

The Energy Efficient Network

Providing a cost-effective and collaborative network platform supporting the organisation's requirements now and in the future

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► MANAGEMENT SUMMARY

Catalyst

The need for a new network architecture paradigm is apparent. Inefficiencies, high overhead, and network complexity can no longer be sustained in the current economic climate. A network platform must be capable of supporting networked sustainability and green IT services, collaboration, mobility, and network virtualisation. To do this, it must be flexible, efficient, and optimised to enable seamless and efficient interaction at any time and from anywhere.

Summary

What is becoming increasingly apparent is that the network can no longer be managed in isolation but must take cognisance of challenges and imperatives faced by the organisation. In discussions with those responsible for the enterprise network a continual theme was of course the need for a secure, available, and cost-effective solution, but also that there is also a growing requirement for the infrastructure to be flexible and scalable enough to cater for new opportunities when they present themselves - be they the inclusion of new partners and stakeholders, additional services, or the connecting of new types of end point to the networking environment.

The network is uniquely positioned to play a leading role in reducing energy consumption and Greenhouse Gas (GhG) emissions with the resultant cost savings, and as a consequence helping to meet the organisation's environmental goals. Whilst networks are responsible for some of the reported 2% that IT contributes to an organisation's total energy usage, and it is important to reduce individual device consumption, this pales into insignificance when compared with the contribution an enterprise network-based power management framework can provide by making inroads into the 98% of energy consumed by the rest of the organisation. In providing support for collaboration tools and services, such as telepresence, the network can also enable better productivity, reduced travel, and flexible working. Although not all the focus should be purely on cost savings, it would be wise to take notice of research that indicates customer satisfaction is also an important business imperative.

The Cisco Collaborative LAN is ideally placed, with the Network as the Platform mantra, to meet the flexibility, scalability, and resilience imperatives expected from a LAN/campus solution and to enable network managers to have the confidence that they will be able to face the future regardless of the internal and external challenges thrown at them. Benefits of the solution highlighted by network administrators include the excellent resilience of the infrastructure and the ability to relatively easily cater for new workload and services.

- The network has a crucial role to play in reducing energy consumption not only of the infrastructure itself, but throughout the organisation exploiting the many connected end points.
- Collaboration is driving the next wave in productivity improvements, supported by unified communications and Web 2.0, as well as multimedia.
- Network virtualisation is extending virtualisation beyond the data centre and supporting environmental objectives.
- The overriding imperatives of network management are to provide a resilient and scalable infrastructure and the need to become proactive rather than reactive, as well as catering for the opening up of the network to all stakeholders.

► FIVE BUSINESS IMPERATIVES

1. Reducing Run-the-organisation Spending

Many organisations are being forced to pursue cost-reduction strategies across the enterprise and also within the IT department. Whilst it is vital to continue to invest in the constant improvement of existing services and infrastructure, it is perhaps more important, from the perspective of adding value, that funds are made available to invest in projects that support new ways of doing business and improving collaboration. Consequently, intelligently reducing run-the-organisation or 'keeping the lights on' spending to fund change-the-organisation/innovation investments has increased significance especially when IT budgets are under pressure. This dovetails very well with a sustainability strategy, as savings made on energy usage also contribute to green objectives.

IT management and senior management must reach an understanding as to the relative merits of each investment strategy and ensure that a balance is achieved between funding for run-the-organisation and change-the-organisation investment. What is important to recognise is that IT management must make a conscious effort to monitor IT spending, and once expenditure is understood, endeavour to increase the proportion of change-the-organisation investment in projects which can aid business transformation and innovation. It is very easy for the day-to-day firefighting and maintenance issues to swallow up increasing amounts of the IT spend and scarce resources.

The challenge for today's network managers is to focus investment in infrastructure and services that deliver flexibility and resilience. The expectation that IT can quickly respond to new opportunities means more pressure will be placed upon the current network infrastructure. If it is not robust enough to handle the new requirements, additional spend will be required to maintain and repair the network to meet new and increasing commitments. What is important is that the network is flexible and scalable enough to meet the demands put upon it and that the services can be provided in the most cost efficient and appropriate manner, ideally without major upgrades.

