Cristian's algorithm

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Cristian's Algorithm (introduced by Flaviu Cristian in 1989)[1] is a method for clock synchronization which can be used in many fields of distributive computer science but is primarily used in low-latency intranets. Cristian observed that this simple algorithm is probabilistic, in that it only achieves synchronization if the round-trip time (RTT) of the request is short compared to required accuracy. It also suffers in implementations using a single server, making it unsuitable for many distributive applications where redundancy may be crucial.

The algorithm [edit]

Cristian's Algorithm works between a process P, and a time server S — connected to a source of UTC (Coordinated Universal Time). Put simply:

1. P requests the time from S
2. After receiving the request from P, S prepares a response and appends the time T from its own clock.
3. P then sets its time to be T + RTT/2

This method assumes that the RTT is split equally between request and response, which may not always be the case but is a reasonable assumption on a LAN connection.

Further accuracy can be gained by making multiple requests to S and using the response with the shortest RTT.

We can estimate the accuracy of the system as follows. Let *min* be the minimum time to transmit a message one-way. The earliest point at which S could have placed the time T, was *min* after P sent its request. Therefore, the time at S, when the message is received by P, is in the range (T + *min*) to (T + RTT - *min*). The width of this range is (RTT - 2**min*). This gives an accuracy of (RTT/2 - *min*).

References [edit]

1. ^ Cristian, F. (1989), "Probabilistic clock synchronization", *Distributed Computing* (Springer) **3** (3): 146–158, doi:10.1007/BF01784024

See also [edit]

- Allan variance
- Clock synchronization
- International Atomic Time
- ntpd, OpenNTPD and Ntpdate
- NTP pool, a collection of worldwide computers that provide a highly accurate time via the Network Time Protocol
- NTP server misuse and abuse
- Synchronization
- Time server

Other time synchronization protocols:

- Berkeley algorithm
- DAYTIME protocol, older time synchronization protocol using TCP or UDP port 13
- ICMP Timestamp and ICMP Timestamp Reply, older time synchronization protocol using ICMP
- Precision Time Protocol
- TIME protocol, older time synchronization protocol using TCP or UDP port 37

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