



Cloud-based Solution for Real-time Reporting of Cancer Data

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CDC/NPCR Program Review

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Problem Statement, Need, and Solution



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Problem Statement

- Current data collection and reporting methods are hindered by manual processes
- Result is inherently needless time lags and costly inefficiencies



Overarching need for more timely cancer incidence data for

- Faster identification of cancer cases for evaluation and improvement of cancer control strategies
- Better-informed decisions about where resources need to be allocated for cancer prevention, control, and treatment



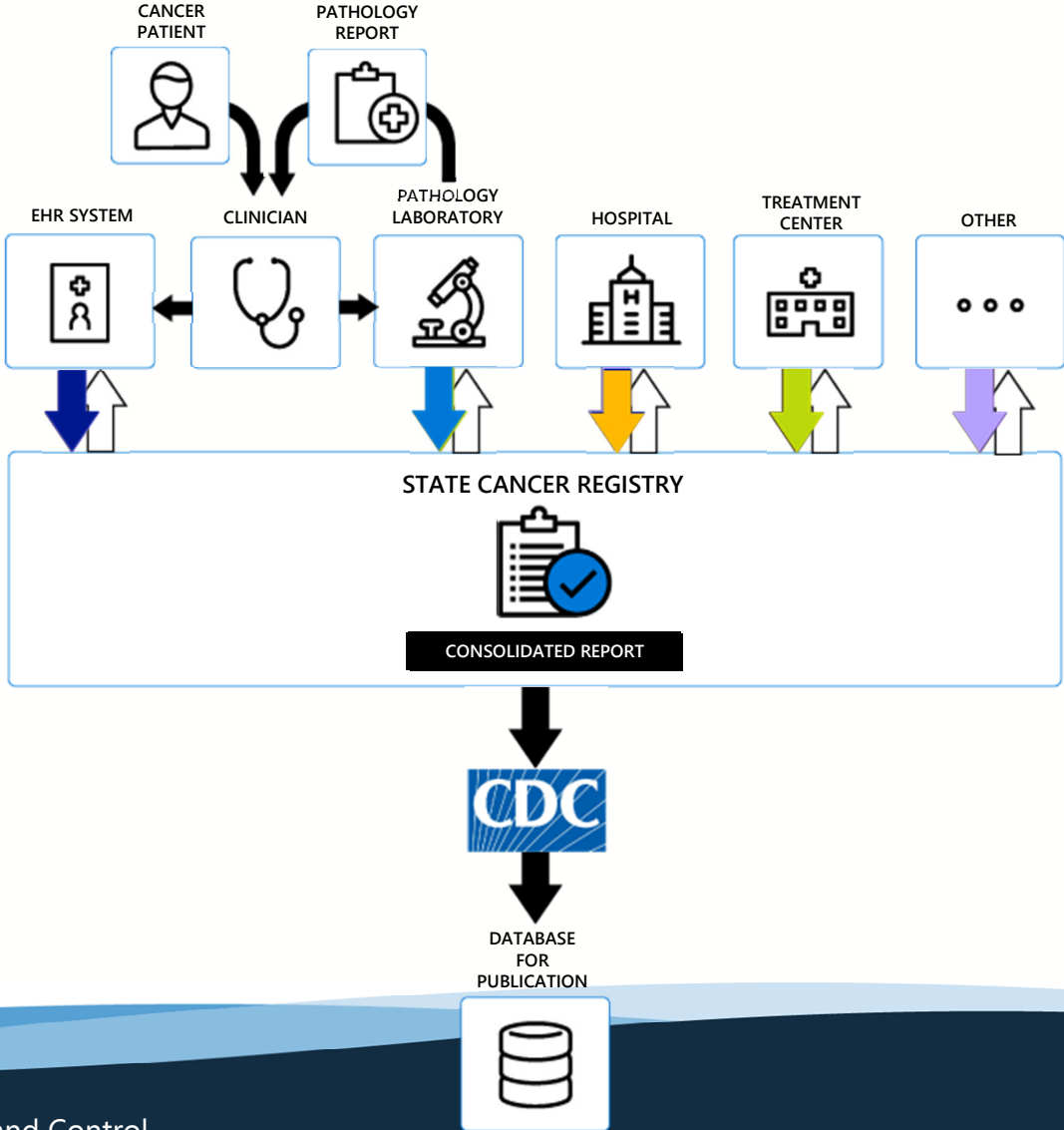
Solution

- Removal of inefficiencies to move from publishing on 24 month to real-time data
- Use of cloud-based platform to achieve real-time reporting to the central cancer registry

