s132_nrf52_5.0.0 release notes

Introduction to the s132_nrf52 release notes

About the document

The release notes describe the changes in the s132_nrf52 v5 from version to version.

The release notes are intended to list all relevant changes in a given version. They are kept brief to make it easy to get an overview of the changes. More details regarding changes and new features can be found in the s132_nrf52 migration document (normally available for major releases only).

Issue numbers in parentheses are for internal use and should be disregarded by the customer.

s132_nrf52_5.0.0

The main new features of this major version compared to the 4.0.0 version are the L2CAP Connection-Oriented Channels, the LE 2M PHY, and Network Privacy.The updates from the previous alpha version (5.0.0-3.alpha) include support for the Channel Selection algorithm #2 and some minor changes and bug fixes. This is the first version of the SoftDevice that is Bluetooth 5.0 qualified.

Notes:

- The development of the s132_nrf52_5.0.0 started from s132_nrf52_3.0.0 and has been going in parallel with the development of the s132_nrf52_4.0.x SoftDevices. All features and all relevant changes done in the s132_nrf52_4.0.x series have been brought into the s132_nrf52_5.0.0 and released in the 5.0.0 alpha releases (s132_nrf52_5.0.0-1.alpha, -2.alpha and -3.alpha) and in this production release. They are mentioned in the corresponding release notes.
- This release has changed the Application Programmer Interface (API) from the 4.0.0 release. This requires applications to be recompiled.
- The memory requirements of the SoftDevice have changed.

SoftDevice properties

- An updated SoftDevice Specification document will be available at http://infocenter.nordicsemi.com/.
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.2.0 (DRGN-8852).
  - This version of the MBR is compatible with the previous versions.
- The combined MBR and SoftDevice memory requirements for this version are as follows:
  - Flash: **140 kB** (0x23000 bytes).
  - RAM: **5.18 kB** (0x14b8 bytes). This is the minimum required memory with the BLE stack enabled. The actual requirements depend on the configuration chosen at `sd_ble_enable()` time.

New functionality

- BLE
  - The SoftDevice now supports Channel Selection algorithm #2 (DRGN-7147).

Changes

- SoftDevice
  - Added definitions for timing constraints that must be taken into account when using the NRF_RADIO_SIGNAL_CALLBACK_ACTION_EXTEND action with the Radio Timeslot API (DRGN-8931).
- LL
  - The SoftDevice slave role now accepts overlapping peer-initiated Link Layer control procedures (DRGN-8623). The following LL control procedures can be executed in parallel with any other control procedure, except for themselves: LE Ping, Feature Exchange, Data Length Update, and Version Exchange. This is done for compatibility reasons.
  - The SoftDevice now has improved control procedure performance in scenarios involving multiple links (DRGN-9001).
- GAP
  - A flag `lesc` is added to the `ble_gap_evt_auth_status_t` struct, indicating if an authentication procedure has resulted in an LE Secure Connection (DRGN-7801).
- GATT
  - The SoftDevice will no longer prevent using "Write Command" on Characteristic Descriptors (DRGN-9085). This change reverts a change done for s132_nrf52_4.0.0. Note that according to the Bluetooth Core Specification v 5.0 (Vol. 3, Part G Chapter 4.12.3), when writing Characteristic Descriptors "The Attribute Protocol Write Request is used for this sub-procedure". While the SoftDevice will no longer prevent the use of the "Write Command", it is up to the application to ensure the correct procedure is used.

