# Microsoft Windows 7 Deployment

# White Paper

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# 1. Introduction

Since its release in October 2001Windows XP has been the corporate standard for desktop operating systems. The subsequent release of Windows Vista in January 2007, "the next generation desktop OS" with its well documented problems was overwhelmingly rejected by most businesses, meaning the majority of businesses still rely on an 8 year old operating system. The release of Window 7 in October 2009 with new features and none of the problems attributed to Vista has been well received and to date Windows 7 has exceeded the anticipated adoption rates set by Microsoft.

This white paper provides an overview of Windows 7 features and benefits, and provides a guide to the essential project stages, and technologies required to ensure a successful deployment of Windows 7 across the enterprise.

# 2. Microsoft Windows 7 Offering

## 2.1 Overview

The Windows 7 family of Operating Systems is Microsoft's replacement for Windows Vista. The corporate uptake of Vista as an Enterprise desktop has been much lower than anticipated and as such corporate clients have been extending the life of their XP environments citing performance on existing hardware and application compatibility as major reasons for not replacing XP.

Microsoft have looked to address these issues and provided enhancements with Windows 7 that better position it as a replacement for XP in the corporate workspace:-

- Performance increases so user expectations are better met on lower specified hardware
- Better collaboration with hardware vendors to ensure greater device driver availability
- Improvements in imaging technology to allow dynamic provisioning of drivers
- New migration tools, User State Migration Tools (USMTv4), that support hard-linking of user data on local drives so that data does not have to be copied to remote servers and then restored
- Power Management and Wake-on-LAN improvements to lower costs of operations in Enterprise Environments
- Improvements to user interface (UI)
- Disk-encryption through BitLocker and removable drive (USB) encryption through BitLocker –To-Go enhancements [1,2]
- XP Mode Virtual PC image support for access to XP based only applications [3]
- Software Installation Restrictions through AppLocker technology [4]
- Branch Office cache support for improving access to files in remote office [4]
- DirectAccess for accessing corporate file data or intranet sites remotely [4]

The benefits of these improvements provide lower the cost of deployment, reduction in operating costs and improved end user productivity.

**Notes:**

1. Disk encryption only available with Windows 7 Enterprise or Windows 7 Ultimate Editions
2. Windows 7 Enterprise only available to clients with software assurance (SA)
3. XP Mode has the following requirements:-
    i. Windows 7 Professional, Enterprise, or Ultimate editions.

ii. A computer capable of hardware virtualisation. This means the computer has a central processing unit (CPU) with either Intel-VT or AMD-V virtualisation features.

iii. Virtualisation features turned on in computer's basic input/output system (BIOS).

4. Requires Windows 2008 R2 server features

# 3. Strategic Review of existing desktop deployment

If not already completed, many organisations will need to consider how operating systems and applications are to be delivered and managed as part of any new enterprise desktop deployment.

This may encompass the use of:-

- Management Solutions such as System Center Configuration Manager
- Application Virtualisation solutions such as Microsoft App-V
- VDI centralised delivery of new desktop environment
- Monitoring Solutions such as System Center Operations Manager

A key decision point for many clients is whether a Microsoft Enterprise Agreement is taken out to cover the desktop deployment and in-addition what additional benefits to the organisation an accompanying software assurance agreement would bring.

We have found that many of the System Center Configuration Deployments undertaken this year have been driven by client's EA agreements that provide the desktop ConfigMgr CALs as part of the package.

As enterprise IT infrastructure becomes increasingly complex to manage, the Microsoft Desktop Optimisation Pack (MDOP) is available as a subscription for Software Assurance clients; that aims to increase desktop manageability, reduce total cost of ownership and improve overall infrastructure satisfaction through six product technologies.

- **Microsoft Application Virtualisation (App-V**) turns applications into centrally managed services that are never installed, never conflict, and are streamed on demand to end users.

- **Microsoft Enterprise Desktop Virtualisation (MED-V)** provides deployment and management of virtual PC images to enable key enterprise scenarios, primarily resolving application compatibility with a new version of Windows. [1,2]

- **Microsoft Advanced Group Policy Management (AGPM)** enhances governance and control over Group Policy through robust change management, versioning, and role-based administration.

- **Microsoft Asset Inventory Service (AIS)** is a hosted service that collects software inventory data and translates it into actionable business intelligence.