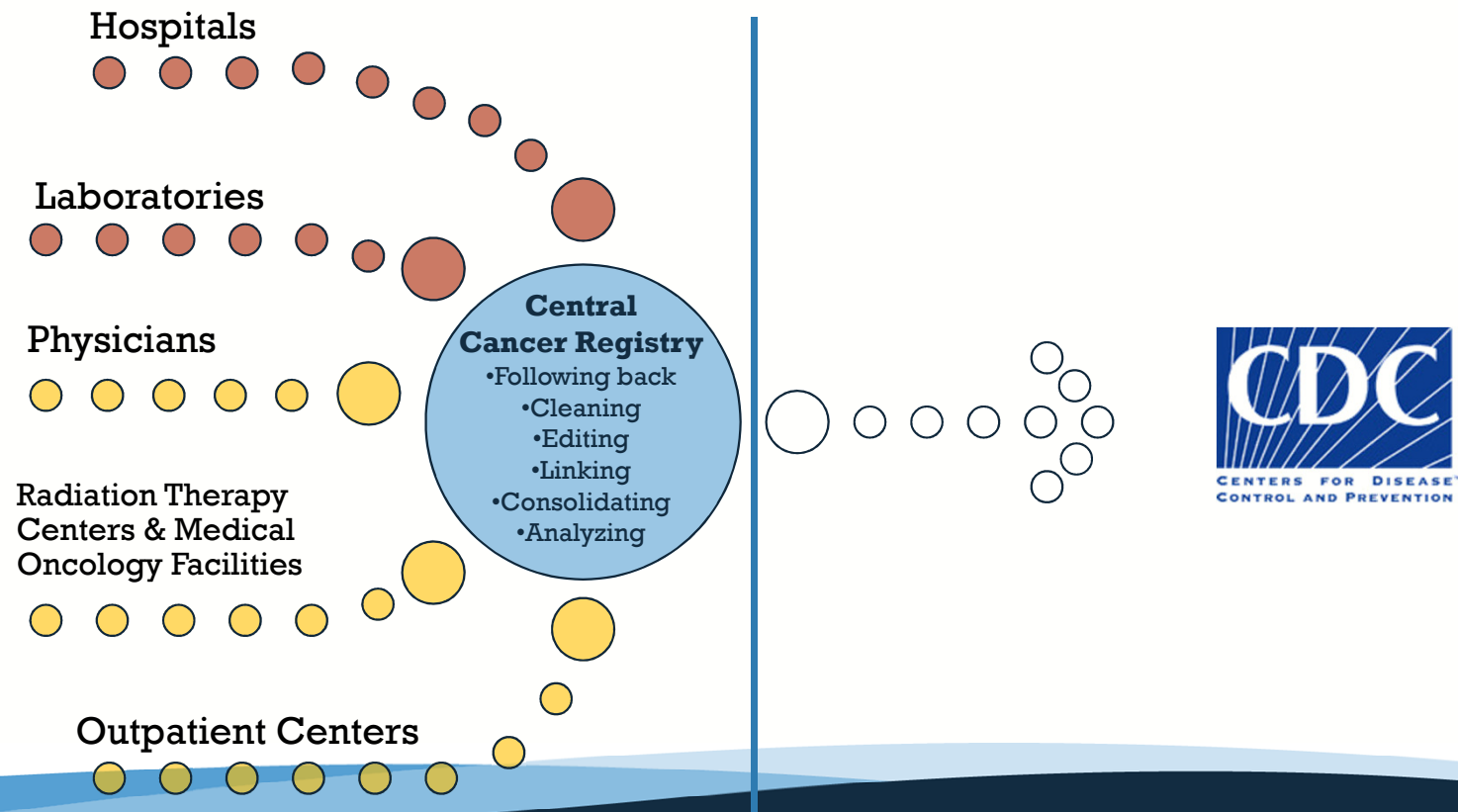
Current State



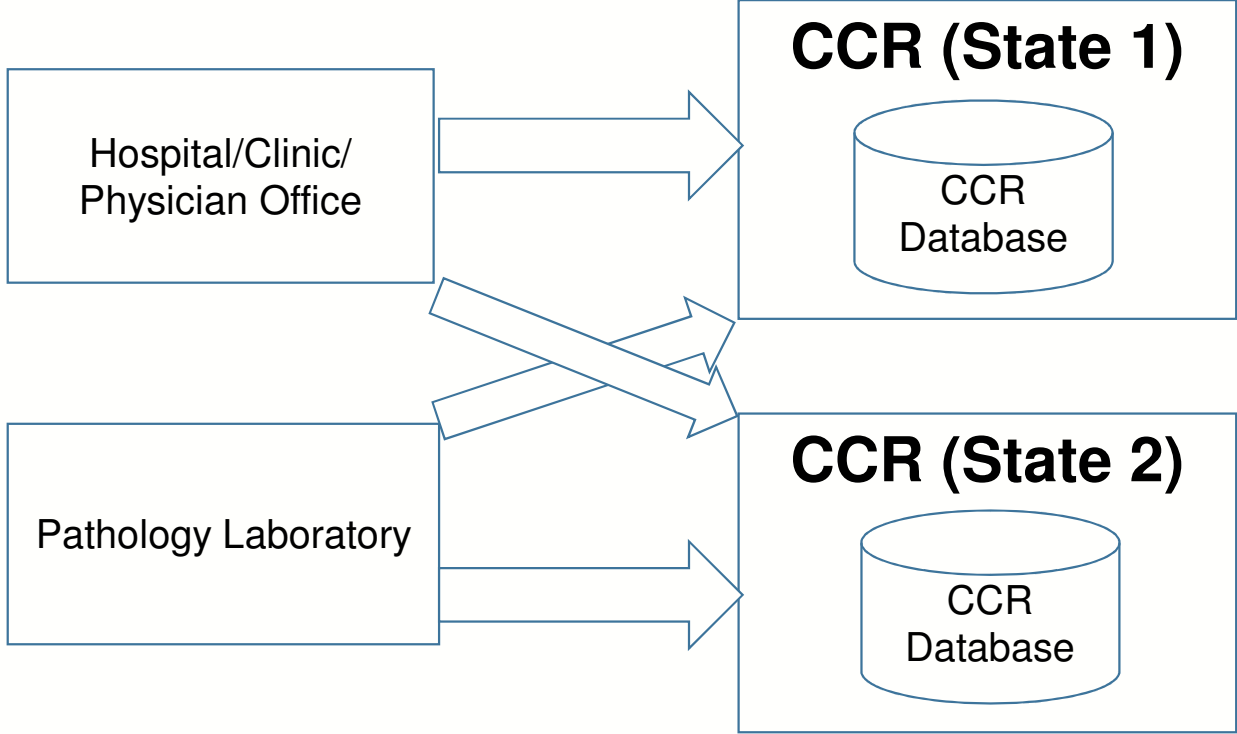
Current State:
National Program of Cancer Registries (NPCR)
Information Flow



Current State: National Program of Cancer Registries (NPCR) Information Flow



Current State: National Program of Cancer Registries (NPCR) Information Flow



Future State



Future State: Cloud-based Computing Platform (CBCP) for Real-Time Reporting

Advantages


- Shorten time from case identification to completed incidence record available in CCR database
- Shift CCR staff work to spend less time on file processing, running multiple separate applications, and tracking down missing data, to more productive tasks

Vision

- Labs send electronic pathology reports in real time to cloud-based service
- Service automatically processes these reports by extracting and coding salient data elements

Future State: Cloud-based Computing Platform (CBCP) for Real-Time Reporting

CBCP initiates abstracting process by automatically notifying the ordering facility to request that they complete partial abstract created by CBCP



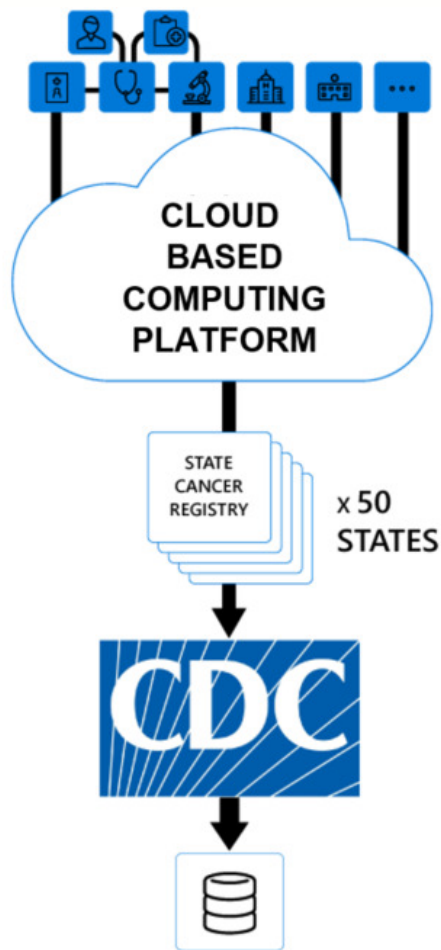
Facility completes abstract via the cloud service(s)



