



Cerner **code Learning Lab** 2019

R4 > DSTU2

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Agenda

- Overview
- DSTU2 -> R4 Changes
- What's Available and What's Next
- Migration Strategy
- Q&A

“

This is your only goal for the year.
R4 > DSTU2

”

Yegor Hanov

Director, Platform Engineering

Shared Services Engineering - Platform Engineering

Overview

- HL7 FHIR Release 4.0.0 (R4) published 12-27-2019
- First normative release
 - Definition of Trial Use vs. Normative
- US Core vs. Argonaut
- Cerner Development of R4
 - Shifting gears
 - Any new capabilities will be planned for R4 only
 - DSTU2 has gone into maintenance mode
 - It will exist alongside R4
 - Deprecation plans will eventually be announced, likely 2-3 years out.

DSTU2->R4 Changes

General Technical Changes (HL7)

- Accept Type
 - application/fhir+json vs. application/json+fhir
 - Cerner R4 server will support both for compatibility
- Strings moving to Markdown
- Some Codes changing to CodeableConcepts
- Operation Outcome changes
 - Deprecated *OperationOutcome.issue.location* (xpath) in favor of *OperationOutcome.issue.expression* (FHIRpath)
- Source on resources
 - *Resource.meta.source* added in R4

General Technical Changes (Cerner)

- Framework to utilize HL7 schema definitions for code base
- Extending support for more interactions
 - Additional Create and Update support on several concepts
 - Addition of Patch support on certain concepts
- Resource.meta.id can change between versions
 - No guarantee that an id from DSTU2 still represents the same thing in R4.
- Addition of support for HTTP method overrides

General Technical Changes (Cerner)

HTTP Method Override Header - Example

POST | <https://fhir-ehr-latest.sandboxcerner.com/r4/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/Encounter/4027918>

Headers:

```
Authorization: 'Bearer token'  
Content-Type: application/json-patch+json  
If-Match: W/"3"  
X-Http-Method-Override: patch
```

Body:

```
[  
  {  
    "op": "replace",  
    "path": "/period/start",  
    "value": "2016-06-20T21:05:00.000Z"  
  }  
]
```


General Technical Changes (Cerner)

_method parameter - Example

```
POST |https://fhir-ehr-latest.cerner.com/r4/34a135c8-c081-4294-9b53-1b68b280e2a6/Encounter/4499909?_method=patch
```

Headers:

```
Authorization: 'Bearer token'  
Content-Type: application/json-patch+json  
If-Match: W/"2"
```

Body:

```
[  
  {  
    "op": "replace",  
    "path": "/period/start",  
    "value": "2018-12-10T21:32:00.000Z"  
  }  
]
```

General Technical Changes – Error Handling

- Adding extensive support for returning [OperationOutcomes](#)
 - Returned on all 4XX and 5XX responses
 - Clearer information on the type of error occurring
 - 400 (spec violation) vs 422 (Cerner business rule violation)

Operation Outcome Example - 400 (Bad Request)

POST Call on DocumentReference

DSTU2

22]
23	},
24	"status": 123
25	}

Body

Cookies (1)

Headers (10)

Tests (1/1)

Status: 400 Bad Request

Time: 44 ms

Pretty

Raw

Preview

Text

1

status not 'current'

Operation Outcome Example - 400 (Bad Request)

POST Call on DocumentReference

R4

22]
23	},
24	"status": 123
25	}

Body Cookies Headers (10) Tests (1/1) Status: 400 Bad Request Time: 340 ms

Pretty Raw Preview JSON

```
1 {
2   "resourceType": "OperationOutcome",
3   "issue": [
4     {
5       "severity": "error",
6       "code": "value",
7       "details": {
8         "coding": [
9           {
10            "system": "http://terminology.hl7.org/CodeSystem/operation-outcome",
11            "code": "MSG_BAD_FORMAT",
12            "display": "Bad Syntax: 'DocumentReference.status' must be of type 'code'"
13          }
14        ],
15        "text": "The syntax for DocumentReference.status is not valid."
16      },
17      "diagnostics": "DocumentReference.status: must be a valid code",
18      "expression": [
19        "DocumentReference.status"
20      ]
21    }
22  ]
23 }
```

