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## SOS Usage Profile for the Hydrology Domain

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### i. Submitting organizations

The following organizations submitted this document to the Open Geospatial Consortium Inc.

a) KISTERS, Germany

b) To be extended

### ii. Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

| CONTACT      | COMPANY | EMAIL  |
|--------------|---------|--|
| Stefan Fuest | KISTERS | <a href="mailto:stefan.fuest@kisters.de">stefan.fuest@kisters.de</a> |
|              |         |  |
|              |         |  |
|              |         |  |
| ...          |         |  |

### iii. Revision history

| Date       | Release | Editor  | Primary clauses modified | Description                            |
|------------|---------|---|--------------------------|--|
| 15.09.2010 | 1.0.0   | Stefan Fuest,<br>Michael Natschke,<br>Michael Utech |                          | initial draft                          |
| 20.09.2010 | 1.0.1   | Stefan Fuest  |                          | Some additional statistics             |
| 12.10.2010 | 1.0.2   | Stefan Fuest  |                          | Slight changes after toulouse workshop |
| 27.10.2010 | 1.0.3   | Stefan Fuest  |                          | Changes based on toulouse minutes      |



## 1 Scope

Experience with the existing SOS services shows that there is a range of ways to understand the generic SOS terminology. Discussions have taken place in several groups and it appears that all of those led to different ways of SOS implementations. Different SOS implementations cause ambiguous client/server interaction with technically proper but semantically wrong request/response pattern. Interaction is just possible, if client and server have been doing a process of adjustment, development, implementation.

Why is this? Current SOS approach is an intentional approach in order to support a broad range of use cases ranging from fixed in-situ sensors to tracking applications or even complex remote sensing systems. Thus, the flexibility is absolutely necessary to accomplish this. It is up to the certain domain to limit this flexibility to get a reasonable set of options.

This document should therefore serve as a base for discussion and should result in an agreement within the group. The group should propose a certain way of SOS usage (with respect to the WaterML2 proposal). It should be seen as a “SOS Usage Profile for the Hydrology Domain” to which data providers and data consumer in the hydrological world can agree and comply with their software systems. This is necessary because just “SOS compliance” will not mean that the client knows how the specific server understands the main SOS terms (“procedure”, “observed property”, “feature of interest”, “offering”).

## 2 Use cases

The following use case is seen as a standard in data discovery and data download. This is the client side perspective, but of course the server side should allow requests in a corresponding way:

- **DISCOVERY:** Move to a geographical extent (bounding box)
- **DISCOVERY:** Provide a list of measuring locations (Station/Sites) with Metadata like (1) period of record, (2) number code, (3) elevation, (4) short name, (5) long name, (6) other metadata
- **DISCOVERY:** Provide available Variables/Parameters (which observedProperty if it is seen as something like WaterLevel and not WaterLevel\_DailyMean) which should result in a list of time-series instances
- **DATA DOWNLOAD:** Retrieve data for certain measuring locations (Station/Sites) and certain Variable/Parameter (or for a defined list of time-series) and a defined time-range
- **DATA DOWNLOAD:** for a set of defined Stations / Sites and defined Variables / Parameters (or for a defined list of time-series) the data should be downloaded on a regular base.

### 3 Definitions

General definitions taken from the SOS 1.0 and O&M 1.0 specification documents:

**Observation Offering:**

An observation offering is a logical grouping of observations offered by a service that are related in some way. The parameters that constrain the offering should be defined in such a way that the offering is 'dense' in the sense that requests for observations that are within the specified parameters should be unlikely to result in an empty set.

**Procedure:**

Method, algorithm or instrument. (O&M: ...which is often an instrument or sensor but may be a process chain, human observer, an algorithm, a computation or simulator.)

**ObservedProperty:**

The observedProperty identifies or describes the phenomenon for which the observation result provides an estimate of its value. It must be a property associated with the type of the feature of interest.

**FeatureOfInterest:**

The featureOfInterest is a feature of any type (ISO 19109, ISO 19101), which is a representation of the observation target, being the real-world object regarding which the observation is made.

