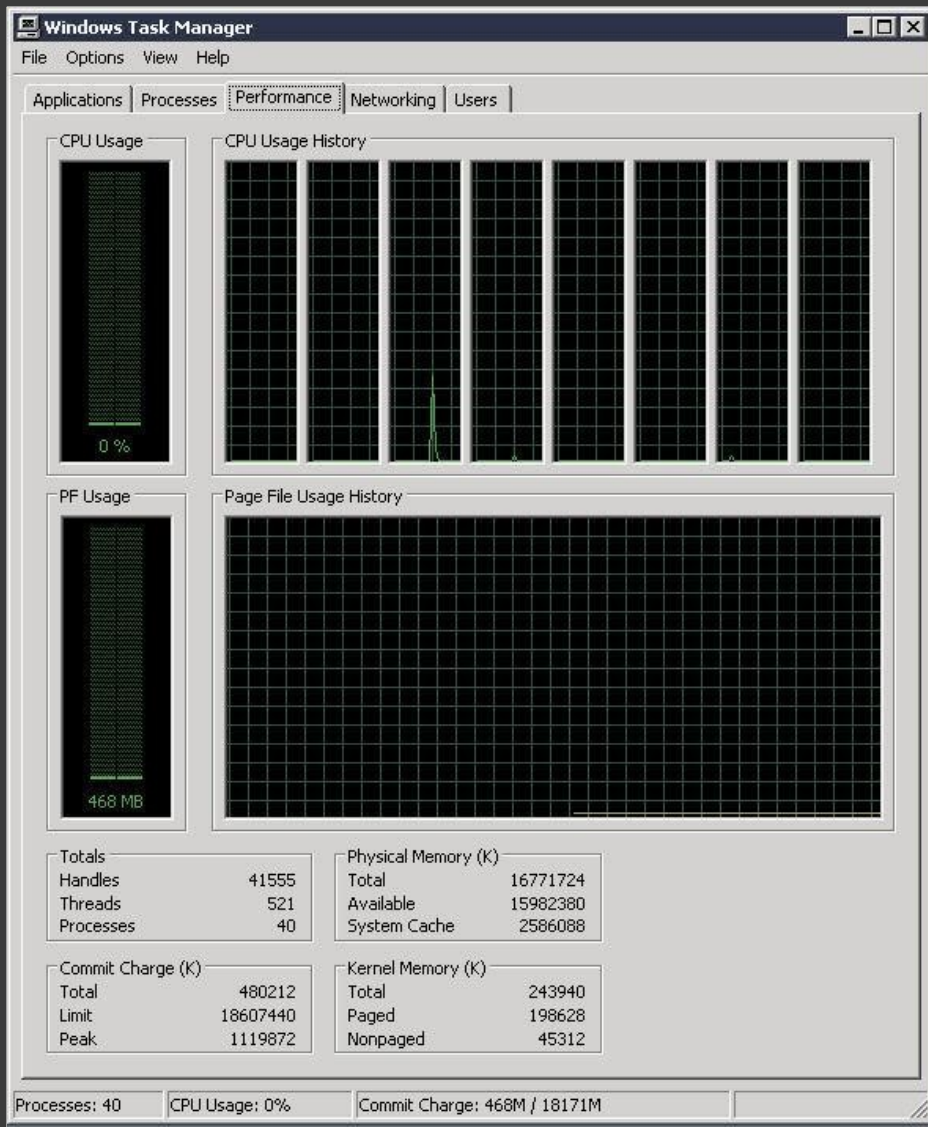


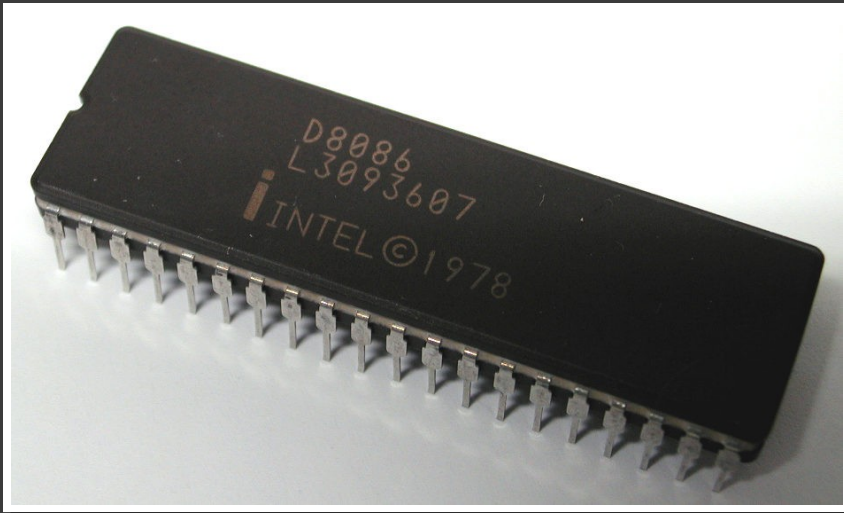
I'M THIN AND *GREEN*  
BUILDING THE GREEN COMPUTING CAMPUS

Richard Toeniskoetter  
Technology Director  
The W. A. Franke College of Business  
Northern Arizona University