- **Microsoft Diagnostics and Recovery Toolset (DaRT)** reduces downtime by accelerating troubleshooting, repair, and data recovery of unbootable Windows-based desktops.

- **Microsoft System Center Desktop Error Monitoring (DEM)** provides insights into application and operating system failures, allowing helpdesk to be more proactive in managing PC problems, without installing an agent to the endpoint.

**Notes:**

1. MED-V 1.0 SP1 with support for Windows7 (32bit and 64bit) will be available in the first quarter 2010
2. MED-V 1.0 SP1 will rely on Virtual PC 2007 technology, and will not require hardware-assisted virtualisation (e.g. Intel VT, AMD-V)

# 4. Desktop Deployment Project Dependencies

## 4.1 Overview

In this whiter paper, we have focused on the deployment of Windows 7 Enterprise.

There are a number of interdependent tasks that must be part of the deployment plan. For each of the tasks a suitable technology product has been identified.

Clients who have already adopted Microsoft System Center Configuration Manager (R2) can through the provision of an upgrade to Service Pack 2 benefit from the following:-

- Asset Inventory extensions for covering reports for Window 7 readiness
- Identify applications in use across their PC estate
- In-corporation of new Operating System Deployment Features to deploy Windows 7 based images
- Adoption of Windows Automated Installation Kit 2.0 (WAIK) that has Windows PE 3.0 support, USMTv4 for hard-link data migrations and new Image-X functionality

To prepare for any deployment of Windows 7 the following tasks must be completed:-

## 4.2 Asset Inventory

Determines the current hardware levels and applications within the organisation

For Clients with Microsoft System Center Configuration Manager environments then an upgrade to Service Pack 2 is a pre-requisite for Windows 7 readiness information and deployment options.

The older Microsoft Systems Management Server 2003 product can provide basic inventory information.

For clients who do not have this information available then the following scenarios need to be considered:-

- Will ConfigMgr be deployed to support Windows 7 deployment
- Implementation of Microsoft Assessment and Planning Toolkit (MAP)

MAP is a free download from Microsoft and can capture the readiness for Windows 7 and provide an analysis of the installed operating systems and applications within a client's infrastructure.
This product requires a Microsoft SQL database and performs an agent-less inventory of the computer estate using remote WMI calls to the identified devices, by IP-subnet for example.

The information returned from a MAP inventory is summarised in the following sections.

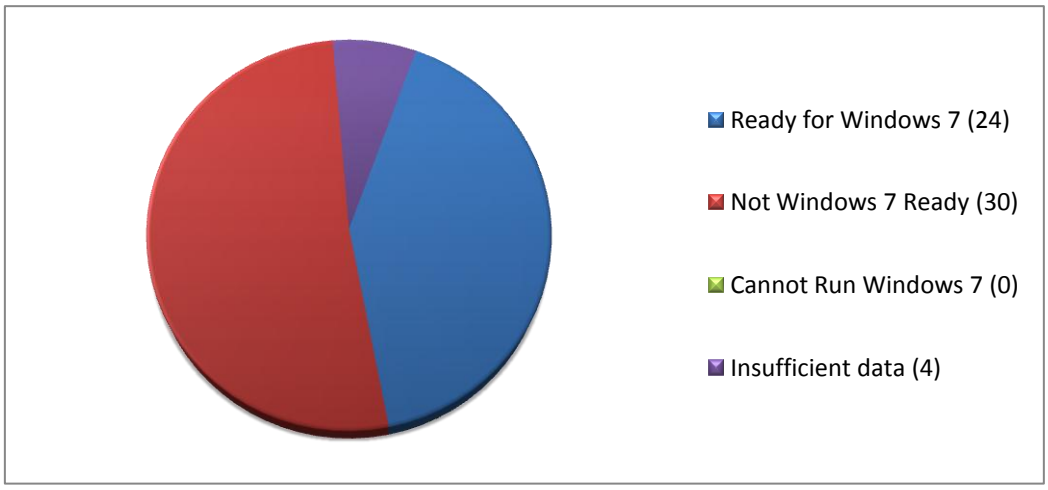
- Hardware Analysis
- Recommended Hardware Upgrades
- Software Analysis – Device Drivers
- Software Analysis – Operating Systems Installed
- Software Analysis – Discovered Applications

They show a typical output of the MAP inventory summary information about assessed computers on the network and provides details about whether these computers can run Windows 7 Enterprise.

