A Presentation of our Work

The Swedish Interns

2016-08-18

Created for NVI Inc. at the Goddard Space Flight Centre

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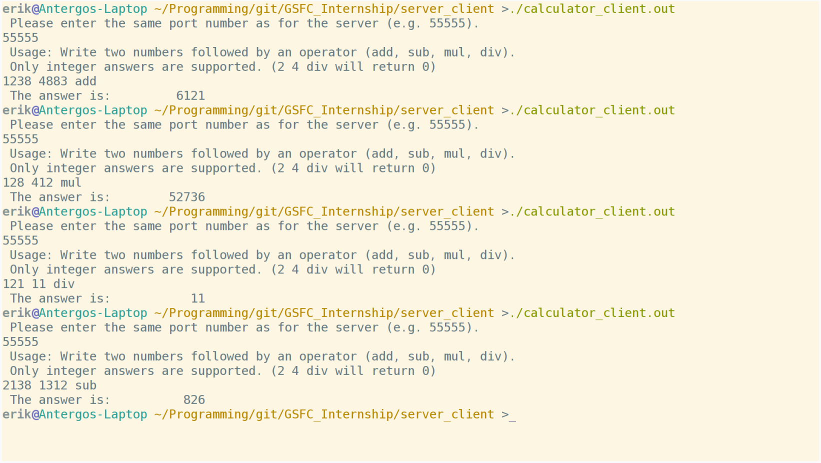
Weeks 1-2: Learning Fortran

Calculator



```
erik@Antergos-Laptop ~/Programming/git/GSFC_Internship/server_client >./calculator_client.out
 Please enter the same port number as for the server (e.g. 55555).
55555
 Usage: Write two numbers followed by an operator (add, sub, mul, div).
 Only integer answers are supported. (2 4 div will return 0)
1238 4883 add
 The answer is:         6121
erik@Antergos-Laptop ~/Programming/git/GSFC_Internship/server_client >./calculator_client.out
 Please enter the same port number as for the server (e.g. 55555).
55555
 Usage: Write two numbers followed by an operator (add, sub, mul, div).
 Only integer answers are supported. (2 4 div will return 0)
128 412 mul
 The answer is:        52736
erik@Antergos-Laptop ~/Programming/git/GSFC_Internship/server_client >./calculator_client.out
 Please enter the same port number as for the server (e.g. 55555).
55555
 Usage: Write two numbers followed by an operator (add, sub, mul, div).
 Only integer answers are supported. (2 4 div will return 0)
121 11 div
 The answer is:           11
erik@Antergos-Laptop ~/Programming/git/GSFC_Internship/server_client >./calculator_client.out
 Please enter the same port number as for the server (e.g. 55555).
55555
 Usage: Write two numbers followed by an operator (add, sub, mul, div).
 Only integer answers are supported. (2 4 div will return 0)
2138 1312 sub
 The answer is:          826
erik@Antergos-Laptop ~/Programming/git/GSFC_Internship/server_client >_
```

Figure 1: Example usage of the TCP calculator.

Weeks 3-7: Our First Project

Problem Description

Rewrite how globl/solve handles its passing of data to and from usrpartials and usrprogs.

By minimizing disc I/O we want to increase the speed at which data is sent.

Week 3-4: Testing I/O performance

I/O Performance

- A couple of contenders:

I/O Performance

- A couple of contenders:
    - Read/Write with files

I/O Performance

- A couple of contenders:
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    - Read/Write with pipes

I/O Performance

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    - Sending/Receiving with OpenMPI

I/O Performance

- A couple of contenders:
    - Read/Write with files
    - Read/Write with pipes
    - Sending/Receiving with TCP Sockets
    - Sending/Receiving with OpenMPI
    - Sending/Receiving with ZeroMQ

Performance Test

1. The producer generates a list of length n and fills it with integers.

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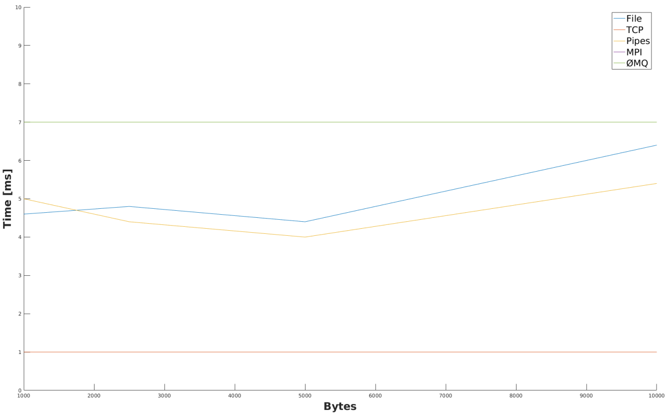
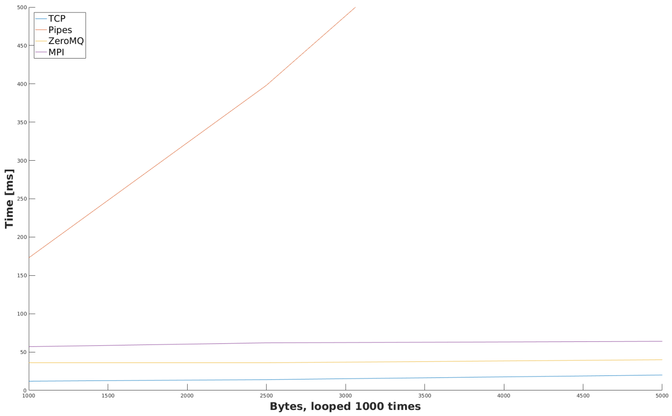
Performance Test

