
CAP Electronic Cancer Checklists (CAP eCC) Overview

An International Implementation of SNOMED CT®



Outline

- Structured Reporting
- The CAP Cancer checklists
- Moving from paper form to application
- XML & the Cancer Checklists
- Demo of the example XHTML implementation
- Adoption
- Putting collected Pathology information to use

Structured Reporting

A systematic process for the creation and management of clinical documentation

- Standardized content
- Consistent placement/sequence of information
- Processible content
 - All clinically significant information is semantically encoded
 - Clinical decision/diagnostic support systems (CDSS)
 - System interoperability
 - Supports a robust electronic analysis process

Narrative → Structured Reports

- **Traditional Narrative Report**
 - Stored, managed and utilized as a document
- **Synoptic Report**
 - A summary (synopsis) of the findings included in the narrative
 - Generally accepted & standardized content
 - **Synoptic/Summary Section augments a traditional Narrative Report**
- **Structured Report**
 - Expands the concept of the synoptic report
 - All clinically important information is coded
 - Limited narrative, only where needed for clarification
 - **Narrative information augments a Structured Report**

Some Functional Aspects of Structured Reports

- **Collection (templates or checklists)**
 - CAP Cancer Checklists
- **Transport (interoperability)**
 - HL7 2.X
 - Clinical Document Architecture (HL7)
 - Emerging Anatomical Pathology sub-standard
 - Continuity of Care Record (ASTM → HL7)
 - Semantic Web
- **Data Management**
 - OLTP (transaction processing)
 - OLAP (analytical processing)
 - Semantic Web
- **Presentation**
 - Synoptic/Summary Section of Pathology/Clinical Reports
- **Analysis**
 - Clinical Decision Support Systems
 - Public Health
 - Research



CAP Cancer Checklists

What are they?

- Guidelines to aid the pathologist in collecting the essential data elements needed in the pathology report for each tissue/procedure type
- Created in printable format by CAP Cancer Committee
- The CAP eCC is the electronic form of these checklists

Form vs. Application

Paper Form

CAP Approved

Digestive System • Colon and Rectum

Surgical Pathology Cancer Case Summary (Checklist)

Protocol revision date: January 2005
 Applies to invasive carcinomas only
 Based on AJCC/UICC TNM, 6th edition

COLON AND RECTUM: Resection

Patient name:
 Surgical pathology number:
 Other identifiers:

Note: Check 1 response unless otherwise indicated.

MACROSCOPIC

Specimen Type

- Right hemicolectomy
- Transverse colectomy
- Left hemicolectomy
- Sigmoidectomy
- Rectal/rectosigmoid colon (low anterior resection)
- Total abdominal colectomy
- Abdominoperineal resection
- Other (specify): _____
- Not specified

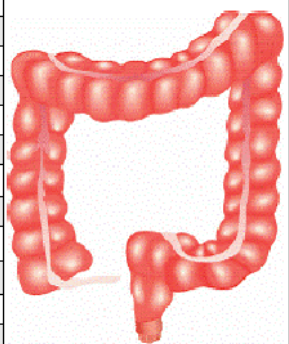
*Specimen Length (if applicable)

*Specify: ___ cm

Tumor Site

- Cecum
- Right (ascending) colon
- Hepatic flexure
- Transverse colon
- Splenic flexure
- Left (descending) colon
- Sigmoid colon
- Rectosigmoid
- Rectum
- Colon, not otherwise specified
- Cannot be determined (see Comment)