**Suggestions with respect to WaterML2**

|                          | <b>How it could be filled</b>   | <b>How it should NOT be filled</b>  |
|--------------------------|---|---|
| <b>Offering</b>          | Any logical grouping  | With the Site as logical group because SITE is already encoded in the FOI |
| <b>Procedure</b>         | RawData, DailyMean, 5minMean, ...<br>(see SOS Type A,C)   | Depends on type<br>SiteA~WL~RawData<br>(see SOS Type B)                   |
| <b>ObservedProperty</b>  | WaterLevel<br>Discharge<br>other occurrences/elements of upcoming WaterML2<br>derived Variables are see as ObservedProperty as well | WaterLevelDailyMean<br>DischargeXYZ<br>CologneWaterLevel                  |
| <b>FeatureOfinterest</b> | SiteA, StationB, MyLocationC  | Cologne_WaterLevel  |

#### 4 Matrix of terms and functions

The following terms exist in OGC specification, existing system, and in “Real World terminology”

**Table 1: Matrix of terms and functions**

|    | SOS1  | SOS2   | WML2   | WMS/WFS analogy   | CUAHSI                       | KISTERS   | Real World Term Example  | Remark  |
|----|---|--|--|---|------------------------------|---|--|---|
| D1 | observedProperty  | observableProperty   | observableProperty                                   |   | Variable                     | Parameter   | WaterLevel, Discharge  | Will be a defined list in WaterML2  |
| D2 | SamplingFeature   | SamplingFeature  | SamplingFeature                                      |   | Site                         | Station/Site  | Cologne  |   |
| D3 | FeatureOfInterest   | relatedFeature   | WaterMonitoringPoint                                 |   | Site                         | Station/Site  | Cologne  |   |
| D4 | procedure<br>(seen as sensor type)  | procedure<br>(seen as sensor type)   | WaterObservationProcess<br>(seen as sensor type)     |   | Not existing                 | Time-series type  | RawData, Daily Mean, AnyOtherFunc  | CUASI WoF usually codes this as part of the Variable (WaterLevelDailyMean) or the whole service address (DailyDataService)                      |
| D5 | procedure<br>(seen as sensor instance)  | procedure<br>(seen as sensor instance)   | WaterObservationProcess<br>(seen as sensor instance) |   | Site&Variable                | Time-Series<br>(accessed via station → parameter → time-series path)              | Cologne/WaterLevel/RawData<br>Cologne/WaterLevel/ DailyMean<br>Cologne/WaterLevel/ AnyOtherFunc  |   |
| D6 |   | Contents<br>obsProp 1..n<br>relF(eature) 1..n<br>procedure 1..1  |  |   |                              |   |  | Contents is new in SOS2; all contents mentioned at the top are used in offerings when the offering does not explicitly mention separate entries |
| D7 | Offering 1..n<br>obsProp 1..n<br>procedure 1..n<br>foi 1..n                         | observationOffering 1..n<br>procedure 1..1<br>obsProp 1..n<br>relF(eature) 1..n<br><br>(wglobally defined in contents section) |  | Layer or Feature<br>(depends on the way the server is encoding) | Not existing                 | Stations or time-series group   | Could be any service specific collection, could be called “SurfaceWaterData” or “AllMyMearsurements” or “ProjectXYZ”<br>Some SOS2 proposals see this as a Station/Site | This should not be misused for any major entity or structural information like “GaugeCologne”   |
| F8 | getobservation(<br>offering 1..1<br>obsProp 1..n<br>procedure 0..n<br>foi 0..1<br>) | getobservation(<br>obsOffering 0..n<br>obsProp 0..n<br>procedure 0..n<br>foi 0..n<br>)   |  |   | Getvalues()<br>Variables 1-n | getTsInfo&getTsd<br>ata()<br>with option to filter based on time-series instances |  |   |

|      | SOS1                   | SOS2                   | WML2 | WMS/WFS analogy | CUAHSI  | KISTERS  | Real World Term Example               | Remark   |
|------|------------------------|------------------------|------|-----------------|---|--|---------------------------------------|--|
| F9   |                        | getResult              |      |                 |   | getTsdata()  |                                       |  |
| F10  | describeSensor()       | describeSensor()       |      |                 |   | getParameterDetails                                  |                                       |  |
| F11  | getFeatureOfInterest() | getFeatureOfInterest() |      |                 | getSiteInfo   | getStationDetails                                    |                                       |  |
|      |                        | GetObservationByID     |      |                 |   |  |                                       |  |
| Misc |                        |                        |      |                 | User authentication is possible as part of the Soap communication | User permission system exists for data and functions | User: Stefan.fuest<br>Pwd: mypassword | User specific data exchange is an important aspect in any cross border or cross agency scenario. |

