Cellocator Division
Pointer Telocation Ltd.

Dynamically Pair MultiSense Devices with the CelloTrack Nano Hubs (Application Note)

This application note describes how to dynamically associate and get data from an unlimited number of operated MultiSense devices when several Nano hubs are in the vicinity.

An ideal use case example of this feature fits a logistics center, where many trucks with embedded Nano hubs load / unload cargo and need to receive temperature data from the MultiSense devices located inside their cargo holds in real-time.

Background

The Nano hub can work in three different communication modes with the MultiSense devices:

- **Paired mode:** The Nano hub can be paired with up to 16 MultiSense devices. In this mode, the Nano hub receives MultiSense sensor data and manages their thresholds, with no reference to other Nano hubs that may be located in the same environment.
- **Guest mode:** In this mode, an unlimited number of MultiSense devices send their sensor-data to the Nano hub, as long as only one Nano hub is the same environment.
- **Tag mode:** In this mode, an unlimited number of MultiSense devices send only their MAC Address data without sending any of their sensor data (similar to a beacon or RFID tag). This mode can be operated when other Nano hubs are in the vicinity.

Note: When the hub is in Guest or Tag modes, it also regularly serves its paired MultiSense devices (up to 16), so is in fact creating a mix of Guest + Paired or Tag + Paired.

The Problem

In an example logistics use case, where many (even a few hundreds) MultiSense devices exist, monitoring environmental parameters of assets or cargo items, and where those cargo items can be loaded onto different trucks in which Nano devices are temporarily or permanent installed, none of above modes is sufficient, for the following reasons:

- In **Paired** mode, a maximum of 16 MultiSense devices can be paired.
- In **Guest** mode, only one Nano hub can be used to get the information from the MultiSense devices. With more than one Nano hub in the same environment, a collision in data exchange may occur between the Nano hubs.
- In **Tag** mode, a number of fields are sent, including the MultiSense device MAC addresses, but not the sensor data.
- In the mix of **Paired + Guest**, a data collision may occur for any MultiSense devices in Guest mode.
- In the mix of **Paired + Tag**, the sensor data will only be sent from devices in Paired mode and not from devices in Tag mode.

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The Proposed Solution

For use cases with controlled environment shipments such as the one described above, the Nano should be configured as Tag mode and the server side should manage a conditional logic (as suggested below) in order to support unlimited number of MultiSense with many Nano units in the same area. This logic manages the paired MultiSense devices via OTA commands - "PL PAIR" and "PL UNPAIR". The Paring logic should only be active during the dynamic transportation phase - after the truck leaves the logistic center (not during the loading / unloading phase in which many unrelated MS devices can be received).

The suggested logic could be based on one of these or a combination of them:

- "Received Signal Strength" of the MultiSense by Nano units in the vicinity (RSSI level).
- Geo-fence. Identify an area that may be crowded with Nano devices. (E.g. warehouses or distribution centers). This may lead to build logic (at the server side) of which Nano should be the MultiSense's master.
- Movement. For example, by identifying if the truck is moving for predefined time before setting the master of each MultiSense.
- MultiSense MAC address. For example, if a specific MultiSense device MAC address is already paired with another Nano hub, the "PL PAIR" command is not executed.

Here is an example for such a logic applied by the server to decide if MultiSense should be paired with a specific Nano master:

- If the RSSI is higher than a certain threshold or
- It is not associated (paired) with any other Nano system and/or
- The Nano is in motion for predefined duration and/or
- The Nano exits from geo fence area (i.e. logistic center)

Then, server site should send PL PAIR command OTA to the Nano.

PL UNPAIR action can be taken after "lost" event.

