

Houston...we have a situation within our
Info Model!

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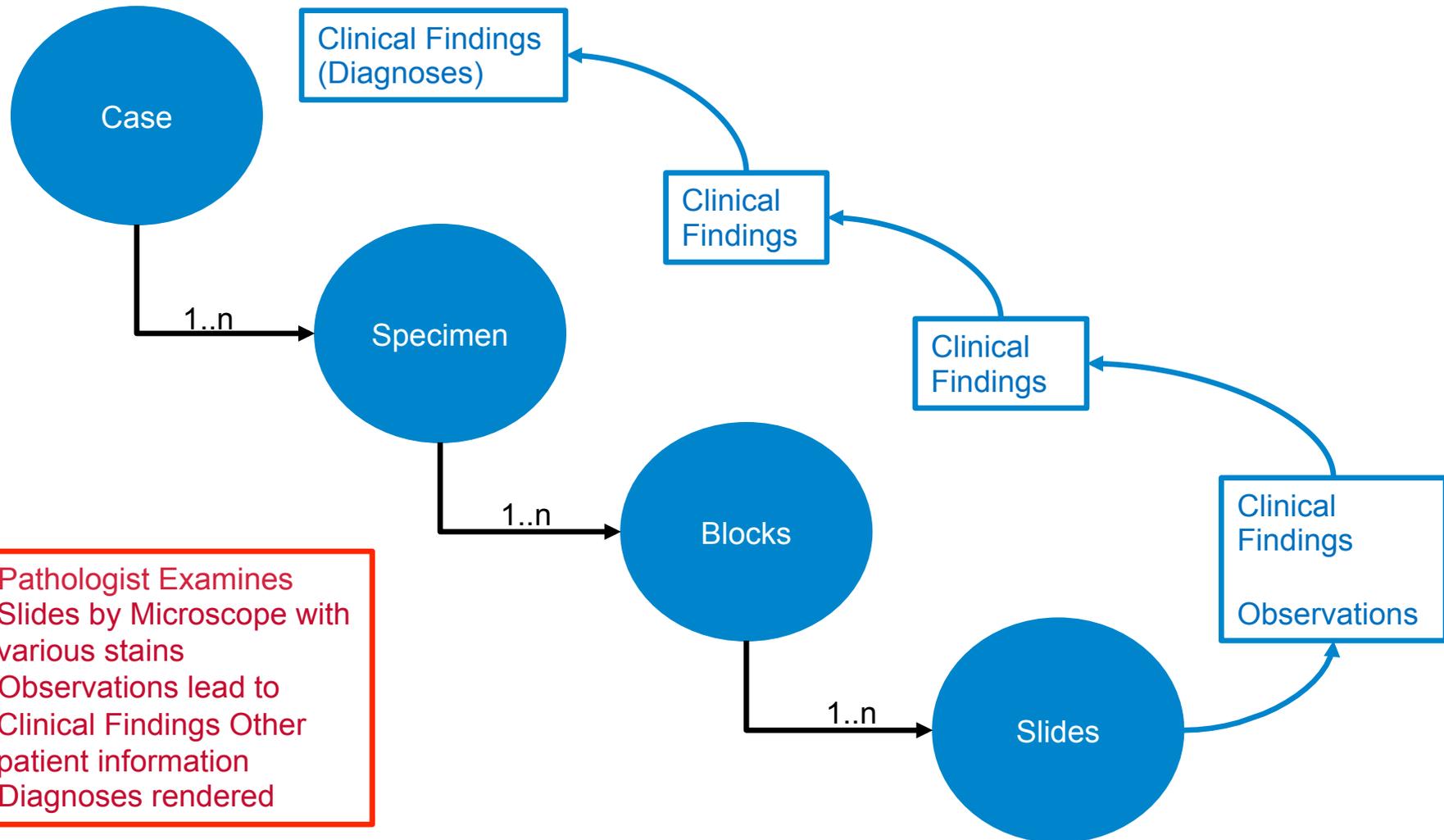


Objective

- Brief Overview of Surgical Pathology
- SNOMED CT representation of Surgical Pathology observations and findings
- Challenges to Information Models and Interoperability
- Examination of Developing Network application



Surgical Pathology Overview



- Pathologist Examines Slides by Microscope with various stains
- Observations lead to Clinical Findings Other patient information
- Diagnoses rendered



Typical Pathology Report

Final Diagnosis:

RIGHT BREAST, VACUUM-ASSISTED NEEDLE CORE BIOPSY:

- DUCTAL CARCINOMA IN SITU WITH EXTENSIVE PERIDUCTAL SCLEROSIS AND INFLAMMATION.
- FOCUS SUSPICIOUS BUT NOT DIAGNOSTIC FOR MICROINVASION.
- GROWTH PATTERN: SOLID.
- NUCLEAR GRADE: HIGH.
- NECROSIS: PRESENT.
- MICROCALCIFICATION IN DCIS: YES.

