Lecture Notes in Computer Science 9466

Commenced Publication in 1973
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Ahmed Bouajjani · Hugues Fauconnier (Eds.)

Networked Systems

Third International Conference, NETYS 2015
Agadir, Morocco, May 13–15, 2015
Revised Selected Papers

Springer

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ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-26849-1 ISBN 978-3-319-26850-7 (eBook)
DOI 10.1007/978-3-319-26850-7

Library of Congress Control Number: 2015954980

LNCS Sublibrary: SL5 – Computer Communication Networks and Telecommunications

Springer Cham Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

Message from the Program Chairs

NETYS 2015 received 133 submissions from 25 countries from all over the world. The reviewing process was undertaken by a Program Committee of 31 international experts in the areas of networking, distributed computing, security, formal methods, and verification. This process led to the definition of a strong scientific program. The Program Committee accepted 29 regular papers and 12 short papers. In addition, 22 papers were selected for poster presentations. Besides these high-quality contributions, the program of Netys 2015 included keynotes talks by three world-renowned researchers: Javier Esparza (Technische Universität München), Christoph Kirsch (University of Salzburg), and Madan Musuvathi (Microsoft Research).

We warmly thank all the authors for their great contributions, all the Program Committee members for their hard work and their commitment, all the external reviewers for their valuable help, and the three keynote speakers to whom we are deeply grateful for their support. Special thanks to the two conference general chairs, Mohammed Erradi (ENSIAS, Rabat), and Rachid Guerraoui (EPFL, Lausanne), for their invaluable guidance and tremendous help.

Ahmed Bouajjani
Hugues Fauconnier

Message from the General Chairs

The recent developments in the Internet as well as mobile networks, together with the progress of cloud computing technology, have changed the way people perceive computers, communicate, and do business. Today's Internet carries huge volumes of personal, business, and financial data, much of which are accessed wirelessly through mobile devices. In addition, cloud computing technology is providing a shared pool of configurable computing resources (hardware and software: e.g., networks, servers, storage, applications, and services) that are delivered as services over a diversity of network technologies. Advances in Web technologies, social networking, and middleware platforms have raised new opportunities for the implementation of novel applications and the provision of high-quality services over connected devices. This allows participatory information sharing, interoperability, and collaboration on the World Wide Web. All these technologies can be gathered under the umbrella of networked systems.

After the great success of the previous editions of the International Conference on Networked Systems (NETYS 2013 and NETYS 2014), this year's edition, NETYS 2015, took place in the sunny city Agadir, Morocco, during May 11–15, 2015. It provided a forum to report on the best practices and novel algorithms, results, and techniques in networked systems. To face the challenge of building robust distributed systems and to protect such networked systems and data from attack and abuse, this edition gathered researchers and experts from both the community of distributed systems and the community of formal verification; it also addressed the challenging issues related to networked systems such as multi-core architectures, concurrent and distributed algorithms, middleware environments, storage clusters, social networks, peer-to-peer networks, sensor networks, wireless and mobile networks, as well as privacy and security measures.

We would like to express our cordial thanks to our partners and sponsors for their permanent trust and support. A special thanks goes to Springer, who have ensured that the proceedings, since the first edition of NETYS, reach a wide readership around the world. We are grateful to the Program Committee co-chairs, the session chairs, and the Program Committee members for their excellent work and we wish to take this opportunity to congratulate all the authors for the high quality displayed in their papers and to thank all the participants for their support and interest. Finally, no conference can be a success without the valuable contribution of the Organizing Committee, whom we thank for their dedication and hard work in making this conference a success.

