Understanding the Multidimensional Model

Model-Based Reporting

- To interact with computers things need to be reduced to models.
- The **relational model** is one way of modeling information: databases, tables, fields, rows.
- The **multidimensional model** is another way of modeling information.
- Each model has its strengths and weaknesses.

Actual Business Model is Dimensional

From *OLAP Council White Paper*: (http://www.symcorp.com/downloads/OLAP_CouncilWhitePaper.pdf)

Multidimensional views are inherently representative of an actual business model. Rarely is a business model limited to fewer than three dimensions. Managers typically look at financial data by scenario (for example, actual vs. budget), organization, line items, and time; and at sales data by product, geography, channel, and time.

A multidimensional view of data provides more than the ability to "slice and dice"; it provides the foundation for analytical processing through **flexible access to information**. Database design should not prejudice which operations can be performed on a dimension or how rapidly those operations are performed. Managers must be able to analyze data across any dimension, at any level of aggregation, with equal functionality and ease.

Logical Multidimensional Data Model

From *The Multidimensional Data Model*:
(http://www.stanford.edu/dept/itss/docs/oracle/10g/olap.101/b10333/multimodel.htm#i1017034)

As Ralph Kimball states in his landmark book, *The Data Warehouse Toolkit*:

"The central attraction of the dimensional model of a business is its simplicity.... that simplicity is the fundamental key that allows users to understand databases, and allows software to navigate databases efficiently.“

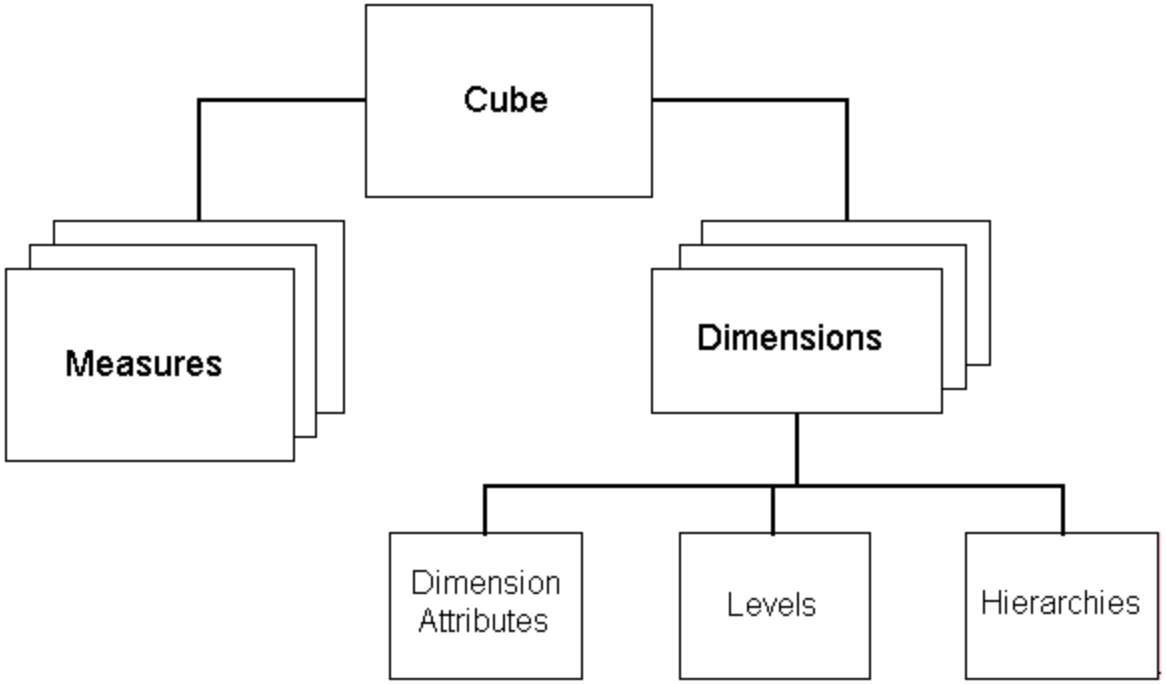
Multidimensional Model

- A logical model for expressing information
  - More flexible than the relational model (i.e. database tables)
  - Unfortunately, there is no one standard multidimensional model
- US GAAP Taxonomy uses a multidimensional model, sometimes explicit other times implied

One Logical Multidimensional Data Model

Figure 2-1 shows the relationships among the logical objects.

