

# **Business Intelligence for Actuaries**

**SOA Spring Meeting  
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June 15, 2004**

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## **Agenda**

- **Context & Background**
- **Data Modeling**
- **Technology & Tools**
- **Implementation Strategy**

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## Audience Survey

- Tools...
  - Excel Pivot Tables
  - Microsoft Access
  - Cognos, MicroStrategy, Actuate, SAP BW, Business Objects...
- “Data Modeling”
- “Data Warehousing”
- SQL

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## Basic Problems

- *Aggregate* data can mask the underlying business patterns and drivers.
- *Detailed* data can be difficult to manage, organize and visualize.
- It can be difficult or impossible to *reconcile* aggregate data to detailed data.
- When different users/processes take different approaches to solving these problems, the result can be “*multiple versions of the truth*”.

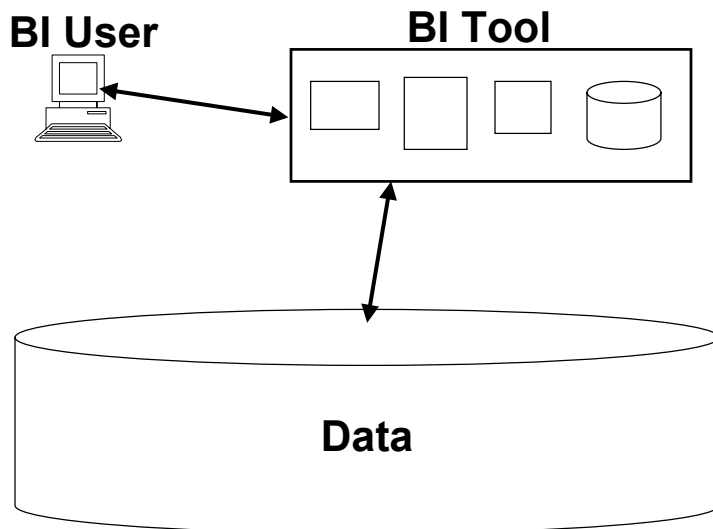
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## Basic Solution

- A good Business Intelligence implementation can address these problems.
- “Business Intelligence” refers to a proven, established set of *approaches* and *technologies* that can help a company understand what is going on in the business.

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## BI Provides a Window to the Data



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## General Theme

- Of course, Actuaries have been confronting and solving these problems for many years, even without any new techniques and technologies.
- Ironically, this has led to a situation – at least as I see it – where Actuaries have not been using these newer technologies.
- The goal here is to help you become more familiar with what is out there, and to gain confidence in working with it.

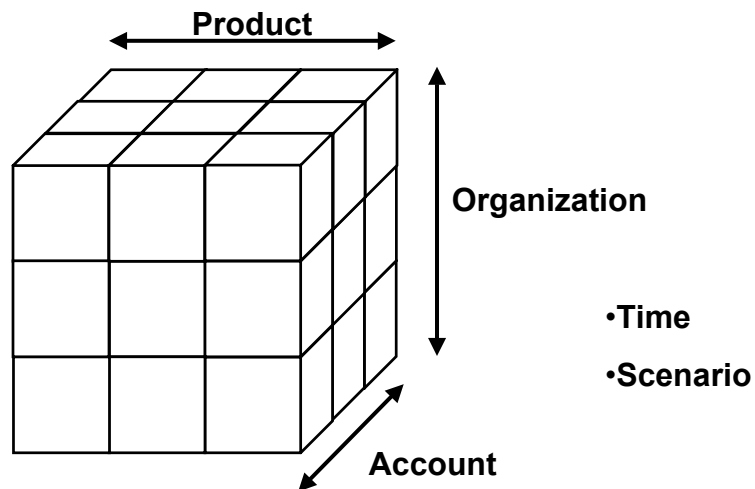
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## Online Analytical Processing (OLAP)

- Originally, the “opposite” of Online Transaction Processing (OLTP)
- Now, more specifically,
  - Technology that supports multidimensional structures.
  - Allows the user to look at data across many business dimensions or hierarchies .
  - OLAP structures also referred to as “cubes”.
  - OLAP functionality also referred to as “slice-and-dice”.

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## MultiDimensional “Cube”



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## Examples of BI

- *Report Delivery & Alerting* – Dashboards, automatic e-mail notifications and links.
- *Enterprise Reporting* – Automatically provide monthly accountability reports to all Cost Centers, at all levels of the organizational hierarchy, over the intranet
- *Interactive Reporting* – Provide the Claims organization with customizable report templates, capturing different views of the Claims data.

