

Telescope Scheduling Messages

A proposal for a standard data exchange format

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1st European Asteroid Observer Meeting
01/02/2016

(1) ESA SSA-NEO Segment, (2) ESA SSA-SST Segment, (3) GMV Aerospace & Defence SAU

1. Why a Standard?
2. Scope of the Proposed Standard
3. General Architecture

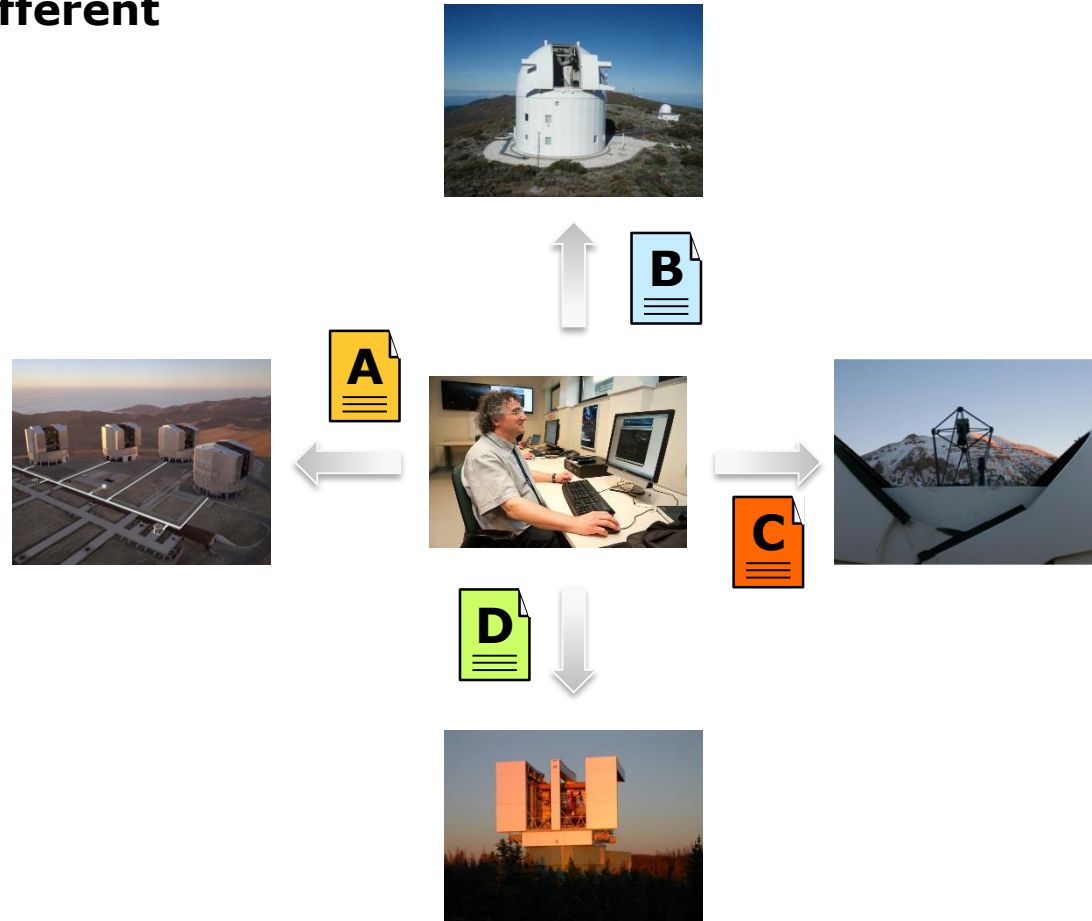


1 – Why a Standard?

