FDSN Web Service Specification
fdsnws-availability

PROPOSAL DRAFT Version 1.0 (2019-02-13)

Purpose

To specify a web service interface for the exchange of time series data availability within the context of the International Federation of Digital Seismograph Networks (FDSN). The intention is to provide a specification that, when implemented at different FDSN data centers, can be used interchangeably by the same client software. Combined with common FDSN web service specifications, this document fully defines the request parameters and expected results.

Common service characteristics

This document must be combined with the common service characteristics defined in version 1.1, or later version 1.x, of the "FDSN-WS-Specification" for a full specification. The common service characteristics include versioning scheme, general calling pattern, common service methods, common error responses, and more.

Service methods

The following methods shall be supported by the service:

> **timespan** – to submit a data request
>
> **timespanauth** – to authenticate and submit a request, optional
>
> **extent** - to submit a data request
>
> **extentauth** – to authenticate and submit a request, optional
>
> **version** – to request the full service version number
>
> **application.wadl** – to request a WADL for the interface

Purpose of the *timespan* and *extent* methods:

The fdsnws-availability service is designed to return a description of available time series data. To support a broad range of use cases there are two major result styles. The first, returned by the *timespan* and *timespanauth* methods, includes full resolution time series listings with an option to merge overlapping time spans. The second, returned by *extent* and *extentauth*, includes time series listings with only the earliest and latest data available.

Purpose of the *timespanauth* and *extentauth* methods:

The optional *timespanauth* and *extentauth* methods behave identically to their *timespan* and *extent* counterparts except that submission requires authentication. The data center may then include restricted data that would be available using the credentials in the results.

Common parameters for the *timespan* and *extent* methods:

The service shall accept requests formulated using the parameters identified in the Table 1. The **alias** values are acceptable synonyms for the given **parameter** name.

Table 1. Common parameters for the *timespan* and *extent* methods:

Parameter	Alias	Support	Default	Minimum	Maximum	Type	Unit
starttime	**start**	**required**	**[Any]**	**[Any valid time]**		**time**	**UTC**
Limit results to time series samples on or after the specified start time.							
endtime	**end**	**required**	**[Any]**	**[Any valid time]**		**time**	**UTC**
Limit results to time series samples on or before the specified end time.							
network	**net**	**required**	**[Any]**	**[Valid ASCII or * or ?]**		**string**	
Select one or more network codes. Can be FDSN network codes or data center defined codes. Multiple codes are comma-separated.							
station	**sta**	**required**	**[Any]**	**[Valid ASCII or * or ?]**		**string**	
Select one or more FDSN station codes. Multiple codes are comma-separated.							
location	**loc**	**required**	**[Any]**	**[Valid ASCII or * or ?]**		**string**	
Select one or more FDSN location identifiers. Multiple identifiers are comma-separated. As a special case "--" (two dashes) will be translated to a string of two space characters to match blank location IDs.							
channel	**cha**	**required**	**[Any]**	**[Valid ASCII or * or ?]**		**string**	
Select one or more FDSN channel codes. Multiple codes are comma-separated.							
quality		**optional**	**[Any]**	**[Valid ASCII or * or ?]**		**string**	
Select a specific FDSN quality indicator, handling is data center dependent.							
merge		**optional**	**[None]**			**string**	
If set to one or more of the following values, time spans are merged as described. Multiple values may be specified as a comma-delimited list, e.g. *merge=samplerate,quality*.							
samplerate: time spans from data with differing sample rates will be grouped together.							
quality: time spans from data with differing quality codes will be grouped together.							
overlap: time spans from data that overlap will be merged together. This option does not apply to the *extent* method.							
orderby		**optional**	**nslc_time_quality_samplerate**			**string**	
Sort results by one of the following values in the order specified:							
nslc_time_quality_samplerate: network, station, location, channel, time-range, quality, sample-rate (**default**)							
latestupdate: update-date (past to present), network, station, location, channel, time-range, quality, sample-rate							
latestupdate_desc: update-date (present to past), network, station, location, channel, time-range, quality, sample-rate							
timespancount: number of timespans (small to large), network, station, location, channel, time-range, quality, sample-rate							
timespancount_desc: number of timespans (large to small), network, station, location, channel, time-range, quality, sample-rate							
limit		**optional**	**[Unlimited]**			**integer**	
Limit results to the specified number of timespans.							
includerestricted		**optional**	**false**			**boolean**	
If true, all data is reported. If false, only data that can be openly accessed ...							
format		**optional**	**text**			**string**	
Specify format of result, either 'text' (the default) or 'geocsv' or 'json' or 'request'.							
nodata		**optional**	**204**	***204* or *404***		**string**	
Select HTTP status code for "no data", either '204' (default) or '404'.							

Parameters specific to the *timespan* method:

Additional parameters for the *timespan* method are in Table 2.

