
1 Bindings for OBIX: Web Socket Bindings Version 1.0

2 Working Draft 06 29 October 2013

3 Technical Committee:

4 OASIS Open Building Information Exchange (OBIX) TC

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9 Additional artifacts:

10 None

11 Related work:

12 This specification is related to:

- 13 • *OBIX Version 1.1*. Latest version. [http://docs.oasis-open.org/obix/obix/v1.1/obix-](http://docs.oasis-open.org/obix/obix/v1.1/obix-v1.1.html)
- 14 [v1.1.html](http://docs.oasis-open.org/obix/obix-v1.1/obix-v1.1.html).
- 15 • *Encodings for OBIX: Common Encodings Version 1.0*. Latest version. [http://docs.oasis-](http://docs.oasis-open.org/obix/obix-encodings/v1.0/obix-encodings-v1.0.html)
- 16 [open.org/obix/obix-encodings/v1.0/obix-encodings-v1.0.html](http://docs.oasis-open.org/obix/obix-encodings/v1.0/obix-encodings-v1.0.html).
- 17 • *Bindings for OBIX: REST Bindings Version 1.0*. Latest version. [http://docs.oasis-](http://docs.oasis-open.org/obix/obix-rest/v1.0/obix-rest-v1.0.html)
- 18 [open.org/obix/obix-rest/v1.0/obix-rest-v1.0.html](http://docs.oasis-open.org/obix/obix-rest/v1.0/obix-rest-v1.0.html).
- 19 • *Bindings for OBIX: SOAP Bindings Version 1.0*. Latest version. [http://docs.oasis-](http://docs.oasis-open.org/obix/obix-soap/v1.0/obix-soap-v1.0.html)
- 20 [open.org/obix/obix-soap/v1.0/obix-soap-v1.0.html](http://docs.oasis-open.org/obix/obix-soap/v1.0/obix-soap-v1.0.html).

21 Declared XML namespaces:

- 22 • <http://docs.oasis-open.org/obix/ns/2013>

23 Abstract:

24 This document specifies WebSocket binding for OBIX.

25 Status:

26 This [Working Draft](#) (WD) has been produced by one or more TC Members; it has not yet been
27 voted on by the TC or [approved](#) as a Committee Draft (Committee Specification Draft or a
28 Committee Note Draft). The OASIS document [Approval Process](#) begins officially with a TC vote
29 to approve a WD as a Committee Draft. A TC may approve a Working Draft, revise it, and re-
30 approve it any number of times as a Committee Draft.

31 Initial URI pattern:

32 <http://docs.oasis-open.org/obix/obix-websocket/v1.0/csd01/obix-websocket-v1.0-csd01.doc>

33 (Managed by OASIS TC Administration; please don't modify.)

34

35

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1 Introduction

All text is normative unless otherwise labeled.

1.1 Terminology

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 [RFC2119](#).

1.2 Normative References

- [\[RFC2119\]](#) Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997. <http://www.ietf.org/rfc/rfc2119.txt>.
 - [\[OBIX\]](#) *OBIX version 1.1*, 8 July 2013. OASIS Committee Specification Draft 01, <http://docs.oasis-open.org/obix/obix/v1.1/csd01/obix-v1.1-csd01.doc>
 - [\[OBIX Encodings\]](#) *Encodings for OBIX Version 1.0*, 8 July 2013. OASIS Committee Specification Draft 01, <http://docs.oasis-open.org/obix/obix-encodings/v1.0/csd01/obix-encodings-v1.0-csd01.doc>
 - [\[OBIX REST\]](#) *Bindings for OBIX: REST Bindings Version 1.0*, 22 February 2013. 8 July 2013. OASIS Committee Specification Draft 01, <http://docs.oasis-open.org/obix/obix-rest/v1.0/csd01/obix-rest-v1.0-csd01.doc>.
 - [\[RFC3986\]](#) Berners-Lee, T., Fielding, R., Masinter, L., "Uniform Resource Identifier (URI): Generic Syntax", IETF RFC 3986, January 2005. <http://www.ietf.org/rfc/rfc3986.txt>.
 - [\[RFC6455\]](#) Fette, I Melnikov, A, "The WebSocket Protocol", IETF RFC 6455, December 2011. <http://www.ietf.org/rfc/rfc6455.txt>.
 - [\[SOA-RM\]](#) *Reference Model for Service Oriented Architecture 1.0*, October 2006. OASIS Standard. <http://docs.oasis-open.org/soa-rm/v1.0/soa-rm.pdf>
- [WEB IDL?](#)

1.3 Non-Normative References

- [\[Reference\]](#) [Full reference citation]

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114 2 WebSocket Binding

115 The WebSocket binding specifies a simple mapping of OBIX requests to WebSocket. After connecting to
116 endpoint URL and switching to the WebSocket protocol, OBIX messages can be exchanged
117 continuously.