Goal

Specimen											
Site	Tissue submitted	Tumor present	Procedure								
Terminal ileum	<input checked="" type="checkbox"/>	<input type="checkbox"/>									
Cecum	<input type="checkbox"/>	<input type="checkbox"/>									
Appendix	<input type="checkbox"/>	<input type="checkbox"/>									
Ascending	<input type="checkbox"/>	<input type="checkbox"/>									
Hepatic flexure	<input type="checkbox"/>	<input type="checkbox"/>									
Transverse	<input type="checkbox"/>	<input type="checkbox"/>									
Splenic flexure	<input type="checkbox"/>	<input type="checkbox"/>									
Descending	<input type="checkbox"/>	<input type="checkbox"/>									
Sigmoid	<input type="checkbox"/>	<input type="checkbox"/>									
Rectosigmoid	<input type="checkbox"/>	<input type="checkbox"/>									
Rectum	<input type="checkbox"/>	<input type="checkbox"/>									
Anus	<input type="checkbox"/>	<input type="checkbox"/>									
Not specified:	<input type="checkbox"/>	<input type="checkbox"/>									
Other:											
Cannot be determined:											
<table border="1"> <thead> <tr> <th colspan="2">Characteristics of Primary Tumor</th> </tr> <tr> <th>Tumor Size</th> <th>Histologic Type</th> </tr> </thead> <tbody> <tr> <td>Greatest dimension: _____ * cm</td> <td><input type="radio"/> Adenocarcinoma</td> </tr> <tr> <td><input type="radio"/> Cannot be determined (specify): _____</td> <td><input type="radio"/> Mucinous adenocarcinoma</td> </tr> </tbody> </table>				Characteristics of Primary Tumor		Tumor Size	Histologic Type	Greatest dimension: _____ * cm	<input type="radio"/> Adenocarcinoma	<input type="radio"/> Cannot be determined (specify): _____	<input type="radio"/> Mucinous adenocarcinoma
Characteristics of Primary Tumor											
Tumor Size	Histologic Type										
Greatest dimension: _____ * cm	<input type="radio"/> Adenocarcinoma										
<input type="radio"/> Cannot be determined (specify): _____	<input type="radio"/> Mucinous adenocarcinoma										

eCC Features

- Interoperable (platform independent)
- Regularly scheduled releases and updates
- Versioning
- Customizable for individual lab practices
- Mappings
 - SNOMED CT® now
 - LOINC future
- Portable, exchangeable format (XML) can be utilized in various HIT systems
- Structured data elements in a logical workflow
- Developed by surgeons, pathologists, registrars and public health agencies

