



Delivering end to end IoT services

# G2021ES

## Multi Service Gateway for IoT



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## About Pacific Controls

Pacific Control Systems (PCS) is a global provider of ICT-enabled managed services and solutions for smart cities, critical assets and machines. PCS, an ISO 9001:2008 certified entity, provides ICT enabled managed services and converged engineering solutions globally. Pacific Controls has pioneered the concept of city centric management of data and has established the world's first Global Command Control Center for managed engineering services. The Command Control Center serves clients globally by enabling the monitoring and management of their assets, carrying out continuous commissioning, measurement & verification of their carbon footprint and converting them into carbon financial instruments, in real time.

Pacific Controls offers its managed services using its Galaxy 2021 Platform hosted on the Pacific Controls Cloud Computing Network. Global assets are connected in real time to the cloud using IoT edge devices and gateways developed by Pacific Controls. The company has delivered some of the

world's largest Internet of Things (IoT) projects. PCS is one of the pioneers within smart city services/Internet of things domain. PCS has deployed smart airports, intelligent buildings, energy optimization services, smart life safety projects, mobile asset management, and a range of other smart city services in different parts of the world. Pacific Controls can provide monitoring and management of virtually all assets within the city from a centralized Command Control Center. This can be achieved by integrating numerous city / building systems, capturing big data, and by applying extensive range of analytics to produce actionable intelligence. Pacific Controls Command Control Center facilitates remote diagnosing of problems in systems, based on built-in artificial intelligence, and in many cases, fixes such problems remotely. Where it cannot fix problems (such as hardware issues), it produces a diagnostic report, which makes it easy for field staff to single out issues and address them swiftly.





# G2021ES

## G2021ES Multi Service Gateway

Pacific Controls has launched a Multi Service IoT gateway which is a multi-technology, headless wireless device that allows communication with on-board systems and provides machine data/information in real time. Various RF technologies including cellular, WiFi, BT, and GPS are used to maximize the availability of the communication link at minimal cost.

The flexible architecture of the product including its Embedded Device Framework (EDF) addresses important aspects including deployment and management of these devices in the realm of connected devices and device cloud.

The key characteristics of multi service gateway powered by EDF are,

- Rich in field interface protocols
- Data normalization and control
- User programmable business/control rules
- Optimized uplink/cellular bandwidth management
- Application driven secured Edge Device Communication Protocol which enable seamless and secure data flows between edge devices and the cloud
- Power optimization algorithms
- Cloud-based device provisioning, management and configuration



Communication with on-board systems over automotive application layer protocols including SAE CAN J1939, J1708, J1979, industrial protocols Modbus RTU, Modbus TCP and leading building management protocol BACnet lead the device as an ideal selection for IoT systems and solutions.

## Product Architecture

High level architecture of the product is depicted in Figure 1. It is a simplified IoT gateway embedded with intelligence. The gateway provides shared processing resources to the machine communication layer, business intelligence layer and the Gbot layer, within and outside the gateway.

