#)	"
Antti Virolainen	Nokia
Shailendra Sinha	Intel
Ujwal Paidipathi	Intel
Yin-Ling Liong	Nokia
Yinghua Ye	Nokia
Jose Costa-Requena	Nokia
Mika Saaranen	Nokia
Bruce Fairman	Sony

"

<pre>
                          !   "# $
    %   & !   '
                ('
)   * *   +
                             !,   +
</pre>

<pre>
          !   "!-   .   /
          O 1 ,
</pre>

<pre>
)   2   & 3   .   4 #   -   2 "
)   2   & 3   .   4 !
</pre>

*   +

'

This service definition is compliant with the UPnP Device Architecture version 1.0. [1]

This service-type enables modeling of "Basic Power Management Proxy" function capabilities. Basic Power Management Proxy (BPMPX) is a combination of UPnP service and a control point. As Control Point, Proxy discovers and controls Low Power Device services running in the network, and as UPnP Proxy service, it advertises itself to the network, and responds to actions from low power aware Control Point. [4] Basic functions that BPMPX does are as follows:

- Receive multicast discovery messages from power managed UPnP devices in order to be aware of their power states (i.e. the BPMPX will act as Control Point).

- Send multicast or unicast discovery messages (i.e. M-SEARCH) to query UPnP devices and keep track of their power states (i.e. the BPMPX will act as Control Point).

- Send GetPowerManagementInfo action to obtain power management mechanism provided by power-aware devices.

- Should send the appropriate wakeup message to the specified sleeping device when it receives WakeupDevice action from power aware Control Point. [4]

- Act as UPnP service

    o Sending BPMPX service announcements and M-Search replies.

    o Respond to SearchSleepingDevices action to provide the information of sleeping devices in network.

    o Respond to Wakeup action from Control Point. (Wake up action is directed to the low power devices and not for waking up the BPMPX)

– *   *

Unless stated otherwise herein, implementation of the mandatory provisions of any standard referenced by this specification shall be mandatory for compliance with this specification.

.   – *

This section lists the normative references used in this document and includes the tag inside square brackets that is used for each sub reference:

[1] UPnP Device Architecture, version 1.0.

[2] Extensible Markup Language (XML) 1.0 (Second Edition), T. Bray, J.Paoli, C. M. Sperberg-McQueen, E Maler, eds. W3C Recommendations, 6 October 2000.

[3] LowPowerDevice:1 Mika Saaranen, Jose Costa-Requena, Shailendra Sinha, Ujwal Paidipathi, Yin-Ling Liong, Yinghua Ye, and Bruce Fairman, etc.

%   / *   **–** *

This section lists the informative references used in this document and includes the tag inside square brackets that is used for each sub reference:

[4] UPnP Low Power Architecture. Ujwal Paidipathi, Jose Costa-Requena, Shailendra Sinha, Yin-Ling Liong, Yinghua Ye, Bruce Fairman, etc.

% #++

Table 1-1 Abbreviations

*	!
BPMPX	Basic Power Management Proxy
UUID	Universal Unique Identifier
DDDURI	Device Description Document Uniform Resource Identifier

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O $

%

The following service type identifies BPMPX service:

urn:schemas-upnp-org:service:LowPowerProxy:1

% %   +

Reader Note: For first-time reader, it may be more insightful to read the action definitions before reading the state variable definitions.

% %   !

This section defines some derived data types that are represented as UPnP string data types with special syntax.

2.2.1.1. XML Documents as UPnP Arguments

The UPnP Low Power service framework often uses XML documents as arguments in UPnP actions. The UPnP data type is a string. This places restrictions on a string's content; it has to represent a well-formed XML fragment (this includes a complete XML document).

The XML schemas used in UPnP Low Power are defined in the respective files located on `http://www.upnp.org/schemas/`

In the XML documents, implementations may use an explicit reference to appropriate name spaces.