118 2.1 Requests

119 The following table describes the mapping of OBIX request and its WebSocket equivalent. As WebSocket
120 is a message-based protocol it cannot be mapped directly, but as OBIX messages contain naming the
121 messages can be send also using this kind of protocol. For more details regarding the request flow see
122 the sections below.

OBIX Request	WebSocket	Target
Read	After connect use WatchService functionality to subscribe to objects and read their state	Lobby (single point of WebSocket connection)
Write	Send a obix:Request message containing an obj	Any object with an href and writable=true
Invoke	Send a obix:Request message containing op element holding input parameters as children, expecting obix:Response message with corresponding request ID as response.	Any op object with an href (especially Watch)
Delete	If an object has an delete operation defined this operation is used	Any object with delete operation

123 2.1.1 Connect request

124 The connect URL is the name or IP of the OBIX server prefixed by the WebSocket protocol, i.e. either
125 "ws" or "wss" for a secure connection using TLS. If the server supports multiple encodings a client MAY
126 request the encoding with the "encoding" parameter on connect (e.g. "wss://myhome/?encoding=json"), if
127 not specified the server uses its default encoding (it is recommend to support XML encoding as default).
128 The response send to client upon successful connection MUST be the Lobby object.

129 2.1.2 Request, Response and Update messages

130 To ensure that a request and response in the asynchronous message exchange of WebSocket is bound
131 together the concept of a request with a defined request ID (denoted as attribute "rid") is introduced. A
132 response to a request contains that specific request ID so that the client can match the request and
133 response. If the server sends a message without the request and response context it uses the Update
134 type to denote this case.

135 Following are the contract definitions of Request, Response and Update:

```
136  
137 <obj href="obix:Request">  
138 </obj>  
139  
140 <obj href="obix:Response">  
141 </obj>  
142  
143 <obj href="obix:Update">  
144 </obj>
```

146 For obix:Request and obix:Response there is a facet "rid" defined as xs:int, which MUST be included (e.g.
147 the attribute can have the value ws:rid="1" to denote the request ID 1. The obix:Request, obix:Response
148 and obix:Update objects MUST not be empty but contain an obj or list. [Here an example for a request](#)
149 [object](#):

```
150  
151 <obj is="obix:Request" rid="1">  
152 <obj href="/device/BrightnessSensor" name="BrightnessSensor" location="Outside"  
153 is="gateway:Brightness" displayName="Brightness Outside">  
154 <real name="value" val="45.5" unit="obix:units/lux" />  
155 </obj>  
156 </obj>
```

157 2.1.3 Watch creation

158 As WebSocket follows a message exchange pattern the REST-style of OBIX needs to be represented
159 differently. For that extensive use is made of the "Watch" concept. After a successful connection to the
160 OBIX server the client can add a "Watch" to subscribe to object changes. This can be done using the
161 make operation on the WatchService object, which is defined in section 11.1 [in \[OBIX\]](#).

162 WatchService.make, when invoked in the context of a WebSockets session, behaves the same than
163 when invoked with an ordinary OBIX session, with following different behavior to be noted:

- [Change events are sent by the server directly to the client directly as unsolicited updates.](#)

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- 170 • The lease time property is not used (as there is an underlying WebSocket timeout).
- 171 • The watch is removed upon the close of the WebSocket session (or upon explicit client
- 172 request through Watch.delete).
- 173 • The watch remains active without the need for the client to invoke pollChanges or
- 174 pollRefresh.
- 175 • Invocation of pollChanges by the client will return an empty list.

176 An OBIX Server that provides a watch in the context of a WebSocket connection MUST provide three
 177 additional properties for configuring the watch behavior, described below. The contract for a watch that
 178 supports connection via WebSockets is:

```

179 <obj href="obix:Watch">
180   <retime name="lease" min="PT0S" writable="true"/>
181   <retime name="unsolicitedBufferDelay" min="PT0S" writable="true"/>
182   <int name="maxBufferedEvents"/>
183   <enum name="bufferHandling" range="/enums/ViolateLifoFifo" />
184   <op name="add" in="obix:WatchIn" out="obix:WatchOut"/>
185   <op name="remove" in="obix:WatchIn"/>
186   <op name="pollChanges" out="obix:WatchOut"/>
187   <op name="pollRefresh" out="obix:WatchOut"/>
188   <op name="delete"/>
189 </obj>
  
