

WorkShop on Distributed, Object Oriented Computing for Seismology



The distributed seismological observatory:
a Web based seismological data analysis
and distribution toolkit



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Introduction

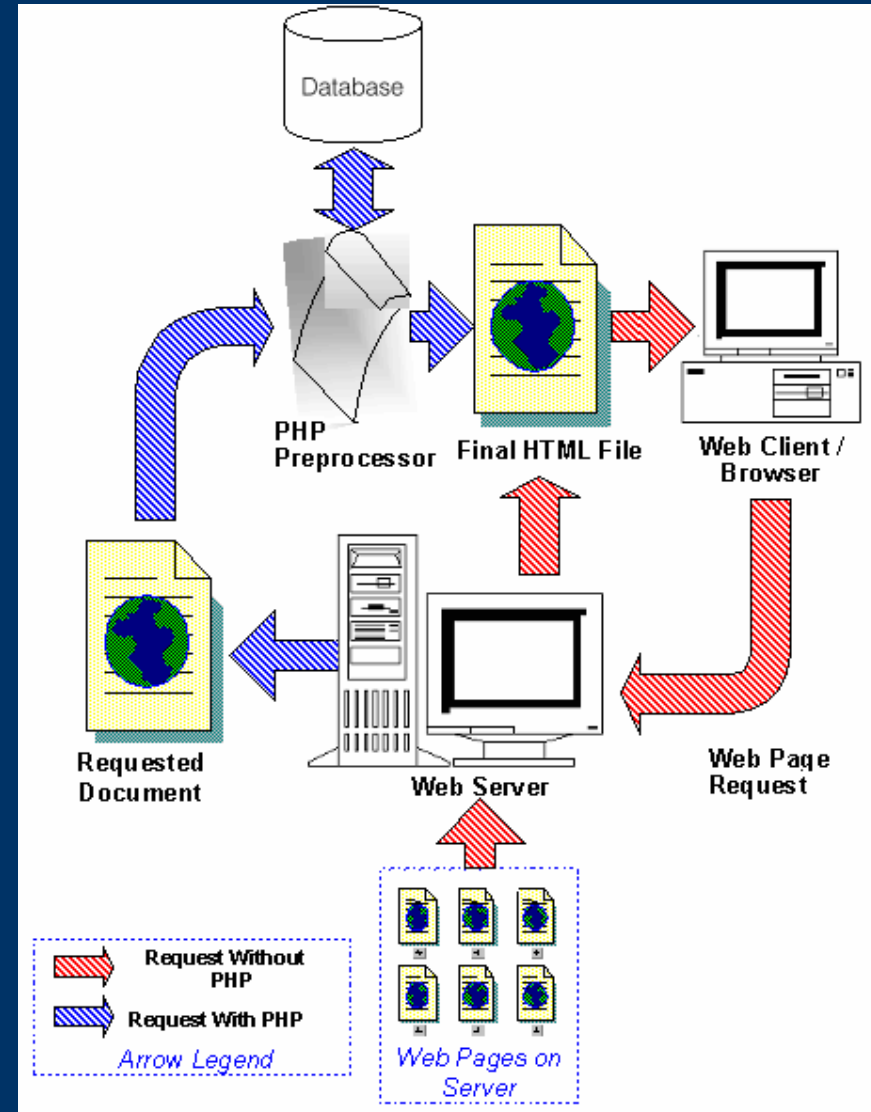
How to develop an application for routine observatory data analysis?

- ◆ client/server data access
- ◆ graphics
- ◆ accessibility from different systems
- ◆ portability/scalability

Web serving

A universal infrastructure for developing client/server applications:

- ◆ single user interface – HTML
- ◆ single client platform - the web browser
- ◆ single network protocol – HTTP
- ◆ single server platform - the Web server



