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Corporate Networks: a Proposal for Virtualization with Cloud Computing

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Abstract: - Most Educational Universities encounter difficulties in developing a work of integration when need to do planning: allocation of classes, distribution of rooms, allocation of classes and establish better communication between the coordinators of other units belonging to the same institution (geographically distributed). According to Veras (2010) as a way to react to the increased competition, many companies have sought to use a more flexible organizational format. Currently, the use of business networking alliances has become an option in the search of this flexibiildade. The networks that interconnect, organizations offer support for processes, in response to the new times of this competitiveness. It may be noted that the inter-organizational networks supported by information technology (it), allow organizations to act together as a great value system. According to Fusco and Sacomano (2009), alliances may develop in any supply chain, provided the environment in which they occur, operations tasks, and processes to be developed, the qualities required, and available and the objectives to be developed. The performance of each part is what will make the difference in getting the results of the companies involved in the business. In order to better meet the studies related to behavioral analysis of alliances in enterprise networks with the use of technologies of *cloud computing* (cloud computing), this project applies the structure of how virtualization assessment tool for analysis of relationships between companies and the strategic alignment in organizations. In this context, this project intends to propose an architecture of integration of technology *cloud computing* with SOA (*Service Oriented Architecture* – service-oriented architecture) using *web services* (WEB Services) to assist in the execution of strategic business processes within the organizations aimed at universities that have multiple geographically distributed units.

Keywords: - *performance, virtualization, web services, cloud computing, service-oriented architecture.*

I. INTRODUTION

Reality increasingly dynamic and volatile and that configures the competitive assumptions and paradigms of competitiveness, have brought the need to speed up processes, business and organizations, therefore internationalize should be the presence of thought competitive and the strategic alignment of that reality (FUSCO and SACOMANO, 2009). Conform Tonini, Carvalho and Spinola (2009), for competitive advantage, companies must continually update themselves on technology, get maturity in processes and eliminating operational inefficiencies. This requires an engagement ads people, processes and the Organization as a whole.

Currently the companies are organizing network format, and business processes among the organizations increasingly use the applications that process and provide information for the operation of this new arrangement. The new organization, is a combination of various organizations, composed of interconnected cells with several access points provided by infra-structure information technology (IT), while the central element of processing and storage of information and data in the cloud is the *DATACENTER* (VERAS, 2009).

Aiming to establish a model of integration of alliances in corporate networks and the application of technologies *cloud computing*, SOA and *web services* to assist in strategic business processes of organizations into networks of relationships, the proposed project features the use of these technologies. Checks the possibility of alliances and resource to sharing, to enter into multilateral agreements, the organizational relationships, interpersonal and inter-organizational.

The SOA is an architectural model agnostic to any technology platform and causes a company to have the freedom to get constantly the strategic objectives associated with service-oriented computing, taking advantage of the technology. The *web services* platform is defined by several industry standards supported by all communities, suppliers can be distributed and provide a *framework* for communication based on physically decoupled service contracts. To enable the business processes of a company the implementation of the strategy depends on your infra-structure information technology (IT). The infrastructure is the part of YOU that supports applications that support business processes is the Foundation of the Organization's operational model based on information. Can also be seen as the set of shared services, available for your entire organization, because it has the role of enabling the Organization to function and grow without large interruptions. A *cloud computing* is a set of virtual resources easily usable and accessible (*hardware*, *software*, and services development platform), which can be dynamically reconfigured to fit a workload (*Workload*) variable, allowing for optimization of the use of resources such as virtualization, application architectures, service-oriented infrastructure and technologies based on the Internet (VERAS, 2009).

To developer an architectural model will use the implementation on *web services*, the SOA, and the *cloud computing* for the strategic simulation on intra-organizational networks in the departments of an educational institution of higher education to planning and formation of new courses and adapting existing courses. The proposal established in this project is related to an IES (Higher Education Institution), aiming at the studies in corporate networks, production engineering and analysis of application of new technologies used for strategic planning within companies.

II. THEORETICAL FRAMEWORK

This section describes the main aspects and justifications for the construction of the system proposed in this paper and related to: cloud computing, service-oriented architecture, *web services* and University Educational Center as companies in networks.

2.1. Application of alliances in enterprise networks

The role of the Alliance will make the difference in getting the results of the companies involved in the business. Thus it is important to create solid alliances, but well developed, sufficiently flexible to include changes, as the market environment and corporate objectives change and the relationship evolve. The rings can be threatened only if the expected benefits of the relationship growing ever smaller, or if the behavior of any of the parties is considered opportunistic, (FUSCO and SACOMANO, 2009).

In this context, the relationship and the types of relationships should establish the density, the centralization and fragmentation of the network, establishing measures of position of the actors in the network. Figure 1 shows a model of communication with firms in networks, where using contracts for systems of cooperation and alliance relationships between organizations.

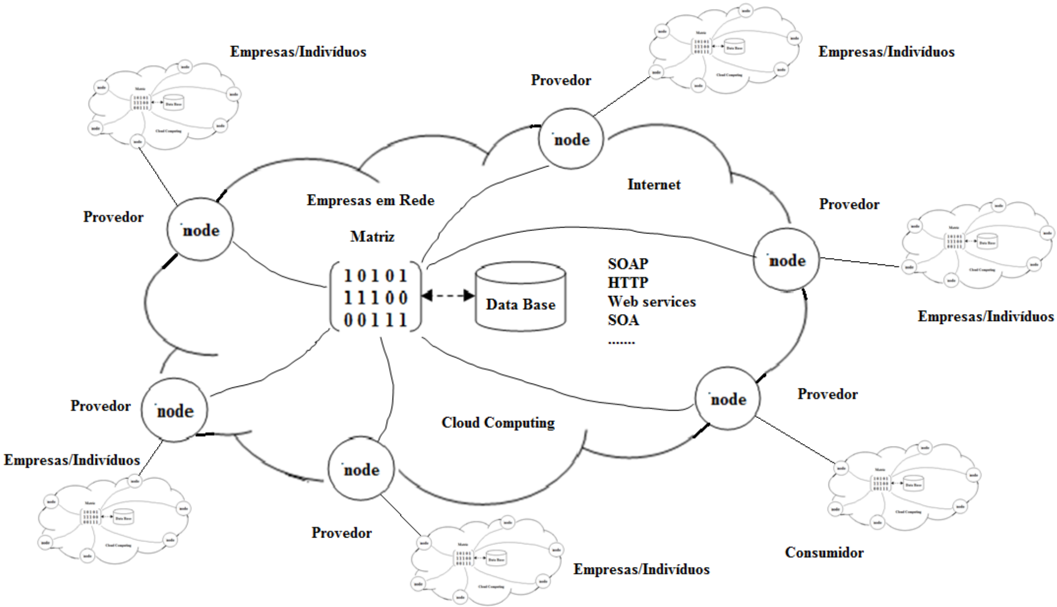

Figure 1-business networks, Contracts, Departments, Teams and Individuals, author.

The model presented in Figure 1 (proposal of this work) represents a set of *nodes* (nodes) or cloud computing providers that interconnect dynamically through a structure of type array. This structure is the mechanism responsible for locating services between providers and its main components are the array (static structure), in the tree structure (structure dynamic), graphs (search techniques and locations) and database (or knowledge base) where are located the services described using the architecture SOA (*Service Oriented Architecture*), *web services*technologies, protocols, HTTP (*Hypertext Transfer Protocol*), SOAP (*Simple Object Access Protocol*) and features of the *internet* itself. Subnets are comprised of companies or individuals that can be of type consumer or supplier of services and are responsible for the exchange of communication within the network (network Companies).

2.2 Practice of service design principles

A design paradigm, in the context of business automation is considered the approach that governs the design of logic, which consists of set of rules (or principles) complementary that define collectively the broad approach represented by paradigm. The fundamental unit of service-oriented logic is the *service* and by itself represents a distinct design paradigm. Each service gets its own distinct functional context and has a set of capabilities related to this context via public service contract (ERL, 2009).

In this context, the practice and the fundamentals of service contracts allow for greater interoperability, alignment of business and technology domain, greater organizational agility, greater diversification of suppliers, lower workload, low service coupling, service abstraction, and reuse of service and reduced amount of application-specific logic.

2.3. Application of integration of cloud computing and networking companies

Cloud computing is a set of virtual resources easily usable and accessible *hardware* (physical), *software* (logical), and services development platform. Its resources can be dynamically reconfigured to fit a workload (*Workload*) variable, allowing the optimization of the use of resources and replace it assets. These features and services are developed using new virtualization technologies, which are: application architectures and service-oriented infrastructure and technologies based on the internet as a means to reduce the resource usage costs of hardware and software you used for processing, storage and networking, (ERL, 2009). For the purposes of integration with corporate networks are analyzed the fundamentals the inter-organizational network, intra-organizational and inter-personal.

Inter-and intra-organization networks are special cases of interpersonal networks. In business, relationships are conducted between individuals (interpersonal network), because they are the ones who start an Alliance or contact between these companies. The inter-organizational network is networks based on the relationship between companies or organizations in General. Already the inter-organizational network is networks of individuals in organizations, (LAZZARINI, 2008). In this context, the use of infrastructure virtualization allows establishing flexible structures to meet the demands of business and structure dynamically strategies and corporate goals, as shown in the figures 2 (classic networking companies) and Figure 3 (proposed model of networking companies).

