

Modifying code to produce a faster Image Quality Plot Generator

By Noah Luis

- NASA Infrared Telescope Facility (IRTF) at the Institute for Astronomy (IFA)
- Located in Hilo, Hawaii and Mauna Kea
- Elevation above 13,700 ft

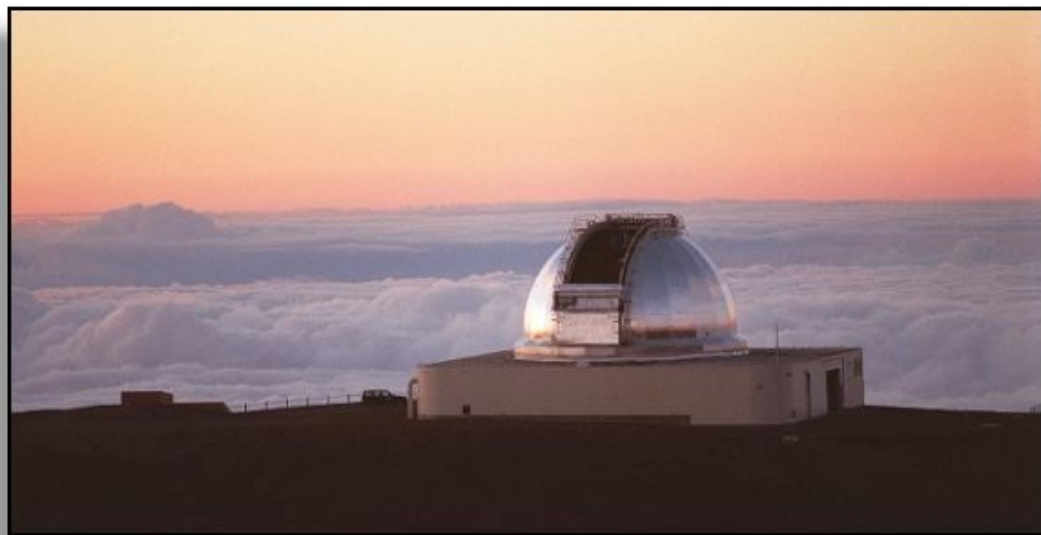


Photo courtesy of Ernie Mastroianni

Background

- 3.0 m telescope
- IRTF needed a way to monitor the environment around the facility
- Finding patterns to help with future observing
- Project started in Jan. of 2003
- I've contributing since Dec. of 2003

Main Question

- What could be done to get this program to run faster?

Why does the program need to run faster?

- 1) Current server is an older computer
- 2) This program is very calculation-intensive
- 3) Requires lots of RAM
- 4) The program was SLOW.

Example:

It takes about 3 minutes to graph a day of averages
and about 12 minutes to graph a week of averages.

- 5) Time = Money AND Speed = Efficiency

What could I do?

- Reduce and reorganize code
- Have code be as efficient as possible logic-wise
- Reduce memory usage to a minimum

-Used lists instead of arrays

What did I do?

- Read and processed all data in main memory
- Closed all file input streams ASAP
- Minimized disk accesses
- Returned memory whenever possible
- Reused variables, arrays, and lists for storage
- Reorganized code to be readable and understandable
- Minimized loop usage

Example:

-Finding minimum and maximum values for auto scale

The results

- After all the changes plots took about half the amount of time the original code took.
- Move the system to a faster computer

Web Interface

Horizontal Axis

Start Date: 2002 Jan 01
Start Time: 00:00

	Range	Increment	Interval
<input type="radio"/> Detail	6 hrs	15 min	15 min
<input checked="" type="radio"/> Daily	24 hrs	1 hr	1 hr
<input type="radio"/> Weekly	168 hrs	6 hrs	6 hrs
<input type="radio"/> Other	<input type="text"/> hrs	<input type="text"/> hrs	<input type="text"/> hrs

Vertical Axis

Left Axis	Right Axis
Temperature	None
<input checked="" type="radio"/> Autoscale	<input checked="" type="radio"/> Autoscale
<input type="radio"/> Default	<input type="radio"/> Default
<input type="radio"/> Manual	<input type="radio"/> Manual
Min <input type="text"/> Max <input type="text"/>	Min <input type="text"/> Max <input type="text"/>

