White Paper

iCAP – Tackling the Main Challenges of Large-scale AIoT Deployment

Executive Summary

This white paper uses Innodisk's iCAP™ (Cloud Administration Platform) to demonstrate how we can tackle some of the more pressing challenges of artificial intelligence and Internet of Things (AIoT) integration.

The drastic change in the device-to-operator ratio that the rapid expansion of AIoT brings makes central management capabilities central to any streamlining and cost reduction efforts. Without such capabilities, device maintenance and monitoring become close to insurmountable undertakings that put future innovation at risk.

By using iCAP, the system integrator can gather all connected edge devices under one umbrella. Centrally managing edge devices is beneficial as we move toward a future with an ever-growing number of devices operating autonomously at the edge.

Introduction

Our reliance on technological solutions has spurred an enormous growth of IoT devices. Increasingly coupled with AI to form AIoT, this trend sees human labor increasingly getting replaced by cheaper, faster, and smarter machines. Estimates vary, but experts expect the number of IoT devices to reach 75 billion by 2025.[1] The growth is not purely numerical, but also in a geographical sense as edge devices are moving to new and more remote areas where they replace human labor in the most challenging environments.[2]

With more devices, more area to cover, and fewer operators, maintenance and management emerge as the core challenges for system integrators. AIoT is a broad category encompassing connected devices of every size, ranging from simple to incredibly complex. But one thing that is essential to each device is memory and storage, often in the form of DRAM and flash-based modules.[3] In other words, each device will at least have several onboard components. A further compounding factor is the increasing use of external sensors and other input/output (I/O) integration.

Factoring in the finite lifespan of these components means that the number of items any single operator needs to keep operational is potentially staggering.

This white paper sets out to explain how using Innodisk's iCAP™ (Cloud Administration Platform) software tool addresses these challenges to enable a future where AIoT can improve business and life all around the world.

Background

Innodisk Cloud Administration Platform

iCAP™ was initially planned as a tool to monitor solid-state drive (SSD) lifespan. SSDs operating in harsh industrial settings face many risks that can lead to failure and costly downtime.

However, during the design progress, the potential to include new features meant that iCAP eventually evolved into a more comprehensive tool that focused not just on individual components, but rather on connected devices as a whole.

iCAP serves as a platform accessible through any compatible browser on a connected device. The result is that the user can manage their devices from virtually any location where there they have a working connection.

IoT

The internet of things is a phrase that refers to the trend of connecting things through a network (usually the internet). The “things,” in this case, does not necessarily refer to separate electronic devices; it can also refer to things like wearable electronics or even people that have medical devices on or implanted in them. In essence, it refers to every individual device that can transfer data within a network in some capacity.[4]

AIoT

The AIoT can be described as the intersection where AI and the IoT meet. This can be thought of as AI moving closer to the edge and letting a larger piece of the computational cake take place where the IoT device is located.[5] Picture a surveillance system that runs facial recognition. Instead of sending any footage to the cloud for analysis, which may cause delays, the local AIoT device directly analyzes the data.

Challenges

Device Growth and Innovation

AIoT threatens to cause job losses across many sectors and industries, especially where jobs have tasks of a more repetitive nature. Some sources estimate that as many as 50% of current jobs could be partially or wholly replaced by automation within the next 15 years.[6] The main driver behind this development being cost reduction. Computational power has until recently followed Moore's law and roughly doubled each year, while labor costs remain high. It follows that industry analysts expect IoT to experience drastic growth as it continues to get more affordable and more autonomous.

Geographical Spread and Maintenance

With affordability, more robust devices, better connectivity, and more advanced AI, AIoT devices keep moving into new areas. These devices are often located in hard-to-reach places, facing new and difficult challenges. This increased complexity of edge device environments necessitates sophisticated monitoring to ensure that maintenance sessions that are few and far between can be planned accordingly to avoid system crashes.[7]

It also means that maintenance costs are poised to become substantial, and that specialized personnel is required to reach the less accessible locations. These two factors strongly incentivize companies to keep maintenance to a minimum.

