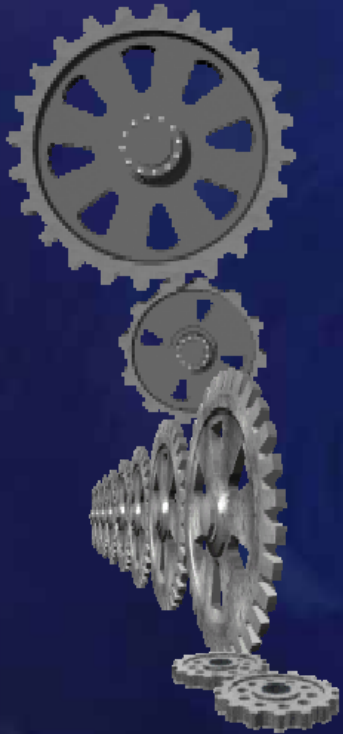


Standard terminology in pathology reporting, storage and retrieval

Next-generation systems
at Duke University



Anatomic pathology reporting: a complex process



- Reporting standards
- Customizability
- Many data consumers with varied requirements
- Retrievability



Fobcnf !
dpot ju fou!
tuboebset!
efwfnqgn fou



Dmjb jbm' !
fqjfn jph j
sftfbsdi

Gbd jnjbuf !
lopx mfehfi!
tibsph



Gvwsf
ifbmidsbf!
ebub!
sfqptjpsjt

Qspdf tt!
j gspwfn fou



I fbmidsbf
pshbo j bujpot



Fyqfsu
pqj jo

Qspn puf !
qsbdujfi !
tuboebset



E jhoptujj!
qbuijph ju



Iptqjbm!
jpsn bujo!
tztufn

Tvqqpsu
ebub!
bhhsfhbujo

T j qmiz
bddvsbuf
dbodfs!
fqjfn jphz



Uvn ps
sfh jusz

Gbd jnjbuf !
qbuijphz
sfqpsu!
hf ofsbujo

Fobcnf !
fnfduspo j!
n fe jbm
sfdpse



Qbuijphz
sfqpsu

Foibodf
qbuijph ju.
dmjb j jo!
dqn n vo jbujo



Dmjb j jo



Next generation systems at Duke University

- “Medical Assistant on the World Wide Web”
(MAW3™)
- Standardized Cancer Reporting System



Medical Assistant on the World Wide Web (MAW3™)



- Prototype for a centralized, multi-institutional medical database
- Addresses need for a centralized electronic medical record (EMR)

Currently serves as Autopsy IS at Duke

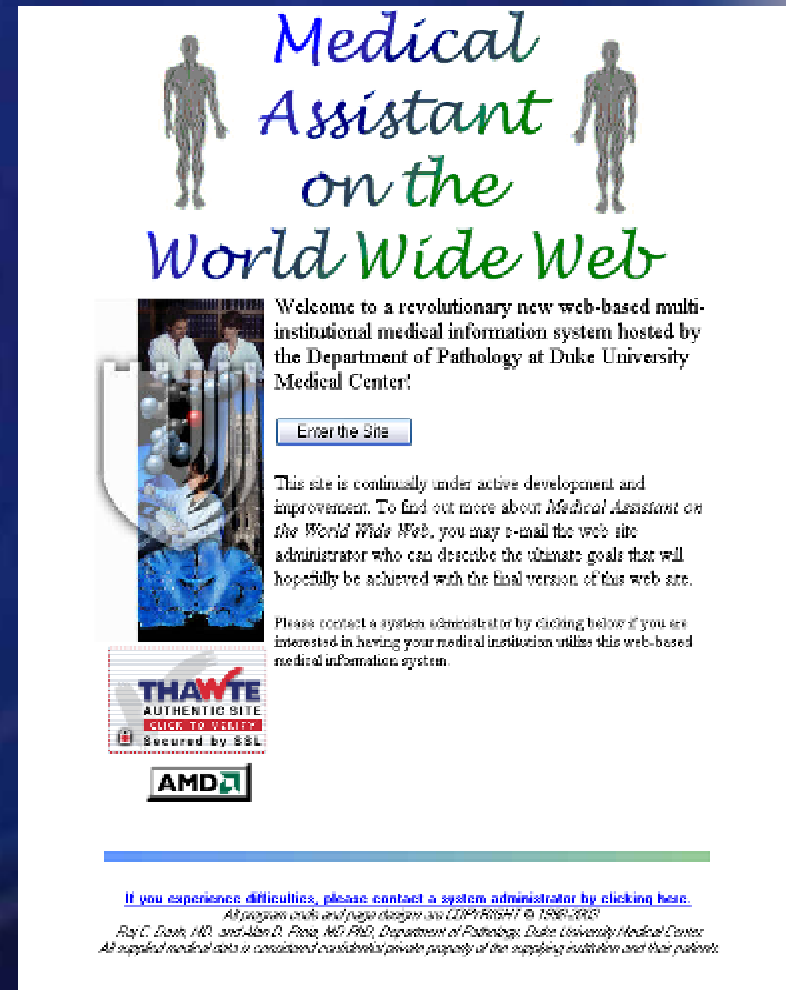
- Security is critical
- SNOMED CT encodes all data elements



