Performance Measurement
&
Instrumentation

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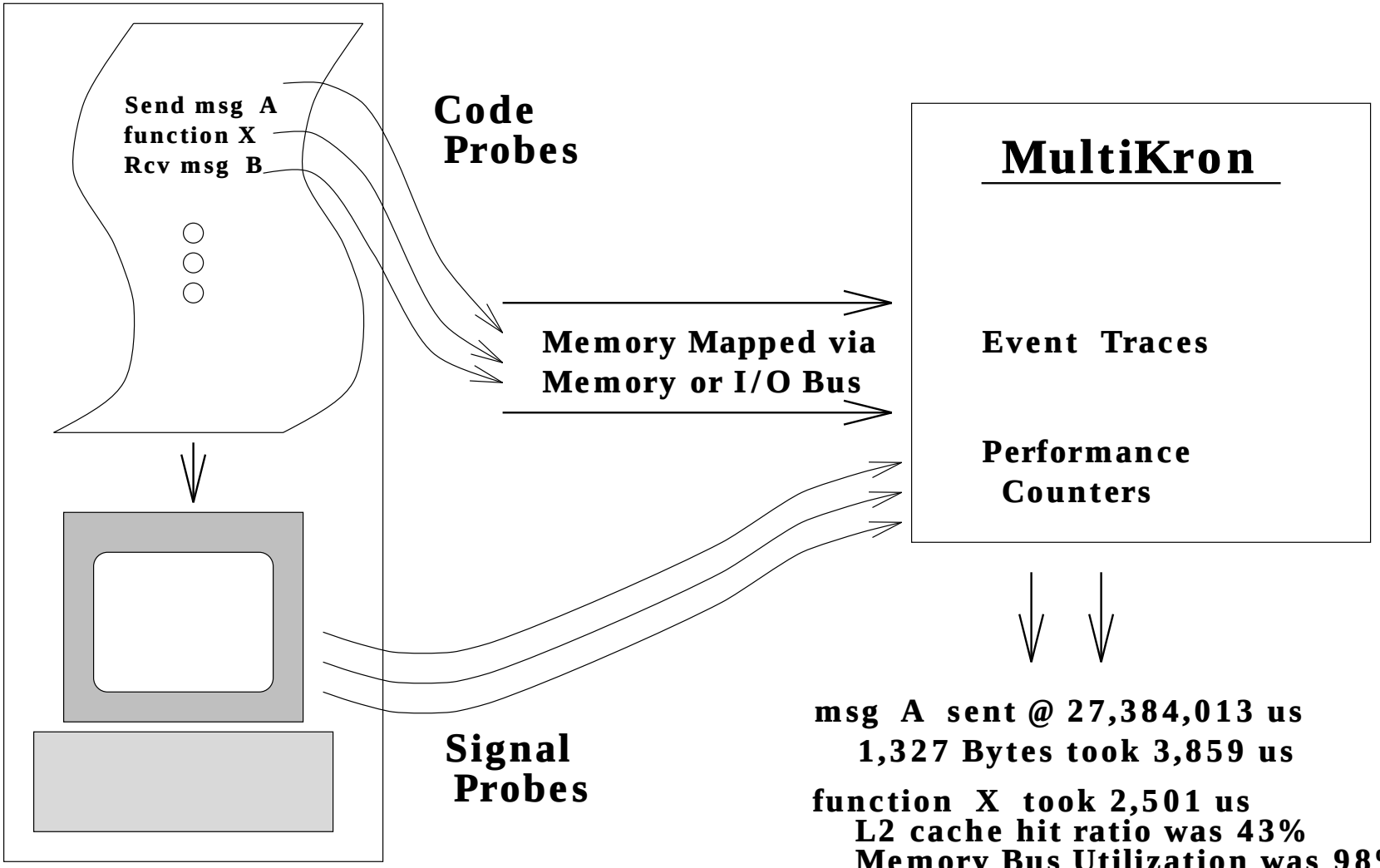
Performance Testing Using the MultiKron



Performance counters are starting to appear on commercial processor chips (e.g., Intel Pentium, MIPS R10000, IBM Power2, DEC Alpha)

