ONLOGIC

Making Buildings Smart

Leveraging Real-time Insights at the Edge

ONLOGIC

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Leveraging Data for a Smart Building

Introduction

“The measure of intelligence is the ability to change” is a quote widely attributed to Albert Einstein. He was most likely talking about smart people,but the same idea could apply to smart buildings - a building is only as smart as its ability to change and adapt to the data.

New York City has the most ambitious building emissions legislation enacted by any city in the world.

Smart building solutions leverage data to deliver next-level benefits that promote sustainability, deliver savings, improve occupant satisfaction, and enhance security. The best part is, they deliver all those benefits by adapting to changing data - now that’s intelligent!

In this eBook, we present a series of articles that provide you with a solid foundation for understanding smart buildings. What they are, their benefits, and how buildings become smart by leveraging real-time insights from the network edge.

Let’s start at the ground floor with a definition.

What is a smart building?

A smart building uses technology and real-time data to optimize operations and enable efficient and economical use of energy while creating a safe and comfortable environment for occupants.

Whether you own or manage a high-rise commercial building or a small warehouse, just about any building size can benefit from smart building technology. It all starts with the data.

Smart building goals

Goals for implementing smart building solutions include:

1. Energy and money savings
2. CO2 emission reduction
3. Building maintenance improvements
4. Occupant comfort, health, and safety
5. Tenant retention
6. Increased property valuation

Smart building goal 1: energy and money savings

Buildings are among the largest consumers of energy. In fact, buildings account for more than 70% of electricity use in the United States. One of our customers shared with us that they found the estimated energy cost of running a high rise is upwards of $50 per minute.

Smart buildings help to ensure a healthier environment for the future.

Smart building goal 2: reduce CO2 emissions

With all that energy consumption, buildings are also one of the largest sources of greenhouse gas emissions. Reducing carbon emissions is top of mind for many governments from the city level to the national level, which is why the Paris Agreement was established in 2015 at the UN Climate Change Conference.

International cooperation is required to reach the agreement's overall goal to limit global warming to no more than 1.5 degrees Celsius. The first step to reach that goal is to reduce emissions by 45% in 2030 and reach net zero by 2050.

What is net zero?

Net zero means that greenhouse gas emissions are cut to as close to zero as possible, with any remaining emissions offset by removing an equivalent amount of greenhouse gasses from the atmosphere.

Cities are under pressure to meet net zero goals

Today, cities occupy 3% of the Earth's land, but account for two thirds of the world's energy demand and 70% of CO2 emissions. This large carbon footprint of cities impacts air quality which, in turn, impacts the health and well-being of citizens.

The impact of cities is enormous. But so are the opportunities.

New York City legislation with a goal to achieve net zero emissions

Cities, including the largest city in the United States, are creating their own pathways to address climate change. Local Law 97 is New York City legislation created to drive deep emission cuts from buildings. It's the most ambitious building emissions legislation enacted by any city in the world.

The law requires large buildings of over 25,000 square feet to meet energy efficiency guidelines and limit carbon emissions starting in 2024 or pay an annual fine. The amount of the fine increases over time and can be significant. The ultimate goal is a drive toward net zero emissions by 2050.

With a population of about 8 million people, New York City uses and generates a lot of power.

Smart building goal 3: building maintenance improvements

Maintenance costs are a huge part of a building's operating budget. In fact they can account for roughly the same percentage of expenditure as energy expenses. Using data to improve building maintenance might add years to the life of the building's operational technology.

Usually building maintenance is a combination of the following 3 approaches:

- Reactive maintenance
  - Corrective action is performed only after equipment falters or fails completely. Sometimes this can't be avoided.
- Preventative maintenance
  - Performing regular, prescheduled maintenance checks and repairs — whether they are needed or not.
- Predictive maintenance
  - Maintenance is based on data rather than a predetermined schedule. This is where smart building technologies can be the most helpful.

HVAC solutions need maintenance to maximize performance and minimize downtime.

Example: air filter maintenance

To understand the difference in these types of maintenance it's helpful to look at an example. Consider the process for caring for heating, ventilation, and air conditioning (HVAC) filters.

Filters are used in HVAC applications to remove airborne particles such as dust and pollen for occupant health and wellness. The airborne contaminants accumulate in the filter and can reduce efficiency and even eventually block the filter. A clogged air filter can adversely affect the performance of the HVAC system and may cause damage to HVAC components.

Let's look at how the three types of air filter maintenance play out in practice.

- Reactive maintenance would happen after damage had occurred.
  - For example, after the air conditioning stops working, the repair team pinpoints a frozen evaporator coil caused by a blocked air filter.
    - Cost would include not only a new filter, but the cost of repair, plus the expense of downtime.
- Preventative maintenance would involve replacing the air filter on a schedule.
  - For example, every 60 days or as recommended by the manufacturer.
    - Budget would be fixed and, ideally, reactive maintenance could be reduced, or even eliminated.
- Predictive maintenance could identify a need for maintenance due to a change in air pressure or flow rate drop.
  - In a building with low occupancy, a filter change may need to happen less frequently. Or a building exposed to a lot of airborne dust might need to have a filter changed more frequently.
    - Ideally, reactive maintenance could be reduced or eliminated and it might save money and/or enable a healthier environment for the occupants.

Smart building goal 4: occupant comfort, health, and safety

Building owners and managers want to provide the maximum amount of occupant comfort and safety for the minimum amount of cost. A smart building can incorporate occupancy, weather, and historical values to control heating and air conditioning in order to maintain a comfortable temperature (often prescribed in the lease or even by law).

Safety requirements also include air quality, fire prevention, and elevator safety. For example, a smart building can often predict a power loss before it happens and recall elevators to the nearest floor and open doors.

Smart building goal 5: tenant retention

A landlord that delivers on goals 1 to 4 is likely to attract and retain the best tenants. This is important because whenever a tenant leaves a property, finding another qualified tenant costs money.

Smart building goal 6: increased property valuation

Commercial buildings are valued based on their future income. With a growing preference for sustainable technology, a smart building could be considered more valuable. Sustainable buildings often have an easier time finding financing and have a larger market of buyers when they sell. Furthermore, since many occupants have their own carbon neutral goals, sustainable buildings might command a rental premium which can impact valuation.

For example, LEED (Leadership in Energy and Environmental Design) is the most widely used green building rating system in the world. They provide a framework for healthy, efficient, and cost-saving green buildings. Buildings that are LEED certified can command a 21.4% higher average market sales price per square foot over non-LEED buildings. In addition, they have consistently achieved higher rents than non-LEED counterparts, averaging 11.1% higher rent than non-LEED certified buildings.

Achieving a high LEED (Leadership in Energy and Environmental Design) rating is a selling point for any building.

Data, the key to reaching smart building goals

The key to reaching all of a smart building's goals is to first acquire and understand the data from a building's operational technology (OT). Every building has control systems throughout, each generating data and most running independently. A building's operational systems can include:

- Electricity
- Gas
- HVAC controls
- CO2 monitoring
- Water
- Steam
- Elevator and escalator controls
- Occupancy monitoring
- Security systems
- Fire

In addition, data can be collected by any number of IoT sensors. To get a handle on all the data, many building owners are creating a data lake.

What is a data lake?

A data lake is a centralized repository that allows all data to be stored at scale. It can be helpful to imagine each OT system creating data that flows like water into a lake overseen and maintained by the building owner. The data can be stored on-site or in the cloud with providers like Amazon Web Services (AWS).

