

# Performance and Diagnostic Metrics Destination Options Header

Nalini Elkins: Inside Products, Inc.

Mike Ackermann : BCBS Michigan

(Team : Keven Haining : US Bank, Sigfrido Perdomo: DTCC,  
William Jouris: Inside Products, David Boyes : Sine Nomine)

One of the great flaws of the internet architecture is that it makes fault detection, isolation, and repair third class technologies.

- Karl Auerbach

# Metrics Needed

- Packet sequence number
  - Speeds diagnostics
  - Many use cases given in Internet Draft, last IETF
  - IPv4 IP ID
- End-to-end response time WITHOUT agents
  - Service Level Agreements
  - First Mover Advantage
  - Separate metrics needed for quick triage:
    - Inbound network time
    - Server time
    - Outbound network time

# IPv4 Work-Arounds

- **No unified place for performance / diagnostic metrics**
- IPv4 IP ID field used as de facto packet sequence number
- Doesn't work for some platforms
- Possibly deprecated
- Not available in IPv6 (moved to fragment header)
- Timestamps for response time not available

## Requirement

- In basic IP transport
- Unmolested by middle systems

## Solution

- **Implementation** of existing extension header :  
Destination  
Options Header  
(DOH)
- Performance and Diagnostic Metrics  
(PDM) DOH

# PDM Destination Options EH

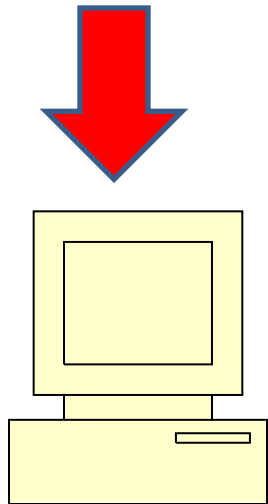
Size (bits)	Field Name	Description
8	Next Header	Points to next header or payload
8	Reserved	Set to 0.
8	Option Type	To be assigned by IANA
8	Option Length	Length
16	Packet Sequence Number	Initialized at 0 and monotonically incremented for protocol packet on the connection. 16-bit unsigned integer. This field will obviously wrap quickly. It is intended for human use.
64	Timestamp (This packet sent)	A 64-bit unsigned integer field containing a timestamp. This is the time this packet was sent. NTP format timestamp
64	Timestamp (Last packet received)	A 64-bit unsigned integer field containing a timestamp. This is the time the last packet was received on this connection. NTP format timestamp
64	Application Specific	To be used by end-nodes to convey information

# Appendix

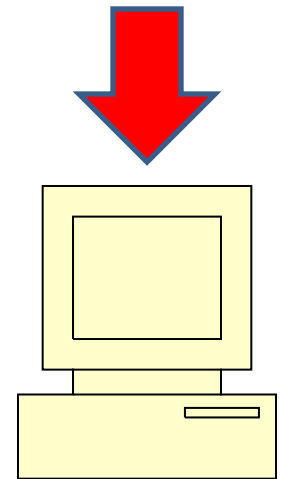
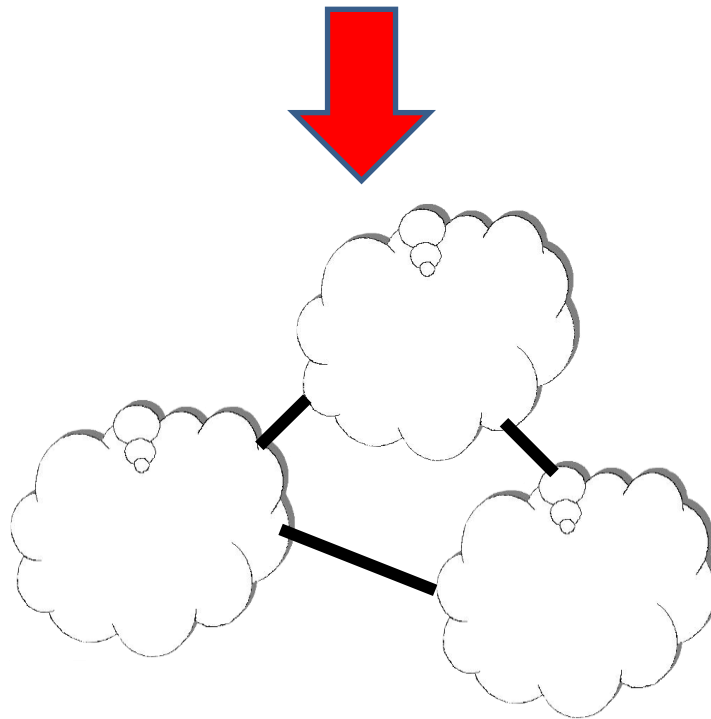
# Response Time Measurements

