PRACTICAL ASPECTS OF THE INTERCONNECTION BETWEEN ATM SWITCHES

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Abstract- This paper presents the results of practical work carried out to integrate ATM switches within the CAMAN (Cluj-Napoca Academic Metropolitan Area Network), the first ATM network in Romania. The equipment involved for two of four nodes were based on CoreBuilder 9000 (3Com) and VIRATAswitch 1000 (ATML), integrated into the 155 Mbps optical fiber ring with other two APEX (General DataComm) - based switching systems. The first part is focused on system's design and configuration, followed by a description of the experimental results in the second part, including protocols like Classical IP over ATM and LAN Emulation services (ATM Forum or proprietary solutions).

I. Cluj-Napoca Academic Metropolitan Area Network (CAMAN)

A. Introduction

In 1996 the Consortium of the Universities from Cluj-Napoca agreed to implement an ATM-based metropolitan area network in order to interconnect all their 39 sites. The funding for the infrastructure was supplied by the Ministry of Education, whilst the project was done by the Cluj Branch of RomTelecom S.A one year later. In 1998 the constructor was selected on a bidding basis, so Teleconstructia S.A. finished to install the 28 km. single-mode optical fiber infrastructure by the end of December 1998. The supplier for the passive components was M.T.IL Technologies and Systems.

The paper is focused on practical work carried out to integrate two of the four ATM switches within this 155 Mbps high performance MAN.

B. The CAMAN architecture

Figure 1 presents the CAMAN architecture, including four main nodes, depicted as follows: *node A* (RoEduNet Administration Office, placed in Baritiu Street, providing the

general management of the system and the Internet access), *node B* ("Babes-Bolyai" University), *node C* ("Iuliu Hatieganu" Medicine and Pharmacy University) and *node D* (Technical University of Cluj-Napoca, at Observator Street site). Due to the fact that the funding for the active equipment was provided from several sources during different stages of the project implementation, the ATM switches that had to be installed were not supplied by the same manufacturer. *Node A* and *Node B* got technical support from Ericsson Romania to install APEX from General DataComm, *Node C* chose VIRATAswitch 1000 from Advanced Telecommunications Modules Ltd. (through Alcatel Bell) and finally *Node D* preferred CoreBuilder 9000 from 3Com (through Net Brinel Computers). Several leaves are connected to each node by optical links too, but the switching systems are based on 100 Mbps Fast Ethernet technology from Cisco (Catalyst 5000, Catalyst 3000) or 3Com (SuperStack II 3000).

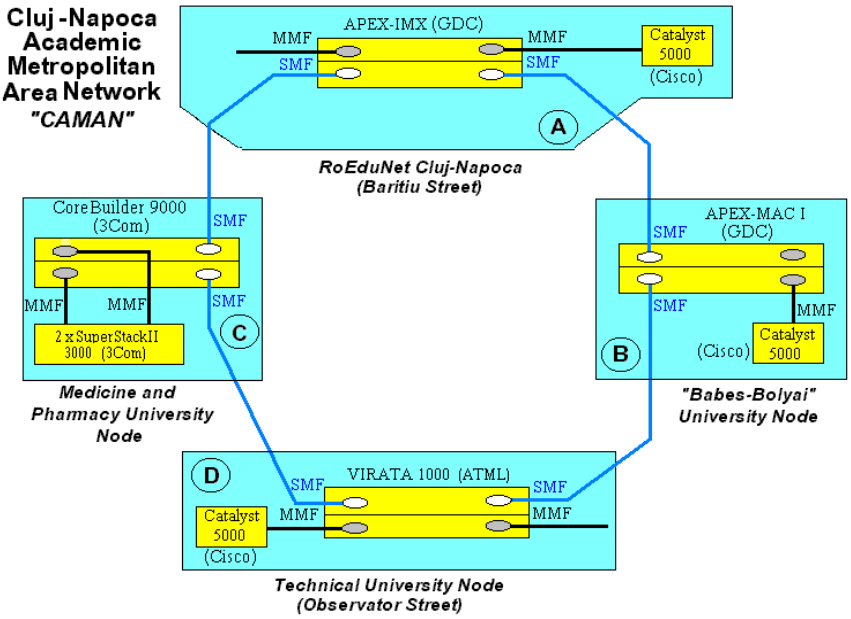

Figure 1. Cluj-Napoca Academic Metropolitan Area Network

II. Experimental results

A. Classical IP over ATM

The well known Classical IP model has the following characteristics: the hosts are organized in subnetworks, sharing a common IP prefix; the communication across subnetworks goes through routers; the ARP *(Address Resolution Protocol)* is used for IP address-to-MAC address resolution. Applying this model to ATM world means that ATM is used to replace the "wires" and local LAN segments connecting IP workstations and IP routers. The system will operate in the "classical" LAN-based paradigm, according to RFC

1577.