2. Improving Employee Productivity

Advancements in networking technologies are radically changing the way in which information workers go about their business, and by this we do not necessarily mean the archetypal corporate employee sat tethered to his or her desk in front of a PC monitor. Today's information workers are just as likely to be found out in the field servicing equipment or making sales calls. Indeed, estimates based on government figures from both the US and UK suggest that around 70% of salary costs are now spent on so-called 'information work'.

The new world of work is typified by information access and information dissemination systems, by which of course we mean the World Wide Web and e-mail. But what if these two key aspects of everyday life could be augmented and better integrated in some way? Moreover, how much more effective could businesses be if synchronous and asynchronous communications were unified by some means? In most enterprises, information workers still have separate applications for e-mail, IM, video conferencing, application sharing, collaboration, and Web access. But even those organisations that have standardised on integrated suites still employ working practices and procedures that date back decades. The possibilities and alternative ways of working that are afforded by some of the collaboration solutions that are now on the market are there to be grasped by forward-thinking organisations. There is an opportunity to provide capability that enables employees do more with less and to help them work more efficiently.

3. Maximising Customer Relationships

Datamonitor conducts global surveys of enterprise IT budgets and spending priorities to track IT decision makers' attitudes towards the IT market. In the survey respondents have identified increasing customer satisfaction as an important business driver. IT managers currently promoting new investment as a means of helping organisations lower costs and improve productivity should perhaps take note of the emphasis placed by the respondents in the survey on increasing customer satisfaction, and possibly refocus the justification and messaging to emphasise the customer-facing benefits of network technology.

Despite huge investment in Customer Relationship Management (CRM) and other sales and support systems, organisations continue to find that the information they required to deal with a complex customer query or business issue still resides inside the minds of their employees, and that getting access to this person and their knowledge is not as straightforward as they believe it should be. Indeed, the knowledge required to deal with many of today's high-value business processes will, it seems, always reside inside the collective heads of the organisation's employees, partners, contractors, and representatives. This being the case, connectivity strategies must be reassessed and re-evaluated so that all constituencies within a given ecosystem, supply chain, or business network, can respond as though they were part of a single virtual organisation.

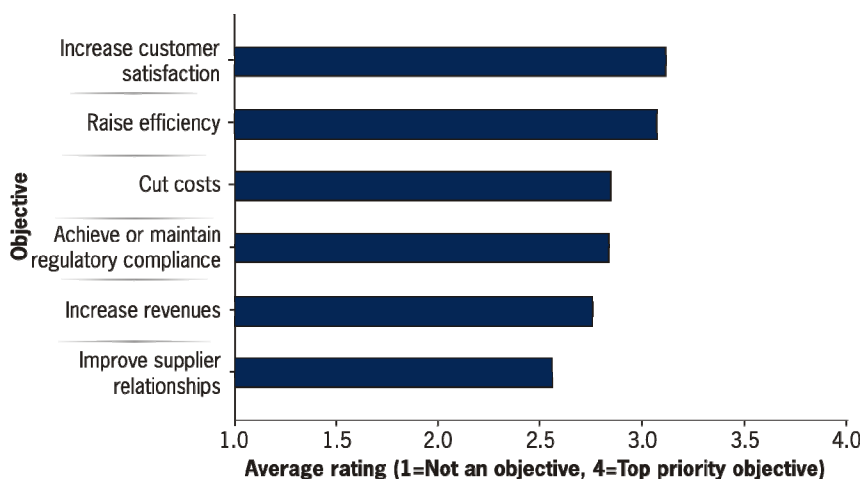


Figure 1: Important Objectives for IT Investment Strategy (Source: Datamonitor Technology Trends Survey 2008 - 4969 respondents)

4. Gaining Competitive Advantage

Business imperatives continue to include the requirement for better flexibility, greater mobility, and continuously improved business processes. In addition, organisations are always on the lookout for ways to reduce costs to keep ahead of the competition. The new breed of networking and collaboration technologies presents an opportunity for companies to realise these objectives. Many organisations are moving from traditional hierarchies based on command and control, to looser structures utilising collaboration and team work. There is a fundamental shift from one-to-one to many-to-many communication. The integration with the Internet, the increasing mobility of employees, and the move towards virtual organisations, alongside the requirement to always improve profitability and customer service, mean that enterprises must embrace the adaptability that services-based communications can provide.

