University of Strathclyde

Information Systems Development Framework

Strategy for 2014-19

Enabling the future: transforming our information systems and technology
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Foreword

Strathclyde’s tradition of technological innovation is the foundation of our aspirations as a leading international technological university. Our strategy to realise this is progressing successfully, evidenced by our title of Times Higher Education UK University of the Year in 2012 and Entrepreneurial University of the Year in 2013. We will continue to focus on delivering this vision for our students, staff and the wider community. Major initiatives which will help secure this include: the Technology and Innovation Centre; the Industry Engagement Inovo Building; the Power Network Demonstration Centre; the Catapult investment in Future Cities and the UK’s first Fraunhofer Centre. We will expand our local partnerships with further education colleges, as well as continuing to grow our global network with outstanding international institutions.

Technology is central to the delivery of higher education and will help us deliver transformational services for staff, students and partners alike. Through the provision of state-of-the-art facilities, we intend to offer them access to all the information they require, regardless of their physical location, and to deliver widespread benefits in teaching, learning, research and collaboration activities. The University’s Information Systems Strategy is a critical component and key to enabling our vision; implementing the Strategy will transform our information systems, services and capabilities. This Strategy sets out what we will do, how we will achieve it and, importantly, why we are taking these measures.

Professor Sir Jim McDonald, Principal and Vice-Chancellor, December 2013
1 Introducing the Information Systems Strategy

1.1 About the Strategy

The University of Strathclyde is a leading international technological university. In support of this new position we are transforming our information systems, technology and estates to create a digital campus. This will deliver next generation technology capabilities to all our users.

Strathclyde’s Information Systems Development Framework (ISDF) is one of the critical building blocks necessary for achieving a digital campus. Documentation about the ISDF includes: an Information Systems Strategy (this document); a Portfolio of Programmes and Projects (quarterly updates on the implementation); and annual Operational Plans.

This Information Systems Strategy states clearly our intention to bring information technology to the forefront of our business vision over the next three to five years. Through the provision of state-of-the-art facilities, our goal is for all users of our systems to have access to the information they need, when they need it and regardless of their location. Our Strategy sets out how we will achieve this.

The Strategy is of relevance to the University’s Court members, management, academic and professional service staff, students and partners.

1.2 Basis of the Strategy

At Strathclyde, we place technology at the heart of our vision. The rise of consumer driven technological advances offers the opportunity to embrace and exploit the latest technologies available. This will bring benefits to our staff and students as well to our partners and the wider community.

To help define and shape this Strategy, we looked at sector trends, and at how the University’s delivery of teaching and learning, research, knowledge exchange, international activities and operations are changing. We consulted with Court members, management, students and staff to find out what they want, need and value, to help us identify and prioritise key areas for change.

As our users’ needs become increasingly diverse, our information systems, services and capabilities need to transform in response. This Strategy explains how we will meet our users’ needs in the coming years. It sets out our strategic imperatives and longer term goals for this transformational journey.

Our programme to deliver the Strategy has three distinct strands:

1. Tactical: to provide practical technology solutions and capabilities;
2. Strategic: to introduce new capabilities and ways of working; and
3. Visionary: to transform the University through the use of technology. In this strand, technology can help drive change, as it alters our perceptions and expectations as to what is possible.

The tactical and strategic strands will build on and develop the University’s existing programme of technology change, providing a stronger foundation for new capabilities and services. The visionary strand is about looking ahead to understand how technology may develop. Our tactical and strategic strands will allow us to investigate and potentially implement such visionary capabilities, in close dialogue with our users.

Our Strategy is designed to be updated as the needs of the University change, but also as the capabilities of technology change. Ultimately, our programme of change will support and contribute to the achievement of the University’s goals and aspirations, by providing a truly encompassing, responsive, transparent and effective technology service.
At Strathclyde, we place technology at the heart of our vision. Our aim is to build on our existing solid foundations to allow us to innovate and deliver new technology supported capabilities.

Continually evaluating new capabilities (visionary) will allow us to deliver new services (strategic), that will become the technology norm (tactical).

The result will be a truly encompassing, responsive, transparent and effective technology service.
2 The University of Strathclyde’s vision

2.1 Sector context

The higher education (HE) sector is facing multiple challenges, including funding constraints, continued expansion of access, growing national and international competition and increased scrutiny of value for money. This is against the backdrop of the economic climate, changing regulatory requirements and ongoing changes to the HE sector’s policy and funding context.

These changes have led to increasing differentiation in cost and reputation among institutions. Consequences include wider differences in economic returns to students for HE qualifications, in turn impacting on demand for specific institutions and courses. The emphasis on improving the student’s overall experience of HE, their employability and obtaining competitive advantage has grown as a result. Therefore HE institutions are employing a range of strategies to secure sustainability, drive growth, markedly differentiate themselves from their peers and support their students and staff.

2.2 Our vision and mission

Strathclyde’s vision is to be a leading international technological university. From our foundation as a place of useful learning, we take it as our responsibility to research, teach and be of benefit to society – to reach outside the University to make the world better educated, prosperous, healthy, fair and secure. We have a proven track record of making technologies and innovation applicable for the benefit of wider society and the environment.

2.3 Enabling our strategic themes

Our ambition to take our place as a leading international technological university is being delivered across five strategic themes. Within each strategic theme there are a range of objectives, strategies and environmental influences. Stemming from these are implications for our users’ requirements, which our information systems, capabilities and services must adapt to and support.

2.3.1 Renowned research quality and intensity

Strathclyde is focussing on a number of specific market sectors: manufacturing; health; future cities; and energy. We want to see increases in: our research income from industry and international sources; our postgraduate research student numbers; and the number of grant Principal Investigators.

Key influencing factors on this theme in coming years, which will have to be supported by enhanced information systems, include: the results of the Research Excellence Framework in 2014, which will drive quality-related research funding; the EU’s Horizon 2020 research and innovation framework programme, which will run from 2014; and the need to meet Research Councils UK’s requirements for storing, maintaining and allowing structured access to data.

2.3.2 Exemplary knowledge exchange and impact

At Strathclyde, we are focused on transforming the way academia works with business and industry, and we have created an exemplary new model for how such engagement should be done. In the coming few years we will: operationalise and expand our industry engagement model; grow our licensing, consultancy and CPD activity; facilitate commercialisation; and increase government knowledge exchange.

Increasingly, our information systems will have to support the University’s greater connectivity with industry through such initiatives as our: Technology Innovation Centre from 2014; Advanced Forming Research Centre; Power Networks Demonstration Centre; and a range of collaborative ventures to help other organisations innovate and develop, including through knowledge transfer partnerships.
2.3.3 Outstanding teaching and student experience

Our overarching aims are to: improve our widening access profile; enhance our postgraduate and CPD offering and increase its uptake; deliver an outstanding and distinctive student experience through tailored support and investment in the learning and teaching environment; and produce satisfied, skilled and successful graduates.

Resultant changes which our information systems will need to support will include:

- Changing patterns of student demand and recruitment from different markets leading to a more diverse student profile;
- An ever more competitive environment and the need to optimise students’ overall University experience;
- Enhanced professional education and lifelong learning offerings;
- Growing student emphasis on the use of collaborative learning tools, and their use of digital resources and social media;
- More student involvement in curriculum enhancement and decision-making;
- Increasingly non-location centric learning;
- Embedding our graduate attributes to equip them with skills and business links to ensure employability; and
- Encouraging interdisciplinarity and flexibility in the curriculum.

2.3.4 Thriving international profile and reputation

Our aims internationally are to: expand and deepen our strategic international partnerships; increase our proportions of international students and staff; and streamline our international admissions processes. Resulting changes over the period of this Strategy, which our information systems will need to support, include the following:

- More and deeper collaboration at a University level with international partners, requiring, support for more effective knowledge sharing as well as support to collaborative activities;
- Greater reliance on robust management information to provide evidence for instance about new markets and the impact or otherwise of marketing initiatives;
- Increasing support for staff and student mobility;
- More transnational initiatives, including flexible and distributed learning and franchising arrangements with overseas providers;
- The increasingly global market for academic staff, requiring support for different ideas and expectations.

