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Method for Computational Intelligence Based on Behavior of Grasshoppers

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***Abstract*— This work refers to a proposal of an intelligent model dedicated to solving problems of distributed systems, using as a basis the behavior of locusts, for building applications together and defense systems.**

Keywords—cloud computing; social insects; distributed systems.

I. INTRODUCTION

Year after year the society is growing, time and space is decreasing. The use of manual means to make products or make deliveries as a quick way for the current market is not as efficient as before. In this context comes the computer networks and its benefits to society today. Several current applications running on interconnected computer networks, so it is necessary to work together to improve current programs and applications.

With the advancement in technology, constant attacks and defenses are made in computers and servers. This is due to the constant use of computer networks where information is being shared in real time, thus facilitating access to business data and people.

The distributed system is a "collection of independent computers that appears to the user as a single, consistent system" [1]. Through this study we can work with prevention and defense of attacks on networks, a topic that addresses this type of study this work is the System of Prevention and Intrusion Detection - IDPS.

It is necessary to work together in networks, the method of grasshopper address a model that aims to unite several machines into one in favor of the defense or attack it. Then comes some guiding questions to be discussed before the project. They are:

• Which computational model can be used to solve distributed problems?

• What can be improved in computer applications through mathematical functions that simulate the behavior of locusts?

• What is the mathematical model that simulates the behavior of locusts in computational systems?

The methods of systems distributed together with study of the behaviour of the grasshoppers, it is the form of resolving this type of computational problem, soon the grasshoppers work with a similar technique to that of the algorithm of colonies of ants, whose group across feromônio, they plan you form for an attack of a plantation or search of food.

In section II of this article will address concepts of communication networks and their evolution in today's society. Section III is a new model of computational network that is growing year after year, cloud computing. Section IV highlights the importance of social insects in computing, as examples, colonies of ants and bees are common in problem solving heuristics goal in computing. Will also be addressed as locusts behave to help in problems of computational grid, thereby arriving at a conclusion in section V of this article.

II. COMMUNICATION NETWORK

In today's society, we find that more and more frequent use of computer networks connecting people and machines. These transformations are occurring in our society due to marriage of telecommunications and informatics, which greatly contributed, to this occurring.

Because of this junction, machines work harder and better, thus helping organizations to perform their tasks with greater competency, therefore, not only organizations are undergoing changes, but the society itself is experiencing this new time, which many authors and scholars consider the Information Age.

According to Tanenbaum (2003), rapid technological process in the fields of technology are converging rapidly and

increasingly are minor differences between collecting, transporting, storing and processing information. Tanenbaum (2003) mentions that with a simple push of a button you can review the current status of remote branches of hundreds of corporate offices scattered across a wide geographic area. It also says that as they grow, it becomes even greater demand for processing forms even more sophisticated information [2].

In this new information era, where computers and applications are increasingly joining and becoming part of day-to-day society, people started to get closer to each other with new technologies involving networks computing.

Safety is a primary factor when working in networks, because through it we can protect our important data and prevent us from fraud or theft. According to [2], security is a broad subject and includes many types of problems. She is concerned to ensure that people with bad intentions do not read or secretly modify messages sent to other recipients. She also tries to find out if a real message is fake or not.

Security comes to situations where legitimate messages are captured and reproduced, and deal with people who try to deny the fact that they sent certain messages. Thus, as precepts [2], confidentiality, authentication, non-repudiation and integrity control divisions are areas of interconnected problems of network security. What usually comes to mind when we think in network security is the fact that they keep the information away from unauthorized users, and so be related to confidentiality. Generally takes care of authentication to determine who the person is communicating before revealing sensitive information or entering into a business transaction process.

III. CLOUD COMPUTING

Cloud computing is a computing model that allows users to access platform-independent, a large amount of services and applications anywhere, simply by being connected to a terminal to the cloud[3].

Through internet you can store your data on cloud servers without the need to use the Hard Disk (HD) to save them. The clouds have the function to replace the hardware that store data, thus making it more flexible workspace user.

According to [3], the word cloud suggests an idea unfamiliar environment, where we can only see its beginning and end. For this reason, their nomenclature was well used this new model, in which all the infrastructure and computational resources are, in a way, hidden the user access to only a standard interface are provided through which the various applications and services.

There is no need to know programming to use the cloud as companies that offer the service have a very dynamic interface which utilizes the user without the need to program something, i.e., as is the normal operation of a computer.

The representation of the cloud is given by the internet via the communication infrastructure, which consists of a set of hardware, software, interface, telecommunication networks, control and storage devices that enable the delivery of data as a service.

These sets of software and hardware that make up the company are responsible for storing user data securely without the need for users to store on your hard disks.