MAW3 Key Components

- Data entry
- Data storage
- Data reporting
- Very flexible: multiple data paradigms
- Underlying unifying factor: **SNOMED CT**

Common terminology in which all data is encoded, stored, and referenced



The screenshot shows the homepage of the 'Medical Assistant on the World Wide Web' website. At the top, the title is written in a stylized font with 'Medical Assistant' in blue and 'on the World Wide Web' in green. Two human silhouettes are positioned on either side of the title. Below the title is a 'Welcome to a revolutionary new web-based multi-institutional medical information system hosted by the Department of Pathology at Duke University Medical Center!' message. A 'Enter the Site' button is present. A vertical image strip on the left shows medical equipment. Below the button, there is a paragraph about the site's development and a contact email address. At the bottom, there are security logos for 'THAWTE AUTHENTIC SITE SECURED BY SSL' and 'AMD'. A footer contains contact information for Ray C. Dash, MD, and Alan D. Fong, MD, PhD, and a disclaimer about medical data.

Medical Assistant on the World Wide Web

Welcome to a revolutionary new web-based multi-institutional medical information system hosted by the Department of Pathology at Duke University Medical Center!

[Enter the Site](#)

This site is continually under active development and improvement. To find out more about *Medical Assistant on the World Wide Web*, you may e-mail the web site administrator who can describe the ultimate goals that will hopefully be achieved with the final version of this web site.

Please contact a system administrator by clicking below if you are interested in having your medical institution utilize this web-based medical information system.

THAWTE
AUTHENTIC SITE
SECURED BY SSL

AMD

[If you experience difficulties, please contact a system administrator by clicking here.](#)

All program code and page design are ©1994-1995
Ray C. Dash, MD, and Alan D. Fong, MD, PhD, Department of Pathology, Duke University Medical Center
All supplied medical data is considered confidential/private property of the supplying institution and their patients.

Current User: Raj Dash (Attending, Administrator, Director) at Duke University Medical Center, Durham, NC

Connection: web server prancer, data s

Current Topic: ATEST-11-01 - Autopsy Report - Cardiovascular System - Heart

Autopsy

Coronary artery

Normal

Right Coronary Artery

The coronary artery has no atherosclerosis. There are no occlusive thromb

Left Main Coronary Artery

The coronary artery has no atherosclerosis. There are no occlusive thromb abnormalities. A normal distribution of red and white pulp is present. No c

Circumflex Branch

The coronary artery has no atherosclerosis. There are no occlusive thromb

Encoding Free Text using SNOMED CT

- Link from source text to encoded representation
- Natural language processor
- Related term browser

Medical Assistant on the World Wide Web - Encode Text -- Web Page Dialog

Free Text Encoder [Encode]

Representative sections of the heart demonstrate no evidence of fibrosis or hemorrhage. There is no evidence of ischemia or inflammation. No lesions are

[Find Related] [Change]

