IPPM Considerations for the IPv6 PDM Extension Header

Nalini Elkins: Inside Products, Inc.
Mike Ackermann: Blue Cross Blue Shield of Michigan
(Team : Keven Haining: US Bank, Bill Jouris: Inside Products)

Metrics / Fields Needed

- Packet sequence number
  - Speeds diagnostics
  - IPv4 IP ID used as de facto sequence number
- End-to-end response time WITHOUT agents
  - Metrics needed for quick triage:
    - One way delay
    - Server delay
    - Two way delay

We propose:

Requirement

- In basic IPv6 transport
- Unmolested by middle systems

Solution (IPv6)

•**Implementation** of existing extension header: Destination Options Header (DOH)

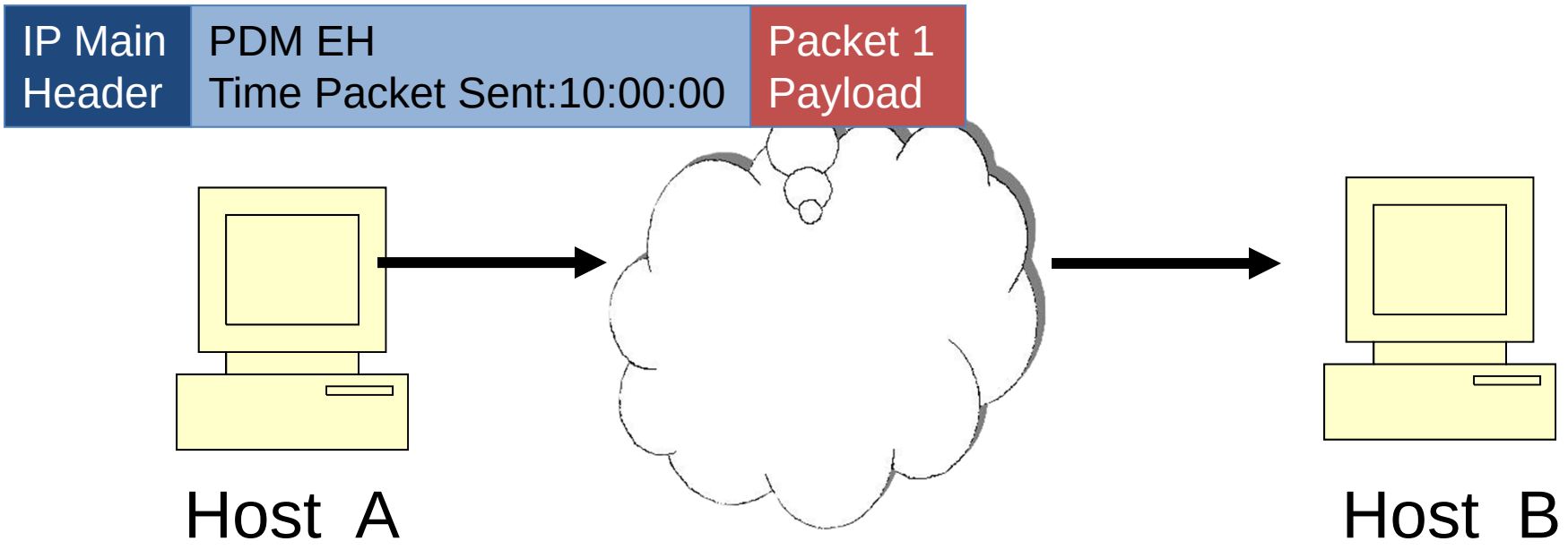
•Performance and Diagnostic Metrics (PDM) DOH

