Internet Engineering Task Force (IETF) C. Ma
Internet Draft J. Chen
Intended status: Informational X. Fan
Expires: July 16, 2020 M. Chen
Z. Li
China Academy of Information and Communications Technology
January 16, 2020

HTTP Usage in the Industrial Internet Identifier Data Access Protocol (IIIDAP)
draft-ma-identifier-access-http-01

Status of this Memo

Copyright Notice

Abstract

This document describes an Extensible Provisioning Protocol (EPP) for the provisioning and management of enterprises and identifiers between the server which is called Business Management System (BMS) and is entitled to manage the identifier top-level node and the client which is also referred to as Second Node Management System (SNMS). Specified in XML, the mapping defines EPP command syntax and semantics as applied to enterprise and identifier management.

Table of Contents

1. Introduction 3
2. Conventions used in this document..... 4
   2.1. Acronyms and Abbreviations..... 4
3. Design Intents 5
4. Queries 5
   4.1. HTTP Methods 5
   4.2. Accept Header 6
   4.3. Query Parameters..... 6
5. Types of HTTP Response..... 6
   5.1. Positive Answers..... 6
   5.2. Redirects 6
   5.3. Negative Answers..... 7
   5.4. Malformed Queries..... 7
   5.5. Rate Limits 8
   5.6. Cross-Origin Resource Sharing (CORS)..... 8
6. Security Considerations..... 8

7. Internationalization Considerations..... 9
7.1. URIs and IRIs 9
7.2. Language Identifiers in Queries and Responses..... 9
7.3. Language Identifiers in HTTP Headers..... 9

8. References 9
8.1. Normative References..... 9
8.2. Informative References..... 10
Appendix A. Protocol Example..... 12
Appendix B. Cache Busting..... 13
Appendix C. Bootstrapping and Redirection..... 14

1. Introduction

This document describes the usage of the Hypertext Transfer Protocol (HTTP) [RFC7230] for the Industrial Internet Identifier Data Access Protocol (IIIDAP). The goal of this document is to tie together usage patterns of HTTP into a common profile applicable to the various types of directory services serving identifier data using practices informed by the Representational State Transfer (REST) [REST] architectural style. By giving the various directory services common behavior, a single client is better able to retrieve data from directory services adhering to this behavior.

Identifier data expected to be presented by this service is Industrial Internet Identifier data -- some of the information that identifiers of Second-Level Nodes (SLN) and Enterprise-Level Nodes (ELN) contain (see [RFC]). This protocol is expected to provide a specification for queries and responses, redirection to authoritative sources, and support for localized identifier data such as addresses and organization or person names. This function is expected to be provided by SLN.

In designing these common usage patterns, this document introduces considerations for a simple use of HTTP. Where complexity may reside, it is the goal of this document to place it upon the server and to keep the client as simple as possible. A client implementation should be possible using common operating system scripting tools (e.g., bash and wget).

This is the basic usage pattern for this protocol:

1. A client determines an appropriate server to query along with the

appropriate base Uniform Resource Locator (URL) to use in such queries. [IDENTIFIER-AUTHORIZATION] describes one method to determine the server and the base URL. See Appendix C for more information.

2. A client issues an HTTP (or HTTPS) query using GET [RFC7231]. As an example, a query URL for the enterprise identifier 86.100.1 might be

http://example.com/iiidap/identifier/86.100.1

[IDENTIFIER-QUERY] details the various queries used in IIIDAP.

3. If the receiving server has the information for the query, it examines the Accept header field of the query and returns a 200 response with a response entity appropriate for the requested format. [IDENTIFIER-RESPONSES] details a response in JavaScript Object Notation (JSON).

4. If the receiving server does not have the information for the query but does have knowledge of where the information can be found, it will return a redirection response (3xx) with the Location header field containing an HTTP(S) URL pointing to the information or another server known to have knowledge of the location of the information. The client is expected to require using that HTTP URL.

5. If the receiving server does not have the information being requested and does not have knowledge of where the information can be found, it returns a 404 response.

6. If the receiving server will not answer a request for policy reasons, it will return an error response (4xx) indicating the reason for giving no answer.

It is not the intent of this document to redefine the meaning and semantics of HTTP. The purpose of this document is to clarify the use of standard HTTP mechanisms for this application.

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",

"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

In this document, an IIIDAP client is an HTTP user agent performing an IIIDAP query, and an IIIDAP server is an HTTP server providing an IIIDAP response. IIIDAP query and response formats are described in [IDENTIFIER-QUERY] and [IDENTIFIER-RESPONSES], while this document describes how IIIDAP clients and servers use HTTP to exchange queries and responses. [IDENTIFIER-SECURITY] describes security considerations for IIIDAP.

