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Title: Lessons Learned from Switching LoRaWAN Network from Helium to The Things Network (TTN)
Tags: #Helium, #TTN, #Datacake

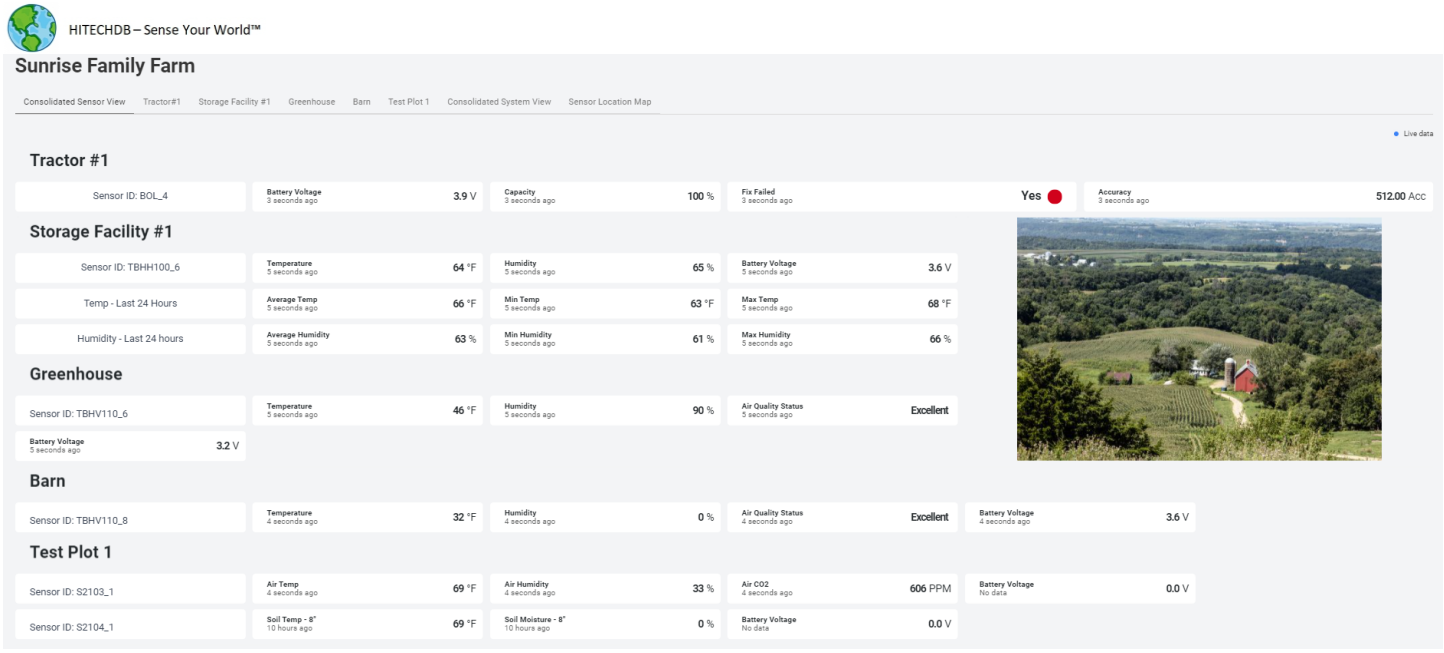
Contents

Executive Summary

This article shares lessons learned from the experience of transitioning a Smart Farm proto-type IoT system running on the Helium VIP Console to The Things Network (TTN) for the LoRaWAN Network Server component. The article starts with an overview of the proto-type system then discusses the trigger for making the change. After that, the article explains the steps that went into making the change as well as the results of the change. Finally, the article shares key lessons learned from the effort.

System Overview & Trigger for Change

Sunrise Family Farm is a smart farm prototype with 6 IoT sensors. The screenshot below shows the main sensor dashboard.