Mohammed Erradi
Rachid Guerraoui

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Abstracts of Posters

Evaluation of MCR Protocol for WSNs

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Abstract. The networking techniques now allow the easily deployment of sensor networks, even in places with difficult access. The evolution of wireless communication has extended the application of sensor network. The application in a medical context requires operation at a low consumption of energy. Another constraint is related to the quality of information sent by the network. And in order to respond to these criteria, different methods of wireless communication area used. In this work, we evaluate a multi-hop clustering routing protocol to resolve our constraint by comparing his concept with HEED protocol, who is a single hope clustering routing protocol, who reduce the communication overhead by selecting a cluster head to forward data to base station via one hop. Comparing the concept of the MCR with that of HEED, we notice that it offers best performance in terms of network lifetime and consumption of energy and this is due to the concept of the gateway node that is used to transmit data from cluster head to BS. With that the CHs can keep the energy in data transmission and the gateway node by not participating in clustering. In addition CHs rotation is adopted to balance the consumption of energy.

Keywords: WSN · Gateway node · MCR · Clustering · Single hop clustering routing

The First Step Towards Securing a Distributed Collaborative System

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Abstract. In a distributed collaborative system dedicated to remote diagnosis in eHealth, one fundamental requirement is to secure the data exchange and the interactions among the collaborative users. To tackle this problem, we need first to provide a formal model describing the involved entities and their interactions during a collaborative session. As a formal description of the distributed eHealth system, we propose an emergency medical system containing three organizations (hospitals, university hospitals and emergency medical services). Each organization is composed of subjects (human resources) and objects (medical files, scans …). The collaborative interactions are considered as a sequence of accesses. Each access is modeled by an automaton with four states linked by labeled transitions, and represented by a graph whose nodes and arcs are the states and the transitions of the automaton respectively. The final states of each automaton are associated to a specific action (e.g. read). The proposed model can be used to verify whether the collaborative session answers the security requirements of the involved organizations.

Minimum Interference in Wireless Mesh Networks

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Abstract. In this paper, we consider a multi-channel multi-radio wireless mesh network. Most of the work on channel allocation propose to allocate orthogonal channels which will reduce the flow in high-density networks. In our work, we address the problem of channel assignment by using a new metric MICE that uses metric uses partially overlapping channels POC and considers the channel separation and the distance between the nodes to allocate the best channels to the network in order to minimize the overall interference. Compared to metrics as WCETT and MIC, our metric considers both: inter-flow and intra-flow interference, and both the distance between nodes and channel separation which will allow us to choose the best set of channels that will reduce the network overall interference. It has been shown that considering different factors that affects the interference will positively affects the overall interference problem in a mesh network. In our future work, we plan to extend the interference metric for multicast routing in multi-radio/multi-channel mesh networks.

Keywords: Multi-channel · Multi-radio · Mesh · Interference · Channel assignment

A Routing Algorithm for Wireless Sensor Networks Based on Ant Colony Optimization and Multi-criteria Decision Aid

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Abstract. Wireless Sensor Networks (WSN) are becoming a key building block of our communication infrastructure; as they find applications in several military as well as civilian domains. Examples range from target tracking to monitoring and environmental scenarios. Due to their use and design, WSN are facing many problems, which can be categorized as optimization problems such as energy consumption, routing and quality of service. Many researchers have done research to solve these problems and recently new class of routing algorithms came up which is based on Swarm Intelligence. In this poster, we propose a routing algorithm for WSN based on Ant Colony Optimization (ACO) heuristic and Multi-criteria Decision Aid (MCDA) methods. Allying ACO heuristic to MCDA methods result in an approach that facilitate tackling complex decision problems that are characterized by a great number of possible choices as in routing in WSN. The basic idea would be to perform the search through the solution space in a more directed manner, already taking valuable information into account. This will result in an improved routing protocol for WSN; designed to optimize the node power consumption and increase network lifetime as long as possible, while data transmission is attained efficiently.

Keywords: Ad-hoc networks · Wireless sensor networks · Ant colony optimization · Multi-criteria decision aid · Routing · Swarm intelligence

Hybrid Intrusion Detection System in Cloud Computing (Hy-CIDS)

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Abstract. Actually, Cloud Computing is an exciting field, but security and privacy is a major obstacle to its success because of its open and distributed architecture that is vulnerable to intruders. In this context, Intrusion Detection System (IDS) is the most common mechanism used to detect attacks in the cloud environment. This article gives an overview of different intrusions, IDS types and techniques, as we proposed a hybrid IDS architecture (Hy-CIDS) that uses three techniques to know the artificial neural networks, Bayesian networks and genetic algorithms. This architecture aims to increase the detection accuracy with low false positive rate.

