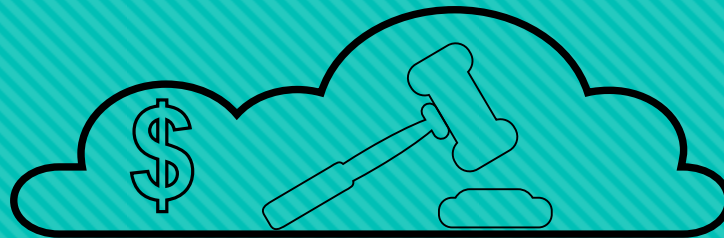# Why Are Repeated Auctions In Resource-as-a-Service (RaaS) Clouds Risky?

Danielle Movsowitz[1], Liran Funaro[2], Shunit Agmon[2], Orna Agmon Ben–Yehuda[2,3], Orr Dunkelman[1]
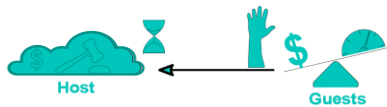
[1]*Computer Science Dept., University of Haifa*
[2]*Computer Science Dept., Technion − Israel Institute of Technology*
[3]*Caesarea Rothchild Institute for Interdisiplinary Applications of Computer Science, University of Haifa*

1

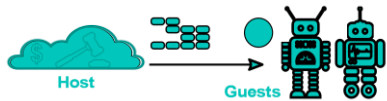# The Ginseng Protocol (VCG-Like)

The host announces an auction every 12 seconds

Each guest bids (p, q): a unit price p it is willing to pay for up to a quantity q of the resource
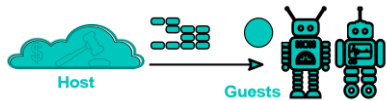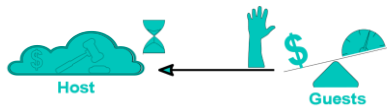
The host finds the allocation that maximizes the social welfare: the allocation that all the guests together value the most

The host informs the guests of their allocation and charges them according to the **exclusion-compensation** principle
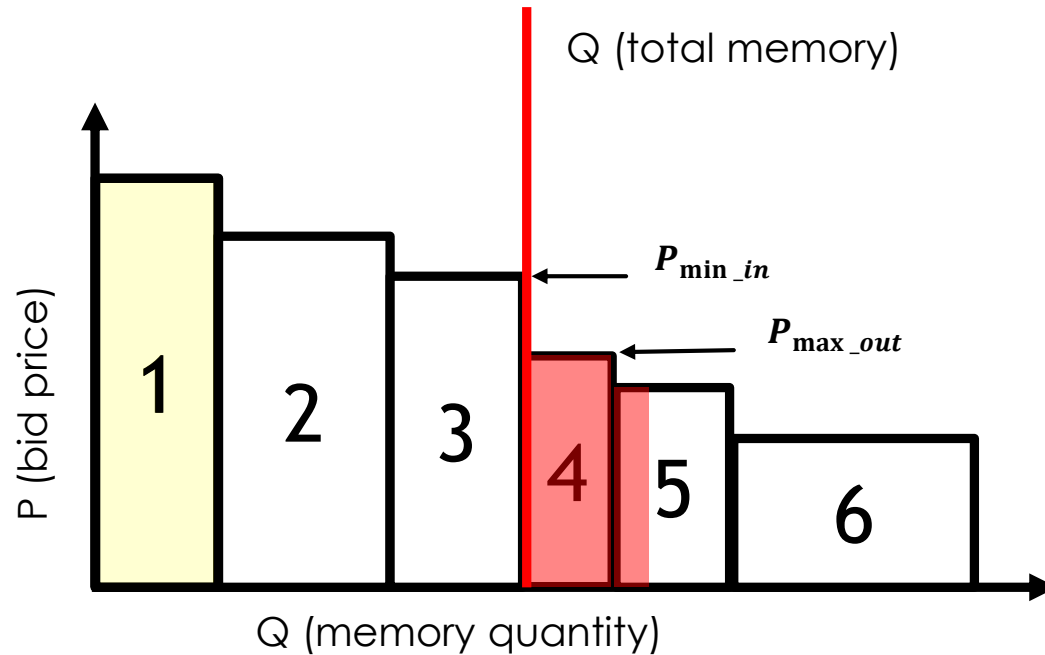
2

