### 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).
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).
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:
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).
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

• A couple of contenders:

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

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  - Read/Write with pipes

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  - Sending/Receiving with TCP Sockets

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- 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

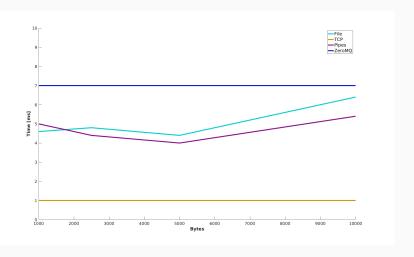
1. The producer generates a list of length n and fills it with integers.

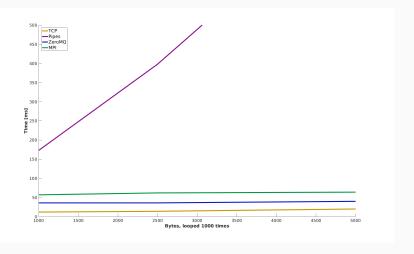
- 1. The producer generates a list of length n and fills it with integers.
- 2. The producer writes the list to file (or sends it over the designated transfer protocol).

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- 2. The producer writes the list to file (or sends it over the designated transfer protocol).
- 3. The consumer reads (or receives) the list.

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- 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.

- 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.





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

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- 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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- Installation of Software on bootes
- Porting our code to ifort

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

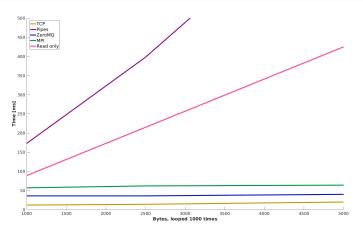
Running userpartials for 200 observations.

Old version of globl/solve: 8 minutes 47 seconds

New version of globl/solve: 9 minutes 5 seconds

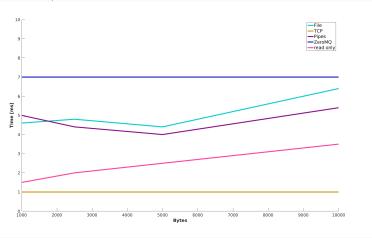
Why?

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



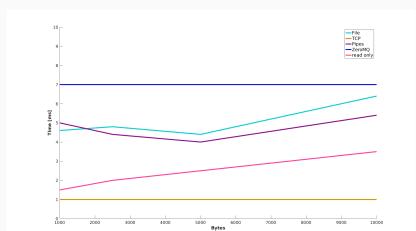
but read only is still slower...

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



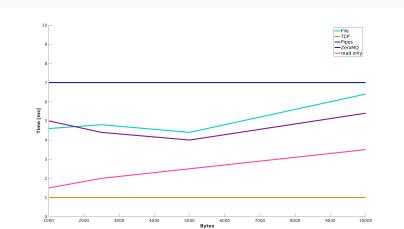
#### **Future studies**

• Remove the writes that are no longer needed.



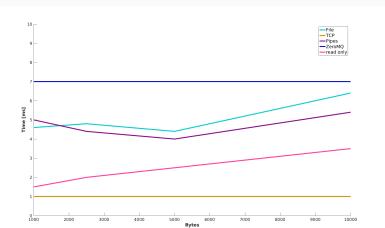
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- Remove the writes that are no longer needed.
- TCP should have been the way to go?



#### **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 R174	7				
Source Start AZ EL	AZ EL AZ EL	AZ EL AZ EL	AZ EL AZ EL	AZ EL A	Z EL AZ EL	AZ EL AZ	Z 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	i i	341 74 360 24	410 45 398 29	3	78 68 341 74	397 23 37	70 8
2052-474 16186-170332	239 80	543 6 536 57		<b>5</b> 35 6 5	30 11 183 7		95 66
0808+019 16186-170341 287 72			612 13			255 15	
1717+178 16186-170709	55 23	628 34	468 22	j 6	20 51 268 34	455 28	i
1923+210 16186-170918	325 18	607 61 329 49	į į	j 5	84 77 247 61	İ	i
0955+476 16186-171036 366 38	i i	į į	593 55 627 63	İ	į į	283 61	i
2008-159 16186-171235	i i	i i	į į	5	39 43 202 35		35 75
0059+581 16186-171315		i i	į į	400 42	i i	359 18	i i
1908-201 16186-171450	290 49	576 25 253 65	i i	i	į į	i	i
2059+034 16186-171504	i i	i i	i i	<b>5</b> 28 57 5	14 60 192 57	i	i
1144+402 16186-171552 392 37	334 17	i i	561 50 580 69	i	į į	601 74	i
1759-396 16186-171642	i i	228 44	į į	İ	į į	23	37 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:ssmalla=1 2016.186.17:01:32.00:!2016.186.17:01:32.00:22 2016.186.17:01:52.00#trakl#Source acquired
```

#### Parse the Data

• Correlate the log data with the Sked data.

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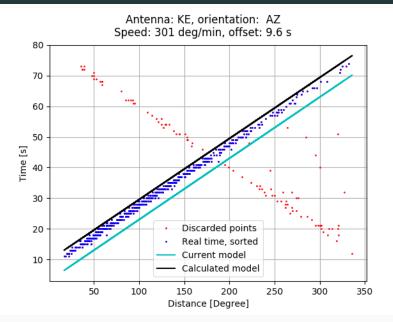
- Correlate the log data with the Sked data.
- Least Square Fit

#### 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

## Result for Project Two



### **Future studies**

• Fix the bug in Sked.

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

Week 10: Returning Home

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- learned the importance of conducting thorough research.

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- 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...

Thank you!