

Building a Smart Container for VistA Lessons Learned

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Contents

1. Introduction	p. 3
2. Approach	p. 4
3. Demographics	p. 16
4. Problems	p. 18
5. Medications	p. 22
6. Lab Results	p. 26

1. Introduction

During the period of March to May, 2012 a prototype Smart Container for VistA was developed by the team of George Lilly, CIO of WorldVistA and Rob Tweed, the creator of EWD, and Joseph Del Molin of eColony who provided project coordination. The work was done in collaboration with the Harvard Smart Project with funding from the ONC via the Harvard Smart project.

The project objective was to demonstrate that a Smart Container for VistA was feasible and to gauge the level of effort to create one. Also, to provide a public demonstration of the VistA Smart Container and publicly available source code and servers that would allow developers to create Smart Applications using VistA.

The VistA Smart Container was demonstrated at the June 5, 2012 VistA Community Meeting at George Mason University. Since then, it has been demonstrated at several other forums, including NHS Hack day in England and at the Seattle VistA Expo in September. Further demonstrations are planned.

The software has been released publicly under a GPL version 2 or greater license and can be found on the WorldVistA trac server at this address:

<https://trac.opensourcevista.net/browser/smart>

The VistA Smart Container has also been included fully configured in the latest dEWDrop 3 virtual machine, which allows developers to use it right away without the effort of installation and configuration. The dEWDrop virtual machine can be downloaded free of charge from the Fourth Watch Software website at this address:

<http://www.fourthwatchsoftware.com/>

The prototype implements the following Smart clinical domains:

- Demographics
- Problems
- Medications
- Lab Results

This paper is in partial fulfillment of the Smart/ONC contract and relates the experiences we had in trying to map the VistA data elements to the Smart data model.

2. Approach

The server side of the Smart Container is written in Mumps. The front end of the Smart Container is written in javascript and Mumps using EWD. Why Mumps? It is a very efficient and productive language for doing this kind of mapping work and most importantly, it is the native language of VistA. When the Mumps routines are put together into a package, they can be easily added to any VistA system without the addition of any other subsystem for data transformation. In addition, the Smart Container was implemented as a standard VistA RPC, allowing it to be easily accessed by any external system using a standard VistA interface.

Several months before the start of the project, the first version of the Fileman Triple Store was released. It provides the ability to represent triples in Fileman and to import triples as RDF, Json, and Mumps arrays. We used the triple store for the Smart Container. The Smart Container generates triples, stores them into the triples store, and then renders the Smart RDF from the stored triples. The Fileman Triple Store can be found here: <https://trac.opensourcevista.net/browser/fmts> It is also discussed in its own google group here: <https://groups.google.com/forum/?fromgroups#!forum/fileman-triple-store>

The clinical values used in the Smart Container are obtained from the xml output of the VistA NHIN package. Below is a sample output. The Smart Container makes an internal Mumps RPC call to obtain the xml and parses it and turns it into a more easy to use Mumps array.

```
<results total='13' >
<patient>
<address streetLine1='635 Big Sky Ln' city='BIXBY'
stateProvince='OKLAHOMA' postalCode='74008' />
<bid value='A1117' />
<dob value='2531016' />
<exposures>
<exposure value='AO' />
</exposures>
<facilities>
<facility code='050' name='VOE OFFICE INSTITUTION' />
</facilities>
<familyName value='ALLEN' />
<fullName value='ALLEN, JASON RYAN' />
<gender value='M' />
<givenNames value='JASON RYAN' />
<id value='6' />
<lrdfn value='49' />
<maritalStatus value='N' />
<religion value='6' />
<sc value='0' />
<ssn value='111111117' />
<supports>
<support contactType='ECON' name='ROOT, JOANNE' relationship='MOTHER' >
<address streetLine1='635 Big Sky Ln' city='BIXBY'
```

```

stateProvince='OKLAHOMA' postalCode='74008' />
<telecomList>
<telecom usageType='H' value='333-333-3334' />
</telecomList>
</support>
<support contactType='NOK' name='ROOT,JOANNE' relationship='MOTHER' >
<address streetLine1='635 Big Sky Ln' city='BIXBY'
stateProvince='OKLAHOMA' postalCode='74008' />
<telecomList>
<telecom usageType='H' value='333-333-3334' />
</telecomList>
</support>
</supports>
<telecomList>
<telecom usageType='H' value='333-333-3334' />
</telecomList>
<veteran value='0' />
</patient>
<allergy>
<adverseEventType value='D' />
<comments>
<comment id='1' entered='3110622.163636' enteredBy='KING,MATTHEW MICHAEL'
commentType='O' commentText='active ' />
</comments>
<drugIngredients>
<drugIngredient name='CEPHALEXIN' void='4018891' />
</drugIngredients>
<entered value='3110622.1636' />
<facility code='050' name='VOE OFFICE INSTITUTION' />
<id value='51' />
<localCode value='1495;PS(50.416,' />
<mechanism value='ALLERGY' />
<name value='CEPHALEXIN' />
<reactions>
<reaction name='HIVES' />
</reactions>
<severity value='SEVERE' />
<source value='0' />
<void value='4018891' />
</allergy>
<problem>
<entered value='3110504' />
<facility code='100' name='VOE OFFICE INSTITUTION OLD' />
<icd value='486.' />
<id value='44' />
<location value='ZZ*DR OFFICE' />
<name value='Pneumonia' />
<provider code='76' name='VAN NESS,NANCY' />
<removed value='0' />
<sc value='0' />
<status value='A' />
<unverified value='0' />

```

```

<updated value='3110504' />
</problem>
<problem>
<entered value='3110504' />
<facility code='100' name='VOE OFFICE INSTITUTION OLD' />
<icd value='496.' />
<id value='45' />
<location value='ZZ*DR OFFICE' />
<name value='Chronic Obstructive Pulmonary Disease' />
<provider code='76' name='VAN NESS,NANCY' />
<removed value='0' />
<sc value='0' />
<status value='A' />
<unverified value='0' />
<updated value='3110504' />
</problem>
<lab>
<collected value='3120425.231037' />
<comment xml:space='preserve'>GPLTEST SMART Report Released Date/Time: Apr
25, 2012@23:11</comment>
<facility code='100' name='VOE OFFICE INSTITUTION OLD' />
<groupName value='CH 0425 5' />
<id value='CH;6879573.768963;67008' />
<labOrderID value='118' />
<localName value='HDLCHLS' />
<loinc value='2085-9' />
<orderID value='855' />
<result value='45' />
<resulted value='3120425.231116' />
<sample value='SERUM' />
<specimen code='0X500' name='SERUM' />
<status value='completed' />
<test value='HDL CHOLESTEROL' />
<type value='CH' />
<void value='4662693' />
</lab>
<lab>
<collected value='3120425.230609' />
<comment xml:space='preserve'>~For Test: CHOLESTEROL ~GPLTEST SMART Report
Released Date/Time: Apr 25, 2012@23:07</comment>
<facility code='100' name='VOE OFFICE INSTITUTION OLD' />
<groupName value='CH 0425 3' />
<high value=' 200' />
<id value='CH;6879573.769391;12' />
<labOrderID value='103' />
<localName value='CHOL' />
<loinc value='2093-3' />
<low value='120 ' />
<orderID value='852' />
<result value='163' />
<resulted value='3120425.230719' />
<sample value='SERUM' />

