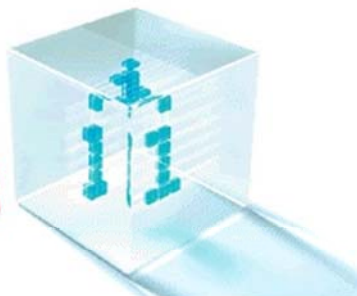


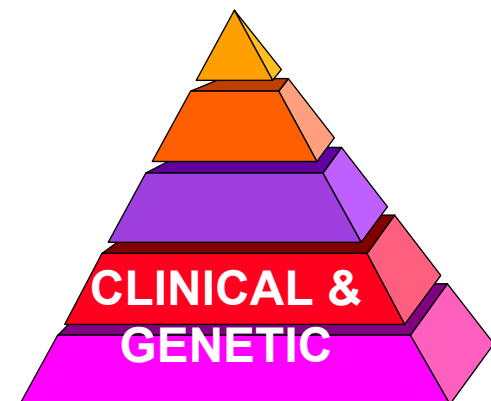
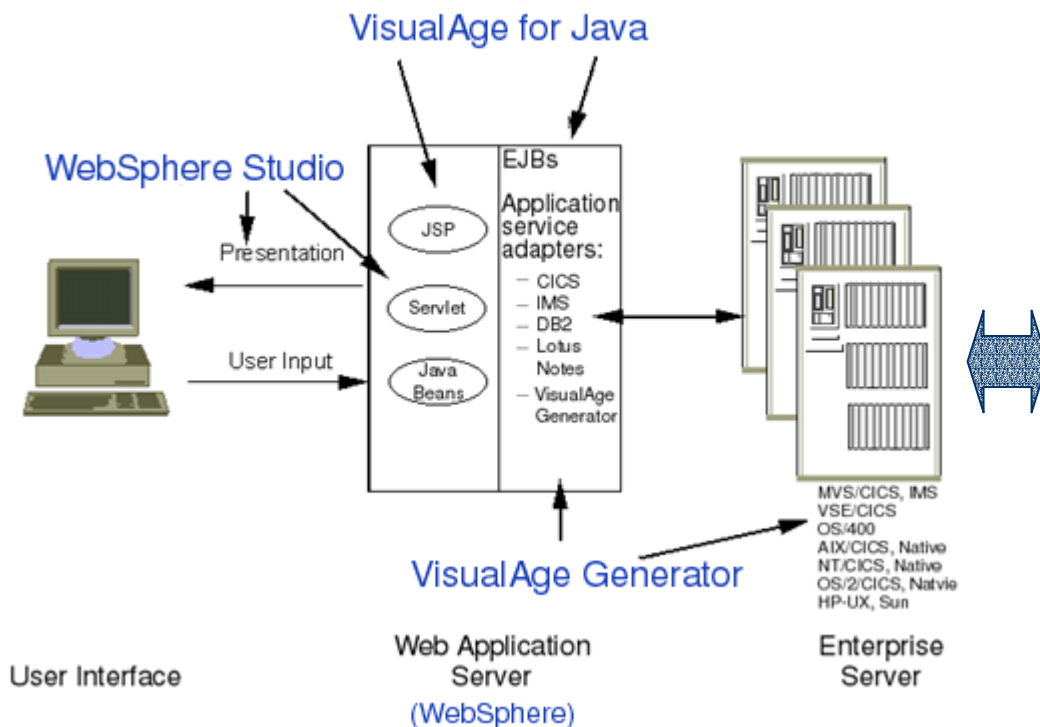
Managing Clinical & Genetic Data

understanding
information



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Real-time Internet Applications Example



Needs and Benefits

- Needs
 - Get clinical systems up quickly
 - Simple database design
 - Store complex clinical data within a relational database
 - Avoid changing the database to add clinical data
 - Store complex genetic information
- Benefits
 - Can be used for any clinical application
 - Based on a vocabulary definition process for flexible use
 - Can store clinical, patient or genetic data without changing basic database storage
 - Patented



Goals and Objectives

- Data Management
 - Handle large numbers of persons >1M Persons
 - Optimize for modern large-scale computers/OS, e.g., MVS/S390/DB2 and Sun E10000/Oracle
 - Define clinical attributes “on-the-fly” with no DBMS table re-builds
 - Separate data structures from nomenclature (except for atoms)



Patent Goals and Objectives

- Use compact data structures and minimize “outer-joins”
- Solve the sparse matrix problem (no nulls!)
- Clinical Taxonomy
 - Define the nomenclature “on-the-fly”
 - Separate vocabulary hierarchy from the atomic data elements
 - Handle complex nested terms, multiple languages, synonyms
 - Allow for multiple classifications (nasty but extant in the real world)



Past Clinical Storage Solutions

- Break domain into many tables ($15,000 = 300 \times 50$)
 - Use RDMS like Oracle or DB2 (32T tables)
 - Creates complex outer joins
 - Mathematically proven to rapidly degrade in performance
 - Extremely sparse matrix problem grows nonlinearly



Past Clinical Storage Solutions

- Extremely difficult or impossible to add columns to tables when VLDB beyond a certain size
 - Deterministic tuple size must also be small in VLDB for RDBMs to be optimized for outer join queries.
- Use array languages (Mumps) or OO DBMS not RDMS
- Track only a subset of taxonomy (restricted domain of discourse)



Clinical and Genetic Repository

- CGR Data Dictionary
 - Clinical observation variable
 - Definition
 - Valid values
- CGR Relationships
- CGR Objects
 - Observation (within visit)
 - Date/time/visit
 - Provider
 - Person
 - Case
- CGR
 - Date value
 - Text Value
 - Real number value
 - Binary value
- Medications & Side Effects
- Lab Results
- Imagery
- Quality Measures
- Genetic Information



Example: Defining the Clinical Nomenclature

- SNOMED is a standard taxonomy of objects, attributes, observations, places, things, and their relationships
- Define nomenclature (clinical taxons) atomic and otherwise, but keep it simple so clinicians recognize it:
 - “normal office exam”
 - “blood pressure”
 - “blood pressure diastolic”
 - “blood pressure systolic”



Example: Defining the Clinical Nomenclature

- Blood pressure Class and Relationships:

<u>Class</u>	<u>Relationship</u>	<u>Class</u>
“blood-pressure-diastolic”	<is part of>	“blood-pressure”
“blood-pressure-systolic”	<is part of>	“blood-pressure”
“blood-pressure”	<is part of>	“normal-office-exam”



Populating the Repository

- Populate the classes as observed
 - Continuous clinical audit trail by Person, Provider, Date, Time, Visit, Observation
- Populate only extant attributes, no sparse matrices
 - No null attributes in DBMS ∴
 - Not there \equiv Not Taken \equiv No space reserved in DBMS



Populating the Repository

- Change or create nomenclature at will:
 - “eye color”
 - “handedness”
 - “P53 gene is defective”
 - “received health status questionnaire”
 - “received health status questionnaire”
<translate><Spanish> “El cuestionario sobre el estado de salud ha estado recibido”



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