CRITICAL INFRASTRUCTURE MONITORING AND MANAGEMENT ROOTED IN SIMPLICITY.

RADIX®

THE RADIX IOT PLATFORM

Radix IoT is a technology company with a mission to **unify data from disjointed building and automation equipment to create meaningful outcomes**, driven by data, for businesses and individuals. Radix IoT supplies an award-winning manufacturer agnostic IoT Platform as a service (PaaS) that allows clients – with one location to tens of thousands - to drive better business performance through data.

Mango

Install on your hardware, VM, Windows, Linux or Mac at the edge. Allows Mango for a single location or connected to the Radix IoT Cloud.

Radix IoT Appliances

Affordable, optional, edge hardware, pre-installed with Mango, for those not wanting to install Mango on their own hardware.

Radix IoT Cloud

Each location optionally runs Mango on nearly any operating system, allowing local control, management, and operation. Mango can then communicate with the Radix IoT Cloud or other Cloud provider to allow centralized control and visibility.

FROM ANALYTICS TO REMOTE FACILITY MONITORING AND AUTOMATION, RADIX IOT USERS HAVE ACCESS TO AN INTUITIVE, OUT-OF-THE-BOX FLEXIBLE PLATFORM THAT TURNS DISJOINTED DATA INTO BUSINESS SOLUTIONS.

RADIX IOT WORKS TO...

- **Centralize** disjointed systems, protocols, and sensing technologies within a location, allowing for a normalized single source of truth locally for analytics.

- **Connect** thousands of these locations, affordably, seamlessly, and reliably, into a single ecosystem that can be managed from anywhere.

- **Simplify**, allowing for 'self-service' or 'managed service through Radix IoT' of onboarding, modifications, or offboarding of equipment and locations all from a user-friendly web environment.

- **Enable** critical reporting and alarming natively, fostering consistent commissioning, triage, asset management, and remote control of sites through comprehensive and easy-to-use web services from Radix IoT.

- **Consolidate** facility data to be useful far beyond just facility management through the ability to push some or all portfolio data to third party services, allowing seamless integration with thousands of external software and analytics tools.

