

Infrastructure Planning and Design

Windows® User State Virtualization

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# The Planning and Design Series Approach

This guide is one in a series of planning and design guides that clarify and streamline the planning and design process for Microsoft® infrastructure technologies.

Each guide in the series addresses a unique infrastructure technology or scenario. These guides include the following topics:

* Defining the technical decision flow (flow chart) through the planning process.
* Describing the decisions to be made and the commonly available options to consider in making the decisions.
* Relating the decisions and options to the business in terms of cost, complexity, and other characteristics.
* Framing the decision in terms of additional questions to the business to ensure a comprehensive understanding of the appropriate business landscape.

The guides in this series are intended to complement and augment the product documentation.

## Benefits of Using This Guide

Using this guide will help an organization to plan the best architecture for the business and to deliver the most cost-effective user state virtualization technology.

Benefits for Business Stakeholders/Decision Makers:

* Most cost-effective design solution for an implementation. Infrastructure Planning and Design (IPD) guides help eliminate over-architecting and overspending by precisely matching the technology solution to the business needs.
* Alignment between the business and IT from the beginning of the design process to the end.

Benefits for Infrastructure Stakeholders/Decision Makers:

* Authoritative guidance. Microsoft is the best source for guidance about the design of Microsoft products.
* Business validation questions to ensure the solution meets the requirements of both business and infrastructure stakeholders.
* High integrity design criteria that includes product limitations.
* Fault-tolerant infrastructure, where necessary.
* Proportionate system and network availability to meet business requirements. Infrastructure that is sized appropriately to meet business requirements.

**Benefits for** Consultants or Partners:

* Rapid readiness for consulting engagements.
* Planning and design template to standardize design and peer reviews.
* A “leave-behind” for pre- and post-sales visits to customer sites.
* General classroom instruction/preparation.

Benefits for the Entire Organization:

Using this guide should result in a design that will be sized, configured, and appropriately placed to deliver a solution for achieving stated business requirements, while considering the performance, capacity, manageability, and fault tolerance of the system.

# **Introduction to** the **Windows User State Virtualization** Guide

IT departments must protect and manage their organizations’ data while providing users with increased flexibility and ease of access. For example, IT must ensure that business data on users’ devices is securely stored while accommodating users’ requests to work when they aredisconnected from the organization’s network. The challenge for IT professionals is to find the right balance between centralized management of business-critical data and an optimal user experience.

Windows® *user state virtualization (USV)* is a collection of Microsoft technologies that enables synchronization of user state information from individual computers to a central location. Centralized management and storage of user state is desirable because it provides users with mobility and flexibility while helping IT departments manage costs and compliance.

Developing a USV strategy requires consideration of numerous factors, including mixed environments of different operating system versions, different applications and platform architectures, security concerns, backup considerations, network bandwidth, and different user needs.

This Solution Accelerator guide describes a scenario assessment process that helps IT pros understand their USV requirements and map them to appropriate USV technologies. It also explains real-world caveats and considerations that might apply so IT pros can develop realistic strategies for their organizations.

This guide focuses on the following three Windows USV technologies:

* Folder Redirection (FR)
* Offline Files (OF)
* Roaming User Profiles (RUP)

## Assumptions

To limit the scope of material in this guide, the following assumptions have been made:

* The reader has basic familiarity with the core Windows technologies of Folder Redirection, Offline Files, and Roaming User Profiles. This guide does not attempt to educate the reader on the features and capabilities of these or other Microsoft technologies other than to describe the basic terminology used to explain these technologies and to summarize their capabilities and benefits. For detailed information about how these technologies work and how to implement them, see the documentation for each technology on Microsoft TechNet. See also Chapter 15, “Managing Users and User Data,” of the *Windows 7 Resource Kit* (Microsoft Press, 2010) for an integrated overview of these technologies.
* All content in this guide refers to Windows 7 unless Windows XP and Windows Vista® are explicitly called out. See Appendix A, “Advances in Windows USV Technologies,” for a comparison of how USV technologies have evolved through versions of the Windows client operating system.

## Windows User State

The term *user state* refers to the collection of data and settings that pertain to each user. Examples of *user data* are documents, pictures, videos, and music. *User settings* include identity information as well as application and operating system configuration settings that personalize the Windows desktop, such as network drive mappings, printer connections, and wallpaper settings.

## User Profiles

Windows user state information resides in and is implemented as user profiles. A *user profile* consists of a standard set of folders that contain user data files, desktop personalization files, application settings files, and registry information (the user’s HKEY\_CURRENT\_USER, or HKCU, registry hive) that together influence users’ experiences when they log on and access their desktop.

A user profile can be either a *local profile* (stored on the hard drive of the user’s computer) or a *network profile* (stored on a shared folder on a network file server). The *default user profile* is a special user profile that is configured for every new user who logs onto a computer. The default profile can be either a local or network profile and contains the settings and configurations that a new user will encounter when they first log on to their computer.

### Roaming Profiles

Network profiles can be used to allow users to *roam* between different computers on the network and access their personalized desktop. Such profiles are known as *roaming user profiles*. There are also two variations on roaming user profiles: *mandatory profiles* and *super-mandatory profiles*. A *mandatory profile* is a roaming profile that is read-only. Users who have mandatory profiles can make changes to their desktop but these changes are discarded when they log off, thereby providing a consistent experience to every user session. Super-mandatory profiles are the same as mandatory profiles except that users cannot log on when the server that stores the mandatory profile is unavailable.

## User State Virtualization

The following figure illustrates the parts of Windows user state that are stored locally, and the parts that can be centrally stored and managed by using Windows USV technologies.



 Figure 1. Locally stored and Centrally stored/managed user state

**\***   The default user profile can be local, but it can also be stored in the NETLOGON share on a domain controller.

## Benefits of USV

By centralizing the storage of user state that typically resides on users’ computers, USV simplifies backup and management of business-critical data; when the central storage is backed up, the user state that was synchronized from users’ computers is also backed up. Centralized management of user state also yields the following benefits:

* **The ability to work from different computers*.*** Centralized data and settings can be synchronized and cached locally across different computers, thereby providing users with flexibility and mobility options that can help them be more productive.
* **The ability to work when disconnected from the organization’s network.** USV technologies automatically and seamlessly cache local updates to user data and settings so as to synchronize them with the central store when network connectivity is reestablished.
* **Faster and simpler user migration.** USV technologies enable the dynamic composition of user state on new computers over the network and thereby simplify migration.
* **Recovery from disaster scenarios and when hard disks fail or computers are lost or stolen.** Centralized data and settings that are regularly backed up can be automatically restored to new hard disks when the user logs in, thereby reducing the time required for organizations and users to become productive again.

## Windows USV Technologies

USV works by decoupling user data and settings—user profile information—from personal computers and making it available to users from any managed computers on the network. To accomplish this decoupling, a USV strategy can combine the use of the following three Windows technology components: Folder Redirection, Offline Files, and Roaming User Profiles.

### Folder Redirection

Folder Redirection (FR) enables specific folders within user profiles to be redirected to locations on network servers. Windows 7 supports the redirection of the following 13 folders found within user profiles: AppData\Roaming, Desktop, Start Menu, Documents, Pictures, Music, Videos, Favorites, Contacts, Downloads, Links, Searches, and Saved Games. These folders are referred to as *known folders*.

FR replicates file–based information and is configured using Group Policy. Different settings can be applied to different organizational units (OUs) in Active Directory® Domain Services (AD DS) to create customized solutions. FR can also be used to significantly reduce the size of roaming user profiles, which results in faster logon/logoff times.

### Offline Files

Offline Files (OF) provides users with the ability to work with local copies of files that are stored in shared folders on network servers, even when they don’t have network connectivity. Any changes to these local files are then automatically synchronized with the server when network connectivity is reestablished.

OF also helps maintain user productivity at branch offices when WAN links become congested or unavailable. Users’ perception of latency is reduced because users work on locally cached copies and do not need highly available network connectivity.

OF is enabled by default in Windows 7 Professional, Enterprise, and Ultimate editions.

**Note**Synchronization back to network servers requires connectivity. In deploying OF, IT assumes a risk that some clients may not reconnect, and therefore data on the local cache may never be synchronized with the network server. Additionally, merge conflicts may occur during the synchronization process if both the client and server copy of data was independently modified.

### Roaming User Profiles

Roaming User Profiles (RUP) enables user profiles to be stored in a folder shared from a network server and then downloaded to the user’s computer whenever the user logs on using their domain credentials. After the profile has been downloaded and applied to the user’s computer, the user will see his personalized desktop with all its application settings and operating system preferences, such as network drive mappings, printer connections, and wallpaper selections. When the user logs off, any updated profile information is uploaded to the network server. RUP thus replicates user profiles that contain both user data files and user settings (registry–based information) to the server, and synchronizes it to users’ computers. RUP enables users to log on to any managed computer on the network and download their profiles to experience their personalized desktop environments.

# IPD in Microsoft Operations Framework 4.0

Microsoft Operations Framework (MOF) offers integrated best practices, principles, and activities to assist an organization in achieving reliable solutions and services. MOF provides guidance to help individuals and organizations create, operate, and support technology services, while helping to ensure the investment in technology delivers expected business value at an acceptable level of risk. MOF’s question-based guidance helps to determine what is needed for an organization now, as well as providing activities that will keep the organization running efficiently and effectively in the future.

Use MOF together with this IPD guide to ensure that people and process considerations are addressed as you design and plan a USV strategy for the organization. Specifically:

* Use the Plan Phase to maintain focus on meeting business needs, consider business requirements and constraints, and align business strategy with the technology strategy. IPD helps to define an architecture that delivers the right solution as determined in the Plan Phase.
* Use the Deliver Phase to build solutions and deploy updated technology. In this phase, IPD helps IT pros design their technology infrastructures.
* Use the Operate Phase to plan for operations, service monitoring and control, as well as troubleshooting. The appropriate infrastructure, built with the help of IPD guides, can increase the efficiency and effectiveness of operating activities.
* Use the Manage Layer to work effectively and efficiently to make decisions that are in compliance with management objectives. The full value of sound architectural practices embodied in IPD will help deliver value to the top levels of a business.



Figure 2. The architecture of Microsoft Operations Framework (MOF) 4.0

# Windows User State Virtualization Technology Evaluation Process

This guide presents a systematic approach to identifying the user and IT needs of the organization in order to design and plan a suitable user state virtualization strategy.

## Decision Flow

Assessing the requirements of the business is key to planning the right USV strategy. The steps of this guide walk the reader through common user and IT requirements that are prevalent in most organizations. Each step contains job aids in the form of checklists that can be used to keep track of the requirements that are relevant to the organization. These requirements can then be given to IT infrastructure designers to assist in the USV planning process.



Figure 3. Windows USV technology evaluation process decision flow

## Steps

This document contains five steps designed to guide the reader through the user/IT requirements and real-world scenarios that influence planning a USV solution:

Step 1: Assess User Data Requirements

Step 2: Assess User Settings Requirements

Step 3: Evaluate Compatibility Considerations

Step 4: Evaluate Different Usage Scenario Considerations

Step 5: Evaluate Infrastructure and Manageability Requirements

## How to Use This Document

The steps presented in this guide are not sequential and can be performed in any order, but all should be completed to obtain the fullest picture of the suitability and importance of the various technologies.

Within each step, each topic is subdivided into three areas:

* Definition of the topic.
* Impact of the topic on USV solution.
* A comparison of the functionality available between the USV technologies.

Additional context may also be included to help the decision maker evaluate the impact associated with the decision. For each step, technical decision makers should perform the following actions in the order given:

1. Read the introduction to the step for a list of the topics covered within the section.
2. For each topic in the step, read the description of the topic and its function in the business.
3. If the topic is relevant to the organization, use the **Select** column in the table provided within the section to select the related check box.

