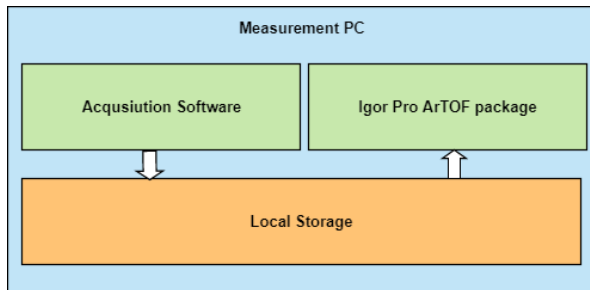
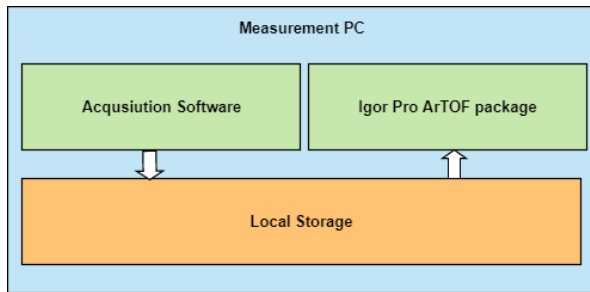


LowDosePES Data Workflow

Ruslan Ovsyannikov, HZB



- Control hardware
- Read RAW data stream
 1. RAW → 240 Mbytes/sec
 2. Reduce → 12 Mbytes/sec
 3. Save
- Read EPICS data stream
 1. Monitor parameters
 2. Save START/FINISH metadata
 3. Save per point metadata



All data related to single experiment saved to a single folder.

- Control hardware
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 1. RAW → 240 Mbytes/sec
 2. Reduce → 12 Mbytes/sec
 3. Save
- Read EPICS data stream
 1. Monitor parameters
 2. Save START/FINISH metadata
 3. Save per point metadata

aaz_000/...

...

fixed_000/...

...

fixed_042/...

...

fixed_1248/...

multiscan_000/...

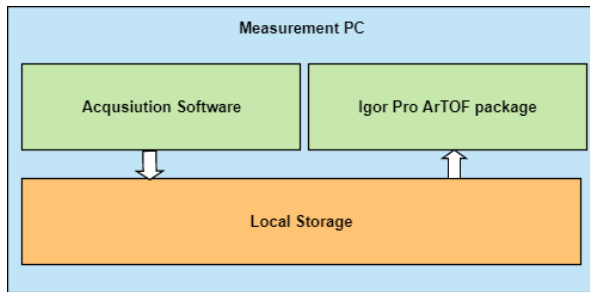
...

photon_000/...

...

sweep_000/...

...



All data related to single experiment saved to a single folder.

Two types:

- Simple scans
 - fixed
 - sweep

- Control hardware
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 2. Reduce → 12 Mbytes/sec
 3. Save
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aaz_000/...

...

fixed_000/...

...

fixed_042/...

...

fixed_1248/...

multiscan_000/...

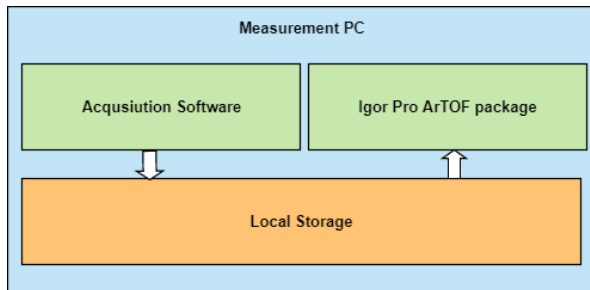
...

photon_000/...

...

sweep_000/...

...



- Control hardware
- Read RAW data stream
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 3. Save
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All data related to single experiment saved to a single folder.

Two types:

- Simple scans
 - fixed
 - sweep
- Multi-scans
 - multiscan
 - i.e. “aaz”

aaz_000/...

...

fixed_000/...

...

fixed_042/...

...

fixed_1248/...

multiscan_000/...

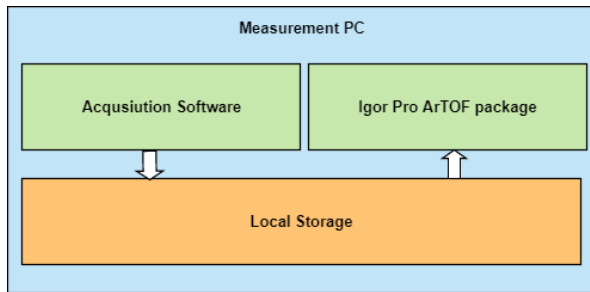
...

photon_000/...

...

sweep_000/...

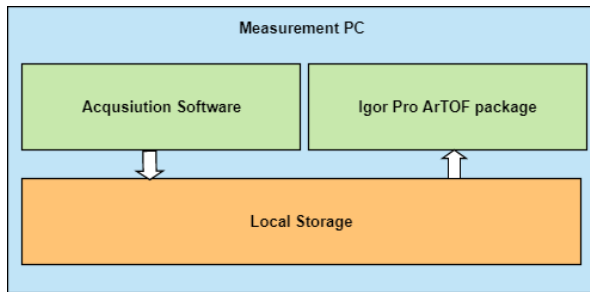
...



“fixed” example:

- Control hardware
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 1. RAW → 240 Mbytes/sec
 2. Reduce → 12 Mbytes/sec
 3. Save
- Read EPICS data stream
 1. Monitor parameters
 2. Save START/FINISH metadata
 3. Save per point metadata

0_0
 1_0
 ...
 1234_0
 ...
 acquisition.cfg
 detector.txt
 elements.txt
 epics_data.txt
 extra.txt
 timing.txt
 ...
 TRG_0
 ...
 TRG_1234



“fixed” example:

- Raw binary data

0_0

1_0

...