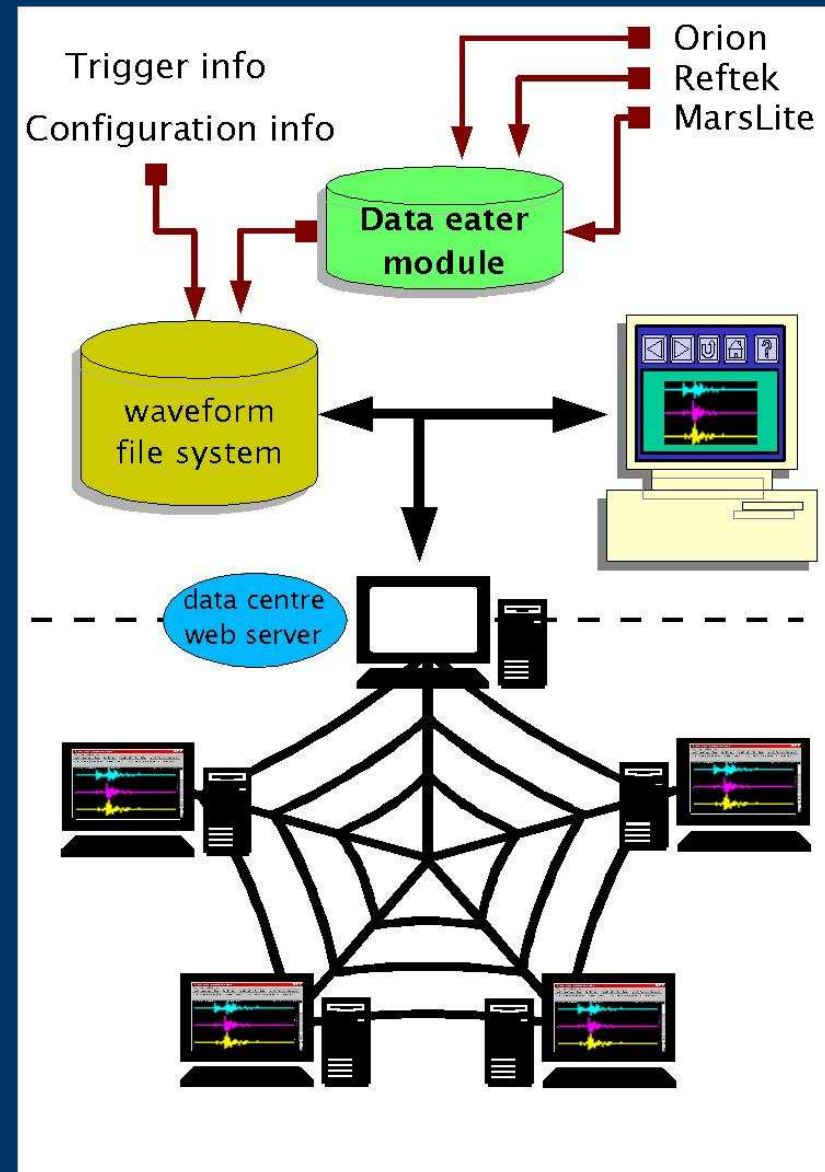
The design key concepts

- ◆ Thin client approach:
 - ◆ any PC with a JAVA enabled Web browser can interact with a set of remote data servers located in the world computer network
- ◆ Minimum standards:
 - ◆ the language needed for client/server interaction should be abstract enough to avoid that everybody know all the details of the transaction - this is solved by XML
- ◆ Task distribution:
 - ◆ a set of servers is able to provide to the client not only a data object but also the computing power to perform a particular task - this limits the exchange of data to results making possible client interaction also in very limited bandwidth situations (JAVA RMI/CORBA)

The data flow

This is the typical data flow at a data acquisition centre. The raw data is processed and organized in an archive.

All users from inside and outside can access the data using the web interface.



