
RNAget Compliance Documentation

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Welcome to the RNAget Server Compliance documentation.

This documentation (and associated [compliance testing application](#)) determines a server's compliance with the [RNAget API specification](#) for serving RNAseq datasets. The specification, developed by the [Global Alliance for Genomics and Health](#), serves to provide a standardized API framework and data structure to allow for interoperability of datasets hosted at different institutions.

RNAGET SERVERS

RNAget Servers enable access to RNAseq datasets and their metadata using unique identifiers for each object in a hierarchical data model. Servers can be queried for expression matrices, as well as project and study information associated with the raw RNAseq data. Servers support the slicing of expression and continuous signal intensity matrices by various parameters, so that only subsets of large matrix files need to be transferred. Expression matrices can be subsetted by gene, sample, and/or expression value thresholds. Continuous signal intensity matrices can be subsetted by chromosome and start/end base positions.

COMPLIANCE DOCUMENT

This documentation is for implementers of RNAget servers. Implementers **MUST** adhere to this documentation during development of RNAget-compliant servers, as the compliance tests outlined herein conform with the [RNAget specification](#). The testing suite performs API testing on all routes discussed in the specification. Reference server responses **MUST** comply with the correct responses in this document for requests made to each route/endpoint.

RNAget maintains an up-to-date report of the compliance status of its reference implementers. [Click here to view the latest report](#).

Click [here](#) to learn more about the [API Specification](#)

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3.1 API Specification

The RNAget specification describes, at maximum, 18 API routes. These routes are subdivided into 4 groups according to the data type they serve. These routes, broken down by data type, are as follows:

1. Projects: Serves project-related information. 3 Routes

- /projects/:id
- /projects
- /projects/filters

2. Studies: Serves study-related information. 3 Routes

- /studies/:id
- /studies
- /studies/filters

3. Expressions: Handles requests for querying, slicing, and downloading expression matrix data by gene name/id. 6 Routes

- /expressions/formats
- /expressions/filters
- /expressions/:id/ticket
- /expressions/:id/bytes
- /expressions/ticket
- /expressions/bytes

4. Continuous: Handles requests for querying, slicing, and downloading expression matrix data by genomic coordinate. 6 Routes

- /continuous/formats
- /continuous/filters
- /continuous/:id/ticket
- /continuous/:id/bytes
- /continuous/ticket
- /continuous/bytes

Detailed descriptions of each route are available in the [specification document](#).

Important points:

- A server **MAY** implement all 18 API routes
- A server **MAY** have unimplemented routes from the Expressions and/or Continuous data type groups. If a data type group is unimplemented, then **ALL** of the associated routes **MUST** be unimplemented. In other words, a server **MUST NOT** implement only some routes for a data type group.

3.2 Test Dataset

This page contains links to test dataset files. The compliance suite expects the test dataset project, study, expression, and continuous resources to be available on the server and accessible by all relevant routes.

- Project json
 - Download `project.json`
 - id: 9c0eba51095d3939437e220db196e27b
 - Format: json
 - **How to Prepare for Compliance Testing**
 - * upload `project.json` to RNAget server
 - * `project.json` **MUST** be accessible by its id, ie. `/projects/9c0eba51095d3939437e220db196e27b`
 - * `project.json` **MUST** appear in `/projects/search` results array
 - * `project.json` **MUST** be filterable by implemented search filters
- Study json
 - Download
 - id: f3ba0b59bed0fa2f1030e7cb508324d1
 - Format: json
 - **How to Prepare for Compliance Testing**
 - * upload `study.json` to RNAget server
 - * `study.json` **MUST** be accessible by its id, ie. `/studies/f3ba0b59bed0fa2f1030e7cb508324d1`
 - * `study.json` **MUST** appear in `/studies/search` results array
 - * `study.json` **MUST** be filterable by implemented search filters
- Expression ticket json
 - Download
 - id: ac3e9279efd02f1c98de4ed3d335b98e
 - Format: json
 - **How to Prepare for Compliance Testing**
 - * modify `expression_ticket.json` url property, so that it points to the test expression matrix file on the server

- * modify `expression_ticket.json` `fileType` property to indicate test expression matrix file format (ie. 'loom' if loom, 'tsv' if tsv)
- * upload modified `expression_ticket.json` to RNAget server
- * `expression_ticket.json` **MUST** be accessible by its id, ie. `/expressions/ac3e9279efd02f1c98de4ed3d335b98e/ticket`
- * a valid ticket must be returned for requests for an expression ticket pertaining to the compliance dataset (e.g. `/expressions/ticket?format=loom&studyID=f3ba0b59bed0fa2f1030e7cb508324d1`)

- Expression loom

- Download
- id: `ac3e9279efd02f1c98de4ed3d335b98e`
- Format: loom
- **How to Prepare for Compliance Testing**
 - * upload `expression.loom` **ONLY** if `expression_ticket.json` `fileType` property was set to 'loom'
 - * if uploaded, make `expression.loom` accessible by the url in the `url` property of `expression_ticket.json`
 - * if uploaded, `expression.loom` must be sliceable by all subsetting parameters (`featureIDList`, `featureNameList`, `sampleIDList`)

- Expression tsv

- Download
- id: `ac3e9279efd02f1c98de4ed3d335b98e`
- Format: tsv
- **How to Prepare for Compliance Testing**
 - * upload `expression.tsv` **ONLY** if `expression_ticket.json` `fileType` property was set to 'tsv'
 - * if uploaded, make `expression.tsv` accessible by the url in the `url` property of `expression_ticket.json`
 - * if uploaded, `expression.tsv` must be sliceable by all subsetting parameters (`featureIDList`, `featureNameList`, `sampleIDList`)

- Continuous ticket json

- Download
- id: `5e22e009f41fc53cbea094a41de8798f`
- Format: json
- **How to Prepare for Compliance Testing**
 - * modify `continuous_ticket.json` `url` property, so that it points to the test continuous matrix file on the server
 - * modify `continuous_ticket.json` `fileType` property to indicate test continuous matrix file format (ie. 'loom' if loom, 'tsv' if tsv)
 - * upload modified `continuous_ticket.json` to RNAget server

- * `continuous_ticket.json` **MUST** be accessible by its id, ie. `/continuous/5e22e009f41fc53cbea094a41de8798f/ticket`
- * a valid ticket must be returned for requests for a continuous ticket pertaining to the compliance dataset (e.g. `/continuous/ticket?format=loom&studyID=f3ba0b59bed0fa2f1030e7cb508324d1`)

- Continuous loom

- Download
- id: `5e22e009f41fc53cbea094a41de8798f`
- Format: loom
- **How to Prepare for Compliance Testing**
 - * upload `continuous.loom` **ONLY** if `continuous_ticket.json` `fileType` property was set to 'loom'
 - * if uploaded, make `continuous.loom` accessible by the url in the `url` property of `continuous_ticket.json`
 - * if uploaded, `continuous.loom` must be sliceable by all subsetting parameters (`chr`, `start`, `end`)

- Continuous tsv

- Download
- id: `5e22e009f41fc53cbea094a41de8798f`
- Format: tsv
- **How to Prepare for Compliance Testing**
 - * upload `continuous.tsv` **ONLY** if `continuous_ticket.json` `fileType` property was set to 'tsv'
 - * if uploaded, make `continuous.tsv` accessible by the url in the `url` property of `continuous_ticket.json`
 - * if uploaded, `continuous.tsv` must be sliceable by all subsetting parameters (`chr`, `start`, `end`)

- Filter json

- Download
- Format: json
- **How to Prepare for Compliance Testing**
 - * `filter.json` is an example, this file does not need to be uploaded, but requests for supported filters must respond with an array of valid `filter` objects

- Error json

- Download
- Format: json
- **How to Prepare for Compliance Testing**
 - * `error.json` is an example, this file does not need to be uploaded, but requests that produce an error must respond with a valid `Error json` object
 - * valid `Error json` objects **MUST** at least contain a "message" property

3.3 Project Tests

This page outlines the success and failure criteria for all tests of Project resources.