Operation Outcome Example - 422 (Unprocessable Entity)

POST Call on DocumentReference

R4

```
23   },  
24   "status": "invalid"  
25 }
```

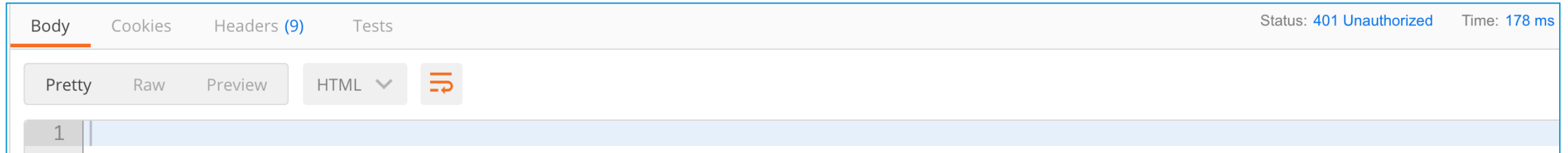
The screenshot shows a REST client interface with the following details:

- Body** tab selected. Sub-tabs: Pretty, Raw, Preview. Format: JSON.
- Status:** 422 Unprocessable Entity
- Time:** 366 ms
- JSON Body:**


```
{  
  "resourceType": "OperationOutcome",  
  "issue": [  
    {  
      "severity": "error",  
      "code": "business-rule",  
      "details": {  
        "coding": [  
          {  
            "system": "http://terminology.hl7.org/CodeSystem/operation-outcome",  
            "code": "MSG_PARAM_INVALID",  
            "display": "Parameter 'DocumentReference.status' content is invalid"  
          }  
        ],  
        "text": "The value for DocumentReference.status is not supported."  
      },  
      "diagnostics": "DocumentReference.status: must be current",  
      "expression": [  
        "DocumentReference.status"  
      ]  
    }  
  ]  
}
```

Operation Outcome Example - 401 (Unauthorized)

DSTU2



Body Cookies Headers (9) Tests Status: 401 Unauthorized Time: 178 ms


Pretty Raw Preview HTML 

1

R4



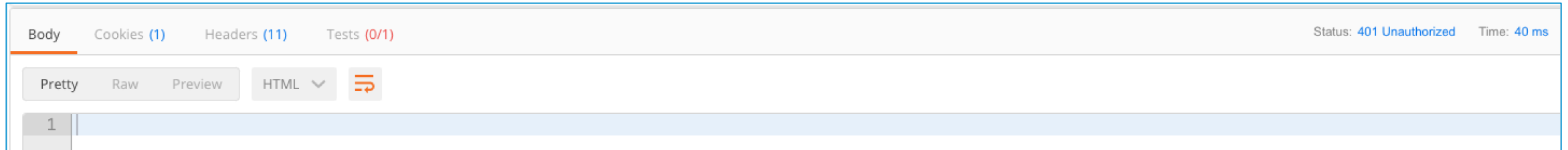
Body Cookies Headers (11) Tests Status: 401 Unauthorized Time: 192 ms

Pretty Raw Preview JSON 

```
1 {
2   "resourceType": "OperationOutcome",
3   "issue": [
4     {
5       "severity": "error",
6       "code": "login",
7       "diagnostics": "Bearer realm=\"fhir-ehr.sandboxcerner.com\"",
8       "expression": [
9         "http.Authorization"
10      ]
11    }
12  ]
13 }
```