Bug fixes

- SoftDevice
  - Fixed an issue where the SoftDevice might assert in some cases if the application delayed pulling of SoftDevice events (DRGN-8823).
- LL
  - Fixed an issue where the master could initiate a Channel Map Update or Connection Parameter Update procedure while a slave-initiated PHY Update procedure is in progress (DRGN-7975, DRGN-8898).
  - Fixed an issue where the slave would accept that master initiates a Channel Map Update or Connection Parameter Update procedure while a slave-initiated PHY Update procedure is in progress (DRGN-7975, DRGN-8898). Previously this could lead to an assert. Now the slave will instead disconnect in this situation.
  - Fixed an issue where the slave would assert if a control packet was received in the same event as it sent a LL_LENGTH_RSP packet (DRGN-9036).
  - Fixed an issue where the slave could assert if it received a PAUSE_ENC_REQ followed by an LL_ENC_REQ (DRGN-9035). This sequence of packets is illegal behavior according to the Bluetooth Core Specification v 5.0, so the slave will now disconnect in this situation.
  - Fixed an issue where the slave in some cases could disconnect with wrong disconnect reason (`BLE_HCI_DIFFERENT_TRANSACTION_COLLISION` instead of `BLE_HCI_CONN_TERMINATED_DUE_TO_MIC_FAILURE`) if master misbehaves (DRGN-8998).
  - Fixed an issue where scanner/initiator would use wrong local IRK when SoftDevice is configured to use more than one local IRK (DRGN-9072).
  - Fixed an issue which could lead to a deadlock in the Channel Map Update procedure if an unexpected disconnection occurred before the instant (DRGN-9033). The deadlock would have blocked any future Channel Map Updates.
  - Reverted a fix done in s132_nrf52_5.0.0-3.alpha, where `BLE_HCI_LOCAL_HOST_TERMINATED_CONNECTION` was reported instead of `BLE_HCI_STATUS_CODE_LMP_RESPONSE_TIMEOUT` as disconnect reason when a TERMINATE_IND packet was not acknowledged (DRGN-8837, DRGN-9005). The revert is done because the related test specification erratum (TSE ID: 8670) is still open.
- GATT
  - Fixed an issue where setting `gatts_conn_cfg.hvn_tx_queue_size` or `gattc_conn_cfg.write_cmd_tx_queue_size` to 0 would lead to a SoftDevice assert during connect for the last connection that fits in memory (DRGN-9056).

Limitations

- SoftDevice
  - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
  - Synthesized low frequency clock source is not tested or intended for use with the BLE stack.

    - Applications must not modify the `SEVONPEND` flag in the `SCR` register when running in priority levels higher than 6 (priority level numerical values lower than 6) as this can lead to undefined behavior.
- GATTS
    - To conform to the Bluetooth Core Specification v 5.0, there shall be no secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906).

Known Issues

- SoftDevice
    - If Connection Event Length Extension is enabled, the Radio Notification may be suppressed between connection events (DRGN-7687).

s132_nrf52_5.0.0-3.alpha

The main new feature of this alpha version, compared to the 5.0.0-2.alpha version, is the implementation of the L2CAP Connection-Oriented Channels in LE Credit Based Flow Control Mode.

Notes:

- This release has changed the Application Programmer Interface (API) from the 5.0.0-2.alpha release. This requires applications to be recompiled.
- The memory requirements of the SoftDevice have changed.

SoftDevice properties

- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.2 (DRGN-8340).
    - New command, SD_MBR_COMMAND_IRQ_FORWARD_ADDRESS_SET added.
- The combined MBR and SoftDevice memory requirements for this version are as follows:
    - Flash: **140 kB** (0x23000 bytes).
    - RAM: **4.86 kB** (0x1368 bytes). This is the minimum required memory. Actual requirements depend on the configuration chosen at `sd_ble_enable()` time.
    - Call stack: The SoftDevice uses a call stack combined with the application. The worst-case stack usage for the SoftDevice is **1.48 kB** (0x05f4 bytes). Application writers should ensure that enough stack space is reserved to cover the worst-case SoftDevice call stack usage combined with worst-case application call stack usage.

New functionality

- L2CAP
    - Connection-Oriented Channels in LE Credit Based Flow Control Mode (DRGN-8572).
- LL
    - PA/LNA supported for LE 2M PHY (DRGN-8259).

Using L2CAP Credit Based Flow Control Mode

The SoftDevice provides several new SV calls and events related to setting up and using L2CAP Credit Based Flow Control. For more details, refer to ble_l2cap.h and the L2CAP Message Sequence Charts (s132_nrf52_5.0.0-3.alpha_API/doc/html/index.html -> dragoon -> Modules -> Logical Link Control And Adaptation Protocol (L2CAP) -> Message Sequence Charts) inside the API documentation.

