

Real World Enterprise Reports Using VB6 and VB .NET

CARL GANZ, JR.



Real World Enterprise Reports Using VB6 and VB .NET
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To the memory of my three thousand fellow Americans murdered by terrorists on September 11, 2001, at the World Trade Center, the Pentagon, and in Shanksville, Pennsylvania.

God bless the United States of America.

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 Martin Morales Zempoaltecatl
 Zhe (Zack) Zeng
 Marc Scott Zeplin
 Jie Yao Justin Zhao
 Ivelin Ziminski
 Michael Joseph Zinzi
 Charles A. Zion
 Julie Lynne Zipper
 Salvatore J. Zisa
 Prokopios Paul Zois
 Joseph J. Zuccala
 Andrew Steven Zucker
 Igor Zukelman

American Airlines Flight 11

John Ogonowski
 Thomas McGuinness
 Barbara Arestegui
 Jeffrey Collman
 Sara Low
 Karen Martin
 Kathleen Nicosia
 Betty Ong
 Jean Roger

Dianne Snyder
 Madeline Sweeney
 Anna Williams Allison
 David Angell
 Lynn Angell
 Seima Aoyama
 Myra Aronson
 Christine Barbuto
 Berry Berenson
 Carolyn Beug
 Carol Bouchard
 Robin Caplin
 Neillie Casey
 Jeffrey Coombs
 Tara Creamer
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 Andrew Curry Green
 Brian Dale
 David DiMeglio
 Donald Ditullio
 Albert Dominguez
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 Carol Flyzik
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 Karleton D.B. Fyfe
 Peter Gay
 Linda George
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 Robert Hayes
 Ted Hennessy
 John Hofer
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 Robin Kaplan
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Richard Ross
Jessica Sachs
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Heather Smith
Douglas Stone
Xavier Suarez
Michael Theodoridis
James Trentini
Mary Trentini
Mary Wahlstrom
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John Wenckus
Candace Lee Williams
Christopher Zarba

American Airlines Flight 77

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Michele Heidenberger
Jennifer Lewis
Kenneth Lewis
Renee May
Paul Ambrose
Yeneneh Betru
M.J. Booth
Bernard Brown
Suzanne Calley
William Caswell
Sarah Clark
Asia Cottom
James Debeuneure
Rodney Dickens
Eddie Dillard
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Dana Falkenberg
Joe Ferguson
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Dee Flagg
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Ian Gray
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Bryan Jack
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Chandler Keller
Yvonne Kennedy
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Shuyin Yang
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Graham Berkeley
Touri Bolourchi
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Daniel Brandhorst
David Brandhorst
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Christoffer Carstanjen
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Gloria Debarraera
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Ronald Gamboa
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Now let's roll!

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Introduction

REPORT WRITING HAS ALWAYS BEEN a thorn in the side of software developers. Like all other tools for software development, report writing technologies have evolved dramatically over the past several years. When Visual Basic was first released, there were only two viable ways of building reports: 1) Using an interactive report writing tool like Crystal Reports or R&R Report Writer, or 2) hand-coding using the VB Print object. The more adventurous addressed the Windows Printer API directly, calling functions such as OpenPrinter and TextOut. The VB Printer object was (and still is) rather weak, especially in its lack of an event-driven interface, and most developers had neither the time nor the expertise to deal with the API approach. This left interactive report writers as the only viable possibility. In time, many developers became experts in their chosen report writer and, overall, these tools have served their purpose very well.

Times have changed and scores of other tools have emerged into the marketplace. Today, the way I see things, there are three categories of report writing tools:

- The now-classic interactive report writers like Crystal Reports
- Source code-only alternatives like VS-View and Preview, both from ComponentOne, Inc.
- Tools that are a cross between an interactive report writer and source code like ActiveReports from DataDynamics, Inc., and VS-View Reporting Edition from ComponentOne, Inc.

There's also a wide assortment of other not-so-standard report writers that seem to defy categorization. Some even come with source code. Which tool is best is a long-running philosophical discussion among software professionals, and strong opinions vary from developer to developer. I personally prefer the VS-View/Preview approach, whereas many of my colleagues prefer ActiveReports. Both of these products are consistently among the top sellers at VBXtras.com. I also have many experienced colleagues who prefer Crystal Reports. There are even some users of R&R Report Writer (<http://www.livewarepub.com>) out there, although the market has been dominated by Crystal Reports for the past several years. We each have very specific reasons why we have chosen the tools that we use and, to be honest, familiarity has a lot to do with it.

Other developers have their choices and reasons as well. In August 2002, I suggested a survey question to the Webmasters of VBWire.com, a Web site

dedicated to providing updated technical and product information to users of VB and .NET technologies. The question was, “If you had your choice, what tool would you use for report development?” I gave five possible responses: Crystal Reports, ComponentOne’s VS-View/Preview for .NET, Data Dynamics ActiveReports, Actuate, and Other. With 1297 people responding, the response percentage breakdown was as follows:

Crystal Reports	42%
VS-View/Preview for .NET	16%
ActiveReports	20%
Actuate	10%
Other	12%

Since the first word of this book’s title is “Enterprise,” rest assured that I intend to show you how to make reports available to the enterprise by hosting report engines on servers. Because Crystal Decisions has the largest market share of any report development tool, as evidenced by the results of the preceding Web poll, I’ll concentrate on the Crystal Enterprise technology as an example of enterprise-wide report distribution. Nevertheless, I’ll also discuss the advantages of creating your own report server (it’s not difficult) using tools such as ActiveReports and VS-View/Preview. There are certainly other alternatives to these approaches such as Actuate, Cognos, Business Objects, and WebFocus, but detailed coverage of these tools is beyond the scope of this book.

