

Monitoring and Control of new, worldwide VLBI2010 Telescopes

FESG

Alexander Neidhardt (FESG)
neidhardt@fs.wettzell.de



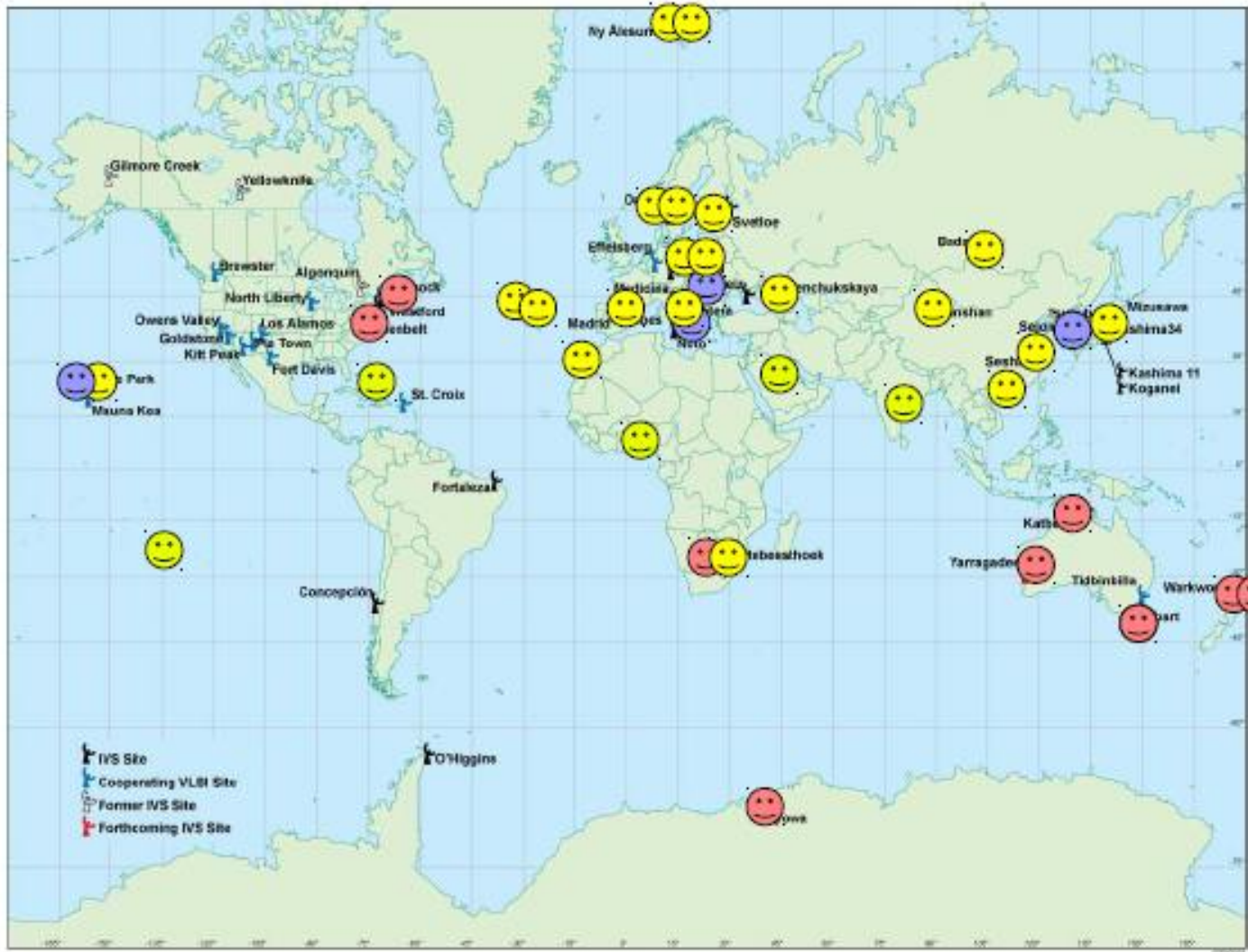
***Martin Ettl (FESG), Matthias Mühlbauer (BGK),
Ed Himwich (NASA/GSFC), Christopher Beaudoin (MIT-Haystack), Jim Lovell (UTAS),
Christian Plötz (BKG), Arpad Szomoru (JIVE), Walter Alef (MPIfR),
and the colleagues from TIGO, Chile and from Wettzell***

Global situation and the future

Global situation and the future



Global situation and the future



- VLBI2010 very fast**
- ☺ radio telescope
- ☺☺ twin radio telescope

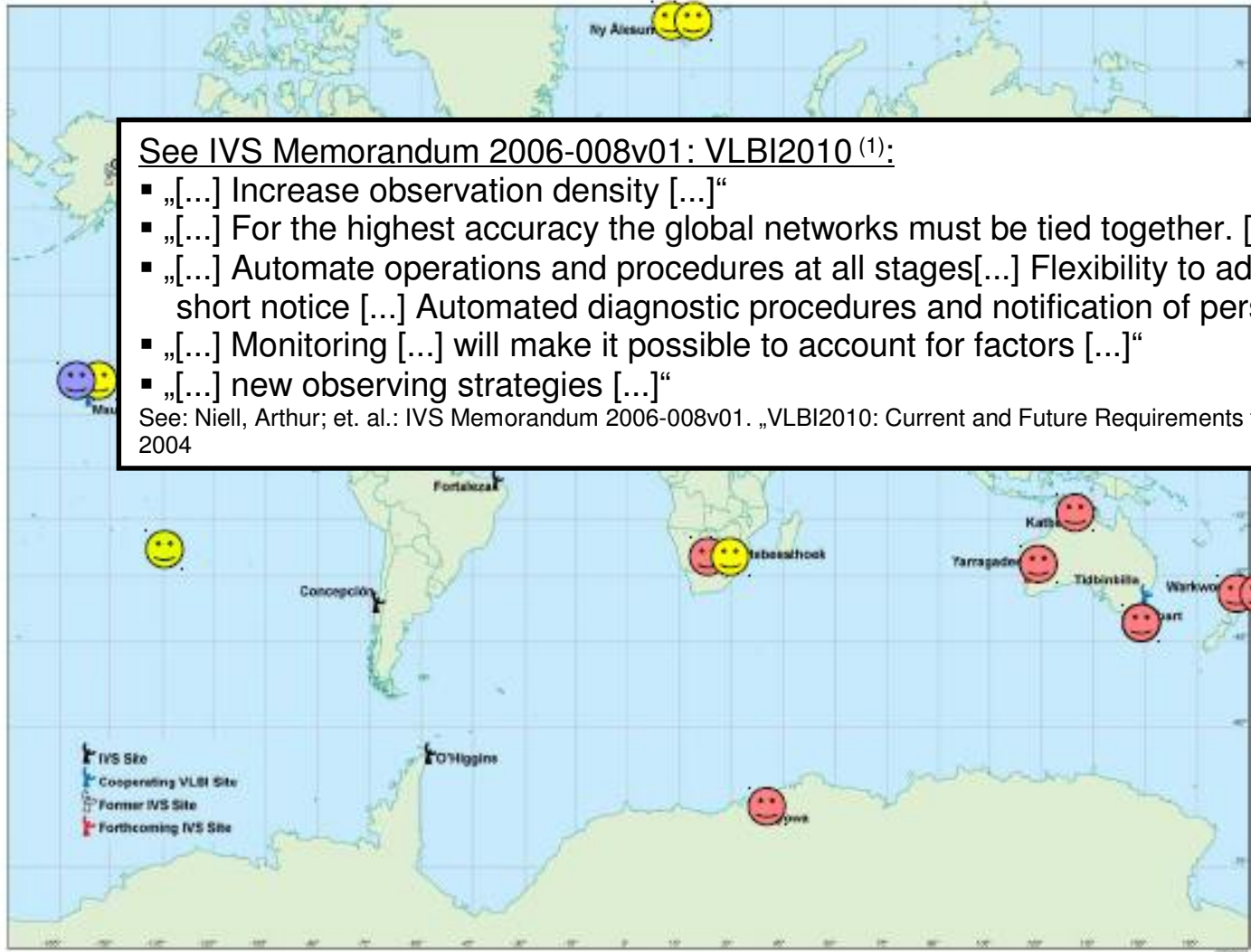
- VLBI2010 fast**
- ☹ radio telescope

- upgrade legacy**
- ☹ radio telescope

- potential new site**
- ☺ radio telescope

See: Hase, H. et. al.: The future global VLBI2010 network of the IVS. 20th EVGA Meeting Bonn 2011

Global situation and the future



VLBI2010 very fast

See IVS Memorandum 2006-008v01: VLBI2010 ⁽¹⁾:

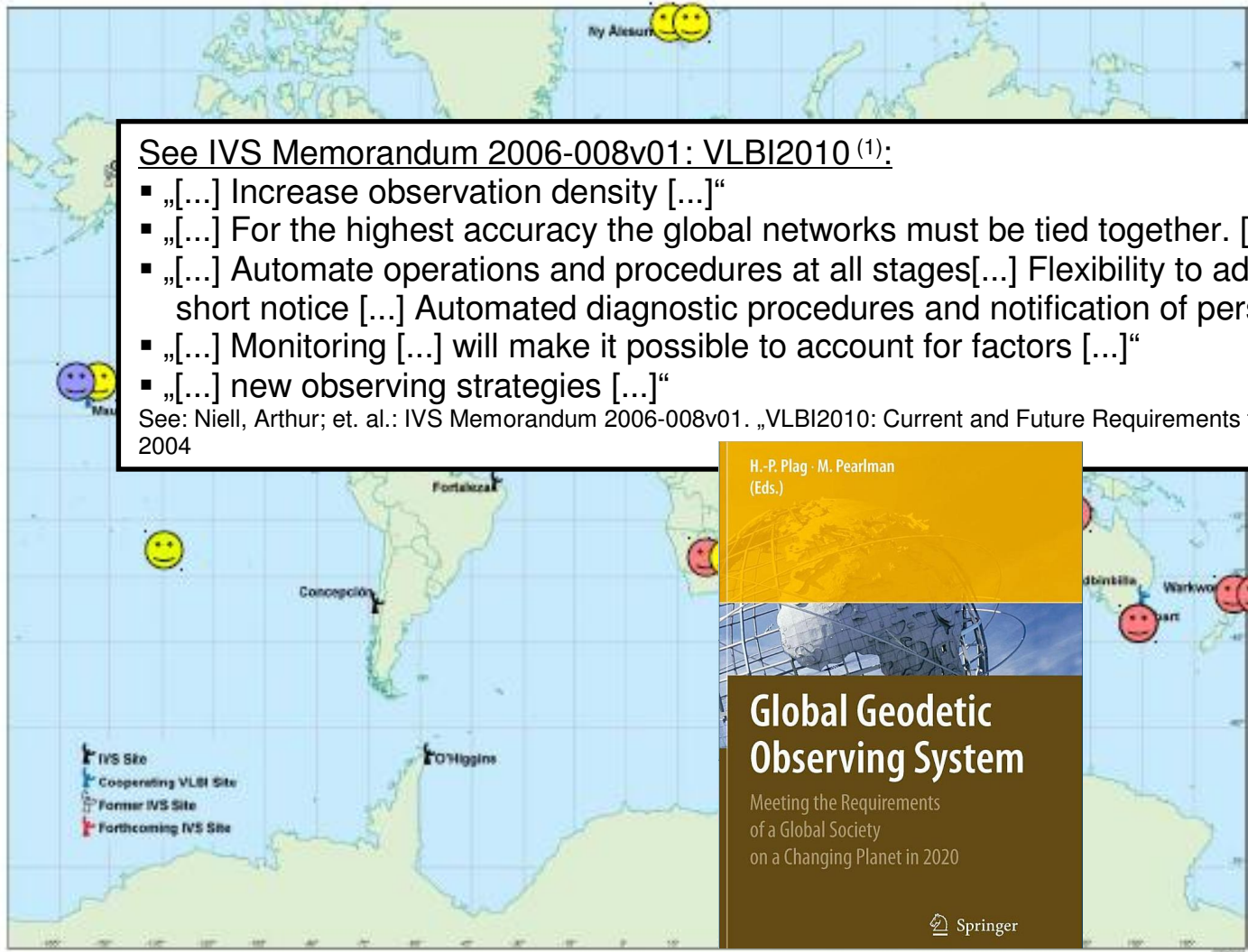
- „[...] Increase observation density [...]“
- „[...] For the highest accuracy the global networks must be tied together. [...]“
- „[...] Automate operations and procedures at all stages[...] Flexibility to add/subtract stations on short notice [...] Automated diagnostic procedures and notification of personel when necessary [...]“
- „[...] Monitoring [...] will make it possible to account for factors [...]“
- „[...] new observing strategies [...]“

See: Niell, Arthur; et. al.: IVS Memorandum 2006-008v01. „VLBI2010: Current and Future Requirements for Geodetic VLBI Systems“. Sept. 2004

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Global situation and the future



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See: http://www.amazon.de/Global-Geodetic-Observing-System-Requirements/dp/3642026869/ref=sr_1_1?ie=UTF8&qid=1300913444&sr=8-1, Download 2011-03-23

Global situation and the future

New observation strategies

New observation strategies



Local

- Standard operations
- Local operator

New observation strategies



Local

- Standard operations
- Local operator



Remote

- Check system states from everywhere at the observatory
- Tele-working
- Remote assistance and diagnostics
- Control very remote, inaccessible telescopes

New observation strategies



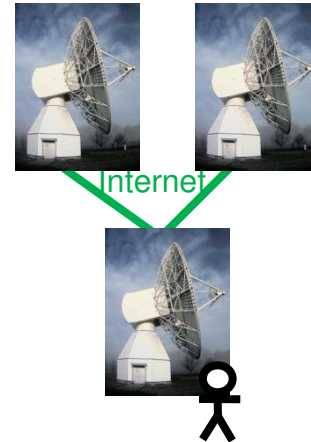
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Shared

- Save, passive data live monitoring
- Dedicated control access by responsible person
- Shared access from different observatories
- Shared night shifts

New observation strategies



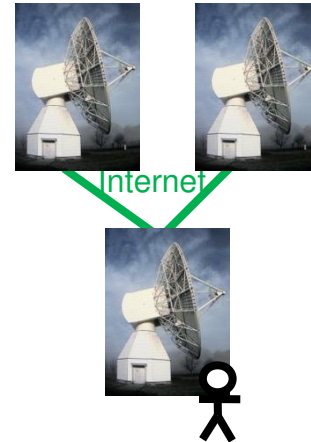
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Shared

