ANT_S332_nrf52_7.0.1 release notes

Contents

ANT_S332_nrf52_7.0.1

The ANT_S332_nrf52_7.0.1 SoftDevice for the **nRF52832 platform** is based upon the ANT_S212_nrf52_7.0.1 (ANT) SoftDevice and S132 v7.0.1 (BLE) SoftDevice combined.

Notes

- This S332 release has changed the Application Programming Interface (API) and memory requirements from the previous S332 production release (ANT_S332_nrf52832_6.1.1). This requires applications to be recompiled.

SoftDevice Properties

- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.4.1 (DRGN-10680). This MBR version is compatible with previous MBR versions.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
    - Flash: **196 kB** (0x30000 bytes)
    - RAM: **8 kB** (0x2000 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 **1.75 kB** (0x700 bytes). Application writers should ensure that enough stack space is reserved to cover the worst-case SoftDevice call stack usage combined with the worst-case application call stack usage.
- The Firmware ID of this SoftDevice is 0xCF

New Functionality

- **GAP**
    - API to obtain the next connection event counter (DRGN-10913).
    - API for triggering a task when the SoftDevice is about to start a connection event (DRGN-10914).
    - API for inclusion configuration of the CAR and PPCP characteristics (DRGN-10874).

Changes

- **SoftDevice**
    - Bluetooth Core Specification v5.1 qualified (DRGN-12400).
    - The VersNr field in the LL_VERSION_IND packet now contains the value 0x0A to indicate Bluetooth Core Specification v5.1 compatibility (DRGN-12466).
    - References to Errata are added to the documentation of all the events and APIs which report RSSI and should be observed if using RSSI measurements.
    - Removed macros defining PPI channels and groups available to the application (DRGN-10382).

- **LL**
  - Bluetooth Core Specification Erratum #10818 is incorporated. The SoftDevice now allows HCI ACL data packets with 0-length payload, but does not transmit anything until receiving the next non- zero continuation fragment (DRGN-11430).
  - Bluetooth Core Specification Erratum #10750 is incorporated. The `BLE_GAP_EVT_DATA_LENGTH_UPDATE` event will now be raised to the application when switching to and from Coded PHY. On-air behavior has not changed (DRGN-11435).
- **GAP**
  - The API for configuring improved advertiser role scheduling is removed. The SoftDevice now uses the improved scheduling configuration by default (DRGN-10754).

Bug Fixes

- **ANT**
  - Fixed an issue where Slave Shared Channels would not send an uplink reply in specific cases where the shared address matched.
  - Fixed an issue where Timestamp of a received message would be invalid on initial channel acquisition.
- **SoftDevice**
  - Fixed an issue in the QoS channel survey feature where the reported RSSI value for a channel was influenced by the noise on the previously checked channel (DRGN-10441
  - Fixed an issue where the application would be blocked when requesting an earliest possible Radio Timeslot (DRGN-10402).
- **LL**
  - Fixed an issue where the slave might disconnect if many packets were lost and there was an ongoing Connection Parameter Update (DRGN-11147).

Limitations

- **ANT**
  - The low frequency RC oscillator clock source (NRF_CLOCK_LF_SRC_RC) is not tested or intended for use with the ANT stack.
- **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 ANT or 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.
  - If the scanner is configured with a scan window larger than 16 seconds, the scanner will truncate the scan window to 16 seconds (DRGN-10305).

- Flash write operations may exceed the timeout provided when performed with certain protocol operations (e.g. ANT Continuous Scan).

