## 2.2 Conceptual 概念上的Overview

This section specifies how higher-level features of the file format are represented by combinations of records.

### 2.2.1 Cell Table

Text, formulas, and numerical data within [**workbooks**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe) are primarily stored in the cells that make up **worksheets** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) and **macro sheets** (section [2.1.7.20.4](#Section_0dddd943f77a4fc2bf92868acb4587f7)). Cells are the fundamental building blocks that contain data, formulas, and formatting to form the workbook. The data structure associated with the grid of cells is called the **cell table**.

The cell table is stored in the sequence of records that conform to the **CELLTABLE** rule (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)) within the Common Productions [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf). The cell table consists of a series of row blocks. From the first row containing data to the last row containing data, every 32 consecutive rows, including blank rows, comprise a row block.

The number of row blocks in a [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) is specified by the following algorithm that uses fields from the **Dimensions** record (section [2.4.90](#Section_5fd3837c9f3d49528a85ad93ddb37ced)):

if ((rwMac –rwMic) % 32 == 0)

number of row blocks = (rwMac –rwMic) / 32

else

number of row blocks = (rwMac –rwMic) / 32 + 1

Within each row block, a **Row** record (section [2.4.221](#Section_4aab09eb49ed4d01a3b11d726247d3c2)) is saved for each row that contains data or row formatting. For each such row, every [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) that contains data or individual cell formatting is represented by a record. Formatting information for a cell can be derived from individual cell formatting, row formatting, column formatting, or the default cell format as specified by the **XFIndex** structure (section [2.5.282](#Section_0b683865eeee4621a3d8b18d20a2afd9)). The order of precedence for formatting is individual cell formatting with the highest precedence, followed by row formatting, and then column formatting, and then the default cell format. Cells that do not contain data and do not contain individual formatting are not saved.

Cells are specified by any of the records specified in the **CELL** rule (section 2.1.7.20.6). Multiple cells can be represented by one record—for example, a **MulBlank** record (section [2.4.174](#Section_a9ab7fa1183a487ca5066b4a19e770be)) specifies a series of blank cells. Note that blank cells are only included when they contain individual cell formatting. Rows are saved in increasing order, and cells are saved in row-major order.

The order of the records that comprise a row block begins with a series of **Row** records (a maximum of 32 such records), followed by the records representing the cells, followed by the **DBCell** record (section [2.4.78](#Section_e08dc762bf8a457cb3ba39055bff423a)). A cell in the cell table is referred to by its row and column indexes, which are zero-based. The maximum row index is 65535. The maximum column index is 255.

The bounding box of the non-empty cells is stored in the **Dimensions** record. Information that applies to each column is specified in the **COLUMNS** collection (section 2.1.7.20.6).

#### 2.2.1.1 Retrieval of Last-Calculated Cell Values Without Loading Cell Table

The only way to retrieve formulas, formats and other cell data is to read the cell table normally as defined earlier. However, in certain situations (for example when resolving external references to values) it is beneficial to retrieve only the last calculated value from a cell, without actually loading the cell table. To improve the performance of a random read access to the values in the **cell table** (section [2.2.1](#Section_d690007dd25c4822a650b24c13288bb7)), [**BIFF**](#gt_f9965de8-cd18-4e26-a9c6-adfee3d67517) provides **Index** (section [2.4.144](#Section_67c2092204274c2d96cc2267d3f09e8c)) and **DBCell** (section [2.4.78](#Section_e08dc762bf8a457cb3ba39055bff423a)) records. To find a particular [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) value, an application can perform the following:

1. Read **Index** records to find one such that the cell row is greater or equal to **rwMic** and less than **rwMac**.

2. Compute the data offset of the required **DBCell** record according to the description of the **Index** record.

3. Read the **DBCell** record (section 2.4.78) in the obtained position, and compute the data offset of the cell row according to the following:

1. The file position of the first non-empty **Row** (section [2.4.221](#Section_4aab09eb49ed4d01a3b11d726247d3c2)) in a row block is equal to the file position of the **DBCell** record ─the **dbRtrw** field of **DBCell** record.

2. The file position of the first **CELL** record (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)) for the first non-empty **Row** (section 2.4.221) is equal to the file position of the second **Row** record (the end of the first **Row** record) + **rgdb[0]**. Other non-empty **CELL** records for the first row follow this first **CELL** record.

3. The file position of the first **CELL** record for the second non-empty **Row** is equal to the file position of the first **CELL** record for the first **Row** + **rgdb[1]**. Other non-empty **CELL** records for the 2nd row follow this first **CELL** record.

4. The file position for the first **CELL** record for the third non-empty **Row** is equal to the file position of the first **CELL** record for the second **Row** + **rgdb[2]**.

4. Read cell table data starting from the previously computed position.

Note that if the **Row** of the **CELL** record is known, it is possible to calculate the file position of the first **CELL** record of that **Row** first, and then get all the following **CELL** recordswithout going through the first **Row**, the second **Row**, and so on.

### 2.2.2 Formulas

A formula is sequence of values, cell references, names, functions, or operators in a cell that together produce a new value. **Formulas** are stored in a tokenized representation known as "parsed expressions." In this section, formula is a synonym for parsedexpression. A parsed expression is converted into a textual formula at runtime for display and user editing. Cell formulas are specified by the **Formula** record(section [2.4.127](#Section_8e3c69786c9f4915a82607613204b244)). Array formulas are specified by the **Array** record (section [2.4.4](#Section_c6ee7512d6ec4d818dfba01a744a1f39)). Shared formulas are specified by the **ShrFmla** record (section [2.4.260](#Section_984826cc8bb7412b99077bbb9b08b4ad)).

**Formulas** that are part of a [**revision**](#gt_b799ab69-7abc-447e-b9f8-10cb8fd7016e) as specified in the Shared Workbooks overview (section [2.2.11](#Section_e45a62c4490f4304a09668908b57dacc)) are specified by the **pe**.**rgce** field or the **peOld**.**rgce** field of the **RRDDefName** record (section [2.4.225](#Section_3393f8cdcedc46cababa3cf614f8a77a)), or by the **xpe**.**rgce** field or the **xpeOld**.**rgce** field of the **RRDChgCell** record (section [2.4.223](#Section_f7c1ffa25ac54cccb1e941d556ff4b75)).

