

# A new GNSS station **M**etadata **M**anagement and dissemination system in support of **M**ultiple networks - **M**<sup>3</sup>

A. Fabian, C. Bruyninx, J. Legrand

Royal Observatory of Belgium – EPN Central Bureau

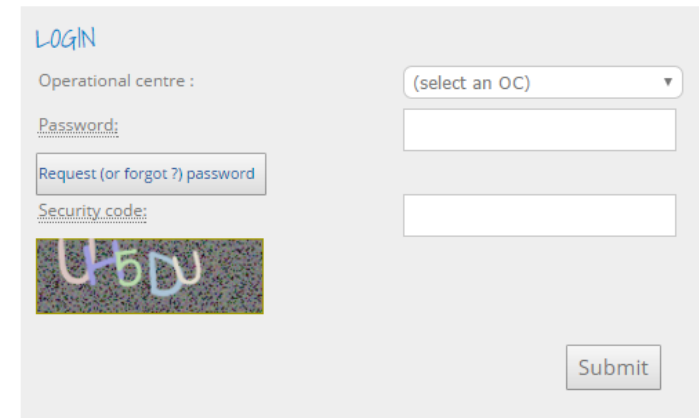
# History of the GNSS metadata management

Maintenance of metadata is mandatory for:

- a correct data analysis
- a correct interpretation of the GNSS results

Historically, EPN CB always made a lot of effort to guarantee reliable GNSS metadata

- The first site log plain text format submission was by email
  - **validation** of the site log
  - **saving** to the ftp server
- In 2009, EPN CB released the first online tool
  - **create** a new site log
  - **upload** a site log from the local disk or from the EPN CB DB
  - **update** the site log
  - **save** the site log on the local disk / in the EPN CB data base
    - (all in IGS/EPN site log format)




LOGIN

Operational centre :

Password:

[Request \(or forgot ?\) password](#)

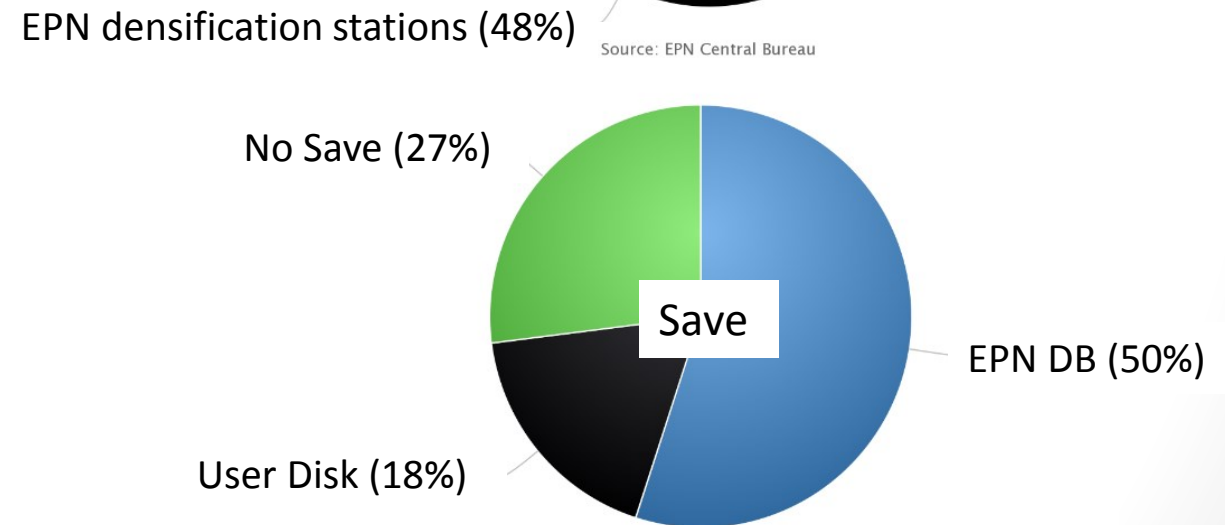
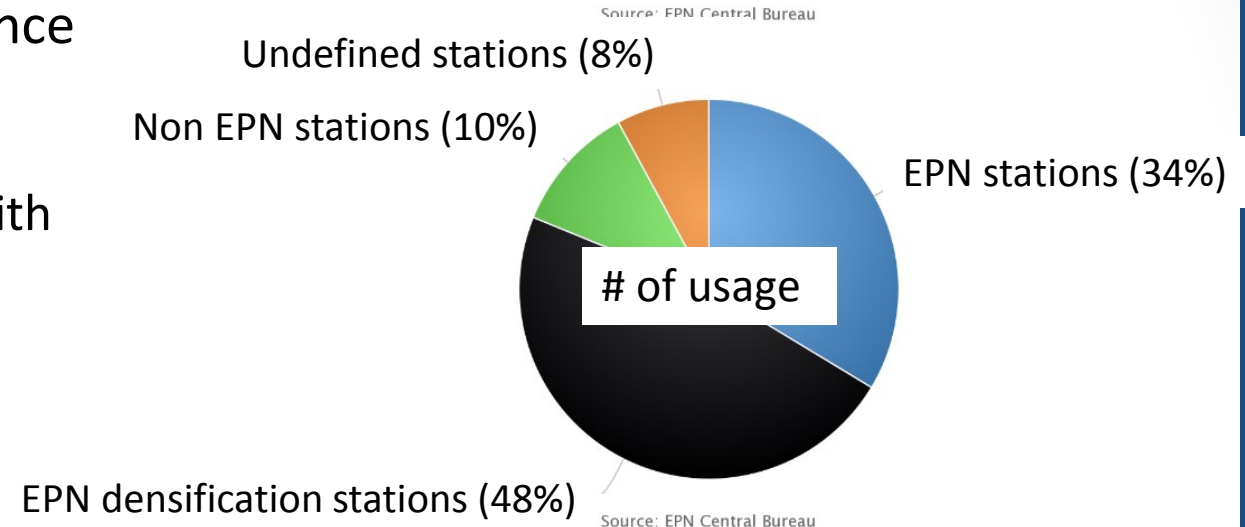
Security code: 

# Current usage of online site log tool

- Collected several years of user experience

- More than 2000 usage per year
- Larger number of usage for networks with more stations

- Save it to the db. (General usage)
- “No save” is significantly huge
  - Check the form
  - Prefer to restart



## Introduction of new tool:

- M<sup>3</sup> Metadata Management for Multiple GNSS Networks**

# New requirements for the system

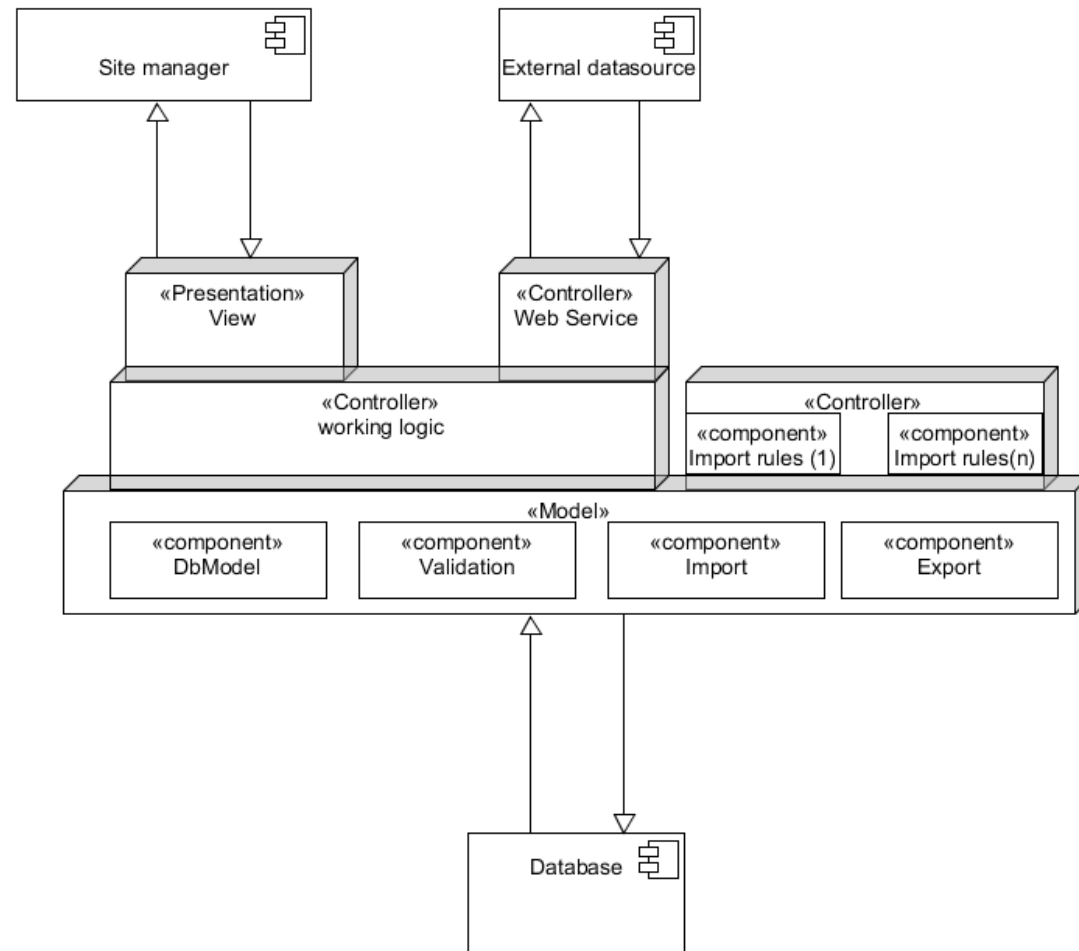
Should be able to:

- Handle the site log submission of a station to multiple networks (EPN, EPN densification, EPOS) in one place
- Handle the independent network requirements and validation process
- Create and update online Operational Center (OC) Form
- Handle the information common to several site logs in one place (e. g. on site point of contact)
- Handle multiple site log updates within one day
- Separate the historical and current information during the update
  - Avoid changing historical information by accident
- Handle the individual exception rules for stations
- Be prepared for new export/import formats (GeodesyML (M2M), Json)

# The abstract design of the new system

Based on the model view control architecture

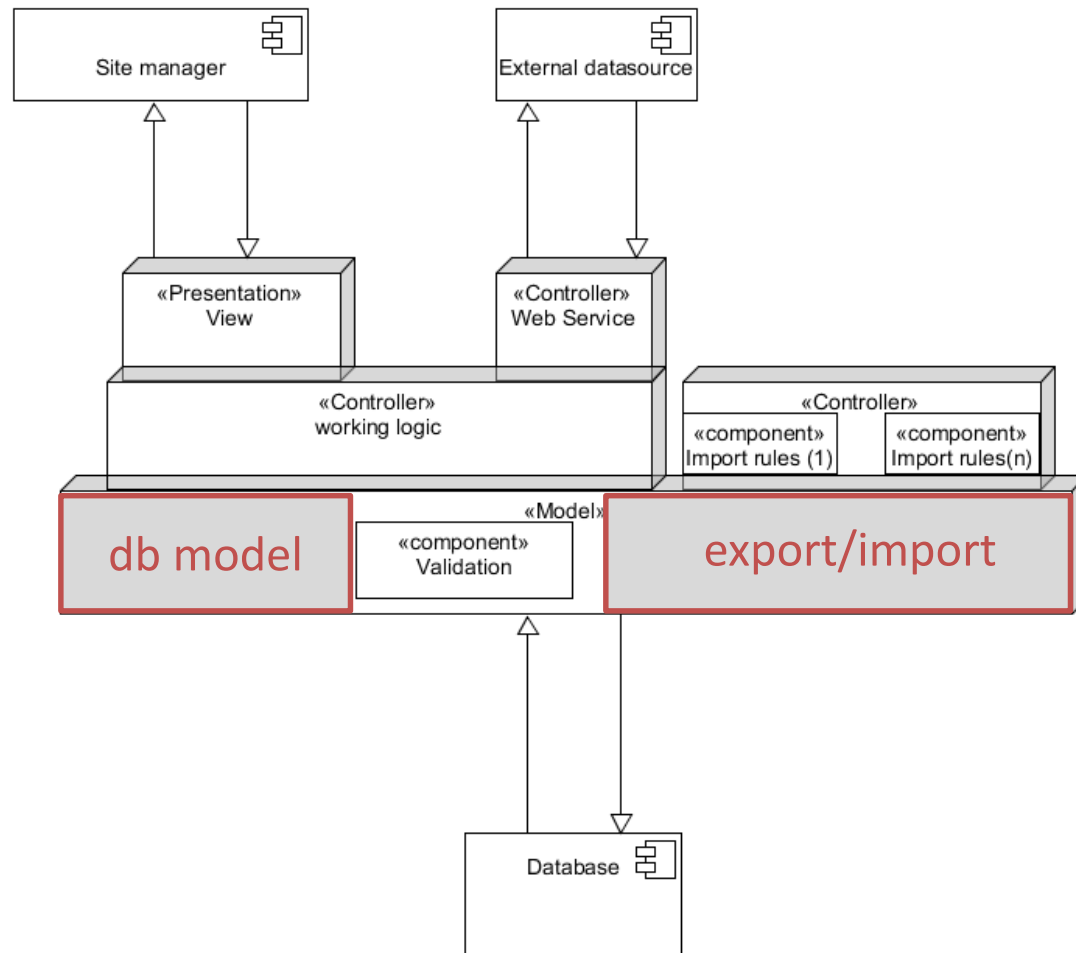
- More flexible
- Easy to extend it with new features
- The db model and the Export/Import modules are separated
- The database model and validation rules are separated from the working logic
- Separated components to import and export the list of auxiliary information (IGS antenna/receiver types)
- Separated web service can use the same External formats and validation rules as the Site manager



