Weeping Angel Time Research

SECRET // REL US, UK

Time on Smart TV

1. TV Time
    1. Go to Menu > System > Time > Clock to configure/view time displayed anywhere on TV
    2. Auto time pulls time based on timezone and DST
    3. Manual can be used to set time different from timezone
        1. When TV is unplugged on manual, time resets to --:-- and requires configuration
    4. TV Time is not effected and appears unrelated to the System Time
        1. SmartHub pulls time from this setting
        2. Backend (implant side) system time does not match or effect TV time
2. System Time
    1. The system time resets to Unix Epoch (1 Jan 00:00:00 1970) each time the TV is unplugged
    2. The system time persists when remote is used to turn TV off (in fake-off mode)
    3. date command prints current system time (UTC)
    4. Files created in the file system use the time reported by date as their creation/modification times
    5. Files created in /mtd_rwcommon with current (2014) timestamps remain unaltered even when TV resets to Unix Epoch on power cycle
    6. **TODO:** test implant to ensure timestamps on audio files use same time as reported by date
3. NTP Syncing
    1. **ntpd** and **rdate** (deprecated) are NTP clients included with BusyBox and can fetch time from server but cannot set local system time
        1. Error reported: "settimeofdate: bad address" related to underlying implementation in BusyBox
    2. **ntpclient** (http://doolittle.icarus.com/ntpclient/) is an NTP client for unix-alike computer and is a small subset of xntpd (not included in BusyBox)
        1. Recommended by BusyBox in "External Tiny Utilities"
        2. Compiled for Linux on 32-bit build environment. Ran on Virtual Machine to test functionality
        3. Attempted to cross-compile for ARM but got error related to glib version
        4. Found pre-compiled ARM build on SamyGo forums (forums.samygo.tv/download/file.php?id=1248)
        5. Ran on TV using:

```
/mtd_rwcommon/ntpclient-arm -s -h pool.ntp.org
```

1. Successfully updated system time from Unix Epoch to current time reported by NTP server (uses different method of setting time than BusyBox)
2. -s flag for simple (implies -c 1) and -h for NTP host
3. Returns string in format:
   <days since 1900> <secs since midnight> <NTP transaction time> <internal server delay> **<clock difference bt local and NTP (µS)>** <dispersion> <adjtimex frequency (not implemented on ARM)>
4. Check ntpclient-2010/README and HOWTO for more details on flags and reported strings
5. HOWTO also has details on measuring and logging systems performance

3. **ntpdate** does not exist on the TV or in BusyBox
4. Syncing with NTP servers changes the System Time but appears to have not effect on TV Time

4. Clock Drift
   1. Several simple attempts were made to measure the time drift
      1. Started at 15:50:30 UTC on 6 AUG with System Time synced to pool.ntp.org
      2. In approximately 22 hours, the drift on the TV was less than 1 second
      3. No clarity was given beyond seconds is given by date so exact ms drift could not be determined
      4. Same time period on Linux laptop yielded 600ms drift
   2. Look into ntpclient's logging and measuring characteristics of hardware clock over period of time
5. Sync scripts (not started)
   1. Sync time with NTP server on power-on and once? per day
   2. Use non-US related NTP server
      1. mx.pool.ntp.org - Does not currently have enough (1 active) servers in country/time zone
      2. Recommend using **north-america.pool.ntp.org** (721 active)

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