

# STRATEGIC MANAGEMENT OF SHARED CLOUD SERVICES

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# CLOUD MARKETS

- ONE OPTION - PURCHASE RESOURCES FROM SINGLE PROVIDER



OPENSIFT

(AS INTERNAL SERVICE PROVIDER)

# CLOUD MARKETS

- POSSIBLE ALTERNATIVE:  
OPEN EXCHANGE WITH  
AUCTION VARIANT



IMAGE SOURCED FROM [HTTPS://DIGILANT.COM/BLOG/FEATURED-BLOG/PROGRAMMATIC-BUYING-101-THE-DIFFERENCE-BETWEEN-FIRST-AND-SECOND-PRICE-AUCTIONS-IN-RTB](https://digilant.com/blog/featured-blog/programmatic-buying-101-the-difference-between-first-and-second-price-auctions-in-rtb)

# CLOUD ECONOMICS

- INTERPLAY BETWEEN ENGINEERING AND MANAGEMENT DECISIONS
- **WANT TO PREVENT USERS FROM GAMING THE MARKETPLACE.**
- **HOW DO USERS MAKE PURCHASING DECISIONS?**

# GAME THEORY

- **PLAYERS:** USERS AND/OR PROVIDERS
- **STRATEGY:** BEST RESPONSE AGAINST OTHER PLAYERS' ACTIONS
- **EQUILIBRIUM:** NO PLAYER WANTS TO DEVIATE

# EQUILIBRIUM CHARACTERIZATION

- **UNIQUENESS AND STABILITY**
- **PROVIDER'S REVENUE**
- **SOCIAL WELFARE**

# KEY INSIGHT

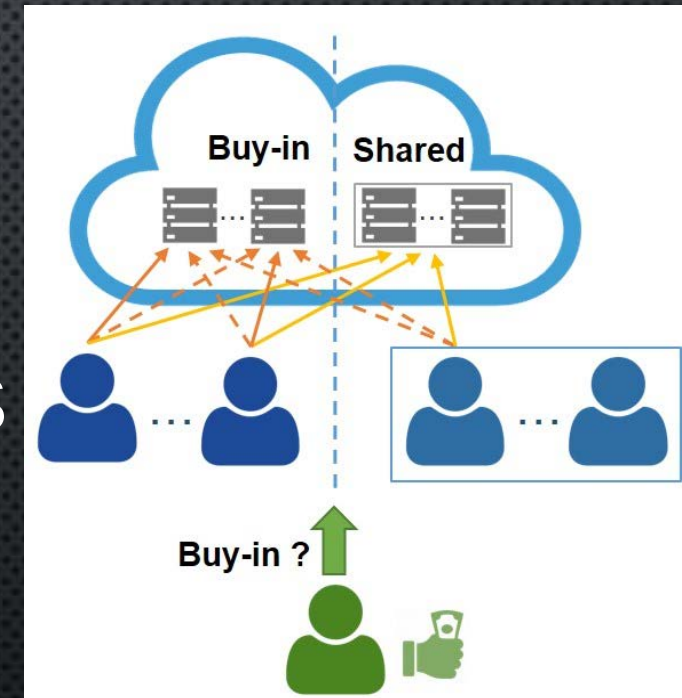
- IT IS POSSIBLE TO INCREASE REVENUE AND/OR SOCIAL WELFARE **WITHOUT** INVESTING IN ADDITIONAL RESOURCES
- How?
  - **JUDICIOUS PRICING**
  - **JUDICIOUS RESOURCE ALLOCATION AND SCHEDULING**

# SHARED/BUY-IN COMPUTING

- GAME THEORETIC ANALYSIS OF **SHARED/BUY-IN COMPUTING SYSTEMS**

- **KEY INSIGHT:**

- HEAVY USERS "SUBSIDIZE" LIGHTER USERS
- POSSIBLE EMERGENCE OF "FREE-RIDERS"



Zhenpeng Shi, Azer Bestavros, Ariel Orda, and David Starobinski, "A Game-Theoretic Analysis of Shared/Buy-in Computing Systems," *IEEE Open Journal of the Communications Society*, 2020.



