

[bit.ly/smart-fhir-tech](http://bit.ly/smart-fhir-tech)



SMART

App Platform for Health care

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HL7 FHIR DevDays



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# KLAS Connected Apps Report

<http://SmartHealthIT.org/apps-report>



## CONNECTED APPS IN HEALTHCARE 2017

A Look at Trends and Provider Attitudes in a Growing Market

 KLAS DECEMBER 2016

*“... we had this wonderful population health tool, but we couldn’t get the [EHR] system to interface with it, so we had to enter information by hand. We just had to give up on that because we couldn’t physically keep up.”*

- Physician, KLAS Interview

# SMART Core Focus

## Healthcare Apps



**Clinical Systems**  
(EHRs, Patient Portals, Data Warehouses)

SMART:  
UX Integration  
Authorization  
Single Sign-On  
Clinical Data





# Why SMART?

- Users:
  - App choice (substitutability)
- Developers:
  - Low barriers to entry (open standards, large community)
  - Single app can run in systems by different vendors
  - Single app can run in different contexts (e.g. EHR and Patient Portal)

# Modern EHRs become a platform!

- User and Patient Management
- Workflow and core services
- Data persistence
- Regulatory compliance
- Apps

# What is FHIR ?

**API and Data models** representing discrete clinical and administrative units (patient, practitioner, allergy, medication order, etc.)

- ~ 100 have been defined
- Narrative text for “lowest common denominator data exchange”
- Developer readable data format (JSON or XML)
- Can reference other resources by their URL
- Don’t include the kitchen sink

“We only include data elements if we are confident that most normal implementations using that resource will make use of the element”

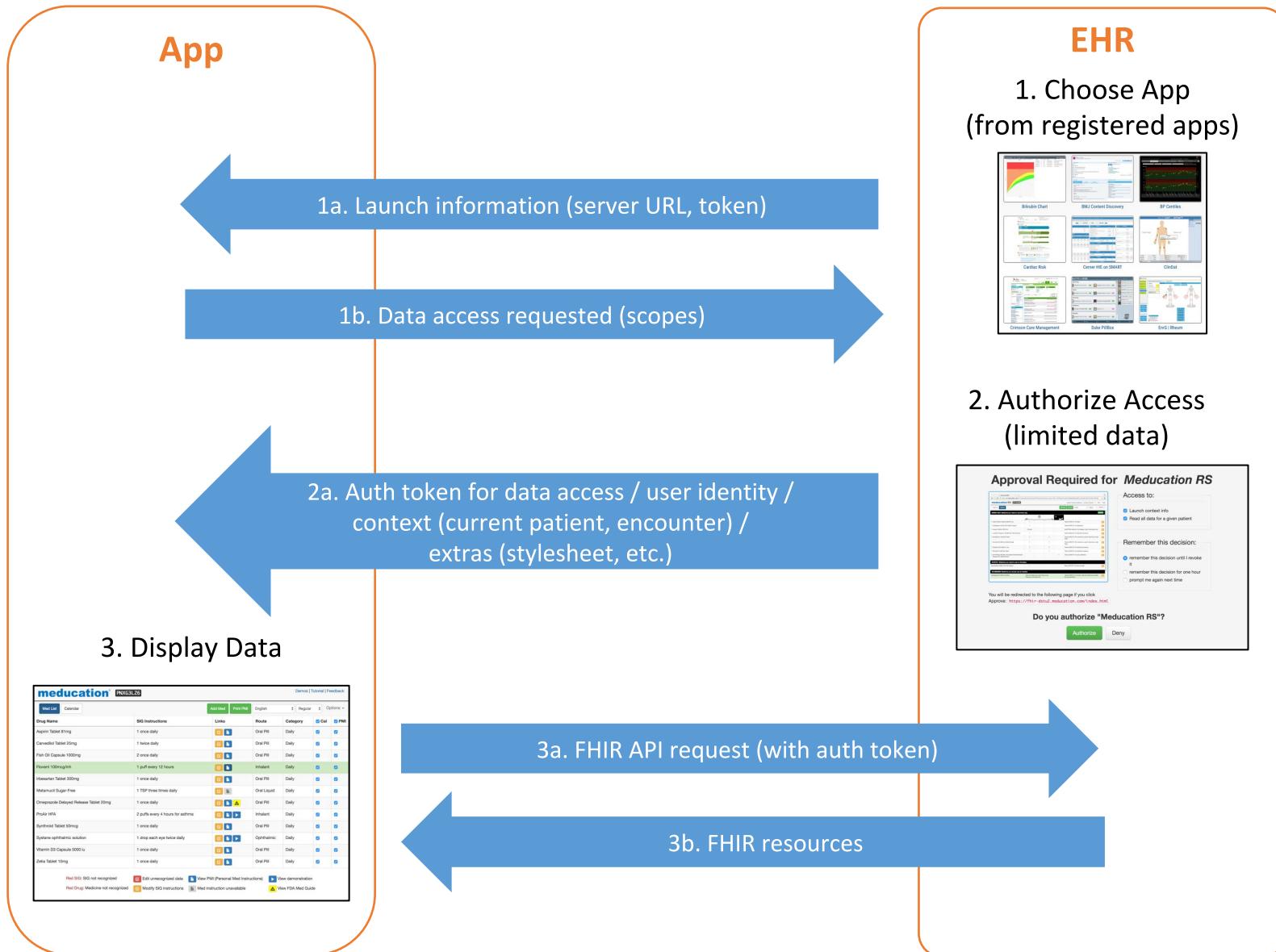
- Grahame Grieve (FHIR Product Director)