```

190 The range for bufferHandling is defined as following:

```

191 <list is="obix:Range" href="/enums/ViolateLifoFifo">
192   <obj name="violate" displayName="Violate buffer delay property" />
193   <obj name="LIFO" displayName="Use buffer as last in first out" />
194   <obj name="FIFO" displayName="Use buffer as first in first out" />
195 </list>
  
```

196 Following three properties were added:

- 197 - **unsolicitedBufferDelay**: The interval contract for unsolicitedBufferDelay is the period of time for
 198 which any events on watched objects will be buffered before being sent by the server in an
 199 Update. Clients must be able to regulate the flow of messages from the server. A common
 200 scenario is an OBIX client application on a mobile device where the bandwidth usage is
 201 important; for example, a server sending updates every 50 milliseconds as a sensor value jitters
 202 around will cause problems. On the other hand, server devices may be constrained in terms of
 203 the available space for buffering changes. Servers are free to set a maximum value on
 204 unsolicitedBufferDelay through the max Facet to constrain the maximum delay before the server
 205 will report events.
- 206 - **maxBufferedEvents**: Servers may also use the maxBufferedEvents property to indicate the
 207 maximum number of events that can be retained before the buffer must be sent to the client to
 208 avoid missing events.
- 209 - **bufferHandling**: Defines the handling of the buffer on the server side when the buffer runs over. A
 210 value of "violate" means that the unsolicitedBufferDelay property is violated in this case and the
 211 events are sent to free the buffer, a value of "LIFO" or "FIFO" does not trigger sending of the
 212 events but specifies how the buffer content shall be treated.

213 Note that unsolicitedBufferDelay MUST be writable by the client, as the client capabilities typically
 214 constrain the bandwidth usage, whereas maxBufferedEvents is typically constrained by server
 215 capabilities, and is therefore not generally writable by clients.

216 For a Watch object which was created during a WebSocket session the existing Watch operations keep
 217 the same semantics:

- 218 1. Watch.add: adds an object to the watch
- 219 2. Watch.remove: removes an object from the watch

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Comment [1]: I'm wondering if it might be better to define a new type, obix:WsWatch, which derives from obix:Watch, but adds these two additional properties. This might be a little cleaner from the standards doc perspective. However, it would probably make it harder to allow smooth transfer of a watch from WebSockets to non-WebSockets or vice-versa (per Toby's use case from TC discussion 2013-10-17). The other option, which we sort of hinted at, was moving this into the core – we could make these default to null="true" unless used in the context of a WebSocket connection.

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- 239 3. Watch.pollChanges: a no-op as the updates are send continuously and the Watch is kept open
- 240 until the WebSocket session closes
- 241 4. Watch.pollRefresh: returns all objects in the current state (even the client should have the current
- 242 state already)
- 243 5. Watch.delete: deletes the watch

244 2.1.4 Continuous Updates

245 As long as the connection is open the server MUST send (i.e. push) obix:Update messages to the client if
 246 a property of the watched objects is changed. That ensures that the client has a consistent state with the
 247 server.

248 2.1.5 Example Request Flow

249 The request and response flow below shows an example of WebSocket exchanges in the XML encoding
 250 style:

251 *1. Client initiates connection with server for subsequent data exchange, e.g. to wss://myhome*



2. Server sends message containing the OBIX Lobby in response to connection from Client



```
<obj is="obix:Lobby">
  <ref name="about" is="obix:About"/>
  <op name="batch" in="obix:BatchIn" out="obix:BatchOut"/>
  <ref name="watchService" is="obix:WatchService"/>
  <ref name="device" href="/device/" is="gateDevice"/></ref>
</obj>
```

3. Client sets up a watch service on the server with calling the WatchService.make operation:

```
<obj is="obix:Request" rid="1">
  <op name="make" href="watchService" />
</obj>
```

4. Server sends message in response to "watch service" message from Client (the lease time is not used):

```
<obj is="obix:Response" rid="1">
  <obj is="obix:Watch" href="/watch/1">
    <reltime name="lease" val="PT0S" />
  </obj>
</obj>
```

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</obj>

5. Client adds default devices to established watch service calling Watch.add operation for /device/:

```
<obj is="obix:Request" rid="2">
  <op name="add" is="obix:Watch" href="/watch/1">
    <obj is="obix:WatchIn">
      <list names="hrefs">
        <uri val="/device/" />
      </list>
    </obj>
  </op>
</obj>
```

