SWAPP : building a common framework for NWP-related applications at Météo-France

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Warning !

- This talk is somewhere on the frontier of several fields : data management, research and operations interface and methods, visualisation aplications, experiments definition, etc…

- … without being sure that is of valuable interest to any of these fields, taken solely.

Some requirements …

- An application for recording and retrieving any change in operational suites and resources.

- An application for setting up and monitoring experiments based on operational components. This application should allow duplications and comparisons of experiments, as well as interactive building of new configurations, etc.

- An application for lauching and visualizing graphical diagnostics, or at least prepare data input to existing tools (eg. Metview or Synergie).

- A simple archive manager including a garbage collector mechanism.

- An uniform access to these applications for MF people and ALADIN partners (no authorization policy defined yet).

… and some suggestions

- The applications which display the information should be the same that manage and define the information.
- The applications should be self explanatory (as most as possible) in order to improve didactic support to new users of our NWP systems.
- Nothing should be hidden to the user (most of them are advanced users, and their opinion is quite important !).
- Use SMS for the definition of jobs sequence and monitoring.
- Use XCDP as an « external » application as long as a Web-cdp is not integrated in the SWAPP framework.

Yet, an other virtual file system !

- Do not start from the end (the web engine rendering). Of course, we did, because we are always in a hurry to « see » the « nice » graphic interface.

- First version was based on the Baudoin Raoult's *webmars* engine, extended to handle multiple applications, users permissions, and some sms features. Integrated in an Apache/mod_perl server. (version 0 in used since 02/2003).

- … and then we started again from scratch, from the bottom, the so-called version 1 (to be delivered 12/2003) : what should be the more generic-purpose foundation for any of the application we were supposed to build ? Here comes the SWAPP architecture, based on an other VFS.

SWAPP objects

- Within Swapp, objects are persistent : once an object is created by a program, it will still exist (if not removed) when the program exits.
- Swapp objects are Perl objects. They are blessed references in Perl packages which may inherit from each other.
- Swapp objects are shared across processes : each and every program that accesses Swapp databases sees the same set of objects. Programs of various kinds can access Swapp databases; up to now, we have been fiddling with HTTP servers, daemons, shell command line, etc...
- Swapp objects live in a tree whose nodes are objects : each database has a root which has kid objects, which in turn can also have kids, and so on. The database primary model for storing Swapp objects is a filesystem like model.

SWAPP virtual filesystem

- The Swapp virtual object-filesystem makes use of the same approach as the well-known Unix virtual filesystem.
- Its aim is to provide a common interface to all types of object storage (that is to all types of Swapp object databases).
- Swapp databases are analogous to Unix disk devices, and the Swapp *Vfs* allows to mount those databases onto the root database or an already mounted database. To the end user, the Swapp *Vfs* just appears as a tree of objects.
- Basic database class is a raw of serialized perl objects in a Berkeley DB. Other kind of databases included indexed database (using DB file again or MySQL) and heavy-attributes database for managing objects with one or several huge components (images, binaries).

Access methods

We have seen that several kind of programs could access swapp objects :

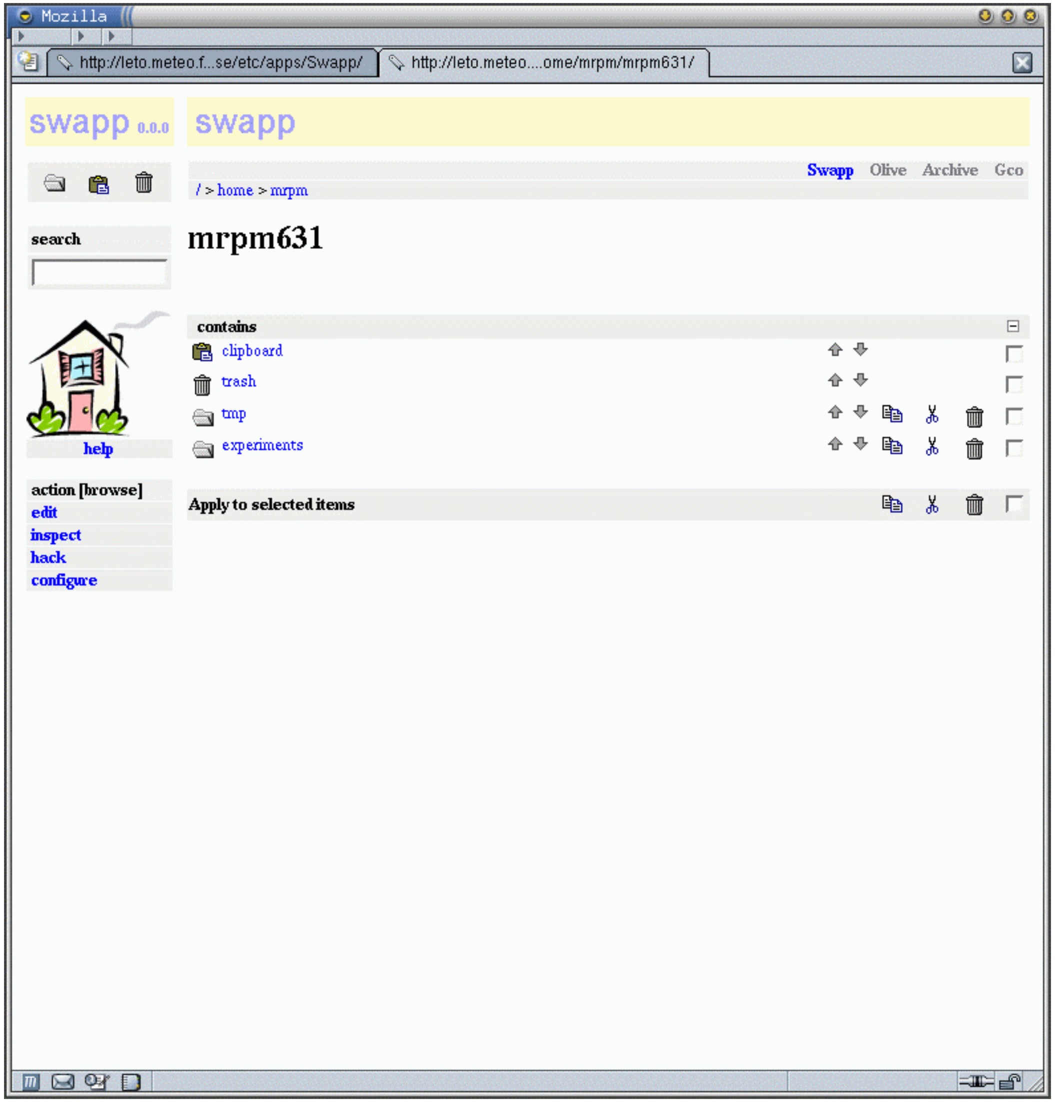
- API : one could write a program using the ‘Vfs’ main module which defines the main manipulations on swapp objects.
- Psh : more or less the standard shell command line.
- Apache Server (mod_perl), including handlers to SWAPP-based modules. This is the usual user interface to the applications.

User interface : web rendering

- The URL of the HTTP request defines the current application, the object’s path in the VFS, a method to apply and possibly some arguments.

