FHIR
and JSON

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This presentation

- Based on presentations by the 3 core architects of FHIR:
  - ➢ Grahame Grieve, Australia
  - ➢ Ewout Kramer, The Netherlands
  - ➢ Lloyd McKenzie, Canada

- Creative Commons, specifically:
  - ➢ Creative Commons Attribution 3.0 Unsuported License
  - ➢ (Do with it as you wish, so long as you give credit)

FHIR in one slide

- **F**ast **H**ealthcare **I**nteroperable **R**esources
- New *free and open* healthcare data API
- Builds on simplicity of HL7 V2
- With modern (web) standards
  - XML, JSON, HTTP, REST, UML
  - Familiar to new generation of developers
- Easy to implement the basics
- Getting rapid take up

FHIR in one bullet

- **FHIR is:**

    a set of XML (and/or JSON) health data resources, plus a REST API for accessing them.

- Probably two unfamiliar acronyms there:
  - JSON is an increasingly popular alternative markup to XML
  - REST is the name for accessing data via basic HTTP read/write/update operations

Examples

- FHIR allows XML (or JSON) data to be read from and written to URLs, via HTTP, in a controlled, organized manner.

  Lets see some XML…

This is what a FHIR Patient resource looks like in XML

```xml
<?xml version="1.0" encoding="utf-8"?>
<Patient xmlns="http://hl7.org/fhir">
    <text>
        <status value="generated" />
        <div xmlns="http://www.w3.org/1999/xhtml">
            <p>Harley Hobbs</p>
            <p>16 Pier Road</p>
            <p>Salisbury</p>
            <p>SY4 7IW</p>
            <p>Date of birth: 1966-06-07</p>
        </div>
    </text>
    <identifier>
        <use value="official" />
        <label value="SSN" />
        <system value="http://hl7.org/fhir/sid/us-ssn" />
        <key value="1" />
    </identifier>
    <name>
        <use value="official" />
        <family value="Hobbs" />
        <given value="Harley" />
    </name>
    <birthDate value="1966-06-07" />
    <address>
        <use value="home" />
        <text value="16 Pier Road, Salisbury, SY4 7IW" />
        <line value="16 Pier Road" />
        <city value="Salisbury" />
        <zip value="SY4 7IW" />
    </address>
</Patient>
```

REST: URL based API

- Use REST to get patient #1 from a FHIR server

```
https://server.nhs.org/Patient/1
```

resource type

identifier

secure http protocol

endpoint

REST: JSON

- JSON is an alternative format to XML

- To use REST to read the same patient, but get it in JSON instead:

```
https://.../Patient/1?_format=json
```

Patient resource in JSON

```json
{
    "resourceType": "Patient",
    "text": {
        "status": "generated",
        "div": "<div xmlns='http://www.w3.org/1999/xhtml'><p>Harley Hobbs</p>...."
    },
    "identifier": [{
        "use": "official",
        "label": "SSN",
        "system": "http://hl7.org/fhir/sid/us-ssn",
        "value": "1"
    }],
    "name": [{
        "use": "official",
        "family": ["Hobbs"],
        "given": ["Harley"]
    }],
    "birthDate": "1966-06-07",
    "address": [{
        "use": "home",
        "text": "16 Pier Road, Salisbury, SY4 7IW",
        "line": ["16 Pier Road"],
        "city": "Salisbury",
        "zip": "SY4 7IW"
    }]
}
```

REST: Searching

- Search is a also via URL

query

https://.../Patient/search?name=Smith

This URL searches patient resources.

Step back - why FHIR?

- HL7 V3 works, but is too hard
- Documents aren't enough for all use cases
- HL7 V2 needs a transition path
- The world has evolved
- New markets, web, mobile, cloud

New markets, new questions

- "How can I get data from my server to my iPhone app?"

- "How do I connect my applications using cloud storage?"

- "How can I give standardized record level access to my PHR product?"

- "How can I get my PAS to talk to my Community health system?"

Left screen:

4:47

PATIENT VIEWER

COLLINS, CLAIRE ELI
21 Ulinga Crescent 8 Bimbah Street ALGEST
1997-01-23   Female

Home
21 ULINGA CRESCENT
8 BIMBAH STREET
ALGESTER
4115

Home
153-6156

Medicare Card   PLS Patient ID
Number   916610
22062340191

Medications

Penicillin VK oral suspension 125mg/5ml
10.0 ml oral administration of treatment
on 2/06/2012 12:30 AM

http://spark.furore.com/fhir/patient/@916610

Right screen:

4:48

PATIENT VIEWER

Collins, Calvin
99 Booth Drive, Merricks, 3916
1992-12-29   Male

Home
99 Booth Drive
Merricks
Victoria
3916

Home   Mobile
5975 9999   0419 999 999

Medications

Penicillin VK oral suspension 125mg/5ml
10.0 ml oral administration of treatment
on 2/06/2012 12:30 AM

Penicillin VK oral suspension 125mg/5ml
10 ml oral administration of treatment
on 1/06/2012 2:30 PM

http://spark.furore.com/fhir/patient/@10000

FHIR®© DSTU Candidate (QA Version)

HL7 INTERNATIONAL

Home | Documentation | Implementation | Resources | Clinical | Administrative | Infrastructure

Home

This is the DSTU candidate version, for QA review. There's also the version that was balloted for DSTU, and a Nightly Build is also available.

