Relation-aware Resource Provisioning and Management for Virtualized Services

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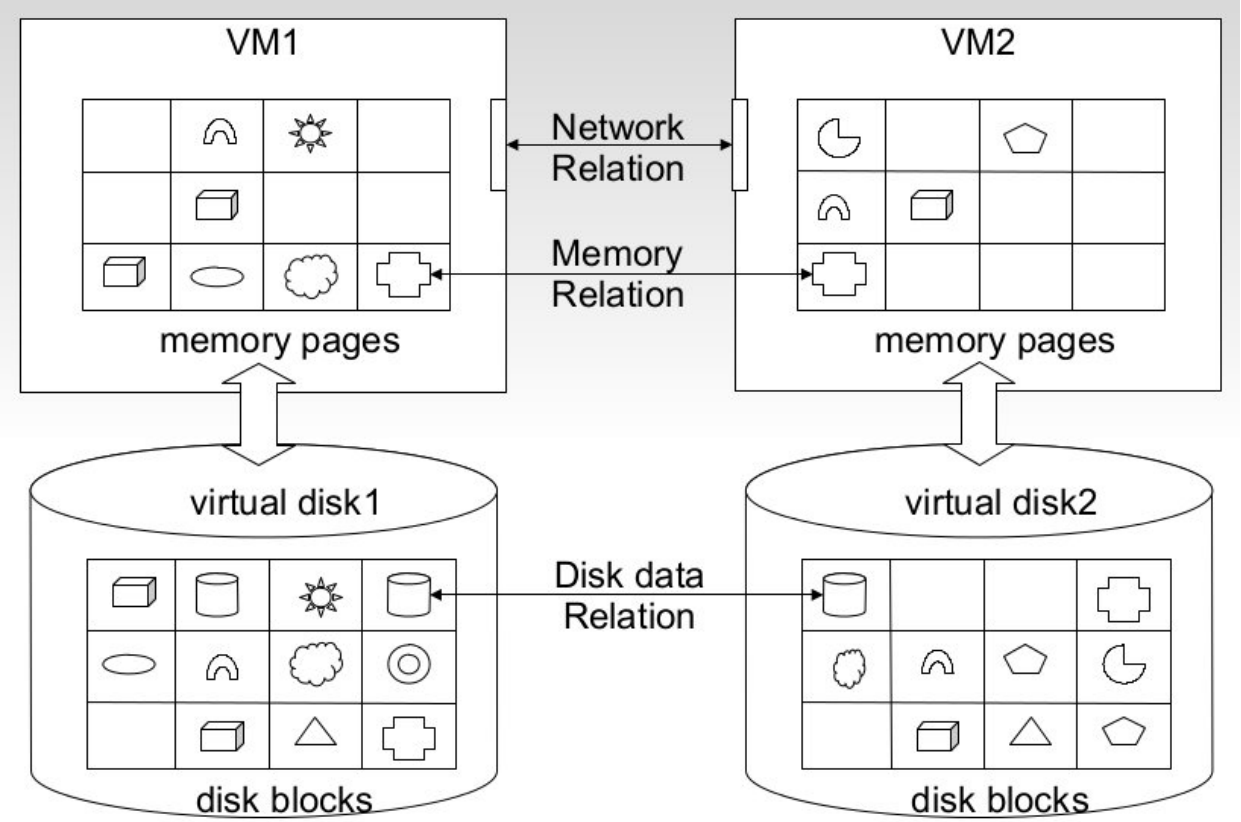
Pre-synopsis Presentation

Virtual Machine Relations



- Network relation refers to network traffic between virtual machines.
- In previous talks, we have discussed nature of network traffic and effects on CPU utilization
- Both the memory and disk data relations are based on data-similarity => *data-similarity relation*

Talk Outline

Part I

A-RESCUE: Affinity-aware Modeling of CPU Usage for Provisioning Virtualized Applications