A parsed [**expression**](#gt_6d43b116-acad-45af-aea5-a8e7240a1106) contains a sequence of parse tokens, each of which is either an **operand** token (section [2.2.2.2](#Section_011ec51c5e8742aea0a1f5ee242c1189)), an **operator** token (section [2.2.2.1](#Section_0c6cc754f96f4061a9759d6eae97f8a3)), a **control** token (section [2.2.2.3](#Section_3701f8837bef4eacb0e05ecbf4a23cbd)), a **display** token (section [2.2.2.4](#Section_44ae9bca374542a482095e7ded229789)), or a **mem** token (section [2.2.2.5](#Section_0e7857a5d73a4abaafdaaa3996f562fd)). All tokens are stored as Parse Things (**Ptg** (section [2.5.198.25](#Section_9310c3bbd73f4db0834228e1e0fcb68f))).

With the exception of **control** tokens (section 2.2.2.3), **display** tokens (section 2.2.2.4), and **mem** tokens (section 2.2.2.5) that are described in subsequent sections, parsed expressions are stored in **Rgce** (section [2.5.198.104](#Section_6cdf7d38d08c4e56bd2f6c82b8da752e)) using Reverse-Polish notation. Reverse-Polish notation is a logical system for the specification of mathematical formulas in which operands are followed by operators. Inside an **Rgce,** the operands and operators are represented by an array of **Ptg** structures (section 2.5.198.25) of variable lengths. The first one or two bytes of a **Ptg** structure (section 2.5.198.25) contain the token type that determines which specific **Ptg** type (section 2.5.198.25) the **Ptg** is, as specified in the **Ptg** structure The remainder of the structure varies according to the token type.

Evaluation of a formula specified in Reverse-Polish notation is usually based around an evaluation stack. The expression is parsed from beginning to end, and operands are pushed onto the stack as they are encountered. When operators are encountered, the required number of operands is popped from the stack and the result of the operation is pushed back onto the stack. Evaluation begins with an empty stack, and when the evaluation is finished, there will be exactly one value left on the stack. The value is the result of the evaluation. Subsequent subsections refer to a stack as described by this model.

#### 2.2.2.1 Operator Tokens

**Unary Operator Tokens**

**Unary Operator** Tokens specify operations that are performed on the previous element in the grammar specified by **Rgce** (section [2.5.198.104](#Section_6cdf7d38d08c4e56bd2f6c82b8da752e)). For example, **PtgPercent** (section [2.5.198.81](#Section_980d459ae1d248c3b00b662b029247ce)) divides the last expression on the stack by 100.

**Binary Operator Tokens**

**Binary Operator T**okens specify operations that are performed on the previous two elements in the grammar specified by **Rgce**. For example, **PtgIsect** (section [2.5.198.67](#Section_477524a586b9474e89559ea77d659d79)), which intersects the topmost two expressions on the stack.

#### 2.2.2.2 Operand Tokens

**Operand** Tokens represent values and references that are used by operators and functions. Operands fall into one of two classes, **reference class** (section [2.2.2.2.2](#Section_a8fde0d5759c437eb385169df8117372)), or **value class** (section [2.2.2.2.1](#Section_9a43cbef26504581af603ff0d876d82a)), depending on what result type the formula expects from the operand.

##### 2.2.2.2.1 Value Class

**Value Class** is the most common type of operand, and represents a single value or array of values. When **Ptg records** (section [2.5.198.25](#Section_9310c3bbd73f4db0834228e1e0fcb68f)) with reference contents are used by an operator that requires **Value Class** operands, the **Ptg records** can be stored as **Value Class** operands rather than **reference class** (section [2.2.2.2.2](#Section_a8fde0d5759c437eb385169df8117372)) operands. For example, in a formula where the contents of A1 is added to the integer value 1, the value of [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) A1 is pushed onto the stack as a **Value Class** operand **PtgRef** (section [2.5.198.84](#Section_fc7c380bd7934219a897e47e13c4e055)) because the subsequent **PtgAdd** operator (section [2.5.198.26](#Section_27db2f4511e8423894ed92fd9c5721fb)) requires **Value Class** operands. Arrays are stored in a similar fashion. For example, when adding the array of values {1,2,3,4,5,6}, the values are stored in a **PtgArray** operand (section [2.5.198.32](#Section_61167ac8b0ca42e5b82c41a25d12324c)).

##### 2.2.2.2.2 Reference Class

When operands are stored as **R**eference **Class** operands, any references contained in the operand are not de-referenced and do not return the underlying value or values. They are pushed onto the stack in reference form.

#### 2.2.2.3 Control Tokens

ControlTokens do not perform operations or push values onto the stack. Conditional **C**ontrol Tokens (**PtgAttrIf** (section [2.5.198.36](#Section_d81e5fb43004409a9a311a60662d9e59)), **PtgAttrChoose** (section [2.5.198.34](#Section_24fb579cc65d477194a84380cecdc8c8)), and **PtgAttrGoto** (section [2.5.198.35](#Section_081e17b902a64e78ad2809538f35a312))) are used at runtime to prescribe short-circuit evaluation inside conditional functions and can be ignored when converting parsed expressions into textual formulas.

#### 2.2.2.4 Display Tokens

**Display** Tokens, like **C**ontrol Tokens (section [2.2.2.3](#Section_3701f8837bef4eacb0e05ecbf4a23cbd)), do not perform operations or push values onto the stack. **Display** Tokens (**PtgParen** (section [2.5.198.80](#Section_7a5b73dac5524fa7a4d01a36032a5622) and **PtgAttrSpace** (section [2.5.198.38](#Section_38a4d7be040b4206b07862f5aeec72f3))) are used at runtime to represent parentheses and space characters in a formula when parsed expressions are converted into textual formulas. **Display** Tokens do not affect the order of operations of the formula.