•PDM 1: Requires time synchronization

•PDM 2: No time synchronization

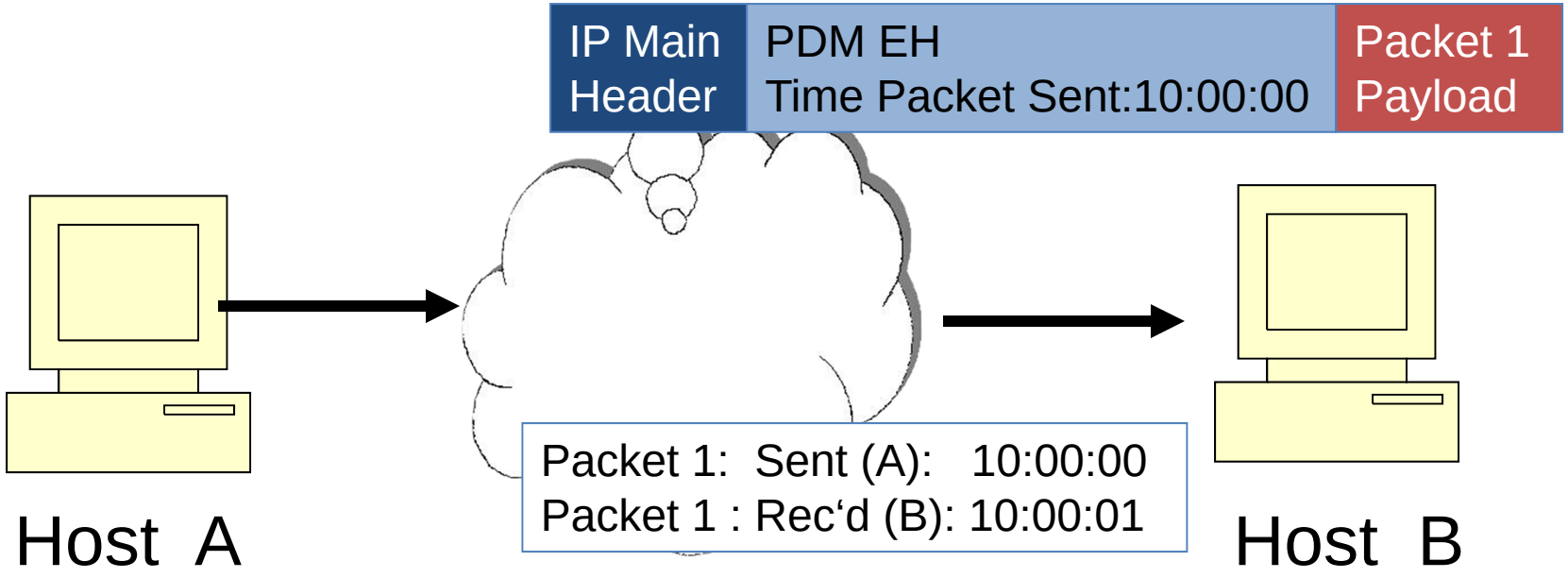
Response Time Measurement
Step 1

- Packet 1 sent from source host A
- Time-stamped leaving Host A
- Timestamp is in PDM extension header



