General purpose data storage for Pamela (and Altea) experiment(s!)

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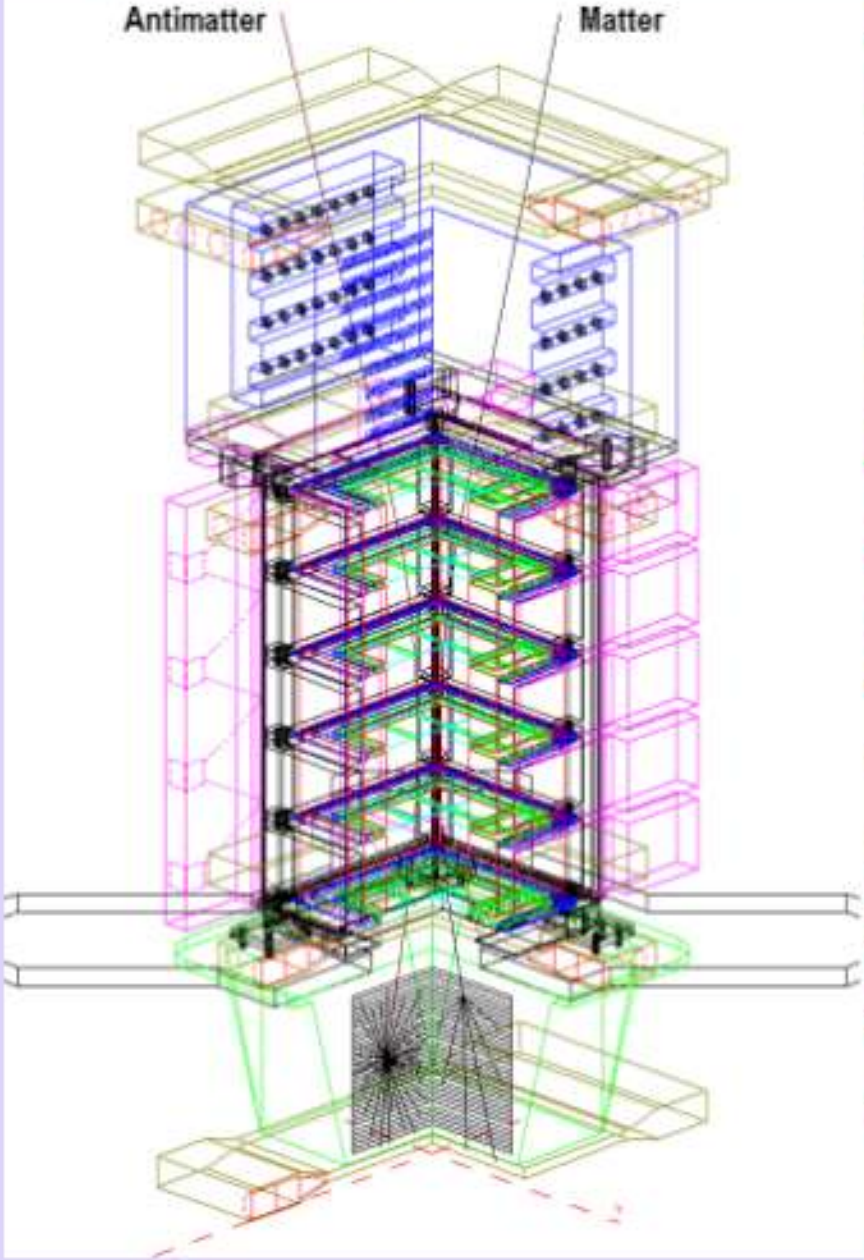


PARTICLE	NUMBER	ENERGY RANGE
protons	$3x10^8$	80 MeV - 700GeV
antiprotons	$>3x10^4$	80 MeV -190 GeV
electrons	$6x10^6$	50 MeV - 2 TeV
positrons	$>3x10^5$	50 MeV - 270 GeV
He nuclei	$4x10^7$	up to 700 GeV/n
Be nuclei	$4x10^4$	up to 700 GeV/n
C nuclei	$4x10^5$	up to 700 GeV/n
antinuclei	limit (90% c.l.)	$7x10^{-8}$ up to 30GeV/n

Average altitude	500 Km. (Polar orbit)
Operating time	3 years
Acquisition rate	10 Hz
Max data downloaded	20 Gb/day

Measurement of the antiproton spectrum up to 190 GeV (present limit 50 GeV);

Measurement of the positron spectrum up to more than 270 GeV (present limit 30 GeV);

Search for antinuclei with a sensitivity of some unity in 10-7 in the antiHe/He ratio (present sensitivity limit about 10-5);

Continuous monitoring of the cosmic rays solar modulation before, during and after the 23rd maximum of the solar activity;

Study of the time and energy distributions of the energetic particles emitted in solar flares and coronal Mass Ejections.

