

Beaglebone Setup - Windows

Document Part Number 53-3021051 Rev 0.3

November 2017

DRAFT



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Exegin Technologies Limited

Printed in Canada

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Revision History

Rev. Number	Date	Notes
0.1	01/17	Preliminary
0.2	10/17	Sub-GHz only
0.3	11/17	Minor edits

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1 Install the Beaglebone drivers

<https://learn.adafruit.com/ssh-to-beaglebone-black-over-usb/installing-drivers-windows>

provide two drivers for Microsoft Windows, one for 32-bit installation and the other for 64 bit installations.

Please download and install one or the other depending on your Windows installation.

These drivers will allow the Beaglebone to be able to do ad hoc networking with your computer, there is nothing to install on the BBB itself. It's all set up and ready to go. However, to be able to run this on a PC, you will need to install the drivers in the downloads.

It has been noted that the drivers available through the adafruit web site, as detailed above, are not compatible with Microsoft Windows 10. However the drivers on this link

<http://beagleboard.org/static/beaglebone/latest/README.htm#step2>

work for Microsoft Windows 10.

2 Connecting to your Beaglebone.

The connection to the beagle bone is through the USB based ad hoc networking interface i.e. the Beaglebone once plugged into the Windows machines USB port will present as a network device. The address of the device (IPv4) is printed on the side of the evaluation unit. The Beaglebone uses secure shell (SSH) to do this.

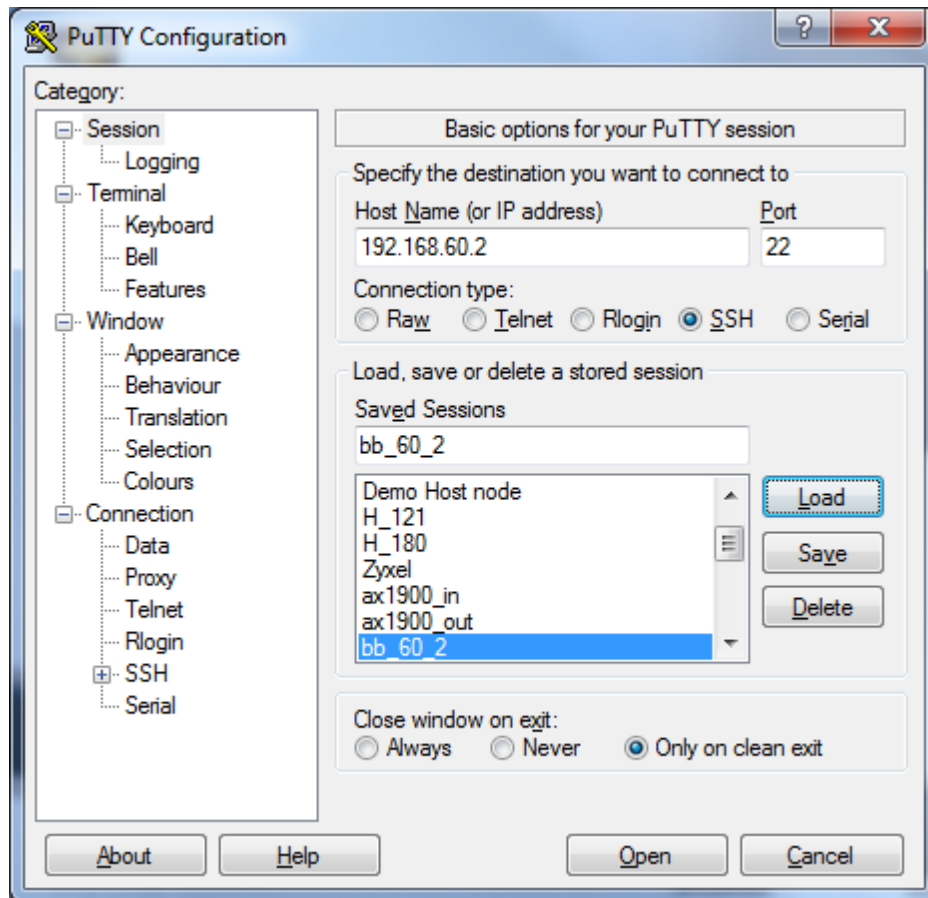
On a windows machine the easiest way to connect is using Putty. Putty can be obtained from

<https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>

Once installed, run Putty.