Due to the previous expertise within COPERNICUS 1529, the first live experiment between two ATM switches through optical fiber in Romania (to the best of our knowledge) was done in 12 November 1998. The 155 Mbps point-to-point link was realised between *Node A* and *Node D,* by employing their two ATM switches. An IP router in *Node D,* based on Compaq ProSignia 500, with 25.6 Mbps ATM card (ATML) and 100 Mbps FastEtherLink XL (3Com) provided Internet access for a client, connected to the *Node A,* through 155 Mbps ATM card (Efficient Networks) by MMF *(Multi-Mode Fiber),* as in [1].

B. LAN Emulation (LANE)

The ATM Forum specified LAN Emulation in order to accelerate the deployment of ATM technology in the local area environment, as a solution for running protocols like Ethernet transparently over an ATM network.

The main issues in this case are the following: address resolution, broadcast and data encapsulation. LANE must enable interconnection of traditional LANs with the emulated LAN (called ELAN), with workstations directly attached to an ATM network. Therefore the architecture includes: LES *(LAN Emulation Server),* LECS *(LAN Emulation Configuration Server),* LECs *(LAN Emulation Clients)* and BUS *(Broadcast and Unknown-Server).*

As LANE specifies a set of services for each instance of an ELAN, it results the observation that the membership in an ELAN is not based on physical location but rather on the association with a specific set of services [5]. For these reasons, LAN Emulation enables constructing and managing of several VLAN *(Virtual LAN).*

First experiment was focused on *Node C-to-Node D* link. The configuration was the following: VIRATAswitch port to *Node C*: UNI 3.0, IISP, netside, CoreBuilder 9000 port to *Node D*: GWY 3.0, userside. The LES was active on Node C, whilst the LECs were connected either to VIRATAswitch in *Node D,* either to SuperStack II in *Node C.*

The second trial implied the *Node A-to-Node C* link, with LES active either in one or in the other side. CoreBuilder 9000 was configured as GWY 3.0, netside and APEX as IISP 3.0, userside. Note that *Node D* was able now to be connected directly to *Node A,* or through *Node C*.

The third experiment was done between *Node B* and *Node D,* involving the following configuration: APEX port to *Node D*: IISP 3.0, userside and VIRATAswitch 1000 port to *Node B*: UNI 3.0, IISP, netside.

III. Conclusions

From the ATM point of view, the optical fiber ring was completed and became fully operational by 18 February 1999. Obviously the configuration and management of CAMAN implies several other problems to be solved, which were coordinated mainly by RoEduNet staff at Cluj Branch. Therefore this paper covered only the practical aspects of ATM switches interconnection, with Classical IP and LAN Emulation.

CAMAN was officially launched in 19 March 1999 at Cluj-Napoca by the Minister of Education, professor Andrei Marga, the audience including all the major contributors to this project. The demonstrations carried out at this ceremony by all universities involved in

this Consortium, such as: Web-based distance learning, videotransmissions or high performance computing anticipated some of the current and future applications of the first ATM MAN network in Romania.

From networking point of you, the next steps are related to the improvement of management facilities for all sites and to the integration of the voice traffic.

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References

[1] V. Dobrota, D. Zinca, A. Vlaicu, K. Pusztai - "Evaluation of ATM Traffic Parameters in Heterogenous Networks", *Proceedings of the 9th IEEE Workshop on Local and Metropolitan Area Networks*, Banff, Canada, May 17-20, 1998, pp.304-309.

[2] V. Dobrota, *Digital Networks in Telecommunications. Volume II: B-ISDN and ATM, Common Channel Signalling System SS7*, Mediamira Science Publisher, Cluj-Napoca, 1998.

[3] V. Dobrota, *Digital Networks in Telecommunications. Volume I: Digital Switching, Traffic Analysis, ISDN. Second Edition*, Mediamira Science Publisher, Cluj-Napoca, 1999.

[4] D. Minoli, T. Golway, N. Smith, *Planning and Managing ATM Networks*, Manning Publications Co., Greenwich, USA, 1997.

[5] S. Giordano, R.M. Schmid, R. Beeler, H. Flinck, J.Y. Le Boudec, "IP and ATM - a position paper", *Proceedings of ATM Traffic Symposium organized by ACTS AC094 EXPERT*, Mykonos, Greece, September 17-18, 1997

[6] ***, *CoreBuilder 9000, Part Number 10011307, Release 2.0.0*, 3Com Corporation, Santa Clara, USA, September 1998

[7] ***, *VIRATAswitch Installation and Administration Guide.* Advanced Telecommunications Modules Ltd., Cambridge, UK, 1997