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Using Crystal Reports® with SAP®

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3 SAP BW as a Crystal Reports Data Source

The purpose of this chapter is to help the reader understand how SAP BW functions as a data source for developing reports using Crystal Reports. This information is critical to the success of your Crystal Reports development effort because it forms the foundation of everything else we'll be covering in the remainder of this book.

**Note**

The information and techniques we'll be covering will benefit not only you as a Crystal Reports developer but also anyone who is responsible for the creation of BW queries in your organization. If someone else besides you creates or will be creating SAP NetWeaver BW queries for use with Crystal Reports, it's imperative that the information in this chapter be passed on that person before you begin your Crystal Reports development efforts.

First, we will cover some basic concepts and terminology concerning SAP BW. Next will be a brief discussion of a phenomenon peculiar to the world of data warehouses called “data explosion” and its potential impact on the Crystal Reports developer. Then we'll have a practical lesson covering the two SAP BW data sources available to the Crystal Reports developer: the BW query and the Data Store Object (DSO). Lastly, and most importantly, we'll get hands-on experience with creating a master BW query and a Crystal Reports template.

3.1 SAP NetWeaver Business Warehouse 101

Fortunately, as a Crystal Reports developer there's not a lot that you need to know about the inner workings of SAP NetWeaver Business Warehouse (or, as its better known, SAP NetWeaver BW). The goal here isn't to make you an expert on SAP NetWeaver BW, but to help you understand when to talk to someone who is.
Let’s get one of the more difficult (and more delicate) items out of the way right up front: What is SAP BW and SAP BI, and are they one in the same? The confusion concerning SAP NetWeaver BW versus SAP BI stems from another case of a new marketing strategy coming head-to-head with a natural human trait commonly known as “resistance to change.” It’s a little like the ill-fated “New Coke” campaign that The Coca-Cola Company put on in 1985, only this time only the name changed and the product remained essentially the same.

To help understand where we have come from, you have to start with SAP NetWeaver BW. The BW stands for Business Warehouse. The warehouse part of the name comes from the fact that SAP NetWeaver BW is SAP’s data warehouse product. SAP NetWeaver BW was originally developed and released in 1997 as SAP Business Information Warehouse (or BIW). Apparently this was about four too many syllables for the market to bear so the name was quickly abbreviated to SAP Business Warehouse, which was now only two words so naturally it was immediately acronym-ed into simple and short “SAP BW.”

Once the market settled into SAP BW, things remained unchanged for many years until the release of NetWeaver 2004s, when SAP renamed SAP BW to SAP NetWeaver BI. Because thousands of SAP customers had been calling it SAP BW for so many years, it became immediately evident that almost all of them weren’t going to be dropping the old familiar name for a new one any time soon. So SAP came up with a bit of a compromise: They retained the NetWeaver BI label for all the frontend tools and interfaces (the stuff the end user sees) and reverted back to the familiar SAP BW label for the backend data warehouse. So, technically speaking, when you’re working with Crystal Reports, you’re using a NetWeaver BI tool on top of SAP BW.

### 3.2 A Short Course on SAP NetWeaver BW Terminology

Like any other highly successful technology in the IT world, SAP NetWeaver BW has developed its own lingo and catch-phrases over the years, some of it official and some of it not so official. The following is a brief list of some of the more common terms and expressions, along with an attempt to convey their meanings.

By way of reminder, if you’re a business-side end user who is interested in producing your own reports using Crystal Reports, it certainly is not a requirement that you understand all of the following terms along with the many others not listed that are associated with SAP NetWeaver BW. However, because the process
of developing reports will almost certainly draw you closer to the IT side of the organization, it can be helpful to learn a little more about what the other side is talking about.

- **Cube**
  In pure SAP BW–speak, the term is *Infocube*. From a business user's perspective, this is simply a place where business data is stored off-line (in a data warehouse) from the transactional system (where data is entered) for reporting purposes. A cube is also known as a *multi-dimensional* data structure. To get even more technical, a cube is the data structure used for OLAP (online analytical processing).

- **Query**
  This can now take on two different functions. For the SAP BEx end user, a query is a report. The query is executed and data is returned into the SAP BEx analyzer. For Crystal Reports, a query is a data source for the Crystal Reports developer.

- **Key figure**
  Known in other data warehouse circles as a *measure*, this is a simply a number that represents an aggregate (or summary). Two common key figures are the total number of an item sold (Quantity Sold) and the dollar amount (Revenue).