Now we want to create a session configuration for the Beaglebone you are working with. The following screen shot shows the Putty configuration for the Beaglebone unit 192.168.60.2

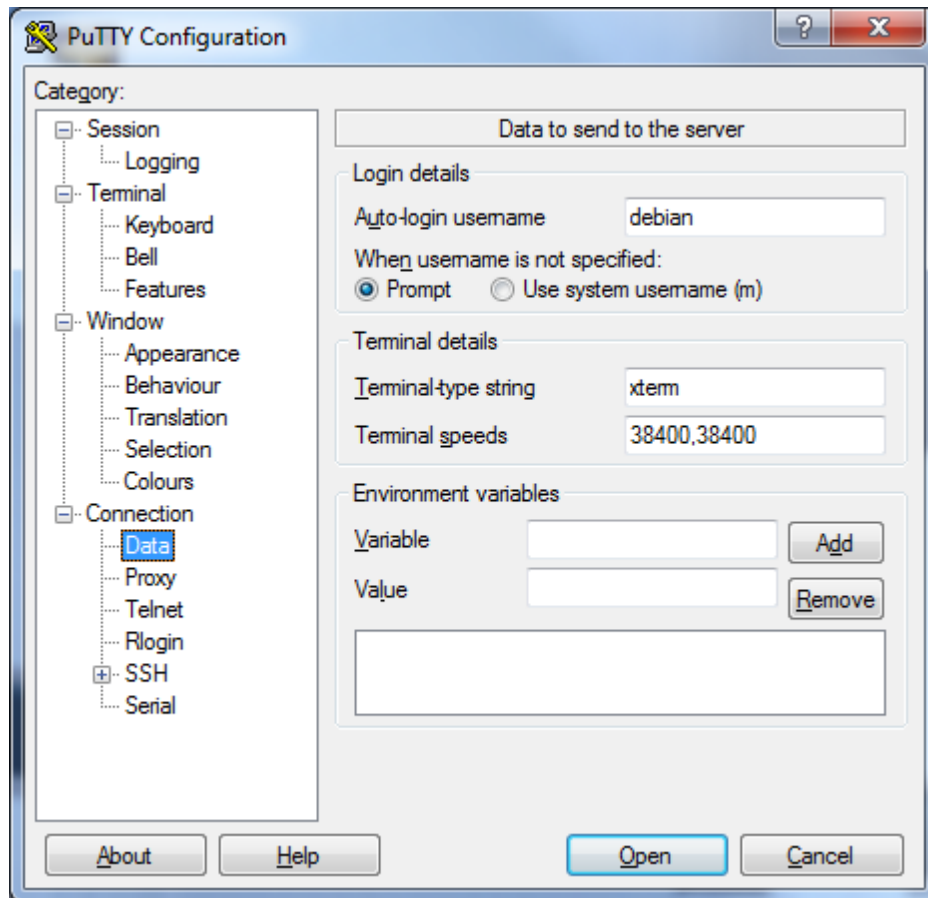
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Once you have entered the HostName (IP address) of the Beaglebone that you have and given the session a name (Saved Sessions) click save.

Then on the left hand pane click on Connection->Data

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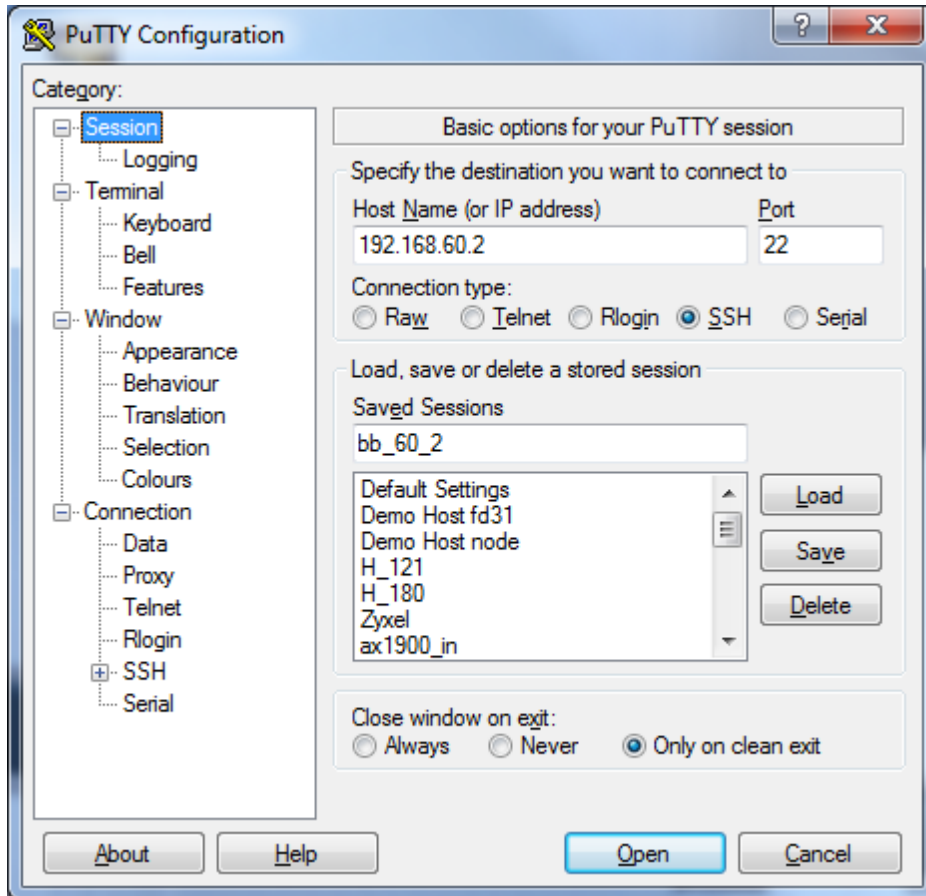


You want to enter the string “debian” in the Auto-login username field. Also make sure that Prompt is selection in the “When username is not specified” selection group.

