Alder Hey Children's NHS
NHS Foundation Trust

ALDER HEY IM&T STRATEGY (2010-2014)
RAPIDLY REENGINEERED IT PLAN

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INTRODUCTION

The digital hospital of the 21st century comprises a completely automated and deeply integrated set of health information services capabilities that fulfil clinical, financial, and administrative requirements. Core technologies in a 21st century hospital include digital radiological image management solutions (picture archiving and communications systems, or PACS), medical devices, patient and equipment tracking solutions, and other technologies. The 21st century hospital relies on technology as an integral and fundamental part of its business strategy. Technology is applied to every facet of clinical and business operations—integrating people, process, technology, and cultural elements. Technology is defined more broadly than is typical in the healthcare industry. The 21st century hospital goes beyond advanced clinical systems and includes significant additional integration between information technologies and medical technologies, such as patient beds, surgical equipment, nurse call and communications systems, hospital lighting systems, mobile phones, personal digital assistants (PDAs), pagers, and heating, ventilating, and air conditioning (HVAC) systems.

A fully digital 21st century hospital would not produce or use paper records. It would have digital imaging, order transmission, clinical notes, and other aspects of the electronic health record. It would have integrated supply chain management and integrated revenue cycle management. The 21st century hospital relies on technology as an integral and fundamental part of its business strategy. It enables organizations to fully realize a hospital's latent potential for delivering higher quality care in increasingly efficient ways through the use of information technology and process redesign. Modern healthcare delivery is increasingly recognized as an information business as well as a people business, but many healthcare delivery organizations seem significantly under-provisioned in modern information management capabilities.

The ideal healthcare system of the future - under any funding model - is typically described as being more flexible, responsive, and adaptive. Such a system comprises organizations that can integrate care across care settings and organizational boundaries, and that can adjust quickly to changing patient needs, to improving standards in clinical practice, and to new market conditions.

MISSION

The IM&T department's mission is to "integrate Information, Information Technology and healthcare resources seamlessly". The goals of this vision are:

1. To optimise the use of technology in healthcare.
2. To satisfy users and facilitate better patient care through the effective use of technology.
3. To facilitate improved communication between IM&T and other departments within the Trust.
4. To improve communication between the Trust and its patients.

The Trust faces a very significant period of change as it re-designs the way in which it delivers healthcare to the population it serves through its Foundation status.

Information and Information Technology will underpin the changes providing a powerful catalyst for service modernisation. All re-design efforts both clinical and administrative will be formed around patient care and information pathways, and will lead to a Trust wide environment where real-time electronic records and enterprise wide systems are available 24 x 7 x 365. Programme managers will lead the work co-ordinating a series of Trust wide projects delivering fully inclusive stakeholder owned changes to the local service provision. Benefits realisation will be an integral part of the programme with ownership of benefits residing with the service deliverers. Underpinning and enabling work around data quality, data accreditation, patient administration and technical IT infrastructure will be running in parallel with a clear mandate for maintaining current service provision as well as supporting the strategic changes. The work will ensure compliance with all statutory and mandated Information Governance obligations including the Data Protection Act and Freedom of Information.

The IM&T department will focus on:

- **Information Technology Infrastructure**: the development of information, technology, associated support, and the proper IM&T professionals to underpin the services within the Trust.
- **Developing People within the IM&T Department**: develop the right information and information management skills; encourage appropriate education, training and development activities at every level and re-engineer the culture of the department.
- **Data Quality and Information Development**: improve the validity, consistency, accuracy and relevance of data and information so that clinical and managerial decisions can be made on the strength of this information.
- **Supporting Clinical Care**: the implementation of clinical information systems that support health care professionals in the delivery of modern front-line care.
- **Information for Patients and the Public**: improve information for patients and the public to help them make well informed healthcare decisions.

INFORMATION TECHNOLOGY INFRASTRUCTURE

This will put in place an IM&T infrastructure of communication links, systems and people that will facilitate the re-configuration of services. The IM&T infrastructure will be:

- **Sustainable**: it will be able to be exploited for the full range of healthcare developments envisaged by the modernisation programme and it will need to be flexible enough to cope with the many changing demands for new healthcare services and applications.
- **Cost effective**: there will be a major challenge to make continuing investment in infrastructure affordable.
- **Trusted**: many ad-hoc and piecemeal infrastructure developments occur because staff do not trust other approaches. A move towards Trust-wide development of a new IM&T infrastructure will need to gain broad support across many stakeholders.
- **Supported**: the priority is not about buying significant volumes of technology. It is about delivering technology in ways that enable users to benefit from it. This implies investment in IM&T support functions, security and confidentiality programmes, and data quality.

DEVELOPING PEOPLE

This priority will:

- Develop the right information and information technology management skills for the Trust.
- Enable staff to find the right assistance, support and guidance and access to shared learning across the Trust.
- Encourage appropriate education, training and development activities at every level and create a learning environment to support the modernisation programme.

DATA QUALITY AND INFORMATION DEVELOPMENT

Improving data quality and developing the breadth and depth of information to support patient care and clinical governance is a key dependency. This priority is about improving the quality of data as well as developing the information required to support the Trust. A key part of this priority is the development and application of data accreditation processes. Further work will also be concerned with the development of data quality standards. The use of such data will be critical to the development of acute care investment plans and clinical governance development. Without this initiative, the other priorities will fail to deliver the desired outcomes and benefits.

SUPPORTING CLINICAL CARE

This priority will establish, identify and resolve the requirements for information systems to support and improve patient care. The priority is about the change in culture within clinical teams and the application of information to support direct patient care, particularly in the areas of multi-disciplinary healthcare, national service frameworks and facilitating the adoption of best practice guidelines and protocols.

INFORMATION FOR THE PATIENTS AND THE PUBLIC

This priority is about the implementation of systems that empower patients and the public to take more responsibility for their health and well-being and to fully inform patients of the healthcare services available to them from the hospital when they require them.

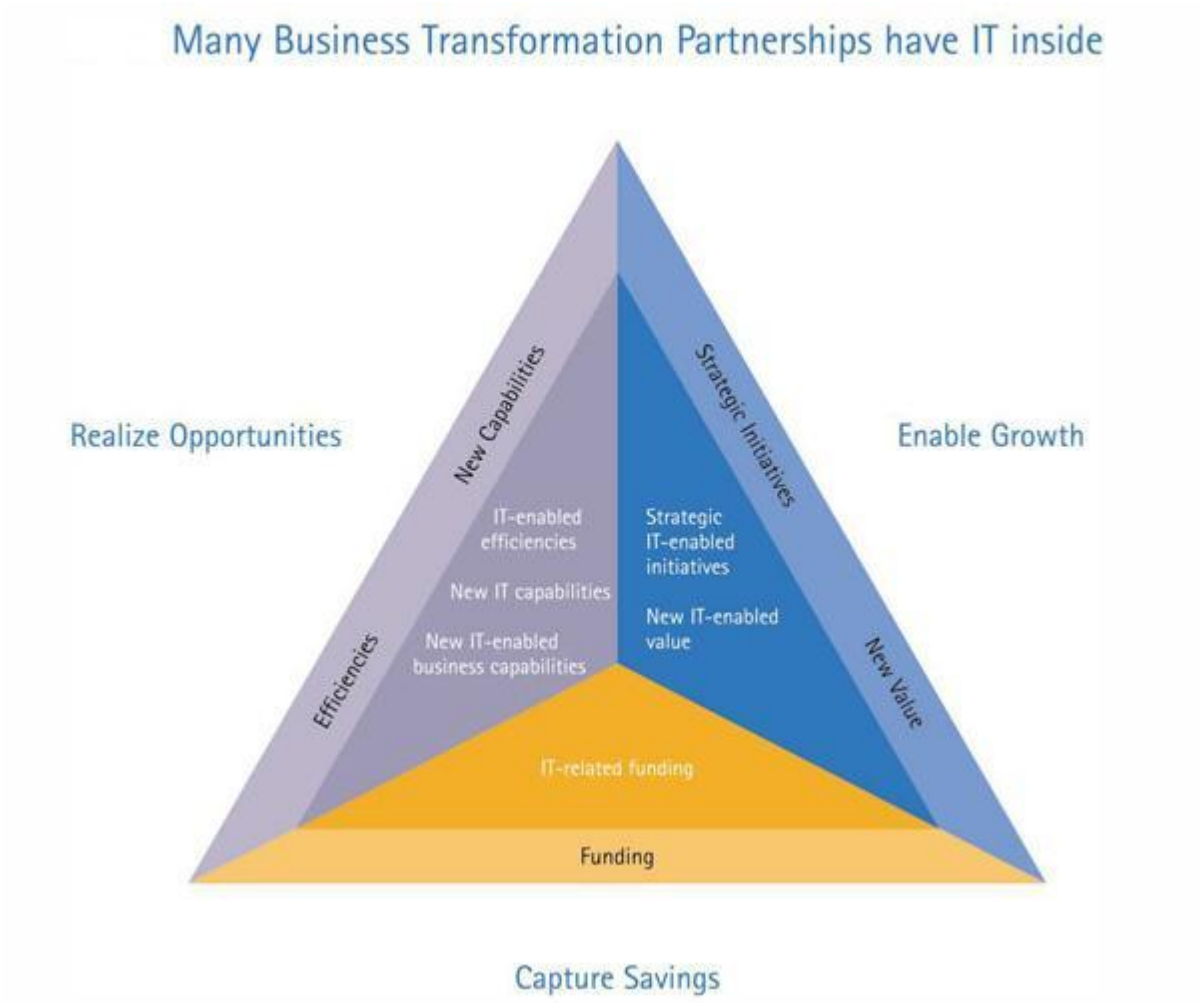
TECHNOLOGY ENABLED CHANGE

Using IM&T to Transform Care

1. **Introduction of shared care records** – Local and national business cases lay claim to £millions of savings per Trust, we still need to turn this into reality.
2. **Mobile working –** Community staff could become much more productive if supported by the right technology. This will support mobile and flexible working.
3. **Links between Health and Social Care** – In getting to shared information systems to help us manage care in the right setting we can reduce demand and improve efficiency.
4. **Digital dictation / voice recognition –** There are now reliable ways in which technology can support the conversion of speech into text, this should allow reduction in clerical costs.
5. **Collaboration tools** – Rather than travel, we ought to be able to use technology to work together more effectively.
6. **Web 2.0 / patient focus –** Using systems that provide interactive services with the public and patients could see a revolution in services and in our relationship with them.
7. **Telehealth / Telemedicine** – There are a number of demonstrators and pilots in the area of providing remote services, e.g. home monitoring in Liverpool.

Better ways of managing Technology

1. **Reduced telephone charges -** A result of previous investment in Community of Interest Networks (COINs) and national negotiation of mobile phone tariffs could potentially save money.
2. **Virtualization** - The introduction of new ways of computing such as Virtualization could save money and be greener.
3. **Better management of ICT -** It is reported by Gartner that if organisations move along the NHS maturity model they increase productivity by as much as 30%.
4. **Reduce Costs** - The cost of producing and managing paper is high. Moving to an electronic platform will significantly reduce these costs.
5. **Reduce non-value added activity** - Working with the information needed to hand significantly reduces the time taken to undertake tasks.
6. **"Key Man Risk"** – Managing information in a collaborative manner reduces the implications of Key Man Risk. Information can be easily shared and found even if staff call in sick.
7. **Information Targeting** – Ensuring users are provided with the information they need depending on their position within the organization.
8. **One Document, One Copy** - Storage of one official copy of a document, with a version history, which can be accessed by authorized users. This reduces printing and storage costs and ensures there is only one version of the truth.
9. **Search** – Ensure that information can be easily retrieved through the use of a Google style search. Now even misfiled items can be easily located and retrieved.

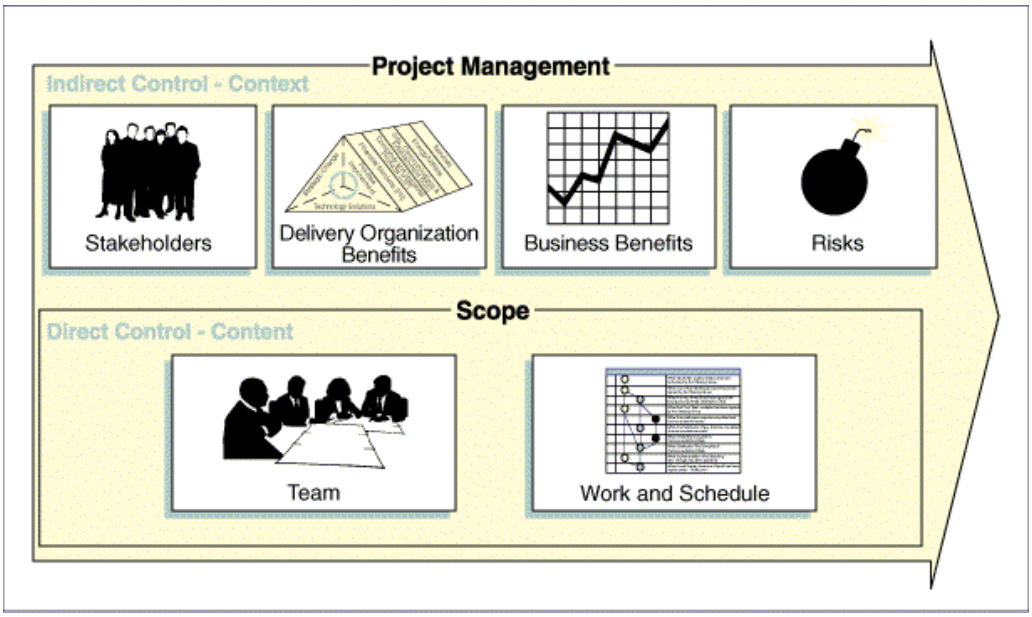

Many Business Transformation Partnerships have IT inside
Realize Opportunities
Enable Growth
New Capabilities
Strategic Initiatives
Efficiencies
New Value
IT-enabled efficiencies
New IT capabilities
New IT-enabled business capabilities
Strategic IT-enabled initiatives
New IT-enabled value
IT-related funding
Funding
Capture Savings

ENABLERS

In order to turn the vision into a reality it will be necessary to ensure that certain enabling factors are in place:

- **Skills**: the IM&T department will require access to individuals with the right level of technical expertise in information, data analysis, clinical coding, information technology, project management and health information management. In addition, all groups of staff, not just IT professionals, will increasingly require a high level of IT literacy, as well as a detailed knowledge of the particular information systems which they use, in order to maximise their effectiveness and job satisfaction. These needs will have to be addressed through service planning and the Trust's policies on recruitment and training.
- **Culture**: an open approach to the provision of information and the use of new technologies will inevitably lead to a wide range of changes which will impact upon staff. The Trust must work towards a culture which recognises and embraces the need for change and which will adopt different ways of working.
- **Infrastructure**: the IM&T department must ensure that appropriate network linkages are available, both internally and externally, to allow the secure and timely communication of information.
- **Resources**: the availability of funding is likely to be a constraint on the implementation of the plan. The IM&T department must actively explore all sources of external funding as well as any internal resources available.
- **Leadership and Management**: the drive and imagination of those involved will be crucial in ensuring that the other enablers are in place and that the objectives are achieved. The Trust should be pro-active, continually planning ahead so as to be at the leading edge of IM&T within the NHS. Management structures and project teams will need to support a coordinated approach to ensure that project priorities are met within available resources and time constraints. All projects will be controlled directly by the teams and the work schedules that drive them. Additionally context is given to the projects by the stakeholders, the perceived benefits to the Trust and the risks associated with the project. Figure 1 describes how a project will move forward by these influences. Coordination and control of the process surrounding a project will be a key focus area to drive improvement.

