SOFTWARE FRAMEWORK FOR GLIDER PILOTING

Bernardet K. [1], **Beguery L.**[1], **Testor P.**[2], **Mortier L.**[3], **Stuart D.** [1], **Bhairy N.** [1], **Mahiouz K.** [1], **Duformentelle P.**[4], **Hafidi Z.** [1], **Cauchy P.**[2], **Godinho E.**[1], **Guyon C**[5]., **Massez A**[5]., **Blaizot T.**[5], **Brun B.**[5]

[1]*INSU - Division Technique, ZI du brégaillon, 83500 La seyne sur mer*

[2]*LOCEAN, UMR 7159, Boîte 100 - 4, place Jussieu 75252 PARIS Cedex 05*

[3]*DGA / ENSTA, chemin de la hunière 1761 Palaiseaux cedex*

[4]*IFREMER, ZI du brégaillon, 83500 La seyne sur mer*

[5]*ISEN, engineering college (Brest, Lille and Toulon)*

karim.bernardet@dt.insu.cnrs.fr

Outline

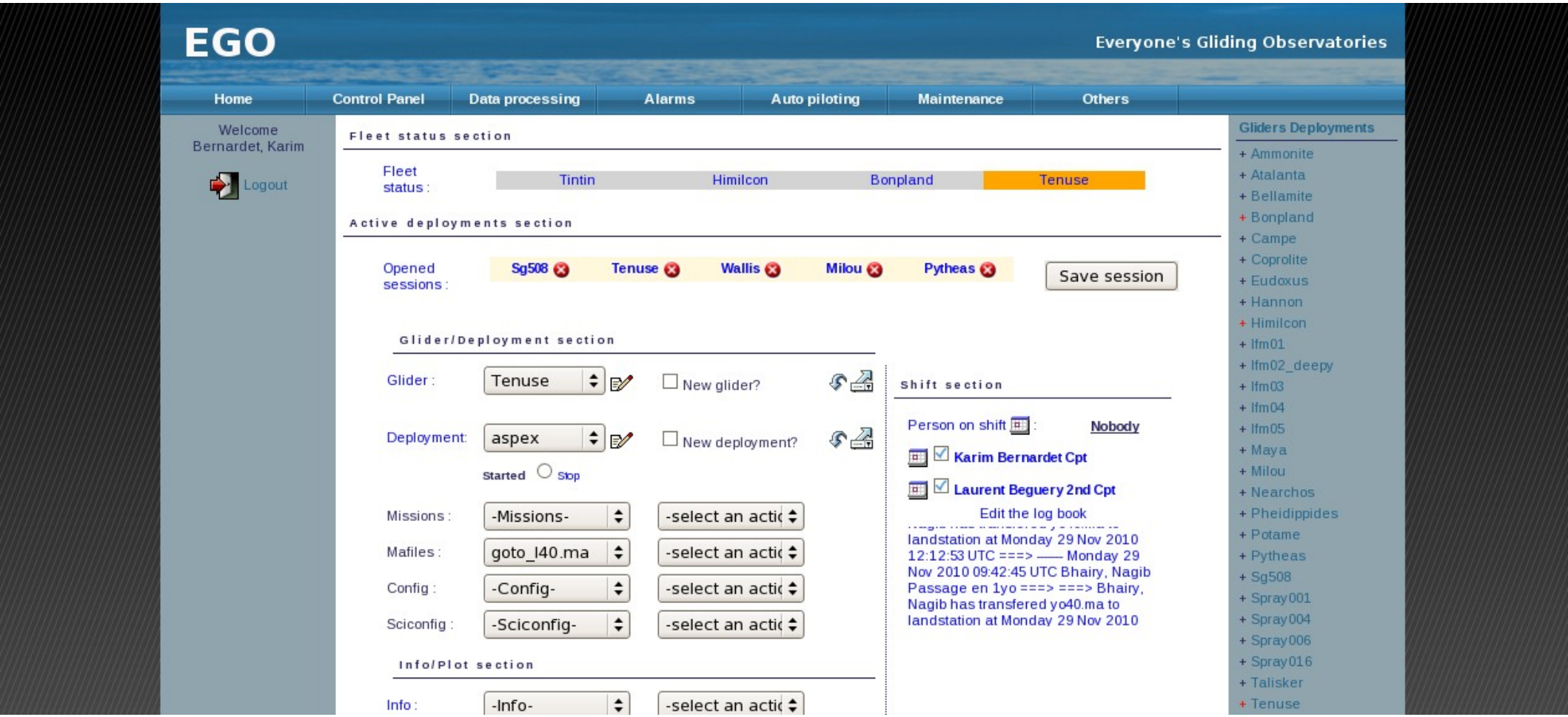
- Computing infrastructure
- Alarms
- Semi automatic / fleet piloting
- Conclusion

