Health*Connect* Systems Architecture Project

Phase 2 – Systems Architecture Development

Current Systems & Technology

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Health*Connect* Architecture Documents

Phase 1 of the Systems Architecture involved the definition of the requirement for the System Architecture project. This was then used in shaping the Systems Architecture Phase 2. The following listed documents form part of the reporting for this second phase of the Health*Connect* Systems Architecture project and are available at www.healthconnect.gov.au.

If you click on the Systems Architecture link on that web page you will be able to obtain the listed documents.

The key Systems Architecture (Phase 2) documents comprise of:

Health*Connect* Architecture Overview	Presents a high-level overview and conceptual model of Health*Connect*.
Health*Connect* Systems Architecture	Defines the Health*Connect* Systems Architecture from the three design viewpoints of Data, Application and Technology. Provides an in-depth description of the Health*Connect* Systems Architecture.
Health*Connect* Implementation Strategy	Describes an implementation strategy for establishing Health*Connect* as a national system of compatible health records systems.

Other System Architecture (Phase 2) documents, available at the above web address, are as follows:

Health*Connect* Architectural Principles	Defines and describes the principles underpinning the architecture.
Health*Connect* Financial Business Model	Describes options for the Health*Connect* financial business model and how the business model might operate. It also explores questions like who might own the assets and data, funding sources for implementation and ongoing operations.
Health*Connect* Business Architecture Models	Documents the business models derived from the Business Architecture (see above). The UML (Universal Modelling Language) models were prepared using Popkin's *System Architect* modelling tool. The document provides instruction on how to navigate the *System Architect* encyclopaedia (see below).
Health*Connect* System Architecture Encyclopaedia	Web browser viewable set of the architectural models built using the Popkin *System Architect* tool.
Health*Connect* Current Systems and Technology paper (This document)	Describes application systems and supporting technology currently in use in the health sector.

Health*Connect* Standards Assessment	Reviews relevant standards that impact/enable Health*Connect*.
Next Steps for the Health*Connect* Systems Architecture	Identifies the activities that are required to complete the development of the Health*Connect* architecture to a level of detail sufficient to guide future implementation activities.

The following documents available at the indicated web addresses are referenced in the draft Systems Architecture (Phase 2):

A Health Information Network for Australia	The report of the National Electronic Health Records Taskforce published in July 2000. The recommendations of the taskforce led to the initiation of the Health*Connect* project. This document is available on the internet at: http://www.health.gov.au/healthonline/publications/publications.html#Pub00
Health*Connect* Interim Research Report	The report comprises three volumes: Volume I, which provides an overarching view of the Project achievements and findings to date, and recommends a way forward for this important national project; and Volumes II and III which contain a number of research reports, case studies and evaluation reports as background materials. www.healthconnect.gov.au
Health*Connect* Business Architecture	Describes the business requirements for Health*Connect*. It was the starting point for the development of the Systems Architecture. Version 1.0 is being published in the Health*Connect* Interim Research Report, which is being released at the same time as the Systems Architecture. www.healthconnect.gov.au

PLEASE NOTE

As well as being available on the web site www.healthconnect.gov.au all the Health*Connect* Architecture documents and Health*Connect* Interim Research Report are available on CD.

Printed versions of the Health*Connect* Interim Research Report and Health*Connect* (Phase 2) draft Systems Architecture document are also available.

If you would like a CD or printed document please send your request to healthconnect@health.gov.au or phone 02 6289 7716.

Glossary of Terms

Term	Definition
ACBHS	Australian Community-Based Health Set
AN-DRG	Australian National Diagnostic Related Group
API	Application Program Interface
CIS	Clinical Information System
CDMDS	Community Nursing Minimum Data Set
CON	Consumer Information System
DICOM	The Digital Imaging & Communication in Medicine standard group of the American College of Radiation (ACR) and the National Electrical Manufacturers Association (AEMA).
DOCLE	DOctors Command LanguagE,
DRG	Diagnostic Related Groups
DSS	Decision Support System
EHR	Electronic Health Record
EHRS	Electronic Health Record System
FEAF	Federal Enterprise Architecture Framework
GP	General Practitioner
HCN	Health Community Network
HIC	Health Insurance Commission
HL7	Health Level 7
HL7 CDA	HL7 Clinical Document Architecture
HL7 MLLP	HL7 Minimal Lower Layer Protocol
HL7 RIM	HL7 Reference Information Model
HTML	Hyper-Text Markup Language
HTTP	Hyper-Text Transport Protocol
ICD	International Classification of Diseases
ICPC	International Classification of Primary Care
IP	Internet Protocol
IT	Information Technology
LOINC	Logical Identifiers Names and Codes
MS.net	MicroSoft .net
ODBC	Object Database Connector

Term	Definition
OPCS	Classification of Surgical Operations and Procedures
PAS	Patient Administration System
PAM	Professions Allied to Medicine
PIT	Pathology Information Transfer
PKI	Public Key Infrastructure
RDBMS	Relational Database Management System
RES	Research Information System
SMTP	Simple Message Transport Protocol
SNOMED	Systematized Nomenclature of Medicine
SOAP	Simple Object Access Protocol
SQL	Structured Query Language
TCP	Transmission Control Protocol
XML	eXtensible Markup Language
XSLT	XML Stylesheet Language Transformation

1 Introduction

1.1 Purpose of this Document

This document defines the current systems environment relevant to Health*Connect*.

This document provides an overview of the current computer applications that support the management of the business and clinical processes of health service delivery. Systems that will not have a direct interface to Health*Connect* have not been included in this report.

More than 60 software products have been identified and their characteristics summarised from readily available published information. Where possible information relating to product capabilities, implementation sites and standards compliance has been confirmed with a vendor representative.

The technology infrastructure review has been limited to identifying, from each vendor surveyed, or their published material, the technology and interfacing standards supported by their applications.

The information in this document is intended to inform the systems architecture development work of the Health*Connect* Systems Architecture Project.

1.2 Document Structure

This document is structured into seven sections:

1. **Introduction**, which describes the purpose and structure of this document and its relationship to the other Health*Connect* Systems Architecture documents.
2. **Current Data Environment**, which describes the current systems that support the management and exchange of standardised health data.
3. **Current Applications Environment**, which describes the current application systems (software products) that support the business and clinical aspects of health service delivery.
4. **Current Technology Environment**, which describes the current technology that is available to implement the HealthConnect Systems Architecture. The current technology environment is discussed Section 5.
5. **Current CIS Software Products**, which provides summary details of a selection of currently available clinical Information system (CIS) software products.
6. **Current Software Integration Products**, which provides summary details of currently available software products that support consumer to provider and provider to provider integration with CIS software products.

1.3 Relationship to Other Documents

The relationship of this document to the other Health*Connect* Systems Architecture documents is shown in Figure 1-1.

