

# The Portable Portfolio: Improving Retirement Planning With Semantic Web Technology

*By Ira Rudowsky*

The following article discusses how to improve the calculations used in online retirement planning software programs so that users can obtain better information for better planning.

The Internal Revenue Code Sec. 401(k) retirement savings plan regulation may have put the employee into the driver's seat, but recent market turmoil has caused major vehicular damage. Worker confidence in a comfortable financial retirement is at an all-time low. Performing a retirement savings calculation improves the chance for successful planning. This article proposes and describes the use of Semantic Web technology as the "lingua franca" for automating the tedious process of gathering data from multiple sources into a standardized, electronic format.<sup>1</sup> This improves the accuracy and portability of a participant's financial retirement portfolio, thereby increasing confidence in the retirement planning process.

## Introduction

One of America's most influential founding fathers, Benjamin Franklin, left a legacy of memorable and

---

Ira S. Rudowsky is Professor of Computer and Information Science at Brooklyn College of the City University of New York. He has over 25 years of hands-on experience in designing, developing and managing application software for the financial industry. During his decade of tenure in Merrill Lynch as a Systems Architect (Vice President), he supported the business systems of the retirement planning division during its metamorphosis from mainframe to LAN and Web platforms.

He received his Ph.D. in Computer Science from the City University of New York in 1982. He is a member of the ACM, AIS, PMI and IEEE Computer Society. Mr. Rudowsky can be reached via e-mail at [rudowsky@brooklyn.cuny.edu](mailto:rudowsky@brooklyn.cuny.edu).

sagacious sayings. Among them one finds "work as if you were to live to a 100 years, pray as if you were to die tomorrow."<sup>2</sup> Franklin must have taken his own advice as he, himself, lived to the ripe old age of 84. American workers in the twenty-first century, however, seem to be ignoring Franklin's advice—the labor force participation rate of men sixty-five<sup>3</sup> and over in retirement plans has dropped from 76.6 percent in 1850 to 17.5 percent in 2000.<sup>4</sup> With increased and healthier longevity, men today can expect to spend more time in retirement than their working brothers did one 150 years ago. Are they properly prepared for this event?

The Pension Protection Act of 2006<sup>5</sup> encourages employers to automatically enroll new workers into 401(k) plans.<sup>6</sup> At the same time, employers (and the financial services firms that administer their 401(k) retirement plans) are encouraged to introduce advice services. Although face-to-face sessions with an adviser are more effective in encouraging savings and diversification, online computer programs are one avenue for providing advice services.

## An Erosion of Confidence

A recent survey by the Employee Benefit Research Institute indicates a drop in retirement confidence by workers.<sup>7</sup> The percentage of workers very confident about having enough money for a comfortable retirement dropped from 27 percent in 2007 to 18 percent in 2008. This is the biggest one-year drop in

the 18-year history of the survey. Decreases in confidence occurred across all age groups and income levels but was particularly acute among younger workers and those with lower incomes. About half of the workers surveyed reported that they (and/or a spouse) have tried to calculate how much money they will need for a comfortable retirement. It appears that doing a retirement savings calculation is particularly effective at changing worker behavior: 44 percent of those who calculated a goal changed their retirement planning, and of those, almost two-thirds (59 percent) started saving or investing more. Thus, performing a portfolio calculation increases the chance of successful retirement planning. Assuming the tools to do this are available, is all the needed information being made available to a participant and being included in the retirement planning evaluation process?

As the first wave of Baby-Boomers moves into retirement age (in 2006, boomers started turning 60) to be followed over the next eighteen years by more than 78 million additional retirees,<sup>8</sup> a great deal of preparation and planning will be needed to ensure a comfortable retirement life. As reported by the Wall Street Journal,<sup>9</sup> the recent rout of the stock market has “ignited a crisis of confidence” for millions of U.S. employees who manage their own 401(k) plans. That same article reported from the Employee Benefit Research Institute that during the period of October 2007 through October 2008, \$1 trillion dollars of 401(k) stock value (out of total assets of \$2.5 trillion) was wiped out of 50 million 401(k) plans. If IRAs are included in the calculation, then “about \$2 trillion of stock value evaporated.” According to the Center for Retirement Research at Boston College,<sup>10</sup> the percent of working-age households at risk of being financially unprepared for retirement has increased from less than one-third in 1983 to 44 percent in 2006.

