

# ION GNSS SDR Metadata Standard Working Group

ION GNSS+ 2017

Wednesday, September 27, 17:30

Room: C123/C124

# Content



- Introduction to the ION GNSS Metadata Standard
- Review of 2016 Meeting
- Request for Comment now open
- Introduction to reference implementation
- Open issues and new developments
- Review of early RFC responses
- List of attendees
- Minutes of Meeting

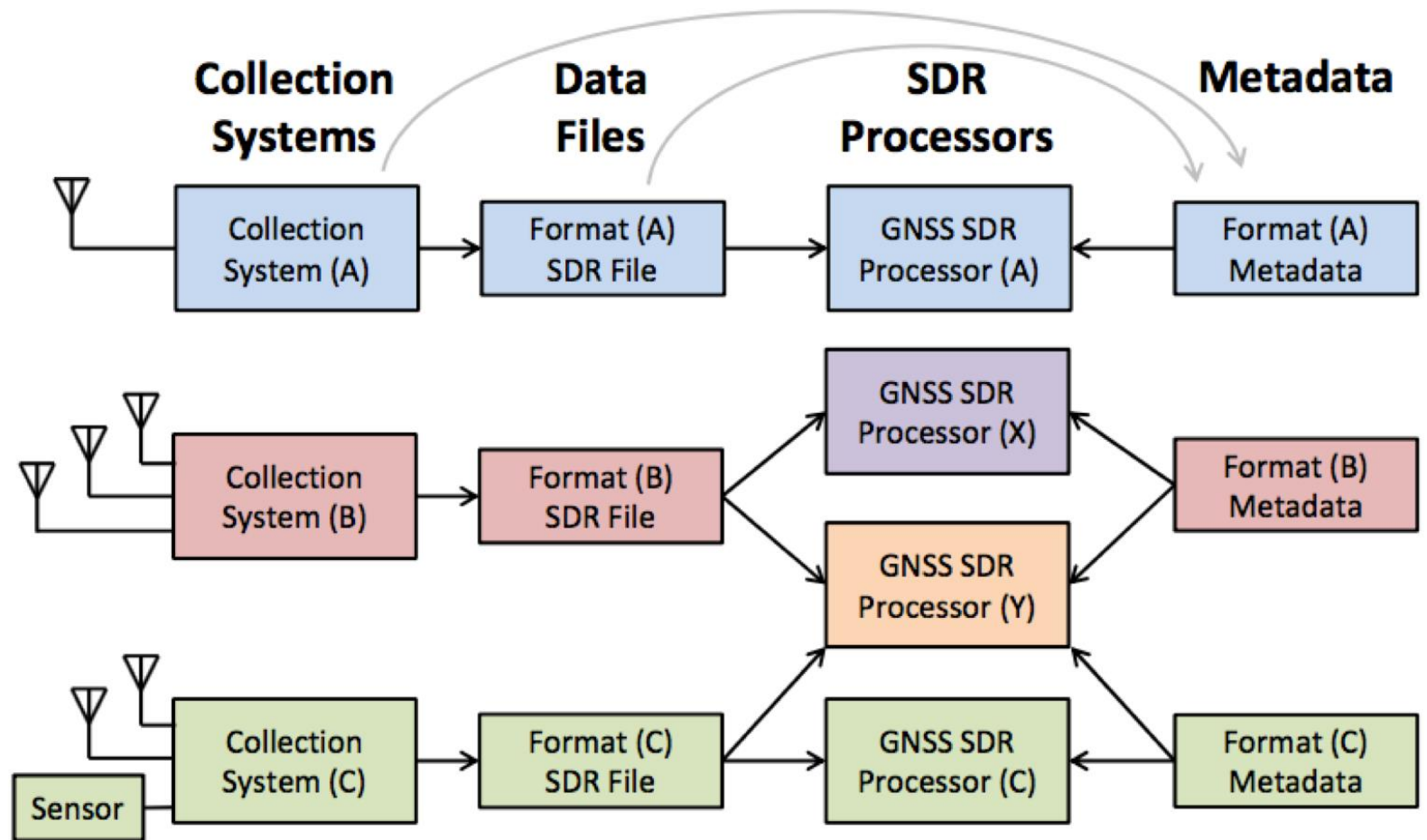
# Background



- Proliferation of GNSS SDR technology in the past 5-10 years
  - Low-cost front-end hardware and data collection systems
  - Maturing GNSS SDR processors, receivers and software frameworks
- Today: no established standard to convey GNSS SDR metadata
  - Existing metadata standards not well suited for needs of GNSS SDR and PNT community
- ION SDR Metadata Standard
  - Objective: To promote/support interoperability between GNSS SDR data collection systems and processors