- But, support extensions for faucets, etc.

# Patient Resource Example

```
1 ▾ {  
2   "resourceType": "Patient",  
3   "active": true,  
4   ▾ "name": [  
5     "use": "official",  
6     "family": ["Coleman"],  
7     "given": ["Lisa", "P."]  
8   ],  
9   "gender": "female",  
10  "birthDate": "1948-04-14"  
11  ...  
12 }
```

# OAuth Based EHR App Launch



# SMART Authorization Scopes

- Scopes convey what access an app needs



- Examples:

- Simple app: **patient/Patient.read, patient/Observation.read**
- Complex app: **patient/\*.read**
- ePrescribing app: **patient/MedicationOrder.write**
- Population health app: **user/\*.read**

# Adoption: Argonaut Project

Group of EHR vendors and hospitals driving support for SMART and FHIR in USA

- Argonaut Implementation Guides
  - Security and Authorization (SMART)
  - Data element query of the ONC Common Clinical Data Set
  - Document query of static documents
  - US Provider Directory
  - Implementation guide for scheduling clinical services
  - Implementation guide for CDS Hooks
- 2018 Projects
  - Clinical notes
  - Bulk Data & Backend Services
  - Questionnaires

# Adoption: Healthcare Organizations



“On October 9, 2015 I successfully logged into our production system for the first time to view *real patient data* in a FHIR app! I'd love to share screenshots with you, but they contain *real patient data*, so I can't! Let me say that again: *real patient data*, via FHIR, within Maestro Care, our Epic-based EHR.”

Ricky Bloomfield Jr, MD  
Director of Mobile Technology Strategy  
<http://www.rickybloomfield.com/2015/10/dukes-on-fhir-for-real-this-time.html>

# Public App Gallery

- SMART App Gallery offer a single place to find and learn about SMART and FHIR apps
- Vendor and license neutral
  - Not restricted to a single EHR platform
  - Hosts commercial and open source apps
- No cost to list or browse apps

<https://apps.smarthealthit.org>

 SMART® App Gallery

Add New Listing Your Listings Search  Login

Sort: Name (A-Z) ▾

## Featured Apps

**Featured Apps**

- All Apps
- Care Coordination
- Clinical Research
- Data Visualization
- Disease Management
- Genomics
- Medication
- Patient Engagement**
- Population Health
- Risk Calculation
- FHIR Tools

**ACT.md**  
ACT.md  
ACT.md extends EMR's across the community, removing the silos that prevent you from addressing social determinants of health.

**Support:** Web, Android, iOS **Specialties:** Pediatrics  
**Designed for:** Clinicians & Patients

**Adherence - Surescripts Medical**  
Surescripts, LLC  
Improves patient medication management by generating messages, and streamlined physician generated messages, and streamlined physician

**Support:** Web **Designed for:** Clinicians & Patients

**Aggregated Patient Data**  
1upHealth  
Helps providers view patient data aggregated from multiple sources and connect their medical data sources using FHIR.