### **Help Is on the Way!**

---

Studies have shown that too many people do a poor job of making investment decisions for their 401(k) savings plans. Managed accounts programs are an attempt to address these poor investment strategies by employing sophisticated models to (1) make invest-

ment decisions on behalf of participants and (2) tailor portfolios to match each investor’s age and appetite for risk. These types of programs also take into account any other retirement income the participants can expect—pensions, Social Security earnings, a spouse’s portfolio, *etc.*<sup>11</sup>

General Motors Corporation (GM) offers advice to its salaried employees through a software planning tool called Financial Engines. According to Preston Crabill, GM’s director of pension and savings plans, participants who use the tool “are both better diversified and have better total returns.” Participants generally enter various personal data online, including any savings outside their 401(k) plans. The programs provide a snapshot of how much income a participant will be able to replace in retirement based on those current factors. Then, the program crunches the numbers and generates a portfolio better suited to meeting the participant’s income replacement needs in retirement.

**The more detailed and specific the information about a participant’s net worth, the more accurate the output of the planning software.**

Many commercial Web sites, for example TIAA-CREF (Teachers Insurance and Annuity Association—College Retirement Equities Fund)<sup>12</sup> and Fidelity Investments,<sup>13</sup> offer calculators and planning tools to help an individual investor make the best investment choices for retirement planning. The more detailed and specific the information about a participant’s net worth, the more accurate the output of the planning software. Some of the sources of financial input data include:

- Checking account
- Savings account
- Defined contribution pension
- Defined benefit pension
- Social Security pension
- 401(k) plan
- Tax-deferred 403(b) annuity
- 457(b) plan
- Keogh
- IRAs
- After-tax annuities
- Brokerage accounts
- Stocks
- Bonds
- Real estate funds
- Mutual funds
- Life insurance cash value

**Figure 1. PortablePortfolio.html code**

```

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/
xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<title>Portable Portfolio of Frank Thomas</title>
</head>
<body>
<h1>Portable Portfolio of </h1>
<h2>Frank Thomas<br />
  <br /> Brooklyn, New York 11209<br /> ID: TR-345A-21</h2> <h2>Stocks</h2>
<table border="1">
  <tr bgcolor="#9acd32">
    <th align="center">Symbol</th>
    <th align="center">Shares</th>
    <th align="center">Purchase<br />
    Price</th>
    <th align="center">Purchase<br />
    Date</th>
  </tr>
  <tr>
    <td>IBM</td> <td>1500</td> <td>87.23</td> <td>2007-01-04</td>
  </tr>
  <tr>
    <td>MSFT</td> <td>2000</td> <td>43.15</td> <td>2005-10-23</td>
  </tr>
</table>
<h2>CDs</h2>
<table border="1">
  <tr bgcolor="#9acd32">
    <th align="center">Issuer</th><th align="center">Shares</th>
    <th align="center">Purchase<br /> Price</th>
    <th align="center">Purchase<br /> Date</th> <th align="center">Maturity<br /> Date</th>
  </tr>
  <tr>
    <td>WaMu</td><td>10000</td><td>10000</td><td>2008-01-11</td><td>2012-01-11</td>
  </tr>
</table>
<h2>Mutual Funds</h2>
<table border="1">
  <tr bgcolor="#9acd32">
    <th align="center">Symbol</th><th align="center">Shares</th>
    <th align="center">Purchase<br /> Price</th> <th align="center">Purchase<br /> Date</th>
  </tr>
  <tr>
    <td>FSLEX</td> <td>1200</td> <td>45.33</td> <td>2004-11-04</td>
  </tr>
</table>
</body>
</html>

```

## More Help Is Needed

As diligent and meticulous as a participant can be in maintaining the latest values for the above categories, the financial data can change on a daily basis. Given that a participant could have multiple sources for the above information (multiple brokerage accounts, pensions from prior and current employers, spousal information for all of the above categories, *etc.*) the collection and summarization of the data can become an onerous task. Yet, its accuracy is crucial to successful retirement planning.

What can be done to simplify and automate the data collection process without compromising the integrity of the data? The goal of this article is to show how improving the programming language used in retirement planning software will provide better financial data gathering and aggregation. More specifically, the author will explore using tagging elements from a process called “eXtensible Markup Language” (XML) to create a common software language. The vendors of retirement planning software will have an incentive to conform to a

standard in order to attract business, thus making a retiree’s data (and spousal information where applicable) portable to the planning services of choice. Hopefully, this will improve the planning process for retirees and increase their confidence in the future, something which has been badly shaken over the past year.

