Benefits and tradeoffs of application-specific WAN acceleration in different bandwidth, latency and loss scenarios.

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Agenda

- IT trends and inner-workings of WX and AppFlow
- Considerations of protocol optimization
- Test lab and lab considerations
- Tests performed
- Test results
- Difficulties of the WX platform
- Conclusion of results

IT trends

- Centralization of services (e.g. email, storage)
- Usage of LAN protocols over WAN links
  - Problem: different link characteristics

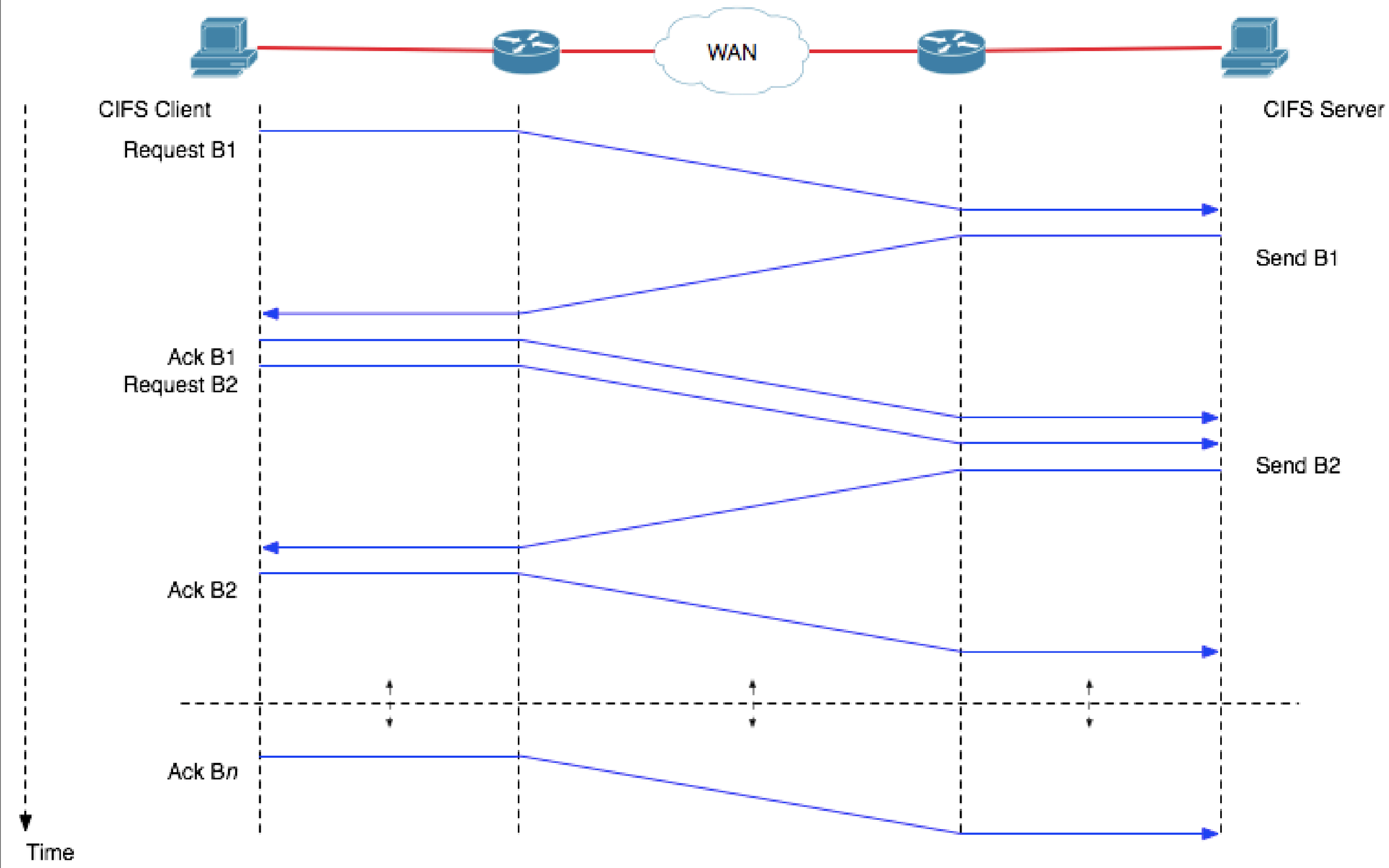
Working of the WX

- 2x WX on both sides work as a black box
- Caching, Compression
- TCP Optimization
  - TCP window size
  - Bandwidth*delay product
- Application Acceleration
  - CIFS, MAPI, HTTP

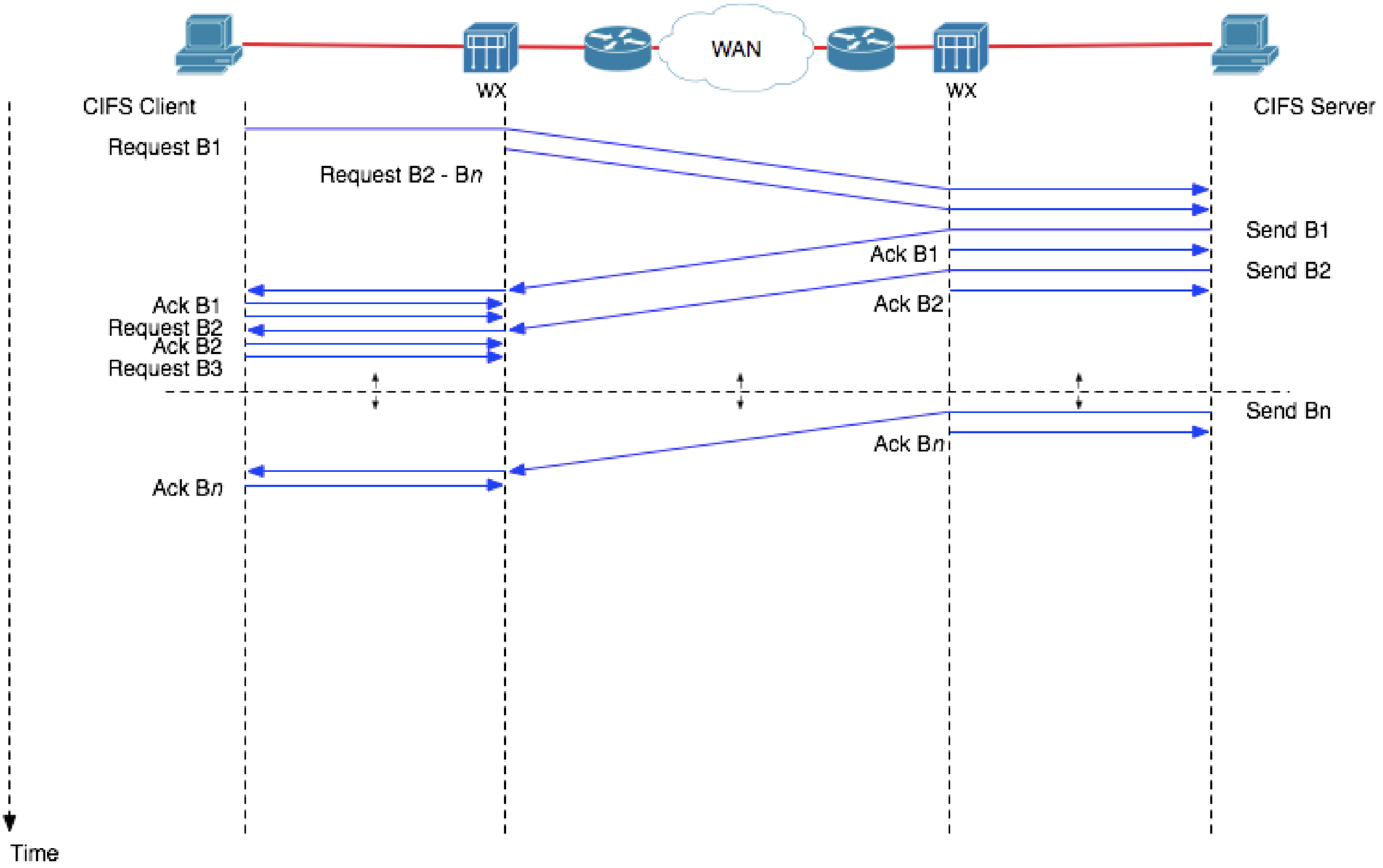
Why application layer acceleration works

