Improving Electronic Health Record Usability, Ensuring Data Integrity and Impacting Analytics with SNOMED CT

Enabling Clinical Data Interoperability and Data Integration Across the Health Care Enterprise.

3M

Learning Objectives

- Understand how Common Terminology Services (CTS) 1.2 can be leveraged in obtaining dynamic SNOMED CT value sets

- Acquire operational methods to implement SNOMED CT into clinical charting at the point of care

3M

Trends in Electronic Data Capture

- Medical record originally intended to treat individual patients by each physician specialty

- Move to the Electronic Health Record (EHR) as a way to conveniently collect and aggregate patient data

3M

Rapid EHR Adoption in the United States

- **Health Information Technology for Economic and Clinical Health Act**
  - 90% Physician Adoption
    - 57% Office Based
    - 68% Family Practice
  - Hospital Adoption-Non-federal Acute Care
    - 44% Basic EHR adoption
    - 85% Certified EHR possession

SNOMED CT Coded Data within the EHR

SNOMED CT Overview by Meaningful Use (MU) Measure	
MU Stage 2 Objective	**Data Element**
Record Smoking Status	Smoking Status
Transitions of Care	MU Data Elements Encounter Diagnosis
View Download and Transmit to a 3rd Party	MU Data Elements
Clinical Summary	MU Data Elements
Submit Electronic Lab Results to Public Health Agencies	Lab Results
Record Family Health History	Family Health History
Report Cancer Cases to Cancer Registry	Cancer Case Information
Data Portability	MU Data Element Encounter Diagnosis

3M

SNOMED CT: Common MU Data Elements

Smoking Status

Problems

Encounter Diagnosis

Procedures

Clinical Quality Measures (CQMs)

MU Common Data Elements

SNOMED CT Versioning for 2014 MU Requirements

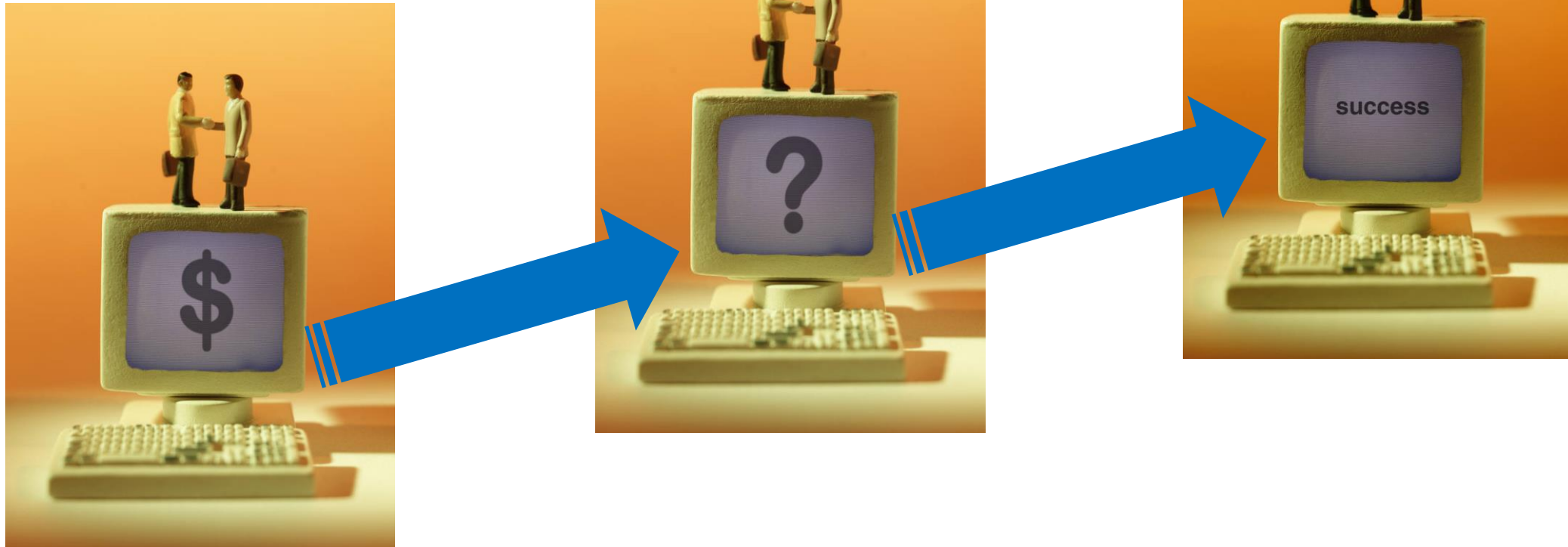|	2014 MU Version	Current Release
SNOMED CT®	July 2012	July 2013
SNOMED CT U.S. Extension	March 2012	September 2013

