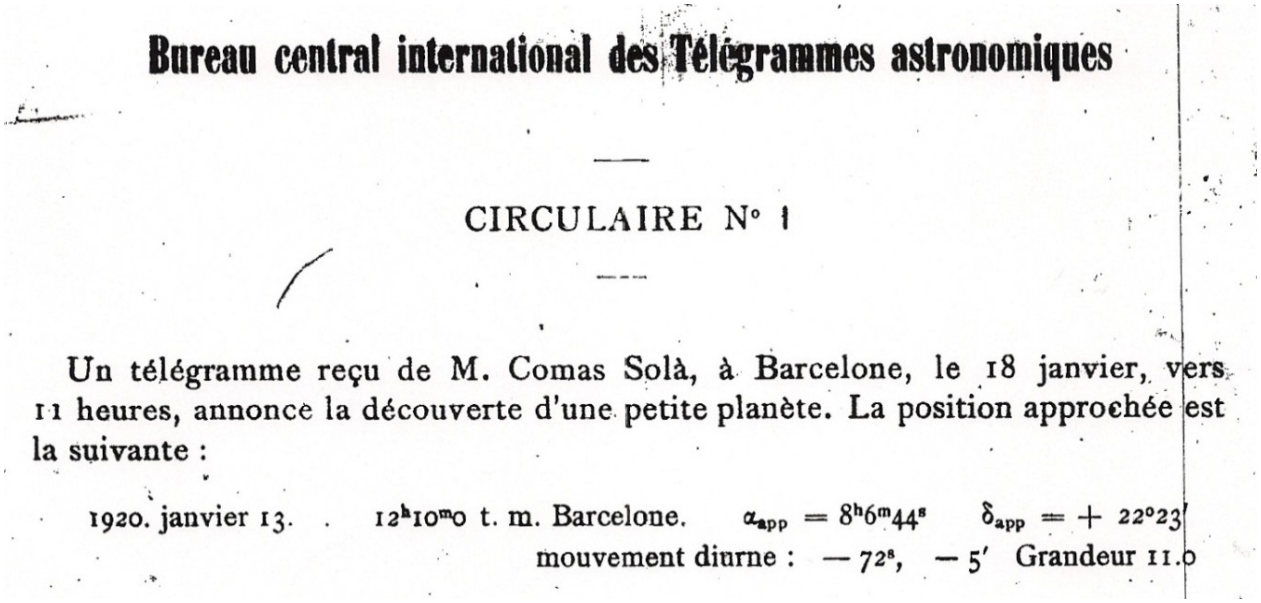
VOEvent for the dummies
by a semi-dummy

Jean-Paul Le Fèvre jean-paul.lefevre@cea.fr
Chef de projet des Svom French Science Centers CEA Irfu

ONE CENTURY AGO … THEN …



Bureau central international des Télégrammes astronomiques

CIRCULAIRE N° 1

Un télégramme reçu de M. Comas Solà, à Barcelone, le 18 janvier, vers 11 heures, annonce la découverte d'une petite planète. La position approchée est la suivante :

1920. janvier 13. 12^h10^m0 t. m. Barcelone. $\alpha_{app} = 8^h6^m44^s$ $\delta_{app} = +22°23'$
mouvement diurne : -72^s, $-5'$ Grandeur 11.0

- International Astronomical Union Circulars
- GCN (BACODINE) pour Batse décembre 1992
- The Astromer's telegram décembre1997

- VOEvent 1.0 publié le 11 juillet 2005

IN THE SVOM FRAMEWORK

- Connection to VOEventNet proposed by November 2008
- Documents about content and distribution of VOEvents Svom delivered & reviewed a couple of times
- Test programs written, French-Chinese trials carried out
- Back en route !

WHY VOEVENT ?

- Structured data, machine interpretable
- Fast and automatic follow-up
- Very high rate of events expected in years to come

VOEVENT 2.0

- In the virtual observatory framework
- VOEvent packet publishing:
  - An author : responsible of the scientific content
  - A publisher : responsible of the xml validity
  - A subscriber : interested in the packets
- VO identifiers
  - IVORN *: International virtual observatory resource name*
  - Event stream / event id
  - Information stored in the VO registry
  - **`http://registry.euro-vo.org/`**

VOEVENT SEMANTICS

<VOEvent> attributes : `ivorn, role` and `version`

`role : observation/prediction/utility/test`

<Who>	*Author Identification*
<What>	*Event Characterization*
<WhereWhen>	*Space-Time Coordinates*
<How>	*Instrument Configuration*
<Why>	*Initial Scientific Assessment*
<Citations>	*Follow-up Observations*
<Description>	*Human Oriented Content*
<Reference>	*External Content*

