


DATA INTEGRATION

**APPA Institute for
Facilities Management
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San Diego, CA**



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TODAY'S PRESENTATION

Course Description:
This course explores:

We will discuss our needs for data, and how we can share our data with our institution's vast data resources. Facilities Management energy, maintenance, financial, space management and other data is fast becoming another sought-after campus utility that should be available to the entire institution in an integrated, globally acceptable manner. To do our jobs, it's not enough to just know how to use data applications, we need to understand how an integrated, easily accessible "data warehouse" can optimize the performance of those applications.

Learning Objectives:

1. Become familiar with database structures
2. Become familiar with integrating databases
3. Learn how this can be useful to those who work in FM
4. Think about how to convert data into information
5. Begin to think about how the various sources of data in your institution can be integrated and used.

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AGENDA

- What is data?
- Database versus Data Warehouse
- Data Integration
- Group Discussion
- If time permits, Converting data into information
 - Metrics, kpi
 - Example applications

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WORDS OF WISDOM

*Knowing that a tomato is a fruit?
That's Data.*

*Knowing not to put one in a fruit salad?
That's Knowledge.*

With apologies to Brian O'Driscoll

DEFINITION

What is data?

Raw facts that are persistently collected and stored for conversion into information used to inform business processes.

It must be accurate, documented, and managed on an on-going basis to ensure its value to the organization.

It must be delivered to the institution on a continuous, as-needed basis.

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WHERE WOULD YOU GET THE INFORMATION TO PRODUCE THIS REPORT?

- Create a report of energy consumption and cost for each building owned by your institution:
 - If served by a District Energy System or local system(s):
 - Chilled Water
 - Steam or Hot Water
 - Electricity
 - Water
 - Fuel-Gas/Oil/Coal
 - If served by the local utility
 - Electricity
 - Fuel-Gas/Oil/Coal
 - Water
- This year versus last year information:
 - Consumption and cost
 - Hours used and weekly schedule
 - Number of occupants, i.e. staff, students, faculty
 - Square footage of building including classification(s), i.e. instructional space, administrative, research, etc.
 - Departmental ownership
 - Weather, e.g. average temperatures, % sun, etc.
 - HVAC system type


Building	Year	Electricity (kWh)	Gas (therms)	Water (gals)
Building A	2013	12000	500	100000
Building A	2014	11500	480	98000
Building B	2013	8000	300	70000
Building B	2014	7800	290	68000

Table 2: Monthly Electricity Use at Building A
Average Use for the Reporting Period

Table 3: Monthly Electricity Use at Building B
Average Use for the Reporting Period

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DATA WAREHOUSING



- Technique for assembling and managing data from various sources for the purpose of answering interrelated questions, allowing for decisions that were not previously easily reached.
- A decision support (analytics) database maintained separately from the organization's operational databases

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CHARACTERISTICS OF DATA WAREHOUSE

- **Subject oriented.** Data are organized based on how the users refer to them.
- **Integrated.** All inconsistencies regarding naming convention and value representations are removed.
- **Nonvolatile.** Data are stored in read-only format and do not change over time.
- **Time variant.** Data are not current but normally time series.

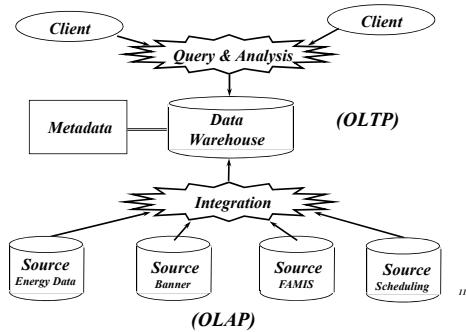
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CHARACTERISTICS OF DATA WAREHOUSE

- **Summarized** Operational data are stored in a decision-usable format
- **Large volume.** Time series data sets are normally quite large.
- **Metadata.** Data about data are stored.
- **Data sources.** Data come from internal and external unintegrated operational systems.