According to [3], says that data centers are large centers and stores that data collected applications, for through it you can make this model possible. Once assembled, user applications and their infrastructure are distributed in the form of services available through the internet.

We also as important to understanding this model of computation participants cloud point. These can be divided into three major groups: the service provider, developer and user. The provider ensures the appropriate level of service and security of data and applications, as it is responsible for providing, managing and monitoring the entire cloud infrastructure. Through the infrastructure provided by the service provider, the developer must be able to provide services to the end user. The end user is the consumer who will use the resources offered by cloud computing, in short, cloud computing is a new service model that provides all types of processing, infrastructure, and storage over the internet..

Many fields of technology are showing up more and more efficient in the use of cloud computing and thus promote greater opportunities for jobs in clouds. According to [4], provides cloud computing services transparently to the user through the convergence of a range of important technologies, among other features and peculiarities. He cites some fields of technology that are of great importance in this convergence, they are: hardware, with virtualization capabilities; internet technologies such as web 2.0, web services, management systems, such as independent computing (autonomic computing) and management automation and maintenance of Data Center; addition of distributed computing, in particular the utility & grid computing.

The greater the number of users using a cloud, the slower it can become. The efficiency expected by users is not always achieved due to various factors, such as examples, slow internet and a large number of users in a single cloud.

Cloud computing can provide the illusion of infinite computing resources available for use. In this case users have the expectation that the cloud is able to quickly provide resources in any quantity and at any time. According to [4], it is expected that additional resources can be provided, if possible automatically, when the increase in demand occurs and retained in the case of decrease in this demand.

To acquire the computing cloud services consumers expect computational resources according to your need and instantly. For this, the clouds must allow self-service access, self-service so that users can request, pay, customize and use the desired services without human intervention, all in an automated process.

Appropriate pricing, accounting, billing, monitoring and optimizing use is what the clouds shall ensure as efficient trading services in the implementation of its resources, since the user must have the option of ordering and use only the amount of resources and services he deems necessary, the services shall be quoted based on a use of low duration, for example, measured in hours of use. This measurement of

resource use should be done automatically and according to the different types of services (storage, processing and bandwidth) and reported immediately, thus enabling greater business transparency, ie "resources should be available over the network and accessed through standard mechanisms that allow their use by heterogeneous platforms such as smartphones, laptops, PDAs, and other "[5]

Ensuring the user of a good quality and quantity of services applications in the modern sense of the structure of clouds has proven robust and reliable. But it is important that a maturing occurs some points because there are some challenges that cloud computing faces, such as data security, standardization and business models that can ensure a fair and safe trading everyone involved.

IV. ANALOGY OF INSECTS IN COMPUTING

Much of the architecture of computers has focused on mathematical and strategic calculations. There is no kind of intelligence in processing these machines provided by this type of architecture, which means that they always execute commands without asking or store any type of knowledge.

In this architecture quoted from the analysis of incorporation and storage of knowledge, it is possible to interpret data and instructions in a smart way. From this, we can see a resemblance to the behavior of the human brain.

The use of knowledge of neural networks to pattern recognition tool is generally, for example speech, images, characters, and others. To gain insight and find the desired standards, this network should be trained initially. It is a great challenge to make this neural network to recognize these patterns.

Patterns of traffic between networks that are interconnected and are responsible for sending information from one point to another can be a result of this study. With learning processes based on intelligence from social insect colonies, one can optimize and discover how to recognize a pattern.

On the other hand, an insect, and may even have a few brain cells, your organization before the colony is able to accomplish great architectures create communication systems and withstand the threats of nature.

For the recognition of a pattern, can make it necessary adaptive routing algorithm based on the integration of learning strategies combined with some mechanisms to increase their speed of adaptation, such as behavior-based learning of these colonies.

The efficiency of some applications for the diversity of insects used in computer science for the improvement and creation of algorithms, has been showing up more and more effective. One can thus see the similarity computing machine to the real world, through this study of the behavior of the real life of insects and application in distributed systems.

A. Ant Colony

The meta-heuristic Ant Colony Optimization by (ACO), introduced in the early 90s by Dr. Dorigo is a generic framework for optimization algorithms based on ant colonies. Combinatorial problems such as traveling salesman, vehicle routing, among others, have obtained promising results of adjustments to the ACO meta-heuristic.

According to [6], the traveling salesman problem consists in determining a route that starts in a city i, passes through each city j the set only once, and returns to the starting city route totaling a minimum total distance. This route is called a Hamiltonian cycle of minimum cost. The high number of existing solutions is more difficult to solve this type of problem. It is possible to obtain approximate solutions to the use of heuristics and meta-heuristics, and in many cases, it is not feasible to guarantee a global optimal solution. The Ant Colony Optimization for, then, is a meta-heuristic for solving this problem.

