Integration with Clinical Information (Electronic Patient Records)

"If you think computers are the solution to your problem, then you don't understand your problem!"

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Disclaimer

The views and opinions expressed in this presentation are those of the authors and do not necessarily reflect the official policy or position of any agency of the National Health Service

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Content

- What is an EPR
- What is in it
- What is not in it
- How do you integrate with them
- Clinical coding

Data Types

- Three core data types which often define the technologies you might use to handle them
  - Binary Large Objects (BLOBs) – Files
  - Unstructured data – Free Text
  - Structured data – Coded Information

What is an EPR

- An **electronic health record** (**EHR**), or **electronic medical record** (**EMR**), refers to the systematized collection of patient and population electronically-stored health information in a digital format

  Wikipedia

History

- Initially hospitals had PAS (Patient Administration Systems)
  - Driven by financial processes and scheduling requirements for planning
  - Diagnosis
  - Procedures
  - Appointments
- As computers become ubiquitous specialties see bespoke products come to market, these are more clinically focussed

History

- The realisation that summary information from these specialties needs to be viewed widely necessitates Results Reporting Systems
- However the majority of the rich clinical information is still stored in unstructured form (paper or electronic documents)
- Some systems are so specialised they have their own eco-system such as Radiology and Laboratory medicine

Radiology

Labs

PAS

Results and maybe requests

Departmental Systems

Demographics
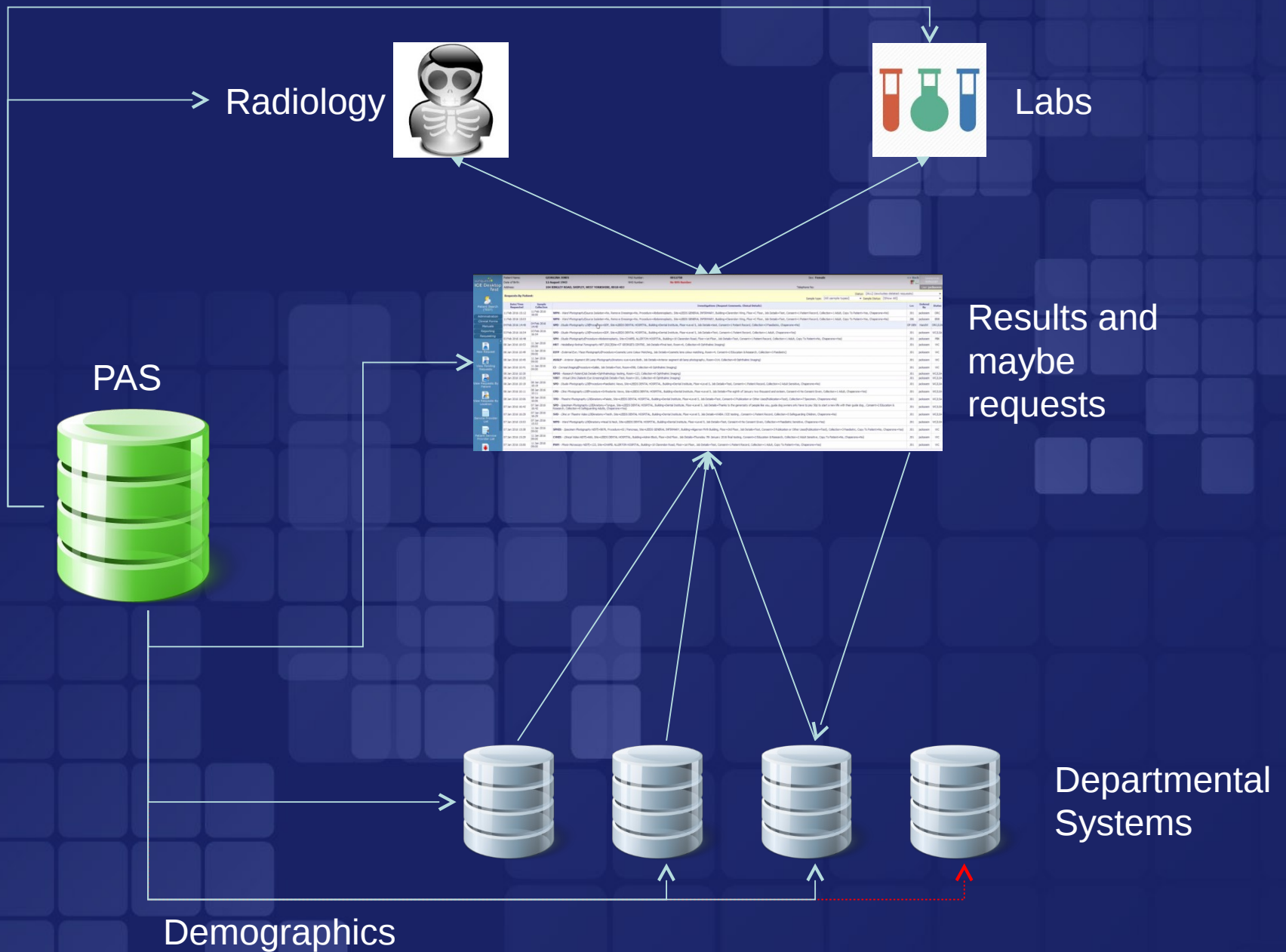
Drivers

- Paper-free at the point of care by 2020
