WMO Hydrological Observing System (WHOS)

Igor Chernov, WMO

WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

WMO HydroHub

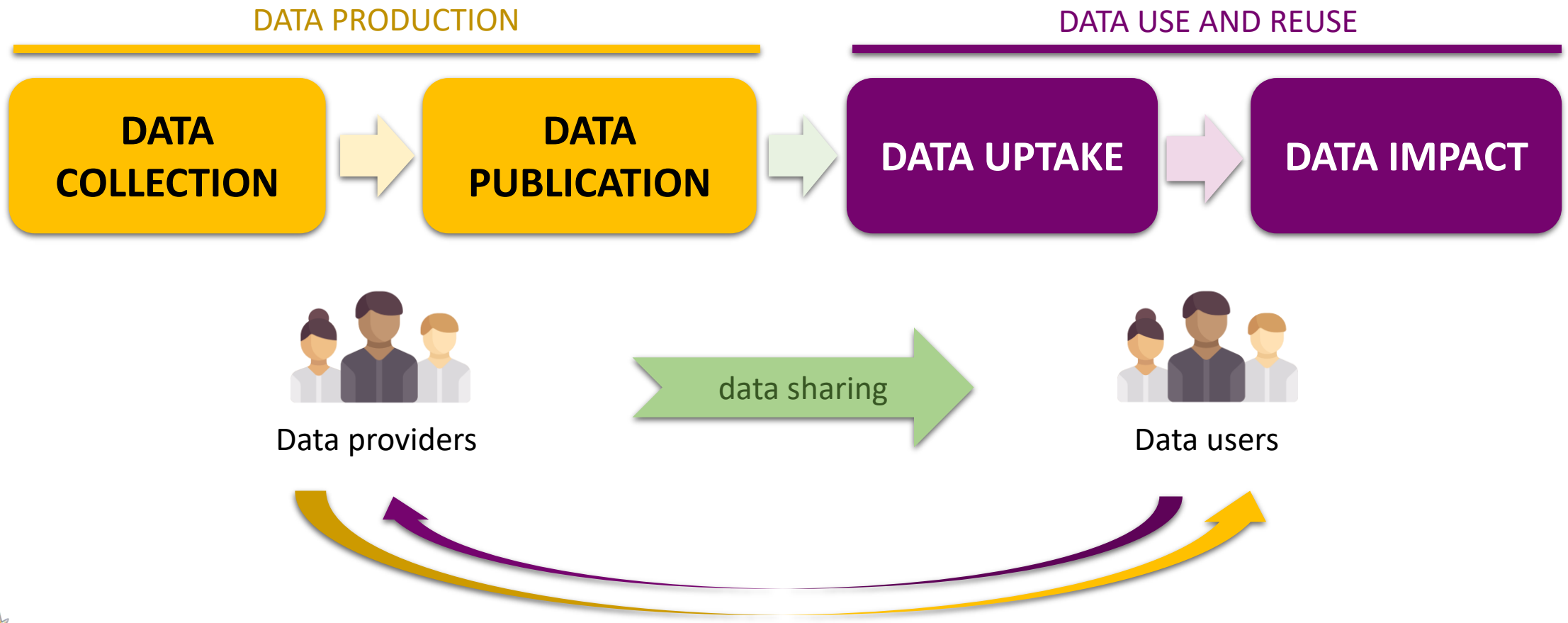
UN environment programme 50 1972-2022

