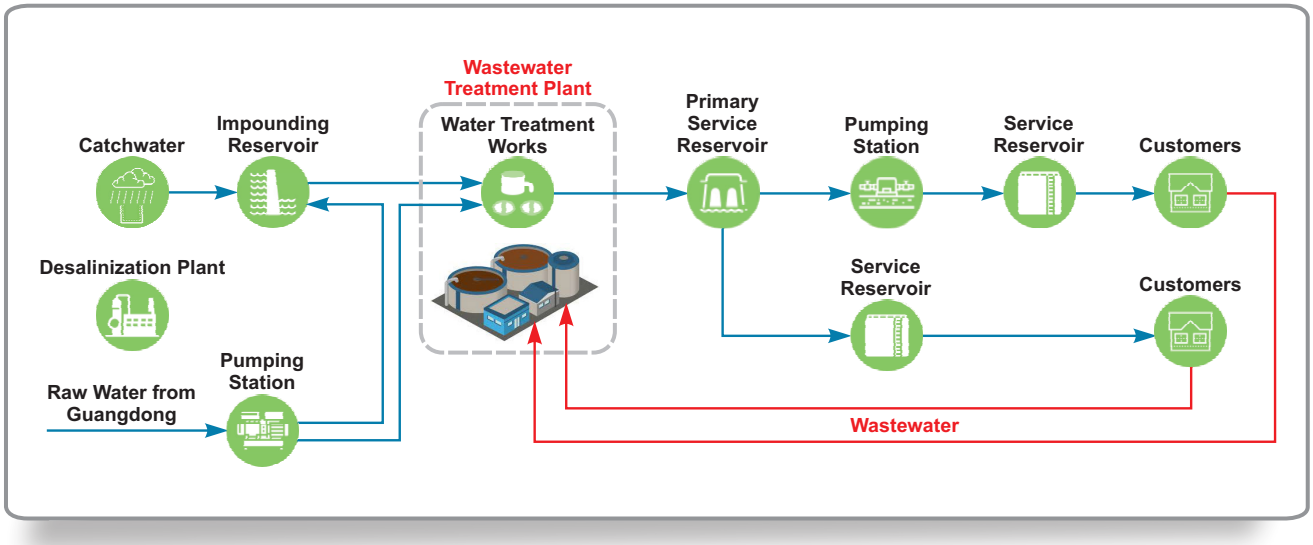
Solution Brief

Asset Monitoring for Water Utilities

Water companies face a multitude of challenges due to their outdated systems. Hence, it impacts their ability to enhance visibility, control operational assets, and address security concerns. Moreover, installing new generation IIoT sensors alongside existing legacy SCADA systems poses additional challenges. These complexities make it extremely difficult for them to improve operational efficiency and performance.



RAD

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Water utilities are composed of several segments and companies forming a multi-layered, heterogeneous ecosystem. This ecosystem includes exploration and production of water from underground sources, rain recovery/collection systems, desalination plants, underground storage sites and above-ground reservoirs, pipelines, channels for water transport, water treatment plants, and distribution systems for potable water and wastewater. Managing all the above may not be glamorous. However, it is among the most essential services we rely on in our daily lives.

For water to flow correctly a complex infrastructure needs to be put in place. This includes drilling sites, machines, pumps, compressors, generators, valves, filters, and miles of pipelines, apparatus, and devices. This also entails installing smart meters in customer premises.

Water quality is essential throughout the entire ecosystem. Therefore, it's imperative to secure all the operational aspects and prevent floods or other emergencies. This requires repairing corrosion, blockages, preventing leaks, and fixing leaks. The best way to keep on top of everything is by implementing sensors. The sensors locate problems, reduce downtime, and preserve environmental assets. Furthermore, they keep security and safety under control within a widely dispersed ecosystem.

Intelligent IIoT-based Monitoring Solution for Water and Waste Management

IIoT-based monitorings assist water and waste management companies in remotely controlling their operations and assets. This is done by deploying smart devices and sensors throughout the network, to provide data on temperature, pressure, flow, PH, and other parameters.

IIoT gateways are required to aggregate and streamline data from different regions and clusters of sensors. These are usually installed in outdoor cabinets and transmit data 24/7 over wireline networks, as well as a variety of wireless technologies, including 3G, NB-LTE, 4G/LTE, CBRS, LoRaWAN, and nowadays 5G networks.

