

Hibernation and the Non-Pageable Device

Document Objective

This document provides the ULE Host Application designer with instructions how to place a non-pageable ULE Device into hibernation via the CMND API. To prolong battery lifetime, it is always desirable to return the ULE Device to hibernation. The Application Designer must account for two responses from a ULE Device when it requests the Device to enter hibernation:

- 1) Device enters hibernation immediately
- 2) Device delays entry into hibernation because it is expecting a message from the Hub

Data Flows and Simulation Logs are provided in the following sections to highlight design strategies allowing the Host Application to successfully deal with these scenarios. For more detailed definition of the CMND API flows see the [han-ule-device-cmnd-api-spec](#)

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Change Log

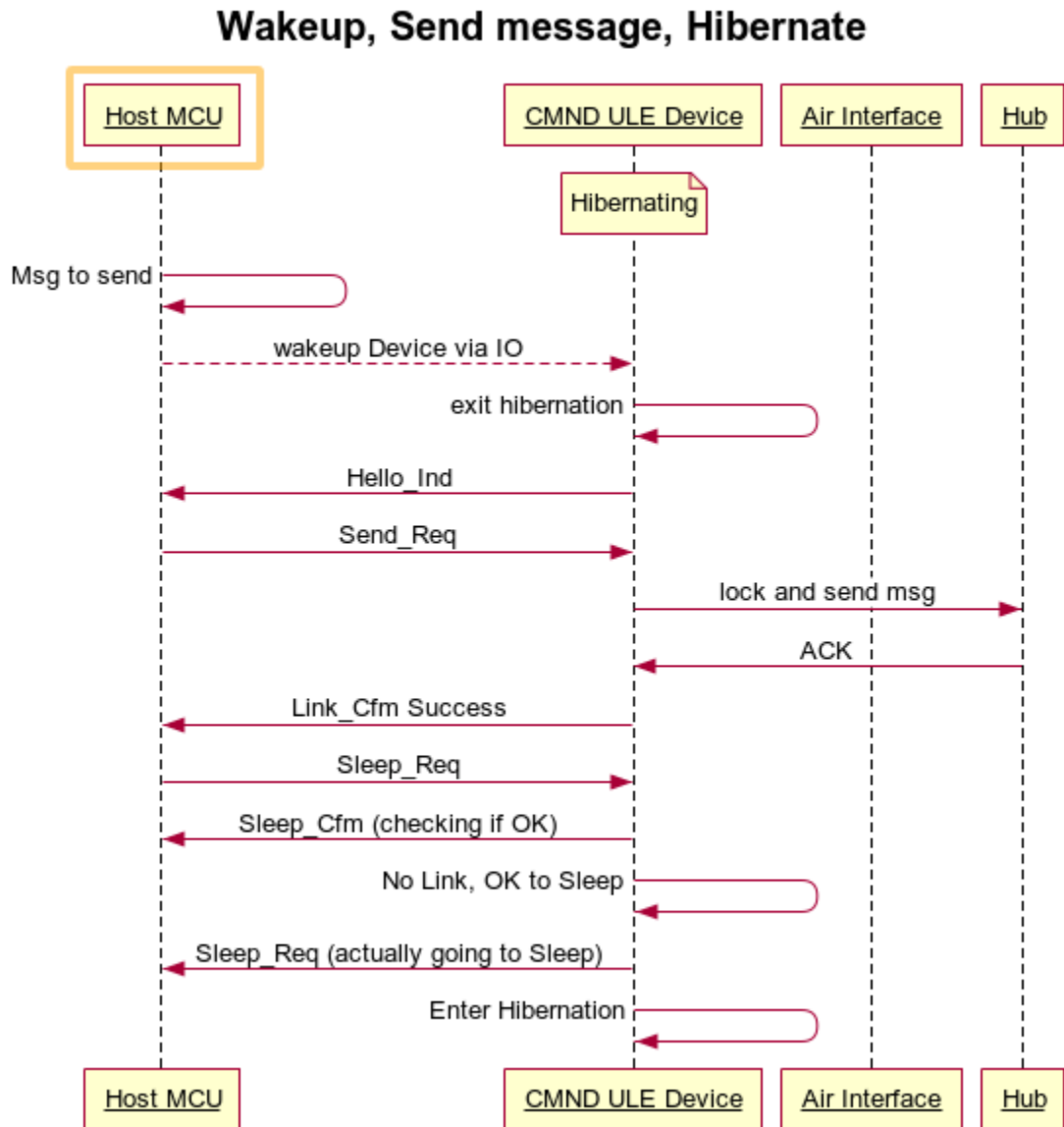
Table 0-1: List of Changes

REVISION	DATE	DESCRIPTION
1.0	November 19, 2018	Baseline release
1.1	December 17, 2018	simulator full log swapped to match the shorthand message Log

ULE Device Hibernates Immediately

Typically, when the Application Host instructs the ULE Device (via CMND API) to hibernate, it will first acknowledge the request (indicating only that it received the request and will make a try) and then confirm that that it is going to sleep. Data flows and simulator logs for this scenario are shown below.