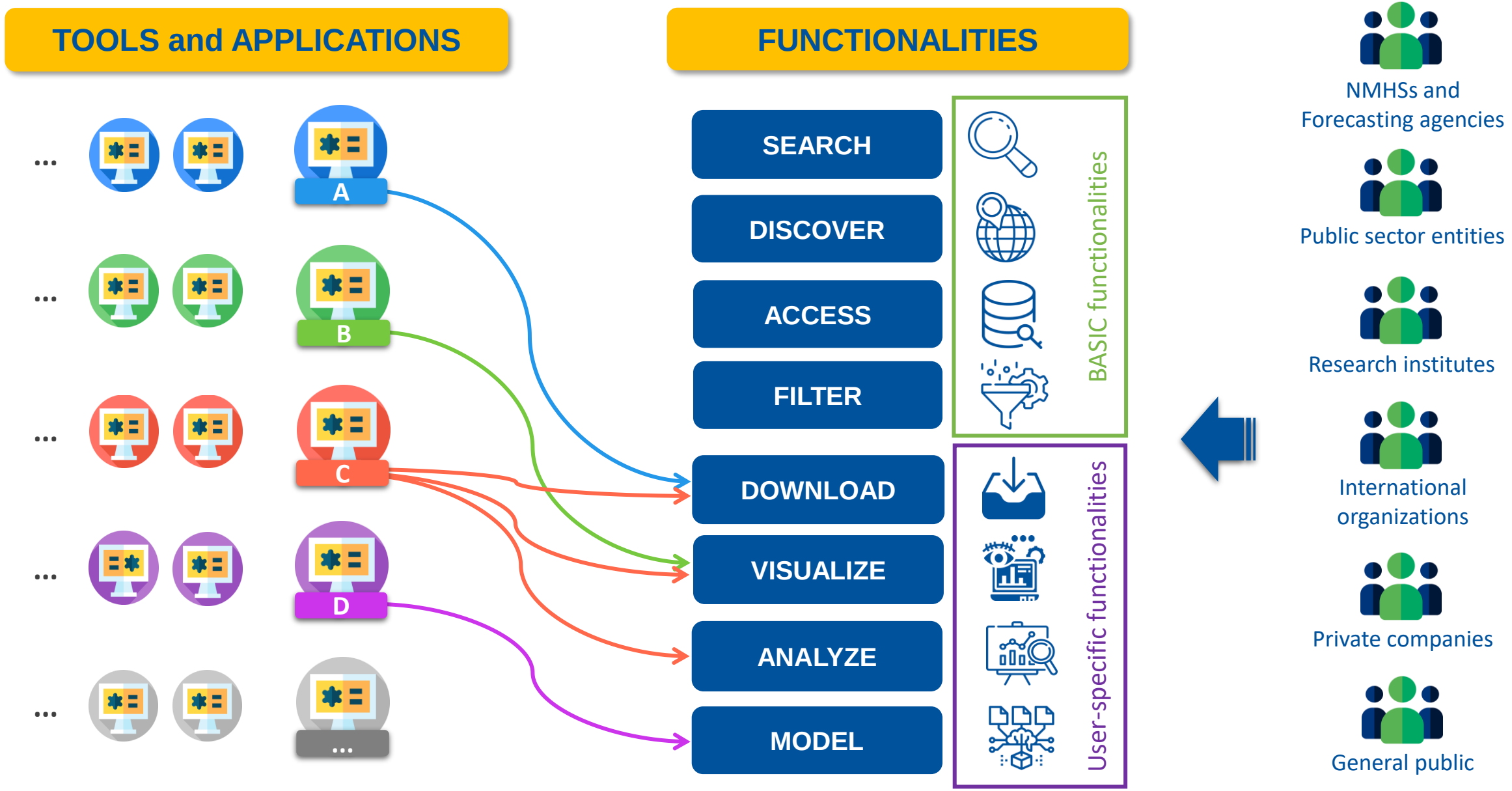
UNESCO

World Health Organization

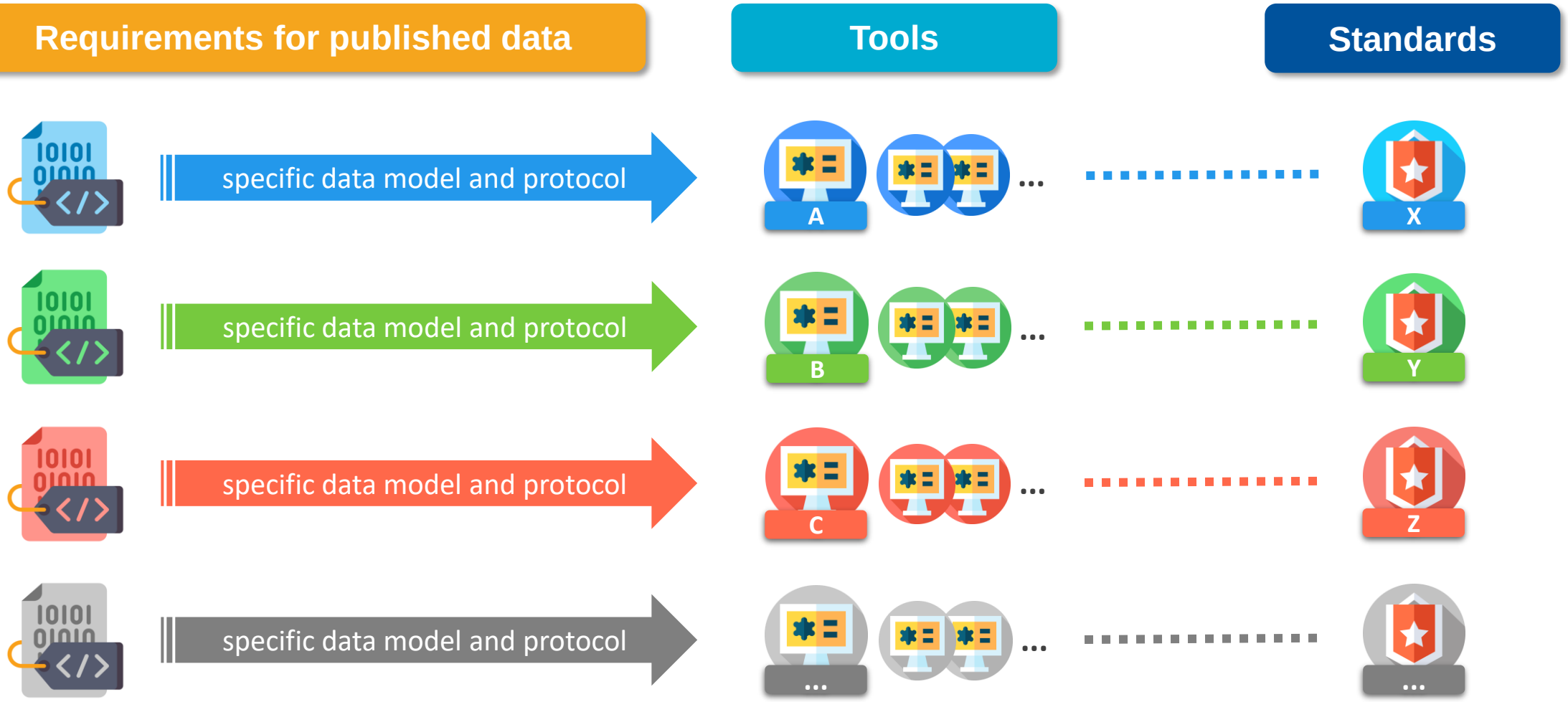
Open Geospatial Consortium

Data value chain




TOOLS and APPLICATIONS
FUNCTIONALITIES
A
B
C
D
...
SEARCH
DISCOVER
ACCESS
FILTER
DOWNLOAD
VISUALIZE
ANALYZE
MODEL
BASIC functionalities
User-specific functionalities
NMHSs and Forecasting agencies
Public sector entities
Research institutes
International organizations
Private companies
General public