### Use of Subjective Analysis in This Guide

Subjective analysis involves the study and examination of real world deployments. The guidance presented within this IPD guide leverages subjective analysis from mid- to large-sized IT deployments of USV technologies in addition to interviews with subject matter experts who have worked with these technologies first-hand. Therefore, the guidance in this IPD guide is generalized in nature and it should not be assumed that the guidance it presents and the scenarios it describes will directly match the needs of all organizations.

**Note**Guidance herein is based on subjective analysis as defined in this section. Further, any references to *subjective analysis* in this guide also refer to the concept described in this section.

## Out of Scope

This guide does not focus on tangential technologies such as Microsoft Exchange Server, SharePoint® products and technologies, and older Windows technologies like Home folders that could also be used to virtualize user state information. The concept of *Credential Roaming*, which uses Active Directory instead of a file server to roam user credentials and certificates, is also out of scope for this guide.

IT can also use such Windows technologies as Group Policy objects (GPOs) and logon scripts to configure the desktop experience. Because these technologies do not intrinsically support synchronization to a central server and across multiple end-user computers, they are out of scope for this guide.

# **Step 1: Assess User Data Requirements**

This step addresses virtualization of the user data aspects of Windows user state. In this step the reader will identify which portions of user data are important to the business, discover technology limitations, and identify real world considerations that apply to the organization.

User data pertains to files that are specific to users in the organization. Users may store data within, or outside their user profile, if they have access to do so. The core USV technologies Folder Redirection (FR) and Roaming User Profiles (RUP) only enable virtualization of user data that is stored within the user profile.

FR and RUP are inherently different in the way they virtualize user data, and each technology has its pros and cons. This step identifies user data components that can be virtualized using these technologies and also provides real-world considerations that influence the choice of technology. As noted earlier, FR works with 13 predefined folders, referred to as *known folders*, within a user profile. *Custom folders* are additional folders created by users or applications at the root of a user profile.

Although both FR (typically used together with OF) and RUP can be used to virtualize user data, subjective analysis reveals that FR and OF are most suitable for virtualizing known folders whereas only RUP can virtualize custom folders.

**Note**   Use Offline Files if users need access to user data when disconnected from the corporate network (for example, when traveling or during network outages). Offline Files makes it possible to work with local copies of documents that are stored on network servers.

The following table lists user state components in known folders. Select the relevant check box if the situation applies. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

Table 1. User State Components for Known Folders

| Select | User state component | **FR & OF** | **RUP** |
| --- | --- | --- | --- |
| ☐ | Desktop |  |  |
| ☐ | Downloads |  |  |
| ☐ | Favorites\* |  |  |
| ☐ | Links |  |  |
| ☐ | My Documents |  |  |
| ☐ | My Music |  |  |
| ☐ | My Pictures |  |  |
| ☐ | My Videos |  |  |
| ☐ | Saved Games |  |  |
| ☐ | Contacts |  |  |
| ☐ | Searches |  |  |
| ☐ | User data and settings stored within the AppData\Roaming folder (\* see table 2) |  |  |
| ☐ | Internet Explorer favorites |  |  |
| ☐ | Custom folders inside the profile | Not applicable |  |
| ☐ | User data outside the profile | Not applicable | Not applicable |

\*   The Favorites folder within the user profile also contains Internet Explorer® favorites.

The following table lists common operating system settings and data stored in AppData\Roaming that may be relevant to the business. See the “AppData\Roaming Considerations” section later in this step for a list of real-world considerations to keep in mind when virtualizing this known folder. Select each user setting component that is relevant to the business and that should be virtualized. Subjective analysis shows that RUP should be used together with FR and OF if the data and settings stored in the AppData\Roaming folder need to be virtualized. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

Table 2. Common Operating System Settings and Data Stored in the AppData\Roaming Folder

|  |  |  |  |
| --- | --- | --- | --- |
| Select | User state component | **FR & OF** | **RUP** |
| ☐ | Start Menu  |  |  |
| ☐ | Cookies |  |  |
| ☐ | Recent Items |  |  |
| ☐ | Libraries |  |  |
| ☐ | Network Shortcuts |  |  |
| ☐ | Printer Shortcuts |  |  |
| ☐ | SendTo |  |  |
| ☐ | Templates |  |  |
| ☐ | Themes |  |  |

Key considerations that affect choice of USV technology to meet the organization’s requirements for virtualizing user data include:

* Logon and logoff time considerations.
* Concurrent logon considerations.
* Performance considerations.
* AppData\Roaming considerations.

For each remaining topic in this step, select the appropriate check boxes in the table at the end of each topic to indicate whether the consideration is relevant to the organization.

## Logon and Logoff Time Considerations

USV technologies replicate user data between client and server computers. Therefore, the amount of time it takes for users to log on and log off will vary according to the amount of data being replicated, whether it is the first time a user logs on, and the speed of the network.

Select the “Logon and logoff time” consideration in the following table if it is relevant to the business. For example, it may be unacceptable to some business units if their logon and logoff processes slow down. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

Table 3. Minimal Logon and Logoff Time

|  |  |  |  |
| --- | --- | --- | --- |
| Select | Topic | **FR & OF** | **RUP** |
| ☐ | Logon and logoff time |  |  |

This section provides additional information about logon and logoff times when using each of these technologies.

Folder Redirection and Offline Files.FR redirects user data folders from local computers to network file servers. The following concepts are relevant to FR and OF with respect to logon and logoff times.

* FR will not slow down logon and logoff.
* First logon performance can be slow on Windows Vista and earlier versions of Windows when FR has been implemented.

Roaming User Profiles. RUP triggers the process of synchronizing user settings and data from the profile server to the local computer during logon, and from the local computer to the profile server during logoff. The following concepts are relevant to RUP with respect to logon and logoff time:

* RUP will slow logon and logoff relative to the amount of the data being synchronized and network characteristics. RUP is not well suited to synchronize large amounts of data. This is especially true for the first-time logon experience. When users log on to a computer for the first time, all user data will need to be synchronized to the computer for the logon process to complete. Updates to the roaming user profile will be synchronized back to the server only during logoff.
* Profile caching, which is turned on by default, can mitigate slow logon and logoff by storing a copy of the user settings and data on the local computer. Any changes on the profile server will be synchronized during logon and changes on the local computer will be synchronized during logoff.
* RUP supports background synchronization of user state in the registry to the profile server while the user is logged on.

### Notes from the Field – Excluding User Data Folders

Users’ music, videos, and pictures folders tend to be large in size. Determine if such data is important to the business and needs to be centrally stored. If such data is not business-critical, exclude these folders from user state virtualization. Doing so will reduce load on server storage and network. The following methods can be used to exclude folders from user state virtualization:

* If FR is also being used and the folder is a known folder, do not redirect the folder.
* If RUP is being used, configure the **Exclude directories in roaming profile** Group Policy setting.
* Because FR will redirect all subsequent references to the data to the network server, using FR in conjunction with RUP should reduce logon and logoff time. Any network lag or loss of connectivity will directly impact application performance; consider using OF in conjunction with FR to mitigate these side effects.

**Note**   In Windows XP, it was not possible to redirect My Documents without also redirecting My Pictures, My Music, and My Videos.

## Concurrent Logon Considerations

The three USV technologies discussed in this guide have different functionality characteristics when users log on to different computers and maintain concurrent computing sessions.

Select the “Concurrent logons” consideration in the following table if it is relevant to the business. For example, users in the business unit may be logged on to more than one computer or to multiple remote desktop sessions at one time. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

Table 4. Use of Concurrent Logons

|  |  |  |  |
| --- | --- | --- | --- |
| Select | Topic | **FR & OF** | **RUP** |
| ☐ | Concurrent logons |  |  |

This section provides additional information about concurrent logons when using each of these technologies.

**Folder Redirection and Offline Files.** FR treats the folder on the remote file server as if it were local; it leverages the file system’s ability to lock the file when opened for creation or editing. If users attempt to open the same file concurrently for edit across different computers, they would see an error message that the file is already open for edit. The following consideration is relevant to FR and OF with respect to concurrent logons:

* When used in conjunction with OF, FR redirects access to the local offline cache. If a user were to update the same file on different computers in their respective offline caches, a merge conflict would appear upon synchronization with the remote file server. Sync Center would reveal these conflicts and give the user a choice to either keep both versions, or overwrite one with the other.

**Roaming User Profiles.** Roaming profiles are downloaded from the profile server when users log on and uploaded to the profile server at logoff. The following consideration is relevant to RUP with respect to concurrent logons:

* Windows user profiles are not designed to be multi-instanced. Unpredictable results may therefore occur when RUP is implemented and users are simultaneously logged on to multiple computers on the network. This is because RUP is a "last writer wins" technology. This means that if a user with a roaming user profile is logged on to two computers, the computer the user last logs off from will be the one whose settings the user will see the next time the user logs on.

## Performance Considerations

Large amounts of profile data that need to be synchronized across computers in the organization might lead to additional load on the supporting infrastructure such as file servers and the network, and an increase in the amount of time required for synchronization to complete. IT should evaluate the need to virtualize data repositories that are known for growing over time and determine the business value in doing so. For example, the business may not find value in virtualizing users’ Music and Videos folders.

Select the “Performance” consideration in the following table if it is relevant to the business. For example, the business may have minimum application response times that must be achieved. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

Table 5. Ensuring Performance

|  |  |  |  |
| --- | --- | --- | --- |
| Select | Topic | **FR & OF** | **RUP** |
| ☐ | Performance |  |  |

This section provides additional information about performance when using Windows USV technologies.

**Offline Files**.The following considerations are relevant to OF with respect to performance:

* OF, when used in conjunction with FR, can mitigate the impact of network lag and loss of connectivity. OF can leverage background synchronization to synchronize updates to files while the user is logged on.
* When FR is used in conjunction with OF, user data is cached on the local computer. OF enables the use of slow link mode, which detects changes in network bandwidth and latency, and automatically switches between accessing user data on the remote file server and the local cached copy of the user data.
* OF supports background synchronization, which allows synchronization of changes to locally cached data back to the file server while the user is logged on.

### Notes from the Field – Limiting Profile Size

Subjective analysis reveals the following guidelines about limiting the profile size:

* When FR is used to redirect known folders, use the File Services Resource Manager (FSRM) on the file server to enforce quotas instead of configuring the **Limit profile size** Group Policy setting because FSRM can send email to users to notify them when they are approaching their quota threshold.
* When RUP is used to roam settings in the HKCU hive of the registry, exercise caution in using the **Limit profile size** Group Policy setting to set the maximum size of a roaming user profile by using the Proquota.exe program. This program can be used to alert users when their user profile exceeds the predefined limit and, on Windows XP and Windows Vista, prevent users from logging off until the size of the profile has been reduced. Note that users who exceed their quota are likely to face a poor user experience because most users will not know how to reduce the size of their profile.
* Both RUP and OF synchronization engines degrade in performance as the number of files to be synchronized increases. If synchronization takes too long, look for settings or data that may be excluded from synchronization (for example, some organizations may not want to centralize storage of Web browser cookies). IT should consider disabling FR for such content and adding the path or file type to the RUP exclusion list.
* OF might experience problems when it synchronizes very large files (gigabytes) over slow or unreliable network connections because the full file must be transferred in order to update the client or server copy during a sync operation. Beginning with Windows Vista, most of the synchronization is performed in the background, which means these types of transient errors are generally unnoticed by the user.

## AppData\Roaming Considerations

The AppData\Roaming folder is a known folder in which user state information that is specific to applications and the operating system are manifested. Although AppData\Roaming is a known folder that can be virtualized either through the use of FR and OF or RUP, this known folder is unique in that over time it can increase both in size and in the number of files it contains. Prior to virtualizing user state within the AppData\Roaming folder, ensure that there is a valid business requirement to do so.