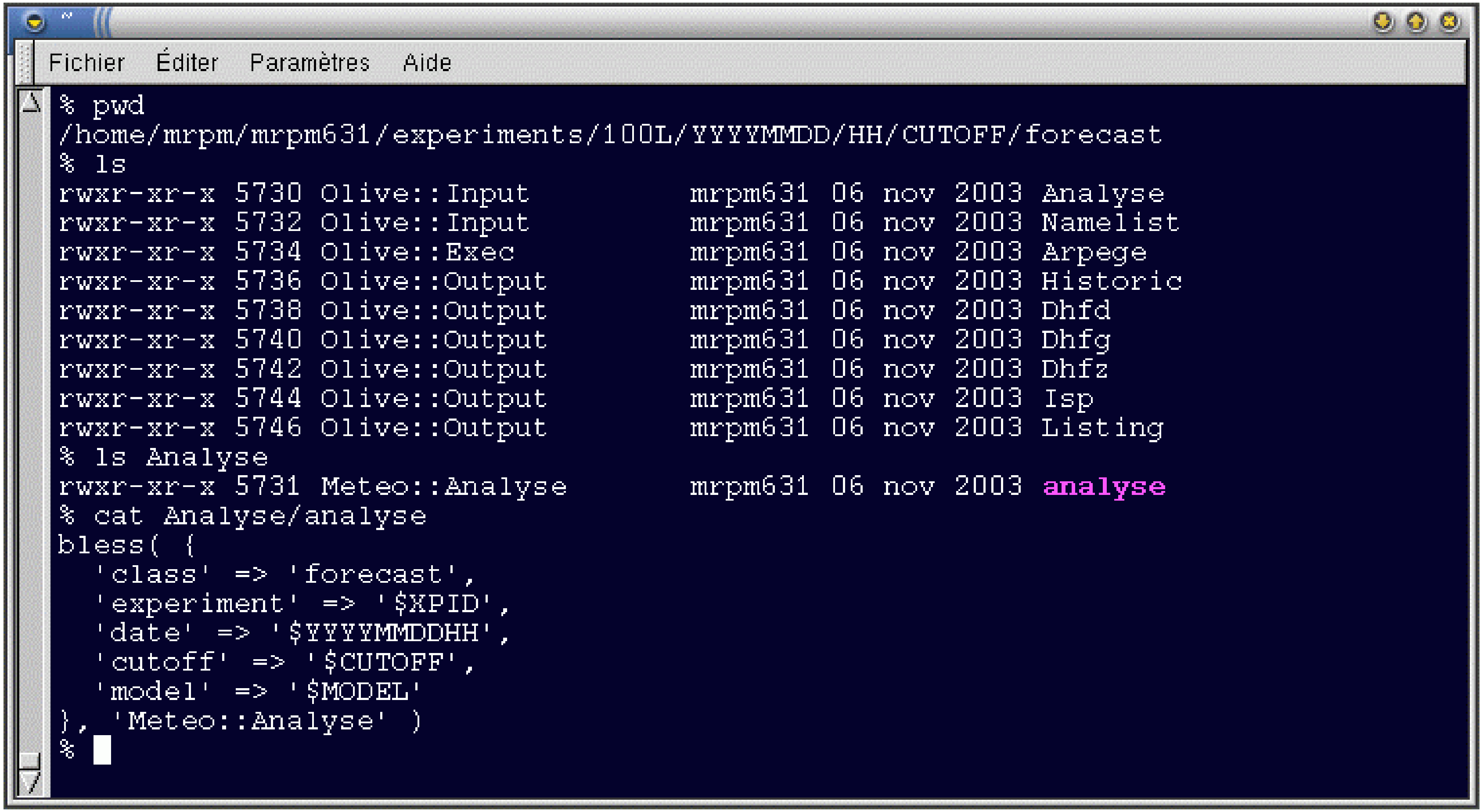
- Basic methods : edit, copy, cut, paste, delete (move to tyrash), destroy (remove from trash), rename, etc.

- External address for ALADIN partners based on IP identification and firewall http access.



User interface : psh

Add one (or more) new rule in the psh strategy list and then acces the full vfs in an interactive way, including node creation and edition.



```
% pwd
/home/mrpm/mrpm631/experiments/100L/YYYYMMDD/HH/CUTOFF/forecast
% ls
rwxr-xr-x 5730 Olive::Input          mrpm631 06 nov 2003 Analyse
rwxr-xr-x 5732 Olive::Input          mrpm631 06 nov 2003 Namelist
rwxr-xr-x 5734 Olive::Exec           mrpm631 06 nov 2003 Arpege
rwxr-xr-x 5736 Olive::Output         mrpm631 06 nov 2003 Historic
rwxr-xr-x 5738 Olive::Output         mrpm631 06 nov 2003 Dhfd
rwxr-xr-x 5740 Olive::Output         mrpm631 06 nov 2003 Dhfg
rwxr-xr-x 5742 Olive::Output         mrpm631 06 nov 2003 Dhfz
rwxr-xr-x 5744 Olive::Output         mrpm631 06 nov 2003 Isp
rwxr-xr-x 5746 Olive::Output         mrpm631 06 nov 2003 Listing
% ls Analyse
rwxr-xr-x 5731 Meteo::Analyse        mrpm631 06 nov 2003 analyse
% cat Analyse/analyse
bless( {
  'class' => 'forecast',
  'experiment' => '$XPID',
  'date' => '$YYYYMMDDHH',
  'cutoff' => '$CUTOFF',
  'model' => '$MODEL'
}, 'Meteo::Analyse' )
% 
```

The OLIVE project

- An effort to share as most as possible common features between operations and research departments.

- An effort to maintain a precise history of changes in main NWP systems configurations in used at Météo-France.

- An effort to document and define any single component of these configurations.

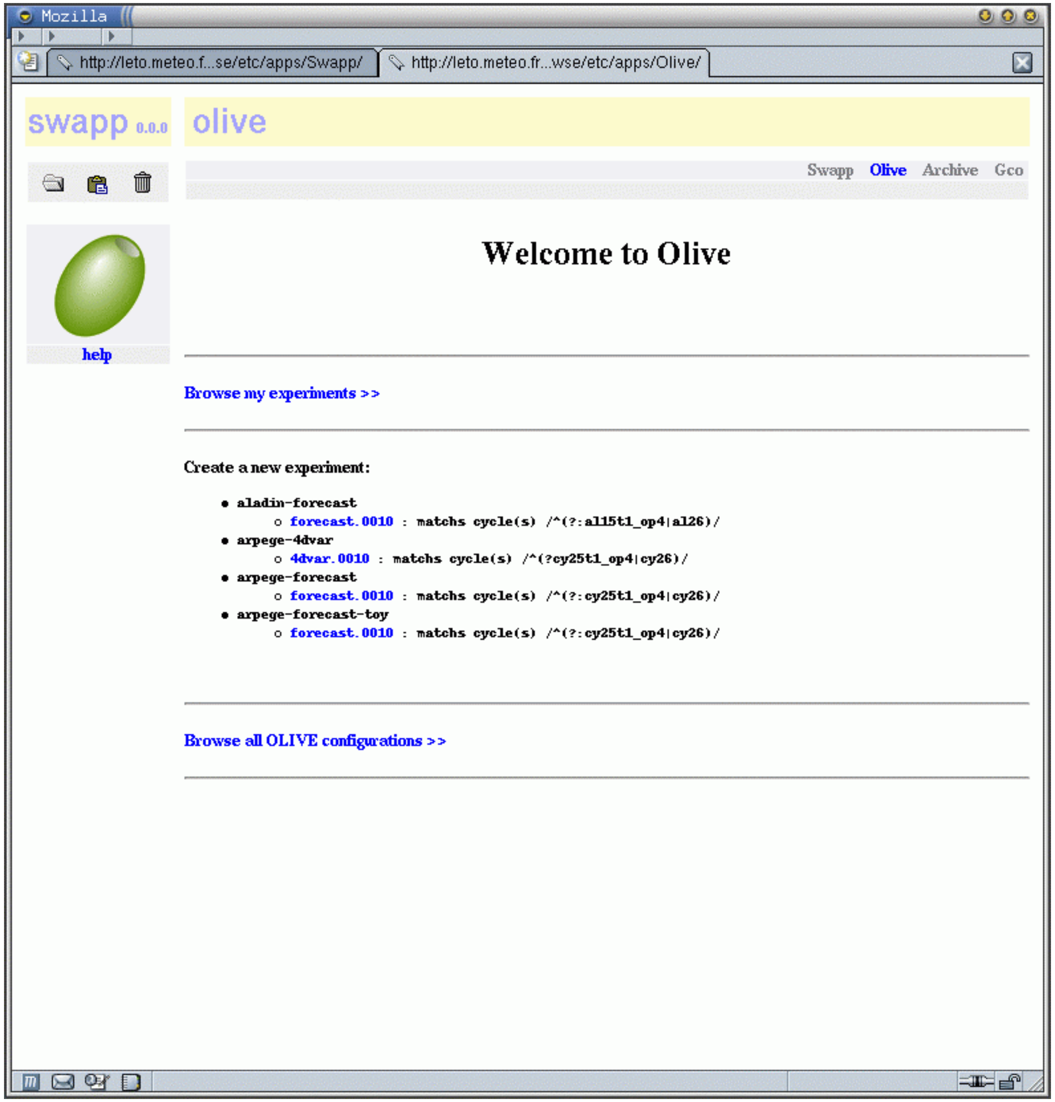
- The whish to have an user-friendly interface for setting new experiments and sharing these experiments between researchers.