DRAFT



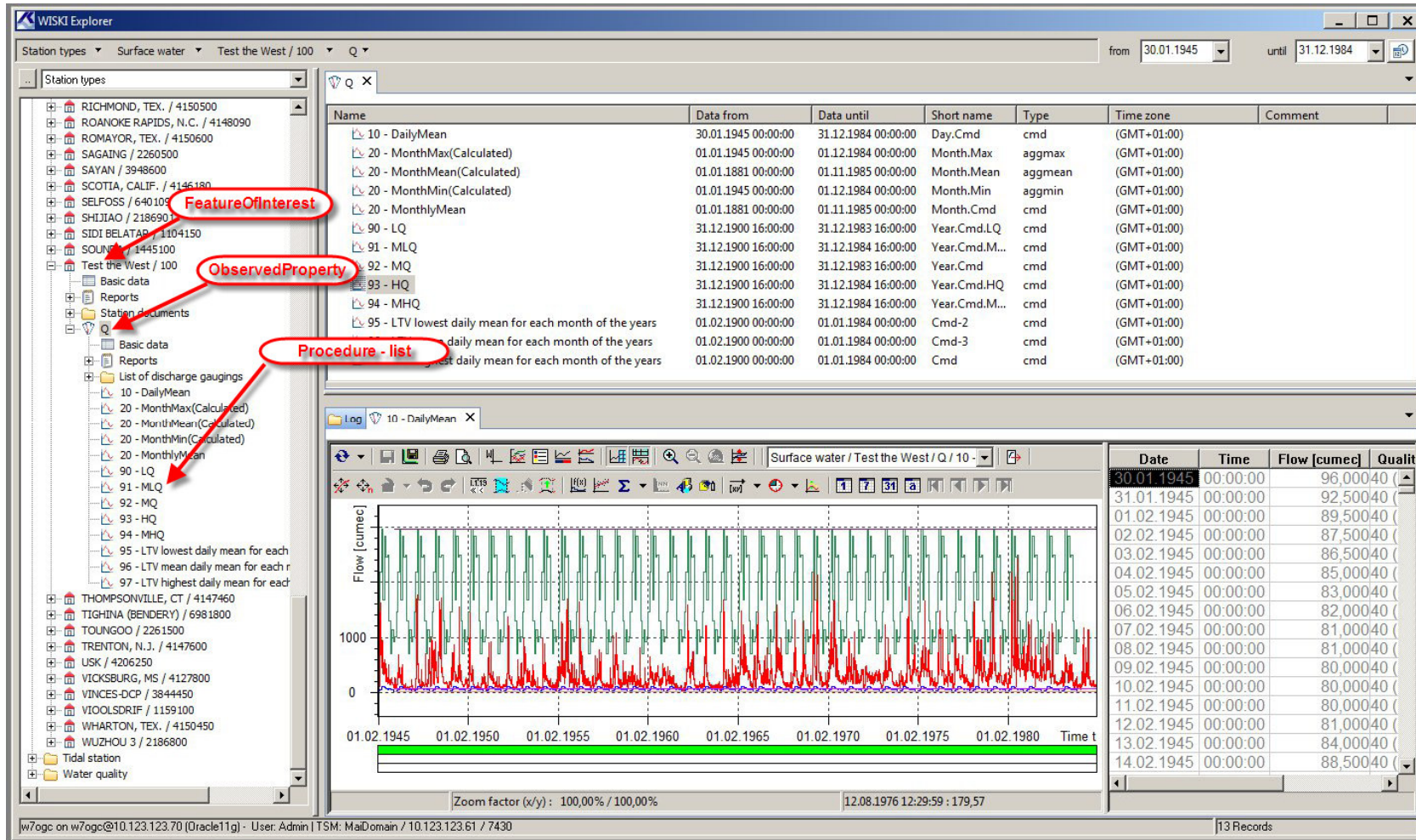


Figure 1: Example screenshot showing KISTERS WISKI7 explorer window and some derived time-series as defined in SW-UC3

## 5 Examples of getCapabilities document - possibilities and comparison SOS1 / SOS2

Note that not all XML node names are the actual names as defined in SOS1/2 spec, it is just meant to show how and what is defined for offering, procedure, foi and observedProperty.