The Ginseng Protocol (VCG-Like)

The **exclusion-compensation** principle:

- Each guest pays for the damage it inflicted on the other guests in the system

As a result:

- The guests cannot improve their status by bidding a higher or a lower value
- Prices are **not** uniform
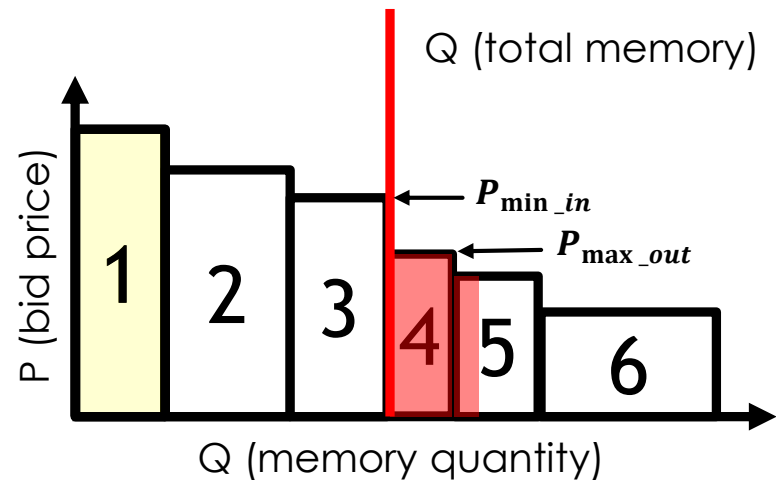- They may drop to a minimal price (possibly zero) if there is no demand for the resources

3

The Ginseng Protocol (VCG-Like)

Cloud Computing and Repeated Auctions

- As a single game VCG mechanisms are truthful, but…

- As a repeated game, guests can collect and analyze auction data to gain an advantage.

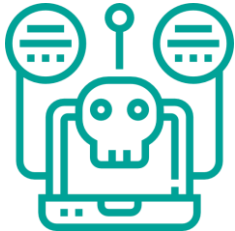# Motivation to Attack Economic Based Cloud Computing

- Motivation to attack:
  - Harm other guests
  - Improve the attacker's resource allocation

- The goals behind an attack:
  - Hindering performance
    - Resource deprivation
    - Inefficient resource rental (suffering the overhead of re-acquiring the resource)
  - Reducing profits
  - Reducing resource pressure (freeing resources)

Known Attacks on Economic Based Cloud Computing

Traditional cyber attacks such as:

- Side channel attacks
  - Ristenpart, T., Tromer, E., Shacham, H., Savage, S.: Hey, you, get off of my cloud: exploring information leakage in third-party compute clouds. 2009

- Co-location attacks
  - Varadarajan, V., Zhang, Y., Ristenpart, T., Swift, M.M.: A Placement Vulnerability Study in Multi-Tenant Public Clouds. 2015

- Resource Freeing Attack (RFA)
  - Varadarajan, V., Kooburat, T., Farley, B., Ristenpart, T., Swift, M.M.: Resource Freeing Attacks: improve your cloud performance (at your neighbor's expense). 2012

Known Attacks on Economic Based Cloud Computing

Pure economic attacks such as:

- Price shading – bribing a bidder to decrease the bid price.

- Collusions between guests

Known Attacks on Economic Based Cloud Computing

Economic Denial of Sustainability (EDoS)

also known as: Fraudulent Resource Consumption (FRC) attack

- Hoff, C.: Cloud computing security: From DDoS (distributed denial of service) to EDoS (economic denial of sustainability), 2008

Compound Economic Attacks on a Repeated Auction

Price Raising Attack

Elbowing Attack

Price Raising Attack

The attacker forces the victim to pay more for its RAM resources, thus reducing its profits and draining its economic resources.
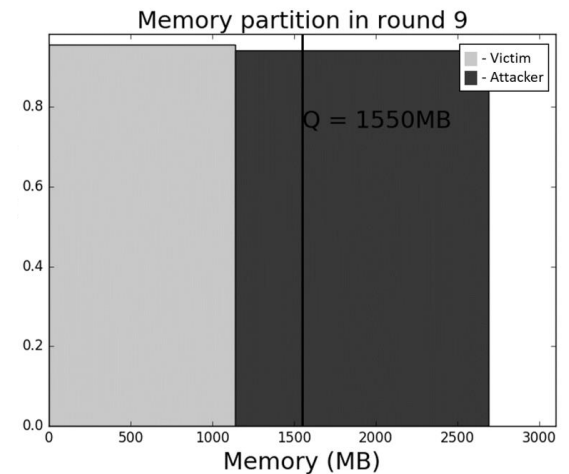