- **GATT**
  - 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**
  - The `BLE_GAP_EVT_SEC_INFO_REQUEST` event will not report the identity address of the peer to the application. This issue was also present in previous releases. A workaround is to do a mapping of the connection handle to the peer's identity address (DRGN-10340).
  - `sd_ble_gap_device_name_set()` may return `NRF_ERROR_INTERNAL` instead of `NRF_ERROR_NO_MEM` if the allocated space for the device name is too small. A workaround is to allocate enough space for the device name before calling `sd_ble_gap_device_name_set()` (DRGN-10195).
  - The MWU protection may become disabled in certain cases if the application ISR is interrupted by SoftDevice ISR (DRGN-10361).
  - A memory access fault (`NRF_FAULT_ID_APP_MEMACC`) can occur in `sd_nvic_critical_region_exit()` if a high priority SoftDevice interrupt occurs during a critical section, for example due to radio traffic (DRGN-10613). This issue was present also in previous releases. It can be fixed by editing `NRF_NVIC_SD_IRQS_1` in nrf_nvic.h so that it becomes:

```
#define NRF_NVIC_SD_IRQS_1 ((uint32_t)(1U << (MWU_IRQn - 32)))
```

  - The SoftDevice will generate a resolvable address for the TargetA field in directed advertisements if the target device address is in the device identity list with a non-zero IRK, even if privacy is not enabled and the local device address is set to a public address. This issue was present also in previous releases. A workaround is to set the IRK to zero or to remove the device address from the device identity list (DRGN-10659).

  - The SoftDevice may generate several events, when connected, based on peer actions, i.e. without prior action from the application. The `BLE_GAP_EVT_PHY_UPDATE_REQUEST` event, for instance, will be generated when a connected peer sends a Phy Update Request, even when an application does not include logic to change phy. There are several such events that may require action from an application if they are received. For more details check `sd_ble_enable()` API in SoftDevice.

- **GAP**
  - If an extended advertiser is configured with limited duration, it will time out after the first primary channel packet in the last advertising event (DRGN-10367).
- **GATTC**
  - The `ble_gattc_service_t::uuid` field is incorrectly populated in the `BLE_GATTC_EVT_PRIM_SRVC_DISC_RSP` event if the `sd_ble_gattc_primary_services_discover()` or `sd_ble_gattc_read()` is called when a Primary Service Discovery by Service UUID is already ongoing (DRGN-11300). When the application has called `sd_ble_gattc_primary_services_discover()`, it should wait for the `BLE_GATTC_EVT_PRIM_SRVC_DISC_RSP` event before calling `sd_ble_gattc_primary_services_discover()` or `sd_ble_gattc_read()`.
- **LL**
  - If the application adds an all zeroes IRK with the `sd_ble_gap_device_identities_set()`, it will be treated as a valid entry in the device identity list. An all zeroes IRK is invalid and must not be added (DRGN-9083).

ANT_S332_nrf52832_6.1.1

The ANT_S332_nrf52832_6.1.1 SoftDevice for the **nRF52832 platform** is based upon the ANT_S212_nrf52_6.1.1 (ANT) SoftDevice and S132 v6.1.1 (BLE) SoftDevice combined.

Notes

- This S332 release has changed the Application Programming Interface (API) and memory requirements from the previous S332 production release (ANT_S332_nrf52832_5.0.0). This requires applications to be recompiled.
- The release notes list includes change progression information from:
    - S132_nrf52_5.1.0
    - s132_nrf52_6.0.0
    - s132_nrf52_6.1.0
    - s132_nrf52_6.1.1

SoftDevice Properties

- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.4.1 (DRGN-10680). This MBR version is compatible with previous MBR versions.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
    - Flash: **196kB** (0x30000 bytes)
    - RAM: **8kB** (0x2000 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)
- The Firmware ID of this SoftDevice is 0xBA

New Functionality

- **SoftDevice**
    - SoftDevice can now use external low-swing and full-swing low-frequency (32.768kHz) clocks.