Keywords: Cloud computing · Security · Attacks · Intrusion detection system

An Overview of VANET: Architectures, Challenges and Routing Protocols

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Abstract. Vehicular ad hoc networking (VANET) is relatively a new environment compared to other wireless networks. In the last years, it has gained in popularity because of its practice in a wide range of applications, mainly in transferring information between auto-mobiles. Therefore the network topology changes rapidly and has a special mobility pattern. The features of vehicular ad hoc routing protocols are crucial and represent an important issue for the intelligent transportation system (ITS). As a condition to communication, the VANET routing protocols must adjust efficiently to the varying route between network nodes and the rapidity of moving vehicles. In this paper, we describe the principal characteristics and discuss the research challenges of routing in this type of networks. We also discuss routing protocols in VANETs. In addition, the advantages and disadvantages of the current protocols in this field are presented.

Keywords: VANET · ITS · V2V · V2I · Routing protocols

Performance Evaluation of Routing Protocols in VANET

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Abstract. Vehicular Ad Hoc Network (VANET) is an instance of MANETs that establishes wireless connections between vehicles and vehicle to road side equipments to provide scalable and cost-effective solutions for the applications of the Intelligent Transportation System (ITS) such as traffic safety, dynamic route planning, and context-aware advertisement using short range wireless communication. to function properly, these applications require efficient routing protocols adapted to vehicular specific characteristics and requirements. the routing performance in VANET is dependent to the availability and stability of wireless links, which makes it a crucial parameter in order to obtain accurate performance measurements. In this paper, we evaluate AODV and DSDV performance under varying metrics such as node mobility and traffic load in realistic urban environment.

Keywords: Urban environment · VANET · Routing protocols · Simulation · Performance

Architecture of Remote Virtual Labs as a Service in the Cloud Computing

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Abstract. Today, Cloud Computing is becoming an attractive technology used in virtualization of resources even in education filed. In fact, it's used in e-learning scenarios due to dynamic scalability offered by the different services of Cloud Computing. we propose an architecture of using Cloud computing to delivering labs as a solution of limited availability of resources in classical labs, it can be viewed as a service in the cloud computing, This architecture fits very well to remote virtual labs requirement like using remote services to provide on-demand access to lab's documentations, lab's resources or lab's realization; we show in this paper that how and why the development of a platform of labs and integrate it into the "cloud computing" is essential.

Keywords: Cloud computing · E-learning · Remote virtual labs · Remote services

Dynamic Integration of Security Requirements in Web Service Composition

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Abstract. Most of the current researches in the web service composition domain are mainly focused on issues about how to ensure desired functional requirements and how to fulfill them. However, it's highly recommended to provide, in addition to functional needs satisfaction, more support for security requirements especially for web services exchanging sensitive information. In this work we propose an approach that generates automatically a composite web service according to user's functional requirements and security constraints. This generation is based on our previous developed DIVISE Framework (DIscovery and Visual Interactive web Service Engine). This framework has the capability to generate a BPEL code of the needed composite web services according to expressed functional requirements. However, to secure the generated composite web services and especially the selected sensitive web services, the current contribution consists on enhancing our DIVISE framework by adding a security layer. This layer has the faculty to inject specific security tags into the generated BPEL code. These tags are related to security requirements in term of web services such as Authentication, Authorization, etc.

Keywords: Web service composition · Security requirements · DIVISE framework

Modeling Wireless Sensor Networks

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Abstract. Wireless Sensor Network (WSN) is a network made of autonomous nodes (sensors) that collect information about its environment and send it back to a central point (base station, or a sink), WSN has so much potentials and possibilities in automation especially data collection. RFID is a technology that allows a verity of items to be automatically identified through small microchips attached to them. Petri Net is a sophisticated graphical modeling technique that relies on three components (places, transitions and tokens) to model complex systems on different levels of abstraction. This poster try to present the main challenges facing the process of modeling WSN using Petri Nets and the integration of RFID technology to form a hybrid network which would lead the ground for the Internet of Things (IoT).