ALTEA - space

EEG

32 channels
128 - 16384 Hz
per chan

SDS

1 SDU:
3 silicon planes with double detectors, view X & Y
Area: 2 x (8 x 8) cm2
Pitch: 2.4 mm
Thickness: 380 µm
Threshold: 5 MIP
Saturation: 2400 MIP
Planes distance: 3.75 cm
Maximum error of angular reconstruction: ±1.8°
Geometric factor: 160 cm2 sr

The position of the 6 SDUs
Can be modified to accommodate for different kind of experiments

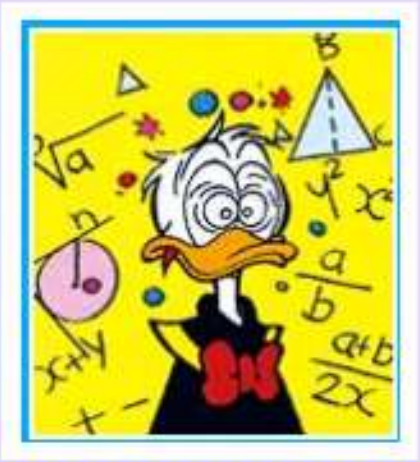
PushB.

Three independent pushbuttons

VSU

Two color LCD-TFT oculars
XGA, 1024 x 768 pixels at 60 Hz
Field of view: 35° diagonal (21° V 28° H)
Luminance 5-50 FL Contrast 40:1
256 colors out of a 16 million colors palette
Video memory: 2 MB

Measure particle trajectories in the brain.
Electrophysiological measurements (EEG) linked to ligth flashes
Further measurements of nuclear abundance in IIS
Scheduled to be operative in the IIS before end of 2005



Prelude:

A three year space mission will transmit at ground a periodic stream of data up to six times a day. Received stream will contains either telemetry and physical data.

PROBLEM

The request is a procedure/infrastructure for preanalisys on the received data to perform necessary instrument calibration, physical data quality control and storage data as well.
Moreover are requested:

- *Statistics on raw data* to determine quality of transmission

- *Statistics on inner* packets data to determine instrument status

- *High flexybility* to minimize refactoring caused by not foreseen situations;

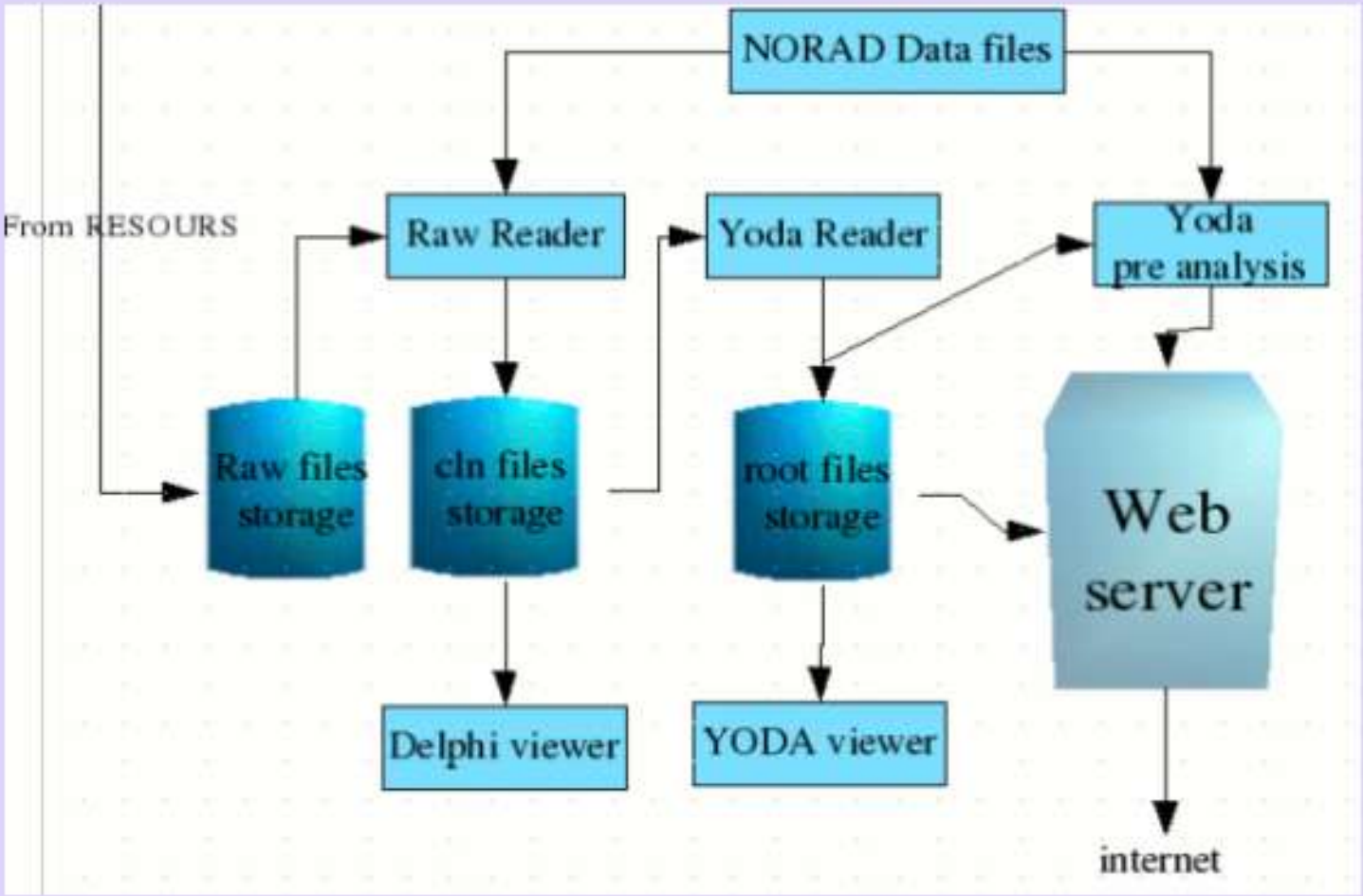
- DATA HAVE TO BE *AVAILABLE WORLDWIDE* THROUGHT INTERNET TO ALL THE MEMBERS OF THE COLLABORATION.

