

Microsoft SQL Server 2012 Reporting Services



 Professional

Stacia Misner

Microsoft SQL Server 2012 Reporting Services



Use your SQL Server skills to create and manage key data reports

Deliver interactive business intelligence reports using SQL Server 2012 Reporting Services, and help facilitate real-time decision making throughout the enterprise. SQL Server expert Stacia Misner shows you in detail how to design, manage, and access custom reports that capture data from multiple sources. This book is ideal for experienced SQL Server developers, whether you're new to Reporting Services or upgrading from an earlier version.

Discover how to:

- Use the latest features, including the Power View ad hoc reporting tool
- Design reports by understanding how your audience accesses and uses data
- Add interactive features to help end users sort and filter data
- Create rich data visualization with charts, gauges, indicators, and data maps
- Configure your report server, provide security, and monitor report contents
- Use SharePoint or Report Manager to search and access reports online
- Create a library of report parts that clients can use for ad hoc reporting
- Build and manage reports using Reporting Services as a development platform

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<http://aka.ms/SQL2012RS/files>

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9

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About the Author

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To Gerry, best of friends forever.

—STACIA MISNER

*To my loving mother, who got me into this mess, in every sense
of the phrase.*

—ERIKA BAKSE

Contents at a Glance

Introduction

xxvii

PART I	GETTING STARTED WITH REPORTING SERVICES	
CHAPTER 1	What's new in Microsoft SQL Server 2012 Reporting Services	3
CHAPTER 2	Introducing the Reporting Services environment	25
CHAPTER 3	Understanding deployment scenarios	45
CHAPTER 4	Installing Reporting Services	55
CHAPTER 5	Exploring Reporting Services fundamentals	99
PART II	DEVELOPING REPORTS	
CHAPTER 6	Planning your report design	139
CHAPTER 7	Working with report server projects	151
CHAPTER 8	Retrieving data for a report	173
CHAPTER 9	Designing the report layout	209
CHAPTER 10	Working with the tablix	249
CHAPTER 11	Developing expressions	273
CHAPTER 12	Using functions	307
CHAPTER 13	Adding interactivity	345
CHAPTER 14	Creating dynamic reports with parameters	367
CHAPTER 15	Managing the page layout	395
CHAPTER 16	Using Analysis Services as a data source	425
PART III	ADDING DATA VISUALIZATIONS	
CHAPTER 17	Creating charts	453
CHAPTER 18	Working with chart elements	485
CHAPTER 19	Comparing values to goals with gauges	517
CHAPTER 20	Displaying performance with indicators	539
CHAPTER 21	Mapping data	555
CHAPTER 22	Working with map elements	579

PART IV	MANAGING THE REPORT SERVER	
CHAPTER 23	Deploying reports to a server	607
CHAPTER 24	Securing report server content	643
CHAPTER 25	Performing administrative tasks	669
PART V	VIEWING REPORTS	
CHAPTER 26	Accessing reports online	707
CHAPTER 27	Working with subscriptions	739
CHAPTER 28	Data alerting	759
PART VI	AD HOC REPORTING	
CHAPTER 29	Reusing report parts	781
CHAPTER 30	Preparing to use Power View	797
CHAPTER 31	Using Power View	823
PART VII	USING REPORTING SERVICES AS A DEVELOPMENT PLATFORM	
CHAPTER 32	Understanding Report Definition Language	859
CHAPTER 33	Programming report design components	877
CHAPTER 34	Programming report server management	905
CHAPTER 35	Programming report access	927
	<i>Index</i>	949

Contents

Introductionxxvii

PART I GETTING STARTED WITH REPORTING SERVICES

Chapter 1	What's new in Microsoft SQL Server 2012 Reporting Services	3
	Introducing new features.....	3
	Power View.....	3
	SharePoint integration.....	13
	Data alerts.....	13
	Reviewing other changes.....	16
	SQL Server Data Tools.....	16
	New rendering extensions.....	16
	Parting with Report Builder 1.0.....	17
	Upgrading from prior versions.....	18
	Preparation.....	18
	In-place upgrade.....	20
	Migration.....	22
Chapter 2	Introducing the Reporting Services environment	25
	A reporting platform.....	25
	Reporting life cycle.....	27
	Report development.....	28
	Report administration.....	28
	Report access.....	29

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Reporting Services architecture	30
Native mode	30
SharePoint integrated mode	38
Chapter 3 Understanding deployment scenarios	45
Single-server deployment	45
Memory	46
Disk space	46
Disk activity	47
Distributed deployment	47
Native-mode distribution	47
SharePoint integrated-mode distribution	48
Other components	50
Scale-out deployment	50
Load balancing	51
Failover cluster	51
Distributed workload	52
Internet deployment	52
Chapter 4 Installing Reporting Services	55
Reviewing hardware and software requirements	55
Selecting an operating system	55
Choosing a Database Engine edition	58
Reviewing SharePoint integrated-mode requirements	59
Planning accounts for reporting services	60
Performing the installation	61
Installing prerequisites	61
Installing SQL Server 2012	63
Configuring native-mode Reporting Services	72
Configuring partial integration with SharePoint	83
Configuring SharePoint for local mode reporting	84
Configuring SharePoint integrated mode	84
Installing the Reporting Services Add-in for SharePoint	86

Creating a SharePoint web application	87
Creating a business intelligence center site.	89
Configuring SharePoint for Reporting Services integration.	91
Installing Report Builder	96
Installing sample databases	97
Chapter 5 Exploring Reporting Services fundamentals	99
Understanding design environments	99
Comparing design environments	99
Choosing a report designer	103
Developing a report with Report Builder	105
Launching Report Builder.	105
Getting Started Wizard	106
Using the dataset designer.	108
Getting familiar with the Report Builder interface.	111
Adding a data source	114
Adding a dataset	117
Adding a report title	117
Using data region wizards	118
Adding a data region manually.	122
Adding fields to a table.	123
Adding a total.	125
Grouping data	125
Inserting page breaks	127
Formatting a report.	127
Previewing a report.	129
Saving a report.	130
Managing a report	130
Publishing a report	131
Adding a description.	131
Reviewing processing options.	132
Viewing a report	134
Opening a report.	135
Using the HTML Viewer	136

Chapter 6	Planning your report design	139
	Knowing your audience	139
	Reviewing report options	143
	Layout decisions	143
	Data considerations	145
	Parameters	145
	Mobile devices	146
	Printed reports	147
	Developing standards	148
Chapter 7	Working with report server projects	151
	Getting started with report server projects	151
	Creating a Reporting Services project	151
	Selecting a project type	154
	Getting familiar with the Visual Studio interface	155
	Removing a project from a solution	157
	Working with report project files	157
	Reviewing report project file types	157
	Using the Report Wizard	158
	Adding a new item to a project	165
	Adding an existing item to a project	165
	Removing an item from a project	166
	Using report project commands	166
	Project menu	166
	Build menu	167
	Configuring report project properties	167
	Working with project configurations	168
	Setting project properties	169
Chapter 8	Retrieving data for a report	173
	Understanding data source types	173
	Relational data sources	174

Multidimensional data sources	177
Miscellaneous data sources	178
Connecting to data with data sources	179
Comparing embedded and shared data sources	179
Working with an embedded data source	181
Working with a shared data source	185
Setting data source credentials	188
Retrieving data with datasets	190
Comparing embedded and shared datasets	190
Working with an embedded dataset	191
Working with a shared dataset	195
Exploring query designers	198
Understanding dataset properties	206

Chapter 9 Designing the report layout 209

Reviewing report items	209
General report items	210
Tablix data regions	211
Graphical data regions	212
Adding general report items to a report	213
Adding a text box	214
Adding a line	215
Adding a rectangle	216
Adding an image	217
Adding a subreport	221
Working with data regions	224
Adding a table	224
Binding data to a data region	225
Grouping data	226
Adding a total to a table	230
Adding a matrix	231
Sorting groups	232
Adding a list	234

Using properties to control appearance and behavior	237
Configuring the placement and size of a report item	237
Changing the appearance of a report item	240

Chapter 10 Working with the tablix 249

Exploring the tablix	249
What is a tablix?	249
Tablix data regions	250
Tablix cells	256
Transforming a tablix	259
Table to matrix	259
Matrix to table	260
Detail list to grouped list	261
Configuring tablix properties	261
No data rows	262
Groups before row header	262
Sort	262
Working with tablix groups	263
Row groups	263
Static columns	265
Adjacent groups	267
Group properties	268

Chapter 11 Developing expressions 273

Introducing expressions	273
Simple expressions	273
Complex expressions	277
Using the Expression dialog box	278
Opening the Expression dialog box	278
Exploring the Category tree	280
Using IntelliSense	284
Using built-in collections	287
<i>DataSets</i> collection	288
<i>DataSources</i> collection	288

<i>Fields</i> collection	289
<i>Globals</i> collection	289
<i>Parameters</i> collection	290
<i>ReportItems</i> collection	291
<i>User</i> collection	291
<i>Variables</i> collection	292
Working with expressions	292
Adding calculations to a report	292
Applying conditional formatting	299
Working with variables	300
Using expressions for dynamic connections and datasets	304

Chapter 12 Using functions 307

Getting help for functions	307
Function description and syntax	307
Function tooltip	308
Using text functions	308
The character functions	308
The search functions	309
The formatting functions	312
The array functions	313
The conversion functions	315
The string manipulation functions	316
The string evaluation functions	317
The cleanup functions	318
Using date and time functions	319
The date calculation functions	319
The date manipulation functions	321
The date conversion functions	322
The current date and time functions	323
Using math functions	323
The trigonometry functions	323
The sign functions	324
The exponent functions	325

The rounding functions	325
Other math functions	326
Using inspection functions	326
Using program flow functions	327
The <i>Choose</i> function	327
The <i>lif</i> function	327
The <i>Switch</i> function	327
Using aggregate functions	328
The aggregate functions	328
The <i>Scope</i> argument	329
The <i>RunningValue</i> function	330
Using financial functions	332
Using conversion functions	333
Using miscellaneous functions	334
The <i>InScope</i> function	335
The lookup functions	335
The row functions	339
Working with hierarchical data	340
The <i>Level</i> function	341
The <i>Recursive</i> keyword	342

Chapter 13 Adding interactivity 345

Interacting with the report layout	345
Interactive sorting	345
Using fixed headers	351
Configuring visibility	352
Adding tooltips	355
Adding navigation features	356
Defining a document map	356
Using embedded HTML tags	359
Working with report actions	361

Chapter 14 Creating dynamic reports with parameters 367

- Working with report parameters 367
 - Creating a report parameter 367
 - Setting report parameter properties 368
 - Deleting a report parameter 379
 - Displaying parameter selections in a report 379
- Using filters 379
 - Creating a filter 380
 - Using a report parameter as a filter 382
 - Understanding filter operators 383
 - Applying OR logic to multiple filters 386
- Using parameters with subreports and drillthrough 387
 - Passing a parameter to a subreport 387
 - Passing a parameter to a drillthrough report 388
- Working with query parameters 389
 - Creating a query parameter 389
 - Linking report and query parameters 390
 - Deleting a query parameter 391
- Cascading parameters 392
 - Creating a child report parameter dataset 392
 - Linking a parent report parameter to a query parameter 392
 - Changing parameter order 393

Chapter 15 Managing the page layout 395

- Understanding rendering 395
 - Reviewing rendering formats by pagination type 395
 - Using the *RenderFormat* global variable 397
- Adjusting the report size 400
 - Understanding the page structure properties 400
 - Using device information to change page properties 406
- Working with the page header and footer 409
 - Adding a page header or footer 409
 - Configuring page header or footer properties 409

Using expressions in a page header or footer	411
Removing a page header or footer.	414
Configuring page breaks.	414
Creating page breaks	415
Using the <i>KeepTogether</i> property	416
Adding page breaks by group.	417
Repeating headers.	418
Numbering pages	420
Naming pages.	421

Chapter 16 Using Analysis Services as a data source 425

Creating an Analysis Services dataset.	425
Analysis Services data source.	426
MDX graphical query designer	426
Building a report.	435
Analysis Services dataset fields	435
Extended field properties.	436
<i>Aggregate</i> function	437
Aggregate values in detail rows	438
Show Aggregations button	440
Designing parameters	442
Auto-generated query and report parameters	442
Custom query parameter	447

PART III ADDING DATA VISUALIZATIONS

Chapter 17 Creating charts 453

Adding a chart to a report	453
Selecting a chart type.	453
Understanding chart types.	454
Using the chart data pane.	456
Values.	457
Category groups	461
Series groups.	464

Formatting chart elements	466
Working with data bars	476
Adding a data bar	476
Configuring data bar properties	478
Working with sparklines.	480
Adding a sparkline	480
Configuring sparkline properties	481

Chapter 18 Working with chart elements 485

Changing color palettes.	485
Built-in color palettes	485
Custom color palette.	486
Working with vertical axis properties	487
Scale break	488
Logarithmic scale	491
Working with horizontal axis properties.	493
Axis type	493
Intervals	495
Working with series properties.	500
Empty points.	500
Bubble charts	503
Calculated series.	505
Secondary axis	508
Multiple chart types.	510
Multiple chart areas.	510
Working with pie charts.	513
Slice consolidation	514
Secondary pie chart.	515

Chapter 19 Comparing values to goals with gauges 517

Adding a gauge to a report	517
Understanding gauge types.	517
Creating a gauge	518

Working with gauge elements	520
Understanding gauge elements	521
Pointer	522
Scale	526
Range	530
Gauge	531
Gauge label	534
Gauge panel	535
Grouping gauges	536
Multiple gauges in a gauge panel.	536
Repeating gauges	537

Chapter 20 Displaying performance with indicators 539

Adding an indicator to a report	539
Understanding indicator types	539
Creating an indicator.	540
Configuring an indicator	540
Assigning an indicator value	541
Defining indicator properties.	541
Grouping indicators.	548
Customizing indicators	550
Using customized images.	550
Adding labels	551
Adjusting location and size	553
Dynamic sizing	553

Chapter 21 Mapping data 555

Understanding spatial data	555
Types of spatial data	555
SQL Server spatial data types.	558
Using the Map Wizard	558
Selecting a spatial data source	559
Choosing spatial data and map view options.	562
Choosing map visualization	566

Adding an analytical data set	571
Setting theme and data visualization options	572
Finalizing the map	576
Map preview	576
Simple adjustments	577

Chapter 22 Working with map elements 579

Configuring map elements	579
Map	582
Viewport	582
Map title	589
Legend	589
Scales	590
Working with map layers	591
Map Layers pane	591
Map layer properties	593
Common spatial element properties	594
Color rules	595
Point maps	599
Line maps	601
Polygon maps	602
Tile layer maps	603
Inserting custom points	603
Understanding order of precedence	604

PART IV MANAGING THE REPORT SERVER

Chapter 23 Deploying reports to a server 607

Deploying content	607
Deploying a report project	608
Saving a report from Report Builder	610
Uploading a report	611
Using the rs utility	614
Deploying a report model	615

Managing content	616
Using folders to organize content.....	616
Moving content	617
Creating a linked report	619
Copying a report	620
Configuring report parameters.....	621
Configuring data source properties.....	624
Selecting a data source for a report.....	625
Sending credentials to a data source	627
Configuring report processing options.....	630
Executing a report on demand	630
Caching reports	632
Configuring report time-out	634
Refreshing the cache	634
Working with snapshots	636
Creating report snapshots	636
Saving report snapshots in report history.....	638

Chapter 24 Securing report server content 643

Configuring report server security policies	643
Understanding authentication types	644
Reviewing default authorization policies.....	644
Assigning user permissions.....	650
Native-mode role assignments	650
SharePoint permission-level assignments	652
Configuring item-level security	653
Securing folders and document libraries.....	653
Approving data sources in SharePoint integrated mode	658
Securing an item	659
Assigning a system role	660
Securing a report model.....	662
Implementing data security	664
Using a query parameter and a role to secure data	664

Using a permissions table to secure data	665
Using a dataset filter to secure data	667

Chapter 25 Performing administrative tasks 669

Configuring the report server	669
Updating report server properties	670
Managing encrypted information	678
Configuring authentication	681
Managing memory	683
Disabling report server features	684
Disabling an extension	685
Managing the report server	685
Canceling jobs	685
Suspending report execution	686
Performing backup and recovery	687
Monitoring the report server	690
Checking the application database size	691
Monitoring the Windows application event log	691
Using the trace logs	691
Adding the HTTP log	693
SharePoint diagnostic logging	694
Execution logging	696
Using the ExecutionLog3 view	698
Using performance counters	699

PART V VIEWING REPORTS

Chapter 26 Accessing reports online 707

Using Report Manager	707
Searching for a report	707
Using the HTML Viewer	709
Using the document map	711
Printing a report	712
Using the My Reports folder	712

Accessing reports in SharePoint.....	714
Searching for a report.....	714
Using the SharePoint Report Viewer	716
Creating a dashboard	718
Exporting reports	725
Using soft page-break renderers	725
Using hard page-break renderers.....	730
Exporting a report for data exchange	733

Chapter 27 Working with subscriptions 739

Creating a shared schedule.....	739
Schedules list.....	739
New schedule	741
Creating standard subscriptions.....	742
New subscription	742
Delivery providers	743
Report parameter values	749
Subscription processing options	750
Creating data-driven subscriptions	750
Creating a subscription delivery table	751
Configuring data-driven subscription settings.....	751
Managing subscriptions.....	757
Using the My Subscriptions page	757
Deleting a subscription	758

Chapter 28 Data alerting 759

Understanding the data alerting architecture.....	759
Data alert workflow.....	759
Alerting service.....	760
Creating data alerts	761
SharePoint Report Viewer.....	761
Data feeds	762
Data alert rules.....	763

Chapter 30 Preparing to use Power View **797**

- Using tabular models with Power View 797
 - Introducing tabular models 797
 - Creating a BI Semantic Model connection 798
- Enhancing tabular models for Power View 803
 - Summarizing values 803
 - Formatting values 806
 - Setting the default sort 807
 - Marking the date table 810
 - Managing grouping behavior 811
 - Adding images 816
 - Improving the appearance of identifying information 818
 - Simplifying the creation of a new table 821

Chapter 31 Using Power View **823**

- Getting started with Power View 823
 - Verifying browser requirements 823
 - Connecting to a data source 824
 - Getting familiar with the design environment 825
- Visualizing data 832
 - Table 833
 - Matrix 835
 - Charts 836
 - Cards 843
- Filtering data 843
 - Highlighted values 844
 - Slicer 844
 - Tiles 845
 - View filter 848
- Selecting a display mode 852
- Saving a Power View report 854
 - File save options 855
 - PowerPoint export 855

Chapter 32 Understanding Report Definition Language 859

- Introducing Report Definition Language 859
 - RDL schema definition 859
 - RDL usage 860
- Exploring key elements 860
 - Report* element 861
 - DataSources* and *DataSource* elements 862
 - DataSets* and *DataSet* elements 864
 - Tablix* element 865
- Working with RDL 867
 - Manual RDL edits 867
 - Programmatic RDL edits 868
 - RDL generation 868

Chapter 33 Programming report design components 877

- Embedding code in a report 877
 - Code* property 878
 - Custom function call 880
- Using assemblies to share custom code 881
 - Class library 881
 - Custom assembly call 885
- Creating a custom data processing extension 887
 - Data processing extension overview 888
 - Data processing extension development 889
 - Data processing extension deployment 900

Chapter 34 Programming report server management 905

- Scripting administrative tasks 905
 - Deploying reports 906
 - Creating a linked report 911

Working with configuration settings	914
Using the WMI provider	914
Using Windows PowerShell cmdlets	917
Using the web service	918
Web.config	918
References	918
Initial variable declarations	920
Page load	920
Recipient list	920
Schedule list	921
Report list	921
Subscription creation	922
Web application execution	924

Chapter 35 Programming report access 927

Linking to reports with URL access	927
Viewing a report	927
Using URL access parameters	931
Using the <i>ReportViewer</i> control	938
Reports Application project	939
Report Wizard	939
<i>ReportViewer</i> control	940
<i>ReportViewer</i> properties	942
<i>ReportViewer</i> application	943
Accessing a report with the web service	944
References	944
<i>Load</i> method	945
<i>Render</i> method	945
Solution deployment	947

<i>Index</i>	949
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Introduction

Microsoft Reporting Services is the component of Microsoft SQL Server 2012 that provides an enterprise-ready and extensible presentation layer for the Microsoft business intelligence platform. In its fifth release, Reporting Services continues its support for the three stages of the reporting life cycle, adds a new option for self-service reporting, and provides tighter integration with Microsoft SharePoint 2010 technologies. This book provides in-depth explanations of these new features and also includes comprehensive coverage of all other features that have made Reporting Services a popular choice for implementing a reporting platform in organizations of all sizes since its initial release in 2004.

We have written previously about Reporting Services as part of the Step by Step series published by Microsoft Press. Although we have borrowed many of our explanations for performing tasks from our previous work, the format of the current book allows us to expand on these explanations, explore a variety of techniques, and describe aspects of Reporting Services that are not fully documented elsewhere. We want this book to be useful to anyone new to Reporting Services as well as to seasoned professionals who need a good reference for properties that are not used often but come in handy when the need arises.



Note A few months after the manuscript for this book was completed, the release of Microsoft SQL Server 2012 Service Pack 1 (SP1) and Microsoft SharePoint 2013 introduced some new features that modify or replace some of the topics we cover in this book related to installation and to Power View. If you are running Reporting Services in native mode, these new features do not affect you. If you are running Reporting Services in SharePoint integrated mode with Microsoft SharePoint Server 2010, the installation of SP1 adds pie charts, maps, and a variety of other features about which you can learn more at <http://officepreview.microsoft.com/en-us/excel-help/whats-new-in-power-view-in-excel-2013-and-in-sharepoint-2013-HA102901475.aspx> to enhance the coverage in Chapter 30, "Preparing to use Power View," and Chapter 31, "Using Power View." If you prefer to use Microsoft SharePoint Server 2013 to run Reporting Services in integrated mode, replace the instructions we provide in Chapter 4, "Installing Reporting Services," with the instructions available at <http://msdn.microsoft.com/en-us/library/jj219068.aspx>.

Who should read this book

Because Reporting Services is a platform of technologies rather than a single application, a variety of people serving in different roles and having different skill sets all need to learn how to work with some aspect of Reporting Services. Whether you're a report developer, IT administrator, or business user, you can use this book to learn how to perform the tasks for which you are responsible. If you're completely new to Reporting Services, this book teaches you the fundamental concepts required to build, manage, and access reports. You need no prior experience with Reporting Services to use this book successfully. If you're already familiar with an earlier version of Reporting Services, this book highlights new features in SQL Server 2012 and provides information about many seemingly mysterious properties and functions that have long been part of Reporting Services.

Assumptions

Throughout most of the book, we assume you currently know nothing about Reporting Services. We make an exception in Chapter 1, "What's new in SQL Server 2012 Reporting Services," to provide you with a jump-start into the new features if you're already using an earlier version of the product. We also assume that you know something about relational databases, but we don't require you to know how to write a query. We have samples that you can use to explore the features of Reporting Services without writing queries. There are some chapters that application developers can use to extend the functionality of Reporting Services, and we expect that you are familiar with Visual Basic or Visual C# before you read those chapters.

Organization of this book

Even if your primary responsibility with Reporting Services requires you to focus on only one component, you benefit from an understanding of all the capabilities that Reporting Services supports. For this reason, if you have time, you should read through the book from beginning to end for the best experience.

Because this book can be used by readers with different needs, you can also choose to read through only the chapters that focus on your area of responsibility. Each part of the book contains chapters related to a different part of the reporting life cycle. However, unlike our previous Step by Step books, in which we used procedures to build up your skills progressively, we have written each chapter without interdependencies. By using this approach, we were able to fully explore options available for performing a

task or configuring a feature without the constraints of developing a linear, task-based sequence of steps to follow.

In Part I, we introduce Reporting Services, starting with the new features in SQL Server 2012 in Chapter 1, and continuing with an explanation of its usage and architecture in Chapters 2 and 3. We also explain how to install Reporting Services in either native mode or SharePoint integrated mode in Chapter 4. We conclude this part of the book with Chapter 5, which provides an overview of Report Builder as a user-friendly report development tool and introduces the deployment and report access stages of the report life cycle.

Part II focuses on report development. We start first by providing some guidelines for preparing to develop reports in Chapter 6 and then explain how to work with report projects in SQL Server Data Tools in Chapter 7. Chapter 8 covers all the different ways that you can retrieve data for your reports. Finally, in Chapter 9, you learn how to create the report itself by using different report items. In Chapter 10, we describe the nuances of the tablix in detail so that you can better take advantage of its flexibility. Then in Chapters 11 and 12 we explore the many different ways that you can create expressions and work with functions to change the behavior and appearance of reports at runtime. Chapter 13 describes the interactive features you can add to reports, while Chapter 14 describes another type of interactivity possible through the use of parameters and filters. In Chapter 15, we discuss many of the options you have for controlling pagination in reports. Then we wrap up report development in Chapter 16, where we explain how to use Analysis Services as a data source for your reports.

In Part III, we continue our focus on report development but with an emphasis on data visualizations. Chapters 17 and 18 explain everything you need to know to successfully develop charts. Chapters 19 and 20 show you how to display key performance data as gauges and indicators. Then Chapters 21 and 22 detail spatial data visualization techniques with the map feature.

Part IV moves on to the management stage of the reporting life cycle. In Chapter 23, you learn the different ways to make reports available to users on the report server. After reports are deployed, you can secure access to reports by using the techniques described in Chapter 24. Chapter 25 addresses all the remaining administrative tasks, such as configuration of the report server, backup and recovery procedures, and report server monitoring.

Part V includes chapters describing the user-focused stage of the reporting life cycle, report access. In Chapter 26, you learn the basics of working with Report Manager or SharePoint to view reports online. You can also set up subscriptions to receive reports in other ways, as you learn in Chapter 27. You can also receive notifications about changes to report data, as described in Chapter 28.

For a more interactive reporting experience, Part VI covers ad hoc reporting. Chapter 29 explains a simple approach to ad hoc reporting through the use of report parts. Then Chapters 30 and 31 introduce the newest ad hoc reporting tool in Reporting Services, Power View.

If you need Reporting Services to provide additional functionality, you can customize it through simple scripts or complex applications. The chapters of Part VII describe the various options you have for each stage of the reporting life cycle. Chapter 32 begins with an explanation of Report Definition Language, and then Chapter 33 shows you how to use code in reports, either as custom functions or as custom assemblies, to expand the capabilities of Reporting Services, such as retrieving data from an unsupported source. Chapter 34 shows you examples of how to use scripts or applications to manage the report server, and Chapter 35 caps off the book with techniques for retrieving reports programmatically.

Conventions and features in this book

This book presents information using conventions designed to make the information readable and easy to follow:

- Boxed elements with labels such as “Note” provide additional information or alternative methods for completing a step successfully.
- Text that you type (apart from code blocks) appears in bold.
- A plus sign (+) between two key names means that you must press those keys at the same time. For example, “Press Alt+Tab” means that you hold down the Alt key while you press the Tab key.
- A vertical bar between two or more menu items (for example, File | Close) means that you should select the first menu or menu item, then the next, and so on.

System requirements

You will need the following hardware and software to install the code samples and sample database used in this book:

- Windows Vista SP2, Windows 7, Windows Server 2008 SP2 or greater, 32-bit or 64-bit editions.
- At least 6 GB of free space on disk.
- At least 1 GB of RAM.
- A 1.0GHz x86 or 1.4GHz x64 processor or better.
- At minimum, an instance of SQL Server 2012 Database Engine and Reporting Services plus client components. Optionally, you can also install SQL Server 2012 Analysis Services in multidimensional mode and another instance in tabular mode. Reporting Services can be a native-mode or SharePoint integrated-mode installation. Full instructions about how to install the required components are provided in Chapter 4, “Installing Reporting Services.”

Code samples

The database used for examples in this book is based primarily on Microsoft’s Adventure Works DW 2012 sample database and, in a few cases, on some sample databases we provide. We recommend that you download the database from the link below rather than use your own copy of Adventure Works to reproduce the examples in this book.

All sample projects and the sample databases can be downloaded from the following page:

<http://aka.ms/SQL2012RS/files>

Follow the instructions to download the SSRS2012Samples.zip file and the sample database.

Installing the code samples

Follow these steps to install the code samples on your computer so that you can follow the examples in this book:

1. Unzip the samples file onto your hard drive.
2. Each chapter has its own directory containing code samples. In many cases, this takes the form of a report server project that must be opened in SQL Server Data Tools. You can find installation instructions for SQL Server Data Tools in Chapter 4.
3. Each chapter relies on the Adventure Works DW 2012 database. In most cases, you use the relational database, but Chapter 16 requires the multidimensional database and Chapters 30 and 31 require the tabular database. You can find instructions for obtaining and installing these databases in Chapter 4.
4. The code samples in Chapter 21 and Chapter 22 require you to use the Spatial-Data database. You can restore it from the BAK file in the Chapter 21 directory. Similarly, the code samples in Chapter 32 and Chapter 35 require the Custom-Reports database, which you can restore from the BAK file in the Chapter 32 or Chapter 35 directory. Refer to <http://msdn.microsoft.com/en-us/library/ms177429.aspx> to learn how to restore a database backup.