The implementation

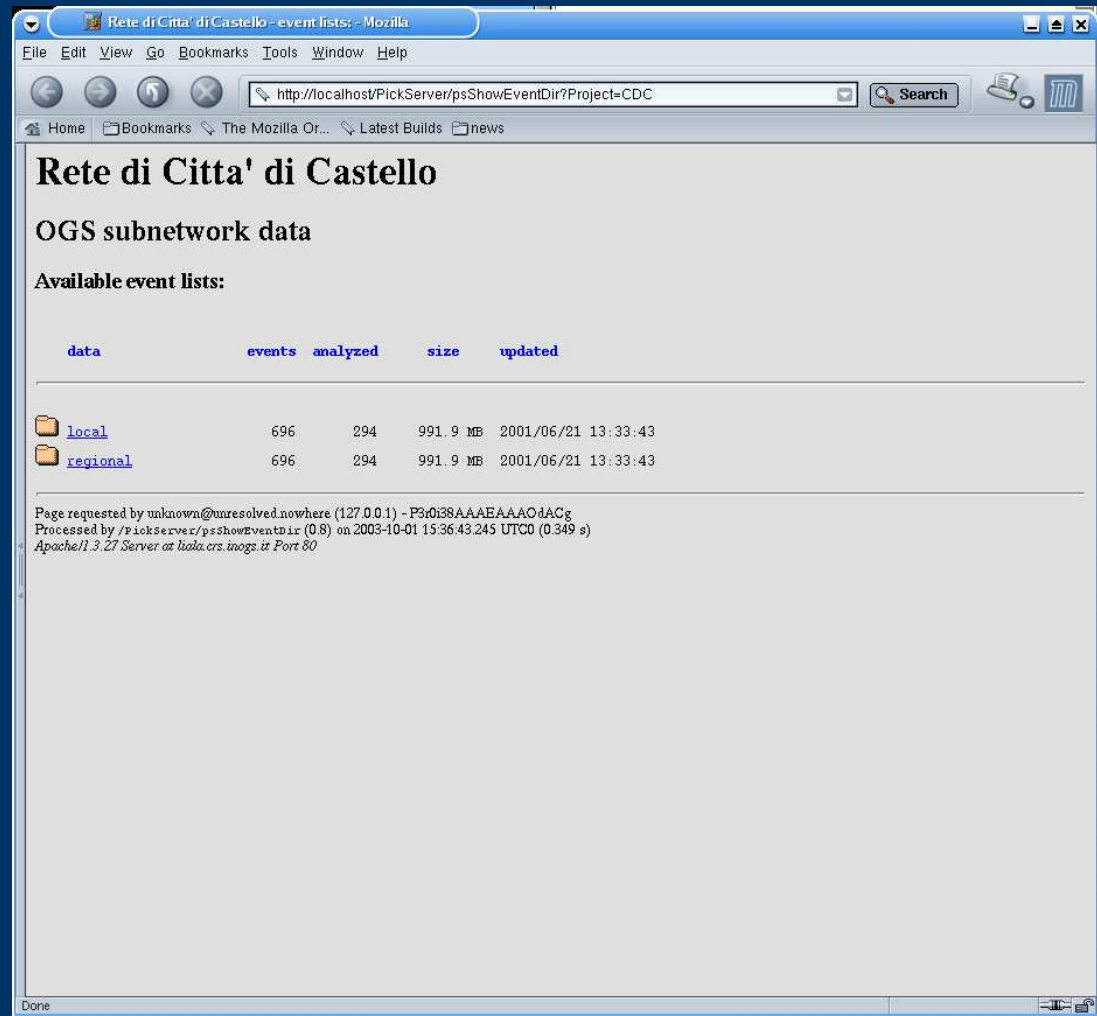
- ◆ Dynamic web pages (still using cgi-bin, PHP much better)
- ◆ Client/server dialog
 - ◆ Persistency
 - ◆ user control, remote application execution
 - ◆ locking of events to prevent multiple users work on the same event
- ◆ Specialized servers for picking management, elaboration tasks like hypocentral location, data format conversion, etc.

The modules

- ◆ **Data eater:** gathers/archives seismological data from a variety of sources ranging from portable digitizers to real-time network data.
- ◆ **Network bulletin generator:** produces both dynamic (for Web site use) and static (for data distribution) HTML observatory bulletin in which the user can easily browse the earthquake event parameters and the associated waveform data
- ◆ **Picking/location server:** allows for multi user Web based analysis of the waveforms using Lomax's SeisGram2K JAVA application, handles the posting of phase picking data, allows remote execution of hypocentral location

A PickServer tour

Here is an example of a PickServer session. You connect to the PickServer pages with your browser. In this examples you can see that there are a couple of event list to process. You see data sizes and the number of events already processed.