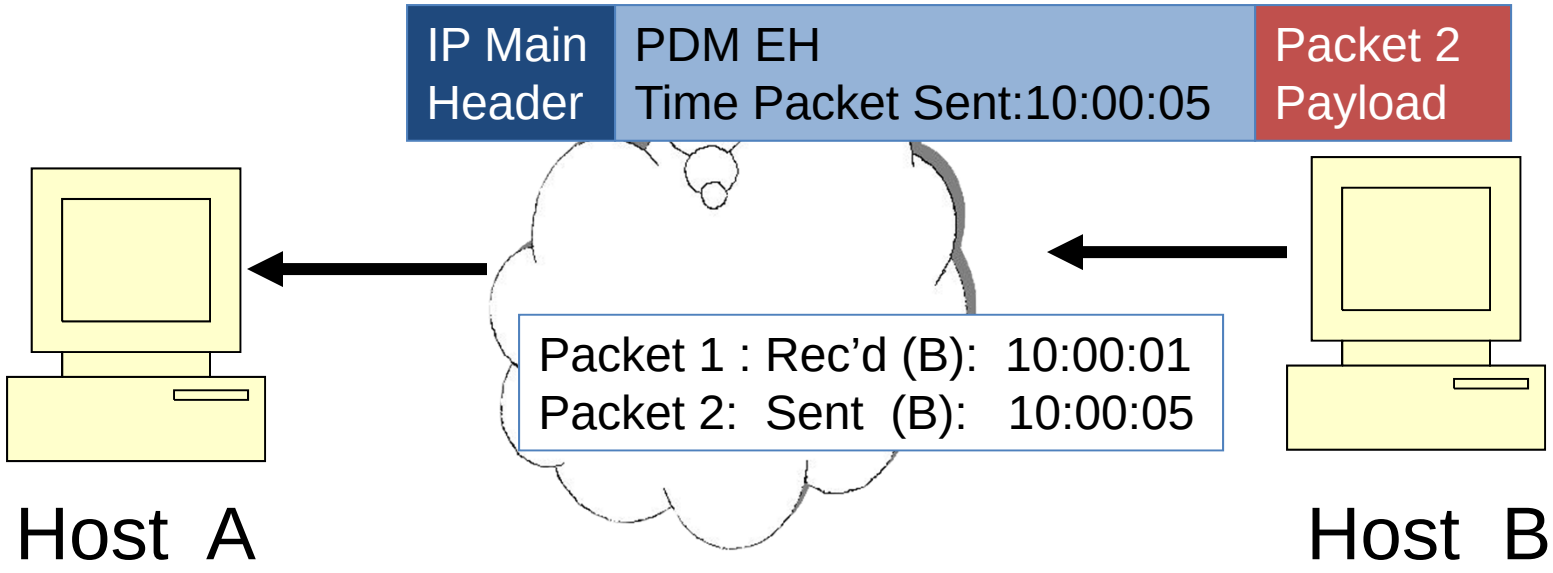
Response Time Measurement
Step 2

- Packet 1 received at Host B
- Time-stamped leaving Host A
- Inbound network time = Packet 1 rec'd (B) – Packet 1 sent (A)



