

Technology Trend Towards Development Of Future Generation Of Computer

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Abstract: Everyone needs high speed computing system. The use of computation is covering almost in every field of science. Hence it is important to maximize the computational performance of the system. But it is very difficult, impractical and costly to do a physical experiment for developing a computational system. On this context, we have to ensure both hardware and software development to maximize the output. So a scientific theoretical experiments are done to improve both hardware and software components by using different model or tool or simulator. In this paper, some of the challenges and technologies are described to develop a high speed super computer for future generation.

Index Terms: Future generation computer, Performance, multi-core processor, IoT, Cloud Computing, High computing machine, Deep learning.

1. INTRODUCTION

We started our journey of using a computing machine from abacus computer system which is used for a simple calculation. But now in this era, we need a super computer. The super computer is used not only to solve a personal complex problem but also used to solve a worldwide problem. Now, a question arises how the computer becomes a super computer. It is the technology which provides drastically improvement in both hardware and software to design a high speed computing machine, machine to develop according to the increase in service demand. On the other context, availability means fault tolerance which continuously provides the services even though hardware or software failure occurs. While designing future generation computer which will ensure scalability and availability. One should give attention to the performance(execution time) and cost metrics in terms of power consumption. In 1980's, the speed of computer measured in IPS(instruction per second). In the 1993,the performance of the system is measured in MIPS(millions instruction per second) or FLOPS(floating point operation per second). Then in 1995, the topmost super computer was designed by Japan named Numerical wind tunnel which was having computation speed 124 GFLOPS(Giga FLOPS).In 1997, the performance of super computer touched some TeraFLOPS. It was ASCI Red HPC(high performance computing) system whose performance upgraded upto 3.1 TFLOPS. In 2008, a super computer named Road runner machine was designed by IBM ranked no.1 crosses the performance TFLOPS and entered to PETAFLIPS.Again in 2017,

Sunway Tainulight another super computer had a performance of 93PFLOPS. It was having hybrid and heterogeneous architecture. In June 2018, a HPC was designed whose performance was 122 PFLOPS consisting of 9CPUs and 6 GPUs (Graphical processor units) on its core. From above data author says that, the performance of super computer has increased by huge order since last decade. Our next performance milestone for future generation computer is 10^{18} FLOPS or ExaFlops. The above growth trend of computing system is due to the unanimous and continuous development of both hardware and software. The following phases of our paper discuss the recent trend in technology for producing high computing system.

2. THEMES OF THIS PAPER:

This paper entitled "Technology trend towards development of future generation computer comprehends some of selected research papers addressing the state of the art and innovate research direction towards development of high performance computing system. Both theoretical and practical aspects can be tested by current modeling and simulations of the system. The domain which is taken into account for developing high speed computing future generation computer is briefly discussed.

a. Hardware of Computing system.

The growth of hardware and its architecture is exceptional in recent years. Hardware developments means fast and multi-core processor chip, new accelerator, fast interfacing peripheral devices, fast and high capacity memory. Some of the research talked about designing of fast multi-core processor using silicon chip which provide less power consumption [12,13] and improves parallelism. Another research emphasizes on suitable memory hierarchy for faster access of data[6,9,11]. By 2018, over 90 CPUs are found in a single chip of super computing machine to obtain performance in PFLOPS. Two decades ago, SoC (system on chip) was an efficient design techniques to improve the speed of performance[34]. SoC is the computing device in which all the components of the system was fabricated in a single chip. Due to less power consumption and high speed performance, SoC has a wide range of application.

b. Fast Networking

For improving performance of distributed computing system, a high speed network technology is essential. Wireless technology such as Bluetooth, Zigbee, WiFi,

