

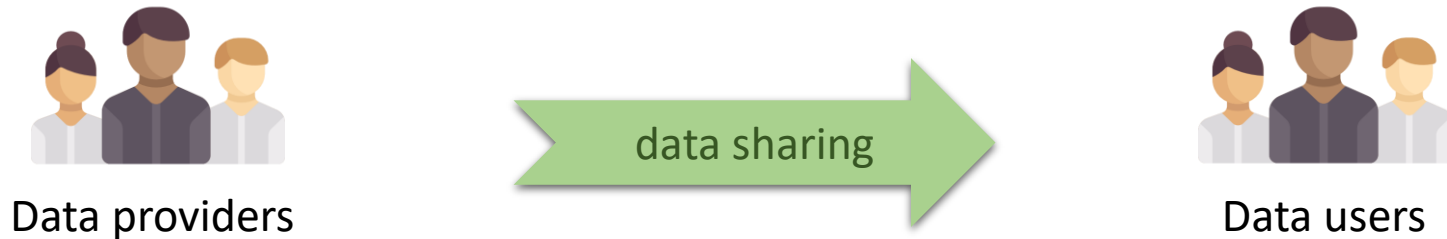
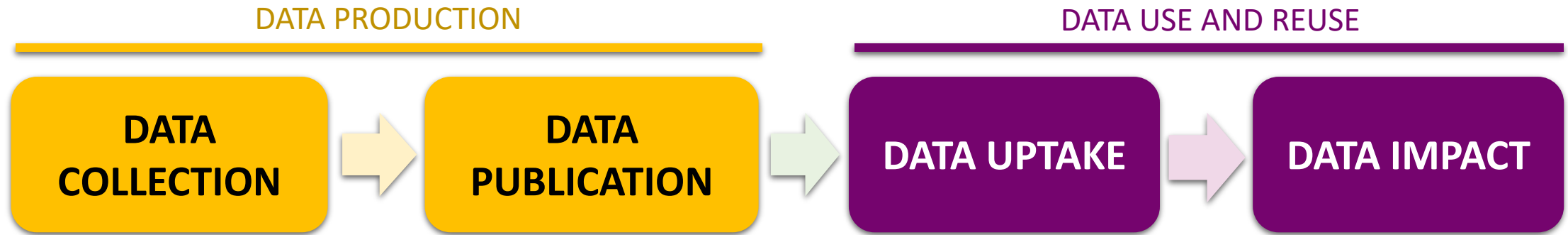
# WMO Hydrological Observing System (WHOS)

Igor Chernov, WMO

WEATHER CLIMATE WATER

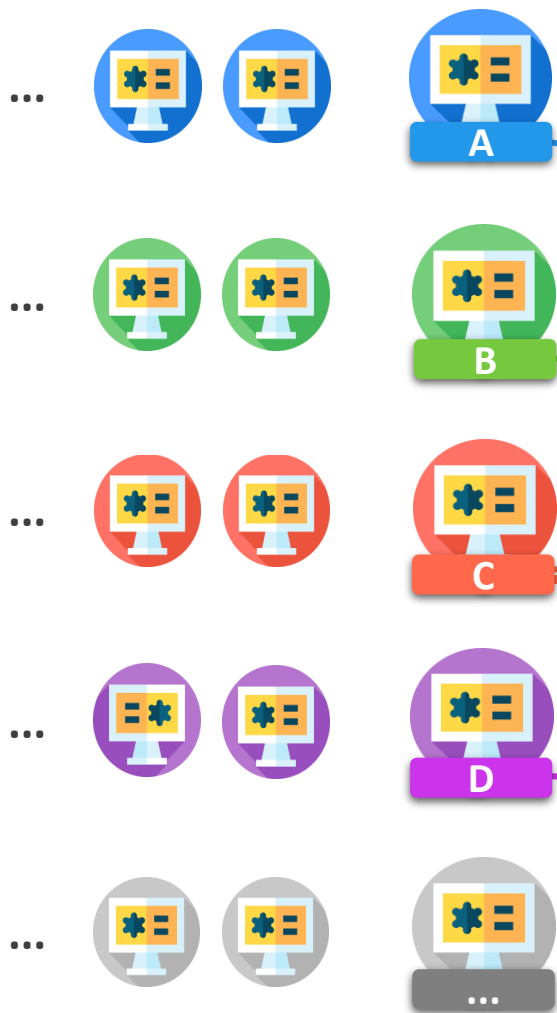


# Data value chain



"user-orientated data production"