2.1. Acronyms and Abbreviations

IIIDAP: Industrial Internet Identifier Data Access Protocol

SLN: Second-Level Nodes

ELN: Enterprise-Level Nodes

3. Design Intents

There are a few design criteria this document attempts to meet.

First, each query is meant to require only one path of execution to obtain an answer. A response may contain an answer, no answer, or a redirect, and clients are not expected to fork multiple paths of execution to make a query.

Second, the semantics of the request/response allow for future and/or non-standard response formats. In this document, only a JSON [RFC7159] response media type is noted, with the response contents to be described separately (see [IDENTIFIER-RESPONSES]). This document only describes how IIIDAP is transported using HTTP with this format.

Third, this protocol is intended to be able to make use of the range of mechanisms available for use with HTTP. HTTP offers a number of mechanisms not described further in this document. Operators are able to make use of these mechanisms according to their local policy, including cache control, authorization, compression, and redirection. HTTP also benefits from widespread investment in scalability, reliability, and performance, as well as widespread programmer understanding of client behaviors for web services styled

after REST [REST], reducing the cost to deploy Registration Data Directory Services and clients. This protocol is forward compatible with HTTP 2.0.

4. Queries

4.1. HTTP Methods

Clients use the GET method to retrieve a response body and use the HEAD method to determine existence of data on the server. Clients SHOULD use either the HTTP GET or HEAD methods (see [RFC7231]). Servers are under no obligation to support other HTTP methods; therefore, clients using other methods will likely not interoperate properly.

Clients and servers MUST support HTTPS to support security services.

4.2. Accept Header

To indicate to servers that an IIIDAP response is desired, clients include an Accept header field with an IIIDAP-specific JSON media type, the generic JSON media type, or both. Servers receiving an IIIDAP request return an entity with a Content-Type header containing the IIIDAP-specific JSON media type.

This specification does not define the responses a server returns to a request with any other media types in the Accept header field, or with no Accept header field. One possibility would be to return a response in a media type suitable for rendering in a web browser.

4.3. Query Parameters

Servers MUST ignore unknown query parameters. Use of unknown query parameters for cache busting is described in Appendix B.

5. Types of HTTP Response

This section describes the various types of responses a server may send to a client. While no standard HTTP response code is forbidden in usage, this section defines the minimal set of response codes in

common use by servers that a client will need to understand. While some clients may be constructed with simple tooling that does not account for all of these response codes, a more robust client accounting for these codes will likely provide a better user experience. It is expected that usage of response codes and types for this application not defined here will be described in subsequent documents.

5.1. Positive Answers

If a server has the information requested by the client and wishes to respond to the client with the information according to its policies, it returns that answer in the body of a 200 (OK) response (see [RFC7231]).

5.2. Redirects

If a server wishes to inform a client that the answer to a given query can be found elsewhere, it returns either a 301 (Moved Permanently) response code to indicate a permanent move or a 302 (Found), 303 (See Other), or 307 (Temporary Redirect) response code to indicate a non-permanent redirection, and it includes an HTTP(S) URL in the Location header field (see [RFC7231]). The client is expected to issue a subsequent request to satisfy the original query

using the given URL without any processing of the URL. In other words, the server is to hand back a complete URL, and the client should not have to transform the URL to follow it. Servers are under no obligation to return a URL conformant to [IDENTIFIER-QUERY].

For this application, such an example of a permanent move might be a SLN operator informing a client the information being sought can be found with another SLN operator (i.e., a query for the identifier 86.100.1 in foo.example is found at http://foo.example/identifier/86.100.1).

For example, if the client uses

http://serv1.example.com/weirds/identifier/86.100.1

the server redirecting to

https://serv2.example.net/weirds2/

would set the Location: field to the value

https://serv2.example.net/weirds2/identifier/86.100.1

5.3. Negative Answers

If a server wishes to respond that it has an empty result set (that is, no data appropriately satisfying the query), it returns a 404 (Not Found) response code. Optionally, it MAY include additional information regarding the negative answer in the HTTP entity body.

If a server wishes to inform the client that information about the query is available, but cannot include the information in the response to the client for policy reasons, the server MUST respond with an appropriate response code out of HTTP's 4xx range. A client MAY retry the query if that is appropriate for the respective response code.

5.4. Malformed Queries

If a server receives a query that it cannot interpret as an IIIDAP query, it returns a 400 (Bad Request) response code. Optionally, it MAY include additional information regarding this negative answer in the HTTP entity body.