- CIFS, MAPI and HTTP
  - HTTP by pre-fetching objects
  - CIFS and MAPI by eliminating protocol inefficiencies (window size = 1)

No acceleration



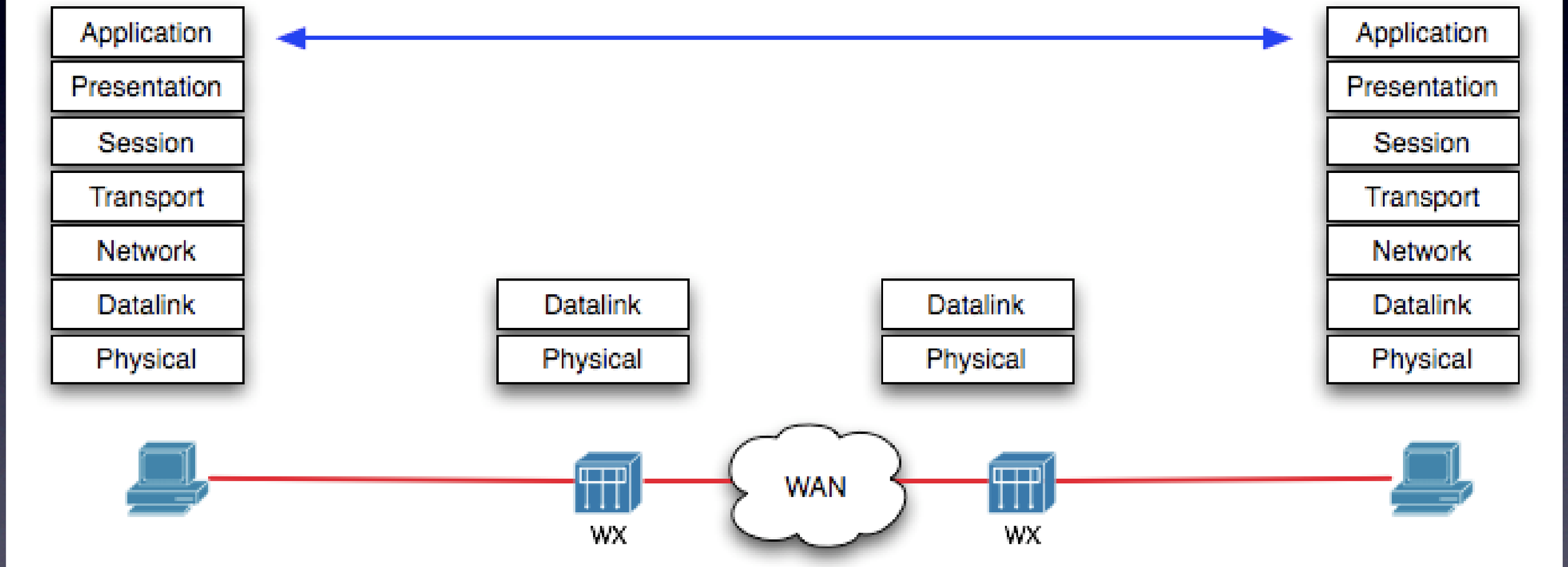
AppFlow Acceleration



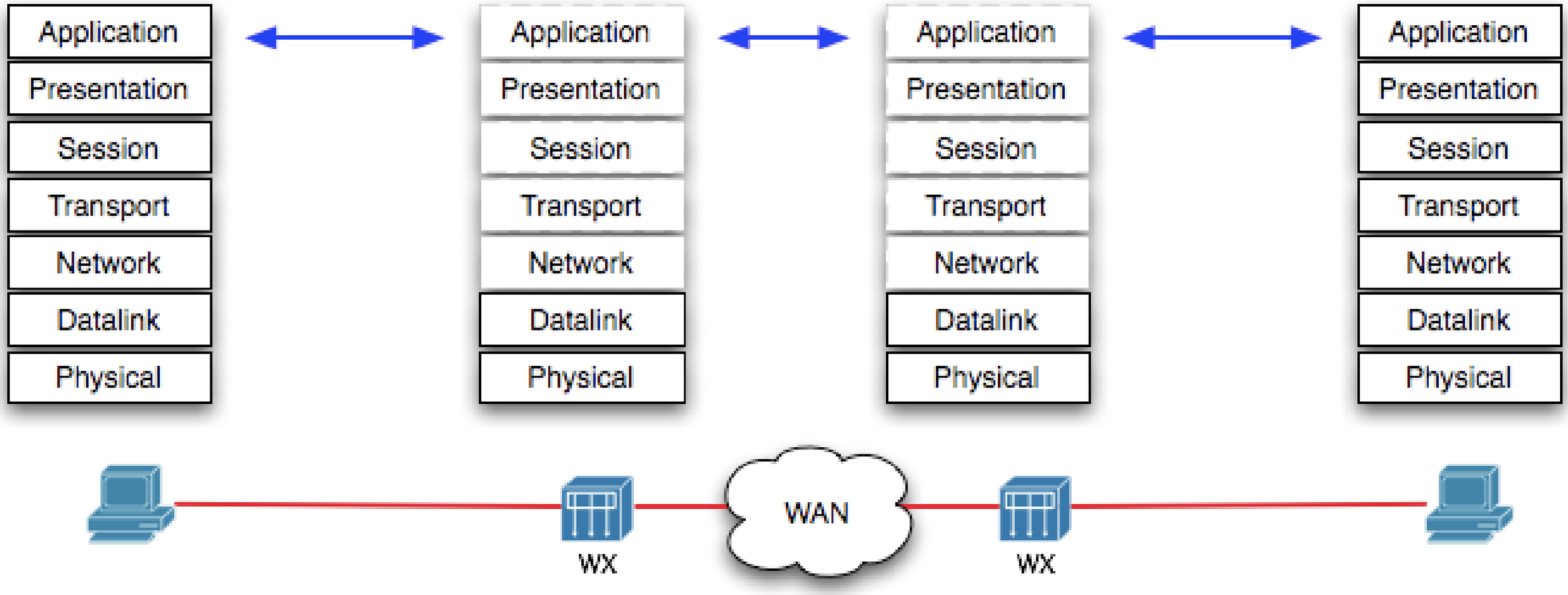
Inline protocol optimization

- Vendors start to optimize their protocols
  - These products exist by grace of Microsoft
    - Otherwise Legacy/Niche market
- Total disregard of the OSI layered model
  - Choice: bad performance or rule breaking
  - Problems with troubleshooting/compatibility

