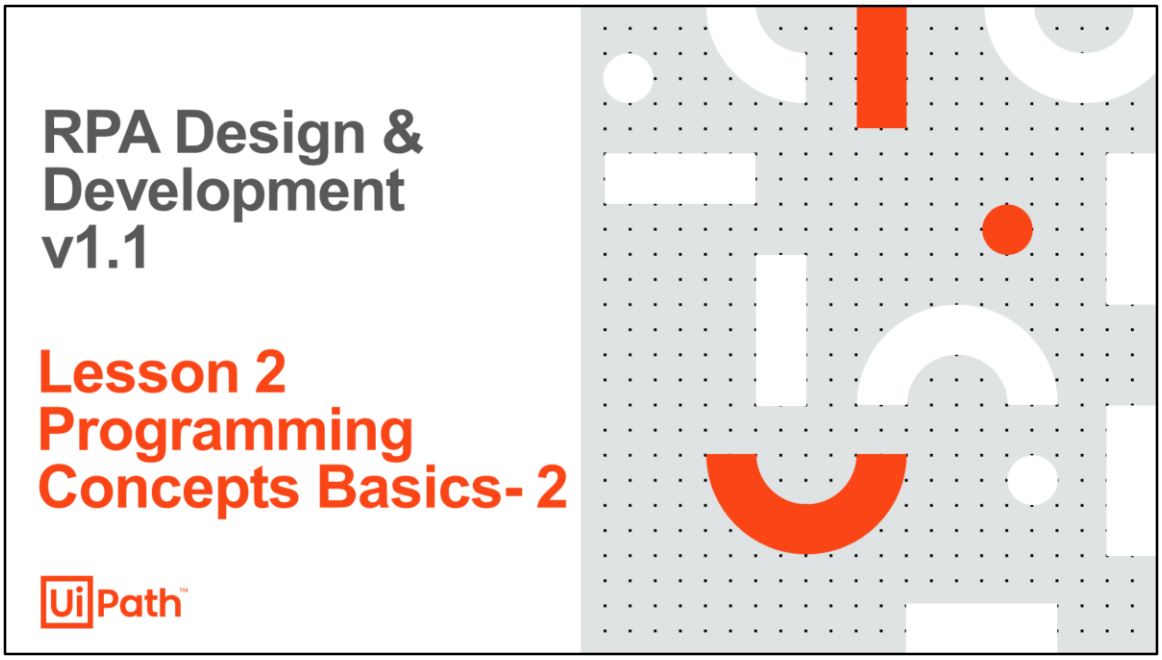
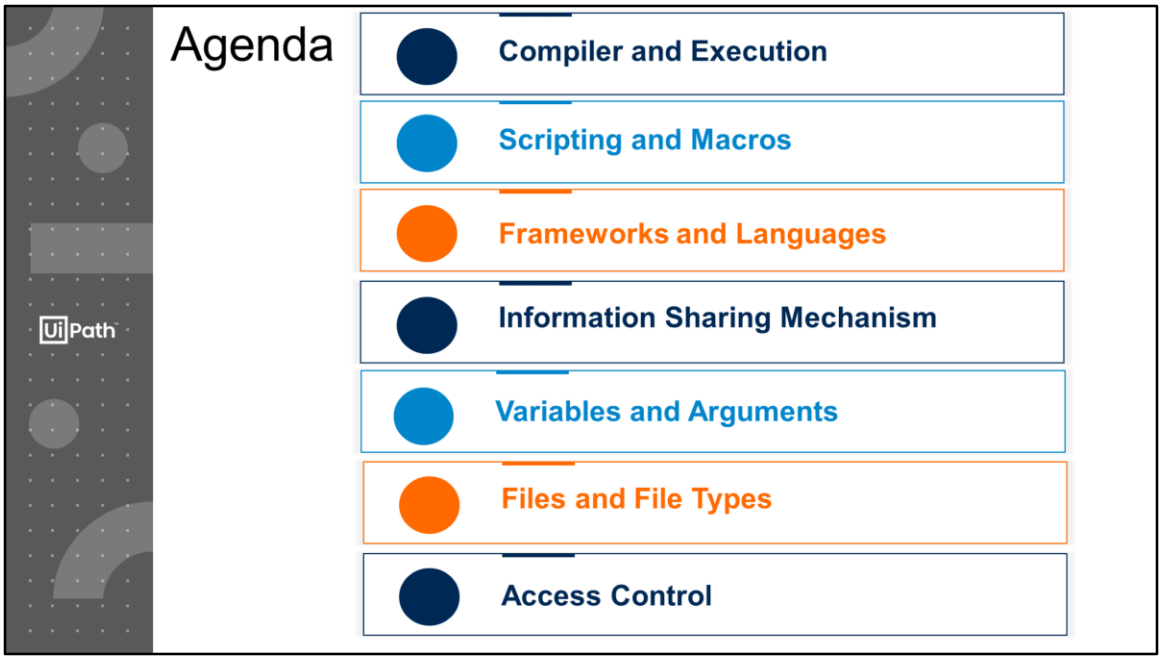


In this RPA Design and Development lesson, we will cover the basics of programming concepts, such as:

- Compiler and execution
- Scripting and Macro
- Frameworks and Languages
- Information Sharing Mechanism
- Variables and Arguments
- Files and Files Types
- Access Control



In this lesson, we will cover the following topics:

- Compiler and Execution
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- Information Sharing Mechanism
- Variables and Arguments
- Files and File types
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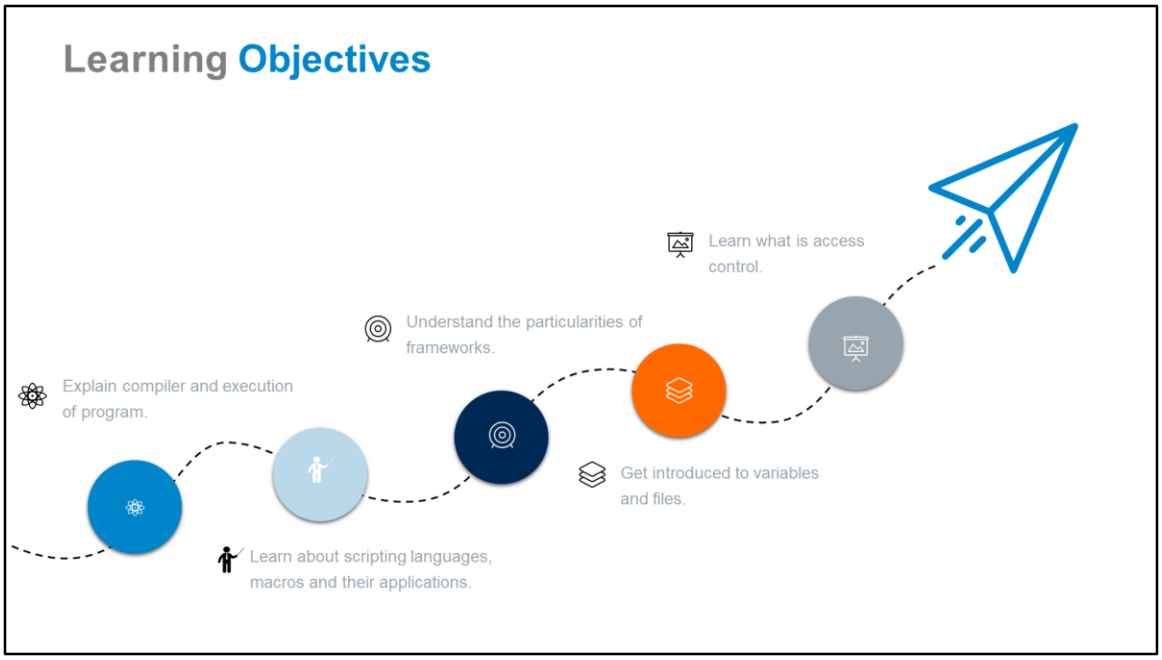
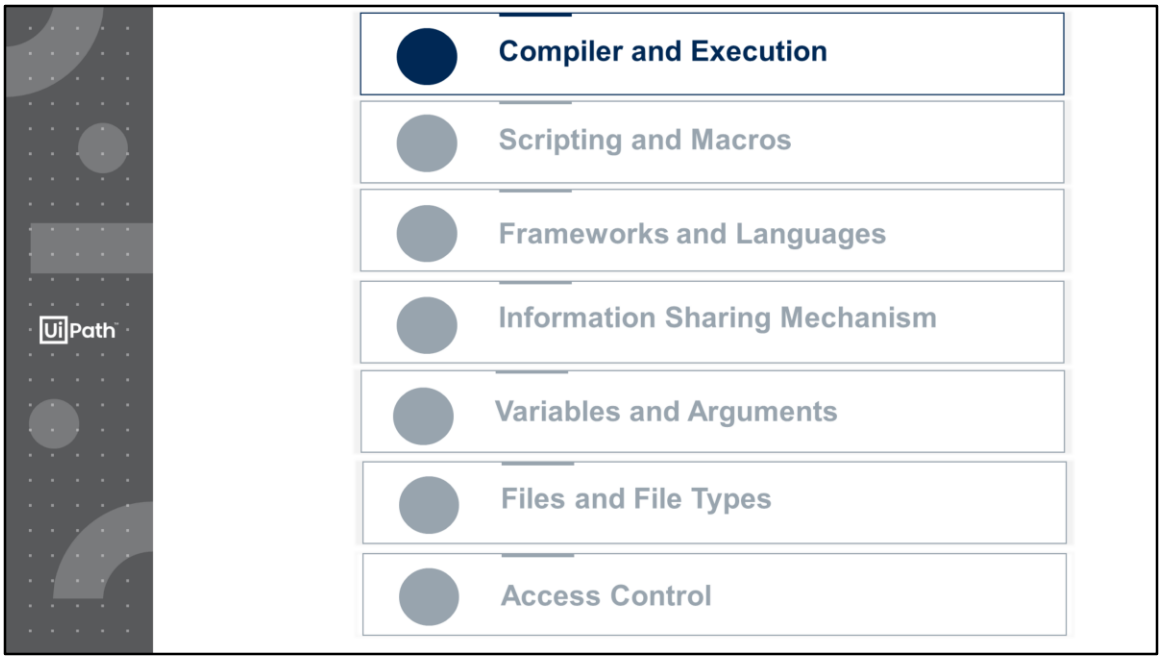
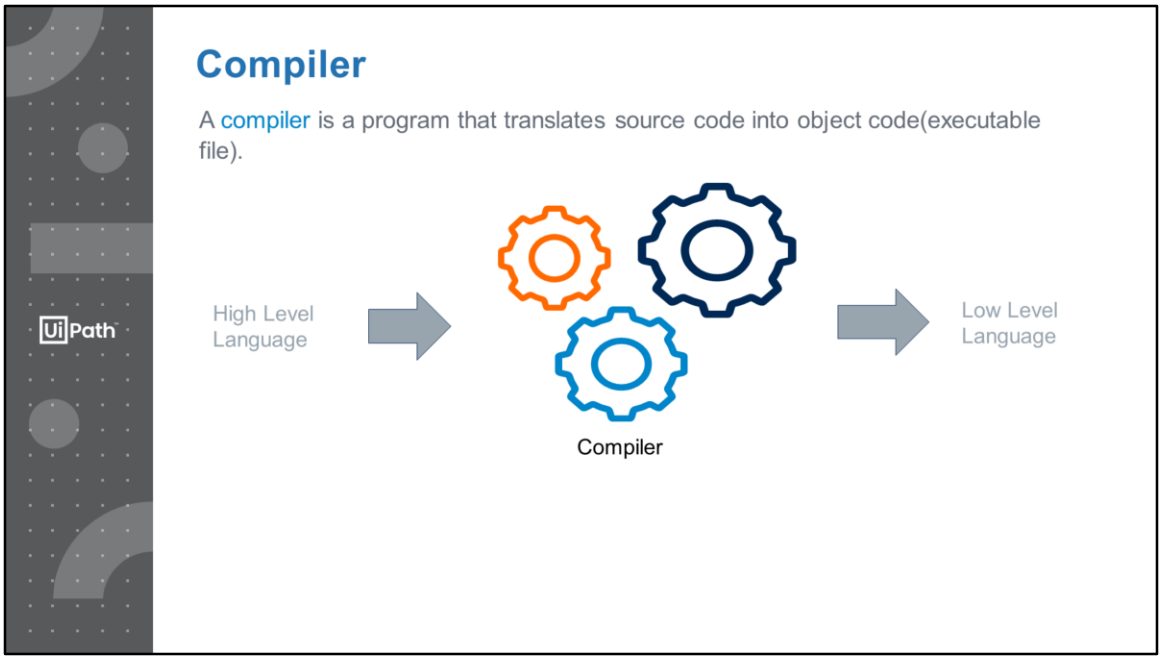


At the end of this lesson, you will be able to:

- Explain the concepts of compiler and execution of program
- Learn about scripting languages, macros and their applications
- Understand the particularities of frameworks
- Get introduced to variables and files
- Learn what is access control



In this topic, we will learn about the compiler and execution of a software program. In the RPA Design and Development, compiling and execution is an integral part of bot software programming that we will discuss in detail.



Compiling
In the software development process, a compiler is a program that evaluates the programming language statements and changes the code in machine language format to process. The entire process is known as compiling process. The software programmer uses Pascal, C, Java, or Python language using an editor tool or software. So, a compiler converts high level language to machine language.

A compiler allows the computer to run and understand the program without the need of the programming software used to create it.
A program is often compiled for a specific platform. For example, if a program is created for IBM platform, it works only with IBM and compatible computers, but not other platforms (e.g., Apple platform).
An example of compiler used with Java is Eclipse and of compiler used with C and C++ is GCC and Microsoft Visual Studio.

High Level Language
In the technology world, a software supports and allows multiple techniques to make a user-friendly programming language to develop a relevant software which is possible by the high-level programming language. Fundamentally, HLL is a Pascal, C or FORTRAN language platform that provides multiple sources to make independent software's.
The Programming language is divided into three forms:

1. High Level Programming Language: In this section, you can see Ruby & Rails, Java, Bash software development languages.
2. Mid Level Programming Language: C, C++, PHP are Mid-level languages.
3. Low Level Programing Language: Assembly language is a low-level programming language for instance: Machine Learning.