Changes

- GAP
    - In Bluetooth Specification Version 5.0 the definition of LE Security Mode 1 Level 4 has changed. LESC MITM protected encrypted link using a 128-bit strength encryption key is now required (DRGN-8759).
    - `BLE_GAP_EVT_TIMEOUT {src: BLE_GAP_TIMEOUT_SRC_SECURITY_REQUEST}` is replaced with `BLE_GAP_EVT_AUTH_STATUS {auth_status: BLE_GAP_SEC_STATUS_TIMEOUT}` (DRGN-8752).
    - `BLE_GAP_ADV_NONCON_INTERVAL_MIN` is now removed (DRGN-8611)
    - Stack will no longer return `NRF_ERROR_BUSY` when calling `sd_ble_gap_connect()`, `sd_ble_gap_scan_start()`, `sd_ble_gap_authenticate()`, or `sd_ble_gap_adv_start()` (DRGN-8843)

- Stack will now only return NRF_ERROR_BUSY on sd_ble_gap_conn_param_update() when a connection parameter update is already in progress (DRGN-8843)

Bug fixes

- SoftDevice
  - Fixed the implementation in sd_flash_protect(), allowing it to support SoftDevice flash size > 128 kB (DRGN-8710)
  - Fixed an issue where calling sd_ble_gap_sec_params_reply(), sd_ble_user_mem_reply(), or sd_ble_gatts_rw_authorize_reply() more than 6 times without pulling events in between would in some cases lead to link disconnect (DRGN-8627)
- GAP
  - Fixed an issue where the calling sd_ble_gap_privacy_get() could cause an hardfault (DRGN-8899)
- GATTS
  - Fixed an issue where incoming packet processing would in some cases be delayed when the BLE_EVT_USER_MEM_REQUEST event is pulled by the application (DRGN-8595)
  - Fixed an issue where the value of the attribute in BLE_GATTS_EVT_RW_AUTHORIZE_REQUEST event corresponding to the first Prepare Write Request could be corrupted if the application delays the pulling of SoftDevice events (DRGN-8595)
- LL
  - Fixed an issue where a peripheral accepted a PHY_UPDATE_IND packet, which indicated PHYs that had not been negotiated in the PHY Update procedure (DRGN-8135)
  - Fixed an issue where a central in some cases did not send a REJECT_EXT_IND packet in a valid control procedure collision scenario (DRGN-8926)
  - Fixed an issue with T_IFS violation in LE connection events with asymmetric PHYs (TX: 1MPHY, RX: 2MB PHY) (DRGN-8762)
  - Fixed an issue where the PA/LNA implementation for symmetric 1M PHY LE connections asserted the PA pin too early (DRGN-8782)
  - Fixed an issue where BLE_HCI_STATUS_CODE_LMP_RESPONSE_TIMEOUT was reported as disconnect reason when TERMINATE_IND packet was not acknowledged. The reason is now correctly reported as BLE_HCI_LOCAL_HOST_TERMINATED_CONNECTION (DRGN-8837).
  - Fixed an issue that was causing a REM request to be blocked indefinitely, if a REM session uses the REM extend feature (DRGN-8859)
  - Fixed an issue where a central would ignore any received LL_REJECT_EXT_IND PDUs (DRGN-8737)
  - Fixed an issue where a peripheral ignored a received LL_UNKNOWN_RSP after an LL_PHY_RSP was sent (DRGN-8134)

Limitations

- SoftDevice
  - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
  - Synthesized low frequency clock source is not tested or intended for use with the BLE stack.
  - Applications must not modify the SEVONPEND flag in the SCR register when running in priority levels higher than 6 (priority level numerical values lower than 6) as this can lead to undefined behavior.
- GATTS
  - To conform to the Bluetooth specification, there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906).

