Bundesministerium für Gesundheit und Soziales (BMGS)
Aktionsforum Telematik im Gesundheitswesen (ATG)

in enger Kooperation mit

dem Bundesverband Informationswirtschaft, Telekommunikation und Neue Medien (BITKOM),

dem Spitzenverband für Informationstechnologie im Gesundheitswesen (svitg)

und dem Zentralverband Elektrotechnik- und Elektronikindustrie (ZVEI)

1. Deutsche Expertenkonferenz
Telematik-Rahmenarchitektur
für das Gesundheitssystem

Anhang zur Dokumentation
Präsentationsfolien der Redner

8./9. September 2003, Kassenärztliche Vereinigung Nord-Würtemberg

Oktober 2003

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Bundesministerium
für Gesundheit
und Soziale Sicherung

Telematik-Rahmenarchitektur für das Gesundheitssystem - Erwartungen des BMGS

MinDirig Norbert Paland

1. Deutsche Expertenkonferenz Telematik-Rahmenarchitektur
für das Gesundheitssystem
KV Nord-Württemberg, Stuttgart
8. und 9. September 2003

Bundesministerium
für Gesundheit
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Stand der Vorbereitungen und Planungen heute

- Gesetzgebung
- Projekt bIT4health
  - Architekturphase
  - Testphase
  - Vorbereitungen für den Dauerbetrieb

Bundesministerium für Gesundheit und Soziale Sicherung

Gesetzgebung

Aspekte zum Ausbau der jetzigen Krankenversichertenkarte zur elektronischen Gesundheitskarte

1. Technischer Rahmen
2. Pflicht und Freiwilligkeit
3. Patientenrechte und Datenschutz
4. Verfahren und Standards

Bundesministerium für Gesundheit und Soziale Sicherung

Gesetzgebung

1. Technischer Rahmen

Die eGesundheitskarte muss technisch geeignet sein, die

- Authentifizierung,
- die Verschlüsselung und
- die elektronische Signatur

zu ermöglichen.

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Gesetzgebung

2. Pflicht und Freiwilligkeit

Sicherer und geschützter Zugang zu administrativen und medizinischen Daten des Patienten.

- Pflichtteil - administrative Daten
- Freiwilliger Teil - medizinische Daten

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Gesetzgebung

2. Pflicht und Freiwilligkeit

2.a Pflichtteil:

- administrative Daten
- eRezept
- europäische Vorgaben für die Inanspruchnahme von Leistungen in den Mitgliedstaaten der EU

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Gesetzgebung

2. Pflicht und Freiwilligkeit

2.b Freiwilliger Teil:

- Arzneimitteldokumentation
- Notfalldaten
- Patientenquittung
- eArztbrief
- ePatientenakte
- Patientenfach, etc..

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Gesetzgebung

3. Patientenrechte und Datenschutz

- Einwilligung
- Leserechte
- Zugriffsregelungen
- Verwendungsverbot
- Beschlagnahmeverbot

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Gesetzgebung

4. Verfahren und Standards

- Vereinbarung der Selbstverwaltung zur Schaffung einer Informations- und Sicherheitsinfrastruktur
- Ersatzvornahme des BMGS

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Gesetzgebung -> Umsetzung

Aus der klaren Strukturierung der Gesetzgebung ergibt sich folgendes Vorgehen für die Realisierung prioritärer Anwendungen:

- Administrative Daten
- Zuzahlungsstatus
- Europäische Vorgaben
- eRezept
- Arzneimitteldokumentation
- Notfalldaten

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Projekt bIT4health

Projekt bIT4health

„Dienstleistungen zur Unterstützung des BMGS bei der Einführung der Gesundheitskarte“

• Europaweite Ausschreibung	April 2003
• Verhandlungsverfahren	Juni / Juli 2003
• Vergabe	August 2003
• Kickoff	3. September 2003

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Projekt bIT4health

Das Projekt bIT4health besteht aus den Arbeitspaketen:

- Arbeitspaket 1: Definition einer Telematikrahmenarchitektur und Sicherheitsinfrastruktur
- Arbeitspaket 2:
  - Akzeptanzbildung
  - Projektmanagement
  - Qualitätssicherung
  - Wiss. Begleitung
  - Begleitung Betrieb 2006

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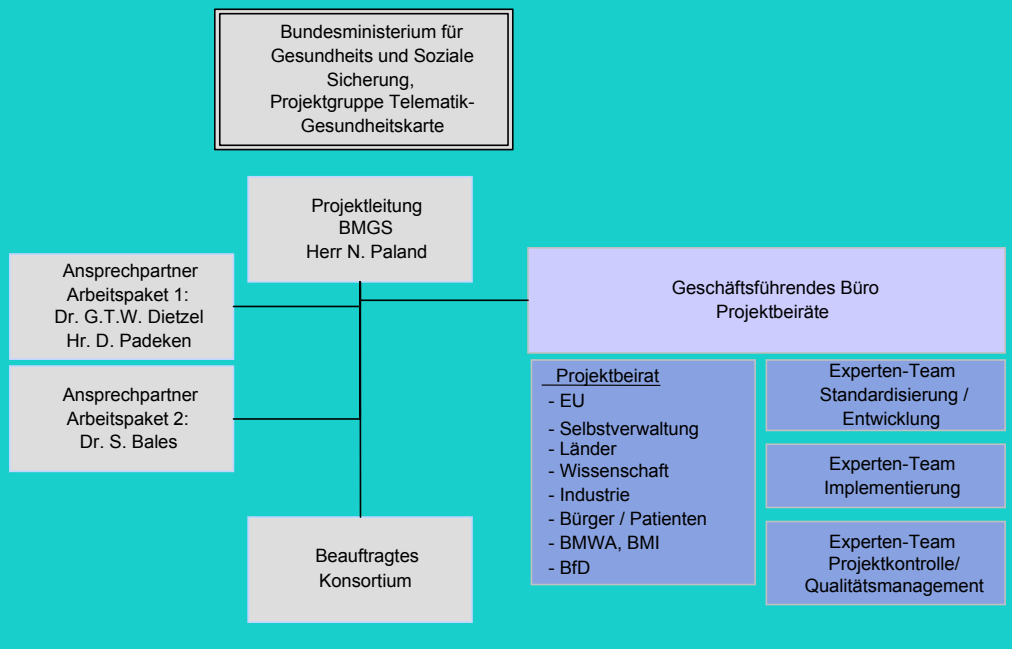
Projekt bIT4health

Vorgeschlagene Projektorganisation für bIT4health



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Projekt bIT4health

Öffentlichkeit / Transparenz

- Für das Gesamtprojekt gilt als oberstes Gebot eine maximale Transparenz und Beteiligung der Öffentlichkeit
- Zwischenergebnisse werden vor der Abnahme der (Fach-)Öffentlichkeit in einem Kommentierungsverfahren verfügbar gemacht.
- Es ist eine öffentliche Informationsplattform beim DIMDI eingerichtet

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Projekt bIT4health

Frühe und wesentliche Meilensteine für den Projekterfolg - derzeitige Planung

Meilenstein	Q3 03	Okt. 03	Nov. 03	Dez. 03	Jan. 04	Feb. 04
Kick Off Meeting	▲					
Projektbüros operational	▲					
Expertenkonferenz zur Architektur	▲					
Projekthandbuch erstellt		▲				
Regelmäßige Risk Reviews		▲		▲		▲
Planungsworkshop BMGS / ATG		▲				
Projektbeiratbesprechungen		▲			▲	
Internationale Expertenworkshop						▲
Entwurf Grobkonzept Architektur						▲
Grobkonzept Kommunikation		▲				
Erster Kriterienkatalog Testphase		▲				
Testphase - Test Readiness Review						~(1.7.) ▲

DIMDI - Telematik Adressen und Links - Microsoft Internet Explorer

Datei Bearbeiten Ansicht Favoriten Extras ?

DIMDI Deutsches Institut für Medizinische Dokumentation und Information

Im Geschäftsbereich des Bundesministeriums für Gesundheit und Soziale Sicherung

Home Englisch Suche

Datenbankvorschau los

Das DIMDI | Arzneimittel | Arzt+Patient | Datenbanken | bIT4health | HTA | Klassifikationen | Medizinprodukte

Aktuelles
Gesundheitskarte
Projektdatenbank
Intranet
Literatur
Links

Druckversion × Logout

Links zum Bereich Gesundheitstelematik und Telemedizin

Die Linkliste bietet relevante Links zu informativen Webseiten, die Gesundheitstelematik und Telemedizin betreffen. Die Liste erhebt keinen Anspruch auf Vollständigkeit.

Für die durch Links aufgerufenen Inhalte liegt die Verantwortung ausschließlich beim Betreiber der jeweiligen Website.

Eine Auswahl nützlicher Einstiegspunkte, nach Bereichen sortiert, bietet Ihnen nachfolgende Übersicht:

- Bund, Länder, Behörden
- Selbstverwaltung
- Nationale Organisationen, Institutionen, Verbände
- Internationale Organisationen, Institutionen, Verbände
- Zeitschriften

Bund, Länder, Behörden:

- Bundesministerium für Gesundheit und soziale Sicherung (BMGS)
- Bundesinstitut für Arzneimittel und Medizinprodukte (BfArM)
- Beschlüsse der 75. Gesundheitsministerkonferenz
- Bundesbeauftragter für den Datenschutz
- Bundesamt für Sicherheit in der Informationstechnik
- BundOnline 2005

Selbstverwaltung:

- Aktionsforum Telematik im Gesundheitswesen (ATG)
- Bundesvereinigung Deutscher Apothekerverbände (ABDA)
- Kassenärztliche Bundesvereinigung

Fertig | Vertrauenswürdige Sites

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Vielen Dank für Ihre Aufmerksamkeit

CORPORATE TECHNOLOGY

Middleware für die eHealth Rahmenarchitektur

Michael Stal, Senior Principal Engineer
SIEMENS Corporate Technology

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CORPORATE TECHNOLOGY

Agenda

- **Motivation**
- **Ein Blick auf Middleware-Ansätze**
  - Paradigmen
  - Beispiel CORBA
  - Beispiel XML Web-Services
- **Blick in die Zukunft**
- **Zusammenfassung**

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Visionen für Industrie und Verwaltung - Ein Blick in die Kristallkugel

- **Smart Traffic**
  Intelligente Kooperation von Fahrzeugen, Gütern und Infrastrukturen für schnellen und nahtlosen Transport
- **E-Government und eHealth**
  Web-basierte Kommunikation und Administration
- **Industry Automation**
  Virtuelle Fabriken und „production on demand“
- **Pervasive Computing**
  Intelligente Dienste, die jedes Gerät überall nutzen kann
- **Intelligent Home**
  Die Vernetzung im häuslichen Umfeld

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Auftretende Probleme

- **Heterogene Applikationen, Dienste, und Systeme müssen miteinander integriert und verbunden werden.**
- **Integrierbarkeit von automatisierten und autonomen Systemen.**
- **(Globale) Bereitstellung intelligenter Dienste mit gemeinsamem Kontext.**
- **Nicht nur funktionale Eigenschaften sind zu berücksichtigen, sondern auch Dienstgüten wie Verfügbarkeit, Ressourcenbeschränkungen bei bestimmten Endgeräten, Skalierbarkeit, …**
- **Nicht nur prozessorientierte, funktionale Integration sondern auch flexibler Austausch von Daten und konsistente Datenhaltung.**
- **Notwendig sind: dienstorientierte Ansätze (Service-oriented Architecture).**

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Agilität ist in diesem Umfeld entscheidend

- **Entwickler dürfen *a priori* nicht zu viele Annahmen über Benutzungskontexte und Umgebungen machen.**
- **Entwickler leben nicht auf einer Insel. Sie müssen die Integration bestehender Funktionalität und bestehender Systeme garantieren.**
- **Entwickler müssen eine Vielzahl heterogener Endgeräte und Plattformen in den Griff bekommen.**
- **Entwickler stehen ebenfalls der Heterogenenität und Dezentralität verfügbarer Datenquellen gegenüber.**
- **Systeme müssen ständig verfügbar sein. Ein Herunterfahren ist nicht möglich. Daraus folgt, dass Änderung, Fehlerbehebung und Erweiterung zur Laufzeit erfolgen müssen.**
- **Software Engineering muss auf neue Anforderungen stets *schnell* reagieren. Dazu bedarf es geeigneter architektonischer Maßnahmen und Prozesse.**

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Fokus auf Architektur und Infrastruktur

- **„Software-Entropie“ ist in der Architektur zu maximieren: lose Kopplung statt zentralisierten Ansätzen wo immer möglich. Das kann zu Problemen führen, z.B. bzgl. Sicherheit.**
- **Software muss flexibel sein. Daher sind monolithische Ansätze nicht tragfähig. Stattdessen sind komponentenbasierte Ansätze nötig:**
  (Verteilte) Bausteine die sich (dynamisch) zu Systemen und Prozessen zusammenfügen lassen.
- **Integrationsaspekte sind essentiell:**
  - Architektur und Infrastruktur müssen Integration von Geräten, Diensten, Daten ermöglichen.
  - Existierende Systeme sind ebenfalls zu integrieren.
- **Die Infrastruktur muss Heterogenität unterstützen:**
  - Entweder: Nutzung offener Standards
  - Oder: Nutzung **einer** vorgegebenen Plattform (unrealistischer Ansatz)

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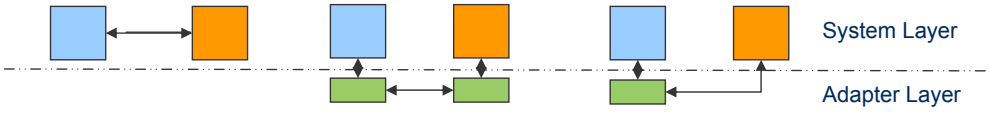
Interoperabilität

- **Es gibt keine allgemeine Definition. In diesem Kontext ist gemeint: *Die Fähigkeit der Kommunikation und Interaktion zwischen heterogenen Systemen*.**
- **Middleware stellt dafür Interoperabilitätsschichten bereit.**
- **Interoperabilität adressiert verschiedene Aspekte:**
  - Connectivity, d.h. Nutzung gemeinsamer Kommunikationsprotokolle oder Adaption an existierende Protokolle. Hier spielen Daten- und Kontrollfluß eine Rolle.
  - Datenhaltung, d.h. die Nutzung gemeinsamer Datenformate/-standards oder Adaption an existrierende Datenformate.
  - Migration (semantik-invariante Portierung).
- **Interoperabilität kann unidirektional (Adaptierbarkeit) oder bidirektional sein.**
- **Adapter sind hierarchisch organisiert (z.B. OSI Schichtenmodell).**
- **Keine naive Interoperabilitätsbetrachtung: Immer Dienstgüten beachten!**
- **Es geht hier nicht nur um Konnektivität, sondern auch um Datenhaltung, gemeinsame (Meta-)Prozesse, Metadaten, usw. Je höher in der Abstraktion Unterschiede auftreten, desto schwieriger ist Interoperabilität zu erreichen.**



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Interoperabilität in objektorientierten, verteilten Systemen

- **Aspekte:**
  - Interoperabilität reduziert sich nicht auf einfache Datentransformation und Kommunikation beschränkt.
  - Fehlerbehandlung muss adaptiert werden.
  - Objektmodelle müssen aufeinander abgebildet werden.
  - Policies (z.B. bezüglich Sicherheit, Speicherverwaltung) müssen ebenfalls aufeinander abgebildet werden.
- **Je einfacher die von Produkten/Plattformen bereitgestellte Adaption, desto mehr Handarbeit bedarf es zum Schließen der semantischen Lücke.**
- **Integrationsprobleme wie z.B. EAI stützen sich in ihrer Lösung auf (Mengen von) Interoperabilitätstechnologien.**

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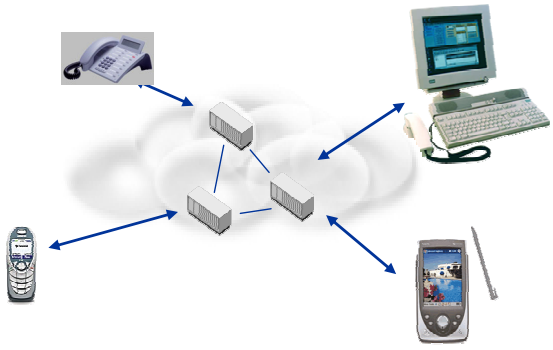
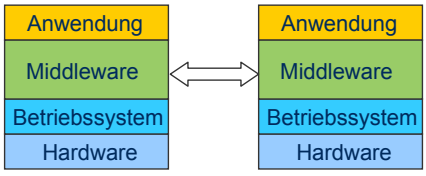
Definition von Middleware als Lösungsansatz





- **Nicht-formale Begriffsdefinition:**
  - Middleware ist ein essentieller Bestandteil der Infrastruktur / Plattform.
  - Middleware fokussiert sich auf Konnektivität/Kommunikation von verteilten Software-Inseln
  - Middleware-Dienste sind in der Regel zwischen Betriebssystem und Anwendungen angesiedelt
  - Middleware fügt Netzwerk, Anwendungen und IT-Prozesse zusammen
  - Middleware abstrahiert von der Plattform (Betriebssystem und Hardware)
  - Middleware abstrahiert meistens auch vom Netzwerk und seinen Protokollen

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Klassifizierung von Middleware

- **Es gibt bedarfsabhängig unterschiedliche Arten von Kommunikation und damit auch unterschiedliche Arten von Middleware.**
- **Die Auswahl von Middleware sollte sich stets nach den architektonischen und technischen Anforderungen richten: Erst das Problem identifizieren, dann die Middlewaretechnologie wählen!**
- **Oft ist auch die Integration mehrerer Middlewarelösungen sinnvoll oder notwendig (kein One-Size-Fits-All-Ansatz!!!).**

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Klassifizierungsaspekte

- Kommunikationsparadigma
  - Nachrichtenorientierte Middleware (z.B. MSMQ, MQSeries, JMS)
  - Aufruforientierte Middleware (z.B. CORBA, RMI, DCOM, .NET Remoting)
- Grad der Zentralisierung
  - Dynamisches Client/Server Modell (z.B. CORBA, DCOM)
  - P2P (z.B. Tapestry, Fasttrack, Gnutella)
- Koordination und Synchronisation
  - Synchrone Kommunikation (z.B. synchrone RPCs)
  - Asynchrone Kommunikation (z.B. Nachrichten in MQSeries, CORBA RMI, COM+ Queued Components)
- Endgeräte und Formfaktoren
  - Mobile und eingebettete Systeme (z.B. OSGI, Minimum CORBA)
  - Standard-PCs/Mainframes (z.B. EJB)
- Programmiersprachen und Plattformen
  - Spezialisierte Middleware für eine bestimmte Programmiersprache oder Plattform (z.B. RMI, .NET Remoting)
  - Sprach- und/oder Plattformunabhängige Middleware (z.B. CORBA, XML Web-Services)
- Netzprotokolle
  - UMTS, WLAN, Bluetooth (Behandlung von Kommunikationsunterbrechungen notwendig)
  - TCP/IP/UDP

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Middleware ≠ Kommunikation

- **Nur in trivialen Fällen genügt reine Kommunikationsfunktionalität.**
- **Orthogonale Dienste wie**
  - persistente und konsistente Datenhaltung
  - Transaktionverarbeitung
  - Sicherheit
  - Administration und Konfiguration
  - Verfügbarkeit und Lastbalanzierung

  sind ebenfalls essentiell.
- **Die verwendete Middleware sollte also neben reinen Kommunikationsmechanismen auch solche Dienste zur Verfügung stellen.**

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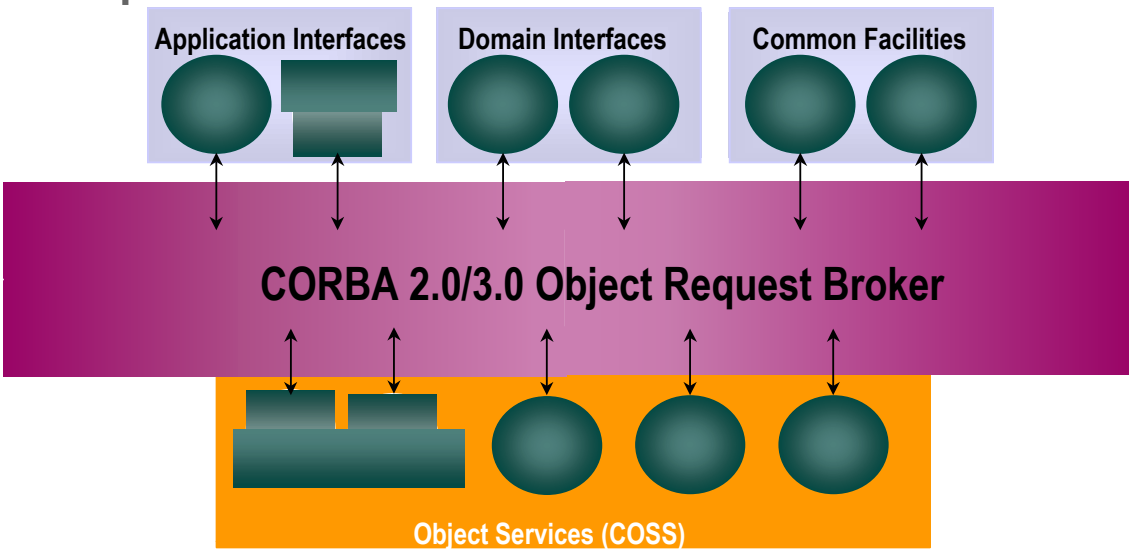
Beispiel CORBA



- CORBA ist ein offener Standard der OMG
- Primärer Fokus sind Interoperabilität und Kommunikation
- Dienste (Object Services) nur separat verfügbar
- Große Verbreitung in der Industrie
- Nur bedingt nutzbar im Web-Umfeld (Sicherheit, Firewalls)
- Kein Komponentenansatz (CCM nur rudimentär verfügbar)
- Hohe Flexibilität, aber auch hohe Komplexität

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Beispiel XML Web-Services

- **Nutzung von XML und Standard-Protokollen (HTTP) als Kommunikationsschicht zwischen Anwendungen:**

```
soap:Envelope>
   <soap:Header>
     <transaction>
       <soap:mustUnderstandstand=„true“ xmlns=„http://tx.com“> <id> 12345678 </id>
     </transaction>
   <soap:Header>
   <soap:Body>
      <m:getPhoneNumber>
         <theName> Bill Gates </theName>
      <m:/getPhoneNumber>
   </soap:Body>
</soap:Envelope>
```

- **Eigenschaften**
  - Offener Standard
  - Integration von Middleware
  - Problemlos für Web-Anwendungen nutzbar
  - Breite Unterstützung durch die Softwarehersteller
  - Low-Level Ansatz
  - Noch stark im Fluß (speziell was orthogonale Dienste betrifft)

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Komponentenbasierte Middleware

- **In Middlewaretechnologien wie CORBA, RMI, .NET Remoting oder DCOM müssen Entwickler die Dienste integrieren**
  - Entwickler sind dadurch mit einer Vielzahl unterschiedlicher Werkzeuge und Diensten konfrontiert.
  - Direkte Abhängigkeiten von Werkzeugen, Plattformen und Diensten in der Software fast unvermeidlich.
- **Komponentenbasierte Middleware-Plattformen wie COM+, EJB entlasten den Entwickler von Integrationsaspekten**
  - Container als Schutzhülle vor der Umgebung.
  - Deskriptive Spezifikation der Anforderungen. Infrastruktur sorgt für Dienstintegration.
  - Nachteil: Ansätze oft sehr ressourcenintensiv und daher für kleine Geräte meist ungeeignet.

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Middleware der Zukunft

- **Morgige Middleware sollte eine Reihe von Eigenschaften haben:**
  - Unterstützung von Reflection-Mechanismen.
  - Dynamische Einbindung orthogonaler Eigenschaften (Aspect-Orientierung).
  - Support für verschiedene Netz-Protokolle.
  - Konfigurierbare und adaptierbare Container.
  - Support für Dezentralität (P2P).
  - Bessere Integration für Dienstgüteeigenschaften wie Sicherheit, Verfügbarkeit, Fehlertoleranz, ….
  - Plattform und Sprachunabhängigkeit.
  - Umfangreiche Unterstützung für Deployment, Administration, Debugging, Testing.
  - Nahtlose Integration von Diensten, Geräten, Prozessen.
  - Leichtgewichtiges Programmiermodell.
  - Leistungsfähige Werkzeugunterstützung.

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Fazit

- **Architektonische Anforderungen definieren, welche Middleware zum Einsatz kommen sollte.**
- **Überwiegt ein Klassifizierungsaspekt, ist die Nutzung einer dafür fokussierten Middleware zielführend.**
  - Im Telematik-Umfeld ist eher ein hierarchischer Ansatz geboten:
    - XML Web-Services zur Integration und Bereitstellung von Diensten zwischen Domänen.
    - Standardmiddleware wie CORBA innerhalb von Domänen.
  - Aspekte wie Sicherheit, Verfügbarkeit und Integrationsfähigkeit sind zu berücksichtigen. Daher komponentenbasierte Ansätze nur dort, wo orthogonale Dienste notwendig sind.
  - In großen Systemen erweisen sich Administrierbarkeit, leichte Installation, Wartbarkeit, dynamische Erweiterbarkeit als *conditio sine qua non*.
  - Middleware sollte standardisierte Adaptionsschnittstellen für Standardsoftware wie SAP, SQL, … bieten.
- **Die heutigen Middlewaretechnologien weisen noch zahlreiche Defizite auf. Keine Technologie bietet daher die komplette Lösung aller Probleme.**
- **Interoperabilität zur Überwindung von Heterogenität erfordert einen holistischen Top-Down Ansatz, der alle Aspekte berücksichtigt (Prozesse, Daten, Kommunikation, Endgeräte, …).**
- **Zudem gilt: Middleware alleine ist keine Lösung!**
  - Vorgehen: Nutzen von Test-Driven Development, Generative Ansätze (MDA, AOSD).
  - Architektur: Nutzen von Best-Practice Patterns (z.B. Core J2EE Patterns)

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Backup Folien

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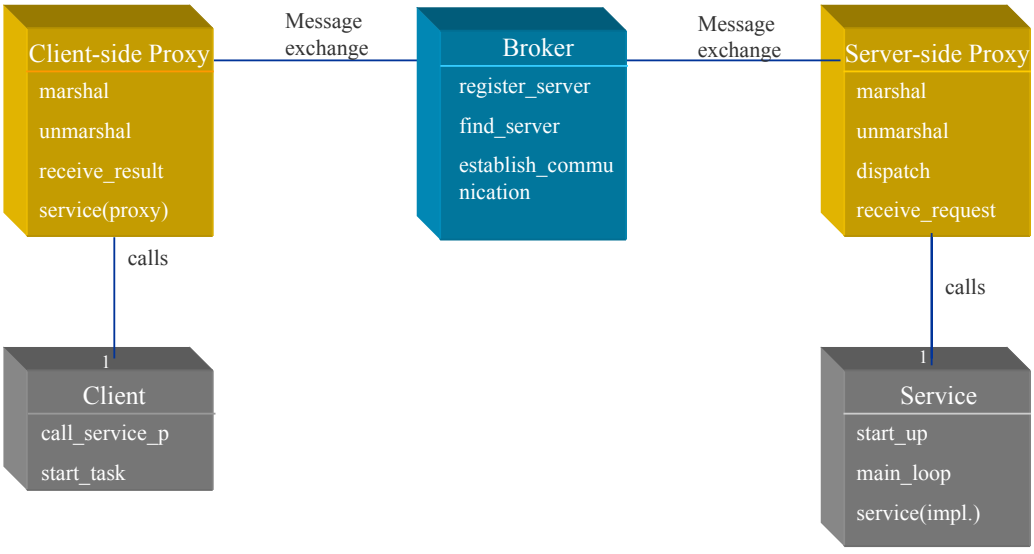
Architektonische Lösung: Broker-Architektur



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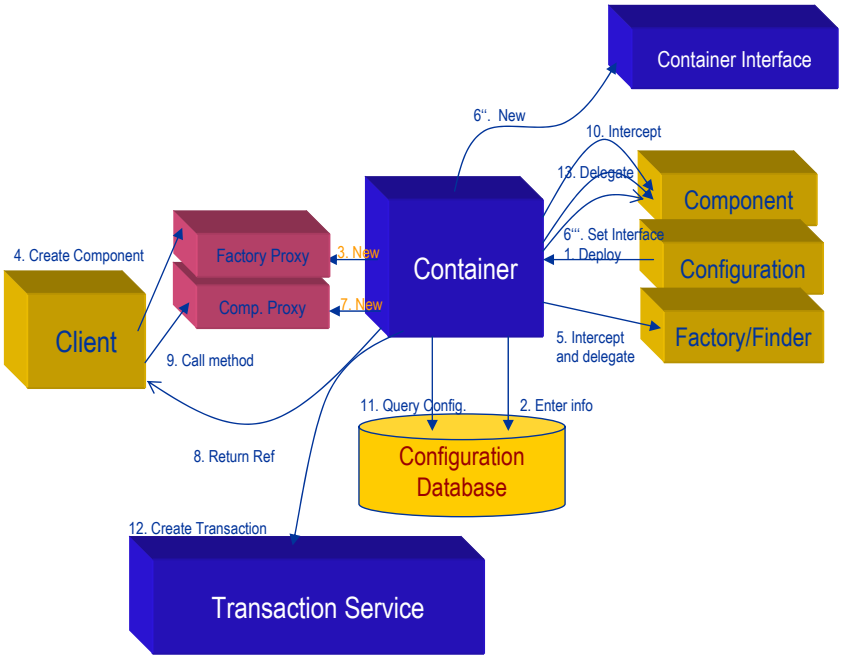
Ein typischer Ablauf in einem Container



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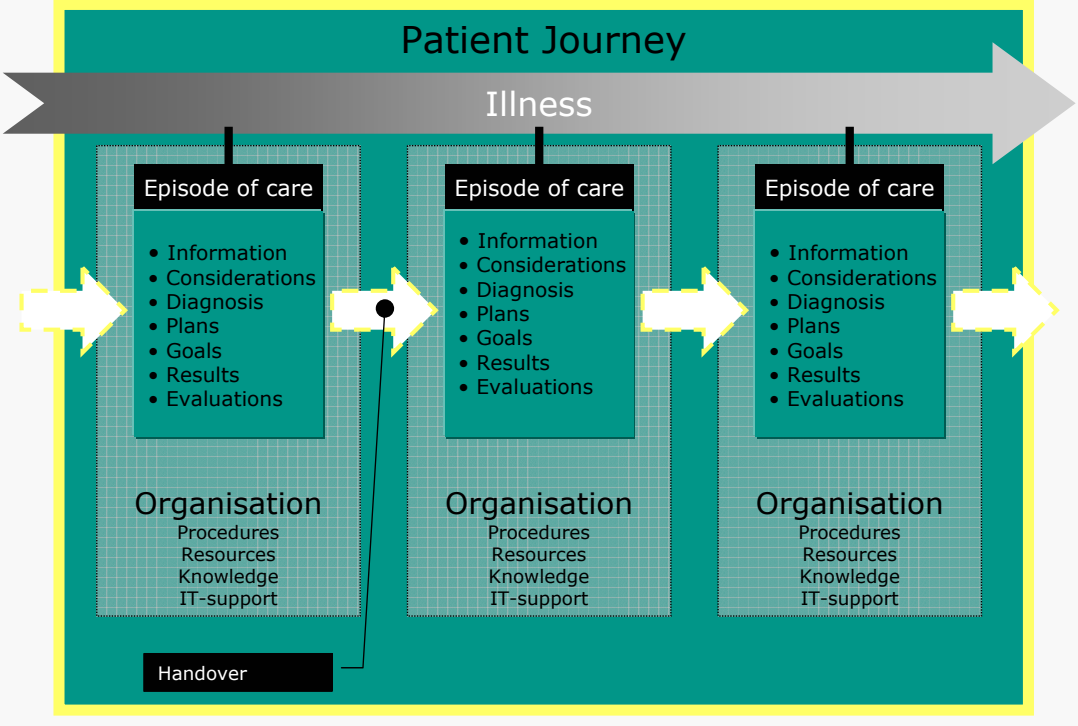
Architectural Concepts for a National Infrastructure for eHealth:
an Industrial Point of View

Thomas M Jones, MD
Vice President and Chief Medical Officer

ORACLE



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Key Questions

- How do we support clinical processes?
- How do we handle the fact that many people and organizations are involved with the care of an indivdual patient?
- How do we ensure that local work procedures can be supported together with regional and national guidelines?
- How do we support the sharing of information in situations where care is handed over from one organisation to another?
- How do we integrate current medical knowledge and information about best practice guidlines?

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The Importance of Infrastructure

- **The provision of infrastructure services is an enabling mechanism.**
- **The main outcomes will be achieved by the provision of additional applications and services.**
- **IT infrastructure enables business activity by users that would otherwise not be economically feasible.**

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NHSIA EHR Infrastructure

- The aim is to implement integrated care records services (ICRS) records which are:
  - integrated across all health and social care settings;
  - designed around the patient, and not around individual institutions;
  - therefore able to support the implementation of care pathways as part of National Service Frameworks.

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NHSIA Draft Consultation – July 26, 2002

British Computer Society Health Informatics Committee

- Long term goal is holistic record (probably virtual) representing birth to death
- Different views for different users
- Different views for different settings
- The record is specific to the patient, the view may be specific to the condition
- Architecture and rule base to support user and condition specific views

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British Computer Society Health Informatics Committee memorandum June 2002

British Columbia – EHR Definition

- "A longitudinal collection of personal health information of a single individual, entered or accepted by health care providers, and stored electronically. The record may be made available at any time to providers, who have been authorized by the individual, as a tool in the provision of health care services. The individual has access to the record and can request changes to its content. The transmission and storage of the record is under strict security."

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Advisory Committee on Health Infostructure.
Tactical Plan for a pan-Canadian Health Infostructure. November 2001.

British Columbia – Initial Focus

- "… confirm the information architecture that will be used to develop the EHR in consultation with existing system operators, including the health authorities, and begin to align systems to ensure interoperability from key existing components."

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Australia – National EHR Taskforce

- The kind of system the Taskforce has in mind would require the following kinds of standards:
  - a shared set of data-representation standards (such as HL7)
  - a shared set of conceptual representation schemes such as SNOMED-CT or UMLS
  - a common (and therefore easily retrievable) structure for electronic health record data across all storage nodes on the Network

Hong Kong EHR Components

- Information model - defines the contents and structure of the EHR data
- Clinical data repository - data acquisition, storage and distribution
- Web-based front end - customizable views
- Security model
- Decision support - coupling patient information to knowledge

A Simple Case

- NC, a 38 year old businessman
- 2/14 – donates blood in Munich; hematocrit 45
- 2/21 – visits GP in Cologne; obtains prescription for Sulindac
- 4/21 – travels to Toronto
- 4/25 – travels to Frankfurt
  - visits infectious disease screening clinic
  - hematocrit is 40

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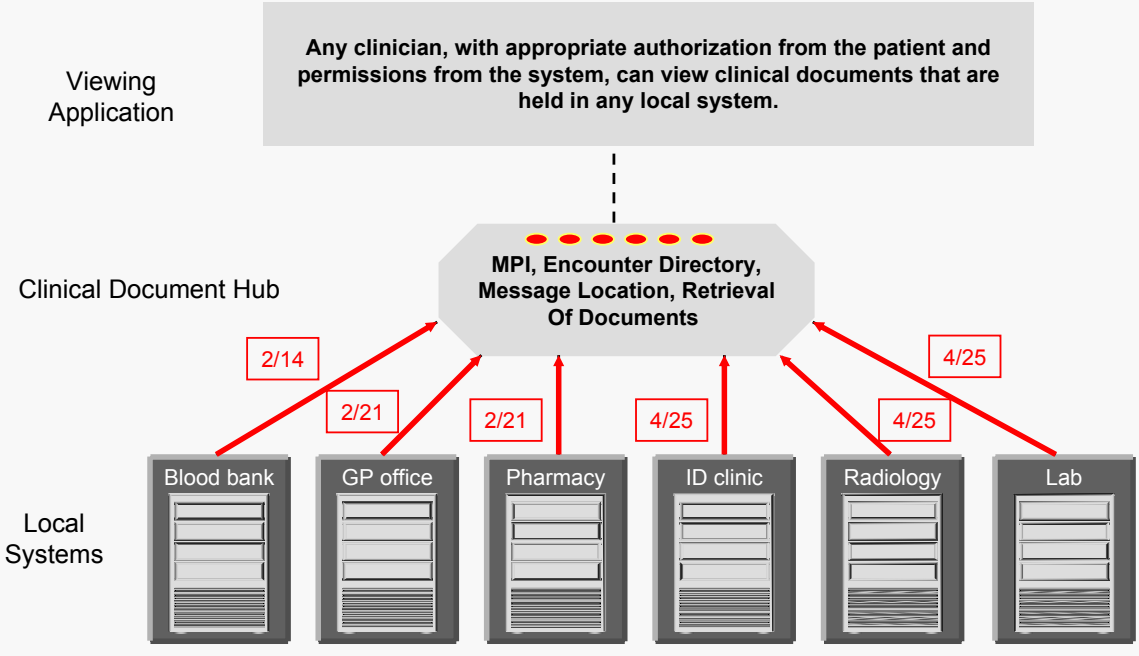
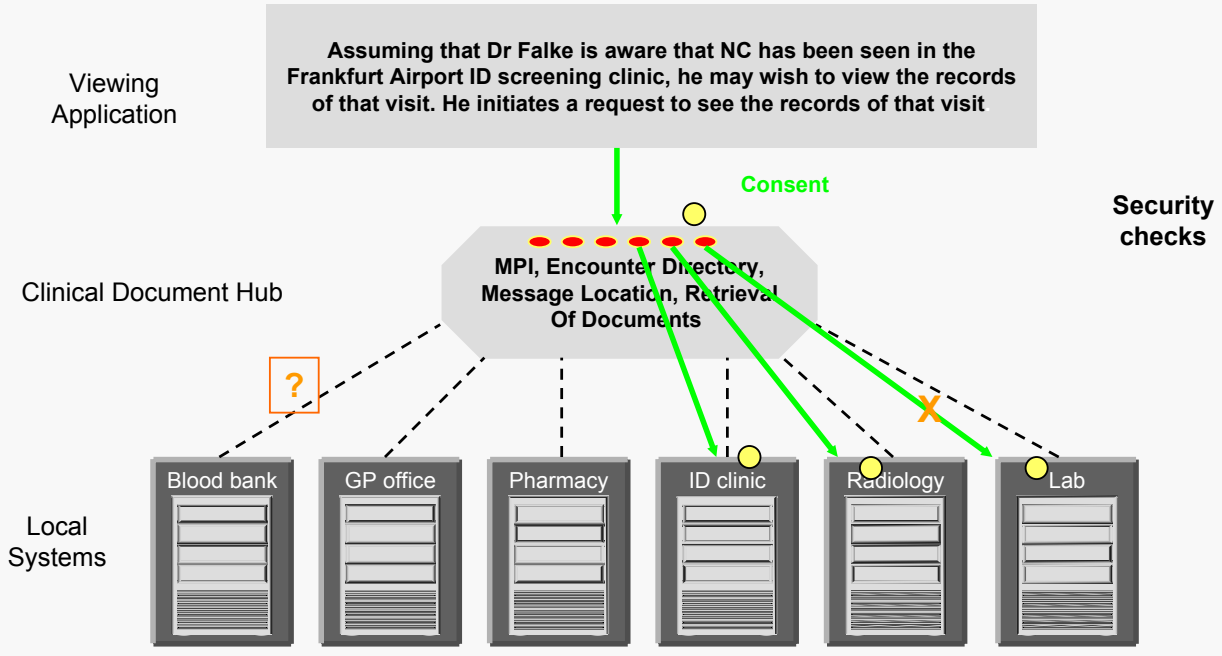
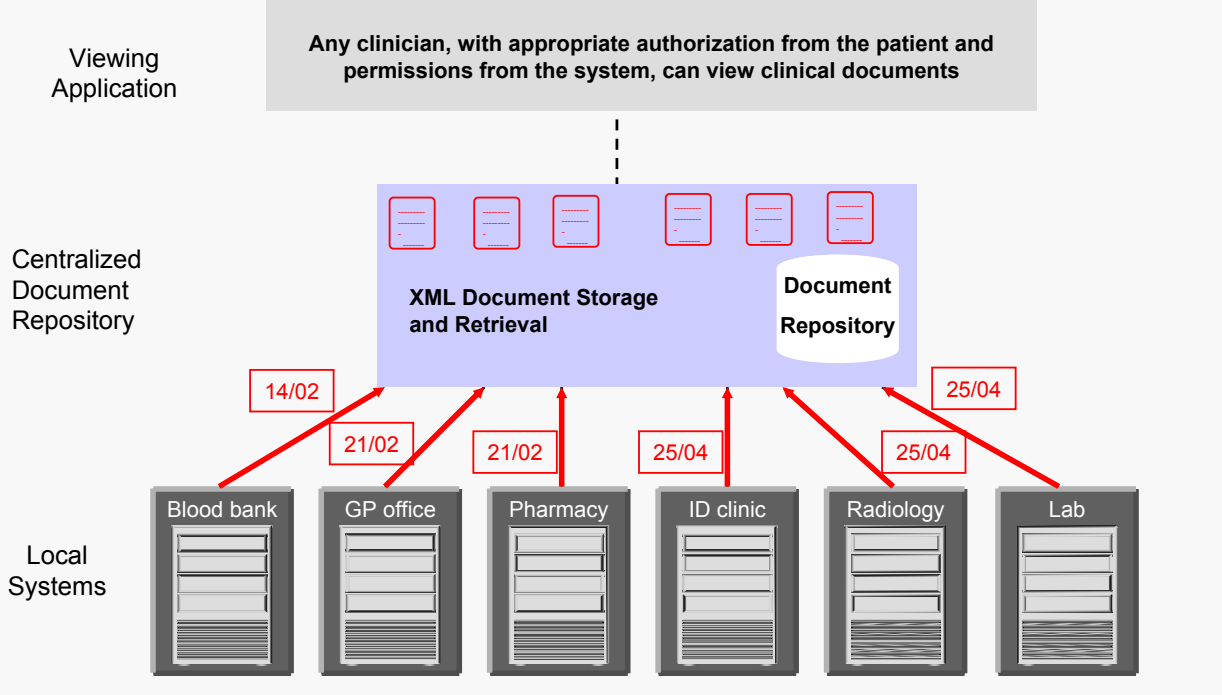
Using a distributed model



