Smart Edge: Visual Internet of Things on NetApp

Key Benefits

At the Edge
New sensors produce vastly larger data volumes and support new use cases that require the data to be accurate, available, and secure. With NetApp ONTAP® Select, you can use the benefits of ONTAP software to capture and to secure data at the edge. You can also manage the lifecycle of data anywhere in the IoT landscape, such as the far edge/IoT gateway, smart edge/fog, legacy edge, core, and any cloud.

At the Core
In addition to the many benefits and capabilities that ONTAP software offers, the NetApp portfolio also includes NetApp HCI, a hybrid cloud infrastructure that enables you to scale compute and storage independently.

In the Cloud
NetApp has a market-leading position with both public and private cloud environments. If you are interested in enterprisewide location-to-location comparisons, NetApp and its partners can help you connect these once-isolated instances to the enterprise. We can also address your concerns or corporate governance requirements that pertain to data sovereignty, security, or cost.

For Analytics
There is a growing need to preprocess all the collected IoT data in place and to move only the resulting insights, alarms and alerts, and trends to the enterprise. With the release of NetApp ONTAP AI, NetApp delivers industry-leading abilities, including NetApp AFF A800 NVMe-connected flash storage, to drive the throughput that GPU-based compute platforms such as NVIDIA DGX-1 require.

Abstract
The continued improvement in the price and performance of compute technology coupled with the evolution of advanced video analytic algorithms enables new solutions to be applied to Internet of Things (IoT) data. This capability is driving new use cases and provides business value. NetApp offers a wide portfolio of storage, compute, data mobility, data management, and data security options. With the breadth of NetApp® solutions, you can easily get high performance, scalability, and robustness anywhere in your organization to help you meet the rapidly emerging needs of video analytics for IoT use cases.

The Challenge
Digital transformation is a disruptive process that most organizations are forced to face. Information volumes are growing at unprecedented rates, requiring new data management practices to be implemented. Data can be viewed as a burden and be perceived as a cost. Alternatively, it can be considered an asset because information is a propellant and can have a positive effect on the business.

Organizations like yours must find new ways to increase operational efficiencies, to improve product quality, increase system health, and reduce safety risks. The digital transformation process is moving data away from living in legacy systems of record to being part of evolved systems of engagement in which data is shared and is used by multiple stakeholders. Data is becoming connected, distributed, predictive, prescriptive, and dynamically responsive.

In recent years, new trends that enable digital transformation have been revealed, including:

- Reduced cost of sensors for all types of equipment that monitor operational (vibration, temperature, pressure, RPM, and so on), environmental (object detection and classification), and behavioral (object movement, zoning, directionality, and so on) conditions.
- Advancements in artificial intelligence (AI), machine learning (ML), and deep learning (DL) algorithms to the point where they are proving to show valuable insights into equipment and operational condition monitoring.
- Reduced technology lifecycle infrastructure costs: Newer technology investments more than offset their costs against the realized operational benefits and insights.
- The ability to connect these once-standalone systems to the enterprise and to use cloud services.
- Insights from monitored operations that are now being compared by geo-distributed facilities or locations to determine enterprisewide best practices.
- Regulatory requirements that drive the demand to preserve auditable records about how products were manufactured and distributed and about how services were delivered and received.
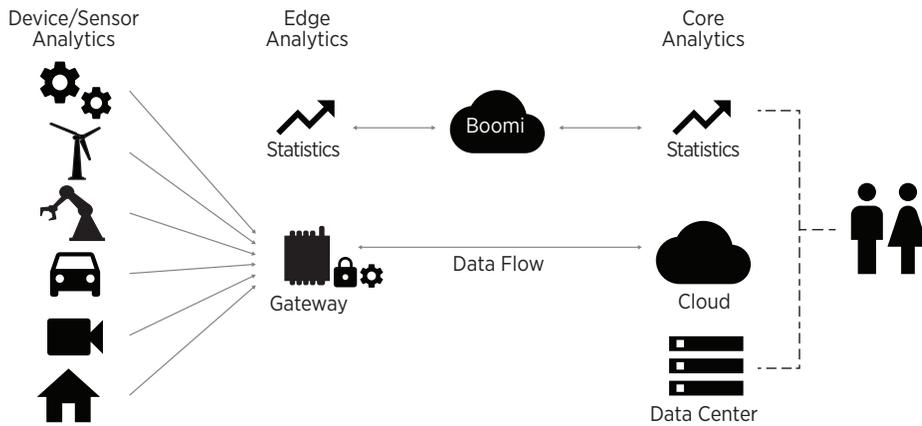
■ NetApp®

Figure 1) NetApp smart edge for video IoT.

