Chapter 4 – Report Authoring

Building Reports

Reports are used to create view charts, dashboards, documents that effectively support different role responsibilities

They are of two types

Development intelligence report

- They are graphical in nature (example: pie charts, graphs, scorecards etc.)
- They communicate status, monitor problems, diagnose problems, identify corrective actions
- They are a decision support tools for managing projects / programs.

Report documents.

- They are document-style.
- Specifications may have to comply with standards/requirement in both structure and styling
- Document often form the basis of a contractual relationship.

Report author's task-flow
Report authors are responsible for creating and customizing reports for the organization.
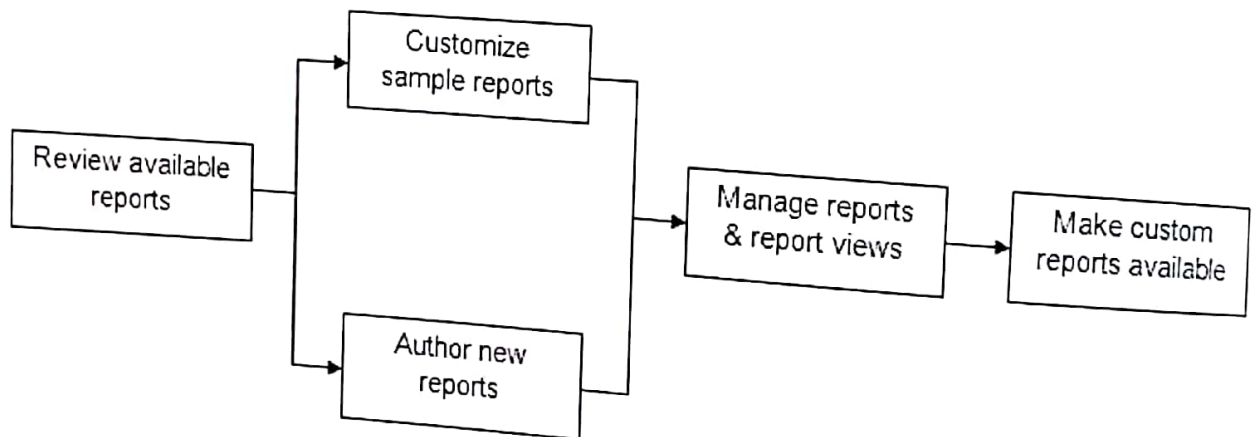
Task flow

Fig 4.01: Task Flow

To customize development intelligence report definitions, you have to install 'Rational reporting for development intelligence' and to customize document- style reports, you have to install 'Rational publishing engine' in the system.

A report author can create reports using 'Report Studio' and 'Query Studio'. You can use 'Report Studio' to create reports to track the progress of your project as well as to identify and track business problems. You can use the 'Query studio' to create a simple report such as graph or a chart report.

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Building a Report

When you create a report, you are actually creating a report specification. This report specification defines the queries and prompts that are used to retrieve the data and the layouts and styles used to present the data.

Creating a report includes

- Creating basic reports
- Understanding how to create accessible reports
- Viewing lineage information for data items
- Accessing the IBM web sphere business glossary
- Creating reports for IBM Cognos Go! Mobile
- Creating reports for mobile devices

Creating a Basic report involves

- Specifying the data package
- Choosing a basic report layout
- Adding data
- Inserting a single data item
- Validating the report
- Saving the report
- Running the report
- Setting 'pdf' page options

- *Specify the data package*, that will provide items for the report.
- The packages are based on models that are created in the modeling tool, Framework Manager. A model is a set of related objects such as query subjects, dimensions, filters and calculations
- *Refresh the package*, to ensure that you are working with the latest version.
- Choose a basic report layout.
- Add data

Select the data items you want to appear in your report. If it is a relational style report or dimensional style report, you add data under the relevant heading.

- *Validate the report*, so that it contains no errors.
- Save the report.
- Run the report.

