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HIT MANIFESTO

March 2013

Leon Jackson
Head of Healthcare IT (CIO)
University of Malaya Specialist Centre

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"HEALING MANKIND"

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UM Healthcare Portfolio

UM Care Delivery Portfolio

UNIVERSITI MALAYA
KUALA LUMPUR

UNIVERSITY OF MALAYA
KUALA LUMPUR
UM MEDICAL CENTRE

Public Teaching Hospital
Does Primary to Tertiary Care
Sees over 1 Million patients a year

UM SPECIALIST CENTRE
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Private Tertiary Care Hospital
Sees about 100,000 patients a year

UMSC Differentiation in the Private Healthcare Market

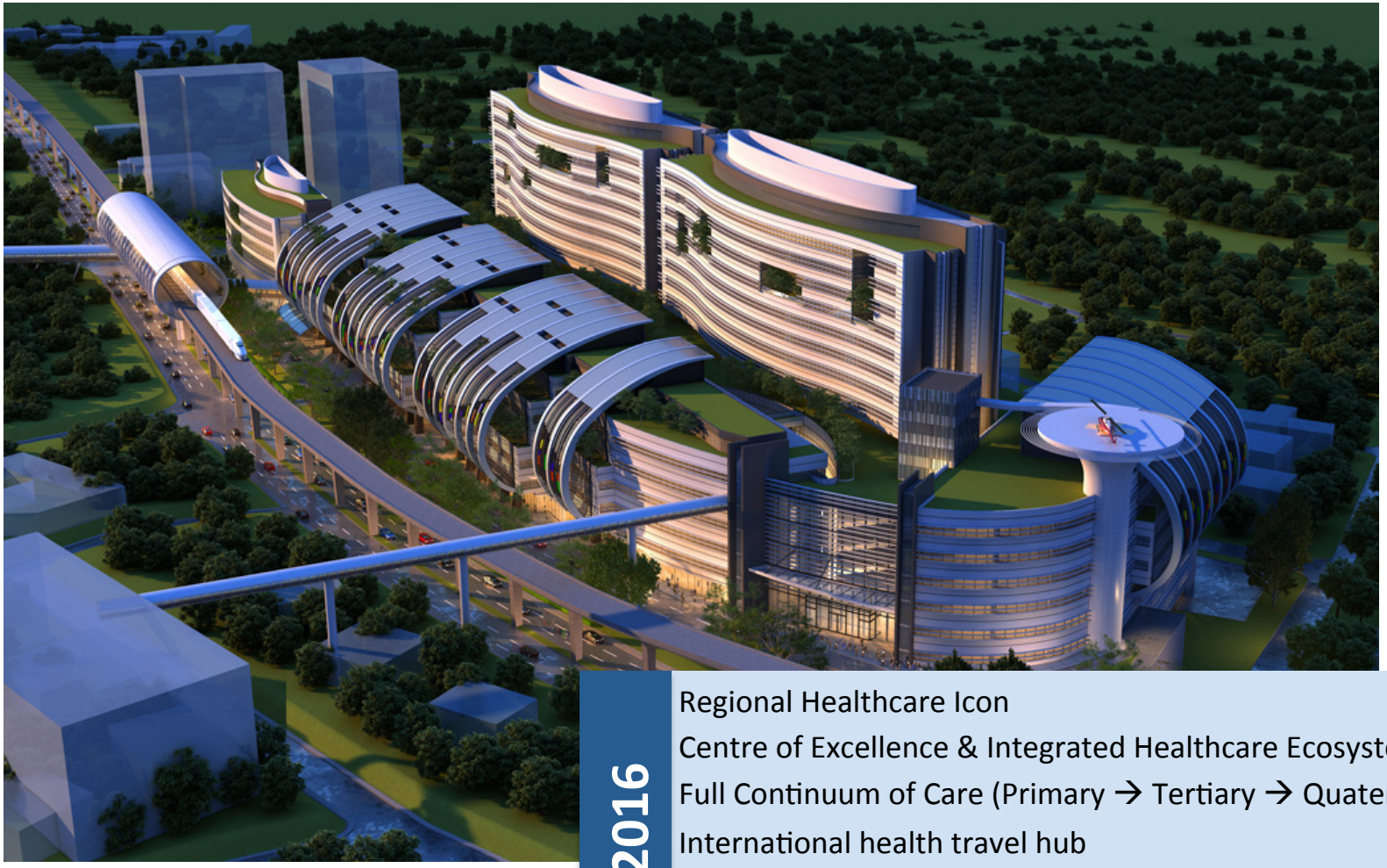
UMSC is built on the same DNA of the UM Healthcare system, with an emphasis on a holistic, cutting edge and interdisciplinary delivery of care in the Tertiary and Quaternary space. Our clinical talent comes from the best of the Faculty of Medicine.

The Origins of UMSC

UMSC begun as a “private wing” to the popular University Hospital more than 11 years ago as a strategy to retain the clinical talent in the public teaching hospital but matured into a full blown private tertiary centre and an important source of revenue to this hybrid system over the years.

Transformation of UMSC from Virtual to Actual

UMSC is currently virtual with a good number of resources running from UMMC but will soon have its own independent infrastructure with the completion of the health metropolis.



The UM Health Metropolis

2016

- Regional Healthcare Icon
- Centre of Excellence & Integrated Healthcare Ecosystem
- Full Continuum of Care (Primary → Tertiary → Quaternary)
- International health travel hub
- Capacity to treat 1.0 mil patients per annum
- 490 beds, 180 clinics, 16 OTs (Stage 1)

With the completion of the UM Health Metropolis, UMSC will grow into a 490 bed Hospital and be expandable to a 980 bed Hospital. With this new infrastructure, our combined healthcare system is expected to be providing care to more than 3 Million Patients a year.

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SOME CHALLENGES

Silos Everywhere

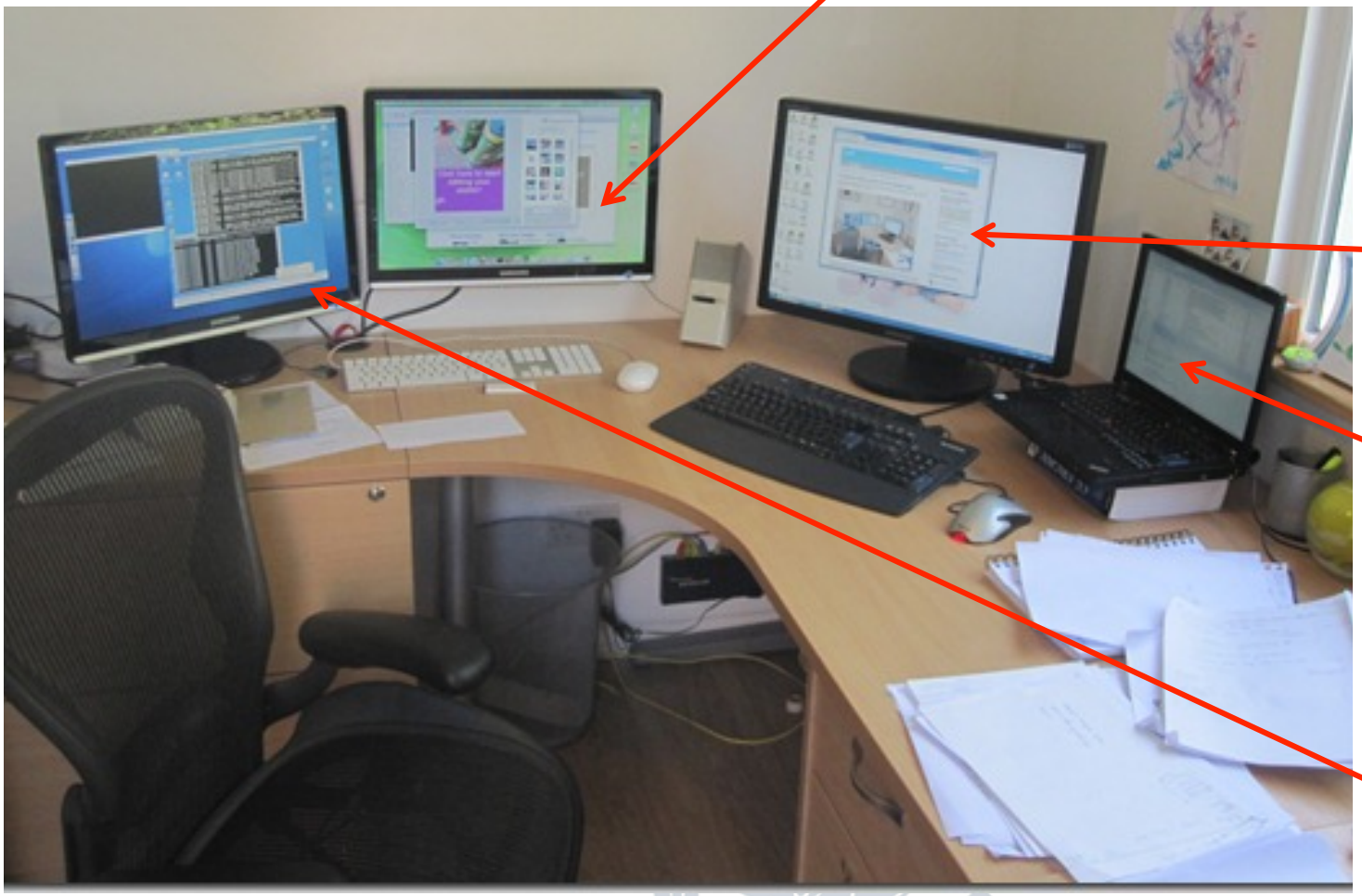
From applications, to data repositories, to back end infrastructure, more than 10 years of healthcare IT has left us with silos of many forms making it very difficult to achieve;

- A Longitudinal complete view of the Patients Medical Record
- Comprehensive Clinical Analytics
- Collaborative platforms for Clinicians

Undigitized, Unstructured Data

Much of the Medical Data is trapped on paper and difficult to provision to the point of care in a timely manner. Simultaneous use by different teams **collaborating** for a comorbidity or differential diagnosis is **virtually impossible**.

Scanning it in to create an online copy allows concurrent use, but the **software is still agnostic** of the content and cannot assist in analytics.



Applications, Access to Information

Many popular & specialized clinical applications are **made by incumbent life science vendors** and often require specialized computing environments to function, causing a proliferation of different terminals and devices needed to access different types of information in the delivery of care.

Killer Silos

In the typical hospital, Nursing staff are bombarded with request from too many channels with **duplication and risk of communication errors**. There is a correlation proven in UMSC between busyness and mistakes. Streamlining task and communication with HIT and Unified Communication not only improves efficiency and mitigates risk of errors, it also has savings from siloes of communication infrastructure.

IT Infrastructure Silos are unsustainable in the long run

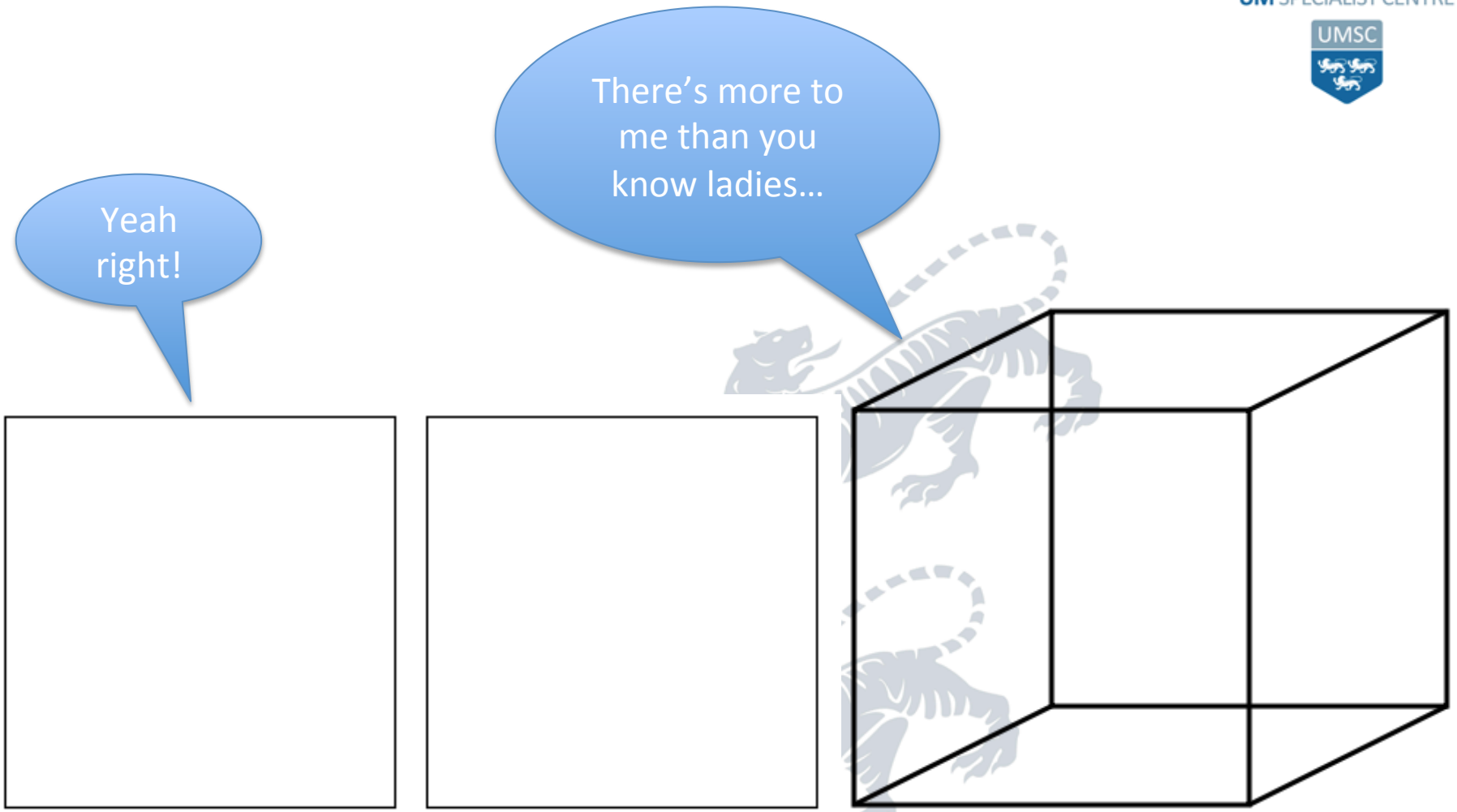
The average cost of a TB of storage in a Zero Information loss architecture is about RM 15,000 – 30,000 per TB – an IT system proliferating Silos is unsustainable. Every 500MB mammogram is really 500MB x 3 to the Hospital IT, 1 on production, 1 on DR and 1 in Backup on a tape.

Buildings based on ID not Architecture

Most of our software projects are very driven by functionality with little thought for architecture. The buildings we build aren't sound. We need good architecture (foundations) to build functionality on (ID)

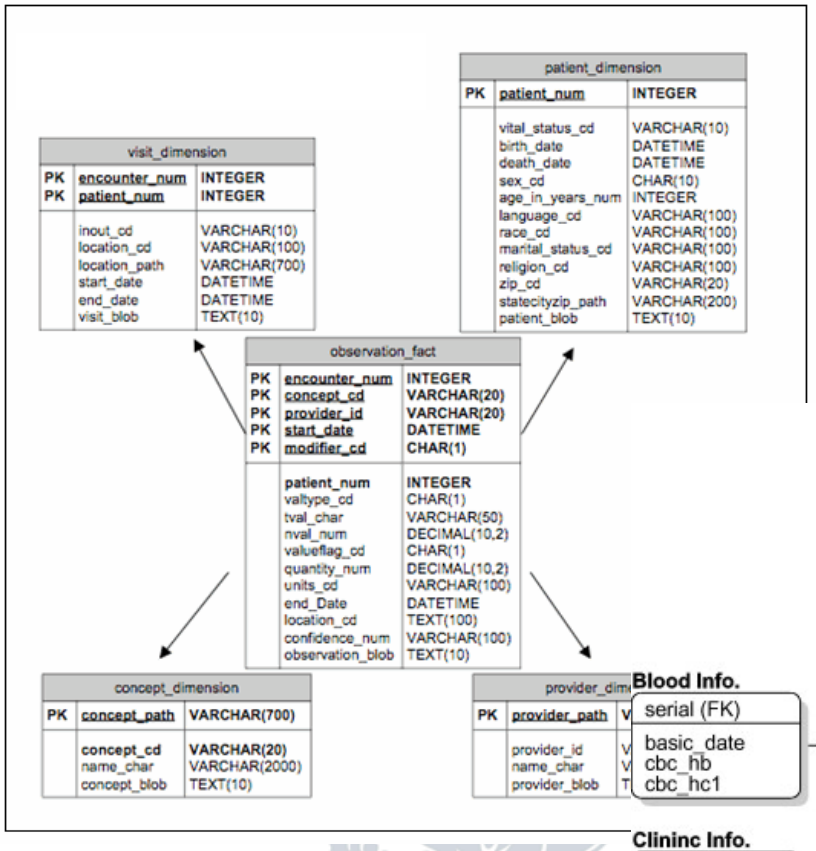
The problems with Integration via HL7

HL7 for just sending messages is prone to issues of version control, loss of dimensions in the data and inability to reconcile with other dimensions