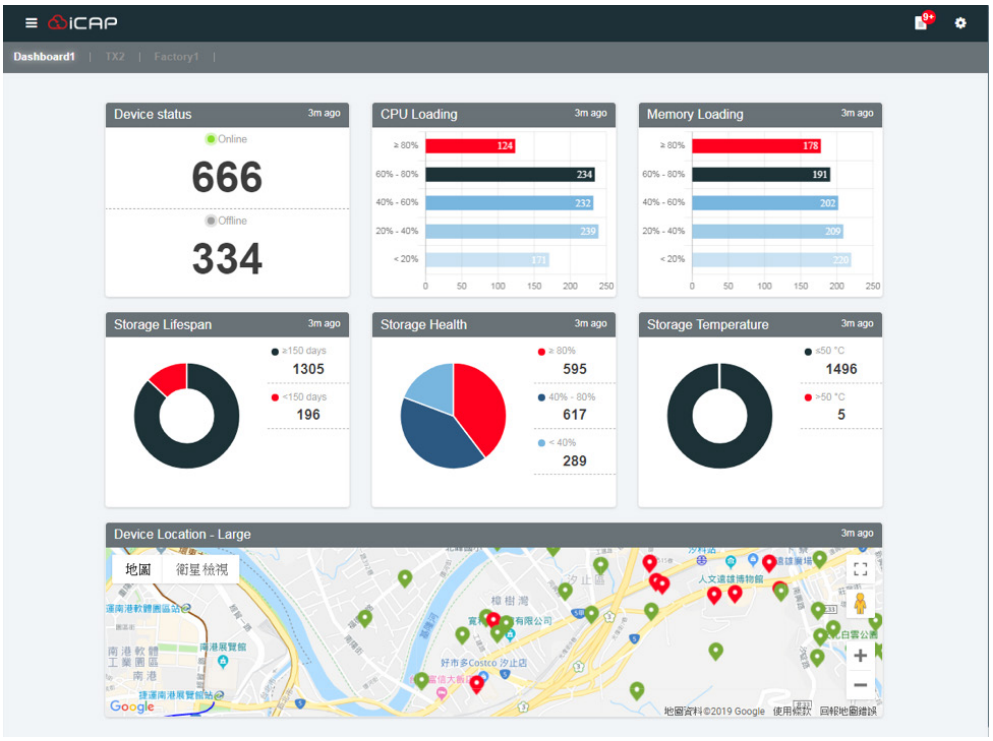
Component Issues

All flash-based storage modules have finite lifespans, making lifespan prediction one of many important parameters to monitor. However, depending on the application, a myriad of additional components also require monitoring. For example, many edge devices run on battery power, necessitating battery life monitoring. Other IoT devices with a wide range of sensors, such as weather stations, may require monitoring of components responsible for everything from temperature, wind speed, and humidity to air quality and seismic activity. In many applications, knowing when to swap out such components out is critical to ensure operational stability or even safety.

Solutions

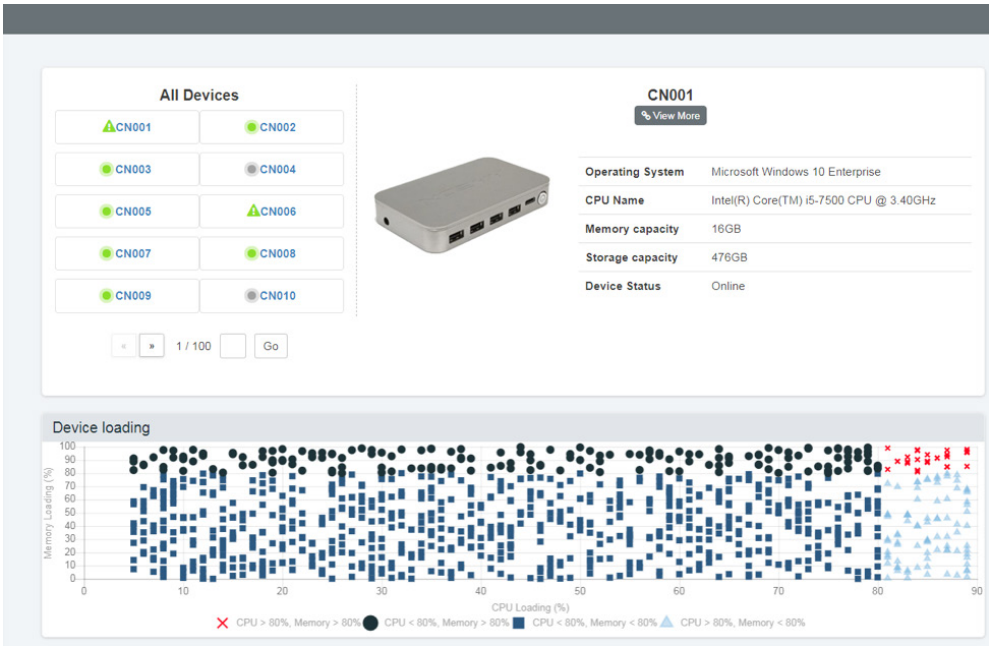
Remote Management under One Umbrella

iCAP is an example of how all connected devices can be gathered on one platform, facilitating component monitoring. With iCAP, a client is installed on a local or central server, which in turn receives input from all one's connected devices, either through an intranet or internet connection. This way, information from each device is remotely accessible for the user, all in the same place.