Once the data is collected, dashboards and real-time analytics can paint a full picture of the building. Machine learning can then be employed to guide decisions and predict outcomes for cost savings and energy efficiency.

Collecting the data

Critical to any smart building solution is data, and critical to data collection is a gateway. A gateway is a bridge between your on-site devices and off-site compute and data storage infrastructure.

Smart building gateway requirements include:

- Compact size with multiple mounting options to fit in a variety of locations, including equipment rooms, closets, or cabinets
- Reliable operation, even when unattended for long periods
- Many industrial I/O options to connect to a variety of inputs including legacy equipment
- Ability to withstand temperature variability, as many mechanical rooms are vented to the outdoors
- Multiple LAN ports to keep cloud-destined data separate from the building network

The HX500 (OR HX511) is compact, replete with I/O, and designed for the Internet of Things (IoT).

Building dashboards and analytics

After building data is collected, software goes to work to make that data powerful. Dashboards from smart building applications can combine the data from disparate operational technologies and properties to present building owners and operators with a single pane of glass for their entire portfolio. Real-time visualization facilitates anomaly detection and correlations can be made between weather, occupancy, and HVAC, while automated reporting can present actionable insights to stakeholders including daily energy savings and carbon emissions.

An example of a dashboard from a smart building solution made by Prescriptive Data.

Machine learning and artificial intelligence in a smart building

Artificial intelligence (AI) and machine learning can take building data further by automating operational technology more strategically to use the least amount of energy for the maximum amount of indoor comfort.

Some examples of AI and machine learning in a smart building include:

- HVAC control: occupancy and weather can be factored into the HVAC system to ramp up or ramp down based on the data. Having this degree of control over an HVAC system can mean energy and money savings – all while maintaining a comfortable environment for occupants.
- CO2 level monitoring: CO2 levels can be monitored in real time, and if they are in line with building guidelines, the system can automatically reduce the outside air intake. If the CO2 levels near the limit, additional outside air can be brought in.
- Occupancy level tracking: the number of occupants can be tracked down to floors, regions, and rooms to adjust lighting and HVAC throughout the course of the day.
- Demand shifted to off-peak times: many municipalities charge a premium during peak hours. For example, during the summer in New York City, Con Edison has times where they charge a peak rate that is significantly higher than the standard rate. Shifting electricity demand to off-peak times can potentially save buildings thousands of dollars in monthly energy costs.
- Alerts: text messages, emails, or any variety of notification alerts can be sent for data thresholds based on data type or even time and day of the week.

A building may have several sources of energy such as steam, gas, and electric.

Using data for a smart building digital twin

Once all the smart building systems are connected and collecting data, building managers and owners can leverage digital twin technology to gain better insight into their property. A digital twin can help to quickly identify issues, optimize space utilization and energy efficiency, improve safety, and simulate the impact of a nearly endless list of scenarios.

What is a digital twin?

A digital twin is a virtual version of a physical object, process, or location that serves as a real-time digital counterpart. These virtual models are built by gathering all of the information and data about your building(s) to give you a holistic view of your operations in a digital space. Digital twins help make complex, costly, or even dangerous processes safer, more affordable, and more achievable.

How are digital twins used for smart buildings?

All of the data sources in a smart building are replicated in a digital space. The digital twin then uses artificial intelligence models to simulate what would happen if changes in design, process, time, or conditions were made, all without ever having to subject the real-world building to those same changes. Using the twin, building managers can test scenarios and outcomes.

For example - what would happen if a fire were to break out, could it be contained? Are the doors wide enough for egress? Or what if the building were to host a special event - how will the HVAC handle 20% more occupants?

With all the data that is collected and available, the use cases for digital twins are pretty much unlimited. Since simulations take place virtually, property managers can be prepared for a wide range of scenarios, anticipate how changes will impact other systems, and test proposed improvements.

Benefits of digital twins in smart buildings

With the use of digital twins, building managers can manipulate data, test theories, and simulate a huge variety of building scenarios without impacting the building or the tenants.

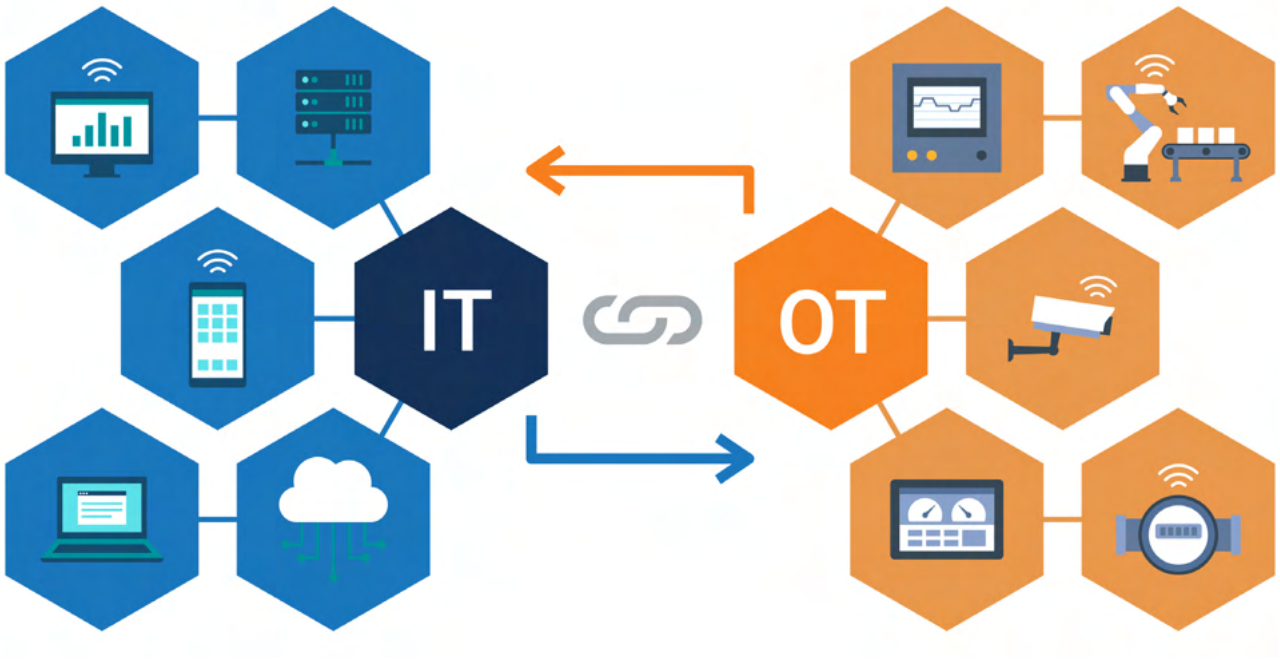
Other benefits include:

- Identifying root causes for unplanned maintenance
- Faster and more informed decision-making
- Intelligent recommendations
- Predictive maintenance insight

What technology can help create digital twins?

With your data in the cloud, AWS offers a tool to digitally replicate buildings - the AWS IoT TwinMaker which not only helps you model data, but also enables 3D visualizations of your building that can help to contextualize the data and generate insights. Check out this case study on the AWS website where they walk through the use case of troubleshooting HVAC issues in a building using a digital twin.

IT vs OT: How Information Technology and Operational Technology Differ



The gap between IT and OT is closing.

IT vs OT: what are they in smart buildings and how do they work?

IT, or information technology, has traditionally referred to the use of computers for information processing and management. The term OT, or operational technology, has most commonly encompassed the hardware and machines responsible for the physical processes of a business.