3.3.1 Project API Tests

Project API tests assert the correct configuration of project-related API routes. In order for a test case to succeed, the following conditions must be met when evaluating the response:

- For all cases, Content-Type checking is enforced. The response **MUST** have a Content-Type header of application/vnd.ga4gh.rnaget.v1.0.0+json OR application/json
- For all cases, Status Code checking is enforced. The response **MUST** have the expected status code
- For all cases, schema checking is enforced. The json object in the response body **MUST** conform to a pre-defined schema of required fields and data types, which is specific to each API route

3.3.2 Project API Test Cases

- *Get Test Project*
- *Project Not Found*
- *Project Filters*
- *Search Projects Without Filters*
- *Search Projects With All Filters*
- *Search Projects With Single Filter, 1*
- *Search Projects With Single Filter, 2*
- *Project Search Filters Non-Matching Resources*

Get Test Project

- **Route:** /projects/<id>
- **Description:** Requests test project by its id. Expects the returned project to match the Project json schema.
- **Rationale:** Asserts that the /projects/<id> endpoint returns **one** valid project object, with id matching the request.
- **Request:**

```
GET /projects/9c0eba51095d3939437e220db196e27b
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
  "id": "9c0eba51095d3939437e220db196e27b",
  "version": "1.0",
  "name": "RNAgetTestProject0",
```

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```
"description": "Test project object used by RNAget compliance testing suite."
```

- **Success Criteria:** Status Code == 200 AND response body is valid Project json
- **Failure Criteria:** Status Code != 200 OR response body is NOT valid Project json

Project Not Found

- **Route:** `/projects/<id>`
- **Description:** Requests a project with an invalid `id`, that is, an `id` that does not correspond to any `Project` on the server. Expects a 404 Not Found status code in the response, and a response body with a message explaining that the specified resource could not be found.
- **Rationale:** Asserts that the `/projects/<id>` endpoint does not return arbitrary `Project` objects, and only returns a `Project` when the `id` matches.
- **Request:**

```
GET /projects/nonexistentid99999999999999999999
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 404 Not Found
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
  "message": "Entry not found in database."
}
```

- **Success Criteria:** Status Code == 404 AND response body is valid `Error json`
- **Failure Criteria:** Status Code != 404 OR response body is NOT valid `Error json`

Project Filters

- **Route:** /projects/filters
- **Description:** Requests the filters that can be used to narrow search results for a list of `Projects`
- **Rationale:** Asserts that the endpoint returns an array of `Filter` objects
- **Request:**

```
GET /projects/filters
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
  {
    "fieldType": "string",
```

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```

    "values": [
      "1.0"
    ],
    "filter": "version",
    "description": "version to search for"
  },
  {
    "fieldType": "string",
    "values": [
      "PCAWG",
      "RNAgetTestProject0"
    ],
    "filter": "name",
    "description": "name of project"
  }
]

```

- **Success Criteria:** Status Code == 200 AND response body is array of Filters
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of Filters

Search Projects Without Filters

- **Route:** /projects
- **Description:** Searches for all projects, without specifying any filtering parameters. Expects an array of Projects in the response body.
- **Rationale:** Asserts that /projects returns an array, and that each element in the array is a Project.
- **Request:**

```

GET /projects
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json

```

- **Successful Response:**

```

HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
  {
    "id": "9c0eba51095d3939437e220db196e27b",
    "version": "1.0",
    "name": "RNAgetTestProject0",
    "description": "Test project object used by RNAget compliance testing suite."
  },
  {
    "description": "Pan Cancer Analysis of Whole Genomes test data from Expression_
↪Atlas E-MTAB-5423",
    "id": "43378a5d48364f9d8cf3c3d5104df560",
    "name": "PCAWG",
    "version": "1.0"
  }
]

```

- **Success Criteria:** Status Code == 200 AND response body is array of Project json AND Array Length >= 1

- **Failure Criteria:** Status Code \neq 200 OR response body is NOT array of Project json OR Array Length < 1

Search Projects With All Filters

- **Route:** /projects
- **Description:** Searches projects, using all filtering parameters associated with test project. Expects an array of Projects to be returned in the response body. Array must contain at least 1 object.
- **Rationale:** Asserts that /projects returns an array of Projects even when specifying filters. The returned array MUST have at least 1 object, as the parameter filters must match the attributes of the test project.
- **Request:**

```
GET /projects?version=1.0&name=RNAgetTestProject0
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
  {
    "id": "9c0eba51095d3939437e220db196e27b",
    "version": "1.0",
    "name": "RNAgetTestProject0",
    "description": "Test project object used by RNAget compliance testing suite."
  }
]
```

- **Success Criteria:** Status Code $==$ 200 AND response body is array of Project json AND Array Length ≥ 1
- **Failure Criteria:** Status Code \neq 200 OR response body is NOT array of Project json OR Array Length < 1

Search Projects With Single Filter, 1

- **Route:** /projects
- **Description:** Searches projects using only 1 filtering parameter associated with test project. Expects an array of Projects, with length of 1 or greater.
- **Rationale:** Asserts filtering parameters can be used independently of one another, and that each filter yields the test Project in the search results.
- **Requests:**

```
GET /projects?version=1.0
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

```
[
  {
    "id": "9c0eba51095d3939437e220db196e27b",
    "version": "1.0",
    "name": "RNAgetTestProject0",
    "description": "Test project object used by RNAget compliance testing suite."
  }
]
```

- **Success Criteria:** Status Code == 200 AND response body is array of Project json AND Array Length >= 1
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of Project json OR Array Length < 1

Search Projects With Single Filter, 2

- **Route:** /projects
- **Description:** Searches projects using only 1 filtering parameter (a different filter than above) associated with test project. Expects an array of Projects, with length of 1 or greater.
- **Rationale:** Asserts filtering parameters can be used independently of one another, and that each filter yields the test Project in the search results.
- **Requests:**

```
GET /projects?name=RNAgetTestProject0
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

```
[
  {
    "id": "9c0eba51095d3939437e220db196e27b",
    "version": "1.0",
    "name": "RNAgetTestProject0",
    "description": "Test project object used by RNAget compliance testing suite."
  }
]
```

- **Success Criteria:** Status Code == 200 AND response body is array of Project json AND Array Length >= 1
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of Project json OR Array Length < 1

Project Search Filters Non-Matching Resources

- **Route:** /projects

- **Description:** Tests that the project search endpoint correctly filters out non-matching `Projects` based on url parameters. Makes a request to the `/projects` endpoint with invalid filters (not matching any `Project`), and expects an empty array as a response.
- **Rationale:** Asserts that the endpoint correctly filters out non-matching entities, that the endpoint does not return an arbitrary list of `Projects` that differ from filters.
- **Request:**

```
GET /projects?version=nonexistentid99999999999999999999&
→name=nonexistentid99999999999999999999
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[]
```

- **Success Criteria:** Status Code == 200 AND response body is an empty array
- **Failure Criteria:** Status Code != 200 OR response body is NOT an empty array

3.3.3 Project API Non-Implemented Test Cases

- *Project Get Not Implemented*
- *Project Search Not Implemented*
- *Project Filters Not Implemented*

Project Get Not Implemented

- **Route:** `/projects/<id>`
- **Description:** If the `Projects` endpoint is specified as `Not Implemented` in the config file, then this test will be run. Requests the `/projects/<id>` endpoint, expecting a 501 `Not Implemented` status code response
- **Rationale:** Asserts that `Project` related endpoints are correctly non-implemented according to the spec
- **Request:**

```
GET /projects/nonexistentid99999999999999999999
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

Project Search Not Implemented

- **Route:** `/projects`
- **Description:** If the `Projects` endpoint is specified as `Not Implemented` in the config file, then this test will be run. Requests the `/projects` endpoint, expecting a 501 `Not Implemented` status code response
- **Rationale:** Asserts that `Project` related endpoints are correctly non-implemented according to the spec
- **Request:**

```
GET /projects
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** `Status Code == 501`
- **Failure Criteria:** `Status Code != 501`

Project Filters Not Implemented

- **Route:** `/projects/filters`
- **Description:** If the `Projects` endpoint is specified as `Not Implemented` in the config file, then this test will be run. Requests the `/projects/filters` endpoint, expecting a 501 `Not Implemented` status code response
- **Rationale:** Asserts that `Project` related endpoints are correctly non-implemented according to the spec
- **Request:**

```
GET /projects/filters
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** `Status Code == 501`
- **Failure Criteria:** `Status Code != 501`

3.4 Study Tests

This page outlines the success and failure criteria for all tests of Study resources.

3.4.1 Study API Tests

Study API tests assert the correct configuration of study-related API routes. In order for a test case to succeed, the following conditions must be met when evaluating the response:

- For all cases, Content-Type checking is enforced. The response **MUST** have a Content-Type header of application/vnd.ga4gh.rnaget.v1.0.0+json **OR** application/json
- For all cases, Status Code checking is enforced. The response **MUST** have the expected status code
- For all cases, schema checking is enforced. The json object in the response body **MUST** conform to a pre-defined schema of required fields and data types, which is specific to each API route

3.4.2 Study API Test Cases

- *Get Test Study*
- *Study Not Found*
- *Study Filters*
- *Search Studies Without Filters*
- *Search Studies With All Filters*
- *Search Studies With Single Filter, 1*
- *Search Studies With Single Filter, 2*
- *Study Search Filters Non-Matching Resources*

Get Test Study

- **Route:** /studies/<id>
- **Description:** Requests test study by its id. Expects the returned study to match the Study json schema.
- **Rationale:** Asserts that the /studies/<id> endpoint returns **one** valid study object, with id matching the request.
- **Request:**