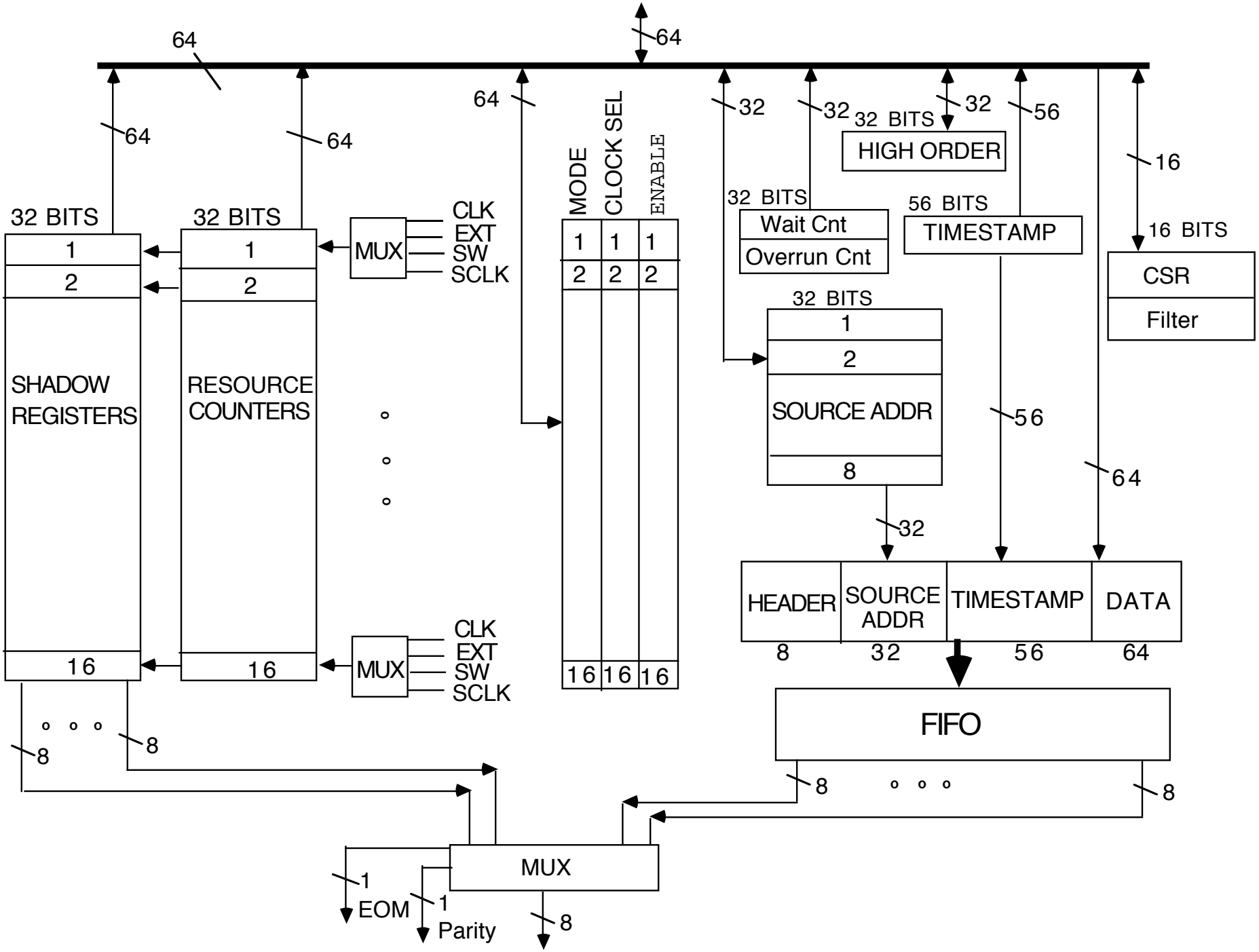


Figure 1. Block diagram of the MultiKron II Chip