Finally, an XML document, conforming to the UPnP V1.0 architecture [1], needs to be escaped by using the normal XML rules, defined in section 2.4 Character Data and Markup of Extensible Markup Language [2] , before embedding it in a SOAP request or response message. The XML escaping rules are summarized from the reference [2] mentioned above:

- The (<) character is encoded as (<)
- The (>) character is encoded as (>)
- The (&) character is encoded as (&)
- The (") character is encoded as (")
- The (') character is encoded as (')

+ .	– 3 ,	!	# %	! * %	4 $
A_ARG_TYPE_SearchCriteria	R	string	See section 2.2.2	N/A	N/A
A_ARG_TYPE_PowerState	R	ui1	See section 2.2.3	N/A	N/A
DeviceListInfo	R	string (XML document)	See section 2.2.4	N/A	N/A
A_ARG_TYPE_UUID	O	string	See section 2.2.5	N/A	N/A
A_ARG_TYPE_Success	O	boolean	See section 2.2.6	N/A	N/A

[1] R = Required, O = Optional, X = Non-standard.

[2] Values listed in this column are required. To specify standard optional values or to delegate assignment of values to the vendor, you must reference a specific instance of an appropriate table below.

%%% #5#-65 7 45)"

This is a string variable. Allowed values are listed below.

1. ssdp:all.

Search for all low power enabled device types.

2. **upnp:rootdevice.**

Search for low power enabled root devices only.

3. uuid: **5****

Search for particular low power enabled device. Device "UUID" specified by UPnP vendor.

4. urn:**schemas-upnp-org**:**device**:_____:_

Search for any low power enabled device with this type. Device type and version defined by UPnP forum working committee.

5. urn:**schemas-upnp-org**:**service**:_____:_ .

Search for any low power enabled device that has a service of this type. Service type and version defined by UPnP forum working committee.

6. urn: **5** :**device**:_____:_.

Search for any low power enabled device with matching domain name and this non-standard device type.

7. urn: **5**   :**service**:_____:_..

Search for any low power enabled device with matching domain name and this non-standard service type.

%%8 #5#-65 7 45

This is an integer type state variable. This variable is introduced to provide type information for the "PowerState" parameter in action "SearchSleepingDevices". Allowed values are listen in the Table 2-2.

+ %2% * #5#-65 7 45

Interested PowerState(s)	Value
Reserved for future purposes	1
Deep Sleep Online	2
Deep Sleep Online	3
Deep Sleep Offline	4
Deep Sleep Offline	5
Deep Sleep Online OR Deep Sleep Offline	6
Deep Sleep Online OR Deep Sleep Offline	7

%%9 ! / *

This is escaped XML string as specified in section 2.2.1.1. DeviceListInfo is a structure that provides information about the sleeping low power enabled devices in the network.

This variable is described by schema identified by "urn: schema-upnp-org:lp:DeviceListInfo"; and it is located at : http://www.upnp.org/schemas/DeviceListInfo.xsd.

DeviceInfo: This is a required field if there is a device with matching search criteria and power state in the proxy device list. It is defined as an XML element. A device definition is required for each matching device in the device list.

DeviceFriendlyName: This is optional field. The value is of type string and contains the device friendly name. [1]

DDDURI: This is a required field. Contains an URL to the UPnP description of the root device. Normally the host portion contains a literal IP address rather than a domain name in unmanaged networks. Specified by UPnP vendor. Single URL.

UUID: This is a required field. The field contains the Universally Unique Identifier of the device. UUIDs are 128 bit numbers that must be formatted as specified by the following grammar.

UUID   = 4*<hexOctet>"-" 2*<hexOctet>"-" 2*<hexOctet> "-" 2*<hexOctet> "-" 6*<hexOctet

 hexOctet = <hexDigit> <hexDigit>

DeviceType: This is a required field. The value is of type string and contains the device type information. For more information about device types refer to [1].

Service: This is a required field and defined as an XML element. This field describes the service of the device. A service definition is required for each service supported by the device.

ServiceType: This is required field. The value is of type string and contains service type information. For more information about service type refer to [1].

ServiceID: This is required field. The value is of type string and contains the Service Identifier. For more information about serviceID refer to [1].

EmbeddedDeviceInfo: This is an optional field and defined as an XML element. This field describes the embedded device information.

EmbeddedService: This is an optional field and defined as an XML element. This field describes the service information of embedded device.

PowerState: This is a required field. The value is an integer and contains the power state of the device. Refer to [3] and [4] for details.