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## Examples of BI

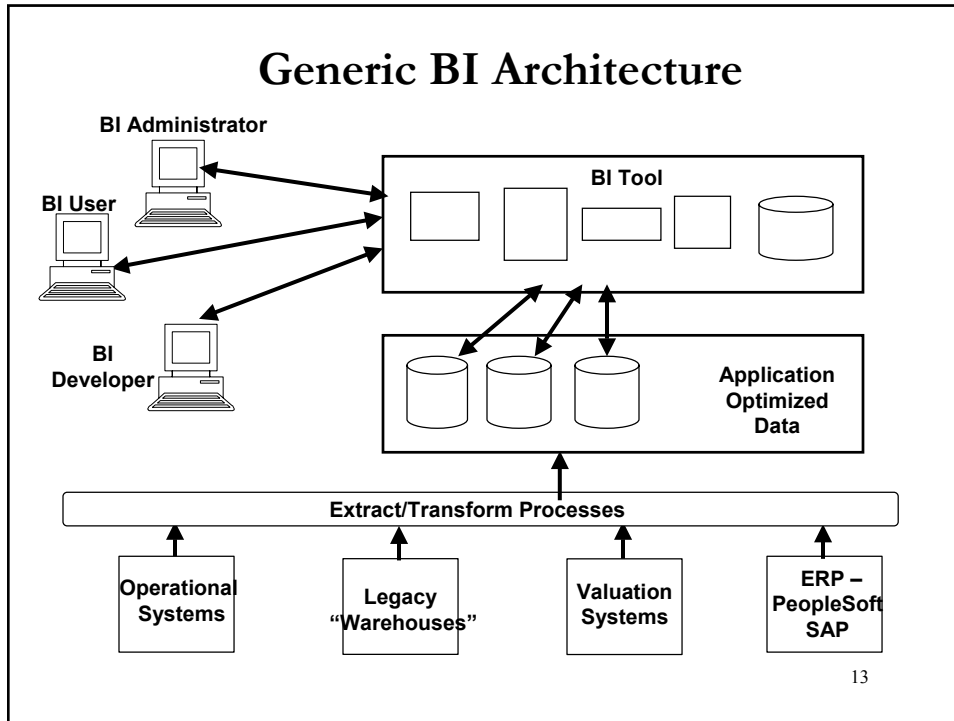
- *Cube Analysis* – OLAP slice-and-dice data to analyze Expenses vs Expense Allowables.
- *Ad Hoc Query and Analysis* – OLAP slice-and-dice general ledger data, with the ability to drill down to transaction detail.
- *Statistics and Data Mining* – Apply advanced formulas to sets of data.

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## Actuarial Examples

- Actuarial Applications that can benefit from BI approaches and technologies.
  - Experience Studies
  - Claims Analysis
  - General Ledger Views and Drilldown
  - Reserve Reporting & Analysis
  - Source of Earnings
    - ◆ Expenses vs Expense Allowables

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## Getting Started

- **Focus the Business Need**
  - It is not enough to say that you can do “better” analysis with “better” data.
  - Define the required capabilities.
  - Be able to explain how you will use these capabilities to optimize your business.
- **Narrow down to a Subject Matter Area**
  - Do not try to solve everything at once, at least not the first time.

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## Getting Started

- **Anticipate Working With IT**
  - Ultimately, the Actuaries are going to work closely with IT, with an appropriate balance of roles and responsibilities.
  - What the Actuaries can do in advance is to think through and define the logical structure of the data.

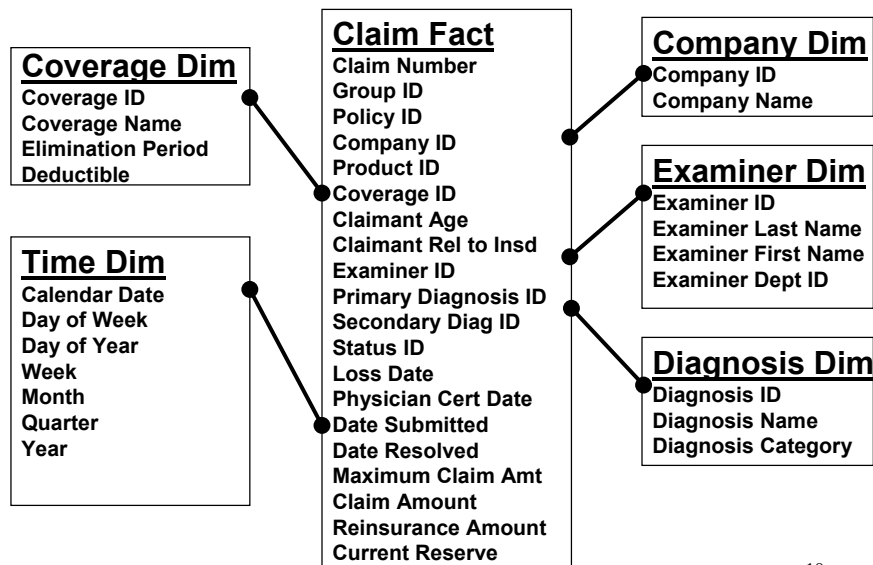
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## Logical Data Model

