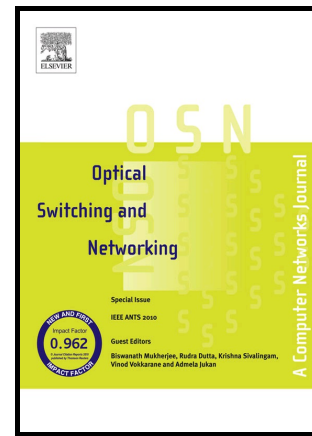


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Information-driven Network Resilience: Research Challenges and Perspectives

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Abstract

Internet designed over 40 years ago was originally focused on host-to-host message delivery in a best-effort manner. However, introduction of new applications over the years have brought about new requirements related with throughput, scalability, mobility, security, connectivity, and availability among others. Additionally, convergence of telecommunications, media, and information technology was responsible for transformation of the Internet into an integrated system enabling accessing, distributing, processing, storing, and managing the payload of these messages.

Users are now visibly more interested in receiving / accessing information independently of the network location of its host. This consideration in turn revived the interest in named data-driven networking (a.k.a. Information-Centric Networking – ICN). Instead of assuming that networks are limited to the manipulation of network locator space, the basic assumption underneath is that information can be named, addressed, and matched independently of its network location leaving in turn the possibility to match message delivery delay requirements.

In this paper, we summarize our research conducted in order to bring a completely different view / perspective of network resilience, originally defined as the ability of a network to assure an acceptable level of service in the face of various faults and challenges to normal operation. That is, instead of maintaining network reachability independently of its actual utility to the “end-points”, our research aimed at exchanging and confronting the key principles that would enable an information-driven resilience (networked) scheme. More precisely, knowing that the user utility function is mainly driven nowadays by information-related criteria such as accessibility (reachability), how to design network resilience schemes that would be directed toward that goal. The main challenge is thus: can one design resilience schemes that combine maximization of end-point utility function and minimization of the network-related cost?

Keywords

Information-centric networking, resilience, failures, availability, accessibility

1. Introduction

Following the seminal work of P. Baran [1] in the early 60’s, information is segmented into packets before being transmitted towards the destination (identified by its network attachment point a.k.a. network locator). Without anticipating the main consequences of such decomposition, P. Baran laid actually the distinction between *names* and *addresses*. Moreover as a result of this decomposition (between application and network data units), functionality of the network layer has been since more than 30 years confined to destination-based packet forwarding along logical communication channels identified by their (destination) address / network locator (connectivity function). Users are now visibly more interested in receiving / accessing information independently wherever it is located rather than accessing a particular node (or a host / server). This in turn gives rise to the Information-Centric Networking (ICN) concept [2], [3] with the basic assumption that information can be named, addressed, and matched independently of its network physical location leaving in turn the possibility to match message delivery delay requirements. However, nowadays networks are mainly used for information exchanges (distribution function).

On the other hand, in response to the increasing Internet traffic volume – 50% per year following the

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