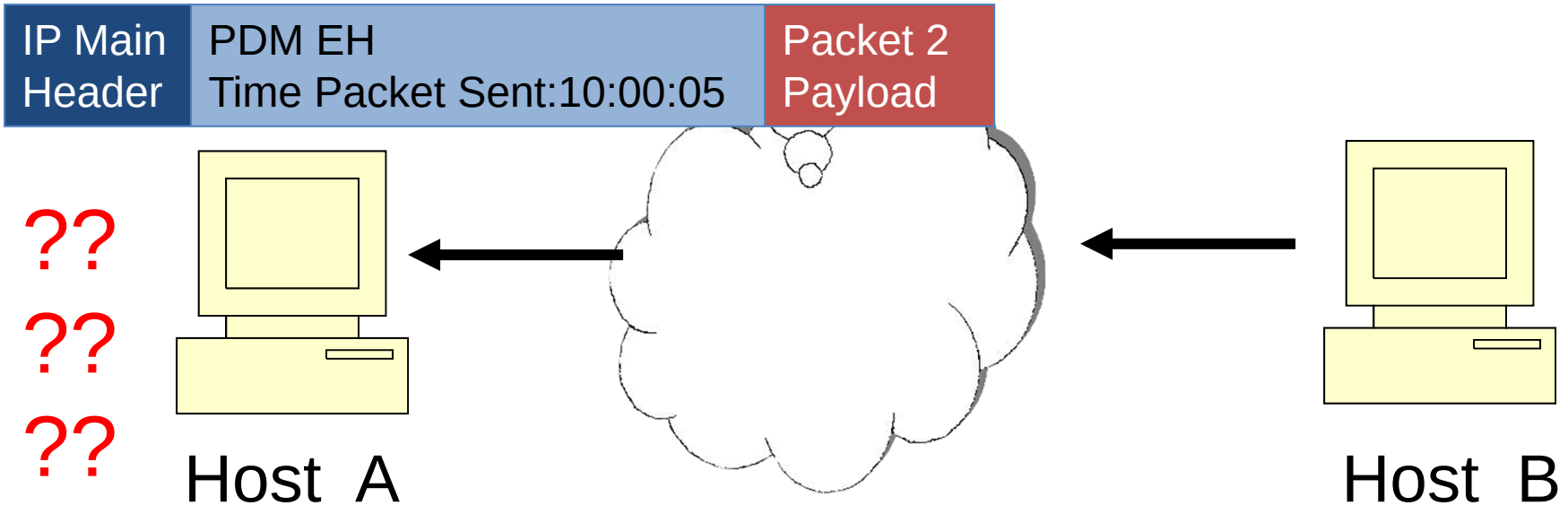
Response Time Measurement
Step 3

- Packet 2 sent from Host B (response to Packet 1)
- Time-stamped leaving Host B
- Processing Time = Packet 2 sent (B) - Packet 1 rec'd (B)



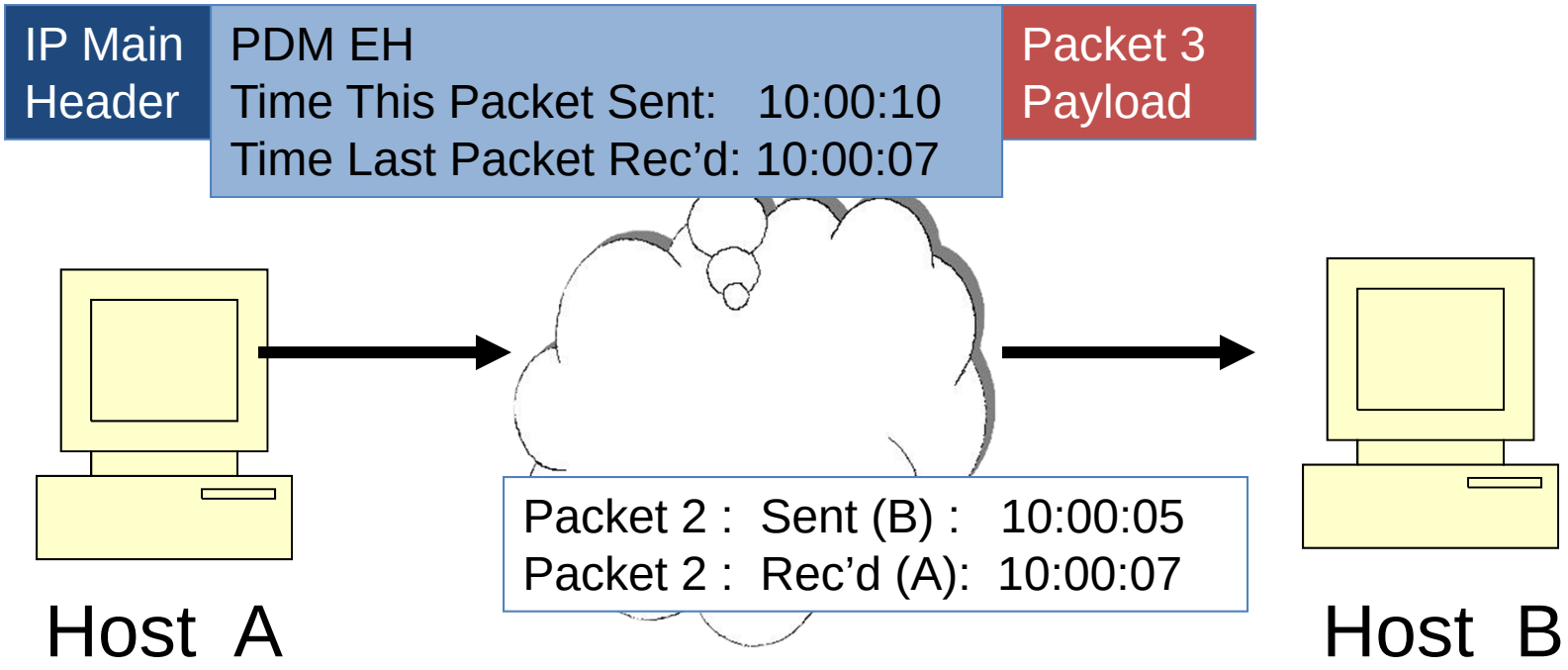
When Did it Get to Host A?

