Devices on FHIR (DoF)
– Update & Discussion

HL7 Baltimore WGM
2016.9
DoF 2016-09 Baltimore

- Wednesday Q3 – WG Discussions
  - DoF General Update
  - Roadmap 2016-17
  - Joint FHIR Agenda - Thursday Q1 Prep.
  - Key Topics / Issues

- Thursday Q1 – Joint with FHIR
  - DoF – Even more general update for FHIR Rep’s
  - PSS Review & Guidance
  - FHIR 2016 SEPT Ballot Resolution [TBD]
  - Key Issues
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- DoF Launched after 2016 May WGM
  - @ http://wiki.hl7.org/index.php?title=Devices_on_FHIR
- Weekly web meetings, etc.
- Updated DEV FHIR PSS (#1277)
- Coordination with CDS Collaborative … as listeners!
- Coordination w/ Continua & IHE
- What’s next? (Roadmap)
New #1277 PSS (replaces #1103)

Simple title: FHIR for Device Data Reporting

Targets …

- Narrow primary focus: Data Reporting using ...
  - Device / DeviceComponent / DeviceMetric / Observation
- Advance FHIR Maturity Model (FMM) for resources
- Consider device-related profiles
- Implementation Guide – for consistent implementation
- White Papers – for topics like alerting or control

Co-sponsors: O&O, mHealth, HSI

Schedule: Target 2017 May
DoF Testing: Virtual & F2F Connectathons

- Pre-2016.09: Dev. Guys were Lonely!
- 2016.09 FHIR Connectathon
  - CDS Collaborative engaged as consumers!
  - Pre-Connectathon testing @ Cognitive Platform
  - But … we all had... Challenges ...
    - HAPI FHIR API ... Massive changes between ver’s
    - Scheduling conflicts / travel challenges
    - Normal spec issues – the main testing purpose!
  - So ... Still a bit lonely BUT more part of the event!? 
  - Bottom Line: Great progress!
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- Post 2016.09 FHIR Connectathon
  - Establish 2-3 week scrums w/ virtual testing?
  - Move to HSPC-based HAPI FHIR sandbox?
  - Testing based on advancing PSS, Continua & IHE use case needs, demonstration events, etc.

- Next F2F Connectathon events …
  - 2016.11 Amsterdam DevDays (Continua managed)
  - 2017.01 San Antonio @ HL7 WGM
  - 2017.01 IHE NA CAT17
  - 2017.08 IHE Australia & Korea Connectathons
DoF @ IHE & HIMSS’17

- FHIR is HL7 … but DoF is broad!
DoF – Harmonized Semantics

Using *common semantic base* is #1 objective.

<table>
<thead>
<tr>
<th>Program</th>
<th>IHE PCD</th>
<th>IEEE PHD / Continua</th>
<th>OpenSDC / OR.net</th>
<th>OpenICE / MDPnP</th>
<th>HL7 Devices on FHIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Base</td>
<td>HL7 V2.6 ¹</td>
<td>IEEE 11073</td>
<td>WS*</td>
<td>OMG DDS</td>
<td>REST / HTTP</td>
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<tr>
<td>Maturity</td>
<td>Dozens of commercially available products</td>
<td>100’s of Certified PnP Products</td>
<td>Prototyped; 11073 standardization in process</td>
<td>Prototyped; IEEE ICE Alliance advancing</td>
<td>Starting FHIR Connectathon Testing</td>
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<tr>
<td>Semantics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IEEE 11073 Terminology &amp; Model ²</td>
</tr>
</tbody>
</table>

¹ Adding HL7 FHIR  
² Core 11073 terms mapped to LOINC
Testing Options

- IHE Profiles and
- HL7’s Consolidated Clinical Document Architecture (C-CDA)
  - January 23 – 27, 2017
- Devices on FHIR®
  - January 24 – 26, 2017
Devices on FHIR®

Collaborative effort to ensure semantically consistent device information exchange whether it is achieved using current Patient Care Devices (PCD) HL7 V2-based messaging or HL7 FHIR-based resources & profiles.

Active participants include:

- IHE
- Continua®
- HL7
- FHIR®
Objective: On-demand, real-time, high-resolution device data access to support services oriented architectures (SOA) and knowledge-based applications for clinical decision support (CDS), precision medicine, and analytics (population & analytics).

Unites activities underway in HL7, Continua, and IHE.

