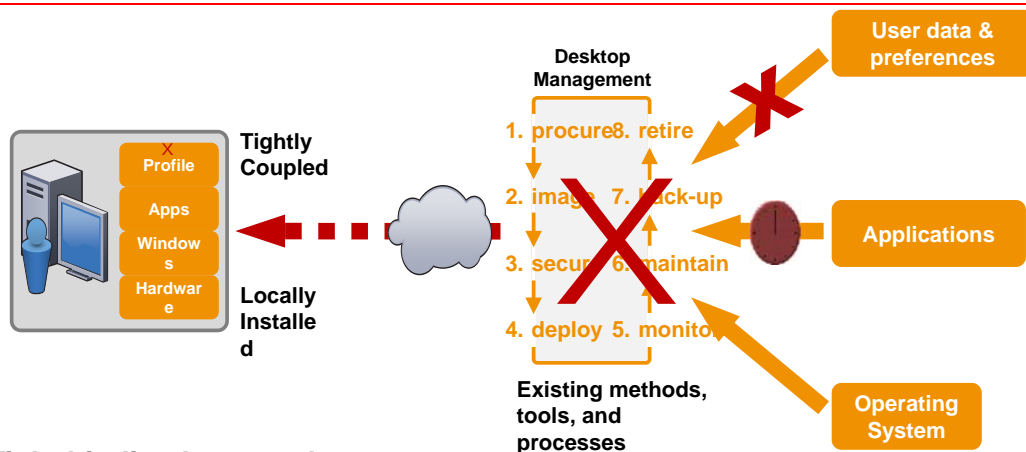# Virtual Desktop Infrastructure (VDI)

**Tien-Fu Chen**

Dept. of Computer Science and Information Engineering

**National Chiao Tung Univ.**

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# Typical Desktop Deployment



- **Tight binding between layers**
    - **The components are linked together in ways that are difficult to support and maintain**

- **A problem at one layer often causes a chain reaction**
    - **May destroy the whole stack**

- **Make recovery difficult**
- **Threaten any locally stored user data and settings**
    - **Most organizations just replace or re-image the whole PC**

# Traditional Desktop Infrastructure Challenges

**Difficult to manage**
- Variety of PC hardware and users' need
- Broadly distributed PC hardware

**Inefficient resource utilization**
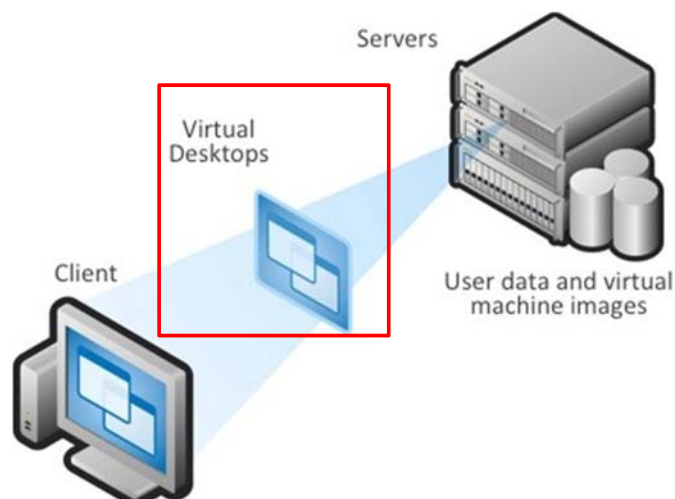- The distributed nature of PCs



**High total cost of ownership**
- High cost of PC management and support
- Lack of standardization and the need for support personnel to troubleshoot issues

**Difficult to protect and secure data**
- Data back-up and data restored when PCs are failed or files are lost
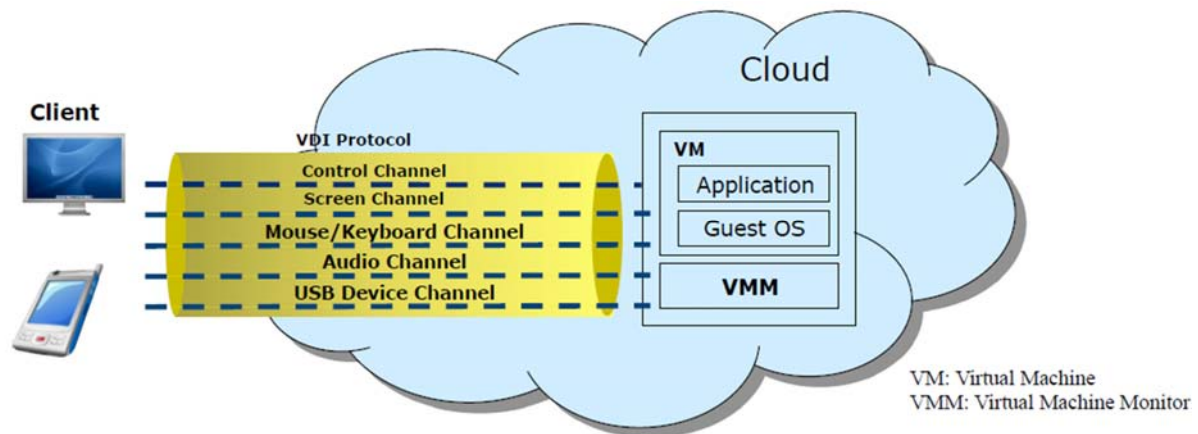- The risk of PC theft threatens the security of important data

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# A Computing Model

❑ Virtual Desktop Infrastructure (VDI) is a computing model that adds a layer of virtualization between the server and the desktop PCs
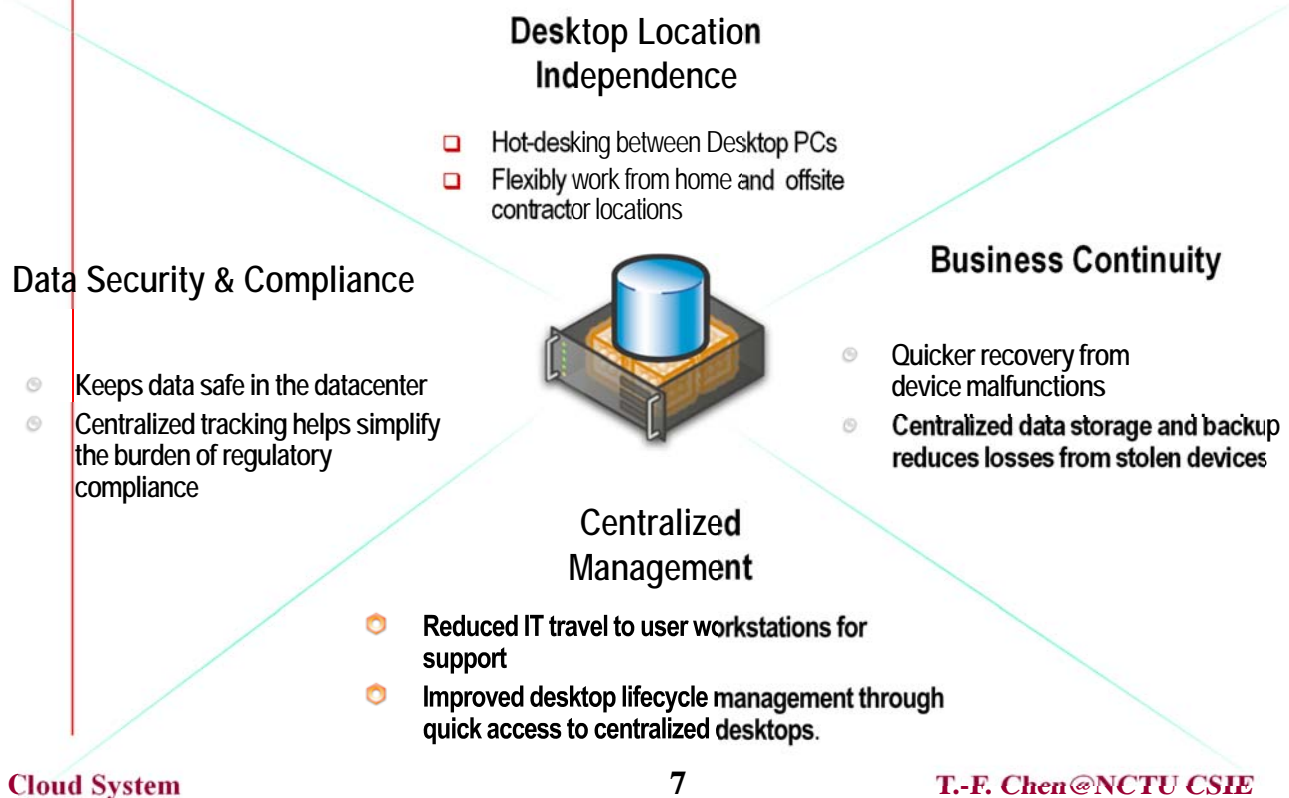
# A Service

