Case Study
Implementation of a Large-Scale Health Information Network

A joint study by:

- Clalit Health Services
- Rambam Medical Center
- Sheba Medical Center
- dbMotion Peter T van der Grinten GM North America
Outline

• About Clalit Health Services
• The need emerges
• In search of a solution
• The solution – from pilot to full implementation
• Sheba and Rambam Medical Centers
  - “adding new enterprises”
• Results and steps ahead
First... there was Clalit
About Clalit Health Services

• The largest Health Maintenance Organization (HMO) in Israel and one of the largest in the world
• 3.8 million customers
• 32,000 employees, 6000 physicians
• 14 hospitals, 600 admitting departments
• 1300 clinics
• 500 pharmacies
Clalit - Activity Volume (per annum)

- Primary Care encounters: 60 million
- Ambulatory Care visits: 2.1 million
- ER visits: 900,000
- Admissions: 600,000
- Surgical Procedures: 120,000
Clalit – IT Infrastructure

- Work Stations: 25,000
- Servers: 2,200
- WAN lines: 2,500
- Switches: 5,000

- Distributed IS/IT infrastructure
Back to the Year 2000…
Myriad of Legacy Systems

• Many different local EMR systems:
  - Oncopro, Clicks, iMDSof, Chameleon, Orion, Cortex, Ofek, Birthcare and more, running on various hardware platforms

• About 25 different legacy/departmental systems:
  - ADT, LIS, ORS, RIS, Pathology, Rx, Scanned documents and more…

• Isolated information repositories
The Challenge

- The Clalit HMO faced multiple information related challenges:
  - Pressures to reduce IT costs
  - A desire and need to avoid unnecessary procedures and tests
  - Service and process oriented systems, rather than customer focused
  - Silos of clinical information with no exchange of data
  - The patient was the “messaging platform”/“information carrier”
  - Organizational information update done only weekly or monthly
  - Antiquated legacy systems – some even 20 years old
Gearing Up to Take On The Challenge
Addressing the Challenge

- Clalit’s CEO (at the time) – Dr. Yitzchak Peterburg
  - Visionary manager and technology early adopter
  - Eager to leverage technology to improve organizational performance

- “MDS” (Minimal Data Set) Committee formed charter:
  - Define the Minimal Data Set that the organization should put before every care provider at every encounter
  - Define goals and objectives to make the vision a reality
The MDS Committee’s Results and Conclusions

• A defined minimal clinical data set
• Solution must be based on a patient-centric approach
• Data in a Federated Model (no Centralized Data Base)
• Sub 10 sec. response time required

Primary Goal

“To manage our customer’s health, in real-time, maintaining continuity of care in a disjointed and distributed environment.”
Seeking A Solution
The Alternative IT Approaches

One (central/hosted) EMR system

- Requires huge investment in SW and infrastructure
- Requires synchronization of large amounts of data
- Requires many changes to systems and processes
- Single Point of Failure
- Lengthy and painful change process
- Loss of investment in legacy systems
The Alternative IT Approaches

Central Repository

- Expensive to implement
- Competitive/Business challenges
- Technological challenges
- Perceived privacy issues
- Security concerns
- Data ownership
- Ethical concerns
The Alternative IT Approaches

A distributed system acting as a virtual repository

- Information remains where it was created
- Information is owned and maintained where it is created
- Information is only “pulled” when required
- Read Only
- Does not require changes to the existing systems
- Information available where and when needed
However,

There are many challenges and hurdles…
Getting Practical - The Challenges

• How does one provide, across such a large organization, the right answers to many sensitive and complex issues, like:
  - ethics, security, privacy, performance, scalability, stability, different standards and coding systems and more…

• How does one transform “off-line” data into valuable and consumable information?

• The volume and size of the organization (quantity of data and users)

• No existing solution available at that time.

• How does one become a leader based on technology when one is so far behind?
What is dbMotion?
The dbMotion™ Solution

The dbMotion™ Solution securely shares medical information, creating a Virtual Patient Record by logically connecting a group of care providers and organizations without data centralization.