Pay-Per-Use Service Model

Electricity Grid

Public Transport

- Software as a Service
- Platform as a Service
- Infrastructure as a Service

Enabling technology ← Virtualization

Pay-Per-Use Service Model

Electricity Grid

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- Software as a Service
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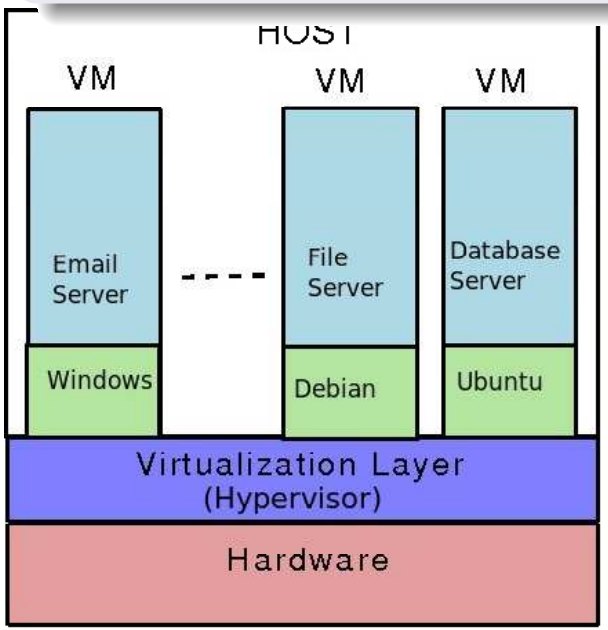
Enabling technology

Virtualization

Infrastructure as a Service (IaaS) via Virtualization

Virtualization Architecture



Enables

- De-coupling hardware & software
- Multiplexing of resources
- Machine-level on-demand resource allocation

Benefits for Users

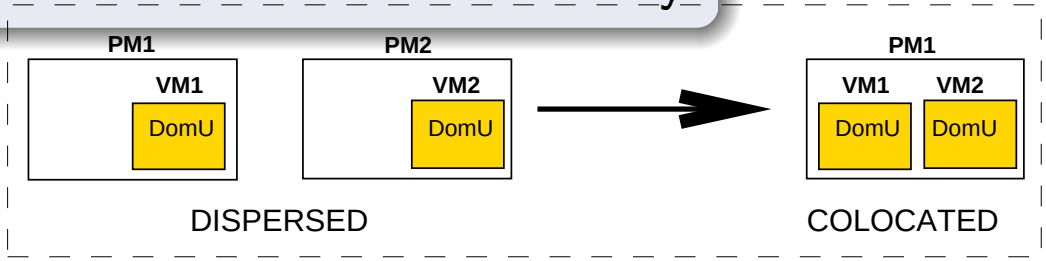
- Pay-per-use
- Infrastructure management outsourced
- Performance guarantees and isolation

Benefits for Providers

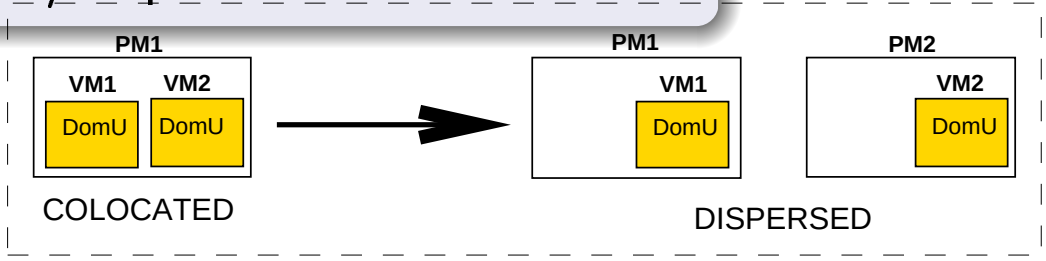
- Multiplex resources for operating efficiency
- Enable server consolidation => reduced server sprawl
- Optimize power and cooling costs

