An Evaluation Criteria of Autonomic Network Architecture

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Abstract **- An Evaluation Criteria of Autonomic Network Architecture is identifies its existing of Autonomic Architectues and also reveals the information about Network Mangement and its tasks which is performed by the Network itself.In this paper providing the criteria which leads in the Autonomic Network Architectue.**

Index Terms— **Architectue Evaluation,Autonomic Network,Network Management, Self Management Generic Model.**

INTRODUCTION

An Evaluation Criteria of Autonomic Network Architecture is part of the Autonomic Networking and its Architectue relates a self management protocol of its capabilities and methodologies which improves its developing of the self managing computing systems.

The capabilities of the Autonomic Network is managing by its own without any external need of its systems. It is completely differ from the Autonomic system and the Autonomic system management has more complex because of its several management standards.

This paper is mainly introduced to overcome the complexity of the autonomic network management and hereby providing a solution for the self way of Autonomic Computing to provide the Autonomic solutions evaluation and analyze by its evaluation criteria

BACKGROUND

The key Building blocks of Autonomic /self managing network is the Generic Autonomic Networking Architectue in which its architectural reference model for the self management network and itself is a Hierarchial model approach for its control architectural framework and it controls the resources at different levels of nodes and network functionalities.The autonomic manager components (elements)that are designed to relate the relationship between the Autonomic control of their Associated self managing features of the managed entities and its networks in the Autonomic network control Architectural framework.The Autonomic systems are self-management, including self-configuration,self-optimization,self-healing self-protection.

Autonomic computing is a computing environment with the ability to manage itself and dynamically adapt to change in accordance with it.

Self Configuration configures about the Automatically adapts to change, Self Healing informs about the Diagnose and correct problems,Self Optimizing is able to optimize its to track changes and act accordingly and Self Protecting is able to anticipate and and handle security tasks.

Autonomic Management control of networks and services whether they are distributed or centralized and it is the combination of the autonomics in not only in the management plane but also in the control plane. The autonomic management is having a control loop in which it controls the self features of self configuration ,self optimization which leads to process of creation of network configuration . The control logic is a control loop in which it is used to regularly change of the network parameters.The control loop can be based upon two models 1)Distributive Model and 2)Centralized model.These Distiributive and centralized models are the Descision elements that can be operated simulataneously in the architecture framework.An Autonomic network consists of Autonomic nodes and these Autonomic nodes are nodes to communicate with each other in the control plane and thereby it is a way of providing the control plane is self orgranizing by itself.An autonomic nodes consists of several elements called Autonomic service agents.Autonomic service agents which implements the behaviour of a autonomic service and its functionalities.The autonomic nodes is understands its properties and characteristics of by its own.The autonomic agents required the service discovery functions also.The autonomic control plane is required to coordinate the communication between the autonomic nodes, service discovery mechanisms also. A survey of autonomic network architectures. The Evaluation Architecture describes an equivalent classification of the existing autonomic architectures . The Evaluation Architecture presents a qualitative comparison between those architectures, focus on the relevance of it.The current autonomic proposals to derive a new self adaptive autonomic architecture according to the requirements of wireless mobile networks for assessing existing autonomic architectures,a self-adaptive architecture for mobile wireless networks It represents two new autonomic features,:1)The IBM reference autonomic model.2)Autonomic control loop around the monitoring component, allowing it to be self-adapted according to the network context.By considering

