# Windows Server 2019 Administration Fundamentals

Second Edition

A beginner's guide to managing and administering Windows Server environments

Bekim Dauti

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**Bekim Dauti**

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**BIRMINGHAM - MUMBAI**

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## *Second Edition*

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*With all respect for mankind's achievements in every aspect, especially technological, the stopping and prevention of wars remains the main challenge that mankind has to overcome.*

*– Bekim Dauti*

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# Foreword

Windows Server 2019 is the latest and greatest server operating system from Microsoft, which combines hybrid cloud and cloud-connected workloads into one box and provides a huge list of new and improved capabilities, which have been addressed in this book.

While Windows Server 2019 is a solid release from Microsoft that addresses some immediate pain points and provides a firm foundation for future data center developments. There is a lot to learn, but there is no definitive guide besides this book that covers everything you need to know about Windows Administration. The book is not just designed to give you theoretical knowledge; it also covers how to implement this theory in practice, and it gives you tips on how to do so step by step via the exercises.

This is not the first book from Bekim Dauti. He has been blogging for years and has authored different books on Windows. His experience will help you to learn what you need to learn much more quickly.

I hope you will enjoy reading the book as much as I did.

Dr. Erdal Ozkaya

Head of Information and Cyber Security

# Contributors

## About the author

**Bekim Dauti's** profession is the administration of computers and networks, as well as training in Cisco and Microsoft.

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These days, he blogs on `Bekim Dauti's Blog`. He works as a system administrator at Kosovo Telecom JSC.

*I thank God for giving me life, health, and the opportunity to contribute through knowledge sharing. May God Almighty reward my family, friends, the folks at Packt Publishing, my teammates at Kosovo Telecom JSC's SysAdmin team, my colleagues both at Dautti Sh.p.k. and QuickStart Inc., and everyone who supported me in writing this book. Last, but not least, peace and blessings to every reader.*

# About the reviewer

**Premnath Sambasivam** is a technical analyst with 7 years of experience in Windows, VMware, and SCCM administration. He is an MCSE Cloud Platform and Infrastructure certified professional. He has also developed and deployed Microsoft System Center Configuration Manager solutions to manage more than 6,000 assets in his clients' environments. Premnath is a Microsoft enthusiast who loves to learn about and explore Azure and PowerShell. He is currently working as a Projects Lead for one of the major retail brands in the USA. He reviewed the book *Mastering Windows Server 2019* earlier this year, which was also published by Packt Publishing.

*I would like to thank my wife and son for encouraging me to spend time learning, since reviewing books also refreshes our memory and enables us to learn about the latest technologies and software improvements. Special thanks to my mom and dad for always being supportive.*

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# Preface

Windows Server 2019 is the latest server operating system developed by Microsoft as part of the Windows NT family of operating systems, based on the Windows 10 platform.

With Windows Server 2019, Microsoft is continuing to build an advanced and secure cloud platform that began with Windows Server 2016. This vision was to bring the cloud to everyone by providing platforms and tools to help build IT solutions that drive success. With Windows Server 2019, Microsoft has consolidated its status in the world of cloud service providers by competing head to head with **Amazon Web Services Cloud** (**AWS Cloud**). For this reason, there has been no better time to become a system administrator.

This book will begin with the computer network essentials and then move into the world of Windows Server 2019. It covers all aspects of the administration-level tasks and activities that are required to become an expert in Microsoft Windows Server 2019. It begins by introducing Windows Server and Windows Server 2019, and then gradually builds up its content with the installation and deployment of Windows Server 2019 in `Chapter 3`, *Installing Windows Server 2019*. After becoming familiar with Windows Server's 2019 post-installation tasks in `Chapter 4`, *Post-Installation Tasks in Windows Server 2019*, you will start to functionalize Windows Server 2019 by adding roles to it. By doing so, you will find out what a domain controller is, how to set up a file and print server, configure a web server and host a website, virtualize your IT environment, automate Windows Server 2019 deployment, centrally manage the Windows Server 2019 updates, and many more interesting things. With the help of multiple hands-on exercises, you will gain an immense understanding of Windows Server 2019, which will help you to solve difficult tasks easily. At the end of the book, you will be exposed to maintenance and troubleshooting tasks where, with the help of best practices, you will manage Windows Server 2019 with ease.

At its heart, this book aims to teach you the system administrator's craft. In order to validate your skills and the knowledge gained from this book, each chapter ends with a concept summary and questionnaire to help you take full advantage of the content provided. By the end of this book, you will have enough knowledge to administer and manage Windows Server 2019 with ease, and also be able to pass the MTA: Windows Server Administration Fundamentals: 98-365 exam with no difficulty.

# Who this book is for

If you are a system administrator or an IT professional interested in deploying and configuring Windows Server 2019, then this book is for you. Additionally, this book will also help you to study and pass the MTA 98-365 exam.

# What this book covers

`Chapter 1`, *Getting Started with Windows Server*, provides you with an introduction to Windows Server. At the beginning of this chapter, there is a recap of the most basic concepts of computer networks. So, this chapter is organized into two parts, where each part attempts to provide a concise, yet complete, description of the basic concepts of computer networks. Definitions of key terms such as hosts, nodes, peer-to-peer, and clients/servers are covered in the *Computer network overview* section.

`Chapter 2`, *Introducing Windows Server 2019*, introduces you to Windows Server 2019. Windows Server 2019 is developed by Microsoft as part of the Windows NT family of operating systems and concurrently with Windows 10 version 1809. The *Windows Server overview* section uncovers the essentials of Windows Server 2019. In addition, it outlines the various Windows Server 2019 editions and compares Windows Server 2019 to Windows Server 2016 with a focus on what is new in Windows Server 2019.

`Chapter 3`, *Installing Windows Server 2019*, provides you with detailed instructions for installing Windows Server 2019. The step-by-step instructions, driven by easy-to-understand graphics, show you how to master the installation of Windows Server 2019. You will quickly learn the installation process without hitting any obstacles. This chapter is an excellent collection of how-to tips and provides information on getting the job done efficiently.

`Chapter 4`, *Post-Installation Tasks in Windows Server 2019*, explains the steps that are required during the post-installation stage of Windows Server, including managing devices and device drivers, checking the registry and status of services, and taking care of the initial server configuration. This chapter is divided into three parts: each topic is accompanied by step-by-step instructions driven by targeted, easy-to-understand graphics.