# The Problem

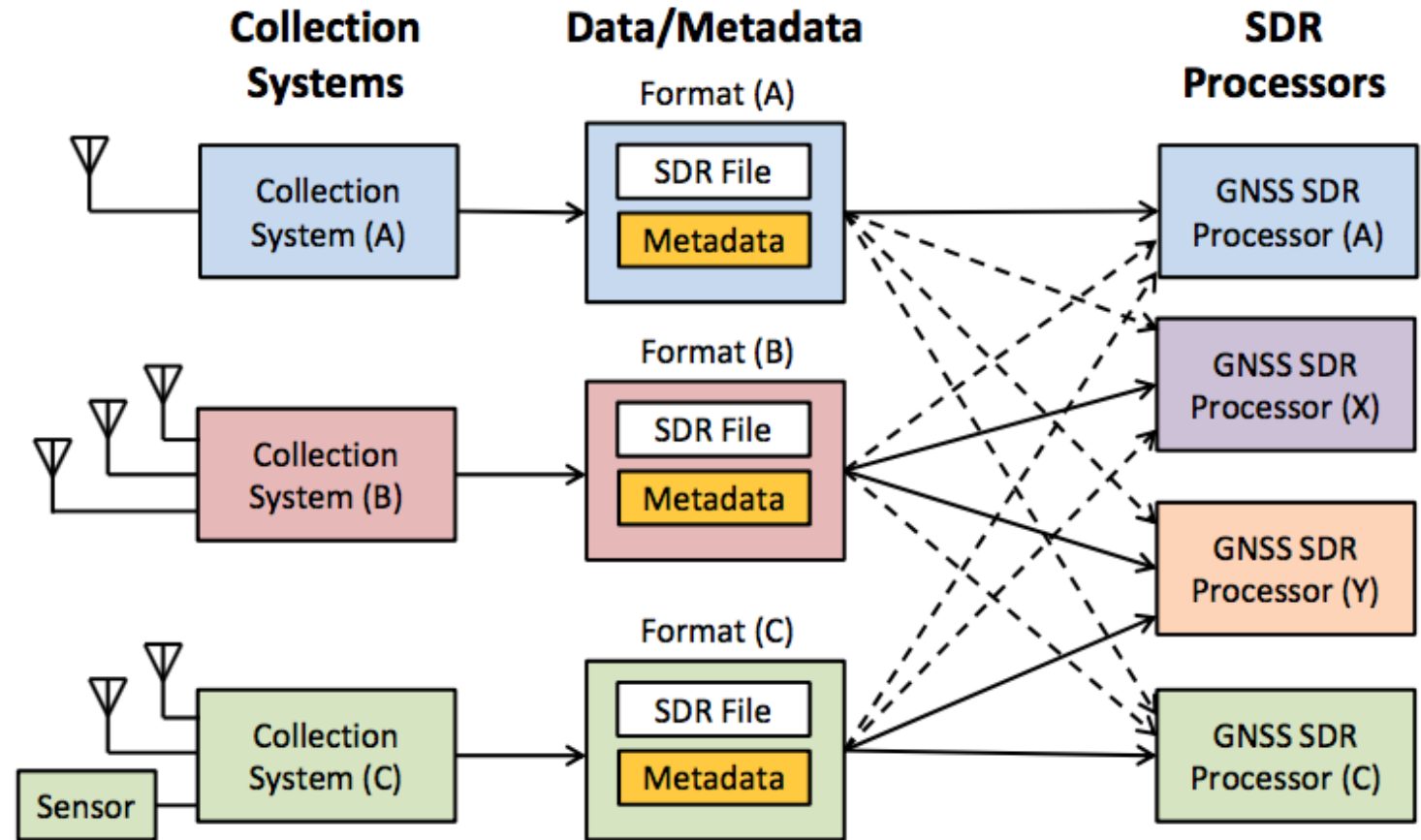
- Some front-end/DCS and SDR processors are bound to one another
- Ad hoc metadata exchange – prone to human error
- Does not promote interoperability
- Does not promote data/resource sharing and re-use