Virtualization  
being driven by

- High performance, multi-core processors
- Interest in “greening” the server room



## Technology still following Moore's Law

-First stated by Gordon Moore in 1965

-Number of transistors per square inch doubles around every 2 years

► Desktops are now 8 times more powerful than when XP was introduced



Example of a multi-core server:  
Sun Fire 4450 server, supporting  
24 CPU cores (4 sockets with 6 core  
2.66GHz Intel Xeon CPUs) and 128GB RAM  
capable of running Windows, Solaris, and Linux in  
a 2 rack unit form factor

# Applying virtual technologies to the computer lab

I need unpatched Windows so my students can learn patch management

I need a different version on Linux

I need multiple versions of the same software,  
and they won't install on the same machine

I need UNIX

I need Windows XP

I need special software only licensed for my students

I need root access

I need the lab accessible from home

I need administrator rights on Windows Servers

I need Linux

Oh, did I mention I need it right away? ...

# Back to the Future

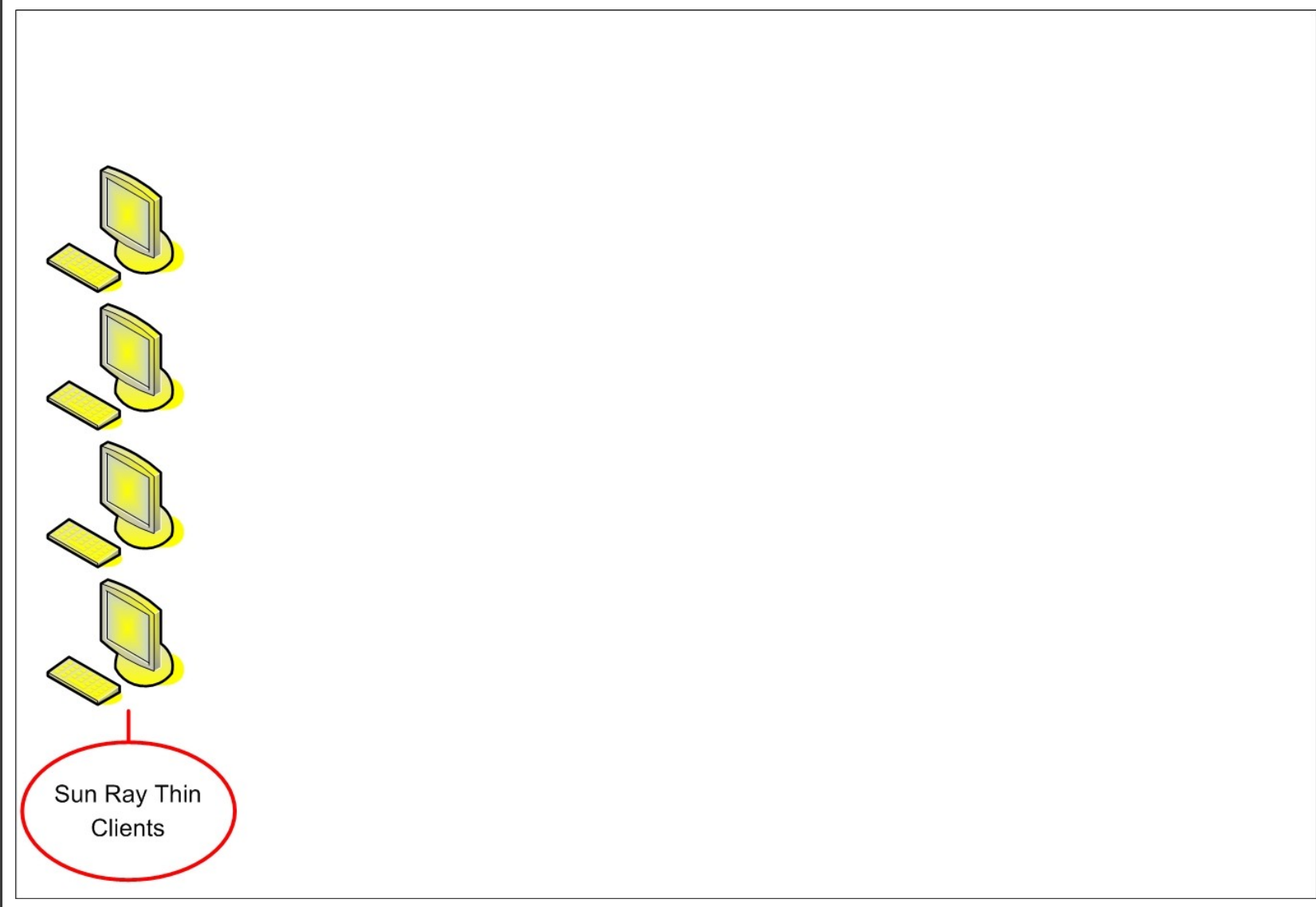


The Concept: Provide everything from the centralized server room

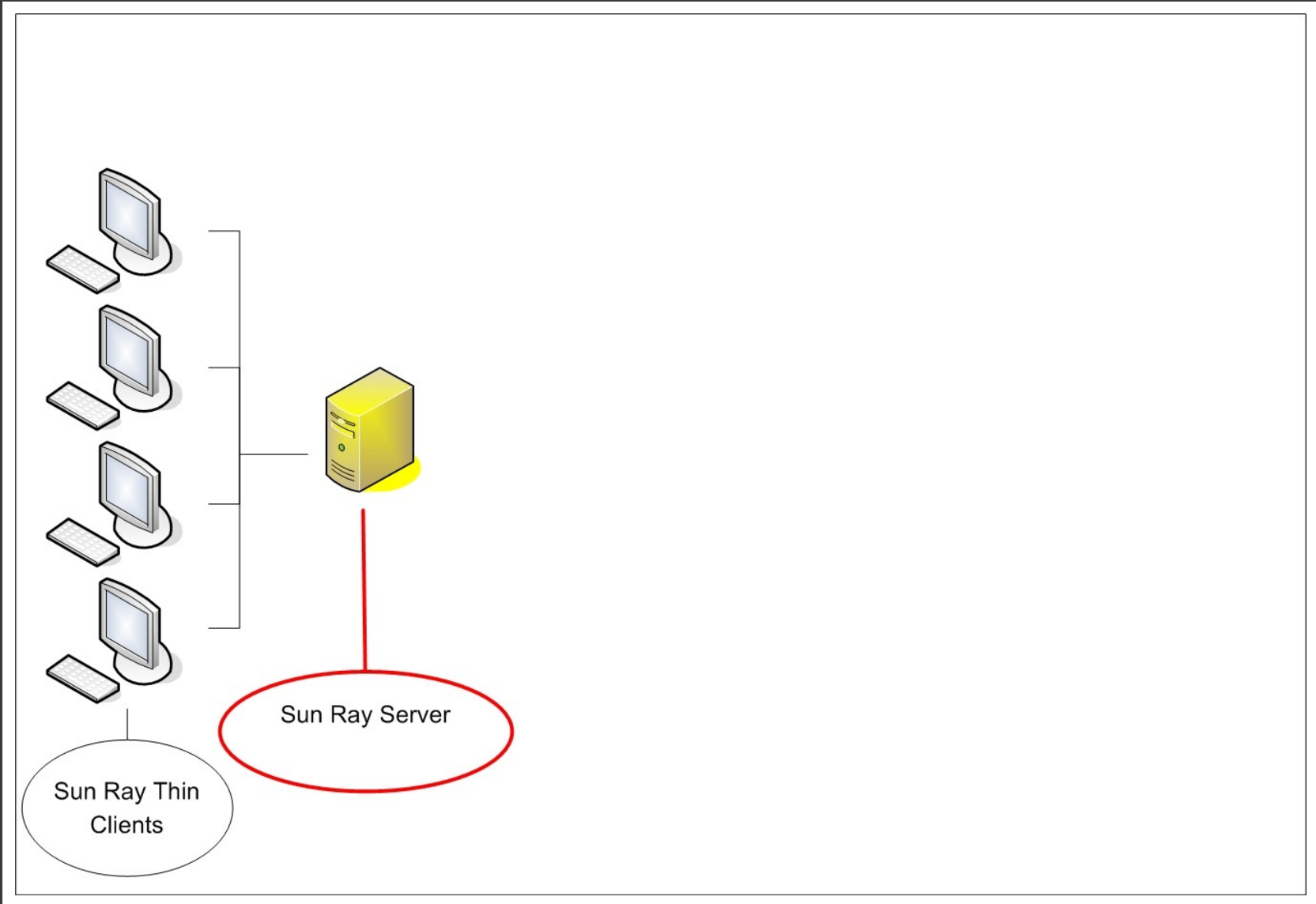


The Technology: Use low cost, low power stateless Sun Ray thin clients at the desktop, delivering a variety of virtual services provided in the server room