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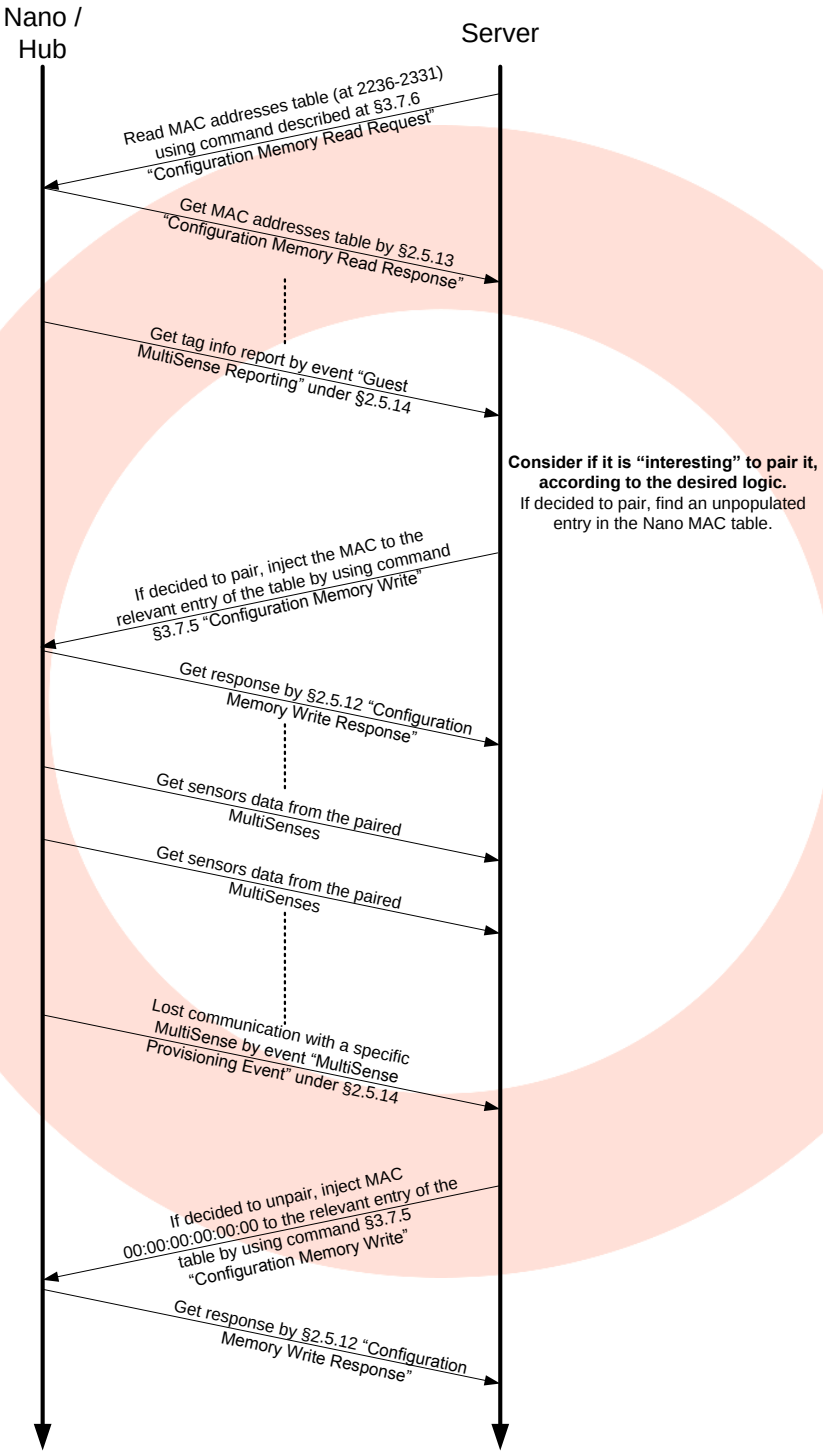
Messaging protocol between the Nano hub and Server side (all sections marked **§** refer to the "Cellocator Wireless Communication Protocol" document)**:**



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References

- Cellocator Wireless Communication Protocol – CelloTrack Nano edition
- CelloTrack Nano Overview

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