Code Details and Related Concepts

- alternative_suggestions
 - "Ischemia"
 - code = 87658016
 - "Retinal ischemia"
 - "Subendocardial ischemia"
 - "Transient ischemia"
 - "Asymptomatic ischemia"
 - "Arterial ischemia"
 - "Peripheral ischemia"
 - "Flap ischemia"
 - "Ischemia score"
 - "Cerebral ischemia"
 - "Choroidal ischemia"
 - "Myocardial ischemia"
 - "Cardiac ischemia"
 - code = 493026016

Encoded Sentence

- "Representative sections of the heart demonstrate"
- "There is no evidence of ischemia or inflammation"
- phrases
 - "ischemia"
 - phrase = ischemia
 - sentenceidx = 1
 - phraseidx = 0
 - charidx = 0
 - charLen = 35
 - absoluteOffset = 89
 - isNegatory = true
 - certainty = 1
 - leftContext = there is no evidence
 - rightContext = or
 - keyword_forms
 - coded_forms
 - "Ischemia"
 - conceptID = 52674009
 - descriptionID = 87658016
 - "inflammation"
 - "No lesions are identified"

52674009 [OK] [Cancel]

Enter free text into the window at the top left, then press the ENCODE button - review the returned codes, and press OK to continue, or Cancel to abort

Encoding Free Text using SNOMED CT

- Identify SNOMED CT code meaning
- Browse Hierarchy
- View canonical forms

Medical Assistant on the World Wide Web - Encode Text -- Web Page Dialog

Free Text Encoder

Representative sections of the heart demonstrate no evidence of fibrosis or hemorrhage. There is no evidence of ischemia or inflammation. No lesions are identified.

Code Details and Related Concepts

- code_details
 - descriptionID = [no value]
 - conceptID = 52674009
 - conceptStatus = 0
 - fullySpecifiedName = Ischemia (disorder)
 - snomedID = F-39340
 - ctv3ID = X79pz
 - isPrimitive = true
 - parent_concepts
 - sibling_concepts
 - children_concepts
 - literal_canonical_form
 - short_canonical_form
 - long_canonical_form

Encoded Sentences

- "Representative sections of the heart demonstrate"
 - "There is no evidence of ischemia or inflammation"
 - phrases
 - "ischemia"
 - phrase = ischemia
 - sentenceIdx = 1
 - phraseIdx = 0
 - charIdx = 0
 - charLen = 35
 - absoluteOffset = 89
 - isNegatory = true
 - certainty = 1
 - leftContext = there is no evidence
 - rightContext = or
 - keyword_forms
 - coded_forms
 - "Ischemia"
 - conceptID = 52674009
 - descriptionID = 87658016
 - "inflammation"
 - "No lesions are identified"

52674009

Enter free text into the window at the top left, then press the ENCODE button - review the returned codes, and press OK to continue, or Cancel to abort

College of American Pathologists Cancer Reporting Protocols



- Specifies of required data elements in cancer reports
- $\geq 90\%$ compliance for ACoS Cancer Center accreditation (begins 2004)
- Over 30 site-specific protocols with complex, cascading requirements
- SNOMED CT encodings developed in cooperation with CAP Cancer Committee



Colon and rectum

CAP. COLO

CARCINOMA OF COLON/RECTUM (SPECIFY):

Histologic type
TYPE co

- [1] Adenocarcinoma
- [2] Mucinous adenocarcinoma
- [3] Signet ring cell carcinoma
- [4] Undifferentiated carcinoma
- [5] Other (specify: _____)
- [X] Cannot be determined

Histologic grade
GRADE co

- [1] Low grade
- [2] High grade
- [X] Cannot be determined

Extent of invasion
INVA co

- [5] Intracolonic carcinoma
 - [5A] Lamina propria invasion only
 - [5B] Into (not through) muscularis mucosae only
- [1] Submucosa
- [2] Into (not through) muscularis propria
- [3] Through muscularis propria into subserosa/pericolic tissue
 - [3A] ≤ 5 mm into subserosa/pericolic tissue
 - [3B] > 5 mm into subserosa/pericolic tissue
- [4] Invades other structures or peritoneal cavity
 - [4A] Directly invades extracolonic organs/structures (specify)
 - [4B] Perforates visceral peritoneum