❑ VDI is a desktop-centric service
  – Host users desktop environments on remote servers and/or blades, which are accessed over a network using a remote display protocol (RDP)

# Characteristics
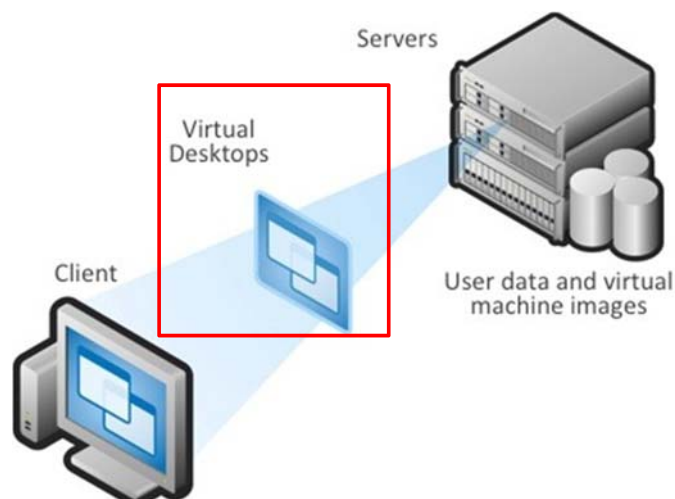
❑ Every desktop user can utilize the same image
  – Reduce management and support costs
  – Generally have just one system to troubleshoot

❑ Processing moves from individual workstations to a VDI server

❑ Hardware costs can be more easily managed
  – Since almost everything will reside in the data center
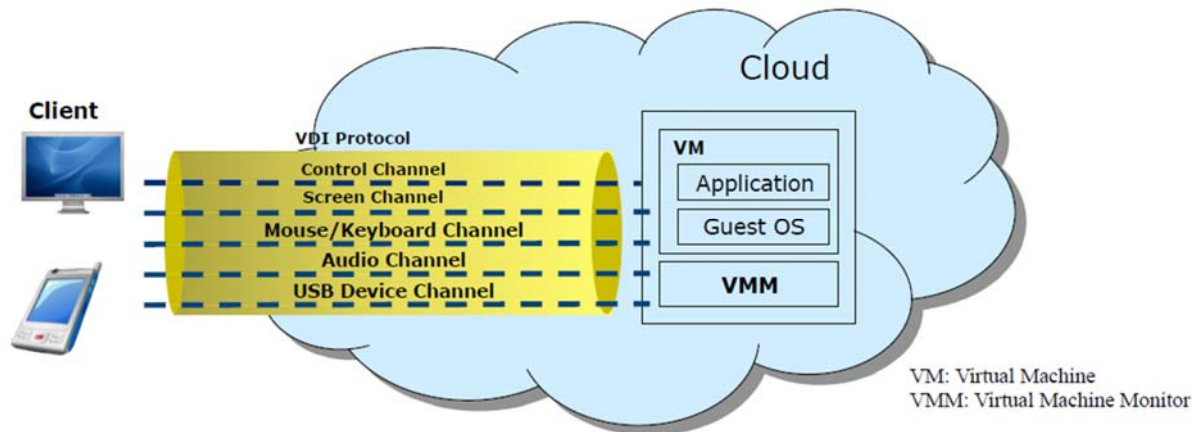
# Why Centralize with VDI?

**Desktop Location Independence**

❑ Hot-desking between Desktop PCs
❑ Flexibly work from home and offsite contractor locations

**Data Security & Compliance**

◎ Keeps data safe in the datacenter
◎ Centralized tracking helps simplify the burden of regulatory compliance

**Business Continuity**

◎ Quicker recovery from device malfunctions
◎ Centralized data storage and backup reduces losses from stolen devices

**Centralized Management**

⬡ Reduced IT travel to user workstations for support
⬡ Improved desktop lifecycle management through quick access to centralized desktops.

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# A Computing Model

❑ Virtual Desktop Infrastructure (VDI) is a computing model that adds a layer of virtualization between the server and the desktop PCs