Figure 1: The new framework for Project Management within IM&T



STRATEGIC VISION (4 Years)

1. Deliver a stable, secure, managed, flexible and intelligent IT architecture that delivers improved service while operating at lower cost, and promotes patient safety whilst reducing medical errors.

2. Develop the next generation, intelligent information infrastructure (data warehouse) to gather critical data from all clinical and non-clinical systems, support business intelligence and effect performance improvements faster and more efficiently (thus supporting CBUs).

3. Deliver interoperable IT systems that provide quality based outcomes through evidence based medicine.

4. Deliver a portal based enterprise view of clinical and non-clinical systems that integrates them under a Microsoft platform.

5. Design an adaptive, transformational IM&T function that manages end-to-end Trust interactions; adopts a service management culture; creates a completely virtualised IT unity and optimises utilisation and performance of Trust processes and applications.

6. Analyse and automate financial information systems to ensure they effectively support Trust's financial objectives.

7. Deliver point of care data collection / coding to maximise income through payment by results.

8. Deliver computerised provider order entry at the patient bedside (point-of-care).

9. Deliver electronic systems to keep patients entertained and informed whilst receiving services.

10. Deliver redesigned patient services function that improves administrative efficiencies and services resulting in a "best-of-class" patient experience.

11. Deliver a patient information portal and website (web 2.0) that provides useful, evidence based information to support patient choice.

12. Provide remote access to key clinical systems to allow point-of-care delivery of Trust services into the community.

13. Develop an enterprise level content management system that underpins all directorate functions and provides portal based instantaneous access to critical clinical and non clinical Trust information at the point-of-care.

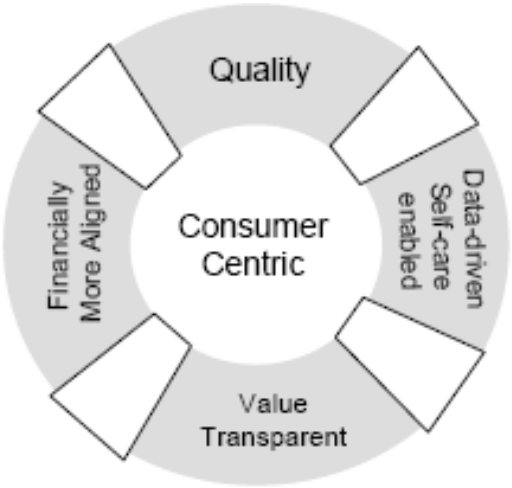
14. Provide remote access to key clinical and non-clinical systems to improve communication and working lives.

15. Deliver an unified enterprise level telecommunications platform that supports patient care.

16. Achieve and maintain ISO certification in 9001 (quality) 14001 (environmental) and 27001 (information security) for the IM&T department.

17. Develop a project management office within IM&T to oversee delivery of all major Trust projects using industry standard, quality driven principles.

18. Implement business process management with IT systems to leverage efficiency and productivity.

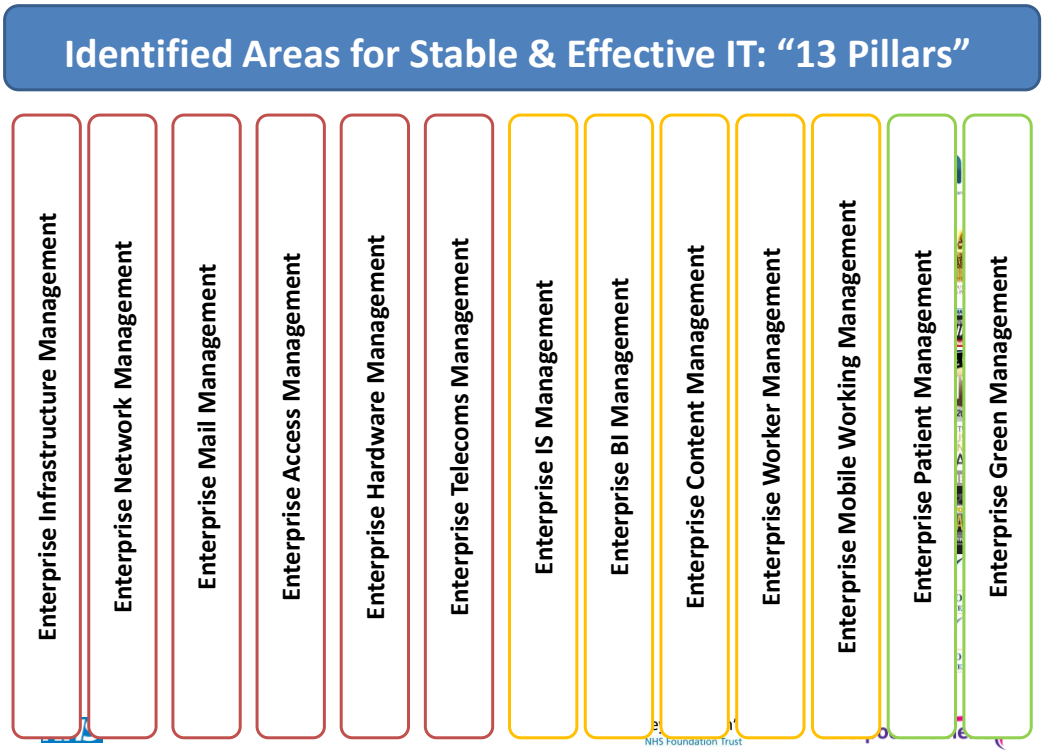


THE RAPIDLY REENGINEERED IT PLAN

Within the umbrella of this new strategy there are a number of key component areas that will be addressed. These include:

- Enterprise Infrastructure Management (EIM)
- Enterprise Mail Management (EMM)
- Enterprise Network Management (ENM)
- Enterprise Telecommunications Management (ETM)
- Enterprise Information Systems Management (EISM)
- Enterprise Hardware Management (EHM)
- Enterprise Patient Management (EPM)
- Enterprise Mobile Management (EMM)
- Enterprise Content Management (ECM)
- Enterprise Building Management (EBM)
- Enterprise Access Management (EAM)
- Enterprise Green Management (EGM)
- Enterprise Worker Management (EWM)

These are the areas that will be addressed within this extensive plan and encompass the thirteen pillars of a stable, adaptive and effective IT service:



In order to ensure that this plan is implemented correctly it is further subdivided into "core" and "building blocks". This simply prioritises what work has to be completed first before other areas within the plan can be actioned.

The "core" pieces of the plan include: infrastructure, network, mail, access, hardware and telecommunications. The "building blocks" are: information systems, workers, content, business intelligence, mobile working, patients and green. Phase 1 will involve the complete rebuild of the IT infrastructure, network and telecommunications and is anticipated to take 9-12 months to complete. This work is in addition to the IM&T yearly operational plan work.

Very simply this translates into the following:

- **Infrastructure:**
  - Rebuild server / storage / backup / disaster recovery enterprise infrastructure (entire rebuild of the data centre)
  - Implement international standards: ISO 9001 (quality), 27001 (information security), 14001 (environmental, green)
  - Ensure full business continuity of all Trust systems
  - Renegotiate all IT contracts
- **Network:**
  - Rebuild the Trust's wired network and firewalls
- **Mail:**
  - Implement a new updated mail system (Microsoft Exchange 2010)

- **Information Systems:**
  - Look at the next generation Patient Administration System / new IS systems / Interface Engine / E-prescribing / Clinical correspondence
- **Telecommunications:**
  - Implement a new telephone system / automated attendant / paging systems
- **Hardware:**
  - Replace PCs / Laptops / Printers / Multi Function Devices / Copiers
- **Patients:**
  - Implement E-check in / Patient Entertainment / E-surveys / Digital Signage
- **Mobile Working:**
  - Implement Computers on wheels
  - Connect Offsite Clinics
  - Enable Remote Working
- **Content:**
  - Implement Knowledge / Document Management Systems
- **Access:**
  - Implement single sign on to all systems / New Security Platform
- **Green:**
  - ISO 14001 / Auto shut-off of Hardware / A/C / Data Centre
- **Workers:**
  - Implement new E-rostering system
- **Business Intelligence:**
  - Build a Data Warehouse / Medicode / Dashboards / Business Intelligence – right information to enable the business

ENTERPRISE INFRASTRUCTURE

The Alder Hey Children's Foundation Trust's ("the Trust") Information Technology (IT) infrastructure is approximately 6½+ years old and is now facing challenges in today's IT environment. The Trust needs to completely redesign and renew its server and storage infrastructure to meet the demands of today's IT needs. With the onslaught of new technologies and intensified pressure to meet demands, the Trust has followed a model of adding PC servers to accommodate new applications needed for specific projects. The proliferation of PC servers has left the Trust managing many servers on a variety of different hardware platforms, with different operating systems and software applications. This environment makes it difficult for the Trust to ensure high levels of availability and cost-effectively manage computing resources.

As the Trust has grown a common practice has been to add another server whenever a new application is needed: Need a firewall? Add a server. Need a mail application? Add a server. Need a load-balancing application? Add a server. However, this practice has led to many servers that are using only a fraction of their capabilities, while still requiring the full amount of cooling, space, power, and management resources. As a result, the Trust is struggling with the management of multiple of servers, along with the resulting costs, yet are not fully utilising these servers. The tendency has been to install a new server for each application. In many cases, desktop PCs were conscripted for use as servers. In addition, different groups within the Trust wanted to control their own computing resources. The result was that servers were scattered throughout the Trust. It was not uncommon to find servers under people's desks and in closets. It was easy for someone to deploy a new server to solve the business problem at hand. Those with a problem did not have to join a queue for IT services that might be several months in length. On the other hand, many disciplines that had been in place in the data centre were lost or ignored. Generally these servers were not backed up on any regular basis, if at all. Security was usually ignored. Perhaps more serious than these issues was the Trust losing control of its data. With databases scattered among so many servers it has become impossible to reconcile the data or even to assure its consistency. Getting control of "server sprawl" is very important for the Trust in moving forwards with its new IT strategy.

The Trust's specific needs for its new infrastructure include the following:

- Deliver high performance, availability, speed, and scalability.
- Reduce infrastructure complexity.
- Simplify and centralise management of systems and services.
- Flexibility in resource provisioning.
- Full disaster recovery.
- Ability to accommodate fast growth and changing infrastructure requirements.
- Reduce time for deploying and managing new services.
- Economise space requirements for server systems.
- Optimise existing physical capacity.
- Standards based enterprise computing platform.
- Consolidate computing resources in a more efficient manner.
- Reduce cost of deploying new systems.
- Reduce system management cost.

- Achieve high return from IT investments.
- Maximise longevity of IT Investments.
- Minimise administration costs.
- Lower total cost of ownership (TCO).
- Leverages industry standard components providing flexibility for incorporating new technology as it emerges.
- Enhanced productivity and improve efficiency.
- Lower management and maintenance costs.

Simplifying Operations

Managing the IT infrastructure presents its own set of challenges, including increased scale and complexity, an accelerated rate of change and specialised training, and process requirements. As a result, the Trust is faced with using different tools to manage their server hardware, storage hardware, operating systems and applications. This use of multiple tools adds another layer of cost and complexity to the overall IT operation. Because operating system and application updates require more time than server hardware updates, the Trust needs to automate updates with tools that are available today. To address the challenges of systems management, the Trust must begin to simplify its operations through automated, deployment and change management tools and integrated monitoring solutions. At the same time, it must look for solutions that are not only robust and reliable, but those that are based on industry standards. Through standards-based systems management, rather than proprietary solutions, the Trust can retain the flexibility, choice and control needed to best manage its IT operation. Utilising these automated, integrated, industry-standard management solutions is a necessity for simplifying operations today and enabling IT operations for the future (Kern *et al*, 2000; Schiesser, 2001).

INFRASTRUCTURE & SERVER CONSOLIDATION

The signs of complexity are everywhere in the Trust's current IT infrastructure - firewalls, routers, servers and multiple operating systems are just the beginning. Server environments, networks and storage are typically silos of resources dedicated per application and grow with only a loose connection to one another - and usually with no regard for overall system complexity. It is no wonder it can be so difficult to understand, manage, secure, update and operate.

Infrastructure simplification is a method of looking at the whole environment - end-to-end - and finding ways to eliminate the complexity that can inhibit the free flow of information necessary in today's fast-paced IT world. The ability to simply and easily share and manage information is a key requirement for integrating business processes end-to-end, and is a key requirement for an on demand business (Schiesser, 2001).