Default values: Temperature: -10 C° to +25 C°
Humidity: 0 % to 100 %
Wind speed: 0 to 60 mph
Direction: 0 to 360 degrees

Data Utilized

Points
 Continuous
 Discrete
 Mean

Chart Properties

Chart Title: Type: Line Scatter

Line 1	red	Legend #1	Line 2	orange	Legend #2	Line 3	green	Legend #3
Line 4	khaki	Legend #4	Line 5	aqua	Legend #5	Line 6	blue	Legend #6
Line 7	pink	Legend #7	Line 8	purple	Legend #8	Line 9	black	Legend #9

Data Selection

Dome Sensor Location

SENSORS

Truss

TT1 TT2 TT3 TT4
TT5 TT6 TT7 TT8

Mirror

TM1 TM2 TM3 TM4
TM5 TM6 TMS1 TMS2

Dome

TD1 TD2 TD3 TD4
TD5 TD6 TD7

Floor

TF1 TF2 TF3 TF4

Outside

TE1 TE2

Humidity

HD1 HD2 HD3 HE1

Dewpoint

Dewpoint

Wind

Avg. Speed Direction

Telescope Sensor Loc.

CALCULATIONS

Averages

Mirror Temp AMT
Outside Temp ATE
Dome Top Temp ATDT
Dome Mid Temp ATDM
Mezzanine Temp ATDZ
Floor Temp ATF
Int. Humidity AHD
Truss Temp ATT

Calculations

ADD CAL 1
 ADD CAL 2
 ADD CAL 3
 ADD CAL 4

Initial Text File

http://iqup.ifa.hawaii.edu/domeenv/data/2004/08/01.txt - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media

Address http://iqup.ifa.hawaii.edu/domeenv/data/2004/08/01.txt Go Links Norton AntiVirus