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Relational Vs Multidimensional database

A multidimensional database (MDB) is a type of database that is optimized for data warehouse and online analytical processing (OLAP) applications. Multidimensional databases are frequently created using input for existing relational databases. Whereas a relational database is typically accessed during a SQL query, a multidimensional database allows a user to ask questions like 'How may 'lenova' laptops have been sold in Bangalore city so far this year' and similar questions related to summarizing business operations and trends. An OLAP application that accesses data from a MDB is known as MOLAP application.

Conceptually, a MDB uses the idea of a data cube to represent the dimensions of data available to a user. For example, 'sales' could be viewed in the dimensions of product model, geography, time or some additional dimension. In this case 'sales' is known as the 'measure atribute' of the data cube and other dimensions are seen as 'feature attributes'.

The multidimensional database management system rapidly processes the data in the database so that the answers can be generated quickly.

While building reports, choose the source of data and authoring tool for the report properly, since the choice of data source and authoring tool are interrelated.
The simplest reports that you can generate are based on work item lists. You can create reports about work items by exporting a work item query to Microsoft Excel. Work items lists are best suited to tables and charts.

You can create status and historical trend data by using OLAP data cube, which is optimized for reporting. The OLAP data cube is best suited to reports that provide aggregated information such as the number of work items that meet a set of criteria. If you want to create reports that show trends over time such as progress charts, you can most easily create them from the OLAP data cube.

You can use the relational warehouse database to create reports that provide line-item details. These include reports that contain titles of work items and more complex reports that do not include trends or historical data.

Your choice of data source depends not only on the kind of data that you want to show but also on the tool that you use to create reports.

Authoring tool	Work item Query results	OLAP data cube	Relational warehouse database
Excel	Yes	Yes	No
Report builder	No	Yes	Yes
Report designer	No	Yes	Yes
These are all Microsoft tools.			

Relational Reporting Style

This style is recommended for relational data sources. Relational data is best represented by lists. This data is organized in Report studio by query items.

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In relational reporting, you summarize data by using headers and footers in lists, summary functions, member summaries and within detail aggregation. You focus data in relational reporting with summary or detail filter.

You can perform the following tasks in relational reporting.

- Add data
- Group data
- Summarize data
- Focus data with filters
- Sort data
- Add queries
- Use calculations

'Query studio' is also available to work with relational data.

Dimensional Reporting Style

This style is recommended for dimensionally modeled relational (DMR) and OLAP data sources. Dimensional data is best represented by crosstabs, maps and charts. This data is shown in 'Report studio' in dimensions, hierarchies, levels and member.

In dimensional reporting, you summarize data by using member summaries and within set aggregates. You focus data in dimensional reporting by adding only the relevant members to the edge of a crosstab or to the context filter. You can also enable drilling up and drilling down in dimensional reports.
'Analysis studio' and the Report studio Express authoring mode are also available with dimensional data.

You can perform the following tasks in dimensional reporting.

- Add data
- Summarize data
- Focus data with filters
- Sort data
- Add queries
- Use calculations
- Enable drilling up and down

Relational Vs Dimensional Reporting Style

Reports can be created in 'Report Studio' using either a relational reporting style or a dimensional reporting style depending upon the type of data source which will be used. It is important to choose a reporting style to ensure the making the most of the data and to avoid mixing dimensional and relational concepts.

The following table outlines the best practices for both reporting styles.

		Relational reporting	Dimensional reporting
1	Report type	Lists, Crosstabs, Charts and Maps	Crosstabs, Charts and Maps
2	Models	Relational models	Dimensionally modeled relational models OLAP models
3	Data tree	Package Folder Namespace Query subject Query item Measures Level	A customized source tree including the following. Package Folder Namespace Fact Dimension Hierarchy Level Level attribute Member
4	Data items	Data items using relational and common constructs	Data items using dimensional and common constructs Extended data items
5	Inserting data	Report studio groups data automatically by query item. For example, when you add the 'Product type' query item to a list, all product types appear when the report is run.	Report studio groups data automatically by level. For example, when you add the 'Product type' level to a cross tab, all product types appear when the report is run. You can also create sets of members from different levels within the same hierarchy.
6	Summarizing data	Headers and footers in lists Summary functions Member summaries Aggregate within detail	Member summaries Aggregate within set
7	Focusing data	Add a query item and then add a detail or summary filter to view only the data you want to see.	Add only the relevant members to an edge of the crosstab or to the context filter. For example, only add the Q3 member to your report.
8	Drilling	Drilling through by value.	Drilling through by member Drilling up and down.
9	Page and section breaks	Simple page break Page sets Sections Master detail relationships using parameterized filters.	Simple page breaks Page sets Page layers Master detail relationship using parameterized edge or slicer expression