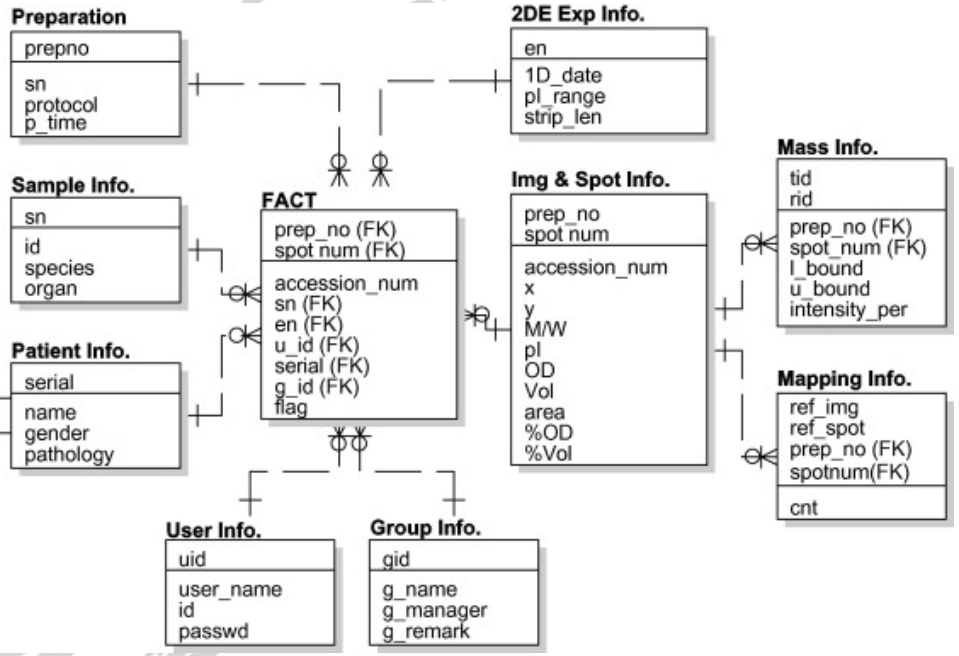
The problems with Integration via HL7

1. We abstract when we turn 3 Dimensional data to 2D messages
2. These spaghetti networks of abstraction become expensive and dangerous to maintain



Star Schema

Snowflake Schema



Missing – ETL and Data Management

1. Integration cost so much because we are trying to stretch basic HL7 Communicators to have ETL and Translation capabilities
2. Add to that the complexity of Iterative analysis (such as calculating drug doses against patient's age and weight) , Time Series Computations, Conversion of Units of measures

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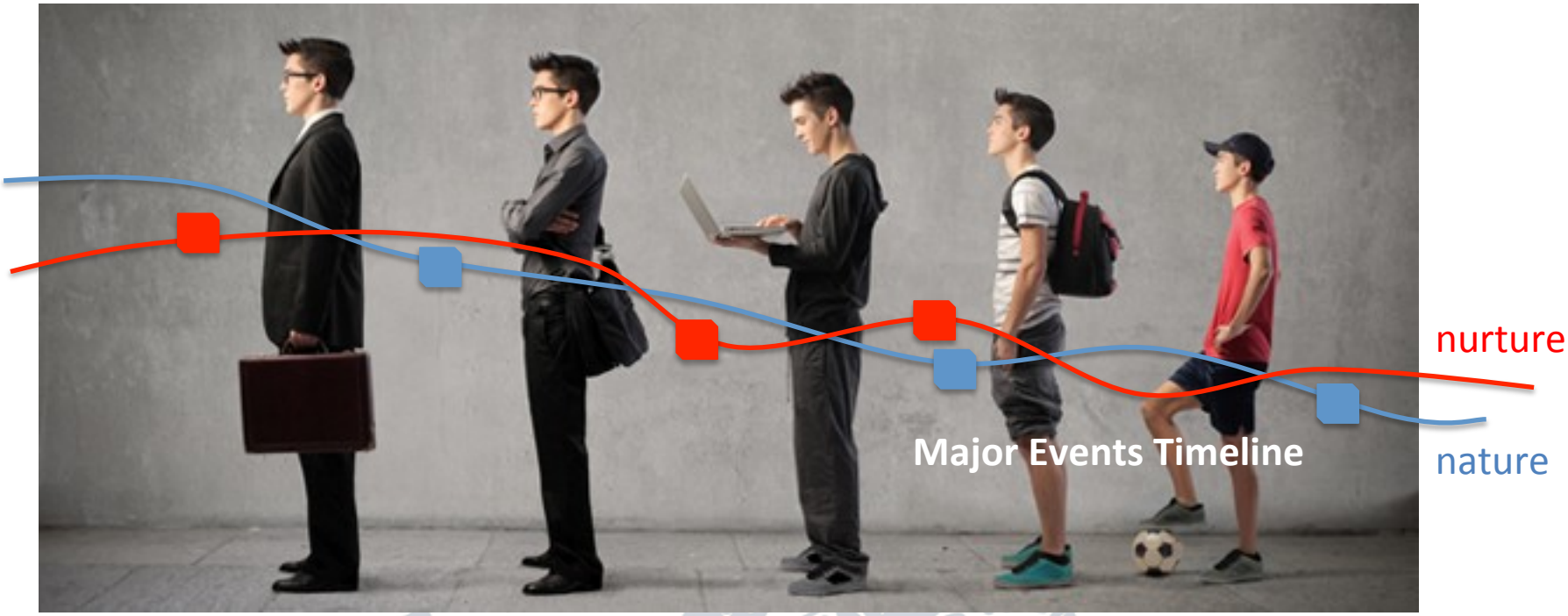
OUR OBJECTIVE

Patient Angelina Jolie 360 Degrees

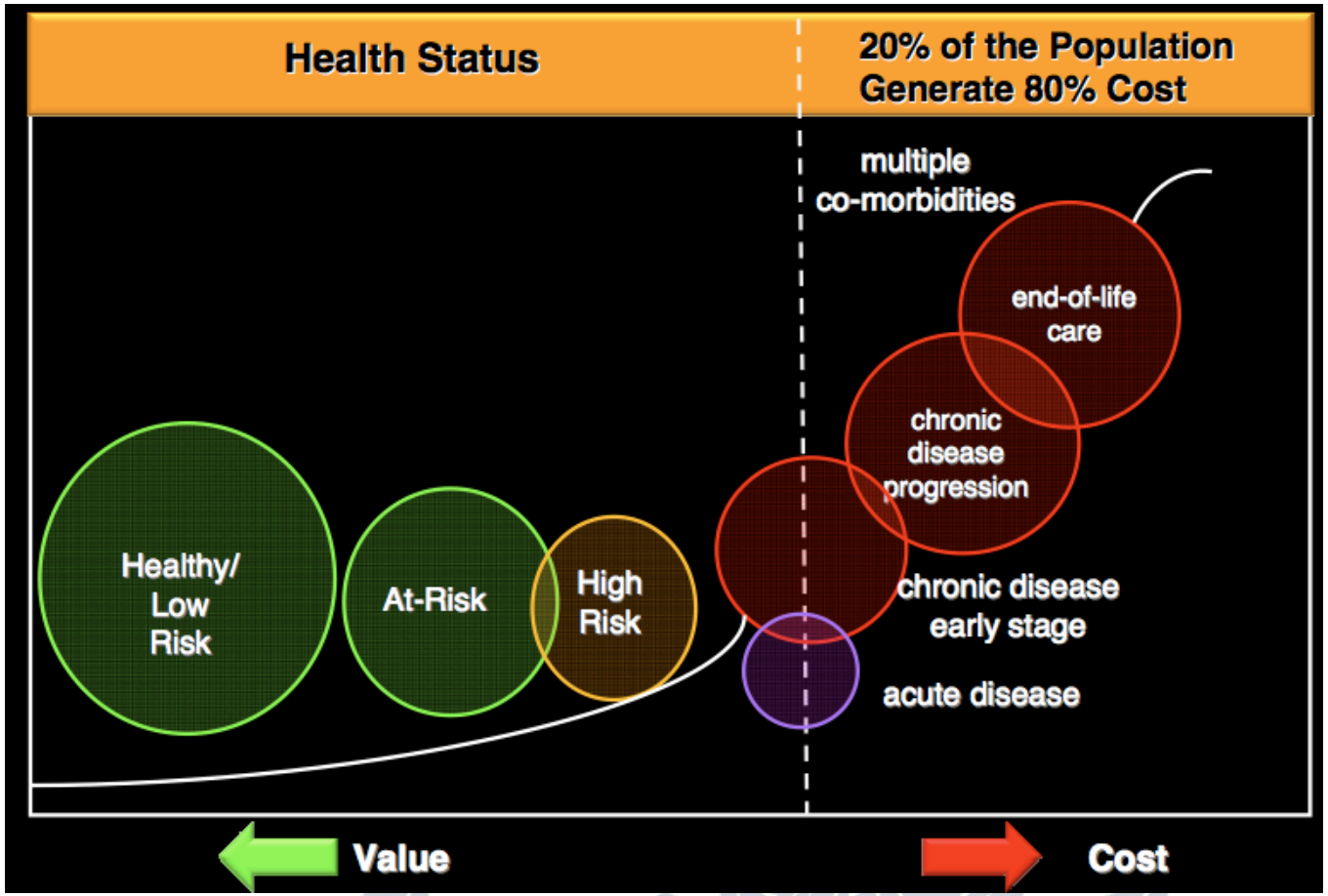


EHRs, Enabling Collaboration between Clinicians

A longitudinal, inclusive & comprehensive lifetime healthcare record that spans multiple care givers and ensures a continuity of care for patients. This patient centered approach will allow a shift from a silo-ed episodic view of care prone to waste, duplication and sub optimal outcomes to case based and lifetime care management paradigm.

HIT for Enabling Collaboration between Clinicians

HIT enabled platforms for collaboration between Clinicians will enable a consolidated lifetime healthcare record and allow care providers access to more markets without geographical constraints.



HIT to drive the wellness business

The next step in the evolution of Healthcare Provision in Malaysia is to address the opportunities for prevention & wellness, which opens up the possibility of selling diagnostics and wellness subscriptions to larger markets. Wellness will be a partnership between providers and patients, with the sole purpose of the prevention of disease. This paradigm shift will require HIT for empowering patients to manage their healthcare records with PHRs, allowing their next of kin to participate as co care managers, assigning specialized primary care and wellness partners while providing tertiary support physically or remotely via telemedicine.

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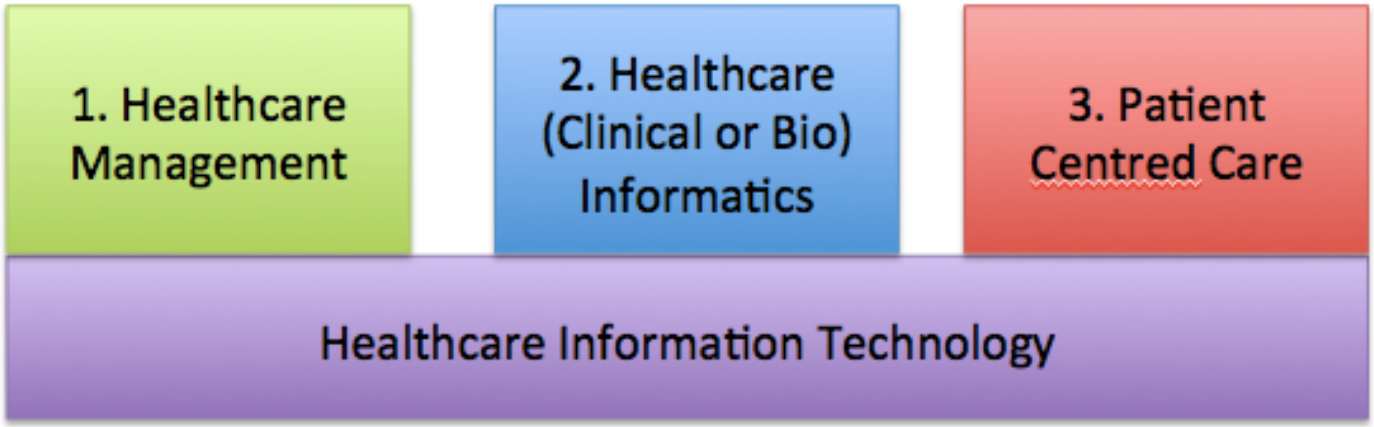
UMSC HIT IN A NUTSHELL

Our use of HIT

1. HIT builds platforms for Information Management in the healthcare practice to enable the different authorized stakeholders to consume and contribute information to the patients profile in realtime. It is also used for the management and administration of the healthcare practice, in the delivery of care, education or research.

2. HIT enables analytics of anonymized information to derive analytics and insights on commercial and clinical trends in the delivery of care and the correlation of this data to bioinformatics will enable systems biology

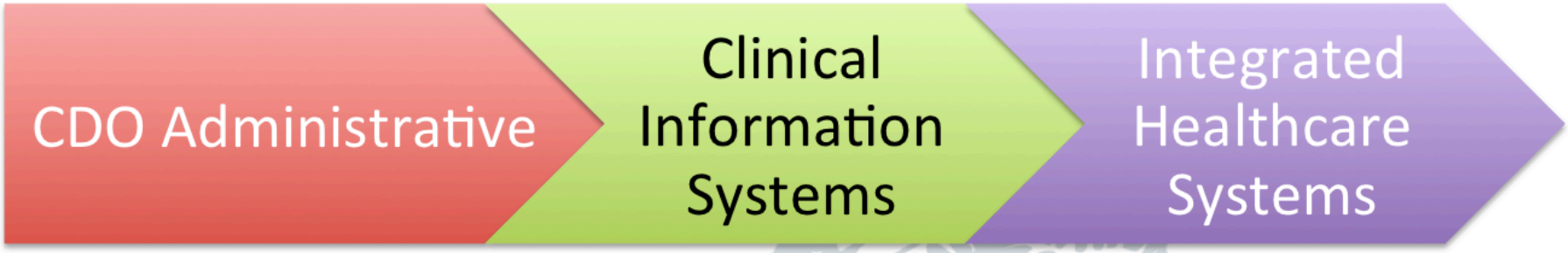
3. HIT enables the shift to Patient Centred Care which begins with an EHR that spans multiple care providers and allows collaboration and then moves on the active engagement of that patient to participate in the management of their healthcare with their trusted providers.



HIT Scope and Purpose

Much like in F1, the supporting team does everything but drive the car – The HIT department provides the tools and systems for those delivering care (the drivers) to use

Evolution of HIT

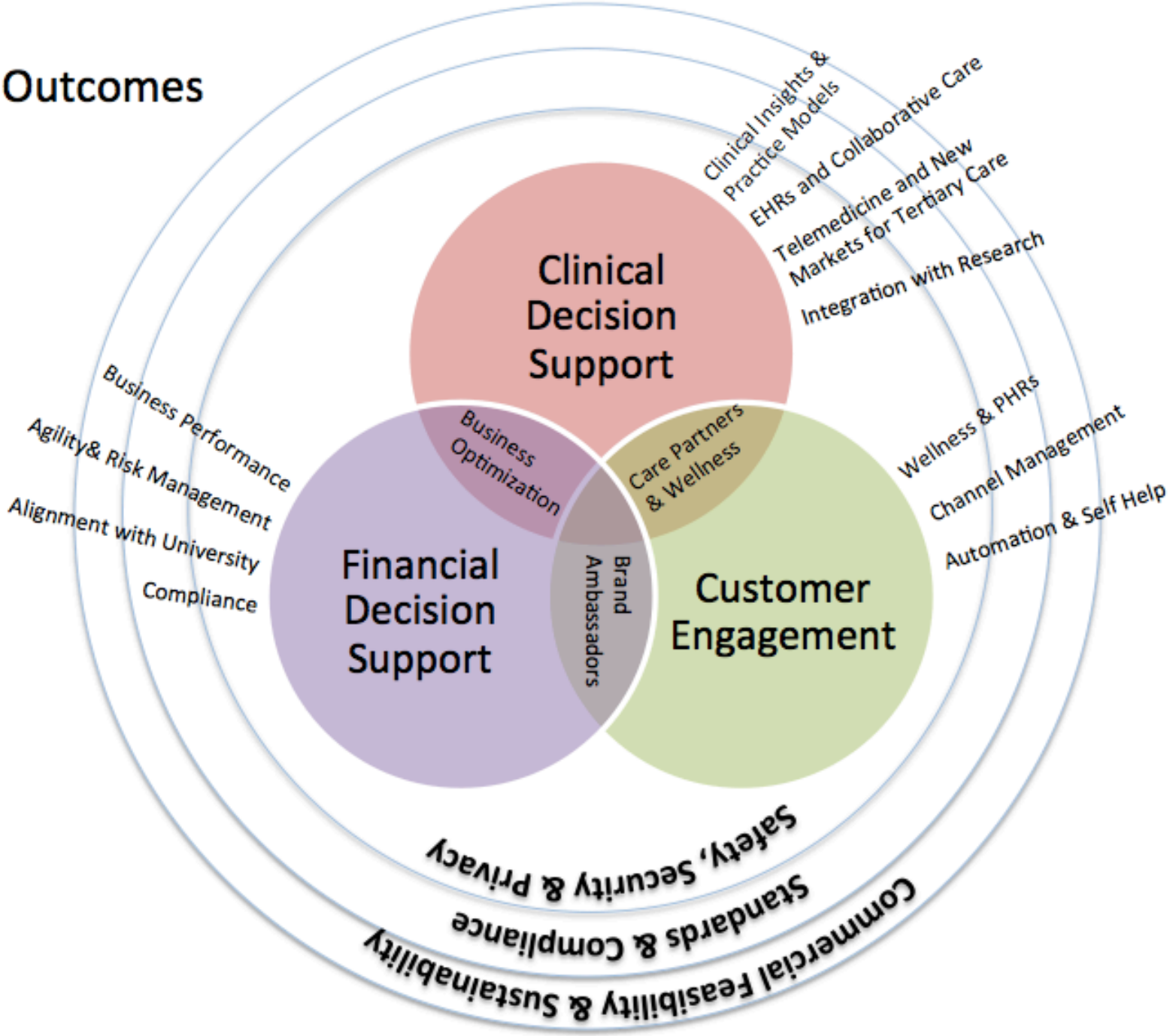


- Resource Management – Time, Facilities, Beds, HR, Inventories, Drugs, etc
- Supply Chain Management
- Patient Management Systems and CRM
- Financial Management & Business Intelligence
- Medical and Financial coding and abstraction
- Computing, Collaboration and Communications Platforms

