The benefit of open standardization for KISTERS time-series management software

Klaus Kisters, KISTERS group
Agenda

KISTERS and Standards

Software

Standardization in projects & products

Interfaces to standards
Water management customers (KISTERS group)

- KISTERS Ibérica S.L., Spain
- KISTERS France SAS, France
- RHEA SAS, France
- EUS, Germany
- SAE Software, Germany
- KISTERS Headquarters, Germany
- KISTERS North America, Inc., United States
- KISTERS Shanghai Co., Ltd., China
- KISTERS Pty Ltd., Australia
- iQuest (NZ) Ltd., New Zealand

Water management customers
KISTERS and Standards

- Where are standards created?
  - System implementation
  - System integration
  - Data standards
    - description
    - storage
    - identification
    - access

- Processing standards
  - Official standards (British Standards, USGS, ISO, DIN etc)
  - Local / organizational standards
  - KISTERS standards (shared workflows in global user community)
KISTERS and Standards

- How to support / achieve standards?
  - Requirement analysis
  - Software development
  - Implementation
  - Customer Management
    - Share knowledge with User Community
    - User group meetings
    - Customer councils
    - Customer work groups

- => Product Management
Move existing apps to standard platforms
Use one approach instead of multiple similar
Defined list of communication options

- Intra-process
  - Inter-process communication should be avoided for high volume data exchange (if possible)
  - Integrate closely coupled services in single server
  - → OSGi framework
- Inter-process: KisRPC
  - High performance API-based client-server and server-server communication
  - Automatic proxy-generation from IDL
- Rest of world: Web services
  - Standards-based interface for external applications
Harmonize interface developments

- Implementation & ongoing support is time-consuming
- Focus developments to one framework

Data Provider Framework
(abstraction to KISTERS and third-party application)
Agenda

KISTERS and Standards

Software

Standardization in projects & products

Interfaces to standards
WISKI TSM: Time Series

- Time Series more than just time stamp and value
  - Scalable system of interpolation type and data type combination to express how the data is treated correctly between the time stamps
  - Hierarchical quality codes stored with every data point are access criteria for every WISKI calculation.
- Free comments, standard remarks and data attributes are added to the data for better interpretation & documentation.
- Advanced time series types combine multiple parameters in dedicated columns (discharge/runoff, wind direction/speed, relative/absolute etc).
- Editing history keeps track of data changes.
WISKI TSM: Parameters

- Parameter types
  - Flexible system based upon generic physical parameters
  - Physical parameters can be combined with media and subject to distinguish different “discharges” (river, spillway, pump, naturalised, modelled, etc).
  - Unit and unit group system enables central use of unit conversions for all parameters and time series.
  - All parameters clearly identified by short names
### KISTERS and Parameters

#### Station list

<table>
<thead>
<tr>
<th>Name</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UplStream</td>
<td>K-40</td>
</tr>
<tr>
<td>DownStream</td>
<td>K-41</td>
</tr>
<tr>
<td>Nick's Creek</td>
<td>K-42</td>
</tr>
<tr>
<td>Stormy Rain</td>
<td>K-43</td>
</tr>
<tr>
<td>Dark Clouds</td>
<td>K-44</td>
</tr>
<tr>
<td>Happy Sunshine</td>
<td>K-45</td>
</tr>
<tr>
<td>Wet Roads</td>
<td>K-46</td>
</tr>
<tr>
<td>Dirty Beach</td>
<td>K-47</td>
</tr>
<tr>
<td>Sunshine Corner</td>
<td>K-48</td>
</tr>
<tr>
<td>Spring/Food Stage</td>
<td>K-49</td>
</tr>
<tr>
<td>Duration Curve</td>
<td>K-50</td>
</tr>
<tr>
<td>Long Term Tarnine</td>
<td>K-51</td>
</tr>
<tr>
<td>Peak Point</td>
<td>K-52</td>
</tr>
<tr>
<td>Frequent Flood</td>
<td>K-53</td>
</tr>
<tr>
<td>Rusty Nail</td>
<td>K-54</td>
</tr>
<tr>
<td>String Coffee</td>
<td>K-55</td>
</tr>
<tr>
<td>Farmers House</td>
<td>K-56</td>
</tr>
<tr>
<td>STG</td>
<td>K-57</td>
</tr>
<tr>
<td>Agri Culture</td>
<td>K-58</td>
</tr>
<tr>
<td>Hunky Dory</td>
<td>K-59</td>
</tr>
<tr>
<td>Fireman</td>
<td></td>
</tr>
</tbody>
</table>