3M

CEHRT Expectations

Satisfied End Users

Excellent Functionality

Improved Workflow
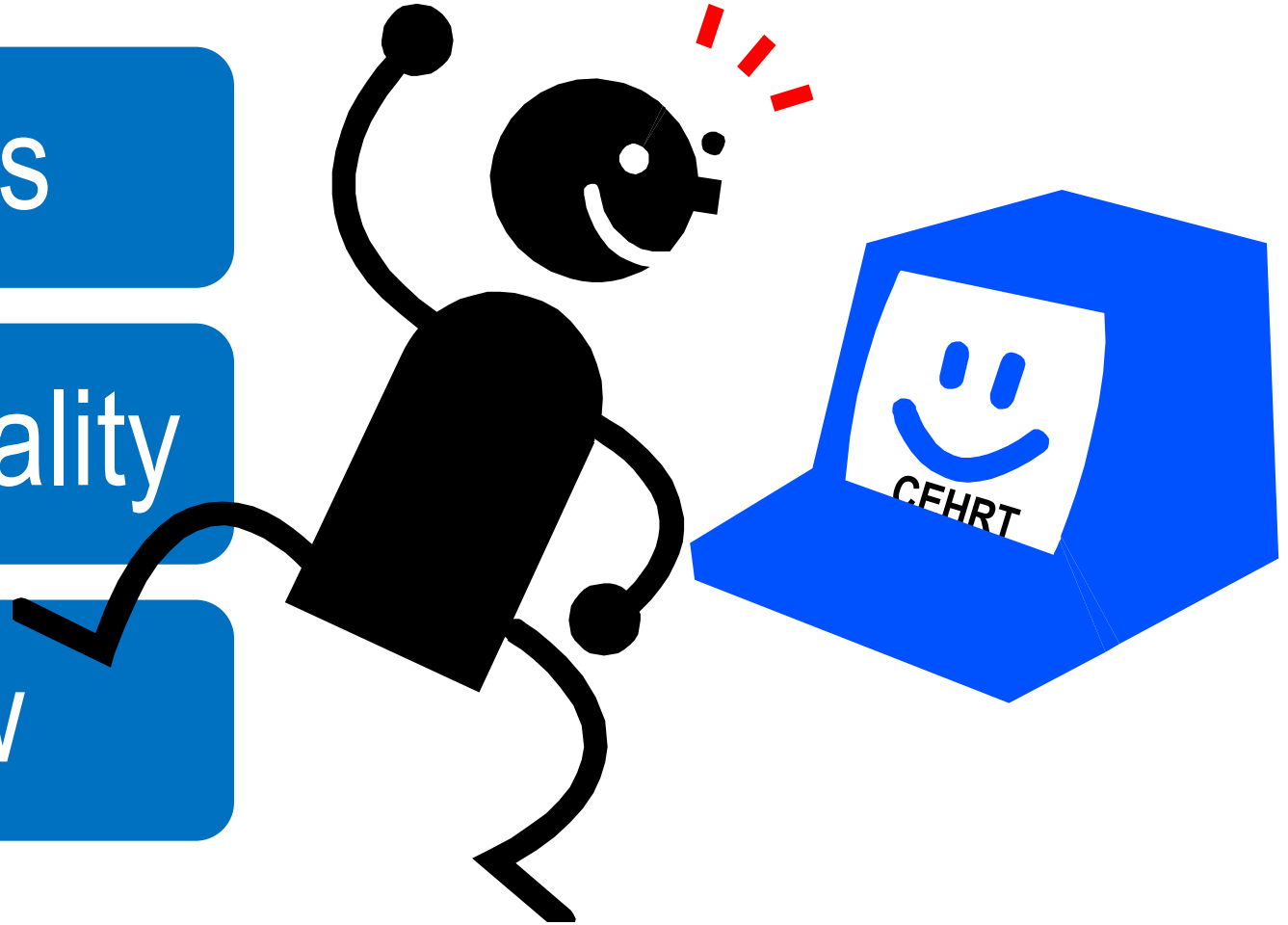
CEHRT Adoption, Implementation and Optimization