5.5. Rate Limits

Some servers apply rate limits to deter address scraping and other abuses. When a server declines to answer a query due to rate limits, it returns a 429 (Too Many Requests) response code as described in [RFC6585]. A client that receives a 429 response SHOULD decrease its query rate and honor the Retry-After header field if one is present. Servers may place stricter limits upon clients that do not honor the Retry-After header. Optionally, the server MAY include additional information regarding the rate limiting in the HTTP entity body.

Note that this is not a defense against denial-of-service (DoS) attacks, since a malicious client could ignore the code and continue

to send queries at a high rate. A server might use another response code if it did not wish to reveal to a client that rate limiting is the reason for the denial of a reply.

5.6. Cross-Origin Resource Sharing (CORS)

When responding to queries, it is RECOMMENDED that servers use the Access-Control-Allow-Origin header field, as specified by [W3C.REC-cors-20140116]. A value of "*" is suitable when IIIDAP is used for public resources.

This header (often called the CORS header) helps in-browser web applications by lifting the "same-origin" restriction (i.e., a browser may load IIIDAP client code from one web server but query others for IIIDAP data).

By default, browsers do not send cookies when cross origin requests are allowed. Setting the Access-Control-Allow-Credentials header field to "true" will send cookies. Use of the Access-Control-Allow-Credentials header field is NOT RECOMMENDED.

6. Security Considerations

This document does not pose strong security requirements to the IIIDAP protocol. However, it does not restrict against the use of security mechanisms offered by the HTTP protocol. It does require that IIIDAP clients and servers MUST support HTTPS.

This document makes recommendations for server implementations against DoS (Section 5.5) and interoperability with existing security mechanisms in HTTP clients (Section 5.6).

Additional security considerations to the IIIDAP protocol are covered in [IDENTIFIER-SECURITY].

7. Internationalization Considerations

7.1. URIs and IRIs

Clients can use Internationalized Resource Identifiers (IRIs) [RFC3987] for internal use as they see fit but MUST transform them to URIs [RFC3986] for interaction with IIIDAP servers. IIIDAP servers MUST use URIs in all responses, and again clients can

transform these URIs to IRIs for internal use as they see fit.

7.2. Language Identifiers in Queries and Responses

Under most scenarios, clients requesting data will not signal that the data be returned in a particular language or script. On the other hand, when servers return data and have knowledge that the data is in a language or script, the data SHOULD be annotated with language identifiers whenever they are available, thus allowing clients to process and display the data accordingly.

[IDENTIFIER-RESPONSES] provides such a mechanism.

7.3. Language Identifiers in HTTP Headers

Given the description of the use of language identifiers in Section 9.2, unless otherwise specified, servers SHOULD ignore the HTTP [RFC7231] Accept-Language header field when formulating HTTP entity responses, so that clients do not conflate the Accept-Language header with the 'lang' values in the entity body.

However, servers MAY return language identifiers in the Content-Language header field so as to inform clients of the intended language of HTTP layer messages.

8. References

8.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, <http://www.rfc-editor.org/info/rfc2119>.

[RFC3986] Berners-Lee, T., Fielding, R., and L. Masinter, "Uniform Resource Identifier (URI): Generic Syntax", STD 66, RFC 3986, January 2005, <http://www.rfc-editor.org/info/rfc3986>.

[RFC3987] Duerst, M. and M. Suignard, "Internationalized Resource Identifiers (IRIs)", RFC 3987, January 2005, <http://www.rfc-editor.org/info/rfc3987>.

[RFC6585] Nottingham, M. and R. Fielding, "Additional HTTP Status Codes", RFC 6585, April 2012, <http://www.rfc-editor.org/info/rfc6585>.

[RFC7230] Fielding, R., Ed. and J. Reschke, Ed., "Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing", RFC 7230, June 2014, <http://www.rfc-editor.org/info/rfc7230>.

[RFC7231] Fielding, R., Ed. and J. Reschke, Ed., "Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content", RFC 7231, June 2014, <http://www.rfc-editor.org/info/rfc7231>.

[W3C.REC-cors-20140116] Kesteren, A., "Cross-Origin Resource Sharing", W3C Recommendation, REC-cors-20140116, January 2014, <http://www.w3.org/TR/2014/REC-cors-20140116/>.

8.2. Informative References

[REST] Fielding, R. and R. Taylor, "Principled Design of the Modern Web Architecture", ACM Transactions on Internet Technology, Vol. 2, No. 2, May 2002.