Inherited history:

S132_nrf52_6.1.0

- **SoftDevice**
    - The SoftDevice variant, flash usage, reserved PPIs, and reserved interrupt priorities are now available at compile time to the application through new APIs (DRGN-9627).
    - Qualified LE Advertising Extensions feature (DRGN-7504).
    - An API is added to enable the application to remove an unused UUID entry from the UUID table (DRGN-10389).
- **GAP**
    - Message sequence charts for Advertising Extensions are added (DRGN-9285).
    - With the new sd_ble_gap_adv_addr_get() API, the application can now get the Bluetooth device address that is being used by the advertiser (DRGN-10470).
- **LL**

- It is now possible to send and receive advertising packets with up to 255 bytes of payload (DRGN-9315).
- Privacy for Advertising Extensions is fully supported (DRGN-9340).
- The SoftDevice is now able to receive chained advertisements (DRGN-9734).
- The SoftDevice is now able to send chained advertisements. The advertising data fragmentation is handled autonomously by the SoftDevice (DRGN-9802).
- The scanner is now able to follow AUX pointers outside the scan window (DRGN-9886).
- The scanner and initiator roles for Advertising Extensions now implement a backoff procedure (DRGN-10271).

S132_nrf52_6.0.0

- **SoftDevice**
  - The SoftDevice API for advertising and scanning is updated and prepared to support future features. For more information, see the migration document (DRGN-9712).
- **GAP**
  - Channel number for RSSI measurement is now available in advertising reports (DRGN-9473).
  - Channel number for RSSI measurement is now available for connections (DRGN-9667).
  - API for channel survey (noise measurement) (DRGN-9580).
  - Support for setting channel map for the Observer role (DRGN-9518).
  - The SoftDevice now supports the configuration of TX power per link and per role (DRGN-6659).
- **LL**
  - Limited support for the LE Extended Advertising feature. (DRGN-7504).

S132_nrf52_5.1.0

- None

Changes

- **SoftDevice**
  - The MBR 2.4.1 is a minor backward compatible configuration update of the MBR for this release. There were no bugs resolved in this update, only minor build configuration option changes (DRGN-10680)
  - Applications can improve the radio utilization for multiprotocol applications by enabling the improved advertiser role scheduling configuration through the BLE Option API. The time reserved for an advertising event will then be decreased by up to 1.3 ms (DRGN-10398).

Inherited history:

S132_nrf52_6.1.0

- **SoftDevice**
  - The sleep current has been improved (DRGN-9628).
  - Improved documentation for the `NRF_ERROR_INVALID_STATE` error code (DRGN-9693).
  - When the SoftDevice is acting as a peripheral, and the RC oscillator is used as the LFCLK source, the configured RC calibration period can now be increased. By default, the SoftDevice will now increase the receive window if two consecutive packets are missed and will then perform RC calibration if necessary (DRGN-9852).
  - SoftDevice s132_nrf52_6.0.0 accepted an advertising interval larger than `BLE_GAP_ADV_INTERVAL_MAX` as an experimental feature. However, this configuration could make the SoftDevice assert. Now, the SoftDevice will return `NRF_ERROR_INVALID_PARAM` if the application configures an advertising interval larger than `BLE_GAP_ADV_INTERVAL_MAX` (DRGN-10322).
  - Radio utilization for multi-protocol applications are improved significantly as the time allocated for a normal Radio Timeslot request session has decreased by up to 1 ms (DRGN-10405).
- **GATT**
  - `sd_ble_gatts_rw_authorize_reply()` now allows sending the 0xFC (Write Request Rejected) profile error code which was introduced in the Bluetooth Core Specification Supplement CSSv7 (DRGN-10373).
- **GAP**
  - Setting the `ble_gap_adv_properties_t::anonymous` or `ble_gap_adv_properties_t::include_tx_power` bits when configuring a legacy advertiser is no longer permitted (DRGN-10024).
  - Using a too short duration for the advertising event when advertising is no longer accepted by the API (DRGN-10067).
  - The advertising data length limit for a connectable extended advertiser is now properly documented and limited in the API to 238 bytes (DRGN-10420).
- **LL**
  - Packet content validation is improved for the scanning of extended advertising PDUs (DRGN-9686).
  - The optional TxPower field is not included in the extended header in extended advertising PDUs (DRGN-8545).
  - Instead of disconnecting, the SoftDevice will now respond with LL_UNKNOWN_RSP when receiving control procedure PDUs with invalid lengths (DRGN-9997).