Memory partition in round 0

Q = 1550MB

Price Raising Attack

Victim's bill rate $7.7/hour$ for $1.5GB$.
The attacker's bill is *$0/hour.*

Victim's bill rate increases to $11.16/hour$ for $1.5GB$.
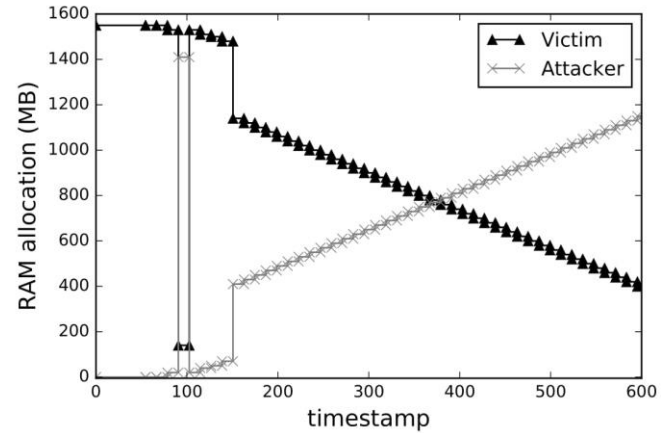The attacker's bill is *$0/hour.*

Victim's bill rate is $10.73/hour$ for only $1.14GB$.
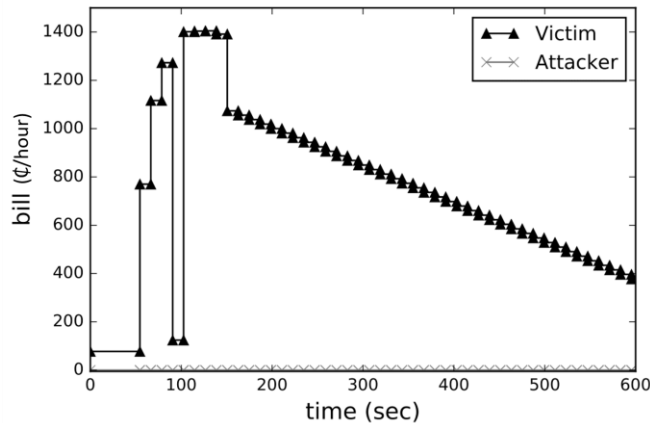The attacker's bill is still *$0/hour.*

Price Raising Attack
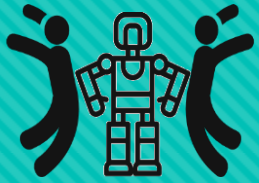

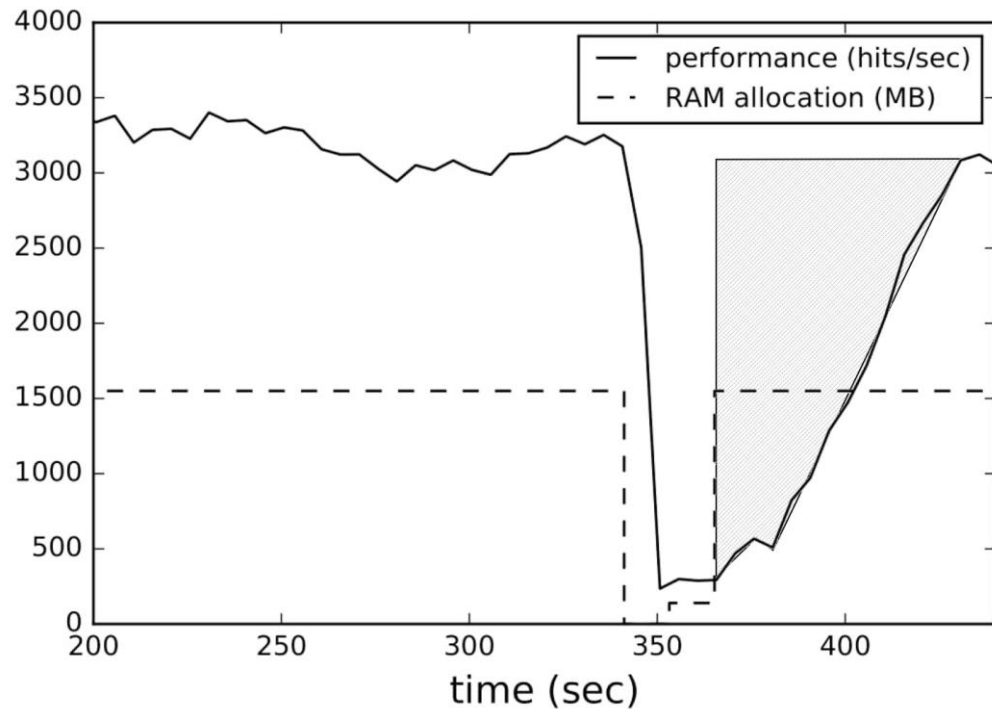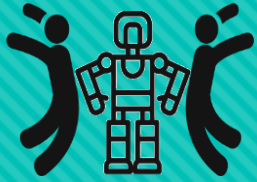Victim's profit