- Just having the EHR is not enough, clinicians have to use the technology and organizations have to leverage that information generated from the EHR

CEHRT for MU is Only the Baseline

- **Functionality**
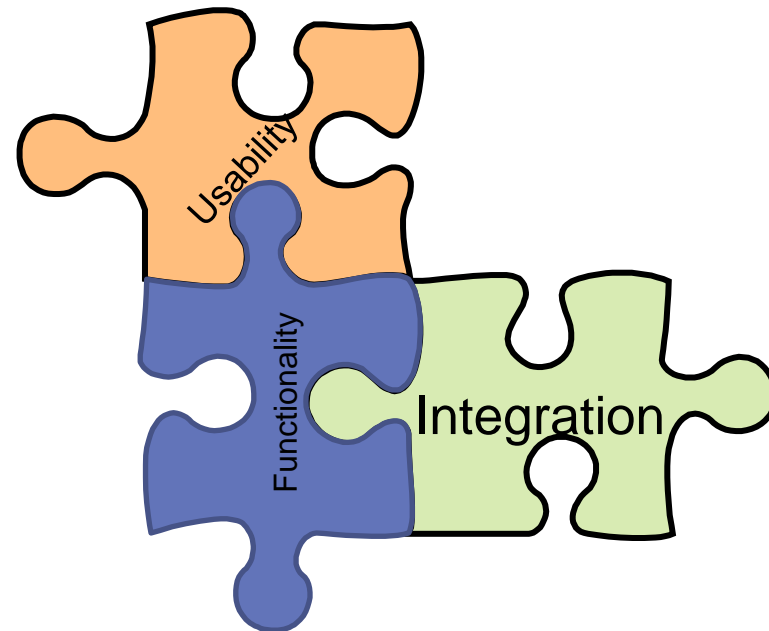 - **Certification for Meaningful Use (MU) requirements**
    - Certification Process
    - Standards
      - Content exchange
      - Security
      - Transport
      - Functional
      - Vocabulary
    - 2011 vs 2014
  - Organization Needs

- **Usability**
  - Clinical workflow
  - User satisfaction
  - Structured data capture

Improving EHR satisfaction and structured data capture at the point of care with SNOMED CT
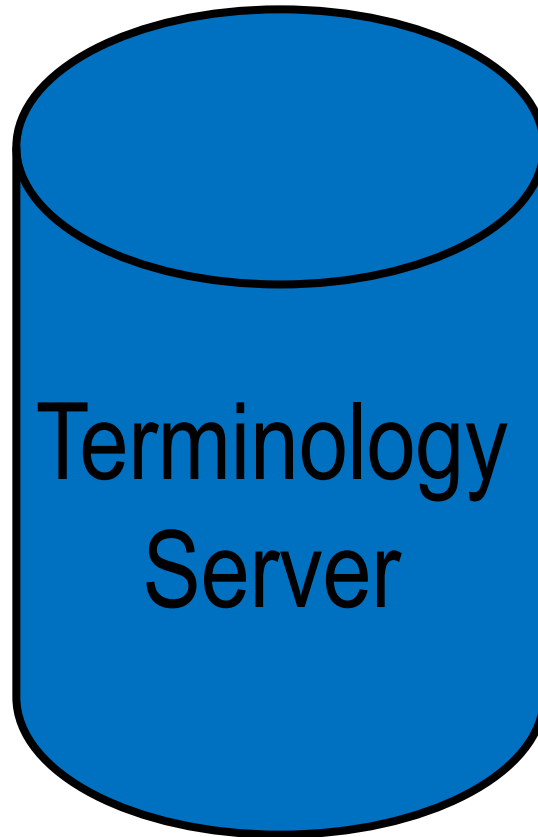
- **Goals**
  - Improve Usability of EHRs
  - Incorporate structured data capture seamlessly into work flow
  - Optimization of a reference terminology with user friendly terms

- **Requirements**
  - SNOMED CT Data source
    - Centralized terminology server
  - Terminology Management Capabilities
    - Browsing features
    - Authoring features
  - Runtime Terminology services
    - Common terminology services HL7 v 1.2
    - Customized Application Programming Interfaces (APIs)