`Chapter 5`, *Directory Services in Windows Server 2019*, introduces you to directory services. Now that you have learned how to install Windows Server 2019 and run the initial server configuration, it is time to set up the very first services in your organization's IT infrastructure. With that in mind, this chapter explains directory services. Additionally, you will become familiar with **Organizational Units** (**OUs**), default containers, user accounts, and groups so that you can organize the user and computer accounts in your domain.

`Chapter 6`, *Adding Roles to Windows Server 2019*, provides a broader explanation of what a role is, as well as the importance of roles in determining the server's function when providing network services. You will also get to know all the roles and features that Windows Server 2019 supports. You will learn how to add roles to your server, as well as the requirements after you have added roles so that you can set up your server whenever it is required.

`Chapter 7`, *Group Policy in Windows Server 2019*, helps you to gain an understanding of **Group Policy** (**GP**) in Windows Server. You will learn about GP processing, become familiar with the GP Management Console, find out about both computer and user policies, and get to know local policies for when your server is not part of a domain. At the same time, you will learn the steps involved in configuring computer and user policies in a domain-based network.

`Chapter 8`, *Virtualization with Windows Server 2019*, teaches you virtualization concepts, as well as getting you familiar with Hyper-V software, which enables the virtualization of Windows-based servers. You will discover the steps it takes to add the Hyper-V role to your server, get familiar with Hyper-V Manager, and learn the steps it takes to create virtual machines. That way, you will be able to understand what virtualization is, and how you can enable the Hyper-V role and create virtual machines.

`Chapter 9`, *Storing Data in Windows Server 2019*, explains storage technologies. As well as understanding storage technologies in general, you will learn about a variety of related topics. These include physical interfaces and disk controllers. We will also explore how data is stored in a medium, the types of storage systems used in network environments, and various storage protocols. Additionally, you will get to know the concepts and types of RAID.

`Chapter 10`, *Tuning and Maintaining Windows Server 2019*, covers the best practices and considerations for server hardware. By understanding the importance of a server's role in a computer network, and learning about each server component, we can be vigilant when selecting server hardware. In addition to this, this chapter teaches you server performance monitoring methodologies and procedures. Performance monitoring will help you to identify the cause of server performance issues early on.

`Chapter 11`, *Updating and Troubleshooting Windows Server 2019*, outlines the server startup process; advanced boot options and Safe Mode; backup and restore; the disaster recovery plan; and how to update the operating system, hardware, and software. Event Viewer is mentioned too, which will help you to monitor different logs in your system, thus helping you to troubleshoot and solve problems. In this way, you will be able to minimize downtime, which, from a business point of view, is expressed in money loss.

`Chapter 12`, *Preparing for the MTA 98-365 Exam*, offers an overview of the MTA 98-365 exam, including a look at the skills measured in the exam. Additionally, this chapter contains explanations as to what the MTA 98-365 exam or Windows Server Administration Fundamentals certification is and how to register for the exam. Furthermore, you will find useful resources to help you gather as much information as possible about the exam in general, discover what it takes to pass it, and, by doing so, launch a successful career.

`Appendix`, *Assessments*, provides you with answers to the chapter questions. Each chapter is accompanied by a considerable number of questions to help you reinforce the concepts and definitions provided. With this appendix, you can check your answers to those questions.

# To get the most out of this book

You must have solid experience of working with the Windows 10 operating system and have solid knowledge of computer networks and network operating systems.

Make sure you have a computer with a processor that supports virtualization technology and has between 8 and 16 GB of RAM.

# Download the color images

We also provide a PDF file that has color images of the screenshots/diagrams used in this book. You can download it here: `https://static.packt-cdn.com/downloads/9781838550912_ColorImages.pdf`.

# Conventions used

There are a number of text conventions used throughout this book.

`CodeInText`: Indicates code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles. Here is an example: "Provide credentials to access the `Deployment Share` folder."

Any command-line input or output is written as follows:

```
Export-SmigServerSetting -FeatureID DHCP -Path C:\DHCP\Store
-Verbose
```

**Bold**: Indicates a new term, an important word, or words that you see on screen. For example, words in menus or dialog boxes appear in the text like this. Here is an example: "Select **Settings** from the **Start** menu."

Warnings or important notes appear like this.

Tips and tricks appear like this.

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# 1
# Section 1: Introducing Windows Server and Installing Windows Server 2019

The first section covers Windows Server, in general, and Windows Server 2019, in particular. It also covers the installation of Windows Server 2019. Upon the completion of this section, you will have enough knowledge about Windows Server in general, and Windows Server 2019 in particular. Additionally, you will be able to clean install, upgrade, and migrate to Windows Server 2019, as well as be able to complete network and unattended installation too.

This section comprises the following chapters:

- `Chapter 1`, *Getting Started with Windows Server*
- `Chapter 2`, *Introducing Windows Server 2019*
- `Chapter 3`, *Installing Windows Server 2019*
- `Chapter 4`, *Post-Installation Tasks in Windows Server 2019*

# 1
# Getting started with Windows Server

This chapter is designed to provide you with an introduction to Windows Server in general, and Windows Server 2019 in particular. Windows Server 2019, the newest version of the Microsoft OS for servers, is the follow-up to Windows Server 2016. Besides introducing Windows Server, right at the beginning of this chapter, you will find an overview of the very basic concepts of computer networks. This chapter is organized into two parts; each part provides a concise but complete description of these concepts.

Definitions such as hosts, nodes, peer-to-peer, and clients/servers are covered in the Understanding Computer Network section. Windows Server 2019 is covered in the Understanding Servers Windows Server Overview section. Finally, once you are acquainted with the essentials of Windows Server in general and Windows Server 2019, in particular, through chapter exercise you will have the option to download Windows Server 2019 and create an installation media.

The following topics will be covered in this chapter:

- Understanding computer networks
- Understanding servers
- Understanding Windows Server
- Chapter exercise—downloading Windows Server 2019

## Technical requirements

In order to complete the exercise in this chapter, you will need the following equipment:

- A PC with Windows 10 Pro, at least 16 GB of RAM, 1 TB of HDD, and access to the internet

# Understanding computer networks

It all began many years ago when the need for **sharing resources** became a necessity. As time went by and demands increased, the development and advancement of computer network technologies also took place. With that, more computers were connected to computer networks and geographical distances were diminished in terms of communication. It created a need for well-defined terms and concepts to describe computer networking. Because of that, different types of computer networks, network topologies, architectures, and components have emerged.

Let's begin by understanding what a computer network is.