2.3.5 Operational excellence

Our aims are for: effective staff; a supportive environment; a high quality infrastructure; maximising value for money; and realising the benefits from our organisational values.

Key features over the coming years will include the implementation of our estates and information strategies, improved business processes and embedding of cultural change.

2.4 Customer orientated service delivery

Technology is central to the delivery of higher education. Any transformation needs to be business led with the customer firmly placed in the centre of thinking and service design. In this way, the organisation provides what the customer needs, in the way that they need it.

The traditional model for many technology solutions has been to design and build for the majority of users, as opposed to focussing on the needs of the individual. However, services must be easily adaptable and configurable to the needs of individuals. The pervasiveness of the mobile app has altered the way individuals identify and consume information services. A ‘pick-and-mix’ approach has become the norm whereby users will collate the apps they need, and in effect architect their own solution – their own User Orientated Architecture.
We know that our students, staff and partners expect the latest technologies to be available. Through the provision of state-of-the-art facilities, they want to have access to all the information they need, regardless of their location. The complexity now lies in the fact that we have moved on from having a discreet set of traditional user groups, that is – students, academic and professional service staff.

Instead the University now has a spectrum of non-traditional users of our systems and services. These include international academic partners, industry partners, parents and guardians, professionals on short courses, flexible and distance learning students and many more.

Further complexity stems from the fact that in the course of their engagement with the University, individuals may fulfil multiple roles, such as student, staff member, or a representative of an external business.

The consequences for the University are that we need a way of providing secure, controlled access for a variety of classes of users to certain institutional resources and knowledge assets. Our Strategy addresses this complex area by introducing new technologies which will provide us with the tools to adapt and change, in line with changes to our customer demographics, business needs and other requirements.

**FIGURE 2 OUR EXISTING AND NEW CUSTOMERS**
3 OUR APPROACH

3.1 Meeting our users’ needs

Our starting point in the development of this Strategy was to consider how the delivery of teaching and learning, our research, knowledge exchange, international activities and operations and management are changing, at what pace, and how our information services, systems and capabilities should transform in response. We also examined the needs of individuals. How, for example, do academics differ from postgraduate researchers, from undergraduate students, from external industrial collaborators? As we looked across the University we understood the changing nature of our users or customers.

The principal existing and emerging requirements of users of our information systems, services and capabilities are for the following:

- Better integration of our major systems;
- Interconnectedness of our systems with business processes;
- Improved and tailored security, to allow collaboration with secure controls whilst working with and sharing data with external partners;
- Ever increasing data storage requirements for researchers and students
- Better curation and management of research data;
- Provision of excellent facilities and infrastructure to attract and then support the best research and business partners, which can be used as, where and when needed;
- Enhanced ways of disseminating, exposing and promoting research results and capabilities;
- More authoritative data sources to provide accurate, effective, trusted and timely management information;
- Where possible, a single entry point for users to our systems;
- Enable users to tailor their view of University systems;
- More robust identity lifecycle and access management;
- Pervasive single sign-on, where appropriate;
- Ubiquitous access to and consistent provision of systems across the physical and digital campuses;
- Increased standardisation of existing systems and services;
- More support for non-standard requirements, to enable customisable and flexible use of systems; and
- Uniform support for any device, on any platform anywhere, anytime – 24/7 connectivity.

3.2 Improving through technology

Information technology has altered the way in which we interact with everything around us, and it must underpin everything we offer as an institution. By looking at IT as an integral part of academia we will invest in, provide and support technology capabilities for our students, staff and other users.

Using technology wisely within a programme of transformation will allow the University to tackle current and future challenges. As our ability to use digital capabilities and tools to create new and unique content has increased and matured, so have our ways of communicating and sharing ideas and concepts. This inherently introduces new challenges which must be addressed. When something is created digitally it is a unique piece of content which must be treated and stored in the same way as non-digital content.

Over the coming years the art of digital curation and research data management will become more important as the transition from the printed world to the electronic world accelerates. We need the ability to select, preserve, maintain, collect and archive such
digital materials, and new tools to allow us to find and exploit these digital assets.

Technology encompasses a wide spectrum and over the coming years we will introduce new capabilities which will enhance all our activities. Strathclyde will be at the forefront of technological change that will allow us to embrace and innovate world class solutions.

### 3.2.1 Centres of excellence

In developing our vision and Strategy we have explored the current and future needs of our users. Meanwhile, our approach to the delivery of all of our technology services will be to identify, test and select the most appropriate means which delivers the best quality of service, balanced with value for money. The use of shared services is one of the options which we will investigate further as and when a suitable opportunity identifies itself. We will look at three key ways of defining and creating centres of delivery excellence, as shown.

**FIGURE 3 CENTRES OF EXCELLENCE**

![Image of centre of excellence diagram](image)

#### 3.2.2 Sustainability of ICT

The University views technology as renewable assets and, as part of our overall approach, the ICT Strategy reflects environmental and technological advances through the development of common measures of delivery. As part of this we will define, and require, mandatory minimum green standards for ICT products and services.

Sustainable ICT will have a significant impact on the delivery of savings across all ICT projects. Green ICT products use less energy and therefore cost less to run, while intelligent use of green ICT can enable flexible working practices, thus supporting academic and estates colleagues to reduce their running costs.

### 3.2.3 Impact of emerging teaching & learning technologies

An explosion in on-demand and consumer led innovation has brought a paradigm shift in how individuals consume data and information. The consequence is a change of student expectations when it comes to learning and accessing materials.

Teaching and learning technologies are more than simple infrastructure projects; they are actively engaged beyond flat learning materials and models of lecturing. The variety and capabilities of supporting technologies provides enhanced, interactive content creation tools, pedagogic techniques, blended learning and social constructivism modes of teaching, along with seamless integration between physical and virtual spaces.

We will continue to look at emerging technologies in key academic, research and business related areas to understand what it can do, but also how it can be taught and integrated into the learning experience.

### 3.2.4 Emerging technologies

Emerging technology is by its very nature a changing landscape and we are looking at how such technologies can be utilised not only in the academic sense, but from a research and commercial perspective. New technologies may have little impact, or become truly disruptive and bring about new and exciting opportunities. A review of surveys from global organisations predicts the emerging and potentially disruptive technologies shown in Figure 4.
### FIGURE 4 EMERGING TECHNOLOGIES

