

NCI Enterprise Services to Support Research and Care George Komatsoulis, Ph.D.

Deputy Director

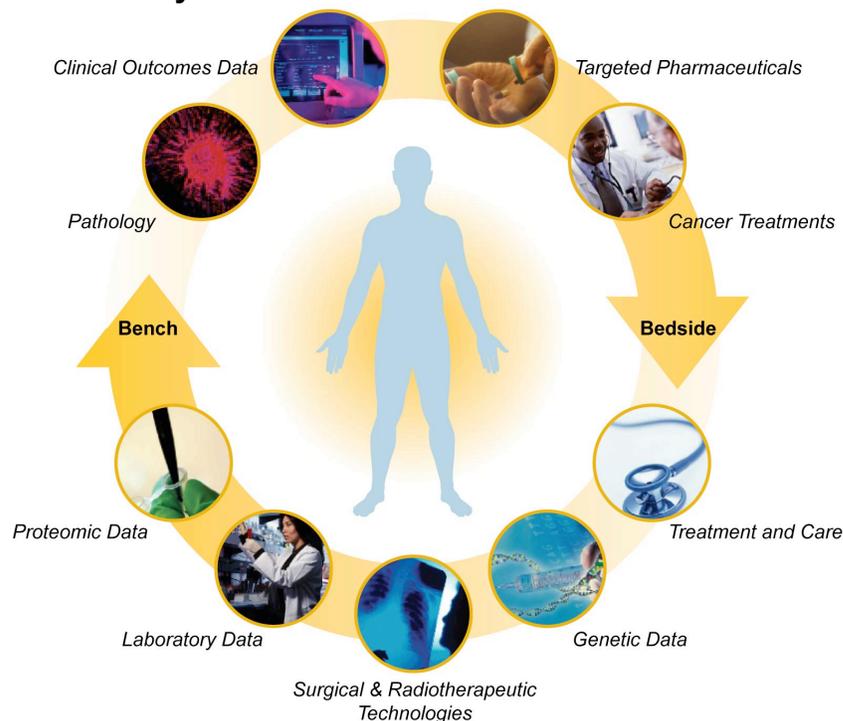
National Cancer Institute

Center for Biomedical Informatics and Information Technology

“If You Don’t Know Where You’re Going, Any Road Will Get You There.”