Systems and applications include:

- Devices & Gateways
- EHRs and Enterprise-level Systems
- Knowledge-based Services and Application Platforms
Devices on FHIR®

Project will include:
• Establishing a consistent mapping from abstract device semantics to FHIR constructs (per IHE Rosetta Term. Mapping)
• Starting with Device-to-Enterprise (DEC) profile ... Others in time
• Integrated approach for use of current V2-based data streams with a FHIR-based, RESTful API / SOA architecture
• Leverage agile methods and tools for profile development
• Coordinate capability development between FHIR Connectathons and IHE Connectathons
• HIMSS’17 Showcase track to highlight these technologies

Todd Cooper, Devices on FHIR, Technical Program Manager,
Email: ToddCooperAFC@gmail.com

To Learn More Visit:
• HL7’s Wiki: wiki.hl7.org/index.php?title=Devices_on_FHIR
• Register to attend the Devices on FHIR® Webinar
  ○ October 17 at 10:30am-11:30am CT
  ○ Registration link will be posted on www.iheusa.org soon
IHE PCD @ FHIR

- IHE PCD 2016-October Boca Raton Kick-off
- Approach and prioritization for current profiles:
  - DEC – integrate V2 & FHIR
  - PCIM, RDQ – both could benefit from FHIR
  - Infusion Pump Profiles? (PIV / IPEC)
- New Profiles?
- Pilot an IHE “agile” development process
PCD Profile: Alert Comm. Management (ACM)

HL7 Messages per ACM and WCM profiles

Parameters, waveforms, etc. as evidentiary data items

Device Specific graphics

Alert Information
Source, Phase, State, Priority
Patient Location Instance Alert text Callback Timestamp Evidentiary data

Dissemination Status
Instance
Accepted by AC Undeliverable Delivered Read Accepted Rejected Cancelled
Callback start/stop

Alert Source
Alert Reporter AR

Report Alert PCD-04 → Alert Manager AM
← PCD-05 Report Alert Status

Disseminate Alert PCD-06 → Alert Communicator AC
← PCD-07 Disseminate Alert Status

Alert Communicator AC

- New ITI mACM (FHIR-based) Profile
- ACM ’16 update to refer to FHIR for PCD-06 & -07 transactions

Note: Supports IEC 60601-1-8 & 80001-2-5 Standards
Example of ACM @ FHIR ...

![Diagram of a healthcare system using FHIR](image-url)
HIMSS’17 Interop. Showcase

Showcase “vignettes” being developed for …

- Devices on FHIR enabled solutions
- CDS / Analytics / Precision Med. use cases
- IHE PCD Profiles: both V2 and FHIR based
- For example …
Cognitive Medical HIMSS ‘16 Demo …

✓ Use Case: Transient, but clinically significant (suboptimal) drops in systemic blood pressure that correlate with each metoprolol administration

✓ Open standards-based API’s (e.g., HL7 FHIR & CDS)

✓ Systems developed independent of use case

✓ Who is risk managing @ implementation & use?!
Joint DEV-FHIR Agenda

- Review DoF & Progress since May
- Review PSS & Roadmap through 2017 May
- FHIR: Schedule & Input to HCD & DoF

Key Topics …

- IG Production
- Mapping: Formalized in STU3
- Terminology Bindings (esp. 11073 & LOINC)
- 11073 BITS-to-FHIR Approach
- Security Considerations

Q3 Discussion: Include FMM discussion and connectathon coordination to advance
Key Topics / Issues

- Mapping 11073 to FHIR Resources / Profiles
  - To Profile or Not to Profile (80/20 Rule)
  - Containment Tree for PoCD & PHD
    - Why these resources? Scaling from pumps to scales …
  - 11073 BITS to FHIR

- DeviceComponent: lastSystemChange 1..1?

- Regulatory Status Indicator

- Terminology Bindings (incl. 11073 & LOINC)

- PCIM – ‘Procedure’ Use (Ioana’s proposal)

- … (other topics)
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**HL7® FHIR® DEVELOPER DAYS 2016**