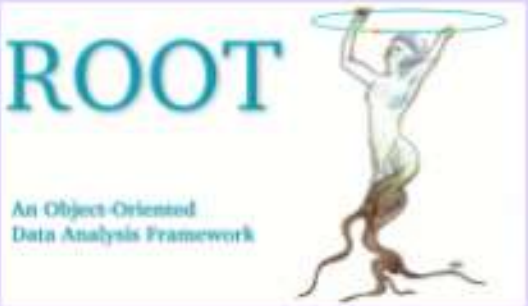
- *STORAGE* RESOURCES IS SUPPOSED TO BE SHARED WITH OTHER EXPERIMENTS.

- GROUND *INFRASTRUCTURE* AS SIMPLE AS POSSIBLE TO MINIMIZE MAINTENANCE COSTS AS FLEXIBLE AS POSSIBLE FOR FURTHER IMPROVEMENTS.

Ground segment solution:

- Modularity to achieve *flexibility* throught OO programming, that is YODA;
- *Automatization* to achieve long time standard quality and minimize maintenance costs;
- Well know framework as *ROOT* because it is a robust data analysis structure packed togheter rich OO libraries.





Storage solution:

- MINIMIZE COST THROUGHT A WELL KNOWN COMMERCIAL ROBUST SOLUTION SAN.

Data storage costs are dramatically fallen down in the lasts few years. WIZARD collaboration experiments will take advange of a little bit bigger initial investment on a mediun size commercial-based Storage Area Network (SAN), instead of an "home-made" solution, on long period because of the consequents hardwares maintenance. Moreover a centralized storage system improve efficiency of the future collaboration experiments (as well external requiring experiments) because all the needed infrastructure is already
developed and ready.

Conclusion:

less the hardware failures, more the physicists have data
less the maintenances costs, more your administrator get happy.

- DECOUPLE STORAGE SYSTEM FROM EXPERIMENTS.

