$E_R(VM) = E_{idle}(VM) + E_{use}(VM)$$

- Scores individual VM usage and users overall energy efficiency

$$S(VM) = \frac{E^*(VM)}{E(VM)}$$

  - should highlight the behavioral differences between academics and commercial cloud users,
  - it should provide higher scores to academics who behave more closely to commercial users,
  - scores should be independent from the time the users joined the leader board,
  - good user behavior should always provide high scores independent from the use of the underlying infrastructure,
  - users should be able to compare their scores to their past selves (whether they improve or worsen compared to the expected behavior),
  - one's contribution to a group score should not diminish because of diminishing resource use,
  - scores should be independent from how many virtual machines for how long the users use.

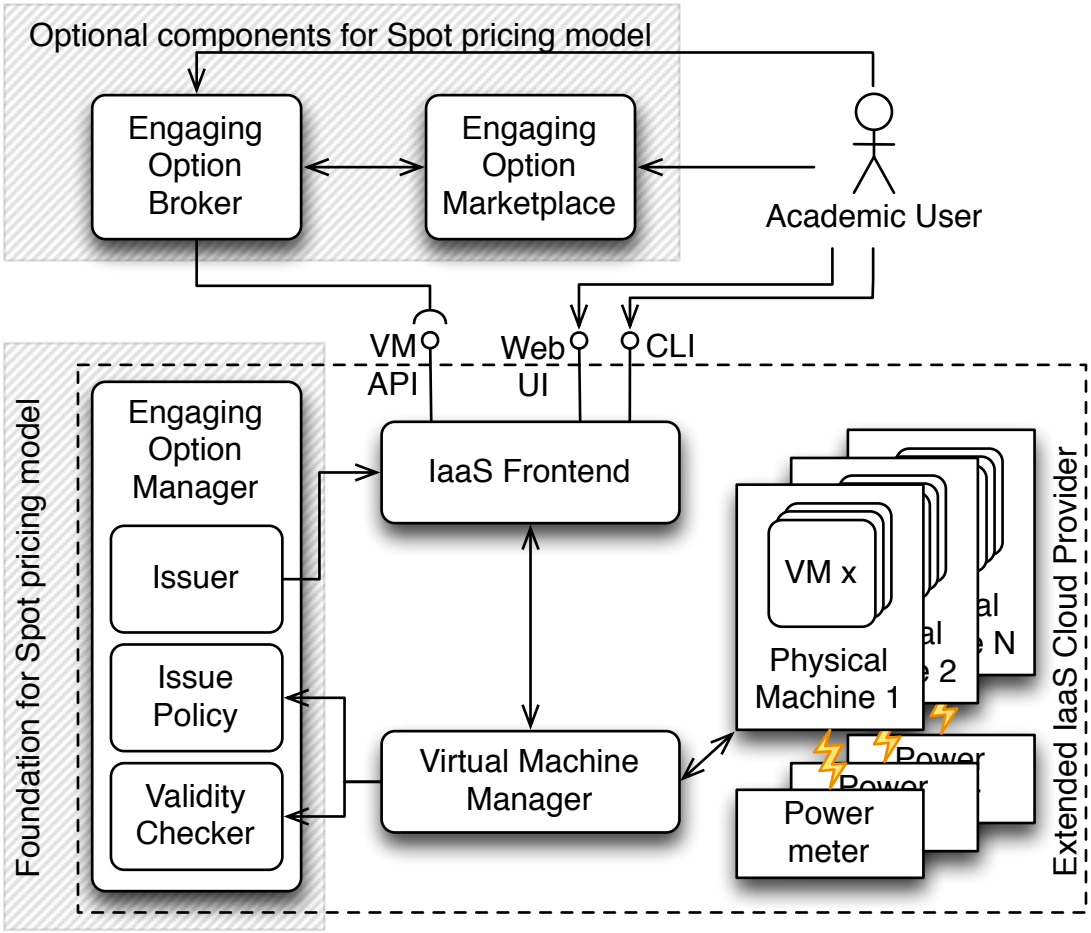
$$S(U) = \frac{\sum_{\forall VM \text{ of U}} S(VM) \cdot t(VM)}{\sum_{\forall VM \text{ of U}} t(VM)}$$