## TOOLS and APPLICATIONS



## FUNCTIONALITIES



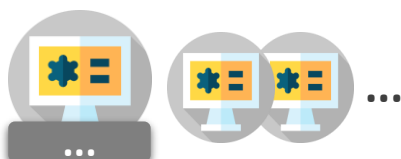
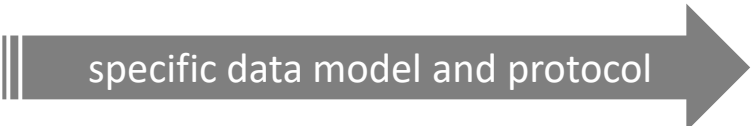
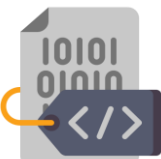
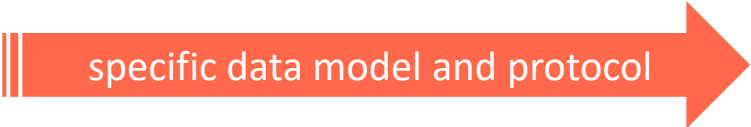
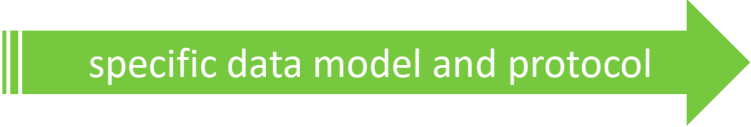
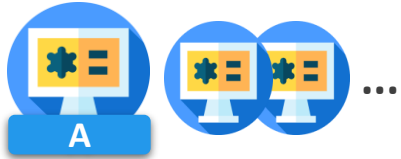
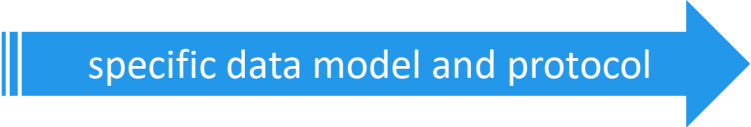
- NMHSs and Forecasting agencies
- Public sector entities
- Research institutes
- International organizations
- Private companies
- General public

