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Documentation of Active Directory Migration

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Tämän opinnäytetyön aiheena on toimialueen aktiivihakemiston migraation dokumentoinnin laadinta yritykselle. Toimeksiantajana toimi keskisuuri yritys Oulun alueella. Yrityksen toimialueella on aktiivihakemistossa satoja käyttäjiä ja koneita, jotka kaikki täytyi siirtää kokonaan uuteen toimialueeseen, jossa käyttöjärjestelmänä on uusin Windows Server 2012 R2. Migraatiolle oli jo annettu ajankohta marraskuulle 2015, mutta valitettavasti migraatio myöhästyi monta kertaa muiden projektien takia, joita tietohallinto suoritti samanaikaisesti. Migraatiodokumenttiin kerättiin tiedot tärkeimmistä työtehtävistä ja tapahtumista. Vaikka suurimman osan migraation työstä teki kolmannen osapuolen yritys, aiheutti migraatio paljon töitä myös toimeksiantajana olevan yrityksen omalle tietohallinnolle.

Työn lopputuotteena oli kattava dokumentti yrityksen toimialueen aktiivihakemiston migraatiosta alusta loppuun asti. Toimeksiantaja voi käyttää dokumentaatiota tulevaisuudessa muun muassa tietojen tarkastamiseen, mitä muutettiin ja miksi, sekä ongelmien ratkointaan. Toimeksiantaja oli erittäin tyytyväinen lopputulokseen.

Opinnäytetyön teoriaosuuden tietoperustana käytettiin kirjoja ja internet-lähteitä, jotka keskittyivät dokumentointiin, Windows Serveriin ja migraatioon. Dokumenttien osuuksissa tutustutaan dokumenttien periaatteisiin, kuten niiden yleisohjeisiin, tärkeyteen ja sääntöihin. Windows Server 2012 R2 -versiot ja yleisimmät roolit esitetään tietoperustan toisessa osiossa. On tärkeää ymmärtää Windows Serverin perusteet, jotta voi ymmärtää mitä tapahtuu itse migraatiossa. Migraatiokappaleessa käydään läpi erilaiset resurssien migraatiovaihtoehdot, kun päivitetään palvelimia tai kun vaihdetaan kokonaan uuteen toimialueeseen.

Työosuudessa tarkastellaan syitä siihen, miksi yritys halusi dokumentoida migraation ja miksi migraatio ylipäätään tehdään. Samalla käydään lyhyesti läpi yrityksen toimialueen resurssit ja se, miten migraatio tehtiin. Työosuudessa käsitellään myös se, mitä itse migraatiodokumentti sisältää käymällä läpi dokumentin jokaisen kappaleen sisältö yleisellä tasolla.

Avainsanat: Windows Server, Aktiivihakemisto, Migraatio

ABSTRACT

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The subject of this thesis is to prepare a document of the Active Directory migration for a case company. This thesis was commissioned by a medium sized company in Oulu region. Their domain has hundreds of users and computers in their Active Directory which had to be moved to an entirely new domain which has a recent Window Server 2012 R2 operating system. The migration was set to take place in November 2015, but unfortunately migration was delayed multiple times because of other projects that the IT department had at the same time. Information about important tasks and events was gathered and added to the migration document. Even though most of the migration was performed by a third party company, it was still a lot of work for the company's own IT department.

The final product was a comprehensive document about the company's Active Directory migration from start to end. The company can use the documentation in the future, for example for checking information about what was changed and why, or for troubleshooting. The case company was very pleased with the end result.

The theory sections of this thesis involved books and internet sources that focus on documenting, Windows Servers and migration. The document section explores the basics of document guidelines and rules as well the importance of documentation. With these guidelines the documentation became even more extensive and comprehensive than was originally planned. The second section explains Windows Server 2012 R2 versions and basic server roles. Understanding the basics of the Windows Server is necessary for understanding what actually happens in the migration itself. The last theory section explores the different ways to migrate resources when upgrading a server or changing to a completely new domain.

The empirical section explores the reasons why the company wanted to document the migration, and why the migration took place. This section also briefly describes the company's domain resources and sums up what was done in the migration. Lastly, it covers what the AD migration document itself contains by going through every section of the migration document and explaining what they contain in general.

Keywords: Windows Server, Active Directory, Migration

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1 INTRODUCTION

The subject of this thesis is documenting Active Directory migration. Documenting this kind of delicate and important task for a company was really interesting, and the skills and knowledge acquired by being part of a migration project will be a valuable asset for the author in the future. Documenting the Active Directory migration taught a lot about the principles of documenting and working on an IT department.

The commissioning company which gave subject for this thesis is a medium sized company located in the center of Oulu, but for security reasons they wished to remain anonymous. They have hundreds of users and computers from over 10 different municipalities in their domain. Almost all the old Windows Server 2008 domain resources were migrated to a new Windows Server 2012 R2 domain.

The theoretical background of this thesis focuses on principles of documenting, Windows Server 2012 R2 and on the migration itself. Advantages of documentation and common effects of poor documentation are explained, and guidelines for migration documents are introduced. Fundamentals of Windows Server 2012 R2 and migration methods are also defined and explained in the theory section. Since the case company uses only Windows based servers, Linux based servers or services are not introduced in this thesis.

In the empirical section the state of the domain before migration is introduced, including the reasons for the migration, state of the resources before migration and the migration methods which were used. The contents of the migration document are introduced and explained. At the end of the empirical section the results of the migration are reflected as a whole.

2 DOCUMENTATION

According to Anttila (2001, 1-2) a paper or a file that contains certain information on some specific subject that can help or guide the reader can be called a document. A file that does not contain any information about any specific subject cannot be called a document. Usually documents are used to record vital information about certain subjects so that they can be used, for example, for troubleshooting or to check vital information.

Nowadays most of the produced documentations are electronic documents such as Microsoft Word files. Paper documentations are still used in some cases but they are not as common as they were before. For example, important documents are often printed out and copied for safekeeping, and it is still common to use paper documents in various events or meetings. (Anttila 2001, 1-2.)