## Packet Capture

Packet capture



Host A



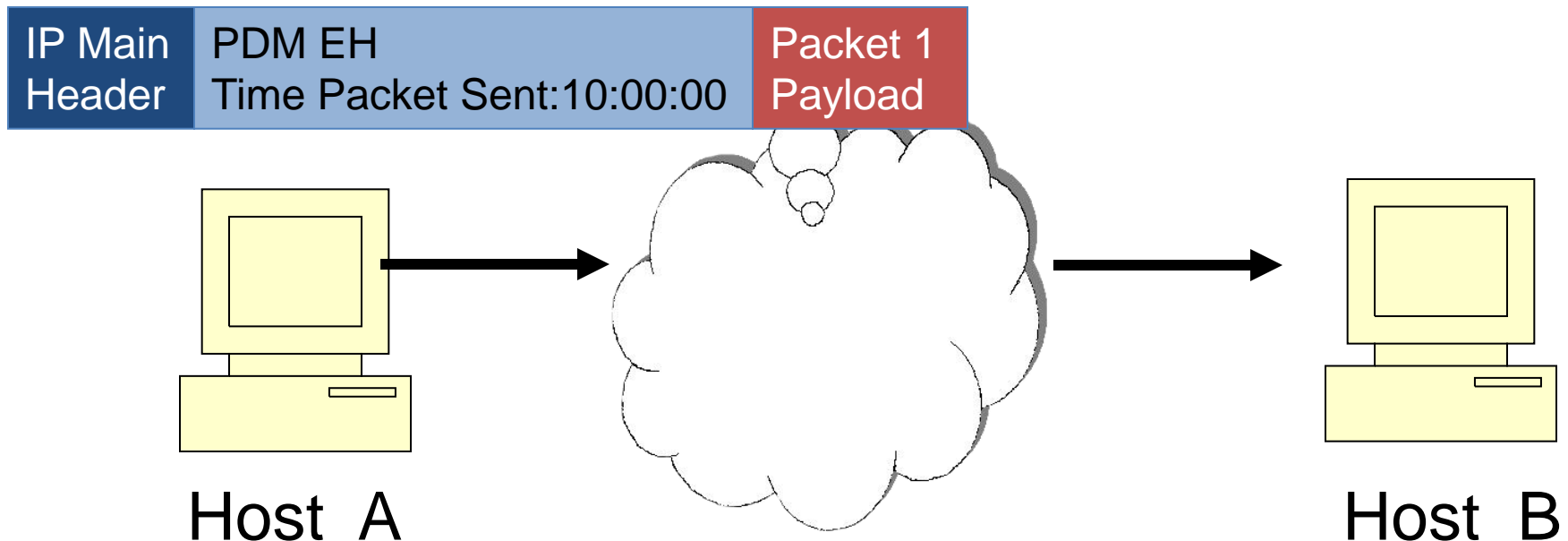
Host B



# Response Time Measurement

## Step 1

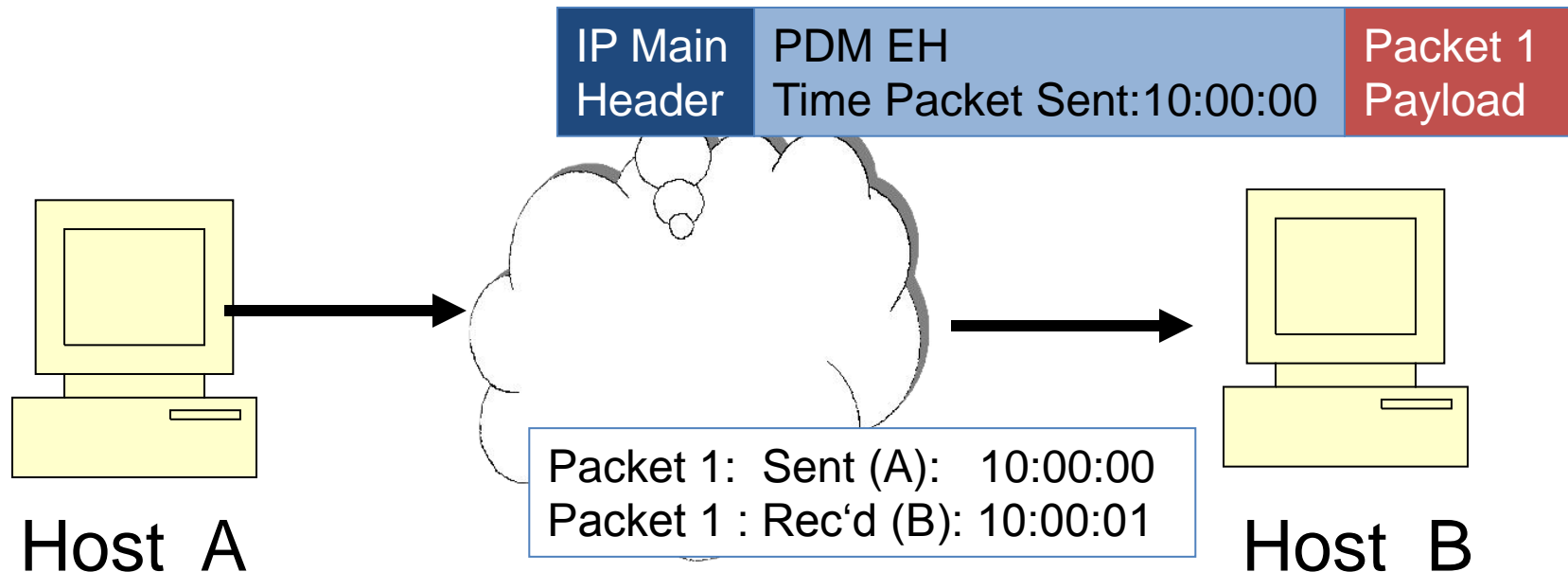
- Packet 1 sent from source host A
- Time-stamped leaving Host A