```
GET /studies/f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
  "id": "f3ba0b59bed0fa2f1030e7cb508324d1",
  "version": "1.0",
  "name": "RNAgetTestStudy0",
  "description": "Test study object used by RNAget compliance testing suite.",
  "parentProjectID": "9c0eba51095d3939437e220db196e27b"
}
```

- **Success Criteria:** Status Code == 200 AND response body is valid Study json
- **Failure Criteria:** Status Code != 200 OR response body is NOT valid Study json

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```

    "PCAWG",
    "RNAgetTestStudy0"
  ],
  "filter": "name",
  "description": "name of study"
}
]

```

- **Success Criteria:** Status Code == 200 AND response body is array of filters
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of filters

Search Studies Without Filters

- **Route:** /studies
- **Description:** Searches for all studies, without specifying any filtering parameters. Expects an array of Studies in the response body.
- **Rationale:** Asserts that the /studies returns an array, and that each element in the array is a Study.
- **Request:**

```

GET /studies
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json

```

- **Successful Response:**

```

HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

```

```

[
  {
    "id": "6cccbdd76b9c4837bd7342dd616d0fec",
    "parentProjectID": "43378a5d48364f9d8cf3c3d5104df560",
    "name": "PCAWG",
    "description": "PCAWG study",
    "version": "1.0"
  },
  {
    "id": "f3ba0b59bed0fa2f1030e7cb508324d1",
    "parentProjectID": "9c0eba51095d3939437e220db196e27b",
    "name": "RNAgetTestStudy0",
    "description": "Test study object used by RNAget compliance testing suite.",
    "version": "1.0"
  }
]

```

- **Success Criteria:** Status Code == 200 AND response body is array of Study json AND Array Length >= 1
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of Study json OR Array Length < 1

Search Studies With All Filters

- **Route:** /studies

- **Description:** Searches studies, using all filtering parameters associated with test study. Expects an array of Studies to be returned in the response body. Array must contain at least 1 object.
- **Rationale:** Asserts that /studies returns an array of Studies even when specifying filters. The returned array MUST have at least 1 object, as the parameter filters must match the attributes of the test study.
- **Request:**

```
GET /studies?version=1.0&name=RNAgetTestStudy0
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
  {
    "id": "f3ba0b59bed0fa2f1030e7cb508324d1",
    "parentProjectID": "9c0eba51095d3939437e220db196e27b",
    "name": "RNAgetTestStudy0",
    "description": "Test study object used by RNAget compliance testing suite.",
    "version": "1.0"
  }
]
```

- **Success Criteria:** Status Code == 200 AND response body is array of Study json AND Array Length >= 1
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of Study json OR Array Length < 1

Search Studies With Single Filter, 1

- **Route:** /studies
- **Description:** Searches studies using only 1 filtering parameter associated with test study. Expects an array of Studies, with length of 1 or greater.
- **Rationale:** Asserts filtering parameters can be used independently of one another, and that each filter yields the test Study in the search results.
- **Requests:**

```
GET /studies?version=1.0
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
  {
    "id": "f3ba0b59bed0fa2f1030e7cb508324d1",
    "parentProjectID": "9c0eba51095d3939437e220db196e27b",
    "name": "RNAgetTestStudy0",
    "description": "Test study object used by RNAget compliance testing suite.",
```

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```
    "version": "1.0"
  }
]
```

- **Success Criteria:** Status Code == 200 AND response body is array of Study json AND Array Length >= 1
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of Study json OR Array Length < 1

Search Studies With Single Filter, 2

- **Route:** /studies
- **Description:** Searches studies using only 1 filtering parameter (a different filter than above) associated with test study. Expects an array of Studies, with length of 1 or greater.
- **Rationale:** Asserts filtering parameters can be used independently of one another, and that each filter yields the test Study in the search results.
- **Requests:**

```
GET /studies?name=RNAgetTestStudy0
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
  {
    "id": "f3ba0b59bed0fa2f1030e7cb508324d1",
    "parentProjectID": "9c0eba51095d3939437e220db196e27b",
    "name": "RNAgetTestStudy0",
    "description": "Test study object used by RNAget compliance testing suite.",
    "version": "1.0"
  }
]
```

- **Success Criteria:** Status Code == 200 AND response body is array of Study json AND Array Length >= 1
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of Study json OR Array Length < 1

Study Search Filters Non-Matching Resources

- **Route:** /studies
- **Description:** Tests that the study search endpoint correctly filters out non-matching Studies based on url parameters. Makes a request to the /studies endpoint with invalid filters (not matching any Study), and expects an empty array as a response.
- **Rationale:** Asserts that the endpoint correctly filters out non-matching entities, that the endpoint does not return an arbitrary list of Studies that differ from filters.

```
GET /studies?version=nonexistentid9999999999999999&
↳name=nonexistentid9999999999999999
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[]
```

- ### 3.4.3 Study API Non-Implemented Test Cases

- ## Study Get Not Implemented

- ```
GET /studies/nonexistentid999999999999999999
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- ## Study Search Not Implemented

- ### 3.4. Study Tests

- **Request:**

```
GET /studies
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

### Study Search Filters Not Implemented

- **Route:** /studies/filters
- **Description:** If the Studies endpoint is specified as Not Implemented in the config file, then this test will be run. Requests the /studies/filters endpoint, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Study related endpoints are correctly non-implemented according to the spec
- **Request:**

```
GET /studies/filters
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## 3.5 Expression Tests

This page outlines the success and failure criteria for all tests of Expression resources.

### 3.5.1 Expression API Tests

Expression API tests assert the correct configuration of expression-related API routes. In order for a test case to succeed, the following conditions must be met when evaluating the response:

- For all cases, Content-Type checking is enforced. The response **MUST** have a Content-Type header of application/vnd.ga4gh.rnaget.v1.0.0+json **OR** application/json
- For all cases, Status Code checking is enforced. The response **MUST** have the expected status code
- For all cases, schema checking is enforced. The json object in the response body **MUST** conform to a pre-defined schema of required fields and data types, which is specific to each API route

### 3.5.2 Expression API Test Cases

- *Get Supported Expression Formats*
- *Expression Filters*
- *Get Test Expression Ticket*
- *Single Expression Ticket - Not Found*
- *Get Test Expression Bytes*
- *Single Expression Bytes - Not Found*
- *Expression Ticket by Format*
- *Expression Ticket - All Filters*
- *Expression Ticket - Single Filter, 1*
- *Expression Ticket - Single Filter, 2*
- *Expression Ticket - Format Not Specified*
- *Expression Ticket - Filetype Matches*
- *Expression Bytes by Format*
- *Expression Bytes - All Filters*
- *Expression Bytes - Single Filter, 1*
- *Expression Bytes - Single Filter, 2*
- *Expression Bytes - Format Not Specified*

#### Get Supported Expression Formats

- **Route:** `/expressions/formats`
- **Description:** Requests the available expression data file formats on the server. Expects an array of strings to be returned in the response body.
- **Rationale:** Asserts that `/expressions/formats` returns an array of strings, indicating which expression file formats the server supports
- **Request:**

```
GET /expressions/formats
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
 "loom",
 "tsv"
]
```

- **Success Criteria:** Status Code == 200 AND response body is an array of strings in json format
- **Failure Criteria:** Status Code != 200 OR response body is NOT an array of strings in json format

### Expression Filters

- **Route:** /expressions/filters
- **Description:** Requests the filters that can be used to narrow search results for a list of Expressions
- **Rationale:** Asserts that the endpoint returns an array of filter objects
- **Request:**

```
GET /expressions/filters
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
 {
 "fieldType": "string",
 "values": [
 "1.0"
],
 "filter": "version",
 "description": "version to search for"
 },
 {
 "fieldType": "string",
 "filter": "studyID",
 "description": "parent studyID"
 }
]
```

- **Success Criteria:** Status Code == 200 AND response body is array of filters
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of filters

### Get Test Expression Ticket

- **Route:** /expressions/<id>/ticket
- **Description:** Requests test expression ticket by its id. Expects the returned expression to match the ticket json schema.
- **Rationale:** Asserts that the /expressions/<id>/ticket endpoint returns a valid ticket.
- **Request:**

```
GET /expressions/ac3e9279efd02f1c98de4ed3d335b98e/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "id": "ac3e9279efd02f1c98de4ed3d335b98e",
```

(continues on next page)

