

e-control: First Public Release of Remote Control Software for VLBI Telescopes

FESG



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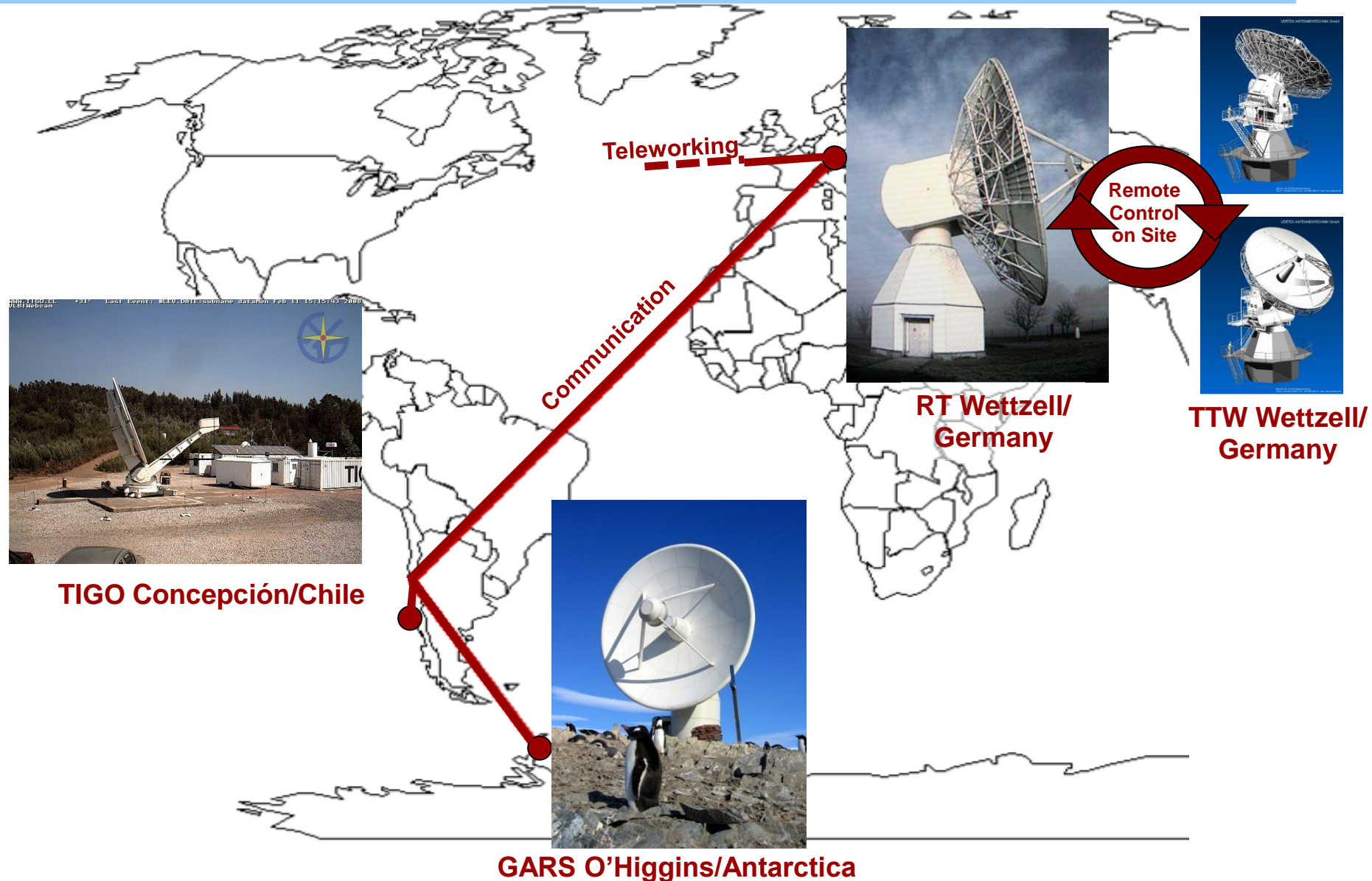
Max-Planck-Institut
für
Radioastronomie



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Matthias Mühlbauer (BKG), Hayo Hase (BKG), Walter Alef (MPIfR),
Sergio Sobarzo (Udec), Cristian Herrera (Udec),
Ed Himwich (NASA/GSFC/NVI)

Wettzell and the idea of controlling VLBI telescopes by remote

The idea: remote attendance and control of the VLBI telescopes Wettzell/Germany, O'Higgins/Antarctica and TIGO/Concepción



The idea: remote attendance and control of the VLBI telescopes Wettzell/Germany, O'Higgins/Antarctica and TIGO/Concepción

Advantages:

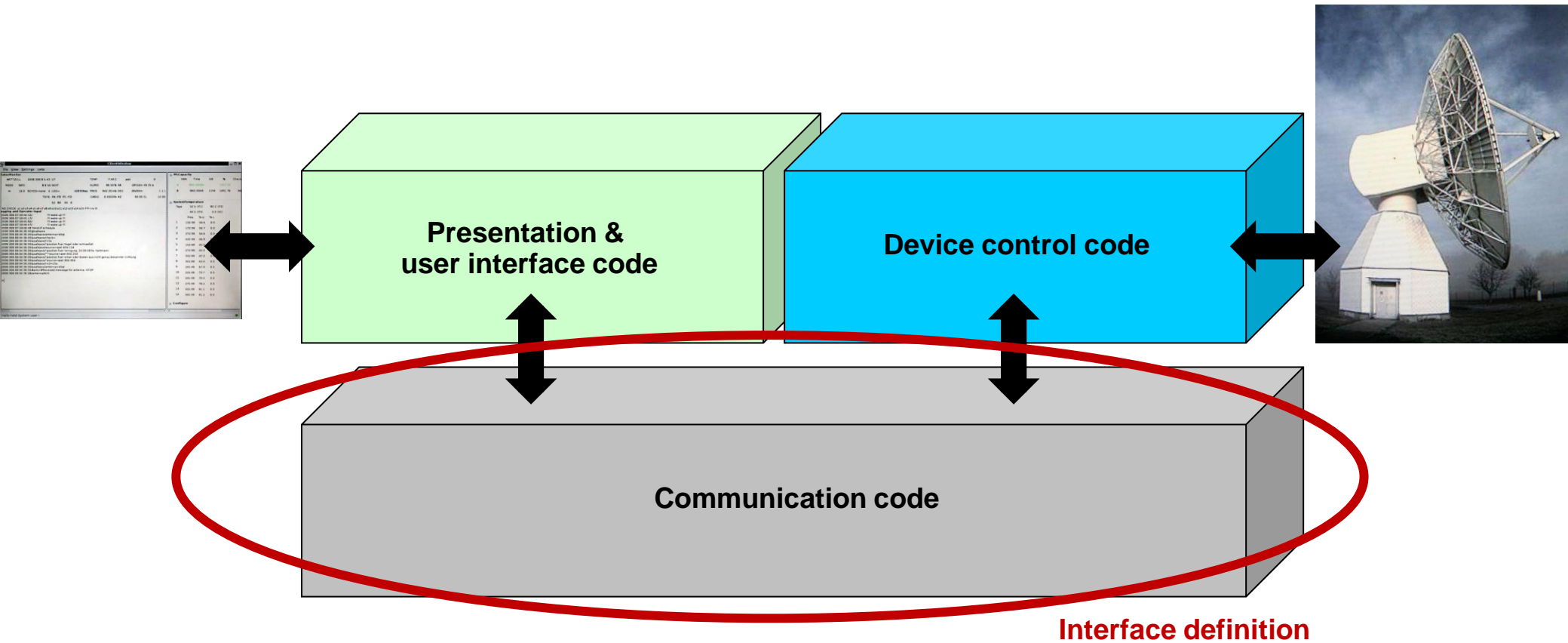
- Check system states from all over the observatory
- Tele-working to attend or check (unattended) observations during weekends
- Remote assistance for operators by a remote specialist
- Reduce burdens for personnel staff in night shifts for a highly utilized telescope
- Control very remote telescopes (like in Antarctica) to assist the local operators
- Offers a first basis for passive data access (live monitoring) and controlling (operating)
- Offers a first basis also for future operation styles

BUT:

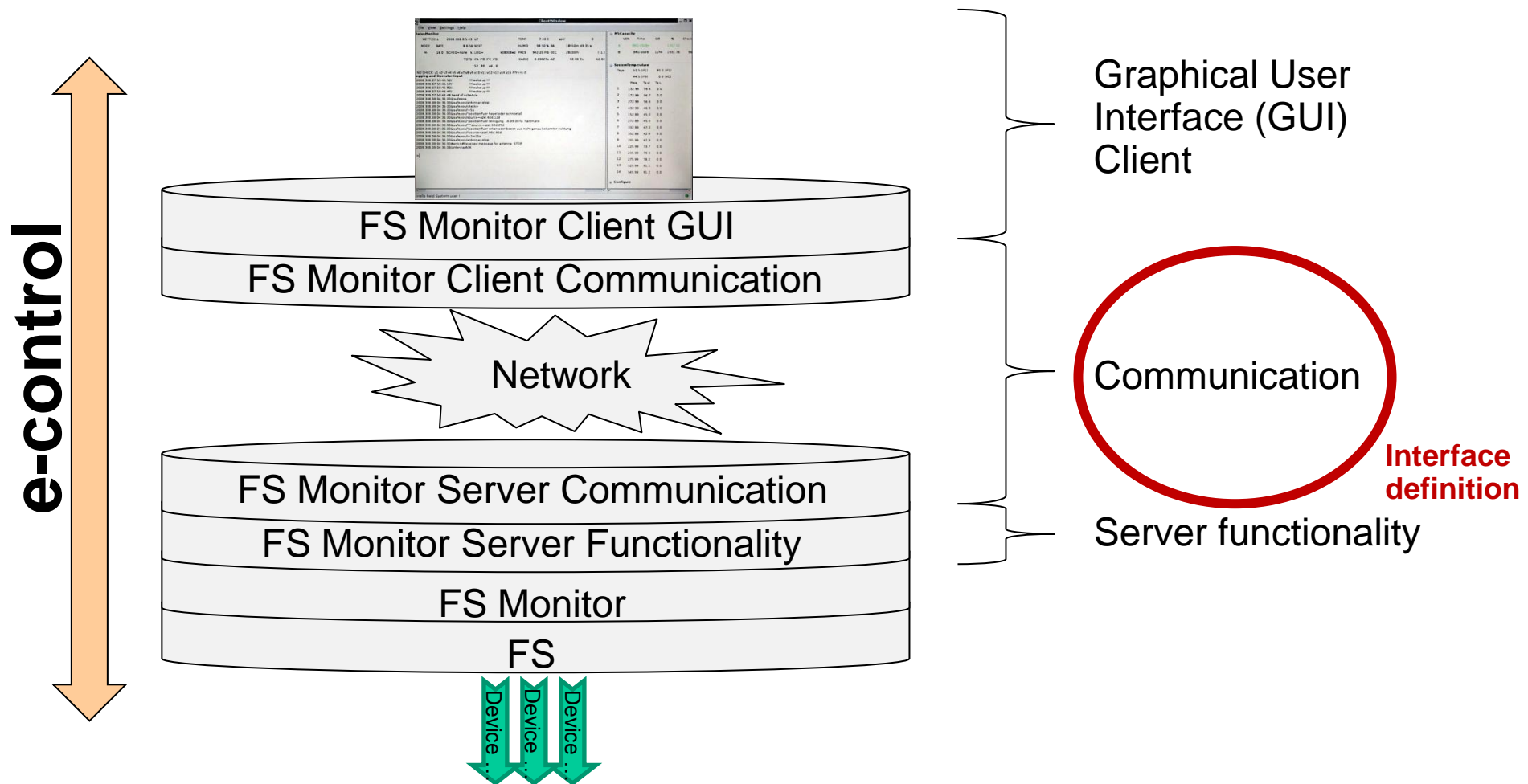
A **reliable telescope hardware** must offer such modes (similar to unattended operations)
Highly educated personnel staff is still needed as stand-by or **on-call service** to re-act on
critical situations.

Wetzell's solution for remote control

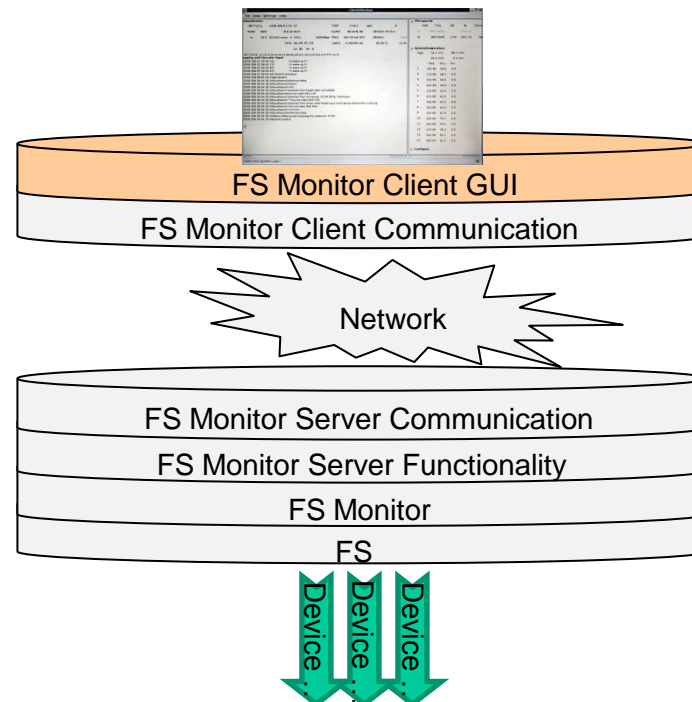
Strict design-separation of presentation, communication and control layer



The resulting e-control stack



What the operators see – A graphical user interface as field system remote client



