Wireless Gauge Reader

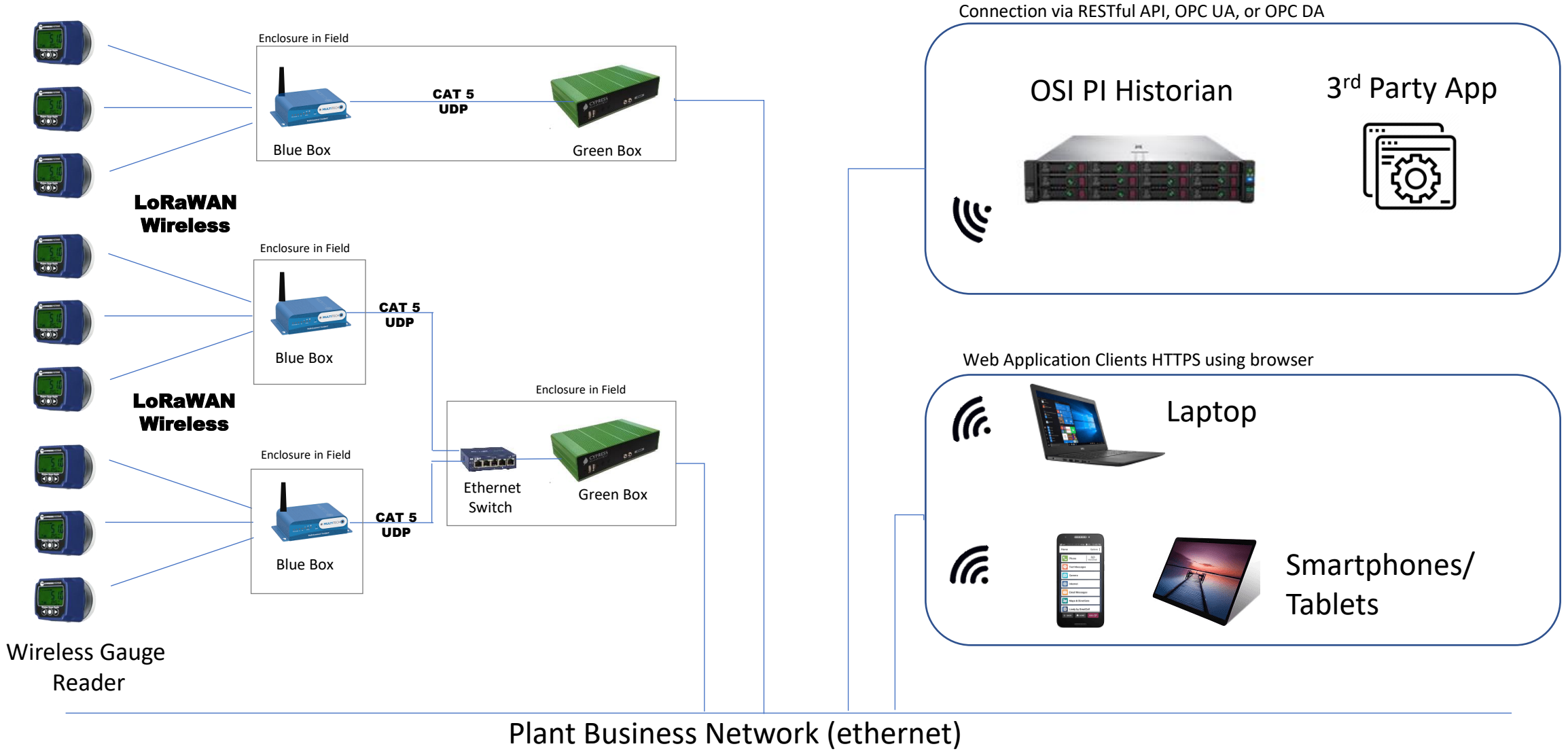
LoRaWAN Network Architecture

Version 6.0 – September 2024

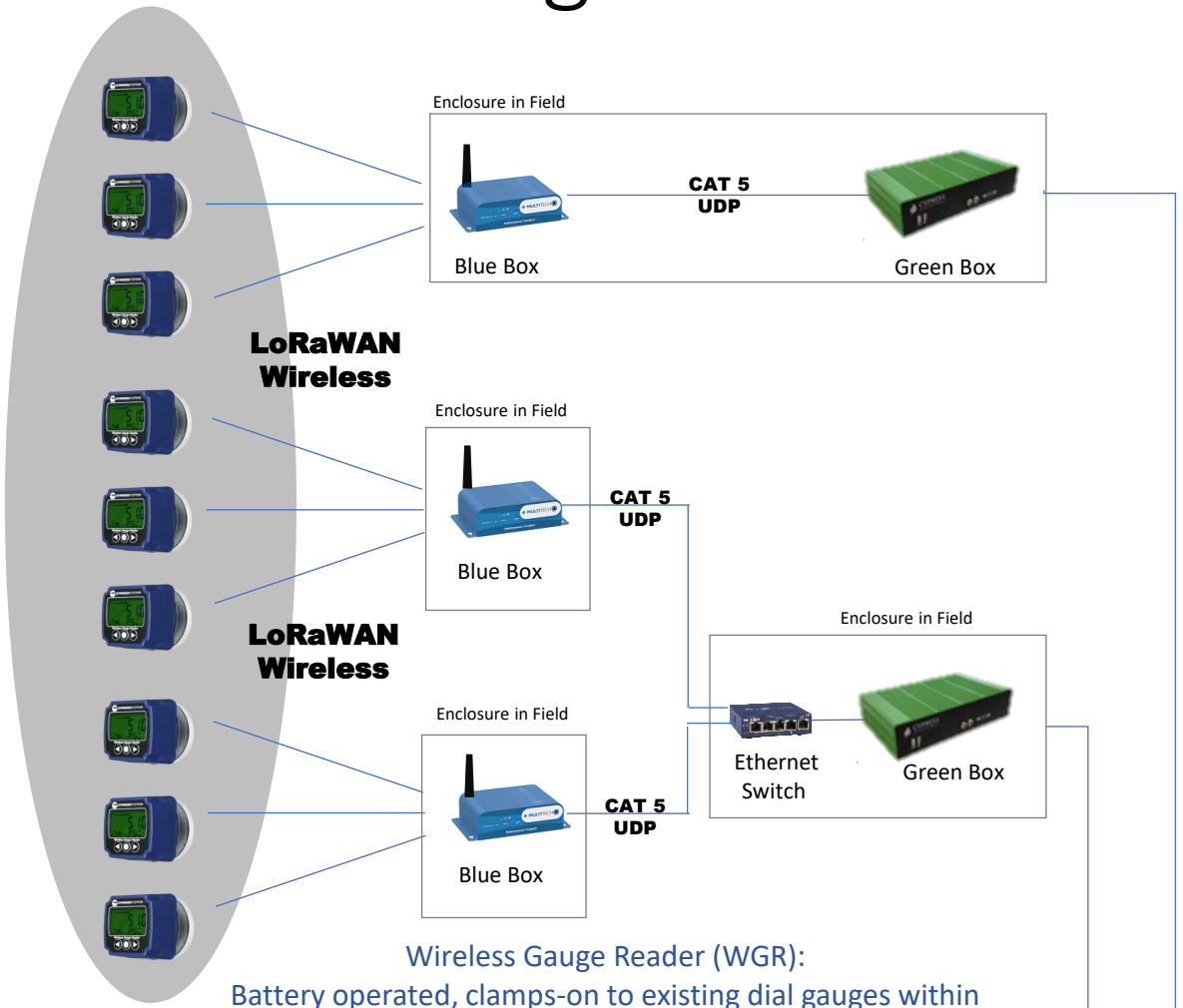
CYPRESS ENVIROSYSTEMS™

Option 1:
Field Deployed Green Box Controller

Deployment Architecture

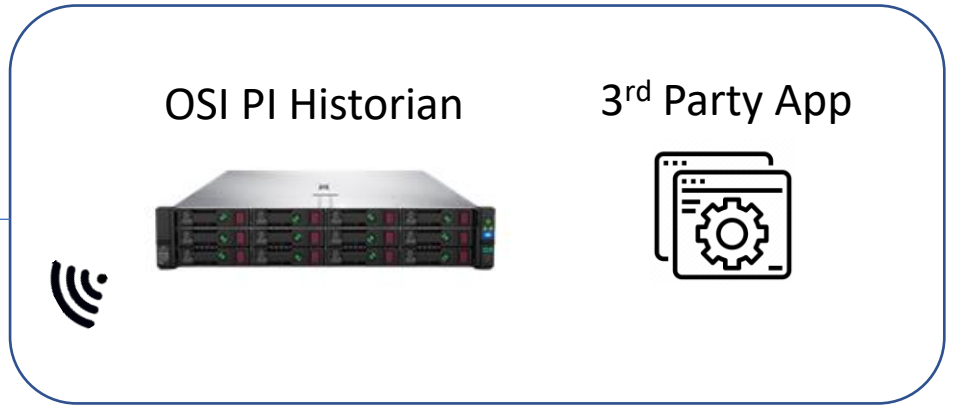


Wireless Gauge Reader

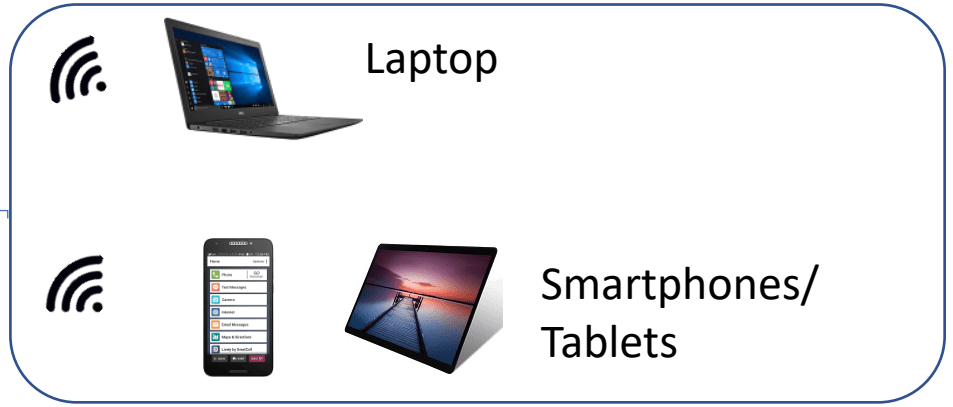


Wireless Gauge Reader (WGR):
Battery operated, clamps-on to existing dial gauges within plant. Uses 2.4 GHz BLE for initial calibration (5 minute task), LoRaWAN for normal operation.