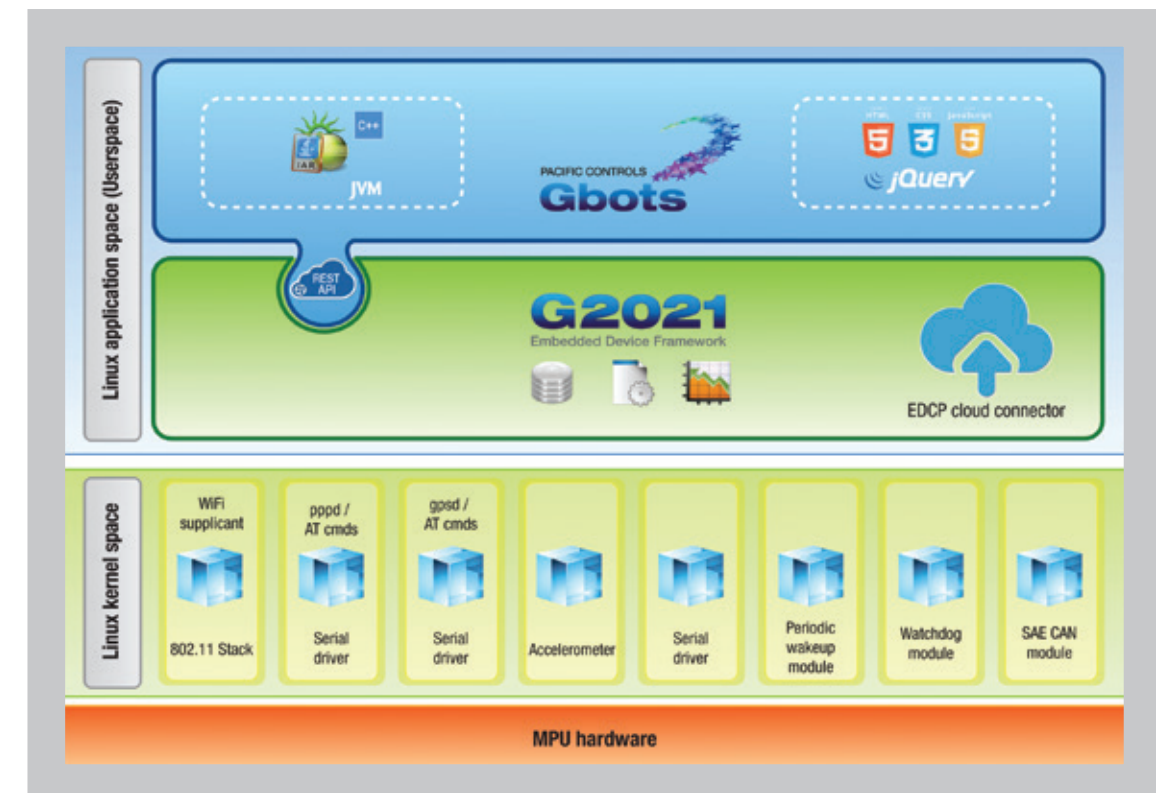


Figure 1



## G2021ES Solution Architecture for Enabling IoT

The Pacific Controls solution architecture enables smart cloud services with G2021ES intelligent multi-service gateway for IoT and the Galaxy 2021 IoT platform. The unique characteristics and features that distinguish our solution from traditional distributed systems are shown in the architecture through real world applications.

