



ResIoT LoRaWAN™ Network Server and IoT Platform v.2.4.99992 (13/07/2020)

Include the components:

ResIoT LoRaWAN™ Network Server: Management of the LoRaWAN radio protocol and Gateways Control

ResIoT IoT Platform/Application Server: management platform for all data and communications

ResIoT Base Station Server: software component for infrastructure management and total control of gateways

ResIoT Base Station Client/Merlin IoT Box: software to be installed on the gateways to allow complete remote control

ResIoT Gateway Remote Access Server: for direct access via SSH or web interface to the gateway without VPN. ResIoT manages a secure connection only if requested

| ResIoT LoRaWAN™ Network Server v. 2.4.9992 | |
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| LoRaWAN™ Protocol | Full support LoRaWAN 1.02, 1.03 and 1.1 |
| Frequency/ISM Bands/Regional Support | EU 863..870 MHz US 902..928 MHz CN 779..787MHz EU 433 MHz AU 915..928 MHz CN 470..510 MHz AS 923 MHz KR 920. .926 MHz IN 865..869 MHz RU 864..870MHz |
| LoRaWAN™ Nodes Class | Class A,B,C |
| LoRaWAN™ Multicast | Yes, Class C ABP |
| Authentication | OTAA(Overt-the-air-activation) ABP(Activation by personalization) |



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| ADR - Adaptive Data Rate Algorithm | Yes, with evaluation through RSSI, SNR and other radio parameters. It is possible to configure for a sensor or groups of sensors specific rules in which for example they must not exceed the speed SF9, or the ADR must be disabled .. |
| ADR Profiles | Possibility of setting different types of ADR profiles, evaluation algorithms and sending power values to sensors based on the loss of messages, algorithms with aggression levels that can be set by the user to prevent sensor loss Limits for SF and powers that can be set by the user |
| Packet de-duplication | messages received from multiple gateways are automatically de-duplicated |
| Uplink Messages | Encoded in Hex |
| Downlink Messages and Duty cycle optimization | Yes, with Downlink ResIoT™ Intellqueue™: choice of the gateway for sending downlinks based on latencies and duty cycle and connection types with retry / rotate gateway functions for devices in Class A, B and C. Configurable sending timeout for each message for class C devices Manual or automatic selection of the Rx1 / Rx2 radio window for sending downlinks |
| Tx Power | radio data transmission powers from gateways settable for single frequency according to international standards |
| Gateway latency management | constant control of gateway latencies integrated with system for sending downlinks, alert management |
| Duty cycle rules and policies | It is possible to configure limits for devices or users in the use of downlinks by configuring the maximum time that can be used in a certain period of time or have it managed directly by the network server, calculating it based on the number of gateways installed in the area |
| LoRaWAN™ Messages type | Confirmed/Unconfirmed |





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| Devices Channel Management | Advanced: for frequencies that allow it to dynamically send additional channels to all connected devices calculated by the present gateways (requires ResIoT Base Station Client/IoT Merlin Box) |
| Key management | The keys configured for the sensors(ABP,OTAA) are saved safely and kept in double copy with a history of all the changes |
| Blocking messages from other NETID networks | it is possible to send gateways (ResIoT Base station Client) such as NETID to exclude in order to block the traffic of irrelevant radio messages and optimize the traffic to the network server. (usable in networks in which the devices are only OTAA) |
| gRPC JSON REST API | Integrate ResIoT™ inside any third-party software with any type of languages programming. More than 150 APIs available for the management of devices / gateways , connectors and variables |
| Statistics | Real Time Monitor (Traffic, Signal, timetoair..) LoRa Traffic Analyzer for advanced management of radio channel occupation with alert Up/Downlink RSSI Analyzer Advanced radio packet analyzer to track and identify any communication problems Full Communication Log (also exportable via CSV) Generic Log (also exportable via CSV) |
| Data retention | data retention of all radio messages rx, tx settable by user with multi-database system for high scalability |
| Device management | Manual entry Import from csv file Complete control via Api Management tools for groups of devices, aliases, hierarchical management with device tree structure |
| LoRaWAN™ functions for large networks | In installations of large city or industrial networks ResIoT™ supports functions such as device sharing, simultaneous management of different networks with different SLAs, profiling |





