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*“How my experience of coding
will support the Reactivate
Digital Obesity Platform over the
next 10 months”*

Date: 07/11/25'



Introduction



Conor P
Heffron

- Software Developer & Data Engineer with Experience across Consulting, Finance, Health & Gambling/Gaming Sectors
- Web applications, APIs & data processes
- Background primarily in the JVM & Python
- RESTful & Graph based APIs
- Linux based DevOps experience with containerized applications (Docker, k8s)
- Experience in Data Analytics & building Data Intensive Pipelines from data collection through to generating reports & visuals to help drive decisions
- Experience deploying/managing apps in the cloud (AWS, GCP, Azure, Heroku etc.) & on-prem/hybrid Linux environments, Learn more @ <https://ironoc.net/>



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Terms

- **Logical Observation Identifier Names & Codes (LOINC)** – DB & Universal Standard for identifying medical laboratory observations, clinical measurements, & health observations.
 - Ensures consistency across electronic health records
 - Examples: **39156-5** for BMI Obs. & **75430-9** for Obesity Med note
- **Health Insurance & Accountability Act of 1996 (HIPAA):**
 - Law enacted in 96' aims to protect patient health information and ensure the privacy & security of medical records.
 - Standards for managing electronic healthcare transactions & the national identifiers / look up services (EDI Document Validation, NPI, EIN) used by providers, health insurance plans, & employers along with other industry regulations & guidelines.
- **Canonical Resource:** Common interface declaration for conformance & knowledge artifact resources (Normally a URL value for given resource in Health Level 7 API (HAPI) Fast Healthcare Interoperability Resources (FHIR) data).
 - Example Canonical: **PlanDefinition**
 - Example Non-Canonical: **Medication, Insurance Policy Group, Substances (Testing)**
- **Segments**
 - **OBX (Observation/Result):** Contains clinical observations like BMI, weight, or diagnostic codes.
 - **DG1 (Diagnosis):** May include ICD codes for obesity (e.g., E66.9 for unspecified obesity).



STAR

SITUATION: Obesity in young people – How to improve patient care & treatment, real time processing of events & encounters, analysis / diagnosis, & status updates per care / treatment plan coverage etc.

- Cross functional effort – Health Insurance Provider, Pharma Companies, Health Care Practitioners, Patient Care / Clinical Trial Data Scientists, IT, CDM, & more
- Analysis – What tech solutions could be useful for this area & how to improve existing platform

TASK: Build something of Value – Drive efficiency, improve upon patient care & care efficiency with the support of useful data analysis, web tools, & applications.

- Data Access & Management – Are there already open APIs that follow industry standards available, asses quality
 - **EMR / EHR: Electronic Medical / Health Records** contain PII (sensitive info) along with segments/chunks of info needed to progress care

ACTION: R&D Work in an agile manner with regular feedback from industry experts on the right techno / functional path for this product & platform

- Offer **micro POCs / Alternative solutions / Hooks / Serverless functions** when appropriate to help build a road map, & an application that improves patients care & the ability for health care professionals to see improvement in BAU activities & patient progress

RESULT: New APIs, Web App and/or improve existing Portal – Deliver Services, Tech Artifact , or Executables that improve the overall platform with technology & IT controls in place for added flexibility in future iterations, pivots, & changes etc.

- Research: Explore AI driven solutions – From improving developer efficiency through to driving an evolving system & landscape