Reporting is as much a philosophy as a technology. It’s fundamentally an issue of getting the right information (not too much and not too little) to the right people quickly and efficiently. There are a myriad of ways to accomplish this: e-mail; Web availability; output format options such as PDE, HTML, Excel, RTE, or Word; options of interactive reports that allow drilldown to subreports or even the raw database information itself; and graphing. Of course, paper printouts will be with us forever. It’s been said that the paperless office is about as likely as the paperless bathroom.

In 1995, I was at a technology conference where the keynote speaker was an expert in virtual reality. He spoke of a future day where users could don virtual reality goggles and view their data in a virtual world where data would be plotted and graphed in three dimensions or even one where an artificially intelligent virtual person would respond to natural language questions as to what the data meant. While such *Star Trek* scenarios are certainly far-fetched, it shows the extent to which people are thinking about meeting reporting requirements.

While there are certainly differences in technology for report delivery, there are also differences in methodology as well. One is just as important as the other. By “methodology,” I refer to the processes and procedures of building a report, designing a criteria screen, and deploying it to the user. It is the rule, not the exception, at most companies I’ve worked with that developers often reinvent the wheel every time a simple report is needed. It often takes days and weeks to deliver a report that should be done in a few hours. Often, no one knows what version of which reporting tools are on what workstations, where to deploy the report, and who has the documentation. Like any other aspect of software development, these problems need to be addressed, or every new report a client requests becomes a project unto itself.

The idea for this book grew out of an e-mail I sent to my long-time *Visual Basic Developer* (now *Hardcore Visual Basic*) newsletter editor at Pinnacle Publishing, Karen Watterson, way back in February 2002. After suggesting an article idea for the Crystal Report Creation API, she suggested that the advanced developer’s features of Crystal would make a good book topic. I thought that this topic had been exhaustively covered by other authors and that I couldn’t add much to the existing field of knowledge. I thought, however, that a book on other reporting tools such as VS-View and ActiveReports and the entire range of report-related technologies would be appropriate. In fact, after researching the market, I couldn’t find another book that had ever been written specifically on the subject of report writing. I found this to be very strange, as report writing is such a vital part of application development.

My goal in this book is to discuss report writing from a developer’s perspective. I plan to discuss the programming of reports using such tools as VS-View / Preview and ActiveReports, as well as the programmatic interface offered by Crystal Reports, and even delivery of reports to handheld wireless devices. In addition, I’ll cover how to design reports and what items to consider when creating a specification document. Then, I’ll discuss the SQL and ADO/ADO.NET issues you’ll need to understand to extract the data necessary for the reports you are building. From there, I’ll show you how to create effective and easy-to-maintain criteria screens. You’ll learn about the role played by the Microsoft Office XP suite. Since reports will often be exported to both Excel and Word, as well as transmitted throughout the enterprise by Outlook, we’ll explore these technologies in depth together. Since both Lotus Notes and Adobe Acrobat also play an important role in the creation and dissemination of reports, I’ll explain the parts they can play as well. Then, you’ll learn how to deliver reports over the Internet using both ASP and ASP.NET, paying careful attention to the role played by XML Web services. Finally, I’ll conclude by showing you the new Palm and Windows CE technologies for Pocket PCs and remote wireless connections.

This book isn’t intended either as an endorsement or a manual replacement for any particular product. For those reporting products covered, it’s not the goal to exhaustively explain every property, method, and event. If you are already

a user of these products, you will find in these pages much helpful information on how to use these products to their fullest potential. For those of you new to report development, this book will help you decide which tools and methodologies are right for you. My goal is to focus on the programming necessary to use these tools to develop “real-world” reports and to integrate these reports into your applications. All of the techniques that I describe—and most of the code examples that I use (with the exception of some of the .NET examples, as this technology is so new)—are taken from production applications that I have delivered to paying customers over the past few years.

All in all, I hope this book provides you with some fresh (or forgotten) ideas about delivering reports. Enjoy, and let me know what you think.

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CHAPTER 1

Reporting in a Nutshell

REPORT WRITING HAS EVOLVED over the years as radically as the tools for software development itself. Those of us who are a little older remember the days when a central computer system would produce the formerly ubiquitous “green-bar” reports. Large, continuous-feed data outputs were distributed by hand throughout the organization by a clerk who carried these monstrosities to individual managers. Mercifully, technology has evolved beyond all that so that now the same report can be served up automatically, usually by e-mail or even wireless transmission to a personal digital assistant (PDA). Moreover, the trend is toward better “just in time” information (often in the form of exception or summary reports instead of comprehensive ones) so that only those individuals who require certain data receive it and those individuals can get timely “bites” of data instead of only large monthly or yearly reports.

Because information technology has evolved so rapidly over the past few years, the definition of what constitutes a report has undergone a dramatic transformation. Traditionally, reports were only thought of as something that printed on paper. This definition has since become blurred as there are multiple ways information can be disseminated throughout the enterprise. Today, paper reports are largely used only as working copies to be carried to meetings or as written notes or archives. Given the use of Web technology, e-mail, PDAs, and Adobe Acrobat PDF files, paper has—mercifully for the environment—fallen to a tertiary position as a means of conveying information.