BASETIME	DATE	TIME	TT1	TT2	TT3	TT4	TT5	TT6	TT7	TT8	TM1	TM2	TM3	T
1091354400	2004/08/01	00:00:00	+2.584	+2.504	+2.411	+3.130	+2.379	+3.161	+3.159	+3.244	+4.687	+4.616	+4.589	+4.9
1091354520	2004/08/01	00:02:00	+2.541	+2.512	+2.417	+3.097	+2.392	+3.142	+3.156	+3.242	+4.682	+4.612	+4.584	+4.9
1091354640	2004/08/01	00:04:00	+2.490	+2.516	+2.419	+3.089	+2.399	+3.117	+3.153	+3.234	+4.678	+4.609	+4.583	+4.9
1091354760	2004/08/01	00:06:00	+2.596	+2.524	+2.430	+3.100	+2.415	+3.129	+3.148	+3.226	+4.669	+4.598	+4.576	+4.9
1091354880	2004/08/01	00:08:00	+2.534	+2.530	+2.442	+3.163	+2.428	+3.204	+3.144	+3.228	+4.665	+4.598	+4.570	+4.9
1091355000	2004/08/01	00:10:00	+2.454	+2.534	+2.441	+3.069	+2.434	+3.087	+3.141	+3.206	+4.660	+4.594	+4.567	+4.8
1091355120	2004/08/01	00:12:00	+2.646	+2.549	+2.453	+3.150	+2.448	+3.167	+3.137	+3.225	+4.654	+4.590	+4.560	+4.8
1091355240	2004/08/01	00:14:00	+2.646	+2.559	+2.465	+3.179	+2.463	+3.211	+3.132	+3.242	+4.648	+4.586	+4.556	+4.8
1091355360	2004/08/01	00:16:00	+2.621	+2.569	+2.475	+3.201	+2.475	+3.248	+3.129	+3.249	+4.645	+4.581	+4.552	+4.8
1091355480	2004/08/01	00:18:00	+2.554	+2.576	+2.483	+3.177	+2.488	+3.221	+3.126	+3.242	+4.638	+4.575	+4.547	+4.8
1091355600	2004/08/01	00:20:00	+2.477	+2.579	+2.485	+3.142	+2.496	+3.172	+3.123	+3.219	+4.633	+4.576	+4.543	+4.8
1091355720	2004/08/01	00:22:00	+2.502	+2.589	+2.492	+3.145	+2.505	+3.194	+3.119	+3.222	+4.630	+4.568	+4.538	+4.8
1091355840	2004/08/01	00:24:00	+2.609	+2.596	+2.495	+3.156	+2.513	+3.190	+3.116	+3.228	+4.628	+4.565	+4.534	+4.8
1091355960	2004/08/01	00:26:00	+2.471	+2.598	+2.494	+3.096	+2.518	+3.139	+3.112	+3.213	+4.622	+4.562	+4.533	+4.8
1091356080	2004/08/01	00:28:00	+2.434	+2.601	+2.504	+3.128	+2.525	+3.159	+3.107	+3.198	+4.616	+4.559	+4.527	+4.8
1091356200	2004/08/01	00:30:00	+2.423	+2.601	+2.507	+3.083	+2.530	+3.112	+3.103	+3.185	+4.612	+4.555	+4.523	+4.8
1091356320	2004/08/01	00:32:00	+2.177	+2.587	+2.487	+2.817	+2.519	+2.869	+3.096	+3.105	+4.608	+4.550	+4.520	+4.8
1091356440	2004/08/01	00:34:00	+2.083	+2.578	+2.474	+2.779	+2.510	+2.847	+3.087	+3.079	+4.603	+4.547	+4.517	+4.8
1091356560	2004/08/01	00:36:00	+2.058	+2.567	+2.465	+2.756	+2.502	+2.831	+3.080	+3.056	+4.599	+4.542	+4.514	+4.8
1091356680	2004/08/01	00:38:00	+1.935	+2.552	+2.451	+2.620	+2.487	+2.671	+3.071	+3.004	+4.593	+4.538	+4.509	+4.8
1091356800	2004/08/01	00:40:00	+1.879	+2.536	+2.437	+2.583	+2.473	+2.659	+3.060	+2.969	+4.585	+4.532	+4.503	+4.8
1091356920	2004/08/01	00:42:00	+1.829	+2.520	+2.421	+2.523	+2.457	+2.604	+3.049	+2.930	+4.580	+4.527	+4.500	+4.8
1091357040	2004/08/01	00:44:00	+1.875	+2.507	+2.415	+2.598	+2.444	+2.667	+3.040	+2.940	+4.572	+4.521	+4.493	+4.8
1091357160	2004/08/01	00:46:00	+1.904	+2.494	+2.405	+2.543	+2.432	+2.607	+3.029	+2.919	+4.567	+4.514	+4.483	+4.8
1091357280	2004/08/01	00:48:00	+1.857	+2.479	+2.396	+2.545	+2.422	+2.622	+3.018	+2.919	+4.560	+4.509	+4.479	+4.8
1091357400	2004/08/01	00:50:00	+1.850	+2.469	+2.392	+2.593	+2.411	+2.683	+3.009	+2.919	+4.557	+4.507	+4.476	+4.8
1091357520	2004/08/01	00:52:00	+1.850	+2.458	+2.387	+2.606	+2.402	+2.694	+3.000	+2.924	+4.551	+4.501	+4.471	+4.8
1091357640	2004/08/01	00:54:00	+1.806	+2.447	+2.379	+2.582	+2.391	+2.669	+2.990	+2.911	+4.545	+4.496	+4.467	+4.8
1091357760	2004/08/01	00:56:00	+1.844	+2.442	+2.378	+2.657	+2.386	+2.728	+2.981	+2.923	+4.541	+4.493	+4.462	+4.8
1091357880	2004/08/01	00:58:00	+1.807	+2.430	+2.370	+2.598	+2.376	+2.676	+2.973	+2.906	+4.536	+4.487	+4.458	+4.8
1091358000	2004/08/01	01:00:00	+1.780	+2.418	+2.361	+2.551	+2.367	+2.625	+2.963	+2.884	+4.530	+4.482	+4.452	+4.7
1091358120	2004/08/01	01:02:00	+1.771	+2.409	+2.356	+2.562	+2.357	+2.647	+2.954	+2.888	+4.523	+4.476	+4.447	+4.7
1091358240	2004/08/01	01:04:00	+1.781	+2.402	+2.355	+2.634	+2.349	+2.713	+2.945	+2.891	+4.519	+4.474	+4.444	+4.7
1091358360	2004/08/01	01:06:00	+1.895	+2.398	+2.357	+2.720	+2.348	+2.802	+2.936	+2.916	+4.513	+4.468	+4.438	+4.7
1091358480	2004/08/01	01:08:00	+1.839	+2.393	+2.353	+2.706	+2.342	+2.796	+2.927	+2.910	+4.510	+4.465	+4.435	+4.7
1091358600	2004/08/01	01:10:00	+1.864	+2.390	+2.357	+2.759	+2.343	+2.859	+2.921	+2.928	+4.503	+4.460	+4.432	+4.7