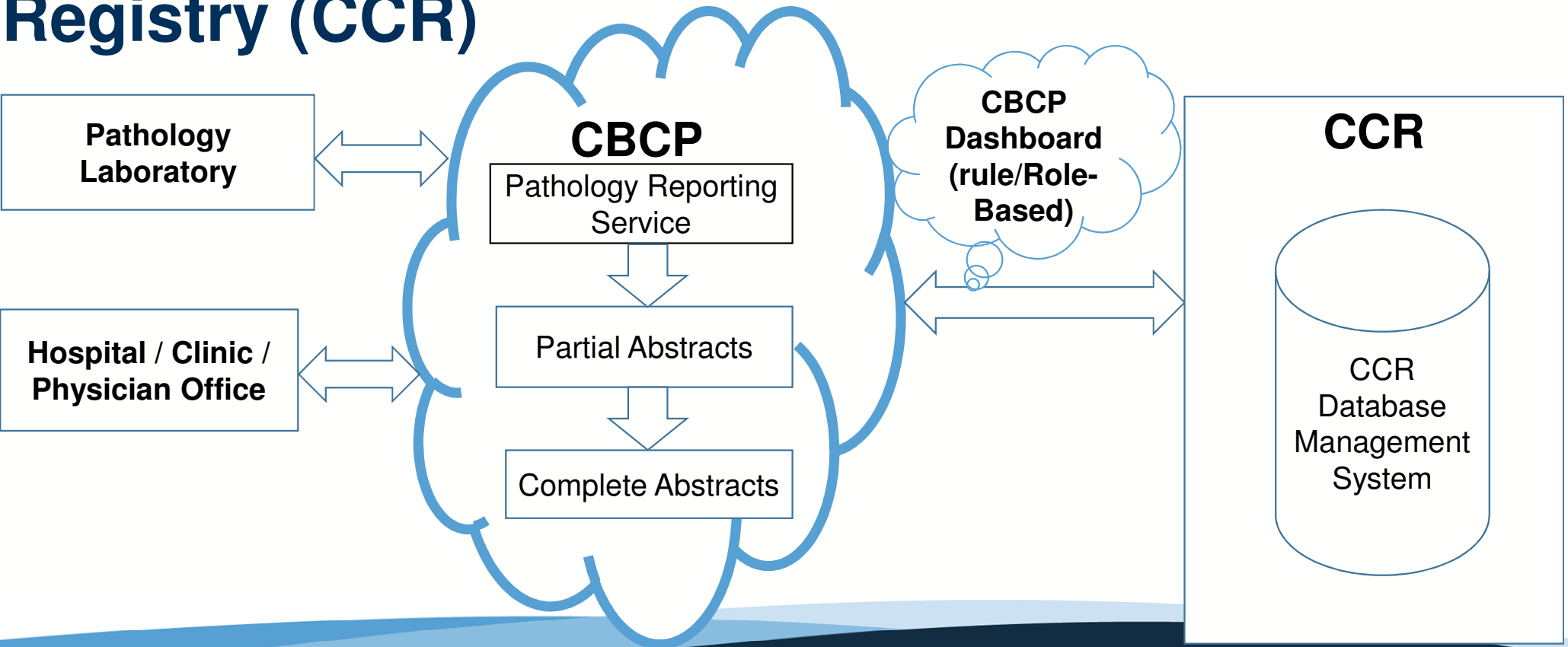
Dashboard interface to monitor abstracting and automatically send completed abstract to CCR, where it enters the usual reporting stream.

- For these reports, minimal to no CCR staff time is needed

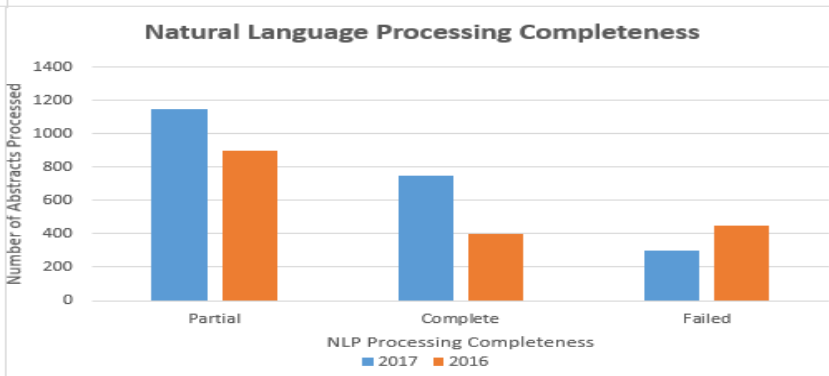
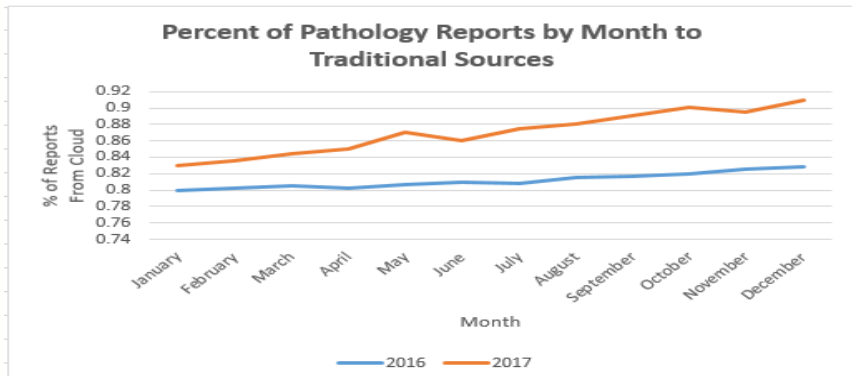
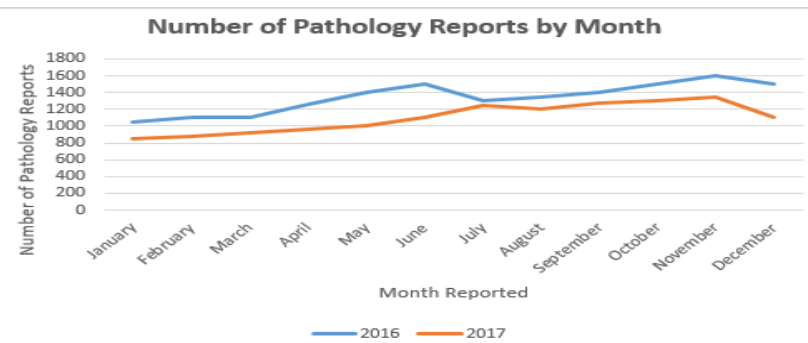
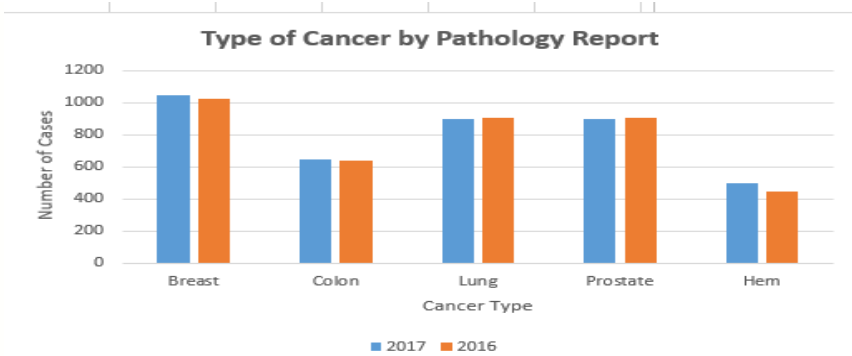
Future State: Cloud-based Computing Platform (CBCP) for Real-Time Reporting



Future State: Cloud-based Computing Platform (CBCP) for Follow-Back by the Central Cancer Registry (CCR)