Select the “AppData\Roaming” consideration in the following table if it is relevant to the business. For example, users in the business unit may need access to all of their operating system personalizations and application customizations when they move between different computers on the network. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

**Table 6. AppData\Roaming**

|  |  |  |  |
| --- | --- | --- | --- |
| Select | Topic | **FR & OF** | **RUP** |
| ☐ | AppData\Roaming |  |  |

In addition to the performance considerations listed in this step, the following considerations also apply to the AppData\Roaming folder.

**Folder Redirection, Offline Files, and Roaming User Profiles.** The following considerations are relevant to FR, OF, and RUP with respect to virtualizing the AppData\Roaming folder:

* Some applications may store portions of user state in both the HKCU registry hive (manifested as the Ntuser.dat file at the root of the user’s profile) and the AppData\Roaming folder. As a result, if the AppData\Roaming folder is redirected using FR, the HKCU hive should also be roamed using RUP. Otherwise, unpredictable application behavior can result, including breaking of certain application features. Otherwise, only the file-based state for applications is roamed and not their registry-based state. The result of doing this can be unpredictable, including breaking application functionality.
* By default, RUP will synchronize only during logoff. If users habitually lock their computers, consider enabling the **Background upload of a roaming user profile's registry file while user is logged on** Group Policy setting. Note that this policy only applies to the HKCU registry hive; therefore, it is possible to get inconsistent state persisted to the server. This setting is typically used in Remote Desktop Services (RDS) environments where AppData\Roaming and the other known folders are redirected to a file server but not cached locally on the computer. In this configuration, the changes to AppData\Roaming go directly to the server, so more frequent synchronization of the registry file will actually help keep the server state more consistent.

### Notes from the Field – AppData\Roaming Considerations

Subjective analysis reveals the following guidelines about user state and data within the AppData\Roaming folder:

* Synchronization of large numbers of files (especially temporary files that change frequently) or large data files in the AppData\Roaming folder over high latency or low bandwidth network connections may result in poor application performance. In such situations, users may perceive that the application freezes or becomes unresponsive.
* The primary benefit of using RUP to roam the contents of AppData\Roaming instead of FR and OF is that RUP allows the administrator to use Group Policy to specify subdirectories within AppData\Roaming that should be excluded from synchronization. Exclusion of specific directories can be particularly beneficial in high latency or low bandwidth situations, or situations in which applications store data that is neither critical to the business nor ideal for synchronization.
* If the AppData\Roaming folder is redirected using FR and also cached by OF, consider listing the folders for applications that have both file and registry configuration data in the list of directories to sync at logon/logoff using the **Network directories to sync at Logon/Logoff** Group Policy setting. Doing so will help keep settings and data under AppData\Roaming consistent with the registry hive data on the server.
* It is not possible to block caching of only the AppData\Roaming folder—if IT disables caching of redirected folders, all redirected folders are affected.
* IT may consider disabling OF in high availability, high bandwidth, low latency, and always connected environments.

## Step Summary

This step helped determine which components of user data the organization needs to virtualize, and then identified related real-world considerations that may be relevant to the organization. The information gathered in this step should be made available to solution architects and designers for consideration in the planning and design process for a Windows USV solution.

The next step helps identify which components of user settings the organization needs to virtualize and then lists real-world considerations that may apply to the organization.

# **Step 2: Assess User Settings Requirements**

Step 1 helped identify which user data components are relevant to the business and need to be virtualized. It also provided information to help determine the most appropriate choice of Windows USV technology based on subjective analysis of experiences by mid- to large-sized IT organizations.

This step addresses virtualization of the user settings portion of Windows user state. In this step the reader will identify which components of user settings are relevant to the business, discover technology limitations, and identify real world considerations that apply to the organization.

## User Settings

The term *user settings* refers to user-specific customizations to applications and the operating system. Examples of user settings can include: network drive mappings, printer connections, the way the Start menu or taskbar works, keyboard layouts, desktop wallpaper, and dictionary and spelling checker options in Microsoft Word. Such settings are typically manifested either within the HKCU portion of the registry hive, or in the form of configuration files in the AppData\Roaming folder in the user profile.

## Virtualizing User Settings

RUP is the only Windows-based technology that can be used to virtualize user settings stored in the HKCU registry hive. Either RUP or FR, with or without OF, can be used to virtualize user settings in the AppData\Roaming folder.

RUP technology does not allow virtualization of specific keys or subkeys within HKCU. If settings in HKCU need to be virtualized, the entire HKCU hive needs to be virtualized. In Windows 7, RUP allows background synchronization of HKCU so that updates to the hive can be synchronized to the profile server while the user is logged on (as opposed to synchronization only during logon or logoff). Appendix A, “Advances in Windows USV Technologies,” describes this and other improvements to RUP, FR and OF.

Subjective analysis based on real-world experiences in mid- to large-sized IT enterprises reveals that FR and OF are most suitable for user settings manifested in the AppData\Roaming folder, and RUP is suitable for user settings in the registry. However, analysis also shows that if the AppData\Roaming folder is redirected using FR, the HKCU hive should also be roamed using RUP. Otherwise, unpredictable application behavior can result, including breaking of certain application features.

The following table lists commonly virtualized user settings stored in HKCU and indicates the relevant USV technology for virtualizing each setting. Select each user state component that applies to the organization. These requirements should be kept in mind when planning the USV solution. Note that FR and OF do not support the virtualization of user settings that are stored in the registry.

**Note**The following table is not a comprehensive list of user settings stored in the registry. Additionally, some applications may store user settings in locations other than the registry.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

Table 7. Commonly Virtualized User Settings Stored in HKCU

| Select | User settings component | **FR & OF** | **RUP** |
| --- | --- | --- | --- |
| ☐ | Desktop themes. For example, select desktop background, window colors, and screen saver. | Not applicable |  |
| ☐ | Sound settings. For example, select which sounds should play when various system events occur. | Not applicable |  |
| ☐ | Desktop icons. For example, configure which icons (such as Computer, Network and Recycle Bin) should appear on the desktop. | Not applicable |  |
| ☐ | Mouse pointer settings. For example, enable or disable pointer trails or pointer shadow.  | Not applicable |  |
| ☐ | Display settings. For example, change the displayed text size from 100 to 125 percent. | Not applicable |  |
| ☐ | Taskbar settings. For example, set the taskbar to auto-hide. | Not applicable |  |
| ☐ | Accessibility. For example, configure magnifier to invert the colors of the magnified area of the screen. | Not applicable |  |
| ☐ | Keyboard settings. For example, change the repeat delay and repeat rate when a key is pressed.  | Not applicable |  |
| ☐ | Action Center. For example, turn different types of notification on or off. | Not applicable |  |
| ☐ | Windows Explorer settings. For example, use Extra Large Icons to display items in a folder.  | Not applicable |  |
| ☐ | Libraries settings. For example, configure the Documents library to arrange files by Author.  | Not applicable |  |
| ☐ | Windows Media Player settings. For example, specify update and privacy settings.  | Not applicable |  |
| ☐ | Command prompt. For example, change the buffer size in command prompt entries. | Not applicable |  |

Some user settings can also be centrally managed to some extent (but not virtualized) by using Group Policy. Subjective analysis reveals that although the user settings listed in the following table can be virtualized using RUP, most organizations will consider Group Policy and/or Group Policy Preferences as more suitable technologies for managing these settings. Select the relevant check boxes if the situation applies. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

Table 8. User Settings that Are Best Virtualized by Using Group Policy

| Select | User state component | **RUP** | **FR & OF** | **Group Policy & Preferences** |
| --- | --- | --- | --- | --- |
| ☐ | Desktop background. For example, select folder containing pictures to display as slide show on desktop. |  | Not applicable |  |
| ☐ | Screen saver settings. For example, specify a screen saver and timeout value. |  | Not applicable |  |
| ☐ | Start menu settings. For example, configure the Start menu to not store and display recently opened programs. |  | Not applicable |  |
| ☐ | Regional options. For example, change currency symbol and long date format. |  | Not applicable |  |
| ☐ | Problem reporting. For example, specify whether Windows should check for solutions to problems that are found on the computer. |  | Not applicable |  |
| ☐ | Folder options. For example, configure Windows Explorer to open each folder in its own window.  |  | Not applicable |  |
| ☐ | Internet options. For example, specify the user’s home page.  |  | Not applicable |  |
| ☐ | Printers. For example, add a printer connection to the network printer published in Active Directory. |  | Not applicable |  |
| ☐ | Network connections. For example, set up a virtual private network (VPN) connection to a VPN server on a remote network. |  | Not applicable |  |
| ☐ | Mapped drives. For example, map a drive letter to a shared folder on the network.  |  | Not applicable |  |

## Step Summary

This step helped determine which user setting components need to be virtualized for the organization. The information gathered in this step should be made available to solution architects and designers for consideration in the planning process for a Windows USV solution.

The next step explores operating system, platform, and application compatibility considerations to help determine their relevance to the organization.

# **Step 3: Evaluate Compatibility Considerations**

Steps 1 and 2 identified user state components that might be relevant to the business. This step identifies common real-world compatibility considerations that might affect the planning and design of a Windows USV solution. Software and hardware infrastructures in mid- to large-sized organizations are seldom standardized. Therefore, planning a Windows USV solution often requires consideration of compatibility between different operating systems, platforms, and applications.

## Operating System Compatibility

The Windows operating system evolves as new versions are released, and changes are sometimes introduced that provide improved functionality but that are not compatible with earlier versions. For example, the user profile namespace changed considerably with the release of Windows Vista. The following table lists operating system compatibility issues to consider when designing a USV strategy for the organization. Select the relevant check box if the situation applies. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis
= Supported / Applicable but not preferable per subjective analysis*

Table 9. Windows USV Operating System Compatibility Considerations

|  |  |  |  |
| --- | --- | --- | --- |
| Select | Compatibility consideration | **FR & OF** | **RUP** |
| ☐ | Need access to data files in known folders from Windows 7– and Windows Vista–based computers. |  |  |
| ☐ | Need access to data files in known folders from Windows 7– and Windows XP–based computers, or from Windows Vista– and Windows XP–based computers.  |  | Not applicable |

This section identifies common operating system compatibility considerations that might affect USV planning and design.

**Folder Redirection and Offline Files.** The following considerations are relevant to FR with respect to operating system compatibility.

* FR in Windows Vista and Windows 7 supports redirecting a greater number of user profile folders than can be redirected in Windows XP. Specifically, Windows XP does not support redirection of AppData\Roaming, Contacts, Downloads, Searches, Links or Saved Games folders because these profile folders are new in Windows Vista and Windows 7.
* When redirecting the AppData\Roaming folder across different versions of the operating system, be aware that there may be application-specific issues between applications designed for Windows 7 and versions of the same applications designed for Windows XP. For example, a Windows 7 version of an application may have additional features that an earlier Windows XP version of the same application does not have.

**Roaming User Profiles**. The following considerations are relevant to RUP with respect to operating system compatibility.

* The “.v2” version of a user profile, which is generated the first time a user logs on to a Windows Vista– or Windows 7–based computer, is incompatible with Windows XP user profiles. As a result, RUP cannot be used to roam user profiles in a mixed Windows 7 and Windows XP environment or in a mixed Windows Vista and Windows XP environment.
* When using RUP, be aware that there may be application-specific issues for different operating system versions. For example, a Windows Vista version of an application may store its customization settings in a different part of the HKCU registry hive than a later Windows 7 version of the same application. Consider standardizing on the most recent version of the application if it can be installed and runs properly on both Windows 7 and Windows Vista.

**Note**Some applications may depend on specific operating system features that are not available in all versions of the operating system. Although settings and data for such applications can be redirected or roamed, these applications may behave differently across different operating system versions.