#### 2.2.2.5 Mem Tokens

**Mem** Tokens have two purposes: they cache the results of **reference class expressions** (section [2.2.2.2.2](#Section_a8fde0d5759c437eb385169df8117372)) and they can return the results of **reference class expressions** (section 2.2.2.2.2) as **value class expressions** (section [2.2.2.2.1](#Section_9a43cbef26504581af603ff0d876d82a)). **Mem** Tokens act on **binary-reference-expressions** (section [2.5.198.104](#Section_6cdf7d38d08c4e56bd2f6c82b8da752e)) that follow them it in a **mem-area-expression** (section 2.5.198.104).

#### 2.2.2.6 Formula Elements

Some **Ptg** records (section [2.5.198.25](#Section_9310c3bbd73f4db0834228e1e0fcb68f)) require extra data that is not stored in the **Rgce** (section [2.5.198.104](#Section_6cdf7d38d08c4e56bd2f6c82b8da752e)). When an **Rgce**contains one or more of these **Ptg** records, the containing formula structure includes an **RgbExtra** (section [2.5.198.103](#Section_70f743b2a8534c5788be8af637ac6e43)) containing the data for those **Ptg** records. The size of these components is specified by the **RgbExtra** structures. The **Ptg** records do not contain an offset into the **RgbExtra** for their data. The **Ptg** records that require a corresponding structure in **RgbExtra** are specified in section 2.5.198.103.

### 2.2.3 Charts

The following diagram identifies the major aspects of the file format representation of a chart.

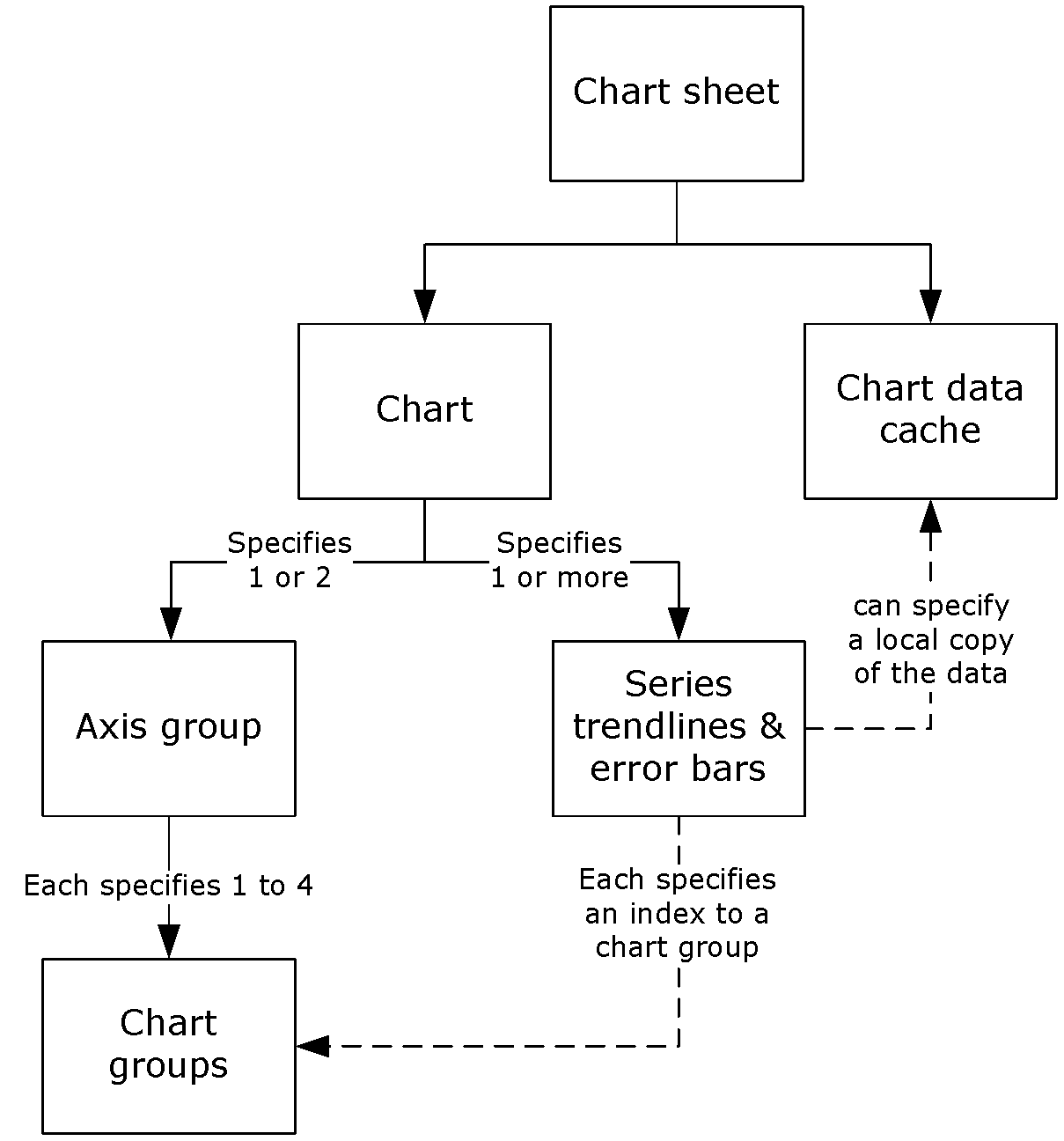


Figure 1: High-level structure of a chart

The **chart sheet** (section [2.2.3.1](#Section_2c90d75bc92645aa8ff29d4483f51831)) specifies a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)), a graphic that displays data or the relationships between sets of data in a visual form, and a **chart data cache** (section [2.2.3.2](#Section_e21d24e4e71f4fdc81077f0d6a6efa6a)), a local copy of the data that is used if the **chart** data is missing or if links to external [**data sources**](#gt_e091613c-6901-4874-b9b2-27273ead1075) are broken. The **chart** specifies one or two **axis groups** (section [2.2.3.5](#Section_578b739742624944b5a67ee6d4d3bb55)), a set of **axes** (section [2.2.3.6](#Section_4117f73aa0f348d89c0f65864918ffb3)) the **chart** data is plotted against, and the set of **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)), **trendlines** (section [2.2.3.12](#Section_61d74ebc36714d6dbdc0626db604530d)), and **error bars** (section [2.2.3.13](#Section_762a461d0a45474ebd7d5994bb294af2)) specified in the **chart**. Each **axis groups** specifies one to four **chart groups** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)) that specify the type of visualization used to display the data. Each **series**, **trendline**, and **error bar** specifies a **chart group** it is associated with.