1. The producer generates a list of length n and fills it with integers.
2. The producer writes the list to file (or sends it over the designated transfer protocol).
3. The consumer reads (or receives) the list.
4. The consumer squares each int in the list and sends it back to the producer.
5. The producer reads (or receives) the modified list.

Result for I/O Performance



Result for I/O Performance



Result for I/O Performance

- TCP was the fastest, but the most difficult to implement.

Result for I/O Performance

- TCP was the fastest, but the most difficult to implement.
- Since we assumed a lot of data would be passed we opted for ZeroMQ due to its presumptive ease of use and performance.

Weeks 5-7: Implementation

Implementation

- Installation of Software on **bootes**

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- Porting our code to ifort

Implementation

- Installation of Software on **bootes**
- Porting our code to ifort
- A lot of coding

Results for Project One

Results for Project One

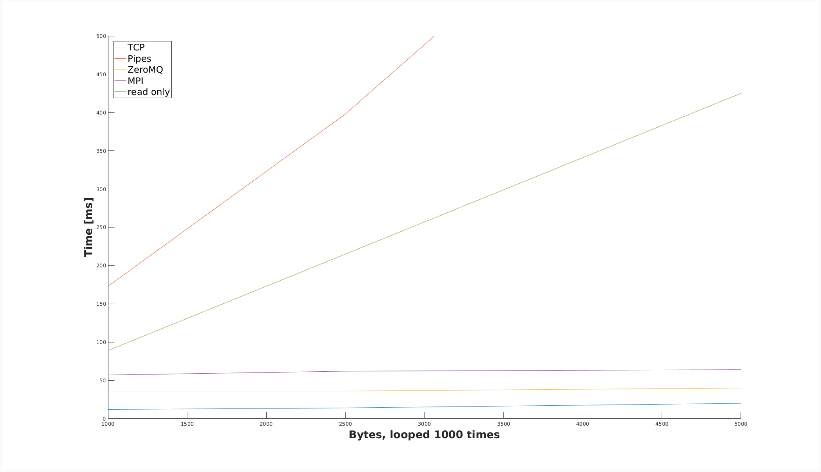
Running userpartials for 200 observations.
Old version of globl/solve: 8 minutes 47 seconds
New version of globl/solve: 9 minutes 5 seconds

Results for Project One

Why?

Results for Project One

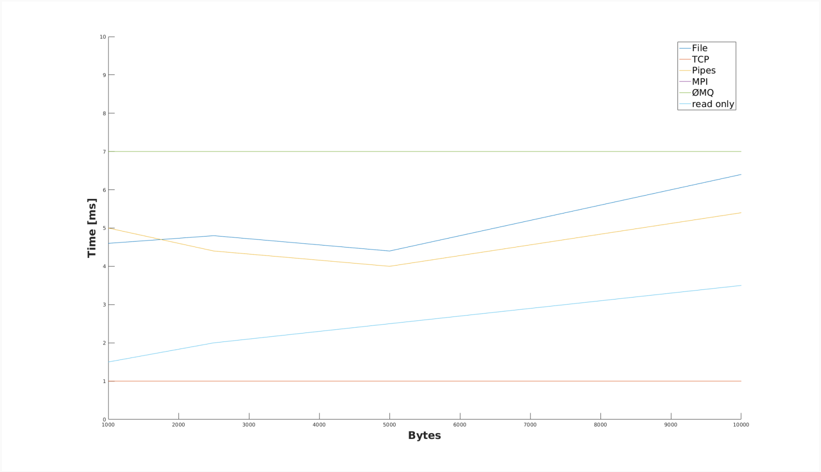
Globl/solve does not read and write a lot, it reads a lot,



but read only is still slower...