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gesture based control systems</strong></td>
<td>Utilising physical body movement and gestures to interact and control with technology.</td>
<td>Gesture controls has substantial opportunity to change areas of health and hazardous working, as well as bringing new capabilities to individuals who may require more assistance. Gesture based solutions are presently being used in sterile operating environments to assist surgeons.</td>
</tr>
<tr>
<td><strong>Interactive Surface technology</strong></td>
<td>The ability to access services and capabilities through an interactive technology surface.</td>
<td>Interactive surfaces can provide a new way of collaborative working though the ability to automatically interrogate additional devices. Imagine attending a meeting with a number of colleagues and upon entering the room you place your mobile on an interactive surface. The surface recognises each device and provides information directly related to the meeting.</td>
</tr>
<tr>
<td><strong>Mesh networks</strong></td>
<td>The ability for multiple devices to interconnect to capture and disseminate its own data and act as a relay for other devices.</td>
<td>With more and more technology devices being present in homes it is possible to utilise these to provide non-invasive support services for those in need of assisted living capabilities. Each device can communicate with each other providing a rich data environment which can remotely be interrogated.</td>
</tr>
<tr>
<td><strong>Ambient</strong></td>
<td>Environments which are sensitive and responsive to the presence of individuals.</td>
<td>With the pressures on energy and the environment it is imperative that technology is used to implement smarter environments which can automatically detect and adapt to the needs of the individuals. Using smart sensors to only power devices if there is some present, or air conditioning that adapts to the number of individuals.</td>
</tr>
<tr>
<td><strong>Ubiquitous computing</strong></td>
<td>Providing computing capabilities everywhere and anywhere through any device.</td>
<td>The topic of Ubiquitous computing touches multiple research topics including distributed computing, mobile computing, location computing, mobile networking, context-aware computing, sensor networks and artificial intelligence.</td>
</tr>
<tr>
<td><strong>Augmented reality</strong></td>
<td>Providing live, direct or indirect views of the physical world to enhance real-time services.</td>
<td>As more of the environment becomes connected the more everyday devices will be able to provide feedback to users. The use of handheld devices providing audio descriptions of museum exhibits has been around for a long time, but now devices include audio, video and data overlays to provide users with a more immersive and interactive experience.</td>
</tr>
<tr>
<td><strong>Mobile internet</strong></td>
<td>Using next generation hand-held electronic devices using video, audio and telestation capabilities over secure networks to provide real-time multi-party collaboration.</td>
<td>Mobile devices provide an ideal platform for bringing together multiple capabilities which can provide access to key information when needed. The use of in home technology which can monitor an individual’s health and environment linked through mobile technologies is providing health care workers easy access to critical data. The devices also provide reactive alerting in the event of a detected incident.</td>
</tr>
<tr>
<td><strong>Semantic web</strong></td>
<td>Bringing meaning to the web to support industry, biology and human sciences.</td>
<td>The internet at present is just information without context. Enter a search keyword and you will return millions of internet links. The semantic web provides a means of joining data together to bring meaning and context to the information. Semantic web driven Internet sites provide a common framework that allows data to be shared and reused across applications, enterprise and community boundaries.</td>
</tr>
<tr>
<td><strong>Immersive virtual reality</strong></td>
<td>Fully immersive environments allowing real-time training in key disciplines.</td>
<td>There are some professions where only so much teaching and learning can be done in a classroom environment, for example surgery does require practical application. The use of immersive feedback environments provides the opportunity for specialist professions to undertake more training using virtual objects. Using such environments also allows the true 3D rendering of objects which again allows individuals to learn in a more realistic environment.</td>
</tr>
<tr>
<td><strong>The Internet of things</strong></td>
<td>Making every object uniquely identifiable through embedded technology to give a virtual representation to a network environment.</td>
<td>Equipping objects in everyday use provides unseen opportunities to transform how we interact with our surroundings. But it also provides a way of simplifying activities, automatic stock control and ordering based on tracking of what has been used. The ability to inform a local authority when a bin collection is needed by the bin sending an request automatically when it is full. It is estimated by ABI Research (the leading technology market intelligence company) that more than 30 billion devices will be wirelessly connected by 2020.</td>
</tr>
</tbody>
</table>
3.3 Taking an architectural approach

Increasingly technology is seen as a commodity which can be turned on or off at will. Our view of technology is different: it is a critical tool to help us in all aspects of research, knowledge exchange, teaching and student experience, international focus and operational activities. Therefore to provide the quality and integrated service needed, we need a more structured and architectured approach to bring together all the rich services and capabilities we have to offer.

Large organisations with a diverse technology landscape, like Strathclyde, tend to adopt more structured approaches to delivering solutions. We will look at adopting and using such Enterprise Architecture approaches, principles, frameworks, tools and thinking as we move forward over the coming years.

Enterprise Architecture at its broadest is about ensuring all components of a solution work together and deliver what is needed, as well as ensuring existing services are not affected.

Our present technology capabilities cover and support all areas of the University, to ensure that we start on the path of Enterprise Architecture we have broken down our core architecture vision to a number of key layers.

The diagram below is a very high level representation of our ambition to deliver a holistic technology service which can provide services and capabilities where needed, when needed, through any device, at any time and to any user.

Our Technology Service Hub design is an outline architecture which provides a structured means by which we can implement new services very quickly across Strathclyde. The layers of our design are simple:

- **Channels of access** – all users must be able to access technology offerings through one or more digital channels including traditional and non-traditional means;
- **Security** – is critical and will be provided by active and passive protection mechanisms;
- **Technology Service Hub** – this is the main integration capability which will ensure users are connected, and can use, the component(s) necessary for their activities. This supports our five strategic themes and will allow the definition and support of specific combinations of software, service and platform capabilities as needed;
- **Software** – we will provide vendor software which can be consumed as our users need it;
- **Platform** – we will provide a number of pre-defined technology/software platforms which will be available to users, structured to meet specific requirements;
- **Service** – at the lowest level we will provide commodity services which can be consumed by our users. Where appropriate we will ensure that services cover the needs of users, for example Managed Desktops will allow for Thin and Thick client working.

The components represented in the three towers of capability are examples, and over the coming years we will continue to define and add into these towers as required. As the diagram illustrates, categories of capability can be represented in multiple towers to reflect different offerings, for example Managed Desktop is both a Platform and a Service – the Platform would be a pre-defined offering to support a specific need (a Media Lab) whereas the Service would be available to individual users to support their needs.

Key to our Strategy is the ability to select and provide appropriate services and capabilities to our users. This approach allows us to commoditise a number of offerings through an integrated front-end. We can also utilise and implement services from third party vendors to enhance our capabilities, as required, allowing us to use the best of breed external solutions without major capital infrastructure investment.
FIGURE 5 UNIVERSITY OF STRATHCLYDE – TECHNOLOGY SERVICE HUB
4 Summary of the Information Systems Strategy

This Information Systems Strategy supports the core and visionary goals of the University in all areas of teaching and the student experience, research, knowledge exchange, international focus and operational capabilities. The Strategy will:

• Improve the whole student experience through the deployment of easy to use connected services, supporting individual and collaborative learning and research;
• Provide relevant leading edge technology to support the needs of our researchers;
• Support multi-party knowledge exchange through the use of integrated technologies;
• Utilise technology to provide teaching, learning and research capabilities for our overseas students and partners; and
• Augment our operations by providing enhanced technology capabilities.

As our user groups grow and change we will continually monitor and embrace the latest technological capabilities to enhance all our users’ experience.

Given the reach and aspirations of our Strategy, we engaged with users from across the full spectrum of University colleagues to understand their needs, desires, and current frustrations. This feedback has been invaluable in providing contextualisation for a number of our strategic ambitions.

The diagram below is a representation of our users’ feedback showing three different aspects. These are:

- **Why** do we need a Strategy and what are the drivers for change;
- **How** will we address delivering the Strategy; and
- **What** will be covered by the Strategy?

We have used each of these areas as core principles in constructing our Strategy to ensure we deliver a quality of service expected by all of our users.

The subsequent diagram summarises and illustrates the key aspects of our Strategy.

**FIGURE 6 CONTEXTUALISATION OF THE STRATEGY**
FIGURE 7 SUMMARY OF THE INFORMATION SYSTEMS STRATEGY

**Infrastructure to support growth**
Providing a technical infrastructure which has high performance, is scalable and robust and drives a platform to support the institution’s immediate and future business needs.

**Security**
Providing a secure and trusted environment for all our users through continual evolution of security. As technology continues to change, so will our detection, protection and security capabilities.

**Collaboration**
Providing tools, services and capabilities allowing our users to collaborate however they require and supporting partnership working globally.

**Information & learning resources**
Providing learning resources which support teaching, learning, and research, in turn providing new capabilities and technologies which embrace new ways of teaching and learning.

**Web presence**
Providing a world-class web experience, ensuring this is the first place individuals look for services and information they need.

**Unified communications**
Providing a campus wide unified communications environment – bringing audio and video together for all aspects of teaching and learning. Creating a unified communications driven teaching capability for global education context delivery.

**Applications & management information**
Providing applications and management information through innovative ways of access and use, regardless of location, time, and device. Ensuring accurate and timely management information through comprehensive master data management.

**End user computing**
Providing state-of-the-art computing facilities, with an adaptable capability, allowing our staff and students to use any device they wish.