- **Avoid** the all-to-common trap of vendor lock-in. The Mango Platform works with all standard protocols used by hundreds of manufacturers avoiding the expense of rip-and-replace. Use what you already have to enrich your business outcomes.
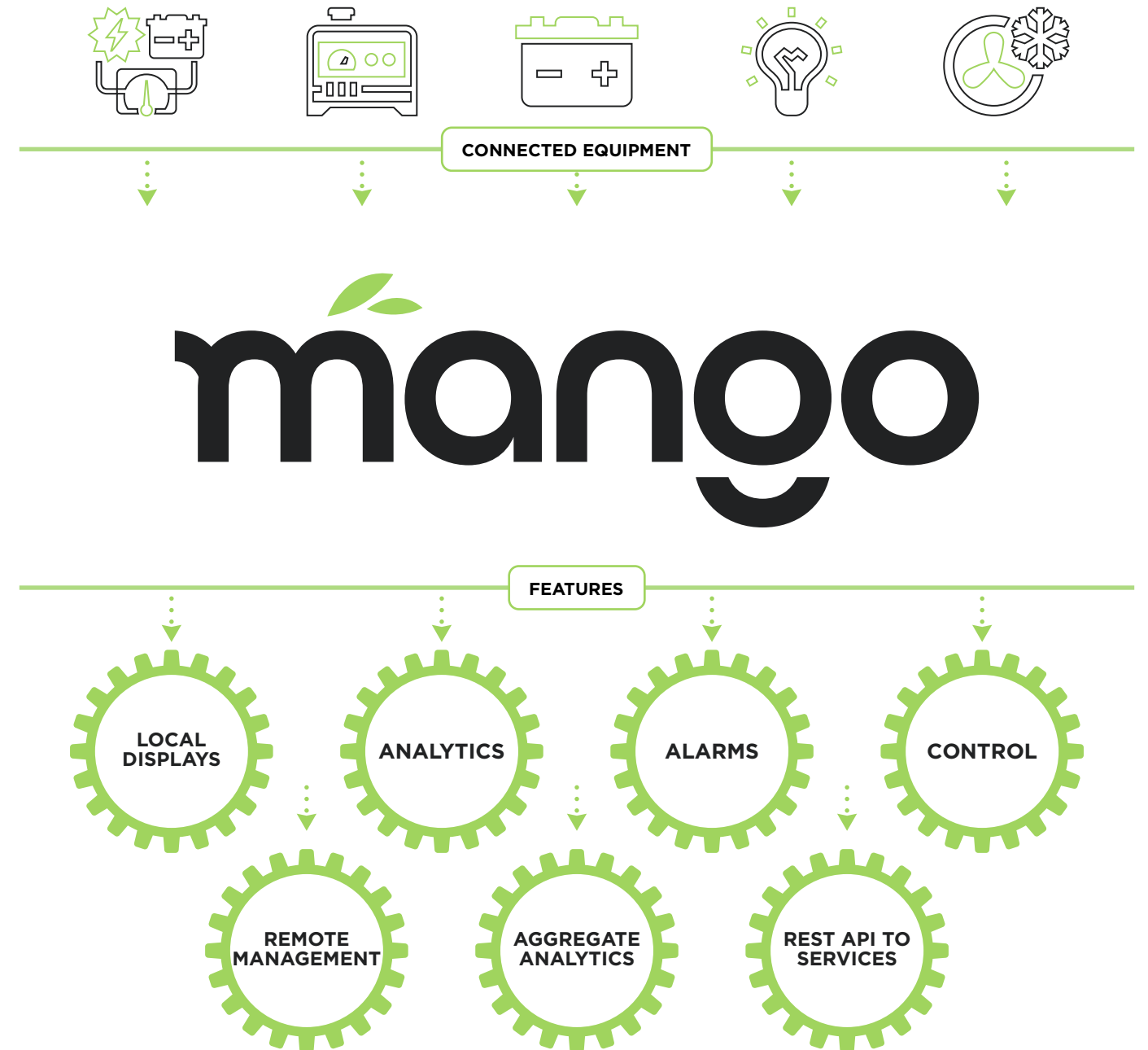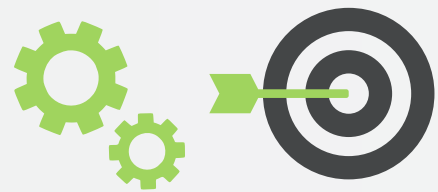
THE FLEXIBLE IOT FRAMEWORK

Mango from Radix IoT is an end-to-end IoT software that empowers enterprises of any size, in any industry or vertical, to collect data from existing or new building data sources. Beyond comprehensive local control, data can then be moved to a cloud location allowing data from tens of thousands of locations to be worked with from the cloud via an intuitive web interface. Mango enables users to get custom-tailored up-to-the-minute status of all connected equipment in a logical way that makes sense to the business.

Mango integrates with any systems or devices that speak a known industry protocol. Out of the box, Mango inter-operates with whatever systems you already have, making it easy to cohesively collect all your data from different systems, devices and locations, no matter how numerous.

Instead of requiring multiple add-on applications, Mango includes everything you need to get going from alarming and event management to reporting, real-time trending, and highly customizable dashboards. Need more? Mango has a robust RestAPI to connect to anything from work order management tools to custom application frameworks and third party analytics services.

MANGO FROM RADIX IOT GATHERS THE DATA YOU NEED, TO IMPROVE HOW YOU DO BUSINESS, WHATEVER BUSINESS YOU'RE IN.

CONNECTED EQUIPMENT

FEATURES

LOCAL DISPLAYS

ANALYTICS

ALARMS

CONTROL

REMOTE MANAGEMENT

AGGREGATE ANALYTICS

REST API TO SERVICES

KEY FEATURES OF MANGO

Unlimited Scalability: Mango is infinitely flexible. Collect and manage data from one location to thousands, the same Mango software scales for all types of needs.