In a smart building, IT includes things like servers, networking devices, and endpoint devices, while OT generally includes things like lighting, HVAC, elevators, surveillance, access control, and more.

IT vs OT was once thought of as representing business needs vs facility needs or software vs hardware, and the distinct teams responsible for each. The IT team was in charge of the data, and the OT team was in charge of the machines. But increasingly, the value of IT data to the success of OT processes is bringing IT and OT closer and closer together. This concept of merging IT with OT is known as IT/OT convergence.

The basics of IT: what does IT do?

IT is used as an umbrella term that covers the processing, creation, storage, exchange, and retrieval of data and information. Although IT most commonly refers to computers, other endpoint devices like smartphones, servers, IoT devices, and tablets are all a part of IT infrastructure.

When it comes to IT, many people think of technical support. While troubleshooting is one part of what an IT team does, there are many other subsets of IT including software development, communication, information security, system administration, infrastructure, networking, and telecommunications.

IT's main objective is to ensure that all data is managed, processed, and stored securely. Because information technology is closely tied to network access, it's important to make sure all data is secure and that any potential risks are continuously identified and mitigated. Security analysts within IT help to protect sensitive information and identify any potential threats through the implementation of cyber security.

The basics of OT: what is operational technology?

OT is most commonly used to monitor and control critical building functions. Unlike IT which primarily deals with the internet, OT plays an important role in dealing with the physical world. Because of this, one of OT's primary areas of concern is downtime.

Downtime refers to the time when building functions are halted, whether planned or unplanned. For example, if the elevators stopped working in a high rise, workers can't get to work and residents can't get home. If the power goes out, workers are unable to access their computers or walk around a building safely.

Unplanned downtime often proves to be very expensive for businesses to deal with and can create customer dissatisfaction. OT's main concern is to prevent downtime as much as possible.

IT/OT convergence

IT/OT convergence offers a lower chance of downtime.

IT and OT have largely remained separate fields, but in recent years, IT/OT convergence has become an increasingly growing idea. When it comes to IT and OT, convergence offers many benefits, but also comes with some potential risks that are important to consider.

On the one hand, IT/OT convergence offers a lower chance of downtime with OT, and since downtime is often very expensive to deal with even for a short amount of time, this is very appealing for OT. However, security analysts within IT are often hesitant to converge because of the potential security risks.

Once you connect building equipment to the internet, cyber attacks to critical infrastructure become a potential threat. The IT and OT teams might have different security standards and decision criteria to address this threat, which can result in friction between the teams.

One example of a critical building automation hardware spec

Typically, to address this friction, IT and OT networks are kept isolated from each other. However, this can be a problem because the building OT data needs to be passed to IT systems to enable the applications to function across the facility.

Industrial PC hardware can help alleviate these concerns when built with isolated dual network connections. One network port is used to connect to the public wide area network (WAN) and the other port is connected to a private internal network (LAN). Ports should have separate network controllers to ensure maximum isolation.

Industrial PCs can deliver dual LAN to alleviate some IT security concerns.

Customer Story: Prescriptive Data

Back in 2003, through a series of cascading events and errors, a small fire in Ohio wreaked havoc on the national grid leading to a major power outage in the northeast. As the outage spread to New York City, the operators at Con Edison's control center realized that in less than 30 seconds, the electrical grid would shut down.

At the time, thirty seconds was not enough time to have any meaningful impact on the outcome. In the end, some areas of New York City were in the dark for over 30 hours. Among other issues, thousands of people had to be rescued from stuck elevators.

Ever worry about getting stuck in a high rise elevator?

Imagine if a smart building solution could identify an imminent power failure. As mentioned earlier, all of the elevators could be directed to go to the nearest floor, stop, and open their doors. If this solution were available in 2003, thirty seconds would have been plenty of time for many elevators to automatically react and thousands of passengers could have been spared a few harrowing hours.

New York City is home to more than 6,600 high rises which is a building with more than 12 stories.

It's scenarios like those that keep the Rudin Management team up at night. The Rudin Management Company is one of the largest privately owned real estate companies in New York City where they oversee the daily operations of 33 commercial and residential properties totaling over 15 million square feet. In addition to occupant safety, sustainability and innovation have always been guiding forces for the Rudin Management Company.

It started with smart grid technology

In 2010, Rudin Management received an incentive grant from the US government to work on Smart Grid Technology. The Smart Grid is not just about utilities and technologies; it is about giving energy consumers the information and tools needed to make choices about energy use. The project grew and evolved and in 2015, Rudin realized that their sustainability solution, known as Nantum OS, could benefit other building management owners and managers so they created the Prescriptive Data company as a wholly owned subsidiary.

Members of the Prescriptive Data team.

Changing how energy is consumed

Prescriptive Data's goals are to improve the way electricity is consumed and reduce the overall quantity of power consumed in buildings. Since buildings account for more than 70% of U.S. electricity use, and a comparable share of CO2 emissions, reaching their goals would significantly reduce energy usage and facilitate the transition to a decarbonized built environment.

To achieve these goals, Prescriptive Data turns to their flagship solution, Nantum OS which provides real estate owners and operators with a secure cloud-based data warehouse and a single pane of glass to manage their entire portfolio.

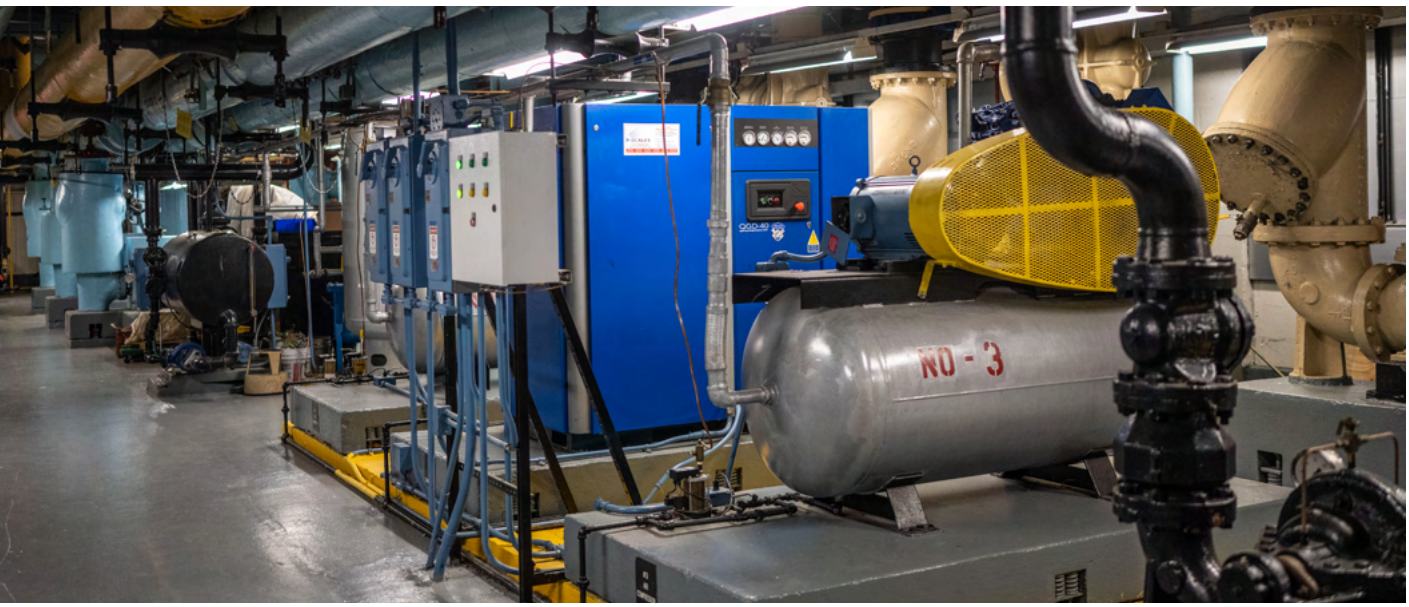
> "With today's connected buildings, data is an absolute necessity for building managers and operators to do their jobs well. Nantum OS takes real time data from a variety of sources such as BMS, occupancy sensors and weather apps and, joining it with historical information, uses AI and machine learning to identify trends and make recommendations to optimize future building operations. These smart recommendations not only reduce a building's carbon emissions, but can save thousands of dollars in operational costs every week."
>
> **— Aaron Brondum, VP of Customer Success, Prescriptive Data**