## What is a computer network?

From my experience, people often confuse what a computer network is with what a computer network does. While the first explains what constitutes a computer network, the latter shows the benefits of a computer network. In *Figure 1.1* we can see that a **computer network** is a group of computers connected to each other in order to share resources. The resources are usually data, network services, and peripheral devices:

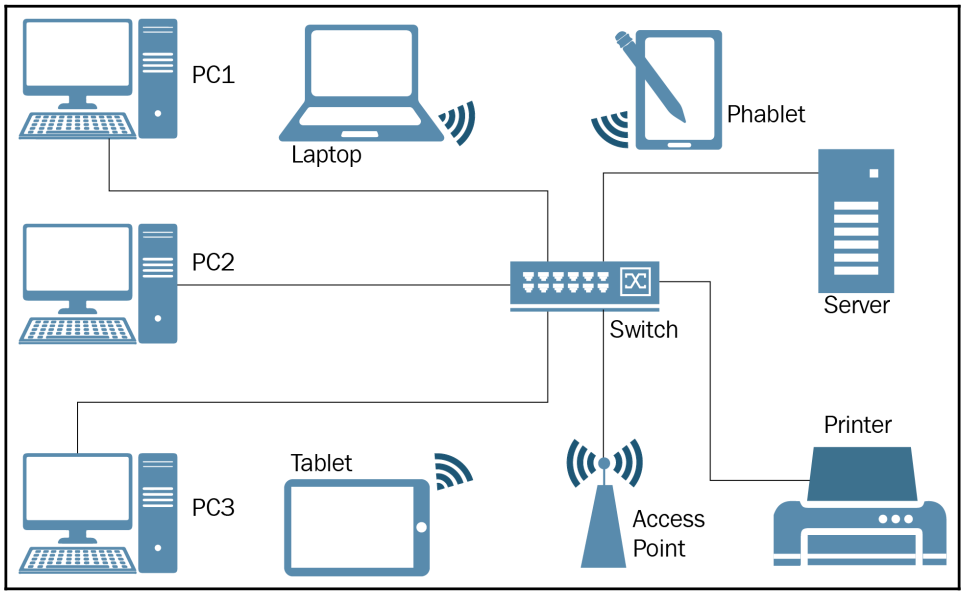


Figure 1.1: A typical computer network

A computer network is divided into different types. Let's take a look at each of them individually.

# Types of computer networks

In general, the categorization of computer networks consists of the **area** they cover and the **purpose** they serve. Some of the most popular types of computer networks nowadays are described in the following subsections.

## Personal Area Network (PAN)

A Personal Area Network (*Figure 1.2*) is a computer network that is used to connect and transmit data among devices located in a private area that is partially or completely protected from external access. Bluetooth and Wi-Fi are the most common communication technologies used to interconnect devices in a PAN. Often, a PAN is also known as a **Home Area Network** (**HAN**):

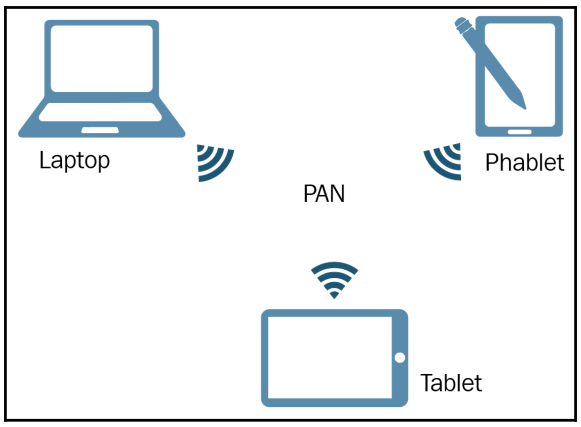


Figure 1.2: A PAN

Another type of network is **local area network** (**LAN**). However its coverage is far greater than a PAN. Let's learn more about it next section.

# LAN

A LAN (*Figure 1.3*) is a computer network that connects two or more computers in a local area. Try to understand a local area as one single room, a floor, several floors, a building, or several buildings adjacent to each other at a distance that Ethernet communication technology permits. A LAN usually utilizes a central device that uses twisted pair, coaxial, or fiber optic cables as a networking media to interconnect computers:

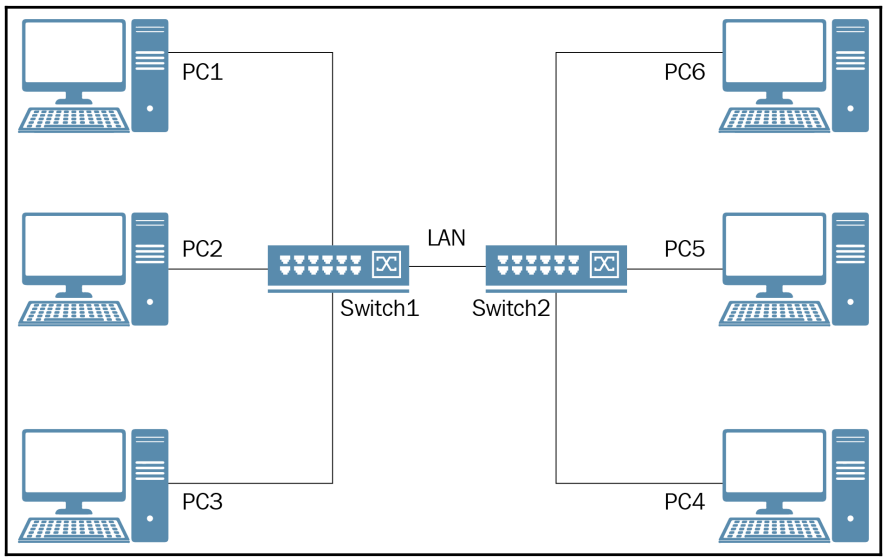


Figure 1.3: A LAN

The next type of network that we are going to look at is the **Metropolitan Area Network** (**MAN**).Its coverage is even greater than a LAN.