(continued from previous page)

```
{
 "version": "1.0",
 "studyID": "f3ba0b59bed0fa2f1030e7cb508324d1",
 "url": "https://url/to/expression/file",
 "units": "TPM",
 "fileType": "loom/tsv"
}
```

- **Success Criteria:** Status Code == 200 AND response body is valid ticket
- **Failure Criteria:** Status Code != 200 OR response body is NOT valid ticket

## Single Expression Ticket - Not Found

- **Route:** `/expressions/<id>/ticket`
- **Description:** Requests an expression ticket with an invalid `id`, that is, an `id` that does not correspond to any Expression on the server. Expects a 404 Not Found status code in the response, and a response body with an error message.
- **Rationale:** Asserts that the `/expressions/<id>/ticket` endpoint does not return arbitrary ticket.
- **Request:**

```
GET /expressions/nonexistentid99999999999999999999/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 404 Not Found
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "Entry not found in database."
}
```

- **Success Criteria:** Status Code == 404 AND response body is valid `Error json`
- **Failure Criteria:** Status Code != 404 OR response body is NOT valid `Error json`

## Get Test Expression Bytes

- **Route:** `/expressions/<id>/bytes`
- **Description:** Requests test expression matrix as `bytes` by its `id`.
- **Rationale:** Asserts that the `/expressions/<id>/bytes` endpoint returns matrix bytes.
- **Request:**

```
GET /expressions/ac3e9279efd02f1c98de4ed3d335b98e/bytes
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200

- **Failure Criteria:** Status Code  $\neq 200$

## Single Expression Bytes - Not Found

- **Route:** `/expressions/<id>/bytes`
- **Description:** Requests expression matrix bytes with an invalid id that doesn't correspond to any Expression on the server. Expects a 404 Not Found status code and an error message in response body.
- **Rationale:** Asserts that the `/expressions/<id>/bytes` endpoint does not return arbitrary matrix.
- **Request:**

```
GET /expressions/nonexistentid99999999999999999999/bytes
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 404 Not Found
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "Entry not found in database."
}
```

- **Success Criteria:** Status Code == 404 AND response body is valid `Error json`
- **Failure Criteria:** Status Code != 404 OR response body is NOT valid `Error json`

## Expression Ticket by Format

- **Route:** `/expressions/ticket`
- **Description:** Requests joined matrix, specifying only the required 'format' parameter. Expects `ticket` response.
- **Rationale:** Asserts that the `/expressions/ticket` returns a valid `ticket`.
- **Request:**

```
GET /expressions/ticket?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "studyID": "6cccbbd76b9c4837bd7342dd616d0fec",
 "url": "/path/to/E-MTAB-5423-query-results.tpmsloom",
 "units": "TPM",
 "version": "1.0",
 "fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket
- **Failure Criteria:** Status Code != 200 OR response body is NOT ticket



### Expression Ticket - All Filters

- **Route:** /expressions/ticket
- **Description:** Requests joined matrix, using all filtering parameters associated with test expression. Expects ticket.
- **Rationale:** Asserts that /expressions/ticket returns ticket when specifying filters.
- **Request:**

```
GET /expressions/ticket?format=loom&version=1.0&
→studyID=f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "url": "https://path/to/expression.loom",
 "units": "TPM",
 "fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket
- **Failure Criteria:** Status Code != 200 OR response body is NOT ticket

### Expression Ticket - Single Filter, 1

- **Route:** /expressions/ticket
- **Description:** Requests joined matrix using only 1 filtering parameter associated with test expression (in addition to format). Expects ticket.
- **Rationale:** Asserts filtering parameters can be used independently of one another, and that each filter yields a valid ticket.
- **Requests:**

```
GET /expressions/ticket?format=loom&version=1.0
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "url": "https://path/to/expression.loom",
 "units": "TPM",
 "version": "1.0",
 "fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket
- **Failure Criteria:** Status Code != 200 OR response body is NOT ticket

### Expression Ticket - Single Filter, 2

- **Route:** /expressions/ticket
- **Description:** Requests joined matrix using only 1 filtering parameter (a different filter than above) associated with test expression (in addition to format). Expects ticket.
- **Rationale:** Asserts filtering parameters can be used independently of one another, and that each filter yields a valid ticket.
- **Requests:**

```
GET /expressions/ticket?format=loom&studyID=f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "studyID": "f3ba0b59bed0fa2f1030e7cb508324d1",
 "url": "/path/to/expression.loom",
 "units": "TPM",
 "fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket.
- **Failure Criteria:** Status Code != 200 OR response body is NOT ticket.

### Expression Ticket - Format Not Specified

- **Route:** /expressions/ticket
- **Description:** Requests joined matrix WITHOUT specifying the required format parameter. Expects a 4xx response with error message.
- **Rationale:** As the format parameter is required to specify file format for the /expressions/ticket endpoint, this test asserts malformed requests raise an error.
- **Request:**

```
GET /expressions/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "Input payload validation failed"
}
```

- **Success Criteria:** Status Code == 4xx AND response body is valid Error json
- **Failure Criteria:** Status Code != 4xx AND response body is NOT valid Error json

## Expression Ticket - Filetype Matches

- **Route:** /expressions/ticket
- **Description:** Requests joined matrix, only specifying the required format parameter. Checks that ticket has a fileType matching requested format.
- **Rationale:** Asserts that the /expressions/ticket endpoint returns ticket with fileType matching the request.
- **Request:**

```
GET /expressions/ticket?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "url": "/path/to/E-MTAB-5423-query-results.tpms.loom",
 "units": "TPM",
 "fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket AND fileType matches requested format
- **Failure Criteria:** Status Code != 200 OR response body is NOT ticket OR fileType DOES NOT match requested format

## Expression Bytes by Format

- **Route:** /expressions/bytes
- **Description:** Requests joined matrix bytes, only specifying the required format parameter.
- **Rationale:** Asserts that the /expressions/bytes endpoint returns matrix bytes.
- **Request:**

```
GET /expressions/bytes?format=loom
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200
- **Failure Criteria:** Status Code != 200

## Expression Bytes - All Filters

- **Route:** /expressions/bytes
- **Description:** Requests joined matrix bytes using all expression filters.

- **Rationale:** Asserts that the `/expressions/bytes` endpoint returns matrix bytes when all filters are provided.
- **Request:**

```
GET /expressions/bytes?format=loom&version=1.0&
↪studyID=f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200
- **Failure Criteria:** Status Code != 200

### Expression Bytes - Single Filter, 1

- **Route:** `/expressions/bytes`
- **Description:** Requests joined matrix bytes using one expression filter (in addition to format).
- **Rationale:** Asserts filter parameters can be used independently of one another.
- **Request:**

```
GET /expressions/bytes?format=loom&version=1.0
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200
- **Failure Criteria:** Status Code != 200

### Expression Bytes - Single Filter, 2

- **Route:** `/expressions/bytes`
- **Description:** Requests joined matrix bytes using one expression filter (different than above), in addition to format.
- **Rationale:** Asserts filter parameters can be used independently of one another.
- **Request:**

```
GET /expressions/bytes?format=loom&studyID=f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200
- **Failure Criteria:** Status Code != 200

### Expression Bytes - Format Not Specified

- **Route:** /expressions/bytes
- **Description:** Requests joined matrix bytes WITHOUT specifying required format parameter. Expects a 4xx response with error message.
- **Rationale:** As the format parameter is required to specify file format for the /expressions/bytes endpoint, this test asserts malformed requests raise an error.
- **Request:**

```
GET /expressions/bytes
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "Input payload validation failed"
}
```

- **Success Criteria:** Status Code == 4xx AND response body is valid Error json
- **Failure Criteria:** Status Code != 4xx AND response body is NOT valid Error json

### 3.5.3 Expression API Non-Implemented Test Cases

- *Expression Formats Not Implemented*
- *Expression Ticket by Id Not Implemented*
- *Expression Bytes by Id Not Implemented*
- *Expression Filters Not Implemented*
- *Expression Ticket Not Implemented*
- *Expression Bytes Not Implemented*

### Expression Formats Not Implemented

- **Route:** /expressions/formats
- **Description:** If the Expressions endpoint is specified as Not Implemented in the config file, then this test will be run. Requests the /expressions/formats endpoint, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Expression related endpoints are correctly non-implemented according to the spec
- **Request:**

```
GET /expressions/formats
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## Expression Ticket by Id Not Implemented

- **Route:** /expressions/<id>/ticket
- **Description:** If expressions endpoints are Not Implemented, this test will request /expressions/<id>/ticket, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts Expression related endpoints are correctly non-implemented
- **Request:**

```
GET /expressions/nonexistentid9999999999999999/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## Expression Bytes by Id Not Implemented

- **Route:** /expressions/<id>/bytes
- **Description:** If expressions endpoints are Not Implemented, this test will request /expressions/<id>/bytes, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts Expression related endpoints are correctly non-implemented
- **Request:**

```
GET /expressions/nonexistentid99999999999999999999/bytes
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## Expression Filters Not Implemented

- **Route:** /expressions/filters
- **Description:** If expressions endpoints are Not Implemented, this test will request /expressions/filters, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Expression related endpoints are correctly non-implemented
- **Request:**

```
GET /expressions/filters
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## Expression Ticket Not Implemented

- **Route:** /expressions/ticket
- **Description:** If expressions endpoints are Not Implemented, this test will request /expressions/ticket, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Expression related endpoints are correctly non-implemented
- **Request:**

```
GET /expressions/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## Expression Bytes Not Implemented

- **Route:** /expressions/bytes
- **Description:** If expressions endpoints are Not Implemented, this test will request /expressions/bytes, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Expression related endpoints are correctly non-implemented
- **Request:**

```
GET /expressions/bytes
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

### 3.5.4 Expression Content Tests

Expression content tests assert that expression matrices downloaded from the RNAget server contain the expected content/results based on the request. Matrix rows, columns, and values are cross-referenced against the request to ensure the correct data has been returned.