The free flow of information across and within the Trust is the main currency for innovation and creativity. When employees have instant access to the information they need - in the form in which they need it - they can provide a better service. Throughout the Trust, the IT infrastructure is where all of this information flows. When the IT infrastructure grows without regard for easing that information flow, complexity can choke that free flow just as an arterial plaque chokes blood flowing to the heart. Simplification strips away inhibitors to business acceleration - e.g. faster product development and communications while allowing shared data to foster

innovation. Most importantly, with a highly efficient, highly automated environment the Trust can help reduce its enterprise's total cost of ownership. "Five-year costs for storage, hardware, software, maintenance, personnel and facilities are reduced between 2.4 and 3.9 times by transitioning from inefficient to efficient scenarios for storage utilisation" (Barrall, 2005, p. 5).

Proven Methods

The choice is clear. With the help of consolidation, the Trust can start by reducing the complexity of its IT environment. This can help the Trust achieve better application availability, improved productivity and better system optimisation including utilisation. Consolidating the environment is a logical first step in the efforts to simplify the infrastructure. There are generally four approaches to consolidation:

- Centralisation or reducing the number of locations where data resides to only what is needed.
- Physical consolidation to fewer, larger-capacity devices ("scale up").
- Data integration through such means as modular storage that easily "scales out" by adding more of the same units.
- Application integration, or moving applications from clusters or multiple linked servers to a smaller number of storage devices.

The general goal of consolidation is to reduce the number of points of management, as well as the number of physical devices. Consolidated environments have fewer elements that help to reduce the chance of error or failure, avoid the creation of islands of storage and take better advantage of economies of scale for owning software, disk and tape. Consolidated environments can be more resilient and more cost-effective to manage, reducing planned downtime and TCO. Both servers and storage can scale up or out, depending on the Trust's needs. The Trust may "scale up" via large capacity tape and disk systems while also "scaling out" via modular storage products. In addition to scaling storage technology, "scale up" server technology will assist the Trust in handling surges in application usage, while "scale out" server technology can assist in handling multiple application instances (Phelps, 2001).

Server consolidation is often defined to mean running many differing types of applications, such as e-mail, financials, databases, and file serving, on a single very large server. However, many of the same benefits of consolidating to a single or very few, servers can be achieved through other consolidation approaches. Due to this, the definition of server consolidation is broad and has evolved to encompass much more than running everything possible on as few servers as possible. The most important part of a server consolidation initiative is the planning and analysis of end user requirements, application requirements, and server environment. Only by having a good understanding of the requirements and challenges of any given infrastructure can a beneficial server consolidation programme be proposed, planned and implemented. In order to fully understand server consolidation in today's IT environment it is necessary to break it down into three different approaches: logical, physical, and workload. Studying existing servers and how they are used determines what type of server consolidation to pursue, and to what degree. Logical consolidation is adopting the same management and control processes across all servers. This approach to consolidation is relatively easy to achieve and will provide benefits quickly. Physical consolidation involves the geographical location of servers

and attempts to keep these locations to a minimum. Workload consolidation is the actual reduction of the number of servers by moving from multiple smaller servers to fewer larger servers. The Trust's strategy will be to adopt a mixture of these approaches to achieve the maximum benefit (IDC, 2004).

Logical Consolidation

The easiest type of consolidation to achieve is logical consolidation. Implementing systems management across all servers and using common administration and setup processes can help save a great deal of time. And it can help save resources too, as fewer system administrators are needed to manage the same number of servers. An enterprise wide implementation of systems management provides great benefits. In addition to being able to better manage all servers, a systems management package also offers the advantage of providing a clear inventory of all systems. This will allow the Trust to have a real-time picture of how many systems of what type are currently deployed. Logically all of the servers are consolidated around a set of management tools and processes. These can be scaled to include how applications are set up and deployed, depending on the environment. By streamlining the number of processes used in the setup of servers and applications, their management becomes much easier to document and maintain (Kern *et al*, 2000).

Physical Consolidation

The physical consolidation approach is to have all servers located in a single location or as few locations as possible. A reduction in the number of data centres can lead to a reduction in costs. Administration typically becomes easier, because administrators are centralised, leading to a more efficient use of their time during maintenance of existing servers and during setup of new servers. By centrally locating servers in as few locations as possible, real advantages and related cost savings can be gained. Physical consolidation is not without its risks and must be done after a careful analysis of the requirements of the Trust. Physical consolidation will allow the Trust to focus their highly skilled personnel on higher value tasks, which gives the IT staff the opportunity to add more value to the Trust (Kern *et al*, 2000).

Storage Consolidation

Storage Area Networks (SANs) provide a highly available, high performance storage backend to multiple servers. Although it is possible to create SANs where the storage and servers are geographically separate, the cost can be significantly reduced if the servers and storage are in the same building. SANs are designed to offer the advantages of lower cost per MB, higher scalability, and better fault tolerance than storage that is directly attached to servers. Using a SAN is an example of storage consolidation. In order to further extend the benefits of server consolidation it makes sense to consolidate storage as well. Storage consolidation provides a number of benefits. By combining disparate storage resources and moving to networked storage, the Trust can simplify the management of storage and significantly improve utilisation. The management of backup and restore processes can also be greatly improved through centralised, networked storage. This centralised storage solution will be the platform for continued, managed data growth for the Trust in the future (Barker and Massiglia, 2001).

Workload Consolidation

Consolidating workload means using fewer larger servers to replace what was being accomplished by a large number of smaller servers. When reducing the number of servers there are two distinct paths that can be followed. The easier and more common approach is to continue to dedicate a server to a specific application, but to use fewer servers by taking advantage of multiprocessor systems using the most recent technology. The other, and more complex, path is to take disparate applications and put them on the same server. An example would be using a single server to provide file and print and e-mail services. This type of consolidation can be very powerful in helping to reduce costs, but it is also is the most difficult to plan and implement. A workload consolidation requires the most planning and analysis of the existing server infrastructure, because it is a change in the workload that the servers will be running. In the logical and physical approaches to consolidation there is no change in the number of servers or the number of users they are supporting. The actual workload that each server is running does not change in these approaches, so there is a low risk of failure due to improper server sizing. In workload consolidation a greater number of users will be accessing each server. In addition, if different applications are consolidated onto a single server then the differences in those application requirements must be considered when sizing the server. In order to avoid unnecessary complexity the Trust will begin by grouping servers of like functionality and avoid mixing different types of applications together on the same server. Although workload consolidation is the most difficult to plan and implement, it can also provide the greatest benefits.

"Pursuing the ultimate consolidation goal of a single system image for all distributed server applications can yield great rewards when balanced with the expense, but the potential for a poor or failed implementation is far greater" (Phelps, 2001, p. 17).
Administration and management are easier because there are fewer servers. This means fewer systems upon which to install software updates and patches. Fewer servers also result in lower software licensing costs for both operating systems and applications. Workload consolidation can also result in a much more efficient use of resources. It is easy to see the benefits of workload consolidation in a simple example of file and print servers. Instead of having ten file and print servers, with each one dedicated to a department and each being utilised 10 to 15 percent, they are replaced with one or two large file and print servers that are shared by the same ten departments. Software licensing costs are greatly reduced. In addition, easier backup of all user data can now be accomplished (Gupta *et al*, 2002).

Application Consolidation

Application consolidation involves the aggregation of distinct applications onto a single server. New server virtualisation technologies enable this by partitioning the server into virtual workspaces for each application. Extensions of this technology now enable the movement of these virtual machines across clustered physical systems, essentially removing physical limits to the number of virtual machines that can be supported. Virtualisation is a technology that is essential for the Trust's new IT infrastructure. Through consolidation and virtualisation, the Trust can dramatically improve utilisation and user satisfaction (Marshall *et al*, 2005).

The Case for Consolidation

The Trust's current infrastructure complexity is hurting its ability to act and respond due to:

- Excess time spent on IT management to deal with day-to-day requests.
- Difficulties in responding rapidly to needs because of the inflexibility of older systems without virtualisation.
- High costs both for equipment acquisition and ongoing operation.
- Large training requirements and unpredictable staffing needs.
- Unwanted risk of human error and failure that come with complexity. Over the past decade, the Trust decided that adding capacity was the answer to any problem because overall IT costs were lower. This resulted in a mixture of hardware and software with different capabilities, interfaces and management requirements. A mix that was sophisticated, but increasingly unmanageable.

"The data centre of the future will be a simplified, commoditised, virtualised set of resources that is enabled by standards. Such standardisation of components and interfaces will enable the transformation of the data centre. The path of the forces that have shaped the data centre throughout its history is not that of a pendulum that reverses direction periodically; rather, it is the path of a ratchet that is inexorably evolving the data centre in a single direction: toward larger numbers of smaller, simpler, component systems that are more dynamically composed into solution systems via increasingly powerful networks" (Meta Group, 2003, p. 5).

The arrival of SAN technology in the marketplace has fuelled storage consolidation. Managing data when it is spread across many servers has become a challenge. There may be processing resources available on one server but the data needed for a job may be on another server. Creating multiple copies of the data proves unsatisfactory because keeping the various copies synchronised creates another systems administrator headache. As a result, complex scheduling issues may arise. Backing up the distributed data is another time-consuming process. All of these issues cause the cost of administering a growing amount of data to skyrocket (Clark, 2003). A number of key factors drive the case for consolidation within the Trust:

- Cost cutting continues to be a factor.
- Continuing improvements in performance and price / performance of industry-standard systems means that more powerful servers have become available to the Trust.
- System management tools are more commonplace as they can help to anticipate IT problems before they occur. They can also track and even remotely manage IT resources.
- Improvement in the functions provided in Windows. In particular, improvements in the workload management capabilities of Windows means that it is possible to combine a number of different workloads in the same system and control the response time and throughput of each workload.
- Virtual servers will allow a single physical server to host multiple operating systems and their workloads. Virtual server software technology creates partitions on a server that enable virtual servers to run in isolation on the same physical server. Since many workloads on Windows servers run at low CPU utilisation, it is quite feasible to combine these workloads on a newer, more powerful system with multiple virtual servers.
- Physical constraints within the Trust's data centre.

- Lowering the number of servers reduces the air-conditioning, power, and space requirements.
- Availability is a consideration. Usually, customers who have consolidated servers or storage have observed an improvement in the availability of their key applications. An improvement here will be noticed by end users and will relieve pressure on systems administrators.

Benefits of Consolidation

The benefits of implementing consolidated servers into the Trust are many. A server consolidation strategy introduces benefits, which have previously been unavailable to the server farm and enterprise environment. Detailed below are some of the common benefits to the IT function of the Trust:

- Increase computing capacity without purchasing or having to manage additional servers.
- Development and deployment of more new applications quickly and efficiently.
- Support of multiple operating systems and applications on one platform.
- Allows expansion of the range of suitable applications within the Trust.
- Streamline development and testing – real environment testing.
- Managed and controlled roll-out strategy.
- Faster deployment and replication of servers.
- Multi vendor strategy accommodated.
- Guarantee service level and high availability.
- Ease of management and control.
- Reduction in real-estate / racking for server farms / fewer machines.
- Reduction of running costs (resources, power, and air-conditioning).

(IDC, 2004).

These benefits are confirmed in a recent study compiled by IDC Research (Eastwood, 2002) that revealed that server consolidation had the following (real time) savings:

- Administration – 5 percent lower.
- Overhead, charge back, vendor management for hardware and software – 15 percent lower.
- Downtime – 40 percent lower.
- Reduced hardware and software costs by up to 60 percent.
- Reduced operational costs up to 70 percent.
- Reduced total TCO up to 64 percent.
- Improved server capacity utilisation.

Infrastructure consolidation is a hot topic, clearly on the minds of many IT departments. In today's climate of flat or shrinking IT budgets consolidation offers a means to achieve significant cost savings. But its attractiveness does not stop with cost savings. The exploding need for space and power in the data centre can be curbed. The performance of both the servers and the storage systems can be drastically increased. System administrator time can be sharply reduced as system availability is improved and user satisfaction increases. An improvement in disaster recovery capabilities will naturally follow from most consolidation projects. This will

allow the Trust's IT infrastructure to be modernised to support its future plans for growth (IDC, 2004).

Improving Utilisation

Underutilisation and less than optimum performance from the Trust's server and storage systems are by products of two main issues. First, servers and storage have been added organically, whenever and wherever needed. While this ability to add servers and storage easily is one of the key benefits of industry-standard technologies, it has also come at the cost of IT control. Second, because the Trust deploys a single application per server, many servers, on average, are underutilised compared to their true performance capacity. The same is true of the storage systems - because these storage systems have been deployed in a decentralised fashion or with a single application / single server configuration, much storage capacity goes unused. Server and storage consolidation is one key way to improve utilisation.

Consolidating the IT infrastructure is the key to better communication across the Trust. Operating costs can be lowered and an improvement in service levels is realised with a minimum of end-user disruption. For end-users increased access to communications services while on the move and fast access to data using familiar applications is key to satisfaction and productivity. The explosive growth of client / server computing infrastructures using industry-standard servers has led to a corresponding growth in administration, hardware, space, and cooling costs. An important part of the strategy for the Trust is the use of VMware virtualisation software. VMware has developed virtualisation software that allows mainframe-class partitioning techniques to be applied to industry-standard servers.

Using VMware software, the Trust can improve resource efficiency, and benefit from improved management and provisioning by consolidating multiple logical servers. VMware technology dramatically reduces the number of servers needed to support applications while maintaining application isolation and encapsulation. It allows multiple virtual machines, each dedicated to an enterprise application, to reside side by side within a single physical server. With VMware Virtual Centre, the Trust can centrally manage multiple servers as well as dynamically allocate resources to virtual machines without any interruption to users. The VMotion technology within Virtual Centre will allow the Trust to dynamically migrate virtual machines across the virtual infrastructure with zero downtime (Martinez, 2004).

THE TRUSTS DATA CENTRE OF THE FUTURE: A PHASED APPROACH

Phase I is known as the "Enabled Phase" and involves the use of automated and integrated systems management tools for the IT infrastructure. Enabling these one-to-many deployment and change management tools is the first step in simplifying operations. Phase I also involves server / storage consolidation projects and the investigation and testing of virtualisation technologies.