**Supporting research and I&E**
Providing leading edge technology in support of all research and knowledge exchange activities through our Technology and Innovation Centre and the high performance computing capability.
5  Detailed Information Systems Strategy

5.1  Overview

The Information Systems Strategy has been designed around a number of key IT related topics and areas which will be addressed throughout the lifespan of this Strategy.

Each area has been designed to provide the foundations upon which we can deliver world-class technology capabilities.

5.2  Infrastructure to support growth

5.2.1  Data centres

The University operates multiple modern data centres, which are used to deliver and support all of our core services. All of these have undergone significant investment to ensure they are fit for purpose to deliver all the hosting capability the University needs. We will continue to operate our own data centres to ensure the best service delivery in support of all of our students and staff and will look to increase the capabilities, where needed, to support new teaching, learning, and research requirements.

The hardware deployed within these spaces is continually changing, but the spaces themselves are well equipped to accommodate the University’s needs over the coming years. As part of our overall rationalisation and consolidation of computing resources, we anticipate that appropriate faculty-based computing resources will migrate to the centrally managed data centres. This will ensure the delivery of services which are cost effective, are supportable, and are backed by Service Level Agreements (SLAs). This will also lead to the avoidance of duplicated work and allow combined skills to be utilised where they can offer most advantage.

5.2.2  Server infrastructure

Over recent years, our physical server hardware has largely migrated from standalone racked devices to blade-based systems, providing a more compact, structured, flexible, and managed environment. This has proven hugely beneficial to our operation, and we will continue with this approach to ensure the most efficient and green server technology is used.

Server virtualisation has offered the university new scope to increase capacity and offer new ways of delivering raw computing power when needed. We will utilise the latest capabilities in server virtualisation to ensure new applications are delivered through highly available and scalable virtual hosting environments. This has proven hugely beneficial to our operation, and we will continue with this approach to ensure the most efficient and green server technology is used.

Did you know?

- You have access to world class server infrastructure
- We use virtualisation to speed up delivery of new services
- You have access to high speed network connectivity
- A large WiFi infrastructure is available
- Staff and students can access WiFi in 54 countries and almost 6,000 sites across the world via the eduroam service
- Access Anytime, Anywhere, Any device capabilities

Tomorrow

- Increased computing power
- Highly resilient, flexible and configurable environments
- Ability to provision new computing resources to suit needs
- Access to massive storage facilities to support your needs
- Utilisation of best of breed external service
- Increased network capabilities

Our core IT infrastructure architecture underpins the University’s entire operations – teaching, research, and operational. The high level design principles are straightforward – designing and deploying a technical infrastructure which has high performance, is scalable, resilient, robust, and delivers a platform to support the University’s immediate and future business needs.
Our ultimate goal is to offer a ubiquitous IT capability where users simply consume the service and resources as needed.

5.2.3 Storage infrastructure
We see data as a valuable commodity which must be protected as closely as any other asset we have. In order to provide the necessary capabilities to support our data needs we have in place a managed, high performance, scalable, and cost-effective storage infrastructure which underpins all of the University’s research, teaching, and corporate operations. At the same time, the provision of this security and integrity is largely invisible to the end user.

Over the coming years and as this Strategy is deployed, we will work with our users to understand their digital storage requirements to ensure that the best and most appropriate storage medium is made available. This has the potential to include portable, semi-portable, volatile, and permanent storage methods, using the best of breed technology from our key partners. Our storage Strategy will be linked to the actual data needs of the different areas of the university, providing appropriate storage options for all aspects of data storage and retrieval.

We will continue to invest in providing world class storage capabilities and our Research Data Management project will evaluate, identify, and procure a scalable storage solution to accommodate our data requirements. As part of this project we will actively seek to utilise the latest in high capacity, high speed storage technology.

Increasingly we will seek non-traditional storage solutions for providing high quality low cost services for non-performant and non-critical data, where access is required infrequently, either publically or privately.

5.2.4 Cloud
“Cloud” is not new. It is largely a rebranding of something that the University – and the IT industry in general – has been doing for many years. The change is the scale on which these services are offered, the costs at which they can be deployed and most importantly the commercial acceptance of moving key components of a corporate operation to an externally-hosted environment.

As the University’s IT operation develops, cloud-based services will play a key role in their deployment. For every service, we will evaluate the pros and cons of local and remote hosting, and deploy the service that provides the most appropriate environment in terms of performance, manageability, security, and cost. For some services this will involve local hosting, for others it may be a cloud service, and for some there may be a hybrid model.

Using “Cloud” services and capabilities will allow us to explore new offerings to support an evolving teaching, learning, and research environment. In addition, the University will provide its own Cloud capabilities for external businesses, research organisations, and the wider local education community.

5.2.5 Connectivity
Bringing all the different aspects of our technology estate and capabilities together across our diverse physical estate is a challenge which can only be addressed by ensuring that we have reliable, scalable, and trusted connectivity capabilities providing users with the quality of service they expect. Providing connectivity is not just about network connections. For us it is about ensuring that the best and most appropriate communications capability is provided to support the needs of our users.

To achieve our Digital Campus vision it is vital we have a pervasive, robust, and resilient high speed data network encompassing all areas of the campus in order to deliver all of our services, and enabling ubiquitous communications between all University staff, students, and collaborators. This infrastructure will utilise both wired and
wireless technology to deliver “last mile” services to end users.

Network infrastructure was perhaps once seen as a useful extra, then an enabler for services but has now become an essential and fundamental component underpinning all of our services and our business infrastructure. Fast, reliable and secure connectivity is assumed, as the network today becomes a utility service, ubiquitously available like power and water.

Our vision for our network capabilities will:

- Ensure a world-class quality of service for all users;
- Provide campus wide high-speed, reliable, resilient, and secure fixed and wireless network connectivity including WiFi and mobile HotSpots;
- Ensure greater flexibility in connectivity and mobility for teaching, learning, research, and wider business needs;
- Ensure high bandwidth connections are available, as required, to support our specialist research and teaching requirements;
- Provide network performance and utilisation information to users;
- Invest in technologies and training to ensure the network service keeps step with technological change and new business needs; and
- Ultimately provide access anytime, anywhere, any device capabilities for all users to access university resources.

Our connectivity solutions will enable us to continue to provide standard communications capabilities, as well as bringing in new capabilities to support new teaching, learning, and research requirements.

We will continue to implement and support tools which provide:

- Voice calls;
- Video-conferencing – one-to-one and one-to-many;
- Application and desktop sharing; and
- Virtual collaboration e.g. 3D environments.
- Presence information;
- Email;
- Instant messaging.

We will introduce a common set of tools which will be available to staff and students, allowing easy communication as and when needed.

Wherever possible we will implement a more integrated set of components which can provide a richer set of capabilities under a single banner. The tools will be integrated with other academic and non-academic solutions to help improve efficiencies in other areas of our operations.

5.3 Security

In today’s digitally literate environment it is vital that as an organisation we ensure that security is paramount to protect all of our users and digital materials. As a large and diverse organisation we have differing security needs, from simple virus protection through to protecting our research intellectual property.

Security for us will be a continual evolution as technology continues to change, as will our detection, prevention, protection, and security capabilities.

Our connectivity solutions will enable us to continue to provide standard communications capabilities, as well as bringing in new capabilities to support new teaching, learning, and research requirements.

Did you know?

- All our systems are protected to ensure privacy and security
- We support Bring Your Own Device across the University

Tomorrow

- Device encryption to protect data at rest
- Enhanced secure remote access for partners and collaboration
- State of the art Intrusion Protection and Detection solutions
- Use of multi-factor authentication to provide more security where needed
- More integration of solutions to provide more single-sign-on access

As such, our Information Security Strategy is to provide a fully integrated and pervasive layered security model which encompasses both consumer and enterprise technologies and capabilities.
To protect users we will utilise technology to:

- Provide extended SSL certificate based authentication;
- Implement multi-factor authentication where needed;
- Implement Single Sign-On; and
- Provide secure Web, Email, and all other electronic communications.