Comprehensive IoT Toolkit: Includes all the tools needed to build an IoT solution tailored to an organization's specific needs.

Open Integration: Integrates into/with existing infrastructure – including BMS – regardless of the technology, and portfolios of equipment and software currently in use. Additionally, easily connect to third party applications via the integrated RestAPI.

Profoundly Simple: Data-driven from turnkey, self-installed software/ hardware and OEM solutions–free of the common complexities and expense of custom programming and steep learning curves.

Advanced Schedules with Exception Calendar: Mango includes a refined scheduling system that can be cloud or edge configured. Schedules can be created at any interval with the ability for exceptions. Rules can be based upon events as well.

Low Cost Entry: Into the platform with transparent site-based pricing. The optional Radix IoT Cloud also offers affordable storage and cloud options to meet the demands of high-availability clients.

Industry Agnostic: Applicable and scalable across lots of industries and applications. Mango works to solve the complexity of data.

Comprehensive & Intuitive Web-based Software: Allowing for self-service deployment, OEM applications, or full turnkey solutions from Radix IoT.

Free of Vendor Lock: No proprietary controls or sensing hardware required. Mango can work with any telemetry that speaks a known industry language. All data collected can be stored in any cloud infrastructure at your option. In the end all data belongs to you.

Secure Platform: Mango was built as an IoT platform first, meaning security has been at the forefront always. Mango follows OWASP guidelines as its base of design. Additionally, Mango undergoes security audits twice a year to assure independent verification. A Radix IoT platform security white paper is available from the radixiot.com website for more information.

INDUSTRY AGNOSTIC & ADAPTABLE

Because of its flexibility, Mango is very adaptable to any application where precise, sub-second high resolution data is required. It is manufacturer-independent, industry agnostic and integrates easily with other systems without fear of proprietary vendor lock.

Mango with the Radix IoT Cloud truly shines in applications with lots of geographic locations. The low cost of entry coupled with simplicity of deployment make Mango a multi-site shoo-in. Yet given Mango's ability to run both at a single location and/or in the cloud; Mango easily fits in a single location deployment and is commonly used in applications that require a more intelligent SCADA solution.

MANGO IS WELL SUITED TO MONITORING A SINGLE LOCATION BUT TRULY EXCELS IN MONITORING AND MANAGEMENT OF MULTI-LOCATION, GEOGRAPHICALLY DISTRIBUTED PORTFOLIOS AND CAN SCALE TO ACCOMMODATE THOUSANDS OF SITES WITH EASE.

The following are a few of the markets in which our customers have found outstanding value in Mango:

DCIM, Edge, & PoP

By definition, edge facilities are closer to the end user - geographically distributed, often unmanned and numerous. Mango monitors all the critical systems of these sites remotely, regardless of the software or data sources present, from a central location. This makes predictive and preventative maintenance possible, which minimizes disasters and controls the expenditures associated with engineering visits.

Carrier / Telecommunications

Telecommunications infrastructure is distributed, often hard to reach and seldom has staff on site. They can also number in the thousands and cross borders. At the same time, uptime is of the utmost importance. Mango integrates with the variety of systems on site, enabling remote monitoring and management. This data enables the diagnosis and prioritizing of problems from afar, and triaging of work to boost efficiency of service calls. Proactive maintenance increases reliability and minimizes expensive surprises.

Energy & Renewables

Energy production and distribution has becoming increasingly more complex and automated. The ability to capture and use data from various sources across vast geographic distances has become imperative to operations from fracking to solar farms. Mango has found a perfect fit in both production, and transport of energy. Its real-time analytics and rich integration allows for remote diagnostics, troubleshooting, and work order management – all remotely – to help mitigate risk, boost uptime, improve cost efficiency and operational continuity. Mango can also scale quickly to accommodate rapid change in needs.