Technical Concerns & Skills

- **Industry Standards & Best Practices**, Case Studies & White Papers from relevant partner colleges/companies
- **Existing systems** for integration: HAPI FHIR APIs (REST & GraphQL end-point)
 - HL7 Interfaces / Models for standard usage etc
 - Streaming from Message Queue Topics – Real Time Data Processing of new Encounters between patient & practitioner, provider plan / policy enrolments & changes in coverage etc.
- Initial synchronous request or query for patient history to present not enough, ***predictive analytics, real time processing of data, mapping to custom or local data stores*** (Cache / SQL / NO-SQL) for Audit purposes etc.
- **APIs, SDKs, Libraries, Dependencies & Standard models**: HL7 models & versions Release Versions R4, R5, Draft Standard for Trial Use (DSTU) 2 / 3, STU3 etc.
- **Support** for Languages & protocols such as Java, Python & Layer 7 for TCP / IP (Specifically HTTP(s))
 - Bespoke / Standard / Hybrid solutions? Are they secure? Ongoing vs Post Go-Live activities, Observability
- **UI / UX**: Frontend tech such as React / Angular, JSP, Templating Engines like Velocity or Thymeleaf, client libraries/plugins such as Apollo for GraphQL queries/mutations, axios / fetch etc. for REST API calls etc.
- **SDLC & IT Controls** (version control, code & image scanning, test coverage reports, CI/CD (Jenkins Jobs / Workflows / Actions), deployments to various envs, cloud native / hybrid or on-prem instances of any new services or APIs)
- **Test Pyramid:**
 - Test Suite with Unit (method / function level) & Integration Tests (service / controller layer) , Mock API requests or DB storage for CI/CD
 - Browser based UI testing that ensures better Regression Test for new releases & frees up time for targeted manual & performance testing



Functional Concerns & Skills

- **Requirements Gathering for new Tech OR new features for existing platform**
 - Example: How to **accurately measure Obesity**, how often? New processes / User Interaction to Happen Daily/Weekly ?
 - Foundation of a system to flag / manage obesity: Parse HL7 messages to extract weight, height, and BMI.
 - Compare BMI against thresholds (e.g., BMI ≥ 30 for obesity), Generate alerts or reports for healthcare providers.
 - Vital Signs (blood work for gender, weight, full medical history (HER / Phenotype) , DICOM for medical imaging content etc)
 - DNA – patients predisposed to obesity for various reasons (background, habits / characteristics, family history etc.)
 - Wearable tech & Apps for step count, HR (bpm, variability etc), Weight / Nutrition Management , vHealth (virtual health encounters)
- **Planning, Data Gathering & Collection**
- **Reverse Engineering, Analysis, Pattern Recognition, & System Integration Techniques**
- **Communication During SDLC -> Common Language for Tech & Non Tech Audience** (*Key for Demos, KPIs, Backlog Grooming, Story/Issue Prioritisation, Feedback loops for working, Way of Working SCRUM/Kanban Board, DOD*):
 - Health Level 7 (HL7) interfaces & prominent health care Systems such as EPIC in the US
 - Expected User Activity, How to document, handle errors, troubleshoot, implement change
 - Areas off focus such as Search Codes (HIPAA Space / LOINC DB), Segment/or Resource Types
 - OBX-5 (Relevant to observations that may help label patients as relevant and not relevant), High volume of data so filters, segment types etc is IMPORTANT!
 - DG-1 for actual Diagnosis codes and corresponding information
- **Testing: Manual, Regression, & Integration Testing**



Data: Segment Example

- **HL7 OBX segment** in pipe-delimited format, which is commonly used to transmit observation results in HL7 messages / files & JSON / XML via APIs:
 - **OBX|1|NM|12345^Glucose^LN||5.6|mmol/L|3.9-6.1|N||F**
- Explanation of the Fields (Note: Additional fields depending on the use case):
 1. **OBX**: Segment identifier.
 2. 1: Set ID (sequence number of the OBX segment within the message).
 3. **NM**: Value type (e.g., "NM" for numeric).
 4. **12345^{Glucose}LN**: Observation identifier (e.g., LOINC code for glucose).
 5. **(empty)**: Sub-ID (not used in this example).
 6. **5.6**: Observation value (e.g., glucose level).
 7. **mmol/L**: Units of measurement.
 8. **3.9-6.1**: Reference range.
 9. **N**: Abnormal flags (e.g., "N" for normal).
 10. **(empty)**: Probability (not used in this example).
 11. **(empty)**: Nature of abnormal test (not used in this example).
 12. **F**: Observation result status (e.g., "F" for final).