Computing architecture

- Main site : La Seyne sur Mer (RUDICS for Slocum, modem for Seaglider)
- Backup site : Meudon (modems for Slocum and Seaglider) *not yet in production*
- Hardware : Virtualisation, Linux CENTOS 5.5
- Software : made of several components (subversion for versioning, redmine for bugs tracking) :
  - GFCP-XX-XX-XX (PHP, JAVASCRIPT, HTML, MYSQL)
  - DataProcessing-XX-XX-XX (MATLAB)
  - JabberArchitecture-XX-XX-XX (PYTHON)
- Nodes dedicated to development (web server, plotstation)
- VPN access

Computing architecture : GFCP (1)

Piloting : Glider Fleet Control Panel



Computing architecture : GFCP (2)

EGO

Everyone's Gliding Observatories

Home | Control Panel | Data processing | Alarms | Auto piloting | Maintenance | Others

Welcome
Gliderman, Gliderman

Logout

Glider : **TENUSE**
Owner : **DT INSU**
Deployment : **aspex**
Status : **Started**
Obs. : Atlantic Observator...
Others deployment in this obs. :
Project :
Alt. project :

All deployment data

Last segment
Last day
Last 2 days
Last week

186_4_0 to 186_4_30
187_0_0 to 189_0_5

07/06 to 07/11
07/11 to 07/17
07/17 to 07/22
07/22 to 07/26
07/26 to 07/31
07/31 to 08/07

last surfacing of tenuse at 11-Mar-2011 13:04:49 UTC from GPS - surface dialogues
next estimated surfacing at 11-Mar-2011 13:04:49 UTC

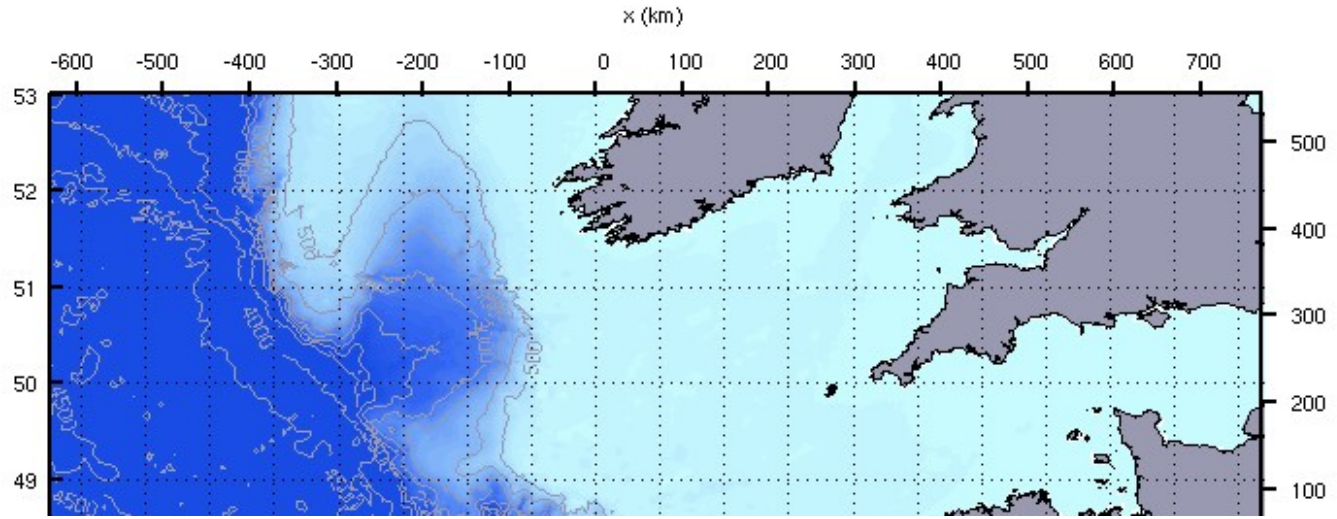
Position (zoom0)	Position (zoom1)	Health
sca Pot. Temp.	sca Sal.	sca Pot. Dens.
sca Oxyg.	sca FLCDOM	sca B532	sca B880

Previous plot

All deployment data / Position (zoom0)

Next plot

Last position at 2011-03-11 13:04:49
Last update of this plot: 2011-02-02 16:50:14