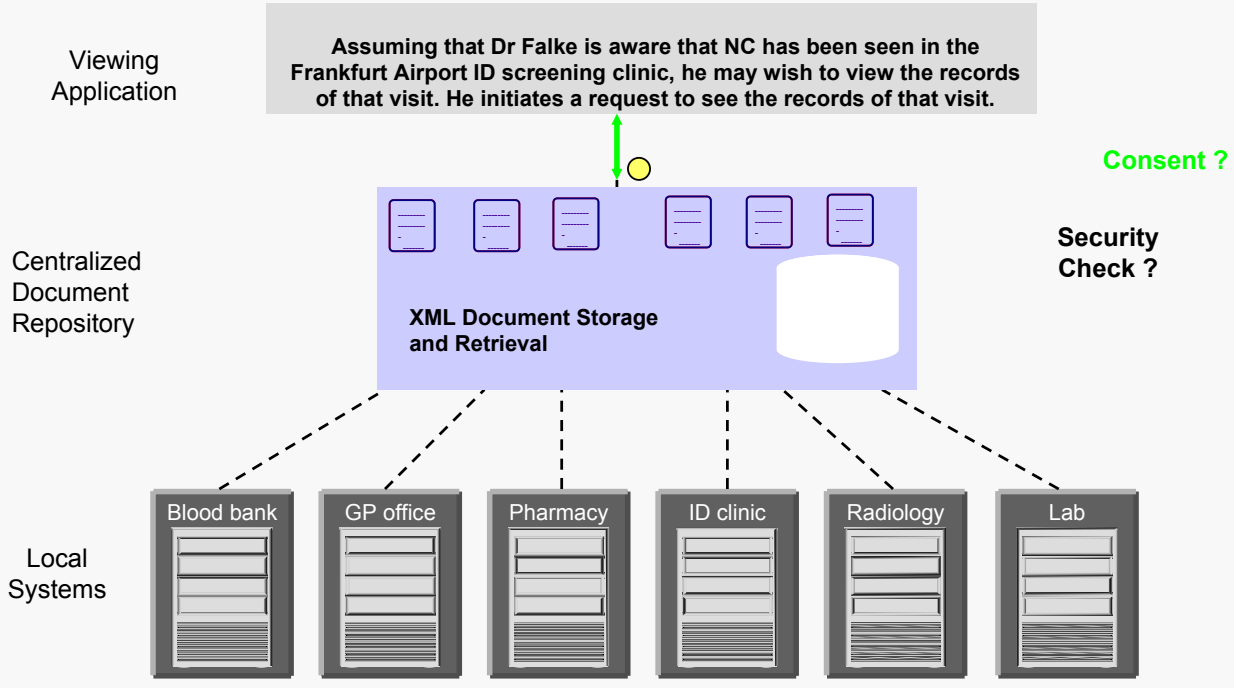
Using a distributed model



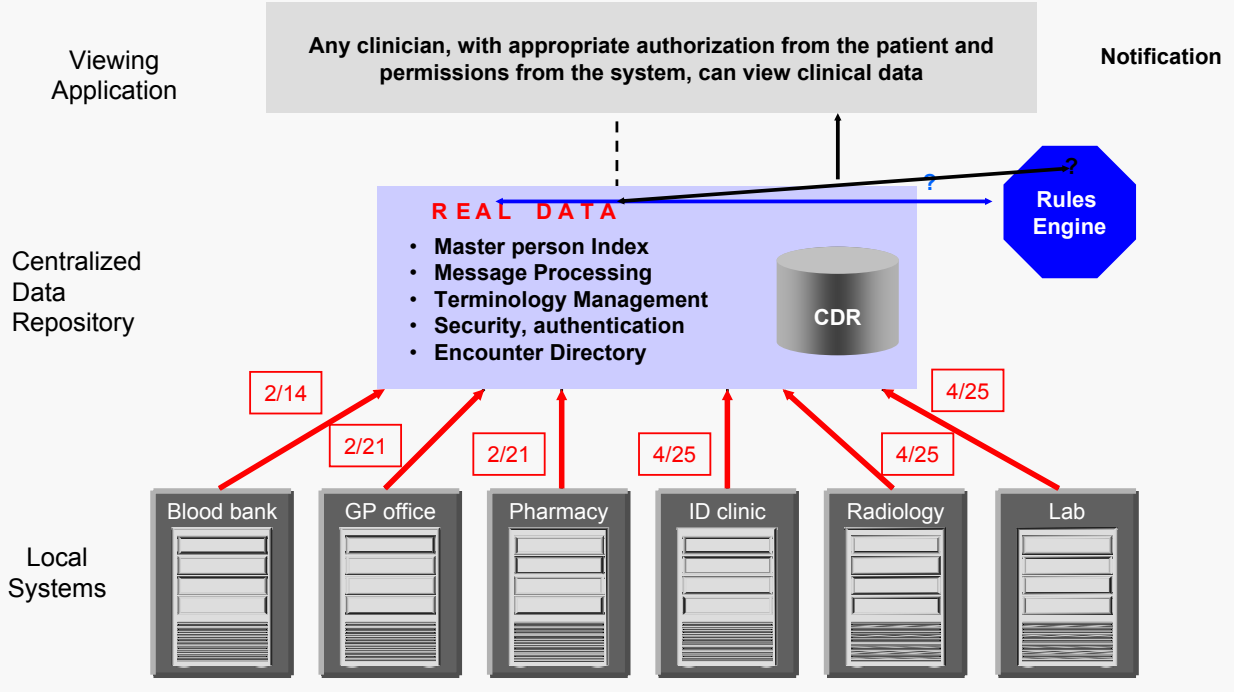
Document repository model



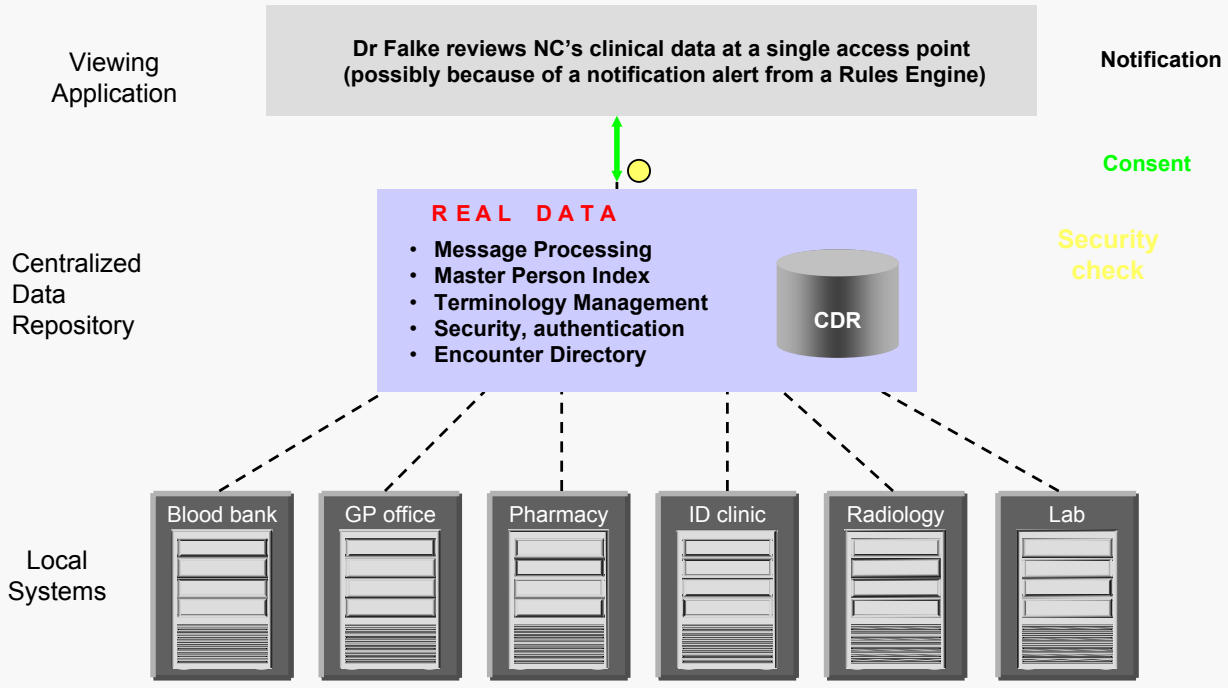
Document repository model



Using a model with a CDR



Using a model with a CDR



In the Absence of Patient Data:

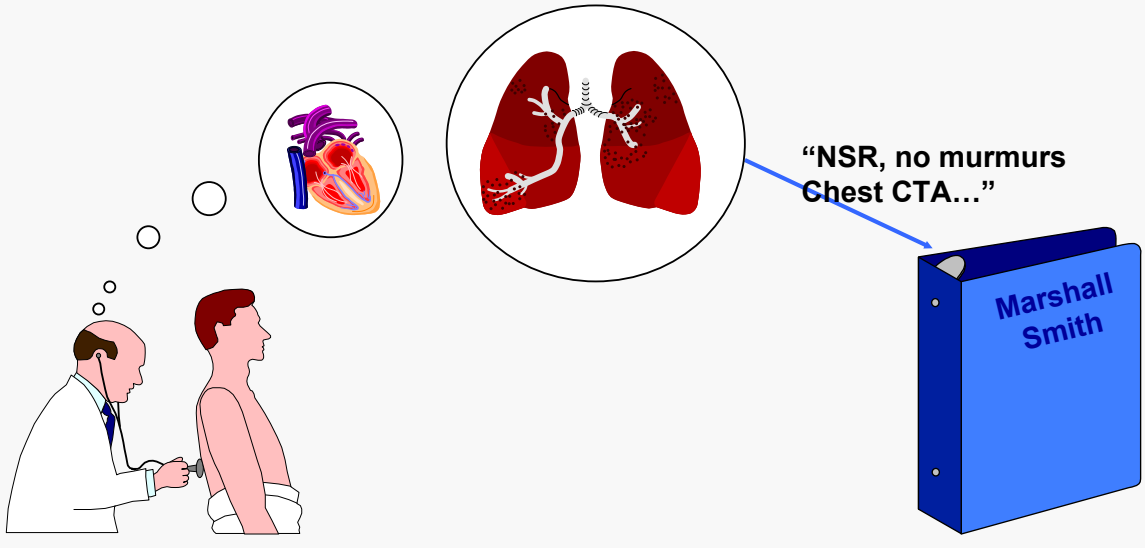
- Rules cannot effectively "reason" over the patient record in the distributed model
- The potential for temporary unavailability of key information is increased in a distributed systems because of requirements for constant connectivity between all systems for all information (not just the most recent)
- Maintenance of distributed systems is more expensive
- The need to unwrap XML documents each time a query is initiated adds to performance overhead
- Security, authentication, and auditing become very complex

Clinical Documentation

- Clinical pictures are communicated from one clinician to another using a highly evolved short hand language which focuses on and emphasizes clinical problems and clinical attributes.
- These “medical descriptors” carry enormous significance for patient care.
- They also become essential pieces of information for clinical decisions and clinical rules.

Clinical Documentation

- As clinicians speak with and examine patients, they distill a stream of conceptual information into these “medical descriptors” which are incorporated in the medical record.



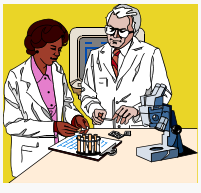
Clinical Documentation

- In the process of "naming" a patient's diagnoses, documenting medications, and recording observations about patients, clinicians are providing fuel to drive clinical decision support.
- In the ideal system, each successive "naming" must be carefully tracked as an instance of a known entity.
- Each successive naming updates the "patient object."

Automated systems

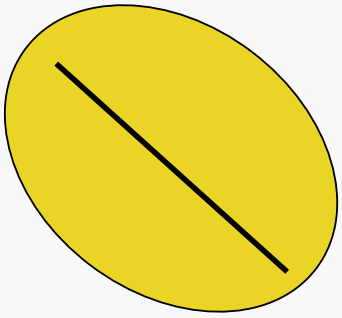
- **Results of laboratory analyses also create clinical descriptors**

```
MSH|^~\&|||||19941122100053||ORU^M01|
EVN|M01|199411181141|
PID|||661041||GARDNER^REED^M|
PV1||I|E7^703^^LDS|
OBR||^A000520|LYTES^Serum Electrolytes|
OBX|1|NM|NAS^Serum Sodium|1|138|mmol/L|
OBX|2|NM|K^Serum Potassium|1|3.2|mmol/L|
OBX|3|NM|CL^Serum Chloride|1|114|mmol/L|
OBX|4|NM|CO2^Serum CO2|1|24|mmol/L|
```



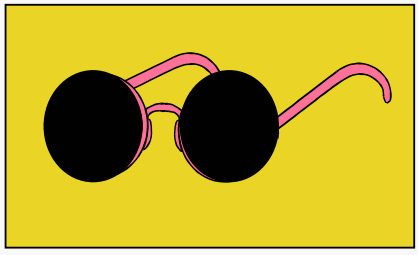
Recognizing Descriptors

Representing the same concept in different words may not be a problem for clinicians;



Blindness

=

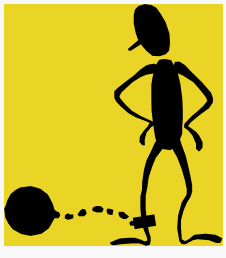


Cannot See

however, it is a huge problem for computers.

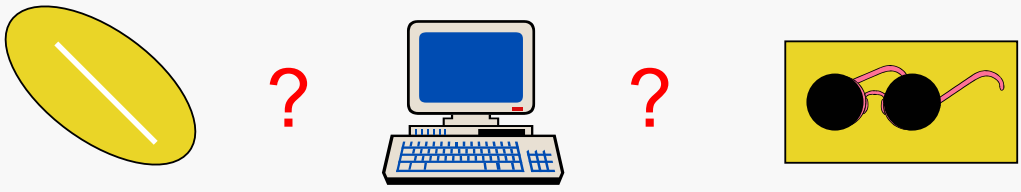
Recognizing Descriptors

Without the ability to immediately recognize the needed patient descriptors, rules are frustratingly handicapped and cannot effectively complete their jobs.



Recognizing Descriptors

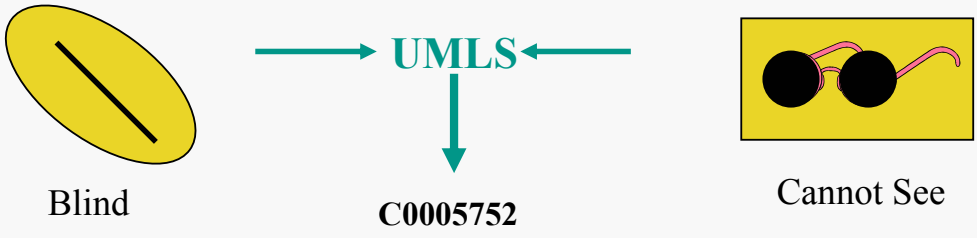
Since computerized applications cannot be expected to automatically make the cognitive link between different representations of the same concept,



developers must be sure to map all representations of the same concept to a unique, universally recognizable concept identifier.

Standardizing Descriptors

- One way of achieving mapping to such identifiers uses the Unified Medical Language System of the National Library of Medicine.

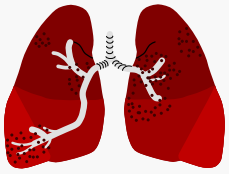


- The UMLS is an ambitious warehouse for concept identifiers and the medical knowledge which they represent.
- Rapid access to the UMLS is available over the internet.

Enhancing the EHR

When descriptors as unique identifiers are available to a patient object,

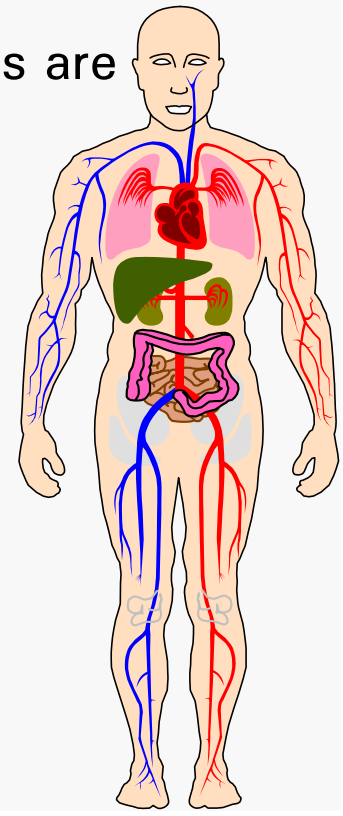
an EHR system



can create

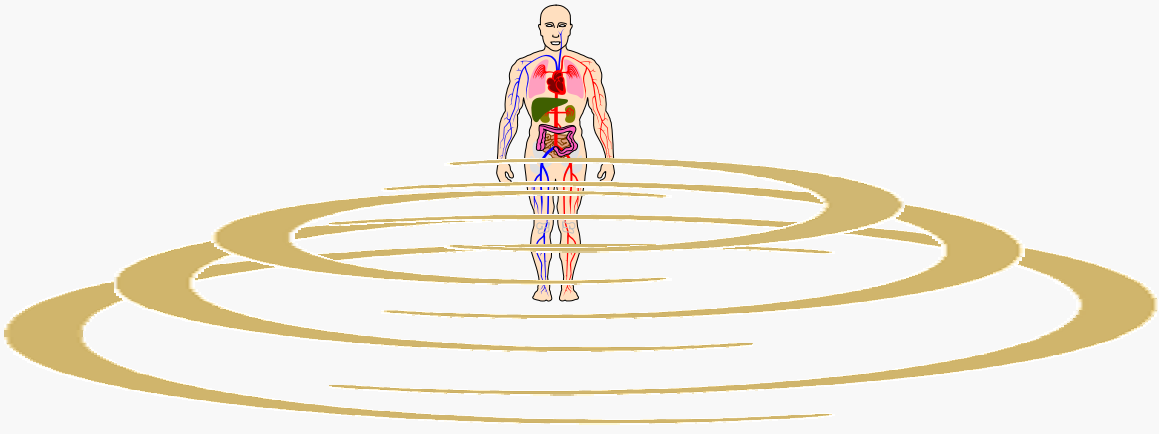
UMLS

a virtual patient



A Virtual Environment

Clinical users can create virtual patients in an environment constructed by development teams working with partners from the medical community.



Enforcing interoperability

- Interoperability
  "Ability of two or more systems or components to exchange information and to use the information that has been exchanged"

Semantic interoperability

Functional interoperability

IEE Standard Computer Dictionary, IEE, 1990

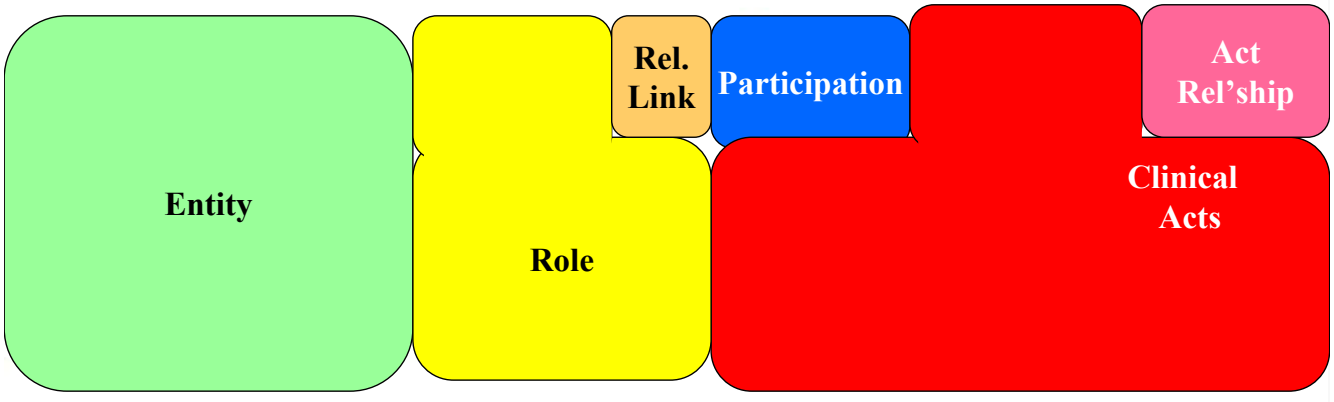
What is the HL7 RIM?

- The RIM (Reference Information Model) is documentation of information from the healthcare domain.
- It is used as a common reference for the data content of all HL7 version 3 standards.
- The RIM has graphical expression and an accompanying data dictionary.
- It is expressed using the Unified Modeling Language notation.

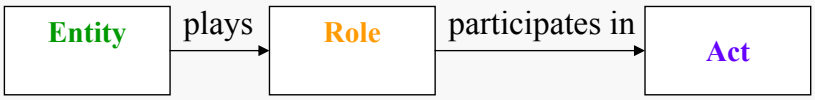
Core concepts of RIM

- Every happening is an **Act**
  - Procedures, observations, medications, supply, registration, etc.
- Acts are related through an **Act_relationship**
  - composition, preconditions, revisions, support, etc.
- **Participation** defines the context for an Act
  - author, performer, subject, location, etc.
- The participants are **Roles**
  - patient, provider, practitioner, specimen, specimen, etc.
- Roles are played by **Entities**
  - persons, organizations, material, places, devices, etc.

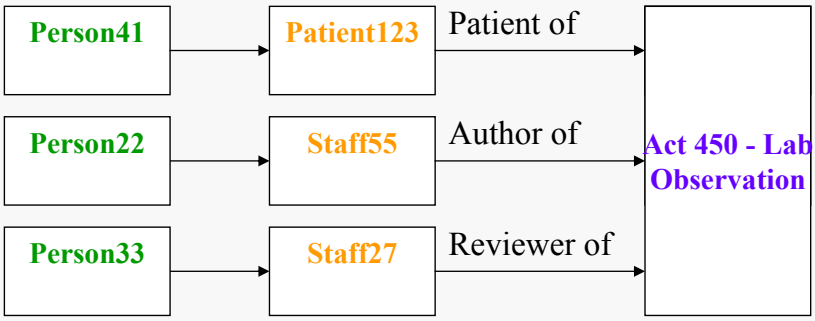
RIM class diagram



Act participation



For example…



Act graphical details

Class: Observation, Procedure, Substance Administration (Drug), Referral, Transportation, Diet, Supply

Mood: Order, Event, …

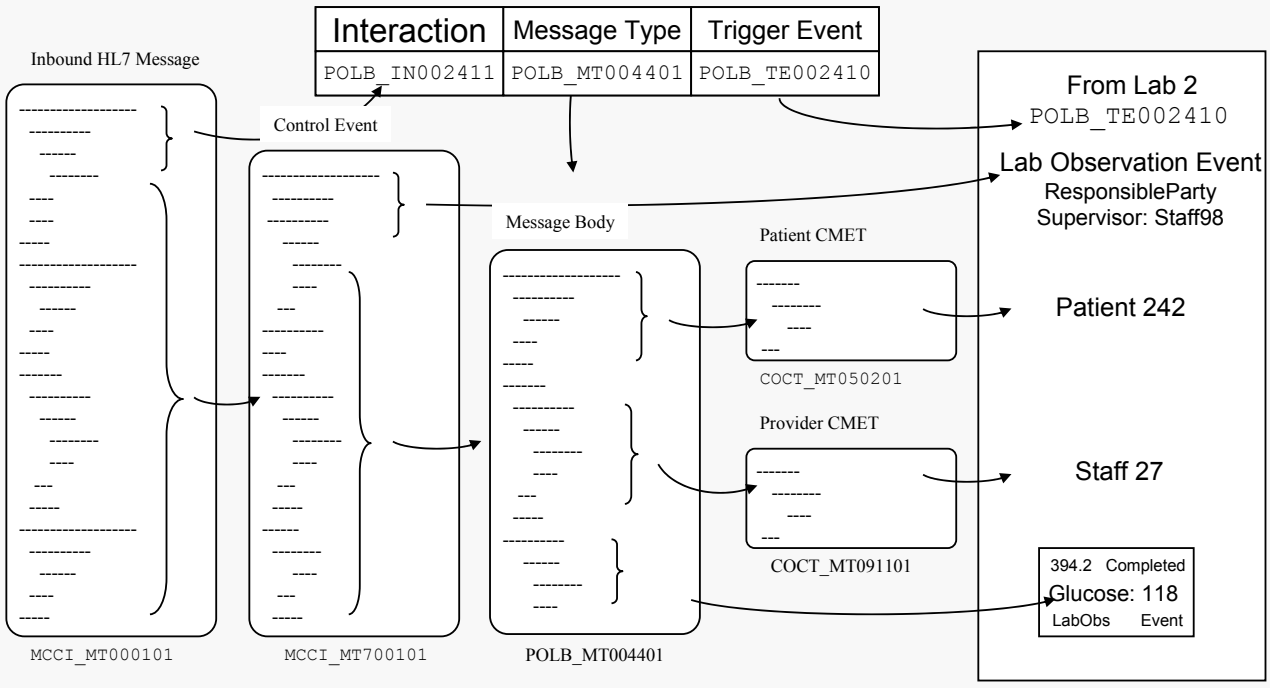
ID.V: The unique ID and version of the act

State: New, active, completed, aborted, nullified, suspended, etc

Name: The name of the ETS concept that is the basis for this act

Value: When appropriate, the value of key attributes of this act

Unwrapping an HL 7 message



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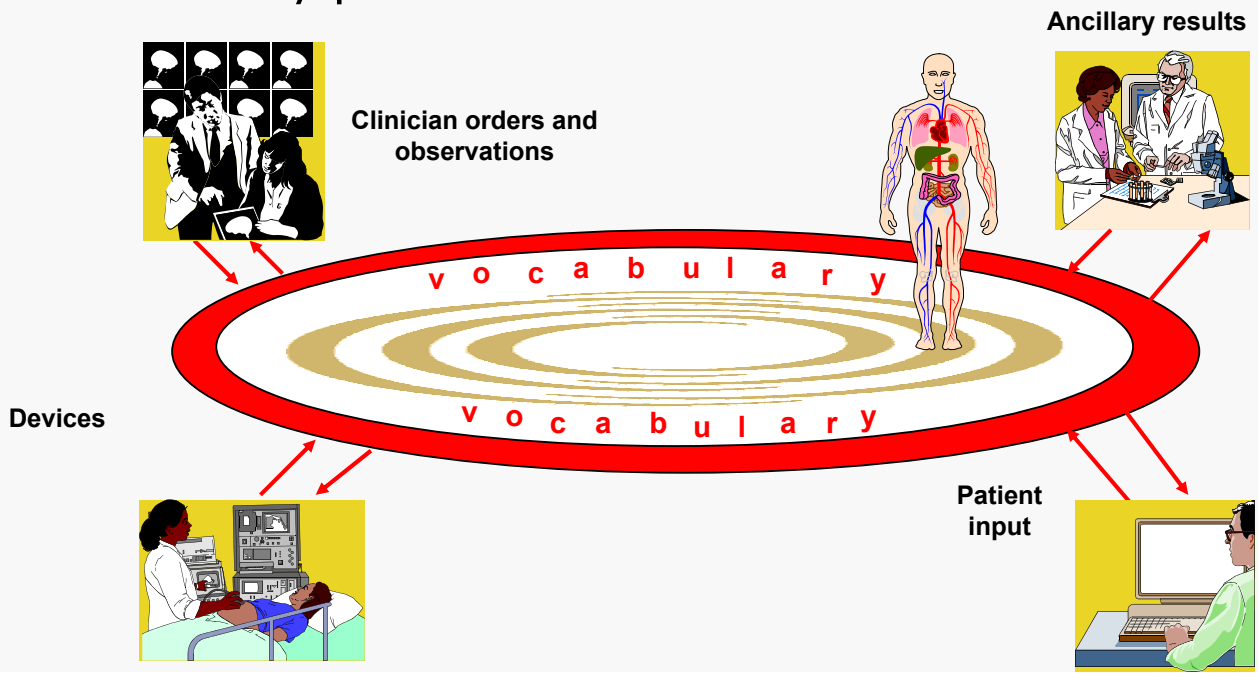
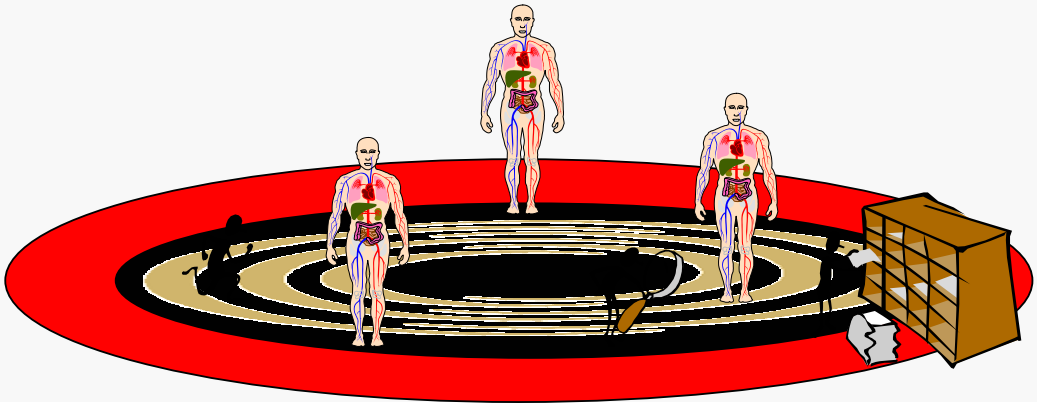
Constructing the System

- A pervasive information model allows many parties to contribute to the EHR.



Using the Virtual Patient

By assuring the accurate identification, description, and representation of patients, we can create a model environment for proactive patient care in which protection of real people can be enhanced by virtual patients.

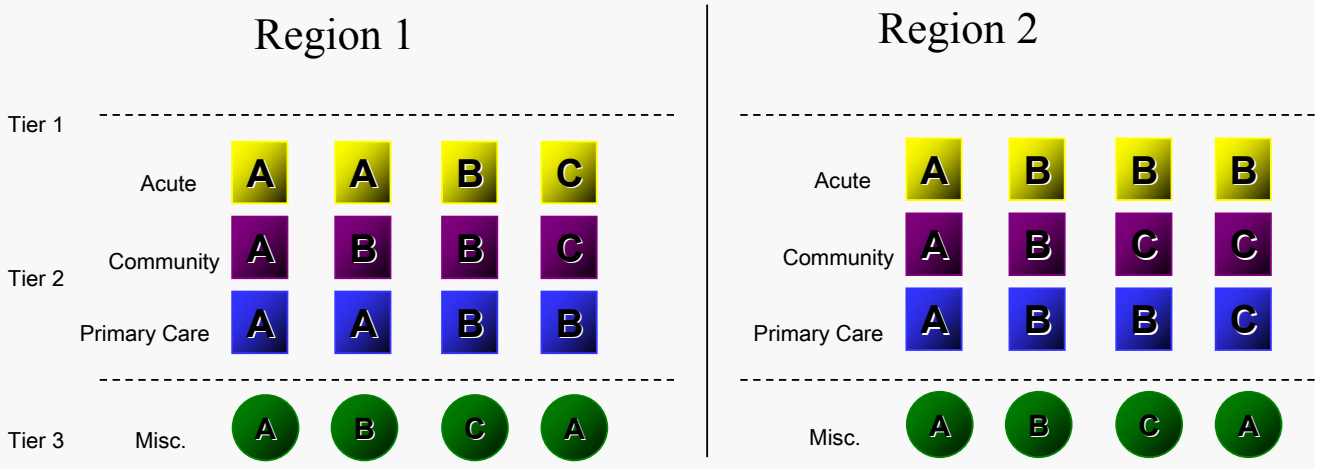


Placing Data at the Center

- If the infrastructure cannot support a simple case, how can we expect it to support complex cases?
- Transactional and retrospective decision support activities depend on data, not documents
- Modern technology allows patient privacy to be honored in a “partitioned” data base environment
- The citizen owns access to his/her data

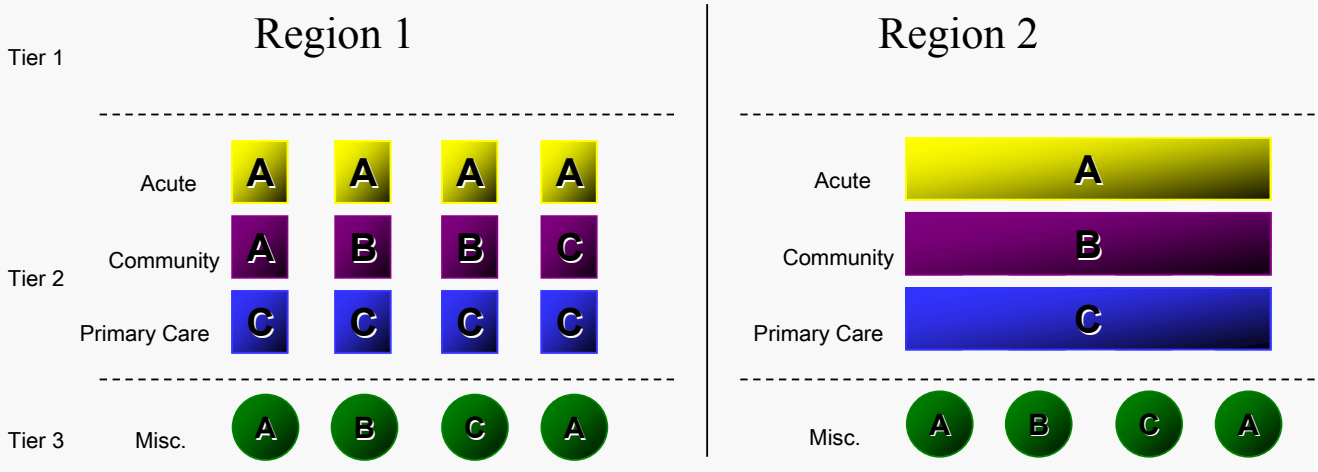
Current Picture

Gradual evolution



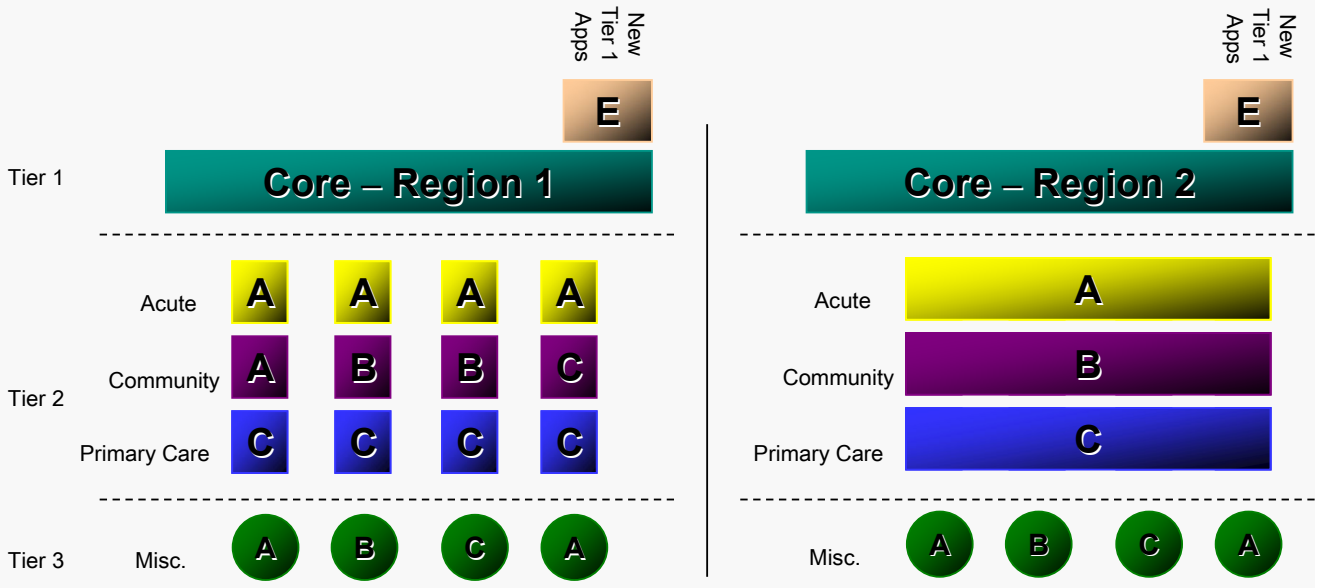
Stage 1

Gradual evolution



Stage 2

Gradual evolution



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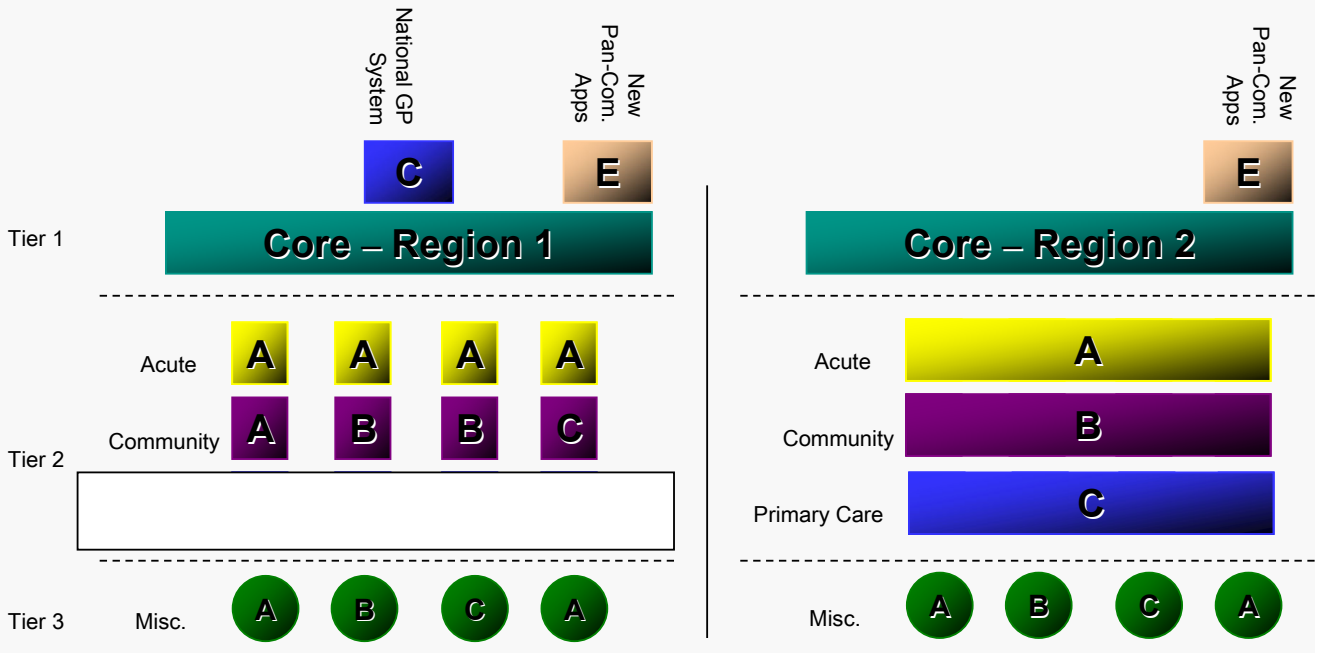
Stage 3

Gradual evolution



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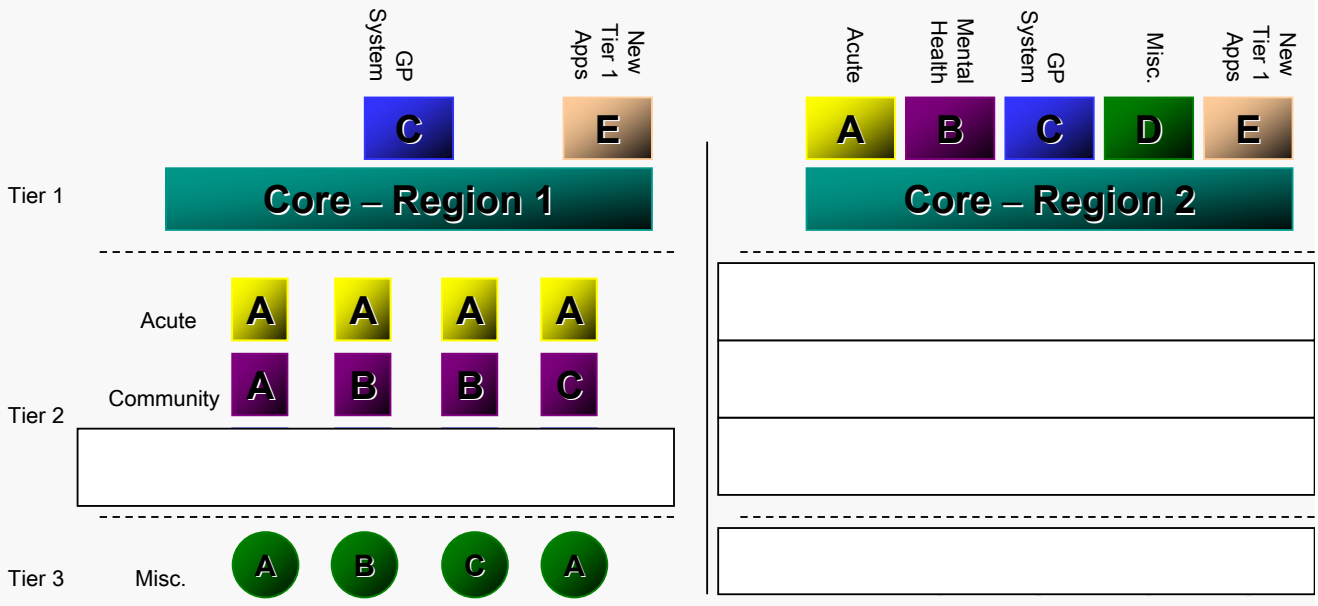
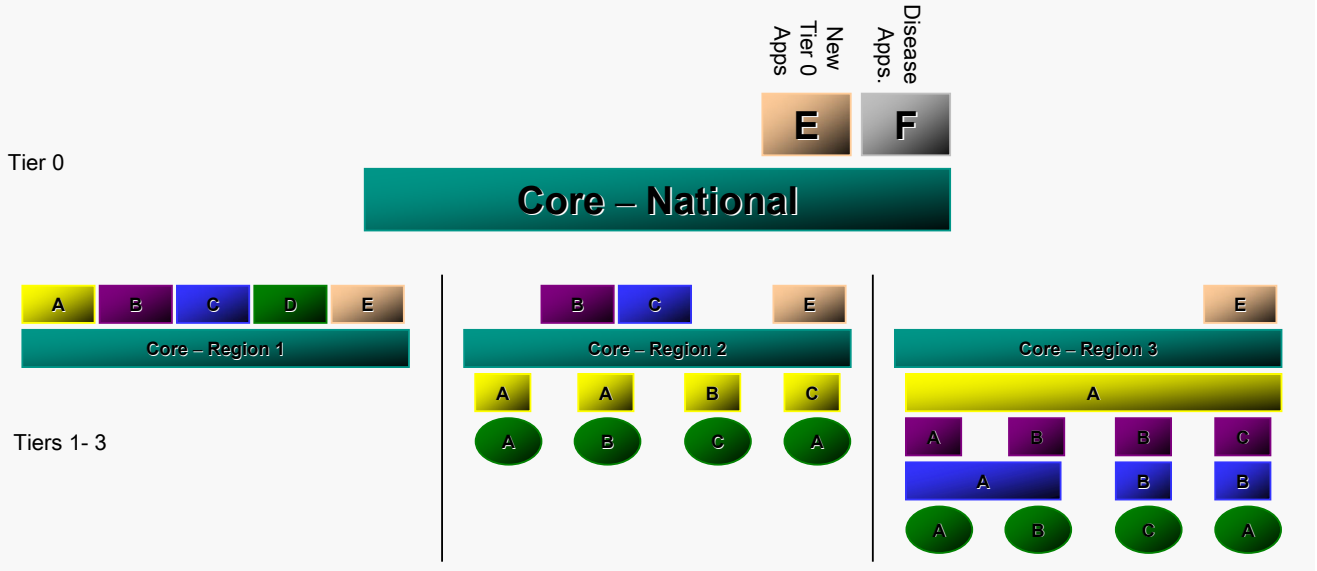
Stage 4

Gradual evolution



Stage 5

Gradual evolution



Architectural Concepts for Telematic Architectures from Industrial Point of View

September, 8th 2003,
First German Expert Conference on a Framework Architecture for ICT Services in Healthcare, Stuttgart

Dr.-Ing. Lutz Kleinholz
CEO and founder

healthpartner consulting GmbH, Munich, Germany
lutz.kleinholz@healthpartner-consulting.de, +49 89 61369926

Presentation of the Architecture Results of the German Expertise and General Impacts on Architecture

Architecture Workgroup

- 15 experts from all major healthcare vendor organizations
  - consulting, integration, software development, telecomms, software vendors, ...
- Work from December 02 to May 03
- Major issues
  - Generic Architecture
  - Framework Definition
  - Use Case Definition
  - Platform Definition
  - Usability, extendibility, user acceptance, legal impacts, security

Presentation Overview

- 4 Thesis for impacts on architectural design
  1. Existing technology lacks behind
  2. Interoperability is not part of the existing systems
  3. Success on IT architecture is driven by use cases and extendibility
  4. Behind licensing and open source is always a business model
  - Impact on architetcure
- Short presentation of the architecture of the expertise

The Four Theses

- Four major impacts and specialties of the existing healthcare market
  - Specific for Germany but very similar to all other worldwide healthcare systems.
  - The impact to the implementation process of large scale IT architectures like the introduction of a telematic platform for a whole country
  - Focus to technical platform or middleware aspects is only one smaller and available part for successful implementation results

Thesis 1: Existing technology lacks behind

- Design of IT systems architecture today is influenced by the existing major architectures
  - Java community
  - Microsoft
- In reality most existing software applications especially in healthcare are mostly older than 6 years in their technology kernel.
- The market is driven mostly by changes in laws and not by business economics of the existing healthcare and social care providers.
- As a result the IT software vendors are either
  - lacking technology innovations
  - but having large functionality base due to slow evolving markets
  - or are technology advanced but lacking functionality.

