project **tsubame**

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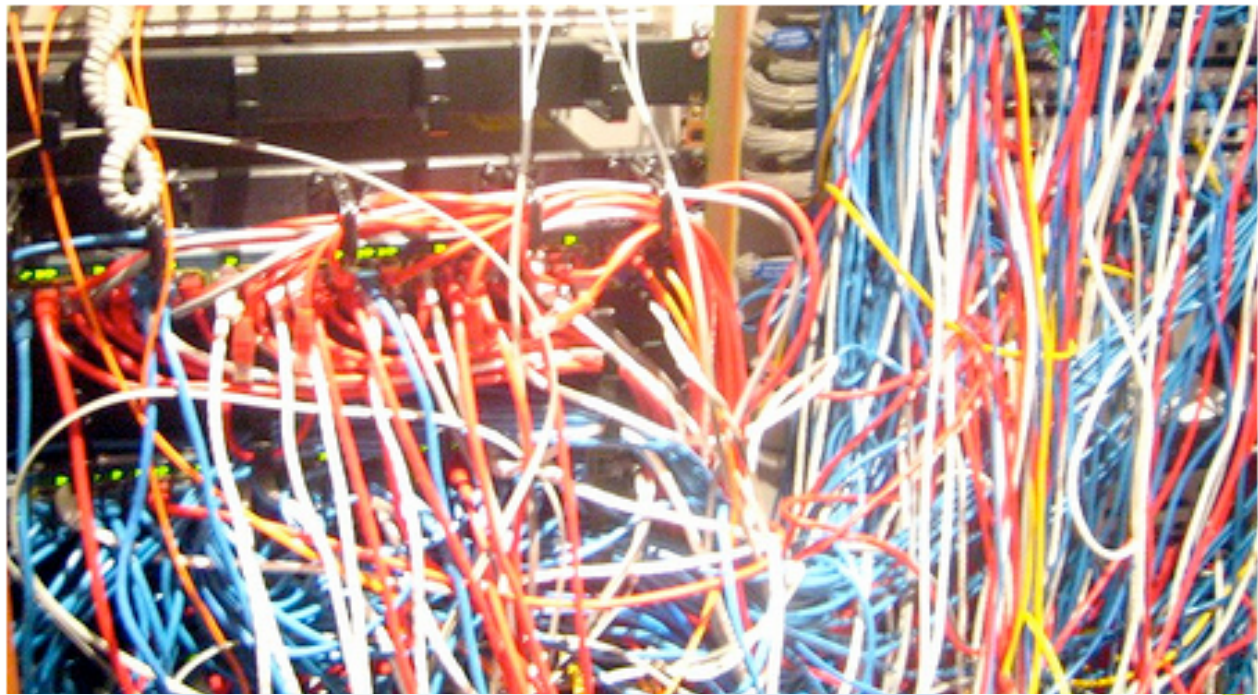
Jeremy Tay   BEng (CS) III

Agenda

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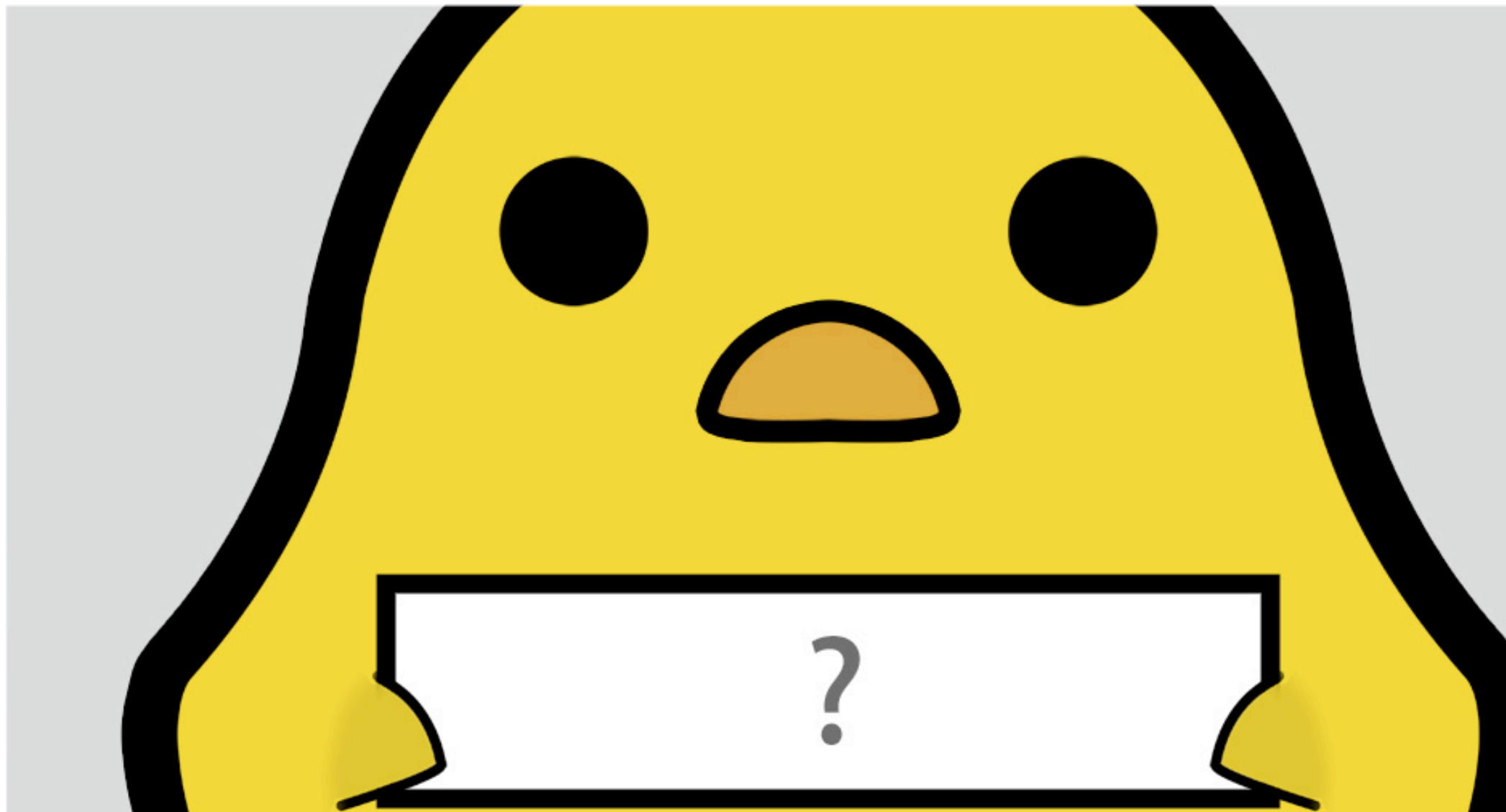- Q & A