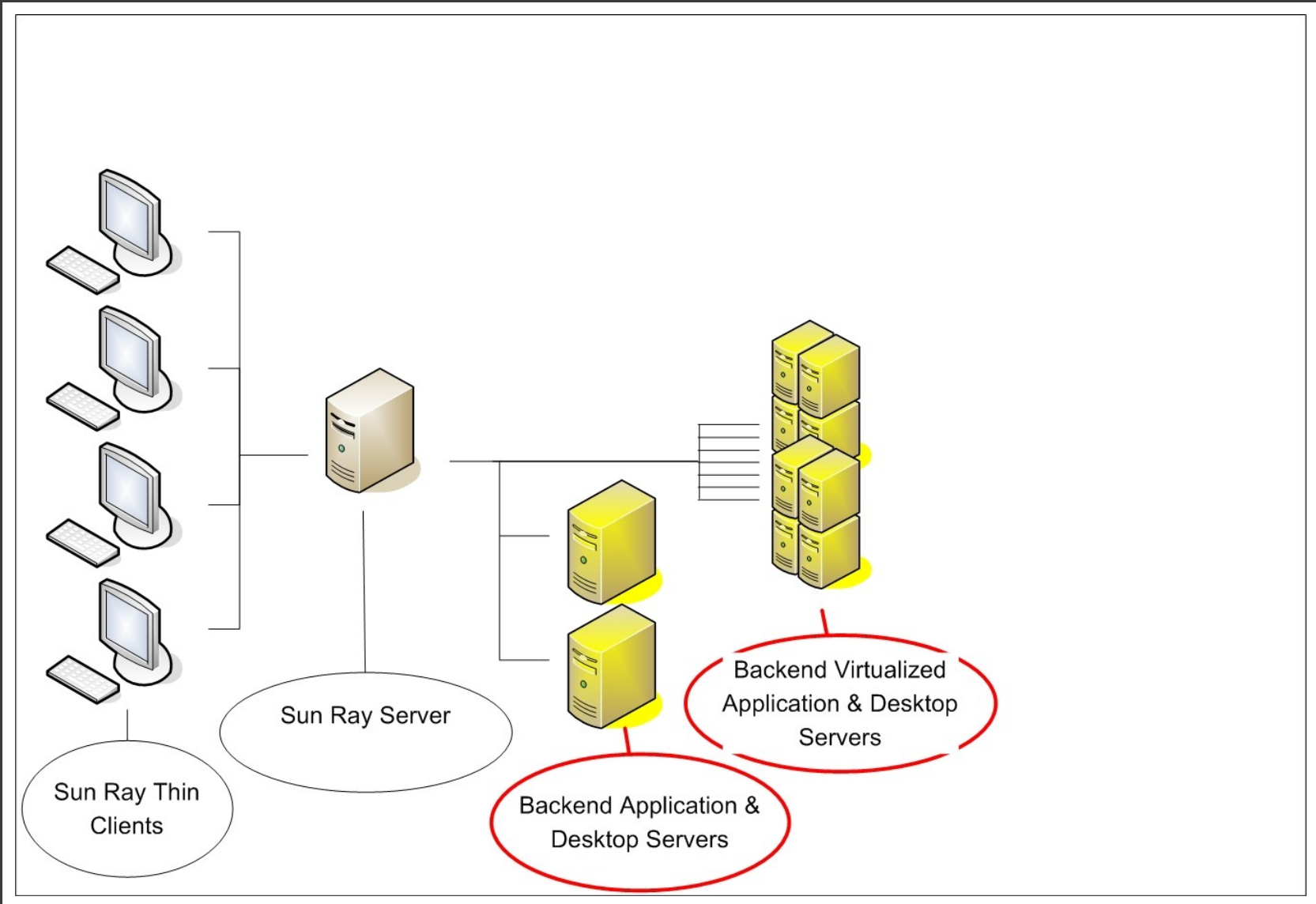
# Putting it together: Start with Sun Ray thin clients



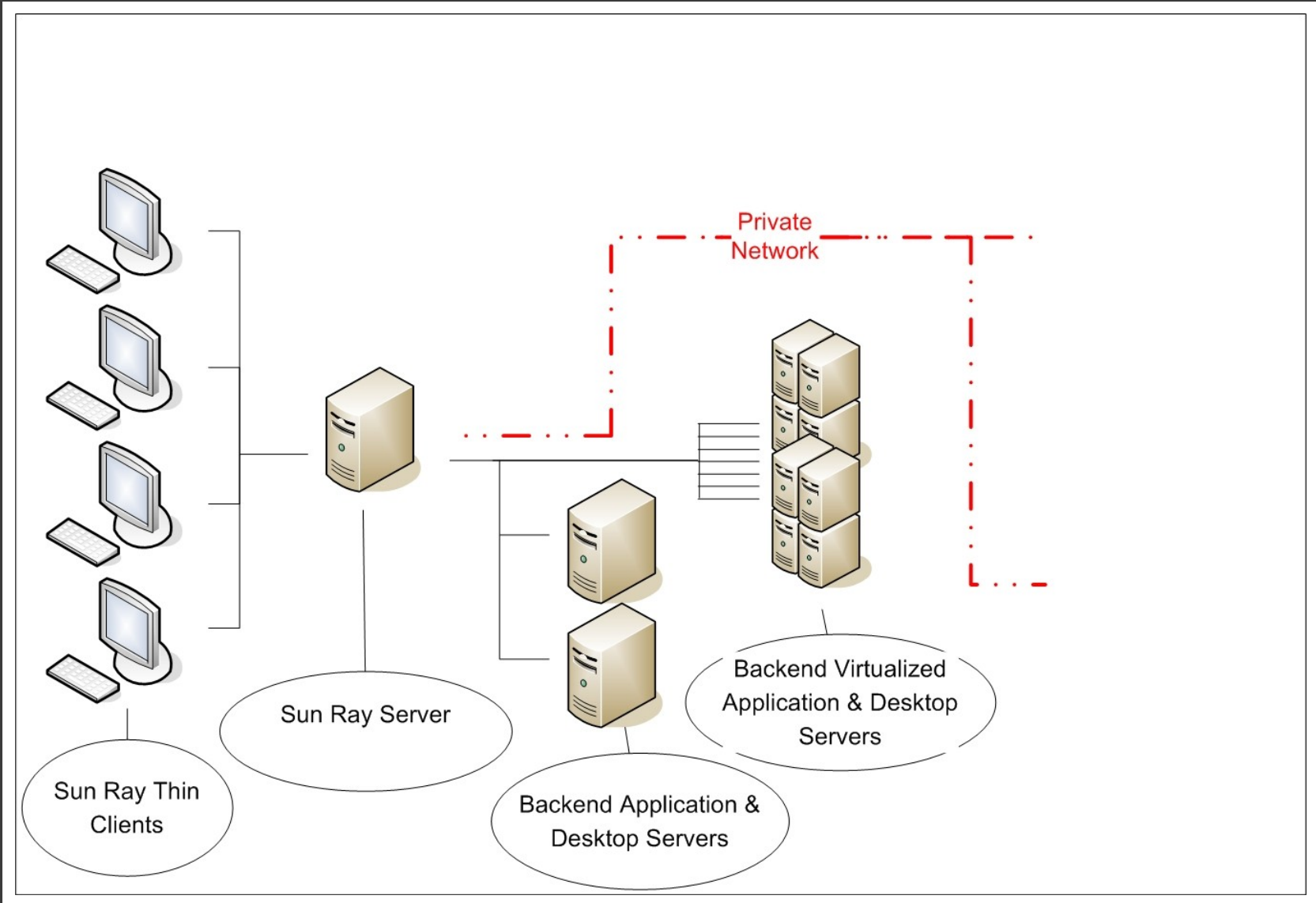
# Putting it together: Add Sun Ray Services as service broker