10	Report studio authoring mode	Professional authoring mode	Professional authoring mode Express authoring mode
11	Alternative studio	Query studio	Analysis studio

Report Types

List

A list report is a simple and common report that is used to view the detail listing of any business entity within a business process. The data is represented in a simple tabular format, in rows and columns. The selected data fields acts as the columns and the series of set of a single column values acts as the rows in the tabular matrix. So, each column holds the values from a specific database item or other pertinent field from the data source to which the report is connected.

Case I

In one Super-Retail shop, a simple list report displays the revenue generated per day for each quarter in the Store A of Central Region division.

Central Region - Store A		
Fiscal Quarter	**Day**	**Revenue**
Quarter 1	1/1/2012	207,708
	1/2/2012	132,512
	1/3/2012	126,647
	1/4/2012	222,934
	1/5/2012	168,737
	1/6/2012	202,695
	1/7/2012	235,470
	1/8/2012	212,745
	1/9/2012	149,483
	1/10/2012	223,150
	1/11/2012	151,866
	1/12/2012	249,482
	1/13/2012	247,037
	1/14/2012	222,538
	Total(for Quarter 1)	**98,02,900**

Fig 4-02: A simple list report.

Crosstab

Crosstab reports also display data in row and column format and is used to display dataset tha relationship between more than one data item from the data source, with summarized value a intersection of the rows and columns. It is also known as matrix reports as it is compact in its disp data.

Case 1

The crosstab report displays summary values of cost and revenue generated per fiscal quarter for the 2012 by stores in each geographic division.

The year 2012 is the crosstab node and the fiscal quarters are crosstab node members along the col The store's geographic region and the stores within region are in crosstab node and its mem respectively along the row.

Revenue by Geographic Division										
		2012								← Crosstab Node
		Quarter 1		Quarter 2		Quarter 3		Quarter 4		← Crosstab Node Member
		Cost	Revenue	Cost	Revenue	Cost	Revenue	Cost	Revenue	← Crosstab Node Member
Central	Store A	137,287	166,453	129,761	160,415	113,997	168,158	124,342	189,357	
	Store B	132,730	152,222	138,461	171,706	145,199	158,172	107,439	189,755	
	Store C	116,607	162,820	130,283	150,962	110,302	186,309	120,278	161,920	
North	Store A	107,635	173,929	131,610	168,562	121,003	151,549	136,456	189,716	
	Store B	149,053	171,519	127,416	164,553	125,504	166,454	127,078	184,367	
	Store C	112,682	150,302	105,296	183,347	145,202	164,291	115,787	171,425	
South	Store A	149,499	182,447	106,263	153,903	142,460	170,091	108,805	164,319	
	Store B	149,736	155,473	123,768	189,593	100,658	168,894	122,826	187,337	
	Store C	121,557	175,473	140,671	185,332	104,355	156,559	143,745	188,676	

Crosstab Node	Crosstab Node Member

Fig 4-03: A typical Crosstab Report.

Charts

The dataset in charts are represented similar to the crosstab reports, where the summary values a displayed at the intersections of the queried data items.