Property Management

In the case of property management, there is plenty of data being collected, from a diverse portfolio of buildings and systems. The challenge is to free the data from its trade silos in order to share it and get greater value from it. Mango gathers all this data remotely, which enables users to improve efficiency quickly. Once the data is unified, further analytics can uncover opportunities to reduce redundancies and optimize operations. Custom reports share the results with different stakeholders in ways that are most helpful to them. Even customers with modern and rich BMS/EMS systems use Mango to affordably centralize data across many locations and cloud base their 'single source of truth' data-set. This allows building owners and operators to use their data with multiple analytics providers at once.

Utilities

As more municipalities invest in smart city infrastructure, the need for monitoring of various operating systems becomes vital. Mango gathers information from a great variety of systems making reduced energy consumption, streamlined operations and improved quality of life for residents possible. Public utilities require uninterrupted uptime and data-driven decision-making while balancing operation costs. Mango is frequently found in water treatment operations as well as traffic systems to allow for secure remote triage.
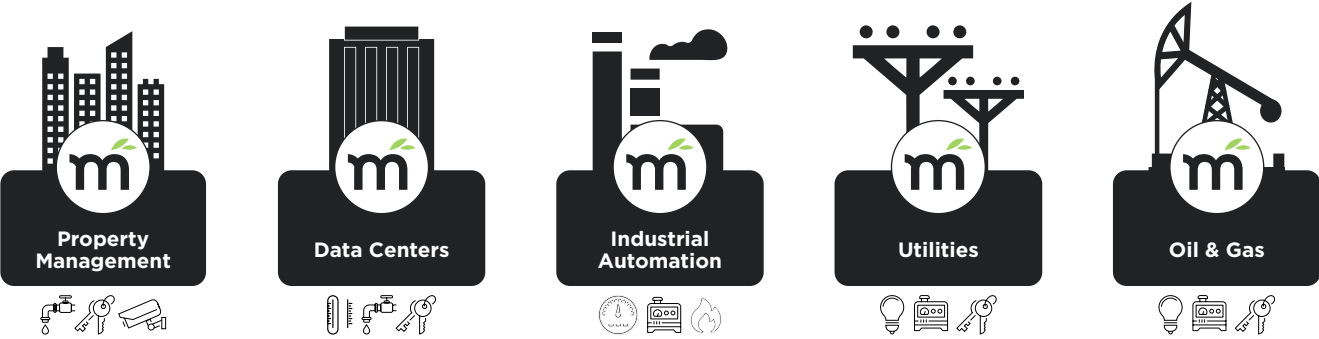
A TYPICAL APPLICATION DESIGN

Mango is a single software that gets deployed on a small piece of computing hardware in the field to allow for control and management locally. Really, this is all that is needed to get a system running. Mango can operate from and for a single location without a problem. The power in Mango however is that this field instance can then communicate up to another Mango instance in the cloud, allowing remote control and operation of thousands of locations and field devices from a central location.

TYPICALLY MANGO IS INSTALLED ON A RADIX IOT APPLIANCE AT EACH SITE, OFTEN REFERRED TO AS 'THE EDGE' WHICH IS CONFIGURED AND CONNECTED TO ALL OF THE LOCAL SUBSYSTEMS AND DEVICES AT THAT LOCATION.

Though data can be stored at the edge, typically a Mango instance at the edge communicates to another instance of Mango in the cloud. This cloud instance is where data is stored from all the edge locations, and allows remote configuration, management, and monitoring of all of the downstream devices. A key advantage to this architecture is that with Mango running at the edge, all logic and data is retained and continues to operate should there be a loss of connectivity between the edge and the cloud, and resynchronizes once the connection has been restored; eliminating any data disparity caused by the loss of connectivity.

The Mango software architecture uses a feature known as Cloud-Connect to facilitate the connection from edge to cloud. Cloud-Connect excels at packaging and transporting data from edge to cloud in exceptionally small payload sizes. This allows for edge locations to not need hard-line ethernet connectivity and instead support data transport technologies such as cellular or satellite.

Users can then access the Mango cloud instance directly through any mobile or desktop device through a web browser and access the full features of Mango's monitoring and management system.