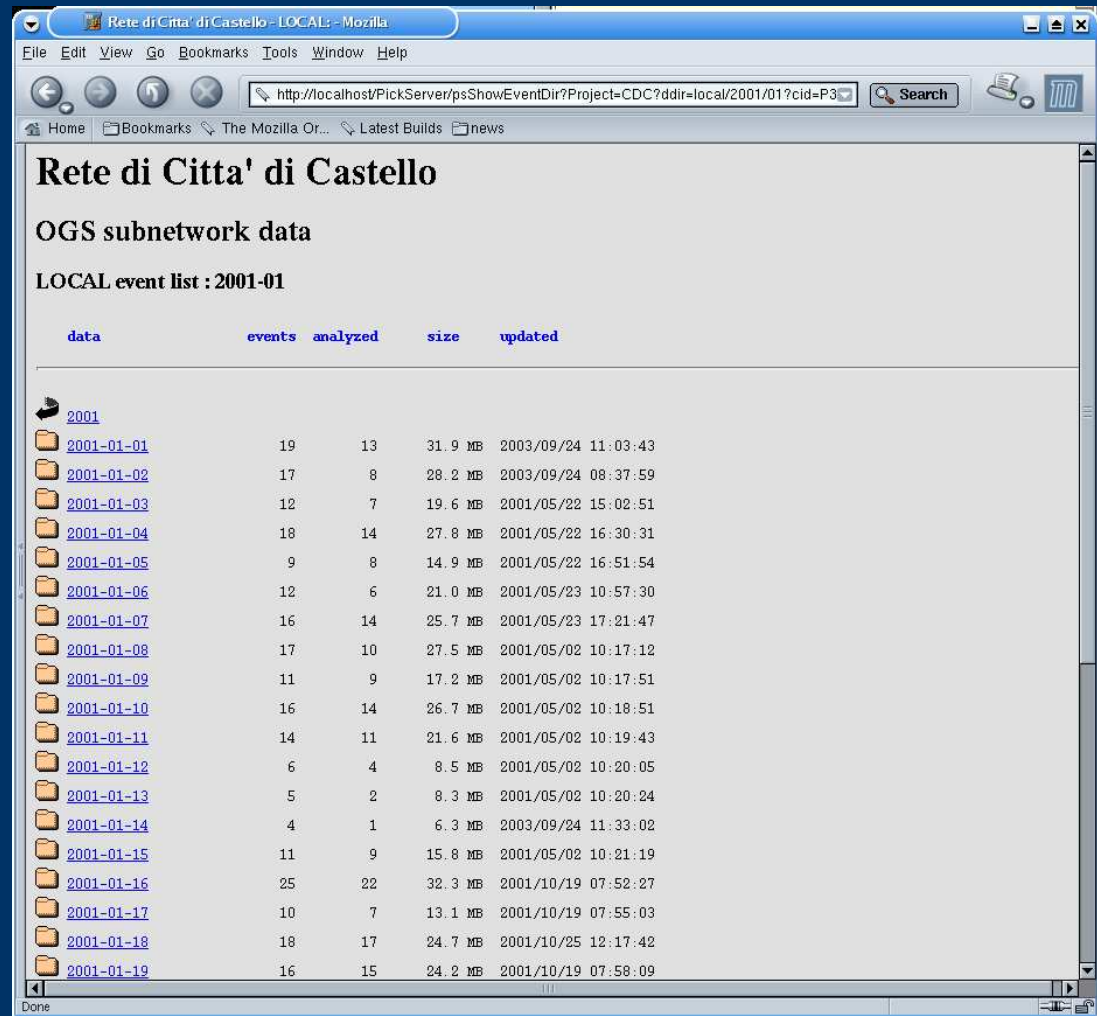
The screenshot shows a Mozilla browser window with the address bar set to `http://localhost/PickServer/psShowEventDir?Project=CDC`. The page title is "Rete di Citta' di Castello" and the main heading is "OGS subnetwork data". Below this, it says "Available event lists:" and displays a table with the following data:

data	events	analyzed	size	updated
local	696	294	991.9 MB	2001/06/21 13:33:43
regional	696	294	991.9 MB	2001/06/21 13:33:43