Types of chart

- Micro Chart
- Pie Chart
- Column Chart
- Marimekko Chart
- Progressive Column Chart
- Pareto Chart

- Bar Chart
- Line Chart
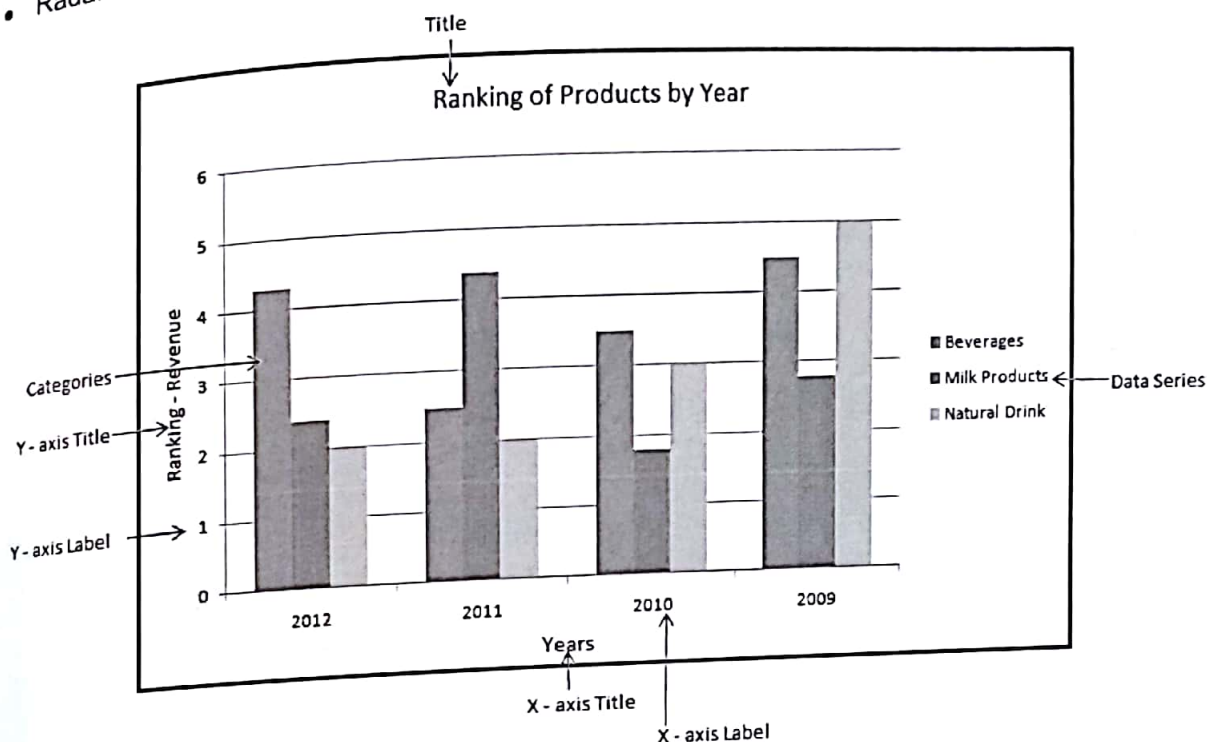- Area Chart
- Radar Chart etc.

Fig 4-04: A Bar column Chart Report.

Axes provide reference lines that provide a frame for reference for measurement or comparison. Normally the x-axis has qualitative item along it such as product and the y-axis has quantifiable values along it such as sales figures.

Data series is a group of related data points marked and plotted as a chart. Each series has a unique color or pattern.

Categories are the groups of related data series plotted along the x-axis. Stacked data plotters are used when multiple groups are needed to be displayed.

Legend the color key assigned to data series and categories for visual aid.

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The following table depicts the different types of charting components and their intended usage.

| Type of Chart	Intended representation
Pie	To display an entities parts to a whole
Stacked component	
Bar	To display time series trends of the entity values
Column	
Line	
Area	
Column-line	To display comparative presentation of entity measure values.
3 – dimension	To display value variance
Radar	
Point	To display two sets of measure values and its correlation
Bullet	To display measure value in dashboard or data visualization report.
Gauge	

Fig—4-05

Maps

Maps are used to represent data points over a display of geographic area. Maps are used to display data in the form of spatial information. They may be literal geographic maps of countries, layout plan of constructed spaces, track spread of race course, auditorium seating plan and so on .

The maps display the data points as the values at the intersection of the data items, similar to a crosstab. The crosstab tabular data is now presented in the spatial informational context.

