Green Model for Optical Networks

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INTRODUCTION – *POWER CONSUMPTION IS SKYROCKETING*

In the current Internet, the demand for bandwidth is increasing exponentially. ICT already accounts for 2 to 4% of the worldwide carbon emissions and by 2020 this share will double; projections indicate ICT will be the major power consumer by 2025. This growth rates are unsustainable and hinder economies based on know-how societies.

THEORY – *INNOVATIVE IDEAS TO REDUCE POWER CONSUMPTION*

All wireless and wired networks (i.e. WiFi, ADSL...) work over core network, which are large point to point optical connections - a core network is the central part of the telecom hierarchy and interconnects large cities. A core network has an *oscillating traffic* during day and night. At night, traffic may be even less than 10% of day traffic, whereby we are wasting resources and causing unnecessary power consumption. I propose to implement the following innovative ideas to decrease power consumption in low traffic demand periods:

- Enabling optical bypass, avoiding wasteful processing in intermediate nodes.
- Turning off underused linecards and rerouting the traffic to running links.
- Rerouting traffic powering off links with sparsely used optical amplifiers.
- Sharing optical amplifiers among channels.

METHODS – *FROM ONE IDEA TO ONE RESULT*

First of all, I designed a theoretical ring-mesh model which serves as a solid basis to study different topologies – the model is compatible with standard growth, redundancy protection and over subscription features. This model was tested with network traffic and its performance measured in term of power consumption. Relative savings of 28%, are achieved confirming our approach is tackling the issue in the right direction. I then extended the study to a commercial network - the Deutsche Telekom Network core system [Figure 1], which contains the Hamburg hub connecting Denmark with continental Europe. I ran the developed routing model with the Dijkstra algorithm, and considered the previous power consumption savers.

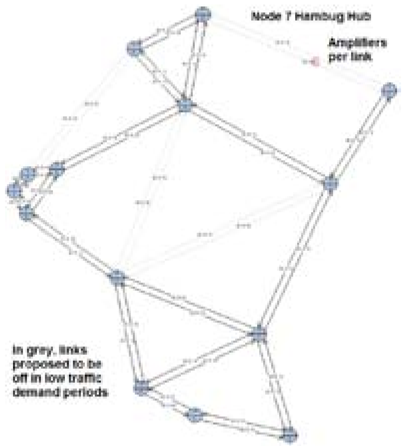

Figure 1. Deutsche Telekom Network

RESULTS – *SAVING MORE THAN 50% POWER CONSUMPTION*

I observed that in low traffic demand scenarios some links could be turned off and optical amplifiers pooled by different channels. Permuting among different scenarios, I observed that in low demand scenarios savings of 43% may be reached for the whole network and savings of 51% for a particular communication between two nodes.

CONCLUSION – *SAVING ENERGY AND MONEY*

The designed model could have an impact that leads to save around 34 million dkk per year.