
**Road vehicles — Extended vehicle
(ExVe) web services —**

**Part 2:
Access**

Véhicule routiers — Web services du véhicule étendu (ExVe) —

Partie 2: Accès
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

A list of all parts in the ISO 20078 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Road vehicles — Extended vehicle (ExVe) web services —

Part 2: Access

1 Scope

This document defines how to access Resources on a Web services interface of an Offering Party using the Hypertext Transfer Protocol Secure (HTTPS). For such an access, the Representational State Transfer (REST) architectural pattern is chosen as a common way to format Resource paths. Some specific extensions to this pattern are defined to allow for asynchronous Resource requests, such as, for example, forcing readouts of data from a connected vehicle.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20078-1:2019, *Road vehicles — Extended vehicle (ExVe) web services — Part 1: Content*

ISO 20078-3, *Road vehicles — Extended vehicle (ExVe) web services — Part 3: Security*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20078-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO 20078-1 apply.

4 Representational State Transfer based Interface

4.1 General

The following defines the requirements on a Representational State Transfer (REST)^[3] based web service interface using Hypertext Transfer Protocol Secure (HTTPS)^{[1][2][8]} based on Transport Layer Security (TLS) to give the Accessing Party secure Access to Resources provided by the Offering Party.

REQ_04_01_01	The REST based web services interface implementation shall use the Hypertext Transfer Protocol Secure (HTTPS) as transport protocol with Transport Layer Security (TLS).
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REQ_04_01_02	HTTP shall only be used with version 1.1 or higher compatible versions.
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REQ_04_01_03	TLS shall only be used with version 1.2 or higher versions.
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REQ_04_01_04	The REST web service shall be a strict client-server interaction, where the Accessing Party (client) sends a request and the Offering Party (server) sends a response.
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NOTE Resources can be transferred both in the request and the response.

REQ_04_01_05	The REST implementation shall be stateless; i.e. the Offering Party server shall not maintain any Accessing Party client context or session information.
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Due to REQ_04_01_05 each request-response pair are handled independently from one another. Each client request by the Accessing Party contains all information required by the server of the Offering Party to successfully respond to the request, including a representation of the client state when necessary.

4.2 Resources

REQ_04_02_01	Information on the server shall be exposed as Resources expressed as plural nouns.
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NOTE 1 This holds true even when the Resource is only available one time on a connected vehicle (e.g. "odometers").

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REQ_04_02_02	The exposed Resources shall be uniquely identified in the form of Uniform Resource Identifiers (URIs).
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The Resources, the Resource Groups or the Containers, and how to apply those on a specific presentation or application layer of the Accessing Party are described in ISO 20078-1. How an Accessing Party authenticates and how it is authorized for Access to Resources is described in ISO 20078-3.

REQ_04_02_03	The Offering Party shall define the base URIs of the web services.
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Table 1 — Examples of possible ExVe base URIs

Resource	Description
https://{example.com}/exve/	URI based on sub directory.
https://exve.{example.com}/	URI based on sub domain.

REQ_04_02_04	The Offering Party shall comply with the URI Resource paths defined by specific ExVe standard applications.
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Table 2 — Examples of possible ExVe Resource URIs

Resource	Description
{base_URI}/{resourcePath}	Resources based on path.
{base URI}/vehicles	A list of the available vehicles for a specific user
{base URI}/vehicles/{vehicleId}/dtcReadouts/	Read all Diagnostic Trouble Codes for a specific vehicle
{base URI}/vehicles/{vehicleId}/ecus/{ecuId}/dtcReadouts/	Read all Diagnostic Trouble Codes for a specific ECU of a specific vehicle

There are two primary elements defining an URI; Entities and Resources ([Table 2](#)). Entities are the fundamental objects representing e.g. vehicles, ECUs, drivers and fleets. Resources are the actual data, aggregated information or functions associated with an entity and a specific use case.

REQ_04_02_05	Resources shall be named and described.
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EXAMPLE Fuel level could be an example of a single data item Resource and vehicle position an aggregate consisting of several data items (e.g. latitude, longitude, sample time), lock and un-lock the vehicle a functionality.

REQ_04_02_06	The Offering Party should have the possibility to extend Resources, but shall not be able to reduce Resources.
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Thus by REQ_04_02_06 it is not possible to remove data items from a Resource, other than through an update of the underlying use case specification. It is however possible to add data items to a Resource (i.e. versioning).