Data Flow



Device Simulator Logs

Short hand Log

Messages Log						
Time	TX/RX	Length	Service Id	Message Id	Unit Id	IE Parsed
15:13:52:467	CMND->MCU:	10	Sleep<0204>	enter_sleep_req<01>	00	
15:13:52:466	CMND->MCU:	10	Sleep<0204>	enter_sleep_cfm<02>	00	
15:13:52:425	MCU->CMND:	14	Sleep<0204>	enter_sleep_req<01>	00	CMND_IE_SLEEP_INFO<0x07> len<1> val<00>
15:13:40:705	CMND->MCU:	14	General<0000>	link_cfm<07>	01	CMND_IE_RESPONSE<0x00> len<1> val<success>
15:13:40:609	MCU->CMND:	10	Keep alive<0104>	i_am_alive_req<01>	01	
15:13:34:874	CMND->MCU:	26	General<0000>	hello_ind<05>	00	CMND_IE_VERSION<0x09> len<5> val<Len: 4; Value: <2.94>> CMND_IE_GENERAL_STATUS<0x0D> len<5> val<Mod

Full Log

19-11-2018 15:13:34

CMND->MCU:

Message Length: 26

Raw message: da da 00 16 00 00 00 00 05 11 0d 00 05 00 00 00 00 05 09 00 05 04 32 2e 39 34

Service ID: General<0000>

Message ID: hello_ind<05>

Unit ID: 00

Cookie: 00

Raw IE: 0d 00 05 00 00 00 00 05

Parsed IE: CMND_IE_GENERAL_STATUS<0x0D> len<5>

val<Mode:Norm,Reg:True,Eeprom:OK,ID:0x0005>

Raw IE: 09 00 05 04 32 2e 39 34

Parsed IE: CMND_IE_VERSION<0x09> len<5> val<Len: 4; Value: <2.94>>

19-11-2018 15:13:40

MCU->CMND:

Message Length: 10

Raw message: da da 00 06 68 01 01 04 01 75

Service ID: Keep alive<0104>

Message ID: i_am_alive_req<01>

Unit ID: 01

Cookie: 68

19-11-2018 15:13:40

CMND->MCU:

Message Length: 14

Raw message: da da 00 0a 68 01 00 00 07 7b 00 00 01 00

Service ID: General<0000>

Message ID: link_cfm<07>

Unit ID: 01

Cookie: 68

Raw IE: 00 00 01 00

Parsed IE: CMND_IE_RESPONSE<0x00> len<1> val<success>

19-11-2018 15:13:52

MCU->CMND:

Message Length: 14

Raw message: da da 00 0a 68 00 02 04 01 81 07 00 01 00

Service ID: Sleep<0204>

Message ID: enter_sleep_req<01>

Unit ID: 00

Cookie: 68
Raw IE: 07 00 01 00
Parsed IE: CMND_IE_SLEEP_INFO<0x07> len<1> val<00>

19-11-2018 15:13:52

CMND->MCU:
Message Length: 10
Raw message: da da 00 06 00 00 02 04 02 0e
Service ID: Sleep<0204>
Message ID: enter_sleep_cfm<02>
Unit ID: 00
Cookie: 00
Message Length: 10
Raw message: da da 00 06 00 00 02 04 01 0d
Service ID: Sleep<0204>
Message ID: enter_sleep_req<01>
Unit ID: 00
Cookie: 00