In general up-to-date technology is rare to find
in existing healthcare software environments and is not easily to adopt.

Thesis 2: Interoperability is not part of existing systems

- Interoperability especially in Germany between the existing healthcare and social care provid-ers is not existing and established.
- The existing software systems have not been designed for data ex-change and often have no process oriented design to handle such data.
- Also security and load balancing for such purposes does not exist to fit such requirements.

Interoperability between these isolated IT sys-tems is only possible when data and process information are separated from the IT systems.

Thesis 3: Success on IT architecture is driven by use cases and extendibility

- Implementing a large scale IT architecture in such a heterogeneous environment is a huge effort when adding complexity in the interoperability and process dependencies.
- This means the use case complexity normally increases only after the first two simple usage scenarios.
- After this phase use cases will increase dramatically in complexity. If the chosen IT infrastructure is not flexible enough and is not capable to handle such increase on complexity they will fail.
- History of introducing IT telematic architectures in Europe: failures are clear to see. Successful large-scale telematic infrastructures will not be implemented addressing only the communication layer or the interfaces between the participating providers.

Only architectures utilizing generic key components and formal described use cases are successful

Thesis 3: Success on IT architecture is driven by use cases and extendibility

- The role of middleware is important but not the only key to success for user accepted telematic architectures.
- Model driven design and meta-model usage combined with use cases will lead to flexible IT architectures that are meeting industrial quality for large scale telematic systems in countries.
- The German industry has focused on the delivery of a framework for such a platform and has included aspects like
  - logical and process oriented modeling,
  - use case definitions,
  - legal,
  - security,
  - user acceptance
  - and general conditions

These conditions needs to be implemented to guarantee success

Thesis 4: Behind licensing and open source is always a business model

- Impact on industrial implementation is about
  - utilizing products or
  - open source
- From architectural point of view there is no difference at all.
- Behind the two approaches two different business models are established.
- The right choice is depending from other criteria like the amount of participating developers, the structure and organization to ensure quality, performance and documentation.
- The critical mass is normally reached in non-market specific and more generic software like operating systems, browsers and tools.

In niche markets like healthcare this approach
has not shown sufficient success

Impact on Architectural Design

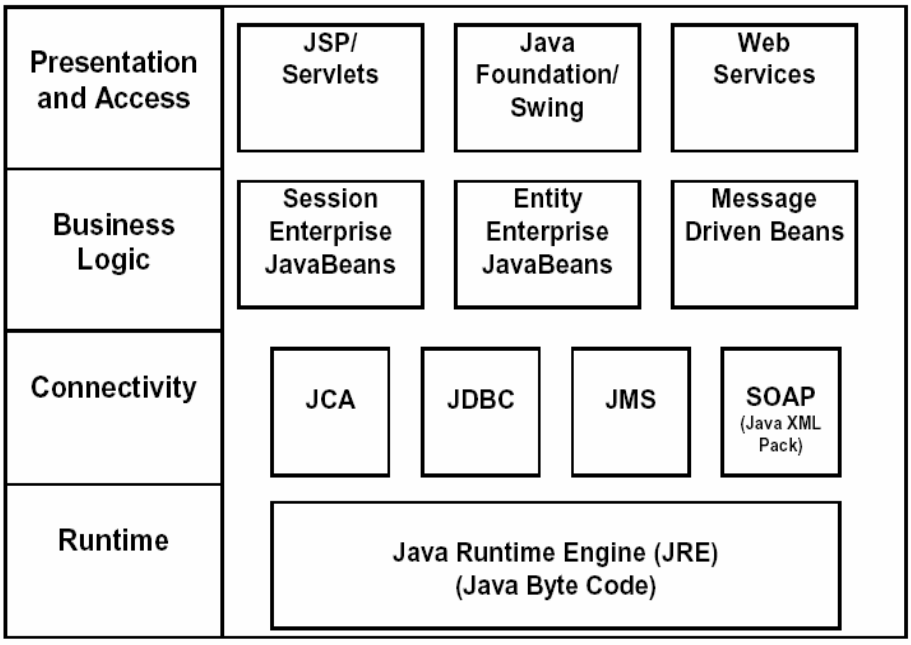
- New It architectural models like .NET or J2EE are strong improvements in architectural design in general.
- Lessons have been learned for interoperability and flexibility in these architectures.
- Pathways are there to keep old existing software environments that are sufficient for the addressed user groups (mostly isolated within single entity environments).
- These new frameworks for architecture are bringing the end-users more into focus than the older middleware oriented approaches.
- The formal implementations of uses cases today are forcing the design of process models and meta-models.
  - They are bringing new possibilities and
  - greater flexibility

  to advanced large scale systems like telematic architectures for one country or later for a whole European platform.

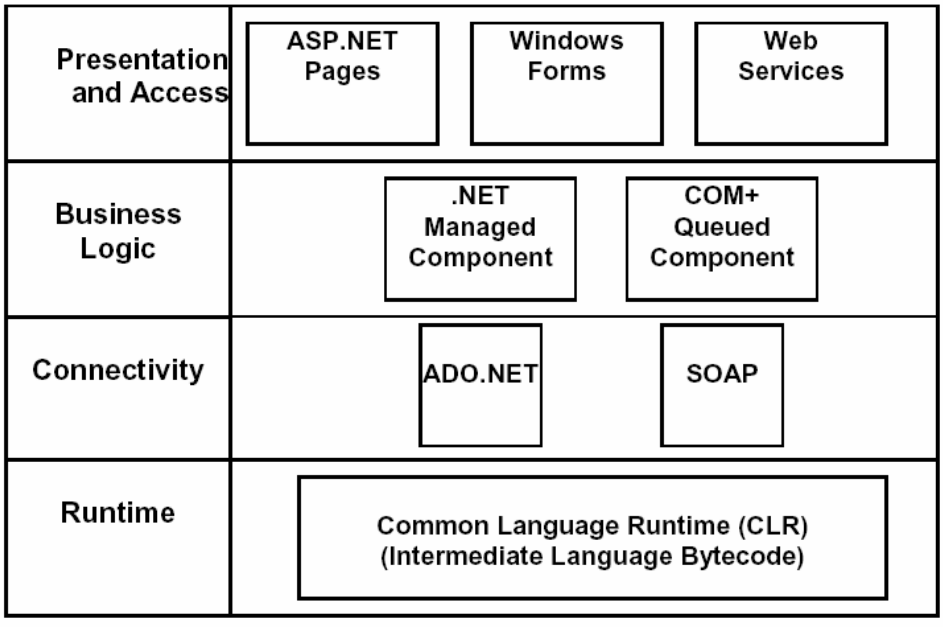
Impact on Architectural Design

- The increase of complexity in such systems have to be addressed in the beginning to lead to proper design
  - that can last longer in the future
  - and is keeping investment adequate to the benefits.
- A manual design and implementation at the level of middleware is leading to larger failure potential and is increasing risk of failures.
- A complete automatic generation of the final code is today even with best practice environments (e.g. Rational Rose) on the other hand an extreme that will not be sufficient.
- Best results will be reached utilizing the new paradigms for large scale software development with state of the art IT architectural models.

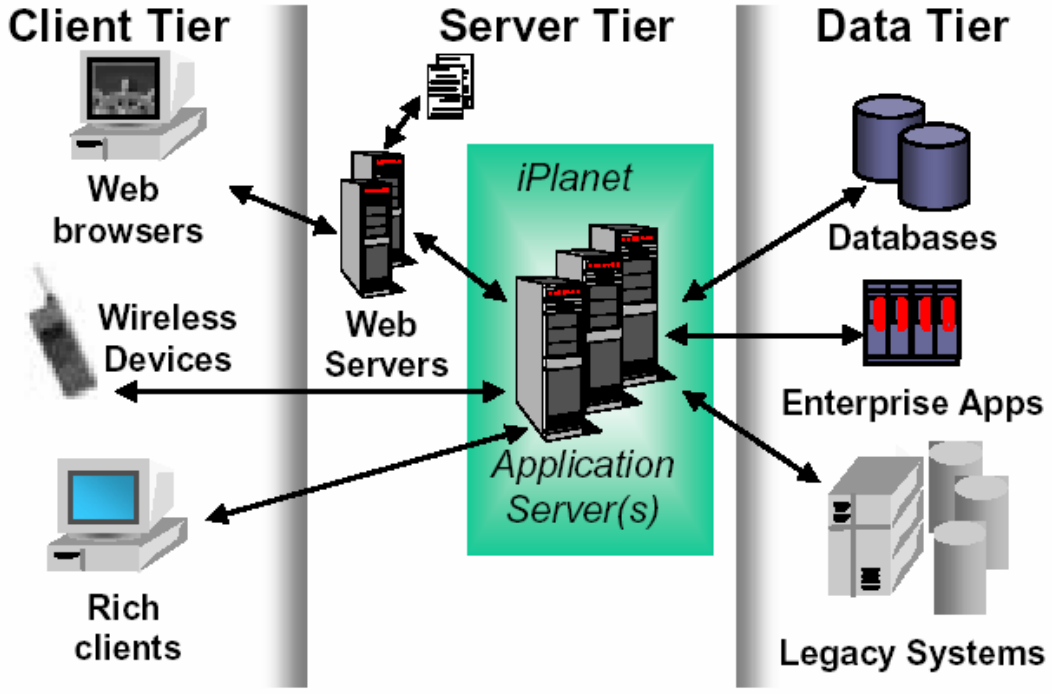
Java Architecture



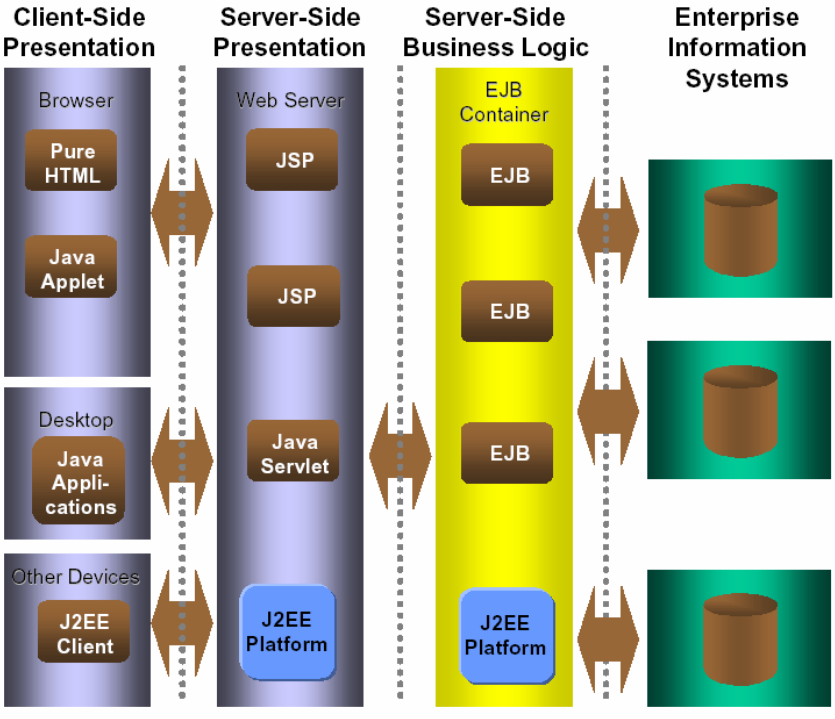
.NET Architecture



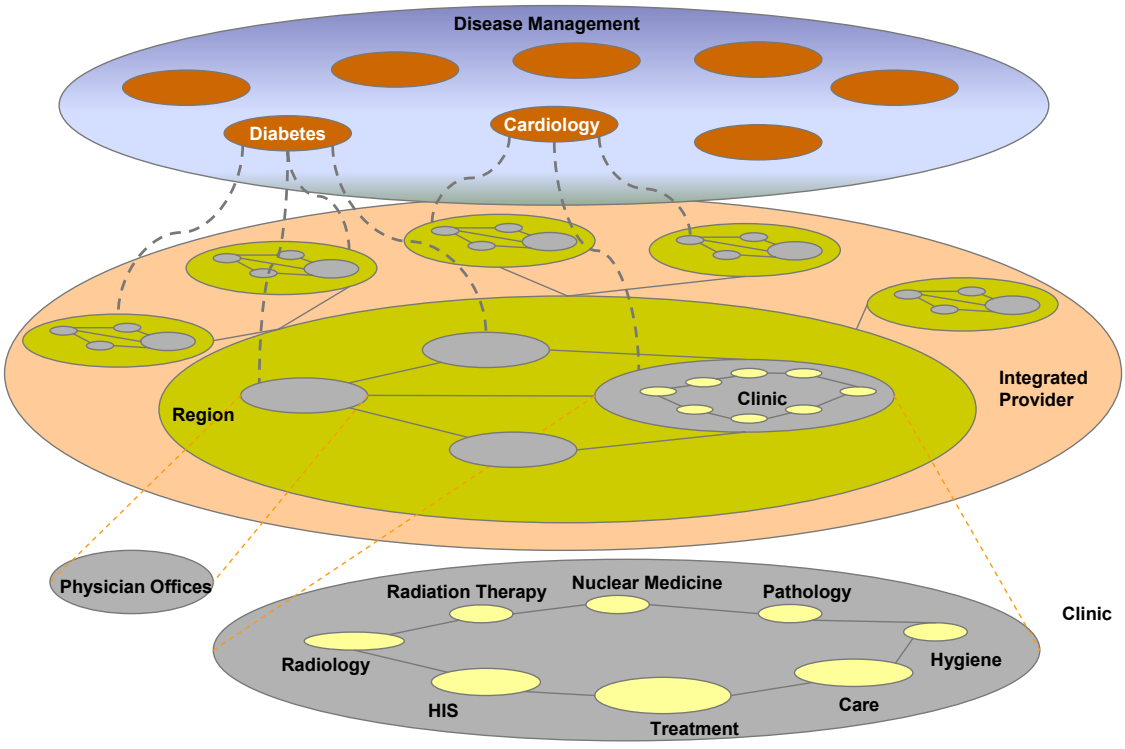
Example of Multi-Tier Architecture



Enterprise Java Beans



The Integrated Healthcare System Architecture for Telematic Platforms



Thank you for your attention

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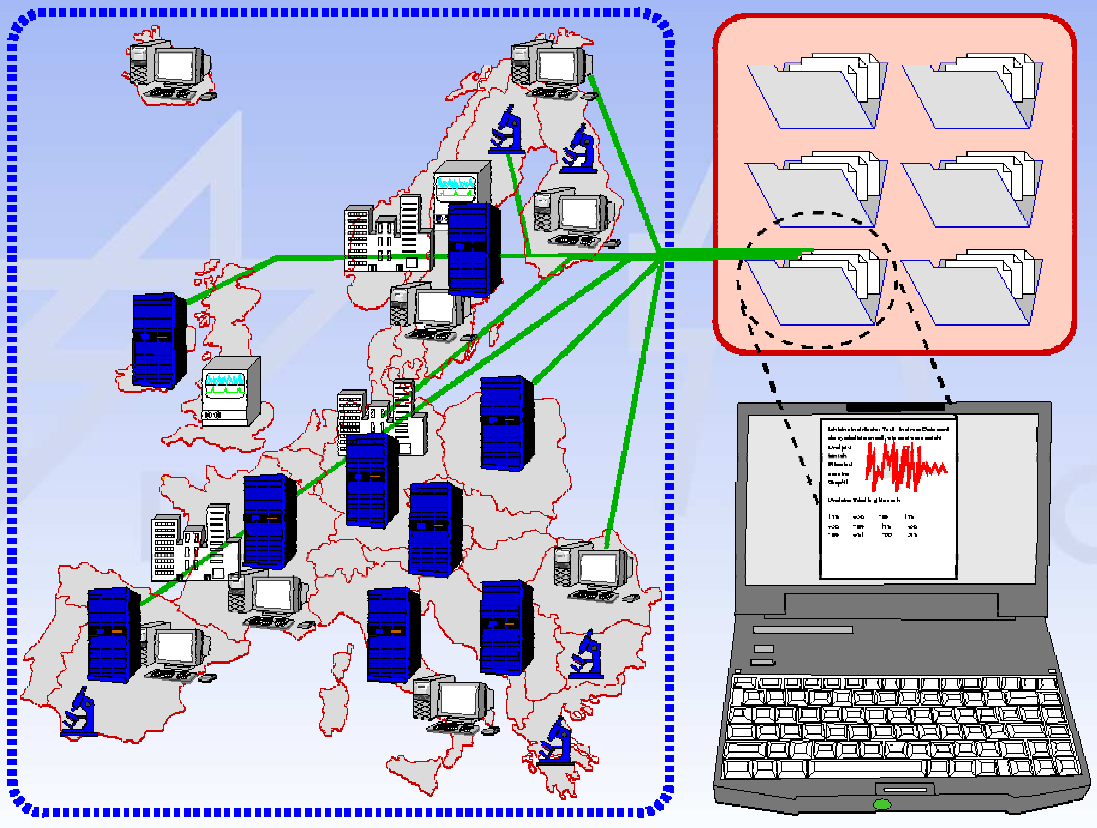
openTP
Offene Telematik-Plattform

Erwin Bartels
(erwin.bartels@dlr.de)

Ziele im Gesundheitswesen

- Offene Plattform für Applikationen
  - Shared Care, Disease Management
  - Organisationsübergreifende Qualitäts- und Effizienzsicherung
  - Kommunikation, Kooperation, Wissensmanagement
- Keine Insellösung!
  - Vernetzung von Forschung, Ausbildung, Wirtschaft, Politik
  - Europäischer und internationaler Kontext

Virtuelle elektronische Patientenakte



Randbedingungen

- Patienten- und Behandlungsdaten existieren bereits verteilt
  - Heterogene Systeme
  - Unterschiedliche Datenmodelle
- Notwendige Ergänzungen
  - Einheitliches, übergreifendes Datenmodell
  - Verknüpfungen von Daten über Systemgrenzen hinweg
  - Gemeinsames Datenschutz- und Security-Modell

Anforderungen an die Plattform

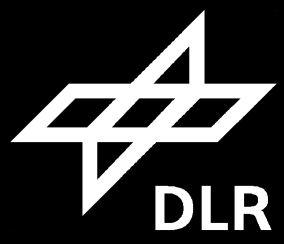
- Kein zentraler Patient-Index (Datenschutz!)
- Einbindung existenter Systeme (kein einfacher Datenimport!)
- Vereinheitlichung des Datenmodells
- Semantische Interoperabilität von Applikationen
- Strukturierung und Verknüpfungen von Daten
- Bereitstellen eines übergreifenden Security Konzepts

Akzeptanzkriterien

- Zukunftssicherheit der Plattform
- Investitionssicherheit
  - Weiterverwendung und Kombination existenter Systeme
- Smooth Migration Path zur Plattform
  - Rasche Einführung der vorrangigen Dienste
  - Schrittweise, modulare Erweiterbarkeit um neue Dienste
- Vermeidung von Monopolstellungen
  - Open Source
  - Koordination durch Konsortien aus Industrie + Forschung

OpenTP

- Entwickelt von Partnern aus Industrie und Forschung
- Middleware
  - Einheitliches Daten- und Verknüpfungsmodell
  - Einbindung und Verknüpfung existenter Systeme
  - Semantisches Netzwerk von Informationen und Anwendungen
  - Einfache Migration existenter Applikationen
- Componentware
  - Smooth Migration Path
  - Einfache Erweiterbarkeit
- Open Source



Architektur einer massiv verteilten, Komponenten-basierten Middleware Plattform

Klaus Schmaranz
(klaus@iicm.edu)

Dirk Schwartmann
(dirk.schwartmann@dlr.de)

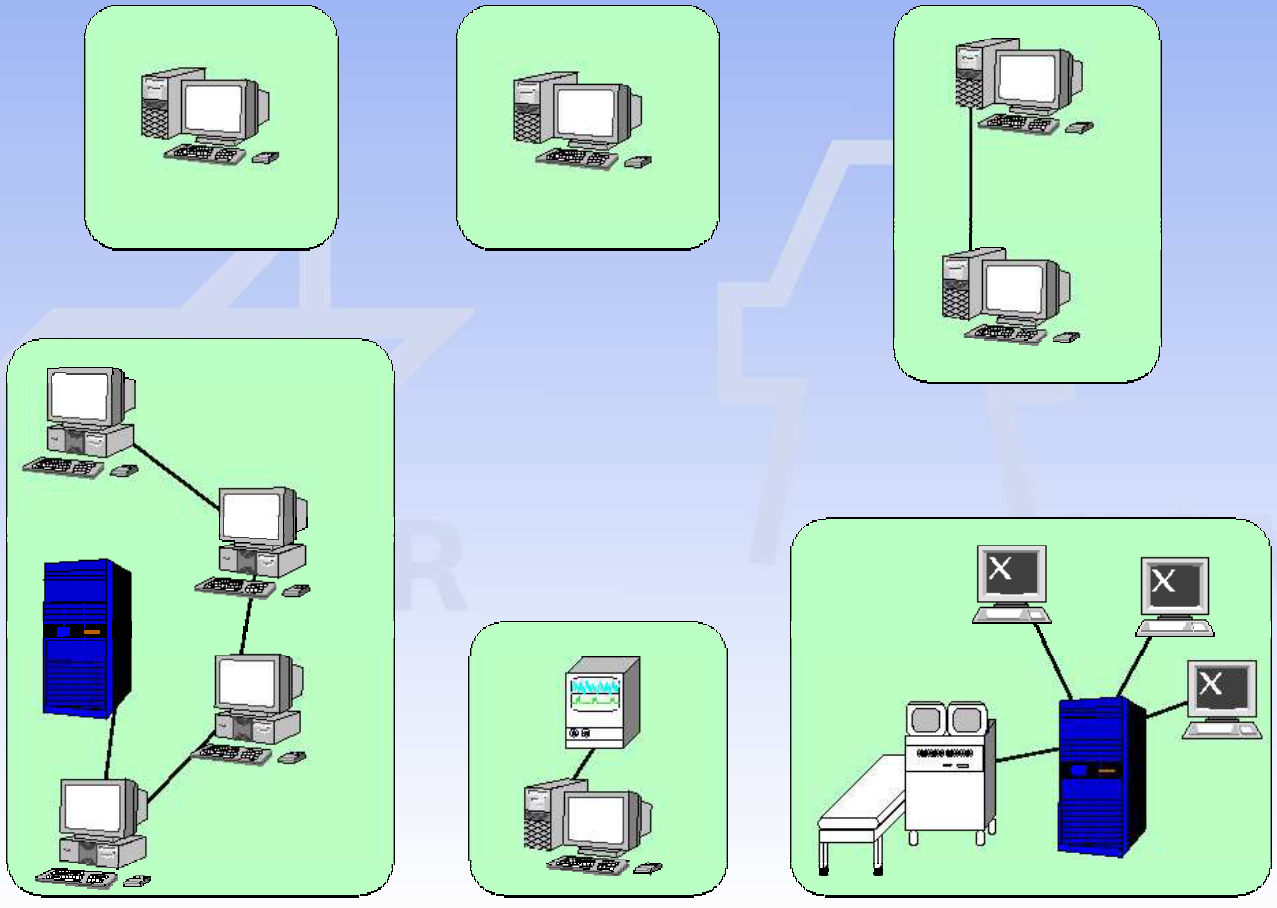
Stand der Dinge

- **Allgemeine Einigkeit**
  - **Vernetzte Systeme**
  - **IP-Technologie (IP ≠ WWW!)**
- **Konsens ist unzureichend!**
  - **Netzwerk-Infrastruktur löst nur einen Teil der Probleme**
  - **Für zukunftssichere Applikationen sind weitere Aspekte zu betrachten**

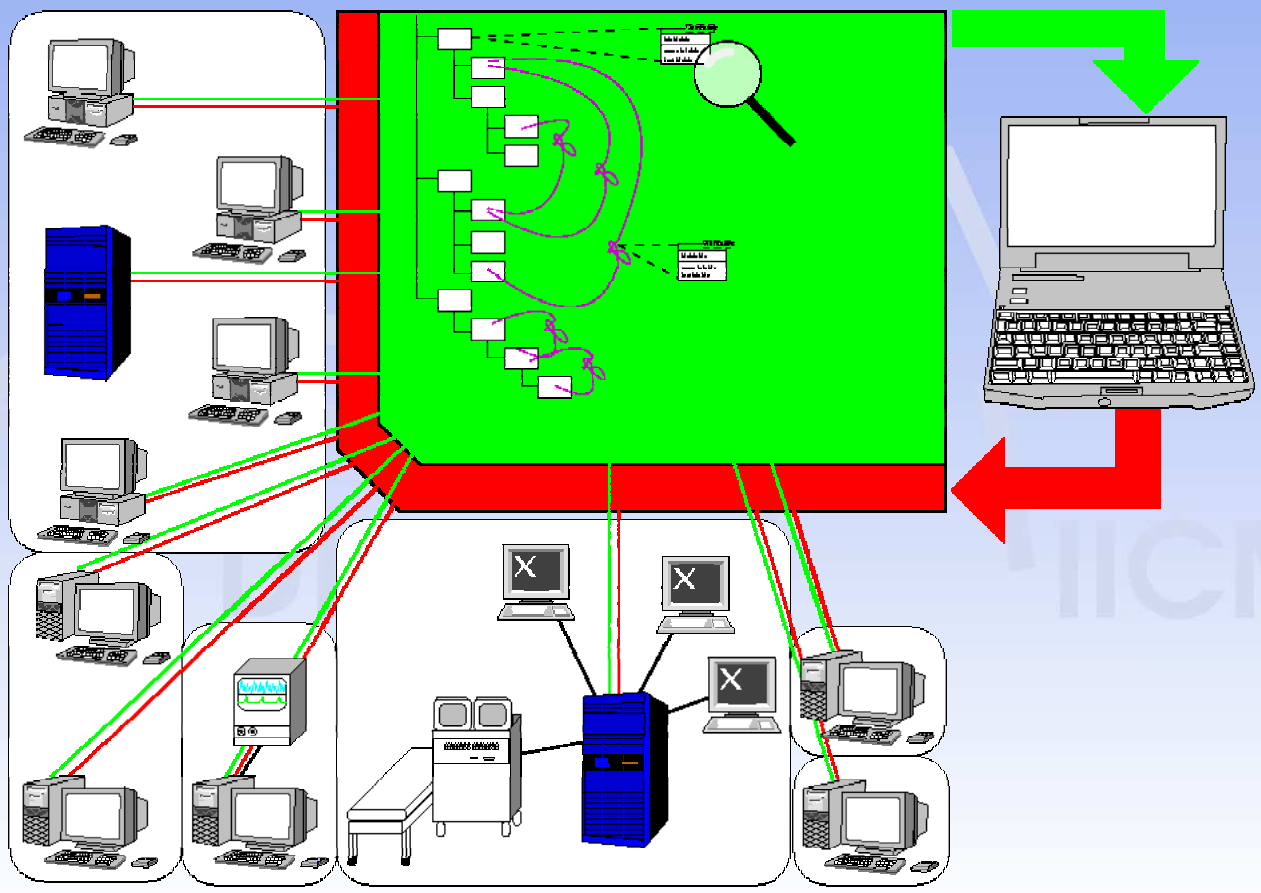
Lebensnotwendige Kriterien

- Global eindeutige, robuste Adressierung (kein *Error 404*)!
- Kein Rückschluss von Adresse auf adressierte Information!
- Garantiert robuste Verknüpfungen (keine *dangling Links*)!
- Verknüpfungen mit integraler, robuster Semantik-Information!
- Keine Software-Monolithen sondern Komponenten!
  - Zur Laufzeit der Semantik entsprechend verknüpfbar!
- Einheitliches, Rollen-basiertes Security Modell!
  - Verknüpfungen wie Daten zugriffs-/sichtbarkeitsgeschützt!
  - Autarke Administration pro Instanz im Netzwerk!
- Einbindung existenter Systeme statt Import!

Derzeitige Landschaft



Integration mit openTP



Liberté, Egalité, Fraternité...

- Fein granulare *Komponenten*
  - Vorhandene Daten: *Content*
  - Context, Semantik, Attribuierung, etc.: *Meta-Data*
  - Strukturierung und Verknüpfung: *Interrelations*
  - Angebotene Dienste: *Operations* und *Services*
- Einheitliches *Security Modell*

Aber... sicher!

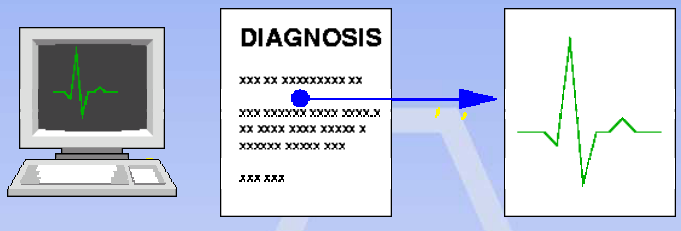
- PKI (Crypto-Tokens)
- Role-based Access Control
  - Basierend auf proposed NIST Standard
  - Role-Templates
  - Role-Mapping
- Elektronische Signatur und Verschlüsselung
- Autarke Administration in den Einrichtungen
- Zertifizierung der Plattform-Komponenten

Struktur und Ordnung bitte!

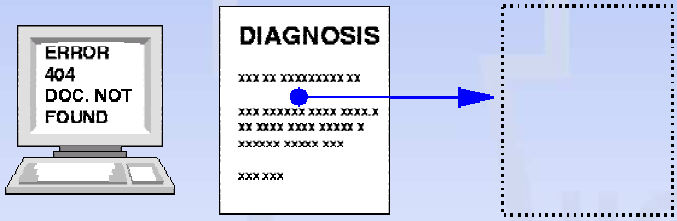
- *Interrelations* zur Navigation und Verknüpfung
  - Multidimensional
  - Typisierbar
  - Attribuierbar
  - Robust im dynamischen Fall
  - Semantisch beschrieben
  - Getrennt von Daten gehalten
  - Auch rekursiv zur Verbindung von Interrelations

Quo vadis, Dokument?

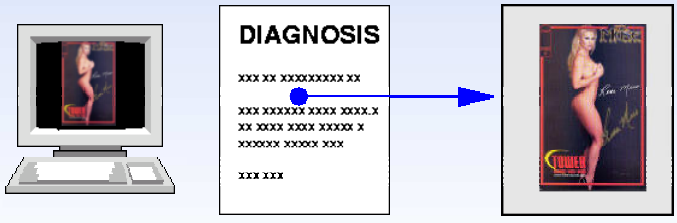
- Montag, 08:30...



- Dienstag, 11:00...



- Mittwoch, 09:30...



DOLSA: I got it, I keep it...

- Globally Unique Handles (*GUH*)
- Strikte Trennung von Adresse und Navigation
- Kein Rückschluss auf adressierte Information
- Kein zentraler Index
- Unbegrenzter Adressraum
- Support für transparente Replikation von Objekten
- Definierbare Speicherungs-Redundanz
- Security-geprüfte Adressauflösung

OpenTP erleichtert Entwicklungen

- Erhalt existenter Systeme
- Vereinfachung zukünftiger Entwicklungen
  - Integration und Kombination bestehender Software
  - Einheitliches Komponentenmodell
  - Robuste Adressierung
  - Semantisch definierte, robuste Verknüpfungen
  - Umfassende Security
- Open Source inklusive Dokumentation nach V-Modell 97

PICNIC Overview

German Experts Conference on Framework Architecture for ICT Services in Healthcare
8-9 September 2003

David Piggott – Integrity Consulting

PICNIC Project

European funded project, IST-1999-10345

Phase I (Design):- 13 partners (Jan 2000 – May 2001)

Phase II (Deploy):- 9 partners (Sept 2001 – Feb 2003)

Cost: €7 million

CEC Funding: €3.5 million

URL: http//www.medcom.dk/picnic

PICNIC Objectives

- to develop a model and an architecture for the future RHCN and to prepare the regional health care providers to implement the next generation of secure, user-friendly health care networks
- deliver a number of Open Source components which are used across different regions, which can be integrated into application, which deliver like services across participating regions, and which can be exploited by other regions and industry to provide products for a European and potentially worldwide market.
- to make the European market for telematic health care services more cohesive and less fragmented.

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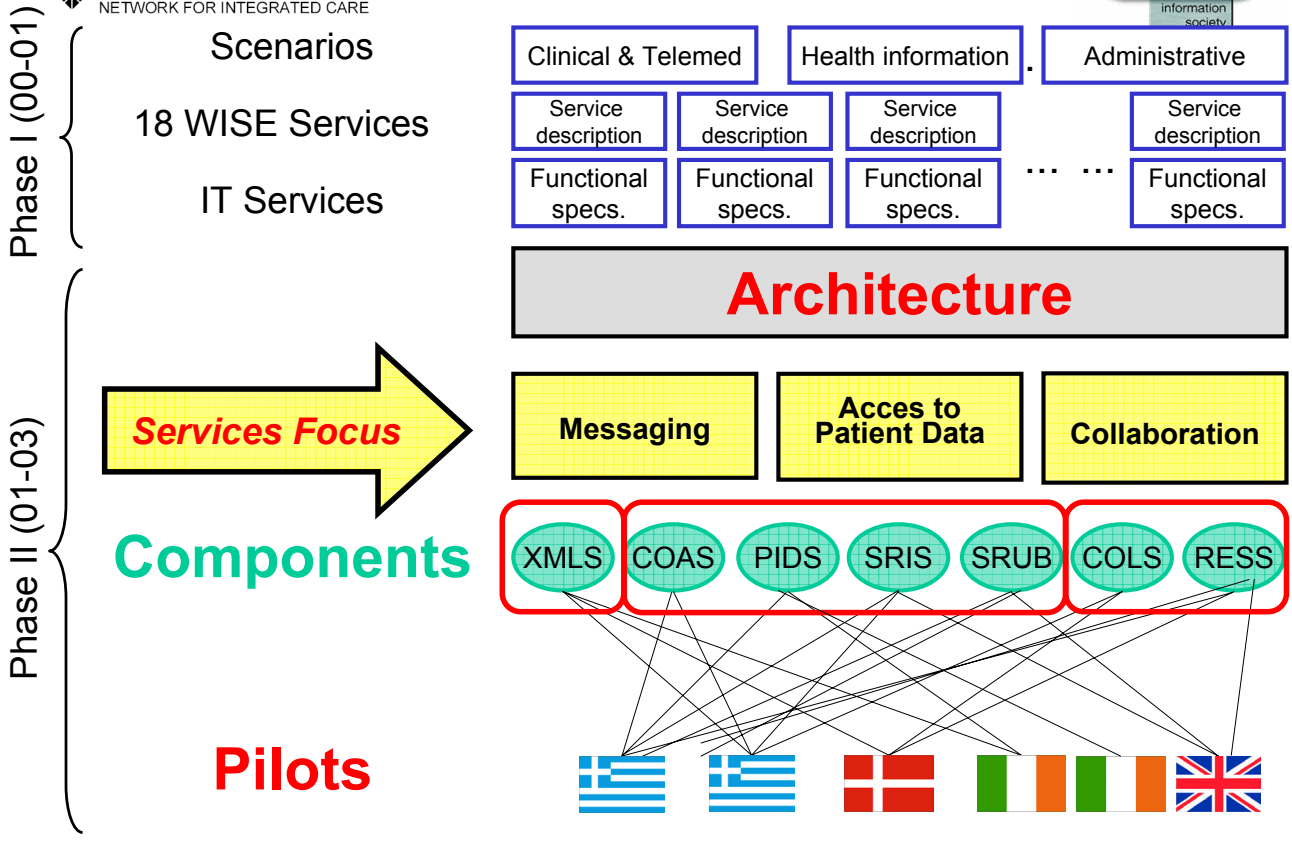
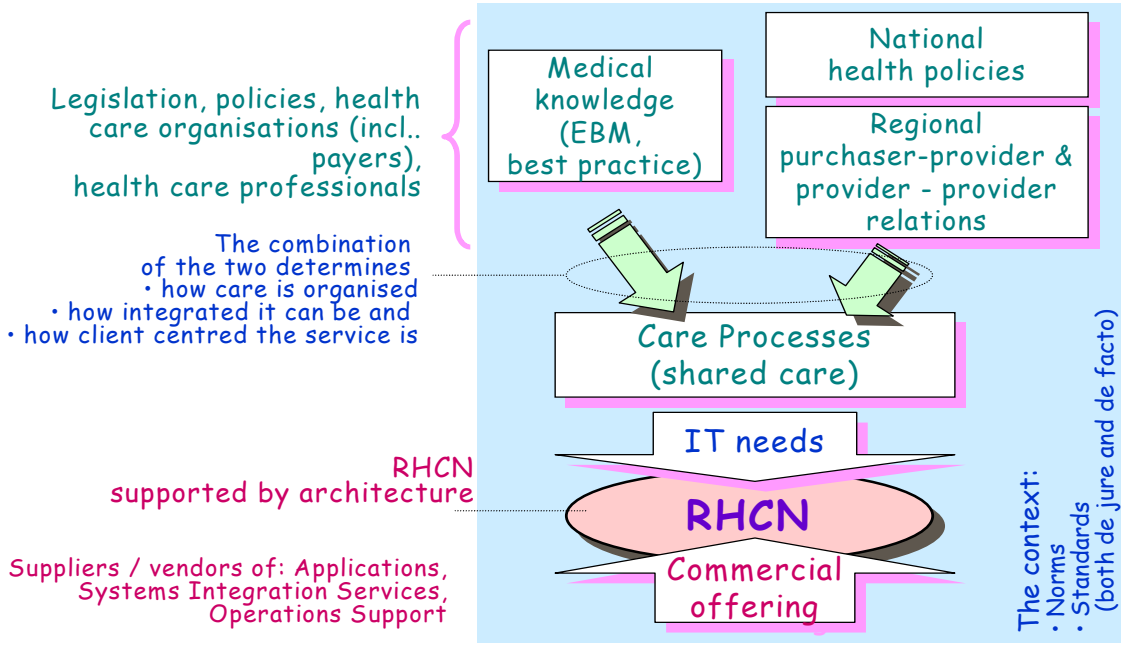


Regional Health Care Network



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Project Deliverables - Reports

- D2.4 PICNIC FINAL Architecture
- D6.2 Messaging Common Component Spec
- D6.3 Access to Patient Data Common Component Specification
- D6.4 Collaboration Service Common Component specification
- D9.2 Regional Assessments Report
- D10.8 Exploitation Plan

Project Deliverables - Software

- Open Source Common Components:
  - Shared Records Service (SRIS, SRUB, COAS)
  - Person Identification Service (PIDS)
  - Collaboration (COLS, RESS)
  - HL7 CDA/XML DTDs for messages for referral, examination report & reimbursement

  (available from: www.picnic.euspirit.org)

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Project Deliverables - Prototypes

- Prototypes developed/deployed in regions:
  - FORTH (Shared Records, Collaboration)
  - FUNEN (Collaboration)
  - GMS (Pharmacy Reimbursement/Patient Validation)
  - SEBT (Shared Records/Emergency)
  - NWHB (Mobile Computing/Patient ID)

Project Results - Conclusions

- Project developed a new paradigm for healthcare ICT architecture – based on web services and HII approach
- This architecture was realised in a range of Open Source ‘common’ software components, which can be used to build RHCN ICT services
- The architecture was validated through the deployment of the components in 5 regional pilots, which were used operationally to deliver benefits to patients and other stakeholders in the RHCN
- The Exploitation Plan enables ICT services vendors to capitalise on the PICNIC research to develop pan-European healthcare ICT products/services for the RHCN of the future

PICNIC ARCHITECTURE

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VTT Information Technology
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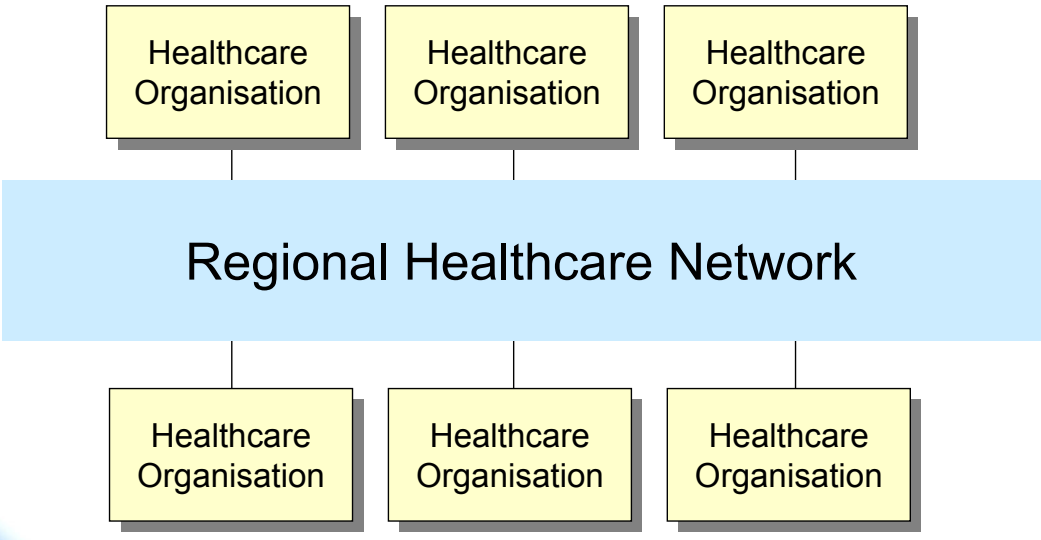
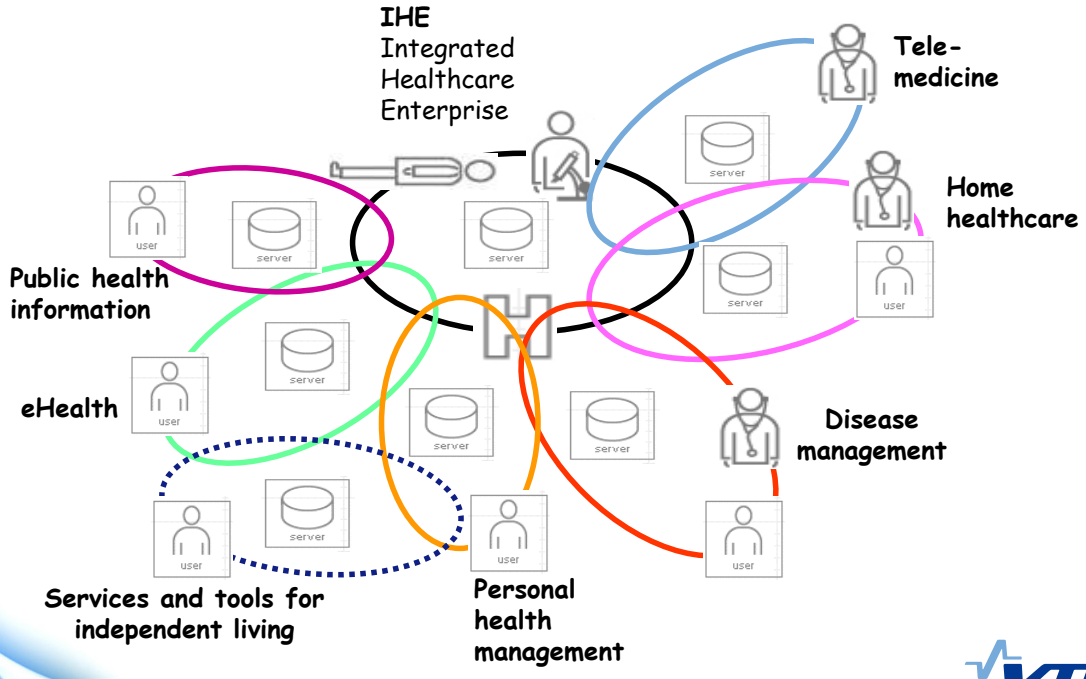
PICNIC Objective



what services, interfaces, technology?

