ATM and IP : competitors or collaborators in future communications?

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Objekttyp: **Article**

Zeitschrift: **Comtec : Informations- und Telekommunikationstechnologie = information and telecommunication technology**

Band (Jahr): **78 (2000)**

Heft 1

PDF erstellt am: **05.06.2024**

Persistenter Link: https://doi.org/10.5169/seals-876415

ATM and IP – Competitors or Collaborators in Future Communications?

The ACTS (Advanced Communications Technologies and Services) programme is focus of the European Union's research into future communications technology. A number of projects within that programme have studied how the best features of traditional telecoms and the Internet can be combined. The results of these projects have been presented in recent guidelines. "Provision of Multimedia Services using IP over Bearer Networks" and "Internet and ATM Coexistence".

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The Internet is often seen as a cheap and cheerful alternative to traditional communications networks. For the price of a local phone call and a monthly subscription to a service provider, one can contact people or call up information from all over the world. Admittedly the quality is a bit unpredictable but most probably these are just teething problems. Soon there will be enough capacity to meet the demand. Turning the Internet into a reliable and efficient global communications system is not just a question of installing higher capacity routers and transmission links. It involves introducing mechanisms that can deliver the Quality of Service required by individual applications. It also involves thinking about how much users are willing and able to pay for guaranteed quality. If somebody wants the Internet equivalent of Business Class airline service – the priority check-in and the wide seats at the front of the plane – it will cost more.

ACTS Guidelines

The guidelines point out that the Internet handles congestion by putting messages in a queue. As congestion increases, the queue gets longer and so do the delays. Eventually bits of some messages may be thrown away. A person will probably get through but the quality will vary from second to second. The current version of the Internet protocol (IP4) has no way of distinguishing between the quality requirements of the various applications. A videophone call (which may have very specific requirements on bandwidth and delay) joins the same queue as an e-mail (which could probably wait a minute or two) and ends up with the same "best effort" quality of service.

Telecoms networks handle congestion differently. If they don't have the capacity for a call, it is rejected. If there is capacity, the calling person is connected and that network capacity is reserved for this exclusive use until that person hangs up. But the calling person pays a price. Network capacity can only be allocated in 64 kbit/s blocks. One may not need that much capacity or may only need it occasionally during the call. However one pays for it, whether it is used or not.

The Best of Both Worlds?

ATM (Advanced synchronous Transfer Mode) is a telecoms technology that offers a more flexible approach to allocating network capacity. Users can choose from a range of qualities of service, from best effort (like the Internet) to guaranteed bandwidth (like the phone network). Although it is a connection-oriented protocol, one can specify how much network capacity is needed and one can change the mind if, during the call, more or less capacity is needed. ATM standards incorporate a growing number of features to support the transport of various applications and protocols on ATM networks.

At the same time, the Internet protocols are evolving. Extensions to the current IP4 protocols and the proposed IP6 protocols introduce concepts such as RSVP (Resource Reservation Protocol) and tag switching. This allows an IP application to specify the quality of service that it needs and pass that information on to the bearer networks that carry the actual data. If these are ATM networks, with a range of quality options, they can respond to the requests and provide the capacity and quality needed by the application. If a user wants videophone quality, he can have it, assuming he is willing to pay.

When an IP based application network uses a telecom network as a bearer network, the telecom network can only contribute indirectly to QoS provisioning. In the case of an IPv4 application network QoS management is restricted to best effort. An IPv4 router can negotiate QoS with the bearer network for a connection to a specific server or router but only for the whole information flow. It can not identify individual applications within that information flow and request an appropriate QoS for each of them.

With the extended IPv4 and IPv6 protocols, QoS management can be a combination of best effort and other strategies, such as controlled load and guaranteed service. Individual applications with different QoS needs can be identified within the overall information flow. A router can therefore request a guaranteed QoS for, say, the path to a video server.

The Long Term Vision

Looking to the longer term, as did some of the presenters at the CONVAIR seminar, IP and ATM will probably converge. The ability to deliver predictable quality of service for real time media and best effort service for less critical applications will drive this. Looking at the actual systems for implementing ATM or IP, it is obvious that they are not very different. Each involves:

– a routing table
– a processing engine
– a switching system
– a network interface

Given time,
- ATM and IP will evolve into a common internetworking protocol
- the differences between connection-oriented and connectionless protocols will blur
- Dual class networks offering simplicity and flexibility will emerge.

