Distributed Systems and Artificial Intelligence in Programming (Proof of Concept)

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***Abstract* — In order to edify the application of a organization methodology for a computing system in a network, that is logically maintained through the guidance of the Open Systems Interconnection Model, the theoretical formulation and implementation of Amdahl's Law depicted in this paper, is mentioned with its redundancy with computer topologies. The Goal of the present work is to present the contexts which impose the resolution of state of the art problems solved with methodologies defining the programming scope and application.**

***Index Terms* — Computer Language, Amdahl's Law, Semiotics, Syntax, Semantics.**

I. INTRODUCTION

Distributed systems are the main subject of this scientific paper and in a convenient acknowledgement with the computer science research field these systems are the future of computer networks and information technology services.

To give a clear explanation of artificial intelligence implications in distributed computing, an argument which specifies the logical use of computing resources, by means of language leveling is sufficient. Language leveling isn't a new feature of hierarchically administering a computer system, because computers have to translate programs in different languages, either from higher to machine level, or having an intermediate language in the middle, as specified for the proper functioning of a computer.

Computers and overall IT systems have gained a lot of possibilities and features that convey information a certain meaning.

The most reasonable methodology of working with electronic components that form a computer, no matter of the architecture is represented as language [1].

Language provides the only means of communication and several aspects that perform interaction with information and knowledge will be presented in the following section.

For an understanding of computing by means of the research disciplines at hand, the author would like to present a few characteristics, as well as their significance to the context of distributed systems. These are:

- computational space, because it implies the complete system on which resources are presented and interacted with;
- artificial intelligence reasoning, because these represent methods that conceptually and logically facilitate the processing of data;
- performance of computing resources, a necessity implied from the limits existent in every electronic circuit that involves software execution;
- Programming languages, involved from the simple conclusion that it is the only form to describe data and give it's use;

II. THE STATE OF THE ART TECHNOLOGY

A. Computational Space

When taking a system into consideration, the main issue that comes to mind is its space. Space meaning geographic area and computer access through an electronic network.

Examples of geographically dispersed computer networks are The OSI Model, TCP/IP Model, The World Wide Web and The Internet.

To convey such systems to the focus of this paper, the following software rules are applied:

- data must be understandable by the communicating network nodes;
- the software is existent, executable on the system, and can have certain features upgraded not implying modifications to the overall machine code;
- the conceptualized platform has a few well defined limits;

To present the evolution of distributed systems, two models, namely the OSI Model and The TCP/IP model, are presented with factors that allow efficient and viable system management. More important on helping network definition is the computer topology which models the way through the computation medium (figure 1).

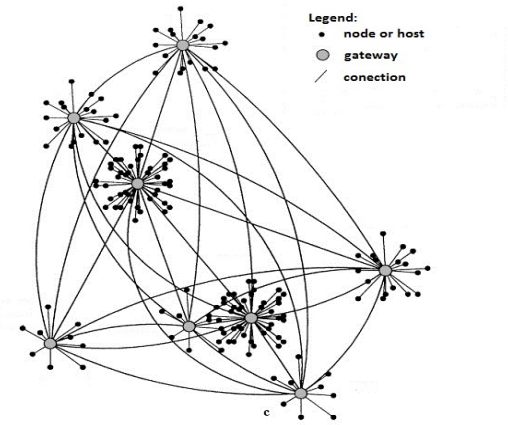

Figure 1 (used from [8])

The OSI Model is a computer system that only exists as an organization chart for a simple computer, but also for a computer network (figure 2).

It's protocol implementation isn't considered a technological evolution for systems that are accessed dynamically, but the specified layers and the logical peer resolution is existent and could be more efficiently tuned, in comparison to TCP/IP, which has received a lot of completion and adjustment for its defined goal accomplishment.

As a research topic, the open systems interconnection model is a continuous research aspect, defining how new standards are applied and how custom and very reliable networks are implemented [2].