# MAN

In contrast to a LAN, a MAN (*Figure 1.4*) represents a group of LANs interconnected within the geographical boundary of a town or city. Nowadays, fiber optics and gigabit layer 3 switches are used to interconnect LANs and route the traffic among them, as seen in the following figure:

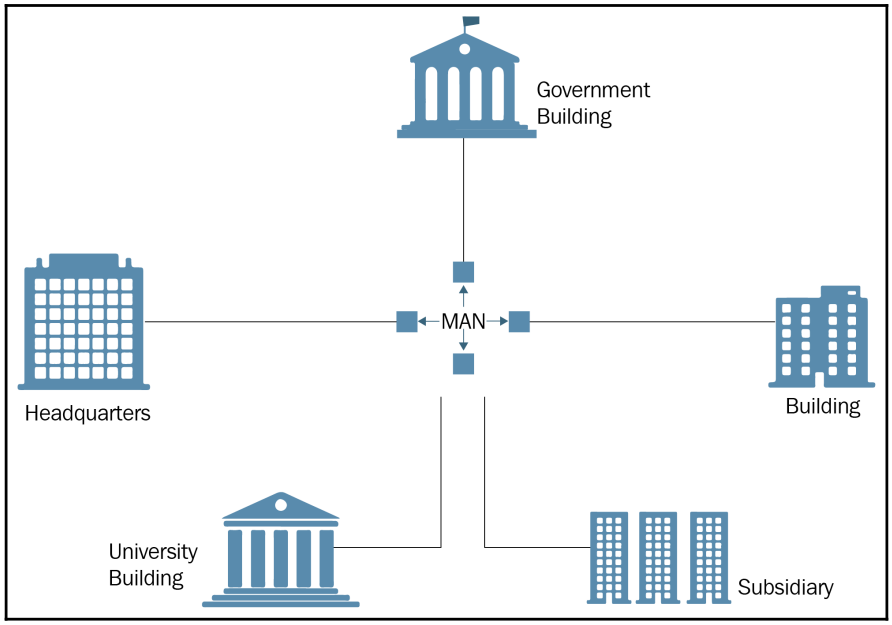


Figure 1.4: A Metropolitan Area Network

Finally, we will understand what is a **wide area network** (**WAN**) which has the greatest coverage.

## WAN

Unlike a MAN, a WAN (as shown in *Figure 1.5*) is a computer network that covers a wide geographic area using dedicated telecommunication lines such as telephone lines, leased lines, or satellites. WANs cover large geographic areas and, as such, they do not have geographic restrictions. The internet is the best example of a WAN:

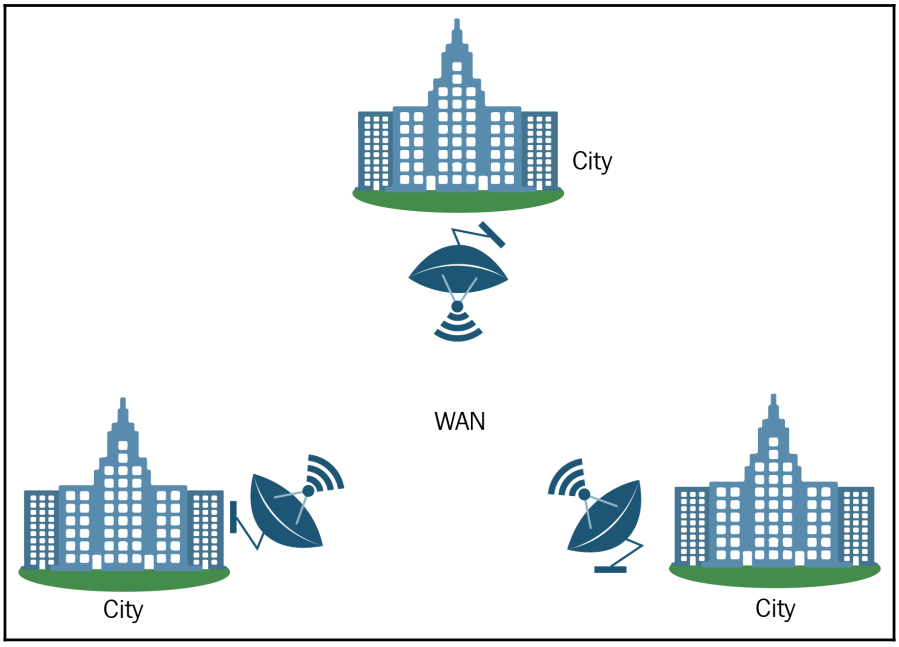


Figure 1.5: A Wide Area Network

Now that we've understood the different types of computer networks, let's take a look at the underlying components that make up these networks.

# Understanding computer network components

Just as PCs have **components**, computer networks have their own components, too. Usually, while PCs and peripheral devices are known to most people, components such as networking devices, networking media, and **network operating systems** (**NOS**) are mostly known by IT professionals.

Let's first understand what clients and servers in a computer network are.

# Understanding clients and servers

Let's assume that the network resource is the point of reference for both clients and servers. Then, in a computer network, **clients** usually request access to resources. On the other hand, **servers** are responsible for providing resources and managing access to those resources. Both clients and servers play an active role in the computer network. In *Figure 1.6*, a server with a directly connected printer provides print resources to PCs in the role of resource requests:

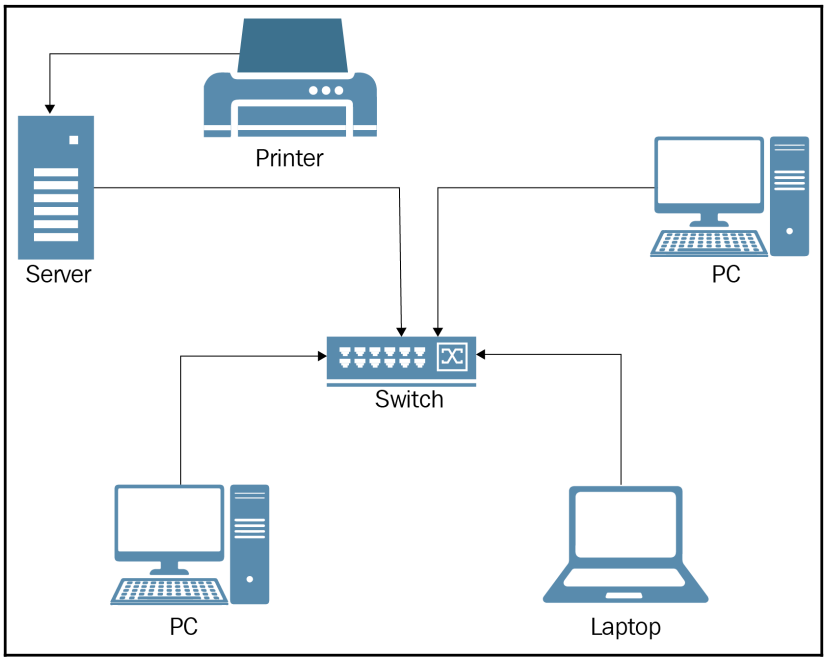


Figure 1.6: Client and server in a computer network

Interestingly, the origin of the word **servers** comes from the word **serve**. If you search for the word serve in the Merriam-Webster dictionary, among the results, you will find one that says: *to provide services that benefit or help*. From that, we can think of a server in a computer network as the computer that provides services to clients. In conclusion, the server serves the clients.