#### Flow

- **Save changes: Parameter type (Estimated Flow)**
- **Open Parameter type: Storm Flow**
- **Save changes: Parameter type (Flow through a Pipe)**
- **Open Parameter type: Flow through a Pipe**
- **Save changes: Parameter type (Flow through a Pipe)**
- **Open Parameter type: Flow through a Pipe**
- **Save changes: Parameter type (Flow through a Pipe)**
- **Open Parameter type: Flow through a Pipe**
- **Save changes: Parameter type (Estimated Flow)**
- **Open Parameter type: Flow through a Pipe**
- **Save changes: Station (FieldAnalyses)**
- **Save changes: Station (DataAnalyses)**
- **Save changes: Station (FieldAnalyses)**
- **Save changes: Station (DataAnalyses)**
- **Save changes: Station (FieldAnalyses)**
- **Save changes: Station (DataAnalyses)**
WISKI TSM: Station

- WISKI Stations
  - Meta data system based upon definable attributes
  - Station characteristics bundle definable attributes (such as attributes for groundwater, surface water or common station attributes).
  - Attribute types are floats, integers, strings that can be entered, picked from drop downs (key lists) or are returned from free SQL statements.
  - Attributes can be mandatory or optional, can be validated during entry.
  - The WISKI GUI Builder arranges attributes on dedicated tab pages in the station register.
KISTERS and Station Data
Another challenge – Weather radar data

- **CALAMAR** – for:
  - Rainfall measurement:
    - Import of weather radar data
    - (Auto) correction/treatment of radar data
    - Polling/import von rain gauge data
    - (Auto) calibration of radar data

- **Real-time-mode:**
  - rain measurement
  - rain forecast
  - risk indicators (threshold exceedance)
  - (Auto) archiving of rain events
CALAMAR - applications

Hydrology

- Determination of rainfall data covering large areas
- Calculation of areal precipitation
- Publishing of rainfall data
- Documentation of rainfall data
- Supply of rainfall data to hydrologic models
CALAMAR - applications

Urban hydrology

- Early warning of heavy rain events

→ enough time allows:

- Preparation of rain management
- Optimization of storage volumes
- Optimization of operation of sewage treatment plants
- Limitation of stormwater overflow
- Survey of maintenance works
CALAMAR - applications

Rainfall forecast / flood forecast / flood management / civil protection

- Early warning of heavy rain events

→ enough time allows:
- Information of emergency task force
- Alarming of action forces
- Evacuation in due time
- Traffic control
Integration into KISTERS software - tomorrow

WISKI-CALAMAR
Integration in KISTERS software - future

WISKI-CALAMAR
to be continued...

see my presentation on Tuesday:

*The Role of Time-Series Management in Hydrology*

- on Tuesday, Jul 14, 10:15AM - 11:30AM
- Location: Room 25 C
Agenda

KISTERS and Standards

Software

Standardization in projects & products

Interfaces to standards
Pre Implementation - initial status

- Multiple data stores (relational-databases, EXCEL, ASCII)
- Rarely “multi user” storage (data often resides on personal folders, home grown MS access databases)
- More than one expert legacy application with specific business logic (Groundwater Databases, Dam Safety Databases, Surface Water Databases, Water Quality Databases)
- Process of data sharing / data publishing is often extremely difficult or not possible at all.
- In house developed legacy systems are difficult to maintain and to extend.
- User community rarely exists.
Implementation process of KISTERS products

- Knowledge transfer
  - raise knowledge of legacy data at KISTERS, design data structure inside KISTERS TSM with customer

- Data migration
  - Migrate legacy data from various data sources into one WISKI/KiTSM Database
  - Meta data, parameter types, time series and time series data, data quality, comments, ratings, gaugings, samples....

