

Proposal for model of remote analysis of experimental data

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1 Foreword

Almost all planned HEP experiments will have a lot of data to be recorded in a place where they will be obtained. No doubt the data will be stored in the one place in the same institute where they were measured and recorded. Only a few research centres will afford to have a replica for the data.

On other hand if all people who wish to analyse the experimental data will come to the place where the data is stored it will probably be difficult to find out required number of simple chairs.

All that lead us to discuss the remote analysis model of experimental data.

2 Starting point

Let we give a name E to an experimental site where data are stored. Presumably site E has sufficient amount of a second storage to keep all the data. E has also enough processor power to realize selection of the requested portion of the data and to send it over a network to a requester.

We suppose also another site U. Site U is a remote site. It has probably only limited computer and network facilities. Site U IP channel has bandwidth from 64 Kbit/sec to 256 Kbit/sec. As a rule such a site has reasonably large ping time (turn around time for test packets). That time can achieve several hundred of mseconds or even more. Possibly it will be interesting for sites which have even more powerful IP connection. It is important that we mean the real bandwidth which is achivable for a concrete workstation. It is clear most of physicists live in site type U.

It is interesting to take into account the real example of the site U the Petersburg Nuclear Physics Institute located at Gatchina, near far St.Petersburg, Russia. As the site E we will discuss CERN. Below we can see the data which characterize the network circumstances in between PNPI and CERN.

```
[rec03] ~ $ date  
Tue Apr 2 16:32:59 MSK 1996
```

```
[rec03] ~ $ nslookup rec03  
Server: rec03.pnpi.spb.ru  
Address: 193.124.84.31
```

Name: rec03.pnpi.spb.ru
Address: 193.124.84.31

```
[rec03] ~ $ ping axcn01.cern.ch
PING axcn01.cern.ch (128.141.239.100): 56 data bytes
64 bytes from 128.141.239.100: icmp_seq=0 ttl=246 time=678 ms
64 bytes from 128.141.239.100: icmp_seq=1 ttl=246 time=732 ms
64 bytes from 128.141.239.100: icmp_seq=2 ttl=246 time=726 ms
64 bytes from 128.141.239.100: icmp_seq=3 ttl=246 time=680 ms
64 bytes from 128.141.239.100: icmp_seq=4 ttl=246 time=663 ms
64 bytes from 128.141.239.100: icmp_seq=6 ttl=246 time=724 ms
64 bytes from 128.141.239.100: icmp_seq=8 ttl=246 time=683 ms
64 bytes from 128.141.239.100: icmp_seq=9 ttl=246 time=812 ms
64 bytes from 128.141.239.100: icmp_seq=10 ttl=246 time=748 ms
64 bytes from 128.141.239.100: icmp_seq=11 ttl=246 time=731 ms
64 bytes from 128.141.239.100: icmp_seq=12 ttl=246 time=714 ms
64 bytes from 128.141.239.100: icmp_seq=13 ttl=246 time=780 ms
64 bytes from 128.141.239.100: icmp_seq=14 ttl=246 time=806 ms
64 bytes from 128.141.239.100: icmp_seq=15 ttl=246 time=773 ms
64 bytes from 128.141.239.100: icmp_seq=16 ttl=246 time=816 ms
64 bytes from 128.141.239.100: icmp_seq=17 ttl=246 time=774 ms
64 bytes from 128.141.239.100: icmp_seq=18 ttl=246 time=870 ms
64 bytes from 128.141.239.100: icmp_seq=19 ttl=246 time=704 ms
```

```
----axcn01.cern.ch PING Statistics----
20 packets transmitted, 18 packets received, 10% packet loss
round-trip min/avg/max = 663/745/870 ms
```

```
[rec03] ~ $ traceroute axcn01.cern.ch
```

```
traceroute to axcn01.cern.ch (128.141.239.100), 30 hops max, 40 byte packets
```

```
 1  cisco.pnpi.spb.ru (193.124.84.199)  4 ms  4 ms  4 ms
 2  DESY.Hamburg.DE.Radio-MSU.net (194.67.80.201)  581 ms  563 ms  590 ms
 3  dante.WiN-IP.DFN.DE (188.1.56.5)  586 ms  578 ms  575 ms
 4  DE.dante.bt.net (188.1.56.10)  618 ms  590 ms  587 ms
 5  DE-f0-0.eurocore.bt.net (194.72.24.193)  608 ms  586 ms  624 ms
 6  CH-s1-0.eurocore.bt.net (194.72.24.206)  745 ms  799 ms  909 ms
 7  CH-f0.dante.bt.net (194.72.24.66)  758 ms  702 ms  699 ms
 8  CERN-s0.dante.bt.net (194.72.26.138)  696 ms  625 ms  709 ms
 9  cgate1.cern.ch (192.65.185.1)  706 ms  735 ms  631 ms
10  axcn01.cern.ch (128.141.239.100)  718 ms  708 ms  769 ms
```

The real throughput of IP line PNPI-CERN is about 5 KB/sec.

It means in reality that if you use X protocol over IP line you will have only limited X facilities because of slow changing of your screen. For instance simple mosaic screen you will

see 2-3 minutes later after the start command. More complex graphic screen will appear later. On other hand if you will transfer over such a WAN a reasonable volume of experimental data (for example the fragments of DST) it might be not possible because of the bandwidth.

It is clear there is no single method to overcome the difficulty. It seems it will require several corresponding steps.

Our aim is to realize a program environment which permits to involve into the remote analysis the people from sites U around the World as many as possible.

3 Technical Consideration

Let we consider remote analysis (computing) in more detailed manner. The remote computing consists of several basic operations:

- remote text editing; It is well known that a local editing is more suitable. Obvious aim of remote editing is to transform it into the local editing with minimum of the network traffic (caching, compressing, etc.). Probably it will be useful to develop or adopt a new shell like "xtem" with an appropriate tuning (editor type, cache size, other parameters).
- remote job submission and observation of the results; here we should take into account the properties of the NQS or other batch system.
- remote interactive work; here we mean PAW and other programs. Of course we say about rebuilding the binaries with CS pack (or other tool) to realize client-server model.
- communication tools (irc, audio, etc.).

The general goal is to reduce the unnecessary network traffic in all above scenarios as much as possible. It will help to a physicist to overcome the network delays during the remote sessions.

Presumably the result of this work should be prepared as a whole package which may be deployed and used everywhere: in home institutes, universities, etc.

4 Who could do it

I could involve several people from our institute (PNPI) and from another interested institutes and universities. It will be extremely useful to obtain some sort of supporting from collaborations and separate experimental groups.