**Support:** Web **Specialties:** Trauma **Design:** Web

**ASCVD Risk Calculator**  
Cerner Corporation

**BP Centiles v1 (Open Source)**  
Boston Children's Hospital

[Website](#)

Interpreting blood pressure measurements for children is complicated by the need to account for a constantly changing body size. It is time-consuming to calculate and/or do any entry, yet assessment of blood pressure percentiles is medically recommended from the age of 3 onward because 75% of cases of pediatric hypertension and 90% of cases of prehypertension in children from 3 to 18 years of age go undetected.

The BP Centiles app reads a child's relevant vitals and calculates systolic and diastolic blood pressure percentiles normalized by age, sex, and height. The app also includes a pop-up calculator and a graphical history of the child's blood pressure percentile, enabling full screening at each visit.

Color coding reveals at a glance whether individual readings are normal (green), prehypertensive (yellow), hypertensive (red) or hypotensive (blue). Users can zoom in on a group of readings for more information and apply various filters to help them interpret the measurements—such as looking only at BPs measured in the legs, sitting down or by machine.

BP Centiles was developed in collaboration with Interopion.

**Designed for**  
Clinicians

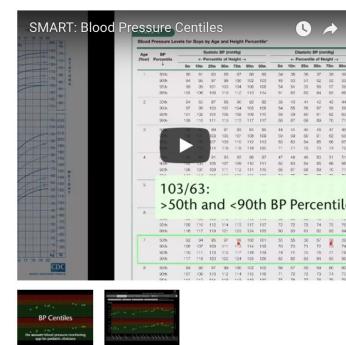
**Categories**  
Data Visualization, Risk

**FHIR Compatibility**  
DSTU 2

**Specialties**  
Cardiology, Pediatrics

**Licensing & Pricing**  
Open Source, Free

Open source code at: <https://github.com/smart-on-fhir/bp-centiles-app>



# FHIR for Populations

Proposed “bulk data” extension to FHIR to support efficient access to data on large groups of individuals

- Use cases include: assess the value of the care provided, conduct population analyses, identify at-risk populations, and track progress on quality improvement
- Queries return data on all patients that the client’s account has access to or all patients in a nominated group, since the starting date time provided
- Can restrict to only records to specific FHIR data models (resource types)

# In-workflow decision support

<http://cds-hooks.org>

Goal: tighter integration of third-party decision services in EHR

- Approach: Enhance workflow with cards displayed inline
- Collaborators: EHR vendors, CDS Vendors, HL7 Clinical Decision Support Workgroup,
- Timeline: 1.0 publication in early 2019

# Sync for Science <http://syncfor.science>

Goal: helping patients share EHR data with researchers

- Approach: SMART, FHIR, Argonaut, and MU3 API certification requirements
- Collaborators: Government (NIH, ONC, OSTP), EHR vendors (Allscripts, Cerner, eClinicalWorks, Epic, and others)
- Timeline: Piloting with ~10 provider sites and testing with real patients
- All of Us Research Program is one early S4S "customer" (research study). There will be lots more, if we're successful.

# Open Source Tools

[dev.smarthealthit.org](http://dev.smarthealthit.org)