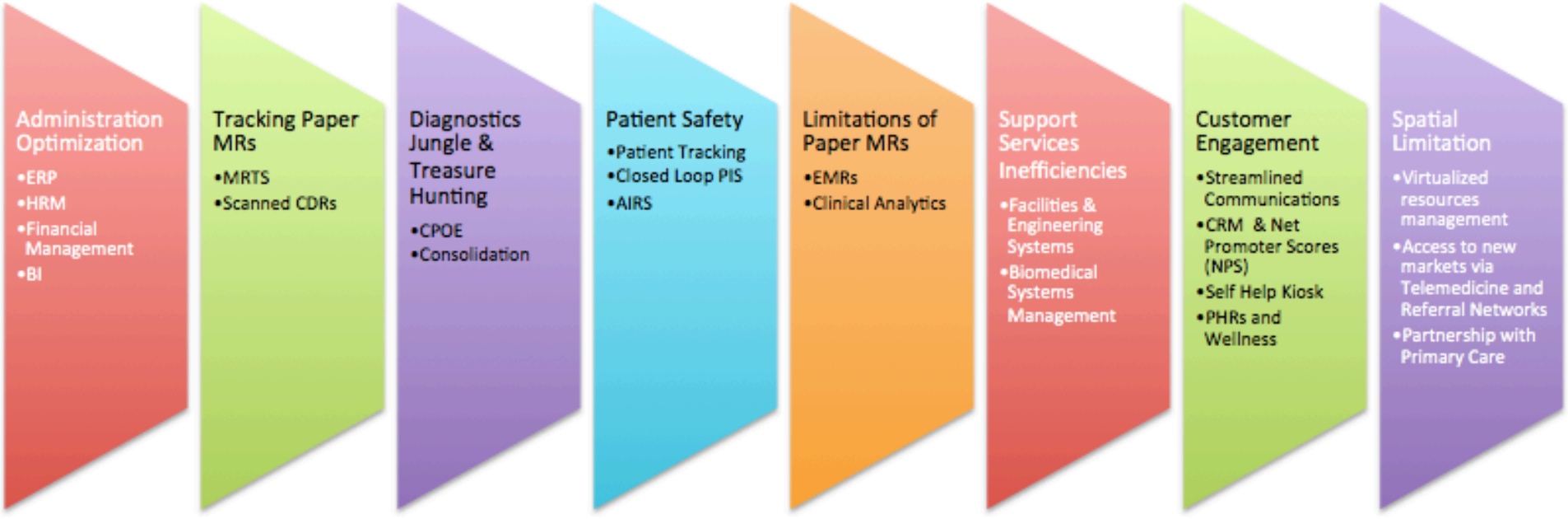
- Imaging and Diagnostic Investigation Management
- Archived Legacy Paper Medical Records
- Drug Prescriptions and Administration Management
- Clinical Decision Support and Care Pathways (Clinical Best Practices)
- Supporting therapy sub systems – Interventional Radiology, Hemodialysis, Physiotherapy, Dietary

- Interoperable Electronic Health Records (EHR)
- Integrated Payment and Payor Systems
- Integrated Supply Chains and Procurement Systems
- Integrated Diagnostic Services Networks
- Integrated Referral and collaborative networks
- Patient Portals and Personal Health Records (PHR)
- Integrated Emergency Systems and Epidemic Management

HIT Outcomes



HIT Problem Solving



Ubiquitous & Mobile Access

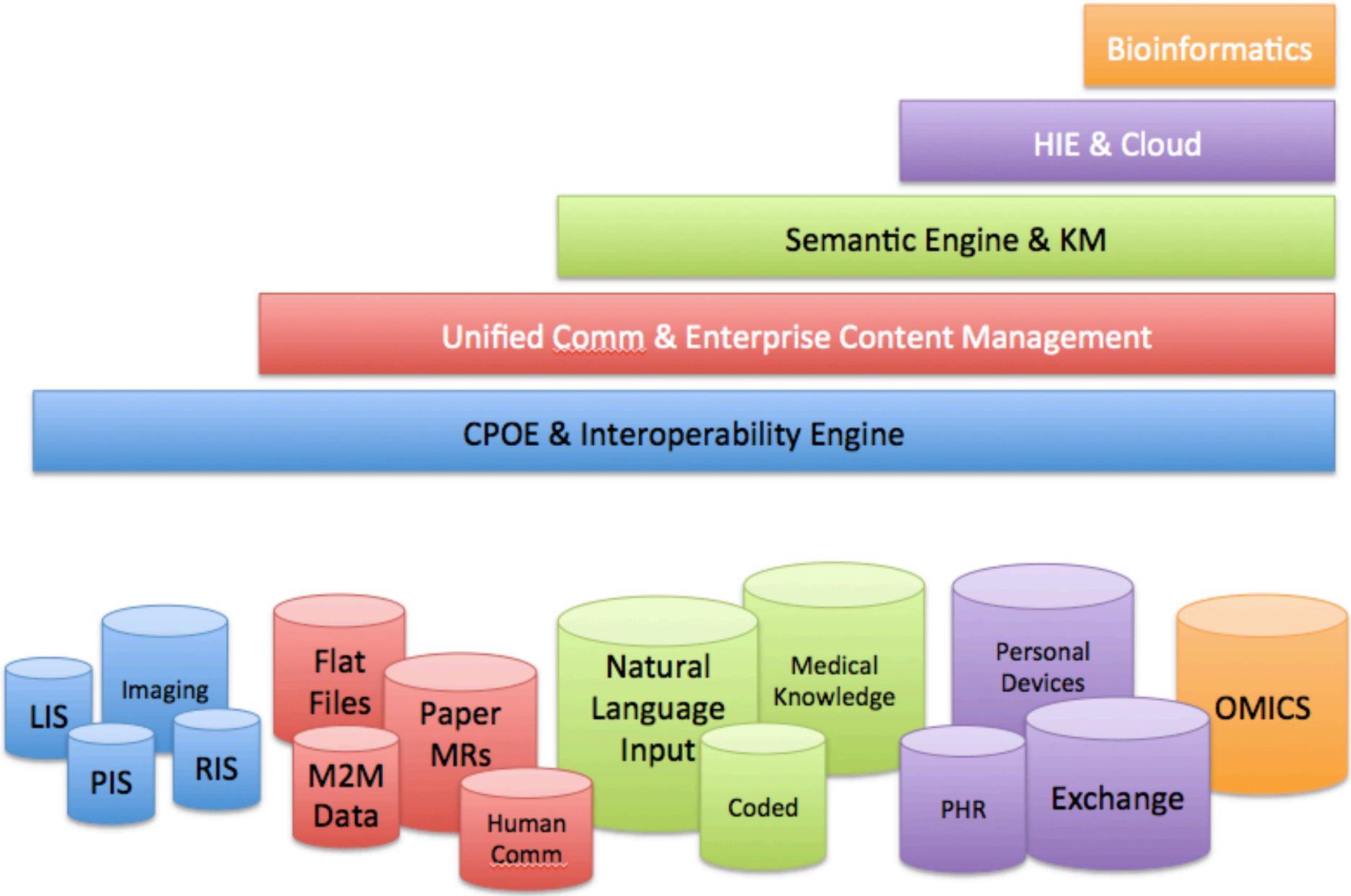
Big Data Capable

HIE Level Interoperability

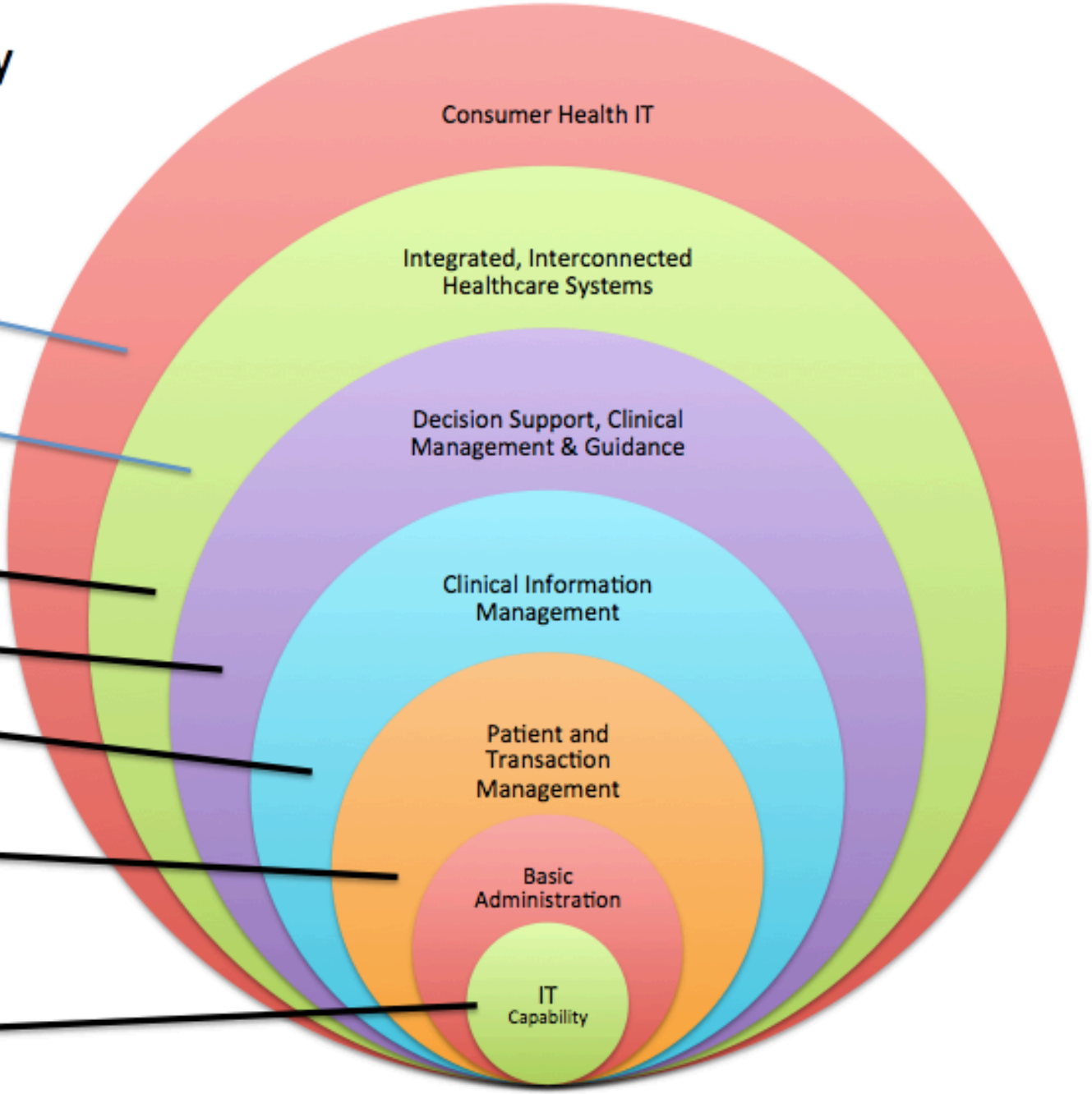
Technology Partnerships

Cloud Enabled Highly Available & Highly Managed Infrastructure

Phases of Breaking Silos



UMSC HIT Journey



Step 2: Patients Participate

Step 1: CDOs and Clinicians Collaborate

Nebulium Phase 1 – Q2, 2013

UMSC HIS Phase 3 – Q4, 2013

UMSC HIS Phase 2 – Q3, 2012

UMSC HIS Phase 1 – Q4, 2011

UMSC IT Dept – Q4, 2010

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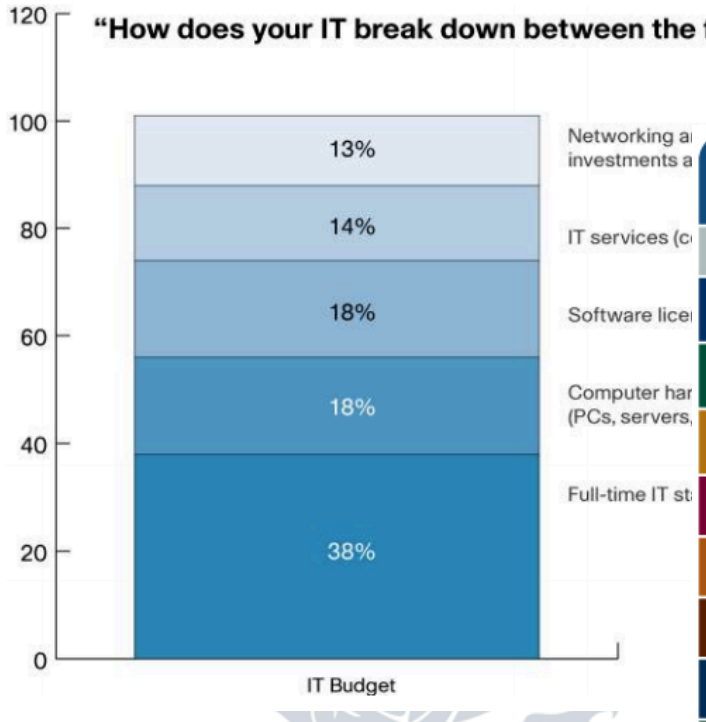
01. IT CAPABILITY

Figure 1. IT Budgets



EMR Adoption Model℠

Stage	Cumulative Capabilities	% of US Hospitals 3rd Quarter
Stage 7	Medical record fully electronic; CDO able to contribute to EHR as byproduct of EMR	0.0%
Stage 6	Physician documentation (structured templates), full CDSS (variance & compliance), full PACS	0.6%
Stage 5	Closed loop medication administration	1.4%
Stage 4	CPOE, CDSS (clinical protocols)	2.2%
Stage 3	Clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology	24.1%
Stage 2	Clinical Data Repository, Controlled Medical Vocabulary, Clinical Decision Support System (CDSS) Capability	39.1%
Stage 1	Ancillaries – Lab, Rad, Pharmacy	15.0%
Stage 0	All three Ancillaries not installed	17.6%

Source: HIMSS AnalyticsTM Database (derived from the Dorenfest IHDS+ DatabaseTM).

IT Capability | Strategic Information Systems Planning

Healthcare Providers have to balance between their strategic and operational use of IT against the sheer cost of doing IT. IT is often the one of the biggest expenses in the modern healthcare providers budget. Organic growth over time can often lead to unsustainable silos of systems that are to expensive to grow and maintain. Careful planning & management is needed to ensure that the IT investments are sustainable over time and able to meet strategic goals.

IT Capability | Technology, Infrastructure and Systems

The datacentre is the brain of the modern hospital, and the network is its central nervous system. With mission critical applications such as, OT, ICU and ED Management systems depending on critical infrastructure, the modern datacentre has to be designed to be resilient to disruptions and disasters. It has to also offer agility to IT and business units to deploy new Clinical and Business systems in short time frames, because healthcare is a very dynamic industry in the midst of big transformations.

IT Capability | End User Computing & Interfaces

Large hospitals often sprawl through large geographical spaces and require a continuity of IT and communications no matter which building or wing a user is in. Clinicians and staff need follow-me-desktops with persistent sessions, rights and applications that can be accessed from various terminals or mobile devices because its not always feasible to carry a device or computer around with them.

IT Capability | Talent

The hospital also needs the right talent that includes;

- Computer and Network Engineers
- Software Engineers
- Database Administrators
- Health IT professionals

Smart partnerships and cloud computing help the modern hospital cope with these needs by outsourcing to technology partners better equipped to recruit and retain such talent. While it is possible to outsource execution and operations, design and management of the Health IT must be carried out by an internal resource who is guaranteed to protect the interest of the hospital.

IT Capability | Adoption & Change Management

The single biggest asset of any health IT project is the adoption of the clinicians and staff. Change management strategies and complex business process reengineering is needed to transform a hospital to embrace automation and electronic workflows.

IT Capability | Governance and Compliance

A detailed study of compliance and governance frameworks must be conducted that should result in a clear understanding of the economics of compliance and an action plan to implement the frameworks necessary.

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02. ADMINISTRATIVE IT

Administrative IT | Enterprise Resource Management

The right Hospital Information System will create data models and structures to understand the hospitals resources, cost and revenue structures tied down to the various business units, such as Radiology, Cardiology, etc. This will enable better planning for capacity, and investment for growth, etc, and translate to a better bottomline or the ability to maximize the available funding.

Administrative IT | Enterprise Resource Management

Asset management systems help track and manage expensive biomedical and engineering assets while allowing managers to optimize their utilization and lifecycle.

They will also help the hospital maintain quality and compliance requirements .

Administrative IT | Business Intelligence

Advanced use of modern BI tools provide the modern hospital managers with information they need to better understand their business drivers, demand, issues and risk while making more evidence based projections and resource allocation. They also help create platforms of transparency, where governing Boards can be assured that they are looking at performance metrics and KPIs from actual live data.

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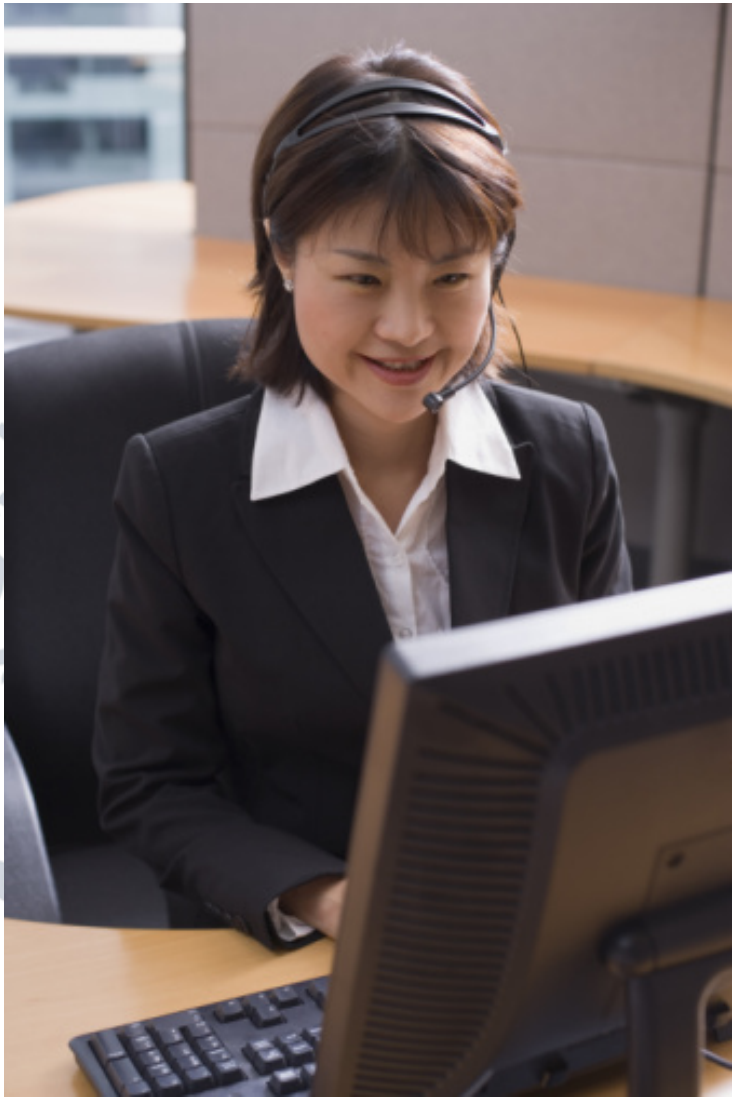
03. PATIENT MANAGEMENT

Patient Management | Hospital Call Centre

In outpatient and tertiary care clinics, the consultation often begins with a call to the hospital call centre. The call centre has to be equipped to identify returning patients and referral partners and translate that into an appointment with a clinician.