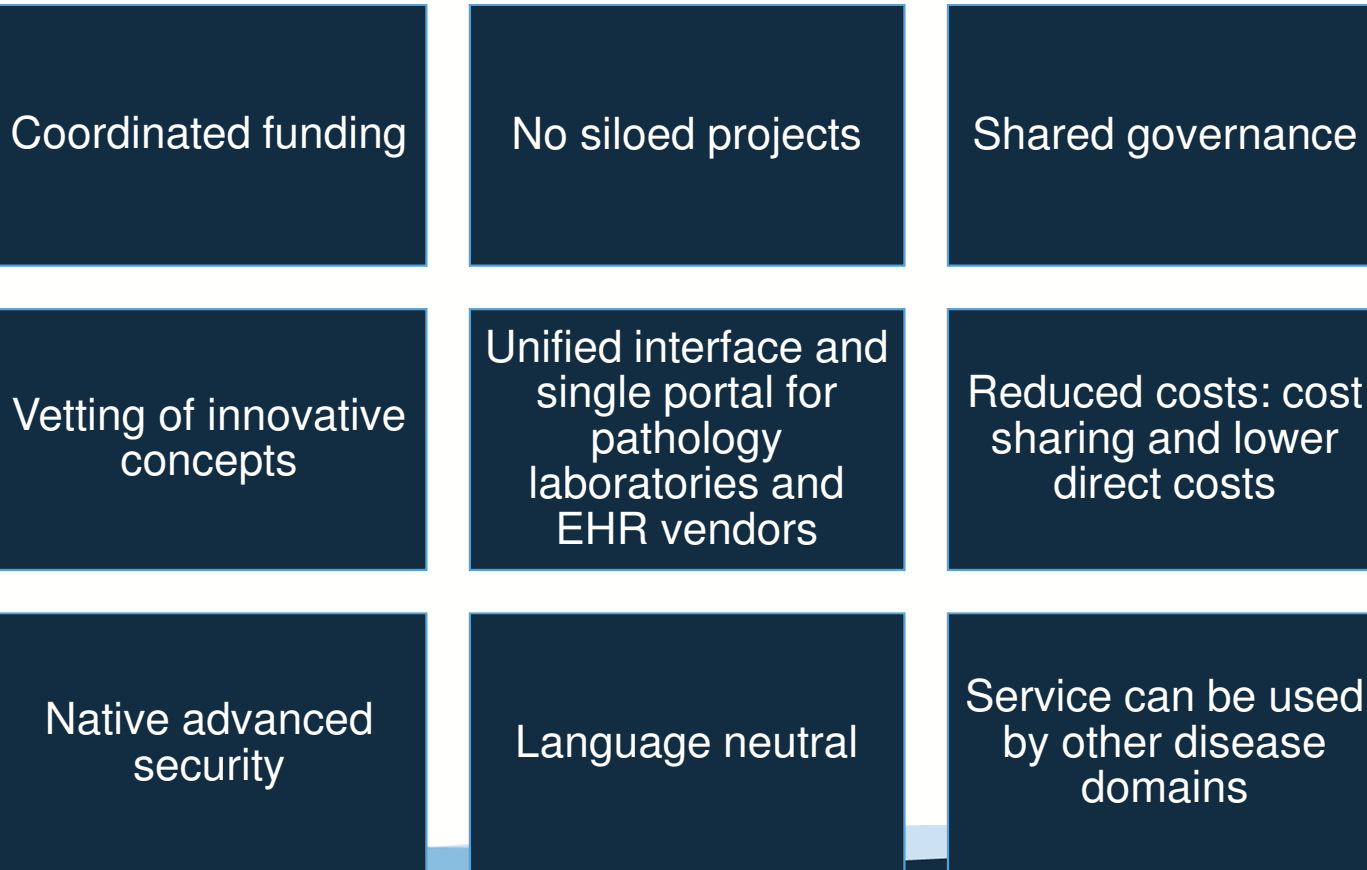
Future State: Dashboard Example



CBCP for Real-time Reporting Advantages



CBCP for Real-time Reporting Advantages











Shared Services

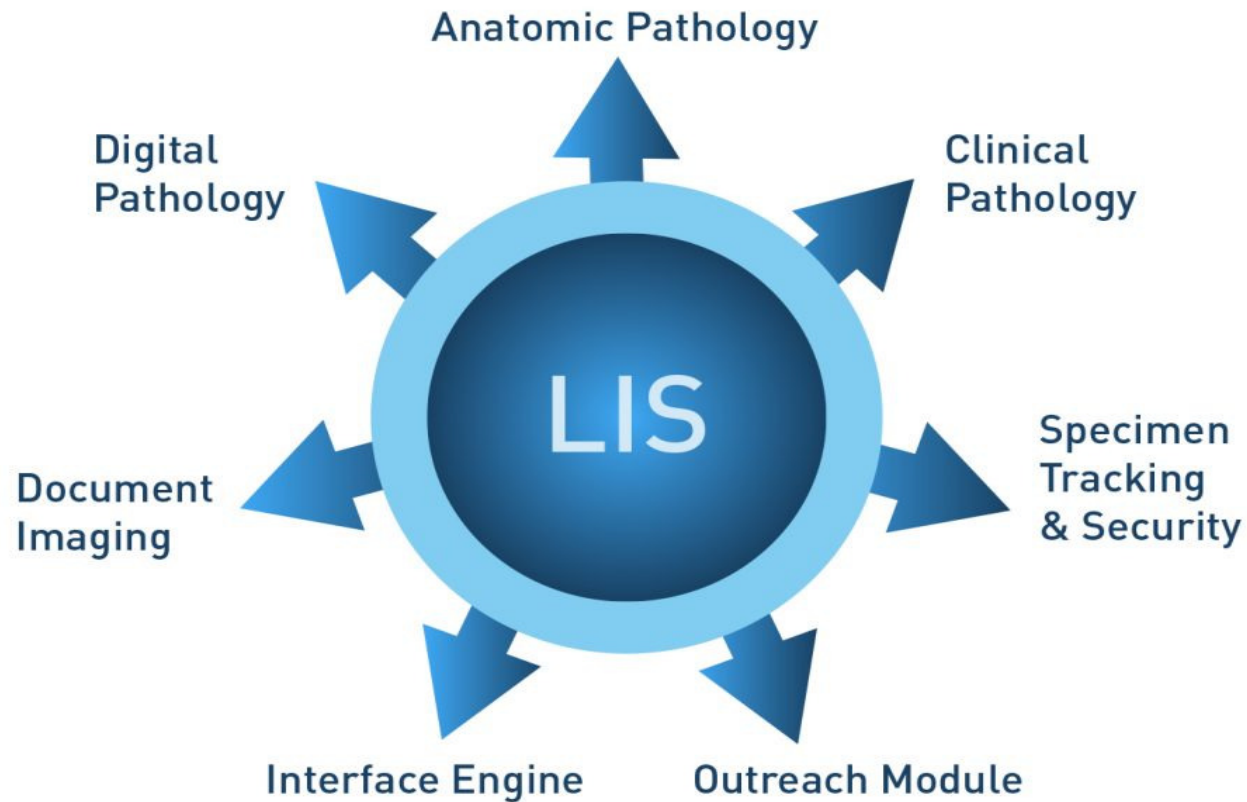


Cancer Surveillance Modernization

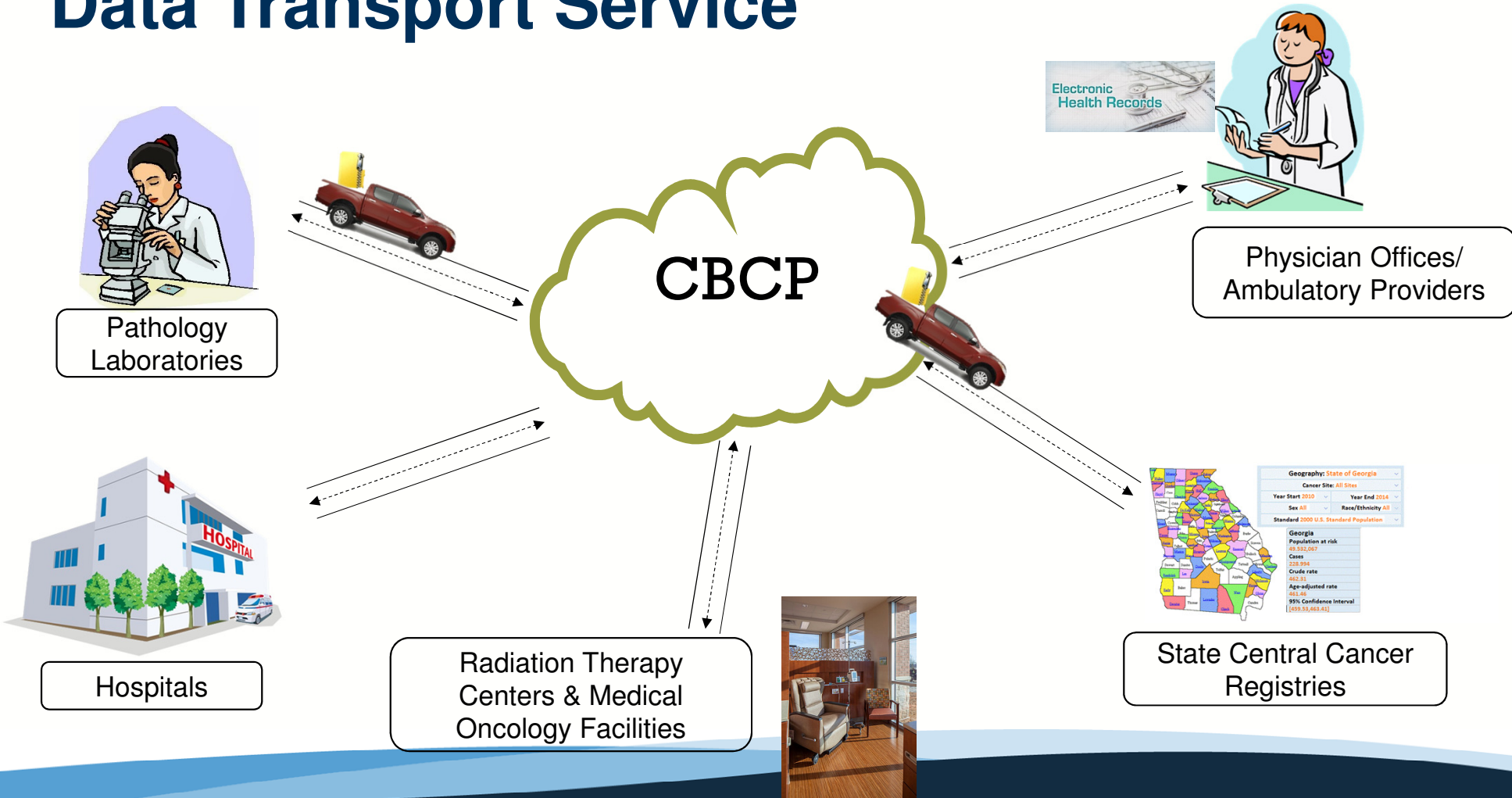
A cloud-based Platform of **shared services** allows different organizations to develop and support a **service**. These services can work in concert as a **fully functional system**.