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| | of users with limitations in the use of gateways, traffic and the number of devices that can be used |
| Multi tenant | Yes, creation of infinite and distinct network servers for countless customers or organizations |
| Carrier-Grade Version | Carrier-grade version that allows you to create a network with infinite horizontal and vertical scalability Internal management of all load balancing systems Support for setup with infinite independent parallel instances even multi region |
| User/Policy management | Yes: sharing of gateways and devices among the various users with group and user management |
| Data Adapters & Connectors | Real time, simultaneous and persistent connections with multiple ResIoT™ LoRaWAN™ Network Servers and other connectors: <ul style="list-style-type: none"> - MQTT Brokers client or server - Websockets client or server - Azure IoT - AWS IoT - Http pusher client or server - Modbus client or server - Snmp Trap Server - MongoDB Pusher - SQL Pusher (Mysql, PostgreSQL, Sql Server) |
| LoRaWAN™ MAC Command Support | view *Tab1 |
| Interface | User friendly secure web interfaces (responsive bootstrap for mobile phone and tablet) |
| Support for multiple instances High availability and scalability | Yes, with failover support |
| Supported OS | Linux Ubuntu 64bit 16.04 LTS |





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| | <p>Ubuntu 64bit 18.04 LTS Debian 8+ RHEL Red Hat Linux 7+ ask for other systems</p> <p>Windows 64 bit 7/8/10 Server 2008/2012/16/19</p> <p>Arm/Linux</p> |
| Upgradable | Yes, with Live Update functions |
| Licensing/Setup | On-premises on private server or provided in a cloud environment, Google, AWS, Digitalocean, Azure with OPEN license on consumption or Fix license |
| Gateways/Base stations Support | Gateway/Base station with software ResIoT Base Station Client/IoT Merlin Box preinstalled with TCP Protocol or Gateway with Semtech Protocol UDP v.1/2 (in case of connection with Semtech standard UDP protocol it is not possible to check the gateway status, configure the channels, etc therefore to be used only for test purposes) |
| ResIoT Base Station Client/Merlin IoT Box Build 12244 | |
| Supported gateways | ResIoT X2/X4/X7, Kerlink, MultiTech, Cisco, Aaeon, Tektelik, Lorixone..(available to support new models) |
| Connection from gateway to network server | Secure TCP, protocol: Websocket, Mqtt and Rest API to network server |
| Management and configuration | Completely automated and centralized, all the parameters are configured within the network server and then takes care of sending them correctly to the gateways |
| Radio Channel configuration | Custom remote channel configuration Automatic reconfiguration of channels for gateways and |





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| | devices |
| Data retention | In case of loss of network connection between gateway and network server the arrived radio messages are not lost, they are saved in memory and forwarded to the network server when the connection is restored. (in this configuration the platform decrypts the message and saves it as a payload with correct date of arrival but obviously cannot handle messages returning to the sensor as ack ...) |
| Health check and gateway status | Advanced watch dog for Gateway hardware / software Automatic restart of network, services or system in case of fail Radio card, LTE/Ethernet connection |
| Monitoring and reporting | Full monitoring of all parameters: Disk, Memory, Cpu, ethernet or 2g/3g/4g/Lte quality connection All data is sent periodically to the network server and visible through graphs and reports |
| Alert management | It is possible to configure different types of alerts by configuring different alert thresholds for: timeout, 2g / 3g / 4g / Lte connection quality, disk errors, full Ram ... The alerts can be configured and sent by ResIoT with email, Snmp server, Snmp trap, Modbus, generic Curl call, etc ... through the ResIoT platform functions and programmable in Lua scripts |
| VPN management | It is possible to configure and send the VPN configuration remotely |
| Software management | Through web interface [gateway ip: 50056], API or remotely through ResIoT Network Server |
| Remote access | the gateways are accessible via Ssh or web directly from the ResIoT platform through ResIoT Gateway Remote Access Server |
| Reverse proxy support | It is possible to configure a reference server (ResIoT Reverse Proxy) for direct access via SSH or web interface to the gateway |





