



- **Resource Containers: A New Facility for Resource Management in Server Systems.**  
**Gaurav Banga, Peter Druschel, and Jeffrey C. Mogul, OSDI'99**
  - What is the problem being addressed?



## OS as a resource manager...

- Operating systems manage resource consumption: keeps track of how much a particular application has used in order to decide on how much to allocate in the future
  - If a process is CPU intensive (measure CPU), then less aggressively schedule process
- Problem: Resource management is conflated with process/thread
  - Many scenarios (servers: web, file, ...), many processes /threads perform same operation, many operations performed by same process/thread



## Resource container...

- Make resource accounting explicit and separate from process/thread
  - Create a resource container, assign it to a operation. Every time this operation consumed resources, the OS will charge it. The OS schedulers will use this resource consumption metric to provide appropriate service (QoS)
  - Each process is endowed with a certain amount of “resources” which it can then split among many operations.
    - Lottery scheduling is one such mechanism
    - LAR is another work from these authors will allows network operations to be charged to a RC early



# Issues

- What is a resource, how do you unify various resources (e.g. CPU, network, memory etc.)
  - Defining resources is a perennial problem. OS makes decisions on whether one resource is more important than another
- In traditional OS, kernel resource consumption is (approximately) added to the process which it relates to. Why do we need to muck with it?
  - So that disk/network requests can get better QoS
  - So that we can be fair.
    - What if we take it all the way? What happens to operations that are shared by multiple RC?



# Challenges

- What about other forms of distributed computing?
  - Grid computing?
- Can this be used to fight denial of service attacks?
  - What about interrupt overhead?
- Performance cost of too many RC