PICNIC CONTEXT 1
EXTENDING CARE OUTSIDE THE "HOSPITAL WALLS"



PICNIC CONTEXT 2
THE HEALTH CARE ENVIRONMENT

- Organisations will retain their independence and their collaboration is determined by their interests.
- There will be competing interests.
- There is no single owner of the RHCN. Its development will depend on how the organisations can reach consensus / agreements.

- Different technology platforms for enterprise applications co-exist
- There is no one technology platform that fits all needs.

- The challenge is to make data and information securely available where it is needed, when it is needed and in the format it is needed.

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Regional Health Economy

- Different technology platforms for enterprise applications co-exist
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FEDERATION

- The challenge is to make data and information securely available where it is needed, when it is needed and in the format it is needed.

PICNIC CONTEXT 3
Issues Considered

- Security & confidentiality of patient data
  - National and European regulations
- Investments in existing IT solutions
- Ease and cost of migration to "PICNIC"
- Building on what has been done (WISE 18 and others)
- Open Source - Will it make a difference ?
- Unified Modelling Language (UML)
- Component Based Software Development
- Multiple Technology Platforms
- Interoperability - Mainstream Standards
- EHR vs. "virtual EHR" (Link Directory Approach)
- Middleware - Architectural Design

PICNIC CONTEXT 4
Conclusion

- Goal statements in many EU countries
  - EHR, smart cards, security / privacy, eHealth
- To achieve these
  - One needs an IT-infrastructure
  - But this cannot be created ad-hoc (by "self-organisation")
  - Instead it requires structure ("architecture")
    - agreements between the actors on what they are willing to share
- But how to reach these agreements in healthcare (win-win)?
  - Role of authorities, providers, payers, citizens and vendors?
  - Local, regional, national, European, global?
- What agreements are needed?
- "Learn from other domains both from their successes and mistakes"

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ARCHITECTURE

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Architecture

- “Describes the structure of a system”.
- Architecture describes the style by which a system is composed. It is the set of constraints on all composition options.
- An organised framework consisting of
  - Principles, rules, conventions and standards that serve to guide development and construction activities such that.
  - All components of the intended structure will work together.
  - To satisfy the ultimate objective of the structure.

- Describing an IT-architecture (ISO ODP RM)
  - IEEE
  - TOGAF
  - 4+1 "Kruchten"

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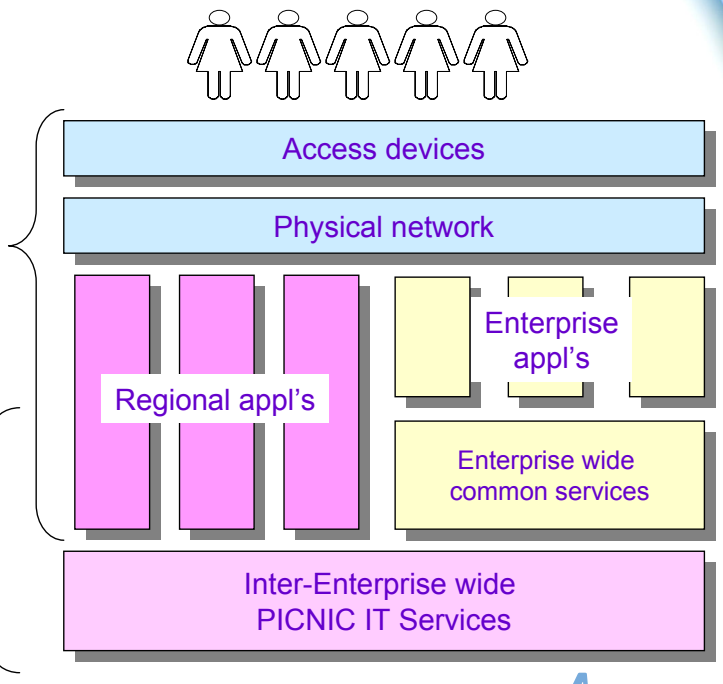
PICNIC ARCHITECTURE

A WEB SERVICES ARCHITECTURE FOR
INTER-ENTERPRISE INTEROPERABILITY

GENERAL IS ARCHITECTURE

Physical users access regional and enterprise applications through various access devices using wired and wireless networks

Common services are used by regional and enterprise applications to enable inter-operability and to add modularity

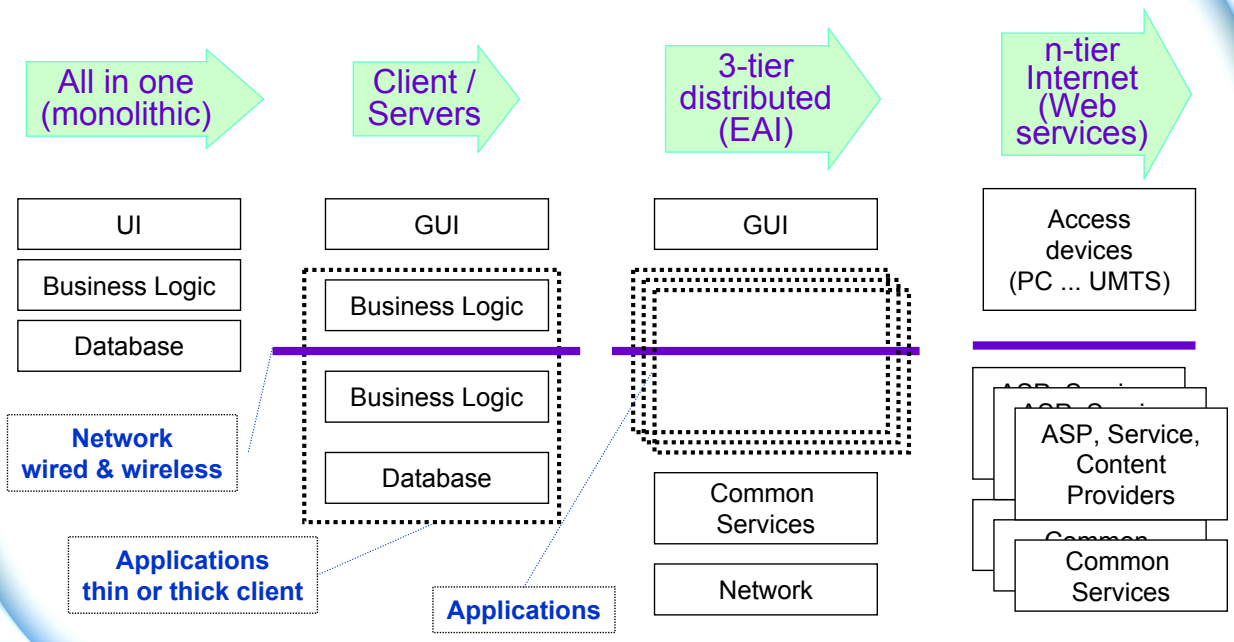


PICNIC ARCHITECTURE

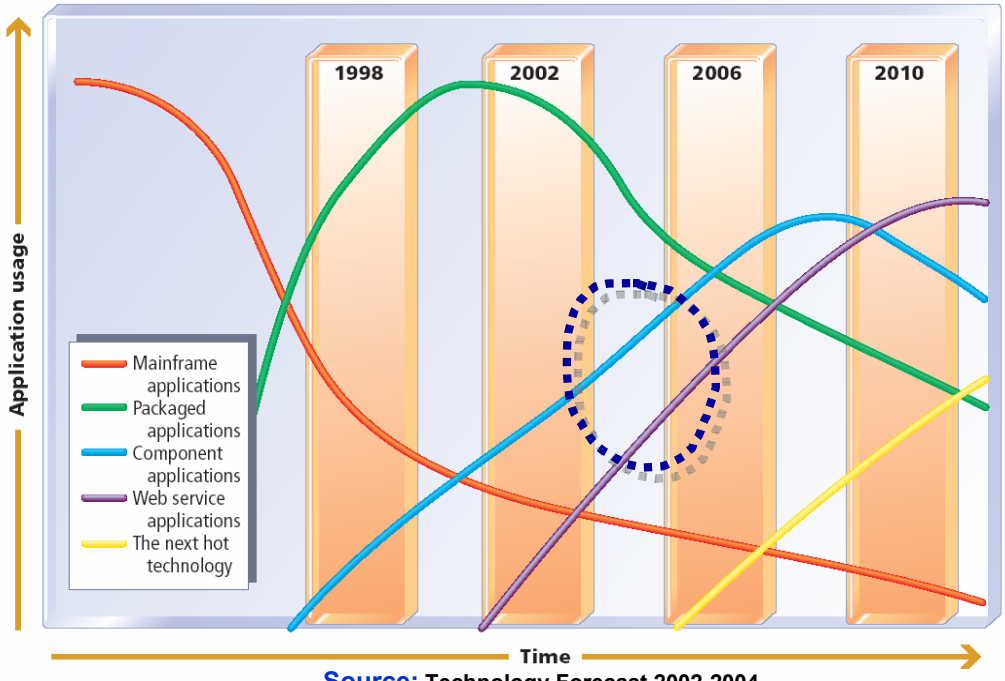
Stakeholders have different views to the architecture because their interests (concerns) are different, e.g.

Views	Stakeholder group
Why use it, what are the benefits	Vendors and HDE's / RHE's
What does it do, what services does it offer, can I trust it (security)	Users
How does it do it, what components & interfaces does it use	Developers
How does one implement it, what technologies does it use	Implementers (user and vendor side)

EVOLUTION OF ARCHITECTURES

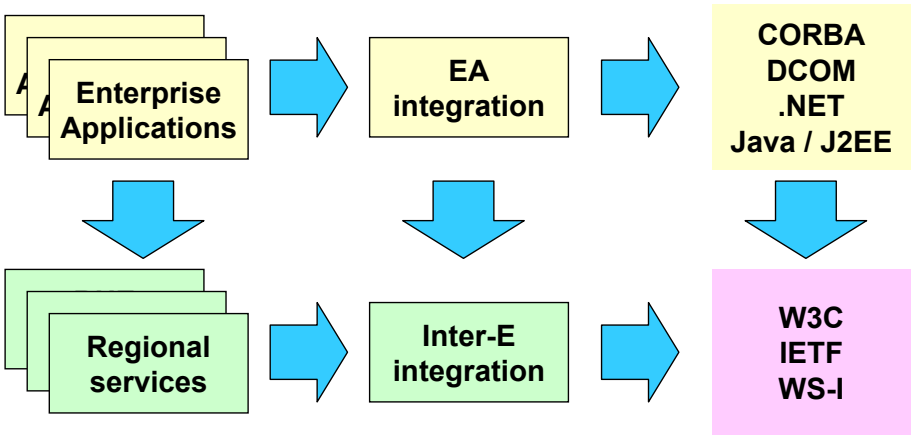


Forecast on TECHNOLOGY PLATFORMS



Source: Technology Forecast 2002-2004, Volume 1- Navigating the future of software, PWC, 2002

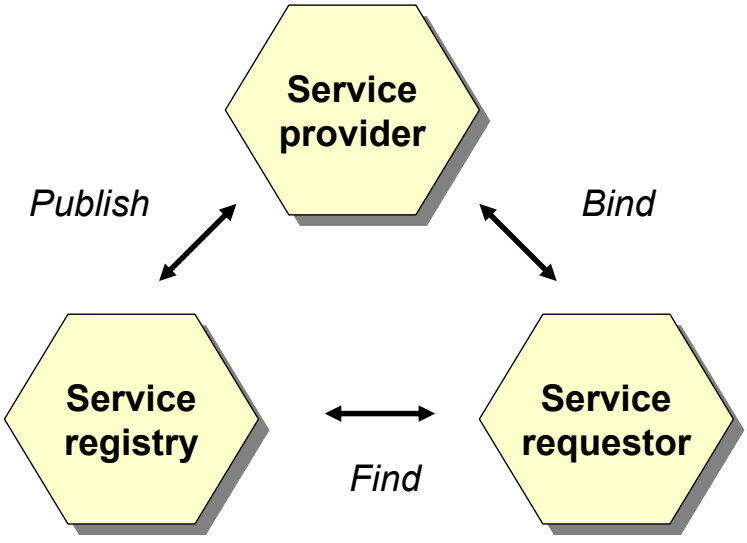
Technology Platforms for MEETING INTEGRATION NEEDS



ISSUES
Interoperability
Security
Flexibility
Scalability

Standards

WEB SERVICES



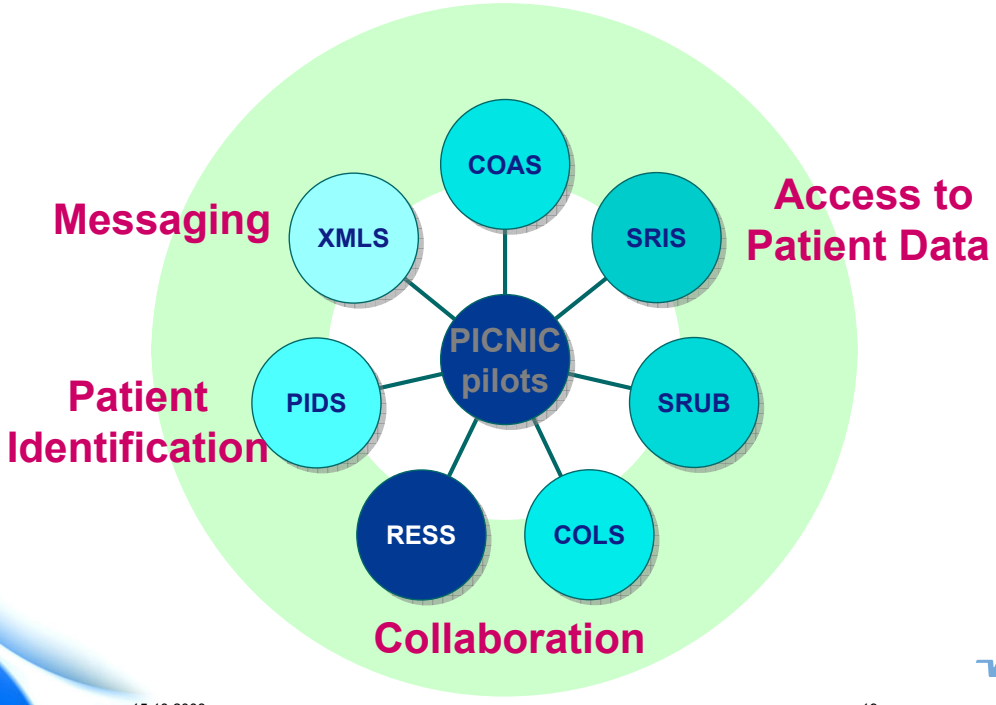
WEB SERVICES & PEER-to-PEER COMMUNICATION
W3C solution - “A whole new alphabet soup”

stack	standards	purpose
Discovery	UDDI	*Locating services*
Description	RDF, WSDL	*Describing services*
Packaging	XML, SOAP	*Requesting / performing services*
Transport	HTTP, Jabber	*Transporting requests*
Network	TCP/IP	*Network*

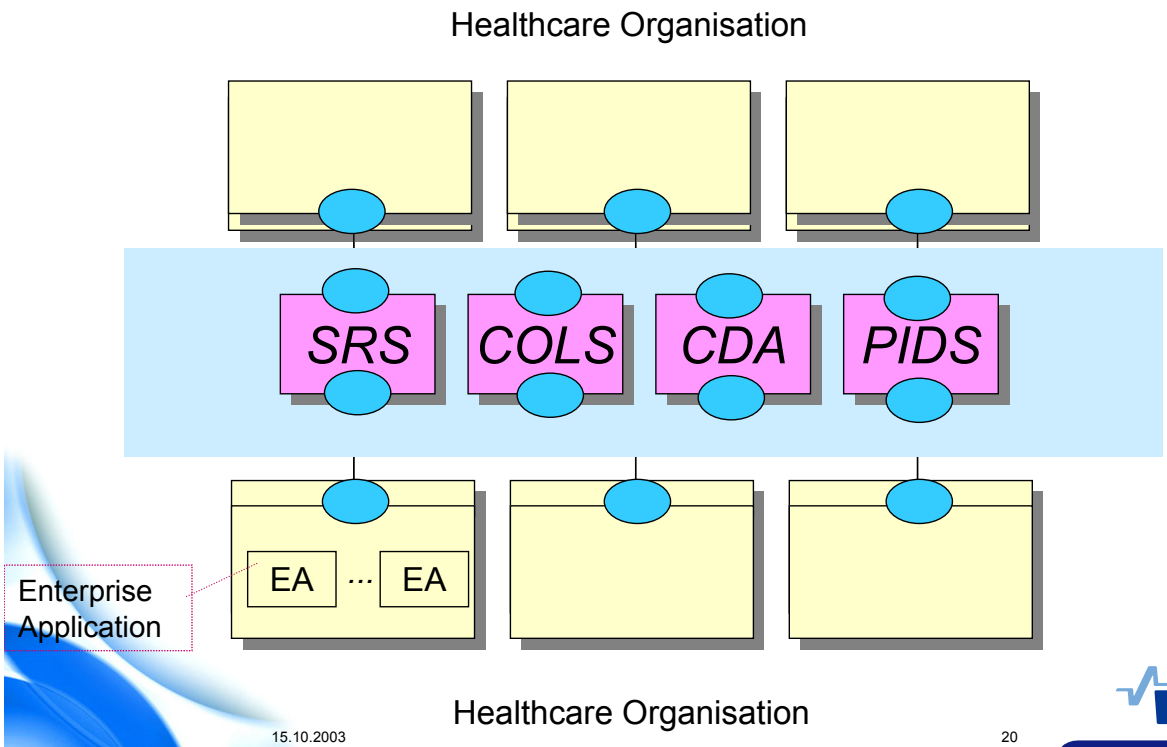
PICNIC IT SERVICES

- From "WISE 18" to PICNIC IT Services
  - Messaging based on CDA Level 1 (XMLS)
  - Patient ID validation (PIDS)
  - Access to patient data stored in the enterprise application systems (SRS)
  - Collaboration for conferencing, referrals and second opinion etc. (COLS)
  - Supported by generic middleware IT services
    - Auditing Service
    - Authentication Service
    - Encryption Service
    - Resource Service
    - Terminology Service
    - User Profile Service

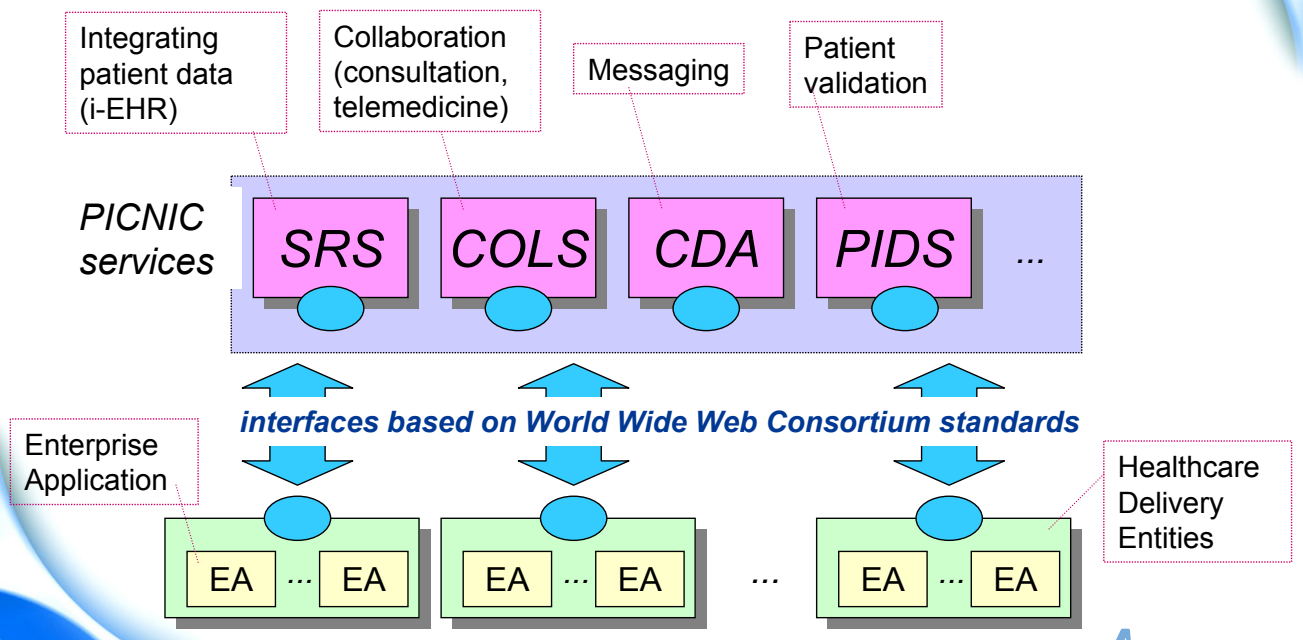
COMMON COMPONENTS IN OPEN SOURCE



PICNIC IT Services



INTER-ENTERPRISE INTEGRATION IN A REGIONAL SETTING



"ISSUES" vs. PICNIC Solutions

Functionality
Interoperability
Security
Flexibility
Scalability
Standards

- PICNIC IT services
  - Common components (identified, implemented in PICNIC)
  - "Implemented in any technology"
- Interfaces complying to
  - Functional interoperability (SOAP / XML)
  - Security (e.g. ISO TR xxx, certificate exchange)
  - Semantic interoperability
    - CDA level 1, only header level (Health Level Seven, HL7)

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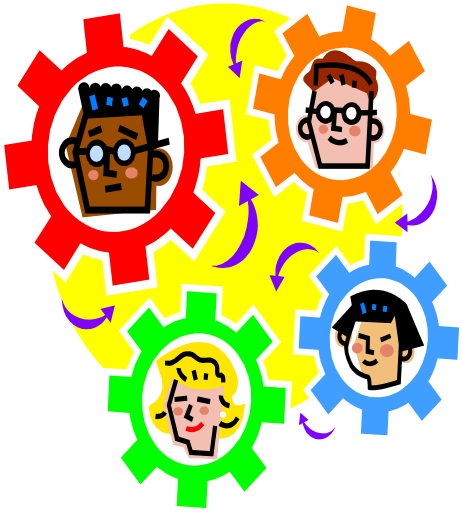
IMPLEMENTATION GUIDE TO USE PICNIC COMPONENTS, IT SERVICES AND ARCHITECTURE

Part of the final architecture deliverable D2.4



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IMPLEMENTATION GUIDE TO USE PICNIC COMPONENTS, IT SERVICES AND ARCHITECTURE 1/3

- *Initial definition of the project*
  - Identify the committed parties within the RHE
- *Planning phase*
  - Analyse what exists
  - Decide which PICNIC IT Services to use
  - Identify the Enterprise Applications to be interfaced with a PICNIC IT Service
  - Decide how security will be handled
  - Select the technology platform
  - Write a project plan
  - Contract vendor(-s) to develop, implement and integrate the system.

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IMPLEMENTATION GUIDE TO USE PICNIC COMPONENTS, IT SERVICES AND ARCHITECTURE 2/3

- *Development phase*
  - Design a Technical Architecture based on web technologies for the RHCN and for its users (the Enterprise Applications through which the PICNIC IT Service(-s) will be accessed)
  - Design a 'federated schema' for the data to be used and communicated in the RHCN
  - Configure the PICNIC components and the interfaces to the Enterprise Applications
  - Design, develop and update the functionality of the Enterprise Applications to make use of the PICNIC IT service(-s).
  - Integrate the new PICNIC IT service(-s) and the added-functionality Enterprise Applications

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IMPLEMENTATION GUIDE TO USE PICNIC COMPONENTS, IT SERVICES AND ARCHITECTURE 3/3

- *Testing and verification phase*
  - Test fully all services/components/systems in the RHCN.
  - Test and validate the whole process and all services/components/applications.
  - Pilot the new RHCN in a few real-time operational contexts.
  - Operationalise the PICNIC IT services and roll-out the RHCN.
  - Enlarge the number of new applications using RHCN services.

WHY USE IT

- PICNIC IT services provide new regional functionality for collaborating healthcare organisations to deliver citizen centred shared care.
- The PICNIC solution has been validated & evaluated & is used
- Regions can use PICNIC IT services with minimal migration as PICNIC IT Services can be added to an existing RHCN autonomously one by one.
- The architecture is based on a cohesive set of main stream Web Services standards and HL7 CDA Level One standard for semantic content.
- It enables competition between vendors as the IT services can be implemented on a technology platform of the vendor's choosing.
- The PICNIC Components are available to anyone in Open Source and can be enhanced by anyone.
- Regions can be joined to a nation-wide IT service infrastructure.

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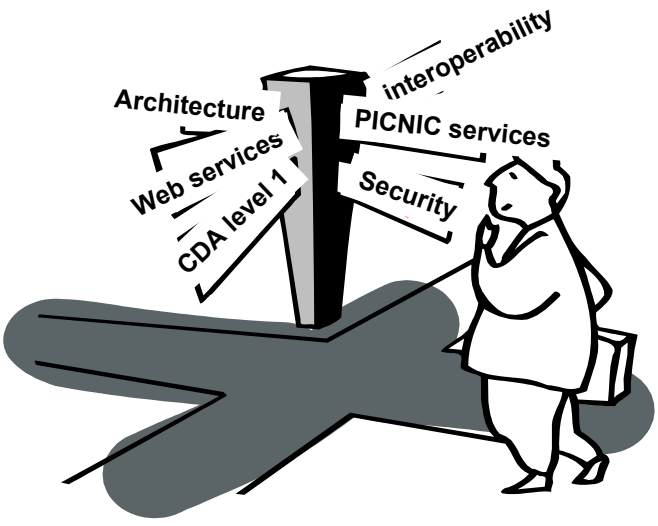
any questions…



www.medcom.dk/picnic

The Shared Record Service: Web-access to patient data from different record systems

Dimitrios G. Katehakis
Senior Telecommunications Engineer
Center of Medical Informatics and
Health Telematics Applications

Ινστιτούτο Πληροφορικής
Institute of Computer Science
Ίδρυμα Τεχνολογίας και Έρευνας
Foundation for Research and Technology Hellas

Institute of Computer Science

- ✓ one of the largest research centers of Greece
- ✓ distributed national research center (seven institutes)

FOR MORE INFO...

http://www.ics.forth.gr/

Center of Medical Informatics and Health Telematics Applications

PICNIC
PROFESSIONALS AND CITIZENS NETWORK FOR INTEGRATED CARE

CRETE – Health Telematics Center

ET-ASSIST European Telemedicine For Medical Assistance

OpenECG

ATTRACT Network Evolution

star

RETRANSPLANT

HECTOR HEALTH EMERGENCY CARE THROUGH TELEMATICS OPERATIONAL RESOURCES

InterCare

ADOL

HEALTHNET

TEMeTeN Towards a European Medical & Teleworking Network

irAiA

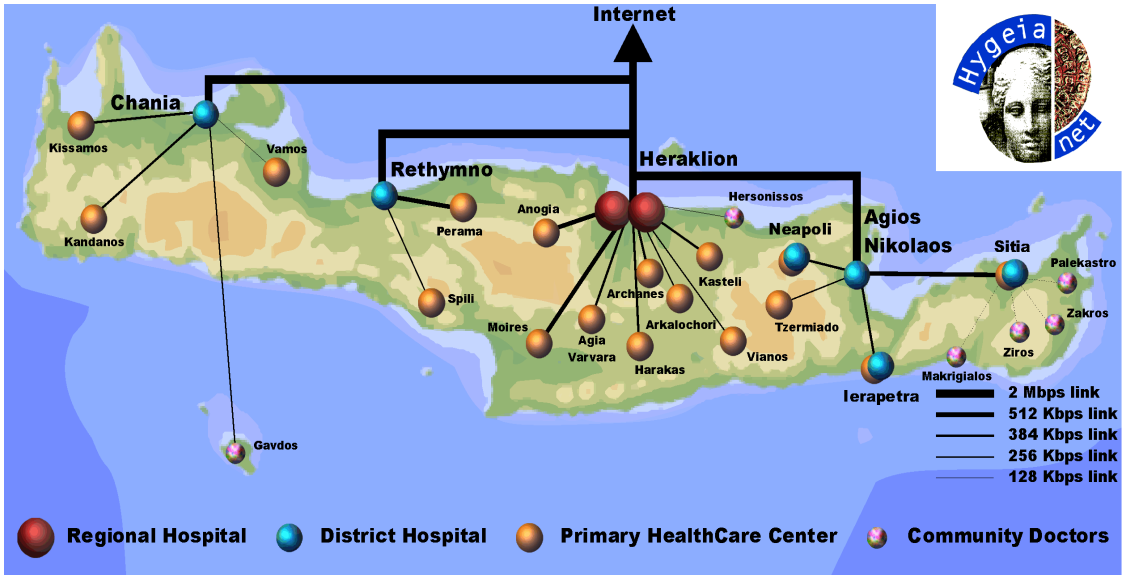
TEN Telemed

JUST in time health emergency interventions

I.H.I.S.

Emispher Europe-Mediterranean Integrated Service Platform for Health, medical Education and Research

HYGEIAnet: Integrated Health Information Network



FOR MORE INFO...

http://www.hygeianet.gr

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eHealth

The eEurope Awards for eHealth to be presented at the:

"eHealth 2003: ICT for Health" - High Level Conference on eHealth, Brussels, 22-23 May 2003

The Commission will organise, in collaboration with the Greek Presidency, a high-level conference on eHealth in Brussels, Belgium, on 22-23 May 2003. The "eHealth 2003: ICT for Health" Conference will bring together European ministers and senior policy makers both from the telecom and health sectors. The objective of this event is to disseminate information on best practices in eHealth and to promote the adoption of eHealth applications across Europe.

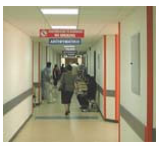
eEUROPE AWARDS FOR eHEALTH CALL FOR APPLICATIONS

- DESCRIPTION OF THE EVENT
- OBJECTIVE OF THIS CALL
- ELIGIBILITY CRITERIA FOR PARTICIPANTS
- SELECTION PROCESS
- DATES AND DEADLINE
- HELPDESK AT EIPA

1. DESCRIPTION OF THE EVENT

- The conference will last for one and a half-days. It will include two plenary sessions, on the mornings of the first and the second day, and four thematic sessions in the afternoon of the first day. These sessions will cover the policy aspects of implementation. The presentations will be chosen to meet the expectations of an audience of ministers and other key policy makers.

Internet



Presentation Overview

- The Integrated Electronic Health Record or Shared Records IT Service
- The Need for an Architecture
- Service Demonstration
- Involved Infrastructure Components
- Deployment under a Different Setting
- HCI Considerations
- International Efforts
- Dependencies – Conclusions
- Status in Greece

What is the EHR?

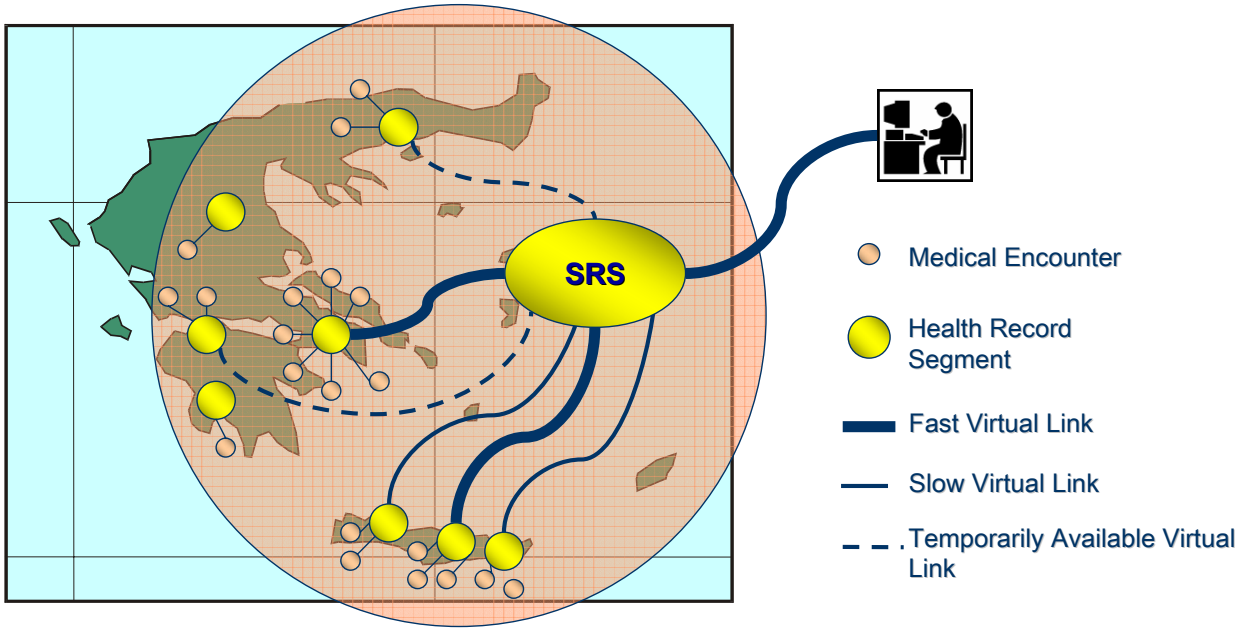
- an electronic longitudinal collection of personal health information usually based on the individual, entered or accepted by health care providers, which can be distributed over a number of sites or aggregated at a particular source. The information is organised primarily to support continuing, efficient and quality health care. The record is under the control of the consumer and is stored and secured securely. (HINA)
- a longitudinal collection of personal health information of a single individual, entered or accepted by health care providers, and stored electronically. The record may be made available at any time to providers, who have been authorized by the individual, as a tool in the provision of health care services. The individual has access to the record and can request changes to its contents. The transmission and storage of the record is under strict security. (OHIH)
- a collection of data and information gathered or generated to record clinical care rendered to an individual. (ASTM)
- a healthcare record in computer readable format (CEN)
- a comprehensive, structured set of clinical, demographic, environmental, social, and financial data and information in electronic form, documenting the health care given to a single individual. (ASTM)
- an electronic patient record that resides in a system designed to support users through availability of complete and accurate data, practitioner reminders and alerts, clinical decision support systems, links to bodies of medical knowledge, and other aids. (IOM)
- a virtual compilation of non-redundant health data about a person across a lifetime, including facts, observations, interpretations, plans, actions, and outcomes. Health data include information on allergies, history of illness and injury, functional status, diagnostic studies, assessments, orders, consultation reports, treatment records, etc. Health data also include wellness data such as immunization history, behavioral data, environmental information, demographics, administrative data for care delivery processes, health insurance, and legal data such as consents. (CPRI)

ISO/ TC 215 Ad Hoc Group Report, Standards Requirements for the Electronic Health Record & Discharge/ Referral Plans, Final Report, July 26, 2002.

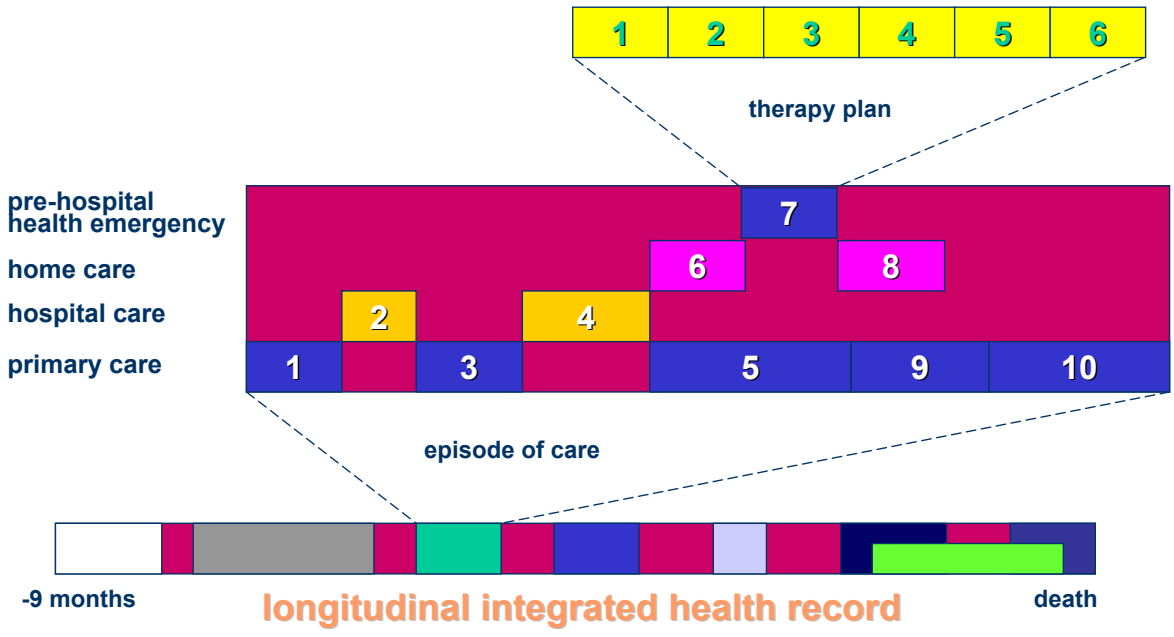
The Shared Records Service:

- An IT Service for professionals or citizens who need a uniform way to access parts of patient record data that are physically located in different clinical information systems.
- Provides fast, secure and authorized access to distributed patient record information from multiple disparate sources.
- This service should not be confused with
  - Autonomous Clinical Information Systems (CIS)
  - Message based communication of EHR data
  - Centralized Clinical Data Repositories (CDR), or
  - Monolithic information systems that have embedded in their structure mechanisms for accessing directly host systems.

The Concept in Space



The Concept in Time

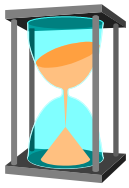


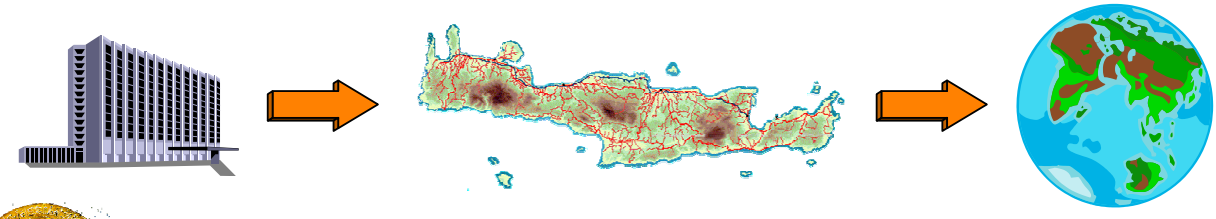
Problems & Needs

- Clinical information consists of composite data that come from various sources and exist in multiple formats.
- There is no single method, format, standard or process for the integration or the exchange of clinical information.
- Thorough medical information about an patient is difficult to be obtained in an efficient manner.
- Seamless integration of distributed EHR fragments requires interoperability between individual clinical information systems.