Known Issues

- SoftDevice
  - If Connection Event Length Extension is enabled, the Radio Notification may be suppressed between connection events (DRGN-7687).
- LL
  - To conform to the Bluetooth specification, master shall not initiate a Channel Map Update or Connection Parameter Update procedure while a slave-initiated PHY Update procedure is in progress (incompatible LL procedures). This is not enforced by the SoftDevice, and doing this can lead to an assert or incorrect behavior (DRGN-7975).

s132_nrf52_5.0.0-2.alpha

The main new features of this alpha version, compared to the 5.0.0-1.alpha version, are application control of the Data Length Update and

PHY Update Procedures, SoftDevice configuration API extensions, support for Network Privacy Mode, support for multiple peripheral connections, support for up to 20 connections in total, and configuration of individual links including per link ATT_MTU configuration.

Notes:

- This release has changed the Application Programmer Interface (API) from the 5.0.0-1.alpha release. This requires applications to be recompiled.
- The memory requirements of the SoftDevice have changed.

SoftDevice properties

- The combined MBR and SoftDevice memory requirements for this version are as follows:
  - Flash: **132 kB** (0x21000 bytes).
  - RAM: **5.12 kB** (0x1478 bytes). This is the minimum required memory. Actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time.
  - Call stack: The SoftDevice uses a call stack combined with the application. The worst-case stack usage for the SoftDevice is **1.48 kB** (0x5EC bytes). Application writers should ensure that enough stack space is reserved to cover both worst-case SoftDevice call stack usage combined with worst-case application call stack usage.

New functionality

- SoftDevice
  - The SoftDevice now supports sleep clock accuracy values less than 20 ppm as a peripheral (DRGN-8158).
  - The RC oscillator accuracy can now be set to any of the defined `NRF_CLOCK_LF_ACCURACY` values, and there is no default anymore. In other words, the `nrf_clock_lf_cfg_t::accuracy` parameter now has the same functionality when used with the RCOSC clock source as with the XTAL clock source (DRGN-8666).
- BLE
  - Support for 20 links in total with freely selectable role (Central/Peripheral) for each link (DRGN-7102, DRGN-7152, DRGN-7848).
  - The BLE bandwidth configuration and application packet concept has been replaced with per link configurable:
    - Event length (DRGN-7858)
    - Write without response queue size (DRGN-7488, DRGN-7858)
    - Handle Value Notification queue size (DRGN-7487, DRGN-7858)
  - The GPIO pin to toggle can now be the same for PA and LNA (DRGN-8354).
- LL
  - The SoftDevice can be configured to disable and enable slave latency (DRGN-8305). This allows the application to override the slave latency set by the master.
  - The SoftDevice can be configured to not disconnect if the peer initiates parallel version and feature exchange procedures (DRGN-8306).
  - Support for Network Privacy Mode (DRGN-8658)
- GAP
  - The event length (i.e. the time set aside on every connection interval) can now be configured per link by the application (DRGN-7858).
  - The application is given control of the Data Length Update Procedure. The application can initiate the Data Length Update Procedure and has to respond when initiated by the peer (DRGN-8297).
  - The application is given control of the PHY Update Procedure. The application can initiate the PHY Update Procedure and has to respond when the procedure is initiated by the peer (DRGN-8473).
  - GAP option `BLE_GAP_OPT_PREFERRED_PHYS_SET` to set the default PHY preferences for the SoftDevice is removed (DRGN-8473).
- GATT
  - The maximum ATT_MTU can now be configured per link by the application (DRGN-7858).
- GATTC
  - The application packet concept has been replaced with a dedicated transmission queue for Write without responses. Also, the `BLE_EVT_TX_COMPLETE` event has been replaced with `BLE_GATTC_EVT_WRITE_CMD_TX_COMPLETE`. Write without response queue size can now be configured per link by the application (DRGN-7488, DRGN-7858).
- GATTS
  - The application packet concept has been replaced with a dedicated transmission queue for Handle Value Notifications. Also, the `BLE_EVT_TX_COMPLETE` event has been replaced with `BLE_GATTS_EVT_HVN_TX_COMPLETE`. Handle Value Notification queue size can now be configured per link by the application (DRGN-7487, DRGN-7858).