Migration-Enabled Resource/Performance Management

Consolidate VMs for Resource Efficiency

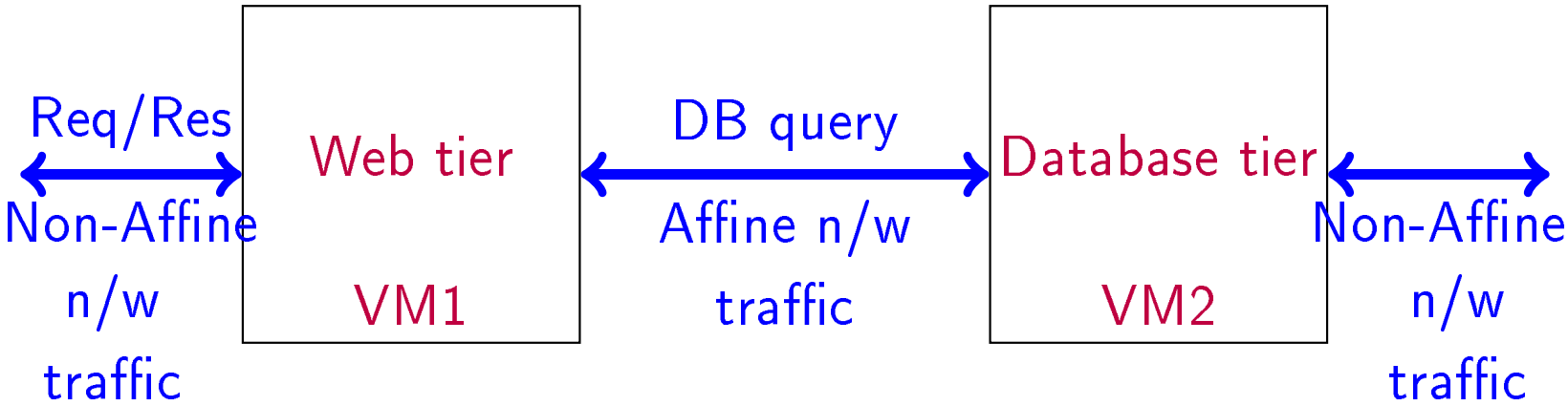


De-consolidate/disperse VMs for QoS



- Both server consolidation and QoS assurance need resource usage estimation
- Incorrect estimation is sub-optimal
  - Under-estimation => degraded performance
  - Over-estimation => wasted resources