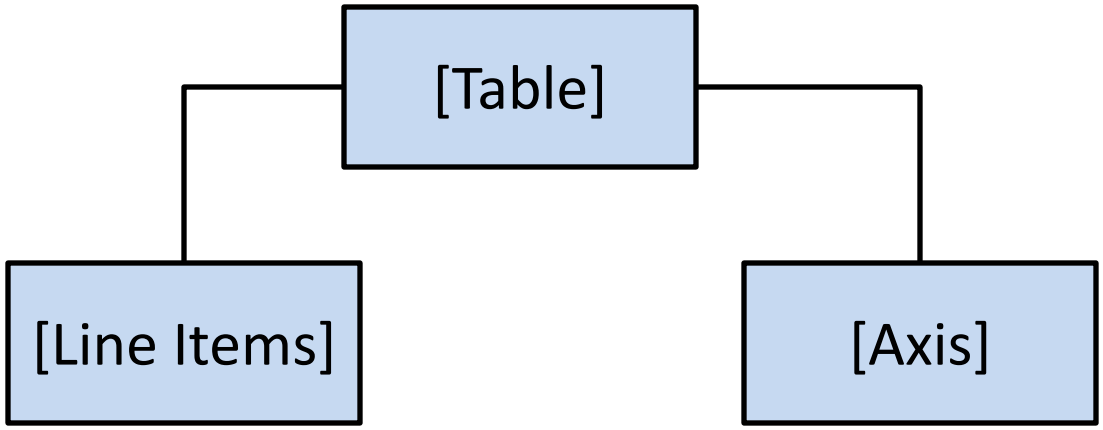
Figure 2-1 Diagram of the Logical Multidimensional Model



Description of the illustration logicalm.gif

Source: http://www.stanford.edu/dept/itss/docs/oracle/10g/olap.101/b10333/multimodel.htm#i1017034

US GAAP Taxonomy Dimensional Model



- A [Table] has one or more [Axis] and one set of [Line Items].
- All [Table]s have an implied [Axis] of Entity and Period.
- If something is not modeled as a [Table] in the US GAAP Taxonomy, it is a [Table] with only two [Axis]: Entity and Period.

Scalar

Pi
3.14

- A **scalar** has no dimensions.
- A scalar always the same value for every company, every period, every reporting scenario, whether it is audited or unaudited…it never changes.
- The value of *pi* is an example of a scalar. Pi is a constant whose value is the ratio of any circle's circumference to its diameter.
- Not many things in financial reporting are scalars.

Data

Value
1000

- **Data** has no real context (http://www.systems-thinking.org/dikw/dikw.htm)
- What is being reported: sales, net income, cash?
- What company does the data relate to?
- What period?
- Is the data actual or budgeted?

Information

Concept	Period	Scenario	Value
Cash	December 31, 2010	Actual	1000
Sales	December 31, 2010	Actual	1000
Net Income	December 31, 2010	Actual	1000

- **Information** is data which has a context.
- You know the concept reported, the period, the reporting scenario, and the value.
- But, you DON'T know the currency, the entity.
- Some information COULD be implied

Implicit versus Explicit

Concept	Period	Scenario	Value
Cash	December 31, 2010	Actual	1000
Sales	December 31, 2010	Actual	1000
Net Income	December 31, 2010	Actual	1000

- What is the currency?
- What is the entity?
- You could imply the currency and entity, but that is dangerous
- What if two different business systems implied differently?

SEC XBRL Filings

XBRL Entity Identifier	XBRL Period	Concept	Value
http://www.sec.gov/CIK = 0000000001	2010-12-31	us-gaap:Cash	1000
http://www.sec.gov/CIK = 0000000001	2010-12-31	us-gaap:Cash	1000
http://www.sec.gov/CIK = 0000000001	2010-12-31	us-gaap:Cash	1000

- The entity identifier and period in an XBRL instance context is a dimension. Every reported fact value has an *entity* and *period*.
- But, is the *entity* the **reporting entity**, the **legal entity**, or the **business segment**?
- Is the *period* the **calendar period**, the **fiscal period**?
- Default dimensions are misunderstood; just because you cannot physically see them in the context does not mean that they are there. Default dimensions are where [Axis] (dimensions) of one or more [Table]s intersect.