Data Source : Container

SNOMED CT Expressions

Multiple SNOMED CT Versions

SNOMED CT Hierarchy

SNOMED CT Content (International and Extension)

Terminology Server
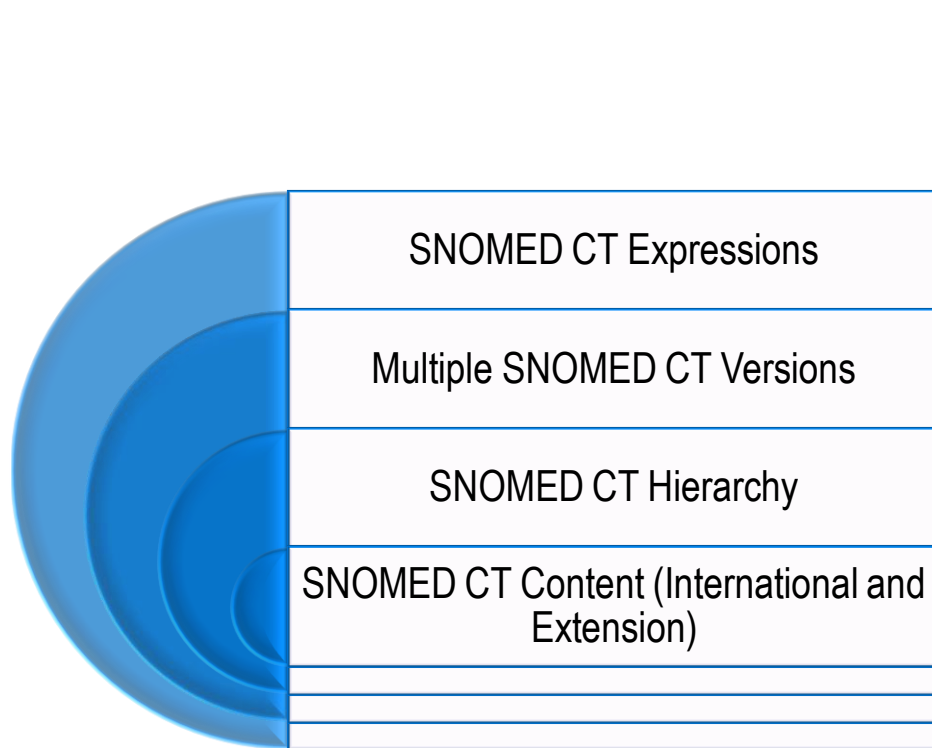
- Benefits
  - Streamlined import and update of SNOMED CT files
  - Alignment of SNOMED CT version across applications
  - Improved efficiency in access to SNONMED CT across the enterprise

3M

Terminology Management Capabilities

- **Browsing**
  - Search and filter criteria

- **Authoring**
  - Creation of Organization Specific Value Sets
  - Creation of custom displays

- **Translation**
  - Translate between SNOMED CT designations
    - Preferred term
    - SCT ID
    - Fully Specified Name
    - Custom displays

Runtime Terminology Services

- Health Level 7 (HL7) Common Terminology Services (CTS) compliance enables various applications to easily and transparently access a Terminology Server without knowing its internal architecture
  - Get Concept Data
  - Get mappings
  - Get Value Sets

3M

3M HDD and HDD Access – common features

- Concept-based terminology server

- Knowledge base

- Information Model

- Integrates multiple standard and local terminologies

- Enables various applications such as EHR, interface engines to achieve data interoperability, healthcare information exchange (HIE) and meaningful use

- Local extensions are supported

- Authoring capabilities

- Import and Export

3M

HDD Access (And HDD) Demonstration

3M

Areas of Implementation

Problem List

- Real time search for SNOMED CT problems
- Match algorithms and filtering

Populating Assessment Forms

- List of potential choices for clinical observations
- Text selection adds the SNOMED CT ID to the patient record

