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APPLICATION OF SOFTWARE AGENT IN NEXT GENERATION NETWORKS

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Abstract: The paper will present the basic elements and characteristics of the NGN network, the requirements that placed before them that would be widely accepted and implemented. Introduction of Next Generation Network, a proposed new telecommunications architecture network make possible interoperability between deferent protocols, networks and terminals and the development and provision of new services which will arise from the convergence of Internet and traditional telecommunication services. We will also explain application of the software agent which are software which in interaction with the environment (surrounding) have capability to react autonomy and flexible in accord with the goal that is given. Design and implementations of Belief-Desire-Intention agents, which operate based on their (possibly imperfect) beliefs about the current status of the network and use their predefined plans and capabilities to cope with the real world intrusion detection and automated response problems. The agents are context-sensitive to accommodate the changes in the network status and are capable of re-planning to recover from the failures. BDI software agent for its flexibility and adjustment position has great potential applications for developing services in new generation networks.

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1. Introduction

NGN is about the network infrastructure that will enable the provision of the existing telecommunications services and innovative applications of the next generation. The term NGN refers to a converged network capable of carrying both voice and data over the same physical network, with all traffic (voice and data) carried as IP.

IP networks are likely to be simpler and easier to run and maintain as compared to the existing legacy networks. In addition, all IP networks allow for innovation in terms of new services and applications, with a truly converged product offering that bridges the current distinction between fixed and mobile networks.

The process of realization of NGN will lead to a revolution in the design and build-up of telecommunications network architecture, which will result in a change in the way service providers offer their services and the way people communicate. Ultimately, NGN would phase out the existing legacy networks at a point of time in the future.

There are some practical factors that have collectively formed the key drivers for NGN migration. Firstly, the existing network operators are facing fierce competition in the market and they have to remain competitive to survive. In order to achieve this, operators are trying to build cost-effective businesses on the one hand and create new business models and generate new revenue streams on the other hand. The convergence of fixed and mobile networks and integration of voice and non-voice services are becoming their targets because such approach would lower operational cost and allow greater flexibilities for service innovation and shorter time-to-market. Secondly, the increasing service requirements from end users call for innovative applications/multimedia services, high flexibility of service access, high bandwidth, high quality of service and etc. Apparently, the operators' need for remaining competitive and the end-users' demand for increased service requirements are together forming a strong driving force pushing the development of NGN all over the world with characteristics and features that would fulfill the needs of network operators, service providers and end-users.

NGN is as much about easier provision of advanced services such as VoIP, Broadband, multimedia applications etc. as it is about cost saving through simplification of network.

A migration to NGN will bring about a complete change in the existing business models which is a source of concern for both operators and regulators world over.

Agent systems based on Belief-Desire-Intention (BDI) architecture, which is developed by Rao and Georgeff, are becoming increasingly common. A BDI agent is able to continuously reason about beliefs, goals, and intentions and act accordingly. This model represents both present uncertainties (due to limitations in perception) and future uncertainty (due to dynamism). BDI also distinguishes between success and failure in the execution of events. The underlying theoretical model of BDI is described briefly here.

2. Next Generation Network

Next Generation Networking (NGN) actually is a broad term to describe some key architectural evolutions in telecommunication core and access networks. The general idea behind NGN is that one network transports all information and services (voice, data, and all sorts of media such as video) by encapsulating these into packets, like it is on the Internet. NGNs are commonly built around the Internet Protocol, and therefore the term "all-IP" is also sometimes used to describe the transformation towards NGN. In other words, the fundamental difference between NGNs and today's network is the switch from current circuit-switched networks to packet-based systems.