A growing challenge is in providing an opportunity for the interaction of disparate employees and organisations in order to drive innovation. However, this inter- and intra-company interaction brought about through collaboration is not without its risks – loss of corporate intellectual property and commercially sensitive information, for example. But generally speaking, fostering innovation and a product formed through the collaborative efforts of several minds is likely to be inherently more valuable than the thoughts of a lone individual. Like cogs in a machine, bringing together the right people, at the right time, in the right way is what good management is all about, and in the current working environment this is difficult to achieve without collaborative-working tools, such as TelePresence, and Web-based meetings.

5. Catering for the Extended Enterprise

What all of these business drivers point to is a transition to an organisation that is inclusive of all stakeholders, and is no longer constrained by distance, time, unnecessary costs, or other inefficiencies. The extended enterprise now requires a network infrastructure to capitalise on information mobility and the need to be more flexible. There is a requirement for greater location independence, with remote working becoming more popular and many employees no longer remaining in one place for any great length of time. In order for this flexibility and changes in work practices to be catered for it is becoming apparent that the existing separate siloed infrastructures are no longer the answer. To support this ultimately leads to increased network demand, requiring a platform that is both cost and energy efficient, as well as flexible to meet the requirements of an agile and extended organisation.

► TEN LAN/CAMPUS IMPERATIVES

1. Networked Sustainability and Energy Efficiency

Energy usage is not something that the IT industry can ignore any longer. There is growing disquiet both within organisations as a consequence of rising costs, and also in governmental quarters from an environmental perspective. There are mounting regulatory pressures with both the EU Code of Conduct for Data Centres in this area and with the European Commission putting forward the climate action and renewable energy package of proposals which are designed to contribute to the European Union's commitments on fighting climate change and promote renewable energy up to 2020 and beyond.

According to a study published by the Carbon Trust (a non-profit organisation funded by the UK Government), office equipment now accounts for around 15% of total energy use. Moreover, this figure is expected to rise to 30% by 2020 unless businesses act now. With rising energy prices affecting every sector of industry, any reduction in energy use clearly makes good business as well as environmental sense; and so energy consumption is of increasing concern to executives. However, only 2% of a typical organisation's energy consumption is caused by IT so where the network can play an increasingly important role is in controlling the energy usage of connected devices and helping to make inroads into the remaining 98%.

2. Supporting Collaboration

Organisations are working ever more closely with customers, suppliers, contractors, and third parties, and so it is becoming increasingly important to provide up-to-date, efficient, and effective collaboration capabilities. The purpose of any investment in collaboration technology is to enable the organisation to improve the effectiveness and performance of its employees, unlocking their potential. The promise of collaboration solutions is that of enabling geographically dispersed teams and remote workers to engage in value-added activities with customers, suppliers, and business partners.

Increasing productivity means reducing the cost of doing business, and so this is about enabling the business professional to create, find, organise, and collaborate. It means working with people through 'shared spaces' that may be Internet service based, enterprise server based, or connected directly by using Peer-to-Peer (P2P) technology. It means working within and across locations, such as home(s), hotels, and offices; it also means working across and within different businesses, organisations, workgroups, and projects; and furthermore, working across and between different IT regimes, business processes, and corporate policies.

3. Virtualisation

Comprised of physical equipment, such as cables, fibre optics, hubs, switches, routers, and firewalls, most corporate networks are managed as a complex mix of logical, virtual, and physical circuits. In contrast to the general trend of server and storage consolidation organisations are expanding the reach and range of their networks to encompass partners, customers, teleworkers, homeworkers, Managed Service Providers, and of course outsourcers. This places more emphasis on functionality such as access control enabling the authentication and authorisation of entities connecting at the edge of the network and assigning them to their specific network 'segment'; path isolation creating independent logical traffic paths over a shared physical network infrastructure to ensure separation of segments across the network; and services at the edge with a central policy enforcement point where it is possible to control communications between separate logical partitions or services. Using Virtual LAN (VLAN) and Virtual Private Network (VPN) solutions, network administrators can simplify complex physical networks into more manageable and secure logical networks, as well as extending virtualisation beyond the data centre.

