AirID - Technical Statement - Linux Kernel v5.1.20

Date: 05 Sep 2019

Using Linux Kernel version 5.1.20 with AirID family products – Bluetooth connection slowdown

With the current release of the Linux Kernel version 5.1.20, there have been an update on the Bluetooth Low Energy connection intervals.

The Bluetooth Low Energy connection interval describes the time between two connection events and therefore it is balancing two essential factors: throughput and power consumption. Reducing the connection interval allows an increased throughput and a reduced time for sending data while also the power consuption increases. The reverse is true for increasing the interval. The appropriate connection parameters are always depending on the application. [1]

The Linux Kernel before version 5.1.20 allowed the peripheral to negotiate connection interval values from a minimum of 7.5ms to a maximum of 4.0s; the entire range of the Bluetooth Low Energy protocol. In order to gain more control over the intervals, the acceptable range in Linux have been configured to a minimum and maximum value of 30ms to 50ms. The corresponding patch is the patch "Bluetooth: validate BLE connection interval updates" [2] from June 12, 2019.

As low connection intervals are essential for a fast Bluetooth communication and a high throughput as especially required for the application of AirID family products, this update leads to a much slower Bluetooth connection and communication with AirID. The currently used Bluetooth API does not allow a different setting option here. Hence, to overcome this issue of connection slowdown, the mentioned patch needs to be reverted within the Kernel. Alternatively, it is also possible to manually adjust the configuration of the minimum connection interval within the Linux Kernel to allow a minimum of 7.5 ms. Therefore, the value "6" needs to be written to */sys/kernel/debug/bluetooth/hci0/conn_min_interval*. This configuration must be done once during the boot process after the Bluetooth adapter is recognized but before BLE connection is established. To make the configuration, the CONFIG_BT_DEBUGFS option must be enabled in the kernel configuration which is often not the case for kernel binaries shipped with distributions.

Affected kernel versions (Mainline)

v5.3

v5.2.x (x >= 3): Commit 33401f6ba0d9f23ca5877540375b88d7cd5b1f8f

v5.1.x (x >= 20):Commit 572af11ec2252a9c57cc6ee5e247ebe04da18bb7

v4.19.x (x >= 61): Commit 202de90df2b7e96786a17cd54409317906e579c2

v4.14.x (x >= 135): Commit 408694ef507c1893f0325e0871690d5507a23811

v4.9.x (x >= 187): Commit 427d80d8a462a8ce8554ab07410f229a3fe388c2

v4.4.x (x >= 187): Commit ccc188308c0394571dcab9673ceee169839ef6b2

Distribution kernels

Ubuntu-5.0.0-27.28 (ubuntu disco, 19.04): not affected

Ubuntu-4.15.0-x (x >= 59.66): (ubuntu bionic 18.04 LTS)

References:

[1] http://dev.ti.com/tirex/content/simplelink_cc2640r2_sdk_1_40_00_45/docs/blestack/ble_user_guide/html/ble-stack-3.x/gap.html

[2] https://www.spinics.net/lists/linux-bluetooth/msg80328.html