Affine and Non-affine Network Traffic

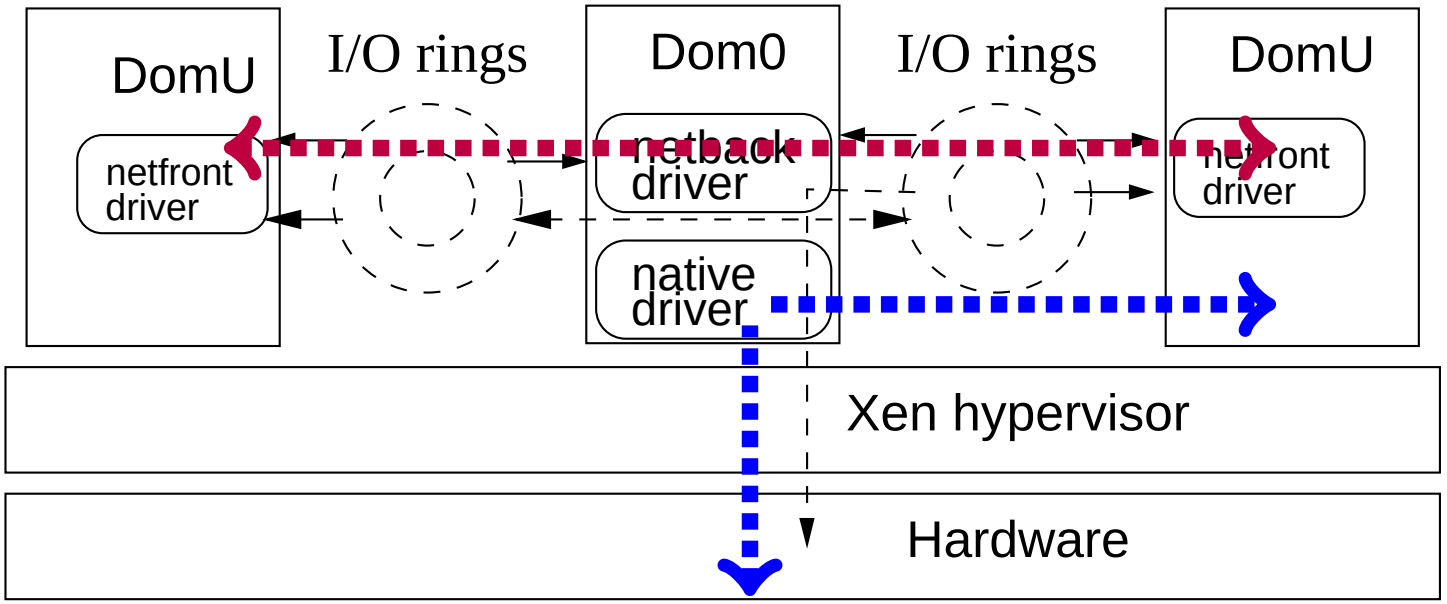


Affine traffic: Network traffic between VMs co-hosted in a data center/cluster

Our hypothesis

Affine and non-affine traffic have different CPU overheads => ignoring affinity effects could result in incorrect usage estimation

Communicating VMs (Xen-view)



- Dom0 overhead for DomU's I/O activity (network & disk)
- Affine traffic
  - Dom0 does not use native I/O drivers
  - Shared memory based copying of packets
- Less CPU overhead for affine traffic compared to non-affine
- Needs to be accounted for during VM migration

Problem Formulation

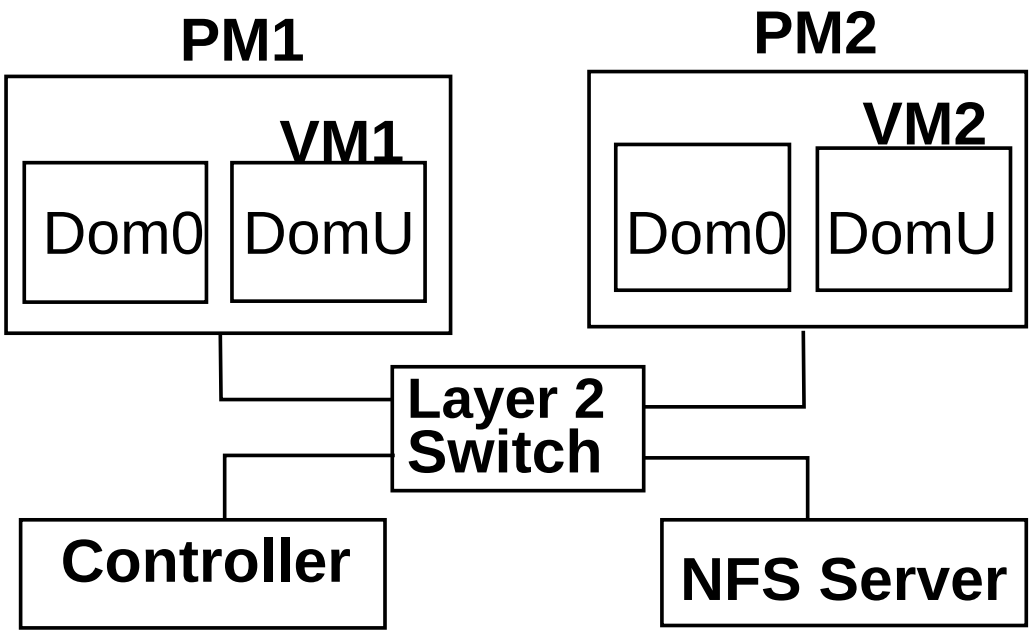
Question

With mutually-communicating VMs, does transition from dispersed state to colocated (or vice-versa) impact their CPU requirements?

Goals

- Benchmark change in requirements for both DomU and Dom0 (in Xen-based VMs), and identify correlation with different types of workloads
- Build a model to "correctly" estimate resources based on VM movement scenario

Benchmarking: Setup and Tools



Expt. scenarios

- Dispersed VMs
- Colocated VMs

Dom0 Measurement Tools

- xentop
- sar

Microbenchmarks

- CPU: 10% to 90%, steps of 10%
- Network: 10Mbps to 90Mbps, steps of 10Mbps
- Disk: 0 - 1500 blocks/sec, powers of 2

DomU Measurement Tools

- tcpdump
- sar