2.1 Documentation in corporations

Companies produce large amounts of different documents such as project plans, statements, manuals, spreadsheets and entry forms. However, several of the documents among them contain irrelevant or outdated information. It is also common that documents are scattered on the employees' computers and on the company servers. To prevent this, companies should have proper guidelines for producing and managing documents. (Anttila 2001, 19-21.)

Anttila (2001, 19-21) states that it is difficult for the company's management to see the effects of poor documentation management on the daily life of the employees, or how much company's money is wasted because of it. Usually documentation is seen as very cumbersome and time consuming, and the benefits of good documentation are not taken into account. A company's management and superiors have to be the driving force to encourage employees to comply with the documentation rules and guidelines. Benefits of a good documentation in the daily tasks of an employee should be highlighted.

2.2 Documentation management programs

Anttila (2001, 3, 167-169) claims that larger companies should consider using documentation management programs, as with these programs all documents can be managed and controlled through one program or website. Documentation management programs are easy to use and they offer far better search parameters than conventional documenting methods. All the documents can be searched, for example, by creation year, author's name, or with a certain word that is used in the document. Furthermore, documents user rights can also be effortlessly controlled within the program, so the IT department does not have to struggle with folder rights.

Keeping up different versions of the documents is automatic, so the reader can switch between different versions effortlessly. Information about documents that needs approval go straight to the authorized person, after this the authorized individual signs the document and then a new version of the document is released. This is why documentation management programs are so popular nowadays. However, cost of these programs can be too high for small companies, so it is wise to make an assessment to ensure that the program meets to the needs of the company. (Anttila 2001, 3, 167-169.)

For example, SharePoint is one well-known documentation management programs that is widely used around the world. It enables the user to configure document types, templates, metadata, stored location, document access and so on. SharePoint offers companies the appropriate tools to manage documents effortlessly. (Microsoft 2014, date of retrieval 27.11.2015.)

2.3 Disadvantages and advantages

According to Anttila (2001, 3, 20, 170) In a company with poor documentation management, up to half of the employee's time can be spent to searching documents or reading ambiguous and unclear documents. If the documents are not gathered in the agreed location in a logical way, it is no surprise why so much time is spent searching for them. This is the most common reason why employees create duplicate documents about the same subjects. When documents are organized, employees work quality will rise and they will not have to make documents about the same subjects over and over again. With proper documents training new employees will be faster and more efficient. Providing the proper documents to right people at the right time is very

important in big companies and organizations. It is also quite common that only certain employees have the knowledge of the content and location of certain documents, and in the worst case scenario the information is only in the employee's memory and not in any written document. In such cases, the resignation or a retirement of the employee can be destructive to the company's performance.

When writing documents, the text should be kept compact and informative. The spelling, abbreviations and punctuations errors should be checked and corrected before releasing the document. Having proper writing guidelines and templates for documents makes creating documents more convenient than creating documents from the beginning every time. An up-to-date version list enables the reader to find out which individuals had modified the document, when it was modified and what changes were made to the document. Reader can also ascertain who authorized the finalization and what were the approval conditions of the document. With all these working properly the work efficiency will rise and the communication between employees will become better. As a result, the company will most likely save money. (Anttila 2001, 20, 170.)

2.4 Security and backups

Company's documentations usually contain vital information of the company, so it is important not to let them end up in wrong hands or to get destroyed. It is important to mention documents in the information security guidelines and train employees comply with the security practices. Dividing documents to groups and levels makes it more convenient to apply access rights for the right users. This way the employees can only see and edit documents they need in their line of work. There are a lot of harmful programs and viruses spreading with the documents so keeping antivirus and firewall updated is vital. It is also possible to prevent malicious software infections by saving the documents in an untraditional format or a format that cannot be edited or tampered. (Anttila 2001, 145, 148, 153.)

Computers do break down occasionally, but still the most common reason for removal or destruction of files are user errors and intentional sabotage. Backing up vital files and documents is very important in any company or organization. When doing the backup, it is common practice to use partial backup every evening by saving all the files and changes made during the day, and running a full back up every week to ensure that everything is backed up. Running the backups

outside working hours will not disrupt the work of the regular employees. If the company uses a documentation management program it is sufficient to take a backup from the database file. (Anttila 2001, 150-151.)

2.5 Migration documentation guidelines

When reading a migration document, the reader should be able to narrate the process of the migration project plan so that the steps are in order and the plan for testing and implementing is clear for the reader. Usually migration documents have quite similar features to those of design documents and this is why many companies usually combine these two documents. However, in design documents the focus is on decisions made and on the end results, but migration document deals with details of the processes and the steps taken. Even simple tasks might take several pages in a migration document. (Amaris, Abbate, Droubi, Yardeni, Noel, & Morimoto 2012, Chapter 2, Creating the Migration Document.)

According to Amaris et al. (2012, Chapter 2, Creating the Migration Document) migration documents summary section has to have concise information of what the entire document contains. Preferably it should depict the steps of the migration on the highest level and the scope of the work. It should also contain the decisions and approvals made during the migration. Migration goals and objectives section might seem unnecessary, but all the goals might not be included in the text of the document. That is why it is good to have all the precise objectives and goals in one section of the documentation, so that the reader can always check them when viewing the document.

The background of the project part should answer to the question 'why'. For example, why use this method instead of some other method, or why the migration is being performed and why these tools are used to do the migration. Many of these decisions are made in conjunction, so it is a good practice to summarize them into a migration document. This way the reader will understand the reasons for these decisions that were made and what was agreed upon. It is also important to assess all the risks and assumptions in the document. Even the most unlikely risks should be listed. (Amaris et al. 2012, Chapter 2, Creating the Migration Document.)