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WAREHOUSE ARCHITECTURE



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THE METADATA

- The name suggests some high-level technological concept, but it really is fairly simple. Metadata is "data about data".
- With the emergence of the data warehouse as a decision support structure, the metadata are considered as much a resource as the business data they describe.
- Metadata are abstractions -- they are high level data that provide concise descriptions of lower-level data.

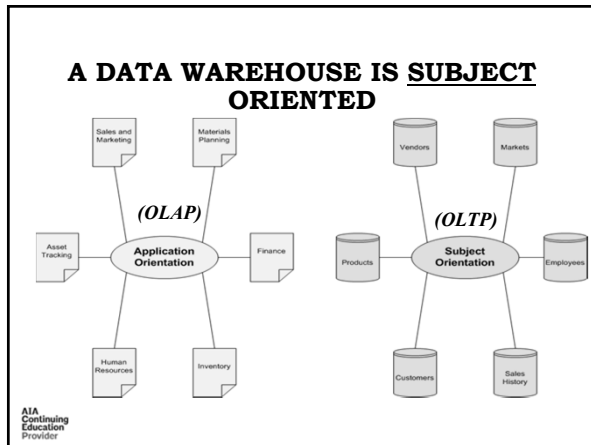
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THE METADATA

All the fields you see by each file in File Explorer is actually metadata. The actual data is inside those files. Metadata includes:

- file name,
- type,
- size,
- creation date and time,
- last modification date and time.

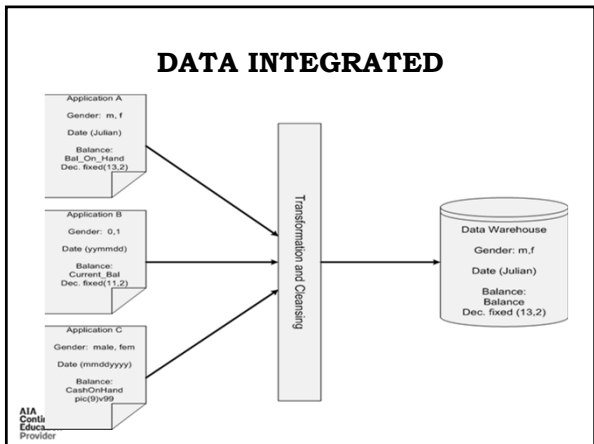
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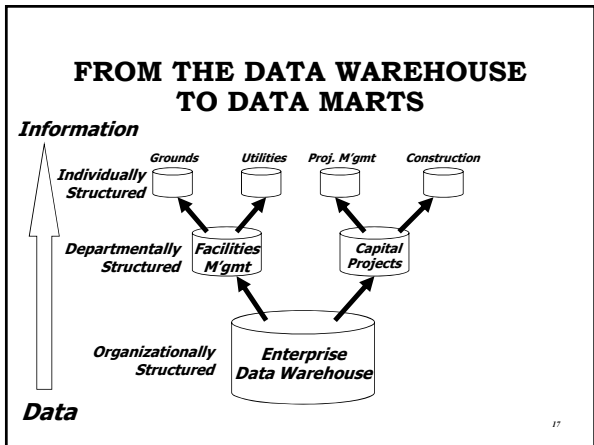


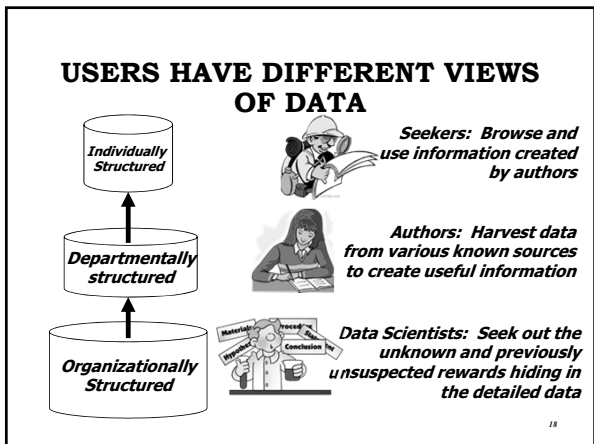
DATA INTEGRATED

- **Integration** –consistency in naming conventions and measurement attributes, accuracy, and common terms.
- Establishment of a common unit of measure for all synonymous data elements from dissimilar databases.
- The data must be stored in the DW in an integrated, globally acceptable manner

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INTERACT-QUERY

- What do you do?
- What data do you gather (or should gather), and who uses it?
- What data does your function need?
- What data is most important to your particular function?
 - Is some or all of it gathered by some other function?
 - How easy is it to get/use?