Case 1

In Super-Retail stores, the effective usage of floor space for inventory, walk area and staff space can be made by the analysis of the floor space index map.
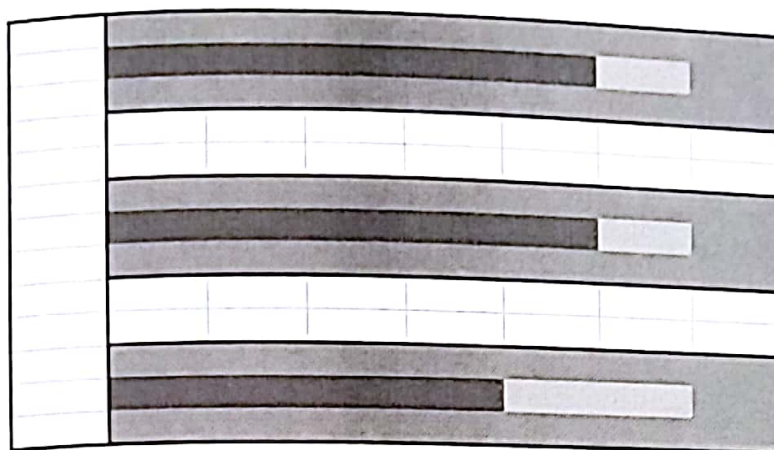
A typical floor space showing usage pattern by shoppers
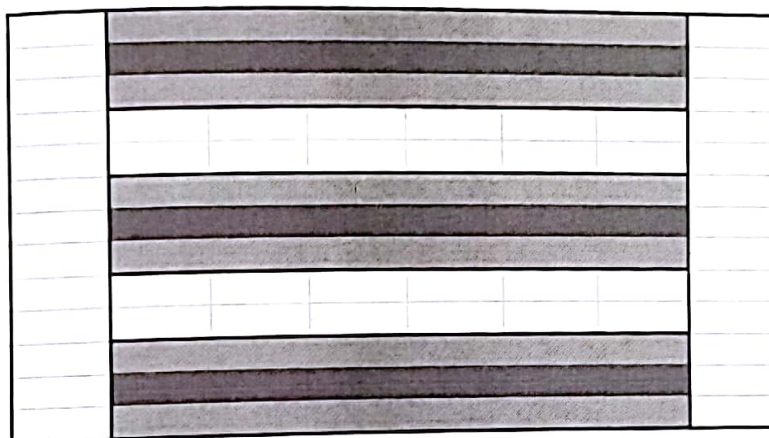
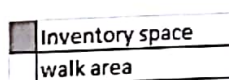Floor space plan revised based on analysis of shoppers usage

■	Inventory space
	walk area

Fig 4-06: A sample Map Chart

Grouping Data and Sorting

Grouping Relational Data

Group, data items in a list report, to remove duplicate values. For example, if you have a report that show products purchased, you can group the 'product type' column to show only one instance of each product type in the list.

In addition to grouping, you can also specify the sort order of data items. In lists, you can sort data items within groups as well as ungrouped items. In crosstabs, you can sort row and column items.

Grouping Dimensional Data

When working with dimensional data sources, you cannot group two levels or hierarchies from different dimensions in the same list.

For example, if a list contains the following levels, namely,

- Product line
- Region
- Product type
- Country
- Revenue

Product line and Product type are one dimension and Region and Country are from another dimension. If you group the first three, you will encounter errors. Also, when working with dimensional data sources, you can group or sort only in the order of the existing hierarchy. If you change the order, the error will show up.

You can omit columns from the grouping. For example, if a level hierarchy contains the levels, Country, State, City and another level hierarchy contains the level 'Product',

- Country, State, City is valid
- Country, Product, State is not valid because a level from another level hierarchy was inserted between two levels from another level hierarchy
- Country, City and Product is valid even though 'State' is omitted.

Sorting Dimensional Data

You can sort items to view them in the preferred order. By default, 'Report studio' retrieves items in the order defined in the data source.

OLAP data sources always have a defined order. Relational and dimensionally- modeled relational data sources may not always have a defined order. The data modeler defines the sorting options in the model. You cannot sort data items from different dimensions that are intermixed.