- The OLIVE aplication is now a SWAPP application.

The OLIVE application

- Basic configurations include : ARPEGE France and tropiques forecast & 4DVAR, ALADIN coupling and forecast, toys versions.

- Select a cycle or defaults (in operations at the time of the experiment, current oper or dble).



Mozilla
http://leto.meteo.f...se/etc/apps/Swapp/
http://leto.meteo.fr...wse/etc/apps/Olive/
swapp 0.0.0
olive
Swapp
Olive
Archive
Gco
help

Welcome to Olive

Browse my experiments >>

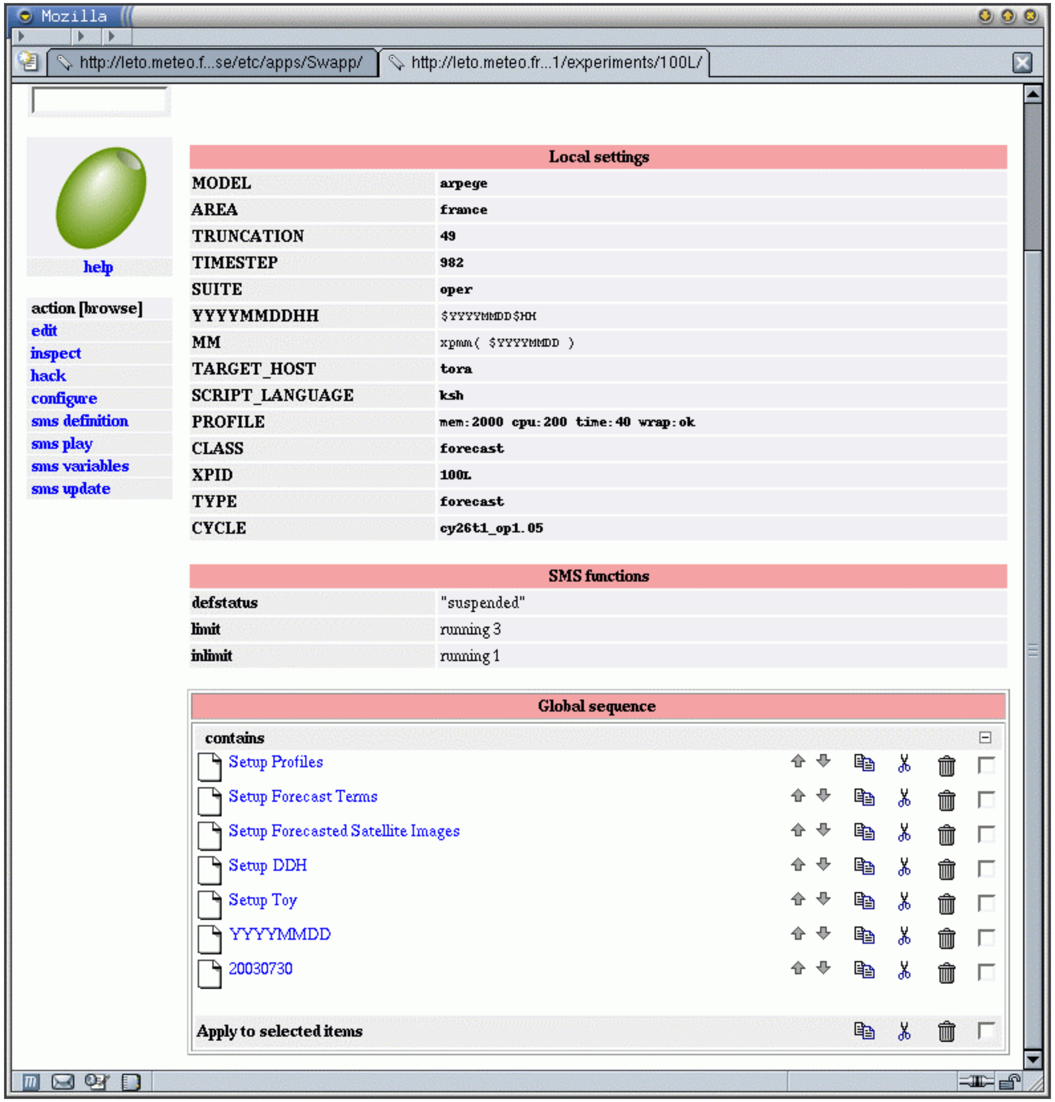
Create a new experiment:

- aladin-forecast
  - forecast.0010 : matchs cycle(s) /^(?:al15t1_op4|al26)/
- arpege-4dvar
  - 4dvar.0010 : matchs cycle(s) /^(?cy25t1_op4|cy26)/
- arpege-forecast
  - forecast.0010 : matchs cycle(s) /^(?:cy25t1_op4|cy26)/
- arpege-forecast-toy
  - forecast.0010 : matchs cycle(s) /^(?:cy25t1_op4|cy26)/

Browse all OLIVE configurations >>

How to define an experiment ?

- Set base hours and dates and any other local setting.
- Cut, paste, edit any task or resource you may need.
- Copy and insert shared resources at any level of the experiment.



Local settings	
MODEL	arpege
AREA	france
TRUNCATION	49
TIMESTEP	982
SUITE	oper
YYYYMMDDHH	$YYYYMMDD$HH
MM	xpmm($YYYYMMDD)
TARGET_HOST	tora
SCRIPT_LANGUAGE	ksh
PROFILE	mem:2000 cpu:200 time:40 wrap:ok
CLASS	forecast
XPID	100L
TYPE	forecast
CYCLE	cy26t1_op1.05