List of the responsibilities and roles section should have detailed information of everyone's tasks on the migration project. In case there is a third party company involved in the migration their tasks should also be listed in the migration document. Making a timeline with milestones of everyone's tasks for the migration project is also very useful. There should always be specific target dates and milestones set in the project schedule. When setting the timelines and milestones one should be aware of the important dates and other large projects, so that they would not overlap with the migration timeline. This section is mainly for managers and executives. (Amaris et al. 2012, Chapter 2, Creating the Migration Document.)

According to Amaris et al. (2012, Chapter 2, Creating the Migration Document) plan of the training should be included on the document. The individual who performs the upgrading as well the managing of the new environment should have the right skillset and knowledge to recognize faults that should be covered in training. The training usually happens during the prototype testing process and it is usually performed in a hands-on fashion with the project team. It is not unusual to use a third party company for the training process. If there are new client side tools it would be wise to consider having training sessions with the users. (Amaris et al. 2012, Chapter 2, Creating the Migration Document.)

In the book Amaris et al. (2012, Chapter 2, Creating the Migration Document) state that proper migration document should have a Gantt chart when describing the migration processes. Gantt chart illustrates start and finish dates of different tasks or processes. Modern versions also have dependencies shown in the chart, which depict the relationships between different activities. Expanding the Gantt chart shows to the resources and what is expected from them. It clarifies what are the processes for each task but there is no need for step-by-step instructions in the chart, for example, if there is indication about Windows Server 2012 R2 configuration, but when the Gantt chart process is 'opened' it should list server roles and applications that are going to be installed on the server.

In the migration document everything should be described in detailed manner. It is important to document the sign-off conditions of the prototyping phase and point out which individual is authorized to do the signing off for the prototyping phase. Documenting piloting should have as much attention as the migration itself. In pilot phase all upgraded functions like remote access, shared folders, and file encryption are the most common things to be tested and documented. It is not uncommon that some cases of piloting might require some external assistance. Migration

document usually also contains support tasks that are performed after the migration. If support phase is documented, then all recovery and maintenance plans or guides should be in the document. (Amaris et al. 2012, Chapter 2, Creating the Migration Document.)

Estimates of the budget usually includes the cost of prototyping, piloting, migration, support and training. There are a lot of variables when it comes to cost and which is why estimating the precise amount of cost can be difficult. Some phases can last longer due to encountered problems and while other phases can go swiftly without problems. The best way to reduce the implementation costs is to try to improve the process phases including piloting and prototyping. (Amaris et al, 2012, Chapter 2, Creating the Migration Document.)

3 WINDOWS SERVER 2012 R2

According to MSDN (2015, date of retrieval 22.11.2015) guide the Windows Server 2012 R2 version 6.3, which was released in 2013, is the most recent version of the Windows Server operating system. The consumer version of Windows 8.1 was also released at the same time. Microsoft TechNet (2015, date of retrieval 23.11.2015) site states that at minimum Windows Server 2012 R2 requires 1.4 GHz processor, 512 MB RAM and 32 GB of free space from the server. It should be noted that Windows Server 2012 runs only on x64 processors, so in other words Windows Server 2012 comes only in 64-bit.

The administrator can configure the settings or add roles to the servers from the Server Manager console, which appears after booting up the server as can be seen in the figure 1. Managing multiple servers is easy and it does not matter whether the servers are virtual or physical. When adding roles, the wizard assists the administrator by showing what tools and features are needed for the requested roles. The new dashboard in Server Manager shows if there is an error in any of the roles or services that are running. With the new built-in features the Server Manager is more comprehensive and efficient. (Roth et al. 2013, Chapter 1. What's New in Windows Server 2012 R2)

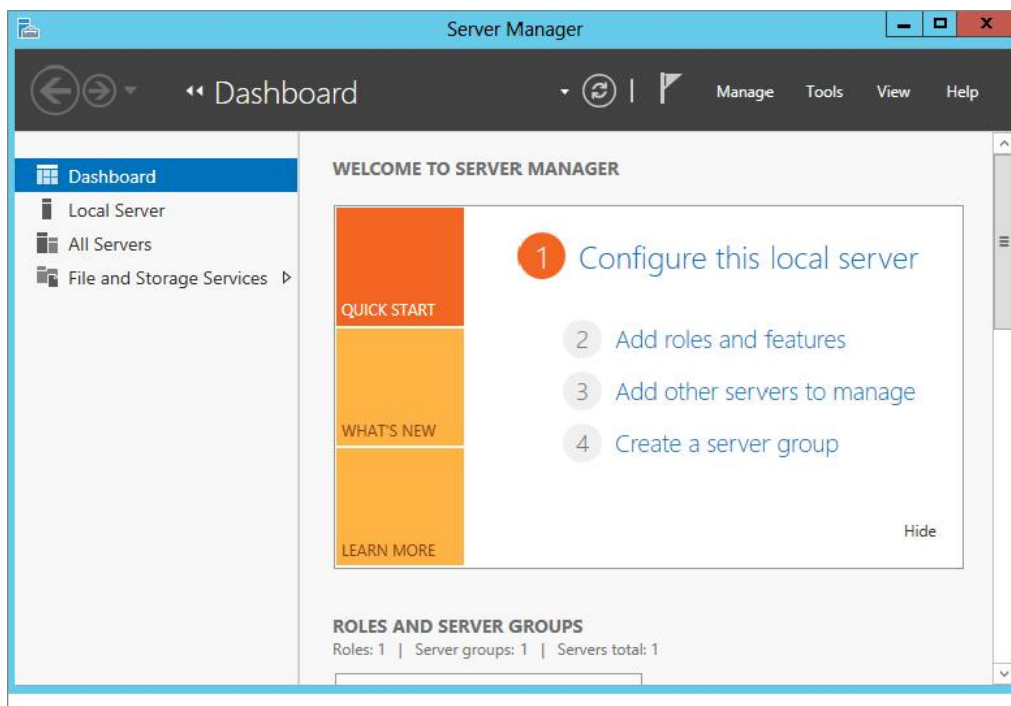


FIGURE 1. Server Manager Dashboard (Roth et al. 2013, Chapter 1. What's New in Windows Server 2012 R2)

Amaris et al. (2012, Chapter 1, Windows Server 2012 defined) write that other notable improvements compared with Windows Server 2008 are performance, security and manageability. When upgrading from Windows Server 2003 to 2012 R2 there are several new features such as PowerShell administration, Active Directory Recycle Bin, managed service accounts, global catalog cloning and offline domain join.

