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PhD Proposal

PhD Title:

Failure Recovery Approaches for Multi-Granular Optical Networks with Multicast Capability

PhD Description:

Without fast failure recovery mechanism, network failures can lead to severe disruption of network services and economical loss to network operators, services providers and customers. Multicast applications such as Internet Protocol Television (IPTV), telemedicine and distance learning are getting more and more popular. Up to now, research on multicast traffic protection has been focused on the wavelength level of granularity, which may introduce very high complexity and overall network implementation costs. Hence, we aim to develop novel protection approaches with multi-granularity (fiber-level, waveband-level, wavelength-level and sub-wavelength-level) for multicast traffic, so as to reduce the complexity, overall network implementation and maintenance costs.

We aim to investigate and develop novel and efficient multicast traffic protection approaches for future multi-granular optical networks, in order to guarantee the success of more and more popular interactive real-time constrained multicast applications.

We want to develop fault-tolerant and intelligent telecommunication networks. Our research results can serve as the guide for network operators and network equipment manufacturers to develop the next generation fault-tolerant multi-granular optical networks with multicast capability. With efficient multicast traffic recovery mechanisms equipped for next-generation networks, people would be able to enjoy high-quality seamless interactive multicast services. With multi-granular p-cycle based protection approaches, the size of optical cross connects, multiplexers/de-multiplexers can be reduced, which in-turn will lower down the power-consumption and overall network cost, in order to provide green network service. Hence, the work will be of great impacts to users, applications and our environment.

Our main objectives are:

- To develop multicast protection approaches with multi-granularity, to reduce the network complexity and overall implementation cost. We foresee p-cycle based protection approaches because p-cycles have proven to be very efficient for both unicast traffic protection and multicast traffic protection. We plan to provide four levels of protection: (i) fiber-level protection; (ii) waveband-level protection, (iii) wavelength-level protection; (iv) sub-wavelength-level protection.
- To develop network design software tool for design, modeling, evaluation and implementation protection approaches with multi-granularity, taking into account optical devices limitations and multicast traffic.

We will examine and compare the performance of the proposed approaches in terms of cost, complexity, efficiency, and blocking probability, by theoretical analysis and running optimization/simulation models using optimization software (as CPLEX) or scientific simulation software (as MATLAB or NS2). We should propose multicast routing algorithms, integer linear programming formulations, and heuristic algorithms considering multi-granularity and optical constraints for multicast protection.

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New Generation Networks, Optical Networks, Failure Recovery, Network Protection, Optical Granularity, Multicast

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