

Automation and remote control as new challenges on the way to GGOS

FESG

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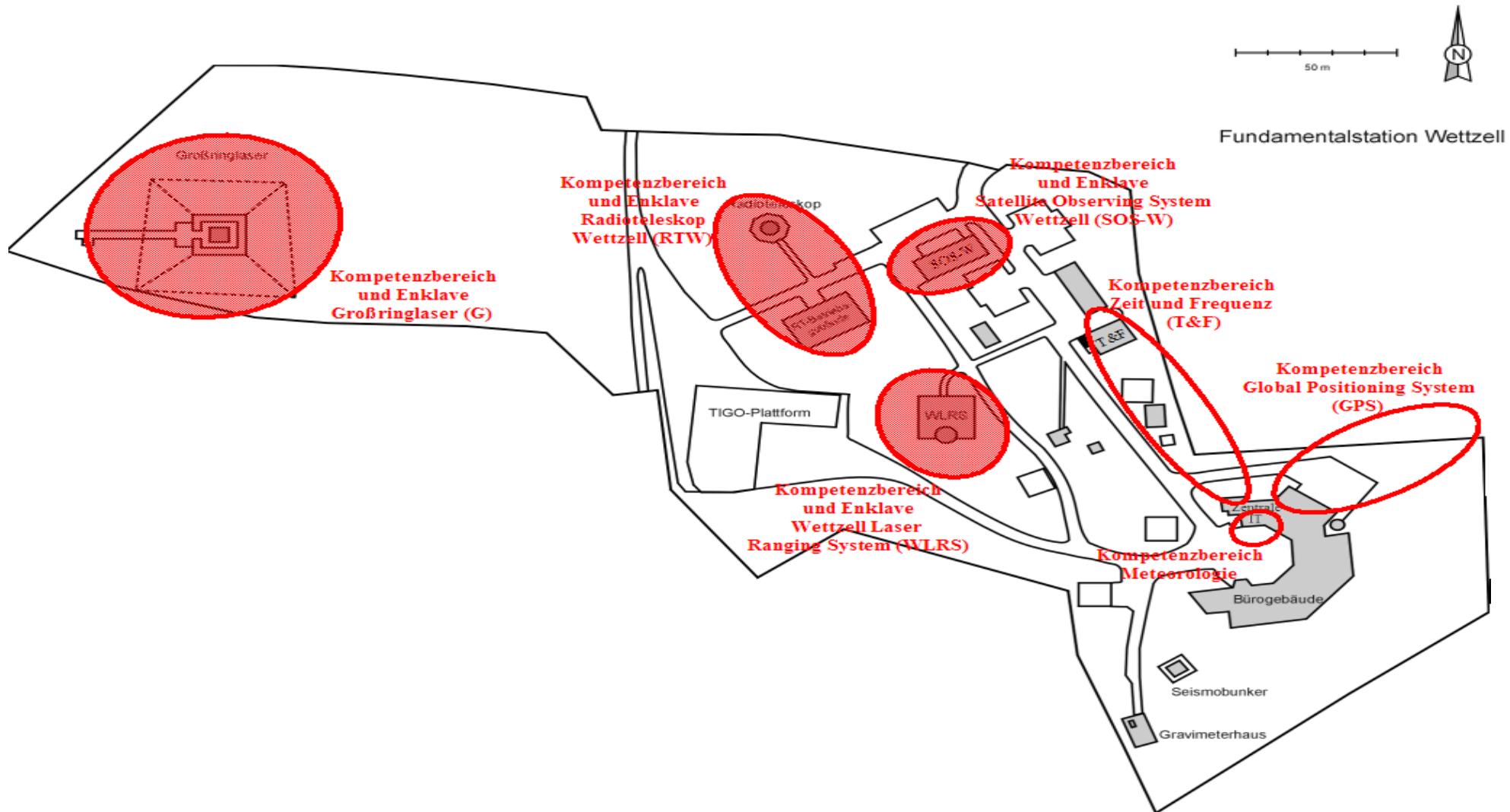


Bundesamt für
Kartographie und Geodäsie

Ettl, M. (FESG), Lauber, P. (FESG); Leidig, A. (BKG); Eckl, J. (BKG); Riederer, M. (BKG);
Dassing, R. (BKG); Mühlbauer, M. (BKG); Plötz, C (BKG), Schreiber, U. (FESG),

A GGOS site ...

Co-located, interoperable systems



Ursprünglicher Stationsplan von Dr. Klügel, FS Wettzell

Future requirements

SLR

See „The History and Future of Satellite Laser Ranging“⁽²⁾:

- [...] High Level of Automation [...] Fully automated [...] Semi-automated: Single Operator or Remote Operation[...]
- [...] Kilohertz Systems [...]

See „The SLR 2000 Pseudo Operator“⁽³⁾:

- „[...] SLR 2000 Pseudo Operator (POP) controls or directs all aspects of the automated SLR 2000 system. [...] POP will monitor the health and safety of the system foremost and control the acquisition and tracking [...] of the satellites.“

VLBI

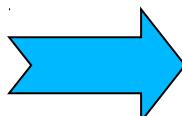
See IVS Memorandum 2006-008v01: VLBI2010⁽¹⁾:

- „[...] 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 personnel when necessary [...]“
- „[...] Monitoring [...] will make it possible to account for factors [...]“
- „[...] new observing strategies [...]“

GNSS

See NTRIP: „Nutzung der Internet-Radio-Technologie zur Übertragung von GNSS-Daten“⁽⁴⁾:

- „[...] Echtzeitübertragung von GNSS-Daten [...]“
- „[...] Möglichkeit der Fernwartung [...]“