```

```

<specimen code='0X500' name='SERUM' />
<status value='completed' />
<test value='CHOLESTEROL' />
<type value='CH' />
<units value='mg/dL' />
<vuid value='4662777' />
</lab>
<lab>
<collected value='3120425.223729' />
<comment xml:space='preserve'>~For Test: HIGH-SENSIVITY C-REACTIVE PROTEIN
~GPLTEST SMART Report Released Date/Time: Apr 25, 2012@22:42</comment>
<facility code='100' name='VOE OFFICE INSTITUTION OLD' />
<groupName value='CH 0425 1' />
<high value=' 3' />
<id value='CH;6879573.776271;1006' />
<labOrderID value='94' />
<localName value='HS-CRP' />
<loinc value='30522-7' />
<low value='0 ' />
<orderID value='850' />
<result value='2.9' />
<resulted value='3120425.224231' />
<sample value='SERUM' />
<specimen code='0X500' name='SERUM' />
<status value='completed' />
<test value='HIGH-SENSIVITY C-REACTIVE PROTEIN' />
<type value='CH' />
<units value='mg/L' />
<vuid value='4673029' />
</lab>
<med>
<doses>
<dose dose='0' units=' mg Tab| 1 Add&apos;l Sig' route='Oral'
schedule='Select Frequency' />
</doses>
<facility code='050' name='VOE OFFICE INSTITUTION' />
<form value='TAB' />
<id value='1N;0' />
<name value='ATORVASTATIN TAB' />
<ordered value='3110429.123852' />
<orderingProvider code='77' name='LILLY,GEORGE' />
<products>
<product code='94208' name='ATORVASTATIN 10MG' role='D' >
<class code='ANTILIPEMIC AGENTS' />
<vaGeneric code='3382' name='ATORVASTATIN' vuid='4024041' />
<vaProduct code='12595' name='ATORVASTATIN CA 10MG TAB' vuid='4012960' />
</product>
</products>
<sig xml:space='preserve'>Lipitor 10 mg Tab| 1 Add&apos;l Sig BY Oral
Select Frequency</sig>
<start value='3110429.1145' />
<status value='active' />

```

```

<stop value='3110504.13373' />
<type value='OTC' />
<vaType value='N' />
</med>
<med>
<doses>
<dose dose='0' units=' mg Tab| 1 tablet' route='by mouth' schedule='as
directed' />
</doses>
<facility code='050' name='VOE OFFICE INSTITUTION' />
<form value='CAP,EC' />
<id value='2N;O' />
<name value='FREE TXT DRUG CAP,EC' />
<ordered value='3110504.18382' />
<orderingProvider code='76' name='VAN NESS,NANCY' />
<sig xml:space='preserve'>Azithromycin 250 mg Tab| 1 tablet BY by mouth
as directed</sig>
<start value='3110504.1733' />
<status value='active' />
<type value='OTC' />
<vaType value='N' />
</med>
<med>
<doses>
<dose dose='0' units='.' route='inhale' schedule='as directed' />
</doses>
<facility code='050' name='VOE OFFICE INSTITUTION' />
<form value='CAP,EC' />
<id value='3N;O' />
<name value='FREE TXT DRUG CAP,EC' />
<ordered value='3110504.18501' />
<orderingProvider code='76' name='VAN NESS,NANCY' />
<sig xml:space='preserve'>Albuterol Sulfate 2.5 mg/3 mL (0.083 %) Neb
Solution| 1 mL BY inhale as directed</sig>
<start value='3110504.1755' />
<status value='active' />
<type value='OTC' />
<vaType value='N' />
</med>
<med>
<doses>
<dose dose='0' route='inhale' schedule='as directed' />
</doses>
<facility code='050' name='VOE OFFICE INSTITUTION' />
<form value='CAP,EC' />
<id value='4N;O' />
<name value='FREE TXT DRUG CAP,EC' />
<ordered value='3110504.190648' />
<orderingProvider code='76' name='VAN NESS,NANCY' />
<sig xml:space='preserve'>Atrovent HFA 17 mcg/Actuation Aerosol Inhaler| 1
puff BY inhale as directed</sig>
<start value='3110504.1811' />

```



```

<status value='active' />
<type value='OTC' />
<vaType value='N' />
</med>
<med>
<doses>
<dose dose='0' route='by mouth' schedule='DAILY' />
</doses>
<facility code='050' name='VOE OFFICE INSTITUTION' />
<form value='TAB' />
<id value='5N;0' />
<name value='WARFARIN 3MG TAB' />
<ordered value='3110622.165848' />
<orderingProvider code='63' name='KING,MATTHEW MICHAEL' />
<products>
<product code='94514' name='WARFARIN 3MG' role='D' >
<class code='ANTICOAGULANTS' />
<vaGeneric code='865' name='WARFARIN' void='4019972' />
<vaProduct code='4659' name='WARFARIN NA 3MG TAB' void='4005206' />
</product>
</products>
<sig xml:space='preserve'>Warfarin 3 mg Tab| 1 tablet BY by mouth
DAILY</sig>
<start value='3110622.160507' />
<status value='active' />
<type value='OTC' />
<vaType value='N' />
</med>
<med>
<doses>
<dose dose='0' route='by mouth' schedule='DAILY' />
</doses>
<facility code='050' name='VOE OFFICE INSTITUTION' />
<form value='TAB' />
<id value='6N;0' />
<name value='WARFARIN 3MG TAB' />
<ordered value='3110622.165848' />
<orderingProvider code='63' name='KING,MATTHEW MICHAEL' />
<products>
<product code='94514' name='WARFARIN 3MG' role='D' >
<class code='ANTICOAGULANTS' />
<vaGeneric code='865' name='WARFARIN' void='4019972' />
<vaProduct code='4659' name='WARFARIN NA 3MG TAB' void='4005206' />
</product>
</products>
<sig xml:space='preserve'>Warfarin 3 mg Tab| 1 tablet BY by mouth
DAILY</sig>
<start value='3110622.160548' />
<status value='active' />
<stop value='3110622.170517' />
<type value='OTC' />
<vaType value='N' />