# The abstract design of the new system

Based on the model view control architecture

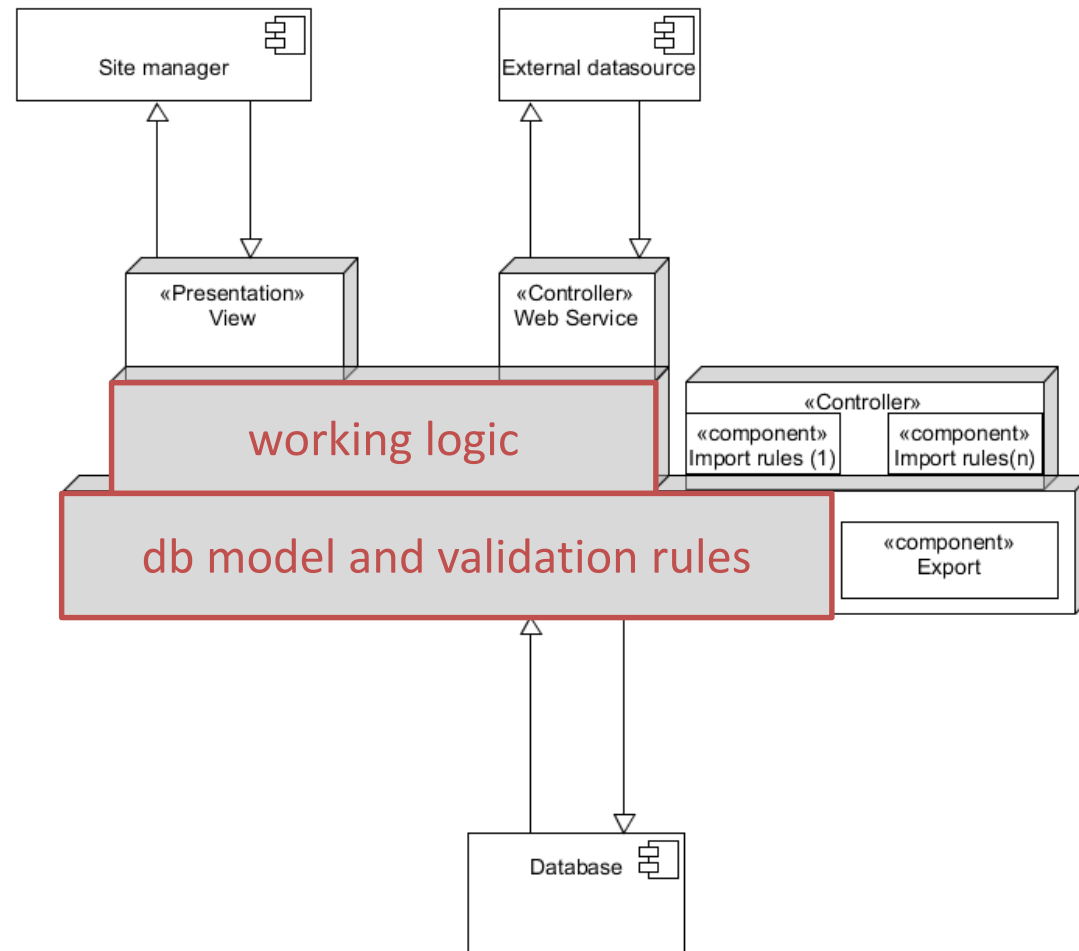
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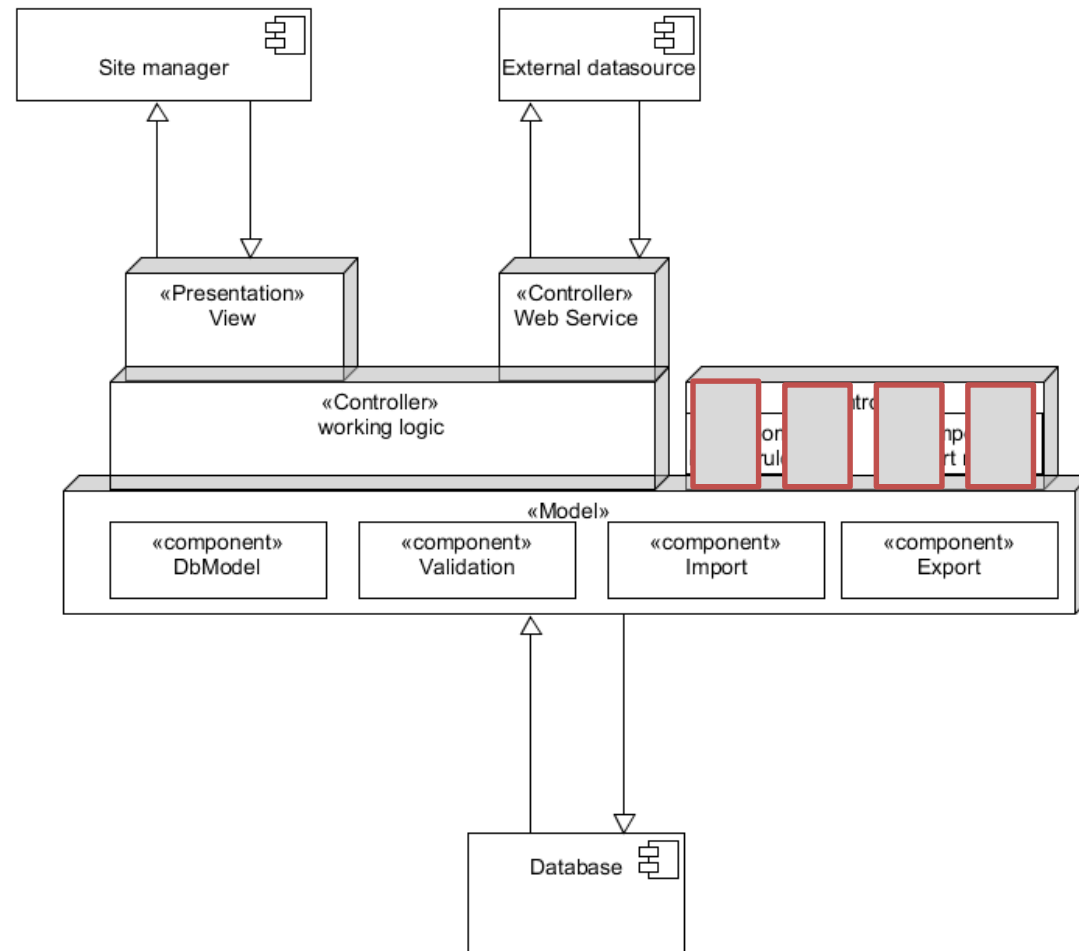
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Based on the model view control architecture

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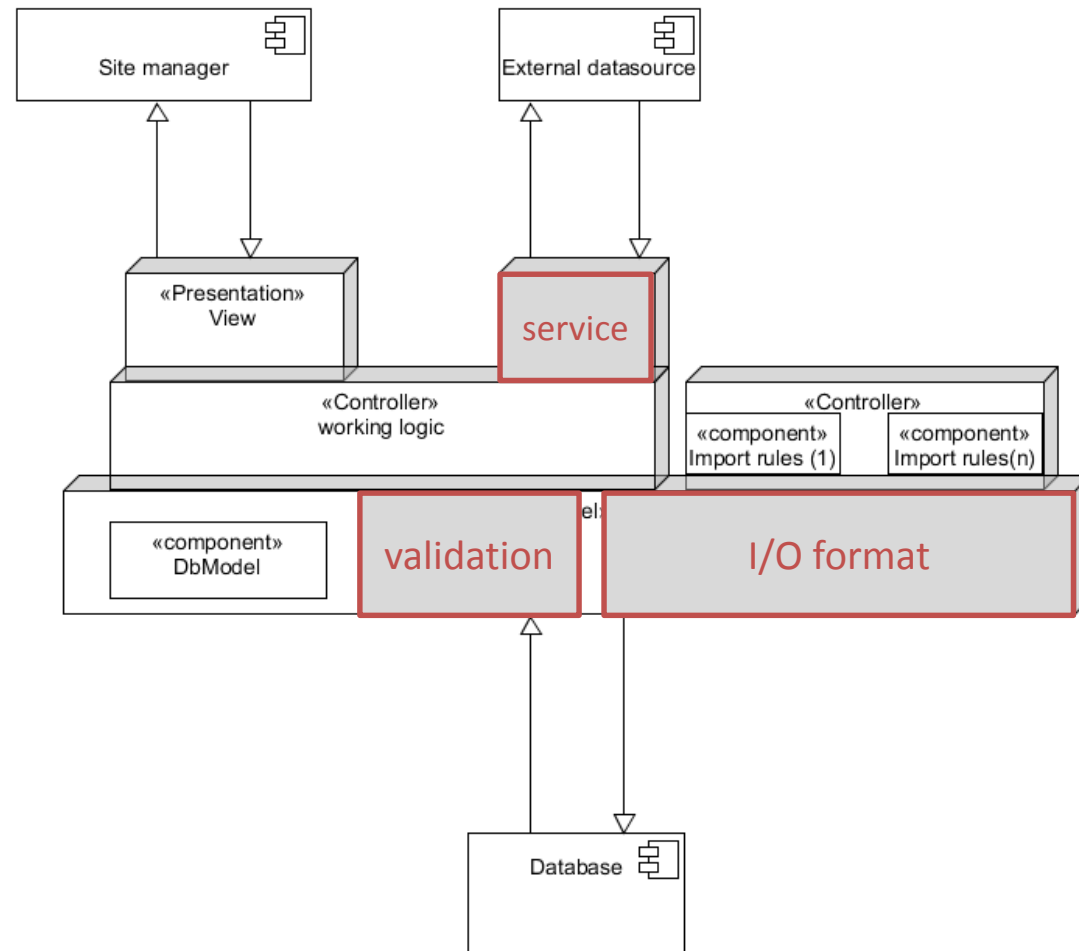