S132_nrf52_6.0.0

- **SoftDevice**

- The SoftDevice now returns `NRF_ERROR_BUSY` from flash API functions until the event generated after a previous flash operation has been pulled (DRGN-9565).
- The SoftDevice now has an additional API for write-protecting memory. This can now be achieved by accessing the BPROT peripheral configuration registers through `sd_protected_register_write()` (DRGN-9337).
- A message sequence chart for Unexpected Security Packet Reception has been added to Peripheral Security Procedures in the API documentation (DRGN-9479).

- **GATT**
  - The SoftDevice will now return `NRF_ERROR_TIMEOUT` instead of `NRF_ERROR_BUSY` from GATT API functions if a GATT procedure is blocked due to a previous procedure timeout (DRGN-9545).
  - Clarified API documentation: The length field in the parameter struct passed to `sd_ble_gatts_hvx()` may be written to by the SoftDevice (DRGN-9620).
- **GAP**
  - The `sd_ble_gap_data_length_update()` input parameter requirements have been relaxed. Previous requirements, which have now been removed, included symmetric input parameters
  - and BLE_GAP_DATA_LENGTH_AUTO as the only valid input for `max_tx_time_us` and `max_rx_time_us` (DRGN-8499).
- **LL**
  - The documentation of the PHY Update procedure is improved (DRGN-9678).
  - Bluetooth Core Specification Erratum #7408 is incorporated, meaning that it is now accepted to receive an LL_UNKNOWN_RSP during encryption procedure (DRGN-8414).
  - nRF52832 with build code E00 or E10 is now autodetected and workarounds for ERRATA-102 and ERRATA-106 are not applied for those devices. The workaround in ERRATA-182 is appliedfor those devices (DRGN-9748, DRGN-9851).

S132_nrf52_5.1.0

- **SoftDevice**
  - References to EGU* have been removed from nrf_soc.h and nrf_nvic.h as the SoftDevice is using SWI and not EGU to generate interrupts (DRGN-9257).
- **L2CAP**
  - Improved overall throughput for L2CAP connection-oriented channels, especially when using long connection event lengths (DRGN-9127).
- **LL**
  - The SoftDevice now sends `LL_REJECT_EXT_IND` instead of `LL_REJECT_IND` if the peer has indicated support for `LL_REJECT_EXT_IND` (DRGN-9539).

Bug fixes

- **ANT**

    - Fixed an issue where synchronous channels would be erroneously blocked while running high duty search in a dense environment.
    - Fixed an issue where the ANT stack would stall while running an ANT master channel, ANT high duty search, and BLE activity at the same time.
- **SoftDevice**
    - Fixed an issue with the QoS channel survey feature, where the LNA control would only work for the first channel to be checked in the survey (DRGN-10466).
    - Fixed a problem where calling `sd_ble_gap_connect()` with scan_phys set to only `BLE_GAP_PHY_2MBPS` would cause an assert when starting to scan (DRGN-10654).
    - Fixed an issue where NRF_TIMER0 may not be reset at the start of a radio timeslot (DRGN-10650).
- **LL**
    - Fixed an issue where the SoftDevice would sometimes delay the LL_LENGTH_RSP in a Data Length Update procedure if a PHY Update procedure was ongoing at the same time (DRGN-10853).
    - Fixed an issue where the SoftDevice could assert when receiving long packets during extended scanning (DRGN-10880).

Inherited history:

S132_nrf52_6.1.0

- **SoftDevice**
    - Fixed an issue where a HardFault could generate a new HardFault if the application called a NULL pointer (DRGN-9607).
    - Fixed an issue where the SoftDevice HardFault handler could hang if the application wrote to protected memory (DRGN-9694).
    - Fixed an issue where the SoftDevice could assert if configured with too many L2CAP Connection-oriented Channels (DRGN-9946).
    - Fixed an issue where the HFXO would sometimes not be released properly after RC calibration. This is in addition to the bug fix for a similar condition resolved in s132_nrf52_6.0.0 (DRGN-9920, DRGN-10166).
    - Fixed an issue where the PA/LNA GPIOs could be triggered too late. Furthermore, the PA pin is now set active 23 µs before RADIO TX start, instead of 5 µs before RADIO TX start. The LNA pin is set active 5 µs before RADIO RX start, as before (DRGN-9928).
    - Fixed documentation for `SD_EVT_IRQHandler` and `RADIO_NOTIFICATION_IRQHandler`, where the default interrupt priority was documented incorrectly (DRGN-10174).
    - Fixed an issue where LFRC oscillator calibration could fail (DRGN-10255).
    - Fixed an issue that could make the SoftDevice assert when scheduling events close together (DRGN-10316).
- **GAP**