```

```
</med>
</results>
```

This xml is transformed to a more usable Mumps array. The array indexes are derived from the xml tags:

```
G("allergy",1,"adverseEventType@value")="D"
G("allergy",1,"comments.comment@commentText")="active "
G("allergy",1,"comments.comment@commentType")="O"
G("allergy",1,"comments.comment@entered")=3110622.163636
G("allergy",1,"comments.comment@enteredBy")="KING,MATTHEW MICHAEL"
G("allergy",1,"comments.comment@id")=1
G("allergy",1,"drugIngredients.drugIngredient@name")="CEPHALEXIN"
G("allergy",1,"drugIngredients.drugIngredient@vuid")=4018891
G("allergy",1,"entered@value")=3110622.1636
G("allergy",1,"facility@code")="050"
G("allergy",1,"facility@name")="VOE OFFICE INSTITUTION"
G("allergy",1,"id@value")=51
G("allergy",1,"localCode@value")="1495;PS(50.416,"
G("allergy",1,"mechanism@value")="ALLERGY"
G("allergy",1,"name@value")="CEPHALEXIN"
G("allergy",1,"reactions.reaction@name")="HIVES"
G("allergy",1,"severity@value")="SEVERE"
G("allergy",1,"source@value")="O"
G("allergy",1,"vuid@value")=4018891
G("lab",1,"collected@value")=3120425.231037
G("lab",1,"comment")="GPLTEST SMART Report Released Date/Time: Apr 25,
2012@23:11"
G("lab",1,"comment@xml:space")="preserve"
G("lab",1,"facility@code")=100
G("lab",1,"facility@name")="VOE OFFICE INSTITUTION OLD"
G("lab",1,"groupName@value")="CH 0425 5"
G("lab",1,"id@value")="CH;6879573.768963;67008"
G("lab",1,"labOrderID@value")=118
G("lab",1,"localName@value")="HDLCHLS"
G("lab",1,"loinc@value")="2085-9"
G("lab",1,"orderID@value")=855
G("lab",1,"result@value")=45
G("lab",1,"resulted@value")=3120425.231116
G("lab",1,"sample@value")="SERUM"
G("lab",1,"specimen@code")="0X500"
G("lab",1,"specimen@name")="SERUM"
G("lab",1,"status@value")="completed"
G("lab",1,"test@value")="HDL CHOLESTEROL"
G("lab",1,"type@value")="CH"
G("lab",1,"vuid@value")=4662693
G("lab",2,"collected@value")=3120425.230609
G("lab",2,"comment")="~For Test: CHOLESTEROL ~GPLTEST SMART Report Released
Date/Time: Apr 25, 2012@23:07"
G("lab",2,"comment@xml:space")="preserve"
G("lab",2,"facility@code")=100
```

```

G("lab",2,"facility@name")="VOE OFFICE INSTITUTION OLD"
G("lab",2,"groupName@value")="CH 0425 3"
G("lab",2,"high@value")=" 200"
G("lab",2,"id@value")="CH;6879573.769391;12"
G("lab",2,"labOrderID@value")=103
G("lab",2,"localName@value")="CHOL"
G("lab",2,"loinc@value")="2093-3"
G("lab",2,"low@value")="120 "
G("lab",2,"orderID@value")=852
G("lab",2,"result@value")=163
G("lab",2,"resulted@value")=3120425.230719
G("lab",2,"sample@value")="SERUM"
G("lab",2,"specimen@code")="0X500"
G("lab",2,"specimen@code")="0X500"
G("lab",2,"status@value")="completed"
G("lab",2,"test@value")="CHOLESTEROL"
G("lab",2,"type@value")="CH"
G("lab",2,"units@value")="mg/dL"
G("lab",2,"vuid@value")=4662777
G("lab",3,"collected@value")=3120425.223729
G("lab",3,"comment")="~For Test: HIGH-SENSIVITY C-REACTIVE PROTEIN ~GPLTEST
SMART Report Released Date/Time: Apr 25, 2012@22:42"
G("lab",3,"comment+xml:space")="preserve"
G("lab",3,"facility@code")=100
G("lab",3,"facility@name")="VOE OFFICE INSTITUTION OLD"
G("lab",3,"groupName@value")="CH 0425 1"
G("lab",3,"high@value")=" 3"
G("lab",3,"id@value")="CH;6879573.776271;1006"
G("lab",3,"labOrderID@value")=94
G("lab",3,"localName@value")="HS-CRP"
G("lab",3,"loinc@value")="30522-7"
G("lab",3,"low@value")="0 "
G("lab",3,"orderID@value")=850
G("lab",3,"result@value")=2.9
G("lab",3,"resulted@value")=3120425.224231
G("lab",3,"sample@value")="SERUM"
G("lab",3,"specimen@code")="0X500"
G("lab",3,"specimen@name")="SERUM"
G("lab",3,"status@value")="completed"
G("lab",3,"test@value")="HIGH-SENSIVITY C-REACTIVE PROTEIN"
G("lab",3,"type@value")="CH"
G("lab",3,"units@value")="mg/L"
G("lab",3,"vuid@value")=4673029
G("med",1,"doses.dose@dose")=0
G("med",1,"doses.dose@route")="Oral"
G("med",1,"doses.dose@schedule")="Select Frequency"
G("med",1,"doses.dose@units")=" mg Tab| 1 Add'l Sig"
G("med",1,"facility@code")="050"
G("med",1,"facility@name")="VOE OFFICE INSTITUTION"
G("med",1,"form@value")="TAB"
G("med",1,"id@value")="1N;O"
G("med",1,"name@value")="ATORVASTATIN TAB"

```

G("med",1,"ordered@value")=3110429.123852
G("med",1,"orderingProvider@code")=77
G("med",1,"orderingProvider@name")="LILLY,GEORGE"
G("med",1,"products.product.class@code")="ANTILIPEMIC AGENTS"
G("med",1,"products.product.vaGeneric@code")=3382
G("med",1,"products.product.vaGeneric@name")="ATORVASTATIN"
G("med",1,"products.product.vaGeneric@vuid")=4024041
G("med",1,"products.product.vaProduct@code")=12595
G("med",1,"products.product.vaProduct@name")="ATORVASTATIN CA 10MG TAB"
G("med",1,"products.product.vaProduct@vuid")=4012960
G("med",1,"products.product@code")=94208
G("med",1,"products.product@name")="ATORVASTATIN 10MG"
G("med",1,"products.product@role")="D"
G("med",1,"sig")="Lipitor 10 mg Tab| 1 Add'l Sig BY Oral Select Frequency"
G("med",1,"sig+xml:space")="preserve"
G("med",1,"start@value")=3110429.1145
G("med",1,"status@value")="active"
G("med",1,"stop@value")=3110504.13373
G("med",1,"type@value")="OTC"
G("med",1,"vaType@value")="N"
G("med",2,"doses.dose@dose")=0
G("med",2,"doses.dose@route")="by mouth"
G("med",2,"doses.dose@schedule")="as directed"
G("med",2,"doses.dose@units")=" mg Tab| 1 tablet"
G("med",2,"facility@code")="050"
G("med",2,"facility@name")="VOE OFFICE INSTITUTION"
G("med",2,"form@value")="CAP,EC"
G("med",2,"id@value")="2N;O"
G("med",2,"name@value")="FREE TXT DRUG CAP,EC"
G("med",2,"ordered@value")=3110504.18382
G("med",2,"orderingProvider@code")=76
G("med",2,"orderingProvider@name")="VAN NESS,NANCY"
G("med",2,"sig")="Azithromycin 250 mg Tab| 1 tablet BY mouth as directed"
G("med",2,"sig+xml:space")="preserve"
G("med",2,"start@value")=3110504.1733
G("med",2,"status@value")="active"
G("med",2,"type@value")="OTC"
G("med",2,"vaType@value")="N"
G("med",3,"doses.dose@dose")=0
G("med",3,"doses.dose@route")="inhale"
G("med",3,"doses.dose@schedule")="as directed"
G("med",3,"doses.dose@units")="."
G("med",3,"facility@code")="050"
G("med",3,"facility@name")="VOE OFFICE INSTITUTION"
G("med",3,"form@value")="CAP,EC"
G("med",3,"id@value")="3N;O"
G("med",3,"name@value")="FREE TXT DRUG CAP,EC"
G("med",3,"ordered@value")=3110504.18501
G("med",3,"orderingProvider@code")=76
G("med",3,"orderingProvider@name")="VAN NESS,NANCY"
G("med",3,"sig")="Albuterol Sulfate 2.5 mg/3 mL (0.083 %) Neb Solution| 1 mL BY inhale as directed"

```

G("med",3,"sig@xml:space")="preserve"
G("med",3,"start@value")=3110504.1755
G("med",3,"status@value")="active"
G("med",3,"type@value")="OTC"
G("med",3,"vaType@value")="N"
G("med",4,"doses.dose@dose")=0
G("med",4,"doses.dose@route")="inhale"
G("med",4,"doses.dose@schedule")="as directed"
G("med",4,"facility@code")="050"
G("med",4,"facility@name")="VOE OFFICE INSTITUTION"
G("med",4,"form@value")="CAP,EC"
G("med",4,"id@value")="4N;O"
G("med",4,"name@value")="FREE TXT DRUG CAP,EC"
G("med",4,"ordered@value")=3110504.190648
G("med",4,"orderingProvider@code")=76
G("med",4,"orderingProvider@name")="VAN NESS,NANCY"
G("med",4,"sig")="Atrovent HFA 17 mcg/Actuation Aerosol Inhaler| 1 puff BY
inhale as directed"
G("med",4,"sig@xml:space")="preserve"
G("med",4,"start@value")=3110504.1811
G("med",4,"status@value")="active"
G("med",4,"type@value")="OTC"
G("med",4,"vaType@value")="N"
G("med",5,"doses.dose@dose")=0
G("med",5,"doses.dose@route")="by mouth"
G("med",5,"doses.dose@schedule")="DAILY"
G("med",5,"facility@code")="050"
G("med",5,"facility@name")="VOE OFFICE INSTITUTION"
G("med",5,"form@value")="TAB"
G("med",5,"id@value")="5N;O"
G("med",5,"name@value")="WARFARIN 3MG TAB"
G("med",5,"ordered@value")=3110622.165848
G("med",5,"orderingProvider@code")=63
G("med",5,"orderingProvider@name")="KING,MATTHEW MICHAEL"
G("med",5,"products.product.class@code")="ANTICOAGULANTS"
G("med",5,"products.product.vaGeneric@code")=865
G("med",5,"products.product.vaGeneric@name")="WARFARIN"
G("med",5,"products.product.vaGeneric@vuid")=4019972
G("med",5,"products.product.vaProduct@code")=4659
G("med",5,"products.product.vaProduct@name")="WARFARIN NA 3MG TAB"
G("med",5,"products.product.vaProduct@vuid")=4005206
G("med",5,"products.product@code")=94514
G("med",5,"products.product@name")="WARFARIN 3MG"
G("med",5,"products.product@role")="D"
G("med",5,"sig")="Warfarin 3 mg Tab| 1 tablet BY by mouth DAILY"
G("med",5,"sig@xml:space")="preserve"
G("med",5,"start@value")=3110622.160507
G("med",5,"status@value")="active"
G("med",5,"type@value")="OTC"
G("med",5,"vaType@value")="N"
G("med",6,"doses.dose@dose")=0
G("med",6,"doses.dose@route")="by mouth"