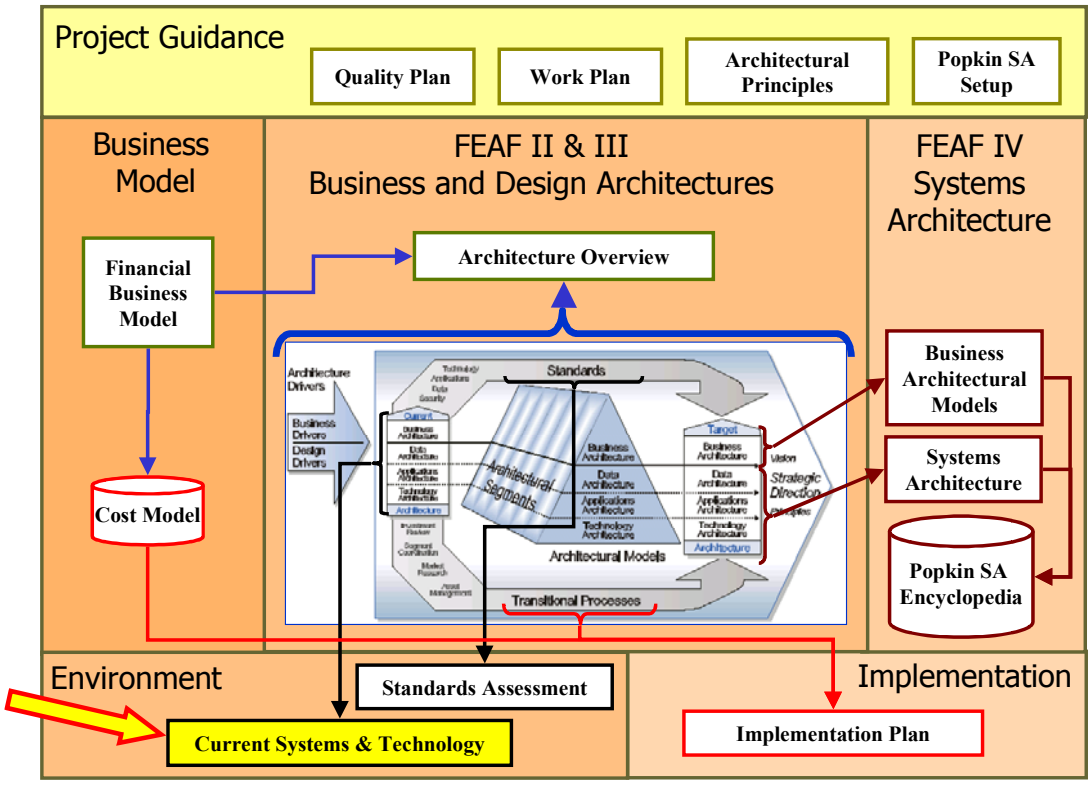

Figure 1-1 HealthConnect Systems Architecture Documentation

2 Current Data Environment

This section provides an overview of existing systems that support the management and exchange of standardised health data across health information systems. These systems can be classified into three meta-data system domains as follows:

- **Health Directories**, which provide a common source of reference data.
- **Data Dictionaries/Terminologies**, which provide a common set of data definitions.
- **Health Records Standards**, which provide a common set of record structures.

This domain model is illustrated in Figure 2-1.

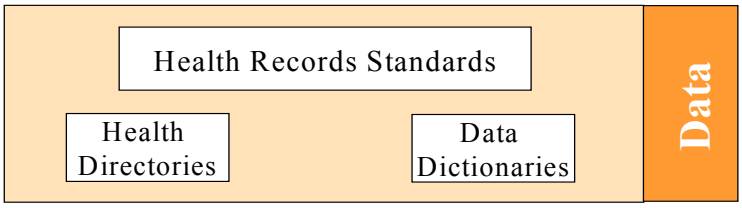

Figure 2-1 Meta-Data System Domain Model

2.1.1 Health Directories

Directories are often described as "system master files or tables" where information is collected to be used as reference data by a range of computer systems within or between organisations. Directories may be managed by an independent organisation providing information services to a range of organisations. While there are a number of localised directories existing, or emerging, for various purposes (such as service directories, professional registers, etc), to date there has been no standardised approach to establish national health directories.

The Health Insurance Commission maintains possibly the largest systematised collection of providers and service delivery organisations to support their business process. Outside of the HIC, most directories are State or Territory based.

2.1.2 Data Dictionaries/Terminologies/Controlled Vocabularies

This sub-section draws on a Commonwealth paper by Professor Siaw-Teng Liaw and Associate Professor Heather Grain[1] et al, that categorises health data dictionaries or controlled vocabularies, into "Interface, Reference and Aggregating Terminologies". The paper recognises the importance of these categories as a means of understanding the use and focus of terminologies.

The Liaw category definitions are reproduced here to identify which stakeholder groups have adopted terminologies.

[1]Teng Liaw, Heather Grain, An approach to terminology standards for electronic health records: conceptual frame work and issues, Commonwealth Department of Health and Ageing.

2.1.2.1 Interface Terminologies

An interface terminology refers to the collection of terms that end users use to enter and retrieve information. Interface terminologies are usually proprietary and modified or mapped to a suite of local terms on a local ad hoc basis.

Within the current computer systems the expression "data dictionary" encapsulates the terms and expressions held in master files or look-up tables that are used to facilitate data entry (ie interface terminologies). Independent data dictionary capability is limited to the larger health service organisations such as the major hospitals. Most implementations of data dictionaries are less formal with specific collections of common usage terms only being applicable to the services being provided or the health profession involved.

This capacity is frequently created or modified within an organisation's application or data base environment and, as a result, there is little capability for transportability or reference outside the application environment. Pathology laboratories are likely to be using LOINC[2], or SNOMED[3] whilst general practice typically uses ICPC2+[4] or DOCLE[5]. In addition both professions have added specific local terms.

2.1.2.2 Reference Terminologies

A reference terminology is defined as a representation of clinical meaning to which knowledge representation formalisation is used to represent concepts and their relationships. Unique concepts are described by their preferred (or canonical) terms along with allowable terms[1].

It does not appear that reference terminologies have been implemented in Australia at this time.

2.1.2.3 Aggregating Terminologies

An aggregating terminology groups similar concepts, using relationships that may be hierarchical and/or uni- or multi-dimensional, for statistical management and other secondary information purposes[1].

Laiw has identified that there are a number of well-supported and maintained Aggregating Terminologies being used within Australia for statistical reporting. These are listed in Table 2-1.