Consolidating operational technologies

To collect and consolidate operational technology (OT), data such as electrical, water, CO2, steam, elevator control, occupancy, and more, each building needs an IoT gateway. The gateway is also responsible for communicating that data to the AWS cloud.

Prescriptive Data's other gateway requirements included:

- Scalable - consistent architecture that stretches from the building to the cloud
- Reliable - downtime is not an option
- Flexible - abundant I/O to connect to a variety of inputs including legacy equipment
- Resilient - ability to withstand the environment of a mechanical room which could include airborne dust and oil as well as temperature variability
- Secure - dual LAN for security purposes
- Adjustable - multiple mounting options



Even the cleanest mechanical room is not a hospitable environment for a standard off-the-shelf PC.

> "We needed a device robust enough to survive in our mechanical spaces, with a proven track record, powerful enough to manage thousands of data points, and capable of supporting our network security requirements. We were already working with and trusted Intel so teaming with OnLogic helped us find the best Intel-based platform for our needs. OnLogic has proven to be a valued partner in helping deliver our solution."
>
> **— Aaron Brondum, VP of Customer Success, Prescriptive Data**

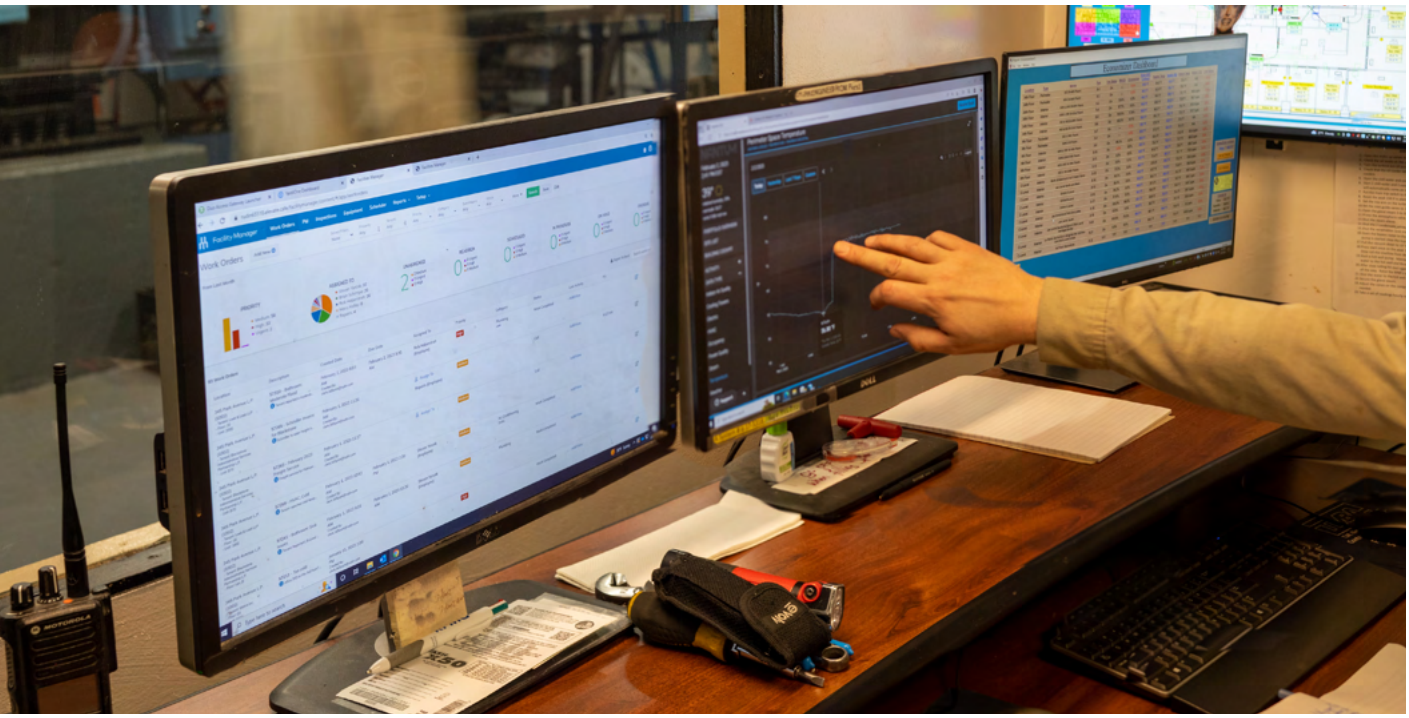
Reliable gateway for smart building solutions

The reliable OnLogic Helix 500 met all of Prescriptive Data's requirements. The solution leverages 10th generation Intel® processing up to core i9 and provides a wide range of I/O and expansion options. The system is fanless and ventless which means the inner electronics are protected from airborne contaminants. Several mounting options are available including DIN Rail or VESA mounts to make it easy to install and maintain.

> "Prescriptive Data's innovative software solution utilizing OnLogic's platform, is a great example of a smart building automation that offers many benefits from energy efficiency to tenant health and wellness while fostering the property's reputation for environmental sustainability. There is no need to guess on the benefits, the solution clearly enables you to track and evaluate your goals."
>
> **— Rick Lisa, Director Worldwide Government Center of Excellence, Intel Corporation**

The proof is in the data

The results of implementing Nantum OS are remarkable. By leveraging AI (artificial intelligence) and machine learning, building systems can utilize the least amount of energy without sacrificing indoor comfort. Building engineers love the solution for automated alarms and predictive maintenance alerts along with the ability to optimize large building systems to extend equipment efficiency and longevity. Management teams love the analytics based on occupancy data, and can leverage automation to receive the highest levels of health & wellness certifications. The C-suite loves the reports on daily energy savings, cost savings, and carbon emissions. And, occupants love being in a building that is doing its part in reducing commercial real estate carbon emissions.



Nantum OS provides historical and real-time data for building engineers to visualize equipment health and manage energy and carbon emissions.

By leveraging Nantum OS, the Rudin Management Company has seen incredible results including:

- 41% reduction in electric consumption
- 47% reduction in steam consumption
- 44% reduction in carbon emissions

In 2019, Rudin estimated the energy cost savings across its commercial portfolio totaled $19 million overall.

What's next for Prescriptive Data

Prescriptive Data will continue to leverage OnLogic solutions in their AI algorithms and provide customers with actionable insights leading to energy and cost savings in their buildings and portfolios.

Best PCs for Building Automation Systems

Like any Internet of Things (IoT) application, building automation requires deploying local devices in order to collect, process, and execute on data. Data is usually collected from the edge - including HVAC systems, boilers, power metering systems, and more, then delivered to the systems that use the data to make decisions.

