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meets the exceptional.

Enterprise Data Access

Beyond the Clinical Data Warehouse

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About the Presenter

1. Project manager for several EMR implementations as well as ancillary applications (CVIS, PACS)
2. Significant background in healthcare Enterprise Data Warehousing
3. Technical by profession (understand the data and how to get the data)



Objectives

1. To describe benefits of data management programs
2. To outline Key Performance Indicators important to capture
3. To offer guidance on the data warehouse development process and outline a practical approach for establishing a system-wide data management program

Agenda

- Why Data Warehousing?
- Data Warehousing Past and Present
- Challenges and Opportunities with Vendor Data Marts
- Towards Enterprise Data Access
- Using KPIs for Data Modeling
- The Virtual Warehouse

Why Data Warehousing?

- Quality data is required for informed decision making on managed care, operational efficiency, clinical management, financial management, and quality management initiatives.
- More data is now available electronically
- Accessing data across multiple systems is challenging but necessary to evaluate clinical and financial performance historically, currently, and in real-time at the point-of-care.
- Increased focus on cost and quality (safety and pay for performance initiatives) make it even more critical to have efficient and effective data analytics capabilities evaluate own performance data.
- The ability to produce relevant, timely, and accurate information is a competitive advantage (improve planning, monitoring, and decision-making).

What is Data Warehousing?

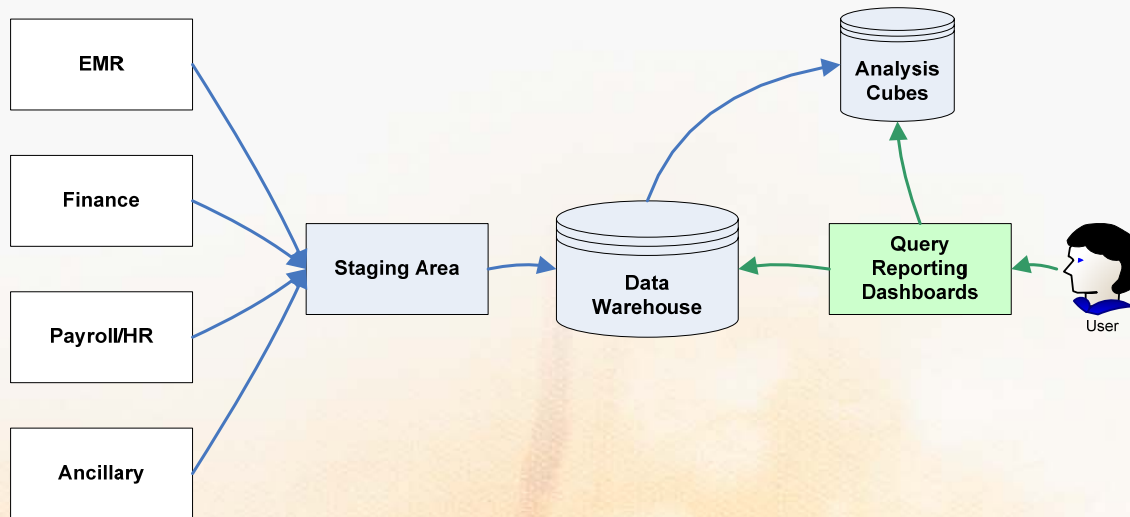
- Data Warehousing refers to systems that:
 - Offload reporting and analysis from core transaction systems
 - A transaction system is your Financial system, your EMR, your Lab system, your HRIS.
 - By moving queries OFF of these systems, you allow users to get information without impacting day-to-day processing.
 - MAY combine data from multiple systems into one reporting framework:
 - EMR + Financial System + HR/Payroll + Legacy Data + ?
 - Combine data from 2 EMRs
 - Or just provide a better way to report on one system
 - Restructure Data to optimize analysis:
 - De-normalized data
 - Joins and indices built for query performance
 - Simplified views and pre-calculated measures for end-users

Waves of Warehouses

- 1980s:
 - “Data Warehousing” theory established
 - Report Tables inside of transaction systems
 - Replicated systems for offline reporting
 - Hardware not ready for it
- Mid-Late 1990s:
 - “Data Warehousing” grows as a discipline.
 - CPU and DB technology supports complex indices required
 - Disk affordable enough to replicate a lot more data
 - Inaccessibility of data from ERP systems creates first wave of opportunity
 - Some forward-looking hospital systems begin building DWs off of their mainframe-based HIS systems
- Early 2000s:
 - First wave of early “next generation” Client-Server EMR adopters begin to feel the reporting pinch: A lot of DWs started at Cerner Millennium sites (i.e. Intermountain Health).