Clinical Quality and Outcomes Measures

- Ease in identification of value sets for MU CQMs

3M

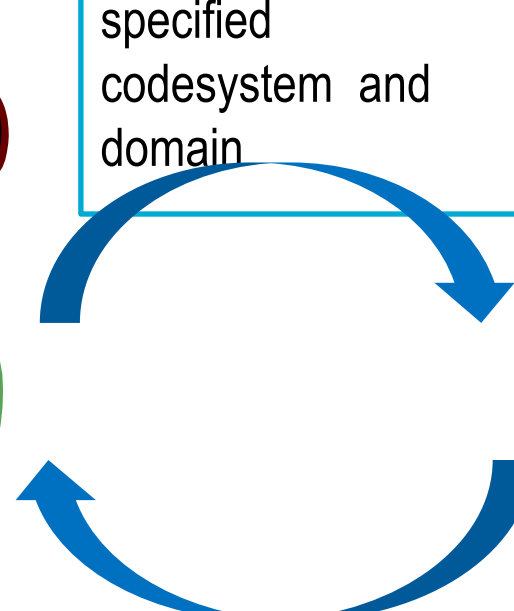# Problem List Process Flow

EHR is configured to search the SNOMED CT codesystem and the clinical finding domain

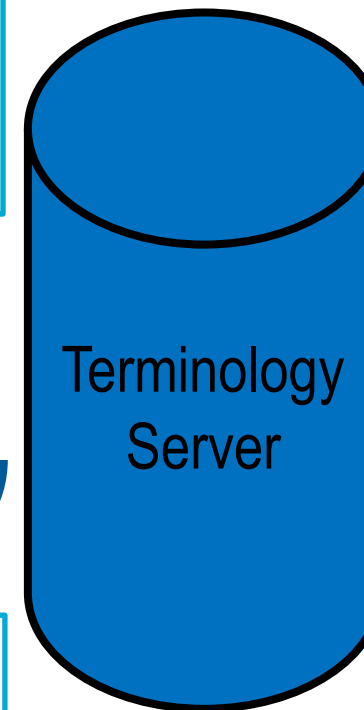The EHR queries the terminology server based on the specified codesystem and domain

Terminology Server

Clinicians enter text into the EHR to search for problems to add for a patient encounter

The applicable results are then supplied to the clinician

Problem List

- **Goal**
  - Text search within a EHR platform to support a SNOMED CT coded problem list

- **Features**
  - Near-real-time Searching
  - Type-ahead
  - Surface the correct concept the end user

- **Requirements**
  - Web services to access content
  - Limit problem list content to SNOMED CT concepts
  - Support HL7 CTS search functions

3M Confidential – for customer's internal review only.
Further use or disclosure requires prior approval from 3M.
© 3M 2013. All Rights Reserved.

Examples and Problem List Demo

3M

Search Features

Near Real Time Searching	Quick Response Time	Sensitivity
Specificity	Variable Word Ordering	Abbreviation Search
Synonym Search	Custom Ranking	Recalling previous searches

3M

Query Only the Terminology and Domains that Contain Problem List Concepts

| String Text Search | → | Code system: SNOMED CT | → | Code System Domain: Clinical Findings |
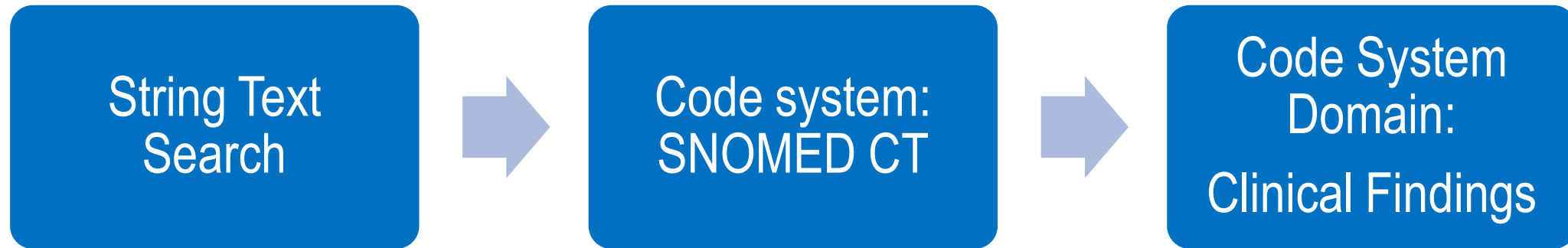
- The search returns the preferred designation for the concepts in the code system that match the text string search (and domain if specified)
- Returns the top 25 results limit to the hypersearch score >0.7

3M

Limiting the Search to Improve Sensitivity

- **Limit Search to the 'Problem list'**
  - Kaiser Permanente CMT Problem List subset
  - Core SNOMED and KP extensions in the top 2500 problems will be members of this domain (NCID=45788)
- **Limit Search based on Body System Domain**