To protect our infrastructure and services we will utilise technology to:

- Provide protection for all University end user computing devices;
- Provide device and network authentication;
- Ensure appropriate file, disk, and removable media encryption;
- Provide secure remote access;
- Provide secure boundary and end-to-end messaging;
- Utilise Intrusion Prevention (IPS) and Intrusion Detection (IDS); and
- Enhance security across all of our connectivity solutions.

In addition, our security layered model will provide the capabilities to support a full Bring Your Own Device (BYOD) programme which offers the same protection capabilities as university owned assets.

Whilst these physical security measures, techniques, and technologies will ensure we provide the most secure service we can, it is also key that we provide logical level security to protect our users and systems in other ways. User access to any of our services will be controlled through a full Identity Lifecycle Management capability, which will ensure the right people get access to only the data and services they are permitted to.

This will also provide us a platform for a programme of service integration which will make the majority of University systems and services available through a single sign-on capability.

5.4 Unified communications infrastructure

Over the coming years the University will create a campus wide Unified Communications environment bringing together audio and video capabilities for all our activities. Our goal is to create a Unified Communications driven teaching capability for global education content delivery.

In today’s technology driven world, being able to communicate effectively and efficiently is critical to promote integrated thinking and working. The further integration of traditional telephony, video conferencing, instant messaging, group discussions, presence information, and application and desktop sharing has opened up new opportunities and is helping reshape how individuals interact.

At Strathclyde we have embraced unified communications, not only for improving how we operate internally, but for improving the whole teaching and learning experience. Throughout the University we will continue to deploy various technologies to support our unified communications approach which has allowed us to provide:

- Support for remote teaching via web conferencing and messaging;
- Support for home and itinerant working;
- Collaborative research and working with partners at other organisations – or simply in other parts of the University;
- Improvement in internal communications
- Minimising time lost by staff “in transit”;
- Real-time presence information to all staff and students;
- Remote support capabilities; and

Did you know?

- You have access to Microsoft Office Communications Software (OCS)
- You can use various collaboration tools to communicate with colleagues
  - We have full video conference capabilities
  - We have over 100 software packages available for download from PEGASUS for staff and students

Tomorrow

- Have more collaboration capabilities for remote research and partner working
- Be able to see when a colleague is available
- Have easy access to video and audio facilities on your device
- Be able to communicate when you want, how you want and where you want
Potential cost savings in telephony and travel charges.

Our telephony capabilities will continue to evolve and converge to bring about a fully integrated digital communications platform. By replacing old legacy PABX technology we will provide enhanced telephony capabilities, such as Voice Over IP (VOIP), follow-me numbers, interactive voice, and other services which will help all of our users to effectively communicate.

We will continue to implement communications capabilities across all areas of the University with the ultimate goal of creating the potential for a fully virtual teaching experience with students participating from across the globe through a truly Unified Communications Platform.

5.5 **End user computing**

Providing a quality user experience is vital to achieving our ambitions and our End User Computing Strategy is how we will bring our vision to life for our users. We will continue to provide state-of-the-art computing facilities, coupled with a flexible and adaptable capability, allowing our staff and students to use their device of choice.

The consumer driven transformation of how individuals utilise technology services has brought about significant challenges for organisations in how they provide and support an unknown estate of devices. At Strathclyde we embrace this diversity of technology to allow our users the freedom to utilise and explore the full range of potential approaches and services through a multi-faceted End User Computing approach.

As in other large organisations, the University’s needs for user devices can be summarised as:

- Standard configuration desktop and portable devices for the majority of academic, Professional Services and support staff
- Flexibly configured devices for staff with specialist requirements
- Standard fixed configuration devices for students;
- Specialist devices for teaching & learning;
- Mobile devices including laptops, tablets, and phones; and
- BYOD –Bring Your Own Device.

There is no single answer solution to the devices which our users want to employ whilst working and/or studying with us. Accordingly, our approach is to provide services that can be consumed through different devices dependent upon the needs of the individual. We will continue to provide state-of-the-art computer lab facilities which are available to all students as needed, but increasingly we will enable more services to support user-owned devices. The trend for BYOD is nothing new to the University, with this approach having been supported, for students and staff for a considerable time. Going forward, we will implement more capabilities to support the utilisation of user-owned devices to access services from within the University and externally.

One of the major factors in any End User Computing (EUC) Strategy is the provision of an application estate which can be used effectively. In common with most traditional models, we have had a reliance on “fat client” based applications. This now needs to transform to allow us to adopt more flexible and transformational ways of deploying and using applications.

Over the coming years we will move to a more on-demand driven application model which will support our end user devices, as well as looking at how best to utilise:

- Did you know?
  - We support lots of devices including windows, Mac and Linux
  - We provide state-of-the-art lab facilities
  - We support Bring Your Own Device (BYOD)
  - Provide secure remote access

- Tomorrow
  - Access to more software and services on demand
  - Self-service provision of desktop needs
  - Full printing facilities
  - Secure remote access
  - enhanced BYOD support
  - Mobile working solutions across the University

Providing a quality user experience is vital to achieving our ambitions and our End User Computing Strategy is how we will bring our vision to life for our users. We will continue to provide state-of-the-art computer lab facilities, coupled with a flexible and adaptable capability, allowing our staff and students to use their device of choice.
• Thin client computing for non-intensive applications;
• eDistribution of licenses and applications on demand;
• 3rd party provided Software as service capabilities; and
• Web-based application solutions.

Our approach to End User Computing is intrinsically linked to all aspects of this Strategy and is key to bringing together and creating a quality user experience. As a part of our EUC Strategy and approach we will also provide simple to use services such as:

• Fully transparent and consolidated print management capability;
• 3rd party hosted services for collaboration and storage, where appropriate;
• Secure remote access to services; and
• Mobility services to allow users to access services whilst on the move.

5.6 Collaboration through technology

Collaboration is taking place in spaces where multiple technologies and environments (physical and virtual) are converging. An open, innovative, and forward-looking approach to collaboration is therefore required to foster developments in collaborative teaching, learning, research, knowledge exchange, and operations, both on a local and global scale.

A growing proportion of collaboration involves meetings attended virtually, as well as physically, and our information technology infrastructure and physical estate will provide high-quality support for this practice, to reflect our institution's image and ideals. This collaboration model extends to teaching and learning, where more classes are delivered by, or have contributions from, staff who are based off campus, both with one-way, broadcast/lecture style, and two-way online/partially online tutorial style interactions.

5.6.1 Collaboration environments

Our collaboration platforms or tools include robust privacy and security with identity management at the core for shared access, which allows us to deliver and support effective collaboration environments with high levels of engagement, whilst engendering trust amongst our users. In addition to security, functional requirements of collaboration environments, involving document or knowledge sharing, include content/document management, version control, workflow, approval mechanisms, tracking, reporting, and audience targeting.

We will continue to invest in collaboration environments and technologies, which will allow us to implement new capabilities in support of teaching, learning, and research collectively.

Our collaboration capabilities will be extended to support relevant open initiatives which promote joint working in research and with external businesses.

5.6.2 Virtual collaboration

Geographically distributed teams are now commonplace, whether operating in the areas of teaching and learning, research, and knowledge exchange, or through the delivery of professional services. With
internationalisation at the core of Strathclyde’s vision, provision for facilitating the work of such teams is paramount. We will use our virtual collaboration capabilities to:

- Support meetings across different time zones and organisations;
- Provide sharing access to our network and services;
- Provide tools to help bridge language barriers;
- Introduce new ways of working for staff and students alike; and
- Introduce common working practices and standards.

5.7 Information & learning resource

Learning resources are critical to all aspects of teaching, learning, and research and, as such, they need to reflect the best aspects of technology. Throughout the university we will implement new capabilities and technologies which will not only provide better ways of working, but which will allow us to investigate and embrace new ways of teaching and learning.

