martybugs.net Electronics Projects

Serial Port Temperature Sensors - Graphing Temperatures

This page describes the scripts to allow temperature values to be historised into an RRDTool database, and how to generate graphs of the temperature.

Note that this page assumes the use of digitemp on linux. Similar Windows software is available, and RRDTool is also available for Windows, so converting the code shown on this page to run on a Windows PC is certainly feasible (and is left as an exercise for the reader).

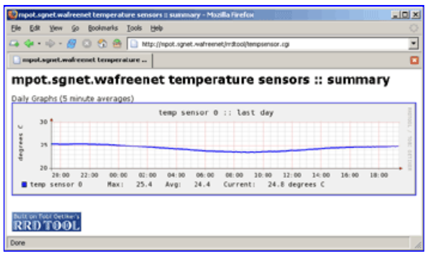
Background

See my Installing RRDTool page for detailed info on installing and configuring RRDTool.

Note that this page assumes all directories and installation locations are as per the page mentioned above.
If your configuration is different, you may need to adjust some parts of the installation instructions appropriately.

Screen Shots

Here's a screen shot of the summary page, showing a graph for a single temperature sensor for the last 24 hours.


mpot.sgnet.wafreenet temperature sensors :: summary - Mozilla Firefox

http://mpot.sgnet.wafreenet/rrdtool/tempsensor.cgi

mpot.sgnet.wafreenet temperature sensors :: summary

Daily Graphs (5 minute averages)

File
Edit
View
Go
Bookmarks
Tools
Help
temp sensor 0 :: last day
degrees C
30
25
20
20:00
22:00
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
temp sensor 0 Max: 25.4 Avg: 24.4 Current: 24.8 degrees C
Built on Tobi Oetiker's RRD TOOL
Done

temperature graph for last 24 hours

The sample web page provided below also allows weekly, monthly and yearly graphs to be viewed.

Requirements

You'll need:

- a Linux box
- a web server running on the Linux box
- a working installation of RRDTool, including the shared RRD perl module
- my rrd_tempsensor.pl script for data collection and graph generation
- my tempsensor.cgi webpage for viewing the graphs
- an SCP client (such as WinSCP, or SSH Secure File Transfer Client, part of SSH Secure Shell) for copying files onto your linux box.
- a way of getting a command-line prompt on your linux box (either by logging directly onto your linux box, using a SSH client such as PuTTY or SSH Secure Shell).

Note that I'm using a custom installation of Red Hat 9.0 linux.
If your configuration is different, you may need to adjust some parts of the script appropriately.

Getting Data

The first task is to determine how to obtain the data we want to insert into the RRD database.
Some shell scripting can easily be used to obtain the items of information required.

The statement below will return just the numerical temperature for sensor 0 in degrees Celsius:

```
digitemp -t 0 -q -c /etc/digitemp.conf -o%C
```

Automating Data Collection

To automate data collection, I wrote a Perl script which performs the following tasks:

- create RRD database for any specified sensor
- retrieve data for any specified sensor
- store data into the RRD database
- generate daily, weekly, monthly and yearly graphs

You can download a copy of my `rrd_tempsensor.pl` script.

Rename it to `rrd_tempsensor.pl`, and save it in `/usr/local/bin/`.
Make it executable by changing the file permissions on it:

```
chmod 755 /usr/local/bin/rrd_tempsensor.pl
```

and adjust the settings defined at the top of the script to make them appropriate for your linux box (and make sure these directories exist):

```
# define location of rrdtool databases
my $rrd = '/var/lib/rrd';
# define location of images
my $img = '/var/www/html/rrdtool';
```

The following lines in `rrd_tempsensor.pl` specify for which sensor data will be collected. Add/modify/delete any lines here as appropriate (lines can be commented out with a "`#`" character).

```
# process data for each sensor (add/delete as required)
&ProcessSensor(0, "temp sensor 0");
#&ProcessSensor(1, "temp sensor 1");
#&ProcessSensor(2, "temp sensor 2");
```

You can also specify the description of each sensor. This description will be printed on the top of each graph generated by this script.

