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Networks Best Practice

Network modelling and emulation

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You're a military commander, with tens of different teams scattered throughout a mountainous area. The enemy is difficult to see, because it's foggy and raining, and your teams may need to call in an air strike over their GPS-enabled digital links at any time. But with all these mountains in the way, will you get the signal?

The easiest way to know what is going to happen to something is to build a copy of it to experiment with, but some models are easier to build than others. Building a second server to test how software will behave if a component fails is one thing, but how do you replicate an entire digital network? Forget a mobile radio network spread around a mountain range, few if any companies have the wherewithal to recreate what's in their building.

Luckily, there is an answer. Companies have taken to building logical models of physical networks to help them understand how they will perform in the future. Network emulation and modelling tools have been available for several years. Some of them, like Scalable Network Technologies' QualNet, came from military research. SNT emerged from a DARPA-funded project to explore ways of predicting network operation during just this sort of military situation, and are now being applied in the commercial space too.

Others are provided by companies such as Shunra Software and Opnet Technologies. They can help companies conduct "what if" scenarios, analysing what will happen to their network if traffic peaks beyond a certain point, for example, or projecting the result of consolidating several links into one for cost-saving purposes.

Pradeep Singh, senior vice-president of engineering in the network management solutions group at Opnet, argues there is a difference between network modelling, and network emulation. The former involves recreating a logical copy of your network and analysing traffic flow. "You have to build a simulation model that faithfully represents a production network to do any kind of accurate analysis," says Singh. A network model can be useful for analysing packet flows across a network and finding security holes such as misconfigured firewalls, for example.

Emulation takes things a step further by running real-world traffic in real time across the virtual model of your infrastructure to see how it copes. "The traffic representation is very important for many of the performance-related modelling practices," Singh says.

Opnet's competitor Shunra sells modelling and emulation software under its virtual enterprise (VE) banner. VE Modeler discovers and models a network topology. VE Network Capture is a software-based tool that captures the network behaviour, and both of these tools fuel the VE Appliance, which emulates the network.

"You can run real traffic through our network in a box, and experience applications in a lab as if they were running thousands of miles apart," says senior product manager Gene Litt.

Because end users are interested in applications and not network packets, it's important to consider application performance and latency rather than simple bandwidth when emulating a network, warns Chris Knowles, head of solutions at network consulting company Dimension Data. "If a customer has three datacentres, and they want to close two and move all the applications into the third, how well will the application perform in the remote country? That would be a typical scenario that a customer might want to model," he says.

Producing a paper-based analysis won't necessarily answer that problem. Some of the more successful projects that Knowles has seen involve connecting an application to the virtual network along with several end-user workstations, and seeing what it feels like.

With the rising importance of wireless technologies in the last few years, the need to model and emulate these networks has also increased. However, as Rajive Bagrodia, CEO of Scalable Network Technologies explains, the parameters affecting the performance of a wireless network can be even more complex. In addition to the technological considerations inside a wired network, you have to consider everything from weather conditions to the changing number of wireless devices in a given area, and how all of this may affect radio signals.

"Because there are so many variables affecting the physical environment, the most important part of computing a wireless network is computing the signal path as a result of them. That is what makes it computationally intensive," he says, adding that the firm takes advantage of parallel computing to speed up simulations.

Whether you're halfway up a mountain about to call in an air strike, or rigging up a VoIP system and trying to predict what it will do to your existing LAN, network modelling and emulation can be a good way to find out. Better know now, and avoid getting into a combat situation with your managing director.