String Text Search → Code system: SNOMED CT → Code System Domain: Cardiovascular Disorders

3M
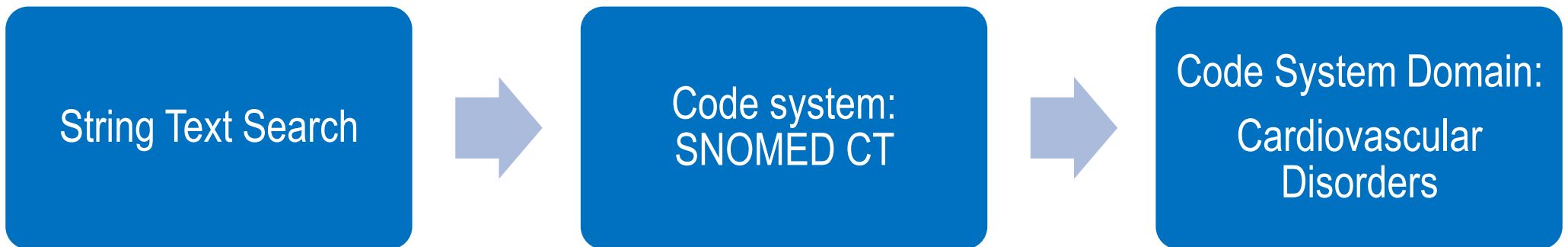
getMembersByDomain function

- Given a domain NCID returns all the NCIDs of its members using the has-member (relationship_NCID 363) relationship of the former

- **Input**
  - domainNCID, Required (1…1), NCIDDomain
    - NCID, whose members will be returned

- **Output**
  - Struct (0…n) {memberNCID, required (1…1), NCID
    - NCIDs of concepts that are members of the input Domain NCID.}

3M

Terminology Server Offers Authoring Capabilities

- **Roles and Privileges**
  - Allows browsing
  - Allows interactive authoring
- **Example**
  - Add user preferred displays to existing SNOMED CT concepts
  - Create a Neurology Code system with preferred codes
  - Create a physician specific 'Dr. Johnson's frequently used problem list' domain
- **Surface real time selection of which domains to surface to the end user**
  - Body System
  - Clinician Specialty
  - Physician Name

3M

Allow Users to Create Custom Representations

- Create a Local Code system with the end user preferred designation and implicitly map them to the SNOMED CT concepts
  - On the provider level
  - On the specialty level
  - On the encounter level
- By creating local problem list code system improves hypersearch performance to return relevant results

3M

Surface Custom Representations to End Users

- Customize the application to recognize text string and suggest the desired result
  - Hypersearch functions to limit by context
  - API functions to limit by codesystem
- John James Neurologist types 'CP' and means Cerebral Palsy to return as a preferred result
- Patrick Pansy Oncologist types 'CP' and means Cervical Polyp

3M

addRepresentation function

- **Add a representation to a given concept**

- **Inputs**
  - Name
    - Name of the new representation.
  - conceptNcid
    - Ncid of the concept for this representation.
  - contextNcid
    - Context for the new representation.
  - preferredScore
    - Preferred score for the new representation.
  - namespaceNcid
    - The NCID for the namespace that this concept will be associated with.

- **Output**
  - Representation
    - RsFormContextResult
  - Representation
    - As was specified
  - rsformId
    - The new created Id given to this representation
  - contextNcid
    - As was specified
  - preferredScore
    - As was specified

Authoring Content in HDD Access Demonstration

3M

Problem List Mappings

- End users may want to see mappings from SNOMED CT to other terminologies
- When the SNOMED CT problem list concept is picked the mappings if any are generated by the appropriate APIs
  - Mapconceptcode and 3MMapconcept code

3M

mapConceptCode

- **Maps one concept code from code system to another code system**

  - **Input**
    - Source code system ID
    - Source concept code
    - Target system ID

  - **Output**
    - Target Concept code
    - Does not recognize one to many map

3M

3M:mapConceptCode

- Maps one concept code from code system to another code system

  - Input
    - Source code system ID
    - Source concept code
    - Target system ID

  - Output
    - Target Concept Code(s)
    - 3M Map Quality
    - Supports one to many maps

3M

Problem List Mappings Demonstration

3M

3M Map Concept Code in the HDD

User Implications

- Map from Diagnosis Code sets to Problem Lists
- Map from Problem Lists to Standard Terminologies
- Map from diagnosis or problem lists to orders or order sets
- Map from order sets to billing procedure codes