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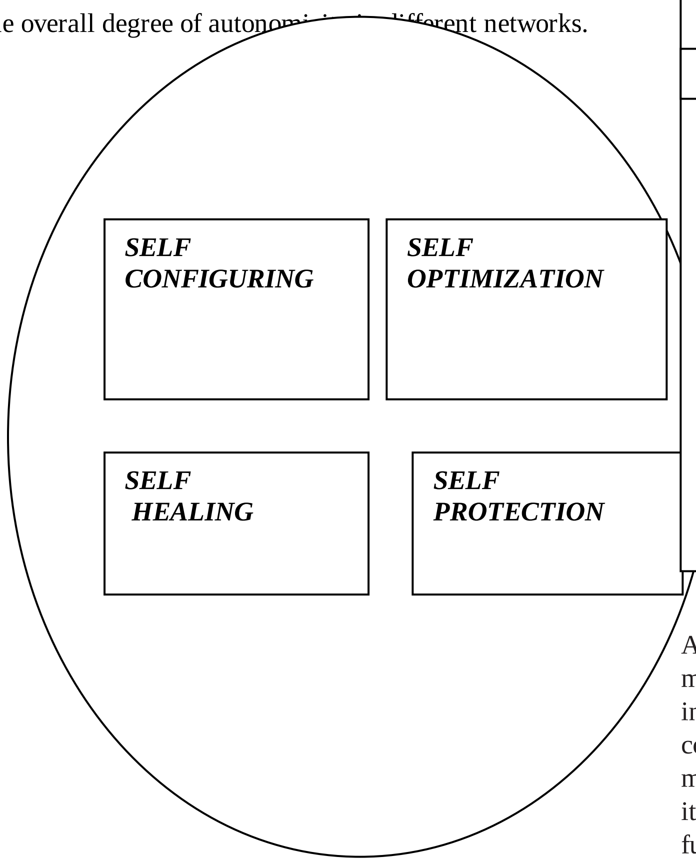
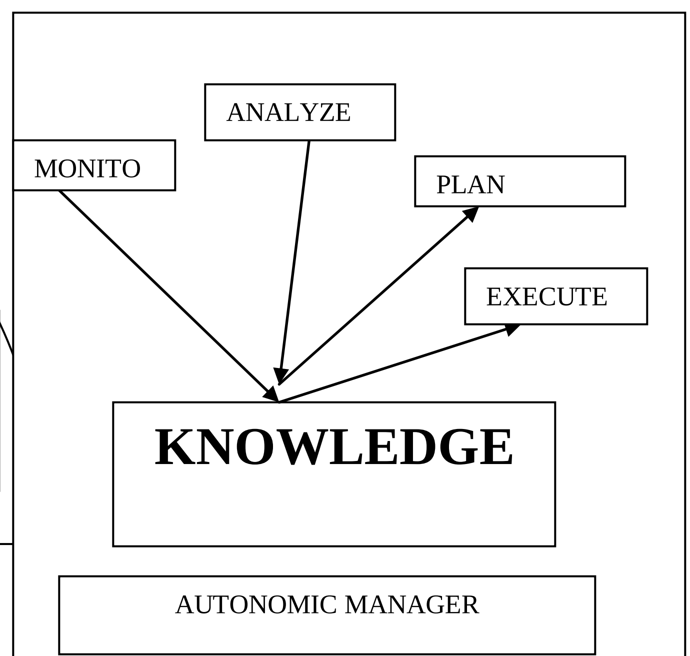
the first autonomic feature, the proposed Self Adaptive network architecture uses a learning mechanism based on random neural networks with reinforcement learning inspired by biological neurons. For the second contribution, a self-adaptive monitoring approach is proposed which uses normal transiting packets in the network to provide required information for adaptation algorithms. ATMS: Autonomic Trust Monitoring Scheme for mobile ad hoc networks. By, applying the SADA architecture to design a self-adaptive knowledge monitoring scheme for autonomic network trust management the ATMS is to provide an uniform up-to-date trust knowledge throughout the network with a minimum monitoring overhead, reducing the impact of double-face attacks. ATMS is characterized by its protocol and trust framework independence, self-adaptation, simplicity and low computational intensiveness. It consists in two propositions: first, to identify main quantitative evaluation criteria contributing to the efficiency of autonomic architectures,to allow the straightforward applicability of the identified evaluation criteria in different network contexts, a measurement technique has been proposed for each of the proposed evaluation criteria. Second, for proposed a quantitative methodology for evaluating and comparing autonomic network architectures in Our methodology is based on fuzzy-logic and correlates the identi fied criteria to obtain an overall measure of autonomicity. This autonomicity score can be used to compare quantitatively different existing autonomic architectures and classifies them approximatively regarding to the network management efficiency and performance. The set of reference scenarios, evaluating the efficiency of the architecture in terms of individual evaluation criteria as well as the overall degree of autonomicity in different networks.