- Design calculation of derived data
  - Setup standardized calculation to produce main statistics time series (summary stats, long term values, etc)

- User training
  - Train end users & administrators
The national hydrometric archive of England and Wales

The **HARP** Project of the Environment Agency

- ~50,000 stations
- 300 concurrent users
- 600 maximum users
- 230 GB national archive

Pictures are taken from the EA web site
Process at Environment Agency, England

- All public authorities are using WISKI to manage their hydrometric and hydrological data (data is processed in the same workflow).
- XML standard exchange format for all parties getting and delivering data from and to the Environment Agency.
- In addition vendors implemented the KISTERS zrxd format for manual data downloads.
- Most of the agencies are using SODA for telemetry.
- Data publishing with the KISTERS Web Solution (WDP + WISKI Web).
- Calculations according to the british standards and best practice.
- Own user group established.
Process in Germany

- All public authorities are using WISKI to manage their hydrometric and hydrological data (data is processed in the same workflow).
- Most of the agencies are using SODA for telemetry.
- DDP format is standard format implemented into the SODA telemetry system.
- Data publishing with the KISTERS Web Solution (WDP + WISKI Web)
- Data management according German Pegelvorschrift
- Own user group established
Process at MNR, Ontario

Complete hydrometric archiv
- 500 river gages
- 1000 climate stations
- 300 snow courses
- Fail-safe infrastructure (two locations)
- 5-10 concurrent users
- 50-100 web users
Process in Australia

- All major authorities are using KISTERS HYDSTRA software to manage their hydrometric and hydrological data (data is processed in the same workflow).
- All major authorities are using KISTERS telemetry solutions.
- KISTERS has developed import / export routines to the Australian Bureau of Meteorology.
- HYDSTRA provides its own XML export format.
- Own user group established
Agenda

KISTERS and Standards

Software

Standardization in projects & products

Interfaces to standards
Selected examples for time-series standard

- **CUAHSI: WaterOneFlow / WaterML**
  - very easy but still lack in information types
  - supported by WISKI & WEB framework

- **XHydro: efficient data transmission from/to data logger**
  - has been suggested to data logger vendors
  - will be supported in telemetry solution

- **OGC: SensorWEB Framework with SOS and O&M**
  - very complex, few implementations
  - under observation

- **OpenMI: API approach to connect model in/output**
  - will be important once models are used
  - under observation – might be supported upon customer request

- **Upcoming WaterML 2.0**
  - will hopefully find a good mixture (complexity vs. simplicity)
  - will likely be supported by WEB framework
Consume external webservice into workbench

Ts-range

getSites()

GetValues()

GetVariables()
Consume external webservice into database

- keep a local copy and
- automatically update the copy
- processed by server system
- use of information in all modules
KISTERS telemetry

One black box and one API for 150 logger and X protocols!
Selected examples for spatial standards

- **WMS/WFS**
  - Widely used map services
  - Supported by WEB framework

- **GML/KML**
  - Widely used map format
  - Supported by WEB framework

- **ESRI ArcHydro database**
  - Widely used hydrological data model
  - Will be supported by Hydrology solution

- **ESRI ArcGIS / ArcMap, ArcEngine, ...**
  - Most common spatial desktop software
  - Supported in WISKI

some examples about usage...
ArcGIS – direct access to data archive
OGC-WMS: getMap?
output_format=image/png
time=2008-12-24T00:00:00
## KISTERS FUNCTIONAL OVERVIEW

<table>
<thead>
<tr>
<th>Feature</th>
<th>KISTERS TELEMETRY</th>
<th>WISKI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collect data from over 150 data logger types</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Automatically Collect data from CUAHSI: WaterOneFlow services</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Store short term history of collected data</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Store complete history of retrieved information (archive)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Use of high level hydrological workbench tools: powerful graph, automation in data acquisition, correction, statistical forecast, alarming</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Show WaterOneFlow information in hydrological workbench</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>CUAHSI: WaterOneFlow/WaterML</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>OGC: WMS/WFS/WCS</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>XHydro</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Communities

KISTERS is member/partner of:

- CUAHSI - Consortium of Universities for the Advancement of Hydrologic Science
- OGC – Open Geospatial Consortium
- OGC/WMO Hydrology domain workgroup
- .....
Benefits of standardization

- Standardized data exchange, e.g. GRDC (ca. 157 countries are delivering data)
- Same understanding and more transparency will improve the effectiveness in the water industry.
- Faster project implementation
- Better project communication because of similar concepts/terms/languages
- Streamline interests and efforts

→ Investment on short term but gain on medium/long term
Thank you for your interest!

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