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Emerging Computing Resources

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Abstract – Computers are an essential part of many activities in day to day life. Computers fundamentally acquire and process data including image oriented medical applications. Advancements in processor technology has enabled the use of multiple CPU cores in a chip and also the use of multiple chips for processing user needs like Cloud computing, resulting in higher computational speeds. Earlier computers look bigger and did mono activities. Nowadays computers look simple and small but are doing heterogeneous enormous activities. It is due to modern computing resources, availability of Internet and nanotechnology making resources. The modern resources are competent to the high speed of computers to meet out the demands of users. Now Laptops and desktops are wire-free and become interactive with 3D depth-sensing cameras. Apple's iPad has changed people's view on computers. Hardware manufacturers are innovating and improving from mobile devices, gaming consoles and 3D printers to rethink computers. This paper is dealt with computing resources that changed the traditional use of computers doing data processing

1. Evolution of Computers

Computer invention has a long history. This section highlights a few excerpts in the evolution of the present day computers. Abacus used five thousand years ago in Babylonia,is the earliest recorded calculating device. It is a counting device, depicted in Figure 1, used for additions and subtractions.

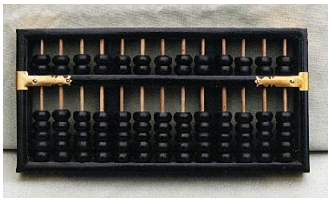

Figure 1 – Modern Abacus

Al-Khwarizimi, a famous Baghdad scholar around 800 BC presented geometrical demonstrations and numerical in his book. The book had transpositions which he called al-jabr. This reflected in European thoughts of that time culminating in algebra. The scholars Latin name Algoritmi, became synonymous for a new style of

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reasoning, the Algorithm. Raymon Lull, a Spanish courtier of the Thirteenth Century is the first person in history known to have devised a "logic" machine—a machine for computing logical proofs and reasoning called inference. It derived information from previously known information. Greek philosopher Aristotle (384-323 B.C.) was the first to recognize information capture and its subsequent exploration of symbol oriented methods, making reasoning or logic, a kind of computation. RaimundusLullus belonging to Aristotelian tradition, devised a machine composing of a series of concentric circles containing symbols representing subjects and is depicted in Figure 2

Figure 2 - . Lull's logic machine

The circles were rotated to align combinations where a combination represented a statement subject. The basic idea was to generate mechanically all of the possible thoughts or ideas that could be expressed about some given subject. It computed truths using mechanical methods. John Napier, a mathematician discovered logarithms used by astronomers and bankers to reduce complexity in multiplication and division operations. In the 17th century, Blaise Pascal (France) and Gottfried Wilhelm Leibniz (Germany) invented the mechanical digital calculating machine. Englishman Charles Babbage's invention in the 1830's is credited with the first digital computer. This analytical Engine, a mechanical device, combined basic arithmetic operations with decisions with computations and is the base for modern digital computer. Figure 3 depicts a Difference Engine

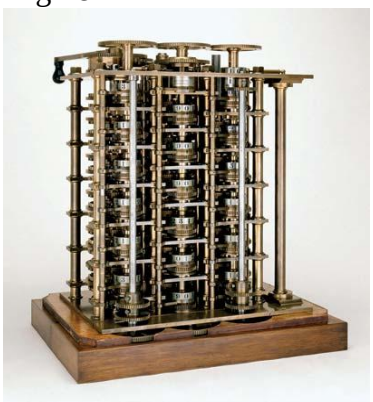

Figure 3 - The Difference Engine

English mathematician and logician George Boole's similarity between algebraic symbols and logic operated on 0 and 1 or present day Boolean algebra. A Computer's switching and procedures are grounded on Boolean algebra. American mathematician and physicist, John V. Atanasoff was the first to build an electronic digital computer from 1939 to 1942. He was assisted by Konrad Zuse, a German engineer acting who completed construction of the first operational program-controlled calculating machine in 1941. In 1944 Howard Aiken and a group of engineers at International Business Machines (IBM) Corporation completed work on the Harvard Mark I, depicted in Figure 4, a machine whose data-

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processing operations were controlled primarily by electric relays (switching devices).