Additional Notes*

The first compiler was developed by Grace Hopper while working on the Harvard Mark I computer.
The compilation process is a flow of several programming and software development phases. These types of phases extract the input from its prior stage. It has own representation of the program source which shows the program output to the next phase of the compiler.

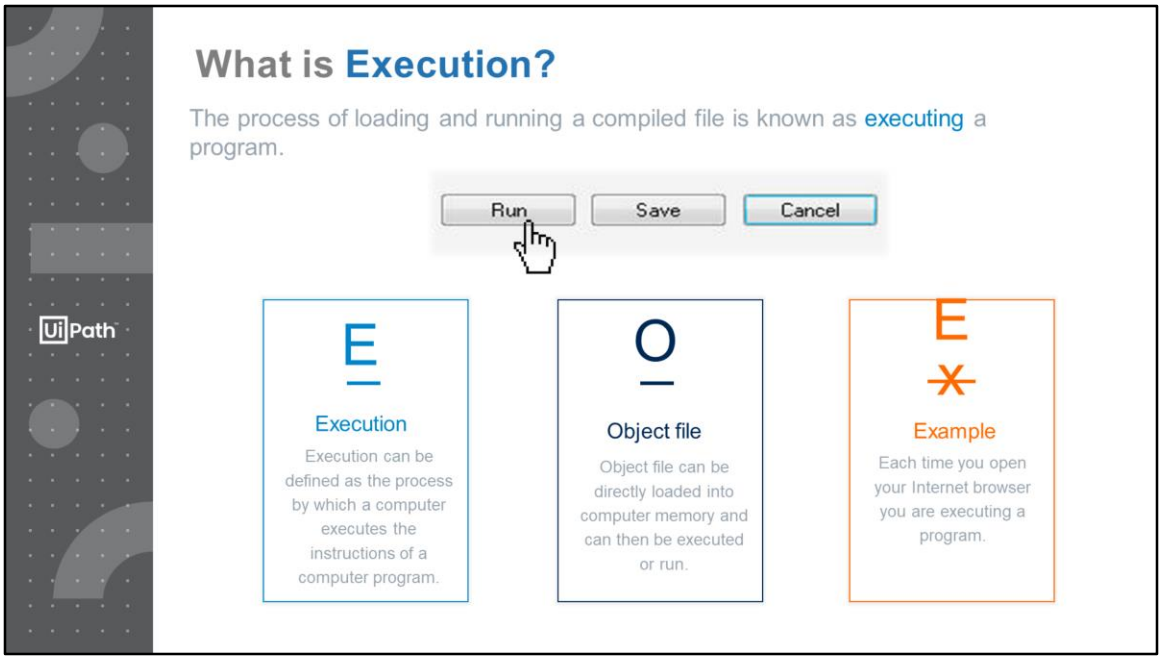
Machine Code/ Low Level Language
A low-level language is a programming language that understand the machine code language. This language is specially used to develop or make a software program which executes a particular task for hardware or architecture or specific platforms. The machine code language is comprised of only two characters, 0 and 1 and is difficult to read and understand. So, the low-level programming language is referred to these solutions based.

- Assembly Language
- Machine Code

A machine understands the binary logic of 0 and 1 where 0 stands for false and 1 stands for true.

Source Code
Source code refers to the computer program that is compiled before it is ready to run in a computer.

Object Code: The output of the compilation is called *object code*.



Execution
Whenever we create a program, the programming process executed by the virtual machine is known as Execution and we get a file known as executable or object file which is in machine language.
For example, you can run or execute your program on the Internet browser and get an excellent output.
In the operating system you can execute a program according to this step:
1. Write a software program code.
2. Open with command prompt or compiler tool and compile it.
3. Get output according to your design code. If you design excellent code then you can get the best output, otherwise it will show mistakes.
Additional Notes*

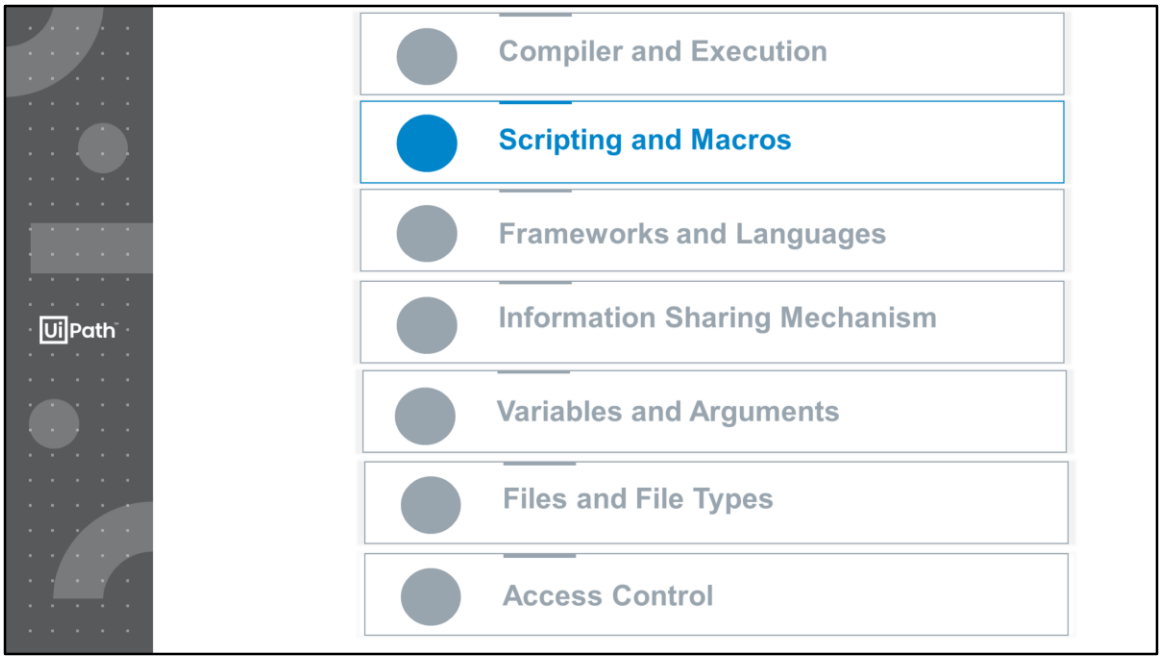
"RUN" & "EXECUTE" are synonymous terms.

For instance - When you open your browser (Google Chrome, Mozilla Firefox, Safari, Internet Explorer, etc) then you can execute any programs or activities. Execution can also be defined as the process by which a computer or virtual machine executes the instructions of a computer program.

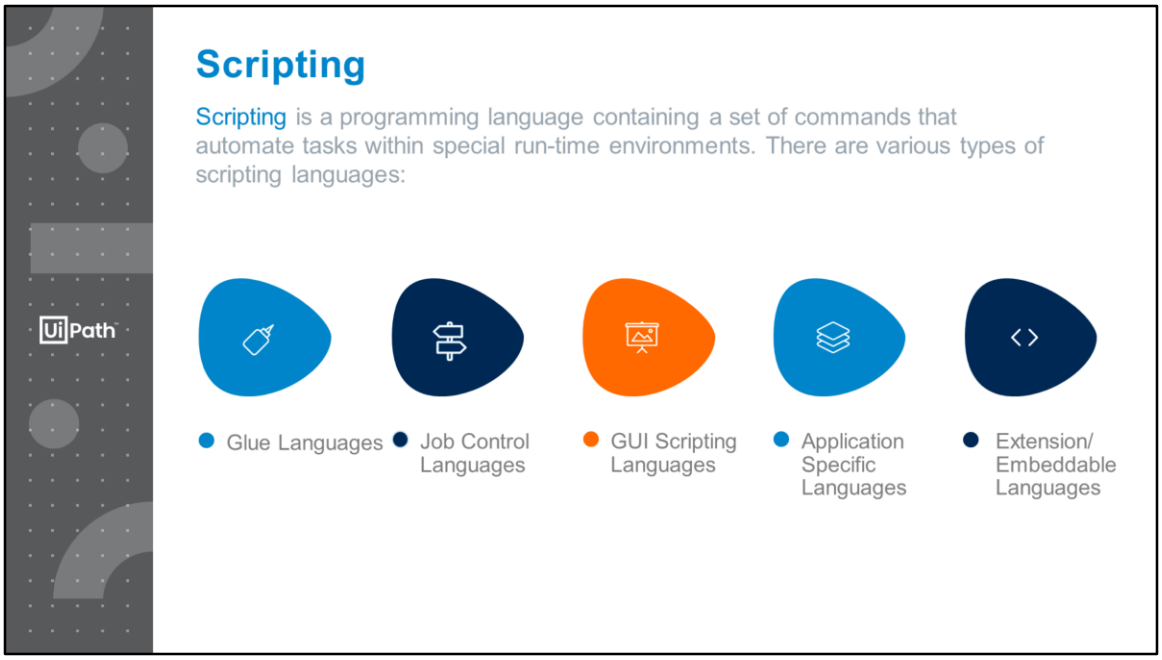
Lets us understand by taking an example -
- Programs are stored in secondary storage device such as hard disk. when we

install a program on our computer, the program is actually copied to our hard disk

- But When we execute a program the program is copied from our hard disk to the main memory and that copy of program is executed.



In this topic, we will learn about Scripting and Macros.



Scripting languages can be referred to as a control language or a high-level programming language as it operates at a high level of abstraction. Scripting can be used in multiple environments and they can define from how a web page looks like to program execution and file manipulation.

There are various types of scripting languages:

Glue Language
Glue language refers to a programming language written specifically to manage the program and the code which connects different software components.
A very common example would be web development, which basically interfaces a database and a web server. Some more examples of Glue language are: AppleScript, JavaScript, Modern Pascal, Perl, PHP, Python, Ruby, Unix Shell scripts.

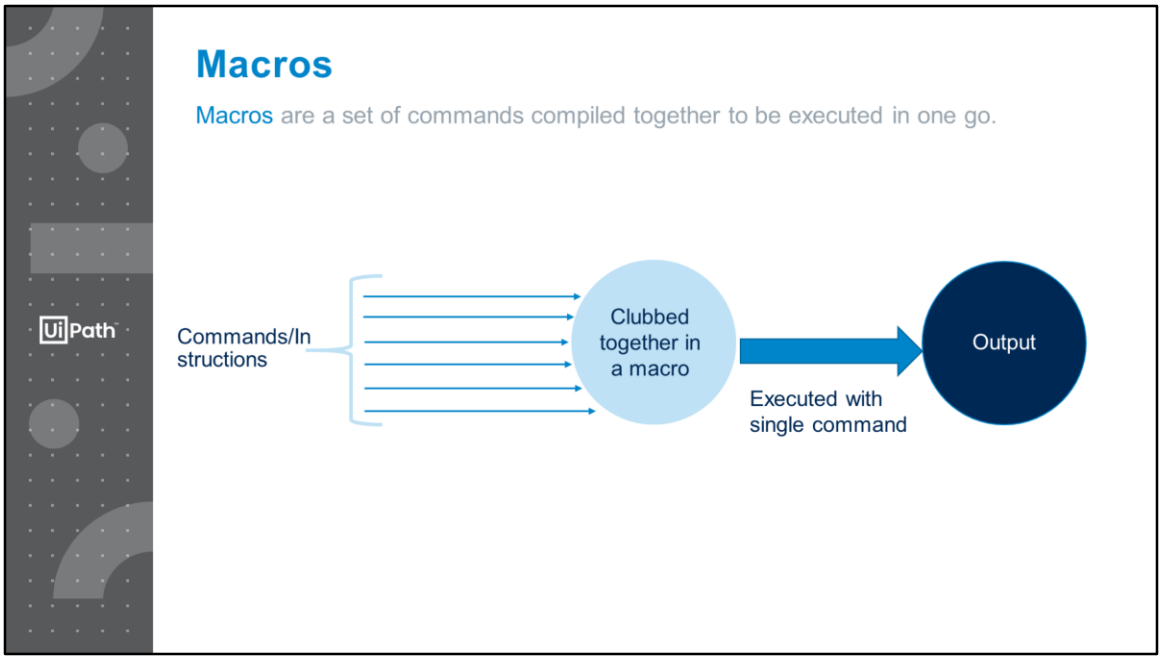
Job Control Language
Usually, JCL is used in multiple types of operating systems, Which gives the command to the system that how to run a batch job or start a subsystem. Most of these languages are used in command-line interpreters. An example of JCL is the Unix shell, or the MS-DOS.

GUI Scripting
With the ever-growing use of graphical user interfaces, a specialized scripting

language emerged for controlling a computer. GUI Scripting
language interacts with the graphical windows, menus and buttons by simulating the actions of a human user.

Application Specific Languages
These can be split into many subcategories like standalone app languages (executables), internal application specific languages like XML or gscript and even idiomatic scripting languages which are specifically created for the needs of application users.

Extension/Embeddable languages
These languages are designed for the purpose of replacing application-specific languages by becoming embeddable in application programs. An application programmer can include "hooks" where the scripting language can control the application. There are some types of applications that will need a quicker addition to modify and run cycles that use embedded languages. This is done for a more efficient prototyping allowing the user to make changes to the application without having an in-depth knowledge of the inner workings of that specific application.