- A Logical Data Model is a “map” that defines the data elements in the Subject Matter area, and explains the relationships among them.
- The “test” of the model is whether your desired outputs (reports, views, etc) could be created if you had the data as defined in the model.
- Don’t worry (yet) about
  - Creating a physical database
  - Populating a physical database with real data from your real source systems.

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## Claims Logical Model



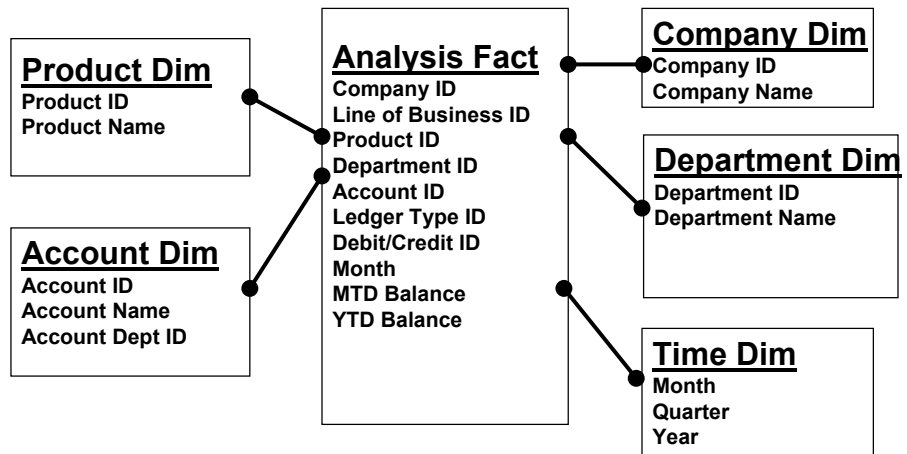
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## Company Dimension

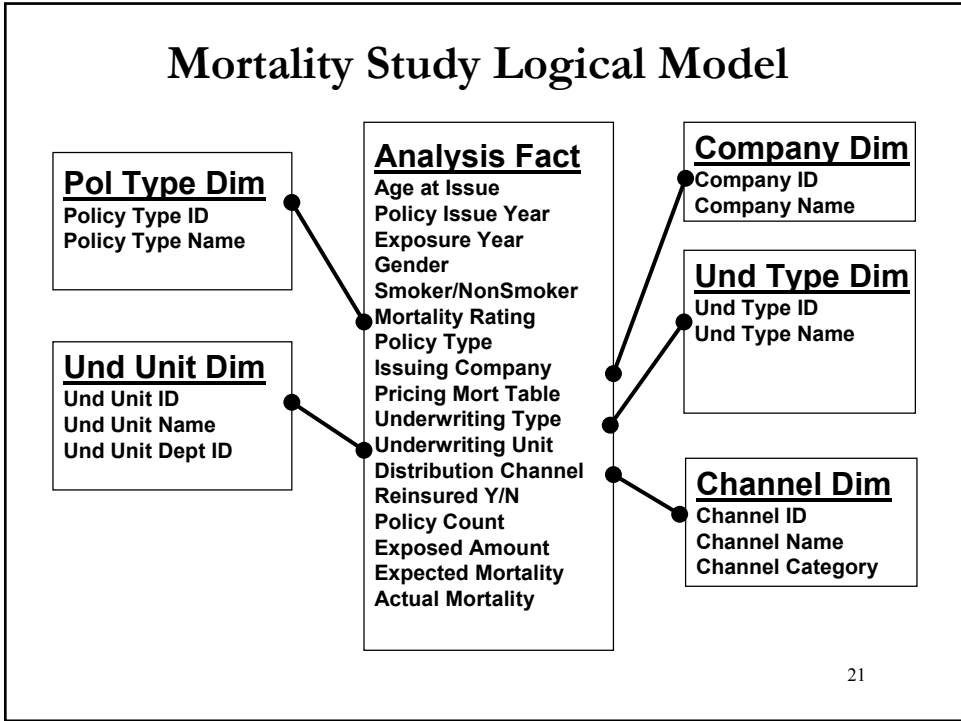
<u>Company ID</u>	<u>Company Name</u>
100001	ABC Insurance Company
100002	ABC of New York Insurance Company
100003	ABC of Arizona Insurance Company
100004	ABC Property & Casualty Insurance Company
100005	XYZ Insurance & Annuity Company