Servers

Virtual Desktops
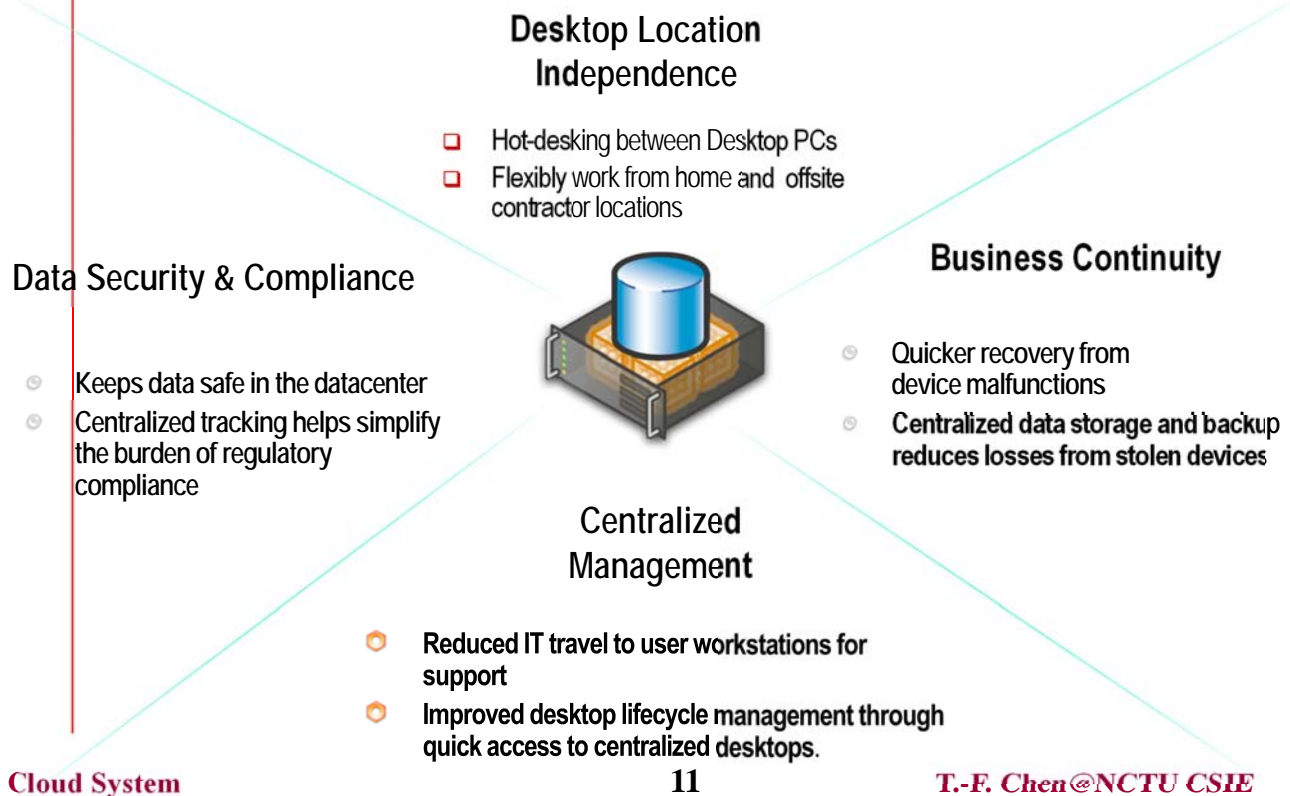
Client

User data and virtual machine images

# A Service

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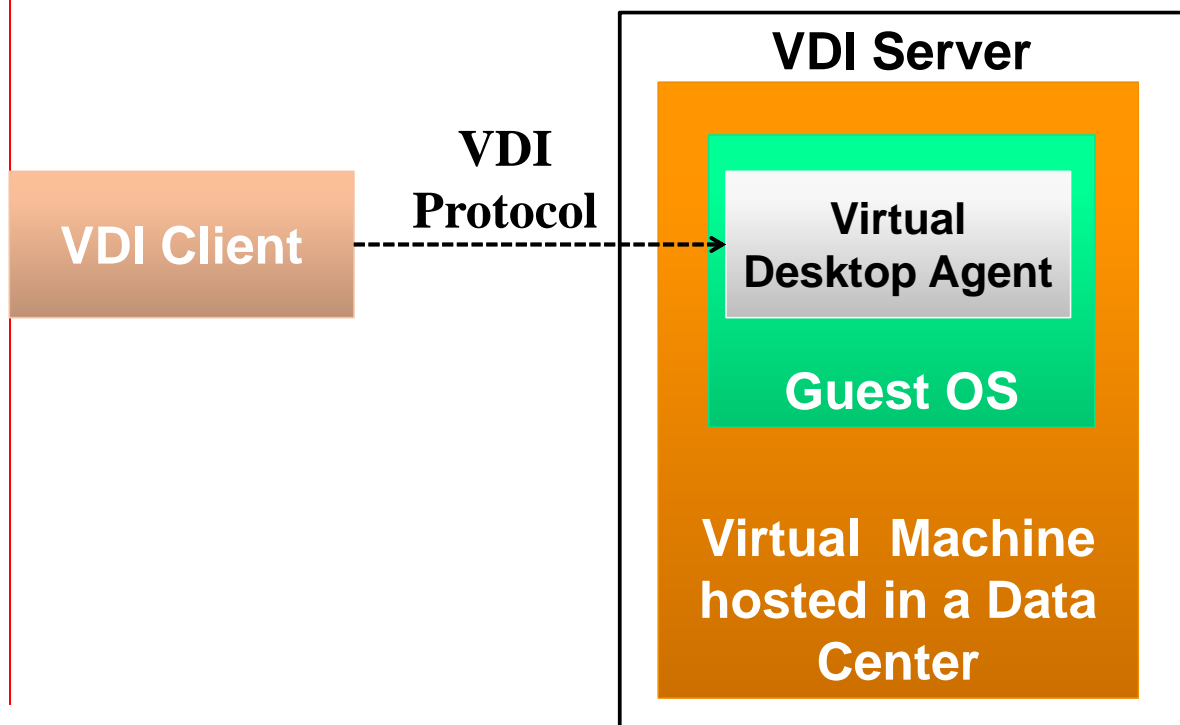
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# Basic View

**VDI Client**

**VDI Protocol**

**VDI Server**

**Virtual Desktop Agent**

**Guest OS**

**Virtual Machine hosted in a Data Center**

# Basic View

❏ Virtual Desktop Client (VDC)

   – The converged end user device

❏ VDI server

   – Virtual Desktop Agent (VDA)

      ❏ The control software resides in a virtual machine hosted in a data center

❏ VDI protocol

   – Connect client and server,

   – Transport the necessary control commands and I/O data

      ❏ Different I/O data may be encapsulated in different virtual channel

# VDI Components
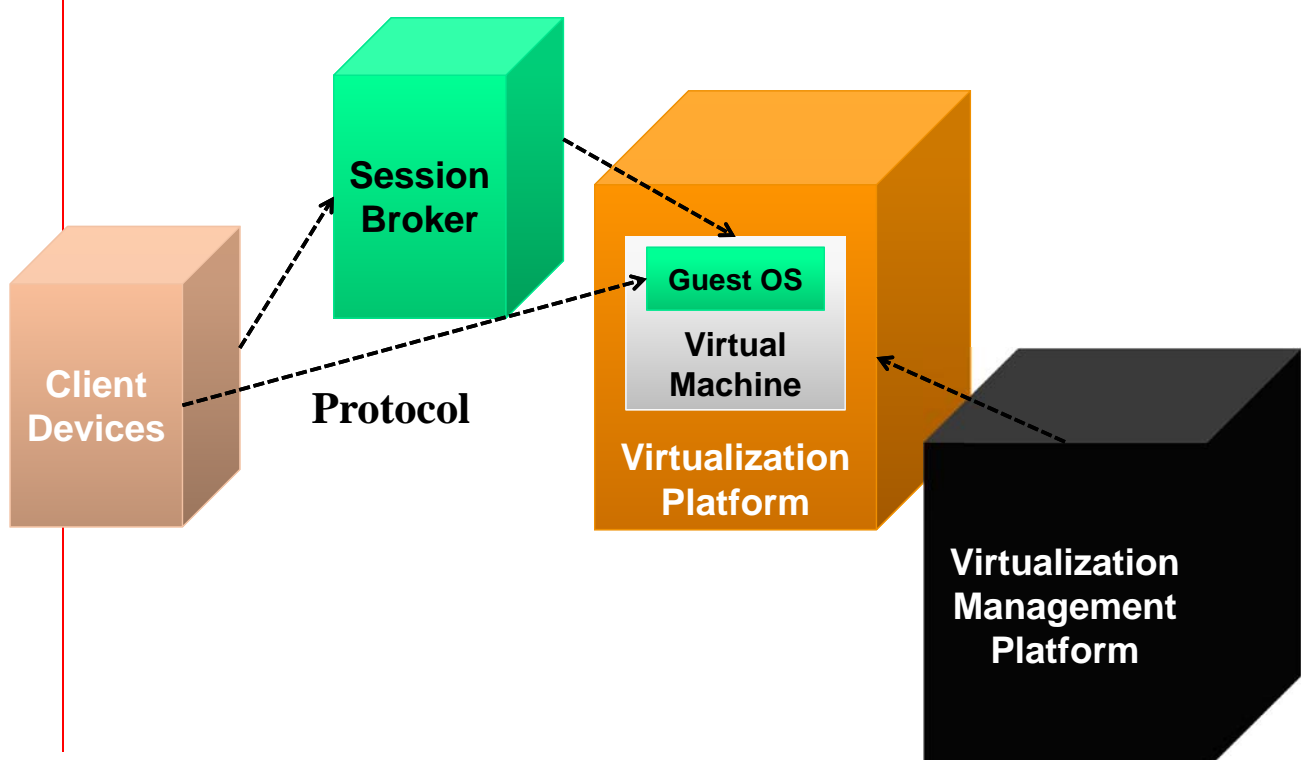
# Protocol

- ❑ For users to connect to the virtualized OS
  - – Handle certain features such as device and printer redirection

- ❑ Decision about a protocol depends on the device end users
  - – Example: a thin client or a remote client under a full OS

- ❑ Examples:
  - – Remote Display Protocol (RDP)
    - ❑ A part of CP or Vista
    - ❑ RDP allow users to access systems at remote locations with the ability to manipulate the system as if physically sitting at that computer terminal
  - – Independent Computing Architecture (ICA)
    - ❑ A proprietary protocol for an application server system, designed by Citrix
    - ❑ The protocol lays down a specification for passing data between server and clients, but is not bound to any one platform.

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# Desktop Remoting Techniques

- ❑ Fundamentally there are several different ways that a desktop running at one place can show up on a screen of a client at another location:
  - – The "screen scrape" method
  - – Screen scrape + multimedia redirection
  - – Server graphics system virtualization
  - – Hardware acceleration on the server and client

# Screen-Scraping

❑ The general idea with "screen scraping" is that whatever graphical elements are painted to the "screen" on the host are then scraped by the protocol interface and sent down to the client. This can happen in two ways:

  – The client can contact the server and pull a new "snapshot" of the screen from the frame buffer. This is how VNC works.

  – The server can continuously push its screen activity to the client. This can be at the frame buffer level, the GDI / window manager level, or a combination of both. (This is how RDP and ICA work)

# Screen Scrape + Multimedia Redirection

❑ A technique whereby server-side multimedia elements are sent in their native formats down to the client devices. Then the client can play the multimedia streams locally and dynamically insert them back into the proper position on the screen. This works well

  – If your client has the technical capability and hardware specs to render the multimedia, and

  – Your client has the proper codec installed so that it knows how to render the multimedia content. In effect, this means that your clients can't be "too thin."

❑ This is what Citrix does in ICA with their "SpeedScreen" multimedia acceleration enhancements.

❑ It's also what Wyse does in RDP with their TCX enhancements.

# Server Graphics System Virtualization

❑ Software on the host captures all possible graphical layers (GDI, WPF, DirectX, etc.) and renders them into a remote protocol stream (like RDP) where they're sent down to the client as fast as possible.

– This will give the client an experience which is very close to local performance, regardless of the client device (even on very low-end WinCE and Linux clients).

❑ GPU capabilities must exist on server side where the rendering is taking place.

– This is fine if you plug a physical graphics card into physical hardware running a physical OS.

– In a VDI scenario, your hypervisor must be able to virtualize the GPU just like any other piece of hardware. This means that the Windows desktop OS running inside the VM be able to detect the "virtual" GPU so that it can enable all of it's cool graphical features.

# Hardware Acceleration on Server/Client

❑ Screen and video content is captured on the host via a special chipset and sent across the network in a proprietary way to a client device with a matching special chipset.

❑ Teradici: The solution works with physical blades (with their special TERA chips) and their clients (also with TERA chips.