**Table 2: GetCapabilities document - SOS Server Type A (procedure==sensor-type)**

| <b>SOS Server Type A (procedure==sensor-type)</b><br>A SOS service which serves more than raw data or medium/larger networks should use the following structure for the getCapabilities response. Here a procedure is seen as a sensor-type (==time-series type) and NOT a sensor instance (==time-series instance). This structure should be homogenously used and not be used with other encodings. (refer to <a href="http://kiwis.kisters.de">http://kiwis.kisters.de</a> for example)   |  |
|--|--|
| SOS1   | SOS2   |
| <b>MYSERVICE 1</b><br>(syntax has been reduced to get a better overview)<br><pre> &lt;offering&gt;   &lt;sos:procedure xlink:href="RawData" /&gt;   &lt;sos:procedure xlink:href="DailyMean" /&gt;    &lt;sos:observedProperty xlink:href="WaterLevel" /&gt;   &lt;sos:observedProperty xlink:href="Discharge" /&gt;    &lt;sos:featureOfInterest xlink:href="aSite1" /&gt;   &lt;sos:featureOfInterest xlink:href="aSite2" /&gt;   &lt;sos:featureOfInterest xlink:href="aSite3" /&gt;   (... round about XXX other stations/sites...) &lt;/offering&gt; &lt;offering&gt;   &lt;sos:procedure xlink:href="RawData" /&gt;   &lt;sos:procedure xlink:href="DailyTotal"/&gt;    &lt;sos:observedProperty xlink:href="Precipitation" /&gt;    &lt;sos:featureOfInterest xlink:href="Riedenburg" /&gt;   &lt;sos:featureOfInterest xlink:href="Hanau_Bruecke" /&gt;   &lt;sos:featureOfInterest xlink:href="Lehnitz_Op" /&gt;   (... round about XXX other stations/sites...) &lt;/offering&gt;                     </pre> | <b>MYSERVICE 1</b><br>(syntax has been reduced to get a better overview)<br><pre> &lt;contents&gt;   &lt;sos:observableProperty xlink:href="WaterLevel" /&gt;   &lt;sos:observableProperty xlink:href="Discharge" /&gt;   &lt;sos:relatedFeature xlink:href="aSite1" /&gt;   &lt;sos:relatedFeature xlink:href="aSite2" /&gt;   &lt;sos:relatedFeature xlink:href="aSite3" /&gt;   (... round about XXX other stations/sites...) &lt;/contents&gt; &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="RawData" /&gt;   &lt;sos:observableProperty xlink:href="WaterLevel" /&gt;   &lt;sos:observableProperty xlink:href="Discharge" /&gt;   &lt;sos:observedProperty xlink:href="Precipitation" /&gt; &lt;/observationOffering&gt; &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="DailyMean" /&gt;   &lt;sos:observableProperty xlink:href="WaterLevel" /&gt;   &lt;sos:observableProperty xlink:href="Discharge" /&gt; &lt;/observationOffering&gt; &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="DailyTotal" /&gt;   &lt;sos:observableProperty xlink:href="Precipitation" /&gt; &lt;/observationOffering&gt;                     </pre> |

**Table 3: GetCapabilities document - SOS Server Type B (procedure==sensor-instance)**

|   |
|---|
| <b>SOS Server Type B (procedure==sensor-instance)</b> |
|---|

A SOS service which is a bit more as originally intended by SOS specification should use the following structure for the getCapabilities response. Here a procedure is seen as a sensor-instance (==complete identification of a single timeseries) . This structure encodes a path into the procedure field but allows inconsistent requests with features and properties.

| SOS1  | SOS2  |
|---|---|
| <p><b>MYSERVICE 2</b><br/>(syntax has been reduced to get a better overview)</p> <pre> &lt;offering&gt;   &lt;sos:procedure xlink:href="aSite1~~WaterLevel~~RawData" /&gt;   &lt;sos:procedure xlink:href="aSite2~~Discharge~~DailyMean" /&gt;   (... round about XXX other procedures...)    &lt;sos:observedProperty xlink:href="WaterLevel" /&gt;   &lt;sos:observedProperty xlink:href="Discharge" /&gt;    &lt;sos:featureOfInterest xlink:href="aSite1" /&gt;   &lt;sos:featureOfInterest xlink:href="aSite2" /&gt;   &lt;sos:featureOfInterest xlink:href="aSite3" /&gt;   (... round about XXX other stations/sites...) &lt;/offering&gt;  &lt;offering&gt;   &lt;sos:procedure xlink:href="Riedenburg~~Precipitation~~RawData"/&gt;   &lt;sos:procedure xlink:href="Riedenburg~~Precipitation~~DailyTotal" /&gt;   &lt;sos:procedure xlink:href="Lehnitz_Op~~Precipitation~~DailyTotal"/&gt;   (... round about XXX other procedures...)    &lt;sos:observedProperty xlink:href="Precipitation" /&gt;    &lt;sos:featureOfInterest xlink:href="Riedenburg" /&gt;   &lt;sos:featureOfInterest xlink:href="Hanau_Bruecke" /&gt;   &lt;sos:featureOfInterest xlink:href="Lehnitz_Op" /&gt;   (... round about XXX other stations/sites...) &lt;/offering&gt; </pre> | <p><b>MYSERVICE 2</b><br/>(syntax has been reduced to get a better overview)</p> <pre> &lt;contents&gt;   &lt;sos:observableProperty xlink:href="WaterLevel" /&gt;   &lt;sos:observableProperty xlink:href="Discharge" /&gt;    &lt;sos:relatedFeature xlink:href="aSite1" /&gt;   &lt;sos:relatedFeature xlink:href="aSite2" /&gt;   &lt;sos:relatedFeature xlink:href="aSite3" /&gt;   (... round about XXX other stations/sites...) &lt;/contents&gt;  &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="aSite1~~WaterLevel~~RawData" /&gt; &lt;/observationOffering&gt;  &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="aSite2~~Discharge~~DailyMean" /&gt; &lt;/observationOffering&gt;  &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="Riedenburg~~Precipitation~~DailyTotal" /&gt; &lt;/observationOffering&gt;  (... round about XXX other procedures... HOWEVER all single procedures need to be put into separate observationOfferings according to current SOS proposal; this is a conceptual change - the purpose and nature of an offering will then change from something like "MyGroundWaterProgram" to "MyGroundWaterProgram-RawData", "MyGroundWaterProgram-MonthlyMean") </pre> |