#### 2.2.3.1 Chart Sheet

A **chart sheet** is a set of data and the **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)) that displays the data. There are two types of **chart sheets**: embedded **chart sheets**, and chart sheets that are not embedded.

A **chart sheet** that is not embedded is a separate [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) in the [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe) that is intended to display a **chart**. An embedded **chart sheet** is the logical container for a **chart** displayed on a [**worksheet**](#gt_2fdc6291-fa6a-48a6-afbb-04f910d68615).

A **chart sheet** is specified by the **chart sheet substream** (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)).

The **chart sheet substream** for an embedded **chart sheet** is contained within a **worksheet substream** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)). A chart sheet that is not embedded is specified by a **chart sheet substream** that is not contained in another substream.

The following records and rules specify the significant parts of a **chart sheet**:

 The **SheetExt** record (section [2.4.259](#Section_780be3426fd04265aaeba51f422a9c08)) specifies properties of the sheet (1) containing the **chart**. If the **chart sheet** is embedded, the **SheetExt** record MUST NOT exist.

 The **WebPub** record (section [2.4.344](#Section_55e5f315770d494d85bbb2a4596e0beb)) specifies properties of a **chart sheet** that has been published to the web.

 The sequences of records that conform to the **PAGESETUP** rule (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)) and **BACKGROUND** rule (section 2.1.7.20.6) and the **HFPicture** (section [2.4.138](#Section_20401a12d4a245a9ba65d4d12e82010e)), **PrintSize** (section [2.4.204](#Section_67d08dd9153e476385198354a5ef3ace)), and **HeaderFooter** (section [2.4.137](#Section_5d3587f3baef46abb2cf1c57e8b3dccf)) records specify information about how the **chart** is printed.

 The **Fbi** (section [2.4.109](#Section_f3d70b00be314223b3ec717dfab54ec1)) and **Fbi2** (section [2.4.110](#Section_eb7675c3f43743508b53c75d88d72c06)) records specify properties used for [**font**](#gt_f8aa3f46-99d1-49bb-858f-b4bfa546c1c2) scaling on the **chart**.

 The **Palette** (section [2.4.188](#Section_bf61236aa89e4425967934992c61ae5e)) and **ClrtClient** (section [2.4.50](#Section_b8ac373afef94c18bbb49cfa9cafb924)) records specify properties of the [**color palettes**](#gt_05879d13-b9e0-4333-b96d-63cc3433997e) used in the **chart sheet**.

 The sequence of records that conforms to the **PROTECTION** rule (section 2.1.7.20.6) and the **WriteProtect** record (section [2.4.350](#Section_8d791d7b82f242599230ea58afe5fd07)) specify [**protection**](#gt_dbeb9653-2ab1-4ec4-b64e-e77a8951c499) settings for the **chart**. If the chart sheet is embedded, the **WriteProtect** record MUST NOT exist.

 The **SXViewLink** (section [2.4.316](#Section_e729a06cb73f4c01a57609c193a2b1a8)), **PivotChartBits** (section [2.4.196](#Section_ba79170d6be34c788d47d7e4e26032a5)), and **SBaseRef** (section [2.4.242](#Section_ffcf01ed6fb7418eb9e9ce9828dae568)) records specify the **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) that is the data source for this **chart**. If the **chart** is not a **Pivot Chart** (section [2.2.3.4](#Section_bed5fbd356f54997bb54b49f04e734b7)) these records MUST be ignored.

 The sequence of records that conforms to the **OBJECTS** rule (section 2.1.7.20.6) and the **MsoDrawingGroup** record (section [2.4.171](#Section_43e0d49645db4f19bb33bcb2464aa83c)) specify the drawing objects on the **chart**

 The sequence of records that conforms to the **CHARTFOMATS** rule (section 2.1.7.20.6) specifies the **chart** that is contained in the **chart sheet**.

 The sequence of records that conforms to the **SERIESDATA** rule (section 2.1.7.20.6) specifies the **chart data cache** (section [2.2.3.2](#Section_e21d24e4e71f4fdc81077f0d6a6efa6a)).

 The sequences of records that conform to the **WINDOW** rule (section 2.1.7.20.6) and **CUSTOMVIEW** rule (section 2.1.7.20.6) specify the sheet (1) that contains the **chart**. If the **chart sheet** is not embedded, at least one sequence of records that conform to the **WINDOW** rule MUST exist. If the **chart sheet** is embedded, a sequence of records that conforms to the **WINDOW** rule and **CUSTOMVIEW** rule MUST NOT exist.

 The sequence of records that conforms to the **CRTMLFRT** rule (section 2.1.7.20.6) specifies **future records** (section [2.1.6](#Section_b660b67822684414839ed1ae9a4e4e85)) for the **chart sheet**.

#### 2.2.3.2 Chart Data Cache

A **chart data cache** is a local copy of the data for a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)). The **chart data cache** is used if data is missing or if links to external [**data sources**](#gt_e091613c-6901-4874-b9b2-27273ead1075) are broken.

A **chart data cache** is specified by a sequence of records that conforms to the **SERIESDATA** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

The following records and rules specify the significant parts of a **chart data cache**:

 The **Dimensions** record (section [2.4.90](#Section_5fd3837c9f3d49528a85ad93ddb37ced)) specifies the cells that contain data used by this **chart**.

 The **SIIndex** record (section [2.4.262](#Section_b3b98d4884a44a76b8c6e10b0c7a1e60)) specifies the beginning of a sequence of records that contains a cache of the data for the sequence of records that conforms to a specific **AI** rule (section 2.1.7.20.1) in the **series** (section [2.2.3.12](#Section_61d74ebc36714d6dbdc0626db604530d)) and **error bars** (section [2.2.3.13](#Section_762a461d0a45474ebd7d5994bb294af2)). The relationship between the **series** and the chart data cache is specified as follows:

 The first **SIIndex** record in the **chart sheet substream**, which MUST contain a **numIndex** field equal to 0x0001, corresponds to the second sequence of records that conforms to the **AI** rule.