At the bottom of the page, there is a footer with the following text: "Page requested by unknown@unresolved.nowhere (127.0.0.1) - P3:0i38AAAEAAO dACg Processed by /pickServer/psShowEventDir (0.8) on 2003-10-01 15:36:43.245 UTC0 (0.349 s) Apache/1.3.27 Server at liala.crs.inogs.it Port 80".

Events view

You follow the links
up to an event to
process.



The screenshot shows a Mozilla browser window with the address bar containing the URL: `http://localhost/PickServer/psShowEventDir?Project=CDC?ddir=local/2001/01?cid=P3`. The page title is "Rete di Citta' di Castello" and the main heading is "OGS subnetwork data". Below this, it says "LOCAL event list : 2001-01". A table follows with columns for "data", "events", "analyzed", "size", and "updated". The table lists 19 events from 2001-01-01 to 2001-01-19, each with a folder icon and a link to its details.

data	events	analyzed	size	updated
2001				
2001-01-01	19	13	31.9 MB	2003/09/24 11:03:43
2001-01-02	17	8	28.2 MB	2003/09/24 08:37:59
2001-01-03	12	7	19.6 MB	2001/05/22 15:02:51
2001-01-04	18	14	27.8 MB	2001/05/22 16:30:31
2001-01-05	9	8	14.9 MB	2001/05/22 16:51:54
2001-01-06	12	6	21.0 MB	2001/05/23 10:57:30
2001-01-07	16	14	25.7 MB	2001/05/23 17:21:47
2001-01-08	17	10	27.5 MB	2001/05/02 10:17:12
2001-01-09	11	9	17.2 MB	2001/05/02 10:17:51
2001-01-10	16	14	26.7 MB	2001/05/02 10:18:51
2001-01-11	14	11	21.6 MB	2001/05/02 10:19:43
2001-01-12	6	4	8.5 MB	2001/05/02 10:20:05
2001-01-13	5	2	8.3 MB	2001/05/02 10:20:24
2001-01-14	4	1	6.3 MB	2003/09/24 11:33:02
2001-01-15	11	9	15.8 MB	2001/05/02 10:21:19
2001-01-16	25	22	32.3 MB	2001/10/19 07:52:27
2001-01-17	10	7	13.1 MB	2001/10/19 07:55:03
2001-01-18	18	17	24.7 MB	2001/10/25 12:17:42
2001-01-19	16	15	24.2 MB	2001/10/19 07:58:09

The event analysis page

In the event view all links will load the waveform or the group of waveforms in to the SeisGram2K. A small applet let you see the available picks on the trace.

Rete di Citta' di Castello

OGS subnetwork data

LOCAL event list : 2001-01-01_00-34-57

[2001-01-01](#)

Waveform data

2001-01-01 00:34:57 UTC			
OGS	INGV_1	INGV_2	UNIGE
<ul style="list-style-type: none">• CCA1• CCA2• CCA3• CCA4• CCB1• CCB3	<ul style="list-style-type: none">• B005• BBB2• BBB4• C002• C004• CC03	<ul style="list-style-type: none">• D002• D003• DD01• E002• F002• F003• G004	<ul style="list-style-type: none">• CCE3• CCE4• CCG1• CCG2• CCF1• CCF4