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## Expense Study Logical Model



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- ## Logical Model Components/Concepts
- Granularity
  - Dimensions
  - Metrics
  - Hierarchies
  - Sorting
  - Filtering
  - Derived Metrics
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## Logical Model Components/Concepts

- Granularity
  - The “grain” of the model is basically the definition of what constitutes a row in the fact table.
  - In the Claims example, each row is a Claim, which is a natural “atomic” element – a natural intersection of attributes.
  - In the Expense Study example, each row is an intersection of attributes, not preserving the “atomic” transaction.

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## Logical Model Components/Concepts

- Dimensions
  - AKA Attributes, Characteristics
  - Descriptions of the granular entity
  - Usually non-numeric
  - For example, for Claims
    - ◆ Coverage
    - ◆ Company
    - ◆ Diagnosis
    - ◆ Examiner
    - ◆ ...

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## Logical Model Components/Concepts

- **Metrics**
  - **AKA Measures, Key Figures**
  - **Numerical quantifications associated with the granular entity**
  - **Claims example**
    - ◆ **Claim Amount**
    - ◆ **Maximum Claim Amount**
    - ◆ **Reinsurance Offset**

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## Logical Model Components/Concepts

- **Fact Table**
  - **Each row is an intersection of attributes and contains metrics.**
- **Dimension Table**
  - **Each row is an element of the dimension**

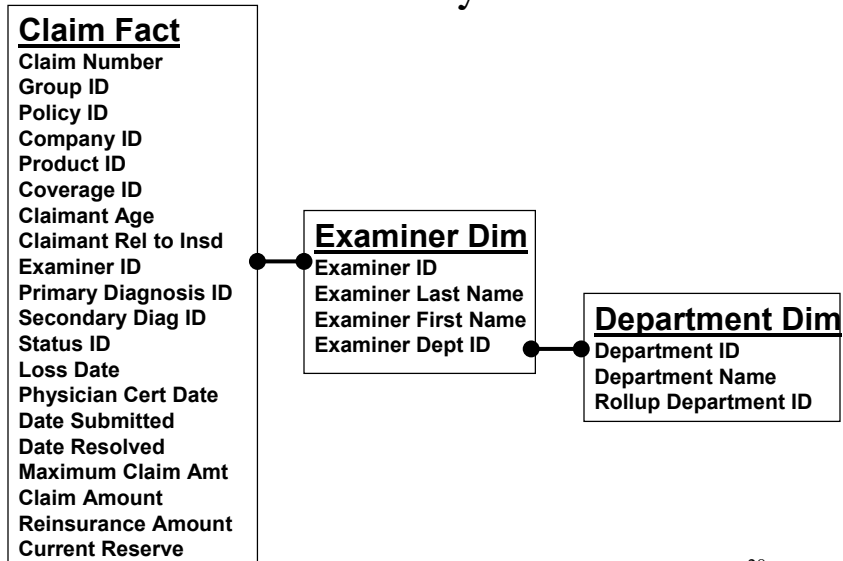
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## Logical Model Components/Concepts

- Hierarchies
  - Usually, Dimensions are organized into Hierarchies
  - You might want multiple hierarchies on the same data

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## Claims Logical Model – Dept Hierarchy



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## Syncing to the Target

- Putting it in these terms, most reporting and analysis simply involves taking different views of the available Dimensions and Metrics
  - *What BI is about is managing your data, and defining your Dimensions and Metrics, so that it is very easy to get all these reports and analyses.*
  - *As you think through your data model, will it support your analytical requirements?*

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## Logical Data Modeling

- Other Important Concepts
  - Keys
  - Sorting
  - Filtering
  - Derived Metrics

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## Things to Keep in Mind

- Do not let dimensions get confused with each other
  - The “Individual Life” Product is not the same as the “Individual Life” Department.
- Don’t be afraid to leverage an existing “enterprise data model”.
  - Don’t be afraid to challenge it, either
- You can do the initial work in Excel or Access

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## Data Planning Next Steps

- Identify Likely Data Sources
  - Where do you currently get your data?
  - What is the structure? The rows and columns?
  - What are the inadequacies?
  - What are likely data sources for the reference structure of the organization?

