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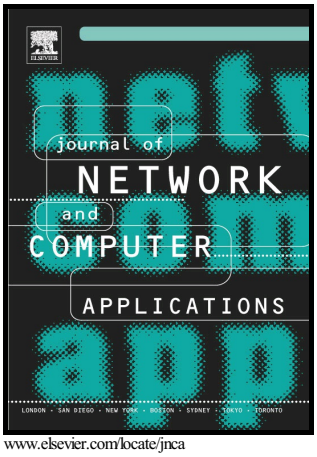

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A Monte-Carlo Approach to Lifespan Failure Performance Analysis of the Network Fabric in Modular Data Centers

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Abstract

Data centers have been evolved from a passive element of compute infrastructure to become an active, core part of any ICT solution. In particular, modular data centers (MDCs), which are a promising design approach to improve resiliency of data centers, can play a key role in deploying ICT infrastructure in remote and inhospitable environments in order to take advantage of low temperatures and hydro- and wind-electric capabilities. This is because of capability of the modular data centers to survive even in lack of continuous on-site maintenance and support. The most critical part of a data center is its network fabric that could impede the whole system even if all other components are fully functional, assuming that other analyses has been already performed to ensure the reliability of the underlying infrastructure and support systems. In this work, a complete failure analysis of modular data centers using failure models of various components including servers, switches, and links is performed using a proposed Monte-Carlo approach. The proposed Monte-Carlo approach, which is based on the concept of snapshots, allows us to effectively calculate the performance of a design along its lifespan even up to the terminal stages. To show the capabilities of the proposed approach, various network topologies, such as FatTree, BCube, MDCube, and their modifications are considered. The performance and also the lifespan of each topology design in presence of failures of their components are studied against the topology parameters.

Keywords: Monte-Carlo Analysis, Failure Analysis, Modular Data Centers, Network Topology.