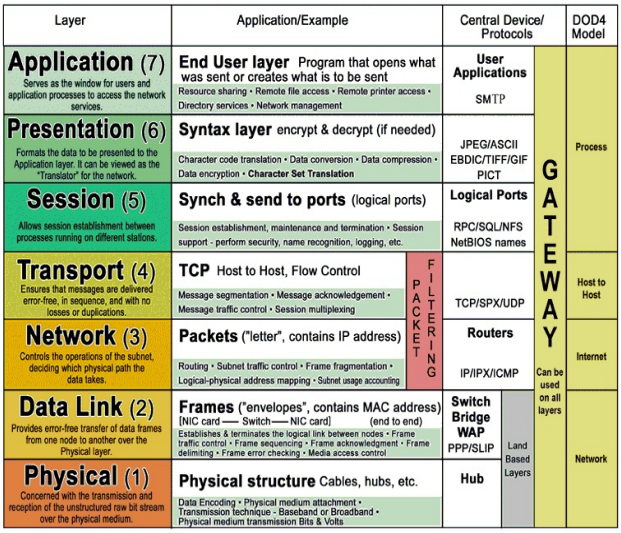

Figure 2 (used from http://www.escotal.com/osilayer.html)

The TCP/IP Model is a computer system, tuned for its required needs. It has a well specified number of host's that it can support and being a constrained number environment, through IP classes, sub-networks, and geographically defined types of networks, it's topology can have various forms.

The computer network development period resides in the constrained environment, composed out of binary representation of IP addresses that form routing and switching capabilities.

One issue that was a problem was the computer 32 bit representation of IP addresses, which in turn weren't sufficient to satisfy all the user requests to connect to the global computer network. This was the definition of TCP/IPv4, a version of the software that composed the TCP/IP computer programs.

The solution to the necessity of allowing more users to access the global computer network was to modify the network addresses identifier representation, known as IP's, from 32 bit representation to 128 bit representation. Technically, on the lowest levels that would require translating higher language level representation to electronic, digital and analogical signal, this was a data integrity problem. The newest version, TCP/IPv6 can represent hexadecimal characters, which require a longer time to be processed and to avoid new unnecessary tuning, TCP/IPv6 is only available for certain network services and networks have been partitioned into public or private networks.

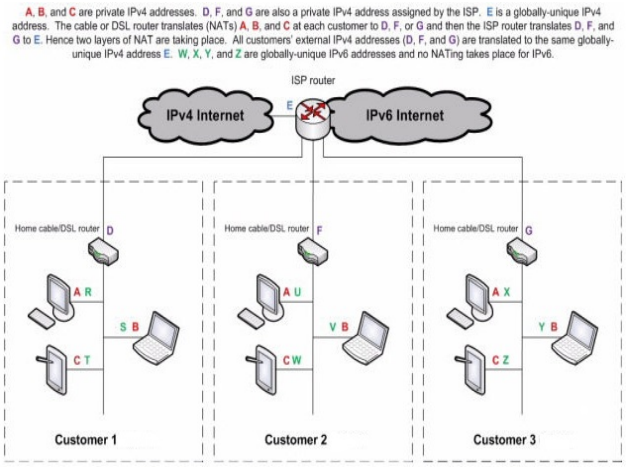

Figure 3 (used from http://features.techworld.com/applications/3314234/will-the-sky-fall-if-you-dont-deploy-ipv6/)

B. Artificial Intelligence Reasoning

Artificial Intelligence Reasoning is the process of administering data that is believed to have a truth value.

Presenting processor language as the representational form of computing, the architecture of a processor specifies the language agreed upon by the software platform.

A typical computer processor performs arithmetic operations and with the use of logic gates, specifies instructions that allow faster execution of data.

As a state of the art technology topic, the instructions that are stored in the processor are essential to any program definition.

Computer programs are developed to implement desired capabilities, but for data management, algorithms that imply searching through nodes of a database and data structure, have been developed to ensure easier structuring of information (figure 4).

Data volumes have grown and to be accessed on demand, computers software systems imply algorithms which search on dimensions and levels.