Gliders Deployments

+ Ammonite
+ Atalanta
+ Bellamite
+ Bonpland
+ Campe
+ Coprolite
+ Eudoxus
+ Hannon
+ Himilcon
+ Ifm01
+ Ifm02_deepy
+ Ifm03
+ Ifm04
+ Ifm05
+ Ifm06
+ Ifm07
+ Ifm08
+ Ifm09
+ Ifm10
+ Ifm11
+ Maya
+ Milou
+ Minke
+ Nearchos
+ Orca

Computing architecture : GFCP (3)

- In production for Slocum and Seaglider, implemented for Spray but never tested
- The web application allows :
  - Create/edit new deployments
  - Modify/send mission files to gliders
  - Shifters planning, logbook
  - View health and science plots
  - View glider status

Computing architecture : Data Processing

- Matlab scripts
- For Slocum, Seaglider and Spray

Computing architecture : Jabber (1)

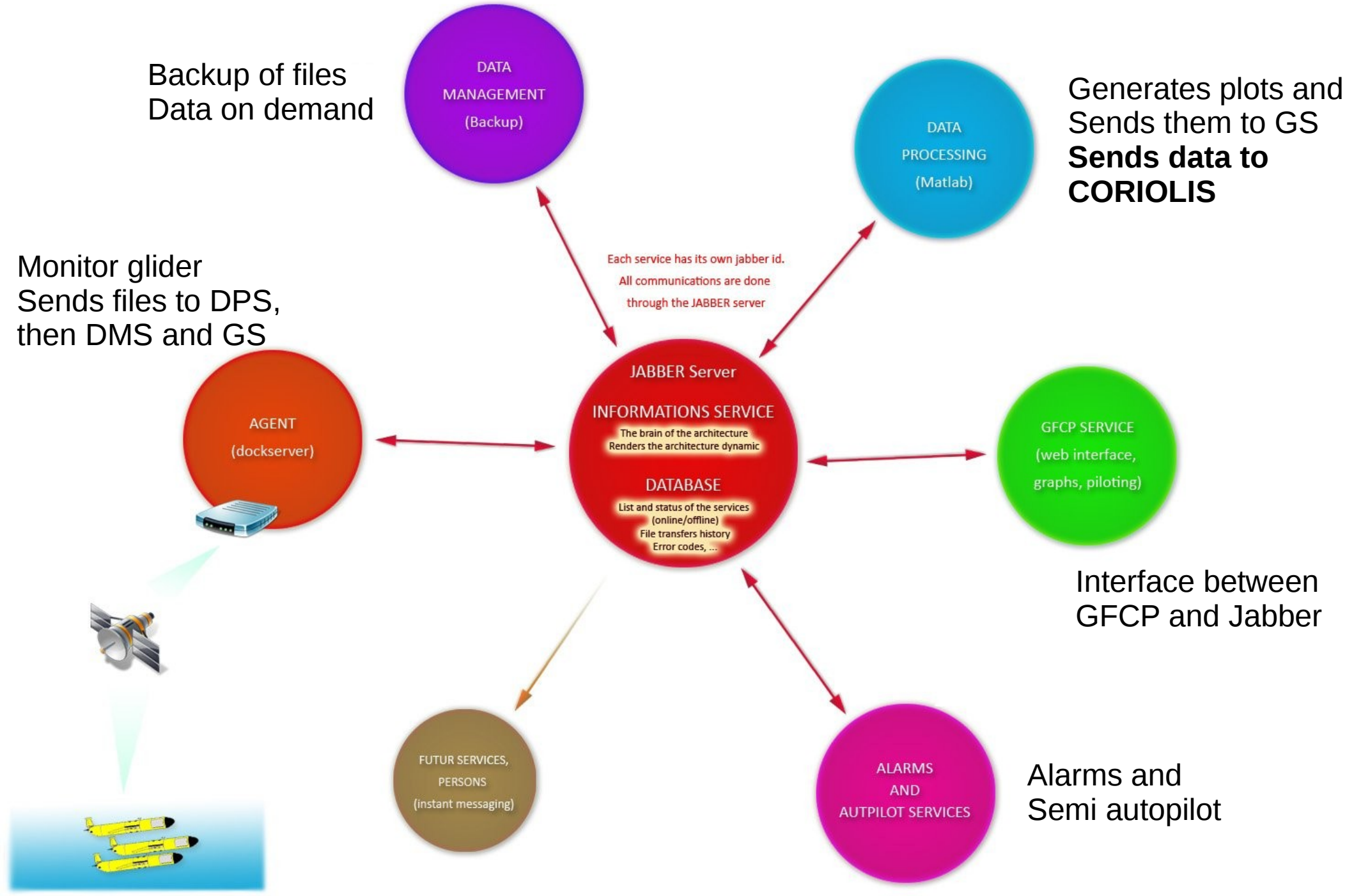
Python services communicating using the Jabber protocol (XMPP)