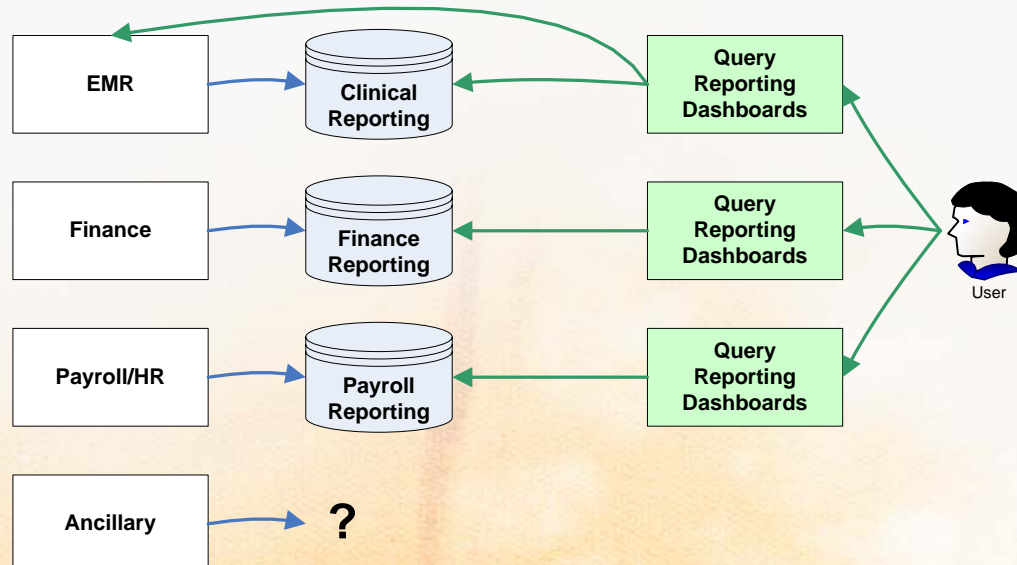
Present Day

- EMR Adoption now at >30% of hospitals in U.S.
- More “next generation” EMRs being implemented
 - Epic, Soarian, McKesson Horizon
- But data is still hard to access....
 - *People are talking about Data Warehouses again, but are they really necessary?*
- Here’s the traditional Data Warehouse Model (ridiculously simplified):



Things have Changed

- Most systems (EMR, CVIS, Financials, HRIS, etc.) are trying to address reporting issues by bundling a daily/hourly updated “reporting database” or Data Mart
 - Epic Clarity is one example: Loaded nightly, SQL/Oracle DB, plays nice with Cognos, BO, Crystal.
 - Oracle Financials and HRIS have bundled BI tools as well
 - Dashboards are built directly into many applications
- Who needs a Warehouse? The current state ...



Mart Advantages

- By bundling Data Marts with their applications, vendors give users powerful analysis, reporting, and dashboard tools.
 - Many single-system key performance indicators (KPIs) can be found using these marts!
 - Average Length of Stay
 - Current Census, 24 Hour Census, 1 week, 1 month, 1 year comparisons
 - Time from transfer request to transfer completion
 - Re-admission for same/related diagnosis
 - Re-admission in time period
 - Report turnaround time
 - Revenue vs Budget
 - (More on these later...)
- Bundles include very good Query/Reporting tools
 - If perhaps limited by licensing (great cross-platform tools restricted to use on only the intended DB)
- Extract/Transform/Load processes pre-built by vendor

Mart Challenges

- Varying degrees of friendliness/completeness
 - Epic Clarity essentially 4000 replicated tables and some Crystal templates (improving with Business Objects partnership)
 - Oracle BI tools have pre-built analysis tools
 - All still require developers to assist. None are “plug and play”
- Requires users to log into multiple tools
 - Even if all are using the same tool (i.e. Cognos, BO), user usually needs to switch contexts in some manner – Universes and Catalogs don’t cross DBs well.
- Not all systems are represented (see the “?” on the previous slide?)
- Marts don’t answer cross-system questions