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## Data Planning Next Steps

- Mapping
  - Get a conceptual idea of how you would *transform* source data to the logical view.
- Volume Metrics
  - Numbers of rows.
  - Growth rates.
  - Refresh frequency.

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## Bottom Line

- Your goal is to define things in terms of the Dimensions, Metrics, etc. that make sense.
- You have an opportunity to define how you would like to restructure, reorganize and transform the data.
- You are the expert, here. If you don't take this opportunity, it won't happen.

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## Technologies & Tools

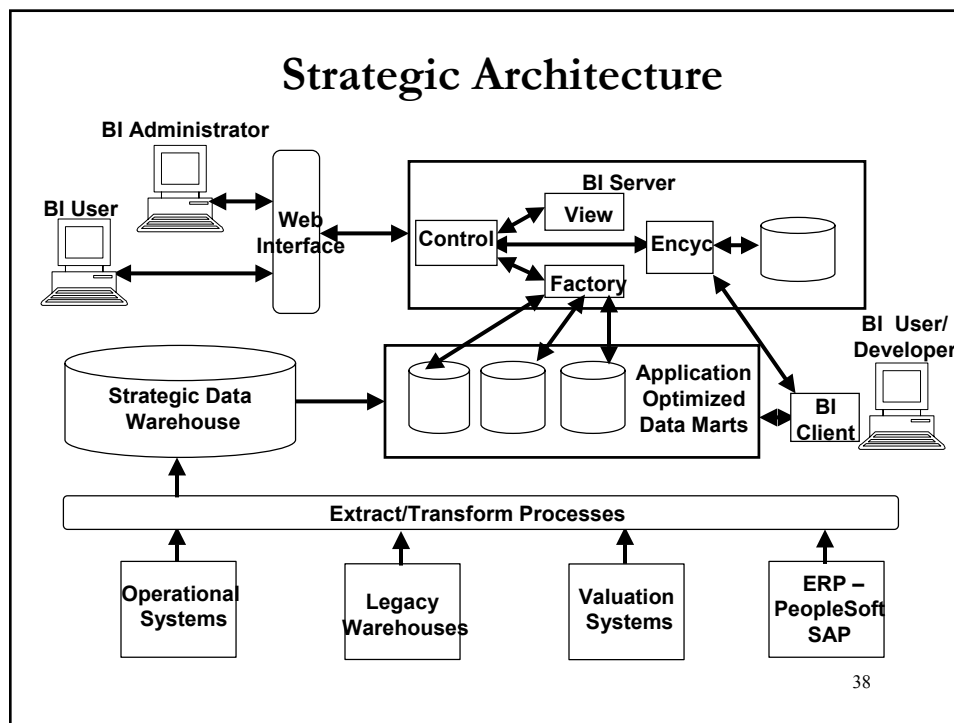
- **These are good concepts. Now, what technologies does it take to make it work?**
  - **Data management technologies.**
  - **“Strategic” BI architecture**
  - **Approaches that are less “strategic”, but still viable and useful.**

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## Strategic Architecture

- Corporate View
- May appear daunting, and more than needed for your Actuarial application, but useful to review.
- Your company may already have this in place, for a range of applications. By understanding the Company's existing technology, you can see exactly where your particular application would fit in.

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## **Main Components**

- **Data Sources**
- **Data Transform and Loading into the Enterprise Warehouse**
- **Enterprise Data Warehouse that integrates all the data**
- **Data Marts – subsets of the data, optimized for the BI Tool**

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## **Main Components**

- **BI Client**
- **BI Server**
- **Web Interface**
- **Security**

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## Basic Data Sources

- Could be anything
  - Legacy admin systems
  - Legacy General Ledger
  - A modern Enterprise Resource Planning (ERP) application, such as PeopleSoft or SAP, especially as the General Ledger.
  - Legacy “warehouses”
  - Specific Actuarial systems, such as the applications that generate reserves or cash flow testing

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## Data Transformation

- Data Cleaning and Transformation processes
  - The jargon term is “ETL” or “Extract/Transform/Load”.
  - Standardize data and definitions
    - ◆ Resolve data inconsistencies
    - ◆ Recall the example of multiple identifiers of “Issuing Company”
  - Schedule timing

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## Enterprise Data Warehouse

- **Most effective way to integrate data from multiple applications.**
  - **Consistent transformation rules.**
  - **Consistent reference structures.**
- **Different subject matter areas can be added incrementally.**
- **Unfortunately, does not always exist.**