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| | even without VPN. ResIoT manages a secure connection only if requested |
| Autoprovisioning | With the ResIoT™ Autoprovisioning functionality, the gateway automatically configures itself to the LoRaWAN™ network without the need for other interventions. The gateway is completely manageable remotely. It also has a practical web control interface |
| Easy installation with App iOS/Android and QR CODE | For the supported models it is possible to create a QR CODE on the label to be pasted on the gateways (by default on the ResIoT X2,X4, X7 gateways we produce). Through the iOS / Android ResIoT mobile app it is possible to connect a gateway to the network in just a few seconds and safely. |
| Supported OS | Linux 32/64 bit Arm/Linux ask for other systems |
| Upgradable | Yes, with Live Update functions |
| ResIoT IoT Platform / Application Server v. 2.4.9992 | |
| Programmability | ResIoT™ Platform integrates the Lua5.1 scripting language interpreter into the ResIoT™ Smart Advanced Scene. In addition to the standard functions, more than 100 functions have been introduced to integrate with all the devices in the system, for parsing the payloads with hexadecimal management, bytes array, for saving data (eg temperature and humidity with dynamic creation of charts), to send downlinks, manage queues, create alerts, debug and much more |
| Device Data Model | Advanced: possibility to create customized models with fields / events and commands for saving historical data and display them in dashboard in real time. Payload parsing with Lua 5.1 scripting. |





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| Data retention | It is possible to configure for how many days the payload data or the data parsed in values (such as temperature, humidity, etc.) must be maintained |
| Infinity Automation | With ResIoT™ Smart Scene and ResIoT™ Advanced Scene with Lua 5.1 scripting language, you can build and setup all kinds of automation between IOT LoRaWAN™ devices, Low Power Wide Area Network or standard protocols Tcp, Http, Curl devices See manual: docs.resiot.io Scheduling: It is possible to schedule any type of event or action at configured intervals |
| Dashboard | Yes with widgets: <ul style="list-style-type: none">- Maps (Google / Openstreetmaps) : monitoring of gateways and devices on a map for synoptic errors or defects in real time- Real time Charts: Line, Bars, Gauge, Pie , Radar, Polar area with custom design- Buttons: for actions- Table values and notes html- Image with static positioning of sensors for building maps |
| Web interface | Yes, responsive bootstrap. Full support for Chrome, FireFox and Safari, Edge |
| Data Adapters & Connectors | Real time, simultaneous and persistent connections with multiple ResIoT™ LoRaWAN™ Network Servers and other connectors: <ul style="list-style-type: none">- MQTT Brokers client or server- Websockets client or server- Azure IoT- AWS IoT- Http pusher client or server- Modbus client or server- Snmp Trap Server- MongoDB Pusher- SQL Pusher (Mysql, PostgreSQL, Sql Server) |





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| gRPC JSON REST API | Yes: Integrate ResIoT™ inside any third-party software with any type of languages programming. More than 150 APIs available for the management of devices / gateways / Smart scenes / connectors and variables |
| App Mobile | IoS, Android |
| Asset management Tracking & Maps | ResIoT™ Dashboard integrates a management system for Openstreetmap™ and Google Maps™ with which it is possible to monitor the position or the path of the devices |
| IoT preconfigured devices | More than 150 preconfigured devices to simplify use in plug-and-play mode. Some manufacturers: Ascoel, MultiTech, Adeunis, Elsys, etc. With the guided procedure it is possible to quickly connect the devices and immediately start using them without complex payload decoding configurations |
| Alerts and Notifications | Built-in notification system on events: messages can be sent via email using private SMTP servers, with Telegram™ BOT or displayed directly on the ResIoT™ dashboard. It is also possible to send messages through ResIoT™ Smart Scene or Advanced Scene Lua5.1 |
| Plug-in Support | it is possible to export Lua scripts to a Plug-in and then distribute it to other ResIoT installations in order to optimize the release and maintenance of applications such as Smart Parking, Smart Agriculture ... (with version control) |
| Storage System | PostgreSQL (Linux or Windows) or SQLite (only ARM) Redis |
| Internal Message Queue Software | MQTT protocol versions 3.1 and 3.1.1: Mosquitto, RabbitMQ, EMQX, VerneMQ, HiveMQ.. Google Pub/Sub |
| Support for multiple instances High availability and scalability | Yes, with failover support |
| Supported OS | Linux |