Did you know?

- You have access to Audio and Visual tools to support teaching and learning
- We provide over 1500 devices in our teaching labs
- We provide smart space working solutions to support your learning
- We provide a state of the art Library facility
- You have access to a Virtual learning Environment which is Tailored, Integrated, Pervasive and Dynamic

Tomorrow

- Ubiquitous Connectivity across the University
- Automated capture of learning content for digital consumption
- Real-time support for AV
- Access to the latest multimedia content creation tools
- Smarter Lab spaces
- On-Demand teaching and learning Applications
- Flexible learning spaces
- Access to more digital resources through the Library

Information and learning resources covers a large range of capabilities, service, and facilities, which are provided across all areas of the University. Our ultimate goal is to ensure all learning resources are available ubiquitously through any device and in any location. Such resources should be simple, easy to use, and, at all times access should be as invisible to the users as possible.

Over the coming years of this Strategy we will ensure that:

- Our learning spaces underpin our core business – teaching and learning – and also facilitate our conferencing and external engagement activities;
- Integration of teaching resources with our estates;
- Ubiquitous connectivity - connecting laptops, tablets, phones, and other devices to display systems within a teaching space, whether wired or wireless;
- Infrastructure that will support all devices;
- Implementation of automated content capture services, integrated with the VLE where suitable;
- Provision of on-line remote support for AV equipment;
- Development and implementation of common specifications, to ensure compatibility and familiarity; accordingly, a set of standards for all teaching locations will be developed;
- An active programme to implement new technology and the ability to remove and remove support for out-dated equipment which does not meet current requirements;
- Deployment of facilities and training to allow staff to prepare online teaching materials, with video, audio, and screencast content; and
- Training and guidance on the use of any new technology installed.

5.7.1 Audio-visual (AV) provision

With an ever changing range of equipment being brought into teaching spaces, an up to date digital infrastructure is required which provides both wired and wireless connectivity in all locations. Over the period of this Strategy we will ensure that all learning spaces have an integrated digital capability which allows individuals easy access to AV-based capabilities through any device.

As a key part of our future digital learning capability we will implement automated
content capture systems, with the optional facility to record full or part of a lecture, which can then be made available to view within the virtual learning environment. This will support the introduction of new teaching techniques, such as the “flipped classroom” where the students first study the topic, typically using video lessons, then use the precious classroom contact time for problem solving and group activities rather than traditional lectures.

5.7.2 IT laboratories
Information Services manages approximately 1,500 teaching devices in labs throughout the campus. Currently the majority of these are set out in rows within rooms where students can carry out self-study work and the spaces can also be used for class teaching with data projection facilities provided. Our vision is to augment and enhance the existing formal spaces with a more flexible and less structured environment which promotes collaborative working as well as removing the fixed nature of technology. Our lab-based environments will become “hot labs” where each working station has flexible capabilities which students can utilise, very similar to “hot desk working”. The labs will include new touch and interactive surface capabilities, as well as audio & video capabilities which will allow individuals to communicate and collaborate from within the lab.

Group Study Areas have been set up in key locations within the campus. These have provided students with a popular way of collaborating on work and assignments. We will introduce more of these environments throughout the University and include new technology capabilities to enhance the student experience. Each area will be equipped with full connectivity to support audio, video, and collaborative sharing capabilities.

With the rapidly changing technology and the increased number of tablet devices appearing on campus the ability to integrate these devices into the existing infrastructure, particularly to provide printing facilities, will be one of the main challenges facing us over the next few years.

Based on all of this, we will:

- Continue investment in computer teaching facilities to maintain our continual high standings as communicated via student surveys;
- Investigate software deployment mechanisms, license management, and rationalisation of different software images to ensure that all software applications are available in all teaching areas;
- Provide BYOD facilities in existing PC teaching areas to allow connection to display devices;
- Consolidate printing infrastructure to allow simple printing from University- and student-owned devices; and
- Provide different types of computer/study spaces to accommodate differing teaching styles – for example, individual PCs, group study spaces, social learning café areas with quick access short usage stations for checking e-mails.

5.7.3 Flexible learning space
The current emphasis on providing flexible teaching spaces relates to any room with no fixed furniture, which can be reconfigured to allow the room to be used for multiple functions. This provides teaching spaces which are extremely popular with staff and students.

The foreseeable developments within these rooms relates to providing the ability to connect multiple wireless devices to the display system within the space. Teaching methods, particularly where group work is concerned, are moving towards students and staff presenting to a group from a number of devices whether it be laptops, tablets, or phones.

In conjunction with colleagues within the Estates Services, we will:
• Deploy high quality flexible teaching environments to accommodate our varied styles of teaching, drawing on influences and best practice from within the UK and worldwide sector;
• Provide facilities to support the spaces both from a technological point of view and also in terms of furniture management;
• Support multiple devices inputting simultaneously to the display facilities, whether wired or wireless; and
• Provide on-line remote support for AV equipment.

5.7.4 Software services

Strategically, the University has identified a number of core software products that are regarded as essential to its research, teaching, and commercial operations e.g. Microsoft OS and Office applications, corporate software, anti-virus software, and specific research and teaching applications that are used across multiple Departments and Faculties. Facets within this Strategy presume a one-size fits all approach, which could result in a less than optimal user experience. As a key part of ensuring that the appropriate software is available, we will create an ongoing forum to ensure that this application suite remains relevant to the needs of the individuals.

Students must have access to software applications and packages which support their academic programmes. The vast array of available, and required, software brings its own challenges and we will use a combination of technologies to deliver software and licences on-demand. Our vision is to provide a full virtual application delivery and eDistribution capability for all software applications, thus allowing students and staff to have access to and use only the applications they need, when they need it.

In the teaching areas, there is demand for ubiquitous software deployment, with all applications available in all areas. While this is achieved with the core set of applications, it often is not practical for some more specialist packages, due to licensing costs, technical limitations of differing hardware, or simply the size of the package. We will investigate and implement tools which are available to better manage the deployment of such applications. These virtual application delivery and eDeployment technologies have developed rapidly in recent years, and systems such as Microsoft’s App-V and Numecent’s Application Jukebox make this an appropriate technology for deployment in our environment.

5.7.5 Library resources

Our Library facilities are more than just a place to find materials; they are a key feature of our entire teaching, learning, and research capabilities. The library is the heart of the University. It is the place where students and staff alike can work in collaboration or in private, have access to multiple eServices and traditional services all in one place, can socialise and can share ideas. Our Library is and will continue to be a major hub which supports all aspects of teaching, learning, and research. Over the coming years the Library will provide more flexible offerings to users, including working spaces, technology labs, and collaboration areas, whilst maintaining the expected and optimal quality of service which is expected of a modern university library.

The Library will continue to expand the availability of learning and research resources by investing in print, electronic and digital content. We will ensure, through the application of robust authentication and delivery methods, that content is available to all Strathclyde staff and students regardless of their location (on or off campus) or time of day (24/7). Our collaborative approach to purchases, licenses and contracts will continue to deliver value for money for Library materials. New models of purchasing will be explored in order to improve operational efficiencies and user satisfaction, e.g. using patron driven purchasing methods and automating ordering, cataloguing, and delivery of print material from suppliers.
We will ensure that all content and resources can be found via a single ‘discovery’ portal regardless of format (print, electronic, or digital) or physical location (online or in the Library). The discovery portal will integrate with other University systems to enable delivery of context-sensitive links to Library resources, ensuring students know what is available for any course of study being undertaken.

In order to provide a more flexible offering we will implement self-service technologies to maximise the availability of physical items, enabling customers to manage their library accounts online. We will provide self-help learning materials and 24/7 support to enable them to work in ways that suit their learning styles and study needs.

5.7.6 Virtual learning environment
The Virtual Learning Environment (VLE) is not a single system but an interconnected eco-system of products which can maximise the content and capabilities offered by other systems, and widen the impact of systems by taking into account the potential of the VLE.