Table 2. Additional *timespan* method parameters:

Parameter	Alias	Support	Default	Minimum	Maximum	Type	Unit
mergetimespans		**optional**	**false**			**boolean**	
If true, merge overlapping time spans.							
show		**optional**	**[None]**	**"latestupdate"**		**string**	
If set to ***latestupdate***, the latest times at which data contributing to the returned time spans were loaded into the repository are included in the result. This option applies to all formats except 'request'.							

Parameters specific to the *extent* method:

Additional parameters for the *extent* method are in Table 3.

Table 3. Additional *extent* method parameters:

Parameter	Alias	Support	Default	Minimum	Maximum	Type	Unit
show		**optional**	**[None]**			**string**	
If set to one or more of the following values, include additional information in the result as described. Multiple values may be specified as a comma-delimited list, e.g. *show=latestupdate,timespancount*. This option applies to all formats except 'request'. ***latestupdate***: Include the latest times at which data contributing to the returned time spans were loaded into the repository are included in the result. ***timespancount***: Include the number of timespans intersecting a given extent. ***restriction***: Include status of data access, one of "OPEN", "RESTRICTED", "PARTIAL". Where "OPEN" means that the entire time range of data is openly available, "RESTRICTED" means that the access to the entire range of data is restricted, and "PARTIAL" means that a time range includes both open and restricted access data.							

Requests using the *timespan* and *extent* methods:

These parameters may be submitted using either of the HTTP GET or POST methods. The POST method is useful to support the submission of a large number of data selections.

For the GET method, the parameters should be submitted as key=value pairs and may not be specified more than once; if a parameter is submitted multiple times the result is undefined.

For the POST method, all parameters must be submitted as part of the POST body. The non-repeating parameters should be specified as key=value pairs on separate lines, while the data identifier (*network*, *station*, *location*, *chanel*) and time (*starttime*, *endtime*) parameters are repeated as many times as necessary following this pattern:

```
parameter1=value
parameter2=value
NET STA LOC CHA STARTTIME ENDTIME
NET STA LOC CHA STARTTIME ENDTIME
NET STA LOC CHA STARTTIME ENDTIME
```

This would be POSTed to the URI "<site>/fdsnws/availability/1/timespan" or "<site>/fdsnws/availability/1/extent".

All rules for parameters apply equally whether submitted using the GET or POST methods with the exception of blank location IDs, which must be specified as "--" in the POST body due to spaces being used as the field separator.

Responses for the *timespan* and *extent* methods

The results of a successful request shall be returned as text by default, using the MIME type **text/plain**. If the *format* parameter is 'geocsv' the results shall be returned in GeoCSV formatting using MIME type **text/csv**. If the format parameter is 'request' the results shall be returned in the FDSN web service POST-style request format using MIME type **text/plain**.

The earliest and latest times included in a 'request' format response should be truncated to the start and end times if they are submitted in the request. This allows the result to be used as a request without selecting more than originally desired. At a data center's option the earliest and latest times for all other formats may be trimmed as well.

Behavior for the *timespanauth* and *extentauth* methods

HTTP Digest Authentication (RFC 2617) should be requested from the client. After successful authentication, a request should be accepted and handled as per the *timespan* or *extent* method respectively. Authentication credentials (user database and associated licensing schemes) are data center specific.

Behavior for the *version* method

The service shall return the return the implementation version as a simple text string using the MIME type **text/plain**. Any parameters submitted with the method will be ignored.

Behavior for the *application.wadl* method

The service shall return a WADL conformant description of the interface using the MIME type **application/xml**. Any parameters submitted with the method will be ignored. The WADL shall describe all parameters supported by the interface and is primarily used to document which optional parameters are supported.

Behavior for the **error** conditions

All errors shall use the type and pattern described in the common FDSN web service specifications.

Text output format

This 'text' output format contains one timespan per line with fields separated by spaces (ASCII 32) as needed for column alignment. This output is aligned for human readability. Lines beginning with a hash character ("#": ASCII decimal 35) should be considered comment lines. A single header line describing the columns is strongly recommended.