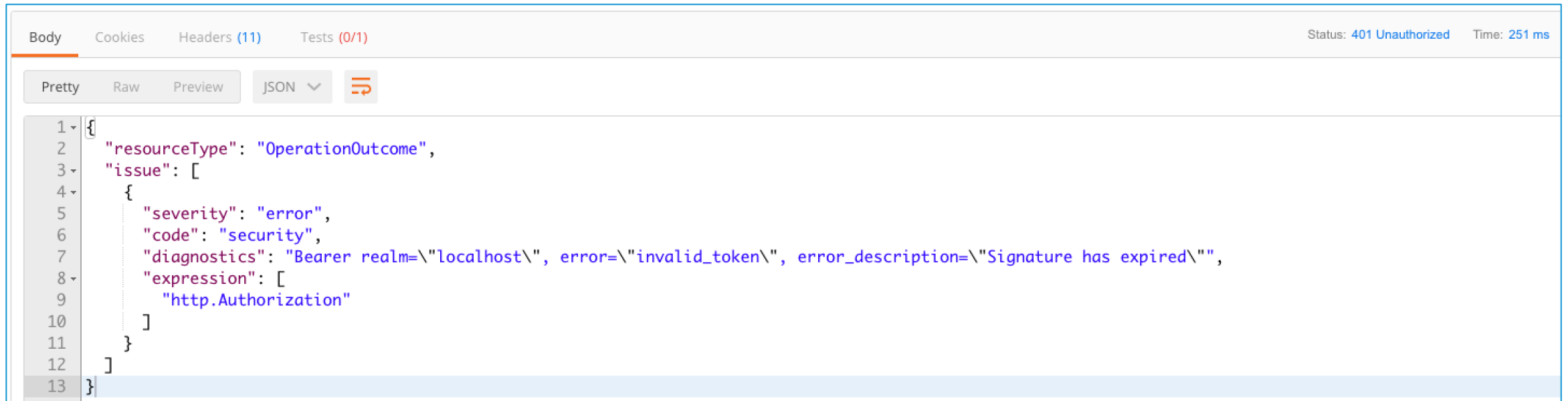
Operation Outcome Example - 401 (Unauthorized)

DSTU2



The screenshot shows a REST client interface with the 'Body' tab selected. The status bar at the top right indicates 'Status: 401 Unauthorized' and 'Time: 40 ms'. The response body is empty, and the 'Pretty' button is active. The 'HTML' dropdown menu is visible.

R4



The screenshot shows a REST client interface with the 'Body' tab selected. The status bar at the top right indicates 'Status: 401 Unauthorized' and 'Time: 251 ms'. The response body is displayed in JSON format, showing an 'OperationOutcome' with an 'issue' of 'security' and a description: 'Bearer realm=localhost, error=invalid_token, error_description=Signature has expired'. The 'Pretty' button is active, and the 'JSON' dropdown menu is visible.

```
1 {  
2   "resourceType": "OperationOutcome",  
3   "issue": [  
4     {  
5       "severity": "error",  
6       "code": "security",  
7       "diagnostics": "Bearer realm=localhost, error=invalid_token, error_description=Signature has expired",  
8       "expression": [  
9         "http.Authorization"  
10      ]  
11    }  
12  ]  
13 }
```

Proprietary Codes

- Millennium groups repetitive textual responses into Code Sets
- Code Sets store a numerical value that represents a textual or character display
- Code Sets are consistent across all clients
- Values in a Code Set vary between clients
- Values are only guaranteed unique within a specific EHR
- Thus the reason for the EHR source id (or tenant) in the system URL
- Cerner Ontologies map proprietary codes to standard codes

Concept Mapping Example (Appointment.serviceType)

[Appt Synonym Code Set 14249](#)

- Office Visit New
- Office Visit Followup
- Office Visit 60 minute
- Sleep Lab Evening 4 hr
- Sleep Lab Morning 8 hr
- Site A PT Treatment
- Site B PT Treatment

=

<http://terminology.hl7.org/CodeSystem/service-type>

- Community Medicine
- Sleep Studies – specialty
- Rehabilitation

Proprietary Code Advantages

- Common for proprietary codes and standard codes to not align
- Allows for reading and writing with client proprietary codes
- Eliminates the need to map proprietary codes to standard codes
- Allows for faster implementation of a resource or application
- Beneficial for concepts that are highly customized by clients such as documents, orders, and appointment types
- May provide granularity/specificity not supported by a standard code
- Encounter participant type: both Ordering Physician and Anesthesiologist are primary performers