### 4.2.1 Hardware Analysis

This section uses the term "ready for Windows 7" to describe a computer that meets the hardware requirements for Windows 7 Enterprise.

As part of the assessment, the MAP tool gathers information about the client operating systems that are already in use in the environment. Computers that are already running Windows Vista to Windows 7 Enterprise can normally be upgraded without difficulty. Client computers that are running earlier versions of Windows might require hardware upgrades before deploying to Windows 7.




**Client computer readiness for Windows 7 Enterprise**

### 4.2.2 Hardware Requirements

To run Windows 7 Enterprise, the client computer requires at least:

- 1 GHz 32-bit (x86) or 64-bit (x64) processor
- 1 GB of system memory (32-bit)/ 2 GB (64-bit)
- 16 GB available disk space (32-bit)/20 GB (64-bit)
- DirectX 9 graphics processor with WDDM 1.0 or higher driver

**Microsoft and User Defined Thresholds for MAP Analysis**

| Property | Microsoft Recommended x86 | Used in this Assessment x86 | Microsoft Recommended x64 | Used in this Assessment x64 |
|---|---|---|---|---|
| Processor (GHz) | 1 | 1 | 1 | 1 |
| Memory (MB) | 1024 | 1024 | 2048 | 2048 |
| Free Disk (GB) | 16 | 16 | 20 | 20 |
| Optical Drive | True | True | True | True |
| Video | True | True | True | True |
| Audio | True | True | True | True |

### Recommended Hardware Upgrades

The following table describes the number of computers and the type of upgrade that is recommended to make a computer ready for Windows 7 Enterprise. Because CPU upgrades are assumed to be too costly to be considered, they are excluded from this list.

**Count of Computer Hardware Upgrades Recommended**

| Recommended Hardware Upgrade | To Minimum | To Recommended |
|---|---|---|
| Increase System RAM | 9 | 42 |
| Increase Hard Disk Free Space | 19 | 35 |
| Upgrade Graphics Card | 0 | 3 |
| Upgrade Optical Drive | 20 | 18 |
| Add Audio Output Capability | 0 | 42 |
| Upgrade BIOS | 0 | 0 |

### 4.2.3 Software Analysis

The software analysis provides the following information:

- Summary of devices and how to obtain drivers for the devices discovered on client computers.
- Current client operating systems discovered during the assessment.
- Summary of the most prevalent software applications discovered on client computers during the assessment.

### 4.2.4 Device Driver Analysis

Computers require drivers to use hardware devices such as optical disk drives or network adapters. The assessment distinguishes between three categories of device drivers:

- Drivers that are included on the Windows 7 installation disks.
- Drivers available from Microsoft Update.
- Drivers that should be available from the device manufacturer.

The following table describes the number of devices and percentage of devices where the device driver is available through the specified source.

**Count of Device Drivers by Source**

| Source of Device Driver | Hardware Devices | Percentage |
|---|---|---|
| Included on the Windows 7 DVD | 407 | 99% |
| Available from Microsoft Update | 4 | 1% |
| Information available from manufacturer website | 3 | 1% |
| Contact the Device Manufacturer (unknown driver or incompatible) | 0 | 0% |
| Total | 411 | 100% |

### 4.2.5 Operating System Analysis

The following table shows an example of the client operating systems found within the environment and indicates the number of installations for each operating system.

**Operating Systems That the Assessment Found**

| Operating System Name and Version | Computer Count | Percentage |
|---|---|---|
| Insufficient Data | 4 | 7% |
| Microsoft Windows 7 Business | 1 | 2% |
| Microsoft Windows 7 Enterprise | 3 | 5% |
| Microsoft Windows XP Professional | 1 | 2% |
| Microsoft Windows XP Professional Service Pack 1 | 2 | 3% |
| Microsoft Windows XP Professional Service Pack 3 | 10 | 18% |
| Microsoft(R) Windows(R) XP Professional x64 Edition Service Pack 1 | 1 | 2% |
| Microsoft(R) Windows(R) XP Professional x64 Edition Service Pack 2 | 4 | 7% |
| Microsoft® Windows Vista™ Business | 2 | 3% |
| Microsoft® Windows Vista™ Business Service Pack 1 | 6 | 10% |
| Microsoft® Windows Vista™ Business Service Pack 2, v.286 | 2 | 3% |
| Microsoft® Windows Vista™ Enterprise | 7 | 12% |
| Microsoft® Windows Vista™ Enterprise Service Pack 1 | 6 | 10% |
| Microsoft® Windows Vista™ Enterprise Service Pack 2, v.286 | 2 | 3% |
| Microsoft® Windows Vista™ Ultimate | 2 | 3% |
| Microsoft® Windows Vista™ Ultimate Service Pack 1 | 3 | 5% |
| Microsoft® Windows Vista™ Ultimate Service Pack 2, v.286 | 2 | 3% |
| Total | 58 | 100% |