1234_0

...

acquisition.cfg

detector.txt

elements.txt

epics_data.txt

extra.txt

timing.txt

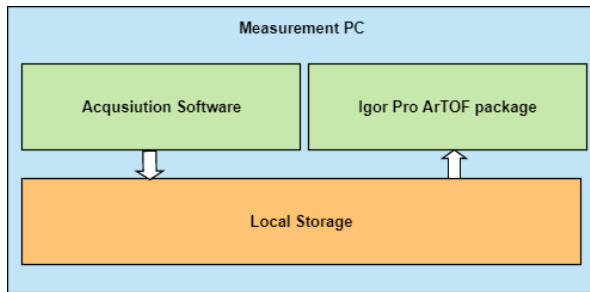
...

TRG_0

...

TRG_1234

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“fixed” example:

- Raw binary data
- Metadata

0_0

1_0

...

1234_0

...

acquisition.cfg

detector.txt

elements.txt

epics_data.txt

extra.txt

timing.txt

...

TRG_0

...

TRG_1234

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```
[general]
version=2.0
acquisitionStarted=2019-05-16, 20:03:15
spectrumBeginEnergy=90.722772
spectrumEndEnergy=105.13168
spectrumChannelWidthEnergy=0.14554455
lensLowEdgeEnergyStep=0.14554455
lensDwellType=timerNoFilter
lensDwellTime=1000
lensIterations=4305
lensSteps=1
userSpectrumEndEnergy=105.13168
userLensLowEdgeEnergyStep=0.14554455
acquisitionMode=fix
centerEnergy=98
xytFormat=normal
conversionLibraryName=TDC2XYT MultiProcess
conversionLibraryVersion=1.6.2.0 / (Jan 10 2019)
[lensmode]
lensK=0.15
vectorSize=21
maxTheta=0.26179939
eKinRef=10
tofVector=[7.244636e-007 7.287965e-007 7.331294e-007 ...
```

[start]
timestamp=05/16/19 18:50:16
DLDDeadTime=5000
DLDFilterMax=1000000
DLDFilterMin=0
DetectorID=0
GroupMode=Any channel
MCPDeadTime=6000
XFilterMax=2250
XFilterMin=1350
XYTFormat=normal
XYTFormatProtect=false
YFilterMax=2250
YFilterMin=1350
dllVersion=1.6.2.0
tdcChannelMCP=7
tdcChannelTRIGGER=6