6. Server sends message in response to "add device" message from Client

```
<obj is="obix:Response" rid="2">
  <list name="device" of="obj">
    <obj href="/device/bathTemp" name="BathTemperature" location="Bathroom"
      is="gateway:Temperature" displayName="Temperature Bathroom">
      <abstime name="Timestamp" val="2013-07-24T10:01:15.883+02:00"></abstime>
      <real name="ActualValue" val="28.2" unit="obix:units/celsius"
        displayName="ActualValue"></real>
      <bool name="Warm" val="true" displayName="Warm"></bool>
    </obj>
    <obj href="/device/bathLight" name="BathLight" location="Bathroom" is="gateway:Switch"
      displayName="Light Bathroom">
      <abstime name="Timestamp" val="2013-07-14T22:25:31.331+02:00"></abstime>
      <bool name="Status" val="false" displayName="Status" writeable="true"></bool>
    </obj>
  </list>
</obj>
```

7. Client removes established default devices from an established watch service with calling Watch.remove operation for /device/:

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```

<obj is="obix:Request" rid="3">
  <op name="remove" is="obix:Watch" href="/watch/2">
    <obj is="obix:WatchIn">
      <list names="hrefs">
        <uri val="/device/" />
      </list>
    </obj>
  </op>
</obj>

```

Server does not send out any message upon reception of "watch remove" message from Client
 Removed successfully, no response

8. Client adds first device with ability to watch for changes, but that device has no changes that occur.

```

<obj is="obix:Request" rid="4">
  <op name="add" is="obix:Watch" href="/watch/1">
    <obj is="obix:WatchIn">
      <list names="hrefs">
        <uri val="/device/bathTemp" />
      </list>
    </obj>
  </op>
</obj>

```

9. Server sends message in response to "add device" message from Client (bathTemp information within the WatchOut object):

```

<obj is="obix:Response" rid="4">
  <obj is="obix:WatchOut" href="/watch/1">
    <list names="values">
      <obj href="/device/bathTemp" name="BathTemperature" location="Bathroom"
        is="gateway:Temperature" displayName="Temperature Bathroom">
        <abstime name="Timestamp" val="2013-07-24T10:01:15.883+02:00"></abstime>
        <real name="ActualValue" val="28.2" unit="obix:units/celsius"
          displayName="ActualValue"></real>
        <bool name="Warm" val="true" displayName="Warm"></bool>
      </obj>
    </list>
  </obj>

```

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</obj>
</obj>

10. Client sends message on its own timing after having received the "device information" message from Server

<obj is="obix:Request" rid="5">
 <op name="pollChanges" is="obix:Watch" href="/watch/1" />
</obj>

11. Server sends message in response to "watch poll changes" message from Client, sends empty response as the state is current:

<obj is="obix:Response" rid="5">
</obj>

12. To keep the WebSocket session open Client sends an empty WebSocket frame like e.g. ⁴⁷⁷

Server does not send out any message upon reception of empty WebSocket messages from Client

13. Client adds second device with ability to watch for changes, and that device has changes that occur

<obj is="obix:Request" rid="6">
 <op name="add" is="obix:Watch" href="/watch/1">
 <obj is="obix:WatchIn">
 <list names="hrefs">
 <uri val="/device/kitchenTemp" />
 </list>
 </obj>
 </op>
</obj>

14. Server sends message in response to "add device" message from Client containing the current object:

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```

<obj is="obix:Response" rid="6">
  <obj is="obix:WatchOut" href="/watch/1">
    <list names="values">
      <obj href="/device/kitchenTemp" name="KitchenTemperature" location="Kitchen"
        is="gateway:Temperature" displayName="Temperature Kitchen">
        <abstime name="Timestamp" val="2013-07-24T10:01:15.883+02:00"></abstime>
        <real name="ActualValue" val="26.1" unit="obix:units/celsius"
          displayName="ActualValue"></real>
        <bool name="Warm" val="true" displayName="Warm"></bool>
      </obj>
    </list>
  </obj>
</obj>

```

A period of some minutes has elapsed during this time slot

15. *Server sends message after 2 minutes from previous message as an update from the temperature sensor was received (note: this is in unsolicited update message);*

```

<obj is="obix:Update">
  <obj is="obix:WatchOut" href="/watch/1">
    <list names="values">
      <obj href="/device/kitchenTemp" name="KitchenTemperature" location="Kitchen"
        is="gateway:Temperature" displayName="Temperature Kitchen">
        <abstime name="Timestamp" val="2013-07-24T10:03:15.883+02:00"></abstime>
        <real name="ActualValue" val="26.2" unit="obix:units/celsius"
          displayName="ActualValue"></real>
        <bool name="Warm" val="true" displayName="Warm"></bool>
      </obj>
    </list>
  </obj>
</obj>