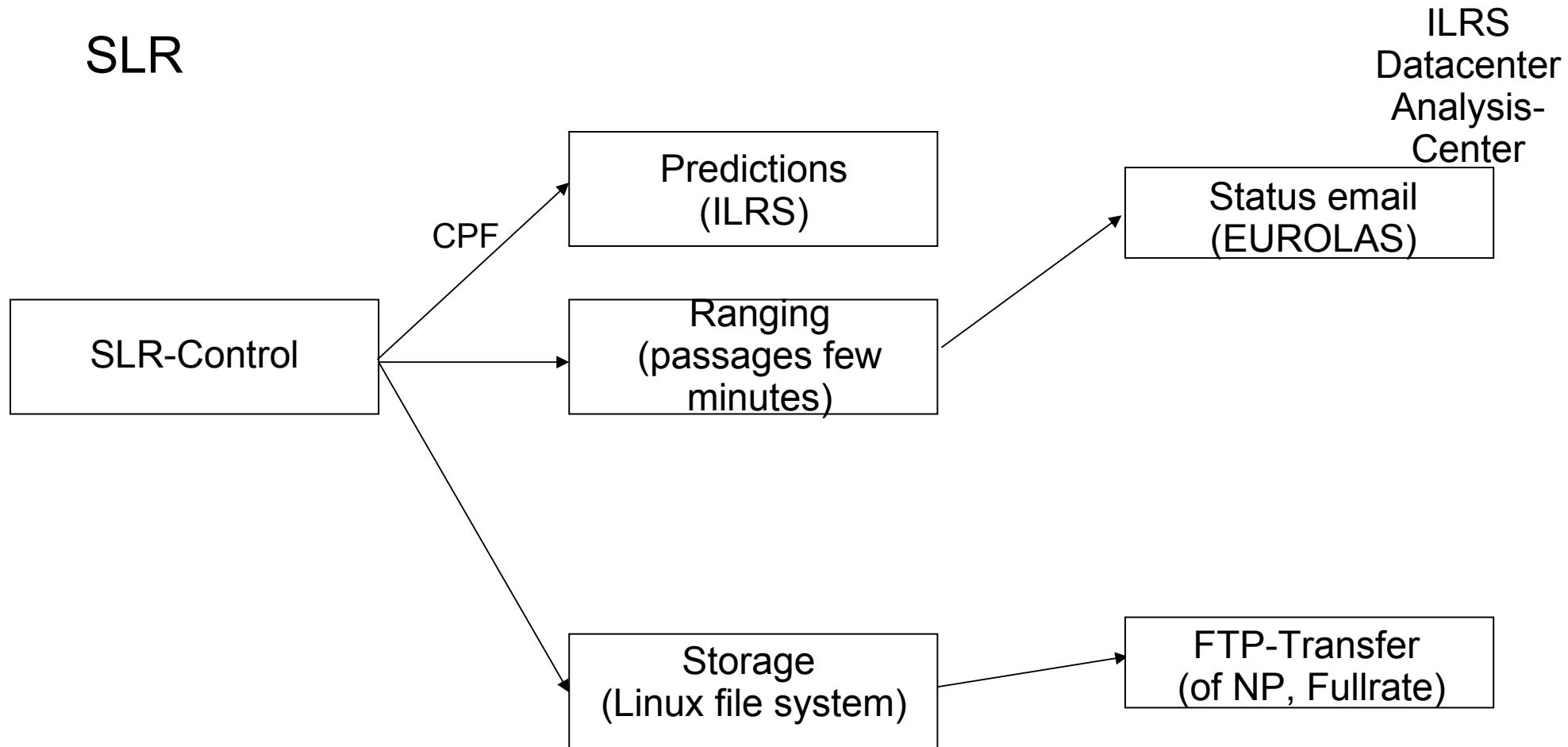


Flexible, remote accessible, reliable, independent, automated and safe systems (throughout all technical levels)

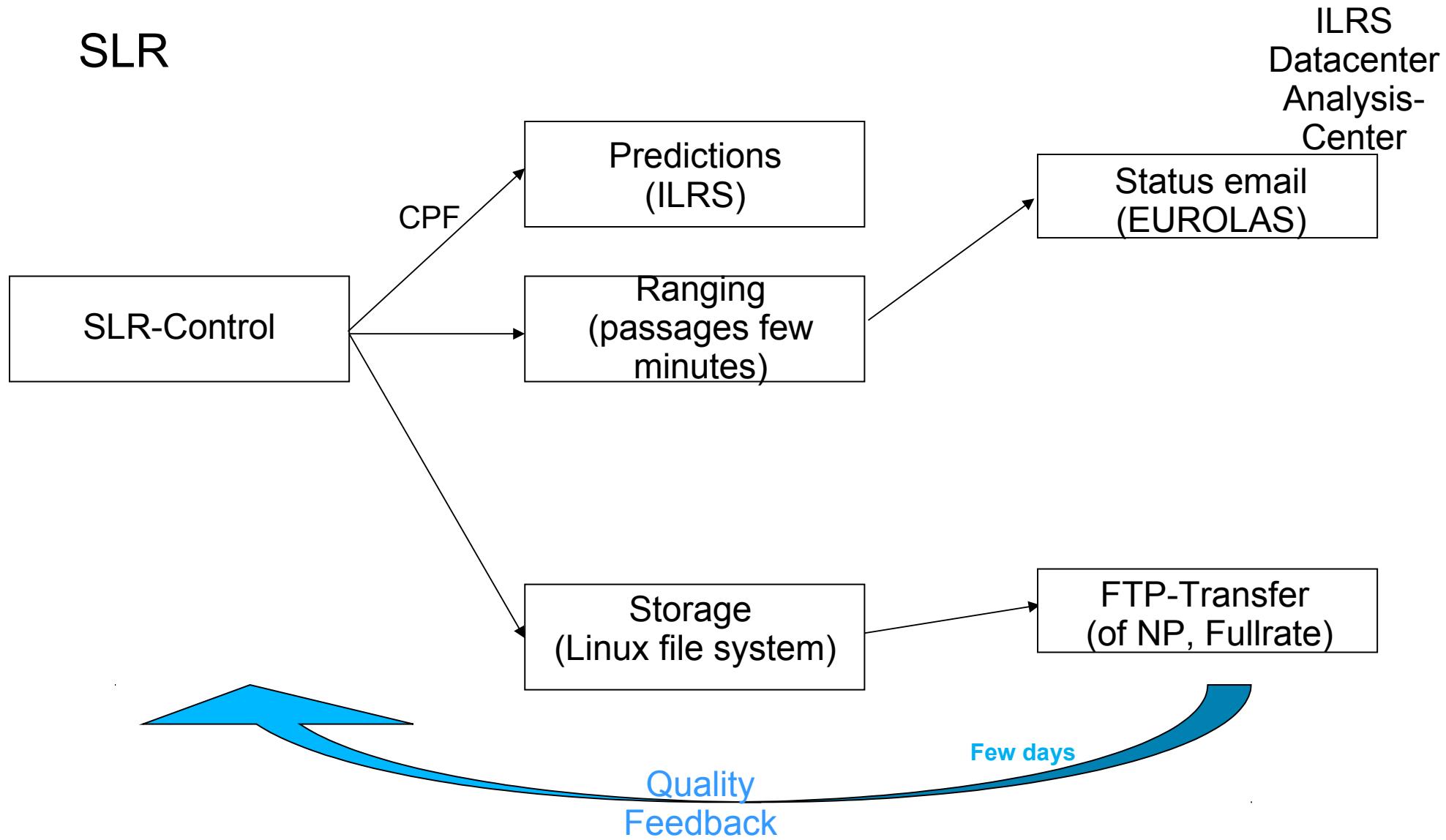
liell, Arthur; et. al.: IVS Memorandum 2006-008v01. „VLBI2010: Current and Future Requirements for Geodetic VLBI Systems“. Sept. 2004
http://ilrs.gsfc.nasa.gov/docs/degnan_0603.pdf (3) http://cddis.nasa.gov/slr2000/docs/pseudo_operator.pdf
http://igs.bkg.bund.de/root_ftp/NTRIP/documentation/sapos03_gebhard.pdf