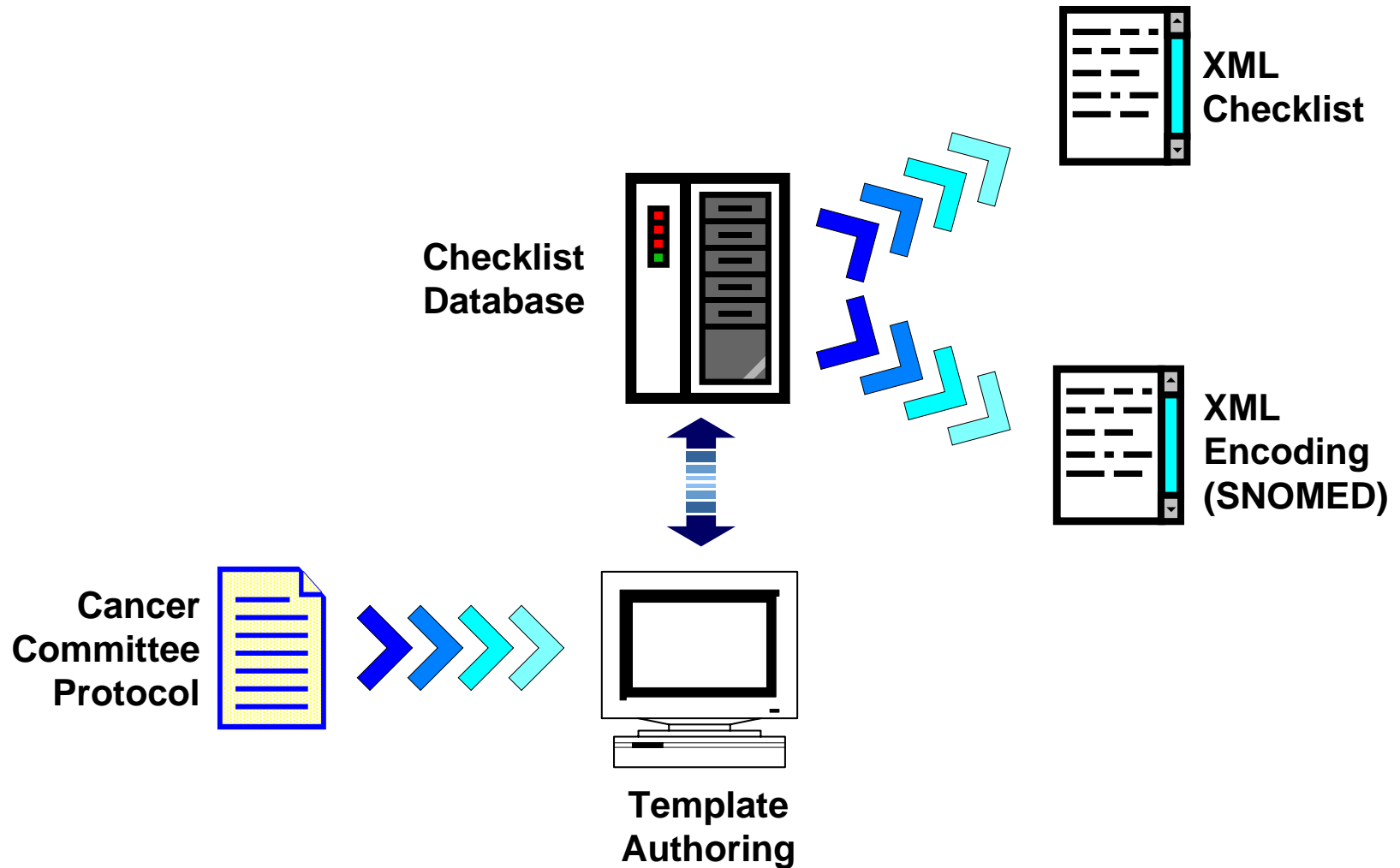
eCC Benefits

- Ensure essential data elements are collected in cancer reports
- Consistency in data collection and reporting
- Increases completeness of reports
- Aids cancer registrars; educating residents
- Allows for compliance with
 - American College of Surgeons CoC reporting requirements
 - Cancer Care Ontario's (CCO) quality standards for pathology reporting