Although clients and servers are the most important elements of a computer network, it depends upon hosts and nodes. Let's see how it fits into this structure.

# Understanding hosts and nodes

Have you ever heard terms such as hosts and nodes and wondered what they are? Although our first impression might drive us toward thinking that they are the same thing, they are not! While all hosts can be nodes, not every node can act as a host. Hence, a **host** is any device with an IP address assigned to its network interface that requests or provides networking resources on the network. Usually, clients, servers, and routers act as hosts.

An Internet Protocol address, popularly known as an IP address, is a logical element comprised of numbers that is assigned to host's network interface in order to identify it in a computer network.

However, a **node** is any device that can receive and transmit the networking resources on the network but has no interface with an IP address assigned to it. Nodes have a network interface that is used for their management. In *Figure 1.7*, the PCs and the file server act as hosts, while switches act as nodes:

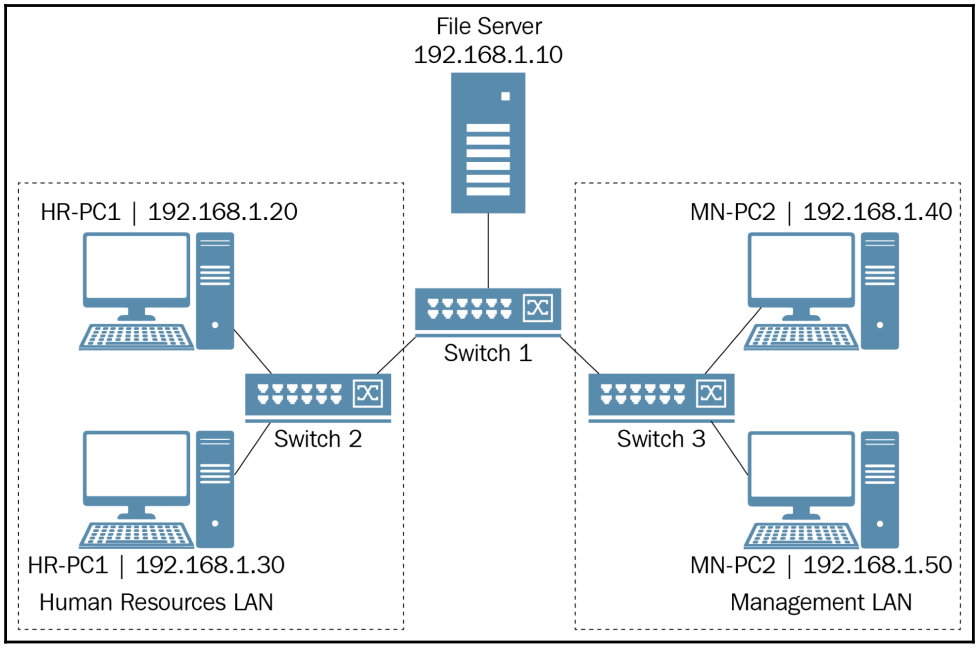


Figure 1.7: Hosts and nodes in a computer network

Now that we have learnt what a network is and its components we are well equipped to understand its architecture.

# Understanding computer network architectures

A computer network architecture represents a computer network design that enables network components to communicate with one another. Computer architecture is actually a framework that incorporates many aspects, such as physical and logical topology, network components, communication protocols, and its operational principles and procedures. Among network architectures, the most popular are **Peer-to-Peer** (**P2P**) and client/server.

Let us first understand the P2P network architecture.

## P2P network architecture

**P2P**, often known as a workgroup, is a computer network (see *Figure 1.8*) in which hosts do not have predefined roles. Instead, they change roles from client to server, and vice versa, based on their actual activities on the network. For example, if **PC1** is requesting resources from **PC2**, then **PC1** acts as the client and **PC2** acts as the server. If **PC2** requests resources from **PC1**, then **PC2** acts as a client and **PC1** acts as the server. Usually, PANs represent the best examples of P2P computer networks:

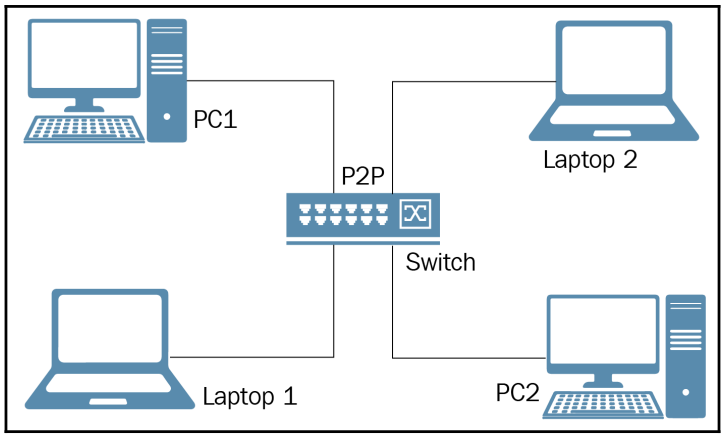


Figure 1.8: A Peer-to-Peer computer network

Peer-to-Peer (P2P) network architecture refers to a network model in which hosts or computers are equal in terms of capabilities and responsibilities. Having said that, depending on the circumstances, each host may be a client or server depending on whether it requests or provides services in that network.

The next type of network architecture is the Client/Server architecture.

## Client/server network architecture

A **client/server**, often known as a domain-based network, is a computer network (see earlier *Figure 1.7*) in which hosts have a predefined role. In such a network, hosts that request resources act as clients, whereas hosts that provide resources act as servers. In general, the client/server network architecture is a network with dedicated servers. Usually, LANs, MANs, and WANs represent the best examples of client/server computer networks.

At this point we have a greater understanding of how a network operates. However for a computer to communicate in a network it requires an IP address. We will learn more about this in the next section.

