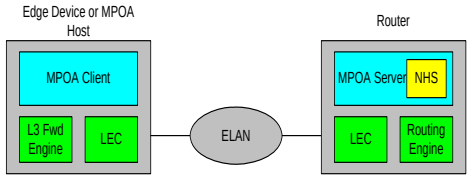
Interworking 1998

Interoperability in heterogeneous environment:

MULTIPTROTOCOL OVER ATM (MPOA)



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Ottawa, 7th July 1998

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- IP- and ATM features in comparison
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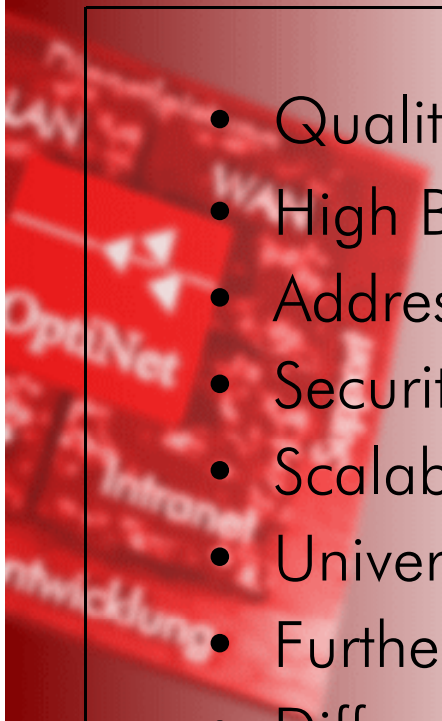
Network Requirements



- Quality-of-Service (QoS): End-to-end connections
- High Bandwidth in the Backbone and to the Clients
- Address Flexibility
- Security and Billing mechanisms
- Scalability
- Universal Connectivity
- Further use of Legacy LANs
- Different support of Services and Networks
- Availability of Applications
- Integration of new Services
- Simple, flexible Management and Configuration

IPv4 Features

- Internet Protocol works connectionless (hop-by-hop-transmission)
- No acknowledgements, error- and duplicate detection with IP
- Data packets are variable: 20 byte - 65 kbyte; destination address identified the other client
- Lost data packets have to repeat requested by higher layer protocols (TCP)
- Multicast/Broadcast functions
- Best-Effort: Type-of-Service (TOS)

ATM Features

- Connection-oriented technology: virtual connections will establish for the cell transport (PVC/SVC)
- ATM has its own address structure, signaling, and routing funktions
- 53 byte cells with fixed size contain payload and control data
- Point-to-point connections
- Quality-of-Service (QoS)

Classical-IP (CLIP)

- RFC-1577: Classical-IP and ARP over ATM
- RFC-1483: Logical Link Control Encapsulation and VC-Based Multiplexing
- D-MTU 9180 Byte - higher efficient as smaller MTU sizes
- PVC/SVC connections are supported
- Adaptation layer AAL-5
- Point-to-point connections
- Address resolution by central ATMARP server

