User Guide

N32WB03x MESH User Guide

Introduction

The document will introduce the principles and application routines of NS32WB03X MESH to help users understand the MESH process and facilitate rapid development.

N32WB03X MESH Function Features:

- SIG MESH is a network suitable for small data and one-way transmission.
- SIG MESH is a mesh network, suitable for scenarios where messages need to be forwarded multiple times.
- SIG MESH supports industry security, supports 256-bit elliptic curve algorithm, and multiple optional identity authentication mechanisms.
- SIG MESH supports AES 128 messages encryption to ensure message security.
- SIG MESH supports subscription and publishing mechanisms, one-to-many subscriptions, and one-to-many publishing.
- SIG MESH supports relay and low power consumption functions.

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1 Instance Demonstration

1.1 light_switch project

- MESH ligh_control project directory: n32wb03x_mesh v1.0.0\examples\ light_switch\MDK-ARM\light_switch.uvprojx
- Burn file directory: n32wb03x_mesh v1.0.0\examples\light_switch\MDK-ARM\Objects\light_switch.hex
- Test APP: Use Nordic Mesh APP.
- Use JLink to burn light_switch.hex, reset the chip, and view the GPIO PB12 serial port output (baudrate: 1Mbps, 8N1)

1.2 Network Access and Configuration

- Open the Nordic Mesh APP, click the ADD NODE button in the lower right corner of the screen, and allow prompt permissions.
- Turn on the development board that has been programmed with light_switch.hex.
- APP scans the development board (MESH_XXXX: XXXX is the last two bytes of the MAC address)
- Click MESH_XXXX, click IDENTITY, click PROVISION, click OK, wait for the network access to end.
- The APP returns to the main interface, clicks the device MESH_XXXX, and clicks the symbol in the lower right corner of the Elements card.
- Configure Generic On Off Server Model: Click Generic On Off Server, click BIND KEY, select Key1, then click SUBSCRIBE and select existing group (if there is no select Create a new group to subscribe), complete the subscription configuration, you can click ON/OFF at the bottom of the screen to test whether the light of the development board is turned on and off normally.
- Configure Generic On Off Client Model: Click Generic On Off Client, click BIND KEY, select Key1, then click SET PUBLICATION, then click Publish Address, click All Nodes on the right side of the subscript, select Groups, the default is the same GROUP as SUBSCRIBE, return The interface clicks APPLY in the lower right corner, SO publish and subscribe belong to one group, and different development boards can subscribe to each other and publish.

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1.3 Subscription and Publishing Test

- Prepare two or more development boards, each development board needs to complete the network access and configuration process.
- The Subscription group of the Generic On Off Server needs to be configured the same as the Publish group of the Generic On Off Client.
- Press button1 on the development board to turn on the lights on other development boards.
- Press button2 on the development board to turn off the lights on other development boards.

1.4 Proxy Function Test

- Prepare two or more development boards, each development board needs to complete the network access and configuration process.
- Click the CONNECT tab at the top of the APP, select to connect a development board node.
- Return to the APP Network Tab, click to select another development board, enter Generic On Off Server, and control the on and off of the development board light in the lower right corner of the interface.

1.5 Relay Node Test

- Prepare three or more development boards, each development board needs to complete the network access and configuration process.
- The three development boards are separated by 5 meters to 10 meters. The light on the farthest end development board is turned on by pressing button1 on the development board, and then the light on the farthest end development board is turned off by pressing button2 on the development board to complete the relay node test.

1.6 Manually Delete Node Information

Long press button2 on the development board, the chip will return to the un-networked

state, delete the device on the APP side, restart network access and configuration process.