A graphical user interface as field system remote client

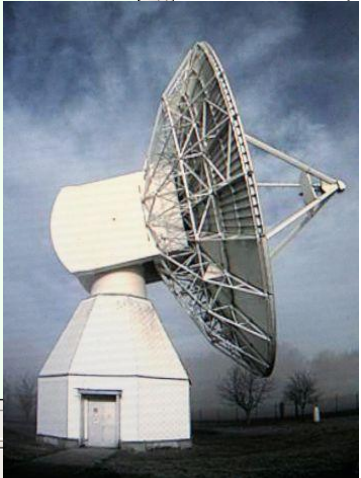
Basis for graphical user interface: wxWidgets (C++ based Open-Source-Framework for platform independent development of graphical user interfaces)

The screenshot shows the 'econtrol' application window. The top menu bar includes 'File', 'View', 'Settings', and 'Help'. The main interface is divided into several panels:

- Station Tools / StatusMonitor:** Displays station parameters for 'WETTZELL' on '2010.023.08.46.24 UT'. It shows temperature (-5.8 C), humidity (90.5%), pressure (951.6 mb), and various system settings like 'MODE', 'RATE', 'SCHED', and 'LOG'.
- Logging and Operator Input:** A scrollable log window showing a series of timestamped messages and commands, such as 'Received message for antenna: STOP' and 'startmka'.
- M5Capacity:** A table showing capacity data for different VSNs (A and B) with columns for Time, GB, %, and Check UT.
- SystemTemperature:** A table listing system temperatures for various components (Ts1 to Ts13) with columns for Freq, Ts-U, and Ts-L.

At the bottom of the window, it shows 'Connected to 127.0.0.1'. The taskbar at the very bottom includes a browser window for 'webcam1 - Mozilla Fire...', a terminal window for '[rtwadm@ubuntu: ~/S...]', and the 'econtrol' application icon.

Webcam (currently in a Browser)



Live demo is on 4th floor in the operator room!

A graphical user interface as field system remote client

Some features: command sending, log recording, log filters and acoustic signals via sound card

Logging and Operator Input

70K 20K **Log filter opens a new tab with just the filtered lines**

```

2010.023.08:03:43.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:04:59.49/rx/1E(20K),on,a,on,on,on,off,locked,17.09
2010.023.08:06:16.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:07:33.49/rx/1E(20K),on,a,on,on,on,off,locked,16.95
2010.023.08:08:49.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:10:17.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:11:51.49/rx/1E(20K),on,a,on,on,on,off,locked,16.89
2010.023.08:12:22.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:14:17.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:15:42.49/rx/1E(20K),on,a,on,on,on,off,locked,16.95
2010.023.08:17:11.49/rx/1E(20K),on,a,on,on,on,off,locked,17.09
2010.023.08:18:44.48/rx/1E(20K),on,a,on,on,on,off,locked,17.09
2010.023.08:20:00.49/rx/1E(20K),on,a,on,on,on,off,locked,17.09
2010.023.08:21:16.48/rx/1E(20K),on,a,on,on,on,off,locked,17.09
2010.023.08:22:33.49/rx/1E(20K),on,a,on,on,on,off,locked,17.09
2010.023.08:23:50.48/rx/1E(20K),on,a,on,on,on,off,locked,17.09
2010.023.08:25:06.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:26:30.49/rx/1E(20K),on,a,on,on,on,off,locked,17.09
2010.023.08:27:48.50/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:29:04.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
    
```