## What Can Help?

### Markup Languages

Formalized in the late 1970s, Standard Generalized Markup Language (SGML),<sup>14</sup> is a meta-language that can be used to provide, in a human-readable form, information about the content of each element of a document. The roots of SGML can be found in IBM’s Generalized Markup Language (GML) that was developed in the 1960s by Goldfarb, Mosher and Lorie. Early applications of SGML were in document interchanges between authors and publishers, and military documentation projects. One of the most famous applications of SGML is HyperText Markup Language (HTML) which was developed by Tim Berners-Lee in 1991 while working at CERN. HTML’s forte is in describing the format of a document. It was through HTML and Berner-Lee’s concurrent development of Hyper Text Transfer Protocol (HTTP) that the explosive growth of the Internet began, and has not yet subsided.

What can be done to simplify and automate the data collection process without compromising the integrity of the data?

HTML is an excellent tool for the task for which it was designed—enabling the sharing of scientific research results across a computer network and providing the ability to link documents via hyperlinks. However, it is limited in its extensibility and cannot meet the need for content management. See Figure 1 for an example of an HTML file that portrays a sample portfolio and Figure 2, which shows how the HTML file is displayed in a browser. Note that the descriptive and financial information are embedded in the formatting tags e.g., header tags <h1> and <h2> and table tags <table>, <th>, <tr> and <td>. Changes to the data are made directly to the HTML file. Thus, if new investments are added or existing investments removed, manual changes to sections of the formatting code must be made. A web page developed in HTML is, unfortunately, limited to the formatting tags published by the World Wide

Web Consortium (W3C). There is no way to associate any content information with the data—enter XML and *The Portable Portfolio* to the rescue.

### eXtensible Markup Language (XML)

The eXtensible Markup Language (XML),<sup>15</sup> is a simple subset of SGML developed by the W3C in 1996. It is a meta-language to describe content rather than formatting. Its tags can be extended and modified by the developer to meet the customized needs of an application.

As described in a W3C press release,<sup>16</sup>

XML is primarily intended to meet the requirements of large-scale Web content providers for industry-specific markup, vendor-neutral data exchange, media-independent publishing, one-on-one marketing, workflow management in collaborative authoring environments, and the processing of Web documents by intelligent clients ... The language is designed for the quickest possible client-side processing consistent with its primary purpose as an electronic publishing and data interchange format.

### XML Document

An XML document contains descriptive data for each attribute that comprises an element. For example, a

Figure 2. PortablePortfolio.html

Portable Portfolio of Frank Thomas Brooklyn, NY 11209 ID: TR-345A-21				
<b>Stocks</b>				
Symbol	Shares	Purchase Price	Purchase Date	
IBM	1500	87.23	2007-01-04	
MSFT	2000	43.15	2005-10-23	
<b>CDs</b>				
Issuer	Shares	Purchase Price	Purchase Date	Maturity Date
WaMu	10000	10000	2008-01-11	2012-01-11
<b>Mutual Funds</b>				
Symbol	Shares	Purchase Price	Purchase Date	
FSLEX	1200	45.33	2004-11-04	

simple XML description of a stock might be written as follows:

```
<stock>
  <symbol>IBM</symbol>
  <shares>1500</shares>
  <purchase_price>87.23</purchase_price>
  <purchase_date>2007-01-04
</purchase_date>
</stock>
```

An opening and closing tag named <stock> indicates that the information contained within those tags relates to an element entity named stock. The four tags contained with the stock entity are descriptive attribute information, *i.e.*, the stock symbol, number of shares owned, purchase price and purchase date. Because XML is extensible, it is possible to create as many additional elements and attributes as needed to complete the financial picture of a participant.