The study of ACO was through observation of the behavior of ant colonies in search of food. Dorigo observed that ants always seeking the shortest path between the colony and the food, and, in his remarks, noted that they used a chemical called pheromone to trace the shortest path. With this, developed a meta-heuristic calculation that shows how each ant acts on the route and how the pheromone is updated along the way. This calculation has been applied to distributed to find the best routes in the ways data systems.

B. Artificial Bee Colony - ABC

Another algorithm is known to compute the Artificial Bee Colony Algorithm (ABC). It was initially proposed by Karaboga in 2005, inspired by the behavior of the collective intelligence of a swarm of bees during their search for provisions. In the ABC algorithm, the colony consists of three groups of bees: employed bees curious and Girl Scouts. It is assumed that there is only an artificial bee used for each food source.

In other words, the number of employed bees in the colony is equal to the number of food sources around the hive. Employed bees go to their food source, they return to the hive and dance on this area. The employed bee whose food source has been abandoned, becomes a hunter and starts looking for a new food source. Spectators watch the dances of employed bees and choose the place with food, according to the dances.

In ABC, the position of a spot with food represents a possible solution to the optimization problem and the amount of nectar from a power source matches the quality of the solution which is related. The number of employed bees is equal to the number of solutions in the population. In the first step, an initial random population (food source positions) distributed is generated. After booting, this population is subjected to repeated cycles of processes of job search, viewer, and scout bees, respectively.

A bee employed make a change in the position of the local food in his memory and discovers a new food source position. Since the amount of new nectar is greater than the previous source, the bee memorizes the new position of the source and forgets the former. Instead, it leaves the position in his memory.

After all employed bees have finished completing the research process, they pass on the position information of the sources with spectators in the dance area. Each observer evaluates the nectar information taken from all employed bees and chooses a food source depending on the quantities of nectar sources.

As in the case of the employed bee, she produces a change in its original position in memory and Verifies the quantity of nectar. Taking Into Consideration que its nectar is larger than the previous one, the bee memorizes the new position and forgets the old. The sources are determined abandoned and new sources are produced at random to be replaced with artificial abandoned by scouts.

According to [7] attributed the good performance of ABC mainly to the fact that it presents a good balance between the processes of global and local exploration of the search space, and also by employing together different selection operators. This prevents premature convergence of the algorithm.

We can conclude that we can apply in many problems such learning processes which are based on social insect colonies. For this there is a need to discover not only the problems but make them able to solve and reduce such problems in a way that it is possible to observe the learning and optimization obtained as a result of the search.

C. *Behavior of Grasshoppers*

During training in clouds, locusts or other insects may undergo profound transformations. The process of beginning to the formation of clouds of locusts is the appearance of favorable environmental conditions that lead to the proliferation of insects[8].

A grasshopper can only be a helpless insect extermination easy, but the locust have a defense strategy that makes them almost unbeatable when they are together, this strategy would be the formation of clouds of locusts.

Researchers have been examining how does the formation of clouds of locusts, and realized that some factors are relevant to the formation of these clouds as the weather conditions and the abundance of food in the region[8].

According to the mathematical model proposed by Reynolds (2006), in his doctoral thesis, the subject is exactly in this period, in which individuals are in large numbers, but still not gathered in a massive cloud. "In this remarkable form of phenotypic plasticity, changes in the density of the local population, generate distinct solitary and gregarious phases that differ in behavior, physiology, and appearance." [9], i.e., grasshoppers can undergo transformations on cloud formation. An example would be-the-desert locust (Schistocerca gregaria), which, prior to the formation in clouds is lonely, harmless and has a green color, after joining undergoes physiological changes thus giving a yellowish tinge to the insects, and the Since then, they gather in huge flocks, acquire rapid and random movement, a much more powerful immune system (the body's defense) and have a habit to eat toxic plants.

British and Australian researchers found that the increase of the neurotransmitter serotonin in desert locusts is to blame for these insects to form clouds of attacks that cause great damage to agriculture. And through a study is possible to control this pest in crops, as well as study them for other purposes[8].

V. CONCLUSION

As seen, the communication networks is a great reality in today's world, the advance of technology makes the information spread more quickly and efficiently through it. But factors cause some security problems will result in the transmission efficiency of data in these networks.

Distributed systems allied to defensive techniques such as intrusion detection and prevention of attacks systems are ways of working with the security of networks of today..

The proposed model based behavior Grasshopper is a possible solution to problems in distributed systems, which can provide applications work together in the cloud computing and defense tools, through the organization of this behavior machines can be grouped according to the needs to work simultaneously on the verification of an intruder or an attack occurs, thus making it more efficient defense.

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