start Noahs_stuff Noah Luis Dougs http://iqup.ifa.ha... untitled - Paint 1:05 PM

Text file of Average Temperature

AMT = Average Mirror Temperature
ATE = Average Temperature Outside
ATDT = Average Dome Top Temperature
ATDM = Average Mid Dome Temperature
ATDZ = Average Mezzanine Temperature
ATF = Average Floor Temperature

#BASETIME	_DATE_	_TIME_	AMT	ATE	ATDT	ATDM	ATDZ	ATF
1091354400	2004/08/01	00:00:00						
1091358000	2004/08/01	01:00:00	4.744	ERROR	3.643	2.453	2.012	3.161
1091361600	2004/08/01	02:00:00	4.627	ERROR	3.406	2.208	1.799	2.972
1091365200	2004/08/01	03:00:00	4.545	ERROR	3.475	2.211	1.783	3.245
1091368800	2004/08/01	04:00:00	4.476	ERROR	3.115	1.801	1.423	3.237
1091372400	2004/08/01	05:00:00	4.406	ERROR	3.076	1.673	1.305	3.180
1091376000	2004/08/01	06:00:00	4.338	ERROR	3.310	1.989	1.562	3.186
1091379600	2004/08/01	07:00:00	4.291	ERROR	3.736	2.542	2.223	3.250
1091383200	2004/08/01	08:00:00	4.256	ERROR	4.154	3.049	2.658	3.530
1091386800	2004/08/01	09:00:00	4.230	ERROR	4.712	3.649	3.123	3.761
1091390400	2004/08/01	10:00:00	4.213	ERROR	5.479	4.392	3.704	4.104
1091394000	2004/08/01	11:00:00	4.207	ERROR	6.056	4.929	4.252	4.453
1091397600	2004/08/01	12:00:00	4.210	ERROR	6.417	5.187	4.644	4.672
1091401200	2004/08/01	13:00:00	4.221	ERROR	6.712	5.340	4.863	4.835
1091404800	2004/08/01	14:00:00	4.237	ERROR	6.913	5.412	5.000	4.941
1091408400	2004/08/01	15:00:00	4.255	ERROR	7.213	5.545	5.158	4.943
1091412000	2004/08/01	16:00:00	4.275	ERROR	7.494	5.683	5.305	4.950
1091415600	2004/08/01	17:00:00	4.298	ERROR	7.626	5.853	5.496	5.013
1091419200	2004/08/01	18:00:00	4.322	ERROR	7.929	6.109	5.610	5.124
1091422800	2004/08/01	19:00:00	4.343	ERROR	7.677	5.936	5.313	5.116
1091426400	2004/08/01	20:00:00	4.317	ERROR	4.392	3.071	2.620	4.123
1091430000	2004/08/01	21:00:00	4.225	ERROR	3.073	1.832	1.579	3.161
1091433600	2004/08/01	22:00:00	4.125	ERROR	2.864	1.646	1.458	2.800
1091437200	2004/08/01	23:00:00	4.018	ERROR	2.602	1.439	1.208	2.549
1091440800	2004/08/02	00:00:00	3.915	ERROR	2.457	1.235	0.956	2.581