Sunrise Family Farm – Consolidated Sensor View Dashboard

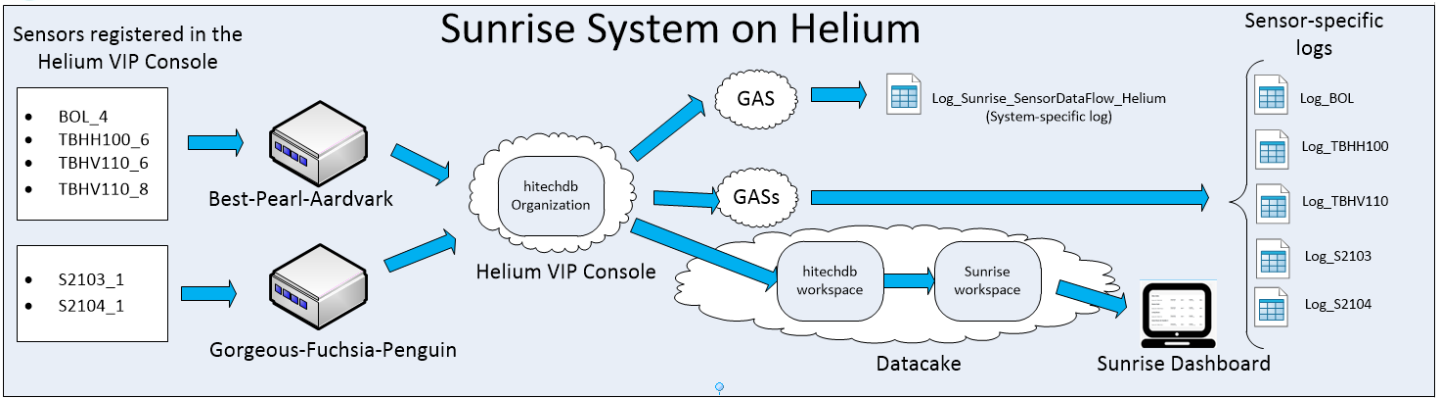
Details on the 6 sensors can be found in the table below.

Sunrise Family Farm Sensors			
Sensor Model	**Description**	**System Sensor ID**	**Location**
Browan Tabs Object Locator	GPS Tracker	BOL_4	Davis, California
Browan Healthy Home Sensor IAQ	Indoor Air Quality Sensor	TBHV110_6, TBHV110_8	Davis, California
Browan TBHH100	Temperature & Humidity Sensor	TBHH100_6	Davis, California
SenseCAP S2103	Outdoor CO2, Temperature, and Humidity Sensor	S2103_1	Atlanta, Georgia
SenseCAP S2104	Outdoor Soil Moisture and Temperature Sensor	S2104_1	Atlanta, Georgia

The Sunrise Family Farm System was built in 2022 using the Helium VIP Console for the LoRaWAN Network Server (LNS) and Datacake for sensor data visualization. A custom logging solution using Google Application Scripts (GAS) and Google Sheets is used to log sensor and system data.

Sunrise System on Helium

The system diagram below shows the components that made up the Sunrise Family Farm system on Helium.



(above) System Diagram – Sunrise System on Helium

Key characteristics of the Helium-based system are as follows:

- The sensors in California connect through the Helium hotspot, Best-Pearl-Aardvark
- The sensors in Georgia connect through the Helium hotspot, Gorgeous-Fuchsia-Penguin
- Both hotspots are using Wi-Fi for backhaul, i.e. each hotspot is connected to a local Wi-Fi network
- Log_Sunrise_SensorDataFlow_Helium stores **undecoded** messages from all 6 sensors. With this log you can see when each sensor sent a message and the signal characteristics of the message (RSSI, SNR, SF, etc.). This log is useful for getting a health check on the LoRaWAN portion of the system. See a screenshot of the log below.
- Each sensor type has its own log where decoded messages are stored. These are the Sensor-specific logs on the far-right side of the diagram above. These logs are useful for analyzing what's going on in an environment where a sensor is deployed. See a screenshot of Log_TBHV110 further below
- Because the Helium Console allows integrations to be made at the device level, all logging data flows from the Helium Console to various Google Application Scripts which parse the message data then write the data to various Google Sheets.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	UTC Time	(America/NewYork	(Local Time)	From Device	Frame Count	Hotspot	Channel	Frequency	Hold Time	RSSI	SNR	Spreading	Hotspt Status	Payload	Payload Size	Port	Reported At
356188	10-18-2023 4:34:31	10-18-2023 0:34:31	10-18-2023 0:34:28	TBHV110_8	101235	best-pearl-aardvark	4	904.7	0	-29	13.50	SF7BW125	success	AAs3NkgFAgDsADc=	11	103	1.6976E+12
356189	10-18-2023 4:34:47	10-18-2023 0:34:47	10-18-2023 0:34:44	TBHV110_6	156062	best-pearl-aardvark	2	904.3	0	-78	10.20	SF7BW125	success	AAs3Oj4FAgDuADY=	11	103	1.6976E+12
356190	10-18-2023 4:39:31	10-18-2023 0:39:32	10-18-2023 0:39:28	TBHV110_8	101236	best-pearl-aardvark	0	903.9	0	-29	13.50	SF7BW125	success	AAs3NzwFAgDqADY=	11	103	1.6976E+12
356191	10-18-2023 4:39:47	10-18-2023 0:39:48	10-18-2023 0:39:44	TBHV110_6	156063	best-pearl-aardvark	5	904.9	0	-78	13.50	SF7BW125	success	AAs3OqAFAwD6ADY=	11	103	1.6976E+12
356192	10-18-2023 4:44:04	10-18-2023 0:44:04	10-18-2023 0:44:01	S2104_1	9371	clever-orange-mustang	4	904.7	0	-66	13.20	SF7BW125	success	AQYQBEIAAAEHEAwwA	16	2	1.6976E+12
356193	10-18-2023 4:44:31	10-18-2023 0:44:32	10-18-2023 0:44:28	TBHV110_8	101237	best-pearl-aardvark	2	904.3	0	-28	11.20	SF7BW125	success	AAs3NlgFAgDwADY=	11	103	1.6976E+12
356194	10-18-2023 4:44:47	10-18-2023 0:44:48	10-18-2023 0:44:44	TBHV110_6	156064	best-pearl-aardvark	6	905.1	0	-78	13.00	SF7BW125	success	AAs3Om4FAgDxADY=	11	103	1.6976E+12
356195	10-18-2023 4:49:31	10-18-2023 0:49:32	10-18-2023 0:49:29	TBHV110_8	101238	best-pearl-aardvark	5	904.9	0	-28	14.00	SF7BW125	success	AAs3N3QFAgD2ADY=	11	103	1.6976E+12
356196	10-18-2023 4:49:49	10-18-2023 0:49:49	10-18-2023 0:49:44	TBHV110_6	156065	best-pearl-aardvark	1	904.1	0	-78	13.50	SF7BW125	success	AAs3OtcFAwD6ADY=	11	103	1.6976E+12
356197	10-18-2023 4:54:32	10-18-2023 0:54:32	10-18-2023 0:54:29	TBHV110_8	101239	best-pearl-aardvark	6	905.1	0	-28	13.80	SF7BW125	success	AAs3N00FAgDwADY=	11	103	1.6976E+12