Connection via RESTful API, OPC UA, or OPC DA

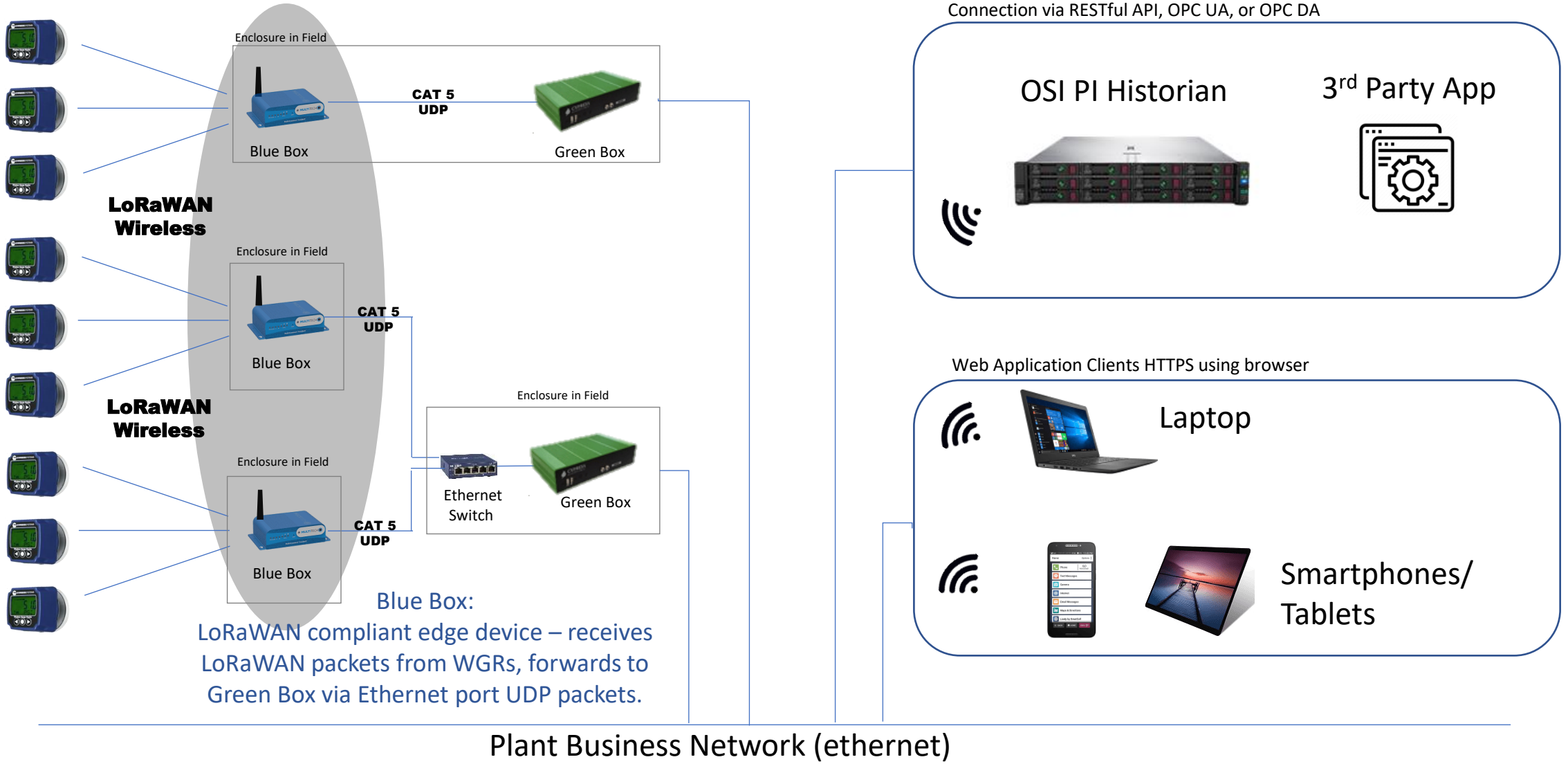


Web Application Clients HTTPS using browser

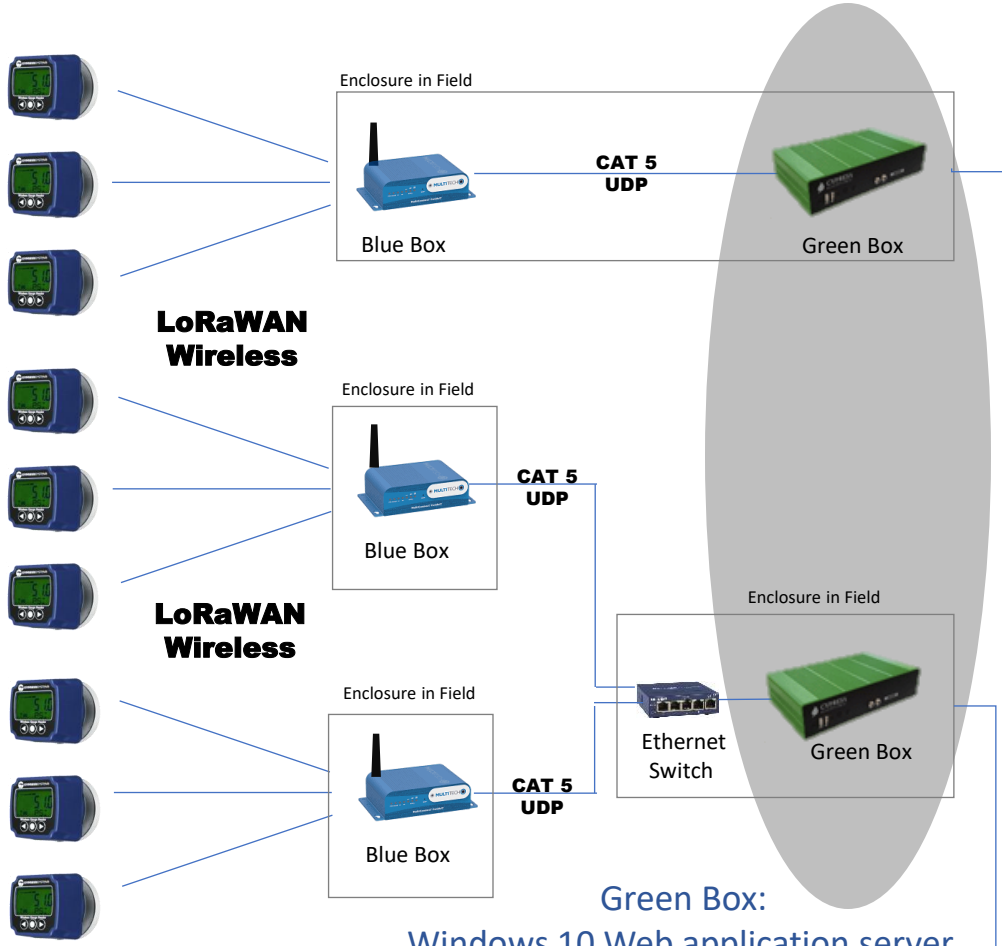


Plant Business Network (ethernet)

Blue Box (LoRaWAN Network Gateway)



Green Box (Applications Server)



Green Box:
Windows 10 Web application server,
OPC UA server and RESTful API server.
Connects to plant Business LAN Wi-Fi.

Connection via RESTful API, OPC UA, or OPC DA

OSI PI Historian

3rd Party App

Web Application Clients HTTPS using browser

Laptop

Smartphones/
Tablets

Plant Business Network (ethernet)

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Overview of Application

- Green Box Controller connected to Plant Level 2 network via Ethernet:
  - Windows 10 Pro, IIS, SQL Server Express, web application, TLS 2.0 compliant
  - Connected to Business LAN via existing in-plant ethernet
  - OPC DA server (or available OPC UA server - requires additional license fee)
  - RESTful API server
  - Web Application for User Interface

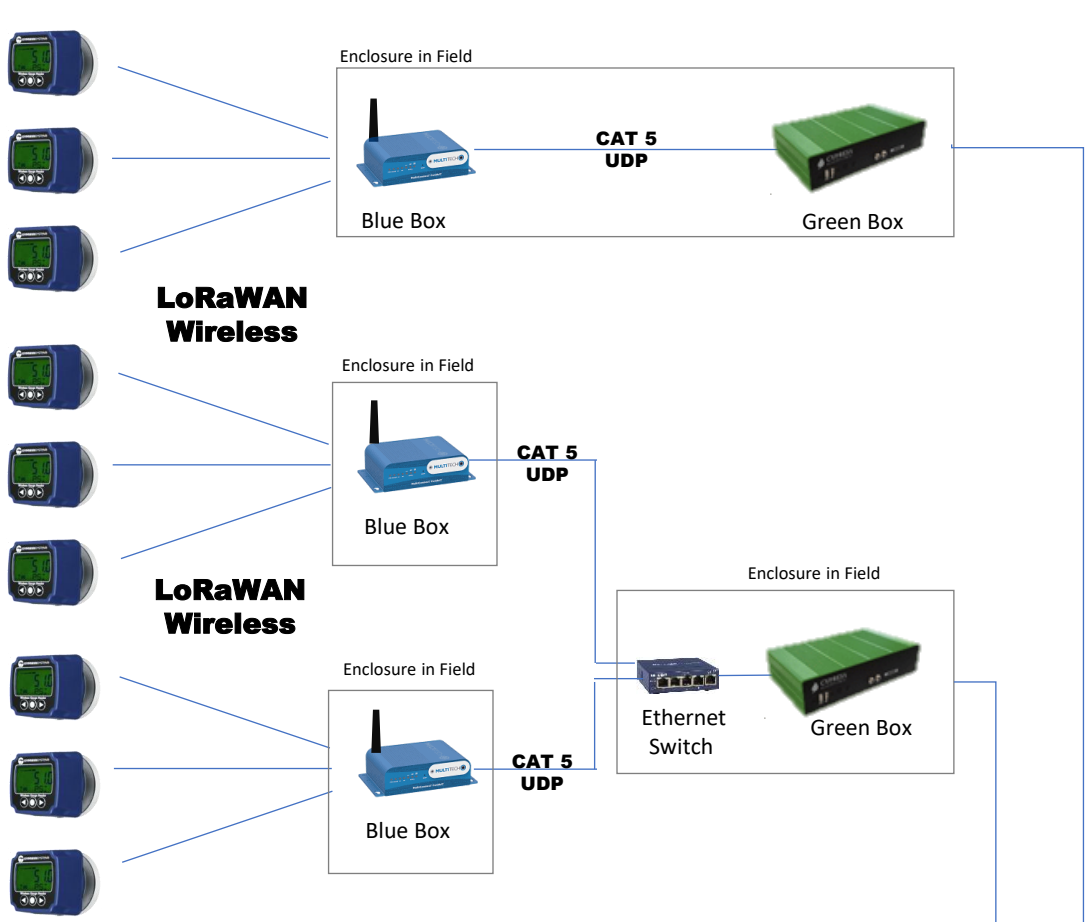
- Web application accessible from any web browser on Plant LAN

- Web application does not require password login to view sensor data, but password is required to change configuration settings such as sensor description

- Passwords are encrypted, but stored locally, no password policy enforced, no external user authentication used (e.g. Microsoft Active Directory)