```

```

G("med",6,"doses.dose@schedule")="DAILY"
G("med",6,"facility@code")="050"
G("med",6,"facility@name")="VOE OFFICE INSTITUTION"
G("med",6,"form@value")="TAB"
G("med",6,"id@value")="6N;0"
G("med",6,"name@value")="WARFARIN 3MG TAB"
G("med",6,"ordered@value")=3110622.165848
G("med",6,"orderingProvider@code")=63
G("med",6,"orderingProvider@name")="KING,MATTHEW MICHAEL"
G("med",6,"products.product.class@code")="ANTICOAGULANTS"
G("med",6,"products.product.vaGeneric@code")=865
G("med",6,"products.product.vaGeneric@name")="WARFARIN"
G("med",6,"products.product.vaGeneric@vuid")=4019972
G("med",6,"products.product.vaProduct@code")=4659
G("med",6,"products.product.vaProduct@name")="WARFARIN NA 3MG TAB"
G("med",6,"products.product.vaProduct@vuid")=4005206
G("med",6,"products.product@code")=94514
G("med",6,"products.product@name")="WARFARIN 3MG"
G("med",6,"products.product@role")="D"
G("med",6,"sig")="Warfarin 3 mg Tab| 1 tablet BY by mouth DAILY"
G("med",6,"sig+xml:space")="preserve"
G("med",6,"start@value")=3110622.160548
G("med",6,"status@value")="active"
G("med",6,"stop@value")=3110622.170517
G("med",6,"type@value")="OTC"
G("med",6,"vaType@value")="N"
G("patient",1,"address@city")="BIXBY"
G("patient",1,"address@postalCode")=74008
G("patient",1,"address@stateProvince")="OKLAHOMA"
G("patient",1,"address@streetLine1")="635 Big Sky Ln"
G("patient",1,"bid@value")="A1117"
G("patient",1,"dob@value")=2531016
G("patient",1,"exposures.exposure@value")="AO"
G("patient",1,"facilities.facility@code")="050"
G("patient",1,"facilities.facility@name")="VOE OFFICE INSTITUTION"
G("patient",1,"familyName@value")="ALLEN"
G("patient",1,"fullName@value")="ALLEN,JASON RYAN"
G("patient",1,"gender@value")="M"
G("patient",1,"givenNames@value")="JASON RYAN"
G("patient",1,"id@value")=6
G("patient",1,"lrdfn@value")=49
G("patient",1,"maritalStatus@value")="N"
G("patient",1,"religion@value")=6
G("patient",1,"sc@value")=0
G("patient",1,"ssn@value")=111111117
G("patient",1,"supports.support[1].address@city")="BIXBY"
G("patient",1,"supports.support[1].address@postalCode")=74008
G("patient",1,"supports.support[1].address@stateProvince")="OKLAHOMA"
G("patient",1,"supports.support[1].address@streetLine1")="635 Big Sky Ln"
G("patient",1,"supports.support[1].telecomList.telecom@usageType")="H"
G("patient",1,"supports.support[1].telecomList.telecom@value")="333-333-3334"

```

```

G("patient",1,"supports.support[1]@contactType")="ECON"
G("patient",1,"supports.support[1]@name")="ROOT,JOANNE"
G("patient",1,"supports.support[1]@relationship")="MOTHER"
G("patient",1,"supports.support[2].address@city")="BIXBY"
G("patient",1,"supports.support[2].address@postalCode")=74008
G("patient",1,"supports.support[2].address@stateProvince")="OKLAHOMA"
G("patient",1,"supports.support[2].address@streetLine1")="635 Big Sky Ln"
G("patient",1,"supports.support[2].telecomList.telecom@usageType")="H"
G("patient",1,"supports.support[2].telecomList.telecom@value")="333-333-3334"
G("patient",1,"supports.support[2]@contactType")="NOK"
G("patient",1,"supports.support[2]@name")="ROOT,JOANNE"
G("patient",1,"supports.support[2]@relationship")="MOTHER"
G("patient",1,"telecomList.telecom@usageType")="H"
G("patient",1,"telecomList.telecom@value")="333-333-3334"
G("patient",1,"veteran@value")=0
G("problem",1,"entered@value")=3110504
G("problem",1,"facility@code")=100
G("problem",1,"facility@name")="VOE OFFICE INSTITUTION OLD"
G("problem",1,"icd@value")="486."
G("problem",1,"id@value")=44
G("problem",1,"location@value")="ZZ*DR OFFICE"
G("problem",1,"name@value")="Pneumonia"
G("problem",1,"provider@code")=76
G("problem",1,"provider@name")="VAN NESS,NANCY"
G("problem",1,"removed@value")=0
G("problem",1,"sc@value")=0
G("problem",1,"status@value")="A"
G("problem",1,"unverified@value")=0
G("problem",1,"updated@value")=3110504
G("problem",2,"entered@value")=3110504
G("problem",2,"facility@code")=100
G("problem",2,"facility@name")="VOE OFFICE INSTITUTION OLD"
G("problem",2,"icd@value")="496."
G("problem",2,"id@value")=45
G("problem",2,"location@value")="ZZ*DR OFFICE"
G("problem",2,"name@value")="Chronic Obstructive Pulmonary Disease"
G("problem",2,"provider@code")=76
G("problem",2,"provider@name")="VAN NESS,NANCY"
G("problem",2,"removed@value")=0
G("problem",2,"sc@value")=0
G("problem",2,"status@value")="A"
G("problem",2,"unverified@value")=0
G("problem",2,"updated@value")=3110504

```

From this mumps array, triples are formed according to the Smart data model and then rendered as rdf. Examples of each type are shown in the sections that follow.