According to International Telecommunication Union's standardization body (ITU-T), the Definition of NGN is: A Next Generation Network (NGN) is a packet-based network able to provide Telecommunication Services to users and able to make use of multiple broadband, QoS enabled transport technologies and in which service-related functions are independent of the underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users [1]. ITU determined further that the NGN is characterized by the following fundamental aspects:

1. Packet-based transfer
2. Separation of control functions among bearer capabilities, call/session, and application/service
3. Decoupling of service provision from transport, and provision of open interfaces
4. Support for a wide range of services, applications and mechanisms based on service building blocks (including real time/streaming/non-real time

services and multimedia)

5. Broadband capabilities with end-to-end QoS and transparency
6. Interworking with legacy networks via open interfaces
7. Generalized mobility
8. Unfettered access by users to different service providers
9. A variety of identification schemes which can be resolved to IP addresses for the purposes of routing in IP networks
10. Unified service characteristics for the same service as perceived by the user
11. Converged services between Fixed and placeCityMobile networks
12. placeCity Independence of service-related functions from underlying transport technologies
13. Support of multiple last mile technologies.

NGN, also defined as "broadband managed IP networks", includes next generation "*core*" networks, which evolve towards a converged IP infrastructure capable of carrying a multitude of services, such as voice, video and data services, and next generation "*access*" networks, *i.e.* the development of high-speed local loop networks that will guarantee the delivery of innovative services. NGN is expected to completely reshape the present structure of communication systems and access to the Internet. The present structure of vertically independent, although interconnected, networks may be transformed into a horizontal structure of networks based on Internet Protocol. Investment requirements for NGN are high and, as for any investment, there are risks. Policies need to ensure that risks and uncertain returns are compensated while ensuring competition since, without competition, the benefits of high speed broadband and NGN will not be realized.

Next generation access networks tend to refer to a specific technological deployment, there are other technologies which can compete in providing some of the services which it is envisaged will be provided by NGNs. There are also other technologies which may not be able to fully compete with NGN access networks in terms of capacity and the plethora of bundled offers which NGNs can provide, but may be perfectly suitable for users who do not have the need for high capacity access. The different technologies available include existing copper networks upgraded to DSL, coaxial cable networks, power line communications, high speed wireless networks, or hybrid deployments of these technologies.

The term next generation networks frequently encompasses some kind of fixed-mobile convergence (FMC), [2] as it allows the transition from separate network infrastructures into a unified network for electronic communications based on IP, which facilitate affordable multiple play business models, seamlessly integrating voice, data and video. The introduction of 3G technology supports the transmission of high-speed data with speeds theoretically reaching 2/4 Mbit/s, and third-generation handsets give users access to the Internet and multimedia content on the go. Existing 3G technologies will need to be upgraded in order to support very high bandwidth or extensive concurrent usage that may be demanded by users in the future. The future evolution of mobile networks for example using LTE technology (Long Term Evolution) – a next generation mobile technology – may significantly increase speeds, enabling high peak data rates of 100Mbit/s downlink and 50Mbit/s uplink. However, deployment of this technology may not begin, at the earliest, before 2010.

The next generation *core* networks are defined on the basis of their underlying technological components that include – as mentioned in the ITU definition – packet-based networks, with the service layer separated by the transport layer, which transforms them into a platform of converged infrastructure for a range of previously distinct networks and related services. These features may have an impact on traditional business models and market structure, as well as on regulation:

1. IP-based network: "Next generation core networks" generally cover the migration from multiple legacy core networks to IP-based networks for the provision of all services. This means that all information is transmitted via packets. Packets can take different routes to the same destination, and therefore do not require the establishment of an end-to-end dedicated path as is the case for PSTN-based communications.

2. Packet-based, multi-purpose: While traditionally separate networks are used to provide voice, data and video applications, each requiring separate access devices, with NGN different kinds of applications can be transformed into packets, labeled accordingly and delivered simultaneously over a number of different transport technologies, allowing a shift from single-purpose networks (one network, one service), to multi-purpose networks (one network, many services). Interworking between the NGN and existing networks such as PSTN, ISDN, cable, and mobile networks

Figure 1: Separation of functional planes, see [3]

can be provided by means of media gateways.

3. Separation of transport and service layer: This constitutes the key common factor between NGN and convergence, bringing about the radical change in relationship between network "layers" (transport infrastructure, transport services and control, content services and applications). In next generation networks service-related functions are independent from underlying transport-related technologies (Figure 1). The uncoupling of applications and networks allow applications to be defined directly at the service level and provided seamlessly over different platforms, allowing for market entry by multiple service providers on a non-discriminatory basis.