All information remains in its original format, location, system and ownership. On-demand, relevant information is instantly integrated, analyzed and delivered to the point of care.
The dbMotion™ Unified Medical Schema™

The dbMotion Unified Medical Schema is derived from HL7 and other standards and enables sharing information between different parties regardless of the systems and structures employed by each party.
The dbMotion™ System Architecture
The dbMotion™ Collaboration Platform™

- n-node network of symmetrical dbMotion Servers that serve as a unified platform running multiple services required to participate in the integration process
- Metadata (information about the location of data) and indices maintained to ensure fast retrieval of data
- EMPI integration where needed
  - Can be based on existing EMPI
- XML based

- More than standard “data integration”
  - Medical context-sensitive
  - Smart merge process
  - Transparency of data sources
  - Asynchronous integration
  - Data integration based on security policies

The Result – a Virtual Patient Object
The Situation Back In 2000 – Currently Admitted Patients

Daily fax report from Hospitals to Clinics with yesterday’s data regarding ‘currently’ hospitalized patients (basic data set)
The Pilot - Current Admissions

On-line list of all “my” patients that are currently hospitalized in one of the 45 hospitals in Israel

• Transferring up-to-date medical information from acute to primary care environments

• Creating a channel of “care communications” between the primary and acute care environments

• Improving the quality of care

• Strengthening the relationship between the physician and the patient/family
The Results
The Pilot - Results

• Pilot deemed successful

• Decision to proceed with complete implementation of dbMotion

• The goal: implementation at all hospitals and clinics throughout the entire Clalit organization
Options for Expanding the System

• **Geographic growth** – Implementing a fully functional solution in a limited geographical area and then repeating this in other locations

• **Application growth** – Implementing a partial application across the entire health system and then gradually adding functionality

• **A combination of the above**
Implementation at Clalit Health Services
The Setup

- Steering Committee
- Ethics Committee
- Users Committee
- Implementation Committee and professional services arrangement
- CMO in charge (Executive Level)
The Principles

• **No central database** – all the information stays where, and in the same format, it was created

• No single point of failure

• Rigid security and privacy

• No need to replace any of the legacy systems

• Performance (no more than 10 seconds!)

• Use for viewing only - saving data not allowed
First… The Hospitals

- **Soroka**: 1,180 beds
- **Beilinson**: 900 beds
- **Kaplan**: 640 beds
- **HaEmek**: 520 beds
- **Meir**: 800 beds
- **12 Hospitals**
- **Carmel**: 520 beds
- **Beit Rivka**: 300 beds
- **Levinshtein**: 240 beds
- **Herzfeld**: 310 beds
- **Golda**: 360 beds
- **Herzfeld**: 310 beds
- **Levinshtein**: 240 beds
- **Beit Rivka**: 300 beds
- **Carmel**: 520 beds
- **12 Hospitals**
Then... The Clinics

1,200 clinics
Security and Profiles

- Developed with dbMotion
- Implements the Ethics Committee’s definitions
- Defines the authentication framework
- Defines the authorization levels: users’ profiles and roles, login methods, restrictions, etc.
Security and Profiles

32 different roles and profiles:

Resident, Physician, Senior Physician, Lab Worker, Nurse, Dep. Manager, CMO, etc.
Diagnosis
Main Complaints
Allergies
Meds
Labs
X-Ray Reports
Pathology Reports
ER Visits
Admissions
Primary Care Encounters
Operations
Procedures
and more…

23 different legacy systems
Clalit Use Analysis
Logins
Year 2001
Logins
Years 2003-2005

Logins/Month at major hospital

### Current Usage Analysis (Clalit)

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>12</td>
</tr>
<tr>
<td>Clinics</td>
<td>1,100</td>
</tr>
<tr>
<td>Users</td>
<td>9,000</td>
</tr>
<tr>
<td>Units/Depts using dbMotion in Hospitals</td>
<td>792</td>
</tr>
<tr>
<td>Logins</td>
<td>6 million</td>
</tr>
<tr>
<td>Pages viewed</td>
<td>51 million</td>
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<tr>
<td>Total amount of records in CDRs</td>
<td>2 billion</td>
</tr>
<tr>
<td>Avg. response time</td>
<td>&lt;10 sec.</td>
</tr>
</tbody>
</table>
The Results
The Results…

Clalit CIO Testimonial

Intel Promotional
Then…Sheba Medical Center
Sheba Medical Center

- An IDN serving the Tel-Aviv metropolitan area
- The largest and most comprehensive medical center in Israel and the Middle East
- General hospital, rehabilitation hospital, children’s hospital, research and education centers and more…

- Number of beds.................. 1,900
- Number of employees........... 6,000
- Annual outpatients............... 1,000,000
- Annual ER visits................... 150,000
- Annual surgical procedures ...... 36,000
Sheba’s Path to the Network