- Fixed an issue where the source of the timeout event might be set to `BLE_GAP_TIMEOUT_SRC_CONN` instead of `BLE_GAP_TIMEOUT_SRC_SCAN` when the scanner times out (DRGN-10000).
- Fixed an issue where the advertiser would not update its address type if `sd_ble_gap_addr_set()` or `sd_ble_gap_privacy_set()` was called after `sd_ble_gap_adv_set_configure()` and before `sd_ble_gap_adv_start()` (DRGN-10025).
- Fixed an issue where the SoftDevice incorrectly reported advertising packets from non-whitelisted devices if the `BLE_GAP_SCAN_FP_WHITELIST_NOT_RESOLVED_DIRECTED` filter policy was used (DRGN-10196).
- Fixed an issue where the scanner incorrectly reported the `data_id` field in extended advertising PDUs as zero (DRGN-10204).
- Fixed an issue where passing a zero-initialized parameter to `sd_ble_gap_connect()` could cause an assert (DRGN-10331).
- Fixed an issue where the SoftDevice could return `NRF_ERROR_INVALID_STATE` if the application called `sd_ble_gap_scan_start()` or `sd_ble_gap_connect()` right after receiving `BLE_GAP_EVT_TIMEOUT` for a previous call to `sd_ble_gap_connect()` (DRGN-10215).
- Fixed an issue where the SoftDevice could return `NRF_ERROR_INVALID_STATE` if the application called `sd_ble_gap_scan_start()` or `sd_ble_gap_connect()` right after calling `sd_ble_gap_connect_cancel()` (DRGN-10226).
- Fixed an issue that could cause an assert when an advertiser configured with invalid parameters connected to a peer (DRGN-10355).
- Fixed an issue that could cause an assert when the advertiser was stopped (DRGN-10364).

- **LL**
  - Fixed an issue where the advertiser could send advertising packets beyond the set advertising duration (DRGN-10069).
  - Fixed an issue where the slave might not listen during the entire connection parameter update (DRGN-10086).
  - Fixed an issue where the master used wrong timings while establishing a connection with Advertising Extensions (DRGN-10112).
  - Fixed an issue where a privacy enabled extended advertiser would never be able to connect (DRGN-10205).
  - Fixed an issue where the SoftDevice sent ADV_EXT_IND PDUs with an incorrect AUX Offset (DRGN-10207).
  - Fixed an issue where the extended advertiser could assert if receiving longer PDUs than expected (DRGN-10232).
  - Fixed an issue that could result in lost advertising reports and advertising reports with all fields set to zero (DRGN-10393).

- Fixed an issue where the scanner would not generate a report for information received in scanned ADV_EXT_IND and AUX_ADV_IND if the AUX_SCAN_RSP was missed (DRGN-10397).