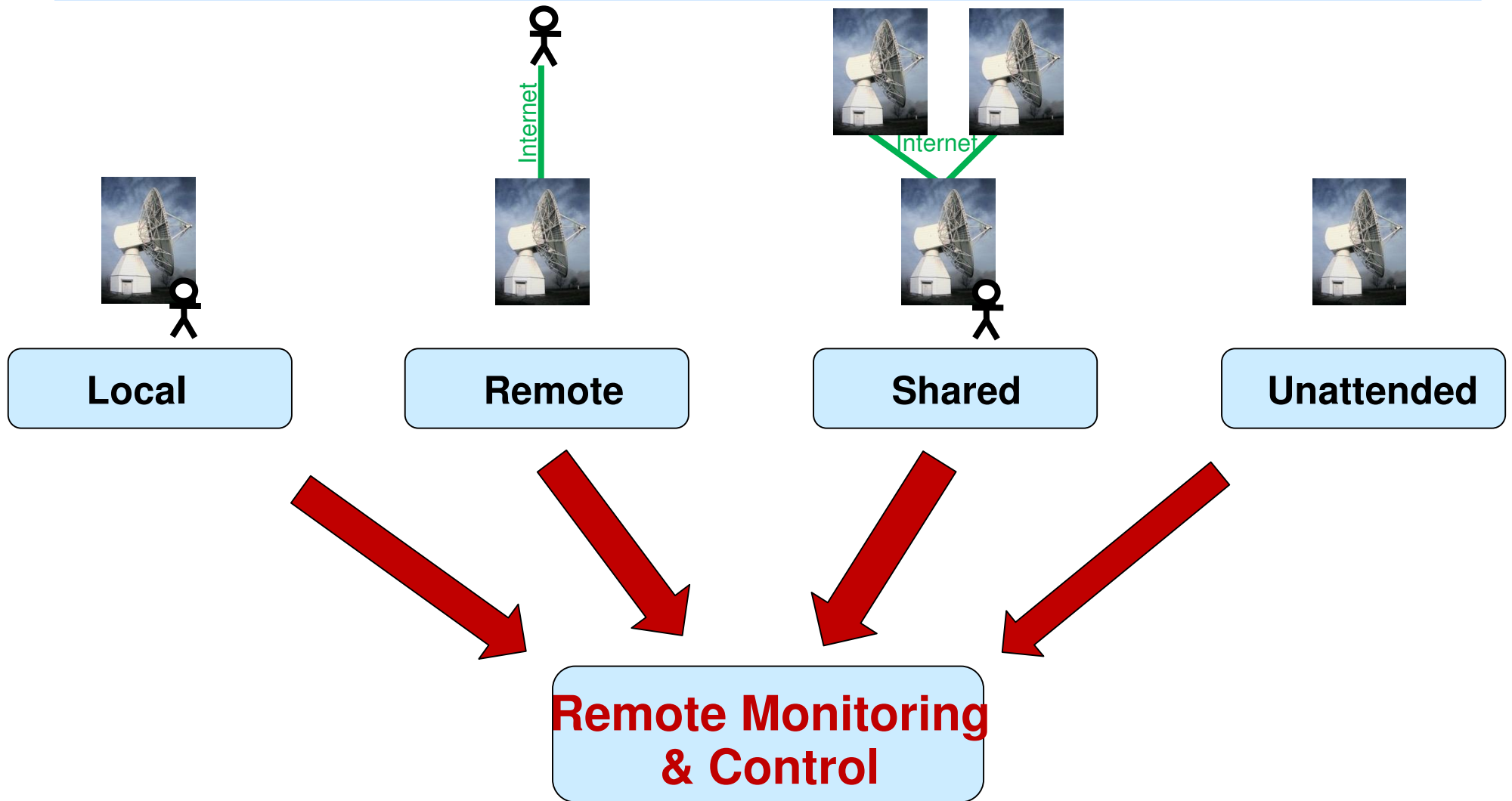
- Save, passive data live monitoring
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Unattended

- Observations run autonomous, (semi-) automated and unattended

New observation strategies

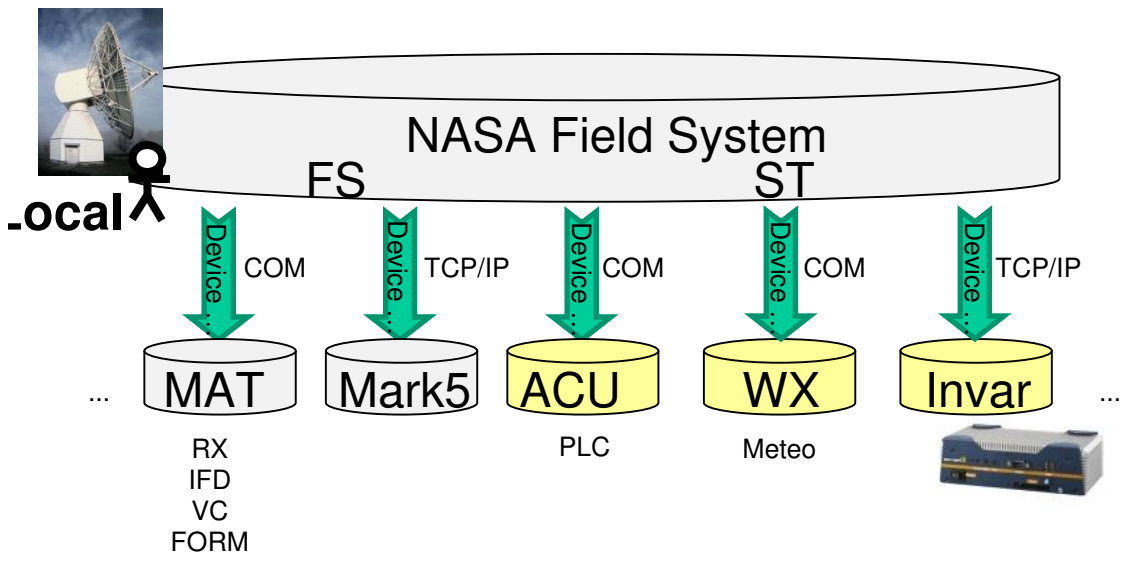


Global situation and the future

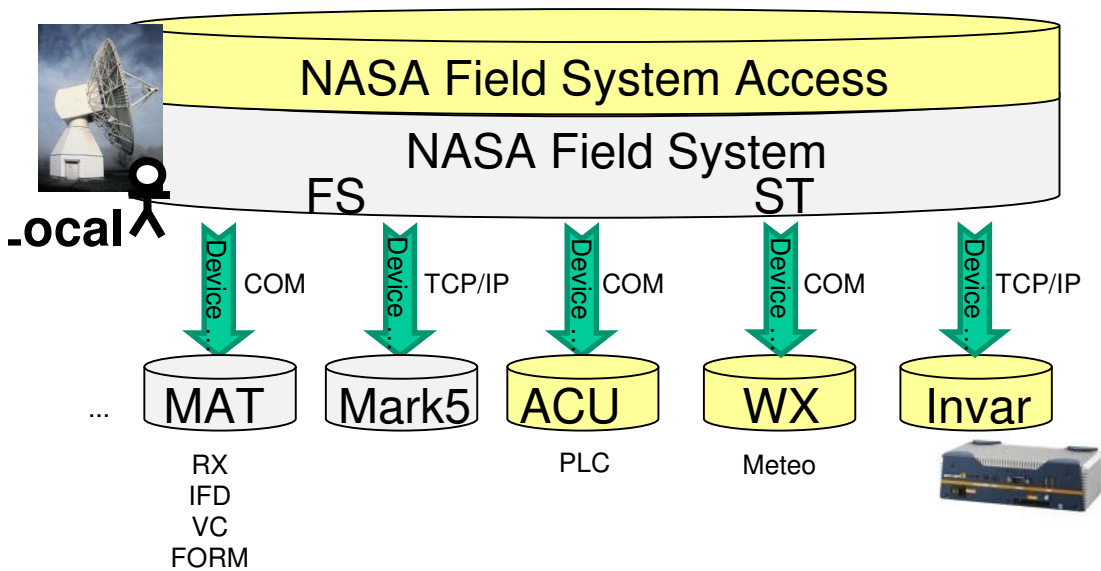
New observation strategies

Realization solutions

Realization solutions



Realization solutions



Realization solutions

Virtual Network Computing

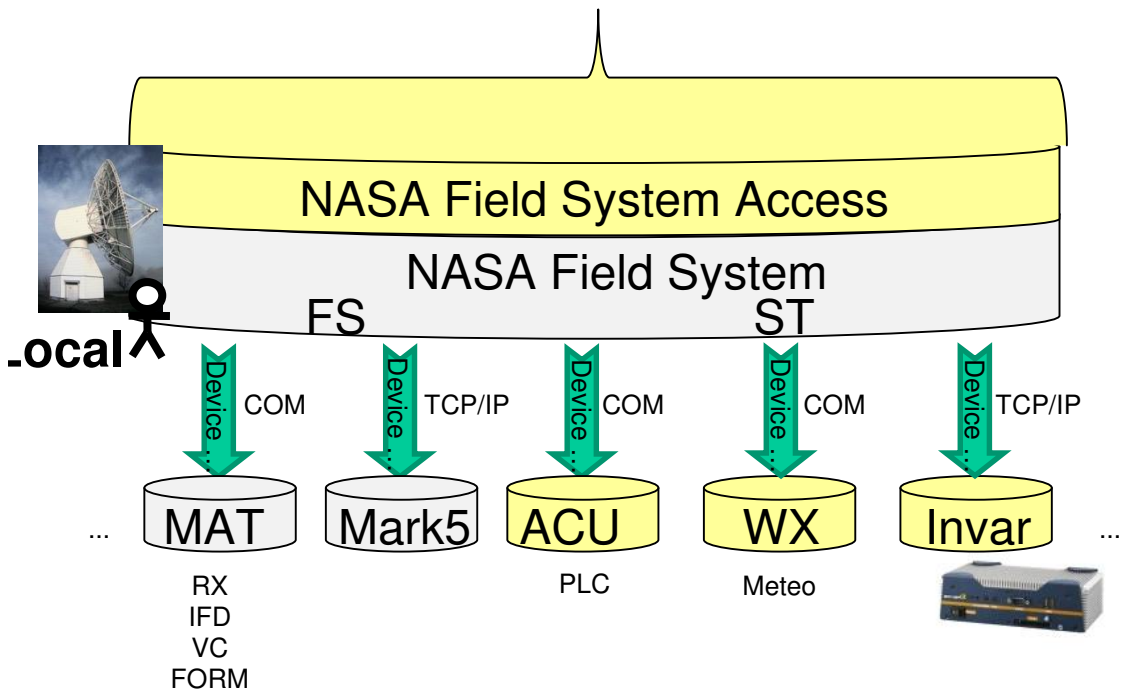
Secure Shell

Java & Web pages

Socket Connections

Remote Procedure Calls

Mobile Phone Apps



Realization solutions

Virtual Network Computing

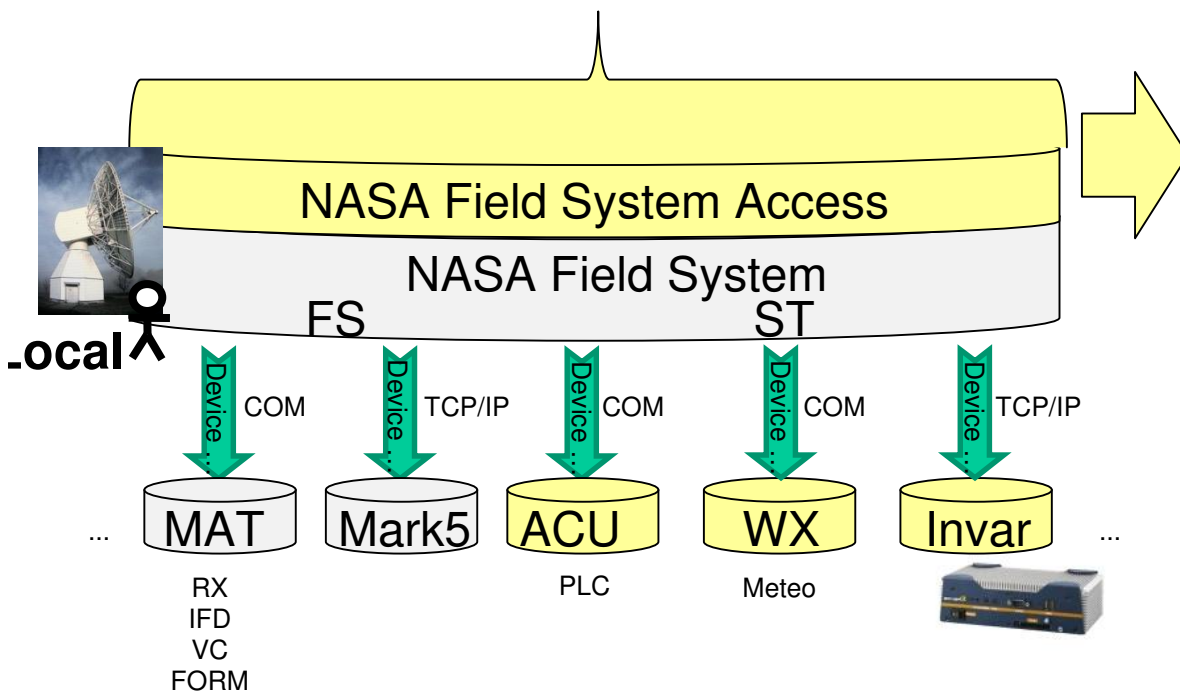
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Mobile Phone Apps



Attributes:

- They solve the tasks and requirements
- Local know how
- Proprietary and individual
- Missing safety and security issues
- Partial solutions
- Open response times
- Missing connection and quality control