3. Demographics

All of the fields in demographics mapped directly from the NHIN xml output except the following:

sex - Sex is given as M or F in VistA, must be male or female for Smart

Date of Birth - all dates in VistA are in fileman format. The Smart date format is different and requires special transformations. An example is 1988-01-03. the zeros are required to keep the dates in sort order even though they are strings

Triples:

SUBJECT	PREDICATE	OBJECT
nodeID:163928854	rdf:type	v:Home
nodeID:163928854	v:locality	BIXBY
nodeID:163928854	v:postal-code	74008
nodeID:163928854	v:region	OKLAHOMA
nodeID:163928854	v:street-address	635 Big Sky Ln
nodeID:627173842	rdf:type	v:Name
nodeID:627173842	v:additional-name	RYAN
nodeID:627173842	v:family-name	ALLEN
nodeID:627173842	v:given-name	JASON
nodeID:825405422	dcterms:identifier	6
nodeID:825405422	dcterms:title	VistA Patient Record 6
nodeID:825405422	rdf:type	rdf:type
nodeID:825405422	sp:system	VistA Patient Record
nodeID:835095016	rdf:type	v:Tel
nodeID:835095016	rdf:value	333-333-3334
vistaSmart:6/patient	foaf:gender	male
vistaSmart:6/patient	rdf:type	sp:Demographics
vistaSmart:6/patient	sp:belongsTo	vistaSmart:6/patient
vistaSmart:6/patient	sp:medicalRecordNumber	nodeID:825405422
vistaSmart:6/patient	v:adr	nodeID:163928854
vistaSmart:6/patient	v:bday	1953-10-16
vistaSmart:6/patient	v:n	nodeID:627173842
vistaSmart:6/patient	v:tel	nodeID:835095016

RDF:

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
<rdf:Description rdf:nodeID="iDPsDPss635992783">
<rdf:type rdf:resource="http://www.w3.org/2006/vcard/ns#Tel"/>
<value xmlns="http://www.w3.org/1999/02/22-rdf-syntax-ns#">333-333-
3334</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss675298425">
<rdf:type rdf:resource="http://www.w3.org/2006/vcard/ns#Home"/>
<locality xmlns="http://www.w3.org/2006/vcard/ns#">BIXBY</locality>
<postal-code xmlns="http://www.w3.org/2006/vcard/ns#">74008</postal-code>
```



```

<region xmlns="http://www.w3.org/2006/vcard/ns#">OKLAHOMA</region>
<street-address xmlns="http://www.w3.org/2006/vcard/ns#">635 Big Sky
Ln</street-address>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss769124988">
<identifier xmlns="http://purl.org/dc/terms/">6</identifier>
<title xmlns="http://purl.org/dc/terms/">VistA Patient Record 6</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#">VistA Patient Record</system>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss960163516">
<rdf:type rdf:resource="http://www.w3.org/2006/vcard/ns#Name"/>
<additional-name xmlns="http://www.w3.org/2006/vcard/ns#">RYAN</additional-
name>
<family-name xmlns="http://www.w3.org/2006/vcard/ns#">ALLEN</family-name>
<given-name xmlns="http://www.w3.org/2006/vcard/ns#">JASON</given-name>
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/6/patient">
<gender xmlns="http://xmlns.com/foaf/0.1/">male</gender>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Demographics"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/records/6/patient"/>
<medicalRecordNumber xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss769124988"/>
<adr xmlns="http://www.w3.org/2006/vcard/ns#" rdf:nodeID="iDPsDPss675298425"/>
<bday xmlns="http://www.w3.org/2006/vcard/ns#">1953-10-16</bday>
<n xmlns="http://www.w3.org/2006/vcard/ns#" rdf:nodeID="iDPsDPss960163516"/>
<tel xmlns="http://www.w3.org/2006/vcard/ns#" rdf:nodeID="iDPsDPss635992783"/>
</rdf:Description>
</rdf:RDF>

```

4. Problems

All of the fields in problems mapped directly from the NHIN xml output except the following:

SNOMED code - Problems in VistA are coded with ICD9. We added a mapping file donated by Conor Dowling to the triple store that maps some ICD9 codes to SNOMED. the file is posted here:

<https://trac.opensourcevista.net/svn/smart/trunk/data/icdToSNOMEDCG.zip> in cases where there was no map, we delivered the ICD9 code

Triples:

SUBJECT	PREDICATE	OBJECT
nodeID:322421093	dcterms:title	Diabetes Mellitus without mention of Complication, type II or unspecified type
nodeID:322421093	rdf:type	sp:CodedValue
nodeID:322421093	sp:code	snomed:443694000
nodeID:521484640	dcterms:title	Essential Hypertension
nodeID:521484640	rdf:type	sp:CodedValue
nodeID:521484640	sp:code	snomed:59621000
nodeID:540863376	dcterms:title	Other and unspecified hyperlipidemia
nodeID:540863376	rdf:type	sp:CodedValue
nodeID:540863376	sp:code	snomed:55822004
nodeID:733217502	dcterms:title	Coronary Atherosclerosis of Native Coronary Vessel
nodeID:733217502	rdf:type	sp:CodedValue
nodeID:733217502	sp:code	snomed:233817007
snomed:233817007	dcterms:identifier	233817007
snomed:233817007	dcterms:title	Coronary Atherosclerosis of Native Coronary Vessel
snomed:233817007	rdf:type	sp:Code
snomed:233817007	sp:system	http://purl.bioontology.org/ontology/SNOMEDCT
snomed:443694000	dcterms:identifier	443694000
snomed:443694000	dcterms:title	Diabetes Mellitus without mention of Complication, type II or unspecified type
snomed:443694000	rdf:type	sp:Code
snomed:443694000	sp:system	http://purl.bioontology.org/ontology/SNOMEDCT
snomed:55822004	dcterms:identifier	55822004

SUBJECT	PREDICATE	OBJECT
snomed:55822004	dcterms:title	Other and unspecified hyperlipidemia
snomed:55822004	rdf:type	sp:Code
snomed:55822004	sp:system	http://purl.bioontology.org/ontology/SNOMEDCT
snomed:59621000	dcterms:identifier	59621000
snomed:59621000	dcterms:title	Essential Hypertension
snomed:59621000	rdf:type	sp:Code
snomed:59621000	sp:system	http://purl.bioontology.org/ontology/SNOMEDCT
vistaSmart:32/problems/10615684156984147	rdf:type	sp:Problem
vistaSmart:32/problems/10615684156984147	sp:belongsTo	vistaSmart:32/problems
vistaSmart:32/problems/10615684156984147	sp:problemName	nodeID:733217502
vistaSmart:32/problems/10615684156984147	sp:startDate	2011-06-24
vistaSmart:32/problems/31242565042232200	rdf:type	sp:Problem
vistaSmart:32/problems/31242565042232200	sp:belongsTo	vistaSmart:32/problems
vistaSmart:32/problems/31242565042232200	sp:problemName	nodeID:540863376
vistaSmart:32/problems/31242565042232200	sp:startDate	2011-06-24
vistaSmart:32/problems/66251106326332453	rdf:type	sp:Problem
vistaSmart:32/problems/66251106326332453	sp:belongsTo	vistaSmart:32/problems
vistaSmart:32/problems/66251106326332453	sp:problemName	nodeID:521484640
vistaSmart:32/problems/66251106326332453	sp:startDate	2011-05-05
vistaSmart:32/problems/76280003527800514	rdf:type	sp:Problem
vistaSmart:32/problems/76280003527800514	sp:belongsTo	vistaSmart:32/problems
vistaSmart:32/problems/76280003527800514	sp:problemName	nodeID:322421093
vistaSmart:32/problems/76280003527800514	sp:startDate	2011-05-05

RDF:

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
<rdf:Description rdf:nodeID="iDPsDPss163430217">
<title xmlns="http://purl.org/dc/terms/">Essential Hypertension</title>
```

```

<rdf:type rdf:resource="http://smartplatforms.org/terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/SNOMEDCT/59621000"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss415968161">
<title xmlns="http://purl.org/dc/terms/">Diabetes Mellitus without mention of
Complication, type II or unspecified type,</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/SNOMEDCT/443694000"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss782573457">
<title xmlns="http://purl.org/dc/terms/">Coronary Atherosclerosis of Native
Coronary Vessel</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/SNOMEDCT/233817007"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss982120930">
<title xmlns="http://purl.org/dc/terms/">Other and unspecified
hyperlipidemia</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/SNOMEDCT/55822004"/>
</rdf:Description>
<rdf:Description
rdf:about="http://purl.bioontology.org/ontology/SNOMEDCT/233817007">
<identifier xmlns="http://purl.org/dc/terms/">233817007</identifier>
<title xmlns="http://purl.org/dc/terms/">Coronary Atherosclerosis of Native
Coronary Vessel</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/SNOMEDCT"/>
</rdf:Description>
<rdf:Description
rdf:about="http://purl.bioontology.org/ontology/SNOMEDCT/443694000">
<identifier xmlns="http://purl.org/dc/terms/">443694000</identifier>
<title xmlns="http://purl.org/dc/terms/">Diabetes Mellitus without mention of
Complication, type II or unspecified type,</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/SNOMEDCT"/>
</rdf:Description>
<rdf:Description
rdf:about="http://purl.bioontology.org/ontology/SNOMEDCT/55822004">
<identifier xmlns="http://purl.org/dc/terms/">55822004</identifier>
<title xmlns="http://purl.org/dc/terms/">Other and unspecified
hyperlipidemia</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/SNOMEDCT"/>
</rdf:Description>