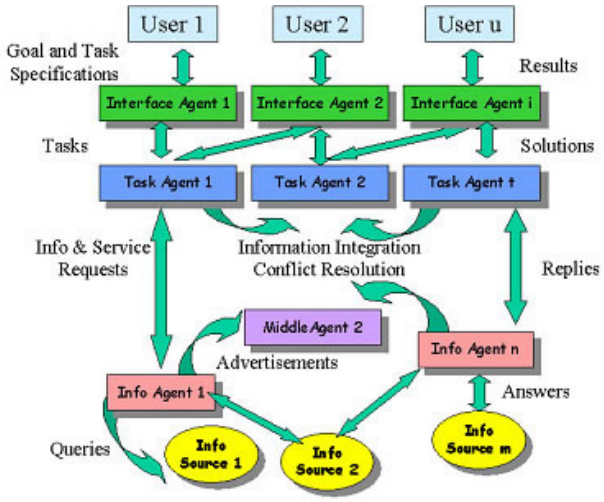

Figure 4 (used from http://finntrack.co.uk/learners/decisions_support.htm)

C. Performance of Computing Resources

Computers have allowed clear information management capabilities existence. Having facets that present efficient program design, a computer program being a simple flow chart that is executed by the electronic machine, to compose real software platforms for distributed systems (Figure5), metrics that allow a definition of a systems reliability are developed (Figure6).

Performance metrics address several issues for a specific context. The contexts notable for allowing performance metrics usage are:

- computer clusters, in which data is categorized and classified and analyzed in dimensions that contain the information volume;
- load balancing, in which processor workload is measured and distributed as evenly as possible between members of a computing facility, for example a server farm;
- grid computing, in which resource consumption is handled by means of access to the resources for a time interval;

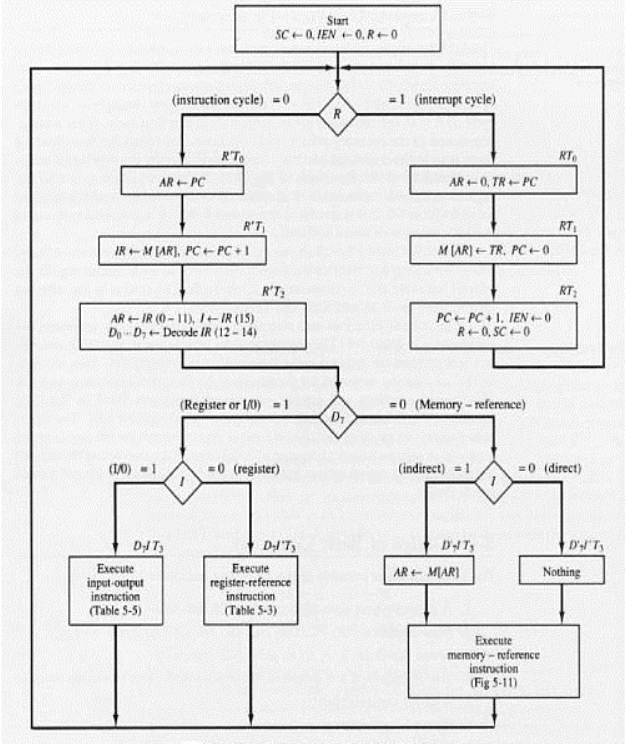

Figure 5 (used from http://www.ee.oulu.fi/research/tklab/courses/521415A/exercises/nexercise6.html)

Computer network topologies are redundant with performance metrics, because a network is designed to comply with needs and in order to be implemented correctly, scalability and data communication speeds are taken into consideration.

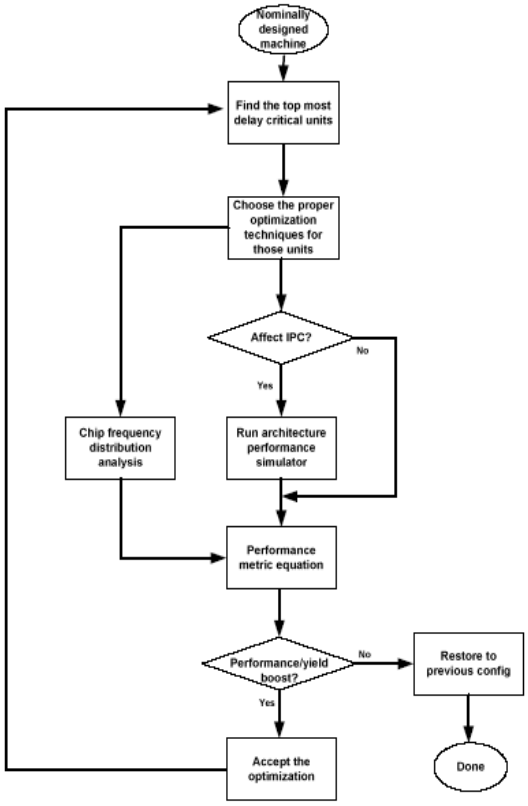

Figure 6 (used from http://www.eecs.harvard.edu/~xliang/research.html)