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INTERACT-SUMMARIZE

- What data is most used?
- What data is most required for our various functions?
- What are the most common reasons why the data is needed?
- Who gathers most of the data?

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INTERACT-SYNTHESIZE

- What data is collected by other functions in your organization that you can/want to use?
- What data is collected institutionally that can be used to meet your needs?
- What formats does the data require, i.e. spreadsheet, dashboard, formal reports, etc.?
- How can we convert the data into information in the required format(s)?

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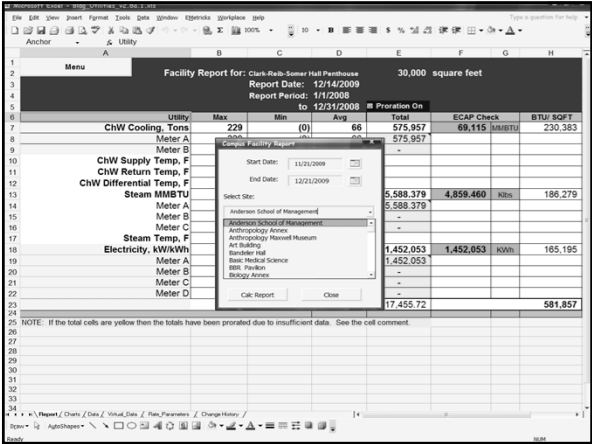
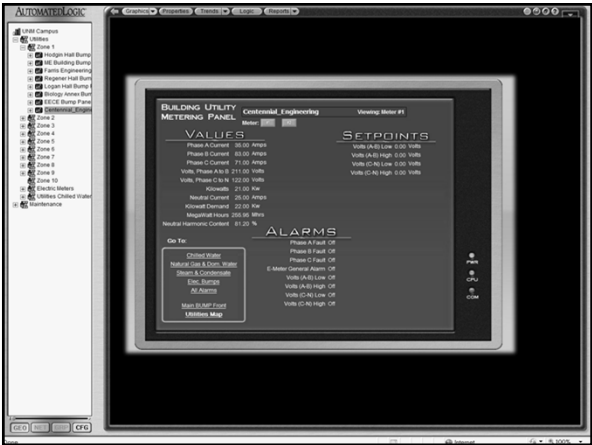
EXAMPLES OF OPERATIONAL SYSTEMS

Utilities Examples:

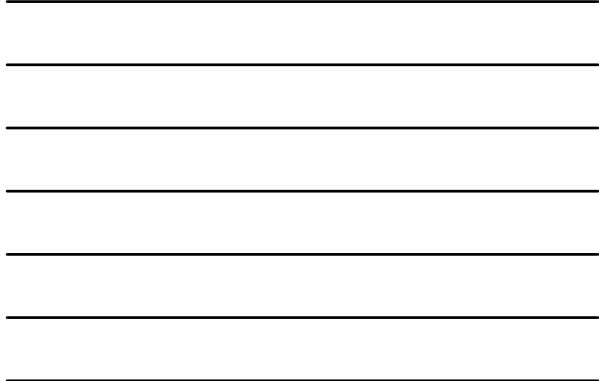


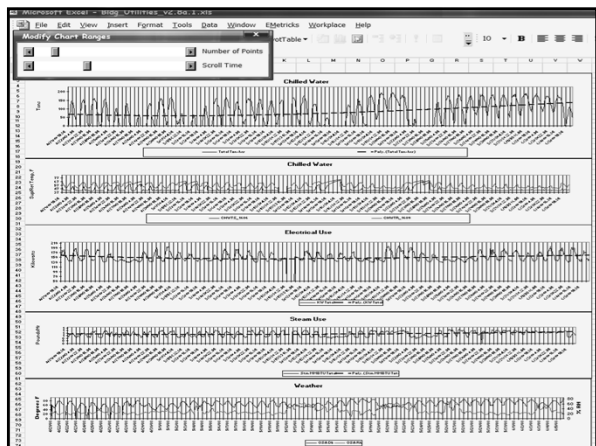
Real-Time Web Viewer **Data Analysis Report Writer** **Web-based Reporting and Billing** **Statistical Analysis** **Data Provisioning to 3rd Party Applications**

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Utility	Max	Min	Avg	Total	ECAP Check	BTU/ SQFT
CHW Cooling, Tons	229	(0)	66	575,957	66,115 MMBTU	230,383
Meter A				575,957		
CHW Supply Temp, F						
CHW Return Temp, F						
CHW Differential Temp, F						
Steam MMBTU				5,588.379	4,858.460 Klbs	186,279
Meter A				5,588.379		
Meter B						
Meter C						
Steam Temp, F						
Electricity, kW/kWh				1,452,053	1,452,053 kWh	185,195
Meter A				1,452,053		
Meter B						
Meter C						
Meter D						
Electricity, kW/kWh				17,455.72		581,857

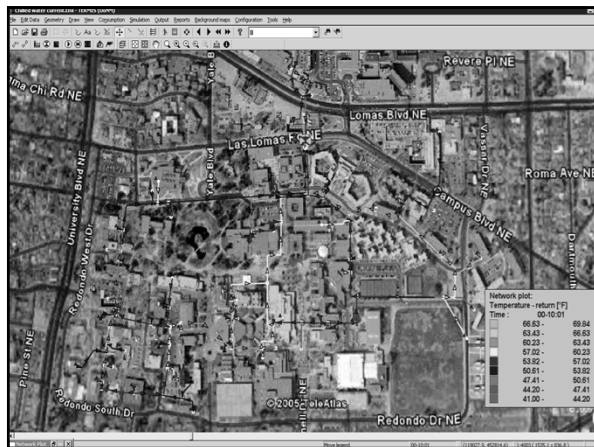
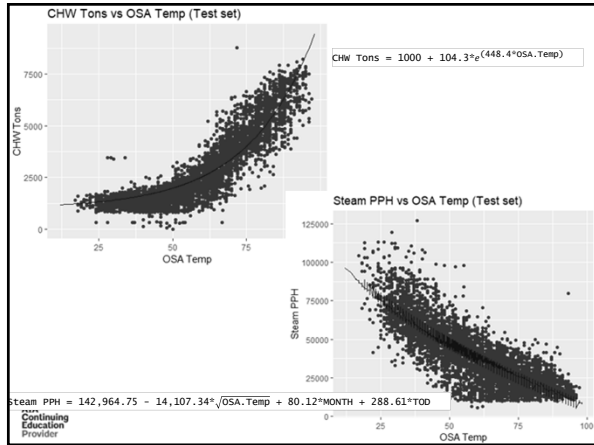
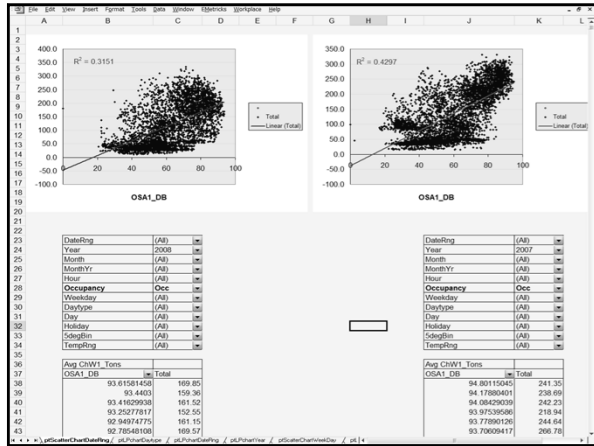




This screenshot shows a detailed data table from the 'Energy & Metering' software. The table lists various energy-consuming departments and their usage over time. The columns include Account Code, Billing Period, Begin Date, End Date, Total Cost, Usage, Usage Unit, and Cost/Unit. The total cost for all bills is \$1,079,510.00.