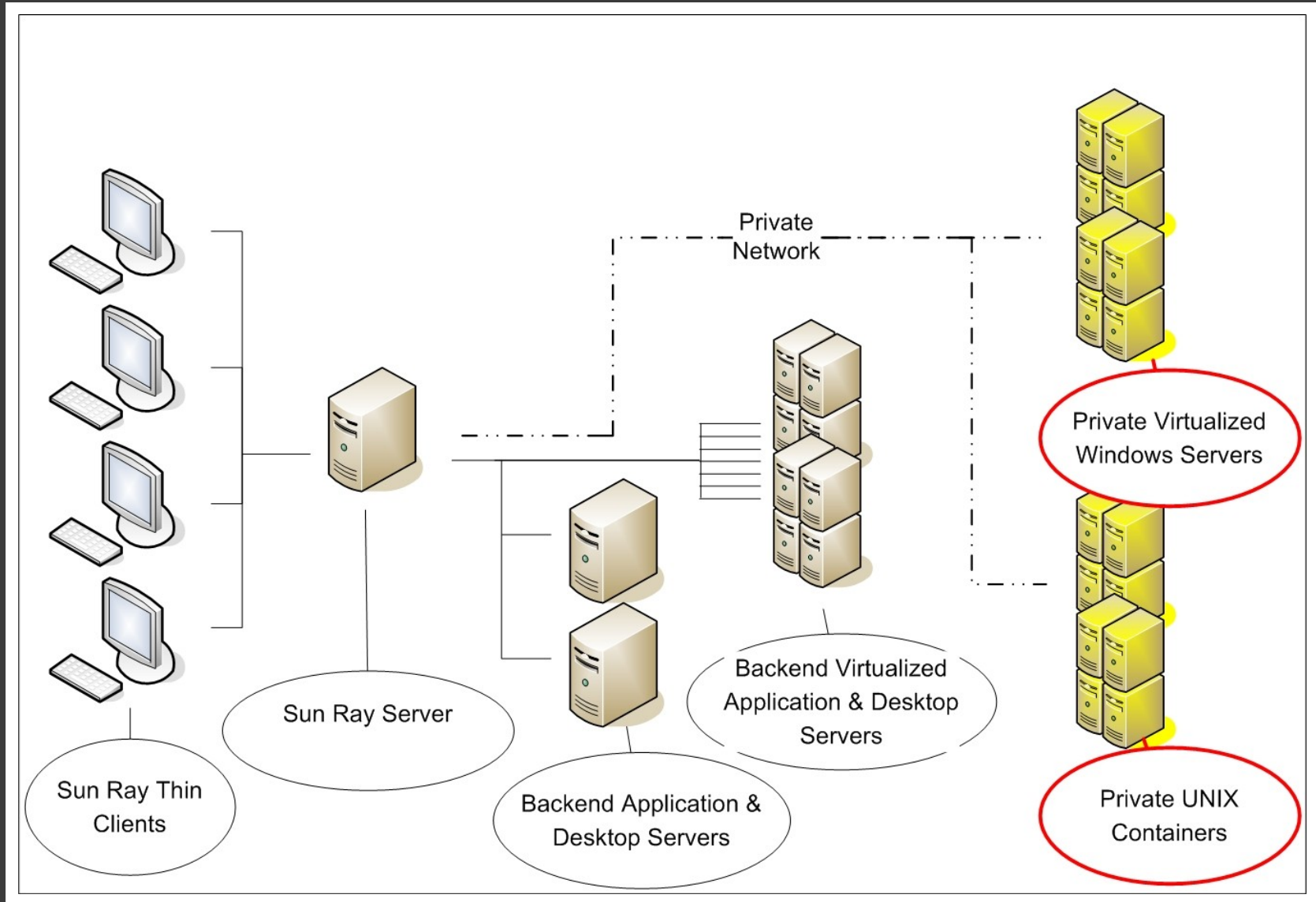
# Putting it together: Add Backend Appl & Desktop Servers



