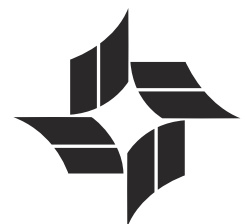


learning

architecture framework



learning
in an ONLINE world



MCEETYA

Australia - New Zealand



Learning architecture delivers learner-centred schooling anywhere, anytime by designing the connections between curriculum and administration systems – inside and outside the school.



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Learning in an online world 2003 – 06 articulates national priorities for action by schools and associated educational organisations.

A key infrastructure priority is a Learning Architecture that supports teachers, students and administrators to effectively plan, design, deliver, assess and report.

The Learning Architecture Framework is a reference document to support organisation and school planning. The framework articulates issues for consideration by ministers and departmental leaders. It provides vendors and industry partners with an overview of national strategic directions in school education.

The scope of formal learning is shifting from the compulsory years to lifelong learning, and from age-based and classroom-based cohorts to distributed, local and global communities. There are closer links between schools, homes, communities, industry and the VET and tertiary sectors, bringing a shift from organisational processes to processes focused on learners.

Learners are increasingly using interactive, multimedia tools and resources at all stages of the learning process – locating, processing and presenting information and knowledge. Interactive technologies and online curriculum resources are increasing the speed and immediacy of feedback, enabling more flexible

approaches to curriculum delivery. Networked technologies are connecting learners with experts, teachers and other learners beyond their school while supporting collaboration and cooperative learning.

This connectivity is enabling teachers to individualise instruction at a pace, place and time suited to learners' needs. It is increasing curriculum choices and pathways for learners, breaking the barriers of geographic isolation, extending the range of instructional and assessment methods and increasing access to specialist support. Teachers need online access to all relevant student and administrative data to develop individualised learning plans and to continuously monitor and report on student achievement.

Increasingly, students, parents, caregivers and organisations require and expect electronic access to regular and accurate information on student progress and achievement.

The application of information communication technologies (ICT) to the processes that support learning promises to deliver improved learning outcomes and administrative and management efficiencies. Learner-centric processes are now possible across education systems through a Learning Architecture designed to interface curriculum and administrative systems.

learning architecture

Purpose

Over the past decade, the public and private sectors have realised the benefits of using architecture processes to guide decisions designed to optimise returns on investment in ICT. Learning Architecture provides a planned enterprise ICT framework, comprising hardware, software and people. It enables the school sector to share information and software applications internally and with external organisations.

Educational leaders can use the paradigm of architecture and design to provide effective educational support structures in response to the challenging demands of contemporary learning.

The planning and delivery of school facilities take account of macro considerations including the nature of learning experiences to be conducted, the nature of the learners who will use the facility, the function of the building and its relationship to other buildings both within and outside the campus, and the resources available to deliver the project.

These considerations inform the architecture of the physical facility. People who are expert at delivering building projects use detailed plan and design processes to deliver a facility that meets the functional specifications within the

allocated resources. Similar considerations are required for ICT development and implementation.

Architecture processes assist decision makers to plan for the smooth interaction of essential ICT activities and processes within their organisation. In the school sector, Learning Architecture provides a seamless, co-ordinated, secure ICT environment that optimises administrative, management, curriculum and business processes, and improves learning. Throughout this document, the application of this architectural model to the school sector is referred to as Learning Architecture.

Informed planning and design have enabled the delivery of contemporary learning programs in schools that were built in a previous era. Similarly, planning and design for ICT development and implementation through Learning Architecture facilitates a strategic blueprint that utilises existing systems within a future orientated development plan.

Figure 1 provides an overview of the need for integration and interoperability between internal systems and with external organisations at the school, organisation, and jurisdiction levels.



learning architecture

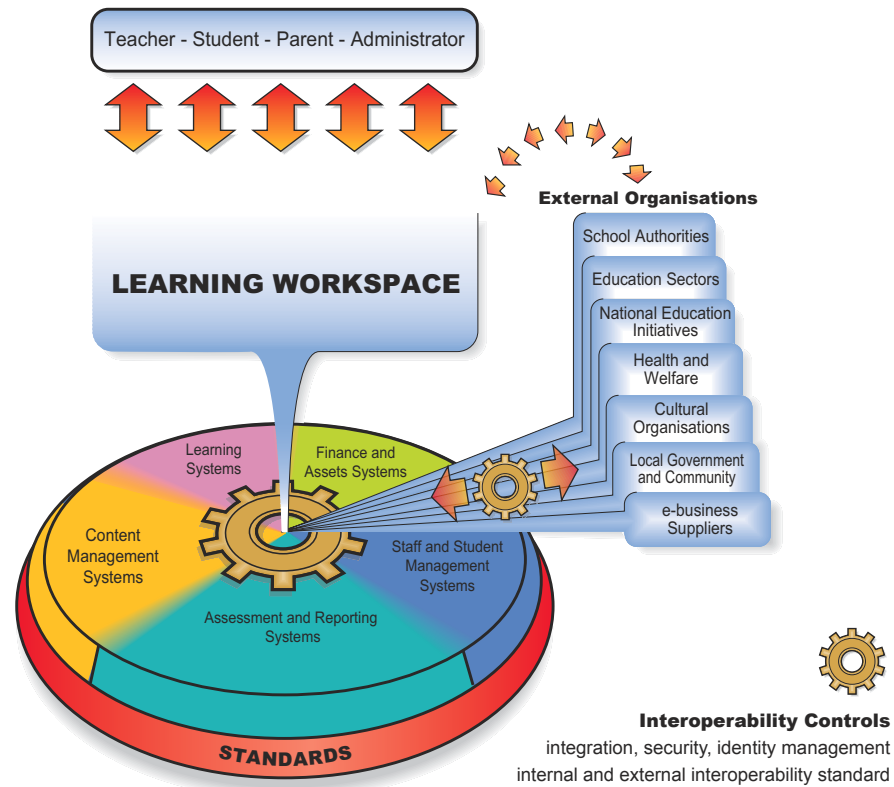


Figure 1: Overview of a Framework for Learning Architecture

Benefits

Developing a Learning Architecture will ensure that investments in technology deliver:

- **flexibility:** solutions that adapt to new business challenges and technology opportunities as they arise
- **interoperability:** systems that transparently share information both within and between organisations, avoiding duplication
- **reusability:** solutions that maximise the use of information, applications and infrastructure for multiple purposes
- **efficiency:** solutions that are sustainable and managed at minimum cost.

learning architecture

Guiding Principles

The following principles, developed by the ICT in Schools Taskforce, provide a high level strategic guide for the development of Learning Architecture within organisations and schools.

Learning Architecture will:

- build on a detailed understanding of the business of the organisation in the context of community
- be articulated, shared and understood
- accommodate changes in the organisation's business and the external technology environment
- maximise information and communication flows
- interconnect with relevant external agencies
- ensure the integrity of data and maximise the use of data.

A jurisdiction is establishing a Learning Architecture that meets the requirements of the state, taking into account the national initiative, The Le@rning Federation. 'Across department' working groups have been established to collaboratively identify and agree to the nature of the education environment within which the Learning Architecture is to operate.

Establishment of the 'across department' groups has maximised information flows and ensured input by the curriculum, business, administrative, library and technical experts, building shared understandings of the proposals for the Learning Architecture.

Discussions are regularly held with the non-government sectors to consider possible synergies between the government and non-government planned Learning Architectures.



overarching ICT considerations

Public and private enterprises, including the school education sector, recognise the essential role that information communication technologies play in facilitating the delivery of business objectives. Improved learning underpins, and is the key driver for, school sector organisations. Policy and processes directly or indirectly contribute to the attainment of this goal.

The development of Learning Architecture, or the revision of an existing architecture, helps to ensure that the financial and human resources invested in ICT maximise the delivery of organisation outcomes and accommodate changed business needs.

Significant overarching ICT considerations that apply across all layers of the school's or

organisation's Learning Architecture in order to achieve education objectives include:

- interoperability and standards
- security and privacy
- risk and return.

Interoperability and Standards

Interoperability

To ensure accuracy and consistency, information technology applications must be able to automatically exchange information in an efficient, flexible but controlled fashion. Each application will provide distinct functionality but there will often be overlap in the information they manage. For example: assessment and reporting information needs to link with content

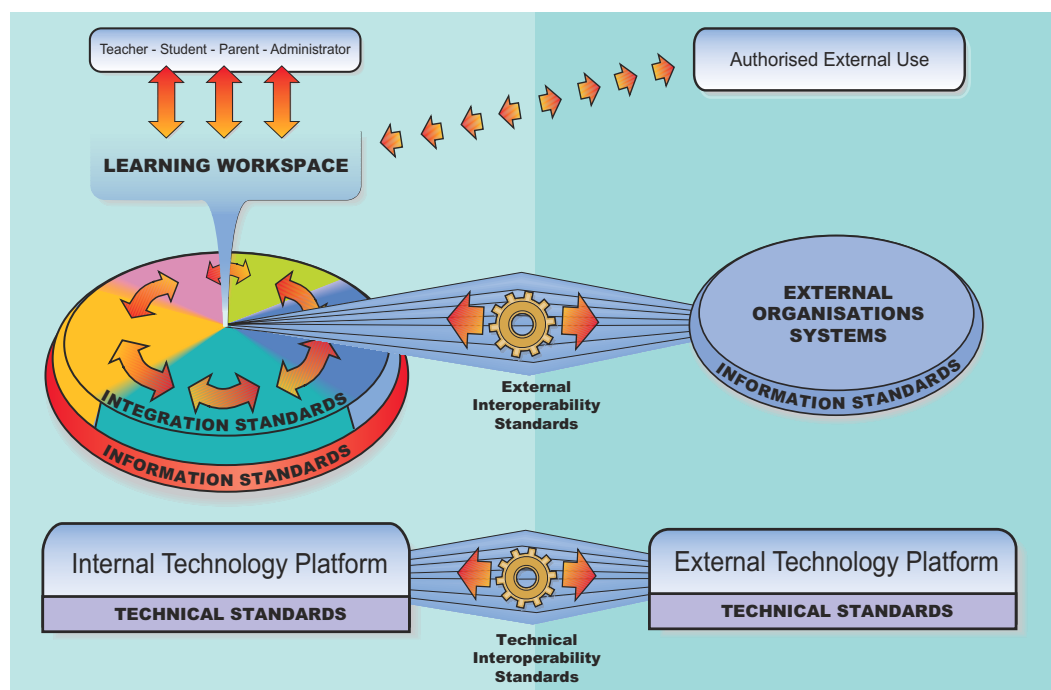


Figure 2: Information Flows Based on Standards

overarching ICT considerations

management systems and student information systems in a secure and private environment; at both central and site levels human resource information needs to link with finance, facility and educational information.