Filtering Reports

Filters are used to limit the results that are displayed in a report, when an analysis is run, so that the results answer a particular question. Only those results that match the criteria are shown.

Filters are applied on a column-level basis and can be applied directly to attribute columns and measure columns. Filters are applied before the query is aggregated.

When working with dimensional data, you can use 'context filter' or 'slicer filter', to quickly focus your report on a particular view of the data.

Context filters are different from other filters. When you filter data, members that do not meet the filter criteria are removed from the report. A context filter does not remove members from a report, instead their values are filtered or/and you see blank cells.

There are two types of filter, 'Embedded' and 'Stand alone'.

Adding Calculations to Reports

You can add calculations to lists, crosstabs and all other data containers. You can also add calculations directly to a page header, body or footer. However you must first associate a query to the relevant page.

Calculations make a report more meaningful by deriving additional information from the data source. For example, you create an invoice report and you want to see the total sale amount for each product ordered. Create a calculated column that multiplies the Product price by the Quantity ordered.

For relational data sources, if an expression is used in multiple reports or by different report authors, ask your modeler to create the expression as a stand-alone object in the model and include it in the relevant page. If you start with an embedded calculation, you can later convert it into a stand-alone calculation.

In 'Report studio', we can create the following types of calculation, when working with dimensional data sources:

- Inserting a simple member calculation with the insert calculation buttons.

- Creating 'calculated members' or 'calculated measures', where the expression is a member or value expression.

- Using set expressions to create calculated sets of members. Each set expression must contain members only from the same hierarchy.

- Using a 'layout calculation' in all other cases.

If you want to create a calculation specifically for one query subject or dimension, you can embed the calculation directly in that object. For query subjects, the calculation can be done for either data source query subjects or model query subjects. However it is recommended that you apply calculations in model query subjects wherever possible. This allows for better maintenance and change management.

Conditional Formatting

Formatting data in a report is to improve readability. For example, you can show all data values in the order Year, Month and Day. If you do not set 'Data format' properties here, data is formatted according to the properties set in the model. If the properties were not set in the model, data is formatted according to the 'International Components for Unicode' (ICU) formats.

You can also format data, based on a condition or specify the format for a particular object.
Formatting data includes

- Setting default data formats
- Understanding the data format for members
- Specifying the data format for an object
- Understanding locale- sensitive properties
- Suppressing empty cells
- Specifying what appears for data containers that have no data
- Using patterns to format data

Conditional Formatting

You can define conditions to control what users see when they run a report. Conditions can apply to specific items in a report. For example, you can define a conditional style to highlight exceptional data such as product revenue exceeding the target.

Conditions can apply at the report layout level. Conditional layouts are useful for delivering reports to a multilingual audience. For example, you can have text items, such as titles and cover pages, appearing in the same language as the data in the report.

You can use conditions to,

- Highlight data using conditional styles

- A conditional style is a format, such as cell shading or font color that is applied to objects if a specified condition is true. For example, creating conditional styles color-codes information in the reports that needs attention.

- Highlight data using style variables

- Style variables are useful if you are working with reports that were created in a previous version of IBM Cognos or if you want to use language variables to specify conditional styles.

- It helps to better identify exceptional results. For example, you want to identify sales representatives who have exceeded their quota, you create a condition that checks whether each representative's sales for the year is greater than their quota for the year.

If a report contains both conditional styles and style variables, the style variables are applied before the conditional style.

- You can specify which objects are rendered when a report is run. You can,

- Add variables

- Hide and show objects

- Add conditional rendering

- Add multiple layouts

- Create multilingual reports

Adding Summary lines to Reports

In a report, data can be summarized to obtain totals, averages, aggregates and so on. You can also add both detail and summary aggregation.

Detail aggregation, which is supported only for relational data sources, specifies how a data item is totaled at the lowest level in a report. In lists, detail aggregation specifies how the values that appear in the rows are totaled. In crosstabs, detail aggregation specifies how the values in cells are totaled.

Summary aggregation, which is supported for all the data sources, specifies how data items are totaled in the headers and footers of a list and in the total rows and columns of a crosstab.