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PART I

Getting started with Reporting Services

The chapters in Part I provide you with a foundation for Microsoft SQL Server 2012 Reporting Services in preparation for learning about its features in detail throughout the remainder of this book. In Chapter 1, “What’s new in Microsoft SQL Server 2012 Reporting Services,” you learn how to use the new features in Reporting Services and how to upgrade reports if you already have an earlier version of Reporting Services in place. In Chapter 2, “Introducing the Reporting Services environment,” you learn about the features and architecture of Reporting Services, which we expand upon in Chapter 3, “Understanding deployment scenarios,” by describing the different deployment topologies so that you can decide which is best for you. In Chapter 4, “Installing Reporting Services,” you learn how to plan for and complete an installation. Chapter 5, “Exploring Reporting Services fundamentals,” provides an overview of report development with Report Builder and introduces the deployment process and report access with Report Manager.



What's new in Microsoft SQL Server 2012 Reporting Services

Of all the business intelligence components in Microsoft SQL Server, Reporting Services has consistently expanded its feature base in each release since it first appeared as an update to SQL Server 2000. If you have used earlier versions of Reporting Services, you can use this chapter to familiarize yourself with these major new features and other miscellaneous changes. We also let you know about features that have been deprecated in this release and how to upgrade Reporting Services from prior versions.

Introducing new features

The most significant new feature in the latest version of Reporting Services is the introduction of Power View, an ad hoc reporting tool that combines data visualization and self-service reporting in a SharePoint integrated-mode deployment. Another change in this release is the new architecture of Reporting Services as a SharePoint service application, which improves the administration and scalability of your reporting environment in this mode. You can also take advantage of the new data alerts feature in SharePoint integrated mode when you want to receive an email notification when a report contains data that matches rules you have defined.

Power View

As an ad hoc tool, the target audience for Power View is a business user rather than a professional report developer. It's simpler to use than Report Builder or Report Designer in many ways and yet provides some more advanced data visualization capabilities. To use Power View, you must have access to a server running SharePoint Server 2010 Enterprise Edition and a supported data source. In this section, we provide an introduction to Power View to highlight its main features. You can learn much more about it in Chapter 31, "Using Power View."

Data sources

To get started, you select a data source and then launch Power View to explore its data. You can choose from one of the following data source types:

- **PowerPivot workbook** Locate a PowerPivot workbook in the PowerPivot Gallery or in a SharePoint document library, and then click the Create Power View Report icon in the upper-right corner of the PowerPivot workbook tile.
- **Shared data source** A Reporting Services Shared Data Source (RSDS) file can have its *Data Source Type* property set to Microsoft BI Semantic Model For Power View. For this type of data source, the connection string references a PowerPivot workbook (such as *http://SharePointServer/PowerPivot Gallery/myWorkbook.xlsx*) or an Analysis Services tabular model (such as *Data Source=MyAnalysisServer; Initial Catalog=MyTabularModel*). To use this type of shared data source for a Power View report, point to the shared data source name in the document library, click the down arrow, and then click Create Power View Report.
- **Business Intelligence Semantic Model (BISM) connection file** Like a shared data source, a BISM file can connect either to a PowerPivot workbook or to an Analysis Services tabular model. However, you can use a BISM file not only as a data source for Power View reports but also for Microsoft Excel workbooks. To create a new Power View report using a BISM file as a data source, point to the file name in a SharePoint document library, click the down arrow, and then click Create Power View Report.

Data visualization

Power View is unique because it allows you to interact directly with the data, starting with a table layout to select and group fields, switching to alternate data visualizations such as a column or line chart, combining multiple data visualizations on a page, as shown in Figure 1-1, and highlighting values or applying filters to one or data visualizations on the page. You can even create multiple pages, known as views, in the same report.

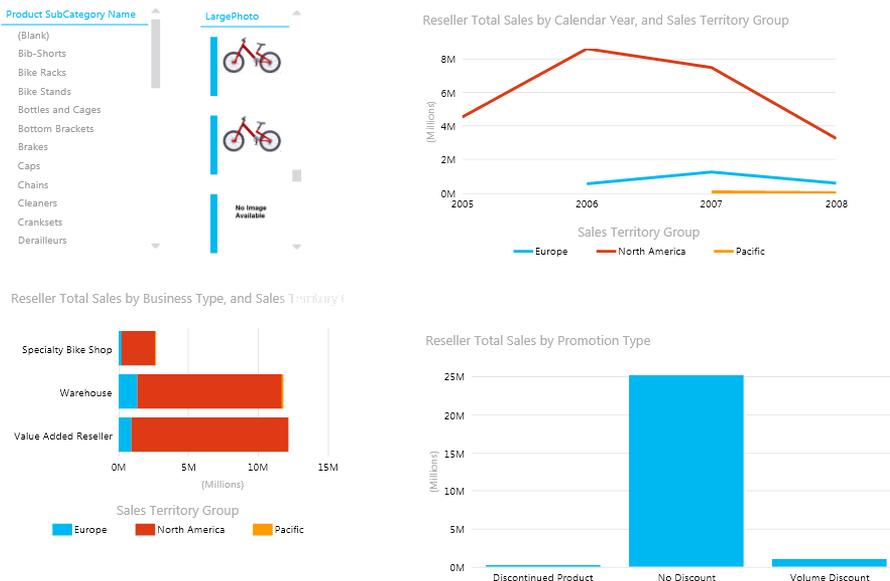


FIGURE 1-1 You can create a variety of data visualizations in Power View.

You start with a blank view workspace, as shown in Figure 1-2. As you develop the report, you add tables and data visualizations to the view workspace. The view size is a fixed height and width, just like the slide size in PowerPoint. If you need more space to display data, you can add more views to the report and then navigate between views by using the Views pane.

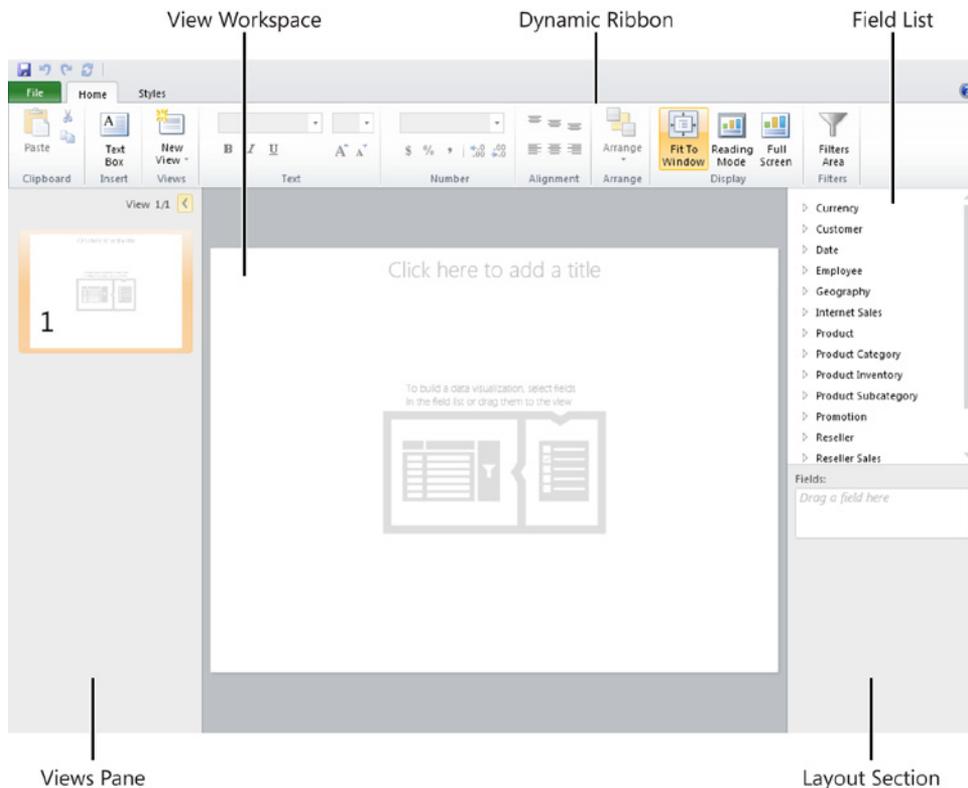


FIGURE 1-2 You use the Power View design environment to explore the data source and develop data visualizations.

To begin your exploration of the data, you select fields from the field list on the right. Fields are organized by table name. You can double-click a table to create a tabular arrangement of default fields defined in the data source, or you can expand the table to select individual fields. As you add fields to the view workspace or select an item in the view workspace, the dynamic ribbon at the top of the screen changes to show the buttons and menus applicable to your current selection. For example, you can select the table of fields in the view and use the Column button on the Chart Tools Design tab of the ribbon to change the visualization type.

Power View displays only as much data as it can fit in the space allotted to the current visualization. If more data is available, scroll bars display to allow you to access the remaining data incrementally. By limiting the amount of data you can see at one time, Power View can optimize the query performance of very large data sources.

As you add fields to a data visualization, your selections display in the layout section in the bottom right of your screen. The structure of the layout section depends on the current visualization. For example, the layout section for a column, bar, or line chart, shown in Figure 1-3, allows you to define which fields to display as values, the horizontal axis category, and the series grouping. You can rearrange the sequence of fields in the layout section by using drag-and-drop, or you can click the arrow next to the field name to change the behavior of a field, such as changing which aggregation function to use or whether to display rows with no data.

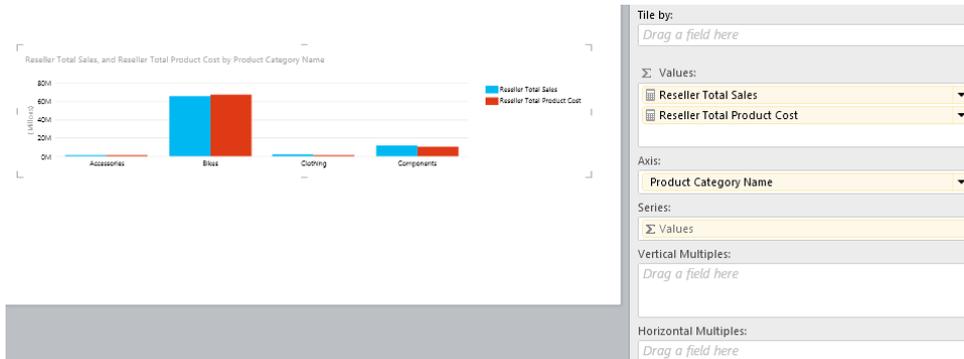


FIGURE 1-3 You use the layout section to arrange fields in a data visualization.

You can move or resize a data visualization at any time. You can move it by pointing to its border and then dragging it to another location in the same view when the cursor changes to a hand. Another option is to use the data visualization as the starting point for a new data visualization. When you see the cursor change to a hand, click the Copy button on the Home tab of the ribbon, and then click the Paste button to add the copy to the same view. You can also click the New View button on the ribbon if you want to add another page to your report. Either way, you can then move the copy to a new position. Also, when you point to the border and see the cursor change to a double-headed arrow, you can drag the border to make the data visualization larger or smaller.

Of course, Power View contains standard chart types, such as column, bar, and line charts, but it does not support other chart types that you can create in Report Builder or Report Designer. However, some unique data visualizations are available, such as the cards visualization shown in Figure 1-4, which is a scrollable list of grouped fields. You can use the cards visualization simply to display information about an entity, or you can use it as a type of filter for other data visualizations on the same view.

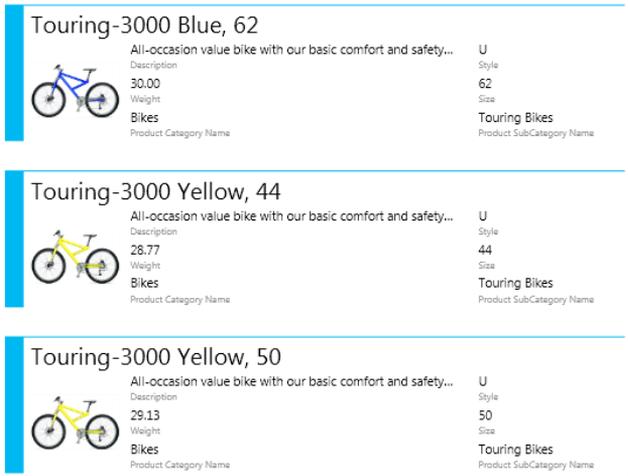


FIGURE 1-4 You can arrange a set of fields as a cards visualization.

Interactive scatter chart

Another feature of Power View is the ability to create an interactive scatter chart. This type of chart requires two numeric values. You place one value on the X axis and another value on the Y axis and then add a Details field that Power View uses to calculate corresponding X and Y coordinates. You can also add a third value to display points as bubbles for which the size increases as that value increases. A scatter chart can also include a field in the Color section to use for grouping. The interactive feature of the scatter chart applies when you add a field to the Play Axis, as shown in Figure 1-5.

Tile by:	<i>Not available with play axis</i>
Σ X Value:	Reseller Sales YTD
Σ Y Value:	Reseller Total Gross Profit Percent
Σ Size:	Reseller Distinct Count Sales Order
Details:	Product SubCategory Name
Color:	Product Category Name
Play Axis:	Month Name
Vertical Multiples:	<i>Not available with play axis</i>
Horizontal Multiples:	<i>Not available with play axis</i>

FIGURE 1-5 An interactive scatter chart includes X Value, Y Value, Details, and Play Axis fields, and optionally includes Size and Color fields.

The addition of a Play Axis field displays a play button below the scatter chart in the view. When you click the play button, the scatter chart cycles through each distinct value specified as the Play Axis field (which is typically a time period). You can also use the slider to select a specific value on the Play Axis. Whether you use the play button or the slider, you can see a watermark in the background of the chart for the current item in the Play Axis. You can filter the scatter chart to focus on a single Details value and see the path that it travels for each Play Axis value, as shown in Figure 1-6. Like other data visualizations, you can point to an area of the scatter chart to display a tooltip for more information.

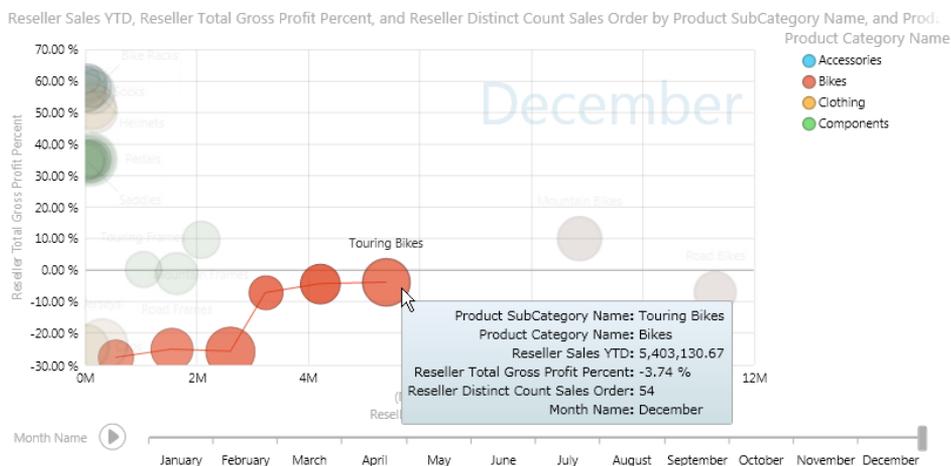


FIGURE 1-6 You can click a point or bubble in a scatter chart to see its path up to the selected value in the play axis.

Multiples

You can compare trends in data by creating multiple copies of the same chart. To do this, add a field to the Vertical Multiples or Horizontal Multiples area of the layout section, as shown in Figure 1-7. You can fine-tune the arrangement of tiles by using the Grid button on the Layout tab of the ribbon.

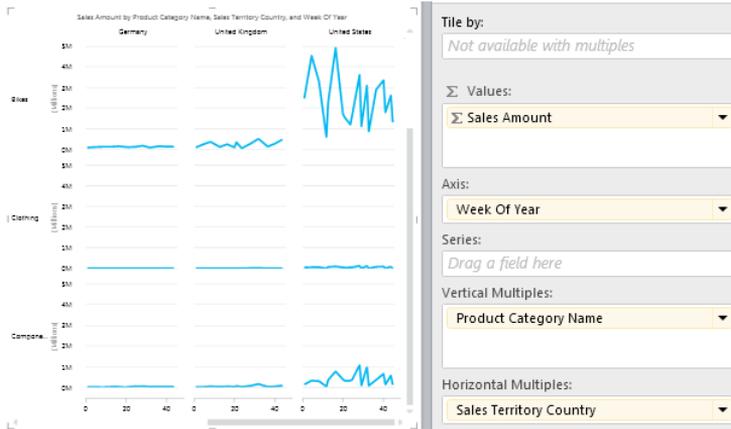


FIGURE 1-7 You can break out a chart by groupings called multiples.

Highlighted values

When you have multiple visualizations in the same view, you can select a value, such as a column or a legend item, to see relationships across all visualizations. Power View highlights related values in all visualizations and dims the other values to help you see the proportional relationships. For example, in Figure 1-8, the selection of Europe in the bar chart's legend highlights the proportion of sales in Europe compared to all other sales in each chart. Furthermore, the table displays only sales data for Europe. To clear the highlighting, click elsewhere in the chart without clicking another value.

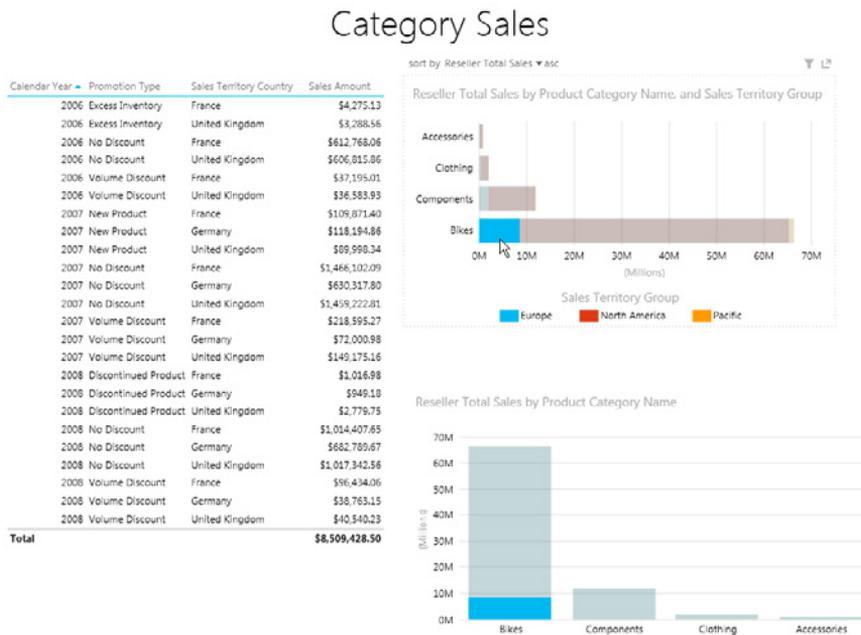


FIGURE 1-8 You can click a value to see highlighted values that are in all charts in a view and filter other visualizations, such as a table or matrix.

Slicer

A slicer is a single-column table that you add to the view for use as a filter. The table can contain labels or images. When you select one or more items in the slicer, Power View filters everything else in the same view, including other slicers, as shown in Figure 1-9. You can restore the unfiltered view by clicking the Clear Filter icon in the upper-right corner of the slicer.



FIGURE 1-9 You can use a slicer to filter all content in a view.

Tiles

Rather than filter everything in a view, you can use a tile container to filter only visualizations inside the container, as shown in Figure 1-10. You can convert an existing table or matrix to a tile container by clicking the Tiles button on the Design tab of the ribbon. You then transform the table or matrix to another visualization type, if you like, and define the Tiles By field in the layout section to create a tile strip. To filter the tile container, you select one of the items in the tile strip. You can resize the tile container and add more visualizations to it if you want the filter to have broader scope without filtering the entire view.

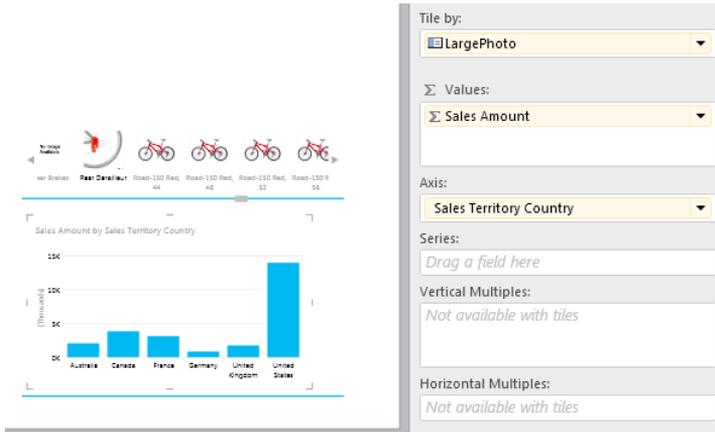


FIGURE 1-10 You can use a tile container to filter only the visualization it contains.

View filter

To use yet another type of filtering, you can set up filter criteria for the current view. Click the Filters Area button on the Home tab of the ribbon to toggle the visibility of the Filters area, which is not visible initially in a new report. Then drag a field to the Filters area and configure the criteria for basic filters, as shown in Figure 1-11.

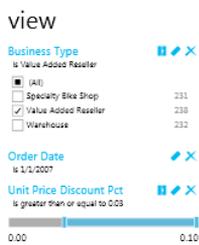


FIGURE 1-11 You can add basic filters to a view by selecting specific items, dates, or numeric value ranges.

The first icon in the toolbar to the right of the field name in the Filters area opens the advanced filter mode for that field. When a field has a string data type, you can create filter criteria based on partial words by using operators such as Contains, Starts With, and so on. A filter for a numeric field allows you to use a comparison operator like Greater Than Or Equal To, while a filter for a date data type allows you to use a calendar control in combination with a comparison operator like Is On Or After. You can also create compound filters consisting of two conditions by using a logical AND or logical OR operator, as shown in Figure 1-12.

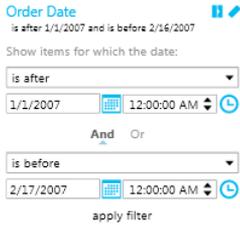


FIGURE 1-12 You can create a compound filter by using the logical AND or logical OR operator.

Visualization filter

To use the basic or advanced filter modes for a single visualization, click the Filter icon in the top-right corner of the visualization. The Filters area then displays a tab for the selected visualization where you can add fields and define filter criteria, as shown in Figure 1-13.

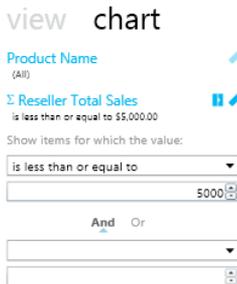


FIGURE 1-13 You can create basic or advanced filters to apply only to a selected visualization.

Report sharing

When you want to save your report to review later or to share with others, you can save it by using the File menu, as long as you have the Add Items permission on the target document library. If you save it to a PowerPivot Gallery, you can use the Save Preview Images With Report option to include thumbnail images for display in the gallery views. Otherwise, save the file without images. Either way, your report saves as an RDLX file, which you can open only from SharePoint in Power View. This file type does not work with Report Builder or Report Designer.

You can also print the current view when you use Fit To Window or Reading mode only. You can switch to these viewing modes by using the applicable button on the Home tab of the ribbon. Then open the File menu and then click Print to print the current view in landscape orientation.

You can also share your report with other users by saving the report as an RDLX file to a SharePoint document library. If you prefer, you can export the report as a Microsoft PowerPoint file. In the latter case, other users can interact with the data within PowerPoint as long as they have an active connection to SharePoint and have the necessary permissions to view the tabular model. When a user displays a slide in Reading View or Slideshow modes, a Click To Interact link displays in the lower-right

corner of the slide. Clicking this link loads the view from Power View and allows the user to change filter values in the Filters area, in slicers, in tile containers, and to highlight values.

SharePoint integration

The integration of Reporting Services into a SharePoint technology was first possible in SQL Server 2005. Since that introduction, incremental improvements to Reporting Services integration with SharePoint have been made in subsequent releases of SQL Server. However, the architecture received a complete overhaul in SQL Server 2012. Reporting Services is now a shared service application, which simplifies configuration. Chapter 4, “Installing Reporting Services,” provides detailed instructions on installation and configuration.

The shared service application architecture means that you can now scale Reporting Services across web applications and SharePoint Server 2010 farms more easily. This architecture allows Reporting Services to take advantage of built-in network load balancing and use fewer resources. Consequently, Reporting Services delivers better performance overall as compared to previous versions. You can learn more about scalability in Chapter 3, “Understanding deployment scenarios.”

Furthermore, deeper integration with SharePoint technology also simplifies administration. If you’re using claims-based authentication in your SharePoint farm, you can extend it for use with Reporting Services. Another integration point is the backup and recovery process built into SharePoint backup that you can now use for Reporting Services content. We describe backup and recovery in Chapter 25, “Performing administrative tasks.”



Note For more information about claims-based authentication, see <http://msdn.microsoft.com/en-us/library/hh231678.aspx>.

Data alerts

Ever since the first release of Reporting Services, you have had the option to configure standard and data-driven subscriptions. A data-driven subscription is one in which you use a query to provide values for a subscription definition, such as recipient names or parameters to set. However, nothing in Reporting Services has been available to monitor the report content. That is, the data in the reports could not be evaluated against a set of predefined criteria. In SQL Server 2012, you can create a data alert to send an email when conditions in the predefined criteria are satisfied, but only if you are running Reporting Services in integrated mode on a SharePoint Server 2010 Enterprise Edition server. In this section, you learn the basic operations of data alerts; you can learn more by referring to Chapter 28, “Data alerting.”

Data Alert Designer

If the report returns data when you open it, contains at least one data region, and all data sources use stored credentials or no credentials, you can create a new data alert. In fact, you can create one or more data alerts for any report that you can access, as long as the prerequisites are met. To do this,

open a report in a SharePoint document library and select New Data Alert from the report's Action menu. You use the Data Alert Designer, shown in Figure 1-14, to define rules for each data region in the report, assign a schedule for checking the rules, configure email settings for recipients of the alerts, and provide a static subject and description.

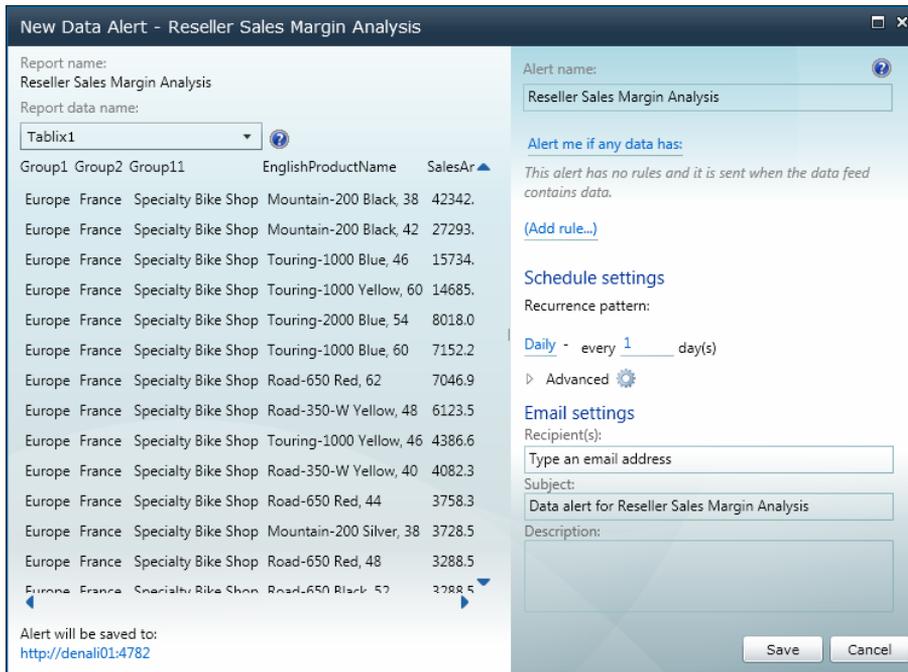


FIGURE 1-14 You can define criteria and a schedule for each data region in a report.

If the report runs successfully at the scheduled time and the report data satisfies the rules you specify, the alerting service sends an email message to each recipient. The email includes the description that you define when creating the alert and lists the raw data values that satisfied the alert criteria, similar to the one shown in Figure 1-15. If the report uses report parameters, the report parameter values also display in the rendered report. However, if the report execution fails, each recipient specified in the Data Alert Designer receives an email describing the error.

