Colocation Games
And Their Application to Distributed Resource Management

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In the Infrastructure as a Service market, providers offer fixed-sized instances. Provider’s profit = number of instances sold; no incentive to collocate customers. Virtualization enables customers to collocate to reduce costs without QoS compromises. Customers’ selfishness reduces colocation to a strategic game.
Current Model

$P$

CPU

I/O

$P$

CPU

I/O

A

B
Customers’ Strategic Actions

Modeled as a Game
Solution concept: Nash Equilibrium

$ fP$

$ (1-f)P$

$ f'P$

$ (1-f')P$
Formal Classification and Analysis

- **General Colocation Game**: Multiple resources over multiple processes per customer
  - No guarantee of Nash Equilibrium (NE)

- **Process Colocation Game**: Multiple resources over a single process (e.g., VM) per customer
  - Converges to a NE
  - Price of Anarchy = $\frac{3}{2}$ (if homogeneous resources)
  - 2 (otherwise)
Actual-to-Best Social Cost Ratio
(Synthetic workloads)

Median over all experiments

Worst-case experiment

- BFS
- DFS
- DP KP
Worst-to-Best Social Cost Ratio
(PlanetLab traces)

Median over all experiments

Worst-case experiment
CloudCommons
(On-Going Work)

- Strategic Services: To facilitate colocations, e.g., allowing users to find each other, compute strategic responses, ...

- Operational Services: To enforce outcomes of colocation game, e.g., reconfiguration, accounting, ...
Questions ?

Thanks!