Global situation and the future

New observation strategies

Realization solutions

What is needed

Realization solutions

Virtual Network Computing

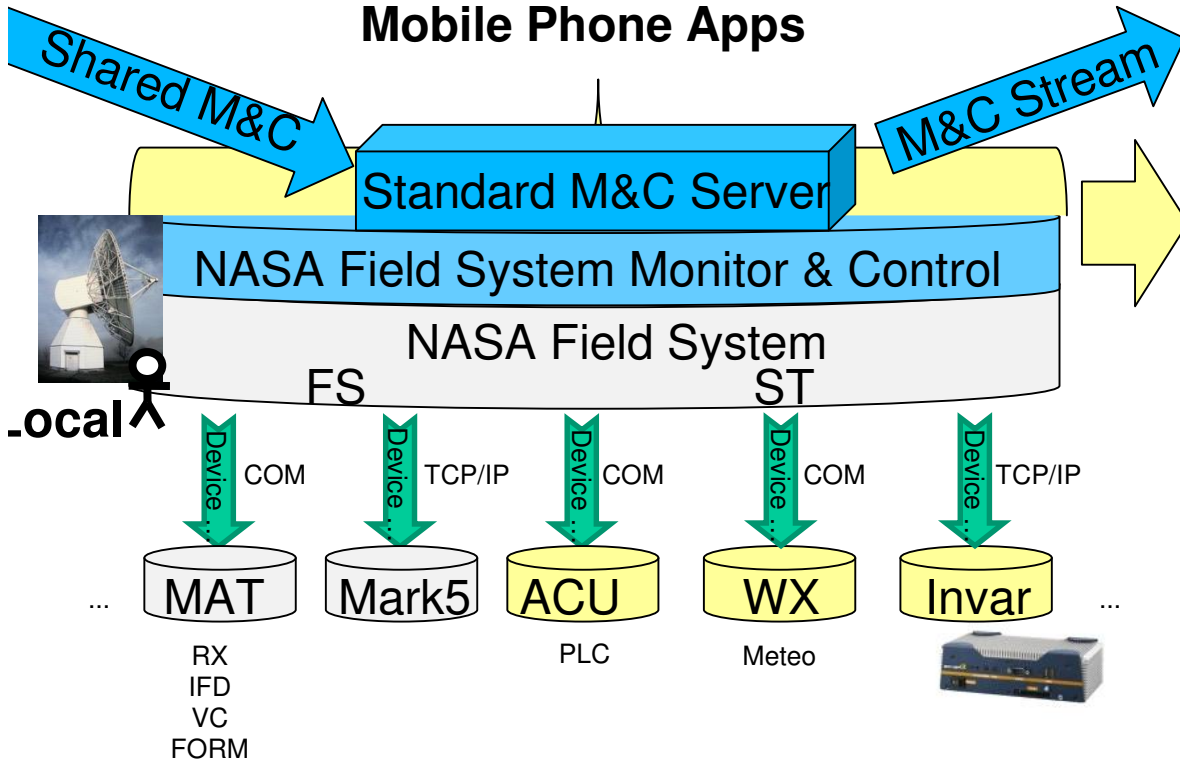
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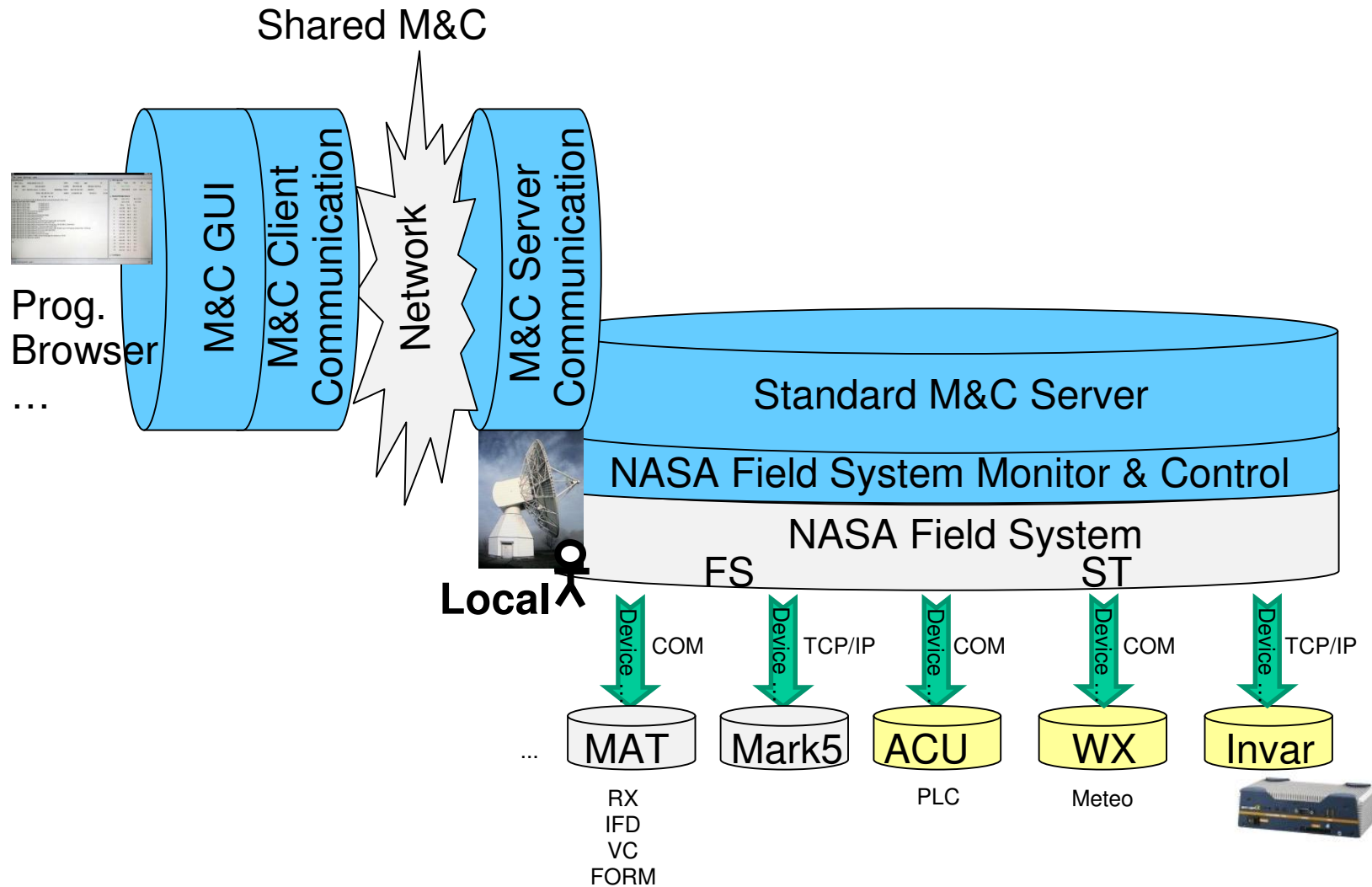
Mobile Phone Apps



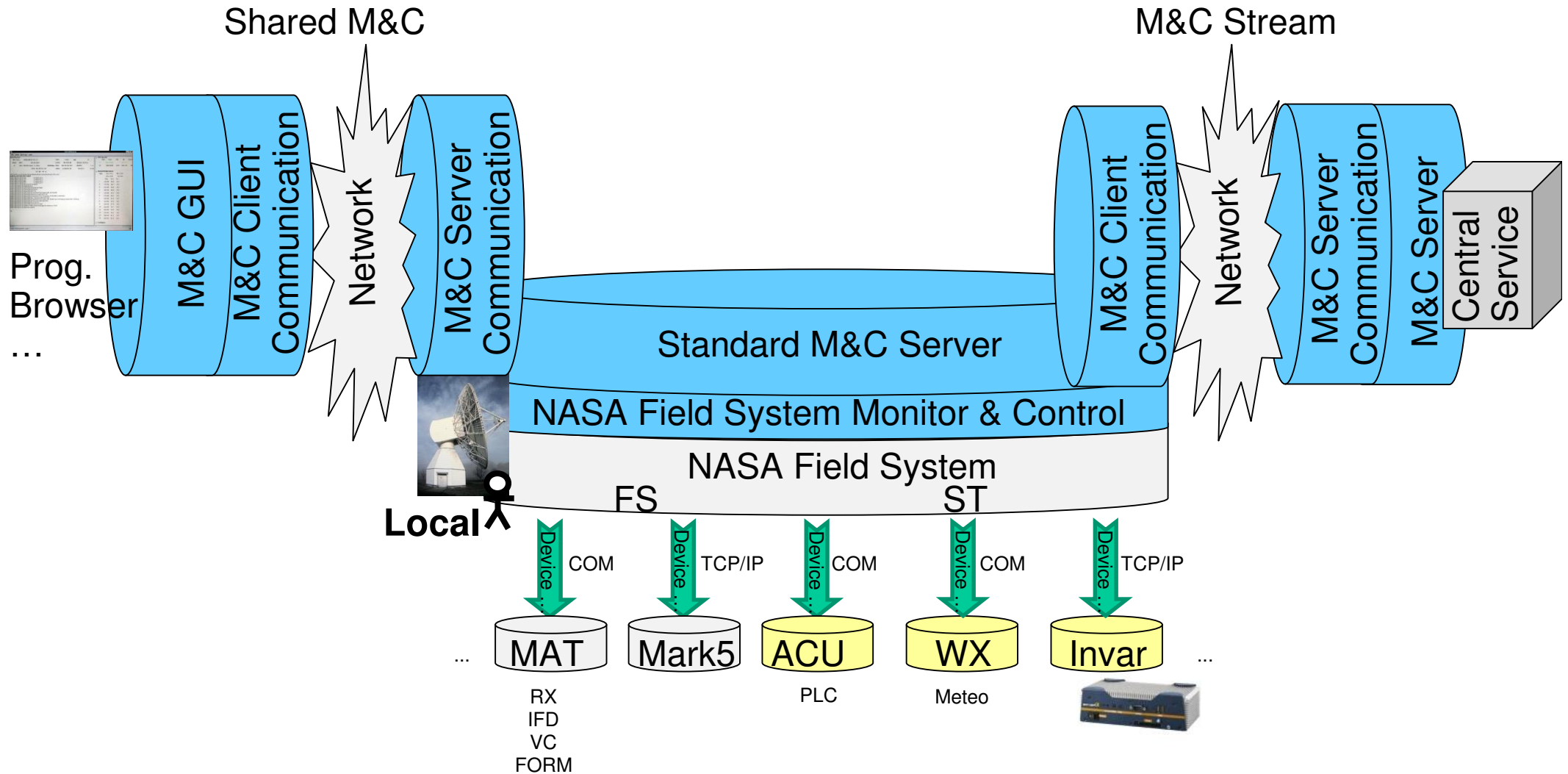
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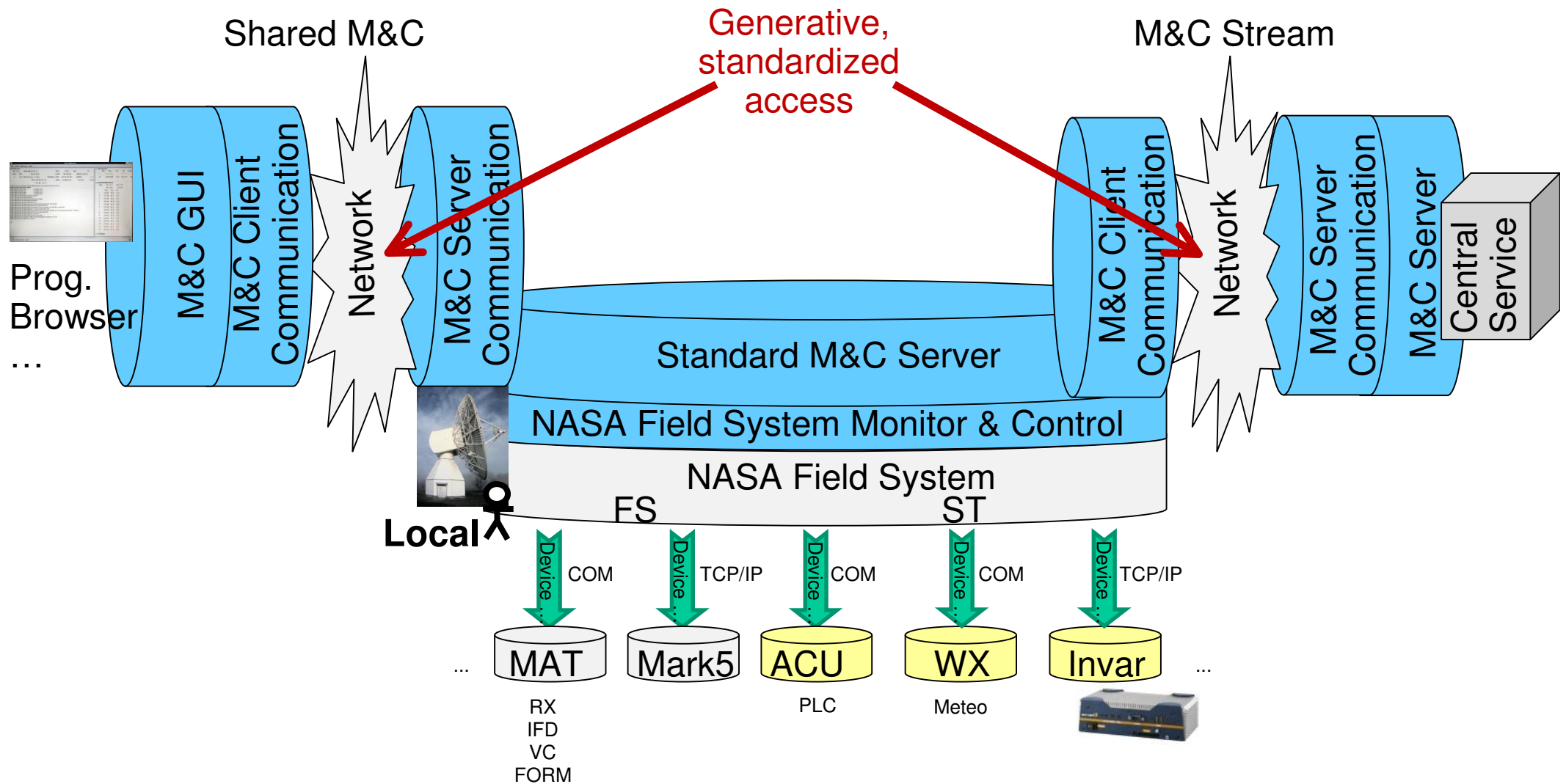
Realization solutions