Basic Principles

- Promotion of Interoperability
- High Quality Services
- Modular Architecture
- Evolution from Current State



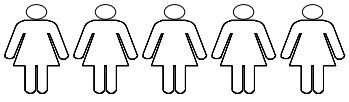


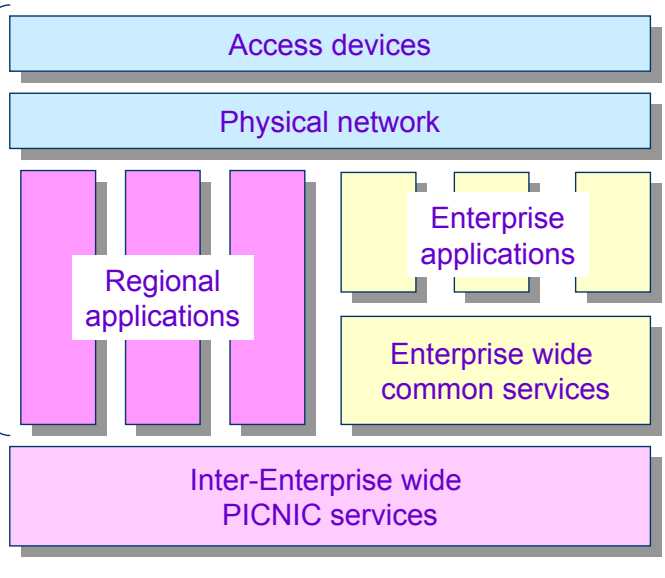
Architecture

PICNIC
PROFESSIONALS AND CITIZENS NETWORK FOR INTEGRATED CARE

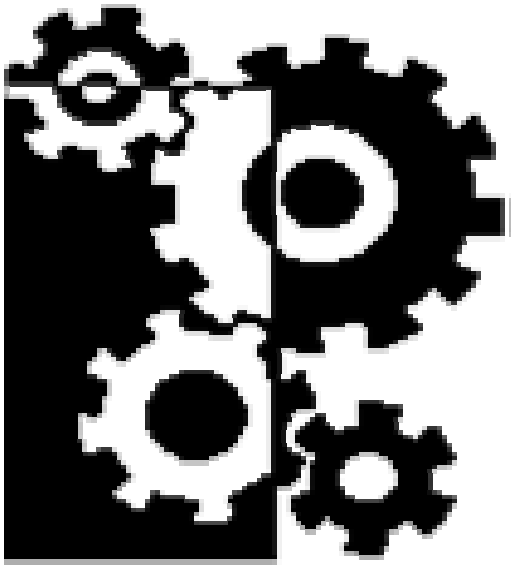
Physical users access regional and enterprise applications through various access devices using wired and wireless networks

Common services are used by regional and enterprise applications to enable inter-operability and to add modularity





Enabling Components



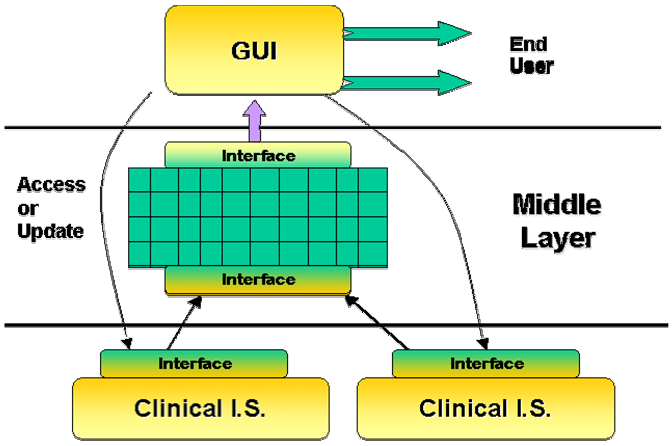
- Patient Identification Services
- SRS Indexing Services
- Clinical Observations Access Services
- SRS Update Brokers
- Resource Services
- Terminology Services
- Message Brokers
- Collaboration Services
- User Profile Services

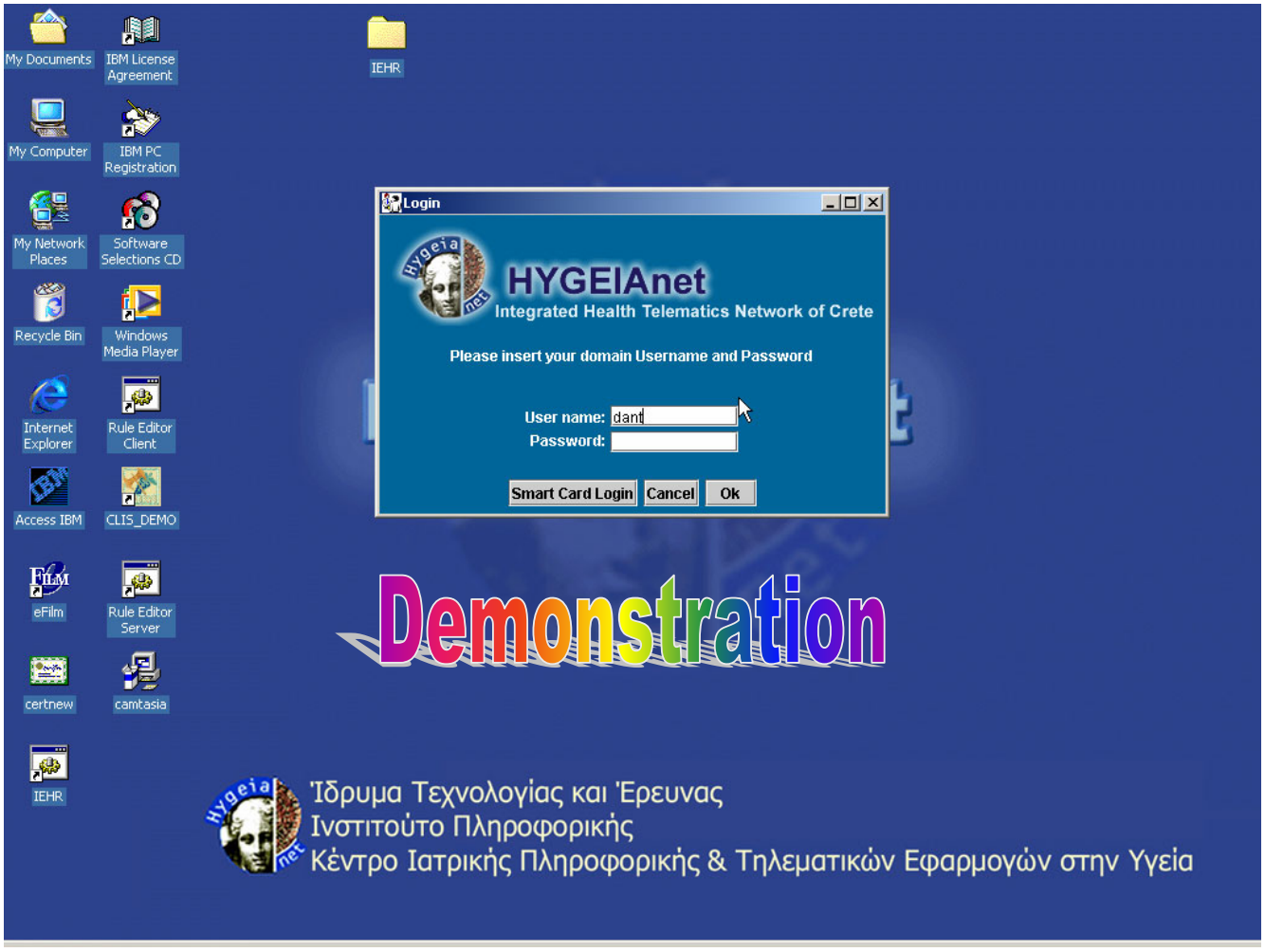
Security Services

- Access Control
- Auditing
- Certification
- Client Authentication
- Client Impersonation and Delegation
- Consent Management
- Cryptography
- Smart Cards

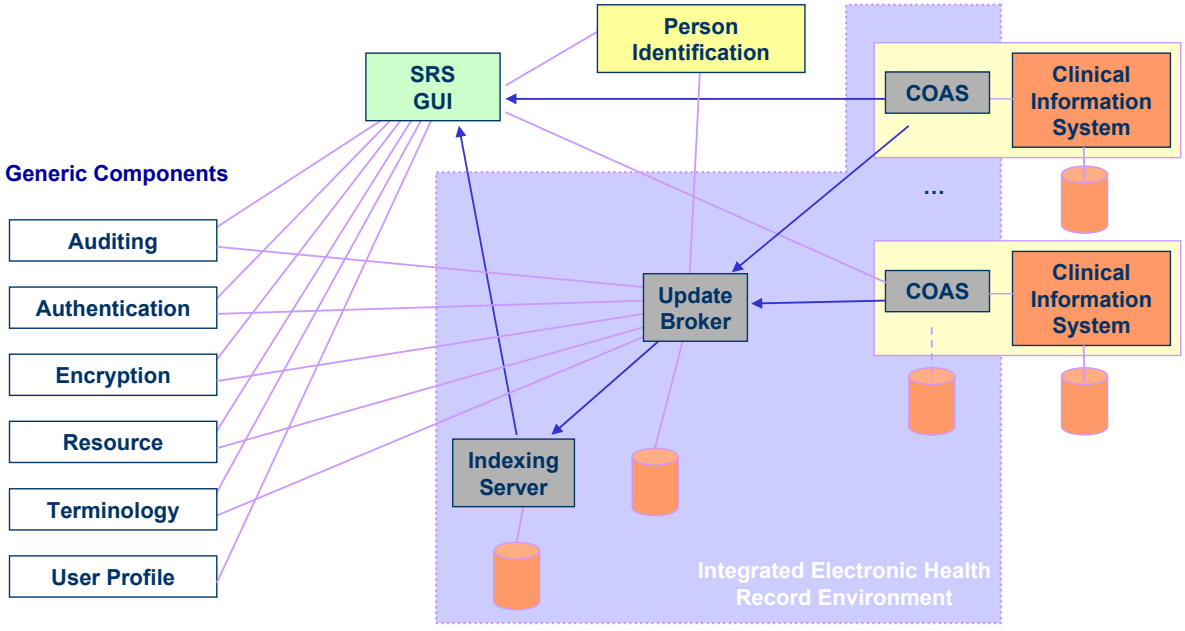
Scenario of Use:

- Clinical data acquisition
- Integration with the Federation
- Interfacing with the SRS
- Access to clinically significant information





Component Orchestration



Federated Approach

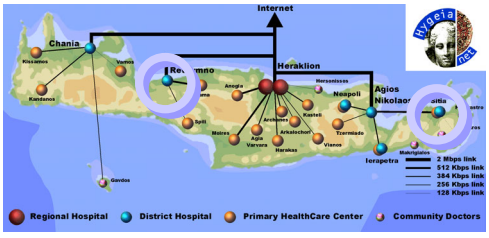
- depends upon a common/ federated canonical model
- based on an underlying infrastructure (middleware)
- requires the existence of data extraction gateways

- data from the participating systems have a predefined place in the overall model or architecture of the EHR

- requires schema integration/ translation effort
- agreeing on a common data structure for the EHR is difficult, across different settings.

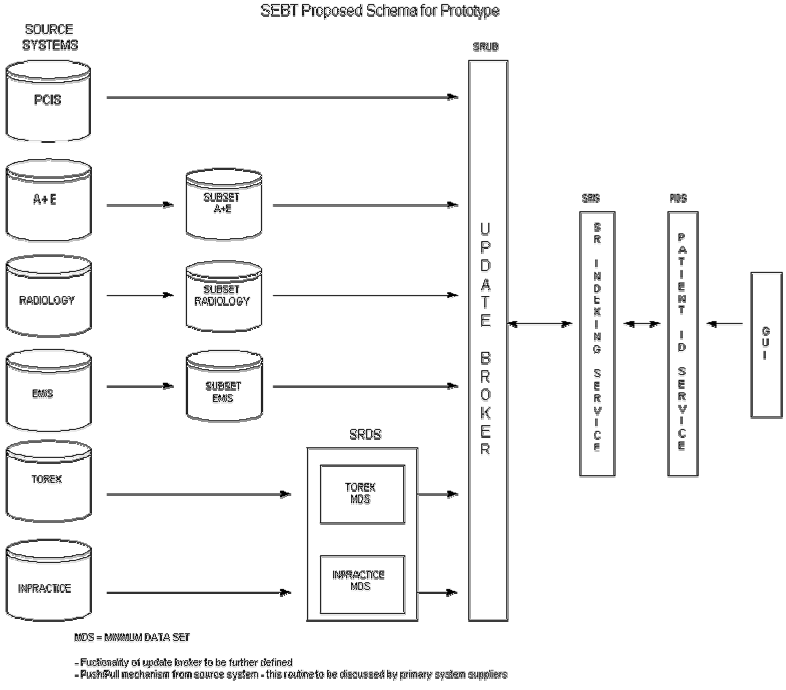
Crete Pilot

- Involves
  - two hospitals
    - Sitia
    - Rethymno
  - five vendors
    - FORTH (•)
    - Πληροφορική Ελλάδας (•)
    - Computer Team (•)
    - Unisoft (•)
    - CCS (•)
  - nine clinical information systems
    - PHCCIS (•)
    - PATHIS (•)
    - XRFDC (•)
    - CARDIS (•)
    - NIS (•)
    - LIS (•)
    - Administrative (•)
    - Financial (•)
    - Pharmacy (•)

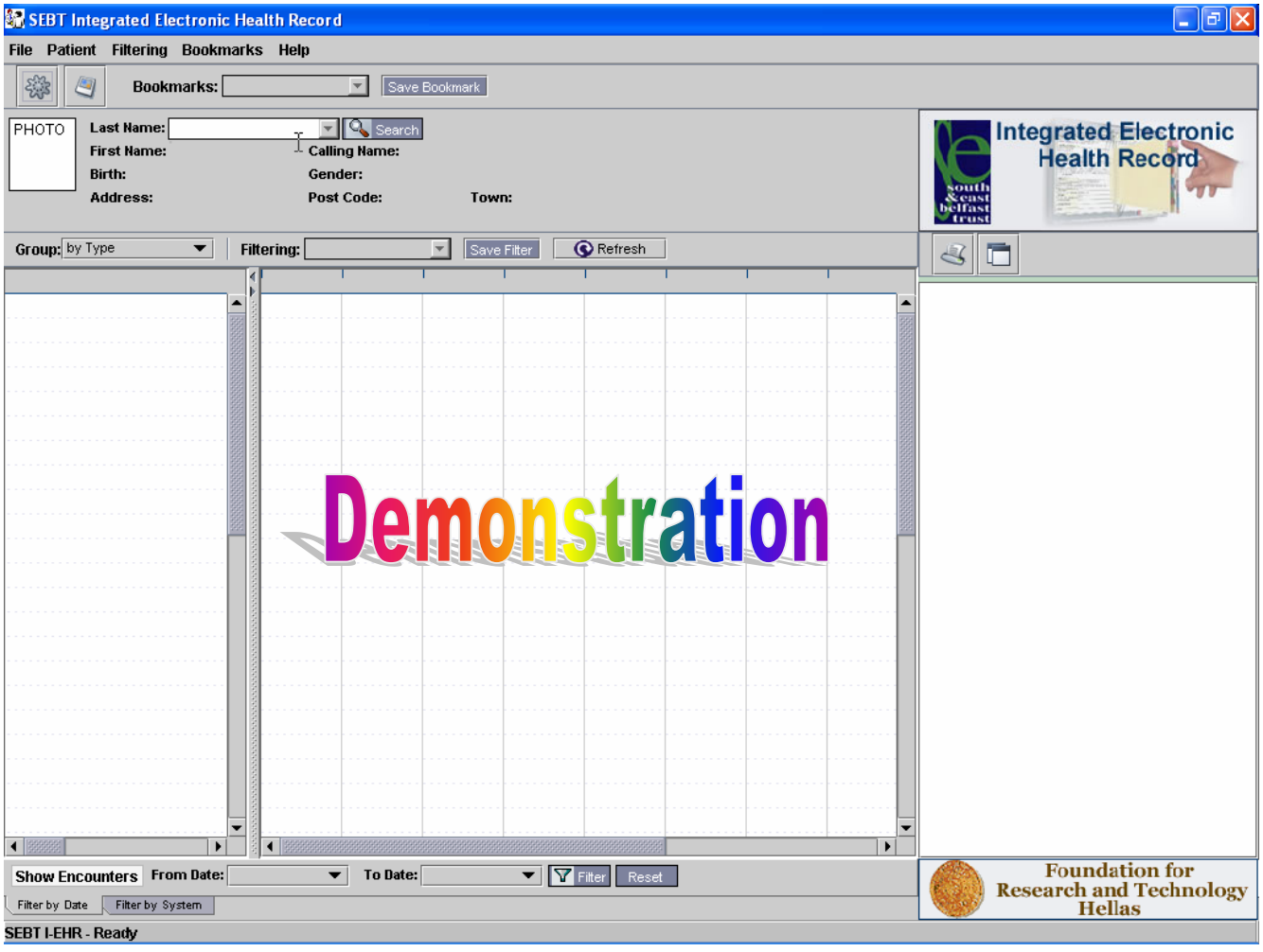


SEBT Prototype: Out of Hours GPs

Allergy
Referral
Medication
Event
Consultation

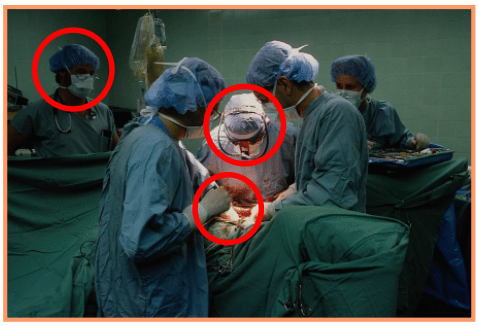


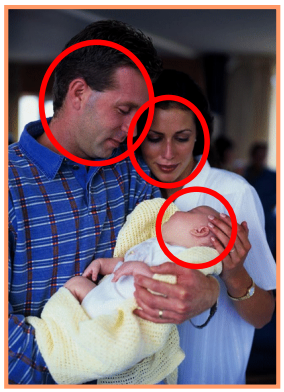
south & east belfast trust
Bringing Care To People

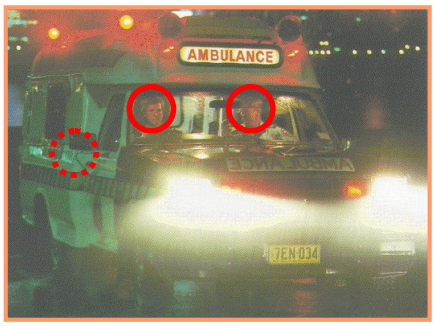


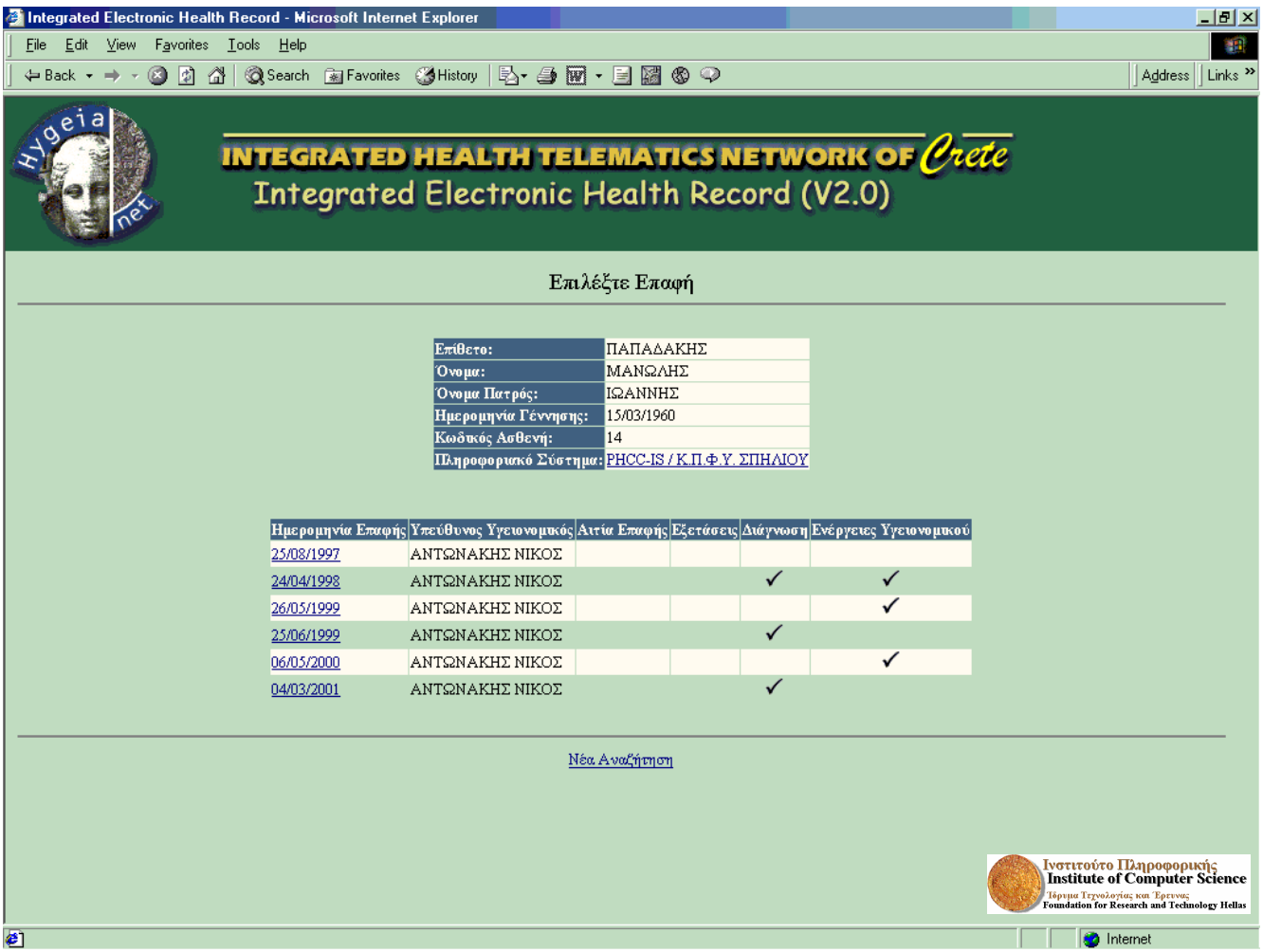
Universal Access in Information Society

- Variety
  - **Application Domains**
    - **EPR; tele-consultation; tele-management, training & education; hospital information systems; ….**
  - **Technologies**
    - **Existing and future hardware (not limited to computers) and software (operating systems, applications, …) technology**
  - **End-user Environments**
    - **Hospital, infirmary, pharmacy, home, ambulance, street….**
  - **Population - target**
    - **Persons of different age, cultural roots, education, training and professional experience, experience in the use of computers, …**
    - **Different roles in the use of services and applications: physicians, nurses, patients, …**






AMBULANCE


Integrated Electronic Health Record - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Address Links
Hygeia net
INTEGRATED HEALTH TELEMATICS NETWORK OF Crete
Integrated Electronic Health Record (V2.0)
Επιλέξτε Επαφή
Επίθετο: ΠΑΠΑΔΑΚΗΣ
Όνομα: ΜΑΝΩΛΗΣ
Όνομα Πατρός: ΙΩΑΝΝΗΣ
Ημερομηνία Γέννησης: 15/03/1960
Κωδικός Ασθενή: 14
Πληροφοριακό Σύστημα: PHCC-IS / Κ.Π.Φ.Υ. ΣΠΗΛΙΟΥ
Ημερομηνία Επαφής | Υπεύθυνος Υγειονομικός | Αιτία Επαφής | Εξετάσεις | Διάγνωση | Ενέργειες Υγειονομικού
25/08/1997 | ΑΝΤΩΝΑΚΗΣ ΝΙΚΟΣ
24/04/1998 | ΑΝΤΩΝΑΚΗΣ ΝΙΚΟΣ | ✓ | ✓
26/05/1999 | ΑΝΤΩΝΑΚΗΣ ΝΙΚΟΣ | ✓
25/06/1999 | ΑΝΤΩΝΑΚΗΣ ΝΙΚΟΣ | ✓
06/05/2000 | ΑΝΤΩΝΑΚΗΣ ΝΙΚΟΣ | ✓
04/03/2001 | ΑΝΤΩΝΑΚΗΣ ΝΙΚΟΣ | ✓
Νέα Αναζήτηση
Ινστιτούτο Πληροφορικής
Institute of Computer Science
Ίδρυμα Τεχνολογίας και Έρευνας
Foundation for Research and Technology Hellas
Internet

Fragment IDs - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

ΟΛΟΚΛΗΡΩΜΕΝΟΣ ΗΛΕΚΤΡΟΝΙΚΟΣ ΦΑΚΕΛΟΣ ΥΓΕΙΑΣ

Αναζήτηση ασθενή με επιθετο

Αναζήτηση

Αρχική Σελίδα | Σύνθετη Αναζήτηση | Βοήθεια

Γλώσσα : Greek

• Patient Demographic

FirstName: ΝΙΚΟΛΑΟΣ
LastName: ΑΡΒΑΝΙΤΑΚΗΣ
Sex: Male
ParentName: ΜΑΝΩΛΗΣ

• Patient visit

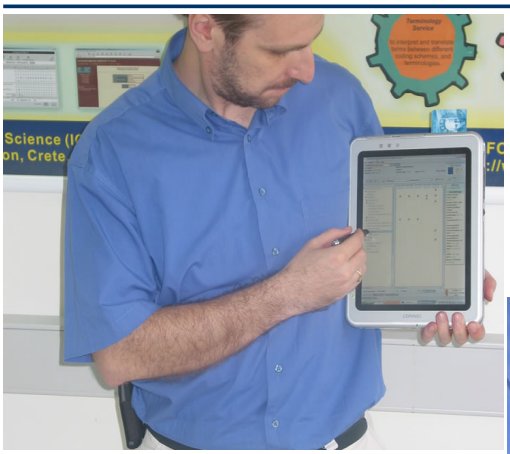
- Ιστορικό Ασθενή
  - 02/07/1997
  - 09/07/1997
  - 03/08/1997
  - 03/08/1997
  - 03/08/1997
  - 03/08/1997
  - 23/09/1997
  - 29/09/1997
  - 30/10/1997
  - 26/06/1997
  - 26/07/1997
  - 26/06/1997
  - 19/06/1996
  - 14/04/1993

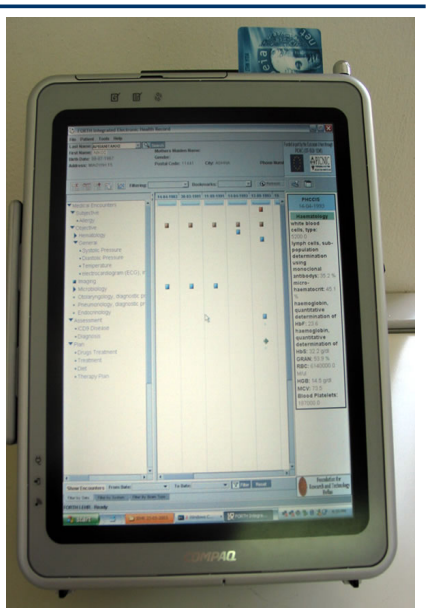
• Results

- :SPILI_COAS
  - Επίσκεψη
    - Συμπτώματα : ΙΛΙΓΓΟΣ
    - Κλινικές Εξετάσεις
      - Συστολική Πίεση : 170.0
      - Διαστολική Πίεση : 90.0
    - Ενέργειες
      - Φαρμακευτική Αγωγή
        - Φάρμακο : VERTIGO-VOMEX
        - Σχόλια : 1X3
      - Δίαιτες
        - Δίαιτα : Δίαιτα υπερλιπιδαιμίας

Ινστιτούτο Πληροφορικής
Institute of Computer Science
Ίδρυμα Τεχνολογίας και Έρευνας
Foundation for Research and Technology Hellas

Done Internet





Active I-EHR

- An 'active I-EHR' can be used to automatically generate alarms, alerts & reminders

  requires mechanisms to:
  - automatically and continuously monitor health status and the data in the EHR
  - evaluate current treatments and
  - propose new treatments
- Link the record to external knowledge
  - guidelines
  - protocols
  - genetic information

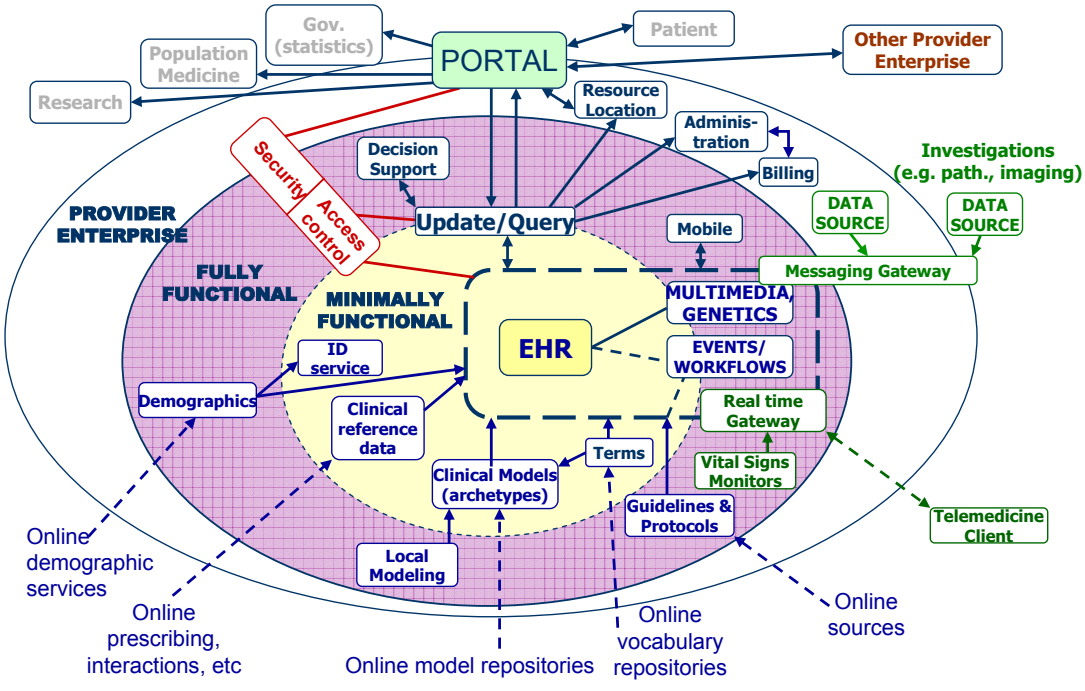
Dependencies …

- Existence of Reliable and Useful Information
- Patient Identification
- Availability of Information
- Use of Coding Schemes
- Systems Interoperability
- Patient Consent on Sharing Personal Information
- Organizational Commitment
- Legal Framework

International Efforts in Developing the EHR

- EU Projects
  - GEHR
  - Synapses
  - InterCare
  - SynEx
- Open Source Software
  - OpenEMed
    - Los Alamos, NM, USA
- Australia Initiatives
  - GEHR
  - OpenEHR
- Standards
  - CEN/ TC 251
    - WGI, Information Models
    - WGIV, Technology for Interoperability
  - ISO TC 215
    - WG1, Health Records and Modeling Coordination
  - ASTM
    - E31, Health Informatics
  - HL7
    - CDA, RIM
  - OMG
    - Healthcare DTF

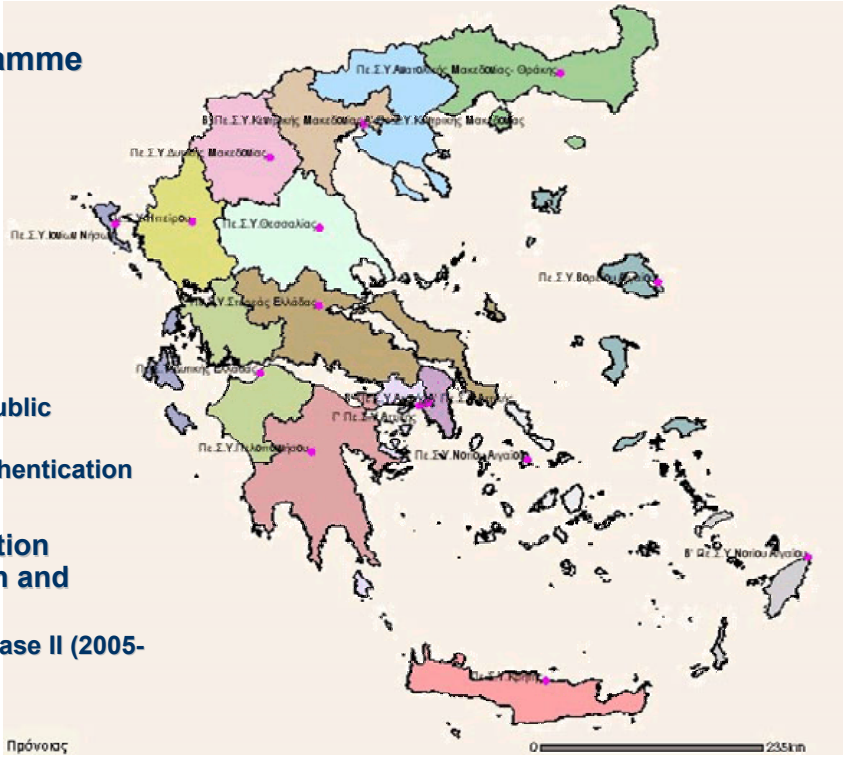
Are there "open issues" ??



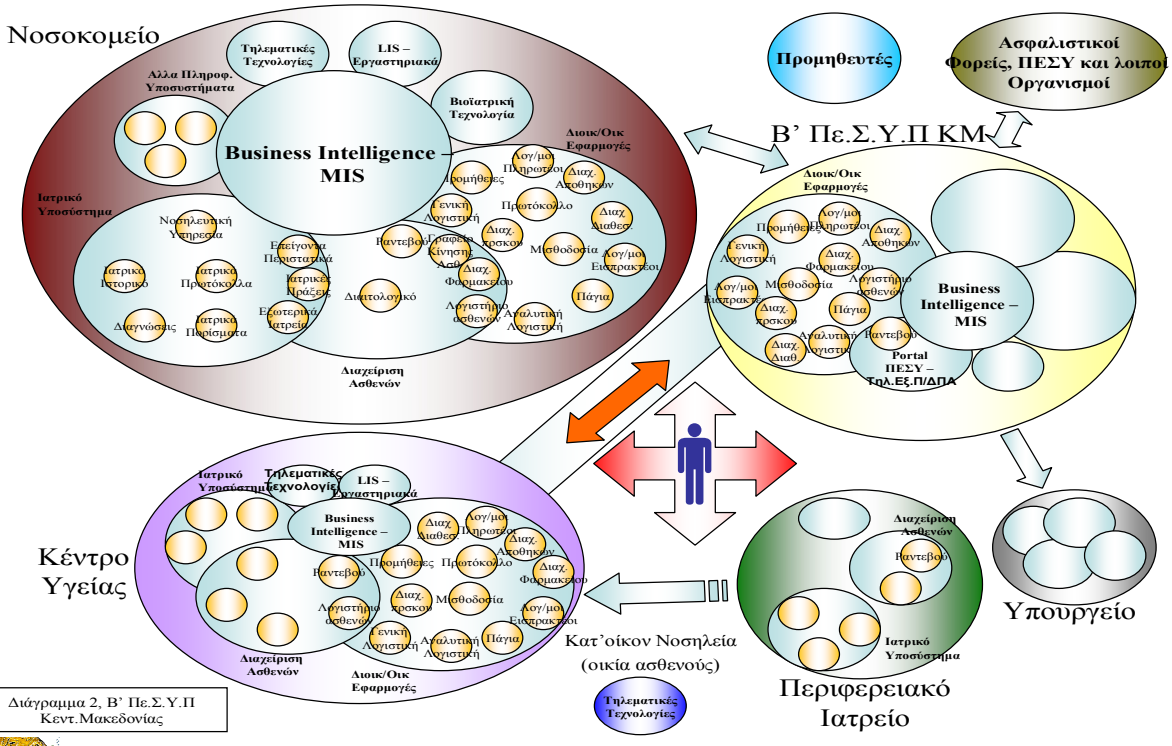
ISO/ TC 215 Ad Hoc Group Report, Standards Requirements for the Electronic Health Record & Discharge/ Referral Plans, Final Report, Jul y 26, 2002.

Current Activities in Greece

- **Information Society Programme 2002-2006**
  - **National Public Administration Network – SYZEFXIS (MINISTRY OF THE INTERIOR, PUBLIC ADMINISTRATION & DECENTRALIZATION)**
    - **Broadband network of public sector Services**
    - **User Identification & Authentication**
  - **Integrated Health Information System (Ministry of Health and Welfare)**
    - **Phase I (2002-2004) & Phase II (2005-2006)**



Content of a Typical Tender



Technical Requirements

- Complete Security Operation Plan
  - Risk Assessment and Security Plan Development
  - Data Protection and Privacy
  - Security Safeguards-Countermeasures
  - Disaster Recovery Plan-Contingency Plan
- Scalability
  - Shared Records → Integrated Electronic Health Record
- Utilization of the SYZEFXIS Infrastructure
- Interoperability between Applications and Services
  - Integrated Systems
  - Use of Standards
  - Incorporation of Legacy Systems
  - Adoption of HL7 (Conformance Statement & Profiles)

Conclusions

- *"The initial challenge with implementing electronic health records is knowing where to start. The pragmatic approach is to start small and then incrementally expand the implementation of the electronic health record system over time"*

[Office of Health and the Information Highway Health Canada: "Advisory Committee on Health Infostructure, Tactical Plan for a pan-Canadian Health Infostructure", 2001 Update, November 2001]

- The needs for stability, manageability, maintainability and most importantly ability to evolve are of paramount importance;
- The multitude of complex issues arising in developing a longitudinal I-EHR was successfully solved through
  - evolving technical infrastructure
  - a component based architecture
  - consistent use of widely available standards and technical frameworks
- Whatever the technical platform is in real life, its selection is only part of the solution.

Future-Proof Architectures for Secure Information Systems: Generic Models for Specifying Components and their Aggregations (RM-ODP. HARP, ...)