# Proposed Solution: Metadata Standardization

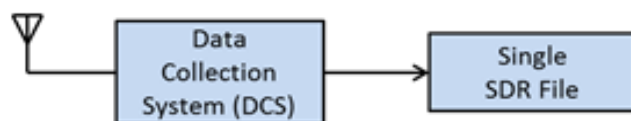


- Unambiguous transfer of all essential SDR metadata
- Standardization encourages vendors to support major formats
- Spurs community to develop open-source software handlers and plugins
- Promotes interoperability
- Promotes data portability, resource sharing and re-use

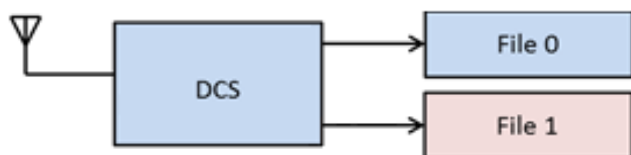


# System Topologies

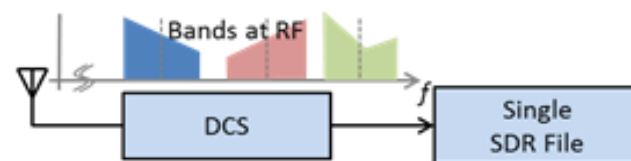
(a) single band, single-stream, single file



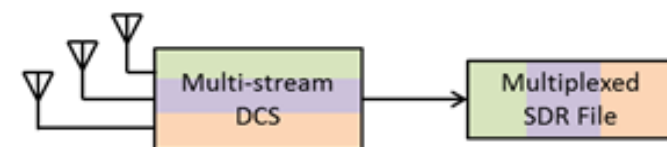
(b) single band, single-stream, multiple files



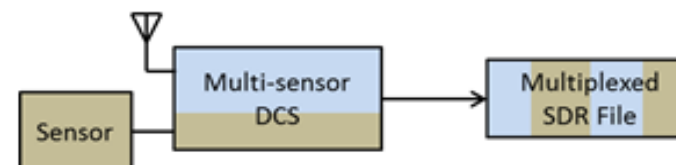
(c) multi-band, single stream, single file