Margin

Proximal: _____ Negative _____ Positive _____ Indeterminate

Distal: _____ Negative _____ Positive _____ Indeterminate

Radial (deep): _____ Negative _____ Positive _____ Indeterminate

Closest margin: _____, cm

Vascular (small vessel) invasion: _____ Negative _____ Positive _____ Indeterminate

Vascular (large venous) invasion: _____ Negative _____ Positive _____ Indeterminate

Perineural invasion: _____ Negative _____ Positive _____ Indeterminate

Tumor border configuration: _____ Pushing (smooth) _____ Infiltrating (ragged)

Peritumoral lymphocytic response: _____

- [1] None
- [2] Mild to moderate
- [3] Marked ("Crohn's-like response")

Associated adenoma(s): _____ Absent _____ Present (specify: _____)

Appendix: _____ No pathologic diagnosis _____ Other (specify: _____)

Regional lymph nodes
NODES co

- [N] Negative for carcinoma, _____ lymph nodes examined
- [P] Metastatic malignancy in _____ of _____ lymph nodes
(For solitary metastatic focus ≤ 2 mm, include explanatory note)
- [S] Lymph nodes reported separately
- [X] No lymph nodes recovered

Additional findings: _____



Cancer Reporting System Software layers

- Data entry module
 - Web server pages
- Relational database backend
 - SNOMED CT encoding
 - Item logic
- Visual template construction environment