Some examples :

```
<voe:VOEvent role="test"
xmlns:voe="http://www.ivoa.net/xml/VOEvent/v2.0" version="2.0"
ivorn="ivo://nasa.gsfc.gcn/Fermi#LAT_Test_Pos_2015-02-16T22:28:51.00_999_1-648">
```

```
<voe:VOEvent role="observation"
xmlns:voe="http://www.ivoa.net/xml/VOEvent/v2.0" version="2.0"
ivorn="ivo://nasa.gsfc.gcn/SWIFT#FOM_Obs_50365284-588">
```

```
<voe:VOEvent role="observation"
xmlns:voe="http://www.ivoa.net/xml/VOEvent/v2.0" version="2.0"
ivorn="ivo://org.svom/svom/mxt#2009-10-29.3/5">
```

It is the responsibility of all who receive VOEvent packets to pay attention to the role, and to be quite sure of the difference between an actual event and a test of the system or a prediction of an event that has yet to happen.

```
<Who>
    <AuthorIVORN>ivo://nasa.gsfc.tan/gcn</AuthorIVORN>
    <Author>
        <shortName>VO-GCN</shortName>
        <contactName>Scott Barthelmy</contactName>
        <contactPhone>+1-301-286-3106</contactPhone>
        <contactEmail>scott.barthelmy@nasa.gov</contactEmail>
    </Author>
    <Date>2015-02-17T11:42:42</Date>
    <Description>
       This VOEvent message was created with GCN VOE version: 1.14 01may14
    </Description>
</Who>


<Author>
    <title>French Science Center</title>
    <shortName>FSC</shortName>
    <contactName>Arnaud Claret</contactName>
    <contactEmail>arnaud.claret@cea.fr</contactEmail>
</Author>
```

```
<What>
    <Param value="0" name="TrigID" ucd="meta.id"/>
    <Param value="17165" name="Burst_TJD" ucd="time" unit="days"/>
    <Param value="43403.68" name="Burst_SOD" ucd="time" unit="sec"/>
    <Param value="11.34" name="Inten_Sigma" ucd="stat.snr" unit="sigma"/>
    <Param value="0.5300" name="Time_Error" ucd="time" unit="sec"/>
    <Param value="0.5000" name="Time_Scale" ucd="time" unit="sec"/>
    <Group name="Obs_Support_Info">
        <Description>
            The Sun and Moon values are valid at the time the VOEvent XML message was created.
        </Description>
        <Param value="330.21" name="Sun_RA" ucd="pos.eq.ra" unit="deg"/>
        <Param value="-12.16" name="Sun_Dec" ucd="pos.eq.dec" unit="deg"/>
        <Param value="31.97" name="Sun_Dist" ucd="pos.angDistance" unit="deg"/>
        <Param value="-1.99" name="Sun_Hr_Angle" unit="hr"/>
    </Group>
     …
     …
</What>
```

The Unified Content Descriptor (UCD) is a formal vocabulary for astronomical data :
"*what sort of quantity is this*?"

```
<How>
   <Description>
     Swift Satellite, BAT Instrument (FOM Task)
   </Description>
   <Reference type="url" uri="http://gcn.gsfc.nasa.gov/swift.html"/>
</How>

<Why importance="0.90">
   <Inference probability="0.98">
   <Name>GRB 150217</Name>
   <Concept>process.variation.burst;em.gamma</Concept>
   </Inference>
</Why>
```

<Why> seeks to capture the emerging concept of the nature of the astronomical objects and processes that generated the observations noted in the <What> element.

Natural language words and phrases are used to express the hypothesized astrophysics.

```
<Citations>
    <EventIVORN cite="followup">
      ivo://nasa.gsfc.gcn/INTEGRAL#Wakeup_Pos_000000-0-554
    </EventIVORN>
    <Description>
        This is an updated position to the original trigger.
    </Description>
</Citations>
```

A VOEvent packet without a <Citations> element can be assumed to be asserting information about a new celestial discovery.

Citations reference previous events to do one of three things:

- follow-up an event alert with more observations or other relevant data, or
- supersede a prior event with better, equivalent information, or
- issue a complete retraction of a previous event.