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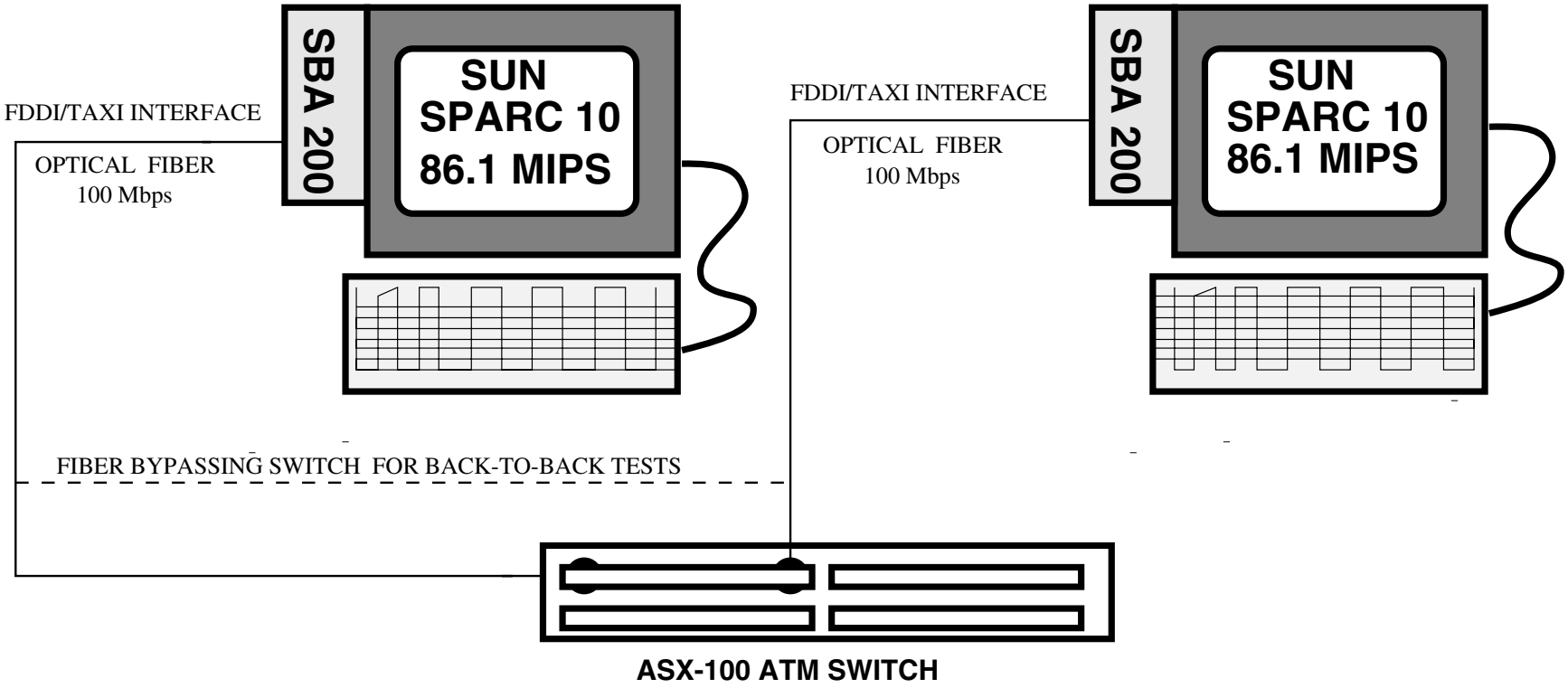
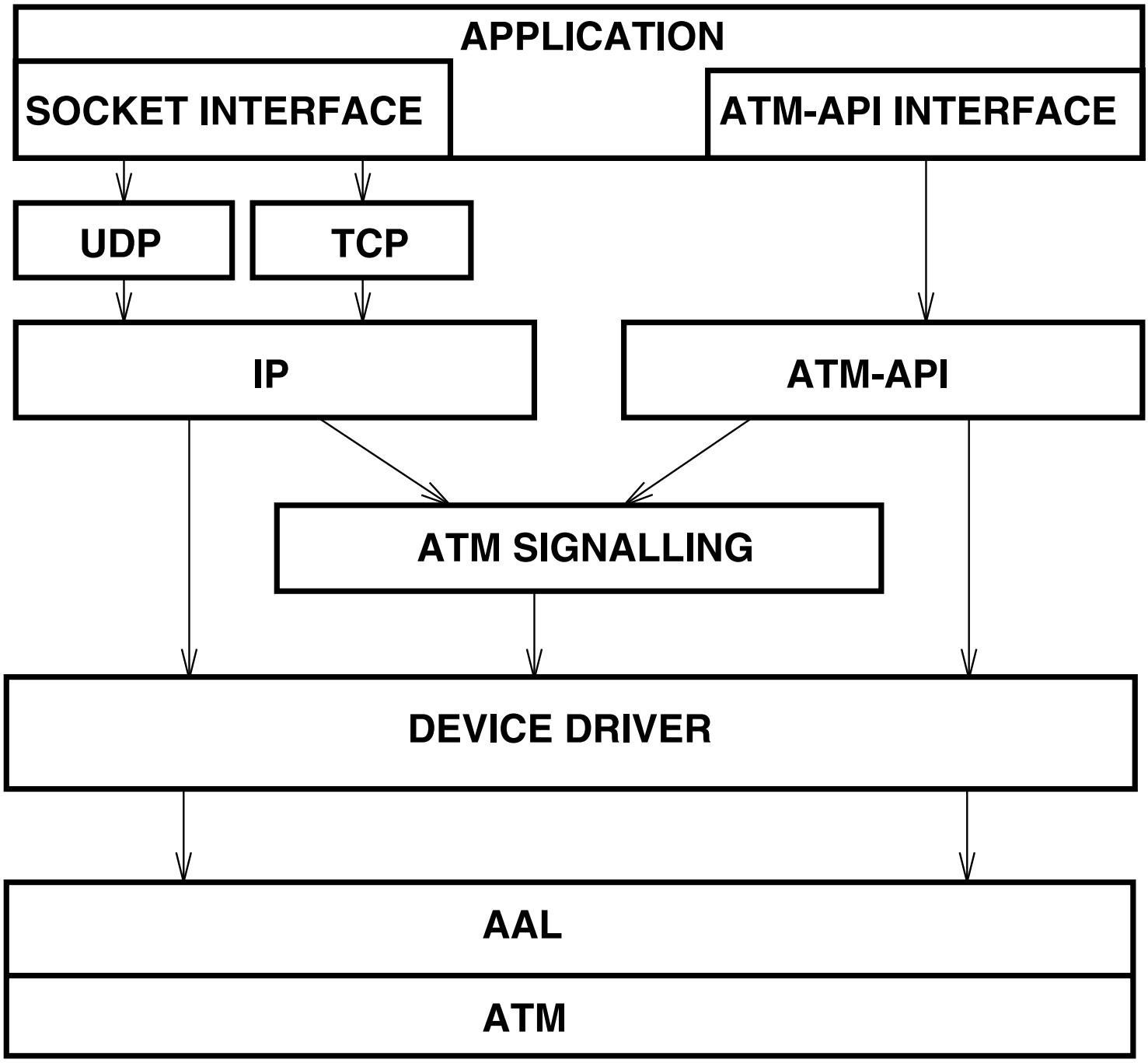