D. Programming Languages

Programming is the main research topic in computer science. Being a methodology that serves to specify what a computer does, any other category of computer science is dependent of the programming discipline of conveying information a meaning in the electronic computer.

Computers specify mathematically how a program is performed and in order for programs to be developed in accordance with the machine capabilities, language is the main method for introducing sequenced instructions in the numbered system.

The main languages that should be considered for the practice of programming are:

- binary language, which is the language that constrains the digital signal representation, by means of the 1 and 0 numbers, 1 standing as truth for the existence of an electrical impulse and 0 for a interrupt. In the binary language 0, mathematically known as nothing, is a very significant value, because without its implementation in the number system, patterns could not be specified to allow data representation;
- mathematical language, the computer purpose language, as it generally implies handling numbered systems which are formalized for efficient usage;
- intermediate language, that is a language which serves as a middle layer between the machine code instruction set and the language in which the programmer describes and implements the work needed to be accomplished;
- high level language which is a understandable lan-

guage from many perspectives, developed for faster program development and allows more means of abstracting data which in turn is put to use;

III. SIGNIFICANCE FOR DEFINING A COMPUTER SYSTEM

Significance is what computers are all about. In a computer system, all the above mentioned topics that compose a distributed system are handled through significance [7].

Three main research categories that treat the logical place of information in a computer are:

- semiotics;
- syntax;
- semantics;

Semiotics are a subject that allowed to fit in a smaller electrical device, the mechanisms imposed by mechanical computers which had limits (performance capabilities) constrained because of the few physical components existent to create an instruction performing machine.

The syntax is a research filed which covers a wide range of technology and it is defined by the pragmatic use of technology. The syntax can be either written, either verbal or visual, being a interaction method with technology.

The semantics, a methodology to convey meaning to patterns implying specific characteristics of hardware and software language.

A. Semiotic Machine

The semiotic machine is a knowledge management process also known as embedding a certain meaning to a part of the process.

As the computer needs to manage different processes and allow efficient resource usage, without good significance for the processes that create the computer, processing would be hard.

Information is administered with help of coding techniques and standards that have defined data sources stand as basis for unanimous communication agreement for software systems (figure 7).

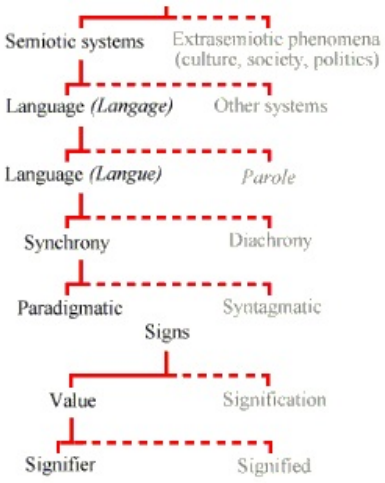

Figure 7 (used from http://www.aber.ac.uk/media/Documents/S4B/sem05.html)

B. The Syntax Use

The syntax is the aspect through which programmers and computer users interact with the computer.

Mostly represented as written text with only a few possibilities for the steps that are presented with the graphical environment, it is essential for domain application.

The syntax commands the important IT systems. It is essential for computer systems administration and is necessary for computer users.

A comprehensive understanding of the syntax is described by programming languages, where each language has it's syntactic structures that present the well-formed language purpose (figure 8).