In this context, the migration from separate network infrastructures to next generation *core* networks is a logical evolution, allowing operators to open up the development of new offers of innovative content and interactive, integrated services, with the objective to retain the user base, attract new users, and increase ARPU. NGN is therefore often considered essential for network operators to be "more than bit pipes" [4] and to strategically position themselves to compete in the increasingly converged world of services and content, where voice is no longer the main source of revenue, and may become a simple commodity. The investment in next generation access networks – both wired and wireless – will be necessary in order to support the new services enabled by the IP-based environment, and to provide increased quality. At the same time, the important investment necessary to develop next generation infrastructures brings about new economic and regulatory issues, which will be analyzed in the following sections. For a successful introduction of new generation networks will be necessary to modify the current architecture of telecommunications networks to as it will enable easier access to infrastructure and simplify the process of service delivery. Three key features of each system are the automation of service delivery, capacity of adaptation and reconfiguration. For the growing diversification service network as well as client terminal was created a need for automating the process of providing services to reduce costs and the time of introduction of new services. In the process of installing new services must take into account the technology used in a development of services, service type (on which the characteristics of the target node where we want to install the necessary software) as well as cost and utilization node itself. Research users showed that except for a small number of technological users the most user don't wishes to use the services for which they themselves have to install and configure software update service and when they develop new versions of the same. Therefore we need to automate and the procedure to provide services to user terminals.

Adaptive capacity is defined as the system's capability to adapt to the needs of users and the current state of the network, and as a result of adjustments in the particular environment be needed and reconfiguration of elements used in the process of service delivery.

To enable users' access the service providers' network infrastructure and services, you will enable access to its elements to other market participants. Access to the elements used 'to be so that other providers could define the parameters of the new service, request their installation on network elements, their adaptation and reconfiguration and monitoring of work of services [5]. Providers of services will not have direct access to network elements but will be achieved by using standardized interfaces' will define the functionality of the network. The process of providing services and the elements that are used must be hidden from the service provider. Using the above principles is enabled by interoperability between of the business systems provider, also and technology because provider of network infrastructure can add new elements in its network and new procedures to provide services without the need for change in the business of other service providers.

Taking into the consideration all the problems with which they will meet the telecommunications service providers during the introduction of new generation of network need for the technology with which the same could be solve is greater.

3. Software Agents

Software agents is a software which in interaction with the environment (surrounding) have capability to react autonomy and flexible in accord with the goal which is given. Software agents have the following feature:

1. Autonomy: Agent has the capability to perform operations independently without the need for user intervention using it. This feature requires that the agent owning the mechanisms that 'he will enable independently catch all necessary information about the environment in which it is located. Depending on the obtained information agent performs respective operations. In case of error mechanisms must enable to continue the work of the agent,

2. Sociability: Although there are situations in which the agent can perform operations independently, with increasing the complexity of operations performed by an agent, these situations are becoming more infrequently. Therefore, an agent must possess mechanisms that he enables to coordinate their operations with other agents in its environment. Coordination enables efficiently execution agents of operations and reduces the complexity of the agent because the functionality of the system can be divided into larger number of agents, where each agent is in charge of the functionality.

3. Reactivity: Reactive agents do not possess an internal model which enables to predict the future state of the environment already react especially on the basis of current knowledge and a set of actions that they know. They react to the impact from the environment with from the action predictability for the current state of the environment and the kind of impact. This type of the agent for implementation is simpler and faster but their great disadvantage that is less adaptable. In cases where impacts occur that are not pre-considered agent while not be able to react to such influence or 'will react in none adequately,

4. Activity: Unlike reactive agents, which only react to environmental impacts, active agents possess mechanisms that they enable to affects to the environment changing its condition. In this shows target-oriented behavior in fact each agent has one or several goals. In situations when the state of the environment is inconsistent with its goals, the agent affects the environment while not accomplish a given goal.