Using 2 Mbps

The SoftDevice provides a new SV call `sd_ble_gap_phy_update()`and two new events, `BLE_GAP_EVT_PHY_UPDATE_REQUEST` and `BLE_GAP_EVT_PHY_UPDATE`, to support initiating or responding to a PHY Update procedure and to be notified about incoming peer initiated

PHY Update procedures and link PHY updates. Upon receiving a BLE_GAP_EVT_PHY_UPDATE_REQUEST, the application needs to respond with an sd_ble_gap_phy_update() SV call. For more information, see API documentation.

This alpha version of the SoftDevice supports connection establishment using the 1 Mbps PHY and then changing either the transmitting PHY or the receiving PHY (asymmetric link configuration), or both (symmetric link configuration) to use the 2 Mbps PHY. The PHYs can be changed using the abovementioned SV call.

Link Layer encryption and long data packet payload (up to 251 octets) are supported on both 1 Mbps and 2 Mbps PHYs.

Changes

- SoftDevice
  - The sd_power_ramon_set(), sd_power_ramon_clr(), and sd_power_ramon_get() SoftDevice APIs have been replaced with sd_power_ram_power_set(), sd_power_ram_power_clr(), and sd_power_ram_power_get() (DRGN-8117). Therefore, the application now has access to the registers RAM[x].POWER instead of the deprecated RAMON/RAMONB.
  - SWI3 is no longer reserved for use by the SoftDevice and is available for the application (DRGN-8367).
  - Interrupt priority 5 is now available to the application (DRGN-8853).
- BLE
  - More pointers have been defined as const in the BLE API allowing the application to put more data into flash instead of RAM if desired (DRGN-6133).
  - Configuration parameters passed to sd_ble_enable() have been moved to the SoftDevice configuration API (DRGN-8107).

- Documentation
  - The Message Sequence Charts (MSCs) for LL Data Length Update Procedure have been corrected, extended, and improved (DRGN-8722).
  - Improved documentation for sd_ble_gap_adv_start() (DRGN-8799)

Bug fixes

- SoftDevice
  - Fixed an issue where sd_ble_enable() may corrupt up to 8 bytes above the returned app_ram_base when the SoftDevice is configured with 0 Peripheral roles and 0 Central roles (DRGN-8802).
  - The sd_power_pof_threshold_set API has been fixed to support all the new levels that were introduced in nRF52 (DRGN-8348).
  - Fixed an issue where the SoftDevice could trigger a BusFault when forwarding a HardFault to the application (DRGN-8604).
  - Fixed an issue where scanning or advertising with timeout greater than 256 seconds and having two host protocol timers running at the same time might lead to delayed timeouts (DRGN-7804).
  - sd_softdevice_enable() now returns an error code if called with fault_handler set to NULL or to an invalid function pointer. If the application returns from the fault_handler function, the SoftDevice will do an NVIC_SystemReset() (DRGN-7122).
  - It is no longer required to clear INTENSET for TIMER0 before the timeslot ends if the application uses TIMER0 inside a timeslot scheduled with the Radio Timeslot API (DRGN-7776).
  - The SVCALL macro can now be used with the GCC C++ compiler as well (DRGN-8028).
- BLE
  - Several Doxygen documentation errors have been corrected (DRGN-7386, DRGN-7853, DRGN-8136).
- LL
  - Fixed an issue where using more than eight links and receiving a lot of data concurrently could lead to undefined behavior (DRGN-8433).
  - Fixed an issue where the SoftDevice could assert if scan parameters are updated after the scanner has accepted a new LE connection (DRGN-8635).
  - Fixed an issue where using encryption on multiple master links at the same time could cause an assert (DRGN-8532).
  - Fixed an issue where the SoftDevice would only be able to send two packets per connection event after a Data Length Update Procedure to a LL Data Channel PDU payload size of more than 34 bytes (DRGN-8392).
  - Fixed an issue where a connection parameter update from a short connection interval to a longer connection interval when using long ATT MTUs could lead to reduced bandwidth (DRGN-8427).
  - Fixed an issue where the controller completed a procedure when it received an LL_UNKNOWN_RSP without checking if it was the expected procedure that returned the error opcode (DRGN-7999).
  - The SoftDevice no longer rejects LL_LENGTH_REQ and LL_LENGTH_RSP with parameters which are out of range according to Bluetooth 4.2 specification (DRGN-7872).
  - Fixed an issue where bit errors in the length field of an encrypted packet caused the packet to be interpreted as longer than was sent by the peer (DRGN-7898). This issue could have manifested in the following ways:
    - SoftDevice memory buffer corruption which could lead to an assert or incorrect behavior.
    - SoftDevice may send a packet with an incorrect MIC field leading to a disconnect from the peer.
  - The SoftDevice no longer accepts LL_PHY_REQ and LL_PHY_RSP with empty TX and/or RX PHY fields (DRGN-7950).