Report development is often one of the last processes in developing an application when, practically speaking, it should be one of the first steps when performing a system design. By starting with the reports and other data outputs that are required, you can better determine what the inputs should be. In fact, when all is said and done, if a data element that is used in the application is not found on any of the reports, the need for that data element should be questioned.

Certain standards govern the format of reports. Text and date information, for example, should be left justified in their respective columns along with their column titles. Numeric amounts and their column titles, however, should be right justified so that decimal points and digits line up. Margins can be adjusted

as necessary given the amount of data you intend to print on a page, but remember that users may want to hold printed output in a binder, so take this into consideration when sizing margins.

To make sure that no information is lost, it is judicious to evaluate whether the page numbers should read “Page x of y”. Also, the phrase “End of Report” should appear after the last row of data on the last page. For reports that contain sensitive data, it is often a good practice to include a phrase on each page footer to this effect: “The information contained in this report is internal corporate information only and should not be distributed outside of the organization.” Highly sensitive reports can be printed with the label “Copy x of y” so as to account for all printed copies. Moreover, special paper can be used that will preclude photocopying the printed documents.

As a rule, users should be provided with the option to print a criteria page at the beginning of each report that indicates the criteria used to filter the data contained within it. If possible, these criteria can also appear on the first page of the report before the data itself.

Report distribution has made huge leaps since the introduction of the Internet and corporate intranets. Since many reports are built into applications (compiled EXEs), a user would normally need a copy of that application installed on his or her desktop in order to access the report. Now, the reporting functionality can be completely Web-based. Using Web-based technology, the comparatively finite number of desktop users can still have access to report functionality, while the often much larger number of Web users can access a Web-based application that will provide them with report criteria screens to allow them to run and export reports.

Security

Of course, all these means of disseminating information bring with them numerous security issues. While a comprehensive discussion of computer security is beyond the scope of this book, a brief mention of report-and document-related security issues is appropriate. There are different levels of security related to report information. It could be simply that the ability to print certain reports is available only to specified users. This fails, of course, when one of these users sends a report to a shared printer to which anyone on the floor has access. I once had a user print a list of salary and bonus information that was fortunately found by the human resources director before any damage was done. It was the last time that user ever made that mistake. It is difficult to employ any kind of security measures on a computer system without incurring significant expense. All it takes is one user to write their password on their keyboard and the most elaborate security system is immediately compromised. One way to track who is being careless is to create a log entry in an audit trail table every time a report is run.

You can record what report was run, the criteria, at what date and time, by whom, and on what machine. You could also print the ID of the user who ran the report on all output so that when the salary report is carelessly left on a table in the lunchroom you'll know who to blame.

Another form of data access restriction is to allow multiple users permission to run the same report but restrict the set of criteria. Thus, one user could run a compensation report for Departments A, B, or C, whereas another user might only be able to run it for Department B. Optionally, any user could be allowed to run the report, but the Compensation column could be suppressed for those users who don't have authorization to view this information.

Some of the technology for securing documents lies in the forms upon which they are printed. Checks are a common example. Most checks have numerous security devices to deter fraud. First, they can be printed on paper that has various color tones throughout the document as well as a distinctive watermark to prevent photocopying. Then, the check amount is printed in several locations on the check itself. I've even seen checks that have heat-sensitive logos on the reverse side that will disappear for a few seconds when heat, say, from your thumb, is applied to them. Taken together, these security devices may not completely prevent fraud, but they'll at least make it very difficult for the culprits and show that you've done due diligence.

Magnetic ink character recognition (MICR) allows you to print the entire check—logo, check and account numbers, signature, etc.—directly on blank paper rather than maintain preprinted check stock, which is easier to steal. In this way there is no need to constantly void preprinted checks that are destroyed in printing.

Security threads are polyester or plastic bands embedded into paper just beneath the surface. The new U.S. currency employs this device as an anticounterfeiting measure. Security threads restrict visibility in reflected light while permitting visibility in transmitted light. They offer protection against photocopying, as copiers see documents only in reflected light. Also, the presence of threads in a document provides for easy authentication. You can obtain more information on the different products and techniques for document security from your forms manufacturer.

Aesthetics

Effective report presentation requires also that you consider your audience's background. Many of my clients are investment banking and pharmaceutical companies. While there is certainly a remarkable difference in the corporate cultures between the two industries, there is also a vast difference in the average age of the staff. The majority of the users at the investment banking firms are under 35, whereas the opposite is true of the pharmaceutical clients. This age difference

manifests itself in the way reports are produced. Younger people can generally see reports printed in a smaller font and in fact often prefer it as there is more information printed on one page. Older people have a much harder time viewing this information, and the font size for your reports needs to reflect this.

Font size can also come into play when there is a significant need to conserve paper. I have a client who is a reseller of telecommunication service. His company works on a multilevel marketing model. A person becomes a dealer in the organization and recruits other people as dealers, who in turn recruit others, and so on. Dealers receive commissions from their sales as well as the sales of all the dealers in their sales organization. Because telecommunication sales is such a high-volume, low-margin industry, cost efficiency is a far more sensitive issue than it is in many other industries, and this sensitivity affects reporting. Each month, commission reports need to be mailed to individual dealers, along with a statement of which dealers in the downline produced what sales. Since some of these commission reports run to several pages, and anything more than four $8\frac{1}{2}\times 11$ sheets in an envelope will push the letter into the next postage bracket, it behooves the client to cram as much information as possible onto one sheet of paper. The result is a commission report that uses a 6-point Arial font with a line spacing of .75, meaning that the space between printed lines is 75 percent of the spacing required by a printed line. The result looks something like this:

Name	Sales	Comm.	Bonus	Total
John Smith	100.00	10.00	4.00	14.00
Jane Jones	200.00	20.00	8.00	28.00

Naturally, this is not an easy read without the use of a ruler and a magnifying glass. But, since the reports were printed duplex (note that not all printers support duplexing), that is, printed on both sides of the paper, a lot of paper was saved and only rarely did the letter get pushed into the next postage level. Most importantly, the client was happy.