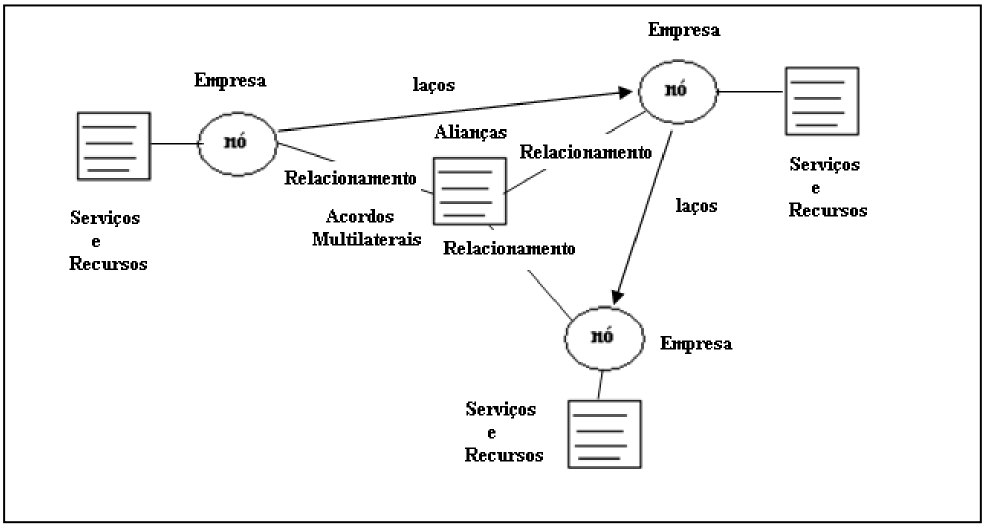

Figure 2-Business networking and relationships between businesses, the classical model, author.

Figure 2 shows the classic model of a relationship structure of firms in networks, where the nodes are companies where each one of them describe their services and provide their resources to be shared. In the Centre of the relationship are the alliances that are established between companies and multilateral agreements in accordance with the rules and policies of relationships established between these companies that must be met. The problem observed for this type of model is the static relationship, lack of control and transaction management services. There is no application of technological resources available in the market and many ties clusters as shown in Figure 3 below.

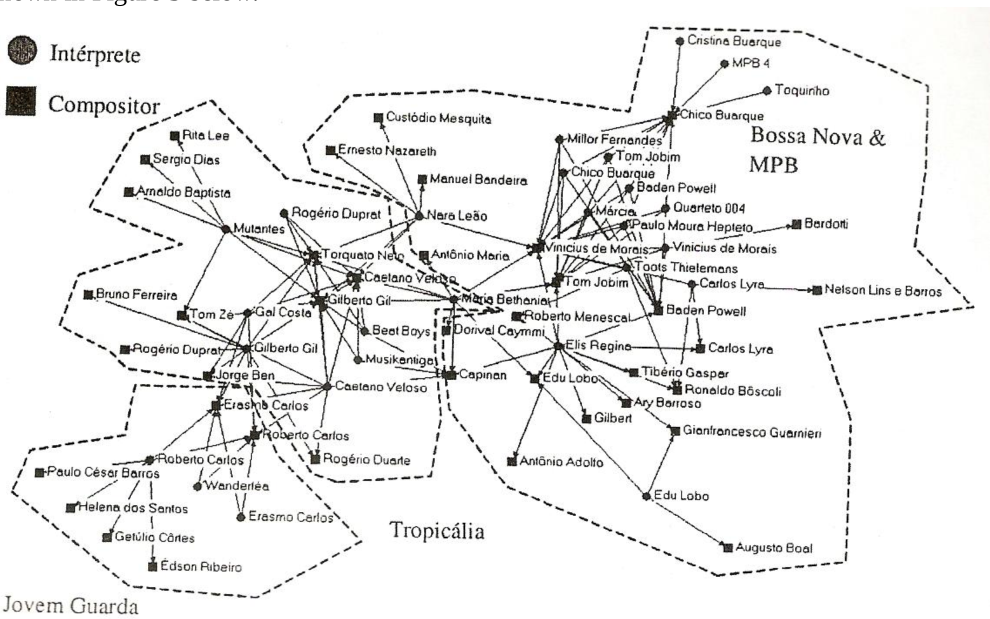

Figure 3-Network intérptretes and composers of Brazilian music period 1958-1961. Source: Kirschbaum and Vasconcelos (2007).

The figure 3 shows a network of interpreter of composers of Brazilian music using a model of relationship and interconnection between music styles and compositions of the 1958 and 1961 season. The figure 4 shows an improvement relation using the techniques of cloud computing and web service where companies, individuals or groups of individuals who can form alliances or service contracts using the resources of service orientation (SOA) technologies and communication protocols available over the internet.

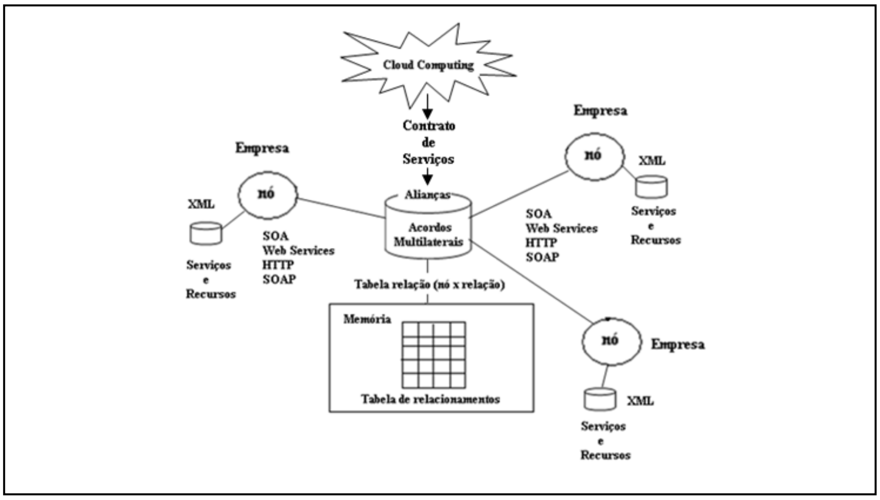

Figure 4-Companies in networks and relationships between the companies, proposed model, author.

Figure 4 represents a proposed model for setting up companies in network with the use of web technologies, service-oriented architecture, cloud computing and communication protocols for exchanging information and messages between the enpresas. The nodes represent companies, where each one of them have their own services and resources in their own bases. At the center of this control are multilateral agreements where are established alliances and service contracts using virtualization techniques of cloud computing. The main search engine is responsible for the relationship table cotnrole and dynamic management of firms that tracks the relationship between the nodes for the exchange of information using the techniques of transaction services.

2.4. *Web services* integration with service-oriented architecture

The SOA is an architectural model agnostic to any technology platform, in this way companies can get their strategic objectives associated with service-oriented computing. In the current market, the platform of more associated with technology? , realization of SOA is the *web services*. This platform can be distributed e possui collections of standards and specifications that provide service description language, definitions from schemas, protocols of accesses to simple objects, Integration and discoveries of universal basic Profiles descriptions, message level security, transactions, cross-service and reliable message exchanges. All this are being provided by the technology of *web services* platform, (ERL, 2009).

In this context the following communication standards interfaces based on service contracts and independent implementation technologies given the loosely coupled paradigm. Coupling is the relationship established between the service contract, the logic and the resources that are encapsulated.

III. METHODOLOGY AND MATERIALS

Models will be developed and made available in cloud computing applications, for depends on of the foundations proposed in this project. In addition will be monitored and simulated in a intraorganizacional network within the IES (higher education Institution) in the undergraduate program in computer science and information system.

3.1. Scope of the experimental work

Will be built an application with service orientation structures (SOA) and development platforms (*web services* and *cloud computing*) based on the fundamentals presented according to the main authors of literature FUSCO and SACOMANO, (2009); ERL (2009); VERAS (2009 and 2010); LAZZARINI (2008); DEITEL (2005) and JORGESEN (2002).

The system will be analyzed and compared with the concepts of networking companies according to their use in cloud computing and virtualization technologies of *web services*. The application of time planning for the courses of computer science and information system is part of the proposed system and allows them to be shared among engineers using the distribution and d virtualization to cloud computing. Apply the features of intra-organizational networks according to the organizational structure of each unit who are geographically distributed that IES (Higher Education Institution).

3.2. Project architecture

Figure 5 shows the architecture of the integration *cloud computing* with companies in networks, using *web services* with SOA model, the communication protocol HTTP (*Hypertext Transfer Protocol*), the interfaces WSDL (*Web service Description Language*) and the default language XML (Extensible Markup Language).

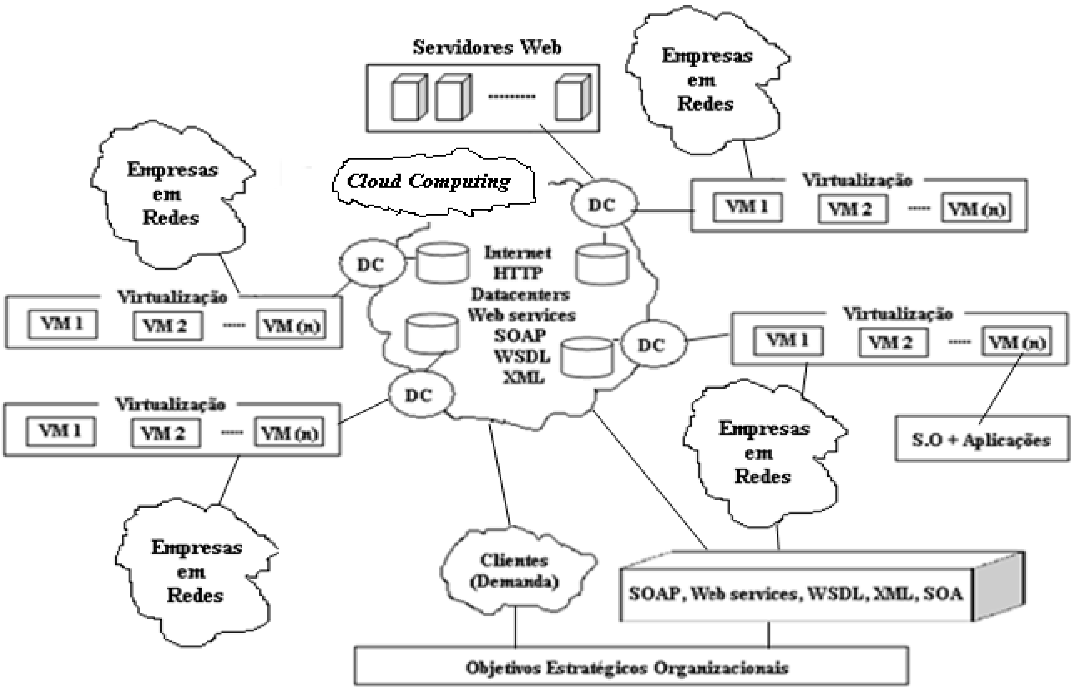

Figure 5 - Architecture integration companies in networking, cloud computing, web services and SOAP, author.