- Started with integrating data from within the Medical Center (across hospitals and units)
- After completion (internally) asked to connect into Clalit’s dbMotion network – adding a completely independent organization to the dbMotion network
- Legal and CMO approved – after satisfying their concerns with data ownership issues
- Adopted Clalit’s security and ethics standards
- Connected to Clalit in 2 months
<table>
<thead>
<tr>
<th>Hypersensitivities</th>
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<tbody>
<tr>
<td>ACAMOI</td>
<td></td>
</tr>
<tr>
<td>ASPIRIN</td>
<td></td>
</tr>
<tr>
<td>CFPHORAI</td>
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<tr>
<td>ERYTHROMYCIN</td>
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<table>
<thead>
<tr>
<th>Medications</th>
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<tbody>
<tr>
<td>VABEN 10 MG</td>
<td></td>
</tr>
<tr>
<td>PERCOCET-5 MG</td>
<td></td>
</tr>
<tr>
<td>MODAL [CAPSULES] 60 MG</td>
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<table>
<thead>
<tr>
<th>Main Complaints</th>
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<tbody>
<tr>
<td>MALIGNANT NEOPLASM HOS'</td>
<td></td>
</tr>
<tr>
<td>ANEMIA NEC</td>
<td></td>
</tr>
<tr>
<td>PULM EMBOL./INFARCT NEC</td>
<td></td>
</tr>
<tr>
<td>PRIM CARDIOMYOPATHY NEC</td>
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<table>
<thead>
<tr>
<th>Hospital Admissions</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Sheba MC</td>
<td></td>
</tr>
<tr>
<td>Sheba MC</td>
<td></td>
</tr>
<tr>
<td>Sharon Ho.</td>
<td></td>
</tr>
<tr>
<td>Sharon Ho.</td>
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<table>
<thead>
<tr>
<th>Diagnosis</th>
<th></th>
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<tbody>
<tr>
<td>PHLEBITIS/THROMBOPHIL...</td>
<td></td>
</tr>
<tr>
<td>OTHER INCISION WITH...</td>
<td></td>
</tr>
<tr>
<td>CELLULITIS AND ABSCE...</td>
<td></td>
</tr>
<tr>
<td>ADULT ONSET TYPE DIA...</td>
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<table>
<thead>
<tr>
<th>Admission Details</th>
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<tbody>
<tr>
<td>Date: 7/12/2003</td>
<td></td>
</tr>
<tr>
<td>Time: 11:46</td>
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<table>
<thead>
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<th>Lab Results</th>
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<tbody>
<tr>
<td>Test Name</td>
<td>Value</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>13.4</td>
</tr>
<tr>
<td>Erythrocyte</td>
<td>4.8</td>
</tr>
<tr>
<td>WBC</td>
<td>8.2</td>
</tr>
<tr>
<td>Platelet</td>
<td>250</td>
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</table>
Sheba’s Path to the Network (cont.)
Sheba Usage Analysis

Sheba - Logins

Years: 2004-2005
And then came... Rambam Medical Center
Rambam Medical Center

- One of Israel's five major hospitals and the only tertiary care center serving the northern third of the country and the US Navy’s 6th Fleet
Rambam MC - Unique Attributes

- Use a highly advanced home-grown EMR throughout the Medical Center
- XML based message broker used to build a CDR at the Medical Center
- Extensive use of PDF documents
- Connected to Clalit and Sheba in 4 months
**Rambam MC – From EMR to IHR**