CAP Cancer Protocol Checklists

Select
template

Abdominoperineal resection

Other

Length

Histologic type

Adenocarcinoma

Mucinous adenocarcinoma

Signet ring cell carcinoma

Undifferentiated carcinoma

Other

Cannot be determined

Breast

Colorectum

Lung

Pancreas

Test

Histologic grade

Low grade

High grade greater than or equal to 50% gland formation

Cannot be determined

Not applicable

Extent of invasion

Intramucosal carcinoma

Submucosa

Into (not through) muscularis propria

Through muscularis propria into subserosa/pericolic tissue

Invades other structures or peritoneal cavity

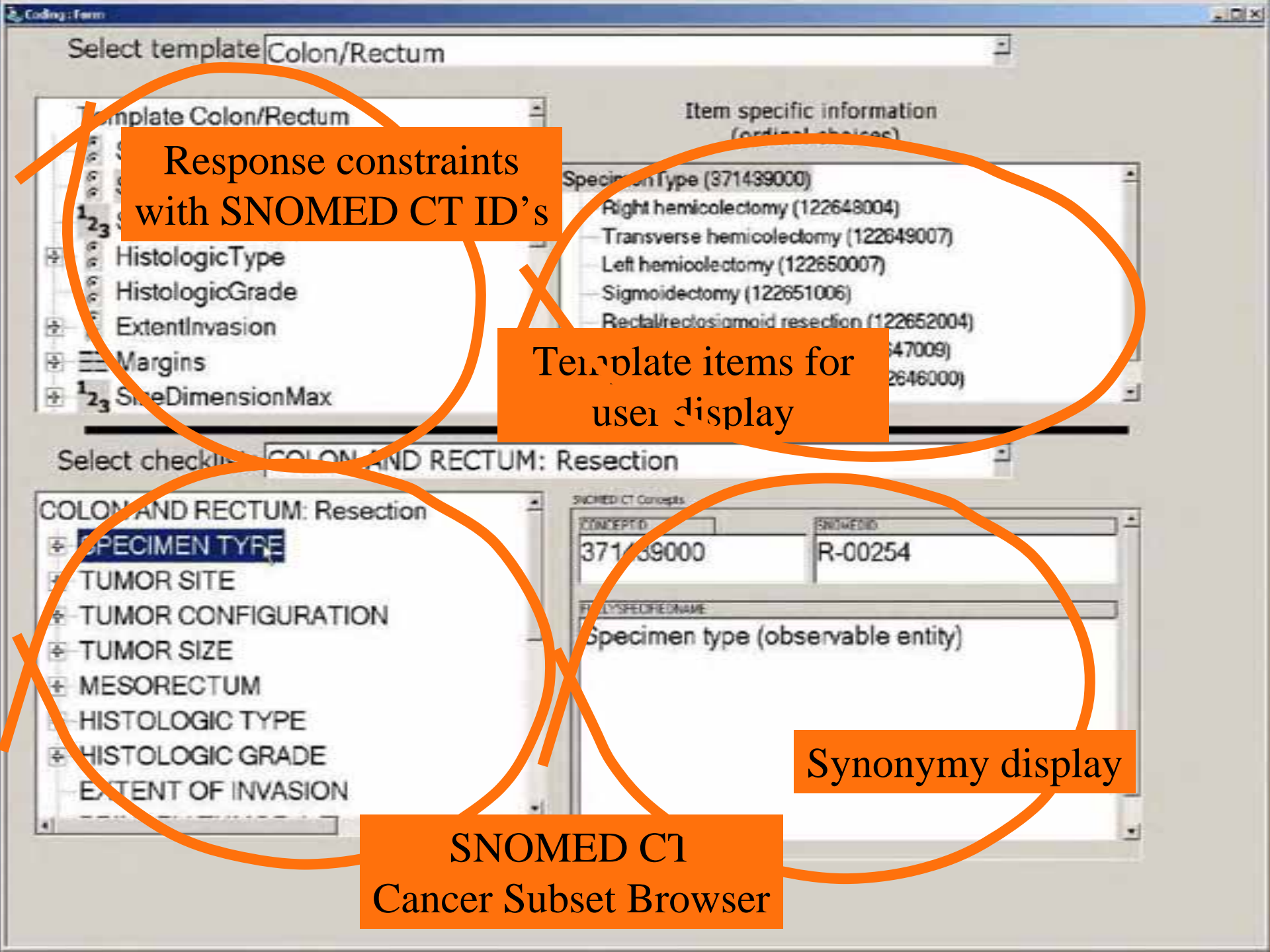
Margins

Cancer Reporting System

User Input

- Simple, visual interface
 - Checkboxes, dropdown lists, etc.
 - Error & type checking
 - Context dependent constraints, hide/show, computed outputs
- Hyperlinks to protocols, tooltip help
- Platform independent (web-based)