5. Mobility: software agents can migrate from one network node to another. Each mobile agent consists of three components: the code of software that contains the logic of the agent's internal data or attributes that represent the knowledge that the agent owns the state of execution. Depending on the mode of transmission condition statement during migration we

distinguish between strong and weak migration. With a strong migration, after migration, the agent continues to extract following instruction while in the weak migration does not pass the state of execution. It is therefore necessary to implement the principle agent using finite automata. During migration, it is necessary to move all three components from one node to another. Frequent application of mobile agents [13] is in distributed systems because enable remote processing and data retrieval. Agent in order to transfer all the necessary data through network (such as client server paradigm) has a position migration to remote nodes where the download and processing of data or perform the required operations on the node, the agent, in need migrate to another node, and after the end the operation gets back to the initial node where it presents to the user the results of execution [6].

6. Rationality: Defines that if an agent has a set of goals, of which only one is active, it while not perform actions that might be inconsistent with its current goals. Rational agent should always perform the actions that will ultimately maximize the expected result by using their knowledge about the current and future state of the environment [11].

7. Well intention: Agent targets can't be conflicting with each other if the agent wants to maximize the expected result.

The term intelligent agent is considered to be software agents that owns above properties, and is able to autonomously carry out the goals that witch are given to it. In order to accomplish our goals intelligent agents often have the capability to learn, which he enable on the basis of previous result know how to fix your reaction future in fact to adapt to changes in their environment, and capability to plan, which he enable on the basis of knowledge about the environment and the mechanisms that has developed a plan to more efficiently accomplish a given goal [7].

In complex systems, agents are organized in multi-agent system. JADE agent platform [8], [9] is currently the most developed agent platform that provides an environment for the development and execution multi-agent systems. The platform is compatible with the FIPA specifications. FIPA (U.S. Foundation for Intelligent Physical Agents) [10] international organization responsible for defining standards in the field of agent technology.

4. BDI Agents

The best example of human intelligence researchers take these human beings way of thinking man's attempt to develop an agent that uses the same principles. Although conceived as a paradigm for the development of intelligent agents, for the flexibility and dynamics programming frameworks that implement it, BDI agents are used for design simulation, business and telecommunications applications and automate a process that normally does the staff of the companies [11].

The roots of the BDI paradigm derived from the philosophy and from the works of Bradman M. et al [12]. The author in his work with the philosophical positions analyzed contradictions purpose-oriented future and emotions going on, and has identified three components: ***b****elief*, ***d****esire* and ***i****ntentions*.

Belief is an information component in which the agent stores the knowledge which possesses about the environment in which it operates. Knowledge can be acquired to receive information from the environment, and at the agents who possess the mechanisms of learning and prediction the behavior of environment. The first component is important for reactive agents, whereas the second component is present in pro-active agents. Manner of storing knowledge depends on the scope of the agent or the implementation of BDI agent systems. The second component, which is often called to as the motivation component, are the desires. Each agent has determinate set of operations that can execute, depending on their internal condition and state of the environment.

Last component of a BDI system are intentions. While desire represent the set of all operations which the agent can execute intentions represent the part of those operations that are currently running. "The intention is a desire, with responsibility" is a phrase that the author of the article [13] used to describe the purpose because if the agent made a decision some of the operations he assumed the obligation to end the operation.

The intentions affect the performance of the agent [14] limiting purposes of further elections because two intentions, which are currently running, should not be a mutually conflicting. Once initial execution intentions end only in case of successful completion, not a position to further the execution of intention or if the agent decides to perform further makes no sense. Intentions affect the performance of agents because an agent assumes that the selected intentions while be successfully executed their further action based on that belief. If the agent fails successfully to end the intentions with one set of action is obliged to choose any other set.

In the based on the work of Bradman and the author of the article [15] is developed the first BDI agent system called Procedural Reasoning Systems (PRS) [16]. PRS was defined by the core agent and basic operating principles of a translator (English interpreter) with the task of controlling the BDI agent systems. Each agent owns a communication system whose task is to receive information from the environment in which the agent operates. After receiving information from the environment, the function revision beliefs analyze the received information and generate a revised set of beliefs. This set is created by adding, modifying or deleting a certificate from the base of agent's beliefs depended of received information.

