Ateneo de Manila University

Developing a UTC-synchronized University Network Time Service

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Correct Time is Relative
Universal Time

In General:

★ essential component of any modern society
★ critical component of global communications
★ scheduling and synchronization

In Particular:

★ synchronization of the University Bell System
★ synchronization of network enables workstations
★ provide accurate time for communication systems
Section I

System Overview
System Outline

- Distributed Time Service
- University Bell System
- Bell Trigger Hardware
- Bell Scheduling Software
Section II

Distributed Time Service
Network Time Protocol

★ protocol to synchronize time across a WAN or the Internet
★ time is synchronized to Universal Coordinated Time (UTC)
★ also free and open source software package
★ provides different means for synchronizing to UTC:
  – Internet Host (tens of milliseconds)
  – Global Positioning System Receivers (hundreds of picoseconds)
  – CHU Radio Service (not available 24 hours a day in PH)
  – Telephone Modem Service (not available in PH)
AdMU University Time Service
Section III

University Bell System
AdMU Bell System

Old System:

★ Simplex 6400 Master Time Controller
★ contains an internal clock
★ numeric keypad is used to configure the bell times
★ considerable drift has been detected in the past few months
★ centered at the Administrative Services Room, Colayco Hall
★ 24V signals are distributed throughout the system
AdMU Bell System

New System:

★ PC-based System running on the Linux Operating System
★ system will be synchronized with University Time Service
★ uses a parallel port interface relay circuit to trigger the bell system
★ a manual override and a backup circuit will be provided
★ still centered at the Administrative Services Room, Colayco Hall
★ still uses 24V signals to trigger bells in the system
Section IV

Bell Trigger Hardware
Relay Trigger Circuitry

- Manual switch (push button)
- Optoisolator
- Selector switch
- Magnetic relay
- $1 \, \text{k}\Omega$ resistor
- 5V power supply
- Q2N3904 transistor
- Connection to Bell
Section V

Bell Scheduling Software
Bell Scheduling Software

composed of two critical operations:

★ synchronization

★ triggering

synchronization

★ uses NTP software

★ configured to synchronize with the GPS clock server

★ Linux configured for precision time keeping

triggering

★ wrote a parallel port interface program called **trigger**

★ **trigger** uses a general purpose parallel port library called **libparport**

★ **trigger** is invoked by the **cron** daemon
Using *cron*

*cron*

★ a powerful scheduling daemon

★ allows tasks to be repeated periodically

★ flexible

★ initially intimidating/confusing

★ reads schedule from *crontab* file
**crontab**

- Each line has five time/date fields
- Followed by a username and then the program to be executed
- Commands are executed by crond when the time fields match

<table>
<thead>
<tr>
<th>field</th>
<th>allowed values</th>
</tr>
</thead>
<tbody>
<tr>
<td>minute</td>
<td>0-59</td>
</tr>
<tr>
<td>hour</td>
<td>0-23</td>
</tr>
<tr>
<td>day of month</td>
<td>1-31</td>
</tr>
<tr>
<td>month</td>
<td>1-12</td>
</tr>
<tr>
<td>day of week</td>
<td>0-7</td>
</tr>
</tbody>
</table>

Table 1: Date and Time Fields for CRON
sample crontab

20 8-20 * * 1,3,5 root trigger 2 10
30 7-19 * * 1,3,5 root trigger 2 20
20 10,13,16,19 * * 2,4 root trigger 2 10
30 7,10,13,16,19 * * 2,4 root trigger 2 20
50 8,11,14,17,20 * * 2,4 root trigger 2 10
00 9,12,15,18 * * 2,4 root trigger 2 20

Figure 1: Sample crontab file

- typical Ateneo bell schedule
- includes warning bell schedules
- bell durations and time periods can be configured
Section VI

Demonstration and Conclusion
Points for Improvements

★ better interface to cron

★ smaller Linux distribution
   ★ floppy
   ★ cdrom

★ Use Real-time Linux instead of just Linux

★ another GPS receiver
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