tdcChannelX1=0
tdcChannelX2=1
tdcChannelY1=2
tdcChannelY2=3
tdcChannelZ1=63
tdcChannelZ2=63

[finish]
timestamp=05/16/19 20:03:16
DLDDeadTime=5000
DLDFilterMax=1000000
DLDFilterMin=0
DetectorID=0
GroupMode=Any channel
MCPDeadTime=-1
XFilterMax=2250
XFilterMin=1350
XYTFormat=normal
XYTFormatProtect=false
YFilterMax=2250
YFilterMin=1350
dllVersion=1.6.2.0
tdcChannelMCP=7
tdcChannelTRIGGER=6
tdcChannelX1=0
tdcChannelX2=1
tdcChannelY1=2
tdcChannelY2=3
tdcChannelZ1=63
tdcChannelZ2=63

[start]
timestamp=05/16/19 18:50:16
Acceleration Element=-83
DBIAS=-33.993735
DLDAH=79.99552
DLDR=-49.99896
DLDS=220.00253
L1=572.98639
L2=5.054154
L3=-55.659102
L4=-13.61761
L5=46.006791
MCP=2550.0015

[finish]
timestamp=05/16/19 20:03:16
Acceleration Element=-83
DBIAS=-33.993735
DLDAH=79.99552
DLDR=-49.99896
DLDS=220.00253
L1=572.98639
L2=5.054154
L3=-55.659102
L4=-13.61761
L5=46.006791
MCP=2550.0015

[start]

timestamp=05/16/19 18:50:16

Cff=1.59997

Chopper IOC version=default/60 (20181116-1449)

Chopper disk temperature=31

Chopper drive state=Full speed

Chopper drive temperature=47.7

Chopper phase=363

Chopper phase state=Phase lock OK

Chopper selected slit=100 um

Chopper slit position=15.2

Chopper top aperture=0

Cryo diode voltage=0.5587

Cryo heater output=0

Cryo heater range=Off

Cryo ramp rate=10

Cryo ramp rate state=On

Cryo set temperature=300

Cryo setpoint readback=300