- Made of central services :
  - information service to know who does what
  - messages service (sms, emails, jabber, argos)

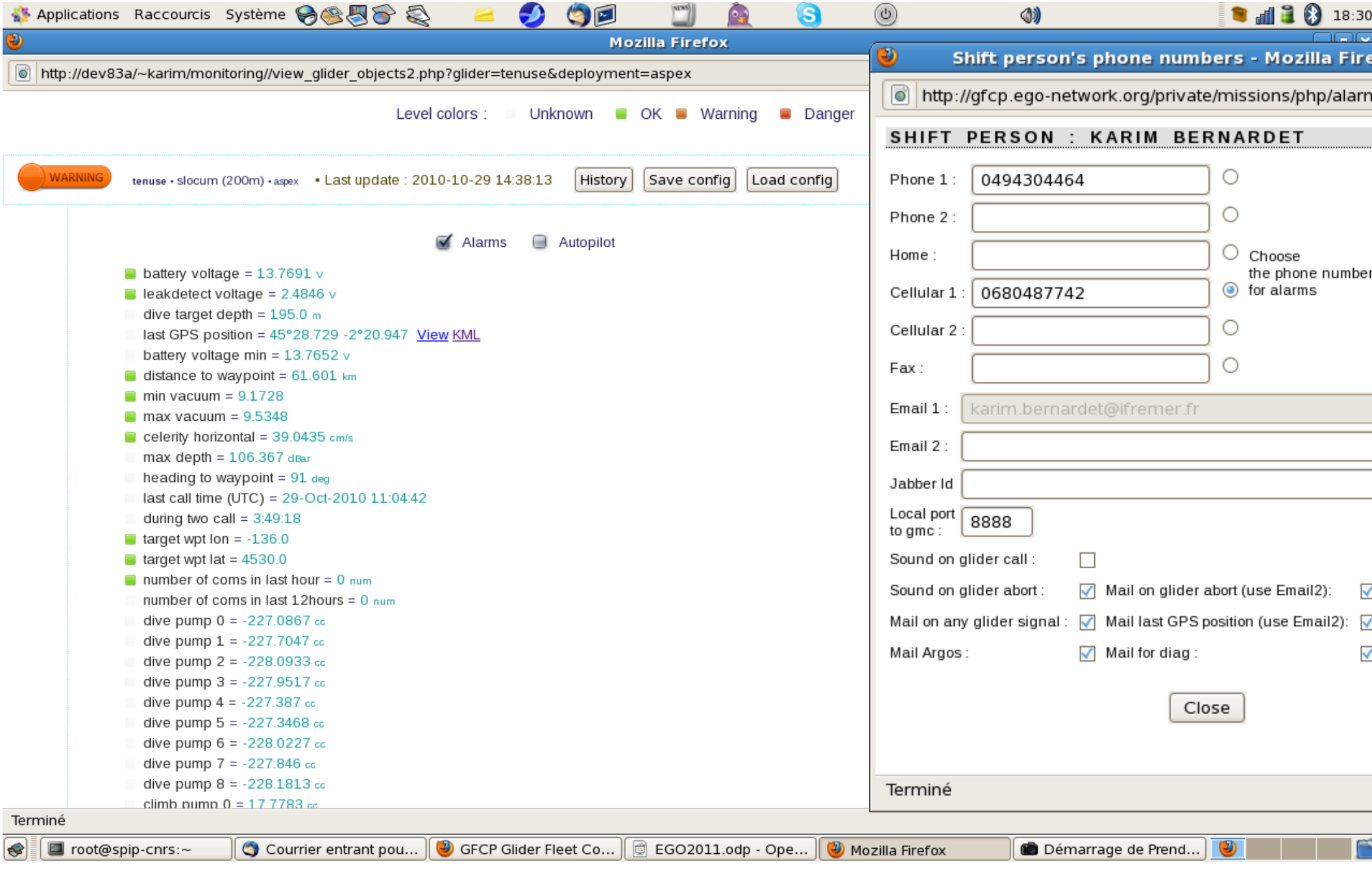
- Services for each glider
  - data processing (health plots, science plots, send data to data centers, ...)
  - data management (backup, data on demand, ...)
  - agent (detects surfaces, aborts, ...)