OPC DA/UA, RESTful API Clients

PI Historian and other Applications can retrieve WGR data via OPC or RESTful API



Connection via RESTful API, OPC UA, or OPC DA

OSI PI Historian

3rd Party App

Web Application Clients HTTPS using browser

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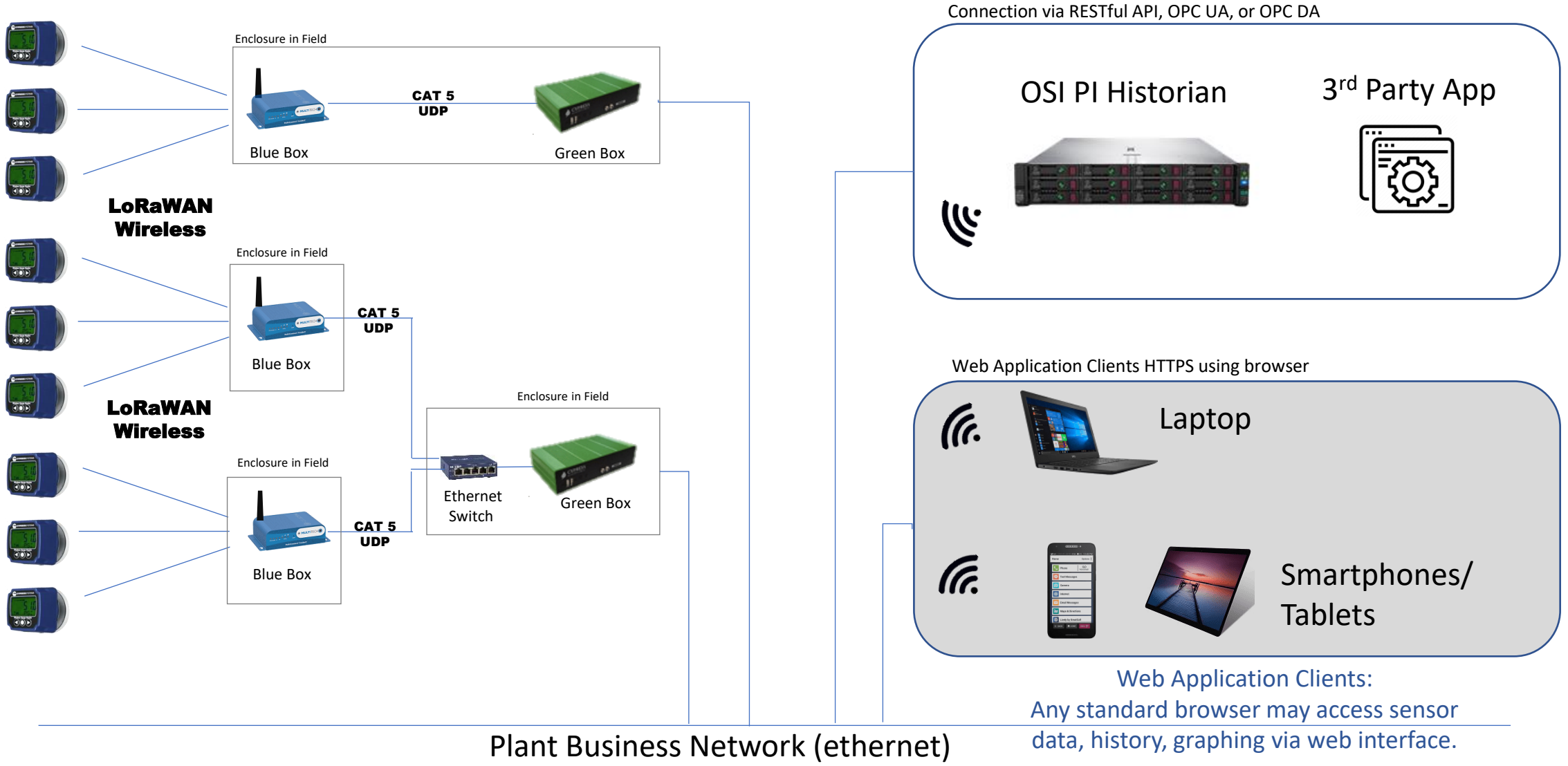
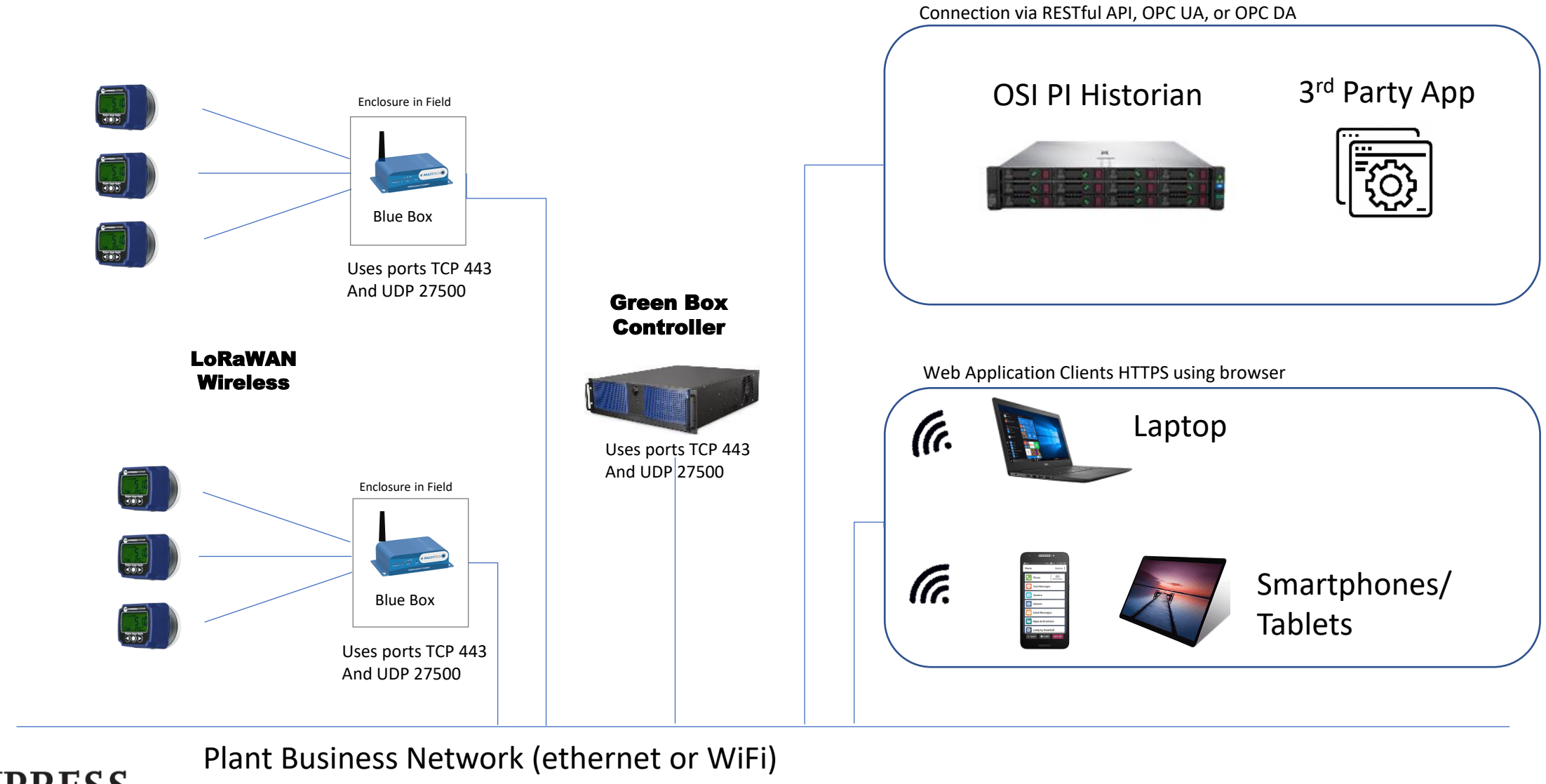
Plant Business Network (ethernet)

Web Application Clients



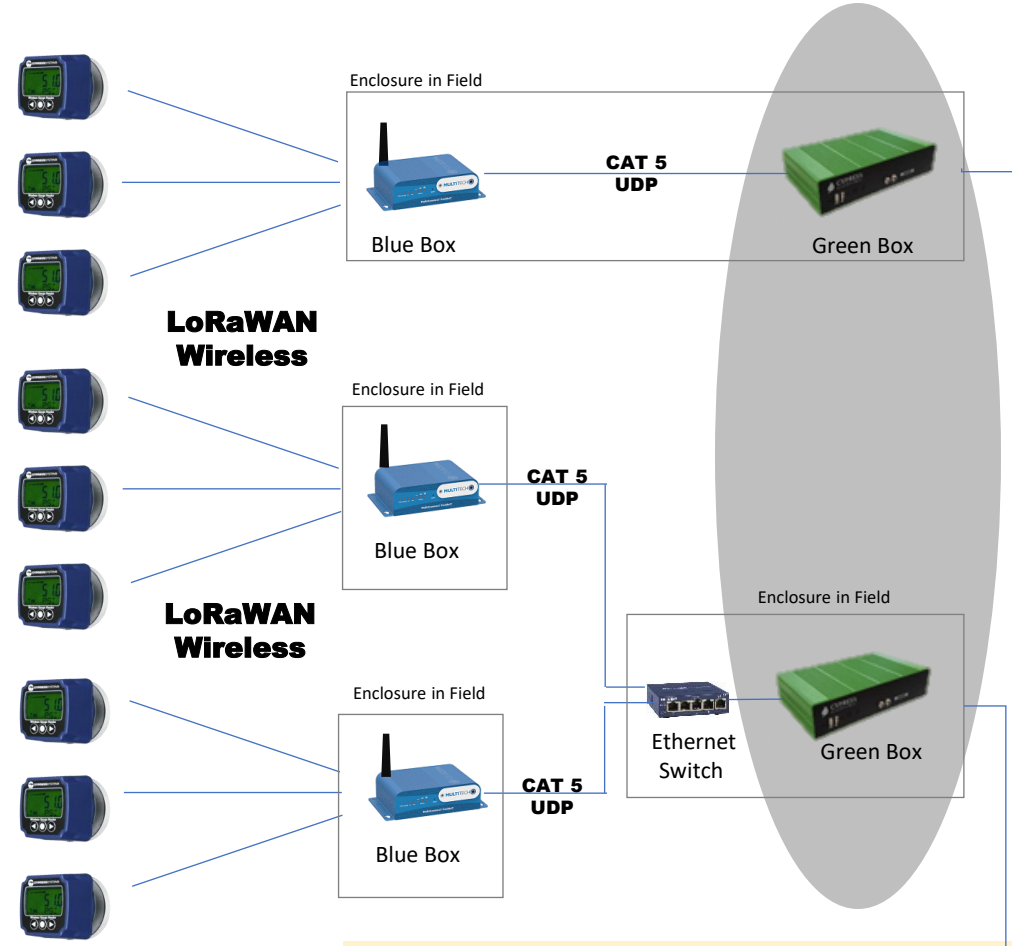
Option 2:
Centralized Green Box Controller