The functions of generating and filtering options are part of a process called deliberation. This process from a set of agent's desire, based on agent's convictions, which intentions with the agent will further execute which actions for that will use. The correct implementation of the process of BDI agent systems is crucial because the process deliberation takes processor time that an agent used to carry out intentions. In dynamic systems due bad implementation of the process of deliberation may happen situations that the agent spends more time on the process of deliberation rather than executive goal The author A. S. Rao and M. P. Georgeff et al [15] defines three types of agents based on defined process concludes research and environment in which they operate: blindly-committed, open-minded, and Single minded agent Blindly-committed agent, after making a set of detachment intentions persist in their intentions until they've achieved, regardless of changes in the environment. This type of agent is not suitable for dynamic environments with low intensity changes.

Open-minded is suitable for highly dynamic environment because enable continuous analysis of environment and quickly adapt to new circumstances of their intentions. Combining open-minded and blindly-committed agent originated single-oriented agent. In addition to being defined by the model interpreter, PRS-defined architecture and model bases BDI agent systems. This model, as before, defined by the model interpreter, is upgraded in new performances of BDI agent systems ([17], [18], [19]), but the basic principle of work remained unchanged. Figure 2 shows the basic architecture of BDI agent systems.

Except the interpreter and bases beliefs and intentions were introduced two additional elements: a base library of goals and plans. The goal is according to its functionality is very similar to the concept of desire. It defines the operations that the agent is able to run. Agents represent a subset of desires agent goals. Each goal has a determined number of preconditions which define the value of belief in the agent. When the environment defined by the value achieving the goal has conditions for its creation. Agent system then creates the goal and adds

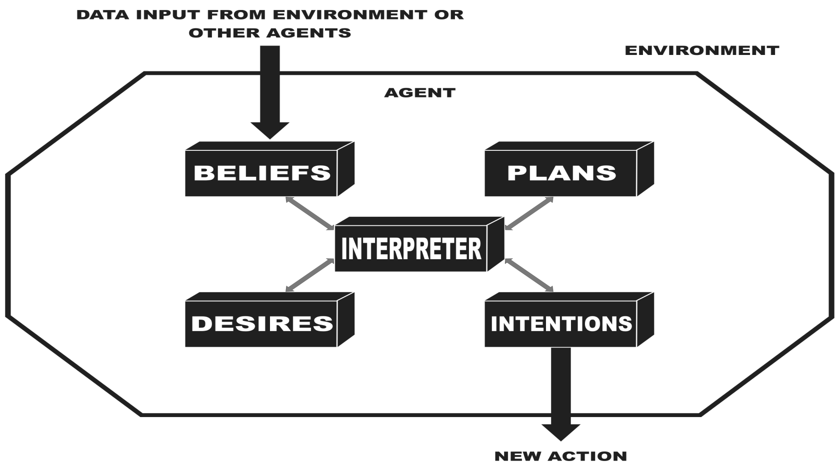

Figure 2: A Belief-Desire-Intention agent architecture

it to the set of the agent desires. In order to increase efficiency and flexibility has created several types of goals. Each type of goal consists of parameters that define when a goal of creating, running, and when its statement ends. By this are enabled easier adjustment operations which agent runs.

Goals are the motivational force driving an agent's actions. They come in different flavors allowing various attitudes of an agent to be expressed. BDI currently supports nine application relevant goal types: achieve, cease, avoid, optimize, test, perform, query, preserve and maintain goals.

1. Perform goals express an agent's wish to directly engage in actions which are already satisfied if something else has been achieved. Such behavior is suitable for abstractly modeling activities such as driving around with a car just for fun. In contrast to such activity centric goals,

2. Achieve goals are associated with a desired world state. An example of this would be having the car parked close to its driving destination. In this case the state and position of a car is relevant for the goal's fulfillment state and hence expresses the goal's target world state. Therefore, achieve goals clearly emphasize the decoupling of what is to be achieved and how it will be brought about.