- Citizens to have full access to their care records and access to an expanding set of NHS accredited health and care apps and digital information services
- Give care professionals and carers access to all the data, information and knowledge they need' – real-time digital information on a person's health and care by 2020 for all NHS-funded services

What is an EPR

- An EPR seeks to integrate all of these functions into a single structured record so all clinical data at every level is available to anyone with the need to access it, even those beyond the traditional institutional boarders (GP, Ambulance, Social Care, Mental Health etc) ..... Awesome

What is in an EPR

- Diagnosis
- Procedures
- Appointments/Scheduling
- Test requesting (Order comm's)
- Results Reporting
- Medicines management
- Clinical Forms
- Clinical Correspondents

What is not in an EPR

- PACS (Picture Archiving and Communication System) – Handles all image storage and viewing. Combined with a RIS (Radiology Information System) handles the whole Radiology function
- LIMS (Laboratory Information Management System) – Focussed on sample handling and reporting
- Many other support service departments.

What is not in an EPR

- CDA (Clinical Document Archives) are also becoming common, sometimes merging with PACS through a VNA (Vendor Neutral Archive)

- The most common standard for this interface is XDS, although you are just as likely to find them in a shared folder

- Its also common to find large specialties with their own data management systems, Renal is a common example

What is not in an EPR

- Depending on the EPR system GP information might be visible in an EPR but the data is pulled on-demand through the MIG (Medical Information Gateway) but not stored locally
- This distinction is quite important depending on what you are trying to achieve!
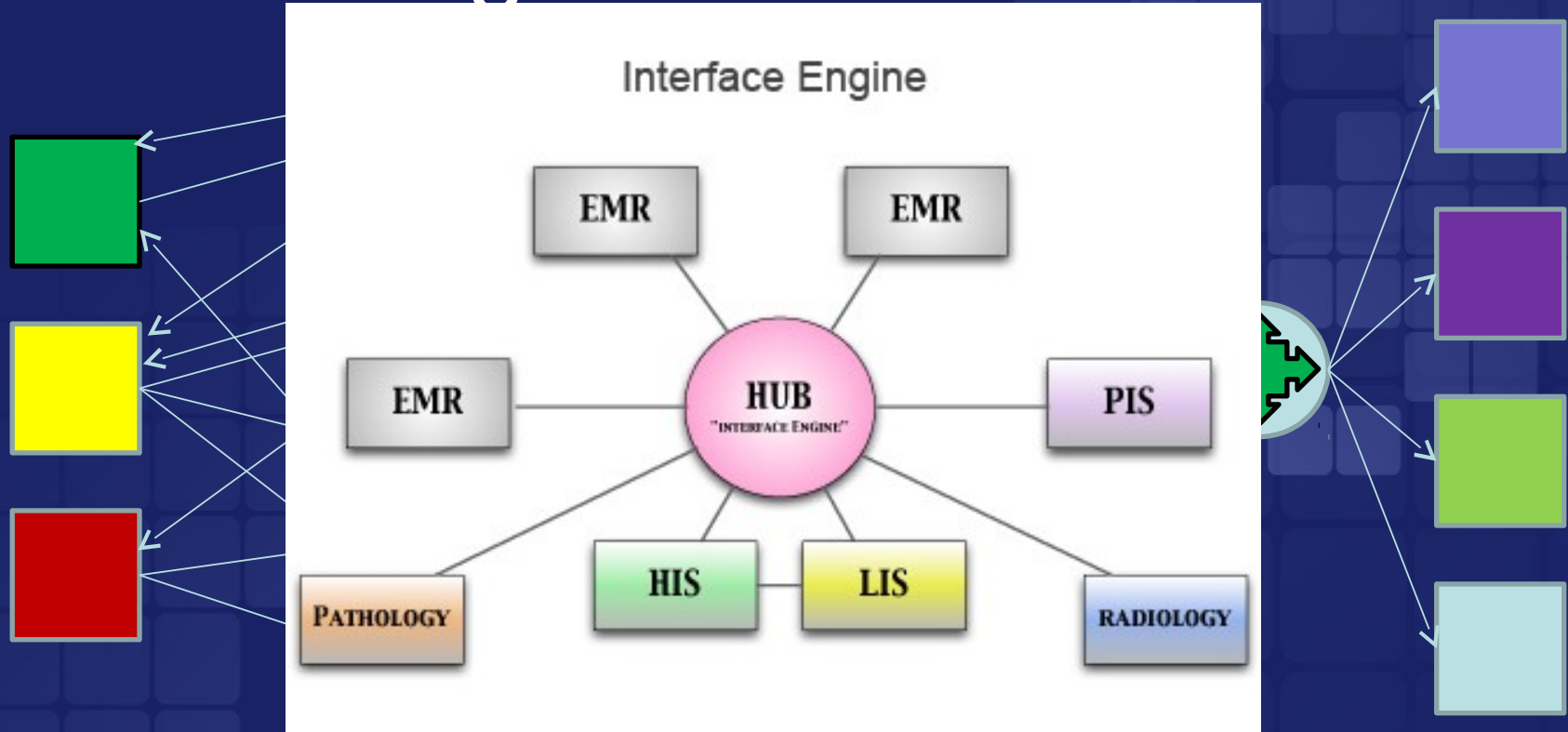
Data Integration

