BLUETOOTH BLOG

Bluetooth Pairing Part 2 Key Generation Methods

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In Bluetooth Pairing Part 1: Pairing Feature Exchange, we talked about the pairing feature exchange in *Bluetooth*® with low energy. The pairing feature exchange is used to make both devices, initiator and responder, understand each other's pairing features.

The pairing features that can be enabled are:

- **OOB Data Flag bit**
- **MITM—Man-In-The-Middle bit**
- **SC—LE secure connection indicator bit**
- **IO Cap—IO Capabilities**

**For an introduction to these features, please refer to Bluetooth Pairing Part 1: Pairing Feature Exchange.*

After this exchange, both devices can select which key generation method is used in subsequent phases. Here is the list of key generation methods for Bluetooth LE legacy pairing and Bluetooth LE Secure Connection.

Bluetooth LE Legacy Pairing:

- **Just Works**
- **Passkey**
- **Out-of-Band(OOB)**

Bluetooth LE Secure Connection includes the three methods above and adds one new one:

- **Numeric Comparison**

Workflow

Here is the workflow on how a device decides which key generation method to use.

Step 1: Check SC bit in pairing feature exchange frame. If the SC bit is equal to 1 on both sides, an LE secure connection is used, go to step 2. Otherwise, it is LE legacy pairing, and go to step 3.

Step 2: When it is LE secure connection, below is the matrix that initiator and responder will follow.

		Initiator			
		OOB Set	**OOB Not Set**	**MITM Set**	**MITM Not Set**
Responder	**OOB Set**	Use OOB	Use OOB		
	OOB Not Set	Use OOB	Check MITM		
	MITM Set			Use IO Capabilities	Use IO Capabilities
	MITM Not Set			Use IO Capabilities	Use Just Works

- "Use OOB" means Out-of-Band is selected.
- "Check MITM" means ignore "OOB Data Flag" and check MITM flag, "Man-In-The-Middle" flag.
- "Use IO Capabilities," go to step 4 to select the key generation method depending on IO Capabilities of both devices.

Step 3: When it is LE legacy pairing, below is the matrix that initiator and responder will follow.

- "Use OOB" means Out-of-Band is selected.
- "Check MITM" means ignore "OOB Data Flag" and check the MITM flag, "Man-In-The-Middle" flag.
- "Use IO Capabilities", go to step 4 to select the key generation method depending on IO Capabilities of both device.

Step 4: Below is a mapping of the IO Capabilities to Key Generation Method. With this table, both devices, initiator and responder, will find an appropriate method for connecting depending on their pairing features.

After this, the initiator and responder understand the method that will be used in the key generation phase. In part 3, I will introduce how to generate the corresponding key in Bluetooth® LE legacy pairing by using the Passkey method.

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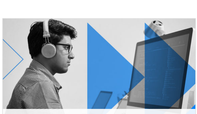

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