NATIONAL ETHERNET: FACILITATING THE REAL TIME ENTERPRISE

Technology briefing

Cisco Powered Network

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INTRODUCTION: TOWARDS THE LOW LATENCY ENTERPRISE

In the traditional way of doing business, when a manager wants to know sales figures for the South East, or production volumes at the Manchester plant, or inventory levels at the Glasgow warehouse, it's a matter of waiting until the numbers come in, usually in the form of a daily, weekly or monthly report. In both large and small enterprises, there's often a delay between real world events and business response. Event... Delay... Response.

1. National Ethernet is the ideal wide area networking service for distributing, event driven N-tier applications between business sites.

2. National Ethernet makes it far easier and affordable to distribute and share common applications between sites on your network.

3. As all IS systems and applications can be effectively glued together using National Ethernet, it becomes possible to maintain real time information in a single decision support system (DSS) allowing different levels of management to access financial and operational performance information that they require.

4. National Ethernet allows consolidation of IT resources and improved server and storage utilisation across your network.

5. National Ethernet makes it more affordable to unite enterprises with their suppliers, customers and partners in a seamless network of real time B2B interactions. As extended supply chain management (SCM) traffic increases, the National Ethernet service is flexible to be upgraded within days.

Delays are seemingly a fact of life. Recently, however, leading companies are achieving significant operational and competitive advantages by going against the principle that there must be a substantial delay between real world events and business responses. For these companies, latency is not a given. In a wide range of organisations, including banks, manufacturers, service companies and retailers, the success stories are starting to emerge: it pays to reduce business process latencies in production, supply chain, distribution, decision making, reporting and other key functions.

Low latency leadership

Real Time Enterprise (RTE) is one way to describe organisations that progressively eliminate unnecessary delays from business processes at all levels of the enterprise. Note that RTE in this context is not "instantaneous" or "real time" as it is in assembly-line automation or robotics. RTE in the

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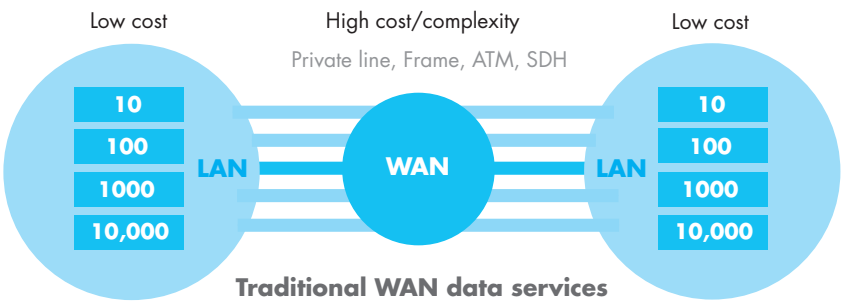
enterprise IT setting means "near real time" responsiveness, allowing rapid, intelligent reactions to market conditions and external events.

In terms of customer relations, operational efficiency and competitiveness, Real Time Enterprise scenarios are quite compelling. Consider, for instance...

- A customer orders a product on an ecommerce web site and sees real time inventory information that resides on a back office system in another city 500 miles away.
- A sales representative in a virtual call centre executes a successful up-sell by consulting a live record of the customer's history of interactions at many different touchpoints across the enterprise.
- An exception alert is triggered in an ERP database, causing a travelling director to receive an instant message on a handheld PDA device: "Inventory levels for widget X are unusually low!"

The Real Time Enterprise is a worthy goal, but it requires the right mix of advanced IT and networking resources. In enterprises that are distributed across geographically distant sites, the Wide Area Network is a big factor. This guide will examine the role that National Ethernet services can play in successful Real Time Enterprise initiatives, with a focus on three particular areas:

1. Event driven enterprise applications.
2. Real time business intelligence.
3. Adaptive enterprise capacity management.



Wide Area Networks: The process bottleneck

Enterprises are increasingly moving towards applications that support near real time business processes. But advanced back office and front office applications cannot reach their full potential if they are not protected from the negative effects of distance on data flows. The latencies introduced by distance are felt at every level of the enterprise. Given the highly dynamic and distributed nature of today's business climate, enterprise resources are getting more distant from each other as time passes, not closer. In the ebusiness era, distances between employees and key applications are bridged by the enterprise's Local and Wide Area Networks. LANs and WANs knit together an enterprise's business processes and the quality of these networks has a great effect on the overall business performance of the enterprise. Ethernet is the dominant LAN method in today's enterprise IT systems. Ethernet is a universal standard that creates high performance, low cost connectivity within buildings and local campuses in all types of organisations. In the past 20 years, the speed of Ethernet Local Area Networks has increased more than 1000 times. In the same period, the speed of Wide Area Enterprise Network links has increased by only a small fraction of this amount.