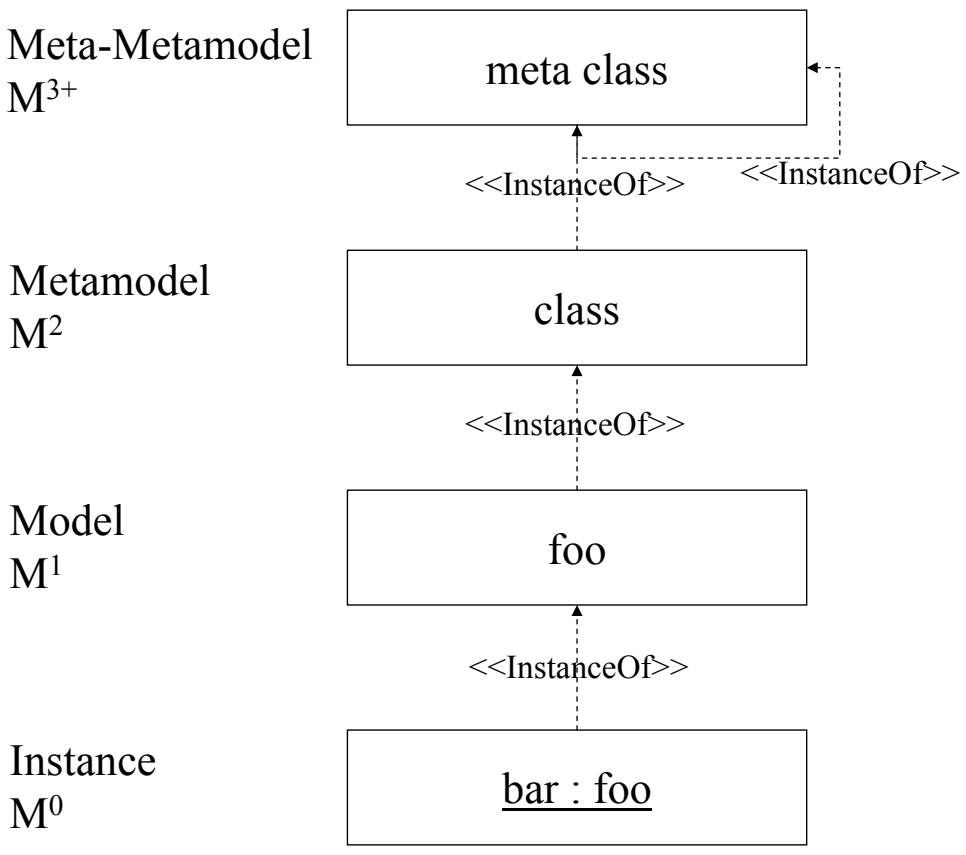
Bernd Blobel
Otto-von-Guericke University Magdeburg
Email: bernd.blobel@mrz.uni-magdeburg.de

Related Projects

- The following presentation is influenced by our work, e.g., at ISO TC 215 “Health Informatics”, CEN TC 251 “Health Informatics”, HL7 Communication Standard v3 and HDF, openEHR, DoD Governmental ePeople Project, Australian Healthnet, German Health Telematics Platform

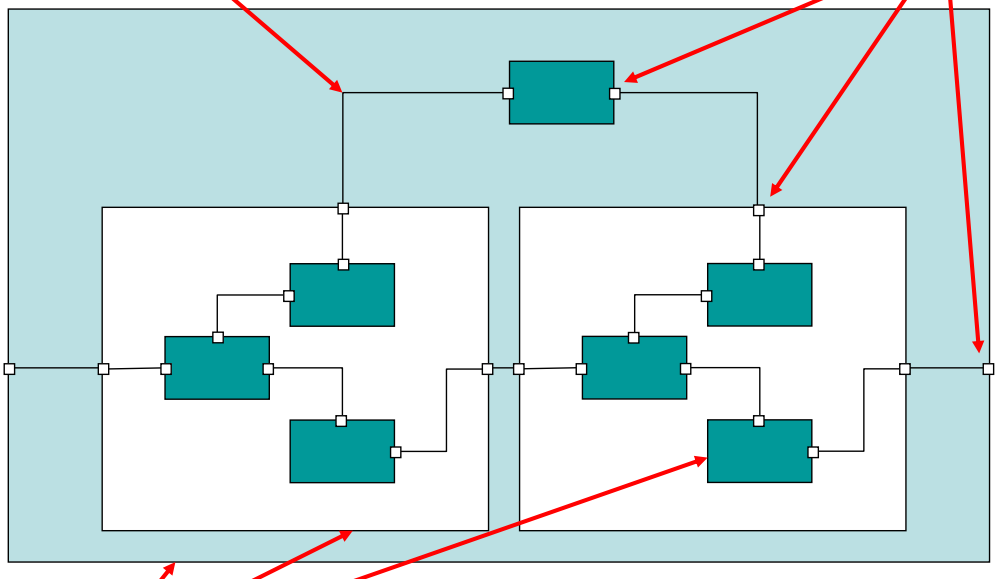
Architectural Paradigms for Future-Proof HIS

- Distribution
- Component-orientation (flexibility, scalability)
- Separation of platform-independent and platform-specific modelling →
- Separation of logical and technological views (portability)
- Specification of reference and domain models at meta-level
- Interoperability at service level (concepts, contexts, knowledge)

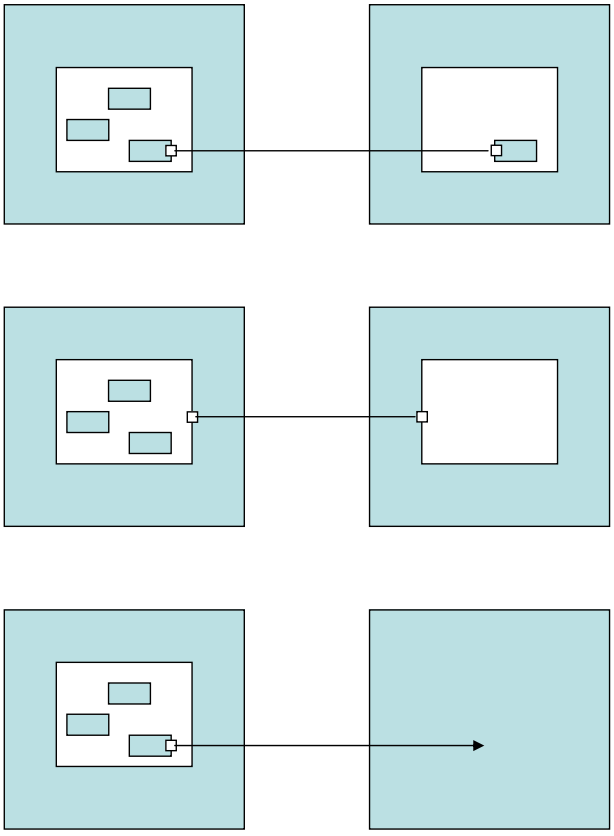


Component Decomposition (Granularity) \ Component View	Enterprise View	Information View	Computational View	Engineering View	Technology View
Business Concepts					
Relations Network					
Basic Services/ Functions					
Basic Concepts					

Hierarchically Built Capsules



Encapsulation Shell
(Capsule / Active Object)

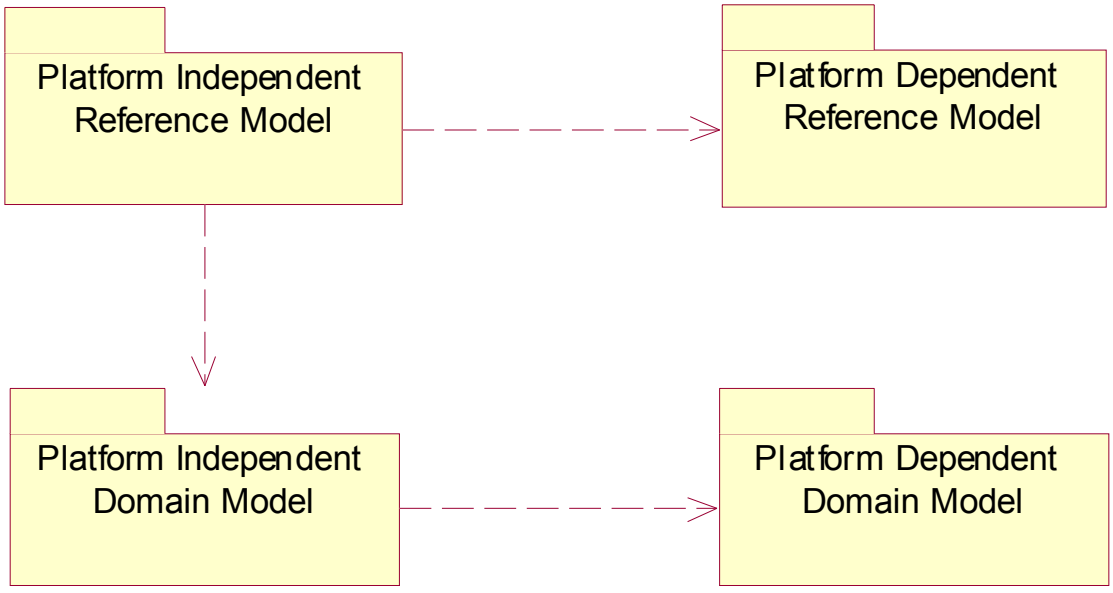


General Development Path

- Basis for the IS design are connected model pairs
  - platform-independent reference model
  - platform-independent domain model

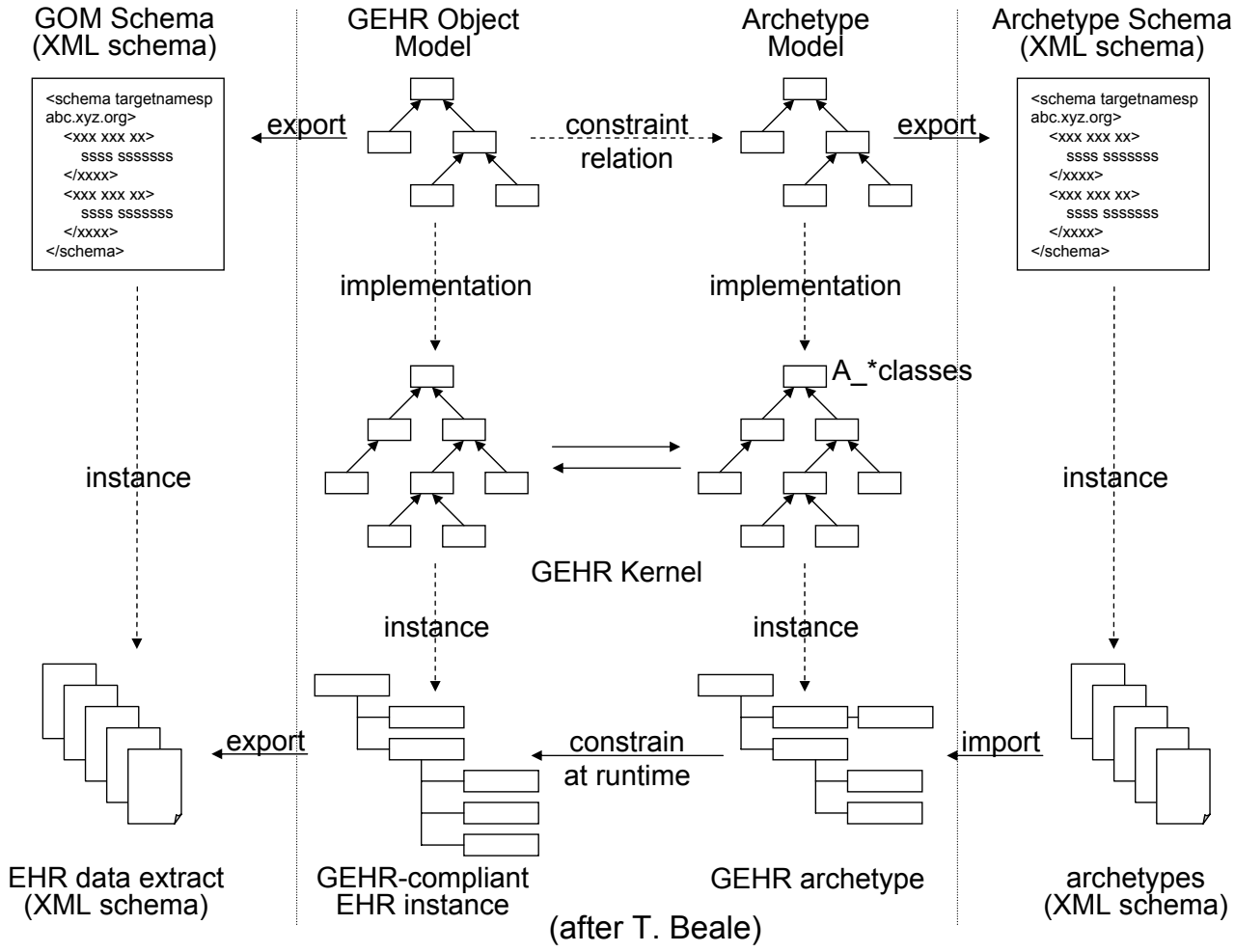
  which are used to derive the platform-specific models.

CORBA 3 MDA Schema



Domain Model

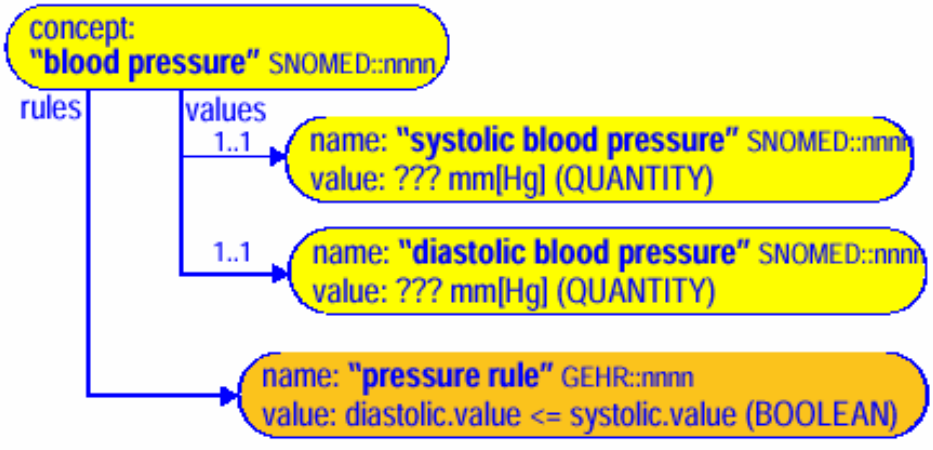
- The domain model describes the domain-specific constraints resulting from domain-specific requirements and representing the domain-specific knowledge for all the levels of abstraction mentioned. This concerns medical knowledge as well as legal basics, organisational relationships and the specific workflow.



(after T. Beale)

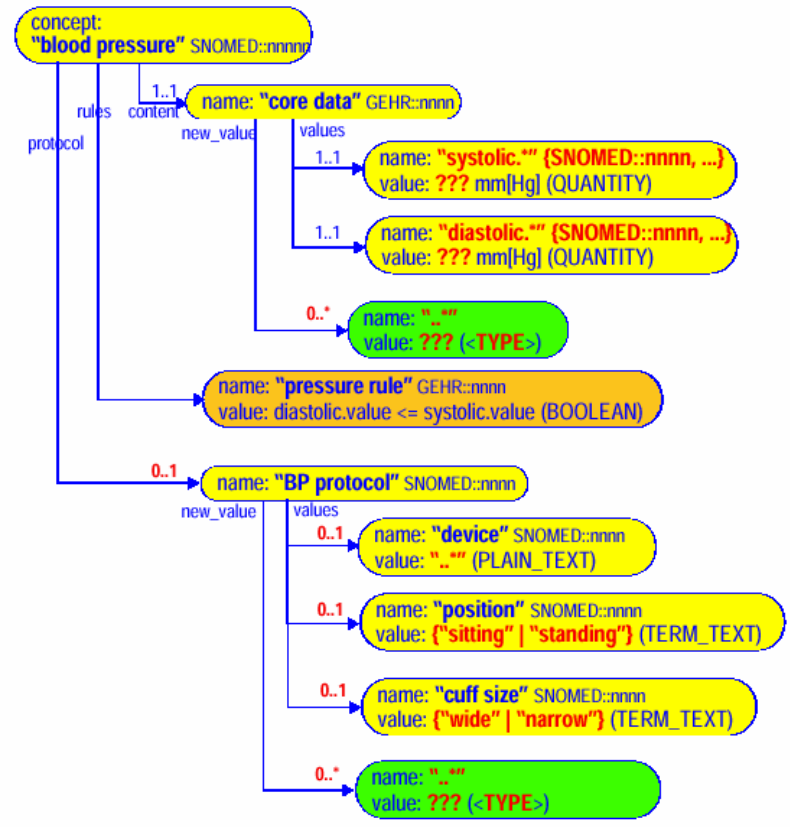
Simple Model of Blood Pressure

after T. Beale



Improved Domain Model of Blood Pressure Concept

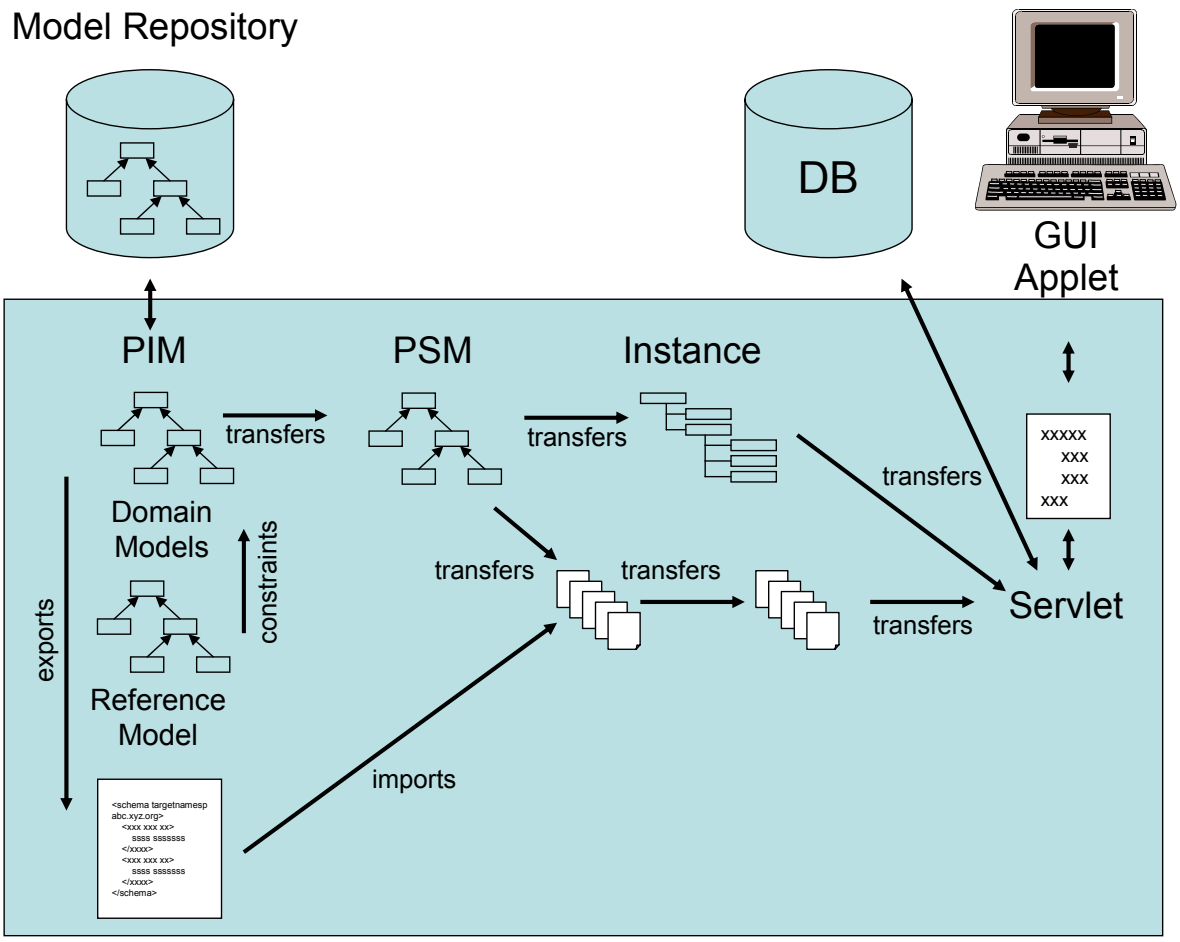
after T. Beale



General Development Path

- Basis for the IS design are connected model pairs
  - platform-independent reference model
  - platform-independent domain model

  which are used to derive the platform-specific models.
- Thereby, the models follow the approach of the Generic Component Model based on the ISO Reference Model - Open Distributed Processing (RM/ODP).
- By that way, the different development phases from general requirements over domain-specific views up to implementation and maintenance of any HIS can be described.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Applet
PIM
PSM
Instance
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transfers
transfers
Domain
Models
constraints
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Servlet
exports
Reference
Model
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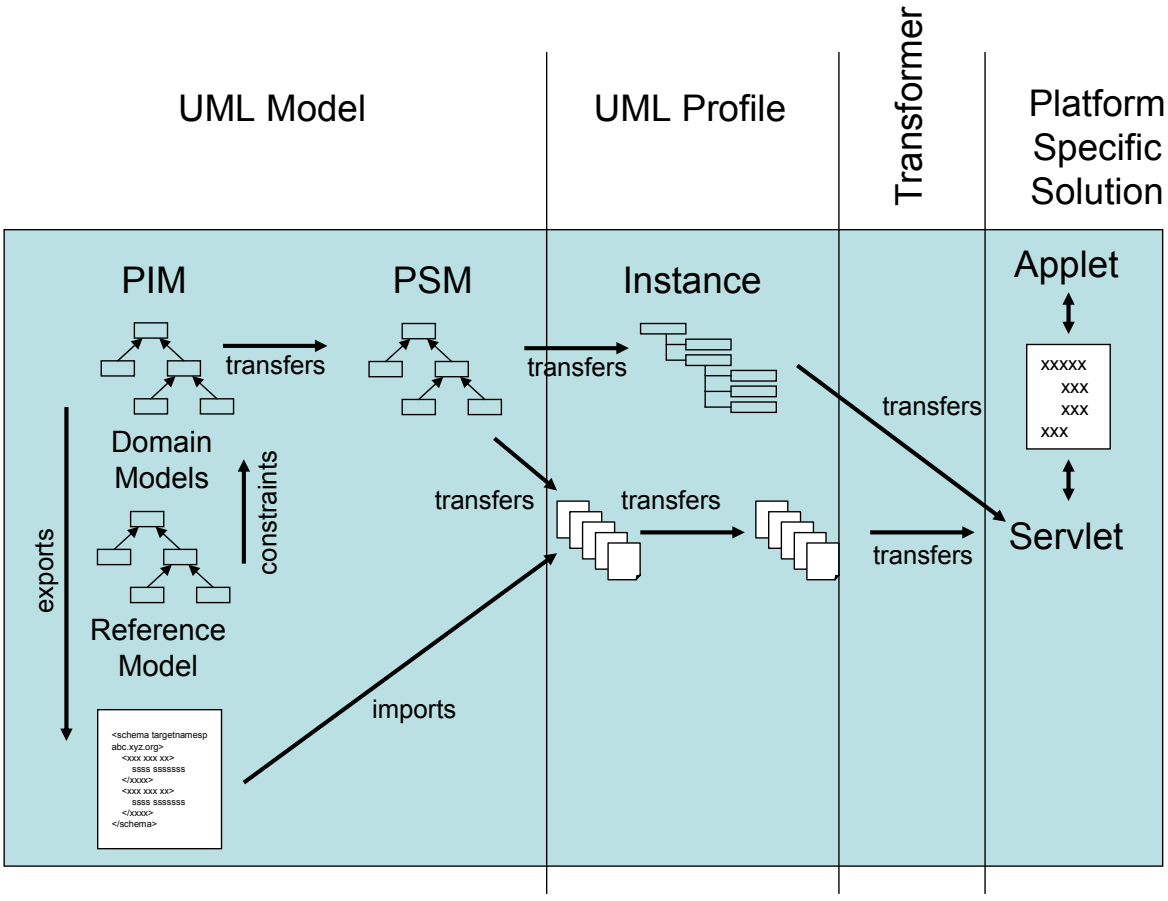
UML Model
UML Profile
Transformer
Platform
Specific
Solution
PIM
PSM
Instance
Applet
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transfers
transfers
Domain
Models
constraints
transfers
transfers
transfers
Servlet
exports
Reference
Model
imports
xxxxx
xxx
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xxx
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abc.xyz.org>
<xxx xxx xx>
ssss sssssss
</xxxx>
<xxx xxx xx>
ssss sssssss
</xxxx>
</schema>

Security Infrastructure

- Assurance of communication security and application security based on security token, a PKI as well as Trusted Third Party (TTP) Services

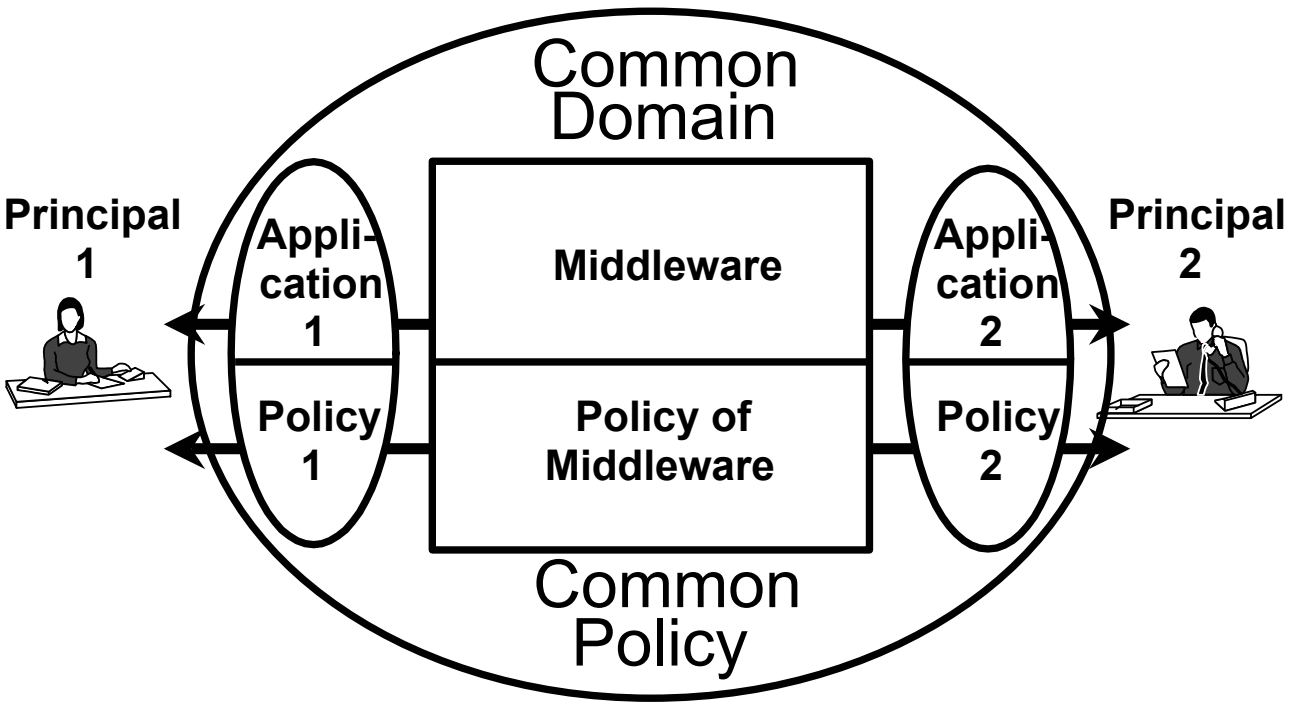
Communication Security

- Strong mutual authentication
- Management of access to systems
- Assuring integrity, confidentiality, and accountability/auditability of communicated information

Application Security

- User and role management
- Authorisation
- Access control including emergency access management
- Assurance of integrity, availability, confidentiality, and accountability/ attributability of stored and processed information
- Audit