2.1.3 Health Record Standards

There is no dominant definition of an electronic health record implemented in Australia. While there are a significant number of localised or institutional computer systems storing patient information, because of their proprietary nature there is a lack of detail in the public domain about the content or data structures of such health records. However, research in relation to electronic health record architectures is occurring in the HL7 Reference Information Model and Clinical

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[2] LOINC Reference: www.regenstrief.org/loinc/loinc.htm

[3] SNOMED Refrence: www.snomed.org

[4] ICPC2+ Reference: www.fmrc.org.au/classifi.htm

[5] DOCLE Reference: www.docle.com

Document Architecture in the USA[6], the *open*EHR[7] and the GP Data Model in Australia[8] and a number of other standards development organisations is being harmonised by the developers of those models.

This work is developmental in nature and, over time, is likely to provide a set of common agreed definitions for health records.

Stakeholder	Aggregating Terminology/ Classification	Interface Terminology	Reference Terminology
General Practice	ICPC2, ICHPPC	ICPC2+ DOCLE	N/A
Pathologists	SNOMED International LOINC	N/A	SNOMED-CT?
Psychiatrists	DSM4	N/A	N/A
Psychologist	DSM4	N/A	N/A
Emergency Physicians	ICD10AM ICPC2	N/A	N/A
Physician	MED ICD10	N/A	N/A
Surgeon Gynaecologist	Classification of Surgical Operations & Procedures 4th Revision (OPCS-4) ICPM	N/A	N/A
Nurses (inpatient general & specialist) Nurses (outpatient general & specialist)	Australian National Health Minimum Data Set for Institutional Care, Australian Health Care Data Dictionary ICNP (52) UK Nursing Terms Project (Read). Euro-nursing Health Database	N/A	N/A
Nurses (community general and specialist)	Australia: Community Nursing Minimum Data Set (CDMDS); ACBHS USA: NANDA standardised language and Classifications for Home Health Care, Interventions and Outcomes. Omaha classification of nursing care in the home setting.	N/A	N/A
Nutritionist / Dietician	DRG, ICD9CM ACBHS Read Clinical Terms for PAMs	N/A	N/A

[6] HL7 RIM and CDA Reference: www.hl7.org

[7] OpenEHR References: www.openehr.org

[8] GP Data Model References: www.GPCG.org.au/projects/data_model.html

Stakeholder	Aggregating Terminology/ Classification	Interface Terminology	Reference Terminology
Physiotherapist	DRG, ICD9CM ACBHS Read Clinical Terms for PAMs	N/A	N/A
OT	DRG, ICD9CM ACBHS Read Clinical Terms for PAMs	N/A	N/A
Speech Therapist	DRG, ICD9CM ACBHS Read Clinical Terms for PAMs	N/A	N/A
Podiatrist/Chiropodist	DRG, ICD9CM ACBHS Read Clinical Terms for PAMs	N/A	N/A
Ambulance paramedic	Various casemix developments	N/A	N/A
Admin/reception	Various casemix developments	N/A	N/A
Other staff and workers		N/A	N/A
Health Administrators	Various casemix developments	N/A	N/A
Policy makers (federal/state)	Various casemix developments	N/A	N/A
Researchers, Librarians	Various casemix developments, ICD10AM	N/A	N/A
Standards Developers & Health Data Managers	Various casemix developments	N/A	N/A
Health Info Technologists	Various casemix developments	N/A	N/A
Patient & Carer	N/A	N/A	N/A
Consumer	N/A	N/A	N/A
Community organisation	N/A	N/A	N/A
Local Govt	N/A	N/A	N/A

Table 2-1 Aggregating Terminologies in use in Australia

2.2 Data Environment Conclusions

There are no common data architecture definitions or structures that can be wholly drawn from current health systems. Significant work will need to be conducted to ensure that Health*Connect* data can be populated from current systems. Useable messaging standards exist for pathology, medications and potentially hospital discharge summaries. However the contents of those messages are likely to hold human readable information rather than computer processable information. Data is collected using localised terms relevant to individual organisations that cannot be codified without the development of an Australian terminology translator. As Liaw[1] observes a reference terminology is required to avoid ambiguity in exchanging and computer processing of clinical information.

3 Current Applications Environment

This section provides an overview of application systems that support the business and clinical operations of health service delivery. There is currently no national health records system (HRS) in operation. Rather there are a large number of diverse systems supporting specific health service delivery functions. Each system maintains its own health record structure, most of which have evolved over time to reflect the immediate processing needs of the owner organisation.

3.1 System Domains

For the purposes of the Systems Architecture Project the current health application systems of relevance to Health*Connect* have been categorised into six application system domains, as follows:

- **Patient Administration Systems.** Patient Administration Systems (PAS) are IT systems that support the administration of patients at health facilities such as hospitals and health clinics.
- **Clinical Information Systems.** Clinical Information Systems (CIS) are IT systems used by Health Providers to maintain information relating to the health services that they provide to consumers. Systems in this category include GP and specialist systems such as HCN "Medical Director", laboratory and hospital-based clinical systems.
- **Consumer Information Systems.** Consumer Information Systems (CON) are IT systems that are used by consumers. This category consists of systems running on home-based personal computers, workplace workstations and (potentially) handheld devices such as palm-top computers and mobile phones.
- **Decision Support Systems.** Decision Support Systems (DSS) are IT systems that support automated expert diagnosis and health decision-making. This category also includes government registers such as the existing registers for notifiable diseases, births and deaths.
- **Research Information Systems.** Research Information Systems (RES) are IT systems that support health research functions. This category includes specialised analysis environments at universities, research institutes, teaching and research hospitals and government health departments.
- **Electronic Health Records Systems.** Health Records Systems (EHRS) are IT systems that specifically support the management and exchange of EHR. EHRS are considered do be distinctly different in nature to the existing systems domains. Rather than being a source or sink for information they act as a store and/or exchange for health information enabling this information to be shared between systems within the other domains. This category includes Health*Connect* and potentially other (future) similar systems that support other types of health records.

The System Domain Model is illustrated in Figure 3-1. It is noteworthy that this categorisation does not imply that a specific IT system or application must fall wholly within one domain. Rather it is expected that over time most systems will include functionality and information from multiple domains.