**Table 4: GetCapabilities document - SOS Server Type C (procedure==sensor-type/system)**

| <b>SOS Server Type C (procedure==sensor-type/system)</b>  |  |
|---|--|
| <p>A SOS as intended by the GroundWater IE should use the following structure for the getCapabilities response. Here a procedure is seen as a sensor-type or system. This structure requires additional requests or knowledge to “drill” into the data if you want to do it by sensor instance (also refer to <a href="http://external.opengis.org/twiki_public/bin/view/HydrologyDWG/GwleGetCapabilitiesBestPractices">http://external.opengis.org/twiki_public/bin/view/HydrologyDWG/GwleGetCapabilitiesBestPractices</a>, <a href="http://external.opengis.org/twiki_public/bin/view/HydrologyDWG/SOSLargeCollectionSensorDiscussion">http://external.opengis.org/twiki_public/bin/view/HydrologyDWG/SOSLargeCollectionSensorDiscussion</a>)</p> |  |
| <b>SOS1</b>   | <b>SOS2</b>  |
| <p><b>MYSERVICE 3</b><br/>(syntax has been reduced to get a better overview)</p> <pre> &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="DailyMean"/&gt;   &lt;sos:procedure xlink:href="RawData"/&gt;    &lt;sos:observedProperty xlink:href="urn:ogc:def:property:OGC:GroundWaterLevel"/&gt;    &lt;sos:featureOfInterest xlink:href="urn:x- ngwd:feature:OntarioWellNetwork"/&gt; &lt;/observationOffering&gt;                 </pre> <p>If possible, the Network-FOI should provide some spatial extent expressed as a bounding box.</p>  | <p><b>MYSERVICE 3</b><br/>(syntax has been reduced to get a better overview)</p> <pre> &lt;contents&gt; &lt;/contents&gt; &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="DailyMean"/&gt;    &lt;sos:observableProperty xlink:href="urn:ogc:def:property:OGC:GroundWaterLevel"/&gt;    &lt;sos:featureOfInterest xlink:href="urn:x- ngwd:feature:OntarioWellNetwork"/&gt; &lt;/observationOffering&gt; &lt;observationOffering&gt;   &lt;sos:procedure xlink:href="RawData"/&gt;    &lt;sos:observableProperty xlink:href="urn:ogc:def:property:OGC:GroundWaterLevel"/&gt;    &lt;sos:featureOfInterest xlink:href="urn:x- ngwd:feature:OntarioWellNetwork"/&gt; &lt;/observationOffering&gt;                 </pre> <p><b>(according to current SOS2 proposal all single procedures need to be put into separate observationOfferings; this is a conceptual change - the purpose and nature of an offering will then change from something like "MyGroundWaterProgram" to "MyGroundWaterProgram-RawData", "MyGroundWaterProgram-MonthlyMean")</b></p> |

Table 5: GetCapabilities document - SOS Server Type D “MIXED”