Different input formats for different telescopes



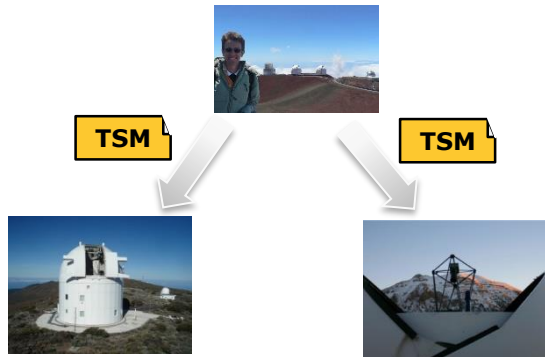
- Effort to produce observation commands / requests in different formats
- Effort to transfer from one format to the other
- Difficulty to include sensors in observation systems
- Difficulty for coordinated observations
- Difficulty to simulate & then execute observations



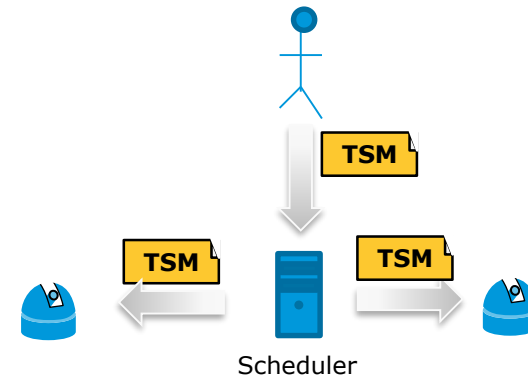
1 – Why a Standard?