Figure 5 shows the architecture of the proposal of this work and its principal components. In the Centre is implementing ads techniques and resources available by cloud computing that are the *internet*, HTTP protocols, the *datacenters*, technologies *web services* SOAP protocols (*Web Services Object Access Protocol*), WSDL, and XML.

3.3. Details of the components

The infrastructure will be developed and the key components to extend the capabilities of communication between companies and networks enable service transactions between organizations.

In this project the main components are: the doors of communication between the structures of clouds Computing Virtualization, networking organizations, SOA service models and technologies of *web services*.

3.4. Tools used

The main tools used are: the hosting cloud computing, *web services*technologies, the SOA services models and techniques of intelligent search and dynamics of the tree and graphs.

3.5. Application environments

The environment for realization will be built on a network of educational company of type intraorganizacional. The infrastructure for the implementation of the case study should be built within a University where the departments need to be interconnected on networks of computers. Aiming at the implementation of this work is its implementation with cloud computing and the demonstration of its advantages.

3.5.1. Measure of network structure

The structure of a network can be characterized by their general structure or the way the ties are established between nodes (actors) of a network. However the assessment of the structure of this network can be accomplished through the density, centralization and fragmentation. A network is dense when several actors are connected to each other. The measure of density can be easily computed. Considering that there are no actors for certain context and ties not directional, the maximum number of links that it is possible to be established can be applied using the formula is N(N-1)/2 this occurs when all actors are connected to each other. Already the measure of density represents the number of observed network ties, dividing by the maximum number of links that is allowed for this network. However, if the actors don't have a bow to each other, the measure of density is equal to zero and if all actors were connected to each other, the density is equal to one (LAZZARINI, 2008).

A network can be coordinated by applying the concepts of network centralization. In this case the central actor joining several other actors who are not connected with other groups, this central actor then plays the role of coordinating and controlling other actors. According to Lazzarini (2008), the central actor can add to the actors don't low density plants offering guidance to perform certain task. Density and centralization indicate how the network (as a whole) is structured. Already a fragmentation are disconnected subnets where the actors don't relate to other groups of actors. A high fragmentation means that there exists a strong cohesion, but locally the actors may be strongly cohesive.

Regarding the measurement of position of the actors in the network (known as positional indicators), she shows how a given actor can extract benefits according to their position in the network and the main indicators used are classified as grade and centrality of middle (LAZZARINI, 2008). Degree centrality evaluates the number of ties that an actor has with other actors. Already the centrality of middle, evaluates the degree as a particular actor is linked, directly or indirectly (actors who are located in different parts of the network). According to Wasserman and Faust (1994) the calculation of centrality of means to evaluate the measure for each actor, verifies that this actor is part of the minor road that connects each pair with other actors in the network, because the smaller the path, the greater its centrality to middle. So an actor with high centrality of middle allows this actor is connected directly or indirectly to various parts of the network.

The figure 6 show the model architecture (octal) proposed for the construction of enterprises in service networks, in the form "*octal*", graphs, trees and arrays. However the mathematical formula used was N(N-4.5)/2 for numbers of bonds observed (totaling 20 actors from the root) and the measure of density, the number observed on the network divided by the maximum number of links. The value of 4.5 is the result of the total number of elements in the first row divided by 2, which corresponds to the maximum number of main actor's relationship with the other actors in the network.

	A	B	C	D	E	F	G	H	I			
A		1		1		1		1		A		
B	1		1		1		1		1	B		
C		1		1		1		1		C		0,5
D	1		1		1		1		1	D		
E		1		1		1		1		E		1
F	1		1		1		1		1	F		
G		1		1		1		1		G		1
H	1		1		1		1		1	H		
I		1		1		1		1		I		1
	A	B	C	D	E	F	G	H	I			
												1
										Total =		4,5

Figure 6 Matrix octal structure of an enterprise networking, author

Figure 7 represents the array and network configuration "octal" balanced in relation to the actors connected on that network. The merged form defines the control mechanism of trade in communication with reducing conflicts between these actors. Then define the octal structure as shown in Figure 6. The structure can be increased or decreased in accordance with the existing interactions between actors. The general formula for calculation can be defined as N (N-(N-d))/2, where “d” is the total number of diagonals counting from the main diagonal. For N = 11 (number of actors in the network) the number of observed ties has approximately 30 related actors (above the main array), represents (11 (11-5.5))/2 = 30.25 relationships between actors.

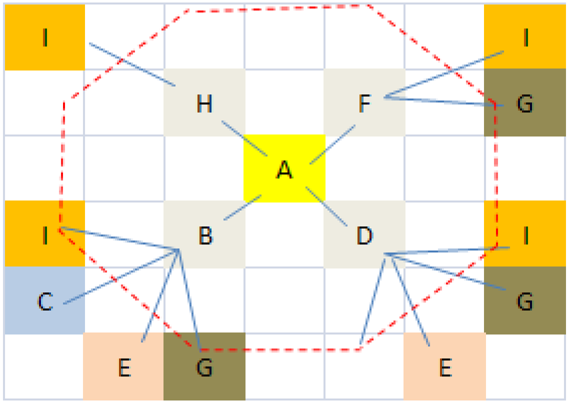

Figure 7 octal structure of an enterprise networking, author

Figure 7 shows the structure in octal format of actors, relations between these actors that determine the measures of network structure "octal" proposed in this work. The setting was obtained of the array shown in Figure 6, which determines the balanced relationship based on the concepts of density, centrality and of fragmentation. For this it is necessary to establish the new configuration (based on the array of figure 6) forming the octal model.

The actors B, C, G and I are connected directly or indirectly to the actors of the inner layer which are the actors B, D, F and H and with the central actor, moreover, can be connected or disconnected from the network to establish their communications and exchanges of information. On the new architecture can exist several different ways of settings, keeping the consistency of the initial structure. The new structure may be linked to their peers that have the same types of businesses or services (played by the American actors that has the same color) or to connect with groups that perform services or sell different products (represented by actors who have different colors), as shown in Figure 8.

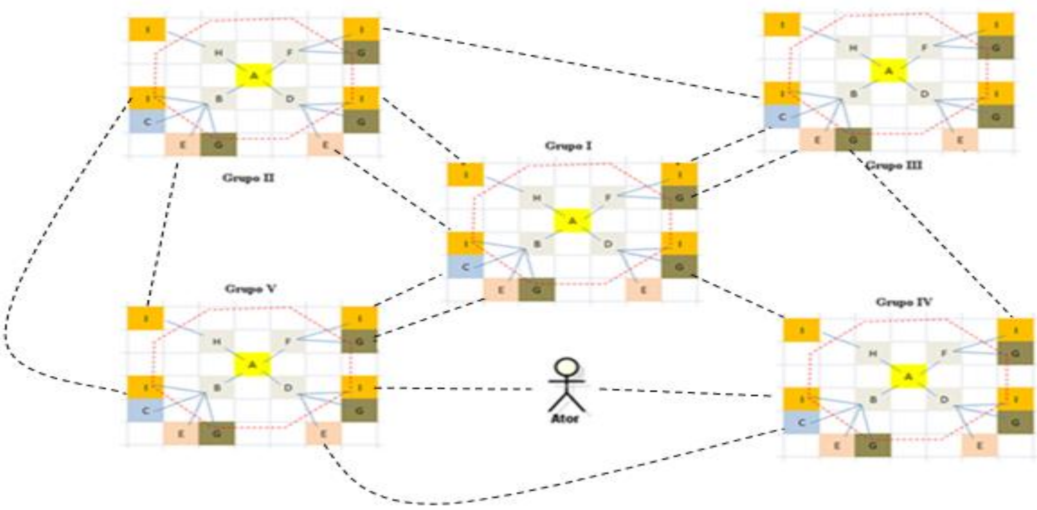

Figure 8 Architecture octal structure of a company in interconnected networks to other networks, author

The architecture of figure 8 shows the exchange of services between actors of different groups to achieve their common goals. Each group has its main actor by applying the techniques of measures of density, centralization, fragmentation, and degree of centrality. In this way it is possible to apply also the techniques of structural holes in order to obtain advantages in the negotiations. The actor (represented in Figure-8) shows how can extract more benefits according to its positioning between the groups on the network. The nodes (*nodes*) that have the same colors have in common the same interests and types of services or products in common (companies in the same sector), nodes (*nodes*) of different colors (interconnected) represent alliances with adjacent sectors companies but which complement each other.

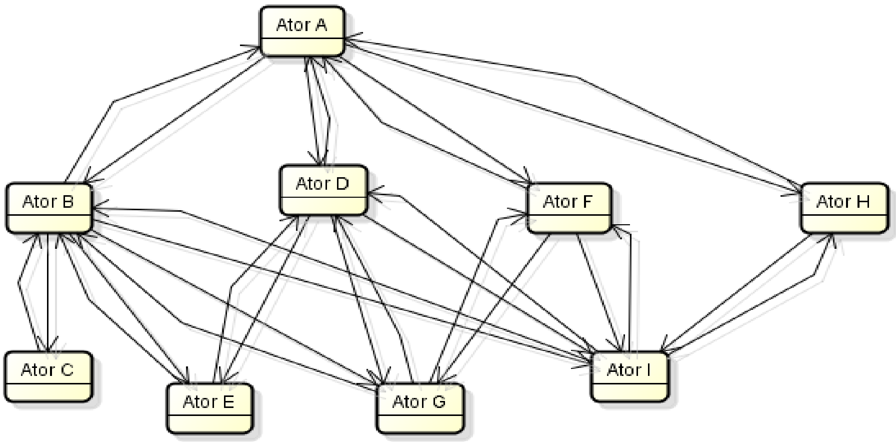

Figure 9 Structure Structural Holes company networks, author

In Figure 9 actors represent behaviors (Exchange or sharing services) of the companies or individuals belonging to companies in networks. Right now there is Exchange of information in the search or location of services provided between the actors to combine existing resources and obtain advantages in distinct parts that are disconnected from the network. Conform Lazzarini (2008), the lack of links between actors creates a structural hole that can be exploited. The benefits of this exploration (using the graph in Figure 8) may also allow the actors to combine existing resources in others parts of the network.