Daily Average Plot

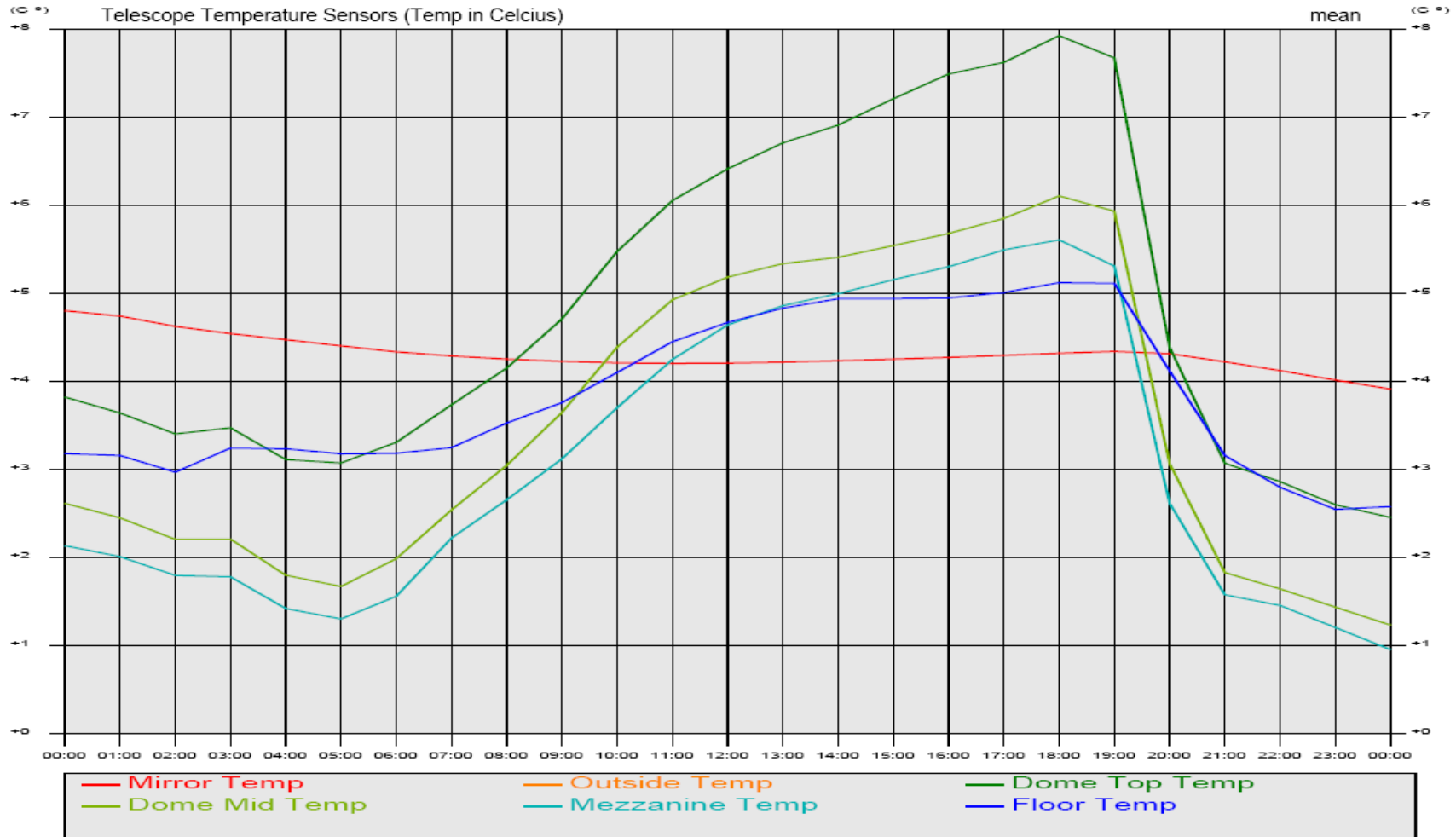


Infrared Telescope Facility

Start Date: 08/01/04-00:00
End Date: 08/02/04-00:00
LEFT AXIS: Unit: C°
Min: 0.956
Max: 7.929

RIGHT AXIS: Unit: C°
Min: 0.956
Max: 7.929

Image Quality
08/01/04-00:00
Temperatures



Overall I learned that...

- Most programming errors are logical or syntactical errors that are the programmer's fault.
- Problems almost always never get completed on the first pass.
- More than one way to implement a solution
- Some implementations are more useful and/or efficient
- Having a plan always helps

Tools Used

- Tool Command Language (TCL)
- Hypertext Markup Language (HTML)
- POSTSCRIPT Language
- Dreamweaver MX
- Secure Shell (SSH)
- Exceed
- Unix/Linux

People



Noah Luis



Miranda Hawarden-Ogata



Tim Bond



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