To achieve the seamless exchange of data, the design of Learning Architecture addresses the following questions:

- What information is required by the organisation?
 - Who, within and outside the organisation, requires access?
 - Who, within and outside the organisation, needs to access and manage the information?
 - How will the information be managed?
 - What standards facilitate the exchange of information between internal systems and with external groups?
- The need to exchange information between organisations is an increasingly important requirement for the school sector. Organisations, schools and jurisdictions need to exchange information with external agencies, including private providers of products and services. For example:
 - students move from one school to another and from one schooling sector to another
 - students concurrently undertake study within several institutions
 - student achievement data is exchanged with external assessment authorities
 - jurisdictions share digital materials and services
 - schools and organisations provide information for agreed jurisdiction and Commonwealth reporting.

The Le@rning Federation

The Le@rning Federation is an Australian and New Zealand initiative where all school jurisdictions are working together to ensure the seamless delivery of online content down to the desktop for student and staff use.

Jurisdictions are ensuring that their portfolios of software are standards compatible enabling the exchange of digital objects.

The Le@rning Federation has the objective of stimulating the development and exchange of digital resources to meet the curriculum and pedagogical needs of Australian schools. As well as the development of new learning resources, the initiative also involves the development of the Exchange, a national software application that manages the acquisition, hosting, distribution and intellectual rights management of digital resources.



overarching ICT considerations

Standards

School sector Learning Architecture requires standards that support:

- **interoperability:** ensuring that different applications can share information and work together within and across organisations
- **reusability:** enabling learning content, information and software modules to be used and re-used, maximising their value to the sector
- **accessibility:** ensuring that people have access to appropriate information as required
- **durability:** avoiding rapid obsolescence by allowing existing applications to continue to interoperate with new applications that conform to compatible standards
- **modularity:** allowing for a modular design that ensures the longer-term viability and scalability of the systems as the organisation changes.

Developing Learning Architecture requires organisations to:

- identify standards relevant to their business
- assess the compliance of potential technology solutions with these standards
- build in compliance with the standards.

Articulation of required standards enables vendors to provide products, services and solutions to meet the specific needs of Australian schools. A critical element of the development of online learning is the ability to share digital objects

Railway Gauges

Many different organisations participate in the railway industry. Some manufacture carriages and their components while others build tracks. For a railway system to operate effectively, carriages from one company must be able to run on the tracks built by another.

The spacing of the tracks is a critical factor in the capacity of the carriages and tracks to operate together. An agreement between the participating companies on the track gauge and therefore wheel gauge is a standard. Trains and tracks that conform to the standard will be able to work together.

Standards that are agreed within a single region or jurisdiction are of value only within that region. Carriages are not able to travel beyond their region to one with a different 'standard' gauge.

To achieve the maximum flexibility and efficiency, and interoperability of trains and tracks throughout the railway system, it is necessary to agree on a national standard track gauge.

between schools and across state boundaries. Nationally, The Learning Federation Initiative is implementing standards for the development, packaging and communication of digital learning materials; EdNA Online is progressing key standards to support electronic resource discovery across multiple repositories. Jurisdictions' software tender documentation articulated standards compliance as a critical component of enterprise solutions.

The Australian school sector is collaborating on a range of technology issues, including the

overarching ICT considerations

development of standards through the MCEETYA ICT in Schools Taskforce (<http://www.icctaskforce.edna.edu.au>) and the Australian Information and Communications Technology in Education Committee (AICTEC) Standards Sub-committee (<http://www.standards.edna.edu.au>).

Security and Privacy

Students, teachers and administrators need to use a range of technologies to locate, interrogate, process and present information. Increasingly this occurs beyond the boundaries of central office, school buildings and administrative centres. Authorised access to relevant components of administrative systems that manage information about students and their progress, staff, finances and assets is essential to supporting teaching and learning and business processes. Critical security and privacy issues need to be addressed to ensure that information is accessible only to those entitled to it.

Learning Architecture defines the requirements of the school or organisation for security and privacy of information, and for compliance with security

requirements for data exchange. It addresses the need to move from maintaining the security of information systems within software applications to developing a more holistic approach as the boundaries of applications blur.

Authentication and identity management systems are central to providing privacy and security of information. School sector organisations need to ensure the following elements:

- compliance with appropriate-use policy
- ease of use
- role-based access
- network security
- legislative requirements in relation to privacy.

Learning Architecture aims to seamlessly achieve authentication and authorisation, within and between systems, through the use of unique identifiers and single logons. This supports the delivery of an interface for each user that is customised to the role and authority within the school or organisation.

A primary teacher logs in to the corporate mail server and reads her email from an interstate colleague reminding her of their book-club chat later in the morning. She sources information from the internet and uses a planning tool to create a group activity based on an international event that occurred overnight. The student view of the activity is stored in the class area of the school intranet.

The teacher and students go to the collaborative project site. They are directed to their secure collaboration area where they begin discussions with the interstate class. During the online session, student information is updated in the assessment system.