The go back to the Session window and click on Save again.

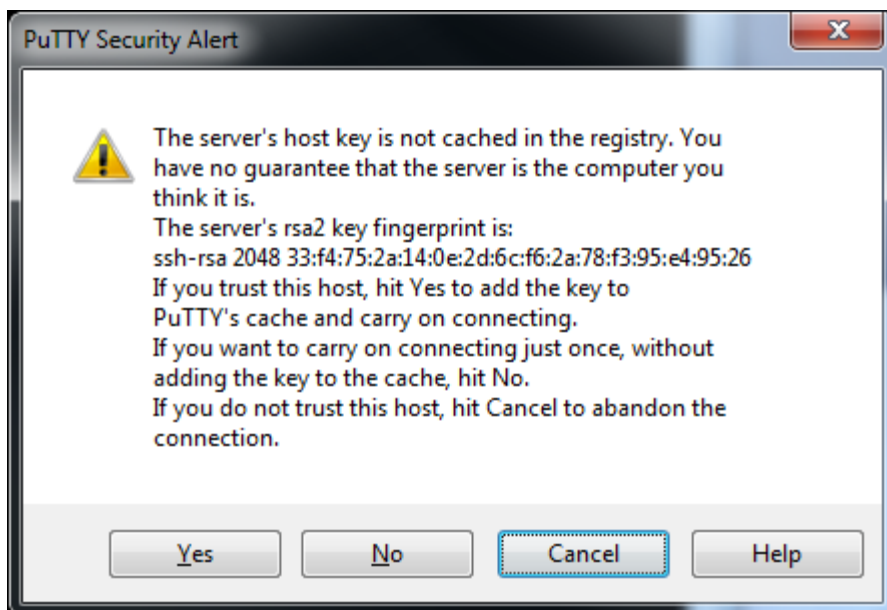
With the Beagle bone plugged into a USB port,

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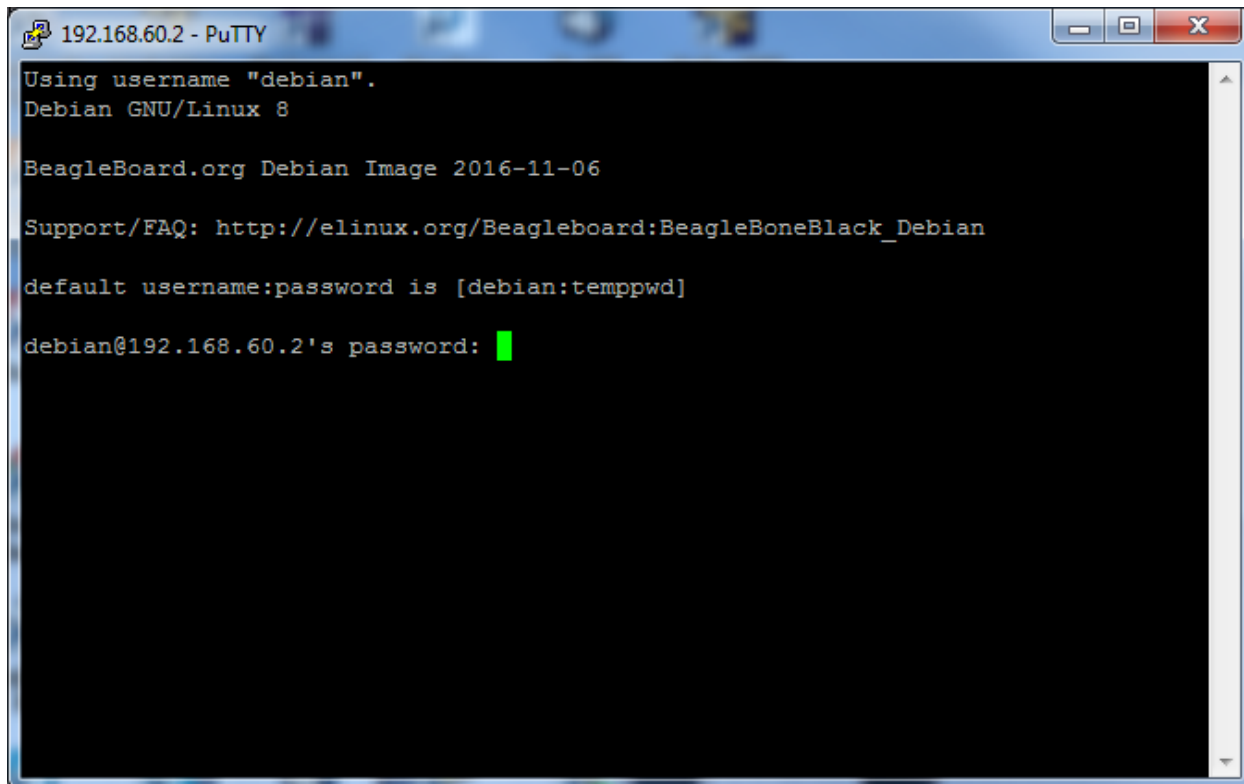
Click “Open” on the Session screen.