- **Aggregate**
  This is a summary or total. The primary job of a data warehouse it to produce aggregates on-the-fly, or as you need them. An aggregate is a key figure that has been summarized across a set of characteristics (e.g., total sales by division and month).

- **Characteristic**
  Similar to the data warehouse term *dimension*, this is something that can be used to identify or classify a business transaction (the name of a product, the zip code of the customer, the name of the division, etc.). The SAP NetWeaver BW Query Designer groups characteristics into dimensions.

- **Display attribute**
  This is additional descriptive information associated with a particular characteristic. Color or size might be display attributes of the characteristic Product_ID. Crystal Reports treats display attributes as fields that can be added to the report. Adding a display attribute to a report has the same effect on aggregation as adding the characteristic itself.
Navigational attribute
In SAP BEx, this is additional information associated with a particular characteristic that can be used to generate further aggregation. Adding the navigational attribute Color to a report that's currently aggregated on Product_ID will produce aggregates (or summaries) for each color.

InfoObject
In SAP NetWeaver BW, key figures and characteristics are collectively known as InfoObjects.

Drill down
This is the process of progressing to further details from a summary level. A common drill down would be to move from a summary of sales by year to sales by month. This is the most common analytic technique used in a data warehouse environment. Crystal Reports supports drill-down functionality.

Variable
A variable appears to the SAP BEx end user as a prompt used for filtering the resulting data set from a BW query. When using a BW query as a data source, Crystal Reports automatically creates a parameter for each user variable in the query. These parameters are then presented to the end user when viewing Crystal Reports through a web browser.

Hierarchy
This is a mechanism within SAP NetWeaver BW for organizing characteristic values in an ad hoc fashion. Because hierarchies are created manually and aren’t driven by data values, they’re by their nature a very flexible way to organize data, but at the same time they can be very maintenance intensive in a dynamic data environment. Crystal Reports fully supports the use of hierarchies in SAP NetWeaver BW.

Landscape
This term is used primarily by IT personnel. It refers collectively to the three environments that normally exist in any SAP client site: development, test (or quality), and production, most commonly referred to as simply Dev, Q, and P.

Transport
This is the process of moving code, or objects, from one SAP NetWeaver BW system to the next. An object is first created (or developed) in the development environment, then transported up to the quality environment, and then, after being tested and approved, finally transported into the production environment. Both BW queries and Crystal Reports are moved from development to production in this way.
3.3 Handle with Care: The Exploding Data Warehouse

Before we move on to the practical, hands-on lessons on creating SAP BI reports using Crystal Reports, it can be useful to explore a phenomenon unique to the world of data warehousing, something known as “data explosion.” This is the tendency for data being stored and returned from a data warehouse to expand dramatically (sometimes exponentially) as the number of characteristics (or dimensions) increases.

This topic can get very technical and very confusing very quickly as you start to bring in such concepts as “sparse data” and “preaggregates” and a whole spectrum of very impressive-sounding words. Fortunately for us, we’re only interested in how it directly effects our efforts to produce Crystal Reports against SAP NetWeaver BW (specifically, against an InfoCube in SAP NetWeaver BW).

Here’s how it plays out for the Crystal Reports developer. As you add characteristics from your BW query to your Crystal Report, you’re now requesting more summaries (aggregates) to be generated for you by SAP NetWeaver BW. This brings us to the one key difference between reporting off of a multidimensional data source (such as SAP NetWeaver BW) and reporting off of a relational data source (such as SAP R/3, Oracle, SQL Server, etc.).

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>When you retrieve data from a relational database, you’re asking for (N) rows (records) of data.</td>
</tr>
<tr>
<td>When you retrieve data from SAP NetWeaver BW using a BW query, you’re asking for (N) summary calculations to be generated. Each summary will return one row.</td>
</tr>
</tbody>
</table>

To look at it in a simplified way, when you retrieve data from a multidimensional data source like SAP NetWeaver BW, you’re in reality asking it to create a set of summaries of whatever key figures (measures) you have included in your query. It makes sense that doing this will require a bit more work.