The call centre also manages reminders to patients to reduce the amount of no shows.



Patient Management | Customer Service & Hospitality

A unified Hospital Information System can facilitate the identification of a patient and transaction at the various points of care, translating to more comfortable patient experience with the added benefit of the timely and accurate generation of all charges.

Patient Management | Queue and Appointment Management

Integrated Queue and Appointment systems can significantly speed up the patient journey while allowing the hospital to maximize its patient volumes. It can also enable a more comfortable wait with the right digital signage, where the patient's next of kin could pass the time in more comfortable settings such as a cafeteria or library.

Patient Management | Patient Throughput

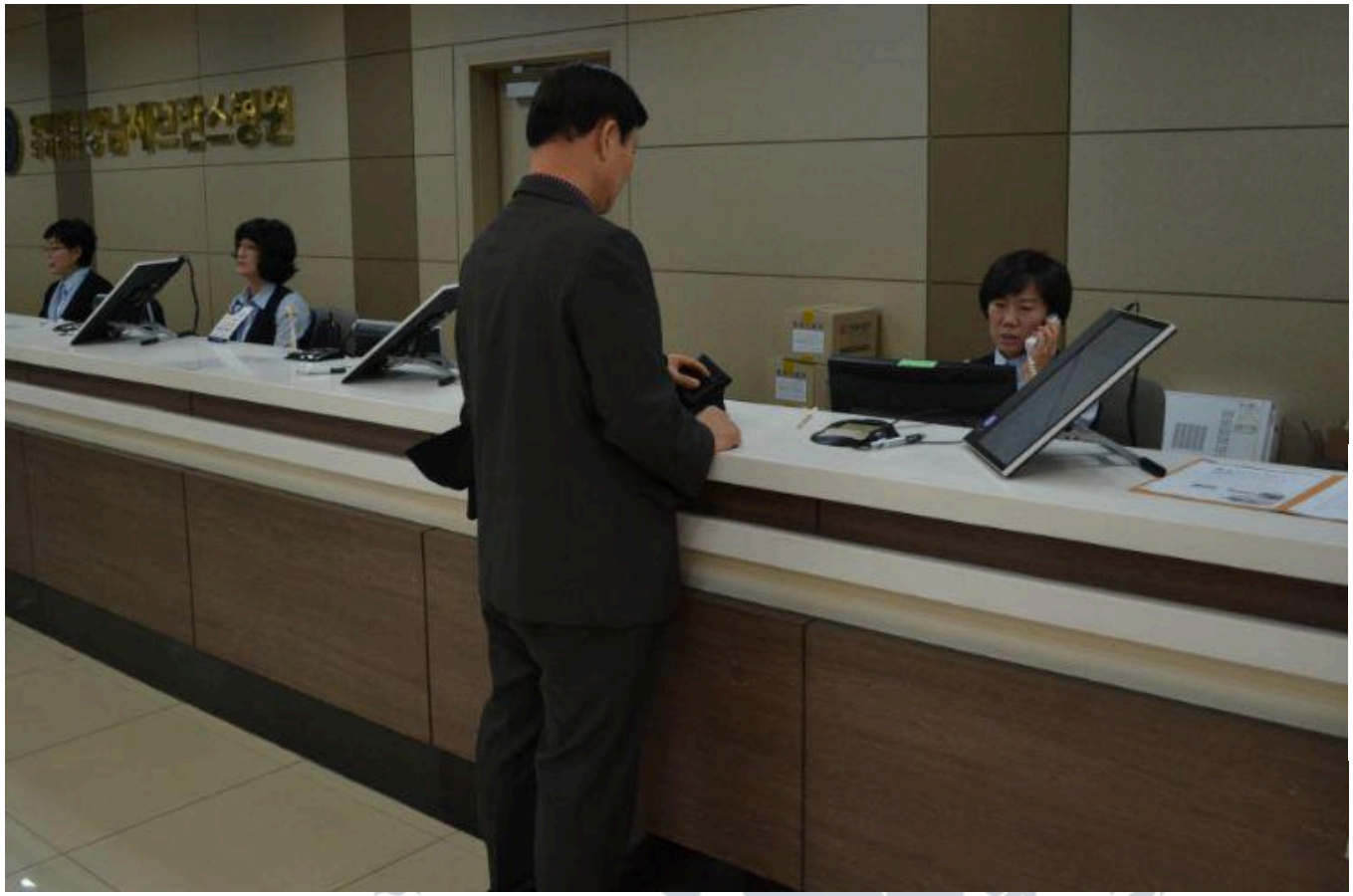
The goal of Patient Management systems is to get Patients in and out of the system as quickly as possible while ensuring their safety and comfort. This is a win/win, more throughput means the Care Delivery Organization can see more patients while no patient enjoys staying in the hospital longer than they need to.

Patient Management | Automated Identification & Patient Tracking

Automating the identification of patients during the process of care is a fundamental of patient safety, reducing the risk of medication errors or mixing up diagnostic information. RFIP technology can also enable active tracking of patient in larger hospitals and even alert nurses when a patient falls or is unusually inactive outside of their ward beds.

Patient Management | Amenities & EMR Interfaces

The bedside tablet can be offered as an amenity which can provide the patient access to the internet, piped in entertainment and even paid on demand content. The patient can also order additional products and services from the hospital or surrounding vendors and have it charged to their bill if they so choose. The patient can also have access to their bill if so configured. The screen also had clinical functionality, with the ability to video call a clinician and give clinicians access to the patients EMR at the bedside. This will reduce the risk of cross infection when a clinician carries a tablet with him from patient to patient.



Gangnam Severance Hospital, Yonsei University, Gangnam, Seoul

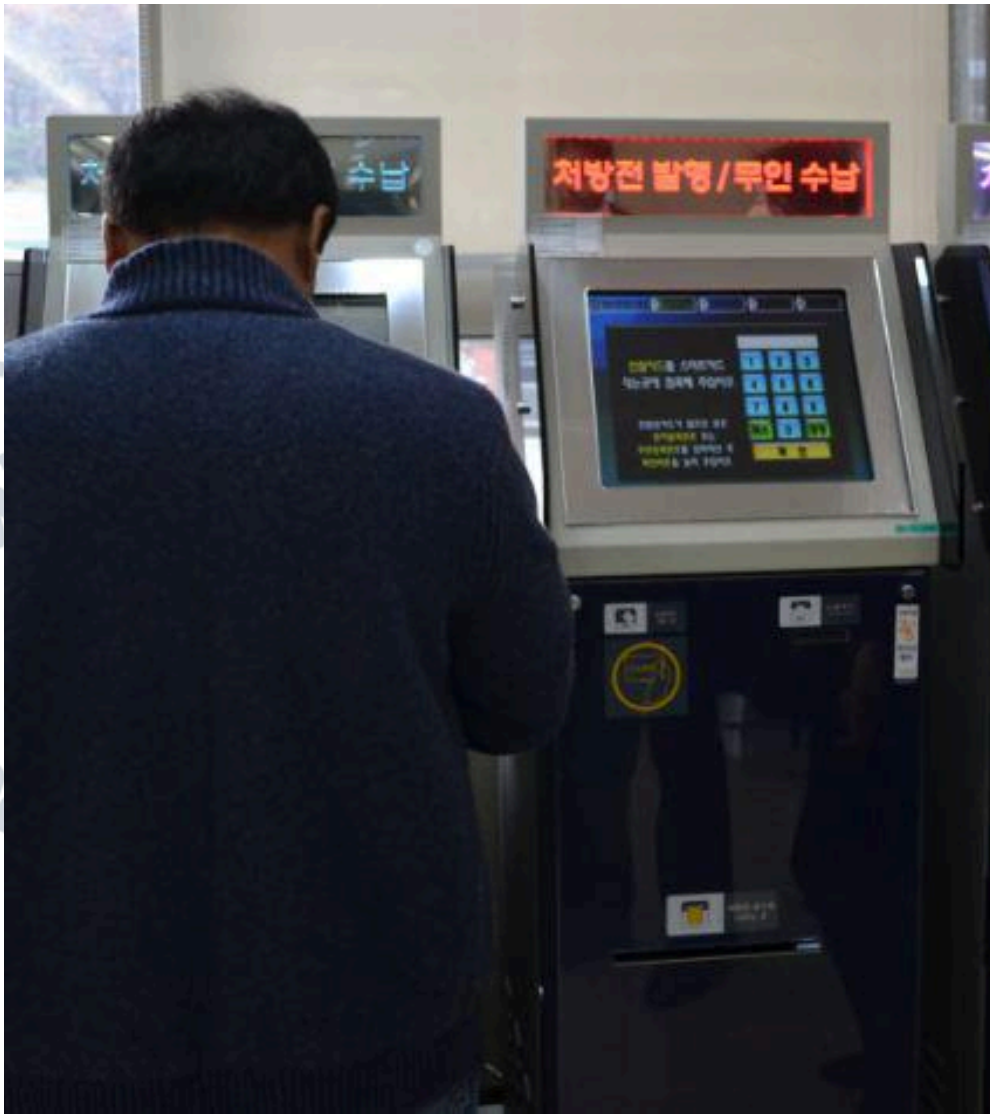
Patient Management | Billing Automation

Billing systems with interoperable data models that automatically capture charges during the patient journey so that the patient always finds the bill waiting for them, and not vice versa. A well modeled billing system will also be interoperable with payor networks, to reduce waiting time for authentication and credit checks against GL payments.

Patient Management | Self Service Kiosk

Self service kiosk can reduce patient waiting times by allowing patients to register themselves, get statements, diagnostic reports, etc and even schedule their next appointment by themselves.

Such kiosk have the added benefit of reducing the manpower needed to service patients.



Gangnam Severance Hospital, Yonsei University, Gangnam, Seoul

Patient Management | Website and Social Networking

The hospital website should be an application that serves the patients with the utilities they need and are willing to do remotely. This can include finding the right clinician, making an appointment and paying your bills. The website should also be a source of information for counseling and preparation of patients for consultation, treatment and procedures.

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04. CLINICAL INFORMATION MANAGEMENT

Clinical Information Management | Diagnostic Investigations

The modern hospital has a plethora of diagnostic modalities and methodologies. These require the tagging specimens, patients or images acquired to the correct patient ID and transaction to ensure patient safety and billing integrity. This automation requires integration between various diagnostic systems and the HIS using industry standard protocols such as HL7 and DICOM . They also require corresponding computing power and storage for information acquired from these modalities, that need to be tied back to the patients profile so that looking up a patient on the EMR also gives you access to all diagnostic information so that collaborating clinicians can make a decision from the data for themselves.

Diagnostic Investigation: Imaging Systems

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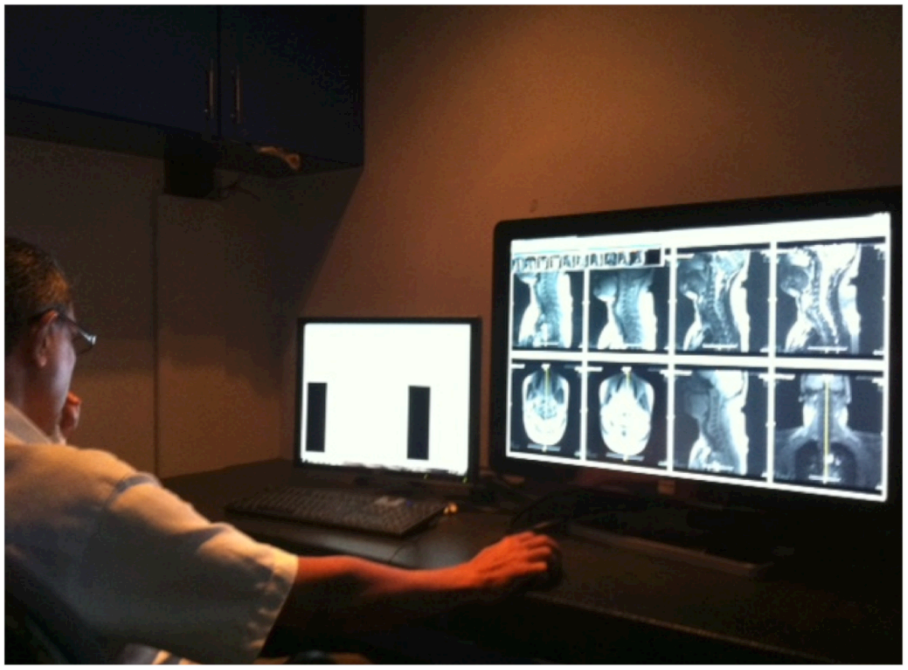
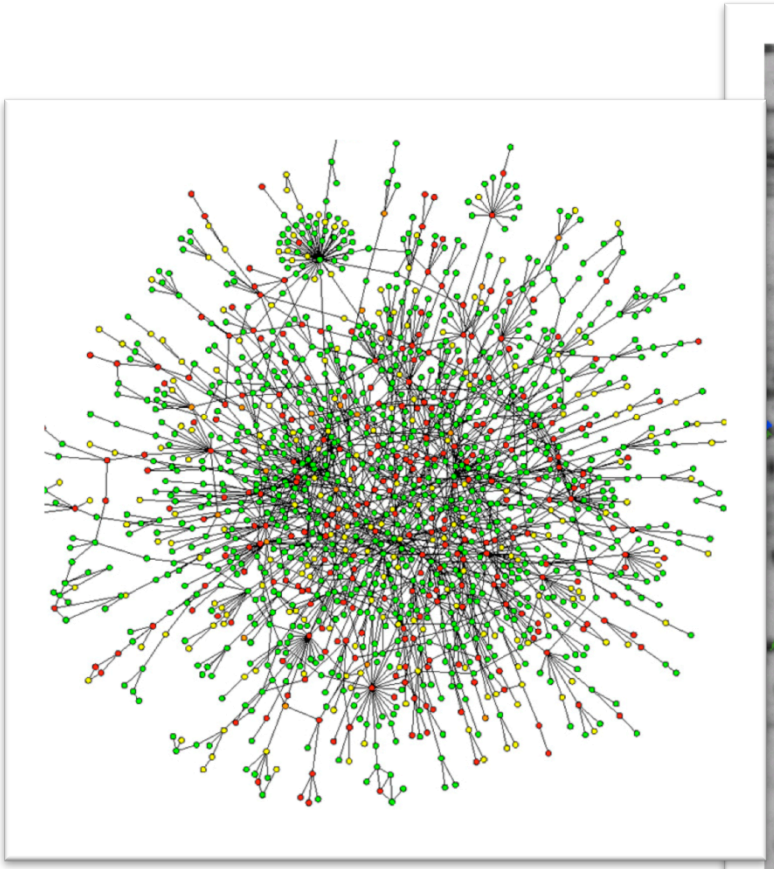
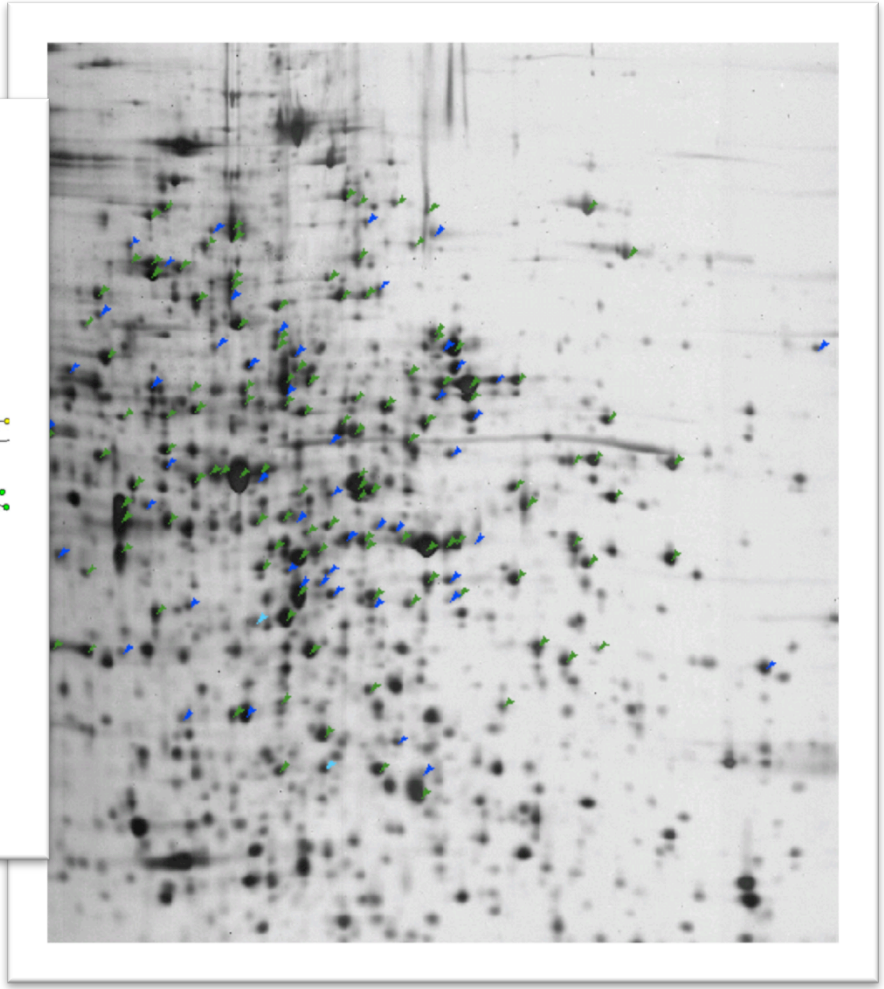
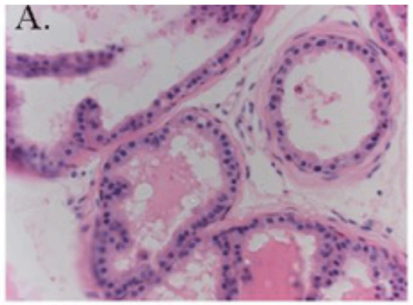


