

Synchronizing timestamps of trace events between host and guest VM


Tzvetomir Stoyanov

VMware Open Source Technology Center

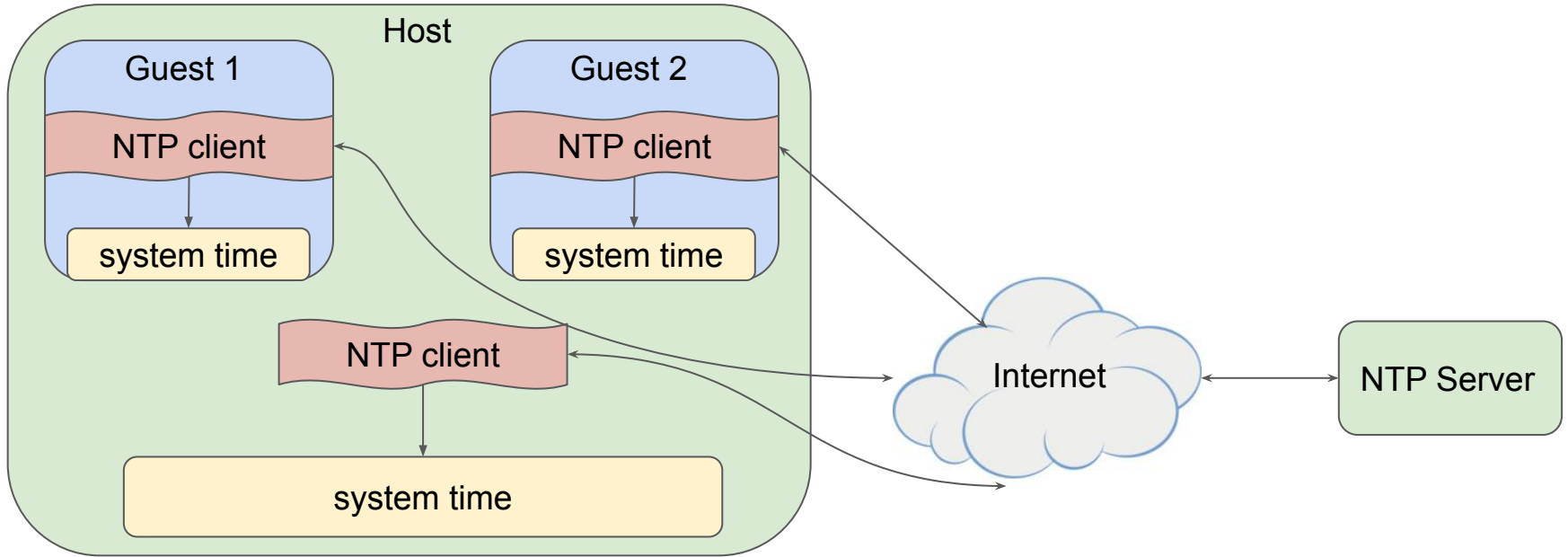
The problem

- Calculate the timestamps offset in nanosecond precision
- Frequencies of the host and guest clocks are different
- The synchronisation solution should work with all hypervisor

ftrace clock sources

- 
- local
 - global
 - counter
 - uptime
 - x86-tsc
 - ppc-tb
 - mono
 - mono_raw
 - boot