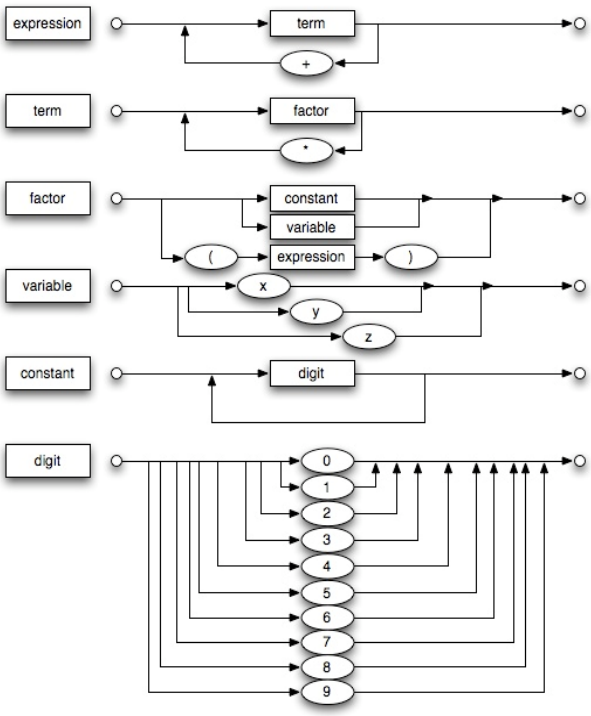

Figure 8

Its inspiration and creation is given by facts that every natural language has its rules in using words and phrases and in computer science, it was done as a necessity to translate text from one natural language into another.

C. Meaning through Semantics

Semantics are methods for dealing with information. The role that words have in specific contexts is an example of semantics and it reaches a vast domain application in computer science (figure 9).

Unlike the syntax of computing, the semantics is more on the level for scientific research, where programmers develop a system.

Each and every programming language is a system [1]. Whether or not seen as a system, it's structure and purpose is the language that translates all the typed in ideas of a programmer into the machine, giving a output representation.

A lot of paradigms exist in the programming discipline, ascertaining the language purpose, but with a good analysis

on the language, through semantics, which can only be done by true programmers that don't limit themselves to a few common programming rules and styles, a language is structured in a systematic way. Compiled once and performable on any computer was one semantic goal that was accomplished with the standardization of instruction sets (structuring).

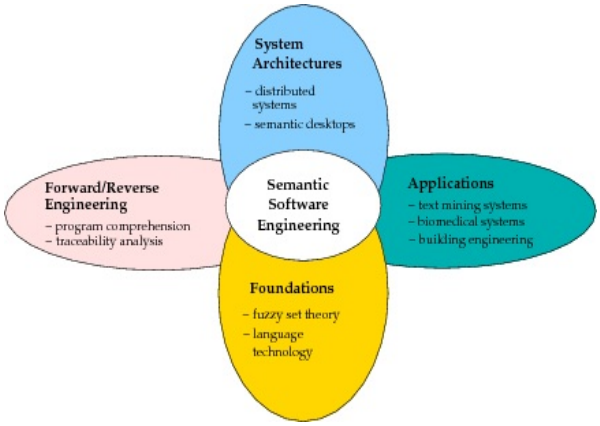

Figure 9 (used from http://www.semanticsoftware.info/research)

Interpreted languages also exist, but given their increased usage in common architecture systems, the same goal applied to them as well. For example Java, has to be translated with a virtual software machine that holds the language code, but as the electronic equipment still must have mutual agreement on communication rules, the scope of the language is contained as a subsystem dependent of hardware features.

IV. COMPUTING SYSTEMS

A computer is a mathematical formalism for dealing with numbers.

The computer can only represent data through value of numbers.

Numbering systems have been developed to deal with quantities and capacities, measuring capabilities of components that cover a system.

The most known computer number system is the decimal representation which is translated to binary sequences.

Forms of comparing the use of numbers we're developed to speed up the processor of a computer and also allowed the development of new technologies.

Amdahl's Law is a law that measures processor performance. To optimize execution of instructions, the concept of parallel execution was developed and it contained the principle of applying constraints on the mathematical numbers to divide a computer program into parts and resolve its issues faster.

A. Operating Systems

An operating system, from the perspective of this work is a conceptual processing of language.

As its development inspiration necessitates easier usage to the user of a computer, everything in it represents language. Files have readable names, are ordered graphically with directories and contain text and visual elements that inform the person of everything he does with the input devices.