Each of the systems the teacher used is 'best of breed', but she has needed to log on once only. Without common authentication she may have had to log on eight times with eight different usernames and passwords.

overarching ICT considerations

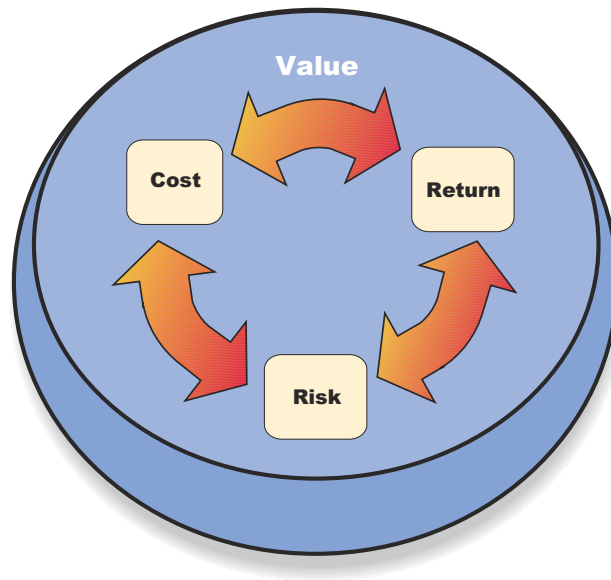


Figure 3: Calculating Value of ICT Investment

Assessment of Risk and Return

ICT is now part of school infrastructure and recurrent expenditure. Detailed Learning Architecture planning and implementation will maximise the value achieved from this investment. The value of an ICT investment can be estimated through an analysis of the costs, returns and risks.

Cost

In considering the expected cost of a planned initiative, an estimate of the total cost of the project is often used to select from available options. The 'Total Cost of Ownership' assesses over a defined period, the full cost of implementing a particular solution in comparison to the status quo. Use of the 'Total Cost of Ownership' concept can lead to decisions that

are better aligned with the organisation's longer-term objectives. It does not favour options that may have a low capital cost but an increasing cost of maintenance and support.

Capital cost is one element of the cost of an initiative. Other elements include the cost of staff (technical and operational) to manage the systems, software and hardware maintenance costs, the cost of adding capacity as the organisation grows, periodic software upgrade costs and the indirect impact of the project on the cost of other technology or business projects. Some cost elements represent capital investment, whereas others represent ongoing operational costs that need to be factored into the organisation's budget outlook.



overarching ICT considerations

Return

The overall financial impact of an initiative can also be approached in several different ways. The return achieved through a technology or other change initiative can be viewed as having three components: strategic, social and economic. It is important to consider all three components in assessing the Return and, ultimately, the value of a proposed initiative. A narrow approach that defines Return as including only those projects that can demonstrate measurable cost savings will achieve only a 'slightly more efficient business as usual' outcome.

School sector organisations use Learning Architecture to plan and implement fundamental long term change and incremental change. In this way, Learning Architecture enables the return on

ICT investment to be calculated in terms of the strategic goals of the organisation.

Risk

In developing Learning Architecture, school sector decision makers calculate short and long-term risks. This includes consideration of the cost and educational return of the proposed initiative. Decision makers balance the long-term financial outlook and risk profile with the achievement of the strategic objectives of the organisation. There are long-term risks to students, the organisation, and society if action to develop a robust Learning Architecture is not taken. Learning Architecture can be viewed as a three-level model for the organisation and the information and communication technologies that support it.

Successful online learning environments are dependent on high levels of access management and identity management, which together effectively match people, resources and services in a variety of distributed environments. Jurisdictions are bringing together educators, IT managers, business managers, and library staff to articulate priorities and to work through the functional requirements to ensure better integration of services that have previously been managed and accessed as separate systems. This is informed by rigorous requirements-gathering processes.

New ways of expressing service requirements that are informed by business owners and stakeholders are being developed and translated into functional architectures capable of informing technical architectures and multiplatform technical solutions.

This is minimising organisational risk and maximising education return.



overview of learning architecture

Learning Architecture can be viewed as a three-level model for the organisation and the information and communication technologies that support it.

- The business layer describes the vision, objectives, drivers, key functions, processes, organisations and their relationships
- The systems layer describes the information and applications that support the business level
- The technology layer describes elements such as hardware and networks, integration and security facilities that support the systems level.

A conceptual view of the components of Learning Architecture (Figure 4) and a model for Learning Architecture (Figure 5) are provided as a guide for organisations and schools.

In developing their Learning Architecture, organisations and schools need to provide a level of detail that articulates the functional and technical requirements for the implementation of the required ICT systems.