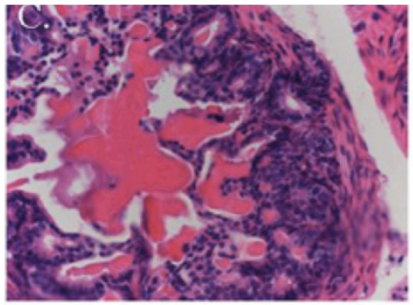
Diagnostic Investigation: Pathology, Genes, Microbial, Biomarkers, Molecular

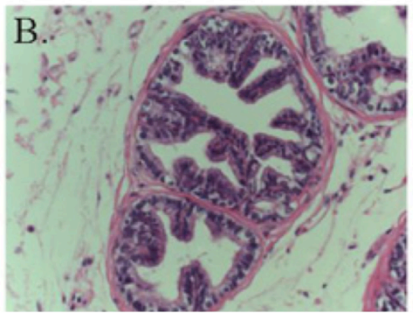


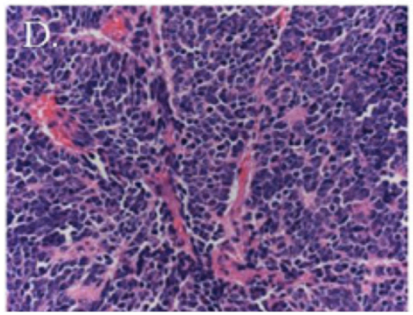


Diagnostic Investigation: Pathology, Genes, Microbial, Biomarkers, Molecular

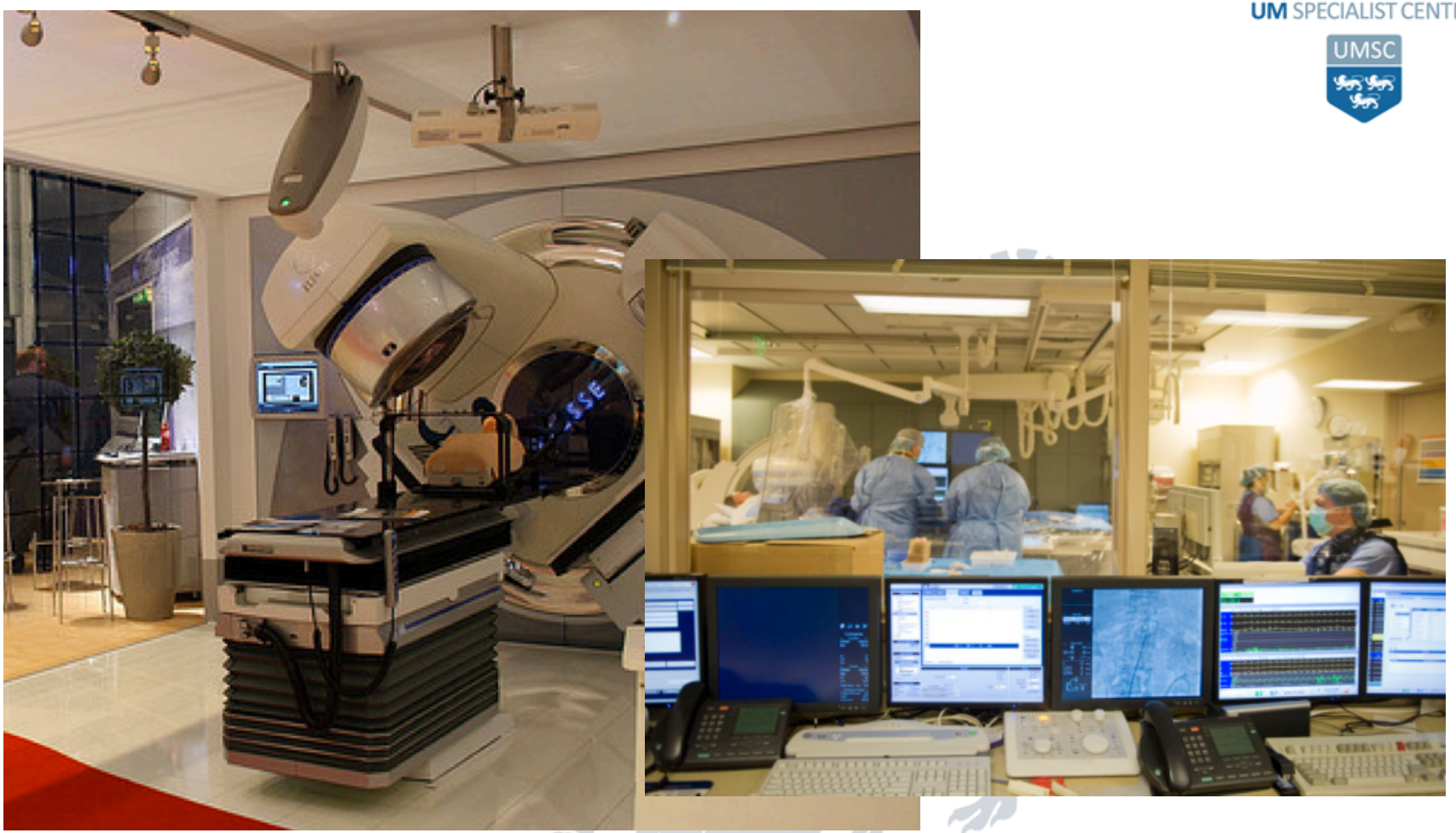








Diagnostic Investigation: Pathology, Genes, Microbial, Biomarkers, Molecular



Clinical Information Management| OT & Therapeutic Equipment Management

Modalities that perform procedures on patients such as hemodialysis units and interventional radiology require IT to receive work orders with the right patient ID, profile and transaction while automatically documenting details of procedure to episode documentation. The modern OT is also full of biomedical equipment that uses software and generates data that has to be managed and stored.

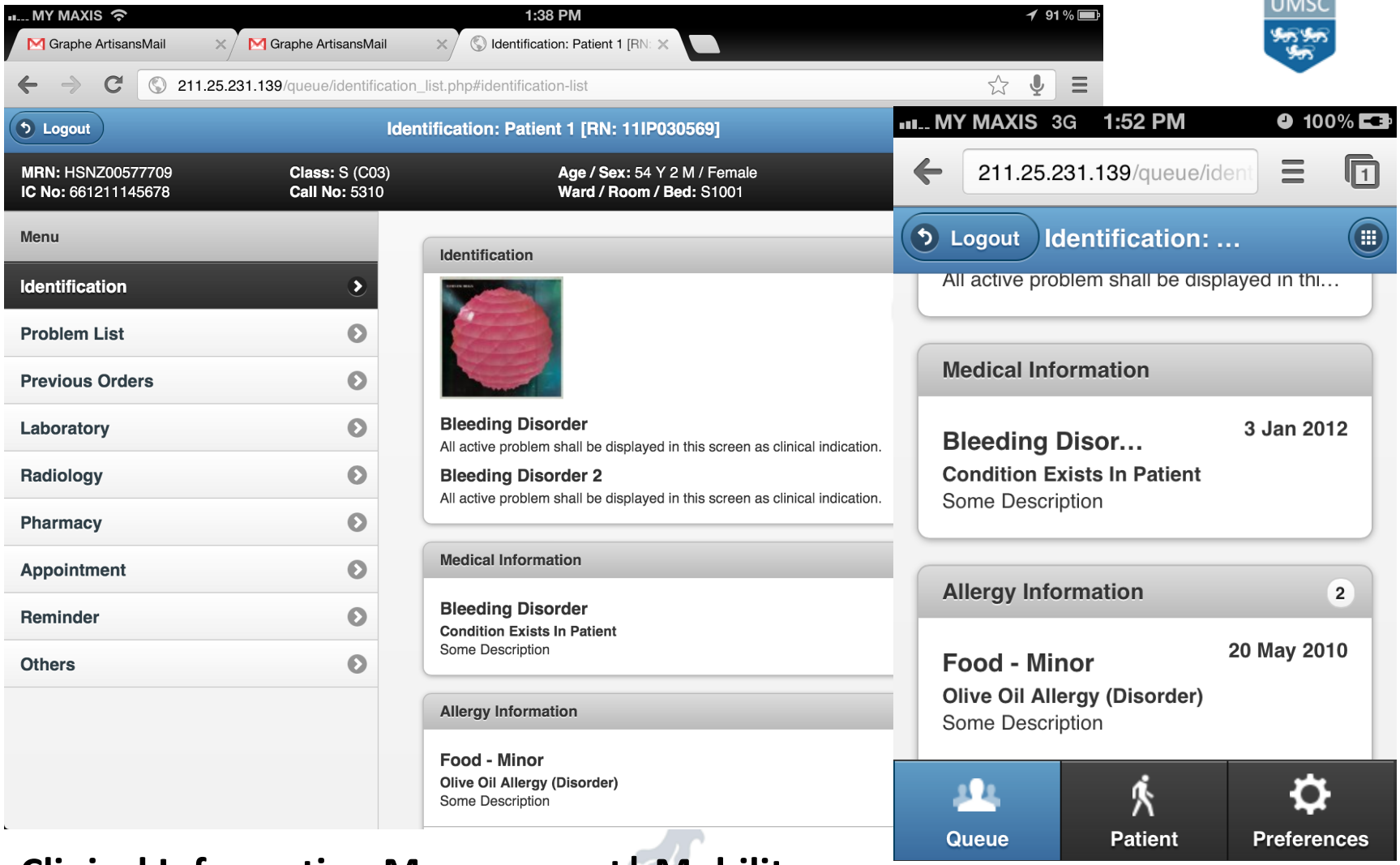
Clinical Information Management| Pharmacy Management Systems

Pharmacy supply chain management systems allow the optimization of inventories and the migration towards a just-in-time stock to reduce inventory cost. A hospital can also move towards vendor managed inventories by integrating with Pharmaceutical vendors using common retail EDI standards. Automation also reduces the hospitals exposure to pilferage and wastage.

Clinical Information Management | Pharmacy Drug Administration

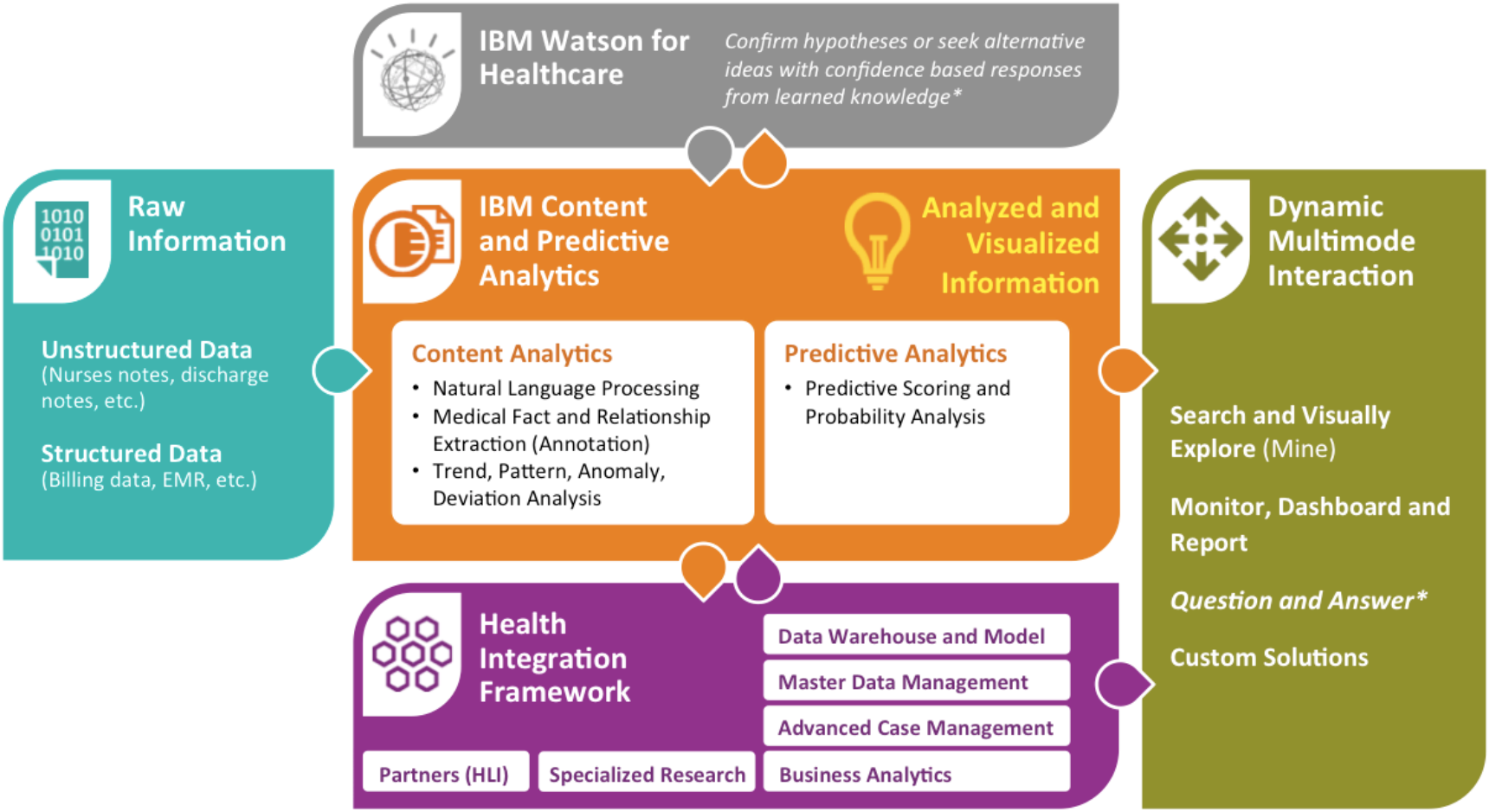
Electronic prescribing by clinicians with ward drug administration automation reduce risk of medication errors by ensuring that the right drug is administered to the right patient in the right form, dose, frequency and route. In an electronic workflow, pharmacist can collaborate with clinicians in real time to advise of drug interaction, adverse side effects, pharmacokinetic and pharmacodynamic parameters. Decision support subscriptions are also available electronically to advise clinicians at the point of prescription.

An integrated EMR and PIS has the added benefit of being able to data mine for the right profiles for clinical drug trials.



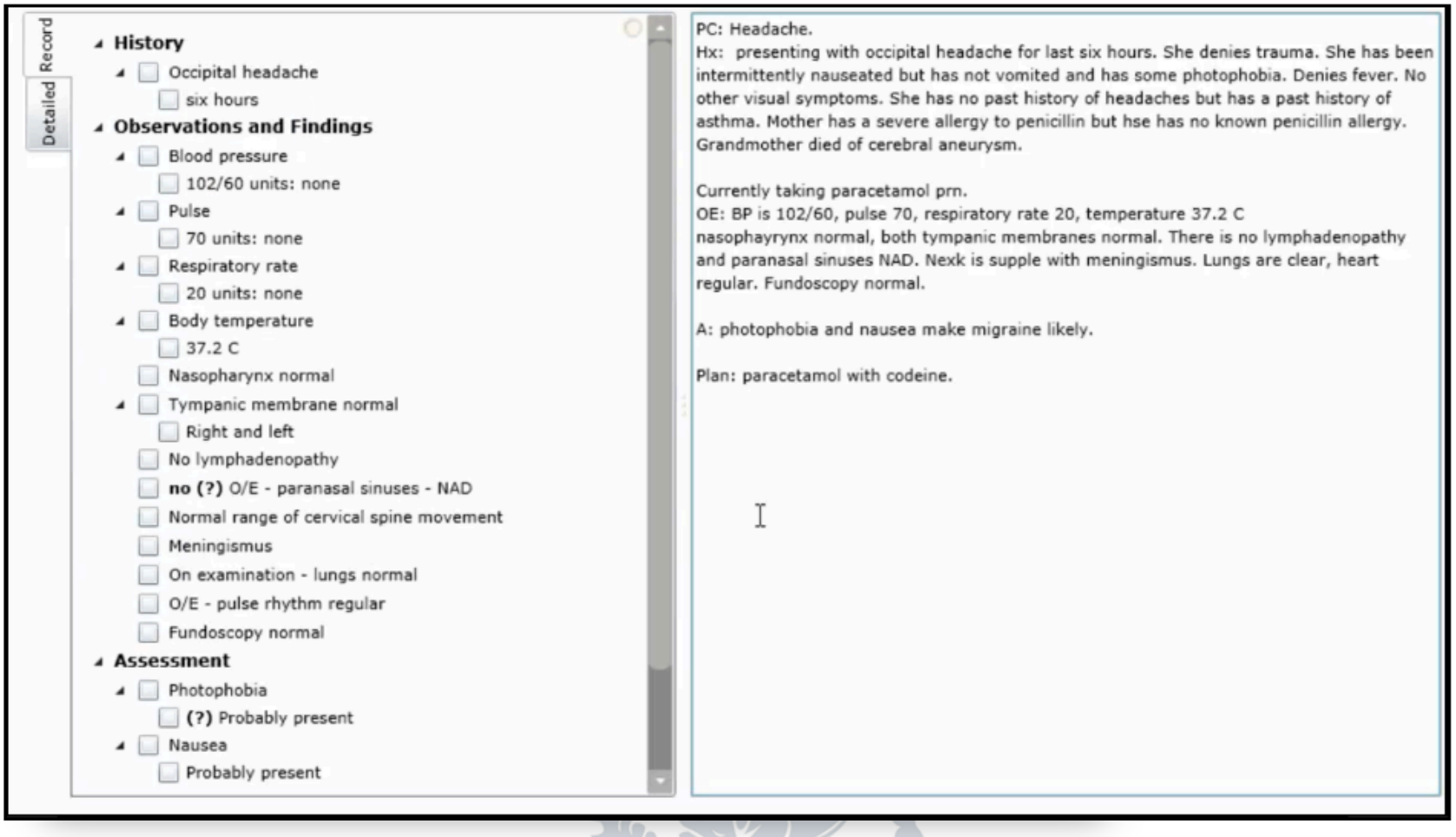
Clinical Information Management| Mobility

Mobility enables realtime consumption and contribution of clinical information of the patient allowing for more efficient workflows, better productivity resulting in higher patient throughput and better safety. A patient record or note made in front of a patient is always more accurate than one made retrospectively from memory later at a desk.



