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Computer Programming

What is difference between thread, process and program?

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Animesh Srivastava, Computer Science & Engineering

Answered Aug 5, 2017

1. **Program** : Program is nothing but the set of all the instruction which requires to carry out some specific job.Before come into execution they must be convert in binary codes which should be understood by loader os OS.Generally in Windows it like EXE file which is stored in Portable Executable (PE) Format on Secondary Memory Like hard disk.A process is usually defined as an instance of a running Program and consists of two components:1) A kernel object that the operating system uses to manage the process. The kernel object is also where the system keeps statistical information about the process. 2) An address space that contains all the executable or DLL module's code and data. It also contains dynamic memory allocations such as thread stacks and heap allocations.Processes are inert. For a process to accomplish anything, it must have a thread that runs in its context; this thread is responsible for executing the code contained in the process's address space. In fact, a single process might contain several threads, all of them executing code "simultaneously" in the process's address space. To do this, each thread has its own set of CPU registers and its own stack. Each process has at least one thread that executes code in the process's address space. If there were no threads executing code in the process's address space, there would be no reason for the process to continue to exist, and the system would automatically destroy the process and its address space.
2. **Process** : Each process provides the resources needed to execute a program. A process has a virtual address space, executable code, open handles to system objects, a security context, a unique process identifier, environment variables, a priority class, minimum and maximum working set sizes, and at least one thread of execution. Each process is started with a single thread, often called the primary thread, but can create additional threads from any of its threads.

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and system resources. In addition, each thread maintains exception handlers, a scheduling priority, thread local storage, a unique thread identifier, and a set of structures the system will use to save the thread context until it is scheduled. The thread context includes the thread's set of machine registers, the kernel stack, a thread environment block, and a user stack in the address space of the thread's process. Threads can also have their own security context, which can be used for impersonating clients.

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Updated Mar 7, 2018



Program, Process and **Threads** are three basic concepts of the operating systems about which every computer science engineer must be familiar with. Here, I will explain what each of them is all about and how they differ from each other.

What is a program?

Program is an executable file containing the set of instructions written to perform a specific job on your computer. For example, **notepad.exe** is an executable file containing the set of instructions which help us to edit and print the text files.

Programs are not stored on the primary memory in your computer. They are stored on a disk or a secondary memory on your computer. They are read into the primary memory and executed by the kernel. A program is sometimes referred as **passive entity** as it resides on a secondary memory.

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What is a process?

Process is an executing instance of a program. For example, when you double click on a notepad icon on your computer, a process is started that will run the notepad program.

A process is sometimes referred as **active entity** as it resides on the primary memory and leaves the memory if the system is rebooted. Several processes may related to same program. For example, you can run multiple instances of a notepad program. Each instance is referred as a process.



main thread of that process.

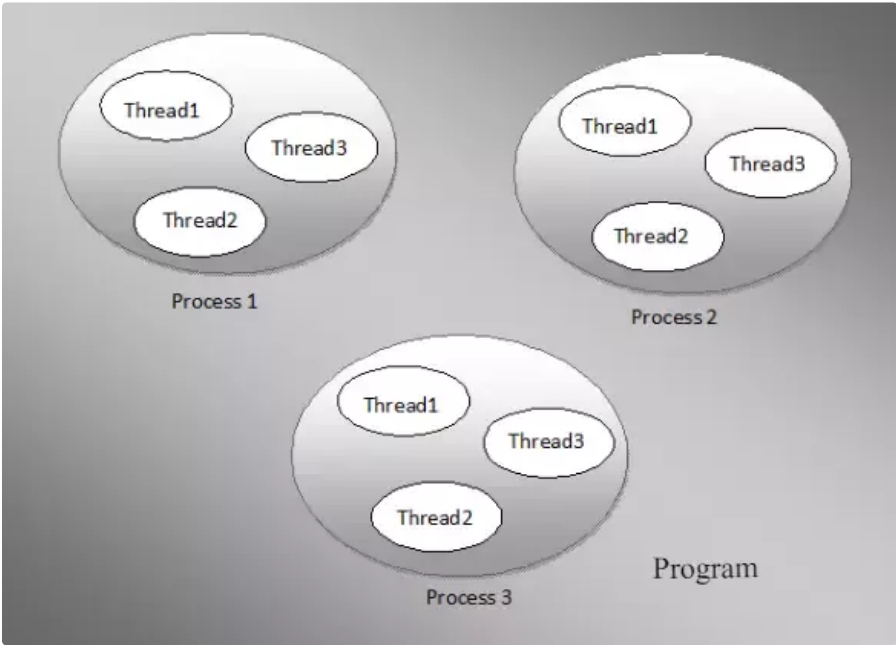
A process can have multiple threads. Each thread will have their own task and own path of execution in a process. For example, in a notepad program, one thread will be taking user inputs and another thread will be printing a document.