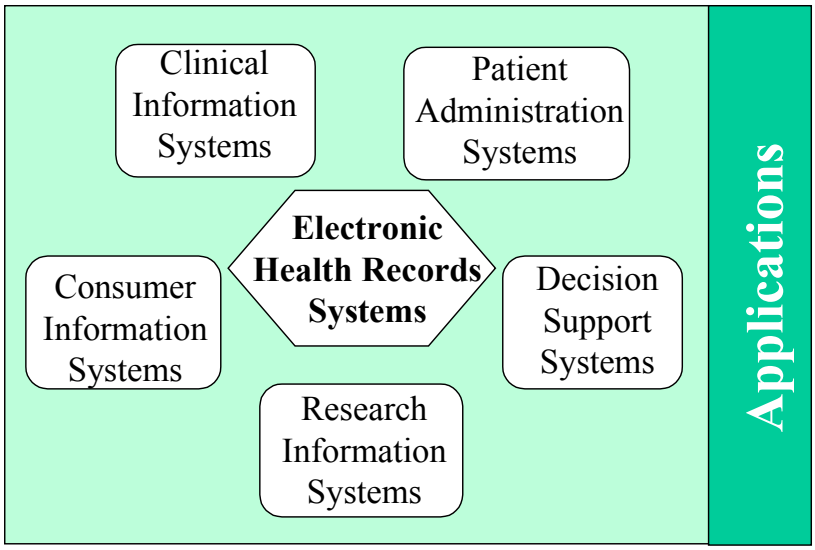

Figure 3-1 Application System Domain Model

3.1.1.1 Patient Administration and Clinical Information Systems

A significant number of health service organisations have PAS and or CIS in place. PAS and CIS have the potential to directly provide and receive information from Health*Connect.* The major organisation types that employ PAS and CIS are: laboratories, hospitals, emergency departments, general practice, diagnostic services, and community based allied health providers.

CIS are characterised as systems that reflect the clinician's or health professional's perspective of information collection. CIS hold higher levels of clinical detail necessary for patient care than might be collected by PAS. They are also usually tailored to a particular institution's model of healthcare operation.

CIS run on a wide range of platforms and computing environments with little integration or opportunity for sharing of patient information between organisations. Where integration with peer systems such as PAS has occurred it has been mostly through interface engine and messaging technology based services.

3.1.1.2 Consumer Information Systems

Consumer uptake of information technologies is mostly based on either e-mail or Internet browser environments with individual circumstances ranging from very basic to highly sophisticated environments.

There is evidence that both the aged and the young are taking up computing and electronic messaging at ever increasing rates. The Australian Bureau of Statistics reports that by the end of 2001 every second household in Australia will have home Internet access. As at November 2000, 66% of all adults used a computer and 50% of all adults accessed the Internet[9].

However, consumer computer technologies are not yet sufficiently pervasive to be relied on as the sole means for consumers to access their Health*Connect* information.

[9] ABS statistical report 8147.0 Use of the Internet by Householders, Australia. www.abs.gov.au/ausstat

3.1.1.3 Decision Support Systems

Clinically based DSS are largely new developments being undertaken through trials or on an experimental/research basis. There are significant variations to the approaches of individual DSS. Therefore, it is appropriate to classify them to better characterise the potential relationship between DSS and Health*Connect*. A candidate categorisation that attempts to identify major differences in DSS functionality is provided in Table 3-1.

Category	Major Functionality Provided
Reference	May have context sensitive or problem orientated best practice guidelines.
Clinical pathway	Clinically researched anticipated sequence of clinical treatment and/or course or progress of disease.
Care pathway	Best practice resource schedule and treatment plan based on problem.
Care Plan	Best practice scheduling of activities or services intended to deliver an outcome to an individual. Possibly assessment based, requiring understanding of service availability and clinical and social goals of both patient and provider.

Table 3-1 Decision Support System Categories

Most implementations of DSS are closely coupled with CIS or PAS as software modules configured to interoperate within clinical workflow and application data collection based on local data definitions or terminologies.

In the absence of a well-structured reference terminology, there is little opportunity to share these localised data definitions between service delivery organisations in an unambiguous way.

3.1.1.4 Research Information Systems

Most universities, registries and health research centres (which will include teaching hospitals and clinics) maintain a health research capability of some description, operating a wide range of stand-alone computing environments.

3.1.1.5 Health Records Systems

For the purposes of this section, HRS are systems that collect patient data, within facilities or organisations, reflecting the history of health services and activities provided by that service delivery facility or organisation. From the Systems Architecture point of view current HRS are differentiated from CIS and PAS largely by the granularity of information they hold. Current HRS reflect patient process management and billing rather than holding the significant levels of clinical detail needed by clinicians.

There is a wide range and variety of capabilities within these systems. However, most have some means of communicating with peer systems, largely by messaging, as opposed to being more closely integrated. Within larger institutions or organisations, such as moderately sized hospitals and larger diagnostic centres, messaging is used to deliver levels of integration sufficient to meet current business priorities.

Recent research and project based activities to identify Australian requirements for the messages has enhanced the capacity of smaller systems such as those that support general practice and the bespoke systems of smaller pathology laboratories. However, it is not yet clear if software vendors outside of these projects have rolled out these enhancements to other locations.

3.2 Application Environment Conclusions

There is currently no national EHRS in operation. Rather there are a large number of diverse IT systems and vendor products that support specific health service delivery functions. Each system maintains its own health record structure, most of which have evolved over time to reflect the immediate processing needs of the owner organisation. No existing health IT system provides the core functionality of Health*Connect* as identified in the Systems Architecture. However, there is an increasing capability for current applications, either directly through messaging standards or other infrastructure services, such as interface engines, to provide information to Health*Connect*.

4 Current Technical Environment

4.1 Deployed Technology

The health technology environment is characterised by a wide variety of platforms, standards and vendor products. Health organisations appear reluctant to update computer systems when the installed systems are deemed to be meeting the organisation's business need. In fact, vendors believe that software functionality, i.e. the application, is what health organisations based their procurement decisions on rather than alignment with technology objectives.

Because of this variety and complexity a detailed consideration of current technology has not been perused. Rather the application survey has included details of the technology platforms supported by each product where this information has been readily available from the vendor.

4.2 Enabling Technologies

To be feasable Health*Connect* must be implemented as a data and platform independent service. This approach has been enabled by the emergence of the following platform independent technology capabilities:

- **HTTP based web browsers**, which provide a standard client service, independent of operating system and application, enabling users to access Health*Connect* from most types of computing systems.
- **Internet communications**, which provide a low cost ubiquitous public data network service for the delivery of Health*Connect* data to end users' computing systems.
- **HTML and XML**, which provide a standard means of marking up the format, layout and definition of Health*Connect* data.
- **XML databases**, which provide the capability to store, search and retrieve Health*Connect* data contained within XML documents.

4.3 Technology Architecture Conclusions

A majority of vendors are claiming to support the Internet and more specifically Web- based technologies identified above, however few can reference actual operational systems. In particular, it is the XML technologies, that are now supported by health standards development organisations, that offer the most significant way forward. However, there will need to be significant collaboration amongst standards development organisations world wide to resolve the ambiguities in health document structure and content that currently exist.