| <b>SOS Server Type D “MIXED” (procedure==sensor-instance AND derived timeseries type)</b><br>In addition to all types above there is also the option to use everything together in a “MIXED” way of doing. A procedure is seen as a sensor-instance or a derived timeseries type. This way actual sensor timeseries and derived timeseries can be distinguished. There is one procedure, one relatedFeature and one obsProp per offering as long as there are different properties. This is a clear language but it will generate very large getCapabilities documents.<br>[also refer to <a href="https://wiki.csiro.au/confluence/display/WaterML20/Adapting+to+SOS+(2.0)">https://wiki.csiro.au/confluence/display/WaterML20/Adapting+to+SOS+(2.0)</a> ]   |   |
|---|---|
| SOS1  | SOS2  |
| <p><b>MYSERVICE 4</b><br/>(syntax has been reduced to get a better overview)</p> <pre> &lt;offering&gt;   &lt;sos:procedure xlink:href="   http://www.csiro.au/sensorweb/air_temp_sensor_ben_lomond"/&gt;   &lt;sos:observedProperty xlink:href="   urn:ogc:def:phenomenon:airtemperature"/&gt;   &lt;sos:featureOfInterest xlink:href="   http://csiro.au/sensorweb2/southesk/samplingFeatures/BenLomondAWS   "/&gt; &lt;/offering&gt; &lt;offering&gt; &lt;offering&gt;   &lt;sos:procedure   xlink:href="http://www.csiro.au/sensorweb/mean_hourly"/&gt;   &lt;sos:observedProperty xlink:href="   urn:ogc:def:phenomenon:airtemperature"/&gt;   &lt;sos:featureOfInterest xlink:href="   http://csiro.au/sensorweb2/southesk/samplingFeatures/BenLomondAWS   "/&gt; &lt;/offering&gt; &lt;offering&gt; &lt;offering&gt;   &lt;sos:procedure xlink:href="   http://www.csiro.au/sensorweb/rimco_tipping_bucket_2832"/&gt;   &lt;sos:observedProperty xlink:href="   urn:ogc:def:phenomenon:rainfall"/&gt;   &lt;sos:featureOfInterest xlink:href="   http://csiro.au/sensorweb2/southesk/samplingFeatures/SnowHillRoad   "/&gt; &lt;/offering&gt; &lt;/offering&gt; </pre> | <p><b>MYSERVICE 4</b><br/>(syntax has been reduced to get a better overview)</p> <pre> &lt;contents&gt;&lt;/contents&gt; &lt;offering&gt;   &lt;sos:procedure xlink:href="   http://www.csiro.au/sensorweb/air_temp_sensor_ben_lomond"/&gt;   &lt;sos:observedProperty xlink:href="   urn:ogc:def:phenomenon:airtemperature"/&gt;   &lt;sos:featureOfInterest xlink:href="   http://csiro.au/sensorweb2/southesk/samplingFeatures/BenLomondAWS   "/&gt; &lt;/offering&gt; &lt;offering&gt; &lt;offering&gt;   &lt;sos:procedure   xlink:href="http://www.csiro.au/sensorweb/mean_hourly"/&gt;   &lt;sos:observedProperty xlink:href="   urn:ogc:def:phenomenon:airtemperature"/&gt;   &lt;sos:featureOfInterest xlink:href="   http://csiro.au/sensorweb2/southesk/samplingFeatures/BenLomondAWS   "/&gt; &lt;/offering&gt; &lt;offering&gt; &lt;offering&gt;   &lt;sos:procedure xlink:href="   http://www.csiro.au/sensorweb/rimco_tipping_bucket_2832"/&gt;   &lt;sos:observedProperty xlink:href="   urn:ogc:def:phenomenon:rainfall"/&gt;   &lt;sos:featureOfInterest xlink:href="   http://csiro.au/sensorweb2/southesk/samplingFeatures/SnowHillRoad   "/&gt; &lt;/offering&gt; &lt;/offering&gt; </pre> |

**Table 6: Some statistics to the size of the different GetCab documents**

| Stations/<br>Sites/<br>FOI | TS per<br>Station | Lines<br>per<br>Proc | Lines<br>per<br>FOI | Lines<br>per<br>ObsProp | SOS A = TS type |                   | SOS B = TS instance |                   | SOS C = GW IE |                   |
|----------------------------|-------------------|----------------------|---------------------|-------------------------|-----------------|-------------------|---------------------|-------------------|---------------|-------------------|
|                            |                   |                      |                     |                         | Lines           | File size<br>(kB) | Lines               | File size<br>(kB) | Lines         | File size<br>(kB) |
| 0 (Info only)              | 0                 | 0                    | 0                   | 0                       | 100             | 4                 | 100                 | 4                 | 100           | 4                 |
| 1                          | 20                | 3                    | 2                   | 2                       | 164             | 7                 | 164                 | 9                 | 107           | 4                 |
| 10                         | 20                | 3                    | 2                   | 2                       | 182             | 9                 | 722                 | 49                | 107           | 4                 |
| 100                        | 20                | 3                    | 2                   | 2                       | 362             | 20                | 6,302               | 456               | 107           | 4                 |
| 1,000                      | 20                | 3                    | 2                   | 2                       | 2,162           | 134               | 62,102              | 4,526             | 107           | 4                 |
| 10,000                     | 20                | 3                    | 2                   | 2                       | 20,162          | 1,277             | 620,102             | 45,219            | 107           | 4                 |
| 50,000                     | 20                | 3                    | 2                   | 2                       | 100,162         | 6,355             | 3,100,102           | 226,078           | 107           | 4                 |
| 100,000                    | 20                | 3                    | 2                   | 2                       | 200,162         | 12,703            | 6,200,102           | 452,153           | 107           | 4                 |
| 500,000                    | 20                | 3                    | 2                   | 2                       | 1,000,162       | 63,484            | 31,000,102          | 2,260,746         | 107           | 4                 |
| 1,000,000                  | 20                | 3                    | 2                   | 2                       | 2,000,162       | 126,960           | 62,000,102          | 4,521,488         | 107           | 4                 |

