Virtual Disk based Centralized Management for Enterprise Networks

Joint work:

Yuezhi Zhou, Yaoxue Zhang, Tsinghua University, China

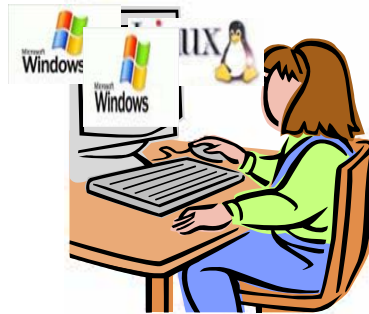Yinglian Xie, Carnegie Mellon University

Challenge of enterprise system

- Management of enterprise network systems based on PCs is still a big challenge:
  - Software maintenance
  - Security

  Becoming more complicated with many types of OSes and applications coexist!

Maintenance scenario

1 Every machine have to install all the needed
OS and applications
2 System must be corrected for following classes

Security scenario

Failed!!!

1 Devices should access the software and data in a limited area

2 No software and data outside the network or area

Existing management tools

- Examples: Marimba, Ghost
  - Automatically pushing installation image, patches and new software image
  - Out of consistency
  - Security vulnerability for various errors or malicious attacks due to local copies
  - Out of central control

What is the central management

- Centralizing data and software, yet distributing computing
  - Maintenance can be performed on one machine
  - Enable sharing of software
  - Eliminate the vulnerability of distributed storage
  - Easy software migration
  - Easy backup and recovery
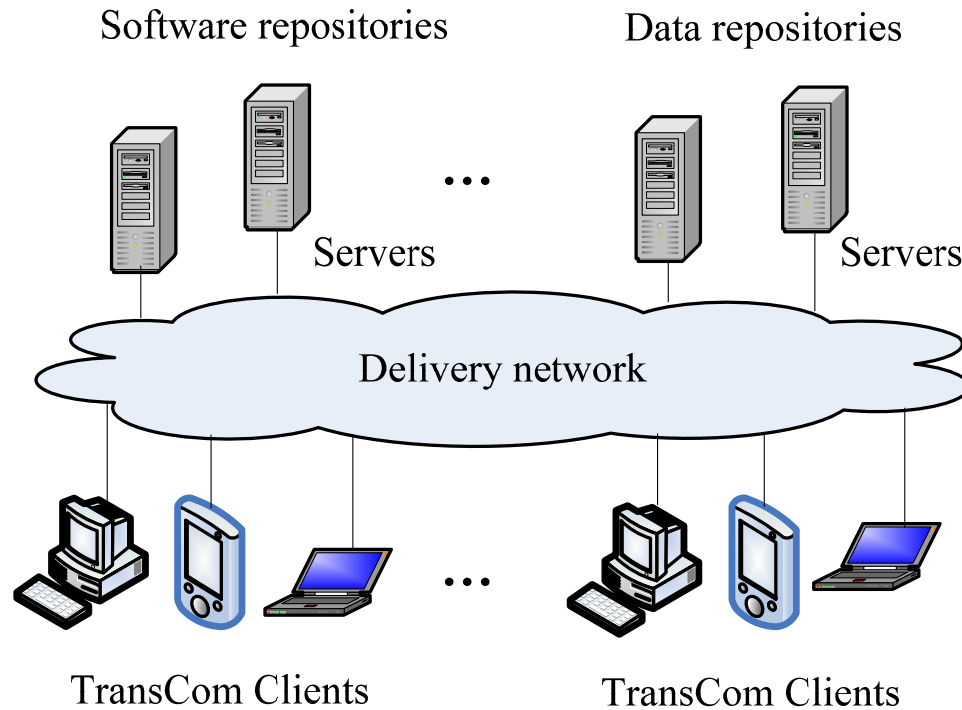
Why centralized management

	Distributed	Centralized
Cost of installing, patching & upgrading (100 hosts)	5'*100+90'+30'*5 =740'	30'+120-150'= 150~180'
Sharing of OS and applications	Potentially limited	Much easier
Availability	Low, with long service down time	High, with short service down time
Data security	Low, with local copy	High, with central copy

Versus thin clients

- Performance scalability
  - Scalability is poor due to centralized both computing and storage
  - Thin clients is not appropriate for CPU/memory intensive applications
- Cost
  - Need powerful server
  - Can not leverage the cheap computing power of clients

