

MALAYSIAN METEOROLOGICAL DEPARTMENT

**Keeping citizens in the know,
whatever the weather.**

Whether rain or shine, we all need to know what the weather will bring. With a new Lenovo supercomputer, the Malaysian Meteorological Department can deliver longer-term, more detailed weather forecasts to keep citizens informed and safe.



The Malaysian Meteorological Department (MMD), an agency of the Ministry of Science, Technology and Innovation, is the country's national weather service. Its duties cover everything from weather observation and forecasting to climate change modeling, atmospheric science studies and aviation services.

MMD's main role is to produce weather forecasts, which are shared with relevant government agencies and made available to the public via national broadcasters. MMD also issues weather warnings in the event of adverse conditions, such as typhoons, torrential rain or monsoons, and releases flood, earthquake and tsunami alerts. Crucially, MMD supplies the National Disaster Management Agency (NADMA) with the latest meteorological data to support emergency preparedness and response.

To generate weather forecasts, MMD runs highly complex numerical weather prediction (NWP) models that require a huge amount of compute power. But with its existing high-performance computing (HPC) system reaching end of life, MMD found that it could not support new modeling requirements.

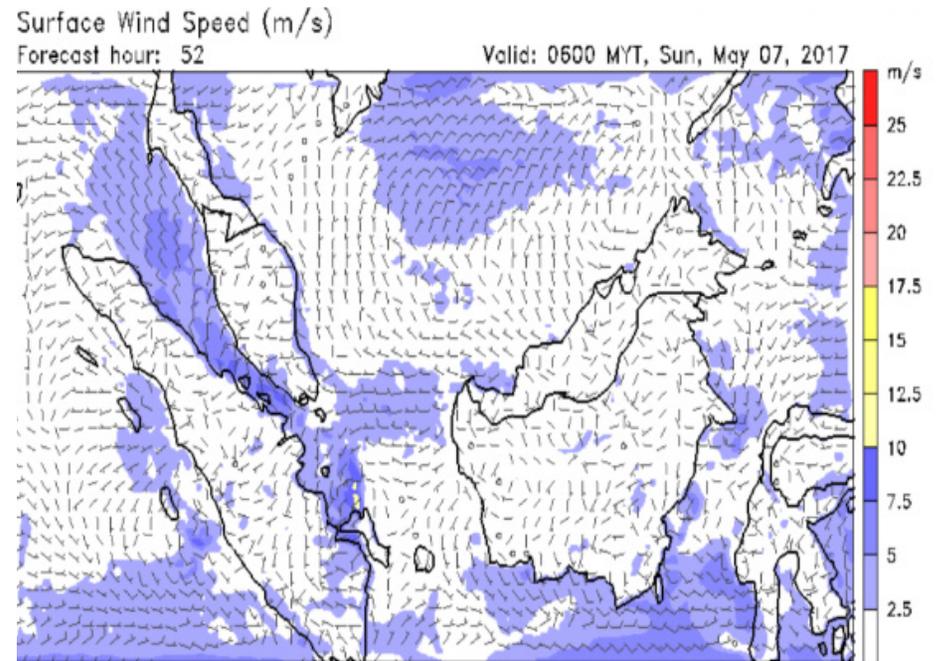
Dr. Wan Azli B Wan Hassan, Deputy Director General (Strategic & Technical) at MMD, elaborates: "With our old system, we were only able to run detailed weather forecasts for three days ahead at a resolution of 3km.

"Not only did we want to increase the range of our in-depth weather forecasts to a week, we also wanted to improve the resolution of our NWP models to give more accurate results."

But when MMD looked at moving to the latest version of its Weather Research and Forecasting (WRF) modeling software, which is specifically configured for the tropics and includes all the new dynamics needed to produce longer-term, higher-resolution forecasts, it realized that its existing HPC system could not support it.

Dr. Hassan explains: "To improve the accuracy of our weather forecasts, we needed to capture smaller-scale weather phenomena. For example, convective thunderstorms can occur in a very localized area that we were previously unable to capture at a resolution of 3km. Convective storms are very common in Malaysia, and they can bring heavy rain, hail, strong winds and even tornados. In order to give people plenty of warning about localized storms, we wanted to be able to generate weather forecasts at a much higher resolution of 1km, not 3km."