VOEVENT STREAM

Concepts defined in a registry extension document:

- VoEventRegExt version 1.0 13 May 2014

A VOEventStream is a source of VOEvents. It is analogous to an astronomical catalog, in the sense that all the entries of the stream are uniformly observed, with each entry having the same parameters

A stream should have single point of leadership and scientific responsibility (the Author)

A stream should have a single set of parameters (Params) for the event vocabulary

The event identifier also expresses the stream identifier:

ivorn="ivo://nasa.gsfc.gcn/INTEGRAL#Refined_Pos_000000-0-555"

Stream id :

ivo://nasa.gsfc.gcn/INTEGRAL

VOEVENT STREAM

- **Title and Shortname**: the first is 3-10 words describing the nature of this stream, and the second is a single abbreviation word for the stream.

- **Curation**: This section contains the IVORN for the publisher, with creator, date, and contact information.

- **Content**: This section defines the nature of this content as a set of subject categories (eg "radio astronomy", "gamma-ray bursts"), and it has description, a text description of the stream, in terms of meaning, science, team, experimental method, relation to other streams and surveys, etc etc.

- **Coverage**: This means the sky coverage, expressed in STC.

- Each stream has a defined set of named "*parameters*", and each event that is a member of the stream should use only parameters that are selected from the list in the stream definition.
- In a stream a parameter template is defined.

VO REGISTRIES

- VOEventStream are defined in a registry
- The registries are dababases storing VO resources
  - Metadata about services
- They are searchable
- EURO-VO is a full harvestable VO resource registry
- **http://voparis-astrogrid.obspm.fr:8080/astrogrid-registry**

TESTS PREVIOUSLY IMPLEMENTED

From 2010 …

Openfire server installed, configured and tested
http://www.igniterealtime.org/

Manage the XMPP protocol

It supports the pubsub messaging system
Test programs have been implemented.

It has been successfully Dockerized recently at Saclay

TESTS PREVIOUSLY IMPLEMENTED

Summer 2014 …

VTP : VOEvent Transport Protocol
Comet: a python implementation of VTP
http://comet.transientskp.org/
LOFAR transient key project

A java version has been implemented (code available in git)
`fr.svom.xmpp.clients.VtpClient`

The comet broker has also been Dockerized at Saclay.

WHAT ABOUT TRANSPORTATION ?

VOEvent is transport neutral, but deploying and operating a robust general-purpose network of interoperating brokers has always been a high-priority issue.

VOEventServers for a stream are registered in the registry.

The VOEventRegExt schema defines 3 derived vr:Interface types to be used with the **`voe:Subscription`** capability:

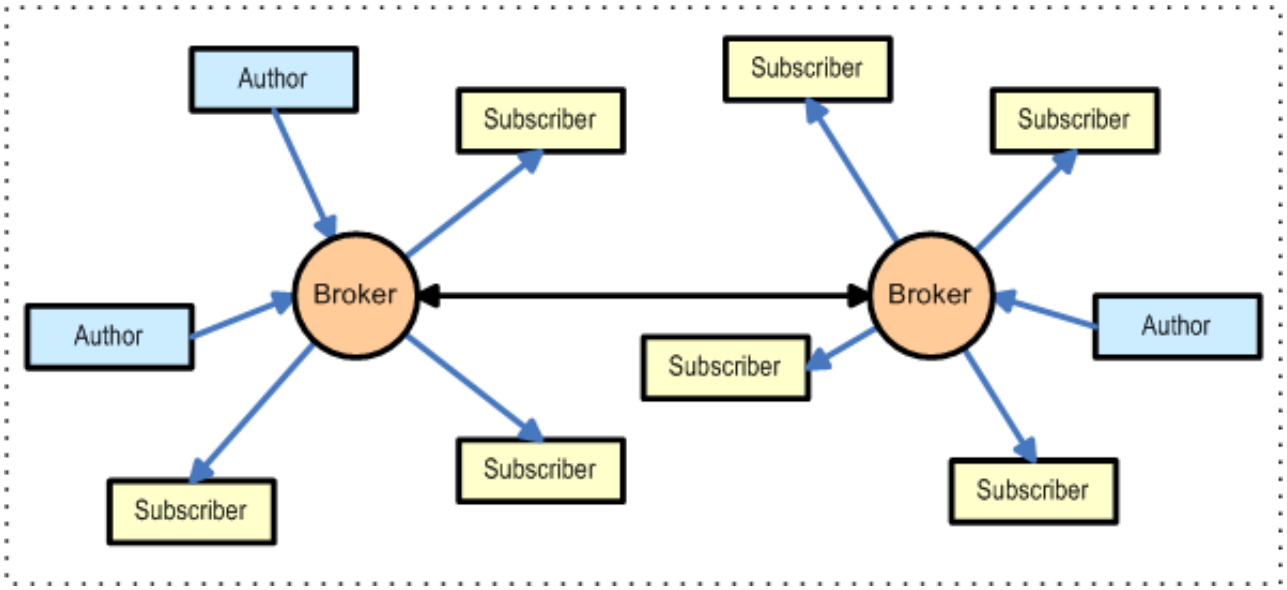
- **`voe:VTP`**
- **`voe:Jabber`**
- **`voe:RSS`**

VTP

This protocol is intentionally as simple as possible while still accomplishing the required task.