Advantages of a single format

1 Multiple telescopes



2 Networks/coord. observations



3 Observer services



1 – Why a Standard?



```
023002_2100UT - Editor
Datei Bearbeiten Format Ansicht ?
#lentry 2014:01:31:21:00:41.000
#
track   coor1="00:32:13.027" coor2="+00:07:40.00" \
        timeref="2014:01:31:21:01:17.000" vha=0. vdec=0.
#
acq_async start="2014:01:31:21:01:19.000" exposure=30.0 \
          filename="/data/sd/SSA_NEO/20140131/023002/T023002_01150010_x_A" \
          obsname="/data/sd/SSA_NEO/20140131/023002/T023002_01150010_x_A.fit" \
          serienum=1 serienam="20140131-023002" trdelay=2 \
          coor1="00:35:21.130" coor2="+00:07:41.50" \
          timeref="2014:01:31:21:01:57.000" vha=0. vdec=0.
#lentry 2014:01:31:21:01:57.000
#
track   coor1="00:35:21.130" coor2="+00:07:41.50" \
        timeref="2014:01:31:21:01:57.000" vha=0. vdec=0.
#
acq_async start="2014:01:31:21:01:59.000" exposure=30.0 \
          filename="/data/sd/SSA_NEO/20140131/023002/T023002_01150011_x_A" \
          obsname="/data/sd/SSA_NEO/20140131/023002/T023002_01150011_x_A.fit" \
          serienum=2 serienam="20140131-023002" trdelay=2 \
          coor1="00:38:29.133" coor2="+00:07:41.50" \
          timeref="2014:01:31:21:02:37.000" vha=0. vdec=0.
#lentry 2014:01:31:21:02:37.000
#
track   coor1="00:38:29.133" coor2="+00:07:41.50" \
        timeref="2014:01:31:21:02:37.000" vha=0. vdec=0.
#
acq_async start="2014:01:31:21:02:39.000" exposure=30.0 \
          filename="/data/sd/SSA_NEO/20140131/023002/T023002_01150012_x_A" \
          obsname="/data/sd/SSA_NEO/20140131/023002/T023002_01150012_x_A.fit" \
          serienum=3 serienam="20140131-023002" trdelay=2 \
          coor1="00:41:37.135" coor2="+00:07:41.50" \
          timeref="2014:01:31:21:03:17.000" vha=0. vdec=0.
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```