## Platform Compatibility

Like the Windows operating system, hardware architectures, or platforms, also evolve to provide improved performance and functionality. For example, many recent releases of Windows are available in both 32-bit and 64-bit versions. The following table lists platform compatibility issues to consider when designing a USV strategy for the organization. Select the relevant check box if the situation applies. These requirements should be kept in mind when planning the USV solution.

*= Supported / Applicable and preferable per subjective analysis of mid- to large-sized IT enterprises
= Supported / Applicable but not preferable per subjective analysis of mid- to large-sized IT enterprises*

Table 10. Windows USV Platform Compatibility Considerations

|  |  |  |  |
| --- | --- | --- | --- |
| Select | Compatibility consideration | **FR & OF** | **RUP** |
| ☐ | Need access to data files in known folders from different computers running the same operating system but a different hardware architecture. For example, 32-bit and 64-bit versions of Windows 7. |  |  |

This section identifies common platform compatibility considerations that might affect USV planning and design.

**Folder Redirection and Offline Files.** Known folders within the user profile share the same directory structure across 32-bit and 64-bit platforms. Therefore, data that is platform-agnostic can be virtualized using FR either with or without OF. The following considerations are relevant to FR with respect to platform compatibility.

* Some applications may store settings and data differently and in different locations depending on the platform architecture. Although FR can redirect the application state and data within the AppData\Roaming folder, the application may not look for it in the same location and may interpret it differently on varying platforms.
* 64-bit applications cannot be installed on 32-bit platforms. Redirection of the AppData\Roaming folder will result in synchronization of the 64-bit application’s settings and data to the 32-bit platform because known folders share the same directory structure across both platforms. However, any 32-bit applications that attempt to consume the 64-bit data may behave unpredictably.
* 64-bit applications cannot be installed on 32-bit platforms. Redirecting the Start Menu folder could result in the inclusion of invalid references to the 64-bit applications from the 32-bit platform.

### Notes from the Field – Platform Compatibility

Per subjective analysis, certain applications may display unexpected behavior in cross-platform scenarios in which the 32-bit and 64-bit versions of these applications store registry keys in the corresponding 32-bit and 64-bit registry hive, but write settings and data to a shared location such as a known folder, or a network share. In such situations, although applications will load registry keys that match the architecture of the underlying platform, they may also load data that is incompatible with the underlying platform. Even if the 32-bit application is used on both the 32-bit and 64-bit versions of the operating system, the application could store application state that is architecture-specific and prevent the application from correctly roaming across these platforms.

Because Windows Server 2008 R2 is a 64-bit–only platform, and Windows 7 client can be either 32-bit or 64-bit, such situations are commonly introduced when users share a roaming profile across an RDS farm (constituting 64-bit servers) and a laptop or desktop running a 32-bit client. One option to address such cross-platform incompatibility is to use a different roaming profile between 64-bit RDS farms and 32-bit clients.

## Application Compatibility

Application compatibility from the perspective of USV refers to the suitability of running different applications, and different versions of the same application side by side on the same computer. The following table lists application compatibility issues to consider when designing a USV strategy for the organization. Select the relevant check box if the situation applies. These requirements should be kept in mind when planning the USV solution.

Table 11. Windows USV Application Compatibility Considerations

|  |  |
| --- | --- |
| Select | Compatibility consideration |
| ☐ | Need to virtualize user state across computers that have different applications installed. |
| ☐ | Need to virtualize user state across computers that have different versions of the same application installed. |

This section identifies common application compatibility considerations that should be kept in mind when planning a USV solution.

**Folder Redirection and Roaming User Profiles.** FR and RUP can be used to synchronize user state across users’ computers regardless of which applications are installed. However, the following considerations should be kept in mind when virtualizing user state across computers that have different versions of the same application installed:

* If the Start Menu folder is virtualized, links to applications that are not installed on the computer, and links to different versions of applications that are not installed on the computer, could appear on the Start menu. The resulting user experience when virtualizing the Start Menu folder can be poor unless each computer is configured in exactly the same way in terms of which applications are installed and their installation location.
* If the user’s desktop contains shortcuts to applications, and the desktop is virtualized, shortcuts to applications that are not installed on the computer, and shortcuts to different versions of applications that are not installed on the computer, could appear on the user’s desktop. The resulting user experience when virtualizing the Desktop folder can be poor unless each computer is configured in exactly the same way in terms of which applications are installed and their installation location.
* Different applications may read/edit/delete the same objects in user state. If this happens, the applications may behave in an unpredictable manner.
* Depending on how the applications are written, different versions of applications may store user state in different locations of the user profile, and interpret the stored data differently. If this happens, the applications may behave in an unexpected manner.

**Note**Virtualized application delivery solutions such as Microsoft Application Virtualization (App‑V) and Remote Applications based on Terminal Services may help address these issues and can complement a USV strategy for virtualization of user data and settings.

### Notes from the Field – Compatibility

Standardization of applications, operating systems, and platforms will help address the majority of the compatibility concerns mentioned in this step. Technologies such as RemoteApp and App-V may also help deliver a standardized application experience.

If standardization is not feasible, subjective analysis of mid- to large-sized IT organizations suggests the following strategies might be helpful for an organization that faces different compatibility issues.

**Compatibility issues with Windows XP.** The following considerations should be kept in mind when Windows XP–based computers are still in use on the network:

* Default roaming user profiles for Windows XP are incompatible with those for Windows Vista and Windows 7 because of changes to the structure of the user profile namespace introduced in Windows Vista. Roaming across all three operating systems requires one profile for Windows XP and another for Windows Vista or Windows 7, which would double the space requirements on the profile server. Also, data and settings can’t be shared between these profiles.
* It is not feasible to provide full roaming ability by using only FR because RUP is needed to redirect such folders as Favorites for Windows XP–based computers. RUP would cause Windows XP–based computers to experience performance issues while the entire profile is downloaded and as profiles become larger.
* Roaming with RUP only is feasible by turning off FR for Windows XP–based computers, but those computers would likely experience performance issues as profiles become larger. Also, RUP in Windows XP only sync at logoff, which could be an issue.
* Providing roaming capability by using FR and RUP is technically feasible, but Windows XP–based clients would likely experience performance issues as their profiles become larger.
* Configuring FR policy on a Windows XP–based computer will make Windows Vista– and Windows 7–based computers apply the FR policy as if they are running Windows XP.
* Configuring FR policy on a Windows Vista– or Windows 7–based computer should be Windows XP–centric—that is, to redirect only those known folders in Windows XP that can be redirected.
* Adding a known folder from Windows Vista or Windows 7 to an FR policy created in Windows XP will prevent FR policy settings from being able to be saved from Windows XP–based computers.

**Other compatibility issues.** Per subjective analysis, consider the following guidelines if users need to access their data files from different Windows 7–based computers that may have different operating system features, different applications, or different versions of the same applications installed:

* Use FR to redirect specific user profile data folders, such as My Documents or My Pictures, to a location on a network server. If users store data on their desktops, use FR to redirect their Desktop folders to a location on a network server.
* Do not use FR to redirect application settings stored in the AppData\Roaming folder because there may be application-specific issues. For example, an earlier version of an application installed on one computer may use a different custom dictionary file than a later version of the same application installed on another computer. Such a scenario could confuse users and cause additional calls to the Help Desk.
* Do not use RUP because there may be feature-specific or application-specific issues. For example, if the XPS Viewer feature is enabled on one computer but not on another computer, the user will be able to open and view XPS documents from the first computer but not the second. This may confuse the user and cause additional calls to the Help Desk. As a second example, if an application is installed on one computer but not on another, a roaming user may see a desktop shortcut for the application on the second computer that doesn’t work, because it isn't installed on the second computer.
* Consider using RDS, Virtual Desktop Infrastructure (VDI), App-V, or RemoteApp to dynamically deliver session–based or virtual desktops or applications to users.

## Step Summary

This step identified compatibility considerations for different operating systems, platforms, and applications. Guidance based on subjective analysis of mid- to large-sized IT organizations was also provided for these considerations. The information gathered in this step should be made available to solution architects and designers for consideration in the planning and design process for a Windows USV solution.

The next step identifies different usage scenario considerations to help determine their relevance to the organization.

# **Step 4: Evaluate Different Usage Scenario Considerations**

The previous step identified different compatibility considerations. This step identifies and describes different common usage scenarios and considerations for each. Guidance from the field is also provided.

Subjective analysis of mid- to large-sized IT organizations reveals three common usage scenarios that leverage USV:

* **Assigned computer scenario.** Each business user is assigned a dedicated computer.
* **Occasionally roaming user scenario.** Business users have assigned dedicated computers but may occasionally use public computers.
* **Always roaming user scenario.** Business users are not assigned a dedicated computer but instead always log on to a computer within a shared pool of computers.

## Assigned Computer Scenario

Users with assigned computers might not need to use different computers in the organization, but implementing a USV strategy can still be useful because it provides the ability to centralize users’ business-critical data so it can be easily backed up. USV also provides the ability to cache data files locally so that they can continue to work when remote network servers and mail servers are offline. If these users are assigned laptop computers, USV also provides the ability to work while traveling. Taking additional steps such as configuring Outlook® connectivity to Exchange Server can improve the user experience for this scenario.

Subjective analysis of mid- to large-sized IT organizations wherein the business users are assigned a computer suggests the following.

**Folder Redirection, Offline Files, and Roaming User Profiles.** The following considerations are relevant to FR, OF, and RUP with respect to this scenario:

* Use FR to redirect user’s data folders.
* Use OF so that business users can continue working while disconnected from the network.
* Utilize the slow-link mode of OF so that users automatically work on locally cached copies of data when the network slows down.
* Enforce periodic synchronization of the OF store to the redirected folder on the corporate server so that the centrally managed business data remains current.
* Avoid redirection of the AppData\Roaming folder unless it contains business-critical data.
* Avoid redirection of known folders such as Music and Videos unless they contain business-critical data.
* Avoid use of RUP unless business-critical settings or data exists in the HKCU hive of the registry.

**Outlook and Exchange Server.** The following considerations are relevant to Outlook and Exchange Server with respect to this scenario:

* Configure Outlook in cached/offline mode to enable indexing and allow users to continue working while offline.
* If needed, consider the use of PST files for personal email storage.

These configuration settings provide an optimal user experience for the assigned computer scenario. Users have access to all of their data immediately after logon via FR, and email is available after an initial download. The ability to search email messages and data files is immediate after initial indexing.

## Occasionally Roaming User Scenario

This scenario applies to users who are assigned primary computers but have occasional needs to work from shared public (kiosk) computers. USV provides the ability to cache user state on local computers and to synchronize user state across different computers in the organization, which benefits users when they work offline and when they log on to different computers such as public kiosk computers. Taking additional steps such as configuring Outlook connectivity to Exchange Server can improve the user experience for this scenario.

Subjective analysis of mid- to large-sized IT organizations suggests following the guidelines in the assigned computer scenario described previously for primary computers that are assigned to business users, while adhering to the following guidelines for the public (kiosk) computers these users might occasionally use.

**Folder Redirection, Offline Files, and Roaming User Profiles.** The following considerations are relevant to FR, OF, and RUP with respect to this scenario:

* Do not use FR to redirect the Start Menu folder because a kiosk computer will typically have a different set of programs installed than a user’s dedicated computer.
* Do not use FR to redirect application settings stored in the AppData\Roaming folder because users typically do not need to access application-specific files such as custom dictionaries or templates from a kiosk computer.
* Disable OF so that redirected data files accessed by users are not locally cached.
* Consider using mandatory profiles for kiosk computers where saving of user settings is not required.

**Outlook and Exchange Server.** The following considerations are relevant to Outlook and Exchange Server with respect to this scenario:

* Configure Outlook to run in online mode so that email is not stored on the public computer.