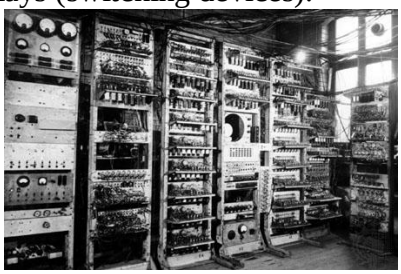

Figure 4 - Manchester Mark I, (1949)

Since then, the digital computer has evolved at a rapid pace. Subsequent advances in computer equipment can be divided into generations, where each generation comprises of a group of machines sharing a common technology

2. Types of Computers

Currently there are many types of computers. Personal computers come in many forms, including iPad. Desktop computers are usually less expensive than forms of computers. It is not designed for portability and exists in a permanent location. Current desktops offer more power, storage and versatility for lesser costs. Laptops and notebooks, are portable computers that integrate the display, keyboard, a pointing device or trackball, processor, memory and hard drive all in a battery-operated package slightly larger than an average hardcover book. Personal Digital Assistants (PDAs) are integrated computers that often use flash memory instead of a hard drive for storage. These computers usually do not have keyboards but rely on touch screen technology for user input. PDAs are typically smaller than a paperback novel, very lightweight with a reasonable battery life. A slightly larger and heavier version of the PDA is the handheld computer. Servers are also computers optimized to provide services to other computers over a network. Servers usually have powerful processors, lots of memory and large hard drives. The next type of computer can fill an entire room. Mainframe computers are huge machines capable of processing millions of transactions every day.

3. Computer Chips

Chip evolution started with transistors, invented in 1947 at Bell Laboratories by John Bardeen and then was substituted with semiconductor devices. Revolution started with the first fabricated integrated circuit, a solid-state device containing hundreds of transistors, diodes, and resistors on a tiny silicon chip. This chip made it possible to produce mainframe computers with higher operating speeds, capacity, and reliability at significantly lower cost. The development of a personal computer, an inexpensive digital computer was produced for ordinary customers. The use of personal computers grew from 1980's but the use of World Wide Web brought millions of users onto the Internet, the worldwide computer network, and by 2015 about three billion people, half the world's population, had Internet access. Computers became smaller and faster with smart phones and tablets.

4. Current trends in IT

Technology analysts speculate on new advances for a year and publish their forecasts. Internet of

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Things (IOT) is an interconnection of devices embedded with sensors like vehicles, security systems and household appliances. These objects can be monitored with mobile devices. In processing, Cloud storage computing offers infinite computing capability and transcends memory. Cloud integration will offer integrated systems as a whole. There will be an increased use of intelligent systems in health care, government services and online education. There are a number of trends in computing worth mentioning and is detailed below

- **Internet of Things(IOT):** IOT is getting a lot of attention from analysts and media. It involves interconnected objects installed with sensor-chips and software and connected to the internet. The elements of IOT are Hardware, Software; and Cloud. Common hardware elements in IOT are Low energy sensors for sensing, Communication hardware including gateways, modems, routers and Touch screens for the user's front end. IOT involves Sensing ad the first step or a point of activity, captured by an appliance, a wearable device, a wall mounted control or any number of commonly found devices. The sensing can be biometric, biological, environmental, visual or audible or all the above. The sensed data is then communicated using gateways, switched, LAN, WAN in the medium of internet. This transmitted data is then consolidated using Cloud Based services and finally delivered. User interface can be provided across multiple device and platforms like tablets, smart phones, desktop and operating systems like OS, Android, Windows, etc. In IOT device Manufacturing of smart watches, home devices and personal appliances are on the rise and analysts expect above 20 billion IOT devices by 2018. Organizations will have new ways to track employees and communicate with customers. The challenge would be in analyzing data generated from IOT devices.