# Understanding IP addressing and subnetting

For a computer to be able to communicate in a computer network, it must have an **IP address**. As explained earlier, the IP address identifies the computer on that network. In addition, in complex networks, we encounter the term **subnet**, which helps to identify the specific network within the overall network. So far, the world of networks recognizes two IP-addressing technologies: IPv4 and IPv6. Nevertheless, even though IPv6-addressing technology is becoming more and more plausible, it still prefers the role of spectator in the great arena of the internet, in which IPv4-addressing technology continues to be the norm.

Let's first take a look at IPv4 network addresses.

## IPv4 network addresses

An **Internet Protocol version 4** (**IPv4**) addressing technology—is often referred to as just an IP address. The label v4 represents the fourth version of IP addressing as specified in IETF publication RCF 791. It is a logical element in a network that consists of 32 bits organized into 4 octets with 8 bits each, divided by a decimal point for simplicity of interpretation (for example, `192.168.1.1`).

Additionally, the IETF's RFC 791 document organizes IP addresses into 8-bit, 16-bit, or 24-bit prefixes, which introduces the **classful addressing** that enables IP addresses to be organized into classes of A, B, C, D, and E. With classful addressing, the IP address is split into the bits used for the network portion and bits used for the host portion for a given class.

Now let's take a look at the IPv6 addressing technology which was introduced to overcome the IPv4 address exhaustion of IPv4 network addresses.

# IPv6 network addresses

An **Internet Protocol version 6** (**IPv6**) addressing technology - is another logical element that identifies a device on a computer network. The label v6 represents the sixth version of IP addressing, as specified in IETF publication RFC 2460. Unlike IPv4, IPv6 is a 128-bit address size organized into 8 hextets with 16 bits each, divided by a colon for simplicity of interpretation (for example, `2001:0DB8:85A3:0000:0000:8A2E:0370:7334`). The fact that IPv6 uses 128 bits makes it possible to use $2^{128}$ IPv6 addresses which when calculated gives an approximate number of 340 undecillion IPv6 addresses . Undoubtedly, that represents an extremely large number of available IPv6 addresses.

Next, let's take a look at IPv4 subnetting which plays an important role in identifying the network addresses

# IPv4 subnetting

**Subnetting** represents a logical division of one large network into multiple smaller networks. In subnetting, a subnet mask plays an important role in identifying the network and determining the size of the network. Additionally, subnetting enables you to identify the network address, host addresses, and broadcast address of a given network. By definition, a subnet mask is a 32-bit address used in combination with an IPv4 address to indicate a network and its hosts.

The default subnet masks, otherwise known as **classful networks**, for each class of IPv4 addresses are shown:

| **IPv4 Class** | **Default subnet mask** |
|---|---|
| A | 255.0.0.0 |
| B | 255.255.0.0 |
| C | 255.255.255.0 |

You can learn more on IPv4-addressing technology, address space exhaustion, and classful networks at `https://blogs.igalia.com/dpino/2017/05/25/ipv4-exhaustion/`.

So far we have understood what a computer network is and the various types, components, and architectures. In the next section, we will introduce to Windows Server and its related concepts.

# Understanding servers

Throughout its history, **Windows Server** has evolved from a simple file server to an operating system that is capable of handling network services in complex environments such as corporate networks. Thus, Windows Server can provide network services such as domain controllers, web servers, print servers, and file servers. It often acts as a separate platform in which enterprise applications such as Exchange Server, SQL Server, SharePoint Server, and others are executed. With its robust performance and advanced security, nowadays, Windows Server is shaping **cloud computing**.

# Understanding server hardware and software

As you may recall, computer hardware and software represent the physical and logical components of a server, respectively. Thereof, since the primary role of the server is to provide network services to the clients, a server requires powerful hardware too. This is because software such as Windows Server is designed to process large workloads; therefore, reciprocally, its hardware is required to be durable and made of high-quality materials so it can continually deliver services and support network-based operations. Thus, apart from distinguishing it from the ordinary computer, a server is also specific to the types of services it provides. For example, a database server requires more memory and storage space.

The CPU, memory, disk, and network are known to be the **key system components** that affect the overall performance of your servers. It is recommended that the performance of key system components is continuously monitored in order to maintain the optimal performance of servers for both normal and heavy workloads.

Let's first understand what a CPU is.

# Understanding a CPU

A **Central Processing Unit** (**CPU**), or processor, is a chip on a server's motherboard. In literature, you often encounter the term **computer's brain**. It is a component that does all the processing and calculations. Intel and AMD are the biggest CPU manufacturers for PCs and servers. Their newest CPUs on the market are based on 64-bit architecture, which differs from 32-bit architecture-based processors. In 64-bit architecture, 64 bits of data are exchanged between the CPU and RAM in each communication session. On the other hand, in 32-bit architecture, only 32 bits of data are exchanged per communication session between RAM and CPU. That is half as less data being communicated via 32-bit architecture as compared to a 64-bit architecture.

In order to give out the performance, the CPU depend on RAM. Let us learn about this next.

# Understanding memory

RAM represents the server's working memory, which is used by Windows Server 2019 and server applications. Thus, the more RAM on the server, the more applications can run simultaneously. You can learn more about RAM in the *Understanding memory* section in `Chapter 10`, *Tuning and Maintaining Windows Server 2019*.

Now let's understand what a disk is in the case of servers.

# Understanding disks

As you know, data is usually stored on a **disk**. In the case of servers, they mostly have more than one disk, which is referred to as the server's disk sub-system. As for disk performance, read/write speed is an element that must be taken into consideration, because the faster the disk's throughput, the higher the performance of your disk sub-system.

Now let's understand what a network interface is.

## Understanding a network interface

A **network interface** enables the server to connect to an organization's LAN and to the internet. Servers usually have more than one network interface. The faster the server's network connection speed is, the more data the server can send and receive to and from the network.

Now that we have understood what a server is, let's take a look at the various server sizes, form factors, and shapes.