- Generally there three reasons you want to integrate with an EPR
  - View/Read a single patients clinical record
  - Insert/Write data into a patients record
  - Query all patient records to identify some cohort with specified attributes, typically research, service improvement or audit

Data Integration

- Reading and Writing to clinical systems generally takes the form of on-demand "messages"

- This is usually managed through an integration engine which acts as a buffer/queue between systems

- Integration engines can also transform the data content or structure as it passes through

Data Integration

Interface Engine

Point-Point connections
Complex to manage
Expensive (require vendors on both sides to configure systems)
Almost impossible to fix problems when systems don't quite match

Integration Engine
Single point of management
Expensive
Can handle mismatches in formats
Puts the owner in control of their information, but requires skills

Data Integration

- The most common form of data exchange is based on the HL7 standard

- Due to legacy systems V2.4 is still the most common format

- V3 does exist but only relatively new systems use it

Data Integration

- HL7 message structures (v2.*)

MSH|^~\&|GHH LAB|ELAB-3|GHH OE|BLDG4|200202150930||ORU^R01|CNTRL-3456|P|2.4<cr>
PID|||555-44-4444||EVERYWOMAN^EVE^E^^^^L|JONES|19620320|F|||153 FERNWOOD DR.^ ^STATESVILLE^OH^35292||(206)3345232|(206)752-121||||AC555444444||67-A4335^OH^20030520<cr>
OBR|1|845439^GHH OE|1045813^GHH LAB|15545^GLUCOSE|||200202150730||||||||| 555-55-5555^PRIMARY^PATRICIA P^^^^MD^^|||||||||F||||||444-44-4444^HIPPOCRATES^HOWARD H^^^^MD<cr>
OBX|1|SN|1554-5^GLUCOSE^POST 12H CFST:MCNC:PT:SER/PLAS:QN||^182|mg/dl|70_105|H|||F<cr>

Data Integration

- Common message types

  ACK – General acknowledgement
  ADT – Admission Discharge Transfer
  MDM – Medical document management
  ORM – Order (Pharmacy/treatment)
  ORU – Observation result (unsolicited)
  QRY – Query, original mode
  RAS – Pharmacy/treatment administration
  RDE – Pharmacy/treatment encoded order
  RGV – Pharmacy/treatment give
  SIU – Scheduling information unsolicited

ORU Message

Documentation on how these messages are constructed is readily available from many sources

Almost always you will find vendor specific implementations do not quite match the standard

Be prepared for a lot of negotiation, investigation, fiddling and testing to set up one of these interfaces