356198	10-18-2023 4:54:48	10-18-2023 0:54:49	10-18-2023 0:54:45	TBHV110_6	156066	best-pearl-aardvark	7	905.3	0	-78	12.80	SF7BW125	success	AAs3OqEFAwDwADU=	11	103	1.6976E+12
356199	10-18-2023 4:59:32	10-18-2023 0:59:32	10-18-2023 0:59:29	TBHV110_8	101240	best-pearl-aardvark	1	904.1	0	-29	13.50	SF7BW125	success	AAs3NyYFAgDpADY=	11	103	1.69761E+12
356200	10-18-2023 4:59:48	10-18-2023 0:59:48	10-18-2023 0:59:45	TBHV110_6	156067	best-pearl-aardvark	3	904.5	0	-78	12.80	SF7BW125	success	AAs3OtAFAwD6ADU=	11	103	1.69761E+12
356201	10-18-2023 5:04:30	10-18-2023 1:04:30	10-18-2023 1:04:29	TBHV110_8	101241	best-pearl-aardvark	7	905.3	0	-29	13.20	SF7BW125	success	AAs3Nz0FAgDuADY=	11	103	1.69761E+12
356202	10-18-2023 5:04:48	10-18-2023 1:04:48	10-18-2023 1:04:45	TBHV110_6	156068	best-pearl-aardvark	4	904.7	0	-78	13.80	SF7BW125	success	AAs3OmoFAgDoADU=	11	103	1.69761E+12
356203	10-18-2023 5:09:32	10-18-2023 1:09:32	10-18-2023 1:09:29	TBHV110_8	101242	best-pearl-aardvark	3	904.5	0	-28	13.50	SF7BW125	success	AAs3N1sFAgD1ADY=	11	103	1.69761E+12
356204	10-18-2023 5:09:48	10-18-2023 1:09:48	10-18-2023 1:09:45	TBHV110_6	156069	best-pearl-aardvark	0	903.9	0	-79	13.20	SF7BW125	success	AAs3O5QFAgDwADU=	11	103	1.69761E+12
356205	10-18-2023 5:14:32	10-18-2023 1:14:32	10-18-2023 1:14:29	TBHV110_8	101243	best-pearl-aardvark	4	904.7	0	-29	13.80	SF7BW125	success	AAs3N/YEAgDiADY=	11	103	1.69761E+12
356206	10-18-2023 5:14:48	10-18-2023 1:14:48	10-18-2023 1:14:45	TBHV110_6	156070	best-pearl-aardvark	2	904.3	0	-80	10.20	SF7BW125	success	AAs3O4kFAgDvADU=	11	103	1.69761E+12
356207	10-18-2023 5:19:32	10-18-2023 1:19:32	10-18-2023 1:19:29	TBHV110_8	101244	best-pearl-aardvark	0	903.9	0	-29	13.50	SF7BW125	success	AAs3N0IFAgDxADY=	11	103	1.69761E+12
356208	10-18-2023 5:19:48	10-18-2023 1:19:48	10-18-2023 1:19:45	TBHV110_6	156071	best-pearl-aardvark	5	904.9	0	-78	13.50	SF7BW125	success	AAs3O+4FAwD6ADU=	11	103	1.69761E+12
356209	10-18-2023 5:20:52	10-18-2023 1:20:52	10-18-2023 1:20:49	S2103_1	9563	wild-glossy-swallow	6	905.1	0	-112	-7.80	SF7BW125	success	AQQQOIULAAEBEOgcA/	23	2	1.69761E+12
356210	10-18-2023 5:24:32	10-18-2023 1:24:32	10-18-2023 1:24:29	TBHV110_8	101245	best-pearl-aardvark	2	904.3	0	-28	10.80	SF7BW125	success	AAs3NzQFAgDvADY=	11	103	1.69761E+12
356211	10-18-2023 5:24:48	10-18-2023 1:24:48	10-18-2023 1:24:45	TBHV110_6	156072	best-pearl-aardvark	6	905.1	0	-75	13.20	SF7BW125	success	AAs3O3wFAgDmADU=	11	103	1.69761E+12
356212	10-18-2023 5:29:32	10-18-2023 1:29:33	10-18-2023 1:29:29	TBHV110_8	101246	best-pearl-aardvark	5	904.9	0	-28	13.20	SF7BW125	success	AAs3N88EAgDcADY=	11	103	1.69761E+12
356213	10-18-2023 5:29:48	10-18-2023 1:29:49	10-18-2023 1:29:45	TBHV110_6	156073	best-pearl-aardvark	1	904.1	0	-75	13.20	SF7BW125	success	AAs3OzQFAgDaADU=	11	103	1.69761E+12
356214	10-18-2023 5:34:27	10-18-2023 1:34:28	10-18-2023 1:34:24	TBHH100_6	8578	best-pearl-aardvark	7	905.3	0	-67	14.00	SF7BW125	success	CAs1QP////8=	8	103	1.69761E+12