5 Current CIS Software Products

This section describes a sample of the CIS software products currently available in the marketplace. This survey is intended to be representative of the types of systems that are available and is not an exhaustive list of available products. The survey has not considered site specific implementation issues such as specific product version releases, implementation configurations and whether the specific software as implemented in a specific environment can be modified or adapted to interface with Health*Connect*. The section is divided into the following categories:

Vendor Market place	Current Systems Architecture Alignment
General Practice and Specialist Software	These systems can be categorised as either EHRS or CIS
Diagnostic Service Software	CIS
Pharmacy / Dispensing (non GP) Software	CIS
Acute Care	EHRS or CIS
Community Health / Client Management	EHRS

5.1 General Practice and Specialist Software

Software Product	Major Functionality	Market Penetration	Standards Used
Health Communications Network – Miscellaneous products for general practitioners and specialists	General Practice: **Medical Director** Practice Management and clinical: Medical Director, Patient Histories, containing Patient Demographics, Family/social history, Medication record, previous medication list, recalls, progress notes, document imaging, databases for pharmaceutical companies, patient education handouts, drug interactions and alerts, clinical decision support tools, Problem specific records for diabetes, Immunisation, PAP smear and antenatal. Specialist: **Endoscopy**, **Scribe, Pracsoft** provide information management for imaging, notes, reporting, reference library, Pat Admin, statistical reporting, billing. www.hcn.com.au	Medical Director quotes 14,000 health practitioners or 85% of GPs Australia wide. Specialist implementations at Prince of Wales NSW, The Alfred VIC and Princess Alexandra QLD Day Surgery: Blue Chip	HL7 DICOM 3.0 UNEDIFACT ODB ICD10 AN-DRG, DOCLE References: Harrison's Online Cochrane Library
Genie Solutions – Genie	**Genie** is a GP clinical desktop application supporting the following functions: • Clinical, • Script, • MIMs drug interactions, • Allergies, • Alerts, • Referrals • Pathology requests, • Follow-up, • Results, • Graphing, • Pap smear tracking, • Reminders, • Immunisation schedule and reminders,		HL7 XML

Software Product	Major Functionality	Market Penetration	Standards Used
	• Patient recalls, • Patient summaries, • Merge letters, • Specialist modules for theatre, • Data conversion, • Appointments, • Billing. www.geniesolutions.com.au		
Medtech Healthcare	**MedTech32** is a system for GP Practice; patient demographics, appointments, patient accounting, and clinical records for: clinical assessments, plans, diagnoses, prescriptions, referrals recall, and screening assessments. Functionality: • Patient Register, • Patient Accounting, • Clinical Records, • Document management, • Recall, • Screening, • Health assessment and management. • Clinical assessments, • Plans, • Diagnoses, • Prescriptions, • Referrals, • Print government forms, letters, • Scanning of incoming reports, • Electronic receipt of hospital discharge & lab results. **LinkTech** is a powerful data management mining tool that collects, aggregates and warehouses health management information. By	MedTech32 has 190 practices in all State. Linktech well established NZ beginning sales in Aus. ResCare is under development MedTech Specialist is underdevelopment Medtech HIS has sites in Asia	Delphi development environment Interbase ODBC NT and Windows SQL, client/server technologies ICPC2+ MIMS Pharmaceutical and Interaction. HL7 messaging PIT compliant

Software Product	Major Functionality	Market Penetration	Standards Used
	providing a unique user-defined interface that allows a user to determine the type and content of the data collected thus providing health administrators and funding agencies the tools for the delivery of capitated funding, public health interventions, sector planning and much more. **ResCare** is a software product for the management of residential care facilities. It is used primarily for rest homes for the elderly. **MedTech Specialist** is designed to meet the clinical and practice management needs of medical specialists. **MedTech HIS** combines scheduling, billing and full clinical Electronic Medical Record functionality with an ADT (Admission, Discharge, Transfer) module to offer an advanced Hospital Information System www.medtech.com.au		
Jam Software	**M.E.D** (Medical Electronic Desktop) Patient records, prescribing, referral letters, checklists, orders, results, reminders and recalls, drug interactions and alerts, patient condition review, patient education, on-line help and personal notes, dictionary. Reference: www.jamsoft.com.au	400 medical sites in Australia Every State of Australia	Internet tools Mac and PC. PIT text translation PC– ODBC & SQL Mac SQL Java in future
Muse Solutions P/L	**Totalcare**, a GP practice, specialist and day hospital software for, appointments, patient registration, banking, payments, billing, reporting and analysis, claims, incl HIC, waiting room, follow-up, path results review, recalls, referrals, prescribing, investigations, observations, patient histories, Suitable for larger organisations, multi site and multi company	All States	Gupta Relational Database HL7 for orders and reports, ICPC-2 Plus MIMS Product and Interactions.

Software Product	Major Functionality	Market Penetration	Standards Used
	installations. www.musesolutions.com.au		
Global Health – Working Systems – Locum3	**Locum3** is a clinical management systems used by Doctors for clinical records, medications, diagnostic orders and results. New releases focussing on electronic messaging/ collaboration and improved workflow – internal and with external entities. www.ws.com.au	400+ sites. All States – majority in Victoria.	SQL Compliant Database PIT HL7 messaging PKI ICPC2+
Compudoc	**Compudoc** complete GP Practice Management system and prescribing, clinical notes etc. http://www.compudoc.au.com/	Most States	Windows based
Medical Spectrum	**Medical Spectrum** is a fully integrated and user-friendly clinical and practice management software program. It empowers every team member with hands-on control over performance and profitability. It maximises patient care by ensuring that day-to-day operations run like clockwork, even during the busiest of times. The system consists of a local network of computers, linked to a central database. This gives the medical and administrative staff instant access to appointment lists, accounting information, medical records, diagnostic results, and unlimited reporting facilities Functionality: • Reception/waiting rooms • Consulting room • Diagnostics • Patient Reminders	All States, 300 practice sites.	Delphi development Microsoft Windows ICPC2+ Interbase DB ISAM client server ODBC MIMS database and Interactions PIT no HL7 yet

Software Product	Major Functionality	Market Penetration	Standards Used
	• Communication • Records • Accounts • Data analyses www.medispec.com.au		

5.2 Diagnostic Service Software (Pathology and Radiology)

Software Product	Major Functionality	Market Penetration	Standards Used
pja computer consultants	**AUSLAB** and **AUSCARE**, provide laboratory and healthcare solutions for the public and private sectors. AUSLAB, laboratory management and reporting system for pathology, forensic science, veterinary, food, water, industrial and environmental testing services. AUSCARE is a reporting engine to integrate clinical and allied health reporting such as cardiology, dietetics etc www.pjacc.com.au	AUSLAB is QLD Health's statewide laboratory software; there are also sites in NSW and Victoria supporting over 60 laboratories.	HL7
Kestral Computing – Pathology Laboratory System (PLS)	**PLS** is a complete laboratory information system for both hospital and non-hospital laboratories. www.kestral.com.au	In all States except NT for all products.	HL7 and PIT Messaging; DICOM Higher levels of integration are provided through Kestral's HL7 Connect and Clinical Information System product interfaces
Kestral's Radiology Management System (RMS)	**RMS** is designed for radiology practices in hospitals and private practices. Www.kestral.com.au	WA health public labs, SA Vic NSW Qld	See Kestral Pathology System above.