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## Data Marts

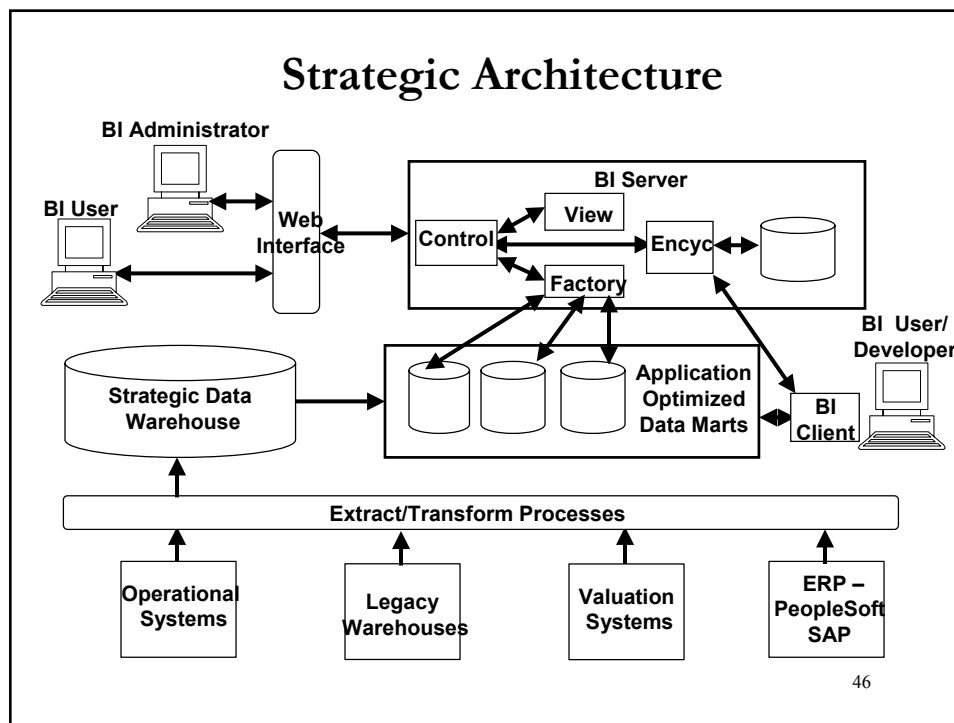
- **Physical or logical subsets of the data.**
- **Organized/optimized for the application and the analytical tool**
  - **For example, with an experience studies application, you might want policy level data, but you might not want all the customer-type information that Marketing might want (such as address).**
  - **Or, you might only want cell data.**

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## Business Intelligence Software

- Typically a specialized vendor product, such as MicroStrategy, Cognos, Actuate, Hyperion/Brio, Business Objects, Crystal
- Could be a component of other software, such as SAP BW
- BI Client – Desktop. Developers and possibly users.
- BI Server – There is a lot going on here, but it is mainly “beneath the covers”. I am going over it so you understand the things that this technology is doing.

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## **Business Intelligence Software**

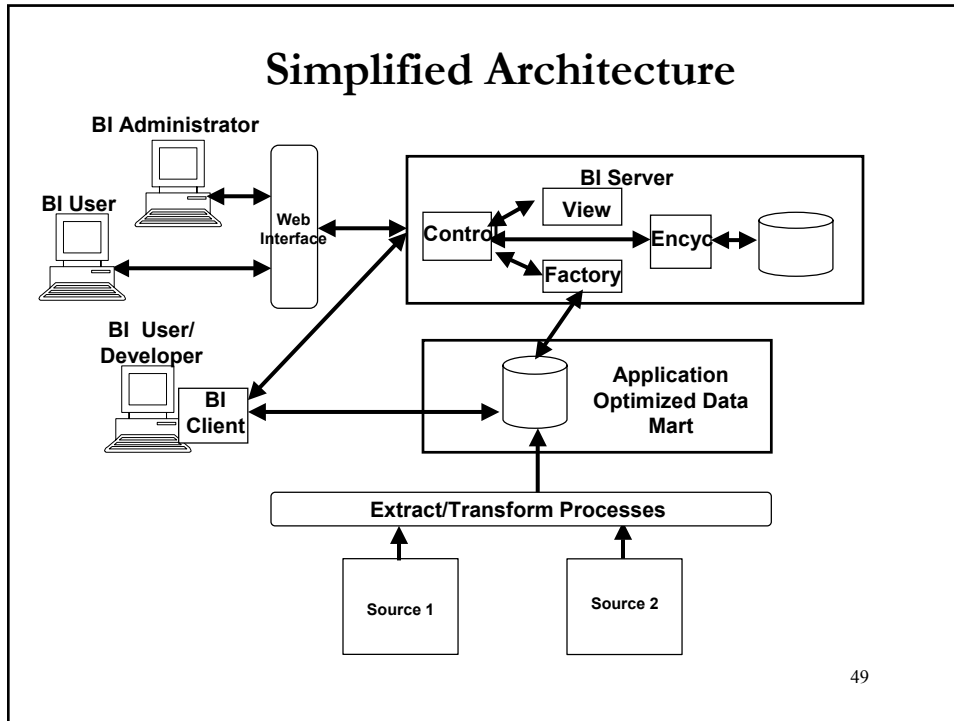
- **BI Server Components**
  - **Control**
  - **Factory**
  - **Encyclopedia**
  - **View**
- **Web Interface – Increasingly the vendors want to provide you with the ability to get at information with nothing more than a web browser on your local machine.**