`VOEvent Transport Protocol Version 1.1` IVOA Note 05 August 2009

This is an IVOA Note expressing suggestions



XMPP

This protocol can be defined as a VOEventServer interface in the registry

The `voe:Jabber` interface indicates that VOEvents are available from this server through a Jabber/XMPP interface.

The `<accessURL>` gives the endpoint for the Jabber server.

Extensible Messaging and Presence Protocol (XMPP) is a communications protocol for message-oriented middleware based on XML .The protocol was originally named Jabber.

Left behind in the middle of the war of the instant messaging systems.

Openfire server developments still in progress.

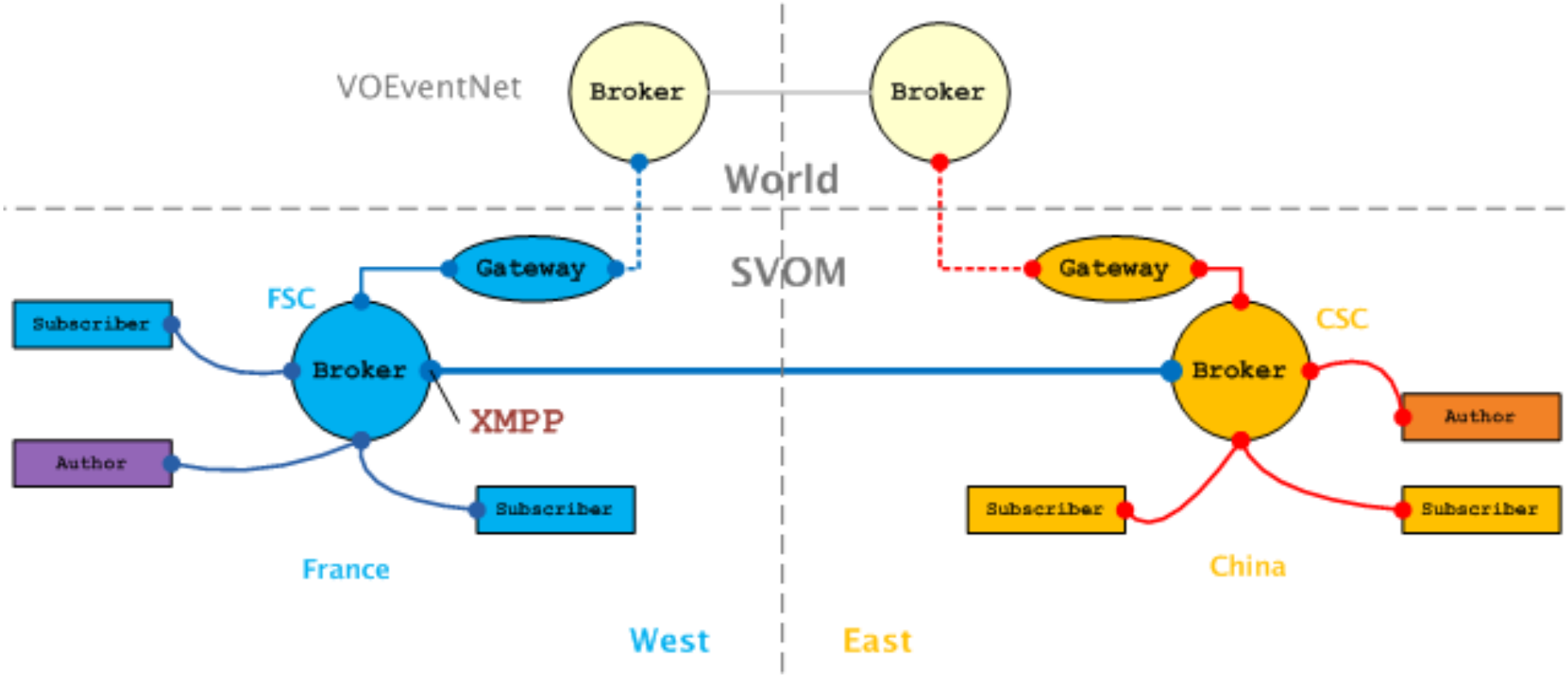
VTP vs XMPP

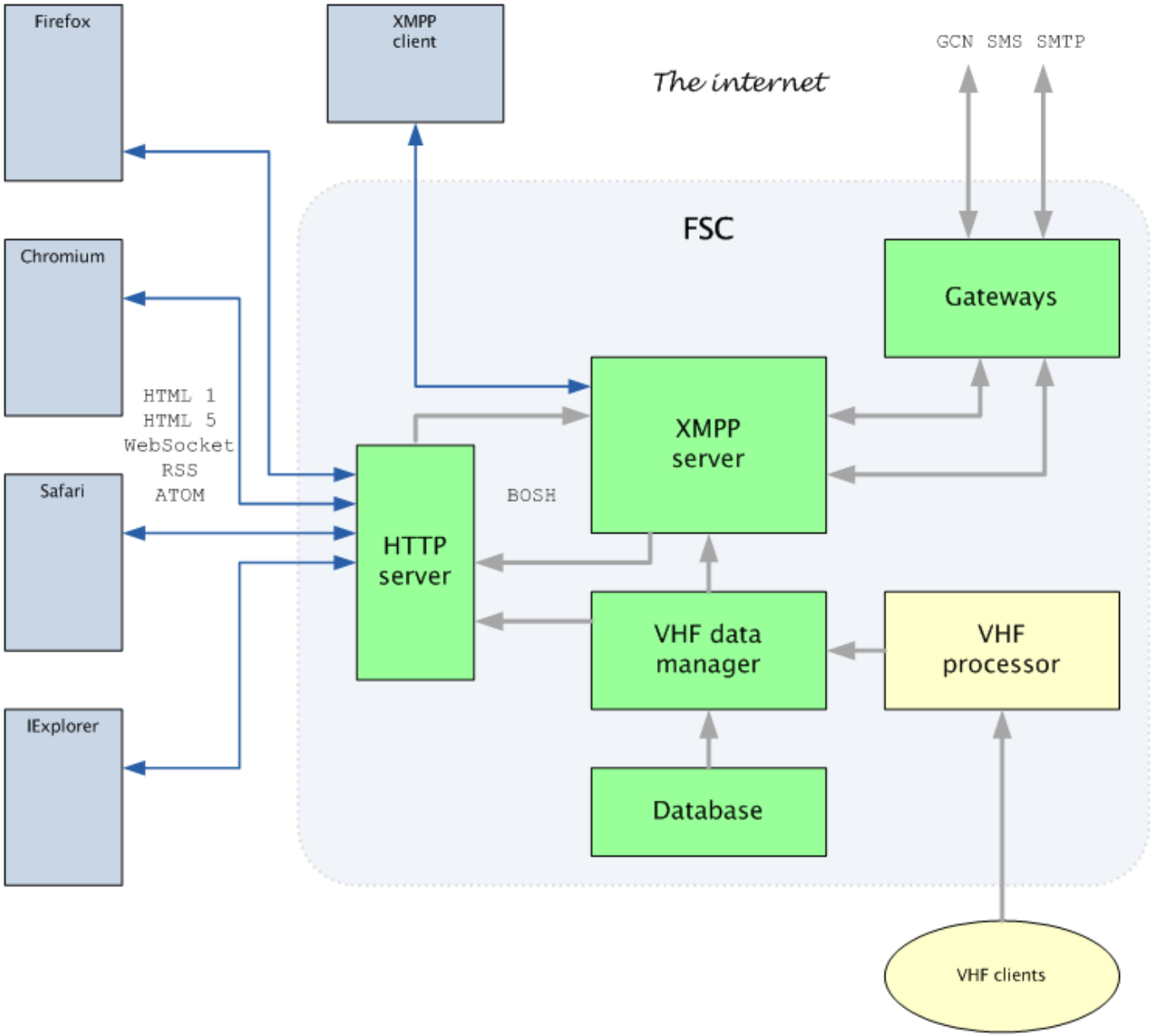
VTP	XMPP
Simple	Complex
Simplistic	Powerful
Developed from scratch	Mature technology born in 1998
Tiny community	Large community
No consensus	IETF standard
Used and working for VOEvent	No longer used for VOEvent
Specific clients needed	Bunch of standard clients available

SVOM MESSAGING ARCHITECTURE

France-China symmetry

Gateway between Svom and the rest of the world




Firefox
XMPP client
The internet
GCN SMS SMTP
FSC
Chromium
Gateways
HTML 1
HTML 5
WebSocket
RSS
ATOM
XMPP server
Safari
BOSH
HTTP server
VHF data manager
VHF processor
IExplorer
Database
VHF clients