Using NTP



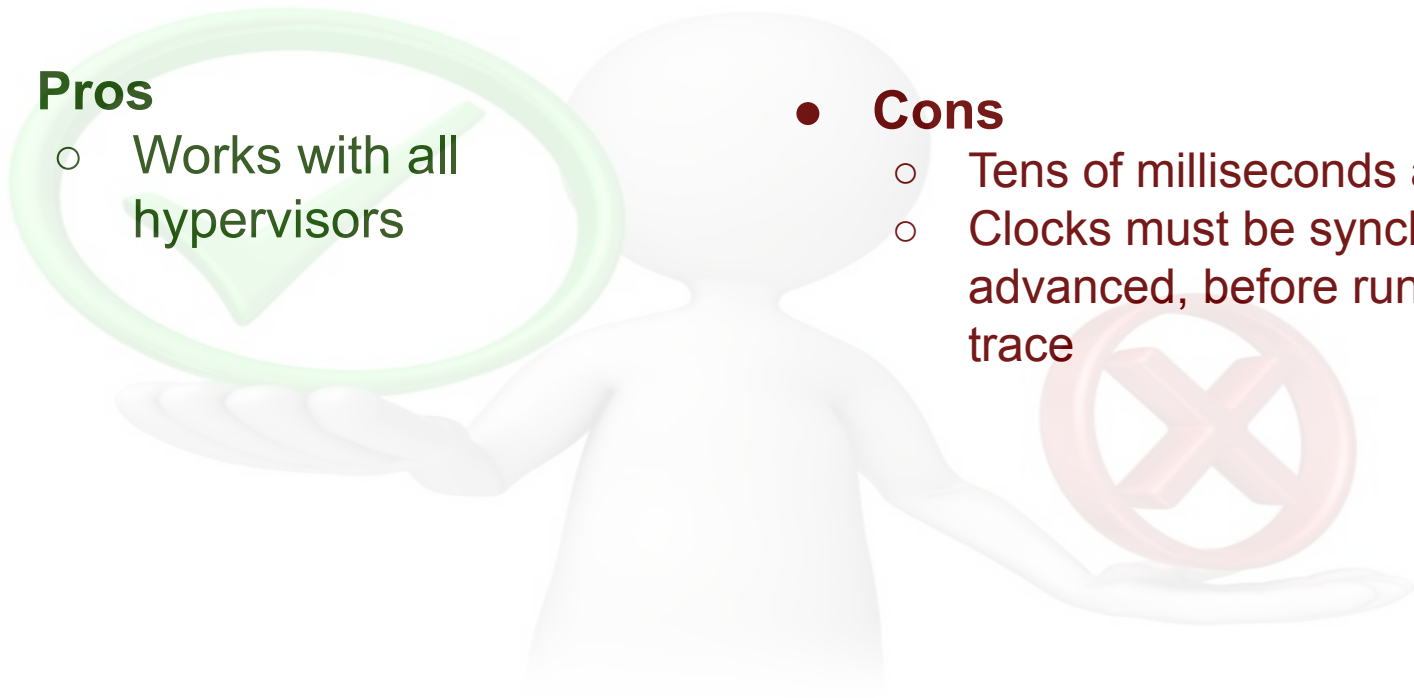
NTP approach

- **Pros**

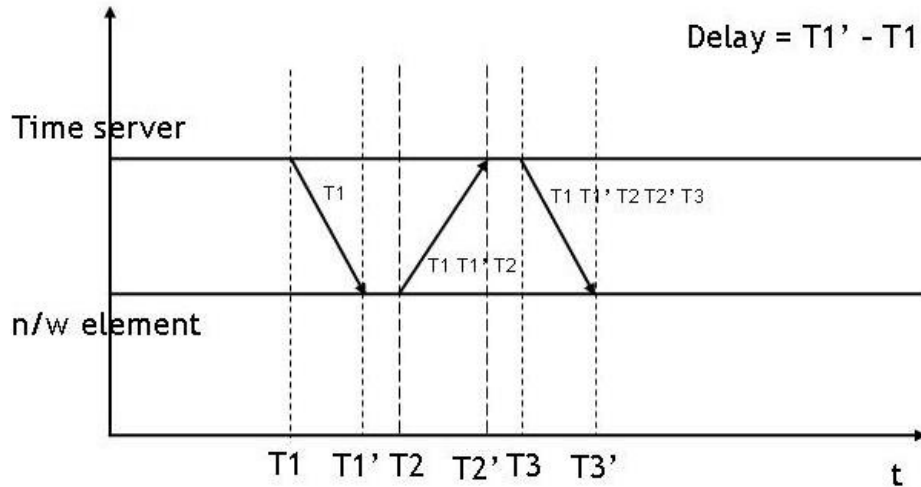
- Works with all hypervisors

- **Cons**

- Tens of milliseconds accuracy
- Clocks must be synchronized in advanced, before running the trace



