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Capsule Reviews

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The Capsule Reviews are intended to provide a short succinct review of each paper in the issue in order to bring to a wider readership. The Capsule Reviews were compiled by Fairouz Kamareddine. Professor Kamareddine is an Associate Editor of *The Computer Journal* and is based in the Department of Mathematical and Computer Sciences at Heriot-Watt University, Edinburgh, UK.

Aggregation Dynamics in Overlay Networks and Their Implications for Self-Organized Distributed Applications. SAFFRE, TATESON, HALLOY, SHACKLETON, AND DENEUBOURG

Recent studies in autonomic communications have highlighted the need to coordinate and organize the actions of many services. This paper advocates the idea that such coordination is best engineered into the underlying system as self-organizing principles, and presents a principled analysis of a self-organizing overlay that is more inherent in the design and behaviour of the system as a whole. This paper concentrates on approaches that cause systems to reconfigure themselves from within in response to changes in perceived demand.

The focus is on service provision via a peer-to-peer (P2P) overlay network. Here, components are distributed across a collection of processing nodes and hence in cooperative service provision, the key objective is to reach a configuration in which interactions are limited to first neighbours. In order to achieve this, the paper starts by giving in Section 2, a simple on-demand clustering algorithm where communications occur exclusively between first neighbours.

Since such cluster formation is conditional on the nodes following simple local rules, the authors move on to explore the dynamics of a population that can enjoy a mixture of behaviours. In Section 3, the authors consider two behaviours: clustering (where the nodes request links to new neighbours of the same type as themselves) and reverse-clustering (where the nodes request links to new neighbours of a type different from themselves). The authors show that even in this mixed network, self-organization occurs. In Section 4, the authors show how the local 'on demand' clustering rules can generate and maintain a collaborative overlay that improves the system as a whole.

To do so, the paper proposes a dynamical description of the system and then proceeds to carry out a simulated implementation and numerical experiments aimed at studying the load-balancing properties of the proposed overlay construction. Interesting results emerge during these experiments (for example, overloaded elements effectively succeed in surrounding themselves with helpers that help with their overloaded tasks).

Dynamic Selection of a Video Content Adaptation Strategy from a Pareto Front. SOFOKLEOUS AND ANGELIDES

This article concentrates on the process of selection of a video content and adaptation strategy in environments like the dynamic content adaptation framework (DCAF). The article aims to improve such a process by searching for a best-fit strategy. After Section 1, the paper extensively discusses in Section 2 the related work on usage environment and content adaptation schemes and gives the common threads and research challenges that arise from adapting content and usage environments. Thereafter in Section 3, the authors introduce DCAF which is a complete MPEG-21 framework for adapting video content with reference to the usage environment requirements and the constraints placed on resources by audio-visual content. DCAF combines the use of genetic algorithms and Pareto optimality and adapts video content by randomly selecting an adaptation strategy from the Pareto front. This section introduces the various layers (XML, Java and adaptation) of MPEG-21. The adaptation layer consists of the adaptation decision engine (ADE) and the resource adaptation engine (RAE). ADE extracts a Pareto front of optimal adaptation policy binding (APB) while the RAE uses a randomly selected optimal APB to adapt the original video. This paper proposes to refine the search for a best-fit optimal chromosome. The paper does so by introducing in Section 4 the OADE, which uses self-organizing neural networks to rank the non-dominated chromosomes using prior knowledge. OADE acts as an intermediary between the ADE and the RAE and searches for the best-fit optimal chromosome. Section 5 gives the five phases of the video adaptation methodology and Section 6 analyses the performance of the proposed OADE. Section 7 concludes.

A Pragmatic Methodology for Testing Intrusion Prevention Systems. ZHONGQIANG CHEN, ALEX DELIS AND PETER WEI

Intrusion prevention systems (IPSs) attempt to avoid the protection weaknesses of a number of elements of network infrastructures (like firewalls, anti-virus systems and intrusion detection systems).

Although IPSs allow for both detection/prevention of evasive attacks and traffic normalization, there are a number of concerns with regard to their detection accuracy, successful blocking rate and overall performance. However, although testing IPSs is of utmost importance, it is also extremely challenging. This paper proposes a comprehensive methodology to systematically analyse and establish measurements for an IPS-under testing with respect to attack coverage, detection and prevention accuracy, reliability and performance under various kinds of traffic and attacks.

Section 2 reviews related work on testing methods for intrusion detection systems and explains why such approaches are unfeasible for IPSs. The paper then makes the case that an IPS test framework should be based on a trace-driven simulation engine. Section 3 introduces the proposed trace-driven simulation engine and the proposed IPS testbed termed IPS evaluator. In particular, this section introduces the design and architecture of the IPS evaluator and gives the trace-driven simulation engine (including addressing and routing issues) for IPS testing. Since it is important that the IPS evaluator can effectively distinguish traffic coming from attackers and victims, the authors ensure that the simulation engine automatically partitions packets in a traffic trace into parts based on their origin (attacker or victim) and use the Traffic Partitioner as well as the Packet Manipulator components to give the desired characteristics to the simulation engine. In this spirit, Section 4 describes the partitioning traffic traces for IPS testing and gives the manipulation operators for sharing traffic. New IPS test procedures are given in Section 5, which illustrates the effectiveness and performance of the proposal of the authors. At this stage, the ground is well set for the experimental evaluation of the proposed framework. In Section 6, the authors report on their experimentation and testing methodology to examine a number of IPSs in order to investigate their features and performance aspects. In particular, the effectiveness of attack coverage and prevention, and the performance of testing IPSs are studied in detail in this section. This is followed by a discussion of the results and possible future work.

A Location Prediction-Based Reactive Routing Protocol to Minimize the Number of Route Discoveries and Hop Count per Path in Mobile *Ad Hoc* Networks. NATARAJAN MEGHANATHAN

In a mobile *ad hoc* network (MANET), the operating transmission range of the dynamic distributed wireless nodes is limited meaning that MANET routing protocols are either reactive or proactive in nature.

Since reactive on-demand routing is preferred to the proactive, this paper concentrates on route discoveries during the use of the location information of the nodes. The author proposes a new MANET routing protocol called 'location prediction-based routing' (LPBR), which simultaneously minimizes the number of route discoveries and the number of hops in the paths of a source–destination session. The article starts by reviewing the MANET routing protocols (both topology-based and position-based routing protocols and their improved versions) and the hierarchical location service scheme used in the position-based routing protocols. Section 3 introduces the proposed location prediction-based routing protocol by first describing in detail the route-request reply cycle to collect location update vectors, the data packet transmission and route maintenance, how node location can be predicted using the location update vector and how the minimum hop can be predicted and the source notified. This section also discusses how prediction failure can be handled. Section 4 gives the simulation conditions that will be used to compare the proposed LPBR with the already discussed topology-based and position-based routing protocols. Section 5 gives the simulation results.