When you’re dealing with relatively small amounts of data and fewer characteristics, this task can be quite easy and efficient for SAP NetWeaver BW (or any other multidimensional database) to handle. These smaller, focused queries can take just a second or two to process. However, things can change quite dramatically and quite suddenly as either one of two things happen: the size of the database increases and/or the number of characteristics (dimensions) increases.
To explain this, let’s take a look at a simple scenario. Let’s say we have an SAP NetWeaver BW InfoCube that contains sales transactions. Each sale, or transaction, in the InfoCube has three characteristics associated with it: Sales Division, Sales Representative, and Date of Sale.

This tells us the number of characteristics being stored in the cube but not the possible number of members in each characteristic. This is how things break out in this example:

- There are three sales divisions.
- There are 10 sales representatives.
- There are 30 days of data at any given time in the InfoCube (when a new day is added, the oldest day is dropped).

We know two critical pieces of information: the number of characteristics and the number of possible members in each characteristic. But we need one last, critical piece of information: How many sales transactions are there in the InfoCube?

The answer to that question of course depends on who this InfoCube belongs to. In other words, how big and how busy is the company (specifically the number of sales people in the company)? It would be one thing if we’re talking about the local hardware store on the corner. It’s a completely different thing if we’re talking about Home Depot worldwide sales. For the sake of our discussion, we’ll assume we’re talking about a small, local business that makes around 100 sales per month.

We’re now going to create a Crystal Reports report using a sales query against our SAP NetWeaver BW sales InfoCube. The first report we create is going to be very simple: Total Sales by Division. To do this, all we need to do is place the Sales Division characteristic on the report along with the Sales Revenue key figure. After the report is run, it may look something like Figure 3.1.

**Figure 3.1** Crystal Reports Report Using a Sales Query against Our SAP NetWeaver BW Sales InfoCube

<table>
<thead>
<tr>
<th>Division</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>$10,000</td>
</tr>
<tr>
<td>Central</td>
<td>$20,000</td>
</tr>
<tr>
<td>Western</td>
<td>$15,000</td>
</tr>
<tr>
<td>Total</td>
<td>$45,000</td>
</tr>
</tbody>
</table>
Because the company has three divisions, the highest number of rows (and summaries) that would be returned is three. It’s possible to have fewer than three, but it’s not possible to have more because all we have is three divisions. And it doesn’t matter if there were 10 sales or 10,000 sales that month. The number of aggregates (and therefore rows) returned is determined not by the number of sales, but by the total number of members in the current set of characteristics.

Let’s take our report to the next level. We now want to see the sales not only for each division, but for each sales representative within that division. After adding the Sales Representative characteristic to our report, we’ll see something like figure 3.2.

<table>
<thead>
<tr>
<th>Division</th>
<th>Sales Rep</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>John Roman</td>
<td>$5,000</td>
</tr>
<tr>
<td>Eastern</td>
<td>Louise Boardman</td>
<td>$2,000</td>
</tr>
<tr>
<td>Eastern</td>
<td>Jeff King</td>
<td>$3,000</td>
</tr>
<tr>
<td>Central</td>
<td>David Bennefield</td>
<td>$8,000</td>
</tr>
<tr>
<td>Central</td>
<td>Mike Brophy</td>
<td>$5,000</td>
</tr>
<tr>
<td>Central</td>
<td>Kent Welkener</td>
<td>$3,000</td>
</tr>
<tr>
<td>Central</td>
<td>Aan Coleman</td>
<td>$4,000</td>
</tr>
<tr>
<td>Western</td>
<td>Jim Johnson</td>
<td>$5,000</td>
</tr>
<tr>
<td>Western</td>
<td>Steve Kim</td>
<td>$5,000</td>
</tr>
<tr>
<td>Western</td>
<td>Edna Tokay</td>
<td>$5,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$45,000</strong></td>
</tr>
</tbody>
</table>

Figure 3.2 Report with the Sales Representative Characteristic Added

Because there are a total of 10 sales representatives in the company, the highest number of summaries that would be returned would be 10.

So far, in our simple two-step progression, things have progressed in an almost linear fashion. We started with a Sales by Division report that produced three summaries, one for each of three divisions. We then moved on to a Sales Representative report that produced 10 summaries, one for each sales rep. In this case because each sales rep belongs to only one division, the number of divisions has no effect on the final number of summaries generated, but the number of sales reps is what now determines the number of summaries.
Now let's see what happens when we decide to go to the next level and create a report that breaks out the sales for each sales representative by date.