# Different tools – different requirements for data models and communication protocols

## Requirements for published data

## Tools

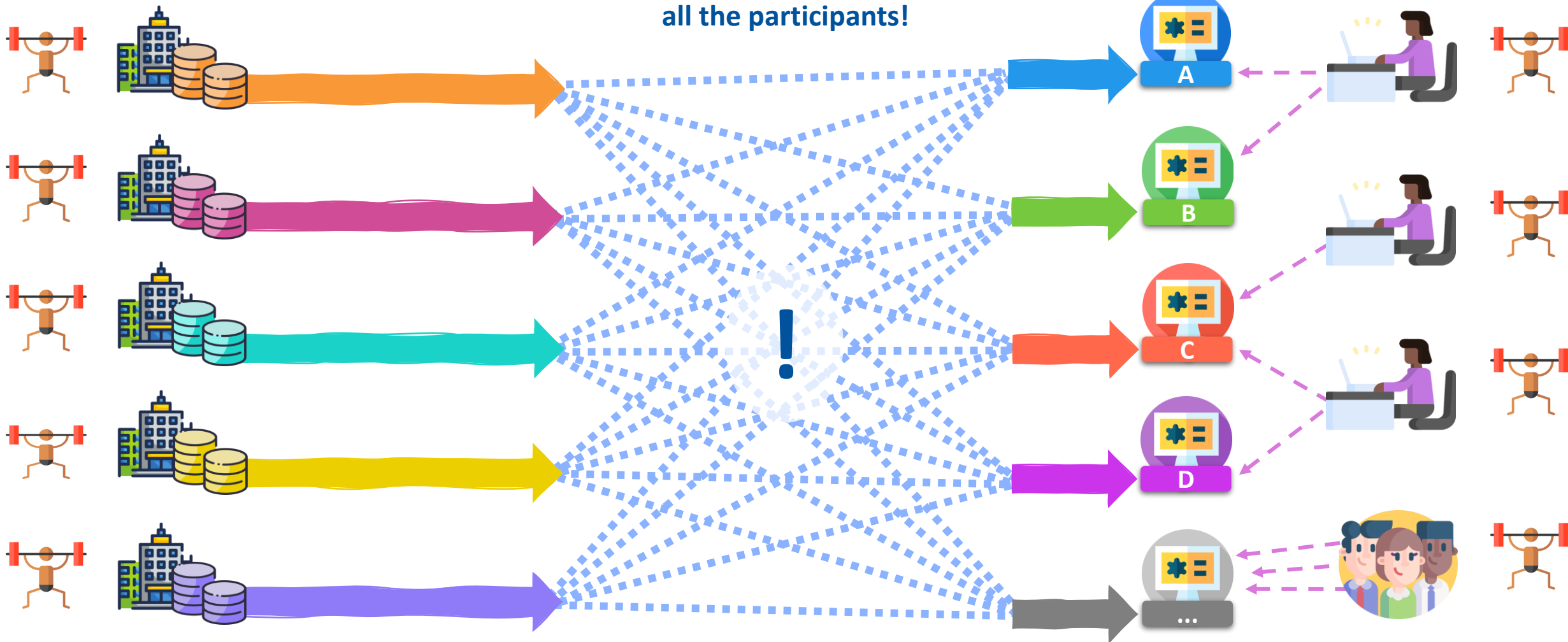
## Standards



## DATA PROVIDERS and WEB SERVICES

Interoperability burden  
represents a huge effort for  
all the participants!

## DATA USERS and TOOLS



## The need for Interoperability

**Interoperability** is the ability of multiple users' tools and applications to access and process data from multiple sources within and across organizational, national regional boundaries.

### Interoperability enables:

- ✓ to find, explore, and understand the full structure and content of data sets
- ✓ to cooperatively use data from different sources to help create more holistic and contextual information



In today's world, people's expectations are for **greater interconnectivity** and **seamless interoperability**



## Layers of interoperability

### Technological layer

Data are **published**, and made accessible through **standardized interfaces**



### Data and format layers

(Meta)data are structured according to **standardized models and schemas**, and codified using standard **classifications and vocabularies**

### Human layer

There is **common understanding** among data providers and users regarding the meaning of the terms used to describe its contents and its proper use



### Institutional and organizational layers

**Responsibility and accountability** for data collection, processing, analyses and dissemination are effectively allocated

# Standardization and brokering approaches

WMO Hydrological Observing System (WHOS)



## Standardization approach

is key in making data more findable, accessible, interoperable and reusable



compatible  
and  
complementary



## Brokering approach

addresses technological, data and format layers of interoperability



# Standardization approach

Through joint activities of WMO and Open Geospatial Consortium (OGC), **WaterML 2.0 standard** had been developed and its following parts have been approved by OGC and WMO through **WMO Resolutions**:

- Part 1 - Time Series;
- Part 2 - Ratings, Gaugings and Sections;
- Part 4 - Groundwater Features.