The text format follows this pattern:

```
#Net Sta  Loc Chan Qual SR   Earliest  Latest
NET  STA  LOC CHAN QUAL SR   EARLIEST  LATEST
NET  STA  LOC CHAN QUAL SR   EARLIEST  LATEST
…
```

For the *timespan* method, if the *show* parameter is set to *latestupdate*, the text format includes an additional column with the latest update time:

```
#Net Sta  Loc Chan Qual SR   Earliest  Latest   Updated
NET  STA  LOC CHAN QUAL SR   EARLIEST  LATEST   UPDATED
NET  STA  LOC CHAN QUAL SR   EARLIEST  LATEST   UPDATED
…
```

For the *extent* method, if the *show* parameter is set to any combination of *latestupdate, timespancount,* or *restriction*, additional columns are added with the ordering as follows:

```
#Net Sta  Loc Chan Qual SR   Earliest  Latest   Updated   TimeSpans  Restriction
NET  STA  LOC CHAN QUAL SR   EARLIEST  LATEST   UPDATED   SPANCOUNT  STATUS
NET  STA  LOC CHAN QUAL SR   EARLIEST  LATEST   UPDATED   SPANCOUNT  STATUS
…
```

In these text listings:

- NET, STA, LOC, CHAN and QUAL are FDSN data source identifiers
- SR is sample rate in Hertz
- EARLIEST, LATEST and UPDATED are date-times in the form specified in the common FDSN web service specifications
- SPANCOUNT is the number of timespans contributing to an extent
- STATUS is the restricted status, one of: OPEN, RESTRICTED, or PARTIAL

GeoCSV output format

The 'geocsv' version of results is a text format designed to contain enhanced metadata and be consistently machine readable. The output format contains the exact same data at the 'text' format within a GeoCSV container, which provides annotations to describe the data structure. For this output, the column delimiter should be vertical bar characters ("|": ASCII decimal 124). Field entries cannot contain vertical bar characters.

For the *extent* method, if the *show* parameter is set to any combination of *latestupdate, timespancount,* or *restriction*, additional columns are added with the ordering as follows:

```
#dataset: GeoCSV 2.0
#delimiter: |
#field_unit: unitless|unitless|unitless|unitless|unitless|hertz|ISO_8601|ISO_8601|ISO_8601|unitless|
unitless
#field_type: string|string|string|string|string|float|datetime|datetime|datetime|integer|string
Network|Station|Location|Channel|Quality|SampleRate|Earliest|Latest|Updated|TimeSpans|Restriction
NET|STA|LOC|CHAN|QUAL|SR|EARLIEST|LATEST|UPDATED|SPANCOUNT|STATUS
NET|STA|LOC|CHAN|QUAL|SR|EARLIEST|LATEST|UPDATED|SPANCOUNT|STATUS
…
```

The same pattern is used for the variations with fewer columns, as described for the 'text' format.

JSON output format

The 'json' output format contains the same information available in the text-based formats. The schema is defined in JSON Schema in the associated file named 'fdsnws-availability-schema-1.0.json'.

[**NOTE: if approved, the schema document can be on the fdsn.org site and referenced]**

Request output format

The 'request' output format is a text listing of the selected time spans or extents in the FDSN web service POST-style request format. This response is designed for easy submission to other FDSN web services, e.g. fdsnws-dataselect, fdsnws-station. The pattern of this format is:

```
NET STA LOC CHA STARTTIME ENDTIME
NET STA LOC CHA STARTTIME ENDTIME
NET STA LOC CHA STARTTIME ENDTIME
...
```

Time span definition

The *timespan* method of this service returns timespans representing the coverage of continuous time series data or the range of non-time series data. The earliest and latest times reported are, respectively, the times of the first and last sample times in the span. When determining continuous time spans from otherwise fragmented data, such as data records, it is recommended to use a time tear tolerance equal to or less than ½ the sampling period.

Examples

Requesting extents in default 'text' format with all extra columns:

https://DataCenter/fdsnws/availability/1/extent?show=latestupdate,timespancount,restriction&network=IU&station=ANMO&channel=BHZ

```
#Net Sta  Loc Chan Qual SR    Earliest                    Latest                      Updated                 TimeSpans Restriction
IU   ANMO --  BHZ  M    20.0  1989-08-29T22:07:20.482000Z 1998-10-26T17:38:43.640000Z 2018-05-08T21:47:09Z    611       OPEN
IU   ANMO 00  BHZ  M    0.0   2002-08-28T18:17:51.000000Z 2008-05-23T23:09:24.000000Z 2017-12-06T03:42:35Z    9051      OPEN
IU   ANMO 00  BHZ  M    20.0  1998-10-26T20:35:58.310000Z 2018-07-09T20:45:47.369000Z 2018-07-10T08:29:54Z    2238      OPEN
IU   ANMO 00  BHZ  M    40.0  2018-07-09T20:46:40.594000Z 2019-02-04T23:59:59.994000Z 2019-02-05T09:27:24Z    1         OPEN
IU   ANMO 10  BHZ  M    0.0   2002-11-28T04:00:00.000000Z 2007-06-01T19:29:00.000000Z 2017-12-06T03:09:51Z    47        OPEN
IU   ANMO 10  BHZ  M    40.0  1998-10-26T20:35:59.072000Z 2019-02-04T23:59:59.994000Z 2019-02-05T09:27:24Z    176       OPEN
```