Microscopic Report: Performed

- Natural Language
- Not easily computed for knowledge use and reuse
- Microscopic Findings not enumerated



SNOMED CT Representation of Histopathology Data

- Post-coordination required for accurate expressivity
- Investigation into breast biopsy reporting (cite)
 - 75% Statements represented using post-coordinated SNOMED CT
 - 25% Statements could not be represented
 - Architectural Features, Measurement, Staining Techniques
- Observables model helps, but not entirely
- Situation hierarchy necessary
 - Interpretive specialty
 - Not black and white (uncertainty and existence)



Observable Model Example: Ductal Carcinoma in situ suspicious for microinvasion

|IS ABOUT| = 404684003|Clinical finding|:

{363698007|Finding site|= 64633006| lactiferous duct structure|,
116676008|Associated morphology|= 82711006|infiltrating duct
carcinoma|

|Scale| = 26716007|qualitative|,

|Has value| = 373068000|undetermined|,

|Technique| = 418775008|Finding method|=

What if
Immunohistochemistry?

(104210008|hematoxylin and eosin stain method| +

252416005|histopathology test| + 104157003|light microscopy|)

|DIRECT SITE|=373102004 | specimen from breast obtained by image
guided core biopsy|



Diagnostic Level Statement:

Example: Ductal Carcinoma in situ suspicious for microinvasion

243796009|situation with explicit context|:

{408729009|finding context| = 415684004|suspected|,

410510008|temporal context value| = 410585006|current –
unspecified|,

408732007|subject relationship context| = 410604004|subject of
record,

246090004|associated finding|= 404684003|clinical finding|:

{363698007|finding site| = 64633006|lactiferous duct structure|,

116676008|associated morphology| = 82711006|infiltrating duct
carcinoma|}

}



Communication and Storage Challenges

- How to store and exchange histopathology information without ambiguity?
- Information model?
- Messaging?
- Both?



Information Model Approach?

Axiom:

\forall Use Case (U) \exists InfoModel (I_n) where $n \geq 1$

OR

There are many potential information models
for any single use case

Therefore

Broad acceptance and adherence to model is
necessary to succeed



Example: CAP Cancer Checklists

- Represent a broadly accepted info model
- Series of Key-Value pairs important
- SNOMED CT representation
 - Primitive concepts used
 - Not necessarily consistent between entities
 - \exists Gaps in expressivity needed



Sample Question From DCIS Checklist

+ Architectural Patterns (select all that apply) (Note E)

+ ___ Comedo

+ ___ Paget disease (DCIS involving nipple skin)

+ ___ Cribriform

+ ___ Micropapillary

+ ___ Papillary

+ ___ Solid

+ ___ Other (specify: _____)

All are morphologic abnormalities with primitive codes



Suspicion of microinvasion?

- No concept or answer in DCIS checklist
- No concept or answer in Invasive Carcinoma checklist
- Clinically significant concept
 - Not a diagnosis or definitive clinical finding
 - Patient will be treated more aggressively
- Absence findings not represented (e.g., epithelial hyperplasia w/o atypia)

Information Model Approach is incomplete



Messaging Approach?

- **HL7 - Use syntax of terminology** (http://www.hl7.org/v3ballot/html/infrastructure/datatypes_r2/datatypes_r2.htm)

- **Augmented Backus-Naur Form (ABNF)**

DCIS Suspicious for microinvasion^243796009:{408729009=415684004, 410510008=410585006,408732007=410604004,246090004=404684003: 363698007 = 64633006|,116676008 = 82711006}}^SN

- **CDA Defined Format (for Surgical Pathology Reports?)**
 - Management of post-coordinated expressions



Messaging Challenges

- Valid expression testing
- HL7 standard CDA for surgical pathology reports
- Information system ability to construct / deconstruct expression and store
- Difficult...but not impossible
 - Use of Interface engines
 - Expression validator (similar to HL7 format validation?)