### 4.2.6 Application Summary

The following table provides an example of a MAP analysis of installed applications for the most prevalent software installed on the client computers in reality this will be a much more extensive list.

**Prevalent Software Installed on the Network**

| Name | Version | Installations |
|---|---|---|
| Microsoft SQL Server 2008 Database Engine Services | 10.0.1600.22 | 46 |
| Microsoft SQL Server 2008 Common Files | 10.0.1600.22 | 38 |
| Microsoft SQL Server 2008 Database Engine Shared | 10.0.1600.22 | 34 |
| Microsoft SQL Server 2008 Management Studio | 10.0.1600.22 | 32 |
| Microsoft Office Proofing (English) 2007 | 12.0.4518.1014 | 29 |
| Microsoft SQL Server 2008 Client Tools | 10.0.1600.22 | 26 |
| Microsoft .NET Framework 3.5 SP1 | 3.5.30729 | 25 |
| Microsoft Save as PDF or XPS Add-in for 2007 Microsoft Office programs | 12.0.4518.1014 | 24 |
| Microsoft Office Shared Setup Metadata MUI (English) 2007 | 12.0.4518.1014 | 19 |
| Microsoft Office Shared MUI (English) 2007 | 12.0.4518.1014 | 18 |
| Microsoft Office Proof (English) 2007 | 12.0.4518.1014 | 18 |
| Microsoft Office Proof (French) 2007 | 12.0.4518.1014 | 18 |
| Microsoft Office Proof (Spanish) 2007 | 12.0.4518.1014 | 18 |

## 4.3 Application Compatibility Testing

Once information is available on the installed application base, application compatibility testing with Windows 7 will need to be carried out.

For clients with an extensive application base i.e. many hundreds of applications, then it may be necessary to use tools such as the Microsoft Application Compatibility Toolkit (ACT) to provide further analysis of the installed applications and their compatibility status with Windows 7.

This tool is a free download from Microsoft and provides the following capabilities:-

- SQL based repository for capturing installed application information
- MMC based Workbench for reporting application compatibility status, issue reporting and status monitoring during the application test phase
- Link to Microsoft ACT exchange database for gathering information provided by software vendors or other ACT community users who have uploaded information to the exchange database

Applications that will not run under Windows 7 will need to have a strategy formulated:-

- Upgrade to a version that is compatible
- Investigate use of XP Mode or Application Virtualisation to provide compatibility
- Identify a replacement product that works under Windows 7

## 4.4 Application Deployment

When the application compatibility status has been identified this will help formulate how applications are to be deployed within the enterprise and may take the form of:-

- Software Packages available as part of Microsoft System Center Configuration Manager deployment
- Software Packages that will be delivered as part of any Application Virtualisation strategy
- Software Packages added to the Windows 7 master image

For clients with ConfigMgr already deployed then software packages may have already been created for automated deployment. In many cases, provided that the packages install silently without user interaction, then they can easily be incorporated into a software installation task sequence as part of the operating system deployment.

Windows 7 requires a new OS to be laid down on an existing PC[1], therefore application re-installation is an essential part of the deployment project.

**Notes:**

1. There is no upgrade path from Windows XP to windows 7, upgrades from windows Vista to windows 7 are supported, but not recommended

## 4.5 Windows 7 OS Deployment

It is envisaged that two Microsoft based tools will be the primary deployment systems used to install Windows 7, these are:-

- Microsoft System Center Configuration Manager (ConfigMgr) with SP2 (R2)
- Microsoft Deployment Toolkit (MDT) 2010

For clients running ConfigMgr 2007 RTM or SP1, then it is a pre-requisite to upgrade to SP2 which enhances the Operating System Deployment (OSD) to support Windows 7 deployments.