You can add simple summaries to the groups in a report by using the 'aggregate' button. This button provides a subset of the aggregate functions available in 'Report studio'. For list reports, a 'Custom' option is also available so that you can add you own aggregate function in the expression of the data item.

Product Line	Product Category	Quantity (Units)
Beverages	Brand A	3,500
	Brand B	4,110
	Brand C	3,005
	Brand D	1,220
	Brand E	350
Total - Beverages		12,185
Coffee products	Brand A	1,800
	Brand B	2,000
	Brand C	2,300
	Brand D	1,200
Total - Coffee products		7,300
Tea products	Brand A	1,250
	Brand B	2,450
	Brand C	2,200
	Brand D	590
Total - Tea products		6,490
Total - Product Line		25,975

Fig – 4.07: Grouped Summary List Report.

Quantity sold (units)	2010	2011	2012	Total (Yearly)
Beverages	1,50,540	1,60,500	1,80,000	4,91,040
Coffee Products	95,000	1,12,550	1,04,000	3,11,550
Tea Products	90,000	1,30,000	80,000	3,00,000
Packaged water	2,30,000	2,65,000	2,80,000	7,75,000
Total (Productline)	5,65,540	6,68,050	6,44,000	18,77,590

Fig 4-08 – Crosstab with grand summary data item.

Drill-up, Drill-down Capabilities

While analyzing data, you can drill up and down to review different levels of your data in a crosstab or a chart.

You can drill down to see more detail about the children of the data in the workspace. For example, you can review revenue for each product line and their drill-down to analyze the revenue for each product. In other words, drilling down is exploring for more detail.

You can drill up to compare the results of the parent data in your workspace. For example, you can examine revenue for a single product and drill up to see revenue for the entire product line for comparison. In other words, drilling up is to get an overall picture.

You can drill up or down on a row or column heading or you can drill on a crosstab cell. If you drill on a crosstab cell that appears within a row and a column, you can choose whether you want to drill up or down on the row or the column. For example, a cell appears in 'January column and in the 'Quantity' row. When you right click the cell and choose 'drill down', you can click January or Quantity.

When working with dimensional or dimensionally- modeled relational (DMR) data sources, you can create reports that allow the reader to view more general or more detailed information on your data within a predefined dimensional hierarchy (such as Year-Quarter-Month) without having to create different reports.