Server Sprawl

Decreased utilization, energy efficiency

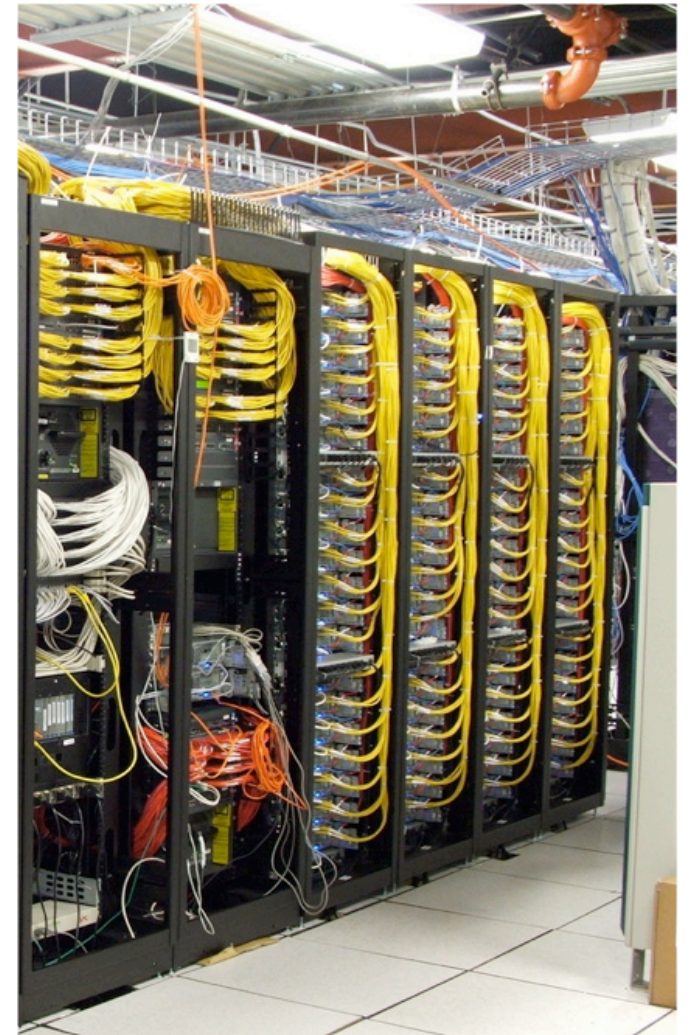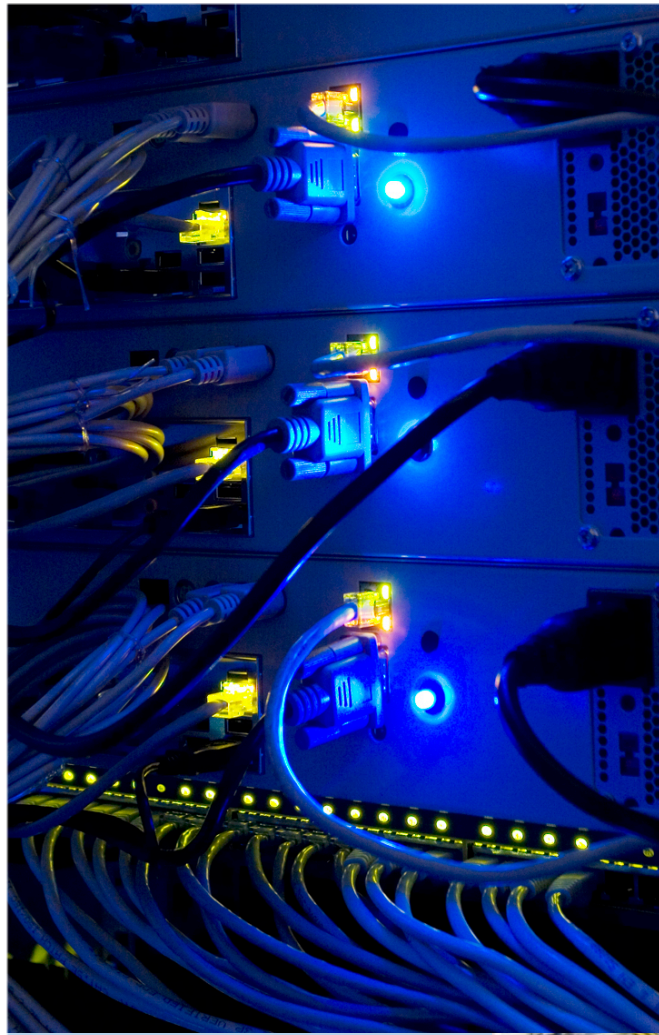Increased administrative overhead, running cost

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.
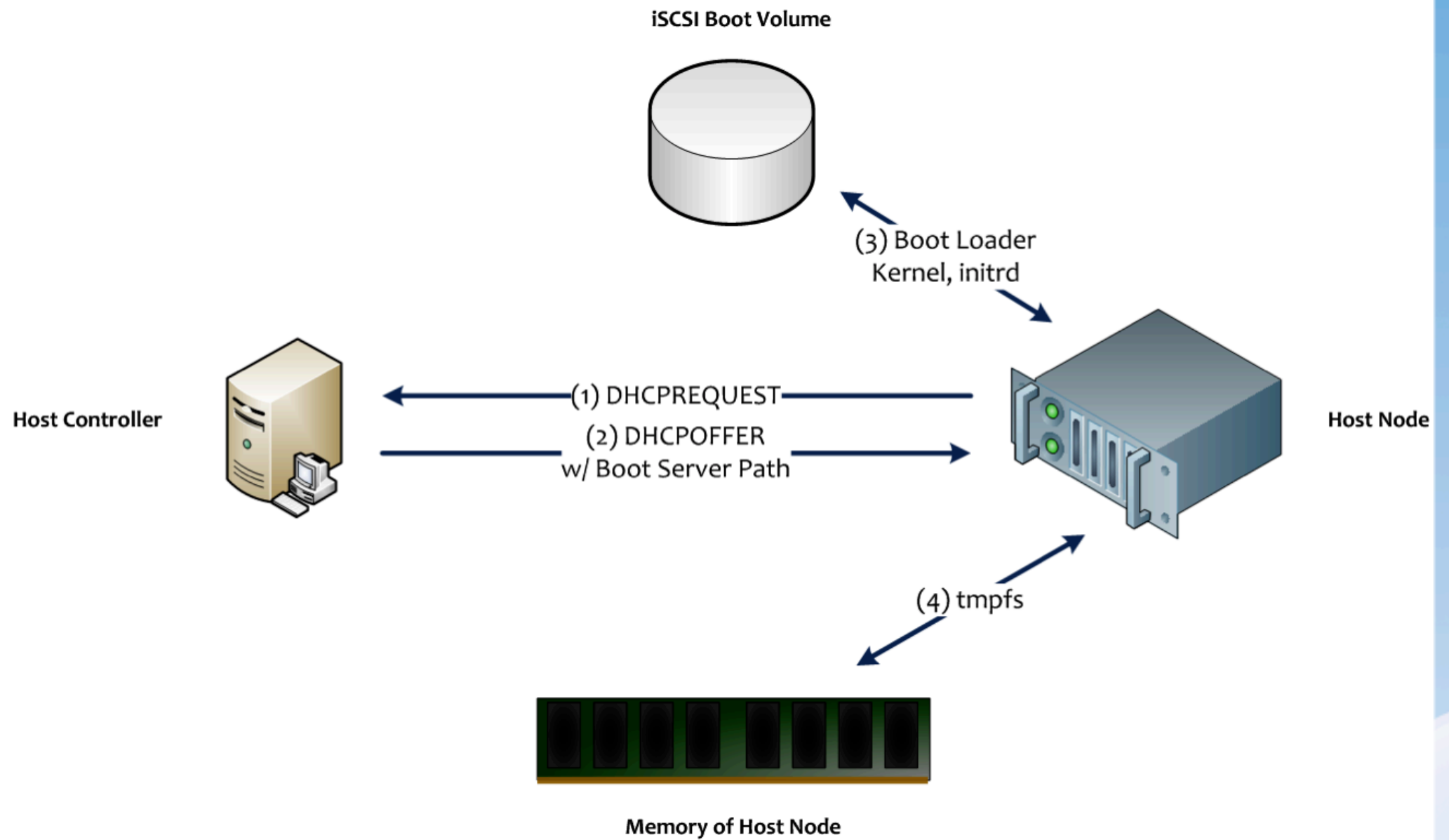
Reliability, Availability, Scalability