# Understanding server sizes, form factors, and shapes

Regarding size and form factors, servers come in three different shapes:

- **Rack-mountable servers** are designed to be installed in a frame called a rack (see *Figure 1.9*). These servers usually populate on-premises server rooms or data centers:

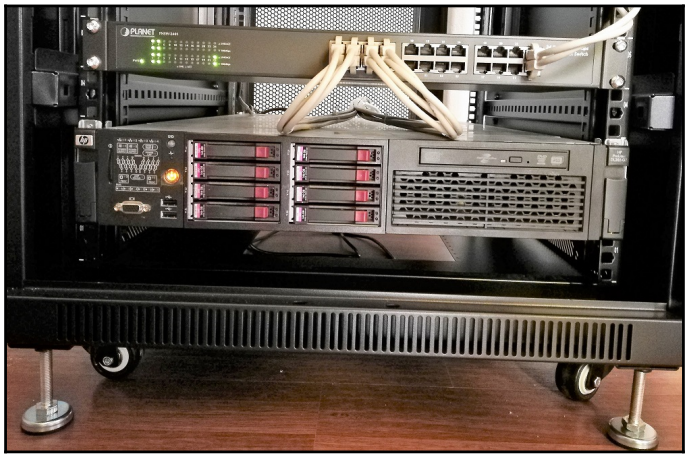

Figure 1.9: An HP server in a rack

- **Blade servers** are small modules known as blades that are installed on a server's chassis to save space and power. These servers usually populate data centers or supercomputer facilities.
- **Tower servers** are single big case servers that stand upright. These servers are usually either used for testing purposes or to provide local services in a SOHO.

A 64-bit Windows Server installed on a 64-bit hardware server can process double the amount of data compared to a 32-bit Window Server installed on a 32-bit hardware server.

Just like your computer, the server too has its own operating system that enables network services. Let us learn more about it.

# Understanding a Network Operating System

A **Network Operating System** (**NOS**) is software that is capable of managing, maintaining, and providing resources in a network. Additionally, an NOS is capable of sharing files and applications, providing web services, managing access to resources, administering users and computers, providing tools for configuration, maintaining and providing resources, as well as other functions related to network resources. With that in mind, a NOS is an important component when it comes to managing computer network resources.

These days, versions of Windows Server, Linux Server, and macOS Server are all considered to be an NOS because they are all capable of providing network services. Let's understand each one of them individually.

# Windows Server overview

As you know, Windows OS is a Microsoft product. Its server line began with Windows NT 3.5 in the early 90s, which was then followed by other Windows Server versions, starting with Windows Server 2000. At its core, it's a GUI-based OS; however, as of Windows Server 2008, a Server Core edition was introduced, which is a CLI-based OS. From Windows Server 2003 to Windows Server 2008, the architecture was both 32-bit, and 64-bit; however, since Windows Server 2012 it's only 64-bit. The **New Technology File System** (**NTFS**) continues to be its native filesystem; from Windows Server 2012, **Resilient File System** (**ReFS**) was introduced to replace NTFS. However, even on Windows Server 2019 (see *Figure 1.10*), NTFS is a native filesystem. Nowadays, Windows Server powers many organizations' backend systems and is thus able to provide network services for Windows-based hosts as well as to hosts with a non-Windows OS.

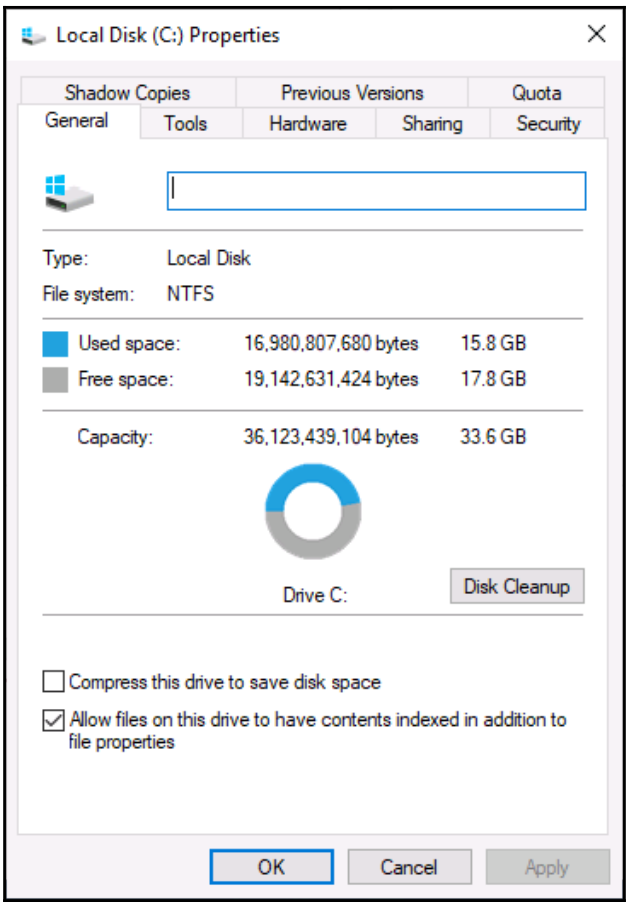


Figure 1.10: The NTFS continues to be used by Windows Server 2019

The ReFS overview can be found at `https://docs.microsoft.com/en-us/windows-server/storage/refs/refs-overview`.

## Linux Server overview

If there is something interesting to talk about in the world of OSes, the Linux operating system is unequivocal. This is because the world of technology does not recognize any innovative initiatives as having gathered more volunteers than Linux did. Everything started as a desire to improve functionality in an existing operating system such as MINIX. Instead of an improved MINIX, it turned out that, in the early 1990s, Linus Torvalds developed a new operating system called Linux. So, the GNU GPL project took over the licensing of Linux, the penguin became a Linux mascot, the first Linux booklet published was *Linux Installation and Getting Started*, the first Linux virus was *Bliss*, and *Linux Journal* and *Linux Weekly News* marked the first-release Linux magazines. Just like that, many other global activities followed that would form the so-called Linux community, which then turned out to be one of the world's largest volunteer communities, contributing globally to the further development of Linux. Nowadays, due to its security and open source nature, Linux Servers (see *Figure 1.11*) power the majority of web servers and supercomputers.

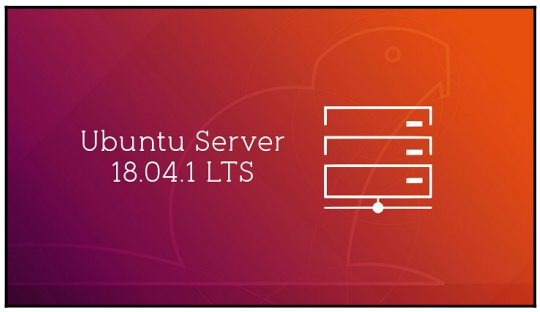


Figure 1.11: The long-term support version of Ubuntu Server

Find out how to run Linux distros on Windows Server 2019 at `https://docs.microsoft.com/en-us/windows/wsl/install-on-server`.