Scenarios for Coexistence

The ACTS guideline "Internet and ATM Coexistence" has identified a number of scenarios for the coexistence/convergence of IP and ATM. It examines each in some detail, identifying the state-of-the-art, the costs and benefits and suggesting situations where each is most appropriate. The scenarios are:

IP over ATM via an Intermediate Layer

Local Area Network Emulation (LANE) allows Ethernet LANSs to be extended transparently across an ATM backbone network. IP applications running on the LAN are also extended transparently across the bearer network. However if an application is aware that IP is running over LANE, it can call for a direct ATM Switched Virtual Connection to provide the desired quality of service.

IP directly over ATM

There are quite a number of options here.

Trunking of IP over ATM

IP hosts/routers and hosts are interconnected by ATM Virtual Connections but there is no address resolution mechanism. A static mapping of IP and ATM addresses is set up manually. Any number of ATM connections with any ATM QoS can be supported between individual pairs of IP systems.

Emulating a Virtual IP Subnetwork over ATM

IP hosts/routers belong to virtual or emulated IP subnetworks called Logical IP subnets (LISs). IP systems belonging to a given LIS can be located at different places on an ATM network and can communicate using ATM Virtual Connections. Any number of ATM connections with any ATM QoS can be supported between individual pairs of IP systems.

Unicast Shortcuts between IP Devices over ATM

Next Hop Reservation Protocol (NHRP) opens a shortcut between a source and a destination, bypassing the normal IP router to router forwarding mechanism. NHRP lets an IP source determine the IP and ATM addresses for the most suitable "next hop" towards its destination. This can be the destination itself, if the destination is on the ATM network or the router on the network that is "nearest" to the destination. Once the addresses have been found, one or more direct ATM Virtual Connections with appropriate QoS can be set up.

Shortcuts for Bridged IP Traffic between two LAN based Devices

IP hosts belong to an Inter Address Sub Group (IASG) or are connected via LANE. NHRP and MPOA (Multi Protocol over ATM) are used to provide shortcuts inside the ATM network. Unicast, multicast and broadcast are supported. Any number of ATM connections with any ATM QoS can be supported between individual pairs of IP systems.

Resource Reservation in the ATM Network

The resource reservation protocol (RSVP) is used to specify the QoS in the IP layer and map it onto an ATM QoS. IP hosts/routers can then be interconnected by ATM Virtual Connections with the desired QOS.

Differential Services over ATM

Differential Services are used to define different priority levels for individual IP flows. These are then mapped to handwidth reservation at the ATM level.

IP Merged with ATM

This involves using Multi Protocol Label Switching (MPLS) to provide IP flow forwarding at the ATM level and a number of suppliers are developing switches which implement this concept. The switches act as normal IP routers but, during routing, they make a statistical estimate of the traffic generated by each individual IP flow. Whenever a flow exceeds a defined level, the switch opens a direct ATM Virtual Connection with the required QoS for that flow.

Conclusions

The message from ACTS is that IP and ATM will probably one day converge into a common internetworking protocol. In the more immediate future, extensions to the IP and ATM standards will allow IP applications to demand and receive appropriate quality of services from ATM bearer networks. These hybrids of ATM and IP will cost less than a permanent connection but will cost more than an Internet "hope for the best" connection. 9.4

Acknowledgement

The work conducted in the ACTSLINE is partly financed by Bundesamt für Bildung und Wissenschaft (BBW), Switzerland and the European Union. The contents of the paper is the result of the work done by consortium members of the project, and the members of Chain groups contributing to Guidelines.

Zusammenfassung

ATM und IP – in Zukunft Konkurrenten oder Partner?

Das Programm ACTS (Advanced Communications Technologies and Services), das sich mit hochentwickelten Kommunikationstechnologien und -dienstleistungen befasst, steht im Zentrum der Forschung der Europäischen Union im Bereich zukünftiger Kommunikationstechnologien. Einige Projekte innerhalb dieses Programmes haben sich mit der Frage befasst, wie die besten Leistungsmerkmale der traditionellen Telekommunikation mit dem Internet kombiniert werden können. Die Ergebnisse dieser Projekte wurden kürzlich in den Richtlinien «Provision of Multimedia Services using IP over Bearer Networks» (Verbreitung von Multimediadiensten mittels IP via Trägernetze) und «Internet and ATM Coexistence» (Koexistenz von Internet und ATM) präsentiert.