Scalable Environment

- Network boot

- Diskless, headless hosts

- Isolated operating system

- Rapid deployment

iSCSI Boot Volume

(3) Boot Loader
Kernel, initrd

Host Controller

(1) DHCPREQUEST

(2) DHCPOFFER
w/ Boot Server Path

Host Node

(4) tmpfs

Memory of Host Node

Live Migration

- Moving virtual machines from one physical host to another

- Decouples service from hardware
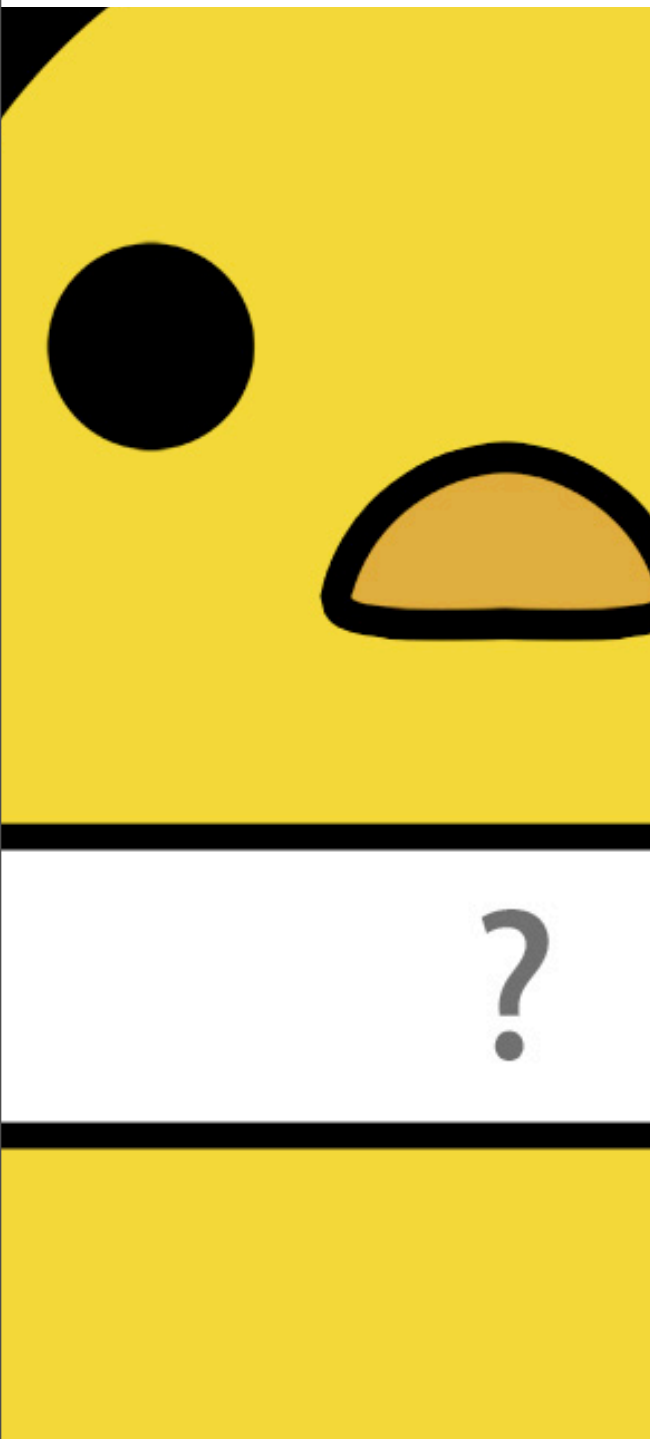
- Negligible service interruption
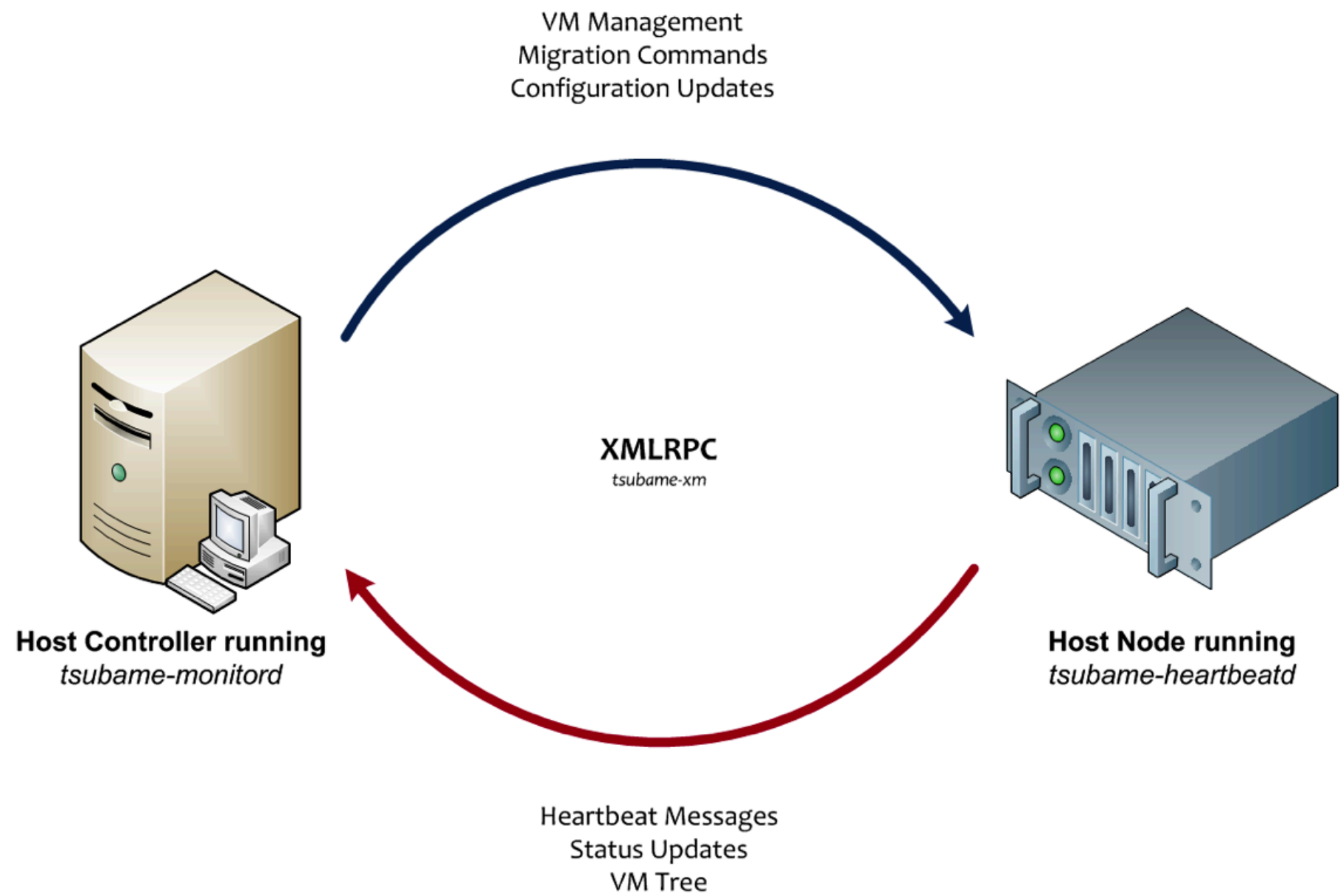
- Transparent to user