Enterprise WANs are slow and complex, relative to needs of LAN-based business applications. They are also expensive and time consuming to configure and change. WANs use a set of protocols, devices and network management systems that have very little in common with the technology

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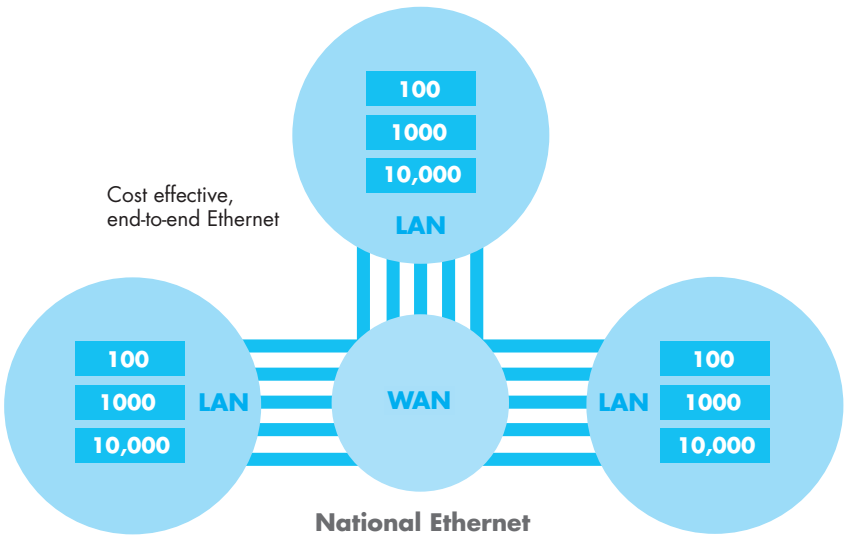


used in Ethernet LANs. The result of all these WAN differences and deficiencies is that enterprise IT planners have to design enterprise applications so they accommodate the bottleneck that WANs introduce into the end-to-end IT architecture. For years the high costs and low speeds of circuit based methods like Frame Relay and private lines have made it difficult for enterprises to span distances with real time business processes and low latency workflows.

National Ethernet: A transformational technology

Fortunately for the Real Time Enterprise movement, the inherent limitations of circuit based Wide Area Networks have finally been surpassed. National Ethernet services from THUS, make it possible to seamlessly bridge distances between enterprise locations with cost effective Ethernet WAN connectivity. With National Ethernet, enterprises can now connect sites throughout a city or across the country at speeds of up to 1 Gigabit/s, far surpassing traditional WAN services in terms of bandwidth, compatibility, ease of deployment and cost efficiency.

National Ethernet is accessed by standard Ethernet interfaces that are found on low cost LAN routers and switching devices in office buildings everywhere. In addition to its low installation and maintenance costs, National Ethernet also has the advantage of being software provisioned, which means that WAN bandwidth may be easily adjusted up or down in small increments to meet the needs of real time processes.

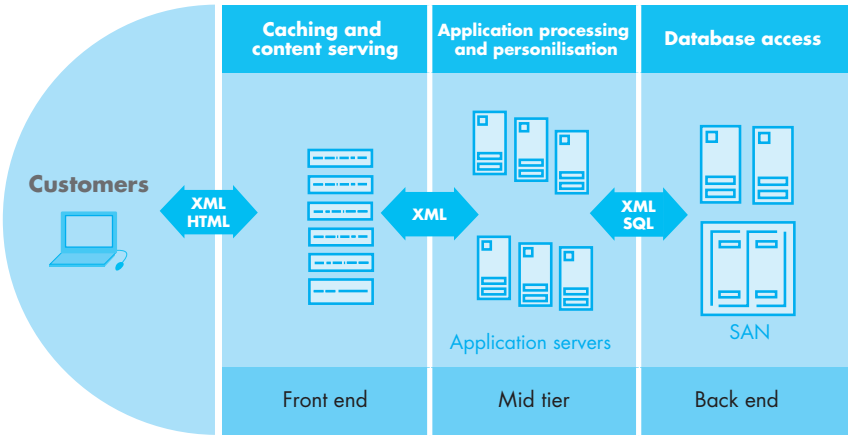
National Ethernet is in many senses the ideal low latency approach to Wide Areas Networks, delivering unprecedented levels of bandwidth in a service that changes and evolves at the speed of business. Now let's look at the real time applications that are possible when National Ethernet is used to improve the speed, intelligence and agility of enterprise processes.