```

16. *Client sends a message on its own timing to update the bathLight device:*

```

<obj is="obix:Request" rid="7">
  <obj href="/device/bathLight" name="BathLight" location="Bathroom" is="gateway:Switch"
    displayName="Light Bathroom">
    <bool name="Status" val="true" displayName="Status" writeable="true"></bool>
  </obj>
</obj>

```

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</obj>

Server does not send out any message upon reception of "update" messages from Client as not watched

17. Client disconnects from wss://myhome/

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Comment [8]: Is there no acknowledgement of removal?

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Comment [9]: Does the client need to wait for the response from the Server here?

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256 **2.2 Security**

257 Existing standards SHOULD be used when applicable for OBIX WebSocket implementations including:

- 258 • RFC 4346/2246 – The TLS Protocol (Transport Layer Security)

259 **2.3 Localization**

260 Servers SHOULD localize appropriate data based on the desired locale of the client agent. Localization
261 SHOULD include the `display` and `displayName` attributes. The desired locale of the client SHOULD
262 be determined through authentication. A suggested algorithm is to check if the authenticated user has a
263 preferred locale configured in the server's user database.

264 Localization MAY include auto-conversion of units. For example if the authenticated user has configured
265 a preferred unit system such as English versus Metric, then the server might attempt to convert values
266 with an associated `unit` facet to the desired unit system.

267 3 Conformance

268 An implementation is conformant with this specification if it satisfies all of the MUST and REQUIRED level
269 requirements defined herein for the functions implemented. Normative text within this specification takes
270 precedence over normative outlines, which in turn take precedence over examples.

271 An implementation is a conforming OBIX Server [supporting WebSocket](#) if it meets the conditions
272 described in Section 3.1. An implementation is a conforming OBIX Client [supporting WebSocket](#) if it
273 meets the conditions described in Section 3.2. An implementation is a conforming OBIX Server
274 [supporting WebSocket](#) and a conforming OBIX Client [supporting WebSocket](#) if it meets the conditions of
275 both Sections 3.1 and 3.2.

276 3.1 Conditions for conforming OBIX Server [supporting WebSocket](#)

- 277 1. An OBIX server [supporting WebSocket](#) must conform to an OBIX server as defined in **JOBIX**.
- 278 2. An OBIX server [supporting WebSocket](#) MUST accept WebSocket connections and MUST return
279 the Lobby object on successful connection.
- 280 3. An OBIX server [supporting WebSocket](#) MUST support the make operation of the
281 obix:WatchService object.
- 282 4. An OBIX server [supporting WebSocket](#) MUST support the obix:Request, obix:Response and
283 obix:Update contracts and return the request id "rid" within the obix:Response object.

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284 3.2 Conditions for conforming OBIX Client [supporting WebSocket](#)

- 285 1. An OBIX client [supporting WebSocket](#) must conform to an OBIX client as defined in **JOBIX**.
- 286 2. A conformant OBIX client [supporting WebSocket](#) must support WebSocket connections and the
287 request flow as stated in Section 2.1.
- 288 3. A conformant implementation MUST generate request IDs for each obix:Request message

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290 **Appendix A. Acknowledgments**

291 The following individuals have participated in the creation of this specification and are gratefully
292 acknowledged:

293 **Participants:**

294 Gareth Johnson, Tridium Inc.

295 Craig Gemmil, Tridium Inc.

296 [Ludo Bertsch, CABA](#)

297

Appendix B. Revision History

Revision	Date	Editor	Changes Made
WD01	1-Aug-2013	Matthias Hub	Initial submission
WD02	8-Aug-2013	Toby Considine	Moved to standard template, added some normative references
WD03	13-Aug-2013	Matthias Hub	Incorporated review comments by Gareth Johnson
WD04	15-Oct-2013	Matthias Hub	Incorporated review comments from TC: removed separate watch concept – instead re-using standard watch concept, added definition of Watch properties
WD05	18-Oct-2013	Matthias Hub	Incorporated Craig Gemmill input to Watches
WD06	29-Oct-2013	Ludo Bertsch	Improved example in Section 2.1.5
WD07	30-Oct-2013	Matthias Hub	Updated Terminology section Added bufferHandling property to the Watch Changed request / response flow style in the example Updated conformance section for different naming and to refer to the core spec

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