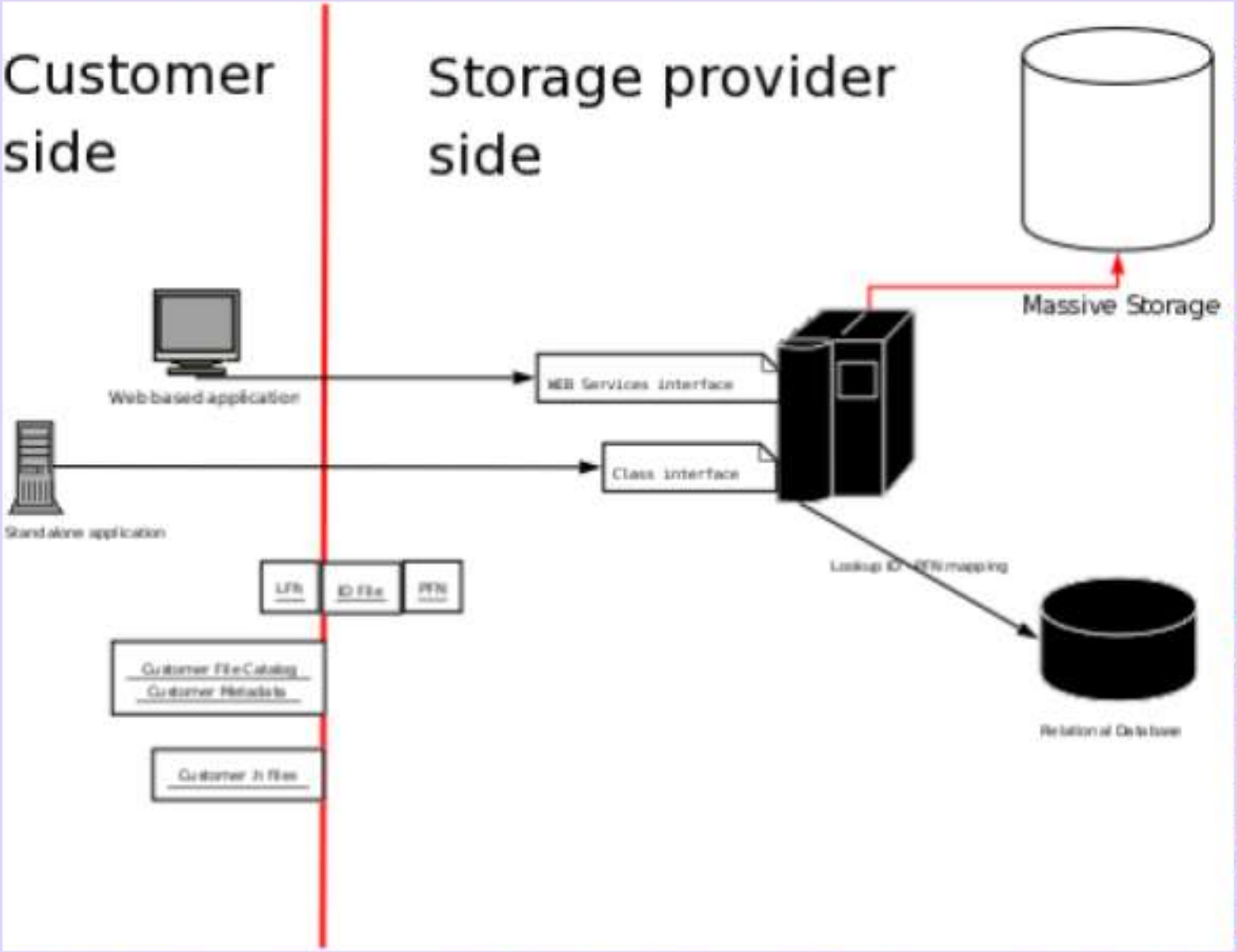
POOL architecture, throught the

LOGICAL FILE NAME <—> ID FILE <—> PHYSICAL FILE NAME

relations, well fits the decoupling of a multitude of users sharing the same resources BUT insisting on different data sets.

Conclusion:

less the complexity, more the robustness (Occam rules!)



- Not all experiments need pool flexibility for data hiding (filename, no DB, no ditributed environment)
- Small-medium experiments has to maximize resources rendimento(small group, not experienced skills)

Customer advantages:

- mildly start a data storage standardization
- easy to use storage services
- stable structured enviroment
- one point data source (for each experiment)
- NO BACKUP

Customer disadvantages:

- slow data store/retieve (?)

Storage administrator advantages:

- focus management only on well known machines
- standardized data storage (hardware/software)
- better network baancing

Storage administrator disadvantages:

- the usuals.....

Hide POOL to customer, provide a better efficiency either for experiments and for storage infrastructure

- a POOL based storage factory allow a people (on the storage side) to get more experience about it than a single experiment group can
- use 10% the features of a software reflects in a not optimal resources usage for the customer group
- multilanguages interfaces exposed to the customer; why constrain the customer application to a C++ interface?
- storage-side server-based applications could take advantages of new developed technologies without affecting the customer application.

Prototype goals:

- develop a common interface for Pamela & ALTEA data storage/retrieve including POOL tool in a server-based application

"Why all this research? A world where only useful things were to be studied would be even more sad, miserable and perhaps even more violent than that which fate has given us..... The future is uncertain even in more prosperous countries and the quality of life becomes worse; however, I believe that what we now discovering about the infinitely large and the infinitely small is sufficient to absolve the end of this century and the end of the millennium. Knowledge about the physical world that is being bravely acquired by some will show that this era will not be remembered as a pure return to barbary"

Primo Levi "L' altrui mestiere"