SMS functions	
defstatus	"suspended"
limit	running 3
inlimit	running 1

Global sequence

contains

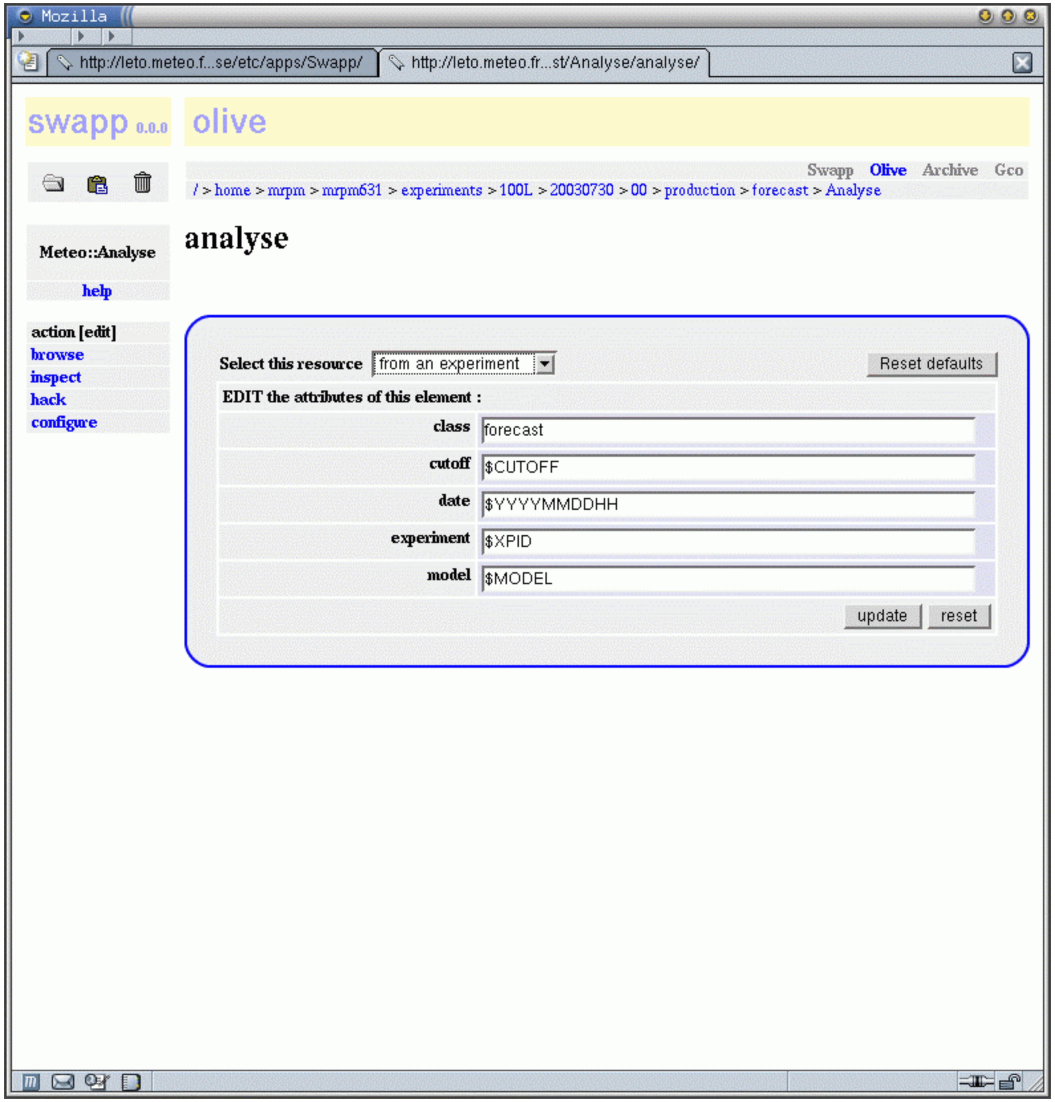
- Setup Profiles □
- Setup Forecast Terms □
- Setup Forecasted Satellite Images □
- Setup DDH □
- Setup Toy □
- YYYYMMDD □
- 20030730 □

Apply to selected items □

Deep in the task…

- A task is an SMS-like object which could run on a target computer. It contains input, run and output sections.

- One section contains one resource which is provided to the section through a method (from oper env, from other xp, from remote file or command, etc.).



/ > home > mrpm > mrpm631 > experiments > 100L > 20030730 > 00 > production > forecast > Analyse

analyse

Select this resource: from an experiment

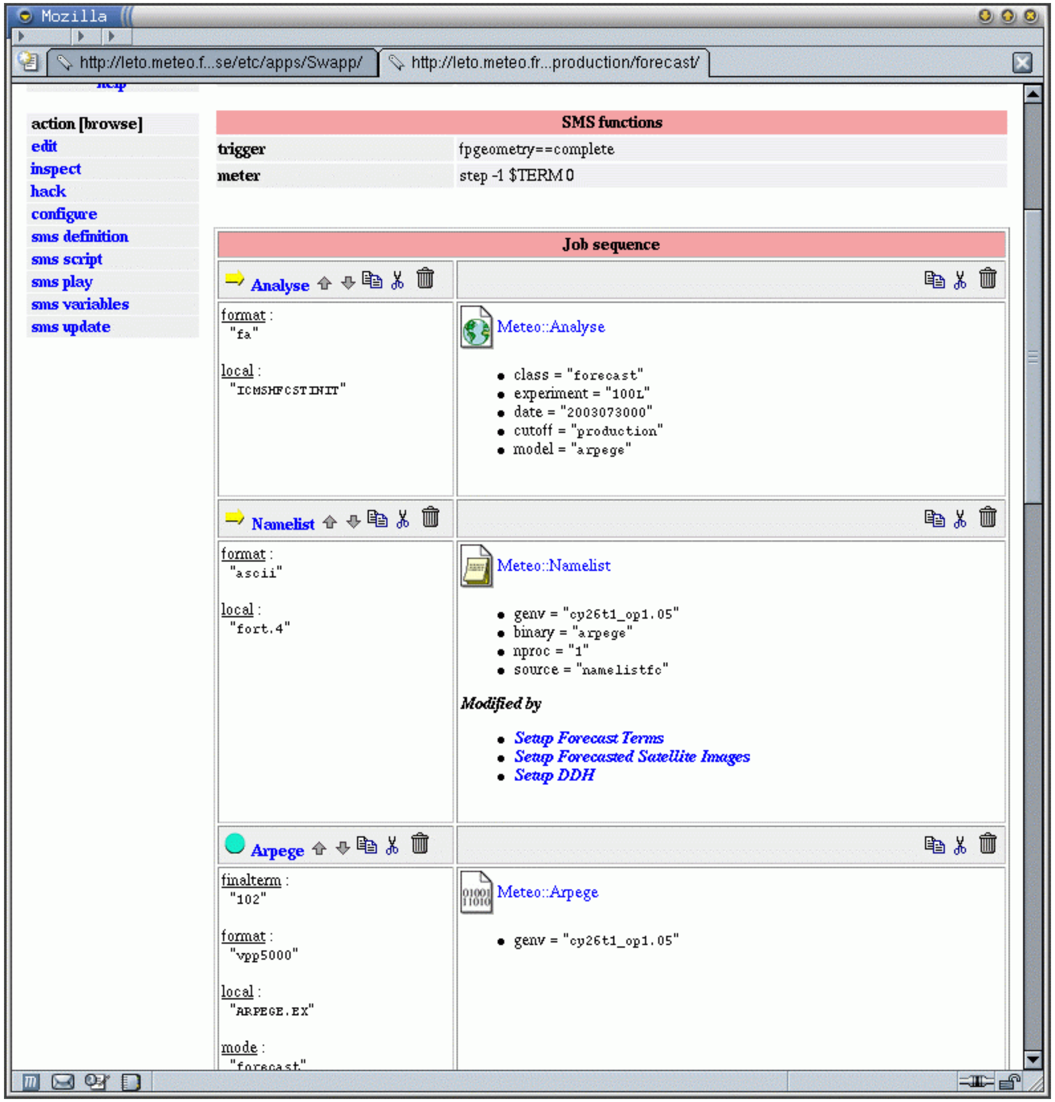
EDIT the attributes of this element :

class	forecast
cutoff	$CUTOFF
date	$YYYYMMDDHH
experiment	$XPID
model	$MODEL

The setup objects

- The setup objects could selectively apply to variables of the current family, define a namelist delta, activate or inactivate resources.

- It could be done though selection patterns (such as the base hour).



SMS functions	
trigger	fpgeometry==complete
meter	step -1 $TERM 0

Job sequence

Analyse

format :
"fa"

local :
"ICMSHFCSTINIT"

Meteo::Analyse

- class = "forecast"
- experiment = "100L"
- date = "2003073000"
- cutoff = "production"
- model = "arpege"

Namelist

format :
"ascii"

local :
"fort.4"

Meteo::Namelist

- genv = "cy26t1_op1.05"
- binary = "arpege"
- nproc = "1"
- source = "namelistfc"

Modified by

- *Setup Forecast Terms*
- *Setup Forecasted Satellite Images*
- *Setup DDH*

Arpege

finalterm :
"102"

format :
"vpp5000"

local :
"ARPEGE.EX"