Guests RAM allocation
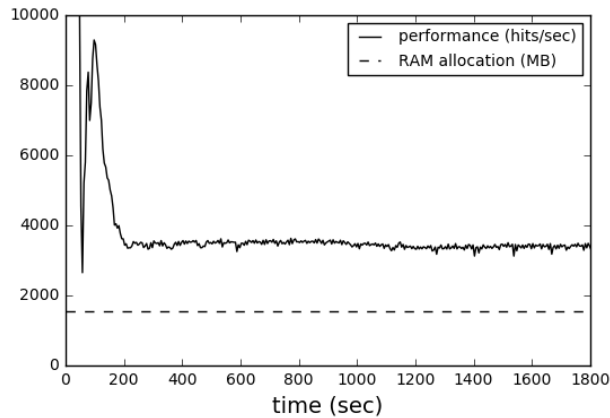

Guests bill. The attacker's bill is 0

13

Elbowing Attack

The attacker attacks in a timely manner that hinders the victim's performance and profit.
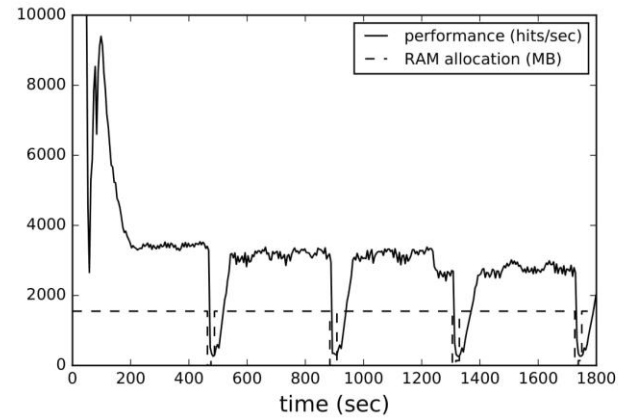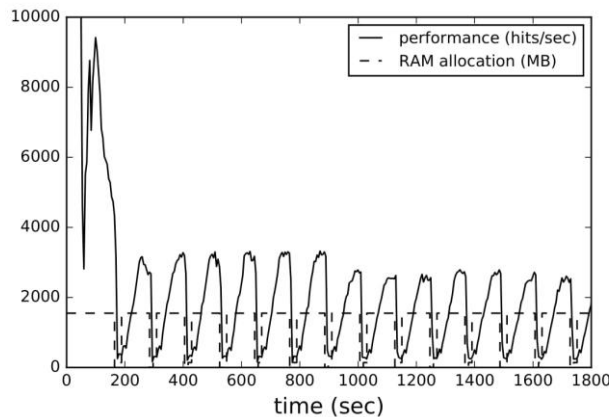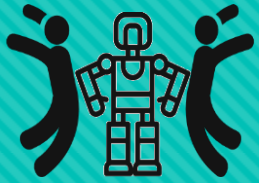
Elbowing Attack