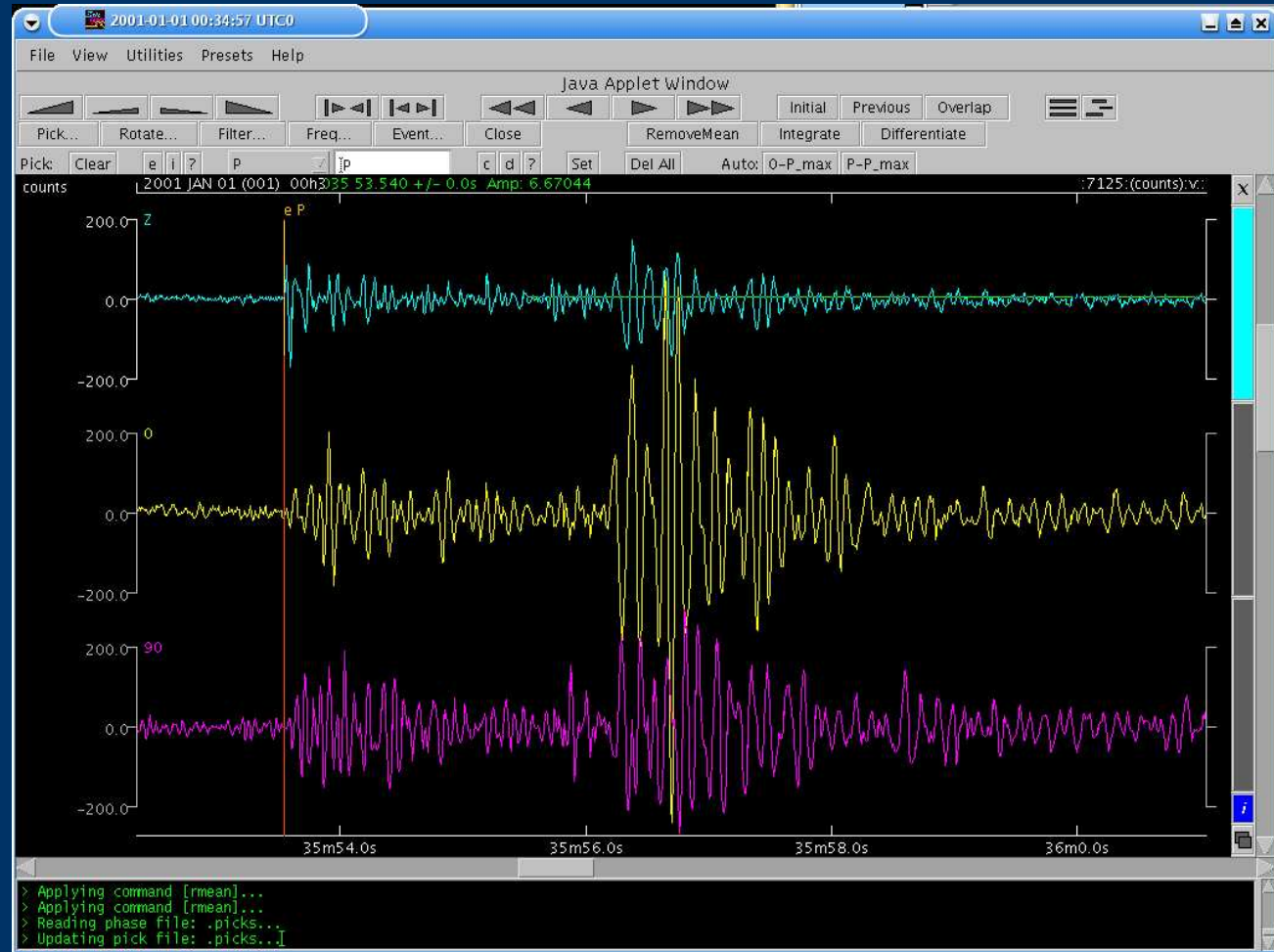
Pickings

```
.picks 87 bytes
|status=inserted 7135 (counts) Z 1 P c 20010101 0035 27.180 GAU 0.0 0.0 -32.193134
```