TransCom system Overview

Software repositories   Data repositories

Servers   Servers

Delivery network

TransCom Clients   TransCom Clients
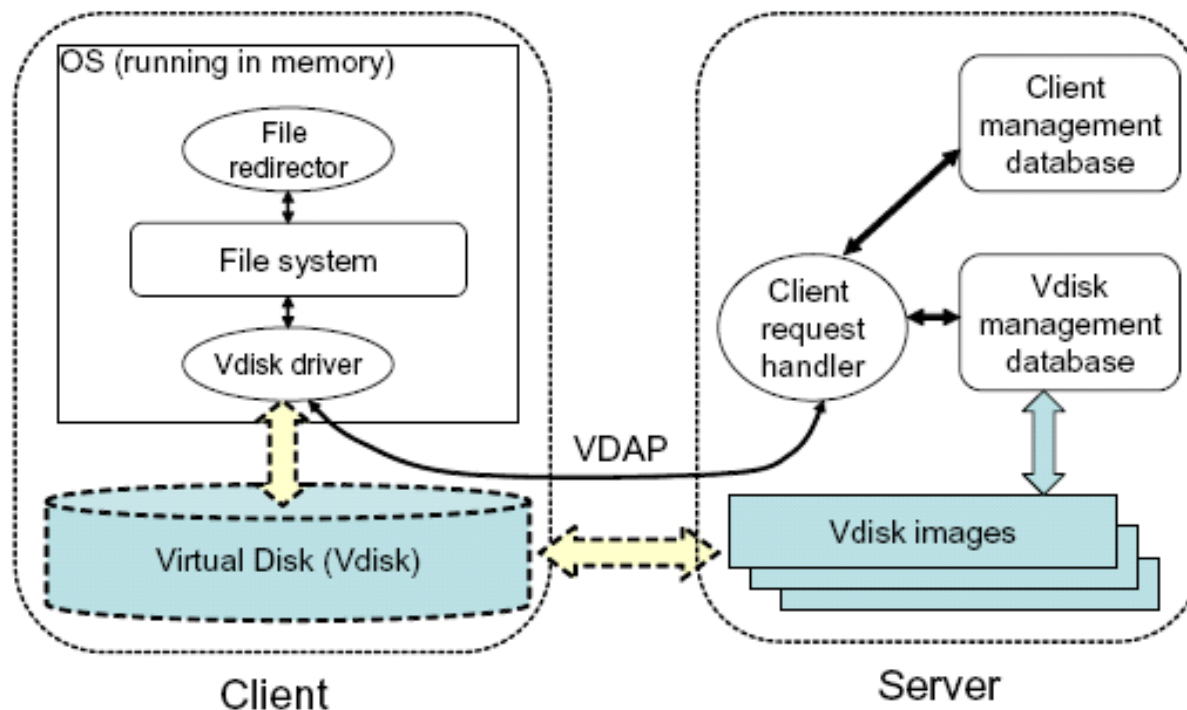
Sever: Regular desktop computers
Client: bare-hardware like computing application
Connected by Ethernet

One such server can support 30-50 clients

Virtual disk concept

- Simulating traditional disks, with disk images holding the actual contents on the server

Booting, sharing and protection

- Remote OS booting
  - Enabling BIOS-enabled Vdisk access function at first
  - Loading OS, as if with regular hard disks
- Vdisk sharing, isolation and recovery
  - Use different Types of Vdisk for sharing and private usage separately
  - Copy On Write (COW) for system image protection and recovery

Implementation

- Client
  - Remote booting: compatible to Intel PXE, in ASM language (15000 lines)
  - Windows 2000 professional: No modification of kernel; with two drivers
  - RedFlag 4.1 (Kernel 2.4.26-1): Minimum change of the kernel; with one driver
- Server
  - Multi-process program for Vdisk services
  - Boot manager for remote booting

Deploy experience

Location: Central South University of Forestry & Technology
Usage: e-learning classroom for online English
Numbers of clients: 120
Duration time: from Sept 2005 to July 2006

|	Before	After
System maintenance time	4-8 hours, even with tools	30 minutes
Availability	4-8 hours service down time every Thursday	Operation without service interruption
Improved security	Virus found, physical theft	No virus and worms found, no physical theft

