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VMware, Kyndryl, Bucknell University Show Smart Wind Turbine Predictive Maintenance at Hannover Messe 2023

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At Hannover Messe 2023, VMware will share an exciting demo co-developed with Kyndryl and Bucknell University: using edge computing to keep wind turbines safe and operational. Visit VMware booth F59 in Hall 15 to find out more.

Edge computing brings innovative applications to life by analyzing large data sets and making intelligent decisions locally, making it a perfect solution for hard to reach, remote locations such as wind farms. The VMware-Kyndryl partner innovation lab, in collaboration with Bucknell University, developed an intelligent predictive maintenance solution for wind turbines, using edge computing and SD-WAN, to improve safety and reduce downtime for wind power plants.

Wind turbines are becoming a common source of clean energy. The International Energy Agency reported that wind electricity generation increased by a record 273 TWh in 2021, and notes an ambitious goal of 7,900 TWh by 2030. Although wind is free and abundant, wind turbines are costly to build and maintain: between $2-4 million for a turbine on land, and $10 million for an offshore turbine.

One serious problem facing wind turbines is fire, leading to a total loss of the turbine in 90% of the cases. Losing one turbine often means that a whole field must be taken out of operation for repair, and a turbine fire can cause wildfires and ecosystem damage. What if we could stop that catastrophe before it starts?

The technology behind the demo

The solution deploys a single edge node running VMware Edge Compute Stack at a wind turbine. A thermal camera sends images of the turbine to an edge node, where an ML algorithm analyzes the images to identify abnormalities in the turbine operation. VMware SD-WAN™, also running on VMware Edge Compute Stack, provides secure uplink to send the analysis results to an operations center. Running an ML algorithm locally on Edge Compute Stack drastically reduces bandwidth usage, and can provide intelligent real-time decision making to avoid catastrophic turbine failures. The software can send commands to the local PLCs to shut down the wind turbine automatically, without human operator interaction.

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> *"Bucknell prides itself on preparing graduates for an increasingly collaborative and complex world. The partnership between VMware, Kyndryl, and Bucknell University has provided our students an authentic learning experience where they have gained unique insights into how advances in computing technology can enhance wind turbine safety. This is a testament to the power of bringing together diverse perspectives and expertise to tackle complex challenges."*
>
> *Brad Putman, Ph.D., Richard E. Garman Dean of the College of Engineering, Bucknell University*

The architecture brings machine learning algorithms directly to the wind farm in a lightweight form factor for containerized applications, enabled by an edge-optimized VMware Tanzu Kubernetes cluster.

It is flexible to support any upstream energy production site worldwide, including difficult-to-reach locations via secure low earth orbit satellite. VMware SD-WAN connects all sites and provides secure internet access, connecting heterogeneous links including fiber, copper and satellite.

The Hannover Messe demo is based on a distributed, containerized microservices architecture. The demo only uses a small part of the full capability of this architecture. The long-term goal is to be able to add new software functions or hardware components simply by deploying a new microservice—without downtime and without affecting other services. For example, while the demo focuses on a heat sensor, other inputs from a wind turbine such as vibrations and acoustic data could easily be incorporated using a microservice. Because of these characteristics, the solution can easily be ported to other use cases including healthcare, transportation, retail, distribution, and manufacturing.

Why edge compute?

The wind turbine use case is not only perfectly suited for edge computing, it was impossible to address before edge computing. A high-resolution video stream from a single monitoring camera at a wind turbine could reach 140 GB per hour. Multiplied by hundreds of cameras at a wind farm, that is an impossible amount of data to be streamed for processing. Data streams must be processed reliably, without dropping packets, and in real time to enable real-time decisions. Instead, a small, affordable computer running a microservice architecture can process all that data locally and change the bandwidth consumption from terabytes to kilobytes per hour.

VMware Edge Compute Stack empowers edge-native applications deployed on edge-optimized Kubernetes runtime, bundled with a secure, software-defined wide-area network. Kyndryl has the right set of consulting and managed services to help customers bring the technology into the mainstream. VMware and Kyndryl continue to expand their development of new applications for the intelligent edge.

Visit VMware and Kyndryl at Hannover Messe to experience these solutions for yourself, and see the team demonstrate a functional system for wind turbine predictive maintenance.

Learn more

- Visit the VMware Edge Compute Stack web page

- Learn more about the VMware-Kyndryl partnership at the Kyndryl website

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Kangwarn Chinthammit

Kangwarn is responsible for driving solution development and architecture for VMware Edge Computing. He initially joined VMware through its acquisition of cloud-delivered SD-WAN leader, VeloCloud Networks, where he managed its...

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