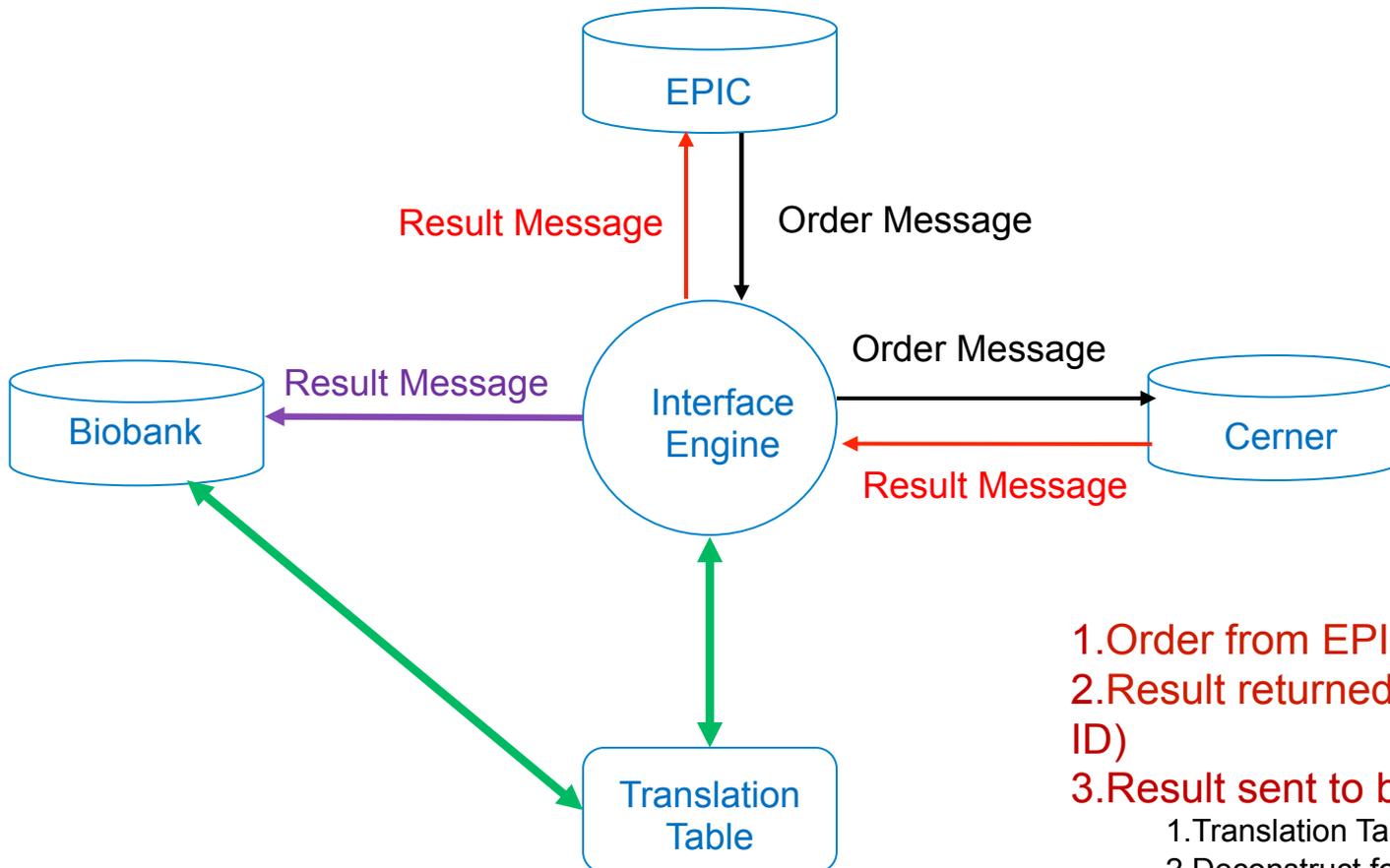


Local Example of Possibilities

- **Four systems**
 - EPIC EHR (Cache)
 - Cerner Copath Pathology Information System (Cache)
 - Tissue Biobank Information System (Neo4j)
 - Cloverleaf Interface Engine
- **Key Workflow Facts**
 - All surgical pathology cases reported in Cerner Copath
 - SNOMED CT encoded synoptic reports produced (single SCTID)
 - EPIC and Cerner use translation tables
 - Biobank stores data in post-coordinated form