The VLE is essential in delivering the University’s core activities of teaching and learning, and is firmly embedded into the work practices of our staff and students. The foundations in place allow us to innovate and enhance the teaching, learning and experience of students.

Over the coming years of this Strategy we will continue to build on these foundations, developing the VLE to expand the range of tools that support better administration, innovative teaching methods and continue to increase the reach of the institution to individuals who cannot attend the physical campus.

We will continue to develop innovative ways of creating digital teaching assets which can be delivered through our VLE. This will enable us to deliver a more diverse set of courses to individuals who cannot attend the physical campus. Our key to delivering services is the rich and interactive delivery of the student experience.

Our VLE is a tailored, integrated, pervasive, dynamic, flexible system comprising software systems and the physical environment delivered through enterprise and end-user platforms, which aligns with our Education Strategy and meets the Institution’s goals for flexible learning, innovation, and use of technology. It will reflect our underpinning ideas on how teaching and learning is delivered across the Institution.

Tailored: The VLE reflects the ethos of Strathclyde’s teaching & learning approaches as defined in our Education Strategy, and ensuring the VLE has mechanisms to deliver this is essential through:

- Student-led learning;
- User driven development;
- Cross discipline/international learning;
- Sharing, supporting and scaling best practices for staff and student teaching & learning

Integrated: The VLE will expand on the existing systems, processes, and data from across the University’s IT environment to enhance the contextualised view that is appropriate to our learner’s needs through:

- Consumption of centrally managed solutions and services;
- Push back/return of data to centrally managed solutions and services;
- Publication of VLE data via web services for other systems to integrate; and
- Integration with library, estates, and other systems as relevant.

Pervasive: The VLE is one of the key resources which teachers and learners have access to helping support seamless transitioning from "digital" learning tools to "physical" spaces and back again. We will achieve this through making:
• Access to the VLE available as widely as possible, and not reliant on specific tools such as requiring a desktop PC.

Dynamic: This will provide:

• Information from institutional data sources which allows the VLE to reflect in real-time a student’s curriculum and their status, as well as reacting to instances of amendments of staff role allocations; and

• The mechanism by which to amend the communication of educational content from the University to allow the same content to be delivered via different mechanisms

5.8 Applications & management information

Applications are the primary means by which most users access our services. As the needs of our users change we will introduce new applications, as well as new and innovative ways for users to access and use applications from any location, at anytime, and through any device. We will provide accurate, relevant and timely management information through comprehensive master data management environment.

Did you know?

• We provide specialist applications, and services, to support research
• Ensure the University delivers on its regulatory obligations
• You have access to a portfolio of applications and services

Tomorrow

• Highly flexible and adapted business systems
• Standardised offerings
• Real-time data access between systems
• Enhanced Business Intelligence to support the University
• Single source of authoritative data

5.8.1 Applications

As our technology estate continues to evolve and mature so must our approach to applications which are used throughout the University. Providing relevant and suitable applications for use is vital to ensuring that all our users have access to the right tools for teaching, learning, and research.

In order to deliver to all our users the applications and services they require, we will:

• Implement cost effective replacement of legacy systems using flexible, highly configurable business systems;
• Develop new standardised business processes with key business staff supported by modern business systems;
• Ensure interoperability of business systems where appropriate;
• Provide real-time data between systems, wherever possible; and
• Ensure suppliers of packages:
  ▪ Have a proven track record with other HEIs;
  ▪ Use technologies which are well established with a robust future-proofed roadmap;
  ▪ Have a well-established user group and ideally one dedicated to the HEI sector; and
  ▪ Include modules that meet our statutory and regulatory and reporting requirements as an institution (e.g. Home Office, HMRC, HESA, SCF).

Our traditional model of providing client-based applications has to change as more and more users require flexibility and non-traditional delivery mechanisms. As such, we will provide alternative ways for all our users to access and use applications through the use of web-based provision which is accessible through common internet browsers.

We will also implement more self-service capabilities to allow users control over the selection and use of applications as needed. The continued growth and adoption of Software as a Service has opened up more opportunities for the University and we will look to utilise such services where they are cost effective, hosted within the UK (and therefore under EU law), and conform to statutory and regulatory requirements.

The needs of teaching, learning, research, and knowledge exchange from an application perspective are very diverse, with some areas being very well supported by external vendors, whilst others rely on non-traditional application approaches. As a University we
will continue to provide development and enhancement services to all areas, working closely with our users to ensure we deliver quality software which meets their needs. As part of this we will work closely with all of our partners, suppliers, and vendors to ensure we have access to the best they can offer. We will also ensure that Open Source Application technology is included where relevant.

When selecting applications for use we will look at solutions which can deliver flexible systems that support the information and access requirements of initiatives and external collaboration such as the SFC Articulated Scheme (Engineering Academy).

5.8.2 Management information

Throughout our Strategy we have emphasised how we will be introducing new services, technologies, and capabilities to support all of our users. In order to help us achieve this we require accurate, relevant, and timely management information which can provide the insights necessary for ensuring that the University make well-informed future decisions.

Management information goes further and, through the use of integrated tools, services and data, we will provide a powerful decision support tool which will support all aspects of the University. In support of providing management information capabilities we will:

- Ensure a single source of data which is referenced and used as needed.

5.9 Supporting research and knowledge exchange

Research is vital to the University achieving a number of its ambitions, including the integration and collaboration with external businesses. Through the implementation and further development of the Technology Innovation Centre and the High Performance Computing capability, we will provide world-class technology in direct support of all aspects of research.

Did you know?

- We provide systems to support knowledge exchange
- Provide High Performance Computing resources for Research
- We are addressing the needs of managing vast volumes of Research data
- Provide state of the art Library facilities

Tomorrow

- Higher performance computing capability
- Large scale data management solutions to support Research
- Access to more digital assets from multiple sources
- Digital preservation strategy to support all aspects of the University

5.9.1 Changing needs

The University recognises the vital roles which Research and Knowledge Exchange have across all aspects of the University.

Historically, the research community has been fairly self-sufficient in addressing its own technology needs due to the often specialist nature of the research. The needs and requirements of our researchers will continue to grow and increasingly they will require technology which can be more adaptable to their immediate needs. We are investing significantly in technology to support our research community, as well as providing services which will promote collaboration and sharing of knowledge within the HE community, and with external businesses and partners.

Our ongoing Research Data Management initiative will help bring new capabilities in digital storage and information security to our research needs. By delivering a technical infrastructure and policy framework for the
storage and management of experimental and research data sets, we will empower our researchers to do more with the facilities available.

In direct response to the University’s requirements for supporting research we have placed High Performance Computing (HPC) at the core of how we will provide technology resources to researchers. We will continue to evolve and enhance our current HPC environment as new technology becomes available. Our investment in the Technology Innovation Centre will enable us to share resources such as our HPC capabilities with external partners and businesses in support of our research goals.

5.9.2 Supporting research and the institution

The Library will play a pivotal role in our vision for research by continuing to acquire research level content from publishers in digital as well as print format, promoting and preserving the research output of the University through the continued provision of institutional repository systems and services, and the administration of funded Open Access publishing. Corresponding services and systems will be implemented for research data ensuring the ongoing availability of not just published outputs but the underlying data.

The corporate memory of the University will be managed and preserved through the implementation of information management and preservation policies, and supporting systems. Increasingly the work of the University is born and remains digital; building on its good practice in relation to paper records, the Library and University Archives will support the institution in developing a preservation Strategy for digital material which sits alongside its curation and preservation role for print materials within its special collections.

5.10 Web presence

The web is now the place where individuals look for services and information in the first instance. As is referenced throughout this strategy, the delivery of services is predominately through web-based delivery means. We will continue to ensure that all services and information are available through our web presence.

Did you know?