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## **Wait a Minute!!!**

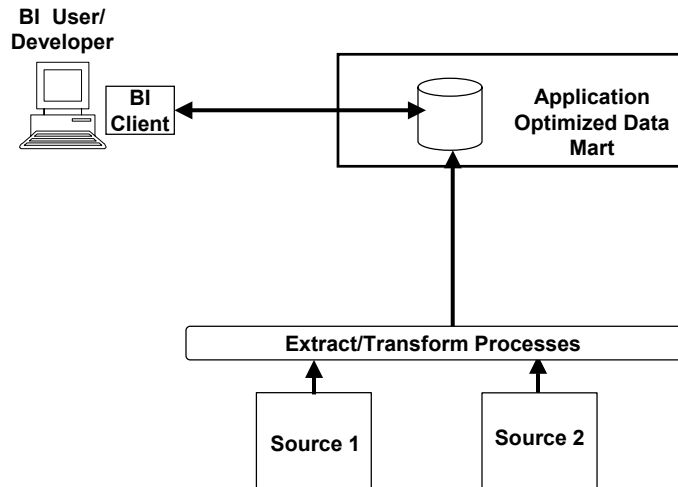
- **“This is starting to sound nice, but I can’t afford to wait for -- or to pay for -- a great big database project in order to start accessing and analyzing my data.”**
- **Maybe there is more in place than you realize**
- **Simplified Architecture**
  - **Let’s just design a database that will support our initial application.**

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- ### Really Simplified Architecture
- We don't need web distribution right away.
  - Just put a strong analytical tool on a few peoples' desktops.
  - This would have been the main paradigm maybe five or ten years ago, when the web based components were simply not that mature.
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## Really Simplified Architecture



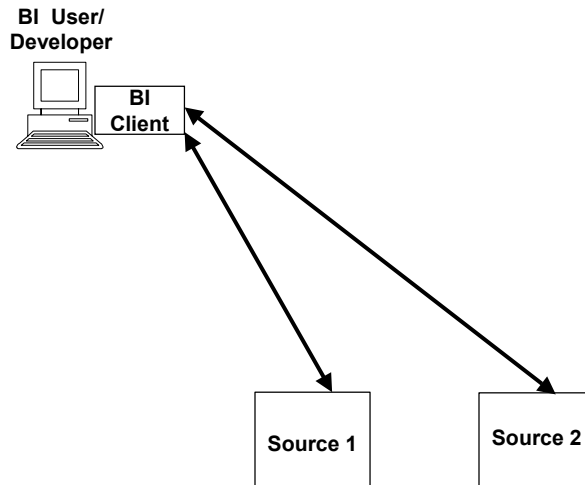
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## Or even,...

- With some tools, you could interface directly with basic source data, bypassing the initial setting up of the data.
- All other things being equal, it is *better* to be able to build a DB that aligns with the subject area, but it is not always mandatory.
- **CAUTION** -- Not all tools will work as well, or do as much, if you want to take a simplified approach. There are tradeoffs. This is discussed next.

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## Or Even...



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## Making Technology/Tool Decisions

- Usage Considerations
  - What type of Business Intelligence?  
Enterprise reporting, OLAP slice-and-dice or ad hoc query?
  - How much data?
  - How many users?
- Architectural Considerations
  - What is in place already? What is IT already supporting?
  - If a standard BI Tool is in place, what version?
  - Intended to be foundational or standalone?