[RFC7159] Bray, T., Ed., "The JavaScript Object Notation (JSON) Data Interchange Format", RFC 7159, March 2014, <http://www.rfc-editor.org/info/rfc7159>.

[IDENTIFIER-SECURITY] Ma, C., "Security Services for the Industrial Internet Identifier Data Access Protocol (IIIDAP)", Work in Progress, draft-mcd-identifier-access-security-00, December 2019.

[IDENTIFIER-QUERY] Ma, C., "Industrial Internet Identifier Data Access Protocol (IIIDAP) Query Format", Work in Progress, draft-mcd-identifier-access-query-00, December 2019.

[IDENTIFIER-RESPONSES]
Ma, C., "JSON Responses for the Industrial Internet Identifier Data Access Protocol (IIIDAP)", Work in Progress, draft-mcd-identifier-access-responce-00, December 2019.

[IDENTIFIER-AUTHORIZATION]
Ma, C., "Finding the Authoritative Registration Data (IIIDAP) Service", Work in Progress, draft-mcd-identifier-access-authority-00, December 2019.

Appendix A. Protocol Example

To demonstrate typical behavior of an IIIDAP client and server, the following is an example of an exchange, including a redirect. The data in the response has been elided for brevity, as the data format is not described in this document. The media type used here is described in [IDENTIFIER-RESPONSES].

An example of an IIIDAP client and server exchange:

```
  Client:
      <TCP connect to iiidap.example.com port 80>
      GET /iiidap/identifier/86.100.1 HTTP/1.1
      Host: iiidap.example.com
      Accept: application/iiidap+json

  iiidap.example.com:
      HTTP/1.1 301 Moved Permanently
      Location: http://iiidap-
      identifier.example.com/iiidap/identifier/86.100.1
      Content-Length: 0
      Content-Type: application/iiidap+json
      <TCP disconnect>

  Client:
      <TCP connect to iiidap-identifier.example.com port 80>
      GET /iiidap/identifier/86.100.1 HTTP/1.1
      Host: iiidap-identifier.example.com
      Accept: application/iiidap+json

  iiidap-identifier.example.com:
      HTTP/1.1 200 OK
      Content-Type: application/iiidap+json
      Content-Length: 9001

      { ... }
      <TCP disconnect>
```

Appendix B. Cache Busting

Some HTTP [RFC7230] cache infrastructures do not adhere to caching standards adequately and could cache responses longer than is intended by the server. To overcome these issues, clients can use an ad hoc and improbably used query parameter with a random value of their choosing. As Section 4.3 instructs servers to ignore unknown parameters, this is compatible with the IIIDAP definition.

An example of using an unknown query parameter to bust caches:

```
http://example.com/identifier/86.100.1?__fuhgetaboutit=xyz123
```

Use of an unknown parameter to overcome misbehaving caches is not part of any specification and is offered here for informational purposes.

Appendix C. Bootstrapping and Redirection

These issues are solved in IIIDAP using HTTP redirects and bootstrapping. Bootstrapping is discussed in [IDENTIFIER-AUTHORIZATION]. In constrained environments, the processes outlined in [IDENTIFIER-AUTHORIZATION] may not be viable, and there may be the need for servers acting as a "redirector".

Redirector servers issue HTTP redirects to clients using a redirection table informed by [IDENTIFIER-AUTHORIZATION]. Figure 1 diagrams a client using a redirector for bootstrapping.