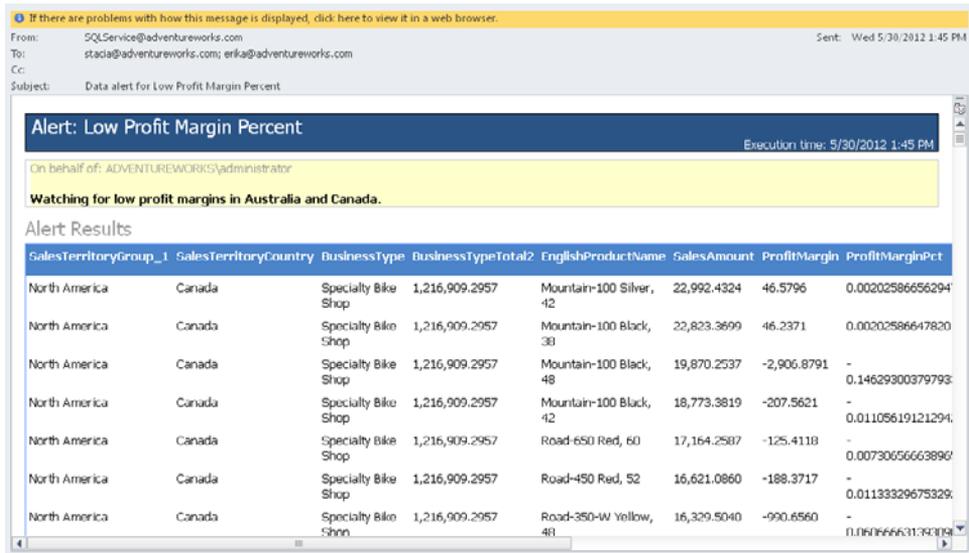


FIGURE 1-15 An email notification is sent to you with raw data values satisfying the alert rules and the description that you specify for the data alert.

Data Alert Manager

The Data Alert Manager keeps track of all your data alerts. To open the Data Alert Manager, open the document library containing your report, click the down arrow to the right of the report name, and then select Manage Data Alerts. The Data Alert Manager shows you the number of alerts sent by data alert, the last time it was run, the last time it was modified, and the status of its last execution. A portion of the Data Alert Manager page is shown in Figure 1-16.

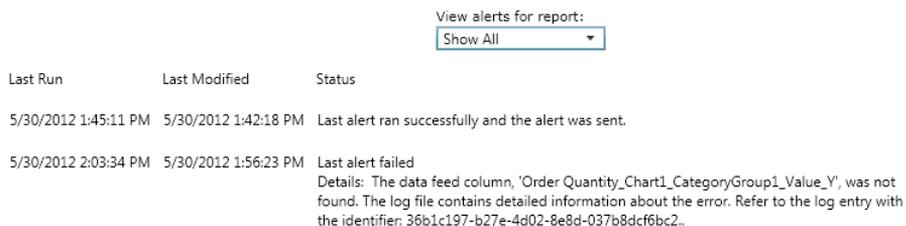


FIGURE 1-16 You use the Manage Data Alerts page to keep track of alert execution and to change, delete, or execute a data alert.

You can right-click a data alert here to edit, delete, or run it on demand. A site administrator can view and delete your data alerts, but no one other than you can edit and run your data alerts on demand.

Reviewing other changes

Although the majority of changes to Reporting Services in SQL Server 2012 are new to the product, two others don't change your usage of Reporting Services as significantly but are important to know about. First, the design environment moves to a Microsoft Visual Studio 2010 Shell called SQL Server Data Tools (SSDT). Second, two new rendering extensions are available.

SQL Server Data Tools

Business Intelligence Development Studio (BIDS) has been the host of the design environment for Reporting Services since SQL Server 2005. The only place you see this name for the tool is in the program group for SQL Server on the Start menu. After you launch it, you never see the name again. That's because it's really just a shell for the version of Visual Studio for which it was made. The release cycles of SQL Server and Visual Studio have never been aligned, so a newer version of Visual Studio has always been available long before SQL Server business intelligence components begin using that version.

SQL Server 2012 is no exception. The difference this time is that the BIDS is gone from the Start menu, replaced by SSDT. Otherwise, the experience is the same. The same business intelligence project types, Report Server Project Wizard and Report Server Project, are available. You use the same user interface for developing reports as you did in BIDS, although the color scheme of Visual Studio is different. The advantage of having SSDT is the ability to add related projects to the solution containing your report project and use the Visual Studio 2010 integrated development environment for developing a class library or custom application.

New rendering extensions

This version of Reporting Services adds support for the most current versions of Microsoft Excel and Microsoft Word as output formats. Previously, you could export a report only as an XLS file in all versions of Reporting Services or as a .doc file in SQL Server 2008 and SQL Server 2008 R2. These file formats provide compatibility with Excel 2003 and Word 2003, respectively. Although users of Excel 2010 and Word 2010 can also open these file formats, there were some limitations that affected the size of the report that you could export to Excel and the size of the output file for both Excel and Word documents. These limitations are removed in SQL Server 2012.

Excel 2010 renderer

When you select Excel as the export option in SSDT, Report Manager, or the SharePoint Report Viewer, you now save the report as an XLSX file in Open Office XML format. That means you can open the file in either Excel 2007 or Excel 2010, as long as you have the client installed on your computer. It also

means you can export a larger report to Excel, which supports 1,048,576 rows and 16,384 columns. In addition, the XLSX format supports 16 million colors in the 24-bit color spectrum. Another benefit of the new renderer is the smaller file size for the exported report, made possible by better compression.



Tip You can download the Microsoft Office Compatibility Pack for Word, Excel, and PowerPoint at <http://office.microsoft.com/en-us/products/microsoft-office-compatibility-pack-for-word-excel-and-powerpoint-HA010168676.aspx> if you prefer to produce XLS files for Excel 2003. If you need to support both formats, you can enable the Excel 2003 renderer in the `RSReportServer.config` and `RSReportDesigner.config` files by following the instructions at [http://msdn.microsoft.com/en-us/library/dd255234\(SQL.110\).aspx#AvailabilityExcel](http://msdn.microsoft.com/en-us/library/dd255234(SQL.110).aspx#AvailabilityExcel).

Word 2010 renderer

Exporting a report as a Word document in prior versions of Reporting Services did not have the same limitations as exporting an Excel workbook. However, the benefit of having a Word 2010 renderer is in maintaining consistency across the Office products as well as producing a smaller file than the Word 2003 renderer. The new renderer compresses the report to generate a .docx file in Open Office XML format.



Tip If you want to open the exported document in Word 2003, you can install the Microsoft Office Compatibility Pack for Word, Excel, and PowerPoint, available for download at <http://office.microsoft.com/en-us/products/microsoft-office-compatibility-pack-for-word-excel-and-powerpoint-HA010168676.aspx>. Another option is to enable the Word 2003 renderer in the `RSReportServer.config` and `RSReportDesigner.config` files by following the instructions at [http://msdn.microsoft.com/en-us/library/dd283105\(SQL.110\).aspx#AvailabilityWord](http://msdn.microsoft.com/en-us/library/dd283105(SQL.110).aspx#AvailabilityWord).

Parting with Report Builder 1.0

Report Builder 1.0 was known simply as Report Builder when it was first released in SQL Server 2005 as a simple ad hoc reporting tool. Then SQL Server 2008 released Report Builder 2.0, and the first Report Builder was known thereafter as Report Builder 1.0. Although both versions of Report Builder are intended for self-service reporting, the user interface and report development process in each version are completely different. Report Builder 1.0 requires you to create a semantic model describing the tables and fields available for reporting, whereas Report Builder 2.0 allows you to create data sources and data sets much like you do in SSDT. In fact, Report Builder 2.0 is the predecessor to Report Builder in SQL Server 2012. Likewise, the current version of Report Builder (described in Chapter 5, “Exploring Reporting Services fundamentals”) is nothing like the original Report Builder in SQL Server 2005.

In SQL Server 2008 and SQL Server 2008 R2, Report Builder 1.0 coexists with Report Builder 2.0 and Report Builder 3.0, respectively. In those versions, BIDS also includes a Report Model Project that you use to develop the semantic model required to use Report Builder 1.0. This project type is no longer available in SQL Server 2012, nor is Report Builder 1.0. Nonetheless, if you have an existing report model, you can continue to use it as a data source in the SQL Server 2012 Report Builder or SSDT, as described in Chapter 8, “Retrieving data for a report.”

Upgrading from prior versions

You can transition your reports from a prior version of Reporting Services to SQL Server 2012 in two ways. One way is to perform an in-place upgrade to update your existing environment and keep everything in its current location. Another way is to migrate by creating a new environment and copying your reports to that new environment. You can use SQL Server Setup or a command-line utility to upgrade your existing report server database to the schema required for SQL Server 2012. When you run the setup wizard on a computer containing an earlier version of SQL Server, you can choose to upgrade or to install a new instance of SQL Server for a side-by-side installation. Regardless of which option you choose, the System Configuration Checker runs during setup to ensure that your computer meets the requirements for a successful installation.



Important This section provides an overview of the process to upgrade or to migrate a standard Reporting Services environment. If you have customized your environment by adding custom applications, custom assemblies, or modifying configuration files, you should refer to <http://msdn.microsoft.com/en-us/library/ms143747.aspx> for more detailed information.

Preparation

Although SQL Server Setup proceeds with an upgrade only when your computer meets the requirements, you should also prepare for the upgrade by running the Upgrade Advisor to analyze your environment to uncover any potential problems in advance. Even if you are performing a migration, you should run the Upgrade Advisor to identify potential issues and to show custom settings of which you might not be aware if you did not configure the existing report server.



Tip You can download the Upgrade Advisor from <http://www.microsoft.com/en-us/download/details.aspx?id=29065&ocid=aff-n-in-loc--pd> or install it from the Servers\redist\Upgrade Advisor folder of your SQL Server 2012 installation media.

It's also a good idea to back up important files and databases before you perform an upgrade or migration. That way, if the process fails before completing, you can restore everything and resume

normal operations in the prior version until you can resolve the problem. You should back up the following items:

- **Symmetric key** Use Reporting Services Configuration Manager or the Rskeymgmt command-line utility to back up the symmetric key. The procedure to do this in earlier versions is the same as we describe for SQL Server 2012 in Chapter 25. In SQL Server 2012, you use Report Configuration Manager only for a native-mode report server, but you can use it for both types of report servers in all previous versions.
- **Report server database** Back up the ReportServer database (and optionally the ReportServerTempDB database) by using the same process you use to back up other databases in SQL Server. It's possible that the report server database has a different name, so be sure to correctly identify the database. This database exists for both a native-mode and SharePoint integrated-mode report server.
- **Rsreportserver.config** Save a copy of this file, which contains important settings for your report server. You can find it in the folder for the Reporting Services instance, which is in the Program Files\Microsoft SQL Server folder. The instance might be in a folder like MSSQL.3 or MSRS10.MSSQLServer. Within that folder, you can navigate through the folder hierarchy to locate the ReportServer folder, which contains this configuration file.
- **Rssvrpolicy.config** Save a copy of this file, which contains the security policies for the report server. You can find it in the ReportServer folder.
- **Reportservicesservice.exe.config** If you are running a native-mode report, this file is located in the bin folder that you find in the ReportServer folder.
- **Rswebapplication.config** Save a copy of this file, which contains settings for Report Manager and is used only for a native-mode report server. It's found in the ReportManager folder, which is a sibling to the ReportServer folder.
- **Rsmgrpolicy.config** If you are running a native-mode report server, save a copy of this file, which contains security policies for Report Manager. You can find it in the ReportManager folder.
- **Web.config** Locate and save each Web.config file for your report server. Both types of report servers have a Web.config file in the ReportServer folder, and a native-mode report server has one in the ReportManager folder.
- **Machine.config** If you have modified the Machine.config file for use with Reporting Services (which is not a common occurrence), you should save a copy of this file as well. You can locate this file in the applicable Windows folder for your operating system in the Microsoft .NET\Framework\v.1.1.4322\CONFIG folder for SQL Server 2005 and in the Microsoft.NET\Framework\v2.0.50727\CONFIG folder for SQL Server 2008 and SQL Server 2008 R2.
- **Virtual directories** If you are upgrading from SQL Server 2005 and have added files to the virtual directories used by the report server, back up those files. Reporting Services no longer uses Internet Information Services (IIS).



Important If you have invalid or expired SSL certificates on the report server, you must remove them first. Otherwise, the upgrade will fail.

In-place upgrade

If your computer passes the System Configuration Checker in SQL Server 2012 Setup, you can proceed with an in-place upgrade of a native-mode or SharePoint integrated-mode report server. Depending on the version of Reporting Services that you are upgrading, you might need to manually complete some steps before or after the upgrade process.



Note If you prefer to use the Setup.exe command-line utility to perform the upgrade, refer to <http://msdn.microsoft.com/en-us/library/ms144259.aspx> for instructions.

Native-mode report server upgrade

You can perform an in-place upgrade for the following versions of Reporting Services running in native mode:

- SQL Server 2005 Reporting Services Service Pack 4
- SQL Server 2008 Reporting Services Service Pack 2
- SQL Server 2008 R2 Reporting Services Service Pack 1

SQL Server Setup creates folders for a new Reporting Services instance in the Program Files\Microsoft SQL Server folder. The root folder for this collection of folders is named MSRS11.MSSQLServer for a default instance or MSRS11.<instance> for a named instance. SQL Server Setup also adds all the files necessary to support the report server, configuration tools, and utilities and upgrades the schema of the report server databases.

Setup does not upgrade existing installations of client tools like BIDS or SQL Server Management Studio. Instead, it adds new versions as a side-by-side installation. You can delete these tools following the upgrade if you have no further need for these tools for working with other Reporting Services instances.



Important If the report server database is on a separate computer from the report server, your Windows login must have sysadmin or database update permissions. Otherwise, SQL Server Setup prompts you for credentials with the required permissions.

Each version of Reporting Services relies on a set of configuration files. Depending on the version you are upgrading, Setup creates new configuration files by merging settings from the existing files and leaves the existing files in place. You can manually remove the folders for the previous Reporting Services instance after you confirm that the upgrade is successful. Reporting Services will use only files in the folder with the MSRS11 prefix.

If you are upgrading from SQL Server 2005, Setup uses the virtual directory settings for Reporting Services to reserve corresponding URLs. It might be necessary to manually remove the virtual directories when the upgrade is complete. Also, if your version of SQL Server 2005 is prior to Service Pack 1, Setup adds Database Owner permissions to the RSExecRole.

SharePoint integrated-mode report server upgrade

You can perform an in-place upgrade for the following versions of Reporting Services as long as you have already upgraded the SharePoint farm to SharePoint Server 2010:

- SQL Server 2005 Service Pack 2
- SQL Server 2008 Reporting Services Service Pack 2
- SQL Server 2008 R2

Regardless of the version you are upgrading from, you start the upgrade process on your SharePoint farm by installing the Reporting Services add-in on all web front-end servers. Then start the SQL Server 2012 upgrade process by running Setup on the report server. During the upgrade process, you might see a prompt asking you to provide credentials for SQL Server Reporting Services SharePoint Mode Authentication. The upgrade process uses these credentials to create a new SharePoint application pool.



Important The SharePoint Server 2010 prerequisite installer installs the SQL Server 2008 R2 add-in for Reporting Services. You must download and install the SQL Server 2012 version of this add-in from <http://www.microsoft.com/en-us/download/details.aspx?id=29068>.

Reports upgrade

Reports are stored in the ReportServer database. Setup upgrades only the schema of this database, without modifying the reports it contains. When a user or a background process executes a report, the report server upgrades the report and replaces the compiled version of the report in the ReportServer database. Any RDL files found on the same computer are not upgraded. You must open these files in SSDT to upgrade them to the current RDL schema.

Migration

If you are unable to perform an upgrade in place, you can perform a migration instead. You might also opt to perform a migration to minimize downtime. Your report server is unavailable to users during an upgrade but remains available during a migration.

Native-mode report server migration

You can perform a migration of a native-mode report server running SQL Server 2005 or later by installing SQL Server 2012, as described in Chapter 4, on the same computer as a side-by-side installation. If you prefer, you can install SQL Server 2012 on a separate computer. Either way, choose the Install Only option on the Reporting Services Configuration page of Setup so that you can configure Reporting Services to use your existing report server database after installation completes.



Important If you want to use a new Database Engine instance to host your report server databases, move the databases before configuring the new report server. To preserve all security settings, it's important that you move the databases by performing detach and attach operations rather than copying these databases. If the Database Engine instance has never hosted report server databases, you must create the RSExecRole in the *master* and *msdb* databases as described at <http://msdn.microsoft.com/en-us/library/cc281308>. Then use the Reporting Services Configuration Manager to restore the encryption key that you saved as part of the preparation process.

For a scale-out deployment, you must take each report server node offline and perform a migration on each one individually. You must also manually delete records from the Keys table in the ReportServer database before you configure Reporting Services.

Use Reporting Services Configuration Manager to configure the Report Manager and web service URLs and connect to the report server databases. When you connect the first report server to the report server database, an upgrade is performed on the database to make it compatible with SQL Server 2012 Reporting Services. You also use the Reporting Services Configuration Manager to restore the symmetric key that you saved during the preparation process. Last, you can add the other report servers if you have a scale-out deployment.

Make sure port 80 is open if you have a firewall running on the report server. You can use the Reporting Services Configuration Manager to use a different port if you prefer, but you must open that port manually in your firewall to enable remote access to the report server.

Open Report Manager and run several reports to ensure that the new installation works correctly. If so, you can uninstall the previous version of Reporting Services. You might also need to manually remove the following items:

- RSExecRole (in *master* and *msdb* databases of original Database Engine), if you moved the report server databases to a new Database Engine instance

- Service account running Reporting Services
- Reporting Services log files

If you migrated from SQL Server 2005, you should remove the following items:

- Application pool for the Report Server web service
- Virtual directories for Report Manager and web service
- IIS server, if not used for other purposes

SharePoint integrated-mode report server migration

You must perform the report server migration within the same SharePoint farm due to the use of unique identifiers within the farm. An exception to this requirement is a migration of all SharePoint content to a new farm. If you plan to host SharePoint configuration and content databases, including those used for Reporting Services in a SQL Server 2012 Database Engine instance, you must upgrade the farm to SharePoint 2010 and apply Service Pack 1.

In addition to performing a backup of the items listed in the “Preparation” section of this chapter, you should back up the SharePoint content databases and detach them. Also, back up the following files in Program Files\Common Files\Microsoft Shared\Web Server Extensions\14\Web Services\Reporting:

- Rsreportserver.config
- Rssvrpolicy.config
- Web.config

Next, to perform a complete migration of a farm, create the new SharePoint 2010 farm and install Reporting Services in SharePoint mode, as described in Chapter 4, but don’t create the Reporting Services service application yet. Restore the SharePoint content database on the new server, and attach it to a web application. You can also restore the report server databases at this time.



Important You can attach a SharePoint content database to a web application by using Windows PowerShell or the stsadm utility. SharePoint Central Administration does not include a page to perform this task. For more information, see <http://technet.microsoft.com/en-us/library/cc263299.aspx#AddDB>.

Copy the Rsreportserver.config file to the new server. You need to place it in the folder that has the same name as the one from which you originally backed it up, Program Files\Common Files\Microsoft Shared\Web Server Extensions\14\Web Services\Reporting.

Next, create the Reporting Services service application by following the instructions in Chapter 4, with one exception. On the page you use to create the new service application, change the Database Server and the Database Name to the correct values for the restored report server database.

The last step is to restore the Reporting Services encryption key. To do this, click the Manage Service Applications link in SharePoint Central Administration and click the Reporting Services service application link, the Key Management link, and the Restore Encryption Key link. Click the Browse button, navigate to the location where you stored the symmetric key that you saved in the “Preparation” section, and then provide the password.

Planning your report design

Before you read this chapter, you should have Reporting Services installed and have a general understanding of how to create a basic report. If you are still fairly new to Reporting Services report development, you might not fully understand how to implement some of the concepts that we discuss in this chapter, but that should not deter you from skimming through it. The purpose of this chapter is to help you think about how to prepare for the report development process. Knowing who will view reports and how they want or need to interact with reports has an impact on how you should design those reports.

Reporting Services provides a lot of flexibility in report design, which can be overwhelming at first. You can spend a lot of time trying out different approaches to report design before you discover that a feature that users need most conflicts with the features you've been implementing. With some advance planning, you can decide which features are most important for your current project and be more productive throughout the report development process. The suggestions we make in this chapter are not exhaustive, but they describe situations we commonly encounter in our consulting practice and strategies we have found useful.

Most importantly, we recommend that you involve users as much as possible during the development process. Prototype early in the development cycle with a subset of data (or even fake data if necessary) and solicit feedback. Make sure you ask questions to clarify your understanding of the requirements, and working with a prototype can help enormously with this process. A prototype is something tangible around which you can generate a discussion. With a prototype, users can confirm that the design is right, wrong, or maybe close but not quite what it needs to be. Furthermore, users are better able to answer your questions about whether a particular design feature would be useful if they can see it in action.

Knowing your audience

Knowing your audience is important. An understanding of how users typically interact with information, their technical skill and interest level, and whether they plan to use the data in other ways will affect how you approach the design of reports. More likely, you will have a mixed audience and will need to create different styles of reports to accommodate a diverse audience.

One of the first things to know is how users will be viewing reports. The access method they use to view a report can give you more freedom for creativity in the report design or can impose certain restrictions. As you gather information about report access, consider the following scenarios:

- **Will users go online to find a report and view it there?** If users are viewing reports online, you can consider any interactive feature that Reporting Services supports. However, many of these features are useless if users will be referring to printed reports. For interactivity features that you can add to online reports, see Chapter 13, “Adding interactivity.” If you must plan for printed reports, see the “Printed reports” section later in this chapter.

When designing a report for online consumption, users typically don’t want to scroll through pages and pages of a report to find needed information. The addition of report parameters, in conjunction with query parameters, can enable the user to focus on information of interest. You can learn more about parameters in Chapter 14, “Creating dynamic reports with parameters and filters.”

- **Will users primarily receive reports via an email subscription?** If so, you need to find out whether the email should contain an embedded copy of the report, include an attachment to the report, or simply provide a link to the report online. In the latter case, you can design your report by using the same criteria for an online report.

If the report must be embedded in the email, the report should be relatively small in size, containing a minimal number of records and using a layout that fits easily within the width of the user’s monitor if they usually use a computer to view emails. If the users rely primarily on mobile devices for email, consider sending reports as an attachment instead. A report sent as a PDF attachment must be designed with pagination in mind, which we explain in Chapter 15, “Managing the page layout.” However, if users need access to the data to combine with other sources or to perform computations, you can send the report as an Excel attachment, and you can focus more on the data structure and less on conforming the report appearance to a corporate standard.

- **Will users be using mobile devices to access reports?** A recent development is the increasing use of tablets and smartphones to access corporate information. Rather than try to fit everything into a one-size-fits-all dashboard-style of report, consider focusing on a few key subject areas and then provide access to additional information through links that open separate reports or jump to another section of the same report.

When users are in the office, they’re often accessing the BI system to check on the general status of operations. They’ll be looking at the big picture to see whether things are going as expected or not, and they can then explore areas of interest to get into more specific information as needed. By contrast, the mobile audience is usually responding to a circumstance, either searching for something specific to answer a question or looking up the high-level status of some business process. They’ve either encountered a problem that needs to get resolved or anticipate that they’re on the verge of a problem that they want to pre-empt. Mobile users might be under pressure standing in front of a client or in an otherwise distracting environment, so the reports must be designed to make it as easy as possible to get to specific information and to follow a train of thought by drilling from one type of information to another type of information, and to filter the data down to relevant details as needed. Parameters and actions are useful features to implement in mobile reports. See Chapters 13 and 14 to learn how to use these features.

The technical skills and interest level of your users also play a role in determining how best to make information available. Technical skills among users can vary widely in an organization or even within a department. You should be prepared to provide building blocks for users who are capable of some level of self-service reporting if interest exists. The following are some strategies to consider for different types of users:

- **Data-savvy advanced users** Some users spend their entire day focused on data. This group of users likely has the technical skills necessary to acquire and manipulate data from relational or multidimensional data sources. They want as much unfettered access to data as you're willing to give them. You can set this group up to work with Report Builder and allow them to build reports from scratch, or you can create a library of starter reports that they can modify as needed.
- **Motivated power users** This group of users knows their data very well. Perhaps they are capable of building reports but are unable to write their own queries. You can give this group permission to use Report Builder and publish shared datasets for them to use when creating their own reports. That way, they have the freedom to create the reports they want and you can control the data that they use. See Chapter 8, "Retrieving data for a report," for more information about shared datasets.

Within this group, you might even have people who know what they want when they see it but are unable to put together their own queries and are intimidated by the thought of building a report from scratch. For this group, you can publish report parts that represent commonly accessed data in a variety of data structures—tables, charts, maps, and so on. Then this group can use the Report Part Gallery in Report Builder to browse published report parts and piece together multiple report parts to build a report just the way they like it. Chapter 29, "Reusing report parts," explains how to do this.

- **Basic users** Some users lack the time, the skills, or the interest to explore data and build their own reports. They just want access to information as quickly and flexibly as possible. When creating reports for this group, you might find a lot of similarities between reports. To save yourself from creating a maintenance nightmare and also save users the trouble of trying to determine which of the many possible reports has the answers they need, try to consolidate multiple reports into a single report as much as you can. Use parameters to modify the content of the reports, either by filtering the data or by hiding or showing elements dynamically. You can create linked reports, as we describe in Chapter 23, "Deploying reports to a server," to create the illusion of multiple reports if necessary and hide the parameters that you don't want users to change.

Yet another aspect to understand about your audience is how they plan to use the report. The intended use can make a difference in the direction you should focus your development effort. The following are some common ways that people use reports and related development considerations:

- **Standard reporting** The most common reason to implement Reporting Services is to provide standard reporting at the department, division, or organizational level. This type of reporting typically requires the use of standard styling to produce a consistency of appearance across multiple reports.

After the standards for your reporting environment are established, you can create one or more base reports to use as templates. For example, you might create a portrait version and a landscape version of a table layout and include common parameters in each version. You can store the report definition files in the Program Files (x86)\Microsoft Visual Studio 10.0\Common7\IDE\PrivateAssemblies\ProjectItems\ReportProject folder on your computer. When you use the Add A New Item command in SSDT to create a new report, you can select the template and continue report development by adding a dataset and assigning fields to a data region.

- **Raw data** Reporting Services can export data to Excel, CSV, XML, and ATOM formats. Some people just want the raw data so that they can develop their own Excel workbooks or import it into PowerPivot for Excel or other applications. Creating a report to deliver data might be preferable to allowing direct access to data sources because you might need to enhance the data with calculations, you might want to schedule data retrieval to manage the impact on source systems or your network, or you might want to deliver the data by using subscriptions rather than require the user to go to the report server. If the report is simply a means to an end, you don't need to spend a lot of time conforming a report to a standard format with page heads and footers, and so on. You should keep these reports in a separate folder to emphasize their purpose as data structures.
- **Quick information retrieval** Sometimes people need access to information without a lot of formality. This information might come in the form of an email to report the status of a process, or it might be a lookup to get customer contact information. Either way, this type of report is not typically something a user prints out to share with others or present at a meeting. Therefore, the layout can be simple, without the formatting that you would require for official corporate reports.
- **Operations monitoring** This type of reporting can take the form of a dashboard or detailed reports that include conditional formatting to highlight trends and exceptions. When designing a dashboard, you should consider the standard size screen for the majority of users so that you can use the screen effectively. A dashboard should convey summarized information clearly at a glance, using data visualization techniques to provide comparisons, display trends, or highlight exceptions. Ideally, the user can see the entire dashboard without scrolling. Use the chapters in Part III, "Adding data visualizations," to learn about the variety of data visualizations at your disposal.

You should also consider the questions that might result from viewing a dashboard and prepare supporting detailed reports. You can add actions to each data visualization to open a related report and pass the context of the user's click to that report. For example, in a chart that displays sales trends by week, a user can click a specific week to open a report that displays the daily detail for that week. See Chapter 13 for information about actions.

- **Management or external stakeholder reporting** The most formal type of reporting that you might have is the set of reports prepared for management or external stakeholders. Although these reports might be viewed online, you should anticipate that they might be printed or shared as PDF documents. You typically apply consistent styling and branding to this type of report and must take care to adjust the design so that the report produces a clean layout in print or PDF format. We provide suggestions for styling in the “Developing standards” section of this chapter.
- **Information as a service** You might produce a series of reports as a service to customers. This type of reporting often requires consistency in appearance. You might provide access to reports online, or you might deliver a set of reports as a single PDF document. To combine reports into one document, you create individual reports and then create one parent report that uses subreports to organize the individual reports in the correct sequence. When working with subreports in this way, to avoid introducing blank pages, you must take care to manage the page sizes of the individual reports as well as the parent report. See Chapter 14 for information about subreports, Chapter 15 for page size management, and Chapter 32, “Understanding Report Definition Language,” for an alternative approach to combining reports.