<table>
<thead>
<tr>
<th>Code</th>
<th>Diagnosis</th>
<th>Date</th>
<th>Time</th>
<th>Division</th>
<th>Code of Diagnosis</th>
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<tbody>
<tr>
<td>TRAUMATIC SUBDURAL HEM</td>
<td>LT PARIE</td>
<td>10/11/2004</td>
<td>10</td>
<td>85220</td>
<td>LT PARIE</td>
</tr>
<tr>
<td>SEC MAL NEO BRAIN/SPINE</td>
<td>FOSSA</td>
<td>10/11/2004</td>
<td>20</td>
<td>1383</td>
<td>FOSSA</td>
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<tr>
<td>OBSTRUCTIVE HYDROCEPHALUS</td>
<td></td>
<td>10/11/2004</td>
<td>30</td>
<td>3314</td>
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<tr>
<td>CATAFRACT NOS</td>
<td></td>
<td>10/11/2004</td>
<td>40</td>
<td>3669</td>
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<tr>
<td>UNSPECIFIED FALL</td>
<td></td>
<td>10/11/2004</td>
<td>50</td>
<td>E9009</td>
<td></td>
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<tr>
<td>FX NECK OF FEMUR NOS-CL</td>
<td>RT</td>
<td>10/11/2004</td>
<td>60</td>
<td>8208</td>
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<tr>
<td>CAROTID ARTERY OCCLUSION WITHOUT LIPOSAFCOMA NOS</td>
<td>BLT RT</td>
<td>10/11/2004</td>
<td>43310</td>
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<tr>
<td>HYPERTENSION ESSENTIAL</td>
<td></td>
<td>10/11/2004</td>
<td>401</td>
<td></td>
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<tr>
<td>CAROTID ARTERY OCCLUSION WITHOUT LIPOSAFCOMA NOS</td>
<td>LT RADIA</td>
<td>10/11/2004</td>
<td>M38560/3</td>
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Rambam MC – From EMR to IHR

<table>
<thead>
<tr>
<th>Hypersensitivities</th>
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<tbody>
<tr>
<td>Rambam Carmel Ichilov</td>
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<tr>
<td>OSMO ADALAT 20MG TAB 26...</td>
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<tr>
<td>NORMALOL 25MG TAB 25...</td>
</tr>
<tr>
<td>DISOTHIAZIDE 25MG TAB 25...</td>
</tr>
<tr>
<td>LIPOSARCOMA OF LT THIGH OPP...</td>
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</table>

<table>
<thead>
<tr>
<th>Hospital Admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rambam Carmel Ichilov</td>
</tr>
<tr>
<td>16/11/2004 09:14...</td>
</tr>
<tr>
<td>26/05/2003 13:43...</td>
</tr>
<tr>
<td>07/09/1997</td>
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</table>

<table>
<thead>
<tr>
<th>Diagnosis</th>
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<tbody>
<tr>
<td>TRAUMATIC SUBDURAL HEM...</td>
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<tr>
<td>CATARACT EXTRACTION...</td>
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<tr>
<td>SENILE CATARACT, UNS...</td>
</tr>
<tr>
<td>CHRONIC SUBDURAL HEM...</td>
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<table>
<thead>
<tr>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
</tr>
<tr>
<td>24 hours</td>
</tr>
</tbody>
</table>
The Diversity of These Implementations

- Different standards for **coding** – From ICD9 to proprietary or no coding
- A variety of **operating systems** and **databases** on which the clinical systems run – from Oracle 9i and SQL 2003 to Ingress on Mainframe
- The **data structure** in which the medical information is contained - from HL7 and XML to delimited ASCII files
- Multiple distinct **dictionaries** used to define names or medical data objects
  - e.g. the term “Emergency Room Number” – may be used to denote the number of the encounter in the emergency room **OR** for the number of the room in the emergency department
Expanding Functionality - Care Messages

• A messaging capability for patient related messaging

• Messages are “attached” to the VPO

• Enables messaging between non-specific care providers
  - Message made available, based on permission and relevance, to the next care provider regardless of the provider’s location

• Proven to have extremely high rates of adoption - 115,000 messages in 2004

☑ Implemented since the end of 2003
Keeping the Network Working

- **Support and Implementation**
  - 1st tier referents in each hospital
  - 2nd tier support in Clalit’s HQ (for Clalit Hospitals and Clinics)
  - 3rd and 4th tier support + system monitoring by dbMotion
  - On-going training - ½ FTE mobilized between locations
  - A team of 15 professionals handling new versions and change requests

- **Project Management**
  - Rambam/Sheba – managed by the CIO – no new net headcount
  - Clalit – managed by the MIS department (reporting to the CIO) – 2 FTEs

- **Medical Management of the Network** – by assigned executive
  - Currently CEO of one of the hospitals
The Results – Anecdotal Evidence

- Increased Patient Safety
  - Less unnecessary medical tests & procedures
  - Lower risk of medical errors
  - Increasing efficiency and shortening the care cycle

- Reduced Costs to the Healthcare System
  - Less unnecessary costly medical tests & procedures
  - Lower probability of medical errors

- Proactive Care
  - Care Professionals can know where and when their patients are hospitalized
  - Patient related messaging among care providers
Questions?