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| | Ubuntu 64bit 16.04 LTS Ubuntu 64bit 18.04 LTS Debian 8+ RHEL Red Hat Linux 7+ ask for other systems Windows 64 bit 7/8/10 Server 2008/2012/16/19 Arm/Linux |
| Upgradable | Yes, with Live Update functions |
| Software Live Update | Yes, automatic updates even scheduled at certain times |

LoRaWAN Mac Commands Support (*Tab1)

| CID | Command | Transmitted by | | Description |
|------|--------------|----------------|---------|---|
| | | End Node | Gateway | |
| 0x01 | ResetInd | x | | Used by an ABP device to indicate a reset to the network and negotiate protocol |
| 0x01 | ResetConf | | x | Acknowledges ResetInd command |
| 0x02 | LinkCheckReq | x | | Used by an end-device to validate its connectivity to a network |
| 0x02 | LinkCheckAns | | x | Answer to LinkCheckReq command. Contains the received signal power estimation indicating to the end-device the quality of reception (link margin) |





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| 0x03 | LinkADRRReq | | x | Requests the end-device to change data rate, transmit power, repetition rate or channel. |
| 0x03 | LinkADRAns | x | | Acknowledges the LinkADRRReq. |
| 0x04 | DutyCycleReq | | x | Sets the maximum aggregated transmit duty-cycle of a device |
| 0x04 | DutyCycleAns | x | | Acknowledges a DutyCycleReq command |
| 0x05 | RXParamSetupReq | | x | Sets the reception slots parameters |
| 0x05 | RXParamSetupAns | x | | Acknowledges a RXParamSetupReq command |
| 0x06 | DevStatusReq | | x | Requests the status of the end-device |
| 0x06 | DevStatusAns | x | | Returns the status of the end-device, namely its battery level and its demodulation margin |
| 0x07 | NewChannelReq | | x | Creates or modifies the definition of a radio channel |
| 0x07 | NewChannelAns | x | | Acknowledges a NewChannelReq command |
| 0x08 | RXTimingSetupReq | | x | Sets the timing of the of the reception slots |
| 0x08 | RXTimingSetupAns | x | | Acknowledges RXTimingSetupReq command |
| 0x09 | TxParamSetupReq | | x | Used by the Network Server to set the maximum allowed dwell time and Max EIRP of end-device, based on local regulations |





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| 0x09 | TxParamSetupAns | x | | Acknowledges TxParamSetupReq command |
| 0x0A | DIChannelReq | | x | Modifies the definition of a downlink RX1 radio channel by shifting the downlink frequency from the uplink frequencies (i.e. creating an asymmetric channel) |
| 0x0A | DIChannelAns | x | | Acknowledges DIChannelReq command |
| 0x0B | RekeyInd | x | | Used by an OTA device to signal a security context update (rekeying) |
| 0x0B | RekeyConf | | x | Acknowledges RekeyInd command |
| 0x0C | ADParamSetupReq | | x | Used by the Network Server to set the ADR_ACK_LIMIT and ADR_ACK_DELAY parameters of an end-device |
| 0x0C | ADParamSetupAns | x | | Acknowledges ADParamSetupReq command |
| 0x0D | DeviceTimeReq | x | | Used by an end-device to request the current date and time |
| 0x0D | DeviceTimeAns | | x | Sent by the network, answer to the DeviceTimeReq request |
| 0x0E | ForceRejoinReq | | x | Sent by the network, ask the device to rejoin immediately with optional periodic retries |
| 0x0F | RejoinParamSetupReq | | x | Used by the network to set periodic device Rejoin messages |
| 0x0F | RejoinParamSetupAns | x | | Acknowledges rejoinParamSetupReq |