0 Welcome to FHIR® 🌐

First time here? Read the high level summary and then the FHIR overview / roadmap. See also the open license.

Major Sections:

General Documentation | Implementation & Exchange | Clinical Resources | Administrative Resources | Infrastructural Resources

Quick links:

Documentation
- Resource List
- XML & JSON
- REST API & Search
- Data Types
- Using Terminologies
- Extensions
- Full table of contents

Implementation
- Downloads
- FHIR Schemas & Schematrons
- Examples: XML, JSON
- Code: Java, C#, Pascal
- Common Use Cases & Profiles
- Security
- Support Links

External Links
- Stack Overflow (When to use)
- Public Test Servers & Software
- FHIR Wiki
- Translations: Japanese

Search the FHIR Specification:

Google™ Custom Search

Note: FHIR requires a browser that is SVG compatible. (Microsoft Internet Explorer 10+, Firefox 3.0+, Chrome, or Safari).

© HL7.org 2011 - 2013. FHIR v0.12-2115 generated on Tue, Dec 31, 2013 16:15+1100. License. QA Report
Warning: This version of FHIR is the DSTU Candidate version (see the Version History). Publicly available versions.
Implementers are welcome to experiment with the content defined here, but should note that the contents are subject to change without prior notice at the end of the QA review period (late in January).
Propose a change to the FHIR Specification

hl7.org/fhir
(FHIR home)

Freely available

- Unencumbered – free for use
  - Free as in beer (gratis)
  - and as in speech (freedom)
  - If you are looking for the simple free open health API, this is it

- http://hl7.org/fhir

FHIR License   1.0.3

FHIR plain English license:

- FHIR is © HL7. The right to maintain FHIR remains vested in HL7
- You can redistribute FHIR
- You can create derivative specifications or implementation-related products and services
- Derivative Specifications cannot redefine what conformance to FHIR means
- You can't claim that HL7 or any of its members endorses your derived [thing] because it uses content from this specification
- Neither HL7 nor any of the contributors to this specification accept any liability for your use of FHIR

Principles:keep it simple

- You should be able to "figure it out" over a weekend.

- Easy to get started, grow into the spec for more complex scenarios

- *FHIR is interoperability for people who have other things to do*

FHIR supports "common" scenarios

- **FHIR is kept readable by focusing on the most common use cases**

- **Inclusion of content in core specification is based on an "80%" rule**
  - If it isn't used by 80% of implementers, it doesn't go in
  - Makes it easy to get started, not bogged down in the less common details
  - The remainder is not ignored: 100% coverage is achieved by having by non-core "extensions". *You don't need to understand those to get started.*

Existing technologies

- **XML and/or JSON** - for data
- **REST API** – http web calls
  - ➢ like Amazon, Facebook, Twitter
  - ➢ read/write data via URLs (web addresses).
- **UML class diagrams** - for models
- **XSD, Schematron** - for validation
- **HTTPS, OAuth** – industry standard security

Implementer Focus

- Specification is written to be implemented
- Implementers have been forgotten recently
  - You can design what you want, but if I can't be built…
  - FHIR is tested by implementation *before publication*
- Publicly available test servers
- Working code is published with the specification
  - C#, Java, …
- Connectathons, verify specification works
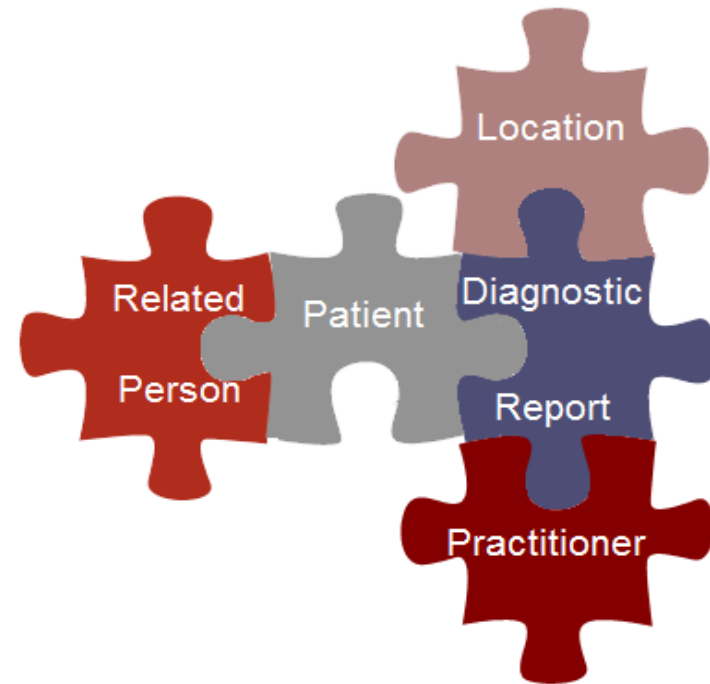- Lots of examples, easy to understand

