APPLICATION NOTE - LORA NETWORK

HIGHER CAPACITY WEATHER STATION

APPLICATION BACKGROUND

In this example the weather station is connected via an SDI-12 interface to 3004ML Neon LoRa Logger that collects and records the weather station data. 3004ML Neon LoRa Logger then sends recorded data, at specified intervals, via a LoRa network to a central Neon Server.

The Neon Server can either be customer owned physical or cloud server, or a fee based Neon Hosting service that can be purchased from Unidata.

The weather station is set up with a logging scheme using the Starlog 4 software to read the measuring instruments on a predetermined schedule, every 15 minutes, and send the data to the Neon Server via the LoRa network on each measurement cycle. As this is a message based service, there is no on-line configuration from the Neon Server; hence the system needs to be set up with a logging scheme before deployment to the field.

When the data arrives at the Neon Server, it is displayed on a graphical interface. If out of limits conditions occurred, alarms are raised and emails / SMS texts are sent to appropriate staff.

APPLICATION DETAIL

LoRa is one of the several LPWAN technologies which allow for a free spectrum connection between the LoRa system in the field and a LoRa gateway. The range of LoRa depends on the local geography and the antenna type. A small chip antenna soldered onto the 3004ML allows for a range of around 1 km depending on the geography i.e. if unit is installed outdoors and there is line of sight from the LoRa field unit and the gateway. A large antenna mounted high on a pole may extend the range to 10km or more, also depending on the geography.

The setup of LoRa is more complex than other systems and requires the skills of a communications engineer familiar with the LoRa system. LoRa gateway needs to be purchased, configured and installed and LoRa network needs to be configured before the system can be set to work. There are several gateway manufacturers and in this example either a MultiTech gateway or a Kerlink gateway can be used. The gateways need to be powered-on all the time and they also need a direct Ethernet connection, a cell phone hot spot or a satellite modem.

The 3004ML LoRa nodes can be setup to use OTAA (Over the Air Activation) OR ABP (Activation by Personalisation). In general ABP is usually used by larger networks which utilize multiple gateways over a large geographical location where the activation is controlled by a network server such as Actility.

OTAA is generally used with smaller networks where there are a small number of LoRa nodes connecting to a single gateway like Kerlink or MultiTech and the gateway can authenticate the devices appropriately.

Using **ABP** join mode requires the user to define the following values and input them into both, the device and gateway or network server.

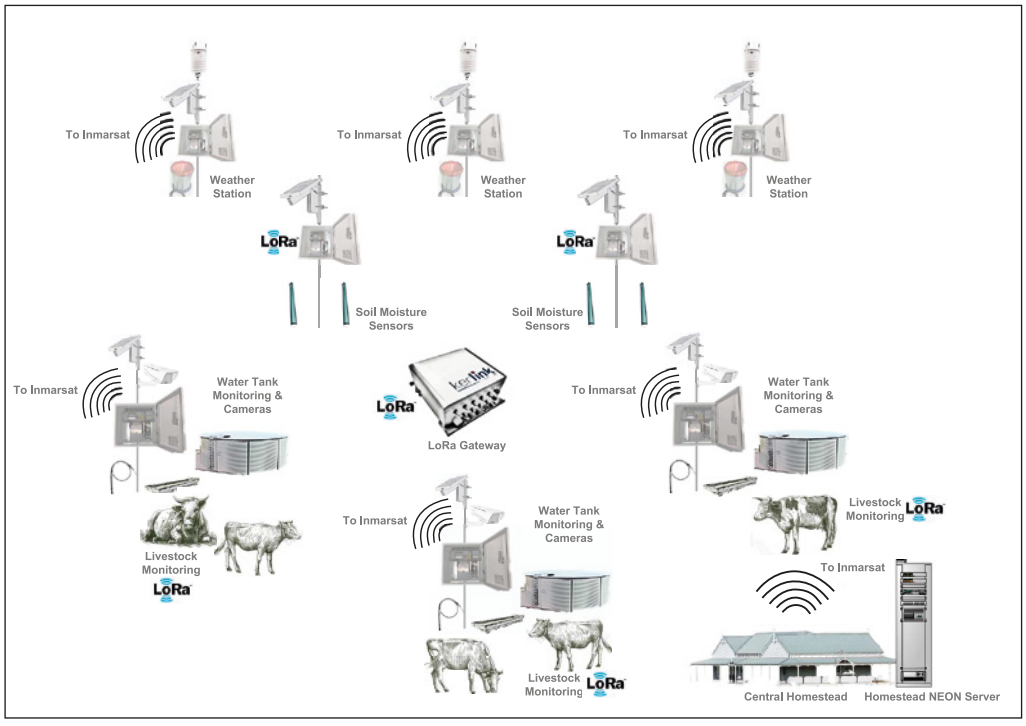
- **DevAddr**: This is a logical address used to identify the object on the network.