## Parts under development:

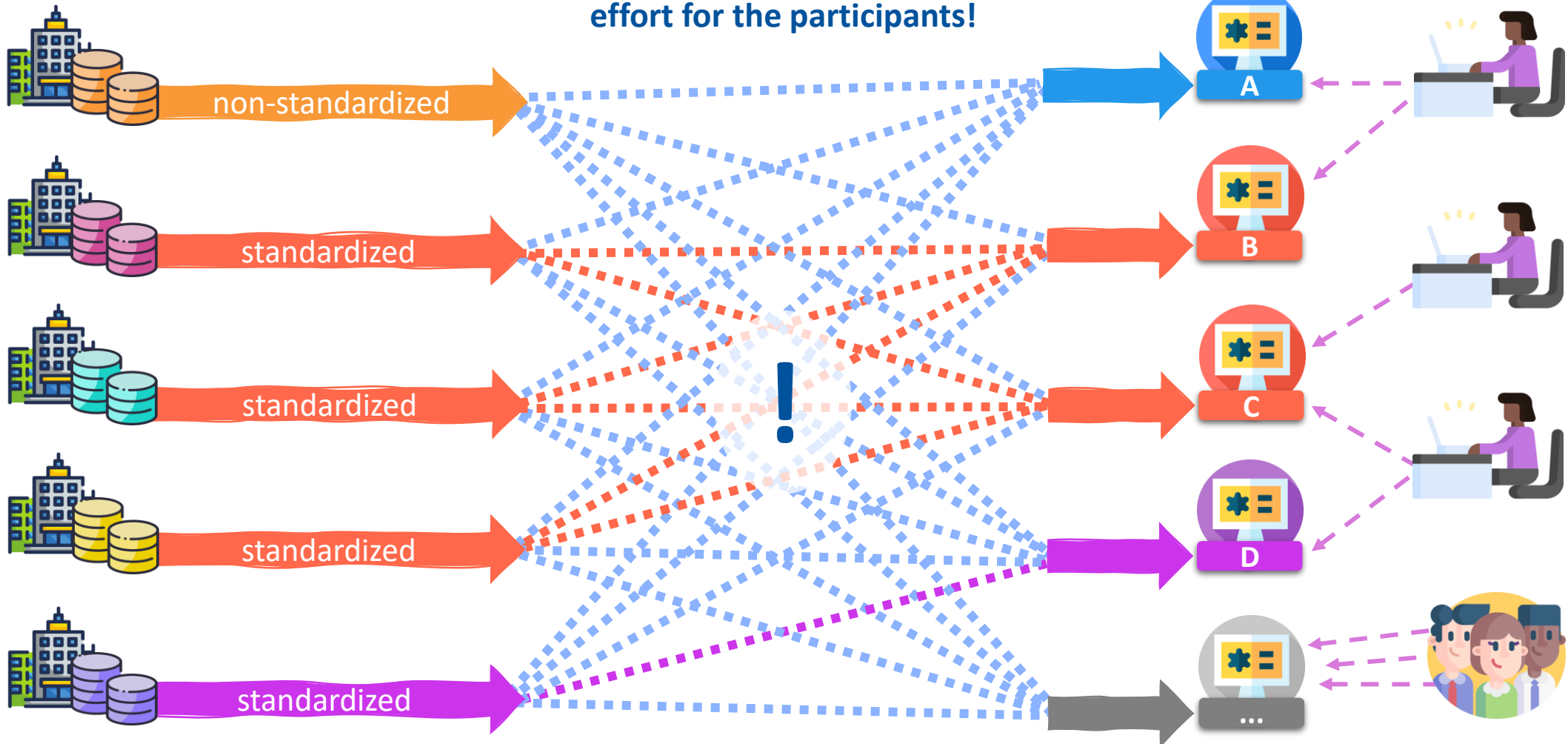
- Part 3 - Surface Hydrology Features; and
- WaterML-WQ – an O&M and WaterML 2.0 profile for water quality data.

**In real world**, the standardization approach alone is **not sufficient**, because in many cases a single country **does not have the possibility** (e.g. limited resources) or **willingness** to implement a specific standard for their NHS.

## DATA PROVIDERS and WEB SERVICES

Interoperability burden  
still represents a huge  
effort for the participants!