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Apple iBeacon , RFID, NFC , CISCO Intelligent proximity are some of the fast network technologies used in computing devices. The wireless technology is becoming so crucial day by day that all the communication of information depends on this distributed networking system. Now the speed of transmission is about 100Gbps through WiFi technology. Like SoC , NoC(network on chip) was developed and playing pivotal role in super computing device. It avoids congestion at the router[16]. One of research paper by Maqsood gave idea on congestion control among multi-core communication. It also proposed a congestion control method which outperforms the existing algorithm and shows simulation results [17]. So one has to give attention to design of faster network while developing a high computing machine. Now the speed of transmission is about 100Gbps through WiFi technology. Like SoC , NoC(network on chip) was developed and playing pivotal role in super computing device. It avoids congestion at the router[16]. One of research paper by Maqsood gave idea on congestion control among multi-core communication. It also proposed a congestion control method which outperforms the existing algorithm and shows simulation results [17]. So one has to give attention to design of faster network while developing a high computing machine

c. Use of advanced and fast Peripheral device

When we concentrate on designing of high computing system, we have to give importance to performance of all peripheral devices used for the system. The common peripheral technology used for my computing system are hard drive, sensor, expansion slot , RAM , USB, Fireware, eSATA etc. all these devices need to be faster by using advanced technology. The most important component used to make communication between these devices is known as bus. Different types of buses are used to speed up computation process in different computing system. One of the bus named PCI (peripheral communication interface) is used to connect component of PC. There are internal and external slots are there to connect with high speed bus. Internal slots include AGP, PCMCIA and external slots include USB, fireware, PS/2 , removable storage(CD/DVD) and non-removable storage slot, input and output slots. Recent trend technology shows path to develop faster peripheral devices for future generation computer.

d. Advanced Architecture and Organization

The development trend of computing system architecture is as follows: Von-neumann architecture, Harvard architecture, modern architecture, RISC, CISC, DSP, VLIW, MISC architecture, Processor array architecture and massively parallel architecture. It plays a major role to improve the performance of computingsystem. Depending upon the application domain a particular architecture is selected to design a computing machine. Melab [18] propounded two parallel models. One model is able to execute the part of code and another model is able to execute the rest code and library functions. This architecture avoids data transfer overhead and results better performance. Again the experimental result of vectorization architecture show a better performance by a computing system. Now a days, the innovative architectures and its implementation can be analyzed easily by using different simulation tools like Auto- desk

product design suit, MATLAB, CATIA,ZW3D, Mech-Designer , PTC Creo, Rhino , Top-solid design, PSPACE CLAIM, Patransimulink etc. A simulation model named PRAM(parallel Random access massive) is extensively used to measure the performance of many core architecture system[25,26].

Considering the application domain, one of major steps towards development of high computing system is a proper combination of CPUs and GPUs on multi core system chips. The implementation of architecture is carried out in a simulator known as Multi2Sim [21]. For high computing system, if we increase number of cores per node it may mismatch with input output performance. Hence a new architecture was provided by Zhang [23] for multi-core processor to provide high throughput. It provides better performance over a different domain possessing different characteristics. We can summarize that high speed hardware components plays a major role for designing a super computer. Above description provides a path to develop different areas of hardware.

e. Software development of computing machine:

The super computer has a wide range of use in various fields which include molecular modeling, macro-molecules, oil and gas exploration, weather forecasting, satellite controlling. Industry control system, nuclear weapon design. Hence major changes are made in different system software as well as in application software. A parallel architecture of super computer need a special programming technique like MPI, PVM,VTL and Beowulf. GPGPUs have more than hundred CPUs and GPUs which is programmed by using a programming model CUDA. In order to test and debug the parallel programming a special technique should be adopted. Linux was found the topmost platform to run super computer in November 2017. The IBM super computer known as Blue Gene run on CNK operating system which is modified version of Linux Kernel. It is basically used for job scheduling problem in 3D business environment. Another Super computer named Cray XT3 uses a PBS processor .Different module of OS needs to be changed for different domain of super computer. Like in IBM's Blue Gene Slum workload manager is used to provide best fit algorithm[16].another researcher Young-Kyu Yang provided a system software C-ERIMS(Environment and resources integrated management system for CRAY) which was more effective in image processing[17]. In this section the author brings attention towards development of software for different domain. So a specific software is required for a particular application domain so that the computation speed can achieve its goal.

f. Different application domain forces to build high computing future generation computer:

Due to advancement of technology many application domains found in computing system like cloud computing, mobile computing, big data analysis, grid computing, block-chain, IoT and soft computing(Deep learning). These application area motivates the researcher to build high computing machine to incorporate. The author talks about only cloud computing and IoT in this section.