(above) Excerpt from Log_Sunrise_SensorDataFlow_Helium

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totals.

1	Local Time (America/NewYork)	Reported At (Local Time)	From Device	Frame Count	Hotspot	Channel	Frequency	Hold Time	rssi	snr	Spreading	Hotspt Status	Board Temp	Battery (V)	Temp Ambient	Rel Humidity (%)	RH error	CO2	CO2 error	VOC	VOC Error	IAQ
320908	9-30-2023 7:36:53	9-30-2023 7:36:46	TBHV110_5	114515	dizzy-eggplant-corgi	1	904.1	0	-66	12.80	SF7BW125	success	71.6	3.6	69.8	57	FALSE	525	FALSE	0	FALSE	38
320909	9-30-2023 7:37:24	9-30-2023 7:37:16	TBHV110_6	150964	best-pearl-aardvark	4	904.7	0	-76	13.00	SF7BW125	success	64.4	3.6	62.6	80	FALSE	3254	FALSE	46	FALSE	250
320910	9-30-2023 7:37:50	9-30-2023 7:37:42	TBHV110_8	96137	best-pearl-aardvark	7	905.3	0	-26	12.80	SF7BW125	success	71.6	3.6	68	63	FALSE	616	FALSE	0	FALSE	91
320911	9-30-2023 7:37:57	9-30-2023 7:37:53	TBHV1110_2	37388	creamy-holographic-cat	0	903.9	0	-81	13.50	SF7BW125	success	75.2	3.6	75.2	44	FALSE	877	FALSE	1	FALSE	168
320912	9-30-2023 7:41:52	9-30-2023 7:41:46	TBHV110_5	114516	dizzy-eggplant-corgi	7	905.3	0	-64	13.20	SF7BW125	success	71.6	3.6	69.8	58	FALSE	523	FALSE	0	FALSE	37
320913	9-30-2023 7:42:24	9-30-2023 7:42:16	TBHV110_6	150965	best-pearl-aardvark	0	903.9	0	-77	13.00	SF7BW125	success	64.4	3.6	62.6	80	FALSE	3243	FALSE	46	FALSE	249
320914	9-30-2023 7:42:50	9-30-2023 7:42:42	TBHV110_8	96138	best-pearl-aardvark	3	904.5	0	-25	13.20	SF7BW125	success	71.6	3.6	68	63	FALSE	629	FALSE	0	FALSE	98
320915	9-30-2023 7:42:58	9-30-2023 7:42:53	TBHV1110_2	37389	silly-golden-baboon	2	904.3	0	-73	10.20	SF7BW125	success	75.2	3.6	75.2	44	FALSE	857	FALSE	1	FALSE	164
320916	9-30-2023 7:46:53	9-30-2023 7:46:46	TBHV110_5	114517	dizzy-eggplant-corgi	3	904.5	0	-65	13.20	SF7BW125	success	71.6	3.6	69.8	58	FALSE	533	FALSE	0	FALSE	43
320917	9-30-2023 7:47:24	9-30-2023 7:47:16	TBHV110_6	150966	best-pearl-aardvark	2	904.3	0	-75	11.20	SF7BW125	success	64.4	3.6	62.6	80	FALSE	3264	FALSE	47	FALSE	250
320918	9-30-2023 7:47:50	9-30-2023 7:47:42	TBHV110_8	96139	best-pearl-aardvark	4	904.7	0	-26	13.20	SF7BW125	success	71.6	3.6	68	63	FALSE	660	FALSE	0	FALSE	116
320919	9-30-2023 7:47:57	9-30-2023 7:47:53	TBHV1110_2	37390	silly-golden-baboon	5	904.9	0	-76	13.00	SF7BW125	success	75.2	3.6	75.2	44	FALSE	860	FALSE	1	FALSE	164
320920	9-30-2023 7:51:54	9-30-2023 7:51:47	TBHV110_5	114518	dizzy-eggplant-corgi	4	904.7	0	-65	13.50	SF7BW125	success	71.6	3.6	69.8	58	FALSE	527	FALSE	0	FALSE	40
320921	9-30-2023 7:52:24	9-30-2023 7:52:17	TBHV110_6	150967	best-pearl-aardvark	5	904.9	0	-74	13.50	SF7BW125	success	64.4	3.6	62.6	80	FALSE	3264	FALSE	47	FALSE	250
320922	9-30-2023 7:52:50	9-30-2023 7:52:42	TBHV110_8	96140	best-pearl-aardvark	0	903.9	0	-26	13.00	SF7BW125	success	71.6	3.6	68	63	FALSE	633	FALSE	0	FALSE	101
320923	9-30-2023 7:52:58	9-30-2023 7:52:54	TBHV1110_2	37391	silly-golden-baboon	6	905.1	0	-74	14.00	SF7BW125	success	75.2	3.6	75.2	44	FALSE	887	FALSE	1	FALSE	170
320924	9-30-2023 7:56:53	9-30-2023 7:56:47	TBHV110_5	114519	dizzy-eggplant-corgi	0	903.9	0	-66	13.80	SF7BW125	success	71.6	3.6	69.8	58	FALSE	534	FALSE	0	FALSE	43
320925	9-30-2023 7:57:24	9-30-2023 7:57:17	TBHV110_6	150968	best-pearl-aardvark	6	905.1	0	-74	13.20	SF7BW125	success	64.4	3.6	62.6	80	FALSE	3296	FALSE	49	FALSE	250
320926	9-30-2023 7:57:50	9-30-2023 7:57:42	TBHV110_8	96141	best-pearl-aardvark	2	904.3	0	-25	11.80	SF7BW125	success	71.6	3.6	68	63	FALSE	693	FALSE	0	FALSE	126
320927	9-30-2023 7:57:58	9-30-2023 7:57:54	TBHV1110_2	37392	long-quartz-starfish	1	904.1	0	-111	-1.20	SF7BW125	success	75.2	3.6	75.2	44	FALSE	902	FALSE	1	FALSE	174
320928	9-30-2023 8:01:53	9-30-2023 8:01:47	TBHV110_5	114520	dizzy-eggplant-corgi	2	904.3	0	-66	10.20	SF7BW125	success	71.6	3.6	69.8	58	FALSE	520	FALSE	0	FALSE	36
320929	9-30-2023 8:02:25	9-30-2023 8:02:17	TBHV110_6	150969	best-pearl-aardvark	1	904.1	0	-76	13.00	SF7BW125	success	64.4	3.6	62.6	81	FALSE	3318	FALSE	51	FALSE	250
320930	9-30-2023 8:02:50	9-30-2023 8:02:42	TBHV110_8	96142	best-pearl-aardvark	5	904.9	0	-25	13.20	SF7BW125	success	71.6	3.6	68	63	FALSE	664	FALSE	0	FALSE	118
320931	9-30-2023 8:02:58	9-30-2023 8:02:54	TBHV1110_2	37393	silly-golden-baboon	7	905.3	0	-75	13.50	SF7BW125	success	75.2	3.6	75.2	44	FALSE	802	FALSE	1	FALSE	151
320932	9-30-2023 8:06:53	9-30-2023 8:06:47	TBHV110_5	114521	dizzy-eggplant-corgi	5	904.9	0	-65	14.00	SF7BW125	success	71.6	3.6	69.8	58	FALSE	532	FALSE	0	FALSE	42