Policy Bridging



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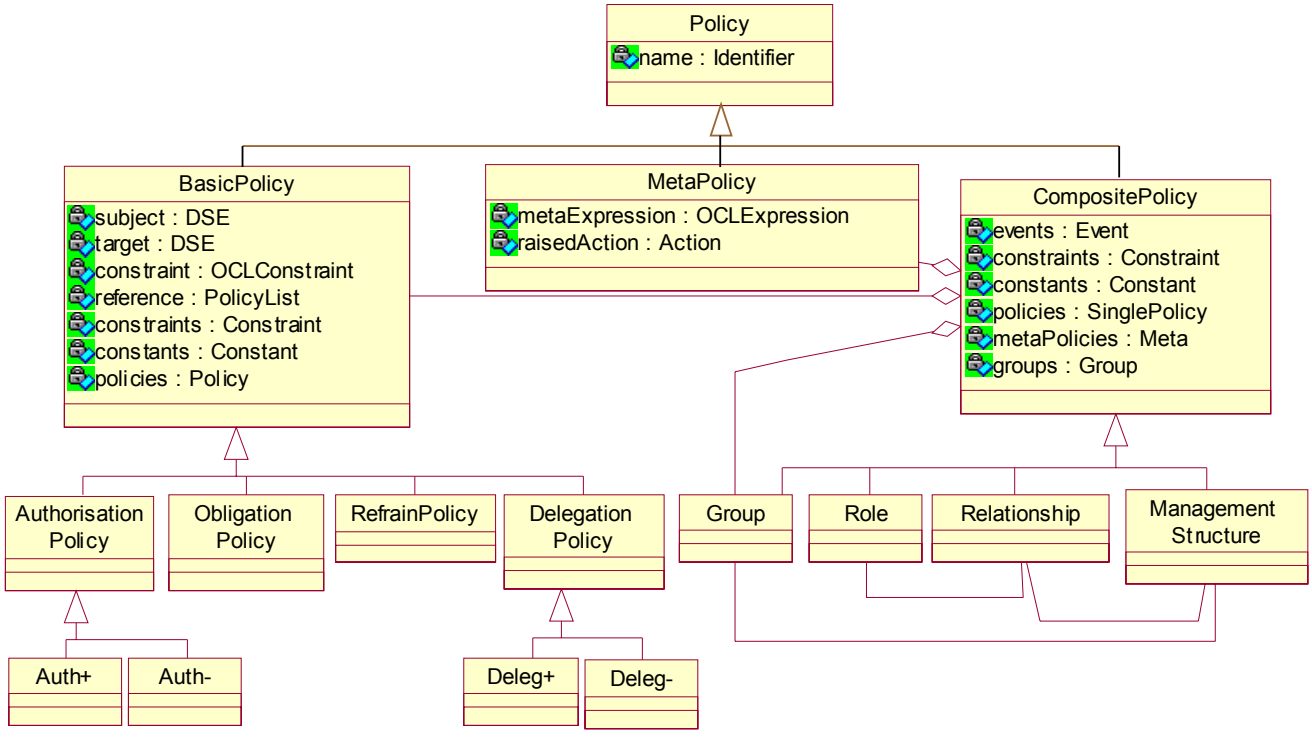
        </target_list>
</policy>
```

PONDER Base-Class Diagram



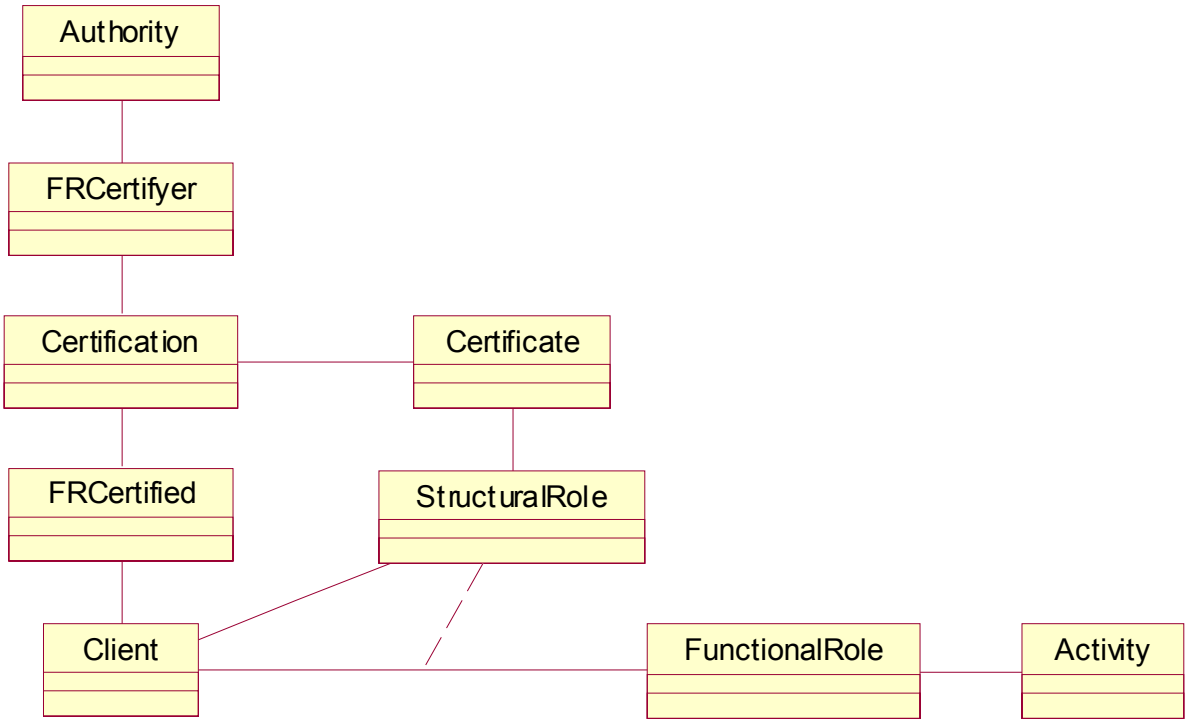
Damianou N, Dulay N, Lupu E, Sloman M. Ponder: A Language for Specifying Security and Management Policies for Distributed Systems. The Language Specification, Version 2.3. Imperial College Research Report DoC 2000/1. 20 October, 2000

Roles

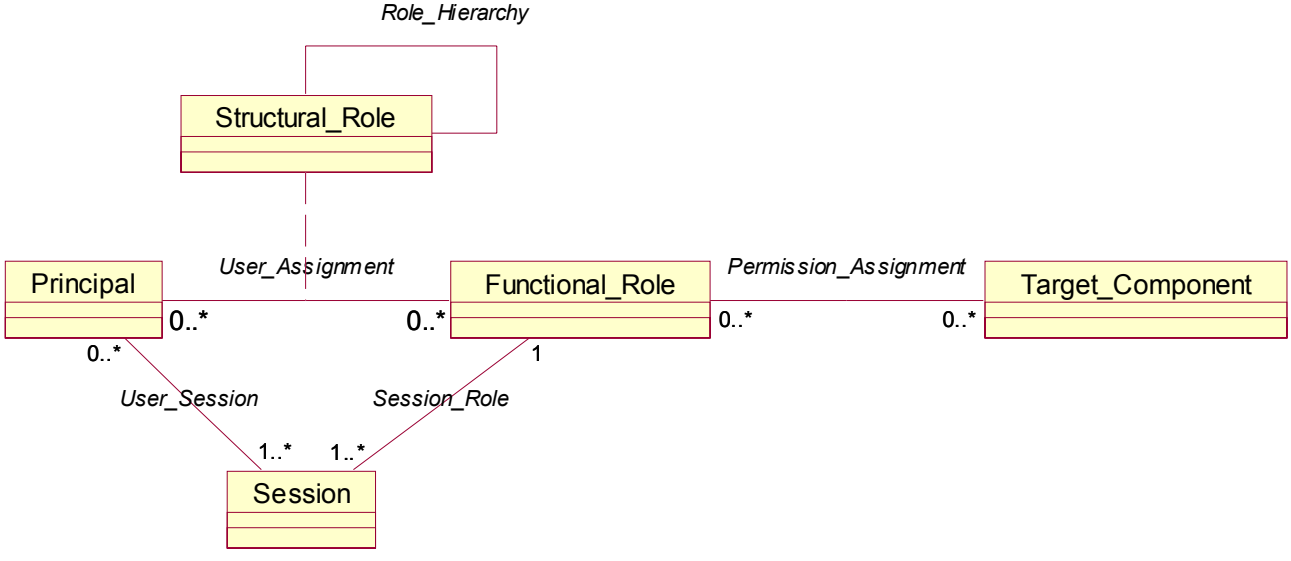
- A role is related to a set of competences and/or performances that are associated with a task.
- For managing role-relationships between the entities, organisational and functional roles can be defined.
- Organisational roles specify relations between entities in the sense of competence (RIM roles) often reflecting organisational or structural relations (hierarchies).
- Functional roles are bound to an act. Functional roles can be assigned to be performed during an act. They correspond to the RIM participation.
- Appropriate UML and XML diagrams have been established by the author in the related CEN and ISO standards.

Functional Roles Established in the CEN ENV 13606 Revision

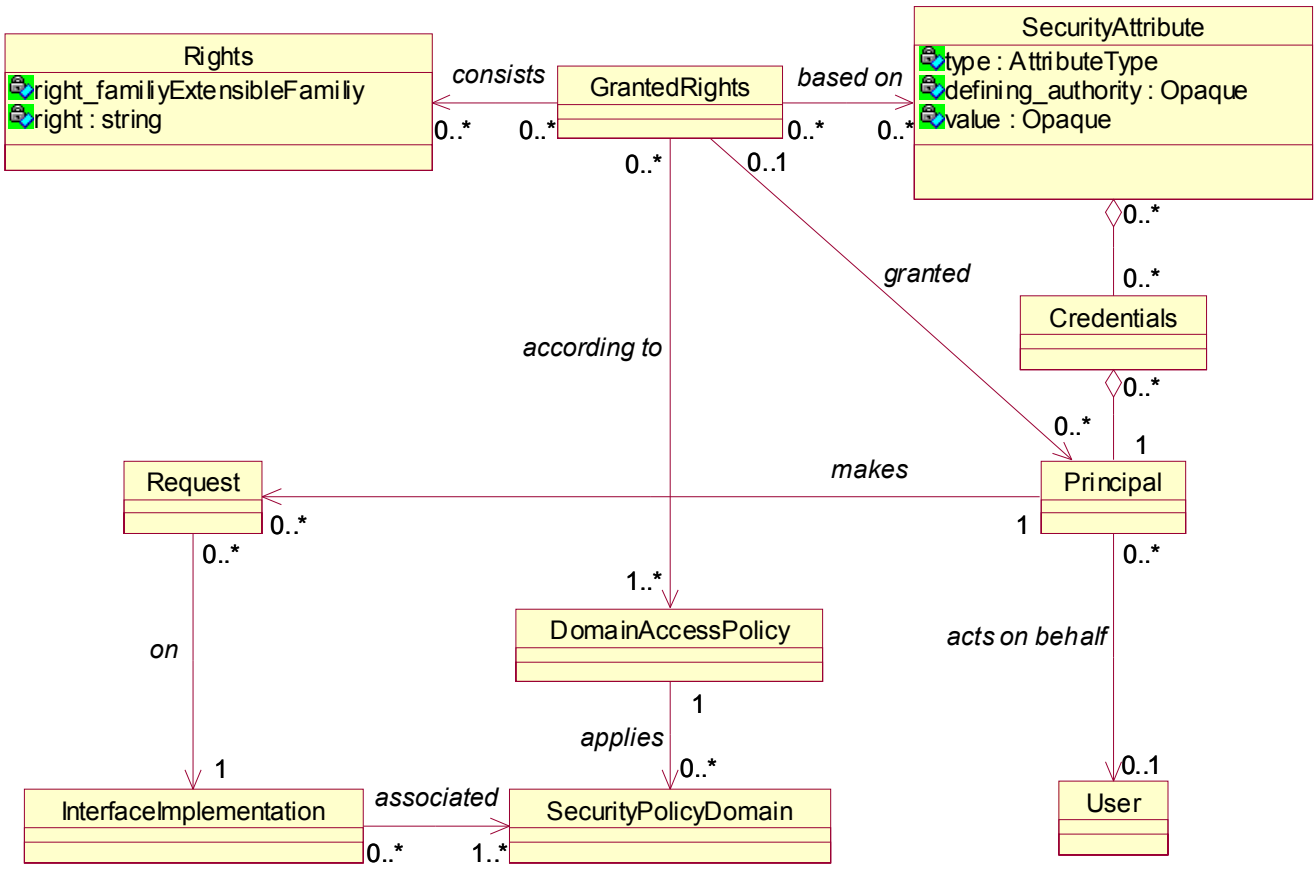
- Subject of care (normally the patient)
- Subject of care agent (parent, guardian, carer, or other legal representative)
- Responsible (personal) healthcare professional (the healthcare professional with the closest relationship to the patient, often his GP)
- Privileged healthcare professional
  - nominated by the subject of care
  - nominated by the healthcare facility of care (there is a nomination by regulation, practice, etc.)
- Healthcare professional (involved in providing direct care to the patient)
- Health-related professional (indirectly involved in patient care, teaching, research, etc.)
- Administrator (and any other parties supporting service provision to the patient)



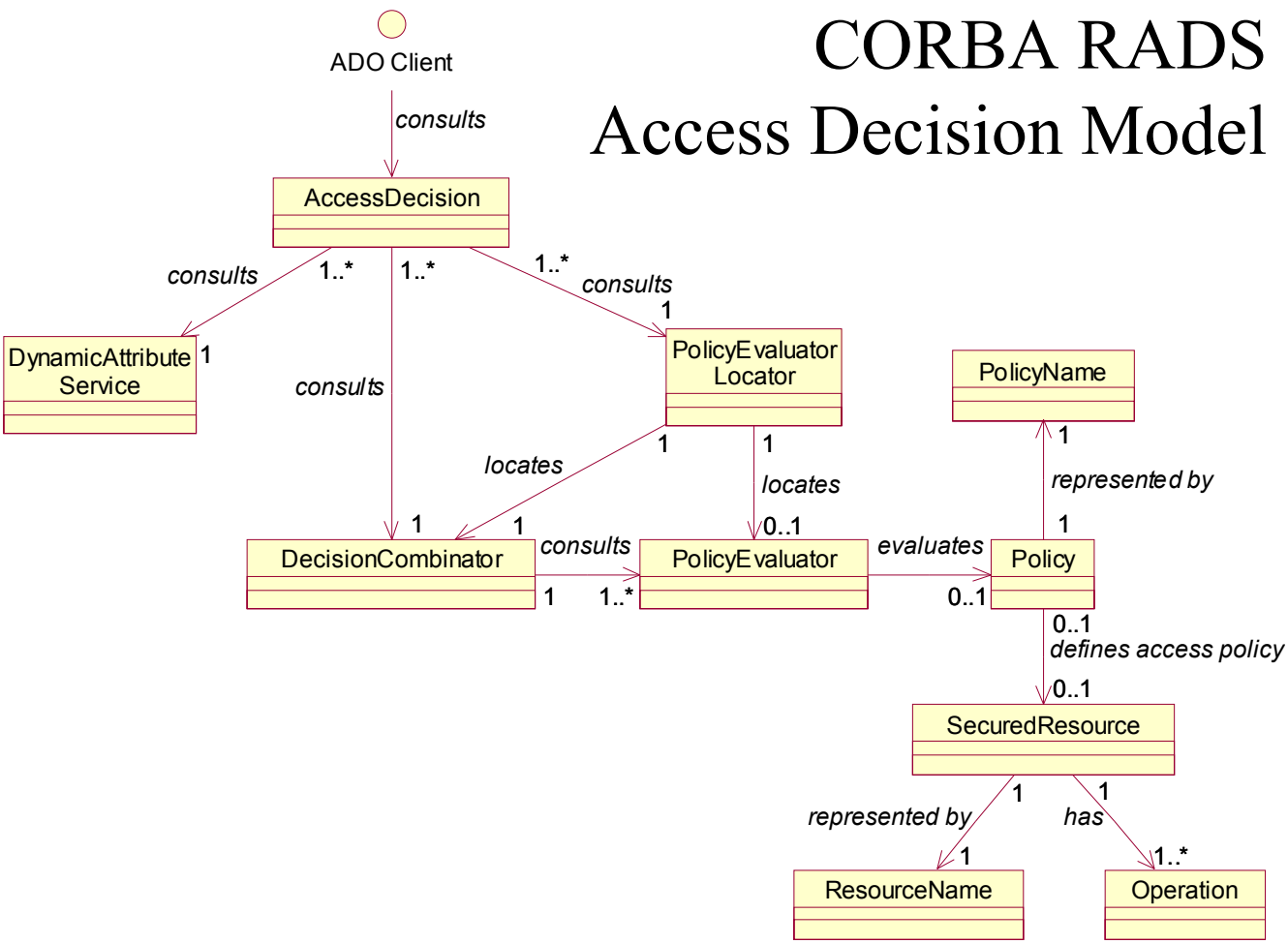
Role-Based Access Control



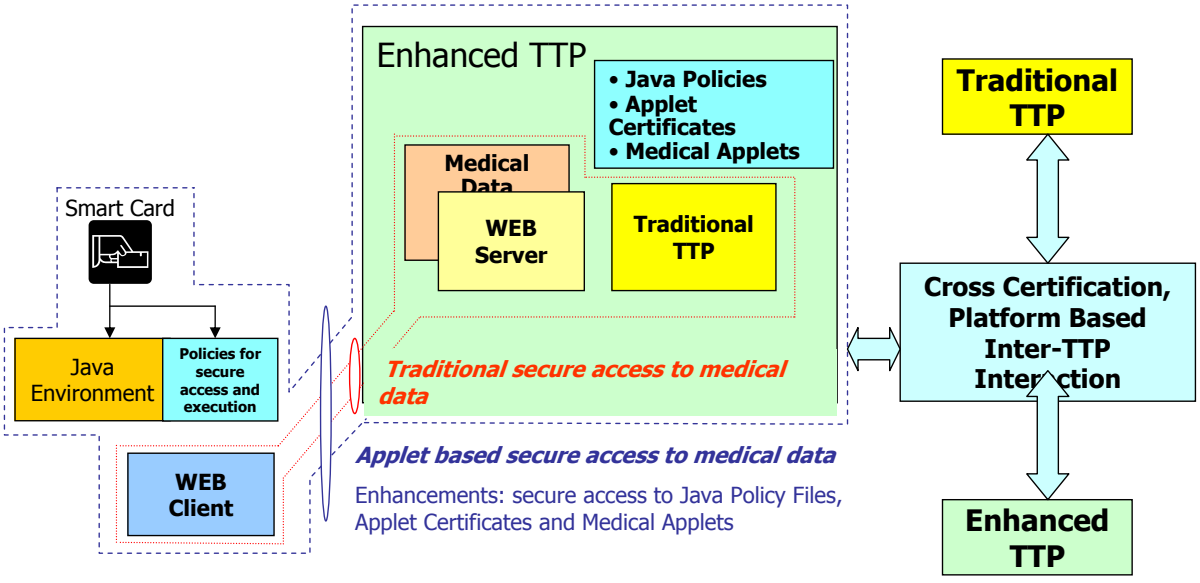
CORBA RADS Authorisation Model



CORBA RADS Access Decision Model



Implementing Trustworthy Communication and Co-operation



HARP Platform Features

General

- XML driven client side interaction and database access
- Generic applet and servlet (acc. to the DB scheme)
- Single XML template
- Enhancement of a typical three tier architecture
- A clearly defined development methodology
- Medical applications

HARP Platform Features

Security related

- Embedding the security into the application
- Fine grained enforcement of security
- Policies in terms of access rights result from roles
- Roles are assigned to users authenticated via smart cards
- Policies are dynamically interpreted and adhered to

HARP Platform Features

Security related

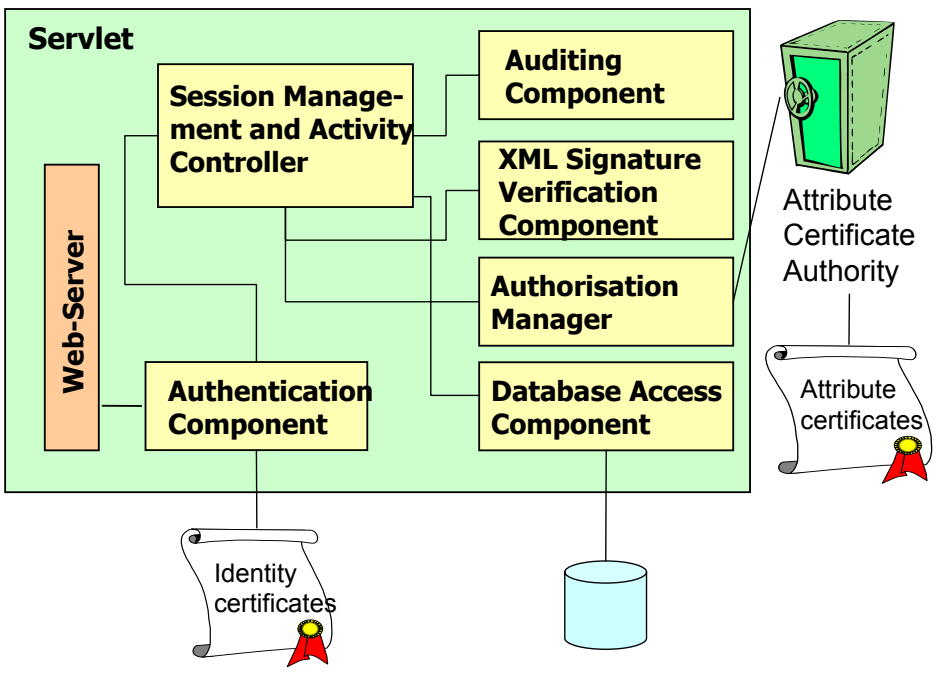
- Accountability of transactions via signing of the XML messages
- Accommodation of standard security mechanisms (SSL, IPsec)
- A clearly defined development methodology
- Medical applications (Clinical Studies)

HARP Platform Features

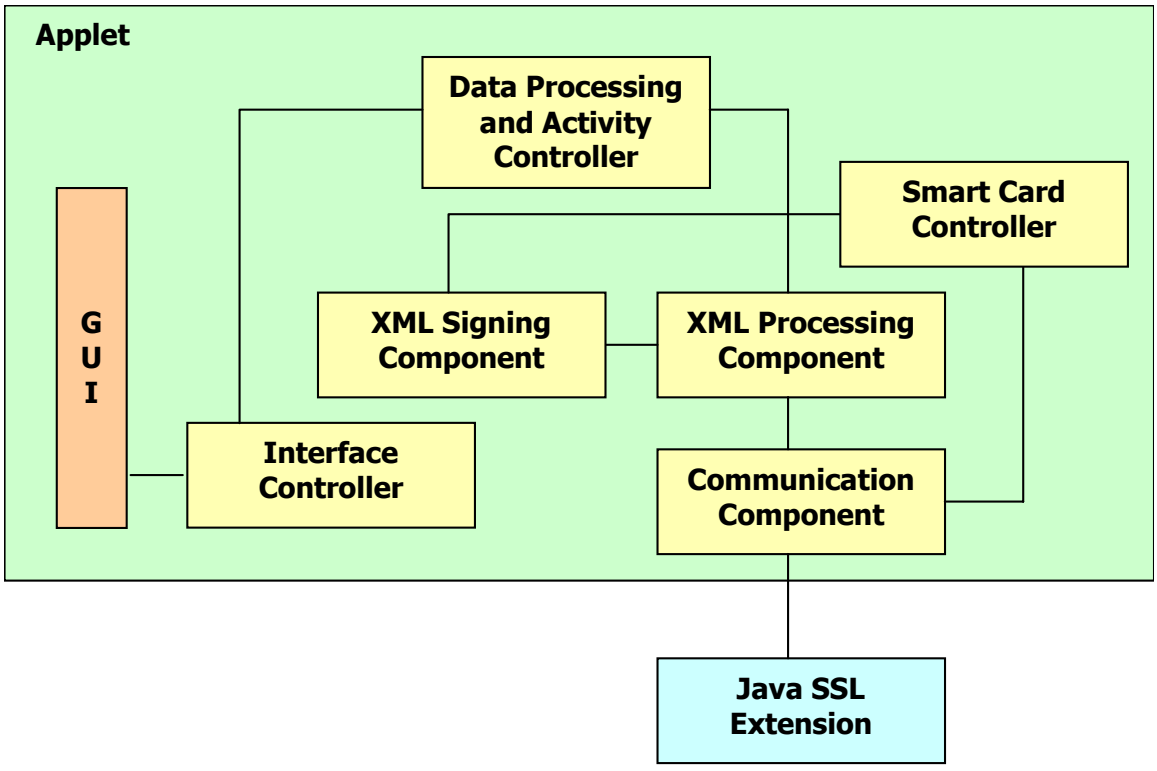
HARP Tools managing among others

- Information Structure DTD
- Profile Structure DTD
- Data Structure DTD

Clinical Studies Servlet Engine Structure



Clinical Studies Applet



Conclusions

- Modelled as a multi-model approach at the metamodel level, the future-proof secure health information system (HIS) is a virtual, at runtime self-organising architecture consisting of certified components which exchange digitally signed and attributed XML messages.
- Reference model, constraint models, terminology, and methodology have to be standardised.
- The specification has to follow the scalable approach.

Canadian Experience in EHR Solutions

Presentation to German Experts Conference

Dennis Giokas
Chief Technology Officer
Canada Health Infoway Inc.
September 8th, 2003

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Presentation Agenda

- **Background on Canada Health Infoway**
  - How we were formed
  - Business and investment model
  - Strategic priorities for the next 3 years
- **Electronic Health Record Solutions Blueprint**
  - Project context
  - Business Architecture
  - Solution Architecture

Canada Health Infoway Inforoute Santé du Canada

Infoway: A strategic response of Canadian governments

- September 2000: unanimous agreement from First Ministers "to work together to strengthen a Canada-wide health infostructure to improve the quality, access and timeliness of health care for Canadians"
- *Infoway* established as an independent, not-for-profit corporation with an initial $500 M investment by Government of Canada
- An additional $600 M and larger role for *Infoway* in telehealth was announced when First Ministers met in February 2003
- *Infoway*'s members represent Canada's federal, provincial, and territorial governments
- *Infoway*'s Board of Directors consists of 11 members (5 regional, 2 federal, 4 non-governmental)

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Infoway's Mission and Vision

Our Mission

"To foster and accelerate the development and adoption of electronic health information systems with compatible standards **and communication technologies on a pan-Canadian basis with tangible benefits to Canadians. The Corporation will build on existing initiatives and pursue collaborative relationships in pursuit of its mission.**"

Our Vision

"A high quality, sustainable and effective Canadian health care system supported by an infostructure that provides residents of Canada and their health care providers **timely, appropriate and secure access to the right information when and where they enter into the health care system. Respect for privacy** is fundamental to this vision."

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Business Model: *Infoway*'s Core Business

Core Business – investing with partners to develop, replicate and deploy robust, reusable, interoperable EHR solutions faster, better and cheaper than any of the partners can do alone

WHAT IT IS	WHAT IT IS NOT

■ **Scouting "best of breed" and other opportunities**
■ **Working in partnership with jurisdictions, regional authorities and, sometimes, vendors to:**
  ■ Plan investment in EHRS
  ■ Leverage existing solutions to make them more robust and reusable
  ■ Replicate solutions *(mass customization)*
■ **Contributing to the development of architecture standards and guidelines for EHRS**
	■ **Building and holding solutions**
	■ **Operating as a software development firm**
	■ **Granting funds to provinces, territories and others**

Investment Portfolio: Programs and Identified Benefits

***Infoway's* focus is on six investment programs.**

A clear set of benefits have been identified for each program. Highlights of these benefits are included below:

Telehealth	■ Support remote and rural care delivery/access ■ Incent Telehealth-EHRS linkages
Laboratory Information Systems	■ Information portability and timeliness for patient care ■ Physician office efficiency
Diagnostic Imaging Systems	■ Increased availability of diagnostic imaging for physicians ■ Improved productivity *(e.g. less duplication, faster turnaround)*
Drug Information Systems	■ Reduced dispensing costs; fewer dispensing clarification call-backs ■ Reduced drug interactions and adverse events
Registries	■ Core patient, provider and location registries; foundation piece for EHRS ■ Secure and trusted identification of individual patients, providers and locations
Infostructure	■ Common blueprint: standards and services ■ Fundamental to interoperability and reduced implementation costs

EHRS BLUEPRINT

an interoperable EHR framework

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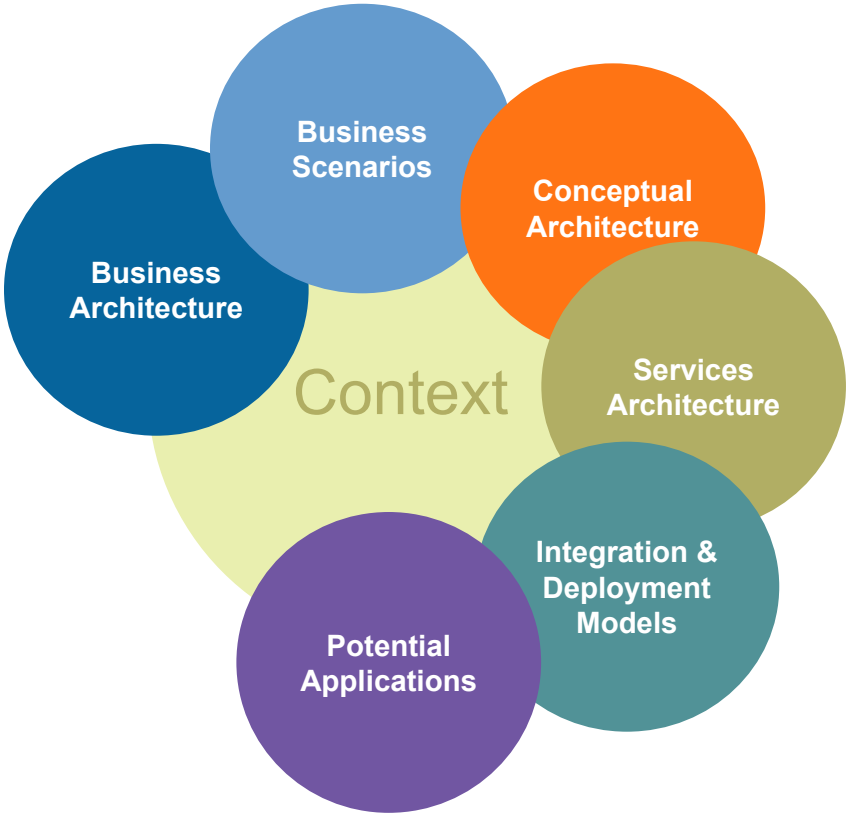
Agenda: EHRS Architecture Perspectives



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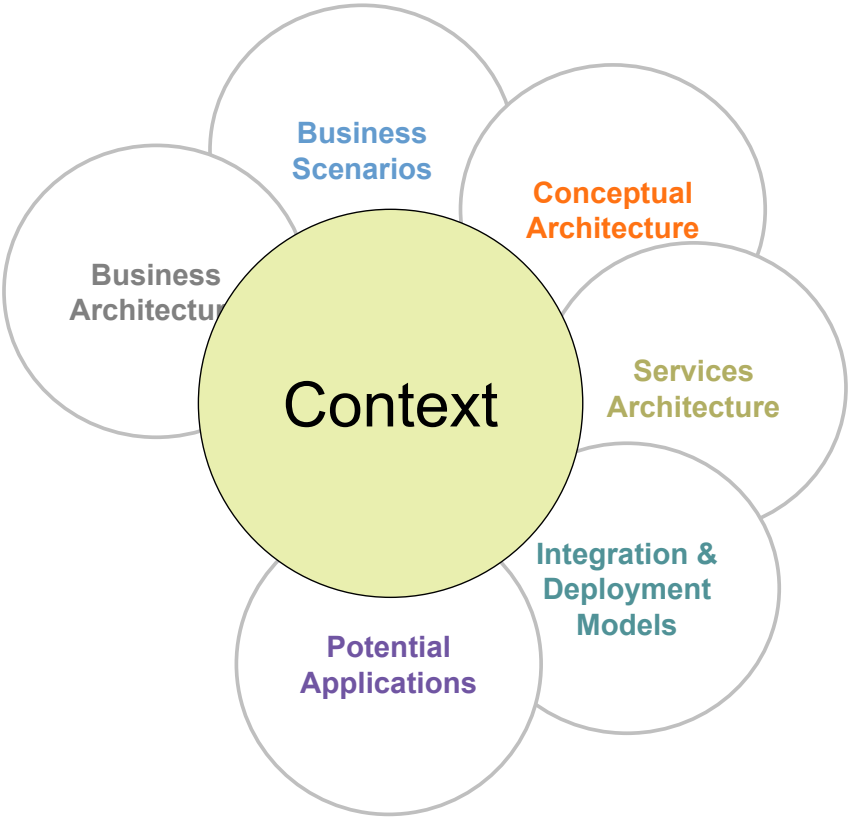
The EHRS Architecture Perspectives



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CONTEXT

Infoway EHRS Blueprint Purpose

- **Scope is <u>only</u> enterprise business and technical architecture for the Electronic Health Record Solution (EHRS)**
- **Reference model for investment in technology and services for the EHRS**
- **Informs our investment and rollout strategy**
- **Protects current investments by building on the current base while remaining vendor neutral**

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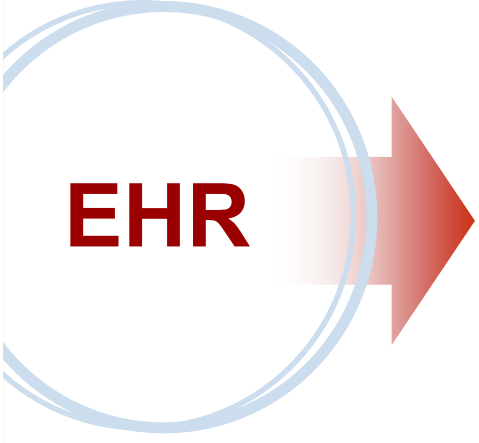
Infoway EHRS Blueprint Process

1. **Consultations with each province on**
   - EHR strategy
   - As-Is and planned solutions
   - Lessons learned
   - Best practices
2. **Development of the future state EHRS Blueprint**
   - Business and technical architects
   - Change management specialists
   - Leveraged experience from other industries (e.g. financial services)
3. **Extensive review of the solution architecture**
   - 8 workshops, 2 webcasts
     - Ministry of Health and healthcare delivery organization staff
     - Vendors
     - Providers and provider associations
     - Academics

Key Definition: EHR



An Electronic Health Record (EHR) provides each individual in Canada with a secure and private lifetime record of their key health history and care within the health system. The record is available electronically to authorized health care providers and the individual anywhere, anytime in support of high quality care.

Key Definition: EHR Solution

EHRS

The EHRS is a combination of people, organizational entities, business processes, systems, technology and standards that interact and exchange clinical data to provide high quality and effective healthcare

It is made up of:

- Mechanisms to find and uniquely identify people, providers and locations
- Patient-centric Electronic Health Record (EHR)
- Presentation solutions and intelligent agents
- Common services and standards to enable integration and interoperability
- Workflow and case management
- Decision support services
- Services to support health surveillance and research
- Services to ensure privacy and security
- Physical infrastructure to support reliable and highly available electronic communications across Canada

Key Definition: EHR Infostructure

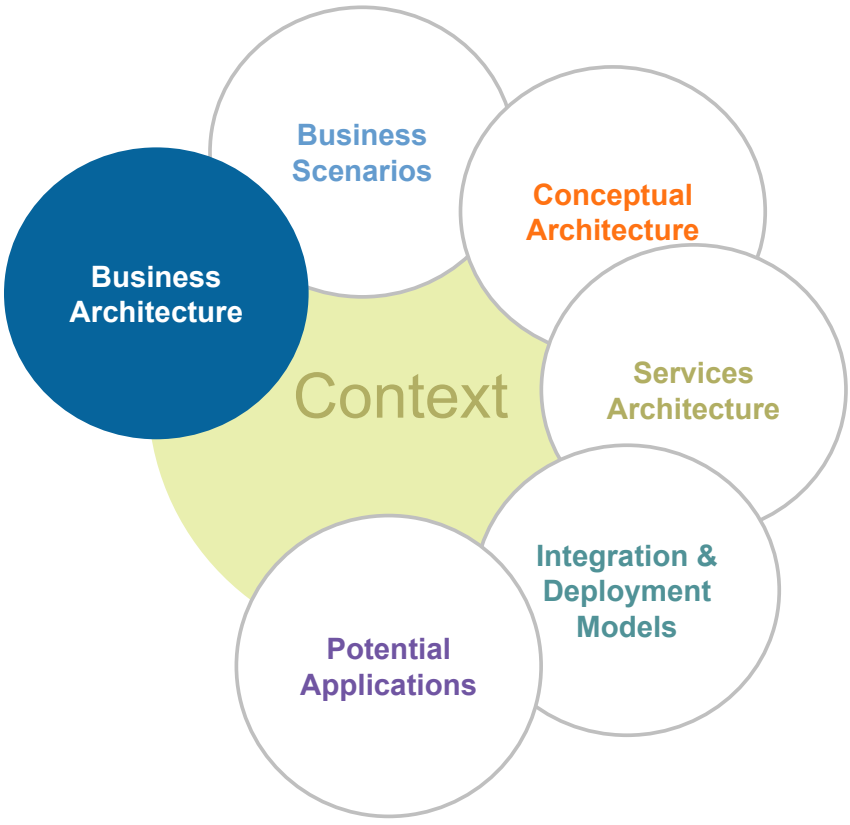
EHRi

Collection of common and reusable components in the support of a diverse set of health information management applications. It consists of software solutions for the EHR, data definitions for the EHR and messaging standards for the EHR;

It is made up of:

- Registry systems to manage and provide peripheral information required to situate any electronic health record. For example client, provider, facility and consent information;
- Domain repositories that sustain the management and provision of subsets of data that pertain to the electronic health record domain;
- An EHR system to manage and provide client clinical information;
- Standardized common services and communication services to sustain the interoperability of the different components within an infostructure, as well as to sustain the interoperability between infostructures and with source systems;
- Standardized information and message structures as well as business transactions to support the storage and exchange of EHR information;

The EHRS Architecture Perspectives



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BUSINESS ARCHITECTURE

The Changing World of Healthcare….

The Old World	The New World
Provider-focused	Patient and family-focused
Illness	Wellness
Site-of-care	Continuum of care
Episode Management	Disease Management
Supply Management	Demand Management
"Lone Ranger" decisions	Collaborative, evidence-based decisions
Efficiency	Effectiveness
De-centralized, generalized care	Centralized, specialized care

The changes in healthcare require significant capability from the health infostructure, capability which does not fully exist today…

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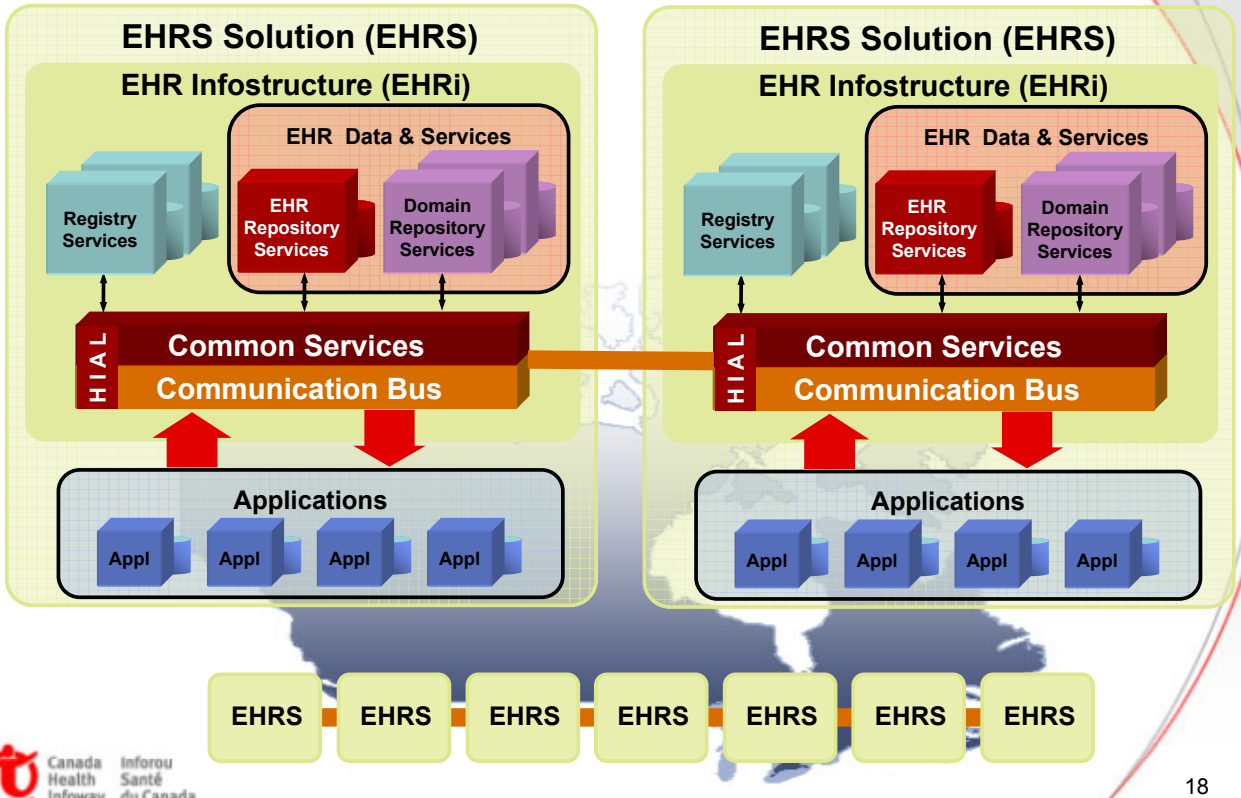
Computerized, Interoperable EHR– Enabling Value

4 things an interoperable EHR does well:

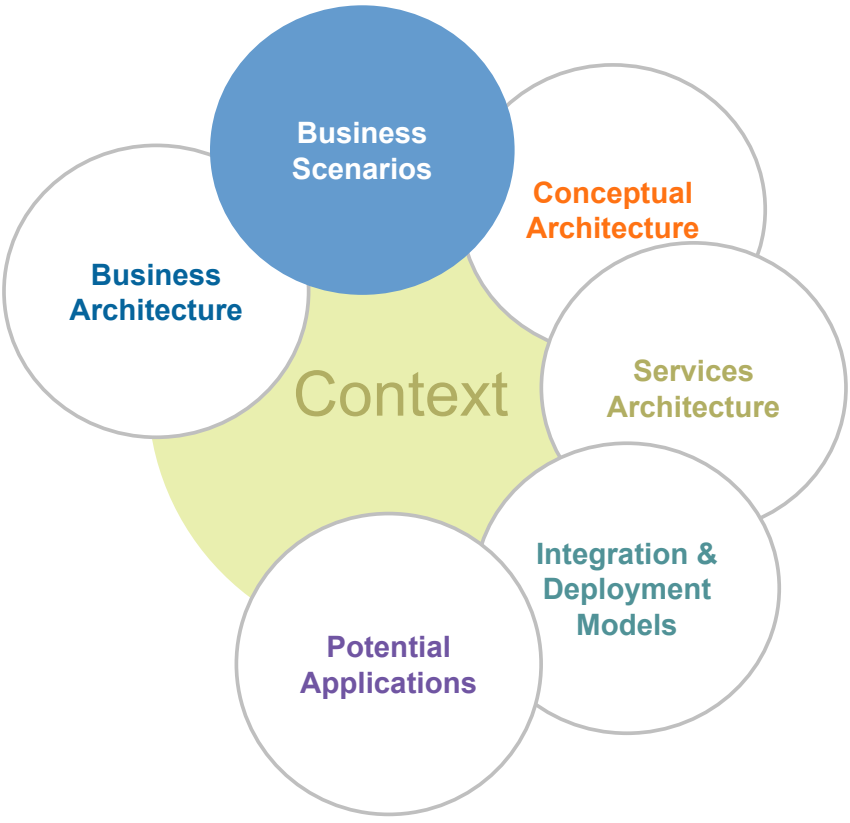
- **Accumulate vast amounts of structured patient centric data**
- **Process vast amounts of data on queries to find patient information**
- **Transport information between points of care insuring levels of speed, accuracy, completeness, reliability and clarity never before achievable**
- **Enable decision support (not decision making) by applying validated scientific and business oriented rules to a patient information**

Proposed Solution

Distributed, Message-based, Peer-to-Peer Network of EHRS Systems



The EHRS Architecture Perspectives



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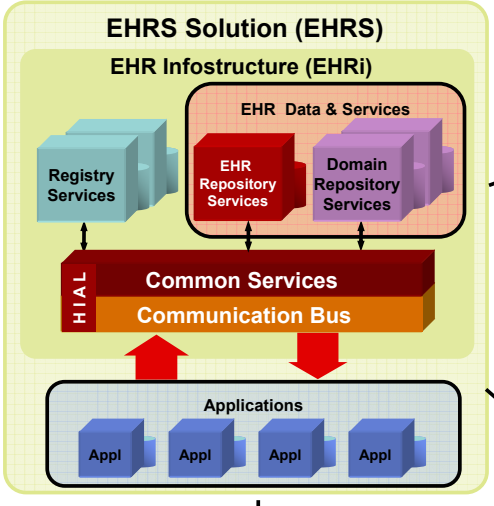
BUSINESS SCENARIOS

EHRS Supporting Entire Process

Applications Exploit The EHR To Support The Process



Presentation
- Summarization
- Normalization
- Trending / graphing
- Navigation

Business Process Integration
- Look up from Client Registry
- Download demographics into ADT or PMS
- Context Management between EHR and Order Entry system(s)
- Case Management

Order Management
- Retrieve order msgs from other systems
- Route order msgs to other systems
- Report order status from other systems

Referral Management
- Grant access to EHR
- Enterprise scheduling

Access to Decision Support Applications
- Share data from EHR
- Alerts
- Advice / knowledge
- Protocols

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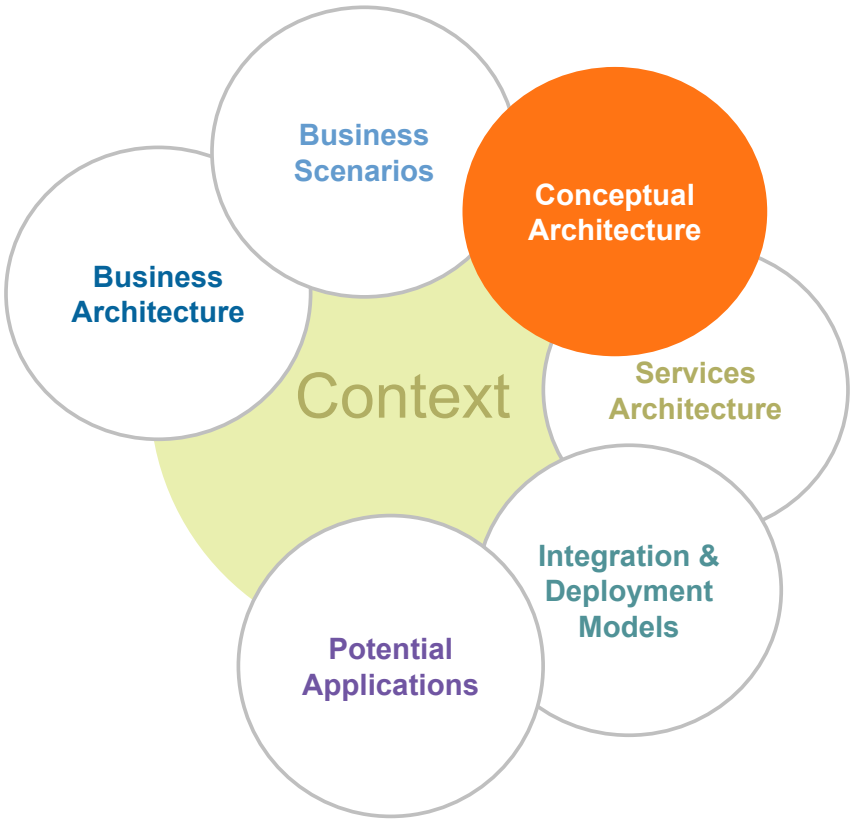
The EHRS Architecture Perspectives



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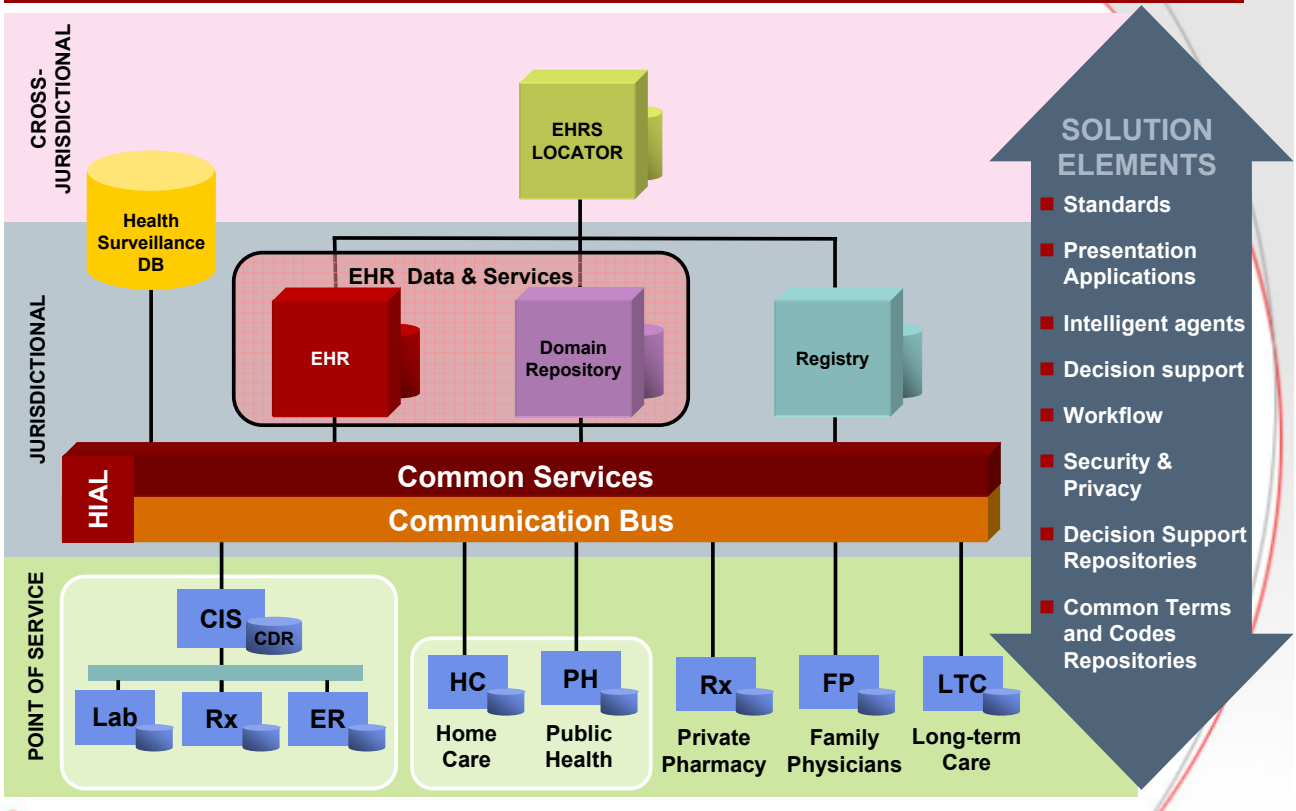
CONCEPTUAL ARCHITECTURE

EHRS Conceptual System Architecture Model



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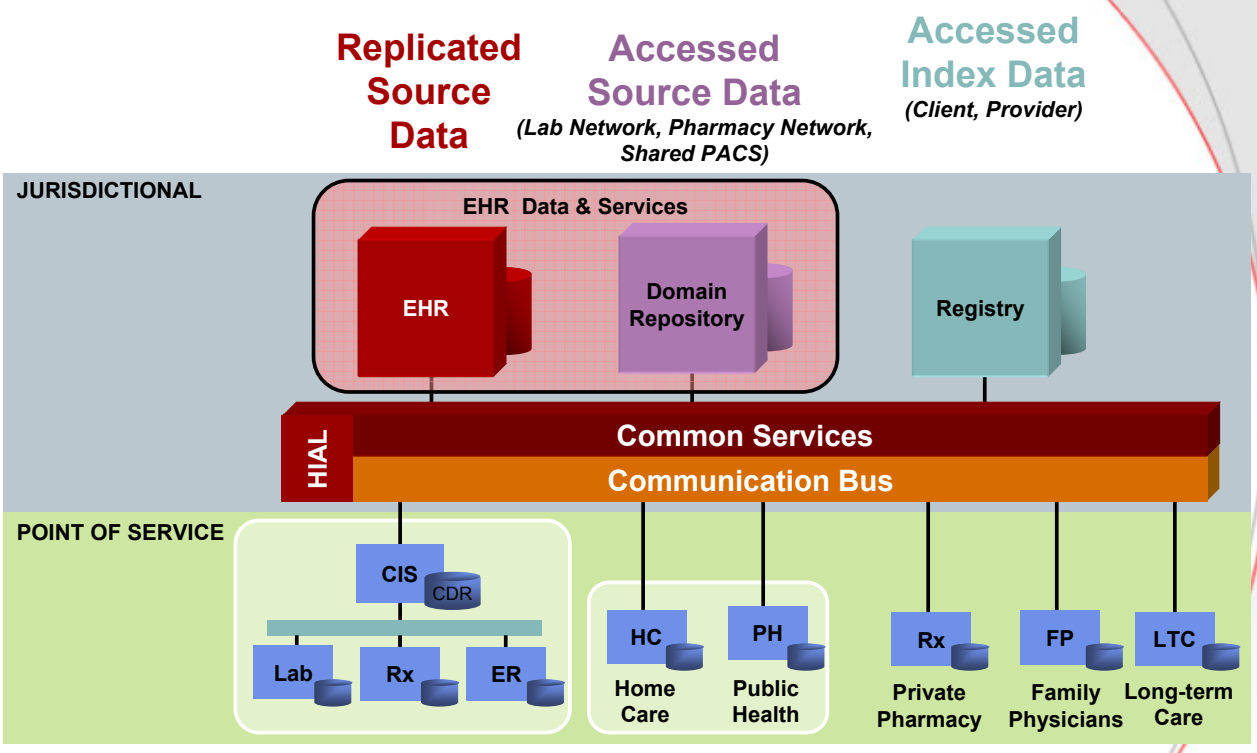
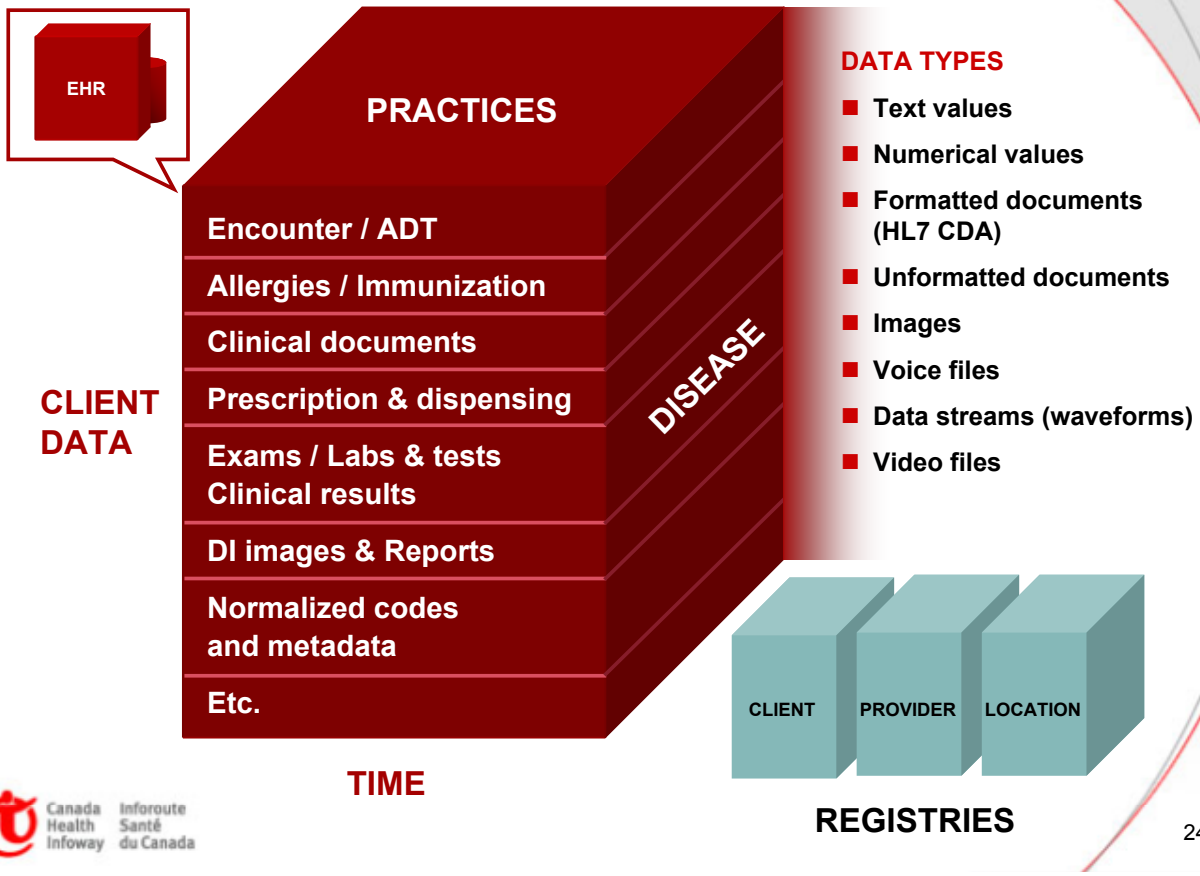
CONCEPTUAL ARCHITECTURE

EHRS Components

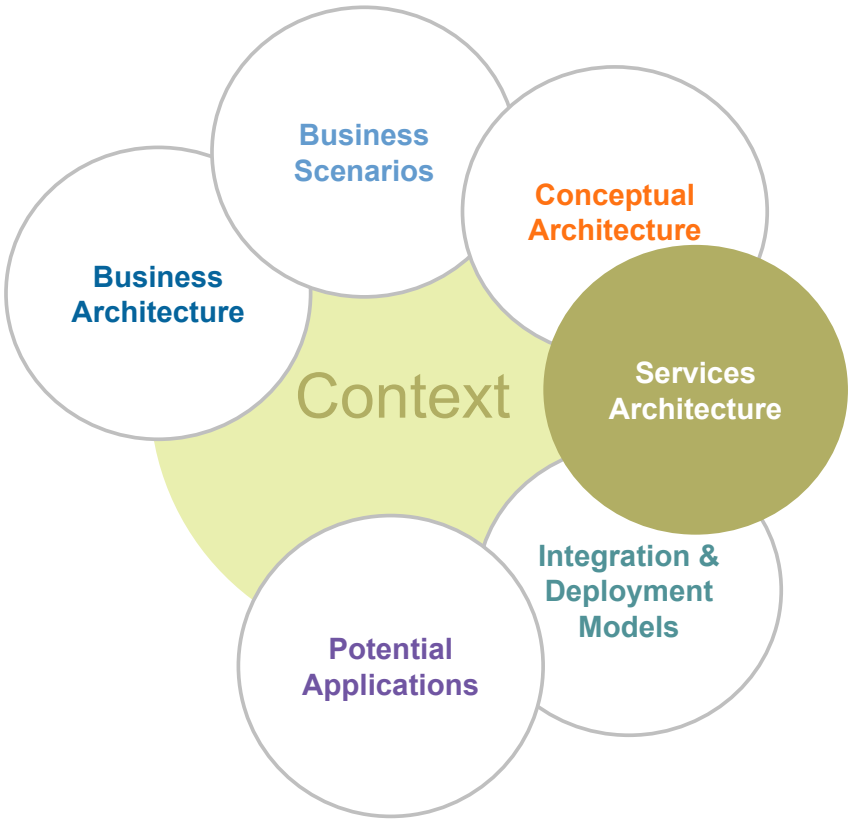


CONCEPTUAL ARCHITECTURE

EHRi Data Domains



The EHRS Architecture Perspectives



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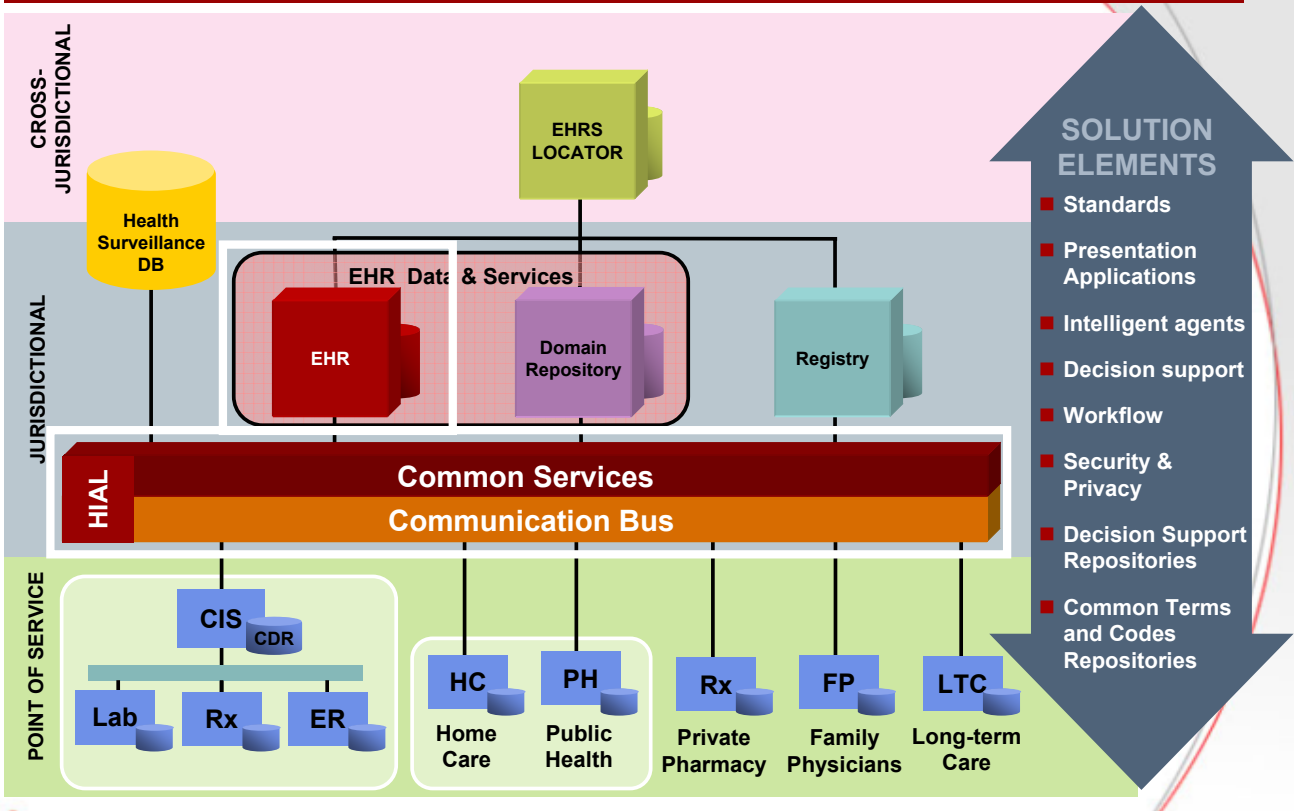
SERVICES ARCHITECTURE

EHRS Conceptual System Architecture Model



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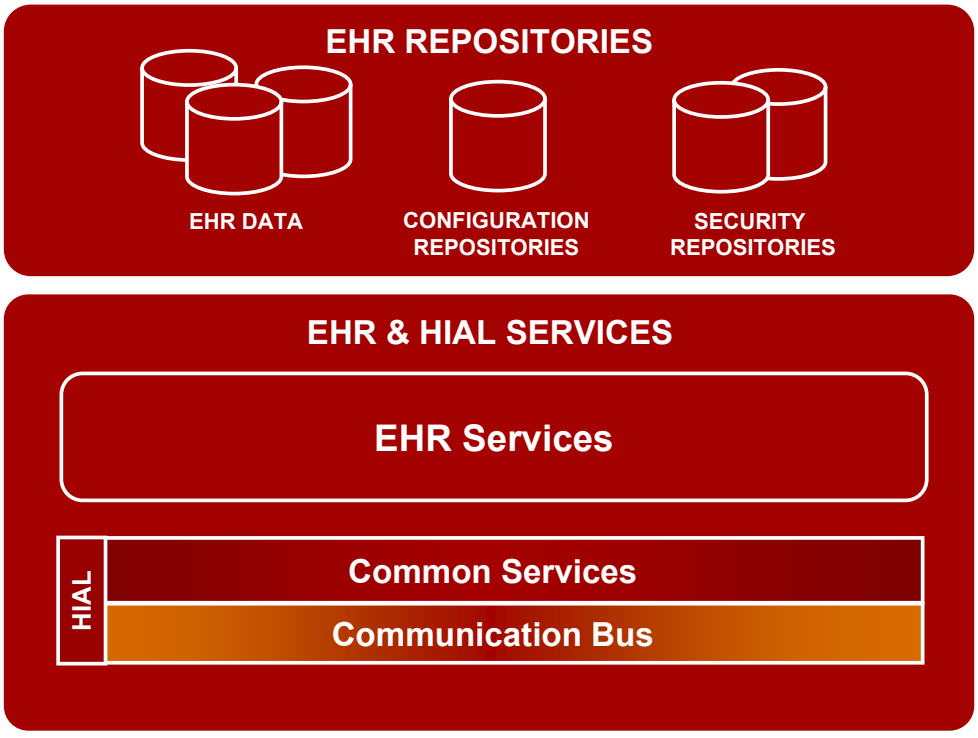
SERVICES ARCHITECTURE

EHR and HIAL Architecture Drill-Down



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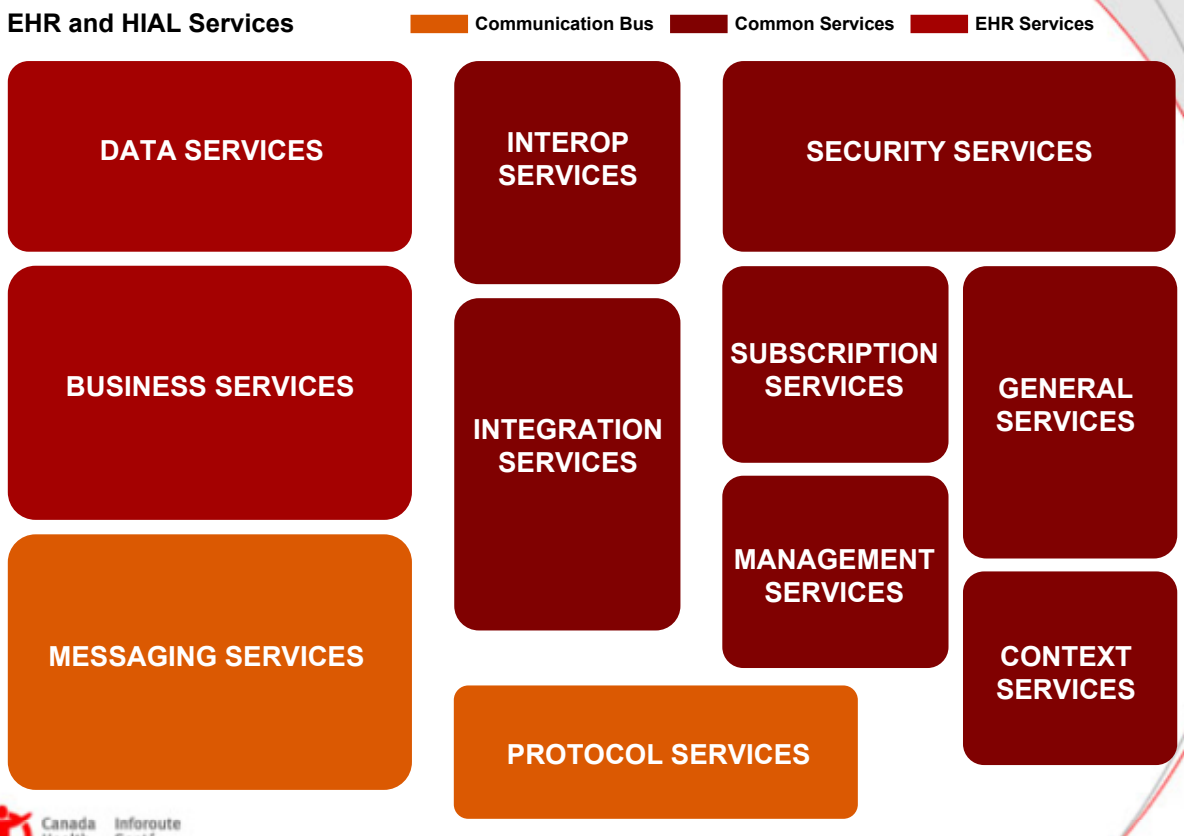
SERVICES ARCHITECTURE

EHR and HIAL Service Architecture



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EHR and HIAL Service Architecture Drill-Down

EHR and HIAL Services

Communication Bus | Common Services | EHR Services

DATA
- Key Management Services
- Data Services
- ETL Services
- Replication Services

INTEROP
- Interoperability Services
- Search / Resolution Services

SECURITY
- Authent'n Mgmt Services
- Permission Mgmt Services
- Security Services
- Policy Mgmt Services

BUSINESS
- Assembly Services
- Normalization Services
- Domain Business Components *(DI, Lab, Pharmacy, Registries)*
- Workflow Services
- Business Rules Services

INTEGRATION
- Service Catalogue Services
- Broker Services
- Mapping Services
- Queuing Services

SUBSCRIPTION
- Alert / Notification Services
- Pub / Sub Services

GENERAL
- Auditing Services
- Log Mgmt Services
- Exception / Error Handling Services

MANAGEMENT
- Management Services
- Configuration Services

MESSAGING
- Transformation Services
- Routing Services
- Encrypt / Decrypt Services
- En / Decoding Services
- Parser Services
- Serialization Services

CONTEXT
- Caching Services
- Session Mgmt Services

PROTOCOL
- App Protocol Services
- Network Protocol Services

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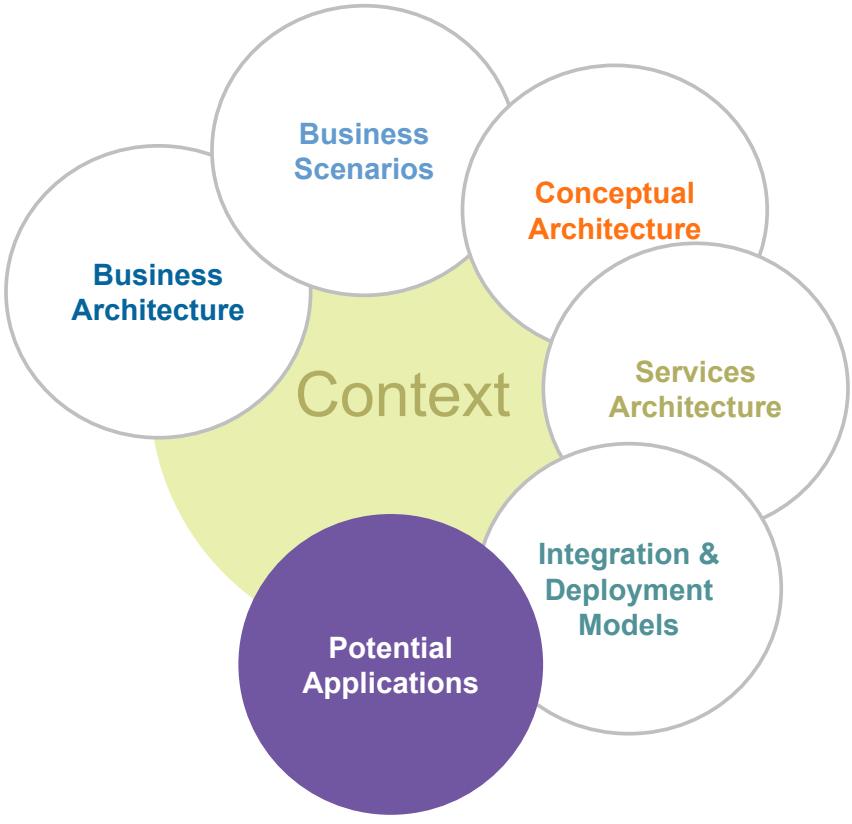
The EHRS Architecture Perspectives



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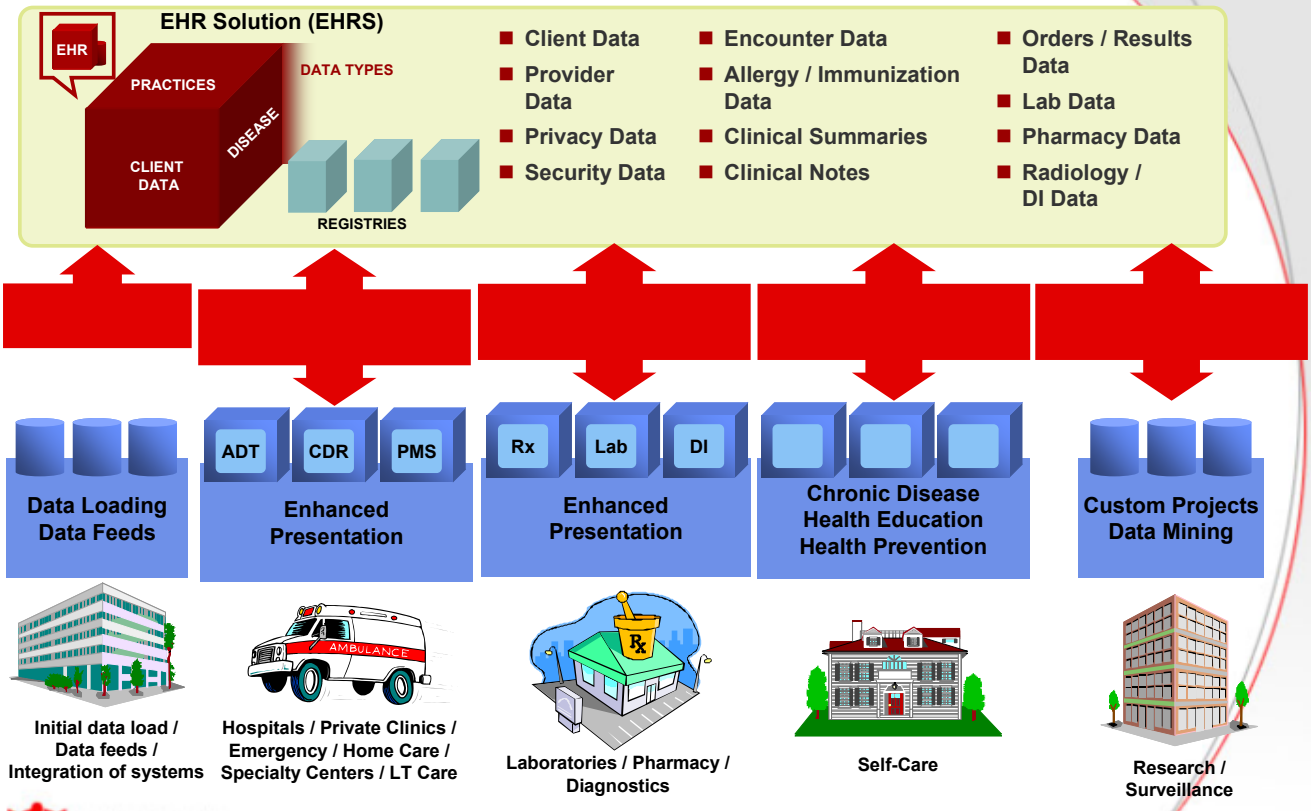
POTENTIAL APPLICATIONS

EHRS Data – Value Enabler For Existing Applications



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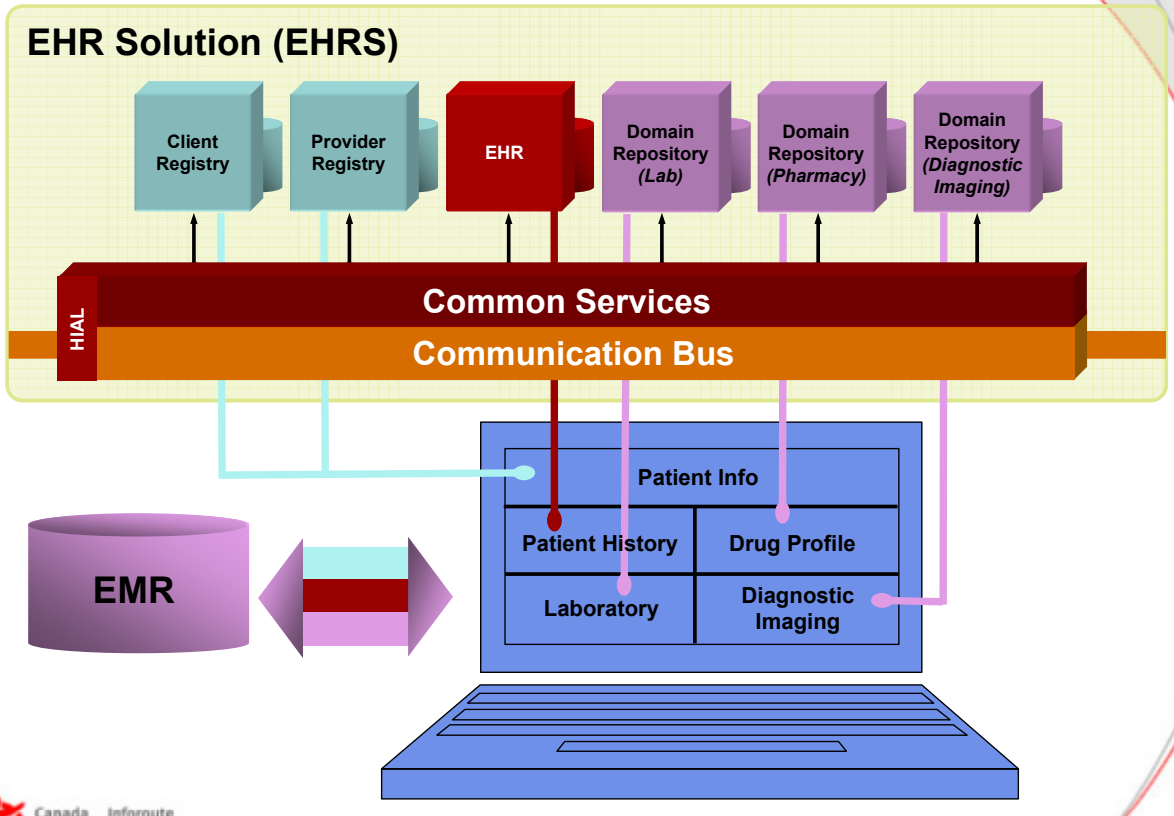
POTENTIAL APPLICATIONS

PCP Provider Consolidated EHR View



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Summary

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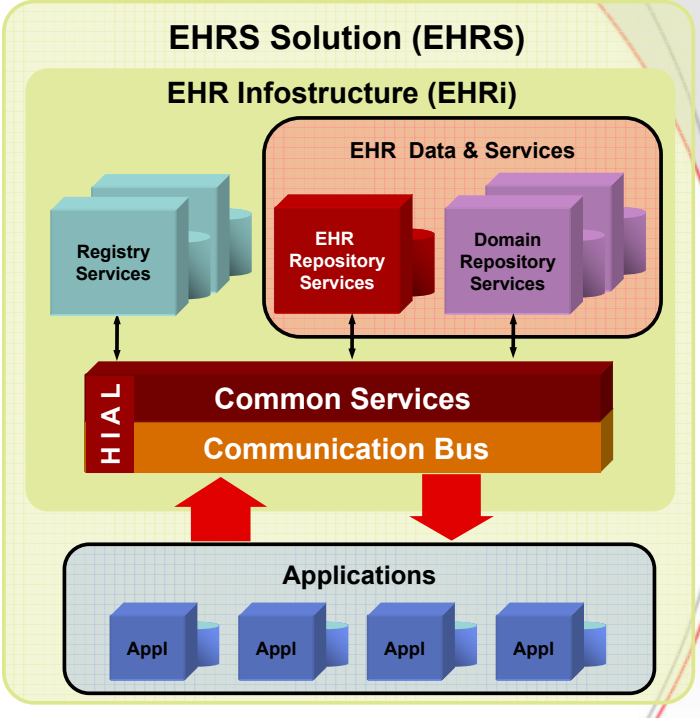
Summary of Key EHRS Architecture Concepts

- EHR Definition
  - Patient-centric, womb to tomb
  - Patient is logically in one EHR
  - Conceptually, EHR is a multi-dimensional view of clinical information
  - EHR is a combination of clinical domain repositories (e.g. PACS, Pharmacy) and data replicated from feeder systems
  - Does NOT replace the operational data store for clinical applications
  - Encounter information
  - All clinically relevant data
  - EHR is one component of the larger EHR Solution (EHRS)
- Enabled by registries, a common services and communications infostructure layer – the Health Information Access Layer (HIAL)
- Data is pushed or published into EHR from source systems
- EHR viewed from applications the providers use in their daily context – for example a Primary Care doctor's PMS
  - View and navigate the EHR
  - Along with application's operational data stores



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Thank You!

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www.infoway-inforoute.ca for general information

knowledge.infoway-inforoute.ca for the knowledge portal and Blueprint

info@infoway-inforoute.ca general *Infoway* mailbox

arch@infoway-inforoute.ca Solution Architecture Group mailbox

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Security Aspects of A Telematics Architecture – An Industry Viewpoint –

9. September 2003,
Expert Conference, Stuttgart

Dr. Steffen Frischat
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We will discuss the results of the security workgroup of the industry expert team

Security Workgroup

- **12 experts from**
  - **Consulting, integration, software development, telecomms, ...**
  - **four industry associations**
- **Work from December 02 to May 03**
- **Major issues**
  - **Security requirements**
  - **General aspects**
  - **Organisational security**
  - **Technical implementation**
  - **Interfaces**

Presentation Overview

- **Introduction and security requirements**
- **Organisational security**
- **Technical implementation**

Introduction and Security Requirements

eHealth systems face four types of attacks with a wide diversity of targets and attackers

Academic	• Aim: find gaps and loopholes • Target: everything! • Possible attackers: hackers, researchers, journalists, internal staff, ...
Economic	• Aim: get treatment for less / free, improve financial situation • Target: clearing system, rendering of service • Possible attackers: patients, service providers, insurance staff, ...
Damage	• Aim: insight into or publication of sensitive data with the aim to damage a participant • Target: medical data, treatment data • Possible attackers: criminal groups, political groups, adminstrators, ...
Supervision	• Aim: access data for a foreign to the actual purpose of the system • Target: medical data, patient data • Possible attackers: state departments, police, pharma industry, ...

Attacks – and failures – address central systems as well as peripheral systems

	Central system parts	Peripheral system parts
High probability of attempt / event	• Compromised integrity of patient data • Lacking actuality and completeness of patient data • Access aiming at use foreign to the actual purpose • Re-Identification	• Access to peripheral components (card, terminal, PCs, ...) • Tapping (long-term, short-term) • Claiming wrong identities • Supplementary compensation fraud
Low probability of attempt / event	• Lacking availability of central systems • Loss of context for a piece of data • Manipulated user rights • Lacking availability of the entire system	• Cover-up of treatment data • Transmission errors • Lack in documentation • Manipulated user rights

A set of premises for the security architecture should be taken ...

- **Meet data protection requirements [!]**
- **Strengthen the patient's control / self-determination**
- **Be realistic**
  - **Realistic requirements and processes**
  - **Support the system and respect usability**
  - **Ensure cost efficiency and quick roll-out**
- **Enclose existing work (Management papers ATG, Spec. HPC-D, ...)**
- **Align with other federal activities (BundOnline 2005, SAGA, Signature Alliance)**
- **Close existing security gaps (KV-card fraud, stolen prescription forms, patient information per fax, patient records „lying around",...)**
- **Use existing, tested technologies and methods**

... and a holistic approach to security is required, based on accepted frameworks

Security is a system of

- **Policies**
- **Processes**
- **Organisation**
- **Components**

Use accepted security frame-works

- **ISO 17799 encorporating „Industry Best Practices“**
- **BSI Grundschutzhandbuch**

Organisational Aspects

The cornerstone is a rôle concept for participants

- **Management of authorisations for the participants**
- **Mapping of processes, organisational and legal requirements, participation to a process**
- **Examples for rôles**
  - **Patients (patient, legal guardian,...)**
  - **Physicians (differentiated by special topic, authorisation,...)**
  - **Medical support personnel (differentiated by organisational relation to a task)**
  - **Pharmacists (and support personnel, differentiated by topic/level)**
  - **Other renderers of medical service, not organised in chambers or associations (midwife, physiotherapist, ...)**
  - **Administrative personnel (e.g. health insurances, state authorities)**
  - **Technical personnel (e.g. hospital technicians, IT service personnel)**
  - **Institutions (e.g. hospitals, doctor‘s pracitce, laboratories, ...)**

Renderers of service authenticate themselves by Health Professional Cards

- **Authentication of participants by smart cards**
- **Authorisation concept must cover**
  - **Rôle of card holder**
  - **Transaction performed or type of data**
  - **Type of access (read, write, change, delete)**
  - **Patient consent required (yes/no)**
- **HPCs also used for encryption/decryption, electronic signatures, visual ID**
  - **Contain rôle information, certificate for qualified signature, encryption keys**
- **Institution cards / HSMs required in order to identify source / track of data**
- **Institution certificates allow encryption / decryption of data sent by or addressed to an organisation**
- **Cards must be managed by a trust center infrastructure**

A Health Card is used for patient data and pointers

- **Use of smart cards with crypto co-processors**
- **Carries picture of the patient**
- **Content of the card**
  - **Adminstrative data**
  - **Emergency data**
  - **Medical data or pointer to medical data on a server**
- **Protection by secure cryptographic methods (e.g. PKCS #7, XML-encryption standard)**
- **Access to data only after authentication of patient (PIN) and the renderer of service (HPC)**
- **Patient should have freedom to chose her level of security vs. usability (e.g. use of PIN for elderly patients) and the functional scope**

Technical Implementation

Security infrastructure is composed of procedures and components

- ***Security procedures***

  .... are processes that enhance IT security, for example
  - **Electronic signature**
  - **Encryption**
  - **Authentication and access control**
  - **Secure data storage and archiving – or recovery (data availability)**
  - **Emergency planning (non-availability of systems or data) or high availability**
  - **Use of anonymised data or pseudonyms**
  - **Protocolling and autiding**

- ***Infrastructure components***

  ..... are IT components required to provide security procedures, for example
  - **Trust centers for certificate and key management**
  - **Directory services for identity management**
  - **Smart cards (e.g. HPC, patient card) and terminals**

Important security procedures are electronic signatures ...

- **Required from renderers of service (e.g. physicians, pharmacists) for**
  - **Electronic prescription**
  - **Electronic medical report**
- **Security level according to legal requirements (advanced, qualified, accredited?)**
- **Implementation should be conformal to SAGA standards / signature alliance**
- **Tested standards and products are available**
  - **S/MIME for eMail signature and encryption**
  - **XML standards for document signature**
  - **PDF document signature**
- **eSignature solutions are already in use in the health sector**
  - **VCS standard for the exchange of medical reports**
  - **Telemedicine (SaxTelemed, CHILL)**

.. as well as authentication and access control (examples)

Authentication	Access Control
• Authentication proves a user's or system's identity in one or several systems • Access to or use of confidential data or critical applications is possible only for authorised users and after successful authentication • Users must authenticate themselves by using a card and a PIN • PIN should not be used for emergency data and administrative data • Certificate-based log-on to central components or client/server software (e.g. SSO)	• Medical data must be protected from unauthorised access by encryption or logical / physical access control • Logical control on smart cards based on operating systems and appropriate file structure • Logical control on central systems based on firewalling and rôle-based access management • Management of access rights must be transparent, traceable and user-friendly

Required components have been in use for long

Availability must be ensured by system design and fallback processes

No availability of data or systems, loss of card, broken terminal, ...

System design

- High-availability of central systems (cluster, RAID in secure location)
- Original data on system of renderer of service
- Secure replication of patient data on a voluntary basis (possibly as an external service)

Fallback processes

- Use of traditional paper-based processes
- Local storage of data (e.g. at doctor's office) and later copy
- Fast replacement of card

Most important security components are trust centers, directory services and smart cards

Trust Centers	• Tasks: Manage certificates and issue qualified time stamps • There are major implementations of national public key infrastructures available (e.g. Macao)
Directory Services	• Task: Identity management (certificates, keys, access rights) • Run by trust centers in order to garantuee rapid online queries for renderers of service (use of HPC) • Use of LDAP-protocol
Smart Cards	• Common media for secure storage of certificates and keys • Specification for HPC available [now HPC 2.0] • In use in multiple projects (Taiwan, SaxTelemed, CHILL, HPC pilots...)

Miscellanea

- **Social pressure on a patient to unclose her medical data**
  - Is not a technical issue, but a social & legal one. Not a new one, either
  - Cannot be prevented by technical measueres, only by law
- **No „red emergency button“ for unlimited access to patient data**
  - There should be no „red button“
  - This would completely compromise the security of the system
  - Protocolling unlimited access is not sufficent as a deterrent
  - The availability of emergency data is improved by the new system!
- **Integration into processes is very important**
  - Security must be usable in order to prevent „workarounds“
  - Automatisation should be used wherever possible
  - Real-time usability for the renderers of service
- **Communication & training of users is key to security**

In summary: patient data security can be achieved

- Security is of **highest priority** in the eHealth sector
- A **integrated concept** based on policies, organisation, processes and components can ensure comprehensive protection of data from unauthorised access, manipulation and system failures
- The smart card / server based architecture – as well as patient **voluntariness** – strengthen the **patient's control and security**
- All system participants authenticate themselves based on a **smart card system** (with picture) integrated into a **differentiated authorisation management system**
- **Medical data are protected** by encryption, usually also with card and PIN-authentication
- **Necessary technologies are available** and have been tested

Aspects of Standardisation

Infrastructure

Mark Oswald
Program Manager
eBusiness Solutions
Microsoft Corporation

Microsoft

VIDEO

Microsoft

Healthcare Without Boundaries

Agenda

- Vision – Healthcare Without Boundaries
- **Business Issues and IT Challenges**
- Removing the Barriers with Open Standards
- Standards Efforts - HIPAA and HL7
- Summary

Key Business Issues in Healthcare

- Increasing Standards and Government regulations
- Increasing healthcare costs
- Business processes re-invention
- Waste, fraud and abuse
- Industry consolidation
- Patient empowerment
- Patient safety

Microsoft

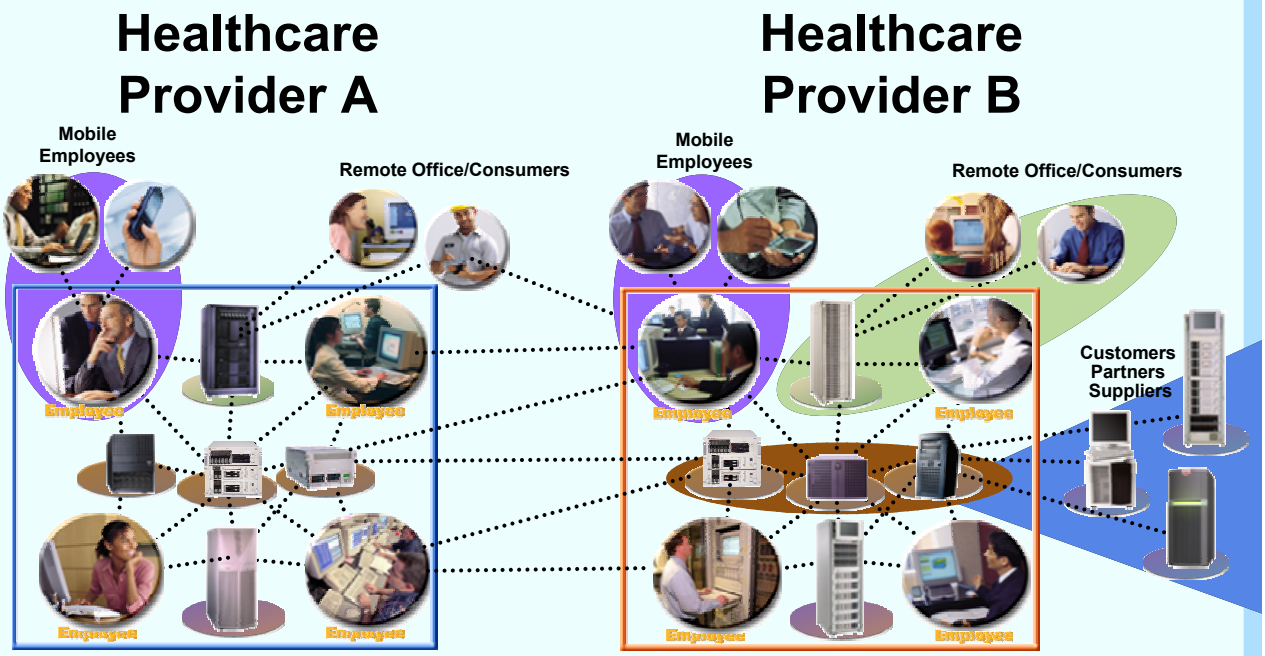
Healthcare IT Challenges

Agility And Value

- Get connected
  - Deeper customer connections
  - More strategic partner integration
  - Better quality from empowered employees
- Build for change
  - Create flexibility to adapt, evolve in future
  - Streamline business processes
- Capture business value at all levels
  - Bottom line: do more, do it faster, do it with less
  - Top line: new value from new & existing assets

Microsoft

The Integration Challenge



Business demand = everything connected

Connection Imperative

Implications & Challenges

- Shift from single function application to constellations
- Information flow primary requirement
  - Mandate to connect "islands" of information
- Integration "pain" has reached breaking point
  - Systems not designed to work together
  - Interoperability an afterthought
  - Expensive, hard, time consuming, brittle

Current model can't keep up with business

Agenda

- Vision – Healthcare Without Boundaries
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- **Removing the Barriers with Open Standards**
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Microsoft

Web Services

Industry standards for interoperability

- Based on open, Internet standards
  - XML, SOAP, WSDL, UDDI
- Enable disparate systems to work together
  - Across languages, platforms, applications
  - Computer to computer
  - Inside/outside the firewall
- Modular and Composable
  - Factored to stand alone or work together
- Broad industry support
  - Key area of vendor alignment

Microsoft

Web services Benefits

- Reduce the cost of integration
  - Currently $7 for every $1 of software purchase
  - Connect with and reuse existing assets
- Increase revenue opportunities
  - Extend to new end-points, devices
  - Broaden partnerships
  - Deepen customer relationships
- Gain competitive advantage
  - Opportunity for market leadership
  - Position for success – Business Agility

Microsoft

The Industry Is Aligned…

WS-I

WEB SERVICES INTEROPERABILITY ORGANIZATION

www.ws-i.org

- Broad industry initiative for web services
  - Over 170 industry leaders
- Interoperability across platforms, applications, and languages

Microsoft

Web Services Architecture

Connected Applications	Management	Business Process	…	Applications & Application Infrastructure
Security	Reliability	Transactions	Metadata	Foundation
Messaging				
XML				
HTTP	TCP	SMTP	…	Transports

Microsoft

Agenda

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- Summary

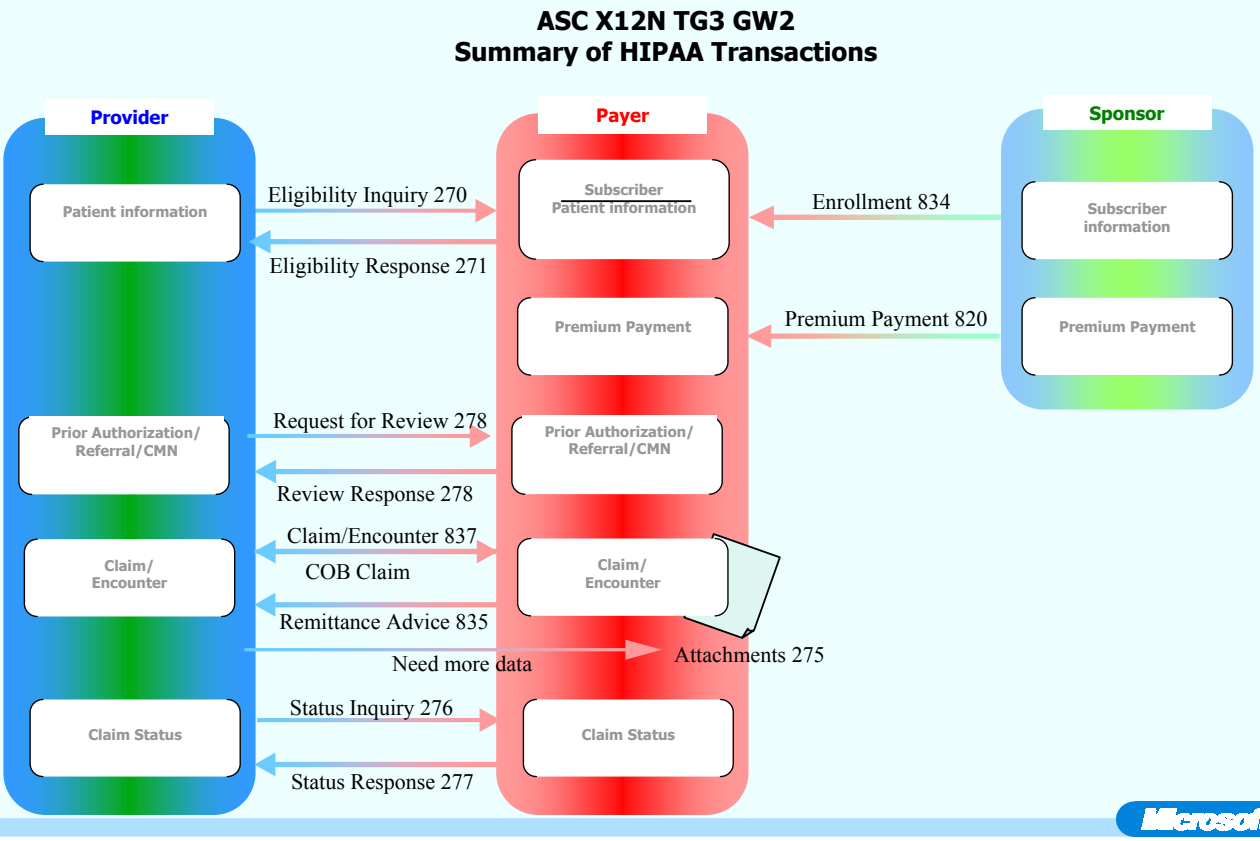
Microsoft

What Is HIPAA?

- Focused on Health benefits and financial transactions
  - Not clinical information – that's HL7 (next slide)
- A standard for transmitting enrollment, eligibility, claims, and remittance information between sponsors, payers, and provider businesses
  - HHS Approved (HIPAA legislation) Implementation Guide
  - A rigid framework for interactions generally non negotiable
  - Formats developed by X12N committee
  - EDI data structures
- Longer term…
  - X12N has committees evaluating XML encoding, Web Services, other open standards

Microsoft

HIPAA Transactions



What Is HL7?

- A standard for transmitting (mostly) clinical data between healthcare applications
  - ANSI approved
  - Considered by some to be "a framework for negotiation"
  - Can be difficult to use, debug, test, and support
  - The most widely used clinical messaging standard
- Example message (v2.3)