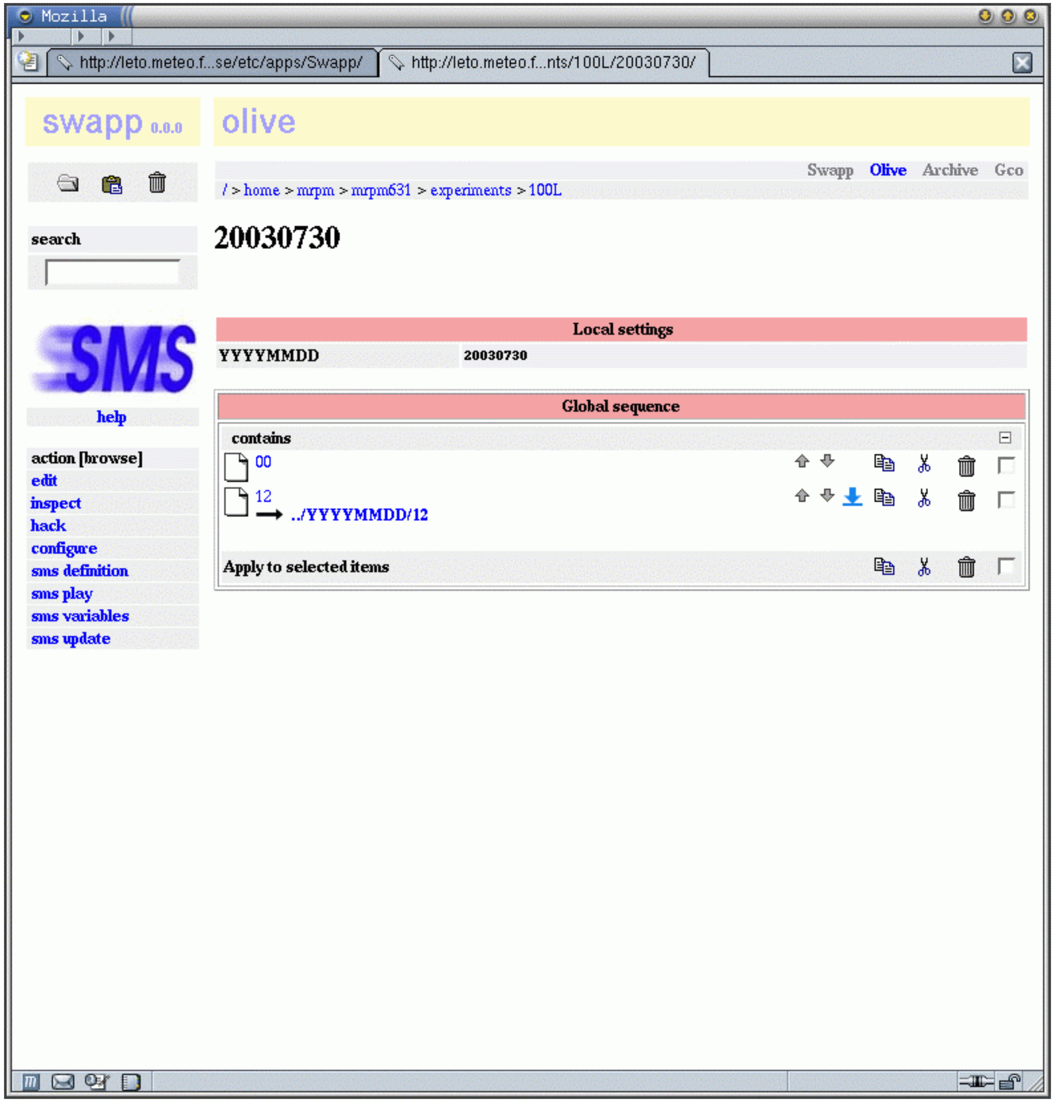
mode :
"forecast"

Meteo::Arpege

- genv = "cy26t1_op1.05"

Refinements

- One could « instantiate » a date or hour.
- Then, all the underlying objects are copied and could be changed independently.



20030730

Local settings	
YYYYMMDD	20030730

Global sequence

contains

- 00
- 12 → ../YYYYMMDD/12

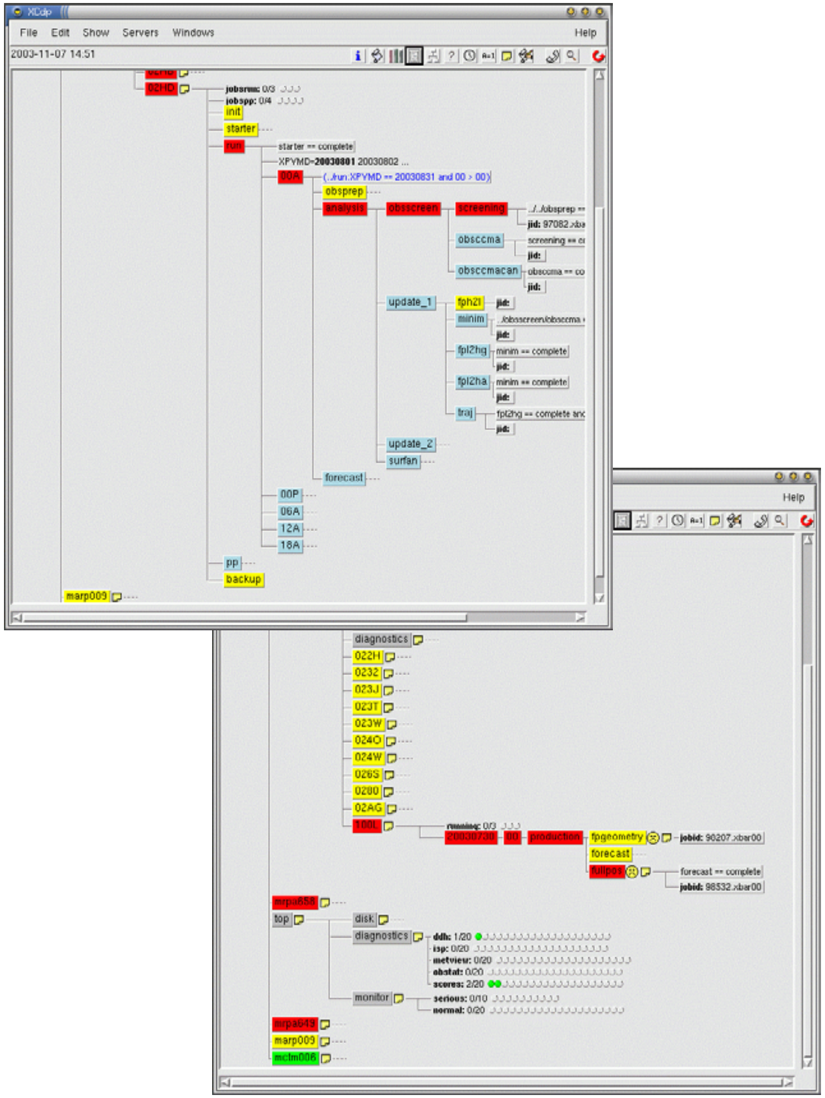
Apply to selected items

About the OLIVE architecture

- The root experiment node « plays » the SMS definition. The user monitors the experiment with XCDP.

- At any level of the experiment, objects could be « updated » to the SMS server, whatever the current stage of the experiment run is (one could extend the experiment, change the profile of one task, change a resource, etc.).