Context Important to Financial Reporting

- Reporting entity
- Legal Entity (parent company, subsidiary)
- Calendar time
- Fiscal period
- Report date (as information can be reissued or restated)
- Business segment (consolidated entity, specific business segment)
- Operating segment (continuing operations, discontinued operations)
- Reporting scenario (actual, budgeted, forecast, pro forma)
- Third party verification (audited, unaudited, reviewed, compiled)
- Others in specific contexts (which long term debt instrument, which pension plan)
- Other contexts may also be important

Information to Computer

	A	B	C	D	E	F	G	H	I
1	Concept	Legal Entity Name	Business Segment	Period	Reporting Scenario	Report Date	Third Party Verification	Value	Units
2	Net Income (Loss)	ABC Company	Consolidated Entity	2008-01-01/2008-12-31	Actual	As reported on March 18, 2011	Audited	-4000	US Dollars
3	Net Income (Loss)	ABC Company	Consolidated Entity	2007-01-01/2007-12-31	Actual	As reported on March 18, 2011	Audited	-4000	US Dollars
4	Net Income (Loss)	ABC Company	Consolidated Entity	2006-01-01/2006-12-31	Actual	As reported on March 18, 2011	Audited	-4000	US Dollars
5	Net Income (Loss)	ABC Company	Consolidated Entity	2010-01-01/2010-12-31	Actual	As reported on March 18, 2011	Audited	500	US Dollars
6	Net Income (Loss)	ABC Company	Consolidated Entity	2009-01-01/2009-12-31	Actual	As reported on March 18, 2011	Audited	-4000	US Dollars
7	Revenues, Net	ABC Company	Consolidated Entity	2008-01-01/2008-12-31	Actual	As reported on March 18, 2011	Audited	4000	US Dollars
8	Revenues, Net	ABC Company	Consolidated Entity	2007-01-01/2007-12-31	Actual	As reported on March 18, 2011	Audited	4000	US Dollars
9	Revenues, Net	ABC Company	Consolidated Entity	2006-01-01/2006-12-31	Actual	As reported on March 18, 2011	Audited	4000	US Dollars
10	Revenues, Net	ABC Company	Consolidated Entity	2010-01-01/2010-12-31	Actual	As reported on March 18, 2011	Audited	4000	US Dollars
11	Revenues, Net	ABC Company	Consolidated Entity	2009-01-01/2009-12-31	Actual	As reported on March 18, 2011	Audited	5000	US Dollars
12	Income (Loss) from Continuing Operations	ABC Company	Consolidated Entity	2008-01-01/2008-12-31	Actual	As reported on March 18, 2011	Audited	-4000	US Dollars
13	Income (Loss) from Continuing Operations	ABC Company	Consolidated Entity	2007-01-01/2007-12-31	Actual	As reported on March 18, 2011	Audited	-4000	US Dollars
14	Income (Loss) from Continuing Operations	ABC Company	Consolidated Entity	2006-01-01/2006-12-31	Actual	As reported on March 18, 2011	Audited	-4000	US Dollars
15	Income (Loss) from Continuing Operations	ABC Company	Consolidated Entity	2010-01-01/2010-12-31	Actual	As reported on March 18, 2011	Audited	500	US Dollars
16	Income (Loss) from Continuing Operations	ABC Company	Consolidated Entity	2009-01-01/2009-12-31	Actual	As reported on March 18, 2011	Audited	-4000	US Dollars
17	Cash Flow Provided by Operating Activities	ABC Company	Consolidated Entity	2008-01-01/2008-12-31	Actual	As reported on March 18, 2011	Audited	0	US Dollars
18	Cash Flow Provided by Operating Activities	ABC Company	Consolidated Entity	2007-01-01/2007-12-31	Actual	As reported on March 18, 2011	Audited	0	US Dollars
19	Cash Flow Provided by Operating Activities	ABC Company	Consolidated Entity	2006-01-01/2006-12-31	Actual	As reported on March 18, 2011	Audited	0	US Dollars
20	Cash Flow Provided by Operating Activities	ABC Company	Consolidated Entity	2010-01-01/2010-12-31	Actual	As reported on March 18, 2011	Audited	-1000	US Dollars
21	Cash Flow Provided by Operating Activities	ABC Company	Consolidated Entity	2009-01-01/2009-12-31	Actual	As reported on March 18, 2011	Audited	4000	US Dollars
22	Average Number of Employees	ABC Company	Consolidated Entity	2008-01-01/2008-12-31	Actual	As reported on March 18, 2011	Audited	250	US Dollars
23	Average Number of Employees	ABC Company	Consolidated Entity	2007-01-01/2007-12-31	Actual	As reported on March 18, 2011	Audited	240	US Dollars
24	Average Number of Employees	ABC Company	Consolidated Entity	2006-01-01/2006-12-31	Actual	As reported on March 18, 2011	Audited	220	US Dollars
25	Average Number of Employees	ABC Company	Consolidated Entity	2010-01-01/2010-12-31	Actual	As reported on March 18, 2011	Audited	300	US Dollars
26	Average Number of Employees	ABC Company	Consolidated Entity	2009-01-01/2009-12-31	Actual	As reported on March 18, 2011	Audited	250	US Dollars
27	Capital Additions	ABC Company	Consolidated Entity	2009-01-01/2009-12-31	Actual	As reported on March 18, 2011	Audited	650	US Dollars
28	Capital Additions	ABC Company	Consolidated Entity	2008-01-01/2008-12-31	Actual	As reported on March 18, 2011	Audited	550	US Dollars
29	Capital Additions	ABC Company	Consolidated Entity	2007-01-01/2007-12-31	Actual	As reported on March 18, 2011	Audited	450	US Dollars
30	Capital Additions	ABC Company	Consolidated Entity	2006-01-01/2006-12-31	Actual	As reported on March 18, 2011	Audited	350	US Dollars
31	Capital Additions	ABC Company	Consolidated Entity	2010-01-01/2010-12-31	Actual	As reported on March 18, 2011	Audited	1000	US Dollars