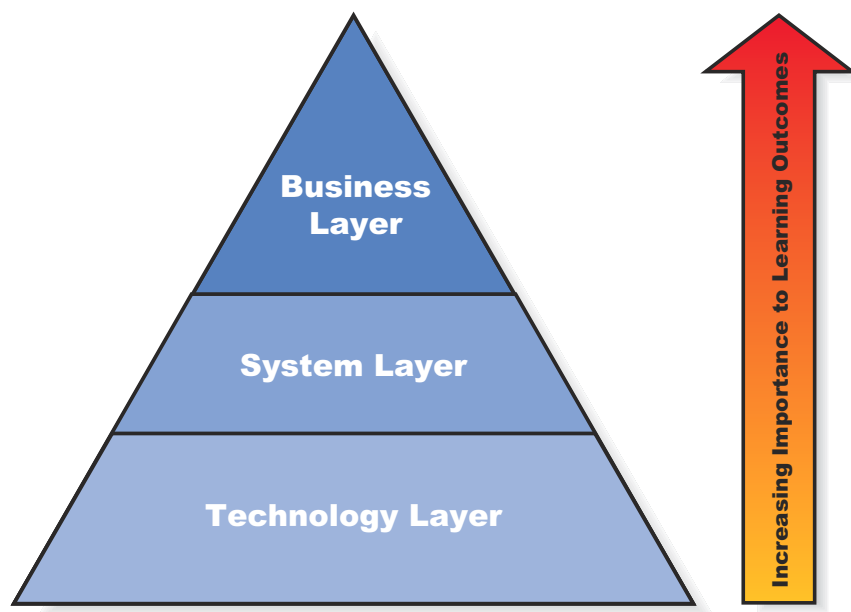


Figure 4: Components of Learning Architecture

overview of learning architecture

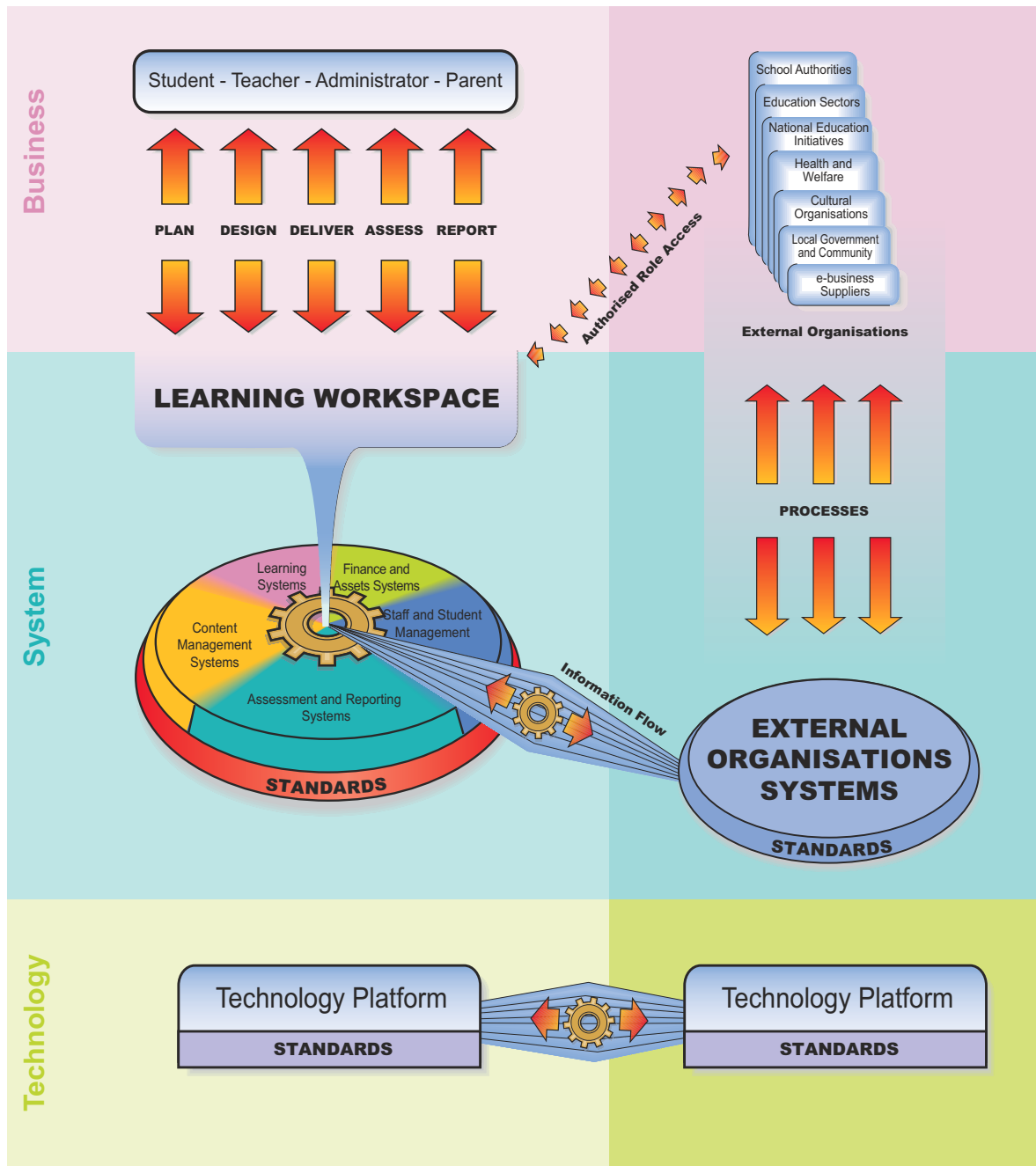


Figure 5: Learning Architecture Model for the School Sector



dimensions of learning architecture

business layer

Business Layer

Learning Architecture that supports the achievement of education goals is underpinned by a clear understanding of vision, objectives and drivers. The business level of the Learning Architecture provides a structured description of functions, processes and people that need to drive development of the systems and technology layers to achieve the vision and objectives of organisations and schools.