Cryo temperature=300.41

Experiment=Multibunch

FS Bump=-0.57

Fast orbit correction=Automatic Corr.

Fill gap=200

[finish]

timestamp=05/16/19 20:03:16

Cff=1.59997

Chopper IOC version=default/60 (20181116-1449)

Chopper disk temperature=31

Chopper drive state=Full speed

Chopper drive temperature=47.68

Chopper phase=363

Chopper phase state=Phase lock OK

Chopper selected slit=100 um

Chopper slit position=15.2

Chopper top aperture=0

Cryo diode voltage=0.5587

Cryo heater output=0

Cryo heater range=Off

Cryo ramp rate=10

Cryo ramp rate state=On

Cryo set temperature=300

Cryo setpoint readback=300

Cryo temperature=300.4

Experiment=Multibunch

FS Bump=-0.57

Fast orbit correction=Automatic Corr.

Fill gap=200

[start]

timestamp=05/16/19 18:50:16

MasterPeriod=800602.24990929

PulsePeriodEstimate=31875.1

TriggerPeriod=31874.863766796

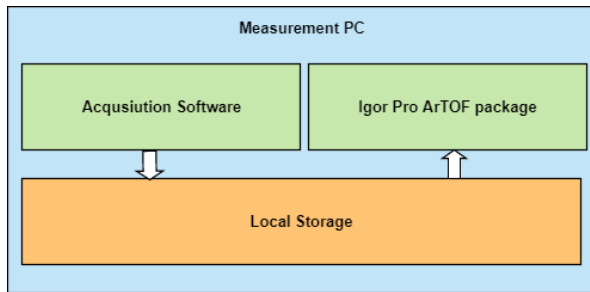
[finish]

timestamp=05/16/19 20:03:17

MasterPeriod=800602.24211566

PulsePeriodEstimate=31875.1

TriggerPeriod=31874.863801595



“fixed” example:

- Raw binary data
- Metadata
- Per-point (meta)data

0_0

1_0

...

1234_0

...

acquisition.cfg

detector.txt

elements.txt

epics_data.txt

extra.txt

timing.txt

...

TRG_0

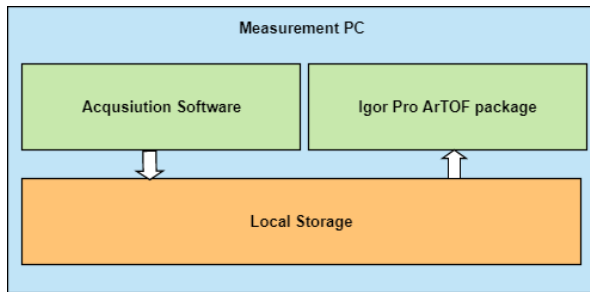
...

TRG_1234

- Control hardware
- Read RAW data stream
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 3. Save