```

```

<rdf:Description
rdf:about="http://purl.bioontology.org/ontology/SNOMEDCT/59621000">
<identifier xmlns="http://purl.org/dc/terms/">59621000</identifier>
<title xmlns="http://purl.org/dc/terms/">Essential Hypertension</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/SNOMEDCT"/>
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/32/problems/
64819214446430644">
<rdf:type rdf:resource="http://smartplatforms.org/terms#Problem"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/records/32/problems"/>
<problemName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss163430217"/>
<startDate xmlns="http://smartplatforms.org/terms#">2011-05-05</startDate>
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/32/problems
/66129578201842218">
<rdf:type rdf:resource="http://smartplatforms.org/terms#Problem"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/records/32/problems"/>
<problemName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss415968161"/>
<startDate xmlns="http://smartplatforms.org/terms#">2011-05-05</startDate>
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/32/problems/
83941170608484934">
<rdf:type rdf:resource="http://smartplatforms.org/terms#Problem"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/records/32/problems"/>
<problemName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss982120930"/>
<startDate xmlns="http://smartplatforms.org/terms#">2011-06-24</startDate>
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/32/problems/
99015174911688942">
<rdf:type rdf:resource="http://smartplatforms.org/terms#Problem"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/records/32/problems"/>
<problemName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss782573457"/>
<startDate xmlns="http://smartplatforms.org/terms#">2011-06-24</startDate>
</rdf:Description>
</rdf:RDF>

```

5. Medications

We only processed Outpatient meds for the first version of the Smart Container. Inpatient meds were skipped.

All of the fields in medications mapped directly from the NHIN xml output except the following:

- RxNorm - VistA meds are coded with VUIDs. We used a mapping file in VistA to map the VUID codes to RxNorm.
- Units and Values in VistA do not conform to the Smart standards, and we could find no way to map them we delivered what VistA stores.

Triples:

SUBJECT	PREDICATE	OBJECT
nodeID:251667904	dcterms:title	ATORVASTATIN TAB
nodeID:251667904	rdf:type	sp:CodedValue
nodeID:251667904	sp:code	rxnorm:617314
nodeID:482950547	sp:unit	UNKNOWN
nodeID:482950547	sp:value	0
nodeID:513189765	sp:ValueAndUnit	nodeID:577056569
nodeID:528278275	sp:unit	mg Tab 1 Add'l Sig
nodeID:528278275	sp:value	0
nodeID:577056569	sp:unit	Oral
nodeID:577056569	sp:value	Select Frequency
nodeID:718165755	sp:ValueAndUnit	nodeID:528278275
nodeID:742808564	sp:ValueAndUnit	nodeID:993436766
nodeID:743714867	sp:ValueAndUnit	nodeID:482950547
nodeID:785423494	dcterms:title	WARFARIN 3MG TAB
nodeID:785423494	rdf:type	sp:CodedValue
nodeID:785423494	sp:code	rxnorm:855320
rxnorm:855320	sp:unit	by mouth
nodeID:993436766	sp:value	DAILY
rxnorm:617314	rxnorm:617314	617314
rxnorm:617314	dcterms:title	ATORVASTATIN TAB
rxnorm:617314	rdf:type	smartplatforms.org/terms/codes/RxNorm_Semantic
rxnorm:617314	rdf:type	sp:Code
rxnorm:617314	sp:system	http://purl.bioontology.org/ontology/RXNORM/
rxnorm:855320	dcterms:identifier	855320
rxnorm:855320	dcterms:title	WARFARIN 3MG TAB
rxnorm:855320	rdf:type	http://smartplatforms.org/codes/RxNorm_Semantic
rxnorm:855320	rdf:type	sp:Code

SUBJECT	PREDICATE	OBJECT
rxnorm:855320	sp:system	http://purl.bioontology.org/ontology/RXNORM/
vistaSmart:6/med/12595-3110429.123852	rdf:type	rdf:type
vistaSmart:6/med/12595-3110429.123852	sp:belongsTo	vistaSmart:6/med
vistaSmart:6/med/12595-3110429.123852	sp:drugName	nodeID:251667904
vistaSmart:6/med/12595-3110429.123852	sp:frequency	nodeID:513189765
vistaSmart:6/med/12595-3110429.123852	sp:instructions	1 Add'l Sig BY Oral Select Frequency
vistaSmart:6/med/12595-3110429.123852	sp:quantity	nodeID:718165755
vistaSmart:6/med/12595-3110429.123852	sp:startDate	2011-4-29
vistaSmart:6/med/4659-3110622.165848	rdf:type	sp:Medication
vistaSmart:6/med/4659-3110622.165848	sp:belongsTo	vistaSmart:6/med
vistaSmart:6/med/4659-3110622.165848	sp:drugName	sp:drugName
vistaSmart:6/med/4659-3110622.165848	sp:frequency	nodeID:742808564
vistaSmart:6/med/4659-3110622.165848	sp:instructions	1 tablet BY by mouth DAILY
vistaSmart:6/med/4659-3110622.165848	sp:quantity	nodeID:743714867
vistaSmart:6/med/4659-3110622.165848	sp:startDate	2011-6-22

RDF:

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
<rdf:Description rdf:nodeID="iDPsDPss282620764">
<ValueAndUnit xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss771302706"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss604981601">
<title xmlns="http://purl.org/dc/terms/">ATORVASTATIN TAB</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/RXNORM/617314"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss712371360">
<ValueAndUnit xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss939328262"/>
</rdf:Description>
```