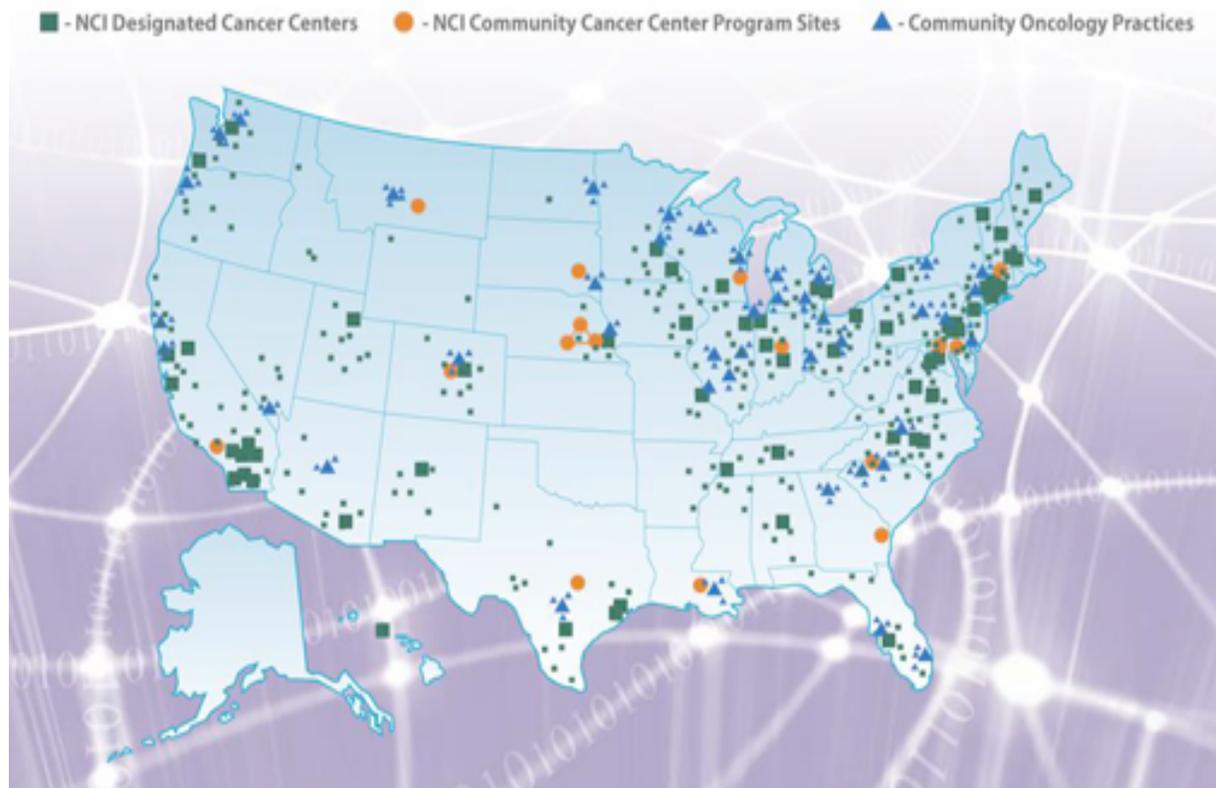
- Lewis Carroll: *Alice’s Adventures in Wonderland*, 1865

21st Century Biomedicine



- Personalized, Predictive, Preemptive, Participatory...
- Unifies discovery, clinical research, and clinical care (bench-bedside-bench) into a seamless continuum
 - a Learning Health System
- Results in improved clinical outcomes
- Accelerates the time from discovery to patient benefit
- Enables a health care system, not a disparate “sector”
- Empowers consumers in managing their health over a lifetime

Linking the NCI-supported Cancer Community



Oncology-Extended Electronic Health Record: A Collaborative National Effort

- American Society of Clinical Oncologists (ASCO)
 - Began evaluating issue, involving end users
 - Engaged the vendor community EHR lab (30), utilizing unique case scenarios
 - High level requirements document/white paper outlining the issue
- cancer Biomedical Informatics Grid (caBIG®)
 - Vendor technology evaluation
 - Problem assessment
 - Technical Specification
- NCI Community Cancer Center Program (NCCCP)
 - Oncology EHR Laboratory
- Other domain experts

Semantically-aware Services Oriented Architecture

- Semantically-aware Service Oriented Architecture (sSOA) supports the challenges of integrating diverse classes of information distributed across a distributed, heterogeneous cancer research and care community
- In addition to data integration, sSOA enables the coordination of functionality between the various information systems that reside within

those organizations and enable collaborative data processing and work flow execution