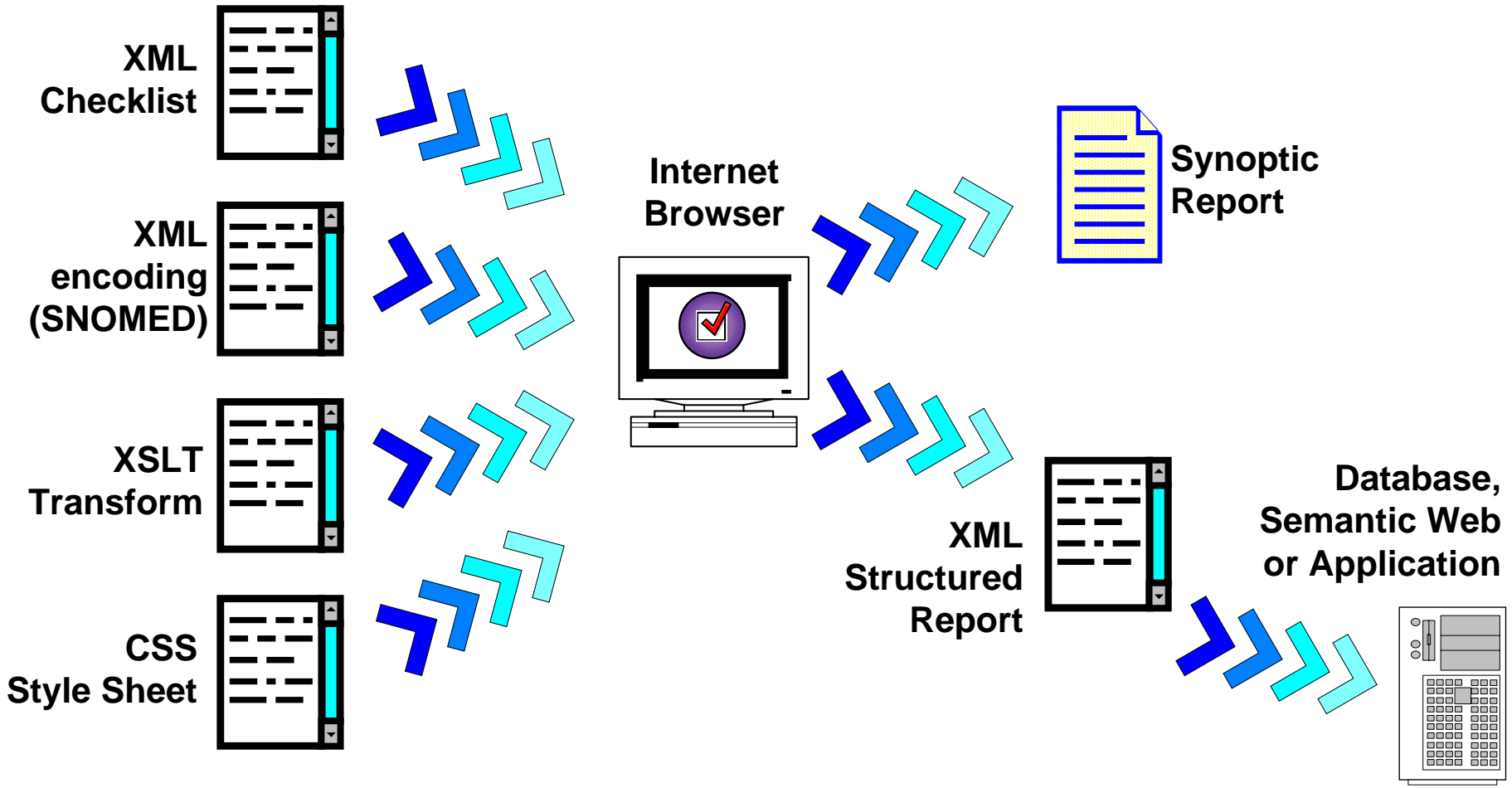
eCC in XML

- First XML release Jan 2009
 - Previously released as a database image
- Why XML?
 - Widely used open standard
 - Interoperable bridge for exchanging data between applications
 - Structured electronic document representing the information to be exchanged
 - Compatibility with existing standards (HL7, IHE, etc)

XML & the Cancer Checklists



A technology preview



CAP eCC – The XML Format

- XML file instance (each checklist)

```
ColonRectumExcisnlBx.xml
1  <?xml version="1.0" encoding="utf-8"?>
2  <?xml-stylesheet type="text/xsl" href="srtemplate.xslt" ?>
3  <template xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="http://www.w3
4  <required xmlns="">true</required>
5  <template-header xmlns="">
6  <title>Colon and Rectum: Excisional Biopsy (Polypectomy)</title>
7  <category>Digestive System</category>
8  <versions>
9  <version display-name="AJCC_UICC" major-version="6th Edition" minor-version="" />
10 <version display-name="FIGO" major-version="" minor-version="" />
11 <version display-name="CS" major-version="" minor-version="" />
12 </versions>
13 <publication>
14 <revision-date>2005-01-01</revision-date>
15 <approval-status>0</approval-status>
16 </publication>
17 <generic-header>Surgical Pathology Cancer Case Summary (Checklist)</generic-header>
18 <restrictions>Applies to invasive carcinomas only</restrictions>
19 </template-header>
20 <template-body xmlns="">
21 <note note-id="48113.100004300" sort-order="100">
22 <text>*Data elements with asterisks, or otherwise marked as optional, are not requ
23 </note>
24 <note note-id="8878.100004300" sort-order="200">
25 <text>Note: Check 1 response unless otherwise indicated</text>
26 </note>
27 <header-group header-group-id="8879.100004300" sort-order="300">
28 <required>true</required>
```

Linking to SNOMED

```
<question question-id="12267.100004300" item-ckey="12267.100004300">
  <answer-required>false</answer-required>
  <title>PRELYMPHADENECTOMY TREATMENT</title>
  <authority-required>
    <authority-id>CAP Cancer Committee</authority-id>
  </authority-required>
  <fixed-list-answer allow-multiple-selection="false">
    <fixed-list-item answer-id="12268.100004300">
      <layout column-widths="" />
      <title>Chemo/radiation therapy</title>
    </fixed-list-item>
    <fixed-list-item answer-id="12269.100004300">
      <layout column-widths="" />
      <title>No chemo/radiation therapy</title>
    </fixed-list-item>
    <fixed-list-item answer-id="12270.100004300">
      <layout column-widths="" />
      <title>Unknown</title>
    </fixed-list-item>
  </fixed-list-answer>
  <layout column-widths="" />
</question>
```

**XML
Checklist**

**SNOMED
Encoding**

```
<concept-descriptor ckey="57892.100004300" code="399497006" />
<concept-descriptor ckey="12267.100004300" code="399498001" />
<concept-descriptor ckey="13466.100004300" code="399499009" />
```

CAP eCC Example – Basic Format

Surgical Pathology Cancer Case Summary (Checklist)

Protocol revision date: 2005-01-01
Applies to invasive carcinomas only
Based on AJCC/UICC TNM, 6th Edition

Colon and Rectum: Excisional Biopsy (Polypectomy)

Patient Name:

Surgical pathology number:

*Data elements with asterisks, or otherwise marked as optional, are not required for accreditation purposes for the Commission on Cancer. These elements may be clinically important, but are not yet validated or regularly used in patient management. Alternatively, the necessary data may not be available to the pathologist at the time of pathologic assessment of this specimen.

