**Alphabet Soup of Terms**

**IoT** – Internet of Things. The term for the combination of embedded devices on the “edge” communicating with the cloud via gateways, facilitating highly scalable computing resources such as processing, storage, and analysis of massive data. Other IoT components are mobile computing devices and browser-based portals.

**cIoT** – Cellular IoT. A relatively new concept allowing edge devices to talk directly to the cloud without a separate gateway (although the cellular network is effectively the gateway in this casae).

**LPWAN** – Low Power Wide Area Network. The WAN part refers to a network more spread out than a LAN (local area network) that might be found in a home or university or business. The cellular network, with new low-power standards such as LTE-M and NB-IoT, form a worldwide LPWAN.

**LTE-M** – Abbreviation for LTE-M1 – Long Term Evolution (4G) Category M1. A standard for relatively low bandwidth communication on LTE networks that allows mobile roaming.

**NB-IoT** – Narrow Band IoT. A standard providing lower bandwidth than LTE-M but greater range for static devices (e.g., a smart parking meter).

**eDRX** – Extended Discontinuous Reception. A technique used by LTE-M1 for reducing power consumption.

**PSM** – Power Saving Mode. A technique used by LTE-M1 for reducing power consumption.

**GPS** – Global Positioning System. A system of satellites used to determine location.

**FOTA** – Firmware over-the-air (update). A method of updating the firmware for the application or communications stack of a wireless device via its radio (instead of having to connect a cable to it). There are many robustness and security issues that must be considered when designing a FOTA schema.

**NFC** – Near Field Communication. A communication standard designed for identification and short-range data exchange.

**BLE** – Bluetooth Low Energy. A subset of the Bluetooth standard designed for low-power, low-bandwidth communication.

**Zigbee** – A low-power wireless mesh network communications standard.

**IP** – Internet Protocol. Communications standard for devices on a network.

**UDP** – User Datagram Protocol. Connectionless communications protocol that does not guarantee delivery of packets or the order in which they are delivered.

**TCP** – Transmission Control Protocol. Connection oriented communications protocol that guarantees delivery of packets in the order in which they were sent.

**HTTP** – Hypertext Transfer Protocol.

**MQTT** – MQ Telemetry Transport. A simple, lightweight messaging protocol designed for IoT devices with constrained resources

From the mqtt.org FAQ:

MQTT stands for MQ Telemetry Transport. It is a publish/subscribe, extremely simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency or unreliable networks. The design principles are to minimize network bandwidth and device resource requirements while also attempting to ensure reliability and some degree of assurance of delivery. These principles also turn out to make the protocol ideal of the emerging “machine-to-machine” (M2M) or “Internet of Things” world of connected devices, and for mobile applications where bandwidth and battery power are at a premium.

**CoAP** – Constrained Application Protocol. A protocol to allow simple, constrained devices to join the IoT through low bandwidth, low availability networks.

**M2M** – Machine-to-Machine. Generic term used to describe communication between devices without human involvement, for monitoring and control.

**JSON** – JavaScript Object Notation. A lightweight data-interchange format. It is easy for humans to read and write and it is easy for machines to parse and generate.

**The TCP/IP Network Stack & Protocols**

There are five layers to the TCP/IP (Transmission Control Protocol/Internet Protocol) network stack. Each layer takes the input of the layer above it and embeds that information into the **Protocol Data Units (PDUs)** of that layer, which is an atomic unit of data for that layer.

**Layer 5 – Application**

Protocols: CoAP, HTTP, MQTT, etc. PDU: Data

**Layer 4 – Transport**

Protocol: TCP (Transmission Control Protocol) PDU: Segment

Protocol: UDP (User Datagram Protocol) PDU: Datagram

**Layer 3 – Network**

Protocols: IP (Internet Protocol) PDU: Packet

**Layer 2 – Data-Link**

Protocols: 802.11 MAC PDU: Frame

**Layer 1 - Physical**

Protocols: 802.11a,b,g,n,ac PDU: Bits

**Getting the Thingy:91 Connected to the nRF Cloud**

Follow the instructions at:

[www.nordicsemi.com/thingy91](http://www.nordicsemi.com/thingy91)

For now, don’t update the Thingy:91 firmware, as it is somewhat involved and time-consuming.

**Class Notes**