The table is a very rough estimate using

- a couple of lines for the ServiceIdentifikation / ServiceProvider sections
- variable lines depending on the amount of FOI
- variable lines for the amount of Procedure
- a rough estimate of 55-75 Bytes per line

It is obvious that – depending on the SOS service type – the size is exploding. It was common sense in the HydroDWG workshop on Sept, 21<sup>st</sup> that the GetCap document should be a quick handshake document and not a full listing of database content (that just excludes the time-series values from the full description).

## 6 Examples of different SOS 1 usages

The following comparison shows some of the existing server's terminology. Please keep in mind that this is just a selection. There are even more interpretations in use.

**Table 7: some selected SOS 1 server and used terminology**

| Service | Offering   | Procedure  | ObsProp  | FOI  |
|---------|--|--|--|--|
| 1       | one per procedure with similar name                                    | sensor instance  | mixed calculated and measured properties                               | not used at all (urn:renci:sdb:featureOfInterest:1.0.0:NotSpecified)     |
| 2       | one per procedure with similar name + one offering with all procedures | sensor type  | a multidimensional "CompositePhenomenon" with properties as components | One single station, same in all offerings                                |
| 3       | one offering for all data  | sensor instance  | only one   | stations, but one respective for each procedure, so practically the same |
| 4       | one per procedure with similar name                                    | sensor instance  | measured properties  | One single feature, same in all offerings (urn:something:bodyOfWater)    |
| 5       | one per FOI with similar name  | sensor instance (includes id which is also used in offering and FOI) | calculated and measured properties                                     | stations, one in each offering   |

(1) <http://ws.sensordatabus.org/Ows/Swe.svc/?service=SOS&request=GetCapabilities>

(2) <http://vastserver.nsstc.uah.edu/vastGC/adcp?service=SOS&version=1.0&request=GetCapabilities>

(3) <http://ww6.geoenterpriselab.com/CalTransSOS/SOS.asmx/GetCapabilities?request=GetCapabilities&service=SOS>

(4) [http://compsdev1.marine.usf.edu/cgi-bin/sos/v1.0/oostethys\\_sos.cgi](http://compsdev1.marine.usf.edu/cgi-bin/sos/v1.0/oostethys_sos.cgi)

(5) <http://opendap.co-ops.nos.noaa.gov/foos-dif-sos/SOS?request=GetCapabilities&service=SOS>

## 7 Summary and Suggestions

Based on the above evaluation it appears to be very unclear how a SOS could answer. While the structure is defined in the specifications the semantics of the response are impossible to know for a generic client. Currently we just see clients that have been adapted to certain SOS services. One of the objectives of “standardization in Hydrology” is definitely to ease the data exchange between agencies. This is still quite difficult to accomplish because it depends on the certain answer type of the SOS if the client is doing the right things. It is even not possible to distinguish between answering type A,B,C,D (=MIXED) which would allow to dynamically switch to the right way of communication.

Additionally, missing discovery functions in SOS specification make some major use cases impossible. It is therefore absolutely necessary to define specific workflows to provide the necessary server side discovery options e.g. in combination with WMS/WFS services. A critical point in SOS interaction is the getCapabilities call (dynamic interaction will just make sense if the return is fast). One of the options might be to completely skip the call and work via WMS/WFS. But this would reduce the SOS to 1-3 remaining functions (GetObservation, DescribeSensor, and maybe GetResult). It is then questionable if community (agencies, universities, software industry) is willing to invest time and money into the SOS development, because it is quite complicated to understand, adapt and implement (compared to services like WaterOneFlow).

To get a stable communication pattern within the interoperability experiments the HydroDWG workshop group on Sept, 21th suggested to go ahead with SOS type C.