Response constraints with SNOMED CT ID's

Template items for user display

Synonymy display

SNOMED CT
Cancer Subset Browser

Cancer Reporting System

Flexible output



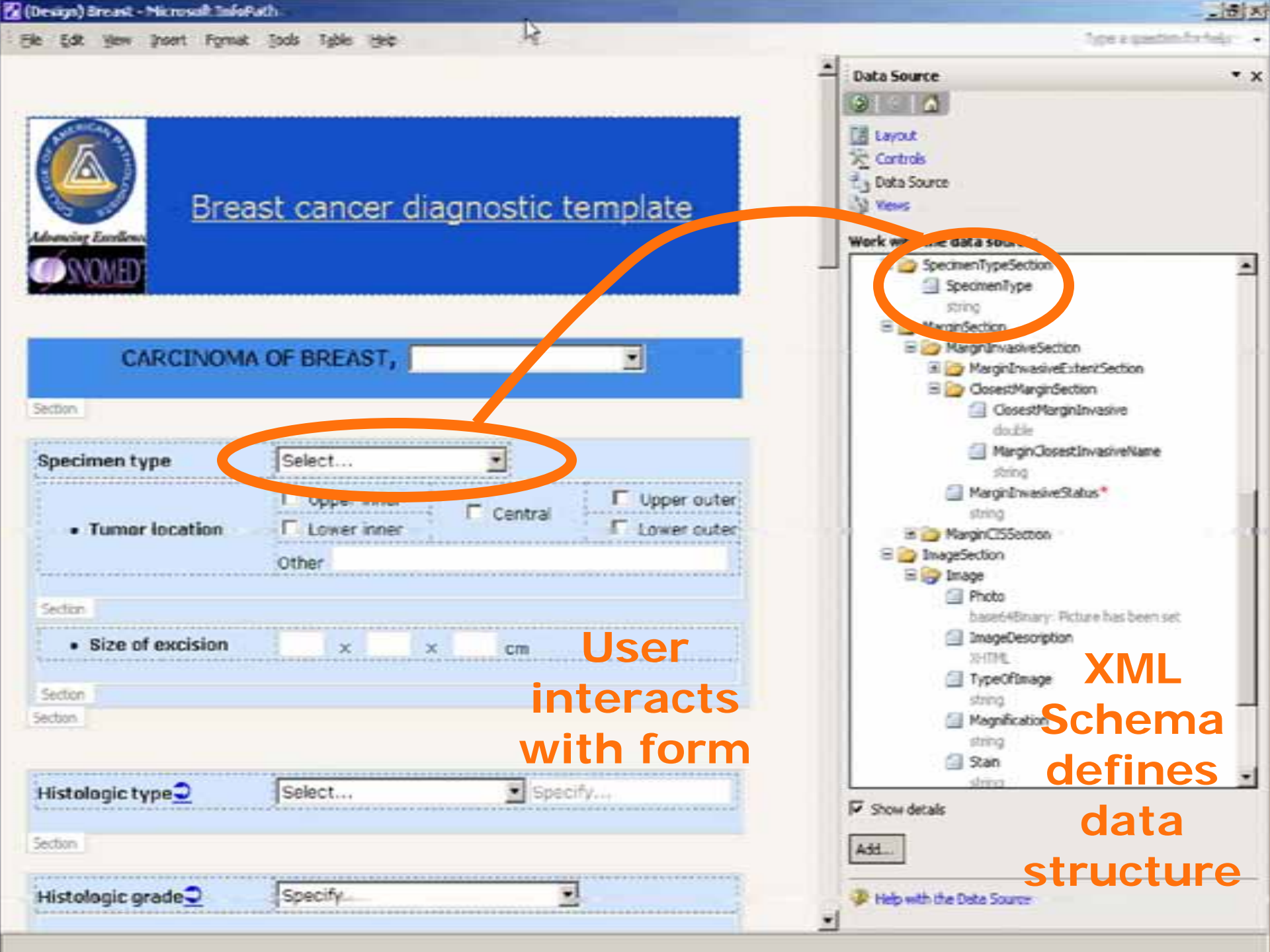
- Same “input” template can have many different output representations
 - TXT, RTF
 - XML, including CDA Level 1 wrapper
 - CDA Level 2 on the way...



XML output with SNOMED CT codes

```
<CAP:Choices>
  <CAP:Choice Name="Cecum" Text="Cecum" Ordinal="1" ChoiceID="1407">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="32713005"/>
    </CAP:Codes>
  </CAP:Choice>
  <CAP:Choice Name="Right (ascending) colon" Text="Right (ascending) colon" Ordinal="2" ChoiceID="1408">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="9040008"/>
    </CAP:Codes>
  </CAP:Choice>
  <CAP:Choice Name="Hepatic flexure" Text="Hepatic flexure" Ordinal="3" ChoiceID="1409">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="48338005"/>
    </CAP:Codes>
  </CAP:Choice>
  <CAP:Choice Name="Transverse colon" Text="Transverse colon" Ordinal="4" ChoiceID="1410">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="485005"/>
    </CAP:Codes>
  </CAP:Choice>
  <CAP:Choice Name="Splenic flexure" Text="Splenic flexure" Ordinal="5" ChoiceID="1411">
    <CAP:Codes>
      <CAP:Code Terminology="SNOMED CT" Value="72592005"/>
    </CAP:Codes>
  </CAP:Choice>
</CAP:Choices>
```





Breast cancer diagnostic template

CARCINOMA OF BREAST,

Select...

Upper inner Lower inner Central Upper outer Lower outer

Other

Size of excision x x cm

Select... Specify...

Specify...

User interacts with form

XML Schema defines data structure

Key terminologic synergies

- **Standard vocabulary (e.g. SNOMED CT)**
 - Rich internal relationships
 - Can constitute new relationships (post-coordinations, compositions)
- **Templates (e.g. CAP Cancer Specs)**
 - Reusable context to capture stereotypical healthcare scenarios
- **Structured documents (e.g. HL7 CDA)**
 - Allow encodings to address natural-language assertions at high granularity