# Session Broker

- ❑ The session broker is responsible for
  - – Distribute sessions from clients to VMs
  - – Redirect disconnected sessions of users back to their original VMs.
  - – Example: Windows Server 2008 R2, XenDesktop (for Microsoft VDI), and VMware View Manager

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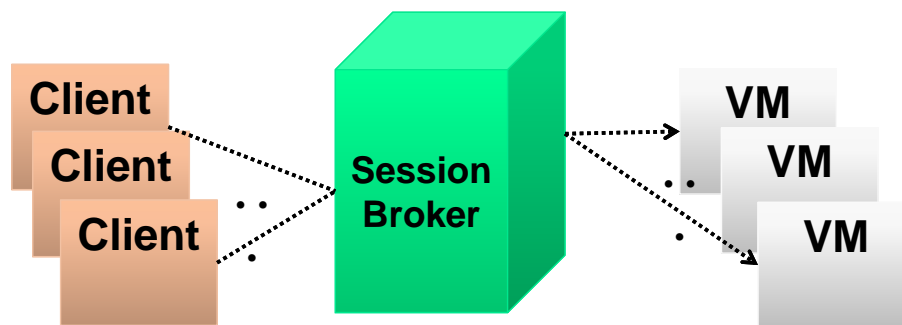
# Virtualization platform

- ❑ A platform hosts VMs with the client operating systems
- ❑ This platform must have the capacity to host enough VMs for all concurrently connected users
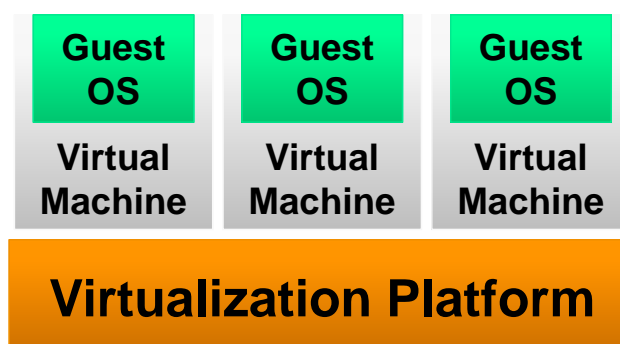
# Virtual Management Platform

- ❑ Virtual management platform is a platform that
  - – Manage the servers
  - – Provision VMs quickly and efficiently
  - – Use templates and libraries of disk images to provision the client OS in VMs.

- ❑ It ensures there is always a pool of VMs available for new connections.

- ❑ Two other functions
  - – Application virtualization
  - – Profile and data redirection

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# Application Virtualization

- ❑ Application virtualization is software technology that encapsulates application software from the underlying operating system on which it is executed.

- ❑ Application virtualization is layered on top of other virtualization technologies, such as storage virtualization or machine virtualization to allow computing resources to be distributed dynamically in real time.

- ❑ Application virtualization enables fast availability of applications to the virtual client OS.

- ❑ Solutions for application virtualization
  - – Microsoft Application Virtualization
    - ❑ For example, Windows 7 provides Windows XP Mode that enables older Windows XP application to run unmodified on Windows 7.
  - – VMware Thin App

# Profile and Data Redirection

- ❑ It is important to maintain customization and configuration done by users between connections
  - – Users would customize their environments

- ❑ Profile and data redirection ensure that
  - – If users switch between VMs, they have a consistent environment
  - – If any data the user stores, including folders such as documents, is stored on a server

# Client Devices

- ❑ Client devices are the point of access

- ❑ It could be
  - – Thin clients
  - – Clients running software on OS
    - ❑ Such as Windows, Linux, or others supported by the VDI solution

# Advantages

- ❑ Improved utilization
  - – Efficient use of CPU and memory resources
- ❑ Improved availability
  - – Reduced desktop downtime
- ❑ Improved manageability
  - – Patches and upgrades performed in data center
  - – Centralized management reduces operational expenses
- ❑ Improved security
  - – Data and applications reside in secure data centers
- ❑ Rapid Client Deployment
  - – New users can be up and running quickly

# Disadvantages

- ❑ Need a unique image for each user who requires a different set of applications

- ❑ Require a major investment in server hardware, and possibly in storage and network infrastructure
  - – This might no be feasible for some smaller businesses

- ❑ Administrators need to learn the VDI software's capabilities and limitations

- ❑ Server-side problems can affect multiple users-- everyone using that server or that image.
  - – It's a good to set up redundant servers as a failsafe

# The Benefits of VDI

**Centralized Management**

- Manage physical and virtual desktops from a single console
- Centralized desktop lifecycle management

**Anywhere Access for Connected Devices**

- Access desktops from any connected device
- Enable rich desktop experiences on thin clients and older PCs

**Enhance Security and Compliance**

- Data always locked in the datacenter
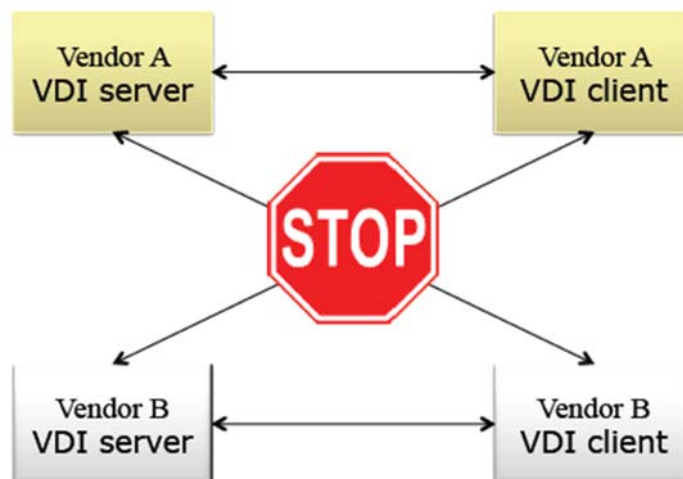- Improved compliance through centralization

**Increased Business Continuity**

- Datacenter grade business continuity for the desktop
- Quicker resolution of desktop failures

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# Challenges for VDI: Interoperability

❑ Although current VDI are aiming the same goal, they are defined by different companies using different methodologies.
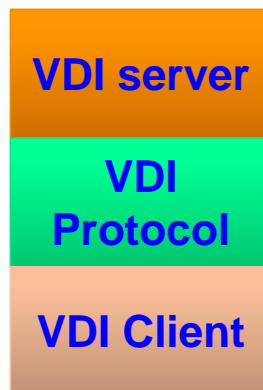
❑ So ……

# Ecosystem

❑ Each layer have tight-coupling relationship

 – They cannot move forward independently


❑ Main problem for less interoperability.

| VDI server |
|:---:|
| **VDI Protocol** |
| **VDI Client** |

# Mobile Access

❑ Streaming application in the best current systems consuming extra 8x bandwidth compared to original bitrate


❑ Service continuity issue

 – Switching over different access networks and different devices


❑ Duplicate sign-on issue

 – Mobile user will be authenticated at least twice (one by the network, and another by VDI server)

# VMware VDI

- An end-to-end desktop virtualization solution
- **Use Vmware's proven virtualization platform (VI3)**
- Deliver enterprise-class desktop control and manageability while providing a familiar user experience



> **Control and manageability in an end-to-end solution**

> **Familiar end-user experience**

> **Rapid desktop deployments**

> **Enterprise-class scalability, management and reliability**

> **Tight integration with VMware VI3 – proven virtualization platform**

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# VMware VDI Solution
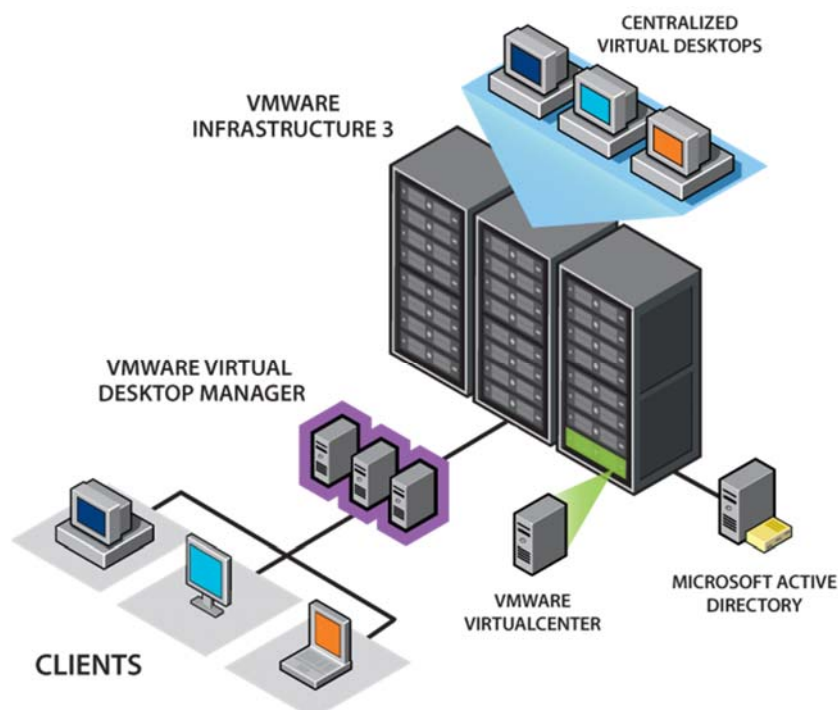
# VMware Infrastructure 3 Integration