Mapping Assumptions

- Every map is a concept that 'has source terminology' and 'has target terminology' relationships
- Exact match maps are representations with different contexts
  - **Implicit** map domain where the link codes via **NCID**
- Non exact maps occur when the codes are representations on two different NCIDs
  - **Explicit** map domain will link concepts via **relationships**

Problem List Dependencies and Expectations

- **Problem List GUI dependencies**
  - Functionality that when the provider selects 'add' to the problem list the Problem is stored as the SCT ID within the record
  - Identification of the domains which to populate problem list fields
  - Identification of what controls to surface to the end user vs control on the back end
- **Terminology Server expectations**
  - Terminology server will provide the most current version of the standard
  - Terminology server will provide active concepts
  - Terminology server can translate to the SCT ID at the time of data storage and never deletes codes so that historical data can be identified

3M

Assessment Forms

- Similar to problem lists a terminology server can be used to incorporate coded structured data into the EHR assessment forms

- Differences

  – Assessment Forms will have variable sets of 'choices' and choice size

  – Assessment Forms vary by clinical specialty (nurse, physical therapy, respiratory care)

  – Assessment Forms may vary by level of acuity or environment (intensive care unit, surgical, outpatient, same day surgery)

3M

Populating Assessment Forms with Structured Data

- **Constraints**
  - Specifying the list of possible values
    - Rules vs. set list
      - Implement subset of findings domain
        - Skin color findings example
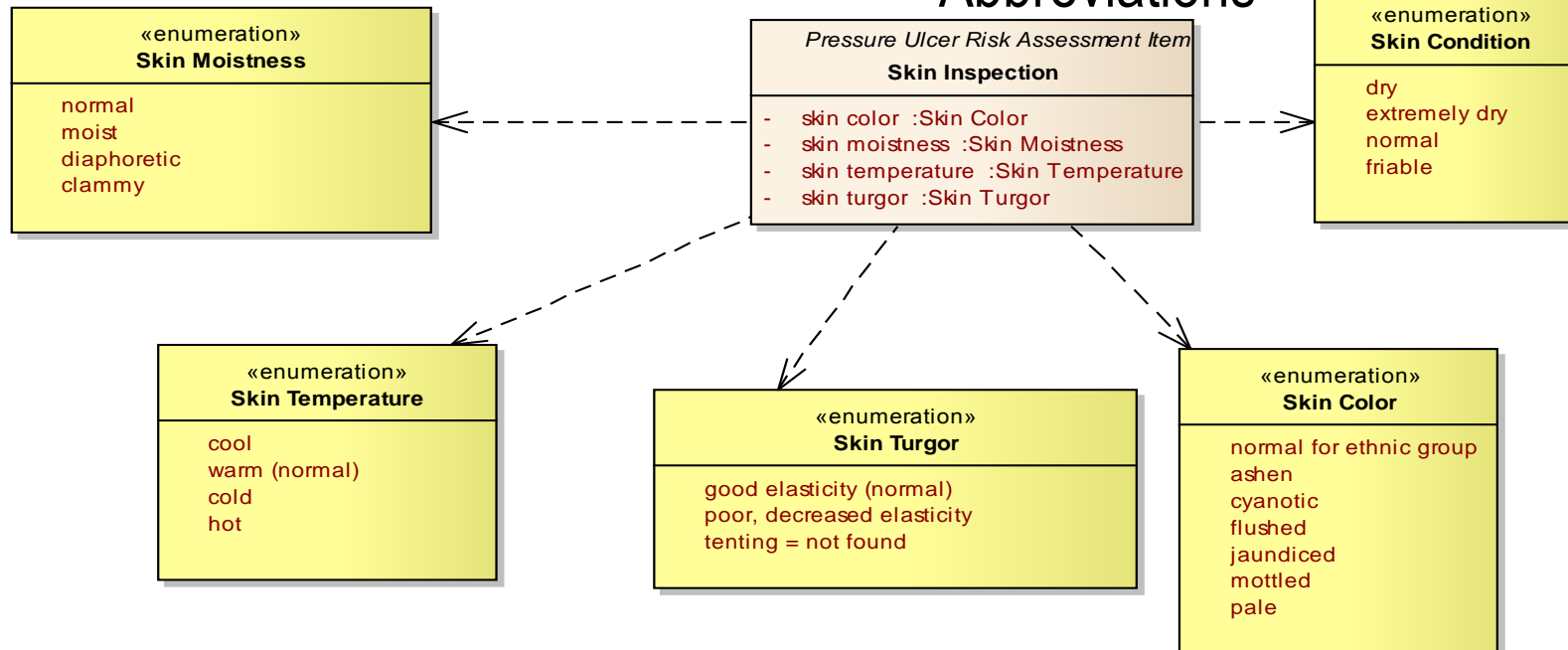
- **Populate pick lists with customized representation of SNOMED CT code**
  - Numerical 'quick keys'
  - Abbreviations