We've already stated that the sales InfoCube always holds exactly 30 days of sales. So what will happen when we add the Date characteristic to our report to show the sales for each day? Would we now get 30 summaries returned, one for each day? Yes, that would be the case if we placed the Date characteristic by itself in the report. However, in this example we're adding the Date characteristic to a report that already contains the Sales Division and Sales Representative characteristics. By doing this, we're asking SAP BW to summarize sales for each unique combination of sales division, sales representative, and date. Assuming each sales representative made at least one sale each day, we would then get as many as 300 summaries returned (10 sales reps × 30 days of sales).

This creates quite a big jump in the number of summaries (or aggregates) that SAP BW has to generate to run our report. So what would happen if we decided to add Product to the mix? The correct answer is, it depends, as in it depends on the total number of unique products that were sold. If the company sells 10 products (and each product was sold a least one time per day by each rep), you'd jump from 300 aggregates to 3,000. If there are 100 different products you'd go to 30,000 potential summaries.

At its most basic level this is a fairly simple and straightforward process: as you add characteristics from your BW query to your Crystal Reports report, you'll very likely increase the number of summaries or aggregates that SAP BW must generate. The reason why we say “very likely” is because not all characteristics will have the same effect on the total number of summaries generated.

Some characteristics will have a relatively low level of granularity (fewer unique members), and others will have a higher level of granularity (more unique members). An example of a common characteristic in SAP NetWeaver BW that would have a low level of granularity is Sales Channel. Most companies have relatively few sales channels. A characteristic that typically has a high level of granularity is Product. Most companies have a lot more products than they have sales channels.

This brings us to the most important thing you need to know about this concept of data explosion when creating reports against SAP NetWeaver BW. The characteristic with the highest level of granularity (the most unique members possible) is what we'll refer to as the “document level” characteristic. For sales information, this would be Sales Document. For accounting information it would be Accounting Document. In purchasing it would be a particular purchase order.
When you think about it, this makes perfect sense. You can’t get any more granular in any business than an individual transaction (actually, one more level is possible — the line item level — but for all practical purposes you would never create a report in SAP NetWeaver BW at the line item level). In one sense, any business is ultimately the sum of all its transactions. And in even the smallest of businesses the number of transactions will (or should) dwarf the number of almost anything else you can think of within that business.

This brings us to our final topic regarding the inner workings of the data warehouse (or at least as much as you need to know as a Crystal Reports developer), and that is, “Does it make sense to include document-level transaction data in an InfoCube?”

First, many organizations use SAP NetWeaver BW to create detail-level reports at the transaction level, so it’s very common to see document-level characteristics included in an InfoCube. This occurs because business end users are interested not only in high-level summary data. They also want to see the details. Because of this the people who build SAP InfoCubes often include transaction-level detail in their cubes.

Why would this be a problem? If this is what the business wants (and needs), why not give it to them? Well, this wouldn’t be a problem if we lived in a world without limits, but unfortunately we do. And we sometimes hit those limits head on. This is what can happen when you try to do too much with too few resources. Things fall apart (or explode).

The practical fallout of all this is when you include a document-level characteristic from a BW query in your report, you run the risk of the report running out of resources on the SAP NetWeaver BW server. What this means ultimately is that the report will fail, with either a timeout or some sort of “out of memory” error. At a minimum the report may take a very long time to run. Either way, you always increase your chances of a significant performance issues when you include a document-level characteristic in your report, especially with very large data sets.

The obvious next question then becomes, “Is there a way to provide business users with transaction-level detail without potentially compromising performance?” Or perhaps another way to say this might be, “Is there a way to provide transaction-
level detail in SAP NetWeaver BW without including it in the InfoCube?” The answer on both counts is “Yes.”

We won’t go into detail at this point, but when you introduce a powerful, highly versatile reporting tool like Crystal Reports into the mix, it introduces some interesting new possibilities for handling the “summary to detail” dilemma often encountered in data warehouses. Essentially it comes down to this: you leave the transaction-level detail out of the InfoCube entirely. This allows the InfoCube to do what it was designed to do: provide high-level summary data on-the-fly with a high level of performance (or at least it increases the chances of providing a high level of performance). The transaction-level detail can be left in a Data Store Object (DSO, which we’ll describe later in this chapter when we look at the two different data sources in SAP BI), and Crystal Reports becomes the bridge between the two.