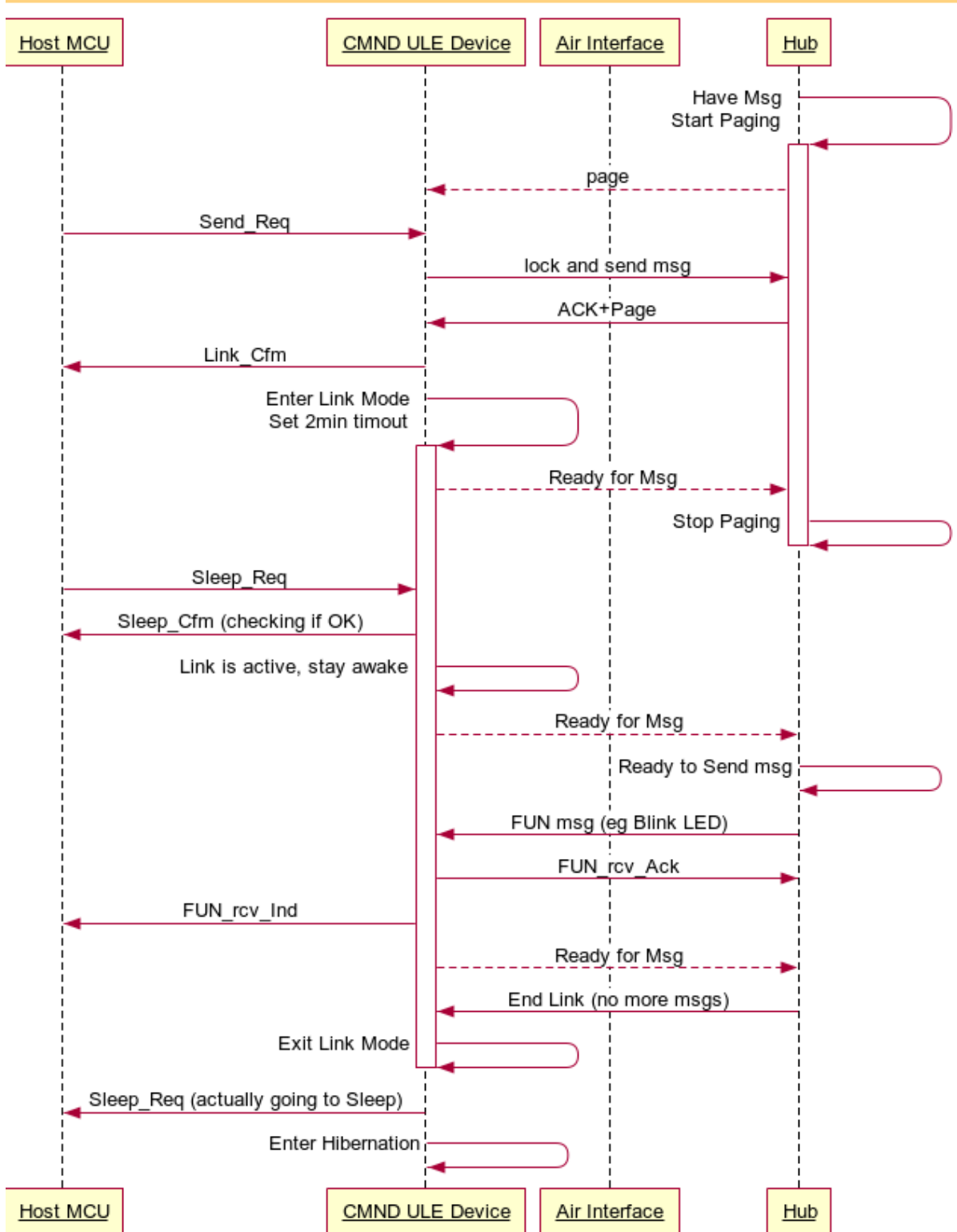
ULE Device Delays Entry Into Hibernation

The Application Host needs to account for a scenario where the ULE Device ACKs the request to hibernate, however, confirmation that it indeed has gone to sleep does not arrive immediately. This is because the ULE Hub has embedded a paging request in the ACK of a message sent prior to the sleep request from the Application Host. This is how the Hub gets a non-pageable device's attention to deliver it a FUN message such as "a new SW version is available" (SUOTA) or "I have a new configuration setting for you". (Conversely, this is how the Application Host of a non-pageable device can efficiently make itself available to be paged!) Once paged, the ULE Device module stays awake (in "Link Mode", temporarily ignoring the Host request to hibernation and pinging the ULE Hub for the message) to receive this message when it becomes available (note: this might take a few seconds or more depending on what other tasks are occupying the ULE Hub!). Once received it will then transfer this message to the Device Application Host. Only afterwards will it inform the Device App Host that it is going to Sleep. The Application Host does not need to resend the Sleep request. **In summary, the Application Host DOES need to account for a message that may be incoming from the Hub** and would prevent the ULE Device immediately entering hibernation.

The Data Flows and Simulator Logs for this more complex scenario are depicted below. As an example, an ON-OFF FUN message incoming coming from the Hub is shown in the simulator logs.