 The second **SIIndex** record in the **chart sheet substream**, which MUST contain a **numIndex** field equal to 0x0002, corresponds to the third sequence of records that conforms to the **AI** rule.

 The third **SIIndex** record in the **chart sheet substream**, which MUST contain a **numIndex** field equal to 0x0003, corresponds to the fourth sequence of records that conforms to the **AI** rule.

 The **Number** (section [2.4.180](#Section_a40c74c63df44e819a4385521cc92c0a)), **BoolErr** (section [2.4.24](#Section_eb6cc28556634859982b6662ee116614)), **Blank** (section [2.4.20](#Section_2918f1db545e432a8f57599c44251f07)), and **Label** (section [2.4.148](#Section_5e14d0af54664709a243868a887351f2)) records each specify an individual value stored in the cache. Each column in the cache corresponds to a **series** or **error bar**, where the zero-based index of the column, specified by the **cell.col** field in the **Number**, **BoolErr**, **Blank**, or **Label** records, equals the zero-based index of the **Series** record (section [2.4.252](#Section_d6eec0192d634c1e8080442af941b462)) in the collection of **Series** records that corresponds to the **series** or **error bar**.

The following restrictions apply to the **chart data cache**:

 The **chart data cache** MUST contain data that corresponds to a sequence of records that conforms to the **AI** rule in a **series** if the corresponding data is not specified in the **chart** or on the same [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) as the **chart**.

 The **chart data cache** MUST NOT contain data that corresponds to a sequence of records that conforms to the **AI** rule in a **series** if the corresponding data is specified in the **chart** or on the same sheet (1) as the **chart**.

 The **chart data cache** MUST NOT contain data that corresponds to the third or fourth sequence of records that conforms to the **AI** rule in an **error bar**.

 If the **ebsrc** field of the **SerAuxErrBar** record (section [2.4.249](#Section_13a7411278424d6fab97de3123ff4199)) in an **error bar** equals 0x04, the **chart data cache** MUST contain data that corresponds to the second sequence of records that conforms to the **AI** rule in the **error bar**.

 If the **ebsrc** field of the **SerAuxErrBar** record in an error bar does not equal 0x04, the **chart data cache** MUST NOT contain data that corresponds to the second sequence of records that conforms to the **AI** rule in the **error bar**.

 The **chart data cache** MUST NOT contain data that corresponds to a **trendline** (section 2.2.3.12).

#### 2.2.3.3 Chart

A **chart** is a graphic that displays data or the relationships between sets of data in a visual form. A **chart** element is an item within the chart such as an **axis** (section [2.2.3.6](#Section_4117f73aa0f348d89c0f65864918ffb3)), **legend** (section [2.2.3.8](#Section_1832229b7d1945f488d455e9c07466f0)), **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)), **data point** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)), **data label** (section [2.2.3.11](#Section_cac7f43a3af142f58ff2814c2870427f)), **trendline** (section [2.2.3.12](#Section_61d74ebc36714d6dbdc0626db604530d)), **error bar** (section [2.2.3.13](#Section_762a461d0a45474ebd7d5994bb294af2)), or **data table** (section [2.2.3.14](#Section_69938f61d2e94da3af87e154edcb0d98)).

A **chart data cache** (section [2.2.3.2](#Section_e21d24e4e71f4fdc81077f0d6a6efa6a)) is specified by a sequence of records that conforms to the **CHARTFOMATS** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

A **chart** can contain the following records and rules that specify the parts of the **chart**:

 The **Chart** record (section [2.4.45](#Section_8f56b001f57445e0932f84cf30408323)) specifies the position and size of the [**chart area**](#gt_5524dd6c-3d8d-4784-bfca-a3323acceb39) (section [2.2.3.17](#Section_73c3fa9c39be46f6bbf32ee5977a2d7d)) for a non-embedded chart.

 The sequence of records that conforms to the **FONTLIST** rule (section 2.1.7.20.1) specifies [**font**](#gt_f8aa3f46-99d1-49bb-858f-b4bfa546c1c2) information for the **chart**.

 The **Scl** record (section [2.4.247](#Section_2cdcac9bf00444cb82e1d592500ffef8)) specifies the [**zoom level**](#gt_bfb33471-a018-422b-bc63-177c8bc1831f) of the current view in the window used to display the **chart**.

 The **PlotGrowth** record (section [2.4.198](#Section_38ca32ff60c0449ca5e97a40b3f95185)) specifies font scaling for the text on the **chart**.

 The sequence of records that conforms to the **FRAME** rule (section 2.1.7.20.1) specifies formatting of the chart area (section 2.2.3.17).

 The sequence of records that conforms to the **SERIESFORMAT** rule (section 2.1.7.20.1) specifies the **series**, **trendlines**, and **error** on the **chart**.

 The sequences of records that conform to the **SS** rule (section 2.1.7.20.1) specify properties of the **data labels**, **series**, **data points**, **trendlines**, and **error bars** on the **chart**. These records MUST NOT exist if the **chart sheet substream** contains a **Series** record (section [2.4.252](#Section_d6eec0192d634c1e8080442af941b462)). See the **data label** overview for additional restrictions on these collections of records.

 The sequences of records that conform to the **DFTTEXT** rule (section 2.1.7.20.1) and **TEXTPROPS** rule (section 2.1.7.20.1) specify default properties of the text in the **chart**. The **DataLabExt** (section [2.4.75](#Section_5c03a5117d77474cac73ee797c1ff9b3)), **StartObject** (section [2.4.267](#Section_2f7fb73d86f64f3d8f1c3b757ea8c0f6)), and **EndObject** (section [2.4.101](#Section_bb3ce42b14974ce2b58d973549813772)) records MUST NOT exist in these sequences of records that conform to the **DFTTEXT** rule (section 2.1.7.20.1).

 The **AxesUsed** record (section [2.4.10](#Section_398ee70d694840338507cf76ce9e4585)) and the sequence of records that conforms to the **AXISPARENT** rule (section 2.1.7.20.1) specify the **axis groups** (section [2.2.3.5](#Section_578b739742624944b5a67ee6d4d3bb55)) of the **chart**.