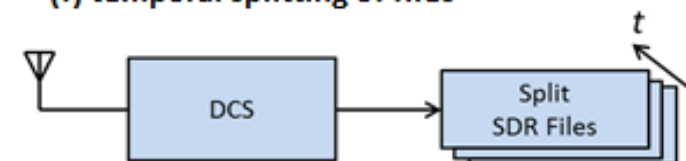
(d) multi-stream, single file



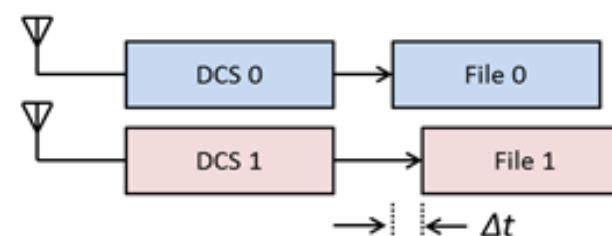
(e) multi-stream, single file



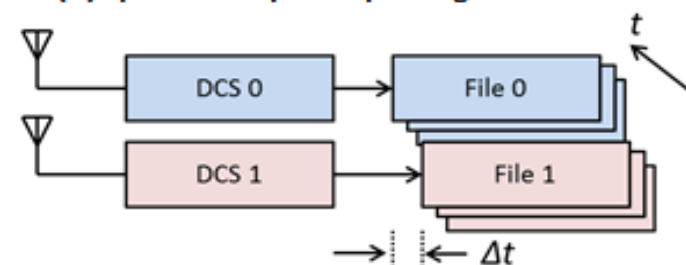
(f) temporal splitting of files



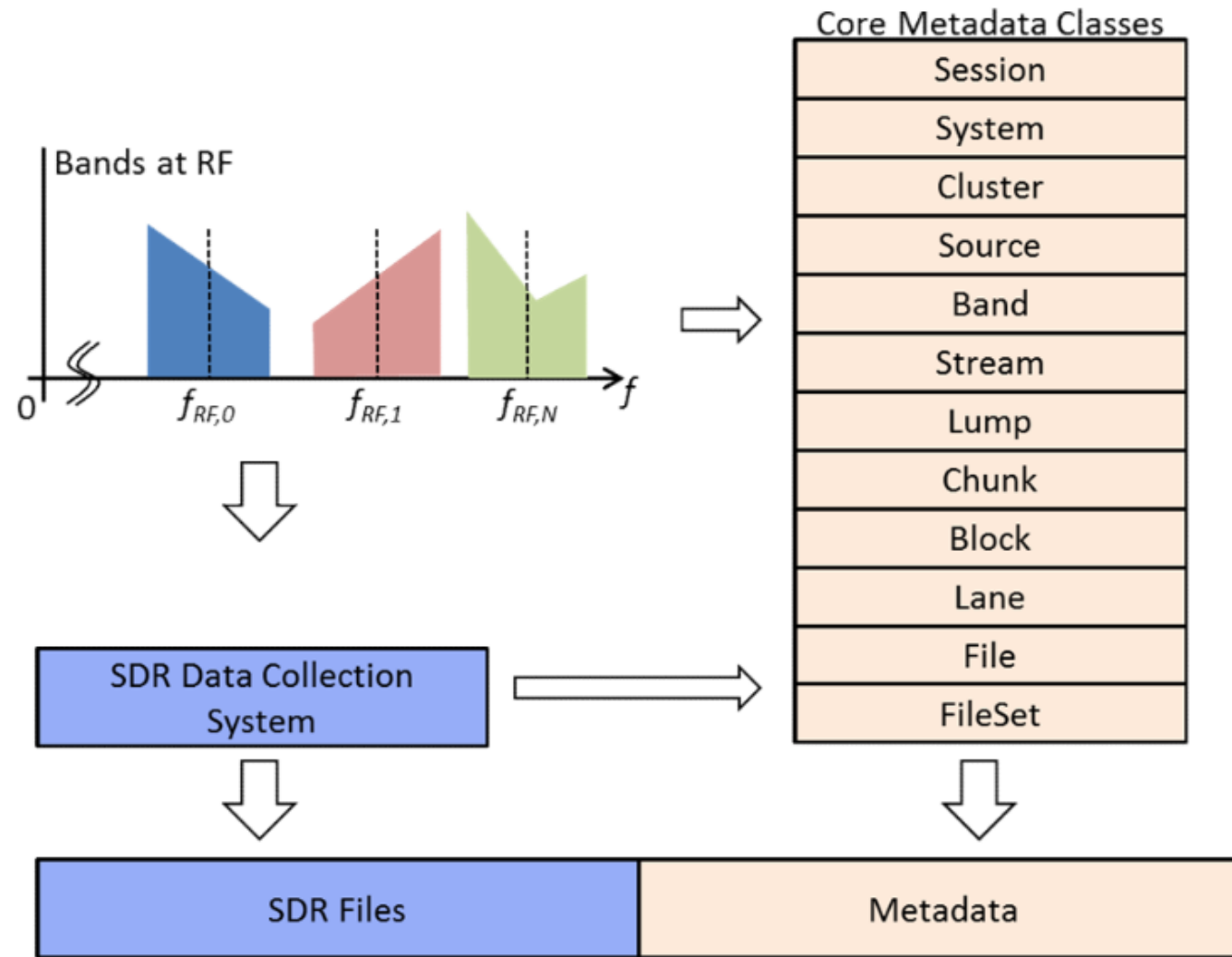
(g) spatial splitting of files



(h) spatial-temporal splitting



# Metadata Domain Model





# Review of 2016 Meeting



## Minutes of the Meeting:

- The group discusses the status of the activity and agrees that the standard is rather mature but final consolidation needs to be achieved before starting the public comment period.
- A number of people express their willingness to review the standard document (Word file).
- It is agreed that the GitHub C++ code shall be moved to the official ION repository
  - The old current content of the ION repository will be wiped
  - Large binary files (samples) will not be included within the ION repository
  - The Word document of the standard will be part of the new ION repository
- The site [sdr.ion.org](http://sdr.ion.org) will be updated
  - Thomas Pany acts as contact point for [sdr.ion.org](http://sdr.ion.org).
  - The ION will be asked to provide a more efficient way to upload large IF samples.
  - Content of [sdr.ion.org](http://sdr.ion.org) will be updated including text, xml-files, new IF sample files.
  - Publications and presentations might be included.
  - Group members are asked to provide more IF samples, including reference decoded sample files.