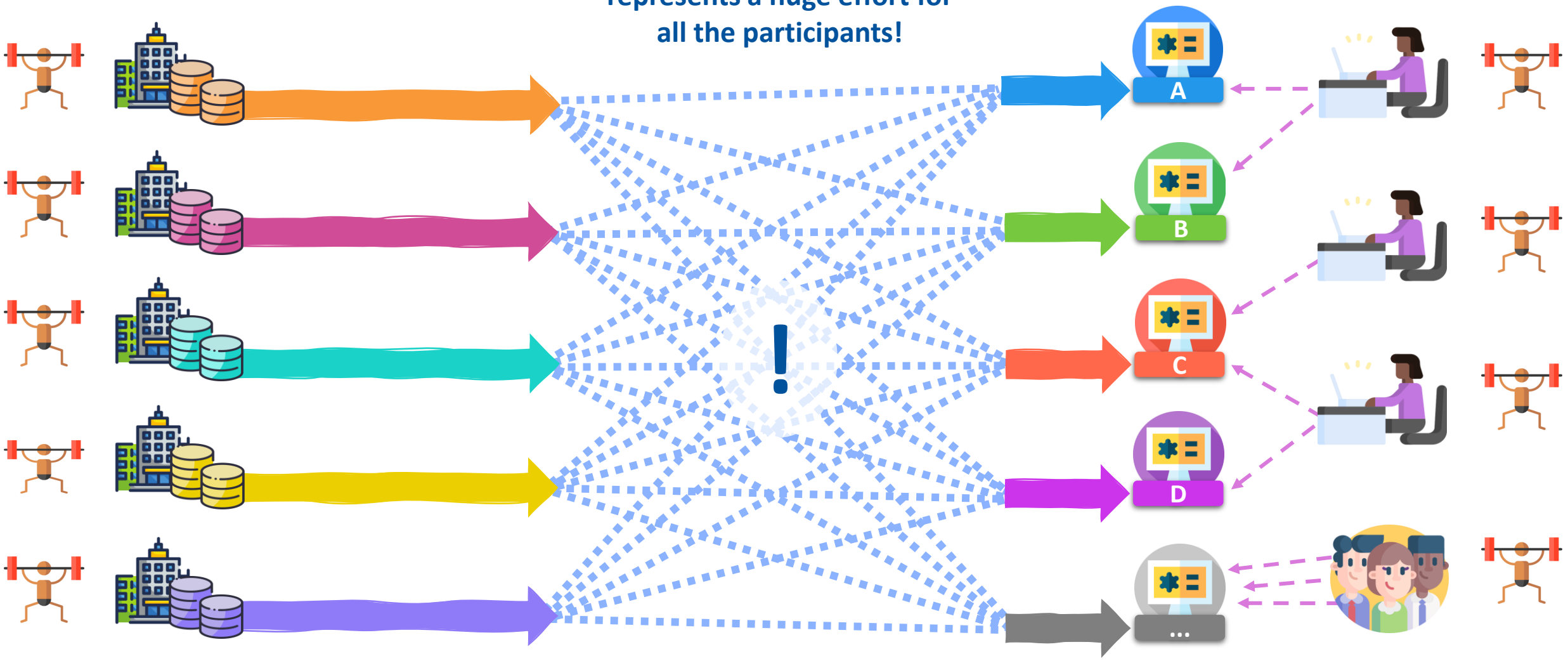
Different tools – different requirements for data models and communication protocols