Smart buildings are using data to make the decision at the right time.

Best computers for smart buildings

What kind of computers are best for collecting, aggregating, analyzing, and acting on the smart building data? Let's walk through some considerations and building automation project examples to help illustrate the important factors when selecting hardware for smart buildings.

Environment and I/O connectivity considerations

The environment in which you need to install a gateway for data collection may not be the most hospitable environment. For example, a boiler room may be hot and have airborne dust or oil. An elevator mechanical room may not be climate controlled and may be subject to vibrations or impact forces. It's important to choose a computer that can withstand that kind of environment. An industrial fanless PC has been designed for use in challenging environments and will ensure the maximum reliability of your solution.

You should also consider connectivity. For example, how will the data be collected from the machinery or sensors? Depending on the age of the building, you may need to communicate with BacNet, Modbus TCP/RTU, MQTT, or OPC devices. So you need to have the right combination of LAN ports, USB, Serial, and/or digital and analog I/O to accommodate those protocols.

Example: access control

An important component for smart building automation is access control. Access control simply means controlling what, when, and who can enter buildings, offices, parking garages, and all other property locations.

Access control solutions include entry systems like a keyfob for an apartment building which relies on RFID enabled readers at the edge, connected to an edge PC. Vehicle access control can be attained by leveraging machine vision with AI inferencing solutions. This can be accomplished with a toolkit like OpenVino from Intel. You can use Optical Character Recognition (OCR) to read the license plates of cars trying to enter a garage and compare them against a list of authorized vehicles.

Example: security systems

In addition to access control you also need to consider the need for security and surveillance inside and outside of your building with a Video Management System (VMS). The backbone of any VMS system is the cameras. Many cameras can accept PoE (Power over Ethernet). This allows you to power the camera directly from a PoE-enabled PC or LAN switch. The features the camera has, such as PTZ (Pan, Tilt, Shift), or onboard inferencing capabilities will determine how much power they require.

A PC such as Onlogic's K800 allows for a number of PoE cameras to be used so you can monitor all your video channels from a single device. Additionally its rugged build allows for it to be deployed in a wider temperature range whether you need to locate the PC inside or outside.

Many security cameras can accept power over ethernet.

Legacy Connections

As mentioned above, the age of the property will heavily influence the sensor and machine information connections. The U.S Energy Information Administration's Commercial Building Energy Consumption Survey (CBECS) regularly makes available information on the commercial building market that can give us some key insights:

- There were almost 5.9 Million commercial buildings in the United states as of 2018. A combined total of nearly 100 billion square feet.
- More than half of commercial properties in the US were built between 1960 and 1999. 25% have been built since 2000.

With older buildings you will need to account for legacy HVAC, elevator, and other connected systems. And, you will need to work with older communication modules. BACnet is still the de facto standard for the building automation industry despite being standardized over 25 years ago in 1995.

One very common legacy connection for building automation is the COM port - also called a serial port. This interface enables a PC to transmit or receive data one bit at a time. It is one of the oldest types of interfaces so it's important that your computer can support it. Many commercial off-the-shelf PCs don't offer this type of interface, but it is a staple of industrial computing I/O.

Industrial Raspberry Pi at the edge

One emerging solution for building automation applications is a system like our industrial Raspberry Pi, the Factor 200 Series. In recent years, Raspberry Pi systems have evolved from a hobbyist platform into a viable solution for industrial applications. This evolution of industrial Raspberry Pi solutions was, in large part, motivated by the development of the Raspberry Pi Compute Module 4 (CM4).

The Factor Series offers an integrated DIN rail connection to mount where you need it.

For example, you can configure a CM4-powered Factor 202 with up to 8 GB of RAM, 32 GB of onboard eMMC storage, and an M.2 SATA drive up to 2 TB. Our custom carrier board gives you a wealth of I/O including serial ports. It also offers a 2.4" capacitive touch screen to give you direct control over the device and the data on it. With an integrated DIN rail and wall mounting options, you can install a Factor 202 just about anywhere you need it. This flexible, reliable, and compact powerhouse lowers the barrier to entry for many IoT projects, allowing you to deploy at scale.

In addition, if the actual monitoring is being done off-site, you can configure the Factor Series, as well as many of our other systems, with cellular connectivity to help streamline communications.

Data aggregation

Once you've collected the data to feed into your Building Automation System (BAS), then you're ready for the next step to create a complete picture of the building. Depending on the scope of the project, you may need gateways to aggregate your edge data first, or send the data to a cloud service like AWS. Alternatively, you may want to process the data before sending it to the cloud with an edge server.

Data aggregators typically need to have a little more compute power. A system like those found in our Helix Series provides incredible reliability with compute performance. For example the HX600 can be configured with a dedicated GPU. The hybrid fanless design of this system maintains the fanless, solid-state reliability of the core system while fans actively cool the GPU in a separate compartment.

HX600

Helix 600 builds on the capabilities of Helix 500 with enhanced cooling surface area and added expansion for additional storage, I/O or graphics cards.

Learn more

HX401

A powerful, compact fanless system featuring 12th generation Intel processing, support for 4 displays and a range of customization options.

Learn more

AC101

The AC101 is a 1U rackmount server built upon the power and performance of Intel® Core™ processors with hybrid architecture and hyper-threading technology.

Learn more

Another great example is the HX401 powered by Intel® 12th Generation CPUs. These processors are specifically enhanced for the edge, featuring a hybrid architecture that combines performance-cores and efficient-cores with Intel Thread Director.

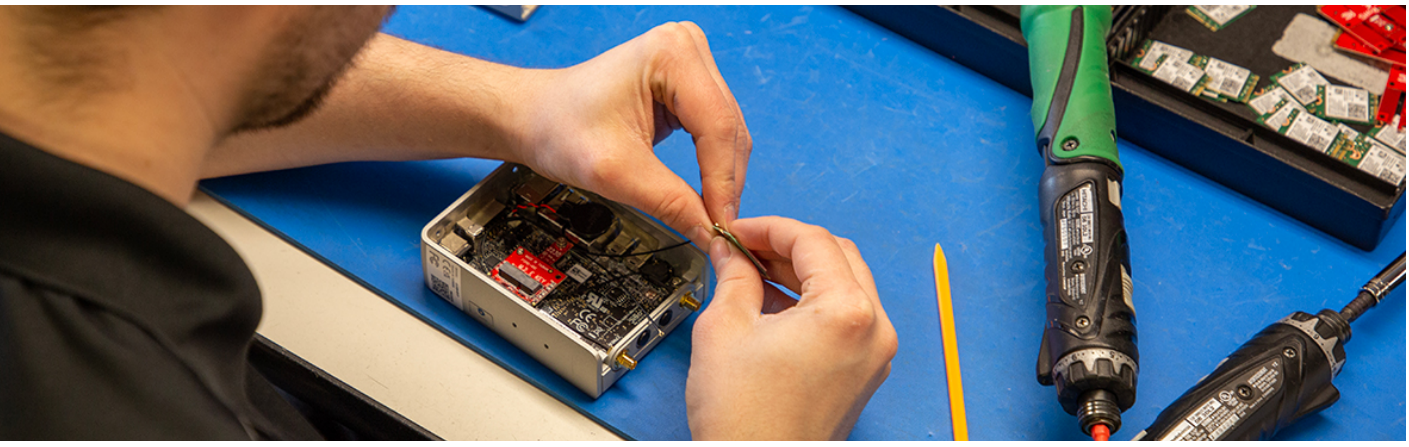
If you are looking to do more data analysis on-prem to minimize latency and reduce your bandwidth or cloud service costs, you can consider an edge server like our Axial AC101 rackmount server.