The concept of creating an operating system is presented with the run-time of computer software, that necessitates to keep certain instructions loaded into the memory, while the applications that require a finer attention are accessed on demand.

As a concise definition, the operating system is the main high language program that gathers all the necessary programs in the main memory and executes operations as required by program specification and application feature.

B. Digital Electronics

From a digital electronic levels point of view, a computer systems comprises technology evolution [6]. Because more over a computer has to encipher streams of data, the properties that hold for the computer development are:

- the same language must be used and agreed upon for usage by the entities (network devices and computers) that want to communicate with each other;
- the communication rules must hold for the same language and these are speed at which data is transmitted through the network, packet sizes are chosen for data fragmentation and data link frames must also be chosen to comply to the insurance so that upper layer functionality is guaranteed.

At a technical level, computers have their existence from the mechanical computers created by Blaise Pascal and Charles Babbage, which performed mathematical operations with a high speed. These operations became flexible with the possibility to create smaller physical components which had their constraints optimized.

What is desired from the context of distributed computing systems is realized with energy administration techniques, because thermic and chemical factors are the factors that act more or less wanted on computing technology.

The electrical signal is processed with electronic components that give the system viability, having characteristics directly established through standards and measurement units.

C. Correlating Performance of Computing Systems with Amdahl's Law

Amdahl's law is a concise theoretical formulation that has in its focus execution speed-up of processors.

In its ideology, the concept of parallel execution that tries to obtain a maximum from physical computing resources, is limited to segmenting a program into parts that can be computed with the ALU of a processor independently and the result being presented after the all the computing results are assembled at the end of a task completion.

In a computing system that has a multitude of processors [4], with instruction sets specific to their applicative roles, performance can be managed in an optimal manner. To be known is the fact that not just having a higher speed to solve represented algorithms is a goal, because degrading the performance of critical components in a given time, in the computer world is considered a control and analysis methodology which helps specify security and data integrity.

Why must there exist a higher processing capability of a computer than the process of sending data is a problem generalized by different factors which help relinquish the cause of errors[5].

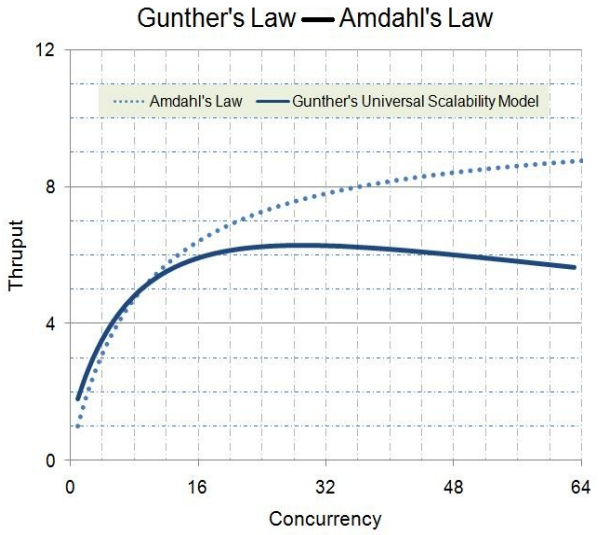

Figure 10 (used from http://www.cmg.org/measureit/issues/mit44/m_44_18.html)

From such factors that acted as limits and constraints over the developed technology, innovations have been created, making possible the logical and rational deduction of key concepts for information processing. Thermodynamics and electrical energetics have rationalized the mode in which physical components are organized and compose processors and integrated circuits.

V. CONCLUSIONS

Computer networks are directly linked with Amdahl's Law and its imposed problems of making performance increases in technical computing.

To transmit data in sequences of time more and more acceptable, the processing of electronic signal is done in a way that must be in concordance with the standardized level, otherwise it cannot operate optimally.

Communication standards in electronic mediums have all been specified given an information processing capacity and to clarify the problems imposed by processors, I mention that data division and transmission in specific intervals must be performable by the system that processes data in a short time.

I must sustain that the computing medium being a space which is dealt with topology modeling and representation, need programming methods that define the correctness of information defined through artificial intelligence techniques of logic representation and distributed systems pragmatic understanding of the goal implementation, which are all presented in the presented content of this paper.

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