MDX Solutions

Second Edition

With Microsoft® SQL Server™ Analysis Services 2005 and Hyperion® Essbase

George Spofford
Sivakumar Harinath
Christopher Webb
Dylan Hai Huang
Francesco Civardi

Wiley Publishing, Inc.

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To my wife, Lisa, and to my parents, for their care and love with their children

—George Spofford

I dedicate this book in the grandest possible manner to my dear wife Shreepriya, who has been fully supportive and put up with me disappearing from home or spent several late nights when I worked on this book. It is also dedicated to my two-month-old twins Praveen and Divya, who do not know yet what a book is. I wish their cute photographs could be on the cover page. Finally, I would like to dedicate this book to the memory of my father Harinath Govindarajalu who passed away in 1999 who I am sure would have been proud of this great achievement and to my mother Sundara Bai.

—Sivakumar Harinath

For Helen and Natasha

—Chris Webb

To Alice, for your support and love.

—Dylan Hai Huang

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—Francesco Civardi

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Introduction

Dimensional applications are best and most easily built using a dimensional language. These dimensional applications are typified by the related notions of OLAP and dimensional data warehouses and marts. MDX (for *MultiDimensional eXpressions*) is the most widely accepted software language used for these applications. The book you read here, *MDX Solutions*, is the second edition of a guide to learning and using MDX. Since the first edition of *MDX Solutions*, the number of analytical applications that use MDX has grown very large, and several more servers and many third-party and homegrown client tools now allow you to use MDX to express the logic you use to calculate and to retrieve your information.

As a language, MDX is rather different in style and feel from SQL, and quite different from other programming languages like C++, C#, Lisp, Fortran, and so on. You can think of the formula language of a spreadsheet like Excel as another programming language, and while it is different than Excel, characterizing MDX as a sort of Excel-like SQL or a SQL-like Excel seems more apt than any other analogy. (If you're familiar with other OLAP query or calculation languages, it has more in common with them, but many readers will not be.)

In particular, compared to the first edition, this edition incorporates both a new version of a product and a product that has added support for MDX since then. Microsoft has released Microsoft® SQL Server 2005™ Analysis Services, which changes its use of MDX from the product's prior version. Hyperion Solutions has released Hyperion® System™ 9 BI+™ Analytic Services™, which builds on the Essbase functionality that introduced the term OLAP to the industry. (Since this book will refer to these products many times, we will refer to them with names that are informally shortened from the vendor's designations: *Analysis Services 2005*, *Analysis Services 2000*, and *Essbase 9*.)

Overview of the Book and Technology

The dimensional language works with a (multi-) dimensional data model. There are no formal or detailed standards of data model in the OLAP industry, and the number of details that would need to be worked out is quite large. However, there are a good number of aspects that are common by convention to different products. MDX has a standard syntax that handles the constructs and capabilities of many servers quite well. Vendors with additional capabilities extend MDX to provide access to them.

MDX originated as part of Microsoft's OLE DB for OLAP specification, and while the language was controlled by Microsoft, it sought input from several OLAP vendors and industry participants to help ensure that the language would be useful to multiple vendors. Microsoft has committed to transfer control of the specification to the XMLA Council (`http://www.xmla.org`), a consortium committed to coordinating and promoting a standard XML for Analysis specification. XML for Analysis is a web services API, spearheaded and supported by Microsoft, Hyperion and SAS Institute.

This book attempts to guide a pragmatic course between learning the language, and learning how to use it for the three product versions that we emphasize:

- Microsoft Analysis Services 2005
- Essbase 9
- Microsoft Analysis Services 2000

Microsoft has made a number of changes to its underlying data model with the 2005 release, and also a number of changes to how things built in MDX work with each other. This book devotes significant attention to using both of these kinds of changes. The Hyperion Essbase model has had a number of additional capabilities as well.

Other vendors or projects whose server products support MDX include: Applix, Microstrategy, MIS AG, Mondrian, SAP, and SAS Institute. Other companies, like Simba and Digital Aspects, provide tools and SDKs to assist construction of servers and clients that use MDX and related APIs. A large number of client tools use MDX to provide end users the ability to access sophisticated applications using MDX.