❏ Manage desktops & servers on a single platform

- No retraining: similar administrative experience across desktops and servers

- End-to-end single vendor solution: common management, service and support

- Bring powerful data center capabilities to the desktop:
    - ❏ VI3 Business Continuity (HA & DRS)
    - ❏ Simplify backups and disaster recovery

- No single point of failure:
    - ❏ Synchronized VDI servers
    - ❏ Support for industry std server load balancing

- Runs desktops on proven virtualization platform (VI3)

# VMware Virtual Desktop Manager

❏ Enterprise-class connection broker, connects users to their desktops via RDP

- Web-based administrative interface
- Automatically assigns desktops
- Performs automatic desktop provisioning as needed

❏ Designed for small to enterprise organizations

- Tightly integrated with VMware Infrastructure 3 for high availability, security & scalability
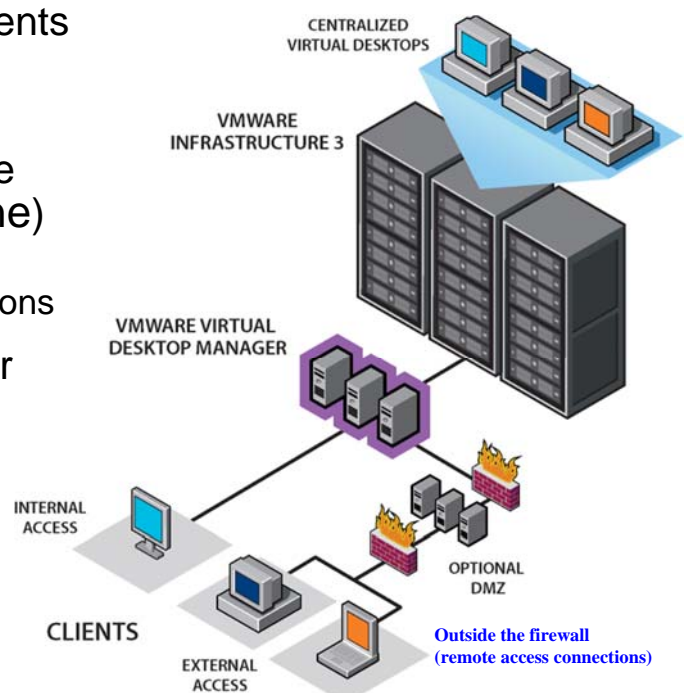- Multiple VDM servers can support thousands of users
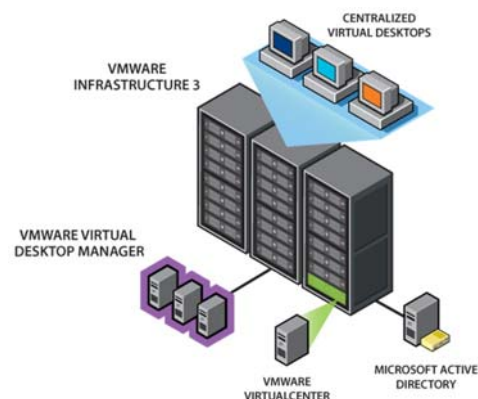
# VMware VDM: Individual Desktops

❑ Desktop virtual machines were created specifically for each user.

❑ User is manually associated with a virtual desktop through VDM Administrator.

❑ User is connected to same desktop on subsequent connections

CENTRALIZED VIRTUAL DESKTOPS

VMWARE INFRASTRUCTURE 3

VMWARE VIRTUAL DESKTOP MANAGER

CLIENTS

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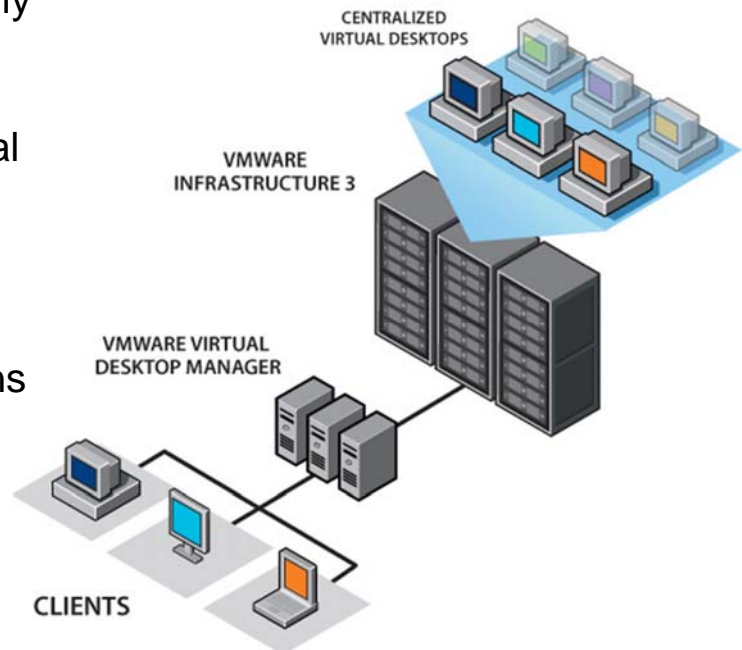
# VMware VDM Security Server

❑ SSL VPN used to secure connections between clients and VMware VDM connection broker

❑ Optionally runs within the DMZ (demilitarized zone) for remote access users
– Fully encrypted connections

❑ Grow security servers for scalability of secure connections

CENTRALIZED VIRTUAL DESKTOPS

VMWARE INFRASTRUCTURE 3

VMWARE VIRTUAL DESKTOP MANAGER

INTERNAL ACCESS

CLIENTS

EXTERNAL ACCESS

OPTIONAL DMZ

**Outside the firewall (remote access connections)**

# VMware VDI Client Access
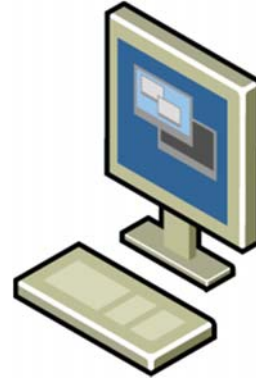
**Native Windows Client**

- – Provides extended capabilities (e.g. USB device support on Windows XP & Vista)

**Thin-Client Support**

- – Thin clients based on Linux and XPe
- – WYSE ThinOS models

**Browser Access**

- – Windows, Linux & Mac

---

# What Distinguishes VMware VDI?

**Familiar End-User Experience**

- – Run applications with no modifications. Virtual desktop is unchanged.
- – Leverage existing desktop mgmt tools
- – Support for USB devices through RDP extensions (e.g. local printing, storage, etc.)
- – Support multi-monitors in "stretch mode"

*Making the move to virtual desktops as seamless as possible*

# What Distinguishes VMware VDI?

**Rapid Deployment**

– VMware Infrastructure templates can be used to replicate 1000s of desktops quickly

– Automatic desktop provisioning with VDI pooling capabilities

– Rapid redeployments of virtual images throughout desktop lifecycle

❑ Changing, patching, restarting images improved when centralized & virtualized

VIRTUAL DESKTOP
TEMPLATE

CENTRALIZED
VIRTUAL DESKTOP
POOLS

VMWARE
INFRASTRUCTURE 3

VMWARE VIRTUAL
DESKTOP MANAGER

CLIENTS

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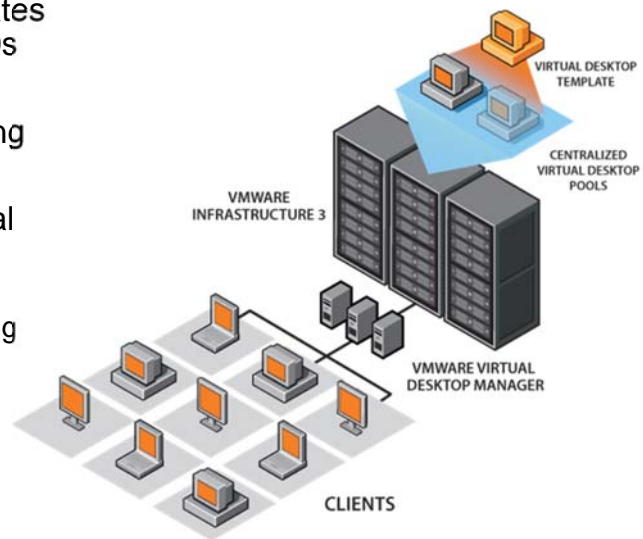
# How Customers Use VMware VDI