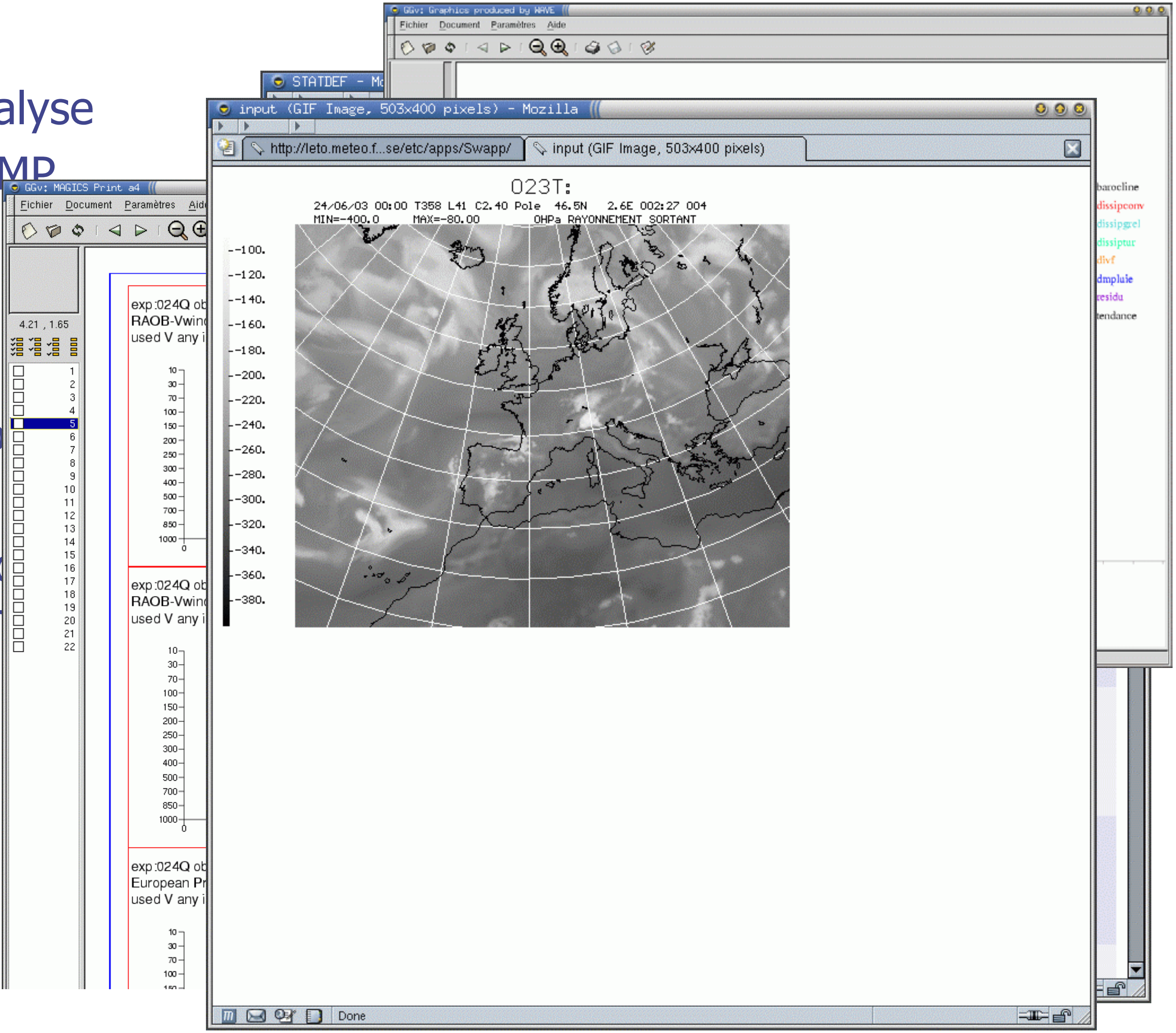
- SMS fetch the script which is delivered on demand by the sms node object at run-time. There is no « permanent » script at all.



Some graphical diagnostics

- Scores / analyse
- Scores / TEMP
- Obstat
- DDH
- ISP
- Metview plo

- Retrieve and data for Syn



023T:

24/06/03 00:00 T358 L41 C2.40 Pole 46.5N 2.6E 002:27 004
MIN=-400.0 MAX=-80.00 OHPa RAYONNEMENT SORTANT

exp:024Q ob
RAOB-Vwind
used V any i

exp:024Q ob
RAOB-Vwind
used V any i

exp:024Q ob
European Pr
used V any i

Some OLIVE relatives

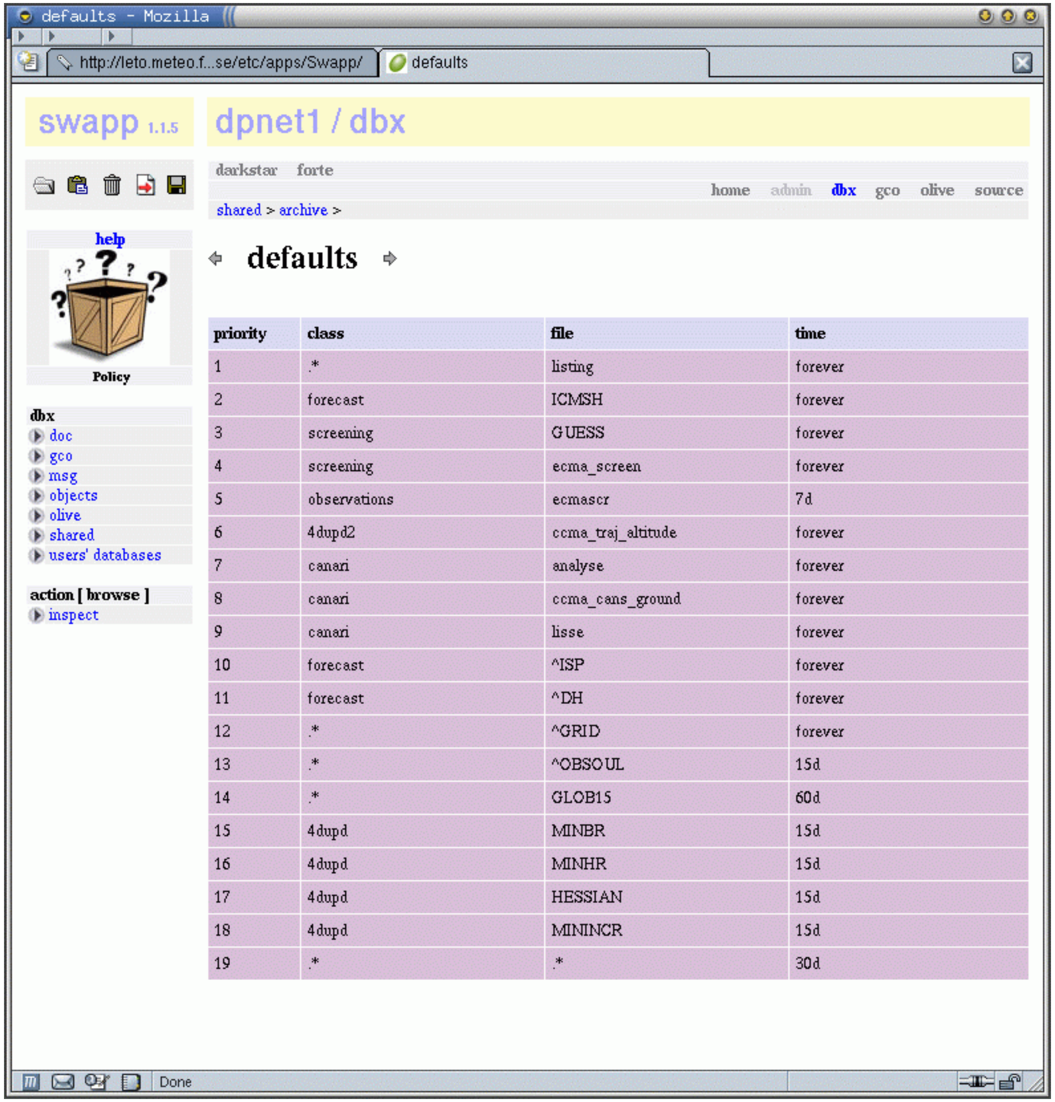
- Inside the SWAPP framework, there are some other applications, more or less connected to OLIVE.

- All these applications could be accessed using common interfaces and programs.

- All these applications could share objects which have a common meaning.

The « archive » application

- Mirror of the mass storage archive machine.
- Automatic cleaning policy.
- Interactive cleaning.
- Selection of components for building experiments.

