Parallelism – Trends to be Studied and Misconceptions to be Eliminated for Future High Performance System

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ABSTRACT

There are two approaches to address the solution, Hardware approach and software approach. The hardware approach toward multicore processors is influenced largely by technology limitations of wire delays, power efficiency and difficulty in getting Instruction Level parallelism. The evolution in software approach has lead us toward cloud computing. Today is the time where we have to think of multicore processors in emerging evolutionary concept of cloud. In this paper the misconceptions associated with the issue that the software is driven by hardware, Multicore processor everywhere means performance and multicore means the parallelism and hence the optimum speed, are raised. The Trends which are the driving force toward these misconceptions are addressed and a justifiable view of future system is presented.

There are two dominating trends emerging today, the Hardware trend that is increased multicore organization and the second is software trend which is the concept of Cloud computing.

Keywords: Instruction Level parallelism, Cloud computing, Hardware and Software trends.

1. TRENDS:

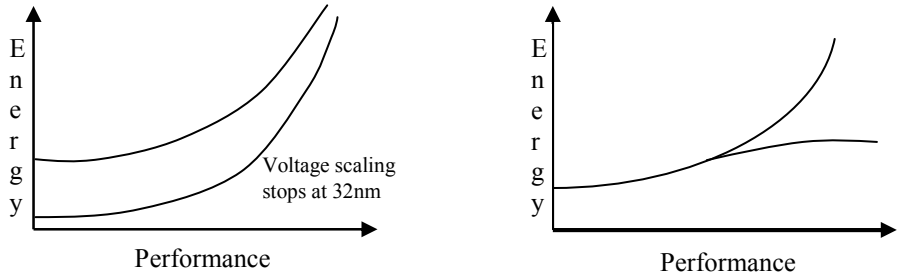
Hardware Trend: The engineers and designer have constantly worked for getting performance with single thread Microprocessors. But now are days the Microprocessor designs are more multicore than single core because of energy efficiency and less wire delay possible due to technological advancement [1].In Multicore architecture multiple simpler processors are deployed instead of single complex and larger one.

Software Trend: Software Trend of Cloud Computing is becoming more popular now a day. The Computer is one of the important platforms which are a device to interact with the cloud and get the services. Where the cloud means the thousand of backend servers which provide services .The impact of cloud computing in its own sense is very crucial to be understood and it has changed the need of parallelism too. The concept tells us that virtually all application with cloud computing are as good as web applications where server side components with client side codes jointly caters the need of user. By study of these trends we can find out the roadmap of future research. But for that, it is necessary to go through the misconception associated with the need of parallelism in the context of the cloud computing.

2. THE MISCONCEPTIONS:

It is the first misconception that the software development is influenced and driven by the development taking in the field of the hardware. Hardware is a costly experience and hence an effective utilization of each and every T-sate is the major focus of the designer. But as a result of the rapid advancement in the technology the price of hardware has dropped and on the contrary surprising enhancement in performance is reported. Now just to worry about effective utilization of T-state is no longer a need. Without thinking of time, speed, cost etc now the programmers are just concentrating on getting things to be done with few lines of codes. The hardware development has no doubt helped in executing this new philosophy. Thus the minimizing codes are the dominant software trend. Clearly speaking the software trends are now not dependent on hardware trends. The demands of software infract drives the hardware and not vice versa.

The second misconception is that the multicore is omnipresent and is the only way to get performance at client side. No it is not true. Here instead of examining Microprocessor trends we have to see the entire information system trends with respect to clouds. As transistor is going to be smaller and faster the overall microprocessor trend is improved over the years. The benchmark SPECINT scores of 700 to 1000 is achieved and consuming only few watts with modern microprocessors on test. The Technology trends suggest that the performance is increased by the time and the graph in figure(1) is showing how the performance is enhanced for 45nm size transistor.



a) Voltage scaling Limitation advantage

b) Cloud computing

Figure (1)

The technology scaling has lowered this graph every year and provided additional performance every year. The no or little benefit is seen from voltage scaling. In short there is no requirement of high performance and optimum energy systems for cloud computing. The microprocessor scaling in terms of cores is projected in the table given below. From this ITRS trends projected, it can be said that the lightweight and portable systems will be dominant in future which may have been associated with large remote clouds and hence multicore will be dominant on the cloud server side but not on the computers used to access the cloud.

