Final Year Project 2008 - Load Balancing Xen
Jeremy Tay  BEng (CS) III
Agenda

- State of the Art - Server Consolidation and Virtualization
- The Project - Aims and Objectives
- System Architecture, Features and Implementation
- Demonstration
- Limitations
- Future Development
- Q & A
Server Sprawl

Decreased utilization, energy efficiency

Increased administrative overhead, running cost
Virtualization
The Project
Aims and Objectives

To create an **ENVIRONMENT** for the execution of **MIGRATABLE VIRTUAL MACHINES** on a **SCALABLE** array of computers running on commodity hardware.

To study the possibilities of **LOAD BALANCING** the virtual machines through **LIVE MIGRATION**.
Reliability, Availability, Scalability
Scalable Environment

- Network boot
- Diskless, headless hosts
- Isolated operating system
- Rapid deployment
Live Migration

- Moving virtual machines from one physical host to another
- Decouples service from hardware
- Negligible service interruption
- Transparent to user
Load Balancing

- Optimize utilization
- Reduce bottlenecks
- Increase manageability and availability
- Done through live migration
VM Management
Migration Commands
Configuration Updates

Host Controller running
tsubame-monitor

XMLRPC
tsubame-xm

Host Node running
tsubame-heartbeatd

Heartbeat Messages
Status Updates
VM Tree
Load Balancing

- Basic, On-demand Load Balancing
- Rule-based Load Balancing
- Statistics-based Load Balancing
Basic, On-demand Load Balancing
Strategy - Affinity Rules
Strategy - Anti-affinity Rules

Migration Candidates

- 20%
- 15%
- 15%

Migration Target

- 25%
- 15%

CPU Load: 60%

CPU Load: 40%
Strategy - Looking Forward with Statistics

Migration Candidates:
- 15% CPU load
- 15% CPU load
- 15% CPU load
- 15% CPU load
- 15% CPU load

Migration Target:
- 15% CPU load
- 15% CPU load

CPU Load: 65% at T=now
Strategy - Looking Forward with Statistics

T = now + t_{lookforward}
Strategy - Looking Forward with Statistics

T=now

Migration Candidates
- 15%
- 15%
- 15%
- 15%

CPU Load: 55%

Migration Target
- 15%
- 10%
- 15%
- 10%

CPU Load: 25%
Limitations

- Migration across CPU families
  - Crash if CPU features do not match
  - Unable to recycle old hardware

- Limited OS support
  - vmxassist Real mode emulation
  - Windows XP, 2003 + Linux
Applications

- Server Consolidation
  ✓ Availability + Manageability + Scalability
  ✓ Increased Utilization, Decreased Downtime

- Thin-Client Model
  ✓ Load-balanced cloud of desktops
  ✓ Economy and Ecology
  ✓ No upgrades = Savings
  ✓ Computing time rental model?
Future Development

- **High Availability Mode**
  - VM Memory mirroring (on 2+ hosts)
  - Requires very advanced interconnect (10GbE? Myrinet? Infiniband?)

- **Optimization of Load Balancing Algorithms**
  - Study typical workload patterns
  - Design better algorithm

- **Removing Limitations of Xen**
  - CPUID flag masking?
  - Support for more operating systems?
Q&A? :)

?