Networks with different levels of density correspond to the number of loops observed in the network about the maximum possible number of ties that can be established between actors (LAZZARINI, 2008). The results obtained from the comparison between the "classic" model and the model "octal" have as values for the densities (for a total of 20 actors and 9 ratios) of 99.87% for model performance "octal", while the "classic" model a value of 55.55% of performance. According to Coleman (1988), the density has a fundamental theoretical significance, because it attaches to dense networks a peculiar function, allowing the maximum flow of information between actors.

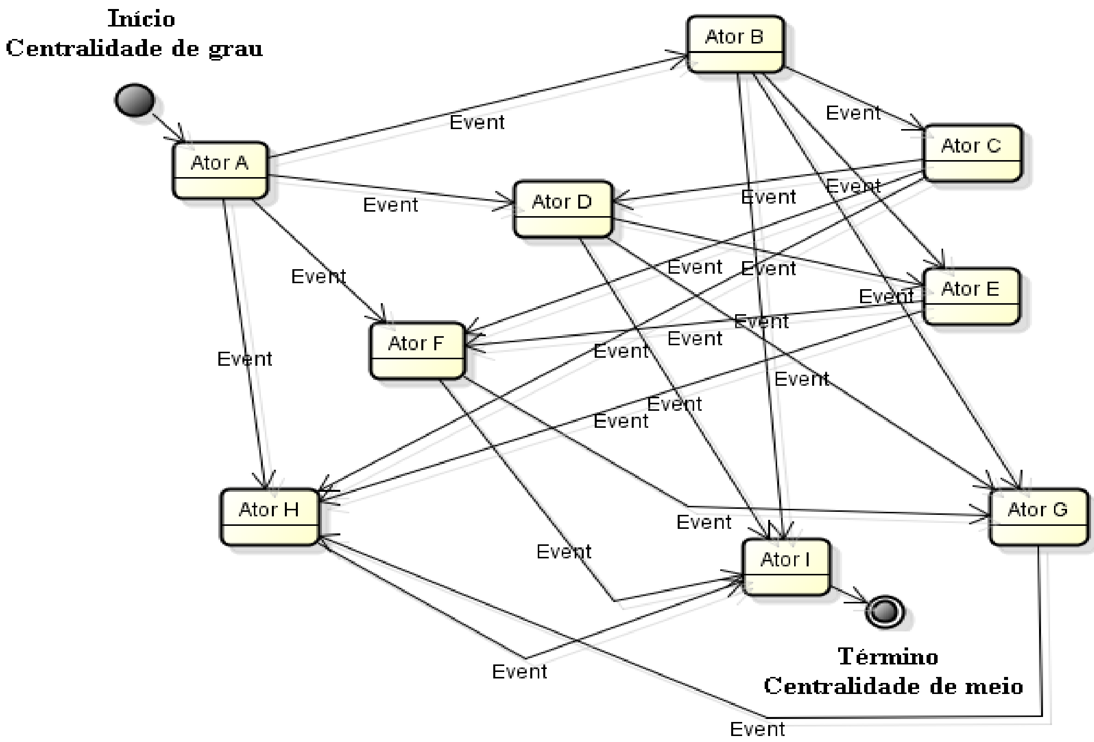

Figure 10 octal graph structure of a company in networks, author

Figure 10 shows the actors, and state transitions between these actors to Exchange or share services and in addition, define the behavior of firms in networks. In this phase it is possible to establish the types of possible relationships to network and establish the position of the actors and the measures of centrality of these actors to configure the best alliances and ties.

Figure 11 shows the tree structure of an octal architecture. The structure allows analyzing the intensity of relations in horizontal and vertical levels, as shown in the degrees of intensity of colors in horizontal line 1 level of the hierarchy.

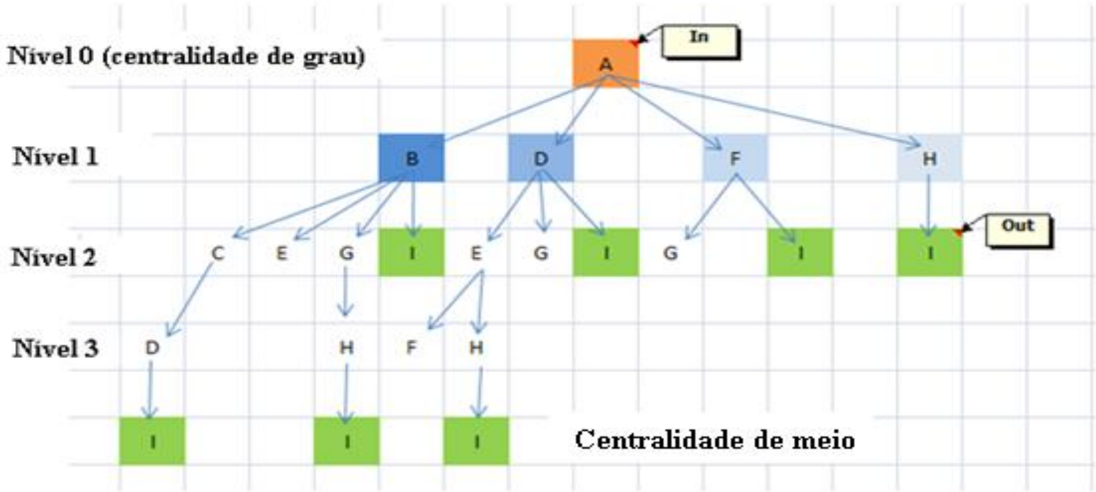

Figure 11 An octal tree structure of an enterprise networking, author

Figure 11 shows the structure in hierarchical levels, where represent the measures of position of the actors according to their centrality that can be of degree or of kind. Centrality of maximum degree centrality of the central actor (root), already the centrality of middle evaluates the maximum degree of interconnectedness that an actor is connected directly or indirectly with other actors that are disconnected in different parts of the network, where all entrances and exits are focused on a specific actor (in the example in Figure xx, corresponds to the actor "I"). The darker blue color shows that has a centralized of greater degree, since there is a larger number of ties that the actor has in relation to other actors and the lighter blue color less number of interconnected ties to this actor.

Structural holes is the absence of a bond between disconnected networks. According to Burt (1992), the non-existence of ties between actors of disconnected networks creates a structural hole and allows opportunities in negotiations to be presented. Actors must seek positions on your network in order to avoid redundant links (must make contacts with actors who do not have ties with each other). An actor can be represented by individuals or businesses that relate to other networked enterprises to obtain benefits and resources by connecting to the various portions of this network as shown in Figure 12.

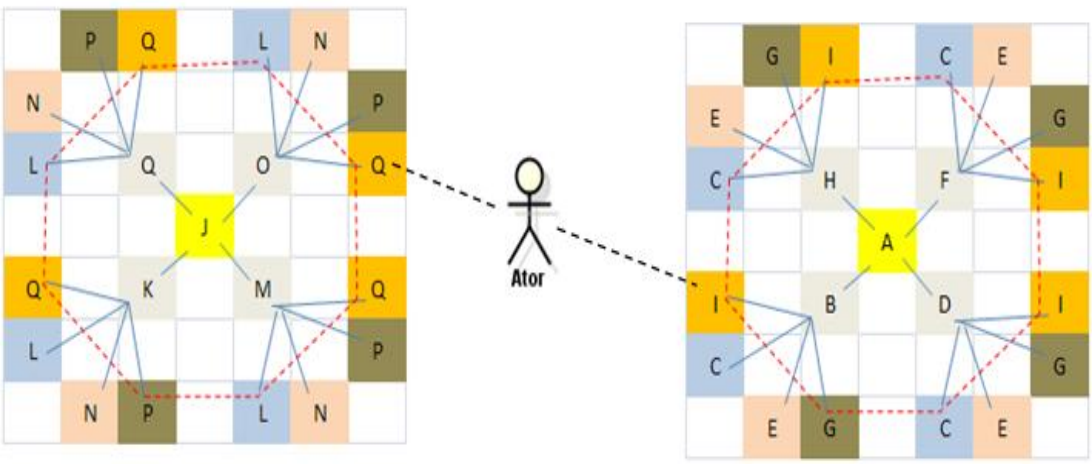

Figure 12 structural hole in a company "octal" network, author

Figure 12 shows the octal structure where the actor (can be individuals or companies) connected to the other companies of different networks but that has in common services that can be shared. This actor has just interconnection using informal structures of relationship with high centrality of middle.

Actors must seek positions in your network and get contacts with actors who do not have ties with each other, because it allows actors can combine existing resources in separate parts and disconnected from a particular network (BURT, 1992).

An organization that wants to develop a new product or service can form alliances with companies of different sectors initially disconnected (LAZZARINI, 2008). Networks of small firms allow company to preserve their specialization in a particular area and reduce contractual risks in market transactions (GETS WORSE, and SABEL, 1984; POWELL, 1990). Thus, an inter-organizational network can be considered as a new type of organization of several autonomous units and connected by means of links of different types. These types of bonds can be of type vertical or horizontal (ZENGER and HESTERLY, 1997). A vertical chain is a network of ties sequentially chained (LAZZARINI 2008). A vertical chain allows you to manage sequential interdependencies between the various actors involved, where each actor forensics a product or service that is the input of the other actor (THOMPSON 1967). Several authors have analyzed how to organize vertical chains: what types of agreements between actos can be established, to ensure that there is compliance with these agreements and how to provide changes to increase the quality or reduce costs along the chain (ZYLBERSZTAJN, 1995; ZYLBERSZTAJN and FARINA, 1999; NICKERSON et al., 2001).

A horizontal network occurs between companies of the same sector or companies of adjacent sectors (LAZZARINI, 2008). Horizontal networks may establish relationships with companies belonging to sectors that are complementary to each other (BRANDENBURGER and NALEBUFF, 1996). Horizontal networks feature two types of interdependencies between actors that sãod and aggregation and reciprocal. A inter-dependencies of type aggregation are weaker (THOMPSON 1967). Contact resulting from common interests, it is not necessary to question and develop intense relations since they may be momentary (SCHNEIDER, 2004). Figure 13 shows the octal structure that aggregates the concepts of vertical and horizontal networks and dynamic management utilizing control techniques for cloud computing, SOA and *web services*.