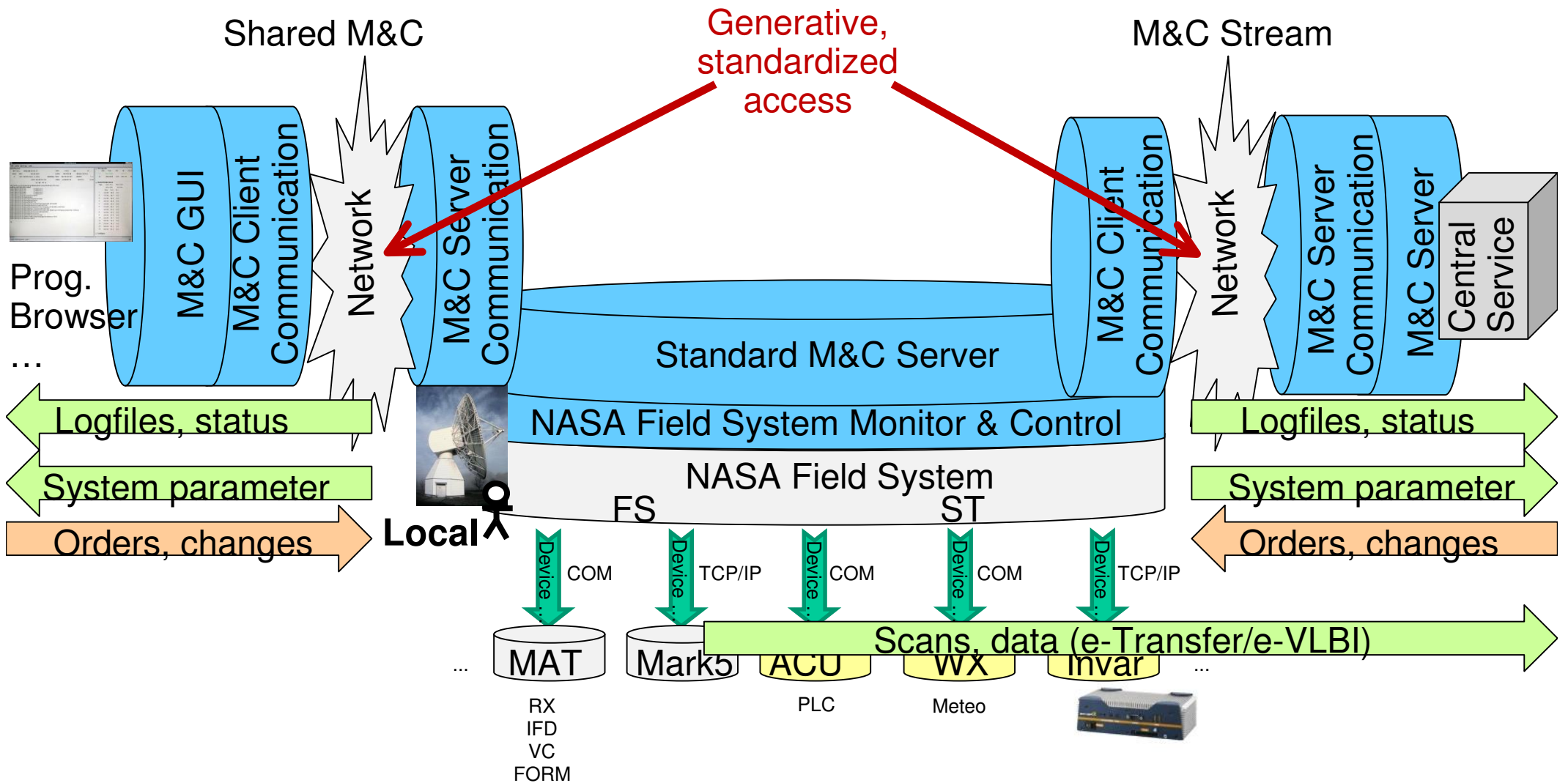
Realization solutions



Realization solutions

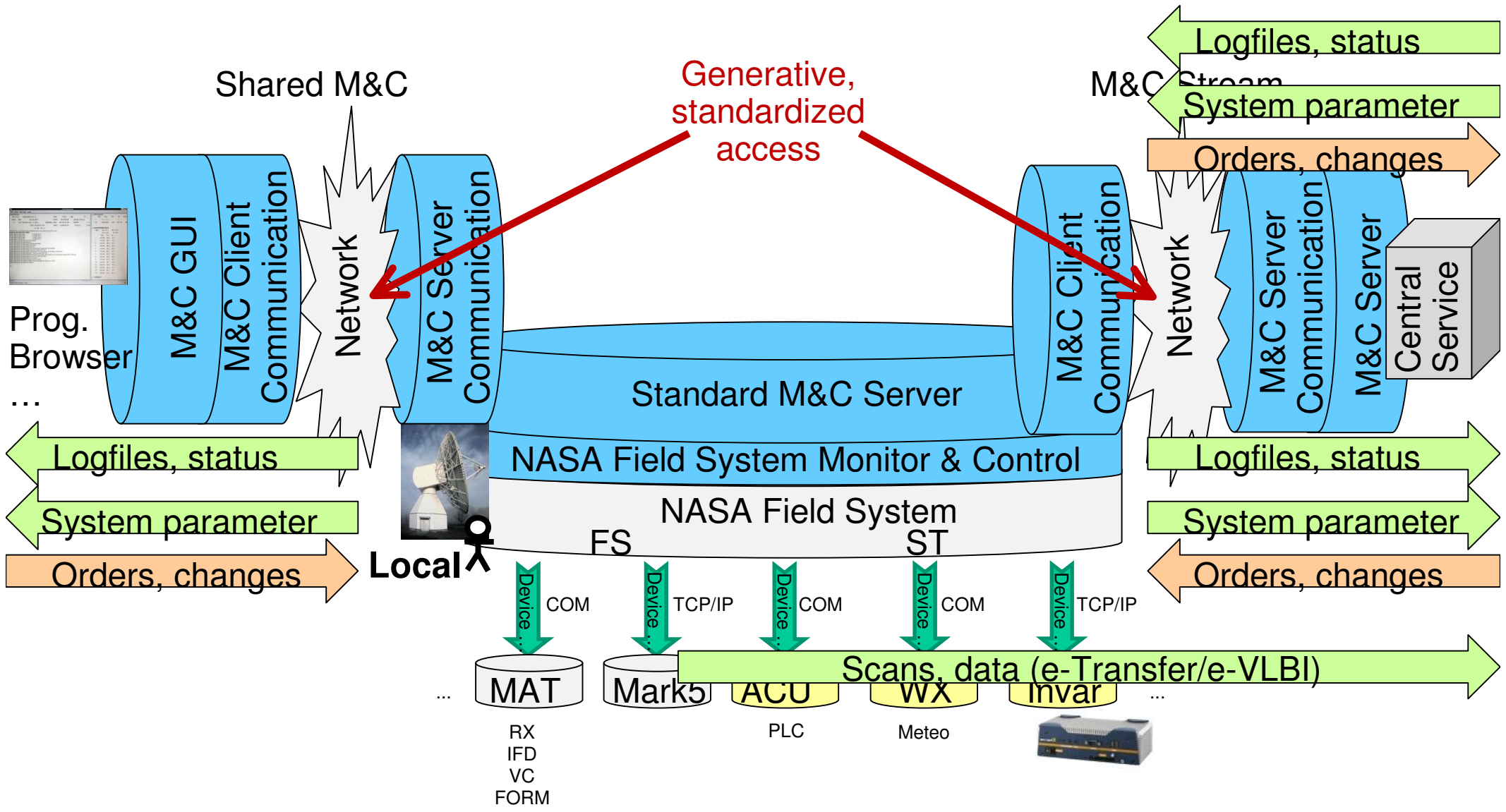


Realization solutions

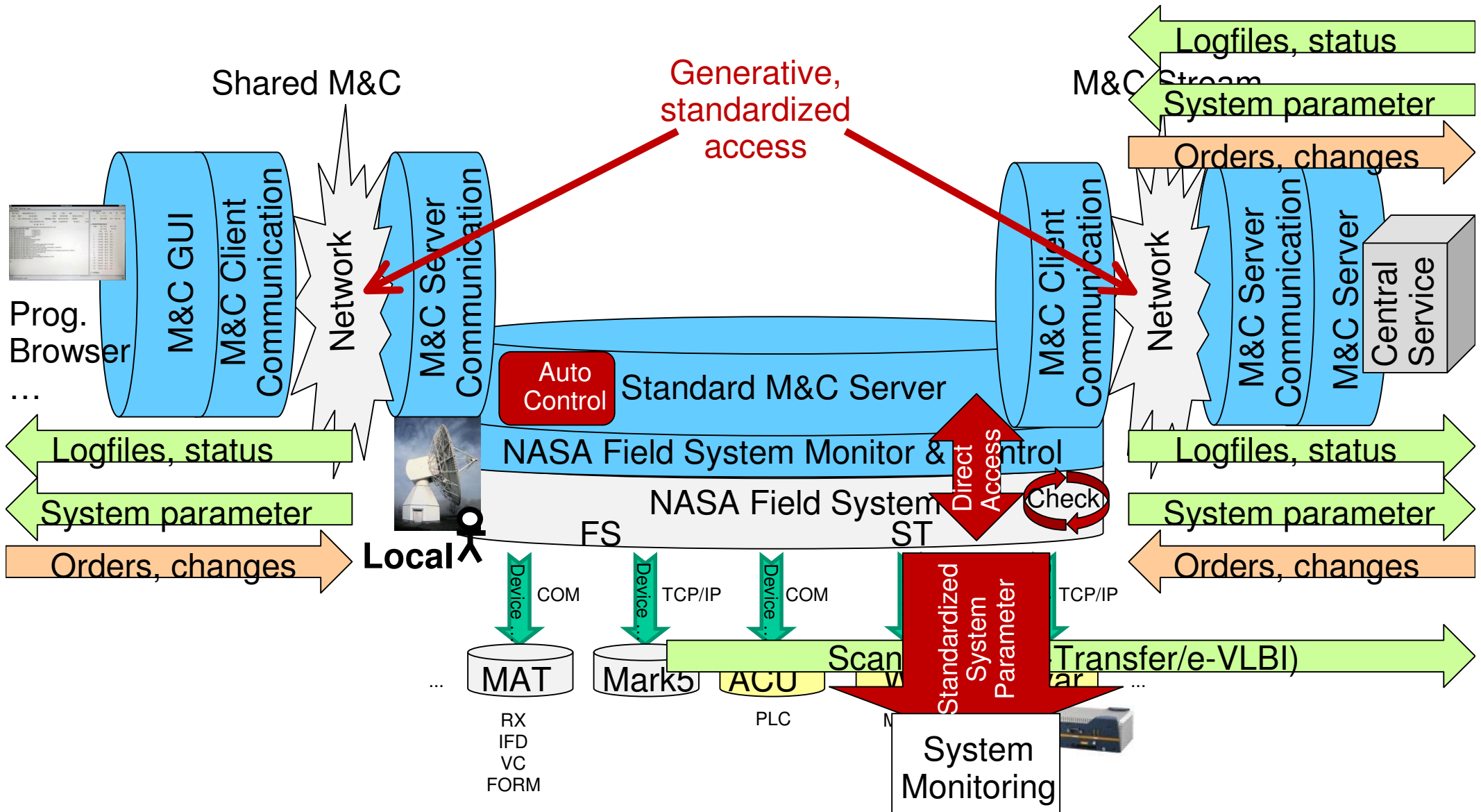


Generative, standardized access

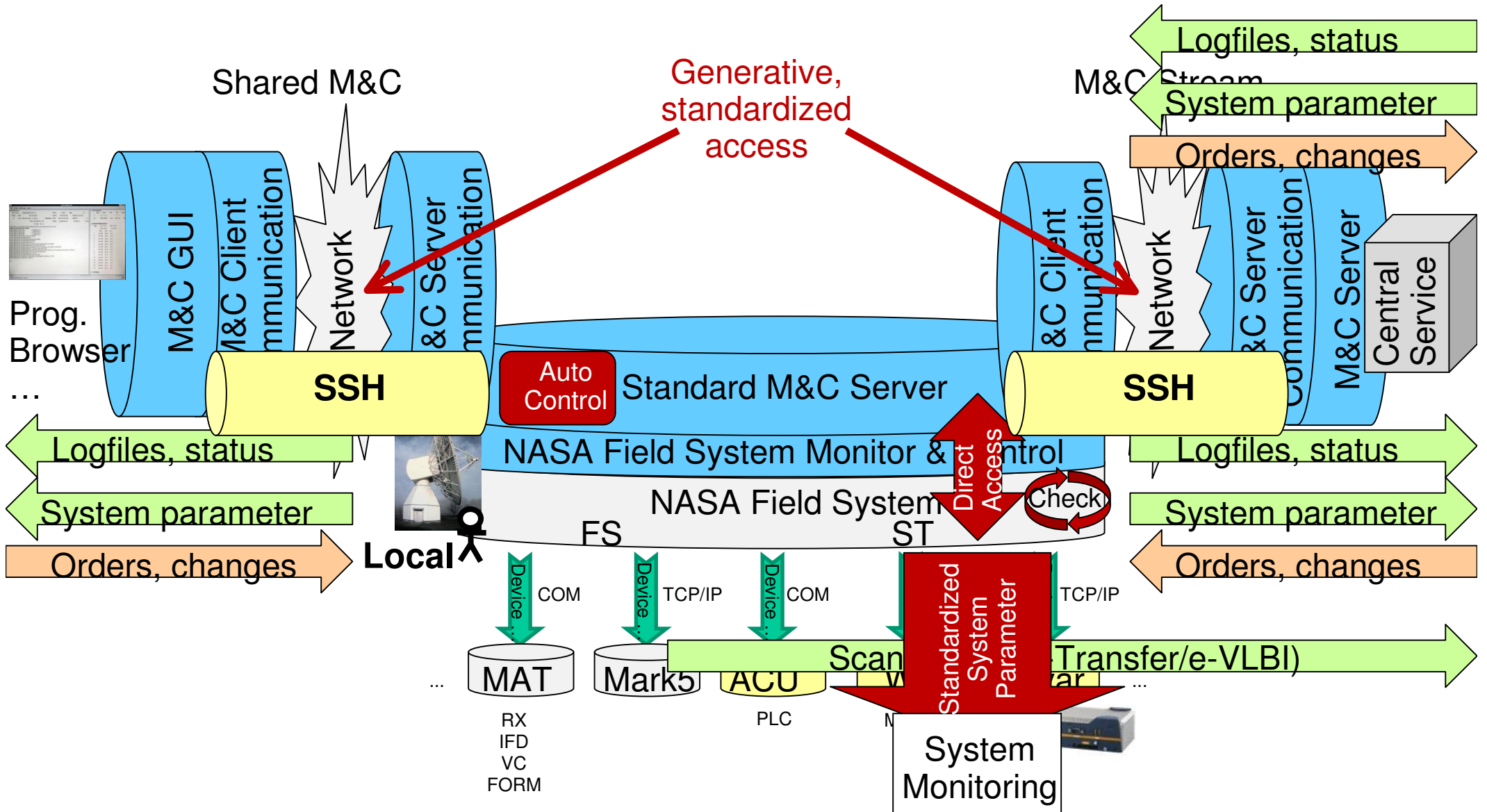
Realization solutions



Realization solutions

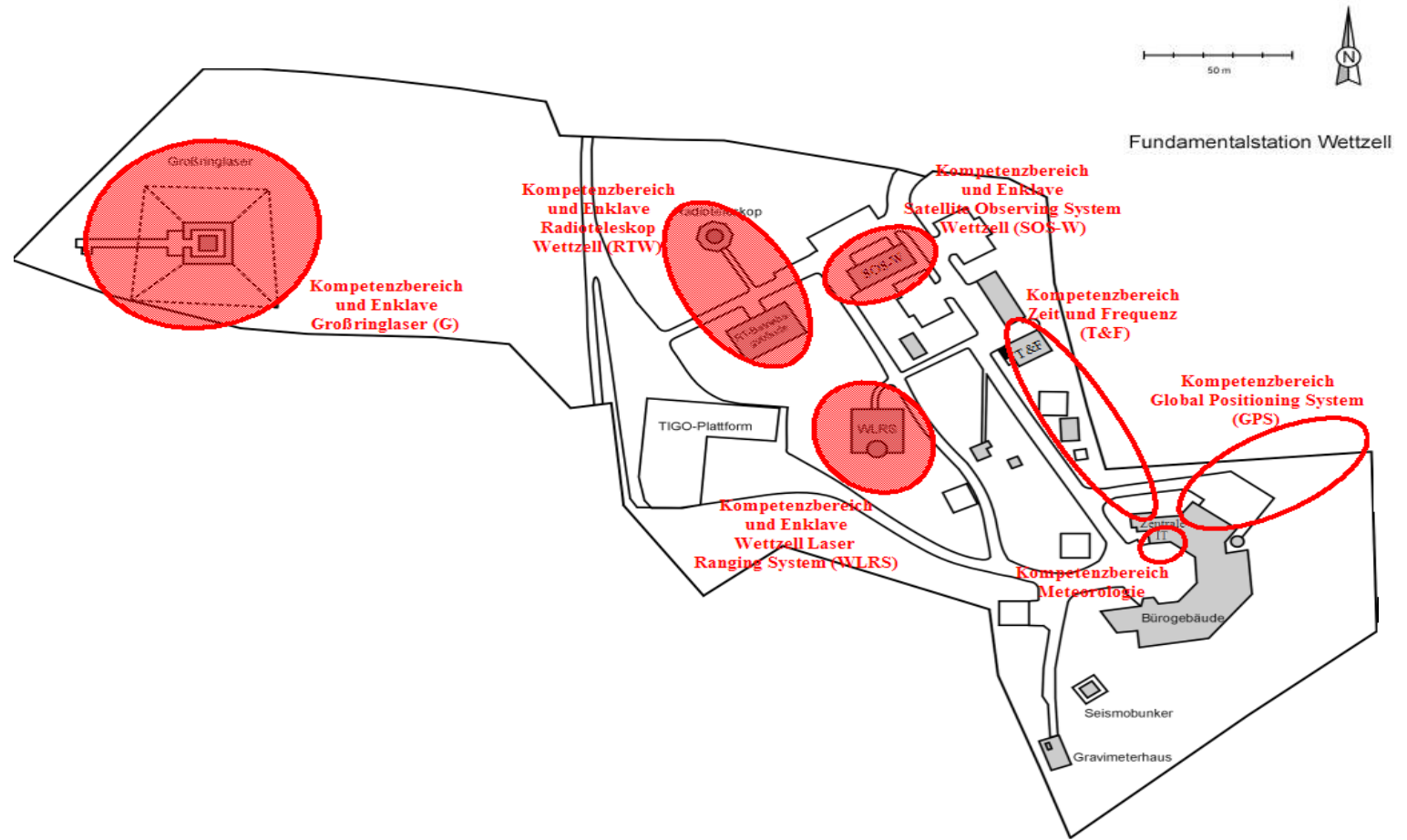


Realization solutions



On site security

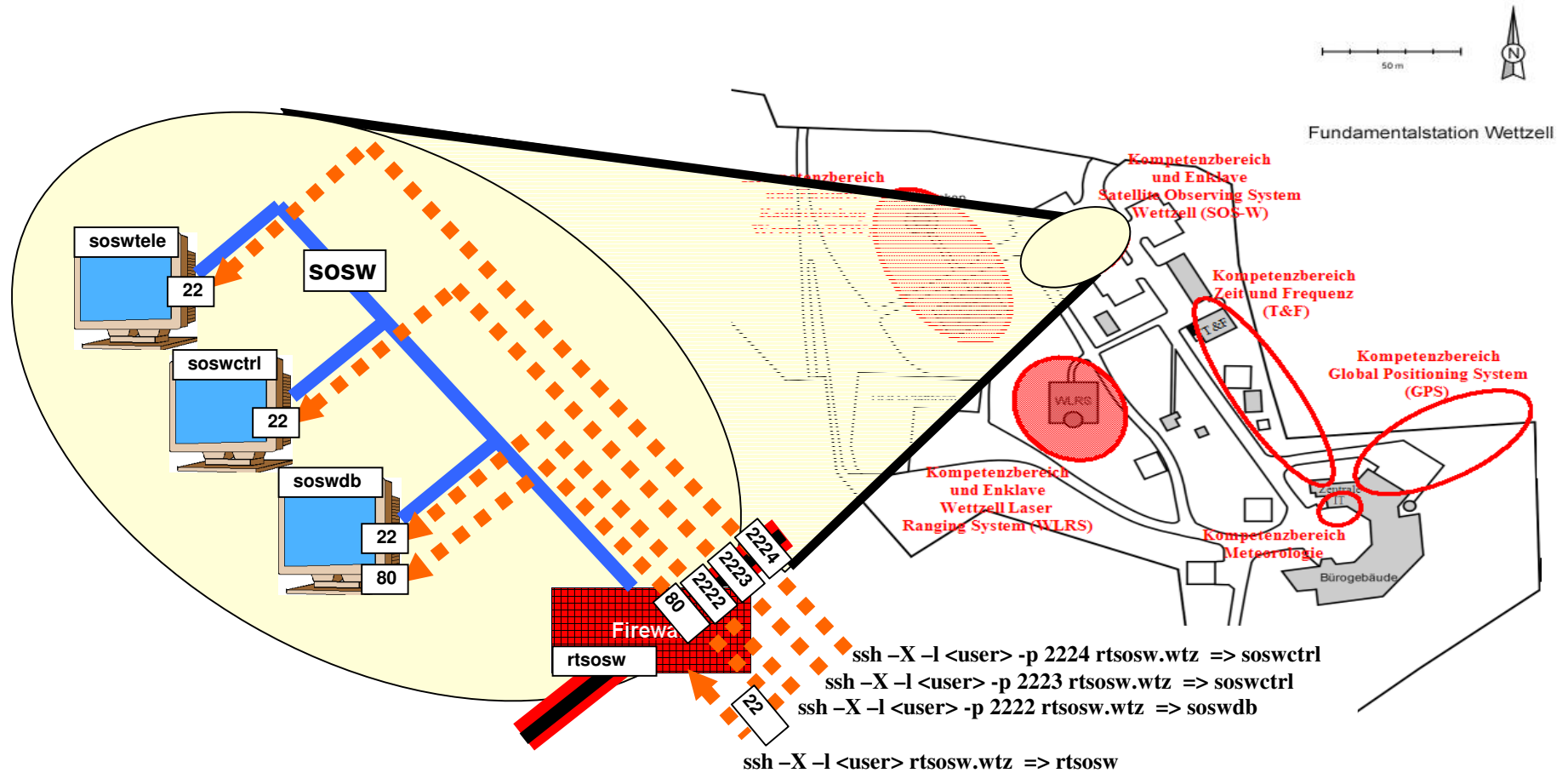
System and observatory enclaves



Ursprünglicher Stationsplan von Dr. Klügel, FS Wettzell

On site security

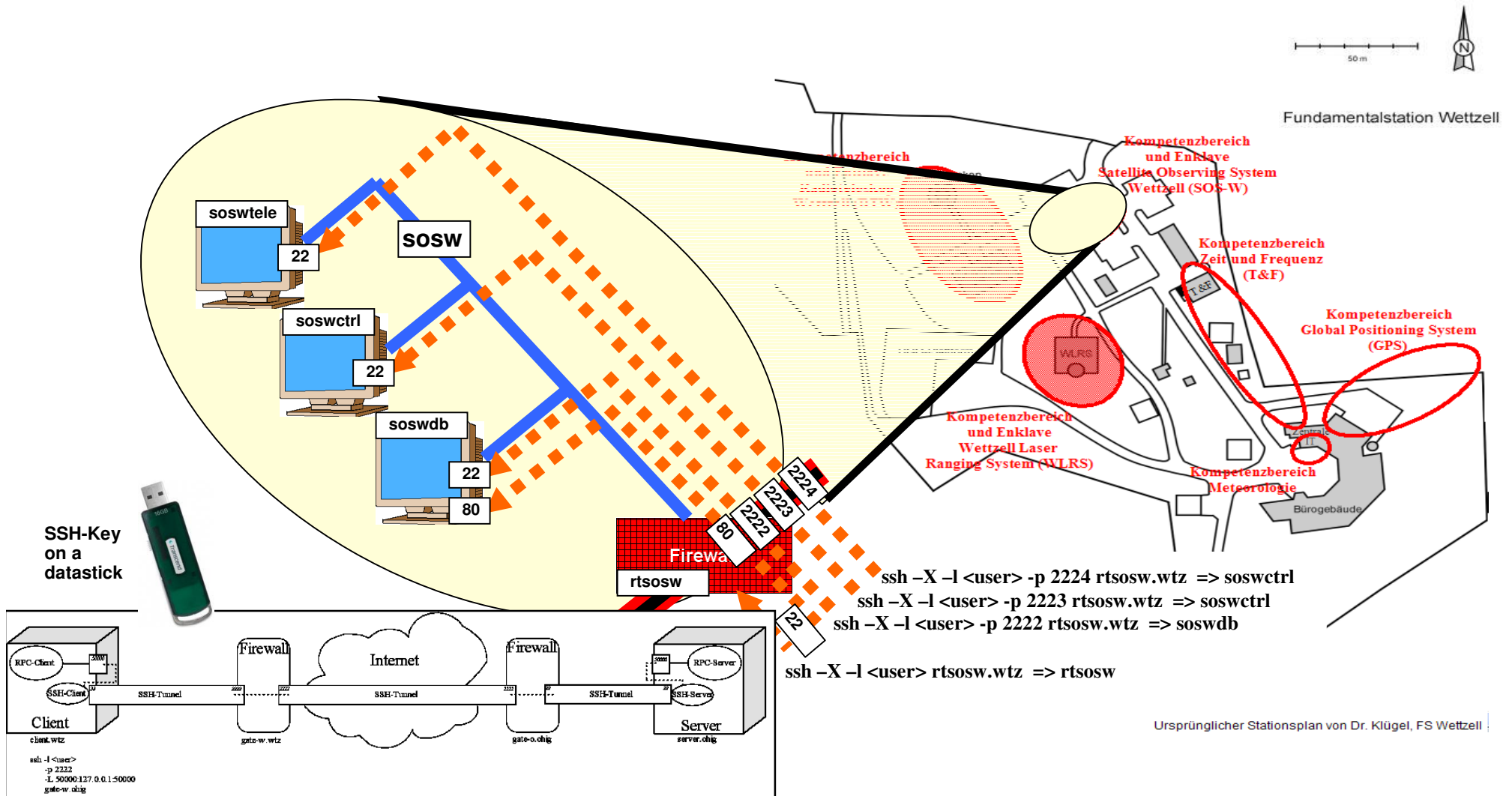
System and observatory enclaves



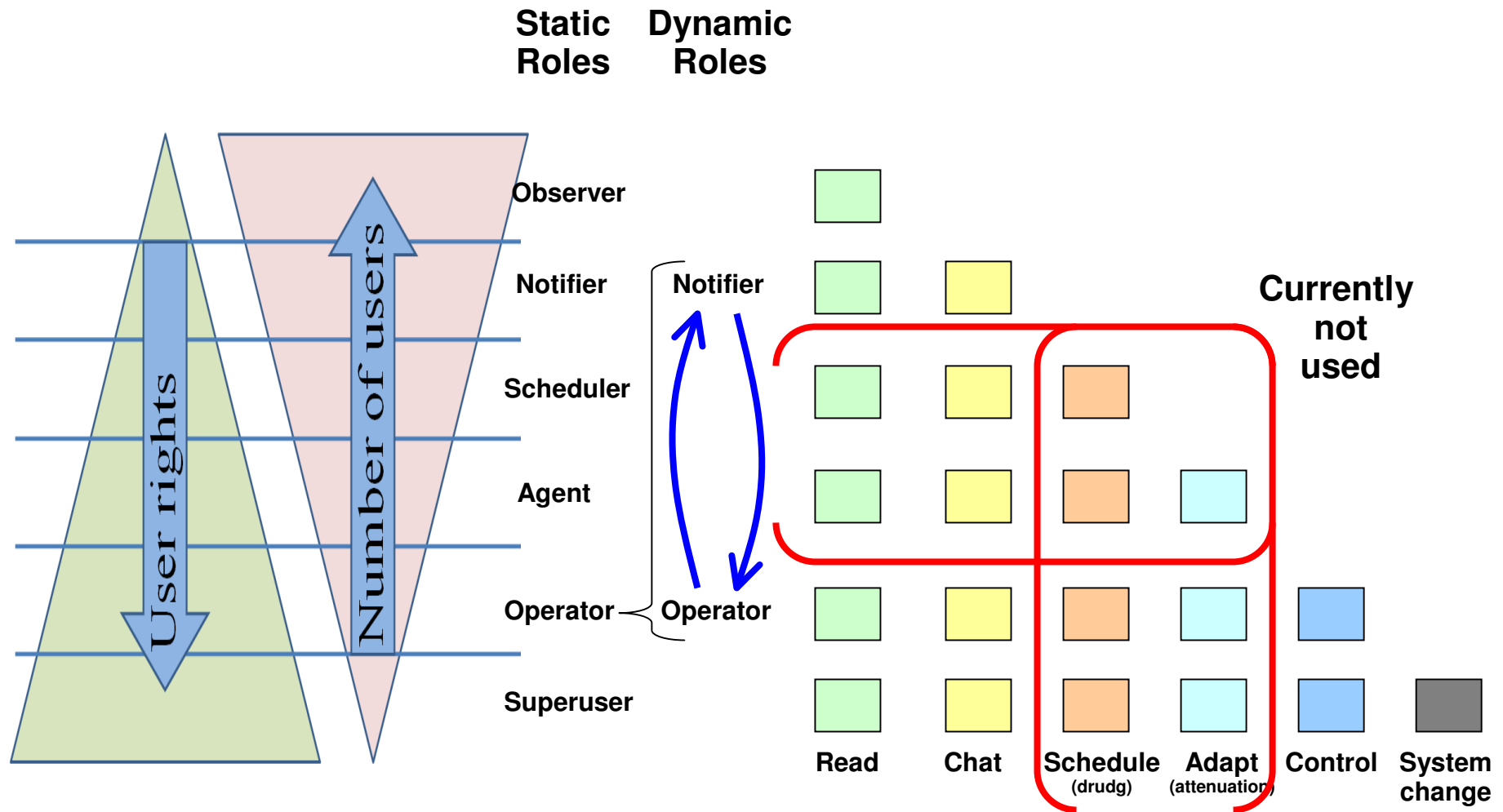
Ursprünglicher Stationsplan von Dr. Klügel, FS Wettzell

On site security

System and observatory enclaves



User access roles and access rights



Complete remote and secure access

Logging and Operator Input

```

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
2010.023.08:10:13.49/rx/1E(20K),on,a,on,on,on,off,locked,17.02
2010.023.08:11:31.49/rx/1E(20K),on,a,on,on,on,off,locked,16.89
2010.023.08:12:52.49/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
    
```

70K 20K

20K

Graphic and Classic main interface

MSCCapacity
A BKG-0069/ 3143.859 G
98% free 2% used
Check : 27h17m Next : 08:28:19

System Temperature
100
90
80
70
60
50
40
30
20
10
0

Configure

RPC-Clients RPC-Server SSH Hot-Key Table

Command	Hot Key		Reload
/usr2/fs/bin/monpcal	CONTROL + SHIFT + V	<input type="checkbox"/>	Save
/usr/bin/xterm -e /usr2/fs/bin/pfmed	CONTROL + SHIFT + p	<input type="checkbox"/>	Append
/usr/bin/xterm	control + shift + x	<input type="checkbox"/>	Delete
/usr2/prog/econtrol/bin/econtrold	control+shift+e	<input type="checkbox"/>	
/usr/bin/nedit	control+shift+n	<input type="checkbox"/>	