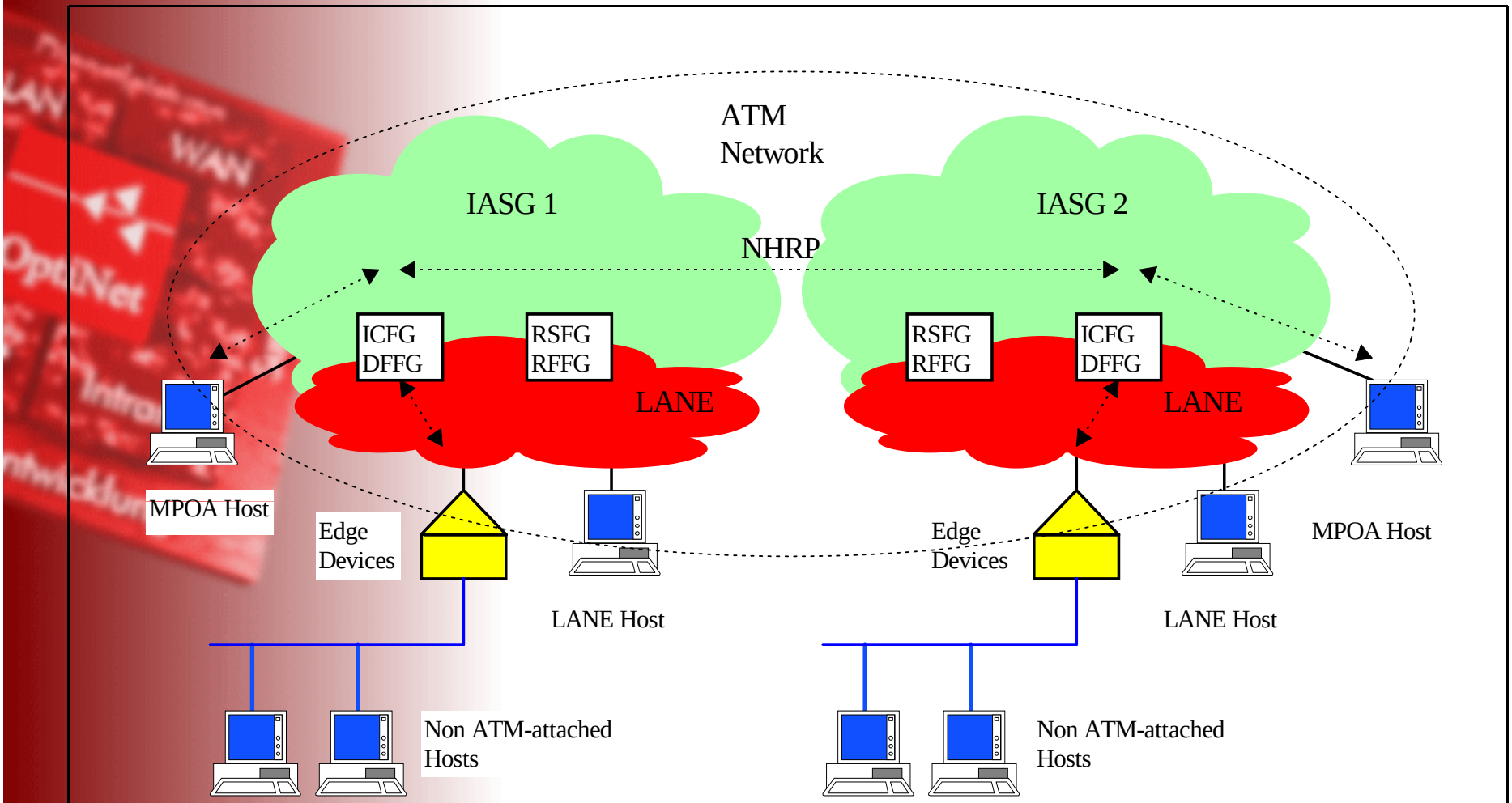
LAN Emulation (LANE)

- Migration of legacy LANs to ATM: Ethernet switch (layer 2) and router (layer 3) coupling
- Universal implementation (MAC layer is emulated): arbitrary LAN protocols
- Using of the application layer without ATM configuration
- Support of PVC/SVC connections
- AAL-5 packet encapsulation
- IP multicasting
- D-MTU: 1500 byte

Multiprotocol-over-ATM (MPOA)

- Emulates a fully routed layer 3 protocol over ATM
- General approach for any layer 3 protocol (IP, IPX, ..)
- Distribute the routing functions between route servers
- Separate routing from switching functions
- Leverage performance and QoS capabilities of ATM network
- Direct connections between ELANs rather than passing through traditional routers
- Direct Virtual Channel Connections (VCC) between data forwarding devices
- Interworking with unified routers
- Enables subnet members to be distributed across the network
- Efficient scalability of the ATM network