Expected scenario



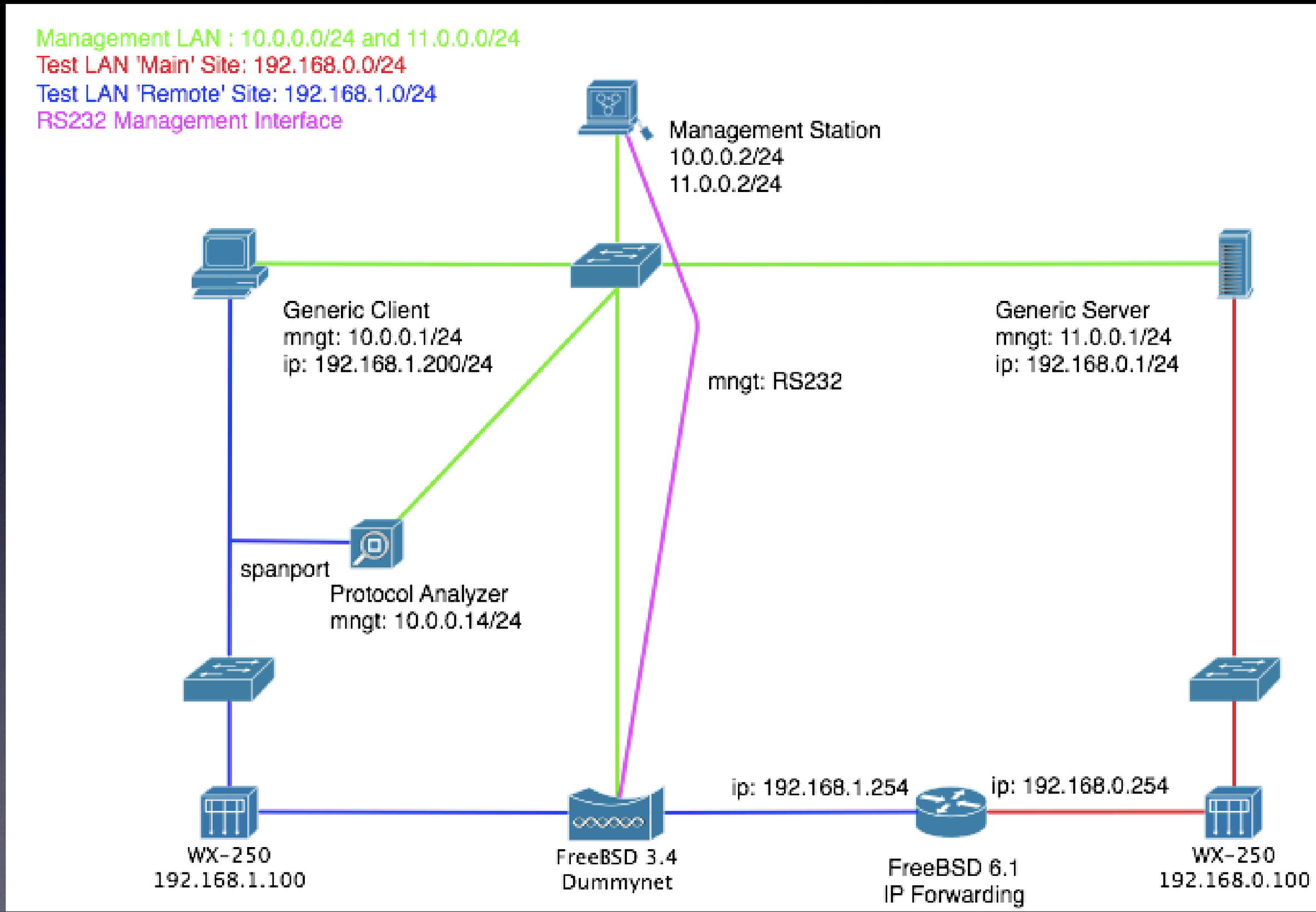
Actual scenario



Test lab

- 2x Juniper WX 250 Appliances
- 1x Windows 2003 File and Exchange Server
- 1x Windows XP client with Outlook
- 1x FreeBSD router
- 1x FreeBSD Link simulator (dummynet)
- 1x FreeBSD sniffer (tcpdump on a spanport)

Test Setup


Management LAN : 10.0.0.0/24 and 11.0.0.0/24
Test LAN 'Main' Site: 192.168.0.0/24
Test LAN 'Remote' Site: 192.168.1.0/24
RS232 Management Interface
Management Station
10.0.0.2/24
11.0.0.2/24
Generic Client
mngt: 10.0.0.1/24
ip: 192.168.1.200/24
mngt: RS232
Generic Server
mngt: 11.0.0.1/24
ip: 192.168.0.1/24
spanport
Protocol Analyzer
mngt: 10.0.0.14/24
ip: 192.168.1.254
ip: 192.168.0.254
WX-250
192.168.1.100
FreeBSD 3.4
Dummynet
FreeBSD 6.1
IP Forwarding
WX-250
192.168.0.100

Considerations

- Keeping the link clean
  - All management out of band
  - Disabled all unused protocols
- Empirical testing
  - Measurement by observation through packet inspection
  - Anomalies and unexplainable results marked, not investigated due to limited time

Measurement

- Products of the equation
  - Volume is a known constant
  - Time needed for throughput measurement
- Time measured with protocol inspector
  - Δt of first block and last block

Measurement (cont'd)

- Interested in AppFlow acceleration
- No caching and compression
  - Files used are random binaries
- Two tests to differentiate between TCP optimization and AppFlow acceleration

Tests done

- Baseline of no acceleration of any kind
- TCP yes, compression no
- CIFS
- MAPI XP
- MAPI 2003 (not yet fully supported by WX)

- Error correction

Link scenarios

- Bandwidth:
  - T1 like speed = 1,544 Mbit/sec
  - OC-1 like speed = 51,84 Mbit/sec
- Delay (one-way):
  - 0 ms = local link
  - 30 ms = national link
  - 100 ms = transatlantic link
  - 250 ms = satellite link

Testing CIFS

- Configure WX, reboot, mount share, open share in new window

- Configure WX, start tcpdump, ping, file transfer, ping close tcpdump

- Open PCAP, note time SMB offset 0 and last offset, calculate time and throughput

Testing MAPI

- Configure WX, mail enough 10MB files, disable preview pane, reboot

- Configure WX, open mail, start tcpdump, ping, save-as, ping, stop tcpdump, close mail

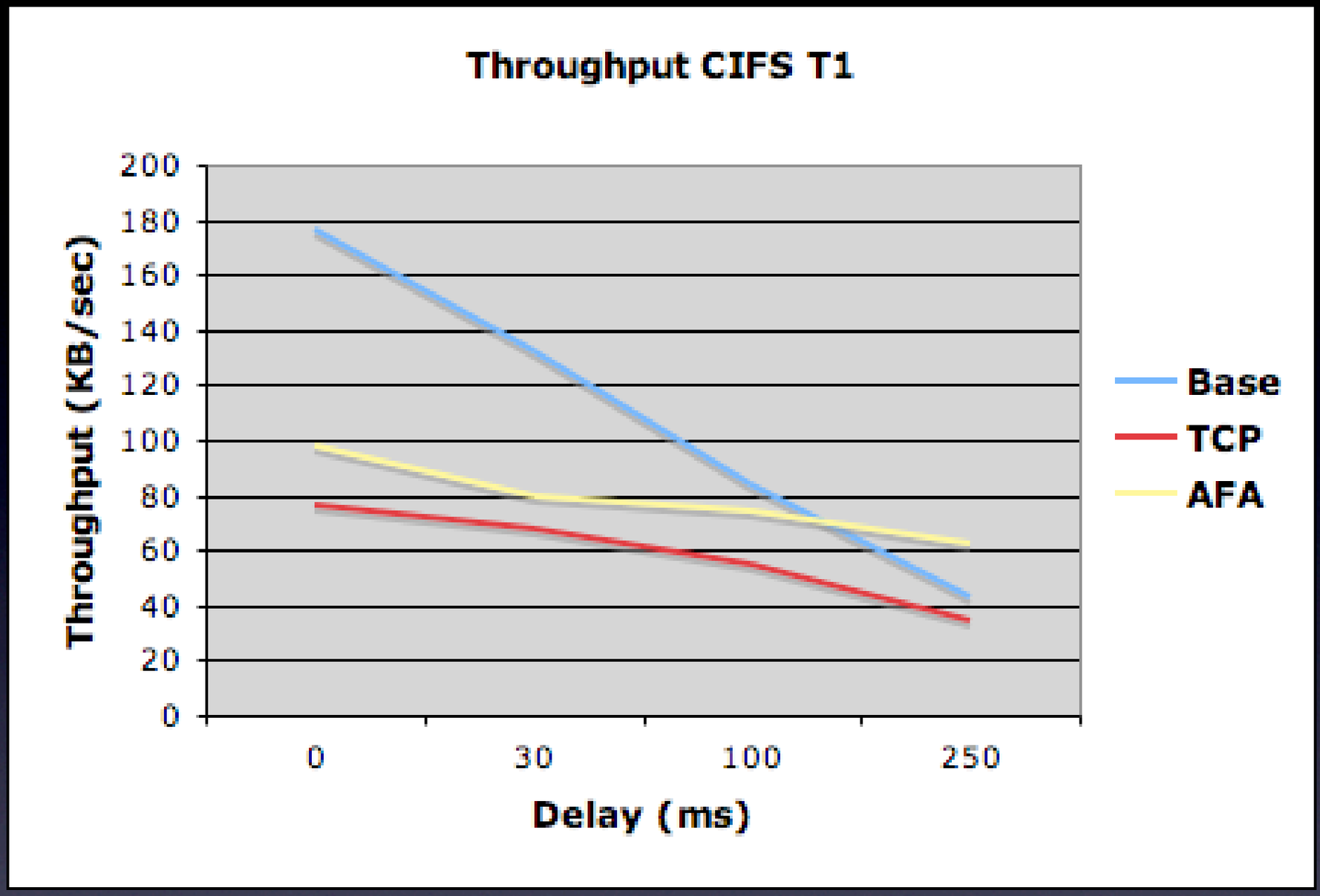
- Open PCAP, note time first and last RPC, calculate time and throughput