Same Information to Human

ABC Company, Inc.
Financial Highlights
(in US Dollars)

	2010	2009	2008	2007	2006
Revenues, Net	4,000	5,000	4,000	4,000	4,000
Income (Loss) from Continuing Operations	500	-4,000	-4,000	-4,000	-4,000
Net Income (Loss) (b)	500	-4,000	-4,000	-4,000	-4,000
Cash Flow Provided by (used in) Operating Activities, Net	-1,000	4,000	0	0	0
Capital Additions	1,000	650	550	450	350
Average Number of Employees (a)	300	250	250	240	220

Same Information to Human, Interactive (pivot table)

	A	B	C	D	E	F
1						
2	Legal Entity Name	ABC Company				
3	Business Segment	Consolidated Entity				
4	Report Date	As reported on March 18, 2011				
5	Reporting Scenario	Actual				
6	Units	US Dollars				
7	Third Party Verification	Audited				
8						
9	Fact Values	Period				
10	Concept	2006-01-01/2006-12-31	2007-01-01/2007-12-31	2008-01-01/2008-12-31	2009-01-01/2009-12-31	2010-01-01/2010-12-31
11	Average Number of Employees	220	240	250	250	300
12	Capital Additions	350	450	550	650	1000
13	Cash Flow Provided by Operating Activities	0	0	0	4000	-1000
14	Income (Loss) from Continuing Operations	-4000	-4000	-4000	-4000	500
15	Net Income (Loss)	-4000	-4000	-4000	-4000	500
16	Revenues, Net	4000	4000	4000	5000	4000

Making [Table]s Work

- **[Table]**s, **[Axis]**, **[Domain]**s, **[Member]**s, **[Line Items]** need to all make sense from a business person's perspective
- One [Table] in the US GAAP Taxonomy needs to properly interact with other [Table]s
- Querying information from an SEC XBRL filing tells you quite clearly if information has been modeled correctly.
- If querying information does not work, it is because the model is incorrect in the taxonomy
- **Simplicity** is achieved by doing things **consistently** and **explicitly** (rather than implicitly)

Resources

- http://www.stanford.edu/dept/itss/docs/oracle/10g/olap.101/b10333/multimodel.htm#i1017034
- http://www.symcorp.com/downloads/OLAP_CouncilWhitePaper.pdf
- http://www.xbrlsite.com/Patterns/2010-08-01/