Reviewing report options

Although many changes to a report can be made at any time during report development, the most important decision you need to make early in the process is the type of layout to use. However, there are other options to consider as well. You need to understand any limitations you might have when retrieving data, and you must give some thought to whether to implement parameters and how best to configure them. If your users intend to access reports by using mobile devices, you should also consider how best to design reports to accommodate the smaller form factor. Similarly, you need to consider how printing a report affects the layout.

Layout decisions

With some practice and a good understanding of how a tablix works, you can convert a table to a matrix or vice versa, but when you’re new to Reporting Services, you might find the necessary steps to be unintuitive. Moreover, you cannot change a table into a chart or map nor turn a list with various nested data regions into a table. Therefore, deciding the layout to use is a critical decision to make.

You can use a table layout when you need to present a simple list of items with a relatively small number of fields per item. If there are a lot of fields, you need to consider whether it’s acceptable for the user to scroll horizontally to view all the fields online. If the user is going to print the report, there are additional considerations we discuss in the “Printed reports” section of this chapter.

Generally, you should design the reports for online viewing to display a limited number of columns. It’s much easier for users to scroll up and down to view information than to scroll left and right. For that matter, you should question whether users really need to see all available columns at once. It

might make more sense to set up a parameter to allow users to choose the columns they want to see. Then you can hide or show columns on demand.

You can also use multiple detail rows and stack the fields vertically if necessary, as shown in Figure 6-1. That way, you can include a larger number of fields in the layout while keeping the width of the data region smaller than the user’s screen width or the printed page.

Product / Weight	Color / Class	Size / Style	Sales Amount	Profit Margin	Profit Margin	Pet Contribution
[SalesTerritoryGroup]						
[SalesTerritoryCountry]						
[BusinessType]			[Sum(SalesAmou			
[EnglishProductName]	[Color]	[Size]	[SalesAmount]	[ProfitMargin]	«Expr»	«Expr»
[Weight]	[Class]	[Style]				
Business Type Total			[Sum(SalesAmou			
Country Total			[Sum(SalesAmou			
Group Total			[Sum(SalesAmou			

FIGURE 6-1 You can use multiple detail rows to reduce the number of columns required to display all fields for a dataset row.

Another option for handling a large number detail fields is to create a grouped list. The advantage of a list is the ability to arrange text boxes in a freeform fashion. You can then accommodate text boxes of varying sizes on each “row” of the list, as shown in Figure 6-2.

First(SalesTerritoryGrou	First(SalesTerritoryCoun	First(BusinessType)
[EnglishProductName]	«Expr»	
[Color]	[Size]	

FIGURE 6-2 You can arrange text boxes inside a grouped list to minimize the width of a report.

A matrix is useful when you need to provide a crosstab layout. However, you run the risk of having too many columns on the screen or printed page if you don’t plan ahead. A table has a fixed number of columns that you define during report development, but a matrix can have a variable number of columns because the data determines the column groupings. Therefore, if your goal is to fit a matrix to a specific size, you should consider implementing a filter to reduce the number of possible column groupings.

On a more granular level, you need to consider how wide each text box should be to comfortably accommodate data. A text box will never grow wider than the size you define, but it has a CanGrow property that is set to True by default, which expands the text box vertically if the data is wider than the text box, as shown in Figure 6-3. This property might be acceptable for reports that you view online but can disrupt the alignment of printed reports by pushing report items from one page to another.

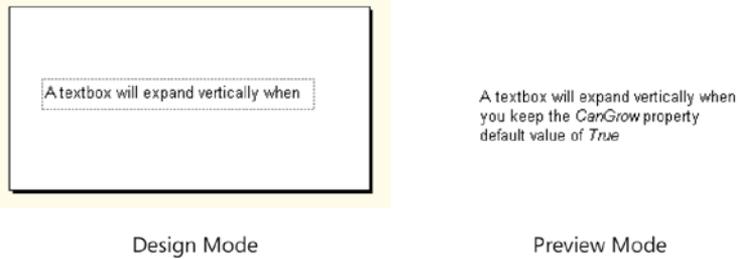


FIGURE 6-3 When the *CanGrow* property is set to *True*, the text box expands vertically to display the entire text it contains.

Data considerations

Rather than create a large report that contains hundreds or thousands of pages, find out whether all that data is really necessary. Usually it's better to add a filter or create a query that aggregates data at the source. When users view reports online, they usually want to look up a piece of information and don't need to scan an entire report to find that one item of needed information.

Rather than create a report that includes pages of detail records with group totals, create a summary report to show only group totals. Have users start their review process from a summary report, and then include an action on the report to drill through to a detail report. The detail report displays only a subset of data related to the portion of the summary report that the user wants to investigate. In both cases, you have a report that retrieves a smaller number of records and generally runs faster than a report that retrieves thousands of records.

Another aspect of managing data in reports is the data definition itself. Some organizations have strict control over access to data sources, requiring report developers to use stored procedures or views maintained in the source database. This requirement simplifies maintenance of commonly used queries by centralizing the query.

Using stored procedures and views is not an option for data that comes from non-relational data sources. For those situations, you might consider using shared datasets to achieve a similar effect. The downside of shared datasets is that they are primarily intended for use in Report Builder. If you use SSDT to develop reports, you must either obtain the current version of a shared dataset from a source control system or download it from the report server. SSDT does not provide direct access to published shared datasets.

Parameters

Parameters are useful elements of a report. You can use them to filter data, set report item properties dynamically at run time, or provide input for calculations. Throughout this chapter, we suggest using parameters to address a variety of scenarios. As you plan your report, you must make several decisions about implementing each parameter, including the following:

- **User input** You must decide whether a parameter accepts user input. In most cases, you should avoid this option due to the increased security risk of an injection attack and due to the limited validation available in Reporting Services. Usually it's better to give the user a list of values from which to make a selection, but you might prompt the user when you want to create a filter by using a user-defined string and wildcard or when the number of possible values is not practical to present in a list, such as a sales invoice number.
- **List of values** The preferred method for prompting the user for a value is to provide a list of valid values. You can hard-code this list if necessary, but using a query gives you more flexibility in the long run and allows you to easily reproduce the same list of values when using the same parameter in multiple reports. You can create an independent query, or you can use a query that depends on the user's selection of a value for a separate parameter. This technique is known as cascading parameters and is described in Chapter 14. You must also decide whether the user can select only one value or multiple values.
- **Default value** If you do not include a default value for a report parameter, the report cannot execute until the user provides a value. This might be a desired behavior when there is no reasonable default, such as a report that displays information about a specific sales invoice. Wherever possible, you should provide a default value. This default can be hard-coded in the report or produced as the result of a query.

Mobile devices

We pointed out earlier in this chapter that you should design reports to use screen space effectively and minimize scrolling when people are working on a desktop. However, with mobile devices, the same rules do not necessarily apply. Users are accustomed to not seeing all information on the screen at one time. A useful feature of tablet devices is the ability to use gestures on the screen to navigate, either by zooming in and out as necessary or scrolling. Therefore, you might not need to worry as much about fitting the contents of a report to the screen, but always check with your users to understand their expectations before establishing a policy one way or the other.

If you are reproducing a dashboard for mobile devices, you might consider limiting the number of perspectives or views of the data to no more than four. If you have four views laid out in a quadrant format, keep in mind that the most important information should be placed in the top-left quadrant. That's where our eyes naturally start, and on the tablet, that should be the information that's most likely to fit completely on the screen.

Another suggestion is to keep the report simple for mobile users. Having too much information on the screen makes it more difficult for users to focus on the information they're looking for, especially if they're in a hurry. Having legends or lots of parameters for filtering can create visual noise and interfere with their ability to locate the data. In particular, when you know your users will be viewing information on tablets, don't use tiny fonts. In addition, if there are actions in a report, associate the actions with report items big enough to handle comfortably on a touch screen.

Printed reports

When designing reports that are destined for printing at some point, you must factor in the page size as you position items in the report layout. You can set report properties to fix the orientation as portrait or landscape, which we explain in Chapter 15. Many of the same considerations that we describe in the “Layout decisions” section of this chapter also apply to printed reports, and perhaps more so. Preview your report, and switch to Print Layout mode so that you can see how the rendered report fits on each page. You should also export the report as a PDF file to check the rendering more carefully.

If a report spans multiple pages, you should configure repeating column headers in the tablix. That way, users don’t have to flip back to the first page to determine what a particular column contains. Chapter 15 explains how to set properties in the tablix to repeat the column headers. The same principle applies to row headers for a matrix. You can repeat the row headers on the second page if a matrix is too wide to fit on a single page.

By default, Reporting Services tries to fit as much content as it can on a page and inserts logical page breaks for a report. For greater control over the location of page breaks, you can define explicit page breaks relative to report items or groups within a data region.

Regardless of whether you set explicit page breaks or rely on the default logical page breaks, each page of the report is assigned a page number. You can reset this page number to maintain a separate page numbering system within sections of a report, but there is also an overall page number that you can use. When you know a report will be printed, it’s a good idea to include the current page number and the overall page number in the page header or page footer, which are the only locations in which the page number can display. That way, if a user inadvertently shuffles the pages of the report or misplaces ones, the presence of page numbers helps the user reorder the pages correctly or notice the missing page.

You should also include the report execution date and time in the page header or page footer. That way, the user can easily tell if the report is recent enough to remain useful. You might also consider including the report server name and report path to help the user locate the report online when it’s time to execute a fresh report.

Sometimes you can design a report that looks good both online and in print, but that’s not always possible. You might need to design two separate reports. Rather than have users open one report and then have to switch to another report, consider having a link visible in online mode only that users click to output the report as PDF or Excel. Reporting Services doesn’t actually allow you to create links dynamically, but you can create an action and then underline the associated text to make it appear to be a link. In the action definition, you can use an expression to dynamically create the URL to produce the requested output. See Chapter 13 for information about actions and Chapter 35, “Programming report access,” for information about URL access.

Developing standards

When your reports have a consistent look and feel, users know what to expect when they view a report and can focus on its important elements rather than spending time trying to figure out how to use the report. Similarly, during the report development cycle, standards provide clear guidelines that you can apply to your report quickly without resorting to trial and error to see what might look good. When you have a set of standards established, you can create a variety of templates with common elements in place to shortcut the development process, as we explain in the “Knowing your audience” section of this chapter.

If you don’t already have reporting standards already established in your organization, consider defining standards for the following report elements:

- **Fonts** Use a single font family. Be consistent with font sizes for different elements. For example, you might use a 10pt font for detail records and a 12pt font for column headers. Use 14pt or 16pt for titles. Use smaller fonts for text in page headers and page footers. Consider using a lighter shading for text in page headers and page footers, such as gray rather than black, to reduce the emphasis on the text. The user’s eye should be drawn towards the primary information on the report through the use of larger fonts, darker colors, and bolding where appropriate.
- **Colors** Use a consistent palette of colors for text and elements (other than data visualizations) that place color onto the report, such as lines, borders, or fill. Ideally, colors should be soft and neutral and should not distract from the information on the report.
- **Logo** If your company has a logo to include on reports, upload it directly to the report server and then reference it as an external image in each report by using its URL access path (described in Chapter 35). That way, if the logo changes in the future, you can replace the file on the report server without the need to update each report individually.
- **Page Header** Include a text box to display the report title and another text box to display the page number and total pages (such as Page 1 of 3). If you prefer, you can place the page number in the page footer. Suppress the page header on the first page if using a text box to display a title on the report body. Use a font smaller than the detail row fonts in the report.
- **Report Header** The report does not include an explicit report header. We use this term to describe any report items, such as a free-standing text box, a rectangle, a line, or an image, that display at the top of the report in the body above a data region. The report header displays only once in the rendered report at the top of the first page. You can use this area to display a title and supplemental information as a subtitle, such as parameter selections and a date. Use a large font for the report title and a slightly smaller font for the subtitle.

- **Group Header or Footer** Use a consistent styling for group headers and footers when you include them in a Tablix. Typically, you use a bold font to distinguish headers and footers from details. Consider using border or background color properties as another means to differentiate group headers and footers from details. Decide whether to include totals in the group header or footer. You should be consistent with the placement of totals in all reports.
- **Page Footer** Include a text box to display the report execution date, report path, and the page numbering if you don't include it in the page header. Use a font smaller than the detail row fonts in the report.
- **Margins** Set a minimum margin of 0.5in on each side of the page.
- **Parameters** When defining a common set of parameters across multiple reports, use the same sequence in each report.
- **Calculations** Decide how to handle a potential divide by zero error. You might use a conditional expression to test the calculation first and return a default string such as N/A or a dash (-).
- **Empty strings and NULL values** You should use a consistent rule for handling empty strings or NULL values returned in the dataset. You might prefer to display nothing, convert numeric data types to a 0, or display a string. Whatever you decide to do, be consistent.
- **No rows** If it is possible for a dataset query to return no rows, you can display a message to the user by setting the *NoRowsMessage* property of the data region. If you leave this property blank, the data region does not display. If it's the only element in the report, the user might not realize the problem is related to data and might think that the report server has failed to render the report correctly.

Index

Symbols

- 32-bit edition of SQL Server 2012, operating system support, 57
- 32-bit operating systems, SQL Server 2012 on, 55
- 64-bit edition of SQL Server 2012, operating system support, 56
- 64-bit operating systems, SQL Server 2012 on, 55
- 90 Degrees Northeast/Northwest/Southwest/Southeast radial gauge, 519
- 180 Degrees North/South/West/East radial gauge, 519
- & (ampersand), in expressions for items in global collection, 276
- * (asterisk), wildcard for multiple characters, 384
- @ (at symbol), prefixing parameter value placeholders, 276
- = (equal sign)
 - beginning complex expressions, 277, 293
 - equality operator, 383
- > (greater than) operator, 383
- >= (greater than or equal to) operator, 383
- <> (inequality) operator, 383
- < (less than) operator, 383
- <= (less than or equal to) operator, 383
- (minus sign), toggling row visibility, 354
- % (percent symbol), wildcard for multiple characters, 383
- + (plus sign), indicating item can be expanded, 352
- ? (question mark)
 - as wildcard for single character, 384
 - next to page number, indicating incomplete rendering, 396
- [] (square brackets), in expression placeholders, 274
- _ (underscore), wildcard for single character, 384

A

- Abs function, 324
- Access
 - importing reports into projects, 166
 - report features supported in Reporting Services, 167
- accessing reports online. *See* online reports
- access to reports, 29
 - programming, 927–948
 - accessing reports with the web service, 944–947
 - linking to reports with URL access, 927–938
 - using ReportViewer control, 938–943
- accounts. *See also* user accounts
 - changing report service connection account, 78
 - execution account for native mode Reporting Services, 81
- Acos function, 323
- Action property, 361
 - for text, 240
- actions
 - Action page for pointers, 524
 - Action page, Gauge Properties dialog box, 533
 - Action page, Scale Properties dialog box, 527
 - Action page, Series Properties dialog box, 461
 - Actions menu, SharePoint Report Viewer, 761
 - using to simulate links in online reports, 147
 - working with report actions, 361–366
- Active Solution Configuration drop-down list, 168
- activities associated with roles or SharePoint groups, 645
- Add A Report Server HTTP URL dialog box, 76
- Add Calculated Member button (MDX query designer), 432, 434
- Add Existing Item command, 166
- Add Existing Item dialog box, 165
- Add Existing Project dialog box, 154

Add Layer button, Map Layers pane

- Add Layer button, Map Layers pane, 592
- Add New Item command, 166
- Add New Item dialog box, 165
- Add New Project dialog box, 153
- Add New Report command, 165
- Add Reference dialog box, 886
- Add Service Reference dialog box, 918
- Add Table dialog box, permissions table, 665
- Add Total command, 230
 - using in a matrix, 232
- ad hoc reports, development tools for, 26
- adjacent columns, using in a tablix, 266
- adjacent gauges, 536
- adjacent groups in a tablix, working with, 267
- adjacent indicators, 548
- administration (reports), 28
- administrative tasks, 669–704
 - configuring the report server, 669–685
 - managing the report server, 685–690
 - monitoring the report server, 690–704
 - scripting, 905–914
 - creating linked reports, 911–914
 - deploying reports, 906–910
- advanced filter mode (Power View), 850
- Advanced Multiple Web Site Configuration dialog box, 75
- advanced options for report parameters, 377
 - parameters dependent on dataset query, 378
- advanced properties, Server Properties dialog box, 676
- AdventureWorksDW2012 sample database
 - installing, 97
- Aggregate function, 328
 - using instead of Sum function in Analysis Services cube, 437
- aggregate functions, 230, 328–331
 - adding field to freestanding text box, 236
 - and FormattedValue property for text boxes, 437
 - applied to values in Chart Data pane, 457
 - changing for Summarize By property in tabular models, 804
 - for gauge's pointer value, 522
 - Recursive keyword with, 342
 - RunningValue function, 330
 - using placeholders, 275
- aggregation
 - aggregate values in detail rows, 438–440
 - custom, 301
 - Show Aggregations button, MDX query designer, 440–442
- alerting
 - alerting service runtime engine, 43
 - configuring alerts for Reporting Services service application, 93
 - data alerting, 759–778
 - alerting service, 760
 - configuring, 772–775
 - creating data alerts, 761–768
 - data alert workflow, 759
 - managing alerts, 770–772
 - monitoring alerting process, 775–777
 - receiving data alerts, 768–770
 - ReportService Alerting database, 41
- alerting extension types and corresponding events, 775
- alignment
 - setting properties for text, 241
 - text properties for, 240
- Allow Blank Value property, report parameters, 369
- Allow Multiple Values property, report parameters, 370
- Allow Null Value property, report parameters, 370
- Analysis Services
 - collation for, 68
 - configuration in SQL Server 2012 Setup, 70
 - data source for Reporting Services, 177
 - feature selection in SQL Server 2012 Setup, 64
 - in SharePoint integrated-mode distribution, 50
 - using as data source, 425–450
 - building a report, 435–442
 - creating Analysis Services dataset, 425–435
 - designing parameters, 442–450
- Analytical Data page, map layer dialog boxes, 593
- analytical data set, adding to maps, 571
- Analytical Map type, 568
- Analytical Marker Map type, 567
 - setting options, 574
- application domains, 37
 - management of, 38
- application tier
 - in native mode Reporting Services, 31–34
 - in SharePoint integrated mode, 41
- architecture (Reporting Services), 30–43
 - native mode, 30–38
 - SharePoint integrated mode, 38–43
- area charts, 455
- arithmetic operators, 282
- Arrange buttons, Home tab of Power View ribbon, 837

- array functions, 313–315
 - Join function, 314
 - Split function, 314
 - Asc and AscW functions, 309
 - ascending sort, applying in text boxes, 346
 - ASCII (American Standards Committee for Information Interchange), function
 - returning a character, 309
 - Asin function, 323
 - aspect ratio for linear gauges, 532
 - assemblies
 - assembly properties, data processing custom extension, 890
 - using to share custom code, 881–887
 - assembly deployment, 885
 - class library, 881–885
 - custom assembly call, 885
 - Atan and Atan2 functions, 324
 - ATOM
 - data renderer, 396
 - exporting reports in, 736–738
 - audience, knowledge of, 139–143
 - authentication
 - authentication extension, 35
 - authentication layer in service architecture, 37
 - BISM connection, 802
 - configuring, 681–683
 - configuring for Database Engine, 69
 - in Internet deployment of Reporting Services, 53
 - new web application, in Web.config, 918
 - Reporting Services connection to data source, 158
 - selecting provider for SharePoint web application, 88
 - understanding types of, 644
 - Author and Description properties, 861
 - Author element, 861
 - authorization, reviewing default authorization policies, 644–650
 - Auto Execute button (MDX query designer), 432
 - AutoRefresh element, 861
 - available values for report parameters, 371–374
 - Get Values From A Query, 373
 - None, 371
 - Specify Values, 372
 - Average() function, 230
 - Avg function, 328
 - axes
 - configuring properties, 469–473
 - play axis, adding to charts in Power View, 841
 - secondary axis, 508–509
 - sparkline axes alignment, 482
 - synchronization for multiple visualizations in tiles container, 847
 - title, 468
 - working with horizontal axis properties, 493–500
 - axis type, 493
 - intervals, 495–500
 - working with vertical axis properties, 487–492
 - logarithmic scale, 491
 - scale break, 488–490
 - Axes And Chart Area page, Series Properties dialog box, 459
 - Axis Properties dialog box, 469–473
 - Axis Options, 469
 - Label Font, 472
 - Labels, 470
 - Line, 473
 - Major Tick Marks and Minor Tick Marks, 472
 - Number, 472
 - scale breaks, 488
 - Axis Title Properties dialog box, 468
 - azimuthal projection, 587
- ## B
- BackgroundColor property
 - for row or column pinned into fixed position, 352
 - setting for text, 245
 - BackgroundImage property, 246
 - background processing, 37, 684
 - BackgroundRepeat value, BackgroundImage property, 247
 - Back To Parent Report button, 363
 - backup and recovery, 687–690
 - configuration files, 690
 - encryption keys, 688–690
 - native-mode report server database, 687
 - SharePoint integrated-mode report server database, 688
 - Backup Encryption Key dialog box, 81
 - bar charts
 - as data bars, 477
 - sort order in Power View, 839
 - when to use, 455
 - basic filter mode (Power View), 849
 - Basic Map type
 - line data maps, 568
 - polygon data maps, 569

Basic Marker Map type

- Basic Marker Map type, 566, 573
- basic users, designing reports for, 141
- Between operator, 381, 384
- BI. *See* business intelligence
- BIDS (Business Intelligence Development Studio), 16
- BigMul function, 326
- binary data, images as, 816
- binding data
 - dataset to a list, 235
 - to a data region, 225–226
- Bing Maps tile layer, 556
 - adding to a map, 565
 - configuring tile layer maps, 603
 - embedded in report, 565
- Bing Maps Web Service, 566
- BISM (Business Intelligence Semantic Model)
 - connection, 94, 798–803, 825
 - authentication, tabular databases, and, 802
 - connection information, 799
 - launching Power View or Excel, 801
 - setting permissions, 801
- BISM (Business Intelligence Semantic Model) files, 4
- bitshift operators, 284
- blank values, Allow Blank Value property, report parameters, 369
- BLOBs (binary large objects), data stored as, disk space requirements and, 46
- block tables, 161
 - example, 162
- Body element, 861
- body of a report, 400
 - properties defining body size, 401
- Bollinger bands formula, 506
- Bonne projection, 588
- Bookmark property, 363
 - for lines, 215
- bookmarks, Go To Bookmark action, 363
- Border element, 866
- borders
 - BorderColor, BorderStyle, and BorderWidth properties
 - setting, 245
 - BorderColor, BorderStyle, BorderWidth properties
 - for scale breaks, 490
 - Border menu, Home tab of Report Builder ribbon, 112
 - Border page, Scale Properties dialog box, 530
 - Border page, Series Properties dialog box, 461
 - Frame Border page, Gauge Properties dialog box, 533
 - Pointer Border page, 524
- boundaries of visible map, setting, 586
 - default settings for the viewport boundaries, 588
- BreakLineType property (scale breaks), 490
- BreakLocation property, 415
- browsers, requirements for Power View, 823
- bubble charts, 503–505
 - adding play axis in Power View, 841
 - creating, 503
- Bubble Map type, 570
 - for polygons, 575
- Bubble Marker Map type, 566
 - setting options, 573
- Build menu, Report Designer, 167
- Build Reports command, 167
- built-in fields
 - placeholder, 275
 - using to add expressions to text boxes, 298
- Built-in Fields category, Expression dialog box, 281
- bullet graph linear gauge, 520
- business intelligence (BI)
 - BI center site, creating in SharePoint for Reporting Services integration, 89–90
- BIDS (Business Intelligence Development Studio), 16
- BISM (Business Intelligence Semantic Model) files, 4
- information resources for SharePoint BI features, 723

C

- C#
 - data processing extension sample, 890
 - configuration files, registering extension, 902
 - function written in, 883
 - sample code in, 887
- caching
 - Cache Refresh Plan for reports, 748
 - configuring for shared datasets, 641
 - EditSessionCacheLimit property, 676
 - reports, 632–633
 - refreshing the cache, 634
- calculated fields
 - naming, 293
 - using in other expressions, 296
 - using in reports, 293–295

- calculated measures (Analysis Services), 428
- calculated members
 - Calculated Member Builder dialog box, 432, 434
 - Calculated Members pane (MDX query designer), 427
 - creating in MDX query, 433
- calculated series, 505–508
 - formulas for, 506
 - moving average, 507
- Calculated Series Properties dialog box, 506
 - Formula drop-down list, 506
 - properties for moving average, 507
- calculations
 - adding to reports, 292–299
 - built-in fields, 298
 - report item references, 296–298
 - text box expressions, 295–296
 - conditional formatting in Analysis Services, 437
 - defining reporting standards for, 149
- calendar control, using for date values in report parameter, 449
- Calendar property, 244
- canceling jobs on report server, 685
- Cancel Query button (MDX query designer), 432
- CanGrow element, 866
- CanGrow or CanShrink properties, text box, 239
 - CanGrow property, 144
- Cap Fill page (pointer cap), 525
- Cap Options page (pointer cap), 524
- Cards
 - using Cards visualization in Power View, 843
 - using for identifying information in Power View, 818–821
- cartographic projection. *See* projection method for maps
- cascading parameters, 392, 447
 - changing parameter order, 393
- Cascading Style Sheets (CSS), length units, 238
- case conversions in strings, 315
- CatalogTempDB.sql script, 687
- categories, too many, in pie charts, 513
- category axis, 466, 493
- Category Group Properties dialog box, 463
 - Filters page, 464
 - General page, 463
 - Sorting page, 464
 - sparklines, 482
 - Variables page, 464
- category groups, Chart data pane, 461–464
 - deleting a category group, 463
 - field selection, 462
- CBool function, 333
- CByte function, 333
- CChar function, 333
- CDate function, 321, 334
- CDbl function, 334
- CDec function, 334
- Ceiling function, 325
- CellContents element, 866, 867
- CELL PROPERTIES clause in MDX queries, 433, 436
- cells
 - tablix, 256–259
 - cell content, 256
 - cell merge and split, 258
 - cell scope, 257
- center point, 563
 - adjusting for maps, 583
 - configuring properties for polygon maps, 602
- character encoding used by rendering
 - extensions, 738
- character functions, 308
- Chart Area Properties dialog box, Align With Chart Area drop-down list, 512
- ChartColor Collection Editor, 487
- Chart Data pane, 456–465
 - Category Group section, 461–464
 - configuring sparkline appearance, 482
 - data bars, 476
 - Series Group section, 464
 - sparklines, 480
 - Values section, 457–461
- chart properties, 467
- Chart Properties dialog box, 482
 - configuring color palette, 485
 - Filters page, 380
- charts, 212, 453–484
 - adding to reports, 453–456
 - selecting chart type, 453
 - understanding chart types, 454–456
 - creating in Power View, 836–842
 - arranging visualizations, 837
 - column and bar chart sort order, 839
 - column, bar, and line chart layout section, 838
 - multiples, 839
 - play axis, 841
 - scatter chart layout section, 840
 - data bars, 476–480
 - adding, 476
 - configuring properties, 478–480

chart title

- formatting chart elements, 466–476
 - axes, 469–473
 - chart-level properties, 467
 - chart titles, 467
 - legend, 475
 - series labels, 473–476
- interactive sorting in, 350
- sorting specification for categories in, 351
- sparklines, 480–484
 - adding, 480
 - configuring properties, 481
- using Chart Data pane, 456–465
 - values, 457–461
- working with chart elements, 485–516
 - changing color palettes, 485–487
 - horizontal axis properties, 493–500
 - pie charts, 513–516
 - series properties, 500–513
 - vertical axis properties, 487–492
- chart title, 466
 - modifying and accessing other properties, 467
- Chart Title Properties dialog box, 467
- Chart Wizard (Report Builder), 121
- child gauges, 537
- child report parameter dataset, creating, 392
- Choose function, 327
- Chr and ChrW functions, 309
- CInt function, 334
- Claims Authentication, 644
- Claims to Windows Token Service, 43
- classes, adding/removing in Report Properties dialog box, 886
- class library, creating, 881–885
 - class definition, 881
 - data processing custom extension, 888
- cleanup functions, 318
 - Replace function, 318
 - Trim, LTrim, and RTrim functions, 319
- Cleanup.sql script, 698
- Client Tools Connectivity feature, 65
- Clipboard, Home tab of Report Builder ribbon, 112
- CLng function, 334
- CObj function, 334
- code, embedding in reports, 877–881
 - Code property, 878
 - generic function returning color or KPI, 879
 - custom function call, 880–881
 - CodePlex, sample code on, 887
- CollapsibleSpaceThreshold property (scale breaks), 490
- collation for Database Engine and Analysis Services, 68
- CollectedChartShowLegend property, 516
- CollectedStyle property
 - CollectedPie, 515
 - SingleSlice, 514
- CollectedThreshold property, 515
- CollectedThresholdUsePercent property, 515
- collections
 - ChartColor Collection Editor, 487
 - IndicatorState Collection Editor, 554
 - member selection, using IntelliSense in Expression dialog box, 284
 - syntax, 277
 - using built-in collections in expressions, 287–292
 - DataSets collection, 288
 - DataSources collection, 288
 - Fields collection, 289
 - Globals collection, 289
 - Parameters collection, 290
 - ReportItems collection, 291
 - User collection, 291
 - Variables collection, 292
- color analytical polygon maps, 575
- colors
 - BackgroundColor property, 245
 - changing color palettes for charts, 485–487
 - built-in color palettes, 485
 - custom color palettes, 486
 - color palette, chart property, 467
 - Color property (indicator state), 543
 - color rules for analytical data in maps, 595–598
 - color scale for maps, 582, 590
 - color theme for maps, 572
 - conditionally changing font color, 300
 - creating expression for color properties, 281
 - defining standards for use in reports, 148
 - empty point color, 501
 - LineColor property, 248
 - line color rules for maps, 601
 - point color rule, 599
 - polygon color rule for maps, 602
 - three color range linear gauge, 520
- Color Selector drop-down list, 246
- Color System drop-down list, 246
- column charts
 - as data bars, 477
 - sort order in Power View, 839
 - when to use, 454