Load Balancing

- ➡ Optimize utilization

- ➡ Reduce bottlenecks

- ➡ Increase manageability and availability

- ➡ Done through live migration

VM Management
Migration Commands
Configuration Updates

XMLRPC
tsubame-xm

Host Controller running
tsubame-monitord

Host Node running
tsubame-heartbeatd
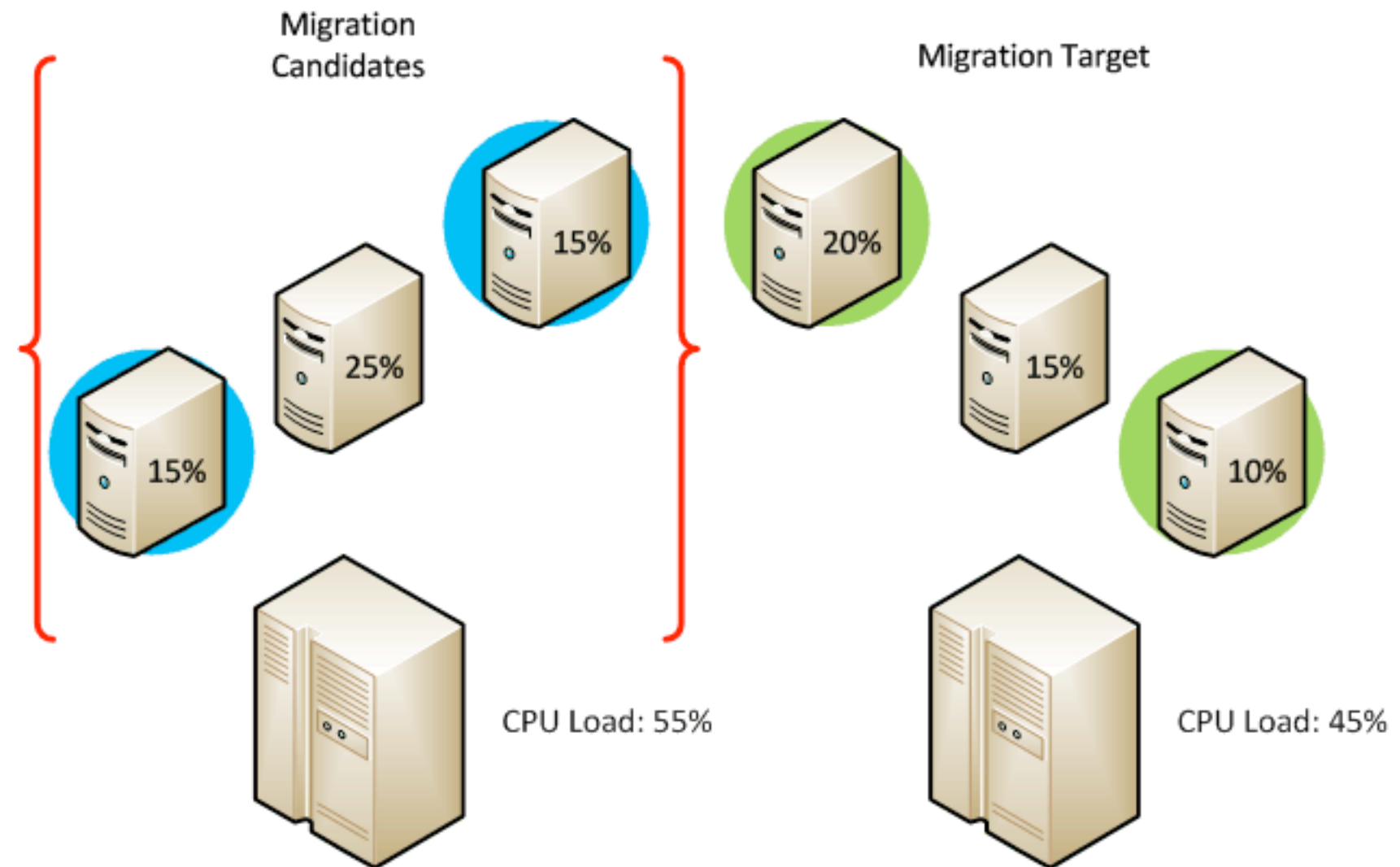
Heartbeat Messages
Status Updates
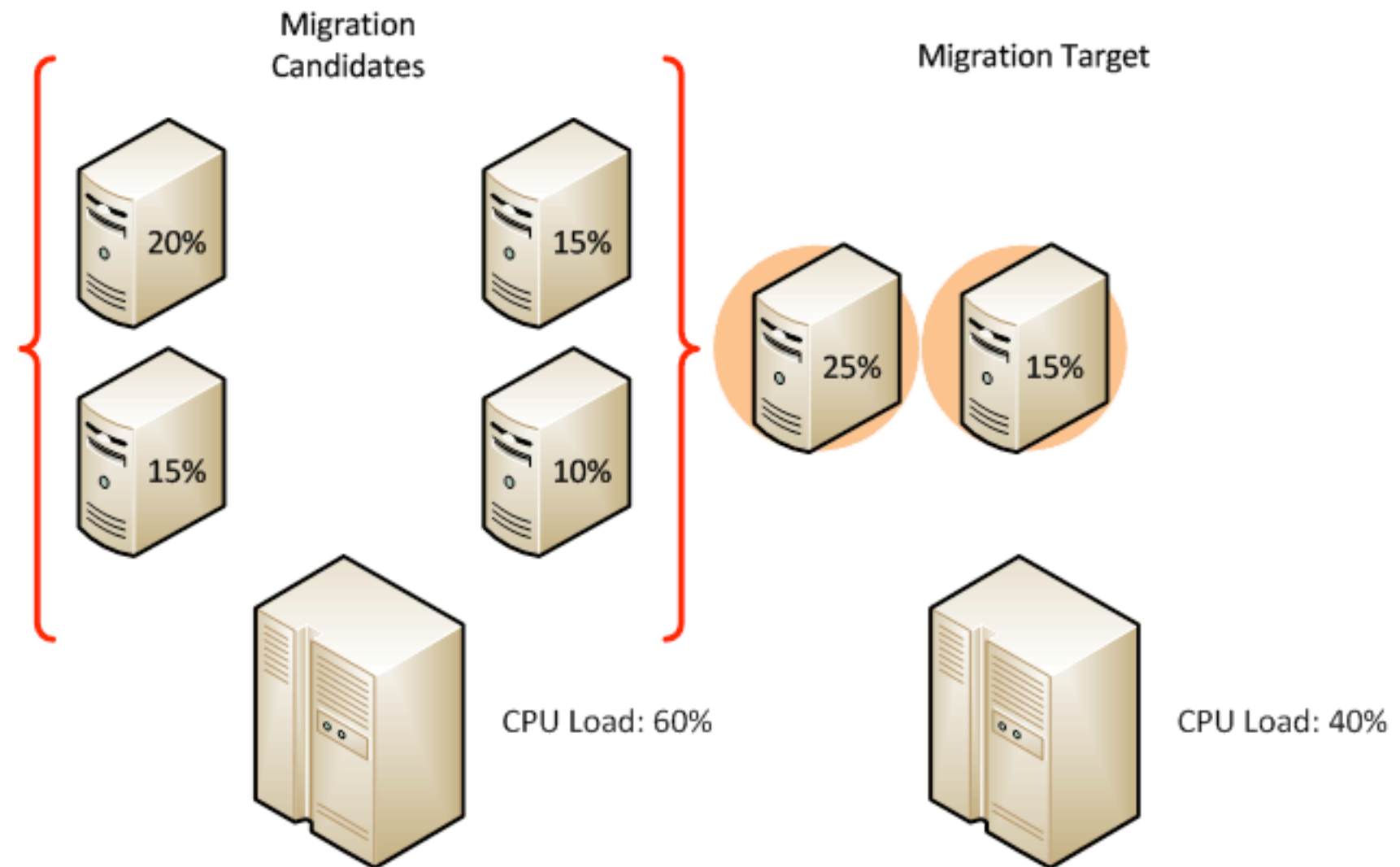VM Tree