You might get



Click Yes, this will record the Beaglebone’s fingerprint in Putty’s knownhost repository. After you should get:

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```
192.168.60.2 - PuTTY
Using username "debian".
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

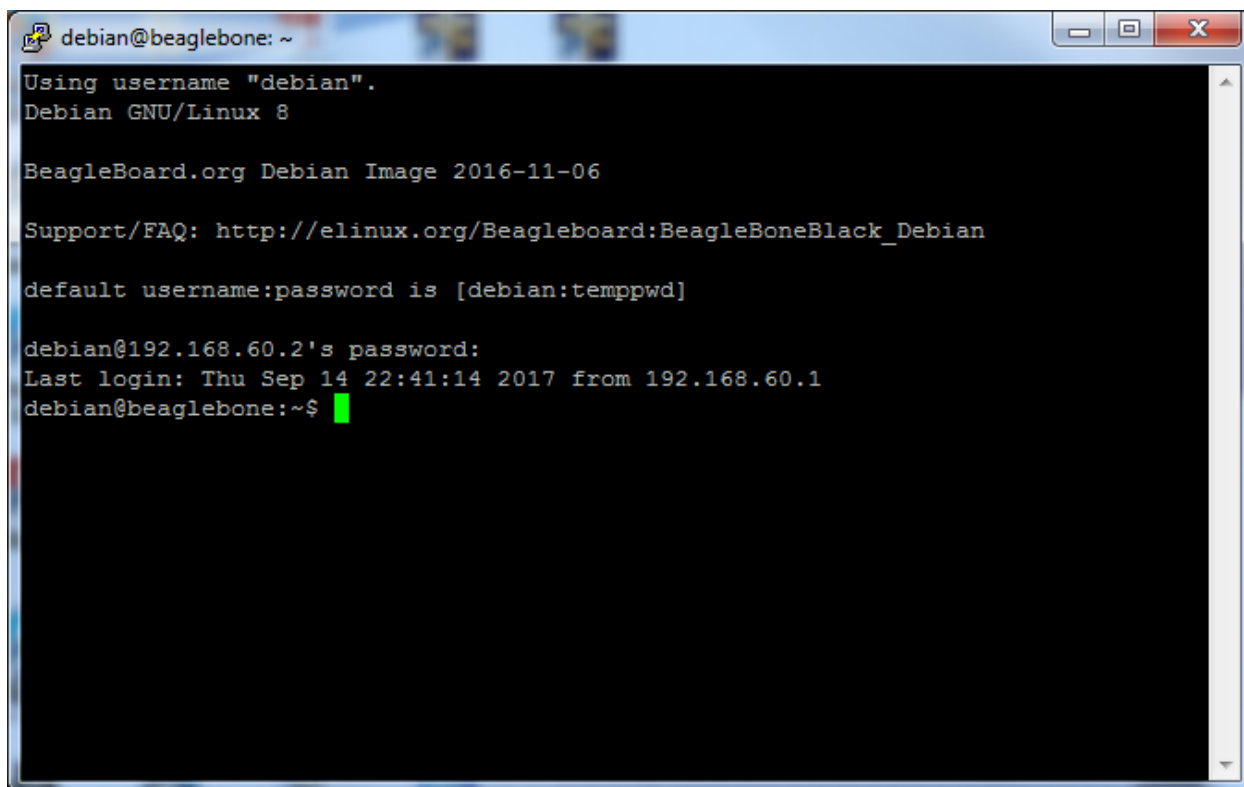
Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.60.2's password: █
```

the password is “temppwd”

If successful you should see:



```
debian@beaglebone: ~
Using username "debian".
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.60.2's password:
Last login: Thu Sep 14 22:41:14 2017 from 192.168.60.1
debian@beaglebone:~$ █
```

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The prompt “debian@beaglebone:~\$” indicates that you have successfully logged into the Beaglebone. This is the Linux command line interface of the Beaglebone.

The zigbee command line interface can be started by entering