You can link groups of data items from different queries so that when you drill up or drill down in one query, the data item also drills up or drills down in the linked query. For example, if your report shows a list and a crosstab that each include the product line data item, you can link the product line data item from the crosstab query to the product line data item from the list query, so that when you drill up in the crosstab product line data item, the list product line data item also gets drilled up.
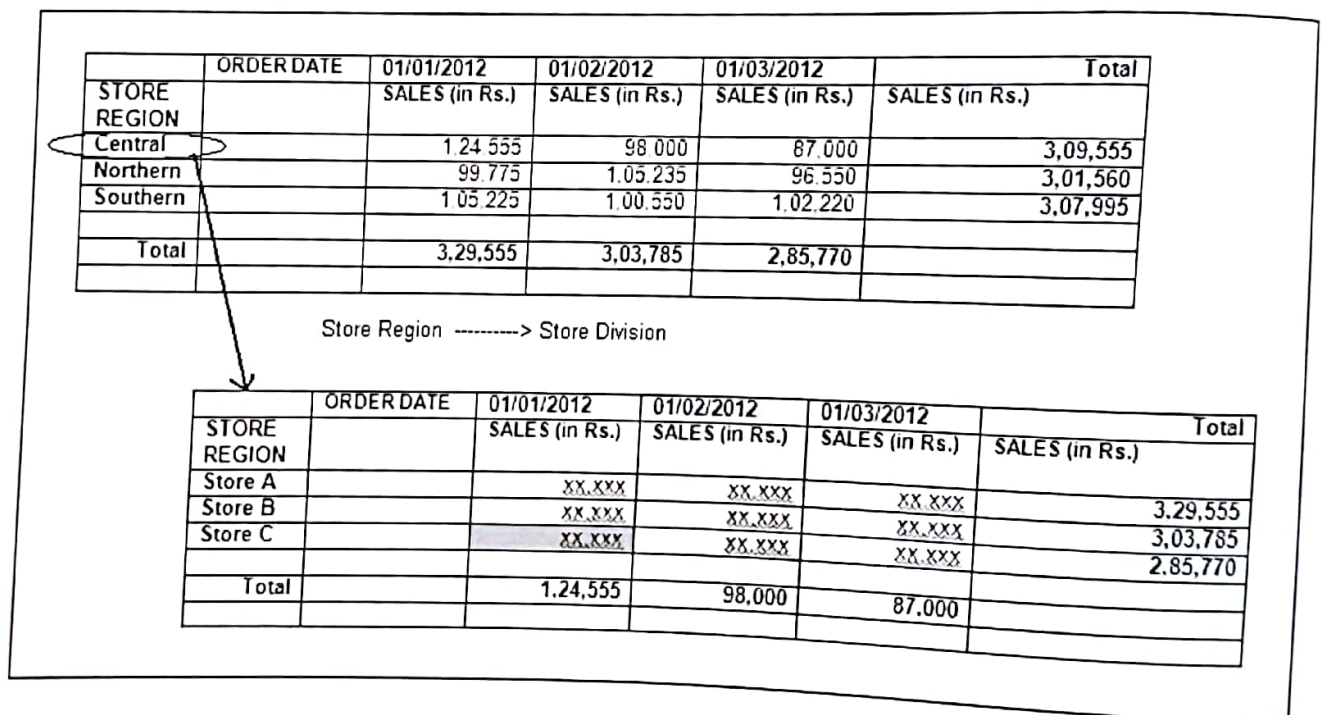
	ORDER DATE	01/01/2012	01/02/2012	01/03/2012		Total
STORE REGION		SALES (in Rs.)	SALES (in Rs.)	SALES (in Rs.)	SALES (in Rs.)	
Central		1.24.555	98.000	87.000		3,09,555
Northern		99.775	1.05.235	96.550		3,01,560
Southern		1.05.225	1.00.550	1.02.220		3,07,995
Total		3,29,555	3,03,785	2,85,770		

Store Region --------> Store Division

	ORDER DATE	01/01/2012	01/02/2012	01/03/2012		Total
STORE REGION		SALES (in Rs.)	SALES (in Rs.)	SALES (in Rs.)	SALES (in Rs.)	
Store A		XX.XXX	XX.XXX	XX.XXX		
Store B		XX.XXX	XX.XXX	XX.XXX		3.29,555
Store C		XX.XXX	XX.XXX	XX.XXX		3,03,785
						2.85,770
Total		1,24,555	98,000	87,000		

Fig: 4-09 : Drill-down

Drill-through Capability

Using drill-through access, you can move from one report to another within a session while maintaining your focus on the same piece of data. For example, you select a product in a 'Sales Report' and move to an 'inventory report' about that product.

Drill-through access helps you to build business intelligence applications that are bigger than a single report. Drill-through applications are a network of linked reports that users can navigate, retaining their context and focus, to explore and analyze information.

Drill-through access works by defining the target report or object and then using information from the source report to filter the target.

For a drill-through link to work, it is necessary to know,

- The source
- The target
- How the data in the packages that contain these objects is related
- Whether to run the target report or to open it
- If the target is being run, in what format to run it and what filters to use on the target

Running Reports

- Before you begin, make sure that you have validated the report
- Open the report with 'Report studio'
- Click Run > Run options. Set the following options in the options window or leave the default values.

Format – In which format HTML, PDF, CSV, XML or Excel?

Paper size – To be specified if the output format is PDF

Paper orientation – To be specified for PDF format

Data mode – It specifies how much data is returned by the report query. You can select all data, limited data (due to filters) and no data.

Language – To be specified

Rows per page

Prompt – If you are required to be prompted for each run defined in the report.

- Click 'Ok'.
- Click 'Run' icon in the tool bar.

You cannot produce a report in CSV format if you have more than one query defined in the report unless the additional queries are used for prompts. The report runs in the IBM cognos viewer.