2 – Scope of the Proposed Standard



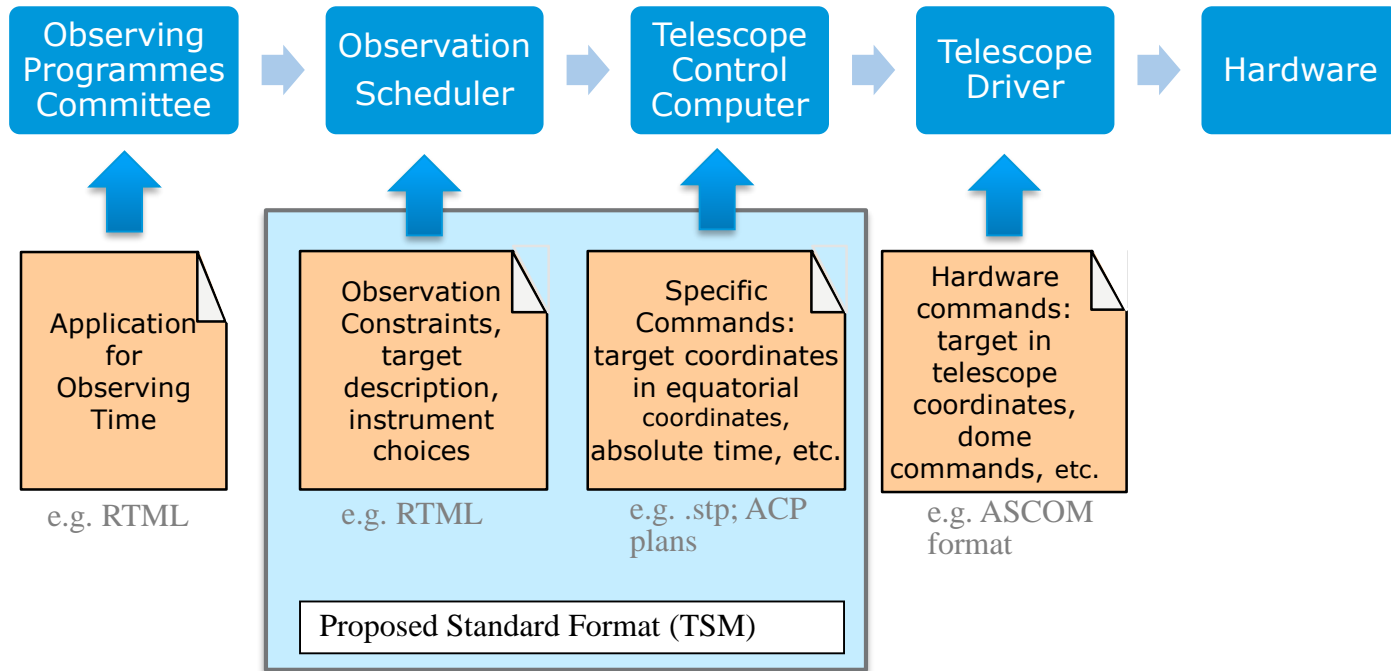
Implementation:

- First version tailored to SSA
- Support in collaborative systems

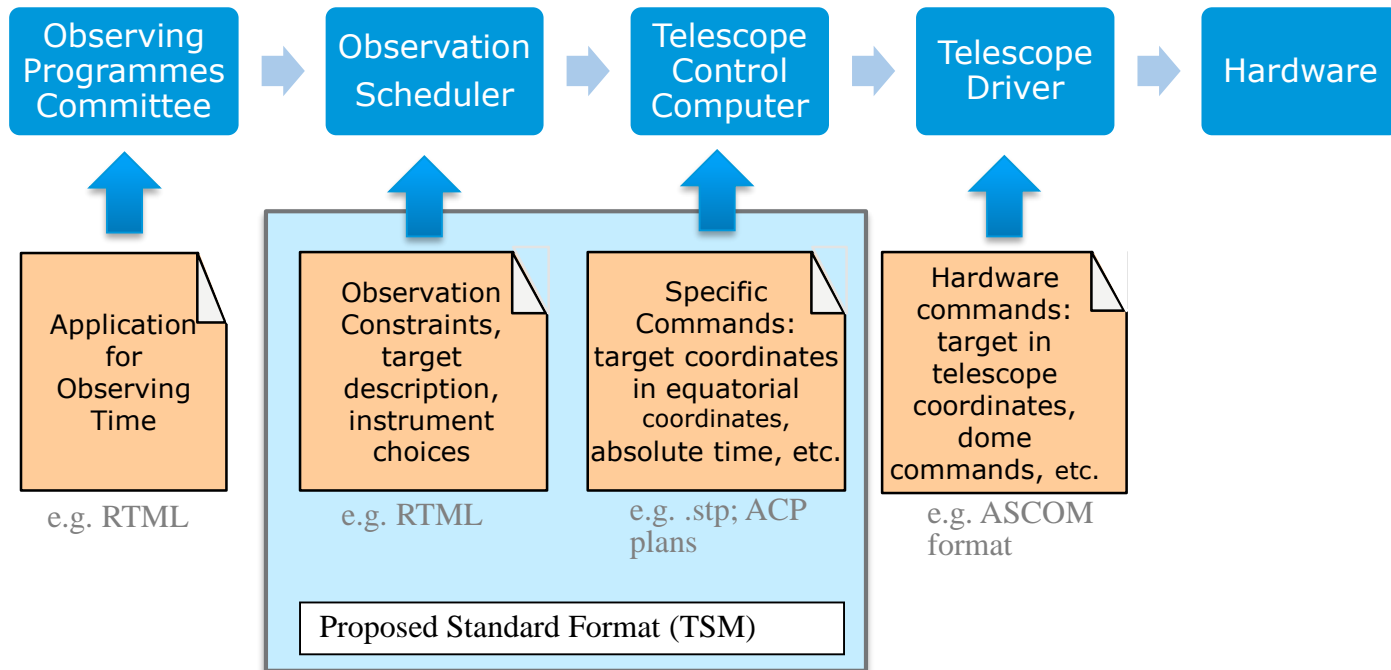
Goals:

- Adaptable for specific instruments and functions
- Adaptable for individual institutions
- Extendible
- Usable by automated and network-oriented systems
- Intuitive
- Consistent with existent formats in the domain

2 – Scope of the Proposed Standard



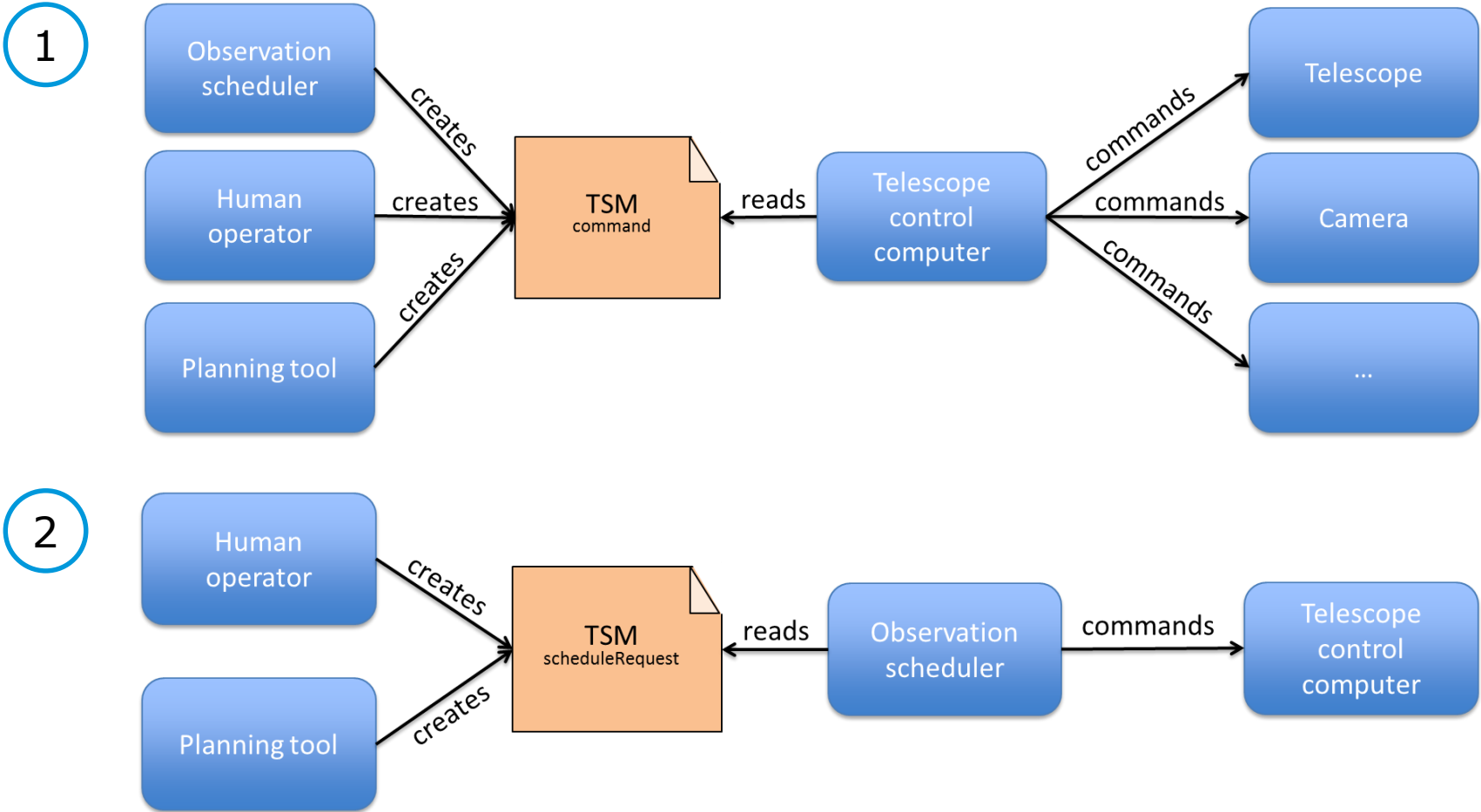
2 – Scope of the Proposed Standard



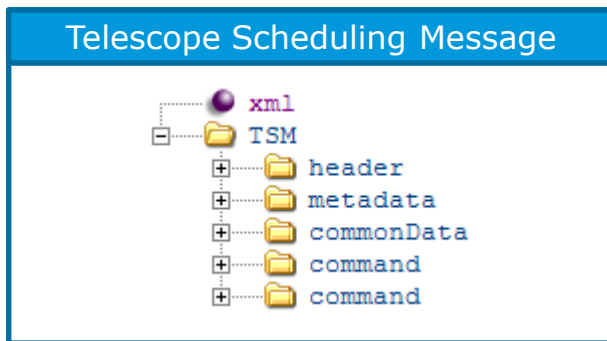
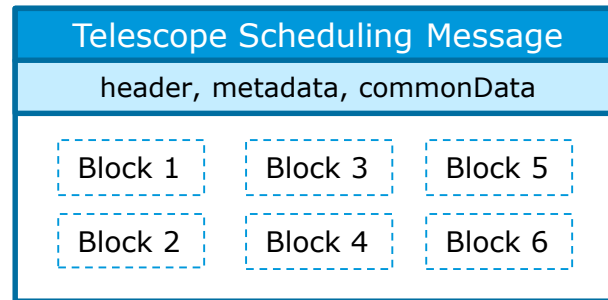
1 Telescope Commands

2 Scheduler Requests

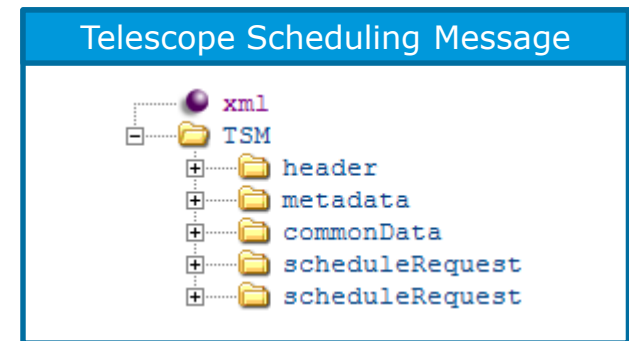
2 – Scope of the Proposed Standard



3 – General Architecture



1 Telescope Commands



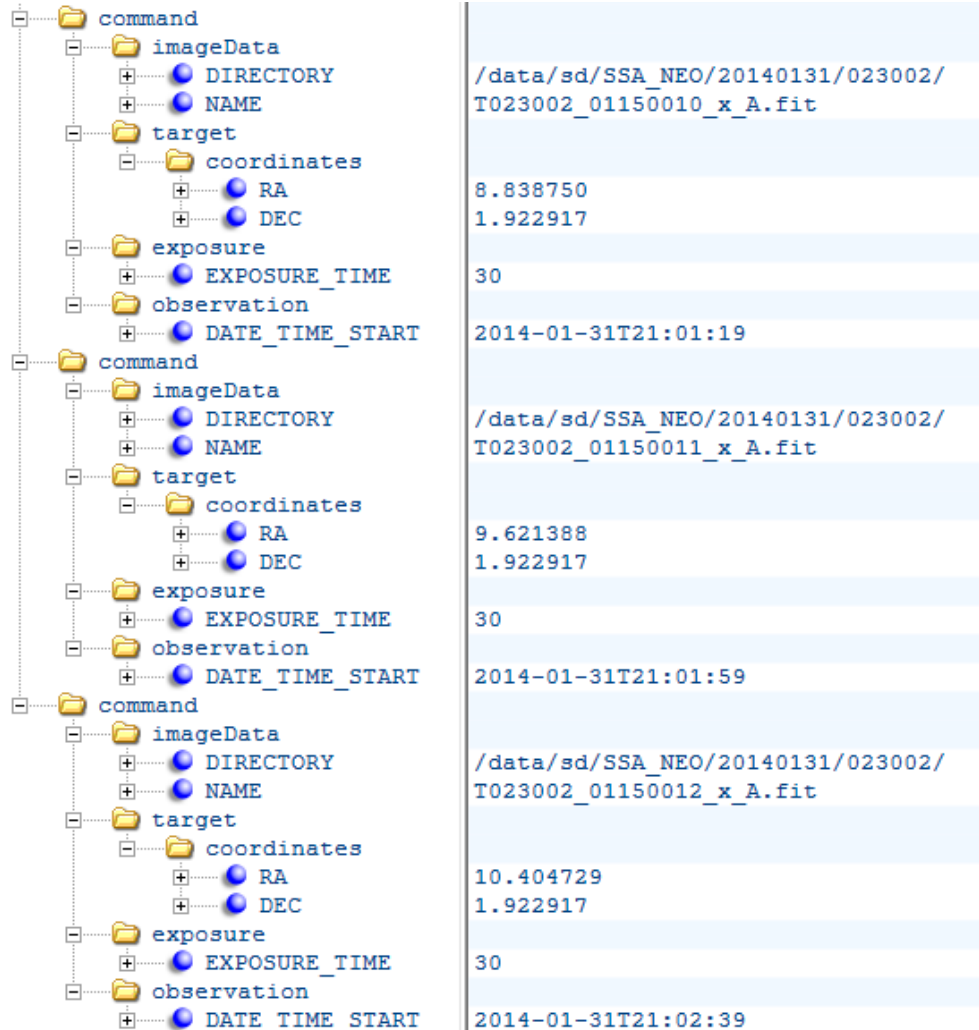
2 Scheduler Requests

3 – General Architecture



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#
acq_async start="2014:01:31:21:01:19.000" exposure=30.0 \
          filename="/data/sd/SSA_NEO/20140131/023002/T023002_01150010_x_A" \
          obsname="/data/sd/SSA_NEO/20140131/023002/T023002_01150010_x_A.fit" \
          serienum=1 serienam="20140131-023002" trdelay=2 \
          coor1="00:35:21.130" coor2="+00:07:41.50" \
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#
acq_async start="2014:01:31:21:02:39.000" exposure=30.0 \
          filename="/data/sd/SSA_NEO/20140131/023002/T023002_01150012_x_A" \
          obsname="/data/sd/SSA_NEO/20140131/023002/T023002_01150012_x_A.fit" \
          serienum=3 serienam="20140131-023002" trdelay=2 \
          coor1="00:41:37.135" coor2="+00:07:41.50" \
          timeref="2014:01:31:21:03:17.000" vha=0. vdec=0.
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#
track   coor1="00:41:37.135" coor2="+00:07:41.50" \
        timeref="2014:01:31:21:03:17.000" vha=0. vdec=0.
```