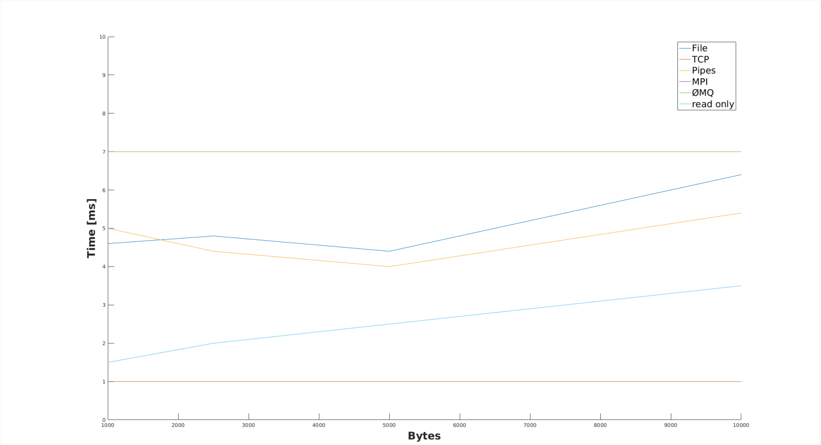
Results for Project One

Globl/solve does not read as much as we thought,



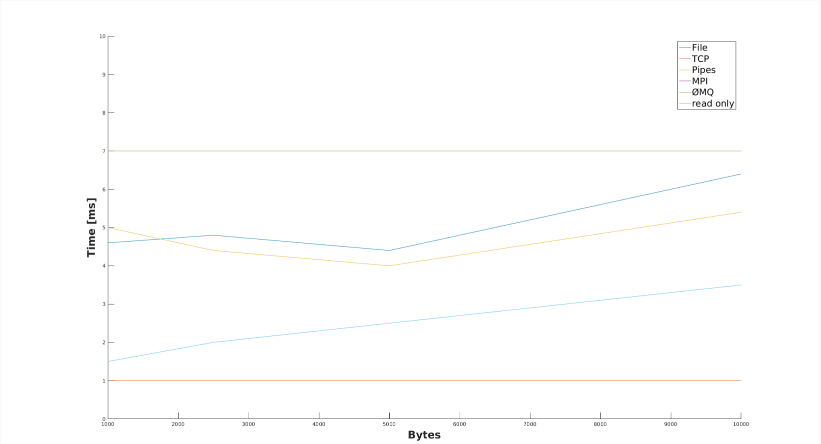
Future studies

- Remove the writes that are no longer needed.



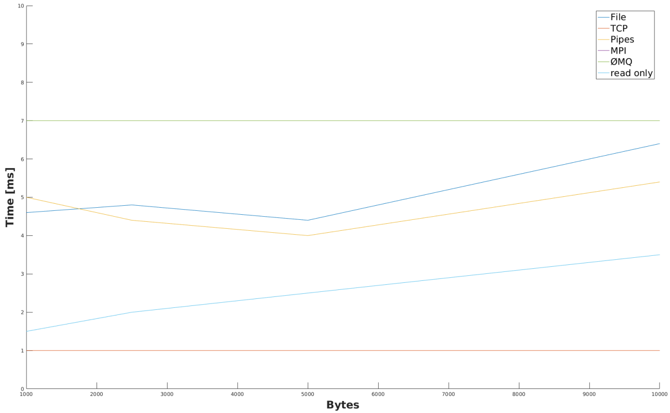
Future studies

- Remove the writes that are no longer needed.
- TCP should have been the way to go?



Future studies

- Remove the writes that are no longer needed.
- TCP should have been the way to go?
- Posix Shared Memory? Conversion between C and Fortran was non trivial.

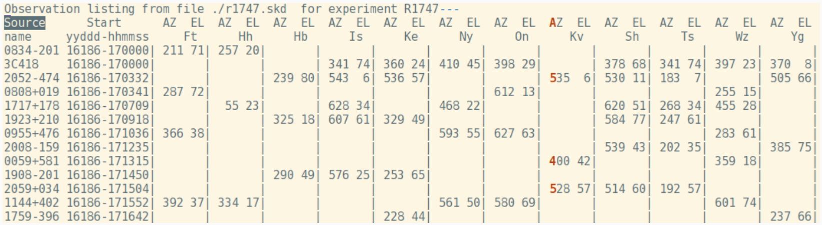


Weeks 7-9: Our Second Project

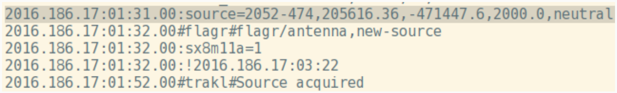
Problem Description

The model used for determining when an antenna acquires a source is a little bit off. Sked will say that an antenna should be on target at time T but the logfiles tells us that the antenna actually was on source at $T \pm c$.