# Public Comments Now Accepted



ION accepting comments on the standard through December 31, 2017.

- The **master** branch of the standards document & reference implementation has been frozen for the RFC
- Public Comment Form: <http://sdr.ion.org/public-comment.html>
- Types of feedback:

**Feedback Type** (select one)

**Critical:** Refers to performance parameter issues/concept of operational employment, etc. Provide convincing support for your critical comment in the RATIONALE section.

**Substantive:** A section in the document appears to be, or is potentially unnecessary, incorrect, misleading, confusing, or inconsistent with other sections.

**Administrative:** Typographical, format grammatical error(s).

**Proposal:** Should be included in the next revision of the standard.

# Reference Implementation

A 'normative reference' implementation of the standard is being developed.

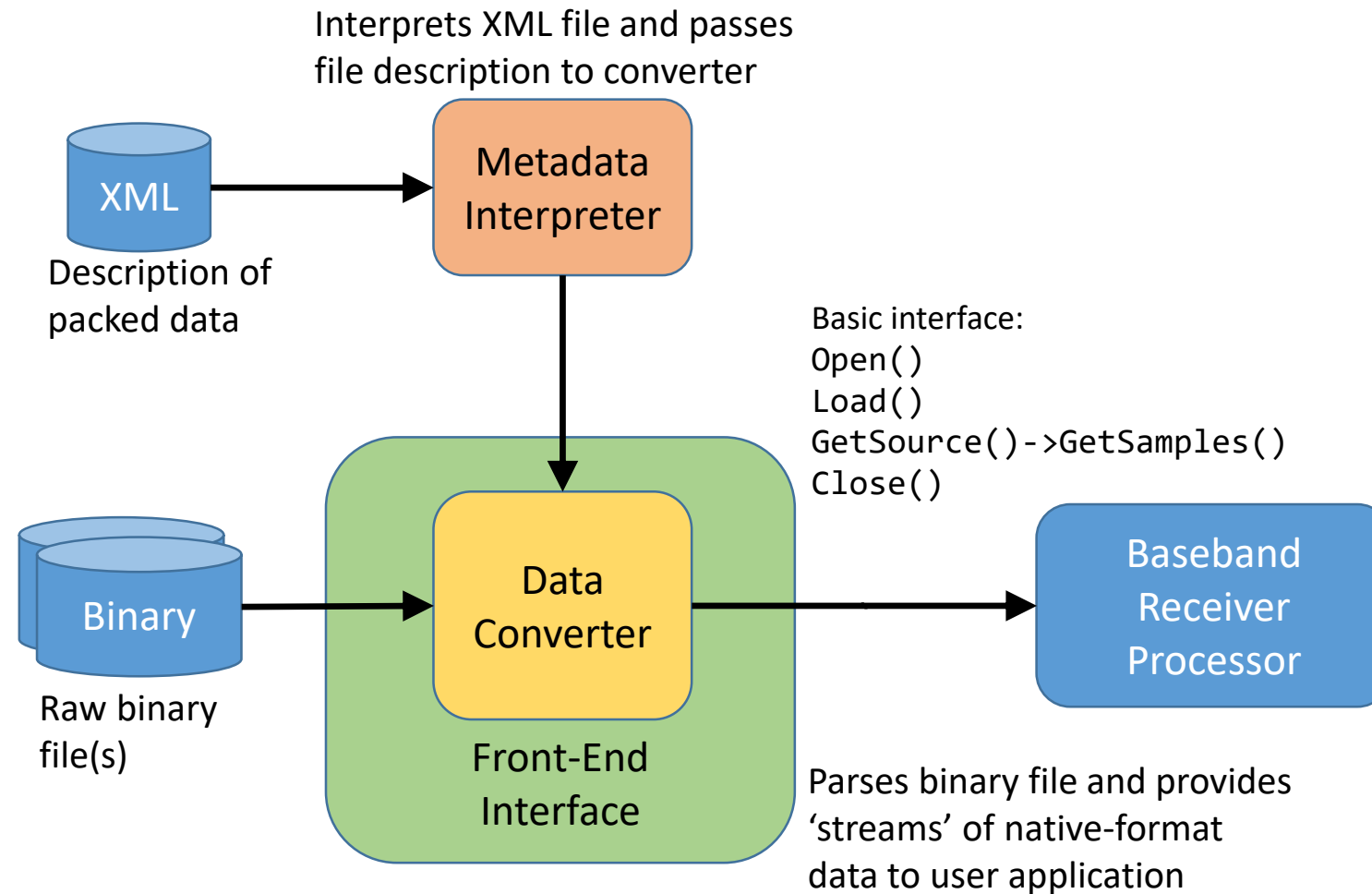
It consists of two parts:

- A Metadata Interpreter: libapi
  - Provides interface to read/write xml Metadata files
- A binary data converter: libcnv
  - Provides an interface to read/convert GNSS IF data files

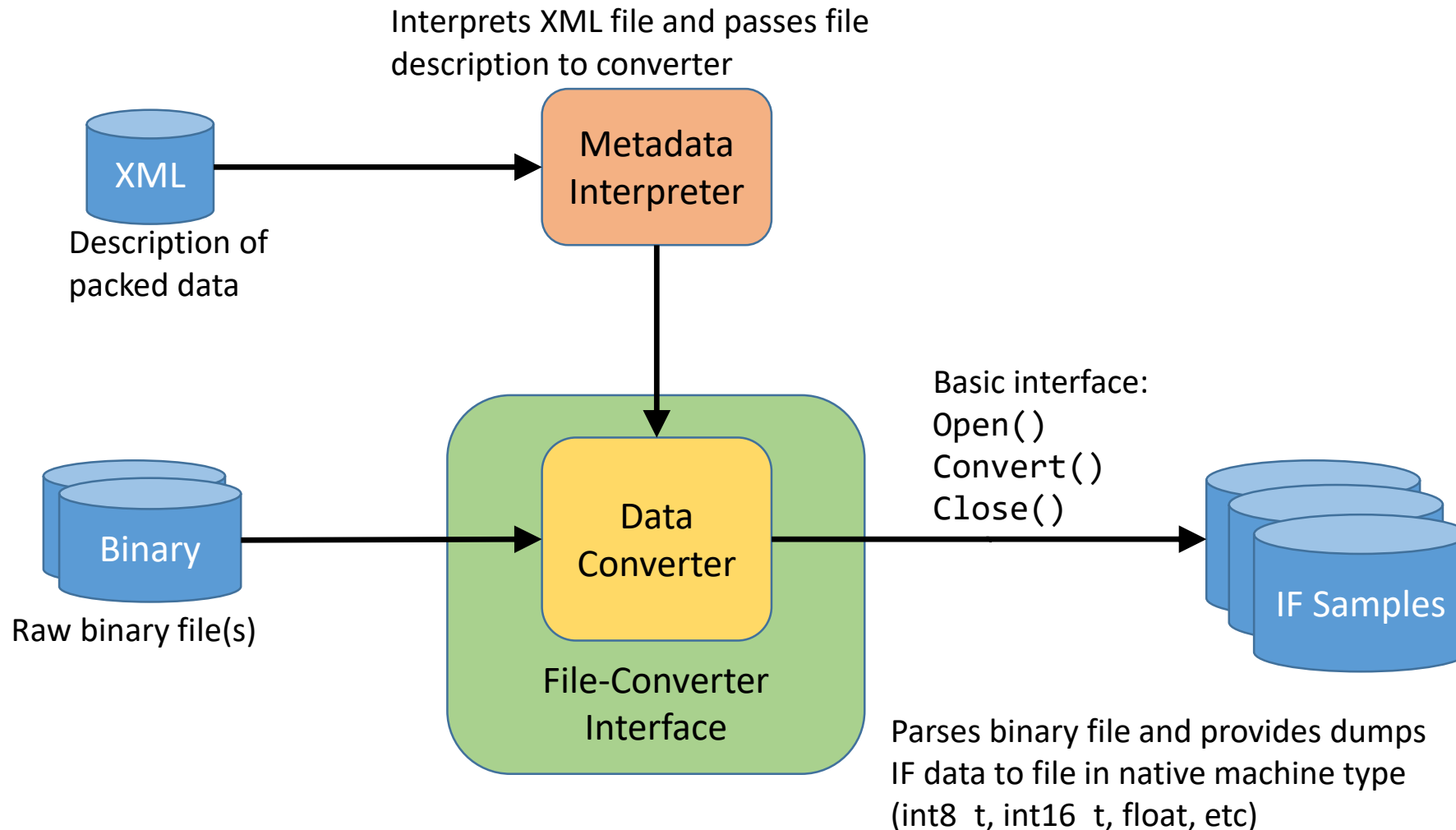
It is an open-source C++ implementation:

- <https://github.com/IonMetadataWorkingGroup/GNSS-Metadata-Standard>
- Two branches: **master** (frozen for RFC) and **devel** (currently active)
- Cross platform: Windows 7, Mac OS, Ubuntu
- Reference IF datasets are also provided to test the code

# Usage: in a software receiver



# Usage: as a file-converter



# Using the Software: download from github



IonMetadataWorkingGroup / GNSS-Metadata-Standard

Unwatch 7 Star 3 Fork 5

Code Pull requests 0 Projects 0 Wiki Settings Insights

GNSS Software Defined Receiver Metadata Standard <http://sdr.ion.org/> Edit

Add topics

69 commits 2 branches 0 releases 2 contributors

Branch: master New pull request Create new file Upload files Find file Clone or download

This branch is 15 commits ahead, 7 commits behind Pull request Compare

committed on GitHub Merge pull request #12 Latest commit cdb4683 15 days ago

Specifications	tidy documentation dir	15 days ago
install	purge converted binary files	15 days ago
source	fixed linux compile	15 days ago
.gitignore	fixed bug in SampleFormatFunctions::ComputeOffsets line 51	a month ago
CMakeLists.txt	CMakeWarning	a month ago
LICENSE	new init	4 months ago
README.md	Update README.md	15 days ago

# Using the Software: generate build files

The project uses CMake to manage build configurations

Available:

- <https://cmake.org/>
- apt-get install cmake
- port install cmake

Windows:

```
cd GNSS-Metadata-Standard
mkdir build
cd build
cmake ../ -G "Visual Studio 14 2015 Win64"
Then open the .sln project and build the 'Release' configuration
```

Mac OS (Xcode):

```
cd GNSS-Metadata-Standard
mkdir build
cd build
cmake ../ -G Xcode
Then open the .xcodeproj project and build the 'Release' configuration
```

Unix (make) or Mac OS (make):

```
cd GNSS-Metadata-Standard
mkdir build
cd build
cmake ../ -DCMAKE_BUILD_TYPE=Release
make
```



# Using the Software: testing your build

- A Matlab/Octave script is included to test the code
- Six reference IF datasets are provided
- Test script runs the data converter and compares the output to references datasets

'check\_converter.m'.

If everything has build OK then you should see the following output:

```
Deleting old files: .....Done.  
Running the test converter ("TestConverter"): Done.  
Checking the converted output:  
FHG: OK  
IFEN: OK  
JRC: OK  
TRIGR: OK  
SJTU: SKIPPED  
  
Test completed.
```



# Using the Software: include in your build (1)

To add the the "GNSS-Metadata-Standard Converter" to your CMake managed project, add the following lines to your CMakeLists.txt file:

```
include_directories(  
  path_to_where_you_copied_the_repository/GNSS-Metadata-Standard/source/api/inc  
  path_to_where_you_copied_the_repository/GNSS-Metadata-Standard/source/converter/inc  
)  
add_subdirectory(  
  path_to_where_you_copied_the_repository/GNSS-Metadata-Standard/source  
)  
  
target_link_libraries( your_library_or_executable api xml cnv )
```

and include the following in your main.cpp file

```
#include "GnssMetadata.h"  
#include "Converter.h"
```

# Using the Software: include in your build (2)

To add the only the "GNSS-Metadata-Standard API" to your CMake managed project, add the following lines to your CMakeLists.txt file:

```
include_directories(  
  path_to_where_you_copied_the_repository/GNSS-Metadata-Standard/source/api/inc  
)  
add_subdirectory(  
  path_to_where_you_copied_the_repository/GNSS-Metadata-Standard/source  
)  
  
target_link_libraries( your_library_or_executable api xml )
```

and include the following in your main.cpp file

```
#include "GnssMetadata.h"
```