In order to fully wield MDX, you will need to really master how the server supports OLAP and how MDX behaves, since the two sides impact each other. Awesome MDX can make up for or extend the capabilities of a dimensional design; an awesome server design can eliminate the need to devote much MDX to solving the problem. This being a book on MDX, we won't spend much time

telling you how not to use MDX, but we will point out some cases where you're better off using some other aspect of your application environment.

How This Book Is Organized

If you are new to MDX, welcome! The chapters are sequenced to introduce you to the syntax, capabilities and use of MDX. Chapters 1, 2 and 3 introduce the basics of MDX and use. Chapter 4 discusses the logic of actually executing MDX in some depth, and although it is sort of a large chapter, there is a lot to know across the three product versions to actually understand in some detail how your MDX actually works. Chapters 5, 6, and 7 then build on using the details of how it works. Chapters 8 and on begin to cover product-specific aspects. So the first half of the book forms a background in capabilities and technique, and the second half introduces a range of possibilities specific to Microsoft and Hyperion.

Appendix A is a reference to all of the functions and operators of standard MDX and the extensions provided by the product versions covered. These functions are a big part of the language, and combining them in the right ways allows you to solve many different problems. They are a big part of the vocabulary for MDX, so the more of them you familiarize yourself with, the better. If the reference weren't so large, it would probably be a chapter in between Chapters 3 and 4, so that after learning the basics of MDX use you would immediately progress to the range of functions available. In several places within the chapters, you are specifically encouraged to look in Appendix A, and here in the introduction we will also encourage you to go through it. We won't be able to cover the use of every single function within the chapters otherwise, so you will pick up some useful nuggets by reviewing it on its own.

You will pick up a lot of technique and a number of tricks from the first seven chapters. These techniques will all be amplified by the contents of later chapters, or will be applicable to them. Unfortunately, we won't be able to give you every solution to every problem that you will have, but we hope to give you all you need to know about putting it together for yourself.

MDX is suited for a large number of applications. In order to simplify examples and explanations, this book includes only a few and really focuses on two. The Waremart 2005 database provides a common frame of reference between Hyperion and Microsoft products across many features and techniques, although it provides only a simple cube to work with. Chapters that deal largely with Analysis Services 2005 capabilities (including Chapters 8, 10, 13, and 14) will also refer to the Adventure Works database that ships with that product. Chapter 13 also includes a series of simple but incrementally more sophisticated databases.

What's Not in This Book

This book does not really cover the non-MDX aspects of building an analytical application. For developers targeting the Microsoft tool set, you may wish to refer to *Professional SQL Server Analysis Services 2005 with MDX* by Sivakumar Harinath, and Stephen R. Quinn, or *The Microsoft Data Warehouse Toolkit : With SQL Server 2005 and the Microsoft Business Intelligence Toolset* by Joy Mundy and Warren Thornthwaite.

Who Should Read This Book

This book is for any developer, consultant, or manager that needs to build and maintain a proficiency in MDX. MDX, dealing with calculations and selections, can be used for a large part of an overall application, so your concern may be as a front-end developer tasked with matching gestures or other specifications into MDX that retrieves a modified query. You may be an ASP or JSP developer, or developing reports in SQL Server's Reporting Services, and need to be able to translate simple and complex report requests. You may also be developing server-side calculation and modeling logic or security filters. Each of these may boil down to MDX that you write or MDX that you form in some helpful GUI. While the GUI may completely address your concerns, the code it generates will interact with other definitions and you are much better off having a good idea of what is going on and what the limits are.

Tools You Will Need

In order to run queries from the book, you will need a front end or API that you can send MDX in through and receive results back. Microsoft SQL Server 2005 ships with the SQL Server Management Studio, which can be used to run MDX queries. If yoiu have upgraded from Analysis Services 2000, you may still use the MDX Sample application from that product edition against Analysis Services 2005. Hyperion Essbase incudes the Analytic Administration Services console and the Essmsh command shell. Other tools are available as well; see the following on the related Web Site.

What's on the Web Site

The web site contains a collection of sample databases and code for use in Analysis Services and Essbase, and an MDX query interface for Essbase.

Summary

MDX is its own language, similar in some ways to languages you are familiar with and different in other ways. Even if you are familiar with OLAP concepts from one of the covered products, and especially if you are new to them, you may find it helpful to approach the language on its own terms. We don't assume that you know any of the language at the beginning, but if you do then we hope you will learn useful details that you didn't know at the outset. And we hope that you enjoy both learning and using it.