A Secure Selection and Filtering Mechanism for the Network Time Protocol Version 4

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draft-ietf-ntp-chronos-00
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Reminder: Threat Model

The attacker:

• Controls a large fraction of the NTP servers in the pool (say, ¼) or the paths between the servers and clients – MitM attacker.

• Capable of either deciding the content of NTP responses or timing when responses arrive at the client.
Reminder: Chronos Architecture
Chronos’ design combines several ingredients:

• Rely on many NTP servers (hundreds) per client

• In each poll interval
  ➢ Randomly choose a small fraction of the servers in the pool (e.g., r=4-10)
  ➢ Avoids overloading NTP servers

• Smart filtering
  ➢ Remove outliers via a technique used in approximate agreement algorithms
Chronos and NTPd

• Chronos compared to NTPv4:
  • Greater variety of sampled servers over time
  • Possible adverse effects on precision

Therefore, in the current draft Chronos is used as a "watchdog" alongside NTPv4, thus matching NTPv4's precision while significantly improving security against time shifting attacks.
Chronos Watchdog Mechanism

• The NTPv4 conventional protocol periodically queries m servers in each poll interval.

• In parallel, a Chronos watchdog periodically queries a (variable) set of r servers in each Chronos poll interval.

• In each poll interval the Chronos virtual clock value is compared with the NTPv4 clock value.

If the difference between NTPv4 and Chronos offsets exceeds a predetermined value, an attack is detected and Chronos' offset is used to update the client's clock.

Otherwise, NTPv4's offset is used for updating the client’s clock.
Next Steps

• Working on implementing Chronos as a watchdog

• Continuing to evaluate the performance and security under different attack strategies and at different locations

• Looking for more feedback about the current version