# SHARED/BUY-IN COMPUTING

- AN EXAMPLE: **SHARED COMPUTING CLUSTER** AT BU
- SOCIAL WELFARE IS SUB-OPTIMAL

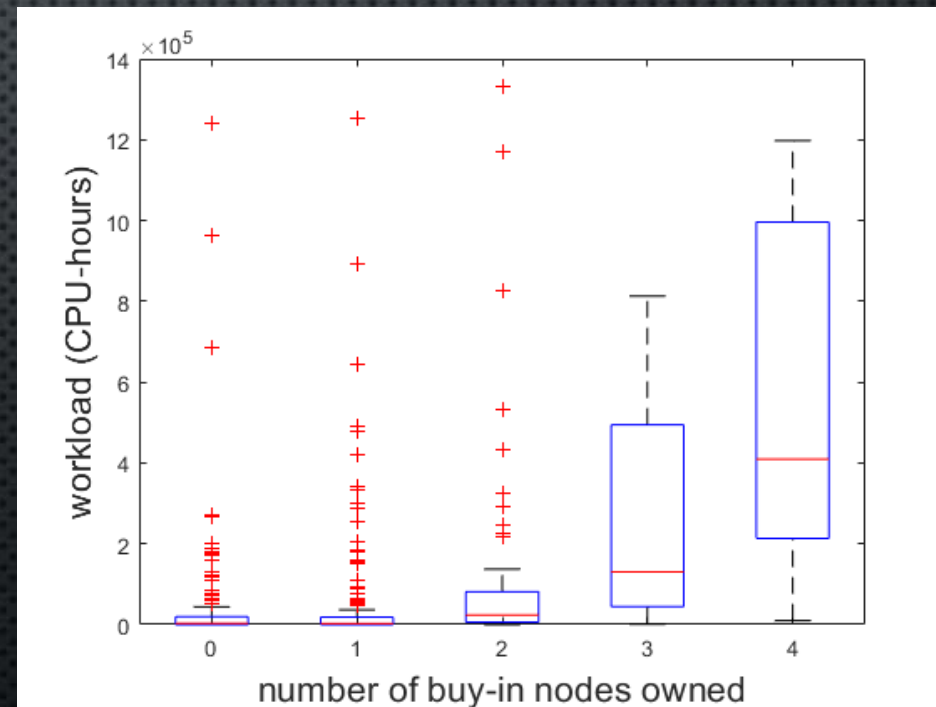
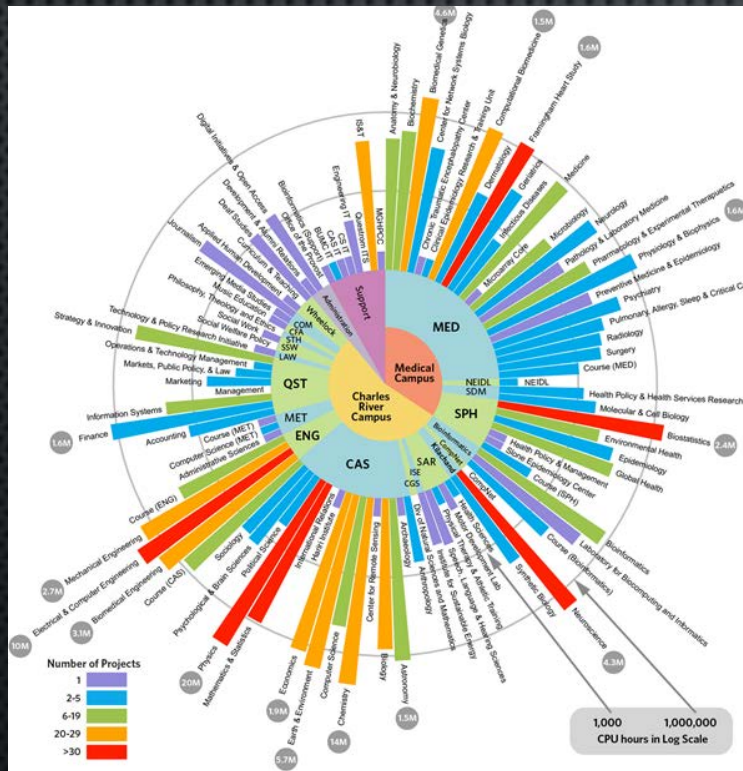