Phase II is the "Integrated Phase". While similar to the "Enabled Phase" in terms of requirements and technologies, in this phase the tools and technologies become more integrated, meaning they work across a multi-vendor and multi-platform environment due to continuing standardisation in the enterprise. Deployment and management of servers, for example, is greatly simplified when interfaces and tools are standardised, allowing the Trust to deploy and manage servers centrally. This integration will also reduce the number of separate management tools that the Trust must use, further simplifying operations and reducing costs.

Phase III is the "Seamless Phase". In this phase, technologies and integration have developed to a point where true dynamic computing and resource allocation can occur. Systems run based upon policies and procedures, and they can monitor, allocate, manage and heal based on these prescriptions. It is in this phase that IT services and business needs are truly aligned and IT services can adjust in real-time to those needs.

(Schiesser, 2001).

A Path to Get There

The way forward for the Trust is one of open standards and integration, with the Trust's IT department in charge of the technology decisions and direction. It has the potential advantages of flexibility, choice and control. An Adaptive IT approach will create an IT environment for the Trust where change can be embraced more cheaply, while ongoing operating costs are reduced. Adaptive IT will lower the Trust's incremental cost of change, through a layered, component based architecture that supports open standards while offering a consistent global view of the user's data.

BUSINESS BENEFITS

The Trust's infrastructure solution seeks to achieve the following key business benefits:

Reduction of Hardware Costs

Hardware cost reduction is achieved via consolidation of applications to a single file system or an aggregated portal of applications, allowing global access to resources on a 24-hour basis.

Reduction of Administration Costs

Administration will be reduced considerably through centralised management of multiple servers in one location.

Lower Business Risk
Consolidation of servers and reduction of administration costs is further supported by a lowering of business risk to multiple applications through a centralised backup, recovery and security model, creating one single environment to administer and secure.

Higher Degree of Productivity per User
This solution is aimed at rapid searching, finding, obtaining and maintaining information. This is achieved in one way through the aggregation of information from different sources within a portal. There is just one search for information across the enterprise. However, users can also achieve increased productivity without a change to their current familiar interfaces through reduced downtime, reliability and security of existing applications.

(Schiesser, 2001).

STORAGE
The Trust is more concerned than ever with ensuring both short-term and long-term access to all of this information. Accommodating the growing array of different information types, while boosting overall business continuity goals, poses significant challenges. In this changed circumstance, boosting the effective utilisation and integration of existing storage assets as well as improving the manageability of those assets are now primary goals. The range of information that the Trust needs to protect is expanding rapidly, and the pressure to ensure adequate protection for all corporate data continues to rise. In today's enterprise, the Trust must deal with many different data types that require different data protection strategies. The Trust cannot just focus on remote disaster recovery; it must coordinate multiple backups for interconnected applications while dealing with ever-shortening backup windows. The Trust cannot just focus on retention of transaction data; it must implement verifiable retention for many types of data. This more complex data protection environment is a source of complexity, exposing the Trust to greater chances for error, more inefficient operation / cost, and the risk of data loss. The Trust will need to move beyond the traditional solution of tape backup in an effort to address these increasingly complex business continuity needs. The new solution will employ a number of disk-to-disk replication, tape backup, "snapshot" and disaster recovery solutions to boost overall business continuity (Barrall, 2005).

The key to meeting these goals is infrastructure simplification. The Trust will deploy solutions that reduce the complexity of managing existing and future assets while boosting their effective utilisation. Simplification is more than just rearranging storage topologies; it is also about implementing management practices that are enabled by a simpler infrastructure. It means:

- Automating repetitive tasks and eliminating application downtime when migrating data from one class of storage to another.
- Having more flexibility to allocate storage capacity on demand without precluding future upgrades.

Expanding Storage System Options
In an effort to meet the conflicting application and cost containment demands of business, the Trust began to look for storage solutions that addressed specific IT

requirements (e.g., better performance, higher reliability, greater capacity, or lower cost).

The Trust can choose from an array of different storage systems, including:

- High-end monolithic storage arrays that provide high performance and reliability in a single, centrally managed system.
- Midrange storage arrays that allow the addition of storage capacity for applications in smaller increments.
- Low-end arrays that enable the sharing of storage capacity across multiple servers in small businesses and remote sites.

In addition, there has been an emergence of a new class of storage system that leverages lower-cost and larger-capacity disk technologies (e.g., Serial ATA) to significantly boost array capacities while reducing capacity costs. While not appropriate for all application workloads, these capacity-oriented technologies can provide the Trust with greater control over costs when allocating storage for specific needs. Incorporating capacity-oriented storage systems into existing environments is a high priority. The Trust can leverage these new systems for specific requirements:

- More cost-effective storage of proliferating fixed content assets such as digital images, large reference files, and e-mail archives (content-aware storage).
- More rapid and frequent backup / recovery of business-critical information at both local and remote data centres (disk to disk to tape).

(Clark, 2003).

Networked Storage

Concurrent with the expansion in storage array options, application servers and storage systems can be connected via SANs. SANs help accelerate the consolidation of server, storage, and tape assets by detaching storage devices from individual servers and applications while simultaneously providing a platform for centralised control of those assets. The combination of SANs and multiple storage systems is also spurring the next step in infrastructure simplification: the development of solutions that will allow the Trust to pool storage resources across multiple systems and applications while shielding server and application administrators from the complexities of configuring storage systems and managing tape backups. This new solution introduces layers of logical abstraction between the physical blocks of data on storage devices and the volumes / files that servers and applications access. Continued improvements in performance, cost, and reliability of storage networking technologies now make it possible to move functions traditionally handled by general-purpose servers or array-based controllers into network-based systems. These functions include volume management, data replication / backup services, and file / database management services.

Building a Tiered Storage Infrastructure

The Trust will employ these new storage solutions constructing a tiered storage infrastructure. Through the deployment of SANs, many of these storage assets will be physically connected to servers that run many different types of applications and create many kinds of information. Finally, with the arrival of network-resident storage services for distributed management of volume, files, and data replication, the Trust

can intelligently provision, reallocate, and protect storage assets to meet the needs of many different applications across the network instead of device by device.

Centralising Control of Storage Services

Delivering effective management for tiered storage requires more than common control of the physical devices. The true value of tiered storage is that it allows the Trust to provision and define storage at a logical level as well. This can create classes of storage based on performance, capacity, cost, and level of data protection across multiple physical systems and then assign application resources based upon their unique requirements. This is also the level at which the Trust can apply consistent rules related to regulatory compliance requirements, such as:

- Service availability: ensuring applications meet set availability requirements through judicious use of data replication and data protection solutions.
- Information access control: ensuring that access to information is controlled at both the user and application levels.
- Data retention: ensuring the accurate retention of specific information sets for set time periods.

(Snevely, 2002).

Storage challenges faced by the Trust include:

- Data growth is continuously accelerating.
- Applications are not meeting performance and availability expectations.
- Backup and restore windows are shrinking.
- Compliance requirements and litigation fears demand that data be kept in tamperproof storage for defined time periods and made available quickly when necessary.
- "Old" data needs to be online and accessible in short time periods (generally seconds or minutes).
- Business continuity objectives require that applications must be recovered in minutes or hours.
- Inexpensive storage devices are unreliable and perform poorly.
- IT budgets and head counts are flat or shrinking.
- Hard-to-manage storage infrastructure, often from multiple vendors, drives management cost to several times the acquisition cost.

VIRTUALISATION

Part of the Trust's new infrastructure proposal includes the virtualisation of IT resources. Effective virtualisation is an essential part of a simplified storage environment and involves a shift in thinking from physical to logical, treating IT resources as a single, logical pool rather than as separate physical entities. Virtualisation is a natural part of the progression of IT systems. Virtualisation is a key component of creating a multi-tier storage environment that is managed separately from the application and server layers. Virtualisation will help the Trust:

- Increase resource utilisation by combining the storage capacity of multiple disk arrays into a single reservoir of storage.
- Improve personnel productivity by enabling administrators to manage their reservoir of storage from a single user interface at a central point.

- Enable a tiered storage environment in which the Trust can match the cost of the storage to the value of the data.
- Aid the consolidation of resources and simplification of management to help reduce cost and complexity, allowing the Trust to focus on innovation and growth.
- Gain the freedom to use heterogeneous hardware providers with common server management, storage management and copy services software.

VMware software will enable the Trust to create virtual machines with one or two processors, allowing multiple operating systems to run simultaneously and independently on the same industry-standard server. VMware software uses a software layer that abstracts the hardware, so that each operating system (OS) thinks it is accessing its own set of hardware resources - when in fact, the resources are shared among multiple virtual machines. The administrator controls the resources committed to each virtual machine. When one of the virtual machines is idle, the other virtual machines on the server are able to use the free resources. Each virtual machine is independent of the other virtual machines. Thus, user error, software failure, or complete shutdown of one of the virtual machines has no effect on other virtual machines (Marshall *et al*, 2005).

VMware Architecture

The key function of VMware software is to abstract, or virtualise, the hardware resources of a server so that multiple operating systems and applications can each access an independent set of virtual hardware resources. The software maps the resources of the virtual machines to the hardware resources of the physical server, so that neither the guest OS (the OS running on each virtual machine) nor the individual application knows which processor, memory, disk drive, or network adapter it is physically mapping to. The VMware virtualisation layer running on bare hardware improves performance and enables fine-grain resource control. In addition, the virtualisation layer provides hardware independence, isolation, and encapsulation (Computer Technology Review, 2005).

Hardware Independence

The VMware virtualisation layer performs all the necessary translations to mask the physical hardware resources from the guest OS. The guest OS sees a consistent set of virtual hardware, regardless of what type of physical hardware is on the server. This means that whether the physical server is using, for example, an Intel network controller or an HP network controller, the guest OS will see only the network controller defined by the standardised virtual hardware set in VMWare. Because applications interact only with the associated guest OS and not with the underlying virtual hardware, once OS compatibility with the virtual hardware is established, application compatibility is not an issue. This hardware independence enhances reliability due to the small number of device drivers required for the virtual hardware and, thus, for each virtual machine OS. This also makes virtual machines simple to transport between physical servers, even if those servers vary significantly in their hardware configuration (Muller *et al*, 2005).

Isolation

The virtualisation layer also provides the ability to completely isolate one virtual machine from another. Each virtual machine includes a completely separate OS,

registry, applications, and data files. Because each OS is isolated, one OS cannot communicate with or leak data to any other OS, other than through networking mechanisms similar to those used to connect separate physical machines. Errors or user actions that interfere with the operation of the OS and applications running in one virtual machine have no effect on the continuing operation of other virtual machines on the same server. This increases the availability for multiple applications in comparison to running them on a single server (Muller *et al*, 2005).

Encapsulation

VMware software encapsulates the entire state of a virtual machine - the memory, disk images, and I/O device state - into as few as two files. The two files include a short text file defining the configuration of the virtual machine and a virtual disk file that contains its data. Thus, the virtual machine can be copied, saved, and moved like a file. The Trust will be able to move entire virtual machines among development, testing, and production environments simply by moving the virtual machine state file from one physical system to another. This will allow the Trust to deploy and redeploy virtual machines easily and flexibly (Muller *et al*, 2005).

Scenarios for Server Consolidation

VMware software can be used for multiple reasons and in different ways to consolidate servers, for example:

- IT proof-of-concept.
- Web server consolidation.
- Multi-tier architectures.
- Development sandbox.
- Standby server.

Consolidating servers can be an extremely large undertaking that involves many servers and applications. To ensure that the consolidation effort runs smoothly, the Trust will set up proof-of-concept servers to test the consolidation process, the manner in which applications are combined, how to partition the servers to achieve the best results, and the server performance level needed for the selected applications. In the past, for the Trust, the best and easiest way to support multiple departments has been to have an individual server for each department. However, because VMware software can create isolated virtual machines the Trust can reliably consolidate many Trust applications onto a single physical server platform. The Trust can greatly increase its hardware utilisation rates while still meeting departmental demands for reliability and security (Senf, 2003).

VMware software will help simplify development and testing. When software development groups within the Trust need to test new versions, they can run the applications on virtual machines rather than dedicating a physical server to each test environment. These development groups can use these virtual machines as “sandboxes,” or isolated environments, so that they can replicate and exchange software bugs between the development and quality assurance checks. Because the “sandbox” contains only the software in development, it removes any concern about application interaction or dependencies. The virtual machine environment is encapsulated, making it easy to transport and move the environment to other physical servers, without disturbing the virtual machine configuration. VMware

software also enables very fast server provisioning from pre-configured templates, which will permit the Trust to shorten development and test cycles.

"It now takes less than 20 minutes to provision a server using VMWare, whereas in the past it took us three to four weeks" (Jones, 2005, p. 45).

As a final example, using VMware software will allow the Trust to keep backup copies of critical server virtual machines in a suspended state, ready to take over for a failed primary server in seconds. VMware software has a suspend / resume feature that saves the memory state of a running virtual machine in a file so that it can be resumed quickly with no boot delay. When a virtual machine is in hot standby mode, it only occupies disk space and does not use any processor or memory resources until powered on. This capability is another way the Trust can provide high availability within its IT environment. VMware software will enable the Trust to adapt its new IT infrastructure to use computer resources more efficiently. By allowing multiple applications to reside on a single server, the Trust can significantly increase its return on investment, reduce capital expenditures for new equipment, and increase their utilisation of existing hardware (Muller *et al*, 2005).

DISASTER RECOVERY

Mission critical data needs to be backed up with the ability to reuse it quickly in the event of a physical failure or destruction of the IT hardware within an organisation. The Trust needs to have a secondary location within its facilities where its mission critical data is copied to and stored so that if the Trust's primary data centre was to ever fail, a secondary location containing the right hardware could be used to bring all IT systems back online within a short period of time. Part of this proposal includes a disaster recovery solution that covers both the hardware and software required to run critical business applications and the associated processes to transition smoothly in the event of a natural or human-caused disaster (Cougias, *et al*, 2004).