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

Remote program startup

_logbook

Logging and Operator Input

```

2010.023.08:34:20.00#antcn#Received message for antenna: STOP
2010.023.08:34:28.09/antenna/ACK
2010.023.08:36:48.20#antcn#Received message for antenna: STOP
2010.023.08:36:49.29/antenna/ACK
2010.023.08:37:05.67,i
2010.023.08:37:05.67/F: 3/5@2010.024.06:45:50.00 sv=/usr2/oper/startevnrec.sh k10024 wz &
2010.023.08:37:05.67/F: 369@2010.024.06:49:50.00 schedule=k1002/wz_#1
2010.023.08:37:05.67/Q: 6@2010.024.06:50:50.00 slerlinka
2010.023.08:37:05.67/Q: 14@2010.024.08:34:27.00 safepos
2010.023.08:37:05.67/F: 375@2010.025.06:15:50.00 sv=/usr2/oper/startevnrec.sh k10025 wz &
2010.023.08:37:05.67/F: 369@2010.025.06:19:50.00 schedule=k10025wz_#1
2010.023.08:37:05.67/Q: 6@2010.025.06:20:50.00 slerlinka
2010.023.08:37:05.67/Q: 14@2010.025.08:03:46.00 safepos
2010.023.08:38:05.03,i
2010.023.08:38:05.03/F: 375@2010.024.06:45:50.00 sv=/usr2/oper/startevnrec.sh k10024 wz &
2010.023.08:38:05.03/F: 369@2010.024.06:49:50.00 schedule=k10024wz_#1
2010.023.08:38:05.03/Q: 6@2010.024.06:50:50.00 startmka
2010.023.08:38:05.03/Q: 14@2010.024.08:34:27.00 safepos
2010.023.08:38:05.03/F: 375@2010.025.06:15:50.00 sv=/usr2/oper/startevnrec.sh k10025 wz &
2010.023.08:38:05.03/F: 369@2010.025.06:19:50.00 schedule=k10025wz_#1
2010.023.08:38:05.03/Q: 6@2010.025.06:20:50.00 startmka
2010.023.08:38:05.03/Q: 14@2010.025.08:03:46.00 safepos
    
```

Chat

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

Complete remote access

Configure

RPC-Clients RPC-Server SSH Hot-Key Table

Station Network Access Settings

Enable

Site Wettzell

Port 22000

User Name vlbi

Port Binding 22222:193.174.166.80:22

Additional Cmd

Station IP gate1-w.wetzell.ifag.de

DSA file /home/rtwadm/econtrol/RT...