- When did Packet 2 to arrive at Host A?
- Return route may not be the same, may be congestion, packet might never arrive.



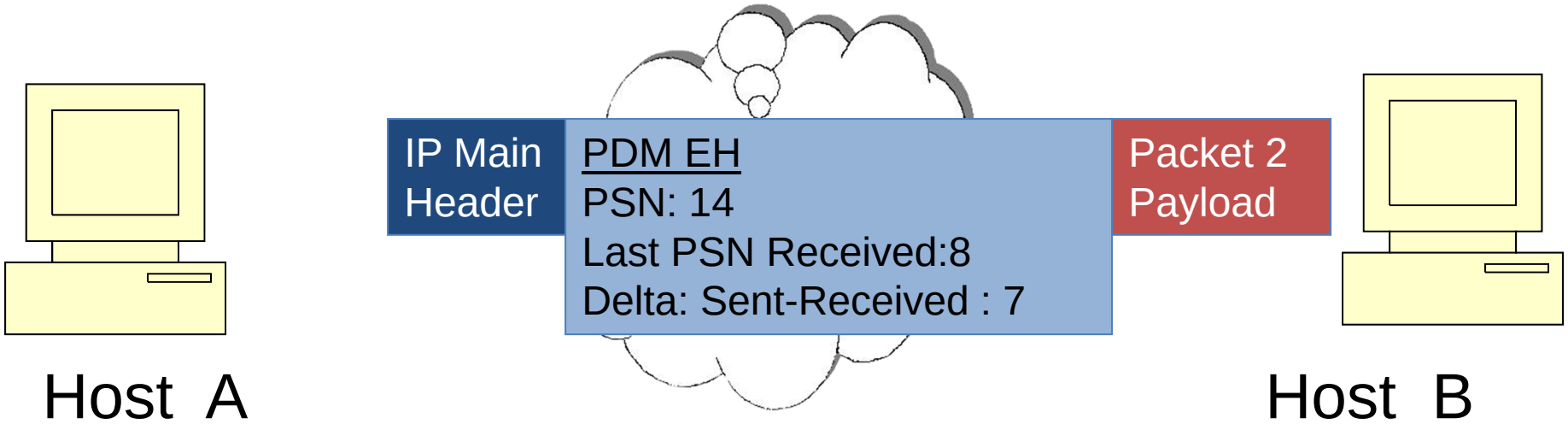
What is Needed?

- With each packet, add “Time Last Packet Received” in PDM EH
- When Packet 3 sent, has when Packet 2 got to Host A
- Outbound Network time = Last rec’d (A) – Time sent (B)
- Processing Time (A) = Packet 3 sent (A) - Last rec’d (A)



