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The BLE (Bluetooth Low Energy) URI Scheme and Media Types  
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## Abstract

In addition to its use as a subnetwork layer for IP (e.g., via [RFC 7668](#)), in various IoT web applications Bluetooth Low Energy (BLE) can serve as a "local interconnect", connecting devices locally (i.e., not over IP) for use as a source of information and a target for actuation. In order to fully use these capabilities in applications using web technologies, there is a need for a method for addressing the resources, i.e., a URI scheme, and definition of the representation of the data exchanged between the application and devices, i.e., media types. This document is a straw man proposal for such a URI scheme and media types for interacting with the Bluetooth GAP and GATT protocols.

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Internet-Draft

concert

July 2016

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## Table of Contents

<a href="#">1.</a>	Introduction . . . . .	<a href="#">2</a>
<a href="#">1.1.</a>	Terminology . . . . .	<a href="#">3</a>
<a href="#">2.</a>	Access to local resources via Bluetooth Low Energy . . . . .	<a href="#">3</a>
<a href="#">3.</a>	Media types . . . . .	<a href="#">5</a>
<a href="#">3.1.</a>	application/ble-nodelist . . . . .	<a href="#">5</a>
<a href="#">3.2.</a>	application/ble-gap-enablement . . . . .	<a href="#">6</a>
<a href="#">3.3.</a>	application/ble-gap-nameinfo . . . . .	<a href="#">6</a>
<a href="#">3.4.</a>	application/ble-gatt-servicelist . . . . .	<a href="#">6</a>
<a href="#">3.5.</a>	application/ble-gatt-characteristics . . . . .	<a href="#">6</a>
<a href="#">4.</a>	References . . . . .	<a href="#">7</a>
<a href="#">4.1.</a>	Normative References . . . . .	<a href="#">7</a>
<a href="#">4.2.</a>	Informative References . . . . .	<a href="#">8</a>
	Authors' Addresses . . . . .	<a href="#">8</a>

## [1.](#) Introduction

In the context of the W3C Web of Things (WoT) Interest Group work, the need to address both resources connected over the Internet of Things and those connected over a "local interconnect" has been raised. The present document is a straw man proposal for a URI format addressing the latter kind, using the example of the Bluetooth GAP and GATT protocols.

The Bluetooth GAP and GATT REST API white papers [[BT-GAP-REST](#)] [[BT-GATT-REST](#)] describe how an HTTP gateway can be used for interacting with Bluetooth devices and their resources over the Internet, using HTTP. If a Bluetooth device is IP-enabled (e.g., [[RFC7668](#)]), also regular IP protocols (e.g., CoAP) and URI schemes can be used for end-to-end communication. When a web application is running on a Bluetooth device, or the Bluetooth device is directly connected to the same device where the web application is running, IP communication is not always necessary but a mechanism for addressing the resources is still needed. This document specifies a URI scheme

for addressing such locally connected Bluetooth resources and functionality.

In addition to locally connected resources, a BLE URI scheme can be used to address resources on a remote host that implements a proxy

Internet-Draft

concert

July 2016

supporting both the BLE scheme and another scheme that is possible to use over a network (e.g., HTTP or CoAP).

The focus of this document is on interaction with the attributes and characteristics that would be exposed as resources for an IoT web application. That is, functionality such as being able to create synchronous audio connection with a Bluetooth headset is out of scope.

(Note that the version you are looking at is less than half-way complete. We plan to fill in the rest of the proposal after receiving some initial feedback about the general approach.)

## [1.1](#). Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [RFC2119].

GAP and GATT are protocols defined in [[BTCorev4.2](#)].

Terminology for constrained nodes and constrained node networks can be found in [[RFC7228](#)].

In this specification, the term "byte" is used in its now customary sense as a synonym for "octet".

All multi-byte integers in this specification are interpreted in network byte order.

Enabled nodes: Nodes that have been configured for automatic connection (and reconnection each time a connection is lost).