16 – 18 NOVEMBER 2016
AMSTERDAM

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<td><strong>FHIR for .NET and Java Developers</strong></td>
<td>Ewout Kramer, Furore</td>
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<td>Mirjam Baltus, Furore</td>
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<td></td>
<td>Marten Smits, Furore</td>
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<td></td>
<td>James Agnew, University Health Network</td>
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<td><strong>Building Bridges: HL7 v2 and FHIR</strong></td>
<td>Simone Heckmann, Health-Comm</td>
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<td><strong>Clinical track</strong></td>
<td>David Hay, Orion Health</td>
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<td><strong>Clinical Decision Support</strong></td>
<td>Bryn Rhodes, Database Consulting Group LLC</td>
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<td><strong>Continua: Personal Connected Health Devices and Applications</strong></td>
<td>Melanie Yeung, University Health Network</td>
</tr>
<tr>
<td><strong>Apps in the EHR: Epic, Cerner &amp; SMART on FHIR</strong></td>
<td>Josh Mandel, Harvard Medical School</td>
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<td></td>
<td>Danielle Friend, Epic</td>
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<td></td>
<td>Dennis Patterson and Matt Henkes, Cerner</td>
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<tr>
<td><strong>Imaging/DICOM</strong></td>
<td>Brad Genereaux, Agfa Healthcare</td>
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<tr>
<td><strong>Logical Models, Profiling and openEHR</strong></td>
<td>Grahame Grieve, Health Intersections Ltd.</td>
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<tr>
<td><strong>Medical Research</strong></td>
<td>Pascal Pfiffner, Boston Children's Hospital and University Hospital Zurich University of Zurich</td>
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<tr>
<td><strong>Scheduling and Appointments</strong></td>
<td>Gaute Brakstad, DIPS ASA</td>
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<tr>
<td><strong>Student</strong></td>
<td>Marten Smits, Furore</td>
</tr>
<tr>
<td><strong>Terminology</strong></td>
<td>Robert Hausam, Hausam Consulting LLC</td>
</tr>
<tr>
<td><strong>Community</strong></td>
<td>Rene Spronk, Ringholm</td>
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CONTINUUM: PERSONAL CONNECTED HEALTH DEVICES AND APPLICATIONS

This track is defined in close collaboration with the Personal Connected Health Alliance (PCHA) and Continua. Goal of the track is exploring FHIR as a standard for communication between health devices and back-end systems, like the EHR. Part of the track is the mapping of the device data to the FHIR data model.

**Track leader**  
Melanie Yeung, University Health Network

**Target audience**  
Developers and architects who are interested in device communication and device app development.

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**Tutorials**

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<th>Tutorial</th>
<th>Instructor</th>
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<tr>
<td>Introduction to FHIR</td>
<td>Ewout Kramer</td>
</tr>
<tr>
<td>FHIR Profiling</td>
<td>Michel Rutten</td>
</tr>
<tr>
<td>Continua Profiling and Mapping</td>
<td>Melanie Yeung</td>
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**Hands-on**

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<tr>
<td>Device to backend</td>
<td>Melanie Yeung</td>
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<td>Continua Profile evaluation</td>
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Objective: Hear from FHIR Management
FHIR Development & Schedule

- See 2016-09 FHIR TSC presentation to co-chairs.
  
  (08_FHIR TSC.pdf)
FHIR 2016 SEPT Ballot Resolution

- See ballot spreadsheet …
  
  [FHIR_R1_D3_2016SEP_amalgamated-cleaned.xls]

- Review also outstanding CP’s
  - Plan for their discussion & disposition
  - Including: 11006 10170 9966 10575 10556 10276
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NOTE: Did not discuss Terminology Bindings or Security Considerations
ASN.1 BIT String => FHIR

• ASN.1 BITs handling
  • This data cannot be mapped in FHIR/CDA templates

• Proposed Solution:
  • Define a Vocabulary that can be constructed from protocol
  • For Enumeration 16 and 32 bit BITs observations
    • Code is specified by Typecode.MderBitPosition.
    • The equivalent ‘Ref-id’ is the ASN.1 name
      • Value is binary 1 (yes) 0 (no)
  • For non-measurement BITs
    • Code is AttribitId/SubAttributeId.MderBitPosition
    • Value is binary 1 (yes) 0 (no)

Source: Brian Reinhold (Lampry Networks / Continua)
ASN.1 BIT String => FHIR

• Example:
  • Pulse Ox pulse characteristic
    TYPE: MDC_PULS_OXIM_PULS_CHAR 2:19512 = 150584
    • pulse-qual-nominal(0) Quality of the detected pulse is nominal, in that there are no recognized abnormalities in the detected pulse
    • pulse-qual-marginal(1) Perfusion or quality of the detected pulse is marginal.
    • pulse-qual-minimal(2) Perfusion or quality of the detected pulse is minimal.
    • pulse-qual-unacceptable(3) Perfusion or quality of the detected pulse is unacceptable

<table>
<thead>
<tr>
<th>Code</th>
<th>ASN.1 name</th>
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<tr>
<td>150584.0</td>
<td>pulse-qual-nominal</td>
</tr>
<tr>
<td>150584.1</td>
<td>pulse-qual-marginal</td>
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<tr>
<td>150584.2</td>
<td>pulse-qual-minimal</td>
</tr>
<tr>
<td>150584.3</td>
<td>pulse-qual-unacceptable</td>
</tr>
</tbody>
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"code": {
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    "code": "150584.0",
    "display": "MDC_PULSE_OXIM_PULS_CHAR.pulse-qual-nominal (pulse quality okay)"
  },
  ]
},

"valueCodeableConcept (binary value set: y/n)"

Source: Brian Reinhold (Lampry Networks / Continua)