Laser Ranging Workflow

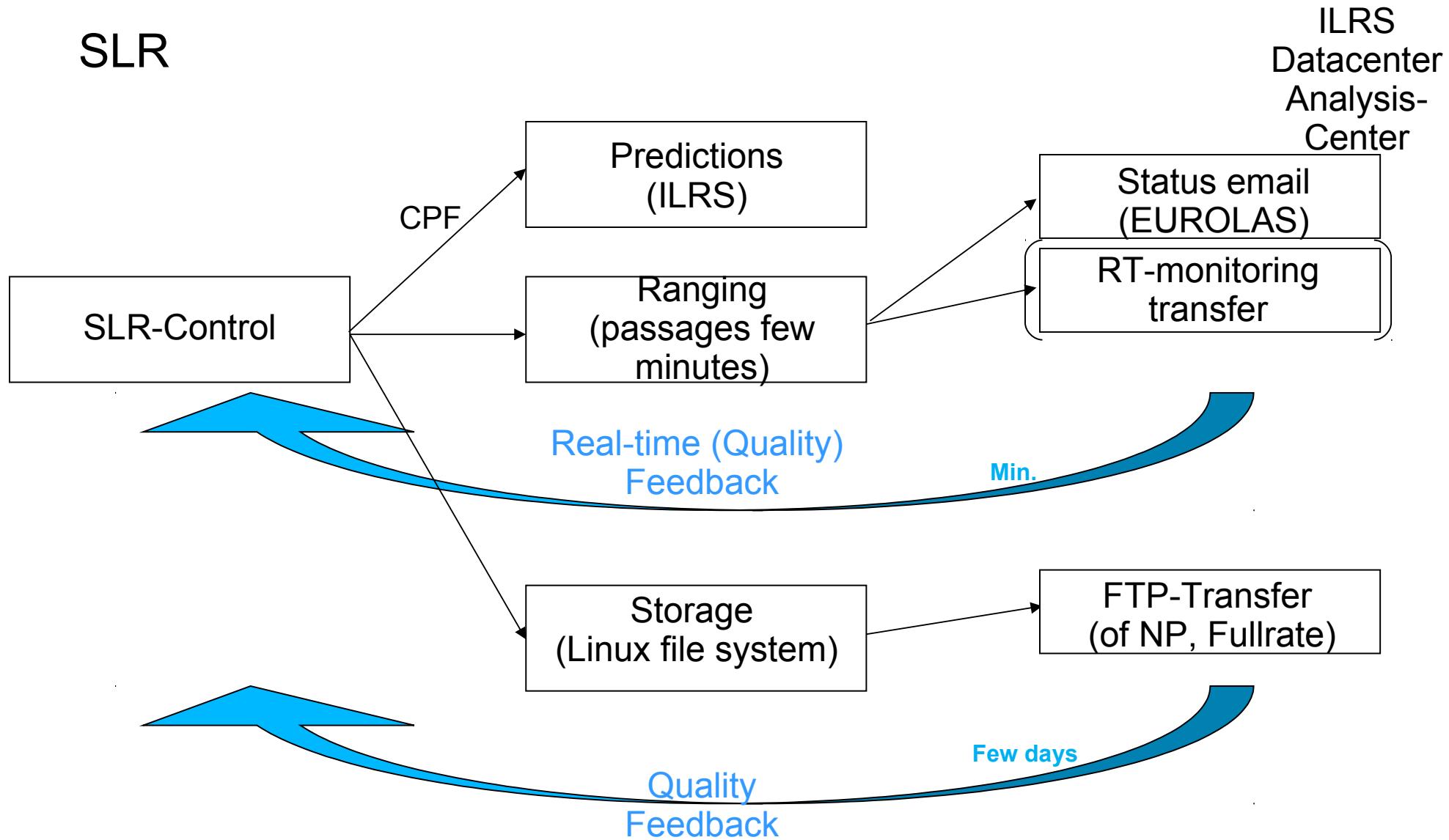
The workflows on a technical point of view