Where Proprietary Codes are Useful

- Document writes
- Slot searches
- Observation reads and writes
- ServiceRequest reads and writes

Proprietary Code Example

```
{
  "type": {
    "coding": [
      {
        "system": "http://snomed.info/sct",
        "code": "394581000",
        "display": "Community medicine",
        "userSelected": false
      },
      {
        "system": "https://fhir.cerner.com/<EHR source id>/codeSet/14249",
        "code": "21265426",
        "display": "Same Day",
        "userSelected": true
      }
    ]
  }
}
```

Proprietary Code with the EHR source id

```
"type": {  
  "coding": [  
    {  
      "system": "https://fhir.cerner.com/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/codeSet/4",  
      "code": "36322657",  
      "display": "Federated Person Principal",  
      "userSelected": true  
    },  
    {  
      "system": "http://terminology.hl7.org/CodeSystem/v2-0203",  
      "code": "AN",  
      "display": "Account number",  
      "userSelected": false  
    }  
  ],  
  "text": "Federated Person Principal"  
},
```

Significant FHIR Resource Differences

- MedicationOrder renamed to MedicationRequest
- Dosage and Timing structure changes with new elements
- PatientInstruction field replaces the patient-friendly-display extension on MedicationRequest
- PractitionerRole now a first-class resource and removed from Practitioner
- ProcedureRequest renamed to ServiceRequest
- CareTeam now a first-class resource
- Contract renamed to Consent
- AllergyIntolerance and Condition split status into clinicalStatus and verificationStatus as CodeableConcepts with invariants
- Note field as an Annotation (author, date, and text)
- General relaxing and improved consistency across resources

Significant Cerner Resource Differences

- DiagnosticReport and DocumentReference support Radiology, Anatomic Pathology, Cardiology, and Microbiology (both read and write)
- MedicationRequest returns all medications types
- MedicationStatement will not be supported in the near term
- RelatedPerson id concatenates related person and patient id
- Provenance resource now supported
- Organization resource now supported
- Appointment request (writing appointment with a proposed status)

What's Available and What's Next?

What's Available

- First R4 deployment end of March
- Currently published:

Resource	Read	Search	Create	Patch
AllergyIntolerance	X	X		
Appointment				X
CapabilityStatement	X			
Encounter	X	X	X	X
Patient	X	X	X	X
Practitioner	X	X		

Cerner touts adoption of normative FHIR R4 standard

By Mike Miliard | April 04, 2019 | 01:53 PM



The vendor, one of the first to use the new version of the HL7 standard, is also offering advice for how providers can take advantage of the spec for better interoperability.



Three months after it was first released, the most recent version of HL7's Fast Healthcare Interoperability Resources specification has been deployed by Cerner, which is touting the normative and backward-compatible FHIR R4 as key interoperability standard for healthcare app developers seeking to interface with its technology.

What's Next?

- Continue adding capabilities to available resources
- Continue exposing more resources

In Progress

(Targeted Production release in 3-6 months)

- **Account** (Read/Search/Create/Update)
- AllergyIntolerance (Read/Search)
- Appointment (Read/Search/Create)
- Condition (Read/Search)
- **Coverage** (Read/Search/Create/Update)
- DiagnosticReport (Read/Search)
- DocumentReference (Read/Search)
- **Financial Transaction (Basic)** (Read/Search)
- Immunization (Read/Search/Create/Update)
- RelatedPerson (Read/Search/Create)
- StructureDefinition (Read)

In Design

(Targeted Production release in 9-12 months)

- AllergyIntolerance (Create/Update)
- Condition (Create/Update)
- DiagnosticReport (Create/Update)
- DocumentReference (Create/Update)
- Immunization (Create/Update)
- MedicationRequest (Read/Search/Create/Update)
- Observation (Read/Search/Create)
- **Organization** (Read/Search/Create)
- Practitioner (Create)
- Procedures (Read/Search/Create/Update)
- **Provenance** (Read/Search/Create)
- ServiceRequest (Read/Search/Create)

What's the future plans of R4 look like?