(above) Excerpt from Log_TBHV110 with decoded sensor data highlighted in red

Trigger for Change

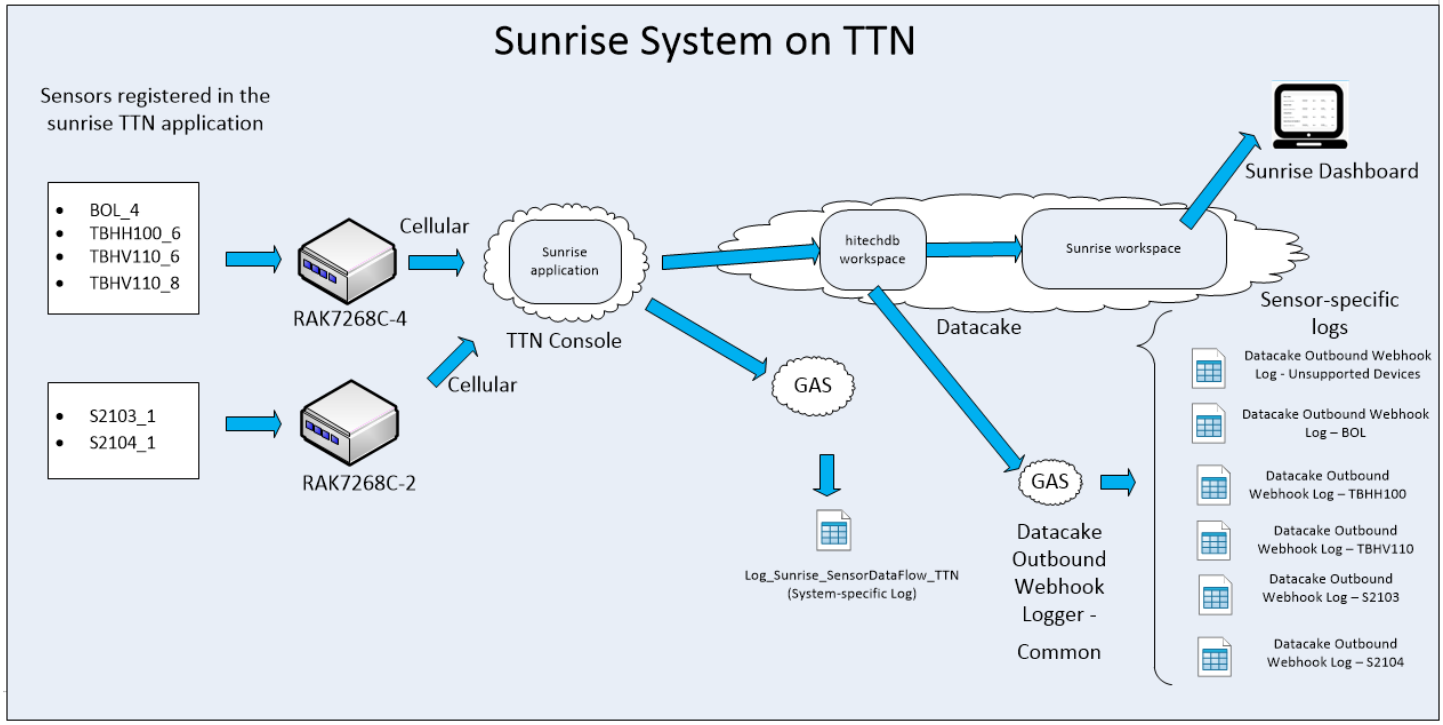
On Aug 31, 2023, Helium announced that the VIP Console would be transitioning from a free service to a paid service called 1663 on Dec 7, 2023. This announcement necessitated a decision to either (a) stay with Helium and use the 1163 service, (b) transition the system to a different LNS, or (c) shut down the system.

After careful thought we decided to move the Sunrise system from Helium to TTN.