# The abstract design of the new system

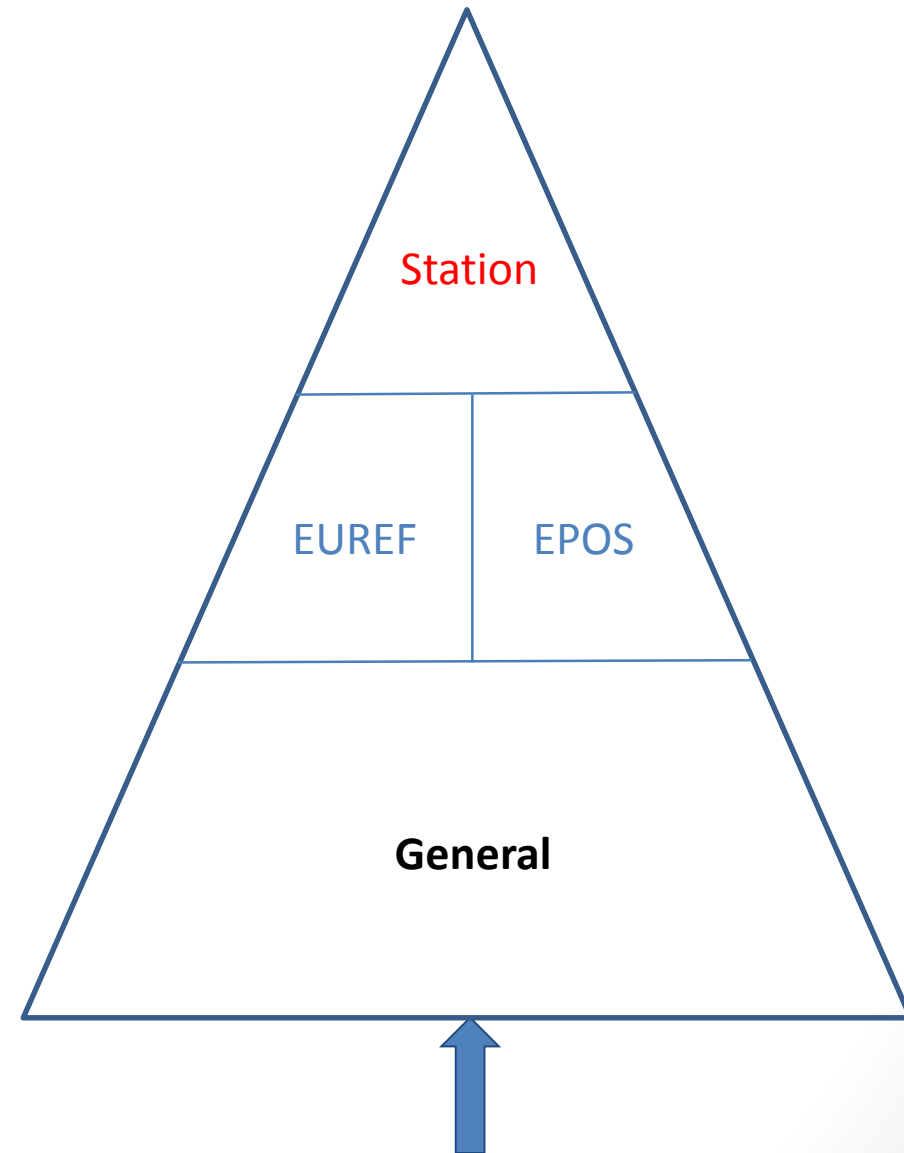
Based on the model view control architecture

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- The database model and validation rules are separated from the working logic
- Separated components to import and export the list of auxiliary information (IGS antenna/receiver types)
- Separated web service can use the same external formats and validation rules as the web form



# Hierarchical Rules for validating the site logs

- **General rules:** same for all networks
  - e.g. antenna type known by IGS
- **Network rules:** depend on the network
  - e. g. DOMES number
    - required for EPN
    - not required for EPOS
- **Station-dependent rules:** to handle **exceptions**
  - e.g. historical antenna which not fulfill present requirements



# Operational Center Form

- Allows to identify for each OC, stations that :
  - fall under the OC responsibility
  - for which the OC has committed to maintain metadata
- ASCII
  - plain text format
  - Maintained by the OC
  - Manually imported, checked and saved by the EPN CB

```
-----
EUREF OPERATIONAL CENTRE
-----

Agency acronym      : ROB
Institution          : Royal Observatory of Belgium
Mail Address         : avenue Circulaire, 3   B-1180 Brussels
Country              : Belgium

Primary Contact
Contact Name         : Bruyninx Carine
Telephone            : 32-2-3730292
Fax                  : 32-2-3749822
E-Mail               : carine.bruyninx@oma.be

Secondary Contact
Contact Name         : Moyaert Ann
Telephone            : 32-2-3730201
Fax                  : 32-2-3749822
E-Mail               : ann.moyaert@oma.be

Third Contact
Contact Name         : Legrand Juliette
Telephone            : 32-2-3730306
Fax                  : 32-2-3749822
E-Mail               : juliette.legrand@oma.be

Report generated     : 2003-03-26
Report updated       : 2010-05-20
                    : 2012-02-08 --> BRUX site added
                    : 2015-03-03 --> third contact modified
-----

OPERATED STATIONS    : BRUS00BEL BRUX00BEL DENT00BEL DOUR00BEL WARE00BEL
THIRD PARTY STATIONS :
-----

4-char ID            : (A4)
Long Station Name     : (AAAAAMRCCC -> 4-char ID/Monument/Receiver/Country)
City Name             :
Country               : (ISO 3166-1 alpha-3)
DOMES Number          : (A9)
Lat | Long | Ht(m)    : ( +/-DD.DD | +/-DDD.DD | F7.2 )
Operational since     : (YYYY-MM-DD)
Station               : (operated/third party)
  Link rcvr -> OC      : (Internet, satellite)
  Data transferred     : (Raw, RINEX, ... options possibilities)
  Transfer mode         : (real-time, hourly ftp, daily ftp, ... mult. possibilities)
  RINEX converter       : (software)
  Operated by           : (agency - for third party stations only)
  Data from             : (ftp, url - for third party stations only)
Addition remarks      :
```

# Operational Center Form

## Online Form

- Contents now online maintained by the OC
- After online validation, OC can directly save the form to the database
- No manual interaction by the EPN CB
- Modify the responsible agency Information
- Modify the station list
- Extend the contact information

**OC FORM :ROYAL OBSERVATORY OF BELGIUM(ROB)**

**Agency Information**

Agency acronym	ROB
Preferred abbreviation	ROB
Full name of the agency	Royal Observatory of Belgium
Country	Belgium
Address	avenue Circulaire, 3 B-1180 Brussels
Date of the register	2017-04-26
Report note	2010-05-20 2012-02-08 --> BRUX site added 2015-03-03 --> third contact modified

**Stations**

OPERATED STATIONS	BRUX00BEL, BRUS00BEL, DENT00BEL, DOUR00BEL, WARE00BEL
-------------------	---

 [Modify](#)

**Contacts**

**Contact**

Full name of the contact	Bruyninx Carine
E-Mail address	carine.bruyninx@oma.be
Primary Telephone number	+32470123456
Secondary Telephone number	
Fax	

 [Modify](#)  [Delete](#)

M3 Demo

# Operational Center Form

## Online Form

- Contents maintained by the OC
  - OC can directly save the form to the database
  - No manual check by the EPN administrator
- 
- Modify the responsible agency Information
  - Modify the station list
  - Extend the contact information

## RESPONSIBLE AGENCY INFORMATIONS

### AGENCY INFORMATIONS

Full name of the agency *	?	<input type="text" value="Royal Observatory of Belgium"/>
Preferred abbreviation *	?	<input type="text" value="ROB"/>
Country *	?	<input type="text" value="Belgium"/>
Address *	?	<input type="text" value="avenue Circulaire, 3&lt;br/&gt;B-1180&lt;br/&gt;Brussels"/>
Report note	?	<input type="text" value="2010-05-20&lt;br/&gt;2012-02-08 --&gt; BRUX site added&lt;br/&gt;2015-03-03 --&gt; third contact modified"/>

### STATION LIST

<input type="text" value="BRUX00BEL"/>	<input type="button" value="x"/>	<input type="text" value="BRUS00BEL"/>	<input type="button" value="x"/>
<input type="text" value="DENT00BEL"/>	<input type="button" value="x"/>	<input type="text" value="DOUR00BEL"/>	<input type="button" value="x"/>
<input type="text" value="WARE00BEL"/>	<input type="button" value="x"/>		

+ Add station

◀ Back

⌵ Save

\* Required field.