20K

Define log filter

Command line input

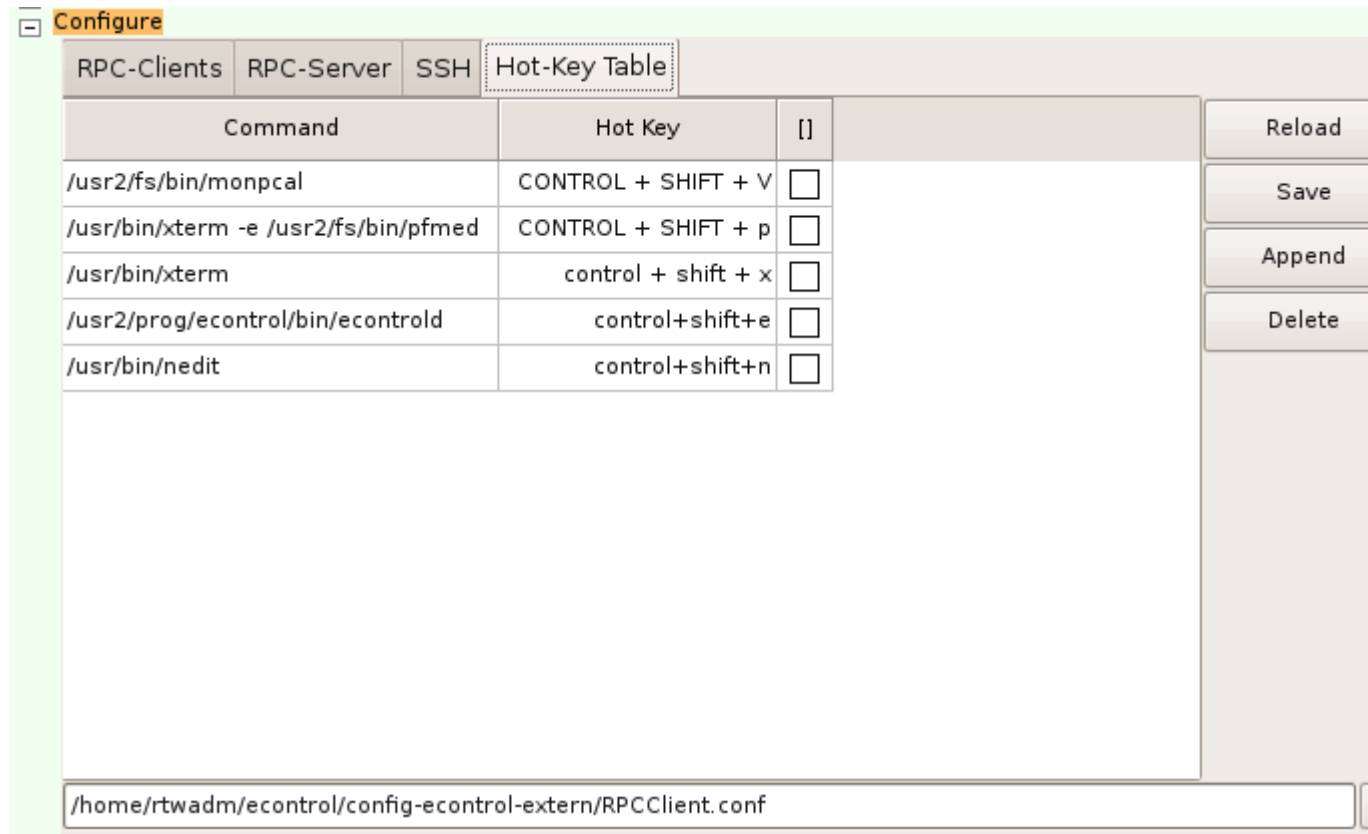
Save current file

Record log file on the fly

Acoustic signal on error

A graphical user interface as field system remote client

Some features: hot key definition during runtime to activate remote programs



A graphical user interface as field system remote client

Some features: MonPCal and chat

MonPCal

☐ MonPCal

	Amp	Phase	Time
1	30	12	2010.023.08:26:16.23
2			
3			
4	32	71	2010.023.08:28:53.43
5	32	-9	2010.023.08:26:17.82
6			
7			
8	35	160	2010.023.08:28:55.02
9	31	-15	2010.023.08:27:40.69
10			
11			
12			
13			
14	22	-87	2010.023.08:27:42.29

Update

Clear

Chat between operators

☐ Chat

[alexander*] hallo
 [oper] hello
 [alexander*] how are you
 [oper] fine, how can i help you?
 [alexander*] the schedule has changed
 [alexander*] please drudg it again
 [oper] ok, thanks!
 [alexander*] thank you

▶

▼ Append to log

A graphical user interface as field system remote client

Some features: classic and graphical mode

The image displays two instances of the 'econtr' software interface. The top instance is in 'Classic' mode, showing a table of station data and a 'SystemTemperature' table. The bottom instance is in 'Graphical' mode, showing a 'SystemTemperature' line graph and 'M5Capacity' gauges. Red circles and arrows highlight the differences between the two modes.

Classic Mode Data:

VSN	Time	GB	%	Chk	UT
A BKG-0069/	27h17m	3143.859	98.2	08:28:19	
B				08:28:19	

Tsys	IF1	IF2	IF3	VC
31.0068		64.3146		0
23.8764				0
Freq	Ts-U	Ts-L		
1	132.99	35.7148	0	
2	172.99	34.3332	0	
3	272.99	32.043	0	
4	432.99	26.0389	0	
5	152.89	24.6385	0	
6	272.89	22.9655	0	
7	332.89	26.0347	0	
8	352.89	24.4271	0	
9	212.99	50.7386	0	
10	220.99	55.176	0	
11	236.99	57.0096	0	
12	292.99	58.4376	0	
13	52.99	65.1272	0	

Graphical Mode Data:

M5Capacity: 98% free, 2% used

System Temperature: 130, 90, 70, 50, 30, 10

A graphical user interface as field system remote client

Some features: SSH management

Complete SSH-tunneling management via included SSH-broker

Configure

RPC-Clients | RPC-Server | **SSH** | Hot-Key Table

Station Network Access Settings

Enable

Site:

Port:

User Name:

Port Binding:

Additional Cmd:

Station IP:

DSA file:

Pass Phrase:

Password:

Timeout-Settings: [s]

System Access Settings

Enable

Name:

Port:

User Name:

Port Binding:

Additional Cmd:

IP Address:

DSA File:

Pass Phrase:

Password:

Reload | Save | Append | Delete

/home/rtwadm/econtrol/config-econtrol-extern/RPCClient.conf

Auto-connection via SSH-tunnel using an integrated SSH-broker

SSHConnectDlg

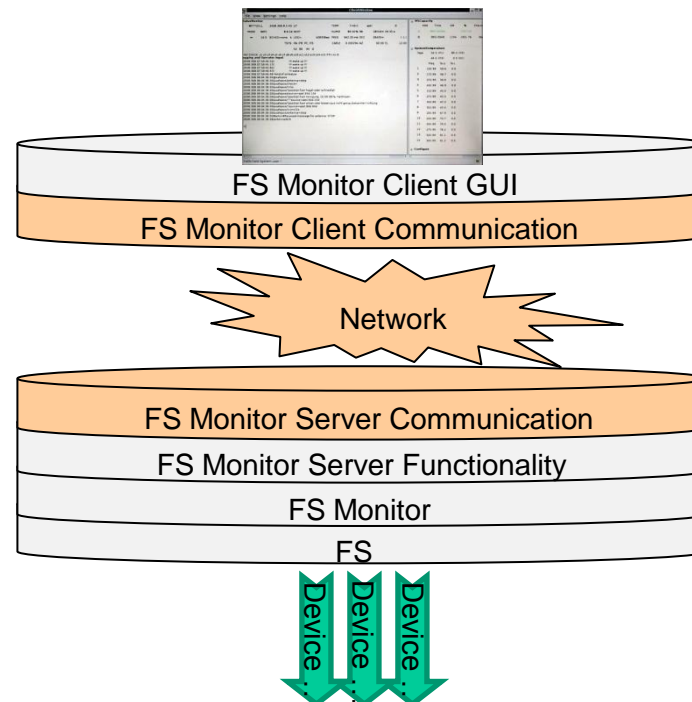
SSH-Site-Access

Connecting to gate1-w.wetzzell.ifag.de
Server logged in and starts running remote task ...

SSH-System-Access

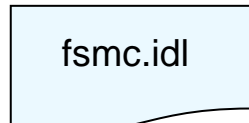
Alexander Neidhardt

The communication – with a remote procedure call middleware and ssh



The communication – using a middleware generator

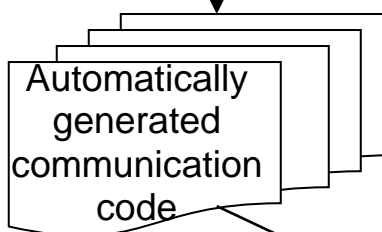
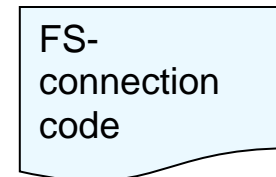
Step 1: Write interface definition for fsmc



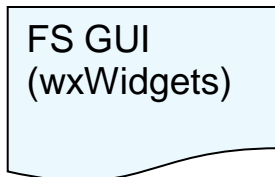
Step 2: Call idl2rpc.pl to generate communication code



Step 3: Write code to connect to fieldsystem



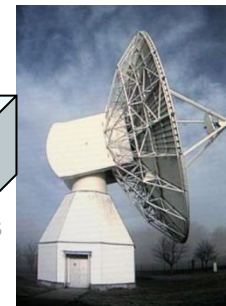
Step 4: Write code for data presentation