Testing loss

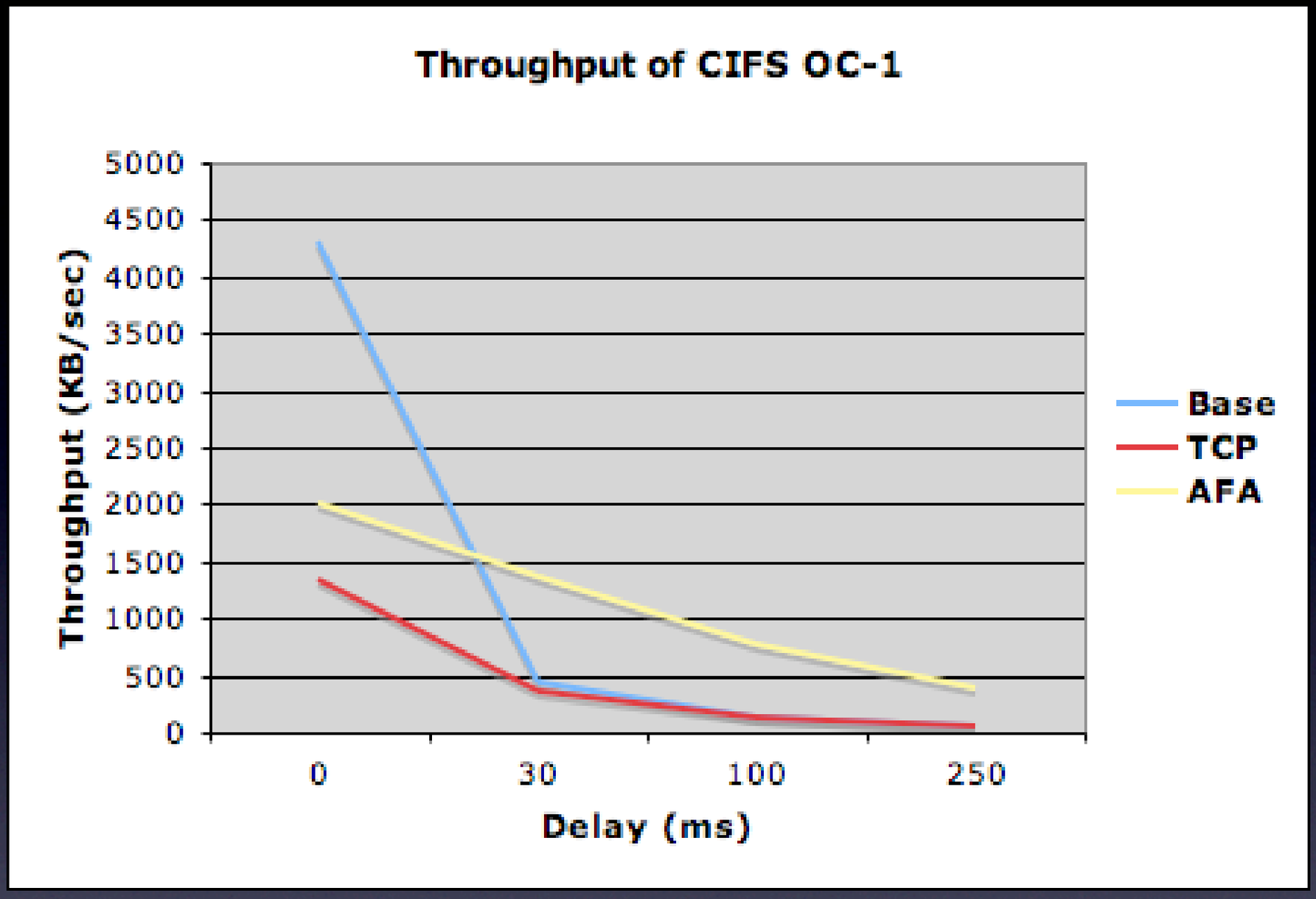
- Take scenarios tested that might be interesting
- configured chances of loss:
    - 0,1 0,05 0,01 0,005 0,001
- Do the exact same way of testing

Test results

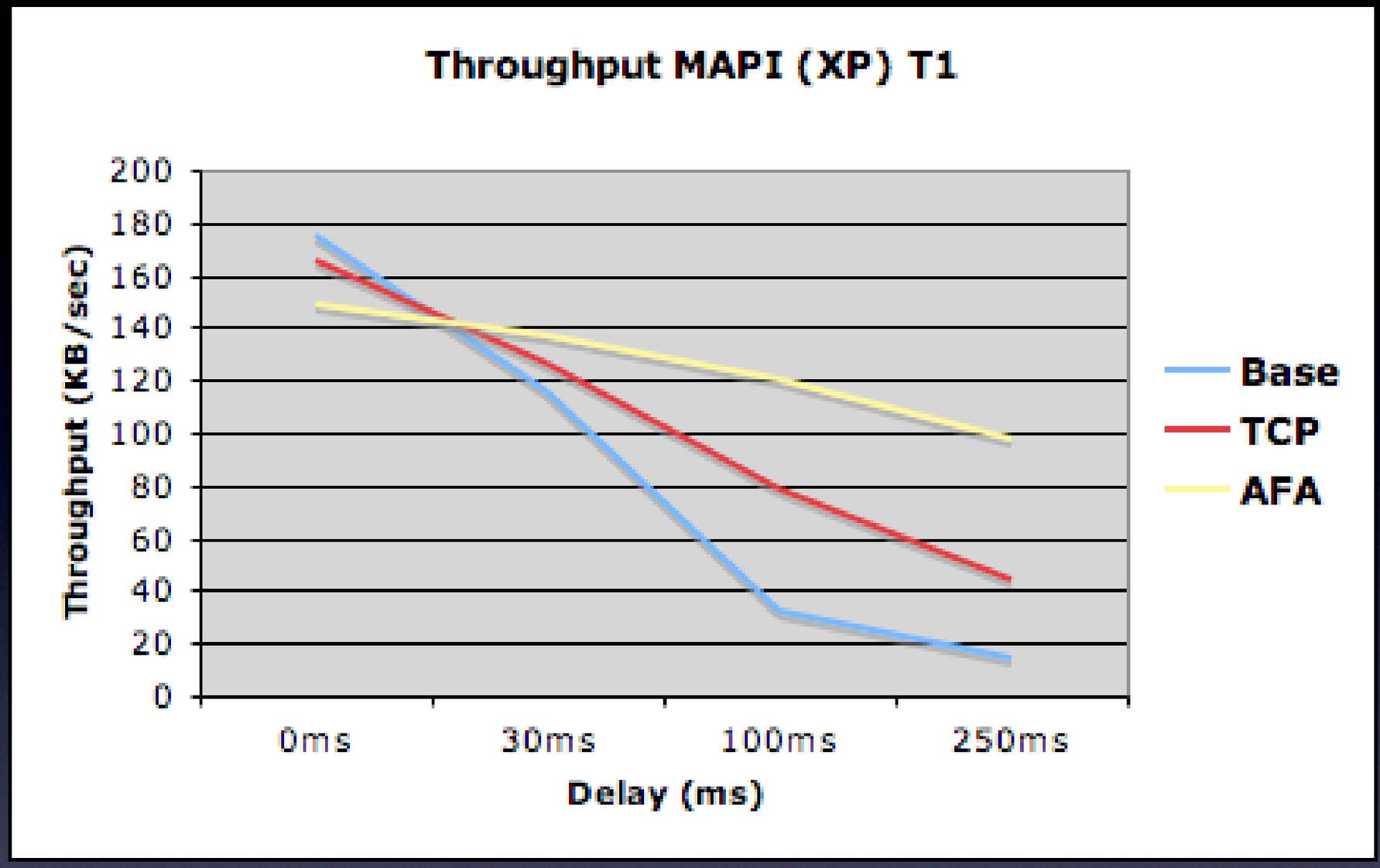
- CIFS T1 & OC-1
- MAPI (XP) T1 & OC-1
- MAPI (2003) T1& OC-1
- Loss:
  - CIFS OC-1, 0 ms
  - MAPI (XP) OC-1, 0 ms
  - MAPI (XP) OC-1, 250 ms