The initial level is maintained by High skill supporters to looking and to find the state of networking state and changes are made into it.The managed legvel represents the system to present in a brilliant way to decrease thw work of skill supporters and to act them according to changes in the system when it occurred. To Understand the behavior of system it whould be monitor in the predictive level. To suggest or to provide some action without human intervention it is adapted in the adaptive level.One of the major challenges of research in the architectural area of autonomic networking is to provide the current state- of-the art of the work carrying out on both classification and evaluation of autonomic computing solutions. At Beginning, the proposed categorization is too generic to differentiate between existing architectures regarding specific relevant characteristics or autonomic techniques. Because, one architecture may belong to more than one type of category. Hence, the evaluation approach of each proposed class of autonomic architectures is to be provided.Therefore,a comprehensive work focusing on each of the MAPE-K components and their implementation is to be provided .The four elements of autonomicity as follows: Support, Core, Autonomous and Autonomic. The support element is when one particular aspect or component of an architecture affecting the performance of the complete architecture is considered. An autonomic monitoring tool is an example of support class. The Core element describes an end-to-end self-management solution for a core application.





An end-to-end IP-mobile solution is used for the supporting of mobility of terminals.To provide a end-to-end emergent intelligent solution the autonomous element is to be produced for considering more than one application. Then, the system is not measuring its own performance but dapting how it carries out its task to perform its performance .Then at autonomic level, a full generic architecture is considered which reflects its own performance and adapts itself accordingly. In this level, the

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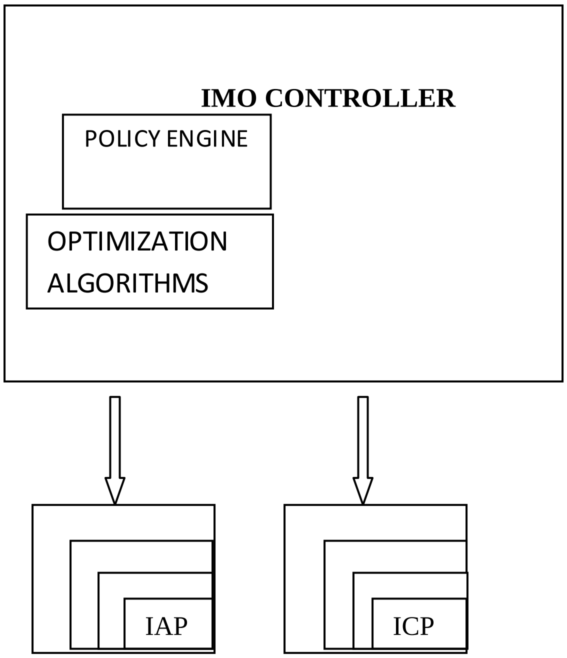
administrator participates only in initial parameterizing of autonomic manager(s) and it is up to the network to operate smoothly afterwards. The main limitation of this model is that it is too generic and does not describe how one



can compare between two solutions belonging to a same category.

By focusing on each of the management functionalities (monitoring, analysis, plan and execution) is presented and provided a coherent classification methodology to classify existing research efforts.By identifying six classes of properties to enable the architecture with autonomic principles,these properties are degree of activity, ability to learn, granularity of the intelligence, degree of awareness, memory strength and degree of self-operation.It is need to describe how the proposed evaluation criteria can be measured and by contrast with our paper, the authors analyze the main contributions on each MAPE-K component separately and need focuson complete ANM architectures.Here, informing some of the major research projects targeting the development of such architectures, without describing approaches used for each of the autonomic architecture's building blocks.

