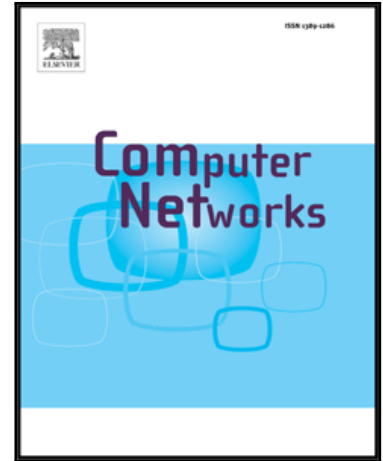


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## Enforcing Network Policy in Heterogeneous Network Function Box Environment

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### Abstract

Data center operators deploy a variety of both physical and virtual network functions boxes (NFBs) to take advantages of inherent efficiency offered by physical NFBs with the agility and flexibility of virtual ones. However, such heterogeneity faces great challenges in correct, efficient and dynamic network policy implementation because, firstly, existing schemes are limited to exclusively physical or virtual NFBs and not a mix, and secondly, NFBs can co-exist at various locations in the network as a result of emerging technologies such as Software Defined Networking (SDN) and network function virtualization (NFV).

In this paper, we propose a Heterogeneous network Policy enforcement scheme (HOOC) to overcome these challenges. We first formulate and model HOOC, which is shown to be *NP-Hard* by reducing from the Multiple Knapsack Problem (MKP). We then propose an efficient online algorithm that can achieve optimal latency-wise NF service chaining amongst heterogeneous NFBs. In addition, we also provide a greedy algorithm when operators prefer smaller run-time than optimality. Our simulation results show that HOOC is efficient and scalable whilst testbed implementation demonstrates that HOOC can be easily deployed in the data center environments.

*Keywords:* Data Center, Network Policy Management, Middleboxes, Network

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