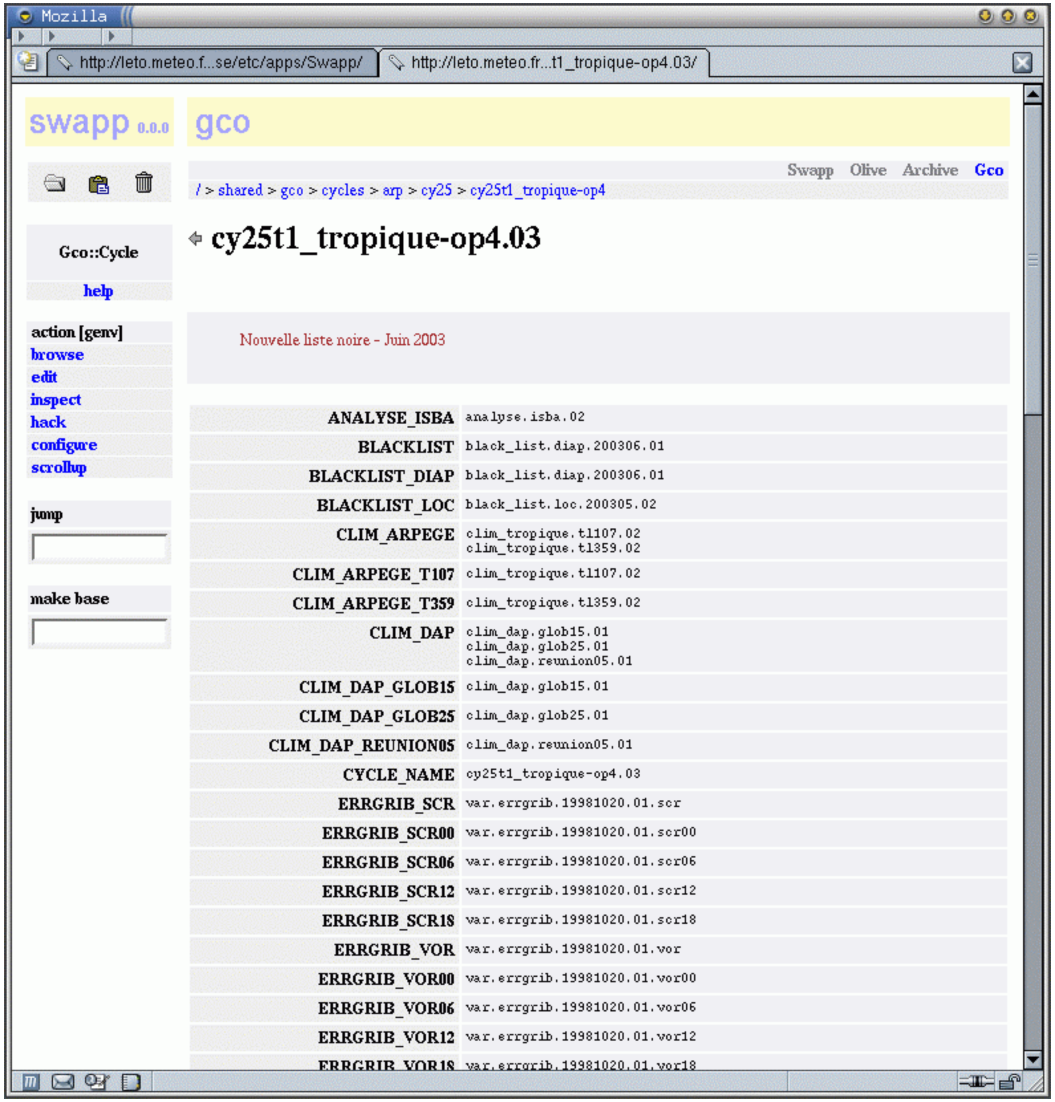


defaults

priority	class	file	time
1	.*	listing	forever
2	forecast	ICMSH	forever
3	screening	GUESS	forever
4	screening	ecma_screen	forever
5	observations	ecmascr	7d
6	4dupd2	ccma_traj_altitude	forever
7	canari	analyse	forever
8	canari	ccma_cans_ground	forever
9	canari	lisse	forever
10	forecast	^ISP	forever
11	forecast	^DH	forever
12	.*	^GRID	forever
13	.*	^OBSOUL	15d
14	.*	GLOB15	60d
15	4dupd	MINBR	15d
16	4dupd	MINHR	15d
17	4dupd	HESSIAN	15d
18	4dupd	MININCR	15d
19	.*	.*	30d

The « GCO » application

- Track history of changes ;
- Document components in evaluation stage or in operations ;
- Search , diff , etc., on these components ;
- Setup next operational cycles contents ;


Mozilla
http://leto.meteo.f...se/etc/apps/Swapp/
http://leto.meteo.fr...t1_tropique-op4.03/
swapp 0.0.0
gco
Swapp
Olive
Archive
Gco
/ > shared > gco > cycles > arp > cy25 > cy25t1_tropique-op4
Gco::Cycle
help
action [genv]
browse
edit
inspect
hack
configure
scrollup
jump
make base