Cloud Services		Cancer	Other Disease Domains
	Laboratory Information System Interface	X	X
	Data Transport Service	X	X
	NLP/Machine Learning Service	X	X
	Patient Matching, Record Linkage, and Deduplication	X	X
	ePath Report Processing / Analysis	X	X
	EHR Report Processing / Analysis	X	X
	Web-based Abstracting Service	X	X
	Interface with Vendor-based Hospital Registry	X	X

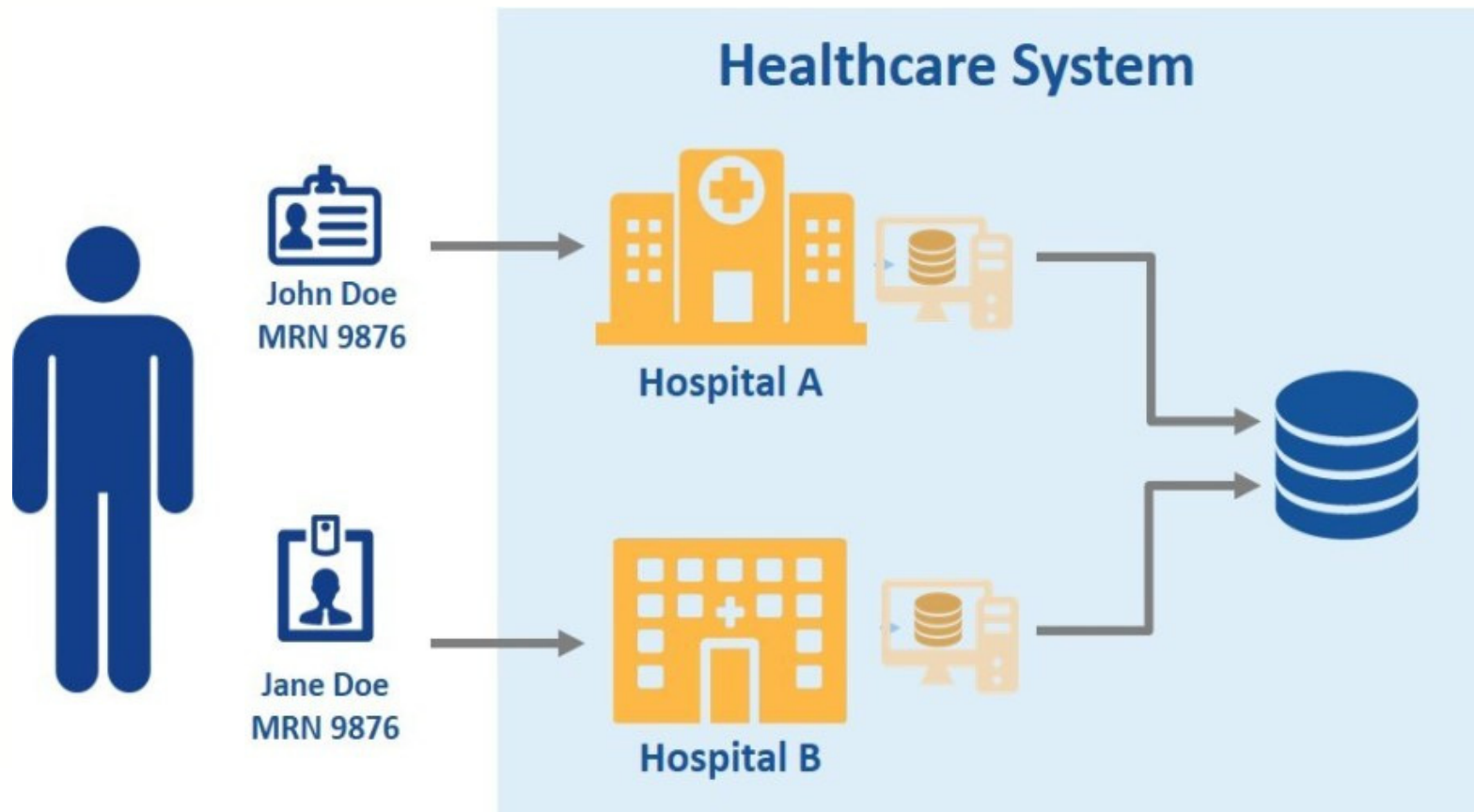
Laboratory Information System Interface Service