The goal is event-driven business processes, where customer, production and demand/supply chain events ripple through the entire enterprise in real time.

NATIONAL ETHERNET AND EVENT–DRIVEN BUSINESS PROCESSES

Event-driven business processes, a key characteristic of RTE, can speed up production cycles, transaction handling, supply/demand chain activity and other time-consuming operational functions. Event-driven applications are the goal of the IT industry but their success is very network dependent.

One of the prime characteristics of today's ebusiness era is the increasingly public visibility of previously isolated back office and finance systems. For instance, a customer can now start a transaction on a web site or in a call centre and get an immediate response from a company's distribution, pricing, or accounting systems. Increasingly, customers and field representatives have direct remote access to core back office IT applications and these transactions must be conducted in real time. Whether it's retrieving money from an automated teller, checking the status of an overnight shipment, or booking an airline ticket, there must be fluid high speed connectivity throughout the enterprise, or business performance response will suffer.

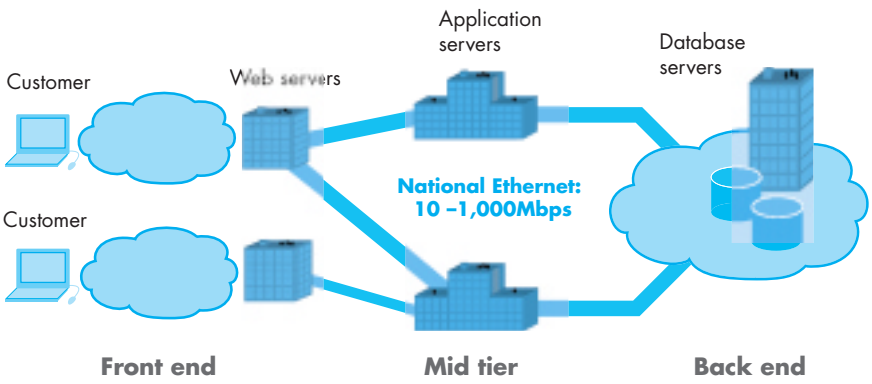


In traditional IT systems, when a sales order or some other front office event takes place, the back office, distribution, billing, and customer support systems may be unaware of the event for a substantial period of time – days in some cases. In the RTE approach, the goal is event-driven business processes, where customer, production and demand/supply chain events ripple through the entire enterprise in real time. In the technology area, there are two major requirements for a distributed, event-driven enterprise:

1. An event-driven IT architecture.
2. A high bandwidth, low latency network that ties all the users, data and application programs together.

To create event-driven architectures, IT architects are using web services, XML, .NET, J2EE and other distributed methods to create "N-tier" applications that separate the various logical aspects of applications onto specialised front, mid and back end servers. N-tier systems are very modular and "loosely coupled".

Avoid huge centralised, monolithic applications with vertical silos of isolated data and batch cycles that don't respond to external events, market dynamics or changing customer needs.



The front tier is made up of web servers, caching appliances and load balancing devices that provide the user interface for customers and other users. The mid tier is where the application's logic resides. The application software can be in the same server as the front end interface, or in a different server in a remote location. Back end transaction processing systems and databases are typically located on large servers or mainframes in data centre facilities where many different applications can access them.

N-tier architectures are ideal for fast evolving event-driven business environments, because they are very flexible and adaptable in the way they are deployed around the enterprise. The modularity of the N-tier approach allows it to maintain its performance and availability while scaling up. Processing power can be scaled incrementally by adding servers and software modules to any tier as needed. The idea is to scale up by "scaling out" in a distributed manner. This avoids huge centralised, monolithic applications with vertical silos of isolated data and batch cycles that don't respond to external events, market dynamics or changing customer needs.