 The **CrtLayout12A** record (section [2.4.67](#Section_c8859c5c5bc14de3810f50d3c176ab51)) specifies layout information for the [**plot area**](#gt_5bf6768b-586e-4869-8247-e0f9e899183c).

 The sequence of records that conforms to the **DAT** rule (section 2.1.7.20.1) specifies the **data table** for the **chart**.

 The sequence of records that conforms to the **ATTACHEDLABEL** rule (section 2.1.7.20.1) specifies the chart title. This sequence of records MUST have an **ObjectLink** record (section [2.4.182](#Section_50f2d49d1e5f416b866f057e0ab23ba9)) where the **wLinkObj** field has a value of 0x0001.

 The sequence of records that conforms to the **ATTACHEDLABEL** rule and is preceded by the optional **DataLabExt** record specifies properties of series and data point **data labels**. This sequence of records MUST have an **ObjectLink** record where the **wLinkObj** field has a value of 0x0004. See the **data label** overview for additional information and restrictions on this collection of records.

 The sequence of records that conforms to the **CRTMLFRT** rule (section 2.1.7.20.1) specifies **future records** (section [2.1.6](#Section_b660b67822684414839ed1ae9a4e4e85)) for the **chart**.

#### 2.2.3.4 Pivot Chart

A **Pivot Chart** is a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)) that uses a **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) as a [**data source**](#gt_e091613c-6901-4874-b9b2-27273ead1075). The **SXViewLink** (section [2.4.316](#Section_e729a06cb73f4c01a57609c193a2b1a8)), **PivotChartBits** (section [2.4.196](#Section_ba79170d6be34c788d47d7e4e26032a5)), and **SBaseRef** (section [2.4.242](#Section_ffcf01ed6fb7418eb9e9ce9828dae568)) records in the **chart sheet** (section [2.2.3.1](#Section_2c90d75bc92645aa8ff29d4483f51831)) specify the **PivotTable**.

#### 2.2.3.5 Axis Group

An **axis group** is a set of **axes** (section [2.2.3.6](#Section_4117f73aa0f348d89c0f65864918ffb3)) that specify a coordinate system, a set of **chart groups** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)) that are plotted using these **axes** and the [**plot area**](#gt_5bf6768b-586e-4869-8247-e0f9e899183c) that defines where the **axes** are rendered on the **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)).

An **axis group** is specified by a sequence of records that conforms to the **AXISPARENT** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

The following records and rules define the significant parts of an **axis group**:

 The **AxisParent** record (section [2.4.13](#Section_5948f3079c624304ae7331bdecd36f9f)) specifies if the **axis group** is the primary axis group or the secondary axis group on a **chart**. Often the **axes** of the primary **axis group** are displayed to the left and bottom sides of the plot area, while **axes** of the secondary **axis group** are displayed on the right and top sides of the plot area.

 The **Pos** record (section [2.4.201](#Section_b2311d215bad4525b759cacc13d394cf)) specifies the position and size of the outer plot area. The outer plot area is the [**bounding rectangle**](#gt_e349a155-0fb9-4ba1-abd4-e363e21abcd1) that includes the **axis** labels, the **axis** titles, and **data table** (section [2.2.3.14](#Section_69938f61d2e94da3af87e154edcb0d98)) of the **chart**. This record MUST be ignored on a secondary **axis group**.

 The sequences of records that conform to the **IVAXIS** (section 2.1.7.20.1), **DVAXIS** (section 2.1.7.20.1), and **SERIESAXIS** (section 2.1.7.20.1) rules in the collection of records that conform to the **AXES** rule (section 2.1.7.20.1) specify the **axes** of the **axis group**.

 The sequences of records that conform to the **ATTACHEDLABEL** rule (section 2.1.7.20.1) in the sequence of records that conform to the **AXES** rule specify the **axis** titles of the **axis group**. Each **attached label** (section [2.2.3.15](#Section_9ac44e58af9940f4a99ace470eff0f5a)) MUST contain an **ObjectLink** record (section [2.4.182](#Section_50f2d49d1e5f416b866f057e0ab23ba9)) that conforms to the following requirements:

 The **wLinkObj** field MUST equal to 0x0002, 0x0003, or 0x0007, indicating which **axis** the **axis** title is associated.

 The **wLinkObj** field MUST specify an **axis** defined in the current **axis group**.

 The **wLinkObj** field MUST be unique among the other **attached labels** that represent **axis** titles in the same **axis group**.

 The **PlotArea** record (section [2.4.197](#Section_95e026c97aa94376ba7c9c67a2a9c7e2)) and the sequence of records that conforms to the **FRAME** rule (section 2.1.7.20.1) in the sequence of records that conform to the **AXES** rule specify the properties of the inner plot area. The inner plot area is the rectangle bounded by the chart **axes**. The **PlotArea** record (section 2.4.197) MUST NOT exist on a secondary **axis group**.

 The sequences of records that conform to the **CRT** rule (section 2.1.7.20.1) specify the **chart groups** of the **axis group**.

Because there are many different ways to represent data visually, each representation has specific requirements about the layout of the data and the way it is plotted. This results in restrictions on the combinations of **chart group** types that can be plotted on the same **axis group**, and the combinations of **chart group** types that can be plotted in the same **chart**.

A **chart** MUST contain one of the following:

 A single **axis group** that contains a single **chart group** that contains a **Chart3d** record (section [2.4.46](#Section_caefd44b1e5542acaed4c475442be33f)).

 One or two **axis groups** that each contain a single bubble **chart group**.

 One or two **axis groups** that each conform to one of the following restrictions on **chart group** type combinations:

 Zero or one of each of the following **chart group** types: area, column, line, and scatter.

 Zero or one of each of the following **chart group** types: bar of pie, doughnut, pie, and pie of pie.

 A single bar **chart group**.

 A single filled radar **chart group**.

 A single radar **chart group**.

In addition to the restrictions on the combinations of **chart group** types that can be plotted on the same **axis group** or **chart**, there are additional restrictions on the **axes** of the **axis group** based on the **chart groups** of the axis group.

The following restrictions apply to the **axes** of an **axis group**:

 The **axis group** MUST NOT contain any **axes** if the **axis group** contains a bar of pie, doughnut, pie, or pie of pie **chart group**.