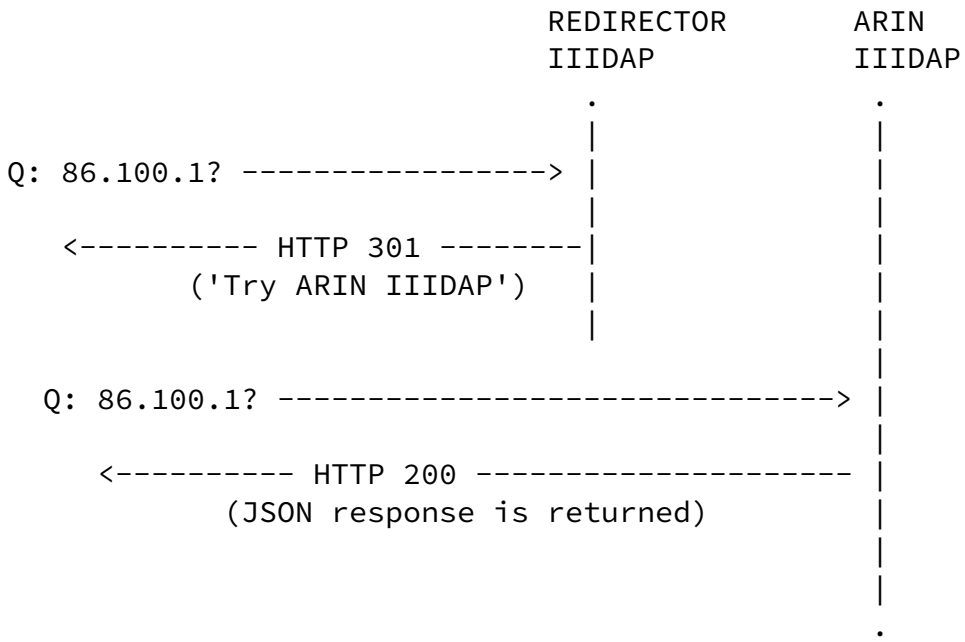
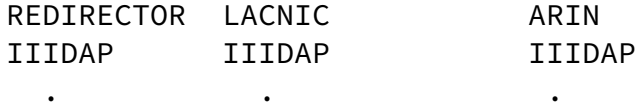
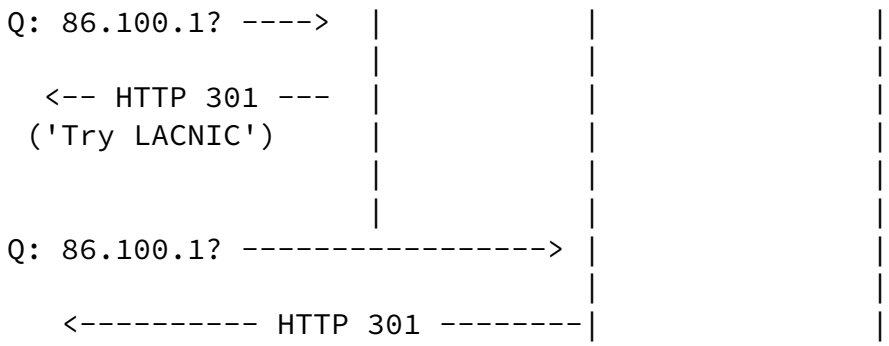


Figure 1: Querying IIIDAP Data for 86.100.1

In some cases, multiple HTTP redirects will be issued. Figure 2 shows such a scenario.





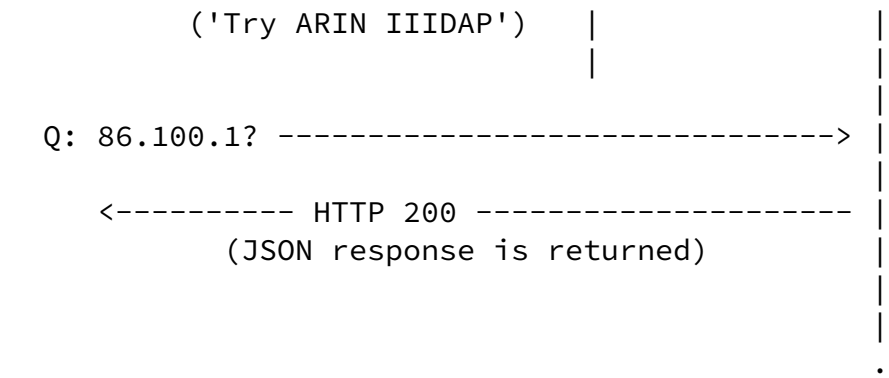


Figure 2: Querying IIIDAP Data for Data That Has Been Transferred

Authors' Addresses

Chendi Ma
CAICT
No.52 Huayuan North Road, Haidian District
Beijing, Beijing, 100191
China

Phone: +86 177 1090 9864
Email: machendi@caict.ac.cn

Chen Jian
CAICT
No.52 Huayuan North Road, Haidian District
Beijing, Beijing, 100191
China

Phone: +86 138 1103 3332
Email: chenjian3@caict.ac.cn

Xiaotian Fan
CAICT
No.52 Huayuan North Road, Haidian District
Beijing, Beijing, 100191
China

Phone: +86 134 0108 6945

Email: fanxiaotian@caict.ac.cn

Meilan Chen
CAICT
No.52 Huayuan North Road, Haidian District
Beijing, Beijing, 100191
China

Phone: +86 139 1143 7301
Email: chenmeilan@caict.ac.cn

Zhiping Li
CAICT
No.52 Huayuan North Road, Haidian District
Beijing, Beijing, 100191
China

Phone: +86 185 1107 1386
Email: lizhiping@caict.ac.cn