DATA PROVIDERS and WEB SERVICES

Interoperability burden **represents a huge effort for all the participants!**

DATA USERS and TOOLS

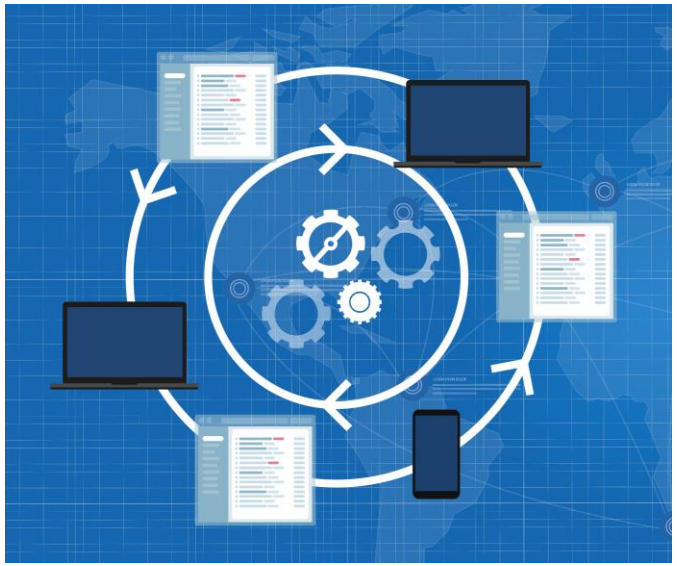


The need for Interoperability

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

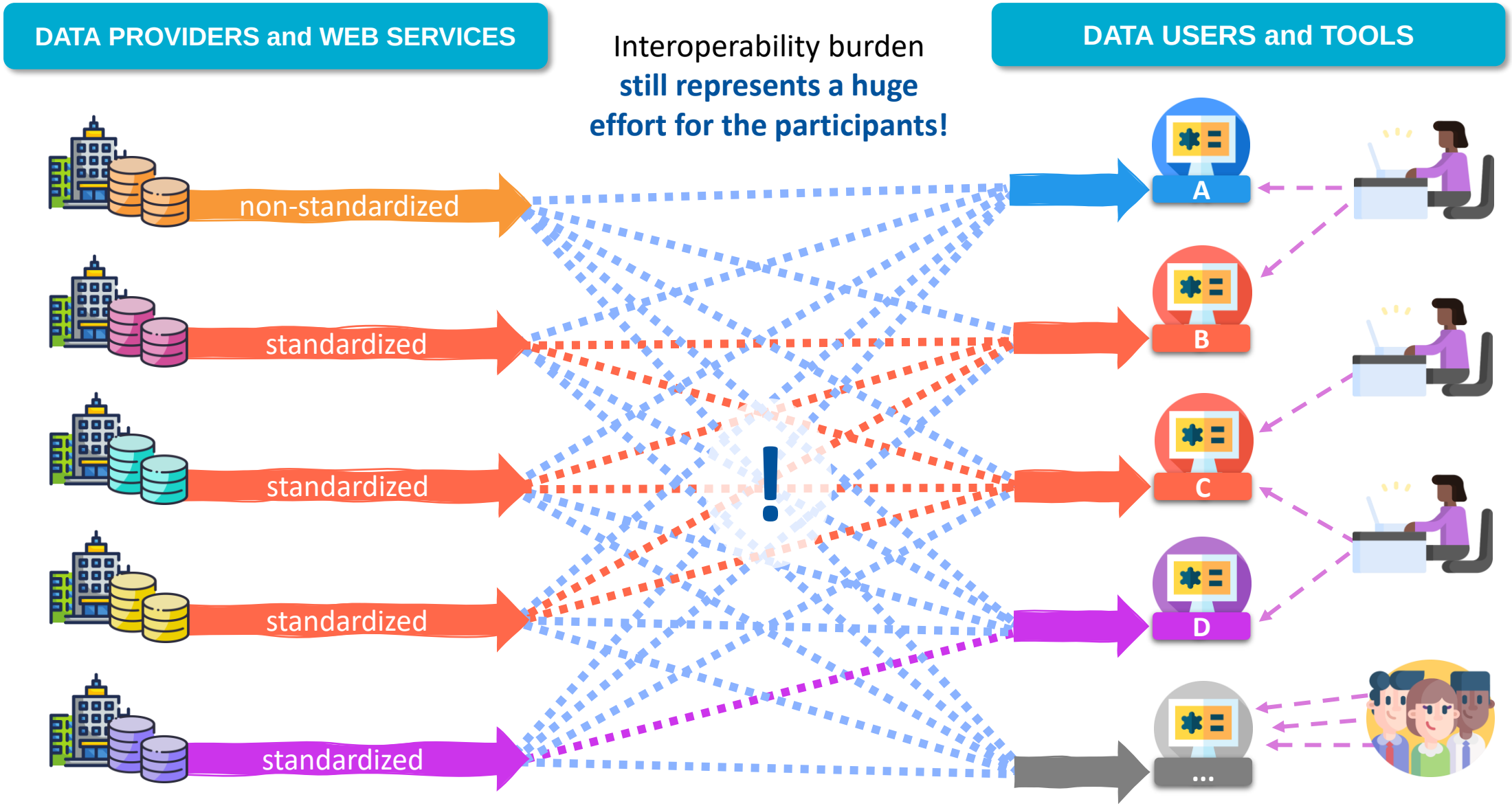
Through joint activities of WMO and Open Geospatial Consortium (OGC), **WaterML 2.0 standard** had been developed and its following parts have been approved by OGC and WMO through **WMO Resolutions**:

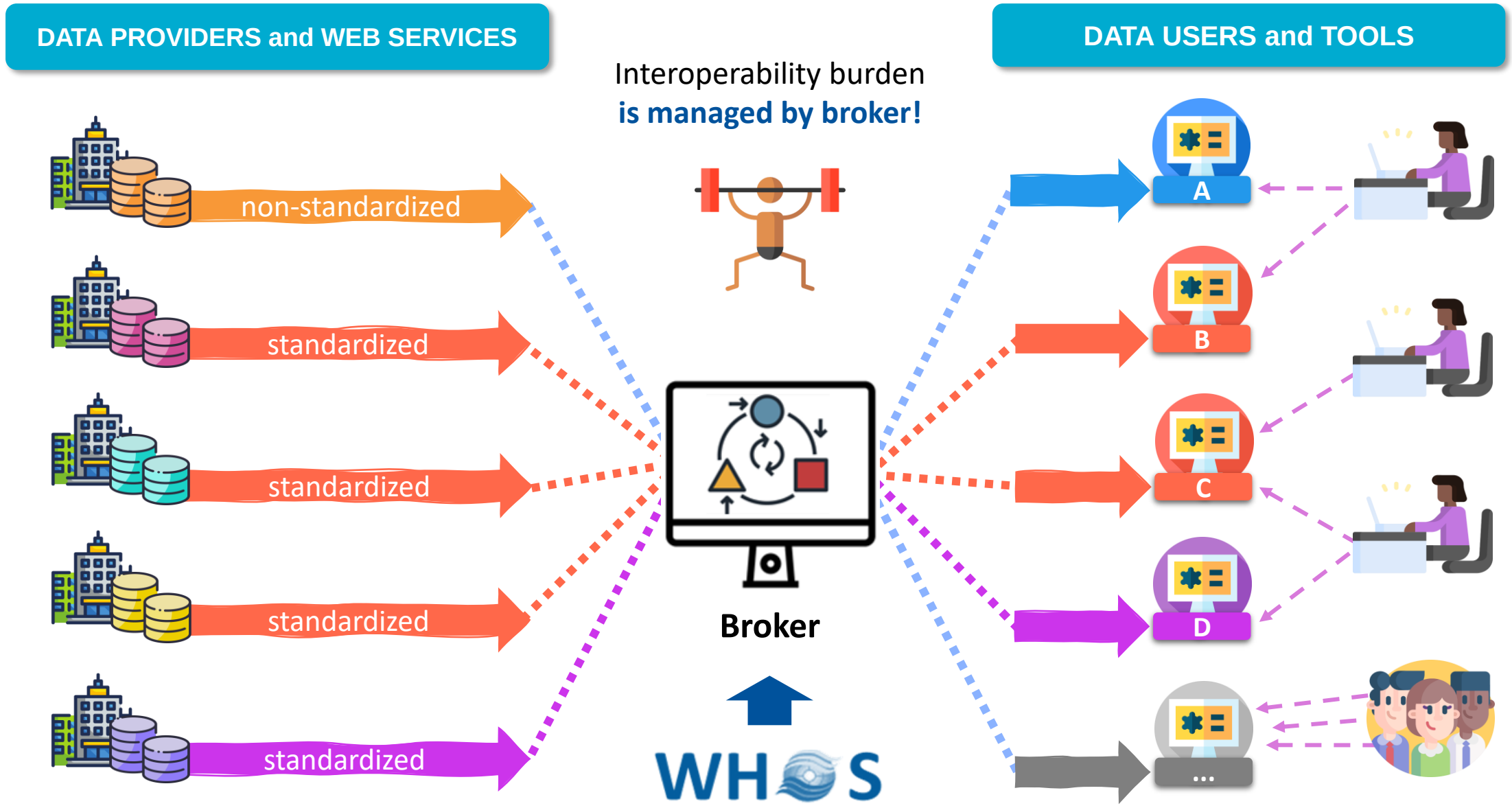
- Part 1 - Time Series;
- Part 2 - Ratings, Gaugings and Sections;
- Part 4 - Groundwater Features.