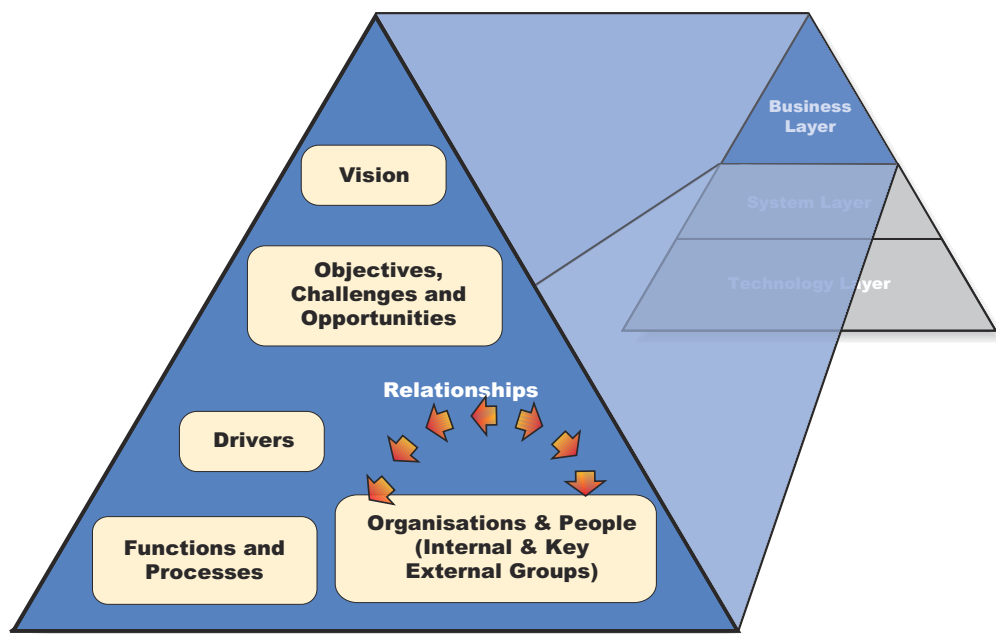


Figure 6: Elements of the Business Layer

Organisations and schools, through their strategic planning processes, have established their vision and their understanding of objectives, challenges and opportunities. It is important that this information is reviewed for currency, and is at the forefront of thinking during the development of the business layer of the Learning Architecture.

An important component of the business layer is the definition of the functions, processes and roles carried out both within the organisation

and with external groups. The business layer needs to describe the external groups that are important to the organisation and the nature of the relationships with them.

The school sector increasingly works with, and exchanges information with external organisations. Figure 7 provides an overview of the range of external organisations with which schools and jurisdictions may be required to develop education and business relationships.

dimensions of learning architecture

business layer



Figure 7: External Organisations



dimensions of learning architecture

business layer

Considerations

- **Focus:** technology, systems and infrastructure usually account for the bulk of the investment in information and communication technologies. As a result, management attention may be too heavily focused on the technology and systems elements of ICT. This can be at the expense of educational alignment.
A primary focus on the learning objectives, functions and challenges is critical to realising the potential for technology to transform learning and business practices.
- **Engagement with the stakeholders:** the outcome of technology specialists developing the organisation's Learning Architecture without adequate consultation with teachers,

parents, students and stakeholders can be the implementation of technologies that are not owned by the community and that are poorly aligned with the achievement of learning and business objectives.

Guiding principles include:

- a consistent experience for staff, students, parents and communities
- access anytime, anywhere, by those who need the information
- an authoritative source for each item of information
- capability for self-service (target investment of human effort in the right place).

A school cluster comprising a large secondary school and three 'feeder' primary schools worked collaboratively to achieve the priority of a seamless and consistent transition from the last year of primary school to the first year of secondary school for students and their families.

Access to information was central to the priority. Relevant information needed to be shared between schools, available to students and staff, and easily accessible for parents from both home and work.

The collective of principals engaged the services of a person from their district team who knew and understood the basic principles of ICT architecture to guide the process. This ensured that the business imperative of delivering the best education outcomes within available resources was met.

dimensions of learning architecture

systems layer

Systems Layer

Defining the systems layer ensures that the ICT capabilities implemented by the organisation are part of a coordinated suite, aligned with the overall needs of the organisation. The systems layer defines the technology applications and information that will be needed to support the business requirements.

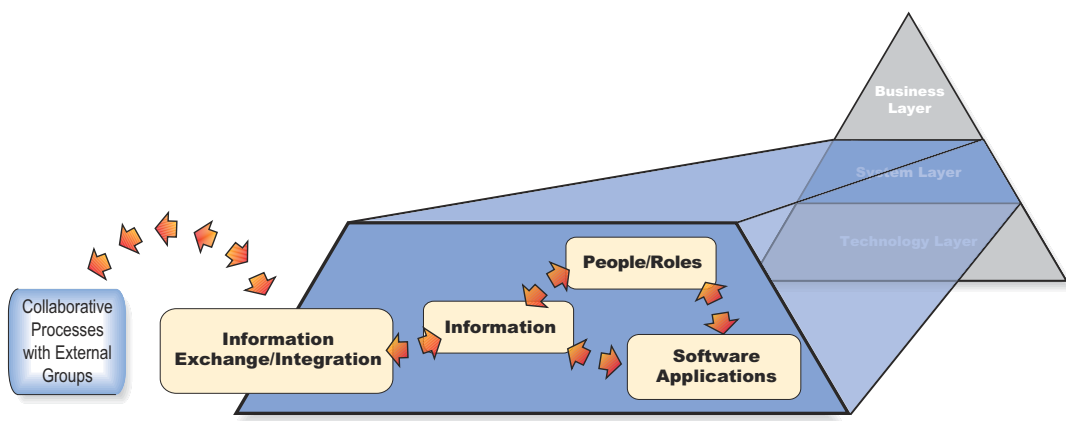


Figure 8: Elements of the Systems Layer

At the system layer the organisation:

- builds an understanding of the information needed about people, processes, activities and assets
- identifies areas targeted for improvement
- describes the internal and external people who perform the various functions, their roles and how they need to use and exchange information
- identifies limits or exclusions
- describes the software applications that support the people, the functions they perform and the information they create and use
- identifies relationships between applications and information
- defines internal and external information exchange/integration that should occur and the security controls that are needed.