No attack on the system

Attack every 35 rounds.
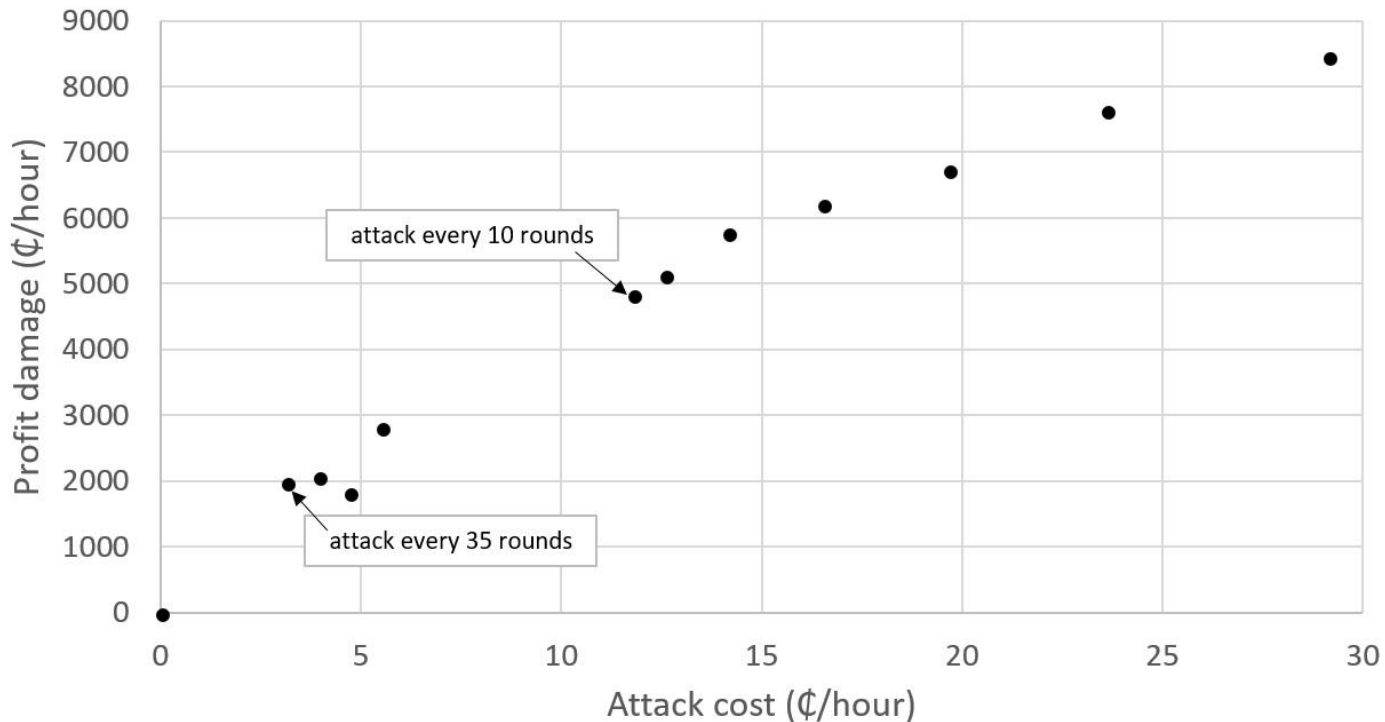Victim damage: $20/*hour* Attack cost: $0.03/*hour*

Attack every 10 rounds.
Victim damage: $48/*hour* Attack cost: $0.11/*hour*

15

Elbowing Attack

For every dollar spent on the attack,
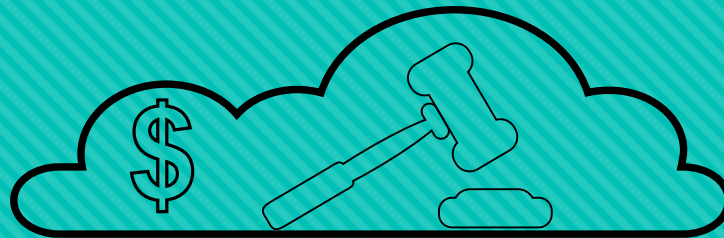the Elbowing attack causes a damage of $290-$630.

Profit damage as a function of the attack cost

16

Conclusions

○ The world of cloud computing is progressing to dynamically allocating resources using economic mechanisms

○ These mechanisms offer better hardware utilization

○ However, they open the door to new types of attacks such as the compound economic attacks we presented

○ Until now there has been little research on the matter

Questions?

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