All threads of the same process share memory of that process. As threads of the same process share the same memory, communication between the threads is fast.

Summing up...


Process	Thread
Processes are heavy weight operations.	Threads are light weight operations.
Every process has its own memory space.	Threads use the memory of the process they belong to.
Inter process communication is slow as processes have different memory address.	Inter thread communication is fast as threads of the same process share the same memory address of the process they belong to.
Context switching between the process is more expensive.	Context switching between threads of the same process is less expensive.
Processes don't share the memory with other processes.	Threads share the memory with other threads of the same process.

Hope by now, you are clear with the differences between program, process and thread and also have discovered the relationship between them... If not, find out below.



Program is a super set of process, whereas, process is a super set of thread.

Enjoy Learning!!!




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 Neel Parikh, Programmer in making, know something about everything,algorithms are my love!

Answered Aug 16, 2016



Program is a set of instructions given to the cpu to perform a specific task..

However it is not possible for a program to execute whole code at a time in cpu.

It is done sequentially i.e each and every line of program is executed sequentially in cpu, this execution of each line is regarded as process. Thus we can say that, Process is a program under execution. Each and every process has its own code segment, data segment and stack.

Thread is a lightweight process. thread is a part of process. The core difference between threads and process is, threads among the same process share code segment and data segment and address space.

Example;- when we have calculator.exe file in our pc then it is a program.

When we do an instance of calculator(ex. Add two numbers) then it is called process.


When we open microsoft word it is a process which can do many tasks together which forms many threads to perform tasks.(copy a file, edit a file, add a picture etc)

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 Deeksha Puri, former Software Test Engineer at SAP Labs (2017-2018)


Answered Mar 1, 2017






Program is a set of instructions that need to be executed to complete a task while process is **program** in execution(that is, when program is in execution state it becomes a process).

Example: a code has been written in notepad and saved as hello_world.exe so it is a program containing a set of instructions to be executed and when we click that file it is in execution state so it becomes a process.

Thread is a smallest unit of execution in a program. However, a thread itself is

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background while you download a new page, or watch three sorting algorithms race to the finish. So rather than considering each task in opening of a web page as a process instead it is considered as a thread as they share a common space and preserves memory. They are light weight processes.

Hope it helps !!


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Sairaj Hemachandran, B.Tech Electrical and Electronics Engineering, Veermata Jijabai Technological Institute (2018)

Answered Mar 1, 2017

There is a hierarchy to program, process and thread. Many threads form a process and many processes form a program.

A program is a collection of instructions that are executed for the operation. Process is a part of the program that is initiated only when it is triggered. While thread are the smallest entities that run in background for the execution of the process.

Processes are used for more heavyweight tasks while threads are used for light tasks. Threads are also used in the concept of multi threading to carry out multiple actions simultaneously with some time division and prioritisation. This helps in smooth execution of the processes and also for faster operation.

Processes also come together in multiprocessing which is a more complex case. For eg. 2 softwares running parallel on your system. Whereas multithreading example would be that you are using Microsoft word and there is autocorrect going on as well as spell check simultaneously. While program ISS the Microsoft word as a whole.


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Dell Mercant, Former Project Manager at Software and Applications

Answered Oct 15

Process Each process provides the resources needed to execute a program. A process has a virtual address space, executable code, open handles to system objects, a security context, a unique process identifier, environment variables, a priority class, minimum and maximum working set sizes, and at least one thread of execution. Each process is started with a single thread, often called the primary thread, but can create additional threads from any of its threads.

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resources. In addition, each thread maintains exception handlers, a scheduling priority, thread local storage, a unique thread identifier, and a set of structures the system will use to save the thread context until it is scheduled. The thread context includes the thread's set of machine registers, the kernel stack, a thread environment block, and a user stack in the address space of the thread's process. Threads can also have their own security context, which can be used for impersonating clients.

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