Keywords: Wireless sensor network · Modeling · Petri net · IoT · RFID · QoS

Geographical Query Reformulation Based on Spatial Taxonomies Constructed Using the Apriori Algorithm

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Abstract. Geographical queries needs a special treatment by Information Retrieval systems (IRS) due to their specificities. Most of search engines are ignoring this fact. In this paper, we propose an approach for building a geographical taxonomy of adjacency automatically in order to use it for reformulating the spatial part of the query. This approach exploit the best-ranked documents retrieved when submitting the spatial entities, which are composed of the spatial relation and a noun of a city. Then, we construct a database of transactions, considering each document extracted as a transaction containing the nouns of the cities sharing the same country of the query's city. The association rules algorithm Apriori is applied to this database in order to extract rules that will form the country's taxonomy. Experiments shows that query reformulation using the taxonomy resulted from our proposed approach improves the effectiveness and the precision of the IRS.

Counting Spanning Trees in Bipartite and Reduced Pseudofractal Scale-Free Network

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Abstract. The number of spanning trees is an important measure of the reliability of a wireless sensor network (WSN) in order to reduce energy consumption and improve network capacity. In this paper, we are interested by the pseudo fractal scale-free network. This type of fractal is considered as a self-similar pattern, it has found applications in many areas of science and engineering... We propose two very important combinatorial approaches facilitating the enumeration of spanning trees of a network containing a large number of nodes and links such as the bipartition and reduction. These techniques allow changing the topological nature of a network, by multiplying the number of nodes in the case of the bipartion approach, or by multiplying the number of links in the case of the reduction approach. The aim of these approaches is the evaluation of the complexity of an infinite network which cannot be find by using the existing methods.

Keywords: WSN · Spanning trees · Pseudofractal scale-free · Bipartition · Reduction

Prosumers Integration and the Hybrid Communication in Smart Grid Context

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Abstract. The success of the smart grid depends on the integration of the prosumers into the grid and his Reactivity, Many stakeholders are involved in, but the role of consumes is neglected, recently the prosumers has been became a very important entity to migrate to Smart Grids because he can consume, produce and powering the electrical grid. In this context, Smart grids, smart meters, demand side management and smart appliances play a crucial role, Inefficient use of these appliances causes a waste of energy and bad management of the electricity, leading to a reduction of this energy wasting behavior. The DSM helps to reduce peak demand and energy consumption while still allowing for the same level of comfort within the household. The challenge is to ensure the interoperability of the PLC, WSN and RFID into an hybrid communication using a mix of technologies, collection data from a heterogeneous platform, analysis of data, save for statistic and offer the information to the end user like a service appliances. This makes it possible to understand the origin of its electricity consumption, identify energy savings, reduce consummation, real-time eco-feedback displays in the home, help to make decision to turn on/off the electrical machine in the peak hours and the most important is to estimate the electrical energy demand.

Keywords: Smart grid · Smart meter · Smart appliances · NIALM · Prosumers · Communications · WSN · Demand management

Integrating Communication-Centric Programming in the Design of Distributed Systems

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Abstract. Distributed Systems are mainly built to provide services; this is why the design is often focused on Service Oriented Architecture. Thus, after the design process, developers find themselves dealing with complex and discrete problems like live locks, race conditions, and deadlocks. Distributed Systems are concurrent by definition, and neglecting concurrency can lead to a complete system re-engineering. In this poster, we will discuss the importance of handling the process view during the design of Distributed Systems. Communication-Centric Programming techniques describe the communication behavior of systems components using formal calculi. Using it during the modeling phase can help to detect problems and then address the right local or global solutions; the final goal of the proposed approach is to achieve a derivation of design components from a distributed system global specification before starting the development phase. In order to illustrate this, we will show step by step, an example of how to integrate Communication Centric Programming while using a Service oriented approach for the design.