Test the script by executing it from a command prompt:

```
/usr/local/bin/rrd_tempsensor.pl
```

The first time the script is run, it'll create an RRD database for each sensor, so you should see output similar to this (assuming the script has been configured to monitor `eth0` and `eth1`):

```
[root@gimli root]# /usr/local/bin/rrd_tempsensor.pl
sensor 0: 25.38 degrees C
creating rrd database for temp sensor 1...
sensor 1: 25.40 degrees C
creating rrd database for temp sensor 1...
```

On any subsequent executions, you should see similar output, but without the `creating rrd database......` lines.

Once you've verified the operation of the script, it can be automatically scheduled to run periodically. To get it to run every 5 minutes, add the following to `/etc/crontab`:

```
# get temperature sensor readings and create graphs
*/5 * * * * root /usr/local/bin/rrd_tempsensor.pl >/dev/null
```

Note that if you find your graphs are being created, but with no data, it's probably because your cron paths aren't setup to include paths to all of the shell commands used in `rrd_tempsensor.pl`. To correct this, you'll have to either:

- edit `/usr/local/bin/rrd_tempsensor.pl` to reference the full pathname for `digitemp` and `cut`,

or

- edit the `PATH` definition in `/etc/crontab` to include the paths of those commands.

Viewing the Graphs

Each time the script is executed, if required, it'll update the temperature graphs.

These graphs are being created in `/var/www/html/rrdtool/`, and assuming you've got a webserver running, they'll be accessible via `http://your_ip/rrdtool/`.

To provide a much cleaner way to view these graphs, I've written a simple webpage for displaying all the graphs.

You can download a copy of my `tempsensor.cgi` webpage.

Rename it to `tempsensor.cgi`, and save it in `/var/www/html/rrdtool/`.
Make it executable by changing the file permissions on it:

```
chmod 755 /var/www/html/rrdtool/tempsensor.cgi
```

and adjust the settings defined at the top of the script to make them appropriate for your linux box, in particular, the sensor name:

```
# define graphs to display (add/remove as required)
push (@graphs, "temp0");
push (@graphs, "temp1");
#push (@graphs, "temp2");

# get the server name (or you could hard code some description here)
my $svrname = $ENV{'SERVER_NAME'};
```

Note that I'm assuming you've got your web server appropriately configured to handle `.cgi` scripts. if not, refer to the inline documentation in your httpd.conf or the Apache documentation for more information.

You should now be able to point your web browser at `http://your_ip/rrdtool/tempsensor.cgi` and you should be rewarded with a page displaying the summary graphs for each temperature sensor.

Clicking any of the daily graphs will then display the detailed graphs for that sensor, ie, the daily, weekly, monthly and yearly graphs.

Comments on Data Storage

This script uses a separate RRD database to hold the details for each sensor. The `rrd_tempsensor.pl` script uses the following code to create the RRD database:

```
RRDs::create "$rrd/temp$_[0].rrd",
              "-s 300",
              "DS:temp:GAUGE:600:U:U",
              "RRA:AVERAGE:0.5:1:2016",
              "RRA:AVERAGE:0.5:6:1344",
              "RRA:AVERAGE:0.5:24:2190",
              "RRA:AVERAGE:0.5:144:3650";
```

This creates an RRD database with the following attributes:

- 5 minute step (base interval with which data will be fed into the RRD)
- 1 data source (called `temp`)
- 10 minute heartbeat for the data source
- 7 days of 5 minute averages
- 4 weeks of 1/2 hour averages
- 6 months of 2 hour averages
- 5 years of 12 hour averages

all in a 75 kilobyte file.

Refer to the `rrdcreate` manpage for more information on these options.

next page: using multiple sensors

last updated 29 Apr 2006