Extract the Data



```
Observation listing from file ./r1747.skd  for experiment R1747---
Source      Start      AZ  EL  AZ  EL  AZ  EL  AZ  EL  AZ  EL  AZ  EL  AZ  EL  AZ  EL  AZ  EL  AZ  EL  AZ  EL  AZ  EL
name     yyddd-hhmmss     Ft      Hh      Hb      Is      Ke      Ny      On      Kv      Sh      Ts      Wz      Yg
0834-201 16186-170000| 211 71| 257 20|       |       |       |       |       |       |       |       |       |       |
3C418    16186-170000|       |       |       | 341 74| 360 24| 410 45| 398 29|       | 378 68| 341 74| 397 23| 370  8|
2052-474 16186-170332|       |       | 239 80| 543  6| 536 57|       |       | 535  6| 530 11| 183  7|       | 505 66|
0808+019 16186-170341| 287 72|       |       |       |       |       | 612 13|       |       |       | 255 15|       |
1717+178 16186-170709|       |  55 23|       | 628 34|       | 468 22|       |       | 620 51| 268 34| 455 28|       |
1923+210 16186-170918|       |       | 325 18| 607 61| 329 49|       |       |       | 584 77| 247 61|       |       |
0955+476 16186-171036| 366 38|       |       |       |       | 593 55| 627 63|       |       |       | 283 61|       |
2008-159 16186-171235|       |       |       |       |       |       |       |       | 539 43| 202 35|       | 385 75|
0059+581 16186-171315|       |       |       |       |       |       |       | 400 42|       |       | 359 18|       |
1908-201 16186-171450|       |       | 290 49| 576 25| 253 65|       |       |       |       |       |       |       |
2059+034 16186-171504|       |       |       |       |       |       |       | 528 57| 514 60| 192 57|       |       |
1144+402 16186-171552| 392 37| 334 17|       |       |       | 561 50| 580 69|       |       |       | 601 74|       |
1759-396 16186-171642|       |       |       |       | 228 44|       |       |       |       |       |       | 237 66|
```



```
2016.186.17:01:31.00:source=2052-474,205616.36,-471447.6,2000.0,neutral
2016.186.17:01:32.00#flagr#flagr/antenna,new-source
2016.186.17:01:32.00:sx8m11a=1
2016.186.17:01:32.00:!2016.186.17:03:22
2016.186.17:01:52.00#trakl#Source acquired
```

Parse the Data

- Correlate the log data with the Sked data.

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- Least Square Fit

Parse the Data

- Correlate the log data with the Sked data.
- Least Square Fit
    - Iteratively re calculate to get rid of noise.

Result for Project Two

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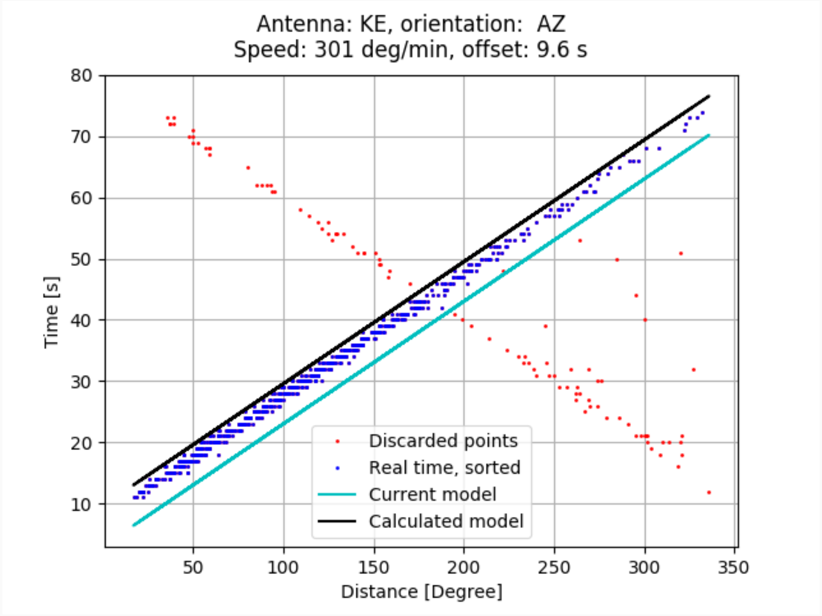

Future studies

- Fix the bug in Sked.

Future studies

- Fix the bug in Sked.
- Set a more intelligent threshold.

Week 10: Returning Home

Returning Home

During our time here we have:

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- been exposed to how it is to work at NASA and NVI.

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- learned the importance of conducting thorough research.

Returning Home

During our time here we have:

- been exposed to how it is to work at NASA and NVI.
- learned the importance of conducting thorough research.
- realized that patience really is a virtue...

Returning Home

Thank you!