Applet: FileWatch started

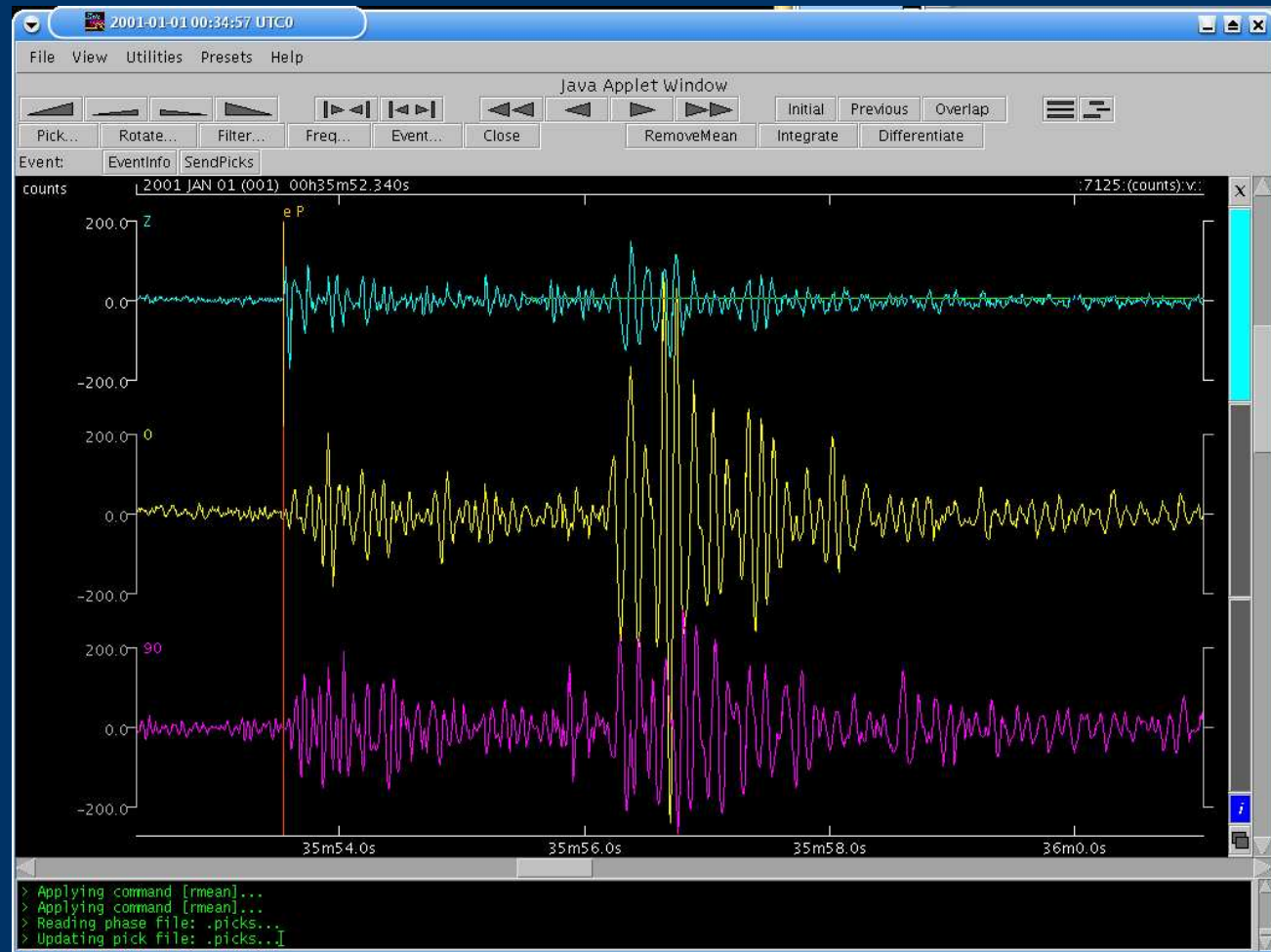
Picking waveforms

Once the SeisGram2K pops up you can proceed as usual picking the waveforms.