3.1 Versions

According to Amaris et al. (2012, Chapter 1, Versions of Windows Server 2012) Microsoft has simplified the licensing and version options for the new Windows Server 2012 R2. Upon its release, it had two main versions: Standard edition and Datacenter edition. These two versions meet most of the needs companies could have. Later they released two other versions which were Windows Server 2012 R2 Foundation server and Hyper-V. The Foundation server is meant for appliance system tasks such as web services or running Windows-based applications. Hyper-V is meant to provide virtualization hosting which means that administrator can create virtual servers and run them in the company's domain.

In Windows Server 2012 R2 changing from graphical user interface (GUI) mode to non-GUI mode called Core is easy and simple. Administrator just chooses change the mode and then re-logs to the server so that the change comes to effect. In previous versions the operating system had to be reinstalled if the administrator wanted to change to Server Core from GUI version or vice versa. As the name implies the Server Core has only the core functions and features of the operating system, as can be seen in table 1. (Roth et al, 2013, Chapter 1, What's New in Windows Server 2012 R2.)

TABLE 1. Comparison of Core and GUI version. (Microsoft TechNet 2014, Date or retrieval 22.11.2015.)

	Core Server	GUI Server
Command prompt	available	available
Windows PowerShell/Microsoft .NET	available	available
Server Manager	not available	available
Microsoft Management Console	not available	available
Control Panel	not available	available
Control Panel applets	not available	available
Windows Explorer	not available	available
Taskbar	not available	available
Notification area	not available	available
Internet Explorer	not available	available
Built-in help system	not available	available
Themes	not available	not available
Windows 8 Shell	not available	not available
Windows Store and support for Windows Store apps	not available	not available
Windows Media Player	not available	not available

When Microsoft updated the Windows Server 2012 R2 licensing after initial release they also made new versions of the operating system which are Windows Server 2012 Essentials, Windows Storage server 2012 R2 standard and Windows Storage Server 2012 R2 workgroup. The Essentials version is rather similar as Foundation version except that it supports more SMB connections, users, Random Access Memory (RAM) and it requires Active Directory Domain Services (AD DS) role. Storage Servers are mainly to set up and manage one or more file servers, which helps provide central location on your network to store files and share them to the users. (Microsoft 2015, date of retrieval 29.10.2015.)

3.2 Roles

Kivimäki (2009, 410) states that Windows Server configuration consists of roles that can be installed to the servers. The roles define what the server can do or what are they used for. There can be one or multiple roles in one server at the same time. In its default form Windows Server has no roles.

With Windows Server roles administrators can organize and manage the functions of Windows Server 2012 R2 operating system. This includes tools for administrators which they can use to maintain, manage and summarize the installed roles and features across multiple systems simultaneously. Administrators can add, manage or remove roles by using Server Manager Control panel. (Amaris et al. 2012, Chapter 1, Managing Windows Server 2012 Roles and Features.)

3.2.1 Active Directory Domain Services

Active Directory Domain Services (AD DS) is a directory service based role on Windows Server operating systems. Active Directory (AD) is Microsoft's Windows-domain user database and directory service which contains information about users, computers and networks resources. Servers that have Active Directory role installed are called domain controllers. The domain controller verifies and authorizes all users and computers that are connected to the domain. The Active Directory role requires Domain Name Service (DNS) to work. It should be installed before or simultaneously with AD. After AD DS role has been installed, it has to be configured and promoted with a post installation. (Kivimäki 2009, 421.)

According to Microsoft TechNet (2014, Date of retrieval 29.10.2015) Active Directory schema is a component that defines all the attributes and objects the Active Directory service uses to store data. Storing and retrieving information from different services and applications is standardized in different ways by the AD. By doing this the integrity of the data is always maintained. The objects itself contains different attributes such as data and related metadata. Properties of other data is described in metadata. For example, user account object has multiple attributes such as logon name, first name, last name and user password. These attributes have their own additional attributes with their own metadata, such as the logon name has its name and syntax value that need to be valid so that the user object itself is valid.

In Active Directory there are five Flexible Single Master Operations (FSMO) roles or Operations Master roles assigned to at least one domain controller. The name flexible comes from the fact that the roles can be transferred to any domain controller in the domain. These five FSMO –roles are Schema Master, Domain Naming Master, Infrastructure Master, Relative Identifier (RID) Master and Primary Domain Controller (PDC) Emulator. FSMO role duties are to control tasks

assigned to them and to prevent conflicts. For example, only the server that is Schema Master can perform updates to the directory schema. (Microsoft, date of retrieval 29.10.2015.)

In a Multi-Domain Active Directory forest, the global catalog works as a distributed data repository which contains partial representation of every object of every domain in the AD DS forest. Domain controllers that have been designated as global catalog server and are distributed through Multi-Master replication are the ones that store the global catalog. Global catalog searches are faster since it does not involve referrals to other domain controllers. (Microsoft TechNet 2014, date of retrieval 29.10.2015.)

Microsoft TechNet (2012, date of retrieval 29.10.2015) states that Lightweight Directory Access Protocol (LDAP) provides support for directory-enabled applications, without the domain related restrictions and dependencies of AD DS. Even member or standalone servers can run LDAP-service. It is also possible to run multiple instances of LDAP on the same server with each having its own independently managed schema.

3.2.2 AD DS Domain

AD DS Domains are policy boundaries for all the objects. All the computers and users are managed and stored within the domain. Domains are logical organizations of objects, and they are not tied to physical locations so it is not necessary set up multiple domains for remote sites (see figure 2). (Amaris et al., Chapter 4, Understanding the AD DS Domain.)