Information Management Overlay (IMO)IMO **is** acts as an solution for self-management functionalities, these are the IMO collects, processes, and disseminates information from/to the network entities and management applications . As represented in above figure , the IMO is including the composition of the IMO controller and a set of IMO-nodes placed dynamically in appropriate points of the network, to form a monitoring hierarchy. IMO-nodes are in charge of information retrieval and act as Information collection point (ICP) or/and as Information aggregation point (IAP). The context information is collected by ICP and periodically sent to the nearest IAP node which processes, aggregates and transmits the data to a node that exploits this information (i.e. a management application).

The IMO Controller is considered as a policy-based centralized controller and the functionalities are responsible for the setup and optimization of the overlay regarding the optimization requirements of management applications (e.g. CPU/memory, network resources, or response time)To make easier the analyusis and the practical implementation and the design of managenment, the AutoI IMO is represented as a combination and a group of planes. Here each plane perform as a combination of the Management tasks.1)Virtualization plane and 2)Management plane.An AutoI planes are defined with Virtualization plane and Management plane.The virtualization plane focused on the physical resources including the migration and reconfiguration of sthe network resources.The virtualization plane abstracts all the vitualization issues awsay from the all other components of the architecture.The Management plane interacts with the maintainence and creation of the ACL's and those loops are related by Autonomic management systems(AMS's) which performs the MAPE-K function of an ACL.Autonomic Management represents an administrative or organization boundary called AMS'S.

ANA project architecture: ANA project architecture is mainly focused upon the designing and developing of a clean-slate meta-management architecture with inherent autonomic behaviors to flexibly host, interconnect and federate multiple heterogenous networks .ANA separates competing interests in the network into smaller and easier manageable parts, called Compartments.ANA defines compartments that are able to interwork and does not impose how network compartments should work internally, left over the addressing and naming up to the compartment. Consequently, each compartment implements the operational rules and administrative policies for its communication context. It defines:

- To find a way to join and leave a compartment: member registration, trust model, authentication, etc.
- In what way to reach (communicate with) another member: peer resolution, addressing, routing, forwarding, etc.
- The compartment wide policies: interaction rules with "external world", the compartment boundaries (administrative or technical), peerings with other compartments, etc.

A compartment is composed of a set of Node Compartments (NCs) which are the conceptual view of the compartment members, representing the available networking resources. An ANA node compartment hosts following compartment abstractions:

Functional Block (FB): Functional Block is responsible for any functionality is needed to communicate for a compartment or inside in a compartment through corresponding functional block. The FB can also beknown ass the processing elements or tasks controlled by an ANA node that promotes eachhe compartment stack. With ANA node several FB's may be succeed to ensure a complete service. The combination of FBs is dynamic and it may be dynamically build and dynamically re-composed at runtime Information Channel (IC): Communication inside a com

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partment is mediated via information channels which are the entry points to beforehand set up communication channels.

Information Dispatch Point (IDP): The Information dispatch point represents a initial indication for infor mation channel when it is to be bound. The IDP enables the network to reach the destination in an address in a neutral way.Each compartment defines a Resolution process for return accessing to an IDP that can be used to reach the target NC member(s) via the bounded IC.

