A Green Router Facilitating Affordable High-Performance Community Networks

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***Abstract*— A cost-effective, high-performance, low-power consuming router facilitating the construction of affordable community networks is presented and demonstrated.**

The router can route 220,000 packets/sec. Besides wifi links, it also supports long distance optical links using 1 Gbps Ethernet SFP transceivers spanning up to 160 km, including digital optical link monitoring (DOM). The low cost optical fibre technology used also opens up for the use of passive wavelength division multiplexing.

The router is entirely based on selected off-the-shelf hardware and open source software (Bfrost/Linux) components on flash or USB-memory.

The power consumption is approximately 20W. The Single 12V DC power supply used opens up for a variety of power source solutions, including most renewable power sources such as solar and wind, and facilitates integrated power backup systems. The system has been tested using ultra-capacitors as replacements for batteries.

***Index Terms*—Open source routing, community networks, optical communication, ICT for Rural Development.**

I. Introduction

There is a common misconception that access to ICT is provided by commercial market forces, if there is only a demand. While this might be true in densely populated areas of developed regions, it is definitely not true in developing regions nor in sparsely populated areas of developed regions. There are many reasons, including under-developed policies and regulatory frameworks creating political risks, lack of all sorts of infrastructures, such as copper and optical fibre wire-lines, electrical power and developed supply chains, as well as poor commercial viability of traditional business models for network operators and service provider leading to high perceived commercial risks, etc.

Another reason is that the network equipment manufacturers are controlled by the business models of their customers, the operators, and thus focused on the development of complex and expensive proprietary technical solutions for extreme traffic volumes and quality of service requirements.

It is also a fact that most of the core network equipment is power-hungry and dependent on electricity supplied from the power grid, which is often unstable. The equipment is designed without consideration to power consumption and robustness required in sparsely populated areas. Little attempt has been made to utilize alternative sources of energy in ICT applications, which could provide sustainable, stable and reliable power supply for infrastructure network equipment.

The simplicity of the Internet technology, open source software solutions, increasingly powerful off-the-shelf standard hardware components and an increasing understanding about how to exploit alternative energy sources all contribute to changing this drastically. Under-served user communities can build their own sustainable high-performance but low-power-consuming community networks on shoestring budgets, including infrastructure-sharing based on passive wavelength division multiplexing, 1-10 Gbps routers and optical links up to 100 km, etc [3]. Once such networks are up and running, all sorts of risks are reduced and the commercial interest will increase. The increasing availability of networking components based on open source software and selected reliable, high-quality off-the-.shelf standard hardware components, makes it possible to deliver technical solutions with a performance on the same level as proprietary systems, or even better [1,2,3,4,5,6,7].

II. The demo

Requirements: Internet access. projector, 1 electrical outlet

The demonstration equipment will consist of two of the featured routers powered by a 12V lead-acid battery that are connected via a 100km fibre pair using passive wavelength division multiplexing components to implement parallel channels over the fibre pair.

Performance tests and applications illustrating the router performance will be demonstrated while the optical power budget and fibre transmission parameters as well as the electrical power consumption of the router are monitored.

Ultra-capacitors, replacing the battery, will be demonstrated to sustain one of the routers for approximately 10 minutes.

III. REFERENCES

[1] Why Vyatta is better than Cisco. Technical white paper, 2007 www.vyatta.com/downloads/whitepapers/Vyatta_Better_than_Cisco.pdf

[2] Bianco A., Finochietto J.M., Galante G., Mellia M. and Neri F. Open - SourcePC-Based Software Routers: A viable Approach to High - Performance Packet Switching. LNCS 3375,pp.353 -366,Springer-VerlagBerlinHeidelberg2005

[3] Amos Nungu, Nsubis Genesis, Björn Pehrson "Serengeti Broadband",The 2nd ACM SIGCOMM Workshop on Networked Systems for Developing Regions (NSDR 2008), Seattle, August 2008.

[4] Kohler, E., Morris, R., Chen, B., Jannotti, J.: The click modular router. ACM Transactions on Computer Systems 18 (2000) 263–297

[5] Bifrost Network Project, http://bifrost.slu.se/.

[6] Olof Hagsand, Robert Olsson, Bengt Görden, "Towards 10Gbps open source routing", Linux kongress 2008. Hamburg Oct 2008.

[7] Robert Olsson, Hans Wassen, Emil Pedersen, "Open source routing in high-speed production use, "Linux Kongress, Hamburg Oct 2008