## macOS Server overview

**macOS Server** may be younger than Windows Server and Linux Server operating systems, but with its reliability, it is slowly gaining the industry's support. At its core, macOS Server is, in fact, a modified Unix OS that already conforms to the familiar Apple GUI for PCs. Much like Windows and Linux, the macOS Server is also offered on 32-bit and 64-bit platforms. However, ever since Apple was designated to use Intel processors for their computers and servers, the macOS Server is only available on 64-bit. Nowadays, although we cannot speak of the exact number of servers powered by the macOS server, Apple continues to provide support for macOS server which has recently offered flexibility in the hardware that supports the macOS Server.

You can learn more about macOS server at `https://www.apple.com/macos/server/`.

In this section, we have understood what is a server, learned about server hardware such as CPU, memory, disk, network interface, understood server sizes, form factors, and shapes, and what is NOS. In the next section, we will be introduced to Windows Server and its timeline.

# Understanding Windows Server

What would your answer be if someone asked you what Windows Server is? I guess your answer would be more or less like the following: ***Windows Server*** *is the server's operating system developed by Microsoft as part of the Windows NT family of operating systems*. In general, whether it is a server based on Windows Server, Linux Server, or macOS Server, it really does not make any difference as long as the version that is being used continues to provide adequate services within an organization's network. However, looking at them from the perspective of deployment, user interface, managing resources, and maintaining a server, many differences are evident.

Let us take a look at the Windows Server timeline to understand how it has evolved over the years.

# Windows Server timeline

So far, in the 23-year history of Windows Server, I think Microsoft has been quite intuitive to adopt new requirements in the server world. Personally, I feel that the Windows Server timeline looks interesting and I want to share it with you. Particularly, notice the transition of the Windows Server technology over time. Simply, it's impressive.

Windows Server timeline is shown in the following table:

| **Server for the masses era 1996-2000** | **Enterprise era 2000-2008** | **Datacenter era 2009 - 2013** | **Cloud for the masses era 2016 - present** |
|---|---|---|---|
| • Windows NT Server 3.5<br>• Windows NT Server 4.0 | • Windows 2000 Server<br>• Windows Server 2003 | • Windows Server 2008<br>• Windows Server 2012 | • Windows Server 2016<br>• Windows Server 2019 |

In this section, we have learnt about Windows Serve and got acquainted with its timeline. In the following section we will learn the steps for downloading Windows Server 2019.

# Chapter exercise – downloading Windows Server 2019

In this chapter exercise, you will learn how to download Windows Server 2019.

# Downloading Windows Server 2019

To download Windows Server 2019 on your Windows 10 computer, complete the following steps:

1. Press the Windows key + *R* to open **Run**.
2. Enter `microsoft-edge:` and press *Enter*.
3. In Microsoft Edge, click the address bar and enter `https://www.microsoft.com/en-us/evalcenter/`, and then press *Enter*.
4. On the **Evaluation Center** page, click the search icon in the right-upper corner and enter `Windows Server 2019`, then press *Enter*.
5. From the *Search* results, select **Windows Server 2019**.

6. Select your *evaluation file type*, and then click **Continue**.
7. Complete the form as shown in Figure 1.12, and then click **Continue:**

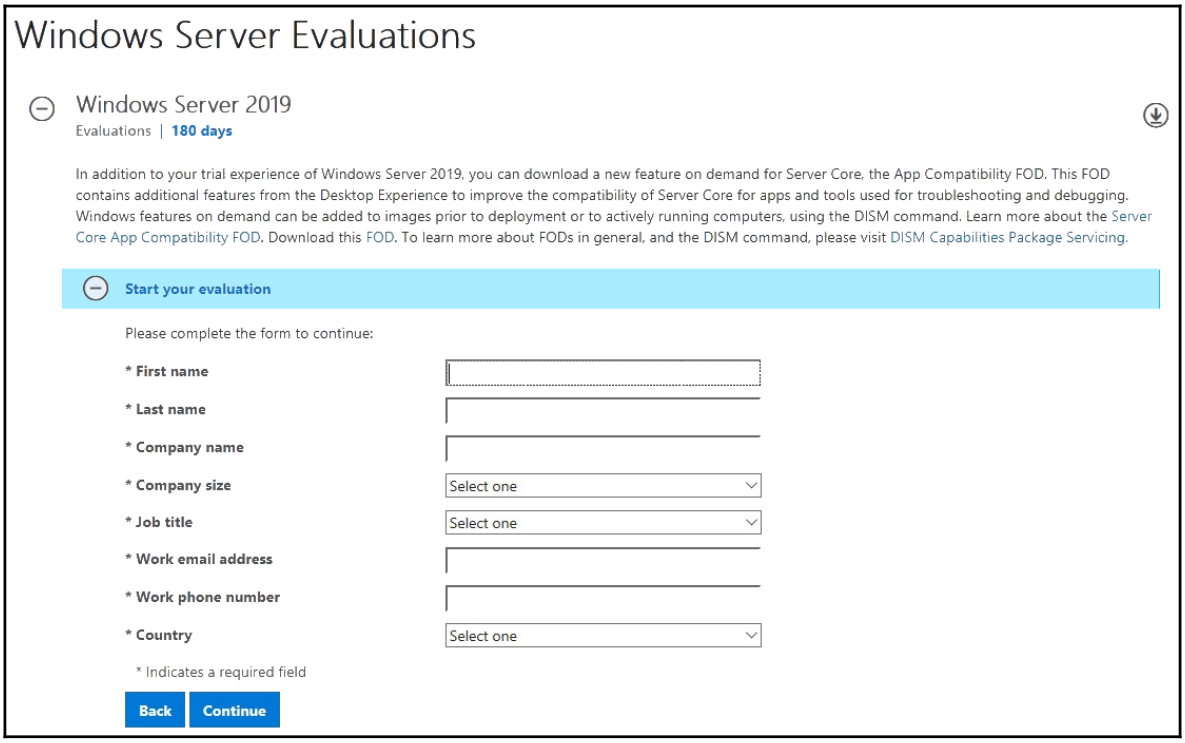


Figure 1.12. Downloading Windows Server 2019 evaluation

8. Select your *language*, and then click **Download**.
9. Shortly after, the **Windows Server 2019** download will begin. If not, you may want to click the **Download** button.

Once your Windows Server 2019 download completes, you should burn the ISO file to a USB flash drive. If you do not know how, then follow the instructions at `https://www.lifewire.com/how-to-burn-an-iso-file-to-a-usb-drive-2619270`. Once completed, you are all set to move on with the installation of the Windows Server 2019 evaluation version.