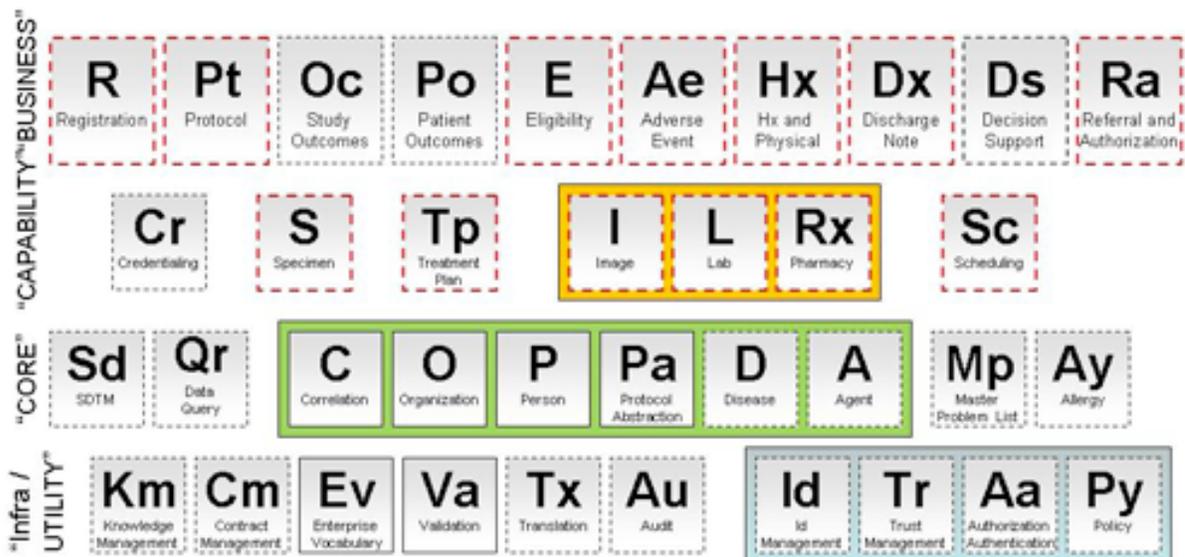
- Services can be implemented in a largely standalone fashion to allow for the rapid creation of composite applications via service marshalling or integrated with existing applications

sSOA ensures working interoperability between differing systems that need to exchange specific classes of information and/or coordinate cross-application behaviors

Classes of Services

- NCI Services are classified into four primary types loosely based on the CBDI service taxonomy
- Infrastructure/Utility
 - Services that are required or utilized by virtually all other services
- Core
 - Services that provide information components to capability and business services
- Business Capability
 - Services that provide “business atoms”, the data most business processes utilize
- Business/Process
 - Arbitrarily complex services that utilize the other three service types to carry out business functions

Periodic Table of Services



Periodic Table of Services: Business/Process

- The Trial Registration service provides investigators with the ability to submit descriptive information about a clinical trial. It also provides the ability to search registered trials based on various criteria
- The Protocol Management service will support creation of a Study Protocol by providing a capability to create a computable part of the protocol
- Study Outcomes establishes a set of reporting patterns for collecting data and validating it in order to report on a particular intervention outcome
- Patient Outcomes provides clinicians or administrators at clinicians' offices with the ability to submit outcome data for the cancer patients. It also provides them with the ability to query the outcomes data they submitted
- Eligibility service provides the capabilities associated with establishing eligibility for a patient to register on a Study based on criteria specified in the Study Protocol

Periodic Table of Services: Business/Process

- The Adverse Event service manages, queries, reports adverse events and the associated work flows
- The History and Physical service provides access to patient's History and Physical document. This service will facilitate requests for and provision documents that capture the clinical history of the patient during a specific encounter
- Provides access to a patient's Discharge Notes for a given encounter³⁰⁰
- This service provides an algorithmically-neutral way to manage decision support services for patients
- Referral is intended to provide core capabilities needed by health care organizations to facilitate the business process of patient referrals and consultations among providers

Periodic Table of Services: Business Capability Services

- Credentialing Management allows the credentials of a given investigator to be enumerated and validated by a trusted third party

- Specimen Management Service provides the core specification for specimen management from both the clinical and research perspectives regardless of the nature of specimen transactions that occur or the type of specimen
- The Treatment Plan service provides the ability to create and update Treatment Plan templates, generate and view prospective calendars of patient activities, track activities as they occur, and manage patient calendars as they change during a plan
- Image Management service includes the ability to manage image, including intersections with order reporting.
- Lab Management service includes the ability to order, track, and manage laboratory orders from a clinical perspective, including intersections with specimen management and pathology reporting
- Pharmacy Management service includes the ability to order, track, and manage prescriptions from a clinical perspective
- The Scheduling service provides the capabilities associated with scheduling a particular appointment for a particular encounter

