**White Paper**

# iCAP - Tackling the Main Challenges of Large-scale IoT Deployment

## Executive Summary

This white paper uses Innodisk's iCAP$^{TM}$ (Cloud Administration Platform) to show how we can tackle some of the more pressing challenges of IoT integration.

Using iCAP, the system integrator can gather all connected IoT devices under one umbrella. This is beneficial as we move towards a future where human labor is increasingly replaced by automation due to streamlining and cost reduction. This drastic change in device-to-operator ratio brings with it challenges regarding device maintenance and monitoring, as well as the need for further innovation and customization.

# Introduction

Our reliance on technological solutions has spurred an enormous growth of IoT devices. Coupled with AI, this trend sees human labor gradually being replaced by cheaper and faster machines. Estimates vary, but experts expect the number of IoT devices to reach 75 billion by 2025[1]. The growth is not simply just in numbers, but also in the geographical spread as devices are moving into new and more remote areas.

With more devices, more area to cover, and fewer operators, maintenance and management emerges as the core challenges for system integrators.

IoT is a broad category encompassing devices of every size; ranging from simple to extremely complex. But one thing that is essential to each device is memory and storage, often in the form of DRAM and flash-based modules. In other words, each individual IoT 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 one operator is tasked with keeping operational is potentially staggering.

This white paper will explain how these challenges can be met by using Innodisk's iCAP™ (Cloud Administration Platform) software tool.

# Background

## Innodisk Cloud Administration Platform

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

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 devices as a whole.

iCAP basically works as a platform accessible through any compatible browser on a connected device. This means that the user can manage their devices from any location as long as they are online (either on an intranet or the internet)

## IoT

The internet of things (IoT) is a phrase that refers to the trend of "things" being interconnected through a network (usually the internet). The "things," in this case, do not necessarily refer to separate electronic devices; they can also refer to things like wearable electronics or even people that have a medical device on or implanted in them. Basically, it is every individual device that can transfer data within a network in some fashion.

# Challenges

### Device Growth and Innovation

IoT and automation threaten jobs losses across many sectors, especially tasks of a more repetitive nature. Certain sources hold that as many as 50% of current jobs will be partially or fully replaced by automation within the next 15 years[2]. The main driver behind this 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 IoT is set to grow drastically as it becomes more affordable.

### Geographical Spread and Maintenance

With affordability, more robust devices, and better connectivity, IoT will keep moving into new areas. These devices are often located in hard-to-reach places, facing new and difficult challenges. This necessitates sophisticated monitoring to ensure that maintenance sessions, that are few and far between, can be planned accordingly to avoid system crashes.

This also means that maintenance costs will be significant 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. This is one of many parameters that have to be monitored to ensure continued device functionality. Certain devices might run on battery power, necessitating battery life monitoring. Other IoT devices connect to a host of sensors, as is the case of weather stations. These devices have sensor measuring everything from temperature, wind speed, and humidity, to seismic activity and air quality. Making sure that all components are up and running and knowing when they need to be swapped is crucial to any operator.

# Solutions

### Remote Management under One Umbrella

iCAP is an example of how all connected devices can be gathered on one platform. A client is installed on a local or central server which receives input from all connected devices, either through an intranet or internet connection. This way, information from each device is accessible to the user.
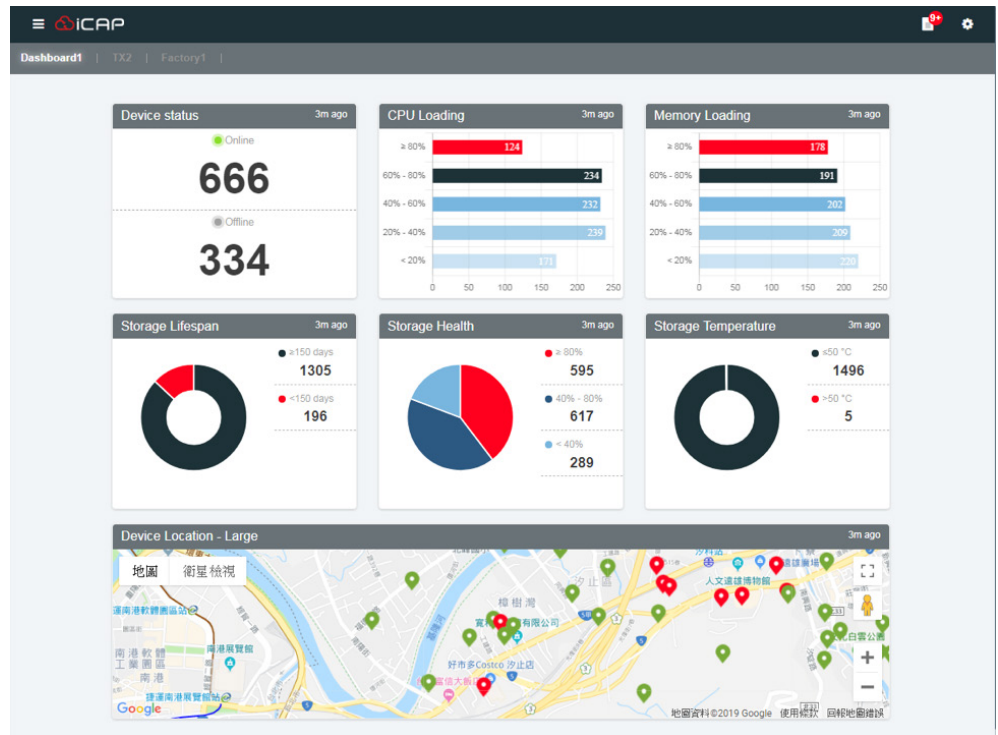
Screenshot 1: iCAP Dashboard showing some of the possible widgets

