Proposition de recherche doctorale

Novel Mechanism for Building Green Optical-Wireless Integrated Access Networks

Mots clés :

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- **Unité de recherche** : Services répartis, Architectures, MOdélisation, Validation, Administration des Réseaux
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- **Domaine scientifique principal**: Divers

Résumé du projet de recherche (Langue 1)

Introduction: The objective of this Ph.D. dissertation is to build energy efficient Optical-Wireless Integrated Access Networks. Energy efficient network issue has become increasingly important, due to its impact on the global warming. And in the network the access networks consume a significant portion of overall Internet energy consumption. With the increase of bit-rate requirements in access Networks, future access technologies need to be energy efficient. The contribution of mobile communication networks was 64 Megatons of CO2 in 2002; however it is one of the fast growing sectors, expected to grow by nearly a factor of three to 178 Megatons in 2020 [10]. On the other hand, Optical-Wireless Integrated Access Networks is one of the tangible solutions for providing long distance internet connection. Hence, it has wide deployment, now it is required to make an energy efficient Optical-Wireless Integrated Access Networks. In this dissertation, the main goal is to devise synchronous sleep mode mechanism in the optical wireless integrated access networks. Furthermore, the objective is to analyze the proposed solution from network architecture point of view, newly introduced protocols, deployed for synchronization, point of view and algorithm point of view. Finally, there would be the implementation concern of the proposed solution in Optical-Wireless Integrated Access Networks. Motivation and Problem Statements: As the size of internet connectivity and demand of it has astronomical growth, the energy consumption is rapidly increasing. One estimation suggests that billions of dollars is spent in US for ruining the internet. One of the main cause such huge amount of electricity consumption (several TWh/year) is inefficient network and system design. Moreover, large portion energy is wasted by the idle network elements (underutilized or unused capacity of a node). Therefore energy can be saved by reducing the electricity demand for these idle network elements. And when these network elements are made sleep mode (switch to active to sleep mode) for saving energy, we need to also think about the QoS issue. For example, long sleep time can introduce high start-up latency, while short sleep interval fails to save significant amount of energy. It implies that, we need to think about the sleeping interval synchronization among the nodes (in this proposal it is called synchronous sleeping mechanism). There are some existing solutions available for saving energy consumption in Optical and wireless access networks. One of the common approaches is to make the device (i.e., network nodes) sleep mode when the capacity of that is underutilized or not used at all. For Example, when there is no traffic for an optical network unit (ONU), it can move to sleep mode by turning off some components; for example, photo detector (PD), limiting amplifier (LA), and continuous mode (CM) clock and data recovery (CM-CDR). Similarly, base station (BS) can turn of some of the modules inside and fans to minimize the energy consumption. However, existing solutions did not consider about the sleep mode synchronization among the network nodes. For example, in a scenario where one ONU, Switch, and BS are connected in a cascaded manner, if the sleeping interval is not synchronized, there should be traffic delay (latency will be increased, hence QoS will be degraded). Furthermore, existing solution do not consider deeply about the transition states of sleep mode. For example, one router, as proposed by CISCO in IETF, may have several energy saving states such as deep sleep, Soft Off, and Hibernate [14]. Similar concept is needed to be developed at nodes of optical-wireless integrated access networks. Expected Contribution: It is expected that proposed solution will not only contribute a great deal of reducing energy consumption in optical-Wireless Integrated Access Networks but also it can ensure better QoS to the user terminals.