Property Management

Data Centers

Industrial Automation

Utilities

Oil & Gas

Radix IoT Cloud

Work Order Management

Third Party Cloud Services

Billing or Task Services

Facility Management
- Generator fuel/ maintenance status
- Beacon light status
- Remote access control and monitoring

Network Operations
- Trouble detection
- Service ticketing
- Remote diagnostics

Operations Management
- Energy reporting of portfolio and outlier detection
- Downtime reporting
- Upgrade provisioning

Field Service
- Dispatch requests
- Remote triage

DIFFERENT DESIGN TOPOLOGIES TO MEET ANY SITUATION

Data without replacement is a core principle of Mango and the Radix IoT design. Hence three models of project can be used and mixed to meet the need of any application. As such, Mango is exceptionally flexible on its deployment architecture to work with what is already in place. Three models are most common.

Standalone Model

Use Mango to monitor a single site or building. Data is gathered by, and users connect directly to the local Mango instance to access dashboards, run reports, and view alarms. All data is organized and retained locally for use on-site.

Edge Model

Individual Mango instances run on edge computing devices such as Radix IoT hardware to connect to subsystems in individual buildings or equipment. These edge locations are then collected to another Mango instance either in the cloud or on a server at a central location (typically off-site).

Direct-Connect Model

Mango runs in the cloud and connects to TCP/IP connected devices at various locations through existing I.T. infrastructure. Mango does not run at the edge location.

STANDALONE MODEL

Mango is deployed on an appliance such as Radix IoT hardware or another computing device and connected to all of the existing or new subsystems and/or devices for which remote monitoring and management is desired. Mango then communicates with these devices via standard protocols and locally collects the data allowing for custom dashboards to be built, trending analytics, alarming, and event management all through the embedded Mango web-browser.

Ideal Applications

○ Stand-alone buildings or structures
○ Local factory or production system management
○ Anywhere that has several pieces of equipment that require collective monitoring and management from a single pane of glass view

Alternate Energy   Generators   Environmental HVAC   Electricity Meters   Batteries