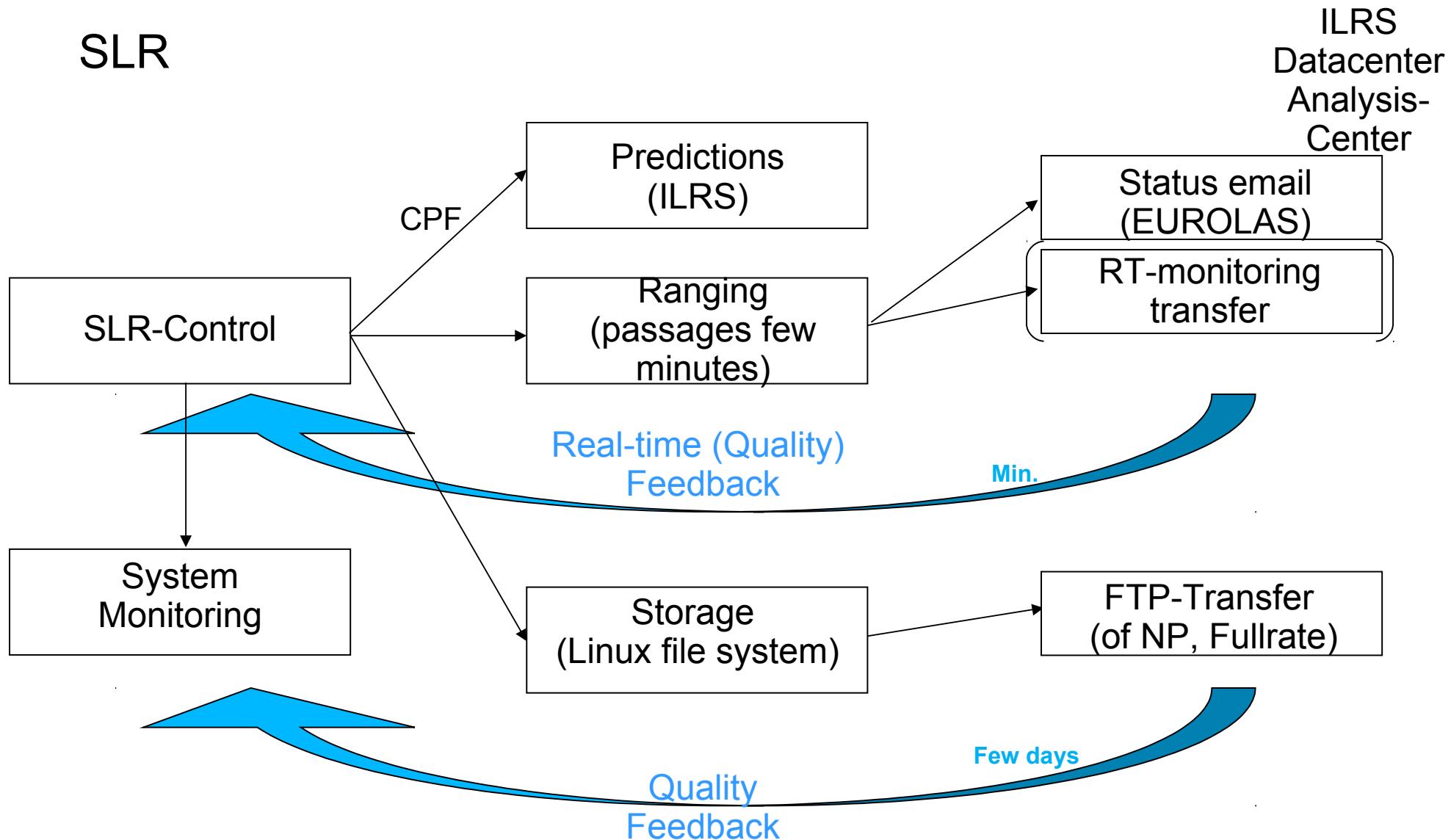
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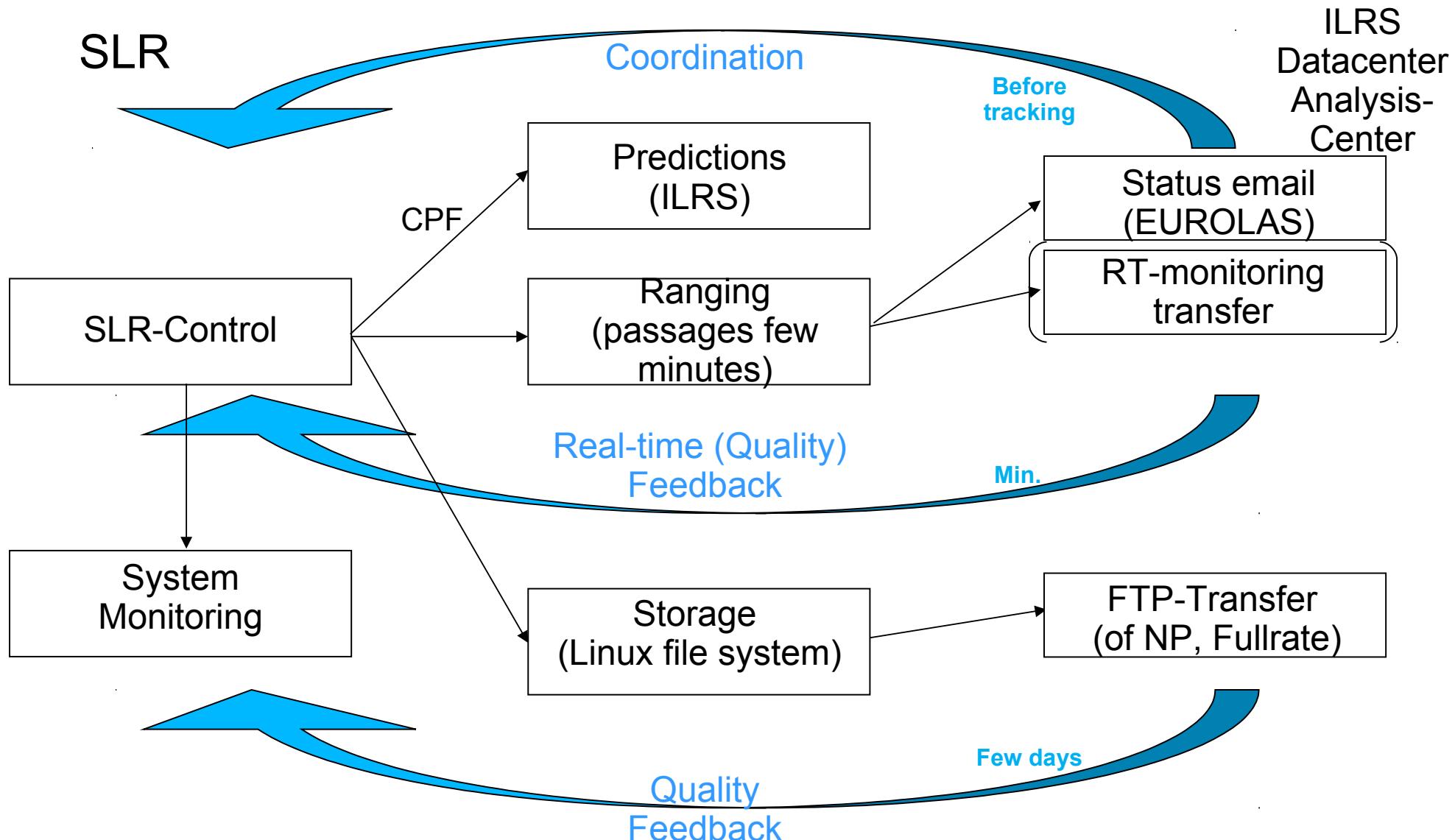
The workflows on a technical point of view