- column groups
 - adjacent, in a tablix, 267
 - defining for matrix report in Report Wizard, 163
- column headers
 - pinning in place, 351
 - repeating on each page, 418
- column properties, 402–404
- columns
 - in Power View tables, 833
 - separate columns for each row group in a tablix, 263
 - single column for each row group in a tablix, 264
 - static columns in a tablix, working with, 265–267
 - adjacent columns, 266
- Command class, 894–896
- command line, installing Reporting Services from, 61
- command-line utilities, 33
- CommandText element, 865
- CommandText property, DataSets collection, 288
- Command Type DMX button (MDX query designer), 431
- Command Type MDX button (MDX query designer), 431
- Comma Separated Values format. *See* CSV format
- Common Functions category, Expression dialog box, 282
- CompareMethod.Binary, 310, 317
- CompareMethod.Text, 310, 317
- comparison operators, 283
 - in filters, 382
- Components setting, for monitoring by trace logs, 693
- concatenation operators, 283
- conditional formatting
 - applying using expressions, 302
- conditional formatting, applying using expressions, 299
- configuration and management tools, 27, 33
- configuration files
 - backing up, 690
 - updating for report server and report designer for new extension, 901
- Configuration Manager, 168. *See also* Reporting Services Configuration Manager
- configuring the report server, 669–685
 - authentication, 681–683
 - disabling an extension, 685
 - disabling report server features, 684
 - managing configuration settings
 - programmatically, 914–918
 - using Windows Powershell cmdlets, 917
 - using WMI provider, 914–917
 - managing encrypted information, 678–681
 - managing memory, 683
 - Rsreportserver.config file, 669, 670
 - updating report server properties, 670–678
 - advanced properties, 676–678
 - execution properties, 673
 - general properties, 671
 - logging properties, 674
 - security properties, 675
- Connection class, 891–894
- Connection Properties, 158
- connections to data sources
 - Analysis Services, 177
 - data processing custom extension, 889
 - defining in Report Builder, 115
 - EnableTestConnectionDetailedErrors property, 677
 - encrypted, in Rsreportserver.config file, 678
 - Hyperion Essbase, 177
 - ODBC, 176
 - Oracle, 176
 - PowerPivot Values documents on SharePoint site, 177
 - RDL elements for, 862
 - SAP NetWeaver BI, 177
 - SQL Server, 174
 - SQL Server Parallel Data Warehouse (PDW), 175
 - Teradata, 176
 - Test Connection button, 625
 - using expressions for dynamic connections, 304
- ConnectionString element, 862
- Connect To Server dialog box, default role definitions, 646
- Console.WriteLine() statements in code for debugging, 908
- Constants category, Expression dialog box, 281
- ConsumeContainerWhiteSpace property, 404
- content
 - deploying, 607–616
 - deploying a report model, 615
 - deployment from SSDT, 608
 - deployment verification, 609
 - saving report from Report Builder, 610
 - uploading reports, 611–614
 - using rs utility, 614
 - managing, 616–624
 - configuring report parameters, 621–624
 - copying a report, 620
 - creating linked report, 619

Content Manager role

- enabling personalized folders, 624
- moving content, 617–619
- using folders for organization, 616
- Content Manager role, 607
- Contributor permissions, 657
- conversion functions, 315, 333
 - LCase and UCase functions, 315
 - StrConv function, 315
- coordinate systems
 - map viewport, 586
 - types of, 586
- copy and paste, visualizations in Power View, 837
- copying reports, 620
- Cos function, 324
- Cosh function, 324
- CountDistinct function, 328
- Count function, 328
- Count property, Parameters collection, 290
- CountRows function, 328
- cover-flow visualization mode, 846
- CreateLinkedItem function, 911
- CreateLinkedReports.rss script
 - execution, 913–914
 - walkthrough, 911–913
- CreateNewFolder function, 913
- Create Power View Report button, 824
- Createtables.sql script, 696
- credentials. *See also* authentication
 - sending to a data source, 627–630
 - no credentials, 628
 - prompted credentials, 628
 - stored credentials, 628–630
 - Windows integrated security, 627
- CShort function, 334
- CSng function, 334
- CSS (Cascading Style Sheets), length units, 238
- CStr function, 334
- CSV (Comma Separated Values) format
 - data renderer, 396
 - exporting reports in, 733–735
 - for reports, 29
- currency, formatting, 242
- Current Cube pane (MDX query designer), 427
- current date and time functions, 323
- custom aggregation, 301
- CustomPaletteColors property, 487
- cylindrical projection, 587

D

- dashboards
 - creating, 718–725
 - information on, 723
 - for mobile devices, design options, 146
- Data Alert Designer, 759
 - data alert rules, 763–766
 - data alert condition removal, 765
 - localization, 765
 - multiple rules, 765
 - rule condition, 763
 - rule scope, 763
 - Email Settings, 767
 - opening, 761
 - schedule settings, 766–767
- data alerting, 759–778
 - architecture, understanding, 759–761
 - alerting service, 760
 - data alert workflow, 759–760
 - configuring, 772–775
 - RsReportServer.config file settings, 773–774
 - SharePoint configuration database settings, 774
 - creating data alerts, 761–768
 - data alert rules, 763–766
 - data feeds, 762
 - email settings, 767
 - schedule settings, 766
 - using SharePoint Report Viewer, 761–762
 - managing alerts, 770–772
 - alert status, 770–772
 - Delete command, 772
 - Edit command, 772
 - Run command, 772
 - monitoring alerting process, 775–777
 - alerting stored procedures, 776
 - performance counters, 777
 - receiving data alerts, 768–770
 - failure of alert, 770
 - successful alert, 768–770
- Data Alert Manager, 15, 760, 770
 - Delete command, 772
 - Edit command, 772
 - Run command, 772
 - viewing alerts and alert status, 770–772
- data alerts, 13
 - Data Alert Designer, 13, 41
 - Data Alert Manager, 15
 - for reports, 29

- SharePoint support for, 60
- SQL Server 2012 editions supporting, 59
- Data Analysis Expressions (DAX) language, time intelligence functions, 810
- data bars, 213, 476–480
 - adding, 476
 - configuring properties, 478–480
 - appearance, 479
 - length, 478
 - converting to full chart, 480
- Database Engines
 - choosing edition, 58
 - collation for, 68
 - configuration in SQL Server 2012
 - configuration, 69
 - grouping with, 263
 - new instance to host report server databases, 22
 - support for hosting Reporting Services database, 59
- Database Engine Services feature, 64
- database images, adding to reports, 220
- databases
 - alerting database, 760
 - checking size of Reporting Services databases, 691
 - in SharePoint integrated mode Reporting Services, 40
 - installing sample databases, 97
- Data Connections document library, SharePoint site, 94
- data considerations in report design, 145
- data-driven subscriptions, creating, 750–756
 - configuring settings, 751–757
 - native-mode report server, 751–754
 - SharePoint integrated mode, 754–756
 - creating subscription delivery table, 751
- Data element, registering custom data processing extension, 901
- data feeds, 762
- DataField element, 864
- Data Format property, 806
- data label keywords, 474
- Data Mining Extensions. *See* DMX
- Data pane (MDX query designer), 428, 430
- data processing extension, 35, 887–904
 - data processing extension deployment, 900–904
 - configuration changes, 901
 - custom extension digital signature, 901
 - file locations, 901
 - implementation, 903
 - data processing extension development, 889–900
 - assembly properties, 890
 - Command class, 894–896
 - Connection class, 891–894
 - DataReader class, 896–898
 - Parameter class, 898–899
 - Transaction class, 900
 - overview of the extension, 888–889
 - DataProvider element, 862
 - data providers, 173
 - DataReader class, 896–898
 - data regions. *See also* graphical data regions; tablix data regions
 - adding manually in Report Builder, 122
 - applying sort to all, 349
 - Data Regions menu, Insert tab of Report Builder ribbon, 113
 - filtering, 382
 - nested, missing group values in, 268
 - NoRowsMessage property, 149
 - tablix, 250–255
 - list, 254
 - matrix, 252–254
 - table, 250–252
 - using data region wizards in Report Builder, 118
 - data renderers, 396
 - data-savvy advanced users, 141
 - data security, implementing, 664–668
 - using dataset filter, 667
 - using permissions table, 665
 - using query parameter and role, 664
 - dataset fields
 - placeholders, 274
 - sorting by, 346
 - DataSetName property, 235
 - Dataset Properties dialog box
 - Add Calculated Field, 293
 - Available Values page, 449
 - configuring options or filters, 865
 - Filters page, 380, 667
 - in Report Builder, 117
 - Options page, Interpret Subtotals As Detail Rows, 439
 - Parameters, 390
 - Parameters page, new query parameter, 666
 - using for tables in reports, 224
- datasets
 - adding in Report Builder, 117
 - adding to a project, 165

Datasets category, Expression dialog box

- Analysis Services dataset fields, 435
- binding to data regions, 225
- creating Analysis Services dataset, 425–435
- creating for custom data processing extensions, 903
- creating shared dataset in Report Builder, 107
- DataSets and DataSet elements, 864
- dynamic, creating using expressions, 305
- embedded or shared, 562
- filtering, 382
- for report parts, reusing, 792
- managing shared datasets, 641
- report parameter's available values, 444
- Shared Datasets folder, 156
- shared, for power users, 141
- sorting in, 234
- SQL Server spatial query, 561
- using Report Builder's dataset designer, 108–111
- Datasets category, Expression dialog box, 282
- DataSets collection, 288
- DataSource element, 862–864
- DataSourceName element, 865
- Data Source Properties dialog box
 - Credentials menu, Use Windows Authentication, 305
 - RDL elements and, 862
- DataSourceReference element, 862
- DataSourceReference property, DataSources collection, 288
- data sources
 - adding to a project, 165
 - adding to report definition in Report Builder, 114–116
 - approving in SharePoint integrated mode, 658
 - configuring properties, 624–630
 - selecting data source for a report, 625
 - sending credentials to a data source, 627–630
 - connecting to, from Power View, 824
 - creating in Analysis Services, 426
 - data processing extensions for, 35
 - DataSources and DataSource elements in RDL, 862–864
 - Data Source Type drop-down list, 904
 - disabling, 686
 - identifying for data-driven subscriptions, 751
 - Power View, 3
 - provider type and connection, in Report Wizard, 159
 - shared, 107
 - Shared Data Sources folder, 156
 - types of, 173–179
 - updating for report model, 616
- DataSources collection, 288
- DataSource element, 862–864
- Data Sources properties page, 626
- Data Source Type property, 4
- data tier
 - in native mode architecture, 30
 - in SharePoint integrated mode, 40
- data tools, SQL Server, 16
- Data Type property, setting for report parameters, 369
- data types
 - conversion functions for, 333
 - conversions to strings, formatting functions for, 312
 - geography, 558
 - geometry, 558
 - variant data type for Globals collection members, 290
- data visualization, 4–7
 - Data Visualizations menu, Insert tab of Report Builder ribbon, 113
- DateAdd function, 319
- DateDiff function, 320
- DateFormat values, 313
- DateInterval enumeration, 319
- DatePart function, 321
- dates and time
 - creating date table in tabular model, 810
 - Date/Time report parameter type, 369
 - using, 371
 - FormatDateTime function, 313
 - functions for, 319–323
 - current date and time functions, 323
 - date calculation functions, 319
 - date conversion functions, 322
 - date manipulation functions, 321
 - referencing consistent time value, 301
 - setting filter condition based on date in Power View, 851
 - using calendar control to get data for report parameter, 448, 449
- DateSerial function, 322
- DateString function, 323
- DateValue function, 322
- DAX (Data Analysis Expressions) language, time intelligence functions, 810
- Day function, 321
- DDB function, 332

- debugging
 - administrative task scripts written in Visual Basic, 908
 - using Debug command in Visual Studio, 943
- DebugLocal project configuration, 168
- Debug project configuration, 168
- Default Field Set dialog box, 821
- Default SMTP Virtual Server Properties dialog box, 758
- DefaultTraceSwitch setting, 692
- Default Value property, 622
 - SharePoint integrated mode, 623
- default values for report parameters, 146, 375–377
 - Get Values From A Query, 376
 - No Default Value, 375
 - Specify Values, 375
- DeferVariableEvaluation property, 303
- Delete Layer button, Map Layers pane, 592
- delivery extensions, 35
 - Reporting Services runtime engine, 43
- delivery providers for subscriptions, 743–749
 - email delivery, 743–745
 - identifying for data-driven subscriptions, 752, 756
 - Null Delivery Provider, 748
 - SharePoint document library, 748
 - Windows file share delivery, 746–748
- Deploy command, 167
- deployment, 45–54. *See also* native-mode deployment; SharePoint integrated-mode distribution
 - custom assembly, 885
 - data processing custom extension, 900–904
 - deploying reports to server, 607–642
 - configuring data source properties, 624–630
 - configuring report processing options, 630–636
 - deploying content, 607–616
 - managing change in reporting life cycle, 642
 - managing content, 616–624
 - working with snapshots, 636–642
 - distributed, 47–50
 - Internet, 52–54
 - scale-out, 50–52
 - scripting deployment of reports, 906–910
 - single-server, 45–47
- DeployReport.rss script
 - execution, 909
 - walkthrough, 906–909
- Deploy Reports command, 167

device information, using to change page properties

- descending sort, applying in text boxes, 346
- Description element, 861
- descriptions, adding to reports, 132
- design components, programming. *See* report design components, programming
- design environments, 99–105
 - choosing a report designer, 103–105
 - comparison of report design environments, 99–102
 - developing a report with Report Builder, 105–130
 - Power View, 825–832
 - field list, 830
 - layout section, 831
 - ribbon, 827–830
 - views pane, 827
 - view workspace, 826
- Designer element, registering custom data
 - processing extension, 902
- designing reports. *See also* design environments; layout
 - planning your design, 139–150
 - developing standards, 148–149
 - knowing your audience, 139–143
 - reviewing report options, 143–147
- Design Mode button (MDX query designer), 432
- Design tab (Power View ribbon), 829
 - Visualization group, 836
- detail fields
 - defining for matrix report in Report Wizard, 163
 - defining for tabular report in Report Wizard, 161
- detail lists. *See also* llists
 - transforming to grouped list in a tablix, 261
- detail rows
 - adding to table in a tablix, 251
 - aggregate values in, 438–440
 - sorting, 347
- Details group (category group), 462
- details group, in list structure in a tablix, 254
- Details View, Search Results page in, 709
- development (reports), 28
 - programmatic interface for report development, 32
- device information settings, 946
- device information, using to change page properties, 406–408
 - device information tags, 407

dialog boxes

- dialog boxes. *See also* dialog box names listed throughout
 - opening Expression dialog from, 278
 - Page Break Options section, 416
 - digital signatures
 - custom assembly, 884
 - custom data processing extension, 901
 - dimension folders, 428
 - directional indicators, 539
 - Direction property, setting for text, 244
 - directories. *See also* files
 - creating separate solution directory for new project, 153
 - Disabled property (page breaks), 415
 - disabling report server features, 684
 - disk activity (in single-server deployment), 47
 - disk space
 - Disk Space Requirements page, SQL Server 2012 Setup, 67
 - requirements for Reporting Services installation, 55
 - requirements for single-server deployment, 46
 - Display Header (or Footer) For This Page, 410
 - display mode, selecting in Power View, 852–854
 - Display property, 623
 - Display Text property, 623
 - distance scale, 582
 - setting properties, 591
 - distended price oscillator formula, 507
 - distributed deployment, 47–50
 - native-mode distributed deployment, 47
 - SharePoint integrated-mode distribution, 48
 - distributed workload in scale-out deployment, 52
 - distribution options for map colors, 596
 - DMX (Data Mining Extensions)
 - Command Type DMX button (MDX query designer), 431
 - query designer, 426
 - DOC files, 16
 - Documentation Components feature, 65
 - document libraries (SharePoint)
 - delivery provider for subscriptions, 748
 - opening a report, 135
 - opening Subscriptions page, 742
 - reviewing processing options in, 133
 - saving Power View reports to, 855
 - searching for reports, 714
 - securing, 655
 - Document Library Settings page, Permissions And Management section, 655
 - DocumentMapLabel property, 357
 - for lines, 215
 - Document Map pane, 711
 - document maps
 - defining, 356–359
 - creating a document map, 356
 - customizing a document map, 357
 - rendering a document map, 359
 - showing and hiding a document map, 358
 - using to navigate online reports, 711
 - DOCX files, 17, 728
 - DomainScope property (for nested data region group), 268
 - doughnut charts, 455
 - drilldowns
 - configuring drillthrough report parameter value, 388
 - configuring visibility, 353
 - Enable Drilldown option in Report Wizard, 162
 - Dtexec utility, 697
 - dynamic connections, using expressions for, 304
- ## E
- Eckert1 and Eckert3 projection, 588
 - Edit Permissions dialog box, 649
 - EditSessionCacheLimit property, 676
 - EditSessionTimeout property, 676
 - email
 - data alert settings, 767
 - delivery of reports, 33
 - email delivery extension, 35
 - delivery provider for subscriptions, 140, 743–745
 - report delivery options, 744
 - notification of alert failure, 770
 - notification of successful data alert, 768–770
 - recipients' list for web service application, 920
 - settings for native mode Reporting Services, 80
 - embedded datasets, 562
 - map data, 564, 595
 - embedded images
 - adding to reports, 217
 - Value setting of BackgroundImage property, 246
 - embedded reports for portals or custom applications, 27, 30
 - empty points, 500–503
 - adding marker to series, 501
 - color for, 501
 - zero value, 502

- EmptyPointValue property, 502
- empty strings and NULL values, defining reporting
 - standards for handling, 149
- Enabled property (scale breaks), 490
- Enable Drilldown option, 162
- EnableRemoteErrors property, 677
- EnableTestConnectionDetailedErrors property, 677
- encrypted information, managing, 678–681
 - backup and recovery of encryption keys, 688–690
 - using Rconfig utility, 679
 - unattended execution account information, 681
- encryption keys
 - command-line utilities for management of, 34
 - configuring for native mode Reporting Services, 81
 - restoring in SharePoint integrated-mode report server migration, 24
- Encrypt property in SQL Azure connection string, 175
- envelopes formula, 507
- Environmental Systems Research Institute shapefiles. *See* ESRI shapefiles
- equality and inequality operators (=, <>, >, >=, <, <=), 383
- equiarectangular projection, 587
- ErrorLevel property, 171
- Error List window (Visual Studio), 156
- errors
 - EnableRemoteErrors property, 677
 - report server project error levels, 171
 - syntax errors in Expression dialog box, 286
- ESRI (Environmental Systems Research Institute) shapefiles, 559
 - selecting as spatial data source, 561
- Excel
 - Excel 2003 renderer, 17
 - Excel 2010 renderer, 16, 29
 - exporting reports into, 725–728
 - Microsoft Power-Pivot Add-in for Excel, 27
 - page headers and footers, 413
 - page names appearing as sheet names, 423
 - rendering reports to Excel 2007-2010
 - render format name EXCELOPENXML, 398
 - Reporting Services support for, 16
 - soft page-break renderer, 396
- EXCEL and WORD render formats, 398
- ExcludedRenderFormats element, 685
- Exclude From Project command, 166–167
- Execute Query button (MDX query designer), 432
- execution
 - date and time for reports in page header or footer, 147
 - executing reports on demand, 630–632
 - execution properties, Server Properties dialog box, 673
 - suspending report execution, 686
- execution account for native mode Reporting Services, 81
- ExecutionInfo object, 945
- execution logging, 696
 - for alerting, 776
 - using ExecutionLog3 view, 698–699
- ExecutionLogLevel property, 677
- Exp function, 325
- exponent functions, 325
- exponential moving average formula, 506
- exporting reports, 725–738
 - for data exchange, 733–738
 - ATOM format, 736–738
 - CSV format, 733–735
 - XML format, 735
 - Power View reports, to PowerPoint, 855
 - using hard page-break renderers, 730–733
 - PDF format, 731
 - TIFF format, 732
 - using soft page-break renderers, 725–730
 - Excel format, 725–728
 - MHTML format, 729
 - Word format, 728–729
- Expression dialog box, 274, 278–287
 - accessing field's extended properties, 436
 - creating dynamic expression to show as tooltip, 355
 - creating expression to use for sorting, 349
 - exploring Category tree, 280–284
 - help with functions, 307
 - opening, 278–280
 - using IntelliSense, 284
- expressions, 273–306
 - building without using Expression dialog box, 280
 - commonly used functions in, examples, 307
 - complex, 277
 - field expression, 125
 - in tablix cells, 256
 - report parameter, 379

extended field properties

- simple, 273–276
 - aggregate function placeholder, 275
 - built-in field placeholder, 275
 - dataset field placeholder, 274
 - parameter value placeholder, 276
 - placeholders for, 273
- SortExpression property for a tablix, 262
- sorting by, 349
- using built-in collections, 287–292
 - DataSets collection, 288
 - DataSources collection, 288
 - Fields collection, 289
 - Globals collection, 289
 - Parameters collection, 290
 - ReportItems collection, 291
 - User collection, 291
 - Variables collection, 292
- using Expression dialog box, 278–287
- using for sorting in matrix, 233
- using in page header or footer, 411–414
- working with, 292–306
 - adding calculations to reports, 292–299
 - applying conditional formatting, 299–300
 - using for dynamic connections and datasets, 304–306
 - using with variables, 300–301
- extended field properties, 289, 436
- extensions. *See also* data processing extension
 - creating custom data processing extension, 887–904
 - disabling, 685
- external functions, using, 343
- external images, adding to reports, 220
- external stakeholder reporting, management of, 143

F

- Fahey projection, 588
- failover cluster, report server database on existing
 - SQL Server failover cluster, 51
- features
 - default location for installation of SQL Server 2012 features, 65
 - disabling report server features, 684
 - selecting in SQL Server 2012 Setup, 63–65
- field properties, extended, 436
- field references (in tablix cells), 256
- fields
 - adding to matrix, 232
 - adding to table in Report Builder, 123–125
 - using Field List icon, 124
 - adding to tables, 225
 - adding to Values section, Chart Data pane, 458
 - built-in field placeholder, 275
 - built-in fields, using for calculations, 298
 - Field element, 864
 - field list in Power View, 830
 - Fields category, Expression dialog box, 281
 - Fields collection, 289
 - Fields element, 864
 - in layout section in Power View, 831
- File menu save options (for Power View reports), 855
- files
 - differences in native mode and SharePoint integrated mode, 909
 - file locations for deploying custom extension assembly, 901
 - report server project file types, 157
- File Share Data Processing Extension Sample, 887
- file share delivery extension, 36
- FileSizeLimitMb setting, 692
- FILESTREAM, enabling access in Database Engine configuration, 69
- file sync feature, 614, 790
- fill
 - Back Fill page, Gauge Properties dialog box, 533
 - Fill page, Scale Properties dialog box, 530
 - Fill page, Series Properties dialog box, 461
 - setting properties for text, 245
- Filter element, 865
- Filter function, 310
- Filter pane (MDX query designer), 428, 430
 - creating report and query parameters, 442
- filters, 379–386
 - applying OR logic to multiple filters, 386
 - available MDX filter operators, 430
 - creating, 380–382
 - expression, 381
 - parts, Expression, Operator, and Value, 380
 - selecting filter operator, 381
 - Value box, 382
 - filtering a data region, 382
 - filtering a dataset, 382
 - filtering a group, 382
 - filtering data in Power View visualizations, 843–852
 - highlighted values, 844
 - slicers, 844

- tiles, 845–848
 - view filter, 848–854
- filtering queries in Report Builder dataset designer, 110
- Filters page, Category Group Properties dialog box, 464
- Filters page, map layer dialog boxes, 594
- understanding filter operators, 383–386
- using dataset filter to secure data, 667
- using report parameters as filters, 382
- Filters Area (in Power View), 848
- Filters element, 865
- Filters page, 380
- financial functions, 332
- financial stock data, calculations for, 505
- Firefox 7, support for Power View, 823
- FirstDayOfWeek values, 320
- First function, 236, 328
- Fit To Window display mode (Power View), 852
- FixedData property, applying to headers, 351
- Fix function, 325
- Floor function, 325
- folders
 - adding role assignments to, 651
 - as targets for report server project deployments, 608
 - CreateNewFolder function, 913
 - differences in path names, native mode and SharePoint integrated mode, 909
 - enabling personalized folders, 624
 - Reporting Services project in Solution Explorer, 156
 - securing for SharePoint integrated-mode report servers, 657
 - securing on native mode report server, 653
 - Universal Naming Convention (UNC), 746
 - using to organize content, 616
- fonts
 - conditionally changing font color, 300
 - defining reporting standards for, 148
 - Font commands on Home tab of Report Builder ribbon, 112
 - for axis labels, 472
 - Label Font/Font page, Scale Properties dialog box, 528
 - reports rendered in PDF format, 731
 - text properties for, 240
- FontWeight property, 341
- footers. *See* headers and footers
- Format property, 437
 - setting for text, 242
- FORMAT_STRING property, 435
- format strings, 128
- FormattedValue extended property, 436, 439
- FORMATTED_VALUE property, 436
- formatting
 - applying conditional formatting, 299
 - reports in Report Builder, 127–129
 - vales in tabular models, 806
- formatting functions, 312
 - FormatCurrency, FormatNumber, and FormatPercent functions, 312
 - FormatDateTime function, 313
 - Format function, 312
- Forms authentication, 644
- forms, POST method, 933
- formulas, selecting for calculated series in charts, 506
- frames, pages in Gauge Properties dialog box, 533
- FROM clause, MDX queries, subselect statement in, 447
- Full Control permissions, 648
- Full Screen Mode (display mode in Power View), 853
- functions, 307–344
 - adding to class definitions, 882
 - aggregate function placeholders, 275
 - Common Functions category, Expression dialog box, 282
 - help with, 307–308
 - function description and syntax, 307
 - tooltips, 308
 - tooltips for, in Expression dialog box, 285
 - using aggregate functions, 328–331
 - RunningValue function, 330
 - scope argument, 329
 - using conversion functions, 333
 - using date and time functions, 319–323
 - current date and time functions, 323
 - date calculation functions, 319
 - date conversion functions, 322
 - date manipulation functions, 321
 - using financial functions, 332
 - using inspection functions, 326
 - using math functions, 323–326
 - exponent functions, 325
 - other, BigMul and Rnd functions, 326
 - rounding functions, 325
 - sign functions, 324
 - trigonometry functions, 323

funnel charts

- using miscellaneous functions, 334–340
 - InScope function, 335
 - lookup functions, 335–339
 - row functions, 339
 - using program flow functions, 327
 - using text functions, 308–319
 - array functions, 313–315
 - character functions, 308
 - cleanup functions, 318
 - conversion functions, 315
 - formatting functions, 312
 - search functions, 309–312
 - string evaluation functions, 317
 - string manipulation functions, 316
 - working with hierarchical data, 340–343
 - writing custom functions to embed in reports, 877–881
 - custom function call, 880–881
 - generic function returning color or KPI, 879
- funnel charts, 455
- FV function, 332
- ## G
- Gauge Data pane, 520
 - indicator value and properties, 540
- gauge element, 521, 531–534
 - common gauge properties, 533
 - linear gauge properties, 532
 - radial gauge properties, 532
- Gauge Orientation Options, 532
- Gauge Panel Properties dialog box, 535
- Gauge Properties dialog box
 - Auto-Fit All Gauges In Panel, 537
 - pages of gauge properties, 533
- gauges, 213, 517–538
 - adding to reports, 517–520
 - creating a gauge, 518–520
 - gauge types, 517
 - comparison to indicators, 539
 - gauge and indicator grouping, 549
 - grouping, 536–538
 - multiple gauges in gauge panel, 536
 - repeating gauges, 537
 - working with gauge elements, 520–536
 - gauge element, 531–534
 - gauge label, 534–535
 - gauge panel, 535
 - overview of gauge elements, 521
 - pointer, 522–526
 - range, 530–531
 - scale, 526–530- Geographic (Longitude, Latitude) coordinate system, 586
- geography data type, 558
- geometry data type, 558
- GetChar function, 309, 310
- Global Administrative Areas, ESRI shapefiles, 561
- Globals collection, 289
 - built-in fields, 275
- goals, comparing to values. *See* gauges
- Go To Bookmark action, 363
- Go To Report action, 362
 - passing parameter as part of, 388
- Go To URL action, 365
 - forcing to render in modal browser window, 366
 - forcing to render in new browser tab, 366
- Grant Permissions dialog box, 652, 656
- graphical data regions, 212
 - chart, 212
 - data bar, 213
 - gauge, 213
 - indicator, 213
 - map, 213
 - sparkline, 213
- graphics file formats supported by Windows GDI+, 732
- grouped lists, 144
 - detail list to grouped list transformation in a tablix, 261
- group headers and footers, standards for, 149
- grouping
 - and scope argument of aggregate functions, 330
 - detail rows with, sorting, 347
 - gauges, 536–538
 - in a matrix, 232
 - indicators, 548–550
 - adjacent indicators, 548
 - gauge and indicator, 549
 - in tablix data regions, 226–229
 - in the database or in the report, 263
 - managing in tabular model in Power View, 811–816
 - recursive hierarchy grouping, 269
- Groupings pane
 - Advanced Mode, Row Groups in, 419
 - pinning column header to top of screen, 351
- Group Properties dialog box, 229, 233, 261
 - Filters page, 380