Data Transport Service



Patient Matching, Record Linkage, and Deduplication Service



Web-based Abstracting Service



Web Plus

Any State Cancer Registry
 email: WebPlusHelp@state.gov
 999-999-9999

- Home
- New Abstract
- Find/Open Abstract
- Release Abstracts
- Reports
- Change Password
- Help
- Log out

Update abstract

All data items marked with an asterisk (*) are required.

GradeC1M1	2	
GradePath	2	
GradePost		
Diagnostic Confirm.	1	
Reg Nodes Positive	98	
Reg Nodes Exam	00	
LVI	0	
SchemaDisc1		
SchemaDisc2		
AJCCID	XX	
SchemalD	00580	

STAGE OF DISEASE

Summary Stage 2018	1	
Summary Stage 2000		
Summary Stage 1977		
TumorSizeSumm	999	
TNMEdition	08	

TEXT - DIAGNOSIS

Physical Exam

PT PRESENTED IN 2018 WITH ABNORMAL DRE & HIGHPSA. HAS HAD URINARY SYPTOMS

Lab Tests

Summary Stage 2018 - Internet Explorer
 Select a code from the table below:

****Prostate**** 8000-8700, 8720-8790, 9700-9701 C619 C619 Prostate gland ****Note 1:**** The following sources were used in the development of this chapter * SEER Extent of Disease 1988: Codes and Coding Instructions (3rd Edition, 1998) (<https://seer.cancer.gov/archive/manuals/EOD10Dig.3rd.pdf>) * SEER Summary Staging Manual-2000: Codes and Coding Instruction (<https://seer.cancer.gov/tools/ssm/ssm2000/>) * Collaborative Stage Data Collection System, version 02.05: <https://cancerstaging.org/cstage/Pages/default.aspx> * Chapter 58 *Prostate*, in the AJCC Cancer Staging Manual, Eighth Edition (2017) published by Springer International Publishing. Used with permission of the American College of Surgeons, Chicago, Illinois. ****Note 2:**** See the following chapters for the listed histologies * 8710-8714, 8800-8934, 8940-9137, 9141-9582: *Soft Tissue* * 8935-8936: *GIST* * 9140: *Kaposi Sarcoma* ****Note 3:**** See the *Urethra* chapter for transitional cell (urothelial) carcinoma of the prostatic urethra (C680). ****Note 4:**** Assign code 1 when there is only a TURP. ****Note 5:**** Imaging is not used to determine the clinical extension unless the physician clearly incorporates imaging findings into their evaluation. ****Note 6:**** If there is no information from the DRE, but the physician assigns a clinical extent of disease, the registrar can use that. * ****Example:**** DRE reveals prostate is "firm." Physician stages the patient as a cT2a. The T2a (localized) can be used since the physician has documented this. ****Note 7:**** Involvement of prostatic urethra does not alter the Summary Stage code. ****Note 8:**** "Frozen pelvis" is a clinical term which means tumor extends to pelvic sidewall(s) (code 7). ****Note 9:**** When prostate cancer is an incidental finding during a prostatectomy for other reasons (for example, a cystoprostatectomy for bladder cancer), use the appropriate code for the extent of disease found.

SS2018	Description
0	In situ, intraepithelial, noninvasive
1	Localized only (localized, NOS) - Clinically apparent or inapparent tumor - Confined to prostate, NOS - Intracapsular involvement only - Invasion into (but not beyond) prostatic capsule - No extracapsular extension - One or more lobes involved
2	Regional by direct extension only - Bladder neck - Bladder, NOS - External sphincter - Extraprostatic/extracapsular extension (beyond prostate capsule), unilateral, bilateral, NOS - Extraprostatic urethra (membranous urethra) - Fixation, NOS - Levator muscles - Periprostatic tissue - Rectovesical (Denonvillier's) fascia - Rectum - Seminal vesicles - Skeletal muscle - Through capsule, NOS - Ureter(s)
3	Regional lymph node(s) involved only - Hypogastric - Iliac, NOS + External + Internal (hypogastric) (obturator), NOS - Pelvic, NOS - Periprostatic - Sacral, NOS + Lateral (laterosacral) + Middle (promontory) (Gerota's node) + Presacral - Regional lymph node(s), NOS + Lymph node(s), NOS
4	Regional by BOTH direct extension AND regional lymph node(s) involved - Codes (2) + (3)
7	Distant site(s)/lymph node(s) involved - Distant site(s) (including further contiguous extension) + Bone + Extension to or fixation to pelvic wall or pelvic bone + "Frozen pelvis", NOS + Other organs + Penis + Sigmoid colon + Soft tissue other than periprostatic - Distant lymph node(s), NOS + Aortic (lateral [lumbar], para-aortic, periaortic, NOS) + Cervical + Common iliac + Inguinal (deep, NOS) * Node of Cloquet or Rosenmuller (highest deep inguinal) * Superficial (femoral) + Retroperitoneal, NOS + Scalene (inferior deep cervical) + Supraclavicular (transverse cervical) - Distant metastasis, NOS + Carcinomatosis + Distant metastasis WITH or WITHOUT distant lymph node(s)
9	Unknown if extension or metastasis

Save

Click to save the abstract and run data Edits. See th

ePath Report Processing/Analysis Service



Parsed HL7 v2 Message

MSH SEGMENT
 CLIA number: 31D0652945 Path Lab Name: BioReference Laboratories, Inc Message control ID: 201110211315500001

PID SEGMENT
 Medical Record Number: 999714211 Social Security Number: 000000000 Name-Last: PATIENT Name-First: TEST Sex: M Name-Middle: Vital Status: Name-Last: PATIENT Sex: M

OBX SEGMENT
 Path Ordering Facility Name: ACCOUNT NAME Path Ordering Facility Name: 321 MAIN STREET SUITE 999
 Path Ordering Client/Phys-First Name: REFERRING Path Ordering Client/Phys-Last Name: PHYSICIAN Pathologist Last Name: Alexa Pathologist First Name: Lillyana

Legend for Highlights
 Red: Histology/Reportable Term
 Blue: Negated Histology/Reportable Term
 Green: Non-reportable Skin Term
 Magenta: Site Term
 Purple: Grade Term

Path Final Diagnosis
 1) Hypercellular marrow with maturing trilineage hematopoiesis, increased stromal myelofibrosis, moderate to marked reticulin fibrosis and focal osteofibrosis, consistent with **PRIMARY MYELOFIBROSIS (PMF)**. 2) No increased CD34 positive blasts detected.