The workflows on a technical point of view



The workflows on a technical point of view



Standardizing interfaces and system software

Control includes ...

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

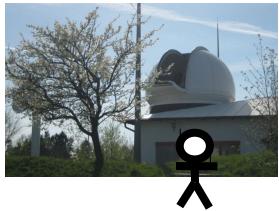
Authenticity and reliability

Standardization
&
synergies over
services and
system borders

...

New control strategies

New control strategies



Local

- Standard operations
- Local operator

New control strategies



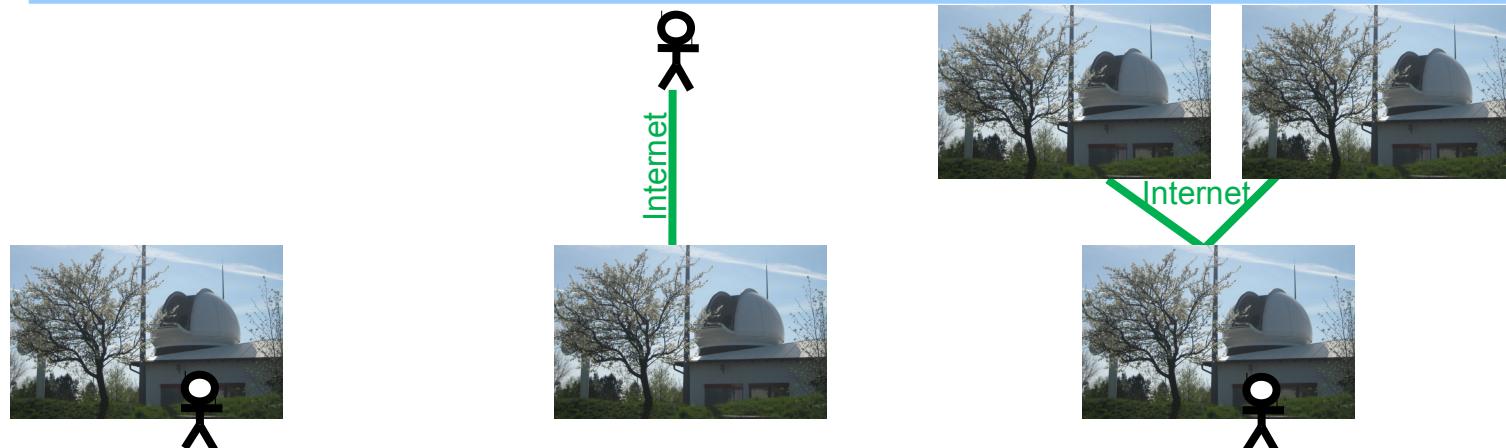
Local

- Standard operations
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Remote