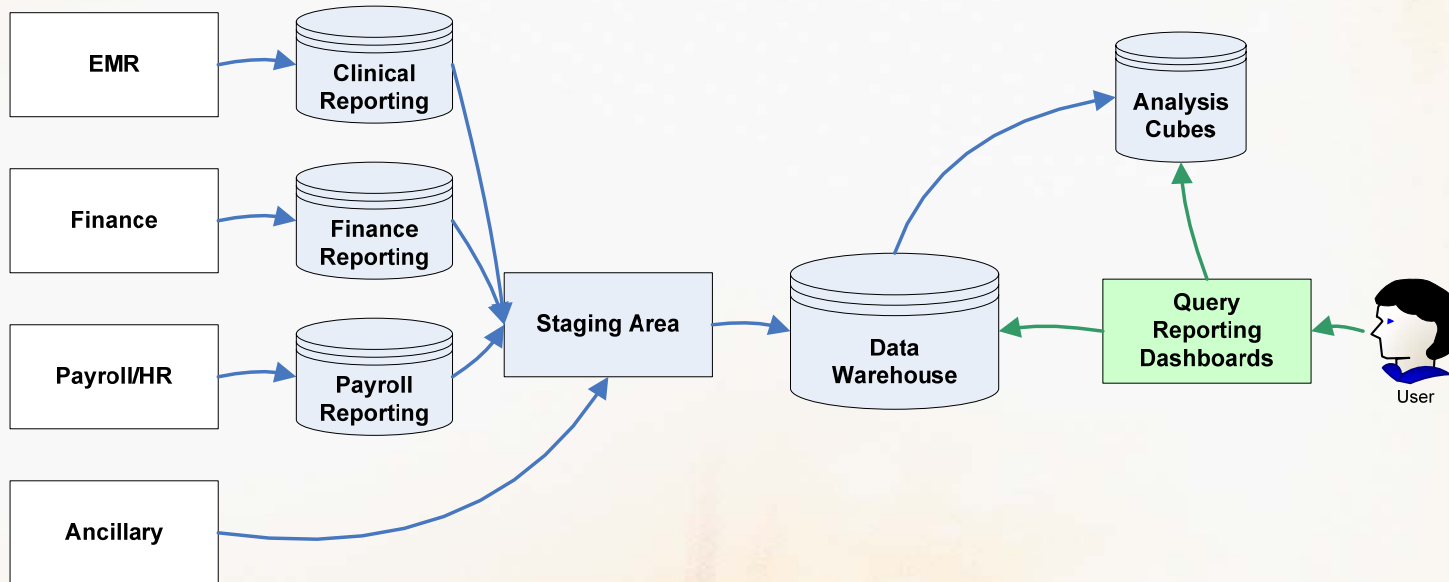
Examples of Cross System Questions

Examples of key metrics calculated using cross-system queries:

- EMR + HR/Payroll:
 - Nursing hours and schedule data compared with unit volume and patient flow data.
- HR/Payroll + Finance + EMR:
 - Analysis on how staffing hours affect profitability incorporating department census figures for workload modeling.
- EMR + PACS
 - Time from Patient Check-in to first image taken
 - Average images taken / procedure type, impact of number of images/series on read turnaround
- EMR + CVIS:
 - Patient length of stay or re-admission rates tied to type of stent used (i.e. drug eluting or bare metal)

So...

- Perhaps a Warehouse isn't such a bad idea:
 - When you have Marts, can you use THEM to source your DW?
 - Now your data is replicated 3 times...



The Solution is probably something more blended...

We'll get to that in a moment ... but first a word about Data.

Towards Enterprise Data Access

- The previous exercise demonstrates a point:
 - When tough data questions come up, our first reaction is to look to a system solution.
- Remember: All the data you need to answer your questions is in your system ... SOMEWHERE*
 - Do you know what your organization's QUESTIONS are?
 - Identify your KPIs
 - Do you know where your ANSWERS are stored?
 - Source the KPIs from your Data Sources

**(As long as you're actually CAPTURING that data somewhere – where are you documenting “check two for safety?”)*

One Solution: The Kitchen Sink DW

- Identify Source Systems, create the all-inclusive data model.
- Move as much data as possible into the DW
 - Support one system at a time.
- Available data then drives what questions can be answered.
- Assumptions:
 - Better to move it all than to miss something the users want.
 - If you build it, they will come.
- Challenges:
 - Lots of replicated data/storage
 - Simultaneous risk of too much and not enough data:
 - Data that may not have relevance to KPIs is there
 - But key KPIs can't be answered.
- A Warehouse is only as good as the questions it can answer.