FHIR Resources

- "Resources" are:
  - Small logically discrete units of exchanged data
  - Defined behaviour and meaning
  - Known identity / location
  - Smallest unit of transaction

What's a Resource?

FHIR

Examples

- Administrative
  - **Patient**, **Visit**, Organization, Invoice
- Clinical Concepts
  - **Allergy**, **Problem**, Questionnaire, Care Plan
- Infrastructure
  - **Document**, Message, Profile, Conformance
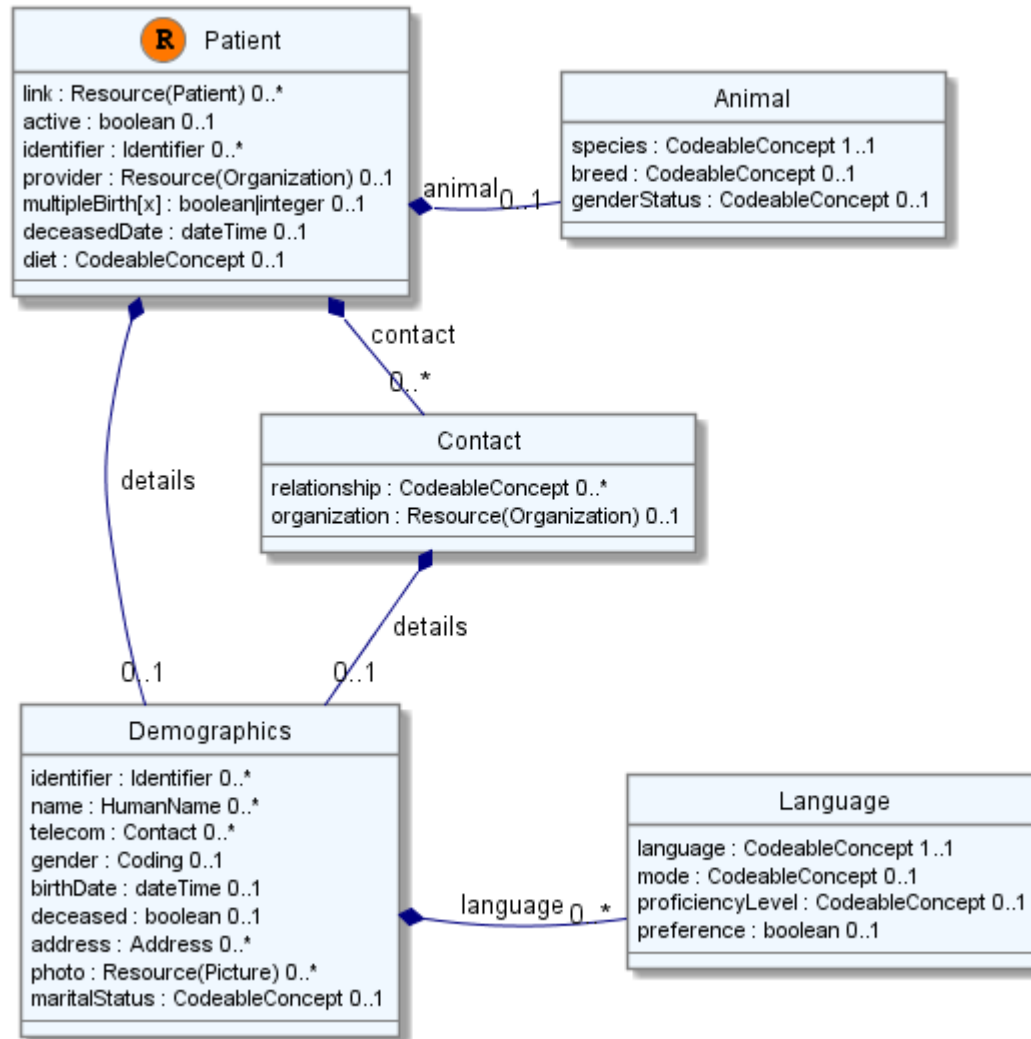
Counter examples

- Gender
  - Too small
- Electronic Health Record
  - Too big
- Blood Pressure
  - Too specific (see *profiles*)
- Intervention
  - Too broad