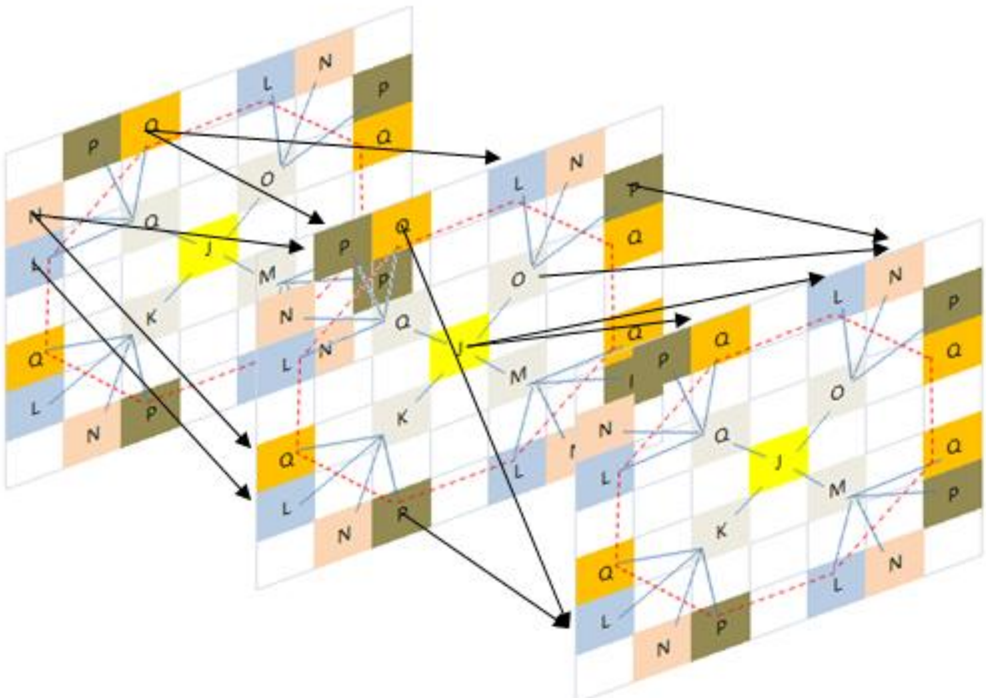

Figure 13- Structure of a network enterprise "octal" in the vertical, horizontal and netchains networks format, author

With the goal of establishing and structuring a more stable network, the purpose of this work presents the results of an analysis for enterprise configuration on networks for the distribution of services using *web services* and cloud computing techniques. The table 1 uses the shape of calculation model density maximum number of loops and the measure of density proposed by Lazzarini (2008). Then apply the calculation model for distribution of services of the *octal* architecture and the graphic models resulting from its calculations as a comparison of their results, in addition to their comments and discussions.

Medidas	Atores (nós)	Modelo clássico (resultado) "laços x densidade"	Modelo Proposto (Resultado) "laços x intensidades"	Observações
Número máximo de laços	2	1 (laço)	1 (laço)	A relação dos laços e a densidade permanecem iguais.
Medida de densidade		2 (densidade)	2 (densidade)	
Número máximo de laços	3	3 (laços)	3 (laços)	A relação dos laços e a densidade permanecem iguais.
Medida de densidade		1 (densidade)	1 (densidade)	
Número máximo de laços	4	6 (laços)	6 (laços)	A relação dos laços e a densidade permanecem iguais, porém com aumento de densidade para ambos.
Medida de densidade		0,666666667 (densidade)	0,666666667 (densidade)	
Número máximo de laços	5	10 (laços)	10 (laços)	A relação dos laços e a densidade sofrem alteração, no entanto o modelo proposto mantém o valor anterior e ocorre a diminuição do valor para o modelo "clássico".
Medida de densidade		0,5 (densidade)	0,666666667 (densidade)	
Número máximo de laços	6	15 (laços)	10 (laços)	A relação dos laços e a densidade sofrem alteração, no entanto o modelo proposto mantém o valor anterior e ocorre a diminuição do valor para o modelo "clássico".
Medida de densidade		0,4 (densidade)	0,666666667 (densidade)	
Número máximo de laços	7	21 (laços)	10 (laços)	A relação dos laços e a densidade sofrem alteração, no entanto o modelo proposto mantém o valor anterior e ocorre a diminuição do valor para o modelo "clássico".
Medida de densidade		0,333333333 (densidade)	0,666666667 (densidade)	
Número máximo de laços	8	28 (laços)	10 (laços)	A relação dos laços e a densidade sofrem alteração, no entanto o modelo proposto mantém o valor anterior e ocorre a diminuição do valor para o modelo "clássico".
Medida de densidade		0,285714286 (densidade)	0,666666667 (densidade)	
Número máximo de laços	9	36 (laços)	10 (laços)	A relação dos laços e a densidade sofrem alteração, no entanto o modelo proposto mantém o valor anterior e ocorre a diminuição
Medida de densidade		0,25 (densidade)	0,666666667 (densidade)	

				do valor para o modelo “clássico”.

Table 1 Comparative Table of Companies in networks (classical model) and distribution services in cloud computing, the author.

Table 1 shows the results obtained from the comparison between the measurements of maximum figures and ties in relation to densities of classical models and model "octal" by the amount of a company's existing actors in networks. From the aggregation of 4 actors and 6 ties, the network suffers change compared to densities. In the classic model network performance begins to decrease while the performance of the model "octal" holds steady as the numbers of actors and increase ties. The increase of number of nodes does not allow calculating the extent necessary when the actors in the network increase with the analyses of the actual performance of the network. As the authors Lazzarini, Greift, Holf, Stiglitz and Jones, the values obtained from densities of a network establish measures and levels of relationships of important information in a network and this justifies the importance of the results of the density of a network. The results generated by the octal model shows the critical limits to establish links between the nodes that can be a relationship between individuals or companies.

In dense networks it is possible to apply sanctions to groups of people who do not comply with the rules established by the groups. In dense networks allow the actors to apply collective sanctions, because this type of service (LAZZARINI, 2008). As (Greif ET al., 1994), this type of mechanism is the basis on which the informal groups of trade and strengthening of credit (HOLF and STIGLITZ, 1990). So the more dense is a local community, the easier it will be to support cooperative relations, because the density aims to facilitate cooperation between the actors (LAZZARINI, 2008). In addition to facilitate communication among the actors in creating a culture based on norms and values developed over time, in pursuit of common goals (JONES, 1997).

The table 2 describe the results obtained from the analysis of the density of the "classic" model in relation to the proposed model of density by applying the model of enterprises in services distributed networks with the SOA, *web services* and cloud computing. The work also has the aim of showing the benefits of this new architecture for a service delivery configuration using dynamic virtualization techniques, autonomous which can behave in the form synchronized or not, according to the needs of resources sharing in cloud computing.

	Modelo de cálculo ("clássico")			
		LaçoMax=	36	Número máximo de laços (Não Direcionais)
nós (atores)	laços(Obs)			
9	20			Não pode haver atores sem laços.
		Densidade=	0,555555556	Medida de densidade
			0,277777778	

Figure 14 -Model (classical) calculation of a company's networks, author

Figure 14 shows the calculation model used for definitions and analyses of comparisons of maximum densities and ties for quantities of actors and established ties between them. The results are generated as shown in the table 2.

Modelo "clássico"			
nós(atores)	Densidade(50%)	LaçoMax	Densidade
1			
2	0,50	1	1,00
3	0,50	3	1,00
4	0,50	6	1,00
5	0,10	10	0,20
6	0,24	15	0,47
7	0,24	21	0,47
8	0,25	28	0,50
9	0,25	36	0,50

Table 2 results obtained from the model (classical) calculation of a company's networks, author

In table 2 shows the values of the simulations and the values generated for maximum density limits and of 50% of its value. For we (actors) and ties maximum establish down between the actors (total 9 actors), interdependencies increase exponentially and the describe flow of information quickly. In this way communication and the exchange of transaction services are unstable. Figure 15 graphically shows the results generated by the simulation.

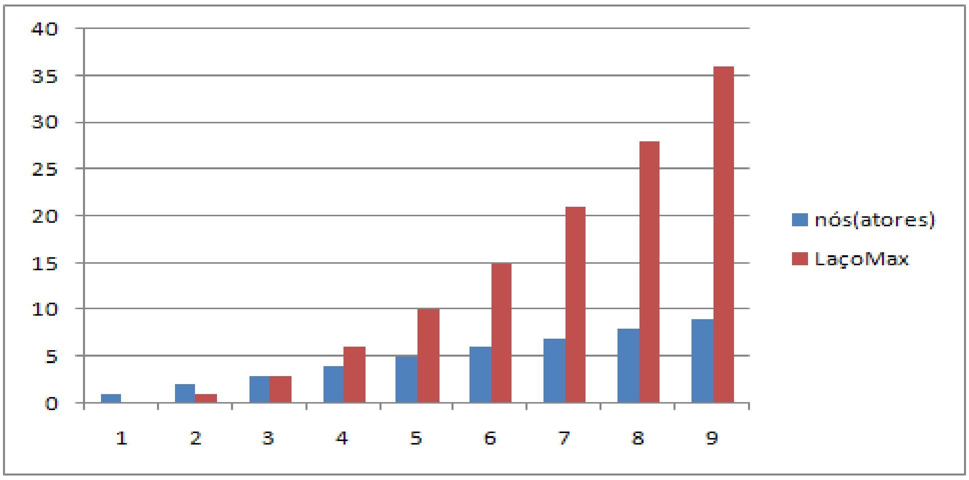

Figure 15 - Model (classical) graph of the calculations of a company in networks of actors in relation to bonds, author

Figure 15 represents the results of the analysis of the numbers of nodes in relation to bonds or relationships established between nodes. As there is an increase in the numbers of us there is a growth in the amount of necessary links required to establish communication or exchange of services, which is reduced in proportion to 8/36 (for a total of 9 us) the intensity of this relationship as you increase the number of nodes. In Figure 16 shows the results generated for the increase of us relative density (information flow).