__Dr. Sathya Rao__ has degrees in electrical communication engineering from Bangalore University and the Indian Institute of Science. He moved to Switzerland in 1980, where he gained his doctoral degree from Neuchâtel University. In 1986, he joined Ascom, where he led much of the work on ISDN systems and broadband communications. He was one of the core members of the team responsible for defining the European research framework on advanced communications, i.e RACE and ACTS. In 1995, he founded Telscom, providing consultancy services and support to advanced communication research work. Telscom has grown ever since into a company which is involved in ATM system development and internet and ATM solutions for business needs. Sathya has published three books on broadband networking issues as an editor and is an editor-in-chief of the journal "Interoperable Communication Networks (ICON)". He has many patents and publications to his credit. Sathya Rao and his company have an established record in organising international and European conferences. Under the patronage of the European Commission, he has organised many international workshops, and distributed seminars using the ATM networks and applications across European centres.

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« Boom bei Helpdesk-Software »

Die Datumsumstellung sorgte knapp vor der Jahrtausendwende für einen Boom bei der Helpdesk-Software und ihren Diensten. Mit der zunehmenden Komplexität der Netzwerke stieg auch die Nachfrage nach Helpdesk-Lösungen, die eine Senkung der Wartungskosten im IT-Sektor bringen sollen.

Der Wert des europäischen Marktes für Helpdesk-Software und -Dienste bezifferte sich 1998 auf knapp zwei Mia. US-$ und soll bis zum Jahr 2005 auf über acht Mia. US-$ ansteigen. Zu diesem Ergebnis kommt eine neue Studie[1] der internationalen Unternehmensberatung Frost & Sullivan.
Die Datumsumstellung im Jahr 2000 und die Einführung des Euro sichern eine positive Entwicklung in der ersten Phase des Prognosezeitraums. Der Aufwärtstrend soll laut Studie langfristig anhalten. Der Markt wird vom Sektor für Helpdesk-Outsourcing dominiert, der 1998 einen Anteil von 81,8% am Gesamtumsatz hatte. Die massive Nachfrage nach Outsourcing-Diensten wird das Marktpotenzial weiter stärken. Nach der Datumsumstellung wird primär die strategische Bedeutung der Helpdesk-Lösungen in den Vordergrund treten, die bereits von immer mehr Unternehmen erkannt wird und dem Markt einen gesunden Zuwachs verspricht.
Eine starke Dynamik zeigt auch der Sektor für externe Helpdesk-Software, der den Anbietern den Einstieg in den CRM-Bereich (Customer Relationship Management) eröffnet. Der Kundenkontakt läuft im Internetzeitalter nicht wie früher ausschliesslich über das Telefon, sondern erfolgt immer häufiger per E-Mail. Viele Unternehmen senden Web-Formulare aus, die der Kunde online ausfüllen kann. Von dieser Praxis haben insbesondere die externen Helpdesks profitiert.
Laut Mukesh Karsan, Research Analyst bei Frost & Sullivan, nimmt das Helpdesk eine zentrale Stellung im IT-Geschäft ein. Die Anwendungsfunktionen werden immer stärker von der jeweiligen Infrastruktur absorbiert, und die Integration zahlloser Technologien und Funktionalitäten ermöglicht es dem Management zunehmend, Aktivposten über die Helpdesk-Datenbank nachzuvollziehen. Traditionelle Programme für das Enterprise Research Planning (ERP) haben ihren engen internen Anwendungsrahmen gesprengt und bieten heute zusätzliche Geschäftsprozesse und ein grösseres branchenspezifisches Funktionsangebot. Frost & Sullivan definiert die neuen erweiterten ERP-Anwendungen als «Enterprise Solutions». Banken, Versicherungen und Makler werden damit schon in naher Zukunft eine enge Verbindung zwischen den Anwendungen auf der Kundenseite und den hochentwickelten Kundeninformations-, Produktentwicklungs- und Analysesystemen herstellen können. Die Migration von einer Client-Server- zu einer Thin-Client-Architektur hat die Helpdesks in ein flexibles Mischsystem verwandelt, wobei traditionelle Client-Server-Anwendungen mit einer verteilten Intranetarchitektur mit Java-Browsern kombiniert werden.
Bei den Ländermärkten behauptet sich vor allem Grossbritannien, das sich auf die extensive Industriebasis und die frühe Durchdringung der Technologie stützen kann. Der britische Markt wird diese Spitzenposition voraussichtlich für die Dauer des Prognosezeitraums halten können, unterstützt durch intensive Investitionen in Dienste und zugehörige Technologien für Call Center und CTI (Computer Telephony Integration).