Pass Phrase

Password

Timeout-Settings 20 [s]

System Access Settings

Enable

Name rtw

Port 22222

User Name oper

Port Binding 50225:127.0.0.1:50225
50226:127.0.0.1:50226

Additional Cmd -2

IP Address localhost

DSA File

Pass Phrase

Password

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

SSH

Global situation and the future

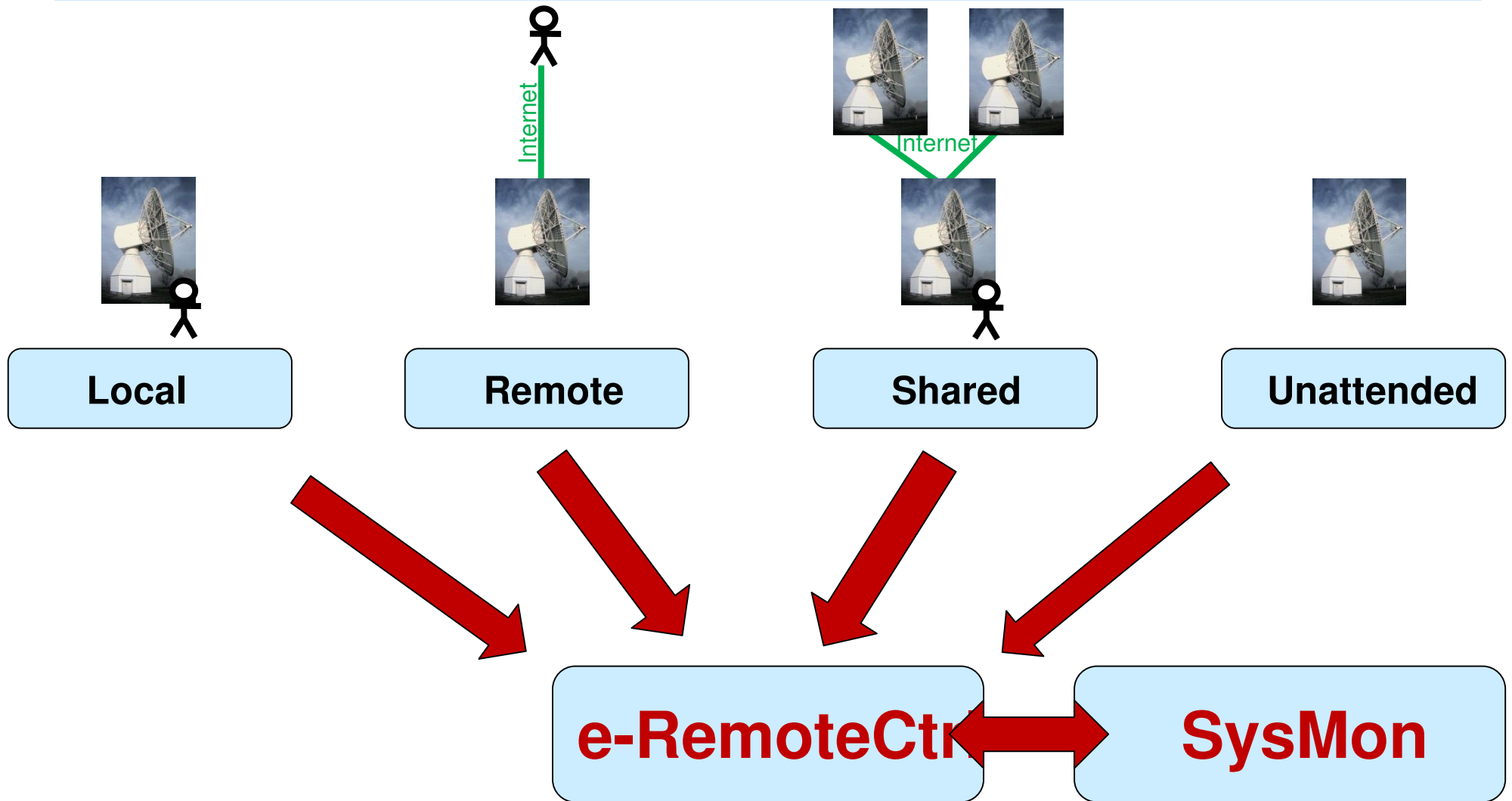
New observation strategies

Realization solutions

What is needed

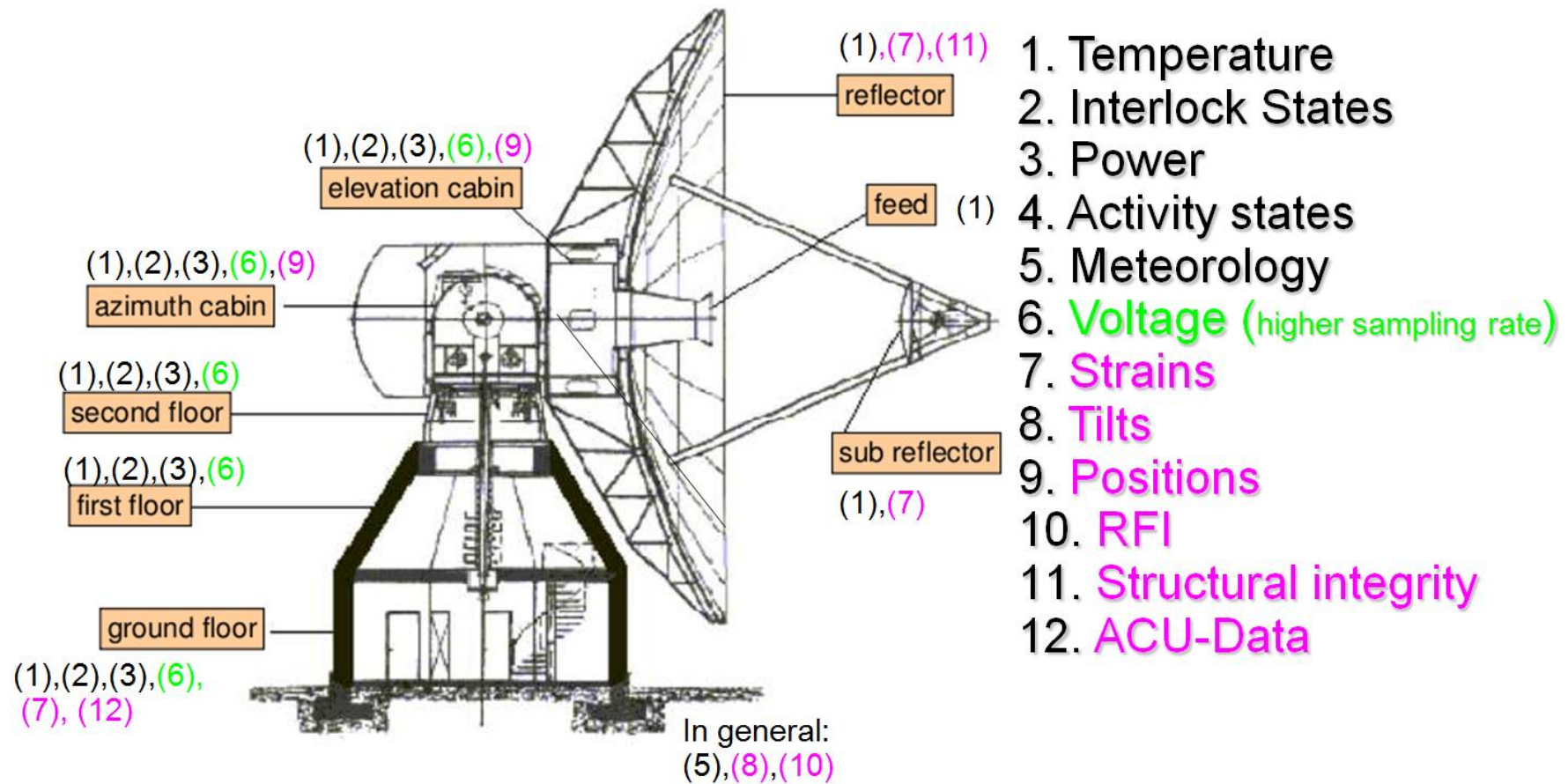
Additional system monitoring

New observation strategies



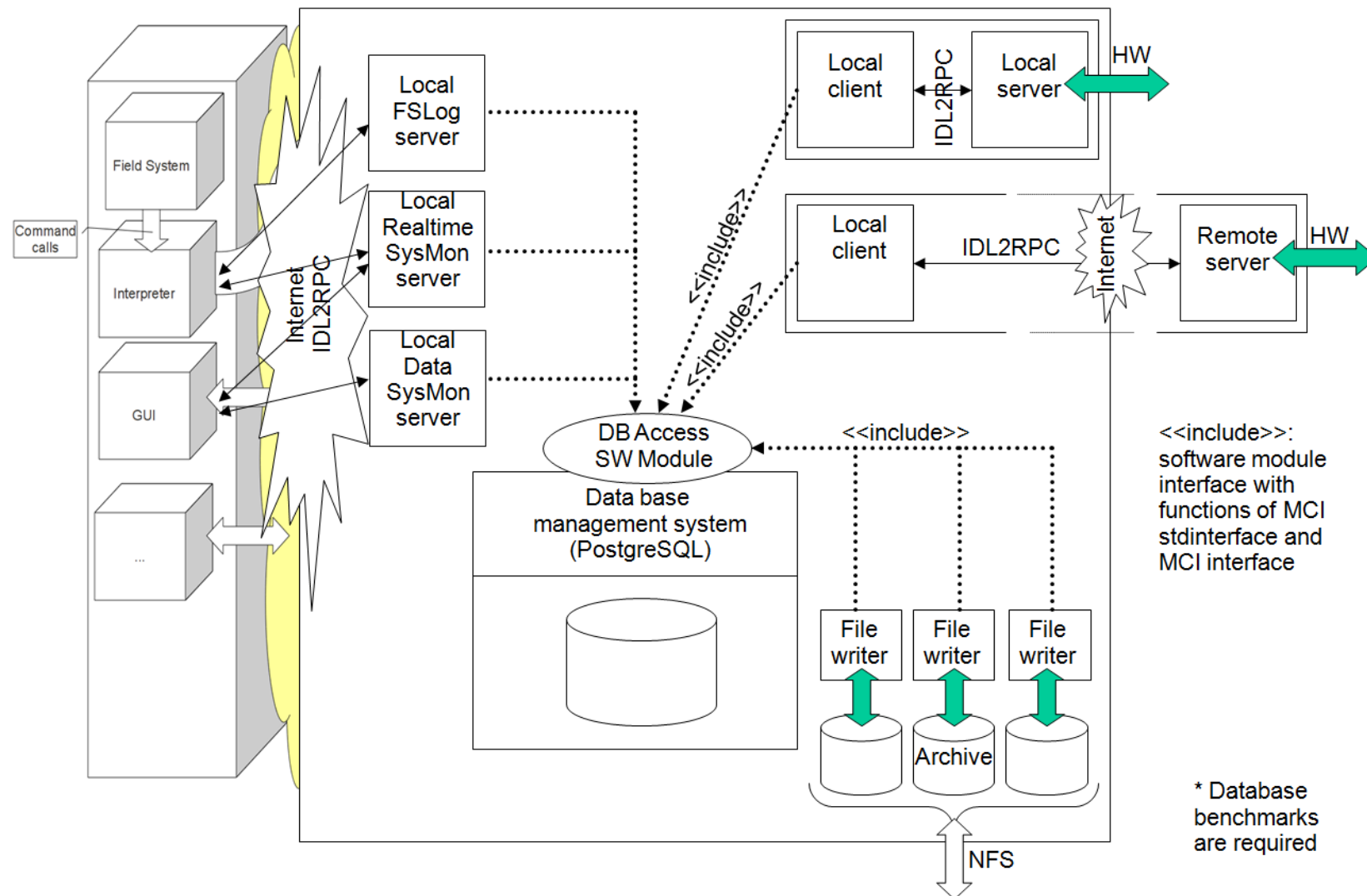
System Monitoring: SysMon

MCI- Monitoring Nodes



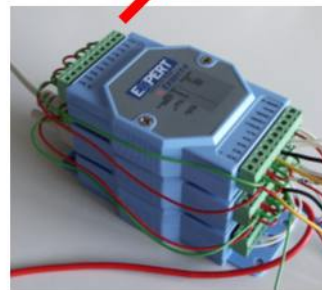
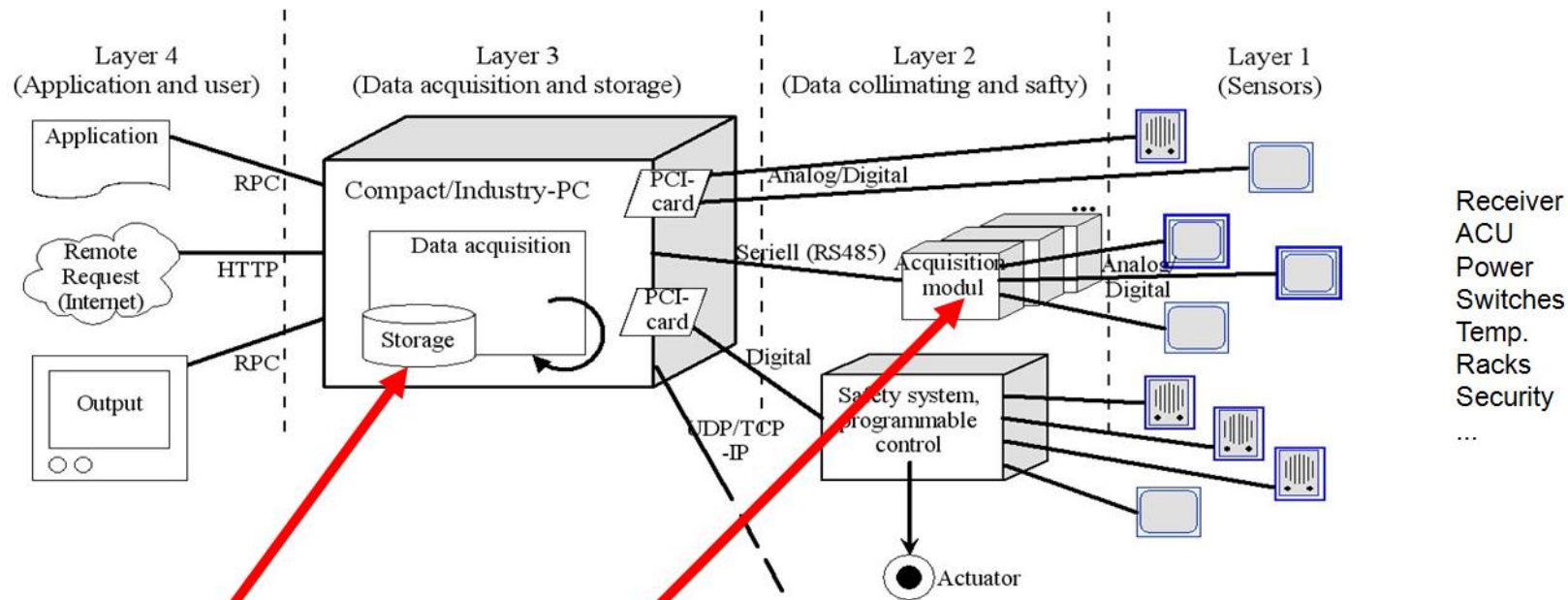
System Monitoring: SysMon