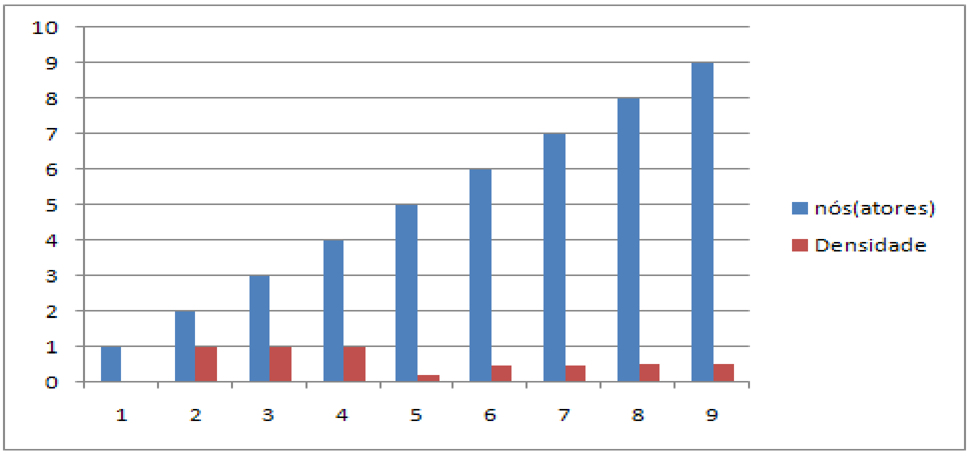

Figure 16 - Model (classical) graph of the calculations of a company in networks of actors in relation to densities author

Figure 16 shows that the increase of us above 50% there is a significant drop in the density. To maintain the stability of information flow between these actors, the limit of reliability of the relationship remains around 1/4 and 0.5/9 (for a total of 9 actors) of that relationship, which equates to 25% and 0.5% risk analysis analysis (margin of error = 20%). The figura 17 shows the calculation model to generate an analysis between the two models presented (classic and octal).

	Modelo de cálculo("octal")			
		LaçoMax=	20,0025	Número máximo de laços (Não Direcionais)
nós (atores)	laços(Obs)			
9	20			Não pode haver atores sem laços.
		Densidade=	0,999875016	Medida de densidade
			0,499937508	

Figure 17 - Model (octal) of calculating a company's networks, author

Figure 17 shows the application to simulate the calculations generated in relation to the numbers of actors and ties established between them, beyond the values of the measures of densities. Table 3 shows the results applied to the octal model.

modelo proposto "octal"			
nós(atores)	Densidade(50%)	LaçoMax	Densidade
2			
3			
4			
5	0,45	1	0,89
6	0,14	4	0,92
7	0,47	8	0,93
8	0,48	13	1,30
9	0,49	20	0,99

Tabela 3 - Resultados obtidos do modelo (octal) de cálculo de uma empresa em redes, autor

In table 3 notes the implementation of the proposed model (octal) increases the value of its density with increasing of number of nodes and links, also sets a limit of ties to the maximum use of information flow (or exchange of services and resources) between the actors. Figure 18 shows graphically the results generated from the proposal of this work.

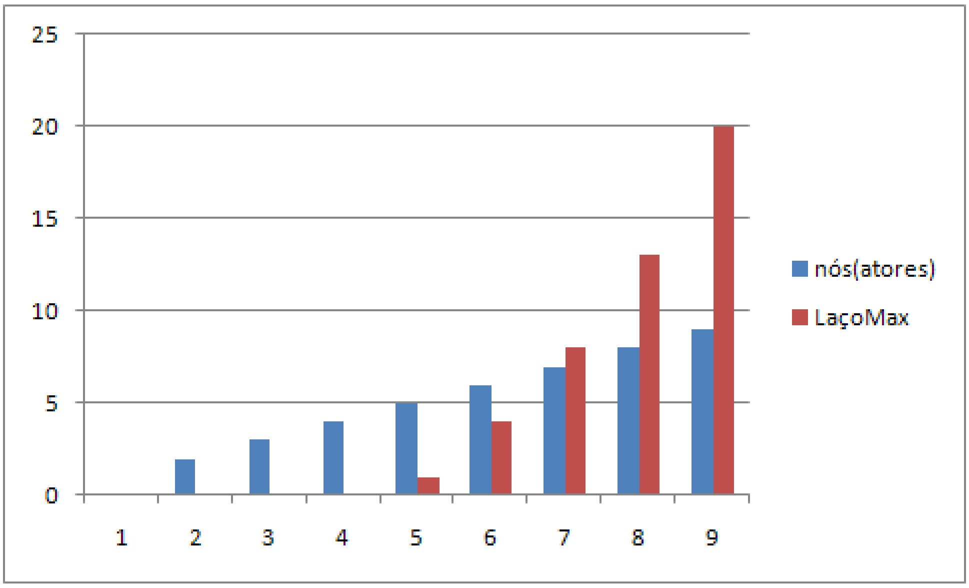

Figure 18 - Model (octal) chart of the calculations of a company in networks of actors in relation to bonds, author

Figure 18 shows the results generated by the simulation and the relationship of nodes and ties established between these actors to the octal model. It is observed that the increase of the influence ties only when the amount is above 50% of the total number of nodes on the network at a maximum ratio of 8/20 or 8 nodes to 20 ties (for a total of 9 nodes). This shows that the octal model has increased efficiency in its application to relations number above 50% of relationship between individuals or companies. Figure 19 shows graphically the results generated by the model octal.

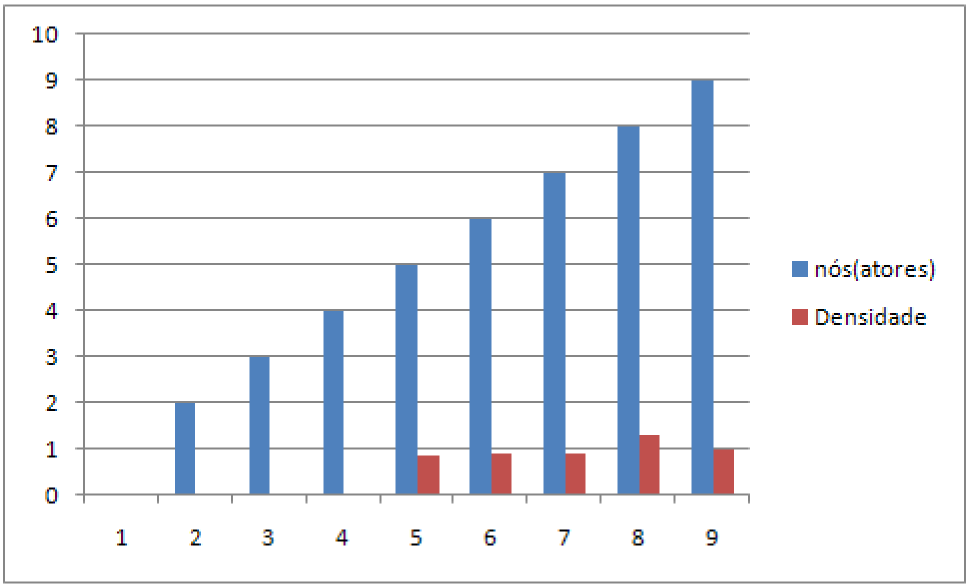

Figure 19 Model (octal) chart of the calculations of a company in networks of actors in relation to densities author

Figure 19 shows the generated results to the analysis of the simulations between actors and density (information flow) for model octal. It is observed that the increase of us regarding the density remains stable or establishes a limit to establish service contracts between individuals or companies of 0.9/5 and 1/9 (for a total of 9 actors) which equates to 18% and 11% of risk analysis of contracts (margin of error = 7%).

nós	Num. de laços máximo "Clássico"	Cáculos (densidade) "Clássico"	Num. de laços máximo "Octal"	(Cálculos de densidade) "Octal"
1				
2	1	1,00		
3	3	1,00		
4	6	1,00		
5	10	0,20	1	0,89
6	15	0,47	4	0,92
7	21	0,47	8	0,93
8	28	0,50	13	1,30
9	36	0,50	20	0,99

Comparative Table 4 - obtained from the model (classical) relative to the model "Octal" a business networking, author

The table 4 shows the results of the simulation loops and densities for the octal model. For a total of 9 we the density for the classic template has greater efficiency when the numbers of links are below 50% of the totality of its nodes. So for quantities of us above 50% of the total of us the octal model has its improved efficiency in almost 100% of its implementation and performance, also sets a limit for the intensity of their relationship. Figure 20 shows the result of the comparison charts of two model.

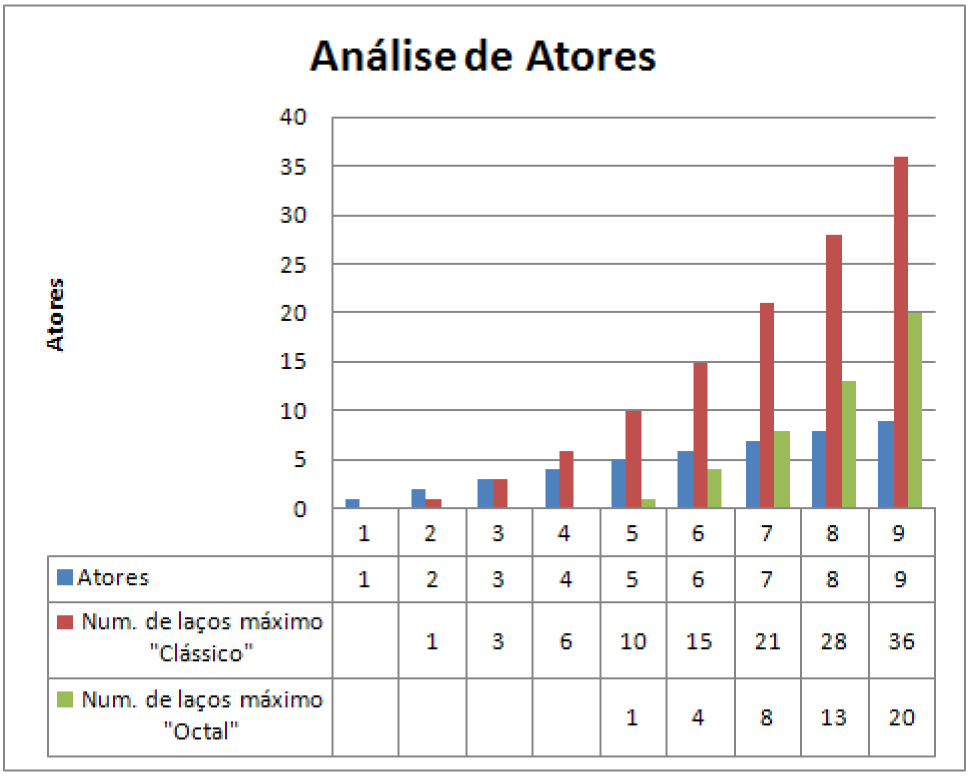

Figure 20 - comparison chart obtained from the model (classical) relative to the model "Octal" Actors and maximum bond of a company in networks, author

Figure 20 shows the results of the comparison between the two models presented (for a total of 9 nodes). In the classic model network performance begins to be perceived already in the early ties or service contracts. The landmark and leveling the network happens to the classic model when the network reaches 30%, for model octal your performance starts from 70%. The ratio of the intensity of relationship in average is 8/21 for the two models presented (40% efficiency for model octal), besides the octal model sets a limit of interconnection between individuals or companies. Figure 21 shows the relationship of density and actors of a network.