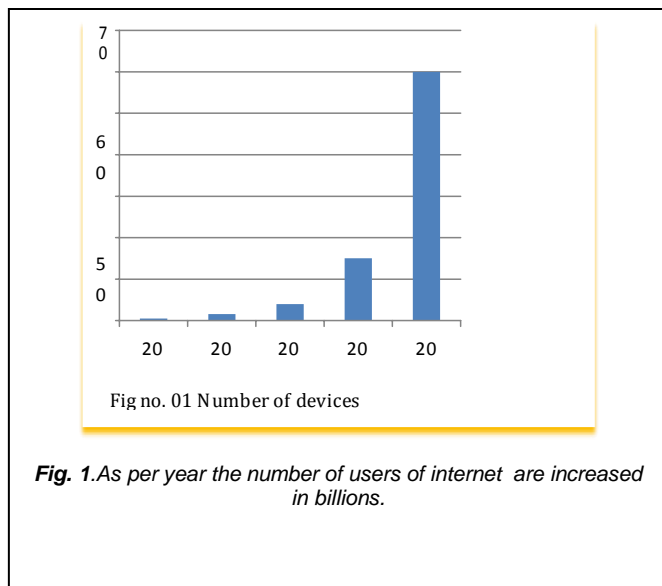
I. Cloud Computing:

To manage easily and improve the utilization of resources cloud computing was introduced. It always provide the effective use of data and computing centre[31,32]. At any time the data services can be used by remote host through the internet. A multi-core processor in a distributed system can easily access the data with high speed. As a result, the super computer achieves high performance through cloud services[10]. The technologies behind cloud computing are high speed accelerators, big dataset and deep learning for AI based powerful algorithms. The architecture of cloud computing plays a pivotal role for providing quick services through three different way : IaaS(infrastructure as service), PaaS(platform as a service) and SaaS(software as service).Many technical challenges are there in Cloud computing[11,12]. It is open for researchers to provide innovative technology to meet the challenges. When many parallel tasks is allocated to multi-core processor , it needs proper process scheduling to achieve high performance with low power resource consumption[14].

While considering high speed, we have to give attention towards security and privacy of data and datacenter [40,41]. It is more vulnerable because of mobility of devices. Hence, it is another challenge towards design of cloud based architecture.

II. IoT(Internet ofTechnology):

According to Didier EiBaz, there is a connection between



8. CONCLUSION

The article basically focuses on recent trends in technology and the challenges to build a future generation computer having higher performance. It also elucidate the issues in fast hardware, advanced system architecture, high speed networking, system software, cloud computing infrastructure and IoT to develop high computing system. It explores the state of the art in the domain of high computing system which can tackle both availability and scalability. I hope this paper can benefit the reader to develop an innovative technique towards future generation computer.

IoT and Super computer. IoT is a technology which connects any smart device with the internet. Within 2015, 6-billion devices were connected to the Internet. But in June 2018, more than 60 billion devices are getting services through IoT. The following statistics (fig no.01) provides growth of more than 10 times within 3 years. That is why it challenges mostly to design high computing supercomputer which acts as interface between the internet and the smart devices. Some of IoT applications are smart house management, smart city management, smart logistics and smart manufacturing etc.

Recent technology like many integrated core (MIC), peer to peer computing, cloud computing, grid computing, GPU computing are trying to meet the challenge of IoT with high computing future generation of computer. Now the keynote shows a strong connection between IoT and high computing system in the smart home management system.

A smart home building consists of smart embedded devices like washing machine, AC, smart TV, Light, Fan, micro-oven etc. To manage all these things, at first it faces scheduling problem. One of the smart house named AD-AM in Europe which consists of 6000 different types sensors named motion sensor, temperature sensor, light sensor, camera etc. To manage these sensors with required energy is a big challenge. Again data management between all the devices is a complex task. Hence a high computing system must be developed to get IoT services.

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