Periodic Table of Services: Core Services

- Correlation Service establishes a central service of record for relationships between core information components (Persons to Organizations, etc.)
- Organization Service establishes a central service of record for the Organization information type
- Person Service establishes a central service of record for the Person Information
- The Protocol Abstraction Service establishes a central service of record for non-annotated, "flat" information about Protocols and their relation to trials
- The Disease service establishes a central service of record for information about various diseases found in trials
- The Agent service establishes a central service of record for information about various agents found in trials

Periodic Table of Services: Other Core Services

- SDTM Represents a key data structure that is reused in regulatory reporting
- Data Query provides a consistent mechanism to query and retrieve information from information systems
- Master Problem service establishes a central service of record for the Problems tied to patients
- Allergy service establishes a central service of record for the Allergies tied to patients

Periodic Table of Services:Infrastructure/Utility

- Identity Management deals with identities of specific entities of interest to the organization
- Trust Management establishes verifiable and explicit relationships between technology endpoints in the deployed architecture
- Authorization and Authentication service provides a means of testing an identity against a set of credentials and explicit policy within a deployed architecture
- The Policy service exposes elaborated, well-formed policies and rules that manifest the organization's permissions, prohibitions, and obligations

Periodic Table of Services: Infrastructure/Utility

- Knowledge Management service represents a series of capabilities around the storage, versioning, and expression of the semantics supporting key capabilities
- Service Contract Management service represents a series of capabilities around the storage, versioning, and expression of the contract semantics supporting interoperability
- Enterprise Vocabulary services support the management, storage, and mapping of terminologies and value sets
- The Validation service verifies structural and semantic consistency across messages used in interoperability scenarios
- The Transformation service provides a functional end point to manage and enact mappings between syntactically disparate information types

- The Auditing service provides an interface that captures auditing information around the access to sensitive data

Periodic Table of Services

NCI is continually refining our periodic table of services to reflect the needs of the cancer research and care community

Usage Patterns for NCI Services

- Service Specifications: NCI services layered service specifications (conceptual model, platform independent model and platform specific model) for organizations wishing to build or adapt products that can interoperate with NCI services
- Reference Implementations: NCI provides reference implementations of these services that provide Application Programming Interfaces implemented in many technologies
- NCI Hosted Services: NCI maintains hosted versions of its services (either standalone or part of larger systems depending on the nature of the service) that are accessible to appropriately authorized entities
- All NCI specifications and reference implementations are made available via a non-viral Open Source license that explicitly allows for commercial, closed source reuse and derivative works

Technology Bindings Utilized by NCI Services

NCI Services are designed to be readily accessed using a variety of technologies. These include:

- Application Programming Interfaces: Commonly implemented as Remote Enterprise Java Beans (EJB's), but increasingly including API's that utilize .NET frameworks
- Grid Services: Access via the NCI's semantically aware SOA infrastructure, caGrid
- Web Services: Access via WS-I compliant web services
- REST APIs: Simple APIs that allow for easy connection to services but can't utilize the advanced semantic capabilities of caGrid

NCI is working with FHA to make NCI Enterprise Services available via the NHIN

Interoperability: Standards

- NCI Services are based, wherever possible, on existing standards to enhance interoperability