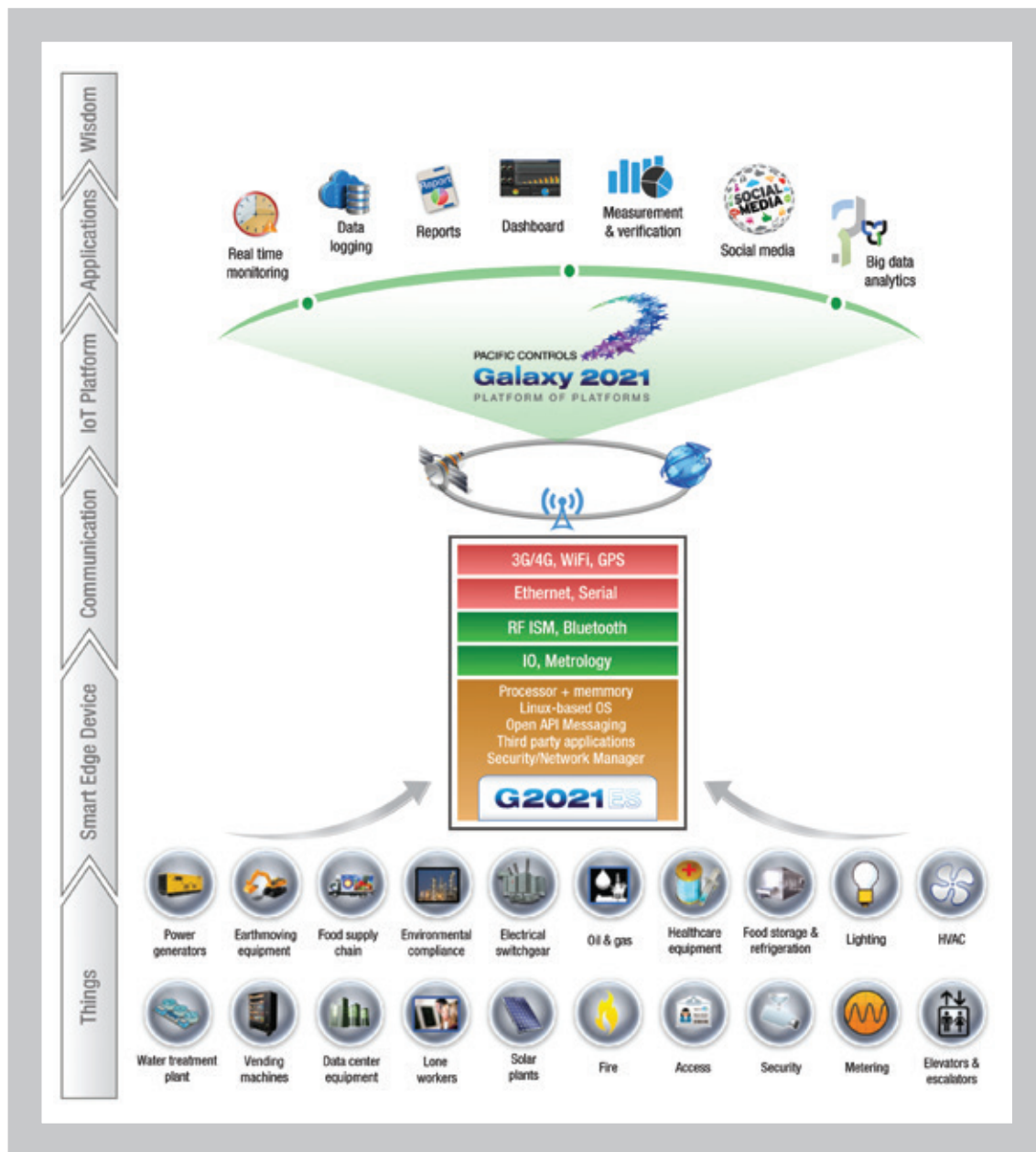


Figure 2

# G2021ES

## G2021ES Product Specifications

### Processor and Memory

- 32 bit RISC Processor with 720 MHz Scalable core frequency
- 4GB of eMMC (Optional 16 GB of eMMC)
- MicroSD slot
- 256 kb of EEPROM

### Cellular with integrated GPS

#### The WWAN features

- Advanced E-GPRS/WCDMA/HSDPA/HSUPA Software protocol stack
- (Layer 1 to 3) – Version: 3GPP Release 7
- GSM Quad band (850, 900, 1800, 1900)
- WCDMA Multi-band (I, II, IV, V, VI, VIII and XIX)
- HSDPA up to 21.0Mbps (for the high-end variants; up to 7.2 Mbps for the others)
- HSUPA up to 5.76Mbps
- WCDMA up to 384kbps downlink/uplink
- DTM (Dual Transfer Mode)
- Receive Diversity, type3i interference cancellation receiver
- CPC (DRX/DTX) (Continuous Packet Connectivity)
- DARP
- Control via AT commands according to 3GPP TS27.005, 27.007 and Telit customized AT commands
- Serial port multiplexer 3GPP TS27.010
- SIM application Tool Kits 3GPP TS 51.014
- Power consumption (typical values):
  - Stand-by current 2G, DRX5, 1.1 mA
  - Stand-by current 3G, DRX7, 1.2 mA
- Output power
  - Class 4 (2W) @ 850 / 900 MHz, GSM
  - Class 1 (1W) @ 1800 / 1900 MHz, GSM
  - Class E2 (0.5W) @ 850/900 MHz, EDGE
  - Class E2 (0.4W) @ 1800/1900 MHz, EDGE
  - Class 3 (0.25W) @ 850/900/1700/1900/2100 MHz, WCDMA
- Sensitivity:
  - 109 dBm (typ.) @ 850 / 900 MHz (GSM)
  - 110 dBm (typ.) @ 1800 / 1900 MHz (GSM)
  - 111 dBm (typ.) @ 850/900/1700/1900 / 2100 MHz (WCDMA)