Step 5: Compile



Client controlled connections



Autonomous process cell

SSH as security layer

Possibility 1: Direct access



Client controlled connections

RPC-Connection

Autonomous process cell



Possibility 2: Access via direct SSH-Tunnel



Client controlled connections

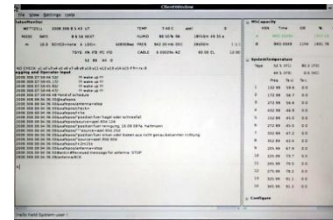
Direct SSH-Tunnel

RPC-Connection

Autonomous process cell

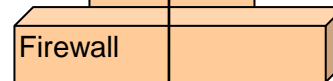


Possibility 3: Access via SSH-Tunnel to firewall



Client controlled connections

SSH-Tunnel to firewall



RPC-Connection

Autonomous process cell

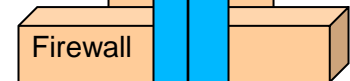


Possibility 4: Access via direct SSH-Tunnel over SSH-Tunnel to firewall



Client controlled connections

SSH-Tunnel to firewall



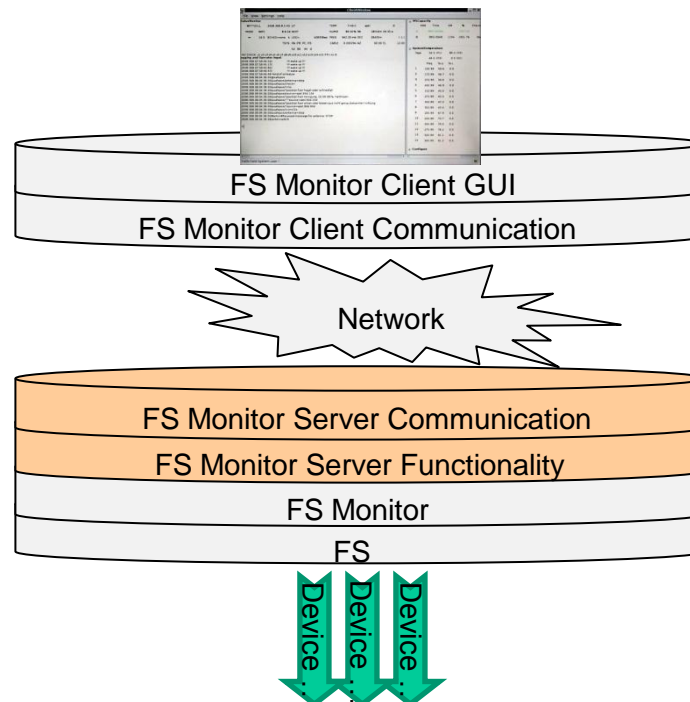
Direct SSH-Tunnel

RPC-Connection

Autonomous process cell

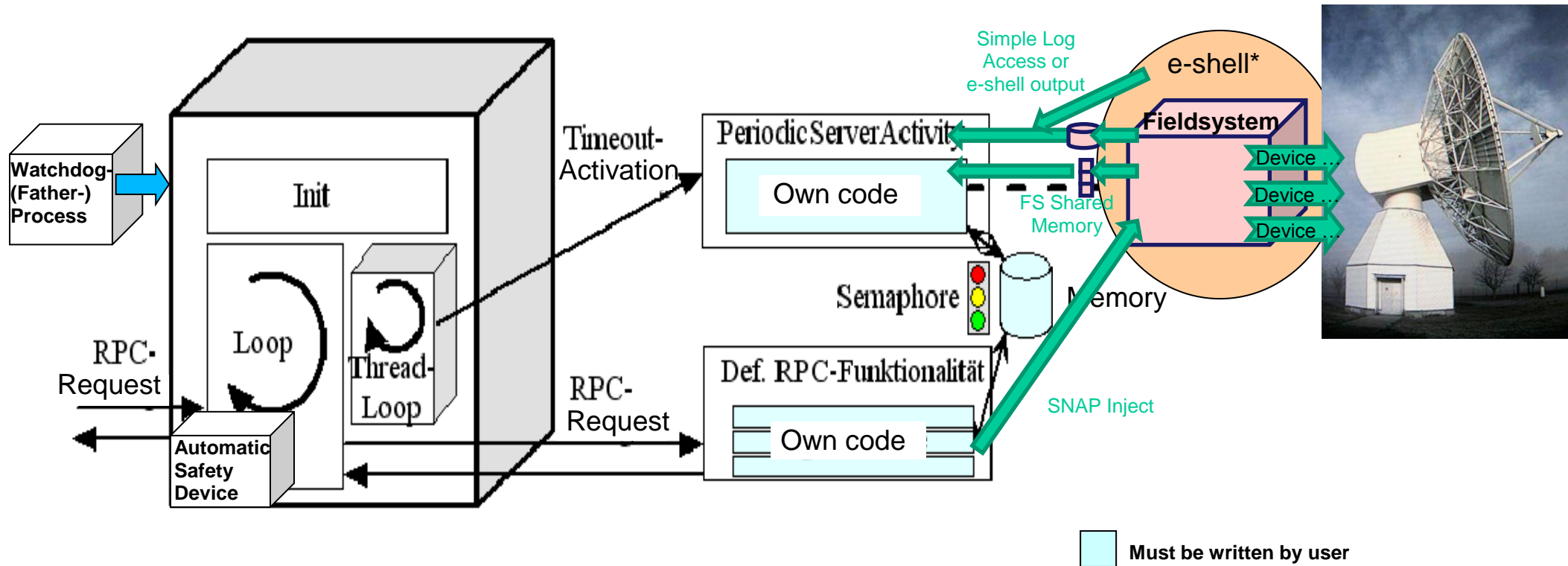


A fieldsystem extension – remote accessible, autonomous process cells



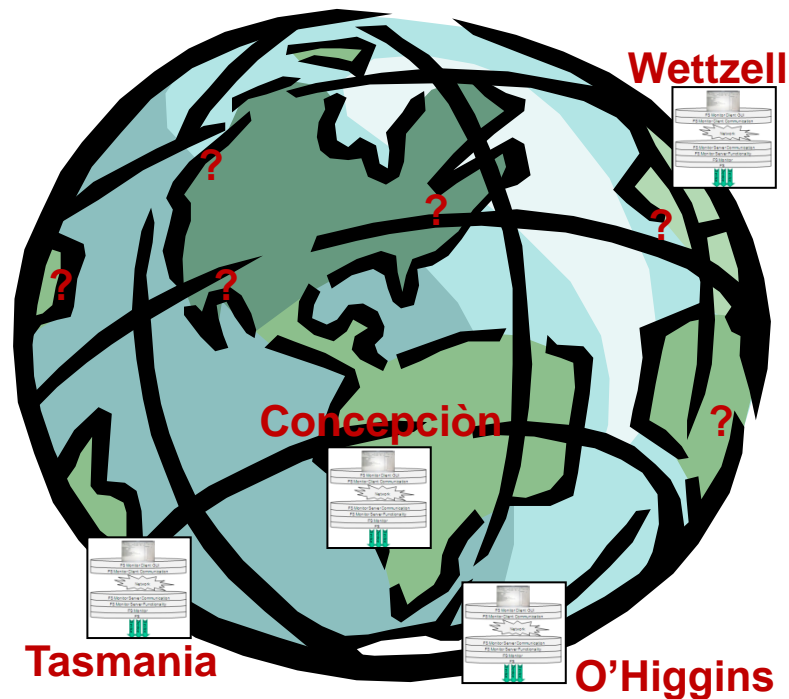
A fieldsystem extension – autonomous process cells

Autonomous process cell offers remote access to the field system
 (at the moment Linux based)



* e-shell is currently under development

First release is available now for testing!
Feel free to try it on your system!!!



First release is available now for testing!

**The Idea is not to control your telescopes by other institutions!
The idea is to offer additional possibilities for you at your site!**

How to get the software?

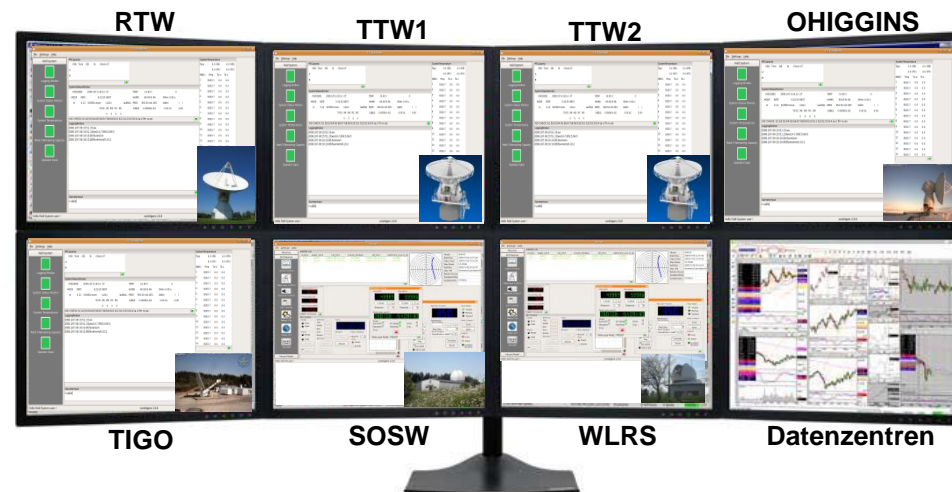
- 1) Email to neidhardt@fs.wetzell.de and you'll get a server and a client package (together about 6 MB code) with basic instructions (complete manual will be developed after response from the testers)
- 2) CD with the code packages or copy on your USB-stick (just ask during workshop and we burn one for you)
- 3) A download server will be available soon (hopefully end of March) at Technische Universität München with release management via Subversion and help desk ticketing
- 4) Should become part of the new, official NASA field system release (under discussion with Ed Himwich)

And the future ...

And the future ...

- 1) Participation at the **NEXPRES-project proposal** (EVN) including the development of an operator based security system (authentication and authorization, read and write control, control handover etc.) together with the MPIfR Bonn
- 2) Main focus lies also on finalizing (and maybe offering) a complete **control system for SLR** in same style
- 3) Develop **additional monitoring systems** to realize a stable system overview (see talk of Martin Ettl)
=> problems occur in the current field system design where information from devices is only collected in large time intervals (not really a real-time overview of the system)
- 4) Realize **hardware-level devices** with same interface technique within the field system
- 5) Improve the technology => **Technical GGOS realizations**

Thank you!



Similar to: Hase, Hayo; et. al.: Twin Telescope Wettzell (TTW) – a VLBI2010 Radio Telescope Project. IVS General Meeting 2008