Keywords: Distributed systems design · Communication centric programming · Software architecture · Service oriented architecture

Mobility Models Impact on the Throughput in MANET

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Abstract. Mobile ad hoc network (MANET) has become an interesting field of the Next Generation Network. It includes several interconnected nodes in charge of delivering information from a given node to another. Routing allows, using routing protocols, choosing the suitable path to reach the destination with the minimum delay. Therefore, it is important to have knowledge about the appropriate protocol for the studied scenarios. The current study is dedicated to performance analysis of the Throughput using five protocols and four mobility models under two different sizes of area. Simulation results demonstrate that, in all mobility models used the throughput works better in the small area than it does in the large one because the number of the received packets is important. Each one of the proposed routing protocol provides high performance for different strategies for a given network scenario. This study has proven that, in the case of throughput, the reactive routing protocols outperform the proactive and hybrid protocols in small and large areas. Moreover, it can be noted that the AODV is the most suitable protocol for throughput in all used mobility models.

Keywords: MANET · Routing protocols · Mobility models · NS2 · BoonMotion

Performance Analysis of ARQ and FEC in WBANs

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Abstract. Recent developments in wireless sensor network and integrated circuits has enabled physiological, intelligent and micro-components sensors nodes strategically are attached on clothing of human body or even implanted under the skin. This exciting new area of research is called Wireless Body Area Networks (WBANs). One of the major challenges in this network is to prolong the lifetime of network. In addition, the data transmitted from the sensors are vulnerable to corruption by noisy channels and others. To deal with these two problems of instability of the radio channel and the energy consumption, several solutions have been proposed in literature, and that they can be grouped into two majors error control modes: ARQ (Automatic Repeat reQuest) and FEC (Forward Error correction). In this context, we evaluated the performances in terms of energy consumption provided by ARQ and FEC in WBAN to show who performs the best. We consider the fountain codes that derives from the FEC, due to its low encoding/decoding complexity and its adaptation with all channels. Our result show that the use of the fountain code in wireless body area networks can significantly increase the node and network lifetime, compared to ARQ.

Keywords: WBAN · ARQ · FEC · Fountain code · Energy consumption

A Generic Natural Language Interface for Database Interface Based on Machine Learning Approach

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Abstract. In the world of modern computing, one of the main sources of information is the database. For extracting information from a database system, it is necessary to formulate a query using database query languages such as SQL (Structured Query Language). However casual users who don't understand SQL can't write such queries. So, asking questions to databases in natural language is a very important method. But without any help, computers cannot understand this language; that is why it is essential to develop an interface that can be able to translate user's query given in natural language to an equivalent one in database query language.

In this paper we present the Architecture and the implementation of a generic natural language query interface for relational database based on machine learning approach. The interface functions independently of the database domain and automatically improves through experience its knowledge base. These properties will certainly provide an interface respecting the qualities of software such as genericity, adaptability and extensibility.

Keywords: Databases · Natural language · XML · Machine learning

Impact of Malicious Behavior on AODV Routing Protocol

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Abstract. Mobile Ad-Hoc Networks (MANETs) is a collection of autonomous nodes that are self-managed without any existing infrastructure and centralized administration. However, the lack of centralized monitoring and the dynamic topology makes the routing protocol more vulnerable and defenseless to different security attacks. In this paper, we focus on the behavior of the Ad hoc Ondemand Distance Vector (AODV) routing protocol under attacks which are mainly Black Hole attack, Flooding attack and Rushing attack in the network layer. Also, we simulate these routing attacks to analyze their impact on AODV protocol using various performance parameters like throughput, packet delivery ratio and end to end delay using different simulation parameters with the NS-2 network simulator. The simulation results show that the black hole and flooding attacks have a severe impact on the network performance while the rushing attack have a less significant effect on the network performance.