## [2](#). Access to local resources via Bluetooth Low Energy

For GAP, clients operating in the GAP Central and Observer roles [BTCorev4.2] are supported. Security setup ("pairing") and the specifics of link encryption are out of scope for this version of the present document. Specifically, there is an assumption that any necessary access control to nodes and resources on these nodes is performed when the URIs defined in this document are operated.

The following URIs are predefined:

URI	Semantics	Op.	Result
ble:/gap/nodes/passive	passive scan for nodes	GET	(1)
ble:/gap/nodes/active	active scan for nodes	GET	(1)
ble:/gap/nodes/enabled	scan for enabled nodes	GET	(1)
ble:/gatt/nodes	list of available nodes	GET	(2)

The GAP operations return gap node links, operations on which are detailed below. The implementation is free to choose the form of these node links, e.g. from the template "ble:/gap/node/{handle}".

URI	Semantics	Op.	Result
{node}	Information about node {node}	GET	(1)
{node}/enable	Enablement of {node}	PUT	(3)
{node}/name	Name of {node}	GET	(4)

The above GATT operations return gatt node links, operations on which are detailed below. Again, the implementation is free to choose the form of these node links, e.g. from the template "ble:/gatt/

node/{handle}". [[twotypes: Do we really need two types of node links or are the GAP and GATT ones possibly interchangeable?]]

URI	Semantics	Op.	Result
{node}/services	Services offered by {node}	GET	(5)

The above GATT operations return gatt service links, operations on which are detailed below. Again, the implementation is free to choose the form of these node links, e.g. from the template "ble:/gatt/service/{nodehandle}/{servicehandle}". [[nodesvsservices: In the current draft, it is not always clear whether a node leads to some resource or the client needs to go through a service to get there. This needs to be clarified (or possibly unified).]]

URI	Semantics	Op.	Result
{service}/secondaryservices	Secondary services for {service}	GET	(5)
{service}/characteristics	Characteristics of {service}	GET	(6)
{node}/{uuid}/characteristics	{uuid} Characteristics of {node}	GET	(6)

	media type
(1)	application/ble-nodelist+json or +cbor
(2)	application/ble-nodelist+json or +cbor, no attributes
(3)	application/ble-gap-enablement+json or +cbor

(4)	application/ble-gap-nameinfo+json or +cbor
(5)	application/ble-gatt-servicelist+json or +cbor
(5)	application/ble-gatt-characteristics+json or +cbor

-----

### 3. Media types

The media types below are tentatively defined in CDDL, for both JSON (add +json) and CBOR (add +cbor) use. Where the type "bytes" is used with JSON, the representation is a base64url [\[RFC4648\]](#) string.

[[separatemediatypes: In the next version, we might possibly move to a single media type that has a choice between all these formats.]]

#### [3.1.](#) application/ble-nodelist

```

nodelist = [* node]
node = {
  href: text, ; link to that specific node
  bdaddr: bdaddr,
  ? ad: attributelist, ; only for GAP use
}

bdaddr = bytes .size 6

attributelist = [* attribute] ; could this be a map?
attribute = [attributename, bytes]
attributename = text

```

#### [3.2.](#) application/ble-gap-enablement

```

enablement = {
    enabled: bool,
    ? interval: uint,    ; define what unit
    ? latency: uint,    ; define what unit
}

```

### [3.3.](#) application/ble-gap-nameinfo

```

node = {
    href: text,    ; link to that specific node
    name: text,
}

```

### [3.4.](#) application/ble-gatt-servicelist

```

servicelist = [* service]
service = {
    href: text,
    uuid: uuid,
}

```

```

uuid = bytes .size 16

```

### [3.5.](#) application/ble-gatt-characteristics

```

characteristics = [* characteristic]
characteristic = {
    href: text,    ; link for this characteristic
    properties: properties,
}

```

```

properties = bytes .bits property
property = &(

```

Broadcast: 0  
Readable: 1  
Writable-with-no-response: 2  
Writable: 3  
Notify: 4  
Indicate: 5  
Authenticated-signed-write: 6  
Extended-property-available: 7  
)

## [4.](#) References

### [4.1.](#) Normative References

#### [BT-GAP-REST]

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