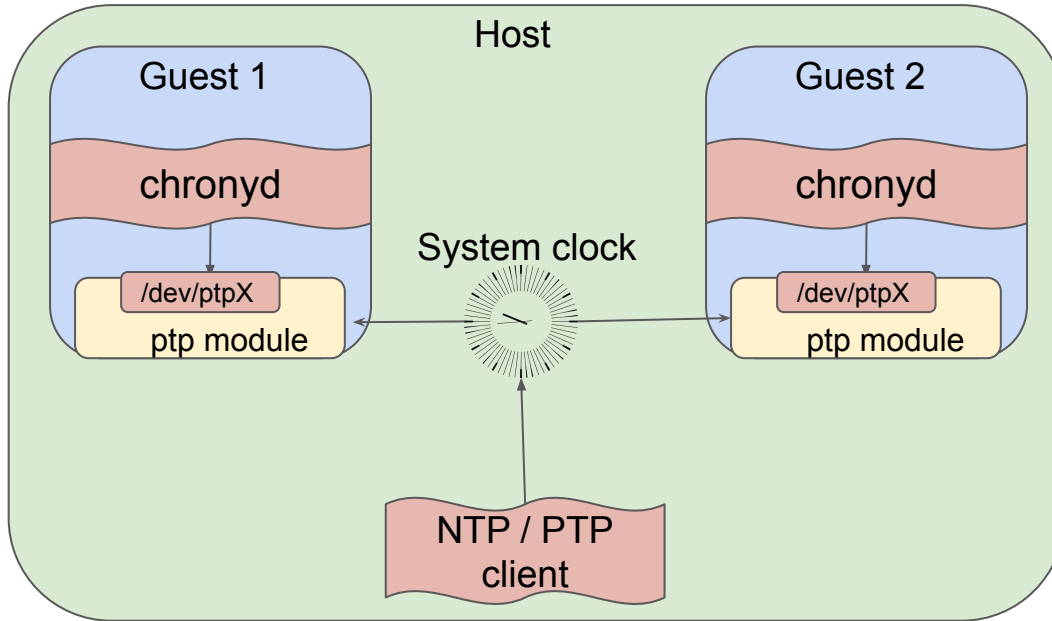
Using PTP



Clock offset

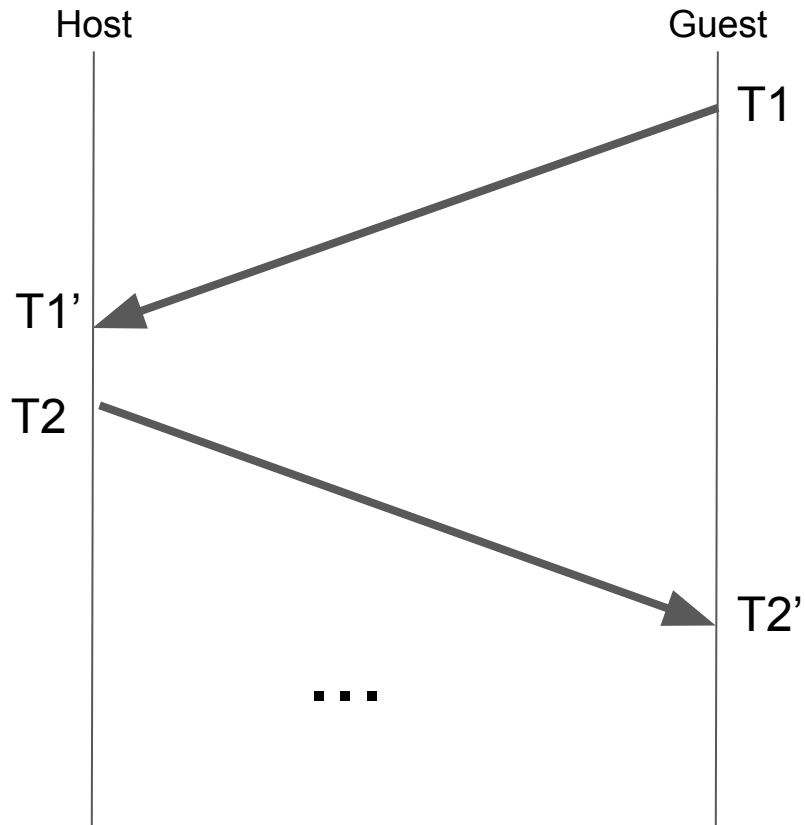
$$(T1' - T1 - T2' + T2) / 2$$

Using PTP



- tens of microseconds accuracy
- clocks must be synchronized in advanced, before running the trace