### 3.5.5 Expression Content Test Cases

- *Expression Ticket by Id Content Test Cases*
- *Expression Bytes by Id Content Test Cases*
- *Expression Ticket Content Test Cases*
- *Expression Bytes Content Test Cases*

#### Expression Ticket by Id Content Test Cases

- **Route:** /expressions/<id>/ticket
- **Description:** Download test expression by ticket multiple times (sometimes slicing by featureIDList, feature-NameList, sampleIDList).
- **Rationale:** Asserts correct matrix file is associated with the test expression id. Validates expression values match expected. Validates returned columns/rows match expected based on slice parameters.
- **Request:**

```
GET /expressions/ac3e9279efd02f1c98de4ed3d335b98e/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Success Criteria:** Test expression matrix columns, rows, values match expected
- **Failure Criteria:** Test expression matrix columns, rows, values DO NOT match expected

#### Expression Bytes by Id Content Test Cases

- **Route:** /expressions/<id>/bytes
- **Description:** Download test expression by bytes multiple times (sometimes slicing by featureIDList, feature-NameList, sampleIDList).
- **Rationale:** Asserts correct matrix file is associated with the test expression id. Validates expression values match expected. Validates returned columns/rows match expected based on slice parameters.
- **Request:**



```
GET /expressions/ac3e9279efd02f1c98de4ed3d335b98e/bytes
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Success Criteria:** Test expression matrix columns, rows, values match expected
- **Failure Criteria:** Test expression matrix columns, rows, values DO NOT match expected

### Expression Ticket Content Test Cases

- **Route:** `/expressions/ticket`
- **Description:** Download joined expression matrix by ticket multiple times (sometimes slicing by featureIDList, featureNameList, sampleIDList).
- **Rationale:** Asserts joined matrix. Validates expression values match expected. Validates returned columns/rows match expected based on slice parameters.
- **Request:**

```
GET /expressions/ticket?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Success Criteria:** Joined expression matrix columns, rows, values match expected
- **Failure Criteria:** Joined expression matrix columns, rows, values DO NOT match expected

### Expression Bytes Content Test Cases

- **Route:** `/expressions/bytes`
- **Description:** Download joined expression matrix by bytes multiple times (sometimes slicing by featureIDList, featureNameList, sampleIDList).
- **Rationale:** Asserts joined matrix. Validates expression values match expected. Validates returned columns/rows match expected based on slice parameters.
- **Request:**

```
GET /expressions/bytes?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Success Criteria:** Joined expression matrix columns, rows, values match expected
- **Failure Criteria:** Joined expression matrix columns, rows, values DO NOT match expected

## 3.6 Continuous Tests

This page outlines the success and failure criteria for all tests of Continuous resources.

### 3.6.1 Continuous API Tests

Continuous API tests assert the correct configuration of continuous-related API routes. In order for a test case to succeed, the following conditions must be met when evaluating the response:

- For all cases, Content-Type checking is enforced. For most routes, a value of `application/vnd.ga4gh.rnaget.v1.0.0+json` **OR** `application/json` is expected. For the `/continuous/<id>` endpoint, a content type matching the format of the file attachment is expected.
- For all cases, Status Code checking is enforced. The response **MUST** have the expected status code
- For all cases, schema checking is enforced. The json object in the response body **MUST** conform to a pre-defined schema of required fields and data types, which is specific to each API route

### 3.6.2 Continuous API Test Cases

- *Get Supported Continuous Formats*
- *Continuous Filters*
- *Get Test Continuous Ticket*
- *Single Continuous Ticket - Not Found*
- *Single Continuous Ticket - Start Specified Without Chr*
- *Single Continuous Ticket - End Specified Without Chr*
- *Single Continuous Ticket - Start Greater Than End*
- *Get Test Continuous Bytes*
- *Single Continuous Bytes - Not Found*
- *Single Continuous Bytes - Start Specified Without Chr*
- *Single Continuous Bytes - End Specified Without Chr*
- *Single Continuous Bytes - Start Greater Than End*
- *Continuous Ticket by Format*
- *Continuous Ticket - All Filters*
- *Continuous Ticket - Single Filter, 1*
- *Continuous Ticket - Single Filter, 2*
- *Continuous Ticket - Format Not Specified*
- *Continuous Ticket - Filetype Matches*
- *Continuous Ticket - Start Specified Without Chr*
- *Continuous Ticket - End Specified Without Chr*
- *Continuous Ticket - Start Greater Than End*
- *Continuous Bytes by Format*
- *Continuous Bytes - All Filters*
- *Continuous Bytes - Single Filter, 1*
- *Continuous Bytes - Single Filter, 2*
- *Continuous Bytes - Format Not Specified*
- *Continuous Bytes - Start Specified Without Chr*
- *Continuous Bytes - End Specified Without Chr*
- *Continuous Bytes - Start Greater Than End*

## Get Supported Continuous Formats

- **Route:** `/continuous/formats`
- **Description:** Requests the available continuous file formats on the server. Expects an array of strings to be returned in the response body.
- **Rationale:** Asserts that `/continuous/formats` returns an array of strings, indicating which continuous file formats the server supports
- **Request:**

```
GET /continuous/formats
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
 "loom",
 "tsv"
]
```

- **Success Criteria:** Status Code == 200 AND response body is an array of strings in json format
- **Failure Criteria:** Status Code != 200 OR response body is NOT an array of strings in json format

## Continuous Filters

- **Route:** `/continuous/filters`
- **Description:** Requests the filters that can be used to narrow search results for a list of Continuous
- **Rationale:** Asserts that the endpoint returns an array of filters
- **Request:**

```
GET /continuous/filters
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

[
 {
 "fieldType": "string",
 "values": [
 "1.0"
],
 "filter": "version",
 "description": "version to search for"
 },
 {
 "fieldType": "string",
 "filter": "studyID",
```

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```

 "description": "parent studyID"
 }
]
}

```

- **Success Criteria:** Status Code == 200 AND response body is array of filters
- **Failure Criteria:** Status Code != 200 OR response body is NOT array of filters

## Get Test Continuous Ticket

- **Route:** `/continuous/<id>/ticket`
- **Description:** Requests continuous ticket by its id. Expects valid ticket.
- **Rationale:** Asserts that `/continuous/<id>/ticket` returns valid ticket.
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "id": "5e22e009f41fc53cbea094a41de8798f",
 "version": "1.0",
 "studyID": "f3ba0b59bed0fa2f1030e7cb508324d1",
 "url": "https://url/to/continuous/file",
 "units": "TPM",
 "fileType": "loom/tsv"
}
```

- **Success Criteria:** Status Code == 200 AND response is ticket
- **Failure Criteria:** Status Code != 200 OR response is NOT ticket

### Single Continuous Ticket - Not Found

- **Route:** `/continuous/<id>/ticket`
- **Description:** Requests continuous ticket with an invalid id. Expects a 404 Not Found status code in the response, and error message.
- **Rationale:** Asserts that the `/continuous/<id>/ticket` endpoint does not return arbitrary ticket.
- **Request:**

```
GET /continuous/nonexistentid99999999999999999999/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 404 Not Found
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "Entry not found in database."
}
```

- **Success Criteria:** Status Code == 404 AND response body is valid Error json
- **Failure Criteria:** Status Code != 404 OR response body is NOT valid Error json

### Single Continuous Ticket - Start Specified Without Chr

- **Route:** /continuous/<id>/ticket
- **Description:** Requests continuous ticket by its id, specifying a start position without a chromosome. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/<id>/ticket endpoint raises an error when start is specified without chr
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/ticket?start=5
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "chr required if either start or end is specified"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Single Continuous Ticket - End Specified Without Chr