- Read EPICS data stream
 1. Monitor parameters
 2. Save START/FINISH metadata
 3. Save per point metadata

Iteration	Timestamp	M1Move	MainPressureCC	PPRECurrent
3	1558025416.8016	0	8.006000000000000e-010	3.013915090875002e+000
4	1558025417.4996	0	7.991000000000000e-010	3.013785172875002e+000
5	1558025418.4716	0	8.006000000000000e-010	3.013785172875002e+000
6	1558025419.5666	0	8.020000000000000e-010	3.011804719875002e+000
7	1558025420.5476	0	8.006000000000000e-010	3.014930407125002e+000
8	1558025421.6306	0	8.006000000000000e-010	3.013195740750002e+000
9	1558025422.5296	0	8.006000000000000e-010	3.013195740750002e+000
10	1558025423.5976	0	8.013000000000000e-010	3.011646006187502e+000
11	1558025424.5836	0	8.006000000000000e-010	3.011379776062502e+000
12	1558025425.6596	0	8.006000000000000e-010	3.012093783000003e+000
13	1558025426.6436	0	8.006000000000000e-010	3.011061519000003e+000
14	1558025427.6396	0	8.006000000000000e-010	3.012007993312502e+000
15	1558025428.6226	0	8.006000000000000e-010	3.011470632375001e+000
16	1558025429.7046	0	8.013000000000000e-010	3.010312576687502e+000
17	1558025430.6926	0	8.006000000000000e-010	3.011328069937503e+000
18	1558025431.6716	0	8.006000000000000e-010	3.009711894000002e+000
19	1558025432.7696	0	8.013000000000000e-010	3.008465714437502e+000
20	1558025433.7496	0	7.998000000000000e-010	3.009981066750002e+000