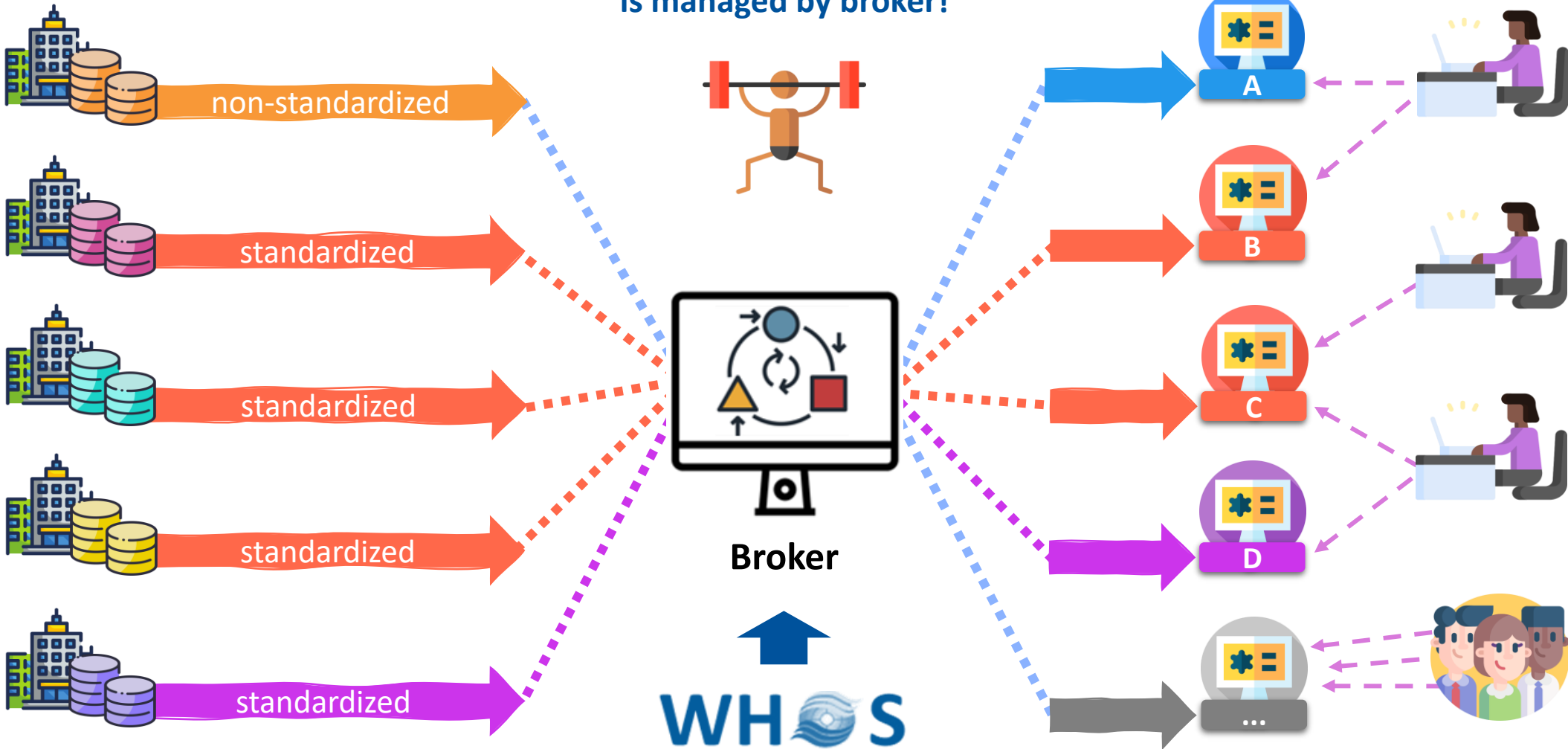
## DATA USERS and TOOLS



# DATA PROVIDERS and WEB SERVICES

# DATA USERS and TOOLS

Interoperability burden is managed by broker!