The stock attribute resides within a complete XML document that includes document header informa-

**Figure 3. PortablePortfolio.xml**

```
<?xml version="1.0"?>
<portfolio>
  <personalinfo>
    <fname>Frank</fname>
    <lname>Thomas</lname>
    <address>1786 Fifth Avenue</address>
    <city>Brooklyn</city>
    <state>New York</state>
    <zipcode>11209</zipcode>
    <id>TR-345A-21</id>
  </personalinfo>
  <stock>
    <symbol>IBM</symbol>
    <shares>1500</shares>
    <purchase_price>87.23</purchase_price>
    <purchase_date>2007-01-04</purchase_date>
  </stock>
  <stock>
    <symbol>MSFT</symbol>
    <shares>2000</shares>
    <purchase_price>43.15</purchase_price>
    <purchase_date>2005-10-23</purchase_date>
  </stock>
  <CD>
    <issuer>WaMu</issuer>
    <shares>10000</shares>
    <purchase_date>2008-01-11</purchase_date>
    <purchase_price>10000</purchase_price>
    <maturity_date>2012-01-11</maturity_date>
    <APR>3.46</APR>
  </CD>
  <mutualFund>
    <symbol>FSLEX</symbol>
    <shares>1200</shares>
    <purchase_price>45.33</purchase_price>
    <purchase_date>2004-11-04</purchase_date>
  </mutualFund>
</portfolio>
```

**Figure 4. Display of XML File With Browser**

```
-<portfolio>
  -<personalinfo>
    <fname>Frank</fname>
    <lname>Thomas</lname>
    <address>1786 Fifth Avenue</address>
    <city>Brooklyn</city>
    <state>New York</state>
    <zipcode>11209</zipcode>
    <id>TR-345A-21</id>
  </personalinfo>
  -<stock>
    <symbol>IBM</symbol>
    <shares>1500</shares>
    <purchase_price>87.23</purchase_price>
    <purchase_date>2007-01-04</purchase_date>
  </stock>
  -<stock>
    <symbol>MSFT</symbol>
    <shares>2000</shares>
    <purchase_price>43.15</purchase_price>
    <purchase_date>2005-10-23</purchase_date>
  </stock>
  -<CD>
    <issuer>WaMu</issuer>
    <shares>10000</shares>
    <purchase_date>2008-01-11</purchase_date>
    <purchase_price>10000</purchase_price>
    <maturity_date>2012-01-11</maturity_date>
    <APR>3.46</APR>
  </CD>
  -<mutualFund>
    <symbol>FSLEX</symbol>
    <shares>1200</shares>
    <purchase_price>45.33</purchase_price>
    <purchase_date>2004-11-04</purchase_date>
  </mutualFund>
</portfolio>
```

tion, along with the stock information. See Figure 3 for a complete example.

The XML file in Figure 3 will display in the web browser as a directory tree (see Figure 4) that repeats the information in the XML file in a hierarchical structure without any user-friendly formatting.

An XML document is said to be well-formed if it complies with the following rules<sup>17</sup>:

- The document has one and only one root element.
- Every element is either self closing or has a closing tag.
- Elements are nested properly.
- The document has no angle brackets that are not part of tags.
- Attribute values are quoted.

To be valid, an XML document must be well-formed, have an associated schema and comply with that schema. A schema provides the ability to specify the explicit form and structure of an XML document. Thus, anyone who wishes to transmit or

receive an XML document in a standardized format must adhere to the schema in order to be fully and correctly understood. The XML schema definition provides the ability to define schemas.

## XML Schema Definition (XSD)

An XML schema definition (a W3C recommendation) provides the ability to define the legal components of an XML document. For example, a schema can define the elements that appear in an XML document, the attributes of the elements, child-parent relationships and data types for elements and attributes. Then, if so desired, the document can be validated against the schema to ensure it conforms to the required rules.

Thus, along with the XML document describing a participant's stock information would be an XML schema named PortablePortfolio.xsd that would describe what type of information belongs to a stock. The XSD below provides the following rules for stocks in a portfolio:

There can be any number of stocks per portfolio (maxOccurs="unbounded")

A stock is composed of:

- Symbol—string type
- Number of shares—decimal type
- Purchase price—decimal type
- Purchase date—date type

The code snippet below depicts a portion of an XSD file that describes the rules for a stock element and its attributes:

```
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="portfolio">
<xs:element name="stock" maxOccurs="unbounded">
<xs:complexType>
<xs:sequence>
<xs:element name="symbol"
type="xs:string"/>
<xs:element name="shares"
type="xs:decimal"/>
<xs:element name="purchase_price"
type="xs:decimal"/>
<xs:element name="purchase_date"
type="xs:date"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:element>
</xs:schema>
```

See Figure 5 for a more complete schema for the PortablePortfolio XML file.