Alternative: The “Shrinkwrap” DW

- Pre-built Data Model
- Key queries, reports, cubes are ready to do.
- All you do is deliver the data in extracts

Advantages:

- Lots of functionality right out of the box.
- Some excellent financial-oriented tools on the market.

Disadvantage:

- Closed systems (or for-a-fee customizable)
 - How will you integrate data from your home-grown Java/MySQL quality-assurance tracking application?
- Data is still replicated
- Not YOUR KPIs, but best practice.

KPIs – Your Organization's Questions

- Key Performance Indicators:
 - The metrics you need to run your business.
 - Applicable to all levels: Rolled up for Executives, drilled down for departmental managers.
- Cross System KPIs:
 - Not just clinical/patient care: Integrating Financial System data lets you see the data as the Payers are...
- IF you want to be able to use your DW to get KPIs, start with identifying the KPIs.

KPIs – Internal and External

- Internal Measures:
 - Department Performance
 - Census/Utilization Trends
 - Compliance
 - These are the usual KPIs we hear about – the “Dashboard”.
 - Add in Financial metrics
- External Measures:
 - Registry Reporting
 - Joint Commission “Core Measures” (ORYX)
 - Facility-Oriented
 - SCIP (Surgical Care Improvement), Pneumonia, Heart Failure, Acute MI, Pregnancy, Children’s Asthma
 - CMS “PQRI” Reporting
 - Physician-oriented

External KPIs

- Quarterly/Summary External Measures ARE useful for internal viewers.
 - Truly become operational when you can drill down to find sources of non-compliance.
 - Give a heads-up BEFORE pay-for-performance reports come back from Insurers.
 - Insurer reporting based only on claims they see
 - KPI Reporting can include other insurers, self pay info.
 - One site used standalone data from STS Registry posting application, developed reports, became core to operations.

In Defense of External Measures

- Core Measures are frustrating, seemingly arbitrary metrics requested by external entities.
 - AND your EMR may already have extracts to support them
 - So why look to them to form the basis of your Enterprise Data Management?
- They come with instructions.
 - For organizations without a bank of PhD data analysts, the exercise of directly sourcing these KPIs builds data knowledge and will build expertise.
 - They provide templates for your own internal KPIs
 - Average 3-6 pages + decision trees
 - Comparing your own calculated KPIs to the system extracted data provides objective QA.