Single Site

Work Order Management

Third Party Cloud Services

EDGE MODEL

Mango is deployed on several computing appliances such as a Radix IoT hardware or other computer devices and connected to existing or new subsystems and devices in various locations. These edge instances of Mango then communicate via the internet through a Mango service known as Cloud-Connect to other instance of Mango that can be located on-premise or in any cloud environment. The Radix IoT Cloud can then remotely control all of the edge instances of Mango as well as collect data required for cloud analytics to be run.
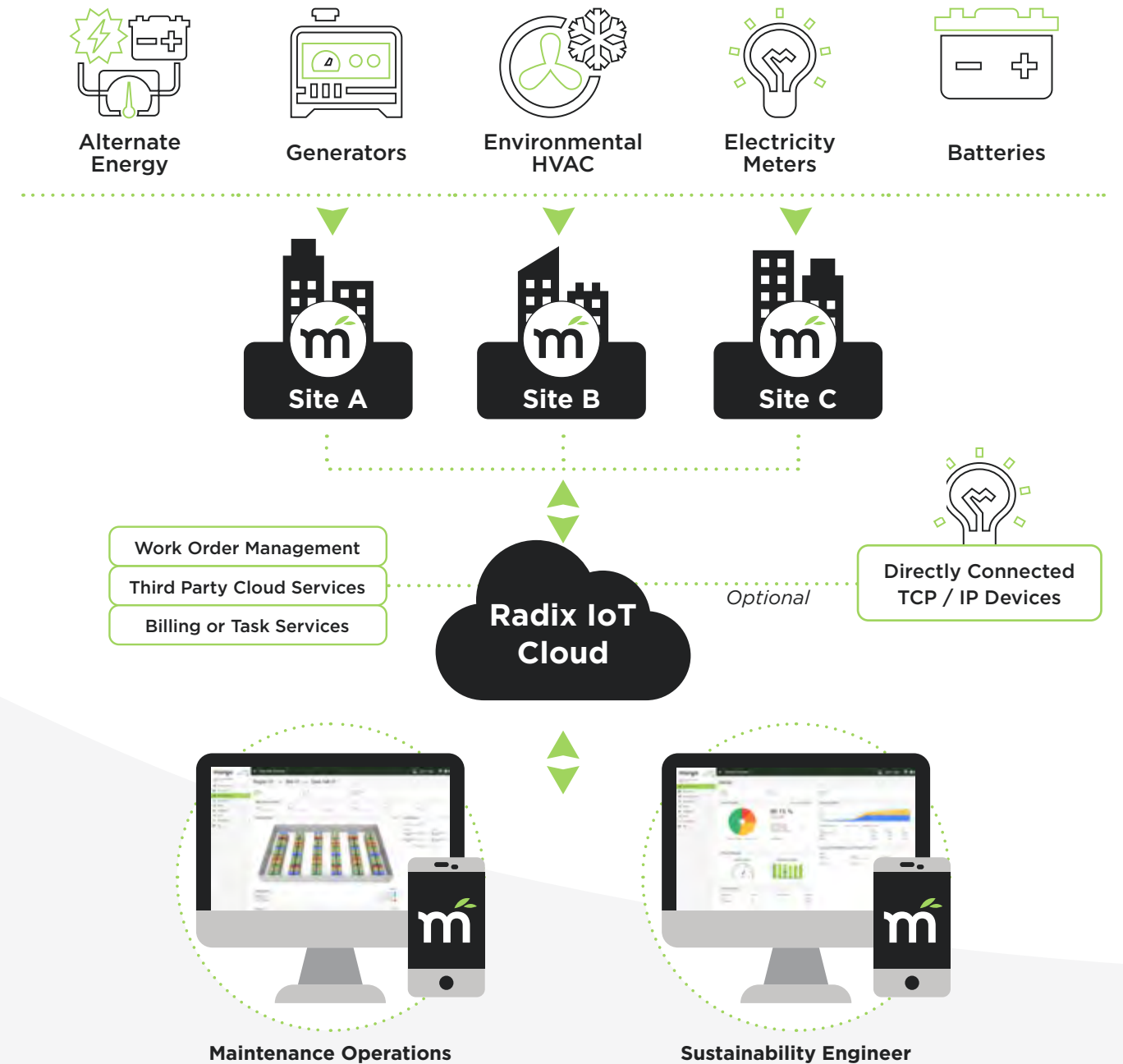
THE POWER OF THIS MODEL IS IN THAT A FULL VERSION OF MANGO IS RUNNING BOTH AT THE EDGE LOCATION AND AT THE SERVER ALLOWING CUSTOM DASHBOARDING, ANALYTICS, AND REPORTING TO BE AUTONOMOUS IN EACH LOCATION AND ON THE SERVER.

This model provides fault tolerance should the server connection be lost (as all data for each site is still retained at the edge). Additionally, different dashboards and analytics can exist at each location, while a master roll-up of data is available at the server level.

It also should be noted that TCP/IP devices such as ethernet capable BMS systems, meters, and more can be directly connected to the server without the need for edge appliances.

Ideal Applications

○ Multi-site campuses or multi-dwelling residential
○ Multi-site industrial automation
○ Energy production portfolios

Alternate Energy   Generators   Environmental HVAC   Electricity Meters   Batteries