Such exacting requirements for report presentation are normally not an overriding issue for most business reports. Presenting data in a clear and organized way, usually some form of a table structure, is all that is required (although I do have clients who have an official font that is used for all their reports, documents, and correspondence so as to create a more uniform look for the firm as a whole). Be careful about using too many different fonts in a report, as this could cause memory overflow errors on older printers (of course, so could too many graphics). Variations in the bold and size attributes of the same font are most

appropriate to highlight important areas of the report. The right font can make all the difference in building an effective report presentation. Font selection can be so important that many books have a paragraph in the front matter describing the font used to print the pages within. Serif fonts are the most popular fonts to use for printed reports, but sans serif fonts such as Arial are preferred for screen viewing. Serif fonts have small lines at the top and bottom of the characters that research has proven makes text easier to read. Sans serif fonts do not have these lines (“sans” is simply French for “without”). Take a look at these examples:

This is a serif font.

This is a sans serif font.

Examine your favorite books, magazines, and newspapers, and you’ll see that as a rule they use serif fonts. When viewing reports on a computer screen, however, studies have shown that sans serif fonts are easier to read than serif fonts. Because Arial is a sans serif font, it is often used for screen displays. Since most reports are viewed on screen and not printed, Arial may be your best bet for font selection.

You can make the layout easier to read by shading alternate rows of data on reports, especially those that print landscape, and most especially those that print landscape on legal-size paper. Though alternating shading is especially good when reading rows of figures and distinguishing between lines with similar kinds of data, consider that the report may be put through a fax machine. If this is the case, you may need to rethink shading, or at least use a very light shade, as shaded text often can’t be read on a fax. When you design a report to print for legal-size paper, you need to consider that the user may or may not have an ample supply of legal-size paper available. While legal-size paper can typically be fed into a printer via the manual feed, this method usually only allows a small number of sheets at a time. If you expect the report to print a large number of pages, recommend that the client obtain a legal-size paper bin. Also, before printing the report, display a message box reminding the user that legal-size paper is required in order for the report to print.

Some reports require a far greater level of fine-tuning. I have a client who develops financial sales software that produces printed sales presentations. The reports for this project were the most complex and involved of any I have ever done. There are a number of forces at play here. First, each phrase, word, and even punctuation mark had to be carefully crafted by the legal department in order to meet regulatory compliance requirements. Then, the marketing department had to be satisfied that it was an effective sales tool. Finally, I had the issue of making sure that the reports were simple to understand for both the financial clients as well as the sales reps because as my client politely tells me, “Carl, they’re idiots.”

International Considerations

If you plan to deliver your applications outside the United States, there is one very important issue you must consider. The United States is one of the few countries that uses letter-size paper (8½×11). Almost everyone else uses A4 paper, which is a bit longer and a bit narrower than letter-size, specifically 8.27×11.69 inches. (The staff at my client's European offices are only mildly amused when I refer to "regular" paper and "foreign" paper.) If you don't take this width difference into consideration, then your data will print off the right side of the page.

You can determine the paper size setting of the currently selected printer via the Visual Basic Printer object. Simply querying the `PaperSize` property as follows

```
iPaperSize = Printer.PaperSize
```

will return a constant value indicating the paper size setting for the currently selected printer. You can find a list of all the different `PaperSize` settings in the Visual Basic documentation.

The Windows Regional Settings, known as Regional Options in Windows 2000 and later, are important for determining the formatting of dates, times, decimals, currency, days of the week, and months of the year. Dates are probably the greatest area of confusion. Many countries use the dd/mm/yyyy format, while the United States uses the mm/dd/yyyy style. In China and some Asian countries, dates appear as yyyy/mm/dd. Therefore, if a date on a report reads 04/01/02, you cannot be certain if it is referring to January 4, 2002, or April 1, 2002. To eliminate all confusion without consuming much extra space, I usually write the date as 04-Jan-2002 on all reports that are used internationally.

Any of the Windows Regional Settings are only an API call away. The `GetLocaleInfo` API function, shown in Listing 1-1, receives a hexadecimal value as a parameter. This value equates to the setting you wish to retrieve.

Listing 1-1. *GetLocaleInfo* API Syntax

```
Function LocaleInfo(lDataNeeded As Long) As String
    Dim cBuffer As String
    Dim lResult As Long
    Dim iBuffer As Integer

    iBuffer = 255

    cBuffer = String$(iBuffer - 1, 0)

    lResult = GetLocaleInfo(LOCALE_USER_DEFAULT, lDataNeeded, _
        cBuffer, iBuffer)
```

```

    If lResult <> 0 Then
        LocaleInfo = Left$(cBuffer, lResult - 1)
    End If

End Function

```

The book's downloadable source code, which is available at the Apress Web site (<http://www.apress.com>), has a list of the Regional Settings values expressed as an enumerator. The example shown in Listing 1-2 illustrates what some of the values are.