PTP-like algorithm

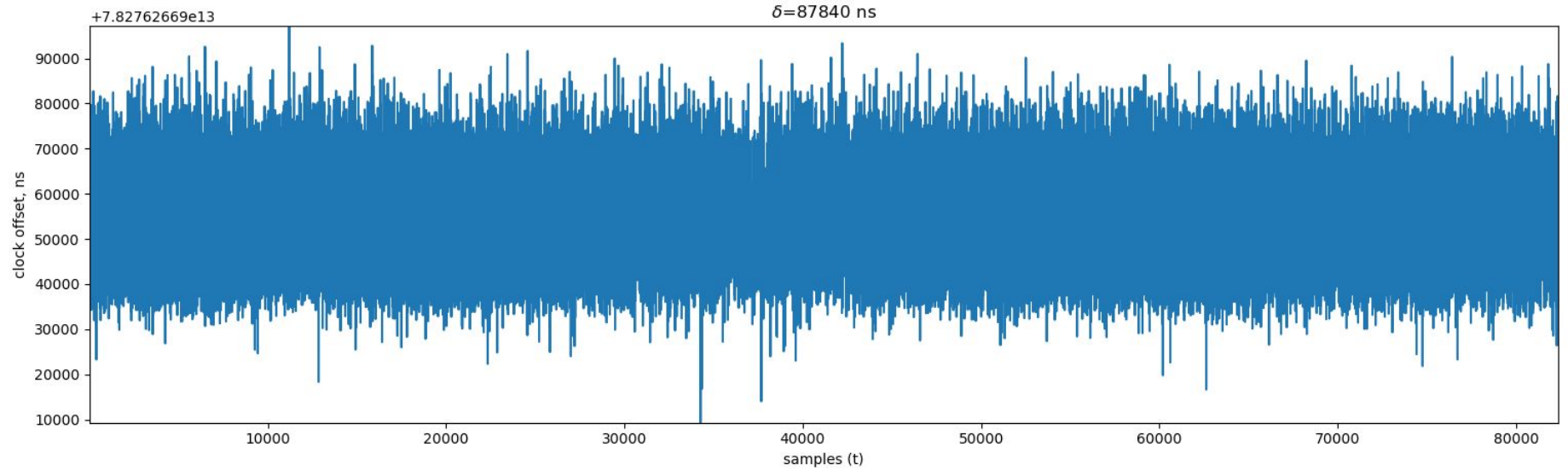


Clock offset

$$(T1' - T1 - T2' + T2) / 2$$

- round trip time is not symmetric
- no hardware timestamping
- Up to few hundred packets are exchanged in one clock offset measurement
- ftrace is used to get the packet times

PTP-like algorithm



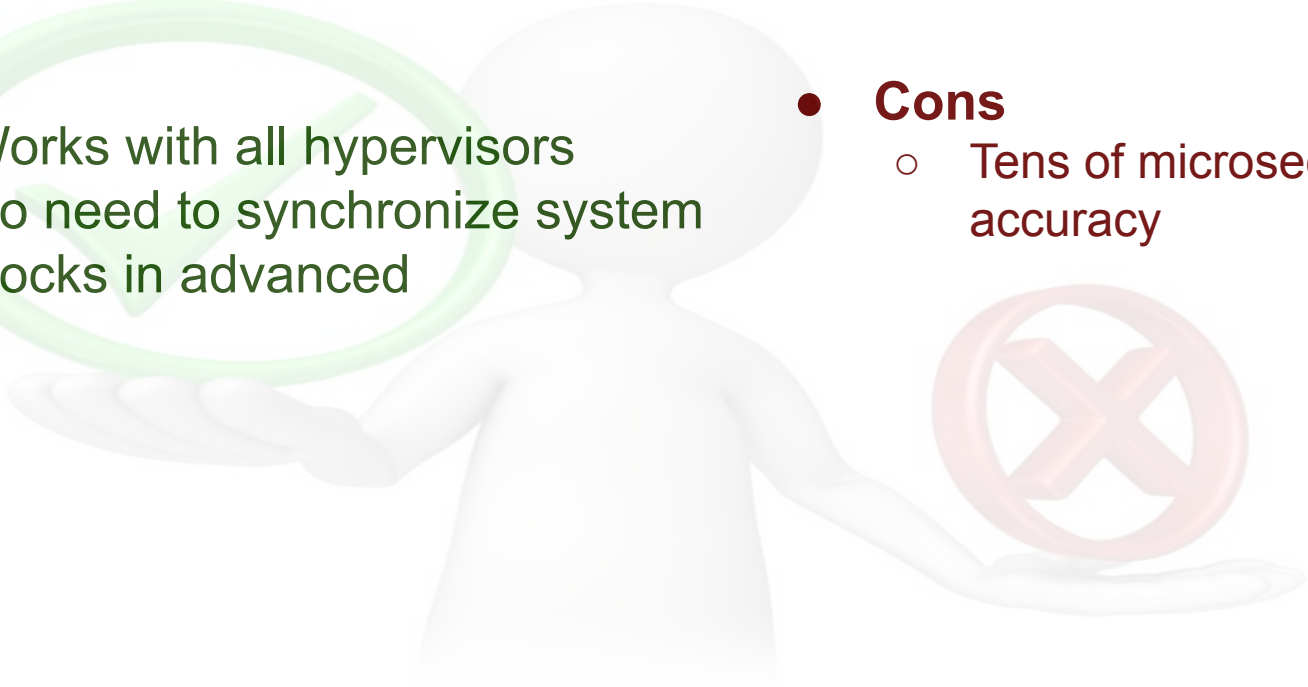
PTP-like algorithm

- **Pros**

- Works with all hypervisors
- No need to synchronize system clocks in advanced

- **Cons**

- Tens of microseconds accuracy



Other ideas

Any other approaches for synchronizing trace timestamps ?

Other time synchronization protocols ?

Idea
VM clock internals

- How the VM clock is implemented ?
- What is the relation between host and guest clock ?