- Implemented for Slocum, in progress for Seaglider, not yet started for Spray

Computing architecture : Jabber (2)



Alarms (1)


Applications Raccourcis Système
18:30
Mozilla Firefox
http://dev83a/~karim/monitoring//view_glider_objects2.php?glider=tenuse&deployment=aspex
Level colors : Unknown OK Warning Danger
WARNING
tenuse • slocum (200m) • aspex • Last update : 2010-10-29 14:38:13
History
Save config
Load config
Alarms
Autopilot
battery voltage = 13.7691 v
leakdetect voltage = 2.4846 v
dive target depth = 195.0 m
last GPS position = 45°28.729 -2°20.947 View KML
battery voltage min = 13.7652 v
distance to waypoint = 61.601 km
min vacuum = 9.1728
max vacuum = 9.5348
celerity horizontal = 39.0435 cm/s
max depth = 106.367 dBar
heading to waypoint = 91 deg
last call time (UTC) = 29-Oct-2010 11:04:42
during two call = 3:49:18
target wpt lon = -136.0
target wpt lat = 4530.0
number of coms in last hour = 0 num
number of coms in last 12hours = 0 num
dive pump 0 = -227.0867 cc
dive pump 1 = -227.7047 cc
dive pump 2 = -228.0933 cc
dive pump 3 = -227.9517 cc
dive pump 4 = -227.387 cc
dive pump 5 = -227.3468 cc
dive pump 6 = -228.0227 cc
dive pump 7 = -227.846 cc
dive pump 8 = -228.1813 cc
climb pump 0 = 17.7783 cc
Terminé
Shift person's phone numbers - Mozilla Fire
http://gfcp.ego-network.org/private/missions/php/alarm
SHIFT PERSON : KARIM BERNARDET
Phone 1 : 0494304464
Phone 2 :
Home :
Cellular 1 : 0680487742
Cellular 2 :
Fax :
Choose the phone number for alarms
Email 1 : karim.bernardet@ifremer.fr
Email 2 :
Jabber Id
Local port to gmc : 8888
Sound on glider call :
Sound on glider abort :
Mail on glider abort (use Email2):
Mail on any glider signal :
Mail last GPS position (use Email2):
Mail Argos :
Mail for diag :
Close
Terminé
root@spip-cnrs:~
Courrier entrant pou...
GFCP Glider Fleet Co...
EGO2011.odp - Ope...
Mozilla Firefox
Démarrage de Prend...

Alarms (2)


Applications Raccourcis Système
Mozilla Firefox
http://dev83a/~karim/monitoring//view_glider_objects2.php?glider=tenuse&deployment=aspex
Level colors : Unknown OK Warning Danger Autopilot
WARNING
tenuse • slocum (200m) • aspex
• Last update : 2010-10-29 14:38:13
History
Save config
Load config
Alarms
Autopilot
battery voltage = 13.7691 v
leakdetect voltage = 2.4846 v
Alarm levels :
warning (low level alarm) : 2.45
danger (high level alarm) : 2.4
vacuum [InHg]
leak detect [V]
12
11.5
11
10.5
10
9.5
9
8.5
8
2.5
2.4
2.3
2.2
2.1
2
Terminé
root@spip-cnrs:~
Courrier entrant pou...
GFCP Glider Fleet Co...
EGO2011.odp - Ope...
Mozilla Firefox
Démarrage de Prend...

Alarms (3)

- Generic glider object, a specific glider inherites from this object
- For Slocum only, not yet implemented for Seaglider and Spray
- 2 levels : WARNING and DANGER
  - Battery voltage
  - Leakdetect voltage
  - Checks if the glider follows its trajectory
  - Checks if distance to waypoint decreases
  - Vacuum
  - Celerity horizontal
  - Heading to waypoint
  - Time between two calls
  - Number of coms in last hour/12 hours
  - Pitch
- Nothing done yet for scientific data

Semi auto piloting

- Currently for Slocum only
- In development
- Automate actions
- Actions implemented :
  - activate/desactivate altimeter if needed
  - Update the target wpt
  - Speed up / slow down when necessary
- Such action implies :
  - Modify automatically a mission file (ma file for Slocum)
  - Send the modified file to the dockserver/basestation

Fleet behavior

- Mainly in thinking phase
- Use of « auto pilot » features
- Types :
  - Follow leader
  - Line
- Integrate external algorithms

Conclusion

- Develop a computing system to enable a single pilot to manage many gliders
- Open architecture (Jabber) suitable to host new services
- To do :
  - Implementation for Seaglider and Spray (services, alarms)
  - Alarms for scientific sensors
  - Fleet behavior
  - Fix bugs