M3 Demo

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OF BELGIUM



# Station information



## Site log BRUX

⚙ NETWORKS & STATIONS

- 📍 Stations 5
- BRUX00BEL
- » Site log
- ⚠ BRUS00BEL
- ⚠ DENT00BEL
- DOUR00BEL
- ⚠ WARE00BEL
- 👤 Profile
- 🔒 Logout



BRUX Site Information Form (site log)  
International GNSS Service  
See Instructions at:  
[ftp://igsb.jpl.nasa.gov/pub/station/general/sitelog\\_instr.txt](ftp://igsb.jpl.nasa.gov/pub/station/general/sitelog_instr.txt)

### 0. Form

Prepared by (full name) : Bruyninx Carine  
Date Prepared : 2017-05-05  
Report Type : NEW  
If Update:  
Previous Site Log : (ssss\_ccyyymmdd.log)  
Modified/Added Sections : (n.n,n.n,...)

### 1. Site Identification of the GNSS Monument

Site Name : Brussels  
Four Character ID : BRUX  
Monument Inscription :  
IERS DONES Number : 13101M010  
CDP Number : (A4)  
Monument Description : STEEL MAST  
Height of the Monument : 8 m  
Monument Foundation : CONCRETE BLOCK  
Foundation Depth : 3 m  
Marker Description : CENTER OF HOLE IN STEEL PLATE  
Date Installed : 2006-07-07  
Geologic Characteristic : SAND  
Bedrock Type : SEDIMENTARY  
Bedrock Condition : FRESH  
Fracture Spacing : (1-10 cm/11-50 cm/51-200 cm/over 200 cm)  
Fault zones nearby : NO  
Distance/activity : (multiple lines)  
Additional Information : (multiple lines)

# Station information

Site log BRUX

NETWORKS & STATIONS

- Stations 5
- BRUX00BEL
- » Site log
- BRUS00BEL
- DENT00BEL
- DOUR00BEL
- WARE00BEL
- Profile
- Logout

BRUX Site Information Form (sl)  
International GNSS Service  
See Instructions at:  
<ftp://igs.cb.jpl.nasa.gov/pub>

0. Form

Prepared by (full name) : Bru  
Date Prepared : 201  
Report Type : NEW  
If Update:  
Previous Site Log : (ss  
Modified/Added Sections : (n.

1. Site Identification of the GNS

Site Name : Bru  
Four Character ID : BRU  
Monument Inscription :  
IERS DOWNS Number : 131  
CDP Number : (A4  
Monument Description : STE  
Height of the Monument : 8 m  
Monument Foundation : COM  
Foundation Depth : 3 m  
Marker Description : CEM  
Date Installed : 200  
Geologic Characteristic : SAM  
Bedrock Type : SED  
Bedrock Condition : FRE  
Fracture Spacing : (1-  
Fault zones nearby : NO  
Distance/activity : (mu  
Additional Information : (multiple lines)

NETWORKS & STATIONS

Stations 5

BRUX00BEL

» Site log

BRUS00BEL

DENT00BEL

DOUR00BEL

WARE00BEL

Profile

Logout

# Station information

Site log BRUX

NETWORKS & STATIONS

Stations 5

BRUX00BEL

» Site log

BRUS00BEL

DENT00BEL

DOUR00BEL

WARE00BEL

Profile

Logout

View

Import

Update

Export

BRUX Site Information

International GNSS Ser

See Instructions at

ftp://igsb.jpl.nasa.g

0. Form

Prepared by (full name) : Bruyninx Carine

Date Prepared : 2017-05-05

Report Type : NEW

If Update:

Previous Site Log : (ssss\_ccyyymmdd.log)

Modified/Added Sections : (n.n,n.n,...)

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Four Character ID : BRUX

Monument Inscription :

IERS DDMES Number : 13101M010

CDP Number : (A4)

Monument Description : STEEL MAST

Height of the Monument : 8 m

Monument Foundation : CONCRETE BLOCK

Foundation Depth : 3 m

Marker Description : CENTER OF HOLE IN STEEL PLATE

Date Installed : 2006-07-07

Geologic Characteristic : SAND

Bedrock Type : SEDIMENTARY

Bedrock Condition : FRESH

Fracture Spacing : (1-10 cm/11-50 cm/51-200 cm/over 200 cm)

Fault zones nearby : NO

Distance/activity : (multiple lines)

Additional Information : (multiple lines)

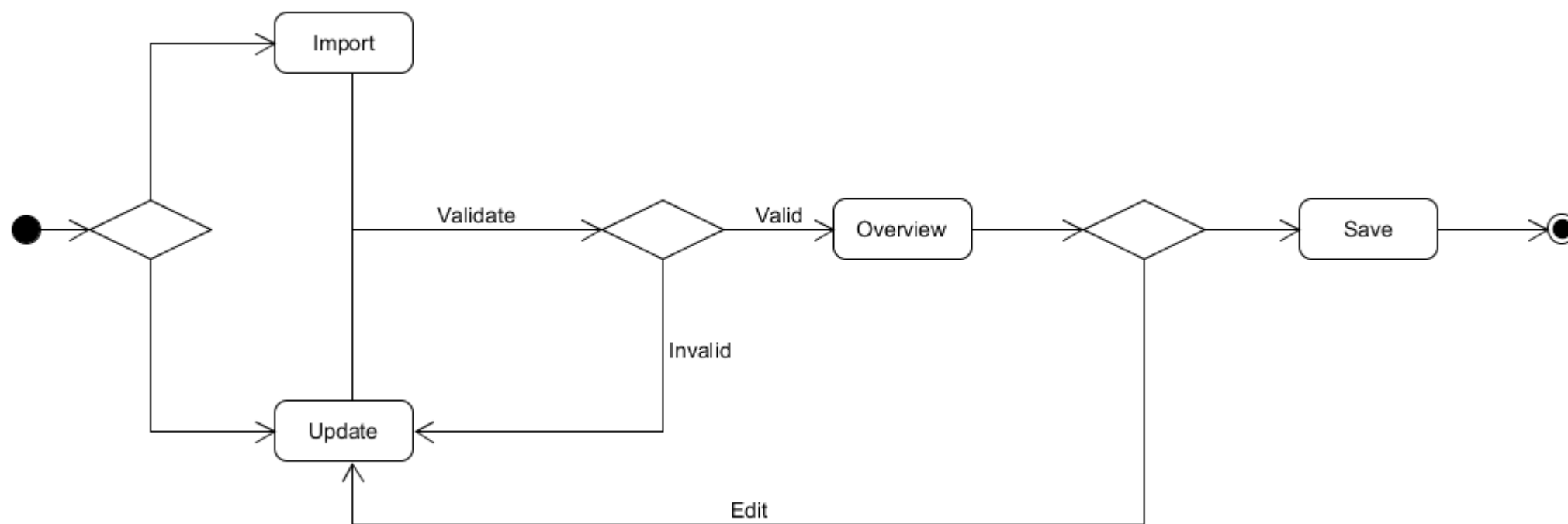


# Site log update functionalities

M3 Demo

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OF BELGIUM

Functionalities implemented in the Demo version:



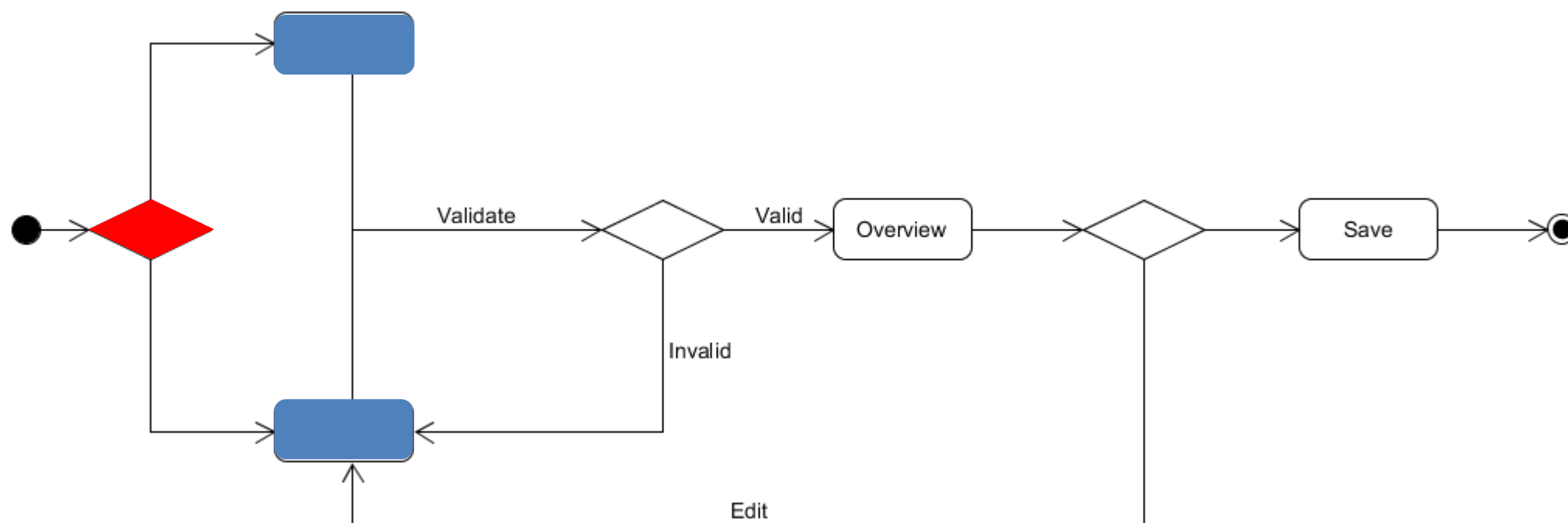
“save as draft” will be implemented later on

