How does agents clock synchronization affects measurements?

Written by Максим
Tuesday, 11 January 2011 14:35 - Last Updated Tuesday, 11 January 2011 16:24

During U7-type (UDP-echo) tests only originating agent's local clock is used, and only RTT parameters are measured. Clock state of the bound passive agent is irrelevant for the measurement precision.

Now, let's see, how is round-trip time calculated for tests involving one-way requests between two IQM agents. (RTT measurement details could be seen in the " How is Round-Trip Time (RTT) measured?   " article).

Let us designate local time difference on the agents as dT.

- dT = T2 – T1 (T1, T2 – local times at the corresponding active and passive agents)
- T1s – test request generation time by the active (originating) agent according to its local clock
- T2(s) - test request generation time by the active agent according to passive (receiving) agent's local clock
- T2r – test request delivery time at the passive agent according to its local clock
- T2s – back-flow test request origination time at the passive agent according to its local clock
- T2(s) – back-flow test request origination time at the passive agent according to the active agent local clock
- SDD – Source to Destination delay, real test request delay between active and passive agents
- DSD – Destination to Source delay, real back-flow test request delay between passive and active agents
- sdd, dsd – calculated values of one-way delays

Following diagram shows the process of one-way delays measurements, which are used for round-trip delay (round-trip time) calculations:
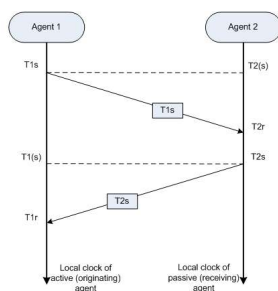
How does agents clock synchronization affects measurements?

Written by Максим
Tuesday, 11 January 2011 14:35 - Last Updated Tuesday, 11 January 2011 16:24

Request delivery times T2r and T1r (local clock-based) could be expressed as:

T2r = T2(s) + SDD = T1s + dT + SDD (1)
T1r = T1(s) + DSD = T2s – dT + DSD (2)

As illustrated in the «How is round-trip time (RTT) measured?» article, SDD is calculated as :

**sdd = T2r – T1s = (using (1)) = T1s +dT + SDD - T1s = SDD + dT (3)**
dsd = T1r – T2s = (using (2)) = T2s – dT + DSD – T2s = DSD – dT (4)
RTT = sdd + dsd = (using (3,4)) = SDD + DSD

As we can see, agents' local clocks offset does not affect the precision of RTT calculation. However, additional condition should be met: dsd>0 and sdd>0, thus for correct calculations, local clocks offset should be no more than one-way delay.

Let's see, how is delay variation (as described in the article " How is delay variation (jitter) measured? ") calculated:
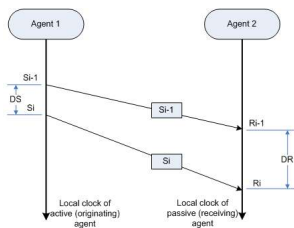
Di-1,i parameter is difference of delays of two consecutive requests:

Di-1,i = (Ri-1 – Si-1) - (Ri - Si) = (Si – Si-1) – (Ri – Ri-1) = DS – DR

Since only relative time differences are used in the calculations, local clock's offset does not affect the precision.

Condition of positive values of calculated parameters dsd > 0 and sdd > 0 should be met, thus local clock offset of agents should be not more than one-way delay for correct calculations.