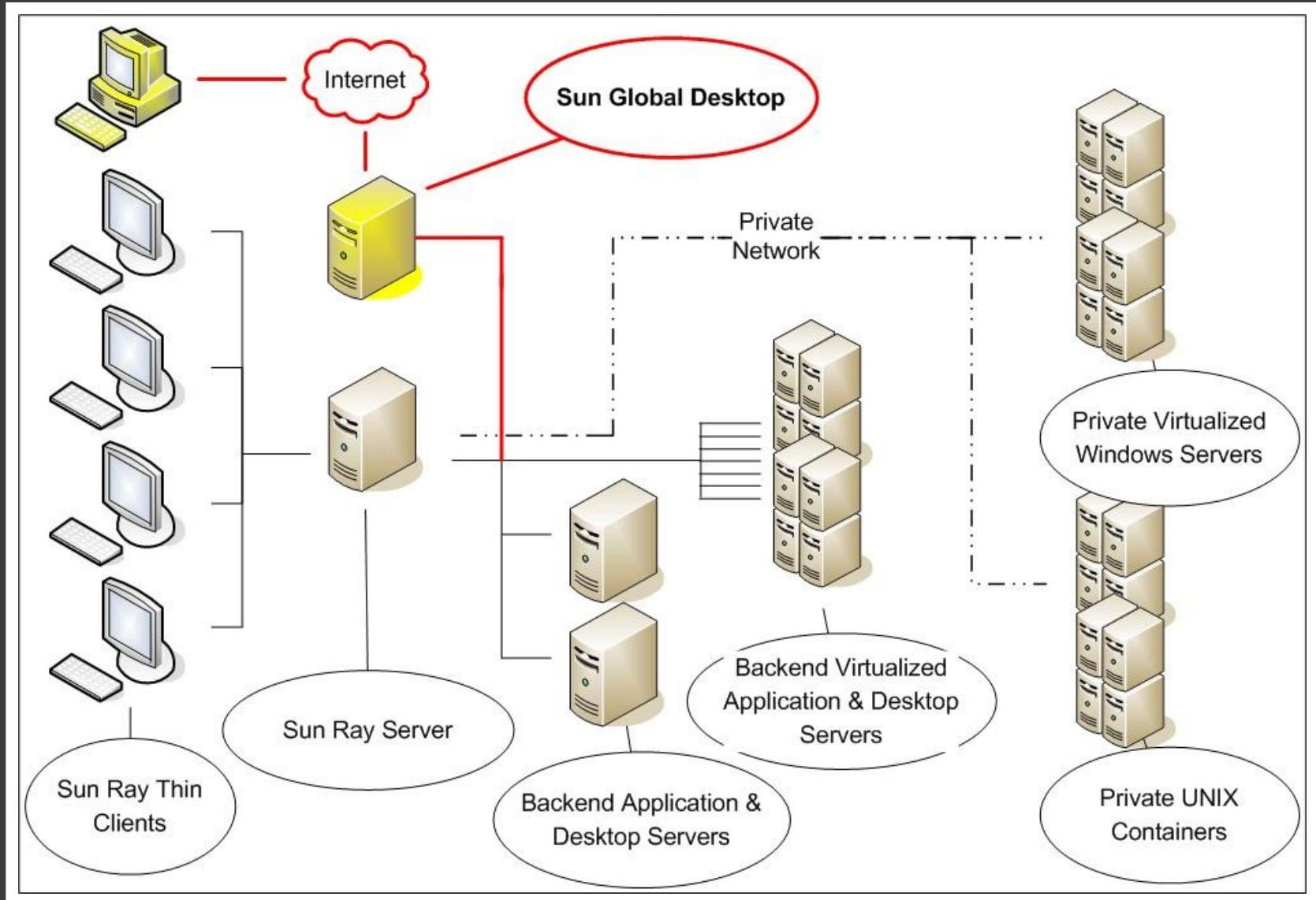
# Putting it together: Layer Private Network



# Putting it together: Add Backend Private Virtualized Servers



# Putting it together: Remote everything via SGD



# The Possibilities

- UNIX desktop, root capabilities for administration study
- Windows desktop, administrator capabilities for administration study
- Provide various Windows versions
- Provide multiple, conflicting versions of software
- Provide license restricted software to a subset of users