**The integrated GPS module:**

- Advanced real time hardware correlation engine for enhanced sensitivity (better than -165 dBm for A-GPS)
- Fast Acquisition giving rapid Time-to-First-Fix (TTFF)
- Capability to monitor up to 28 channels
- Stand Alone and Assisted mode (SUPL 1.0)
- Integrated LNA
- Main characteristics:
  - Accuracy: 3m
  - Hot start autonomous: 1.8 sec.
  - Warm start autonomous: 30 sec.
  - Cold start autonomous: 42 sec.
  - L1 1575.42 MHz
  - GPS NMEA 0183 output format
  - Datum WGS-84

**The cellular modem approvals**

- Fully type approved confirming with R&TTE directive
- CE, GCF (Global and Europe/Australia/New Zealand/ Brazil variants)
- FCC, IC, PTCRB (North America variants)

**Wireless LAN & Bluetooth module****The Wireless LAN module features:**

- WLAN MAC Baseband Processor and RF transceiver - IEEE802.11b/g/n compliant
- WLAN 11n 40MHz (SISO) and 11n 20MHz (SISO)
- Hardware-Based Encryption/Decryption using 64-, 128-, and 256-Bit WEP, TKIP or AES Keys
- Supports requirements for Wireless Fidelity (Wi-Fi) Protected Access (WPA and WPA2.0) and IEEE Std 802.11i - includes hardware-accelerated Advanced Encryption Standard (AES)
- Should be configurable as WiFi Access Point or station mode.
- Designed to work with IEEE Std 802.1x
- Advanced coexistence scheme with Bluetooth

**The Bluetooth module features:**

- Supports Bluetooth 4.0 BLE
- Includes built-in coexistence and prioritization handling for BT, BLE and WLAN
- Supports large number of multiple connections (up to 10)

**Ethernet**

The device provides up to two 10/100-BaseTX interfaces with MAC and complies with both the IEEE802.3u 10/100-BaseTX and the IEEE 802.3x full-duplex flow control specifications. The interfaces are noise and surge protected. The RJ-45 connectors have integrated signal isolation.

**USB**

There are two USB 2.0 host ports available for general purpose usage while an additional port can be used to connect add-on modules via an expansion interface. The external interfaces are noise and surge protected.

**Digital I/O**

Two independent 1kV opt isolated voltage or volt free inputs, 5V TTL level. Two digital outputs (open collector or drain) 50V DC rated with the sink capacity of 10mA, 1KHz maximum switching frequency.

**Serial Ports****EIA-232 / EIA-485**

The device provides two serial ports software configurable as:

- EIA-232, 3 wires (RX, TX, GND)
- EIA-485

EIA-485 termination resistors insertion is managed by software while no fail safe resistors are mounted. The maximum supported baud rates are:

- EIA-232 mode – up to 460 Kilobits per second.
- EIA-485 mode – up to 3.6864 Megabits per second

**CAN**

The device provides up to two CAN interfaces supporting CAN Version 2, Parts A and B. The device can power two CAN devices – 100 mA @ 5V. CAN power can be enabled/disabled by software.

**LEDs**

The device provides six LEDs:

- 1 green LED signalling that the device is powered
- 1 red LED signalling cellular modem status
- 2 green LED for general purpose usage – controllable by software
- 2 red LED for general purpose usage – controllable by software

LEDs are placed on the enclosure in a way that they are visible when the device is mounted on the DIN rail or placed on a table

**Reset button**

The reset button, when pressed, will trigger a hardware reset of the device.

**Programmable button**

The programmable button is sensed by a Linux daemon which will execute a shell script when the button is pressed.