```
./start
```

This will give

```
debian@beaglebone: ~
Using username "debian".
Debian GNU/Linux 8
BeagleBoard.org Debian Image 2016-11-06
Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian
default username:password is [debian:tempwd]
debian@192.168.60.2's password:
Last login: Thu Sep 14 23:08:22 2017 from 192.168.60.1
debian@beaglebone:~$ ./start
zbcli >
```

3 System Start-up

The following discussion is predicated on there being two Beaglebone devices attached to the USB interface of the Windows based computer.

The write-up here uses a Beaglebone with address 192.168.60.2 and one with address 192.168.17.2. The unit with address 192.168.60.2 will become the coordinator of the Zigbee network and the other; 192.168.17.2 will join the network formed by the coordinator.

In the example below use target the sub-GHz radio (/dev/q7x_subghz) and use the startup_channellist command to restrict the active sub-GHz channel to page 28 channel 0.

3.1 Coordinator Start-up

The following dialog is from the coordinator, the lines highlighted in **YELLOW** are user input.

```
==== PuTTY log 2017.09.29 12:50:14 ====
Using username "debian".
Debian GNU/Linux 8
BeagleBoard.org Debian Image 2016-11-06
```

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```
Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian
default username:password is [debian:tempwd]
debian@192.168.60.2's password:
Last login: Thu Sep 14 22:48:24 2017 from 192.168.60.1
debian@beaglebone:~$ ./start
zbcli > wpan serial /dev/q7x_subghz
zbcli[1845]: 000000.000          wpan: wpan device 0
zbcli[1845]: 000000.008          wpan: no device name specified,
using "wpan0"
Description: Q73
Firmware Version: 0000.03.00
Interface Version: 0x0002
Description: Q73
Firmware Version: 0000.03.00
Interface Version: 0x0002
zbcli[1845]: 000002.040          wpan: opened device /dev/q7x_subghz
as wpan0 (Exegin Serial 802.15.4 SAP)
zbcli[1845]: 000002.050          wpan: EUI-64 0xacde4800a518da94 read
from device
zbcli >
zbcli > init
zbcli[1847]: 000065.475          ZbApsmeAddEndpoint: Adding endpoint 0 (0x00),
profile = 0x0000
zbcli[1847]: 000065.485          zcl_cluster_bind: Creating filter rule (endpoint
= 242, profile = 0x0104, cluster = 0x0021)
zbcli[1847]: 000065.492          zcl_cluster_bind: Warning, removing previous
filter for this cluster
zbcli[1847]: 000065.494          zcl_cluster_bind: Creating filter rule (endpoint
= 242, profile = 0xale0, cluster = 0x0021)
zbcli[1847]: 000065.496          ZbApsmeAddEndpoint: Adding endpoint 242 (0xf2),
profile = 0xale0
zbcli[1847]: 000065.498          zcl_cluster_bind: Creating BCAST endpoint filter
rule
zbcli[1847]: 000065.514          init: Success, stack initialized
with EUI64 0xacde480068d05b4c
zbcli > startup_channellist 28 0
zbcli[1847]: 000350.605          startup_channellist: ok
zbcli > startup_form
zbcli[1847]: 000375.760          ZbNlmeResetReq: NLME-RESET.request (warmStart
= 0)
zbcli[1847]: 000375.771          nwk_addr_map_entry_update: New address mapping (extAddr =
0xacde480068d05b4c, nwkAddr = 0x0000)
zbcli[1847]: 000375.777          ZbNwkNibCalcBttDeliveryTime: New calculated
NetworkBroadcastDeliveryTime = 47 seconds
zbcli[1847]: 000375.784          ZbNwkNibCalcBttDeliveryTime: New calculated
NetworkBroadcastDeliveryTime = 47 seconds
zbcli[1847]: 000375.791          ZbNwkNibCalcBttDeliveryTime: New calculated
NetworkBroadcastDeliveryTime = 32 seconds
zbcli[1847]: 000375.794          startup_cbke_config: CBKE suite mask is 0, so
skipping CBKE config.
zbcli[1847]: 000375.805          ZbNwkScanReq: wpan1, type:1, page:28,
mask:0x00000001
zbcli[1847]: 000375.974          ZbNwkFormActiveScanConfirm: MLME-SCAN.confirm (wpan1,
status = 0xea)
zbcli[1847]: 000375.974          ZbNwkScanReq: wpan1, type:0, page:28,
mask:0x00000001
zbcli[1847]: 000376.299          nwk_pick_quietest_channel: Found starting channel at 0
(num devices = 0, energy = 0)
zbcli[1847]: 000376.311          MLME-START.confirm: ifc:wpan1, channel: 0,
page:28, pan:0x7a3f, status:0x00
zbcli[1847]: 000376.316          ZbNwkFormEnergyScanConfirm: NLME-NETWORK-FORMATION.request
successful (nwkPanId = 0x7a3f).
zbcli[1847]: 000376.325          startup_form: ZigBee Startup form successful
```

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```
zbcli[1847]: 000376.328 startup_form: Network Key
a588:7a74:20e9:d006:0f3d:4242:bf24:bd69
zbcli >
```