Note: Check 1 response unless otherwise indicated

MACROSCOPIC	
*SPECIMEN TYPE <input type="radio"/> *Specimen from large intestine obtained by excisional biopsy (polypectomy) of lesion	TUMOR SITE <input type="radio"/> Cecum <input type="radio"/> Right (ascending) colon <input type="radio"/> Hepatic flexure <input type="radio"/> Transverse colon <input type="radio"/> Splenic flexure <input type="radio"/> Left (descending) colon <input type="radio"/> Sigmoid colon <input type="radio"/> Rectum <input type="radio"/> Not specified
POLYP SIZE <input type="checkbox"/> Cannot be determined (see Comment) Greatest dimension (cm) <input type="text"/> *Additional dimension (cm) <input type="text"/> *Additional dimension (cm) <input type="text"/>	POLYP CONFIGURATION <input type="radio"/> Pedunculated with stalk Stalk length (cm) <input type="text"/> <input type="radio"/> Pedunculated, no stalk <input type="radio"/> Sessile <input type="radio"/> Fragmented *Distance of Invasive Carcinoma from Anal Verge (per clinical report) <input type="radio"/> *Specify distance from anal verge (cm) <input type="text"/> <input type="radio"/> *Distance from anal verge unknown

CAP eCC Example – Table of Contents Format

- [Adrenal Gland: Resection](#)
- [Ampulla of Vater: Ampullectomy](#)
- [Ampulla of Vater: Pancreaticoduodenectomy](#)
- [Anus: Excisional Biopsy](#)
- [Anus: Local Excision \(Transanal Disk Excision\)](#)
- [Anus: Resection](#)
- [Appendix: Resection](#)
- [Bone Biopsy](#)
- [Bone Marrow: Blood Film, Aspirate, Cell Block, Trehphine Biopsy, Touch Imprint](#)
- [Bone Resection](#)
- [Brain/Spinal Cord: Biopsy/Resection](#)
- [Breast: Excision Less Than Total Mastectomy \(Includes Wire-Guided Localization Excisions\): Total Mastectomy, Modified Radical Mastectomy, Radical Mastectomy](#)
- [Colon and Rectum: Excisional Biopsy \(Polypectomy\)](#)
- [Colon and Rectum: Resection](#)
- [Endometrium: Biopsy](#)
- [Endometrium: Hysterectomy, With or Without Other Organs or Tissues](#)
- [Esophagus: Biopsy](#)
- [Esophagus: Resection](#)
- [Extrahepatic Bile Ducts: Resection](#)

Ampulla of Vater - Digestive System

CAP Approved

Surgical Pathology Cancer Case Summary (Checklist)

*Protocol revision date: 2005-01-01
Applies to invasive carcinomas only
Based on AJCC/UICC TNM, 6th Edition*

Ampulla of Vater: Ampullectomy

Patient Name:

Surgical pathology number:

*Data elements with asterisks, or otherwise marked as optional, are not required for accreditation purposes for the Commission on Cancer. These elements may be clinically important, but are not yet validated or regularly used in patient management. Alternatively, the necessary data may not be available to the pathologist at the time of pathologic assessment of this specimen.

Note: Check 1 response unless otherwise indicated

MACROSCOPIC	
<p>*SPECIMEN TYPE</p> <p><input type="radio"/> *Specimen from ampulla of Vater obtained by ampullectomy</p>	<p>TUMOR SITE</p> <p><input type="radio"/> Intra-ampullary</p> <p><input type="radio"/> Peri-ampullary</p> <p><input type="radio"/> Junction of ampullary and duodenal mucosa</p> <p><input type="radio"/> Not specified</p>
<p>TUMOR SIZE</p> <p><input type="checkbox"/> Cannot be determined (see Comment)</p> <p style="background-color: #e0e0e0; padding: 2px;"><i>Greatest dimension (cm)</i></p>	

Live Demo of the example XHTML implementation

Adoption

- New format improves content integrity and provides for greater ease of implementation
- Current Licensees
 - Majority of the LIS Vendors
 - End users (hospitals) that have custom built software
 - Cancer Registry Software vendors
- STS works in a consulting capacity to assist with CAP eCC integrations
- Technical model and Q & A approach of the CAP eCC for structured reporting has received great interest (in other areas than cancer reporting)
- In discussions with three countries that have interest in licensing the CAP eCC from a state or national level
- Consideration is being given to creating an internationally adaptive CAP eCC product (language translation, special requirements, etc)