As you’ll learn later in the hands-on exercises, Crystal Reports has a powerful feature known as a “subreport.” If you’re familiar with Crystal Reports at all, chances are you’ve at least heard of subreports. This is a very handy feature that, among other things, allows you as a report developer to “bridge” between two completely different data sources. You can use it to bridge between a BW query and a DSO or even a BW query and SAP ERP Central Component (or SAP R/3). This is very similar in concept to “jump” reports in the BEx analyzer.

It’s now time to move away from the theoretical and on to some of the more practical aspects of developing Crystal Reports against SAP BW, which is why we’re all here. The first step in the process is identifying and understanding the data sources in SAP BW that are available for use with Crystal Reports: the BW query and the Data Store Object (DSO). If you’re a current SAP BEx end user, chances are you’re at least somewhat familiar with the BW query. It’s unlikely, however, that you’d have any idea what a Data Store Object is (unless you’re an SAP BW developer). Let’s take a look at both of these and see how they work with Crystal Reports.

### 3.4 The BW Query: Bedrock of SAP BEx

If you’re an experienced SAP BEx end user, you’ve probably at least been introduced to the concept of the BW query. Whenever you run a report in the BEx analyzer you first open a BW query as your data source. You then typically respond
to one or more prompts and run the query. The results are then displayed in the BEx analyzer (within Excel).

Some advanced end users have the ability to develop their own BW queries for their personal use and for other end users. However, in most organizations the development of BW queries is typically handled by someone in IT. If you don’t have the ability to develop BW queries, you may want to find someone in your organization who does and show them the following section. What you (and they) are about to learn will probably save you both a lot of time and potential frustration. This is especially important if your organization has any history of developing BW queries for use with the SAP BEx analyzer.

### 3.4.1 Designing BW Queries for Use with Crystal Reports

The process of designing a BW query for use as a data source for Crystal Reports differs significantly from the standard process of designing queries for use with the BEx analyzer. Essentially the difference comes down to the fact that when used with SAP BEx, the query designer is in charge of creating the final look and feel of the report (the layout), whereas queries designed for Crystal Reports are simply a data source for the Crystal Reports designer. In this case the person developing the Crystal Reports report is responsible for the final layout of the report.

Therefore, creating queries for use with Crystal Reports is normally an easier process than creating queries for the BEx analyzer, simply because no consideration is given to the final layout of the report. Essentially all you’re really doing is “staging” data into the query and making it available to the Crystal Reports developer. The organization of the query elements means absolutely nothing.

One of the greatest benefits of the MDX query driver used by Crystal Reports is that it allows the query designer to “load up” the query with as many characteristics and key figures as there are in the source InfoProvider. With the MDX query driver there’s now (almost) no reason to create more than one query per InfoProvider, which makes the idea of a “master” query for reporting a reality. In the past, with the original BW query driver, it was necessary to custom tailor each BW query for a particular Crystal Reports report. Now that this is no longer necessary, the process of creating and maintaining BW queries for use with Crystal Reports is much more manageable.
Although it’s true that the MDX query driver allows the query designer to essentially “pass through” all of the characteristics and key figures defined in an InfoProvider, it’s important to realize that this now places the burden of restricting the number of active characteristics and key figures on the Crystal Reports developer. As you’ll recall from our earlier discussion of data explosion, it’s especially important with larger data sets to be careful about how many characteristics you make active in a query.

So, although it’s very convenient and advantageous from a query development and maintenance perspective to maintain a one-to-one ratio of queries to InfoProviders, it becomes very important that the Crystal Reports designer understand the implication of adding additional characteristics to a Crystal Reports report. We’ll cover this in some detail in the next chapter when we begin our hands-on development with Crystal Reports.

Once you’ve created your master BW query for a particular InfoProvider, the next step is to create a Crystal Reports template that uses that BW query as its data source. This Crystal Reports template then becomes the starting point for anyone who wants to create a report against a particular InfoProvider.

Although this is the ideal scenario, two characteristics of the BW query can (and will) stand in the way of achieving the goal of one template to one query to one InfoProvider: hierarchies and variables.