New IIoT systems offer the benefits of miniaturization, long battery life, and affordable connectivity. This facilitates the deployment of thousands of IIoT devices per square kilometer/mile, all of which are connected with advanced performance, quality of service, and security protocols.

The introduction of new IoT systems, however, does not immediately replace the legacy SCADA devices that have been used for many years. These will likely remain operative for a while, posing another challenge for water utility ecosystems, as their data and management needs to be streamlined with the newer deployment.

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RAD's IoT solution for water utilities covers the following challenges that water companies face:

1. Remote assets monitoring and management.
2. Real-time data collection.
3. IoT sensors and devices connectivity.
4. Introduction of edge computing in water system.
5. Co-existence of new gen IIoT systems with legacy SCADA systems.

Monitoring remote assets: A typical site includes many assets, such as wells, wellheads, drilling systems, generators, compressors, pumps, video surveillance cameras, and remote control and automation systems. In addition, cabinets and housings where light, doors, heating, ventilation, and A/C must be controlled and monitored.

The data generated by sensors is collected, processed and analyzed via gateways. The data allows water utilities to improve efficiency, fix errors in real-time, and put maintenance procedures in place according to data trends.

Collecting data in real-time: Collecting data in real-time is key when decisions are data-based, such as for safety monitoring equipment and control systems. This data comes from SCADA, video, IIoT sensors, and many other devices. It can then be analyzed along with trend algorithms. The growing amount of data is processed in central control centers as well as in edge sites.

A main advantage of processing data locally is that edge devices can prioritize and filter data before transmitting it to the central servers or the cloud. This also minimizes latency (delay) and improves reaction time and overall security. Moreover, utilizing edge devices can reduce the volume of traffic that needs to be sent over networks, which, in turn, saves bandwidth and reduces costs.

Connecting IIoT sensors and devices: IoT and IIoT sensors are critical for data collection and monitoring devices. They are small, rugged, and have a long battery life which is also connected and controlled. The sensors on the remote infrastructure collect data including temperature, pressure, flow rates, and equipment status. They are complemented by existing SCADA RTUs and PLCs.

The seamless connection of sensors is facilitated through a combination of traditional copper and Ethernet wires, along with cutting-edge wireless technologies like LoRaWAN, Wi-Fi Halow, and other VHF/UHF legacy systems. This expanding network of sensors and IoT devices, spanning from the field to dedicated data centers and platforms, relies on gateways and an operational technology wide area network (OWAN) for robust connectivity.

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Gateways play a pivotal role in aggregating data from multiple sensors and devices at specific locations, whether it's a desalinization plant, water reservoir or a pipeline. They streamline communications, monitor and manage these devices, enhancing overall operational efficiency. IoT Gateways also enhance data security, protecting the environment from external and internal threats through, firewalls and data encryption.

OWAN mostly utilizes fiber infrastructure to transport and connect data from remote sites and alongside pipelines. However, in some cases, it may utilize wireless technologies where fiber is not available. OWAN wireless options include 4G/LTE and 5G mobile technology, licensed and unlicensed radio systems, such as CBRS and Anterix in North America. Connectivity must be highly resilient and protected, to ensure always-on data delivery and uninterrupted operations.

Edge computing: Edge computing capabilities are supported by IoT gateways, dedicated servers, and other telecommunications devices. These have processing and storage capacity to handle several functionalities at or near the remote sites. Edge computing devices process data locally in real time, analyzing incoming data and applying algorithms to make immediate decisions.

Edge computing therefore provides valuable capabilities for safety monitoring and equipment diagnostics, because when data is processed at the edge, latency is minimized. Hence, data no longer needs to travel to a centralized data center for analysis. This is crucial for applications where real-time response is essential, such as safety and control systems.

Edge computing can enhance cybersecurity by limiting the exposure of critical infrastructure to external networks. Furthermore, it adds and hosts additional cybersecurity functionalities such as anomaly detection systems, deep packet inspection for IIoT and SCADA protocols, distributed DoS protection and much more.

IIoT and SCADA co-existence: Water systems are monitored and controlled using legacy SCADA PLCs and RTUs, employing protocols like Modbus, DNP3, IEC 101, and 104. In the modernization and digitalization process, many legacy systems that had reached end-of-life are replaced. As mentioned above, these systems must be integrated with the MQTT-based IoT platforms that are used with the newer generation of IoT sensors and smart devices.