3. Contrary to achieve the goal of the functionality defined by the cease types of targets,

4. Query goals instead can be used for information retrieval; their outcome

is not defined by some target condition but by a query that needs to be answered. Depending on whether the agent's current knowledge plans may or may not be executed, meaning that if the information is readily available no additional work will be necessary. An example for a query goal is finding out the way to drive a car to an intended destination.

5. Maintain goals are used to describe situations that should be preserved by the agent under all circumstances. Strictly speaking, it means that whenever a specified situation is violated the agent will activate any applicable means to re-establish the desired world state. Ensuring that a car continues to function properly is an example for such a kind of goal. More information about the goal representation in Jadex can be found in [Braubach et al., 2004]. Contrary functionality of maintain is avoid. Similar functionality has also preserve the goal with the difference that his statement stops when the condition of maintenance violation.

6. Optimism is called goal which enable the agents to optimize their future action. Each agent has a set of goals that can be performed. End result of each of the goals associated with the factor values for agent. The task of this objective is that before the check made targets of them resulting in a maximum factor values for the agent and starts its execution only [20].

7. Goal test enable testing fulfillment of conditions.

Plan is another component of the basic model for BDI agent systems. In contrast to the goal that defines what operations can be performed by an agent, the plan specifies how the operation can be executed.

When describing real world scenarios with goals the problem often arises that not all of the individual agent goals can be pursued at the same time. Such goal interferences are an important design aspect that is directly addressed by the goal deliberation facilities of Jadex. With the built-in *Easy Deliberation* strategy goal cardinalities and inhibition links between goals can be modeled at design time, with the system ensuring that during runtime only valid goal subsets are active. If a goal set contains conflicting goals, the system will exploit the defined inhibition links to delay less important goals while executing the more important ones. Whenever goals are finished, the system considers the re-activation of currently inhibited goals. Means-end reasoning is performed with the objective of determining suitable plans for pursuing goals or handling other kinds of events such as messages or belief changes. Instead of performing planning from first principles, PRS systems use the plan-library approach to represent the plans of an agent. A plan consists of two distinct parts: the plan head and the plan body. The plan head contains information about the situations in which the plan will be used. Most importantly it includes the events and goals the plan can handle and conditions that are used to restrict the applicability. Using conditions it is also possible to abort a running plan immediately if the current situation demands it. The plan body represents the recipe of actions that will be performed if the plan is chosen for execution. Depending on the plan's purpose its degree of abstractness varies continuously between very concrete and fully abstract. Concrete plans are fully specified at design time and consist of directly executable actions whereas only fully abstract plans are specified in terms of sub goals only. Two conditions are defined: precondition and the condition of activation. A precondition is defined when the agent system can be included in your program possible plans with which a goal can be achieved. As a condition to the receipt of messages can be set by another agent, the activation of the target agent or change the parameter values in the base believe. The condition defines the activation state of the environment in which this program can apply. The body plan defines the specific steps that must be executed. Within body plan can be activated and some other goal. Thus activated goal takes on the transaction. During the performance objective of the plan is temporarily suspended. In this way is enabling a hierarchical definition of goals per level. Plan which is currently executed is a part of all intentions of the agent.

One of the advantages of application of BDI agents is its capability to recover in case of error. To the error can be came from various reasons, not always enable predicted in advance, because of the complexity of the system or due to changes in environment conditions that annulled the previous decision-making.

BDI agents solve problems that arise due to errors in the system, enabling defines several different plans for each goal. In the process of deliberation interpreter chooses the plan whose probability of success greater. In the event that the plan for some reason fails, in the following cycle of interpreter's works is selected the most probable following plan. This process "will continue until the plan fails, or there is no new plan in the library plans. The same principle can be applied with hierarchically defined goals. In case the goal is not able to continue its statement interpreter in following cycle can activated the following compatible goal [21]. The tubes may interaction positively or negatively [22].