Listing 1-2. Some of the Valuable Data Returned by GetLocaleInfo

```

Dim cSettings As String

cSettings = "Abbrev. Country: " & _
    LocaleInfo(Locale.AbbrevCountry) & vbCrLf

cSettings = cSettings & "Country: " & _
    LocaleInfo(Locale.CountryEnglish) & vbCrLf

cSettings = cSettings & "Currency Decimal Separator: " & _
    LocaleInfo(Locale.CurrDecimalSep) & vbCrLf

cSettings = cSettings & "Language: " & _
    LocaleInfo(Locale.Language) & vbCrLf

cSettings = cSettings & "Currency Symbol: " & _
    LocaleInfo(Locale.IntlCurrencySymbol) & vbCrLf

cSettings = cSettings & "Long Date: " & _
    LocaleInfo(Locale.LongDateFormat) & vbCrLf

cSettings = cSettings & "Short Date: " & _
    LocaleInfo(Locale.ShortDateFormat) & vbCrLf

cSettings = cSettings & "Time Format: " & _
    LocaleInfo(Locale.TimeFormat) & vbCrLf

cSettings = cSettings & "First Day of week: " & _
    LocaleInfo(Locale.DayName1)

MsgBox cSettings

```

This code produces the message box depicted in Figure 1-1.



Figure 1-1. Regional Settings—United States

If you open the Regional Settings dialog box under the Control Panel and change the settings to Germany, you'll see the message box shown in Figure 1-2.

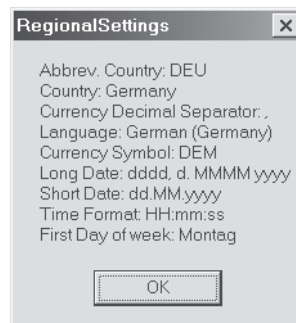


Figure 1-2. Regional Settings—Germany

Of course, you are in no way bound to use the regional settings. Most applications—both in-house and off-the-shelf—have (or at least should have) a security module that manages the names of authorized users and their access levels. This same module can also assign a regional setting as well. The regional setting can refer to a collection of predefined settings—either user-defined or hard-coded—that specify the date format, currency format, etc., regardless of the regional settings specified through the Control Panel. However, if your New York user logs on to a workstation during his trip to the London office, he'll get an

“Insert Letter Size” printer error when he tries to print a report to a printer that is expecting A4.

Report Design

The design stage of any application is the most crucial part of the software development process. My experience has been that almost all projects that go over budget are the result of poor planning, or worse, the complete absence of it. I have had several clients give me a rough idea of their projects and then tell me to begin programming. I would sit at a desk next to a client and work. During the workday the client would tell me to add this or that feature as often as he or she had new and sudden insights about the application. As a junior programmer, I accepted this from clients. As an experienced professional, I no longer tolerate it, although I still see this practice throughout the corporate world. (Note to my clients reading this book: You know if you’re a past offender, so take time out now to feel guilty and then continue reading.)

Creating a Report Specification

The principles discussed here for report design apply as well to the remainder of your application. Screens, logic and workflow, business rules, and database design all need to be prototyped and documented so that the client and the developers understand the mission and objective. Since this book focuses on reports, that is what this design section will focus on.

Report design is often a balancing act of having either too much or not enough information. You have only so much room on a page and a limited amount of time to read it. Therefore, you want to display no less, but no more, than is necessary. First, you’ll need to specify the objective of the report. Is it primarily a summary or a detail? Then determine what columns from what tables will provide the data. This type of design needs to be done working closely with the client. My experience has been that clients have a better understanding of the reports they want from the system than they do of any other feature of the application. Once the purpose and fields have been determined, you can use a tool like Microsoft Word or Excel to lay out the structure of the report. (I personally find Excel easier to work with.) Figure 1-3 illustrates an example of what this layout may look like, using the same fonts and attribute settings that will appear in the final product.

Figure 1-3. Report layout

Sales by Group Report

GROUP	PRODUCT	ON HAND	QTY SOLD	SALE AMOUNT
Group 1	Product 1	4	6	300
	Product 2	3	4	500
	Product 3	6	2	200
<i>Group 1 Totals</i>		<i>13</i>	<i>12</i>	<i>1000</i>
Group 2	Product 5	7	9	600
	Product 6	7	4	800
	Product 8	11	5	500
<i>Group 2 Totals</i>		<i>25</i>	<i>18</i>	<i>1900</i>
Grand Totals		38	30	2900

This layout takes about 5 minutes to create and clearly illustrates to the client exactly how the report will appear. Populating it with sample data is a helpful technique and is better than simply listing the fields or a straight description of the layout. Use paper of the same size as is intended for the final report, even if this means attaching legal-size paper to your specification document. Try to take a what-you-see-is-what-you-get (WYSIWYG) approach and keep all the fonts and font attributes the same as in the final output. Don't make clients use their imagination.

Anticipate client needs by suggesting summary levels that they may not be thinking about. Do they require averages as well as subtotals? Would the report be too difficult to read if there were too many subtotal groupings? Do they want certain parts boldfaced, italicized, or underlined? Are graphs needed? I once used a strikethrough attribute on an employee recruitment report so the client could easily see cancelled interviews. Mention *drilldowns* to clients, that is, paths to get from summary information to detail information. This can occur by having "interactive" reports on a Web page that allow you to click a summarized figure or a bar on a graph to open another report that breaks down detail. These are very intuitive to managers and often elicit "oohs" and "aahs."