SEGMENT/GROUP	NAME	OPTIONAL/REPEATABLE?
MSH	Message header	Required
NTE	Notes and comments	Optional, Repeatable
PatientGroup – Optional group (Required for new orders pertaining to a patient only)		
PID	Patient identification	Required
PID1	Patient demographics	Optional
NTE-1	Notes and comments	Optional, Repeatable
PatientVisitGroup – Optional group, part of PatientGroup		
PV1	Patient visit	Required
PV2	Patient visit – additional info	Optional
InsuranceGroup – Optional and repeatable group, part of PatientGroup		
IN1	Insurance	Required
IN2	Insurance additional info	Optional
IN3	Insurance additional info certification	Optional
PatientGroup continued		
GT1	Guarantor	Optional
AL1	Patient allergy information	Optional, Repeatable
OrderGroup – Repeatable group		
ORC	Common order	Required
OrderDetailGroup – Optional group, part of OrderGroup		
OBR	Observation request	Required
NTE-2	Notes and comments	Optional, Repeatable
DG1	Diagnosis	Optional, Repeatable
ObservationGroup – Optional and Repeatable, part of OrderDetailGroup		
OBX	Observation	Required
NTE-3	Notes and comments	Optional, Repeatable
OrderGroup continued		
CTI	Clinical trial identification	Optional
BLG	Billing	Optional

MSH segment field structure

MSH|^~\&|GHH LAB|ELAB-3|GHH OE|BLDG4|200202150930||ORU^R01|CNTRL-3456|P|2.4

SEQ	LEN	DT	OPT	RP/#	ELEMENT NAME
1	1	ST	R		Field Separator
2	4	ST	R		Encoding Characters
3	180	HD	O		Sending Application
4	180	HD	O		Sending Facility
5	180	HD	O		Receiving Application
6	180	HD	O		Receiving Facility
7	26	TS	O		Date/Time of Message
8	40	ST	O		Security
9	7	CM_MSG	R		Message Type
10	20	ST	R		Message Control Id
11	3	PT	R		Processing Id
12	8	ID	R		Version Id
13	15	NM	O		Sequence Number
14	180	ST	O		Continuation Pointer
15	2	ID	O		Accept Acknowledgement Type

Data Integration

Mirth Connect

Premier open source healthcare data integration engine. Quickly and easily transport healthcare information between data sources and destinations.

Supported Messages Types:
- HL7 (v2 & v3)
- DICOM
- X12/EDI
- XML
- NCPDP
- Delimited Text

Included Connectors:
- MLLP
- HTTP
- File System
- JMS
- Email
- JavaScript
- TCP
- FTP/SFTP
- Web Services
- Database
- PDF/RTF

Enterprise Extensions:
- SSL Manager
- Role Based Access Control
- Channel History
- Email Reader
- NwHIN Connectors
- Channel Report Tool

Data Integration

- A good Integration engine gives a huge amount of flexibility e.g.
  - Connect to a database and pull out new records, then transform them into a HL7 message to send to another system
  - Pick up newly added correspondents to a network share, transform them into CDA format and send them to the GP through an MDM message

Data Queries

- So far we have discussed transactional feeds in and out of clinical systems
- What if you want to do research or service improvement?
- In modern EPR systems there is often the concept of a BI (Business Intelligence) module
- These allow people to run queries and explore/filter the results

Data Queries

- If this functionality is not available then there are often replicas made for secondary use, typically a day old

- Depending on hospital policies you may or may not be granted access to these data sources

- It is quite common to have an information services function who would perform the queries for you, possibly setting up dashboards for common requests

Clinical Coding

- The subject of another lecture
- Clinical coding the in the UK is moving to SNOMED
- This does not fit well with HPO which is common in genetics services and research
- Need to remember that the accuracy of data is dictated by the purpose it was for which it was collected

Clinical Coding

- In general three classes of information exist
  - That needed for direct clinical care
  - That needed for business processes
  - That needed for external reporting
- In terms of clinical care these have decreasing levels veracity
- For example the clinical codes assigned for payment may not accurately reflect the information in a correspondence back to the referring physician

Clinical Coding

- Very commonly clinical coding is done by a specific team of people in the hospital
- They are not clinically trained and are required to apply the right codes based on the clinicians output, often hand written notes
- This does not work so well !!!
- EPR's are trying to introduce the tools that allow the clinicians themselves to enter this data but the cultural barriers are huge

The future (One possible)

- Probably the most significant change in the next 5 years will be the introduction of the FHIR standard into electronic systems
- Lead by the HL7 consortium this is seeking to change the model of data consumption from "push" to "pull" by exposing data through a standard web API
- This exists now but the inertia of the healthcare informatics community means it will not be commonplace for some time
- If you are buying something now ask about it!

The future (One possible)

- All resources are accessed through simple web calls:
  - https://www.hl7.org/fhir/patient-operations.html#everything

- All Weight, Height, Head Circumference, and BMI Observations
  - https ://myserver.sth.nhs.uk/Observation?subject:Patient=f0013&name=3141-9,& &_count=50
    Name parameters are LOINC codes

- Still need to handle security which is often the biggest challenge!

Questions ?