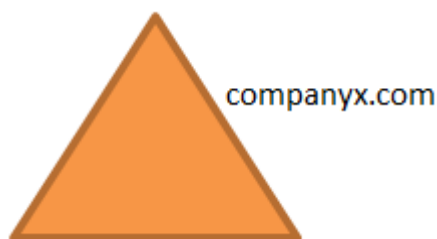


FIGURE 2. Single domain

Amaris et al. (2012, Chapter 4, Understanding the AD DS Domain) states that AD DS domains connected by two-way transitive trusts is called AD DS tree. The main domain in which all of the other domains are connected to is the root or parent domain. The others are usually called child

domains, and the two-way transitive trust between the parent and child domains is usually also called parent-child relationship (see figure 3). All the domains in the AD DS tree share the same global catalog and schema. Trusts between domains in the tree is automatic. All the domains trust each other because the others do, so basically the trust flows through the domain structure. For example, if user is authenticated by one domain in AD DS tree, then the user's authentication is accepted by all the other domains that trust the authenticating domain.

However, this does not mean that, for example, all users in the other domain would have access or permissions to another domains resources. The Administrator of the domain must issue the rights for the users from the other domain so that they could, for example, have access permission to certain resources. Two-way transitive trust simply provides a pathway from one domain to another. Every domain in a tree shares the same namespace, but they still have security mechanisms to segregate access from the other domains. (Amaris et al., 2012, Chapter 4, Understanding the AD DS Domain.)

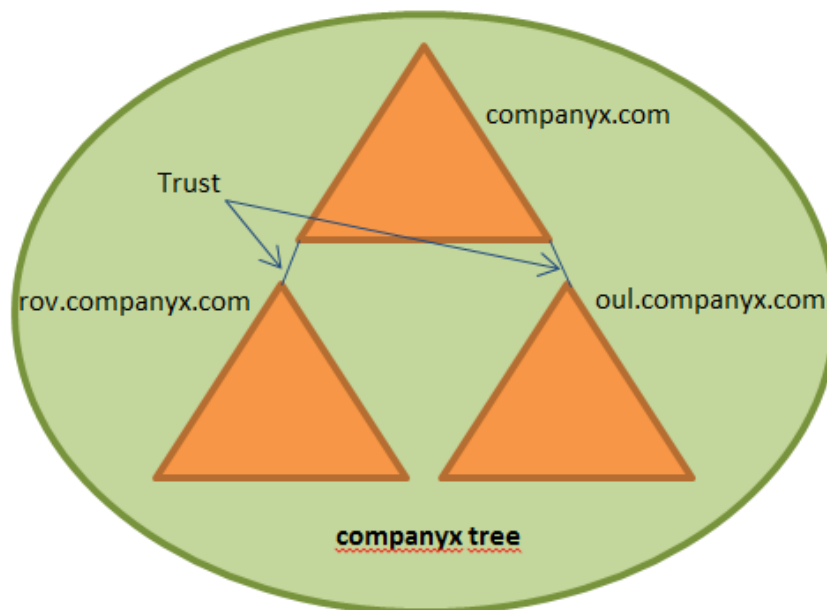


FIGURE 3. Domain tree

Forests consist of groups of interconnected domain trees. Forests have their security policies and they serve as administrative security boundaries for all objects. Each tree is connected together with implicit trusts into a common forest. Every domain and every tree in the forest share a common global catalog and schema (see figure 4). Domains and trees in the forest do not need to share a common namespace. For AD DS the forests are the company's main boundary. It is assumed that all administrators within the forest are trusted to some degree, and if administrator

of a domain is not trusted it should be placed in a separate forest. (Amaris et al., Chapter 4, Describing AD DS Domain trees.)