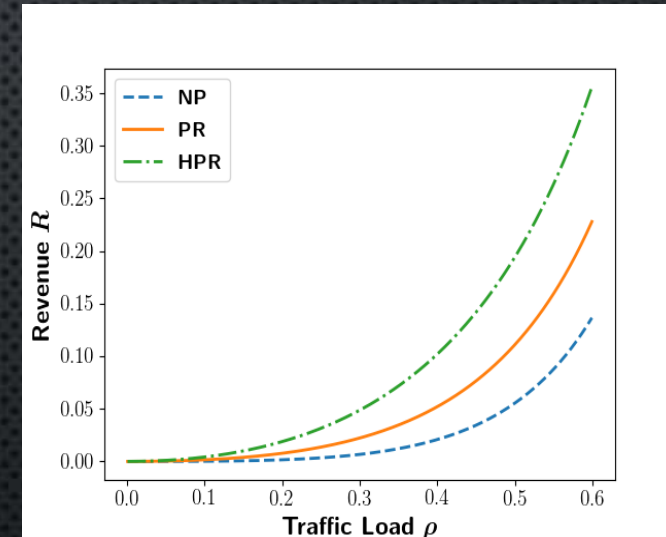
IMAGE ON THE LEFT SOURCED FROM [HTTP://RCS.BU.EDU/PR/SCC-GROWTH/](http://RCS.BU.EDU/PR/SCC-GROWTH/)

# FUTURE WORK

- IS **AUCTION-BASED MARKETPLACE** A MORE EFFICIENT WAY OF SHARING?

# ADVANCE RESERVATION + PREEMPTION

- GAME THEORETIC ANALYSIS OF **PREEMPTIBLE (TRANSIENT) SERVICES**
- **KEY INSIGHT:** ADVANCE RESERVATION + PREEMPTION MAXIMIZES REVENUE



Jonathan Chamberlain, "Strategic Behavior and Revenue Management of Cloud Services with Reservation-based Preemption of Customer Instances," *Masters Thesis*, 2019.

# ADVANCE RESERVATION + PREEMPTION

- USERS HAVE INCENTIVE TO AVOID LATENCY
- PURCHASING SERVICE PRIORITY REDUCES LATENCY

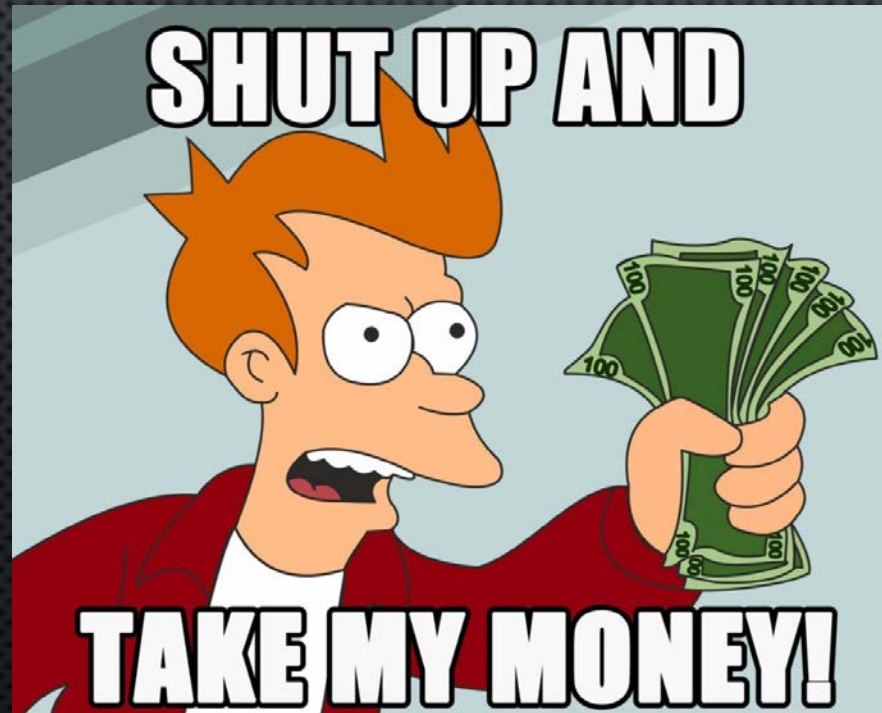


IMAGE SOURCED FROM [HTTPS://WWW.UDORAMI.COM/PROJECT/SHUT-UP-AND-TAKE-MY-MONEY/](https://www.udorami.com/project/shut-up-and-take-my-money/)

# FUTURE WORK

- IN MARKETPLACE/AUCTION SETTING, HOW DO **ADVANCED BIDS** IMPACT USER BEHAVIOR?

# SUMMARY

- THROUGH **GAME THEORY**, WE CAN UNDERSTAND TRENDS OF USER BEHAVIOR IN SHARED CLOUDS
- CAN IDENTIFY **IMPROVEMENTS THROUGH POLICY**
- FUTURE WORK INCLUDES APPLYING OUR RESULTS TO OTHER VARIANTS IN SHARED CLOUD TYPES