These guidelines will help ensure that the hard drives of public kiosk computers that are shared by multiple users do not accumulate user profile data.

## Always Roaming User Scenario

The always roaming user scenario applies to users who are not assigned personal computers, but instead always log on to an available computer from a pool of shared computers. Examples of such users could be call center employees, or employees in a help desk environment. Taking additional steps such as configuring Outlook connectivity to Exchange Server can improve the user experience for this scenario.

Subjective analysis of mid- to large-sized IT organizations suggests the following configurations for this scenario.

**Folder Redirection, Offline Files, and Roaming User Profiles.** The following considerations are relevant to FR, OF, and RUP with respect to this scenario:

* Use FR to redirect users’ data folders.
* Avoid using OF so that hard drives of shared computers do not accumulate data from multiple users.
* Turn on indexing on the remote server to enable search for redirected data.
* Avoid redirection of AppData\Roaming folder unless it contains business-critical data.
* Avoid redirection of known folders such as Music and Videos unless they contain business-critical data.
* Avoid use of RUP unless business-critical settings or data exists in the HKCU hive of the registry.

**Outlook and Exchange Server.** The following considerations are relevant to Outlook and Exchange Server with respect to this scenario:

* Configure Outlook in online mode so that email is not cached on the local computer.
* Configure Outlook to use Exchange Server for searches (this is the default functionality when Outlook is configured in Online mode).

This configuration emphasizes storing data on the central server—data is not cached locally on the shared computers. Users will have access to all of their data immediately after logon via FR. Email is also available immediately after Outlook starts; there is no need to wait for email to download. The ability to search email messages and data files is immediate because there is no need to build a local index; instead, the indexes on Exchange Server and the file server are used.

This configuration minimizes network transmission of user state information every time a user logs on, but it will place additional load on the back-end infrastructure, such as Exchange Server and the file system (because copies of email and data are stored on the network).

The following table lists common usage scenarios that should be taken into account for businesses planning for user state virtualization. Select the specific usage scenarios that apply to the business unit. This information should be considered when planning a USV solution.

Table 12. Windows USV Usage Scenario Considerations

|  |  |
| --- | --- |
| Select | Usage scenario |
| ☐ | Assigned computer scenario |
| ☐ | Occasionally roaming user scenario |
| ☐ | Always roaming user scenario |

## Step Summary

This step identified three different usage scenario considerations to provide information that might affect the planning and design of a Windows USV solution. It also provided information about certain aspects of Outlook features and functionality. This information should be made available to solution architects and designers for consideration in the planning and design process for a USV solution.

The next step identifies infrastructure and manageability requirements and how they relate to Windows USV technologies.

# **Step 5: Evaluate Infrastructure and Manageability Requirements**

The previous step identified a number of usage scenarios for Windows USV technologies. This step identifies common network infrastructure and manageability requirements.

Because Windows USV technologies can move considerable amounts of data, it is important that these technologies be optimally configured for specific infrastructures so that they provide optimal functionality and manageability.

Although the requirements listed in this step are not comprehensive, they are based on subjective analysis of mid- to large-sized organizations, and may apply to organizations planning or designing a Windows USV solution.

## Network Bandwidth and Latency

When USV is used to virtualize user state, network bandwidth and latency must be considered. This section identifies common network bandwidth and latency considerations that might affect USV planning and design.

**Offline Files.** Per subjective analysis of mid- to large-sized IT organizations, the following considerations for OF may be important in such environments:

* OF might experience problems when it synchronizes very large files (gigabytes) over slow or unreliable network connections. Because OF synchronization is a single-threaded process, interruptions to the synchronization process can cause synchronization to start again from the beginning. The result can be excessive numbers of synchronization errors and an increased number of support calls to the Help Desk.
* When working offline, users cannot modify access control lists (ACLs) and cannot restore previous versions of files from the server.

If the business users will be exposed to high latency (such as satellite links) and low bandwidth environments, select the check box in the following table.

Table 13. Windows USV and Network Bandwidth

|  |  |
| --- | --- |
| Select | Infrastructure and manageability consideration |
| ☐ | High latency or low bandwidth environment |

### Notes from the Field – Network Bandwidth and Latency

Per subjective analysis of mid- to large-sized IT organizations, consider the following guidelines that apply to OF from a network bandwidth and latency perspective:

* On client operating systems prior to Windows 7, the OF slow-link detection mode could prevent FR GPOs from applying and cause FR not to work correctly.
* It is recommended that roaming user profiles be stored on a different network share than the redirected folders.
* Consider using the **Configure slow-link mode** Group Policy setting to set the threshold to trigger slow-link mode. When slow-link mode is triggered, a local copy of the file is used instead of a copy stored on the network server. (See the "Offline Files" topic in this section.)
* Generally, if users usually work offline (for example, by disconnecting their portable computers from the organization’s network), OF should be configured so that the users are always working offline. To do this, enable OF but configure Group Policy so that the network link between client computers and the server where the redirected folders are located is identified as a slow link. (The default configuration in Windows 7 is to transition offline if the latency is greater than 80 milliseconds, but this can be configured to be higher or lower through Group Policy.) This configuration will cause OF to automatically transition the client computer into “Offline (slow connection)” mode where users always work from the local Offline Files cache. Then configure Group Policy so that background synchronization automatically occurs at regular intervals to synchronize changes between the client computer and the server. (The default configuration is to sync every 6 hours in the background.)
* If users' desktop computers are always connected to the network over a reliable high-speed LAN link, one could make an argument that OF should be configured so that they are always working online because doing this can help reduce network utilization and boost performance of file open/save operations. However, this argument is more compelling for Windows Vista than for Windows 7. In Windows Vista, the user must explicitly transition back online whereas in Windows 7 users can automatically transition back online when network performance improves. Furthermore, even so-called “reliable” LANs can have sudden, unexpected dips in performance due to various reasons. As a result, enabling slow-link mode for OF even on high-speed LANs is generally recommended.
* Some organizations use OF even in high bandwidth environments. This approach allows users to store data locally and have it replicated in the background to network servers, where it can be backed up and accessed from other computers. OF works so seamlessly that users often don’t realize that their data is stored both locally and on a server.
* In Windows Vista, when OF detects high latency or limited bandwidth and switches to offline mode, the process of returning to online mode and synchronizing with the network server must be initiated manually by users. In Windows 7, this process is initiated automatically.

## Availability and Redundancy

When USV is used to virtualize user state, the availability and redundancy of the server infrastructure must be considered. The following table lists availability and redundancy issues to consider when designing a USV strategy for the organization. Select the relevant check box if the situation applies. These requirements should be kept in mind when planning the USV solution.

Table 14. Windows USV Availability and Redundancy Considerations

|  |  |
| --- | --- |
| Select | Compatibility consideration |
| ☐ | High availability of business-critical data |
| ☐ | Redundancy of business-critical data |

### Notes from the Field – Availability and Redundancy

When using Windows USV technologies, businesses may want high availability and redundancy of business-critical data. This can be achieved through Failover Clustering.

* If RUP and FR are being used in an environment that has Failover Clustering, for performance reasons ensure that users’ roaming profiles and redirected folders are located on different failover clusters. This configuration is recommended for performance reasons because RUP and FR use different mechanisms to determine whether the target server is available.
* Using Distributed File System Namespaces (DFS-N) together with Distributed File System Replication (DFS-R) to provide redundancy for redirected user data is not recommended. This is because if a conflict is found when replicating between two file servers that are targets for the same DFS-N name, the last written file wins and the losing version is no longer accessible to the user, which can make the user perceive that some of his/her data is lost. However, using DFS-N with a single target to provide a logical name to the file server in order to make upgrading/changing the back-end hardware easier is recommended.

## Indexing

If user state is stored on the user’s computer, it can be indexed locally. However, if user state is stored on a network server it may be preferable to build the index on the central server, so that it need not be rebuilt from each computer the user logs on to. If there is a business need to index user data so that it is easy to search, select the relevant check box in in the following table. These requirements should be kept in mind when planning the USV solution.

Table 15. Windows USV and Indexing

|  |  |
| --- | --- |
| Select | Infrastructure and manageability consideration |
| ☐ | Indexing required for user data |

### Notes from the Field – Indexing

Per subjective analysis of mid- to large-sized IT enterprises, when planning a USV solution keep in mind that if FR is used with OF, all data in the redirected folders is indexed locally. However, if FR is used without OF, data is not indexed, and in this case two options are available:

* In environments running Windows 7, Windows Vista, and Windows Server 2008, it is possible to configure remote indexing. The server indexes files locally and provides remote access to its indexed database for users on Windows Vista– and Windows 7–based computers.
* In Windows XP– and Windows Server® 2003–based environments, it is possible by installing a protocol handler to enable the client computer’s local index server to index the files over the network. This approach is slower, but might be preferable for users who roam to many different computers and have searchable data in a stored location (as opposed to storing and indexing data on multiple computers). For more information, see the Windows Desktop Search: Add-in for Files on Microsoft Networks at [www.microsoft.com/downloads/details.aspx?familyid=F7E981D9-5A3B-4872-A07E-220761E27283&displaylang=en](http://www.microsoft.com/downloads/details.aspx?familyid=F7E981D9-5A3B-4872-A07E-220761E27283&displaylang=en).

## Step Summary

This step identified numerous infrastructure and management considerations to provide information that might affect the planning and design of a Windows USV solution. This information should be made available to solution architects and designers for consideration in the planning and design process for a USV solution.

# **Conclusion**

Windows USV helps IT find the right balance between centralized management of business-critical data and a flexible work experience for users. In order to design a suitable USV solution, user requirements and IT requirements need to be well understood. Additionally, the best-fit combination of technologies should be employed to suit the organization’s business priorities.

The goal of this guide is to help IT pros get started with planning and designing effective Windows USV solutions. It was designed to provide a systematic approach to gathering user and IT requirements, comparing the suitability of the various Windows USV technologies from the perspectives of relevant business scenarios, and provide guidance based on subjective analysis of real-world deployments in mid- to large-sized organizations.

## Additional Reading

The following resources provide additional information that could be useful when planning and designing a Windows user state virtualization solution:

* “Choosing an Appropriate User State Virtualization Solution”: [www.microsoft.com/downloads/details.aspx?displaylang=en&FamilyID=fd01ed7a-c603-4f7c-8a60-8e4872b58bdf](http://www.microsoft.com/downloads/details.aspx?displaylang=en&FamilyID=fd01ed7a-c603-4f7c-8a60-8e4872b58bdf)
* *Windows Administration Resource Kit: Productivity Solutions for IT Professionals*: [www.microsoft.com/learning/en/us/book.aspx?ID=11297&locale=en-us](http://www.microsoft.com/learning/en/us/book.aspx?ID=11297&locale=en-us)
* “Implementing an End-User Data Centralization Solution”: [www.microsoft.com/downloads/details.aspx?displaylang=en&FamilyID=d8541618-5c63-4c4d-a0fd-d942cd3d2ec6](http://www.microsoft.com/downloads/details.aspx?displaylang=en&FamilyID=d8541618-5c63-4c4d-a0fd-d942cd3d2ec6)
* *Managing Roaming User Data Deployment Guide*: [http://technet.microsoft.com/en-us/library/cc766489(WS.10).aspx](http://technet.microsoft.com/en-us/library/cc766489%28WS.10%29.aspx)
* “Microsoft Operations Framework Reliability Workbook for User State Virtualization”: <http://technet.microsoft.com/en-us/library/ee923724.aspx>
* *Infrastructure Planning and Design Guide for Windows Optimized Desktop Scenarios*: <http://go.microsoft.com/fwlink/?LinkId=160989>
* *Infrastructure Planning and Design Guide for File Services*: <http://go.microsoft.com/fwlink/?LinkId=160976>
* *Infrastructure Planning and Design Guide for Active Directory Domain Services*: <http://go.microsoft.com/fwlink/?LinkId=157704>

# **Appendix A: Advances in Windows USV Technologies**

As the Windows operating system continues to evolve, so do the USV technologies. This appendix calls out some of the most relevant changes to these technologies in Windows XP, Windows Vista, and Windows 7.