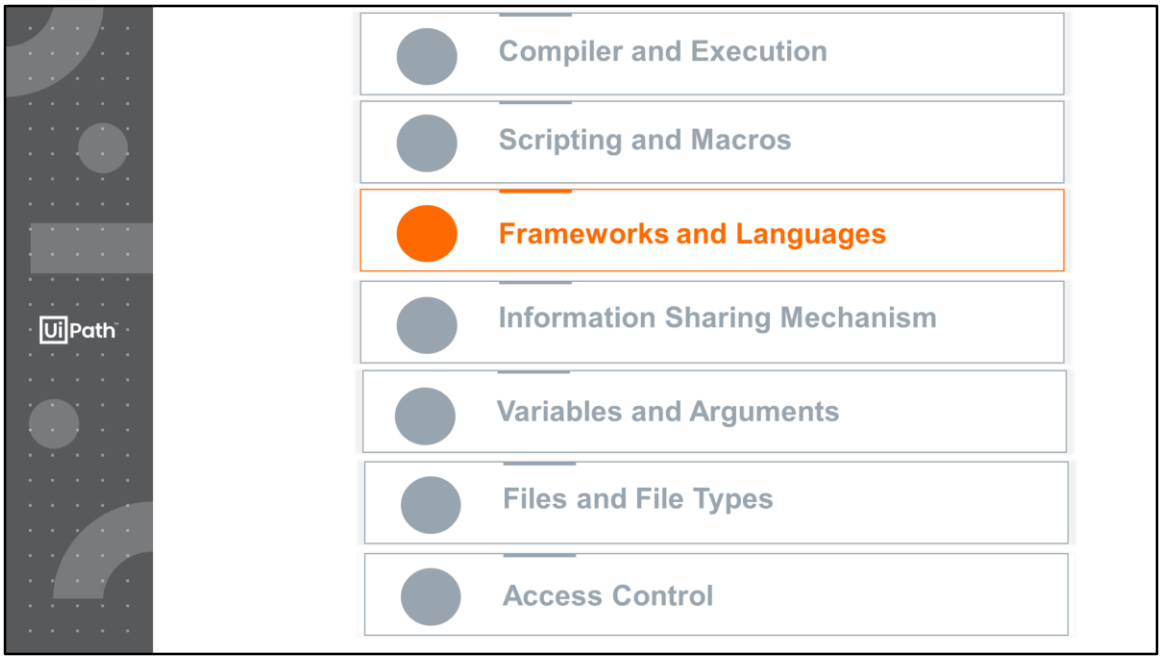


A macro is an automated input sequence in the basic programming od RPA. It imitates keystrokes or mouse actions. Usually, Macros are used to replace the repetitive sequence of keyboard and mouse actions which are typical in spreadsheet and word processing applications like MS Excel and MS Word. Also, The file extension of a macro is common.MAC.

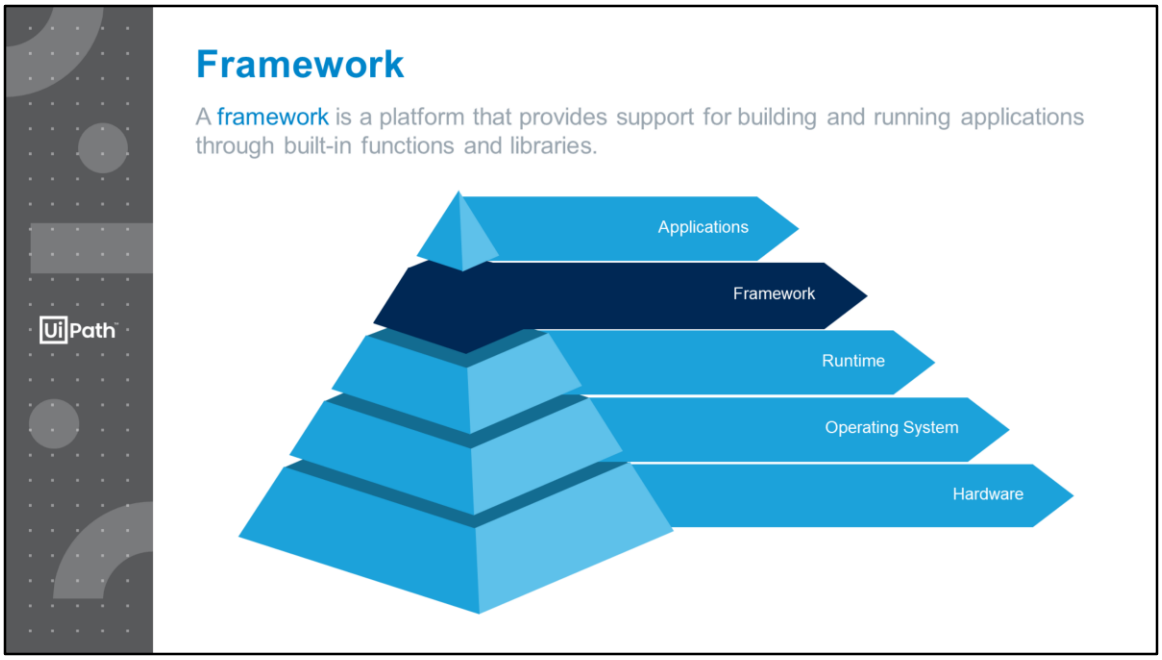
A macro in computer science is defined as a rule or pattern that defines a predefined procedure to map a certain input sequence (often a sequence of characters) to a replacement output sequence.

The basic importance of using a macro is to remove the repetitive work and thereby increase the efficiency. In the entire process of basic programming, macros make a sequence of instructions. In which programmers make a single program statement and make the programming task less tedious and less error-prone.

Additional Notes*
In the basic programming, keyboard Macros enable the short sequences of keystrokes and mouse macros actions to transform into other. It frequently used or repetitive sequences of keystrokes and mouse movements can automate. Individual programs for creating these macros are called macro recorder.



In this topic, we will learn about Frameworks and languages.

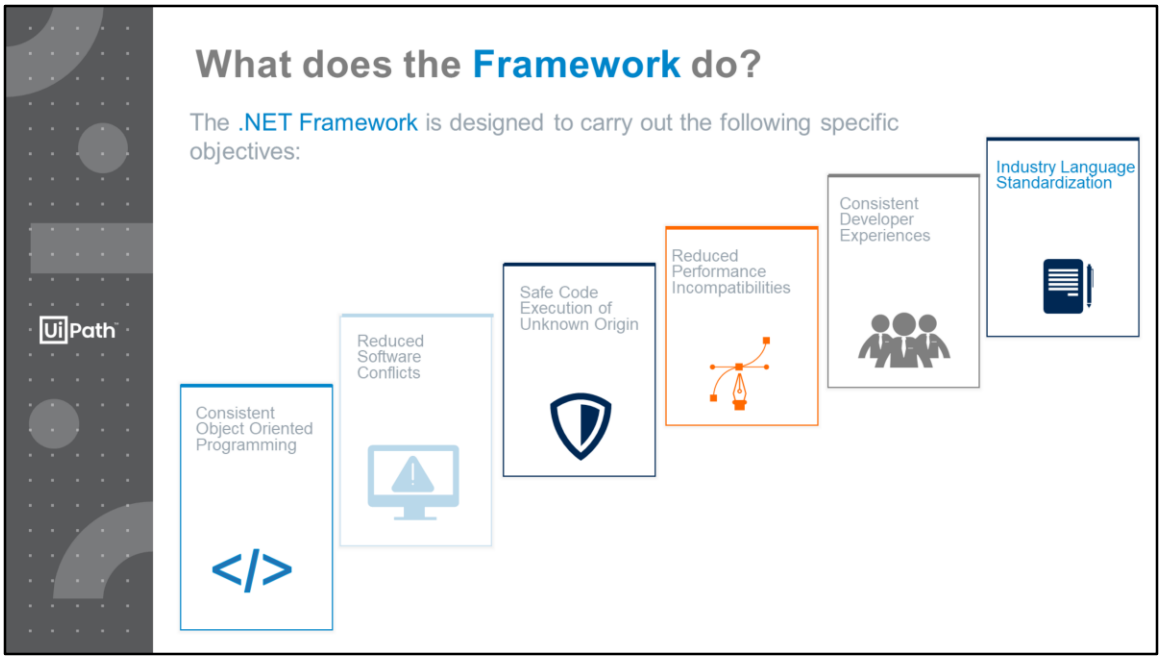


The base of a Framework is the hardware, or the physical component which is the processor. This is operated by the operating system (OS), or system software like Windows or Linux. The system software acts as an interface between the processor and other applications.

.NET Framework is a programming framework that enables developers to easily use other applications on top of it. It provides a foundation on which all software developers can build their own programs or selectively change the functionality of programs by additional user-written code.
The Common Language Runtime is the virtual component within the .NET Framework that manages the execution of .NET programs.

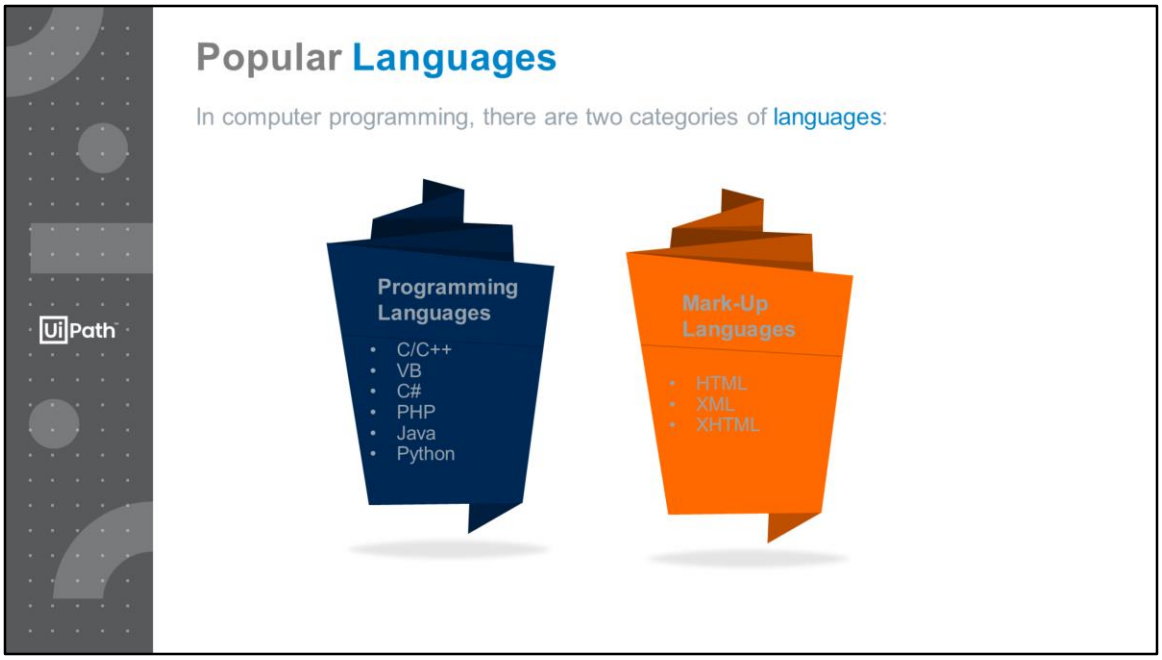
We can look at the .NET Framework as a compilation of code that a programmer can call on without having to write it explicitly, thereby optimizing application development and process.

This compilation can be referred to as a large library that supports some of the most widespread programming languages like C# or VB.NET that help .NET language classes to communicate between themselves. This allows for high interoperability between managed code through distributed link library files also know as DLL files.



The .NET Framework is designed to carry out the following specific objectives:

- It provides a logical object-oriented programming environment in the basic programming of RPA, whether the programming object code is stored or executed locally or else the Internet-distributed, or executed remotely.
- It provides a code-execution process that lessens software deployment and versioning oppositions.
- In the Basic RPA programming, it provides a code-execution environment, that encourages the sustained execution of code, including an unknown or semi-trusted third party.
- It excludes the execution problems of scripted or interpreted code environments.
- In this, it makes the RPA developer experience compatible across the multiple types of apps whether it is based on any operating system.
- It builds numerous communication channels for multiple industry standards that ensure the code based on the .NET Framework integrates with any other code without issues.



There are various programming language that we use in day to day to life.
The most common programming languages are:

C:

C is one of the most popular and basic programming languages. It was invented in the 1970s. Even today, it is one of the most widely used programming languages of all time.

C++:

C++ dates back to the 1970s that is commonly used in beginner computer programs development and courses. Still, it is one of the most extensively programming languages which have major role language in many operating systems, browsers, and games.

VB (Visual Basic):

Visual Basic is a programming language of third generation which uses graphic user interface or GUI to modify and choose preselected codes written in the programming language of Basic.

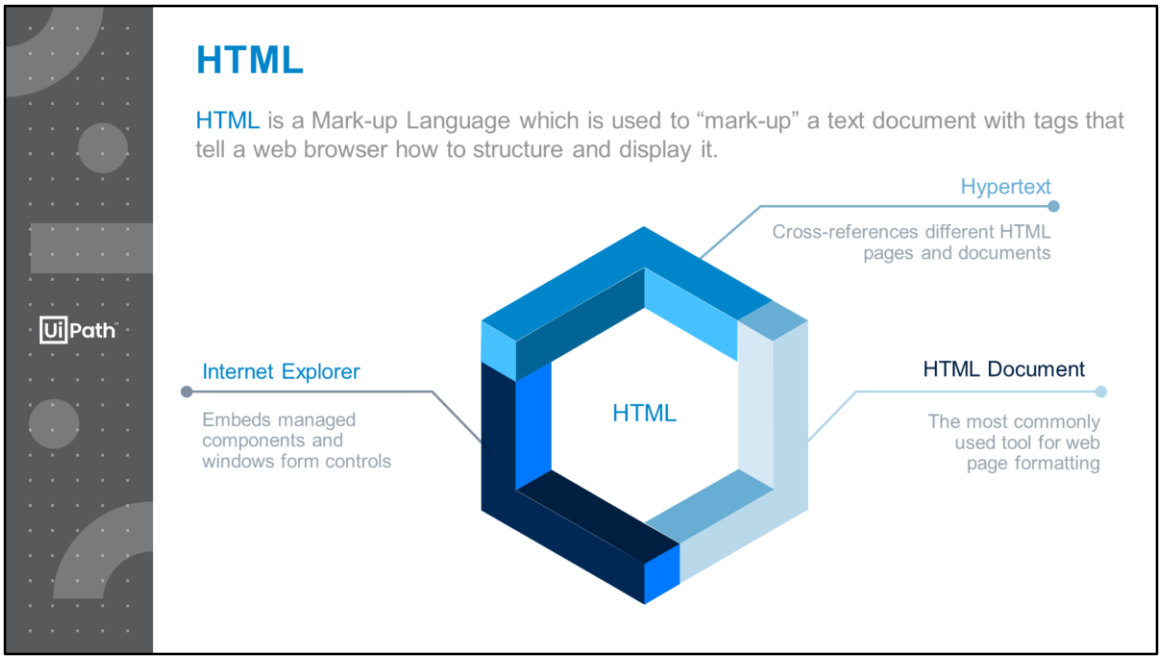
C#:

The right pronunciation of this is C Sharp which was developed by Microsoft. It develops various types of enterprise applications and software for corporate clients. It is also known as an object-oriented programming language that is similar to Java.