- Timestamp is in PDM extension header



# Response Time Measurement

## Step 2

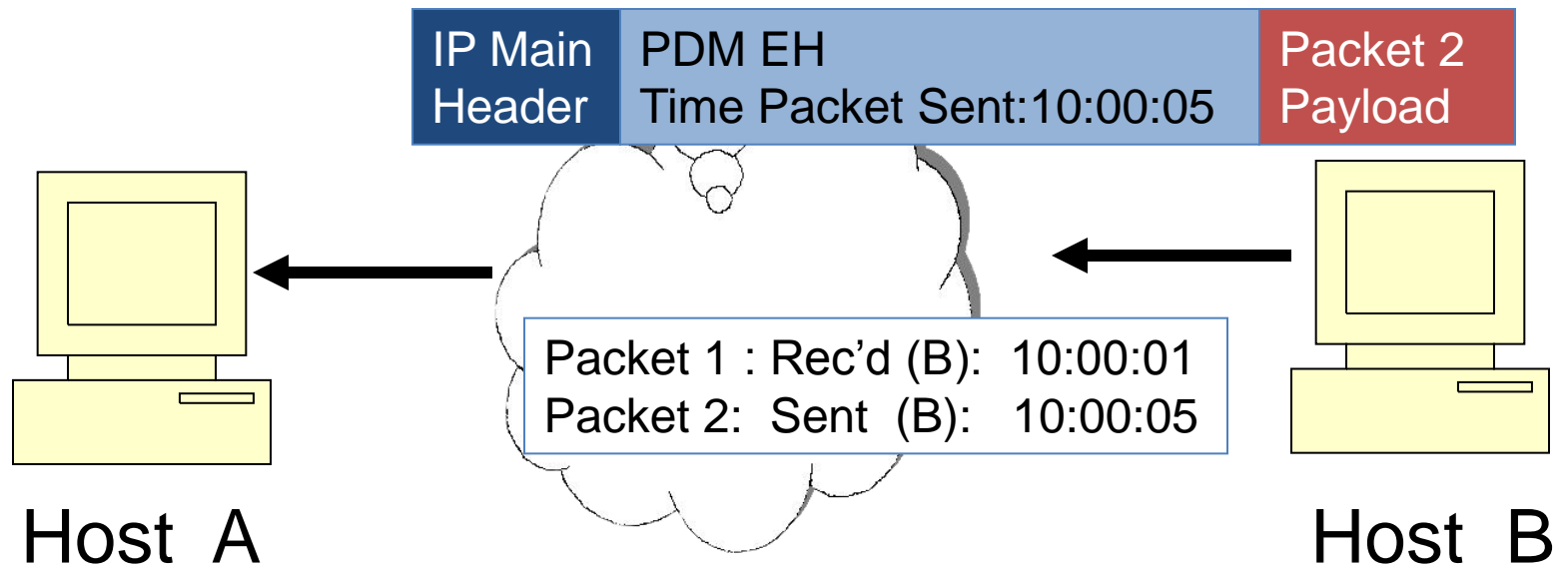
- Packet 1 received at Host B
- Time-stamped leaving Host A
- Inbound network time = Packet 1 rec'd (B) – Packet 1 sent (A)