A conceptual overview of systems and services of importance to the school sector is provided in Figure 9. Standards based systems and services maximise interoperability – a critical issue for the school sector.



dimensions of learning architecture

systems layer

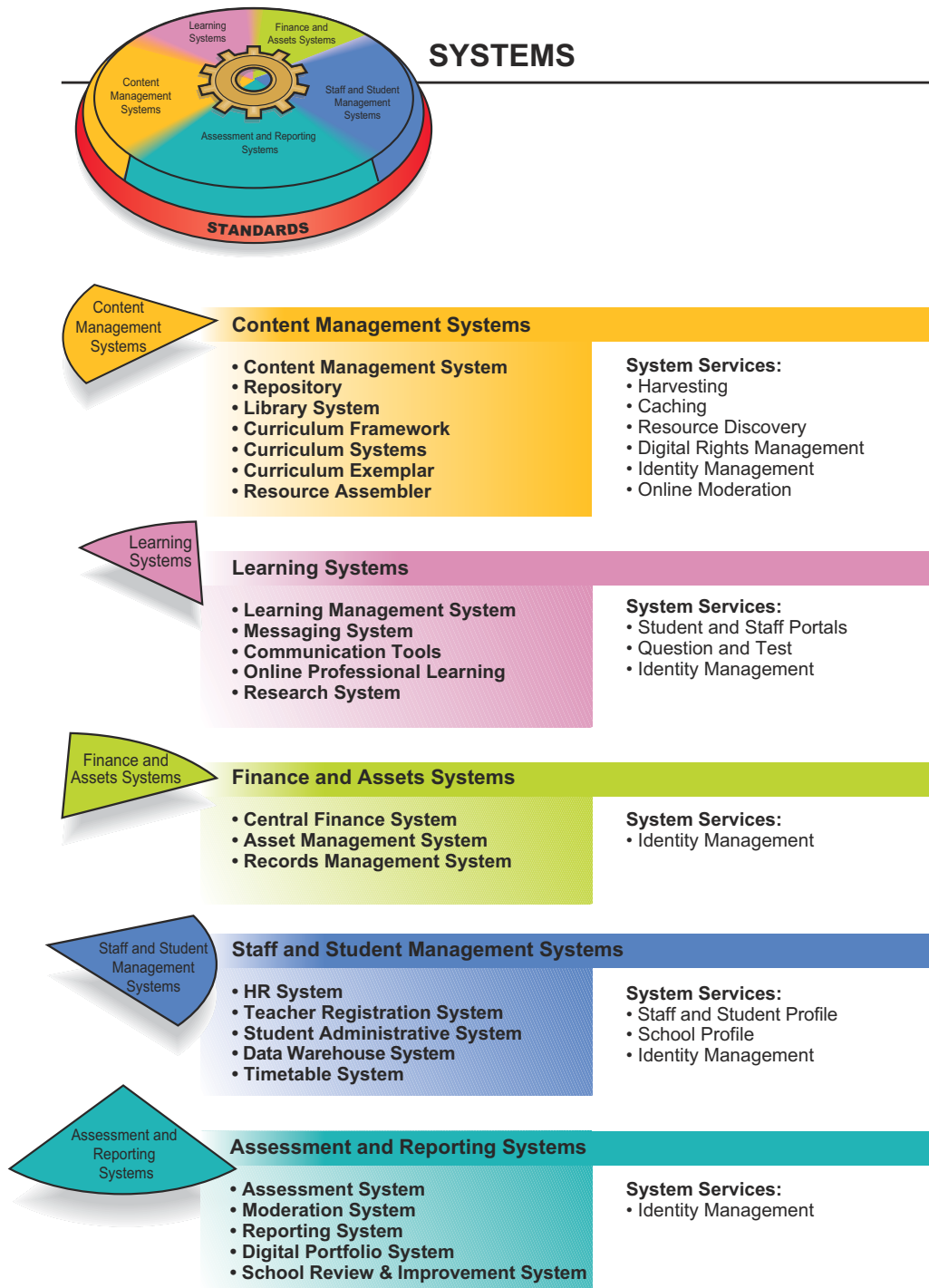


Figure 9: Systems and Services Model

dimensions of learning architecture

systems layer

Considerations

- **Reuse, Build or Buy?:** decisions made in the light of Learning Architecture take account of the organisation and its requirements, enabling achievement of the maximum value from investment in ICT. Decisions on further development or replacement of legacy system are informed by guiding principles and the financial implications.
- **Fitting the software to processes:** system layer design assists organisations to articulate current business processes. It informs vendors of the commercial software need of the organisation and assists organisations to evaluate available and potential commercial software options.

- **Project isolation:** initiatives that introduce new or changed technology capabilities are often funded and managed as self-contained projects. To maximise investment, it is critical that distinct ICT projects are designed as elements of an integrated change program.

Guiding principles include:

- information is fully integrated to maximise its value
- highly modular application systems are selected
- systems are intuitive and easy to use
- information is captured once, at the source
- customisation of commercial software is minimised.

The need to achieve integrated and interoperable systems is a critical issue for a jurisdiction. Teachers, administrators and students become frustrated with lack of cohesion between systems. In many cases this raises the technological barrier to use. Lack of interoperability raises the costs of the professional learning requirements for teachers and administrators.

Efficiencies will be gained if the student administration system enters students' names once only, and this information is reused across a number of systems: eg as the class list, or group of names to assign learning activities within a learning management system; to create student/user names within a library system; or to reuse within the assessment and reporting system.

Teachers and students require systems that are user friendly and meet current pedagogy. It is highly desirable that the system that enables teachers to plan lessons or units of work online also enables them to seamlessly discover resources from a local educational repository or from school library collections without having to log in and out of different systems.