MCI- Internal Architecture of the Monitoring Nodes



System Monitoring: SysMon

MCI- Monitoring Node Communication



- Standard equipment on standard, robust architectures
- Modular, multi-layer system
- Open for several devices and sensors
- Passive system for monitoring without actuators
- Linux-operating system (maybe minimal installation)
- Open Source
- C/C++
- Communication internal with idl2rpc-generator
- Vendor independence

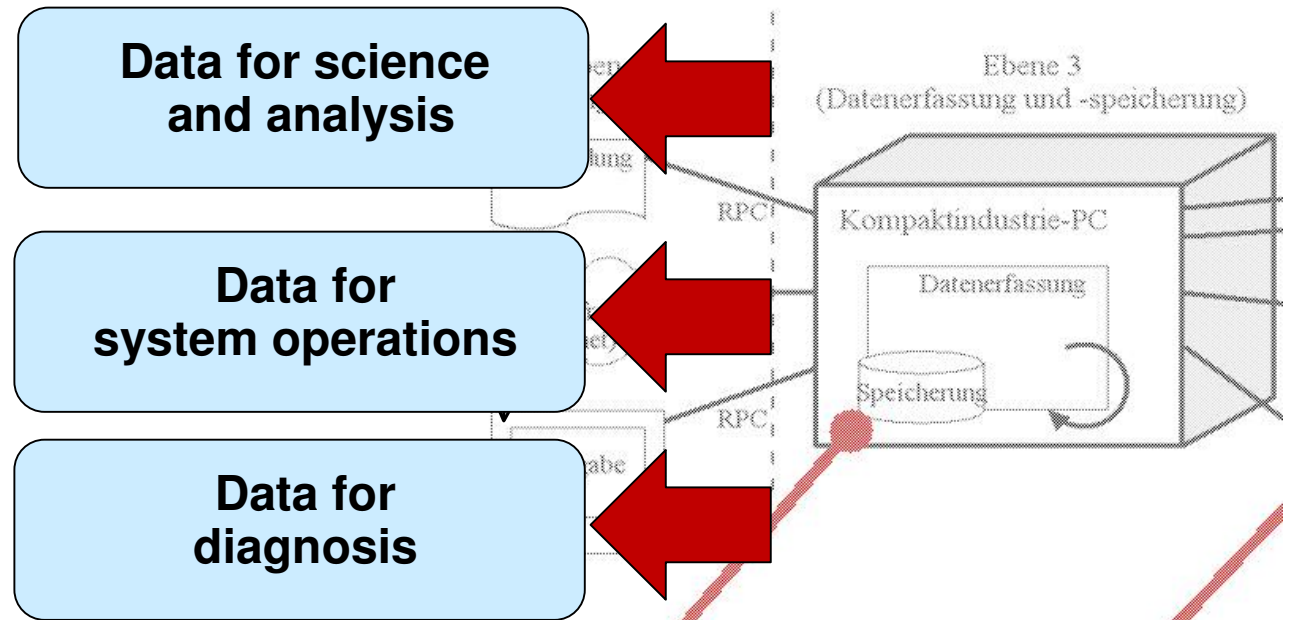
System Monitoring: SysMon

Local safety for people and systems in combination with reliability in operations

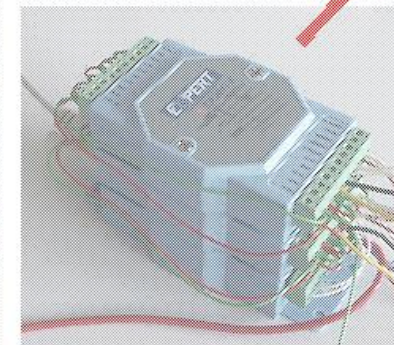
Meteo, WVR, Clock offsets, ...
=> low sampling rates
=> as scheduled

Power supply, wind uploads, emergency stops, rack temp., ...
=> medium sampling rates
=> permanently

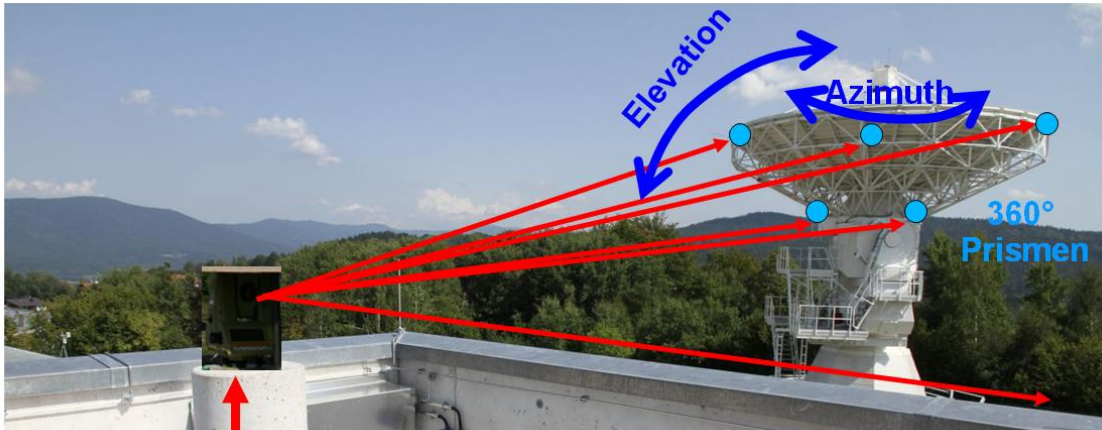
Servo currents, contouring errors, ...
=> high sampling rates
=> on demand



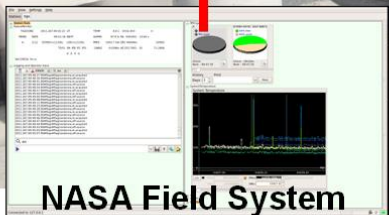
See also:
IVS VLBI2010 Monitoring and Control Interface Collaboration Group
=> Co-operations?



System Monitoring: SysMon

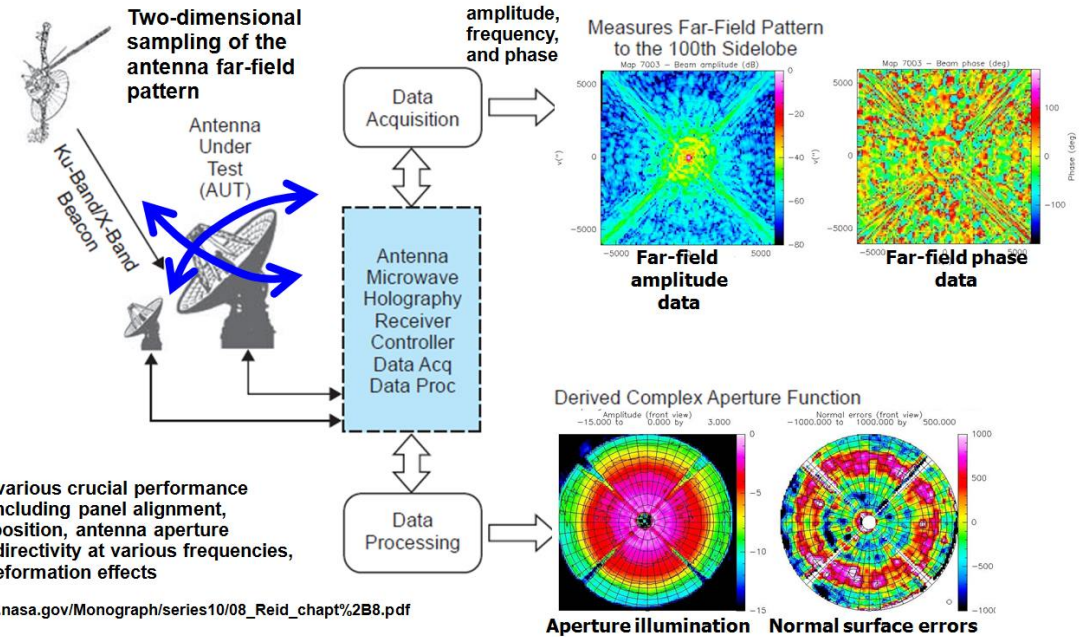


Commanding



NASA Field System (e-RemoteCtrl + SysMon)

Microwave Antenna Holography



Characterize various crucial performance parameters, including panel alignment, subreflector position, antenna aperture illumination, directivity at various frequencies, and gravity deformation effects

[tp://descanso.jpl.nasa.gov/Monograph/series10/08_Reid_chapt%2B8.pdf](http://descanso.jpl.nasa.gov/Monograph/series10/08_Reid_chapt%2B8.pdf)



Global situation and the future

New observation strategies

Realization solutions

What is needed

Additional system monitoring

Standardization

IVS Monitoring and Control Interface Collaboration Group

<http://groups.google.com/group/vlbi2010-mci-collaboration/>

-  john.m.gip...@nasa.gov
Mitglied - beigetreten: 28 Okt. 2009
-  Chopo...@nasa.gov
Mitglied - beigetreten: 28 Okt. 2009
-  mpoir...@haystack.mit.edu
Mitglied - beigetreten: 28 Okt. 2009
-  Ed.Himw...@nasa.gov
Mitglied - beigetreten: 28 Okt. 2009
-  arthur
Mitglied - beigetreten: 28 Okt. 2009
-  Bill Petrachenko
Mitglied - beigetreten: 15 Nov. 2009
-  Brian Corey
Mitglied - beigetreten: 29 Okt. 2009
-  Chris Beaudoin
Mitglied - beigetreten: 28 Okt. 2009
-  Chuck Kodak
Mitglied - beigetreten: 15 Nov. 2009
-  Dirk Behrend
Mitglied - beigetreten: 3 Nov. 2009

-  ettl.martin
Mitglied - beigetreten: 11 Mrz. 2010
-  Irv
Mitglied - beigetreten: 15 Jan. 2010
-  IVSCC
Gruppeneigentümer - beigetreten: 28 Okt. 2009
-  Mark
Mitglied - beigetreten: 29 Okt. 2009
-  Matthias
Mitglied - beigetreten: 11 Mrz. 2010
-  Mike Poirier
Mitglied - beigetreten: 27 Jan. 2010
-  neidhardtwtz
Mitglied - beigetreten: 16 Jan. 2010
-  Smythe
Mitglied - beigetreten: 28 Okt. 2009
-  Tom
Mitglied - beigetreten: 28 Okt. 2009

 **Core Group having several face-to-face meetings**

Standardization

Interfaces
Protocols
Workflows
Data & Formats
SW/HW Techniques
Strategies
Safety & Security

...

Access points,
available functionalities

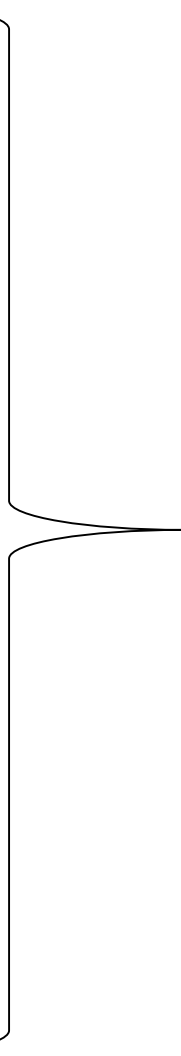
Communication rules
and styles

Communication and
operation schedule

Communication data and
storage descriptions

Communication software and
hardware in a
development process
(New) strategies to operate
sites using communication