Obviously this SP2 upgrade would need to be planned as part of the overall Window 7 deployment, so sufficient time will need to be allowed for this stage and will be dependant on the size of the ConfigMgr deployment and whether OSD features are currently being used.

Microsoft Deployment Toolkit (MDT) 2010 is the next version of the Microsoft Solution Accelerator for operating system and application deployment. It replaces Business Desktop Deployment (BDD 2007) and MDT 2008 for the deployment of Windows 7.

MDT provides comprehensive guidance and tools to optimise the deployment of desktops running Windows 7 Enterprise. The desktop deployment tools that MDT provides are suitable for small to large organisations. Smaller organisations might use the Lite Touch Installation (LTI) method, whereas large organisations that use software distribution tools (Microsoft System Center Configuration Manager 2007) might choose the Zero Touch Installation (ZTI) method. (Please see later table for comparison of features between LTI and ZTI)

There are however some important caveats for MDT 2010:-

- The new Workbench features only apply when used in LTI configurations
- Systems Management Server 2003 is no longer supported for ZTI configurations
- Although MDT 2010 can update earlier versions this is not supported by Microsoft

The deployment solutions that we are likely to have to support are therefore:-

- Windows Deployment Services (WDS) as both MDT 2010 and ConfigMgr 2007 have dependencies on this service.
- System Center Configuration Manager 2007 SP2 (2) - OSD
- New MDT 2010 installations using LTI methods
- New MDT 2010 installations using ZTI integration with System Center Configuration Manager 2007 with SP2

The last option only provides additional scripting capabilities within ConfigMgr and may not be necessary in most cases as Windows 7 can be deployed using native ConfigMgr 2007 SP2 OS deployment features.

It is important to understand some of the key technologies introduced with MDT 2010 and ConfigMgr 2007 with SP2 OSD rely on the Windows Automated Installation Kit (WAIK) 2.0.

- **Support for Windows User State Migration Toolkit (USMT) version 4.0**

  USMT 4.0 is required to support Windows 7 deployments. Specifically, the following new features of USMT 4.0 are supported in LTI deployments and ConfigMgr task sequences

- **Support for USMT 4.0 hard-link migration.** USMT 4.0 includes a new method of saving user state called *hard-link migration*. Hard-link migration creates a snapshot of current user data files before reinstallation, which keeps data in the same location on the disk while upgrading the system and rebuilds the links after Windows 7 is installed. Hard-link migration dramatically reduces the time required to migrate user state, because the data is never moved, which is faster than copying user data to another disk.
- **Support for USMT 4.0 shadow copy.** USMT 4.0 supports the ability to archive files that are in use by using the shadow copy feature in Windows 7 and Windows Server 2008 R2.
- **Support for the Deployment Image Servicing and Management (DISM) tool.** The new DISM tool (Dism.exe) allows for servicing offline images, mounting and un-mounting WIM files, and customising Windows Preinstallation Environment (Windows PE) boot images. The DISM tool replaces many of the tools in previous versions of the Windows AIK, including Package Manager (Pkgmgr.exe), the International Settings Configuration Tool (Intlcfg.exe), and the Windows PE command-line tool (PEimg.exe).
- **Support for Windows PE version 3.0.** Windows PE 3.0 is included as a part of the Windows AIK version 2.0 and is required to deploy Windows 7 using MDT 2010 and ConfigMgr 2007

Probably the most significant advance is the USMT 4.0 hard-link migration tool as this will reduce considerably the time to capture and restore local data on machines being refreshed.

Microsoft testing against similar USMT migrations with Windows Vista has seen reductions from 2-3 hours per machine to sub 1 hour for Windows 7 deployments using USTM 4.0 in a machine refresh deployment.

**Please note**: USMT 4.0 supports XP Professional as a scan target but not a load target, so therefore it cannot be used in an XP to XP refresh scenario.