There are many uses for event-driven N-tier systems in both customer facing and production areas of the enterprise. In the example diagram, an event-driven retail architecture has front end servers located in local store front sites; the application layer (mid tier) is hosted in two different regional ISPs and the back end databases are located in the headquarters data centre. With National Ethernet connectivity, the Wide Area Network looks like one big, high performance LAN to applications and users.

Another example of N-tier event-driven systems can be seen in the financial industry. Banks, brokers and other financial and wholesale financial institutions are under great pressure to make their back office financial systems available to customer transactions in real time. But opening the back office to customer interactions can put tremendous pressure on transaction systems that are not designed to handle so many direct user sessions. With the N-tier approach, a layer of application servers isolate back end databases

The standard protocols and interfaces of National Ethernet integrate easily with distributed applications, greatly lowering deployment costs and capital equipment investments.

from front end customer sessions. This way, customers don't need direct sessions with the back end database server. Instead, customer sessions are aggregated into applications servers and mid tier applications can access back end resources on behalf of customers with a limited number of sessions. National Ethernet provides the LAN like connections between layers, ensuring high response times across a very distributed system.

Enterprises are sinking millions into next generation EAI, web services, J2EE and similar distributed application development efforts. But these applications will not meet their potential, if the Wide Area Network continues to be a complex, expensive bottleneck in the enterprise architecture. N-tier systems by nature require ample amounts of flexible, scalable network bandwidth, which is not possible when Wide Area Networks are built with traditional Frame, ATM and Leased Lines. When National Ethernet is deployed between major sites, all the layers and modules of an N-tier event-driven system can be connected on a seamless wide area Ethernet LAN that provides very high bandwidth (up to 1Gbit/s) via standard 802.3 Ethernet.

The standard protocols and interfaces of National Ethernet integrate easily with distributed applications, greatly lowering deployment costs and capital equipment investments. National Ethernet's lower cost per megabit of WAN connectivity means that Frame, ATM and Leased Line can be replaced with much higher speed WAN pipes, without breaking the budget. National Ethernet is the glue that helps enterprises realise their real time enterprise goals with flexible, modular event-driven N-tier applications.

In addition to the delayed nature of traditional reporting cycles, there is also the problem of fragmented islands of legacy automation silos that make it very hard to get a total view of operational data across workgroups.

NATIONAL ETHERNET AND REAL TIME BUSINESSES INTELLIGENCE

If managers and directors are to use event-driven business processes as a competitive tool, they need high levels of decision support and real time business intelligence (BI) capabilities. What's needed is a continuous flow of timely information about production systems and a myriad of customer touchpoints throughout the organisation.

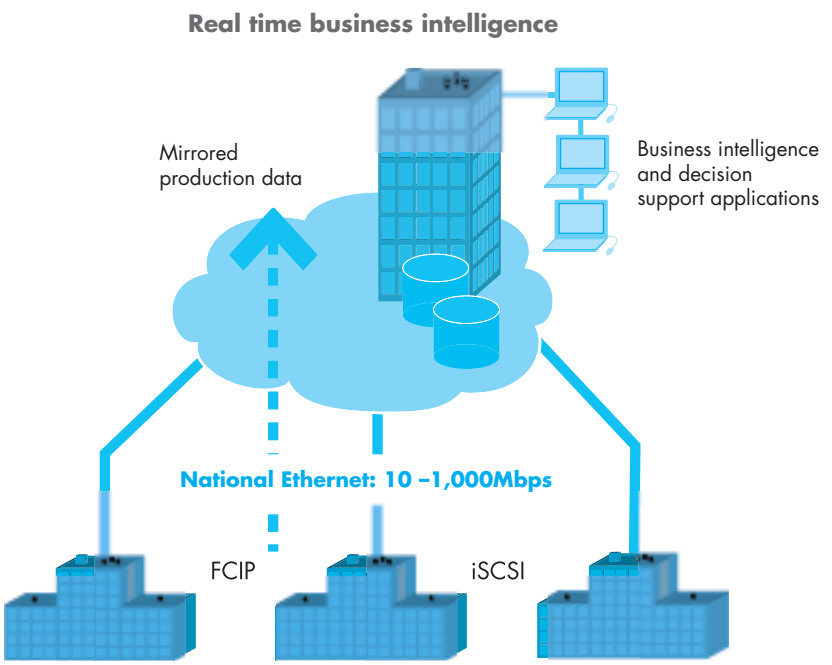
In traditional decision support systems, periodic reports are the main tools that managers, directors and knowledge workers have to base analysis and business decisions on. In addition to the delayed nature of traditional reporting cycles, there is also the problem of fragmented islands of legacy automation silos that make it very hard to get a total view of operational data across workgroups, departments, business units, supply chains, etc.