Load Balancing

➨ Basic , On-demand Load Balancing

➨ Rule-based Load Balancing
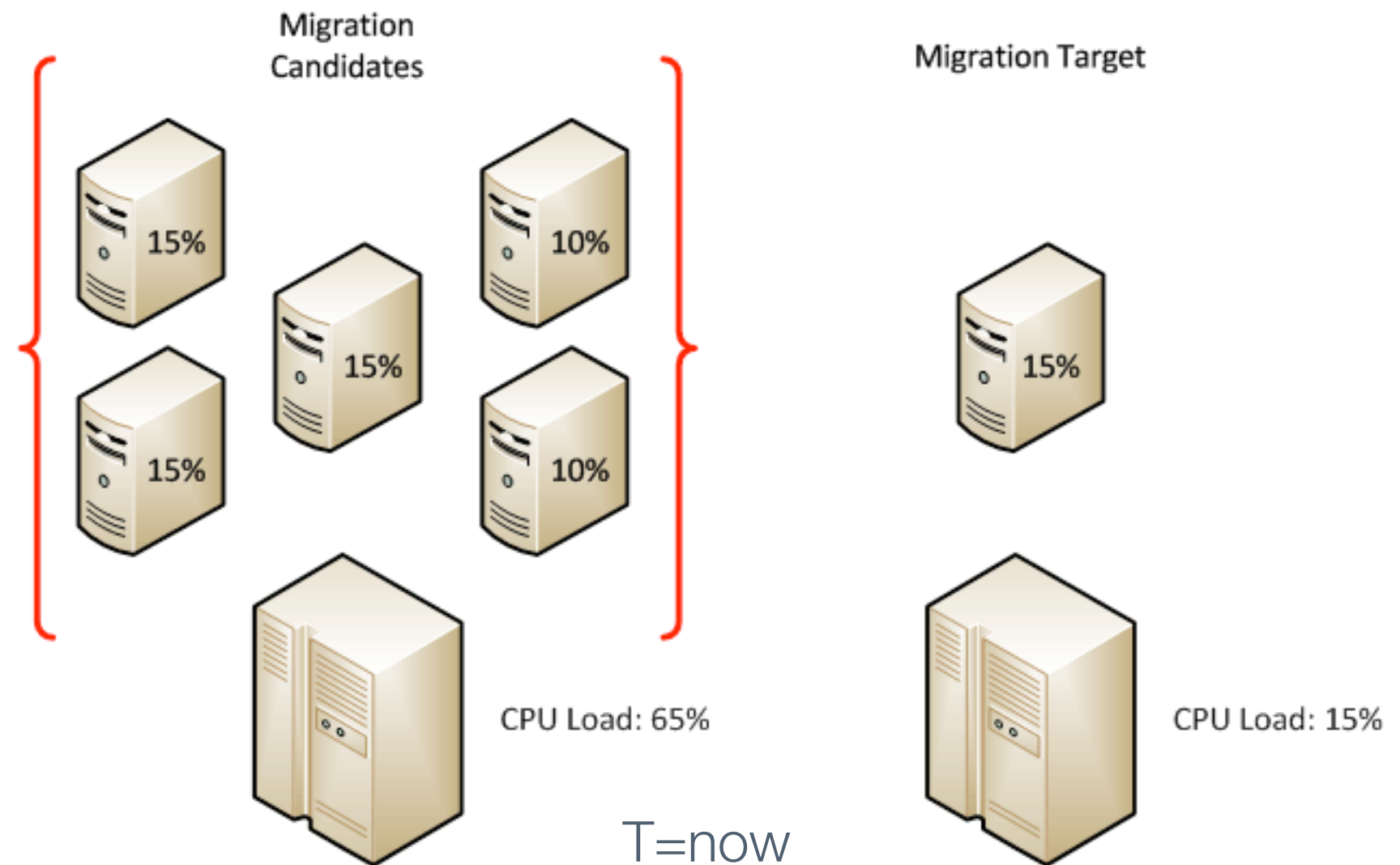