Our goal is to explain not what hierarchies and variables are and how they work, but their impact on the idea of creating a single master query for a given InfoProvider. Later, in the hands-on exercises, we’ll look at both of these BW query elements and how they’re handled in Crystal Reports.
If your organization utilizes hierarchies (and most do, especially in financial reporting), you’ll find it necessary to create at least one additional query to handle your reports that require the use of a hierarchy. This is because once you assign a hierarchy to a characteristic in a query, there’s no way in Crystal Reports to “unassign” the hierarchy. This means you’ll always get not only the base line data (the “postable nodes”) but all of the defined summary nodes as well. Although you don’t have to actually re-create the structure of the hierarchy itself in Crystal Reports, you’re still going to be stuck with additional summary nodes to deal with. So if your report does not require a hierarchy, you’ll up with additional summary nodes you don’t need.

There is a way within Crystal Reports to strip out the summary nodes of a hierarchy to get you back to the base nodes (postable nodes). This is primarily because in Crystal Reports if you know what you’re doing, you can do just about anything. However, this is extremely time-consuming. It’s best to just create another query without the hierarchy.

A second potential obstacle to achieving this ideal one-to-one-to-one scenario is variables. These are better known to end users as prompts and are used by SAP BEx users to filter the returned data set. Because not all reports against a particular InfoProvider require the same filters, this means it may become necessary to create a separate query for each set of end user variables (or prompts). This is because, much like hierarchies, once a variable is attached to a query characteristic, it’s not possible to unattach it in Crystal Reports. As we’ll see later in the hands-on exercises, Crystal Reports will always create a parameter for any variable it finds in the BW query, and that parameter will always get passed on to the end user when he runs the report.

We say “may become necessary” because it’s possible to make a variable optional, allowing the end user to skip or ignore the variable when running the report. This now becomes an issue of usability and the end user’s tolerance for seeing “extra” variables when running a report. We’ll cover this in more detail later when we look in depth at end-user variables.

So although it may not always be possible to have a single BW query for each InfoProvider, with the MDX query driver it’s possible to greatly reduce the number of queries necessary to provide your Crystal Reports designers with the data sources required to meet their BI reporting requirements.
3.4.2 Going “Flat” – the DSO

Before we move on with BW queries and, more specifically, how best to create queries for use with Crystal Reports, let’s briefly explore the other, lesser known SAP BW data source: the Data Store Object (DSO).

First, here again there’s been some name changing going on. The DSO was initially referred to as the ODS (Operational Data Store). In fact, the driver used in Crystal Reports 2008 is still called the SAP Operational Data Store driver.

In its simplest form, a DSO is just transactional data (usually from SAP ERP Central Component or SAP R/3) that’s been moved over to SAP BW. It may have been cleaned up a bit, but usually it’s copied over from the transaction source system as-is. The primary difference between the DSO as a data source and a BW query is that the data isn’t normally summarized and, if it is, it’s stored as a summary only. In other words, unlike working with a BW query, you cannot ask for new summaries to be created for you on-the-fly. What you see is what you get.

In this way a DSO looks and feels just like any other relational (SQL) table (the standard way data is stored in virtually every transaction system on the planet — as a series of interconnected (related) tables). As you may recall from an earlier discussion, SAP R/3 (ECC) is run on a relational database. (As a side note, Crystal Reports includes a driver called the Open SQL driver that allows report developers to directly access the underlying transaction tables of SAP R/3 [SAP ERP Central Component]).

So what are DSOs used for in SAP BW? They’re used almost exclusively to store transaction-level (detail) data to support the use of drill-down reporting in SAP BW. As you may recall from our discussion about the exploding data warehouse earlier in this chapter, it’s inherently challenging (and contradictory) in a data warehouse environment to store transactional data in a multidimensional structure, or cube. Sometimes you can pull it off, but often it’s is impractical owing to performance constraints.

3.4.3 Creating a Master Query

Let’s look at an overview of creating a master BW query against an InfoProvider. Because the goal of this book is to teach you how to use Crystal Reports, not the SAP NetWeaver BW Query Designer, we’re going to take a high-level look at developing basic queries. In the following section we’ll assume that the reader has at
least a basic understanding of developing queries using the SAP NetWeaver BW Query Designer and has previous hands-on experience.

Figure 3.4 shows the SAP NetWeaver BW 7.1 Query Designer with the Sales Overview InfoCube open in the InfoProvider pane at the left.

Next we’ll expand the Key Figures and Dimension nodes to see all of the available key figures and characteristics in this InfoProvider (Figure 3.5).