4. Resiliency: Security and Availability

The issues of security and availability must be adequately and continuously addressed within the network environment. The introduction of voice and video on to the network can introduce new security worries and risks. Communication services using the same network can expose weaknesses that could have more serious ramifications on the enterprise's operation than before. Today, corporate network boundaries are often less structured and more dynamic in their nature than they used to be, making it impossible to guarantee 100% security of the network; however, it is important that organisations have identified and mitigated the risks where appropriate.

Network administrators need to be constantly vigilant and ensure that the latest security upgrades have been applied to enable protection that is as complete as possible. It is feasible, by putting in place a number of precautions, to reduce the risks to acceptable levels; deploying measures such as securing physical access to equipment and servers, can help to minimise the risk. Invasion of privacy can be made much more difficult with the deployment of strong authentication at the end point, and the encryption of traffic can prevent signal tampering and breaches in confidentiality.

Security is the key consideration for the converged network platform. Butler Group recommends an holistic approach, using all the tools, both technological and procedural, in the network administrator's armoury to defeat unauthorised access to company information and systems. In addition, organisations must create and implement policies for the deployment and operation of network security, and consider the potential risks from an enterprise-wide perspective.

5. Operational Effectiveness

In practice there are many tasks that demand the attention of network support staff, for instance there is the continual programme of improvements, along, of course, with problem resolution. Many IT departments today rely heavily on their support staff without providing automated tools to aid their work. The tools play a dual role: monitoring takes over the role of running through daily checklists, or at least speeds up that chore, and when problems do occur the tools assist in identifying the problem and make suggestions to resolve them. The tools reduce the demand on the highly skilled support staff, allowing lesser-skilled staff to manage problem resolution in many cases. IT departments therefore reduce the load on their more skilled staff, enabling their time to be spent on higher value projects.

Within IT operations there are increasing levels of process maturity through greater compliance with IT Infrastructure Library (ITIL) and similar frameworks, the use of standardised equipment, as well as IT policies and processes. In parallel, network management tools are evolving to enable the building of self-maintaining and self-managing infrastructure. This has benefits across many functions and enables the network to run more securely and more efficiently, although, many networks are still some way from achieving such a vision with technologies and users maturing gradually. The vision of the completely autonomic IT environment that the enterprise simply does not need to worry about, may be compelling on a theoretical level, yet many hurdles still face the deployment of this type of technology.

6. Flexibility and Agility

There is more than enough evidence to point to adaptability being a key competence of organisations, and the supporting network. Whilst there has been more than enough focus on aligning IT with the business, perhaps we are missing the point, and it is the capacity to change which is the most important attribute. The reality is that change, change, and more change, is the norm for practically every organisation. Whether this is driven by internal factors such as the search for cost savings and continued generation of value for shareholders, or by external factors such as increased competition or a changing social, political, or regulatory climate, the flexibility to respond to changing demands and conditions has become a prerequisite for a successful organisation.

If a commercial organisation is to maintain or improve its market position, or a public service to meet or exceed its targets, then it must continuously reassess both its internal position and external surroundings, adjust its priorities and launch new initiatives, whilst improving the efficiency and effectiveness of its existing operations. To assist with this, IT management must develop an approach to the network that incorporates flexibility in all aspects; including architectural design through to models of delivery, as well as catering for "anytime, anywhere" stakeholders.

From a strategic perspective, this will require choices on how network investments are planned, prioritised, and measured; the building of a scalable platform; the role of third-party services and how these should be integrated into network delivery; and the incorporation of greater flexibility into resourcing. From a network technology perspective, the first challenge is to achieve a level of abstraction between services and the physical infrastructure. There should be a move to provision of common network services, which are ideal for catering for a complex and distributed environment.

7. Visibility

It is important for network administrators to have end-to-end-visibility of the network. This ties-in with the requirement of having a good understanding of how the network infrastructure impacts the strategic goals of the organisation and IT, and of how the two are inseparable. Network management has to be undertaken with the strategic imperatives at the forefront, as well as the limitations of the network infrastructure having to be made evident to the organisation. This dual requirement means that the network management tools have to move beyond the purely technical. The new era of network management is more about helping the organisation adapt to changing external conditions, rather than simply reacting to internal changes.