In order to link an XML document to the appropriate XSD schema file, additional code is added to the portfolio tag as follows:

```
<portfolio xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="PortablePortfolio.xsd">
```

Though the form and structure of the XML document is fixed via the XSD, the presentation of the data can be customized to the needs of an individual. This can be accomplished via XSL.

## eXtensible Stylesheet Language Family (XSL)

The W3C provided a number of components within the XSL family to manipulate XML documents into other formats. Among these tools is XSL Transformation (XSLT) which enables the specification of transformation rules or stylesheets. The code below shows how the stocks section of a web page might be programmed to appear as an HTML table with column headers, specific border size and background color while the actual stock data in the document is extracted via a loop construct (<xsl:for-each select="portfolio/stock">) as shown below:

```
<font face="Courier New, Courier, mono">
<h2>Stocks</h2>
<table border="1">
<tr bgcolor="#9acd32">
<th align="center">Symbol</th>
<th align="center">Shares</th>
<th align="center">Purchase<br />
Price</th>
<th align="center">Purchase<br />
Date</th>
</tr>
<xsl:for-each select="portfolio/stock">
<tr>
<td><xsl:value-of select="symbol"/>
</td>
<td><xsl:value-of select="shares"/></td>
<td><xsl:value-of select=
"purchase_price"/> </td>
<td><xsl:value-of select=
"purchase_date"/></td>
</tr>
</xsl:for-each>
</table>
```

See Figure 6 for a sample XSL file that will format the data in the PortablePortfolio XML file to display as a Web page, similar to that found in Figure 2. The critical difference between the HTML code and XML/XSL code is that the content and formatting have now been separated—data in the XML file and formatting in the XSL file, while they are tightly coupled in the HTML file.

## Combining Information from Multiple Sources

To facilitate the aggregation of retirement plan data that a participant may be accumulating in accounts

**Figure 5. PortablePortfolio.xsl**

```

<?xml version="1.0" encoding="iso-8859-1"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:xsi="http://
www.w3.org/2001/XMLSchema-instance">
  <xsl:output method="html" encoding="us-ascii" doctype-public="-//W3C//DTD XHTML 1.0 Transitional//
EN" doctype-system="http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd"/>
<xsl:template match="/">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1"/>
  <title>Portable Portfolio</title>
</head>
<body bgcolor="#FFFFCC">
<font face="Verdana">
<h1>Portable Portfolio of </h1>
<h2>
  <xsl:for-each select="portfolio/personalinfo">
    <xsl:value-of select="fname"/> <xsl:text> </xsl:text> <xsl:value-of select="lname"/>
    <br />
    <xsl:value-of select="adress"/><br />
    <xsl:value-of select="city"/>, <xsl:value-of select="state"/> <xsl:text> </xsl:text>
    <xsl:value-of select="zipcode"/>
    <br />
    ID: <xsl:text> </xsl:text> <xsl:value-of select="id"/>
  </xsl:for-each>
</h2>
</font>
<font face="Courier New, Courier, mono">
<h2>Stocks</h2>
  <table border="1">
    <tr bgcolor="#9acd32">
      <th align="center">Symbol</th>
      <th align="center">Shares</th>
      <th align="center">Purchase<br /> Price</th>
      <th align="center">Purchase<br /> Date</th>
    </tr>
    <xsl:for-each select="portfolio/stock">
      <tr>
        <td><xsl:value-of select="symbol"/></td>
        <td><xsl:value-of select="shares"/></td>
        <td><xsl:value-of select="purchase_price"/></td>
        <td><xsl:value-of select="purchase_date"/></td>
      </tr>
    </xsl:for-each>
  </table>
<h2>CDs</h2>
  <table border="1">
    <tr bgcolor="#9acd32">
      <th align="center">Issuer</th>
      <th align="center">Shares</th>
      <th align="center">Purchase<br /> Price</th>
      <th align="center">Purchase<br /> Date</th>
      <th align="center">Maturity<br /> Date</th>
    </tr>
    <xsl:for-each select="portfolio/CD">
      <tr>
        <td><xsl:value-of select="issuer"/></td>
        <td><xsl:value-of select="shares"/></td>
        <td><xsl:value-of select="purchase_price"/></td>
        <td><xsl:value-of select="purchase_date"/></td>
        <td><xsl:value-of select="maturity_date"/></td>
      </tr>
    </xsl:for-each>
  </table>
<h2>Mutual Funds</h2>
  <table border="1">
    <tr bgcolor="#9acd32">
      <th align="center">Symbol</th>
      <th align="center">Shares</th>
      <th align="center">Purchase<br /> Price</th>
      <th align="center">Purchase<br /> Date</th>
    </tr>
    <xsl:for-each select="portfolio/mutualFund">
      <tr>
        <td><xsl:value-of select="symbol"/></td>
        <td><xsl:value-of select="shares"/></td>
        <td><xsl:value-of select="purchase_price"/></td>
        <td><xsl:value-of select="purchase_date"/></td>
      </tr>
    </xsl:for-each>
  </table>
</font>
</body>
</html>
</xsl:template>
</xsl:stylesheet>

