NTP over PTP

Miroslav Lichvar

Red Hat

2021
Timestamping of packets

- Accuracy, symmetry, stability
- Software
  - Application
  - Kernel
  - Driver
- Hardware
  - Physical layer (PHY)
  - Link layer (MAC)
Errors in kernel/driver timestamps
Errors in hardware timestamps

![Histogram and Scatter Plot](image)

- Offset
- RX error
- TX error

The chart shows the distribution of errors in hardware timestamps, with the x-axis representing packets and the y-axis showing the number of errors in microseconds.
Hardware limitations

- Some HW cannot timestamp all packets
- Receive timestamping filter
  - PTP packets
    - Transport (raw ethernet, UDP)
    - Version
    - Message type
  - NTP packets (rare)
- Transmit timestamping filter (rare)
NTP over PTP

- NTP message wrapped in PTP message
- NTP gets full HW timestamping on PTP-only HW
- PTP message format
  - Version 2
  - Delay request
  - Domain 123
  - Unicast flag
  - NTP type-length-value (TLV)
- PTP correction field ignored (for now?)
PTP-only NICs tested with NTP-over-PTP

- Intel XL710 (i40e driver) - works
- Intel X540-AT2 (ixgbe driver) - works
- Intel 82576 (igb driver) - works
- Broadcom BCM5720 (tg3 driver) - works
- Broadcom BCM57810 (bnx2x driver) - doesn’t work
  - Ignores unicast addresses?
BCM5720⇔BCM5720

Plain NTP (SW RX + HW TX)

NTP-over-PTP (HW RX + HW TX)
BCM5720⇔switch⇔BCM5720

**Plain NTP (SW RX + HW TX)**

**NTP-over-PTP (HW RX + HW TX)**
Questions?