IT Automation

Another feature of this proposal is automated management - that is, automating tasks such as provisioning new space for applications even if they involve a significant number of complex and time-consuming steps. This can help produce increased reliability and personnel productivity for the Trust. Automated management will help the Trust understand, manage and make necessary changes to its IT environment. There are four important applications of automated management:

- Driving resource provisioning and workload management with policies based on Trust goals will better align the IT infrastructure with the business.
- Scheduled free space provisioning occurs when someone in the Trust asks for additional storage space. With automated management, the Trust may automate each step along the way. Tasks that previously took as long as 10 days may now take much fewer.
- Trust-wide reporting and monitoring can be done through the automated tracking of capacity, utilisation, performance, file and device health, and integration with systems management software.
- Emergency management can be useful when a device runs out of space or an application suddenly fails in the middle of the night. With automated

management and virtualised storage pools, instead of trying to cobble together the storage needs from different areas, the Trust may remotely draw from one big virtual pool of free space.

The challenge of maintaining and managing desktops and servers is becoming ever more critical and complex. The drive for increased business efficiency and the growth of virus attacks and other security threats have also focused attention on protecting desktops and keeping users as productive as possible. The Trust needs to be able to handle discrete systems management functions, such as patch management, software distribution, and asset management, through the deployment of an integrated management suite that performs all the required management functions. An integrated management suite will also provide the benefits of centralised control and the simplicity and convenience of one console, architecture, and database (Kern et al, 2000).

TRUST TECHNICAL NEEDS

The Trust has the following technical needs over the next few years:

- The IT Infrastructure needs to be simplified, consolidated, centrally managed and virtualised.
- IT services and technical support needs to be automated.
- The Trust's network infrastructure needs to be replaced to support the new infrastructure.
- Access to e-mail offsite needs to be provided for key employees such as Trust executives, consultants and directorate managers.
- All offsite employees need to able to access the Trust's network.
- Due to the increasing number of applications throughout the Trust there is a need for a single sign on solution to login to all applications preferably based on biometrical sign in.
- Legislation requires that data be stored and held indefinitely such as e-mails and PACS images.
- There is a need for Voice over Internet Protocol (VoIP) technology to facilitate improved communication around the Trust.
- New systems are waiting to be implemented across the Trust (e.g. E-rostering).

ENTERPRISE NETWORK

The Trust's network (LAN) is built on a Nortel iPASSPORT (1GB) platform. It has one core chassis supporting the entire network. In its current configuration the LAN is at huge risk as there is no resilience in it because it only has one core; if this core fails then the LAN would not function; LAN functionality is mission critical to the Trust. In addition, Nortel has recently filed bankruptcy and can no longer be the provider of choice for the Trust. The LAN has been maintained by Digica for over 8+ years in terms of break / fix, configuration and remote management.

The Trust's LAN has remained a relatively flat network for many years. However, over the last 24 months, the Trust's LAN architecture has faced the following problems:

- The LAN has become increasingly more complex.
- More strain is being placed on the LAN due to wireless.
- Nortel has filed for bankruptcy and is no longer a viable option for the Trust.
- The Trust's existing LAN maintainer, Digica, has struggled to support the LAN with its increasing complexity.

IM&T has explored the market in terms of the next generation of LAN switching technology and has concluded that the implementation of Juniper technology is the best way forwards for the Trust. This is in line with the IM&T strategy of consolidation and simplification. Implementation of Juniper will provide the Trust:

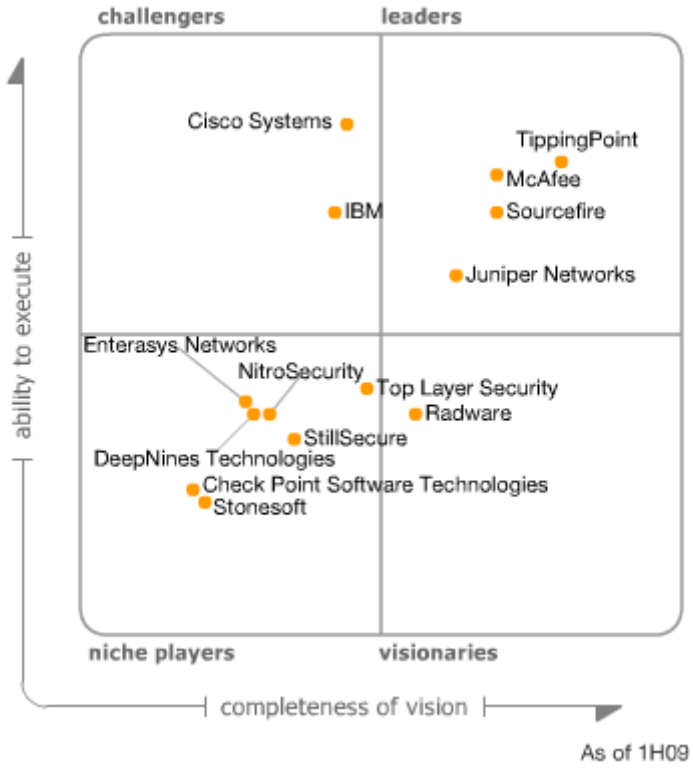
- A high performance 10GB network infrastructure that will create a responsive and trusted environment for accelerating the deployment of services and applications over the Trust's LAN. Networking solutions that provide the foundation for a highly available, reliable, high performance network.
- Security solutions that will protect from threats, privacy or security breaches, and extend secure access to remote locations.
- Application acceleration solutions that improve the performance of applications both locally and over the wide area network, while maintaining availability and security.
- Juniper Networks are financially stable and demonstrate continued investment in R&D at a time when competitors are scaling back investments in these areas – revenues of $3+ billion, $2 billion in cash and $600 million spent on R&D last year (see appendix 1).
- Juniper hardware uses 51% less power and 81% less space than competitors.
- Juniper will provide a resilient 10GB LAN using the one physical core and multiple "virtual chassis" approach.
- A single platform and operating system for network switches, firewall, SSL VPN and intrusion protection.
- Juniper is one of the highest ranked vendors in this sector (see appendix 1).
- This will give the Trust a single network platform with the Liverpool Women's (who also have a new Juniper network) thus simplifying operations and reducing costs through economies of scale.

Juniper Networks were able to demonstrate examples of implementations in Public Sector addressing key projects such as:

- Planning for business continuity.
- Ensuring network and data security.
- Balancing business collaboration and user access with the need for security.
- Optimizing existing infrastructure.
- Supporting secure remote access.
- Enabling e-government / e-citizen initiatives.
- Maintaining the privacy of citizen information.
- Independent industry analysts place Juniper ahead of their competitors.

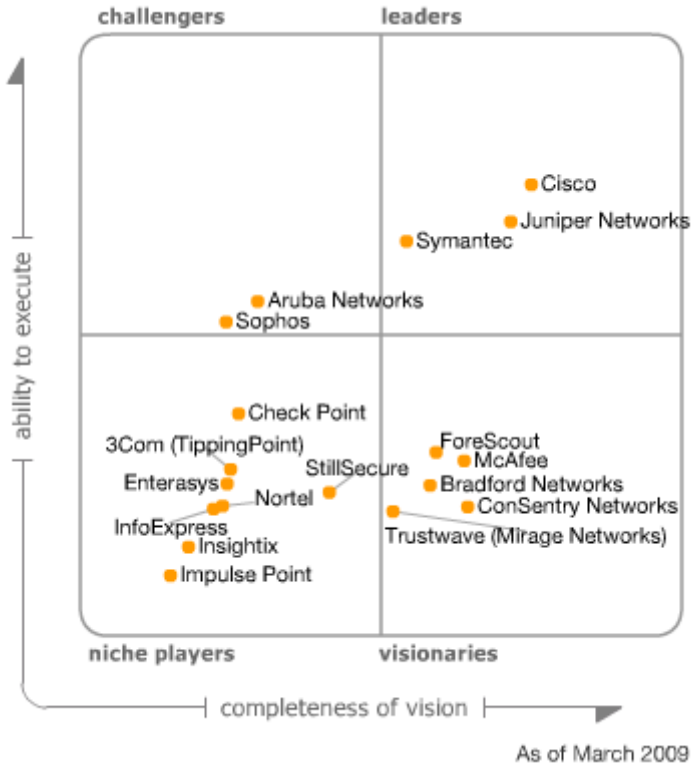
APPENDIX 1

Magic Quadrant for Network Intrusion Prevention System Appliances



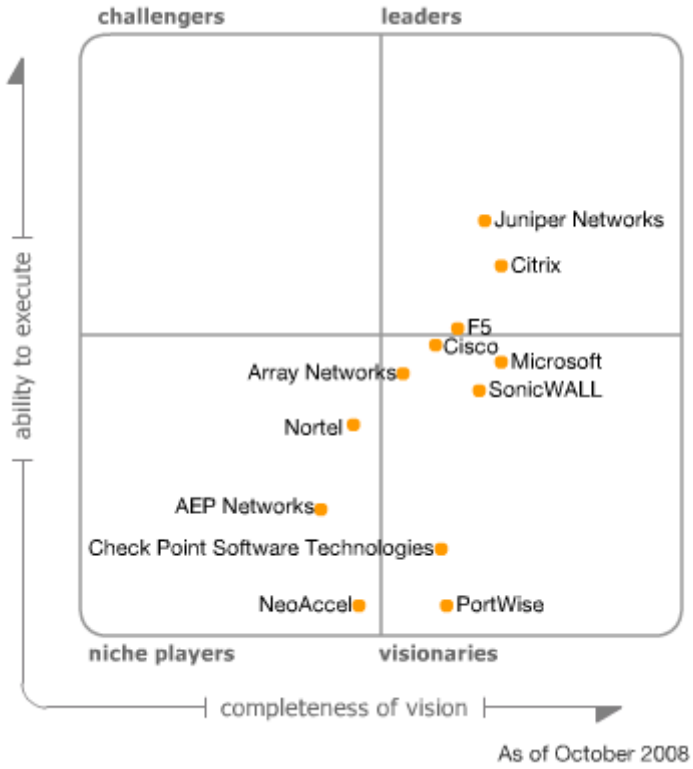
Source: Gartner (April 2009)

Magic Quadrant for Network Access Control



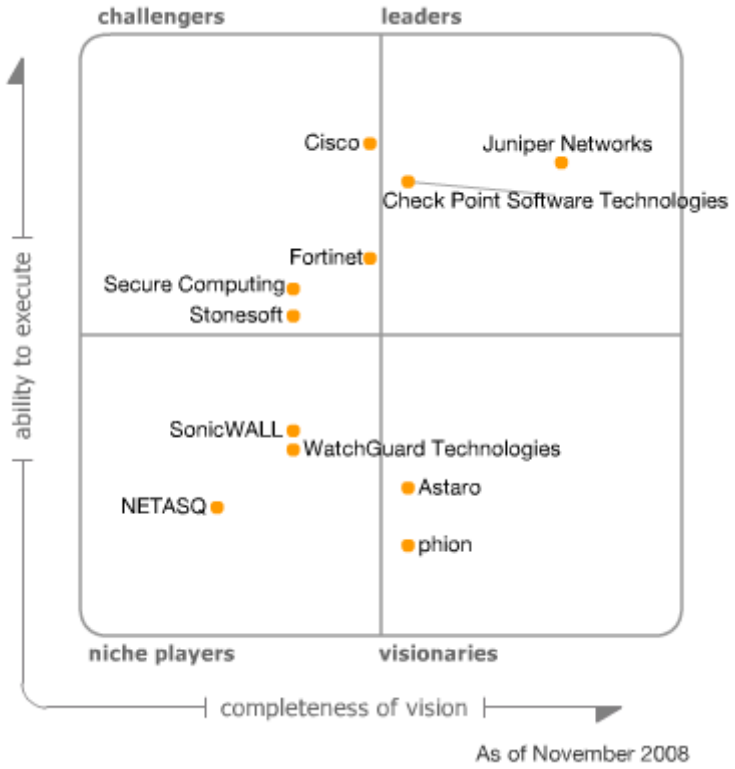
Source: Gartner (March 2009)

Magic Quadrant for SSL VPNs



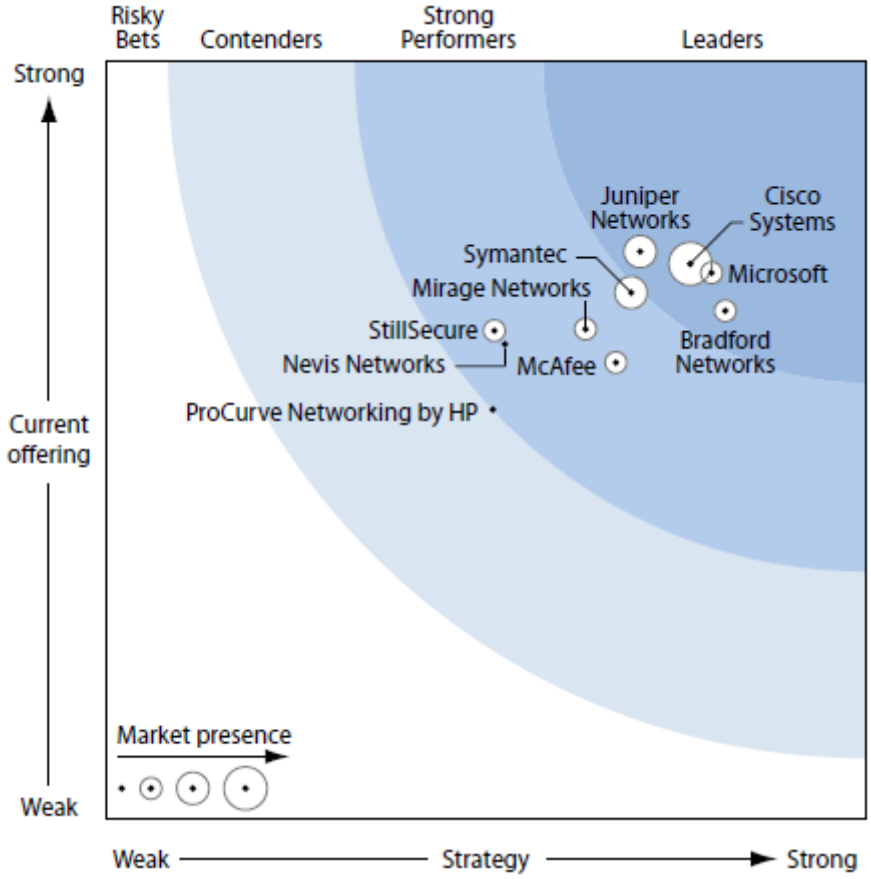
Source: Gartner (October 2008)