 The **axis group** MUST contain a [**category (2)**](#gt_7d6acf13-ba4d-4a0a-930e-3eaee465c7f1) or date **axis** if the axis group contains an area, bar, column, filled radar, line, radar, or surface **chart group**.

 The **axis group** MUST contain an area, bar, column, filled radar, line, radar, or surface **chart group** if the axis group contains a category (2) or date **axis**.

 The **axis group** MUST contain two value **axes** if and only if all **chart groups** are of type bubble or scatter.

 The **axis group** MUST contain a series **axis** if and only if the **chart group** attached to the **axis group** is one of the following:

 An area **chart group** with the **fStacked** field of the **Area** record (section [2.4.2](#Section_43a435d733b841d5b6e6bc0bb9fb9f4a)) equal to 0.

 A column **chart group** with the **fStacked** field of the **Bar** record (section [2.4.15](#Section_5c1879733f114207b9f440e583715357)) equal to 0 and the **fClustered** field of the **Chart3d** record equal to 0.

 A line **chart group** with field **fStacked** of the **Line** record (section [2.4.155](#Section_fec395304bd54a469cec5e4ffae452c9)) equal to 0.

 A surface **chart group**.

 The **chart group** on the **axis group** MUST contain a **Chart3d** record if the **axis group** contains a series **axis**.

#### 2.2.3.6 Axis

An **axis** is a line that borders the **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)) [**plot area**](#gt_5bf6768b-586e-4869-8247-e0f9e899183c) and provides a frame of reference for measurement. In addition to the **axis** line and its properties, the **axis** also specifies all parts of the **chart** that are associated with the **axis** line, such as the **axis** labels, [**major gridlines**](#gt_2803347c-6396-46a5-9ede-6bef1149b013), [**minor gridlines**](#gt_49980976-6314-43ad-ad51-8d3e55ef4b59), and the [**walls**](#gt_c9b1bc1a-a2cf-429d-bf06-27019e9bb73c) and [**floor**](#gt_dc38c098-e0d3-4701-9656-5f2cf4d80f29) of the **chart**.

An **axis** is specified by a sequence of records that conforms to either the **IVAXIS** (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)), **DVAXIS** (section 2.1.7.20.1), or **SERIESAXIS** (section 2.1.7.20.1) rules specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

An **axis** has a type as defined by the following table:

| Type | Specified By | Description |
| --- | --- | --- |
| Category | A sequence of records that conform to the **IVAXIS** that contains an **AxcExt** record (section [2.4.9](#Section_91c0fd3c16e7438ebfc196b738535991)) with field **fDateAxis** equal to 0. | A [**category (2)**](#gt_7d6acf13-ba4d-4a0a-930e-3eaee465c7f1) **axis** displays a set of category (2) labels that are evenly distributed along the **axis** in a given order. A category (2) axis displays arbitrary text values such as "Qtr1", "Qtr2", and "Qtr3", and cannot display scaled numerical values. |
| Date | A sequence of records that conform to the **IVAXIS** rule that contains an **AxcExt** record with field **fDateAxis** equal to 1. | A date **axis** displays scaled date or time values and can display **data points** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)) located at uneven intervals. |
| Series | A sequence of records that conform to the **SERIESAXIS** rule. | A series **axis** displays a set of **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)) names that are evenly distributed along the axis. When this **axis** is used, the **data points** of each **series** are plotted in a 3-dimensional space. The **data points** of a single **series** are plotted on a plane identified by the corresponding **series** name on this **axis**. |
| Value | A sequence of records that conform to the **DVAXIS** rule. | A value **axis** displays scaled numeric values. The bubble and scatter **chart groups** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)), which can contain two value axes, distinguish the value **axes** by specifying the **axis** orientation, either horizontal or vertical. |

The following records and rules define the significant parts of an axis:

 The **CatSerRange (**section [2.4.39](#Section_07bdb87444424468a7e2bd166769e6a9)**)** and **ValueRange** (section [2.4.341](#Section_8a75a0b49985443aa154308516fa359a)) records specify the scaling properties of the **axis**, the crossing location of the other **axis** in the **axis group** (section [2.2.3.5](#Section_578b739742624944b5a67ee6d4d3bb55)), and the direction of the **axis**.

 The **AxcExt** record specifies if an **axis** is of type category (2) or date and specifies properties of a date **axis**.

 The **CatLab** record (section [2.4.38](#Section_ec1fd084707a40288bddb45799813f19)) specifies additional properties of the **axis** labels.

 The **IFmtRecord** record (section [2.4.143](#Section_d38bc2a12bdf416485f584078b31d5d2)) in the sequence of records that conform to the **AXS** rule (section 2.1.7.20.1) specifies the [**number format**](#gt_16fc3e8f-047a-42fe-b28c-4856c09cd74b) of the **axis** labels.

 The **Tick** record (section [2.4.327](#Section_94946c96e4e14e9eb7fccc959c36a030)) in the sequence of records that conform to the **AXS** rule specifies properties of the **axis** labels, and specifies the [**major tick marks**](#gt_a0f545a5-4d18-4580-903b-8d563f4b65fb) and [**minor tick marks**](#gt_c2eb605a-6c5a-427e-8608-f16940de82a6) of the **axis**.

 The **FontX** record (section [2.4.123](#Section_8c065ab610d44029a20dac422620eed2)) and the sequence of records that conforms to the **TEXTPROPS** rule (section 2.1.7.20.1), in the collection of records that conform to the **AXS** rule, specify the font properties of the **axis** labels.

 The **AxisLine** (section [2.4.12](#Section_d59921ddf25e45729d6adee440bb2d67)) and **LineFormat** (section [2.4.156](#Section_1bff256238664b958a6bf3fea1659f6d)) record pairs and the sequences of records that conform to the **SHAPEPROPS** rule (section 2.1.7.20.1), in the sequence of records that conform to the **AXS** rule, specify the **axis** line, major gridlines and minor gridlines of the **axis**, and the [**border**](#gt_85bbea8d-a9f4-40a2-b4f8-68b587d21a4c) lines of the walls and floor of the **chart**. The omission of the **AxisLine** and **LineFormat** record pair specifying the axis line results in the **axis** line having default line format properties. The omission of other **AxisLine** and **LineFormat** record pairs results in the corresponding **chart** element being omitted from the **chart**.