Use existing LAN (Ethernet or WiFi) already on-site



Options for Power Supply

Green Box Power Supply



Green Boxes – always powered via 110 VAC receptacle – power supply provided by Cypress

Connection via RESTful API, OPC UA, or OPC DA

OSI PI Historian

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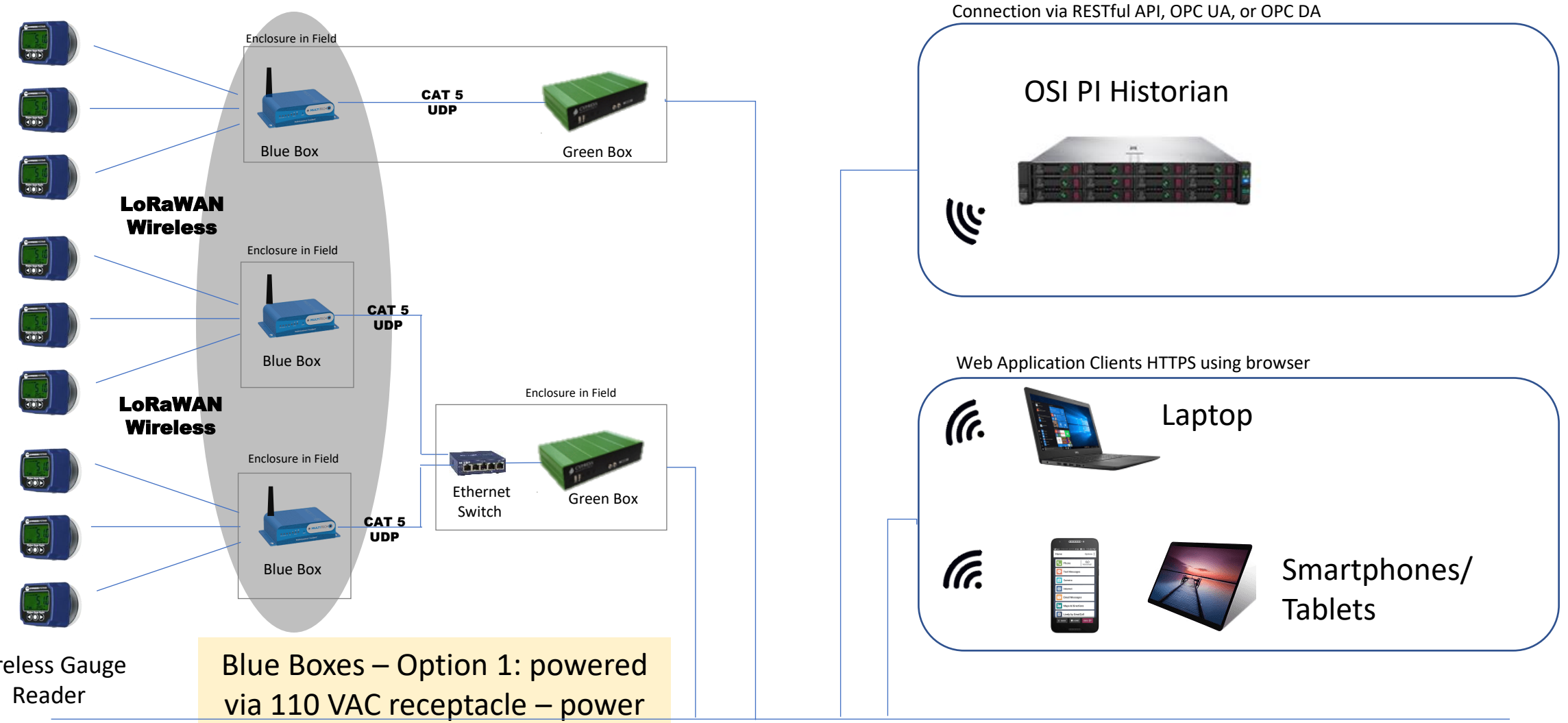
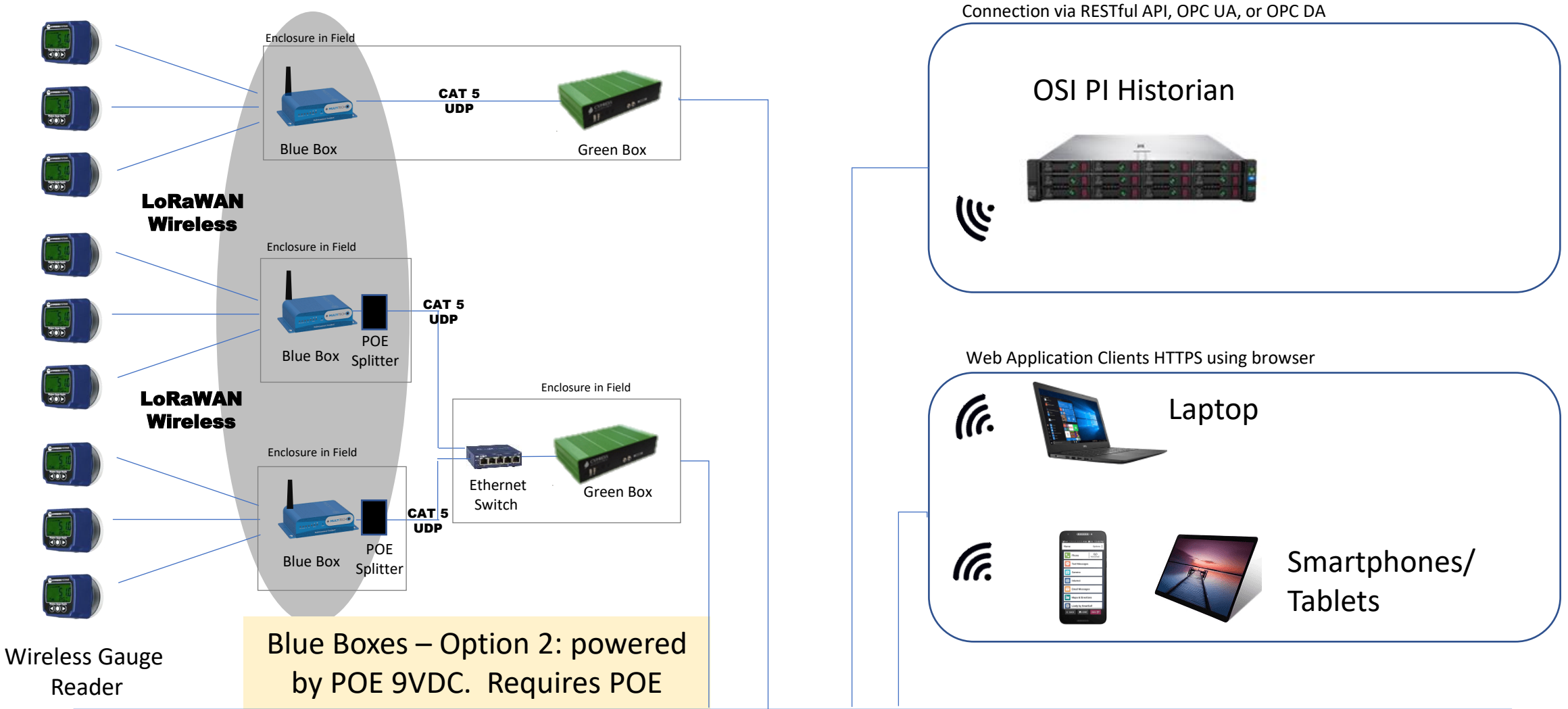
Blue Box Power Supply – Option 1: 110 VAC



Blue Boxes – Option 1: powered via 110 VAC receptacle – power supply provided by Cypress

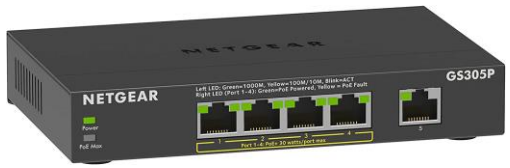
Blue Box Power Supply – Option 2: POE



Blue Boxes – Option 2: powered by POE 9VDC. Requires POE Injector and Splitter – *optionally* provided by Cypress.