Implementation Example- IMPAC Software

- Provider of software solutions for anatomic pathology (AP) laboratories
- PowerPath's synoptic reporting tool, version 9.2.5 and higher, received certification from Cancer Care Ontario (CCO).
- Incorporates SNOMED CT coding for question and answer sets
- Allows users to modify cancer checklist content to capture additional data elements like nipple involvement (ER/PR/HER2neu), modify workflow design, hide data elements that are not required
- Allows users to build new worksheets for synoptic reporting:
 - Flow cytometry results
 - Transplant worksheets
 - Formalin fixation

Worksheets:

Worksheet Name	Specimens Involved	Created	Release
1BREST (required fields version)		5/8/2009 8:48:10 PM	<input checked="" type="checkbox"/>



- ◆ Specimen Type Mastectomy
- ◆ Lymph Node Sampling Sentinel lymph node(s) only
- ◆ Specimen Size Can be determined
 - ◆ Greatest dimension cm
- ◆ Laterality Left
- ◆ Tumor Site Lower outer quadrant

MICROSCOPIC

- ◆ Histologic Type Ductal carcinoma in situ

Nottingham Grading

- ◆ Tubule Formation Majority of tumor greater than 75% (score = 1)
- ◆ Nuclear Pleomorphism Moderate increase in size, etc (score = 2)
 - Small regular nuclei (score = 1)
 - Marked variation in size, nucleoli, chromatin clumping, etc (score = 3)
- ◆ Mitotic Count (40x objective field/area of 0.152mm2) 6-10 mitoses per 10 HPF (score = 2)
- ◆ Total Nottingham Score Grade III: 8-9 points

Pathologic Staging (pTNM)

- ◆ Primary Tumor [pT] pT1c: Tumor > or = 1.0-2.0 cm
- ◆ Regional Nodes [pN] pN0(mol-): No regional lymph node metastasis histologically, negative non-morphologic (molecular) findings for ITCs
- ◆ Number involved
- ◆ Number examined
- ◆ Distant Metastasis [pM] pM1: Distant metastasis

MARGINS

- ◆ Margins involvement Can be assessed
 - Involved by invasive carcinoma True
 - ◆ Specify which margin

CDC cancer checklist pilot projects

- Two pilot projects funded by the CDC:
- Reporting Pathology Protocols I (RPPI) - 2001
 - SNOMED CT & LOINC encoded Colon and Rectum cancer checklists
 - California and Ohio pathology departments and cancer registries
- Reporting Pathology Protocols II (RPPII) -2004
 - SNOMED CT encoded Breast, Prostate and Melanoma cancer checklists
 - California, Pennsylvania and Maine pathology departments and cancer registries
- Reports on the CDC website at:
<http://www.cdc.gov/cancer/npcr/informatics/rpp/>

Putting collected Pathology information to use

```
<?xml version="1.0" encoding="UTF-8"?>
  <synopsis

    pert:schemaLocation="http://purl.oclc.org/medical/reporting/report/cap-cancer/resection/resection@colon.rng"
    pert:version="0.1"
    xmlns="http://www.cap.org/pert/2009/01/"

    xmlns:colon="http://www.cap.org/pert/2009/01/colon/"

    xmlns:pert="http://www.cap.org/pert/2009/01/"
  </>
  <clinical>
    <clinicalFindings>
      <clinicalFinding value="mass"/>
      <clinicalFinding value="biopsy positive for adenocarcinoma"/>
    </clinicalFindings>
  </clinical>
  <specimen>
    <procedures>
      <procedure value="segmental colectomy"/>
    </procedures>
    <sites>
      <site value="cecum"/>
      <site value="left colon"/>
    </sites>
```

```
<tumorLocations>
  <tumorLocation value="cecum"/>
</tumorLocations>
</specimen>
<tumor>
  <histologicTypes>
    <histologicType value="adenocarcinoma"/>
  </histologicTypes>
  <grade value="high"/>
  <colon:suggestMicrosatelliteInstability>
    <colon:highGrade value="positive"/>
    <colon:medullaryComponent value="negative"/>
    <colon:mucinousComponent value="negative"/>
  </colon:suggestMicrosatelliteInstability>
  <colon:immuneResponse>
    <colon:intratumoralResponse value="marked"/>
    <colon:peritumoralResponse value="mild to moderate"/>
  </colon:immuneResponse>
  <colon:tumorPerforation value="negative"/>
</tumor>
```