21	1558025434.8216	0	8.013000000000000e-010	3.008341670625002e+000
22	1558025435.7986	0	8.006000000000000e-010	3.009359807812502e+000
23	1558025436.7766	0	7.998000000000000e-010	3.009098002687502e+000
24	1558025437.7556	0	8.013000000000000e-010	3.007709835937502e+000
25	1558025438.8366	0	8.006000000000000e-010	3.011197355437503e+000

Iteration	Timestamp
MainPressureCC	PPRECurrent
ClockFrequencyMean	M1Move
ClockFrequency	ClockFreqAbsErr
SBCurrent	ClockFreqMaster
ARTOFOutOfRange	ClockPeriod
ClockPeriodMean	RingCurrent
ARTOFInRange	ARTOFRatio
MainPressureFR	ChopperPhase
M1RxSet	M1RxRead
TopPressureFR	BeamShutter
MirrorCurrent	SampleCurrent

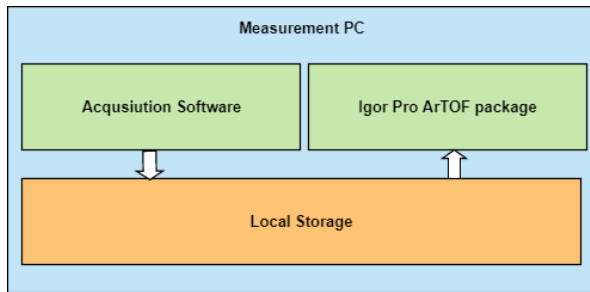


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 3. Save
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“fixed” example:

- Raw binary data
- Metadata
- Per-point (meta)data
- Per-iteration meta data

0_0
 1_0
 ...
 1234_0
 ...
 acquisition.cfg
 detector.txt
 elements.txt
 epics_data.txt
 extra.txt
 timing.txt
 ...
TRG_0
 ...
TRG_1234

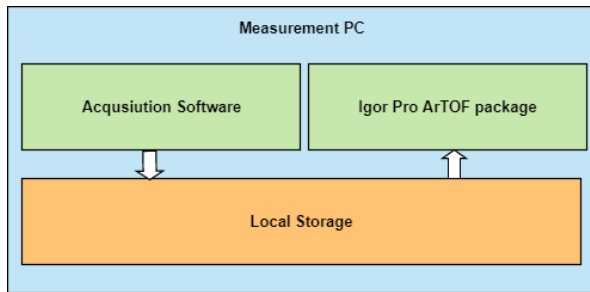


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- Read RAW data stream
 1. RAW → 240 Mbytes/sec
 2. Reduce → 12 Mbytes/sec
 3. Save
- Read EPICS data stream
 1. Monitor parameters
 2. Save START/FINISH metadata
 3. Save per point metadata

“fixed” example:

- Raw binary data
- Metadata