```

Figure 6. PortablePortfolio.xsd

```

<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="portfolio">
  <xs:complexType>
    <xs:sequence>

      <xs:element name="personalinfo" >
        <xs:complexType>
          <xs:sequence>
            <xs:element name="fname" type="xs:string"/>
            <xs:element name="lname" type="xs:string"/>
            <xs:element name="address" type="xs:string"/>
            <xs:element name="city" type="xs:string"/>
            <xs:element name="state" type="xs:string"/>
            <xs:element name="zipcode" type="xs:string"/>
            <xs:element name="id" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>

      <xs:element name="stock" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="symbol" type="xs:string"/>
            <xs:element name="shares" type="xs:decimal"/>
            <xs:element name="purchase_price" type="xs:decimal"/>
            <xs:element name="purchase_date" type="xs:date"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>

      <xs:element name="CD">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="issuer" type="xs:string"/>
            <xs:element name="shares" type="xs:decimal"/>
            <xs:element name="purchase_date" type="xs:date"/>
            <xs:element name="purchase_price" type="xs:decimal"/>
            <xs:element name="maturity_date" type="xs:date"/>
            <xs:element name="APR">
              <xs:simpleType>
                <xs:restriction base="xs:decimal">
                  <xs:minInclusive value="0.0"/>
                  <xs:maxInclusive value="25.0"/>
                </xs:restriction>
              </xs:simpleType>
            </xs:element>
          </xs:sequence>
        </xs:complexType>
      </xs:element>

      <xs:element name="mutualFund">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="symbol" type="xs:string"/>
            <xs:element name="shares" type="xs:decimal"/>
            <xs:element name="purchase_price" type="xs:decimal"/>
            <xs:element name="purchase_date" type="xs:date"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>

    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:schema>

```

held at multiple sources (e.g., financial institutions), just a few minor adjustments to the XSD, XML and XSL files are required. To accommodate the source of the funds, a new element will be added to each `<xs:sequence>` in the XSD data dictionary: `<xs:element name="source" type="xs:string"/>`. This will indicate that in addition to the information currently stored for each investment type, the source of the investment will be stored as well. This, in turn, will expand the XML data file to include that information for each investment. For example, the following might be added to an individual stock record in an XML file to indicate that it is held by Fidelity: `<source>Fidelity</source>`.

The final change to be made involves the XSL formatting file. First, a column header will be added to each table header section to clearly label the information to be printed for each data record. This header will follow the pattern of the other headers: `<th align="center">Source </th>`.

Second, to display the actual data stored on the XML file and sort the records alphabetically, if so desired, a "sort statement" of the form `<xsl:sort select="source" order="ascending"/>` will follow the existing "for-each" statement. Then, the row detail section will begin with: `<td><xsl:value-of select="source"/> </td>`. This is followed by the existing code for the remainder of the investment information (such as symbol, number of shares, purchase price and purchase date for a stock).

Diagram 1 depicts the relationships between the XML, XSD and XSL files that enable a participant's raw financial data from multiple sources to be interpreted by the data dictionary and then aggregated and displayed in various formatted reports at the request of the participant.

Putting all these changes together will produce the output displayed in Figure 7. Thus, the XML/XSD/XSL triumvirate provides a means for an extensible and



user-defined, context-sensitive language with the ability to format the information as needed.

