WMO Guide to Free and Open Source Software

World Meteorological Organization

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Standing Committee on Information Management and Technology (SC-IMT)[1]

Commission for Observation, Infrastructure and Information Systems (INFCOM)[2]

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Introduction

Open source software has become increasingly crucial for WMO and its Members. No longer a "niche" industry, FOSS now powers major initiatives and services worldwide, and is backed by industry support.

FOSS solutions play a pivotal role as accelerators for the implementation of Early Warnings for All, a key WMO initiative aimed at protecting every person on Earth with life-saving early warning systems by 2027. By providing accessible, customizable, and cost-effective tools, FOSS enables Members to rapidly deploy and adapt early warning systems to their specific needs and contexts. This approach is particularly crucial for developing countries (LDCs) and small island developing states (SIDS), where resource constraints often hinder the implementation of proprietary solutions.

Moreover, FOSS initiatives serve as powerful catalysts in supporting Members' efforts towards digital transformation. As National Meteorological and Hydrological Services (NMHSs) worldwide strive to modernize their operations and services, FOSS now offer a flexible and scalable foundation for innovation. They enable Members to leverage cutting-edge technologies, collaborate on development, and share best practices, thus accelerating their digital transformation journeys while optimizing resource utilization.

Audience

The document is intended for WMO Members who are involved in software development activities in their respective organizations (developers, managers/decision makers) as well as WMO Secretariat in the coordination, alignment and support of FOSS within WMO.

Scope

This document provides guidance on FOSS for WMO Members and WMO Secretariat.

Background

- use notes from TT-OSS document to INFCOM Management Group

- strong usage, increasing usage

- WIS 2.0 as an example of FOSS dev during standards dev

- needs coordination

FOSS development and use among WMO Members has been a longstanding activity. Typical FOSS implementations included decoders and encoder libraries of WMO BUFR and GRIB formats (e.g. ecCodes, degrib, libecbufr, etc.), as well as data dissemination services (THREDDS, GDAL, ERDDAP, etc.).

In addition, as part of the global open data/open science movement, numerous government organizations have put forth using FOSS by default; this includes use of exiting FOSS tools as well as developing of same, working in the open by default. Free software development platforms and tools (for example, GitHub) have greatly lowered the barrier for sharing software for research,

development and operations for all.

As part of the development of the WMO Information System (WIS2), FOSS implementation has been a significant activity, as exemplified by a number of Reference Implementations of WIS2 Standards (such as wis2box, wis2-gdc, etc.). The development of software in the open during the pre-operational phases of WIS2 proved valuable in testing WIS2 Standards put forth in Technical Regulations while in development, promoting the "release early, release often" philosophy of agile and iterative development. While FOSS is resident in numerous WMO Member organizations, guidance and coordination becomes more vital to ensure Member services are provided with security, privacy and safety in mind for WMO Members and beyond.

Data policy considerations (TODO Athina)

Enabling Unified Data Policy via software

Open data policies

FAIR data principles

[1]   https://community.wmo.int/governance/commission-membership/commission-observation-infrastructures-and-information-systems-infcom/commission-infrastructure-officers/infcom-management-group/standing-committee-information-management-and-technology-sc-imt

[2] https://community.wmo.int/governance/commission-membership/infcom

Guidelines

WMO Members

Using FOSS

- FOSS as an option during software evaluation

- Risk, hidden costs (TODO Jian)

- Principles apply to ANY software

- Risk management

- Due diligence (maintenance, updates)

- Lifecycle management/EOL → migration

- Total cost of ownership considerations

  ◦ HR profile / IT capacity of organization

- Benefits (freedom, cost, reducing vendor lock in, portability) (TODO Jian)

- Infrastructure considerations

Contributing to FOSS

National policies

The adoption and development of FOSS within NMHSs can be significantly strengthened through supportive national-level policies. Several WMO Members have already introduced digital government strategies that encourage the use of open standards, open data and open-source software as default options within public administrations. Where such frameworks exist, NMHSs can leverage them to increase efficiency, reduce vendor lock-in and ensure long-term sustainability of operational systems.

National FOSS-related policies may include:

- "Open by default" procurement rules requiring public institutions to consider FOSS alternatives alongside proprietary solutions when acquiring software. In some countries, like Romania, when you purchase "on demand" software development services, the source code should be transferred to the customer along with all the IPR associated with the software. Making the source code available under an open-source license is highly recommended.

- Guidelines for software development funded from public budget, encouraging publication of code under approved open-source licenses.

- Policies promoting interoperability and open standards, which naturally align with FOSS implementations within WIS2 and other WMO technical frameworks.

- Capacity-building programs that enable staff to acquire skills for maintaining and developing open-source tools, reducing long-term operational dependency on external vendors.

- Security and lifecycle requirements to ensure that open-source components used in critical

systems follow maintenance, patching, auditing and version management rules.

Where no national regulations exist, NMHSs can still develop institution-level policies or internal guidelines to support responsible FOSS adoption:

- Establish internal rules for licensing, contribution approval and repository management.
- Define procedures for evaluating FOSS components (governance, community health, maintenance model).
- Incorporate sustainability planning (including contribution back to upstream projects when fixes or new features are developed internally).
- Promote transparency by adopting open repositories for research software and operational tools.
- Events/hackathons (e.g. OGC/OSGeo/ASF Joint Sprints) TODO Vasile
  - By product: connection/collab
- Regulations / risk / constraints / considerations
  - Features, maintenance, project

Managing FOSS activities (TODO Tom)

- Aligning with WMO standards
  - Achieving compliance

WMO Activities

Coordination, alignment and support (TODO Dave/Enrico)

- Coordination/support functions
- Software selection for WMO projects and application development
- Managing FOSS activities
- Aligning with WMO ecosystem of activities
- Ensuring sustainability of FOSS usage
- Managing risk
- Functions
- People

Standards compliance

- Compatability / compliance matrix
- Open Standards <→ FOSS support matrix
- Implementation of WMO Tech Regs / compliance ?
- FOSS as an early indicator of Tech Regs feasibility (TODO Tom)

- Ensure FOSS implementations are part of Technical Regulation development/assessment (feasibility)
- Example: wis2box, developed at the same time as WIS2 standards
- Example: OGC standards (3 implementations)
- FOSS is not part of the Tech Reg, but is an indicator of maturity/capability

Software review and evaluation

- Software identification and selection (TODO Vasile)
  - Project checklist/assessment
- "Approved projects" and/or Reference Implementations
  - Make Tech Regs more concrete
  - Tech Regs → FOSS implementations
  - Should FOSS be cited in WMO Tech Regs (suggest no)
  - Criteria needed (TODO Jian)
    - Compliance (data exchange)
    - Software evaluation (FOSS!) checklist → confidence
    - Readiness
    - Bus/retirement factor
  - Rolling review
- Harmonization: regular review of ecosystem to ensure alignment and optimal use of resources

Application development

- Case study: wis2box et. al. (TODO Tom)
  - Agile development during Tech Reg development

References

Annex A: FOSS evaluation rubric

Annex B: Examples of FOSS managed / offered by Member organizations