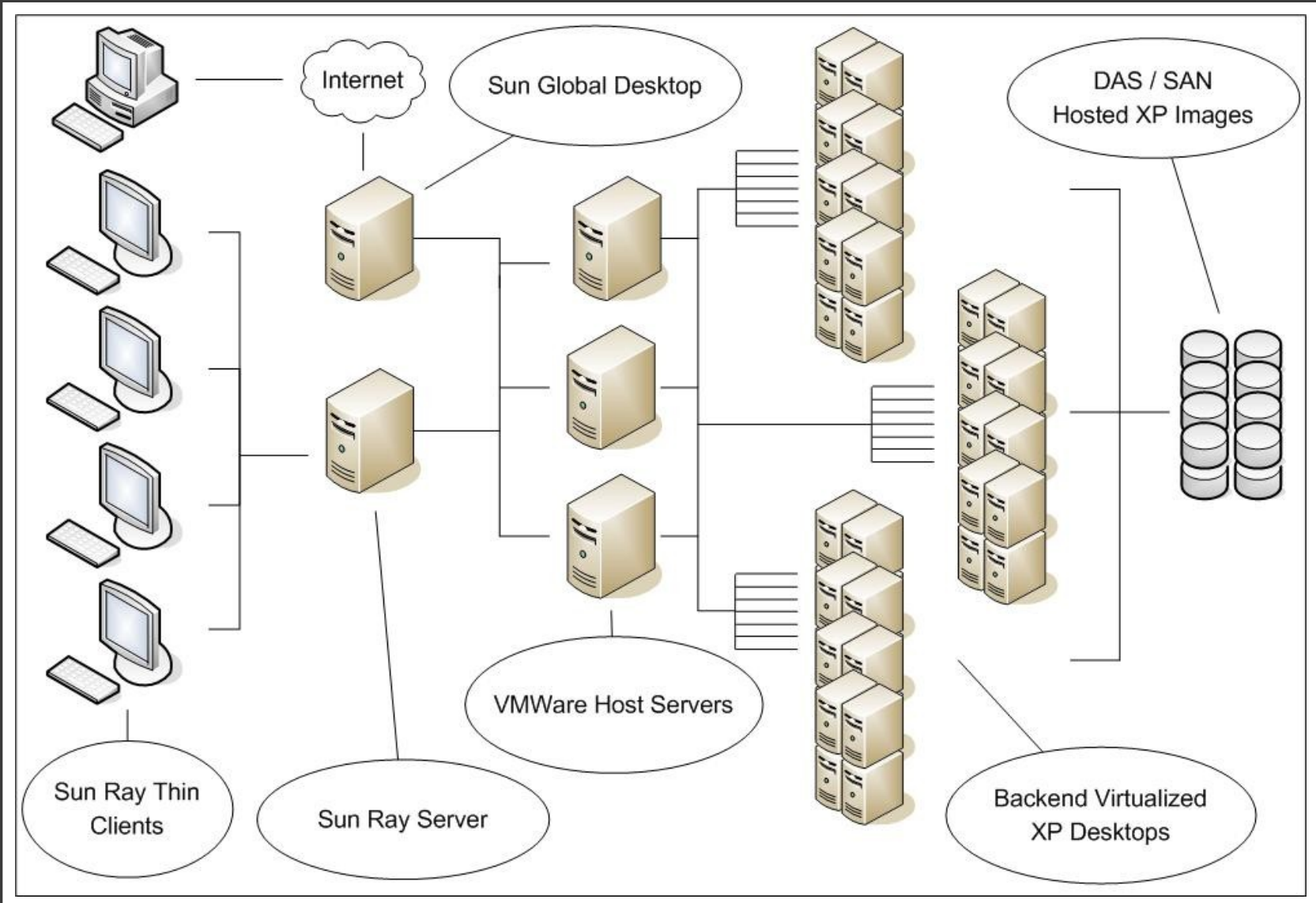
An added benefit – VDI!

–All the components are in place to offer a full Virtual Desktop Infrastructure solution

–With VDI, each user can have a complete personalized desktop, available at work and remotely through the web