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

New control strategies



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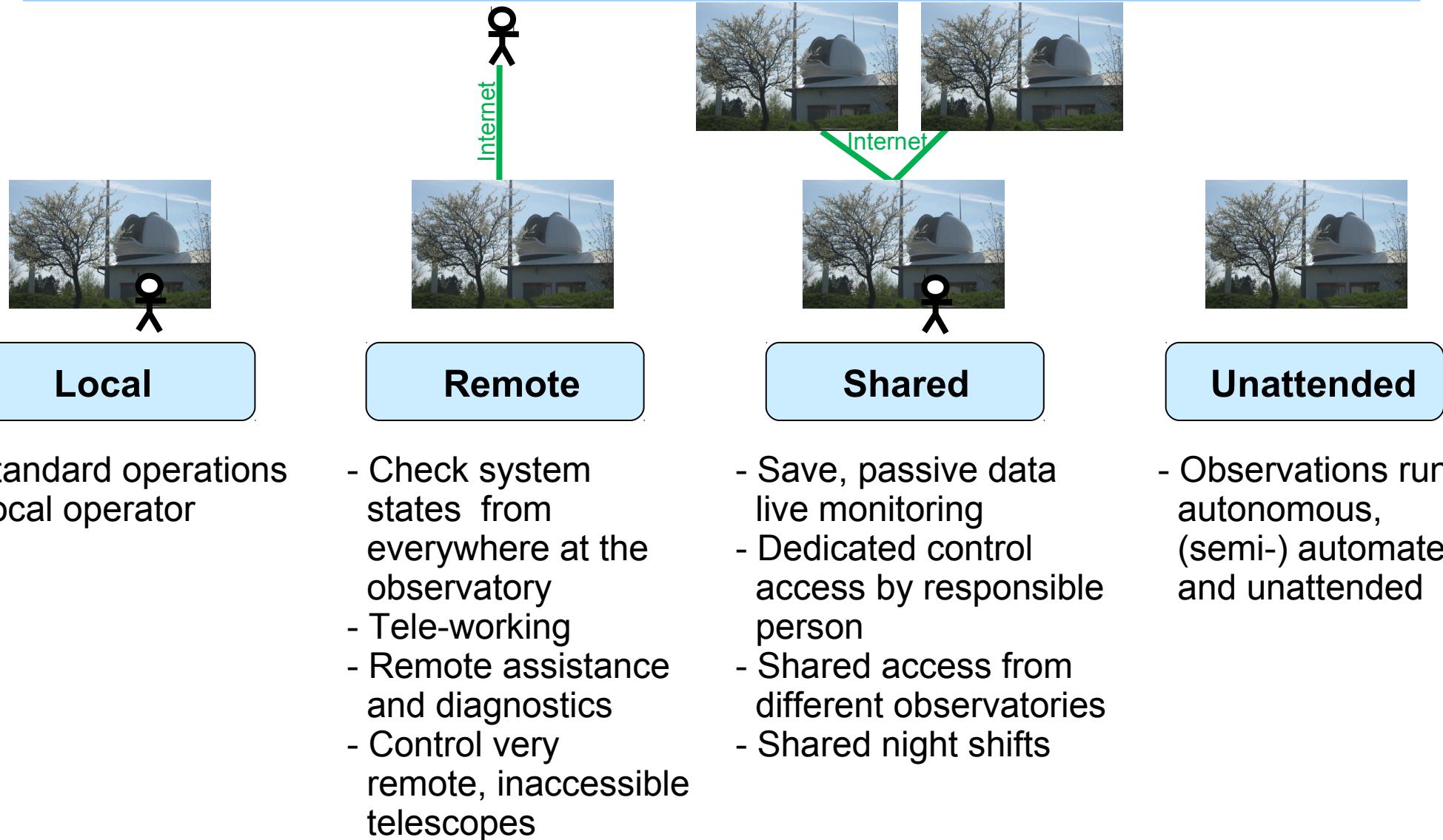
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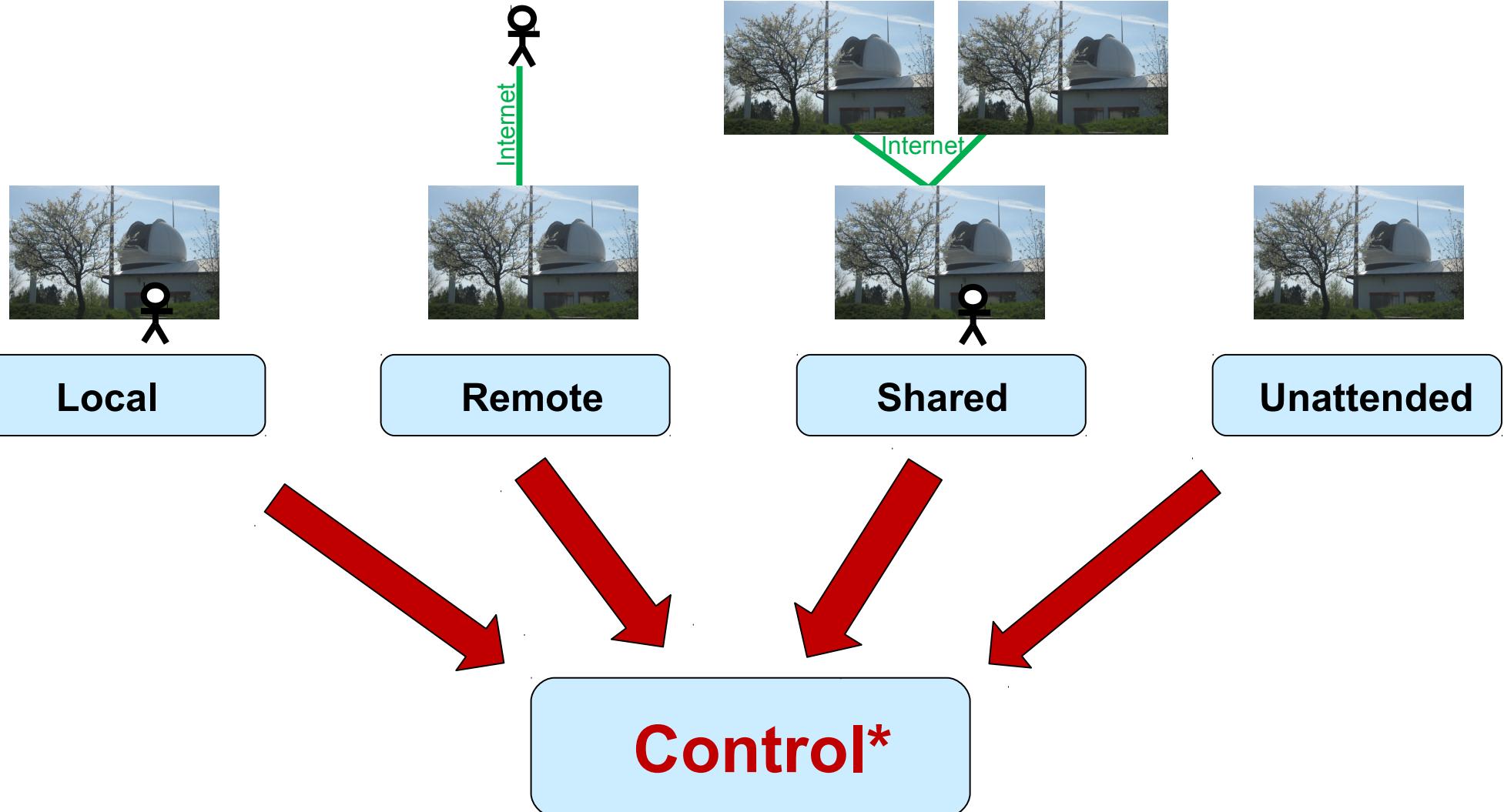
Shared