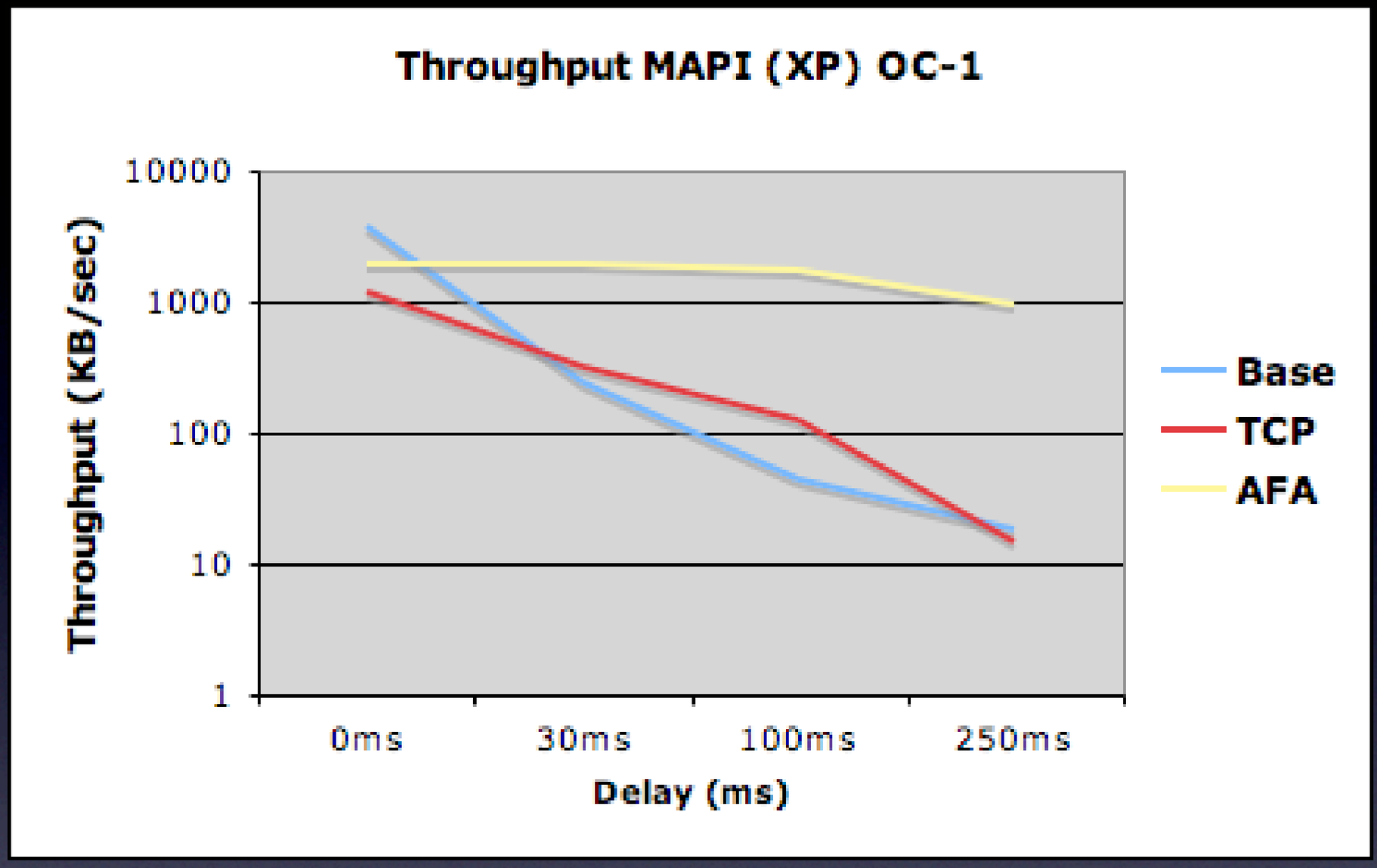
Delay	Base	TCP	AFA	Benefit
0ms	176,6	76,5	97,5	- 44.7%
30ms	131,8	67,8	79,4	- 39.7%
100ms	83,6	54,6	73,7	- 11.7%
250ms	42.7	34,2	62	45.4%



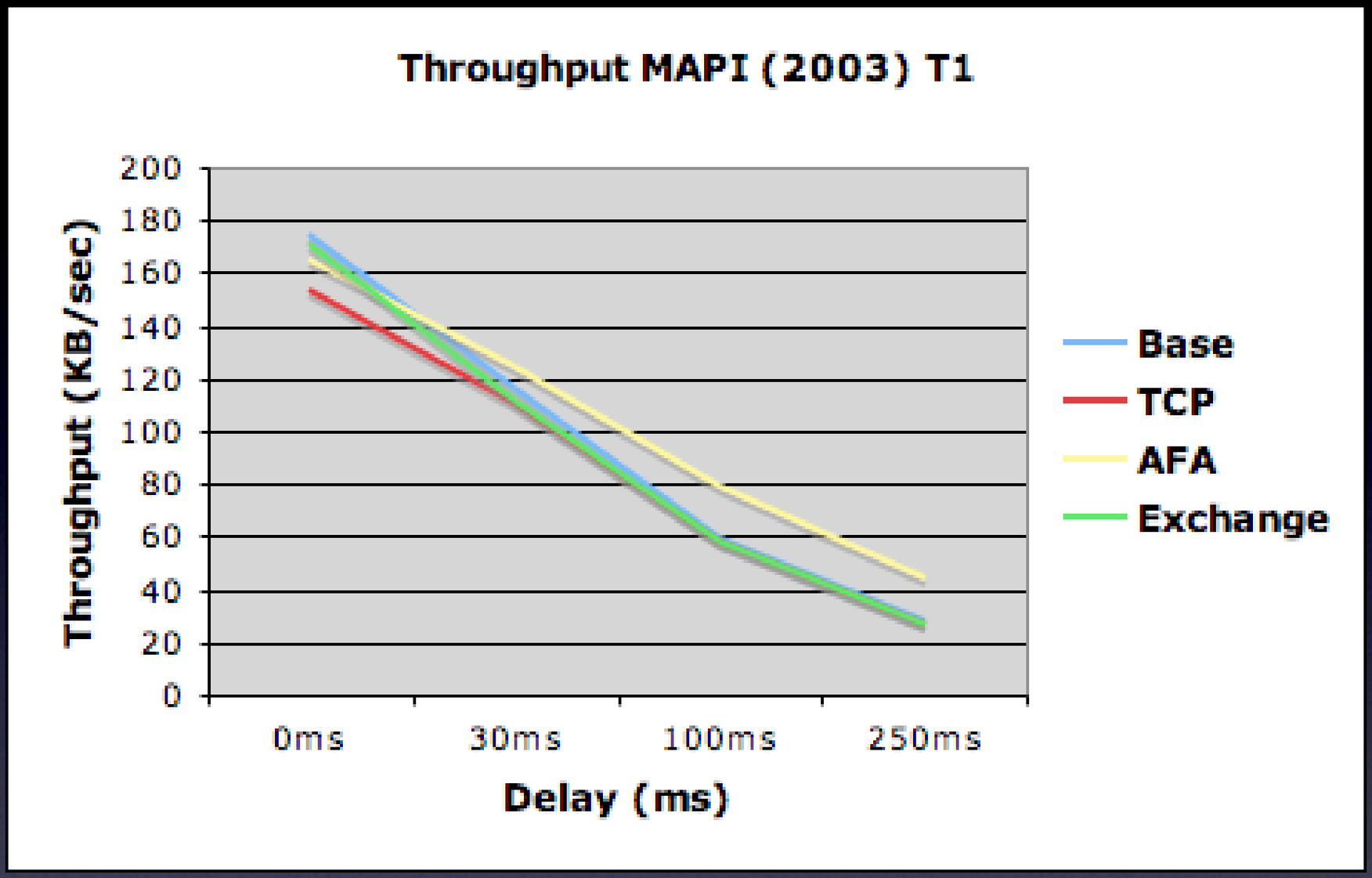
Delay	Base	TCP	AFA	Benefit
0ms	4294.6	1347,6	2008,7	- 53.2%
30ms	425,4	357,6	1373,4	222.8%
100ms	126,1	139,5	774,7	514.3%
250ms	52,3	59,7	375,4	617.4%