SBA 200
SUN
SPARC 10
86.1 MIPS
FDDI/TAXI INTERFACE
OPTICAL FIBER
100 Mbps
SBA 200
SUN
SPARC 10
86.1 MIPS
FDDI/TAXI INTERFACE
OPTICAL FIBER
100 Mbps
FIBER BYPASSING SWITCH FOR BACK-TO-BACK TESTS
ASX-100 ATM SWITCH

Client (sender)

```
OPEN(file)
COPY(file to memory)
Close(file)
CONNECT(server)
MultiKron = start_event
WHILE( data_sent < size_of_file)
{
   ATM_SEND(dev, buffer, size)
   MultiKron = send_event
 }
 MultiKron = end_send_event
 DISCONNECT(server)
```

Server (receiver)

```
ACCEPT(connection)
WHILE(anything to read)
{
   ATM_RECV(dev,buffer,size)
   MultiKron = recv_event
}
MultiKron = end_recv_event
CLOSE(client)
```


APPLICATION
SOCKET INTERFACE
ATM-API INTERFACE
UDP
TCP
IP
ATM-API
ATM SIGNALLING
DEVICE DRIVER
AAL
ATM

	Sending Data		Receiving Data	
	Time (μs)	% of layer	Time (μs)	% of layer
Kernel Supervisory call/rtn overhead	68.9		68.9	
Socket Layer	158	100	97.7	100
-socket processing	8.8	5.6		
-data handling buffer mgt	136	86.4	93.3	95.5
-enqueue/dequeue socket queue	12.8	8	4.5	4.5
TCP Layer	176	100	117.9	100
-TCP processing	1.4	0.8	34.6	29.4
-checksumming	72.5	41.2	68.4	58.0
-allocate & link in data	87.2	49.4		
-fill in & process header	14.8	8.6	14.9	12.6
IP Layer	20.4	100	20	100
-IP processing	7.7	37.7	16.2	81
-checksumming	4.3	21.1	1.8	9
-routing	8.4	41.2	2	10
Device Driver Layer	87.1	100	86	100
-processing	8.8	10	20.0	23.2
-queueing dequeueing	16.7	20	18.6	21.5
-data handling	58.6	67	35.7	41.5
-device handling	3.0	3	11.9	13.8
Layer Totals	510.4		390.5	

Table 1: Detailed measurement of the execution times of the different layers of the TCP/IP protocol stack for sending and receiving acknoledgements. All measurements are averages with approximatly a 10 % variation.

