# Use Case:

Discover, access and use relationships between features in hydrological data sets exposed as Web Services.

## Pre-Conditions

Datasets containing abstractions of surface water hydrology phenomena for a jurisdiction, including catchment boundaries, water bodies, stream networks and catchment topology. (For example NHD+, INSPIRE water theme data, Australian Hydrologic Geofabric etc)

Datasets containing information related to surface water hydrology, such as location of monitoring sites and sensors, built infrastructure (such as roads, bridges etc), modelled flood risk etc.

Datasets containing spatio-temporal attributes of hydrologic and/or related features, such as monitoring archives, sensors etc, exposed via web services (eg. SOS)

Services exposing these datasets, supporting queries on their properties (e.g. WFS)

An identified feature of hydrological interest (any feature part of, or likely to be affected by surface water) – for example a road bridge over water.

An available vocabulary for describing hydrological connectivity. Use of this vocabulary, either directly or via web-accessible ontology describing the mappings from the terms used in the available data and the concepts in that vocabulary. The HY\_Feature model provides a standard ontology describing how hydrological features are related. It may be used in three ways:

1. Standardising data services provided by each jurisdiction
2. Using the HY\_Feature model elements to discover the “native” feature types exposed by services in a specific jurisdiction for a given hydrological concept, and how these features are inter-related.
3. Augmenting existing data and services by providing additional links between features, described using standardised terminology (i.e. relationships between features in the HY\_Feature model)

Note: these pre-conditions do not dictate standardisation of services, terminology or data models – however it is expected that use of interoperable standards in these aspects will maximise the amount of data that can be linked for a given amount of effort.

## Post-Conditions

Identification of set of hydrologically related features (for example upstream monitoring sites, modelled flood risk maps etc).

Access to relevant spatio-temporal information for use in further interpretation, analysis and/or modelling activities. (i.e. this Use Case represents the case of gathering the information required to perform an analysis of a hydrologically related phenomenon).

## Description

Assessing the hydrological relationship between two features in a landscape is akin to navigating an optimum route in the transport network.

A surface water (stream lines) dataset may contain sufficient connectivity to allow network based tracing of paths, but in practice there are multiple problems with this, leading to issues of practicability and consistency. Stream networks are in fact complex abstractions of an even more complex underlying phenomenon, and may be captured in varying levels of detail, To perform reliable network routing demands a need for a high degree of accuracy and completeness and the need to access a very large dataset. In some jurisdictions, such datasets exist at certain scales, but in general these are not available. Furthermore, such processing requires downloading very large datasets, sufficient to encapsulate the entire network.

It is possible to exploit relationships between different abstractions of hydrology – in much the same way as road based navigation will use local detail only to find connections to a topologically pre-computed network of major roads, which may have additional information such as tolls and traffic. Performing analyses on such data is faster and more robust, and involves a lot less data, but requires understanding of the relationships between the different data elements involved.

Each jurisdiction has its own data models for hydrological data sets, and hence discovering the relationships between the elements of these datasets involves interpretation of extensive documentation.

Such data can be exposed via Web Services – such as WFS, or as Linked Data. In this case, the problems of data volumes can be mitigated by accessing such services to acquire only the data needed. Discovering such services is problematic however, since they require prior knowledge of the data types used (Feature Type in WFS, object classes in Linked Data etc), and how the properties of these objects describe the relationship types of interest.

Hydrology phenomena transcend jurisdictional boundaries, and hence it may be necessary to access data from more than one set of services, using different data descriptions.

By using either available links (dereferencing a feature identifier as a URI exposing Linked Data), or using spatial query capabilities of available web services such as WFS, a client is able to access locally relevant detail to determine how the feature of interest (e.g. as bridge) is likely to be related to local hydrology. Using relationships between identified local hydrologic features and a catchment topology, specified using HY\_Features vocabulary, the user is able to determine the upstream catchment, (possibly including any containing catchments in a nested hierarchy) and hence search for water level monitoring, food forecasts etc using these catchment identifiers or boundaries, without ever needing to deal with the quantity and quality issues of the entire stream network. (i.e. there is no “catchment definition” process involved here, with vagaries of input data, algorithm and boundary conditions – however if catchments are not pre-defined it would be possible to generate them dynamically – however the identification of these is problematic, and can be ignored in this Use Case).

## Alternative Scenarios

Note that such a service may be encapsulated in a single service, delivering all the information in a single request – however such a service would need prior knowledge of all related upstream features. A service able to provide all the hydrological elements of the upstream catchment could limit the amount of data – but would logically use HY\_Features to deliver that data, allowing it to be used in multiple jurisdictions, or across jurisdictional border.