Clinical Information Management| Big Data & Advanced Analytics

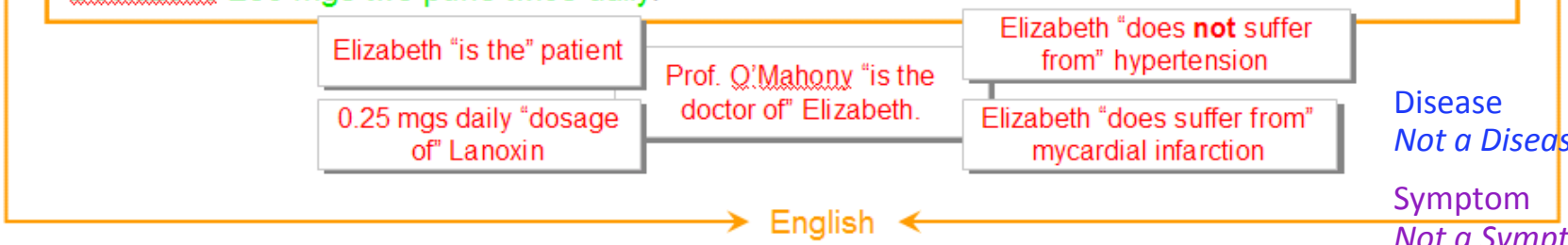
The sheer Volumes and Variety of data being collected by Instrumentation and Clinical staff and the Velocity of the needed processing and analyzing of that data in realtime breaks the capabilities of most existing Healthcare IT setups. Therefore next generation big data enabled architecture is needed along with the capability to automate the understanding of the volumes of unstructured or semi structured legacy data stuck in proprietary structures, formats or on paper.



Clinical Information Management| EMRs with Clinician Notes Guiderails with Natural Language Processing

Real Time ‘guiderails’ with either Trees to check of (pictured on the left column above) or Auto-Complete-as-you-type to normalize and code Clinically relevant information on input in a non intrusive manner.

I reviewed **Elizabeth** at our clinic today. **She** was referred to us by **Professor O'Mahony** for further evaluation. **She** complains of **breathlessness with exertion** and **decreased exercise tolerance** with **intermittent palpitations**. **She** did not have any cough or sputum production, also no orthopnea or paroxysmal nocturnal dyspnea, or angina. **She** had a suspected **myocardial infarction** in 2001, **echocardiography** showed good left ventricular systolic function and normal valves. There is no history of *hypertension*, *diabetes* or *hyperlipidaemia*. Her current medications include Eltroxin 50 ugs daily, Nu-Seals Aspirin 75 mgs daily, Lanoxin PG 0.25 mgs daily, Salbutamol inhaler 2 puffs prn and Beclazone 250 mgs two puffs twice daily.



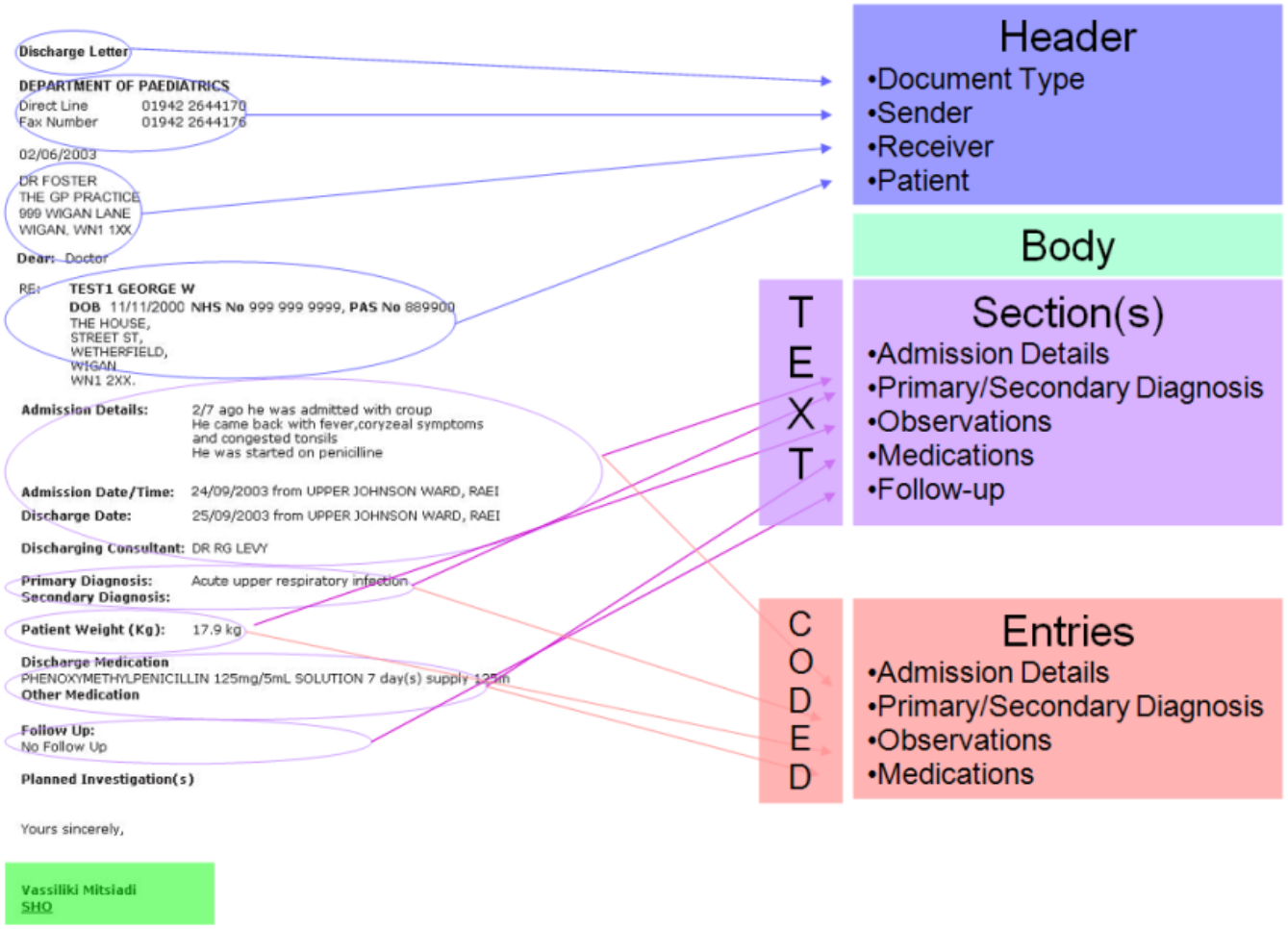
Disease
Not a Disease
Symptom
Not a Symptom
Drug
Dosage
Patient
Doctor
Procedure

Unstructured Information Management Architecture
An Apache Project

IBM Content and Predictive Analytics for Healthcare

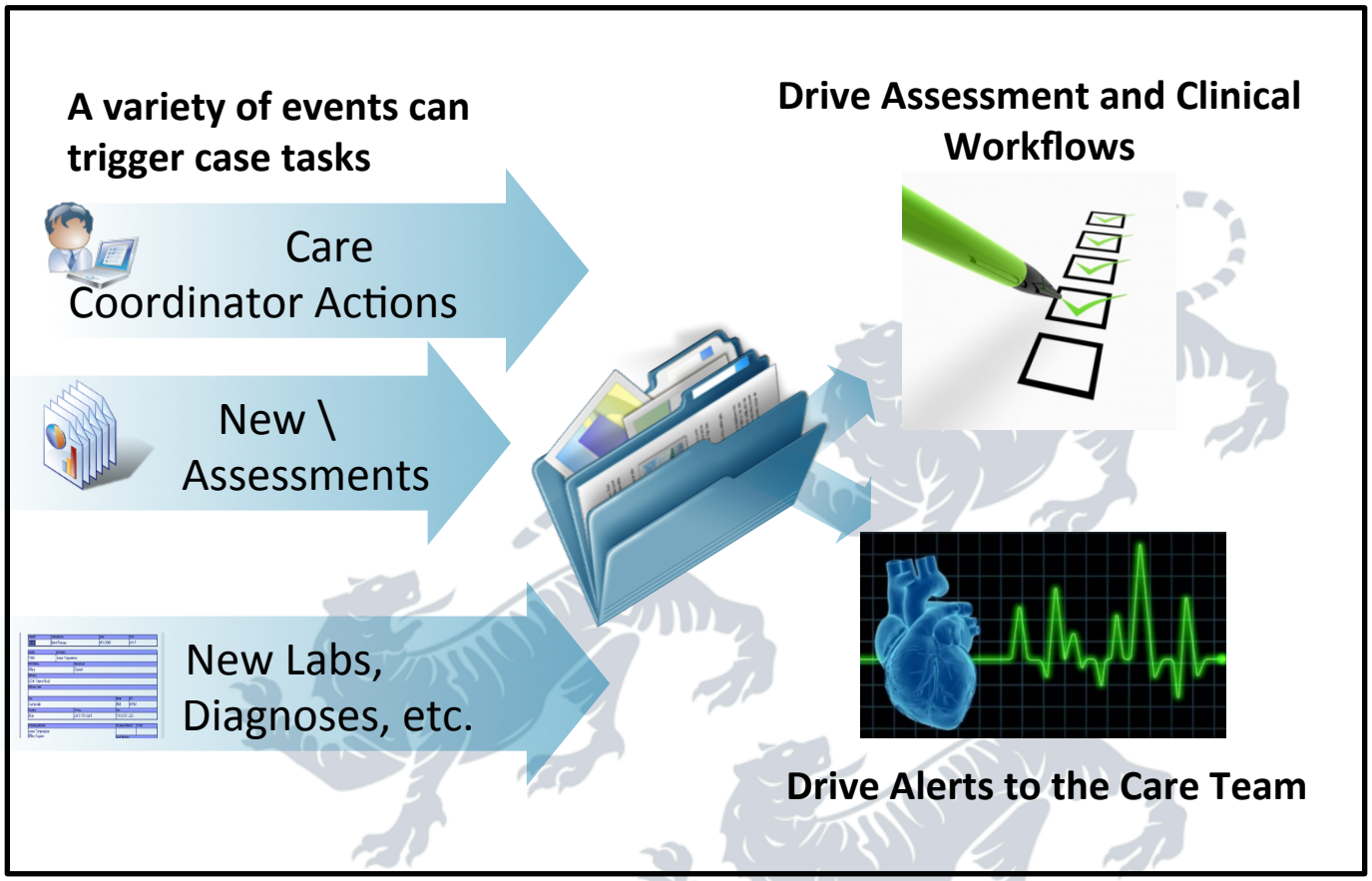
Digitization and Natural Language Processing

Using technology such as IBMs Content & Predictive Analytics for Healthcare to parse and understand unstructured content and map it back to semantic frameworks such HL7 3, CDA 2,3, and Medical Dictionaries such as SNOMED, ICD 10, BNF.



Context Aware Communication & Parsing

Next generation Healthcare enabled (DICOM, HL7) middleware that is HL7 3, CDA 2,3 aware and able to derive context and structure from HL7 messages from legacy clinical systems and translate between systems on-the-fly.



Care Plans, Protocols and Workflows

The Orchestration of the ESB driven by a Healthcare specific Business Process Management (BPM) Engine, the capability of data to flow across multiple systems will allow for the creation of care plans and protocols that translate into actionable task and alerts at the point of care.

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Platform allows flexibility for using multiple applications and interfaces such as mobile devices, etc

Guiderails to encourage structuring on input

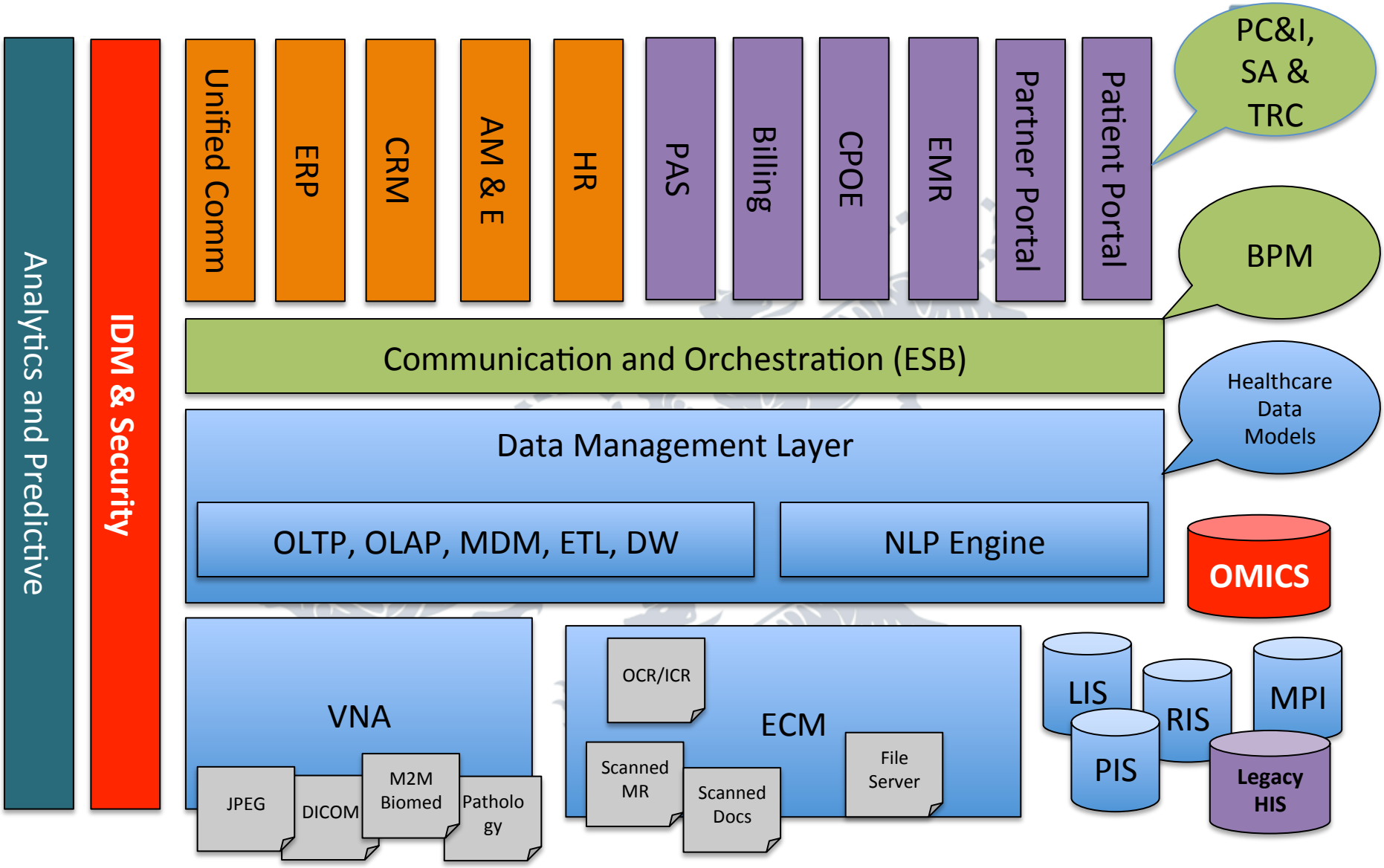
NLP, ESB and Data Management Engine derives meaning and delivers valuable analytics and decision support on the front encouraging Clinician to document and depend on data

NLP Enabled digitization engine to parse paper records, with support from Medical Records driven transcription

Emerging digital tools such as DICOM enabled ECGs, Ultrasounds, Etc provide digital data to the record

CPOE provides all diagnostic information needed and is served back to record via ESB & Data Management Engine

The ideal system



Under the hood of the ideal system

"Some 90% of the world's data have been generated in the past two years"

Article: Where angels will tread, Nov 17, 2011, The Economist

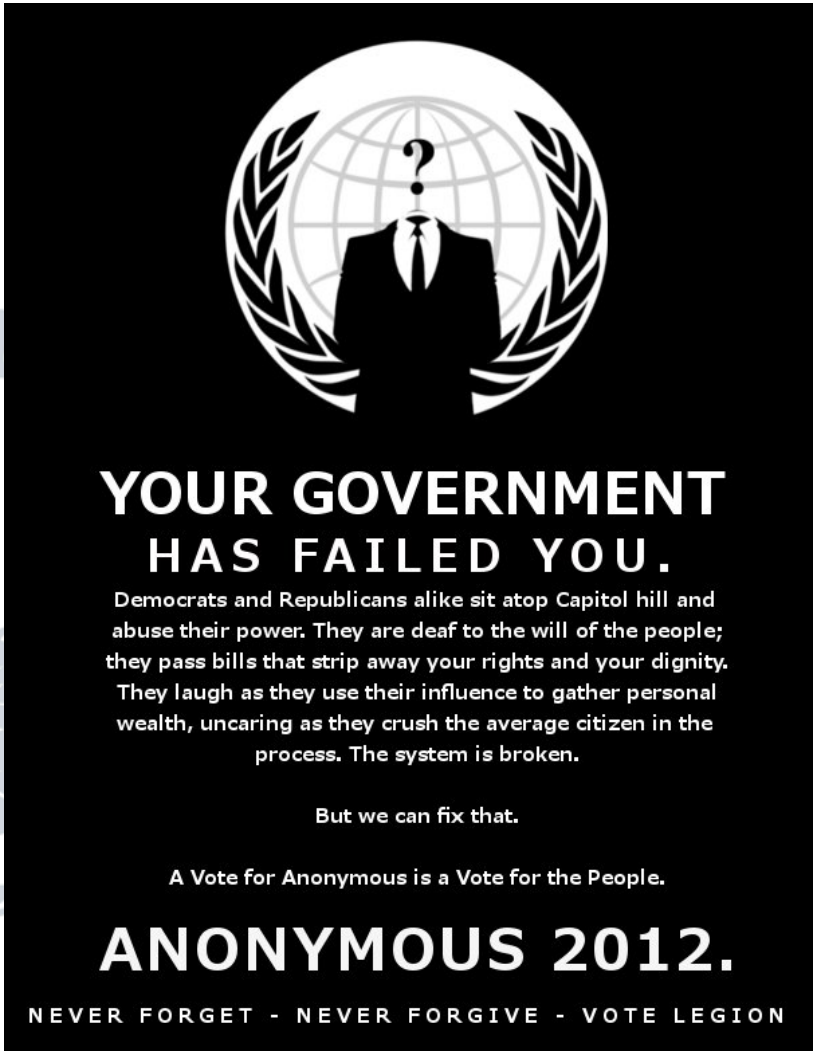
Clinical Information Management | The Data Deluge

The data deluge will soon overwhelm us in healthcare as we are producing more data than we can process and analyze. Many providers will decide to minimize the clinical data they capture, which will lead to poorer decision support to clinicians and poorer outcomes, giving a clear competitive advantage to those who are ready for the big data revolution.