Engaging options

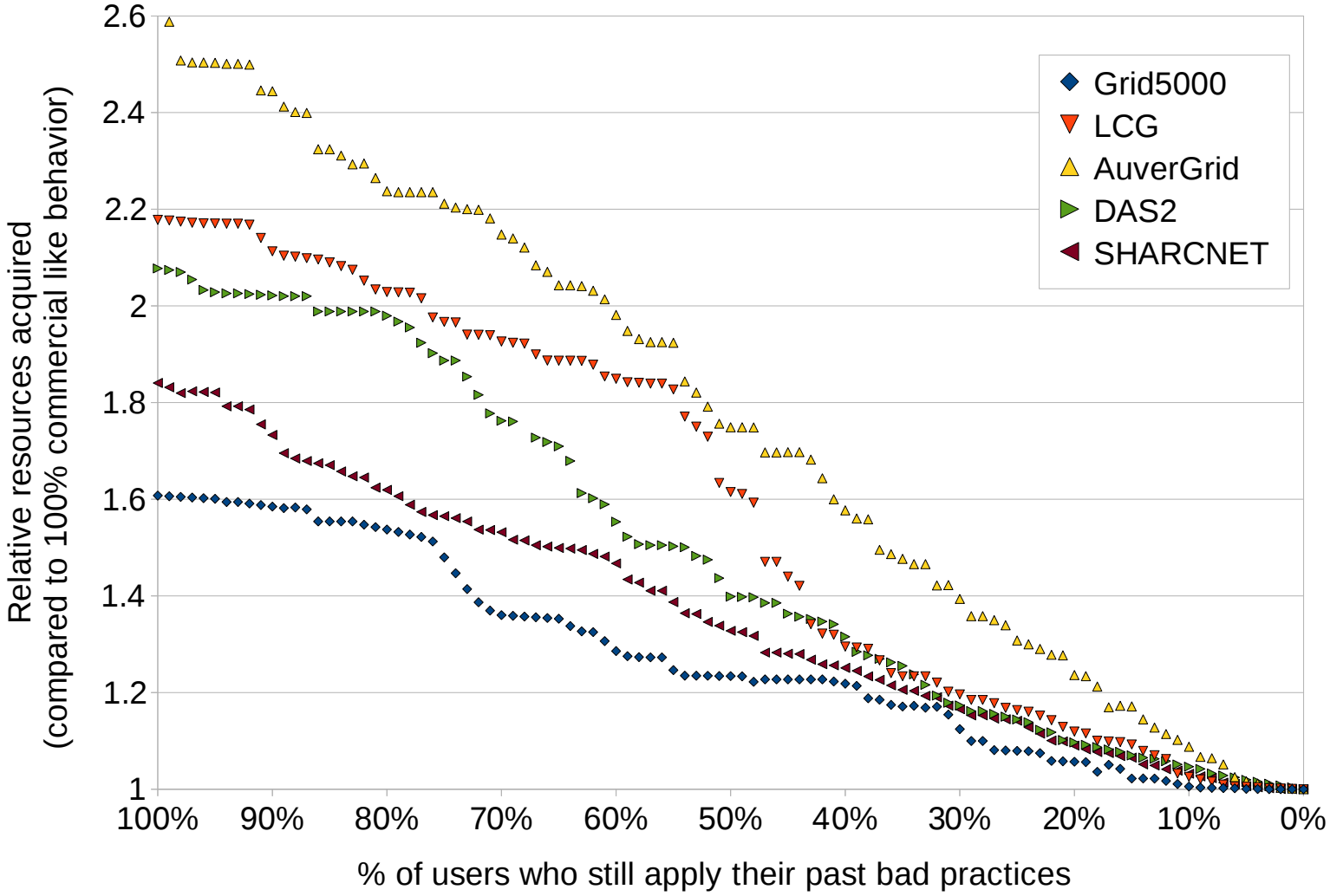
- We define an engaging option as an electronic document that represents a non binding, non exclusive, on the other hand time limited offer to utilize a particular set of resources on a physical machine.
  - Attracts other users (through marketplaces, social networking etc.)
  - Utilizing the acquired options (aiming at the highest scores possible on leaderboards, attaching to VM requests)

Engaging Options #2

- Usage statistics gathering (Monitoring and analysis phase)
- Issue policy (Plan&Execution phase)



Possible energy efficiency improvements



Questions?

For further details please contact me on:
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Or have a look on our recent paper on the presented results:

Gabor Kecskemeti, Simon Ostermann, and Radu Prodan. *An architecture to stimulate behavioral development of academic cloud users.* Sustainable Computing: Informatics and Systems, 4(2):136–150, June 2014.