ANATOMY OF A COMPUTER

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INTRODUCTION

Since its inception over thirty years ago, the computer constantly evolves into more powerful and compact shapes. With increasing scope of technology comes increasing security risks associated with new computer products. This Tech Insight introduces the basic parts of a computer and describes the more recent applications of the basic parts to small devices, the Internet of Things (IoT), and applications in healthcare. Finally, this Tech Insight focuses on how the Department of Veterans Affairs (VA) is managing security risks associated with computers.

OVERVIEW

The basic components of a desktop computer include internal and external components. The internal components consist of the motherboard, expansion slots, central processing unit (CPU or microprocessor), random access memory (RAM), hard drive, and power supply. External components include the tower, keyboard, mouse, and monitor, and these touchable external components are all examples of hardware. Hardware houses software, which is a term for the computer instructions or data that operate the computer or run applications. Internet browsers (Internet Explorer or Google Chrome), operating systems (Mac OS X10 or Windows 7), and word processors (Microsoft Word) are examples of software.

All of the internal components can be found in the tower of a desktop computer. The motherboard is the main printed circuit board (PCB) and connects directly or indirectly to every component to allow communication between components. In addition, the motherboard has expansion slots that fit expansion cards for video, sound, network, and other components. Expansion cards are a circuit board that insert into a computer to give extra services or memory. Most modern computers have built in expansion cards.

Next is the CPU. The CPU is the brain of the computer, and carries out commands. Included in the CPU are various transistors, which are devices that regulate current or voltage flow. Each

transistor acts as a switch for electric signals in order to process commands. The architecture of a CPU comes in two forms: complex instruction set computer (CISC) and reduced instruction set computer (RISC). CISC is the original CPU design where a single set of instructions executes several low-level operations, like solving a math calculation. CISC is included in most computers and servers. In comparison, RISC only uses simple instructions that can be divided into multiple instructions to perform low level operations within a single clock cycle. RISC can be found in mobile devices.

There are two types of storage. RAM provides short-term storage, which disappears when the computer is turned off. When a document needs to be saved, the data is copied to the hard drive. The hard drive provides long-term storage where the software, documents, and other files exist.

There are two types of hard drives – hard disk drives (HDD) and solid state drives (SSD). HDD uses a mechanical arm with a head to move around and read information from the precise location on a storage plate. In comparison, there are no moving parts to an SSD, and data is stored to a pool of flash memory, nonvolatile memory that does not need power to retain data. This aspect makes SSD much faster because it is used more frequently in computers.

Another internal aspect of a computer is the power supply. The power supply converts the power from the wall outlet and sends it through the cables to the motherboard and other components. There are also batteries that provide an addition power source enhancing mobility.

Finally, there are several external components. The keyboard and mouse act as basic input sensors to navigate what is presented on the monitor. Through these visual and touch sensors, the CPU receives and makes decisions on how to respond to the data.

APPLICATIONS

The computer is the pinnacle device for the evolution of modern products, like Internet of Things (IoT) and small devices. Small devices and IoT devices have some of the same elements found in the computer, but in a condensed way. For example, in order to create a small and faster microprocessor, hafnium oxide replaces the silicon oxide that enables faster currents to pass through the hard drive. Innovations in materials and manufacturing enable certain computer elements to be faster and smaller for different devices.

An IoT is the interconnection of computing devices embedded in everyday objects, enabling them to send and receive data via networking or as a single device with networking to the internet. This is called machine to machine (M2M) communication. These devices utilize RISC CPUs (specifically Advanced RISC Machine or ARM), a power supply, external sensors, short and long term (both HDD and SSD) memory, and network connectivity expansion cards to transmit data. These elements may or may not be present depending on the device.

Another example of a computer is a small device, like a smart phone. Smart phones and desk top computers share similar machinery, but in a more compact size. A smart phone contains short and long term storage, a power supply, RISC CPUs, a monitor, external sensors, and network connectivity. The computing mechanism works in the same way where the screen can be touched, which then sends a signal to the CPU to process and react to the information the user wanted.

HEALTHCARE APPLICATIONS

IoTs and small devices are used in a variety of ways in the healthcare field. For instance, mobile medical applications or wearable devices allow patients to capture health data. Medical facilities, including VA, use IoT to keep tabs on the location of medical devices like pacemakers, Fitbits, personnel, and patients. Healthcare services use sensors and CPUs to analyze and transmit data to the host computer via the internet. These devices are becoming more prevalent and utilized in the healthcare field in order to increase communication and data. It also translates to more improved patient care by increasing flexibility patient monitoring. Both of these aspects lower costs for medical facilities.

SECURITY RISKS

Increasing use of IoT and small devices in healthcare can increase communication by directly uploading data directly to healthcare providers. It also creates more risks for data security. For example, one of the biggest threats to security is when mobile devices are lost, stolen, or hacked. Since there are small devices and IoTs connected to hospitals via a wireless connection, it is important to keep all personally identifiable information (PII) and protected health information (PHI) secure.

To address this issue, in the Fall of 2015, VA debuted a new cybersecurity strategy focusing on a medical cybersecurity strategy and new steps to secure connected medical devices. VA's

requirements for a security solution include: (1) not requiring software to be installed on the device; (2) scalability to devices; (3) functionality across different physical and virtual environments; (4) consideration for device lag; and (5) capability to provide reports on device traffic volume, threat indicators, and protocols.

CONCLUSION

The anatomy of the computer evolves and finds new applications in the healthcare field. Parts can be swapped out and updated constantly to accommodate new devices. The healthcare field, including VA, is already embracing new computing technologies, but there are serious security risks that must be addressed to protect confidential information. How much these devices will integrate into patient care and other aspects of healthcare remains to be seen. As we track IoT and small devices, it is important for VA to stay current on innovative technology in order to deliver the best services to Veterans.

Read more technology topics in TS Tech Insights: Machine Learning; and Enterprise Design Patterns. If you have any questions about the anatomy of a computer, don't hesitate to ask TS for assistance or more information.

TS TECH INSIGHT SERIES

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