- **Route:** /continuous/<id>/ticket
- **Description:** Requests test continuous by its id, specifying an end position without a chromosome. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/<id>/ticket endpoint raises an error when end is specified without chr
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/ticket?end=1000
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

```
{
 "message": "chr required if either start or end is specified"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Single Continuous Ticket - Start Greater Than End

- **Route:** /continuous/<id>/ticket
- **Description:** Requests test continuous ticket by its id, specifying chr, start, and end, however, start position is greater than end. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/<id>/ticket endpoint raises an error when start is greater than end
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/ticket?chr=1&start=200&end=100
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

```
{
 "message": "start cannot be greater than end"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Get Test Continuous Bytes

- **Route:** /continuous/<id>/bytes
- **Description:** Requests continuous matrix bytes by its id.
- **Rationale:** Asserts that /continuous/<id>/bytes returns matrix bytes.
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/bytes
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200



### Single Continuous Bytes - End Specified Without Chr

- **Route:** /continuous/<id>/bytes
- **Description:** Requests test continuous matrix bytes by its id, specifying an end position without a chromosome. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/<id>/bytes endpoint raises an error when end is specified without chr
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/bytes?end=1000
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "chr required if either start or end is specified"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Single Continuous Bytes - Start Greater Than End

- **Route:** /continuous/<id>/bytes
- **Description:** Requests test continuous matrix bytes by its id, specifying chr, start, and end, however, start position is greater than end. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/<id>/bytes endpoint raises an error when start is greater than end
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/bytes?chr=1&start=200&end=100
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "start cannot be greater than end"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json



## Continuous Ticket by Format

- **Route:** /continuous/ticket
- **Description:** Requests joined continuous matrix, specifying only the required 'format' parameter. Expects ticket.
- **Rationale:** Asserts that /continuous/ticket returns a ticket with which the matrix can be downloaded.
- **Request:**

```
GET /continuous/ticket?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "studyID": "6cccbbd76b9c4837bd7342dd616d0fec",
 "url": "/path/to/signal-query-results.loom",
 "units": "TPM",
 "version": "1.0",
 "fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket
- **Failure Criteria:** Status Code != 200 OR response body is NOT ticket

## Continuous Ticket - All Filters

- **Route:** /continuous/ticket
- **Description:** Requests joined continuous matrix, using all filtering parameters. Expects ticket.
- **Rationale:** Asserts that /continuous/ticket returns ticket when specifying filters.
- **Request:**

```
GET /continuous/ticket?format=loom&version=1.0&
 ↳studyID=f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "studyID": "f3ba0b59bed0fa2f1030e7cb508324d1",
 "url": "/path/to/continuous.loom",
 "units": "TPM",
 "version": "1.0",
 "fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket

- **Failure Criteria:** Status Code `!= 200` OR response body is NOT `ticket`

### Continuous Ticket - Single Filter, 1

- **Route:** `/continuous/ticket`
- **Description:** Requests joined continuous matrix, using only 1 filtering parameter associated with test continuous (in addition to format). Expects `ticket`.
- **Rationale:** Asserts filtering parameters can be used independently of one another, and that each filter yields a valid `ticket`.
- **Requests:**

```
GET /continuous/ticket?format=loom&version=1.0
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "url": "/path/to/signal-query-results.loom",
 "units": "TPM",
 "version": "1.0",
 "fileType": "loom"
}
```

- **Success Criteria:** Status Code `== 200` AND response body is `ticket`.
- **Failure Criteria:** Status Code `!= 200` OR response body is NOT `ticket`.

### Continuous Ticket - Single Filter, 2

- **Route:** `/continuous/ticket`
- **Description:** Requests joined continuous matrix, using only 1 filtering parameter (different than above) associated with test continuous (in addition to format). Expects `ticket`.
- **Rationale:** Asserts filtering parameters can be used independently of one another, and that each filter yields a valid `ticket`.
- **Requests:**

```
GET /continuous/ticket?format=loom&studyID=f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "studyID": "6cccbbd76b9c4837bd7342dd616d0fec",
 "url": "/path/to/signal-query-results.loom",
 "units": "TPM",
```

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```
"fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket.
- **Failure Criteria:** Status Code != 200 OR response body is NOT ticket.

### Continuous Ticket - Format Not Specified

- **Route:** /continuous/ticket
- **Description:** Requests joined continuous matrix WITHOUT specifying the required format parameter. Expects a 4xx response with error message.
- **Rationale:** As the format parameter is required to specify file format for the /continuous/ticket endpoint, this test asserts malformed requests raise an error.
- **Request:**

```
GET /continuous/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "Input payload validation failed"
}
```

- **Success Criteria:** Status Code == 4xx AND response body is valid Error json
- **Failure Criteria:** Status Code != 4xx AND response body is NOT valid Error json

### Continuous Ticket - Filetype Matches

- **Route:** /continuous/ticket
- **Description:** Request joined continuous matrix, only specifying the required format parameter. Checks that ticket has a fileType matching requested format.
- **Rationale:** Asserts that the /continuous/ticket endpoint returns ticket with fileType matching the request.
- **Request:**

```
GET /continuous/ticket?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "studyID": "6cccbbd76b9c4837bd7342dd616d0fec",
```

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```
"url": "/woldlab/castor/home/sau/public_html/rnaget/signal-query-results.loom",
"units": "TPM",
"version": "1.0",
"fileType": "loom"
}
```

- **Success Criteria:** Status Code == 200 AND response body is ticket AND fileType matches requested format
- **Failure Criteria:** Status Code != 200 OR response body is NOT ticket OR fileType DOES NOT match requested format

### Continuous Ticket - Start Specified Without Chr

- **Route:** /continuous/ticket
- **Description:** Requests joined continuous matrix ticket, specifying a start position without a chromosome. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/ticket endpoint raises an error when start is specified without chr
- **Request:**

```
GET /continuous/ticket?format=loom&start=5
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "chr required if either start or end is specified"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Continuous Ticket - End Specified Without Chr

- **Route:** /continuous/ticket
- **Description:** Requests joined continuous matrix ticket, specifying an end position without a chromosome. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/ticket endpoint raises an error when end is specified without chr
- **Request:**

```
GET /continuous/ticket?format=loom&end=1000
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

```
{
 "message": "chr required if either start or end is specified"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Continuous Ticket - Start Greater Than End

- **Route:** /continuous/ticket
- **Description:** Requests joined continuous matrix ticket, specifying chr, start, and end, however, start position is greater than end. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/ticket endpoint raises an error when start is greater than end
- **Request:**

```
GET /continuous/ticket?format=loom&chr=1&start=200&end=100
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

```
{
 "message": "start cannot be greater than end"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Continuous Bytes by Format

- **Route:** /continuous/bytes
- **Description:** Requests joined continuous matrix as bytes, specifying only the required 'format' parameter.
- **Rationale:** Asserts that /continuous/bytes returns matrix bytes.
- **Request:**

```
GET /continuous/bytes?format=loom
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200

- **Failure Criteria:** Status Code != 200

### Continuous Bytes - All Filters

- **Route:** /continuous/bytes
- **Description:** Requests joined continuous matrix as bytes, using all filtering parameters.
- **Rationale:** Asserts that /continuous/ticket returns matrix bytes when specifying filters.
- **Request:**

```
GET /continuous/bytes?format=loom&version=1.0&studyID=f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200
- **Failure Criteria:** Status Code != 200

### Continuous Bytes - Single Filter, 1

- **Route:** /continuous/bytes
- **Description:** Requests joined continuous matrix as bytes, using only 1 filtering parameter associated with test continuous (in addition to format).
- **Rationale:** Asserts filtering parameters can be used independently of one another.
- **Requests:**

```
GET /continuous/bytes?format=loom&version=1.0
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200
- **Failure Criteria:** Status Code != 200

### Continuous Bytes - Single Filter, 2

- **Route:** /continuous/bytes
- **Description:** Requests joined continuous matrix as bytes, using only 1 filtering parameter (different than above) associated with test continuous (in addition to format).
- **Rationale:** Asserts filtering parameters can be used independently of one another.
- **Requests:**

```
GET /continuous/bytes?format=loom&studyID=f3ba0b59bed0fa2f1030e7cb508324d1
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 200 OK
Content-Type: application/octet-stream
```

- **Success Criteria:** Status Code == 200
- **Failure Criteria:** Status Code != 200

### Continuous Bytes - Format Not Specified

- **Route:** /continuous/bytes
- **Description:** Requests joined continuous matrix as bytes WITHOUT specifying the required format parameter. Expects a 4xx response with error message.
- **Rationale:** As the format parameter is required to specify file format for the /continuous/bytes endpoint, this test asserts malformed requests raise an error.
- **Request:**