Magic Quadrant for Enterprise Network Firewalls

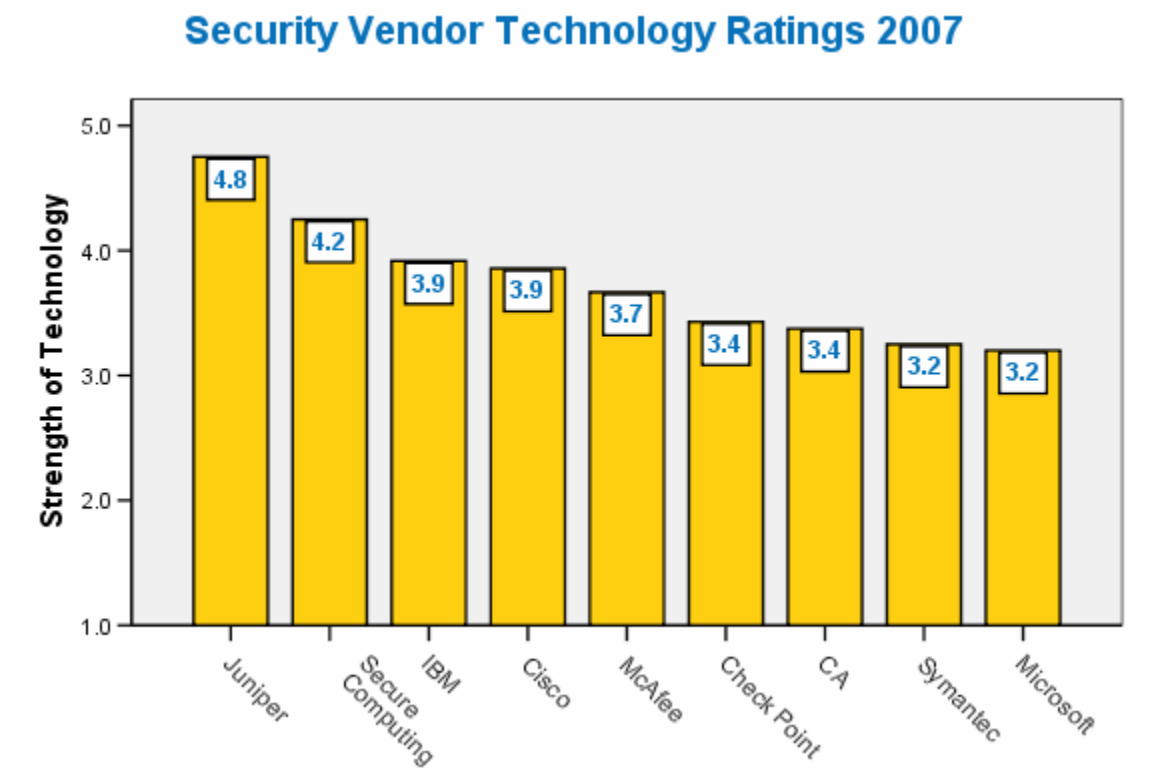


Source: Gartner (November 2008)

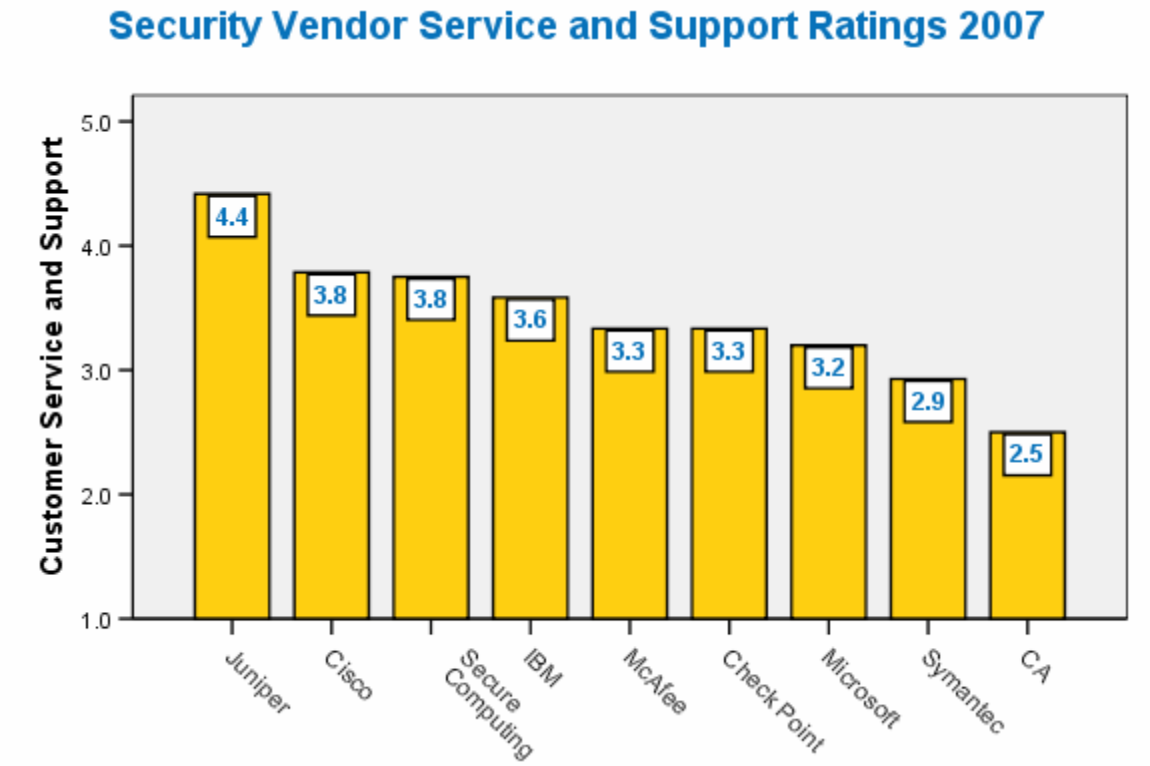
Forrester: Network Access Control Q3, 2008



Source: Forrester (September 2008)



Source: Nemertes (June 2007)



Source: Nemertes (June 2007)

ENTERPRISE TELECOMMUNICATIONS

The Trust's current telephone infrastructure is built around three ISDX PABX systems, two large and one small. The hardware is over 12+ years old and is 4 software update versions behind using obsolete hardware. This means there is a high risk since maintaining the existing system will become increasingly costlier and spare parts will become more difficult to source. If the system was to suffer a catastrophic failure and could not be repaired, then a new system would have to be installed quickly, at a huge cost to the Trust.

A new system will make further expansions easier as well as also improving the way in which communications are carried out throughout the Trust, improving Trust communication with staff and thus enhancing the patient experience.

Unified communications (UC)
UC refers to a trend in business to simplify and integrate all forms of communications. It is typically requires software and infrastructure improvement. In general, it allows an individual to send or receive a message on one medium and received on another. For example, one can receive a voicemail message and then read it in their email inbox using a unified communications programme. The communications leveraged by this term can include phone, e-mail, instant messaging, voicemail, and fax. The software unifies these communication mediums so that any activity or message can be easily transferred to another. A successful implementation can automate and unify all forms of human and device communications into a common user experience. Gains in efficiency can result through an optimization of business processes and enhancing human communications, reducing latency, managing flows, and eliminating device and media dependencies.

Components of Unified Communications
Unified communications can include a variety of elements, such as instant messaging, telephony, video, email, voicemail, and short message services, all of which can be brought into real time and coordinated. The concept of *presence* is also a factor – knowing where one's intended recipients are and if they are available, in real time – and is itself a key component of unified communications. To put it simply, unified communications integrates all the systems that a user might already be using and helps those systems work together in real time. For example, unified communications technology could allow a user to seamlessly collaborate with another person on a project, even if the two users are in separate locations. The user could quickly locate the necessary person by accessing an interactive directory, engage in a text messaging session, and then escalate the session to a voice call, or even a video call – all within minutes. In another example, an employee receives a call from a patient who wants answers. Unified communications could enable that worker to access a real-time list of available expert colleagues, then make a call that would reach the necessary person, enabling the employee to answer the customer faster, and eliminating the rounds of back-and-forth emails and phone-tag.

The examples in the previous paragraph primarily describe "personal productivity" enhancements that tend to benefit the individual user. While such benefits can be

important, organisations are finding that they can achieve even greater impact by using unified communications capabilities to transform business processes. This is achieved by integrating UC functionality directly into the business applications using development tools provided by many of the suppliers. Instead of the individual user invoking the UC functionality to, say, find an appropriate resource, the workflow or process application automatically identifies the resource at the point in the business activity where one is needed.

When used in this manner, the concept of "presence" often changes. Most people associate presence with IM "buddy lists" – the status of individuals is identified. But, in many business process applications, what is important is finding someone with a certain skill. In these environments, presence will identify available skills or capabilities. This "business process" approach to integrating UC functionality can result in bottom line benefits that are an order of magnitude greater than those achievable by personal productivity methods alone.

Unified Communications in Action

Given the sophistication of unified communications technology, its uses are myriad for businesses. It enables users to know where their colleagues are physically located (say, their car or home office). They also have the ability to see which mode of communication the recipient prefers to use at any given time (perhaps their cell phone, or email, or instant messaging). A user could seamlessly set up a real-time collaboration on a document they are producing with a co-worker or consult with a co-worker based on a patient inquiry.

Introducing Intelligent Communications

Unified Communication is the definitive path that leads to Intelligent Communications. Intelligent Communications is about embedding business communications applications into the very fabric of the business, the business process. Adapting the business process to 'fit' to the Intelligent Communications model will:

- Transform how the Trust serves its patients.
- Transform how employees work on a daily basis.
- Transform how its various locations operate separately as well as together as a distributed enterprise.

Intelligent Communications is about making people more productive, customers / patients more satisfied, and business processes more efficient. There are four main components that enable an organisation to deliver and be successful in delivering an Intelligent Communications solution. These are:

- **IP Telephony**. This is the core underlying converged infrastructure (voice, video, etc) that enables voice-grade performance with security, scale-ability, reliability, manage-ability and serviceability.
- **Unified Communications**. These solutions enable businesses to improve the productivity of their information workers by enabling them to be reachable and available anywhere, at any time, via any of a wide array media, devices and applications.
- **Contact Centre.** These solutions enable businesses to achieve exceptional levels of customer satisfaction using any means that customers want to

communicate. This could include technologies such as automated access to self-service applications.

- **Communications-Enabled Business Processes.** These solutions enable communications to be integrated into the fabric of the business to allow orchestration of work in an efficient and effective manner.

Business Outcomes – Benefits

Unified communications help organisations to streamline information delivery and ensure ease of use. Human delays are also minimized or eliminated, resulting in better, faster interaction and service-delivery for the customer, and cost savings for the business. Unified communications also allows for easier, more direct collaboration between co-workers and with suppliers and clients, even if they are not physically on the same site. This allows for possible reductions in business travel, especially with multi-party video communications, reducing an organisation's carbon footprint. Implementing a UC solution within the Trust will result in some or all of the following value added benefits or business outcomes.

- **Customer Satisfaction**. As a public service where the patient care and impression of the organisation is key to the service delivery. The first impression of our Trust is the point of contact (usually telephone); it is vital that a patient or family member can access the person / information they need as easily and seamlessly as possible. Unified Communications and a new telephone platform can address this solution with feature like auto attendant, follow me and having one extension thus giving the user a positive and satisfied service to the public.

- **Worker Productivity / Accelerated Work Flow**. The vision of Unified Communications is to have the ability to access or be reached by voice, email and instant messaging wherever a staff member is, whether that be on site or out in the community. It also enables staff to access there communication applications wherever they are using applications such as voicemail to email. This is great way to improve the productivity of staff members as they can answer queries, take telephone calls and respond to emails wherever they are and the user does not have to remember numerous number as they will just have one extension regardless whether they use their static telephone or mobile number. This reduces the time a query is responded to thus not delaying the business process.

Risk Protection

- **Current System End of Life**. The Trust's current telephone system is end of life. This is a high risk to the Trust; if the system fails this could lead to a costly and disruptive exercise in the future if it cannot be fixed. A solution will have to be deployed without much time for planning and testing the market, this will lead to not only to an expensive project but also lead to a bad experience for staff and most importantly patients.

- **Choosing the Right Partner**. In the current financial market it is crucial that the system sourced will be able to service the Trust for at least 5 years. This is an expensive but necessary investment and the Trust needs

to be satisfied that the partner chosen can deliver the solutions proposed and be around for the duration to support and maintain the solution within a reasonable SLA time as communications is fundamental to our organisation.

Employee Retention

- **Keeping the Knowledge Base**. The Trust recognises that their employees are what make the organisation. The various skill sets and areas of knowledge and expertise are the fundamentals behind making the organisation work; our employees *are* our organisation. The greater the term of their employment at the Trust will increase their knowledge about the organisation and the services, treatments and culture we provide. Employees who are able to easily and successfully communicate are more apt to be satisfied employees who will stay with the organisation for the long haul. So by providing them with the tools to improve the way they communicate and cascade their knowledge will not only improve staff moral, productivity and retention but will also improve the patient experience.

Organisational Objectives

These objectives are what the Trust wishes to achieve from implementing the proposed strategy. These are the key drivers for implementing an improved telecoms system and justification for the investment.