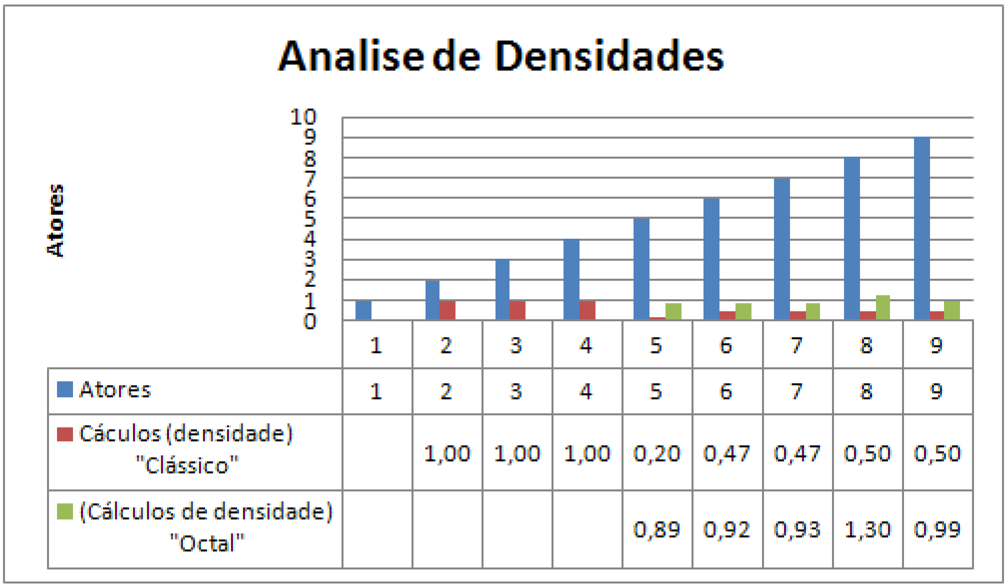

Figure 21 comparison chart obtained from the model (classical) relative to the model "Octal" actors and densities of a company in networks, author

Figure 21 shows the results of density in the graphic form of the models presented (for a total of 9 knots). While the model remains stable the octal interdependency the relationship between the actors in a network there is a reduction of density or flow of information between the network actors when numbers of actors achieve 50% of its entirety. To the octal model its density or information flow capacity increases when the number of actors increases. Figure xx shows the performance between the two models presented.

Análise comparativa de desempenho das densidades do modelo "Clássico" e "Octal"						
Atores utilizados na configuração	Num. De laços utilizados	Valor da densidade "Clássica"	Desempenho da densidade em % "Clássica"	Valor da densidade "Octal"	Desempenho da densidade em % "Octal"	Observações
9	1	0,027	2,7	0,049	4,9	
9	2	0,055	5,5	0,099	9,9	
9	3	0,083	8,3	0,149	14,9	
9	4	0,111	11,1	0,199	19,9	
9	5	0,138	13,8	0,25	24,9	
9	6	0,166	16,6	0,30	29,9	
9	7	0,194	19,4	0,35	34,9	
9	8	0,222	22,2	0,40	39,9	
9	9	0,25	25	0,449	44,9	
9	10	0,277	27,7	0,499	49,9	
9	11	0,305	30,5	0,549	54,9	
9	12	0,333	33,3	0,599	59,9	
9	13	0,361	36,1	0,649	64,9	
9	14	0,388	38,8	0,699	69,9	
9	15	0,416	41,6	0,749	74,9	
9	16	0,444	44,4	0,799	79,9	
9	17	0,472	47,2	0,849	84,9	
9	18	0,5	50	0,899	89,9	
9	19	0,527	52,7	0,949	94,9	
9	20	0,555	55,5	0,99	99	

Table 5 - results obtained from the analysis of the performance of the densities of the model "Classic" model with the "octal" a business networking, author

The table 5 shows the results of the performances of the two model for performance analysis and density of a network when there is an addition of ties (for a total of 20 bonds) that network. It is observed that there is a performance reduction (on average of 27.7/49.9 or 55%) to the classical model in relation to the octal model. Figure xx graphically shows this relationship.

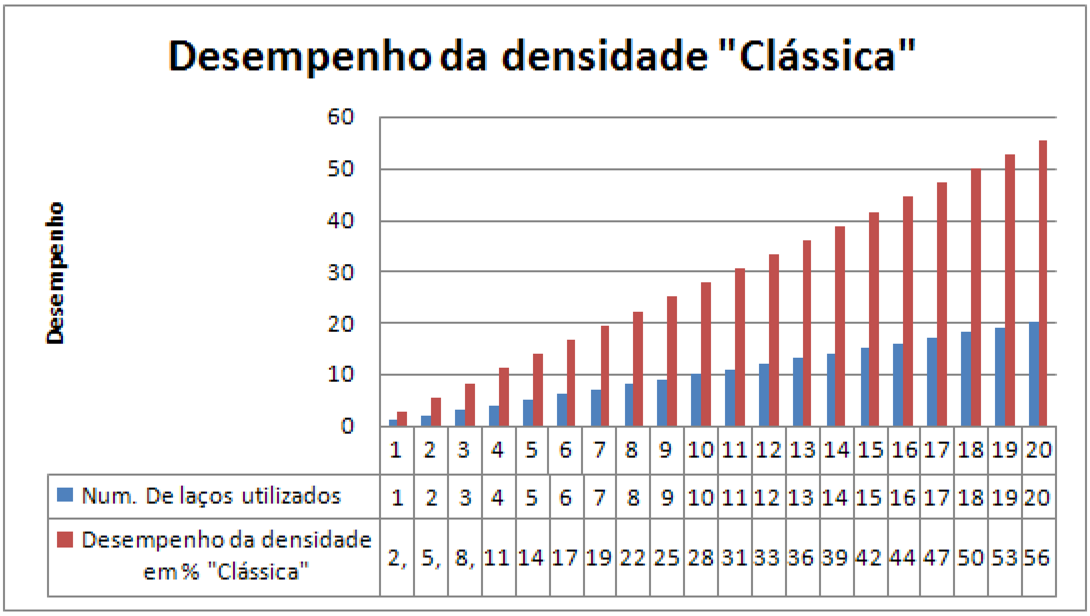

Figure 22 - Comparative graph of the performance model for the (classical) relative to the amount of a company of actors used in networks, author

Figure 22 shows the evolution of the number of ties to the classical model in relation to increased ties and performance loss (maximum) this network, in a proportion of 20/55 or 36%, and performance (minimum) of 1/2 or 50% (margin of error = 14%), for a total of 20 ties of a total of 9 nodes. Figure 23 shows the results generated by the model octal.

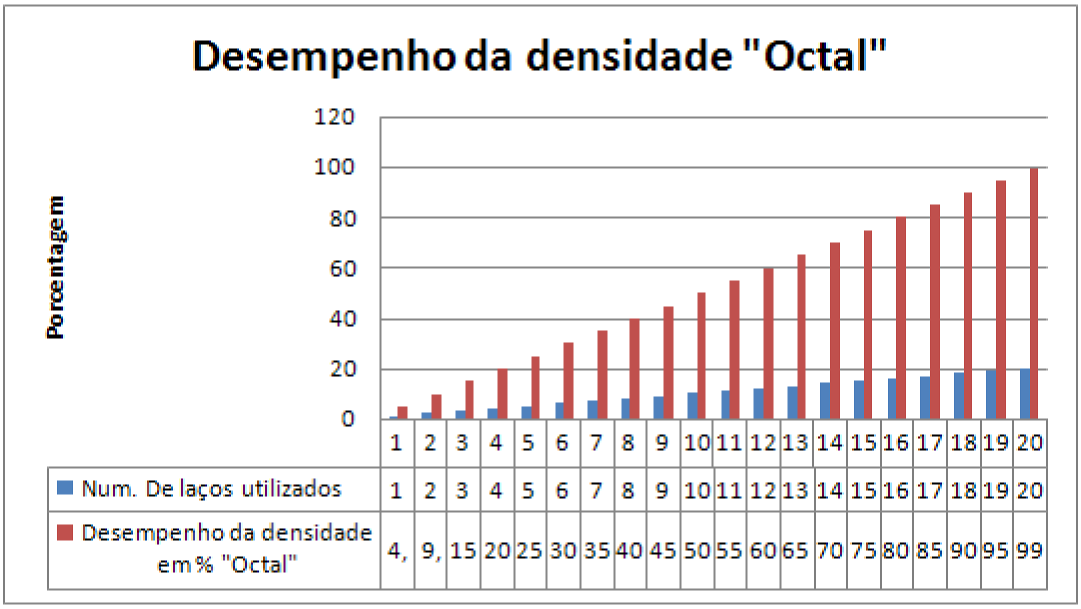

Figure 23 - Comparative graph of the performance for the model (octal) in relation to the amount of players used a company in networks, author

Figure 23 shows the evolution of bond numbers to octal model in relation to increased ties and performance loss (maximum) this network, in a proportion of 20/100 or 20% and performance (minimum) of 1/4 or 25% (margin of error = 5%) for a total of 20 ties of a network with 9 nodes.