–Desktop can stay active, reconnecting from anywhere

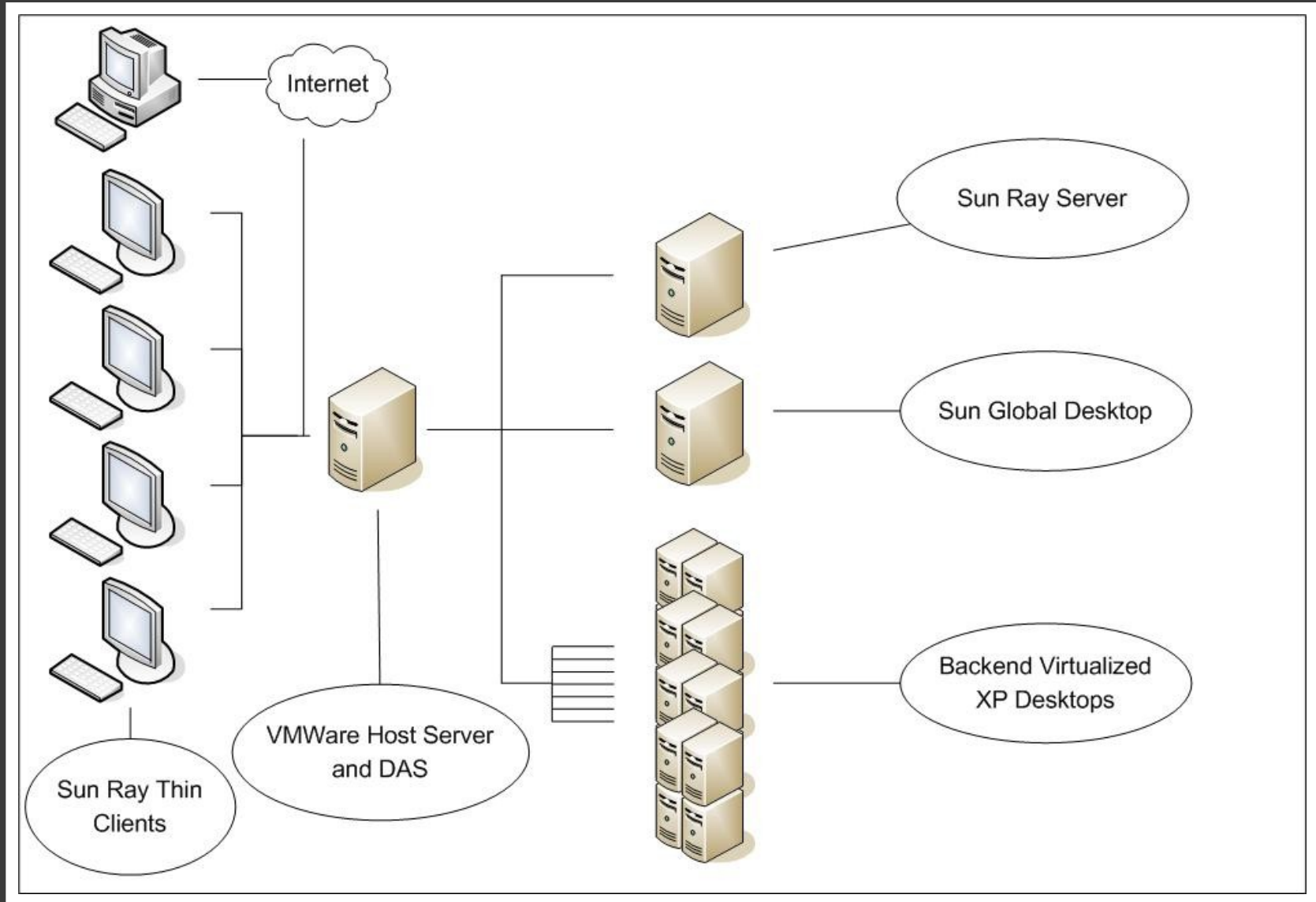
# VDI: Medium Scale Deployment



## Our current model

- 3 VMWare ESXi datacenters running VMWare Infrastructure Foundation on Sun Fire 4150s with 2 Intel quad core and 40 GB RAM
- Each datacenter expected to handle 40-60 XP instances (5-8 per core) allocated 512MB
- Sun StorageTek 2530 Direct Attached Storage Array allocating 16GB per XP

# VDI: Small Scale Deployment



## Small scale model

- Single Sun Fire 4150 with 2 Intel quad core and 40 GB RAM running ESXi
- Sun Ray Services as VM with 1-2 dedicated cores
- SGD as VM with dedicated core
- Remaining cores provide XP instances (5-8 per core)
- Goal to provide 25-30 XPs from a single 4150, minimize network traffic

## VDI Advantages – Low Entry Cost

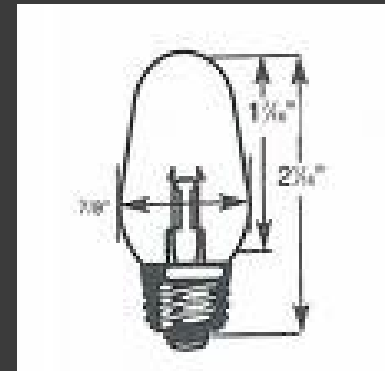
- Sun Ray costs less than \$300 edu
- Adding another \$300 per unit to support server room, total entry cost on par or lower than PC
- Can use existing keyboard, mouse, monitor
- Sun Ray lifespan is very long, likely 5-7 years

## VDI Advantages – Minimal TCO

- Sun Rays have no moving parts, removes break / fix cost from lifecycle
- Almost no need for desktop visits – everything can be managed from the server room and helpdesk
- Removes most cost associated with image building, desktop deployment, desktop re-imaging
- Minimal disposal cost

# VDI Advantages – Low Power

–Sun Rays are no noise or heat  
 “green” technology, low power  
 (about 4W, similar to night light bulb)



Sun Ray	Average Always-on PC	Average PCw/sleep mode	
\$ 0.10	\$ 0.10	\$ 0.10	average cost per kilowat hour
24	24	10	hours per day in use
365	365	210	run days per year
4	80	80	average wat s drawn
4	2	2	average wat s drawn sleep mode
1630	1630	1630	Kwh per carbon metric ton (1630 is average from USDoE)
35	701	172	Kwh annual
0.02	0.43	0.11	carbon footprint metric tons
\$ 3.50	\$ 70.08	\$ 17.23	electrical cost annual
4000	4000	4000	total units
\$ 14,016	\$ 280,320	\$ 68,936	total electrical cost
86	1720	423	total carbon footprint metric tons

# Summary

- Labs are initial targets to place thin clients
- Faculty and staff can achieve significant benefits from VDI, providing their desktop a
- Results in reduced TCO, more secure, and greener environment



I'm Thin  
and *Green*

My choice is helping NAU reduce its carbon footprint by over 300 tons per year.

A silver Sun thin client device with a Sun logo on the front and a CD-ROM tray on the right side. It is standing on a small base.

The logo of Northern Arizona University, featuring a stylized tree and the letters 'NAU'.

NORTHERN ARIZONA UNIVERSITY  
*Green and proud of it*