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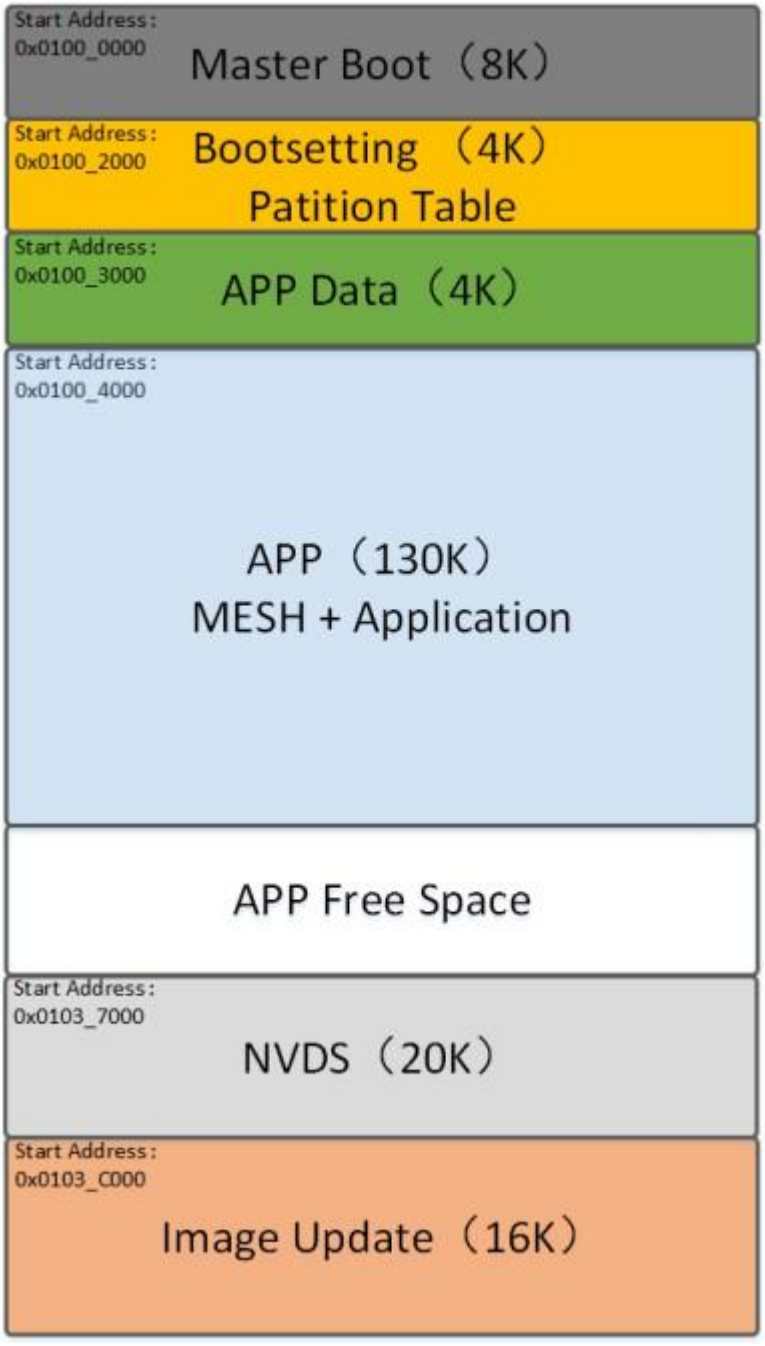
2 FLASH Memory Distribution



- Light_switch example: Program Size: Code=120260 RO-data=5664 RW-data=1492 ZI-data=20088
- The mesh protocol stack occupies 24K Ram (4K RAM is used for encryption algorithms), and users can use 8K Ram.
- Mesh Non Volatile Data Storage occupies 5 Flash Sectors (5*4K) to store network keys and application layer configurations
- Master Boot is used for program jumps and serial upgrades.

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- Bootsetting is used to save partition table information.
- APP DATA is used to save application data.
- APP application.
- APP Free Space remaining application space.
- NVDS Mesh data storage area.
- Image Update Used for Bluetooth OTA upgrades.

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3 API Interface Tutorial

3.1 Generic On Off Server Model Registration

- APP_ONOFF_SERVER_DEF(

  m_onoff_server_0,

  false,

  MESH_TRANSMIC_SIZE_SMALL,

  app_onoff_server_set_cb, // Status change callback function

  app_onoff_server_get_cb) //Read status callback function

- Use macro definitions to configure light status change callback functions and read status callback functions.
- app_onoff_init(&m_onoff_server_0, 0); //The second parameter is the Element Index, because the routine only has one Element, it is configured as 0
- Use the interface to register the macro definition model to the 0th element.

3.2 Generic On Off Set Callback

- static void app_onoff_server_set_cb(const app_onoff_server_t * p_server, bool onoff)
  {

  if(onoff){

  bsp_led_on(LED2_GPIO_PORT, LED_GPIO2_PIN);

  }else{

  bsp_led_off(LED2_GPIO_PORT, LED_GPIO2_PIN);

  }

  }

- When a message is received to change the light status, this callback function is entered, the function judges the onoff status, and sets the light on and off according to the status.