```

<rdf:Description rdf:nodeID="iDPsDPss771302706">
<unit xmlns="http://smartplatforms.org/terms#">UNKNOWN</unit>
<value xmlns="http://smartplatforms.org/terms#">0</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss774053366">
<unit xmlns="http://smartplatforms.org/terms#">Oral</unit>
<value xmlns="http://smartplatforms.org/terms#">Select Frequency</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss862386186">
<ValueAndUnit xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss774053366"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss898261289">
<ValueAndUnit xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss949535912"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss939328262">
<unit xmlns="http://smartplatforms.org/terms#"> mg Tab| 1 Add'l Sig</unit>
<value xmlns="http://smartplatforms.org/terms#">0</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss949535912">
<unit xmlns="http://smartplatforms.org/terms#">by mouth</unit>
<value xmlns="http://smartplatforms.org/terms#">DAILY</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss998719579">
<title xmlns="http://purl.org/dc/terms/">WARFARIN 3MG TAB</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/RXNORM/855320"/>
</rdf:Description>
<rdf:Description
rdf:about="http://purl.bioontology.org/ontology/RXNORM/617314">
<identifier xmlns="http://purl.org/dc/terms/">617314</identifier>
<title xmlns="http://purl.org/dc/terms/">ATORVASTATIN TAB</title>
<rdf:type
rdf:resource="http://smartplatforms.org/terms/codes/RxNorm_Semantic"/>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/RXNORM/" />
</rdf:Description>
<rdf:Description
rdf:about="http://purl.bioontology.org/ontology/RXNORM/617314">
<identifier xmlns="http://purl.org/dc/terms/">617314</identifier>
<title xmlns="http://purl.org/dc/terms/">ATORVASTATIN TAB</title>
<rdf:type
rdf:resource="http://smartplatforms.org/terms/codes/RxNorm_Semantic"/>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/RXNORM/" />
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/6/med/12595-

```



```

3110429.123852">
<rdf:type rdf:resource="http://smartplatforms.org/terms#Medication"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/records/6/med"/>
<drugName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss604981601"/>
<frequency xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss862386186"/>
<instructions xmlns="http://smartplatforms.org/terms#"> 1 Add'l Sig BY Oral
Select Frequency</instructions>
<quantity xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss712371360"/>
<startDate xmlns="http://smartplatforms.org/terms#">2011-4-29</startDate>
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/6/med/4659-
3110622.165848">
<rdf:type rdf:resource="http://smartplatforms.org/terms#Medication"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/records/6/med"/>
<drugName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss998719579"/>
<frequency xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss898261289"/>
<instructions xmlns="http://smartplatforms.org/terms#"> 1 tablet BY by
mouth DAILY</instructions>
<quantity xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss282620764"/>
<startDate xmlns="http://smartplatforms.org/terms#">2011-6-22</startDate>
</rdf:Description>
</rdf:RDF>

```

6. Lab Results

All of the fields in labs mapped directly from the NHIN xml output except the following:

- Loinc codes - VistA supports Loinc codes, and where they were present, we delivered them as output. Where there were no Loinc codes, we skipped the lab result, because we could not figure a way to provide a smart output.

Triples:

SUBJECT	PREDICATE	OBJECT
loinc:2085-9	dcterms:identifier	2085-9
loinc:2085-9	dcterms:title	HDL CHOLESTEROL
loinc:2085-9	rdf:type	sp:Code
loinc:2085-9	sp:system	http://loinc.org/codes/
loinc:2093-3	dcterms:identifier	2093-3
loinc:2093-3	dcterms:title	CHOLESTEROL
loinc:2093-3	rdf:type	sp:Code
loinc:2093-3	sp:system	http://loinc.org/codes/
loinc:30522-7	dcterms:identifier	30522-7
loinc:30522-7	dcterms:title	HIGH-SENSIVITY C-REACTIVE PROTEIN
loinc:30522-7	rdf:type	sp:Code
loinc:30522-7	sp:system	http://loinc.org/codes
nodeID:032215694	rdf:type	sp:ValueAndUnit
nodeID:032215694	sp:unit	HDL CHOLESTEROL
nodeID:032215694	sp:value	45
nodeID:063813166	dcterms:title	CHOLESTEROL
nodeID:063813166	rdf:type	sp:CodedValue
nodeID:063813166	sp:code	loinc:2093-3
nodeID:158083727	rdf:type	sp:Attribution
nodeID:158083727	sp:startDate	2012-04-25
nodeID:274677128	rdf:type	sp:ValueAndUnit
nodeID:274677128	sp:unit	mg/dL
nodeID:274677128	sp:value	120
nodeID:508295096	rdf:type	sp:Attribution
nodeID:508295096	sp:startDate	sp:startDate
nodeID:540929713	rdf:type	sp:Attribution
nodeID:540929713	sp:startDate	2012-04-25
nodeID:572993687	rdf:type	sp:ValueAndUnit
nodeID:572993687	sp:unit	mg/L
nodeID:572993687	sp:value	0
nodeID:603258303	rdf:type	sp:ValueAndUnit
nodeID:603258303	sp:unit	mg/dL
nodeID:603258303	sp:value	163
nodeID:606788887	rdf:type	sp:ValueRange
nodeID:606788887	sp:maximum	nodeID:890032220
nodeID:606788887	sp:minimum	nodeID:274677128
nodeID:616271691	rdf:type	sp:QuantitativeResult
nodeID:616271691	sp:normalRange	nodeID:606788887

SUBJECT	PREDICATE	OBJECT
nodeID:616271691	sp:valueAndUnit	nodeID:603258303
nodeID:639795394	rdf:type	sp:ValueRange
nodeID:639795394	sp:maximum	nodeID:832047616
nodeID:639795394	sp:minimum	nodeID:572993687
nodeID:659053466	dcterms:title	HDL CHOLESTEROL
nodeID:659053466	rdf:type	sp:CodedValue
nodeID:659053466	sp:code	loinc:2085-9
nodeID:716700164	rdf:type	sp:ValueAndUnit
nodeID:716700164	sp:unit	mg/L
nodeID:716700164	sp:value	2.9
nodeID:832047616	rdf:type	sp:ValueAndUnit
nodeID:832047616	sp:unit	mg/L
nodeID:832047616	sp:value	3
nodeID:875882234	rdf:type	sp:QuantitativeResult
nodeID:875882234	sp:normalRange	nodeID:639795394
nodeID:875882234	sp:valueAndUnit	nodeID:716700164
nodeID:890032220	rdf:type	sp:ValueAndUnit
nodeID:890032220	sp:unit	mg/dL
nodeID:890032220	sp:value	200
nodeID:909597545	dcterms:title	HIGH-SENSIVITY C-REACTIVE PROTEIN
nodeID:909597545	rdf:type	sp:CodedValue
nodeID:909597545	sp:code	loinc:30522-7
nodeID:944122350	rdf:type	sp:QuantitativeResult
nodeID:944122350	sp:valueAndUnit	nodeID:032215694
vistaSmart:6/lab_results/ 18050754592291778	rdf:type	sp:LabResult
vistaSmart:6/lab_results/ 18050754592291778	sp:belongsTo	vistaSmart:6/ lab_results
vistaSmart:6/lab_results/ 18050754592291778	sp:labName	nodeID:063813166
vistaSmart:6/lab_results/ 18050754592291778	sp:narrativeResult	nodeID:600844888
vistaSmart:6/lab_results/ 18050754592291778	sp:quantitativeResult	nodeID:616271691
vistaSmart:6/lab_results/ 18050754592291778	sp:specimenCollected	nodeID:158083727
vistaSmart:6/lab_results/ 64750239894166499	rdf:type	sp:LabResult
vistaSmart:6/lab_results/ 64750239894166499	sp:belongsTo	vistaSmart:6/lab_results
vistaSmart:6/lab_results/ 64750239894166499	sp:labName	nodeID:659053466
vistaSmart:6/lab_results/ 64750239894166499	sp:narrativeResult	nodeID:505088543
vistaSmart:6/lab_results/ 64750239894166499	sp:quantitativeResult	nodeID:944122350
vistaSmart:6/lab_results/ 64750239894166499	sp:specimenCollected	nodeID:540929713

SUBJECT	PREDICATE	OBJECT
vistaSmart:6/lab_results/ 89548426370765804	rdf:type	sp:LabResult
vistaSmart:6/lab_results/ 89548426370765804	sp:belongsTo	vistaSmart:6/lab_results
vistaSmart:6/lab_results/ 89548426370765804	sp:labName	nodeID:909597545
vistaSmart:6/lab_results/ 89548426370765804	sp:narrativeResult	nodeID:095171452
vistaSmart:6/lab_results/ 89548426370765804	sp:quantitativeResult	nodeID:875882234
vistaSmart:6/lab_results/ 89548426370765804	sp:specimenCollected	nodeID:508295096

RDF:

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
<rdf:Description rdf:about="http://purl.bioontology.org/
ontology/LNC/2085-9">
<identifier xmlns="http://purl.org/dc/terms/">2085-9</identifier>
<title xmlns="http://purl.org/dc/terms/">HDL CHOLESTEROL</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#" rdf:resource=
"http://loinc.org/codes/">
</rdf:Description>
<rdf:Description rdf:about="http://purl.bioontology.org
/ontology/LNC/2093-3">
<identifier xmlns="http://purl.org/dc/terms/">2093-3</identifier>
<title xmlns="http://purl.org/dc/terms/">CHOLESTEROL</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#" rdf:resource=
"http://loinc.org/codes/">
</rdf:Description>
<rdf:Description rdf:about="http://purl.bioontology.org/
ontology/LNC/30522-7">
<identifier xmlns="http://purl.org/dc/terms/">30522-7</identifier>
<title xmlns="http://purl.org/dc/terms/"
>HIGH-SENSIVITY C-REACTIVE PROTEIN</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#Code"/>
<system xmlns="http://smartplatforms.org/terms#" rdf:resource=
"http://loinc.org/codes/">
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss100425785">
<rdf:type rdf:resource="http://smartplatforms.org/terms#ValueRange"/>
<maximum xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss220854950"/>
```

```

<minimum xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss816211098"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss183485436">
<rdf:type rdf:resource="http://smartplatforms.org/terms#ValueAndUnit"/>
<unit xmlns="http://smartplatforms.org/terms#">mg/dL</unit>
<value xmlns="http://smartplatforms.org/terms#">120 </value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss212335104">
<title xmlns="http://purl.org/dc/terms/">HDL CHOLESTEROL</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/LNC/2085-9"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss215172665">
<title xmlns="http://purl.org/dc/terms/"
>HIGH-SENSIVITY C-REACTIVE PROTEIN</title>
<rdf:type rdf:resource="http://smartplatforms.org/terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/LNC/30522-7"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss220854950">
<rdf:type rdf:resource="http://smartplatforms.org/terms
#ValueAndUnit"/>
<unit xmlns="http://smartplatforms.org/terms#">mg/L</unit>
<value xmlns="http://smartplatforms.org/terms#"> 3</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss260660952">
<rdf:type rdf:resource="http://smartplatforms.org/
terms#QuantitativeResult"/>
<normalRange xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss805024399"/>
<valueAndUnit xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss864181975"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss312599313">
<rdf:type rdf:resource="http://smartplatforms.org/
terms#Attribution"/>
<startDate xmlns="http://smartplatforms.org/terms#"
>2012-04-25</startDate>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss365899243">
<rdf:type rdf:resource="http://smartplatforms.org/
terms#QuantitativeResult"/>
<normalRange xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss100425785"/>
<valueAndUnit xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss963601236"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss536704371">
<rdf:type rdf:resource="http://smartplatforms.org/
terms#ValueAndUnit"/>