The next step in the design process is to create a list of the criteria for the report. I generally recommend being generous in this area as you can't really have

too many criteria unless the users would literally be confused by the sheer number of them. For each criteria you'll need to know if the user can select one or many options, a date range, yes/no options, and different sorting options. Also, you'll need to indicate if certain criteria are mandatory in order to run the report. For example, the criteria description of the Sales by Group Report shown in Figure 1-3 may be

- Sale date from-to range (mandatory)
- Group (one or multiple)
- Product (one or multiple)
- Include discontinued products? Yes/No
- Sort options: On hand, Quantity Sold, Sale Amount

Generally, date criteria should be expressed as a range. If the user only needs one day's worth of information, the "from" and "to" dates are set to the same value. The option of selecting one or multiple criteria, as in the case of the group or product, is expressed in the user interface as a combo box or a multiselect list box, respectively. Finally, the Yes/No options, such as whether or not to include discontinued products in the sales summary, can be expressed with a check box. Sort options belong in a combo box as there is usually only one sort option per report, unless you really need to allow primary, secondary, or even tertiary sorts. When multiple sort options are necessary, you may wish to consider adding Ascending/Descending options next to each sort selection. Often what the client thinks of as a distinct report is simply the same report sorted a different way. Chapter 3 completely explains the technical implementation of these criteria screens.

Report headers are another design element the client needs to approve. Generally, headers will display the name of the company (and, optionally, the company logo), the date and time the report is run, and the page number. Normally, the title of the report is displayed in a larger font in the center. You may wish to display the name of the user who ran the report or even a disclaimer stating that the material included within the report is confidential. Report headers should be consistent across all reports in an application. How critical it is to agree upon report headers at the beginning of the process depends in large part on the report development tool you are using. Crystal Reports, for example, has no easy way of centralizing headers in one location such that a change in one is reflected in all reports. If you are using VS-View or Preview for .NET, report headers can be centralized in one function call that will enable you to change them as needed.

Make sure the report specs are made available to everyone who could possibly have a comment on their final appearance and data composition. Any changes can be discussed at meetings without you, the developer, present. Let the clients fight it out amongst themselves. Doing so will keep you largely insulated from the often excruciating debates as to how data should be organized and presented. In addition, by involving users and management at all levels who wish to participate, no one can truthfully say “I was never consulted” when they end up with a product that isn’t exactly what they want. A technically savvy product or project manager, if not the developer, should be at meetings to handle immediate questions about the technical feasibility of including certain data items and explaining and clarifying often complex relationships between data items. Failing to capture these requirements early on can cause distorted user expectations and ill will between development teams and customers.

Generally, tables that support the various data entry screens in the application need some facility to print out their contents. Since many of these tables consist of simply a primary key value and a verbal description, a generic print routine is easy to create. Usually these dictionary prints don’t even warrant the entry of filter criteria. Other dictionaries are either more complicated and require customization or have a rather large number of records, at which point a criteria screen may be appropriate. These criteria should be discussed with the client during the design stage.

Report aesthetics are also an important topic for discussion. Are there times when color would be appropriate in the report? If so, there are two things to consider. First, color printers are not yet ubiquitous and you cannot depend on one always being available. PDF and Excel files, however, handle color easily, and if your report will largely be disseminated in one of these formats, you are in good shape. The second issue is that of color blindness. About eight percent of men and one half of one percent of women have some type of color-deficient vision. The genes that affect color deficiency belong to the X chromosome, hence the preponderance of male color blindness. Therefore, that sharp-looking grand total of red letters on a green background may be completely invisible to some of your users. For a complete explanation of the various issues regarding color deficiency, see the article “Can Color-Blind Users See Your Site?” at <http://msdn.microsoft.com>.

Export Options

Export options are another point to be decided upon. Normally, reports should print directly to the screen, that is, in “Print Preview,” and from there the client has the option to send the data to the printer or export the data to Excel, ASCII, HTML, or Adobe Acrobat. You could also offer the option of exporting to an Access database. Find out if there are any special report export requirements.

Of course, the report itself could be entirely an export process. Several of my clients have asked me for reports that present a criteria screen and then simply export the results to Excel. They have no interest at all in printed output.

Preprinted Forms

Oftentimes you may need to print a report on a preprinted form, like an IRS 1040 or a W-2. If this is the case, you should examine whether the application really needs to print specific pieces of data at specific locations on the preprinted page, or simply reprint the entire form itself on blank paper. I have a client who was once spending \$7,000 per year on preprinted forms. When I showed him that the same result could be achieved if he performed a mail-merge with a document composed in Microsoft Word, he was naturally elated at the annual savings. Moreover, he now has the flexibility of being able to change the document at will.

High-Volume Printing

High-volume printing raises issues that must be examined for cost efficiency. I have a client who is a New Jersey councilman who printed his constituent reports on an ink-jet printer. Ink-jet printers are relatively cheap, and a decent one can be purchased for about \$100. The hidden costs here are the ink cartridges. With cartridges costing about \$40 each, you don't want to do high-volume printing on an ink-jet printer. In fact, ink-jet printers are loss leaders for the printer industry, as the real profits are in the replacement ink cartridges. Since they are used up at a much faster rate than laser toner cartridges that cost twice as much, you'll end up spending more on ink-jet replacements than you will on toner. There are companies that also sell recycled toner cartridges at a sizable discount compared to new cartridges. In addition to this, ink-jet printers operate at only a fraction of the speed of laser printers. When my client indicated he wanted to print an annual newsletter to send to his 5,000 constituents, I recommended a laser printer. He now prints the text of the newsletter and merges the addresses as well.