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

New control strategies

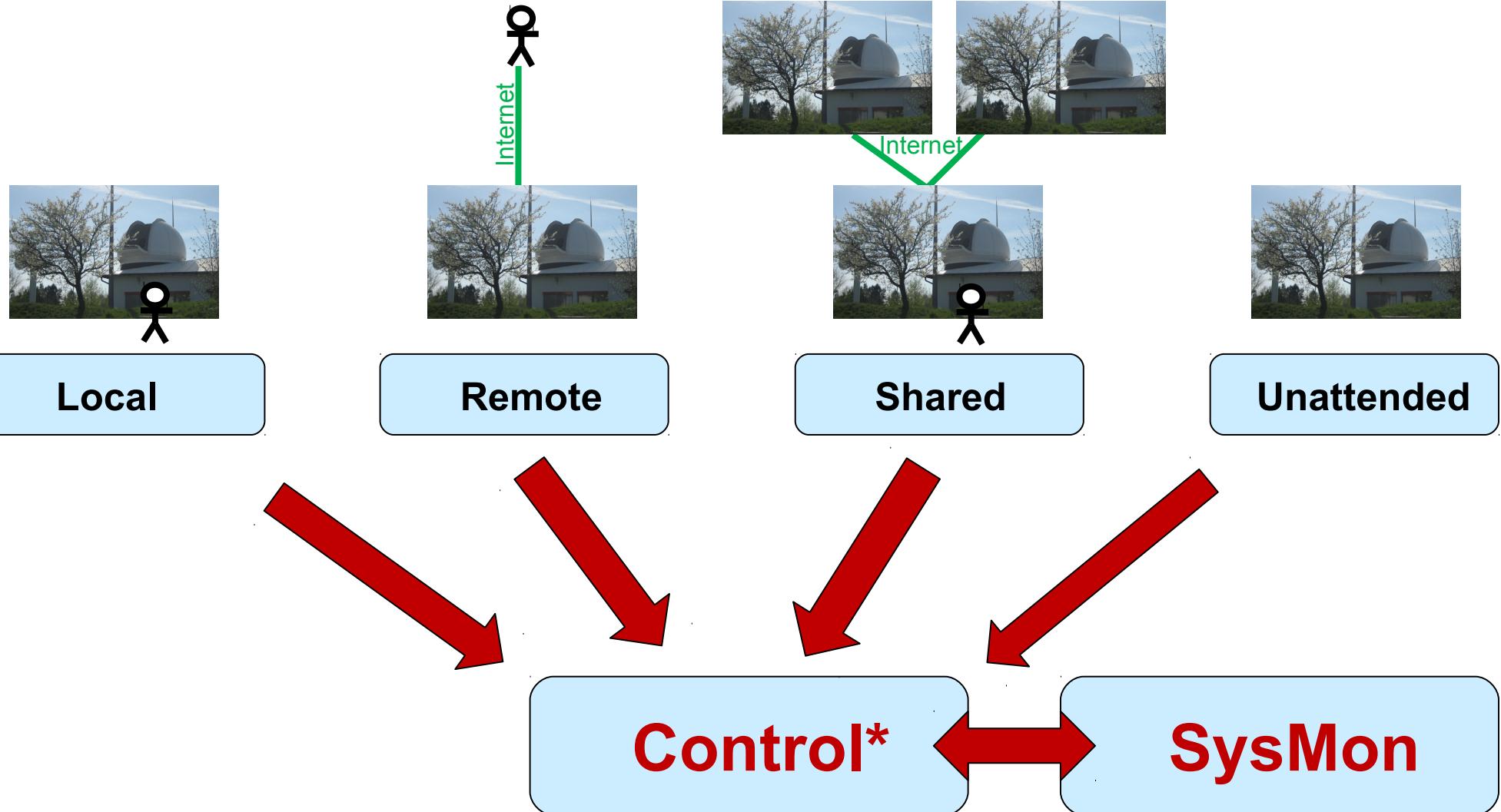


New control strategies



* per system with individual restrictions and
only with reliable, well educated personnel staff on site

New control strategies



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An example from astronomy: The Liverpool telescope

Prof. Iain Steele, Telescope Director



<http://telescope.livjm.ac.uk/>



The Liverpool Telescope

- 2.0 metre f/10
- La Palma, Canary Islands
- Operating since 2004
- Fully Robotic (no on site staff).
- Multiple instruments (change time 20 seconds)
 - CCD imagers
 - Polarimeter
 - Spectrograph
- Common user (~50 users from ~20 institutions)
- Total Operating Budget 600,000 Euro/year
- <http://telescope.livjm.ac.uk/>





Web Based User Interaction

Live Status 2011 May 17
11:12:55 GMT

Master Control Program SUSPEND	Weather Monitor SUSPEND	RCS-TCS Chatter ENABLED	Engineering Override DISABLED
Telescope Control OKAY	Temperature 9.6 °C	Pressure 772 mb	Precipitation DRY
Dew Point 0.5 °C	Humidity 53 %	Wind (blowing to) 5.0 m/s 11 mph	Wind (blowing to) 17 km/h 9 knots
Alt AZ CAS Secondary Focus 0.0 mm	Temperature 9.6 °C	Pressure 772 mb	Precipitation DRY

LT Phase2 UI (v0.5.5d)

Users | Programmes | TAGS

- Newsam.Andy
- Operations
- Ramsay.Gavin
- Simpson.Chris
- Simpson.Elaine
- Smith.Robert
- Steele.Iain**
 - Iain Steele – PI – JL09B05
 - Iain Steele – PI – JL09B06b
 - Iain Steele – PI – JL09B06c
 - Iain Steele – PI – GaiaTest**
 - GaiaTest
 - GalacticField1
 - wmap_1
 - wmap_fixed_a
 - wmap_fixed_b
 - wmap_fixed_c
- Sullivan.Mark
- Tanvir.Nial
- Worters.Hannah

Refresh Tree Include disabled groups in tree.