```

```

<unit xmlns="http://smartplatforms.org/terms#">mg/dL</unit>
<value xmlns="http://smartplatforms.org/terms#"> 200</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss558098398">
<rdf:type rdf:resource="http://smartplatforms.org/terms
#QuantitativeResult"/>
<valueAndUnit xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss912964037"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss577288342">
<title xmlns="http://purl.org/dc/terms/">
CHOLESTEROL</title>
<rdf:type rdf:resource="http://smartplatforms.org/
terms#CodedValue"/>
<code xmlns="http://smartplatforms.org/terms#"
rdf:resource="http://purl.bioontology.org/ontology/LNC/2093-3"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss684965313">
<rdf:type rdf:resource="http://smartplatforms.org/terms
#Attribution"/>
<startDate xmlns="http://smartplatforms.org/terms#">
2012-04-25</startDate>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss805024399">
<rdf:type rdf:resource="http://smartplatforms.org/
terms#ValueRange"/>
<maximum xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss536704371"/>
<minimum xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss183485436"/>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss816211098">
<rdf:type rdf:resource="http://smartplatforms.org/
terms#ValueAndUnit"/>
<unit xmlns="http://smartplatforms.org/terms#">
mg/L</unit>
<value xmlns="http://smartplatforms.org/terms#">
0 </value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss864181975">
<rdf:type rdf:resource="http://smartplatforms.org/
terms#ValueAndUnit"/>
<unit xmlns="http://smartplatforms.org/terms#">mg/dL</unit>
<value xmlns="http://smartplatforms.org/terms#">163</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss901763418">
<rdf:type rdf:resource="http://smartplatforms.org/
terms#Attribution"/>
<startDate xmlns="http://smartplatforms.org/terms#">
2012-04-25</startDate>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss912964037">

```

```

<rdf:type rdf:resource="http://smartplatforms.org/terms#ValueAndUnit"/>
<unit xmlns="http://smartplatforms.org/terms#">
HDL CHOLESTEROL</unit>
<value xmlns="http://smartplatforms.org/terms#">45</value>
</rdf:Description>
<rdf:Description rdf:nodeID="iDPsDPss963601236">
<rdf:type rdf:resource="http://smartplatforms.org/terms#ValueAndUnit"/>
<unit xmlns="http://smartplatforms.org/terms#">mg/L</unit>
<value xmlns="http://smartplatforms.org/terms#">2.9</value>
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/6/lab_
results/08861402014093539">
<rdf:type rdf:resource="http://smartplatforms.org/terms#LabResult"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/records/6/
lab_results"/>
<labName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss212335104"/>
<narrativeResult xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss699635080"/>
<quantitativeResult xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss558098398"/>
<specimenCollected xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss684965313"/>
</rdf:Description>
<rdf:Description
rdf:about="https://smart2.vistaewd.net/vista/smart/records/
6/lab_results/10767060682350514">
<rdf:type rdf:resource="http://smartplatforms.org/terms#LabResult"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/smart/
records/6/lab_results"/>
<labName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss577288342"/>
<narrativeResult xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss584590240"/>
<quantitativeResult xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss260660952"/>
<specimenCollected xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss312599313"/>
</rdf:Description>
<rdf:Description rdf:about="https://smart2.vistaewd.net/vista/smart/
records/6/lab_results/46279775966003159">
<rdf:type rdf:resource="http://smartplatforms.org/terms#LabResult"/>
<belongsTo xmlns="http://smartplatforms.org/terms#"
rdf:resource="https://smart2.vistaewd.net/vista/
smart/records/6/lab_results"/>

```

```
<labName xmlns="http://smartplatforms.org/terms#"
rdf:nodeID="iDPsDPss215172665"/>
<narrativeResult xmlns="http://smartplatforms.org/
terms#" rdf:nodeID="iDPsDPss789205730"/>
<quantitativeResult xmlns="http://smartplatforms.org/
terms#" rdf:nodeID="iDPsDPss365899243"/>
<specimenCollected xmlns="http://smartplatforms.org/
terms#" rdf:nodeID="iDPsDPss901763418"/>
</rdf:Description>
</rdf:RDF>
```