Next steps

Ready to get more specific with your hardware requirements? We've created a guide with a handy checklist outlining the most important information to consider before selecting the hardware platform for your smart building project. Continue reading to learn which variables, configuration options, software choices, and more will inform the hardware you need to launch a successful project.

ONLOGIC

The Ultimate Hardware Selection Checklist



We've collected the most important questions to consider before selecting the hardware platform for your project. Armed with answers to these questions, you'll be in the best position to choose your ideal computer solution.

Application

Knowing how the hardware will be used will help inform system selection.

- ☐ What will the system be used for? (Machinery, Data logger, HMI, Edge Device, Server, etc.)
- ☐ What will the computer actually be doing once installed?
- ☐ What other systems or hardware will it be connecting to? (Peripherals, Gateways, Networks)
- ☐ Where will the data live? (On the system? On a central server? In the cloud?)

Environment

Understanding where the computer will be installed will influence the level of ruggedness required.

- ☐ What type of environment do you plan on installing this system in?
- ☐ What are the extreme low and extreme high temperatures of your deployment environment?
- ☐ Any moisture in the environment? Direct water contact?
- ☐ Any vibration or shock? (Will it be installed in a vehicle or in another vibration or shock-prone location?)
- ☐ Will you utilize an additional enclosure?
- ☐ How do you plan to mount the system?

Technical Requirements (in general hierarchy of importance)

Some technical requirements may be obvious, others may present themselves as the project evolves.

- ☐ Do you have a processor manufacturer preference? (Intel, AMD, ARM)
- ☐ What level of processing will you need? (Intel Atom, Celeron, Core i3/i5/i7/i9 Xeon or AMD Ryzen, EPYC)
- ☐ Does your application require a graphic processing or vision processing unit? (GPU or VPU)
- ☐ Which and how many I/O ports will you need? (LAN, Serial Ports/COM, Video Outputs, USB [Type A or C?])
- ☐ How do you plan to power the system? (AC Adapter or direct input?)
- ☐ What type of input voltage will you be providing? (12V, 24V, 48VDC)
- ☐ How much storage do you need? (Hot-swap, multiple drives, RAID)
- ☐ How much memory do you need? (ECC or non-ECC?, Wide Temp?)
- ☐ Will you require wireless connectivity (Wifi, Bluetooth or 4G)
- ☐ Do you require an operating system? (Windows or Linux & what flavor?)
- ☐ What other software will you be using?
- ☐ Will you want the software image applied prior to shipping?

Time Frame

In addition to the right-fit hardware solution, it's important that your hardware provider can meet all of your project expectations, including timing.

- ☐ When do you need to have a prototype in-house?
- ☐ Once you've received the prototype, how long do you anticipate your testing phase will last?
- ☐ After approving the prototype, when do you anticipate moving to full roll-out?
- ☐ Are there lead time limitations? Other than "as soon as possible," how quickly after ordering would you require fulfillment based on project timelines?

Quantity

The number of systems you require may impact lead times, fulfillment requirements and of course budget.

- □ How many systems do you plan to need to complete your project?
- □ What are your anticipated order sizes?
- □ What is your anticipated order frequency?

Lifecycle Needs

Particularly for industrial applications, the lifecycle of your chosen system, and its components, is a vital consideration.

- □ How long do you expect to be purchasing your chosen configuration?
- □ Will re-certification or other re-evaluation be necessary if a component of the system changes?
- □ Is your project otherwise revision sensitive?

Budget

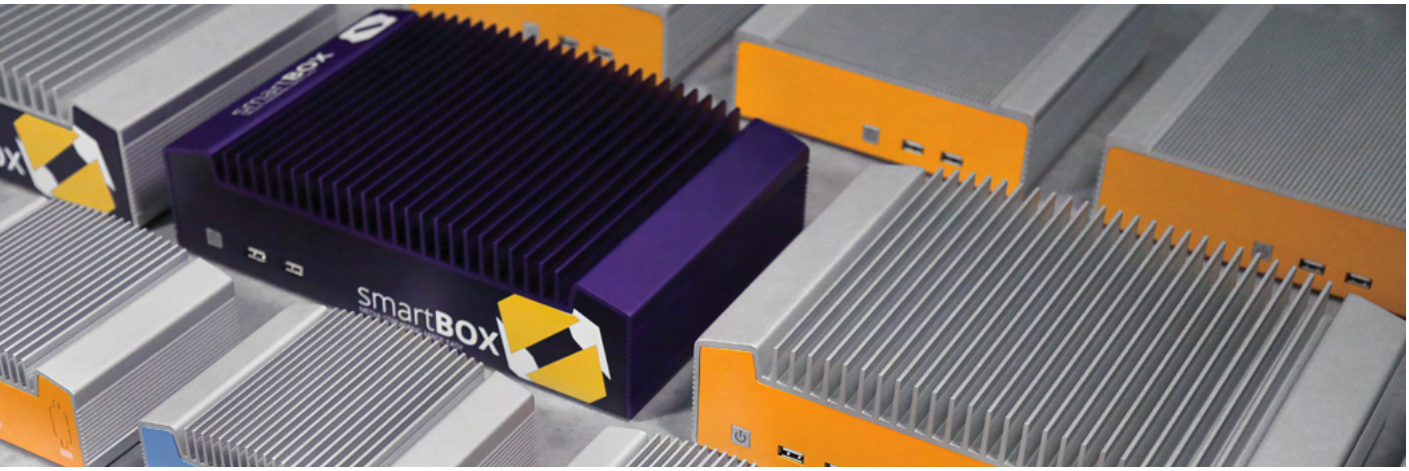
Keeping budget targets front of mind will help inform configuration decisions throughout the selection process.

- □ Do you have a fixed budget for this project?
- □ Do you have a price-per-system target in mind?

Other Services Required

Be sure to consider the other service options that can be added to create your ideal hardware solution.

- □ Do you want to have the systems branded with your company logo or colors?
- □ Do you have any custom labeling requirements?
- □ Will there be additional engineering required to create the right solution?
- □ Are there particular industry or regulatory certifications you require?
- □ Will you require dropshipping directly to your end user(s)?