Requesting extents in GeoCSV format with no extra columns:

https://DataCenter/fdsnws/availability/1/extent?format=geocsv&network=IU&station=ANMO&channel=BHZ

```
#dataset: GeoCSV 2.0
#delimiter: |
#field_unit: unitless|unitless|unitless|unitless|unitless|hertz|ISO_8601|ISO_8601
#field_type: string|string|string|string|string|float|datetime|datetime
Network|Station|Location|Channel|Quality|SampleRate|Earliest|Latest
IU|ANMO||BHZ|M|20.0|1989-08-29T22:07:20.482000Z|1998-10-26T17:38:43.640000Z
IU|ANMO|00|BHZ|M|0.0|2002-08-28T18:17:51.000000Z|2008-05-23T23:09:24.000000Z
```

```
IU|ANMO|00|BHZ|M|20.0|1998-10-26T20:35:58.310000Z|2018-07-09T20:45:47.369000Z
IU|ANMO|00|BHZ|M|40.0|2018-07-09T20:46:40.594000Z|2019-02-04T23:59:59.994000Z
IU|ANMO|10|BHZ|M|0.0|2002-11-28T04:00:00.000000Z|2007-06-01T19:29:00.000000Z
IU|ANMO|10|BHZ|M|40.0|1998-10-26T20:35:59.072000Z|2019-02-04T23:59:59.994000Z
```

Requesting extents in 'request' format for a 36 hour time window:

https://DataCenter/fdsnws/availability/1/extent?format=request&network=IU&station=ANMO&channel=BHZ&starttime=2018-01-31T00:00:00&endtime=2018-02-01T12:00:00

```
IU ANMO 00 BHZ 2018-01-31T00:00:00.000000 2018-02-01T12:00:00.000000
IU ANMO 10 BHZ 2018-01-31T00:00:00.000000 2018-02-01T12:00:00.000000
```

Requesting extents in 'json' format for a 36 hour time window, including the additional *latestupdate, timespancount,* and *restriction* values:

https://DataCenter/fdsnws/availability/1/extent?format=json&show=latestupdate,timespancount,restriction&network=XX&station=STA&location=--&channel=?HZ&starttime=2018-01-31T00:00:00&endtime=2018-02-01T12:00:00

```
{
    "created": "2019-02-13T22:29:09Z",
    "schemaVersion": "1.0",
    "datasources": [
        {
            "network": "XX",
            "station": "STA",
            "location": "",
            "channel": "BHZ",
            "quality": "D",
            "samplerate": 20.0,
            "earliest": "2018-01-31T00:00:00.000000Z",
            "latest": "2018-02-01T12:00:00.000000Z",
            "timespanCount": 2,
            "updated": "2019-02-03T14:01:00Z",
            "restriction": "OPEN"
        },
        {
            "network": "XX",
            "station": "STA",
            "location": "",
            "channel": "HHZ",
            "quality": "D",
            "samplerate": 100.0,
            "earliest": "2018-01-31T00:00:00.000000Z",
            "latest": "2018-02-01T12:00:00.000000Z",
            "timespanCount": 1,
            "updated": "2019-02-03T14:01:00Z",
            "restriction": "RESTRICTED"
        }
    ]
}
```

Requesting timespans in 'json' format for a 36 hour time window, including the additional _latestupdate_ values:

https://DataCenter/fdsnws/availability/1/timespan?format=json&show=latestupdate&network=IU&station=ANMO&channel=BHZ&starttime=2018-01-31T00:00:00&endtime=2018-02-01T12:00:00

```
{
    "created": "2019-02-13T22:29:09Z",
    "schemaVersion": "1.0",
    "datasources": [
        {
            "network": "XX",
            "station": "STA",
            "location": "",
            "channel": "BHZ",
            "quality": "D",
            "samplerate": 20.0,
            "updated": "2019-02-03T14:01:00Z",
            "timespans": [
                [
                    "2018-01-31T00:00:00.000000Z",
                    "2018-02-01T05:01:14.250000Z"
                ],
                [
                    "2018-02-01T05:02:32.050000Z",
                    "2018-02-01T12:00:00.000000Z"
                ]

            ]
        },
        {
            "network": "XX",
            "station": "STA",
            "location": "",
            "channel": "HHZ",
            "quality": "D",
            "samplerate": 100.0,
            "updated": "2019-02-03T14:01:00Z",
            "timespans": [
                [
                    "2018-01-31T00:00:00.000000Z",
                    "2018-02-01T12:00:00.000000Z"
                ]
            ]
        }
    ]
}
```

References

Web Application Description Language (WADL) - http://www.w3.org/Submission/wadl/

GeoCSV, tabular text formatting for geoscience data -
http://geows.ds.iris.edu/documents/GeoCSV.pdf

JSON Schema vocabulary format - https://json-schema.org/

Changes

2019-02-13 – Initial specification, initial draft proposal