Account Code	Billing Period	Begin Date	End Date	Total Cost	Usage	Usage Unit	Cost/Unit
UNM00-110-CHW-01	Aug 2017	08/01/2017	08/31/2017	\$1,022.88	1,225	MWHrs	83.47
UNM00-110-CHW-01	Jul 2017	06/30/2017	07/31/2017	\$2,208.98	1,476	MWHrs	149.58
UNM00-110-CHW-01	Jun 2017	05/31/2017	06/30/2017	\$2,328.29	1,300	MWHrs	179.09
UNM00-110-CHW-01	May 2017	04/30/2017	05/31/2017	\$1,124.48	839	MWHrs	134.01
UNM00-110-CHW-01	Apr 2017	03/31/2017	04/30/2017	\$6,711.06	822	MWHrs	816.43
UNM00-110-CHW-01	Mar 2017	02/28/2017	03/31/2017	\$7,397.34	480	MWHrs	1541.94
UNM00-110-CHW-01	Feb 2017	01/31/2017	02/28/2017	\$1,828.88	219	MWHrs	835.10
UNM00-110-CHW-01	Jan 2017	12/31/2016	01/31/2017	\$1,038.45	166	MWHrs	625.57
UNM00-110-CHW-01	Dec 2016	11/30/2016	12/31/2016	\$1,738.88	173	MWHrs	1004.55
UNM00-110-CHW-01	Nov 2016	10/31/2016	11/30/2016	\$6,820.81	219	MWHrs	3114.52
UNM00-110-CHW-01	Oct 2016	09/30/2016	10/31/2016	\$1,228.21	712	MWHrs	1725.01
UNM00-110-CHW-01	Sep 2016	08/31/2016	09/30/2016	\$1,298.43	1,026	MWHrs	1265.41
UNM00-110-CHW-01	Aug 2016	07/31/2016	08/31/2016	\$1,935.81	1,142	MWHrs	1695.16
UNM00-110-CHW-01	Jul 2016	07/01/2016	07/31/2016	\$2,391.27	1,412	MWHrs	1694.24
UNM00-110-CHW-01	Jun 2016	06/01/2016	06/30/2016	\$1,938.88	1,275	MWHrs	1520.37
UNM00-110-CHW-01	May 2016	05/01/2016	05/31/2016	\$1,202.62	719	MWHrs	1672.63
UNM00-110-CHW-01	Apr 2016	04/01/2016	04/30/2016	\$6,261.06	444	MWHrs	1409.92
UNM00-110-CHW-01	Mar 2016	03/01/2016	03/31/2016	\$6,828.19	379	MWHrs	1801.63





SUMMARY

Data-> Integration-> Information -> Knowledge:

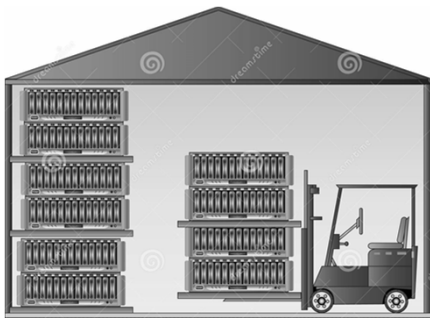
Convert DATA into INFORMATION
Convert INFORMATION into KNOWLEDGE

- Gather dispersed and disparate application data from multiple sites, multiple suppliers and different multiple databases.
- Validate the data and manage missing or erroneous data.
- Convert the raw data into usable management information, particularly meaningful Key Performance Indicators (KPIs).
- Generate meaningful, added-value reports that include the analysis of trends and exceptions.
- Distribute the analyses and reports across multiple sites, internally and externally, in a timely fashion.

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QUESTIONS & ANSWERS

Thank You!



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