With batch reporting cycles and fragmented decision support systems, decision makers are too often out of step with fast moving markets and competitive forces because they must rely on incomplete and untimely information. In contrast, real time business intelligence moves live data from many different production systems into data warehouses and BI programs for immediate ad hoc query and interactive analytics. The cost of multiprocessor workstations, data-mining and visualisation software and high performance 64-bit database server clusters has come down dramatically in the past few years, which has made world class BI capabilities available to a much larger range of companies than was previously possible.

BI hardware and software building blocks are now available at an affordable cost, but in distributed enterprises, production datasets and business analysts are often not in the same location. Take for example, an enterprise with three vertically integrated business units that each has their own ERP and back office IT resources. These systems would traditionally create periodic reports for a headquarters staff that is in the dark about production and front office activities until the next report arrives.

Real time business intelligence systems, in contrast, receive mirrored production data from the three business units in real time (see diagram). Using National Ethernet, the mirrored data flows across the WAN into the central data centre without a bandwidth bottleneck. The remote mirroring process gives business analysts and managers in the HQ office a complete set of live data to analyse without impacting the performance of production processing.

The smoothly scaling 10-1,000Mbps bandwidth of National Ethernet provides the ideal, cost effective high bandwidth WAN connectivity.



Business units and production systems

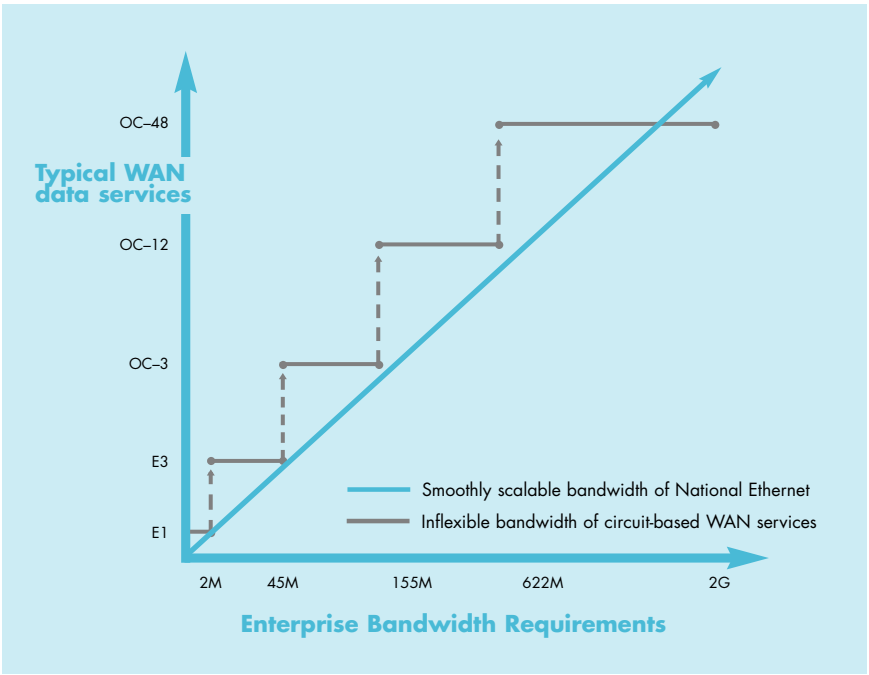
When a company's major datasets are duplicated in a business intelligence system, the live data is typically augmented with archived data from data warehouses that scale to multiple terabytes. The combination of live and historical data "rolled up" from multiple business units gives decision makers a complete 360 degree view of enterprise operations. Real time intelligence lets managers respond immediately to changes in critical business metrics like inventory and raw material levels, production rates, distribution/logistics, and so on.