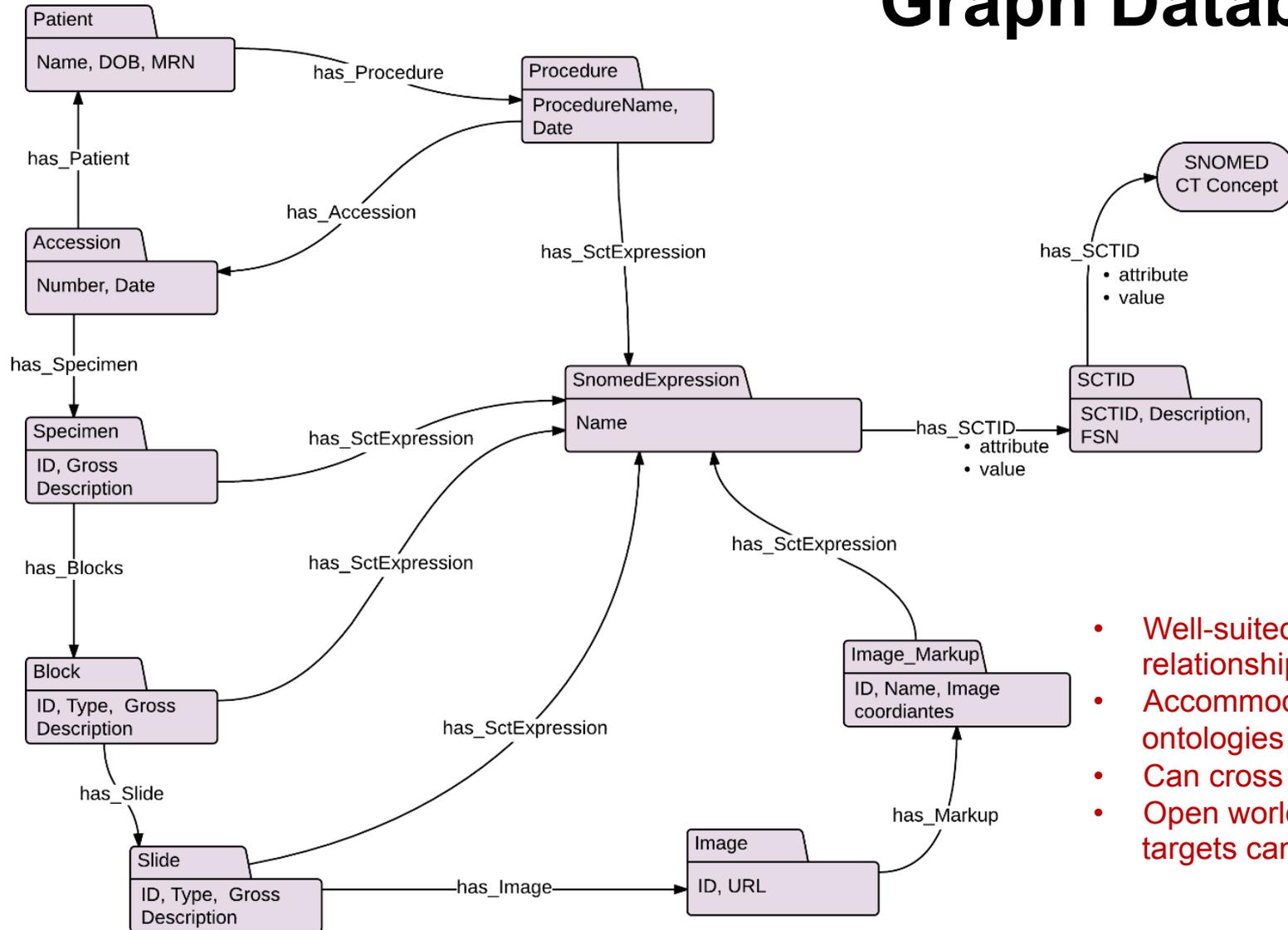
Information Flow



1. Order from EPIC to Cerner
2. Result returned to EPIC (Local ID)
3. Result sent to biobank
 1. Translation Table
 2. Deconstruct for post-coordination
 3. Construct Local ID for pre-coordination



Graph Database



- Well-suited for relationship discovery
- Accommodates ontologies
- Can cross ontologies
- Open world => data targets can be ?



Limitations of Approach

1. Local Extensions Issues

1. Limitation of current information systems
2. Serves purpose well...for now
3. Limits extensibility of post-coordination to those who share the Translation table

2. Post-coordination issues

1. Storage (SQL or NoSQL)
2. NoSQL expertise
3. Expression validity testing



Surgical Pathology Summary

1. Multiple information models for different use cases
 1. Pathology sign out and reporting
 2. EHR
 3. Tissue Banking and histopathology data
2. Need for expressivity requires post-coordination
3. Information created and stored differently by each system. (Info Models can co-exist)
4. Just-in-time post-coordination automation?
5. HL7 standard for CDA AP model needed



Concluding Thoughts – precedence?

1. TCP/IP standard

1. Packet format defined, payload agnostic (messaging?)
2. Devices produce and consume TCP/IP protocol (Info model?)

2. Electrical transmission

1. Current and voltage defined (messaging?)
2. Devices transform electricity for local function (Info model?)



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Thank you