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R&D, Findings to date

- Micro POC to build an API that can query & integrate with standard HAPI FHIR API end-points
- Initial findings & development:
 - Global Test Server Available ✓
 - Documented API end-points & samples available ✓
 - RESTful API & GraphQL
 - Standard models for HL7 interfaces available ✓
 - *Models/Resource Types of interest for Obesity Care Plans:*
 - Care Plan, Plan Definition, Patient, Encounter, Claim, Observation, Device, Device Request, Concept Map, Nutrition Order, Diagnostic Report, Composition ... & many more ✓
 - Using HAPI FHIR Version 8 (latest), Release 4 of Models, & JDK 25/Spring Boot ✓



Technical: Careplan example obesity narrative

 Release 4B Snapshot #1

Home Getting Started Documentation **Resource Types** Profiles Extensions Operations Terminologies

 Clinical Summary > CarePlan > Example Instance

This page is part of the FHIR Specification (v4.3.0-snapshot1: Release 4B Snapshot #1). The current version which supercedes this version is **5.0.0**. For a full list of available versions, see the [Directory of published versions](#). Page versions: **R5 R4B R4 R3**

Careplan-example-obesity-narrative.json

Patient Care Work Group | Maturity Level: N/A | Standards Status: Informative | Compartments: Encounter, Patient, Practitioner, RelatedPerson

Raw JSON (canonical form + also see [JSON Format Specification](#))

Primarily narrative care plan to address obesity

```
{  
  "resourceType": "CarePlan",  
  "id": "obesity-narrative",  
  "text": {  
    "status": "additional",  
    "div": "<div xmlns=\"http://www.w3.org/1999/xhtml\">\n      <p> Care plan to address obesity. Goal is a target weight of 160 to 180 lbs. Activities include diet and exercise.</p>\n    </div>"  
  },  
  "status": "active",  
  "intent": "plan",  
  "subject": {  
    "reference": "Patient/example",  
    "display": "Peter James Chalmers"  
  }  
}
```

Usage note: every effort has been made to ensure that the examples are correct and useful, but they are not a normative part of the specification.



Technical: Example: Condition Model -> JSON (API Integration)

Condition Model Definition

Name	Flags	Card.	Type
Condition	I TU		DomainResource
identifier	Σ	0..*	Identifier
clinicalStatus	$! \Sigma I$	0..1	CodeableConcept
verificationStatus	$2L \Sigma I$	0..1	CodeableConcept
category		0..*	CodeableConcept
severity		0..1	CodeableConcept
code	Σ	0..1	CodeableConcept
bodySite	Σ	0..*	CodeableConcept
subject	Σ	1..1	Reference(Patient Group)
encounter	Σ	0..1	Reference(Encounter)
onset[x]	Σ	0..1	<div style="display: flex; align-items: center;"> dateTime Age Period Range string </div>
abatement[x]	I	0..1	<div style="display: flex; align-items: center;"> dateTime Age Period Range string </div>
recordedDate	Σ	0..1	dateTime

Condition Instance Data in JSON

```
{
  "resourceType": "Condition",
  "id": "example",
  "text": {
    "status": "generated",
    "div": "<div xmlns='http://www.w3.org/1999/xhtml'>Severe burn of left ear (Date: 24-May 2012)</div>"
  },
  "clinicalStatus": {
    "coding": [
      {
        "system": "http://terminology.hl7.org/CodeSystem/condition-clinical",
        "code": "active"
      }
    ]
  },
  "verificationStatus": {
    "coding": [
      {
        "system": "http://terminology.hl7.org/CodeSystem/condition-ver-status",
        "code": "confirmed"
      }
    ]
  },
  "category": [
    {
      "coding": [
        {
          "system": "http://terminology.hl7.org/CodeSystem/condition-category",
          "code": "encounter-diagnosis",
          "display": "Encounter Diagnosis"
        },
        {
          "system": "http://snomed.info/sct",
          "code": "439401001",
          "display": "Diagnosis"
        }
      ]
    }
  ],
  "severity": {
    "coding": [
      {
        "system": "http://snomed.info/sct",
        "code": "24484000",
        "display": "Severe"
      }
    ]
  }
}
```



Technical: HAPI FHIR (Architecture & Partners)

Use the HAPI FHIR parser and encoder to convert between FHIR and your application's data model.

[Learn More](#)

Use the HAPI FHIR client in an application to fetch from or store resources to an external server.