Collecting Internal KPIs

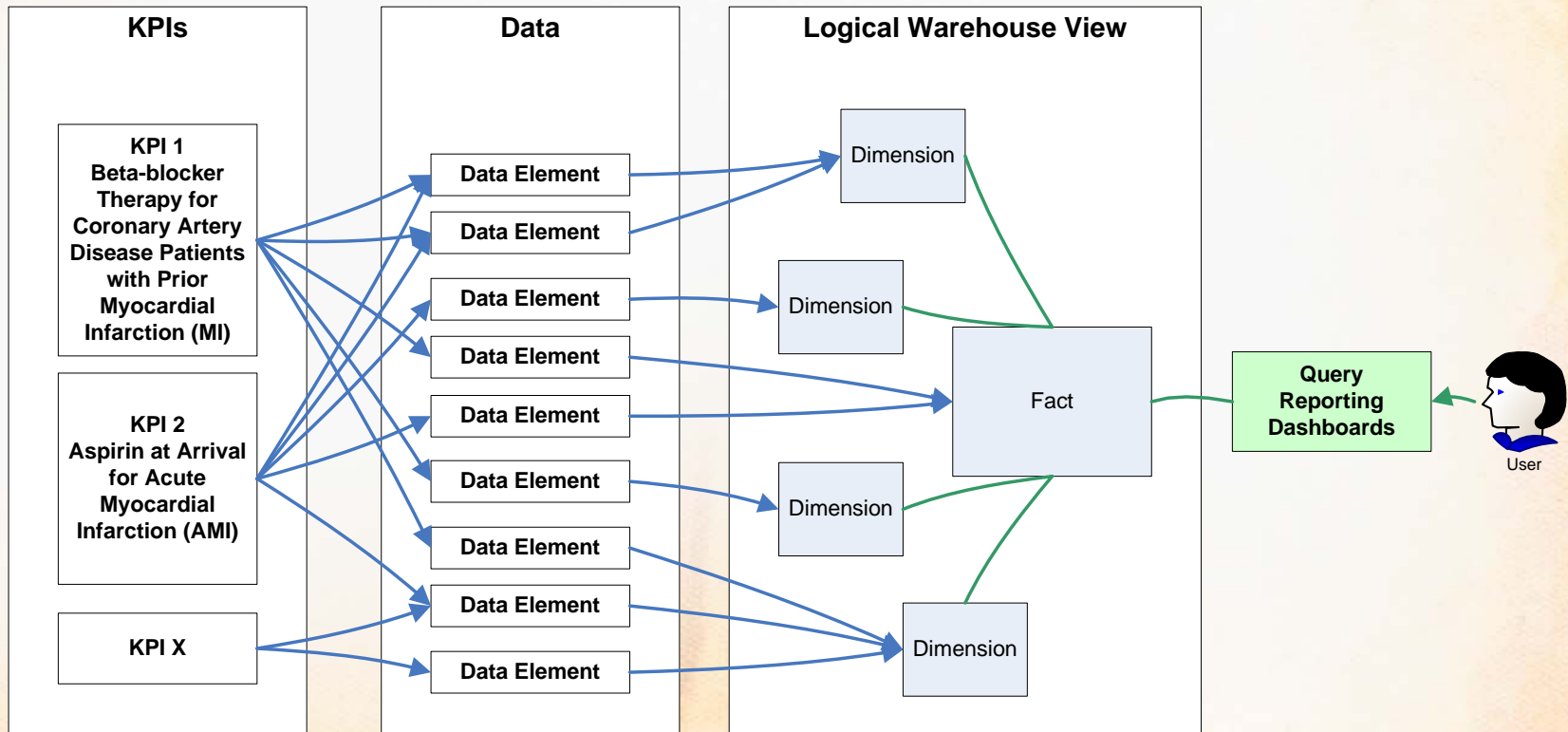
- Development 101: Collect your requirements before you begin to code. External KPIs are mandated... but what about Internals?
 - Every KPI needs a sponsor
 - Every KPI needs a design
 - Start with the questions, and map the data to them.
 - Target key KPIs by department – ask managers for what data they need to be strategic.
 - One project collected queries for >9 months prior to the DW launch: Queries were delivered ad-hoc by a data maven. These requests formed the basis for the internal KPIs.
 - Many projects use more formal interview/design sessions.
 - What KPIs are Payers looking at? Get ahead of them!
- What about the questions we don't yet know?
 - If you have a good base of KPIs, including the Core Measures, the framework should support further exploration.

Internal KPIs and the Super-Analyst

- Some organizations are blessed with super-analysts: PhDs who love to surf through the data and answer research questions.
 - These people will ask for everything and will inflate your data model.
 - Take their advice, but don't let them overrun your model.
 - In some cases, these people need more access to source systems or custom analytic tools (SAS, SPSS, Hyperion) to solve their “what if” scenarios.
 - *These are the tools you need for what-if modeling.*
- Engage the Super-analysts, but stick to the KPIs.
 - At least for the first release!

