Restoring Optical Cloud Services using Relocation

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EXTENDED ABSTRACT

Optical cloud is a very popular concept by which storage and computing resources (i.e., *IT resources*) are distributed over different *datacenter* (DC) locations interconnected via high-speed optical wavelength division multiplexing (WDM) links. In this paradigm cloud services are provisioned in an *anycast* fashion, where only the source node needs to be specified in the routing and resource assignment phase, while any DC (with enough IT resources) can be used to accommodate a cloud service. Anycast provisioning has a number of advantages already recognized by optical cloud providers [1][2]. This kind of provisioning paradigm allows, for example, for the live relocation of the already provisioned cloud services, referred to as the *service relocation* concept. It means that if the DC location is not essential for the execution of a certain cloud service, multiple relocations of the job to other DC locations are possible. This allows for a more efficient management of both the cloud and the transport network resources.

Service relocation has also the potential to bring an extra degree of flexibility to survivability strategies. By providing the option for relocating a cloud service it is possible to use a backup path terminating at a DC that is different from the one used by the primary path. This benefit has been assessed in the literature showing the ability to improve resources efficiency by using service relocation in conjunction with path protection strategies [1]. Another instance in which service relocation might be beneficial is when it is combined with restoration-based survivability strategies. These strategies are very efficient in using backup resources, i.e., they are dynamically provisioned only upon a failure, but restoration-based approaches suffer from a certain risk that the backup network resources might not be available when needed [3]. Service relocation can potentially alleviate this problem.

This talk presents a study where the objective is to investigate if relocating a cloud service disrupted by a network failure is beneficial in terms of both restorability and average connection availability. To this end the talk will present a number of results based on the solution of an efficient and scalable heuristic algorithm able to jointly solve the restoration and service relocation problem. These results are also benchmarked against the performance of an integer linear programming (ILP) model [4] optimizing the same objective function as the heuristic. In summary it can be concluded that by using relocation the average service availability can be significantly improved requiring only a minimal fraction of the cloud services to be relocated. In addition the proposed heuristic behaves very closely to the optimal ILP results in terms of both restorability and average connection availability.

Keywords: Cloud services, restoration, virtual machine migration, wavelength division multiplexing (WDM), data centers, resiliency,

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