Decision making process

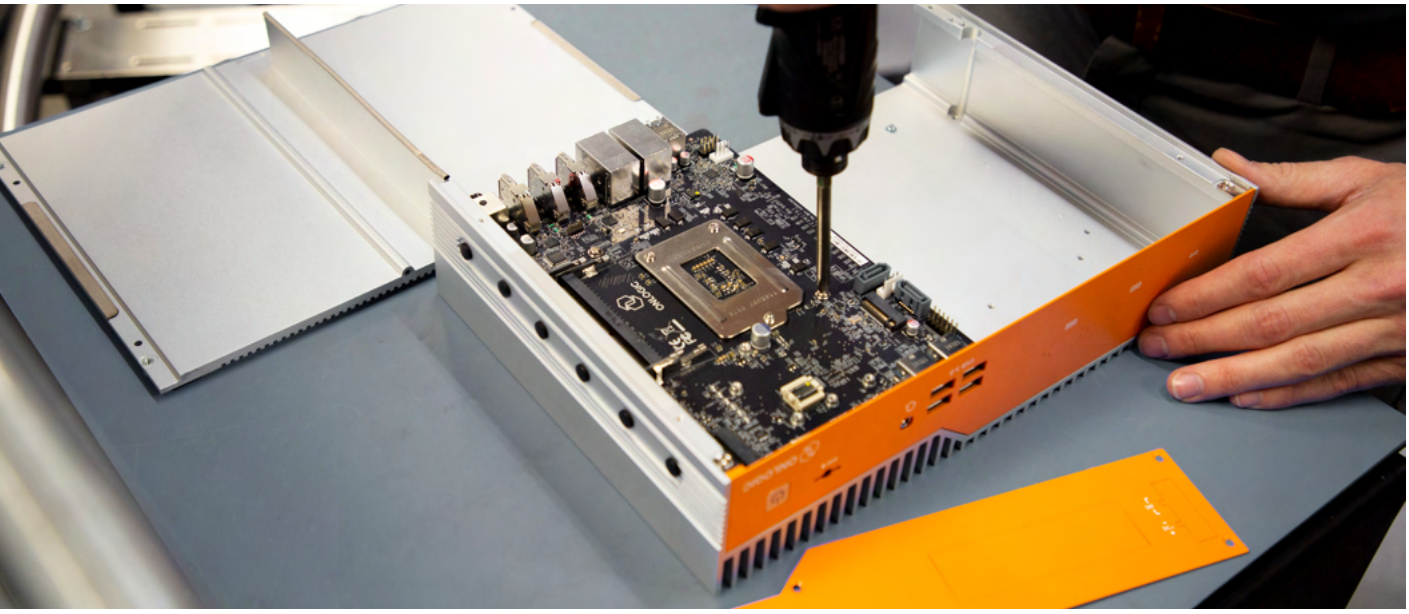
Knowing the individuals and processes involved in your hardware decision will aid in efficient selection and configuration.

- ☐ Who are the primary decision makers? (Individual or group?)
- ☐ What is most important to you in choosing a hardware platform and partner?
- ☐ Has the hardware project already been approved internally, or is approval contingent on a viable hardware solution?

Other Existing Challenges

Examining existing challenges will help you, and your hardware provider, avoid them going forward.

- ☐ Have you been using a previous solution for this project? If so, what was it?
- ☐ What was good about the previous solution and what needs improvement in the new solution?
- ☐ What prompted you to change hardware?How do you plan to mount the system?



Ready To Start Building?

Once you've considered these questions, contact us for help in choosing the OnLogic system that's right for you, or browse our hardware by clicking below.

North America

Call: +1 (802) 861 2300
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ONLOGIC

The Ultimate Guide to Selecting An Industrial Computer

With the innumerable differences in nomenclature, configurations, form factors and features, it can be challenging to determine which industrial computer is best suited for your application. We've created this guide, and its accompanying checklist, to help you make an informed decision when selecting and configuring an industrial computing solution. Getting this decision right the first time can save you a lot of headaches, not to mention significant time and money. Every project is unique, but if you're able to answer these key questions in advance you'll be well on your way to a successful hardware deployment.

What does the project require?

This may seem like a question you would expect to have a clear answer to from the start, but it's easy to conflate "what do I want to do?" with "what do I need?". Your unique application will place very specific demands on the computer you select, and it's important to understand how those factors may impact your hardware decision. You may approach a hardware vendor with a list of specifications (more on that shortly), and while those will be a good baseline, the actual use case of the system may impact your choice and configuration in unexpected ways.

If the computer will only be part of the end solution, be it automation equipment, a data logger, or HMI, then you'll need to establish and clearly define what, specifically, the computer will be responsible for once installed. This will help inform everything from memory and storage needs, to processing power, expansion requirements and connectivity demands. On the connectivity side, you'll want to consider what other equipment the computer will need to connect to or interface with. Peripherals with proprietary connectors, or systems that require a specific wireless communication protocol, should be evaluated and included during the consideration phase.

It's also important to take into account where your data will live. If the computer will collect, process and act on data itself, your needs for wireless or wired network connectivity will be very different than if the system will need to transmit data to a central server or the cloud. Your network infrastructure should also be assessed to ensure it can accommodate the new devices you'll be adding to it.

What's the installation environment?

Once you've clearly defined the "what" of your application, the next important question to ask is "where" your system(s) will be used. This is one of the key considerations in determining the grade of computer that will be best suited for your project, particularly if you're creating a solution that will operate in an environment that's inhospitable to electronics. If your installation environment is subject to extreme high or low temperatures, contains airborne particulates, may expose the system to vibration or impact forces, or contains other devices that produce electromagnetic interference, such as electric motors and solenoids, it's imperative that those factors be taken into account.

Dust, dirt, chemicals and moisture are computer killers. Most traditional computer hardware is cooled using fans to pass air over the heat-generating components of the system. In many industrial environments, that air is accompanied by contaminants that are deposited inside the computer as the air moves through. Those particulates can quickly build up, causing overheating or shorting that can instantly destroy the computer, causing downtime and data loss. Fanless systems prevent this type of damage by implementing alternative cooling technologies, like heatsinks and heat spreaders, to cool the system passively. By using convection to cool the system, the fan can be removed and enclosures without openings can be utilized, helping to protect internal components and eliminating moving parts, creating a fully solid state solution (assuming solid state storage drives are used).

In terms of operating temperature, if your application will subject the computer to ambient temperatures under 0°C (32°F) or above 40°C (104°F), you should probably consider a rugged computer, which utilizes components rated for temperatures at the extreme ends of the scale. Further, if the computer will be exposed to frequent or prolonged vibration or impact forces (like those common with in-vehicle installations), it's best to use a rugged computer. Rugged computers are designed with fewer non-permanent connections and often utilize vibration-dampening technologies. Rugged systems also typically have the best EMC protections, often doubling the requirements of industrial systems.

In some instances it may be most practical or cost effective to consider an additional enclosure for your hardware, particularly if you plan to install or utilize equipment outdoors. If you choose to install your system in an enclosure, be sure to evaluate the airflow to determine if additional fans or other active cooling solutions will be required. Whether you utilize an enclosure or not, be sure to account for how you'll mount or install your devices. Many computing solutions can be wall or VESA mounted, but additional brackets or other components may be required.

What are the desired technical specifications?

Now we come to what is often the first, and sometimes only, item that many hardware project evaluations focus on. For your project, you likely have a list of specifications and features that you require your computer hardware to have. Your needs will, of course, be unique, and the importance of individual configuration options will vary widely, but be sure to consider each of the following carefully.

Processing

The powerplant of your computer, the choice of processor can be complicated depending on the use case for the system. Minimum software requirements, power consumption, thermal management and the number of simultaneous tasks that the system will handle are just some of the factors that may play into your choice between the wide range of available CPUs from Intel, AMD, ARM and others. You, or those on your team, may also have preferences or concerns about particular processor manufacturers that will need to be vetted. This is where having an outside party help you with configuration can pay dividends as they're often able to leverage past experience configuring systems for applications similar to yours that can help inform your decision.

I/O Ports

How you connect the system to the rest of your infrastructure is a crucial element in ensuring an easy installation. LAN ports for networking, Serial Ports for machine to machine communication, Video Outputs for display interface, and USBs in varying generations and form factors will all need to be carefully considered and accounted for. Depending on the system you choose, you may be able to customize the I/O coastline. In some instances, however, you may be limited to what's available on the motherboard, or what's been selected by the computer manufacturer to be populated, so make sure you understand what you need and what can and can't be configured. I/O ports are also a common delivery portal for adverse electromagnetic compatibility conditions, so understanding the desired I/O complement can mitigate unexpected complications during rollout or testing for any desired industry or application-specific certifications.