- **Machine Learning and Cognitive Computing:** Artificial Intelligence, researched for long is becoming a reality. IBM, Google, Facebook, Microsoft and Apple are investing in cognitive computing and machine learning research. Systems are expected to function like a human brain and can understand natural languages, identify images and build hypotheses. IBM's Watson system demonstrated cognitive computing in a television game show. About 1% of software development is done on embedding cognitive capabilities in applications and expected to increase a great deal by 2018. Figure 6 depicts an overview of a Cognitive System

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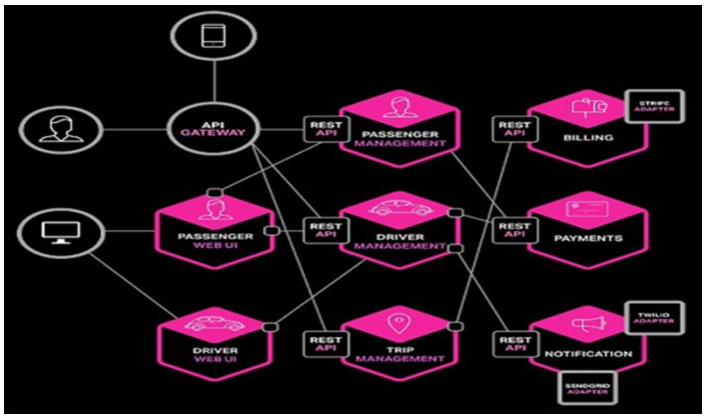

Figure 6 – Overview of Cognitive Systems

- **Adaptive Security:** Cyber attacks occur with an alarming regularity, super ceding existing security measures. Organizations have inadequacy in coping with such attacks. Research firm Gartner recommends adaptive security for enterprises where predictive analytics can be used to anticipate the next strike. Adaptive security can become a top technology trend where user and entity behavior analytics will ensure adaptive security architecture.

- **Cloud Computing: Cloud** computer is to stay, and by 2018 at least half of IT based expenses will be on cloud based systems. Organizations would find it easier, cheaper and secure to adapt to clouds instead of spending on traditional systems and security measures. Cloud computing infrastructure involves a data center whose hardware can vary based on the workload. The data storage element have to handle voluminous data. The Cloud data centers need to be in a cool atmosphere for better performance of boards, and chips, using an air conditioning or water coolant facility. The networking infrastructure have to be resilient for better performance. Cloud also includes a set of software in the context of applications.

- **Smart Assistants: Customers have started using** voice-activated assistants on mobiles. Microsoft has released Cortana assistant for laptops and desktops. These assistants are expected to grow smarter and researchers at MIT, Austin, and improving this technology and may be released in 2017.

- **Wearable computing** : They are computers attached to human bodies or clothing and connected to the Internet. The devices list also includes wrist watches, bracelets, heart monitors and clothing. They represent a new opportunity for customer and employee interactions . This trend will define a new era of mobile apps, specifically designed for wearables. Figure 7 depicts a wearable computer prototype

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Figure 7 - prototype of a wearable PC

- **Nonvolatile Memory:** A connected network of people needs more and more memory. A Nonvolatile memory can retrieve information offline and has been used lesser due to the issues of cost and performance. New forms of nonvolatile memory can lead a trend in more data at lesser costs allowing smaller devices to store more information.

- **Data Science:** This is aninterdisciplinary field studying about processes and systems for knowledge insights. A Scientist's curiosity to extract meaning from big data for buying trends and patterns. This is a growing trend for the opportunities it presents in extraction of meaning from the massive amounts of data available.
- **Network Function Virtualization (NFV):** This trend is synonymous with cloud computing as more the world depends on cloud services, security limitations become difficult. NFV is an emerging technology which provides a virtualized infrastructure on which next-generation cloud services depend. With NFV, cloud services will be provided to users at a greatly reduced price, with greater convenience and reliability by telecommunications companies with their standard communication services.
- **3D-Printing Materials:** Advances in 3D printing will increase on a range of materials like alloy nickel, glass, carbon fiber etc. Recent advances has made it possible to mix materials with traditional 3D printing. Biological 3D printing (Human organs) is on the way to reality.
- **Wireless charging:** Intel is eyeing on a "wire-free" PC, in with wireless technology will replace displays and data transfer cables. The laptop may be without ports but will rely on wireless technology to connect to monitors and external storage devices. Interactive computers with 3D cameras will behave like human eyes and have the ability to recognize objects and measure distances. Sensory inputs through sound, voice and touch will helps PCs respond to user needs. PCs will get thinner, faster, lighter and have longer battery life. Games and movies will have higher-resolution displays.

5. Conclusion

The computing resources have changed the way computing is viewed or done over the years. The

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evolution is still continuing with the application of research to new devices. This paper has highlighted a few of the many upcoming trends.

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