```
zbcli[1847]: 000399.650 ZbNwkJoinHandleAssocInd: Handling MLME-
ASSOCIATE.indication
zbcli[1847]: 000399.651 ZbNwkJoinHandleAssocInd: Association accepted, sending
response (0xc58e, 0xacde4800a518da94)
zbcli[1847]: 000400.186 ZbMonitorBdbJoinerTrack: Tracking 0xacde4800a518da94
zbcli[1847]: 000400.201 ZbMonitorHandleUpdateDeviceInd: Adding shared key for
0xacde4800a518da94
zbcli[1847]: 000400.203 ZbMonitorHandleUpdateDeviceInd: Sending network key to
0xacde480068d05b4c for 0xacde4800a518da94 (assoc)
zbcli[1847]: 000400.203 ZbApsmeTransportKeyReq: APSME-TRANSPORT-KEY.request
(dstAddr = 0xacde4800a518da94)
zbcli[1847]: 000400.204 Received Update Device (dev = 0xacde4800a518da94, status =
Insecure Join)
zbcli[1847]: 000400.874 ZbApsmeTransportKeyReq: APSME-TRANSPORT-KEY.request
(dstAddr = 0xacde4800a518da94)
zbcli[1847]: 000400.882 ZbApsPacketSend: Sending packet to
0xacde4800a518da94 (short = 0xc58e, counter = 3, len = 33, block = 0)
zbcli[1847]: 000401.096 ZbMonitorBdbJoinerUntrack: Untracking 0xacde4800a518da94
zbcli[1847]: 000401.105 ZbApsPacketSend: Sending packet to
0xacde4800a518da94 (short = 0xc58e, counter = 4, len = 10, block = 0)
```

The detail in grey is the coordinator side log of the other unit joining.

3.2 Child Joining

The following dialog is from the child, the lines highlighted in **YELLOW** are user input.