SleepPeriod: This is a required field. The value is an integer and contains the sleep period of the device. Refer to [3] and [4] for details.

WakeupMethod: This is a required field and defined as an XML element. This field describes the method how to wake up the device. Refer to [3] and [4] for details.

ProxyWakeUpPossible: This is a required field. The value is of type string and contains one of the 2 values (Yes, No). This field indicates BPMPX's capabilities of waking up the device.

The sample argument XML string is presented in Appendix A.

%%: #5#-65 7 45   /!

This is a string type state variable. For more details about the data format refer to [1]. This state variable provides type of information for the "UUID" parameter in action WakeupDevice, and contains the "UUID" of the sleeping device that the low power aware control point wants to wake up.

%%; #5#-65 7 45

This is a Boolean type state variable. This state variable provides type of information for the "Success" parameter in action WakeupDevice. It contains one of the two value ("1", "0"). For more information about the Boolean data type, refer to [1].

%8 4 $ O

+   %28 4   O

+ .	4	O 4	O 4 –	$ " +	O ! 4 %
DeviceListInfo		6	6	6	6

[1] Determined by N, where Rate = (Event)/(N secs).
[2] (N) * (allowedValueRange Step).

％ 9 ＃

Immediately following this table is detailed information about action for a BPMPX, including short descriptions of the action, the effects of the action on state variables, and error codes defined by the actions.

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.	– 3 ,
！ "!- .	R
O 1 ,	O

[1]R = Required, O = Optional, X = Non-standard.

％ 9 ） $!

This action allows Low Power Aware Control Points to retrieve the list of sleeping devices that the BPMPX caches. The BPMPX returns the list of sleeping devices matching the SearchCriteria and the PowerState specified by the Low Power Aware Control Point, included in the "DeviceList" parameter. The "DeviceList" parameter may be NULL (empty string) if there is no matching device found on the BPMPX. The BPMPX only searches the information available on the interface that it used to receive the SearchSleepingDevices action.

2.4.1.1. Arguments

＋ ％2: ＃ $ ＊ ） $!

# $	！	＋
SearchCriteria	IN	A_ARG_TYPE_SearchCriteria
PowerState	IN	A_ARG_TYPE_PowerState
DeviceList	OUT	DeviceListInfo

2.4.1.2. Dependency on State (if any)

None

2.4.1.3. Effect on State (if any)

This action doesn't have any effect on the current state of the BPMPX.

2.4.1.4. Errors

＋ ％2; 4 " ＊ ） $!

4 "	4 ！	！
400-499		See UPnP Device Architecture section on Control.
500-599		See UPnP Device Architecture section on Control.

errorCode	errorDescription	Description
600-699		See UPnP Device Architecture section on Control.
701	Unsupported or invalid Search Criteria	The search criteria is not supported or is invalid
702	PowerState value is out of range	The specified value for the PowerState parameter is out of range.
703	Cannot process the request	Cannot process the request.

2.4.2. WakeupDevice

This action is used to wake up a sleeping device specified by the "UUID". After receiving wakeup action, the BPMPX will execute the appropriate wakeup method, which should be recognized by the sleeping device. If the device is in Deep Sleep Offline, the BPMPX would require using bearer dependent out of band wake up mechanism.

Success argument value "1" indicates BPMPX successfully executed the appropriate wakeup mechanism to wake up the sleeping device specified by "UUID". However there is no guarantee that device will be woken up. Value of "0" indicates BPMPX failed to execute the WakeupDevice control action.

2.4.2.1. Arguments

Table 2-8: Arguments for WakeupDevice

Argument	Direction	relatedStateVariable
Uuid	IN	A_ARG_TYPE_UUID
Success	OUT	A_ARG_TYPE_Success

2.4.2.2. Dependency on State (if any)

The supplied "UUID" has to be known by BPMPX.

2.4.2.3. Effect on State (if any)

If the action succeeds, the representation of the low power device in BPMPX will change after BPMPX receives the SSDP announcements from the device. If the action fails, the representation of the low power device in BPMPX changes to disconnected.

2.4.2.4. Errors.

Table 2-9: Error Codes for WakeupDevice

errorCode	errorDescription	Description
400-499		See UPnP Device Architecture section on Control.
500-599		See UPnP Device Architecture section on Control.
600-699		See UPnP Device Architecture section on Control.