Clinical Information Management | Security & Patient Privacy

Information security is now a big concern with the implementation of healthcare systems, networks and clouds. The healthcare industry has very specific compliance such as JCI, HIPAA and ISO 27799 but can also benefit from IT compliance frameworks such as the CSA framework, ITIL, etc.

Complacency is not an option, in this high stakes high risk interconnected world we live in, and security investments have to match the risk and vulnerability we create by being connected and digital.



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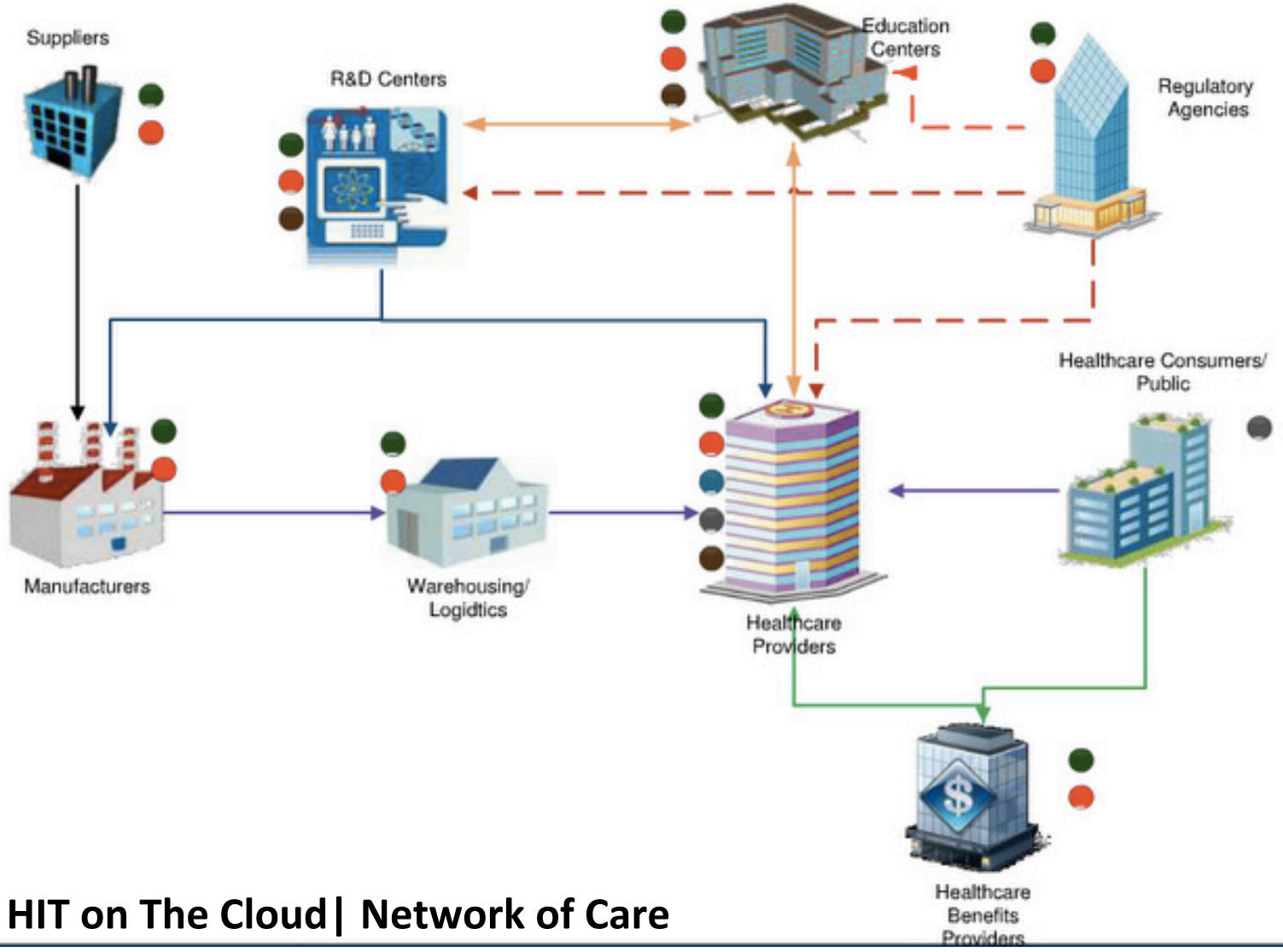
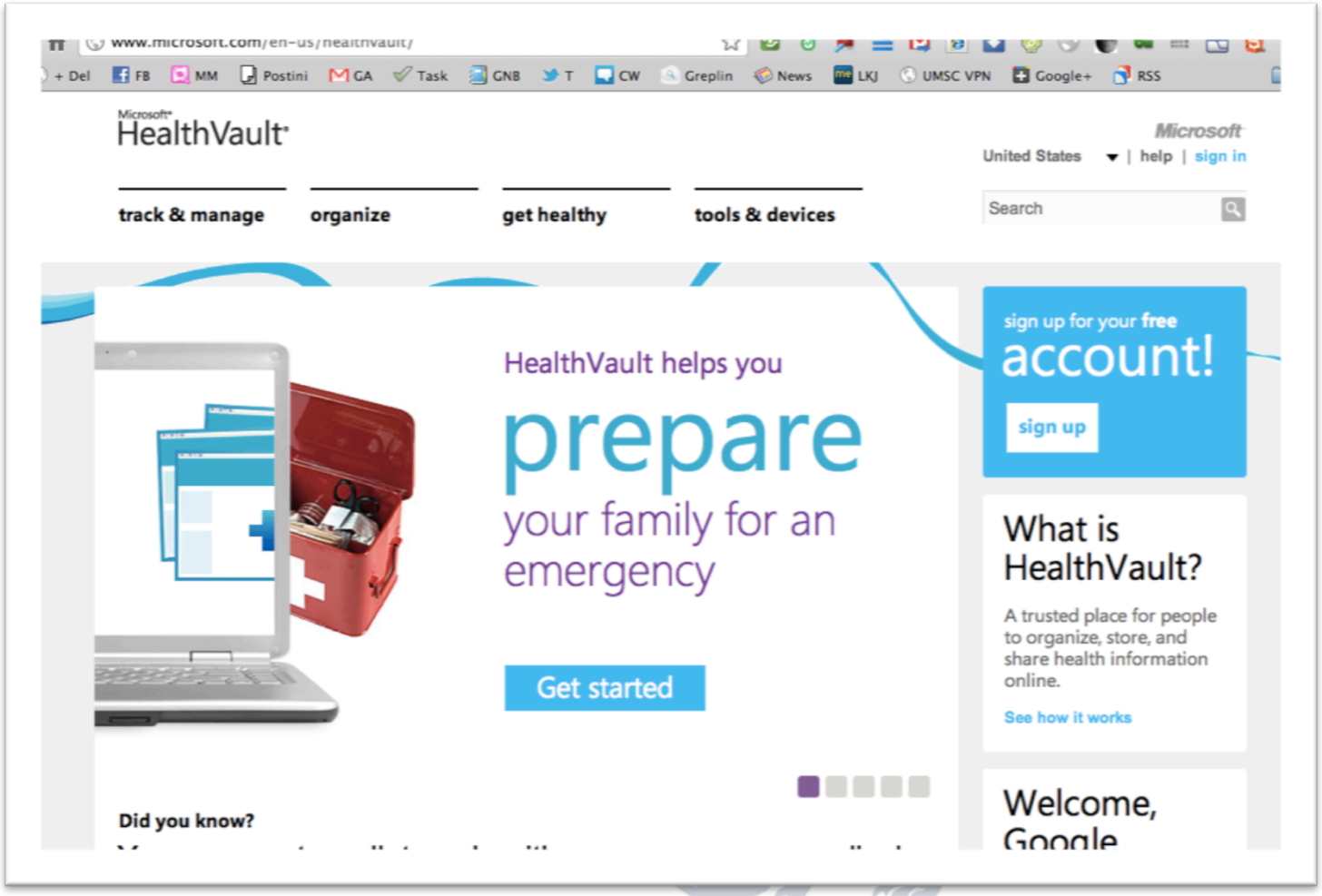
06 & 07. HIT ON THE CLOUD & CONSUMER HIT



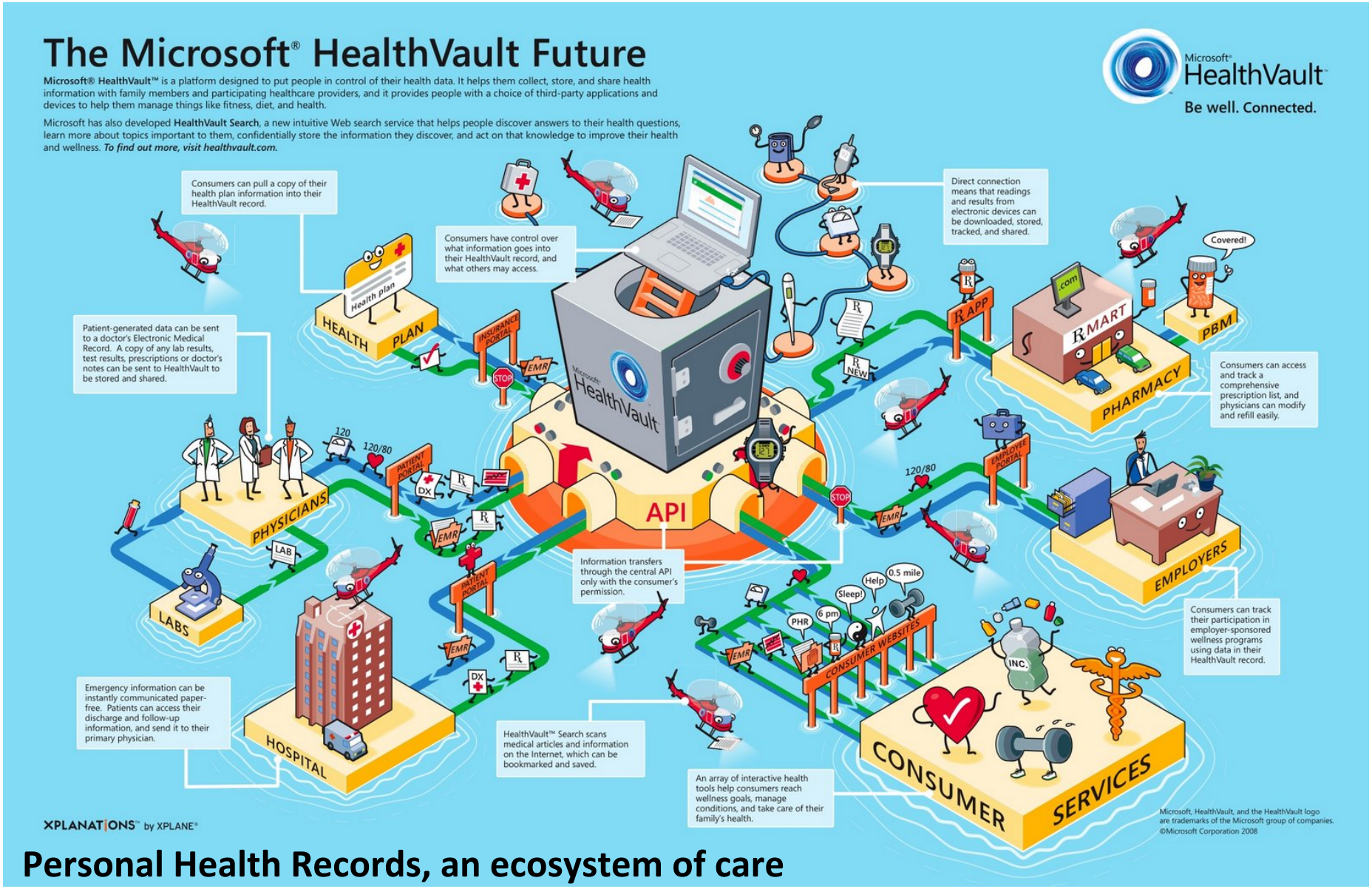
HIT on The Cloud| Network of Care

The network of care, connecting hospitals with one another, with other partners such as suppliers, education institutions and benefits providers (payors) will make explicit these existing tacit referral and collaborative networks while exponentially increasing opportunities for the various nodes to sell more products and services via the network.



HIT on The Cloud | Personal Health Records

This is the perfect time for PHRs in Malaysia. PHRs will hand the ownership of medical / health records back to a patient so that they can own and participate in the partnership designed to manage their health.



Personal Health Records, an ecosystem of care

The network of care, connecting hospitals with one another, with other partners such as suppliers, education institutions and benefits providers (payors) will provide a continuity of care to the patient while allowing a behavioral shift from a passive consumer of care to an active participant.

HIT on The Cloud| The New Healthcare Consumer

With a PHR, Healthcare service providers, wellness partners can provide patients with telemetry devices designed to work with existing technology such as mobile devices, broadband connectivity, etc. These devices will transmit back diagnostic data to their PHR so that clinicians can better help monitor and advise such patients on their progress, conditions and overall health and wellbeing. It can also play very specific monitoring assignments for patients with chronic conditions, pushing alerts to the respective partners when necessary.

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EXCLUSIVELY FOR MAXIS ONE CLUB MEMBERS

Introducing EPI Life, the world's first Electrocardiogram (ECG) mobile phone.

As heart conditions usually differ from one another, symptoms and irregular heart rhythms are often overlooked. Regular monitoring of your heart allows you to respond immediately making all the difference should problems arise. With EPI Life, all you need are a few seconds to record your ECG.

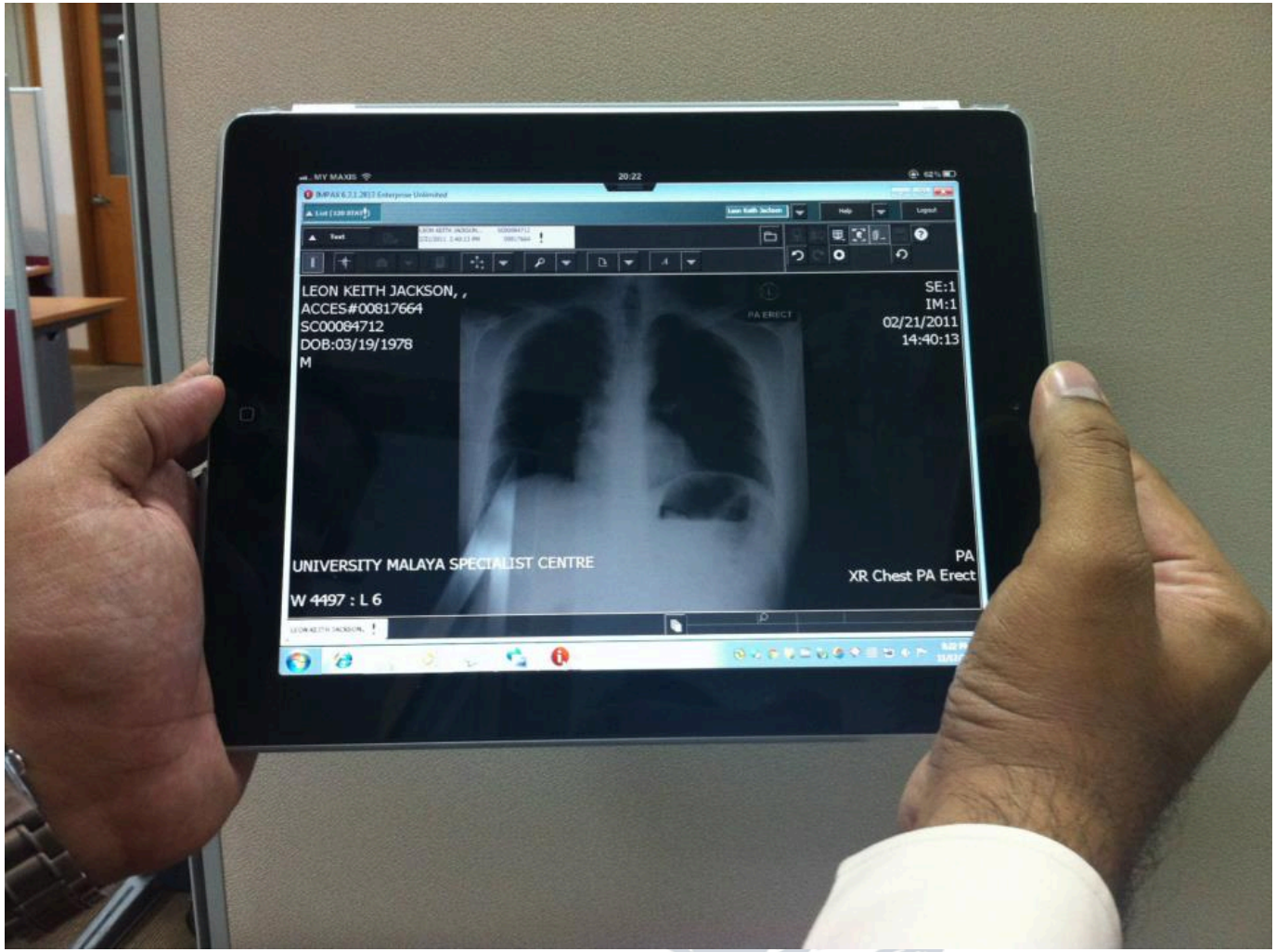
Normal RRP	Discount RM300 for MOC members	Early Bird discount of RM600 for MOC members between 16/7/2012 to 17/9/2012
RM2,299	RM1,999	RM1,699

HIT on The Cloud| Telemedicine, Enabling Collaboration between Clinicians despite the distance

Telemedicine will help provision tertiary and highly specialized care to remote locations that do not have the volumes or demand to keep such clinicians on staff. They also open new opportunities for nurse driven homecare or other primary care interfaces with the remote supervision of a clinician.