- Per-point (meta)data
- Per-iteration meta data
- Special raw data formats for detector/reduction development → up to 1Gbyte/sec

0_0
 1_0
 ...
 1234_0
 ...
 acquisition.cfg
 detector.txt
 elements.txt
 epics_data.txt
 extra.txt
 timing.txt
 ...
 TRG_0
 ...
 TRG_1234



- Control hardware
- Read RAW data stream
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 2. Reduce → 12 Mbytes/sec
 3. Save
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 3. Save per point metadata

“multiscan” example:

Normal single scans:
fixed_%d

Multiscan config:
multiscan.cfg

Standard “log”:
runbook.txt

fixed_000

fixed_001

fixed_002

fixed_003

fixed_004

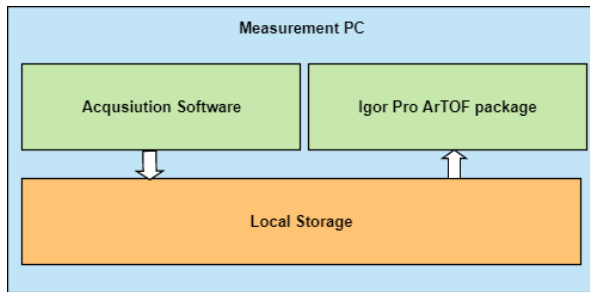
...

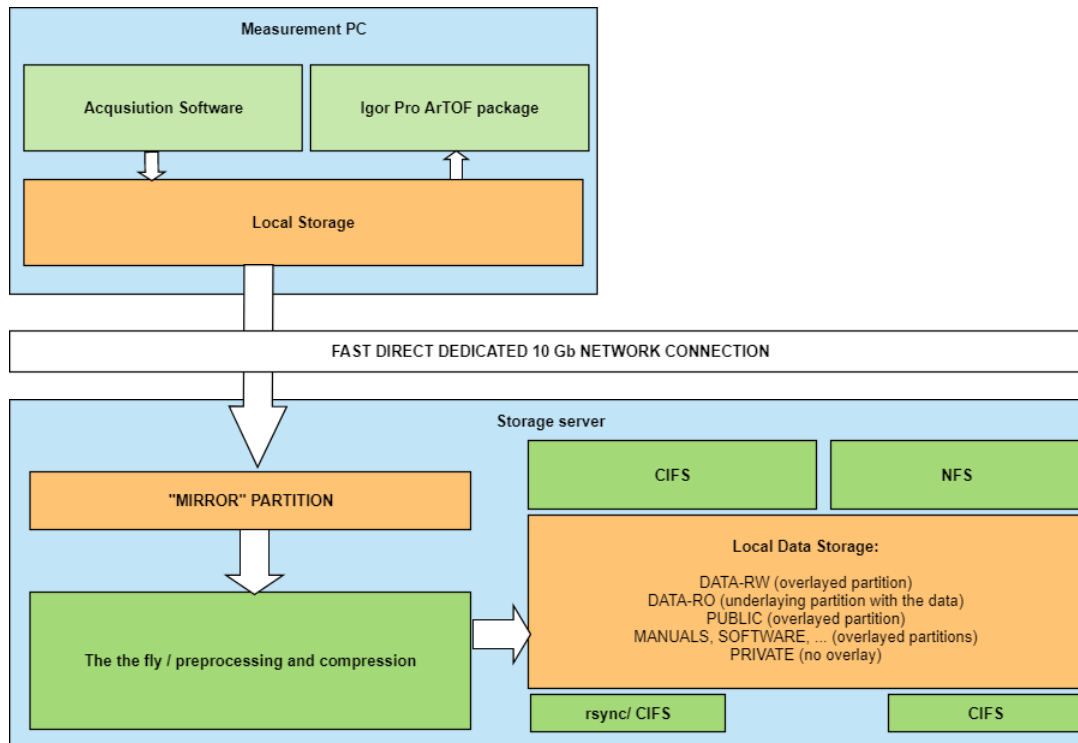
fixed_013

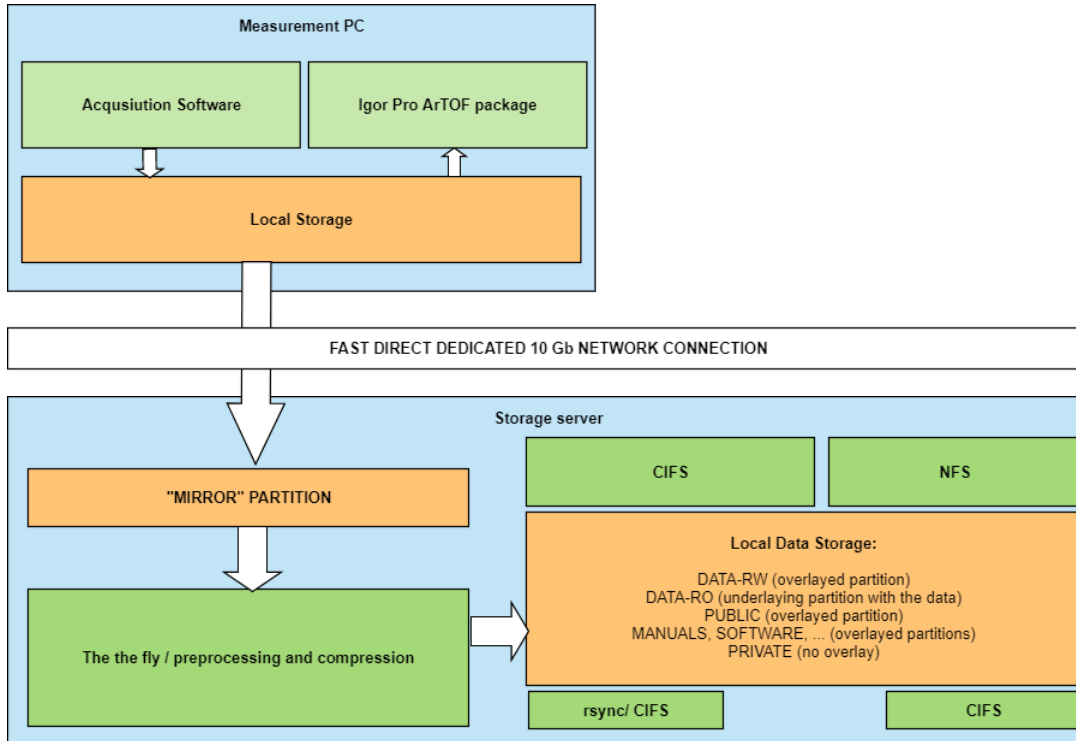
fixed_014

multiscan.cfg

runbook.txt



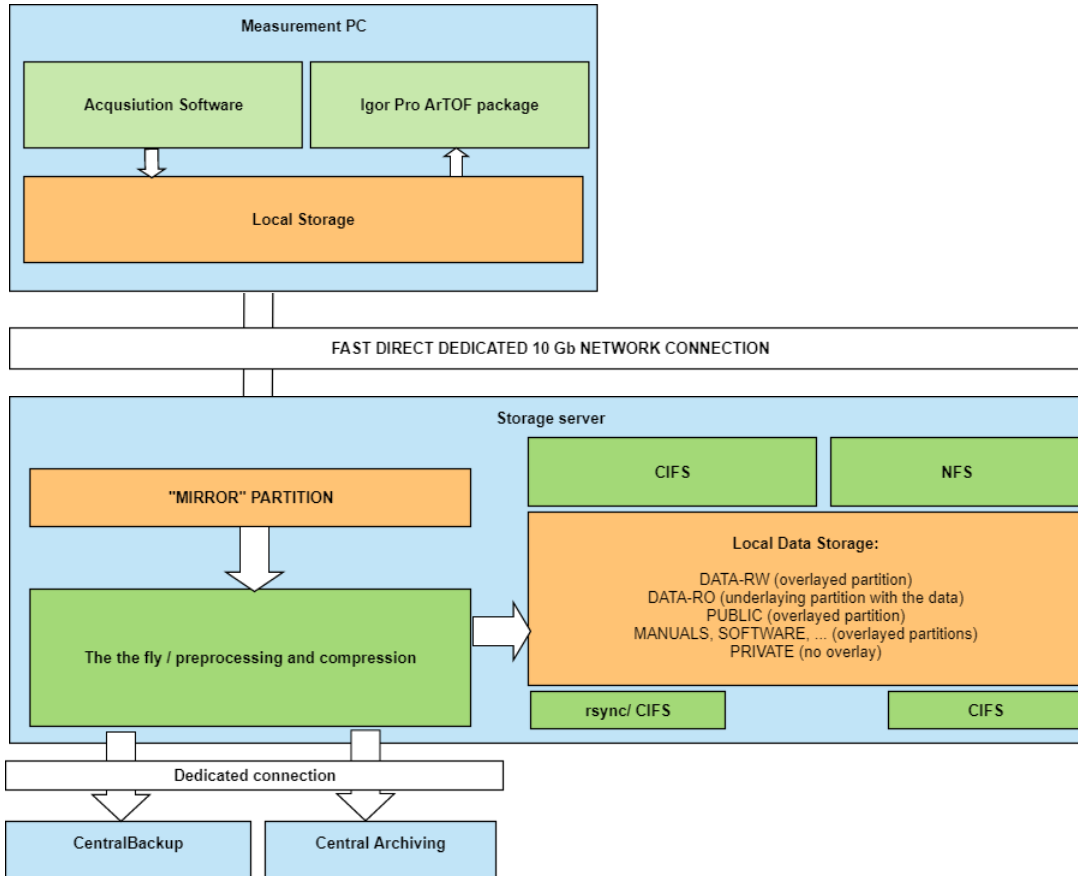




1. RSYNC to mirror partition
2. (coming up) pre-process / compress data
3. Send data to Local Storage

overlays :

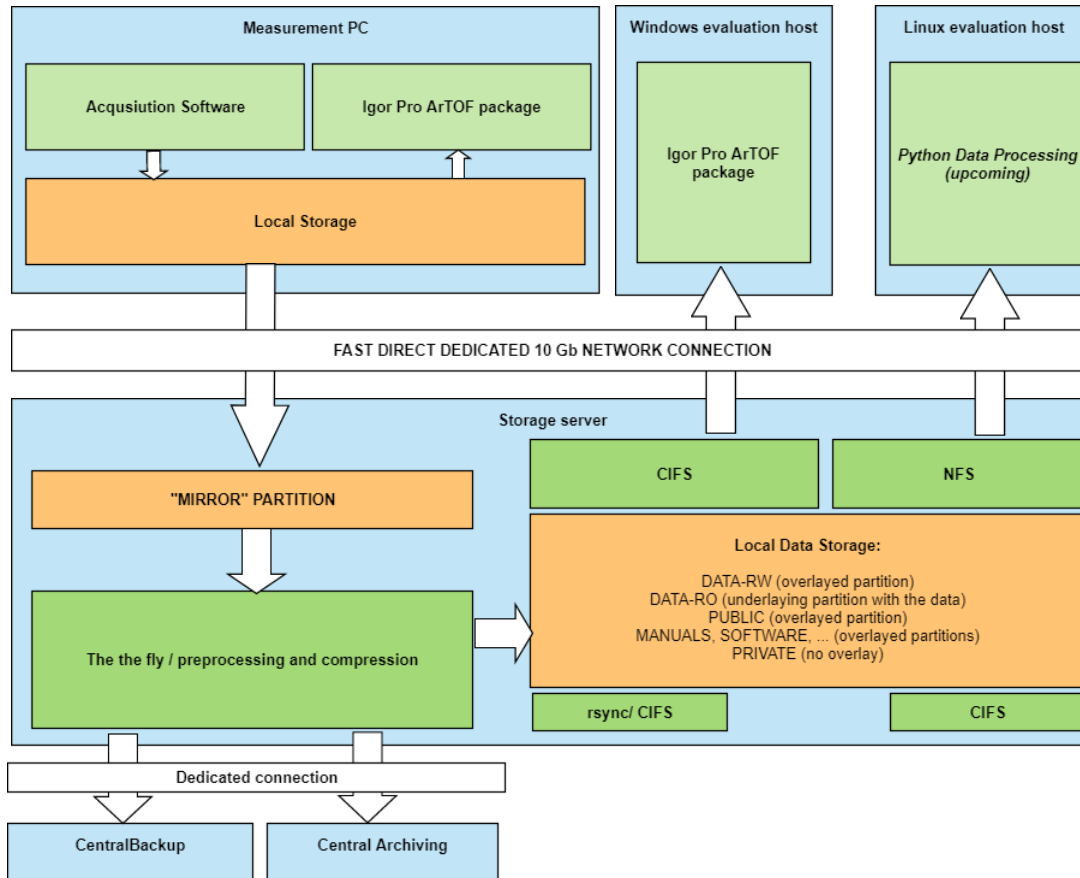
- immutable data
- but still available for "writing"
- DATA and "Sensitive" partitions as overlays



1. RSYNC to mirror partition
2. (coming up) pre-process / compress data
3. Send data to Local Storage
4. Send data to Archive
5. Send data to Backup

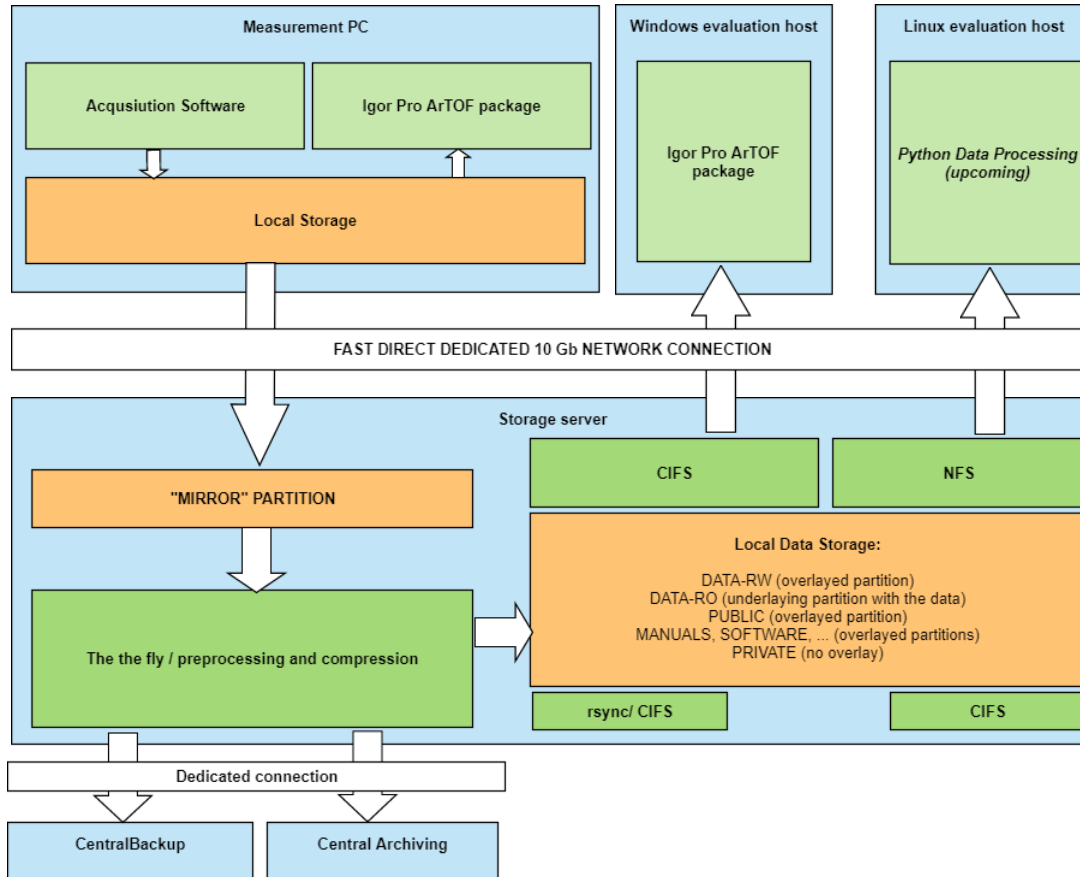
overlays :

- Backup only incoming data and "upperdir" – much smaller dataset to save