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## Making Technology/Tool Decisions

- **General Considerations**
  - **Scope and Budget.**
  - **Roles and Skill Sets -- Will Actuaries be developers, administrators?**
- **Database Decision**
  - **Doesn't really matter.**
  - **Any standard relational database will do – DB2, Oracle, SQL Server.**
  - **Go with IT's standard/recommendation.**
  - **This is basically as generic as determining what type of hardware to use.**

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## Making Technology/Tool Decisions

- **BI Tool Decision**
  - **The BI tool is the link between the data and the business decisions. This demands that the selection be jointly determined by**
    - ◆ **IT personnel who will implement, administrate, and support the tool,**
    - ◆ **Business users who will define what the tool should do.**

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## Making Technology/Tool Decisions

- BI Tool Decision (cont'd)
  - Important advice – *The vendor tools are not all the same.*
  - Still, if IT has a standard, and there is general satisfaction, then my practical bias is to work with it.
  - If IT has several standards, don't just go with the one that your local part of IT is familiar with. Makes sense to speak up, ask to evaluate all options.
  - “Convergence”

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## Trade Offs

	Product A	Product B	Product C
<b>Core Competency</b>	OLAP Slice and Dice	OLAP Slice and Dice	Enterprise Reporting
<b>Data Management</b>	OLAP is directly against the relational database. Performance requires a database that follows a particular model.	Loads data into proprietary “cubes”. OLAP is against these cubes.	Can access data from any source in any format
<b>Advantages</b>	Unlimited “logical” cubes and drill down.	Cubes can quickly be developed from existing sources.	Get any report to anyone from any source, including interactive reports
<b>Disadvantages</b>	Must have built the database that meets the standards.	Hard to drill beyond the “physical” cube.	Not true robust OLAP

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## Every Situation is Different

- **Depends on specific circumstances**
  - **Scope/Subject matter**
  - **Budget**
  - **IT/Business Relationship**
  - **Existing capabilities – data and tools**
  - **Technical capabilities and inclinations of Actuarial resources**
  - **“History”**

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## **General Expectations of IT**

- **Protocol for project initiation.**
- **Development follows a structured, scheduled, “monitored” process.**
- **Roles and responsibilities clearly defined – both Business & IT.**
- **Risk management protocols in place.**
- **Important applications run in “production”.**
- **Application development is segregated from production.**

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## **Ideal Situation for BI**

- **There is an established framework for IT/Business partnership.**
- **The organization has appropriate tools and technology in place in non-actuarial contexts.**
- **Iterative Development – see Business Intelligence value along the way.**
- **Risk Management – both technical and financial.**

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## Allocation of Responsibilities

Task	Responsibility
Infrastructure & Eenvt	IT
Logical Data Model	Defined by Actuarial, implemented in IT Tool
Physical Data Base	IT, based on need to support Logical
Extract Transform Load (ETL)	IT, based on clear specifications from Actuarial
BI Tool Selection	Joint
BI Tool Implementation	IT
Report Development	Actuarial, following IT standards
Web Development	IT
Project Management	Joint management, with each team having a designated lead.

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## Implementation

- If not an Ideal Situation...
  - Recognize that the big risk in handling technology on your own is that you can end up with “mission critical” applications that do not have “mission critical” support.
  - The general goal will be to do as much as you can at low cost/low risk, so that you can ultimately engage IT with much of the problem already solved.

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## Implementation

- **If not an Ideal Situation...**
  - **Work out a Logical Data Model.**
  - **Implement Physical Data Model for a subset of data using Access.**
  - **Develop prototype reports based on the data.**
  - **Analyze the data with Excel pivot tables.**
  - **The point here is to confirm that the data content that you have defined is sufficient to supported the desired reports and analysis**
  - **Look for an “opportunity”**

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## Implementation

- **Tools & Technology**
  - **Having representative data in an Access database is a very smart way to jumpstart a tools assessment process.**
  - **All of these tools can connect to Access easily. (That’s how their marketing people do all their demos.)**
  - **Whether looking at products that are already in house or a new RFP, let the vendor make the case for you.**

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## Wrap-Up

- Context & Background
- Data Modeling
- Technology & Tools
- Implementation Strategy

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## Good Resources

- Kimball & Ross, The Data Warehouse Toolkit, Second Edition, John Wiley & Sons, 2002
- Vendor Websites
  - [www.actuate.com](http://www.actuate.com)
  - [www.businessobjects.com](http://www.businessobjects.com)
  - [www.cognos.com](http://www.cognos.com)
  - [www.hyperion.com](http://www.hyperion.com)
  - [www.microstrategy.com](http://www.microstrategy.com)
  - [www.sas.com](http://www.sas.com)

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# Questions

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