Original MPOA Architecture



Basics of MPOA

- LANE 2.0 is integrated for the Intra-Subnet communication
- Next-Hop-Resolution-Protocol (NHRP) is basic for the extended Address Resolution Protocol, which is used for the establishment of ATM-SVCs over Subnet Limitations
- MPOA Client (MPC): Functionality on Edge Device or ATM Host, is starting and ending point of one shortcut connection, determine of Traffic Flows, storage of shortcut information
- MPOA Router (MPR): Mapping of subnets on layer 3 from ATM networks, NHRP for address resolution, managing of address information (MAC, ATM, IP), OSPF + RIP for the communication with legacy Routers
- MPOA Server (MPS): Logical component of a MPOA router, includes NHS, MPC Layer 3 Forwarding Information

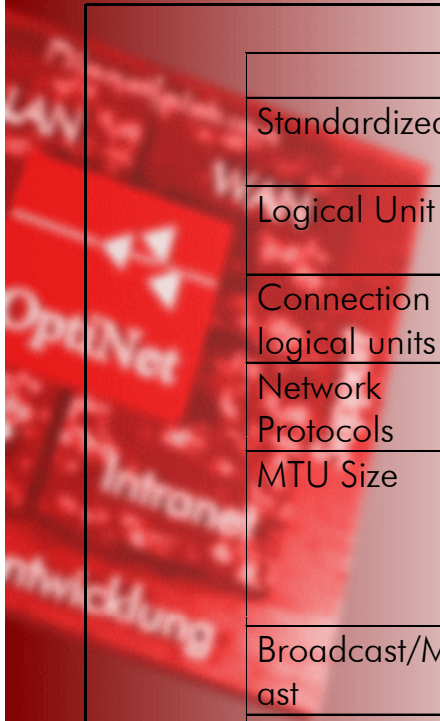
Multiprotocol-Label-Switching (MPLS)

- Integrates the label swapping forwarding paradigm with network layer routing
- Label Swapping improves the scalability of the network layer and layer routing service
- Allowing new routing services to be added without a change to the forwarding paradigm
- MPLS is not confined to any specific link layer technology
- Use of a routing approach whereby the normal mode of operation is that layer 3 routing

MPLS Core Mechanisms

- Semantics assigned to a stream label: Labels are associated with specific streams of data.
- Forwarding Methods: Forwarding is simplified by the use of short fixed length labels to identify streams; Forwarding may require simple functions such as looking up a label in a table, swapping labels, and possibly decrementing and checking a TTL; direct use of underlying layer 2 forwarding, such as is provided by ATM or Frame Relay equipment.
- Label Distribution Methods: Allow nodes to determine which labels to use for specific streams; use some sort of control exchange, and/or be piggybacked on a routing protocol

Comparison of the technologies



	LANE	CLIP	MPOA	MPLS
Standardized by	ATM-Forum	IETF	ATM-Forum, IETF	IETF
Logical Unit	Emulated LAN (ELAN)	Logical IP Subnet (LIS)	Emulated LAN (ELAN)	Logical IP Subnet (LIS)
Connection of logical units	Layer 2 (bridging)	Layer 3 (routing)	Layer 2 or Layer 3	Layer 3
Network Protocols	Any layer 3 protocol	Only IP	Any layer 3 protocol	Mainly IP
MTU Size	1 500 byte, restricted by legacy LANs	9 180 byte, restricted by IP and AAL-5	1 500 byte, restricted by network protocol and AAL-5	Restricted by network protocol
Broadcast/Multicast	BUS	MARS	BUS (MARS)	MARS
Address Resolution	IP→MAC, MAC→ATM	ARP server	NHRP	NHRP
QoS	Not supported	Not support	Will be supported	Will be supported, restricted by the network protocol

View in the near future

- CLIP, Version 2
  - distributed ATMARP server
- LANE, Version 2
  - L-UNI: QoS, Multicast, ELAN Multiplexing
  - L-NNI: distributed LES/BUS
- MPOA, Version 1
  - Further work on integration new protocols like RSVP and P-NNI
  - Further integration of LANE 2.0
- MPLS, Version 1
  - The standard will come this year (1998)
  - Depends on Tag Switching development of CISCO

Book Tip

ATM in TCP/IP-Networks

Basics and Migrations to High Speed Networks

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