4 "	4 !	!
704	Current BPMPX does not know the wakeup mechanism of the sleeping device.	BPMPX does not know how to wake up the device specified by "UUID".
705	Invalid "UUID" reference	The "UUID" reference argument does not refer to a valid sleeping device.
706	Device is active	The device specified by "UUID" is in active state.

%:) *,

Basic Power Management Proxy (BPMPX) is responsible for discovering Low Power devices and facilitating the discovery of Low Power device in a Low Power state by Low Power Aware Control Points in the network.

%: 1 O $ " 1)

This section briefly outlines some typical operations of embedded control point of the BPMPX:

- Discovery of the low power devices and interpretati

specific wakeup messages will be sent from BPMPX to the sleeping device. If the sleeping device is in deep sleep online state, the Wakeup action will be sent from BPMPX to the sleeping device. If the BPMPX does not get a response from the device, it may try to use the bearer specific wakeup mechanism. If BPMPX receives the action, but fails to send out message(s) to the sleeping device, the OUT argument parameter "Success" returns "0".

8 <O   !

```xml
<?xml version="1.0" encoding="utf-8"?>
<scpd xmlns="urn:schemas-upnp-org:service-1-0">
    <specVersion>
        <major>1</major>
        <minor>0</minor>
    </specVersion>
    <actionList>
        <action>
            <name>SearchSleepingDevices</name>
            <argumentList>
                <argument>
                    <name>SearchCriteria</name>
                    <direction>in</direction>
                    <relatedStateVariable>A_ARG_TYPE_SearchCriteria
                    </relatedStateVariable>
                </argument>
                <argument>
                    <name>PowerState</name>
                    <direction>in</direction>
                    <relatedStateVariable>A_ARG_TYPE_PowerState
                    </relatedStateVariable>
                </argument>
                <argument>
                    <name>DeviceList</name>
                    <direction>out</direction>
                    <relatedStateVariable>DeviceListInfo
                    </relatedStateVariable>
                </argument>
            </argumentList>
        </action>
        <action>
            <name>WakeupDevice</name>
            <argumentList>
                <argument>
                    <name>Success</name>
                    <direction>in</direction>
                    <relatedStateVariable>A_ARG_TYPE_Success
                    </relatedStateVariable>
                </argument>
                <argument>
                    <name>Uuid</name>
                    <direction>out</direction>
                    <relatedStateVariable>A_ARG_TYPE_UUID
                    </relatedStateVariable>
                </argument>
            </argumentList>
        </action>
    </actionList>
    <serviceStateTable>
        <stateVariable sendEvents="no">
            <name>A_ARG_TYPE_SearchCriteria</name>
```

```xml
            <dataType>string</dataType>
        </stateVariable>
        <stateVariable sendEvents="no">
            <name>A_ARG_TYPE_PowerState</name>
            <dataType>ui1</dataType>
            <allowedValueRange>
                <minimum>1</minimum>
                <maximum>7</maximum>
            </allowedValueRange>
     </stateVariable>
        <stateVariable sendEvents="no">
            <name>DeviceListInfo</name>
            <dataType>string</dataType>
        </stateVariable>
        <stateVariable sendEvents="no">
            <name>A_ARG_TYPE_UUID</name>
            <dataType>string</dataType>
        </stateVariable>
    <stateVariable sendEvents="no">
            <name>A_ARG_TYPE_Success</name>
            <dataType>boolean</dataType>
        </stateVariable>
    </serviceStateTable>
</scpd>
```

9

No semantic tests have been specified for this service.