- Page Breaks page, 417
- selecting group for document map, 356
- groups
 - adding in Report Builder, 126
 - adding page breaks by, 417
 - filtering, 382
 - group properties in a tablix, 268–272
 - missing group values in nested data regions, 268
 - recursive hierarchy groups, 269–272
 - SharePoint integrated-mode servers, 645
 - and permission levels, 648–650
 - sorting, 348
 - applying sort to all groups, 349
 - working with tablix groups, 263–271
 - adjacent groups, 267
 - row groups, 263
- GroupsBeforeRowHeaders property, 262
- group variables, 301

H

- HammerAitoff projection, 588
- HangingIndent property, 241
- hard page-break renderers, 397
 - preservation of white space in report body, 405
 - support for overlapping report items, 400
 - using to export reports, 730–733
 - PDF format, 731
 - TIFF format, 732
- Has Default property, 622
- headers and footers
 - adding footer row to table in a tablix, 252
 - adding header row to table in a tablix, 251
 - defining standards for, 148
 - fixed headers, using, 351
 - headers in a matrix in a tablix, 252
 - information included in page header or footer, 147
 - in list structure in a tablix, 255
 - lighter shade for text in, 148
 - menu on Insert tab, Report Builder ribbon, 114
 - page headers and footers, 401
 - repeating column headers on each page, 418–420
 - using tablix footer to add totals to matrix, 253
 - working with page header and footer, 409–414
 - adding header or footer, 409
 - configuring properties, 409–410
 - removing header or footer, 414
 - using expressions in, 411–414
- Height element, 866
- Hex function, 334
- Hidden option for report parameter visibility, 370
- Hide property, 622
- hierarchical data, working with, 340–343
 - dimension members of hierarchies, 428
 - Level function, 341
 - Recursive keyword, 342
 - using external functions, 343
- highlighting
 - highlighted values in Power View, 9
 - using to filter data in Power View, 844
- HistoryID property, 945
- history properties, Server Properties dialog box, 674
- Home ribbon (Power View), 827
- Home tab of Report Builder ribbon, 112
- Horizontal Axis Properties dialog box, 469, 482
 - interlacing, 499
 - Interval value, 496
 - scalar axis, 494
- horizontal/vertical linear gauge, 520
- Hour function, 321
- HTML
 - InteractiveSize properties, 402
 - MHTML rendering format and, 729
 - rendering behavior of reports in, changing, 730
 - reports in, 26
 - soft page-break renderer, 396
 - tags, embedded, using for navigation, 359–361
- HTML Viewer, 136, 709–711, 928
 - commands for URL access, 932–935
 - functions for managing report view, 710
 - using Print button to print reports, 712
 - using to interact with reports, 709
 - visibility of items in, properties for, 942
- HTTP listener, 37
- HTTP log, adding, 693
- HTTP status codes, 694
- Hyperion Essbase, 177

I

- Icon property (indicator state), 543
- icons, use as indicators, 550
- IDataReader interface, 896
- IDbCommand interface, 894–896
- IDbCommandRewriter interface, 288

IDbConnectionExtension interface

- IDbConnectionExtension interface, 891–894
- IDbConnection interface, 891
- if function, 327
 - creating expression for conditional formatting, 299
- IIS (Internet Information Services), 37
 - SMTP server implemented with, 758
- Image Properties dialog box, specifying and configuring image in report, 217
- images, 211
 - adding to reports, 217–221
 - database images, 220
 - embedded images, 217
 - external images, 220
 - manually resizing images, 219
 - adding to tabular model in Power View, 816–818
 - using binary data, 816–817
 - using external images, 817
 - background for report items, 245
 - BackgroundImage property, 246
 - default image for each table in tabular model, 818–821
 - using customized images for indicators, 550
- impersonation, 629
- Import button (MDX query designer), 431
- Import Reports command, 166
- Imports statement, 919
- IncludeZero property (scale breaks), 490
- indentation
 - padding versus, for text, 242
 - text properties for, 241
- Indicator Properties dialog box, 541
 - General page, 541
 - Location and Size properties for indicators, 553
 - static size for indicators, 553
 - Value And States page, 542
 - customized image as indicator icon, 550
 - Synchronization Scope, 547
- indicators, 213, 539–554
 - adding indicators to reports, 539–540
 - creating an indicator, 540
 - overview of indicator types, 539
 - configuring an indicator, 540–550
 - assigning value, 541
 - defining properties, 541–548
 - grouping indicators, 548–550
 - customizing indicators, 550–554
 - adding labels, 551–553
 - adjusting location and size, 553
 - dynamic sizing, 553
 - using custom images for icons, 550
- IndicatorState Collection Editor, 554
- indicator states, 542–546
 - adding another, 545
 - customized images for, 550
 - properties defined for, 543
- Indicator States property, 542
- information as a service, report design for, 143
- InitialPageName property, 421
- In operator, 381, 385
- InScope function, 335
- Insert Row command
 - options for positioning new row in tables, 251
 - using in a matrix, 253
- Insert tab of Report Builder ribbon, 113
- inspection functions, 326
- installation configuration rules (SQL Server 2012 Setup), 71
- installing Reporting Services, 55–98
 - configuring native mode Reporting Services, 72–83
 - database, 77
 - email settings, 80
 - encryption keys, 81
 - execution account, 81
 - Report Manager URL, 78
 - service account, 73
 - web service URL, 73–77
 - configuring partial integration with SharePoint, 83
 - configuring SharePoint integrated mode, 84–96
 - hardware and software requirements, 55–60
 - choosing a Database Engine edition, 58
 - review of requirements and supported operating systems, 58
 - selecting an operating system, 55–58
 - SharePoint integrated-mode deployment, 59
- installing Report Builder, 96–97
- installing sample databases, 97–98
- performing installation, 61–72
 - installing prerequisites, 61–63
 - installing SQL Server 2012, 63–72
 - planning accounts for reporting services, 60–61
- instance configuration (SQL Server 2012 Setup), 66
 - directories for default and named instances, 67
- instance methods, 886
- instance names for report server, 916
- InStr and InStrRev functions, 309, 310
- InStrRev function, 317

- IntegratedSecurity element, 862
- Integration Services (in SharePoint integrated-mode distribution), 50
- integration with SharePoint, 13
- IntelliSense (in Expression dialog box), 284
- interactive reports, 28
- interactive scatter chart (Power View), 7
- InteractiveSize properties, 402
- interactivity, adding, 345–366
 - interacting with report layout, 345–355
 - configuring visibility, 352–354
 - sorting, 345–351
 - using fixed headers, 351
 - navigation features, 356–366
 - defining a document map, 356–359
 - working with report actions, 361–366
- interlacing, 499
- Internal option, report parameter visibility, 371
- Internet deployment, 52–54
 - isolated, dedicated report server for Internet access, 53
- Internet Explorer, support for Power View, 823
- InterpretSubtotalsAsDetailRows option, 439
- InterpretSubtotalsAsDetails element, 865
- intervals
 - alerting interval defaults, 773
 - DateInterval enumeration, 319
 - interval functions, 321
 - of horizontal and vertical axes, 495–500
 - interlacing, 499
 - interval properties, 496–499
 - snapping interval for pointer, 526
- Int function, 325
- Ipmt function, 332
- IsAlertingService flag, 773
- IsArray function, 326
- IsDate function, 326
- IsMissing property, Fields collection, 289
- IsMultiValue property, Parameters collection, 290
- IsNothing function, 326
- IsNumeric function, 326
- item-level security, 653–664
 - approving data sources in SharePoint integrated mode, 658
 - assigning a system role, 660
 - securing an item, 659
 - securing a report model, 662
 - securing folders and document libraries, 653–657
 - native mode folders, 653–654

- SharePoint integrated mode document library, 655
- SharePoint integrated mode folders, 657
- items. *See also* report items
 - adding existing item to project, 165
 - adding new item to project, 165
 - removing from project, 166

J

- JavaScript commands forcing rendering of Go To URL action, 366
- Join function, 314
 - concatenating parameter values for multivalue parameter, 379

K

- KeepTogether element, 866
- KeepTogether property, 416
- Keep Unique Rows property, 813–815
- KeepWithGroup property, 420
- Kerberos, 37, 644
- keyboards, On-Screen Keyboard, 318
- key performance indicators. *See* indicators; KPIs
- KPIs (key performance indicators), 428. *See also* indicators
 - displaying with gauges, 517

L

- Label Properties dialog box
 - gauge labels, 534
 - indicator labels, 551
- labels
 - adding to indicators, 551–553
 - axis, 470
 - axis label fonts, 472
 - configuring for map parallels and meridians, 585
 - default label for each table in tabular model, 818–821
 - DocumentMapLabel property, 357
 - for group values in lists, 236
 - for tablix cell's contents, 257
 - gauge label, 534–535
 - including in matrix to display repeating data, 253
 - Label Font/Font page, Scale Properties dialog box, 528

Language-Integrated Query (LINQ) to XML

- Label property, Parameters collection, 291
- Labels page, Scale Properties dialog box, 528
 - series labels in charts, 473–475
- Language-Integrated Query (LINQ) to XML, 871
- Language member, User collection, 291
- Language property, 244
- Last function, 236, 328
- Latin1_General collation, 68
- latitude and longitude
 - Geographic (Longitude, Latitude) coordinate system, 586
 - showing parallels and meridians, 585
- layers, map. *See* maps
- layer type selection, Map Wizard, 563
- layout
 - column, bar, and line chart layout section in Power View, 838
 - decisions on, 143
 - designing report layout, 209–248
 - adding general items to reports, 213–223
 - report items, 209–213
 - using properties for appearance and behavior, 237–248
 - working with data regions, 224–237
 - interacting with report layout, 345–355
 - Layout menu, Home tab of Report Builder ribbon, 112
 - Layout page, Scale Properties dialog box, 527
 - layout section for cards in Power View, 843
 - layout section in Power View, 831
 - Layout tab, Power View ribbon, 829
 - managing page layout, 395–424
 - adjusting report size, 400–408
 - configuring page breaks, 414–423
 - page headers and footers, 409–414
 - understanding rendering, 395–400
 - matrix layout section in Power View, 836
 - scatter chart layout section in Power View, 840
 - table layout section in Power View, 834
- LCase and UCase functions, 315
- Left and LSet functions, 316
- LeftIndent property, 241
- Legend Properties dialog box, 475, 589
 - additional pages for setting legend properties, 476
- legends, 467
 - adjusting for maps, 577
 - CollectedChartShowLegend property, 516
 - formatting in charts, 475
 - Legend page, Series Properties dialog box, 460
 - map, 582, 589
 - color rules, 598
 - text format options, 598
- Len function, 317
- length units (CSS), 238
- Level function, 341
- licensing
 - license terms for SQL Server 2012 installation, 63
 - servers in distributed deployment, 47
- Like operator, 383
- linear data in charts, 454
- Linear Gauge Properties dialog box, 533
- linear gauges, 517
 - linear gauge properties, 532
 - types of, 520
- Linear Pointer Properties dialog box, 523
- Linear Scale Properties dialog box, 526
- Linear Scale Range Properties dialog box, 530
- line charts, 454
- LineColor property, 248
- line data maps, 568
 - configuring line properties, 601–602
 - line analytical maps, 575
 - Line Color Rule command, 595
 - line maps without analytical data, 574
 - Line Properties command, 594
 - Map Line Layer Properties dialog box, 593
- lines, 210, 555
 - adding to reports, 215
 - axis line, line style, 473
 - configuring for parallels and meridians, 586
 - setting line properties, 248
 - use in mapping, 557
- LineStyle property, 248
- LineWidth property, 248
- linked reports
 - creating, 619
 - scripting creation of, 911–914
 - using for data security, 664
- linking to reports with URL access, 927–938
 - using URL access parameters, 931–938
 - HTML Viewer commands, 932
 - Report Server commands, 936
 - Report Viewer commands, 935
 - viewing a report, 927–931
 - URL access on native-mode report server, 927–929
 - URL access on SharePoint integrated-mode report server, 929–931
- links in online reports, 147

- LINQ (Language-Integrated Query) to XML, 871
- ListLevel property, 248
- lists, 212
 - adding to reports, 234–237
 - detail list to grouped list transformation in a tablix, 261
 - grouped, 144
 - providing list of values for user input into parameters, 146
 - setting properties for, 248
 - tablix using list structure, 254
 - text properties for, 240
- ListStyle property, 248
- load balancing (in report server scale-out deployment), 51
- localhost as server name, 670
- localization
 - data alert rules, 765
 - setting locale properties, 243
 - text properties for, 241
- local mode reporting, configuring SharePoint for, 84
- location
 - customizing for indicators, 553
 - Location field, New Project dialog box, 153
- Location property
 - setting for map legend, 590
 - setting for report items, 237
- Log and Log10 functions, 325
- logarithmic linear gauge, 520
- logarithmic scale, 491
- logging
 - adding HTTP log, 693
 - execution logging, 696–698
 - for alerting, 776
 - using ExecutionLog3 view, 698
 - logging properties, 674
 - ExecutionLogLevel property, 677
 - monitoring Windows application event log, 691
 - SharePoint diagnostic logging, 694–696
 - using trace logs to monitor report server, 691–693
 - Windows application even log and Reporting Services log files, 690
- logical/bitwise operators, 283
- logo in reports, 148
- lookup functions, 335–339
 - Lookup function, 335
 - LookupSet function, 338
 - MultiLookup function, 336
- LSet function, 316
- LTrim function, 319

M

- MACD (moving average convergence/divergence), 505
 - formula for, 507
- Machine.config file, 19
- major and minor tick marks
 - in Scale Properties dialog box, 528
 - on chart axis, 472
 - on gauge scale, 521
- managed reports, 27
- Manage Lists permission, 658
- Management Tools - Complete feature, 65
- Manage Parameters page, 623
- Manage Processing Options page, 640
- managing reports, 130–134
 - publishing a report, 131
 - reviewing processing options, 132–134
- managing the report server, 685–690. *See also* report server management, programming
 - backup and recovery, 687–690
 - canceling jobs, 685
 - suspending report execution, 686
- Map Color Rules Properties dialog box, 595
 - Distribution page, 596
 - Legend page, 598
 - Polygon Color Rule, 602
- Map Color Scale Properties dialog box, 591
- Map Distance Scale Properties dialog box, 591
- Map Gallery, 559
 - customizing, 560
- Map Layer Properties dialog box, Filters page, 380
- Map Layer Size Rules Properties dialog box, point size rule, 599
- Map Layers pane, 591–593
 - adjusting center point and zoom level, 583
 - color rules, 595
 - toolbar, buttons on, 592
- Map Layer Width Rules Properties dialog box, line width, 602
- Map Line Layer Properties dialog box, 593
- Map Line Properties dialog box, 601
 - Line Width Rule, 602
- Map Marker Type Rules Properties dialog box, marker type rule for point map, 600
- mapping data, 555–578
 - finalizing the map, 576–577
 - map preview, 576
 - simple adjustments, 577

Map Point Layer Properties dialog box

- understanding spatial data, 555–558
- using Map Wizard, 558–576
- Map Point Layer Properties dialog box, 593
- Map Point Properties dialog box, marker type and size, 599
- Map Polygon Layer Properties dialog box, 593
- Map Polygon Properties dialog box, 602
- maps, 213, 579–604
 - configuring map elements, 579–591
 - common elements, 581
 - map element property pages and Map Wizard settings, 579–581
 - Map Properties, 582
 - viewport, 582–588
 - defining a document map, 356–359
 - inserting custom points, 603
 - understanding order or precedence, 604
 - working with layers, 591–603
 - color rules, 595–598
 - common spatial element properties, 594–595
 - layer properties, 593–594
 - line maps, 601–602
 - Map Layers pane, 591–593
 - point maps, 599–601
 - polygon maps, 602
 - tile layer maps, 603
- Map Tile Layer Properties dialog box, 593
- Map Title Properties dialog box, 589
- Map Viewport Properties dialog box
 - Center and Zoom page, 583
 - Optimization page, 588
 - options for working with center point and zoom, 584
 - viewport coordinate system, projection, and boundaries, 586
- Map Wizard, 558–576
 - adding analytical data set, 571
 - choosing map visualization, 566–570
 - line data maps, 568
 - point data maps, 566–568
 - polygon data maps, 569
 - choosing spatial data and map view
 - options, 562–566
 - Bing Maps layer, 565
 - center point, 563
 - embedded map data, 564
 - map resolution, 564
 - spatial field and layer type, 563
 - coordinate system for viewport, 586
 - in Report Builder, 122
 - map element property pages corresponding to settings, 579–581
 - map layers, 591
 - selecting spatial data source, 559–562
 - ESRI shapefiles, 561
 - Map Gallery, 559
 - spatial queries, 561
 - setting theme and data visualization options, 572
 - analytical marker maps, 574
 - basic marker maps, 573
 - basic polygon maps, 575
 - bubble marker maps, 573
 - bubble polygon maps, 575
 - color analytical polygon maps, 575
 - line analytical maps, 575
 - line maps without analytical data, 574
- margins
 - Margins properties, 402
 - overriding PDF page margin sizes at runtime, 406
 - setting device information in URL access request, 408
 - report properties for, 401
 - standards for, 149
- Mark As Date Table dialog box, 810
- markers
 - adding to series, 501
 - bubbles display in chart, 504
 - marker type rule for data point in map layer, 600
 - selecting type and size for point data maps, 599
- Markers page, Series Properties dialog box, 460
- math functions, 323–326
 - exponent functions, 325
 - other, BigMul and Rnd functions, 326
 - rounding functions, 325
 - sign functions, 324
 - System.Math, 343
 - trigonometry functions, 323
- matrix
 - combining with a table, 250
 - deciding when to use, 144
 - groups before row header property, 262
 - in Power View, 835
 - matrix layout section, 836
 - row and column groups, 835
 - layout in a tablix, 252–255
 - transforming table to, in a matrix, 259–260
 - transforming to a table in a tablix, 260
- matrix data region, 212
 - adding to a report, 231

- matrix format
 - choosing in Report Wizard, 160
 - matrix reports in Report Wizard, 163
- Max function, 328
- MaxNumberOfBreaks property (scale breaks), 490
- MDX injection attack, guarding against, 446
- MDX (Multidimensional Expression) language, 425
 - using graphical query designer, 426–435
 - creating query and report parameters, 442
 - panes for constructing a query, 427
- mean formula, 506
- measurement units (for Location property), 238
- measures
 - in Analysis Services, 428
 - measures only limitation on columns axis of MDX query, 433
- median formula, 506
- members
 - of a collection, referencing, 277
 - selecting, using IntelliSense in Expression dialog box, 284
- memory
 - managing for report server, 683
 - requirements for single-server deployment, 46
 - required by Analysis Services and Integration Services, 50
 - requirements for Reporting Services installation, 55
- memory management, 38
- Mercator projection, 587
- merging cells in a tablix, 258
- meridians and parallels
 - adding to maps, 585
 - configuring properties, 585
- Metadata pane (MDX query designer), 427, 428–429
- meter radial gauge, 519
- Me.Value, 300
- MHTML format, 396
 - exporting reports in, 729
- Microsoft BI Semantic Model For Power View, 4
- Microsoft Excel. *See* Excel
- Microsoft Office Compatibility Pack, 17
- Microsoft OLE DB Provider for Analysis Services 10.0, 426
- Microsoft PowerPivot Add-in for Excel, 27
- Microsoft Reporting Services Add-in for SharePoint Technologies, 60
- Microsoft.ReportingServices.Interfaces assembly, reference to, 890
- Microsoft SQL Server 2012 Reporting Services
 - new features, 3–24
 - integration into SharePoint, 13–16
 - parting with Report Builder 1.0, 17
 - Power View, 3–13
- Microsoft.VisualBasic functions, 343
- Microsoft Word. *See* Word
- Mid function, 316
- Min function, 230, 328
- Minute function, 321
- mobile devices
 - report design for, 146
 - users accessing reports by, 140
- Model Designer, 32
- Model Item Security page in SharePoint integrated mode, 663
- monitoring the report server, 690–704
 - adding the HTTP log, 693
 - checking application database size, 691
 - ExecutionLog3 view, 698
 - execution logging, 696
 - performance counters, 699–704
 - SharePoint diagnostic logging, 694–696
 - using trace logs, 691–693
 - using Windows application event log, 691
- Month function, 322
- MonthName function, 322
- motivated power users, 141
- Move... Webpage dialog box, 618
- moving average convergence/divergence (MACD), 505
 - formula for, 507
- moving average formula, 506
- moving average series, 508
- moving content, 617–619
- MSReportServer_ConfigurationSetting class, 915
- MSReportServer_Instance class, 915
- Multidimensional And Data Mining server mode (Analysis Services), 70
- multidimensional data sources, 177–179
- Multidimensional Expression language. *See* MDX language
- MultiLookup function, 336
- multiple bar pointers linear gauge, 520
- Multiple HTTP Identities For The Report Server Web Service, 76
- multiples (Power View), 8
 - creating for charts, 839
- multivalue data in charts, 456
- multivalue report parameters, 370

My Reports folder

- My Reports folder
 - configuring, 671
 - deployment of report parts to, 783
 - enabling, 624
 - using for online reports, 712–714
- My Subscriptions page, 757

N

- names
 - Name field in New Project dialog box, 152
 - naming pages, 421
 - Solution Name field, New Project dialog box, 153
- namespaces, 881
 - for custom assembly call, 885
 - root namespace for data processing assembly, 890
- native mode, 30–38
 - application tier, 31–34
 - component architecture, 31
 - data tier, 30
 - server tier, 34
 - service architecture, 36–38
- native-mode deployment
 - configuring native mode Reporting Services, 72–83
 - distributed deployment, 47
 - launching Report Builder, 96, 106
 - moving content, 617
 - no support for high availability or web farm management, 51
 - publishing reports to report server, 131
 - Reporting Services Native Mode: Install And Configure option, 70
 - Reporting Services Native Mode: Install Only option, 71
 - selection of Reporting Services - Native features, 64
 - setting TargetServerURL property, 169
 - uploading reports, 611
 - URL access to reports, 927–929
 - using folders to organize content, 616
 - verifying report deployment, 609
- native-mode report server
 - in-place upgrades, 20
 - preparing for upgrade, 19
- navigation features, adding, 356–366
 - defining a document map, 356–359
 - using embedded HTML tags, 359–361
 - working with report actions, 361–366
- nested data regions, 224
 - dataset binding in, 235
- .NET 4.0, prerequisite for Reporting Services installation, 61
- .NET Data Provider for Teradata, 176
- .NET Framework functions, 343
- network interface cards (NICs), placing two in each report server, 51
- network load balancing (NLB), use in report server scale-out deployment, 51
- new features in Reporting Services, 3–24
 - parting with Report Builder 1.0, 17
 - Power View, 3–13
 - rendering extensions, 16
- New Layer Wizard, 591, 592
- New Project dialog box, 152
- New Role Assignment page, 651
- New Solution Configuration dialog box, 168
- 90 Degrees Northeast/Northwest/Southwest/Southeast radial gauge, 519
- NLB (network load balancing), use in report server scale-out deployment, 51
- NoDataMessage property, using with charts, 456
- nonadditive values, Sum function and, 437
- NON EMPTY keyword, 432
- NoRowsMessage property, 149, 262
- NOT IN filter for a data region, 311
- Not In operator, 386
- Now function, 323
- Nper function, 332
- NT LAN Manager (NTLM), 37, 644
- Null Delivery Provider, 748
- NULL values
 - Allow Null Value property, report parameters, 370
 - defining reporting standards for handling of, 149
- numbering pages, 420
 - global variables, 420
 - ResetPageNumber property, 421
- numbers
 - filter comparing numeric values in Power View, 851
 - Format property, 241, 242
 - formatting for chart axis, 472
 - formatting numeric values, Report Wizard and, 164
 - Number menu, Home tab of Report Builder ribbon, 112
 - Number page, Scale Properties dialog box, 528

- predefined and user-defined numeric formats, 312
- NumeralLanguage property, 244
- NumeralVariant property, 244
- numeric keypad, on-screen, 318

O

- Object Linking and Embedding Database. *See* OLE DB
- occurrence indicators for RDL elements, 864
- Oct function, 334
- ODBC (Open Database Connectivity)
 - Client Tools Connectivity feature, 65
 - data providers, 176
- OLAP databases, 425
- OLE DB (Object Linking and Embedding Database)
 - Client Tools Connectivity feature, 65
 - data providers, 176
 - data source type, 426
- omitting a parameter in drillthrough reports, 389
- on-demand report execution, 630–632
- 180 Degrees North/South/West/East radial gauge, 519
- online reports
 - accessing, 707–738
 - exporting reports, 725–738
 - in SharePoint, 714–725
 - using HTML Viewer, 709–711
 - using Report Manager, 707–713
 - designing separately from printed reports, 147
- online viewing of reports by users, 140
 - layout for online reports, 143
- On-Screen Keyboard, 318
- opening reports, 135
- operating systems
 - .NET 2.0 and .NET 3.5 Service Pack 1 update for, 62
 - selecting for Reporting Services installation, 55
 - support for 32-bit edition of SQL Server 2012, 57
 - support for SQL Server 2012 64-bit editions, 56
- operations monitoring, report design for, 142
- operators
 - available MDX filter operators, 430
 - complete list of, 282–284
 - filter, 381, 383–386
 - Between operator, 384
 - equality and inequality operators, 383
 - In operator, 385

- Like operator, 383
- Not In operator, 386
- Top and Bottom, 384
- Operators category, Expression dialog box, 282
 - (subtraction) operator, using, 293
 - using logical AND or logical OR in filters in Power View, 851
- Optimization page for map viewport properties, 588
- Oracle, using as data source, 175
- ORDER BY clause (SQL queries), 234
- order of precedence for map element properties, 604
- orientation
 - for text boxes, changing dynamically, 399
 - Gauge Orientation Options (linear gauge), 532
- OR operator
 - applying OR logic to multiple filters, 386
 - using in filters, 851
- Output window, 156
 - deployment progress in, 608
- OverallPageNumber variable, 421
- OverallTotalPages variable, 421
- overlapping report items, 216
- OverwriteDataSources property, 625

P

- padding
 - setting dynamically for text boxes, 399
 - using padding or indentation for text, 242
- Padding property, 241, 341
- PageBreak properties, 422
- page breaks
 - configuring, 414–423
 - for printed reports, 147
 - inserting in Report Builder, 127
 - rendering formats by pagination type, 395–397
- Page element, 861
- Page Footer Properties dialog box, 410
- page footer, standards for, 149
- page groups
 - defining for matrix report, 163
 - defining for tabular report in Report Wizard, 161
- Page Header Properties dialog box, 410
- page header, standards for, 148
- page layout, 395–424
 - adjusting report size, 400–408
 - page structure properties, 400–406
 - using device information to change page properties, 406–408

Page_Load method (example)