	Read	Search	Create	Patch or Update
Account	■	■	■	■
AllergyIntolerance	■	■	■	■
Appointment	■	■	■	■
Binary	■	■	■	■
CarePlan	■	■	■	■
CareTeam*	■	■	■	■
Condition	■	■	■	■
Consent*	■	■	■	■
Coverage	■	■	■	■
Device	■	■	■	■
DiagnosticReport	■	■	■	■
DocumentReference	■	■	■	■
Encounter	■	■	■	■
FinancialTransaction (Basic)	■	■	■	■
Goal	■	■	■	■

	Read	Search	Create	Patch or Update
Immunization	■	■	■	■
MedicationAdministration	■	■	■	■
MedicationRequest*	■	■	■	■
Observation	■	■	■	■
Organization	■	■	■	■
Patient	■	■	■	■
Person	■	■	■	■
Practitioner	■	■	■	■
Procedure	■	■	■	■
Provenance	■	■	■	■
RelatedPerson	■	■	■	■
Schedule	■	■	■	■
Slot	■	■	■	■
ServiceRequest*	■	■	■	■
Slot	■	■	■	■

- Growth Areas
 - Broader Create/Update Capabilities
 - Revenue Cycle APIs
 - Expansion in document concepts
- Expected regulatory target release for ONC
- Provider, System and Patient access support

■ = New for R4
 ■ = DSTU2 Replacement
 ■ = Not planned

Migration Strategy

Migration Strategy

- What to look out for?
 - Changes in resource name and functionality (new, removed, renamed fields)
 - Changes in cardinality
 - Utilize the HL7 spec diffs on resources (both R3 and R2)
 - Look for Constraints on a resource
 - Follow US Core Implementation Guide
- Ignite Release Notes announce changes on the Cerner specific implementations.
 - Plan to publish Cerner-specific migration guide

2.41.3 Resource Content

Structure	UML	XML	JSON	Turtle	R3 Diff	All
Changes since R3						
DocumentReference						
DocumentReference.type	• Min Cardinality changed from 1 to 0					
DocumentReference.category	• Added Element					
DocumentReference.date	• Added Element					
DocumentReference.agent	• Added Element					
DocumentReference.agent.type	• Added Element					
DocumentReference.agent.who	• Added Element					
DocumentReference.relatesTo	• No longer marked as Modifier					
DocumentReference.context.encounter	• Max Cardinality changed from 1 to * • Type changed from Reference(Encounter) to Reference(Encounter EpisodeOfCare)					
DocumentReference.context.related	• Type changed from BackboneElement to Reference(Resource)					
DocumentReference.class	• deleted					
DocumentReference.created	• deleted					
DocumentReference.indexed	• deleted					
DocumentReference.author	• deleted					
DocumentReference.context.related.identifier	• deleted					
DocumentReference.context.related.ref	• deleted					

See the [Full Difference](#) for further information

Migration Strategy

- Developer Portal for R4
 - Register new version of your application
 - Be mindful of new or updated scopes
- Monitor the Cerner FHIR Developers Google Group
 - Announcements of new changes
- DSTU2 vs. R4 Development
 - Defer to R4 first
 - DSTU2 is still the certified EHR technology
 - No plans to deprecate for at least 2-3 years.

Q&A

Appendix

- Ignite Developer Documentation
 - <https://fhir.cerner.com/>
- Ignite Release Notes
 - <https://wiki.cerner.com/display/OpenDevRN/Cerner+Ignite+APIs+for+Millennium>
- Ignite Reference Pages
 - <https://wiki.cerner.com/display/reference/Cerner+Ignite+APIs+Reference+Pages>
- Cerner FHIR Developers Google Group
 - <https://groups.google.com/forum/#!forum/cerner-fhir-developers>
- HL7 FHIR Spec Differences
 - DSTU2->STU3: <http://hl7.org/fhir/stu3/diff.html>
 - STU3->R4: <http://hl7.org/fhir/r4/diff.html>
- US Core R4 Guide
 - <https://build.fhir.org/ig/HL7/US-Core-R4/>