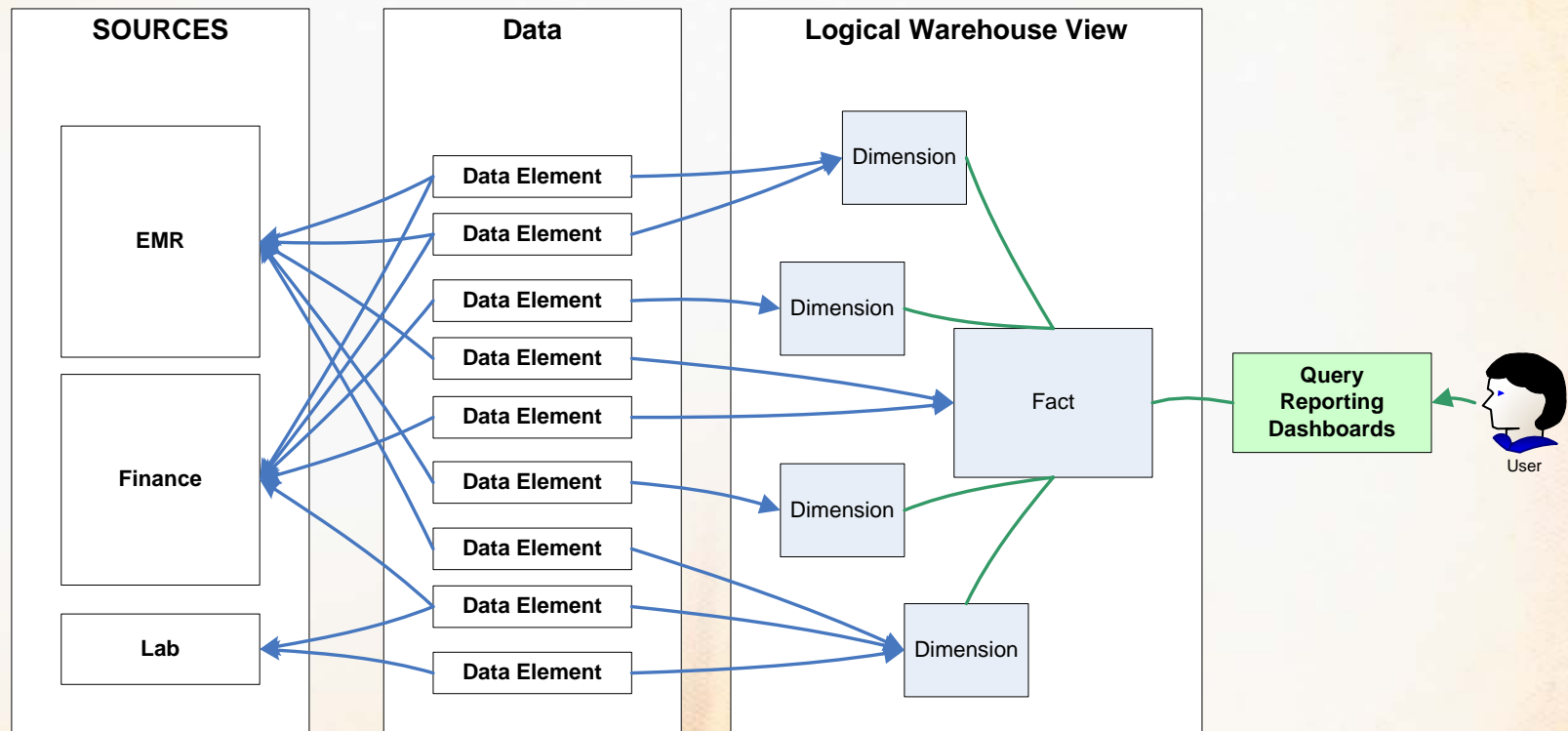
KPI Driven Data Modeling

- KPIs identify Necessary Data Elements
- Those Elements are then mapped to a Presentation Layer for query/reporting
- (Don't ask about where the data comes from just yet)



KPI Driven Data Modeling

- KPIs' identified Data Elements are then sourced to Transaction Systems
- (Don't ask about where the data is stored just yet)



Where is the Data?

- As noted before, MOST newer systems have well developed Marts, optimized for reporting.
 - These databases grow at almost the same rate as the source systems...
 - Perhaps we can use the data already in these marts?
 - Create a “virtual warehouse”
- Optimize Existing Data Stores
- Lean, KPI-Driven Data Structure