Path Text Diagnosis
 Path Clinical History
 Path Nature of Specimen: Bone marrow
 Path Gross Pathology
 1) Core. Received in formalin is a core of firm brown bony material measuring 1.0 x 0.2 x 0.2cm entirely submitted in 1 cassette following decalcification. 2) Clot. Received in formalin, clotted material measuring 2.0 x 2.0 x 1.5cm in aggregate, entirely submitted in 1 cassette. 3) Number of slides received: Ten
 Path Micro Pathology

Abstract Ref ID: 229
 Message ID: 410
 Abstract Ref ID: 229
 PATIENT IDENTIFICATION
 Name-Last: PATIENT
 Name-First: TEST
 Name-Middle:
 Social Security Number: 000000000
 Sex: 1 Male
 Date of Birth: 1961/10/20
 DEMOGRAPHICS
 Addr at DX--No Street: 123 MAIN STREET APT 9999
 Addr at DX--City: PALM COAST
 Addr at DX--State: FL Florida
 Addr at DX--Postal Code: 32137
 Race 1: 99 Unknown
 Spanish/Hispanic Origin: 9 Unknown whether Spanish or not
 CANCER IDENTIFICATION
 Date of Diagnosis: 2011/10/05
 Text--Primary Site Title
 Bone marrow
 Primary Site: C421 - Bone marrow
 Laterality: 0 Not a paired site
 Text--Histology Title
 Myeloclerosis with myeloid metaplasia (C42.1)
 Histologic Type ICD-O-3: 9961 - Myeloclerosis with myeloid metaplasia (C42.1)
 Behavior Code ICD-O-3: 3 Malignant, primary site
 Grade: 9 Grade or cell type not determined, not stated, or not applicable
 Text--DX Proc--Path

EHR Report Processing/Analysis Service



Parsed CDA Document →

Patient Information	
Date/Time of Report	20120225
Patient's First Name	Amy
Patient's Last Name	Fowler
Patient's Middle Name	Farrah
Patient Name Suffix	
Patient Maiden Name	King
Patient Name Alias	
1 of 2	
Patient's Street Address	4732 Charles Avenue
Patient Street Address Supplemental	
Patient's City	Madison
Patient's State	WI
Patient's Zipcode	53705
Patient's County	
Patient's Country	USA
Patient's Address Start Date	20010401
Patient's Address End Date	20110630
2 of 2	
Patient's Street Address	14979 Main Street
Patient Street Address Supplemental	
Patient's City	Menomonie
Patient's State	WI
Patient's Zipcode	54751
Patient's County	
Patient's Country	USA
Patient's Address Start Date	20110701
Patient's Address End Date	
Patient's Address Use	
Patient's Phone Number	tel:(262)9934711
Patient's Gender	Female
Patient's Gender Code	F
Patient's Date of Birth	19640922
Patient's Medical Record Number	325941988
Patient's Social Security Number	325-82-9876
Patient's Race Display Name	African American
Patient's Race Code	2058.6

Auto-generated Abstract →

PATIENT IDENTIFICATION	
Name--Last	Fowler
Name--First	Amy
Name--Middle	Farrah
Name--Maiden	King
Name--Alias	
Name--Prefix	
Name--Suffix	
Name--Spouse/Parent	
Social Security Number	325829876
Sex	2 Female
Date of Birth	19640922
Date of Birth Flag	All or part of date known OR date not
DEMOGRAPHICS	
Addr at DX--No Street	14979 Main Street
Addr at DX--Supplemental	
Addr at DX--City	Menomonie
Addr at DX--State	WI Wisconsin
Addr at DX--Postal Code	54751
County at DX	999
Addr Current--No Street	14979 Main Street
Addr Current--Supplemental	
Addr Current--City	Menomonie
Addr Current--State	WI Wisconsin
Addr Current--Postal Code	54751
Addr Current--Country	USA
County--Current	999

Mapped Values (direct) (Blue arrows):

- Patient's First Name (Amy) → Name--First (Amy)
- Patient's Last Name (Fowler) → Name--Last (Fowler)
- Patient's Middle Name (Farrah) → Name--Middle (Farrah)

Translated Value (Green arrow):

- Patient's Gender (Female) → Sex (2 Female)

Mapped Values (complex rules) (Red arrows):

- Patient's Street Address (14979 Main Street) → Addr at DX--No Street (14979 Main Street)
- Patient's City (Menomonie) → Addr at DX--City (Menomonie)
- Patient's State (WI) → Addr at DX--State (WI Wisconsin)
- Patient's Zipcode (54751) → Addr at DX--Postal Code (54751)
- Patient's County () → County at DX (999)

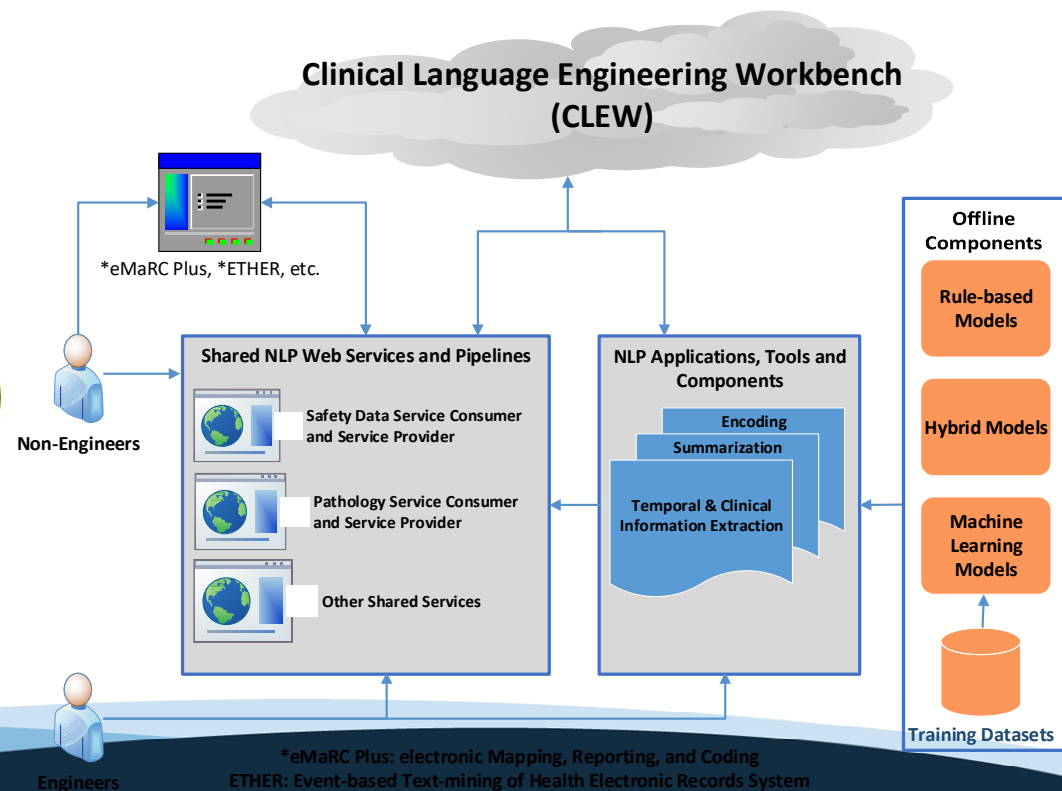
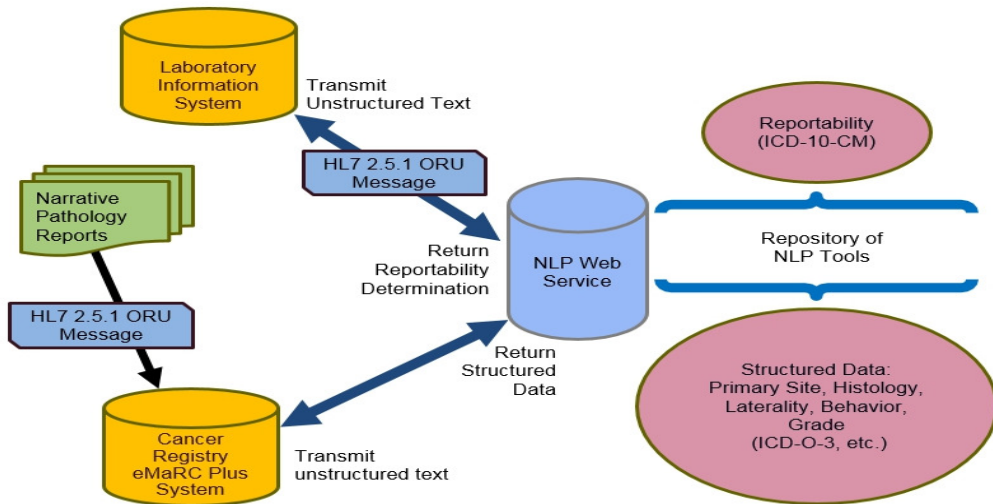
Defaulted Value (Purple arrow):