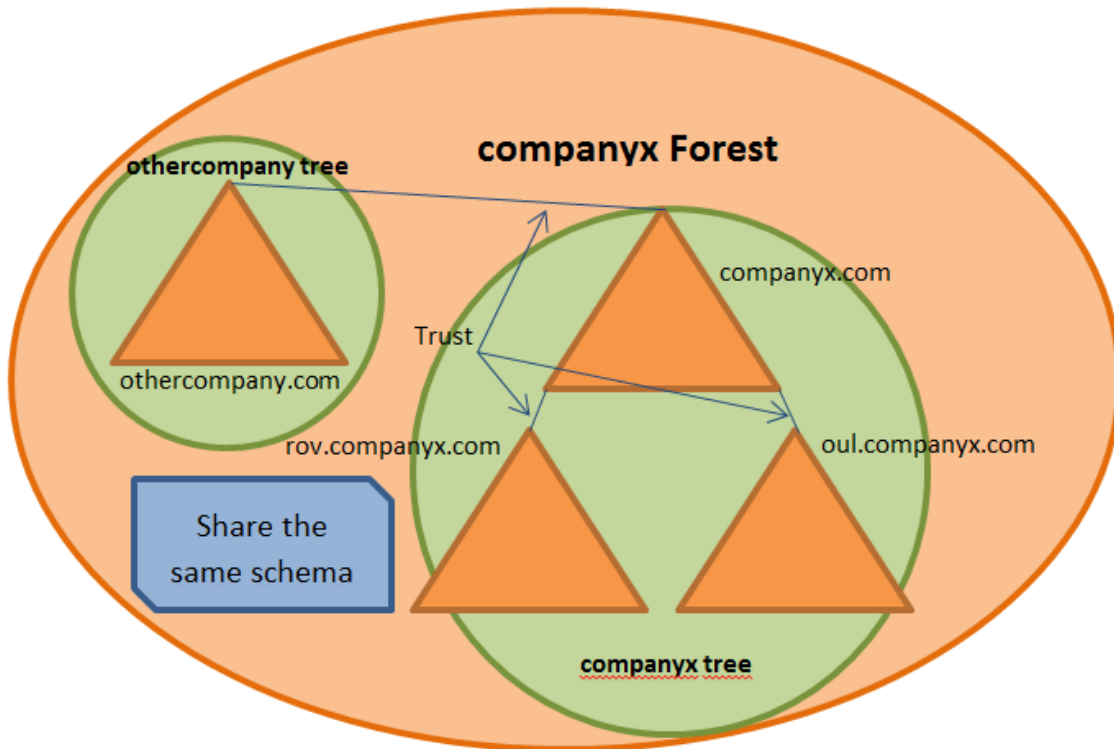


FIGURE 4. Domain forest

3.2.3 Domain Name System

Domain Name System (DNS) is a service that is responsible of the name resolutions, which refers to combining a certain IP-address with the correct name. With the help of DNS, for example, in AD all the computers can be searched by their names instead of their IP-addresses. Primarily DNS is used to make name resolutions in the Internet but it also functions the same way in Active Directory. (Kivimäki 2009, 473.)

Kivimäki (2009, 473) reminds that the DNS service is essential to the Active Directory domains since they form their naming structure and hierarchy with DNS. Active Directory domain controllers register their computer names, IP-addresses and services to the DNS service. Other computers, such as other controller computers, member servers and workstations, locate these controllers and their services with the help of DNS-service.

3.2.4 File and Storage Services

File and Storage Service is the combination of File Services and Storage Services roles in the new Windows Server 2012 R2. Although this role is installed by default; administrator has to use the Server Manager to add additional roles that serve File and Storage Services. (Roth et al, 2013, Chapter 13, Files, Folders, and Basic Shares.)

Roth et al (2013, Chapter 13, Additional Role Services and Features) also state that File Server is one the most commonly used role when managing and creating shares, and it can be used to allow users to access and share files within the company network. When folder is shared the File Server feature is automatically added to the roles. File Server also uses the latest SMB 3.0 protocol, which provides shared access to files, printers, and communication between different machines on a network.

File Server Resource Manager (FSRM) is a File Service role which, for example, services as BranchCache for remote offices and as a Windows Search service. Another very popular new feature is Data Deduplication (Dedup) which enables the administrator to save disk space. Dedup does not store multiple copies of the same files, instead there is only a one copy that takes up space and every other duplicate is just a reference of the original file. The idea is to store more data but use less space by maintaining only a single copy of the duplicates. (Roth et al, 2013, Chapter 13, Files, Folders, and Basic Shares.)

3.2.5 Dynamic Host Configuration Protocol

According to Kivimäki (2009, 601) when using Transmission Control Protocol/Internet protocol (TCP/IP protocol) at least the IP address and subnet mask have to be defined for the computer. Normally also Default Gateway and DNS settings are defined as well. Without these settings the work computer will not work as intended because it cannot connect to the company network, and setting up network settings to every company computer would be very time consuming and problematic. For this reason, Dynamic Host Configuration Protocol (DHCP) is used to automatically set up the IP-address and TCP/IP-settings for the computers.

DHCP server is the one that provides the TCP/IP and other settings to DHCP clients automatically. With DHCP the administrator can control the settings of the distribution of these settings, such as IP scopes. When the DHCP server receives request from a client, it chooses an address from the address pool and offers it to the client computer. When the offer is accepted the DHCP-server leases the IP-address to that client computer for a certain period of time. When the lease expires and if the IP is not in use, the DHCP leases it to another computer that requests IP settings. (Kivimäki 2009, 601.)

4 WAYS TO MIGRATE RESOURCES

Sivarajan (2013, Chapter 1, Instant Migration from Windows Server 2008 and 2008 R2 to 2012 How-to) states that migrating resources could mean upgrading to a new Windows Server environment and retaining the resources that the server has. More likely it means changing to a totally new domain while bringing over existing resources. Resources refer to AD objects like computers, users and group policies. However, according to Amaris et al. (2012, Chapter 2, Creating the Migration Document) there can also be some drawbacks when upgrading or migrating to a new domain like compatibility issues with some of the software that is used in the company, and depending on various reasons some of the resources might not be migrated at all. Administrators should always check the compatibility of their software and make sure that the resources that they need can be transferred before actually doing the migration.

The in-place upgrade is a straightforward operation which means, for example, upgrading the existing Windows Server 2003/2008 R2 to a recent 2012 R2 version and bringing the resources to the new environment. In an addition to operating system upgrade, it will also update most of the settings, services and components that the server has. This includes services such as DNS, DHCP and Windows Internet Naming Service (WINS). This is why in-place upgrade method is very tempting for small companies that have only one domain. Upgrading to a new Windows Server version is usually performed when companies want to increase security or use the new Windows Server features that might benefit the company performance. However, In-place upgrades from 32-bit to 64-bit architectures are not supported. (Amaris et al. 2012, Chapter 16, Exploring Migration Options.)

When upgrading domain controller, it should have 32 GB free space for the operating system and free space that is at least twice the size of the current Active Directory database. When upgrading to a more recent Windows Server version it is recommended that the company has at least Windows Server 2003 SP3 operating system which has the native functional level of Windows Server 2003. The hardware should meet or exceed the requirements of Windows Server 2012 R2, and all the software and drivers should be checked for compatibility. The domain controller's hardware should be powerful enough to support Windows Server 2012 R2 for the next two to three years. Otherwise it should be replaced by a new domain controller with a more powerful

hardware to support the new operating system. (Amaris et al. 2012, Chapter 16, Exploring Migration Options.)

In the phased upgrade method, the migration is as straightforward as in the in-place method, but it is not as fast since the domain controllers are upgraded in phases. The domain controllers will coexist with each other over an extended period of time while the forest is being upgraded. This is easier to do when there are many domain controllers in the forest. This is the highly recommended method if the companies have many domains in their network. (Amaris et al. 2012, Chapter 16, Exploring Migration Options.)