Monitoring hardware and software within the network is essential. Audit and compliance obligations require careful recording of network activity, and monitoring also enables organisations to check whether network is operating as intended and, if not, initiate action to recognise and resolve problems affecting processes and users. The acceleration of enterprise and technology change, combined with the complexity of the modern network environment, is driving the need for more advanced management functionality. Effective network management can unify and automate administrative processes, reducing costs, implementation timescales, and risk.

8. Governance, Risk, and Compliance (GRC)

For most organisations the network has become a fundamental part of their operations, required by the majority of business processes. In this context, board-level executives certainly have a greater awareness of network-related risk, and this is further sustained by high-profile examples of security breaches, and inadequate disaster recovery provision across all sectors. However, a significant gap exists in trying to communicate the impact of these risks in a way that is meaningful to the organisation. When identifying and mitigating network risk it is better to do so using easily understood terms, such as business continuity, information security, data integrity, and business flexibility.

Organisations in both public and private sectors, whatever the nature of their business, are faced with the need to implement improved controls within their enterprises in order to comply with an increasing burden of regulatory requirements, such as Anti-Money Laundering, Payment Card Industry (PCI), Markets in Financial Instruments Directive (MiFID), Basel II, and ISO standards. Because the network now plays such a central role in the automation of processes and the handling of information, much of the effort of compliance is focused on the network and the need to ensure its integrity, security, transparency, and value. Local, European, and international regulations continue to have an impact on the network, and so organisations are compelled to design and implement appropriate control environments and to then operate them effectively. To achieve these objectives the delivery capabilities of appropriate protection technologies need to be aligned with the rules and regulatory compliance requirements that apply to an organisation's specific operational sphere, as well as integrate with compliance frameworks such as ITIL, Control Objectives for Information and related Technology (CoBIT), and Capability Maturity Model (CMM).

9. Optimisation: Applications and Operations

Organisations are relying on their networks more than ever, with outages or degradation of performance jeopardising all parts of an enterprise's operations which can incur lost sales and quickly lose customer goodwill. A significant component of any business today is its network, forming the foundation on which many critical business applications are based. Management software capable of monitoring and administering the network becomes an important element of the overall IT operational equation, as does the ability to proactively manage network resources, and to be able to react before a problem becomes critical.

Before organisations can contemplate any network optimisation programme, it is imperative that asset and inventory management processes, and common management tools, are put in place. The lack of asset management continues to be a major concern, with many organisations failing to maintain even the most basic inventory of assets. Organisations must start the evolution to an optimised infrastructure with the key initial objectives of standardisation, along with enhancing and centralising management processes. The journey continues with the aim of consolidation to improve utilisation, and the provision of a common platform to provide a balanced, optimised environment, enabling the smooth progression to a service-centric infrastructure, which can bring benefits such as better adaptability and quicker deployment.

10. User Choice

Users want IT services and devices that meet their individual needs and help them to become more productive, and consumer technology appeals because of its low cost, usability, and flexibility. Enterprises want the network to be reliable, secure, scalable, and supportive of compliance regulations, which mean they prioritise manageability over user experience. High expectations set by one type, exacerbate dissatisfaction with what is delivered by the other. In today's environment that means users look outside the organisation for tools they like to use that help them do their job, such as Instant Messaging, and Web-based collaboration tools. For IT management, the challenge is to understand why users opt for consumer over enterprise technology, in order to develop a strategy that maintains a balance between user preference and productivity, and corporate security and compliance.

An obvious solution might be to lock down the network so that no unauthorised installations of software can occur which would deal with security and compliance issues and in some situations this will be appropriate. However, a blanket ban can be counter-productive in terms of fostering innovation, business models, and employee morale. What is clear is that the network must be able to adapt. Increasing familiarity with enterprise and consumer technology coupled with their role within the business means that users have valuable insight. Network managers need to maintain control but a goal must be to create balance and break down traditional barriers to allow growth. Resisting user choice is futile and will result in IT departments wasting time on policing that could better be used on improving the network.

► ENTERPRISE LAN/CAMPUS CHALLENGES

Sunderland City Council

The City of Sunderland has a population of just under 300,000 and is the largest city between Edinburgh and Leeds. It is situated on the north east coast of England. Sunderland City Council is a four-star organisation of 14,500 people, which delivers more than 700 council services with an annual budget of more than UK£700 million.