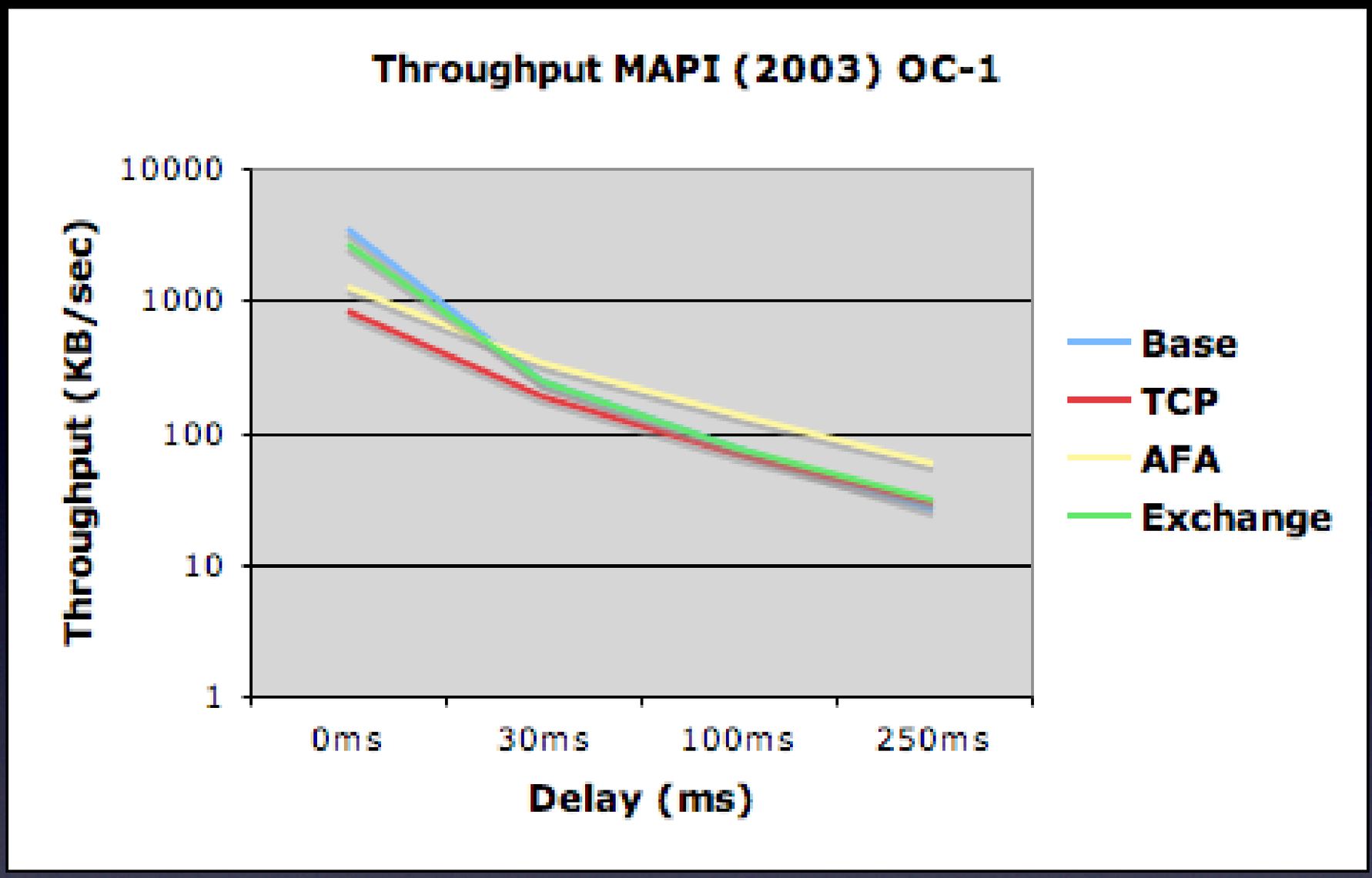
Delay	Base	TCP	AFA	Benefit
0ms	175.1	165.7	148.9	- 14.9%
30ms	116.0	126.1	136.7	17.9%
100ms	32.1	78.8	120.1	274.1%
250ms	14.3	44.1	98.2	585.7%



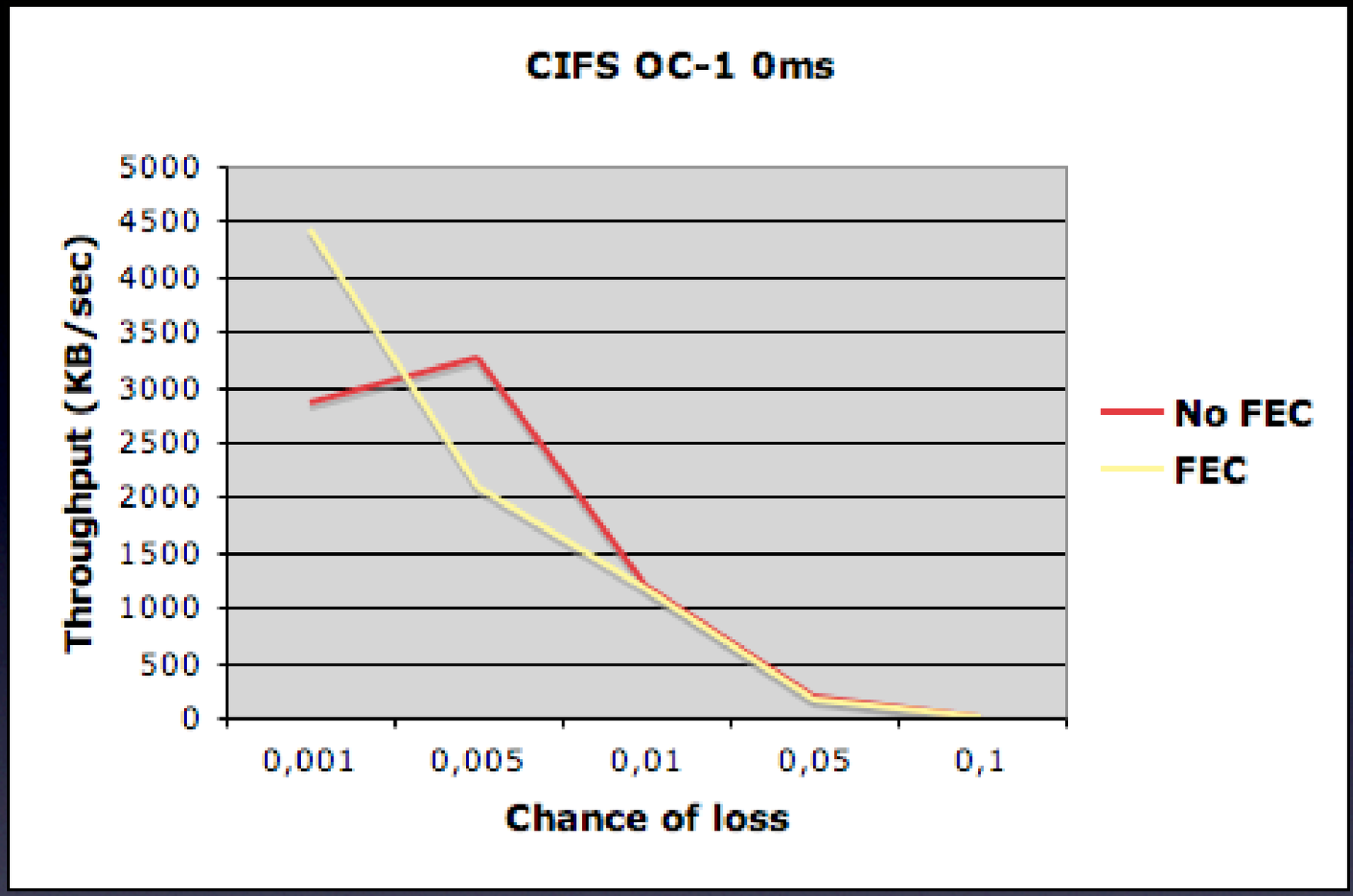
Delay	Base	TCP	AFA	Benefit
0ms	3688,3	1191,4	1969,9	- 46.6%
30ms	243,9	320,4	1949,9	652.5%
100ms	44,3	126,2	1706,2	**3752.9%**
250ms	17,9	15	953,6	**5205.5%**