Given the large amount of bandwidth necessary for remote database mirroring, network costs will in many cases be prohibitive with conventional Frame, ATM and circuit based network connections. The smoothly scaling 10-1,000Mbps bandwidth of National Ethernet provides the ideal, cost effective high bandwidth WAN connectivity, so prodigious amounts of live data can flow from business units to central BI systems. In the event of a failure of a primary production database, the business units can use the National Ethernet backbone to access data in the mirrored BI systems which serve as backup resources.

Changing business conditions, changing network resources

As business conditions change, the amount of data generated by IT systems can change significantly. Seasonal changes in supply and demand, as well as mergers, acquisitions, and many other market and environmental influences can affect the size and transaction rate of production systems. Changes in IT activity have a direct effect on network utilisation, in some cases requiring upgrades to network connections. If private lines or virtual circuits are used for connectivity, upgrades to network bandwidth happen in large increments that do not map well to actual enterprise needs. This often results in

Adjustments to bandwidth can be made with software controls, which avoids the lengthy provisioning times that are associated with changes to physical or virtual circuits.



wasteful oversubscription of WAN lines as WAN networks step from 2 to 34 or 45 and then to 155Mbps, with no intermediate increments (see diagram).

National Ethernet WAN links avoid this situation with flexible bandwidth that can scale up or down from 1 to 1000Mbs in increments as small as 1 Mbps. Adjustments to bandwidth can be made with software controls, which avoids the lengthy provisioning times that are associated with changes to physical or virtual circuits. National Ethernet is unique in its ability to give distributed BI systems the bandwidth they need to respond to market and competitive dynamics. Business intelligence systems based on National Ethernet are an effective management tool for decision makers who guide event-driven "sense and respond" businesses.

To achieve the IT agility and dynamic workload balancing, enterprises must be able to rapidly reconfigure their Wide Area Networks so that large amounts of data can be copied or replicated in real time to remote locations.

NATIONAL ETHERNET – AGILE ENTERPRISE CAPACITY MANAGEMENT

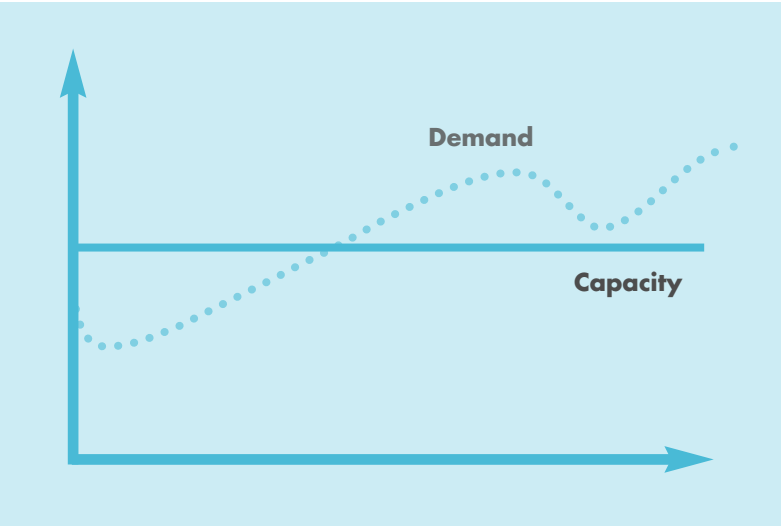
Dynamic, economic and competitive conditions can put a great deal of pressure on a company to rapidly change its internal processes. Businesses must be able to innovate and change in response to any number of external influences. The previous two sections of this guide examine how National Ethernet can be used to reduce latencies in business processes and to increase business intelligence. In this section we will look at how flexible IT capacity management can lead to better business agility and resource load balancing.

One of the biggest challenges for today's business planners is the capacity management of internal resources, including machinery, office space, workers, IT systems, and various supply chain components. Weak capacity management means that enterprise resources are often idle, wasted and underutilised. Weak capacity management can also mean that business is lost when demand spikes occur and capacity can't adapt. Good capacity management lets enterprises get more out of existing resources while responding flexibly to customer and competitive demands. In the ideal capacity management environment, business processes are not completely tied to specific locations or specific sets of physical resources. In the IT realm, this means that major IT applications and datasets can be repurposed at different locations throughout the enterprise to meet changing business needs. If IT capacity is rigid and tied to fixed locations and hardware, the business can't use its valuable resources to best effect.