According to Sivarajan (2013, Chapter 1, Instant Migration from Windows Server 2008 and 2008 R2 to 2012 How-to) the third option is migrating resources to another domain. When companies merge, divide or restructure their network, they have to migrate resources if they do not want to start from the beginning in the new domain. In some cases, migrating is the only way to save resources when the existing domain that has a lot of issues. Migrating resources is not a straightforward operation and often everything cannot be migrated to the new domain. Amaris et al. (2012, Chapter 16, Exploring Migration Options) states that migrating resources to a totally new domain means leaving behind the legacy Active Directory. This way administrators will not have to concern themselves with legacy Active Directory schemas and they do not need to consolidate names or Active Directory services. With the new AD administrators can make a fresh start in the new domain while still retaining their old resources.

Migrating resources any given server can produce more work hours than what was first anticipated. The company servers have many intricate and critical roles that are essential for the companies' performance. That is why it is important to document the specifics of the migrated servers and plan how to perform the migration properly. Migrating file or printing servers is quite an easy task, but in the real world companies' servers have several other roles and features that are not that easily migrated. Migration can disrupt the workflow of the entire company if something goes wrong. When migrating there will be changes to Security Identifiers, which can impact users access to the company network. However, there are techniques and tools that mitigate the problems that could hinder users or the use of the applications. (Amaris et al. 2012, Chapter 16, Exploring Migration Options.)

One of these tools is Active Directory Migration Tool (ADMT) which allows consolidation, collapsing and restructuring for resources. More recent versions also provide tools to restructure existing forest or domain environments which are to be migrated to new Windows Server 2012 R2 Active Directory. For example, with ADMT the administrator can keep user passwords and security settings unchanged. Taking the Source Security Identifier (SID) as a history attribute in the new domain will enable the old and new objects to exist at the same time and enable access to all the resources that has been assigned to either one. However, SID History filtering has to be disabled and trusts has to be enabled for it to work. (Amaris et al. 2012, Chapter 16, Exploring Migration Options.)

5 DOCUMENTING COMPANY'S AD MIGRATION

The thesis plan was to make and design the documentation for the company's Active Directory migration. The documentation will serve as an example and the documentation template will be on their disposal for the future documents. With the documentation the IT department can verify information and it can also help them with troubleshooting in the future. For example, with the document the IT department will be able to look up what settings, IP-addresses or attributes were changed due to the migration.

The IT department's previous documentation was outdated and incomplete, but there was still useful information in the previous documents. They had made the same kind of common documentation management mistakes that were presented in the theory section. Rest of the information was gathered from the third party companies' documentations, meetings and from the employee who was in charge of the migration.

5.1 Reasons and resources of the migration

After many years of consideration, the company's management had finally decided that they will not support child domains anymore since they were restructuring the company network, so the options were to make their own Active Directory domain or to migrate resources to the parent domain. Because of financial status and dependence on the services that the parent domain provides, IT department decided that migrating to the parent domain was the best option for them. As mentioned in the theory section migrating is very common when companies restructure their network. By choosing this method IT department can continue their work as usual after the migration since they could continue using the same third party companies and services as they always had.

Migrating to parent domain enabled users to use only one username and password combination for every application they use, which was of course a very positive feature. Previously before the migration users had to use two different username and password combinations to certain applications and some applications just used the other one, which was quite confusing for many of the users. Migration also meant that IT department in Oulu would not have control of the Active

Directory after the migration since the parent domain had its own administration. Though with the company's LDAP service website the IT department in Oulu can still do basic changes to users and groups when needed. All the changes made in the LDAP service are replicated to the AD.

The company had two domains, one of which was a child domain to the parent domain. The plan was to migrate resources from the child domain to the parent domain and also upgrade from a Windows Server 2008 to a most recent Windows Server 2012 R2, which was introduced in the theory section. The company's old domain and child domain had 52 servers of which 38 were virtual. The older domain servers were not migrated since all of them had Windows Server 2003 operating system which was not supported in the parent domain. The old servers were only kept in operation because of their billing history database, which was important for the Oulu financial department.

The child domain of which resources were to be migrated had 40 servers and close to 600 users and computers. With the help of two third party companies it was decided that half of the servers were outdated or useless and would be decommissioned. All the essential servers were to be transferred or rebuilt onto the parent domain. All the users, computers and printers were migrated to the parent domain. Since the child domain had its own administration and the AD had a different environment structure from the parent domain, the old domains SID information and the group settings could not all be migrated. The IT department did not want to disrupt employees' work with the migration, so the biggest migration tasks were done during the weekend. Because of the systems in place with the parent domain IT department could not import certain resources like groups, so they had to be remade in the parent domain.

Active Directory Connector (ADC) was used to import most of the objects. The only option in this case was to use LDAP queries to migrate all the users, and some of the common user groups that could function in the parent domain. The other options did not meet the requirements that IT department had for the migration or they were not compatible with the environment that the IT department had. The query was made by the third party company, IT Department just made the necessary changes to the query before it was deployed. All the computers were manually changed to the parent domain by the IT department.

5.2 Contents of the migration document

This section explains the structure and contents of the migration documentation. Migration documentation guidelines that were introduced in the theory section were used to make the documentation for the company. Some of the guideline sections were not used, but the unused sections are introduced and reasons for not using them are explained. Microsoft Word 2013 was the mainly used program for making the document, and since the company had no document templates the migration document had to be made from scratch.

First thing that can be seen in the document is the edit list (see figure 5) which contains the editor's name, date and information of what was updated or changed. Actual version numbering was not used since it was concluded to be unnecessary by the IT department. From the list the authorized person who in this case was the person in charge of the migration could check what was edited and by whom.