Authenticity and reliability



Standardization
&
synergies over
services and
system borders

Global situation and the future

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Realization solutions

What is needed

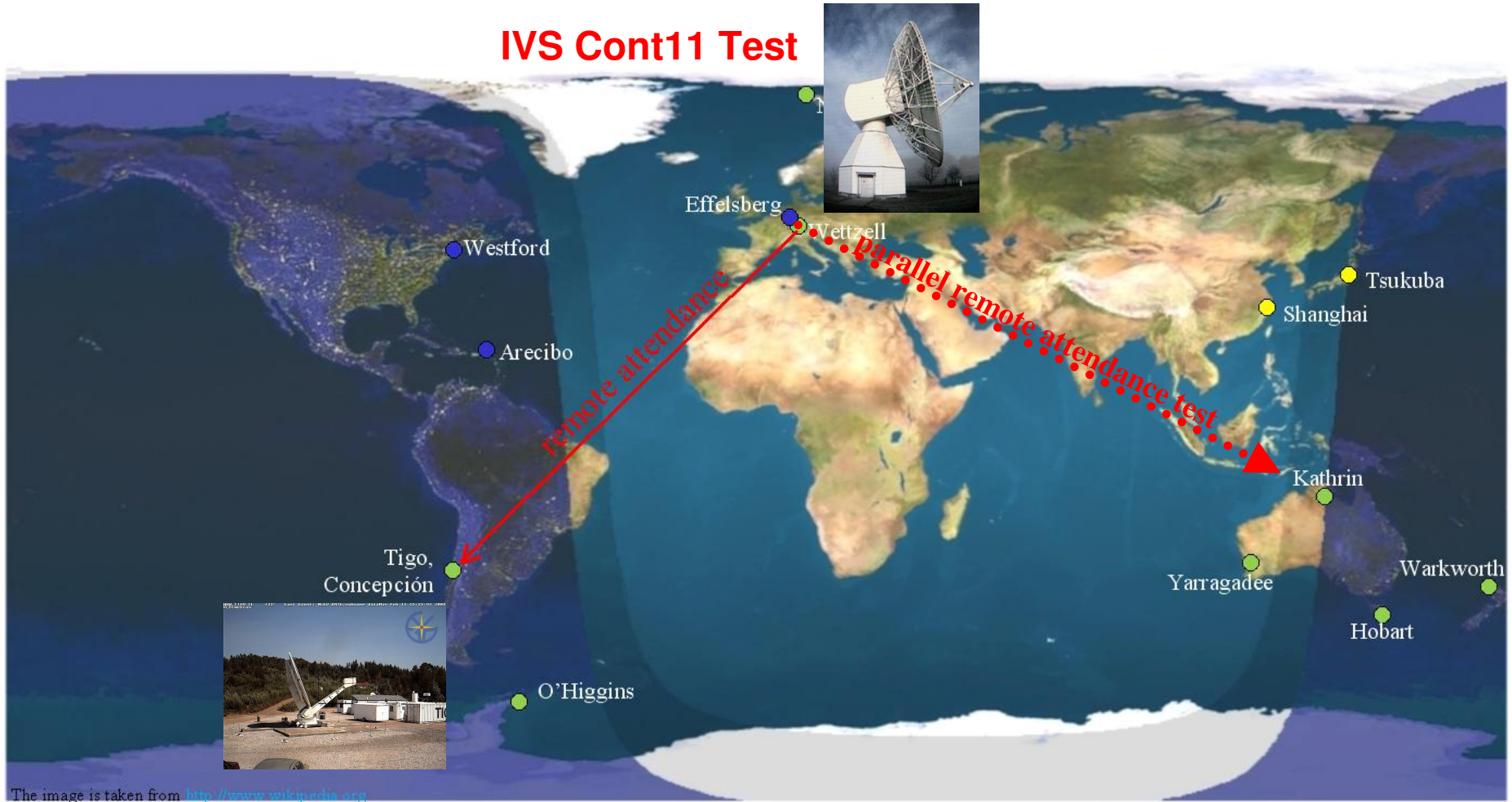
Additional system monitoring

Standardization

Experiences

Experiences

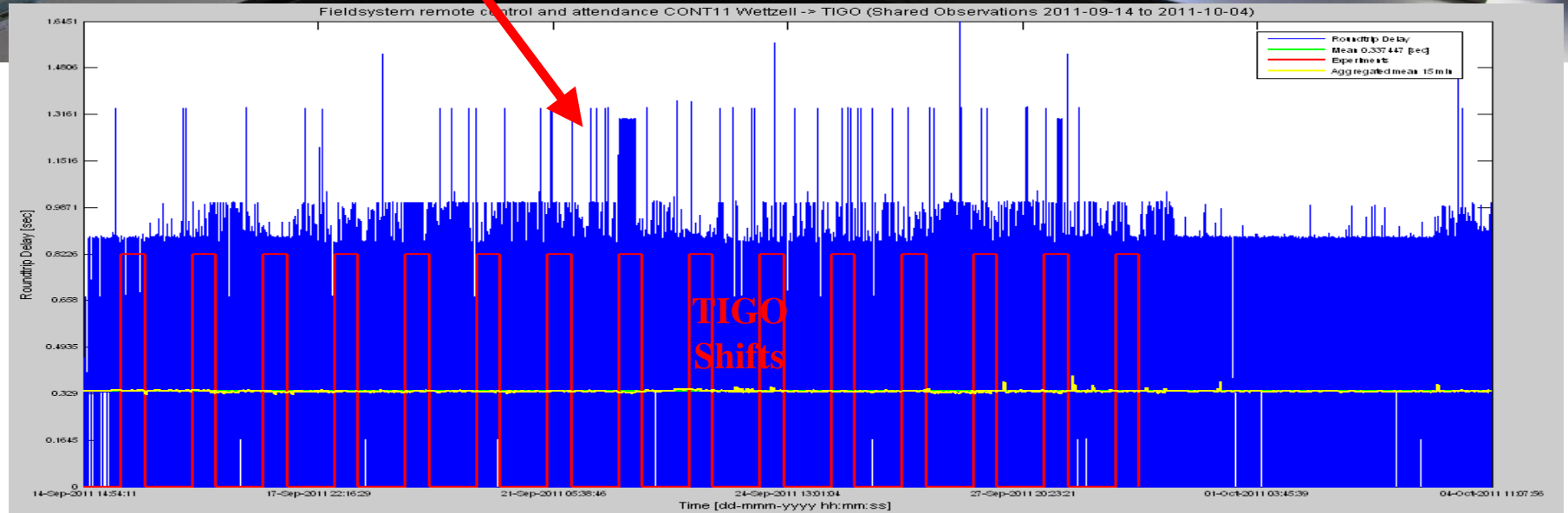
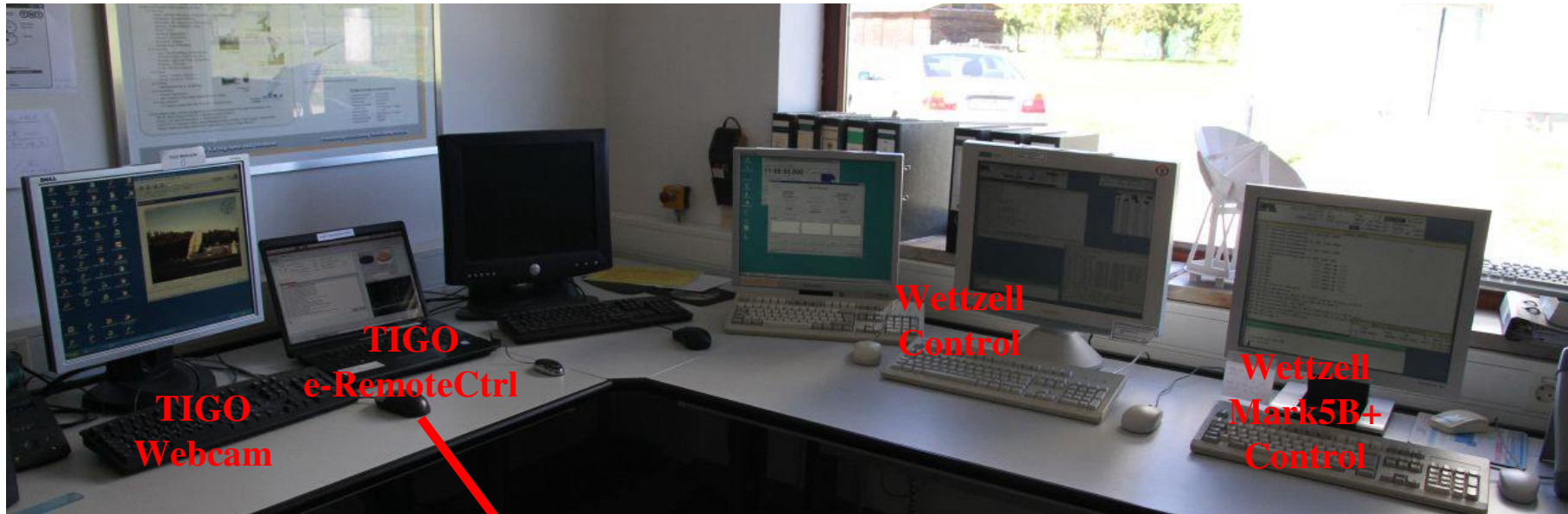
IVS Cont11 Test



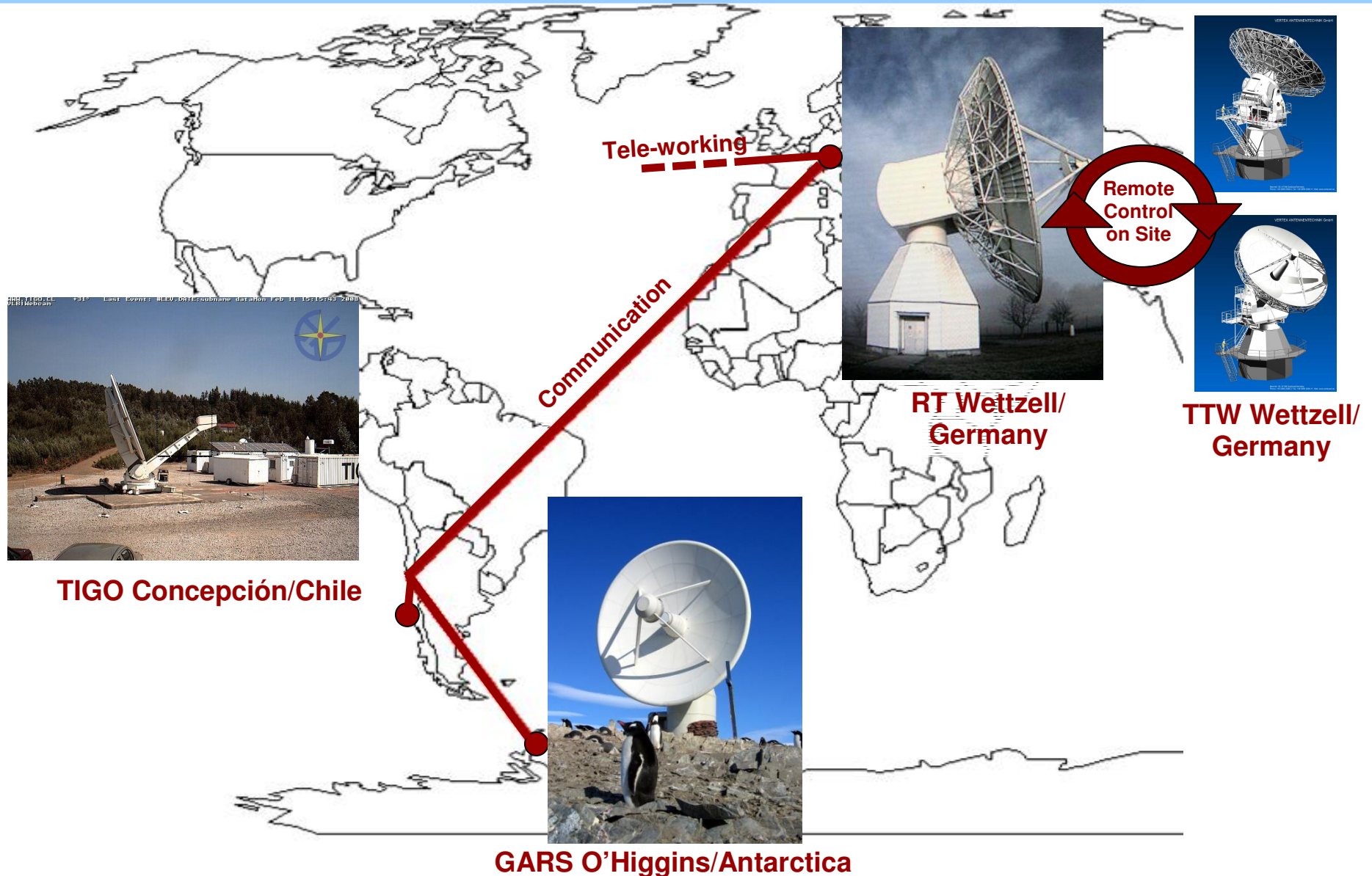
The image is taken from <http://www.wikipedia.org>

● regular used ● testing ● interest

Experiences



Experiences



Global situation and the future

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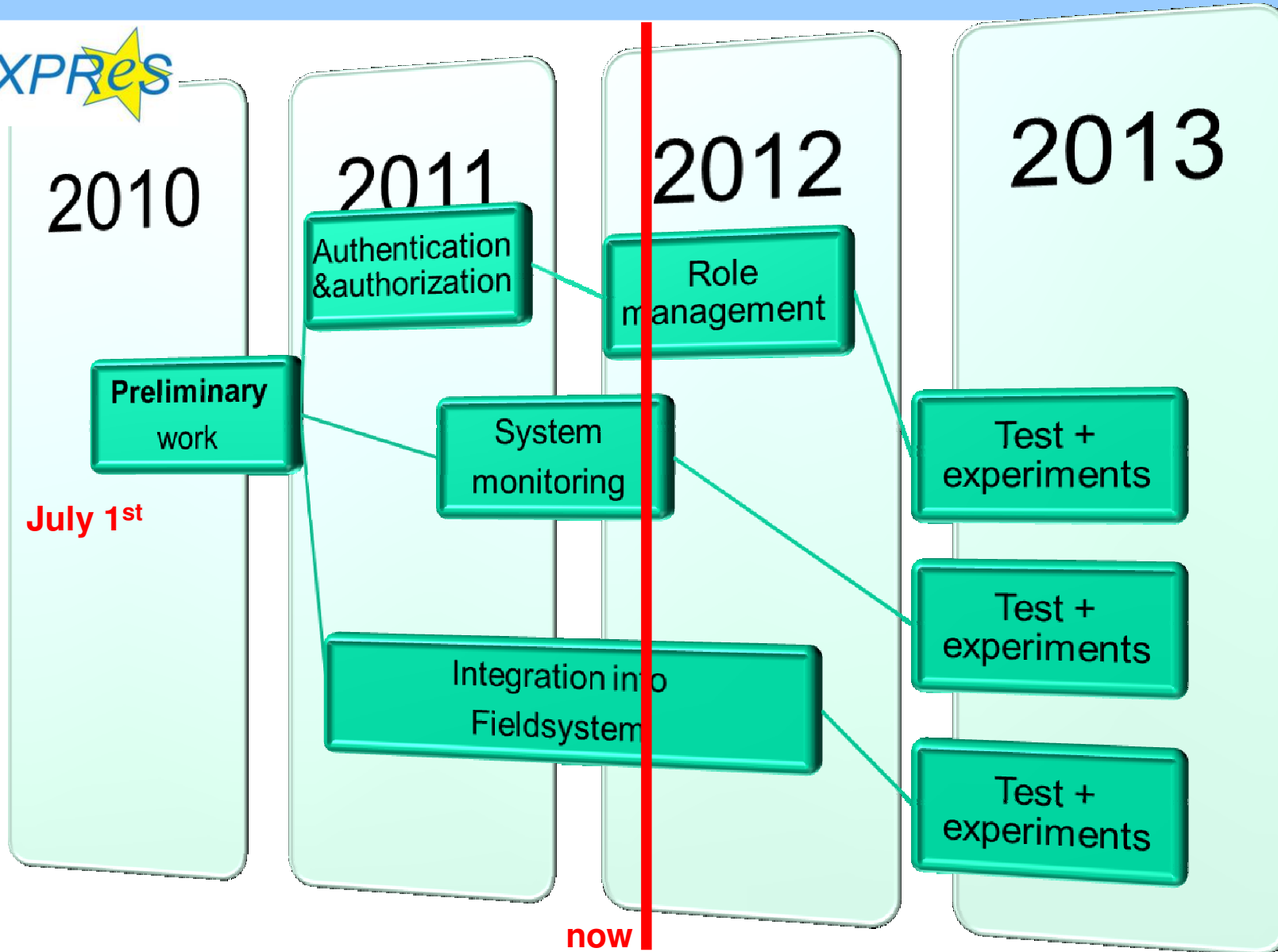
Standardization

Experiences

Further steps

Experiences

NEXPREs



Thank you

Software available under <http://www.econtrol-software.de>