Architectural Limit

Message Size

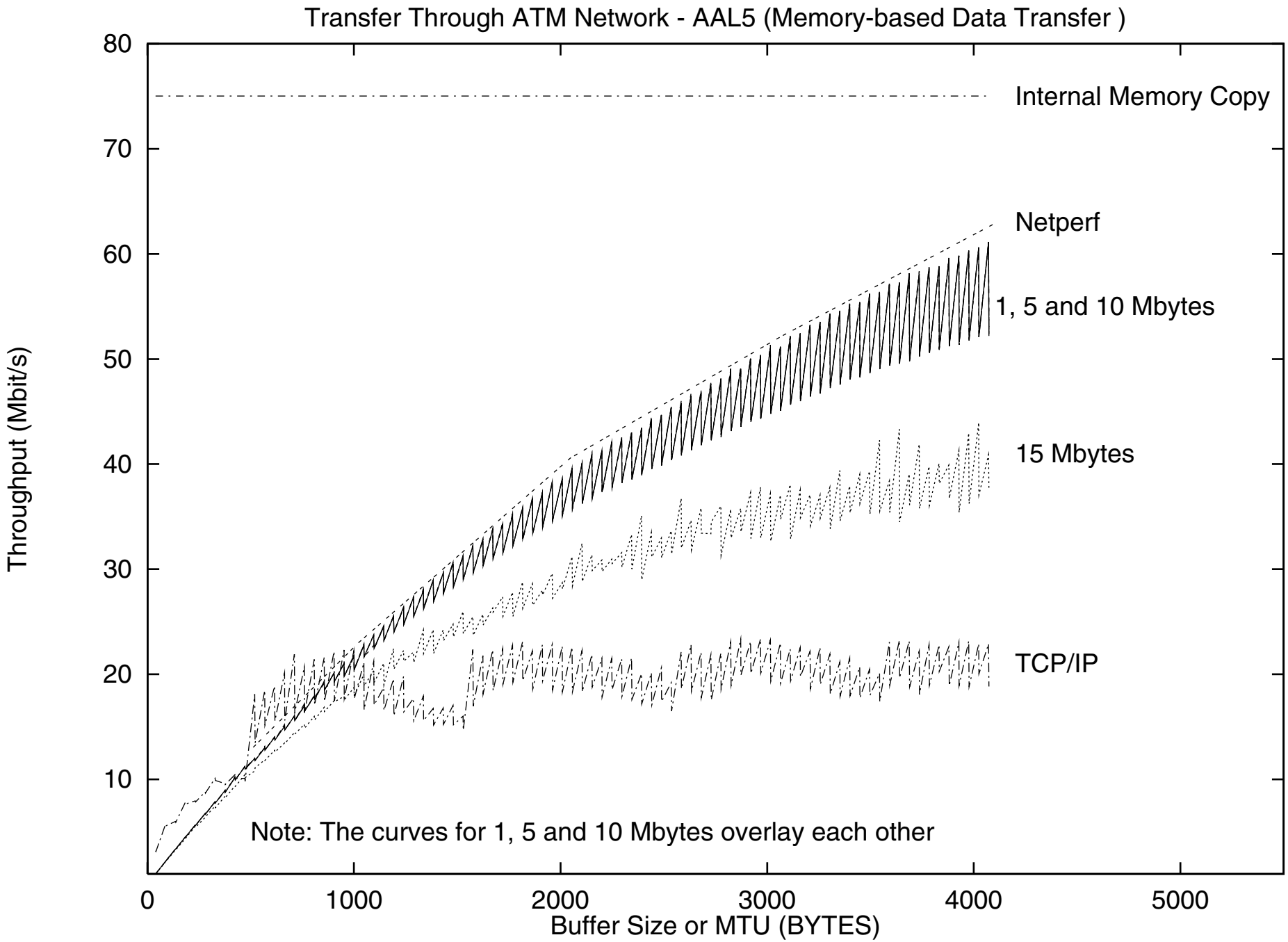
Buffer Size

TCP/IP vs. API

AAL

Switch

Cell Loss


Transfer Through ATM Network - AAL5 (Memory-based Data Transfer)
Throughput (Mbit/s)
Buffer Size or MTU (BYTES)
80
70
60
50
40
30
20
10
0
1000
2000
3000
4000
5000
Internal Memory Copy
Netperf
1, 5 and 10 Mbytes
15 Mbytes
TCP/IP
Note: The curves for 1, 5 and 10 Mbytes overlay each other

Cells Lost

(File Size (Bytes))		Buffer Size (Bytes)		
		2048	3072	4096
	1 MByte	7.46 %	6.17 %	23.89 %
	5 MBytes	20.45 %	23.26 %	37.27 %
	10 MBytes	21.77 %	25.65 %	39.04%