Blue Box Power Supply – Option 2: POE (cont'd)

Typical POE Injector/Switch Combo



https://www.amazon.com/dp/B08LHL1Q2Z?psc=1&ref=ppx_yo2_dt_b_product_details

Typical POE Splitter

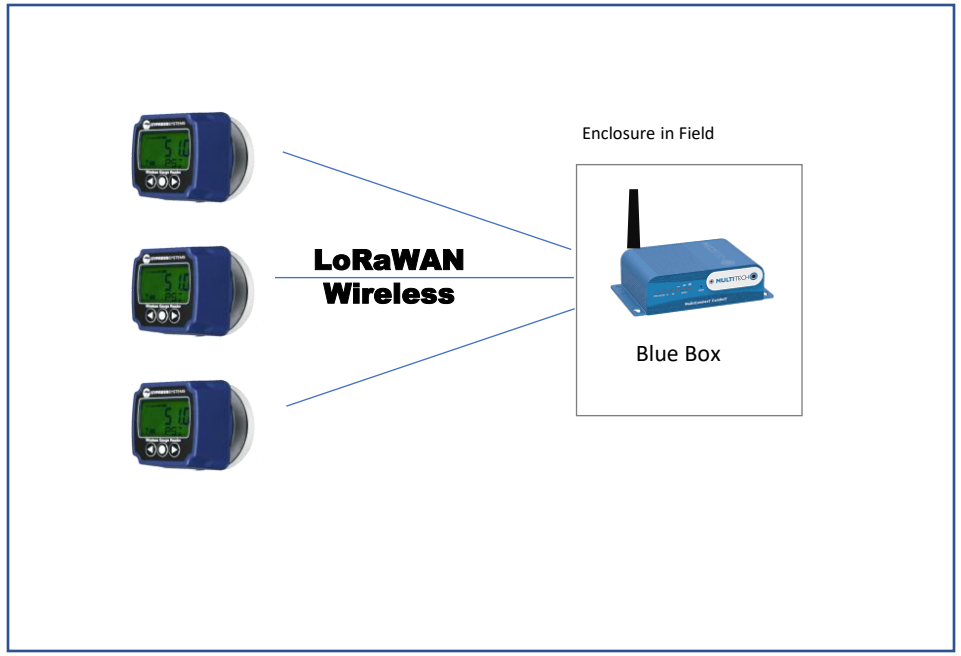
https://www.amazon.com/dp/B01JCKHIGM?psc=1&ref=ppx_yo2_dt_b_product_details