Keywords: MANETs · AODV · Black hole attack · Flooding attack · Rushing attack

An Access Control Model for Collaborative Cloud Environment

Mohamed Amine Madani and Mohammed Erradi

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Abstract. Nowadays, collaborative applications are among services that can be provided by the cloud computing. They enable collaboration among users from the same or different tenants of a given cloud provider. During collaborations, the participants need to access and use resources held by other collaborating users. These resources often contain sensitive data. They are meant to be shared only during specific collaboration sessions. In this context, the security of the shared resources in collaborative session becomes an important issue that must be addressed. After analyzing the access control approaches related to the collaboration in the cloud environment, we noticed that the existing access control models do not provide concepts to secure resources shared among users in collaborative sessions. Moreover, the problem becomes more complex when the shared resources reside in different tenants within the cloud environment. In our work, we propose an approach that ensures access control to the shared resources in a collaborative session in multi-tenants environments. We suggest CBAC, the Collaboration-based Access Control. CBAC consists of an extended version of the OrBAC model. CBAC defines new entities to support access control in collaborative sessions. The suggested model has been implemented within Swift component in the open source cloud-computing platform OpenStack. Currently, we are enforcing CBAC by adding new entities and trust relationships in order to support access control when the collaboration involves resources of multiples tenants.

Keywords: Cloud computing · Multi-tenancy · Trust · Collaborative session · Access control · OpenStack

Social Networks: For Increase More Interactions and Feedbacks

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Abstract. This paper tackles the social networks. It actually gives an analysis about the reliability of Facebook pages according to fans' feedback, to figure out Facebook users' needs and recognize their satisfactions according to their posts. In order to check this strategy we felt the need to create an online survey, which was conducted from November 17th, 2014 to November 21st, 2014 by Computer Science Research Laboratory (LARI) at the Mohammed first University-Oujda. The paper presents all results of this survey and also presents an experimentation that we have achieved, so as to know the most attractive types of posts by which we set a strategy to increase the feedback rate.

Keywords: Social networks · Increase of feedbacks · Facebook · Reach rate

Clustering Algorithm in Vehicular Networks

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Abstract. Vehicular networks have moved from simple curiosity to become today an interest both from the point of view of the automotive industry as networks and service operators. These networks are indeed an emerging class of wireless networks for the exchange of data between vehicles and between vehicles and infrastructure. VANETs will enhance driver safety and will enable the dissemination of traffic and road condition. VANETs suffer from high mobility, high node density and the hidden nodes problem. VANETs have a highlymobile environment with a rapidly changing network topology. In cluster-based routing, a virtual network infrastructure must be created through the clustering of nodes in order to provide scalability [1]. Cluster-based approaches have been applied in VANETs, because the clusters reduce the overhead, delay, and minimize collisions, providing load balance in large scale networks. Clusters are formed by a clustering algorithm. In a high mobility environment the clusters usually are unstable. Cluster stability is an important goal that clustering algorithms try to achieve and is considered as a measure of performance of a clustering algorithm. Cluster stability can be defined in different ways. In this paper, we propose a model which seeks to determine the value of stability of nodes from the average speed, density of the nodes, and the difference in distance parameters. The proposed model possesses a better cluster stability, where stability is defined by long cluster-head duration, long cluster member duration, and low rate of cluster-head change.

Keywords: VANET · Vehicular ad hoc networks · Clustering · Stability

Evaluation of Association Rules Extraction Algorithms

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Abstract. Association rules Extraction is a leading task, which attracted the attention of researchers, it generally spend two important steps, in the first is the extraction of frequent items, and the second is extracting association rules from this frequent items. This extraction is a difficult task, costly in terms of response time and memory space as the number of frequent items is exponential to the number of items in database. Many algorithms have been designed to answer these problems. Nevertheless, the high number of algorithms is itself an obstacle to the ability of expert choice. In this context we propose an approach to make a good choice of extraction algorithm based on multiple criteria analysis.

Keywords: Algorithms · Data mining · Knowledge discovery in database

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