Fast access to saved data for online data processing and analysis using same 10Gb backbone

No extra load on standard HZB network

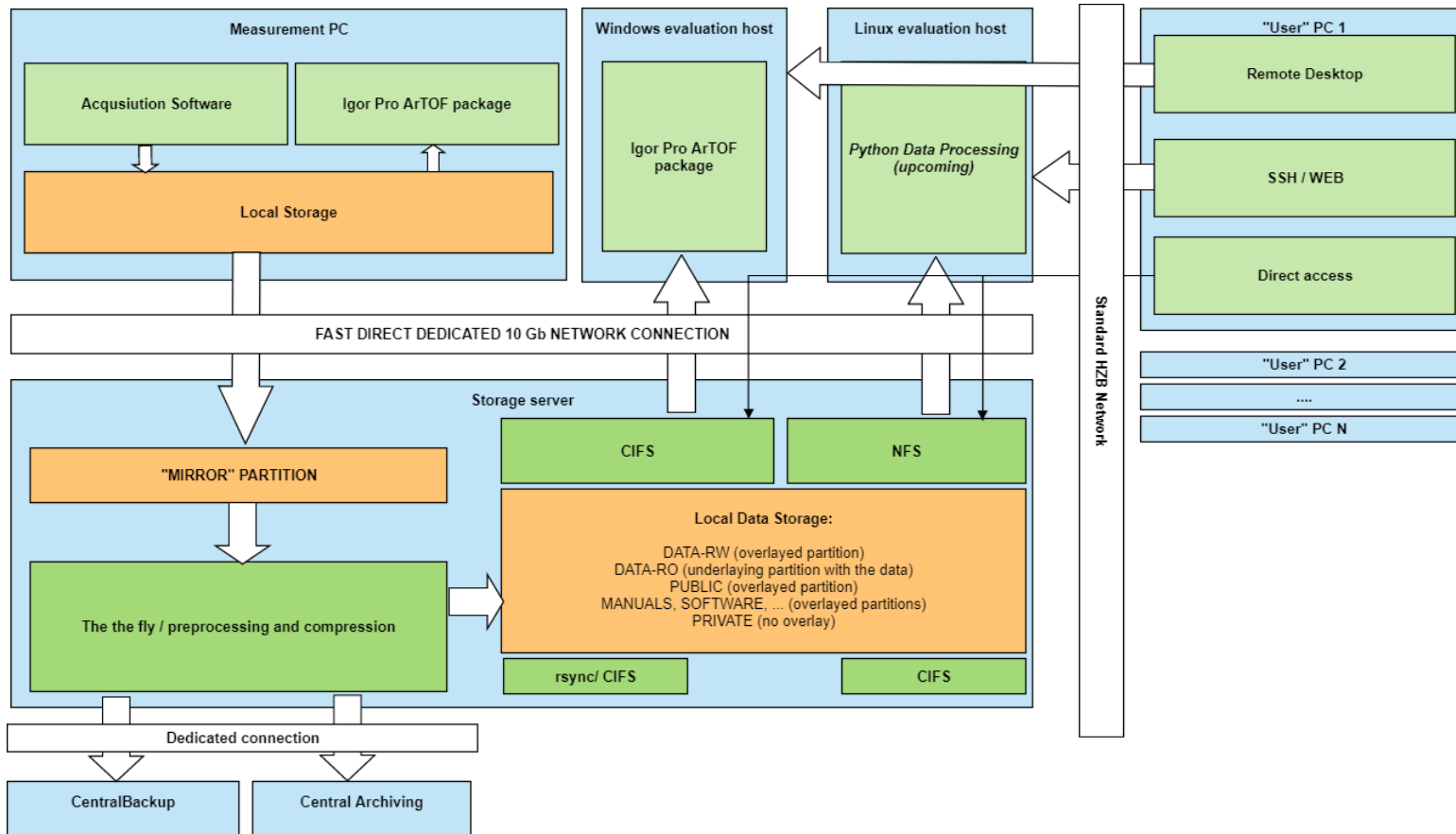


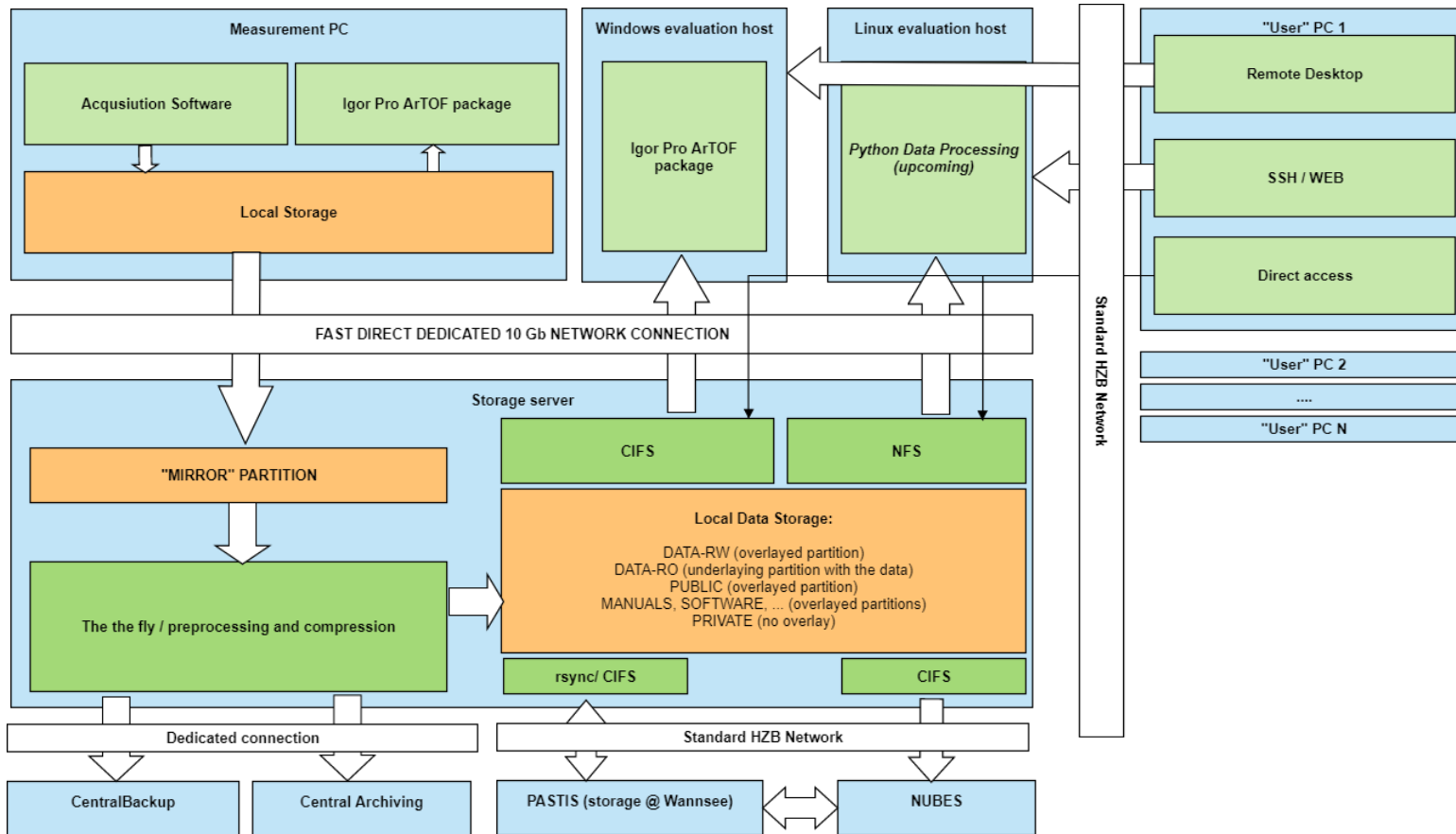
Fast access to saved data for online data processing and analysis using same 10Gb backbone

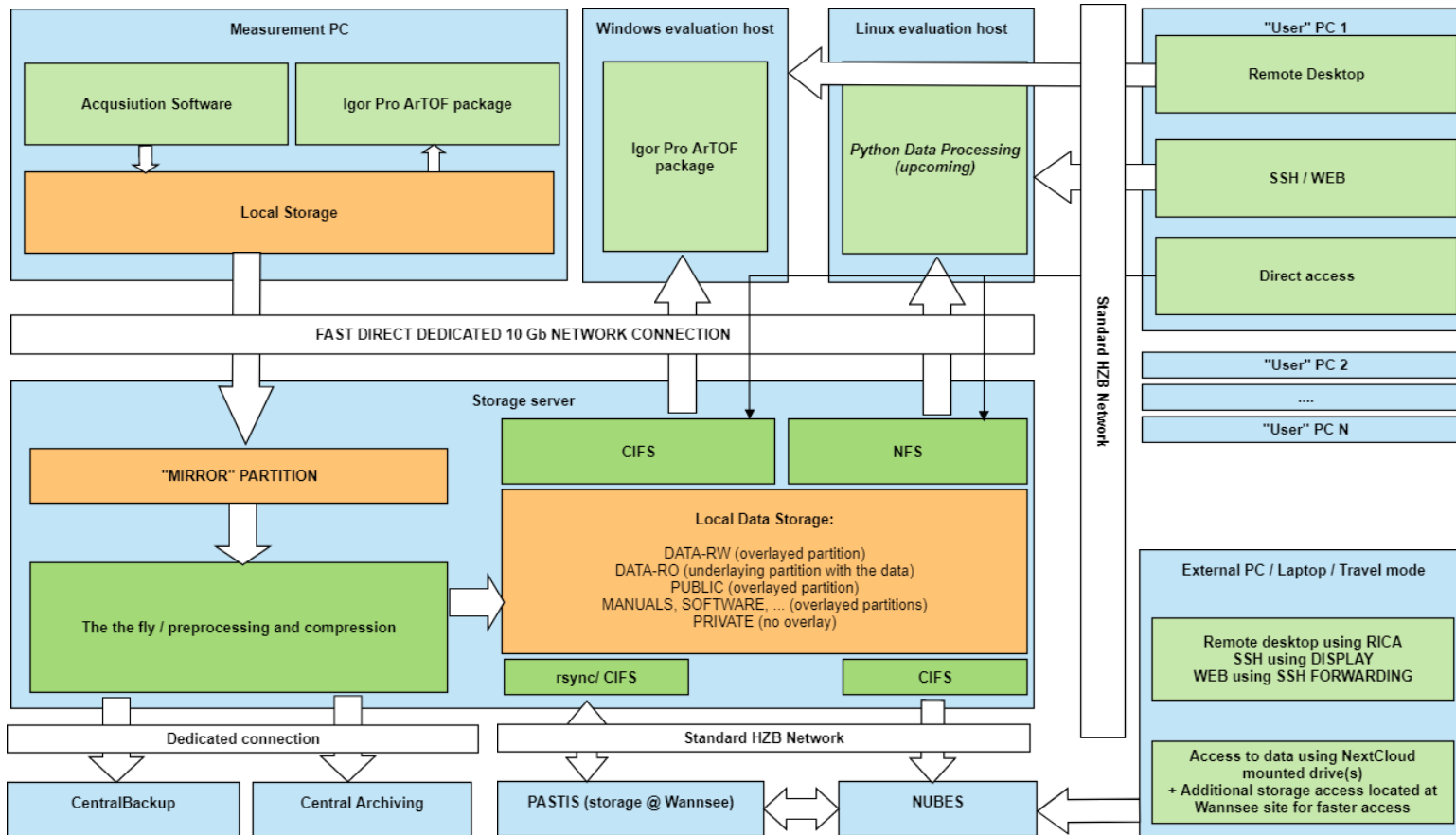
No extra load on standard HZB network

Faster SYNC to develop Windows FUSE (WinFSP/Dokan) overlay fs

1. Save locally
2. Send a copy to CIFS share







1. Centralized solution for authentication and authorization
2. Centralized, modern-standard LABBOOK
3. Centralized solution for data storage for online analysis
4. Centralized hardware (including OS level administration support) for online data analysis
5. Fast network capable of data transfer between experiment, storage and evaluation hosts
6. We need an experimental controls group that
 1. oversees standardization of metadata acquisition and naming
 2. helps to unify solutions between a particular experiment and centralized systems like storage, (pre)evaluation, etc
 3. unification of other standard task and features
7. WEB API for readback of current proposal / schedule for local metadata generation
8. Collaboration, Repository and Distribution web-tools for analysis tools development
9. Redundancy – from hardware to personnel