<accessory>

```
<colon:discontinuousExtramuralExtension
value="negative"/>
  <colon:preexistingPolyp value="villous
adenoma"/>
  <lymphovascularInvasion
value="inconclusive"/>
  <venousInvasion value="negative"/>
</accessory>
<extent>
  <invasion>
    <colon:deepestInvasion
value="muscularis propria"/>
  </invasion>
  <tumorSize dimension-1="3.5"
unit="cm"/>
</extent>
<margins>
  <margin location="distal"
status="negative"/>
  <margin location="proximal"
status="negative"/>
  <margin closest="true"
location="circumferential"
status="negative">
    <distance unit="cm" value="0.8"/>
  </margin>
</margins>
```

<nodes>

```
<nodeGroup location="posterior
cecal">
  <nodeStatus count="7"
value="total"/>
  <nodeStatus count="0"
value="positive"/>
</nodeGroup>
</nodes>
<stage>
  <T value="2"/>
  <N value="0"/>
  <M value="X"/>
</stage>
<additional>
  <findings>
    <finding value="other polyp"/>
  </findings>
</additional>
</synopsis>
```

```

@prefix cap: <http://www.cap.org/pert/2009/01/> .
@prefix colon: <http://www.cap.org/pert/2009/01/colon/> .
@prefix rdfs: <http://www.w3.org/200/01/rdf-schema#> .
@prefix cmh: <http://www.centerville-memorial-hospital.org/pid#> .
@prefix cmhsp: <http://www.centerville-memorial-hospital.org/pathology/sid#> .
@prefix cmhmd: <http://www.centerville-memorial-hospital.org/md-id#> .
@prefix dc: <http://purl.org/dc/elements/1.1/> .

```

```

<#patient> = <cmh:X875693> .
<#specimen> = <cmhsp:SL-09-12345> .
<#> dc:author <#pathologist> .
<#pathologist> = <cmhmd:9876-1> .

```

```

<#patient>
  <cap:clinicalFinding>
    [ a <cap:Mass>,
      [ <cap:diagnosedBy> <cap:Biopsy>; a <cap:Cancer> ]
    ]

```

```

<#patient> <cap:sourceOfSpecimen> <_:ThisSpecimen> .

```

```

<#specimen> =
  [
    a <cap:Specimen>;
    <cap:derivedFromProcedure> [ a <cap:segmentalColectomy> ];
    <cap:includesAnatomicPart> [ a <anat:Cecum>,
      <anat:leftColon> ];
    <cap:involvedByDisease> <_:ThisTumor>
  ]

```

```

<_:ThisTumor>
  a <cap:Carcinoma>;
  <cap:site> [ a <anat:Cecum> ];
  <cap:histologicType> <cap:Adenocarcinoma>;
  <cap:histologicGrade> <cap:highGrade>;
  <cap:hasTumorFinding> <_:microsatelliteInstabilityFindings>;
  <colon:intratumoralResponse> <cap:marked>;
  <colon:peritumoralResponse> <cap:mildToModerate>;
  <colon:tumorPerforation> <cap:negative>;
  <colon:discontinuousExtramuralExtension> <cap:negative>;
  <colon:preexistingPolyp> [ a <cap:Concept>; rdfs:label "villous adenoma" ];

```

```

<cap:lymphovascularInvasion> <cap:inconclusive>;
  <cap:venousInvasion> <cap:negative>;
  <colon:deepestInvasion> [ a <cap:Concept>; rdfs:label "muscularis propria" ];
  <cap:size> [ <cap:dimension> 3.5; <cap:unit> [ <rdfs:label> "cm" ] ]

```

```

<_:microsatelliteInstabilityFindings> =
  (
    [ <colon:highGrade> <cap:positive> ],
    [ <colon:medullaryComponent> <cap:negative> ],
    [ <colon:mucinousComponent> <cap:negative> ]
  )

```

```

<#specimen> <cap:margin>
  (
    [
      <cap:location> <cap:distalMargin>;
      <cap:marginStatus> <cap:negative>
    ],
    [
      <cap:location> <cap:proximalMargin>;
      <cap:marginStatus> <cap:negative>
    ],
    [
      <cap:location> <cap:circumferentialMargin>;
      <cap:marginStatus> <cap:negative>;
      a <cap:ClosestMargin>
    ]
  )

```

```

<_:ThisTumor>
  <cap:regionalLymphNodes>
    [
      <cap:nodeGroup> [ <rdfs:label> "posterior cecal" ];
      <cap:totalNodes> 7;
      <cap:positiveNodes> 0
    ]