**Serial EEPROM**

The device includes a 256 Kilo bit/32 Kilo bytes EEPROM on I2C bus.

**Real-time Clock**

The device includes an RTC with 25' per year accuracy @ 25 °C. A replaceable lithium battery allows more than 30 days of timestamp retention when the device is powered off. A typical CR1220 lithium coin cell should provide retention for 180 days. A jumper under the service panel can be used to disconnect the battery when the device is stored. The CPU can measure the battery voltage level through an analog input.

The RTC can trigger an interrupt to the CPU (periodic or programmable alarm clock).



## Watchdog

The device includes a watchdog/supervisor IC, external to the CPU.

## Accelerometer

Three axis +/- 8g accelerometer with 12 bit resolution and programmable output signal which can trigger an interrupt to the CPU (movement detection).

## Power input

Nominal voltage: 24 Vd (9 V DC to 36 V DC) The interface is protected against surge, noise, reverse polarity, overvoltage and short. The power input is protected with a resettable fuse. Low power mode algorithms for power optimization Device peak demand  $\leq$  15W.

# General Specifications

## Operating Environment

### Temperature:

- Operating Temperature: - 20 °C to 70 °C
- Storage Temperature: -40 °C to 80 °C

### Humidity:

- 90% of Non-condensing humidity
- The device shall not be exposed to water, chemical agents and UV.

## Housing

- NEMA 2 (IP40) Housing
- Dimensions 140 x 80 x 32 mm (W x D x H)

## Product Certifications and Compliance

- CE
- EN 61000-6-2:2005 EMI/EMC Certification Compliance
- IEC 60068-2 Mechanical Vibration, Bump and Shock test compliance
- UL/EN 61010-1 Electrical safety compliance
- FCC Part 15: Subpart B Section 15.107 and 15.109
- Vibration, Shock and Bump Tests
- Mechanical Vibration: IEC 60068-2-6 type Fc (vibration, sinusoidal)
- Mechanical Shock: IEC 60068-2-27 type Ea (shock)
- Mechanical Bump IEC 60068-2-29 type Eb (bump)

## Life and Reliability

The connectivity device has a minimum life expectancy of 5 years or 40,000 hours in an Industrial application without repairs or part replacement. The HALT reports and procedures complies with Qualmark reporting standards.



## PACIFIC CONTROLS Galaxy 2021 PLATFORM OF PLATFORMS

The world is making a transition to ubiquitous cloud computing. Pacific Controls' Galaxy is the world's first cloud platform that offers a variety of solutions to monitor, manage and control devices and infrastructure at any location in the world. It uses M2M (Machine to Machine) technology to make it easy to collect data from a wide range of infrastructure and devices in real time, in order to monitor and control their performance. The platform uses artificial intelligence to analyze the data and pro-actively take action based on this analysis, minimizing human intervention.

Galaxy can control and monitor digital processes of any kind. It can manage enormous volumes of data and perform intelligent data mining to ensure that users can extract the maximum information from this data. The platform can be used for infrastructure management, energy optimization, and to enhance the productivity of operations and maintenance for a wide variety of equipment. Data becomes visible, transparent, and verifiable; users can take control of services that affect them, empowering citizens and employees. The platform is interoperable with any data source, and allows decision makers and managers to have vital information at their fingertips, at the right level of detail.



## PACIFIC CONTROLS Gbots

Gbots are the new paradigm in cloud computing. These intelligent, autonomous and cognitive 'self – learning' remote service delivery agents are deployed to observe and act upon equipment and systems behavior in any location. Gbots are unobtrusive automated tools for customer service integrated into Pacific Controls Galaxy service delivery platform. They are built using Java, a language that is widely used in the internet environment for machine learning and reasoning. They are created and despatched by the Pacific Controls Galaxy Platform, at our Global Command and Control Centres, as and when required. Gbots work independently within the target system or transfers data to the central platform when more powerful analytics are required. This new technology has simplified next generation equipment maintenance and customer service by enabling early fault detection and by creating real-time, predictive, self-healing systems.