```
==== PuTTY log 2017.09.29 12:51:51 =====
Using username "debian".
Debian GNU/Linux 8
BeagleBoard.org Debian Image 2016-11-06
Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian
default username:password is [debian:temppwd]
debian@192.167.16.2's password:
Last login: Thu Sep 14 20:11:43 2017 from 192.167.16.1
debian@beaglebone:~$ ./start
Warning skipped configuration file '/etc/zbcli/config': No such file or directory
zbcli > wpan serial /dev/q7x_subghz
zbcli[1865]: 000000.000 wpan: wpan device 0
zbcli[1865]: 000000.012 wpan: no device name specified,
using "wpan0"
Description: Q73
Firmware Version: 0000.03.00
Interface Version: 0x0002
Description: Q73
Firmware Version: 0000.03.00
Interface Version: 0x0002
zbcli[1865]: 000002.040 wpan: opened device /dev/q7x_subghz
as wpan0 (Exegin Serial 802.15.4 SAP)
zbcli[1865]: 000002.051 wpan: EUI-64 0xacde4800a518da94 read
from device
zbcli > init
zbcli[1865]: 000013.052 ZbApsmeAddEndpoint: Adding endpoint 0 (0x00),
profile = 0x0000
zbcli[1865]: 000013.061 zcl_cluster_bind: Creating filter rule (endpoint
= 242, profile = 0x0104, cluster = 0x0021)
```

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```
zbccli[1865]: 000013.065          zcl_cluster_bind: Warning, removing previous
filter for this cluster
zbccli[1865]: 000013.070          zcl_cluster_bind: Creating filter rule (endpoint
= 242, profile = 0xale0, cluster = 0x0021)
zbccli[1865]: 000013.073          ZbApsmeAddEndpoint: Adding endpoint 242 (0xf2),
profile = 0xale0
zbccli[1865]: 000013.075          zcl_cluster_bind: Creating BCAST endpoint filter
rule
zbccli[1865]: 000013.090          init: Success, stack initialized
with EUI64 0xacde4800a518da94
zbccli > startup_channellist 28 0
zbccli[1865]: 000307.243          startup_channellist: ok
zbccli > startup_join
zbccli[1865]: 000342.309          startup_join: Performing ZbStartup (attempt
1 of 1)
zbccli[1865]: 000342.318          ZbNlmeResetReq: NLME-RESET.request (warmStart
= 0)
zbccli[1865]: 000342.330          ZbNwkNibCalcBttDeliveryTime: New calculated
NetworkBroadcastDeliveryTime = 47 seconds
zbccli[1865]: 000342.340          ZbNwkNibCalcBttDeliveryTime: New calculated
NetworkBroadcastDeliveryTime = 47 seconds
zbccli[1865]: 000342.343          ZbNwkNibCalcBttDeliveryTime: New calculated
NetworkBroadcastDeliveryTime = 32 seconds
zbccli[1865]: 000342.345          startup_cbke_config: CBKE suite mask is 0, so
skipping CBKE config.
zbccli[1865]: 000342.354          ZbStartupJoinStart: Attempting network discovery.
Scans = 3, Duration = 4
zbccli[1865]: 000342.362          ZbNwkScanReq: wpan0, type:7, page:28,
mask:0x00000001
zbccli[1865]: 000342.401          ZbNwkBeaconIndProcess: BEACON addr16=0x0000,
addr64=0xacde480068d05b4c, ch= 0, pan=0x7a3f, depth= 0, lqi=246, pjoin=1
zbccli[1865]: 000342.530          ZbNwkScanReq: wpan0, type:7, page:28,
mask:0x00000001
zbccli[1865]: 000342.568          ZbNwkBeaconIndProcess: BEACON addr16=0x0000,
addr64=0xacde480068d05b4c, ch= 0, pan=0x7a3f, depth= 0, lqi=250, pjoin=1
zbccli[1865]: 000342.695          ZbNwkScanReq: wpan0, type:7, page:28,
mask:0x00000001
zbccli[1865]: 000342.736          ZbNwkBeaconIndProcess: BEACON addr16=0x0000,
addr64=0xacde480068d05b4c, ch= 0, pan=0x7a3f, depth= 0, lqi=250, pjoin=1
zbccli[1865]: 000342.860          ZbNwkJoinAssociate: NLME-JOIN.request(associate)
zbccli[1865]: 000342.861          ZbNwkJoinAssociate: Associating (src =
0xacde4800a518da94) to 0x0000 (lqi = 250)
zbccli[1865]: 000343.421          ZbNwkJoinHandleAssocConf: Association Confirm (status =
0x00)
zbccli[1865]: 000343.536          ZbMonitorHandleTransKeyInd: Trust Center address not
configured, saving: 0xacde480068d05b4c
zbccli[1865]: 000343.540          nwk_addr_map_entry_update: New address mapping (extAddr =
0xacde480068d05b4c, nwkAddr = 0x0000)
zbccli[1865]: 000343.544          ZbMonitorHandleTransKeyInd: Adding network key, sequence
number = 0
zbccli[1865]: 000343.550          ZbNlmeStartRouterReq: NLME-START-ROUTER.request.
zbccli[1865]: 000343.565          ZbZdoDeviceAnnce: Sending Device_Annce for
0xc58e
zbccli[1865]: 000343.565          ZbStartupNodeDescDelayTimer: Performing ZDO Node Desc Req
(for Link Key Exchange). Attempt = 1
zbccli[1865]: 000343.979          ZbStartupRequestKeyDelayTimer: Node-Desc_rsp, sending
Request-Key for TCLK exchange
zbccli[1865]: 000343.986          ZbApsPacketSend: Sending packet to
0xacde480068d05b4c (short = 0x0000, counter = 2, len = 1, block = 0)
zbccli[1865]: 000344.152          ZbApsPacketSend: Sending packet to
0xacde480068d05b4c (short = 0x0000, counter = 3, len = 25, block = 0)
zbccli[1865]: 000344.369          ZbStartupPermitJoinReq: Sending ZDO Permit-Join
Request to 0xfffd (duration: 180)
```

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```
zbcli[1865]: 000344.380 startup_join: Success, ZigBee Startup join
successful (without persistence).
zbcli >
```

The detail in grey is the child side log of the child joining the network.

3.3 Status

The status of the nodes can be shown once the joint is complete.

3.3.1 Coordinator Status