## Folder Redirection

Folder Redirection (FR) has gained additional functionality in recent versions of the Windows operating system. The following table compares key features and identifies technical improvements.

Table A-1. Folder Redirection Feature Comparison and Technical Improvements

| User Experience | Windows XP | **Windows Vista** | **Windows 7** |
| --- | --- | --- | --- |
| Initial Logon Experience | Client replicates local folder data to server then back prior to first logon | Client replicates local folder data to server then back prior to first logon | Local folder data cached immediately, allowing user to log on then synch in the background |
| Number of Redirected Folders | Can redirect up to five folders | Can redirect up to 13 folders | Can redirect up to 13 folders |

### Summary of Historical Changes to Folder Redirection

This section identifies specific changes that were made to FR from Windows XP to Windows Vista and Windows 7.

#### Windows XP

In Windows XP, FR has the following potential drawbacks:

* Only five specific user profile folders are available for redirection. Potentially key folders that cannot be redirected include Favorites and Cookies. These five folders are Application Data, Desktop, My Documents, My Pictures, and Start Menu.

#### Windows Vista

Windows Vista addressed shortcomings in FR and Roaming User Profiles in some significant ways:

* Changes to the structure of the user profile namespace provides better separation of user settings and user data.
* The increase in redirectable user profile folders from 5 to 13 provides flexibility to address slow logon/logoff issues. See the Windows Vista portion of the “Roaming User Profiles” section of this appendix for information about how this change can benefit organizations.
* In Windows Vista and Windows 7, the following 13 folders can be redirected: AppData\Roaming, Desktop, Start Menu, Documents, Pictures, Music, Videos, Favorites, Contacts, Downloads, Links, Searches, and Saved Games.
* Many enhancements to Offline Files (described in the next section) also enhanced the performance of FR.

#### Windows 7

With Windows 7, the first logon experience has been significantly improved when Folder Redirection is used in conjunction with Offline Files (the default setting in Windows 7). Improvements include the following:

* In Windows Vista and earlier versions of Windows, the user logon process could not be completed until all user data is migrated to the profile server, which could take a significant amount of time. With Windows 7, user data is synchronized to the local Offline Files cache, which is much faster.
* Also, Windows 7 determines whether sufficient space exists in the cache to hold the data. If sufficient space isn’t available when Folder Redirection is initially implemented, the data redirection process will not even begin.
* If Offline Files is disabled on the computer, Windows 7 determines whether sufficient room on the server exists for the data. If there is insufficient room, no data is uploaded.
* If the user is working in slow-link mode when an FR configuration change is applied, the share is transitioned back online so the configuration changes can be applied. Once the configuration is applied, the share will transition back to slow-link mode if the connection still meets the slow-link threshold.

## Offline Files

Offline Files (OF) has gained additional functionality in recent versions of the Windows operating system. The following table compares key features and identifies technical improvements.

Table A-2. Offline Files Feature Comparison and Technical Improvements

| Offline Files | Windows XP | **Windows Vista** | **Windows 7** |
| --- | --- | --- | --- |
| ***User Experience*** |
| Online < - > offline transition  | ● Seamless online to offline transition● Disruptive offline to online transition● Users must close and then restart applications● Users must manually initiate synch● Server level network transition● User cannot easily force offline mode to access cache | ● Seamless online to offline and offline to online transition● Share level network transition● Interface provided for user to force offline mode and cache specific documents | ● Seamless online to offline, offline to online, and offline (slow link) to online transition● Share level network transition● Interface provided for user to force offline mode and cache specific documents |
| File synchronization speed and performance | ● Modified files replicated in their entirety from local cache to the server even if only a small part of a file is modified● Manual synch of files required when in auto offline mode● Non-offline files and folders read from server every time | ● Faster file synch● Improved synch algorithm reduces bandwidth to identify differences between local and server cache● Use of Bitmap Differential Transfer to track and then replicate only changed blocks of a file to the server● Manual synch of files required when in auto offline mode● Non-offline files and folders read from server every time | ● Faster file synch● Improved synch algorithm reduces bandwidth to identify differences between local and server cache● Use of Bitmap Differential Transfer to track and then replicate only changed blocks of a file to the server● Automatic background synch of files required when in auto offline mode● Transparent caching feature caches previously read files and folders when latency is above a configured threshold |
| ***Manageability*** |
| Offline File exclusion by file type | ● Limited ability to exclude specific file types | ● Not able to exclude certain file types | ● Can use Group Policy to block selected file types from being created in the cache |
| Cache size management | ● Can use Group Policy to limit disk space used for automatically cached files● No Group Policy available to limit disk space usage for manually cached files | ● Can use Group Policy to limit disk space usage of automatically and manually cached files | ● Can use Group Policy to limit disk space usage of automatically and manually cached files |

### Summary of Historical Changes to Offline Files

This section identifies specific changes that were made to OF from Windows XP to Windows Vista and Windows 7.

#### Windows XP

In Windows XP, limitations of OF included the following:

* Open file handles could block the transition from offline to online status.
* Synchronization occurred on a per-share basis instead of a per-file basis.
* There was no integration with Windows Search, so folders that were redirected through Folder Redirection could not be indexed.

#### Windows Vista

The OF features were redesigned for Windows Vista. The following list includes brief descriptions of some of the most significant improvements and enhancements:

* Synchronization occurs automatically, and users are notified of issues by an icon in their taskbar, which they can use to open the new Sync Center in Control Panel.
* The user interface that shows which files are available for offline use is significantly improved.
* The synchronization process is more efficient because of a new synch algorithm, Bitmap Differential Transfer (BDT).
* The new slow-link operational mode becomes operational automatically when it detects that network throughput falls below a predefined level. When the slow-link mode is enabled, all read and write requests are processed in the local cache.
* The amount of disk space that is used for local caching is configurable, including automatically and manually cached files. It’s also possible to configure the amount of disk space this is used by automatically cached files.
* The number of all cached files and the number of automatically cached files is configurable through Group Policy.
* Individual files within the cache can be encrypted through the use of the user’s Encrypting File System (EFS) certificate.

#### Windows 7

In Windows 7, additional capabilities and improved functionality were provided in OF. When used with FR, OF can provide a powerful solution that ensures users can access files when disconnected from the organization’s network. These capabilities include the following:

* The first logon experience has improved (explained in the preceding “Folder Redirection” section); the amount of time users must wait when they log on to a computer for the first time has reduced.
* The Offline Files Exclusion List feature can be used to prevent certain types of files from being stored on the server. This feature reduces synchronization overhead and disk space usage on the server and can make backup and restore operations faster.
* The new transparent caching capability optimizes bandwidth consumption on WAN links and provides near local read response times for mobile users and branch office workers who access network files and folders that are not explicitly made available offline.
* Automatic transition back online from slow-link mode when network conditions improve.
* Background sync at configurable interval when offline due to slow link being detected.

**Note**If access to redirected folders or home drives is frequently disconnected when using Offline Files on a Windows Server 2008 R2 and Windows 7 environment, review Knowledge Base article 981872 “Access to a redirected folder or a home drive disconnects regularly on a computer that is running Windows Server 2008 R2 and Windows 7,” available at <http://support.microsoft.com/kb/981872/en-us>, and consider application of this hotfix after validation in the environment.

## Roaming User Profiles

Roaming User Profiles (RUP) has gained additional functionality in recent versions of the Windows operating system. The following table compares key features and identifies technical improvements.

Table A-3. Roaming User Profiles Feature Comparison and Technical Improvements

| Capability | Windows XP | **Windows Vista** | **Windows 7** |
| --- | --- | --- | --- |
| ***User Experience*** |
| Profile Synchronization | User profile settings synch only at user logon/logoff | User profile settings synch only at user logon/logoff | Can also configure user profile settings to synch in background while user is online  |
| Slow Network Detection | User notified during logon | User notified prior to logon | User notified prior to logon |
| Folder Redirection Integration | Can redirect only five folders | Can redirect up to 13 folders, which reduces the amount of data synched over the network and greatly reduces user logon and logoff time | Can redirect up to 13 folders, which reduces the amount of data synched over the network and greatly reduces user logon and logoff time |
| ***Manageability*** |
| Profile Folder Structure | Complex nested structure | Simplified hierarchical profile structure, which enables easier separation of user data from application data | Simplified hierarchical profile structure, which enables easier separation of user data from application data |
| Profile Age Management | No policy to automatically delete dormant profiles | Can set a policy to delete dormant profiles older than a defined value | Can set a policy to delete dormant profiles older than a defined value |
| Error and Event Logging | Very basic event logging | More detailed and specific event logging | More detailed and specific event logging |

### Group Policy Settings for Managing Roaming User Profiles

In addition to the manageability improvements identified in the preceding table, a number of new Group Policy configuration settings for controlling RUP functionality were introduced in Windows Vista. These settings are also available in Windows 7. Per-computer Group Policy configuration settings for RUP include those in the following list:

* **Delete user profiles older than a specified number of days in system restart**
* **Do not forcefully unload the user’s registry at user logoff**
* **Set maximum wait time for the network if a user has a roaming user profile or remote home directory**
* **Set roaming profile path for all users logging on to this computer**

**Note**Because the settings in the previous list are per-computer settings, they affect all users of the computers to which they are applied; they do not roam with individual users.

A number of new per-user Group Policy settings for controlling RUP functionality were also introduced in Windows Vista. These settings are also available in Windows 7. Because they are per-user settings, they will affect whatever computer a user logs on to. In other words, they roam with individual users. These per-user settings allow an organization to accomplish the following:

* **Synchronize network directories only at logon and logoff**
* **Set a maximum permitted user profile size**
* **Determine whether the calculation of the profile size includes registry files**
* **Find out whether users are notified about when their profile becomes too large**
* **Create a custom message that advises users that their profile is too large**
* **Specify how often the custom message is displayed to the user**

**Note**This is not a comprehensive list of Group Policy settings that apply to USV. For further reading, refer to Appendix E, “Useful Group Policy Settings for USV,” of this guide and Chapter 15, “Managing Users and User Data,” of the Windows 7 Resource Kit available from Microsoft Press.

### Summary of Historical Changes to Roaming User Profiles

This section identifies specific changes that were made to RUP from Windows XP to Windows Vista and Windows 7.

#### Windows XP

In Windows XP, RUP has the following potential drawbacks:

* Profiles can grow quite large over time, which affects logon and logoff performance. FR helps but can only redirect a limited number of user profile folders.
* Profiles are only saved at logoff.
* The user profile namespace has a different structure than in Windows Vista or Windows 7.

#### Windows Vista

Windows Vista introduced a number of changes that affected RUP:

* The new user profile namespace structure was implemented to provide better separation of user settings and user data.
* The number of folders that can be redirected with FR increased from 5 to 13. As a result, when RUP are implemented with FR, the ability to redirect specific folders can result in significant performance improvements at logon and logoff.
* The number of folders that can be redirected with FR increased from 5 to 13. As a result, when RUP are implemented with FR, the ability to redirect specific folders can result in significant performance improvements at logon and logoff.

For example, in Windows Vista and Windows 7, the My Music, My Videos, and My Pictures folders exist at the same level as My Documents and, therefore, FR can be configured not to redirect significant amounts of personal data. In some organizations these folders are very large, sometimes several times larger than the legitimate business data stored in My Documents and Desktop folders. In Windows XP, because these folders were subfolders of My Documents, redirecting My Documents could cause significant amounts of personal data to be redirected.