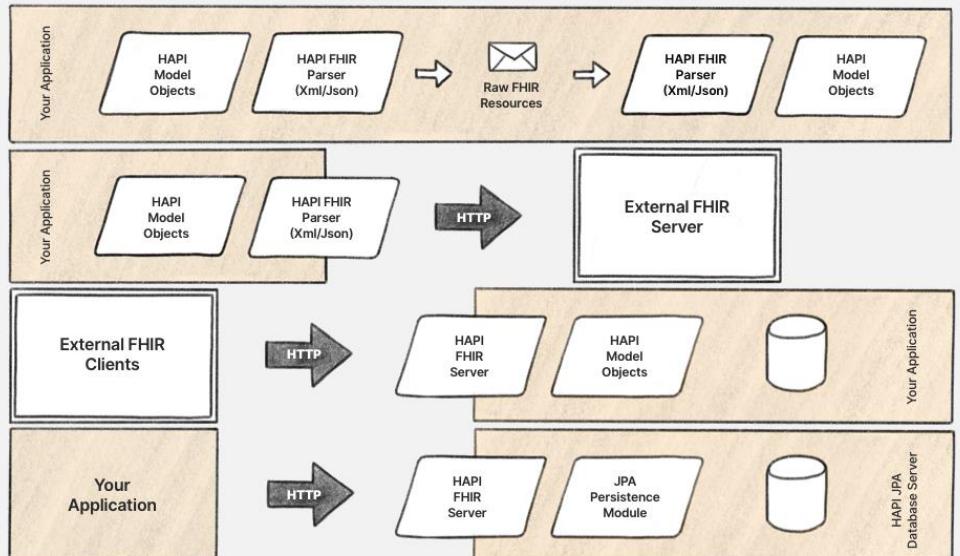
[Learn More](#)

Use the HAPI FHIR server in an application to allow external applications to access or modify your application's data.

[Learn More](#)

Use the HAPI JPA/Database Server to deploy a fully functional FHIR server you can develop applications against.

[Learn More](#)



FRiENDS OF HAPI FHIR

We are on a mission to improve global healthcare. We know that we can't do it alone though! HAPI FHIR thanks all of these amazing organizations who have sponsored HAPI FHIR development, helped out with infrastructure, or otherwise helped us keep the lights on.



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For Reference

- <https://www2.hse.ie/conditions/obesity/diagnosis/>
- <https://hapifhir.io/>
- <https://docs.smarthealthit.org/>
- <https://hl7.org/fhir/directory.html>
- <https://hapifhir.io/hapi-fhir/contributors.html>
- <https://github.com/hapifhir>
- <https://rhapsody.health/resources/hl7-obx-segment/>
- <https://www.hipaaspace.com/products.aspx>
- https://hipaaspace.com/Medical_Billing/Coding/Logical.Observation.Identifiers.Names.and.Codes/39156-5
- https://www.hipaaspace.com/medical_billing/coding/logical.observation.identifiers.names.and.codes/75430-9



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For Reference

- <https://hl7.eu/refactored/segOBX.html>
- <https://hl7.org/fhir/resource.html#canonical>
- https://dev1.hl7.org/implement/standards/product_brief.cfm?product_id=3
- <https://build.fhir.org/ig/HL7/crmi-ig/artifact-lifecycle.html>
- <https://build.fhir.org/canonicalresource.html>
- <https://www.iqvia.com/locations/emea/blogs/2025/01/digital-solutions-for-obesity-revolutionising-care-and-management>
- <https://pmc.ncbi.nlm.nih.gov/articles/PMC6990976/>
- <https://build.fhir.org/ig/HL7/ebm/Composition-179699.json.html>
- <https://vendorservices.epic.com/OpenEpicAPIs>
- <https://www.iehr.ai/fhir/ie/core>



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Demo

- Please see embedded **DEMO** video on next slide
 - **Micro Service / API for HL7 Response Models & Resource Types**
 - **API Integration via HAPI FHIR**



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```
...ce/simple-hl7v2 --zsh ... | ... ~/workspace --zsh ... | ... api-fhir-obs-api --zsh ... | ... api-fhir-obs-api --zsh ... | ... api-fhir-obs-api --zsh ... | ... lr-obs-api/demo --zsh
```

```
conorheffron@MacBookPro hl7-hapi-fhir-obs-api %
```