```
zbcli > status
zbcli[1847]: 000454.271 status: -- ZigBee ZDO Status -----
zbcli[1847]: 000454.271 status: Device Type: Coordinator
zbcli[1847]: 000454.271 status: Trust Center Type: Centralized
zbcli[1847]: 000454.271 status: Trust Center Address: 0xacde480068d05b4c
zbcli[1847]: 000454.272 status: ChannelMask[0]: 0xe0000001 (Page 28)
zbcli[1847]: 000454.272 status:
zbcli[1847]: 000454.272 status: -- ZigBee APS Binding Table -----
zbcli[1847]: 000454.272 status: INDX SRCADDR SRCENDPT CLUSTER DSTADDR DSTENDPT
zbcli[1847]: 000454.283 status:
zbcli[1847]: 000454.285 status: -- ZigBee APS Group Table -----
zbcli[1847]: 000454.286 status: GROUP ENDPT
zbcli[1847]: 000454.288 status:
zbcli[1847]: 000454.288 status: -- ZigBee BDB Info -----
zbcli[1847]: 000454.288 status: TCLKExchangeMethod: 0
zbcli[1847]: 000454.293 status: TCRequiresKeyExchange: 1
zbcli[1847]: 000454.294 status:
zbcli[1847]: 000454.294 status: -- ZigBee Network Status -----
zbcli[1847]: 000454.298 status: Channel (Page 28): 0
zbcli[1847]: 000454.300 status: Extended Address: 0xacde480068d05b4c
zbcli[1847]: 000454.302 status: Extended PAN Id: 0xacde480068d05b4c
zbcli[1847]: 000454.304 status: Short Address: 0x0000
zbcli[1847]: 000454.306 status: PAN Id: 0x7a3f
zbcli[1847]: 000454.307 status: Protocol Version: 0x02
zbcli[1847]: 000454.311 status: Stack Profile: ZigBee PRO
zbcli[1847]: 000454.312 status: Is Concentrator: True
zbcli[1847]: 000454.317 status: Permit Join Value: 0x7e
zbcli[1847]: 000454.318 status: Joining Policy: ALL_JOIN
zbcli[1847]: 000454.320 status:
zbcli[1847]: 000454.320 status: -- ZigBee Network Neighbor Table -----
zbcli[1847]: 000454.323 status: EXTADDR NWKADDR TYPE RXIDLE RELATION TXFAIL AGE LQI
zbcli[1847]: 000454.324 status: 1 0xacde4800a518da94 0xc58e Rtr True Child 0 1 245
zbcli[1847]: 000454.324 status:
zbcli[1847]: 000454.326 status: -- ZigBee Network Discovery Table -----
zbcli[1847]: 000454.330 status: NWKADDR PANID EXTENDED PANID CHAN VERS DEPTH PJOIN LQI PROFILE
zbcli[1847]: 000454.336 status:
zbcli[1847]: 000454.341 status: -- ZigBee Network Routing Table -----
zbcli[1847]: 000454.342 status: DSTADDR NEXTHOP STATUS LASTUSED
zbcli[1847]: 000454.342 status: 0xc58e 0xc58e Active 53
zbcli[1847]: 000454.342 status:
zbcli >
```

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3.3.2 Child Status

```
zbcli > status
zbcli[1865]: 000404.896 status: -- ZigBee ZDO Status -----
zbcli[1865]: 000404.906 status: Device Type: Router
zbcli[1865]: 000404.909 status: Trust Center Type: Centralized
zbcli[1865]: 000404.912 status: Trust Center Address: 0xacde480068d05b4c
zbcli[1865]: 000404.913 status: ChannelMask[0]: 0xe000001 (Page 28)
zbcli[1865]: 000404.916 status:
zbcli[1865]: 000404.918 status: -- ZigBee APS Binding Table -----
zbcli[1865]: 000404.919 status: INDX SRCADDR SRCENDPT CLUSTER DSTADDR DSTENDPT
zbcli[1865]: 000404.924 status:
zbcli[1865]: 000404.926 status: -- ZigBee APS Group Table -----
zbcli[1865]: 000404.928 status: GROUP ENDPT
zbcli[1865]: 000404.929 status:
zbcli[1865]: 000404.929 status: -- ZigBee BDB Info -----
zbcli[1865]: 000404.932 status: TCLKExchangeMethod: 0
zbcli[1865]: 000404.932 status: TCRequiresKeyExchange: 1
zbcli[1865]: 000404.934 status:
zbcli[1865]: 000404.936 status: -- ZigBee Network Status -----
zbcli[1865]: 000404.938 status: Channel (Page 28): 0
zbcli[1865]: 000404.939 status: Extended Address: 0xacde4800a518da94
zbcli[1865]: 000404.940 status: Extended PAN Id: 0xacde480068d05b4c
zbcli[1865]: 000404.944 status: Short Address: 0xc58e
zbcli[1865]: 000404.945 status: PAN Id: 0x7a3f
zbcli[1865]: 000404.946 status: Protocol Version: 0x02
zbcli[1865]: 000404.948 status: Stack Profile: ZigBee PRO
zbcli[1865]: 000404.952 status: Permit Join Value: 0x77
zbcli[1865]: 000404.954 status: Joining Policy: ALL_JOIN
zbcli[1865]: 000404.956 status:
zbcli[1865]: 000404.957 status: -- ZigBee Network Neighbor Table -----
zbcli[1865]: 000404.958 status: EXTADDR NWKADDR TYPE RXIDLE RELATION TXFAIL AGE LQI
zbcli[1865]: 000404.964 status: 1 0xacde480068d05b4c 0x0000 Crd True Parent 0 1 136
zbcli[1865]: 000404.967 status:
zbcli[1865]: 000404.968 status: -- ZigBee Network Discovery Table -----
zbcli[1865]: 000404.970 status: NWKADDR PANID EXTENDED PANID CHAN VERS DEPTH PJOIN LQI PROFILE
zbcli[1865]: 000404.971 status:
zbcli[1865]: 000404.972 status: -- ZigBee Network Routing Table -----
zbcli[1865]: 000404.974 status: DSTADDR NEXTHOP STATUS LASTUSED
zbcli[1865]: 000404.975 status: 0x0000 0x0000 Active 51
zbcli[1865]: 000404.977 status:
zbcli >
```