```
MSH|^~\&|Lab|Test|Lab|Test|20044320185730||ORM^O01|5730|P|2.3
PID|1||20020320||Smith^John||20020320|M|||s1^s2^c^st^81401
PV1||O|||||333^Oswald^Mark^L
ORC|NW|185730
OBR|1|185730||P3-09F09^Chemistry Panel^SN|||20020320185730
```

Does XML Replace HL7?

- No, XML is an encoding language
- HL7 is an information model to describe message content
  - Version 2.x - not a very good one
  - Version 3 – significant modeling effort, but very difficult to understand
- Work in progress on XML encoding of HL7 version 2.x messages
- HL7 version 3 is typically encoded as XML

HL7 version 3

- New modeling and message development process
  - Based on a Reference Information Model (RIM)
  - Several levels of model refinement towards actual message definitions
- Provides a specification for XML encoding
- Web Services communication profile
  - Currently being developed
- U.S. adoption – still 5+ years away (Gartner)
  - Due to size and complexity of current HL7 deployments
- International Early Adopters
  - UK – NHS e-Government initiative
  - Mexico - IMSS
  - Canada – Provincial Health

Agenda

- Vision – Healthcare Without Boundaries
- Business Issues and IT Challenges
- Removing the Barriers with Open Standards
- HIPAA and HL7 efforts
- **Summary**

Microsoft

Call To Action

- Understand Open Standards development process
  - http://www.ws-i.org is a good place to start
- Use Web Services to expose core business functionality within and between Healthcare organizations
- Pilot a specific component
  - Integrate with 1-2 business partners
  - Measurable cost/benefit analysis
- Engage in HL7 version 3 efforts
  - Accelerate v3 development and delivery
  - Web Services profile
  - and other relevant Healthcare standards…

Microsoft

Microsoft In Healthcare

- Healthcare Sales Organization
  - Drive overall vision of MS in Healthcare
  - 140 people in sales, services, and marketing
  - 125 customer accounts and 10 ISV partners of focus
  - Manage over 60 Healthcare ISVs in breadth program
- Product Team Solution Groups (vertical)
  - eBusiness Server team – 25 FTEs
  - Information Worker – 10 FTEs
- MS-HUG
  - Founded in 1995
  - 1,500 members

Microsoft

Microsoft®

Microsoft

Open Source Health Care

Benefits for establishing standards

David Piggott
(for Brian Bray, Minoru)

Experts Conference,Stuttgart,September 9, 2003

Opening Remarks

- Brian Bray
  - President of Minoru
  - Leader of 'Open Health' initiative
  - Manager of EC funded 'Spirit' project
  - Technical Coordinator of PICNIC Phase 2
- PICNIC were Open Source pioneers, but not missionaries
- Open Source and Architecture

Presentation Objectives

- What is open source?
- Open source approach to health care
- How to benefit from open source
- Using open source to support standardisation
- More information

Open Source Introduction

- Sharing is as old as computing
- Open source standardizes sharing:
  - New Licenses
  - **New Processes** and Tools
  - New Business Models
- Sharing has value

What is Open Source Software?

- Open source is copyright software
- With source code
- License to use for any purpose
- License to modify for own use
- License to redistribute and sell
- License (sometimes requirement) to redistribute modified source

Open Source Processes

- Collaborative development
- Open development process on Internet
- Extensive use of collaborative tools
- Extensive reuse of existing components
- Organization
  - Dictator(s)
  - Core team
  - Contributors

Open Source in Health Care

Healthy & Active Community

- 500+ individuals
  - universities & research institutions & government institutions
  - commercial companies
  - national public health services
  - policy makers & funding agencies
  - private medical practices
- mostly technical
- 80+ software projects

Community Resources

- Openhealth mailing list
- Open Source Health Care Alliance (OSHCA)
- SPIRIT Portal
  - single meeting place
  - Development space (Forge)

Major Current Projects

- DHCP/VISTA project: VA Hospitals in the USA.
  - complete hospital suite developed for military hospitals
  - made available through Freedom of Information Act
- Los Alamos National Labs – OpenEmed
- PICNIC, Components supporting an architecture for regional networks.
- OSCAR, Torch, FreeMed and other practice management systems
- Good Electronic Health Record (GEHR, OpenEHR)
- European projects (Dutch medical association, OpenGALEN, ...)

SPIRIT Industry Model

- Concept from Spirit project
- Stages:
  - Innovation stage
  - Evidence stage
  - Commercialization stage
  - Operational stage
- Vision of health care informatics future
- "Production line" for open source software

SPIRIT Industry Model

- Innovation stage
  - Innovators exchange software and ideas to build, critique, and refine software base
- Open source benefits
  - Innovation can move to new areas -- reinventing standard components not needed
  - everyone can innovate (not just copyright holder)
  - Innovations can be combined
  - Incremental innovation

SPIRIT Industry Model

- Evidence stage
  - Deployment in experimental and pilot settings close to innovation groups
  - Evaluation for clinical and cost impacts
- Open source benefits
  - Special license, payments, and legal agreements not required
  - Interior (source code) inspection and repair
  - Safer for independent groups to pilot
  - Combination of innovations at the pilot stage

SPIRIT Industry Model

- Commercialization stage
  - Vendors convert research results into solutions
  - Vendors become innovators for software they distribute and support providing feedback
- Open source benefits
  - Vendor neutral, simple and effective means of technology transfer
  - combine software with hardware, practices, support and infrastructure
  - local adaptation and integration
  - support close to customer

SPIRIT Industry Model

- Operational stage
  - Software reaches care delivery organizations
- Open source benefits
  - Increased competition
  - Increased rate of innovation
  - Lower cost
  - Lower risks related to long term viability
  - No vendor lock-in

Benefit Summary

- Transparency
- Freedom
- Results / Costs

Open Source and Standards

- Open source has a long history of interaction with standards
- Classic case is open source support for internet standards vs OSI standards
- Open source can
  - Keep standards groups grounded
  - Increase participation in standards
  - Increase uptake by lowering barriers

Realizing Benefits

- Use open source software where available
- Publish what you have
- Join the community
- Use open source licenses
- Start small and grow into it

Using Open Source Licenses

- GNU General Public License (GPL)
- GNU Lesser Public License (LGPL)
- BSD Style License
- Vendor specific licenses (IBM, Sun, Netscape, ...)
- Licenses must be compatible to be used together. Multiple licenses increase compatibility

For More Information

- Openhealth^{tm} mailing list
  - http://openhealth.com/en/healthcare.html
- SPIRIT web portal
  - http://www.euspirit.org
- PICNIC site
  - http://picnic.euspirit.org/
- SpiritForge
  - http://forge.euspirit.net/