- **NetSKey (Network Session Key)**: Encryption key between the object and the operator used for transmissions and to validate the integrity of messages.
- **AppSKey (Application Session Key)**: Encryption key between the object and the user (via the application) used for transmissions and to validate the integrity of messages.
- **DevEUI**: This identifier, factory set, makes each object unique. In principle, this setting cannot be adjusted.

Using **OTAA** join mode requires the user to define the following values and input them into both the device and gateway or the network server.

- **AppEUI**: This is a unique application identifier used to group objects. This address, 64 bits, is used to classify the peripheral devices by application. This setting can be adjusted.
- **AppKey**: This is a secret key shared between the peripheral device and the network. It is used to determine the session keys. This setting can be adjusted.

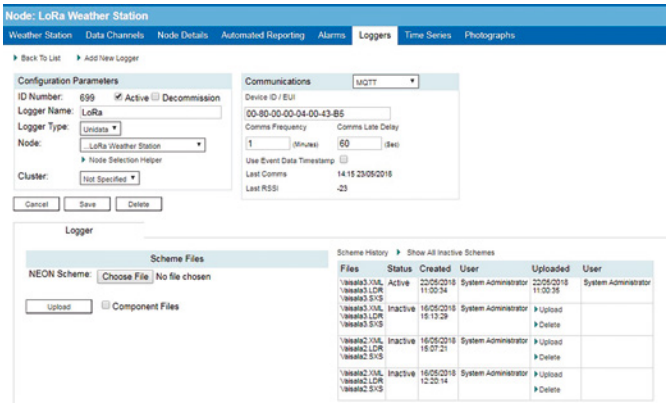
Both the ABP method and the OTAA can be configured using the Unidata StarlogV4 menu system.



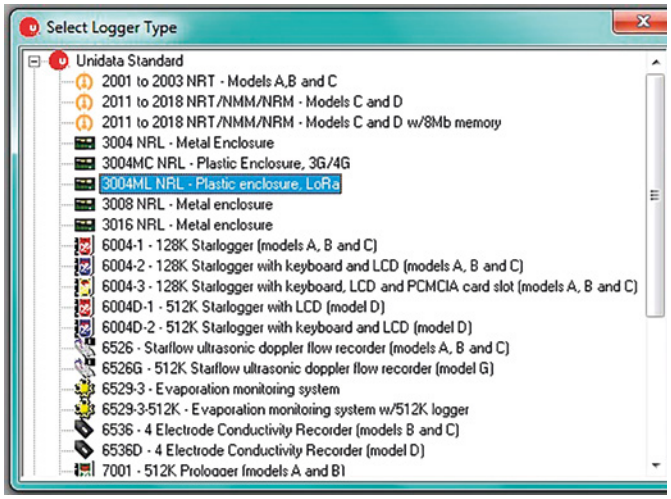
The LoRa payload for this application note is indicated below:

```
------------------------------------------------------------------
LoRa Payload Example:
5C6BFB5AF759DA000100F8008301F5272F007F00
------------------------------------------------------------------
LoRa Payload ( All data is Little Endian)

0x5C6BFB5A - TimeStamp - Can be Ignored when using non Unidata Gateway

0xF759 - Neon Battery Voltage - 0x59F7 = 23031 x 0.000536177 = 12.34 Volts

0xDA00 - Wind Direction - 0x00DA = 218 x 1 = 218 Deg

0x0100 - Wind Speed - 0x0001 = 1 x 0.1 = 0.1 m/s

0xF800 - Temperature - 0x00F8 = 248 x 0.1 = 24.8 DegC

0x8301 - Relative Humidity - 0x0183 = 387 x 0.1 = 38.7 %

0xF527 - Barometric Pressure - 0x27F5 = 10229 x 0.1 = 1022.9 hPa

0x2F00 - Rainfall - 0x002F = 47 x 0.01 = 0.47 mm

0x7F00 - Weather Station Battery Voltage - 0x007F = 127 x 100 = 12700 mV

------------------------------------------------------------------
```