# Site log update functionalities

M3 Demo

ROYAL  
OBSERVATORY  
OF BELGIUM

Functionalities implemented in the Demo version:



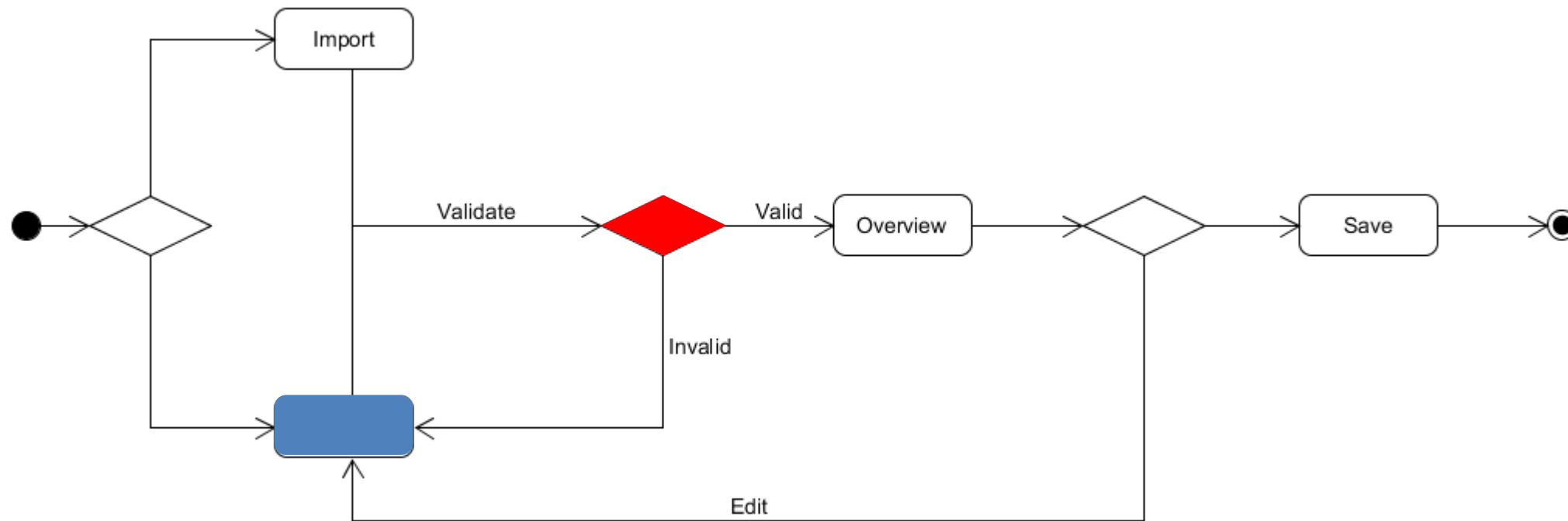
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M3 Demo

ROYAL  
OBSERVATORY  
OF BELGIUM

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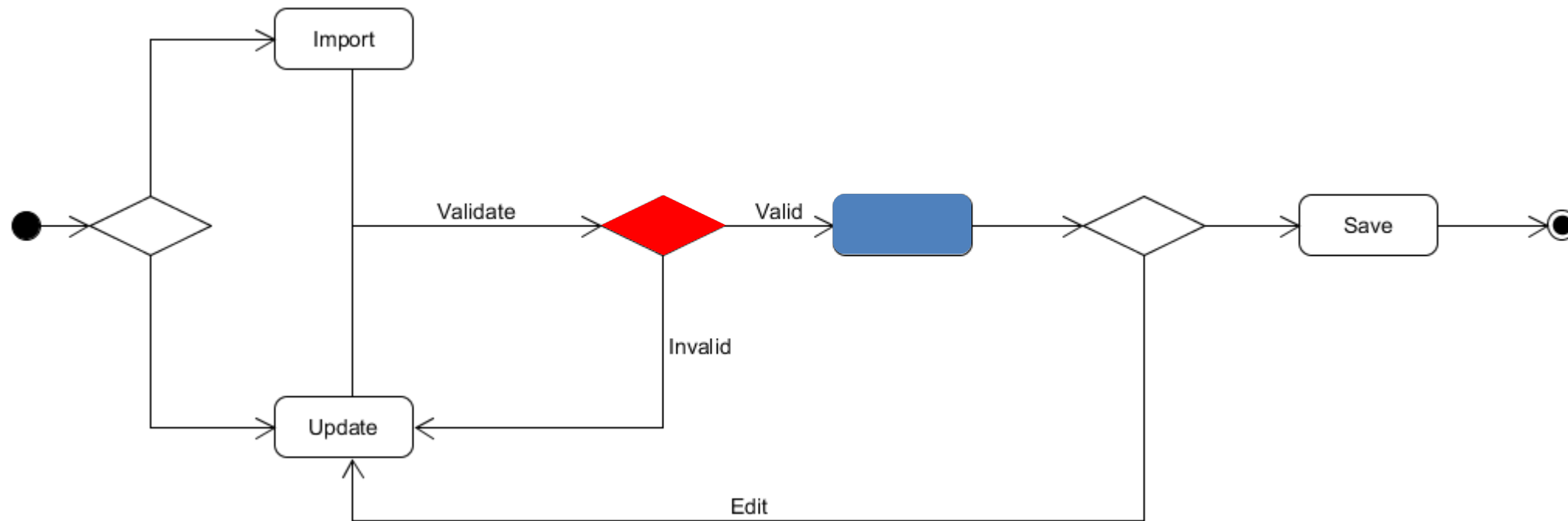
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M3 Demo

ROYAL  
OBSERVATORY  
OF BELGIUM

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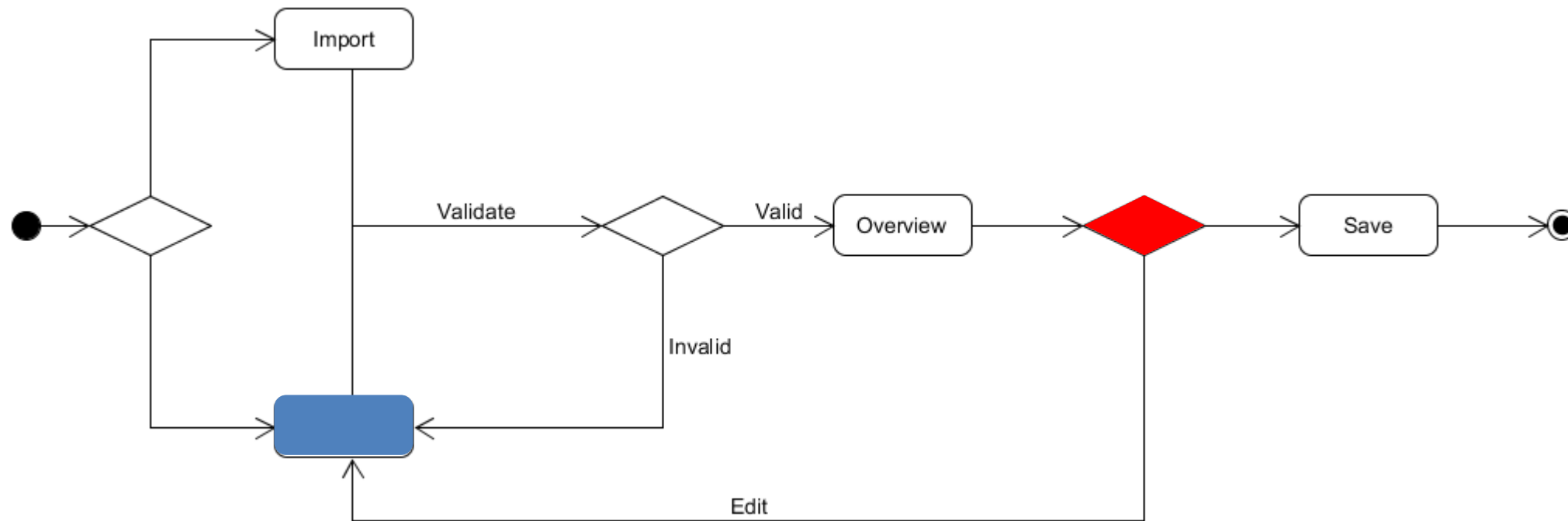
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M3 Demo