There is a high resource management cost if systems do not 'talk' to each other. Maintaining the list of class or student names for the learning management, reporting and assessment systems, attendance register, and student email system is resource intensive. Modularised and standards-based systems result in a higher return for investment.



dimensions of learning architecture

technology layer

Technology Layer

The technology layer defines the technical components required to underpin the information, applications and integration. This allows the applications to share a common infrastructure platform, resulting in a cost-effective and manageable overall suite of ICT capabilities. The technology layer also defines standards that ensure that the applications can work together effectively and provide communication to relevant external groups.

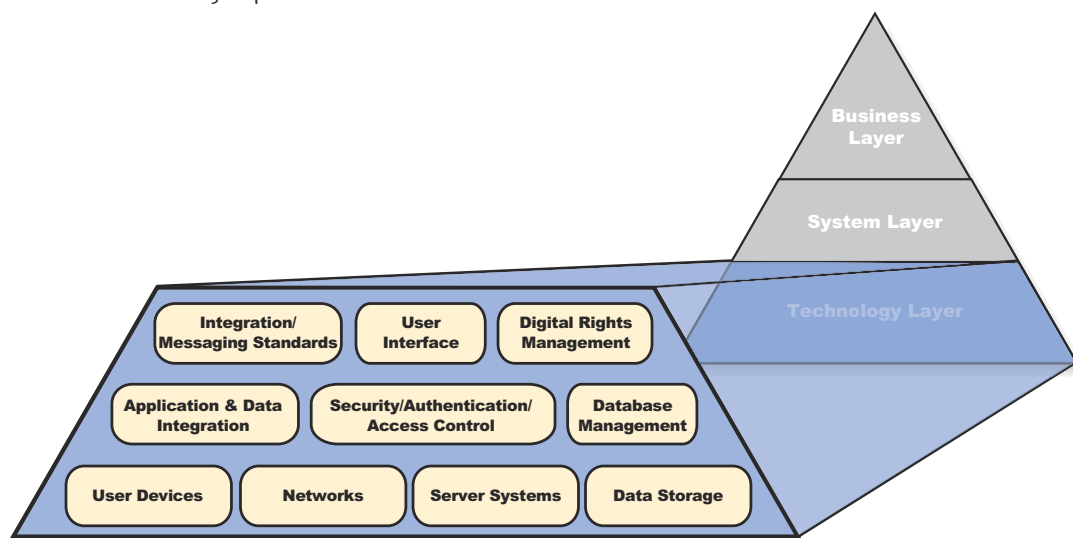


Figure 10: Elements of the Technology Layer

The technology layer establishes policies and standards to guide the selection and implementation of particular technology elements to balance the following goals:

- the various elements of the technology infrastructure interoperate effectively
- the technical diversity and hence cost of operating the overall infrastructure is minimised
- the flexibility to select IT applications that deliver maximum benefits is provided
- security systems are integrated with software applications.

dimensions of learning architecture

technology layer

Considerations

- **Multiple Server Platforms:** policy for server platforms needs to provide the flexibility to select applications that deliver the maximum business benefits but restrict uncontrolled diversity of platforms.
- **Fragmented User Interfaces:** the suite of software applications deployed within an organisation needs to work toward consistent, high-quality, integrated user interfaces that are intuitive. This allows users to work with the technology efficiently and effectively.

- **Standards:** compliance with international and national technology standards maximises modularity, interoperability and return on investment.

Guiding principles include:

- technology components are standards compatible
- technology infrastructure provides real-time access to information sources
- technology provides integrated security, with single sign-on and role-based access
- a consistent user interface standard is adopted.

A jurisdiction is researching how open standards could be used to underpin the Learning Architecture of the department. An audit of existing systems has been undertaken and a map of planned ICT initiatives across the department has been prepared to identify the implications of such approach, migration issues, possible legacy systems, and the dependencies between the planned initiatives.

Requests for information from the market are requiring vendors to base their products on open standards. Issues for the department arising from the planning being undertaken for the technology layer include gaining shared understandings across the department about the planning documentation required to plan the 'technology layer'.

People expect to interact with government in a way that makes agency boundaries transparent and integrated, with cross-agency data more readily available. They also expect their privacy and security to be protected.

(National Office of the Information Economy – E-government Benefits Study, April 2003)



glossary

ICT	information communication technologies
ICT IN SCHOOLS TASKFORCE	the Information and Communication Technologies in Schools Taskforce is one of eight Taskforces established by MCEETYA to progress the achievement of the Australian National Goals of Schooling
JURISDICTION	the sphere of responsibility of an education authority
LEARNING ARCHITECTURE	a planned enterprise ICT framework that enables the school sector to share information and software applications internally and with external organisations
MCEETYA	Ministerial Council on Education, Employment, Training and Youth Affairs – Australia and New Zealand
ON LINE LEARNING ENVIRONMENT	an environment provided by education organisations which may include e-learning systems, library systems, search and discovery tools, communications, caches and databases
ROLE-BASED ACCESS	access to information through log on and authentication determined by the role of the user
SCHOOL	a body registered by a state or territory authority for the delivery of education from school commencement to Year 12
SCHOOL SECTOR	the education sector providing services from Kindergarten to Year 12
STANDARD	a specification produced by an accredited standards developments organisation such as the IEEE Standards Association or the International Organisation for Standardisation (ISO)

Further information regarding this publication can be obtained from:

icctaskforce@mceetya.edu.au