```
GET /continuous/bytes
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "Input payload validation failed"
}
```

- **Success Criteria:** Status Code == 4xx AND response body is valid Error json
- **Failure Criteria:** Status Code != 4xx AND response body is NOT valid Error json

### Continuous Bytes - Start Specified Without Chr

- **Route:** /continuous/bytes
- **Description:** Requests joined continuous matrix as bytes, specifying a start position without a chromosome. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/bytes endpoint raises an error when start is specified without chr
- **Request:**

```
GET /continuous/bytes?format=loom&start=5
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "chr required if either start or end is specified"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Continuous Bytes - End Specified Without Chr

- **Route:** /continuous/bytes
- **Description:** Requests joined continuous matrix as bytes, specifying an end position without a chromosome. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/bytes endpoint raises an error when end is specified without chr
- **Request:**

```
GET /continuous/bytes?format=loom&end=1000
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "chr required if either start or end is specified"
}
```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### Continuous Bytes - Start Greater Than End

- **Route:** /continuous/bytes
- **Description:** Requests joined continuous matrix as bytes, specifying chr, start, and end, however, start position is greater than end. Expects a 400 Bad Request status code in the response, and an error message
- **Rationale:** Asserts that the /continuous/bytes endpoint raises an error when start is greater than end
- **Request:**

```
GET /continuous/bytes?format=loom&chr=1&start=200&end=100
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**



```

HTTP/1.1 400 Bad Request
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

{
 "message": "start cannot be greater than end"
}

```

- **Success Criteria:** Status Code == 400 AND response body is valid Error json
- **Failure Criteria:** Status Code != 400 OR response body is NOT valid Error json

### 3.6.3 Continuous API Non-Implemented Test Cases

- *Continuous Formats Not Implemented*
- *Continuous Ticket by Id Not Implemented*
- *Continuous Bytes by Id Not Implemented*
- *Continuous Filters Not Implemented*
- *Continuous Ticket Not Implemented*
- *Continuous Bytes Not Implemented*

#### Continuous Formats Not Implemented

- **Route:** /continuous/formats
- **Description:** If Continuous endpoints are Not Implemented, then request /continuous/formats, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Continuous related endpoints are correctly non-implemented
- **Request:**

```

GET /continuous/formats
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json

```

- **Successful Response:**

```

HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json

```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

#### Continuous Ticket By Id Not Implemented

- **Route:** /continuous/<id>/ticket
- **Description:** If Continuous endpoints are Not Implemented, then request /continuous/<id>/ticket, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Continuous related endpoints are correctly non-implemented
- **Request:**

```
GET /continuous/nonexistentid99999999999999999999/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## Continuous Bytes By Id Not Implemented

- **Route:** /continuous/<id>/bytes
- **Description:** If Continuous endpoints are Not Implemented, then request /continuous/<id>/bytes, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Continuous related endpoints are correctly non-implemented
- **Request:**

```
GET /continuous/nonexistentid99999999999999999999/bytes
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## Continuous Filters Not Implemented

- **Route:** /continuous/filters
- **Description:** If Continuous endpoints are Not Implemented, then request /continuous/filters, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Continuous related endpoints are correctly non-implemented
- **Request:**

```
GET /continuous/filters
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

### Continuous Ticket Not Implemented

- **Route:** /continuous/ticket
- **Description:** If Continuous endpoints are Not Implemented, then request /continuous/ticket, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Continuous related endpoints are correctly non-implemented
- **Request:**

```
GET /continuous/ticket?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

### Continuous Bytes Not Implemented

- **Route:** /continuous/bytes
- **Description:** If Continuous endpoints are Not Implemented, then request /continuous/bytes, expecting a 501 Not Implemented status code response
- **Rationale:** Asserts that Continuous related endpoints are correctly non-implemented
- **Request:**

```
GET /continuous/bytes?format=loom
Accept: application/octet-stream, application/vnd.loom, text/tab-separated-values
```

- **Successful Response:**

```
HTTP/1.1 501 Not Implemented
Content-Type: application/vnd.ga4gh.rnaget.v1.0.0+json
```

- **Success Criteria:** Status Code == 501
- **Failure Criteria:** Status Code != 501

## 3.6.4 Continuous Content Tests

Continuous content tests assert that continuous matrices downloaded from the RNAget server contain the expected content based on the request. Continuous file tracks, positions, and intensity values are cross-referenced against the request to ensure the expected data has been returned.

### 3.6.5 Continuous Content Test Cases

- *Continuous Ticket by Id Content Test Cases*
- *Continuous Bytes by Id Content Test Cases*

- *Continuous Ticket Content Test Cases*
- *Continuous Bytes Content Test Cases*

### Continuous Ticket by Id Content Test Cases

- **Route:** `/continuous/<id>/ticket`
- **Description:** Download test continuous matrix by ticket multiple times (sometimes slicing by chr, start, end).
- **Rationale:** Asserts correct matrix file is associated with the test continuous id. Validates signal intensity values match expected. Validates returned columns/rows match expected based on slice parameters.
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/ticket
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Success Criteria:** Test continuous matrix columns, rows, values match expected
- **Failure Criteria:** Test continuous matrix columns, rows, values DO NOT match expected

### Continuous Bytes by Id Content Test Cases

- **Route:** `/continuous/<id>/bytes`
- **Description:** Download test continuous matrix bytes multiple times (sometimes slicing by chr, start, end).
- **Rationale:** Asserts correct matrix file is associated with the test continuous id. Validates signal intensity values match expected. Validates returned columns/rows match expected based on slice parameters.
- **Request:**

```
GET /continuous/5e22e009f41fc53cbea094a41de8798f/bytes
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Success Criteria:** Test continuous matrix columns, rows, values match expected
- **Failure Criteria:** Test continuous matrix columns, rows, values DO NOT match expected

### Continuous Ticket Content Test Cases

- **Route:** `/continuous/ticket`
- **Description:** Download joined continuous matrix by ticket multiple times (sometimes slicing by chr, start, end).
- **Rationale:** Asserts joined matrix. Validates signal intensity values match expected. Validates returned columns/rows match expected based on slice parameters.
- **Request:**

```
GET /continuous/ticket?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Success Criteria:** Joined continuous matrix columns, rows, values match expected
- **Failure Criteria:** Joined continuous matrix columns, rows, values DO NOT match expected

## Continuous Bytes Content Test Cases

- **Route:** `/continuous/bytes`
- **Description:** Download joined continuous matrix as bytes multiple times (sometimes slicing by chr, start, end).
- **Rationale:** Asserts joined matrix. Validates signal intensity values match expected. Validates returned columns/rows match expected based on slice parameters.
- **Request:**

```
GET /continuous/bytes?format=loom
Accept: application/vnd.ga4gh.rnaget.v1.0.0+json, application/json
```

- **Success Criteria:** Joined continuous matrix columns, rows, values match expected
- **Failure Criteria:** Joined continuous matrix columns, rows, values DO NOT match expected

## 3.7 Getting Started

The RNAget compliance tool provides insight into how compliant a server is with the specification. The tool can be installed and executed from the command line, and can be configured to run compliance tests against any RNAget server of interest.

When run, the compliance tool generates a report, indicating which test cases succeeded and failed, as well as messages explaining why a test may have failed.

The [next article](#) provides instructions on how to install the RNAget compliance tool.

## 3.8 Installation

This section provides instructions on how to install the RNAget compliance suite application.

As a prerequisite, python 3 and pip must be installed on your system. The application can be installed by running the following from the command line.

1. Clone the latest build from <https://github.com/ga4gh-rnaseq/rnaget-compliance-suite>

```
git clone https://github.com/ga4gh-rnaseq/rnaget-compliance-suite
```

2. Enter rnaget-compliance-suite directory and install

```
cd rnaget-compliance-suite
python setup.py install
```

3. Confirm installation by executing the rnaget-compliance command

```
rnaget-compliance report
```

The [next article](#) explains how to run the compliance application.

## 3.9 Usage

The application can be run from the command line with the following command:

```
rnaget-compliance report
```

Command line parameters are as follows:

Table 1: rnaget-compliance report command line parameters

| Parameter    | Short Name | Required | Description                                                                                                                                        |
|--------------|------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| -user-config | -c         | Yes      | Path to yaml file, indicating which server(s), project(s), expression(s), etc. to query                                                            |
| -output_dir  | -o         | No       | Output directory to write report results and web files. Directory must not already exist. Defaults to ./rnaget-compliance-results if not specified |
| -serve       | N/A        | No       | Flag. If set, the program will spin up a local server serving the HTML report after all compliance tests are completed                             |
| -uptime      | -u         | No       | Integer. The local report server will shut down automatically after this time in seconds                                                           |
| -no-tar      | N/A        | No       | Flag. If set, the program will not write a .tar.gz archive of report results                                                                       |
| -force       | -f         | No       | Flag. If set, the program will overwrite the output directory if it exists                                                                         |

## 3.9.1 User Config YAML File

The compliance application requires configurations to be written to a YAML file, which is specified on the command line. The following is a template of the config file, which can be modified to query different servers, projects, studies, etc.