# Response Time Measurement

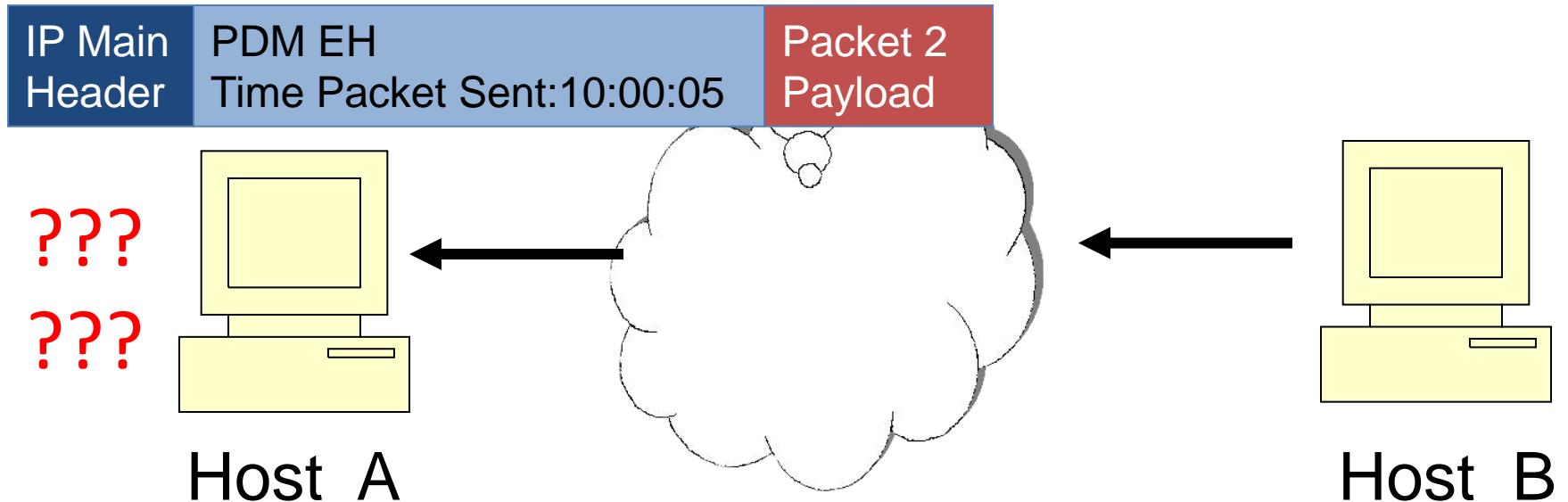
## Step 3

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