REQ_04_02_07	Aggregated Resources shall only include or cross-reference necessary data items for the complete and correct operation of the related use case.
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NOTE 2 REQ_04_02_07 ensures an Accessing Party only receives data items necessary for fulfilling the intended need and nothing else when accessing the Resource (i.e. data economy).

See also ISO 20078-1:2019, 8.3, for further detailing.

REQ_04_02_08	When defining Resources care shall be taken not to redefine a Resource already defined by an existing use case.
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An application may extend the recommended patterns below if none of them meets the needs of the use case.

REQ_04_02_09	Each use case shall define how the HTTP operations GET, POST, PUT and DELETE are supported for each defined Resource and what the response for each operation is.
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REQ_04_02_10	All URI elements shall be written in lower camel case notation.
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NOTE 3 The {baseURI} in following patterns refers to the Offering Party root URI (see [Table 3](#)).

Table 3 — Examples of base URI expresses REQ_04_02_10 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}
Example	{baseURI}/vehicles Returns a list of all vehicles available to the Accessing party.

REQ_04_02_11	Relations of entities shall be expressed using sub-resources.
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NOTE 4 See [Table 4](#).

Table 4 — Examples of sub-URI's expresses REQ_04_02_11 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}/{ID}/{entities2}/{ID2}
Example	{baseURI}/fleets/12/vehicles/456 Get information on vehicle with id 456 of fleet with id 12.
	{baseURI}/vehicles/456/ecus/789 Get information on ecu with id 789 of vehicle with id 456.

REQ_04_02_12	A Resource shall be placed after the entity to which it belongs in the URI.
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NOTE 5 See [Table 5](#).

Table 5 — Examples of descriptive URI's expresses REQ_04_02_12 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}/{ID}/{resource}
Example	{baseURI}/vehicles/123/positions Get all positions for vehicle with id 123.
	{baseURI}/vehicles/456/odometers Get the odometer value for vehicle with id 456.
	{baseURI}/vehicles/456/tirePressures Get the tire pressures of all wheels on the vehicle with id 456.

REQ_04_02_13	If filtering of the response is needed, query parameters shall be used.
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NOTE 6 Several query parameters can be added to a request.

NOTE 7 See [Table 6](#).

Table 6 — Examples of filtering responses expresses REQ_04_02_13 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}?{filter}={filterValue} {baseURI}/{entities}?{filter}={filterValue}&{filter2}={filterValue2}
Example	{baseURI}/vehicles?ignitionState=on Get all vehicles with ignition on.
	{baseURI}/vehicles/123/positions?startDate=...&endDate=... Get the positions for vehicle with id 123 registered in given date span.

REQ_04_02_14	If sorting is needed, query parameters shall be used.
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NOTE 8 See [Table 7](#).

Table 7 — Examples of query parameters expresses REQ_04_02_14 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}?{sorting}={sortingValue}
	{baseURI}/{entities}?{sorting}={sortingValue}&{sorting2}={sortingValue2}
Example	{baseURI}/vehicles?sortField=id&sortOrder=asc

REQ_04_02_15	If selection of subsets of Resources is needed, query parameters shall be used.
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NOTE 9 See [Table 8](#).

Table 8 — Examples of query parameters for subsets expresses REQ_04_02_15 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}?{id}={ID}
	{baseURI}/{entities}?{id}={ID}&{id2}={ID2}
Example	{baseURI}/vehicles?id=123&id=124
	{baseURI}/vehicles?id=YS2RX20001754836

Identifiers may come in multiple formats including, but not limited to, VIN or pseudonymized IDs.

REQ_04_02_16	Pseudonymized IDs may be simple numerical IDs, GUIDs or any other alphanumeric scheme.
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NOTE 10 See [Table 9](#).

Table 9 — Examples of pseudonymized IDs represented by numerical IDs expresses REQ_04_02_16 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}?{id}={ID}
	{baseURI}/{entities}?{id}={ID}&{id2}={ID2}
Example	{baseURI}/vehicles?id=ce5d5e3d-28bc-475f-8ef7-b5cb9c8039d4&id=f95ce756-42fc-48b2-8873-86553f6df5cc
	{baseURI}/vehicles?id=456

REQ_04_02_17	For large Resource responses pagination may be used.
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NOTE 11 See [Table 10](#).