3.3 Generic On Off Get Callback

- static void app_onoff_server_get_cb(const app_onoff_server_t * p_server, bool * p_present_onoff) {

  *p_present_onoff = bsp_led_read(LED2_GPIO_PORT, LED_GPIO2_PIN);

}

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- When a message requesting to read the light status is received, this callback function is entered, and the light status is assigned to the p_present_onoff variable.

3.4 Generic On Off Client Model Registration

- static generic_onoff_client_t m_clients = {
  .settings.p_callbacks = NULL, // Callback function, UnAck message does
  // not need to register callback
  .settings.timeout = 0,
  .settings.force_segmented = false,
  .settings.transmic_size = MESH_TRANSMIC_SIZE_SMALL,
  };
- generic_onoff_client_init(&m_clients, 0); //The second parameter is the Element Index, because the routine only has one Element, it is configured as 0

3.5 Generic On Off Client Set UnAck

- static void generic_onoff_set(bool onoff) {
  static uint8_t tid = 0; //Transaction ID plus one each time
  generic_onoff_set_params_t set_params;
  set_params.on_off = onoff; //Set ONOFF status
  set_params.tid = tid++;
  //Send message that does not require response
  generic_onoff_client_set_unack(&m_clients, &set_params, NULL, 0);
  }

3.6 Mesh NVDS Data Erase

- static void mesh_nvds_erase(void) {
  Qflash_Erase_Sector(0x103B000); //Erase 4K data after address 0x103B000
  Qflash_Erase_Sector(0x103C000);
  Qflash_Erase_Sector(0x103D000);
  Qflash_Erase_Sector(0x103E000);
  Qflash_Erase_Sector(0x103F000);
  NVIC_SystemReset(); //Soft reset
  }

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3.7 Protocol Stack Initialization

/**

@brief Initialize the mesh stack.

@param model_init function used to initialize the application models.

*/

void ns_mesh_stack_init(void (*model_init)(void))

3.8 Protocol Stack Enable

/**

* @brief Mesh stack enables.

*/

void ns_mesh_stack_enable(void)

3.9 Clear Parameters

/**

* @brief Reset the flash sectors.

*/

void ns_mesh_nvds_clear(void)

3.10 MAC Address

/**

@brief A method to get the mac address.

@note This function should only be called at initialization, since the address will be used later.

*/

void make_ble_mac(void)

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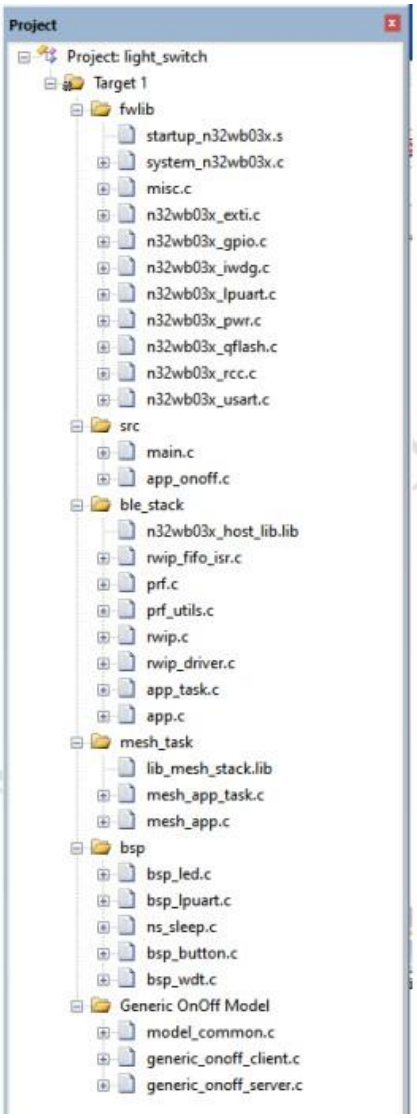
4 Project Tutorial

4.1 Light_switch project Introduction

- It has one Element, three Models, Configuration Server Model, Generic On Off Server Model, and Generic On Off Client Model.
- The system clock is set to 64MHz.
- The key driver supports short presses to send Generic OnOff Client Set Messages, and long presses to delete network access and configuration information and reset functions.
- The node supports Proxy proxy function and Relay relay function.
- ns32wb03x_host_lib.lib Bluetooth host library.
- Lib_mesh_stack.lib SIG MESH library.