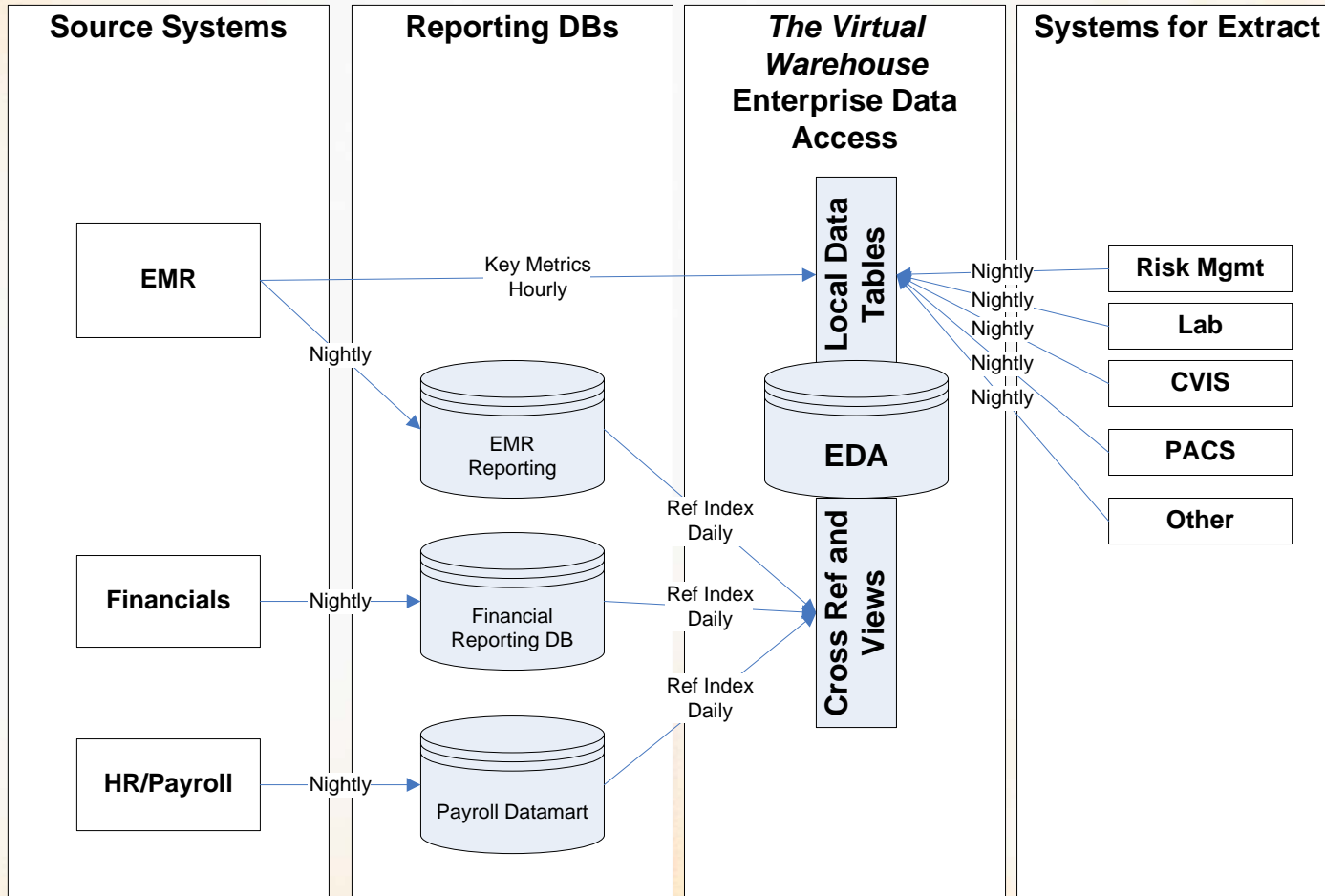
Virtual Warehousing

- Systems with a robust reporting database don't need to have data replicated into another warehouse.
 - You already have Extract/Transform/Load, data scrubbing, and QA from your source systems to these reporting DBs
 - *Don't reinvent the wheel, don't replicate the data.*
- CPU speed and advances in DB technology enable true Virtual Warehousing: Join to external databases when possible, load data when necessary.
 - Need to be creative...
- New Database includes cross-reference tables, views to other databases, and data tables extracted from "island" systems.
 - Presents a cohesive data view to external query and reporting tools.
 - Can include pre-calculated summaries for performance

Enterprise Data Access (EDA) Overview

- One “Presentation Layer” to query/reporting
- Views to other reporting databases with updated cross-reference indices
 - X-Ref Tables enable cross-system queries
 - Views pass queries through, data is NOT replicated in DW.
 - Views can present simplified views of data
- Some data extracted and imported into EDA tables directly
 - Reports from PACS, CVIS, Risk Mgmt, etc.
 - Hourly extracts from EMR (Census, Utilization)
 - Replicate data from older or end-of-life systems as appropriate
 - Pre-calculate summaries for key fact/dimension combinations
- Reduce duplication of data, smaller DB footprint.