Note: Max Ethernet/POE length is 300 ft

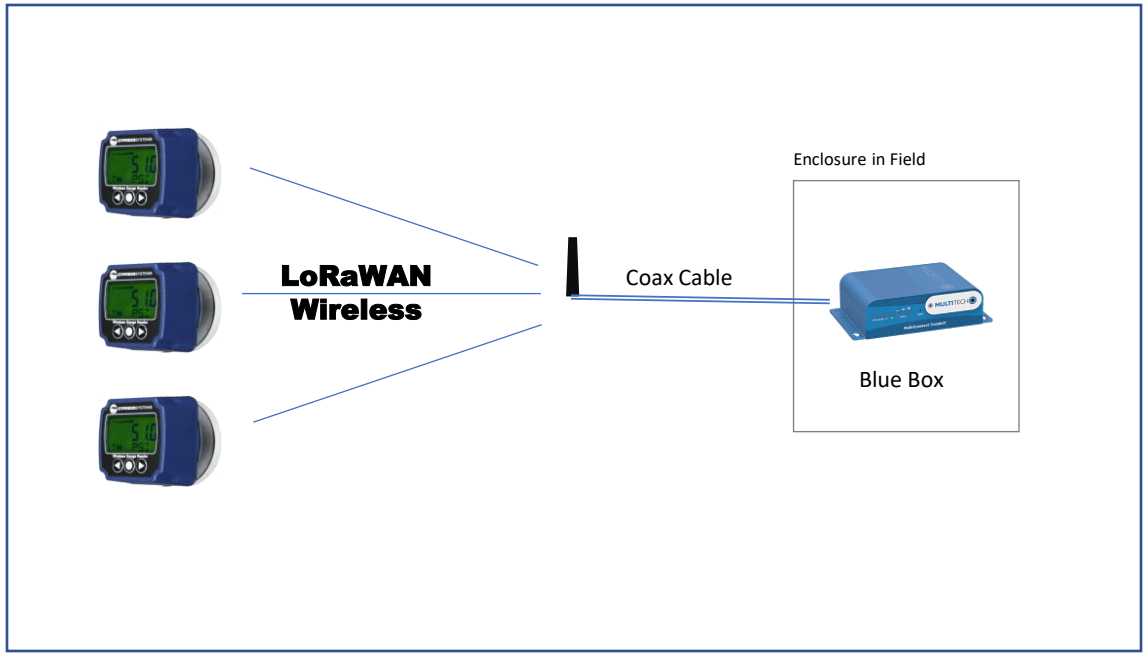
Options for Blue Box Antenna Extension

Blue Box Antenna Extension

Without Antenna Extension

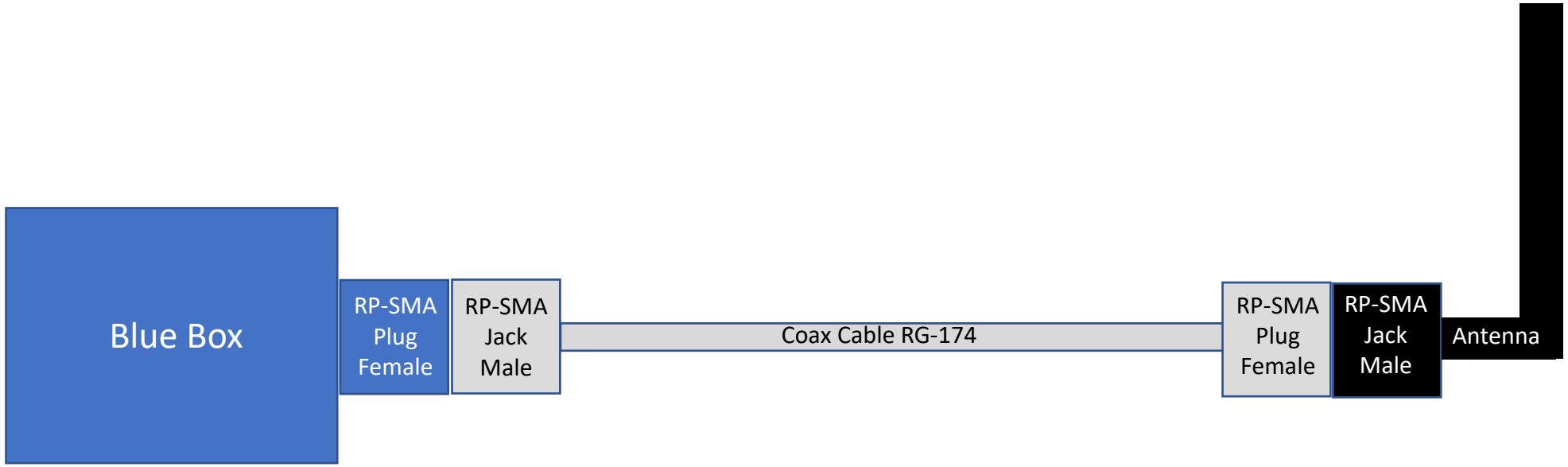


With Antenna Extension via Coax Cable



Note: Antenna Extension max of 100 ft distance – limited by signal loss

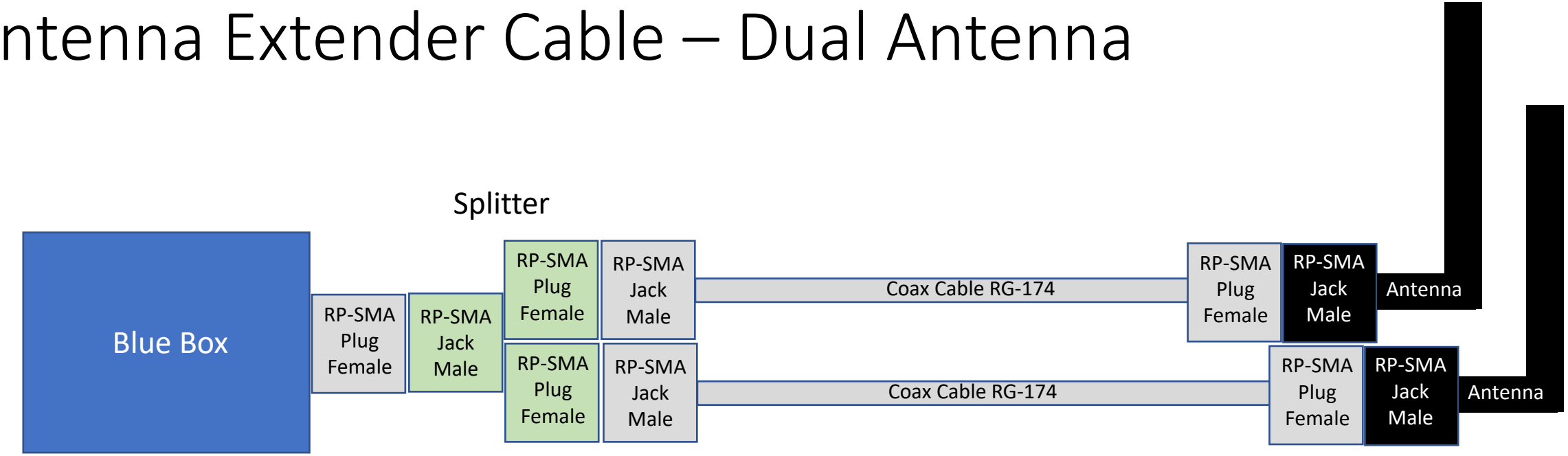
Antenna Extender Cable – Single Antenna



Connectors:
https://www.amazon.com/SUPERBAT-Connectors-Female-Attachment-Connector/dp/B08F4SYDDF

Cable:
https://www.awcwire.com/rg-catalog/rg174-coax-cable
https://www.awcwire.com/rg-catalog/rg142-coax-cable

Antenna Extender Cable – Dual Antenna



Splitter:
https://www.amazon.com/SUPERBAT-Adapter-Splitter-Antenna-Converter/dp/B08V4WGV1R/

Connectors:
https://www.amazon.com/SUPERBAT-Connectors-Female-Attachment-Connector/dp/B08F4SYDDF

Cable:
https://www.awcwire.com/rg-catalog/rg174-coax-cable
https://www.awcwire.com/rg-catalog/rg142-coax-cable

Antenna Extension Cable – Signal Loss Details

http://rfelektronik.se/manuals/Datasheets/Coaxial_Cable_Attenuation_Chart.pdf

27.9 dBm attenuation per 100 ft for RG-174 cable
13 dBm attenuation for 100 ft for RG-142 cable

Signal Losses: Connectors: Typical attenuation per connector is 6 dB
Signal Losses: Combined – 25 dB to 40 dB signal attenuation – very significant

Note: Antenna Extension Cables introduce significant signal loss – not suitable for long distances

Options for OSI PI Historian Connection

Options for OSI PI Historian Connection

Option 1: RESTful API

https://livelibrary.osisoft.com/LiveLibrary/content/en/web-api-v8/GUID-9330057F-C995-4721-A10F-29F3C1EB3E8E