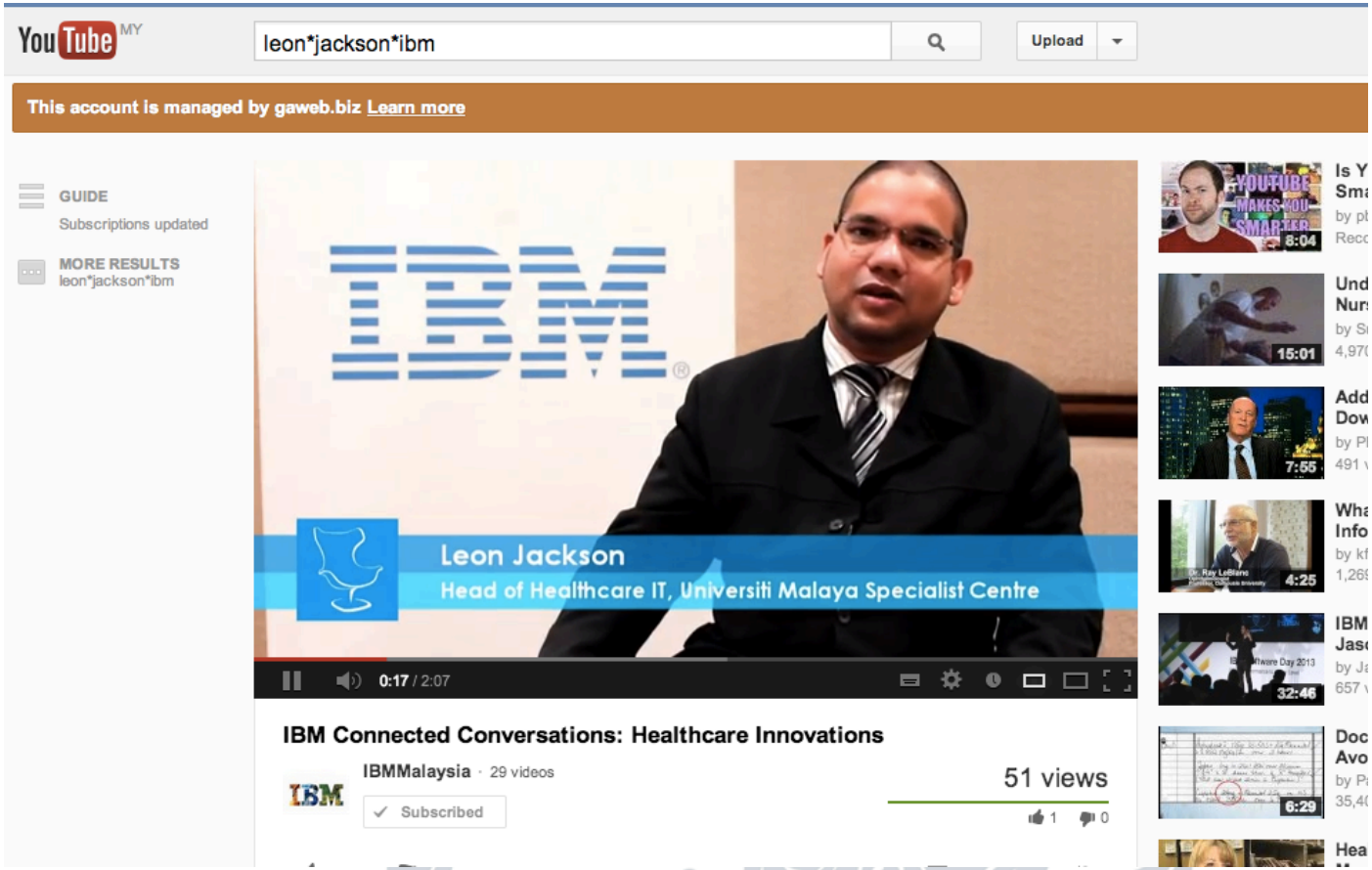
HIT on The Cloud| Teleradiology

Teleradiology solves the problem of access to radiologist, by allowing the hospital to outsource reporting on diagnostic images from specialized teleradiology units. This can speed up turn around times to get a patient imaged and supplemented by a radiologist report.



HIT on The Cloud| Mobile Computing

Mobile access will translate into better access to talent on individual cases as junior clinicians can get access to opinions of senior clinicians who have remote and mobile access to their case notes and diagnostic information. It will also enable clinicians to be more productive and deliberate on their cases at their convenience as they rush around between their various commitments.



Infotainment is now so easy to produce

An online presence also opens up opportunities for Infotainment. UMSC is leveraging on our specialist to create educational content to seal our position as a trusted source of advice and expertise.

Monetizing our content

Being the premiere national university, we are able to generate volumes of valuable content for teaching Doctors, informing patients and contributing to science. We have been developing revenue models around this content.

HIT on The Cloud| National Payor Systems

Medical benefits systems can automate claims and billing for members greatly reducing fraud and errors and reducing turn around times to authenticate and verify a patients eligibility and receive collections from a payor.

An agile payment system also allows nationally subsidized or financed healthcare benefits systems to bid, buy and sell from various providers, to drive down cost and maximize the mileage of the funding.

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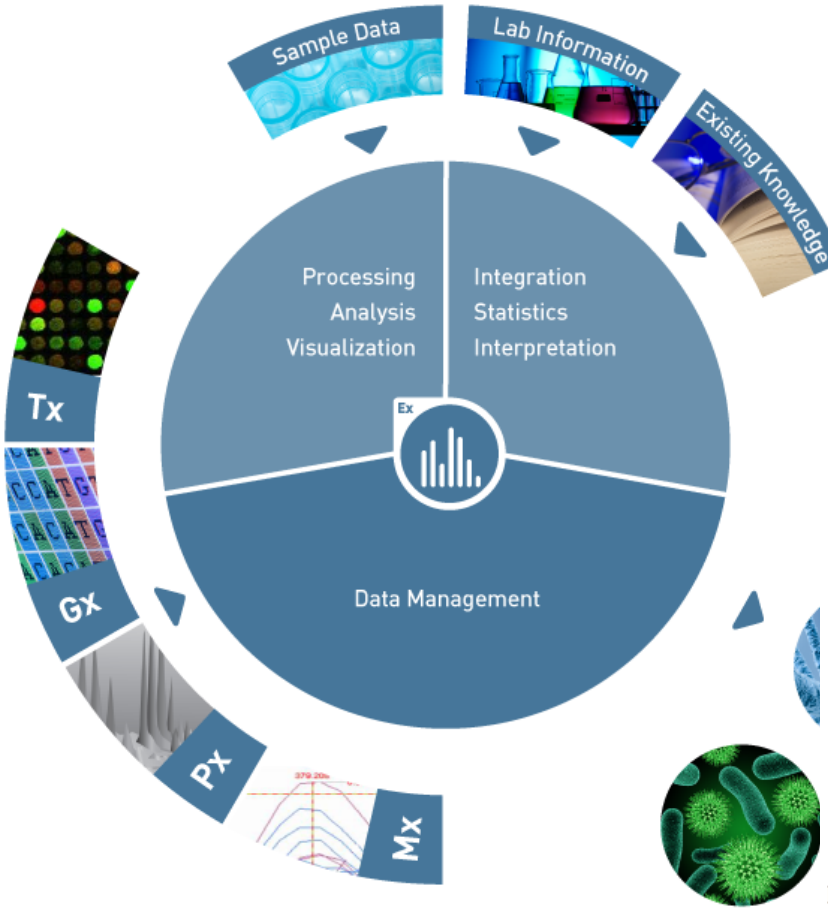
HIT on The Cloud| Emergency Access to Medical Information

A patient's critical medical information such as allergies, chronic conditions, congenital risk and medical history served to ER Clinicians in an Emergency could save their life. With interconnected healthcare systems, this information could even follow you overseas and could be on your healthcare benefits card as a safety measure for offline access.

HIT on The Cloud| Centralized Data Warehousing

The sheer volumes of medical data to be collected, managed and stored is growing exponentially and will soon be 70% of the hospitals IT cost. This is driving the demand for central data warehouses where hospitals can archive their less active records and data at a much lower cost.



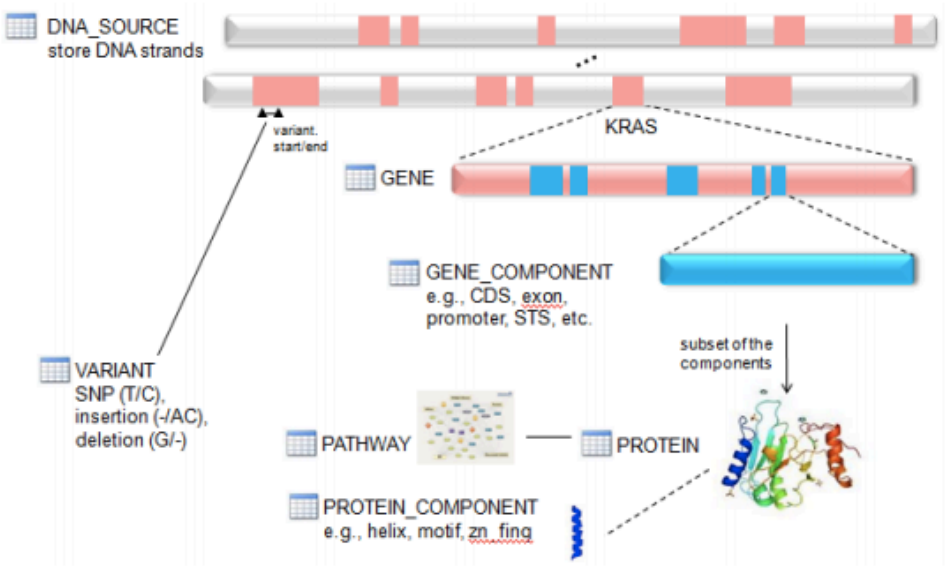
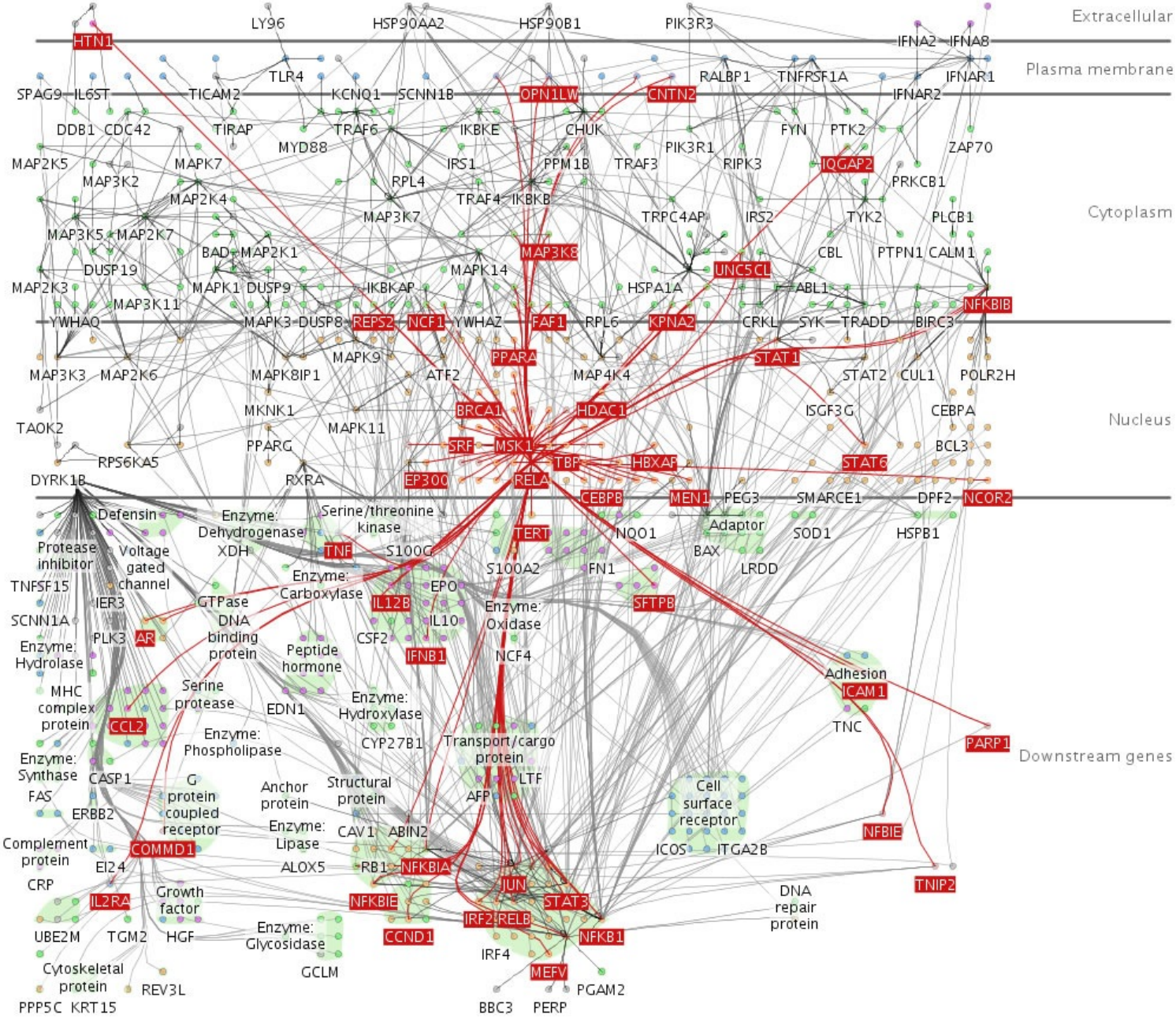


Figure 1: Oracle Health Sciences Omics Data Bank modeled on the central dogma of molecular biology

Clinical Information Management| Translational Research

Digitization of the volumes of Data generated on the UM Healthcare cloud can be aggregated and analyzed along with new streams coming in from UM OMICS work such as Proteomics, Metabolomics and Genomics. Theses Biological and Clinical Analytics can be juxtaposed against other Social and Demographic Data fed in from our CRM and Customer Engagement Platforms to provide a Systems Biology platform for research.


Extracellular
Plasma membrane
Cytoplasm
Nucleus
Downstream genes
HTN1
LY96
HSP90AA2
HSP90B1
PIK3R3
IFNA2
IFNA8
IFNAR1
IFNAR2
TLR4
RALBP1
TNFRSF1A
SPAG9
IL6ST
TICAM2
KCNQ1
SCNN1B
OPN1LW
CNTN2
DDB1
CDC42
TIRAP
TRAF6
IKBKE
CHUK
FYN
PTK2
ZAP70
MYD88
PIK3R1
MAP2K5
MAPK7
IRS1
PPM1B
TRAF3
RIPK3
IQGAP2
MAP3K2
RPL4
PRKCB1
MAP2K4
TRAF4
IKBKB
MAP3K7
TRPC4AP
IRS2
TYK2
PLCB1
MAP3K5
MAP2K7
BAD
MAP2K1
MAP3K8
CBL
PTPN1
CALM1
DUSP19
MAPK14
UNC5CL
MAP2K3
MAPK1
DUSP9
IKBKAP
HSPA1A
ABL1
NFKBIB
MAP3K11
YWHAQ
MAPK3
DUSP8
REPS2
NCF1
YWHAZ
FAF1
RPL6
KPNA2
CRKL
SYK
TRADD
BIRC3
MAPK9
PPARA
STAT1
MAP3K3
MAP2K6
MAPK8IP1
ATF2
MAP4K4
STAT2
CUL1
POLR2H
MKNK1
BRCA1
HDAC1
ISGF3G
CEBPA
TAOK2
MAPK11
SRF
MSK1
BCL3
PPARG
TBP
HBXAP
STAT6
RPS6KA5
RXRA
EP300
RELA
DYRK1B
CEBPB
MEN1
PEG3
SMARCE1
DPF2
NCOR2
Defensin
Enzyme: Dehydrogenase
Serine/threonine kinase
Adaptor
Protease inhibitor
Voltage gated channel
XDH
TNF
S100G
TERT
NQO1
SOD1
HSPB1
BAX
LRDD
S100A2
FN1
TNFSF15
Enzyme: Carboxylase
EPO
IER3
GTPase
IL12B
SFTPB
Enzyme: Oxidase
SCNN1A
PLK3
AR
DNA binding protein
IL10
CSF2
Enzyme: Hydrolase
Peptide hormone
IFNB1
NCF4
Adhesion
ICAM1
MHC complex protein
Serine protease
EDN1
Enzyme: Hydroxylase
TNC
CCL2
CYP27B1
PARP1
Enzyme: Phospholipase
Transport/cargo protein
Enzyme: Synthase
CASP1
LTF
G protein coupled receptor
Anchor protein
Structural protein
Cell surface receptor
FAS
AFP
ERBB2
CAV1
ABIN2
NFBIE
Complement protein
COMMD1
Enzyme: Lipase
ICOS
ITGA2B
EI24
ALOX5
RB1
NFKBIA
TNIP2
CRP
JUN
IL2RA
Growth factor
NFKBIE
STAT3
DNA repair protein
IRF2
RELB
UBE2M
TGM2
HGF
Enzyme: Glycosidase
CCND1
NFKB1
IRF4
Cytoskeletal protein
GCLM
MEFV
REV3L
PGAM2
PPP5C
KRT15
BBC3
PERP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