Software Product	Major Functionality	Market Penetration	Standards Used
Pro Medicus software products	**Practice Management system** is an information management tool used in diagnostic imaging, provides the functionality for a complete business system. It incorporates accounting, clinical reporting and workflow management irrespective of speciality. **Electronic Appointments System**, an enterprise appointments book specifically designed for use in a medical practice. www.promedicus.com.au	All States, hundreds of practices.	HL7, PIT Also their own Java-based messaging engine for DICOM and XML messaging system to integrate with HIS and legacy systems.
Détente	**Omi-LAB**, a comprehensive multidisciplinary solution to the communications and control requirements of all laboratories. Medical management and scientific users obtain accurate, consistent and complete information, quickly and efficiently. **OMNI – Image**, an advanced system to optimise utilisation of equipment and facilities. The benefits of complete tracking, reporting and history of all patient data are realised by Radiologist, Radiographers Administrators and Practitioners. **Med-CouRieR**, a complete messaging system for Results Reporting and Order Entry. Provides for delivery in many form factors including print, fax, web (intra and internet) and email. Includes option for Secure*e*mail using digital Certificate technology to ensure confidentiality. O**MNI-View** An advanced Document Imaging System for the scanning, storage and retrieval of Health paper records with Automatic Indexing. Includes Admission Letters, Discharge Summaries, Medical Records and any other document associated with Patient, Visit or Procedure. www.détente.com.au	NSW South East Area Health Service, covering 22% of NSW Health public pathology. ACT	SQL, ODBC, DICOM HL7 Messaging

Software Product	Major Functionality	Market Penetration	Standards Used
TripleG's – Ultra	**ULTRA Laboratory System** has been designed to fit the needs of a single facility to integrated networks spanning multi-facilities. From test initiation and processing to management reporting and accounts receivable, ULTRA facilitates quick, efficient and precise laboratory management. All system modules are fully integrated and reside under a single database. Other features include improved table design, which lets the user set-up and modify tables with less effort, user-defined Expert/Rules based procedures and data input via system to system interfaces, instrument interfaces, voice, touch and bar code. The ULTRA LIS provides complete functionality and flexibility in all areas of the clinical laboratory including: • Chemistry, • Haematology, • Urinalysis, • Coagulation, • Microbiology, • Pathology, • Cytology, • Quality Control, • Order Entry, • Client Services/Outreach, • Send-out Area, • Specimen Receiving Area, • Phlebotomy • Billing/Accounts Receivable. www.tripleg.com.au	Queensland Medical Laboratories Gribbles Pathology Mayne Nickless Diagnostic Services St. Vincent's Hospital Royal Perth Pathology Centre Institute of Medical and Veterinary Science All States with about 20 clients.	UNIX, RDBMS HL7 Interfaces User interfaces for Machines and analysers.

5.3 Pharmacy/ Dispensing (non GP) Software

Software Product	Major Functionality	Market Preparation	Standards Used
Isoft's STOCCA Pharmacy	**STOCCA** is an integrated pharmaceutical application that allows all aspects of hospital pharmacy practice to be managed and tracked within a single system. Allows users to manage and track pharmacy dispensing, manufacturing, inventory and cost centre accounting requirements www.isoftaus.com.au	As a leading pharmacy software product STOCCA has been installed in over 120 sites globally.	
IBA Pharmacy	**IBA Pharmacy** the solution designed to manage the Pharmacy Department servicing inpatient, outpatient and external patients. With IBA Pharmacy, the management of dispensing medications, inventory control and patient records ensure efficiency and effectiveness of the Pharmacy Department. Functionality: • Dispensing and Labelling is designed to dispense drugs prescribed by Doctors. • Drug Formulary provides detailed information about a drug in its various forms and strengths from a manufacturer's specifications or from other drug sources. • Pharmacy Manufacturing (sterile and non sterile) comprises the compounding of drugs to make other drugs etc. • Purchase Orders and Inventory and stock control www.iba.com.au		
Commonwealth's Medi*Connect* project	**Medi*Connect*** will enable the creation of a centralised electronic medication record linking prescriptions written by different doctors and dispensed at different pharmacies. Consumers will be able to have prescription, over-the-counter and complementary medicines, as well a s their drug allergy information, added to their record. Participation in the system will be voluntary for consumers, doctors and pharmacists, and subject to consumer consent.	Project is in trial formation stage.	HL7, HESA PKI

5.4 Acute Care

Acute Care includes the following service delivery categories:

- Hospital In-patient Admission Discharge and Transfer
- Emergency
- Clinical and Nursing.

Software Product	Major Functionality	Market Penetration	Standards Used
Global Health – Working Systems, MasterCare, BJS, CHIRON, Locum3 Hothealth e-switch	**Global Health** provides a comprehensive suite of applications that span hospital community and home care settings. Consists of the following components: **MasterCare** is a web based health information system or repository for health care organisations enabling users to fulfil clinical and patient administration functions. It provides access to all electronically linked patient information and allows for external access to authorised users. Also has a discharge template for preparation to prepare and transmit discharge documentation. **BJS** is a hospital management system that includes functionality for operating theatres, rehabilitation services, outpatients and private billing. It has a wide range of standard internal reports and the flexibility to link to third party reporting tools. The BJS system has a high level of integration with other "best of breed" systems. **CHIRON +** is an integrated healthcare system for the management of all aspects of public and private hospitals including patient administration, accounting functions, medical billing and materials management. www.ws.com.au		

Software Product	Major Functionality	Market Penetration	Standards Used
Jade Direct Australia's JadeCare Community (JCC)	**Jade Community Care** is a suite of programs for electronic patient records designed specifically by clinicians in an integrated care environment. JCC enables flexible but secure access to consistent clinical information across multiple services. Whether care is being delivered in an acute situation, at home or in a community clinic, clinicians have the same case-based information at their fingertips. Functionality: • Referrals • Assessments • Care plans • Clinical notes • Medication • Reviews • Inpatients • Waiting lists • Alerts • Appointments • Documents • Reporting • Diagnosis coding www.jadecare.com	Sites in NT, ACT, Vic, WA, NSW.	HL7, messages Medical summaries for NT being ODBC capability Jade's Ad-hoc report writer
Cerner –Millennium	**Cerner Millennium™** solutions are built on a person-centric architecture. Sharing databases and processes that consolidate non-repetitive data, eliminating time-consuming duplication of data entry and fragmentation of records. Shared process servers, such as patient identification, scheduling, ordering, charging, results, documentation and measurement. Decision support and an executable knowledge operate across shared data and functions, creating a complete picture of patients' care and supporting	NSW, Qld, and Vic Cerner is a preferred supplier to NSW and Qld Health.	Cerner assert that their use of development tools such as Java and XML to create Millennium Objects and a set of open APIs to allow Cerner and third party developers to leverage their