cy25t1_tropique-op4.03

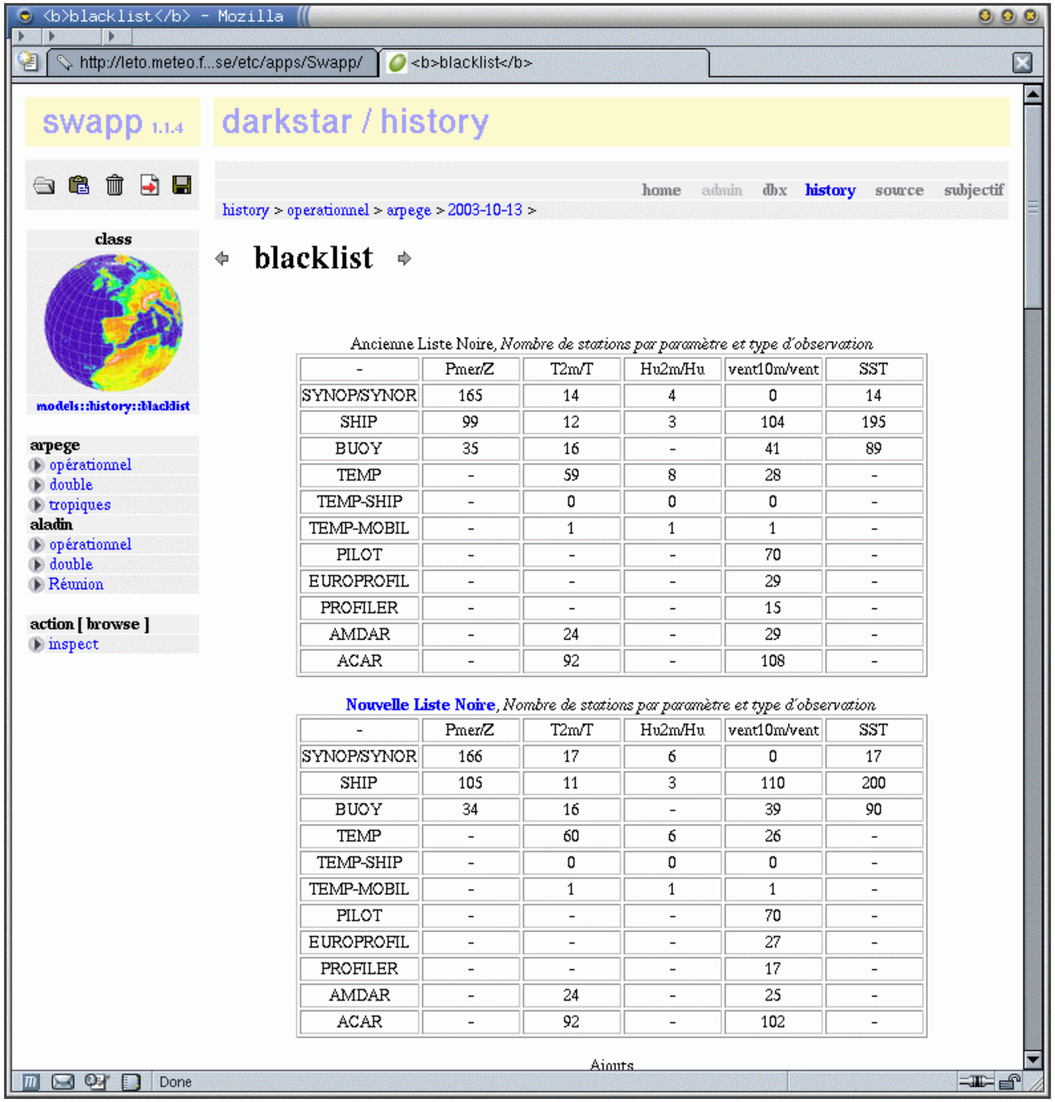
Nouvelle liste noire - Juin 2003

ANALYSE_ISBA	analyse.isba.02
BLACKLIST	black_list.diap.200306.01
BLACKLIST_DIAP	black_list.diap.200306.01
BLACKLIST_LOC	black_list.loc.200305.02
CLIM_ARPEGE	clim_tropique.tl107.02 clim_tropique.tl359.02
CLIM_ARPEGE_T107	clim_tropique.tl107.02
CLIM_ARPEGE_T359	clim_tropique.tl359.02
CLIM_DAP	clim_dap.glob15.01 clim_dap.glob25.01 clim_dap.reunion05.01
CLIM_DAP_GLOB15	clim_dap.glob15.01
CLIM_DAP_GLOB25	clim_dap.glob25.01
CLIM_DAP_REUNION05	clim_dap.reunion05.01
CYCLE_NAME	cy25t1_tropique-op4.03
ERRGRIB_SCR	var.errgrib.19981020.01.scr
ERRGRIB_SCR00	var.errgrib.19981020.01.scr00
ERRGRIB_SCR06	var.errgrib.19981020.01.scr06
ERRGRIB_SCR12	var.errgrib.19981020.01.scr12
ERRGRIB_SCR18	var.errgrib.19981020.01.scr18
ERRGRIB_VOR	var.errgrib.19981020.01.vor
ERRGRIB_VOR00	var.errgrib.19981020.01.vor00
ERRGRIB_VOR06	var.errgrib.19981020.01.vor06
ERRGRIB_VOR12	var.errgrib.19981020.01.vor12
ERRGRIB_VOR18	var.errgrib.19981020.01.vor18

The « history » application

- « Official » description of operational changes by the control team.

- 6 models : ARPEGE France, ALADIN France and ARPEGE tropiques (two versions : oper and double suites).


<b>blacklist</b> - Mozilla
http://leto.meteo.f...se/etc/apps/Swapp/
<b>blacklist</b>
swapp 1.1.4
home
admin
dbx
history
source
subjectif
class
models::history::blacklist
Done

darkstar / history

history > operationnel > arpege > 2003-10-13 >

arpege
- opérationnel
- double
- tropiques

aladin
- opérationnel
- double
- Réunion

action [browse]
- inspect

blacklist

Ancienne Liste Noire, *Nombre de stations par paramètre et type d'observation*

-	Pmer/Z	T2m/T	Hu2m/Hu	vent10m/vent	SST
SYNOP/SYNOR	165	14	4	0	14
SHIP	99	12	3	104	195
BUOY	35	16	-	41	89
TEMP	-	59	8	28	-
TEMP-SHIP	-	0	0	0	-
TEMP-MOBIL	-	1	1	1	-
PILOT	-	-	-	70	-
EUROPROFIL	-	-	-	29	-
PROFILER	-	-	-	15	-
AMDAR	-	24	-	29	-
ACAR	-	92	-	108	-

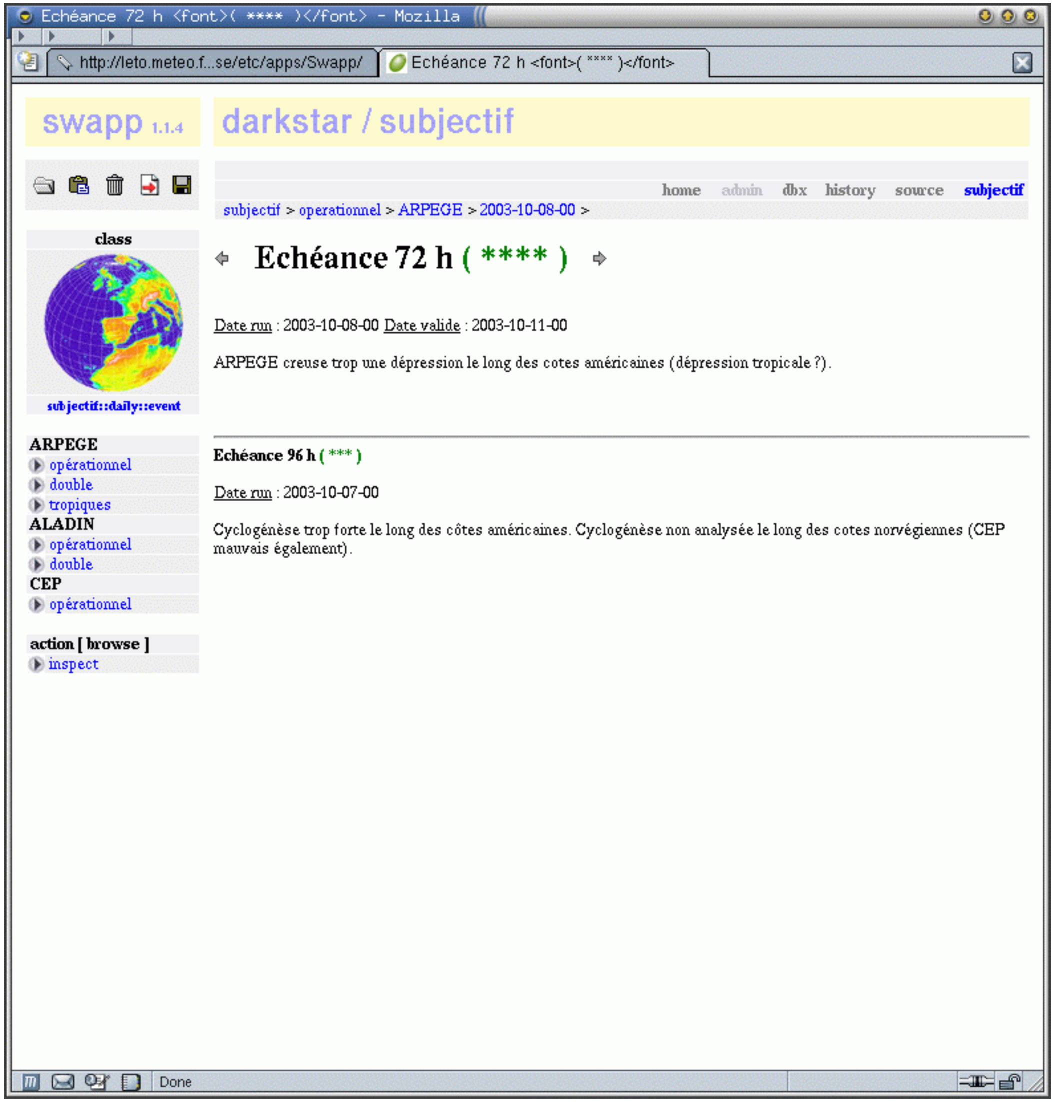
Nouvelle Liste Noire, *Nombre de stations par paramètre et type d'observation*

-	Pmer/Z	T2m/T	Hu2m/Hu	vent10m/vent	SST
SYNOP/SYNOR	166	17	6	0	17
SHIP	105	11	3	110	200
BUOY	34	16	-	39	90
TEMP	-	60	6	26	-
TEMP-SHIP	-	0	0	0	-
TEMP-MOBIL	-	1	1	1	-
PILOT	-	-	-	70	-
EUROPROFIL	-	-	-	27	-
PROFILER	-	-	-	17	-
AMDAR	-	24	-	25	-
ACAR	-	92	-	102	-

Ajouts

The « subjective control » application

- Some people track strange behaviors of our models on the basis of their own meteorological expertise and produce day-to-day reports, possibly including map snapshots.



Echéance 72 h (****)

Date run : 2003-10-08-00 Date valide : 2003-10-11-00

ARPEGE creuse trop une dépression le long des cotes américaines (dépression tropicale ?).

Echéance 96 h (*)**

Date run : 2003-10-07-00

Cyclogénèse trop forte le long des côtes américaines. Cyclogénèse non analysée le long des cotes norvégiennes (CEP mauvais également).

Conclusion

- The underlying components (the SWAPP VFS objects and databases) for software development are ready-to-use.
- The genericity and modularity have been sufficient for any application we have been requested to build so far. However, many detailled aspects could be refined, and the SWAPP/OLIVE project is open to any suggestion.
- One important issue is the ability to share experiments or operational settings in the community : therefore the project is very interested in the integration of the PRISM XML « standards ».

- Many thanks to Baudoin Raoult, Nils Wedi, Claes Larsson, Pascal Lamboley, Jacques Anquetil and Otto Pesonen.