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- **SoftDevice**
  - Fixed an issue where `sd_ble_gap_rssi_get()` could sometimes return `NRF_ERROR_SUCCESS` with an invalid RSSI (DRGN-9746).
  - Fixed an issue where the HFXO would sometimes not be released properly after RC calibration (DRGN-9920).
- **GATT**
  - Fixed an issue where the SoftDevice could drop a write request if it was received at the same time as a write command (DRGN-9709).
- **GAP**
  - Fixed an issue where the SoftDevice would sometimes not report the actual negotiated RX parameters in the `BLE_GAP_EVT_DATA_LENGTH_UPDATE` event (DRGN-9939).
  - Fixed an issue where the SoftDevice could assert if the white list and identity list were set at the same time with matching addresses (DRGN-9535).
- **LL**
  - Fixed an issue where the slave could disconnect with status code `BLE_HCI_DIFFERENT_TRANSACTION_COLLISION` if master sent an `LL_UNKNOWN_RSP` after a PHY procedure collision (DRGN-9870).
  - Fixed an issue where the SoftDevice might advertise with the RxAdd bit set to 1 for undirected advertisements. According to the Bluetooth Core Specification v 5.0, the RxAdd bit is reserved for future use for these PDU types (DRGN-9739).
  - Fixed an issue where the SoftDevice could assert if the identity list was used while advertising or scanning (DRGN-9723).
  - Fixed an issue where the SoftDevice might send an LL_LENGTH_RSP with illegal values for TX/RX octets if the event length configured for the link was either 4 or 5 and LE 2M PHY was used (DRGN-9839).
  - Fixed an issue where incorrect timing calculations during the LE Data Length Update procedure could lead to an assert (DRGN-9612).

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- **SoftDevice**
  - Fixed an issue where Radio Notification could be suppressed between connection events when Connection Event Length Extension was enabled (DRGN-7687).
  - Fixed an issue where `sd_ble_gatts_attr_get()` and `sd_ble_gatts_value_get()` could return undocumented `BLE_ERROR_INVALID_ATTR_HANDLE` error code in a situation where they should have returned `NRF_ERROR_NOT_FOUND` (DRGN-9216).

    - Fixed an issue where the `BLE_EVT_LEN_MAX(ATT_MTU)` macro did not return the worst-case event length because it did not account for a corner case related to GATT primary service discovery response (DRGN-9610).
- **GATT**
    - Fixed an issue where the SoftDevice could assert if ATT packets longer than the LL packet size were sent and received at the same time (DRGN-9328).
- **LL**
    - Fixed an issue where the SoftDevice could send `LL_FEATURE_RSP` with incorrect `FeatureSet` (DRGN-9551).
    - Fixed an issue where the slave could disconnect with reason `HCI_LOCAL_HOST_TERMINATED_CONNECTION` instead of `HCI_STATUS_CODE_PIN_OR_KEY_MISSING` if the LTK (Long Term Key) was missing (DRGN-9190).
    - Fixed an issue where the SoftDevice could get stuck in a deadlock where it would always NACK what the peer was sending. This could happen if LE Data Packet Length Extension was used and `ble_cfg.conn_cfg.params.gap_conn_cfg.event_length` was less than 5 (DRGN-9494).
    - Fixed an issue where the SoftDevice could get stuck in a deadlock where it would always NACK what the peer was sending. This could happen if the peer reduced the data length during the Data Length Update procedure (DRGN-9367).

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 ANT or BLE stack.
    - Internal RC oscillator clock source is not tested or intended for use with the ANT 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.
    - If the scanner is configured with a scan window larger than 16 seconds, the scanner will truncate the scan window to 16 seconds (DRGN-10305).
    - Flash write operations may exceed the timeout provided when performed with certain protocol operations (e.g. ANT Continuous Scan).
- **GATT**
    - 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).

Inherited history:

S132_nrf52_6.1.0

- **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.
  - If the scanner is configured with a scan window larger than 16 seconds, the scanner will truncate the scan window to 16 seconds (DRGN-10305).
- **GATT**
  - 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).

S132_nrf52_6.0.0

- **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.
  - The LE Advertising Extension implementation is incomplete and may not function as specified. The feature is only suitable for development purposes, not production.
    - The main functionality that is missing is scanner privacy for advertising extensions, advertising and scanning AUX_CHAIN_IND PDUs, and advertising intervals longer than 10.24 s.
- **GATT**
  - 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).

S132_nrf52_5.1.0

- **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.