Not All aT Once! (NATO!) For finding the exact estimating the size of a group of nodes affected by the same event, is an efficient statistical probability scheme.The proposed NATO! algorithm suggests INM to decide which management configuration is more appropriate for different network services. For example,with a specific request in the case of QoS routing, the QoS MC of the strategic node can interrogate all the devices within its domain. (i.e. what nodes are able to accommodate a flow with specific QoS requirements). The QoS MC uses either a QoS-aware routing or an alternative mechanism (e.g. network coding.An efficient method introduced for evaluating different architectures from the learning capability point of view and it consists of computing the degree of open-adaptability of the architecture. Learning index is an unified index which is composed from contributive factors characterizing the learning capability of the architecture. These factors are:

The ratio of the number of learnable management objects (policies, weights, parameters), |L|, versus the total number of network management parameters, |M|.The coefficient of learning ability c_A , which is the relative number of well-performing learning-based decisions. This factor is inspired from and can be computed based on the analysis of the evolution of learnable parameters:

Equations:

Max 1 E{D } E{D}
cA ={ − E{NDr } , 0} + min{ E{PD} , 1}

where *E{D}* is the average number of total correct learning-based decisions. *E{D}* is the average number of total incorrect learning-based decisions. *E{PD}* is the total number of correct decisions of "Target Achievers" (learning objects with positive evolution towards the goal). *E{ND^r}* is the total number of incorrect decisions of "Target Damagers" (learning objects with negative evolution against the goal).

- The efficiency of learning e_A, which is the overall degree of well-performance of the learning. This factor can be calculated based on the amount of progress towards the target:

$$eA = \frac{K\{PD\}}{K\{PD\} + K\{NDr\}}$$

where K{PD} is the average of total percent of learning object's enhancement of "Target Achievers".

K{ND} is the average of total percent of learning object's declination of "Target Damagers".

- Standard deviation of global views: To evaluate the quality of network wide awareness and showing the degree of uniformity of the global view in the network uses the standard deviation of global views.But a lower standard deviation indicates a better quality of the network views. Ideally, the standard deviation should converge to zero.
  Correctness: The correctness includeds in the fraction of nodes able to evaluate their relative state correctly. This standarad is calculated by based upon the average of all local views within the network, giving the exact value for a perfect global view. The correctness metric is then obtained by comparing the ratio of nodes which have a same result (below or above the network-wide average) when their local views is compared respectively against the network- wide average and the node's global view. Obviously,a higher value of the correctness factor signifies a more convergent view among network nodes.

Quality of Services (QoS):To increase the overall performances of the network in terms of quality of service, the best way is Autonomic networking. The QoS concludes the exact mean to measure the efficiency of the autonomic solution. By measuring on quantitative measurements of domain-specific metrics, more usually packet delivery ratio (PDR) or throughput, loss rate, end-to-end delay, jitter, etc.The QoS metrics may be different regarding to the objectives and applications of the target network. For example, when a MANET is installed for transferring files with the attendee in a conference scenario, the prominent required QoS is the packet delivery ratio. Whereas, in the case of rescue operation, the delay, loss rate and jitter are more important to the application.There are two types of costs to define one is,Cost of autonomicity: The cost of autonomicity is defined as the overhead of extra autonomic activity which includes internal cost (e.g. CPU usage, storage, etc.) as well as external cost (e.g. overhead of knowledge monitoring, distributed intelligent adaptation, etc.) and Cost of services: The cost of services is defined as the amount of control traffic generated to support prerequisite requirements of network service and the cost of services can be divided into internal and external cost. For the case of a routing protocol service, the internal cost is the CPU usage and storage memory used to support the protocol.

The external cost is the amount of control traffic generated to assist the well-performance of the protocol IndexCost =Costint + min{ E{Overhead}/2.By considering a cognitive network of autonomic communication the cognitive network is combination of set of cognitive nodes exchanging cognitive information between each other nodes and cognitive node is made up three functional elements:

- Cognitive Plane: The cognitive plane is responsible for data analysis and decision making processes, leading to an optimal operational point given the network state.It handles the monitoring information from the protocol stack as well as controlling them by issuing configuration commands. The decision making is based on local or

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network-wide information.