PHP (Hypertext Processor):
PHP is known as a Hypertext Preprocessor language that is used to build dynamic and interactive Web sites or web pages. Facebook and Yahoo are the best examples of this language which was built on PHP language. It’s often called "training wheels without the bike”.

Java :
Java is a superior programming language that is developed by Sun Microsystem. It is known as an object-oriented language, which is now owned by Oracle. It is used for databases, developing Android apps, and as a “backend” programming language for the web, desktop applications and more. It's immensely popular and is considered one of the most stable and reliable ways to build large systems.

Python :
Python is the HLPL (high-level programming language). It is one of the world’s fastest-growing scripting languages. It’s an easy language to start a web project with, where you can often use for higher-level programming like machine learning and data analysis. Along with the programming languages we also have mark up language such as HTML, XML, and XHTML.

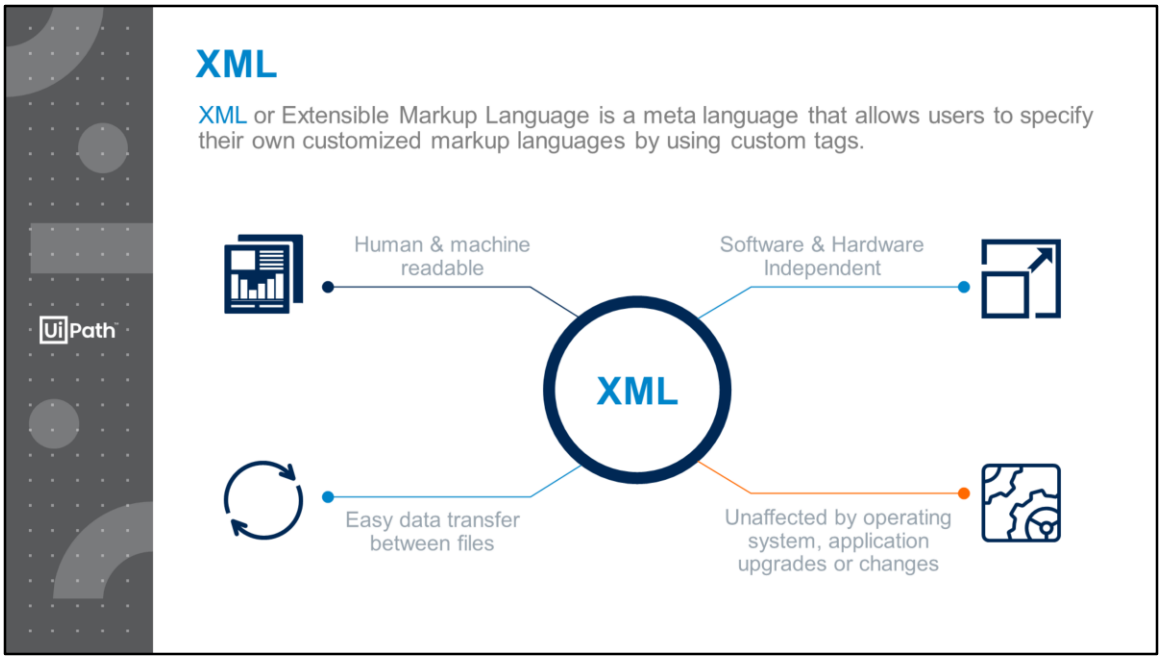


Nowadays, HTML is being widely used to format web pages with the help of different tabs available in the HTML language.

HTML stands as a HyperText Markup Language in software programming.

It refers to the different way of web pages or HTML documents which are linked together or else cross-reference each other or sections of each other. Thus, on the webpage developers present the link which is known as Hypertext.

As the name implies, HTML is a Markup Language. It means that you can allow this language to simply "mark-up" a text document with tags. After that, it presents the resource on a web browser with proper structure and displays the output.

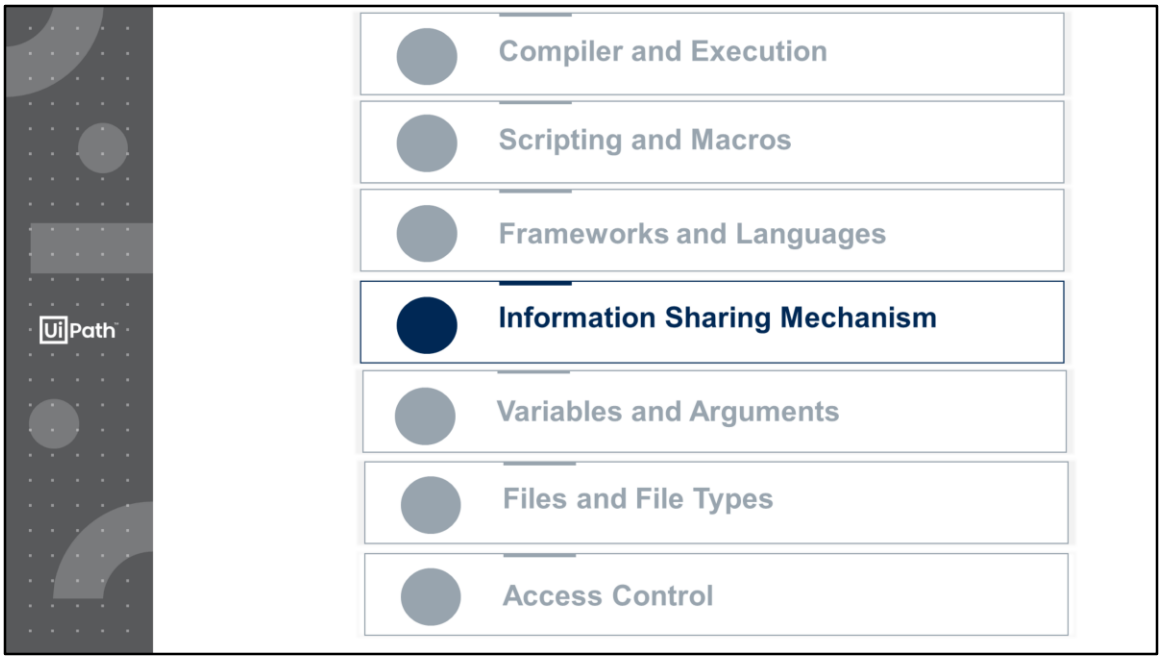


XML is an Extensible Markup Language. It represents the sets of rules for encoding programming documents in a format that is human-readable and machine-readable. It basically is a hardware-independent software tool for storing and transporting data. XML is especially used in displaying documents on the Internet.

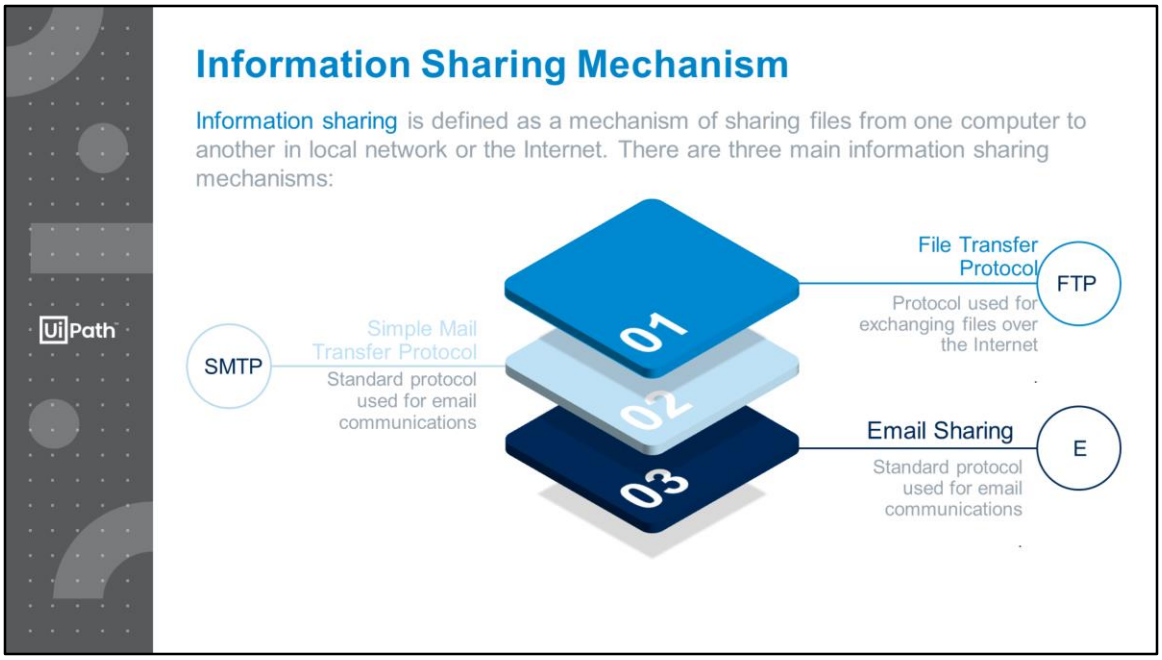
Due to the high variety of data types, many platforms include the data incompatible to each other and exchange the information to time-consuming task for web developers. In this, The massive data must be converted, where incompatible data is often lost.

The best feature about XML is that it stores data in a plain text format that provides software and hardware independent way of storing, transporting and sharing data between the computer systems.

XML also builds the easier process to expand or upgrade new operating systems, new applications or even web browsers without losing data. With the help of XML, data can be transmitted to all types of "reading machines" such as humans, computers and voice machines.



In this topic, we will learn about Information Sharing Mechanism.



There are three main information sharing mechanisms:

- File Transfer Protocol (FTP)
- Simple Mail Transfer Protocol (SMTP)
- Email Sharing

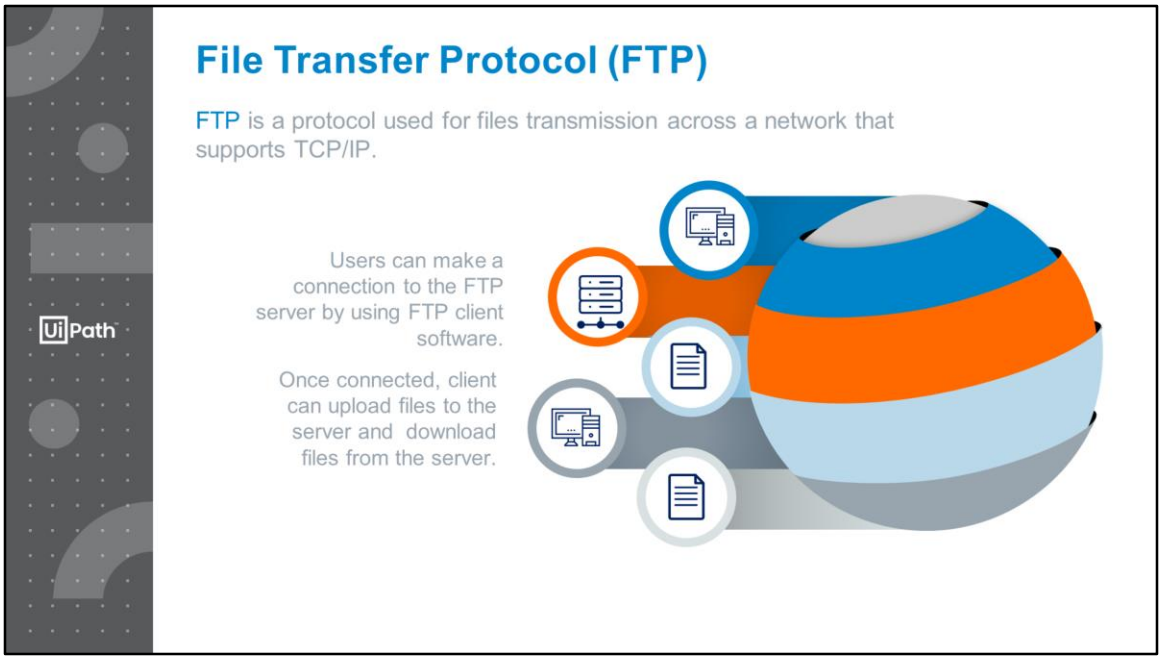
Before defining FTP, we should be familiar with the term Protocol.
The protocol is defined as a set of rules and guidelines by which the data is transmitted.

File Transfer Protocol (FTP) is the commonly used protocol for exchanging files over the Internet. FTP uses the Internet's Transmission Control Protocol/ Internet Protocol (TCP/IP) to enable data transfer. FTP uses a client-server architecture. It is a reliable way of sharing files via remote computers.

FTP is built on a client-server model architecture using separate control and data connections between the client and the server.
This may be authenticated with the user name and password.
FTP also acts as the standard for the transfer of data on the internet from one computer to another.

SMTP: Simple Mail Transfer Protocol is the standard protocol used for email communications.

Email Sharing: It allows us to quickly manage analysis around emails using comments without versatile forwards and replies. Email sharing is a hassle-free process that shares the information via email with your colleagues and represents their opinion/ feedback/ advice about it.