## Desktop PC Replacement

**Replace traditional PCs with thin clients, repurposed PCs or less costly desktop hardware. Address short desktop lifecycles. Simplify moves, adds & changes (MACs) because the desktop images are administered in corporate data center.**

## Transactional Office Workers with Security Needs

**Secure all sensitive personal records or intellectual property running on laptops in host country data center. Control access to centralized desktop images through Microsoft AD. Provide complete desktop isolation. Ensure all sessions are fully encrypted using VMware VDI's optional Security Server.**

## Disaster Recovery & Business Continuity

**Eliminate unplanned desktop downtime through VMware Infrastructure 3 DRS and HA capabilities. Simplify backup and desktop disaster recovery because desktops are located in corporate data center and can leverage shared storage technology.**

# VMware VDI: Summary

**Centralized Desktop Management & Control**
- – Desktops moves, adds & changes (MACs) are easier from a single location. Support personnel no longer needed on location
- – Maintain Desktops in Secure Corporate Datacenter
- – VMware VDI desktops are isolated from one another

**Familiar End-User Experience**
- – A complete isolated desktop that is unchanged, simply running inside a virtual machine. No retraining. No custom modifications.

**VMware Infrastructure 3 Scalability & Reliability**
- – Brings powerful VI3 capabilities to the desktop
- – Single vendor solution

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# Citrix XenDesktop: Composition



**Any delivery model** — Remote PC   XenClient   VDI   Shared

**XenDesktop**

**Any Hypervisor** — Microsoft   XenServer   VMware

XenDesktop today

Project Avalon is built upon industry leading, open, scalable XenDesktop, supporting all of the leading hypervisors.

# Features

- Supports any device, anywhere
- Deliver high user experience, even in 3D
- Deploy virtual desktops and apps for any use case
- Any Windows, Web or SaaS Applications
- Transforms IT with open, scalable and proven technology
- Single-instance management
- Data security and access control

# Different Types of Virtual Desktops

- Local VM
- Streamed VHD
- Hosted VDI
- Hosted Shared



Local VM     Streamed VHD     Hosted VDI     Hosted Shared

# Local VM

❑ Local VM desktops extend the benefits of centralized, single-instance management to mobile workers that need to use their laptops offline.

❑ When they are able to connect to a suitable network, changes to the OS, apps and user data are automatically synchronized with the datacenter.

# Streamed VHD

❑ Streamed VHDs leverage the local processing power of rich clients, while providing centralized single-image management of the desktop.

❑ This approach offers an easy, low-cost way for customers to get started with desktop virtualization by leveraging existing PC resources and keeping datacenter overhead to a minimum.

❑ It can also be ideal for government and university labs that use diskless PCs for maximum data security.

# Hosted VDI

❑ A Windows 7/XP desktop running as a virtual machine where a single user connects remotely. One user's desktop is not impacted by another user's desktop configurations.

❑ Hosted VDI desktops offer a personalized Windows desktop experience, typically needed by office workers, which can be securely delivered over any network to any device.

❑ This option combines the benefits of central management with full user personalization, and can generally support up to 150 desktops per server.

# Hosted Shared

❑ Users get a desktop interface, which can look like Windows 7. However, that desktop is actually being shared by every user on the server.

❑ Hosted Shared desktops provide a locked down, streamlined and standardized environment with a core set of applications, ideally suited for task workers where personalization is not needed — or allowed.

❑ Support up to 500 users on a single server, this model offers a significant cost savings over any other virtual desktop technology.

# On-Demand Apps

❑ Allows any Windows application to be centralized and managed in the datacenter, hosted either on multi-user terminal servers or virtual machines, and instantly delivered as a service to physical and virtual desktops.
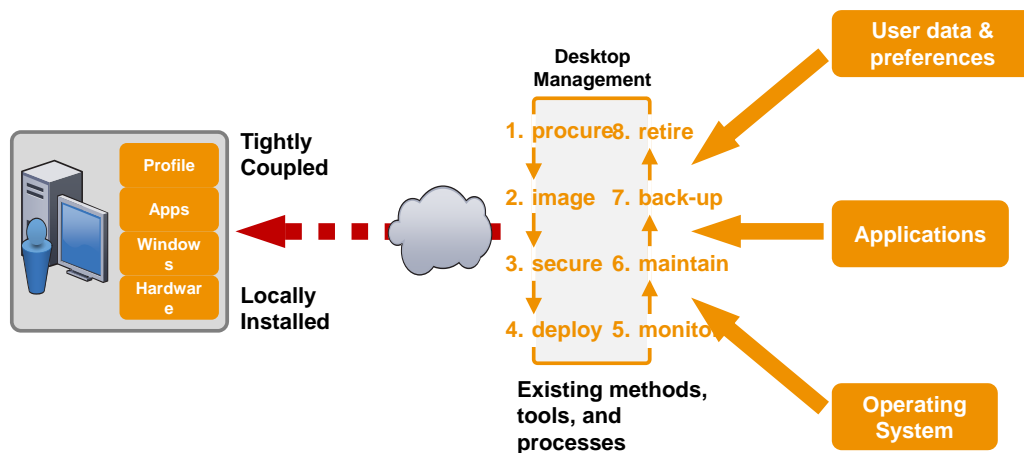


Local VM | Streamed VHD | Hosted VDI | Hosted Shared | On-Demand Apps

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# Typical Desktop Deployment (Revisit)



**Tightly Coupled**

Profile
Apps
Windows
Hardware

**Locally Installed**

**Desktop Management**

1. procure  8. retire
2. image  7. back-up
3. secure  6. maintain
4. deploy  5. monitor

**Existing methods, tools, and processes**

User data & preferences

Applications

Operating System

# Desktop Delivery Vision

**XenDesktop is a Better Way…**

Virtualized & Isolated

Dynamically Delivered

Profile
Apps
Windows
Hardware

Profiles
Apps
OS

XenDesktop
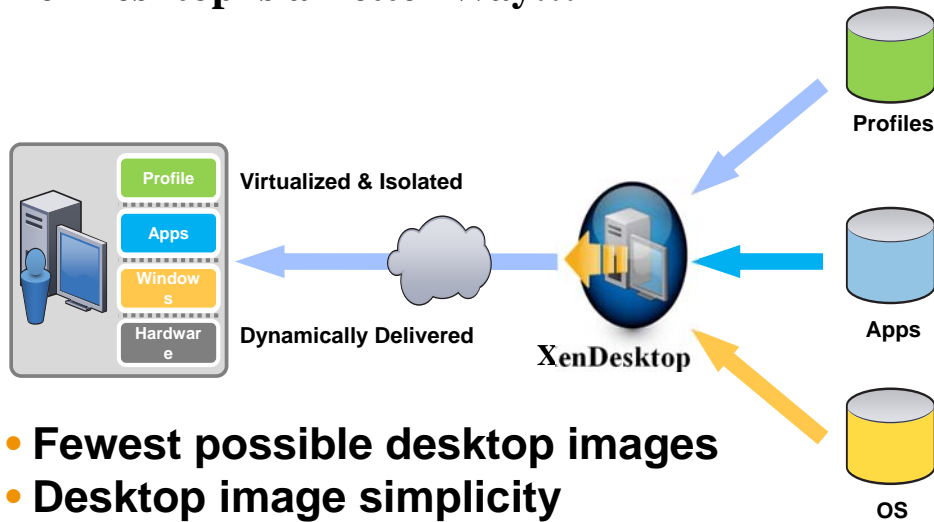
- **Fewest possible desktop images**
- **Desktop image simplicity**
- **Fewer conflicts, minimized testing**
- **Low-touch, self-serve re-imaging**

---

# Desktop Delivery Components

**Support**

**Brokering**

**Monitoring**

**1** Users request their desktop by logging in to the system

**2** Operating Systems, Apps, and user Profiles are provisioned on demand

**Users**

**WAN Optimization**

**Secure Remote Access**

**Hypervisor**

**Blade Chassis**

**Virtual Desktop Infrastructure**

Profiles
Apps
OS

**3** Users are delivered their desktop remotely

# End User Experience

**Access Scenarios**

**Desktop Appliances**



login       Full-Screen

**unmanaged machines**



Web page      Windowed      Full-Screen

---

# Ulteo Open Virtual Desktop (OVD)

❑ Ulteo Open Virtual Desktop is an installable Open Source virtual desktop and application delivery solution for corporations.