One year prior, we had done the same LNS transition with a different but similar system, so we had prior experience.

Sunrise System on TTN

The system diagram below shows what the Sunrise Family Farm system would look like on TTN.



Key characteristics of the TTN-based system are as follows:

- The sensors in California connect through the gateway, RAL7268C-4 (this is a new gateway)
- The sensors in Georgia connect through the gateway, RAL7268C-2 (this is an existing gateway)
- Both gateways are using Cellular for backhaul, i.e. each hotspot is connected to the internet via cellular data service.
    - Note that the reason for switching from Wi-Fi to cellular backhaul is **not** related to the switch from Helium to TTN. The primary reason for switching to cellular backhaul for the TTN system was to make it easier for the customer in California to deploy the new gateway.
- The **system** level logging of undecoded sensor messages comes from the Sunrise application in TTN
- Logging of sensor-specific data travels from the hitechdb workspace in Datacake to a Google Application Script (GAS) that first determines the sensor type, then writes the sensor data to the corresponding device type-specific Google Sheet.

The main differences between the Helium and TTN Sunrise systems are as follows:

1. The Helium system is using Wi-Fi for data backhaul whereas the TTN system is using cellular
2. **System level** logging for the Helium system initiates from the Helium console whereas system level logging for the TTN system initiates from the TTN application
3. **Device level** logging for the Helium system initiates from the Helium console whereas device-level logging for the TTN system initiates from Datacake

Moving the System from Helium to TTN

Listed below are the high-level steps that were performed to move the Sunrise system from Helium to TTN. Since the 2 SEEED sensors were located with me in Atlanta and the remaining sensors were located at the customer site in California, the conversion for the SEEED sensors in step 8 could be done independently and separately from the conversion for the non-SEEED sensors.

1. Purchase a new gateway and a SIM card for cellular backhaul
2. Provision the SIM card with the cellular data service provider
3. Provision the gateway on TTN
4. Validate sensor data flow through the gateway to TTN with a sensor that is already on the TTN network
5. Create a new TTN application for the Sunrise system and register the 5 Sunrise sensors with the application
6. Integrate the new Sunrise TTN Application with Datacake
7. Send the gateway to the customer and have the customer power up the gateway
8. Switch each sensor from Helium to TTN
    a. Disable the sensor on the Helium VIP console
    b. Trigger the sensor to perform a rejoin
    c. Confirm the sensor's data flow into Datacake
    d. Tweak/update the sensor's Datacake decoder to address any Datacake sensor variables that are not populating correctly on the dashboard
        i. Most of the decoder variables worked with no change, but a few needed to be changed. One reason for this is that we're running custom Datacake decoders to display additional information in the Datacake dashboard.
    e. Change the device's network server settings in Datacake from Helium to TTN, which includes obtaining a device key from the TTN application
9. Build out the **system** logging solution for Log_Sunrise_SensorDataFlow_TTN
10. Build out the individual **sensor** logging solutions

Lessons Learned

Total Time Spent

It took 52 hours between October and December to complete the project. The 52 hours includes the time to develop a detailed transition plan.

Because I had good notes from a similar project I had completed the previous year, there ended up being very few unknown unknowns in this project. Had this been the first time converting a working IoT system from Helium to TTN, it would have taken at least double the amount of time.

Cellular VS Wi-Fi Backhaul

A gateway with a cellular connection makes for easy remote deployment but costs a few dollars per month.

The advantage to using cellular backhaul for the gateway is that the gateway can deployed to the customer site without having to connect the gateway to the customer's network. As a result, there is no need for the customer to log into the gateway and configure it for customer's Wi-Fi network or no need to make a hardwired ethernet connection. Instead, all the customer must do is to power up the gateway.

The downside to using cellular backhaul is the cost of the cellular data connection. Because Hitechdb has a small number of cellular gateways deployed, we're using a simple pay-as-you go data plan that costs $0.08 per megabyte. This ends up being a few dollars per month.

One of the reasons for choosing cellular backhaul for this project was to allow us to get more data usage and cost information from another real-world system.

Provision a Gateway Correctly Before Deploying it to a Remote site

Make sure all the gateway settings are correct before sending it to the customer for deployment

Provisioning a gateway is a little more complicated than setting up a new router for a home network. Figuring out how to log into the gateway, then finding and understanding which fields to change and what to change them to is not simple.