**Table 8: Concerns and Suggestions**

| Concern   | Suggestions   |
|---|---|
| <p>The discussion about SOS and Sensor Enablement is sometimes indifferent in terms of “what is a sensor”. Obviously it is often not a sensor but a larger hydrological database.</p> | <p>We might need to distinguish between smaller sensor networks and medium to large databases with a variety of existing time-series products (like derived time-series, graph API, requests like “give me just data based on a certain quality”, etc.). There is no SOS service in the IEs directly serving sensor data, because there is no operational datalogger (or sensor) really capable to speak SOS. Within the IEs we just have databases. For the purpose of the IE the workshop group on Sept, 21th therefore preferred to go ahead with type C.</p>                      |
| <p>Depending on the understanding of “procedure” there are huge capability-documents possible (using type B)</p>  | <p>The most effective mechanism to reduce the capabilities document is to understand the procedure as SENSOR TYPE (type A,C) instead of SENSOR INSTANCE – both for SOS1 and for SOS2. This means, that a procedure is an abstract type like</p> <ul style="list-style-type: none"> <li>RawData</li> <li>Daily Mean</li> <li>AnyOtherFunc</li> </ul> <p>And not a sensor instance (an absolute instantiated path) like</p> <ul style="list-style-type: none"> <li>Cologne/WaterLevel/RawData</li> <li>Cologne/WaterLevel/DailyMean</li> <li>Cologne/WaterLevel/AnyOtherFunc</li> </ul> |
| <p>Depending on the understanding of FeatureOfInterest it is NOT possible to filter the service for</p>   | <p>FOI must be seen as SamplingFeature to allow this. Additionally the GetFeatureOfInterest() function</p>  |



| Concern  | Suggestions  |
|--|--|
| “Station/Site” in order to get a list of all measured sensor types/time-series   | should become mandatory. An artificial, global FOI should be put into the GetCap-Document. This could be seen as a “network”-feature and should provide spatial dimenons regarding the measuring network. This artificial network-feature should then be used to query via getFeatureOfinterest() in order to get back the list of Sites/Stations/realFOI  |
| The FOI is not mandatory in important functions; requests like getObservation(WaterLevel) would need to be answered (with all existing WaterLevel Measurements); currently seen implementation have 3 ways to answer this (1) don’t return anything, (2) return any single station but not all, (3) return all waterlevel but just the most current value for each, and (4) return all waterlevel but stop at a certain amount of time/value pairs. None of the three options matches the original request and the client has no chance to know what the response really is. | getObservation requests should answer according to the real request; if the service provider wants to restrict data downloads this should be done via the defined exception documents with meaningful message like<br><br><ol style="list-style-type: none"> <li>1. please specify time-range to obtain information via getObservation</li> <li>2. please specify a list of feature of interest to obtain information via getObservation</li> <li>3. .... Anything that properly describes why the request is answering in a specific way</li> </ol> |
| There are multiple (flexible) ways how a SOS service might answer.   | The HydroDWG should suggested TypeA as one single approach to be implemented in the IEs.   |
| Client applications have no chance to know which type of SOS service they are talking to   | The SOS should get some generic options to transport something like a “subtype” in the getCap document (if not existing).<br><hr/> OGC Web Services Common Standard defines the ServiceIdentification section:<br>There is a field “Profile” defined as “Identifier of OGC Web Service (OWS) Application Profile” – This usually refers to special OGC-defined profiles, some exist for CSW for instance. There may be a small possibility to define two SOS profiles either with or without OGC help that could be used.                            |

## 8 Related Resources

OGC Web Service Common - [http://portal.opengeospatial.org/files/index.php?artifact\\_id=20040](http://portal.opengeospatial.org/files/index.php?artifact_id=20040)

OGC Observations and Measurments – Part 1 -  
[http://portal.opengeospatial.org/files/?artifact\\_id=22466](http://portal.opengeospatial.org/files/?artifact_id=22466)

OGC Observations and Measurments – Part 2 -  
[http://portal.opengeospatial.org/files/?artifact\\_id=22467](http://portal.opengeospatial.org/files/?artifact_id=22467)

OGC Sensor Observation Service 1.0.0 - [http://portal.opengeospatial.org/files/?artifact\\_id=26667](http://portal.opengeospatial.org/files/?artifact_id=26667)

CUAHSI WaterOneFlow - <http://water.sdsc.edu/wateroneflow/>

WaterML2.0 (User account required) - <https://svn.sdsc.edu/repo/WaterML/WaterML2.0/>

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OGC Sensor Observation Service 2.0.0 - 100817\_10-037\_SOS\_2.0.docx (Currently not available online)

DRAFT