Energy Audit Models for Telecommunications Networks and Services

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Abstract: We present a case study on assessing the energy consumption of a service and discuss the challenges involved in making such assessments.
OCIS codes: (060.4250) Networks

Keywords: Energy efficiency, energy audit, Internet services

The Smarter 2020 report estimates the ICT industry contributes approximately 2% of global carbon dioxide emissions [1]. Furthermore, the energy consumption of ICT is expected to rise significantly in the future due to the increasingly important role of ICT services. As a consequence, significant research efforts have been made to investigate the energy consumption and GHG emissions of ICT services such as telepresence, video-on-demand, telecommuting, and the delivery of multimedia content through telecom networks [2-6]. A diverse range of methodologies have been investigated by researchers for estimating the energy consumption of ICT services in [2-6]. The complexity and accuracy of these methods depend on the network information that can be collected. Therefore, the accuracy of the assessments remains an open question mainly due to the lack of a systematic way of assessing the energy consumption of ICT services.

To develop a measure of the energy consumption of a telecommunications service requires information on: (i) power consumption of the network equipment supporting that service and (ii) traffic utilization of that equipment. Although this may appear obvious, acquiring a meaningful, quantitative measure is far from straightforward.

In the first part of the talk, we use the bottom-up approach in [7], with the 57-node California Research and Education Network (CalREN) as a case study to show how information on equipment model, route processing unit, and line cards for (i) and traffic data for (ii) can be collected from a network database. Using this database, we discuss some of the issues that need consideration when estimating the typical power consumption of all equipment based on manufacture data sheets. We also discuss how data on mean traffic for all ports in all equipment units can be collected and analyzed, in order to build a comprehensive database that reports on the energy consumption of a video service provided over CalREN.

Using this case study, we will then discuss the challenges in determining the energy consumption of a service delivered via CalREN. For example, typical telecom equipment power consumption consists of two parts: (a) the baseload power when the equipment is idle (i.e., carrying no traffic) and (b) the incremental power when the equipment has carrying traffic. Intuitively we would expect the introduction of an additional service into an existing network will increase the network energy consumption. In this context, information of the incremental energy consumption due to provisioning of a new service becomes important. However, when assessing the energy consumption of an additional service in an existing network, an open question remains: should we consider both baseload and incremental power? If both baseload and incremental power consumption are included without careful consideration we find a meaningful estimation of service energy consumption becomes almost impossible. Therefore, in the second part of the talk, we will discuss the challenges when attempting to quantify the energy consumption of a new telecommunications service.

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