The Sunderland City Council network supports up to 5,000 end points and consists not only of a core campus LAN but also 100 interconnected LAN sites. Five years ago the network had a reputation for being unreliable, being made up of multiple vendor components and with new equipment being added with no forethought or planning. The network strategy at that time was non-existent and the network administrators were consistently in firefighting mode. Since then there has been a change of emphasis with a strategic blueprint being put in place and with more focus on providing resilience and scalability through the use of common building blocks.

This approach has been successful not least in reducing the number of incidents which has freed up resources for more productive projects. The move from being reactive to proactive means that administrators, more often than not, are able to tell users there is a problem before they are aware themselves. However, security remains the number one challenge for network management, as with every other organisation it is a matter of always playing catch up. Security provision is one of continual improvement to make sure the network is as secure as possible and having the real-time visibility to identify where problems are in the network.

This success has proven to be a double-edged sword in that the network is now being expanded to include eight secondary schools, which will double the size of the network and add an additional 8,000 nodes. Fortunately, the network architecture is able to cater for these large increases in traffic and users, enabling the Council to play an active role in the 'Building Schools for the Future' initiative, as well as support other programmes such as Government Connect and digital inclusion.

In addition, the network is being asked to provide more services on the one converged platform, such as Integrated Contact Centre, Voice over IP (VoIP), CCTV, Building Management, door access, and time-recording systems. Despite the organisation being in the public sector there is a commercial ethos applied to network management with regard to service availability, which is paramount, especially as the network is central to all operations. A not-for-profit organisation is just as focused on costs and a continuing challenge is to do more for less and save money, especially with regard to energy costs which have increased substantially this year. The network is seen as central to initiatives to centralise, consolidate, and virtualise the IT infrastructure, as well as for schemes such as the automatic powering off of PCs.

► THE NETWORK AS THE PLATFORM

The main issue for IT management is of course network security, but this has to be tempered with ease-of-use. The two interlinked problems of usability and complexity permeate throughout the infrastructure. Network services, virtualisation, mobility, and application intelligence will all create value but they will need a common platform to succeed. We are at a tipping point where providing just connectivity is insufficient, and an architectural approach is required to meet future requirements. The next-generation network based on a single common platform will enable the organisation to provide an adaptable foundation on which services can be rapidly and effortlessly deployed, as well as supporting many different device types and connectivity mechanisms.

Network Architecture

The foundation of the network of the future is an integrated platform providing the transport and control mechanism for the voice, video, and data, as well as power consumption. Moving away from vertical siloed proprietary solutions for voice, video, and data to a horizontal architecture will enable the network environment to be broken down into separate layers, making use of industry standards to integrate the hardware, common services, and administration elements. This componentisation and services-based approach increases flexibility, enabling services to be developed independent of the equipment. Using common components improves resiliency and scalability, along with driving down infrastructure costs.

The network is fundamental to enabling the vision of exploiting external and internal resources combined together to meet the needs of the organisation at that particular moment. Without a responsive, converged, and intelligent network architecture capable of managing traffic dynamically to agreed Service Level Agreements (SLAs), there will be reduced effective interaction and therefore, in the longer-term, a decline in competitiveness. It is of paramount importance that there is a move from an unintelligent pipe, to a platform supporting a range of network services, providing a secure, resilient, integrated, adaptive, and centrally managed environment.

The underlying infrastructure must be adaptive, meaning that the right amount of resource is available at the right time. Scalability is about having an architecture that can be easily and incrementally upgraded, and conversely when the peaks in demand have passed, the ability to be downsized to meet the new lower traffic requirements. To be avoided is the need for large-scale investment in new infrastructure that can erode the justification for new services. In addition to the occasional peaks, the platform must be able to cater for the trend towards rapid growth in resource requirements as more and more services and users utilise the same infrastructure.

Cisco Collaborative LAN

In order to meet both the business and technical imperatives of the enterprise LAN/Campus outlined in this White Paper, as well as address the numerous challenges and issues found in the network environment Cisco has adopted an architectural approach, providing an end-to-end secure networking platform on which many different services can be run. The Cisco Collaborative LAN framework is capable of supporting energy efficiency initiatives; multi-media collaboration tools, such as IP video, IPTV, and TelePresence; unified communications; and high availability. The Cisco Catalyst switching products combine with management software to create a secure and resilient platform on which to support anywhere and anytime access for all stakeholders.