ITRS Projections	No. of Cores				
	(45nm) Current	(32nm) Year 2012	(24 nm) Year 2014	(19 nm) Year 2016	(15 nm) Year 2018
Portable and Mobile Devices	1	2	3	5	9
Complex servers	8	16	28	44	72
Simple servers	64	128	225	360	576

The third misconception is about parallel programming. The parallelism in software is not only difficult but troublesome too. As we said multicore processors will be found more on cloud side rather than user side, large amount of parallel hardware is available there and thus the software side parallelism is rarely needed as there are many cores found in the server. The two tasks are said to be concurrent if they are executing simultaneously but on unrelated task. The two tasks are said to be parallel only if they are executing at the same time and on same larger task. Imagine many users accessing or editing browser docs, the backend elements will execute many but unrelated tasks which are concurrent as per our definition which is fully able to utilize the resources so called parallel hardware. Thus concurrency is the solution, not parallelism. We don't need parallel programming. The web applications are generally written as a set of concurrent tasks. Thus finally saying the concurrency or unrelated tasks are capable of utilizing the many cores of cloud servers and there is in fact no need to parallelize all softwares for the cloud to be efficient.

3. FUTURE SCOPE AND DIRECTION:

It has been deduced that the user side computer is not much affected by multicore processors. The Challenge is more on the server side computers of the cloud. There is a need of datacentric concurrent servers which may satisfy the need of running more concurrent tasks efficiently. The main technology constraint of recent time is decreasing energy efficiency of transistors. While the number of devices gets increased doubled every year the power efficiency of device is growing very slowly in comparison. The reason is the voltage scaling which is almost ended and capacitance of transistors is also reducing slowly from one generation to other. Surely the no. of transistors will grow 16th fold from now up to year 2020, due to limitations in efficiency power will increase [2].Study shows that 5% reduction in voltage per generation, approximate three fold increase in power is experienced. But the datacentric concurrent servers are simpler to design as managing concurrency is simple because the tasks are unrelated. Thus what is needed on cloud side server is capability to handle the concurrency [3].

Hardware Solution:

Locality: The main problem is to extract and exploit locality at unprecedented levels beyond conventional caching techniques. Fundamental abstractions are required to directly map data structures to hardware. For example, staged databases [4] attempt to exploit instruction-locality by dedicating different cores to different types of database queries. PLUG processors take the extreme approach of building a programmable on-chip memory that spatially lays out data-structures and provides a high-level abstraction to software [5].The heterogeneity is the requirement here, as the most software used will be written in interpreted high level languages. Energy efficiency can be obtained by the dedicated hardware. Some frequent and specialized operations can be performed by dedicated hardware which may be thousand time faster than the software approach. All these issues are challenging and need further exploration but this is an attempt to direct the research in this direction.

Software solutions:

In the forthcoming period the software challenges are also to be considered for DCC servers. The memory in future Cloud server need not be coherent and hence operating system support is required. As a simple example, the OS will have to explicitly move memory when changing threads or processes across different cores. The server side Operating system should be able to multiplex thousands of independent and unrelated tasks across a few cores with all priority

settings for providing prompt service to some high payer users and so on. The task management is extremely required and should be supported by OS.

The clouds are nothing but large collections of multicore connected via high performance fast network, the issues regarding scheduling and resource management is of prime requirement. Low latency storage will become the upmost requirement as the cloud is the last in storage hierarchy and large amount of data move towards cloud, flash and other faster storage technologies are preferable. There should be better integration between volatile memories and other existing memory devices.

4. CONCLUSION:

Who is arrived first egg or chicken? Hardware or software? Some says softwares are designed according to hardware and others say hardware design is influenced and driven by software. We suggest in this paper that Parallelism at user side in Cloud computing is not much usable instead Parallelism and multicore processing at Cloud side and building Parallel hardware at server side and using it for largely executing Concurrent tasks many of the problems of performance, energy efficiency and cost can be overcome.

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