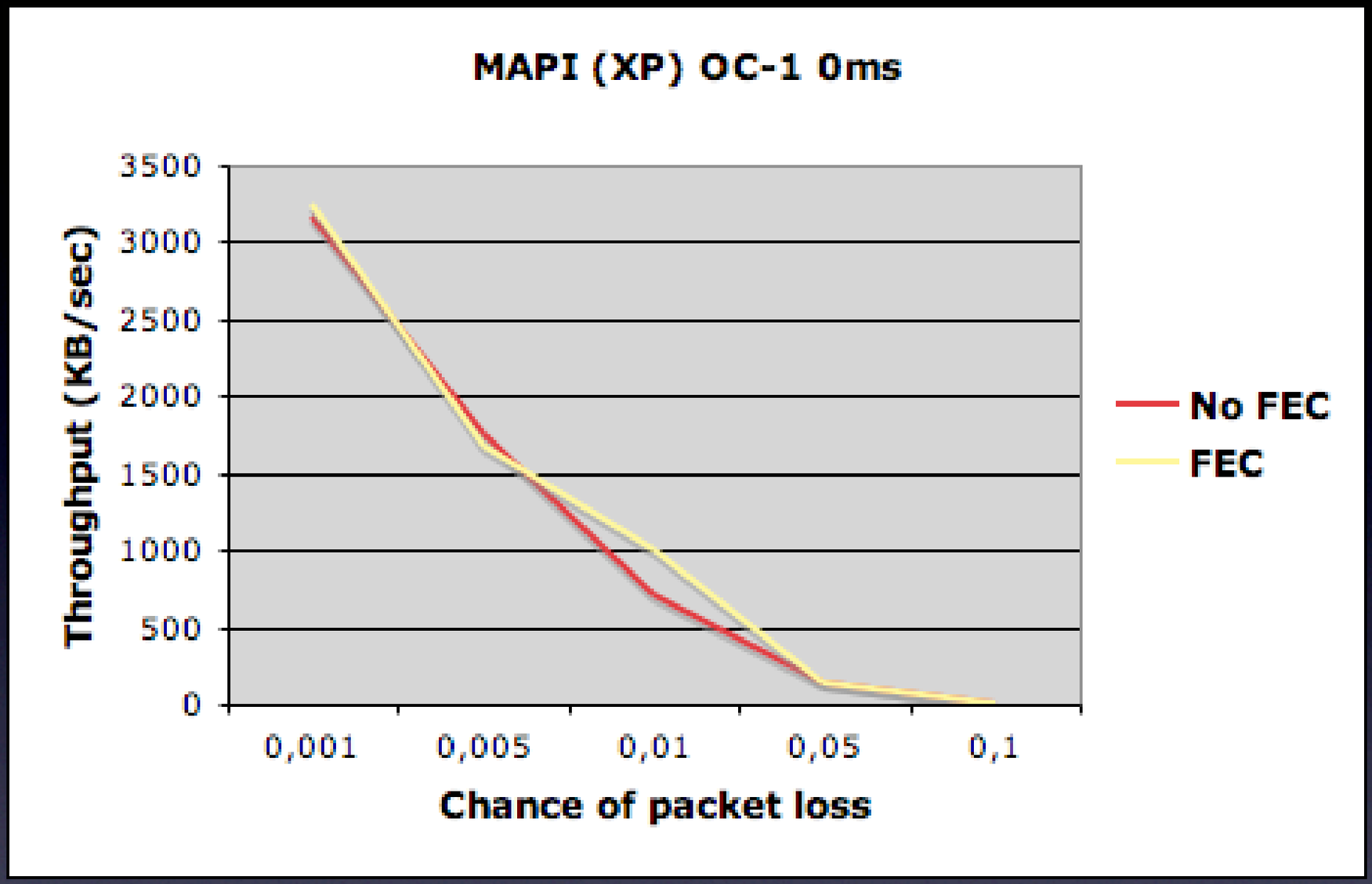
Delay	Base	TCP	AFA	Benefit	Exchange	Benefit
0ms	174	153,8	164,9	- 5.2%	170,8	- 1.8%
30ms	116,1	110,1	124,5	7.2%	111,7	- 3.8%
100ms	59,1	57,8	79,4	34.3%	58,7	- 0.9%
250ms	27,7	26,4	44,5	60.5%	27,2	- 1.8%



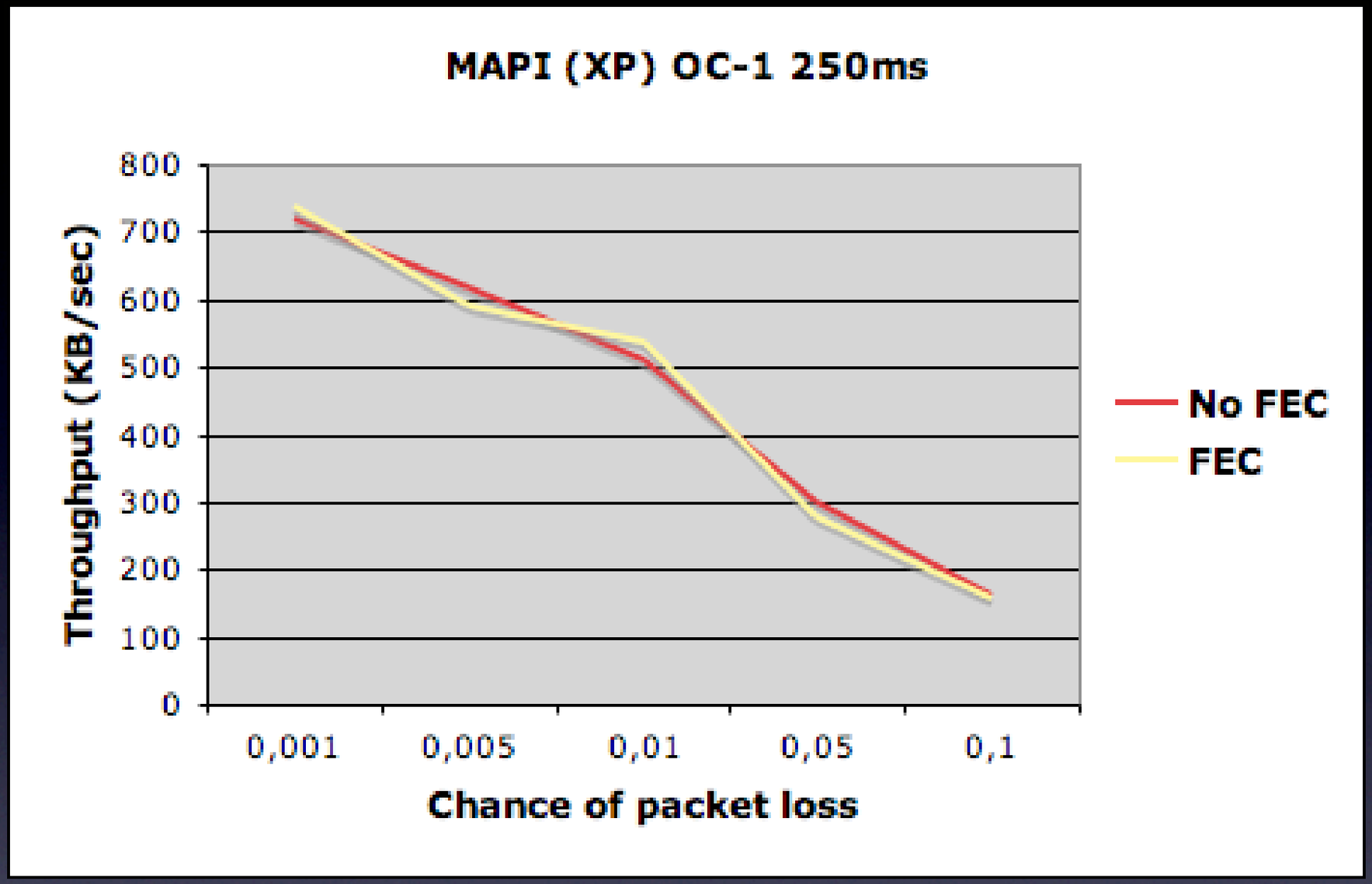
Delay	Base	TCP	AFA	Benefit	Exchange	Benefit
0ms	3447,1	829,6	1234,4	- 64.2%	2600,4	- 24.6%
30ms	244,9	183,3	337,8	37.9%	243,4	- 0.6%
100ms	72,8	68,8	131,2	80.1%	74,5	2.3%
250ms	25,5	28,7	57,8	125.9%	29,9	17.2%



	0,001	0,005	0,01	0,05	0,1
No FEC	2856,01	3263,278	1202,849	190,276	0
FEC	4417,992	2090,559	1159,407	152,972	0
Benefit	54.7%	- 36.0%	- 3.6%	- 19.6%	-