Dealing with demand peaks and valleys

Flexible IT capacity lets businesses balance workloads across multiple sites, making underutilised resources on one site available to a business process on another site that needs more capacity. Take the example of an insurance company facing a natural disaster that demands 50 additional claims adjusters for a period of several months. In this scenario, the existing claims processing office, which is located next to the data centre, has no additional space for new workers. Another office on a different site does have the space for 50 additional workers, but it does not have access to the necessary claims processing database. This is a case where location-dependent IT systems are limiting business agility.

To achieve the IT agility and dynamic workload balancing, an enterprise has to be able to rapidly reconfigure its Wide Area Network so that large amounts of data can be copied or replicated in real time to remote locations. To accomplish a rapid increase in bandwidth on traditional WAN



National Ethernet: Unique WAN agility

The picture with National Ethernet could not be more different. When an enterprise experiences a major spike in demand, National Ethernet has the ability for "just in time" provisioning that anticipates seasonal peaks and valleys. The only special expense in terms of upward scalability is the move from a 10/100 interface on CPE router or switches to a Gigabit Ethernet interface, if bandwidth is needed above 100Mbps.

connections, network engineers will have to add expensive cards to routers, switches or other WAN interface devices. (The cost of a connection port on traditional WAN equipment can be up to 10 times or more the cost of a standard Ethernet interface.)

Added to the cost of expensive network devices and interface cards are the special engineering skills required to install, configure and manage the traditional WAN CPE components. Because upgrades to traditional WAN resources can take weeks or months, network administrators are often forced to upgrade prematurely, so they have a "just in case" margin for applications that require extra bandwidth on short notice.

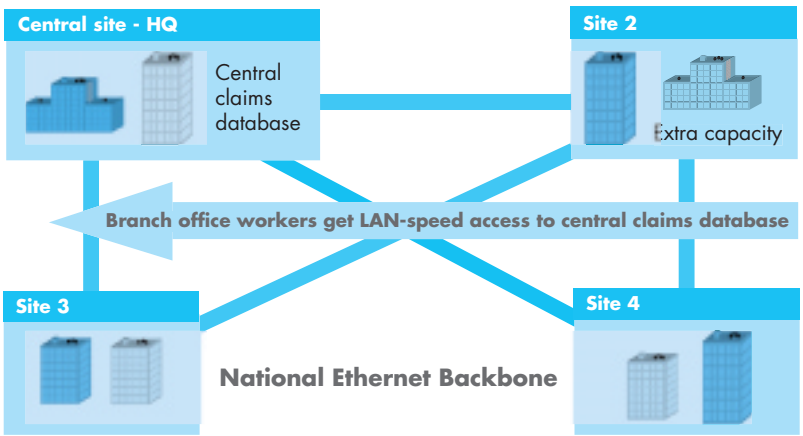
In the case of the insurance company that must rapidly scale up its claims settlement capacity, 50 extra claims adjusters could be added on the remote Site 2 (see diagram). These workers use applications that remotely access claims processing systems in the Central HQ site via National Ethernet. For the duration of the demand spike, the National Ethernet bandwidth between the headquarters site and Site 2 is increased using software controls, with very little labour cost or lead time. When demand returns to normal, the bandwidth is adjusted back to its previous level, ensuring that the enterprise does not pay for unneeded WAN capacity.

A National Ethernet backbone creates a good environment for advanced

The economical and highly scalable nature of National Ethernet WANs gives enterprises the ability to use IT and human resources to their utmost.

capacity management techniques, allowing space, IT resources and workers to play a more flexible role in business operations. Managers are increasingly favouring multipurpose internal resources and services that can be adapted to changing business needs. With a flexible, software controlled National Ethernet backbone, users in one location can access data and IT resources on another site as if they are on the same LAN. When the whole wide area enterprise acts like a virtual LAN, there is no penalty for crossing large distances, enabling very precise capacity utilisation and workload balancing.

In general, the economical and highly scalable nature of National Ethernet WANs gives enterprises the ability to use IT and human resources to their utmost. When this operational agility is combined with an event driven IT architecture and powerful distributed business intelligence systems, the goal of a low-latency high-response enterprise is in reach.