3.5.2. Application and simulation

The simulation of the proposal was performed using a planning schedule, availability of teachers, disciplines as the available courses, schedules, shifts of classes and the rooms as each campus allocations of the IES. The figure 24 shows the application used for simulation and application of the proposal of this work.

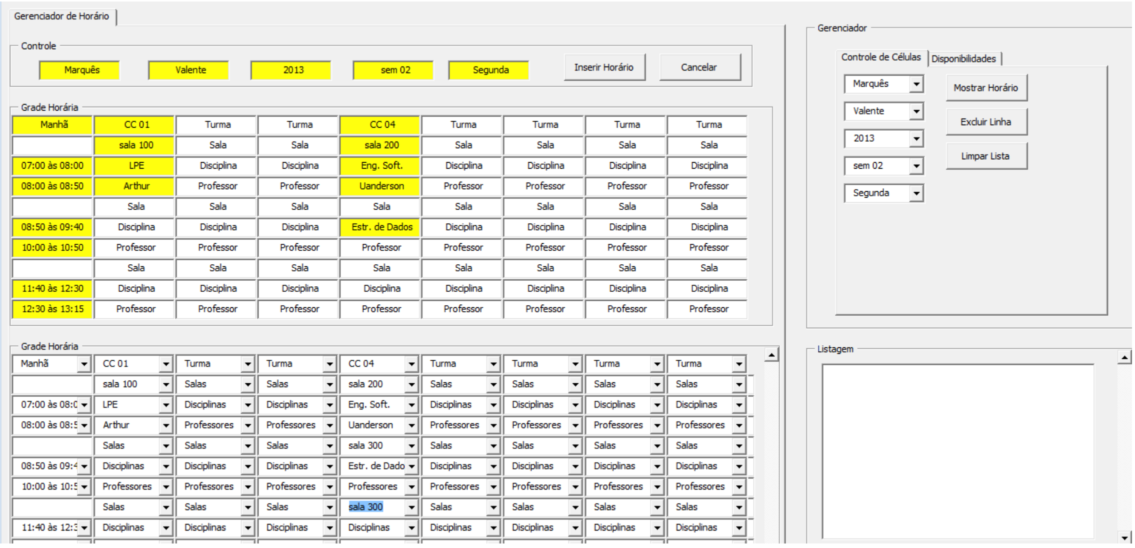

Figure 24 - main application screen distribution of classes, author

Figure 24 is the interface used for the application of the techniques of cloud computing, SOA and *web services*. The main services are contracts of teachers, availability of time and subjects designated for teaching, student enrolment and registration location, availability of rooms of the campus, planning schedules made by the coordination, the specific areas of expertise offered by half the year. The service contracts are based on SOA architecture and is based on the design of services, purpose, ability to reuse, strategic goals and service-oriented computing. In the implementation of the application uses the techniques of *web services* and cloud computing (through the virtualization of *datacenters*). The Foundation of web services is linked to the service logic, logic of processing messages, service contract and exchange of messages, which are responsible for building service-oriented solutions. The main components of the service oriented architecture are the inventories of services and resources for reuse. Communication between components using the proctocolos HTTP (*Hypertext Transfer Protocol*), HTTPS (*Hypertext Transfer Protocol Secure*), SMTP (*Simple Mail Transfer Protocol*) and Internet. Descriptions of message exchanges are performed by SOAP (*Simple Object Access protocol*), JMS (*Java Message Service*), request/response protocol that can be synchronously and asynchronously. The registration of services are business components (name, description, and contracts), techniques of information (languages, technologies and infrastructure access) and services (operations, taxonomies, rules, procedure and service elements). The SOA is the alignment between business model (processes) and IT, as it involves the model of governance, business requirements and IT capabilities. SOAP (*web services Access Protocol*) is the Protocol of access to services and their structure described using XML (*Extensible Markup Language*) responsible for communication between *web* applications and *web services*applications. The communication interface is performed through the WSDL (*Web Services Description Language*) which describes a *web service* that contains the operations and the input and output formats of each operation. Registering a web services in UDDI (*Universal Description Discovery and Integration*) of a *web services*provider, where are registered and published, because the UDDI are directories of *web services*.

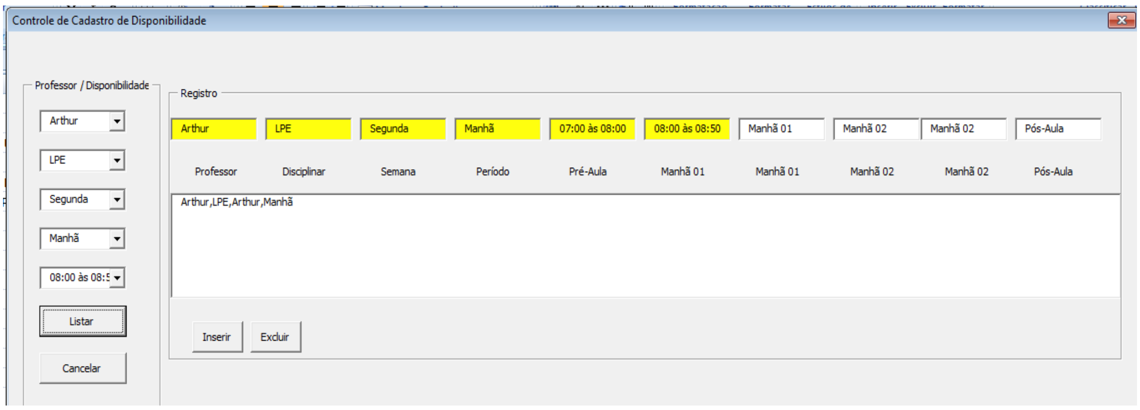

Figure 25 - Screen Application availability of teachers and classes, author

Figure 25 show a communication interface for control and management of schedule and availability fill disciplines input by teachers. This is the main component for the creation of the distribution schedule, classes, subjects and classes each semester of the academic year of an IES.

IV. ANALYSIS OF THE RESULTS

In relation to the analysis of the results, are monitoring the application performance of enterprise networking (it takes into account the analysis of the readings, the causes and effects of communication and efficiency compared to the costs involved). This is also indispensable for the verification of the benefits of new infrastructure with cloud computing and *web services*technologies, beyond the control of services using SOA design patterns.

Modeling of service-oriented computing and services, it should provide the results obtained and their advantages experiementais expected according to the studies carried out within the criteria and limits, as shown in the results below.

- Network configuration "octal" balanced in relation to the actors connected on that network from the array.
- The merged form defines the control mechanism of trade in communication with reducing conflicts between these actors
- The new architecture can exist several different ways of settings, keeping the consistency of the initial structure.
- The configuration can be obtained from matrix that determines the balanced relationship based on the concepts of density, centrality and of fragmentation.
- The actors are connected directly or indirectly to the actors of the inner layer of the octal model with the central actor, moreover, can be connected or disconnected from the network to establish their communications and exchanges of information.
- The new structure may be linked to their peers that have the same types of businesses or services (played by the American actors that has the same color) or to connect with groups that perform services or sell different products (represented by actors who have different colors),
- Each group has its main actor by applying the techniques of measures of density, centralization, fragmentation, and degree of centrality. In this way it is possible to apply also the techniques of structural holes in order to obtain advantages in the negotiations.
- The nodes (*nodes*) that have the same colors have in common the same interests and types of services or products in common (companies in the same sector), nodes (*nodes*) of different colors (interconnected) represent alliances with adjacent sectors companies but which complement each other.
- The mechanisms of state transitions between these actors allows show Exchange or sharing of services and in addition, define the behavior of firms in networks or individuals. It is possible to establish the types of possible relationships to network and establish the position of the actors and the measures of centrality of these actors to configure the best alliances and ties.
- The structure in hierarchical levels, where represent the measures of position of the actors according to their centrality that can be of degree or of kind.
- The intensity of the colors of the hierarchical levels shows that has a centralized of greater degree, since there is a larger number of ties that the actor has in relation to other actors and the lighter blue color less number of interconnected ties to this actor.
- The octal structure aggregates the concepts of vertical and horizontal networks and dynamic management using control techniques for cloud computing, SOA and *web services*.
- The new architecture allows you to establish service delivery configuration using dynamic virtualization techniques and autonomous which can behave in the form synchronized or not, according to the needs of resources sharing in cloud computing.
- The calculation presented in model allows you to define and analyze the maximum ties comparisons and densities in relation to quantities of actors and ties established between them
- The octal model sets a limit of interconnection between individuals or companies.
- The octal model its density or information flow capacity increases when the number of actors increases.
- Allows you to calculate the density, the number of ties, the intensity of relationship and the performance of a network.

V. CONCLUSION

Due to the evolution of the various modeling techniques of them stand out in the current times is the SOA, because it allows to relate business and IT services. Strategic alignment of an organization can be used. Have the web services are implemented allows the idea of services through the internet and be accessed anywhere in the world business logic and its realization with the use of web technology. For this virtualization of datacenters has the role to consolidate IT infrastructure to increase the performance and availability of application offering a dynamic configuration to meet the new demands and requirements with low investment cost. The aim of this study was to propose a model for deploying networking companies in applying the architecture of service orientation and cloud computing techniques with web services for control and management planning academic schedule an IES. The research method was a case study of a set of units, or geographically distributed campus where many teachers teach in different units and coordinators also coordinate several units located in different regions. In relation to the practice and application of simulation - highlight the interdependence of services and cooperation agreements on integration and sharing of resources employed.

The results indicate the implementation of business policies with the IT environment and implementation distribution and technology services. In the management of academic planning results indicate a practice of sustainability and low cost. Thus the results obtained allowed to put into practice the concepts and theories applied in business networking. It was also possible to determine gain time and generate results even with the limitations presented that restricted their automation, efficiency and performance. However there is also evidence that it is possible to deepen the research that leads to even better results with the performance and involvement of more engineers and teachers who participate in the network. Furthermore the impact it has proved possible to facilitate resource allocation geographically distributed datacenters with virtualization. Finally, it should be emphasized that the inter - organizational networks are placed in the context of the current reality and in that sense to be competitive organizations must be aligned with the new technologies and management models for organizations .

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