The rate of IoT data growth is accelerating. IDC and other analysts estimate the growth rate to be more than 35% year over year. New data is being created in the range of 44 zettabytes annually. In this high-growth market, NetApp provides both the infrastructure and the operating environment that you need to enable digital transformation and to help you realize the value and insight of this new wealth of data. We can help manage and secure your data as it moves from the edge, to the core, to any cloud, and as it is processed and presented to key decision makers along its journey. The smart edge is a logical extension of our established Data Fabric story.

NetApp Technology for Intelligent Visual Analytics for IoT

To understand how to build a smart edge deployment, you must first understand a typical IoT workflow. Although industries, customers, and end products might vary dramatically, NetApp's focus is on the data. NetApp focuses on how to capture data, how and where to move data, how to protect data, and how to facilitate analysis of that data at each location.

Because of the size of the data payload and the bandwidth and latency requirements, video images are a difficult type of data to collect. Video cameras now produce very high quality, high-definition images, so the resulting data volumes have increased as much as 4 to 10 times, making data storage a major issue for stakeholders. These storage requirements have slowed the adoption of video in IoT settings because of the cost of storage and bandwidth. The ability to employ the new generation of video analytics at the edge or source is changing how video can be effectively used in IoT applications.

By using AI and ML techniques, video analytics can analyze any image and can produce metadata (geo-location, object identification, movement, and so on) for application processing in several use cases. If a camera can capture a scene, then analytics can process that image and create new usable metadata (data that describes the image data). This metadata can be processed by various applications for different purposes, all contributing to the richness and the value of the information that is shared in the enterprise.

Analysis of images and comparison of new data with related sensor data can provide better insight and value. Data analytic capability is being pushed out as close to the sensors as possible. The effectiveness of video analytics is directly related to the quality of the image data that is available. Because video can be presented in many different formats, various data-grooming workflows are used to preprocess the image data to prepare it for analytics processing. The better the quality of the source image, the more accurate the video analysis is. This process promotes upgrading the video sensor input to provide optimal image quality. Input can be enhanced by producing a second output stream from the camera (most video surveillance cameras can output multiple video streams in different formats). It can also be improved by replacing a camera or by adding a new camera that is capable of better image quality.

Better image quality usually means more data—potentially a lot more data. This issue is not major when capturing that data at the edge, however. At the edge, metadata tags are created from the source image by using video analytics; that metadata is sent for further processing; and the original video image data source is discarded. The process of data reduction becomes critical when data is moved from the edge to the core or to the cloud. This process incurs greater costs, latency, and bandwidth allocations.
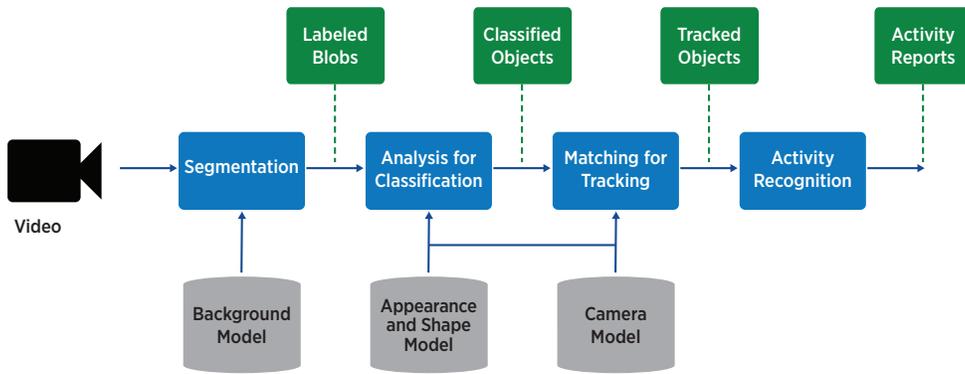
Figure 2) NetApp video IoT data flow.

Depending on video quality conditions, policies, and decision results, multiple types of video analytics could be used independently on the source video at different times. Therefore, the source video should be kept at the edge as an asset. This process requires a smart edge platform. A smart edge provides a domain-specific approach by using standard computing resources combined with accelerated computing for analytics such as AI, ML, and DL, all served by a comprehensive data management resource. ONTAP Select is optimal for that use in that setting.