Improving Customer Interactions

One of the main objectives in most organisations is patient satisfaction. The Trust needs to focus on achieving high patient satisfaction and this is done in two ways: high quality patient care and support services, and exceptional customer service when our patients want or need to interact with our organisation. Unified communications can contribute to improved patient interaction in numerous ways, these are:

- **Simplifying Interactions with Patients.** Implementing one number for all services whether it be telephone, mobile phone or fax. This means that staff, patients and other parties trying to contact a person or department can do so without having to remember several numbers or that particular person having to be static at their desk.
- **Increasing Availability of Staff.** Simultaneous ringing of extension numbers and mobile phones coupled with "find-me" or "follow-me" services increase the probability that a caller can reach the intended person on the first attempt. Patients / staff who can easily reach the right person are less apt to begin focusing on the difficulty of getting help instead of the issue they needed help with in the first place.
- **Increasing Responsiveness.** Patients and staff can reach the right person and also initiate real-time and non-real-time communications from anywhere. Employees can have increased access to associates to deal with patient and vendor issues. Also notification of voicemail is vastly improved using mechanisms such as voicemail to email and instant messaging so the response time to voicemail is improved thus issues resolved in a more speedy fashion.

Increasing Productivity

Unified Communications frees up time otherwise wasted on outdated communications systems and trying to find people. The benefits of improved productivity are countless; here are examples of just a few:

- **Speeding Up Execution**. Employees have improved and faster access to others. They can more easily reach patients, external customers, suppliers, partners, and stakeholders to address issues, create opportunities, and advance work flow.
- **Improving Effectiveness and Efficiency**. Increasing the ability for people to communicate with each other increases their ability to do the right thing and do things right. Providing communication tools across formerly separate device- and network-appropriate environments transforms wasted time into productive time. Simplified communication interfaces increase the user adoption rate of communication tools, resulting in workers taking advantage of productivity tools.
- **Integrating Communications.** Integrated communications reduces the need to manage multiple devices or synchronise information among environments. Empowering the user to manage their own communications increases the staff members' ability to focus on what matters rather then focus on the technology. An example of this would be organising a conference call, as there are conferencing tools built in the UC system the employee does not have to worry about finding a free room, sourcing a conference phone and worrying about if it will all work; they can just focus on the discussion topic and what needs to be resolved.

Enhancing Collaboration

Collaboration is the ability for different groups and teams to work together to achieve business goals. Unified Communications improves collaboration in several ways that are described below:

- **Simplifying Work Flow**. The integration of directories and presence information into communication tools increases the ability to access others. This increases access to the right people at the right time. Simplified communication tools increases the frequency (volume) and intensity (quality, richness) of communication; this in turn empowers people with greater knowledge and context to communicate and get things done.
- **Making the Right Decision**. Employees can access decision makers in a more timely fashion and consult more with others to gather necessary content and contextual information leading to faster and better decisions. They can then share those decisions with individuals, groups, or the entire Trust to keep individuals and directorates up to date.

Reducing Cost and Risks

A good Unified Communications solution can result in reduced costs, freeing up capital to inject into other business critical initiatives. Reduced risk in future disruptions will be addressed allowing the focus to be held firmly on patient care and services. Some of the potential savings are outlined below:

- **Saving on Collaborative and Mobile Expense**. In-house audio and web conferencing facilities can significantly reduce collaboration expenses associated with service providers. The ability to answer a call on a mobile phone and shift it to a desk phone can reduce phone minutes for when they are truly needed. The use of a single personal directory available to all communication tools reduces the use of device-dependent directories and device usage when less expensive means are available.
- **Patient Retention**. With the Payments by Results way of funding the Trust and Choose and Book it is crucial that our patients have an excellent experience with us from day one, so that in the event of them needing future care they will choose us. From a communication prospective Unified Communications can aid us in this by simplifying interactions with patients, increasing the availability of employees, and accelerating the responsiveness to their needs.
- **Increasing Productivity**. Increasing employee productivity increases the leverage of the overall workforce. Simplifying the act of communicating, and integrating it into what people do, ensures that communications take place when and how they should. This eliminates the cost of unsuccessful communications – those not made or delayed because it was inconvenient, or because the ability to do so was not readably available.
- **Business Continuity**. Unified Communications can allow communications regardless of geographical location, in the event of a disaster communications can still be carried out via mobile phones, remote working and soft phones. This is crucial as the Trust is a 24/7 operation with patient care being the ultimate responsibility.

Levels of Communications
There are three main levels of communications that this strategy will explain; these are Basic, where the Trust is at now, Unified where this strategy will take the Trust by 2011 and Intelligent where the Trust will hopefully be in the future (2011 and beyond). The descriptions and what distinguishes one level from the next are outlined below.

Basic Communications (Now)
The basic communications level is an environment that consists of an assortment of communications capabilities in the organisation, many of which are legacy applications. At this stage, the main business driver is containing cost and the main way you measure success is in cost savings. The main issue to note is that all of these communications capabilities are, primarily, unrelated to one another. Each exists as a standalone capability with no awareness of, or connections to, others. In many cases, they use different infrastructure, devices, and directory information. Often the technologies are unrelated, however, even when the same technologies are present (such as a desk phone and a mobile phone), they are often still separate from one another (separate access numbers and voicemail). Basic communications use disparate tools such as:

- **Telephony**. Basic voice communications, analogue phones with limited functionality. All functions are performed manually through access codes.
- **Call coverage and notification.** Manually transferring calls from one mode to another is often not possible (desk to mobile phone).
- **Voicemail.** Characteristic of basic voicemail is that voice-mail boxes for office, mobile and remote office numbers are separate repositories. Notifications for each are also separate.
- **Messaging:** Workers have many modes of text communications available - email, instant messaging, and mobile text-to-text messaging – all of which are separate from and unaware of one another.
- **Conferencing.** The capabilities of bringing multiple parties together for voice-communications are varied and separate. All require manual, proactive effort.
- **Directories.** The most visible characteristic of basic communications is the number of isolated directories that exist. In most cases, you cannot transfer directory information from one medium to another unless manually. Non-native contact information (for instance, a mobile number in an email directory) is often outdated or missing altogether.
- **Availability.** It is impossible to tell which method/s of communications another is using; this makes it laborious effort to raise contact. Trying email, instant messaging, desk phone and mobile phone to reach somebody leaving messages at every port of contact.

Unified Communications (By 2011)
UC is the stage of the journey that the Trust is hoping to achieve through this strategy. Many organisations are taking this path to enable interaction across a virtual enterprise. The measures of success include both accelerated workflow, regardless of where employees are working from, and improved customer service / loyalty. The characteristics of UC are described here:

- **Telephony.** Voice communications take place over UC clients, which take the form of thick or thin clients, SIP phones, and dual-mode wireless phones that can communicate with telecommunications networks over GSM within the Trust site over WiFi.
- **Contact.** Workers have true single-number access: call one number and you find them, regardless of their mode of communications available at that moment. All outbound communications likewise have a single-number origination.
- **Call coverage and notification**. Rules and filters determine how and where incoming calls should be routed, based upon caller identity, time of day, and current business conditions. Message waiting indicators are intelligent and provide more value than a blinking light or symbol.
- **Messaging:** Workers have single voicemail, email to any device, cross-media reply and forwarding and instant messaging.
- **Conferencing:** Audio, video, and web conferencing calls the participants on whatever means they have available; they also integrate into calendars.
- **Directories:** Directories are integrated into all communications types and provide click-to-call capability.
- **Availability:** Integrated presence shows which modes are available for recipients. Workers can edit their preference profiles to display their current status.

Intelligent Communications (2011 and Beyond)

As the Trust's communications evolve, advance and mature, it is then the right time for us to reassess and then it will be time to move up a level from UC to Intelligent Communications, known as IC. It's more important to understand why IC than what makes it work. The business drivers and objectives that come into play are:

- **Improved Patient satisfaction.** Whatever means used for a patient to contact the Trust whether it be inbound or outbound calling, phone or web-based self-service, or all of these, we want the patients to be able to manage their service and get help fast.
- **Reduced Costs.** Facing strict government and local target pressures, the Trust vision would want to streamline and automate processes, make information available faster, reduce the probability that problems will occur, and solve them faster.
- **Communications-Enabled Business Processes:** Traditional and emerging business processes as well as other patient-facing processes can be communications-enabled. This means embedding communications capabilities such as messaging, telephony and conferencing right into processes instead of external capabilities that support them. The result is processes that are instantly aware of the availability of experts and support personnel, and can facilitate real-time communications with these persons in order to keep things moving on time and within everyone's expectations.

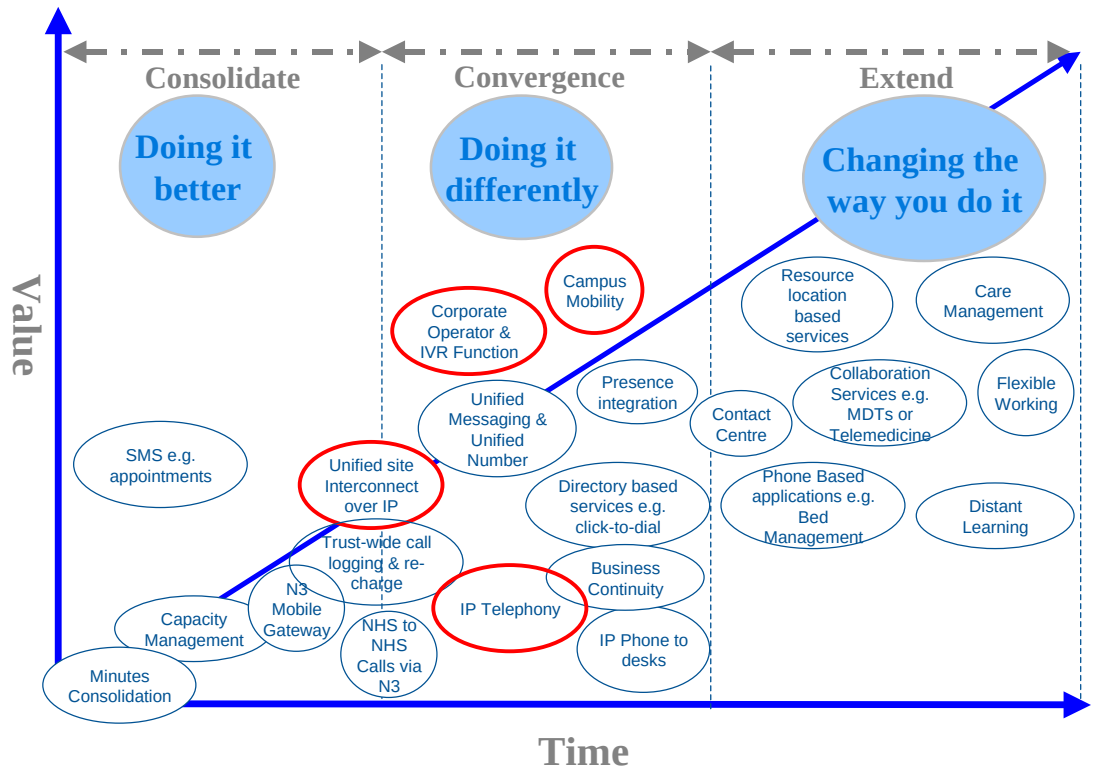
TELECOMMUNICATIONS STRATEGY

The primary objective of the telecommunications strategy is to enable timely, efficient and seamless communications (unidirectional, bidirectional or collaboratively) between people (e.g. patients, relatives, carers, NHS staff and other stakeholders) and people or systems, regardless of setting. In addition, telecommunications is a critical service to hospital service delivery, therefore providing a high level of availability, resilience and contingency is key.

Secondary objectives include:

- Choice of communications for people e.g. voice, text, email, etc.
- Best value for money.
- Enable or deliver further operational productivity and efficiency benefits.
- Standardise telecoms across the Trust.

The diagram below is a roadmap showing the components required to enable the above objectives, those circled in red are critical strategic enablers.

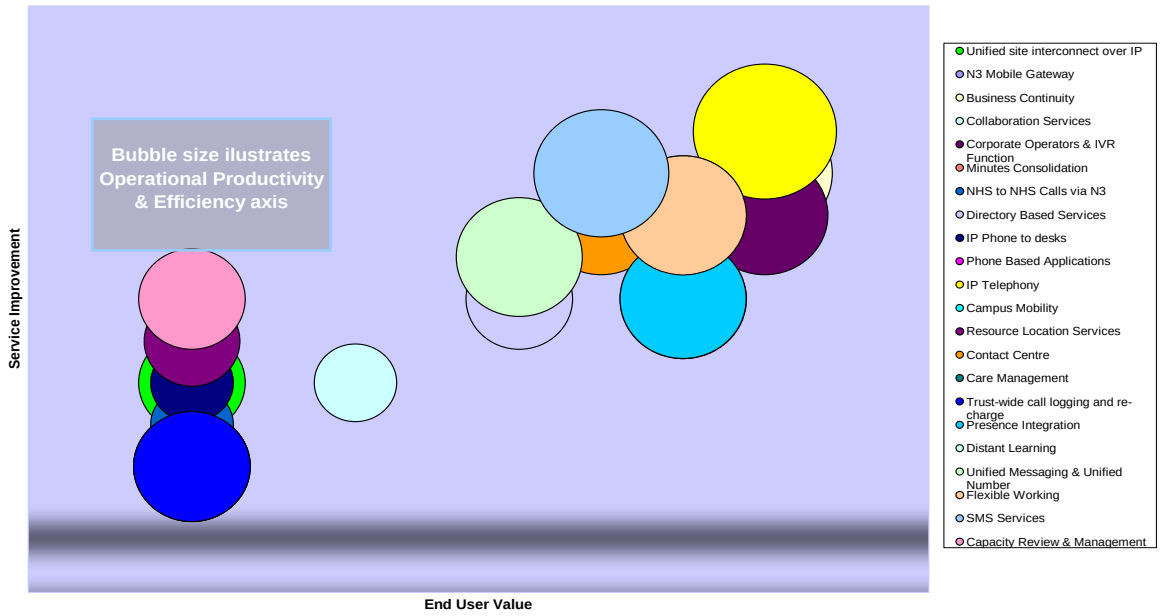


The "Value" axis in the above roadmap is only a fairly crude measure; therefore to explore the value of the each component against the strategic objectives, the component parts have been mapped against three key axis:

- **End User Value:** the end user experience and value. This could be patients, relatives, carers, NHS staff or other stakeholders.
- **Service Improvement:** how the change could improve/impact front-line services.
- **Operational Productivity and Efficiency:** all NHS trusts are under pressure to deliver operational benefits. Therefore the measure here is the

size of effect the change could have directly or indirectly as a key enabler to the Trust's overall operational productivity and efficiency.