```

```

<_:ThisTumor>
  <cap:T> "2";
  <cap:N> "0";
  <cap:M> "X"

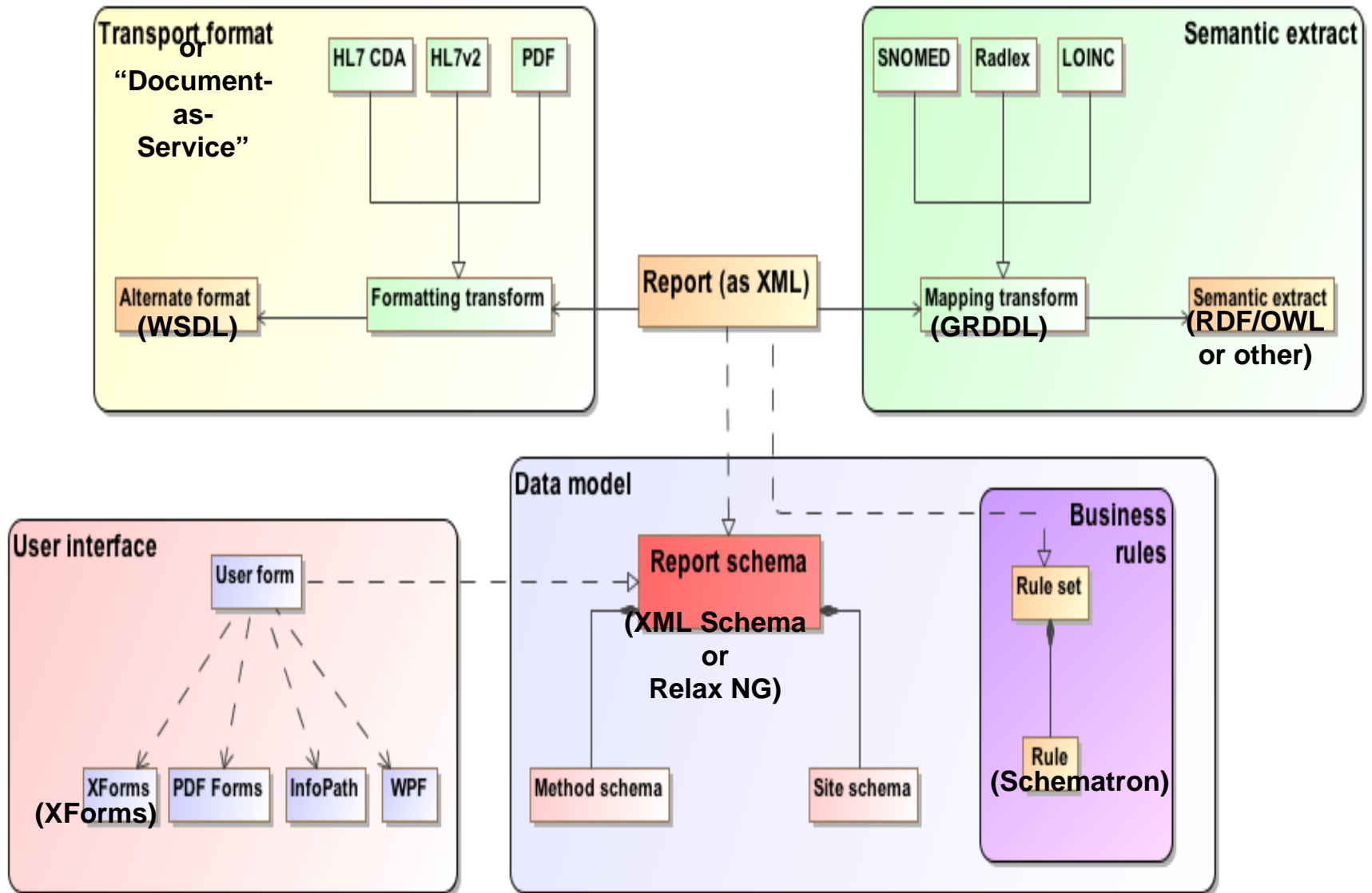
```

```

<_:ThisSpecimen>
  <cap:additionalFinding> <cap:polyp>

```

XML document model architecture



For more information regarding:

- CAP eCC questions, licensing and feedback
- Expert consulting and education programs
- Customization of the CAP eCC tailored to your needs
- Contact us at:
 - 847.832.7700
 - capecc@cap.org