Site A   Site B   Site C

Work Order Management
Third Party Cloud Services
Billing or Task Services

Optional

Directly Connected TCP / IP Devices

Radix IoT Cloud

Maintenance Operations   **Sustainability Engineer**

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DIRECT-CONNECT MODEL

Mango is directly connected to individual devices via TCP/IP which could include protocols such as SNMP, BacNet/IP, ModBus/IP and more. This is accomplished through existing I.T. infrastructure that an organization would have to facilitate secure connections to individual devices. All configuration, monitoring, and management live in the cloud instance of Mango.
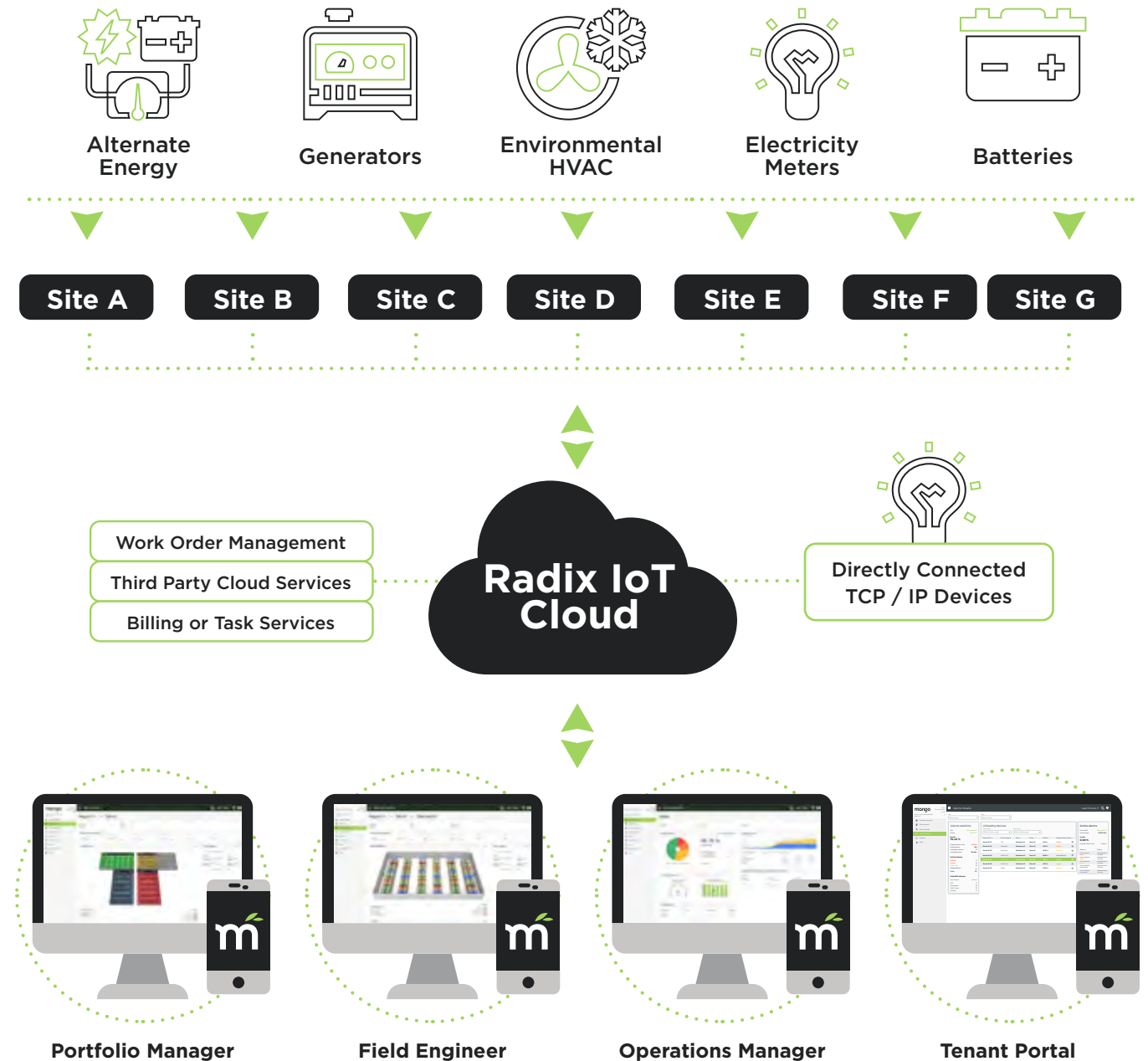
This model does not allow for edge (or on-site) monitoring and management, and assumes all functionality and users will be logging into the cloud only. This is an ideal solution for situations where existing TCP/IP telemetry is already in-place and just requires centralization.

THE DIRECT CONNECT MODEL IS IDEAL FOR SITUATIONS OF RETROFIT AND WHERE LOCAL CONTROL AND MANAGEMENT IS HANDLED BY OTHER SYSTEMS OR IS NOT REQUIRED.