This InfoProvider is fairly limited in the number of available key figures and characteristics. Most real-world InfoProviders have significantly more than what is shown here. In this simple scenario all we need to do is drag all key figures and characteristics into the appropriate panes on the right.
Key figures always go in the Columns pane on the right. For queries designed for the BEx analyzer, where you place individual characteristics depends on how the SAP BEx end user is going to use them when the report is run. If you want to use the characteristic in the initial view of the report, you put the characteristic in the Rows pane. If you don't want it used for the initial view of the report but made available for the end user to create additional views (drill downs, slices), you place it in the Free Characteristics pane.

However, we're not developing this query with SAP BEx in mind, but for Crystal Reports. With Crystal Reports (using the MDX query driver) it makes no difference where you place your characteristics because Crystal Reports will treat them all as free characteristics until you use them in your Crystal Reports report. Then, and only then, do they become active characteristics.

So, where should you place your characteristics when developing a query for Crystal Reports? We recommend putting all characteristics in the Free Characteristics pane of the Query Designer in case an SAP BEx user attempts to run this query.
using the BEx analyzer. It can be possible (given your particular security configuration) for an SAP BEx end user to accidentally run one of your master BW queries that you've designed for Crystal Reports. If this happens and you've made all your characteristics active row characteristics, the query may take a long time to run and will potentially return a lot of data. Plus, it will probably be a very busy report that makes little or no sense. However, if you placed all your characteristics in the Free Characteristics pane, the user running your query will get just the opposite: nothing. One other advantage of this approach is that the original SAP BW Query Driver (which has been deprecated by SAP but is still available for backward compatibility) is incapable of accessing free characteristics. So if you mistakenly use this driver instead of the current MDX query driver, you'll be unable to use any characteristics, rendering the query unusable.

Now we'll drag all of the available characteristics and key figures to their appropriate places on the right, as shown in Figure 3.6.

![Figure 3.6 Drag All Available Characteristics and Key Figures to Their Appropriate Places on the Right](image)
That’s it! We’ve created a simple master query that a Crystal Reports developer can use to create any type of report that requires information from the Sales Overview InfoProvider. The only element we’re missing that’s in virtually every real-world query is at least one characteristic variable (for filtering the data).

We just need to make one more setting before saving our query. The name of the setting is Allow External Access to this Query. You get to this setting by going to the Properties pane on the right side of the Query Designer and selecting the Advanced tab (Figure 3.7).

![Figure 3.7 Allow External Access to Query](image)

All you need to do is select this option to turn it on. Contrary to what you may hear elsewhere, you don’t have to activate this to access a BW query in Crystal Reports as a data source. It is required, however, if you decide to change the data source of an existing Crystal Reports report to a different query. If the new query doesn’t have this option selected, you won’t be able to make the switch (this feature is called Set Location).

Let’s now save what we have so we can proceed to the next step, which is the creation of a Crystal Reports template using this new query. When saving any BW query, you must supply both a description and a technical name. Depending on your organization, the description can be just about anything that adequately describes the query. Technical names, however, normally follow a predefined format. It’s recommended that part of the technical name identify this query as one that was developed specifically for use with Crystal Reports. A common method is to insert “CR” into the technical name, as shown in Figure 3.8.
A thorough understanding of how SAP NetWeaver BW functions as a data source for Crystal Reports is essential if you’re to succeed in developing reports in an SAP NetWeaver BW environment.

The world of SAP BW has its own lingo and practices. It's important that you become at least conversant so that you can understand others when discussing SAP BW.

Data explosion can easily occur in any data warehouse environment. A data warehouse is designed to produce summaries (or aggregates) based upon a particular combination of characteristics. As you add characteristics into the mix, the number of summaries, or aggregates, tends to increase — sometimes exponentially. At some point you can “hit a wall,” and the warehouse runs out of resources to complete your request.

The most dangerous characteristic is the document-level (or transaction) characteristic. When this is added to a query (or in the case of Crystal Reports, to a report) it results in the maximum number of rows being returned.

The primary advantage of using the new MDX query driver in Crystal Reports to create reports against an SAP NetWeaver BW query is that it treats all charac-
teristics as free characteristics until used somewhere in the Crystal Reports report. This allows for the creation of master queries that can be used as the data source for a broad range of Crystal Reports reports.

- Although it may not always be possible to create a single query per InfoProvider, your goal should always be to minimize the number of queries and only create additional queries when absolutely necessary. The most common reason for having to create another query is the need for a different set of variables in a report.
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