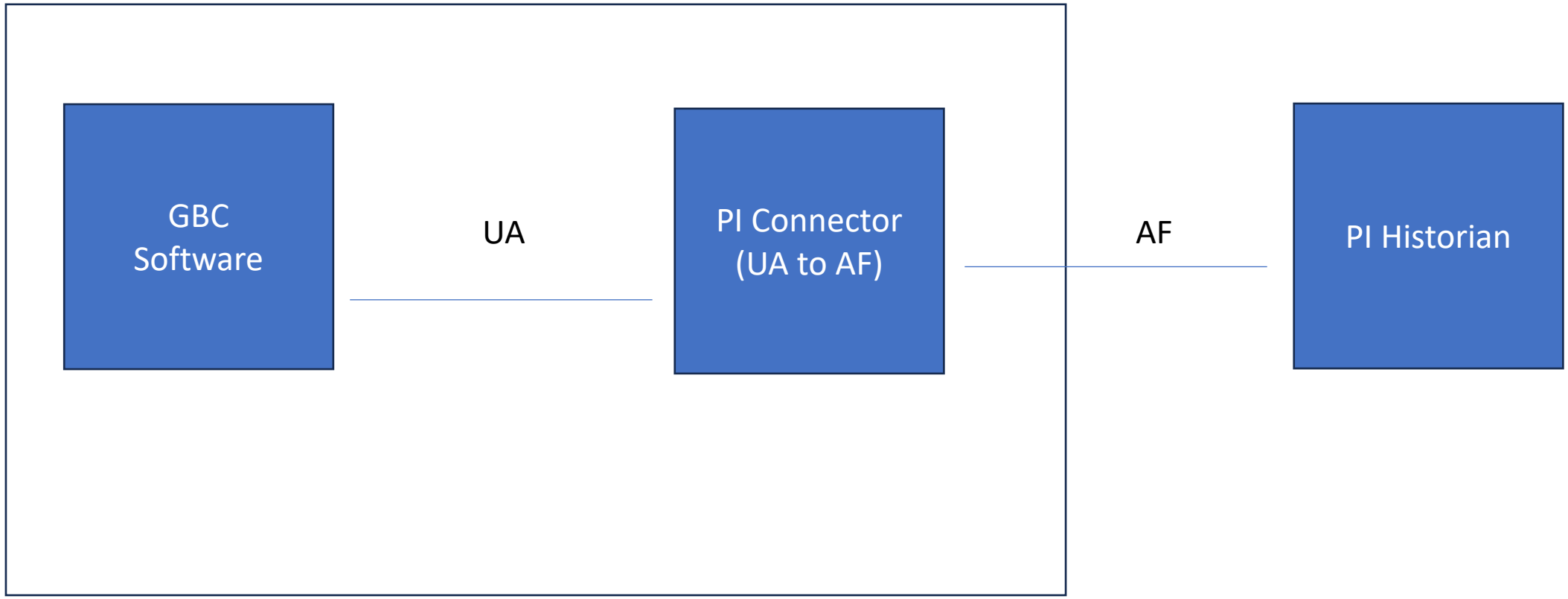
Option 2: OPC UA

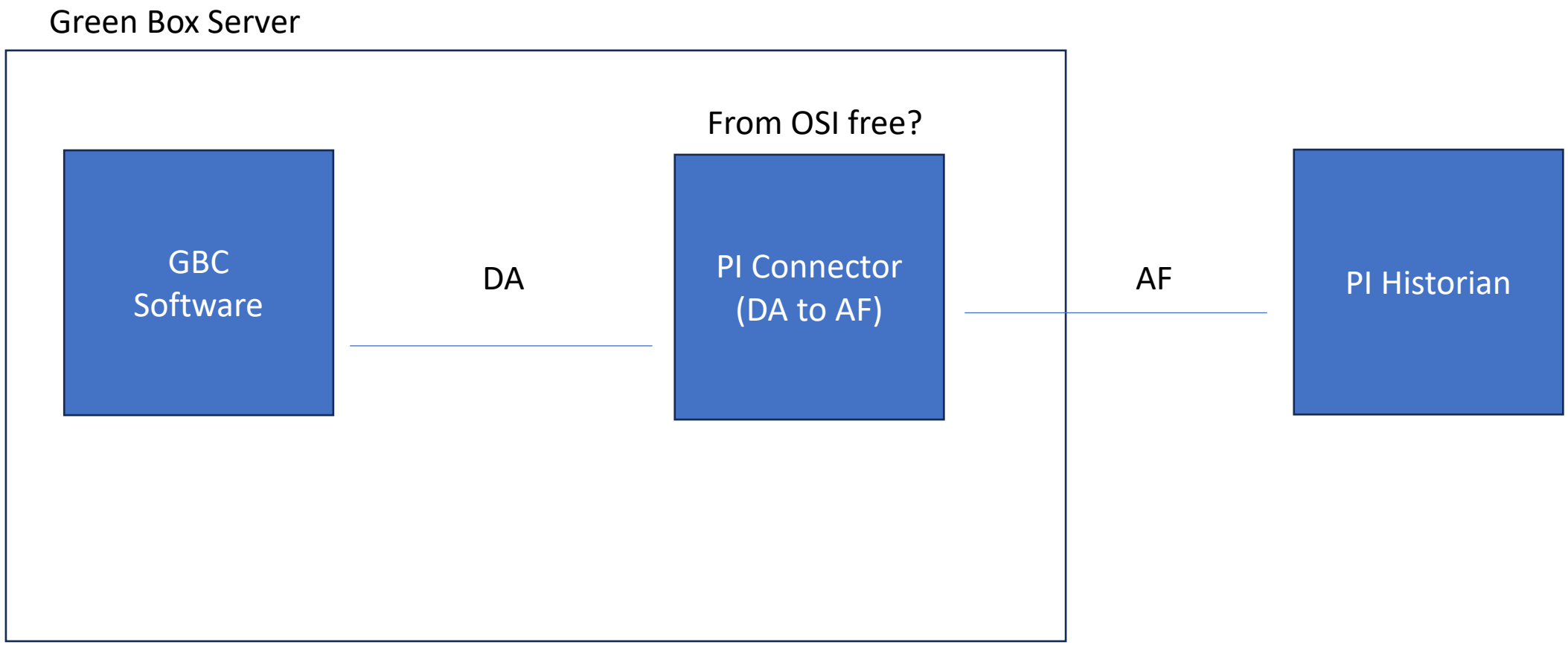
https://techsupport.osisoft.com/Products/PI-Interfaces-and-PI-Connectors/PI-Connector-for-OPC-UA/Interface-Details/

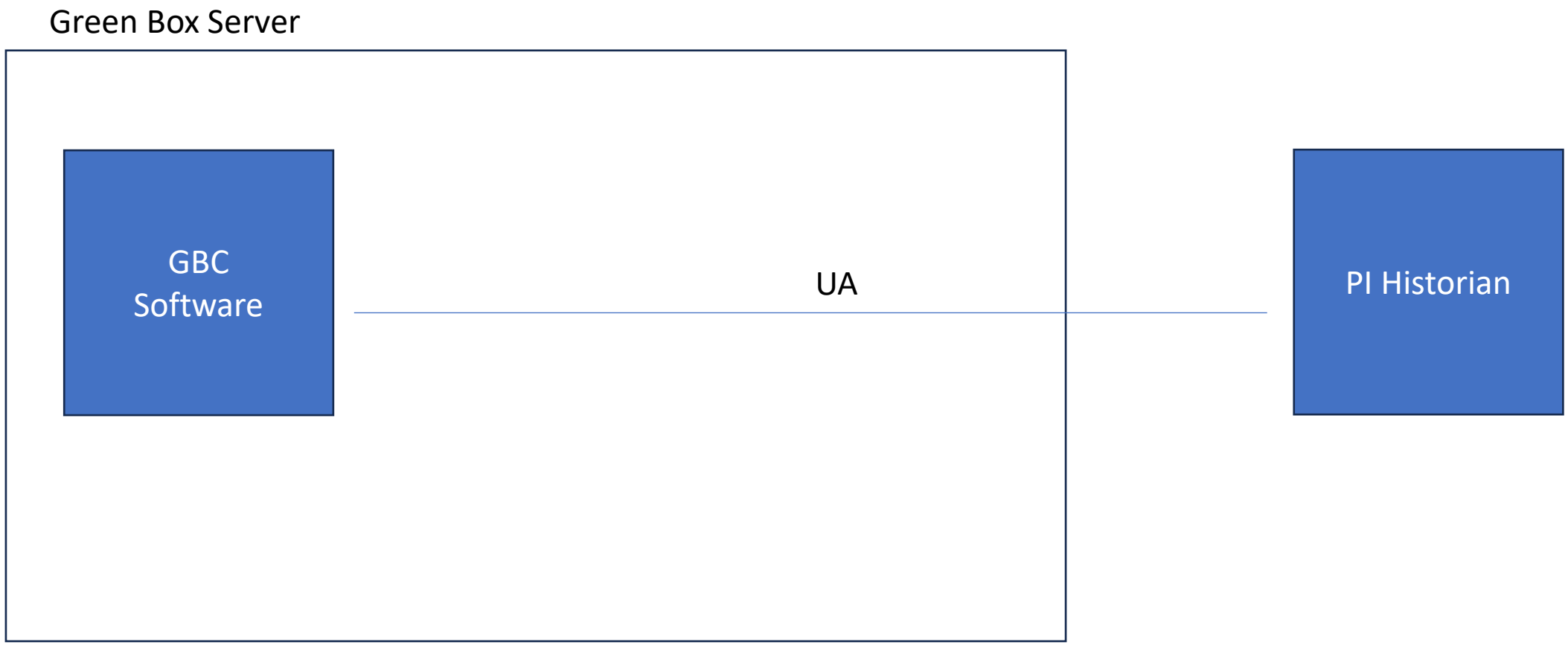
Option 3: OPC DA

http://cdn.osisoft.com/interfaces/1753/PI_OPCInt_2.3.11.0.doc

Green Box Server (Windows)




Green Box Server
From OSI free?
GBC Software
DA
PI Connector (DA to AF)
AF
PI Historian


Green Box Server
GBC Software
UA
PI Historian

LoRaWAN - FAQ

- What is LoRaWAN?
  - It is a Low Power, Long Range radio technology using patented chirp spread spectrum (CSS) technology.
- What are the benefits of LoRaWAN?
  - Long range, low power consumption, low interference, secure, broad adoption – compared to other wireless technologies.
  - See LoRaWAN Alliance https://lora-alliance.org
- What frequencies does it use? Does it interfere with WiFi, Bluetooth or cell phones?
  - 915 MHz band (902–928 MHz) in North America divided into multiple channels (can channel hop)
  - The 915 MHz band is a different frequency than WiFi, Bluetooth and cellular, so no interference
- What is the transmission range of LoRaWAN?
  - Maximum range can be up to 10 miles – but bandwidth and battery consumption suffers.
  - WTL range is 100-150 ft typically, on a single floor. Crossing floor plates or thick walls reduce range by up to 50%.
- Does LoRaWAN use repeaters to extend range?
  - No, it uses a STAR topology where each WTL communicates directly with the Gateway. There are no repeaters.

LoRaWAN - FAQ

- Can it be used in nuclear power plants and RF sensitive locations?
  - Yes, Cypress has deployed LoRaWAN networks at 27 nuclear plants.
- Can 3rd party LoRaWAN devices use the Cypress gateways?
  - Yes, once a LoRaWAN gateway is installed, other 3rd party LoRaWAN sensors and devices can use the same gateway. It is necessary to configure the Gateway and write code to parse payload formats – a service provided by Cypress Envirosystems.
- Is LoRaWAN secure?
  - LoRaWAN has built-in mandatory authentication and encryption.
  - The WGR system has been tested and is in use by critical industries including nuclear power plants and NASA.