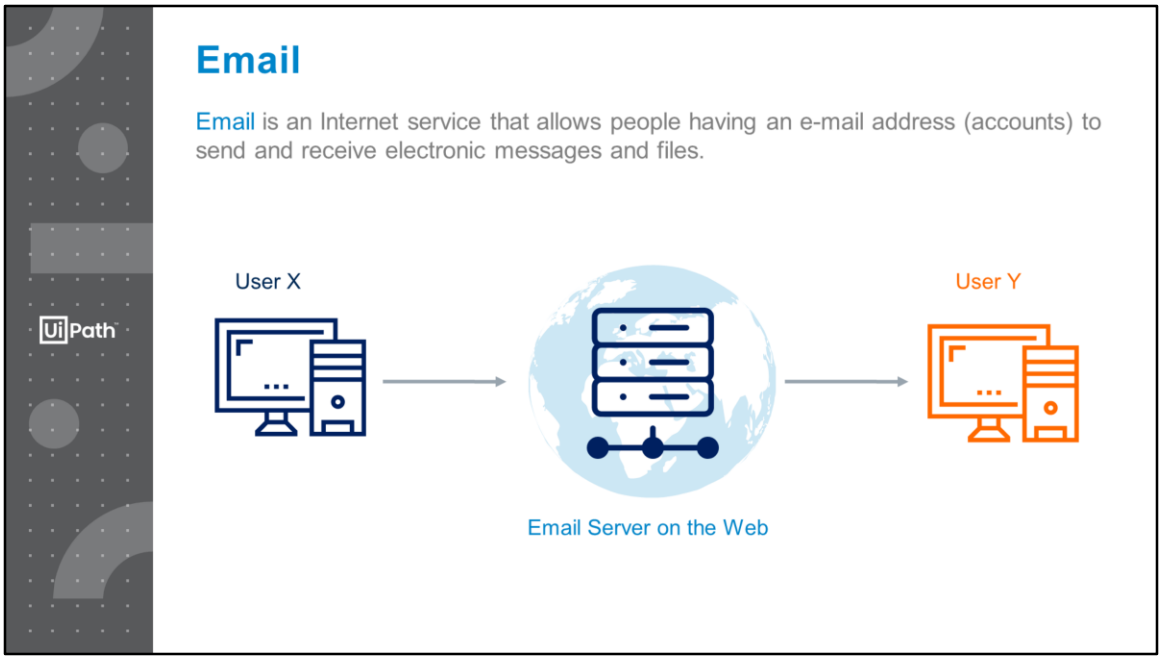
File Transfer Protocol is a protocol for the rapid, simple transmission of files across a network supporting the TCP/IP protocol.
FTP is a method of file accessing on another platform or computer.
Once it connects and authenticates with the source or client it can do various things such as files uploading on the server, file downloading (taking the server's files and putting them on his own computer) from the server, file renaming, file deleting on the server and file changing permissions.

Additional Notes*

Most modern operating systems support FTP.
FTP establishes two different connections:

- for data transfer
- for control information

FTP uses Port 20 for the data connection and Port 21 for the control connection.



An email client is a process of a computer program that is used to read and send electronic messages. An email server is hardware that transports and stores mail centrally for an email provider's many users. An email client downloads the source or messages from the database server for local use and uploads messages to the data server for delivery to its recipients.

On the slide is a basic diagram of how an email reaches its receiver.

Importance of an email:
The email client manages the platform and provides a source to read, organize, and reply to messages on email as well as send new emails.

It organizes the email and email clients that offer a folder and label of emails.

An integrated search engine provide you to find the messages by details for the senders including with subjects, times of receipt, and message content.

Apart from email text, email clients, it also manages the attachments, where you can send and receive multiple files such as images, documents on the email.

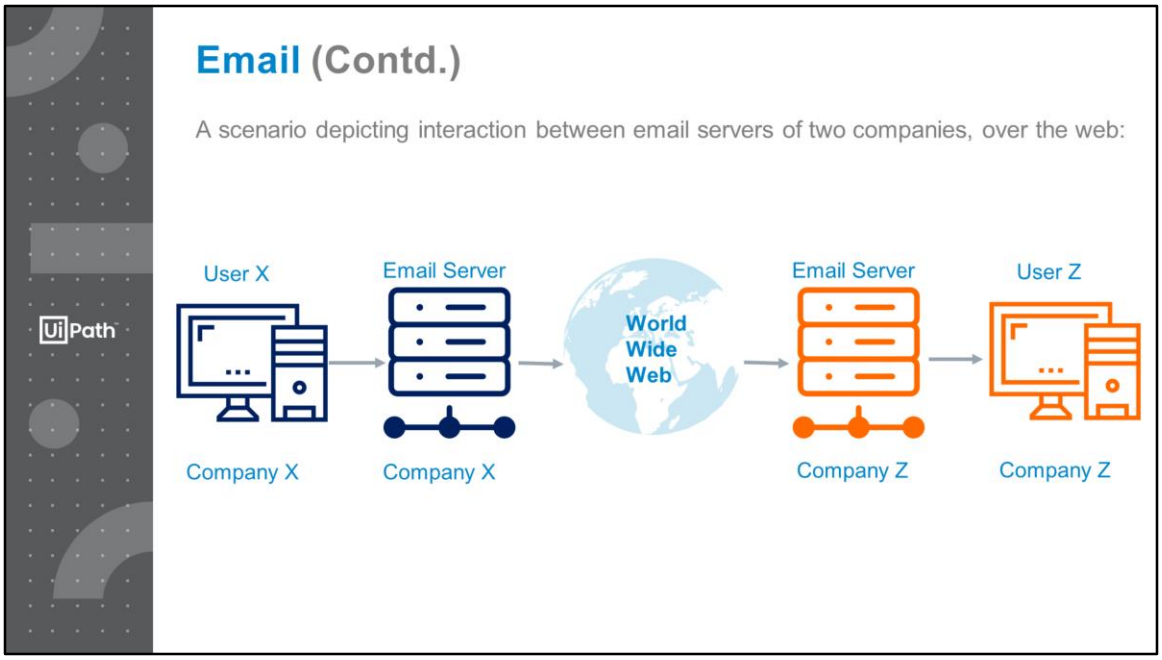
Additional Notes*

Common Email Clients:

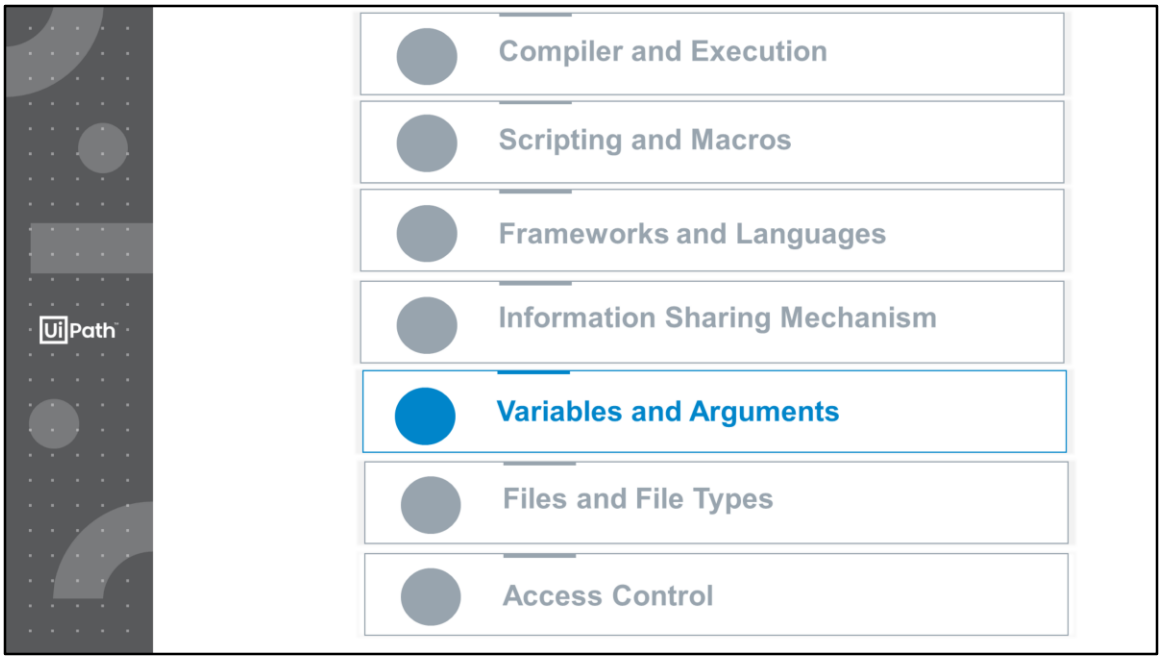
Most of the users use these types of email platforms such as Outlook, Mozilla Thunderbird, MacOS Mail, IncrediMail, Mailbox and iOS Mail.

In the email industry, Gmail is the most popular web-based client email platform and then Yahoo! Mail and Outlook.com.

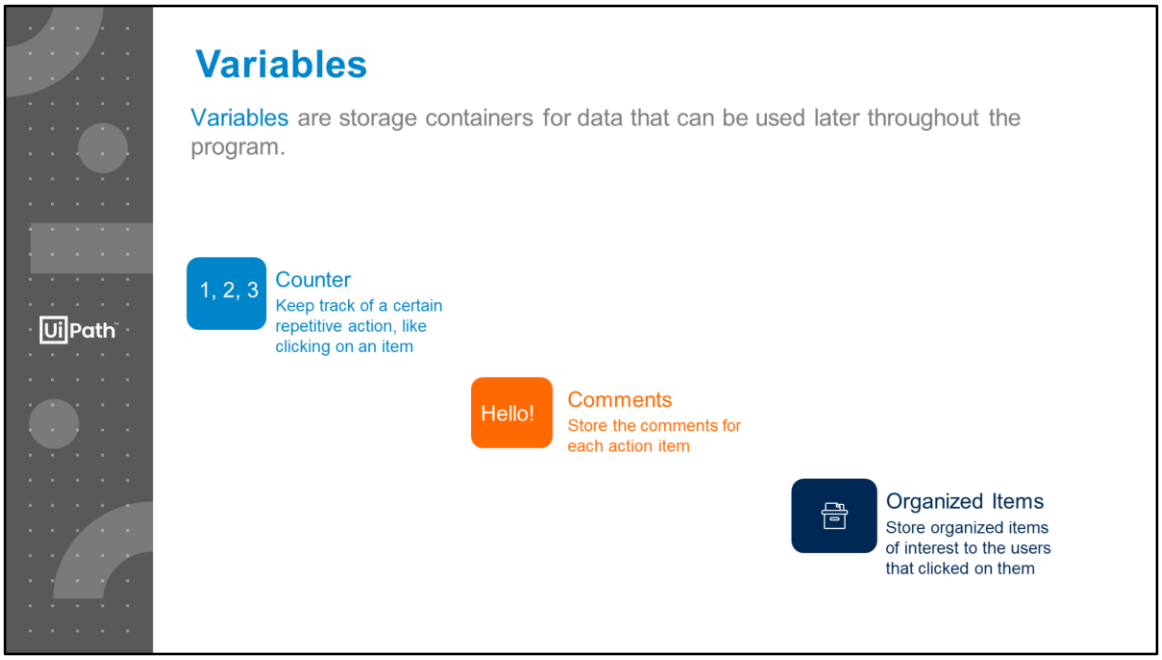
Historically the most of users include the Eudora, Pine, Lotus (and IBM) Notes, and Outlook Express in the email message format.



Let us take a scenario depicting interaction between email servers of two companies, over the web.



In this topic, we will learn about Variables and Arguments.

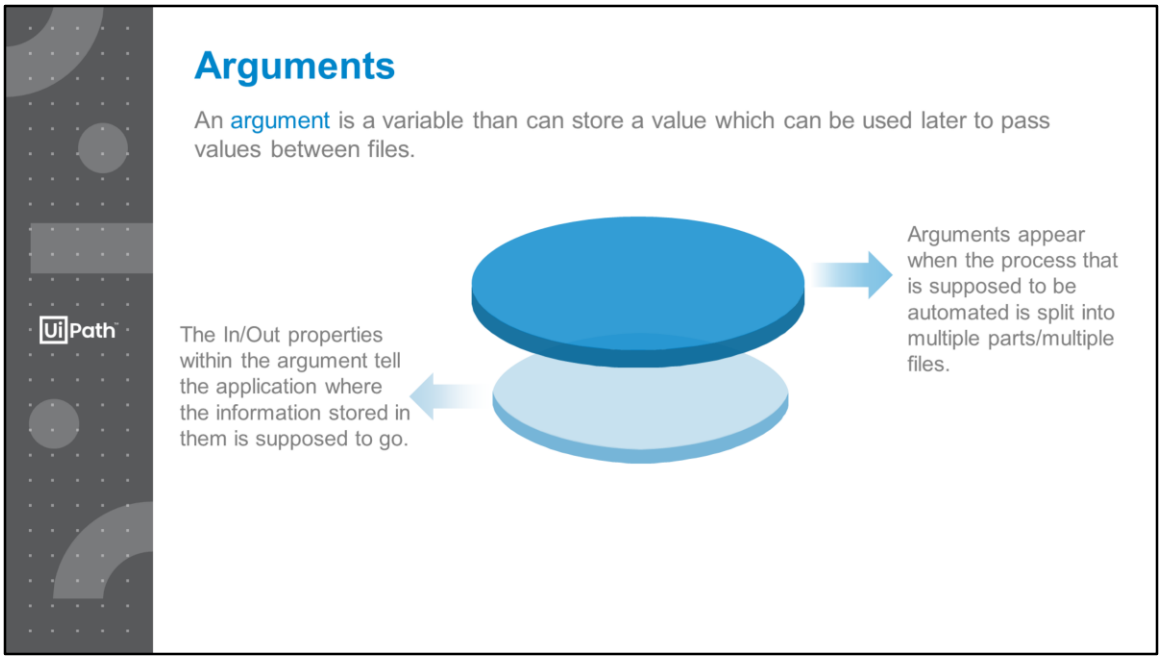


The most practical way to look at variables is to think of them as boxes that contain specific types of data. In this context, the contents of the box can always change, but the box will remain the same.

For example, in our illustration, each box can contain a different type of data.

- The first box can contain a counter which keeps track of a certain repetitive action, like clicking on an item.
- In the second box, we could store the comments for each action item.
- And, in the third box, we can store organized items of interest to the users that clicked on them.

More on variables in the next modules.



