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FROM THE TA-LAN PROJECT TO THE LIGHTNING ISDN MULTICOM ROUTER

A SUCCESS STORY

At the end of 1988, the first document showing how Integrated Service Digital Network (ISDN) could be used to interconnect LAN was drafted by Swiss Telecom Research engineers. The so-called 'inverse multiplexing' principle, allowing to transmit the segmented data stream through several parallel ISDN channels, was proposed. In February 1990, Swiss Telecom Research initiated and cofinanced two research projects, both involving Ascom, the Ecole polytechnique fédérale de Lausanne (EPFL) and Swiss Telecom PTT. One project aimed at studying the theoretical aspects of inverse multiplexing, while the other targeted the construction of prototypes.

Project results

The two projects ended in spring 1992 with the following results:

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- Realization of six prototypes by Ascom, allowing the use of four parallel ISDN channels. These prototypes were based on a modular backplane bus architecture. Two prototypes were delivered to Swiss Telecom Research for testing.
- Several detailed reports by Ascom, covering the system description and performance measurements based on the prototypes.
- A study by EPFL entitled 'ISDN Gateway', covering mainly theoretical aspects of traffic buffering and decision algorithm (opening and closing parallel transmission channels).
- Realization of two prototypes by EPFL, based on 68 000 processors and allowing two ISDN channels to be used in parallel.

How it works

For the sake of simplicity, a mere two sites configuration will be explained. In reality, by extending the routing principle, the Terminal Adaptor Local Area Network (TA-LAN) supports multipoint configurations. Two remote LANs are to be interconnected. On each of these LANs, one TA-LAN is connected. Each TA-LAN is also connected to ISDN (Fig. 1).

The source TA-LAN looks at the traffic running at its LAN interface, considering the Internet Protocol (IP) destination address of each data packet. If the destination host is located on the remote LAN, the TA-LAN buffers this packet. Consulting its routing table, the TA-LAN maps the destination IP address with the corresponding ISDN number(s).

According to the amount of data to be sent stored in its buffer, the source TA-LAN opens one or more parallel ISDN channels. If more than one ISDN channel is open, the data stream is segmented in parallel flows, each flow being sent through a dedicated ISDN channel. The destination TA-LAN reassembles the parallel flows back in

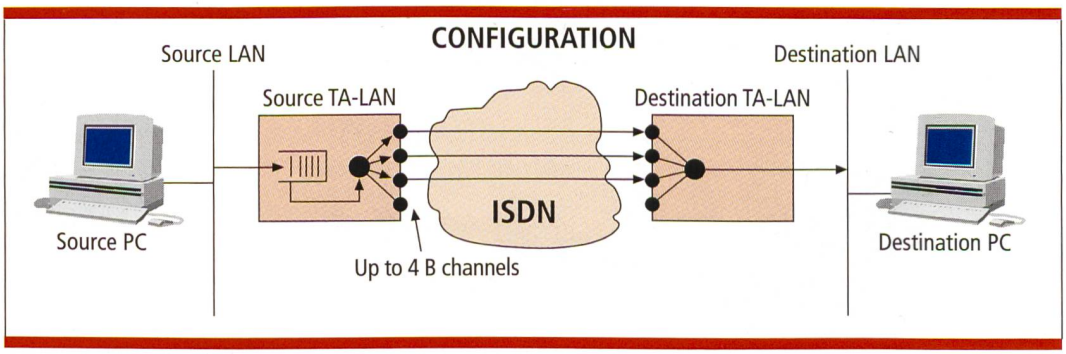

Fig. 1. How it works.

one data stream an forwards it onto the destination LAN.
The source TA-LAN will close down ISDN channels, if the traffic intensity decreases. The last channels will be closed after a predefined inactivity time.

Prototypes throughput performance

Using its IP testbed, Swiss Telecom Research run extensive tests on the two prototypes delivered by Ascom. Despite the segmentation reassembly process, the total throughput trough four parallel B channels reached 232 kbit/s, out of a maximum of 256 kbit/s (91 %).

Industrial transposition: Lightning instead of Ascom

In 1992 the TA-LAN was a very innovative product and almost the only one of its kind. According to the project plan, Ascom should have brought the TA-LAN on the market.
The ever changing Ascom structure and the transfer of all corporate network activities to Timeplex (including the TA-LAN) did not allow the project to reach its commercial goal in the foreseen way. But the TA-LAN was not dead, it survived and grew thanks to Beat Brunner's initiative. M. Brunner was the assistant in charge of the project at EPFL, covering both the theoretical aspects and the prototypes realization.
Coming back from Bell Labs after his PhD graduation, M. Brunner decided to turn the prototype he had previously developed at EPFL in the TA-LAN project framework to a successful commercial product: the Multicom ISDN router. This was the first product in the new orientation of Lightning, the Brunner's family business, towards telecommunication equipment. Lightning is now recognized internationally as an innovative vendor of ISDN-oriented products, especially for integration of Transmission Control Protocol/Internet Protocol (TCP/IP) and ISDN technologies. Lightning is also partnering on a regular base with Telecom PTT for end user ISDN products.

Conclusion

Today's Lightning product line is a successful example how innovative Swiss Telecom Research concepts can lead to commercial results and contribute to develop both the end systems and the Swiss Telecom markets. [4]

ZUSAMMENFASSUNG

Vom TA-LAN-Projekt zum Lightning ISDN Multicom Router

Ende 1988 entstand bei der Telecom PTT der erste Entwurf eines Berichtes, der zeigte, wie das Integrierte Digitale Netz (ISDN) zur Zusammenschaltung von LANs verwendet werden kann. Das sogenannte Invers-Multiplexing-Prinzip wurde darin vorgeschlagen, das es erlaubt, den segmentierten Datenstrom über mehrere parallele ISDN-Kanäle zu übertragen. Im Februar 1990 hat die Hauptabteilung Forschung und Entwicklung der Telecom PTT sodann zwei entsprechende Forschungsprojekte initialisiert und mitfinanziert. An beiden waren Ascom, die École Politechnique Fédérale de Lausanne (EPFL) und die Telecom PTT beteiligt. Ein Projekt betraf das Studium der theoretischen Aspekte des Invers-Multiplexing, das andere die Erstellung von Prototypen.

Daniel Forchelet received his BSc in 1983 and his MSc from the EPFL (Swiss Federal Institute of Technology, Lausanne) in 1987. He joined the Swiss Telecom R&D lab in 1988. He was then in charge of the development of LAN interconnect services (Frame Relay and ISDN). Since 1993 he is responsible for the development of Corporate and Value-Added Network Services within Swiss Telecom R&D. He and his team are presently focusing on ATM services, Intranet and Internet.