Mass mailing can be a science unto itself. If your client needs do customized high-volume mailing pieces—for example, a monthly telephone bill as opposed to a supermarket circular where every recipient receives the same one—you may wish to examine an automated mailing solution. I have another long distance reseller client who sent thousands of telephone bills every month. The billing software creates print images of the bills and sends them to a Pitney Bowes machine that prints the bill, folds it, places it into a postage-paid window envelope, and seals it. Machines such as those sold by Pitney-Bowes are designed specifically for this type of high-volume mailing, and the staff are experts on how

to sort and organize the letters to achieve the maximum bulk rate postage. If you have a requirement for customized high-volume mailing, examine the product solutions at <http://www.pb.com>.

If your volume of mail is so great that it cannot be realistically done in house, consider the services of a bulk mailing company. These firms have the computers and printing equipment to print millions of documents and mail them within a few days. Mailing firms are large, high-volume facilities, some of which print and mail several hundred million documents per year. You can use your software to produce print images according to specifications given to you by the mailing company and then e-mail the data to their facility. Optionally, you can simply give them the raw data, and they will create the print routines for you. Depending on cost, you can work out with them where your work will leave off and theirs will begin. Because it doesn't matter where the mailing company is located, you can contract with virtually any one in the country to obtain the most reasonable rates. Consider this option carefully—you could very easily become overwhelmed with printing and mailing tasks in a high-volume environment.

External Data

You'll need to make sure you can access all the data necessary for your report. A client may want to display sales figures by zip code and then match the zip code to a sales rep roster that you are not maintaining in your application's database. You then need to contact the folks who are the keepers of the sales rep roster and see about joining your tables with theirs or possibly inquire about an export from their system and an import into yours. Be careful here. The machinations you may need to undertake to satisfy a client's seemingly simple request to display sales rep names via a zip code join could add a day or two to the project. Also, going forward you are at the mercy of the owners of the source system. They may change their data structures without warning you, and you'll then need to scramble to adjust your applications to handle the change. I have had this happen to me on several occasions.

Legal Issues

One often overlooked area of report design is the legal implications of system output. Usually, data that is intended for internal corporate use is not an issue. Output that is intended for use external to the organization can often bring with it significant legal liability. As a rule, every report, certificate, fax, statement, or letter that is intended for use outside the organization should be passed by legal counsel for approval. Seemingly innocuous documents may have enormous legal ramifications, and these ramifications may be different from industry to industry.

For example, one of the first systems I ever built was a target market mailing system for the sales agents of a leading U.S. insurance company. A sales agent would buy a list of names, and my system would merge these names with a marketing letter. As I made the system more flexible, I allowed the users to create their own letters. They gladly did so without ever consulting with in-house legal counsel. There were no safeguards in place preventing an agent from sending out a letter promising, say, a guaranteed 20 percent return on a particular product. In the past, courts have ruled that such statements are binding on the company who issued them.

Documents as simple as account statements or even invoices can be potential traps for legal liability. Alert counsel to the format of these documents and exactly what information they contain. Counsel may create a disclaimer that accompanies the text of the document as a safeguard. Even these disclaimers have potential pitfalls, as some states do not recognize this proverbial “fine print” if the print is, literally, too fine. This means by law that if the font is too small, the courts will disregard the existence of the text as having been too small for someone to reasonably read.

Copyright is also a property right that must be guarded. The summarization of even publicly available data has long been held to be copyrightable. Therefore, a company like Dun & Bradstreet, which compiles business information on millions of business entities worldwide, has an intellectual property interest in the data it has collected and in the unique way it presents it. Therefore, it is necessary for any reports that may present this data to individuals outside the organization to affix a copyright notice declaring the information in the report to be proprietary. Absence of a copyright notice can make prosecuting a case for infringement difficult to impossible, as it is incumbent on the copyright owner to make a clear and visible declaration of ownership.

A good rule of thumb is to contact corporate counsel before distributing any information to the outside. The attorneys (and your client) will be impressed by your foresight on these legal issues and will appreciate the fact that you consulted them.

Availability and Distribution

The final design issue is to determine who needs to run the reports. Traditionally there is a Report option on the main menu of desktop-based applications from which criteria screens are launched and reports printed, displayed, and exported. While there may be only 20 users of your application, there may be 100 users of the reports. This is where hybrid application development comes into play. The past few years have seen an explosion in the development of applications for the Web, and the future will offer more opportunities as ASP.NET takes root. Therefore, it may make sense to select some or all of the reports that are needed by

users who are not users of the application itself and create them as Web reports. Chapter 9 explains this process in more detail.

The Web is no longer the only way to make reports available to the masses. As PDAs become more prevalent, more users will want to access their data remotely via a wireless connection to the server. Due to the current state of PDA and wireless technology, you'll need to deal with a number of limitations when allowing reports to be transmitted to a PDA. Because of the slow connection speed, you'll need to limit the amount of data you can transmit between the server and the PDA. Note that this speed problem occurs with wireless modems. People using PDAs with wireless LAN cards enjoy speeds above 10 mbps. This will affect the way you design your reports, especially the HTML exports that PDA devices often use. Chapters 10 and 11 explain these concerns in more detail.

In many instances, users are more interested in receiving reports on a regular basis than they are in running them individually. This is known as the "push" versus "pull" approach. One of my clients has a personnel headcount report that lists the incoming, outgoing, and current employees and temps working in their respective groups. The managing director calls this the "Warm Cushion" report, as it tracks the number of warm cushions, or occupied seats, in the organization. The definitions of these groups are maintained in an organizational hierarchy table. Each Friday, an unattended process is run that loops through the names of each manager, determines what departments ultimately report to him or her, and then produces a report for those departments as a PDF file that is then automatically e-mailed to the manager for review. Chapter 7 explains how to use the VBA interface of such e-mail packages as Outlook and Lotus Notes to send these files.