## Recent WHOS implementations

WHOS-Plata



WHOS-Arctic



WHOS-DR

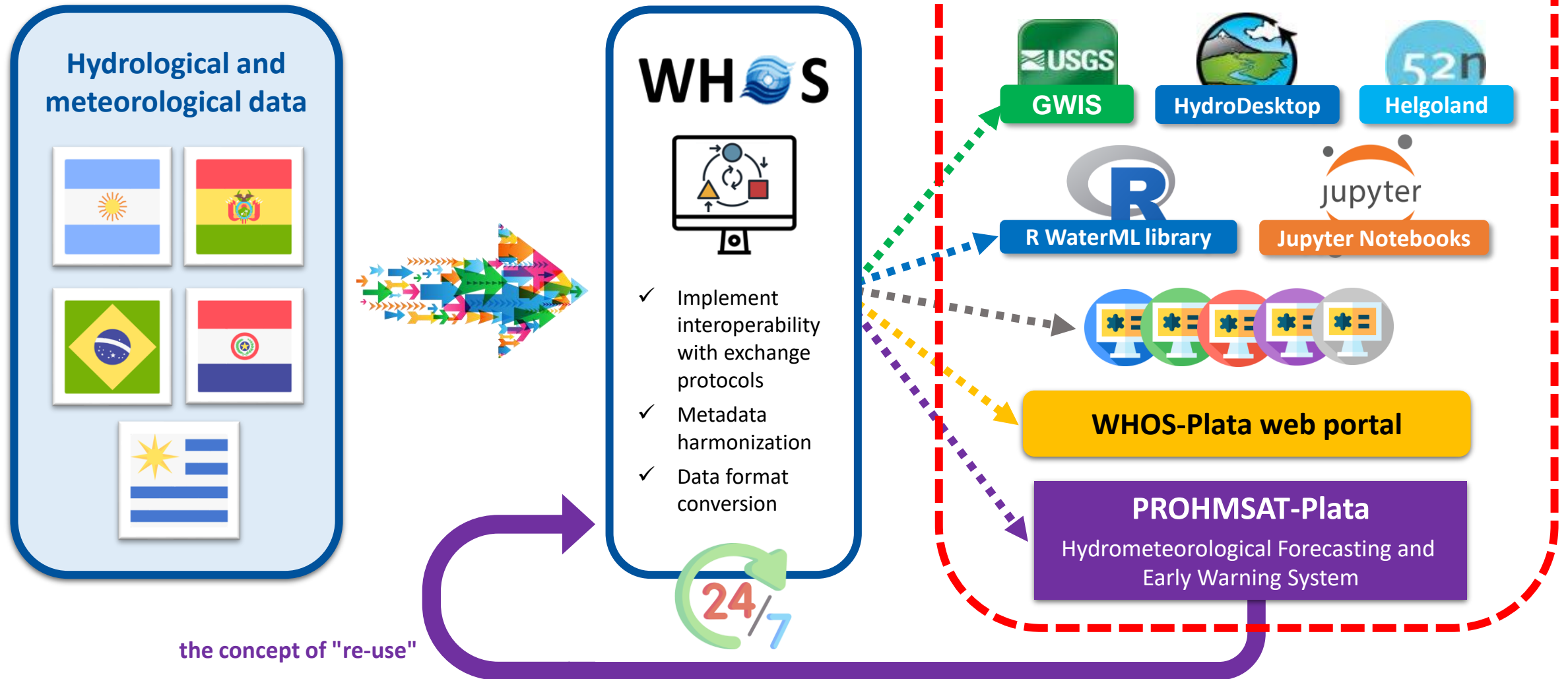


**13 countries**

(Argentina, Bolivia, Brazil, Canada, Denmark, Finland, Iceland, Norway, Paraguay, Russia, Sweden, Uruguay, and the United States)

**freely exchanging and reusing hydrometeorological data  
in an interoperable way**

# WHOS-Plata implementation



# WHOS website

WORLD METEOROLOGICAL ORGANIZATION  
Extranet

HOME MEMBERS GOVERNANCE ACTIVITY AREAS PROJECTS PLANNING & MONITORING WMO WEBSITE LEGACY CONTENT

Home > Activity areas > Wmo hydrological observing system whos

## WMO Hydrological Observing System (WHOS)

**About WHOS**

- WHOS Phase I
- WHOS Phase II
- WHOS Hydrological Ontology

**Discover and access data**

- WHOS Portals
- WHOS web services and supported tools

**WHOS Participation**

- Sharing new data through WHOS
- Connecting a new tool to WHOS
- Distance Learning Course

Contact the WHOS Secretariat

The goal of observations of the hydrological cycle is to collect reliable data for use in water resources planning and decision-making, including for managing flood and drought conditions, integration into hydrological and climate applications and services, and for research. Decisions may be made from raw data measurements, based on derived statistics, or on the results of many stages of modelling beyond the raw data stage, but it is the collected data that form the basis for these decisions. Hydrological datasets have intrinsic value and are worth the huge human and financial commitment required to collect them over long periods of time. Their intrinsic value is revealed when the data are open, discoverable, accessible and interoperable, allowing various end-users to use and reuse them. It is essential that the management and sharing of hydrological data is performed effectively to maximize the benefits of data collection and optimize data reuse, and thus get a return on investment in data collection.

In early 2013, the president of the now superseded WMO Commission for Hydrology (CHy) proposed the development of a WMO Hydrological Observing System (WHOS) as the hydrological component of WMO Integrated Global Observing System (WIGOS). In September 2014, the CHy Advisory Working Group endorsed the concept and development of WHOS.

In 2015, the World Meteorological Congress urged the promotion of WHOS among National Hydrological Services (NHSs) and the hydrological community. Congress advocated for a full implementation of WHOS.

The implementation of WHOS is being carried out in two phases:

- WHOS Phase I** provides a map interface with links to those NHSs that make their real-time and/or historical hydrological data available online.
- WHOS Phase II** provides a fully WMO Information System (WIS)-compliant services-oriented framework linking hydrologic data providers and users through a hydrologic information system of systems enabling data registration, discovery and access.

**ABOUT WHOS** Click to expand [+]

**DISCOVER AND ACCESS DATA** Click to expand [+]

**WHOS PARTICIPATION** Click to expand [+]

<https://community.wmo.int/activity-areas/wmo-hydrological-observing-system-whos>



# Workshop Series on Water Quality Monitoring – Opening Workshop



# Thank you!

WEATHER CLIMATE WATER