Case in point – because the gateway acts as both a Wi-Fi and LoRaWAN gateway, there are both LoRa and Wi-Fi settings that need to be configured. When initially setting up the gateway I successfully set up and tested the LoRa settings but forgot to set up the Wi-Fi settings. Turns out the default setting for Wi-Fi is for an unsecure Wi-Fi connection, meaning anyone with a Wi-Fi device could connect to the gateway without a Wi-Fi password. And if the gateway is using cellular backhaul at $0.08 per megabyte, that could get expensive.

Once I realized I had forgotten to enable a secure password for Wi-Fi, I had to get on the line with customer and walk him through logging into the gateway and changing the Wi-Fi setting.

It's good to Have a Plan

Spending time to write a good plan is worth it as it saves time in the end.

As described earlier, there are quite a few steps to move a running system from Helium to TTN. Getting the steps in the optimal order helps minimize system downtime and helps minimize the amount of time the customer must spend helping to implement the change.

For the sensors in the Sunrise Family Farm system, there is no way to remotely initiate a rejoin sequence. That means that for the 4 sensors located at the customer site, the customer had to be involved to initiate the rejoin sequence. The other task where the customer had to help was to power up the new gateway.

The plan for accomplishing the customer-supported work was to walk the customer through the steps in a short video call. Listed below are the specific Objectives from the video call invitation.

Objectives

1. Power up new gateway and validate connectivity with TTN network
2. Log into the gateway and change the Wi-Fi network broadcast from unsecure to secure by assigning a Wi-Fi password to the gateway
3. Reset each sensor and join it to the TTN network
    a. BOL_6 – we'll do this with button presses on the device
    b. TBHH100_6 – we'll do this with a paperclip shorting out the battery terminals
    c. TBHV110_6– we'll do this with a paperclip shorting out the battery terminals
    d. TBHV110_8– we'll do this with a paperclip shorting out the battery terminals

Objective 2 was necessary because I had forgotten to perform that step prior to sending the gateway to the customer.

For objectives 1 and 3, when the customer performed the corresponding action, I verified the expected data flow in the TTN console.

Had everything gone to plan, it should have taken 30 minutes to complete all the objectives and the customer's work would have been done.

Everything did not go to plan, which brings us to the next lesson learned, which is to expect Unknown Unknowns

Expect Unknown Unknowns

A good plan anticipates and tries to account for all known risks. The challenge, of course, is how to plan for risks that are not known. These risks are the Unknown UnKnowns.

In this particular project, I encountered 1 unknown unknown when attempting to join some of the sensors to TTN. Specifically, the 2 SenseCAP sensors and one of the Browan Healthy Home IAQ Sensors either wouldn't join or would join but not maintain the connection to TTN.

In a LoRaWAN network, the join action occurs when a sensor first makes a request to connect to the network. Upon receiving the join request, the network verifies that the sensor has been registered on the network, then sends a join-accept message back to the sensor. At that point, the sensor and network are ready to exchange data. For more details on the join function, see this documentation from Semtech.

This was not something I had expected because I had experienced no troubles joining these sensors with Helium and in the case of the Browan sensor, had connected many of these sensor types to TTN in the past.

For the Browan Healthy Home IAQ Sensor, we were unable to complete the join during the initial customer video session. A follow-up session had to be scheduled for the following week. After various experiments, it was determined that the issue was a low battery. The battery level was high enough to initiate the join sequence, but not high enough to complete the join sequence.

The SenseCAP sensors were more challenging as they would initially complete the join and start sending data, but several hours later would stop sending data to the network. Several hours were spent researching and experimenting with different settings on the sensor and TTN sides, but no definitive root cause was found. In the end, one of the SenseCAP sensors was successfully joined but the other was not. My hypothesis for the join problem is incompatibility between the sensor firmware and TTN stack related to different protocol versions. All the sensors in the system are at least 2 years old, so are most likely running an earlier version of the LoRa protocol which may have some inconsistencies with the current TTN protocol stack.

Conclusion

In conclusion, changing the Lora Network Servers (LNS) is not for the faint of heart and is difficult to do without impacting system performance. If the Sunrise Family Farm system had been being used to support the operation of a real farm where a disruption to the sensor data flow might impact the farm's operation, it would have been better to stick with Helium and migrate to the 1663 Console as there would have been no rework necessary and no impact to the system data flow.

About Mike

Mike possesses a diverse and progressive career trajectory, having evolved from an electrical engineer to a software engineer, and ultimately to a project, program, and product manager. His experience spans across designing, constructing, and deploying innovative systems and solutions within the Telecom, Mobile, Healthcare, and IoT sectors. Fueled by a passion for leveraging the latest advancements in sensors, IoT, and AI/ML technologies, Mike is dedicated to creating cutting-edge products and services aimed at enhancing the quality of life for individuals and communities.