#### Windows 7

With Windows 7 and Windows Server 2008 R2, the following additional RUP functionality is possible:

* Profiles can be periodically synched to the server in background mode.
* Additional monitoring capabilities are available. Windows 7 logs the following four additional events to the Applications and Services Logs\Microsoft\Windows\User Profile Service\Operational log:
* Background upload started
* Background upload finished successfully
* Hive not roamed due to a slow link
* Hive not roamed due to the storage server being unavailable

## User Profile Namespace Changes in Windows Vista and Windows 7

The structure of the data portion of user state information, the *user profile namespace*, changed significantly with the release of Windows Vista. Many of these changes resulted in better separation between data and settings information than was possible on Windows XP–based computers. (In Windows Vista and Windows 7, these folders are referred to as *known folders*. In Windows XP, these folders were called *special* *folders*.)

The following table provides detailed information about the changes to the user profile namespace that took effect with the release of Windows Vista.

Table A-4. User Profile Namespace Differences between Windows Vista/Windows 7 and Windows XP

| **Windows Vista and Windows 7**Users\<*username*>\... | **Windows XP****Documents and Settings\<*username*>\...** |
| --- | --- |
| …\AppData\Roaming | Application Data |
|  N/A | Local Settings |
| …\AppData\Local | Local Settings\Application Data |
| …\AppData\Local\Microsoft\Windows\History | Local Settings\History |
| …\AppData\Local\Temp | Local Settings\Temp |
| …\AppData\Local\Microsoft\Windows\ Temporary Internet Files | Local Settings\Temporary Internet Files |
| …\AppData\Roaming\Microsoft \Windows\Cookies | Cookies |
| …\AppData\Roaming\Microsoft\Windows\ Network Shortcuts | Nethood |
| …\AppData\Roaming\Microsoft\Windows\ Printer Shortcuts | PrintHood |
| …\AppData\Roaming\Microsoft\Windows\Recent | Recent |
| …\AppData\Roaming\Microsoft\Windows\Send To | SendTo |
| …\AppData\Roaming\Microsoft\Windows\ Start Menu | Start Menu |
| …\AppData\Roaming\Microsoft\Windows\ Templates | Templates |
| …\Contacts | Not applicable |
| …\Desktop | Desktop |
| …\Documents | My Documents |
| …\Downloads | Not applicable |
| …\Favorites | Favorites |
| …\Music | My Music |
| …\Videos | My Videos |
| …\Pictures | My Pictures |
| …\Searches | Not applicable |
| …\Links | Not applicable |
| …\Saved Games | Not applicable |

# Appendix B: Notes from the Field – Backup and Security

## Backup

Folder Redirection (FR) is not a backup solution, but it can simplify management and backup by centralizing user data on servers that can be backed up. For backup, consider solutions such as Volume Shadow Copies or Microsoft System Center Data Protection Manager.

Offline Files (OF) is also not a backup solution. If user data files are accidentally deleted from redirected folders on the file servers, the next synchronization process will assume that the files were intentionally deleted and will delete the locally cached copies of these files.

Be sure to implement a proper server–based backup solution for any file servers that store redirected user data.

## Security

Some organizations might have security policies that pertain to how data is stored, whereas other organizations might be subject to governance, risk, and compliance (GRC) regulations that pertain to how data is stored and accessed.

Some security-related manageability considerations can be addressed through USV technologies and others through other Windows technologies.

**Scenario 1:** IT needs to protect locally cached data in the case of loss or theft of the computer.

* Use Windows BitLocker® Drive Encryption to encrypt the entire system drive and data drives on the computer to safeguard against offline attack. For more information, see Windows BitLocker Drive Encryption Frequently Asked Questions at <http://technet.microsoft.com/en-us/library/cc766200.aspx>.

**Scenario 2:** IT needs to prevent users of shared computers from seeing locally cached data that is not their own. (This scenario only applies when the users involved are local administrators on a shared computer, because only local administrators have the level of privileges needed to be able to modify the ACLs on the Offline Files cache in order to access the data of other users of the computer.)

* Use the **Encrypt the Offline Files cache** Group Policy setting to use the Encrypting File System (EFS) feature, which encrypts each of the user’s files in the local Offline Files cache by using each user’s local certificate. The network versions of files marked for offline use are not encrypted, so IT can safely back up users’ files on the central file server. Note that EFS of the Offline Files folder can be used in conjunction with BitLocker to secure state in the machine outside of the Offline Files cache. For more information, see What’s New in Offline Files for Windows Vista, available at [http://technet.microsoft.com/en-us/library/cc749449(WS.10).aspx](http://technet.microsoft.com/en-us/library/cc749449%28WS.10%29.aspx).

**Note**   When using FR and OF with the **Encrypt the Offline Files cache** policy setting configured on Windows Vista– and Windows 7–based computers, users who work in offline mode with User Account Control (UAC) enabled will not be able to add new Internet favorites in Internet Explorer. This occurs because Internet Explorer runs in protected mode by default, and accessing EFS encryption keys requires medium integrity.

**Note**Windows Vista and later versions of the operating system only cache the encryption context for one user in the Offline Files cache. Therefore, in shared computer configurations, turning on EFS for the Offline Files cache is not recommended.

**Note**EFS is not compatible with Roaming User Profiles. If files or folders in the profile are encrypted, the profile will not roam.

* If FR is enabled but OF is disabled, redirected files can still be encrypted on the remote server if an administrator has designated the server as trusted for delegation, which allows the server to complete delegated authentication, receive a ticket for the user who makes the request, and access the requested information for the user. However, files that are encrypted in this way are decrypted before being transmitted over the network; encryption only protects the files while they reside on the server.

**Scenario 3:** IT needs to ensure that sensitive business data stays inside the data center to comply with jurisdictional data security requirements.

* Provide users with session-based desktops or virtual desktops that run in the datacenter on Remote Desktop Session Host servers or Remote Desktop Virtualization Host servers.
* Use FR to redirect specific user profile namespace folders, such as My Documents or My Pictures, to a location on a network server. If users store folders on their desktops, use FR to redirect their Desktop folders to a location on a network server.
* Disable OF so that redirected data files are not locally cached on the users’ session–based desktops or virtual desktops. Disabling OF means that local indexing of the OF cache is also disabled, which can affect users’ ability to search for content stored in redirected folders. To allow users to search for content stored in redirected folders, consider enabling indexing on the Windows Server 2008 R2 server where the redirected folders are located.

**Scenario 4:** IT needs to disable use of local or temporary profiles to prevent user logons if the server–based profile cannot be loaded.

* Use super-mandatory profiles, which prevent users from logging on unless the server containing the mandatory profile is available and the profile can be downloaded to their computer.

**Scenario 5:** IT needs administrative access to user data files.

* Access to user data files by anyone other than the user is disabled by default. If IT needs administrative access to redirected user data, disable the **Grant the user exclusive rights** Folder Redirection setting in Group Policy and configure NTFS permissions on the network shares. For more information about this setting, see the *Managing Roaming User Data Deployment Guide* inthe “Additional Reading” section of this guide.

# Appendix C: Notes from the Field – Migration

This section summarizes some key considerations for using Roaming User Profiles (RUP) and Folder Redirection (FR) in environments that are migrating computers from Windows XP to Windows 7 or Windows Vista.

## Migrating User Profiles

Use the User State Migration Tool (USMT) to migrate user profiles by running scanstate.exe on the Windows XP–based computers to capture and copy user settings and data to a network location. Then run loadstate.exe on the Windows 7–based computers to migrate user settings and data from the network location to the new computers. Use the custom migration rule (.xml) files of USMT to specify exactly which user data and user settings are migrated. For more information, see the User State Migration Tool 4.0 User’s Guide at <http://technet.microsoft.com/en-us/library/dd560801.aspx>.

* Consider using FR to redirect user data files prior to running scanstate.exe, because doing so can simplify and speed up the process of migrating user profiles. If users currently have home folders they can access using a mapped drive and IT wants to continue using these home folders while providing access to data files from Windows 7, redirect My Documents and other folders to subfolders of the users’ home folders.
* Information about migrating user profiles from Windows XP to environments that run Windows Vista, Windows 7, and Windows Server 2008 is available in Microsoft TechNet Knowledge Base article 947025, “Support guidelines for migrating roaming user profiles data to Windows Vista or to Windows Server 2008,” at <http://support.microsoft.com/kb/947025>.

## Migrating the Profile Namespace

Beginning with Windows Vista, the user profile structure was flattened so that the Music, Pictures, and Videos folders were no longer nested under the Documents directory as they were in Windows XP. If at all possible, when migrating to Windows 7 or Windows Vista, try to move the data to the new namespace by un-nesting these folders manually. The primary benefit of doing this is that it gives the administrator the option to configure the redirection of Music, Pictures, and Videos folders differently than the Documents folder (for example, by not redirecting Documents or by redirecting it to a different file server). However, if it is required to keep the namespace compatible with Windows XP, there is an option in the Folder Redirection configuration to do so.

## Migration on the Server Side

In Windows Vista and Windows 7, if FR is configured to move the contents of a redirected folder, and the FR target location changes from one server path to another, the client will copy the data from the old FR server path to the new FR server path. This work is done synchronously to the user’s logon, so if the network connection is slow or there is a lot of data in the user’s redirected folder, this can take a long time. Also, on Windows Vista, if a particular hotfix (<http://support.microsoft.com/kb/977611>) is not applied, certain data can be lost. If the server path name changes due to a logical namespace change (for example, moving to a DFS namespace) but the server on which the data is stored has not changed, the data can be deleted through the old FR server path name after it is copied, causing the data to be lost.

When migrating users to a new FR server, some customers prefer to copy the users’ redirected data to the new server directly through a backup/restore operation that can often be done within the same data center, then deploy the FR configuration change to the clients and rename the content in the OF caches to reflect the new FR server name. This functionality is provided as a hotfix for both Windows Vista (KB 976698 - <http://support.microsoft.com/kb/976698>) and Windows 7 (KB 977229 - <http://support.microsoft.com/kb/977229>).

# Appendix D: Notes from the Field – Thin Client Scenarios

This appendix identifies considerations for *thin client* scenarios, or scenarios that use Remote Desktop Services (RDS), Terminal Services (TS), and Virtual Desktop Infrastructure (VDI) technologies instead of conventional desktop and laptop computers. For general infrastructure, planning, and design guidance on these technologies, see the *Infrastructure Planning and Design Guide for Remote Desktop Services* (<http://go.microsoft.com/fwlink/?LinkID=177881>), the *Infrastructure Planning and Design Guide for Terminal Services* (<http://go.microsoft.com/fwlink/?LinkID=160987>), and the *Infrastructure Planning and Design Guide for Windows Server Virtualization* (<http://go.microsoft.com/fwlink/?LinkID=147617>).

## Access to Data, Settings, and Personalized Desktops

RDS and TS environments provide significant manageability opportunities and flexibility. Configuring USV technologies varies somewhat, depending on the different types of thin client scenarios and what users need. This section provides additional information about different scenarios.

**Folder Redirection and Offline Files.** Folder Redirection (FR) redirects user data folders from local computers to network servers so that they can be accessed from other computers. The following concepts are relevant to FR and OF for users who need access to their data files, application settings, and personalized Windows desktops in RDS and TS environments:

* Use FR to redirect specific user profile namespace folders, such as My Documents or My Pictures, to a location on a network server. If users store folders on their desktops, redirect their Desktop folders as well.
* Use FR to redirect application settings that are located in the AppData\Roaming folder in addition to redirecting users’ data folders. However, some applications may experience performance issues if the AppData\Roaming folder is redirected because they will be accessing this folder over the network. If this causes problems, consider not redirecting the AppData\Roaming folder; however, doing so can increase logon/logoff times. OF is not recommended for centralized desktop (RDS/TS) environments.