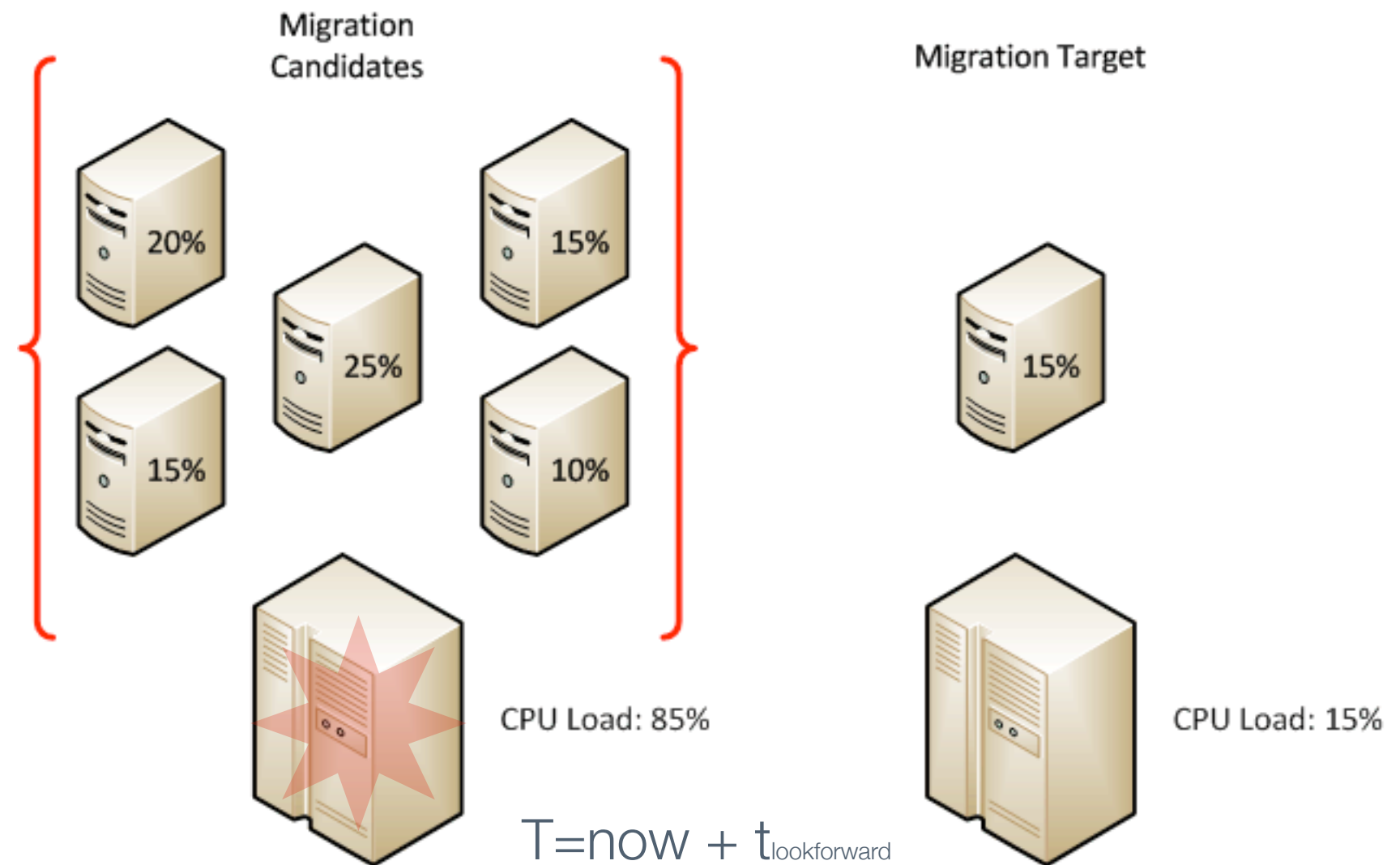➨ Statistics-based Load Balancing
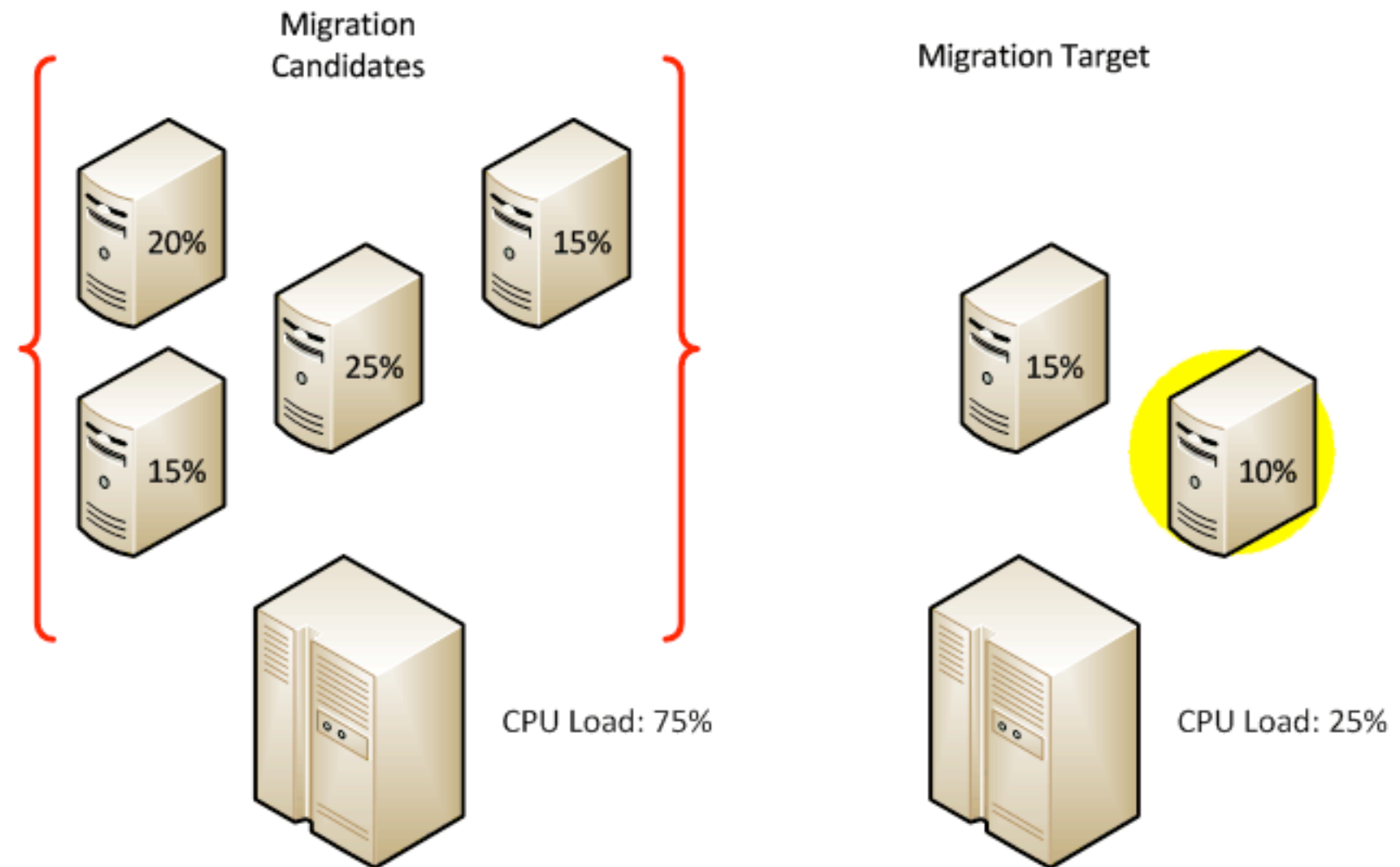
Basic, On-demand Load Balancing