$ <O $

```xml
<?xml version="1.0" encoding="UTF-8"?>
<DeviceListInfo xmlns ="http://www.upnp.org/schemas/DeviceListInfo.xsd"
xmlns:xsd="http://www.w3.org/2001/XMLSchema-instance"
xsd:schemaLocation="http://www.upnp.org/schemas/DeviceListInfo.xsd
http://www.upnp.org/schemas/lp/DeviceListInfo-v1.xsd">
        <DeviceInfo>
                <DeviceFriendlyName>Light(1USD00150)</DeviceFriendlyName>
                <DDDURI>http://172.19.165.110:59741</DDDURI>
                <UUID>c5b57696-e903-42c5-932b-77539143de50</UUID>
                <DeviceType>urn:schemas-upnp-org:device:Light:1</DeviceType>
                <Service>
                        <ServiceType>urn:schemas-upnp-org:service:SwitchPower:1
                        </ServiceType>
                        <ServiceID>urn:schemas-upnp-org:service:SwitchPower.0001
                        </ServiceID>
                </Service>
                <Service>
                        <ServiceType>urn:schemas-upnp-org:service:DimmingService:1
                        </ServiceType>
                        <ServiceID>urn:schemas-upnp-org:service:DimmingService.0001
                        </ServiceID>
                </Service>
                <EmbeddedDeviceInfo>
                        <DDDURI>http://172.19.165.110:59742</DDDURI>
                        <UUID>c5b57696-e903-42c5-932b-77539143de40</UUID>
                        <DeviceType>urn:schemas-upnp-org:device:BinaryLight:1</DeviceType>
                        <EmbeddedService>
                                <ServiceType>urn:schemas-upnp-org:service:SwitchPower:1
                                </ServiceType>
                                <ServiceID>urn:schemas-upnp-org:service:SwitchPower0001
                                </ServiceID>
                        </EmbeddedService>
                </EmbeddedDeviceInfo>
                <PowerState>4</PowerState>
                <SleepPeriod>1800</SleepPeriod>
                <ProxyWakeupPossible>Yes</ProxyWakeupPossible>
                <WakeupMethod>
                        <BearerWakeupMethod>
                                <IanaTechnologyType>71</IanaTechnologyType>
                                <WakeupPattern>0008744C7F1D0008744C7F1D0008744C7
                                F1D0008744C7F1D0008744C7F1D0008744C7F1D0008744C7
                                F1D0008744C7F1D0008744C7F1D0008744C7F1D0008744C7
                                F1D0008744C7F1D0008744C7F1D</WakeupPattern>
                                <AdditionalBearerInfo>
                                        <Address>0008744C7F1D</Address>
                                        <Bearer_Info>Adsilon</Bearer_Info>
                                </AdditionalBearerInfo>
                        </BearerWakeupMethod>
                        <NonBearerWakeupMethod>
                                <BearerType>Infrared</BearerType>
                                <VendorNonBearerInfo>Philips</VendorNonBearerInfo>
                        </NonBearerWakeupMethod>
                </WakeupMethod>
        </DeviceInfo>
        <DeviceInfo>
                <DeviceFriendlyName>Light</DeviceFriendlyName>
                <DDDURI>http://172.19.165.10:59741</DDDURI>
                <UUID>c5b57696-e903-42c5-932b-12345673de50</UUID>
                <DeviceType>urn:schemas-upnp-org:device:Light:1</DeviceType>
                <Service>
                        <ServiceType>urn:schemas-upnp-org:service:SwitchPower:1
                        </ServiceType>
                        <ServiceID>urn:schemas-upnp-org:service:SwitchPower.0001
                        </ServiceID>
                </Service>
                <Service>
                        <ServiceType>urn:schemas-upnp-org:service:DimmingService:1
                        </ServiceType>
                        <ServiceID>urn:schemas-upnp-org:service:DimmingService.0001
                        </ServiceID>
                </Service>
```

```
                    <PowerState>2</PowerState>
                    <SleepPeriod>1800</SleepPeriod>
                    <ProxyWakeupPossible>Yes</ProxyWakeupPossible>
                    <WakeupMethod>
                            <BearerWakeupMethod>
                                    <IanaTechnologyType>71</IanaTechnologyType>
                                    <WakeupPattern>000D5678664F000D5678664F000D5678664F
                                    000D5678664F000D5678664F000D5678664F000D5678664F
                                    000D5678664F000D5678664F000D5678664F000D5678664F
                                    000D5678664F000D5678664F000D5678664F000D5678664F
                                    000D5678664F</WakeupPattern>
                                    <AdditionalBearerInfo>
                                            <Address>000D5678664F</Address>
                                    </AdditionalBearerInfo>
                            </BearerWakeupMethod>
                    </WakeupMethod>
            </DeviceInfo>
</DeviceListInfo>
```