Table 10 — Examples of pagination expresses REQ_04_02_17 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}?start={value}&limit={count}
Example	{baseURI}/vehicles?start=20&limit=10

REQ_04_02_18	A GET request on the returned location may return the total amount of results. If used, it shall be part of the message body using the keyword "exveTotal".
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The following example expresses REQ_04_02_18:

<pre>{ "results": { "exveTotal": "150", ... } }</pre>

REQ_04_02_19	If wildcards are used, a wildcard (*) shall access all sub-entities or Resources of all parent entities.
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NOTE 12 See [Table 11](#).

Table 11 — Examples of wildcards in URIs expresses REQ_04_02_19 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}/*/ {entities2}
Example	{baseURI}/vehicles/*/positions Get all positions for all vehicles.
	{baseURI}/vehicles/*/ecus Get all ECU's of all vehicles.

REQ_04_02_20	If wildcards are used, a wildcard (*) may be combined with other filtering, including IDs, to access a smaller number of entities.
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NOTE 13 See [Table 12](#).

Table 12 — Examples of wildcards in URIs while filtering by IDs expresses REQ_04_02_20 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}*/{resource}?{id}={ID}&{id2}={ID2}&{filter}={filterValue}&{-filter2}={filterValue2}
Example	{baseURI}/vehicles/*/odometers?id=456&id=789&startDate=...&endDate=... Get all odometer values from vehicles with id 456 and 789 registered within the given time span.

REQ_04_02_21	For fully anonymized Access, no entity IDs shall be used in the URIs.
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NOTE 14 See [Table 13](#).

Table 13 — Examples of an anonymized Access expresses REQ_04_02_21 and REQ_04_02_01

Normative generic format	{baseURI}/{entities}/{entities2}
Example	{baseURI}/vehicles/hazardWarnings?isActive=true

4.3 HTTP Header Fields

REQ_04_03_01	A client shall send a Host header field in all HTTP/1.1 request messages, see RFC 7230[8].
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NOTE 1 The server name is the same as the “Host” name as outlined in the extended vehicle URI format; see [Table 1](#).

REQ_04_03_02	The HTTP request header fields “Authorization” shall be present in every client HTTP request.
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REQ_04_03_03	The HTTP request header field “Accept” shall identify the media type the client accepts in the response from the server.
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REQ_04_03_04	The HTTP response header field “Content-Type” shall be present in every server HTTP response with content.
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REQ_04_03_05	The HTTP request header field “Authorization” shall use the “Bearer” authentication scheme to transmit a token.
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NOTE 2 The generation, format and use of the token is further specified in ISO 20078-3.

4.4 Media Types

REQ_04_04_01	The Media type: application/json; utf-8 should be supported in HTTP request and response messages
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REQ_04_04_02	Media types that may be supported in HTTP request and response messages are: <ul style="list-style-type: none"> — text/plain; utf-8, — text/xml; utf-8.
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REQ_04_04_03	At least one media type shall be selected when requesting data.
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4.5 Resource Versioning

REQ_04_05_01	The Resource versioning shall be done on Resource level.
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REQ_04_05_02	The API versioning may be done in the URL.
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REQ_04_05_03	If Resource versioning is used, Resource versions shall be identified by custom media types included in the request and response header fields “Accept” and “Content-Type”
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EXAMPLE Media types indicating Resource versions, when versioning on Resource level:

- application/x.exve.usecase-resource.positions.v2+json; charset=utf-8,
- application/x.exve.usecase-resource.v1+json ; charset=utf-8.

REQ_04_05_04	The syntax of the custom media type shall be: application/x.exve.{usecase-resource}.{resource version}+ {requested return format}; charset=utf-8
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NOTE 1 The use case resource with path is a unique path + name for the Resource type.

NOTE 2 The Resource version is the version of the Resource that the client wants to be returned. It does not have to be the latest available on the server, but the latest the client can handle.

NOTE 3 The requested return format is the format the client wants to have the response in (e.g. json, xml), following REQ_04_05_01.

NOTE 4 The character encoding is utf-8.

REQ_04_05_05	Available versions for each Resource shall be documented in the use case specific Resources.
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REQ_04_05_06	If no version is defined in the accept header, the latest version shall be returned.
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