## Conclusion

XML has become the means of providing a common ground of communications for numerous scientific and business applications.<sup>18</sup> For example:

- **XML Common Biometric Format** provides a standard way to describe information that verifies identity based on human characteristics such as DNA, fingerprints, iris scans, and hand geometry.<sup>19</sup>

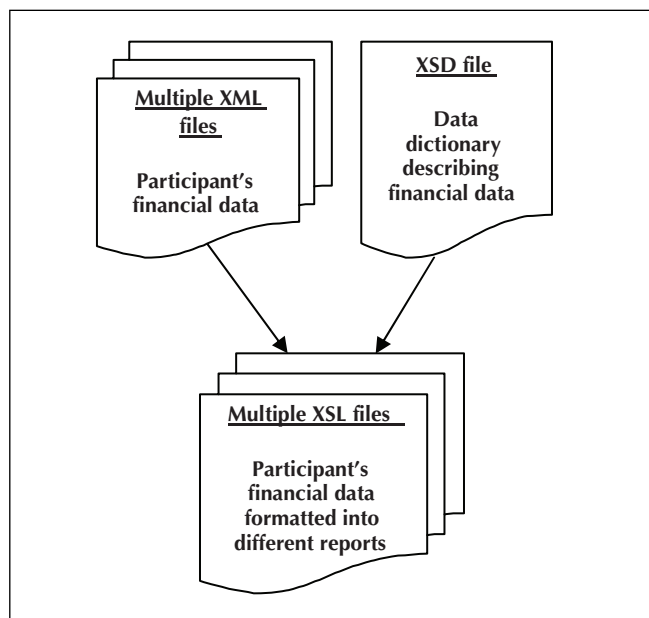
- **Extensible Business Reporting Language (XBRL)** is used in the electronic communication of business and financial data across the globe.<sup>20</sup>
- **Human Resources XML** enables e-business and the automation of human resources-related data exchanges.<sup>21</sup>
- **MathML** is used for describing mathematical notation and capturing both its structure and content. The goal of MathML is to enable mathematics to be served, received, and processed on the Internet.<sup>22</sup>

This article has hewn a path in defining a means of sharing and communicating retirement planning financial information through the use of Semantic Web Technology—XML, XSD and XSL. No matter the proprietary way a financial institution stores customer data, by using an agreed upon XSD standards library the information can be aggregated by the individual retiree across all sources into one standardized XML document. This document, which contains the participant’s complete retirement financial picture, can then be used as input to computer-based financial engines to provide a more accurate forecast of the participant’s retirement future than now possible. Software that uses a proprietary format for receiving external data can be easily adapted to read an XML document as input once a standard has been developed. Changes to the computational portions of the software would not be needed. Hopefully, this will help stem the confidence crisis in retirement planning that has evolved over the past few years and put retirees on a better footing for the future.

**Figure 7. Portfolio With Data from Multiple Sources**

Portable Portfolio of Frank Thomas Brooklyn, NY 11209 ID: TR-345A-21					
<b>Stocks</b>					
Source	Symbol	Shares	Purchase Price	Purchase Date	
BOA	BOA	1000	5.23	2008-10-23	
Fidelity	IBM	1500	87.23	2007-01-04	
Fidelity	MSFT	2000	43.15	2005-10-23	
<b>CDs</b>					
Source	Issuer	Shares	Purchase Price	Purchase Date	Maturity Date
Fidelity	WaMu	10000	10000	2008-01-11	2012-01-11
<b>Mutual Funds</b>					
Source	Symbol	Shares	Purchase Price	Purchase Date	
BOA	CGMT	1200	189.27	2007-01-06	
Fidelity	FSLEX	1200	45.33	2004-11-04	

**Diagram 1. The XML/XSD/XSL Triumvirate**



## ENDNOTES

- <sup>1</sup> This work was supported by PSC-CUNY grant 62097-00 40.
- <sup>2</sup> [www.ushistory.org/franklin/quotable/singlehtml.htm](http://www.ushistory.org/franklin/quotable/singlehtml.htm).
- <sup>3</sup> It is interesting to note that sixty-five was originally selected as the age at which workers of the German industry Krupp weapons and munitions factory would be entitled to a retirement pension. Statistical analysis indicated that most employees would not live to that age. This maximized the loyalty and productivity of the employees but minimized the actual cost to the company. Kaiser Wilhelm of Germany, an admirer of Krupp, adopted the same age for his civil service retirement plan. U.S. industrialists, impressed by the German retirement plan, followed suit. Unfortunately, the plan backfired as life expectancy took a sharp increase shortly after these programs were put in place. (Encyclopedia of Adult Development, Robert Kastenbaum, Oryx Press, 1993).
- <sup>4</sup> Short, J. (2002). Economic History of Retirement in the United States.