- The fwlib directory stores hardware related driver libraries

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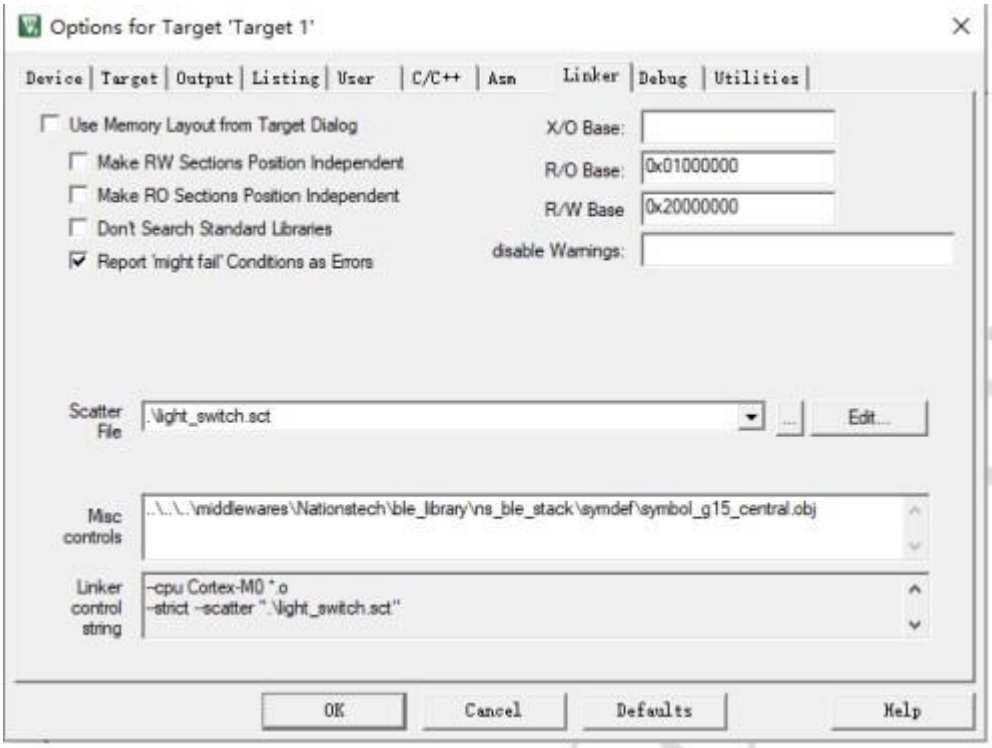
- The src directory stores upper layer application related files
- ble_stack directory stores Bluetooth related files
- mesh_task Mesh related file directory
- The bsp directory stores the light, button and device related files of the development board
- Generic_OnOff_Model directory stores Generic OnOff model related files



- Add custom light_switch.sct file.

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light_switch.sct

```
; *************************************************************
; *** Scatter-Loading Description File generated by uVision ***
; *************************************************************

LR_IROM1 0x01000000 0x0003B000  {    ; load region size_region
  ER_IROM1 0x01000000 0x0003B000  {  ; load address = execution address
   *.o (RESET, +First)
   *(InRoot$$Sections)
   .ANY (+RO)
   .ANY (+XO)
  }

  USER_IRAM1 0x20004000 0x00001000  {  ; RW data
    rwip_fifo_isr.o(+RO +XO +RW +ZI)
    ccm_soft.o(+RO +XO +RW +ZI) ;
    enc.o(+RO +XO +RW +ZI) ;
    mesh_aes_cmac.o(+RO +XO +RW +ZI) ;
    mesh_aes.o(+RO +XO +RW +ZI) ;
  }



  RW_IRAM1 0x20005000 0x00007000  {  ; RW data
   .ANY (+RW +ZI)
  }
}
```

- USER_IRAM1 places the encryption algorithm in RAM for execution to speed up the algorithm.

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5 Common Problems

5.1 Configure network fails

After the user program is programmed, if the MESH function cannot be operated normally or the configuration process fails, it may be related to the default data in the flash data area. The whole chip needs to be erased and then the user program is programmed. , and configure the network.

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6 Version History

Version	Date	Changes
V1.0	2021.12.01	Initial version

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