Positive interaction goals may happen when two goals share the same plan or some other goal at a lower hierarchical level. Instead of a plan or a goal is executed several times an interpreter can optimize statement them made common to all targets that it uses them. In [16] on which the PRS created, it was assumed that two objectives cannot be mutually conflict. In real implementations of BDI agent system where in one agent there are a number of different objectives this assumption is not realistic. The reason is not because the agent has been awarded two m mutually opposite operations, but in most cases because of access to resources. Two goals can at the same time, demand the same access to resources and thereby come into conflict. Although there is no general solution to this problem is one of the offerings protected solutions presented in [23]. The authors introduce two new conditions for the goals: the cardinality and inhibitory branch. The condition cardinality enables define the maximum number of active goals, while the inhibitory branch can be defined when the conflict comes between the two goals. These two conditions are used in the process of deliberation. If the interpreter detects a conflict between the two objectives, a higher priority goal while be activated while the other goal will be temporarily suspended.

Consideration all the components of the BDI architecture, is made the question which are the advantages of BDI agents? Besides being based on the philosophical theory of human thinking and good formal basis, using the first-order logic, temporal, dynamic and BDI logic, the paradigm is used for the development of complex commercial applications [14]. BDI paradigm is a goal-oriented technology, where the goals are the focus of the development process applications. BDI architecture enables hierarchical definition of the goals where one goal is the peak a task applications can be explicated on the goals.

Each addresses the goal of a subset of the problem. Goals can have one or more plans which define the steps that must be performed. The emphasis is that the objectives and plans are as simple as possible because it increases re-usability components of the application.

The developers of the application process last step is application delivery to the end user the life cycle of applications continues to phase maintenance. According to some sources [24] phase of system maintenance can sometimes reach up to 50% of total project costs. The traditional approach to application development It is therefore very important to determine what applications work as well as all possible risks and mistakes that can happen in application in order to reduce the cost of maintaining applications.

In the new generation of network this problem can come be even more evident because the providers are faced with increasing competition in the market must deliver new services in short time and lower development cost to make them more competitive.

Another problem that providers face is the speed of change. Due to the fre-

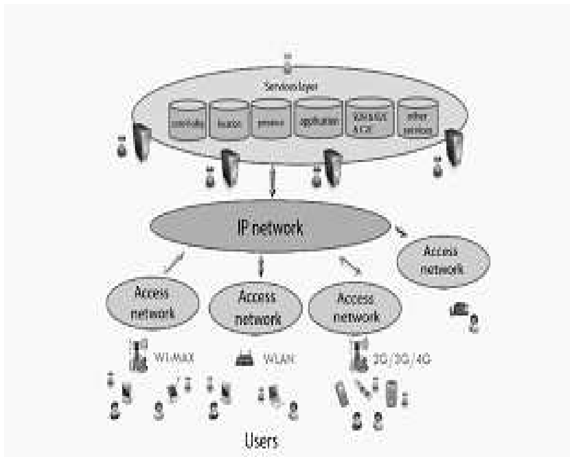

Figure 3: Application of agents in the next generation network

quent introduction new services, changes in payment mechanisms, technology or government regulations often change your application while become reality [25]. Apply the principles of the BDI paradigm can reduce application development costs and enable easier adaptation to changes. Cost reduction is achieved by using the application goals and plans. Unlike traditional methods of development applications where the phase of implementation of the system during the performance of applications and to recover from errors must explicitly, for which great number of situations that may occur during operation applications, in order to reduce the costs of subsequent introduction.

At BDI agents are defined in the implementation phase only known goals for the current requirements. If you are in the process of development or maintenance applications are new requirements only need to define new goals and plans for this claim.

Recovery from errors in BDI agents is solved by the principle of perseverance, because if the performance goal is not successful execution of a plan agent may try to make another plan from the base plans. In this way the amount of the mechanisms for the recovery system which must be implemented is significantly reduced. BDI agents are easily adapted to the changes in dynamic systems, because the course of execution agent determine in a process of deliberation in fact a moment before the execution of the plan itself. In this way the agent always selects the goal or plan that is best suited to the current state of the environment.