Expanding User: Steele.Iain
Expanding Access Permission: Iain Steele – PI – GaiaTest
Displaying Group: wmap_fixed_a

GROUP
Name: wmap_fixed_a

Fixed Timing Constraint
Fixed Time (YYYY/MM/DD HH:MM:SS)
2009 / 11 / 16 02 : 00 : 00 (UTC)
Slack
600000 ms <----> 0 0 10 0 0 DDD HH MM SS ms

Observing Constraints

- Solar Elevation Constraint**: SOLAR ELEVATION= NAUTICAL_TWILIGHT (or darker)
- Seeing Constraint**: SEEING= UNCONSTRAINED (or better)
- Lunar Distance Constraint**

View Execution History Group is enabled

Edit **Submit**

Display Observation Sequence
Edit Observation Sequence
Delete Observation Sequence
Create New Observation Sequence

Quicklook Data

http://150.204.240.8/data/webfiles/quicklook/lt/

WEAVE dust staralt LT skycam vue eBay ADS Simbad wiki Wikipedia ing .mac

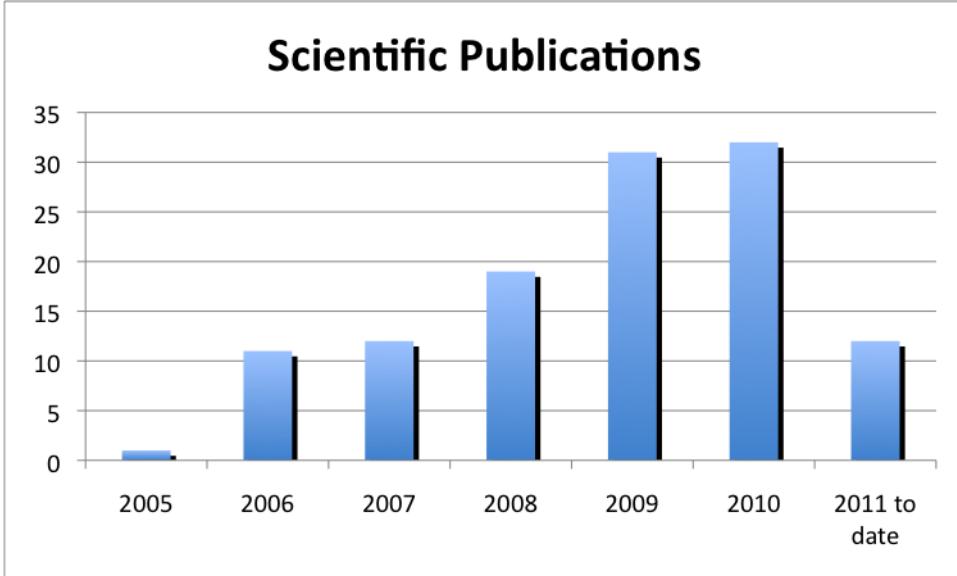
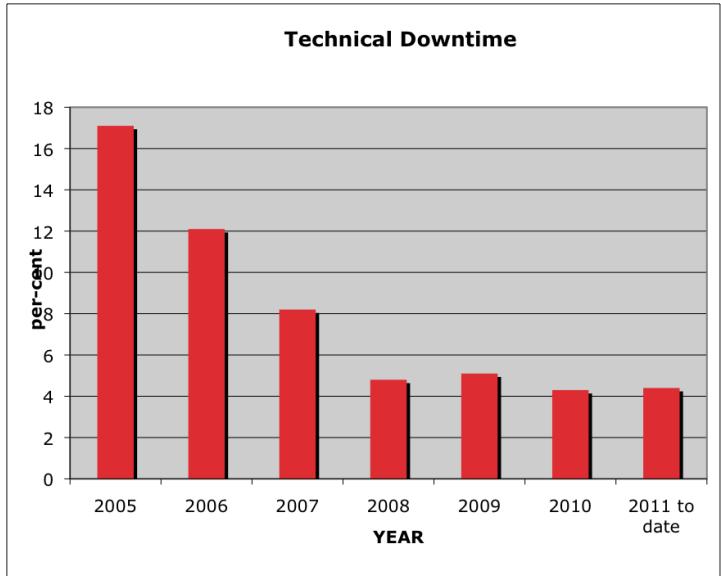
Liverpool Telescope Quicklook Data

Proposal	User Name	16/05	15/05	14/05	13/05
JL10B04	Ian McHardy	8	9	-	-
JL11A02	Mike Bode	-	25	180	24
JL11A03	Iain Steele	-	24	-	27
JL11A04b	David Bersier	-	-	3	-
PL10B02	David Sing	-	20	-	12
PL10B03	Tom Barclay	3	1	-	1
PL10B08	Mark Sullivan	3	-	-	3
PL11A02	Steven Parsons	-	-	-	100
PL11A03	M.T. Botticella	-	11	24	-
PL11A08	Ian McHardy	3	6	-	7
PL11A13	Keith Horne	-	-	-	3
CL11A01	Jose Moreno	-	-	-	100
CL11A05	Luis Goicoechea	15	-	1	1
CL11A06	Nancy Elias	-	-	5	11
CL11A08	Jorge Velasquez	-	8	-	-
IL10B01	Rubina Kotak	30	47	47	41
None	None	4	-	-	-
NSO_Priority_1	Andy Newsam	3	9	-	-
NSO_Priority_2	Andy Newsam	3	11	31	4
NSO_Priority_3	Andy Newsam	14	9	5	10
NSO_Priority_4	Andy Newsam	-	4	-	-
OL11A31	Ernst deMooij	9	9	9	9
RATStand	LTOps	98	98	84	98
RingoStand	LTOps	-	-	-	10
Standards	LT_RCS	284	48	4	8

All RATCam, FrodoSpec and SupIRCam data obtained on the telescope are available here about five minutes after the exposure is complete. A subset of RISE data are also included, though due to the high data rate from this instrument, not every file.

Data here are **quicklook reductions only**. They do not use the most up to date flat fields and have not undergone any detailed quality control inspection. Final reductions are available from the [searchable data archive](#) and [Recent Data](#) web pages next working day.

Some statistics and references ...



- **The Liverpool Telescope: performance and first results, Steele I.A. et al., *Proc SPIE*, 5489, pp. 679-692 (2004).**
- **Design of low cost and reliable instrumentation for robotic telescopes, Mottram, C.J. et al.. *Proc SPIE*, 5492, pp. 677-688 (2004).**
- **Robotic telescope scheduling: the Liverpool Telescope experience, Fraser S. & Steele, I. A., *Proc SPIE* 5493, pp. 331-340 (2004).**
- **Switching the Liverpool Telescope from a full-service operating model to self-service, Smith R.J. et al., *Proc SPIE* 7713 (2010).**

Thank you!