"In the next 10 years, Ethernet will inexorably take over the metropolis." Michael Howard, principal analyst of Infonetics.

UNDERSTANDING NATIONAL ETHERNET

Ethernet is perhaps the most remarkable success story in the network industry. It has overtaken virtually everything in its path in the local area and it's now well on its way to dominating metropolitan and national area networks. Ethernet WAN connections worldwide reached 750,000 in 2002 and Infonetics Research predicts it will grow 337% to 3.3million by 2006.

According to Michael Howard, principal analyst of Infonetics: "In the next 10 years, Ethernet will inexorably take over the metropolis." Clearly, need for faster networks and more flexible provisioning of WAN bandwidth gets ever greater as internal LAN connectivity migrates to Gigabit Ethernet and application traffic patterns get increasingly dynamic. From an end user standpoint, National Ethernet is as simple as a standard RJ45 or optical connector. But as with any enterprise infrastructure technology, National Ethernet does have a number of architectural and deployment issues for IT and network designers to consider.

The most common type of National Ethernet deployment is a point-to-point layer 2 link between two sites. These sites can be in the same city or in widely separated cities. In some cases the Ethernet WAN link can simply be bridged into existing LANs on either side of the wide area. If broadcast filtering and traffic control is desired, the Ethernet WAN link can be terminated by a layer 3 router on either side. Various LAN switching and VLAN methods can also be used to control traffic across National Ethernet links. The key point is that the WAN now looks like a standard 802.3 link on either end.

The bandwidth into sites can be provisioned at 10, 100 or 1000 Mbps. Virtual LANs (VLANs) are then configured between these sites, running as trunks over the MPLS network at bandwidths from 2-1000mb to suit the customer's applications and budget. Trunk bandwidth can be re-graded within a few days to suit your needs. The bandwidth that National Ethernet delivers is up to wire speed, with none of the contention ratios or sharing limitations of conventional first generation broadband connections (e.g. ADSL). The VLANs are very much like VPNs in the sense that each customer's traffic is logically isolated from other traffic on the WAN backbone and on the access pipe where multiple VLANs terminate at a site. National Ethernet bandwidth is completely symmetrical, overcoming the limitations imposed by current asymmetrical broadband services that typically limit upstream traffic to 256Kbps. This makes it highly suitable for real time applications with peer-to-peer relationships.

National Ethernet is highly suitable for voice over IP and video conferencing/streaming applications.

Suitability for enterprise applications

National Ethernet may be suitable for virtually any application environment that utilises LAN connectivity, including high performance transaction processing, financial services, OLAP/BI, ERP, CRM, computer aided engineering, digital content creation and so on. Enterprise applications should see no effective difference between an Ethernet LAN link and an Ethernet WAN link.

Because it has reasonably low latencies (e.g. less than 80ms), National Ethernet is also highly suitable for Voice over IP and video conferencing/streaming applications. As with any layer 2 environment, delay sensitive applications over National Ethernet will benefit from QoS and traffic management services provided at high layers of the network stack.

This guide is part of a series on advanced Wide Area Network solutions from THUS. For additional information, please see these publications:

NATIONAL ETHERNET: ARE YOU READY?

A managers' guide for those interested in preparing for and deploying National Ethernet in UK enterprises.

NATIONAL ETHERNET: FACILITATING THE REAL TIME ENTERPRISE

Along with event driven IT systems, advanced business intelligence and flexible capacity planning, National Ethernet is a key factor in the realisation of low-latency Real Time Enterprises.

NATIONAL ETHERNET: EXTENDING THE ENTERPRISE

A guide to using National Ethernet to extend business critical IT applications to supply chain partners, customers and virtual workgroups across the UK.

NATIONAL ETHERNET: ACHIEVING BUSINESS CONTINUITY

A "how to" primer on using advanced National Ethernet connectivity to create a resilient "bullet proof" IT infrastructure.

EVOLVING TO MPLS VPNs

An in depth look at the state of today's enterprise network and how the evolution from PVC circuits to packet-based IP virtual private networks pave the way for a powerful new peer-to-peer voice, video, CRM and workgroup applications – and the ability to give time sensitive interactive applications and ERP, back office and transaction processing systems, a higher level of traffic priority on a cost effective, IP-based any-to-any mesh network.

For further information on National Ethernet please call 0800 027 0585
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