The Evolution of the GERB Ground Segment Processing System

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Overview

Need for long term operational system
Design choices
Changes along the way
Misnomer

GGSPS is the system at RAL

– Not the full ground segment
The GERB Instrument
600 ms rotational cycle
600 ms rotational cycle
600 ms rotational cycle
3 to 4 g
Up to 9g
Players

EUMETSAT receive the raw data from MSG
RAL
  – Designed and led the building of the instrument
    – Calculate calibrated geolocated radiances
RMIB
  – Expertise in deriving fluxes
    – Calculate fluxes
Imperial College – science and operations

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Flow of data

GGSPS

- L1.5 to RMIB
- L2 from RMIB
- L0 From EUM
Planning for the long term

• GGSPS was designed from 1996
• Originally planned launch in Oct 2000
• Actual launch of MSG-1 in 2002
• MSG-2 launched in December 2005
• MSG-3 launched recently (5 July 2012)
• Expected to go to at least 2018
• Well over 20 years from design to end
  – But at least we knew that!
Choosing the system

Candidate operating systems

- Various favours of (commercial) Unix
- Linux
- VMS
- Windows NT

Choice at end of 1996

- PSS
Considerations

Software development tools
Robust database (central to design of GGSPS)
Programming language
And the winner was …
  – Digital Unix (-> Tru64)
  – Ingres database
  – C++
Slow evolution

Replace original Alpha hardware with more modern processors

Use NAS boxes for data storage
Changes to getting the raw data

Original scheme
- Leased line to EUM operational computers
- Received a data packet every 0.6 sec
- Driven by EUM need for security
Later, raw data delivered to U-MARF
- Now collect data files from U-MARF via internet
- Simpler
- Much cheaper
The Big Bang

HP
- which had merged with Compaq
  - which had bought Digital
    - announced it would drop support for Tru64

Options
- Buy enough hardware to last to the end of the mission
- Port to something with a future
Port to Linux

C++ is portable, isn’t it?
Status of Ingres on Linux was uncertain
  – Move database to Postgres
Porting process
  – Quick build of code on Linux using Ingres as DB
  – Careful port to give code that runs
    – Passes unit tests, executables don’t crash
  – Run full system test, compare data products
Problems along the way

- Make files
- Compiler on Tru64 let us get away with some poor code
  - e.g. multiple fclose()
- Some data types in Ingres different in Postgres
- Error checking used in Ingres not available in Postgres

```c
if ( fp = fopen() ) {
    ...
    fclose(fp);
}
// Final close “to be sure”
fclose(fp);
```
Operational problems

Design of GERB is simple
  – Scan E-W with no filter
  – Scan W-E with short wave filter
  – Repeat

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But ...

- Position of detectors suffer from jitter
  - Timing signal from MSG
- Stray light affects images more than expected
- Mirror can stick on occasions
- Sensor swaps cause position offsets

-> Time spent checking data was much higher than expected
Operational Improvements

- Trap counting data
- Trap mirror pointing anomalies
- Automate generation of geo long-term trend plots
- Automate handling of stray light data
- Automate detection of anomalies
- Improve daily movie software
- Tools to compare L1.5 geo against RGP
- Improve robustness of generation of geo plots
- Extend range of quantities monitored in eng reports
Operational Improvements

Have reduced time spent on routine data validation

Can devote more time to improving the system
GERB-3

Mirror mechanism
  – Velocity control on GERB-1 & GERB-2
  – Position control on GERB-3 & GERB-4

New mechanism has led to revised data packet
Conclusions

• Philosophy of GERB has remained constant
• Have evolved the processing system to be more powerful and useful
• Have improved the operational tools to automate time consuming processes
• Set fair for GERB-3 and 4