RAD offers a comprehensive range of solutions tailored for water utilities. This includes OWAN infrastructure and robust IoT gateways equipped with edge computing capabilities. They enable secure data transport via fiber or licensed and unlicensed wireless links. Furthermore, RAD provides rugged Ethernet switches designed to withstand extreme conditions in remote sites, and smart SFPs. These enable the use of cost-effective XGS-PON fiber infrastructure, while offering straightforward encryption for legacy IP systems.

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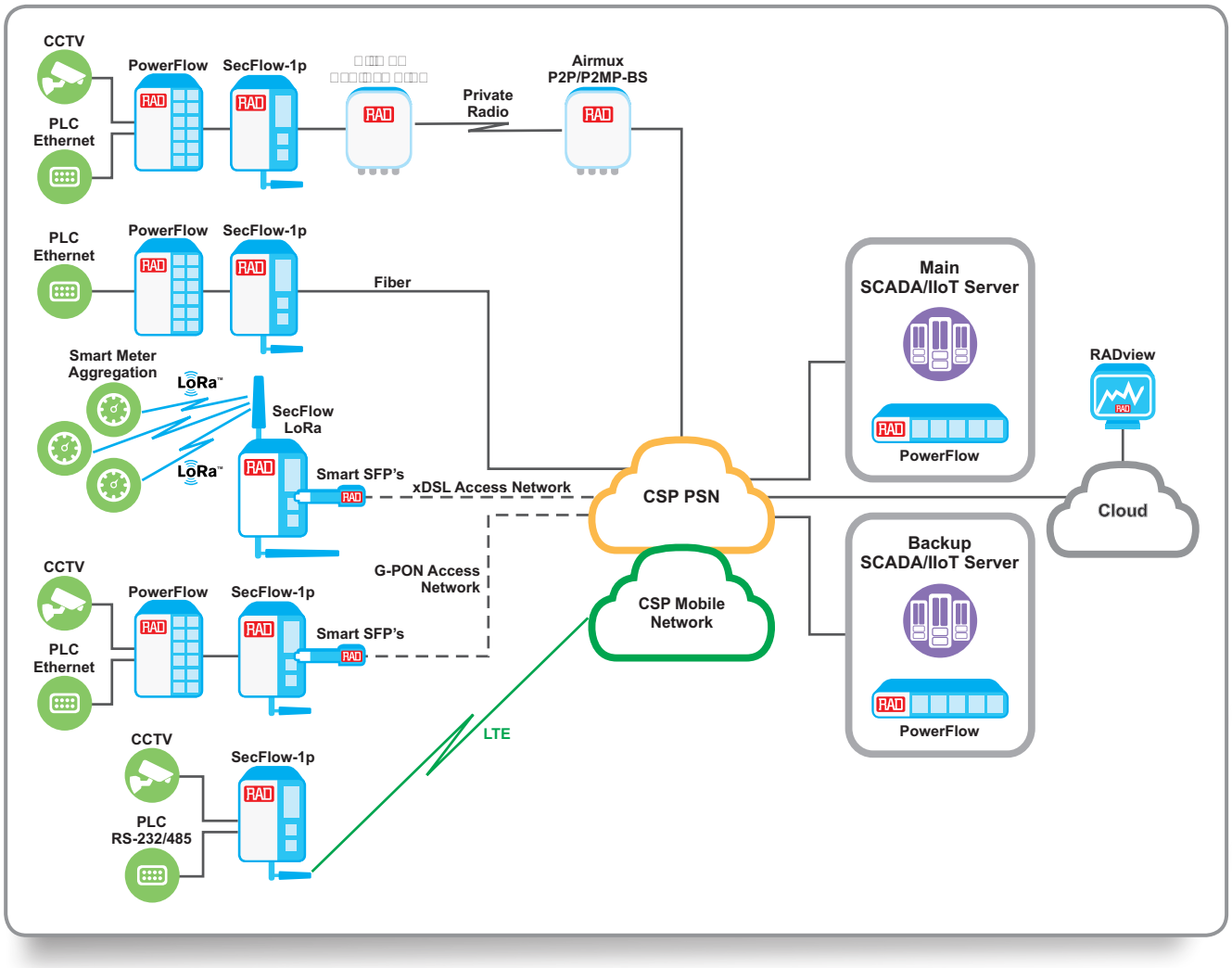
RAD's tailored offering for water utilities also includes end-to-end network management.



Typical water utility network architecture

To discuss your remote water utility asset monitoring needs, contact us at market@rad.com

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