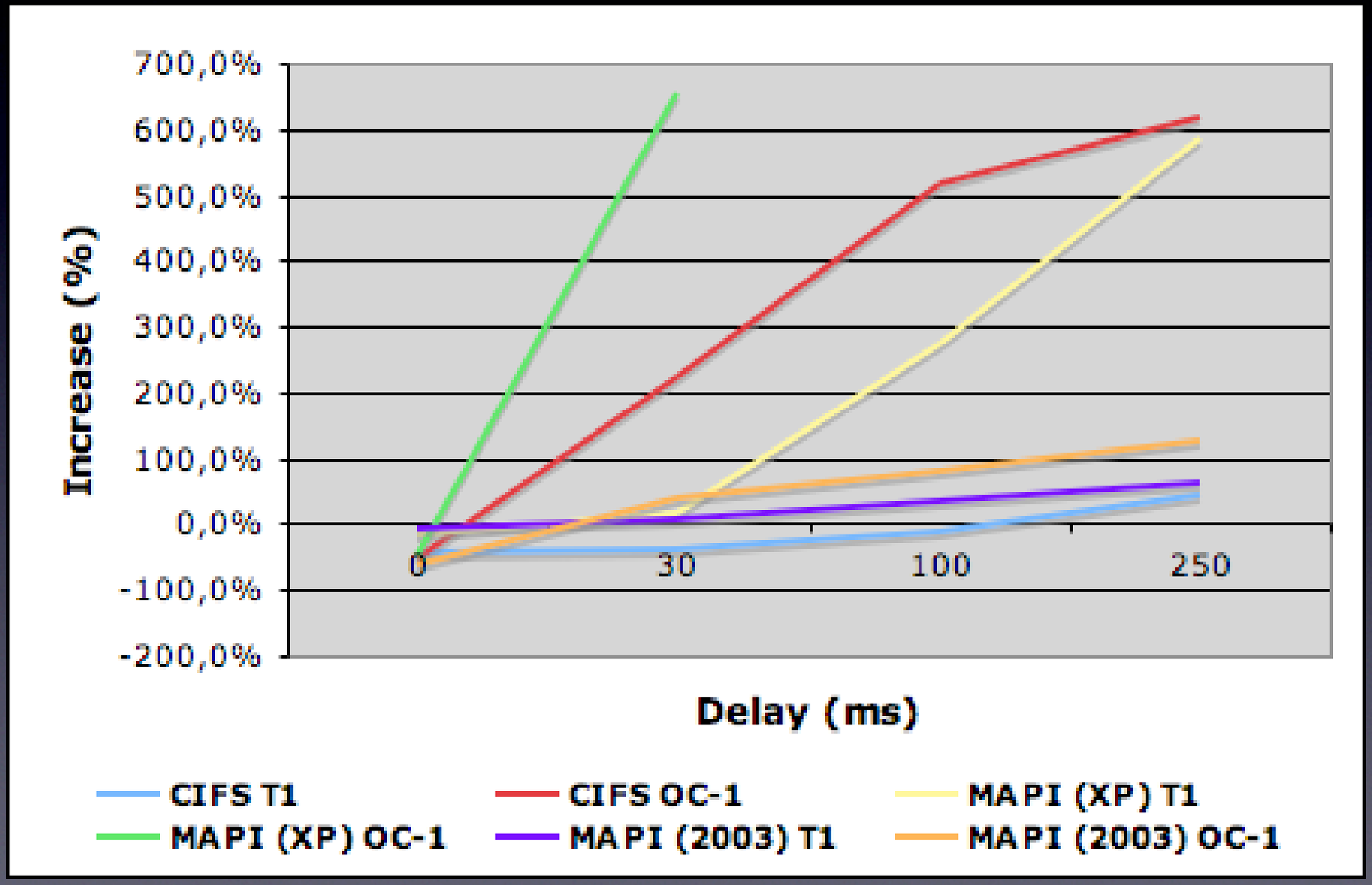


	0,001	0,005	0,01	0,05	0,1
No FEC	3175,211	1752,428	715,445	134,71	0
FEC	3253,187	1671,632	1008,115	131,317	0
Benefit	2.5%	- 4.6%	40.9%	- 2.5%	-

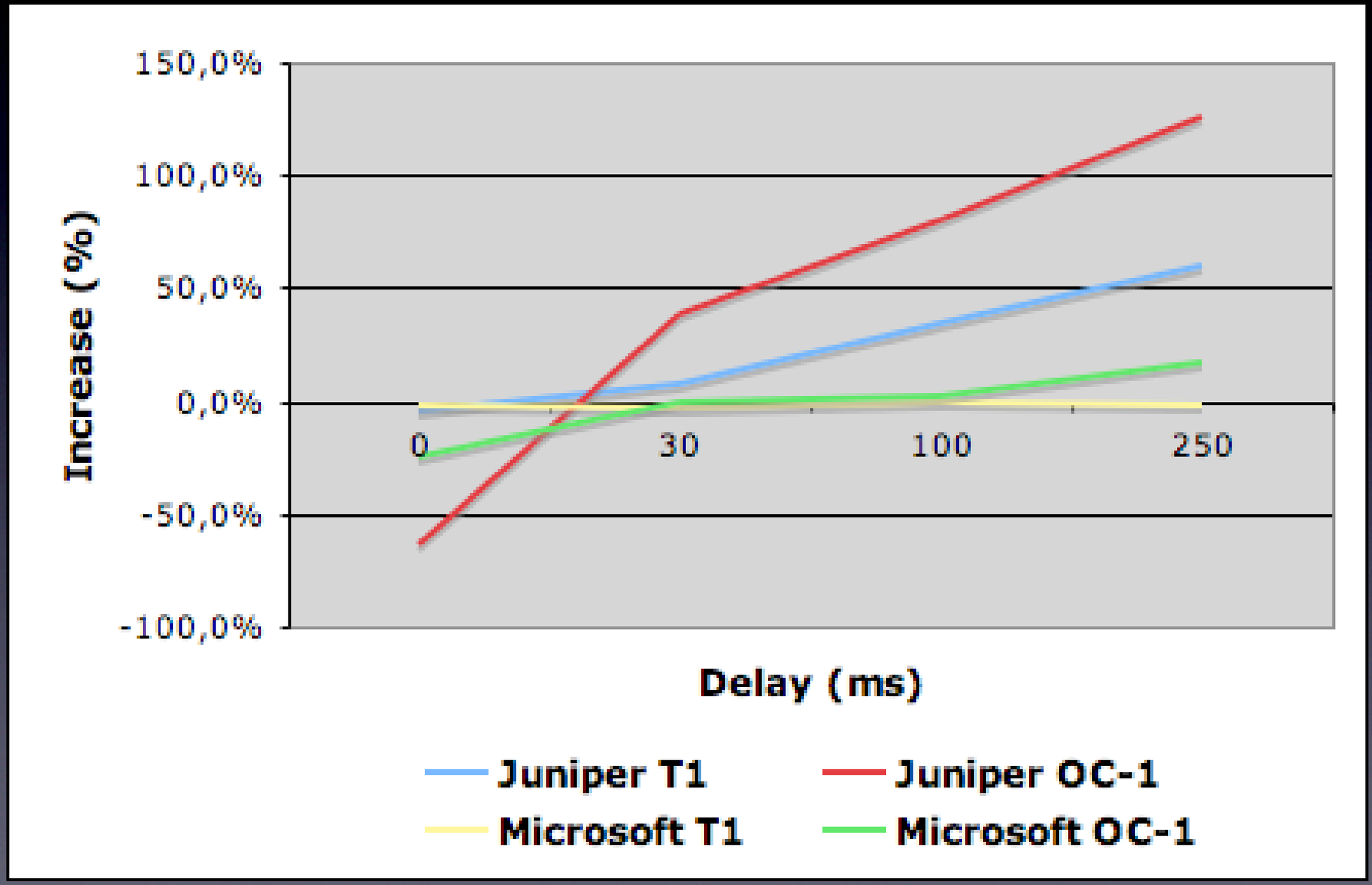


	0,001	0,005	0,01	0,05	0,1
No FEC	718,665	618,808	511,205	299,471	162,352
FEC	735,539	587,953	534,195	277,04	155,296
Benefit	2.3%	- 5.0%	4.5%	- 7.5%	- 4.3%

Conclusion


700,0%
600,0%
500,0%
400,0%
300,0%
200,0%
100,0%
0,0%
-100,0%
-200,0%
Increase (%)
0
30
100
250
Delay (ms)
CIFS T1
CIFS OC-1
MAPI (XP) T1
MAPI (XP) OC-1
MAPI (2003) T1
MAPI (2003) OC-1

Conclusion MAPI 2003



Final Conclusion

- Very good performance of CIFS, MAPI acceleration
- Better acceleration than Microsoft with Exchange 2003
- No significant performance increase FEC
- Disregard of the OSI layered model

Questions