Software Product	Major Functionality	Market Penetration	Standards Used
	caregivers with alerts on quality, safety, best practice and efficiency. The Cerner Millennium™ product provides immediate access to clinical pathways, libraries of reference data, medical profiles and diagnosis databases. www.cerner.com.au		Millennium product. Cerner also provides an interface engine for several hundred other systems – or virtually any HL7-compliant system.
IBA Patient Administration System (ibaPAS)	**ibaPAS** a solution designed to coordinate the patient flow and improve management efficiency within healthcare. With ibaPAS, users can record administrative activity relating to treatment from admission to discharge, thus providing better patient care. Functionality: • Patient Master Index records all patient demographic data. • Patient Admission, Transfer and Discharge (ATD) the ATD module enables staff within the Medical Records Department to manage the coding and tracking functions within their area • Patient Billing provides a patient billing and total revenue cycle management module that seamlessly integrates within the ibaPAS solution suite. • Government and Agency Reporting provide flexible reporting for government and agency reporting. • Results Reporting, Scheduling Private Practice, Theatre Management, Surgeon Information Centre, Wait List, Allied Health. www.iba.com.au		HL7, Web Tools

Software Product	Major Functionality	Market Penetration	Standards Used
Isoft's PiMS	**PiMS s**upports the information management needs of acute care, community care, mental health, child health, aged care and social services at the point of care. Functionality: • Master patient index • Outpatient management • Clinic management • Accident & Emergency management • Pharmacy management • Mental health and Mental Health Act management • Child health management • Patient document tracking and document management • Electronic patient record management • In-patient management • Day case management • Community healthcare management • Theatre department management • Equipment management • Learning disabilities management • Infection control management • Care pathway management and clinical audit reporting • Contract management and billing • Patient, business and clinical management information and statutory reporting • Integration with third-party systems including PACS and analysers www.isoftaus.com.au		Microsoft technologies, XML. HL7, Internet,

Software Product	Major Functionality	Market Penetration	Standards Used
Isoft's Clinical Centre	**ISOFT's Clinical Centre** A Clinical Information Centre developed for an Internet centric world, providing access to clinical information anytime anywhere supporting clinical decision-making process. ICC is tightly integrated with iSOFT's laboratory and patient services products. www.isoftaus.com.au		Microsoft's .NET platform, Web based, XML and HL7 Compliant
Isoft's Clinical manager (ICM)	**ICM** provides comprehensive order entry, management and communication functionality across the healthcare enterprise. ICM's unique, real-time Knowledge-Based Orders with clinical decision support features enable provider organisations to dramatically improve the quality, cost and satisfaction of patient-care services. Through the use of a CDS rules engine and a system-wide rules editor utilising industry-standard technologies, organisations can easily edit existing rules and add new ones as desired. www.isoftaus.com.au		HL7
IBA Clinical	**ibaClinical** provides an holistic approach to patient care, empowering doctors, nurses and clerical staff to effectively chart and manage the patient progress. IbaClinical manages, results, orders and progress notes provide comprehensive clinical information for better patient care. Functions: • Electronic orders enhances clinical decision making by providing all relevant information prior to placing an order • Electronic results enable all patient data to be viewed via a single screen regardless of where the data has come from. • Electronic prescribing allows healthcare providers to prescribe drugs to patients using the electronic orders and electronic results modules		HL7 and Web Tools

Software Product	Major Functionality	Market Penetration	Standards Used
	• Care Plans allows the healthcare organisation to predefine plans for conditions and allows these plans to be automated and audited. • Documentation supports the clinician's workflow by speeding up the documentation process throughout the continuum of care. www.iba.com.au		
SA Health's OACIS Project	**Open Architecture Clinical Information System (OACIS),** is an enterprise-wide**,** patient-centric Clinical Information System that presents on-line information to assist clinical decision-making and facilitates clinicians' action to improve efficiency, quality, and outcomes. Functionality: • Clinical Display, single point of access to the integrated on-line patient record. • Separation summary communicates to GP and other provider's about a patient's hospital encounter. • Clinical Order Management, an electronic ordering system for pharmaceutical, diagnostic, therapeutic, medical and surgical patient services incorporating best practice information into multi-disciplinary order sets. • Clinical Reporting Repository, complements OACIS providing the capability to query, analyse, and explore the substantial clinical data held across the patient population in the OACIS Data Repository.	Expanding to cover South Australia's 8 metropolitan hospitals and some 9,500 users by March 2003.	

5.5 Community Health / Client Management

Software Product	Major Functionality	Market Penetration	Standards Used
Pen Computer Systems P/L Project Ferret	**Project Ferret** is a computer-based health planning and recall system that assists broad-based community health services to deliver multidisciplinary health care. It is a system that uses information about client health status, ethnicity, age, sex, health risks and geographic location to build a picture of appropriate health care for the client and for target risk groups of clients in the community. www.pencs.com.au/serv01.htm	Mostly rural/regional areas in all mainland States.	Microsoft Windows tools, Access Has also completed integration with Medical Director. Future releases will have SQL ODBC HL7 messaging
Global Health – Working Systems – Hothealth	**Hothealth** is a highly secure web-based personal health application. It provides a fully integrated site for managing personal health including wellness and illness plans, lifelong health record, emergency information, assessment and diagnostic tools, together with health news and encyclopedia and links to health care providers, agencies and support groups. www.ws.com.au	Victoria's Women and Children's Hospital is the first implementation.	Web based development tools HL7 messaging e-switch companion XML
Community Health Information Management Enterprise	**CHIME** enables community health clinicians to make informed clinical decisions at the point of care. This could be at a community health centre or in the client's home. A joint venture between NSW, QLD, SA and ACT governments.	In operation in the Hunter Region and progressively being implemented throughout NSW.	

6 Current Software Integration Products

This section describes a sample of the software products that are available to support consumer to provider and provider to provider integration between CIS products.

6.1 Consumers

Software Product	Major Functionality	Market Penetration	Standards Used
Microsoft, Netscape and other suppliers	**Browser** End User interface technologies that support searching, use and browsing of Web based documents, organisation portals and other Internet services such as transaction and research environments. **Email** End User based communication applications for ad hoc Internet based asynchronous communications.	More than 60% of households, % is higher in rural areas	A range of well recognised standard based options exist.