Comparison with regular PC

• Booting performance
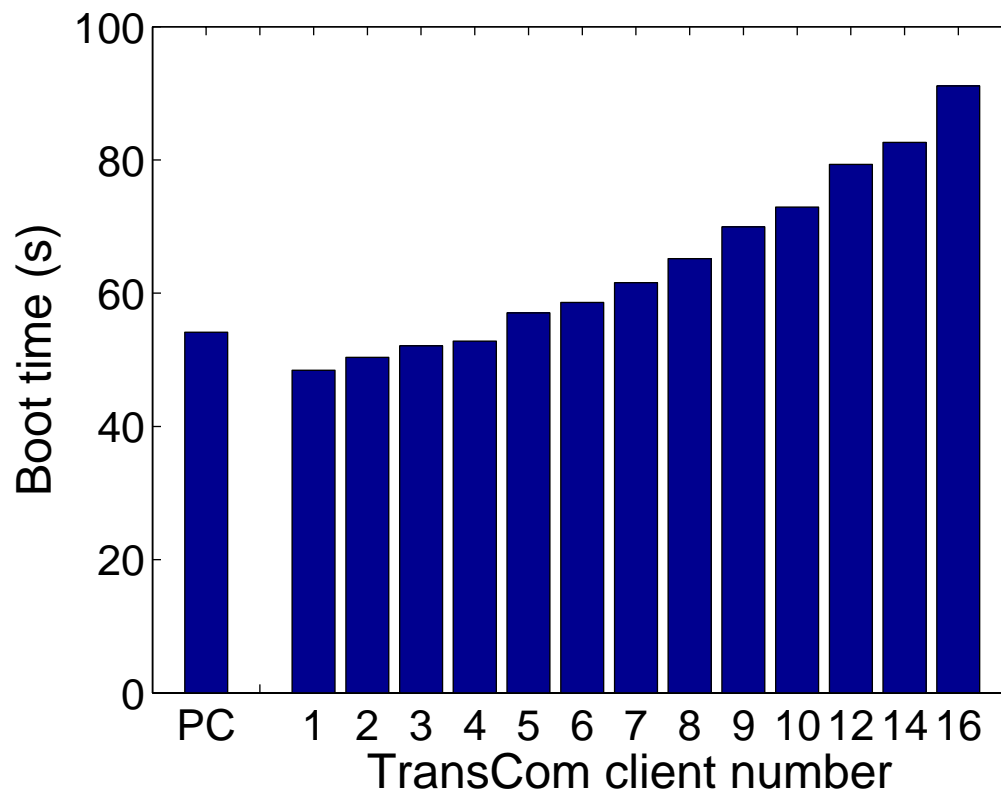
Comparison with Thin-client

- Scalability measured with iBench (run synchronously)
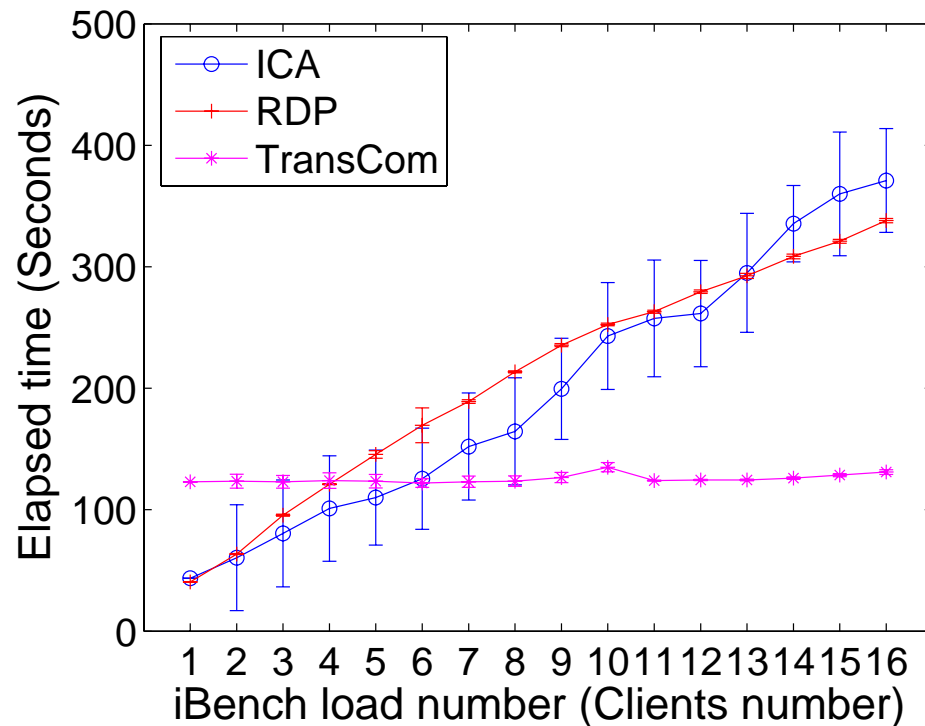
Related works

- Network computer
  - Proposed by Sun,
  - Can not support commodity OS and applications
- Thin-client system
  - Sun Ray 1 [Sun Micro], RDP [Microsoft], ICA [Citrix]
  - Centralized both computing and storage, need high-end servers, with low scalability
- Networked file system
  - NFS [Sandberg, 1985] & AFS [Howard, 1988]
  - Just for sharing data; hard to support heterogeneous OS
- Virtual machine based approaches
  - Collective [Chandra, 2005], ISR [Kozuch, 2004] and SoulPad [Caceres, 2005]
  - Can not achieve native performance

Summary and future work

- By centralizing data and software,yet distributing computing, TransCom can solve the management fundamentally
- TransCom is feasible
  - Maintenance time is reduced
  - Performance is good
- Supporting more types of OSes and devices, optimization, etc.

Thanks !