Data Flow

Send message, Receive Msg, Hibernate



Device Simulator Logs

Time	TX/RX	Length	Service Id	Message Id	Unit Id	IE Parsed
15:18:52:714	CMND->MCU: ie cont	10	Sleep<0204>	enter_sleep_req<01>	00	
15:18:48:844	CMND->MCU:	20	On off<0106>	on_req<01>	01	CMND_IE_OTA_COOKIE<0x13> len<1> val<00>
15:18:42:278	CMND->MCU:	10	Sleep<0204>	enter_sleep_cfm<02>	00	CMND_IE_UNIT_ADDR<0x03> len<3> val<000002>
15:18:42:248	MCU->CMND:	14	Sleep<0204>	enter_sleep_req<01>	00	CMND_IE_SLEEP_INFO<0x07> len<1> val<00>
15:18:32:734	CMND->MCU:	14	General<0000>	link_cfm<07>	01	CMND_IE_RESPONSE<0x00> len<1> val<success>
15:18:32:624	MCU->CMND:	10	Keep alive<0104>	i_am_alive_req<01>	01	

19-11-2018 15:18:32

MCU->CMND:

Message Length: 10

Raw message: da da 00 06 68 01 01 04 01 75

Service ID: Keep alive<0104>

Message ID: i_am_alive_req<01>

Unit ID: 01

Cookie: 68

19-11-2018 15:18:32

CMND->MCU:

Message Length: 14

Raw message: da da 00 0a 68 01 00 00 07 7b 00 00 01 00

Service ID: General<0000>

Message ID: link_cfm<07>

Unit ID: 01

Cookie: 68

Raw IE: 00 00 01 00

Parsed IE: CMND_IE_RESPONSE<0x00> len<1> val<success>

19-11-2018 15:18:42

MCU->CMND:

Message Length: 14

Raw message: da da 00 0a 68 00 02 04 01 81 07 00 01 00

Service ID: Sleep<0204>

Message ID: enter_sleep_req<01>

Unit ID: 00

Cookie: 68

Raw IE: 07 00 01 00

Parsed IE: CMND_IE_SLEEP_INFO<0x07> len<1> val<00>

19-11-2018 15:18:42

CMND->MCU:

Message Length: 10

Raw message: da da 00 06 00 00 02 04 02 0e

Service ID: Sleep<0204>

Message ID: enter_sleep_cfm<02>

Unit ID: 00

Cookie: 00

```

19-11-2018 15:18:48
CMND->MCU:
Message Length: 20
Raw message: da da 00 10 00 01 01 06 01 35 03 00 03 00 00 02 13 00 01 00
Service ID: On off<0106>
Message ID: on_req<01>
Unit ID: 01
Cookie: 00
Raw IE: 03 00 03 00 00 02
Parsed IE: CMND_IE_UNIT_ADDR<0x03> len<3> val<000002>
Raw IE: 13 00 01 00
Parsed IE: CMND_IE_OTA_COOKIE<0x13> len<1> val<00>

```

```

19-11-2018 15:18:52
CMND->MCU:
Message Length: 10
Raw message: da da 00 06 00 00 02 04 01 0d
Service ID: Sleep<0204>
Message ID: enter_sleep_req<01>
Unit ID: 00
Cookie: 00

```

Link Mode Timeout

In some cases, for example upon a ULE Device completing registration, the ULE Hub may page the ULE Device without any specific message to deliver at the instant of the page. In fact, a message might never be sent. In this case, the ULE Device remains in Link mode for 2 minutes and only then will it send the App Host a confirmation that it is entering hibernation. This is depicted in the log below:

Messages Log

Time	TX/RX	Length	Service Id	Message Id	Unit Id	IE Parsed
12:27:07:895	CMND->MCU:	10	Sleep<0204>	enter_sleep_req<01>	00	
12:25:13:184	CMND->MCU:	10	Sleep<0204>	enter_sleep_cfm<02>	00	
12:25:13:149	MCU->CMND:	14	Sleep<0204>	enter_sleep_req<01>	00	CMND_IE_SLEEP_INFO<0x07> len<256> val<0000000...
12:25:07:676	CMND->MCU:	19	Device Managemen...	register_dev_ind<0...	00	CMND_IE_REGISTRATION_RESPONSE<0x1C> len<6> ...
12:25:07:123	CMND->MCU:	14	General<0000>	link_cfm<07>	00	CMND_IE_RESPONSE<0x00> len<1> val<success>
12:24:55:729	CMND->MCU:	14	Device Managemen...	register_dev_cfm<...	00	CMND_IE_RESPONSE<0x00> len<1> val<success>
12:24:55:661	MCU->CMND:	10	Device Managemen...	register_dev_req<...	00	

Summarizing a Strategy for Entering Hibernation

Upon sending the “enter_sleep_req” CMND command (and receiving “sleep_cfm”), the Host should set a 2 minute timer during which it should be prepared to receive either “sleep_req” (indicating hibernation was entered) or an incoming message. If an incoming message is received, the timer should be reset and again, be prepared for both possibilities!

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