5. Application of Agents in New Generation Network

BDI software agent because of its flexibility and adjustment position has great potential applications for developing services in new generation networks. Figure 5 identifies two areas of application BDI agents: the user terminal and the current service level in the architecture of next-generation networks.

Limitations in the application of BDI agents on end-user terminals currently represents a smaller amount of processing power and memory most nowadays mobile office has.

Due to these changes is the implementation of services to the user terminals are currently limited to the detachment of PDA models but because of accelerated development of all advanced mobile office equipment it is expected the possibility of implementation the same to the equipments accessible to a wider customer base [26]. Some of possible applications include:

1. Collecting and filtering information, since its beginnings, when it consisted of only a few computers, the Internet has evolved into a global network that provides a virtually endless source of information. Therefore, the search for relevant information to users has become long-term activity. The new generation of network access information will be easier because new services will make it possible users access to information. Agents can facilitate the retrieval of relevant information due to its characteristics of mobility and learning. Property it makes possible to the agent to migrate to remote nodes on which can search and filter the information available for information not relevant to the user. Learning it makes possible to the agent to predict in advance the needs of users.

2. Control user settings: Each user can define their preferences and thus it makes possible to network to adapt to their needs. User agent analyzes the current state of the network and the user adapted characteristics of services that are used depending on the defined preferences. If, for example, the user is currently located in an area that is covered by only a GPRS signal, and wants to use multimedia services, this agent can make possible to use the service or with a reduced quality of service. If a user during its movement comes to the area network bandwidth more agents can adapt to new circumstances in the service network.

3. Electronic market: electronic market it makes possible to the user of automate the process of purchasing the services. If the user is interested in the procurement of services with a determine characteristics he can

give the parameters of services to the agent specialized for procurement. This agent can migrate to remote nodes and dealing on the electronic market, with an agent service provider, to purchase services with the best ratio quality/price. The same principle can be used for service providers whose agents can, in the market, offer its services to users. The task of these agents is to offer services at an optimal price based on supply and demand in the market.

4. Automated installation services: The next generation network, which will integrate different technologies, networks and terminals and service providers, must make it possible automation of the installation of new services in the network. Depending on the service that installs, software agents can make possible customize the installation process. After initiating the installation services, agents migrate to the nodes in the network on which to install the software. Depending on the characteristics of remote nodes catch necessary software and install and configure the service.

6. Conclusion

The process of realization of NGN will lead to a revolution in the design and build-up of telecommunications network architecture, which will result in a change in the way service providers offer their services and the way people communicate. Ultimately, NGN would phase out the existing legacy networks at a point of time in the future.

There are some practical factors that have collectively formed the key drivers for NGN migration. The existing network operators are facing fierce competition in the market and they have to remain competitive to survive. In order to achieve this, operators are trying to build cost-effective businesses on the one hand and create new business models and generate new revenue streams on the other hand. The convergence of fixed and mobile networks and integration of voice and non-voice services are becoming their targets because such approach would lower operational cost and allow greater flexibilities for service innovation and shorter time to market.

The increasing service requirements from end users call for innovative applications/multimedia services, high flexibility of service access, high bandwidth, high quality of service and etc. Apparently, the operators' need for remaining competitive and the end-users' demand for increased service requirements are together forming a strong driving force pushing the development of NGN all over the world with characteristics and features that would fulfill the needs of network operators, service providers and end-users.

Such agents are one of the technologies that allow development of advanced services because it allows the development of intelligent services which are adjusted to the user. Using the program Agents can also automate the tasks that users or network operators must operate independently. BDI agents to the existing features of software agents added and target-oriented features that facilitate the development new applications and lower maintenance costs. New targets and plans, which are the basis of BDI agents can be added and after implementation of the telecommunications network operator and thus facilitate adaptation of new and existing services to new technologies. Another advantage of BDI agents is that during the execution is not fixed but determined by an agent performs an action which are consistent with the current state of the environment in which the agent operates.

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