❑ It allows IT departments to deliver desktops and applications easily and at a lower cost than other solutions.

❑ It works in both a Windows and Linux environment.

# Infrastructure Overview and Vision



**One broker for all types of applications**

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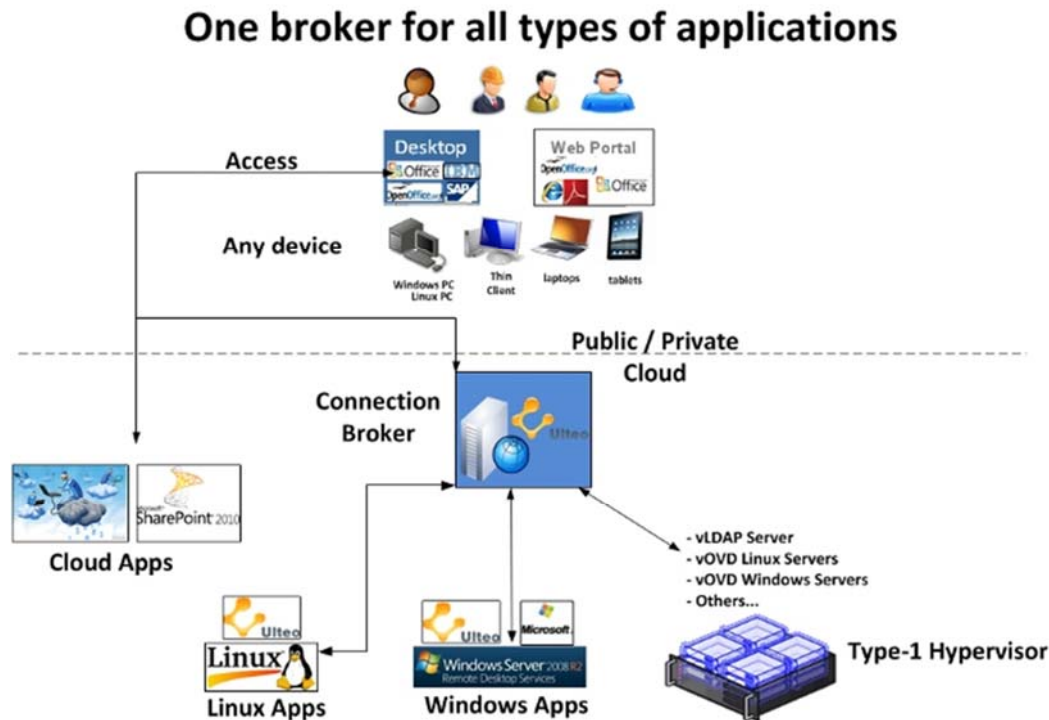
# Key Benefits for IT

- ❑ Ease of use, ease of deployment and management:
  - − Clients can be either a Java enabled web browser or a dedicated software client.

- ❑ Interoperability:
  - − Full integration with existing infrastructures including Microsoft environments (Windows authentication, Windows applications, Active Directory, File server).

- ❑ Customizable:
  - − Ulteo is using Open Source software. Ulteo source code is covered by GPL v2 software licensing terms.

- ❑ Lower cost than any comparable product

- ❑ Secure, reliable, scalable

# Desktop Mode

❑ Windows or Linux Desktop with a mix of remote Windows and/or Linux applications
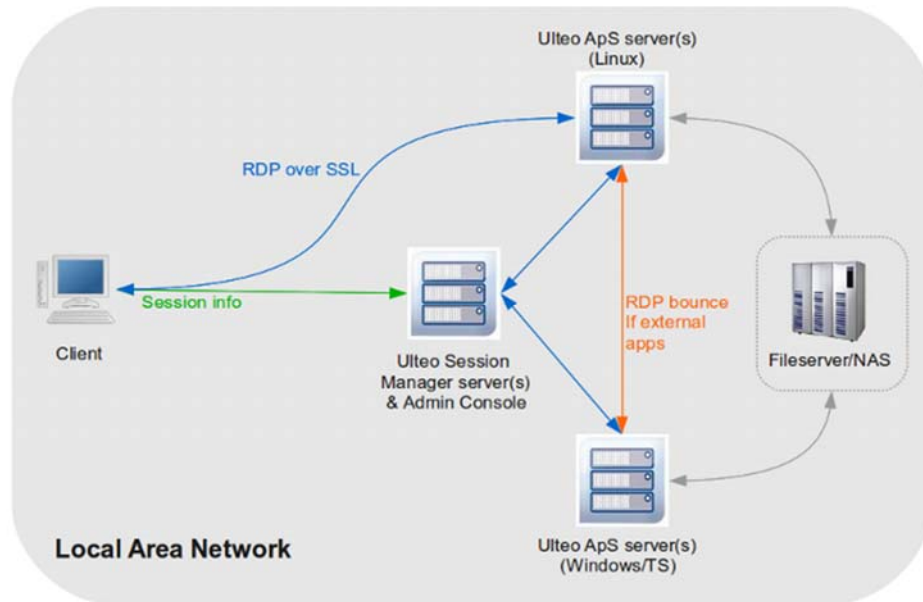
# Desktop Mode Example

❑ Windows & Linux apps on a Windows desktop, in the web browser
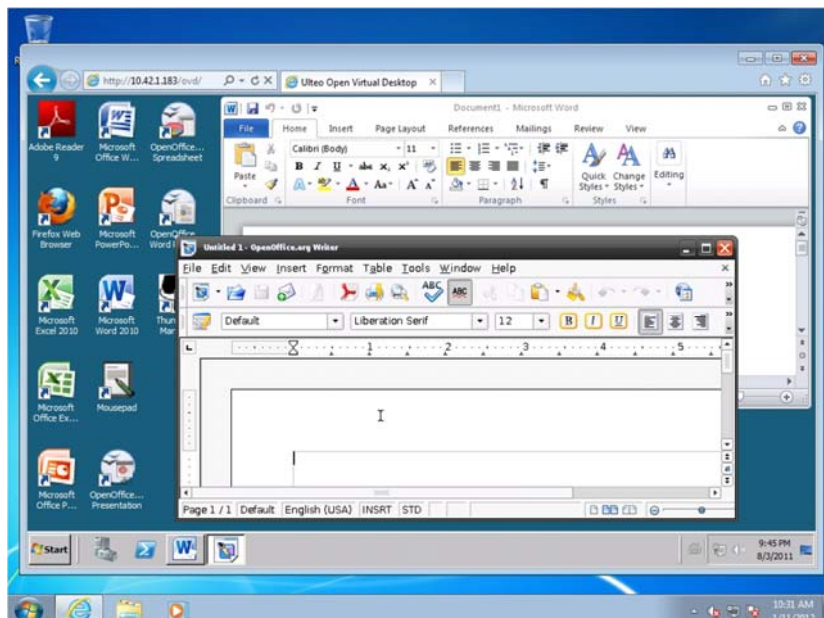
# Desktop Mode Example