ROYAL  
OBSERVATORY  
OF BELGIUM

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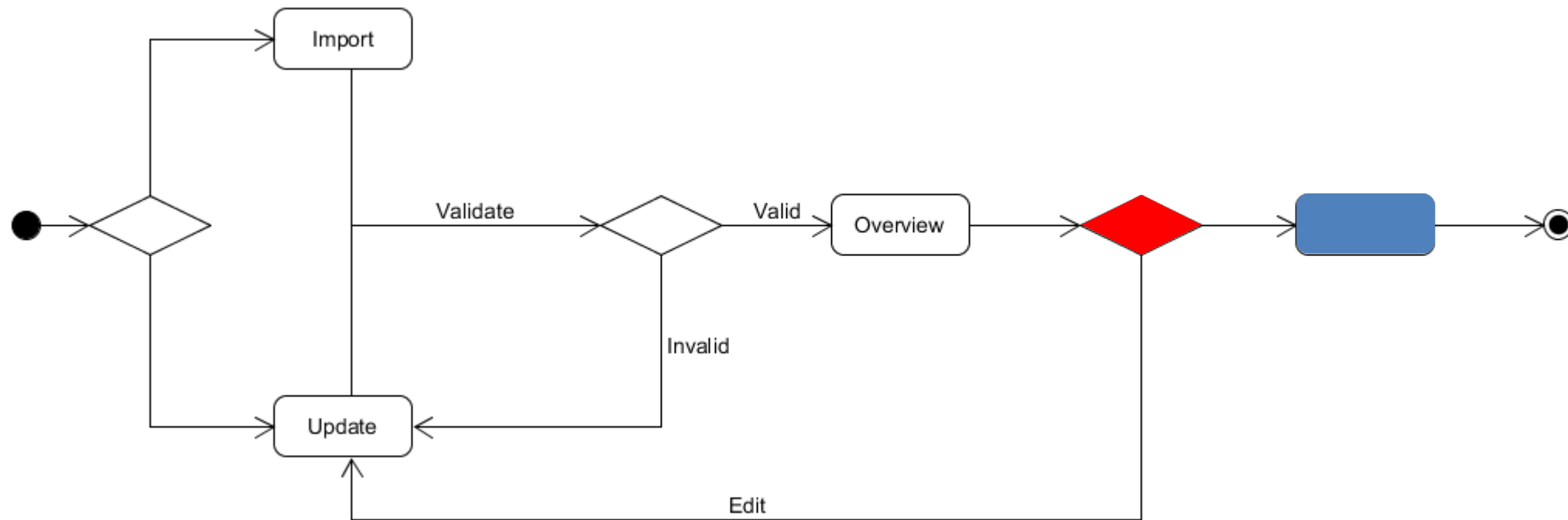
“save as draft” will be implemented later on

# Site log update functionalities

M3 Demo





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Functionalities implemented in the Demo version:




“save as draft” will be implemented later on


# Site log update




Prepared by (full name) \* ? Bruyninx Carine





1. UPDATE Site Identification of the GNSS Monument







2. UPDATE Site Location Information







3. UPDATE GNSS Receiver Information







4. UPDATE GNSS Antenna Information







5. UPDATE Surveyed Local Ties







6. UPDATE Frequency Standard







7. UPDATE Collocation Information







8. UPDATE Meteorological Instrumentation







9. UPDATE Local Ongoing Conditions Possibly Affecting Computed Position







10. UPDATE Local Episodic Effects Possibly Affecting Data Quality







11. UPDATE On-Site, Point of Contact Agency Information







12. UPDATE Responsible Agency (if different from 11.)







13. UPDATE More Information



 Reset

 Save as draft

 Validate

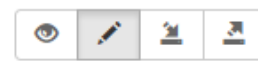
\* Required field.

M3 Demo

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# Site log update



Prepared by (full name) \*



Bruyninx Carine

M3 Demo



1. UPDATE Site Identification of the GNSS Monument



2. UPDATE Site Location Information



3. UPDATE GNSS Receiver Information



Expand

3.11 Receiver Type : SEPT POLARX4TR  
Satellite System : GPS+GLO+GAL+BDS  
Serial Number : 3001376  
Firmware Version : 2.9.6  
Elevation Cutoff Setting : 0 deg  
Date Installed : 2017-01-03T12:15Z  
Date Removed : (CCYY-MM-DDThh:mmZ)  
Temperature Stabiliz. : 18.0 +/- 0.2  
Additional Information : (multiple lines)

+ Add



4. UPDATE GNSS Antenna Information



5. UPDATE Surveyed Local Ties



6. UPDATE Frequency Standard



7. UPDATE Collocation Information



8. UPDATE Meteorological Instrumentation



9. UPDATE Local Ongoing Conditions Possibly Affecting Computed Position







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# Site log update


   

Prepared by (full name) \*


1. UPDATE Site Identification of the GNSS Monument

2. UPDATE Site Location Information


3. UPDATE GNSS Receiver Information

 Modify

3.1 Receiver Type : SEPT POLARX2  
Satellite System : GPS  
Serial Number : 1436  
Firmware Version : 2.6.2  
Elevation Cutoff Setting : 0 deg  
Date Installed : 2006-07-07  
Date Removed : 2008-02-14T09:00Z  
Temperature Stabiliz. : (deg C) +/- 0.1  
Additional Information : hardware replacement of receiver  
: with SN 1128, same receiver, but  
: different serial number (now 1436)

 Modify

3.2 Receiver Type : ASHTECH Z-XII3T  
Satellite System : GPS  
Serial Number : RT820015201  
Firmware Version : 1L01-1D04  
Elevation Cutoff Setting : 0 deg  
Date Installed : 2008-02-15T08:00Z  
Date Removed : 2010-06-28T13:55Z  
Temperature Stabiliz. : (deg C) +/- 0.1  
Additional Information : (multiple lines)

 Modify

3.3 Receiver Type : SEPT POLARX3ETR  
Satellite System : GPS+GLO  
Serial Number : 2001060  
Firmware Version : 1.4.0  
Elevation Cutoff Setting : 0 deg  
Date Installed : 2010-06-28T13:55Z  
Date Removed : 2012-01-31T13:00Z

4. UPDATE GNSS Receiver Information


5. UPDATE GNSS Receiver Information


6. UPDATE GNSS Receiver Information

7. UPDATE GNSS Receiver Information

8. UPDATE Meteorological Instrumentation

9. UPDATE Local Ongoing Conditions Possibly Affecting Computed Position

 Add

 Expand

3.11 Receiver Type :  
Satellite System :  
Serial Number :  
Firmware Version :  
Elevation Cutoff Setting :  
Date Installed :  
Date Removed :  
Temperature Stabiliz. :  
Additional Information :

M3 Demo

# Site log update

Prepared by (full name) \*

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Expand

+ Add

Copy

3.11

Remove Date

T

3.12

Receiver Type

Filter as you type ...

Satellite Systems

☐ GPS

☐ GLO

☐ GAL

☐ BDS

☐ QZSS

☐ SBAS

Serial Number \*

Firmware Version \*

Cutoff Settings \*

deg

Installation Date \*

T

Temperature Stabiliz.