- configuring page breaks, 414–423
 - adding page breaks by group, 417
 - creating page breaks, 415
 - naming pages, 421
 - numbering pages, 420
 - repeating headers, 418–420
 - using KeepTogether property, 416
- page header and footer, 409–414
- understanding rendering, 395–400
 - rendering formats by pagination type, 395–397
 - using RenderFormat global variable, 397–400
- Page_Load method (example), 920
- PageName property, 422
- PageNumber global variable, 420
- page numbering, 420
 - for printed reports, 147
 - global variables, 420
 - ResetPageNumber property, 421
- page size properties, 402
- page structure properties, 400–406
 - column properties, 402–404
 - page size properties, 402
 - report page structure, 400–401
 - white space, 404–406
- pagination. *See also* page breaks
 - built-in fields related to, using for calculations, 298
- paragraphs
 - Paragraph element, 866
 - Paragraph menu, Home tab of Report Builder ribbon, 112
 - Paragraphs element, 866
- Parallel Data Warehouse (PDW), 175
- parallels and meridians
 - adding to maps, 585
 - configuring properties, 585
- Parameter class, 898–899
- parameters, 145–146. *See also* report parameters
 - changing report parameters with HTML Viewer, 709
 - configuring report parameters, 621–624
 - defining standards for, 149
 - defining target report for Go To Report, 363
 - designing when using Analysis Services dataset, 442–450
 - auto-generated query and report parameters, 442–447
 - parameter value placeholders, 276
 - query, passing report parameter value to, 369
 - report parameter values for standard subscriptions, 749
 - setting report parameters for data-driven subscriptions, 754
 - StoredParametersLifetime property, 677
 - StoredParametersThreshold property, 677
 - using query parameter to secure data, 664
- Parameters category, Expression dialog box, 281
- Parameters collection, 290
- parent-child tables, 269
- Parent property (for rectangle report items), 216
- Parts menu, Insert tab of Report Builder ribbon, 113
- PDF files
 - custom web application rendering reports as, 947
 - exporting reports in, 731
 - hard-page break renderer, 397
 - overriding page margin sizes at runtime, 406, 408
 - reports in, 26
- PDW (Parallel Data Warehouse), 175
- percentages
 - formatting, 242
 - getting with Aggregate function, 437
 - percentage-based indicator states, 545
- performance
 - displaying with indicators. *See* indicators running performance tests, 700
- performance counters, 699–704
 - for alerting, 777
 - listing for Reporting Services, 700–704
 - selecting from performance objects, 699
- performance formula, 507
- PerformancePoint Services, 30
- permissions
 - assigning user permissions, 650–652
 - native mode role assignments, 650–652
 - SharePoint permission levels, 652
 - editing for native-mode server roles, 647
 - editing for SharePoint document libraries, 655–657
 - editing for SharePoint integrated mode folders, 657
 - SharePoint integrated-mode groups, 648–650
 - compared to native-mode tasks, 645
 - using permissions table to secure data, 665
- personalized folders, 624
- pie charts
 - when to use, 455
 - working with, 513–516

- secondary pie chart, 515
 - slice consolidation, 514–515
- pivot point location, radial gauge, 532
- Placeholder Properties dialog box, 257
 - HTML - Interpret HTML Tags As Styles, 360
- placeholders
 - for expressions, 273
 - aggregate function placeholders, 275
 - built-in field placeholders, 275
 - dataset field placeholders, 274
 - parameter value placeholders, 276
 - for subreports, 221
 - for text box containing HTML, selecting, 360
- placement, configuring for report items, 237
- Planar (X, Y) coordinate system, 586
- play axis, adding to charts in Power View, 841
- Pmt function, 332
- PNG (Portable Network Graphics) files, 817
- point data maps, 566–568
 - basic, options for, 575
 - configuring point properties for map layer, 599–601
 - inserting custom points in maps, 603
 - Map Point Layer Properties dialog box, 593
 - Point Color Rule command, 595
 - Point Properties command, 594
- Pointer Border page, 524
- pointer cap (gauge element), 521
- Pointer Fill page, 524
- pointer (gauge element), 521, 522–526
 - custom pointer, 525
 - properties, 523
 - pages of pointer properties, 524
 - snapping interval, 526
 - value, 522
- Pointer Options page, 524
- points, 555
 - center point of a map, 563
 - defined, 556
- polar charts, 455
- polygon data maps, 569
 - bubble map, 575
 - color analytical map, 575
 - configuring polygon properties, 602
 - Map Polygon Layer Properties dialog box, 593
 - Polygon Color Rule, 595
 - Polygon Properties command, 594
- polygons, 555
 - use in mapping, 557
- Portable Document Format. *See* PDF files
- POST method (forms), 933
- PowerPivot Feature Integration For Site Collections, 94
- PowerPivot for SharePoint
 - configuring, 85
 - connecting to workbook using Analysis Services data provider, 177
 - installing, 72
- PowerPivot Gallery
 - opening Power View, 824
 - saving reports to, 12
- PowerPivot workbooks, data source for Power View, 4
- PowerPoint
 - exporting Power View reports to, 855
 - Microsoft Office Compatibility Pack for, 17
- power users, 141
- Power View, 3–13, 26, 99, 797–822, 823–856
 - comparison to Report Designer and Report Builder, 99–102
 - data sources, 3
 - data visualization, 4–7
 - enhancing tabular models for, 803–822
 - adding images, 816–818
 - appearance of identifying information, 818–821
 - creating date table, 810
 - formatting values, 806
 - managing grouping behavior, 811–816
 - setting default sort, 807–809
 - simplifying creation of new table, 821–822
 - summarizing values, 803–806
 - filtering data in visualizations, 843–852
 - highlighted values, 844
 - slicers, 844
 - tiles, 845–848
 - view filter, 848–854
 - getting started with, 823–832
 - connecting to a data source, 824
 - learning the design environment, 825–832
 - verifying browser requirements, 823
 - highlighted values, 9
 - implementing in SharePoint, 94
 - in application tier of SharePoint integrated mode, 41
 - interactive scatter chart, 7
 - multiples, 8
 - report sharing, 12

Power View Integration Feature

- saving reports, 854–856
 - PowerPoint export, 855
- selecting a display mode, 852–854
- SharePoint support for, 60
- slicer, 10
- SQL Server 2012 editions supporting, 59
- SQL Server Setup and, 72
- tiles, 10
- using, 104
- using tabular models with, 797–803
 - creating BI Semantic Model (BISM) connection, 798–803
- view filter, 11
- visualizing data, 832–843
 - Cards, 843
 - charts, 836–842
 - copying a visualization, 837
 - matrix, 835
 - resizing and moving a visualization, 835
 - tables, 833–835
- Power View Integration Feature, 94
- Pow function, 325
- PPmt function, 332
- precision placement of report items, 214
- Prepare Query button (MDX query designer), 432
- previews
 - map, 576
 - previewing report before printing, 712
 - previewing report in Report Builder, 129
- Previous function, 340
- printed reports, design options for, 147
- printing, using Report Manager print feature, 712
- Print Layout mode, checking column layout, 404
- Print On First Page property (page headers and footers), 410
- Print On Last Page property (page headers and footers), 410
- ProcessingMode property, 942
- processing options, 132–134, 630–636
 - caching reports, 632–633
 - executing a report on demand, 630–632
 - native-mode report server, configuring report snapshot, 637
 - refreshing the cache, 634
 - reviewing in Report Manager, 132
 - reviewing in SharePoint document library, 133
- product key (SQL Server 2012), 63
- program flow functions, 327
 - creating expression for conditional formatting, 299
 - programmatic interface for management, 34
 - programmatic interface for report development, 32
 - programmatic interface for viewing or delivering reports, 33
 - programming report design components. *See* report design components, programming
 - programming reporting access. *See* access to reports
 - programming report server management. *See* report server management, programming
- project configurations, 168
- Project Context settings, 168
- projection method for maps, 586
 - conversion of three-dimensional coordinates to two-dimensional, 586
 - types available in Reporting Services, 587
- Project menu, 166
- Project Properties command, 167
- projects. *See also* report server projects
 - adding new project to existing solution, 153
 - removing from a solution, 157
 - report project file types, 157
 - selecting project type, 154
- prompted credentials, 628
- Prompt property, setting for report parameters, 369
- Prompt User property, 623
- properties
 - collection, syntax for, 277
 - configuring report project properties, 167–172
 - project configurations, 168
 - setting project properties, 169–172
 - configuring tablix properties, 261
 - groups before row header, 262
 - no data rows, 262
 - sorting, 262
 - creating expressions for, 281
 - extended field properties, 436
 - group properties in a tablix, 268–272
 - map element, accessing, 593
 - order of precedence for map elements, 604
- Properties button, Map Layers pane, 592
- report parameter properties, setting, 368–378
 - advanced parameter options, 377
 - available values, 371–374
 - default values, 375–377
 - general properties, 368–371
 - selecting, using IntelliSense in Expression dialog box, 284
- series properties for chart values, 458–461

- supporting conditional formatting, 299
- using to control appearance and behavior, 237–248
 - changing appearance of report items, 240–248
 - placement and size of report items, 237–239
- Properties window, 156
 - accessing DeferVariableEvaluation property, 303
 - color palette, Custom, 486
 - CustomAttributes section, 515
 - EmptyPoint category, Color property, 501
 - KeepWithGroup property, 420
 - opening Expression dialog box from, 279
 - PageBreak category, 415
 - RepeatColumnHeaders property, 418
 - RepeatOnNewPage property, 420
 - setting ReportViewer properties, 942
- Property dialog box, Configuration Manager
 - button, 168
- Property Pages dialog box, 167
 - opening, 169
- pseudoconic projection, 587
- pseudocylindrical projection, 587
- publishing reports, 131
 - to native-mode report server, 131
 - to SharePoint integrated-mode report server, 131
- PublishReport function, 908
- Publish Report Parts dialog box, 783, 785
 - redeployment of a report part, 788
 - Review And Modify Report Parts Before Publishing, 786
- PV function, 333
- pyramid charts, 455

Q

- queries
 - creating query for report in Report Wizard, 159
 - dynamic query strings, 305
 - SQL Server spatial queries, 561
- query designer (Report Builder), 109
- Query element, 864
- Query Mode (MDX query designer), 433
- query parameters, 389–391
 - auto-generated, for Analysis Services dataset, 442
 - controlling cascading report parameter's values, 392

- creating, 389
- custom, 447–450
 - MDX query parameterization, 448
 - query parameter value, 448
- deleting, 391
- linking parent report parameter to, 392
- linking with report parameters, 390
- parameterized dataset, 446
- Query Parameters button (MDX query designer), 432, 447
- Query Parameters dialog box, 432
 - available values dataset for report parameter, 449
 - manually creating a query parameter, 448
- QueryParameters element, 865
- quick information retrieval, report design for, 142

R

- Radial Gauge Properties dialog box, 532
- radial gauges, 517
 - types of, 519
- radial gauge type, 519
- Radial Pointer Properties dialog box, 523
- Radial Scale Properties dialog box, 526
 - tick marks, appearance of, 529
- Radial Scale Range Properties dialog box, 530
- radial with mini gauge type, 519
- range charts, 456
- range (gauge element), 521, 530
 - multiple ranges, 531
 - properties, 530
- Rate function, 333
- rate of change formula, 507
- ratings indicators, 539
- ratio data in charts, 455
- raw data, delivering to users, 142
- RDL files, 31, 157
 - upgrades of, 21
- RDLGenerator class, 869–875
- RDLGenerator.exe file, 875
- RDL Object Model, 868
- RDL (Report Definition Language), 249, 859–876
 - custom RDL created by web service for accessing reports, 947
 - DataSets and DataSet elements, 864
 - DataSources and DataSource elements, 862–864
 - RDL schema definition, 859
 - Report element, 861

RDLX files

- specification, 866
- Tablix element, 865–867
- understanding the XSD, 863
- usage, 860
- working with, 867–876
 - manual edits, 867
 - programmatic edits, 868
 - RDL generation, 868–876
- RDLX files, 12
- RDLXReportTimeout property, 677
- RDS file extension, 157
- Reading Mode display mode in Power View, 852
- recovery. *See* backup and recovery
- rectangles, 210
 - adding to reports, 216
 - lines versus, in reports, 216
- recursive hierarchy groups, 269–272
- Recursive keyword, 342
- references
 - for web service rendering reports, 944
 - Microsoft.ReportingServices.Interfaces assembly, 890
 - web reference for Reporting Services web service, 918
- refreshes
 - cached datasets, 641
 - cached reports, 634
 - options for report parameters dependent on dataset query, 378
 - Refresh button, MDX query designer, 431
- relational data sources, 174
- relationships, working with, in Report Builder's dataset designer, 110
- relative strength index formula, 507
- relay restrictions (SMTP), 758
- Release project configuration, 168
- remote procedure call (RPC), 38
- rendering, 395–400
 - exporting reports with hard page-break renderers, 730–733
 - exporting reports with soft page-break renderers, 725–730
 - rendering formats by pagination type, 395–397
 - using RenderFormat global variable, 397–400
 - dynamic positioning of text boxes, 399
- rendering extensions, 35
 - new, 16
 - Excel 2010 renderer, 16
 - Word 2010 renderer, 17
 - using soft page-break rendering, 725
- rendering formats for reports, 29
 - eliminating for use with subscriptions, 685
- Render This Report From a Report Snapshot option, 637
- RepeatColumnHeaders property, 418
- repeating gauges, 537
- RepeatOnNewPage property, 420
- Replace function, 318
- report actions. *See also* actions
 - using for navigation features, 361–366
 - Go To Bookmark action, 363
 - Go To Report action, 362
 - Go To URL action, 365
- Report Builder, 26, 32, 99, 105–130
 - adding a dataset, 117
 - adding a total, 125
 - adding data regions manually, 122
 - adding data source to report definition, 114–116
 - adding fields to a table, 123–125
 - adding report parts to reports, 790
 - comparison to Report Designer and Power View, 99–102
 - deploying report parts, 785–790
 - multiple report items in report part, 787
 - deploying reports to My Reports folder, 713
 - formatting reports, 127–129
 - Getting Started Wizard, 106–108
 - inserting page breaks, 127
 - installing, 96–97
 - launching, 105–106
 - as stand-alone application, 106
 - in native mode, 106
 - in SharePoint integrated mode, 106
 - learning Report Builder interface, 111–114
 - parting with Report Builder 1.0, 17
 - previewing a report, 129
 - redeployment of report parts, 788
 - Report Builder 2.0, 17
 - ReportBuilderLaunchURL property, 677
 - Report Part Gallery, 790–792
 - saving a report, 130
 - saving reports from, 610
 - using, 104
 - using data region wizards, 118–122
 - using dataset designer, 108–111
 - versions, 102
- ReportBuilder3.MSI file, downloading and executing, 97

- report caching
 - controlling using Processing Options page, 133, 134
 - disk space requirements and, 46
- Report Data pane, 442
 - accessing and organizing report parameters, 367
 - Images folder, 219
 - Show All Hidden Datasets, 444
- Report Data Source (RDS files), 157
- Report Data window (Visual Studio), 157
- Report Definition Language. *See* RDL; RDL files
- report design components, programming, 877–904
 - creating custom data processing extension, 887–904
 - data processing extension deployment, 900–904
 - data processing extension development, 889–900
 - overview of the extension, 888–889
 - embedding code in reports, 877–881
 - Code property, 878
 - custom function call, 880–881
 - using assemblies to share custom code, 881–887
 - class library, 881–885
 - custom assembly call, 885–887
- Report Designer, 31, 99, 151
 - advantages of, 103
 - comparison to Report Builder and Power View, 99–102
 - Grouping pane, 228
 - report project commands, 166–167
 - viewing RDL files as XML, 859
- report designers. *See* design environments
- Report element, 861
- ReportExecution2005 endpoint, 944
- report execution time-out, 133
- report explorer Web Part, 724
- report files. *See* RDL files
- report header, standards for, 148
- Report History page, 640
- reporting life cycle, 27–30
 - managing change in, 642
 - report access, 29
 - report administration, 28
 - report development, 28
- reporting platform, Reporting Services as, 25–27
- ReportingService2010 object, 920
- ReportingService Alerting database, 41
- Reporting Services
 - architecture, 30–43
 - configuration in SQL Server 2012 Setup, 70
 - creating a project, 151–154
 - creating new project and solution, 152
 - databases, Database Engine support for
 - hosting, 59
 - runtime engine, 42
 - Reporting Services Add-in for SharePoint, installing, 86
 - Reporting Services Add-in For SharePoint Products feature, 65
 - Reporting Services Add-in, installation in SharePoint integrated-mode distribution, 48
 - Reporting Services Catalog Database, 72
 - Reporting Services Catalog Temporary Database, 72
 - Reporting Services Configuration Connection dialog box, 72
 - Reporting Services Configuration Manager, 33, 72, 669
 - backing up symmetric key, 19
 - configuring Report Manager and web service URLs, 22
 - configuring SSL support, 644
 - encryption keys for connection information, 688
 - Report Server web service URL, 76
 - SMTP server configuration, 744
 - Reporting Services - Native feature, 64
 - Reporting Services Report Gallery, access to, with Report Builder, 104
 - Reporting Services Shared Data Source (RSDS) files, 4
 - Reporting Services - SharePoint feature, 65
 - report item references, 296–298
 - report items, 209–213
 - adding general items to reports, 213–223
 - images, 217–221
 - lines, 215
 - rectangles, 216
 - subreports, 221–223
 - text boxes, 214
 - changing appearance of, 240–248
 - configuring placement and size of, 237–239
 - general, 210
 - images, 211
 - lines and rectangles, 210
 - subreports, 211
 - text boxes, 210
 - graphical data regions, 212
 - chart, 212
 - data bar, 213
 - gauge, 213

ReportItems collection

- indicator, 213
 - map, 213
 - sparkline, 213
 - precision placement of, using ruler, 214
 - Report Items menu, Insert tab of Report Builder
 - ribbon, 114
 - tablix data regions, 211
 - matrix, 212
 - table, 212
 - working with, 224–237
 - ReportItems collection, 291, 297
 - ReportItems element, 865
 - Report Manager
 - accessing online reports, 707–713
 - printing a report, 712
 - searching for a report, 707–709
 - using document map, 711
 - using HTML Viewer, 709–711
 - bypassing in Internet deployment, 53
 - configuring report parameters, 622
 - descriptions for reports, 132
 - folders for content management, 616
 - in service architecture, 37
 - moving content, 617
 - on-demand execution of reports, 631
 - opening a report, 135
 - putting on dedicated server in Internet deployment, 54
 - report part management on report server, 789–790
 - reviewing processing options, 132
 - schedules list, 739
 - selecting a data source, 625
 - stand-alone, configuration information, 54
 - subscriptions, creating, 742
 - uploading reports, 611
 - user role assignments, 651
 - using in native mode report server environment, 33
 - verifying report deployment, 609
 - viewing reports in native mode, 32
 - Report Manager URL, configuring for native-mode Reporting Services, 78
 - report models
 - deploying, 615
 - securing, 662
 - Report Name field, 298
 - report page structure, 400
 - Report Parameter Properties dialog box, 442
 - Advanced page, 377
 - Available Values page, 371
 - creating report parameters, 367
 - General page, 368
 - report parameters, 367–394
 - available values dataset, 444
 - cascading parameters, 392
 - changing parameter order, 393
 - creating when using Analysis Services dataset, 442–444
 - in URL access parameters, 931
 - setting for linked reports using scripts, 914
 - using as filters, 382
 - using calendar control with, 449
 - using filters, 379–386
 - using with subreports and drillthrough, 387–389
 - passing parameter to a subreport, 387
 - passing parameter to drillthrough report, 388
 - working with, 367–379
 - creating a report parameter, 367
 - deleting report parameter, 379
 - displaying parameter selections in a report, 379
 - setting report parameter properties, 368–378
 - working with query parameters, 389–391
 - creating a query parameter, 389
 - deleting a query parameter, 391
 - linking report and query parameters, 390
- Report Part Gallery in Report Builder, 141, 790–792
- Report Part Notifications, 378
- report parts, 27, 781–796
 - deploying, 783–790
 - from Report Builder, 785–790
 - from SSDT, 783–785
 - managing report parts on report server, 789–790
 - redeployment of a report part, 788
 - introduction to, 781–783
 - benefits of using report parts, 782
 - creating report parts, 782
 - definition of report parts, 782
 - publishing for motivated power users, 141
 - report parameters added as, 378
 - subreports versus, 795
 - using, 790–794
 - Report Part Gallery, 790–792
 - update notification, 792–794
- ReportPath property, 942
- report processing extension, 35
- Report Processor, 34

- Report Properties dialog box
 - Code page, 878
 - creating report variables, 302
 - References page, Add Or Remove Assemblies, 886
- reports
 - building using Analysis Services dataset, 435–442
 - Power View report developer, 3
 - report list for web service, 921
 - transitioning from prior version of Reporting Services, 18
 - upgrade to Reporting Services 2012, 21
- Report Server Catalog Best Practices, 47
- report server commands for URL access, 936–938
- ReportServer database
 - backing up, 19
 - backup and recovery, 687
 - checking size of, 691
 - in native mode Reporting Services, 30
 - in SharePoint integrated mode, 40
 - reports upgrade, 21
- report server databases
 - disk space requirements, 46
 - managing with many users and heavy reporting workload, 47
 - putting on dedicated server to reduce resource contention, 48
- Report Server Integration Feature, 94
- report server management, programming, 905–926
 - configuration settings, 914–918
 - using Windows PowerShell cmdlets, 917
 - using WMI provider, 914–917
 - scripting administrative tasks, 905–914
 - creating a linked report, 911–914
 - deploying reports, 906–910
 - using the web service, 918–925
- report server projects, 16, 151–172
 - configuring report project properties, 167–172
 - setting project properties, 169–172
 - getting started with, 151–157
 - creating Reporting Services project, 151–154
 - learning Visual Studio interface, 155–157
 - selecting project type, 154
 - using report project commands, 166–167
 - working with report project files, 157–166
 - adding existing item to a project, 165
 - adding new item to a project, 165
 - project configurations, 168
 - project file types, 157–158
 - removing item from a project, 166
 - using Report Wizard, 158–164
- Report Server project type, 154
- Report Server Project Wizard, 16
- Report Server Project Wizard project type, 154, 158
- report server proxy endpoint, 42
- report servers, adding to SharePoint-integrated
 - mode distribution, 95
- ReportServerTempDB database
 - backup and recovery, 687
 - checking size of, 691
 - disk space requirements, 47
 - in native mode Reporting Services, 30
 - in SharePoint integrated mode, 40
- ReportServerURL property, 942
- Report Server web service, 37
- Reportserviceservice.exe.config file, 19
- Reports folder, 156
- Report Shared Dataset (RSD files), 157
- report sharing (Power View), 12
- report variables, 302
- Report Viewer, 716–718
 - commands for URL access, 935
 - creating data alerts, 761–762
 - data alerting support, 760
 - functions for managing the report view:, 717
 - tool pane, 719–725
- ReportViewer control, 938–943
 - configuring Report Wizard, 939
 - properties, 942
 - ReportViewer application, 943–944
- report viewer Web Part
 - adding to dashboard, 718
 - using native-mode reports in SharePoint dashboard, 724
- Report Viewer Web Part, 41
- Report Wizard, 158–164
 - configuring ReportViewer control, 939
- ResetPageNumber property, 421
- resolution, choosing for maps, 564
- resource files for report server projects, 158
- RewrittenCommandText property, DataSets
 - collection, 288
- ribbon (Power View), 827–830
 - Design tab, 829
 - Home tab, 827
 - Layout tab, 829
 - Styles tab, 828
- Right and RSet functions, 316
- RightIndent property, 241

Rnd function

- Rnd function, 326
- Robinson projection, 588
- role-based security
 - activities associated with each role, 645
 - assigning a system role, 660
 - native mode role assignments, 650–652
 - native mode roles, 645, 646
 - required role assignments for using report models, 662
 - use in Internet deployment of Reporting Services, 53
- rotation, axis labels, 470
- Round function, 325
- rounding functions, 325
- row functions, 339
 - Previous function, 340
 - RowNumber function, 340
- row groups
 - defining for matrix report in Report Wizard, 163
 - defining for tabular report in Report Wizard, 161
 - in a tablix, working with, 263–265
- Row Groups in Advanced Mode, viewing, 419
- row headers, pinning in place, 352
- Row Identifier property, 812
- rows
 - dataset queries returning no rows, 149
 - showing or hiding, 353
- Row Visibility dialog box
 - configuring drilldown, 353
 - showing or hiding a row, 353
- RPC (remote procedure call), 38
- RSC files, 785
- Rsconfig command-line utility, 678
 - arguments, 679
- RSD file extension, 157
- RSDS (Reporting Services Shared Data Source) files, 4
- RSet function, 316
- RSExecRole, 22
 - removal from master and msdb databases, 22
- RSExecutionLog database, 696
- RSExecutionLog_Update.dtsx package in SSDT, 697
- Rskeymgmt command-line utility, 19, 688–690
 - arguments, 688
 - remote server instance to join to scale-out deployment, 690
- Rsmgrpolicy.config file, 19
- RSReportDesigner.config file, registering data processing custom extension, 902
- Rsreportserver.config file, 23, 669
 - disabling an extension, 685
 - managing encrypted information, 678
 - managing settings, 670
 - memory management settings, 683
 - saving copy of, 19
- RsReportServer.config file
 - data alert settings, 773–774
 - alerting interval defaults, 773
 - IsAlertingService flag, 773
- RSSharePoint.MSI file, 87
- Rssvrpolicy.config file, saving copy of, 19
- Rs utility, 614, 905
 - arguments, 905
 - syntax, 905
- Rswebapplication.config file
 - saving copy of, 19
- RSWebParts.cab file, 83
- RTrim function, 319
- Ruler, using to place report items, 214
- running jobs, reviewing and canceling, 686
- RunningValue function, 328, 330

S

- Safari 5, support for Power View, 823
- sample databases, installing, 97–98
- SAP NetWeaver BI, 177
- Save As Report dialog box
 - in Report Builder, 130
 - locating report server's URL, 610
- saving reports
 - Power View reports, 854–856
 - File menu save options, 855
 - PowerPoint export, 855
- scalar axis, 493
 - using numeric values, 497
- scale breaks, 488–490
 - chart types unable to use, 489
 - customizing appearance with ScaleBreakStyle properties, 490
- scale (gauge element), 521, 526–530
 - multiple scales, 530
 - properties, 526–530
 - pages in Scale Properties dialog boxes, 527
- scale label (gauge element), 521
- scale-out deployment, 50–52
 - configuring for native mode Reporting Services, 82
 - distributed workload, 52