```
servers:
- server_name: Caltech
 base_url: https://felcat.caltech.edu/rnaget/
 implemented:
 projects: true
 studies: true
 expressions: true
 continuous: true
```

The .yaml config file contains the following important features, which must be taken into consideration when modifying it for a different server:

1. *servers* must be the root property. The value of *servers* is a list of server definitions (ie the application can query multiple servers in a single run).
2. Each server definition requires the following parameters:
  - *server\_name*: a string uniquely identifying the server
  - *base\_url*: the base url at which the RNAget API can be reached
3. If a server requires client authentication, then a server definition can include the OAuth 2.0 bearer access token under the “token” property:

```
servers:
- server_name: Caltech
 base_url: https://felcat.caltech.edu/rnaget/
 token: abcdefghijklmnop
```

(continues on next page)

(continued from previous page)

```
implemented:
 projects: true
 studies: true
 expressions: true
 continuous: true
```

The token will be used for all API tests executed by the compliance suite.

4. A server's *implemented* property indicates which routes (projects, studies, expressions, continuous) have been implemented. This property can be removed if all routes are implemented, as routes are expected to be implemented by default. Use `${ROUTENAME}: false` to indicate non-implemented routes.

## 3.9.2 Basic Usage

The program requires, at minimum, a YAML config file to be specified in order to execute:

```
rnaget-compliance report -c user_config_template.yaml
```

The user can also specify the location at which to create the output report directory. The program will only run if the output directory does not already exist (will not overwrite existing files):

```
rnaget-compliance report -c user_config_template.yaml -o ./results/output
```

The program creates a series of web files at the output directory, which can be used to view the compliance results as an HTML report. A web server can be started manually at the output directory to serve the report. By specifying the `--serve` option, the report server will be started automatically upon completion of the compliance tests:

```
rnaget-compliance report -c user_config_template.yaml -o ./results/output --serve
```

The [next article](#) explains how to view the compliance report, including how to diagnose errors (compliance failures)

## 3.10 Report

Once the compliance report has been generated, the HTML report can be accessed by first starting a web server at the output directory, then navigating to the page via web browser.

### 3.10.1 Viewing the Report

#### Report: Index

The report index page displays a tabular overview of test successes/failures by tested servers and API routes. An example report index is displayed below:

## Details

Generated on July 03, 2019 at 4:32 PM (UTC)

## Results

| Server                                        | Base URL                                                                            | Projects             | Studies              | Expressions          | Continuous           |
|-----------------------------------------------|-------------------------------------------------------------------------------------|----------------------|----------------------|----------------------|----------------------|
| <a href="#">Caltech</a>                       | <a href="https://felcat.caltech.edu/rnaget/">https://felcat.caltech.edu/rnaget/</a> | <a href="#">Pass</a> | <a href="#">Pass</a> | <a href="#">Pass</a> | <a href="#">Pass</a> |
| <a href="#">Centre for Genomic Regulation</a> | <a href="https://genome.crg.cat/rnaget/">https://genome.crg.cat/rnaget/</a>         | <a href="#">Pass</a> | <a href="#">Pass</a> | <a href="#">Pass</a> | <a href="#">Pass</a> |
| <a href="#">CanDIG</a>                        | <a href="https://candig.bcgsc.ca/rnaget/">https://candig.bcgsc.ca/rnaget/</a>       | <a href="#">Pass</a> | <a href="#">Pass</a> | <a href="#">Pass</a> | <a href="#">Pass</a> |

## Links

- [rnaget API specification](#)
- [rnaget compliance documentation](#)
- [rnaget compliance application](#)

Clicking on any of the *Pass/Fail* buttons will take you to an in-depth report of the status of all tests for that server.

## Report: Test Status

This page shows a more detailed report of all tests run on a particular server, organized by API route and test case. For any given test, clicking the *Info* button will display information for that test, including the request url, parameters, and the response body. The *Info* window is also helpful in diagnosing failed compliance tests, as it reports the type of error encountered and related debug messages.

Below is an example of *Projects* test results for one server in the test status page:

### Projects

Project #1

project id: 43378a5d48364f9d8cf3c3d5104df560

|                                           |                      |
|-------------------------------------------|----------------------|
| ✔ Project Get: PASSED                     | <a href="#">Info</a> |
| ✔ Project Get Not Found: PASSED           | <a href="#">Info</a> |
| ✔ Project Search: PASSED                  | <a href="#">Info</a> |
| ✔ Project Search Url Params All: PASSED   | <a href="#">Info</a> |
| ✔ Project Search Url Params Cases: PASSED | <a href="#">Info</a> |
| ✔ Project Search Filters Out: PASSED      | <a href="#">Info</a> |
| ✔ Project Search Filters: PASSED          | <a href="#">Info</a> |

Clicking the *Info* button shows test information, displayed below:



## Projects

### Project #1

project id: 43378a5d48364f9d8cf3c3d5104df560

✔ Project Get: PASSED

Info

**Description:** Requests the /projects/:id endpoint using project id in config file. Checks content type and status code (200). Validates response body matches project schema in the specification.

**Summary:** Project endpoint implemented by the server

**Request:** https://felcat.caltech.edu/rnaget/projects/43378a5d48364f9d8cf3c3d5104df560

**Params:** {}

**Response Body:** {"name": "PCAWG", "tags": ["PCAWG", "cancer"], "studies": [{"name": "PCAWG", "tags": ["PCAWG", "cancer"], "parentProjectID": "43378a5d48364f9d8cf3c3d5104df560", "description": "PCAWG study", "version": "1.0", "id": "6ccbbd76b9c4837bd7342dd616d0fec"}], "description": "Pan Cancer Analysis of Whole Genomes test data from Expression Atlas E-MTAB-5423", "version": "1.0", "id": "43378a5d48364f9d8cf3c3d5104df560"}

✔ Project Get Not Found: PASSED

Info

✔ Project Search: PASSED

Info

✔ Project Search Url Params All: PASSED

Info

✔ Project Search Url Params Cases: PASSED

Info

✔ Project Search Filters Out: PASSED

Info

✔ Project Search Filters: PASSED

Info

Test results can also be viewed as a matrix:

[< Back](#)

## RNAget Implementation Compliance Report

### Server: Caltech

Base URL: <https://felcat.caltech.edu/rnaget/>

Total tests: 36

Total tests passed: 36

Total tests failed: 0

Total tests skipped: 0

Total warnings generated: 0

[Text](#)[Matrix](#)

| Server name | Object and Id                              | Test case                       | Status |
|-------------|--------------------------------------------|---------------------------------|--------|
| Caltech     | Projects: 43378a5d48364f9d8cf3c3d5104df560 | Project Get                     | PASSED |
| Caltech     | Projects: 43378a5d48364f9d8cf3c3d5104df560 | Project Get Not Found           | PASSED |
| Caltech     | Projects: 43378a5d48364f9d8cf3c3d5104df560 | Project Search                  | PASSED |
| Caltech     | Projects: 43378a5d48364f9d8cf3c3d5104df560 | Project Search Url Params All   | PASSED |
| Caltech     | Projects: 43378a5d48364f9d8cf3c3d5104df560 | Project Search Url Params Cases | PASSED |
| Caltech     | Projects: 43378a5d48364f9d8cf3c3d5104df560 | Project Search Filters Out      | PASSED |
| Caltech     | Projects: 43378a5d48364f9d8cf3c3d5104df560 | Project Search Filters          | PASSED |
| Caltech     | Studies: 6cccbbd76b9c4837bd7342dd616d0fec  | Study Get                       | PASSED |
| Caltech     | Studies: 6cccbbd76b9c4837bd7342dd616d0fec  | Study Get Not Found             | PASSED |
| Caltech     | Studies: 6cccbbd76b9c4837bd7342dd616d0fec  | Study Search                    | PASSED |
| Caltech     | Studies: 6cccbbd76b9c4837bd7342dd616d0fec  | Study Search Url Params All     | PASSED |
| Caltech     | Studies: 6cccbbd76b9c4837bd7342dd616d0fec  | Study Search Url Params Cases   | PASSED |
| Caltech     | Studies: 6cccbbd76b9c4837bd7342dd616d0fec  | Study Search Filters Out        | PASSED |