Strategic Value of the Components within the Telecommunications Roadmap

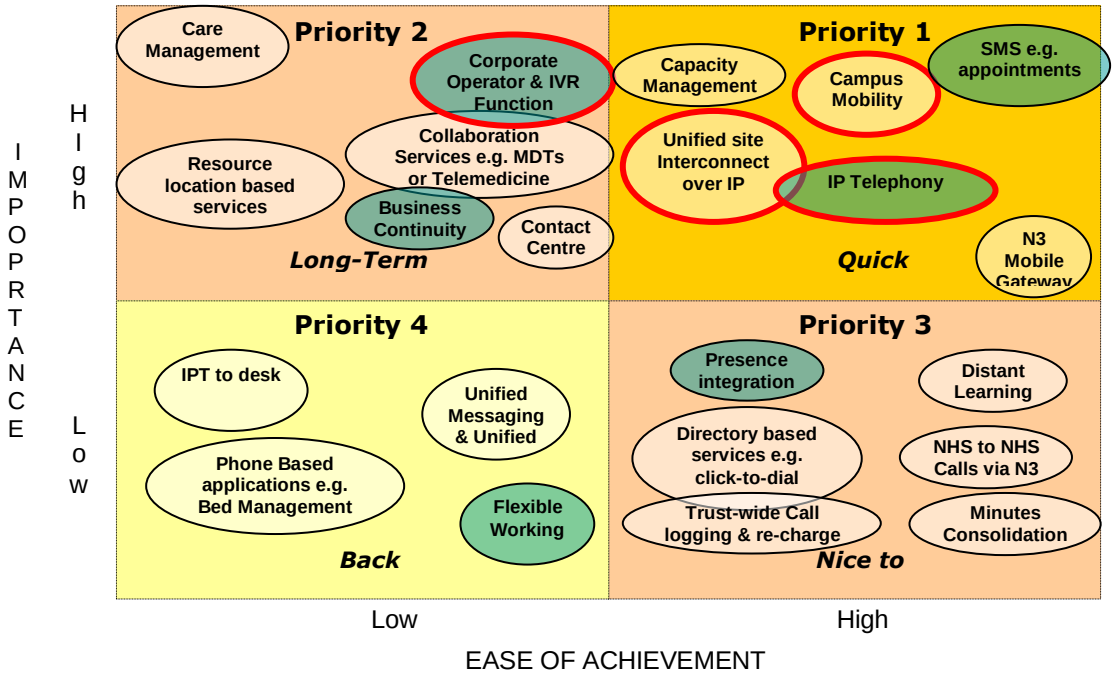


Based on an average of the 3 value axis in the above, the following projects would be the top 6 components:

- IP Telephony.
- Business Continuity.
- SMS Services.
- Corporate Operators & Interactive Voice Recognition / Auto attendant Function.
- Flexible Working.
- Presence Integration.

However in order to deliver the above there are several critical enablers the telecommunications strategy would need to deliver to enable the benefits of these components downstream. Equally there is a need to prioritise the investment and implementation of the telecommunications strategy against the realistic constraints of the Trust, current finances, infrastructure, processes and culture.

The chart below uses ease of achievement and importance to map out the priorities, however investment has not currently been taken into consideration as a factor. In the chart the critical enablers are circled in red and the top 6 value components shaded in green.



PROCUREMENT STRATEGY – GCAT CATALIST

GCat Catalist is a catalogue based procurement scheme from the Office of Government Commerce (Buying Solutions). It is designed to provide public sector organisations with a simplified means of procuring, and contracting for a wide range of IT and Telecommunications products and related services. GCat was designed to reduce the time and costs associated with procurement. The scheme provides the following benefits:

- Increased efficiency of procurement: use of a framework decreases the time and costs associated with a full competitive procurement. Customers have the ability to call-off urgent requirements quickly if required.
- Competitive pricing: value for money prices are ensured at the time of the initial competition.
- Quality of service provision: the experience, expertise and commitment to quality of a prime contractor are assessed at the time of the initial competition. Customer satisfaction with the prime contractors' performance is monitored on an ongoing basis though our auditing activities.
- Opportunities for collaboration: a framework, by promoting networking across its user community, can help to facilitate departments sharing single procurements when they have common requirements. It also helps to co-ordinate the collection and dissemination of customer satisfaction and the sharing of results.
- Common terms and conditions: both customers and prime contractors need only familiarise themselves with one set of the contractual terms and conditions, and need not redraft and / or renegotiate terms for each procurement undertaken.

GCat has seven discrete supply categories for IT and Telecommunications products and related services:

- Hardware and Systems Integration.
- Telecommunications.
- Software.
- Third Party Maintenance.
- IT Managed Services.
- Value Added Reseller.
- Solution Provider.

What is a Framework Agreement?

A Framework Agreement is a contractual vehicle that allows purchasers to order goods or services under the terms and conditions specified in that Framework Agreement. Buying Solutions enters into Framework Agreements with suppliers so that purchasers in the public sector may obtain value for money in their purchasing whilst being assured that their procurement is compliant with UK and EU legislation.

In procuring these Framework Agreements, Buying Solutions carries out a competition in accordance with EU Directives. The evaluation criteria used in each competition are designed to ensure that Framework Agreements are awarded to suppliers submitting the most economically advantageous tenders, taking into account attributes including price; quality; capacity and track record. Using Framework Agreements saves time and money for purchasers and ensures that the terms and conditions of their contract are robust and follow best practice.

The Gcat Catalist framework allows the Trust to select a technology, pick a vendor and place an order without having to undergo a lengthy tender process.

In the determination of the chosen vendors for the Trust on infrastructure, network and telecommunications, a series of vendors were invited to evaluate the needs of the Trust. The vendors were asked to provide solutions for the Trust's infrastructure problems. In selecting the right partner for the Trust the following criteria were used:

- The vendor's listing on the GCat Catalist framework.
- The vendor's ability to deliver identical projects at the Liverpool Women's.
- The financial stability of the vendor.
- The best technology available on the market.

BENEFITS

Some of the benefits of the new IT / network / telecommunications infrastructure will include:

- A Windows® 2008 Enterprise Platform.
- Microsoft® Active Directory.
- Full backup and recovery with centralised storage.
- A solid 10GB fibre channel core with resilience.
- A full disaster recovery solution.
- "Snapshots" in time of data throughout the production day (for quick recovery).
- A centralised and simplified support contract.
- PC inventory / computer audit.
- PC remote control / remote support.
- Patch management (updates to computers automatically, remotely).
- Network monitoring and alerts.
- Windows event monitoring and alerts.
- Software deployment and updates (automatically, remotely).
- Help desk / trouble ticketing.
- Network policy enforcement.
- Integrated reports (full reporting tool for technical services).
- Maximum security and flexible administration.
- Fast and easy PC deployment
- Increased flexibility in delivering voice solutions to the hospital.
- Better regulatory compliance.
- Seamless growth and resource re-utilisation with minimum disruption.
- There are much better features available on the IP Phones. These can be used to enable programmable buttons to be setup to give immediate access to services i.e. bed head data. Telephone directories are available from the phone as would be the intranet. This will speed up staff access to the service they need and help reduce the pressure on Switchboard.
- The solution is able to address emerging requirements for distributed / multisite capability i.e. Branch offices, connection into Liverpool Women's.
- A solution that can take the Trust into the new Health Park with a solid technological foundation (with a platform that can be built upon and partially reutilised in the future).
- Improved Key Performance Indicators – efficiency / performance.
- Enables IT to be transformational and meet the needs of the Trust – to match the standard of care provided by the Trust.
- Improved staff morale.
- Better user / patient experience.
- World class standards.
- Reduced power consumption.
- Reduced spares and maintenance costs.
- Ability to deliver the Business Intelligence needed by the Trust to deliver the new CBU structure.

RISKS

If the Trust decides not to approve the IT / Network / Telecommunications Infrastructure rebuild then it faces the following potential risks:

- The current Infrastructure may completely fail – there are outages on a daily basis and failure is imminent.
- There will a continued exponential increase in labour costs to support the current systems within the Trust due to the fact that all support processes are manual.
- Users will continue to experience lengthy wait times for problems to be resolved due to the manual nature in which the IT department is working.
- The current environment does not allow for the deployment of any new systems without extensive troubleshooting taking place.
- Excess time spent to deal with day to day requests and a manual way of working.
- Problems sourcing spare parts for the old hardware.
- Inability to support the CBU model.
- Without world class IT there cannot be world class care.

COSTS

To complete the total rebuild of the Trust's infrastructure (phase 1) requires:

- A new enterprise infrastructure at a cost of £900,000 (capital) with a revenue implication of £50,000 per year (maintenance, break /fix, 24x7x365x4 support).
- A new network at a cost of £600,000 with a revenue implication of £85,000 (maintenance, break /fix, 24x7x365x4 support).
- A new telecommunications platform at a cost of £175,000 with a revenue implication of £50,000 per year (maintenance, break /fix, 24x7x365x4 support).

All costs include all the equipment, hardware, installation and professional services needed to fully implement the solutions. Prices include VAT. VAT is fully recoverable on all professional services and this will reduce the costs. Revenue costs will be reduced by reviewing the departmental structure, re-evaluation and renegotiation of existing contracts for support and maintenance.

RECOMMENDATIONS

IM&T asks that the Board to:

- Note the contents of this strategy and paper.
- Approve progression of this strategy / plan to procurement of the recommended solutions for infrastructure, network and telecommunications so that the risk of imminent failure of infrastructure is mitigated as soon as possible.
- **£900,000 for the IT Enterprise Infrastructure.**
- **£600,000 for the new Network.**
- **£175,000 for the new Telecommunications platform.**

A total investment of £1,675,000 (including VAT) for Phase 1 of the IT Plan

FINAL THOUGHTS

There are a number of opportunities and challenges that the Trust currently faces that must be addressed - not only to meet today's needs, but to prepare for the future. And, of course, this must be done while managing data growth, dealing with security, staffing and training, managing migrations and upgrades, and understanding new regulations. The Trust must simplify operations through integrated and automated systems management tools. It must improve utilisation through server / storage consolidation, and virtualisation, and cost-effectively scale through the use of industry-standard systems, and the deployment of relevant technology. The Trust's data centre of the future will enable IT processes to match business needs. It will be built using industry standards, offering the benefits of flexibility, integration, choice and control. This new infrastructure will not only improve IT operations now, but will also form the critical foundation for the Trust to be prepared for IT challenges in the future.

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GLOSSARY

Asynchronous Replication: The term *asynchronous* is usually used to describe communications in which data can be transmitted intermittently rather than in a steady stream. For example, a telephone conversation is asynchronous because both parties can talk whenever they like. If the communication were synchronous, each party would be required to wait a specified interval before speaking.

Byte: is an abbreviation for *binary term,* a unit of storage capable of holding a single character. On modern computers, a byte is equal to 8 bits. Large amounts of memory are indicated in terms of kilobytes (1,024 bytes).

Encapsulation: the process of combining elements to create a new entity.

GB: short for *gigabyte* (1,073,741,824 bytes).

Guest OS: the operating system running inside a virtual machine is called a guest operating system.

Hardware: refers to objects that you can actually touch, like disks, disk drives, display screens, keyboards and printers.

Host OS: the operating system running on the physical server hardware on which the VMware software is installed.

MB: short for *megabyte* (1,048,576 bytes).

Operating System (OS): The most important program that runs on a computer. Every general-purpose computer must have an operating system to run other programs. Operating systems perform basic tasks, such as recognising input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers. For large systems, the operating system has even greater responsibilities and powers.

PACS: Picture Archiving Communications System is a state of the art information system that allows for instant access to radiological images and reports.

PAS: Patient Administration System provides the cornerstone of most hospital information systems. They provide links to standalone departmental systems and typically cover admission, discharge and transfer, patient scheduling, bed management, waiting list management and case note tracking. A&E and maternity systems.

SAN: is a high-speed sub network of shared storage devices. A storage device is a machine that contains nothing but a disk or disks for storing data.

SATA: *serial ATA* or *S-ATA*; is a serial link - a single cable with a minimum of four wires creates a point-to-point connection between devices.

Software: is often divided into two categories:

- Systems software: includes the operating system and all the utilities that enable the computer to function.
- Applications software: includes programs that do real work for users. For example, word processors, spreadsheets, and database management systems fall under the category of applications software.

Server: A computer or device on a network that manages network resources. For example, a *file server* is a computer and storage device dedicated to storing files. Any user on the network can store files on the server. A *print server* is a computer that manages one or more printers, and a *network server* is a computer that manages network traffic. A *database server* is a computer system that processes database queries.

TB: short for *terabyte* (1,099,511,627,776 bytes or approximately 1 trillion bytes).

UPS: ***u****ninterruptible* ***p****ower* ***s****upply*, a power supply that includes a battery to maintain power in the event of a power outage. Typically, a UPS keeps a computer running for several minutes after a power outage, enabling the user to save data and shut down the computer.

VMWare: is virtualisation software that is used to partition workstations and servers into separate virtual machines, each containing its own copy of the OS. It resides as a layer between the hardware and the virtual machine partitions. VMware is used by advanced users and developers who need to work with multiple operating systems. It is also used to provide load balancing within the same machine as well as to separate unstable testing environments from production environments.

Virtualisation: the abstraction or idealising of resources so that physical characteristics are masked.

VoIP: ***V****oice* ***o****ver* ***I****nternet* ***P****rotocol*, enables people to use the Internet as the transmission medium for telephone calls by sending voice data in packets using IP rather than by traditional telephone circuit transmissions.