- failover cluster, 51
- load balancing, 51
- Scale Properties dialog box, 526
 - pages, 527–530
- scales
 - adjusting for maps, 577
 - color scale for maps, 582
 - distance scale for maps, 582
 - setting properties for map scales, 590
- scatter charts
 - adding play axis in Power View, 841
 - displaying ratio data, 456
 - interactive, in Power View, 7
 - layout section in Power View, 840
 - when to use, 455
- schedules. *See also* shared schedule, creating
 - data alert schedule settings, 766–767
 - defining for subscriptions, 750
 - data-driven subscriptions, 754, 756
 - schedule list for web service application, 921
 - schedules list, 739
- Scheduling and Delivery Processor, 34
- scope
 - aggregate functions, scope argument, 329
 - cell scope in a tablix, 257
 - InScope function, 335
 - of group header or footer, 257
 - of tablix footer, 257
 - synchronizing scope of indicators, 546–548
- script files (.rss), running, 614
- scripting administrative tasks, 905–914
 - creating a linked report, 911–914
 - CreateLinkedReports.rss script execution, 913
 - CreateLinkedReports.rss script walkthrough, 911–913
 - deploying reports, 906–910
 - SOAP endpoints, 910
- scripts, execution of, 27
- searches
 - configuring search in SharePoint, 715
 - searching for reports in SharePoint, 714–716
 - searching for reports using Report Manager, 707–709
- search functions, 309–312
 - Filter function, 310
 - GetChar function, 310
 - InStr and InStrRev functions, 310
- Search Results page (Report Manager), 708
 - in Details View, 709
- Search This Site box (SharePoint library), 714
- secondary axis, 508–509
- secondary pie charts, 515
- Second function, 321
- Secure Sockets Layer. *See* SSL
- security
 - configuration for SharePoint web application, 88
 - Internet deployment of Reporting Services, 53
 - report server content, 643–668
 - assigning user permissions, 650–652
 - configuring report server security policies, 643–650
 - implementing data security, 664–668
 - item-level security, 653–664
 - scripts for administrative tasks, 907
 - security policies for Report Manager, 19
 - sending credentials to a data source, 627–630
 - settings in Server Properties dialog box, 675
 - shared datasets, 641
- Select Chart Type dialog box, 453
 - preview of chart types, 454
 - Scatter category, 503
- Select Color dialog box, 245, 281
 - colors for custom palette, 487
- Select Data Bar Type dialog box, 476
- selected text properties, setting, 240
- Select Gauge Type dialog box, 518, 536
- Select Indicator Type dialog box, 540
- Select Parameter Visibility property, report parameters, 370
- SELECT statements, FROM clause, subselect statement in, 447
- semantic models
 - Business Intelligence Semantic Model, 4
 - replacement by tabular models, 32
- Series Group Properties dialog box, 465
- series groups, 466
 - Series Groups section, Chart Data pane, 464
 - field selection, 464
- Series Label Properties dialog box, 473
- series labels on charts, 473–475
 - data label keywords, 474
- Series Properties dialog box, 459–461
 - Action page, 461
 - Axes And Chart Area page, 459
 - Secondary axis, 508
 - Border page, 461
 - configuring sparklines, 482
 - Fill page, 461
 - Legend page, 460
 - Marker page, 501

series properties for chart values

- Markers page, 460
- Series Data page, 459
- Shadow page, 461
- Visibility page, 459
- series properties for chart values, 458–461, 500–513
 - bubble charts, 503–505
 - calculated series, 505–508
 - empty points, 500–503
 - multiple chart areas, 510–513
 - multiple chart types, 510
 - secondary axis, 508–509
- Server Configuration page, SQL Server 2012
 - Setup, 67
- server extensions, 34
- server modes for Analysis Services, 70
- Server Properties dialog box, 669
 - Advanced page, 676
 - Execution page, 673
 - General page, 671
 - History page, 674
 - Logging page, 674
 - Security page, 675
- ServerReport properties, 942
- server tier
 - in native mode Reporting Services, 34
 - in SharePoint integrated mode, 42
- service accounts, configuring for native mode Reporting Services, 73
- service architecture (in native mode), 36–38
- service machine instance, 42
- service platform, 38
- Services management console, service account changes and, 73
- session cookies, 677
- SessionTimeout property, 677
- Setup.exe command-line utility, use for upgrades, 20
- Setup Support Rules page, 62
- SETUSER function, 629
- shadows
 - Frame Shadow page, Gauge Properties dialog box, 533
 - Shadow page for pointer gauge element, 525
 - Shadow page, Scale Properties dialog box, 530
 - Shadow page, Series Properties dialog box, 461
- shape indicators, 539
- SharedDataSet element, 864
- Shared Dataset Properties dialog box, 165
- shared datasets, 27, 562
 - managing, 641
 - use by motivated power users, 141
- Shared Datasets folder, 156
- Shared Data Source Properties dialog box, 165
- shared data sources, 625
 - managing, 641
 - Reporting Services shared data source for tabular models, 824
 - URL for, on integrated-mode server, 626
- Shared Data Sources folder, 156
- shared schedule, creating, 739–741, 750
 - new schedule, 741–742
 - viewing schedules list, 739
- shared service applications, 42
- shared service WCF endpoints, 42
- SharePoint
 - accessing reports in, 714–725
 - searching for a report, 714–716
 - access to reports hosted on native mode server, 32
 - configuring for local mode reporting, 84
 - configuring partial integration of native-mode report server with, 83
 - diagnostic logging, 694–696
 - document libraries
 - opening a report in, 135
 - reving processing options in, 133
 - Forms-Based Authentication, 644
 - integration of Reporting Services into, 13–16
 - Power View reports saved to document library, 12
 - Reporting Services as service application, 3
 - Reporting Services support by SharePoint editions, 60
 - schedule options, 741
 - URL reservations and, 75
- SharePoint 2010 Management Shell, 774, 917
- SharePoint 2010 Products Configuration Wizard, 95
- SharePoint 2010 Service Pack 1 (SP1), 60
- SharePoint Central Administration, 42, 669
 - Backup and Restore, 688
 - Configure Diagnostic Logging link, 694
 - configuring Reporting Services service application, 91–98
 - Manage Service Application link, 669
 - Manage Service Applications
 - SMTP server and email address, 744
- SharePoint configuration database, 40
- SharePoint content database, 40
- SharePoint integrated mode, 38–43
 - application tier, 41
 - architecture of Reporting Services in, 39

- benefits of Reporting Services integration, 38
- configuring, 84–96
 - adding another Reporting Services web front-end (WFE), 96
 - configuring SharePoint for Reporting Services integration, 91–96
 - configuring SharePoint site, 94
 - creating business intelligence center site, 89–90
 - creating SharePoint web application, 87–89
 - installing Reporting Services Add-in for SharePoint, 86–87
 - manual registration of Reporting Services into SharePoint farm, 86
 - resources on SharePoint installation, 85
- data tier, 40
- report server migration, 23
- report server upgrade, 21
- server tier, 42
- SharePoint integrated-mode distribution, 48
 - authentication, 644
 - backup and recovery of databases, 688
 - combining report, database, and SharePoint server, 49
 - configuring data sources, 626
 - configuring report parameters, 623
 - copying a report, 620
 - document library security, 655
 - groups and permission levels, 648
 - groups, 645
 - permission level assignments, 652
 - launching Report Builder, 96, 106
 - moving content, 618
 - personal workspace for report storage, 624
 - placing report server with SharePoint and databases on dedicated server, 49
 - publishing report to report server, 131
 - refreshing the cache, 635
 - report execution on demand, 631
 - Reporting Services - SharePoint feature, 65
 - Reporting Services SharePoint Integrated Mode:
 - Install Only option, 71
 - report snapshots, 638
 - saving to report history, 640
 - review of requirements, 59
 - SharePoint, report server, and databases on
 - dedicated servers, 50
 - target server URL for deployment of reports, 608
 - uploading reports, 612
 - URL access to reports, 929–931
 - using folders to organize content, 617
 - verifying report deployment, 610
- SharePoint Report Viewer. *See* Report Viewer
- SharePoint Server 2010 Enterprise Edition, 3
- Show Aggregations button (MDX query designer), 432, 440–442
- Show Context Menu button, Map Layers pane, 593
- Show Empty Cells button (MDX query designer), 432
- Show/Hide Document Map button, 358, 711
- Show/Hide Layer button, Map Layers pane, 593
- Sign function, 324
- sign functions, 324
- Simple Mail Transfer Protocol (SMTP) server, 33
- Sin function, 324
- single-server deployment, 45–47
 - disk activity, 47
 - disk space requirements, 46
 - memory requirements, 46
- Sinh function, 324
- Site Search Results page, 714
- size
 - adjusting for indicators, 553
 - dynamic sizing for indicators, 553
- Size property, setting for report items, 238
- slice consolidation in pie charts, 514–515
- slicers
 - in Power View, 10
 - using in Power View visualizations, 844
- SLN files, 153
- SLN function, 333
- SMTP (Simple Mail Transfer Protocol) server, 80, 744
 - relay restrictions, 758
- snapping interval for pointer, 526
- snapshots, 636–642
 - configuring on integrated-mode report server, 638
 - configuring on native-mode report server, 637
 - controlling using Processing Options page, 133, 134
 - disk space requirements and, 46
 - saving in report history, 638–642, 674
 - integrated-mode report server, 640
 - limiting number of snapshots, 641
 - schedule for subscriptions, 750
 - SnapshotCompression property, 677
 - suspending, 686
- SOAP endpoints, 910
- SOAP (Simple Object Access Protocol)
 - connections, 177
- soft page-break renderers, 396

Solution Configurations drop-down list (in SSDT standard toolbar)

- exporting reports with, 725–730
 - Excel format, 725–728
 - MHTML format, 729
 - Word format, 728–729
- Solution Configurations drop-down list (in SSDT standard toolbar), 168
- Solution Explorer, 155
 - adding new item to a project, 165
 - excluding item from a project, 166
 - launching Report Wizard, 158
 - removing a project from a solution, 157
 - removing item from a project, 166
- solutions
 - adding existing project to existing solution, 154
 - adding new project to existing solution, 153
 - creating for Reporting Services projects, 151
 - removing a project from, 157
 - required fields in New Project dialog box, 153
 - working with multiple projects in single solution, 153
- Sort By Column dialog box, 808
- Sort By drop-down list, 346
- SortExpressions property, 262
- sorting
 - Category Group Properties dialog box, Sorting page, 464
 - column and bar chart sort order in Power View, 839
 - in dataset or report, 234
 - interactive, 345–351
 - applying sort to other groups and data regions, 349
 - sorting by expressions, 349
 - sorting detail rows, 347
 - sorting groups, 348
 - setting default sort for columns in tabular models, 807–809
 - table sort order in Power View, 834
- SpaceAfter property, 241
- SpaceBefore property, 241
- Space function, 309
- Spacing property (scale breaks), 490
- sparklines, 213, 480–484
 - adding, 480
 - configuring properties, 481
 - axes alignment, 482
- spatial data, 555–558
 - choosing spatial data options, 562–566
 - common spatial element properties in maps, 594
 - lines, 557
 - points, 556
 - polygons, 557
 - selecting data source, 559–562
 - ESRI shapefiles, 561
 - Map Gallery, 559
 - spatial queries, 561
 - specifying source of dataset, 593
 - SQL Server spatial data types, 558
 - types of, 555
- spatial queries, 561
- Split function, 314
- splitting merged cells in a tablix, 259
- SQL Browser Startup Type, 68
- SqlDataReader object, 870
- SQL Server 2005, upgrades from, items to remove, 23
- SQL Server 2008, deploying reports to report server, 171
- SQL Server 2012
 - installing, 63–72. *See also* installing Reporting Services
 - Analysis Services configuration, 70
 - Database Engine configuration, 69
 - feature selection, 63–65
 - installation configuration rules, 71
 - installation rules, 66
 - instance configuration, 66
 - product key, 63
 - Reporting Services configuration, 70
 - server configuration, 67
 - setup role, 63
 - installing prerequisites, 61
 - Reporting Services features supported by editions in SharePoint integrated mode, 59
- SQL Server 2012 Enterprise Edition, scale-out deployment, 50
- SQL Server 2012 Express with Advanced Services, memory requirements, 55
- SQL Server Agent
 - alert schedules, 760
 - Startup Type, 67
 - subscriptions and, 742
- SQL Server Configuration Manager, 33
- SQL Server (data source for reports), 174
- SQL Server Data Tools. *See* SSDT
- SQL Server Data Tools (SSDT), 16
 - deploying report parts, 783–785
 - deploying report server project, 608
 - deploying reports to My Reports folder, 713

- editing RDL, 867
- integration with Visual Studio 2010, 151
- Report Designer, 31, 103
- RSExecutionLog_Update.dtsx package in SSDT, 697
- SQL Server Data Tools feature, 65
- SQL Server Management Studio (SSMS), 33, 42, 669
 - built-in reports for monitoring report server, 690
 - checking application database size, 691
 - managing shared schedules, 661
 - reviewing existing default role definitions, 646
 - Server Properties dialog box, 669
 - updating report server properties, 670
- SQL Server Parallel Data Warehouse (PDW), 175
- SQL Server Setup, using to upgrade reports from prior version of Reporting Services, 18
- SQL (Structured Query Language), 32
 - ORDER BY clause in queries, 234
- Sqrt function, 325
- SSDT. *See* SQL Server Data Tools
- SSL (Secure Sockets Layer), 644
 - certificates, invalid or expired, on report server, 20
 - connection between Reporting Services and SQL Azure server, 175
 - implementation in Internet deployment of Reporting Services, 53
 - SSL certificate on report server, 75
- SSMS. *See* SQL Server Management Studio
- stand-alone applications (Report Builder), 106
- standard deviation formula, 507
- standard reporting, 142
 - developing standards, 148–149
- star schema, 97
- Start and End property (indicator state), 543
- Start Debugging command, 168
- Startup Type for services, 67
- States Measurement Unit property (indicators), 542
- static methods, 886
- StDev and StDevR functions, 328
- stepped tables, 161
 - layout, 162
 - with subtotals and dirlltdown, 163
- stock charts, 456
- stored credentials, 628–630
- StoredParametersLifetime property, 677
- StoredParametersThreshold property, 677
- stored procedures
 - for alerting, 776
 - using query parameters with, 390
- StrConv function, 315
- Str function, 334
- string evaluation functions, 317
 - Len function, 317
 - StrComp function, 317
- string manipulation functions, 316
 - Left, LSet, Right, and RSet functions, 316
 - Mid function, 316
 - StrDup function, 317
 - StrReverse function, 317
- Strong Name Tool, 884
- StrToMember function, 448
- StrToSet function, 446
- Structured Query Language (SQL), 32
- Stsadme.exe tool, installing Web Parts, 724
- STSADM.EXE file, 83
- styles
 - for data regions, 121
 - selecting for table or matrix in Report Wizard, 164
- Styles ribbon (Power View), 828
- Subreport Properties dialog box, 222
 - Parameters page, 387
- subreports, 211
 - adding to reports, 221–223
 - troubleshooting subreport rendering, 223
 - passing parameter to, 387
 - report parts versus, 795
 - Subreports menu, Insert tab of Report Builder ribbon, 114
- subscriptions, 739–758
 - creating data-driven subscriptions, 750–756
 - configuring settings, 751–757
 - creating delivery table, 751
 - creating for web service, 922–924
 - creating shared schedule for, 739–741
 - creating standard subscriptions, 742–750
 - delivery providers, 743–749
 - new subscription, 742
 - report parameter values, 749
 - subscription processing options, 750
 - managing, 757–758
 - deleting a subscription, 758
 - using My Subscriptions page, 757
 - provisioning for Reporting Services application, 93
- subtotals, stepped and block tables with, 162
- Sum function, 230, 328
 - nonadditive values and, 437
- Summarize By property, 803

summarizing values in tabular data models

- modifying for tabular models, 804
- options, 804
- summarizing values in tabular data models, 803–806
- suspending report execution, 686
- Switch function, 327
- SYD (sum-of-the-years'-digits) function, 333
- symbol indicators, 539
- symmetric key, backing up, 19
- synchronization scope (indicators), 546–548
- syntax errors in Expression dialog box, 286
- System.Convert functions, 343
- System.IO.DirectoryInfo and System.IO.FileSystemInfo classes, 896
- System.Management component, 915
- System.Math functions, 343
- system roles, 660
- System, System.Management, and System.IO namespaces, 915

T

- Table Behavior dialog box
 - Default Label and Default Image properties, 819
 - setting Row Identifier and Keep Unique Rows properties, 813
- table data region, 212
 - adding total to, 230
 - binding data to, 225
- table layout, deciding when to use, 143
- table of contents for a report, 356
- Table Or Matrix Wizard (Report Builder), 118–121
- tables
 - combining with matrix, 250
 - in Power View, 833–835
 - resizing and moving, 835
 - table columns, 833
 - table layout section, 834
 - table sort order, 834
 - interactive sorting in, 350
 - layout in a tablix, 250–252
 - layout options in Report Wizard, 161
 - transforming to matrix in a tablix, 259–260
- tablix, 249–272
 - cells, 256–259
 - configuring properties, 261
 - groups before row header, 262
 - no data rows, 262
 - sorting, 262
 - data regions, 250–255
 - list, 254
 - matrix, 252–254
 - table, 250–252
 - defined, 249
 - embedding charts in, 453
 - sorting specification for groups in, 351
 - transforming, 259–261
 - detail list to grouped list, 261
 - matrix to table, 260
 - table to matrix, 259–260
 - working with tablix groups, 263–271
 - adjacent groups, 267
 - group properties, 268–272
 - row groups, 263–265
 - static columns, 265–267
- TablixCell element, 866
- TablixCells element, 866
- TablixColumn element, 866
- TablixColumnHierarchy element, 867
- TablixColumns element, 866
- tablix data regions, 211
 - adding to reports, 224
 - working with, 224–237
 - adding a list, 234–237
 - adding a matrix, 231
 - adding total to a table, 230
 - binding data to a data region, 225–226
 - grouping data, 226–229
 - nested data regions, 224
- Tablix element, 865–867
- Tablix Group dialog box, 126, 227, 260
- TablixHeader element, 867
- TablixMember element, 867
- TablixMembers element, 867
- Tablix Properties dialog box, 418
 - Expression field of new filter, 311
 - Filters page, 380
 - Page Break Options section, 416
 - Repeat Header Column On Each Page, 418
- TablixRowHierarchy element, 867
- TablixRows element, 866
- tab-strip visualization mode, 846
- tabular format
 - choosing in Report Wizard, 160
 - specifying arrangement of data fields from query in Report Wizard, 160
- tabular models, 4
 - development of, 26, 41
 - enhancing for Power View, 803–822
 - adding images, 816–818

- appearance of identifying information, 818–821
- creating date table, 810
- formatting values, 806
- managing grouping behavior, 811–816
- setting default sort, 807–809
- simplifying creation of new table, 821–822
- summarizing values, 803–806
- replacing semantic models, 32
- requirement as data source for Power View, 824
- using with Power View, 797–803
 - creating BI Semantic Model (BISM) connection, 798–803
- Tabular server mode for Analysis Services, 70
- Tagged Image File Format. *See* TIFF
- Tan and Tanh functions, 324
- TargetServerURL property, 169, 608
- tasks on native-mode report servers, 645
- technical skills and interest level of users, 141
- templates
 - available in Add New Item dialog box, 165
 - custom, for adding items to projects, 165
- Teradata, 176
- Test Connection button, 625
- test connections,
 - EnableTestConnectionDetailedErrors property, 677
- text
 - setting properties of selected text, 240
 - alignment properties, 241
 - border properties, 245
 - fill properties, 245
 - Format property, 242
 - line properties, 248
 - list properties, 248
 - locale properties, 243
 - static text in tablix cells, 256
 - TextAlign property, 241
 - text box context menu, opening Expression dialog box from, 278
 - Textbox element, 866, 867
 - text boxes, 210
 - adding tooltips to, 355
 - adding to reports, 214
 - built-in fields, using to add expressions, 298
 - controlling text box growth, 239
 - deciding width of, 144
 - dynamic positioning of, 399
 - expressions in, 295
 - hiding conditionally, using RenderFormat, 398
 - HTML text expressions in, 360
 - in a list, 254
 - in a table or matrix, adding data regions or report items, 255
 - interactive sorting in, 346
 - precise sizing of, 215
 - using as toggle item for report item visibility, 354
 - using for list labels, 236
 - Text Box Properties dialog box
 - Action - Go To Bookmark, 364
 - Action - Go To Report, 362
 - Action - Go To URL, 365
 - Apply This Sorting To All Groups And Data Regions, 349
 - in Report Builder, 113
 - Interactive Sorting, 345
 - Number page, format strings, 243
 - sorting groups, 348
 - text functions, 308–319
 - array functions, 313–315
 - character functions, 308
 - cleanup functions, 318
 - conversion functions, 315
 - formatting functions, 312
 - search functions, 309–312
 - string evaluation functions, 317
 - string manipulation functions, 316
 - TextRun element, 866
 - TextRuns element, 866
 - themes, applying to maps, 572
 - thermometer Fahrenheit/Celsius linear gauge, 520
 - thermometer linear gauge, 520
 - three color range linear gauge, 520
 - tick marks
 - in Scale Properties dialog box, 528
 - on chart axis, 472
 - on gauge scale, 521
 - configuring for radial gauges, 529
 - TIFF (Tagged Image File Format)
 - exporting reports in, 732
 - hard page-break renderer, 397
 - reports in, 29, 730
 - TIGER/Line shapefiles, 560
- tiles
 - Map Tile Layer Properties dialog box, 593
 - tile layer maps, 603
 - using in Power View visualizations, 10, 845–848
 - multiple visualizations in tiles container, 846
 - synchronization, 847
 - visualization mode, 846

TimeOfDay function

- TimeOfDay function, 323
- timeouts
 - EditSessionTimeout property, 676
 - RDLXReportTimeout property, 677
 - report execution, 673
 - SessionTimeout property, 677
- Timer function, 323
- TimeString function, 323
- TimeValue function, 322
- titles, map, 577, 582, 589
- Today function, 323
- ToggleItem property, 352
- toolbar (MDX query designer), 431
- Toolbox, using to add report items, 214
- Toolbox window (Visual Studio), 156
- ToolTip property, 240
- tooltips
 - adding, 355
 - configuring for indicators, 542
 - function, 308
 - function tooltip in Expression dialog box, 285
- Top %, Bottom % operators, 382, 384
- Top N, Bottom N operators, 382, 384
- total, adding in Report Builder, 125
- TraceFileMode setting, 693
- TraceListeners setting, 693
- trace logs
 - generated by Reporting Services, 691–693
 - HTTP log, 693
- Transaction class, data processing custom extension, 900
- Transact-SQL script, 93
- transformations
 - tablix, 259–261
 - matrix to table, 260
 - table to matrix, 259
- transparency
 - map layers, 594
 - No Color option for background, 245
- triangular moving average formula, 506
- trigonometry functions, 323
- Trim function, 319
- TRIX (triple moving average) formula, 507
- Try-Catch blocks
 - CreateLinkedItem function, 912
 - in script for deploying reports, 907, 909
- two scales linear gauge, 520
- two scales radial gauge, 519
- Type property, DataSources collection, 288

U

- UCase function, 315
- Unattended Execution Account, 628
 - using for external images in reports, 220
- United States Census Bureau, 559
 - ESRI shapefiles, 561
- units of measurement (Location property), 238
- Universal Naming Convention (UNC) for folders, 746
- update notification for report parts, 792–794
- Update Report Parts dialog box, 793
- Up / Down Arrows button, Map Layers pane, 592
- Upgrade Advisor, 18
- upgrading from prior versions of Reporting Services, 18–24
 - in-place upgrade, 20
 - native-mode report server upgrade, 20
 - preparation for, 18
 - reports upgrade, 21
 - SharePoint integrated-mode report server migration, 23
 - SharePoint integrated-mode report server upgrade, 21
- uploading reports, 611–614
- URLs
 - Go To URL action, 365
 - ImageURL check box, 817
 - linking to reports with URL access, 927–938
 - using URL access parameters, 931–938
 - viewing a report, 927–931
 - locating for report server, 610
 - modifying report URL to hide document map, 359
 - ReportBuilderLaunchURL property, 677
 - Reporting Services 2005 and SharePoint, 75
 - Report Manager URL, 78
 - ReportServerURL property for ReportViewer, 942
 - shared data sources assigned to report on integrated-mode server, 626
 - target server URLs for SharePoint integrated mode, 608
 - URL access to reports
 - changing rendering information, 406
 - setting device information settings, 407
 - using to find folders in target report server, 131
 - web service URL for native mode Reporting Services, 73–77
 - URL reservation defining URL endpoint, 74
- USA By State (Map Gallery), 559
- User Account Control, disabling, 77

- user accounts
 - Analysis Services administrator, 70
 - domain user account and password, 678
 - planning for reporting services, 60–61
 - SQL Server administrator, 69
- UserID member, User collection, 292
- user input for parameters, 146
- User Role Properties dialog box, 647
- users
 - technical skills and interest levels of, 139–141
 - understanding how they will use reports, 141
 - User collection, 291
- UseSessionCookies property, 677

V

- Val function, 334
- value axis, 466
- Value element, 864
- Value property
 - Fields collection, 289
 - indicators, 542
 - Parameters collection, 291
- values
 - comparing to goals. *See* gauges
 - Values and States page of indicator properties, 542
 - Values section, Chart Data pane, 457
 - fields, 458
 - field selection, 457
 - series properties, 458
 - value aggregation, 457
- Value setting, BackgroundImage property, 246
- Var function, 328
- variables
 - global variables for page numbers, 420
 - initial variable declaration for web service application, 920
 - PageName global variable, 423
 - using to manage evaluation of expression-based values, 300–303
 - DeferVariableEvaluation property, 303
 - group variables, 301
 - report variables, 302
 - Variables category, Expression dialog box, 282
 - Variables collection, 292, 301
 - Variables page, Category Group Properties dialog box, 464
- VarP function, 328
- VbStrConv enumeration, 315
- VDS Technologies, ESRI shapefiles, 561
- verification of report deployment, 609
- VerticalAlign property, 241
- Vertical Axis Properties dialog box, 469, 482
 - logarithmic scale, 491
- vertical gauge type, 520
- view filter (in Power View), 848–854
 - advanced filter mode, 850
 - basic filter mode, 849
- viewing reports, 134–136
 - knowing how users will view reports, 139
 - opening a report in SharePoint document library, 135
 - opening reports in Report Manager, 135
 - using HTML Viewer, 136
- viewports, map, 582
 - configuring properties, 582–588
- views
 - Views commands, Home tab of Report Builder ribbon, 112
 - View tab of Report Builder ribbon, 114
- virtual directories, backing up added or changed files, 19
- visibility
 - configuring, 352–354
 - adding tooltips, 355
 - drilldown reports, 353
 - showing or hiding a row, 353
 - Select Parameter Visibility property, report parameters, 370
 - setting for map parallels and meridians, 586
 - showing or hiding a document map, 358
 - Visibility page, map layer dialog boxes, 594
 - Visibility page, Series Properties dialog box, 459
- Visual Basic .NET, 877
 - data processing extension sample code, 890
 - scripting repetitive tasks in, 905
- visualization mode, 846
- Visual Studio
 - learning the interface, 155–157
 - SQL Server and, 16
- Visual Studio 2010
 - Report Designer integration with, 103
 - SQL Server Data Tools (SSDT) integration with, 151
- Visual Studio 2010 SP1, prerequisite for SQL Server 2012, 61

W

- Wagner3 projection, 588
- WCF (Windows Communication Foundation), shared service WCF endpoints, 42
- web applications
 - attaching SharePoint content database to, 23
 - creating SharePoint web application, 87–89
- Web.config files
 - saving for report server, 19
 - updating for new web application, 918
- web front-end (WFE), adding Reporting Services WFE to SharePoint farm, 96
- Web Parts, 32
 - adding SQL Server Reporting Services Report Viewer Web Part, 718
 - configuring, 719–725
 - Appearance section of tool pane, options, 722
 - Layout and Advanced sections of tool pane, 723
 - native mode, 724
 - View section of tool pane, settings, 720
 - creating a Web Part page, 718
 - installing and registering for Reporting Services, 39
 - installing SharePoint 2.0 Web Parts on SharePoint server, 83
 - Report Viewer Web Part, 41
- web service
 - accessing reports with, 944–947
 - Load method, 945
 - references, 944
 - Render method, 945
 - solution deployment, 947
 - using to manage report server, 918–925
 - initial variable declaration, 920
 - page load, 920
 - recipient list, 920
 - references, 918
 - report list, 921
 - schedule list, 921
 - subscription creation, 922–924
 - web application execution, 924
 - Web.config file, 918
- Web Services Definition Language (WSDL), 178
 - Rs utility scripts interacting with web services, 906
- web service URL for native mode Reporting Services, 73–77
- Weekday function, 322
- WeekdayName function, 322
- WeekOfYear values, 320
- weighted moving average formula, 507
- WHERE clause of a dataset query
 - adding query parameter, 389
 - cascading parameters, 447
- white space, 404–406
 - preservation by hard page-break renderers, 405
 - removing in reports by setting ConsumerContainerWhitespace property, 405
- Width element, 861, 866
- Windows application event log, 690
 - monitoring, 691
- Windows Authentication, use for Analysis Services data sources, 426
- Windows Communication Foundation (WCF), shared service WCF endpoints, 42
- Windows file share delivery, 746–748
 - report delivery options, 747
- Windows Firewall, setup check for enablement of, 62
- Windows Graphics Device Interface Plus (GDI+), supported file formats, 732
- Windows integrated security, 627
 - enabling or disabling, 675
- Windows Management Instrumentation (WMI) provider, 914
 - using to change report server configuration settings, 914–917
 - application execution, 916
 - application walkthrough, 915–918
- Windows Management Instrumentation (WMI) service, 62
- Windows on Windows 64-bit (WOW64), 55
- Windows Performance Monitor, 699
 - performance counters for alerting, 777
- Windows PowerShell
 - cmdlets for changing alerting service retries, 774
 - installing Web Parts, 724
- Windows PowerShell cmdlets
 - configuring Reporting Services service application, 91
 - generating Transact-SQL script, 93
 - using to configure report server, 917
 - using to create and configure shared service applications, 42
- Windows User Account Control (UAC) restrictions, 652
- WITH clause, MDX queries, 433

Word

- exporting reports into, 728
- page headers and footers, 412
- Reporting Services support for, 16
- report rendered to Word 2007-2010,
 - WORDOPENXML render format, 398
- soft page-break renderer, 396
- Word 2003 renderer, 17
- Word 2010 renderer, 17, 29

WORD render format, 398

WOW64 (Windows on Windows 64-bit), 55

WritingMode property, 244

WSDL (Web Services Definition Language), 178

- Rs utility scripts interacting with web services, 906

X

x-axis, 466

XElement class, 871

XLS files, 16

XLSX files, 16, 725

XML

- data renderer, 396

- data sources, 178

- exporting reports in, 735

- LINQ (Language-Integrated Query) to XML interface, 871

- RDL files as, 859

- reports in, 29

XSD (XML schema definition) for RDL, 860, 863

Y

y-axis, 466

Year function, 322

Z

ZIndex property, report item visibility and, 216

zoom, adjusting for maps, 583

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