Cisco has identified a number of key capabilities which are supported by the Collaborative LAN solution, which include:

- **Networked Sustainability and Energy Efficiency:** Networked sustainability is becoming an important issue which also goes hand in hand with energy efficiency, and by exploiting Power over Ethernet (PoE) and management software capability power management can be automated for IT and non-IT end points attached to the network. The Cisco EnergyWise power management framework is being developed to monitor, optimise, and control the power consumption of all connected network devices, such as phones, access points, PCs, and building systems. By working with other systems and vendors, the network-based EnergyWise architecture can provide IT, facility managers, and executives with information about headquarters' and branch building systems. This technology can be made available through a simple software update.

- **Virtualisation:** The ability to separate groups of network users and resources into logical partitions is a capability which is utilised more and more as the complexity of networks continues to grow. With Cisco network virtualisation solutions enterprises can deploy multiple closed user groups on a single physical infrastructure whilst maintaining high standards of security, scalability, manageability, and availability throughout the LAN. The Cisco Catalyst Virtual Switching System (VSS) technology on Cisco Catalyst 6500 Series Switches enables IT managers to build resilient, stateful, highly available networks whilst optimising network resource usage. Virtualisation also plays a key role in networked sustainability with the dynamic partitioning of resources and the abstraction of services from the hardware allowing improved utilisation.
- **Converged Services:** One of the main advantages of the Network as the Platform approach is the ability to add new services without the need for a significant upgrade of equipment. The unified Cisco network services approach combines wireless and wired networking to deliver secure, scalable LAN access, as well as new wireless and unified communications services, such as video, voice over wireless data network, building access, and IP video surveillance.
- **Non-stop Communications:** Availability has been identified as one of the most important attributes of the network, supplying uninterrupted access to applications, data, and content from anywhere is fundamental. In addition to hardware redundancy and basic failover mechanisms, addressing availability requires resiliency solutions at network and system levels. Cisco offers a number of resilience mechanisms which include Nonstop Forwarding (NSF) for fast Layer 3 failover, Stateful Switchover for sub-second redundant processor failover, In-Service Software Upgrade (ISSU) to reduce planned maintenance downtime, Generic Online Diagnostics (GOLD) for proactive, non-disruptive troubleshooting, and Cisco IOS Software Modularity to enable Cisco IOS Software subsystems to run independent, self-healing processes.
- **Integrated Security:** Another essential attribute of the network is end-to-end security. The Cisco Self-Defending Network provides pervasive security management, ensuring information integrity, and assists with the compliance requirements of regulations. The Cisco Unified Wireless Network infrastructure provides protection against wireless attacks with infrastructure-integrated threat protection, and visibility into the wireless environment, integrated with wired network security. The Network Admission Control functionality offers access layer defence, identity-based trust, and device assessment.
- **Operational Manageability:** Maintaining the network is where the majority of the cost is incurred. Operational costs can be reduced and administrator productivity improved by using integrated functions and management tools to automate, simplify, and integrate network administration. Network management is provided by the Cisco NAPA solution which utilises the intelligence available from the Cisco network to provide an end-to-end view of network and application performance. Another network management tool is CiscoWorks LAN Management Solution (LMS), a suite that simplifies the configuration, administration, monitoring, and troubleshooting of Cisco networks.
- **Application Intelligence and Performance:** The ability to prioritise business-critical applications over other traffic enables the network to deliver the required performance. This capability gives the network increased understanding of networked applications in general and, more specifically, for the newer more bandwidth-hungry interactive multimedia services. Cisco has provided application intelligence for several years offering application-level visibility and control, including stateful application intelligence, protocol discovery using application signatures, full packet, stateful inspection to identify traffic, and intelligent Quality of Service (QoS) control provided to applications on the network.