### 4.5.1 Comparison of LTI and ZTI Deployments

| LTI deployment | ZTI deployment |
|---|---|
| Allows selection of the level of automation | Supports only fully automated deployments |
| Has minimal infrastructure requirements (SQL / WDS) | Requires System Center Configuration Manager 2007 with SP2 |
| Supports deployments over a network using a shared folder or locally using removable storage such as a CD, DVD, or UFD | Supports deployments only from System Center Configuration Manager distribution points and OSD media (DVD / USB) |
| The deployment process can be initiated manually or automatically using Windows Deployment Services | The installation process can be initiated by System Center Configuration Manager or Windows Deployment Services |
| The deployment process is configured using the Deployment Workbench | The deployment process is configured using the Configuration Manager Console |
| Can require less initial information technology (IT) administration configuration time | Requires more initial IT administration configuration time |
| Can require interaction by the user or deployment technician | Requires no interaction by the user or deployment technician |
| Increases the risk of introducing configuration errors | Reduces the risk of introducing configuration errors |
| Requires users or deployment technicians to have credentials with elevated permissions | Users and deployment technicians are not required to have credentials with elevated permissions |
| Requires that users or deployment technicians know some configuration settings prior to initiating the MDT 2010 deployment process | Users and deployment technicians do not need to know configuration settings prior to initiating the MDT 2010 deployment process |
| Can be used with slow connections or in instances where no network connectivity exists | Requires a high-speed, persistent connection |
| Requires limited infrastructure to support deployment | Requires an infrastructure sufficient to deploy operating system images |
| Supports deployment over the network or local to the computer from media | Supports only network deployments |
| Does not require management of target computers using System Center Configuration Manager | Requires that target computers be managed using System Center Configuration Manager |
| Supports security policies in which automatic software installation is prohibited | Supports only security in which automatic software installation is allowed |
| Supports deployment to target computers isolated by firewalls | Requires remote procedure call (RPC) communication with target computers |

# 5. Appendix- A **Windows 7 Enterprise Features**

Clients who use Windows 7 Enterprise can take advantage of the following features that are not available in Windows 7 Professional:

- DirectAccess
- BranchCache
- Enterprise Search Scopes
- BitLocker and BitLocker To Go
- AppLocker
- Virtual Desktop Infrastructure (VDI) optimisations
- Multi Lingual User Interface.

### 5.1.1 DirectAccess

DirectAccess in Windows 7 enhances the productivity of mobile workers by connecting them seamlessly and more securely to their corporate network any time they have Internet access—without the need to VPN. When IT enables DirectAccess, the whole corporate network file shares, intranet Web sites, and line-of-business applications can remain accessible wherever you have an Internet connection.

In addition, DirectAccess helps IT manage remote computers more effectively. Without DirectAccess, IT administrators can only manage mobile computers when users connect to a VPN or physically enter the office. With DirectAccess, IT administrators can manage mobile computers by updating Group Policy settings and distributing software updates any time the mobile computer has Internet connectivity, even if the user is not logged on. This flexibility gives IT the opportunity to service remote computers on a regular basis and ensures that mobile users stay up-to-date with company policies.

### 5.1.2 BranchCache

In Windows 7, BranchCache helps increase network responsiveness of applications, giving users in remote offices an experience more like working in the head office. When they access content stored on Windows Server 2008 R2, users in a branch office need not wait as long to download files from headquarters. When IT enables BranchCache, a copy of data accessed from an intranet Web site or a file server is cached locally within the branch office. When another user on the same network requests the file, the user can access the content almost immediately because it is downloaded from the local cache rather than over a limited bandwidth connection back to headquarters. BranchCache only serves content to users who have the right permissions and always checks to make sure it delivers the latest version of the file.

BranchCache can operate in one of two modes:

**Hosted Cache mode**. A server in the branch running Windows Server 2008 R2 hosts the cached files.

**Distributed Cache mode**. A branch server is not required, because copies of files are directly cached on computers in the branch and sent to other Windows 7–based clients as needed.

BranchCache supports common protocols for Web content and file servers enabling it to work with a wide variety of application types. BranchCache only retrieves data from headquarters when the user requests it. Because it is a passive cache, it decreases bandwidth utilisation between headquarters and the branch. BranchCache only caches read requests, so it never interferes with a user saving a file. Finally, it works seamlessly with network security technologies, including SSL, SMB Signing, and IPsec to improve application performance even if the content is encrypted.

### 5.1.3 Enterprise Search Scopes

Enterprise users need to access data from a variety of sources in their daily tasks. With Windows Vista, Microsoft introduced advanced desktop search technology, enabling users to find information on their computers instantly. Microsoft Office SharePoint® Server 2007 and the Enterprise Search family of products deliver highly secure, manageable, server-based search. Windows 7 combines these experiences to provide an improved and seamless search experience across local and networked corporate data directly within Windows Explorer.