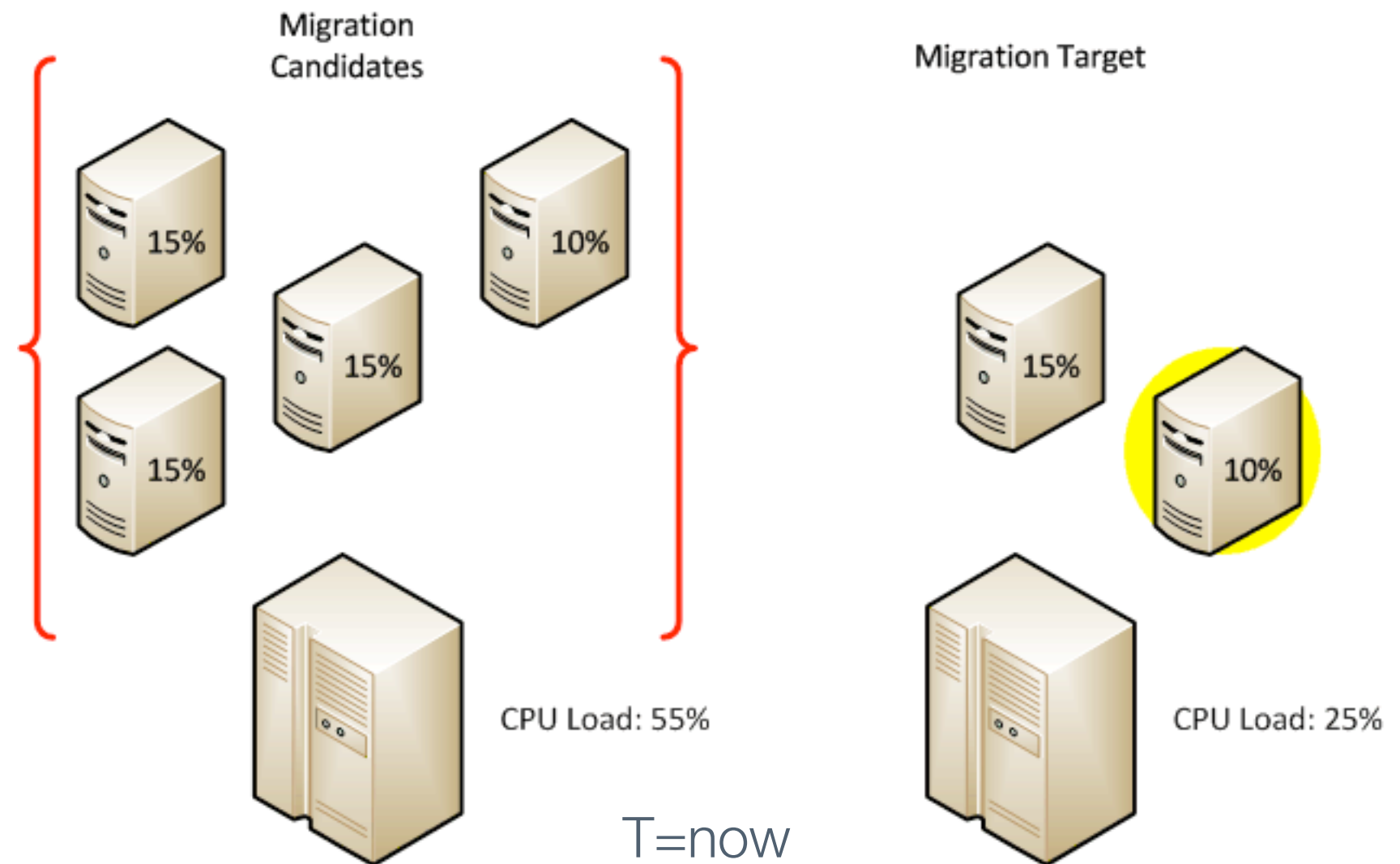Strategy - Affinity Rules

Strategy - Anti-affinity Rules

Migration Candidates

Migration Target

15%

10%

15%

15%
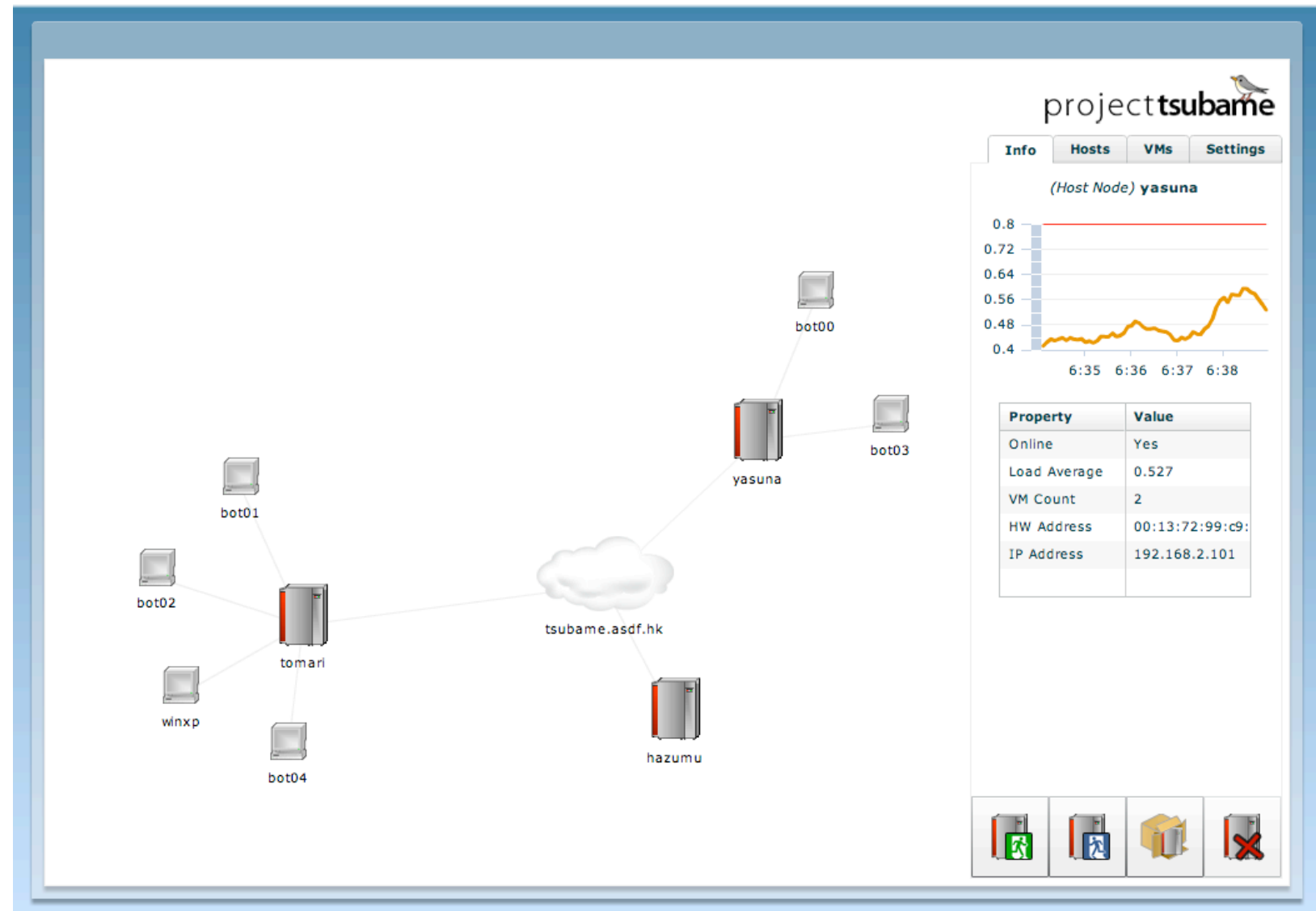
10%

15%

CPU Load: 65%

CPU Load: 15%

T=now

Strategy - Looking Forward with Statistics

Strategy - Looking Forward with Statistics