Customer/End User Benefits of the Cisco Approach

The University of Plymouth

The University of Plymouth has over 30,000 students taught by almost 3,000 staff, making it the fifth largest university in the UK. Over 8,000 of the students are based in 21 partner colleges across the Devon, Cornwall, and Somerset, offering a local learning experience. The University has an annual turnover of UK£180 million. The vision of the organisation is to be an 'enterprise' university. This involves adopting a much more outward facing approach, working in partnership with a range of stakeholders to enable excellence and innovation in research, teaching, and learning, so contributing to economic uplift and social inclusion. A key tenet is that by widening participation it is possible irrespective of age, social class, or neighbourhood to secure a good learning experience. The University was recently ranked first in the UK, out of 119 universities internationally, for its approach to environmental issues.

Key Challenges

The way people interact is beginning to change significantly, especially within the younger generation who increasingly see social networks as places to meet and stay in touch with colleagues, friends, and family. This rise in social networking and its impact on the network is of particular concern to IT management at the University. For many managing the IT environment such behaviour is seen as capability that needs to be prohibited. However, this is not an option for an organisation where the majority of stakeholders are under 21, and where the fundamental desire to communicate and build relationships is viewed as a valuable commodity that has to be harnessed, managed, and channelled for the benefit of all.

This requirement to support the latest collaboration technologies, and where all types of traffic are carried on the network, means that security and resilience continue to be uppermost in the minds of the network administrators. The issue of security must be adequately addressed and continually monitored when contemplating utilising a converged environment. The introduction of voice and video onto the network presents new security worries and potentially exposes new vulnerabilities. Security in general continues to be a major challenge.

The University's many research projects put a particular strain on the network as it is impossible to predict demand for bandwidth. These ad hoc bandwidth requirements are difficult to plan for so there is a need to have the flexibility to be able to react at short notice. In addition, teaching staff and researchers have the expectation that they will be able to have access from any location worldwide and still get the same experience as if they were logged on locally. In managing a network supporting such a diverse and dynamic community, there is a desire to be proactive rather than reactive.

The challenge is to provide the best service possible whilst being constrained by both finite physical, financial, and people resources. This is particularly pertinent during the current economic slowdown which not only has an impact in the commercial sector but is also impinging on public sector organisations. The ability to do more with less is certainly applicable to the University, where personnel constraints mean that the speed of new capability deployment is dictated by resource availability.

The University is leading the way in the UK educational sector with regard to environmental concerns. There are a number of approaches and technologies that can be adopted within the IT environment to assist in meeting the demands of reducing the environmental impact. The more efficient use not only of network infrastructure, but also of equipment attached to the network represents an area that the University is actively looking at to improve sustainability and reduce costs.

Solution History and Benefits

In 2002 the University suffered from poor network reliability and around this time the University was also taking shape from the merger of a number of disparate colleges and further education establishments. The decision was taken to manage IT centrally and to go out to tender for a new network infrastructure with fibre at the core and offering much better resilience, as well as being able to cater for future expansion. Cisco was chosen to provide the new PlymNet 4 network. This network infrastructure served the University very well for a number of years providing a stable platform for connectivity between the centralised IT function and the various faculties.

In 2007, as part of an IT infrastructure refresh programme, the campus network was upgraded to a 10 gigabyte backbone, along with topology changes to further improve security, resilience, and disaster recovery. The upgraded Cisco network formed the first phase of PlymNet 5 where voice, video, and data traffic could begin to utilise a converged platform. The network is no longer seen as a general resource providing just connectivity, e-mail, and Internet access, but as a foundational platform capable of providing support for services such as telephony, CCTV, smartcard access, and building management. The upgrade has also afforded the flexibility to quickly provide additional ad hoc bandwidth when required by research projects. With the network platform in place the University is now in a position, when resources allow, to deploy additional unified communication capabilities and other Cisco services.

One of the main benefits identified by the University from adopting a Cisco networking solution is that its future requirements have already been catered for in the company's roadmap. Whenever the University is ready to adopt a new technology or service Cisco has been able to provide a solution not only used by the company itself but widely tested and proven elsewhere. For example, the ability to deploy IP telephony and Power over Ethernet (PoE) over the network has reduced the installation costs of phones by cutting down on power sockets and cabling. The University is also exploiting its PoE technology to allow it to be an early adopter of new energy-saving capabilities available from Cisco and so be able to further enhance its environmental credentials. Resilience and reliability are also crucial facets of a networking solution. The University feels that by using Cisco infrastructure it is better able to ensure service availability and meet the many challenges found in the networking environment, as well as cater for future requirements.



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