«enumeration»
Skin Moistness

normal
moist
diaphoretic
clammy

Pressure Ulcer Risk Assessment Item
Skin Inspection

- skin color :Skin Color
- skin moistness :Skin Moistness
- skin temperature :Skin Temperature
- skin turgor :Skin Turgor

«enumeration»
Skin Condition

dry
extremely dry
normal
friable

«enumeration»
Skin Temperature

cool
warm (normal)
cold
hot

«enumeration»
Skin Turgor

good elasticity (normal)
poor, decreased elasticity
tenting = not found

«enumeration»
Skin Color

normal for ethnic group
ashen
cyanotic
flushed
jaundiced
mottled
pale

Skin Assessment Example

Type	Text	Terminology	Code	Fully Specified Name
Question	**Skin Moisture**	**LOINC**	**39129-2**	**Moisture:Type:PT:Skin:Nom::**
Value	Diaphoretic	SNOMED CT	52613005	excessive sweating (finding)
Value	Moist	SNOMED CT	16514006	moist skin (finding)
Value	Clammy	SNOMED CT	102598000	clammy skin (finding)
Question	**Skin Temperature**	**LOINC**	**44968-6**	**Temperature:Type:PT:Skin:Ord:Palp**
Value	Consistent With Body Temperature	SNOMED CT	297977002	Skin normal temperature (finding)
Value	Warm	SNOMED CT	102599008	warm skin (finding)
Value	Cool	SNOMED CT	427733005	cool skin (finding)
Question	**Skin Turgor**	**LOINC**	**39109-4**	**Turgor:Imp:PT:Skin:Nom::**
Value	Good Elasticity (normal)	SNOMED CT	297956000	skin turgor normal (finding)
Value	Decreased Elasticity (Poor)	SNOMED CT	425244000	decreased skin turgor (finding)
Value	Tenting	SNOMED CT	297957009	stretched skin (finding)

Skin Assessment Example

Assessment Form Display	Text	Terminology	Code	Fully Specified Name
Skin Turgor		**LOINC**	**39109-4**	**Turgor:Imp:PT:Skin:Nom::**
WDP	Good Elasticity (normal)	SNOMED CT	2979560 00	skin turgor normal (finding)
2-Poor	Decreased Elasticity (Poor)	SNOMED CT	4252440 00	decreased skin turgor (finding)
3-Tent	Tenting	SNOMED CT	2979570 09	stretched skin (finding)

3M

Customization of Assessment Forms

- Representation that are variations of the SNOMED CT concept without changing the meaning
- Support varying levels of granularity
- Manual updates vs. definitions based on hierarchies
- Control assessment form list size and manageable categories for the end user
- Control assessment form list order

Defining Clinical Data Elements with Value Sets

▪ Value Set Guidelines

– Static vs. Dynamic

- Values are bound to one version of a value set
- Values can change and automatically expand or contract with the value set

– Intensional vs. Extensional

- Defined by a computable expression by an exact list of codes.
- Contain an exact set of codes defined by the value set

▪ Examples

– CQM value sets

– Assessment

– Research

CQMs

- Value sets are distributed by the Value Set Authority Center (VSAC) for CQMs

- Easily visualize and compare SNOMED CT value sets used in CQMs

- Consistent codes and capture from multiple sources within the EHR

- Appropriately identify which CQM codes should be incorporated into the EHR and where they should be incorporated

- Access the value sets with CTS 2 services

3M

SNOMED CT, CTS 1.2 and a Value Set Repository Value and Coded Structured Data Capture Benefits

- Improve EHR usability

- Ensure Data Integrity

- Limit time spent 'scrubbing' clinical data and increase knowledge from analytics

- Provide more efficient care to patients

3M