- GAP
  - Fixed an issue where the `BLE_GAP_DATA_LENGTH_AUTO` value for `p_dl_params->max_tx_octets` and `p_dl_params->max_rx_octets` in `sd_ble_gap_data_length_update()` might not work as expected on connections using a configuration with configured event length of 2, 3, or 4 (DRGN-8779).
  - Fixed an issue where the `conn_handle` parameter in the event `BLE_GAP_EVT_DATA_LENGTH_UPDATE_REQUEST` was not populated correctly (DRGN-8749).
  - Fixed an issue where the SoftDevice would assert when was called while
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- The memory requirements of the SoftDevice have changed.

SoftDevice properties

- The combined MBR and SoftDevice memory requirements for this version are as follows:
  - Flash: **128 kB** (0x20000 bytes).
  - RAM: **6.43 kB** (0x19C0 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time).
  - Call stack: The SoftDevice uses a call stack combined with the application. The worst case stack usage for the SoftDevice is **1.54 kb** (0x624 bytes) (s132_nrf52_3.0.0 has 0x600 bytes of worst case stack usage). Application writers should ensure that enough stack space is reserved to cover both worst case SoftDevice call stack usage combined with worst case application call stack usage.

New functionality

- LL
  - Support for transmitting and receiving on the 2 Mbps PHY has been added (DRGN-7552).

Using 2 Mbps

The SoftDevice provides a new GAP option `BLE_GAP_OPT_PREFERRED_PHYS_SET`, a new SV call `sd_ble_gap_phy_request()`, and a new event, `BLE_GAP_EVT_PHY_UPDATE` to support the new PHY. Please read the API documentation for more details about these.

This alpha version of the SoftDevice supports connection establishment using the 1 Mbps PHY and then changing either the transmitting PHY or the receiving PHY (asymmetric link configuration), or both (symmetric link configuration) to use the 2 Mbps PHY. The PHYs can be changed using the above mentioned SV call.

Link Layer encryption and long data packet payload (up to 251 octets) are supported on both 1 Mbps and 2 Mbps PHYs.

Bug fixes

There are no bug fixes in this release.

Limitations

- SoftDevice
  - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
  - Synthesized low frequency clock source is not tested or intended for use with the BLE stack.
  - Applications must not modify the `SEVONPEND` flag in the `SCR` register when running in priority level 1 as this can lead to undefined behavior.
  - If the application uses TIMER0 inside a timeslot (scheduled with the Radio Timeslot API), INTENSET for TIMER0 must be cleared before the timeslot ends (DRGN-7776).
- LL
  - The peripheral role has priority over the central role when it comes to keeping the links alive.
  - For 2 Mbps, see the section "Using 2 Mbps" above.
- GAP
  - A broadcaster **and** a scanner cannot both be active if there are 8 connections established (DRGN-6543).
- GATTS
  - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- If `sd_softdevice_enable()` is called with `fault_handler` set to `NULL`, an invalid function pointer, or a pointer to a returning function, the behavior will be undefined (DRGN-7122).
- If Connection Event Length Extension is enabled, the Radio Notification may be suppressed between connection events (DRGN-7687).
- When `sd_ble_gap_connect()` returns an error code, the scanner may be stopped (DRGN-7679). To ensure the scanner is in a known state, `sd_ble_gap_scan_stop()` should be used to stop the scanner when `sd_ble_gap_connect()` returns an error code.