°C

Additional Information


9. UPDATE Local Ongoing Conditions Possibly Affecting Computed Position


M3 Demo


# Site log update

M3 Demo

2. UPDATE Site Location Information	▶
3. UPDATE GNSS Receiver Information	▶
4. UPDATE GNSS Antenna Information	▶
5. UPDATE Surveyed Local Ties	▶
6. UPDATE Frequency Standard	▶
7. UPDATE Collocation Information	▶
8. UPDATE Meteorological Instrumentation	▶
9. UPDATE Local Ongoing Conditions Possibly Affecting Computed Position	▶
10. UPDATE Local Episodic Effects Possibly Affecting Data Quality	▶
11. UPDATE On-Site, Point of Contact Agency Information	▶
12. UPDATE Responsible Agency (if different from 11.)	▶
13. UPDATE More Information	▶

 Reset

 Save as draft

 **Validate**

\* Required field.

# Site log update

M3 Demo



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- 2. UPDATE Site Location Information
- 3. UPDATE GNSS Receiver Information
- 4. UPDATE GNSS Antenna Information
- 5. UPDATE Surveyed Local Ties
- 6. UPDATE Frequency Standard
- 7. UPDATE Collocation Information
- 8. UPDATE Meteorological Instrumentation
- 9. UPDATE Local Ongoing Conditions Possibly Affecting Computed Position
- 10. UPDATE Local Episodic Effects Possibly Affecting Data Quality

The Site log validation tool found errors in the following subsections:

- GNSS Receiver Information is invalid.

Prepared by (full name) \* Bruyninx Carine

- 1. UPDATE Site Identification of the GNSS Monument
- 2. UPDATE Site Location Information
- 3. UPDATE GNSS Receiver Information

Contact Agency Information

Agency (if different from 11.)

ore Information

☐ Validate



# Site log update

3 Demo

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! The Site log validation tool found errors in the following subsections:

- GNSS Receiver Information is invalid.

Prepared by (full name) \*

Bruyninx Carine

1. UPDATE Site Identification of the GNSS Monument

2. UPDATE Site Location Information

3. UPDATE GNSS Receiver Information

Reset

3.12 Receiver Type : (A20, from rcvr\_ant.tab; see instructions)  
Satellite System : (GPS+GLO+GAL+BDS+QZSS+SBAS)  
Serial Number : (A20, but note the first A5 is used in SINEX)  
Firmware Version : (A11)  
Elevation Cutoff Setting : (deg)  
Date Installed : (CCYY-MM-DDThh:mmZ)  
Date Removed : (CCYY-MM-DDThh:mmZ)  
Temperature Stabiliz. : (none or tolerance in degrees C)  
Additional Information : (multiple lines)

3.12

Receiver Type



Filter as you type ...

Satellite Systems



☐ GPS ☐ GLO ☐ GAL ☐ BDS ☐ QZSS  
☐ SBAS

Serial Number \*



Serial Number cannot be blank.

Firmware Version \*



Firmware Version cannot be blank.

Cutoff Settings \*



deg

Cutoff Settings cannot be blank.

Installation Date \*



Installation Date cannot be blank.

Temperature Stabiliz.



°C

# Site log update



ⓘ Your **site log** is valid although it hasn't been saved. Check you changes and **click on the save** at the bottom of the page to accept it.

BRUX Site Information Form (site log)  
International GNSS Service  
See Instructions at:  
[ftp://igscb.jpl.nasa.gov/pub/station/general/sitelog\\_instr.txt](ftp://igscb.jpl.nasa.gov/pub/station/general/sitelog_instr.txt)

0. Form

Prepared by (full name) : Bruyninx Carine  
Date Prepared : 2017-05-09  
Report Type : UPDATE  
If Update:  
Previous Site Log : BPA  
Modified/Added:



BPA: Bottom of Preamplifier

BCR: Bottom of Choking

All dimensions are in meters.

↺ Reset

✎ Edit

↓ Save as draft

✓ Save

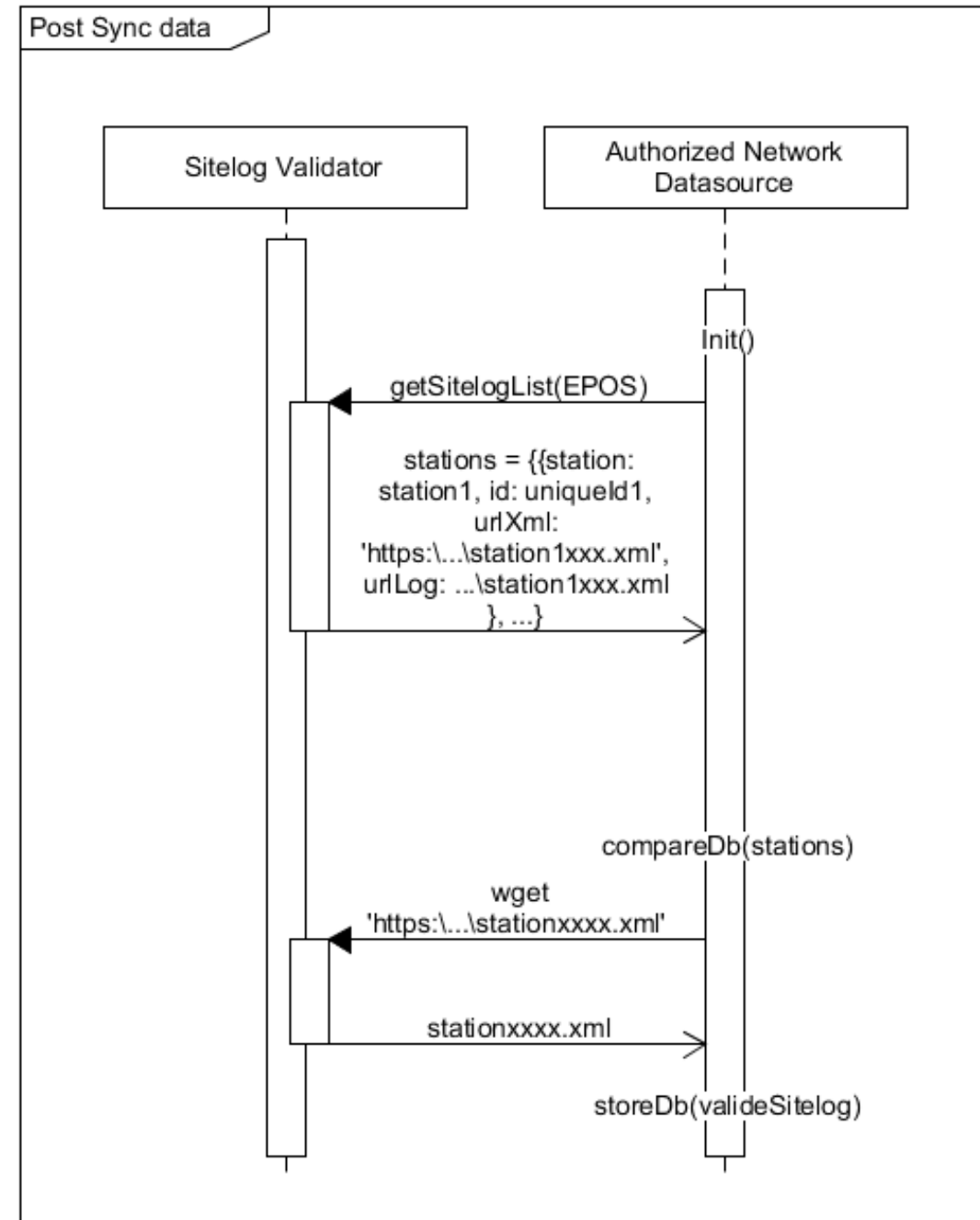


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# Future Functionalities

- Extend with more validation rules (to handle exceptions, to handle other networks rules)
- Enable functionalities (Save as draft, Reset subsection)
- Allow to upload site pictures
- Allow to upload individual antenna calibration files
- New import/export format (GeodesyML/Json)
- Webservices to export/import from/to external GNSS datasource



# Recommendation/ Suggestion

- We are looking for people interested in testing the demo please tell us ([epncb@oma.be](mailto:epncb@oma.be))
- Feedback is welcome!
- First usage within the EPN from September 2017 on



Thank you for your attention....