# SMART Sandbox Demo

**launch.smarthealthit.org**

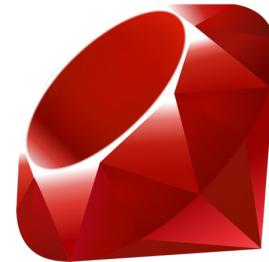
**Glucose sample app:**

Code: <https://glitch.com/edit/#!/exciting-firefly>

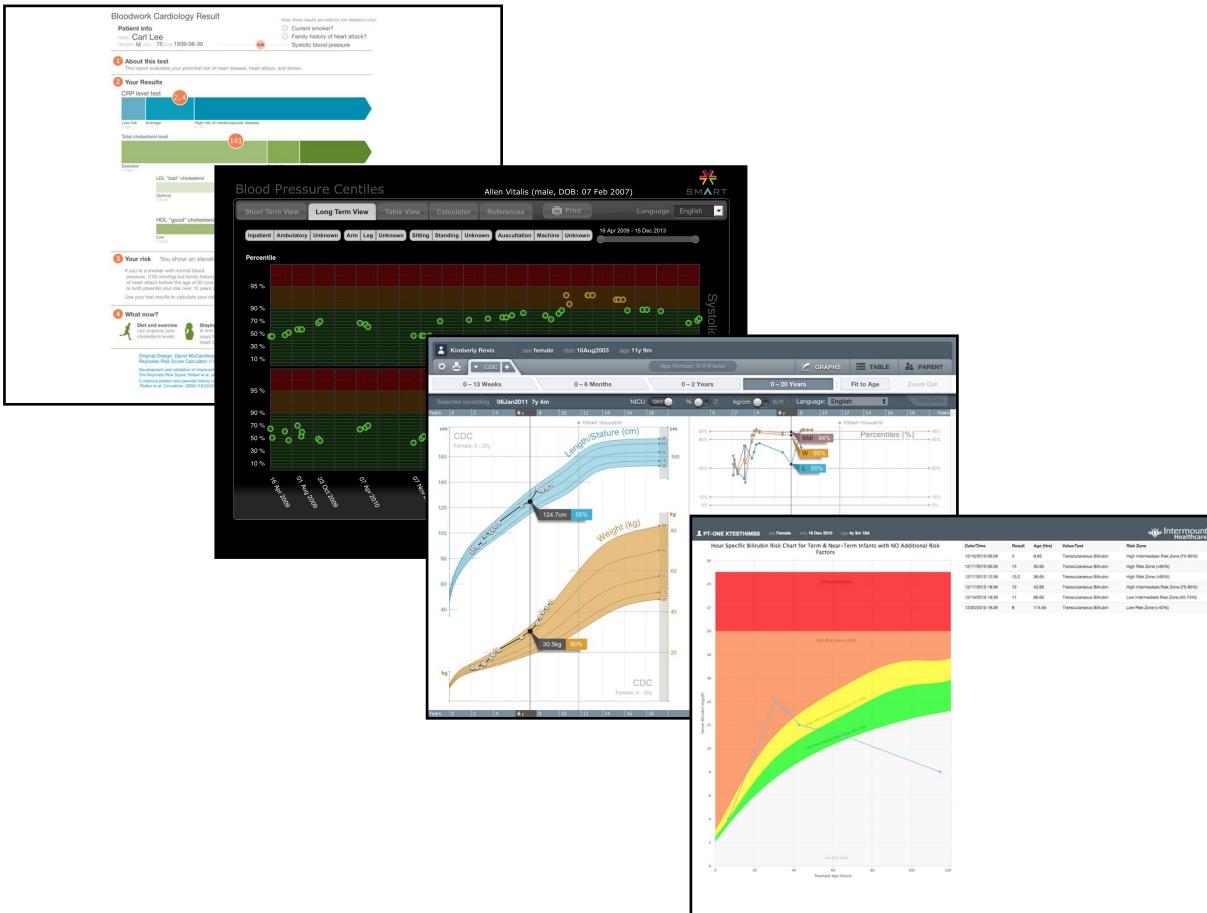
EHR launch: <https://exciting-firefly.glitch.me/ehr.html>

Standalone launch: <https://exciting-firefly.glitch.me/standalone.html>

# Software Libraries for Developers



# Open Source Sample Apps



# Public Sandboxes for Testing



# SMART Sandbox

- De-identified longitudinal medical records
- Over 1,500 synthetically generated patients comprising 150,000 FHIR resources
- PRO data based on NHS pre and post surgery surveys

<http://docs.smarthealthit.org/data>

**Demographics** **Conditions** **Tags** **Advanced**

Type to search for condition codes ...