In NWP, doubling the resolution of a weather forecast requires a minimum of an 8-fold increase (2x2x2) in compute power. Because MMD wanted to triple the resolution of its weather forecasts from 3km to 1km, it required at least a 27-fold increase (3x3x3) in compute performance.



Dr. Hassan comments: “Everything considered, we needed a 30-fold increase in performance to triple the resolution of our forecasts to 1km. So, we issued an RFP for a brand-new supercomputer.

“To run the latest WRF software, we needed the HPC system to benchmark at least 100 TFLOPs performance. We looked at lots of proposals from different vendors, and the Lenovo Scalable Infrastructure (LeSI) came out on top in terms of performance and cost-efficiency – it met all our compute and storage requirements at the best price.”

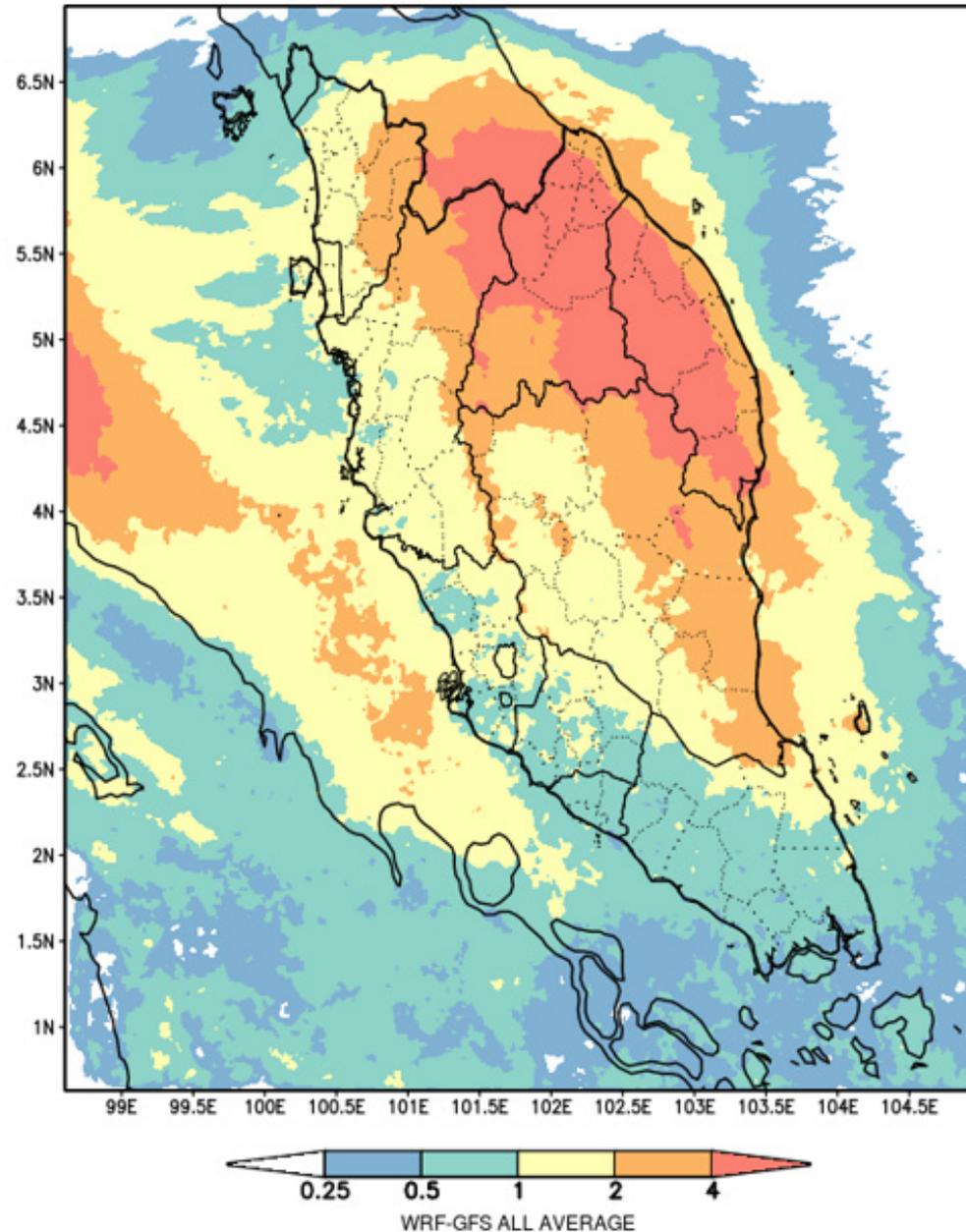
Working with a local partner, MMD implemented a Lenovo HPC system with water cool technology. The cluster is made up of 296 compute nodes with over 8,000 cores, all equipped with powerful Intel® Xeon® E5 processors and interconnected with low-latency Intel Omni-Path switches. The direct water-cooling design, where water is taken into the servers, circulates around the components and then leaves the system drawing heat with it, removes up to 90% of the heat.