[1] Report 3569: "The European Market for Helpdesk-Software and -Services", Preis: 3950 US-$.

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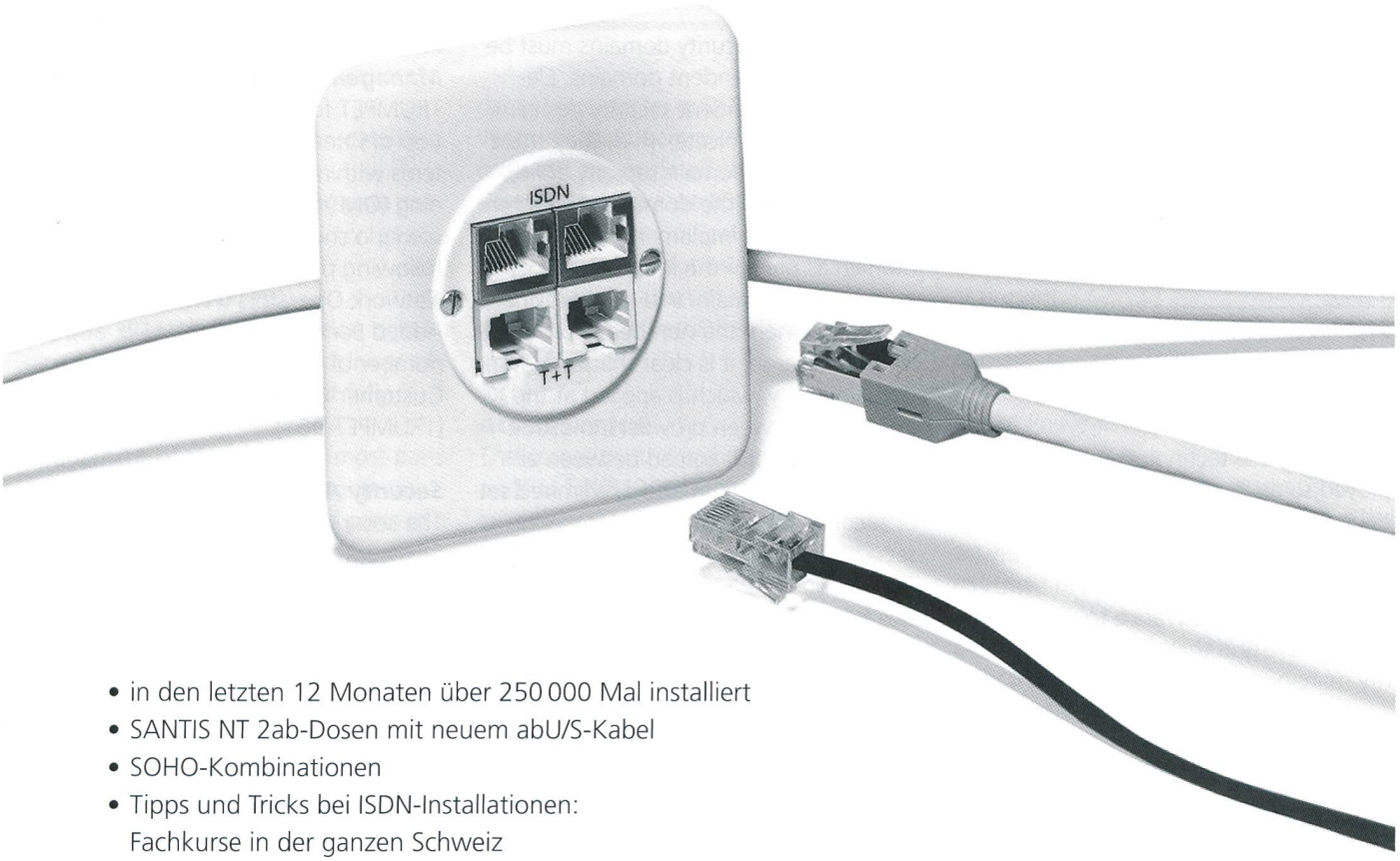

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