- **GATT**
  - 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**
  - `sd_ble_gap_device_name_set()` may return `NRF_ERROR_INTERNAL` instead of `NRF_ERROR_NO_MEM` if the allocated space for the device name is too small. A workaround is to allocate enough space for the device name before calling `sd_ble_gap_device_name_set()` (DRGN-10195).
  - The MWU protection may become disabled in certain cases if application ISR is interrupted by SoftDevice ISR (DRGN-10361).
  - If the application requests an earliest possible Radio Timeslot and the timeslot is blocked, the SoftDevice will repeat the same request until it times out, thereby blocking the main context and the lower application interrupt priority levels. A workaround is to increase the timeout of the Radio Timeslot request to make it able to fit after the event that is blocking the request (DRGN-10402).
  - When using the QoS channel survey feature, the reported RSSI value for a channel is influenced by the noise on the previously checked channel (DRGN-10441).
  - The SoftDevice will generate a resolvable address for the TargetA field in directed advertisements if the target device address is in the device identity list with a non-zero IRK, even if privacy is not enabled and the local device address is set to a public address. This can make devices certified for Bluetooth versions older than 4.2 ignore the advertising packets. This issue is present in SoftDevice versions 3.0.0 and later. A workaround is to set the IRK to zero or to remove the device address from the device identity list (DRGN-10659).
  - If an extended advertiser is configured with limited duration, it will time out after the first primary channel packet in the last advertising event (DRGN-10367).

ANT_S332_nrf52832_5.0.0

The ANT_S332_nrf52832_5.0.0 SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_5.0.0 (ANT) SoftDevice and S132 v5.0.0 (BLE) SoftDevice combined.

SoftDevice Properties

- The SoftDevice Specification for the S332 is available on the ANT website
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.2.0
    - This version of the MBR is compatible with the previous versions.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
    - Flash: **180kB** (0x2D000 bytes)
    - RAM: **7.98kB** (0x1F30 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)

New functionality

- **SoftDevice**
    - 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**
    - The SoftDevice now supports Channel Selection algorithm #2 (DRGN-7147).
- **LL**
    - Support for transmitting and receiving on the 2 Mbps PHY has been added (DRGN-7552).
    - Support for Network Privacy Mode (DRGN-8658).
    - PA/LNA supported for LE 2M PHY (DRGN-8259).
- **L2CAP**
    - Connection-Oriented Channels in LE Credit Based Flow Control Mode (DRGN-8572).

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.

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

- **SoftDevice**
  - It is now possible to set RCOSC accuracy to 500 ppm or 250 ppm when calling sd_softdevice_enable and using nrf_clock_lf_cfg_t::source=NRF_CLOCK_LF_SRC_RC. nrf_clock_lf_cfg_t::xtal_accuracy can be configured to NRF_CLOCK_LF_XTAL_ACCURACY_250_PPM or NRF_CLOCK_LF_XTAL_ACCURACY_500_PPM (DRGN-8838). All other values for xtal_accuracy will default to 500 ppm.
  - Interrupt priority 5 is now available to the application (DRGN-8853).
  - 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).
  - 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).
- **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.
- **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).
    - Fixed an issue where the SoftDevice might assert in some cases if the application delayed pulling of SoftDevice events (DRGN-8823).
    - 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).
    - Fixed an issue where the SoftDevice could trigger a BusFault when forwarding a HardFault to the application (DRGN-8604).
- **LL**
    - 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.

    - 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).
- **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).
- **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).
- **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).
    - It is no longer possible to issue an HVN if the HVN queue size is set to 0 on the config API (DRGN-8353).
- **GATTC**
    - It is no longer possible to issue a write command if the write command queue size is set to 0 on the config API (DRGN-8353).

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 ANT or BLE stack.
    - Internal RC oscillator clock source is not tested or intended for use with the ANT 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).
    - When the SoftDevice is enabled the IRQ priorities of SD_EVT_IRQn and RADIO_NOTIFICATION_IRQn (SWI2_IRQn and SWI1_IRQn respectively) are set to a default of 6. This differs from previous versions of the SoftDevice, as well as what is specified in the SoftDevice Specification. It is suggested to explicitly set these priorities in the application after the SoftDevice is enabled.