Screenshot 1: iCAP Dashboard showing some of the available widgets.

Operators also can assign a physical location to devices, adding a map marker where different color codes signify changes in device status, making it easier to keep tabs on devices both far and near. Similarly, if many devices are located in the same area, they can be grouped for management purposes. Widgets can be added and removed depending on the device and onboard components.



Screenshot 2: Device overview example.

Platforms like iCAP can also facilitate maintenance planning by issuing alerts to the device operator when components reach preset thresholds across different parameters. For instance, an SSD at a remote location might trigger an alert when the estimated remaining lifespan reaches 6 months. For a similar device close to the operator, the same threshold may be set to 2 weeks. This way, maintenance can be planned in a timely manner. If necessary, reports can also be generated, giving the user a snapshot overview of the current device status.

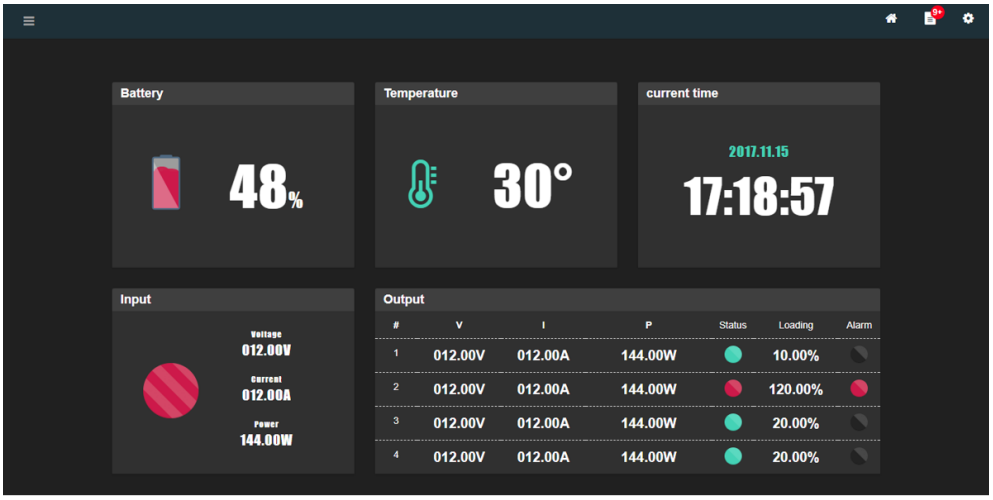
Recovering from Crashes

Even though an AIoT device may be very "smart," its artificial intelligence is rendered entirely useless when encountering a system crash. If located at a remote location, this can mean long-lasting downtime and a severe loss of revenue or valuable data that the AI will not be able to analyze.

iCAP solves this challenge by adding a recovery mechanism to the platform. By storing a mirror image of the operating system (OS) locally or on a server, when a sudden crash occurs, this image can be used to run full system recovery from a remote location.

Customization

Connected devices moving into new industries and environments requires innovation, which in turn requires flexibility in our hardware and software design. To that end, iCAP's design allows for substantial changes to the user interface (UI) and the underlying code. This way, the software solution can be optimized for new AIoT applications. Similarly, if the system integrator installs new components and sensors, iCAP can add these as new parameters under the relevant devices.



Screenshot 3: Customized dashboard for UPS application

In this example (screenshot 3), the UI has been modified to include uninterruptible power supply (UPS) units. These large-scale batteries are essential for data centers and hospitals that run critical equipment reliant on a continuous power supply.

Conclusion

Automation and IoT manifested as AIoT is an inescapable trend that is soon all around us in our daily lives. To thrive and expand in this highly connected future, companies need to address the challenges that emerge in this environment, for example, efficient device maintenance.

iCAP is one of the tools available that helps system integrators address these challenges. By making device maintenance more easily accessible and predictable, it allows companies to deploy resources in a more efficient manner and in a way that is sustainable even as the number of connected devices grows.

Finally, with a strong focus on adaptability and flexibility, it is suitable for a wide variety of use cases, regardless of geographical challenges and the application's overall complexity, thus properly addressing automation and IoT concerns and thus enabling the AIoT solutions of the future.

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