3 – General Architecture



3 – Gene



XML Notepad - D:\ESA Laptop

File Edit View Insert Window Help

D:\ESA Laptop Exchange\08 Telescope Comm

Tree View XSL Output

```
version="1.0" encoding="utf-8"

http://www.w3.org/2001/XMLSchema-inst
C:\Users\Philipp Gerd Maier\Documents
ESA_TSM_VERS
1.0

/data/sd/SSA_NEO/20140131/023002/
T023002_01150010_x_A.fit

8.838750
1.922917

30

2014-01-31T21:01:19

/data/sd/SSA_NEO/20140131/023002/
T023002_01150011_x_A.fit

9.621388
1.922917

30

2014-01-31T21:01:59

/data/sd/SSA_NEO/20140131/023002/
T023002_01150012_x_A.fit

10.404729
1.922917

30

2014-01-31T21:02:39
```

The image shows an XML Notepad window with a tree view on the left and an XSL Output window on the right. The tree view shows a hierarchical structure of XML elements, including 'xml', 'TSM', 'command', 'imageData', 'target', 'coordinates', 'exposure', and 'observation'. The XSL Output window displays the corresponding XML data, including file paths, coordinates, and exposure times.

3 – General Architecture



```
<TCM xsi:noNamespaceSchemaLocation="http://sanaregistry.org/r/ndmxml/ndmxml-1.0-master.xsd"
id="ESA_TSM " version="1.0">
  <command>
    <imageData>
      <DIRECTORY>data/sd/SSA_NEO/20140131/023002/</DIRECTORY>
      <NAME> T023002_01150010_x_A</NAME>
    </imageData>
    <target>
      <coordinates>
        <RA>0.128194</RA>
        <DEC>0.693649</DEC>
      </coordinates>
    </target>
    <exposure>
      <EXPOSURE_TIME>30</EXPOSURE_TIME>
    </exposure>
    <observation>
      <DATE_TIME_START>2014-01-31T21:03:19</DATE_TIME_START>
    </observation>
  </command>
</TCM>
```

XML Notepad - C:\Users\Philipp\Desktop\Philipp Maier\08 Telescope Command Data Format St...

File Edit View Insert Window Help

C:\Users\Philipp\Desktop\Philipp Maier\08 Telescope Command Data Format

Tree View XSL Output

```

xml
├── TSM
│   ├── xmlns:xsi
│   ├── xsi:noNamespaceSchemaLocation
│   ├── id
│   ├── version
│   └── header
│       ├── commonData
│       │   ├── imageData
│       │   │   ├── DIRECTORY
│       │   │   └── target
│       │   │       ├── coordinates
│       │   │       │   ├── DEC
│       │   │       └── exposure
│       │   │           └── EXPOSURE_TIME
│       │   └── command
│       │       ├── imageData
│       │       │   ├── NAME
│       │       │   └── target
│       │       │       ├── coordinates
│       │       │       │   ├── RA
│       │       │       └── observation
│       │       │           └── DATE_TIME_START
│       │       └── command
│       │           ├── imageData
│       │           │   ├── NAME
│       │           │   └── target
│       │           │       ├── coordinates
│       │           │       │   ├── RA
│       │           │       └── observation
│       │           │           └── DATE_TIME_START
│       │           └── command
│       │               ├── imageData
│       │               │   ├── NAME
│       │               │   └── target
│       │               │       ├── coordinates
│       │               │       │   ├── RA
│       │               │       └── observation
│       │               │           └── DATE_TIME_START
│       │               └── command
│       │                   ├── imageData
│       │                   │   ├── NAME
│       │                   │   └── target
│       │                   │       ├── coordinates
│       │                   │       │   ├── RA
│       │                   │       └── observation
│       │                   │           └── DATE_TIME_START