All the enterprise-class data management capabilities that are used in core data centers can now also be deployed at the edge. You get a consistent and resilient approach to the collection, management, and movement of data. The smart edge is an evolution of the IoT gateway device. This device was essentially a single-purpose edge platform that transformed into a multifunctional platform that accommodates most core data center processes and services in an edge deployment form factor. Having the same data management capabilities anywhere in the enterprise reduces costs and complexity and promotes new value-added use cases.

You can use video analytics in almost any situation that has a video source or the ability to place video surveillance or machine vision cameras to capture the scene of interest. The value is in capturing that video and storing it in a format that is optimized for analytics processing, then processing that image data with one or several video analytic algorithms. You can then store the new metadata and forward it to be processed with other data analysis applications that use data science (ML or DL). You then gain insight and can interface these new processes to existing decision support applications, which can help you monetize the new data.

At NetApp, the breadth of our product portfolio can help us extend high-value data management across the IoT continuum and at every point of the data workflow, from anywhere to anywhere. And we provide it all under a common, proven, secure methodology.
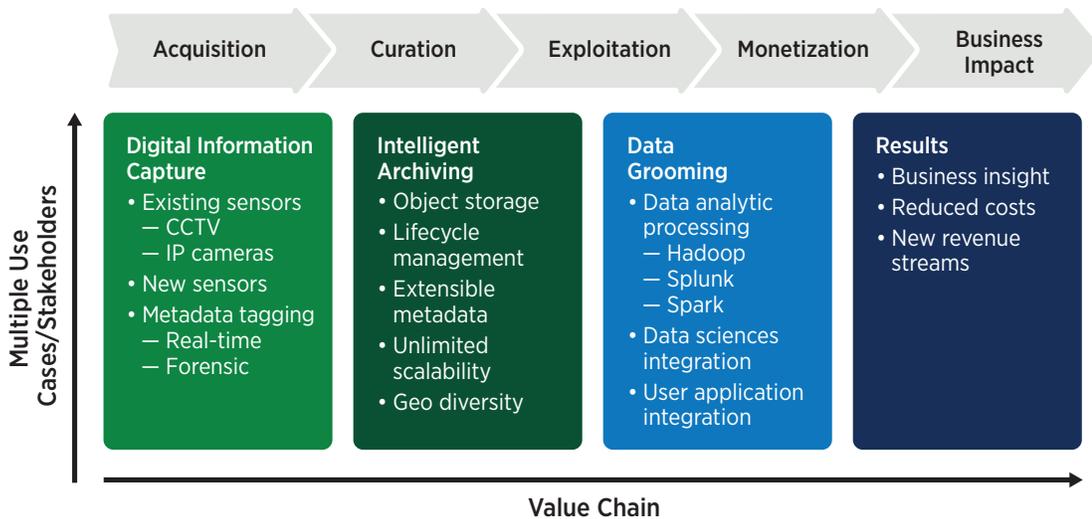
| Acquisition | Curation | Exploitation | Monetization | Business Impact |

Multiple Use Cases/Stakeholders

Digital Information Capture
• Existing sensors
  — CCTV
  — IP cameras
• New sensors
• Metadata tagging
  — Real-time
  — Forensic

Intelligent Archiving
• Object storage
• Lifecycle management
• Extensible metadata
• Unlimited scalability
• Geo diversity

Data Grooming
• Data analytic processing
  — Hadoop
  — Splunk
  — Spark
• Data sciences integration
• User application integration

Results
• Business insight
• Reduced costs
• New revenue streams

Value Chain

Figure 3) NetApp video IoT value chain.

The Solution

IoT can vastly improve real-time connection, efficiency, scalability, time savings, and cost savings for all types of organizations. Video is a key component of this process. Organizations are already benefitting from video analytics for IoT because of the cost savings through predictive maintenance, better safety, and increased operational efficiencies. With IoT networks of intelligent devices, you can eliminate data silos and connect all your people, data, and processes, from the factory floor to executive offices. You can use IoT data to get a full and accurate view of how your enterprise is running and how your customers are being served, which helps you make better decisions. By leveraging the full product portfolio, NetApp can facilitate your digital transformation and streamline the process of data collection, analysis, and migration from the edge to the core to the cloud. We can enhance the speed, throughput, and capabilities of the analytics that you need in visual IoT.

About NetApp

NetApp is the data authority for hybrid cloud. We provide a full range of hybrid cloud data services that simplify management of applications and data across cloud and on-premises environments to accelerate digital transformation. Together with our partners, we empower global organizations to unleash the full potential of their data to expand customer touchpoints, foster greater innovation and optimize their operations. For more information, visit **www.netapp.com**. #DataDriven