Report Servers

Report servers are machines and software dedicated to the purpose of running reports. The decision as to whether or not you'll need a report server is the same as whether or not you'll need a fax server. If your automated reporting requirements are so great that they would interfere with an individual workstation user's productivity, then a dedicated machine needs to be considered.



NOTE See Chapter 9 for a discussion of using Crystal Reports with a report server.

We'll take a look at a report server developed by AR Consulting, Inc. (<http://www.arconsultinginc.com/rptsrvr>) to explain how a report server operates. A workstation connects to an ASP page on a Web server and indicates what report should be run and with what criteria. An example of this criteria screen is shown in Figure 1-4.

CP02 Criteria Page - Microsoft Internet Explorer

File Edit View Favorites Tools Help Links »

Back Forward Stop Home Search Favorites History Print Copy Paste

Address http://localhost/eos/cp02_criteria.asp

AR CONSULTING
A Computer Consulting Firm

[Setup](#)
[Logout](#)

Home WIP CP Ship **Reports**

Reports | My Reports

CP02 Report Criteria - Critical Path Overview

Report Parameters

Region: ---Select Region---

Vendor: ---Select Vendor---

Style:

Required tasks only: ☒

Active critical paths only: ☒

Report description: CP02_20020526_2142

Publish?: ☐

Save?: ☐

Expiration period: days

Done Local intranet

Figure 1-4. Criteria ASP page

This information is then appended to a table in the application's database located on a report server machine. It is this database that serves as the report queue. A report server-based ActiveX EXE continually monitors this queue and runs the requested report.

Report servers are often used to store a queue of those reports that need to run on a periodic basis. For example, a user may wish to request that the Sales by Product report be run every Friday at 3:00 p.m. and contain the previous week's sales data for a particular department. The report server will record the preferred method of delivery of this report—printed to a specified printer, PDF dump to a particular subdirectory, Excel spreadsheet e-mailed to a specified e-mail address, or published on the server in a variety of formats. At the specified time and date, the server will produce the report automatically and deliver it as requested, up through the expiration date of the report.

Most users request that the report, which can consist of a PDF, Excel, Word, or PowerPoint file, be stored on the server for later retrieval (see Figure 1-5).

Admin - Reports Menu - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History

Address <http://localhost/eos/myreports.asp>

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[Setup](#)
[Logout](#)

Home WIP CP Ship **Reports**

Reports | My Reports

My Reports

Description	Status	Submitted	Expiration	
PR02 20020523 2102	F	5/23/02 9:03 PM	5/23/02 10:03 PM	Delete
CP02 20020523 2056	F	5/23/02 8:56 PM	5/23/02 9:56 PM	Delete
Summary perf. by div.	F	5/17/02 0:00 AM	5/16/02 0:00 AM	Delete
Vendor summary perf. by div.	F	5/17/02 0:00 AM	5/16/02 0:00 AM	Delete
Summary by production source	F	5/17/02 0:00 AM	6/17/02 0:00 AM	Delete
Product group summary by div.	F	5/17/02 0:00 AM	6/17/02 0:00 AM	Delete
Product class summary by div.	F	5/17/02 0:00 AM	6/17/02 0:00 AM	Delete
PLNR summary by source	F	5/17/02 0:00 AM	6/17/02 0:00 AM	Delete
YTD PLNR summary by prod. grp.	F	5/17/02 0:00 AM	6/17/02 0:00 AM	Delete
YTD source summ. by prod. grp.	F	5/17/02 0:00 AM	6/17/02 0:00 AM	Delete
Prd Grp/VNDR summ. by PLNR	F	5/16/02 0:00 AM	6/16/02 0:00 AM	Delete
CP01A 20020515 1231	F	5/15/02 0:32 PM	5/15/02 1:32 PM	Delete
Critical Path overview	F	5/15/02 8:15 AM	5/15/02 9:15 AM	Delete
VK02 20020510 1344	F	5/10/02 1:45 PM	5/10/02 2:45 PM	Delete
Plan vs. Actual Pivot Table	F	5/10/02 0:23 PM	5/10/02 1:23 PM	Delete

Local intranet

Figure 1-5. List of published reports

One of the great benefits of publishing reports to the server is that individual users don't need to run the same report from different workstations, wasting their time and putting an increased load on the server. Moreover, since users can view reports in the requested format, such as Excel XLS or Adobe PDF, these users can save them to their local hard disk using Microsoft Excel or Acrobat and take them on the road.

Security features allow the report owner to make the file available only to the user who requested it, a specific workgroup, or to all users. Since the queue is never erased, a log is kept of who ran what report, when, and with what criteria. Each report has an expiration period after which it will disappear from the list. The report queue itself stores the start and end times of each individual report job so that the system administrator might determine if jobs are taking too long and more memory or processors may be required. Several factors affect the length of time needed to generate a report, including the database server, database design, indexing, and performance tuning; the physical RAM and hardware performance characteristics of a server, such as RAID; and other loads on the server, if it's not a dedicated report server.

Conclusion

Proper report design is fundamental to the success of any application. Once you've completed your due diligences in selecting the reporting tools and presenting the layout and criteria options to the client, then you've paved the way for the actual development of the report.

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