Sort: ID Name Gender DOB

<input type="checkbox"/>  <b>William M Robinson</b> 52 year old male DOB: 1965-08-09 ID: smart-967332 MRN: smart-967332
<input type="checkbox"/>  <b>Joseph P Shaw</b> 14 year old male DOB: 2003-12-14 ID: smart-2080416 MRN: smart-2080416
<input type="checkbox"/>  <b>George M</b> 67 year old m DOB: 1950-01-01
<input type="checkbox"/>  <b>Kevin V K</b> 23 year old m DOB: 1994-01-01
<input type="checkbox"/>  <b>Carol T Y</b> 86 year old fe DOB: 1932-01-01
<input type="checkbox"/>  <b>Christopher</b> 85 year old m DOB: 1932-01-01
<input type="checkbox"/>  <b>Kimberly</b> 49 year old fe DOB: 1968-01-01

**Ms. Karmen Abernathy**

Gender: female DOB: 1995-10-29  
Age: 22 year Email: Unknown  
Phone: 1-928-426-5024 Address: 6885 Maia Extensions,Suite 321 01876 Tewksbury US  
ID: d1045b4b-f5ee-4703-b26e-11094d1a1d6f MRN: 7af8c3a7-02fd-4692-ba10-9f4a08f48aff

<b>CarePlan</b> 2		
<b>Condition</b> 3		
<b>Encounter</b> 13		
<b>Immunization</b> 30		
<b>Medication</b> 3		
<b>MedicationRequest</b> 4		
<b>Observation - Laboratory</b> 3		
<b>Observations</b>		
<input type="checkbox"/> Group by Name <input type="checkbox"/>		
Name	Value	Date
Blood Pressure	Systolic: 155 mmHg, Diastolic: 106 mmHg	04/26/2016
Body Mass Index	22.78 kg/m <sup>2</sup>	04/26/2016
Body Weight	55.64 kg	04/26/2016
Body Height	156.3 cm	04/26/2016
Body Mass Index	21.91 kg/m <sup>2</sup>	03/14/2015
Blood Pressure	Systolic: 172 mmHg, Diastolic: 116 mmHg	03/14/2015
Body Weight	53.5 kg	03/14/2015
Body Height	156.26 cm	03/14/2015
Body Weight	52.49 kg	02/16/2014
Body Mass Index	21.53 kg/m <sup>2</sup>	02/16/2014

0 patients selected

**Observation - Vital Signs** 37

<b>Organization</b> 1
<b>Patient</b> 1
<b>Procedure</b> 4

 SMART App Launcher Save ▾

**App Launch Options**

**Launch Type**

- Provider EHR Launch** (practitioner opens the app from within an EHR)
  - Simulate launch within the EHR user interface
- Provider Standalone Launch** (practitioner opens the app directly and connects to FHIR)
- Patient Standalone Launch** (patient opens the app directly and connects to FHIR)
- Backend Service** (app connects to FHIR without user login)
- CDS Hooks Service** (test your CDS services)

**FHIR Version**

R2 (DSTU2) ▼

Open FHIR Server Endpoint: <https://launch.smarthealthit.org/v/r2/fhir> Test

**Patient(s)** launch or launch/patient scope

Patient ID ▼

Simulates the active patient in EHR when app is launched. If no Patient ID is entered or if multiple comma delimited IDs are specified, a patient picker will be displayed as part of the launch flow.

**Provider(s)** openid and profile scopes

Provider ID ▼

Simulates user who is launching the app. If no provider is selected, or if multiple comma delimited Practitioner IDs are specified, a login screen will be displayed as part of the launch flow.

**Advanced**

**Active Encounter in EHR** launch or launch/encounter scope

- Show encounter selector
- Use the patient's most recent encounter if available

**Simulate Authentication Error for Testing**

None ▼

**Launch** Test With Sample App ↗

**client\_id** The app's `client_id` is not validated on the SMART test server, so any text string will work. Use the error dropdown above to simulate the server response to an invalid `client_id`.

**client\_secret** The app's `client_secret` is not validated on the SMART test server, so any secret will work. If provided, the `Authorization` header must conform to the standard format (Example). Use the error dropdown above to simulate the server response to an invalid `client_secret`.

**App Launch URL (required)**

Launch URL Launch App!

Full url of the page in your app that will initialize the SMART session (often the path for a launch.html file)

# Cerner SMART Tutorial

Code: <https://glitch.com/edit/#!/potent-spy>

Write-up: <http://engineering.cerner.com/smart-on-fhir-tutorial>

Standalone launch: <https://potent-spy.glitch.me/launch-patient.html>