The devices can be given a physical location which adds a map marker where different color codes signify changes in device status. This makes 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.
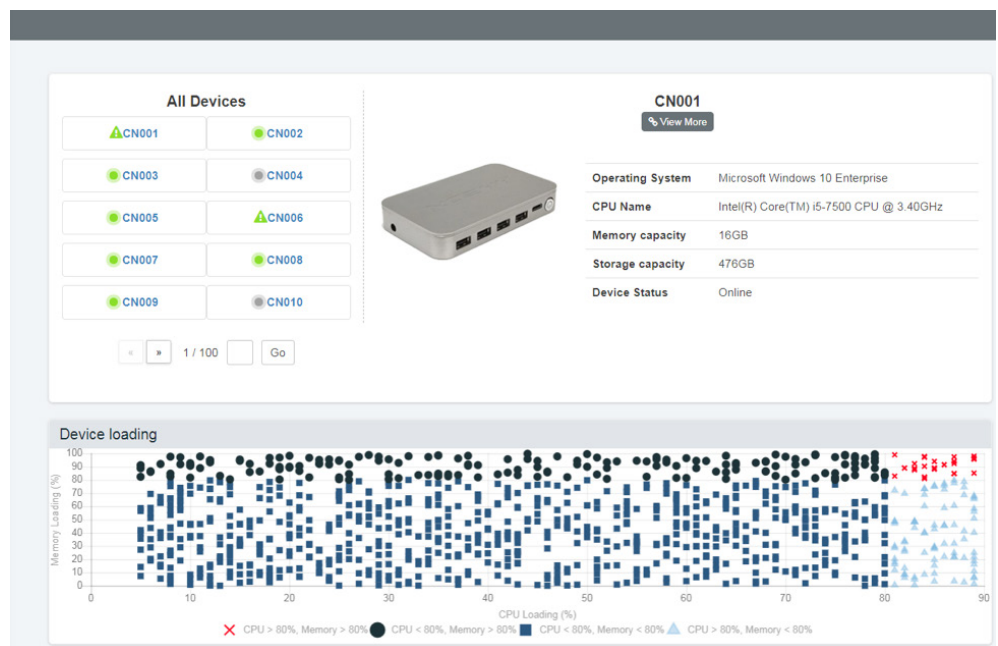


Screenshot 2: Device overview example

To handle the issues of maintenance planning, alerts will trigger if preset parameters are met. In other words, when individual devices meet their preset threshold, an alert will be sent to the operator. 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 it can be set to 2 weeks. This way maintenance can be planned in a timely manner. If necessary, reports can be generated that gives the user a snapshot overview of the current status.

### Recovering from Crashes

System crashes can happen without an apparent reason. If at a remote location, this can mean long-lasting downtime and severe loss of revenue. With iCAP, this is solved by adding a recovery mechanism to the platform. A mirror image of the operating system (OS) is stored either locally or on a server. With a sudden crash, this image can be used to run full system recovery from a remote destination.

### Customization

IoT moving into new fields requires innovation, which in turn requires flexibility in our hardware and software design. iCAP's design allows for large-scale changes to the user interface (UI) and the underlying code. This way, the software solution can be optimized for new IoT applications. Similarly, if new components and sensors are added, iCAP can add these as new parameters under the relevant devices.
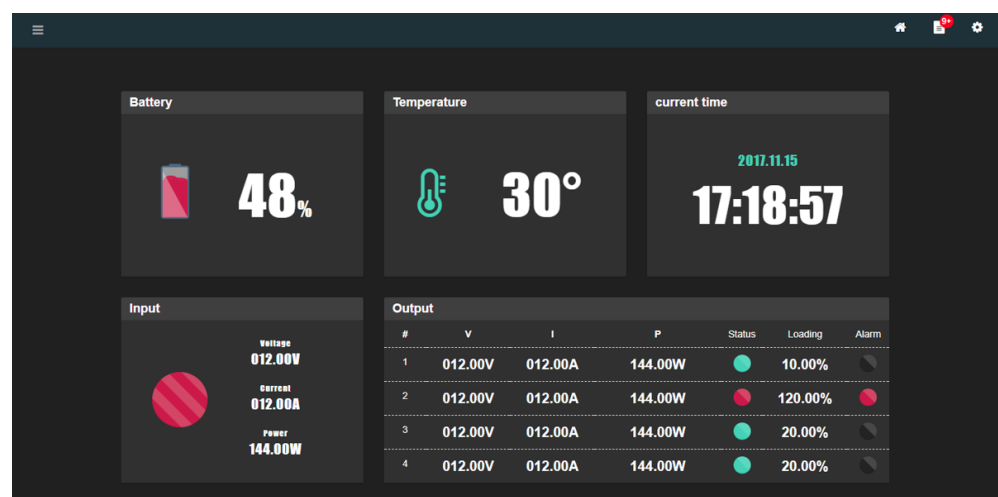


Screenshot 3: Customized dashboard for UPS application

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 continuous power supply.

## Conclusion

Automation and IoT are inescapable trends and will grow into even more all-encompassing features of daily life as we move into the future. Companies that want to thrive and expand have to begin planning how to face the challenges emerging in this new ecosystem.

iCAP$^{TM}$ is one of the tools available for system integrators to manage a multitude of devices simultaneously, and thus making maintenance and planning easier. It is a flexible tool that fits individual cases regardless of geographical issues and complexity.

### References

*1. https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/
*2. https://qz.com/work/1477807/how-many-jobs-will-be-automated-most-predictions-miss-one-big-factor/

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