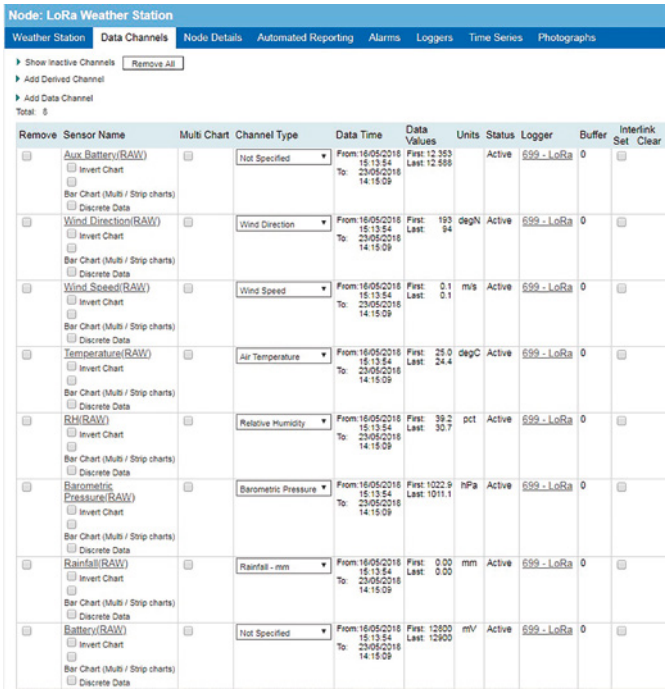
Some screen shots showing the data on the Neon Server are shown below:

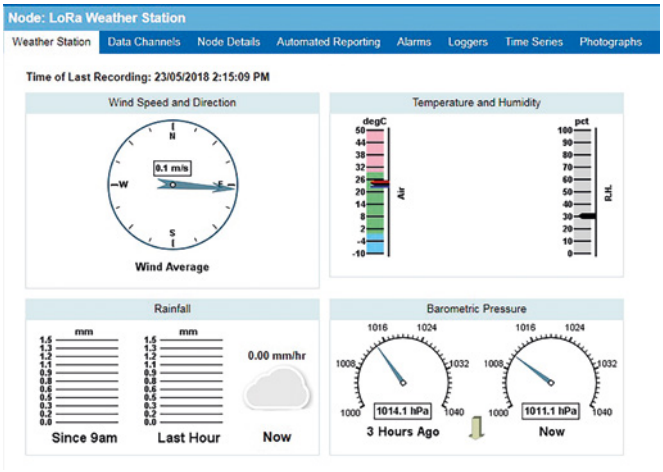


The Starlog 4 Software setup screen shots are shown below:




```
>+
        ABP
        OTA
        FSB
        PN
        DR
        TXDR
>f
FSB = 0
= 1
XRT = 175
IP = 203.59.141.70
PRT =  3900
APN = "telstra.internet"
USR = ,
2SIM_APN = "connectme"
2SIM_USR = ,
SAT_APN = #777
SAT_USR = ,
ETH_IP = 0.0.0.0
ETH_NM = 255.255.255.0
ETH_GW = 0.0.0.0
NJM = OTA
NA =
NSK/NI = 0,0019B24541500000
DSK/NK = 0,4a2f49f4776f20dc79da1c2335300000
FSB = 1
PN = 0
DR = 0
TXDR = 4

        ABP
        OTA
        FSB
        PN
        DR
        TXDR
```





TYPICAL CONFIGURATION

APPLICATION SPECIFIC INSTRUMENTS / INPUTS

Options	Unidata Part Number	Description
M – Series LoRa RTU / NRL	3004B-ML00	Neon Remote Logger - 4 Analog Ch without Li Battery
M – Series LoRa RTU / NRL	3004B-MLB0	Neon Remote Logger - 4 Analog Ch with Li Battery
Ethernet & 3G / 4G and LoRa	3016A-CL0	Neon Remote Logger - 16 Analog Ch / Touch Screen Display
Ethernet & 3G / 4G and LoRa	3008A-CL0	Neon Remote Logger - 8 Analog Ch / Touch Screen Display

NEON APPLICATION SOFTWARE - CUSTOMER SERVER

Options	Unidata Part Number	Description
Neon Applications Software	2302A	Neon Server Software Licence Incl 5 NAL
Neon Applications Software	2302A-10	Additional 10 NRT Access Licence
Neon Applications Software	2302A-20	Additional 20 NRT Access Licence
Neon Applications Software	2302A-50	Additional 50 NRT Access Licence

NEON HOSTING SERVICE - UNIDATA SERVER

Options	Unidata Part Number	Description
Neon Hosting Service	2301A	Neon Data Initial Subscription Setup Fee
Neon Hosting Service	2301A-01	Neon Data Service Fee for 1-50 NRT
Neon Hosting Service	2301A-02	Neon Data Service Fee for 51-100 NRT
Neon Hosting Service	2301A-10	Neon Data Service Fee Metering

DATALOGGER MANAGEMENT SOFTWARE

Options	Unidata Part Number	Description
Starlog V4 Management Software	6308A-AUE	STARLOG V4 Full Licence Key