6.2 Middleware and Generic IT Services Software

Software Product	Major Functionality	Market Penetration	Standards Used
Kestral's Clinical Integration System (CIS)	**CIS** is a combination broker/server designed to manage information flows between data sources and client browsers. Includes notification of events to workstations, pagers mobile devices etc. www.kestral.com.au	WA, SA, Tas, Vic ACT, NSW, Qld	APIs are published for driver development for different data sources drivers are currently available for Kestral's range of products. Windows NT4.0, TCP/IP, Microsoft Internet Information Server 2.0, ODBC compliant databases, IE4 and Netscape Navigator.

Software Product	Major Functionality	Market Penetration	Standards Used
SeeBeyond – Interface Software	**E*Gate** a market leading, highly scalable, asynchronous integration system. Architecture is a componentised messaging bus that couples with adapters for specific protocols. Provides data mapping and message workflow tools to support business process workflow across multiple disparate systems. Strong on transformation of formatted data. http://www.stc.com/	VIC, WA, SA State wide licences with Qld, NSW, and TAS	Specific support for HL7 and X12 data and message formats also strong support for XML and new e-business integration stds.
SeeBeyond – e*Index	**E*Index**, built on e*Gate Integrator Platform, it enables a single customer view, by accessing customer data in disparate systems, then links, cross-indexes and presents a single customer view without necessarily changing any of the systems currently in place. Implementations provide patient master indexes and provider directories. Features: • Real-time automated person matching and cross-indexing using probabilistic matching algorithm to match persons in disparate systems using available demographic information. • Configurable 'fuzzy logic' matching algorithm from Vality's INTEGRITY Data Re-Engineering Environment. • Fully graphical Quality Workstation for customer data management for data administrators. • Advanced Application Security to control user Access • Comprehensive audit trails to record all changes • Flexible application reporting to support data quality via online reports.	State wide licences in Qld, NSW, TAS, Vic sites.	Hl7, XML, ODBC Published APIs

Software Product	Major Functionality	Market Penetration	Standards Used
	www.stc.com		
Orion Symphonia	**Symphonia** is a GUI based Messaging Toolkit that enables application developers to construct message definitions to use in their applications. The toolkit generates ActiveX COM objects that can be called by COM aware development environment (VC++, Visual Basic, MS Java, PowerBuilder, Delphi). The toolkit can access libraries of predefined standards based message formats http://www.orion.co.nz/symphonia_technical_xml.htm	NSW Health, State wide licence. ACT Qld SA WA TAS (HealthConnect fast tract trial)	HL7, X.12, XML, EDIFACT, JDBC Mapper tool provides rapid parsing and translation of message content between formats (eg XML to HL7) to destination system.
Orion – Rhapsody	**Rhapsody** a complementary product to Symphonia that together will provide a N:M solution. Rhapsody provides message routing, queuing, persistent storage, translation of message content and encoding. Allows Symphonia to exchange messages between many disparate systems. Equivalent to an interface engine Requires Java Message Service http://www.orion.co.nz/rhapsody_overview.htm	See Symphonia above.	See Symphonia above.
Orion – Concerto	**Concerto** is a Medical Applications Portal that integrates multiple information systems to provide a single, seamless view of patient data. Concerto allows health organisations to retain existing IT investment, training and institutional knowledge. www.orion.co.nz	NZ NSW VIC	See Symphonia. Also Concerto Application Integration Packages (AIPs) are pre-configured "plug-ins" for Australian Health care systems such as: • PiMS, IBA, Vital (Hospas)

Software Product	Major Functionality	Market Penetration	Standards Used
			• STOCCA, PACs, Agfa,GE
Orion – Soprano	**Soprano** medical information applications are a set of tools designed to complement and leverage Concerto for hospital environments for the entering and display of medical and patient information. Supports: • Order Entry, • Electronic Discharge, • Results Reporting, • Status Messaging and • Disease Management. www.orion.co.nz	NSW VIC, Peninsula Health, 450 – 800 beds; Wangaratta 220 bed.	See Concerto.
Working Systems – e-switch	**e-switch** is a software integration broker that automates business processes within and beyond corporate walls. E-Switch provides a framework that encapsulates all the rules governing data exchange. E-switch provides a core engine for asynchronous and synchronous (ie. Real-time) conversion and transport of messages. www.ws.com.au		Engine Extensions are built-in components/connectors that are value-add the e-switch, such as, HL7 MLLP for real-time acknowledgments of HL7 messages, TCP/IP, SOAP / Web services, SMTP, HTTP and raw Sockets, e-switch API for direct connection to the e-switch engine, native encoding libraries, XML maps and templates and programmatic libraries to support and enhance scripting.

Software Product	Major Functionality	Market Penetration	Standards Used
OptumGroup – Medical Directory Service	**Medical Directory Service** web based Directory Services provides a comprehensive listing of specialists that can be sorted by many categories such as speciality, special interest, language or name. Each specialist via on-line facilities can update Web-Doctor's electronic database instantaneously. www.optum.com.au		
OptumGroup – Telepathology	**Telepathology** is a transaction broker solution for managing pathology requests, results and status tracking. Telepathology design incorporates tolerance of ad hoc network availability and client data loss. www.optum.com.au		Integration is via API, or alternatively templates (and source code) can be provided for integration into any application.
IBA – e-Health	**e-Health** a communications suite providing the following: **MedClaims** via IBA Messenger allows Practice Management software to interact safely with government institutions, so that medical practices can electronically lodge Medicare claims and receive HIC reports. **HealthClaims** via HealthPoint allows patients to claim Private Health fund ancillary benefits online at the point of service using IBA's handy HealthPoint device. **ELPC** via HealthPoint allows electronic lodgement of patient Claims: for lodging non-bulk-billed claims form the consulting rooms, using the HealthPoint system **Electronic Immunisation Recording** via HealthPoint provides an easy and accurate means of recording individual childhood immunisations and forwarding the records to the Australian Childhood Immunisation Register.		

Software Product	Major Functionality	Market Penetration	Standards Used
	www.iba.com.au		
Kestral – PMI Interface Service	**PMI Interface Server** to integrate hospital Patient Administration Systems Patient Index www.kestral.com.au	See HL7 Connect	See above
Kestral – HL7 Connect	**HL7 Connect** is a messaging health server.	HL7 Connect, Vic, ACT NSW	See above
Pro Medicus – Promedicus.net	**Promedicus.net**, a secure email system to link diagnostic service providers and their referrers. www.promedicus.com.au	Claims some 9,000 doctors securely connected	Web and Internet tools
Health eSignature Authority (HESA)	**HESA** and the **HIC Public Key Infrastructure** (PKI) provide authentication, integrity, confidentiality and non-repudiation of data transmitted by health care providers. PKI is a set of procedures and technology that provides security and confidentiality for electronic business. www.hesa.com.au	Not yet deployed	Gatekeeper accreditation, published APIs.