ENDNOTES

- Available online at <http://eh.net/encyclopedia/article/short.retirement.history.us>.
- <sup>5</sup> P.L. 109-280.
- <sup>6</sup> Levitz, J. (2008). *Raiding the 401(k) nest egg*. Wall Street Journal, May 5, 2008.
- <sup>7</sup> McDonald, J., and J. VanDerhi. (2008). *18th Annual Retirement Confidence Survey: Workers show record drop in retirement confidence, health care and economy are major concerns*. Washington, D.C.: EBRI News.
- <sup>8</sup> U.S. Census Bureau. (2006). *Oldest baby boomers turn 60!* U.S. Census Bureau, CB06-FFSE.01-2.
- <sup>9</sup> Laise, E. (2009). *Big slide in 401(k)s spurs calls for change*. Wall Street Journal, January 8, 2009.
- <sup>10</sup> Munnell, A., F. Golub-Sass, M. Soto, and A. Webb. (2008). *Do households have a good sense of their retirement preparedness?* Center for Retirement Research at Boston College, 8–11.
- <sup>11</sup> Lauricella, T. (2006). *The 401(k) that fixes itself*. Wall Street Journal, August 19, 2006.
- <sup>12</sup> [www.tiaa-cref.org](http://www.tiaa-cref.org).
- <sup>13</sup> [www.fidelity.com](http://www.fidelity.com).
- <sup>14</sup> Parsons, D. (2008). *Dynamic Web Application Development using XML and Java: Course Technology*.
- <sup>15</sup> Peltzer, D. (2004). *XML Language Mechanics & Applications: Addison Wesley*.
- <sup>16</sup> World Wide Web Consortium. (1997). W3C issues XML1.0 as a proposed recommendation. Available online at [www.w3.org/Press/XML-PR](http://www.w3.org/Press/XML-PR).
- <sup>17</sup> [www.w3.org/XML/Schema](http://www.w3.org/XML/Schema).
- <sup>18</sup> Murray, M. (2002). *Using the Extensible Markup Language (XML) As a Medium for Data Exchange*. The Communications of the Association for Information Systems: Vol. 9, Article 7. Available online at <http://aisel.aisnet.org/cais/vol9/iss1/7>.
- <sup>19</sup> [www.oasis-open.org/committees/tc\\_home.php?wg\\_abbrev=xcbf](http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=xcbf).
- <sup>20</sup> [www.xbrl.org/](http://www.xbrl.org/).
- <sup>21</sup> [www.hr-xml.org/hr-xml/wms/hr-xml-1-org/index.php?language=2](http://www.hr-xml.org/hr-xml/wms/hr-xml-1-org/index.php?language=2).
- <sup>22</sup> [www.service-architecture.com/xml/articles/math\\_xml.html](http://www.service-architecture.com/xml/articles/math_xml.html).

## CCH Learning Center Course... Boomer Planning (Second Edition)

Boomer Planning provides an overview of major considerations boomers will face as they near retirement. Many of these considerations have been concerns for past generations and will be concerns of future generations. Other concerns have developed only lately and therefore involve a unique problem of carrying little precedent for guidance. In addition to covering the main points for all boomers to consider, this course explores three “hot” tax issues that have been in the news recently:

- How to minimize tax on what is many boomers’ largest asset—their home;
- How to preserve employment-generated retirement savings either through a regular pension, a 401(k) plan, one or several IRAs, or a combination of vehicles; and
- How recent legal developments surrounding the rights of individuals in same-sex relationships have had an impact on the tax aspects of their retirement planning.

Topics covered in the course include home sale exclusion, maximizing the value of IRAs and Roth IRAs, pension reform, and unique planning challenges faced by same-sex couples.

Upon completion of this chapter, you will be able to:

- Understand and apply the home sale exclusion,
- Identify when special circumstances may reduce the home sale exclusion,
- Explain ways to maximize the value of IRAs and Roth IRAs,
- Describe some common features of long-term care insurance,
- Understand new pension reform rules and benefits under the Pension Protection Act, and
- Describe special financial challenges confronting baby boomers who are in same-sex relationships.

For more information on this CCH Learning Center course, please visit <http://cch.learningcenter.com/partners/cchcpe/>, product #43218001.

Copyright of Journal of Retirement Planning is the property of CCH Incorporated and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.