```

```

version="1.0" encoding="utf-8"
http://www.w3.org/2001/XMLSchema-instance
C:\Users\Philipp Gerd Maier\Documents\Philipp...
ESA_TSM_VERS
1.0

/data/sd/SSA_NEO/20140131/023002/

1.922917

30

T023002_01150010_x_A.fit

8.838750

2014-01-31T21:01:19

T023002_01150011_x_A.fit

9.621388

2014-01-31T21:01:59

T023002_01150012_x_A.fit

10.404729

2014-01-31T21:02:39

```

3 – Gene

The screenshot shows an XML Notepad window with the following content:

File Edit View Insert Window Help

standard - XML Documents\TCML\TSM-FollowUp_Example_2015-12-07.xml

Tree View XSL Output

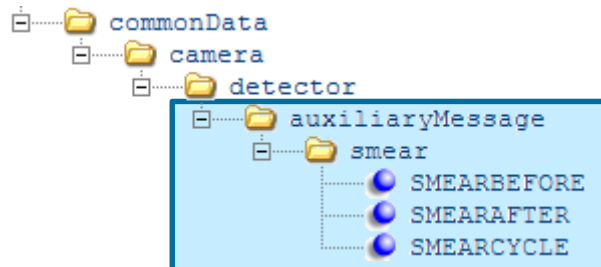
XML Element	XSL Output
xmlns:xsi	http://www.w3.org/2001/XMLSchema-instance
xsi:noNamespaceSchemaLocation	C:\Users\Philipp Gerd Maier\Documents\Philipp...
id	ESA_TSM_VERS
version	1.0
header	
commonData	
camera	
NAME	ESASDC2
imageData	
DIRECTORY	/data/sd/SSA_NEO/20140131/023002/
fitsHeader	
target	
NAME	2015BD515
TARGET_TYPE	NEO
ephemerides	
EPHEMERIDES_TYPE	SSA ID
URI	http://newton.dm.unipi.it/neodys/where-is-2015BD515?
exposure	
EXPOSURE_TIME	30
constraints	
dateTimeConstraint	
DATE_TIME_START	2014-01-31T18:00:00
DATE_TIME_END	2014-02-01T09:00:00
moonConstraint	
DISTANCE	20
nightConstraint	
BEGIN_NIGHT	-PT3M
END_NIGHT	PT3M
scheduleRequest	
blockMetadata	
BLOCK_ID	Observation_1
imageData	
NAME	T023002_01150010_x_A.fit
scheduleRequest	
blockMetadata	
BLOCK_ID	Observation_2
imageData	
NAME	T023002_01150011_x_A.fit
constraints	
waitConstraint	
PREVIOUS_BLOCK	Observation_1
WAIT_TIME	PT1H
scheduleRequest	
blockMetadata	
BLOCK_ID	Observation_3
imageData	
NAME	T023002_01150012_x_A.fit
constraints	
waitConstraint	
PREVIOUS_BLOCK	Observation_2
WAIT_TIME	PT1H



Thank you!

Advanced Provisions

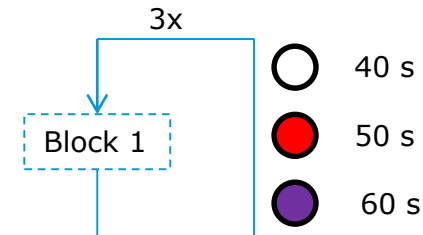
- **For Automated Systems**
 - Linking of blocks
 - STATE and FAILURE_COUNT
- **User-Specific Functions**



Advanced Provisions

- **Extensions**

- Making use of basic blocks
- Allowing higher-order logic



- **Validity Checks for Individual Telescopes**

- XML "schemas" provide grammar and rules
- Schemas for particular telescopes possible