EDA Data Mapping



Maintaining the EDA

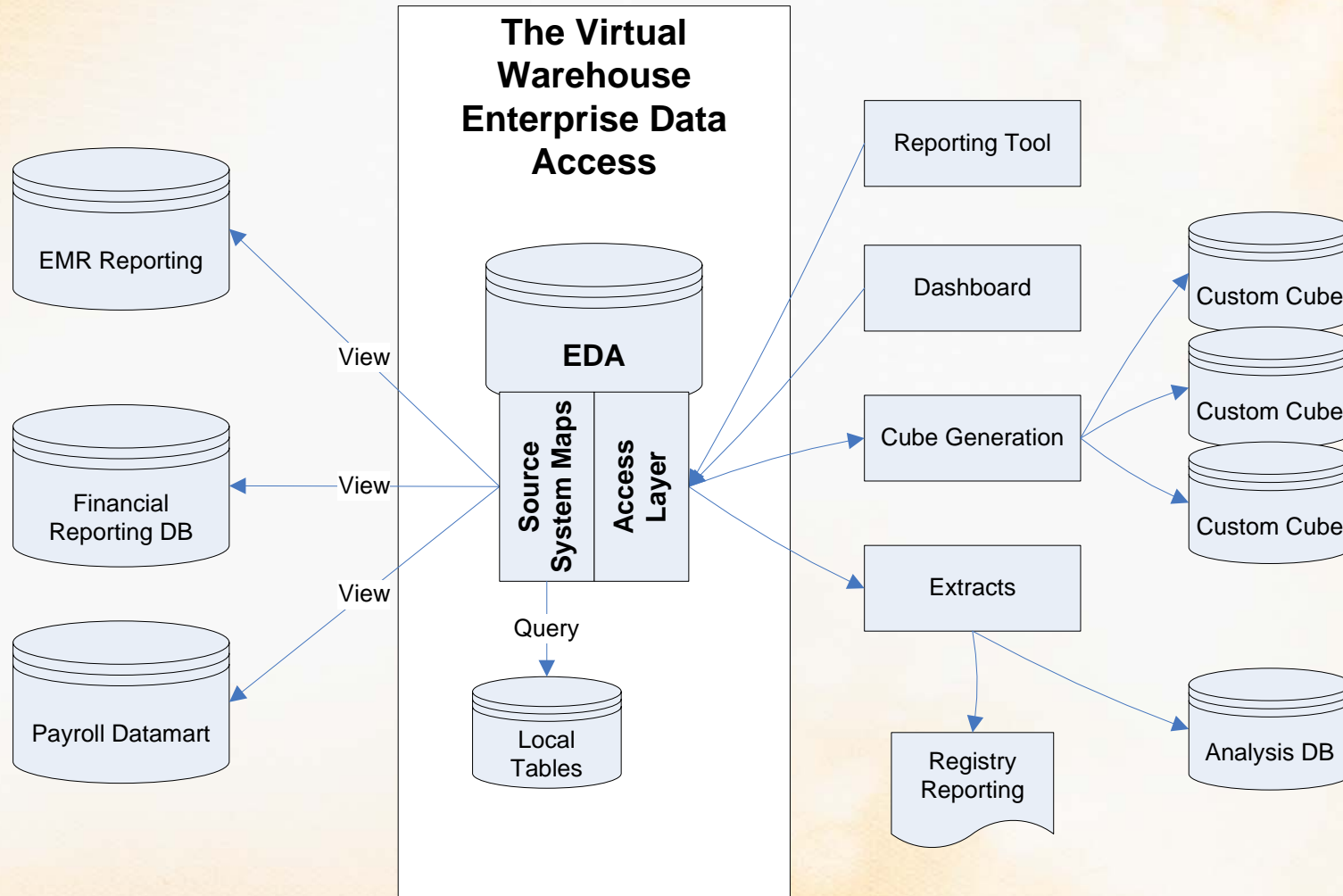
Even a “Virtual Warehouse” needs attention:

- Cross References must be monitored, especially when bringing up new departments, facilities, changing structures
- Expansion: Can start lean and expand available data just by expanding views, with no DB reload needed (for EMR, Financial, HR)
- EDA has the same uptime as your source reporting systems:
 - EDA won't be usable during Reporting Systems load...
 - Need to review DB refresh schedules to make sure availability is high.

Access to EDA

- Existing Reporting Tools can be pointed to EDA for cross system reporting.
 - Tools can maintain existing reports against EMR Reporting, Financial Reporting, others.
 - EDA reports will match EMR reports because the data source is the same!
- For analytical performance, pull data from multiple EDA sources into cubes for analysis, drill through to detail in EDA (mapped through to source systems).
- For what-if and deep statistical analysis, consider a tool like SPSS, SAS, Hyperion, all of which can be fed from the EDA.
- *EDA adds to existing capabilities – it doesn't have to replace tools that work for your users!.*

EDA Reporting Data Access



Caveats

- There is still a role for the Enterprise Data Warehouse:
 - Existing systems that serve as the primary reporting repository are still crucial.
 - EDWs that merge data from legacy or multiple non-compatible EMRs without robust reporting systems.
 - *There's no reason to uproot a working system for an EDA.*
- The EDA may not work in all environments:
 - But in cases where most components are newer (within 5 years) with dedicated reporting systems, an EDA strategy can be cost effective and flexible.
 - And I repeat the caveats:
 - Performance needs to be monitored and tuned.
 - Indices and pre-calculations need to be actively monitored

Questions?

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