Scott Tease, Executive Director of HPC and AI at Lenovo Data Center Group, says: “MMD’s Lenovo Scalable Infrastructure is one of most innovative IT systems used for weather forecasting anywhere in the world. The system’s water-cooling design means that it can deliver massive amounts of processing power very efficiently with a small physical footprint.”

Dr. Hassan recalls: “The implementation went smoothly and was completed very quickly. We’ve been running the latest version of the WRF software on the Lenovo cluster for 10 months now, and we are really happy with the system performance.”

Today, MMD can run the model for a seven-day forecast at a resolution of 1km in under three hours. What’s more, the organization has the computing capacity to complete not one, but four seven-day forecasts every day.

WRF-GFS ALL AVERAGE



“The difference compared to our old HPC system is remarkable,” notes Dr. Hassan. “Performance levels are so much higher, enabling us to generate longer-range, more detailed forecasts than was previously possible. This means that we can provide more informative and accurate services to the public and to affiliated government agencies – who rely on our meteorological data to serve citizens in all kinds of ways, from irrigation and drainage planning to disaster response.”

MMD’s ability to generate seven-day forecasts at 1km resolution means that it has more time to issue early warnings in the event of adverse weather or natural disasters, such as tropical cyclones, tornados, lightning, and flooding from heavy rain.

This gives government agencies, emergency services and the general public more time to prepare for extreme weather situations, potentially saving lives and property.

Scott Tease comments: “Lenovo technology is empowering MMD to deliver higher-resolution, more accurate and longer-term weather forecasts, enabling them to give people earlier warnings that could make the difference between life and death.”

Dr. Hassan concludes: “We’re very satisfied with our Lenovo HPC system – the performance, availability and reliability are excellent. And because we can run longer-term, more detailed forecasts than before, we’re delivering a better, more reliable weather service to Malaysia.”

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– Dr. Wan Azli B Wan Hassan, Deputy Director General (Strategic & Technical), Malaysian Meteorological Department



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Solution components

Hardware

Lenovo Scalable Infrastructure (LeSI)
 • Lenovo NeXtScale System M5 with Water Cool Technology
 • Lenovo NeXtScale n1200 Enclosure
 • Lenovo NeXtScale nx360 M5 compute nodes with Intel® Xeon® E5 processor family and Intel Omni-Path switches
 Lenovo System x GPF5 Storage Server

Software

Altair PBS Works
 IBM Spectrum Scale
 Red Hat Enterprise Linux
 Weather Research and Forecasting

Services

Lenovo Installation Services
 Lenovo Hardware and Software Support Services for 6 years



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—Dr. Wan Azli B Wan Hassan, Deputy Director General (Strategic & Technical), Malaysian Meteorological Department

Generating weather forecasts and prediction models requires lots of computing power. With a powerful Lenovo Scalable Infrastructure (LeSI) equipped with Intel® Xeon® E5 processors, the Malaysian Meteorological Department can deliver longer-term, more detailed forecasts than ever before.