# Open Issues & New Developments (1)

- Missing or untested features in the reference implementation:
  - temporal splitting of files has yet to be tested
  - various encoding/formatting features yet to be tested: e.g. gray-code, nlnQ
  - Others: suggestions from the floor / suggestions from the RFC
- Possible need to reduce format configurations
  - without loss of generality/flexibility
  - do we need to support multiple types of block per lane?
  - do we need to support multiple types of chunk per block?
- XML best practices:
  - There are often multiple ways of describing the same IF data
  - e.g. {SizeWord=1,NumWords=2} is equivalent to {SizeWord=2,NumWords=1}
  - Do we want to recommend a preferred way?

# Open Issues & New Developments (2)

- Current use of the standard / code:
  - IFEN SX3 software receiver
  - MuSNAT (Multi-Sensor Navigation Analysis Tool) from Universität der Bundeswehr München
  - JRC Scintillation Repository (Joint Research Center of the European Commission)
  - Politecnico di Torino (NAVSAS Receiver)
  - UAB cloudGNSSrx (<http://spcomnav.uab.es/cloudGNSSrx>)
  - AFIT
  - Others?
- Possible modifications / enhancements / developments:
  - run-time optimization (speed)
  - Checking/Sanitizing XML files prior to data decoding
  - Data Encoder: pack multiple streams of IF data according to XML spec
  - Others?

# Review of early RFC responses

- 15+ Comments received so far:

## Topics:

1. **Comment #1 [type: critical]** discusses the VITA 49.2 standard, suggests it should be adoption rather than the ION Metadata Standard.  
*Way forward:* Discuss at WG Meeting
2. **Comments #3 to #14 [type: administrative]** discuss formatting, layout, typographical, and clarity of presentation of the standard document.  
*Way forward:* generally agreed/accepted, to be implemented
3. **Comment #15 [type: proposal]:** suggests LaTeX for document preparation.  
*Way forward:* Discuss at WG Meeting

# List of attendees



Name	Organisation	Email
Pablo Dovis	Politecnico di Torino	<a href="mailto:fabio.dovis@polito.it">fabio.dovis@polito.it</a>
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Soeren Zorn	RWTH Aachew University	<a href="mailto:soerer.zorn@nav.rwth-aachern.de">soerer.zorn@nav.rwth-aachern.de</a>
Xin Chen	Shanghai Jiao Tong University	<a href="mailto:xin.chen@sjtu.edu.cn">xin.chen@sjtu.edu.cn</a>
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Adam Shapiro	MITRE	<a href="mailto:ashapiro@mitre.org">ashapiro@mitre.org</a>
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Wim De Wilde	Septentrio	<a href="mailto:dewilde@septentrio.com">dewilde@septentrio.com</a>
Chris Bartone	Ohio University	<a href="mailto:bartone@ohio.edu">bartone@ohio.edu</a>

\* Doubt about the surname or email domain

# Minutes of Meeting

- Meeting started at 5:50 pm
- James Curran presented the slides
- The following questions and comments have been made:
  - Why JSON was not considered instead of XML?
    - XML has been the baseline from the beginning and XML/JSON converters are readily available.
  - Is it possible to foresee parameter changes (e.g. IF) at a certain epoch?
    - Currently not, but possibly in next revision with the help events.
  - Comment period shall be kept open for a longer time
    - Was agreed! Initially it was only for 30 days.
  - Is there a standard file extension for the xml metadata file?
    - No really, but the proposal is to append an 'x' to the stream file name
  - Syntax and content check within the metadata parser is encouraged to detect inconsistencies of within the XML file.
  - Further examples on [sdr.ion.org](http://sdr.ion.org) are encouraged.
  - More support from vendors might be possible, if vendors can use a logo claiming support of the standard.
  - New use cases of the standard are encouraged.
- Next steps:
  - Further work on C++ code and document within a branch (trunk is kept unchanged during the public comment period)
  - Update [sdr.ion.org](http://sdr.ion.org) with publications, papers, presentations and more example data
  - Keep [sdr.ion.org](http://sdr.ion.org) up to date
  - Wait for outcome of the public comment period
- Meeting ended at around 6:30 pm