- Cross-layer Coordination and Signaling Plane (CCSP): This plane provides an optimal signaling information delivery and acts as an interface between protocol stack layers and the cognitive plane.The existing task of layering information monitoring and configuring away from the cognitive plane. Network Cognitive Engine (NCE): The Network Cognitive Engine enhances the coordination of cognitive planes of different cognitive nodes, starting the network-wide scope of the architecture. The cognitive adaptation process is performed according to a quality feedback loop which consists of three phases: data

analysis, decision-making, and action. The cognitive plane look over the overall operation of the network or the performance of current protocol parameters setup according to well defined target quality metrics. For example, the quality metric could be:

- the overall packet delivery ratio for the overall network performance.
- the measured data rate for a physical layer parameter.
- the end-to-end delay for real-time multimedia applica-tions at the application layer.

EVALUATION OF AUTONOMIC NETWORK ARCHITECTURES

The field of autonomic networking is to be able to evaluate and compare the performances approaches that can be considered:

Qualitative evaluation: It consists of different systems compared to characteristics or properties on a non-numeric and discrete scale (e.g. categories, levels, etc.).

Quantitative evaluation: Itdefines about the comparision of different systems numerical measurements and quantities and y the main qualitative and quantitative evaluation criteria contributing to the degree of autonomicity of ANM architectures. Moreover, there is need to analyze and compare the characteristics of surveyed architectures based on the identified set of qualitative criteria.

Quantitative evaluation approach

By mentioning about the definition of the Quantitative evaluation the above ,included in using numeric measurements to compare ANM architectures. The quantitative evaluation is more useful for comparing ANM architectures and focus on objectives of the performance of two architectures addressing the same self-management properties for a same network type under same topology and network configurations can be compared using quantitative evaluation.There are two types of quantitative comparison can be defined1)To compare architectures performances regarding to one specific evaluation view.2The highly importance comparison view, by considering an overall performance measurement metric and calibrating scores across different system. By this, the second alternative has not been addressed in the existing literature and hence, is out of the scope of this survey. However, this evaluation view could be considered as an important future direction to progress the field of autonomic networking. The main quantitative evaluation criteria can be measured through Learning Index. An extreme potential of autonomic networking is its ability to learn from past experiences to enhance future operations and this logic implementation adaptation is happened to the optimal adaptation. For example, a policy based solution without learning capability may consider for any exceed of delay to a built in threshold as an indication of of congestion in its policies description. Therefore, for at each time if this threshold is exceed, then the manager decides to drop some non-priority packets to reduce the delay for QoS packets. In contrast to this, a learning-based solution would rethink the accuracy of previous

congestion perception by analyzing the success of past experiences.

Comparison of surveyed autonomic architectures:Here there is a description of major existing ANM architectures, highlighting the mechanisms used for each of their MAPE-K components and also described how autonomic elements of each architecture interact to each other in order to meet some autonomic objective properties by coherence to a significant number of architectures has been already proposed and different approaches has been taken by each of surveyed architectures. The comparison can be done either by comparing architectures regarding to the results of quantitative measurements or with regard to their qualitative properties.To compare ANM architecture quantitatively, different proposals have to be proposed with the same technology. The ANM architecture was initially evaluated for a particular self-management property and under a specific context of application.This paper proposed the set of evaluation criteria to compare qualitatively between architectures.

CONCLUSION

The autonomic networking architecture provides the solutions optimally all self-property functionalities and the major work provides a holistic view of research in the area of autonomic network management ANM architectures, which is to defined with the merits and demerits of existing architecture to go forward the full autonomicity.Here identifying of category in AutoI IMO architecture.By identifying the main standards that can be used to evaluate and compare the efficiency of autonomic architectures and it could be refined and their measurement can be adjusted by other metrics.Here the fact that the comparison of ANM architectures are designed and applied for management functionalities under same environments. By concluding that the existing architectures do not neither make use of learning mechanisms (except Cognitive Network architecture) nor security techniques which are prerequisite to any ideal autonomic solution and indicated that the use of learning mechanisms can significantly improve the performance of policy-based adaptation schemes towards the optimal solution.

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