Arguments appear when the process that is supposed to be automated is split into multiple parts/multiple files. Arguments are used to pass data from one file to another. Variables cannot be used with this scope. Managing arguments is similar to managing variables. The main difference is that, as the arguments have a direction, "In" or "Out", you need to ensure that the direction is a correct one. The In/Out properties within the argument tell the application where the information stored in them is supposed to go.

Additional Notes*

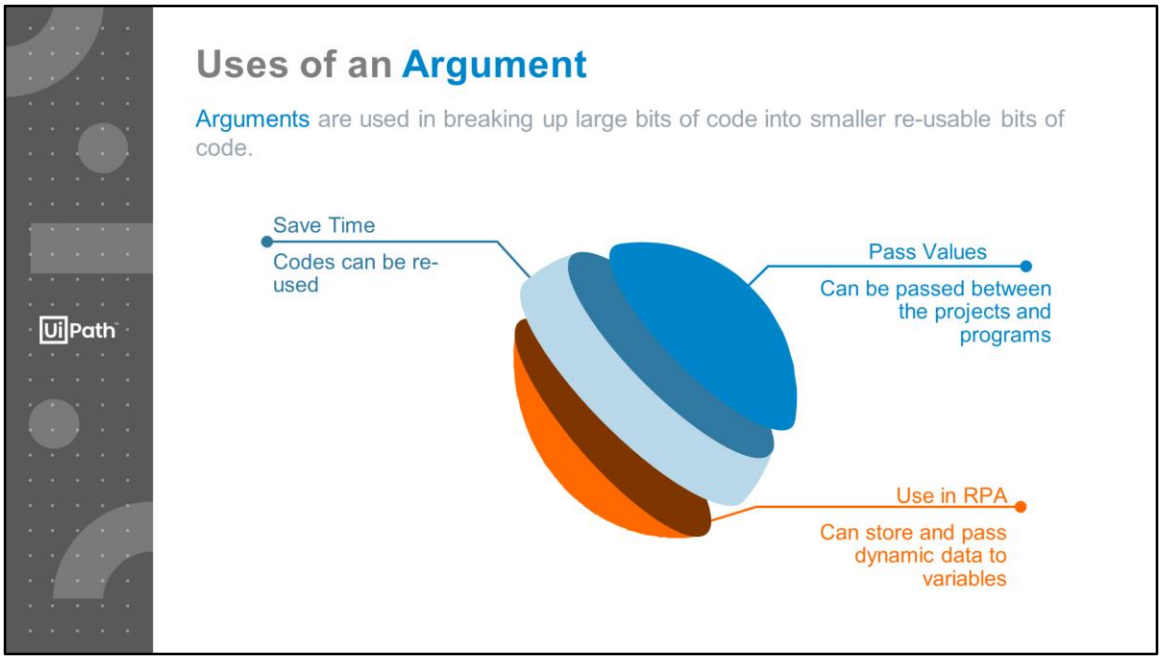
Variable and Arguments are quite similar but they have certain **distinctions** in their **properties** .
Both act as a storing container but **have different properties**.

The main difference is that, as the arguments have a direction, "In" or "Out", you need to ensure that the direction is a correct one. The In/Out properties within the argument tell the application where the information stored in them is supposed to go.

Arguments are used to pass data from one project to another project

They are of various types such as string , integer ,Boolean , Array and so on.

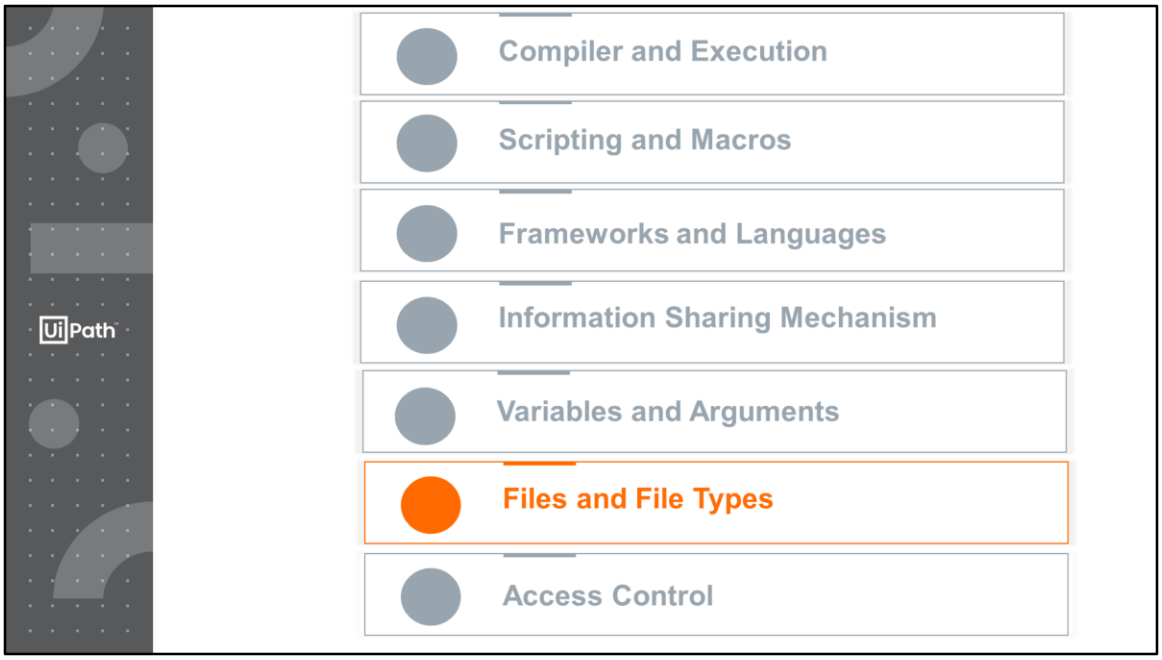
They have four distinct types of direction depending on the fact that whether we are giving or receiving data from another workflow: In, Out, In/Out and Property.



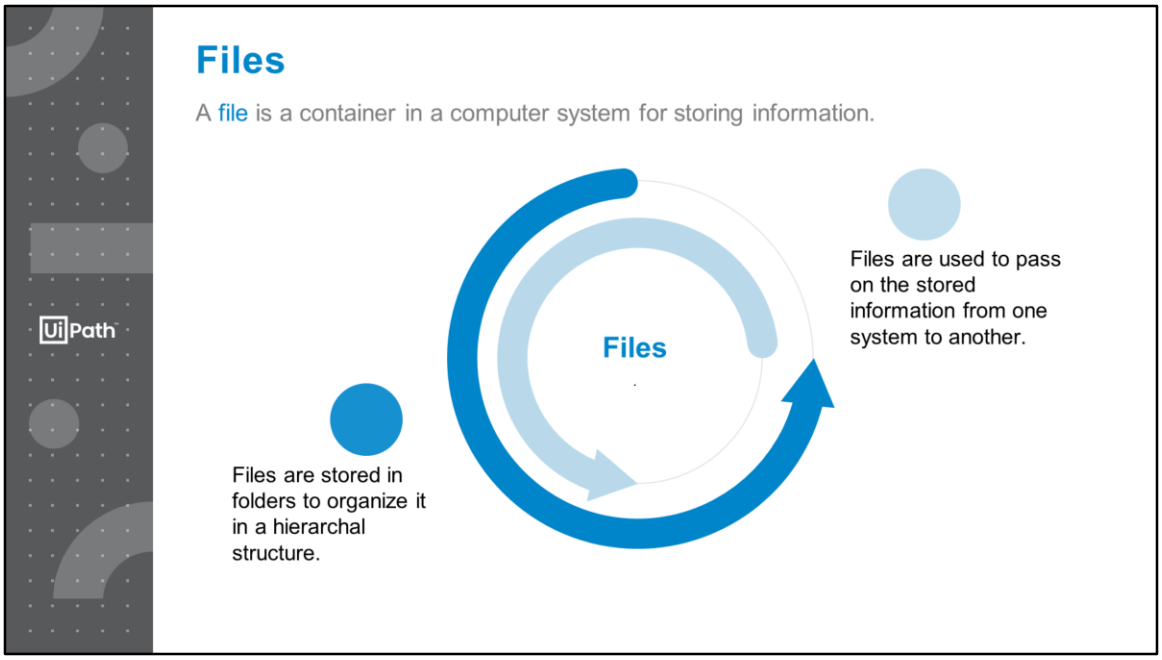
Arguments are generally used in breaking up large bits of code into smaller re-usable bits of code. They are the values that get passed between the projects and programs.
Once a piece of code is broken up (or defined), you will be able to re-use it and invoke that piece of code multiple times in your project without having to re-write that specific part of code each time you need it. This will save you lot of time while working on your projects.

In RPA, it is possible to store and pass on dynamic data to variables.
This enables:

- Reuse of automations in different projects
- Individual testing of an automation
- Quick creation of complex projects



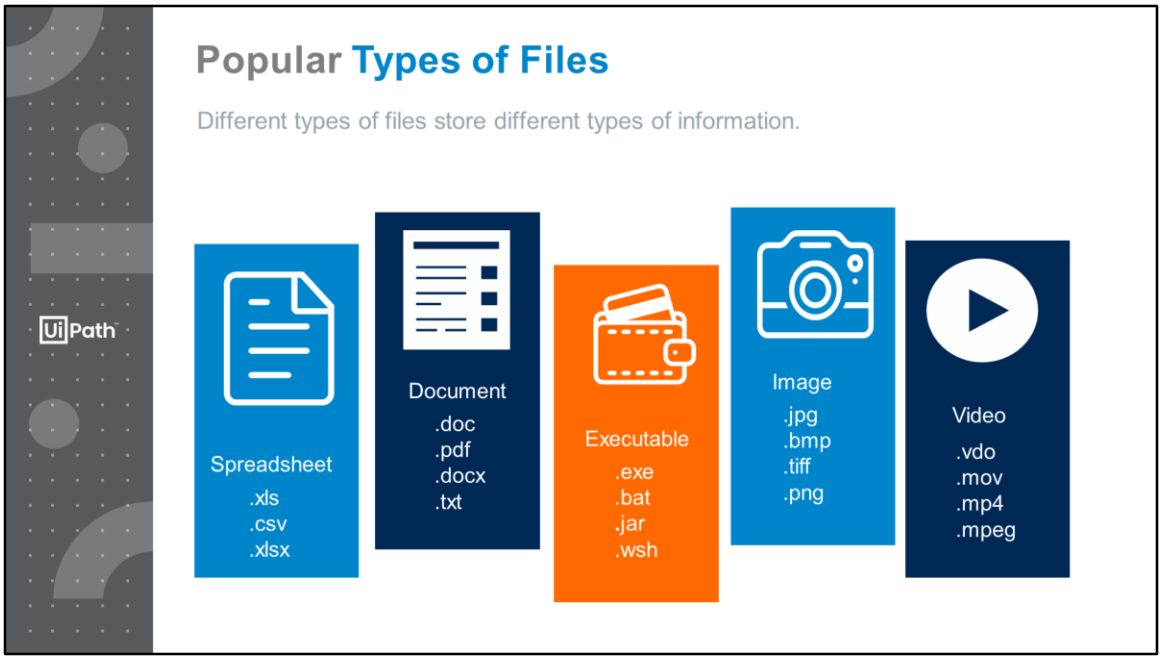
In this topic, we will learn about Files and File Types.



Variables are used for temporary storage of data in computer memory. However, when the data has to persist across session or to be kept permanently, it is stored in files.
Most programming languages support file operations such as creation, modification, and deletion. Operating systems provide file managers for file maintenance. The operating system contains file systems which provide guidelines for storing and identifying files.

Executable File: An executable file is a processor file that includes an encoded sequence of instructions programming that execute directly when the user clicks the file icon.
.BAT
.COM
.EXE
.ISO
.jar

Internet files
.php
.json
.asp
.html
.css

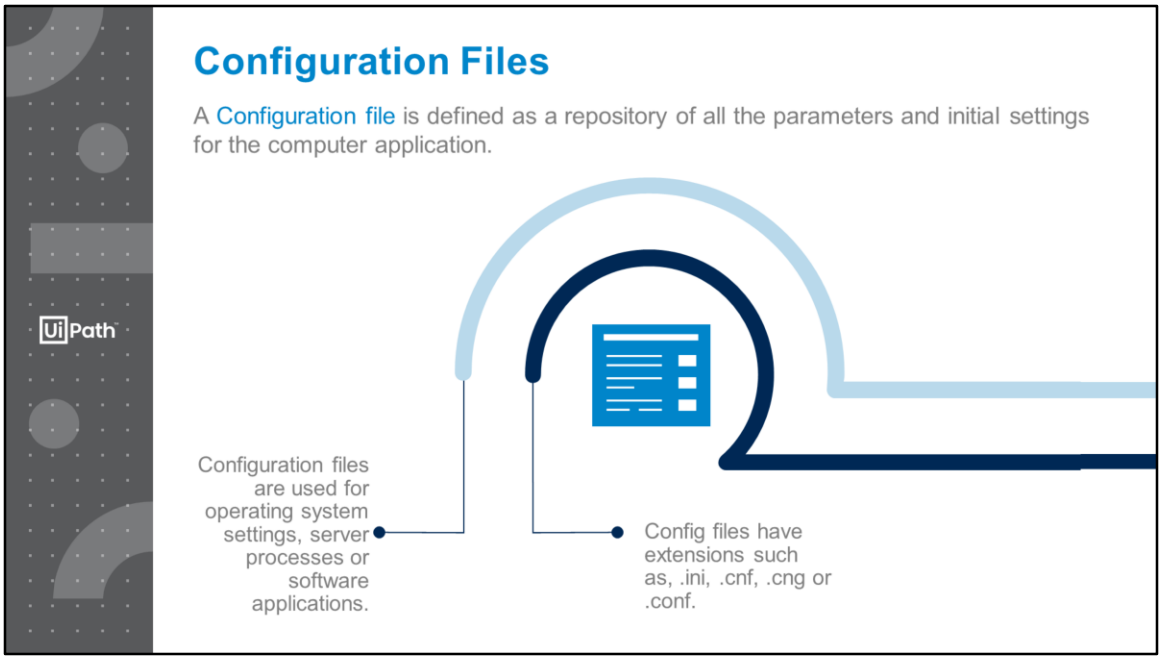


Different types of files store multiple types of information:

1. Spreadsheet: The most common file type that we use in day-to-day life is spreadsheet. It is the best way of storing the data in tabular form. The tabular representation consists of horizontal and vertical lines known as rows and columns. Spreadsheet has made the calculation and manipulation simpler and easier.
2. Document: Document refers to anything that is written, tangible and recorded for future evidence on paper or electronic media.
3. Executable: An executable file is a computer file that contains an encoded sequence of instructions that the system can execute directly when the user clicks the file icon.
4. Image: It is binary representation of visual information such as

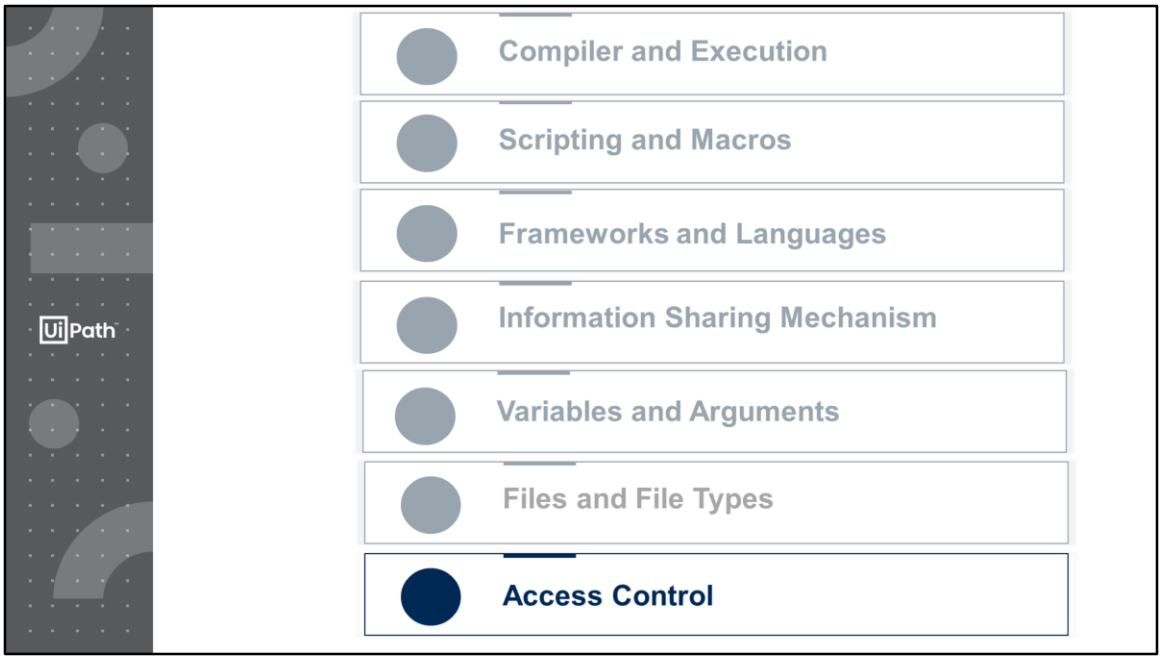
drawings, pictures, graphs, logos.

5. Video: Video is used for recording, copying, playing and broadcasting of moving visual media

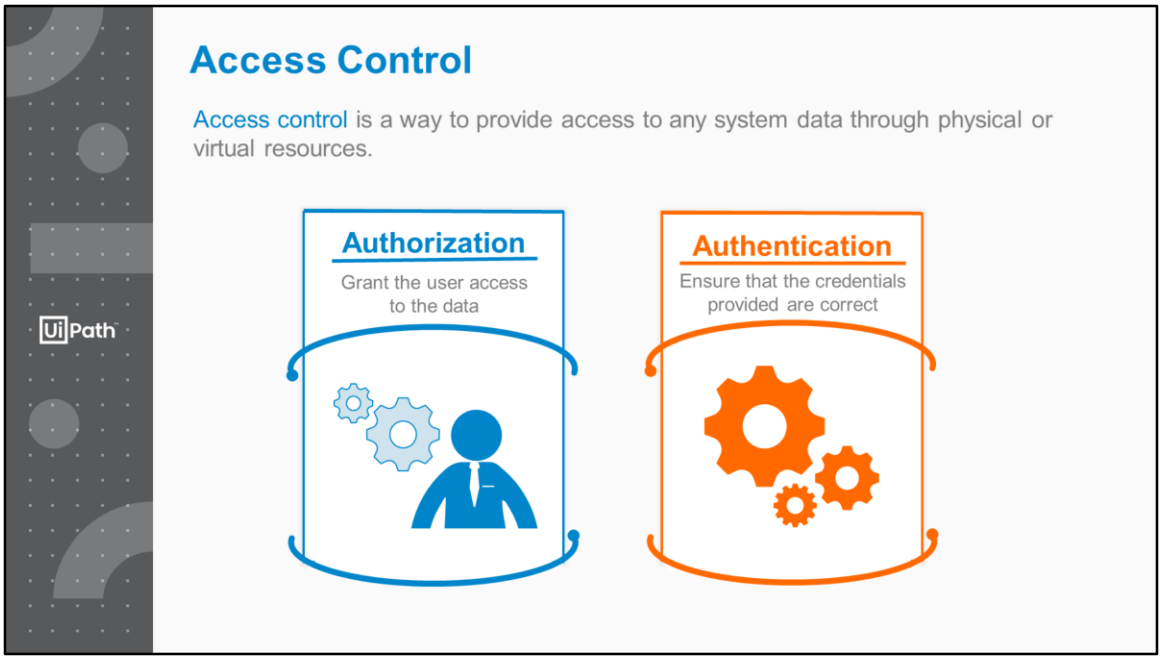


The configuration files change the behavior of the system on the basis of parameters such as options, setting, and preference stored in configuration files. They are also known as Config files have extensions such as, .ini .cnf, .cng or .conf.

Configuration files are used to change the setting without the need of recompiling application, program or operating system.
Configuration files are also used for operating system settings, server processes or software applications.
When we execute a program, it consults with configuration file to check what parameters are in use.



In this topic, we will learn about Access Control.



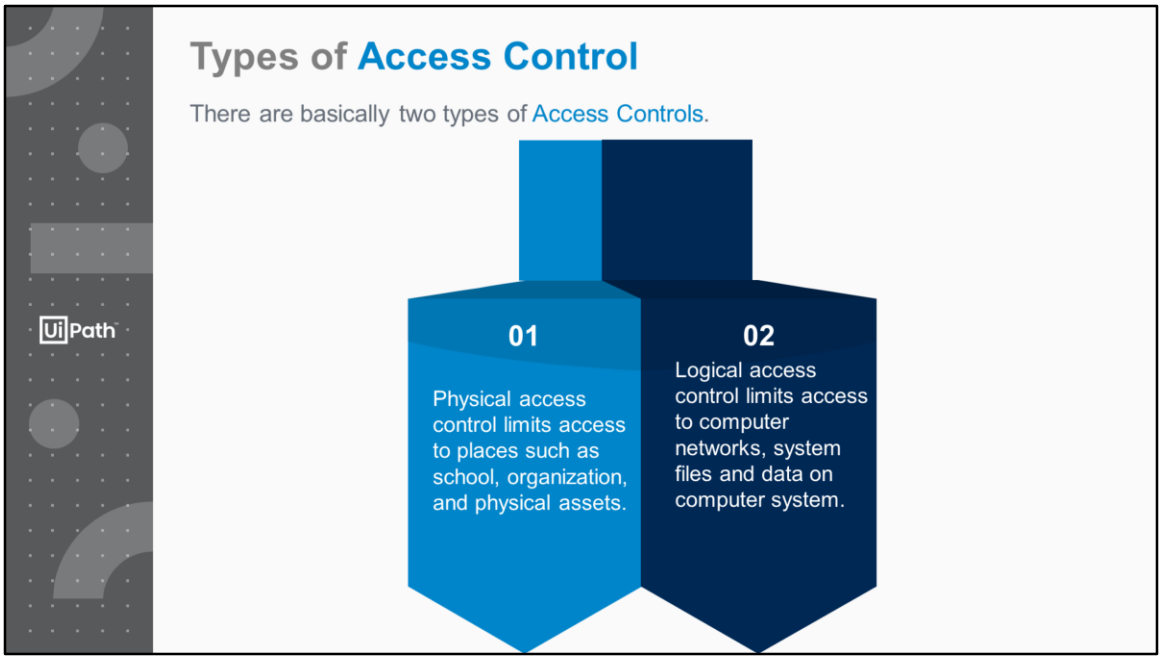
The major components of Access control are Authentication and Authorization. The underlying principle is to check that the provided details are correct.

Authentication: It is used to verify the credentials and ensure that the provided credentials are correct.
Authorization: It is used to grant access to the data to the user.

Additional Notes*

To explain the access control mechanism, lets take an example of an email application like Gmail.

To login into Gmail, we need credentials like username and password. Once the user name and password are authenticated, only then authorization to login into Gmail account is provided.



Access control systems present an identity authentication process. The authorization users and entities evaluate login credentials including with passwords, personal identification numbers (PINs), biometric scans, security tokens or other authentication factors.

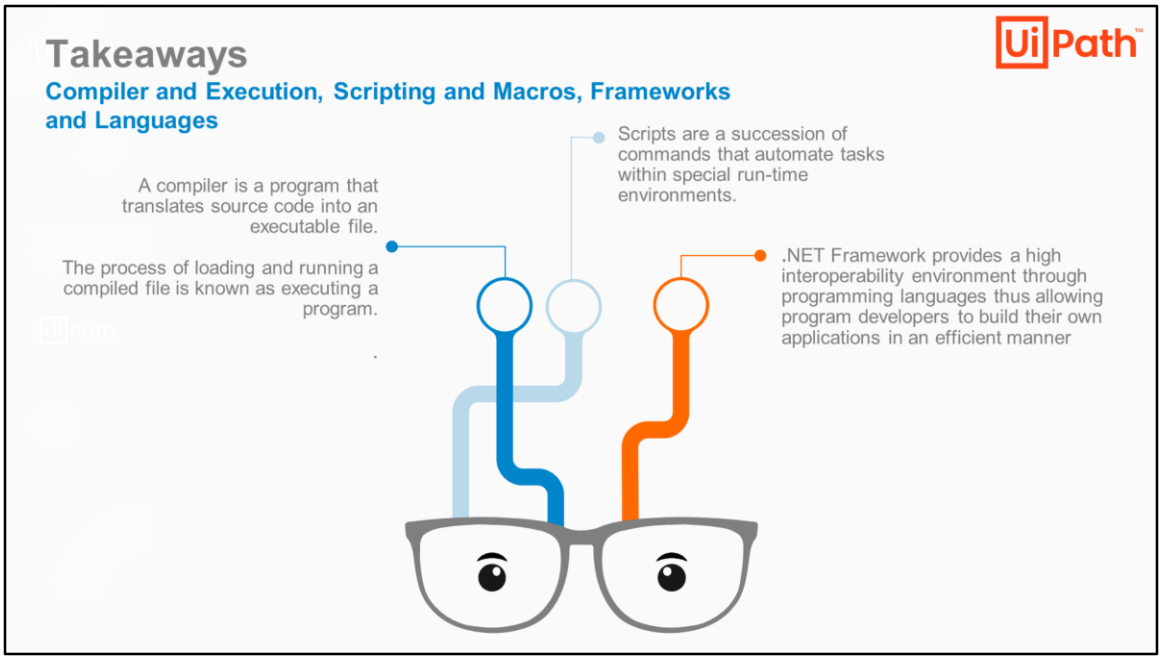
Physical Access Control:
A physical access control system is an initial step in protecting people, property, and assets, which track and restricted door or gate entry that access to a property, building, data centers or room to authorized persons. Key card, key fob, biometric (finger print, retina scan) or PIN-based access control systems provide you the ability to lock and unlock doors.

To secure a facility, organizations use electronic access control systems that rely on user credentials, access card readers access to restricted business locations and proprietary areas, such as data centers.

- Logical Access Control:

To reduce the opportunities for a malicious person to use accounts

as part of an attack, user accounts must be defined according to security principles of need-to-know access. These can include sophisticated password programs, advanced biometric security features, or any other setups that effectively identify and screen users at any administrative level.

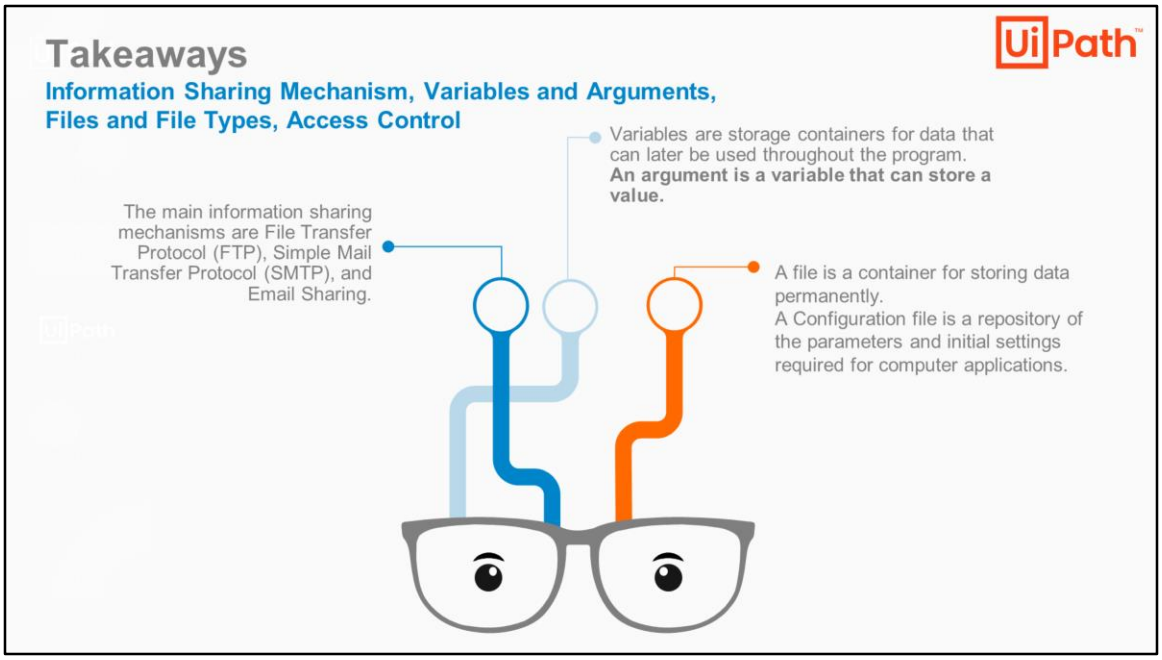


The point of the Recap & Summary section is to go through the most important points covered in the lesson, after the students had the chance to see them in practice and obtain a consolidated view.

