計畫中文摘要
網際網路應用的快速成長使得都會型骨幹網路的頻寬需求隨之大增。而光纖具備傳輸距離長、頻寬大等特性而極適合鋪設在都會網路中。然而傳統電信光網路主要是以提供語音傳輸的TDM (SONET/SDH)或是Circuit Switching。此種架構因頻寬使用效率不佳而不適合傳輸數據資料。為了能夠同時提供數據資料與原有的TDM 傳輸服務,未來新興電信網路將朝設計單一整合型網路而同時可提供語音、數據和影像的服務為目標。其中,Gigabit Ethernet網路技術著眼於其簡單、便宜、高頻寬等特性而成為all-IP 封包整合網路的重要選項。目前星通資訊公司已設計完成以FPGA 為架構,可以同時整合TDM 與GbE 等不同格式訊號並轉成GbE 的格式來傳輸電話、視頻和數據資料的Fiber Optical Multiplexer (Loop-O9340S/R)。除此,並針對point-to-point 的應用發展出先進的排程技術來提供給電信服務商類似TDM 頻寬保證的circuit emulation 之功能。然而為了將此架構延伸成為GbE 環狀網路以提供更廣泛的multi-point to multi-point 之應用時,必須面臨許多電信領域極為嚴苛的規範。因此本研究計畫提案中,我們將以星通資訊公司所開發的Loop-O9340S/R為節點所建構的GbE 光纖環狀網路為研究平台,而進行五大工作項目:(一)研發clock 同步/回復技術以達到synchronous Ethernet 之標準。(二)研發連接保護機制以保證保護切換時間小於電信法規要求的50ms。(三)設計可以通透式整合E1/T1,E3/T3 與GbE 格式訊號,並且具備add/drop 能力之FOM。(四)開發綜合網路管理系統。(五)設計緩衝器嵌入環(insertion ring)架構、媒介存取控制(MAC)、與頻寬分配技術以支援多優先權(prioritized) circuit-emulation 並進而保證多媒體應用的QoS。其中第一項到第四項將由星通資訊公司負責研發。而第五項將由交通大學研發團隊進行研究。所有研發成果將會以雛型系統整合實現在上述的FPGA 研究平台。

關鍵字:Gigabite 以太網路,光纖網路,電路仿真,全IP 網路,緩衝器嵌入環,存取控制技術

Abstract
The proliferation of Internet-based multimedia applications brings about high-bandwidth demands particularly for broadband metro core networks. Among the core network candidates, optical-based networks have been envisioned as the most prominent solution due to its capability of long-distance transmissions and provision of virtually unlimited bandwidth. While traditional optical circuit-switchin-based network is solely successful in supporting bulky steady traffic, future optical networks are expected to support the integration of voice, vedio, and data services in a seamless fasion. Among them, Gigabit Ethernet is considered one of the most promising network technologies. Currently, we ,Loop Telecommunication International, Inc., have accomplished integrating various signal formats, such as TDM and GbE, into an uniform GbE-based signal for the transmissions of voice, video, and Fiber optical Multiplexer (Loop-O9340S/R) of data. At the same time, we also exploit advanced scheduling techniques to support circuit emulation particularly for point-to-point communication applications. However, when it comes to supporting multi-point to multi-point applications, such architecture poses several challenges to stringent protocol conformity and compatability. To this end, in this project, we aim at accomplishing five major tasks over the Loop-O9340S/R-based GbE optical ring network testbed: (1) to develop clock synchronization/recovery technique meeting the synchronous Ethernet requirement; (2) to develop connectivity restoration mechanism meeting the telecommunication requirement of a restoration duration being less than 50ms; (3) to design transparent integrationof E1/T1,

E3/T3, and GbE formats, and the FOM with the add/drop function; (4) to develop an integrated network management system; and (5) to undertake advanced research on optical insertion-ring-based network architecture, medium access control (MAC) schemes, and bandwidth allocation techniques, aiming to support QoS and prioritized circuit-emulation for multimedia applications.
Among the above tasks, while tasks (1) to (4) are undertaken by the Loop Telecommunication International, Inc. development team, task (5) will be accomplished by the NCTU research team. All results from five tasks are to be integrated into the FPGA research testbed by the end of the project.

Keywords: Gigabit Ethernet，FOM，circuit emulation，all-IP network，FPGA，insertion ring, MAC