Virtual Putty: Reshaping the Physical Footprint of Virtual Machines

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Cloud Environments

- Pool of resources for hosting applications
  - Virtual Machines: Application containers

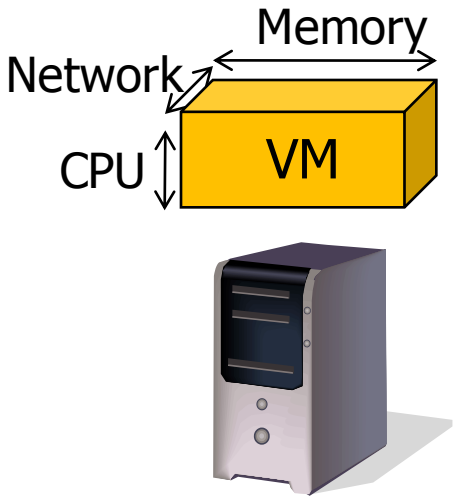
Cloud Management Challenge

- Cloud Provider: High Consolidation
  - Power, cost savings
- Cloud User: Robust performance
  - Isolation from other hosted applications

- **Goal:** Exploit VM characteristics to meet best of both worlds

Physical Footprint of VM

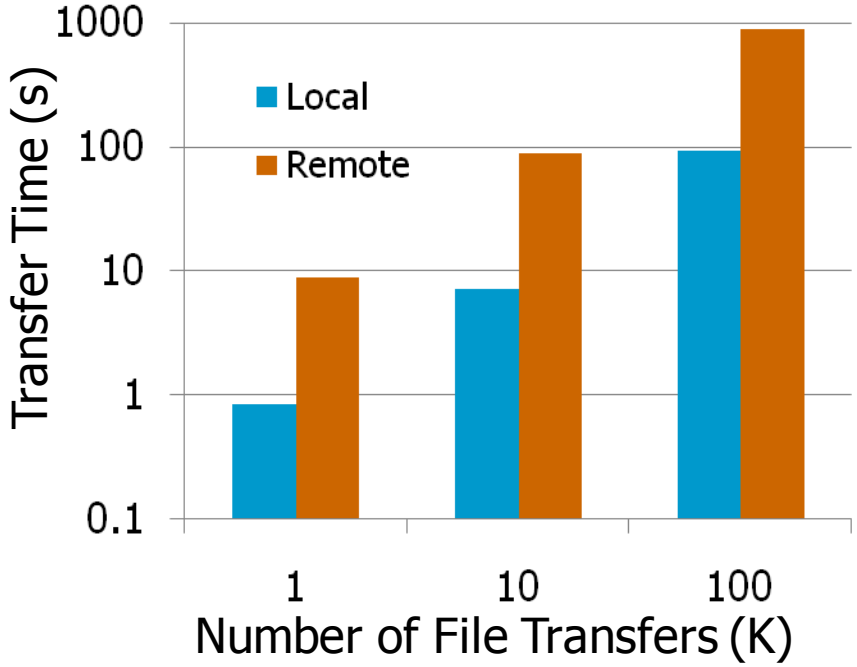
- Physical Resource Consumption
  - Memory usage, disk I/O, network bandwidth, energy usage, etc.
- Impacts:
  - Degree of consolidation
  - Application Performance



- **Question:** Is the physical footprint rigid?
  - Independent of location, environment?

Physical Footprint is Malleable

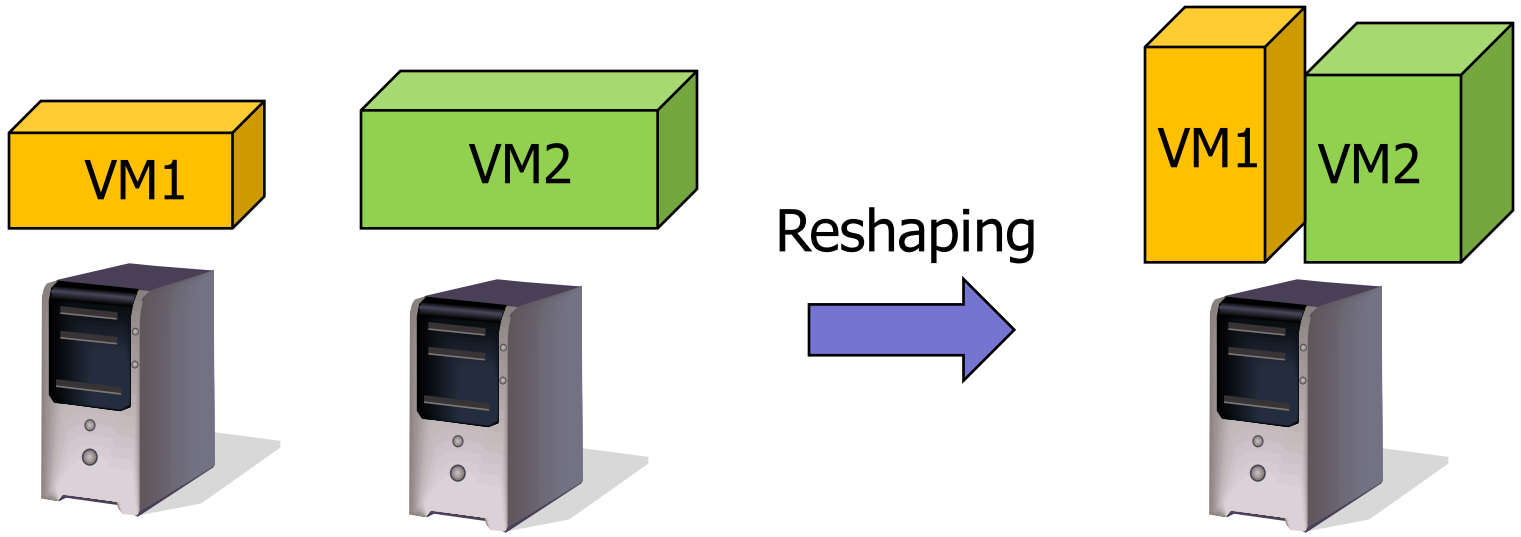
- Communicating VMs sitting locally vs. remotely



- Xen 3.3.0 VMs, 100 Mbps LAN, 100 KB Files

- Network footprint dependent on VM location and affinities

Virtual Putty



- Reshape the physical footprints of Virtual Machines
- **Achieve:** Higher performance, energy savings, …
- **Key Idea:** Exploit affinities and conflicts

Problem 1: Estimating the Footprint

- VM has a "virtual" footprint
  - Memory contents, I/O requests, communication patterns, etc.
  - Can be molded to desired "physical" footprint
- Challenges:
  - How to estimate non-intrusively?
  - How to represent the virtual footprint efficiently?
  - How to handle dynamism?

Problem 2: Reshaping the Footprint

- Enhance migration/placement decisions
  - Reduce data redundancy
  - Place VMs near data
  - Exploit statistical multiplexing
- Challenges:
  - How to reconcile multi-dimensional tradeoffs?
  - How to achieve system-wide reshaping in a scalable, agile manner?

Summary

- Physical Footprint of VM is malleable
- Can be reshaped using affinities and conflicts
- Footprint reshaping can lead to better consolidation, performance

- Project URL: http://vputty.cs.umn.edu