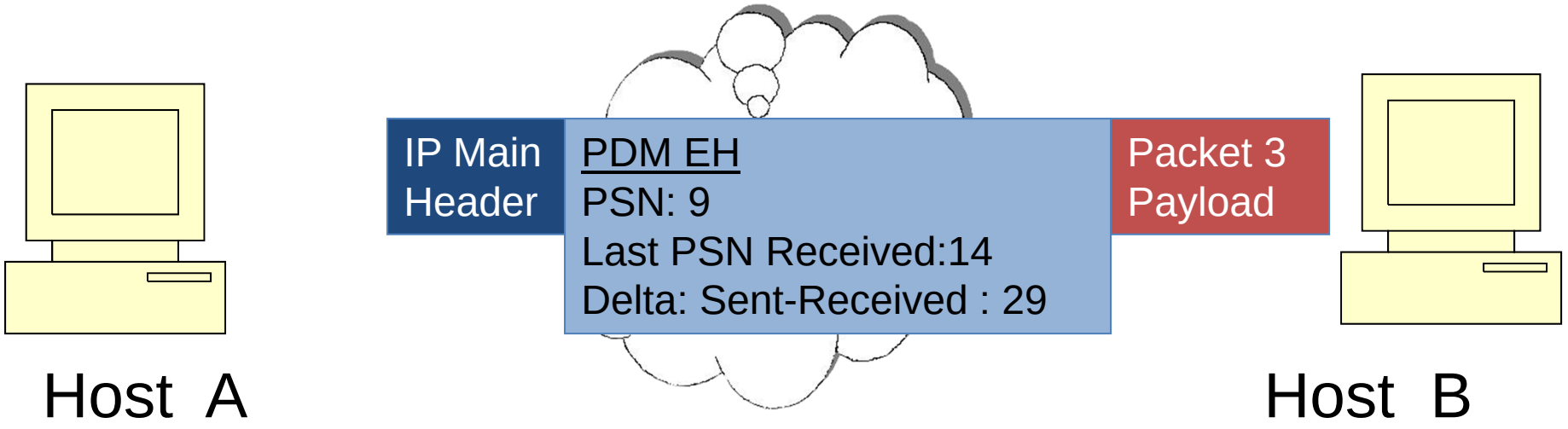
At Host B: PDM Type 2

- Packet 2 sent (10:00:14) – Packet 1 received (10:00:07)
- Server delay time (7 seconds)
- PSN-A starts at 8 (random)
- PSN-B starts at 14 (random)



At Host A: PDM Type 2

- Packet 1 sent (10:00:01) – Packet 2 received (10:00:30)
- Round trip time: 29 seconds
- Server delay time : 7 seconds
- Two way delay: 22 seconds
- PDM is sent in NEXT packet



	PDM 2 (Delta)	PDM 1 (Timestamp)	TCP Timestamp	TCP Seq Number	AH / ESP Header	Agents or OWAMP TWAMP
1. Must apply to all upper layer protocols	Yes	Yes	No	No	Yes	Yes

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4. Low overhead (expense, infrastructure to implement, etc)	Yes	Yes	Yes	Yes	No	No

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5. Not synthetic traffic	Yes	Yes	Yes	Yes	Yes	Varies

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4. Low overhead (expense, infrastructure to implement, etc)	Yes	Yes	Yes	Yes	No	No
5. Not synthetic traffic	Yes	Yes	Yes	Yes	Yes	Varies
6. Easy user implementation / operation	Yes	Yes	Yes	Yes	No	No

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7. Can be only at one end	Yes	Yes	No	No	No	No

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5. Not synthetic traffic	Yes	Yes	Yes	Yes	Yes	Varies
6. Easy user implementation / operation	Yes	Yes	Yes	Yes	No	No
7. Can be only at one end	Yes	Yes	No	No	No	No
8. Effective without time synchronization	Yes	Varies	Yes	Yes	Yes	Varies

Appendix

- Further information

Session Classification

- The PDM may be used to classify sessions as follows:

- One way traffic flow
- Two way traffic flow
- One way traffic flow with keep-alive
- Two way traffic flow with keep-alive
- Multiple send traffic flow
- Multiple receive traffic flow
- Full duplex traffic flow
- Half duplex traffic flow
- Immediate ACK data flow
- Delayed ACK data flow
- Proxied ACK data flow