The Direct-Connect model is ideal when TCP/IP telemetry is the standard, though other legacy style devices or systems using serial protocols can be used via on-site conversion devices.

Ideal Applications

○ Telecommunications infrastructure
○ Municipal infrastructure
○ Edge data center remote management
○ OEM applications

Alternate Energy   Generators   Environmental HVAC   Electricity Meters   Batteries

Site A   Site B   Site C   Site D   Site E   Site F   Site G

Work Order Management
Third Party Cloud Services
Billing or Task Services

Radix IoT Cloud

Directly Connected TCP / IP Devices

Portfolio Manager   Field Engineer   Operations Manager   Tenant Portal

RADIX IOT APPLIANCES

Anyone can bring hardware and install Mango on their own to get going. Mango can be installed on a device as small as a Raspberry Pie, but really excels with an Atom or above processor. Radix IoT also offers several different hardware appliances that come running Mango out of the box and ready to go; each made for different applications based on scale requirements.

RD 121C

The RD 121C Micro IoT Appliance is built specifically for the OEM market but also apt for facilities with medium sized data connectivity needs. It sports dual ethernet, USB, a configurable RS232/RS485 serial port, and local Digital IO. Optionally, it comes with a global cellular capability for communications backup, all in a tiny footprint.
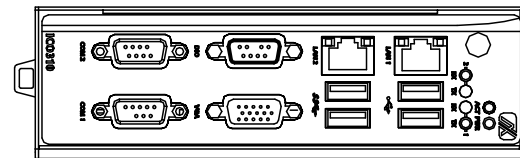
RD 201C

The RD 201C Edge is for larger installations, such as commercial property portfolio management, telecommunications, and edge data centers. It sports dual ethernet, USB, several configurable RS232/RS422/RS485 serial ports, GPS, and local Digital IO. Optionally, it comes with a global cellular capability for communications backup and has an option of a dual cellular redundancy.

Common Protocols Supported:

- BACnet
- Haystack
- Modbus
- MQTT
- MQTT Sparkplug
- SNMP
- DNP3
- SQL
- CSV files

- Excel files
- HTTP
- TCP
- Serial
- Scripting
- Meta data
- REST API

... and more

Common Radix IoT Connected Sub-Systems:

- Building management
- HVAC equipment (RTUs, VAVs, PTACs, etc)
- SCADA
- Video surveillance
- Network infrastructure for monitoring
- Solar, generation and alternative energy systems
- Power metering
- Security systems
- Refrigeration safety monitoring
- Lighting systems, devices and panels
- Water metering
- Access control solutions
- Local user interface and HMI sub-systems

... and many others

MANGO MAKES IT SIMPLE

Simple, competitive, straight-forward pricing allows you to grow at your own pace. Scale up or down, it's all up to you and your needs. We also make things simple for OEMs, integrators and solution providers.

OEMs

Why start from scratch when you don't have to? OEM integrations that leverage Mango as part of their offerings save time and money bringing new features and capabilities to their users. The cost to license Mango as an OEM is a fraction of the cost to develop and maintain an IoT or Cloud-enabled product. OEMs benefit from customizations, custom branding, special pricing options and ongoing support and improvements.

Integrators & Solution Providers

Integrators and solution providers will find Mango coupled with the Radix IoT Cloud will give them a substantial competitive advantage over other products, given the quick and flexible deployment methodology saving both time and money. After installation, Mango helps to keep costs down by offering a simple to understand site model of pricing.

Enterprise Solutions from Radix IoT

Radix IoT has a full professional services team to help enterprises big and small deploy and customize Mango solutions to meet worldwide needs. From offering technical support to full system designs and longterm service, Radix IoT can make your vision possible at a fraction of the cost and deployment time of any other IoT framework on the market.

MAKING ASTUTE BUSINESS DECISIONS DEPENDS ON ACCESS TO AND UNDERSTANDING YOUR DATA, FROM ONE SITE OR THOUSANDS. LET'S GET STARTED TODAY.

RADIX®