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
non-standardized
standardized
standardized
standardized
standardized
!
A
B
C
D
...


DATA PROVIDERS and WEB SERVICES
DATA USERS and TOOLS
Interoperability burden
is managed by broker!
non-standardized
standardized
standardized
standardized
standardized
Broker
A
B
C
D
...
WHOS

Recent WHOS implementations

WHOS-Plata

WHOS-Arctic

WHOS-DR

13 countries

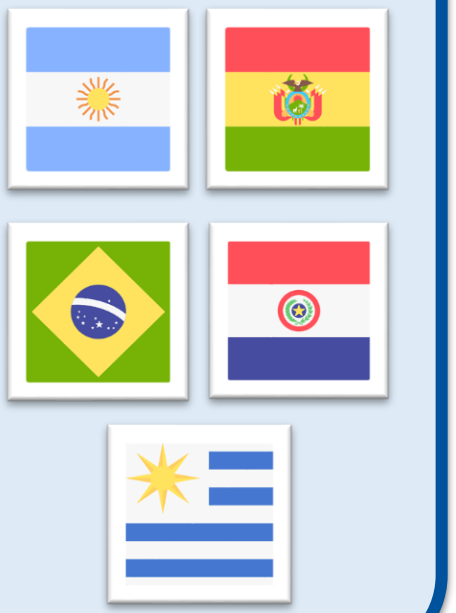
(Argentina, Bolivia, Brazil, Canada, Denmark, Finland, Iceland, Norway, Paraguay, Russia, Sweden, Uruguay, and the United States)

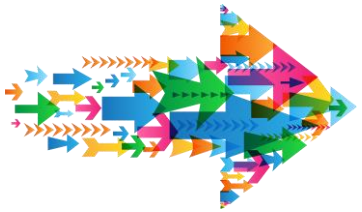
freely exchanging and reusing hydrometeorological data

in an interoperable way

WHOS-Plata implementation

Hydrological and meteorological data





WHOS

- ✓ Implement interoperability with exchange protocols
- ✓ Metadata harmonization
- ✓ Data format conversion

24/7

the concept of "re-use"

Support System for decision-making

- GWIS
- HydroDesktop
- Helgoland
- R WaterML library
- Jupyter Notebooks
- WHOS-Plata web portal
- **PROHMSAT-Plata**
  Hydrometeorological Forecasting and Early Warning System

WHOS website

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

WEATHER CLIMATE WATER

WMO

Workshop Series on Water Quality Monitoring – Opening Workshop

WWQA
World Water Quality Alliance

Thank you!

WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

WMO HydroHub

UN environment programme 50 1972-2022

UNESCO

World Health Organization

Open Geospatial Consortium