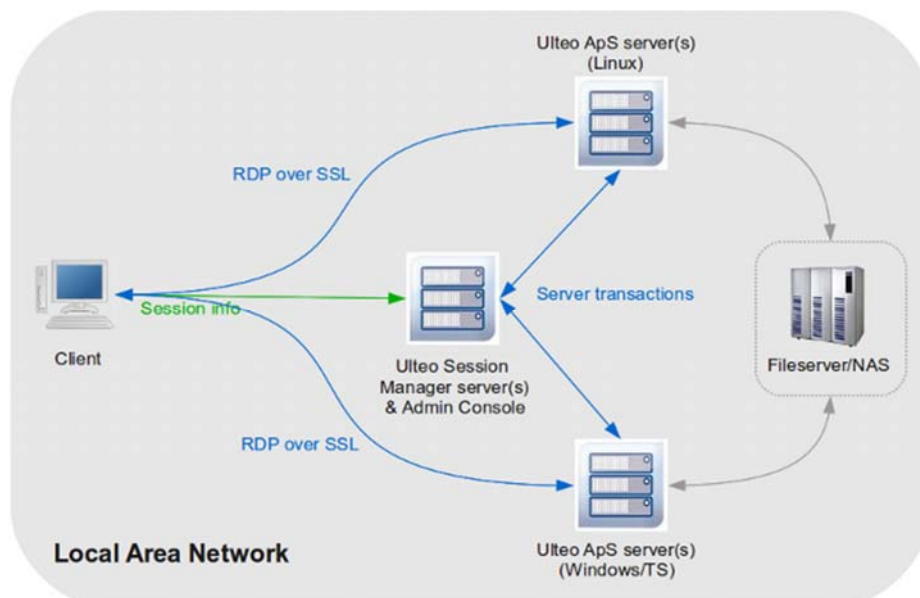❑ Windows & Linux apps on a Linux desktop, in the web browser
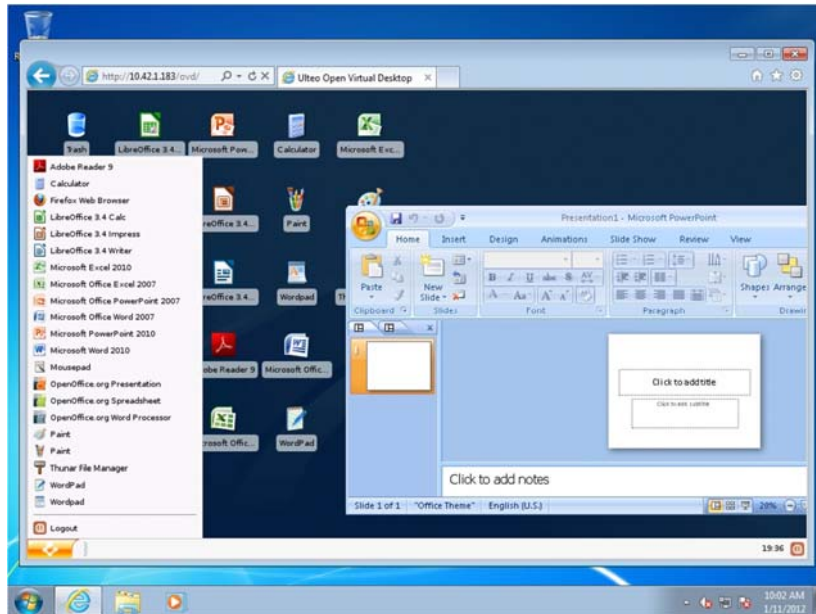
# Application/Portal Mode

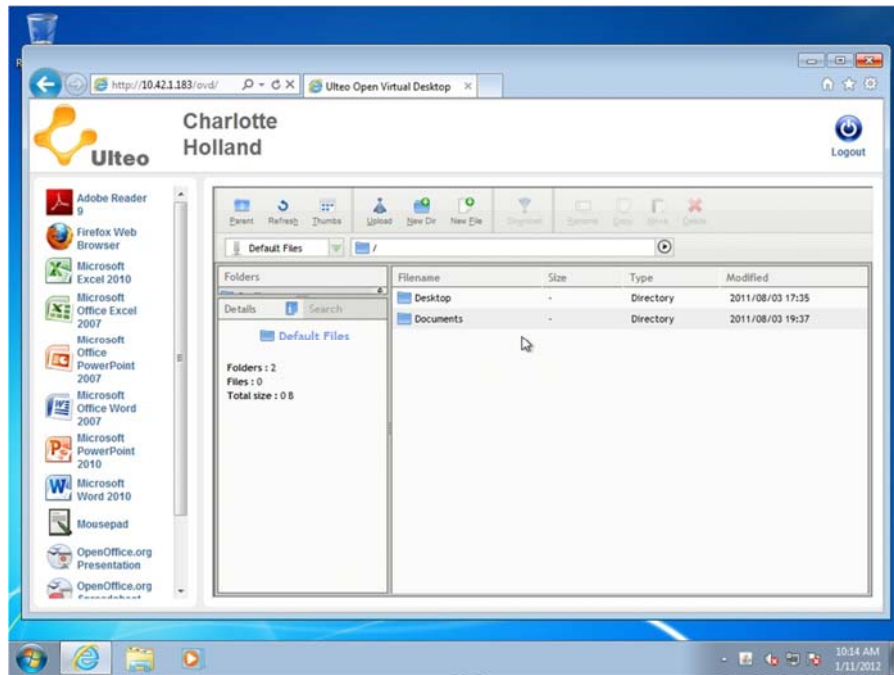❑ Application Portal, to run remote Windows and/or Linux applications from web links

# Application/Portal Mode Example

❑ Portal mode, with embedded file manager

# Application/Portal Mode Example
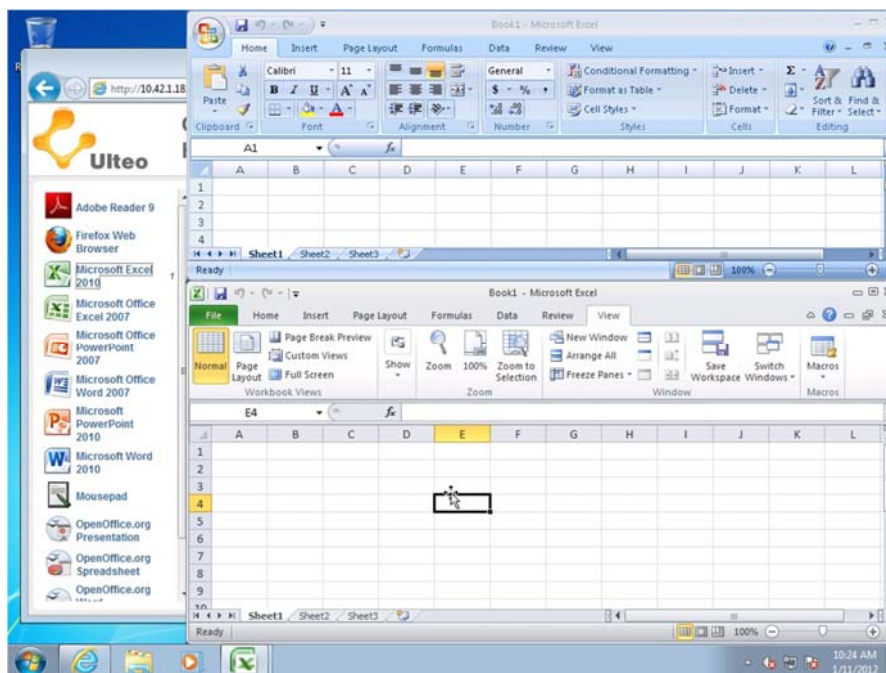
❑ Portal mode, running two flavors of Excel

# Application/Portal Mode Example

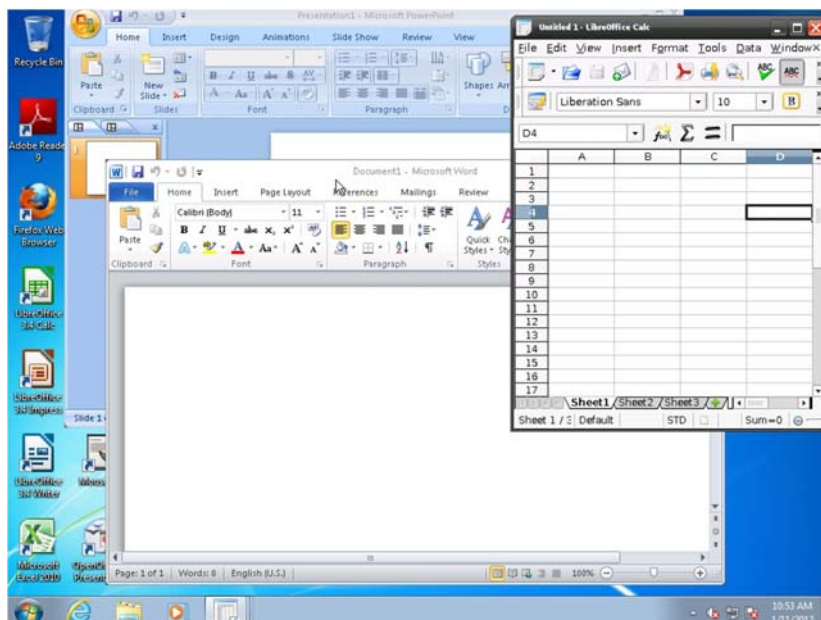❑ Application mode, with remote Windows & Linux applications integration on Windows 7 desktop

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# Application/Portal Mode Example

❑ Applications mode, displaying the remote applications seamlessly on the local desktop

# Application mode or Desktop mode with WAN access through OVD Gateway

❑ Application Publishing, to get remote Windows and/or Linux applications seamlessly integrated in the local end-user desktop