Editor	Changes	Date
Kalle Taskila	Status, reasons and roles, history and present, servers	14.10.2015
Kalle Taskila	Roles and third party companies	18.10.2015
Kalle Taskila	Third party roles, risks	24.10.2015
Kalle Taskila	Plans, IT department, Third party	29.10.2015
Kalle Taskila	Third party plans	3.11.2015
Kalle Taskila	Training and piloting	14.11.2015
Kalle Taskila	Migration tasks, before migration, DC and printing server	28.11.2015
Kalle Taskila	Training and piloting	11.11.2015
Kalle Taskila	Migration tasks, planning the OU and group structure	20.11.2015
Kalle Taskila	Migration tasks	23.11.2015

Authorized persons approval: _____

FIGURE 5. Simplified version of the editor list

The summary section consisted of all the information of the document in a compact manner, all the tasks of the migration were depicted shortly from the start to finish step by step. This way the reader has the general idea of every step and decisions that were made for the migration. The contents of the migration document are depicted in the figure 6.

1	SUMMARY.....	1
2	STATUS, REASONS AND ROLES.....	2
2.1	History and present status of the network resources.....	2
2.1.1	Child domain servers.....	2
2.1.2	Old domain servers.....	8
2.1.3	VMWare datastores.....	11
2.2	Reasons for migrating.....	11
2.3	Role of the IT departmnet.....	11
2.4	Third party organization X.....	12
2.4.1	Role of X.....	12
2.5	Third party organization Y.....	13
2.5.1	Role of Y.....	13
2.6	Possible risks and complications.....	13
3	PLANS.....	15
3.1	IT department plans.....	15
3.2	X plans and guidelines for migrating resources.....	16
3.3	Y companys plans for the servers.....	18
3.4	Plans from the company management.....	20
3.5	Training and Piloting.....	22
4	MIGRATION.....	25
4.1	Migration tasks.....	26
4.2	End results.....	179
5	SUMMARY.....	181

FIGURE 6. Contents of the migration document

The background section of the migration document explains the history of the company and the state of their network before migration. All the servers are listed in alphabetical order in the sub-headings. Next there is a separate section which clarifies the reasons of the migration, which were also described in the previous section. Goals of the migration are also briefly mentioned in the same section as the reasons of the migration. The role of the IT department in the migration is detailed in the next separate section on the document.

After the sections involving the IT department, all the third party companies and employees were introduced so that the reader would get idea what kind of companies they are and what they do. Their roles in the migration processes were also introduced. Information of this section was based on the third party companies' websites and the IT department's previous documentation. All the risks and assumptions regarding the migration were listed onto a table so that they would be precise and easy to understand.

The plans for the migration of all third party companies, company management and IT department were gathered to this migration document so that anybody authorized to access the document could check the plans and changes made during the migration. Every issued and revised versions of the plans can be found in the document, so all details from the plans were kept intact.

IT department made a plan for the training or prototyping with the help of third party companies since they had a lot of experience from migrating the other child domains. All the faults and possible problems from the training were listed in the document. Prototype testing process was performed hands-on fashion by the IT department. The third party companies assisted the IT department in the training and piloting. The piloting itself was documented in precise fashion, for example, all the upgraded functions and tests that were performed in the piloting were documented in detail.

All the tasks and duties performed by the IT department were gathered in one section. Every task is described step by step with screenshots so that it is as accurate and easy to understand as possible. Tasks performed before, during and after were separated on their own headings so that it would be clear for the reader in what phase had those tasks been done. Documenting simple tasks such as setting up the printing service and printers to the new printer server took many pages, since there were screenshots and step by step instructions for the whole process, but listing all the groups and users took almost a hundred pages. After the migration all the support tasks like recovery, maintenance plans and guides were also documented. For example, all the tasks such as changing the shared printer's groups or transferring users' files from the old file server to the new one were documented.

The employee's conclusions and observations were also collected to the migration document. After migration was fully completed the document was checked and authorized by the person in charge of the migration. The document was backed up in the company's file server in non-editable PDF form, and a paper copy was also made and deposited to the company's safe.

Real timeline for the migration was never made since the IT department was guided by the third party company and went by with their time constraints. They had no exact timeframe when the migration itself would take place, but they knew that it would happen in November 2015 and that the preparations for the migration should be performed before that. Many of the migration preparation tasks were given every other week during September and October. Some of the tasks had to be postponed since the IT department had two other projects at the same time.

The budget was not documented because it was decided to leave it out from the document because it was not essential for the project. Most of the consulting from the third party company were paid by the IT departments company's management. IT department just had guidelines how much they could use the consulting assistance of the third party company.

6 CONCLUSIONS

The goal was to make extensive documentation of the AD migration and I think that the final document was quite good and close to what the case company wanted. Many of the migration guidelines that were introduced in the theory section were used to make the documentation. I made the documentation from beginning to the end mostly by myself, with the help of the information of previous documentation and IT departments employees. By being part of the AD migration project and working at the IT department I learned a lot about working in an IT related workplace. I also learned many new skills that I can use in the future.

Because of the many projects that the IT department had, the migration was postponed multiple times. It was quite stressful since nobody was sure if the migration would be finished in time, and working as a trainee while making the document and going to school made it hard to focus on the thesis itself. Producing the text for the thesis was easy, but deciding what information was relevant and what to leave out was sometimes difficult, and I wasn't always able to proofread all of the content properly due to lack of time. Finding the latest, detailed information was challenging since there weren't many recent books available, and some of the books were aimed at people who already have prior knowledge about the subject. Because of this, the accuracy and relevancy of the theory section subjects had to be fine-tuned several times.

The case company was very happy with the final version of the documentation. The document can be useful when checking information about changes that were made during the migration. Hopefully having a proper template and an example document will encourage the IT department to make more and better documents and to keep them up to date, since the old documents lacked simple document qualities and they also were quite scattered. Also by updating the editor list they will always know who edited the document and when was the last time that it was edited.

Personally I would recommend the company to use some kind of documentation program in the future. The company does have a couple documentation platforms, but one of them is meant for historical documents and the other is used only for publishing general instructional documents. Neither of these platforms offer any kind of editing or search tools for managing the documents. With a documentation management program, it would be easier to centralize the documents in one place in a logical manner and searching the documents would be much easier.

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