Strategy - Looking Forward with Statistics

Demo!

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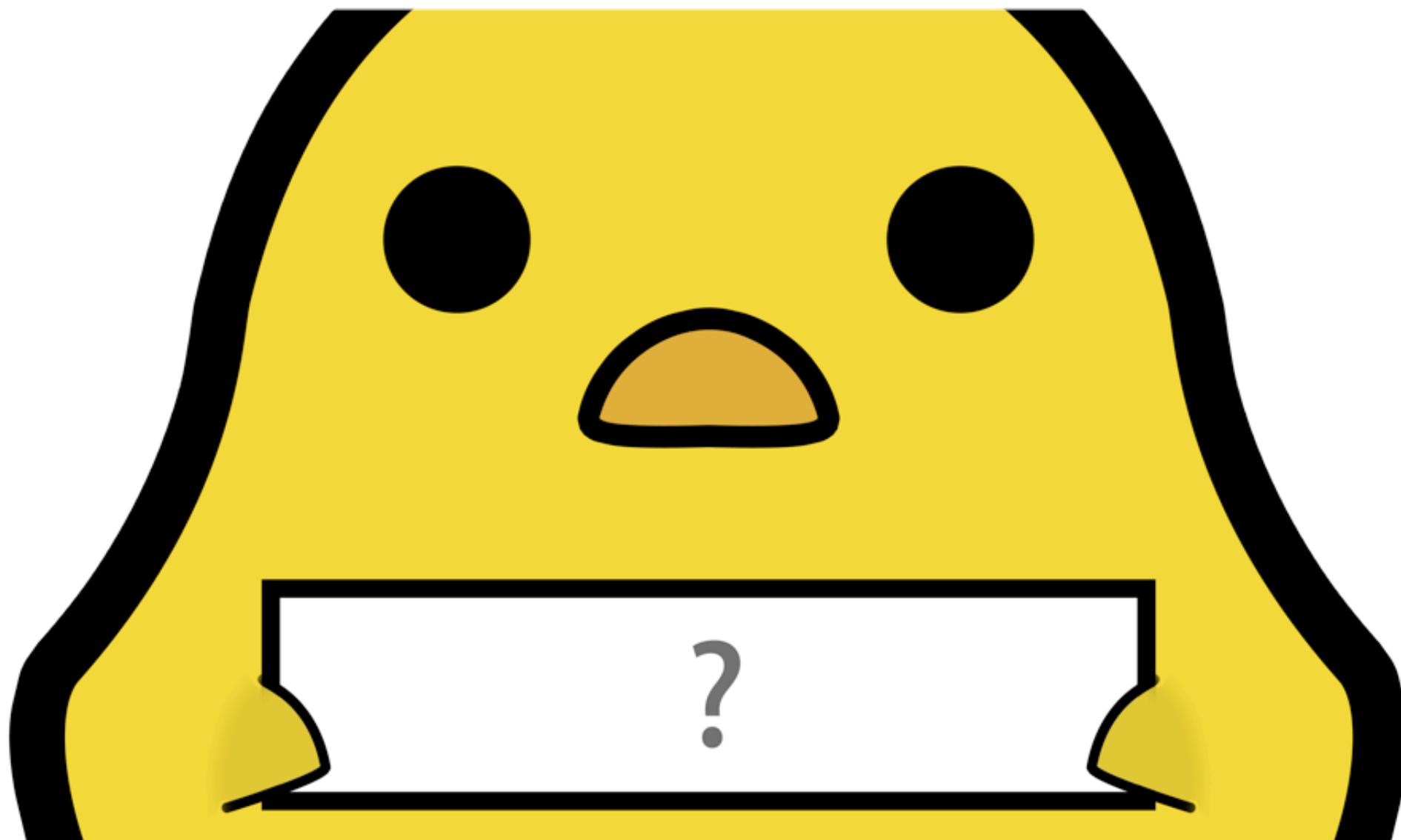
- High Availability Mode
  - VM Memory mirroring (on 2+ hosts)
  - Requires very advanced interconnect (10GbE? Myrinet? Infiniband?)

- 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? :)