Benefits of Enterprise Search Scopes include:

- **Find and organise information intuitively**. Advancements to Windows 7 help users quickly find what they are looking for. Recommendations based on recent searches help narrow results. Libraries provide a single view for accessing documents, presentations, or any type of file that might be located in different folders, on different hard drives, or even on different computers. Windows 7 creates default Libraries for such items as Documents and Pictures, but you can also create custom Libraries, for example to provide one entry point under which to organise, access, and search files spread across multiple locations.
- **Search multiple locations from a single interface with Search Federation**. Windows 7 enables users to search remote document repositories, SharePoint sites, and Web applications through the familiar Windows interface. Windows 7 Search Federation uses an existing public standard called OpenSearch. Users can select which sites are available for searching, or IT can populate the list using Group Policy. Federated search results are presented in Windows Explorer much like local files, with rich views, file details, and previews.
- **Flexible search scopes**. Making it easy to discover and search intranet sites can help organisations maximise their return on these investments. With Windows 7, IT administrators can populate links on the Start menu or in Windows Explorer. These links simplify access to the most appropriate, complete, authoritative data sources on the network, which makes content on intranet portals easier to discover and access.

### 5.1.4 BitLocker and BitLocker To Go

With the continued growth of the mobile workforce, protecting sensitive data on mobile computers remains a major concern of IT decision makers. With Windows Vista, Microsoft introduced BitLocker™ Drive Encryption to help protect sensitive data from being accessed by unauthorised users who come into possession of lost, stolen, or improperly decommissioned computers.

Windows 7 Enterprise makes the original functionality even easier to use and also introduces BitLocker To Go, which extends BitLocker protection to USB storage devices. In contrast to lost or stolen laptops, misplaced USB drives often go unreported—or even unnoticed. Yet prohibiting the use of USB storage devices is often impractical because employees have valid business reasons to store data on removable devices.

BitLocker To Go lets IT administrators set a policy that requires users to apply BitLocker protection to removable drives before they can write to them, enables the drives to be restricted with a passphrase, and lets IT control passphrase length and complexity.

### 5.1.5 AppLocker

Users who run unauthorised software can experience a higher incidence of malware infections, generate more help desk calls, and undermine efforts to standardise corporate desktops. With the vast number of applications available on the Web, IT pros need sophisticated tools to ensure that user desktops run only approved, licensed software.

Windows 7 offers new application control policies with AppLocker, a mechanism that enables IT pros to specify exactly what is allowed to run on user desktops. AppLocker restricts unauthorised software while allowing the applications, installation programs, and scripts that users need. With this capability, IT can realise the security, operational, and compliance benefits of application standardisation.

AppLocker provides simple, powerful, rule-based structures that are centrally managed using Group Policy. It introduces "publisher rules" that are based on an application's digital signature, making it possible to build strong rules that account for application updates. By crafting correctly structured rules, IT pros can safely deploy updates without having to build a new rule for each version update.

### 5.1.6 Virtual Desktop Infrastructure (VDI) Optimisations

Delivering desktop functionality using virtual machines hosted on servers—a solution known as Virtual Desktop Infrastructure (VDI)—is an emerging model for desktop deployment that enables users to access their desktops remotely, thereby centralising data, applications, and operating systems. Windows 7 delivers the latest enhancements to VDI to provide a richer user experience and easier management for IT.

VDI in Windows 7 gives users an experience that is closer to using a local computer. Features include support for:

- Use of the Windows Aero® interface.
- Video viewing in Windows Media Player 11.
- Multiple-monitor configurations.
- New microphone support that enables remote desktops running Windows 7 Enterprise to provide voice over IP (VoIP) and speech recognition functionality.
- Easy Print technology so that users can print to local printers.

With Windows 7, IT pros can use the same rich management tools and processes to manage both native WIM-based system images and Windows 7–based virtual machine images (VHDs). This enables offline servicing of VHD files to add, remove, and enumerate software updates, language packs, drivers, and other components of the operating system image.

**Note** Using Windows for VDI scenarios requires the Windows Virtual Enterprise Centralised Desktop (VECD) license.