Storage

The amount and type of storage you select will go a long way to future proofing your chosen computing solution. You'll want to consider not only how much storage space you need now, but how much you may need in the future. In some instances, storage can be upgraded or hot swapped, but it's best to think about your long term needs in advance to prevent data overruns that might require additional external hardware to support. For most industrial applications, solid state storage drives will be preferred, but for some use cases spinning drives may be a viable, cost-effective solution. It's also important to consider how you'll architect your data and whether you'll want/need to set up a RAID solution to protect mission critical information. This is also the stage at which you'll want to think about how much local storage and computing you'll need, versus what can be stored and/or processed in the cloud. On-premise Edge Servers are an increasingly popular option to help minimize both latency and bandwidth costs.

Memory

The amount and type of RAM will greatly impact the operating speed of your system. Like the processor selection, your choice of RAM will ensure that the system can perform the requisite simultaneous tasks your project requires. The more RAM you configure, the better your systems will be at multitasking. Keep in mind that there is a limit to the amount of RAM that a given motherboard can support. The frequency of the RAM also needs to match that supported by the motherboard. Higher RAM frequencies ensure a faster data transfer, which, in turn, makes for faster task processing. The motherboard specifications will also dictate whether the system will support dual channel communication with the memory controller, effectively allowing

you to double RAM bandwidth by allowing simultaneous access to the RAM modules. This is another instance where working with an experienced hardware vendor can take a lot of guesswork out of the process.

Power

The installation location for your systems will inform how they'll be powered, and you'll want to make sure that your chosen system supports both the input voltage and connection standard available. For example, if you will be directly connecting your systems to power they may not each require a separate power adapter, which could save significant costs depending on how many systems you plan to install. Many industrial computers offer support for variable power input, ranging from 9-48VDC, which can provide some flexibility, but it's important to understand your power setup in advance. Be aware that many systems require a power adapter to properly protect from damage or malfunction when integrated. Only a subset of systems can run on DC power and fewer of those can run on a DC power system shared with other devices. Having a clear understanding of your power system is crucial to ensuring a safe and reliable installation.

Wireless

Wireless connectivity is becoming ubiquitous among consumer devices, but industrial systems most frequently need to be specifically configured with the desired wireless card if Wi-Fi, Bluetooth, 4G or LoRa connections are necessary. In addition to the card itself, be sure to consider the number, type and size of antennas you'll need. Integrated antennas are seldom sufficient, particularly in industrial settings, to enable reliable connectivity. There are also legal constraints regarding antenna gain that can differ by geographic location, as well as functional constraints including antenna polarization and coax loss, all of which are also dependent on the number of total radios in the device. Having a plan for where and how antennas will be installed or mounted is imperative.

Operating System

Your choice of operating system will be informed by the software or applications you intend to run. Understanding which flavors of Windows, Linux or your OS of choice, that your selected hardware will support, or can be pre-configured with, will save you a lot of potential compatibility headaches over time. For some embedded applications, you may not require a pre-installed OS, which can save significant cost, but it's important to verify that up front.

Other Software

Finally, understanding the entire software stack that will be installed on the system can inform everything from processor selection, to RAM requirements and storage needs. You may also be able to leverage your hardware vendor to pre-image any software prior to shipping your systems, saving you a great deal of time and making fulfilment to your customers, or installation into your products or facility much easier.

What is the project timeframe?

Going into a project with a clear timeline will help you ensure that your chosen hardware provider can support your project requirements. You'll want to consider whether you'll need a hardware prototype and how long testing on that prototype will take. Having that information will help you to build a roll-out schedule with

your hardware provider so that they can ensure an interruption-free supply chain. A short timeline may also limit your configuration options based on available stock at a given vendor, so communication is key. Be up front with your suppliers about when you'll need products and, if you expect recurring orders, how long until you'll need the next. The more information you can provide up front, the more likely it is that your selected hardware will be ready and waiting when you need it.

How many systems will you need, and for how long?

In addition to the question about when you'll need to receive that first order, be sure to inform your hardware vendor about how many systems you'll require, and over what amount of time, to ensure adequate stock and minimize lead time concerns. Setting up recurring orders, and/or having an accurate forecast to provide your hardware vendor can significantly reduce instances of backorders or component shortages impacting your project.

Another important consideration, particularly for industrial applications, is component lifecycle. The manufacturers of computer components are constantly updating their offering to keep up with the needs of users. For consumer electronics, those type of product line refreshes are a fact of life, and provide opportunities for users to upgrade their systems as capabilities expand. However, for industrial users, these type of component changes can have far reaching impacts on a project. If you expect to need a precise system configuration over a long period of time, it's important to understand the lifecycle of your chosen system and its components to make sure it will be available for the life of your project.

In some instances, component changes may not matter as long as the capabilities remain the same. But having to install a different brand or capacity of hard drive, for example, due to a product going end of life, can be highly impactful in certain circumstances. Many medical device manufacturers, for instance, must fully certify their chosen configuration to meet industry standards. Changing even a single component can require expensive and time consuming recertifications. Be sure to consider if your project will be revision sensitive and communicate that to your hardware vendor so they can work with you to anticipate any potential impacts over the life of your project.

What's the budget?

It's a key question at every decision point in any project, and your budget will impact every aspect of the hardware selection process. While you'll certainly have an eye toward getting the best value out of your hardware investment, make sure to weigh the soft costs in your calculations. For example, many industrial, edge or IoT projects have very little tolerance for hardware failures, which can cost hundreds of thousands of dollars in lost revenue, sometimes in as little as an hour or two depending on the application. A few dollars saved per system by using spinning hard drives instead of solid state drives, or electing for an industrial system in an environment where a rugged pc would be better suited, can end up costing your organization a great deal more should failures occur.

On the flip side, an experienced hardware vendor can often help save you money by suggesting the right fit solution, rather than simply providing a one-size-fits-all device that may be overkill for your project. Having an idea of your overall project budget, as well as a target per-system price will help you get on the same page with your hardware provider and act as a guide throughout configuration.

What other services could be leveraged?

While this guide is focussed on the hardware for your project, it's important to investigate any other services that your chosen vendor could potentially provide, as well as the factors that will directly impact project success that go beyond system configuration. If hardware isn't your company's specialty, your hardware supplier may be able to take more off of your plate to help you focus on the areas you do specialize in. Some of the elements you may be able to have the hardware manufacturer handle include:

- Hardware Branding
- Custom Labeling
- Enclosure Customization

Taking stock up front of what else you might be able to offload to the hardware provider can help avoid delays on the backend if you don't find out until later that you could be having them image your software or assist with fulfillment. Be sure to ask if it's possible to build these types of services into your overall hardware program, even if you don't expect to utilize them until you move your project into mass production.

Choosing, configuring, testing and fine tuning your hardware-based project is a time consuming and complex proposition, which is why it's so important to go into the process as prepared as possible. Even if you have clearly defined answers to the questions above, there's nearly always something that comes up mid-way through the process that can throw you a curveball. Working with an experienced hardware company that specializes in the type of systems you need can go a long way toward making the process easier and giving you the confidence to take your project from idea to reality. The OnLogic team is here to help if you have any questions or need advice about the best hardware option for your unique project.

Ready to get started? Contact us!

Once you've considered these questions, contact us for help in choosing the OnLogic system that's right for you, or browse our hardware by clicking below.

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