- Patient's County () → County at DX (999)

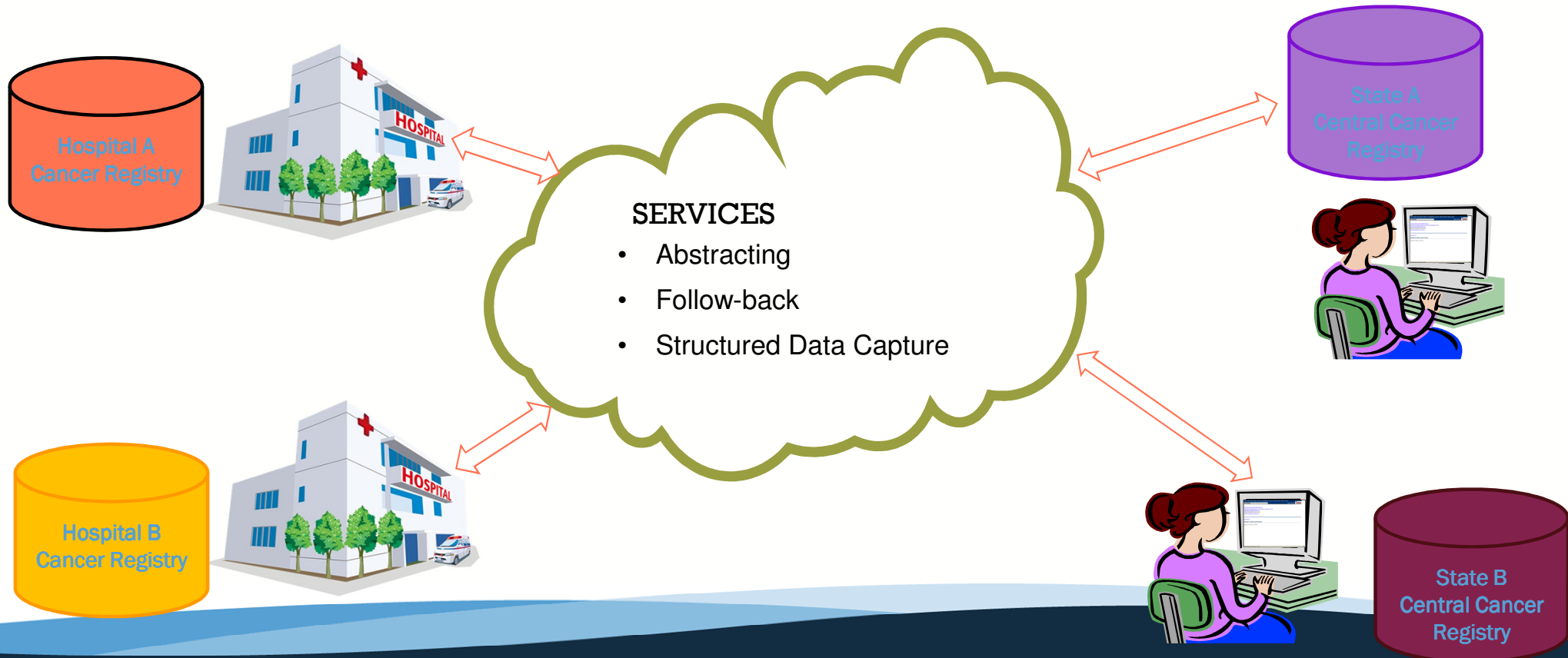
NLP/Machine Learning Service



NLP Use Cases for the Cancer Domain



Interface with Vendor-based Hospital Registry Service



Value of the Cloud and Real-time Data



Value of the Cloud and Real-time Data

- Much faster identification of cancer cases to evaluate and improve cancer control strategies and program planning
- Find out what interventions work or don't and adjust quickly
- Better-informed decisions about where resources need to be allocated
- Timelier identification of cancer patients cases for clinical trials
- Quickly identify where research needs are
- A model for real-time reporting of other chronic and infectious disease data



Central Cancer Registry (CCR) Question and Answers

- **Q:** Where is the data stored in the cloud and for how long?
- **A:** When a request for proposal (RFP) is issued, the standards for server use and location can be stipulated. The CCR can determine how long that data is stored in the cloud (rule-based levels).

Central Cancer Registry (CCR) Question and Answers (continued)

- **Q:** Where is the data stored in the cloud and for how long?

Best	Consolidate reports from multiple facilities and route to CCR database management system
Better	Parse report, create a partial abstract, prompt a single facility to complete the abstract, route to CCR database management system
Good	Parse report and route to CCR database management system

Central Cancer Registry (CCR) Question and Answers (continued)

- **Q:** How will the cloud be governed and how will data access be controlled?
- **A:** A governance team will be made up of CCR representatives and other stakeholders. The CCR will have full control of their data via roles set up for each CCR administrator.

Central Cancer Registry (CCR) Question and Answers (continued)

- **Q:** What role will the CCR and CCR database management system have once the cloud is fully implemented?
- **A:** The CCR and its database management system will continue in its current role; however, the focus will be on case-finding, linking, consolidation, and quality control efforts. The cloud will focus on automating upstream processes and creating real-time data access.

Project Leadership:

- Wendy Blumenthal, MPH, Health Scientist
- Sandy Jones, Public Health Advisor

Action is the foundational key to all success.

Imperfect Action is Better than Perfect Inaction

Success consists of going from failure to failure without loss of enthusiasm

“The best way to predict
your future is to create it”
— Abraham Lincoln



Thank you!

Go to the official federal source of cancer prevention information:
www.cdc.gov/cancer



Division of Cancer Prevention and Control
Reliable. Trusted. Scientific.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.