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Path Protection Design for Robust Communication Networks

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SUMMARY

The robustness of Internet Protocol (IP) networks is increasing in importance in association with the enhanced role of the Internet in everyday life. Path protection technologies enhance the robustness of the networks by providing rapid and efficient recovery in the case of failures, if the backup paths as well as the normal paths are pre-designed.

This paper focuses on ways of designing path protection, which will be used when failures occur. The main concern in path protection design is the method of computing the normal and the backup path routes. Path route computation should be based on the design policies for robust networks. We should analyze the tradeoff between cost efficiency and robustness in considering these design policies. This is a similar condition to many reliable designs in other areas.

This tradeoff occurs when comparing dedicated and shared capacity policies, for example. In a dedicated capacity policy, the traffic volume of all backup paths is summed up as the necessary link capacity, while in a shared capacity policy, only the traffic volume of backup paths triggered by the same failure states is summed up. The shared capacity policy clearly leads to a more cost-efficient network, although at the loss of network robustness, than the dedicated capacity policy.

In this paper, we compare the numerical results of analyzing cost efficiency in the shared capacity policy with that in the dedicated capacity policy. The minimum cost path routes were computed based on the dedicated and the shared path policies using optimization methods to compare the cost efficiency in both design policies under various network conditions. Controversial issues on design policies for robust networks, which we would like to share with many experts in different areas, are introduced. These issues include what failure states we should prepare for in the qualitative as well as quantitative sense under the current situation (after the March 11, 2011 earthquake) in Japan.