**Roaming User Profiles.** Roaming User Profiles (RUP) store users’ desktop and application setting information from the HKCU registry hive on users’ computers in profiles that are stored on network servers so that they can be downloaded to other computers where users might log on. The following concepts are relevant to RUP for users who need access to their data files, application settings, and personalized Windows desktops in RDS and TS environments:

* Use RUP in addition to redirecting users’ data files and AppData\Roaming folders. Consider using mandatory roaming profiles for locked-down environments such as call centers that don't require preserving user settings across sessions.

**Note**   Assign separate user profiles for logging on to session–based desktops. Many of the common options that are stored in user profiles, such as screen savers and animated menu effects, may not be desirable for performance reasons in RDS or TS environments.

## Access to Data from Windows 7–based Computers and Session**–**based Desktops

Another common scenario is one in which users need to access data from Windows 7–based computers as well as session–based desktops in RDS and TS environments. The different types of computers in this scenario have slightly different configuration needs.

**Folder Redirection and Offline Files.** FR redirects user data folders from local computers to network servers so that they can be accessed from other computers. For users who need access to their data files from both Windows 7–based computers and session–based desktops in RDS/TS environments, the following concepts are relevant:

* Use FR within both the desktop computer and session–based environments to redirect specific user profile namespace folders, such as My Documents or My Pictures, to a network server. FR policies for desktop computers and session–based desktops should redirect user profile folders to the same network location. For example, if a policy is configured that redirects a user’s My Documents folder on their desktop computer to a specific network location, configure a similar policy that redirects the user’s My Desktop folder within the session–based desktop environment to the same network location.
* Do not use FR within the desktop computer environment to redirect application settings stored in the AppData\Roaming folder, because such settings will only be available to users when they work on desktop computers and not when they work on session–based desktops. In addition, session–based desktops and RemoteApp programs run on server versions of Windows, not client versions, so issues might arise if application settings stored in the AppData\Roaming folder are allowed to be accessed from session–based desktops and RemoteApp programs running on RDS host servers or Terminal Services servers. Consider using FR within the session–based environment to redirect application settings stored in the AppData\Roaming folder to improve logon/logoff performance for session–based desktops and to help prevent RDS/TS user profiles from growing too large.
* OF is not recommended for centralized desktop (RDS/TS) environments.

**Roaming User Profiles.** RUP stores users’ desktop and application setting information from the HKCU registry hive on users’ computers in profiles that are stored on network servers so that they can be downloaded to other computers to which users might log on. For users who need access to their data files from both Windows 7–based computers and session–based desktops in RDS and TS environments, the following concepts are relevant:

* Do not use RUP within the desktop computer environment, because in this scenario users have two user profiles, one for their Windows 7–based computers and one for their RDS or TS environment. However, consider using RUP within the session–based desktop environment so that users get a consistent experience regardless of which RDS Host server or terminal server in the farm they connect to. Do not try to use the same user profile for both a desktop computing environment and an RDS/TS environment, because desktops in the desktop environment run a client version of Windows whereas desktops in the session–based environment run a server version of Windows.

**Note**   Assign separate user profiles for logging on to session–based desktops. Many of the common options that are stored in user profiles, such as screen savers and animated menu effects, may not be desirable for performance reasons in RDS or TS environments.

## Access to Data from Personal or Pooled Virtual Desktops in VDI Environments

VDI is a centralized desktop delivery solution that enables organizations to store and execute desktop workloads (operating system, applications, data) on virtual machines in the data center and present the user interface (UI) via a remote desktop protocol (such as Remote Desktop Protocol) to user devices. Generally, for personal VDI environments, follow the same set of user and IT requirements as for users who have desktop computers. That is, determine whether users will need to roam between desktops and if so whether they will need to access their data files, application settings, and personalized Windows desktops.

**Folder Redirection and Offline Files.** FR redirects user data folders from local computers to network servers so that they can be accessed from other computers. For users who need access to their data files from pooled and personal virtual desktops in VDI environments, the following concepts are relevant for FR and OF. For pooled VDI environments, use FR to redirect specific user profile namespace folders, such as My Documents or My Pictures, to a location on a network server. If users store folders on their desktops, redirect their Desktop folders as well.

* For pooled VDI environments, use FR to redirect application settings that are located in the AppData\Roaming folder in addition to redirecting users’ data folders. However, some applications may experience performance issues if the AppData\Roaming folder is redirected because they will be accessing this folder over the network. If this causes problems, consider not redirecting the AppData\Roaming folder; however, doing so can increase logon/logoff times.
* Generally, OF should be disabled in both pooled and personal VDI environments because VDI requires constant network connectivity between the client and the datacenter, and OF provides no real advantage for such always-connected scenarios. Another reason OF should be disabled in VDI environments is that the servers that contain the data that users need to access typically reside in the same datacenter and therefore on the same high-speed LAN as the Remote Desktop Virtualization host on which the virtual desktop runs. Finally, enabling OF on virtual desktops can lead to backups of outdated user state if the servers that contain the data that users need to access reside outside the data center and are connected to the data center over slow or unreliable WAN links.

**Roaming User Profiles.** RUP stores users’ desktop and application setting information from the HKCU registry hive on users’ computers in profiles that are stored on network servers so that they can be downloaded to other computers where users might log on. For users who need access to their data files from both Windows 7–based computers and from personal or pooled virtual desktops in VDI environments, the following RUP concept is relevant:

* For pooled VDI environments, use RUP in addition to redirecting users’ data files and AppData\Roaming folders. Consider using mandatory roaming profiles for locked-down environments, such as call centers, that don't require preserving user settings across sessions.

**Note**   Assign a separate user profile for logging on to personal or pooled virtual desktops. Many of the common options that are stored in user profiles, such as screen savers and animated menu effects, may not be desirable for performance reasons in VDI environments.

## Access to Data from Windows 7–based Computers and Personal or Pooled Virtual Desktops in VDI Environments

This scenario applies to users who need to access data from Windows 7–based computers as well as personal or pooled virtual desktops in VDI environments.

**Folder Redirection and Offline Files.** FR redirects user data folders from local computers to network servers so that they can be accessed from other computers. For users who need access to their data files from different Windows 7–based computers and personal or pooled virtual desktop computers in VDI environments, the following concepts are relevant for FR and OF:

* For personal or pooled VDI environments, use FR within both the desktop computer and VDI environments to redirect specific user profile namespace folders, such as My Documents or My Pictures, to a network server. FR policies for desktop computers and session–based desktops should redirect user profile folders to the same network location. For example, if a policy has been configured that redirects a user’s My Documents folder on their desktop computer to a specific network location, configure a similar policy that redirects the user’s My Desktop folder within their session–based desktop environment to the same network location.
* For personal or pooled VDI environments, consider using FR to redirect application settings that are located in the AppData\Roaming folder in addition to redirecting users’ data folders. However, some applications may experience performance issues if the AppData\Roaming folder is redirected because they will be accessing this folder over the network. If this causes problems, consider not redirecting the AppData\Roaming folder; however, doing so can increase logon/logoff times.
* Generally, OF should be disabled in personal and pooled VDI environments because VDI requires constant network connectivity between the client and the data center, and OF provides no real advantage for such always-connected scenarios. Another reason OF should be disabled in VDI environments is that servers that contain the data that users need to access typically reside in the same data center and therefore on the same high-speed LAN as the Remote Desktop Virtualization host on which the virtual desktop runs. Finally, enabling OF on virtual desktops can lead to “dirty” backups if the servers that contain the data that users need to access reside outside the datacenter and are connected to the datacenter over slow or unreliable WAN links.

**Roaming User Profiles.** RUP stores user’s desktop and application setting information from the HKCU registry hive on users’ computers in profiles that are stored on network servers so that they can be downloaded to other computers where users might log on. For users who need access to their data files from different Windows 7–based computers and personal or pooled virtual desktop computers in VDI environments, the following concepts are relevant for RUP:

* For pooled VDI environments, use RUP in addition to redirecting users’ data files and AppData\Roaming folders. Consider using mandatory roaming profiles for locked-down environments such as call centers that don't require preserving user settings across sessions. However, because the user profile used for logging on to personal/pooled virtual desktops is typically a different profile than the one used for logging on to the desktop computer, desktop personalizations and application customizations cannot be preserved when roaming between desktop computers and virtual desktops.
* For personal VDI environments, follow the same set of user and IT requirements as for users who have desktop computers to determine whether or not to implement RUP. However, because the user profile used for logging on to personal/pooled virtual desktops is typically a different profile than the one used for logging on to the desktop computer, desktop personalizations and application customizations cannot be preserved when roaming between desktop computers and virtual desktops.

**Note**   Assign a separate user profile for logging on to personal or pooled virtual desktops. Many of the common options that are stored in user profiles, such as screen savers and animated menu effects, may not be desirable for performance reasons in a VDI environment.

# Appendix E: Useful Group Policy Settings for USV

The following Group Policy settings are relevant to USV for Windows 7 and Windows Server 2008 R2.

## Folder Redirection

The following are Group Policy settings for Folder Redirection.

### Computer Configuration

[Computer Configuration\Policies\Administrative Templates\System\Folder Redirection]

* **Use localized subfolder names when redirecting Start Menu and My Documents**

[Computer Configuration\Policies\Administrative Templates\Windows Components \Windows Explorer]

* **Verify old and new Folder Redirection targets point to the same share before redirecting**

### User Configuration

[User Configuration\Policies\Administrative Templates\System\Folder Redirection]

* **Do not automatically make redirected folders available offline**
* **Use localized subfolder names when redirecting Start Menu and My Documents**

**Note**Folder Redirection also has a custom Group Policy user interface to simplify management. For more information, see Folder Redirection Overview at <http://technet.microsoft.com/en-us/library/cc732275.aspx> on Microsoft TechNet.

## Offline Files

The following are Group Policy settings for Offline Files.

### Computer Configuration

[Computer Configuration\Policies\Administrative Templates\Network\Offline Files]

* **Administratively assigned offline files**
* **Configure Background Sync**
* **Limit disk space used by offline files**
* **Allow or Disallow use of the Offline Files feature**
* **Encrypt the Offline Files cache**
* **Exclude files from being cached**
* **Remove ‘Make Available Offline’**
* **Enable Transparent Caching**
* **Turn on economical application of administratively assigned Offline Files**
* **Configure slow-link mode**

### User Configuration

[User Configuration\Policies\Administrative Templates\Network\Offline Files]

* **Administratively assigned offline files**
* **Remove ‘Make Available Offline’**

## Roaming User Profiles

The following are Group Policy settings for Roaming User Profiles.

### Computer Configuration

[Computer Configuration\Policies\Administrative Templates\System\User Profiles]

* **Add the Administrators security group to roaming user profiles**
* **Delete user profiles older than a specified number of days on system restart**
* **Do not check for user ownership of Roaming Profile Folders**
* **Delete cached copies of roaming profiles**
* **Do not detect slow network connections**
* **Prompt user when a slow network connection is detected**
* **Only allow local user profiles**
* **Set roaming profile path for all users logging onto this computer**
* **Do not log users on with temporary profiles**
* **Prevent Roaming Profile changes from propagating to the server**
* **Wait for remote user profile**
* **Slow network connection timeout for user profiles**
* **Background upload of a roaming user profile’s registry file while user is logged on**
* **Set maximum wait time for the network if a user has a roaming user profile or remote home directory**

[Computer Configuration\Policies\Administrative Templates\System\Group Policy]

* **Allow Cross-Forest User Policy and Roaming User Profiles**

### User Configuration

[User Configuration\Policies\Administrative Templates\System\User Profiles]

* **Network directories to sync at Logon/Logoff time only**
* **Exclude directories in roaming profile**
* **Limit profile size**

# **Version History**

|  |  |  |
| --- | --- | --- |
| **Version** | **Description** | **Date** |
| 1.0 | First release. | August 2010 |

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