Resource diagram

Patient

Patient (R)
- link : Resource(Patient) 0..*
- active : boolean 0..1
- identifier : Identifier 0..*
- provider : Resource(Organization) 0..1
- multipleBirth[x] : boolean|integer 0..1
- deceasedDate : dateTime 0..1
- diet : CodeableConcept 0..1

Animal
- species : CodeableConcept 1..1
- breed : CodeableConcept 0..1
- genderStatus : CodeableConcept 0..1

animal 0..1

contact 0..*

Contact
- relationship : CodeableConcept 0..*
- organization : Resource(Organization) 0..1

details

details 0..1

0..1

Demographics
- identifier : Identifier 0..*
- name : HumanName 0..*
- telecom : Contact 0..*
- gender : Coding 0..1
- birthDate : dateTime 0..1
- deceased : boolean 0..1
- address : Address 0..*
- photo : Resource(Picture) 0..*
- maritalStatus : CodeableConcept 0..1

Language
- language : CodeableConcept 1..1
- mode : CodeableConcept 0..1
- proficiencyLevel : CodeableConcept 0..1
- preference : boolean 0..1

language 0..*

Human Readable

- Success of CDA (documents) taught HL7 a very important lesson
  - Its hard to make computers understand data
  - but that's ok if they can properly render it to a human clinician
- This doesn't just hold for documents
  - important for messages, services, etc.
- In FHIR, **every** resource is required to have a human-readable expression
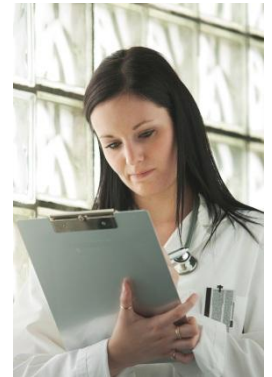
REST

- The API in FHIR

- Use HTTP to do "*CRUD*" operations (create, read, update, delete) on resources (records).

- The REST interface is what adds the *API* onto the *content* of the resources.

- The data is not a website*, but it is convenient to treat it like one.*

- Normal security can be applied via HTTP, firewalls etc.

REST Alternatives

- REST is a key advantage of FHIR
- Inherently simple, adds the transactional behaviour needed
- Resources not limited to being served via a REST API
- Other paradigms: documents, messages, services
  - Fully documented as part of FHIR
- Same FHIR resources are used
  - e.g. Receive a lab result in a *message*. Package it in a discharge summary *document*

FHIR Project Timeline

- First invented July 2011
- First presented San Diego Sept 2011
- Draft for Comment Sept 2012
- Connectathons since Sept 2012
- Formal Ballot Sept 2013 (1000s comments received)
- **DSTU publication in Jan 2014**
  - "Draft Standard For Trial Use" – ANSI rules
  - It's ready to use, we all gain experience, may lead to some changes

Current state of FHIR

- 5 completed international Connectathons
- IHE & DICOM both exploring use of FHIR
  - Likely to be format of MHD (IHE Mobile XDS profile)
- NHS HSCIC using as basis for E-Referrals project
  - Other UK projects in the pipeline
- US Government (ONC) also working with FHIR
- Many suppliers looking at FHIR (connectathons and development meetings), almost certainly implementing it
- One commercial Integration Engine supports FHIR. Several other IE vendors are actively involved in the creation of FHIR.

Getting ready

- Get familiar with FHIR

- Consider FHIR for new requirements
  - e.g. Expose appointments or lab data to patients on their smart phones
  - Compare NHS numbers between systems (SHSW goal)

- Map existing internal interfaces to FHIR to allow easy external interfacing

- Look at adopting FHIR as an internal architecture

Next steps for **you**

- Read the spec: http://hl7.org/fhir
- Comment on the spec: discussion thread on each page
- Join the FHIR email list
http://wiki.hl7.org/index.php?title=FHIR_email_list_subscription_instructions
- Follow #FHIR on Twitter
- Try implementing it
- Come to a Connectathon!
- Get some training…

HL7 UK Training

- **HL7 FHIR 'Hands-on' - 12th March and 12th November 2014**
  - Gain hands-on experience with HL7 latest standard for mobile and cloud based applications.
- IHE XDS Enterprise archiving, VNA and ECM - 28th-29th April and 10th-11th Nov 2014
- HL7 ITK (Interoperability Toolkit) - 26th-27th March and 22nd-23rd October 2014
- HL7/IHE/DICOM/CDA Standards Overview - 30th April 2014 and 13th November 2014
- HL7 Version 2 - 24th-25th March and 20th-21st October 2014

- http://www.hl7.org.uk/marketing/training/training_summary.asp

FHIR

- http://hl7.org/fhir - FHIR home

- http://hl7.org.uk - FHIR UK activity

- Twitter: #FHIR

- Live demo: http://nprogram.azurewebsites.net/