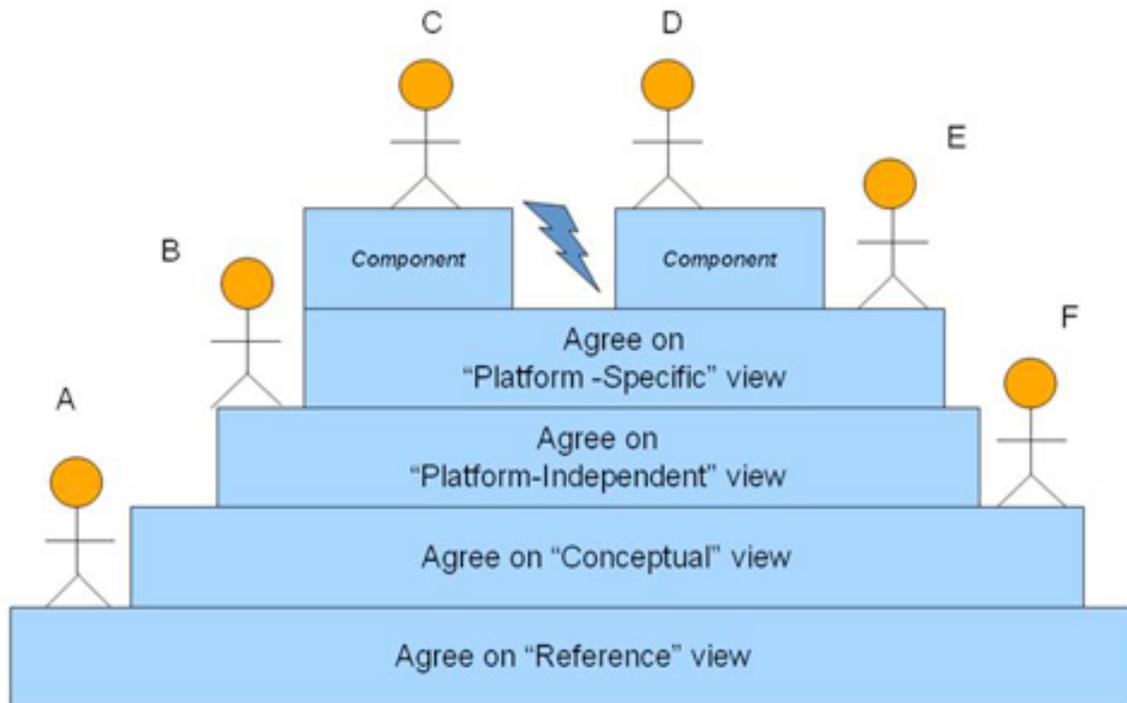
- NCI Enterprise Service payloads are derived from the HL7 v3 Reference Information Model and reference relevant standards wherever possible
- NCI Enterprise Services utilize ISO 21090 data types
- NCI Enterprise Services utilize standard controlled biomedical terminologies such as LOINC and the NCI Thesaurus and the ISO 11179 metadata specification

Interoperability: SAIF and ECCF

- The Enterprise Conformance and Compliance Framework (ECCF) is based on the RM-ODP viewpoints and the HL7 Services-Aware Interoperability Framework (SAIF)
- Three specification levels: Conceptual Model, Platform Independent Model and Platform Specific Model

	Enterprise / Business Viewpoint	Information Viewpoint	Computational Viewpoint	Engineering Viewpoint
<i>Conceptual Model</i>	Business Context, Reference Context	Domain Analysis (Information) Model (plus data type bindings)	Collaboration Analysis, Functional Profile(s), Service Roles and Relationships	Existing Platform capabilities
<i>Platform Independent Model</i>	Business Governance	Project-oriented Domain Information Model, Constrained Information Model, Localized Information Model	Collaboration Types, Interface Specification and Functional Groups, Interaction Types and Collaboration Participations, Contracts Parts	Existing Platform models, libraries, etc.
<i>Platform Specific Model</i>	Rules, Procedures	Localized Information Model Transforms, Schema	Collaboration scripts, Orchestrations, Realized Interfaces	Execution Context, Platform Bindings, Deployment Model

Interoperability: Multiple Levels Based on ECCF Specifications



Additional Information

- NCI service specification and development is an open process; all artifacts are available at the NCI wiki*
- NCI welcomes all interested parties to participate in the service specification and development process

* <https://wiki.nci.nih.gov/display/EAWiki/Candidate+NCI+Enterprise+Services>

"I'm looking for a lot of men who have an infinite capacity to not know what can't be done."

- Henry Ford

"To achieve great things, two things are needed: a plan, and not quite enough time"

- Leonard Bernstein

Thank You