• We have a large scale web site infrastructure which provides information
• You can use Self-Service features through our web site to access services
• Web which meets the usability needs of all our users

Tomorrow

• An easy to use web presence which provides access to information resources
• Dynamic and vibrant web solution driven by user needs
• Technology to allow easy repurposing of content for multiple device delivery
• Up to date and relevant content

Over the years the internet has evolved to become a more intelligent tool which is used constantly in everyday life. Whilst the “public” face and perception of the internet hasn’t radically changed, the technology and capabilities have drastically improved. In common with most organisations, our University web presence has not been utilised to the best of both its, and our, ability.

Our web presence (including internet, intranet, and extranet) is a widely accessed vehicle for content that serves the information needs of both external and internal users. However, we have only scratched the surface of what is possible. Now with the evolution of internet technologies and capabilities we can expand how we use our internet.

Whereas each group has distinct needs, there are overlaps in requirements which dictate that careful planning and investment is of paramount importance in ensuring that the highly visible nature of our web presence effectively supports University aspirations, and is consistent in its presentation and messages.
Development of our University web presence is governed through a University-wide Content Strategy that is authorised by the Executive Team and monitored through the Information Strategy Committee and its sub-committees. Delivery is delegated to a central team responsible for overseeing the development of design sets, for example visual design features, and key language sets and delivery of web content in partnership with other teams and staff across the University.

As with all technology, the capabilities of the web are evolving to provide more capabilities and intelligence. Our Strategy is to utilise our web capabilities as a strategic platform for providing engaging and interactive resources. This is not limited to simple information about the University. Instead, our web presence will encompass all areas of the University, providing everything from public information through to specialist capabilities to support our researchers. We will continue to evolve our offerings, capabilities and services looking to use the latest technologies around the internet.

By providing web based platforms which are easy to use, engaging, informative which allow individuals to access multiple services we will create a key resource for all our users. Along with ensuring we evolve how we use the technology, we will provide simple feedback mechanisms to help us ensure our web offerings deliver what our users want. As part of our web Strategy we will look at new capabilities which will allow us to capture more user feedback.

Our web offerings are not just about allowing people to search for information, they provide rich environments for individuals to engage, find relevant information, support their learning and curriculum, provide academics with rich media tools, allow researchers to go beyond flat data and use semantic intelligence. The use of the web in its many forms and guises is a critical part of how we support all aspects of the University.

But we won’t rely simply on what we within the University think is needed, we will embrace the best of what the wider web community has to offer, especially around social media and the technologies which provide individuals with new ways of communicating and collaborating easily and quickly.

Strategic development is led by the following guiding principles:

- Our web presence should facilitate all users to access information or online services as effectively as possible;
- User requirements should drive content development and design;
- Content development and design should be re-usable wherever possible to support consistency in messaging;
- Single-source data should be used wherever possible;
- Our web systems, internal or external, must meet any user regardless of ability to get quick access to the information they require;
- Conformance with published Accessibility and Usability guidelines;
- Content should be reviewed frequently to ensure it remains current and well-managed; and
- We will implement a rapid “beta” development programme to quickly test and trial new web services.
6 Delivering the Information Systems Strategy

6.1 Governance

Our Information Systems Strategy encompasses a number of functions, activities, capabilities and services which are delivered across all aspects of the University.

A critical success factor of any major programme of change is a governance framework that recognises that:

- The ebb and flow of contemporary issues can both positively and negatively impact on any one strategic objective.
- The more dependencies built into a programme, the greater the likelihood of failure – as governance becomes overwhelmingly complicated and is, in itself, a threat to success.
- Governance has to work to a set of principles rather than hard and fast rules, which are to:
  - match supply with demand;
  - anticipate generic changes;
  - identify duplication and other opportunities for standardisation and sharing;
  - challenge relatively low-value projects; and
  - set priorities when competing for scarce capacity.

For any strategy, clear accountability to and oversight from relevant committees and policy is critical. Overall Governance for this Information Systems Strategy is provided by the Information Strategy Committee (ISC) and its two sub-committees – the Digital Campus Sub Committee (DCSC) and Business Projects Sub Committee (BPSC).

The effective definition and implementation of an appropriate governance structure and framework is critical for the success of all aspects of our Strategy, as well as bringing benefits for the University such as:

- Robust governance of IT;
- Ensuring value for money, and initiatives that are fit for purpose;
- Targeting investment;
- Ensuring IT and information expenditure is aligned with University Strategy; and
- Horizon scanning to deliver continuous improvement.
6.2 Projects

As we work through delivering the Strategy, we will utilise a project based delivery model, which will ensure that each aspect is controlled, managed, and delivered in a structured Prince2 environment. This is a critical aspect of our delivery model as it provides the means and mechanisms to ensure that we can measure the success of any single project.

We have defined the following key aspects which any IT work must follow:

- The implementation of any business change should be via projects;
- Projects must produce a business case that is assessed for return on investment and alignment with the overall University Strategy before commencing;
- A clear process for the development and consideration of project business cases;
- That projects should be managed and sponsored from the relevant business area of the University with IT project managers assisting;
- IT/IS projects must have a project board and report into the University’s portfolio board (i.e. the Business Projects Subcommittee); and
- Projects must follow a robust project management methodology tailored for the University’s needs, including following regular reporting cycles and having stage and gate reviews where the validity of their business case is re-examined.

Following these principles will provide these benefits:

- Projects aligned with University Strategy;
- Robust and controllable management of change;
- Projects being driven by business need;
- Transparent reporting of progress on projects;
- Early indications of problems with projects;
- Controlled and targeted investment in IT/IS; and
- Supporting the University in a continually changing environment.

6.3 Transformational journey

Throughout this Strategy we have identified the areas we will be tackling to either continue building on our exceptional services, or to introduce new capabilities. Our tactical programme of work is underway and we will continue to build upon what is already in place. These tactical projects are the foundation blocks of our technology capabilities and will support our strategic aims by ensuring we implement changes which support our longer term vision.

With such a large transformation we have a robust governance structure in place to ensure that the changes deliver better services and capabilities, provide new tools to support our teaching and research colleagues, allow students more flexibility, and ensure a quality of service to all users.

As we transition through the years of the Strategy we will ensure that our Roadmap reflects all changes, including technology changes, to allow us to innovate as we go.

Technology is often seen as just a thing which people use. Our Transformation Roadmap is about ensuring technology is seen as a tool which can be used in direct support of academic and research needs.

Whilst this Strategy is focused primarily on tactical and strategic goals, we have to ensure the future is not forgotten. As part of our governance approach to ensuring we are a proactive technology organisation, we actively investigate technology trends, or horizon scan, to ensure we understand how new or emerging technologies can be utilised within the University. Such trends will change over time and some will become more relevant to Strathclyde than others. Our visionary part of the Strategy and Roadmap is where we will identify potential futurescape technologies.
The themes we have outlined within this Strategy represent the current trends for technology and where they may be applicable to Strathclyde. However, in order to make these truly visionary and transformational we must ensure they meet the short, medium and longer term goals and needs of all. We will work with our colleagues and students at all levels from across the University to continually investigate and evaluate the most appropriate visionary technology transformational needs.

The University of Strathclyde is undertaking a significant transformational programme over the coming years which will encompass all aspects of the institution and our technology users.

The diagram below represents a timeline based view of how we see our transformation projects being delivered. Additionally, it represents our already initiated projects alongside our visionary aspirations.

As we go through the coming years we will refine and adapt this timeline to ensure the most appropriate and critical projects are addressed as soon as possible.
6.4 Conclusion

During the development of this Strategy we asked many questions of ourselves and our users in attempts to better understand what is needed to support the business visions of the entire University. Our Strategy reflects these goals and ambitions and it also sets out a challenging and ambitious few years for the implementation and use of technology at the University.

These changes will take time, but in due course they will provide a platform upon which we can:

- Deliver world-class teaching;
- Attract the best and brightest students;
- Innovate new capabilities and technologies through our research facilities; and
- Ultimately, deliver a level of technological capability and service, which is recognised across the globe for its excellence.