Use facilitation questions to help the students map the key points and offer a safe space to get questions and comments from them.

Some examples of facilitation questions:

1. What are the different types of scripting languages?
2. What is .NET Framework?
3. What are the different types of files?



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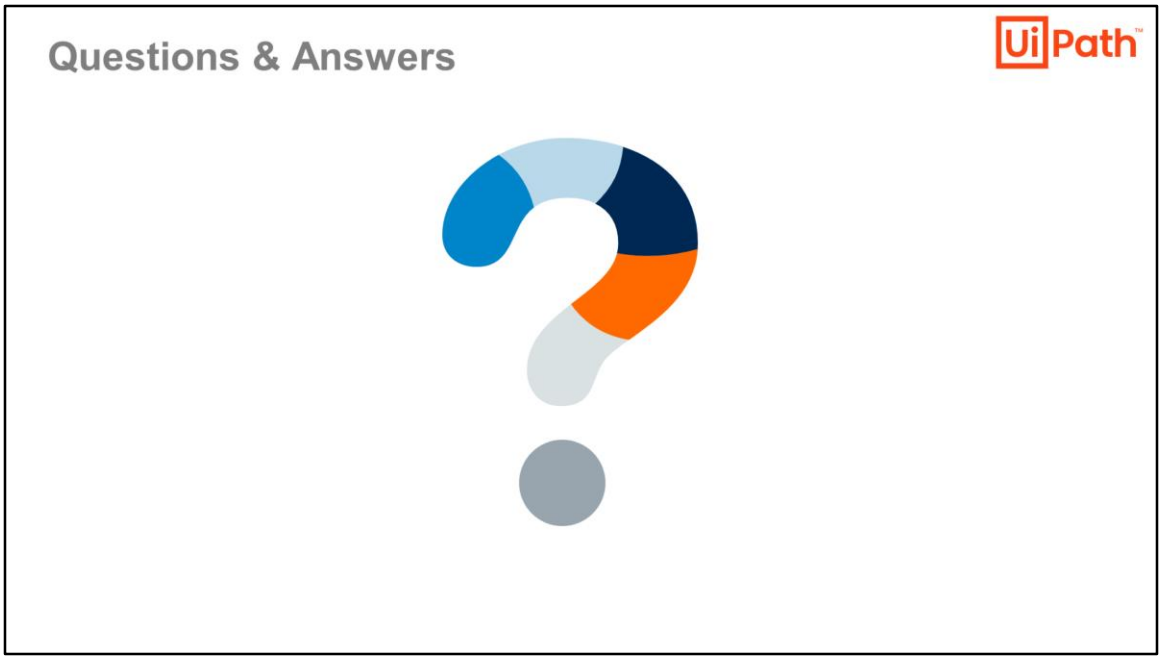
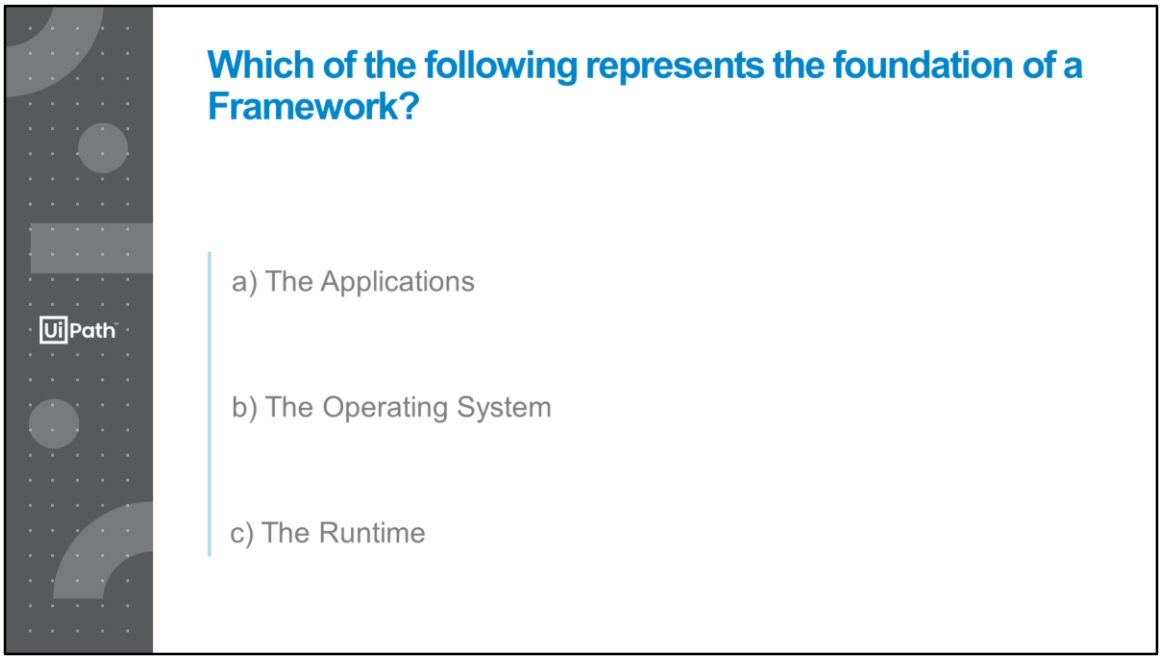
Use facilitation questions to help the students map the key points and offer a safe space to get questions and comments from them.

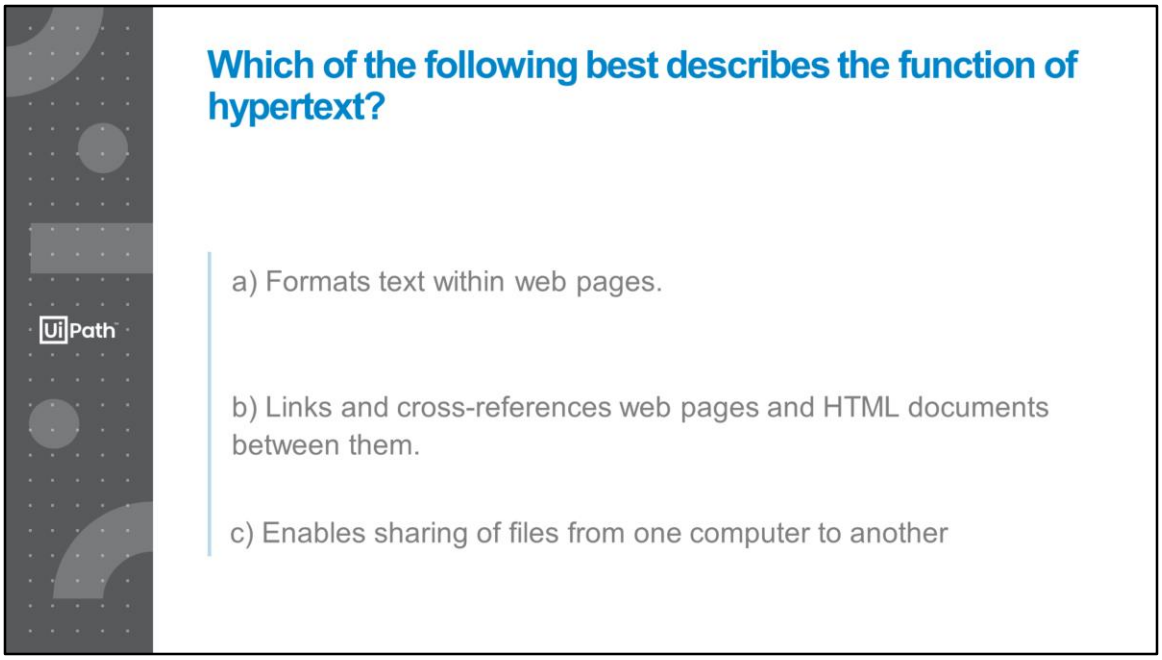
Some examples of facilitation questions:
1. What is a protocol?
2. What is the difference between a variable and an argument?
3. What are the components of access control?



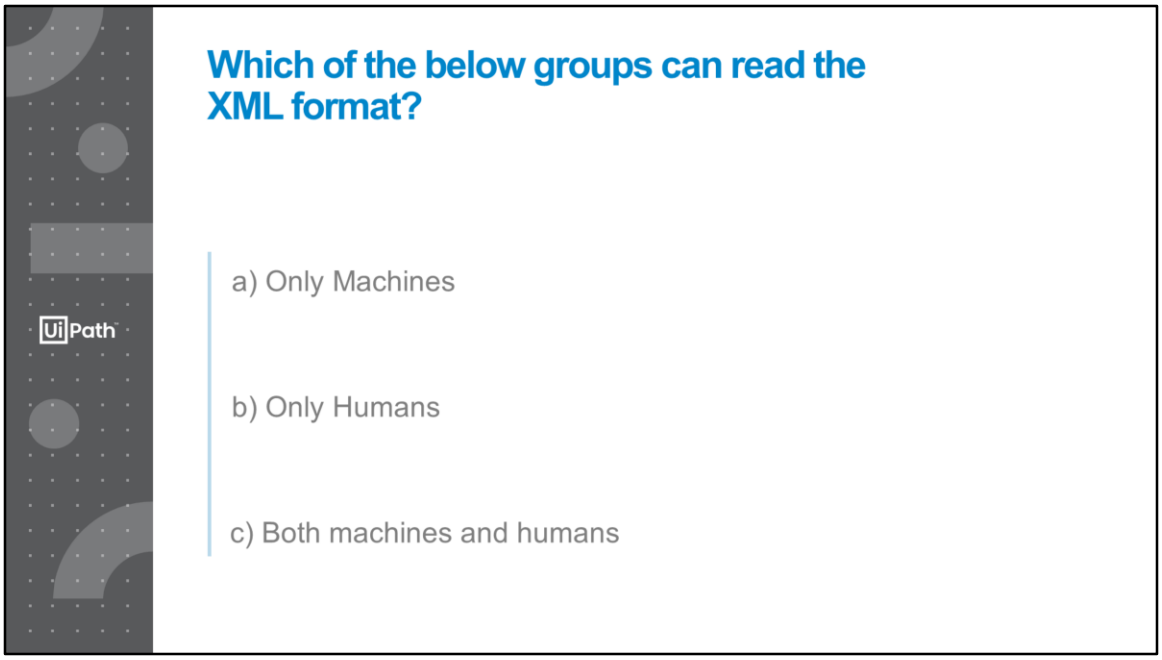
Q&A
Now it’s your turn. What’s on your mind at the end of this?



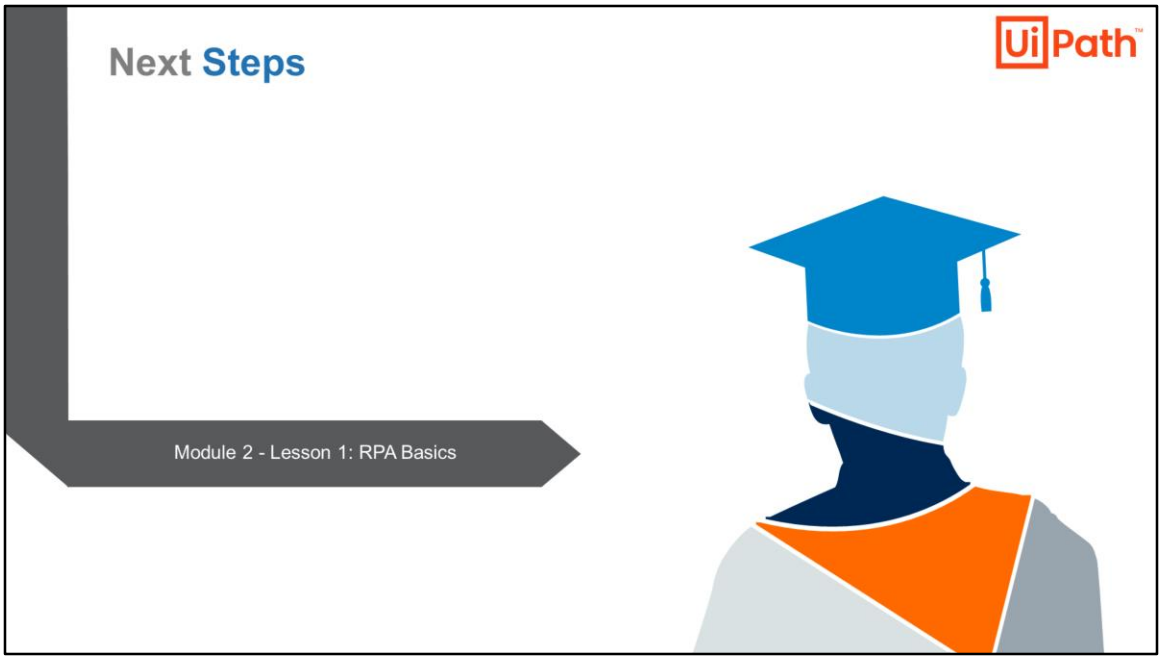
Correct answer: c) The Common Language Runtime represents the foundation of a Framework.



Correct answer: b) Hypertext links and cross-references web pages and HTML documents between them.



Correct answer: c) Both machines and humans



In the next lesson, we will be covering the basics of RPA, its definition, where it can be applied and how it is implemented.