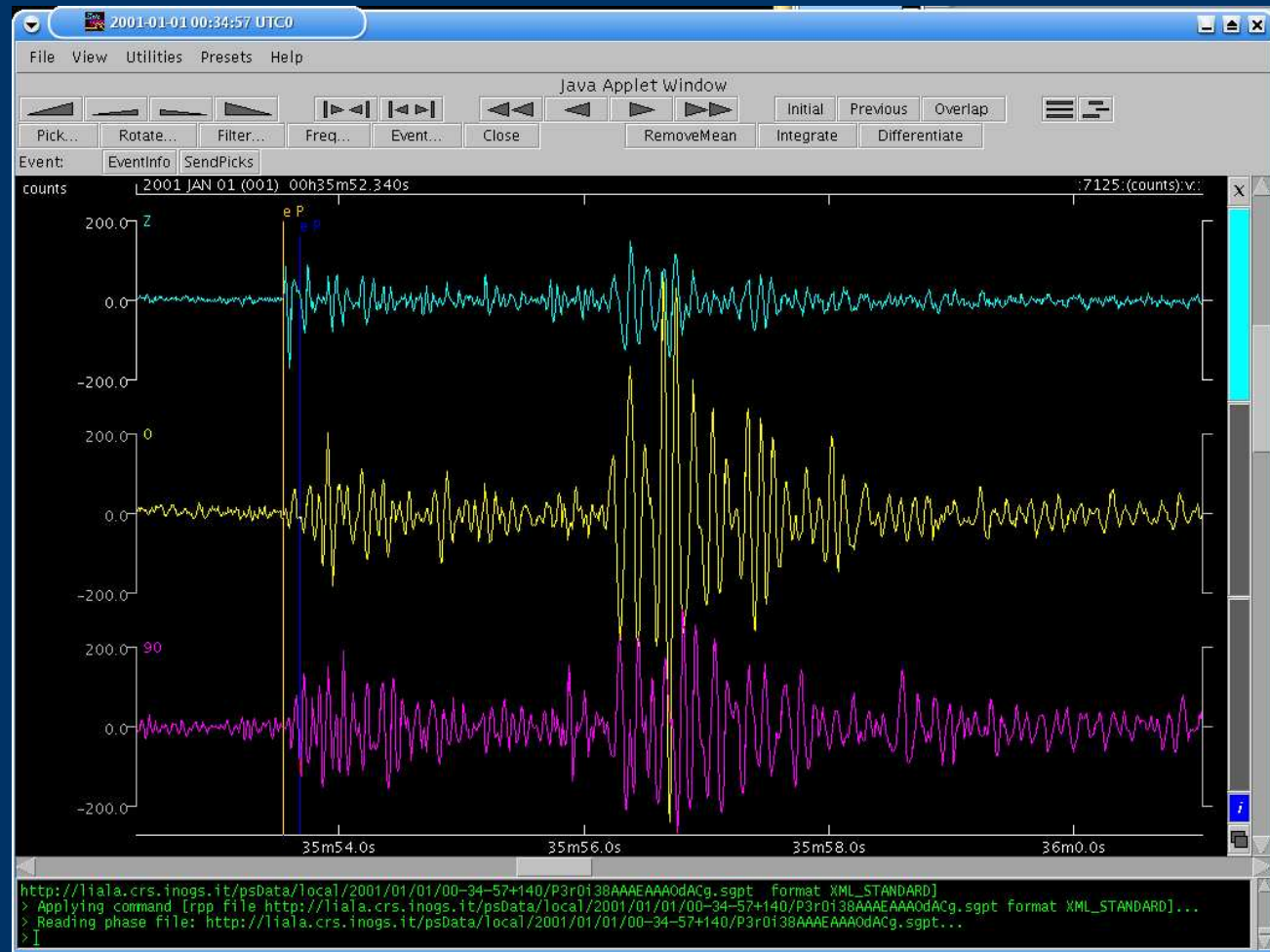
Posting the picks

When you are satisfied with your picks, you can post them to a server using the 'Event'->'SendPicks' Menu



Receiving travel times

This will trigger an hypocentral location on the server and you will receive the results as travel times directly in the SeisGram2K and an HTML location report in the web page



Conclusions

- ◆ This approach seems very promising
- ◆ Actual stage of implementation is near to beta - still testing new solutions.
- ◆ Most modification of the SeisGram2K have been done to improve client/server interaction and event locking for multiuser operations
- ◆ Open questions:
 - ◆ database backend (possibly Postgres)
 - ◆ distributed solutions (very likely RMI)
 - ◆ compatibility/connectivity with other open standards (notably FISSURES)