 The **AreaFormat** record (section [2.4.3](#Section_affb9fe34721495a9e5351c7d3c65480)) and the collection of records that conform to the **GELFRAME** rule (section 2.1.7.20.1) in the sequence of records that conform to the **AXS** rule specifies the fill format for the walls and floor of the **chart**. If the **wType** field of the **Axis** record (section [2.4.11](#Section_33155f3a9afe44a493d178af188f77f6)) in the **axis** equals 0x0000, these records apply to the walls of the **chart**. If the **wType** field of the **Axis** record in the **axis** equals 0x0001, these records apply to the floor of the **chart**. If the **wType** field of the **Axis** record in the axis equals 0x0002, these records MUST NOT exist. If the **chart sheet substream** does not contain a **Chart3d** record (section [2.4.46](#Section_caefd44b1e5542acaed4c475442be33f)), these records MUST NOT exist.

 The sequence of records that conforms to the **AXM** rule (section 2.1.7.20.1) specifies the [**display units**](#gt_7d807b62-cff1-4e03-a73f-840844345b83) and the display units label of a value **axis**.

#### 2.2.3.7 Chart Group

A **chart group** is a set of one or more **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)) that visually represent data in a similar manner and are plotted using the same coordinate system. A **chart group** also includes all parts of the **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)) that are associated with the set of **series** and the chart group can specify default properties for the **data points** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)) and **data labels** (section [2.2.3.11](#Section_cac7f43a3af142f58ff2814c2870427f)) associated with the **series**.

Basic **charts** have a single **chart group** because they contain one or more **series** of a single type and all **data points** are plotted using the same coordinates. Complex **charts**, such as combination **charts** that contain multiple **series** of different types or multiple **series** of similar type that are plotted using different sets of **axes** (section [2.2.3.6](#Section_4117f73aa0f348d89c0f65864918ffb3)), contain multiple **chart groups**.

A **chart group** specifies a collection of **series** of a common type that share an **axis group** (section [2.2.3.5](#Section_578b739742624944b5a67ee6d4d3bb55)) and specifies the **chart** elements that are common to the collection of **series**.

A **chart group** is specified by a sequence of records that conforms to the **CRT** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

A **chart group** has a type as defined by the following table:

| Type | Specified By | Description |
| --- | --- | --- |
| Area | A **chart group** that contains an **Area** record (section [2.4.2](#Section_43a435d733b841d5b6e6bc0bb9fb9f4a)). | A **chart group** type in which the **data points** of a **series** are plotted in a line and the region between the line and the horizontal **axis** is filled. |
| Bar | A **chart group** that contains a **Bar** record (section [2.4.15](#Section_5c1879733f114207b9f440e583715357)) with field **fTranspose** equal to 1. | A **chart group** type in which the **data points** in a **series** are represented as horizontal bars. |
| Bar of pie | A **chart group** that contains a **BopPop** record (section [2.4.25](#Section_810df3fd650345459bf509ab2061818a)) with field **pst** equal to 0x02. | A **chart group** type that plots **data points** as segments in a circle or bar, where the bar displays the details of the data called out from a single segment of the circle. |
| Bubble | A **chart group** that contains a **Scatter** record (section [2.4.243](#Section_25feb64bec3e4c3a9c488ea25e0df8b5)) with field **fBubbles** equal to 1. | A **chart group** type that is a variation on a scatter chart group type in which the **data points** are represented as bubbles. A bubble chart group type compares three variables. The third variable determines the size of the **data point**. |
| Column | A **chart group** that contains a Bar record (section 2.4.15) with field **fTranspose** equal to 0. | A **chart group** type in which the **data points** in a **series** are represented as vertical bars. |
| Doughnut | A **chart group** that contains a **Pie** record (section [2.4.194](#Section_4f749e5278ea4ad4b7278dedec7ad359)) with field **pcDonut** not equal to 0x0000. | A **chart group** type in which multiple **series** are represented as concentric rings and the **data points** are represented as segments of the ring. |
| Filled radar | A **chart group** that contains a **RadarArea** record (section [2.4.213](#Section_1a4e9fc7c9c1421a807b17dfc972c236)). | A **chart group** type that is a variation on a radar group type in which the **data points** in a **series** are connected by a line and the area enclosed by the line is filled. |
| Line | A **chart group** that contains a **Line** record (section [2.4.155](#Section_fec395304bd54a469cec5e4ffae452c9)). | A **chart group** type in which **data points** in a **series** are connected by a line. |
| Pie | A **chart group** that contains a **Pie** record (section 2.4.194) with field **pcDonut** equal to 0x0000. | A **chart group** type that plots **data points** as segments (or slices) of a circle. |
| Pie of pie | A **chart group** that contains a **BopPop** record (section 2.4.25) with field **pst** equal to 0x01. | A **chart group** type that plots **data points** as segments (or slices) of two circles, where the secondary circle displays the details of the data called out from a single segment of the primary circle. |
| Radar | A **chart group** that contains a **RadarArea** record (section 2.4.213). | A **chart group** type in which each **data point** in a **series** is plotted along a separate **axis** that starts at the center of the **chart** and extends outward. |
| Scatter | A **chart group** that contains a **Scatter** record (section 2.4.243) with field **fBubbles** equal to 0. | A **chart group** type that displays quantitative values on both horizontal and vertical **axes** to represent two variables as a single **data point**. |
| Surface | A **chart group** that contains a **Surf** record (section [2.4.272](#Section_0606dd5e8f0040698dbf4663905ce45a)). | A **chart group** type that shows a three dimensional surface that connects a set of **data points**. |

The following records and rules define the significant parts of a chart group:

 The **SeriesList** record (section [2.4.253](#Section_da970b89b0bd4060af1cd9b6fd33a5f7)) specifies the **series** of the **chart**. This record MUST NOT exist in the first **chart group** in the **chart sheet substream**. This record MUST exist when not in the first **chart group** in the **chart sheet substream**.

 The **Chart3d** record (section [2.4.46](#Section_caefd44b1e5542acaed4c475442be33f)) specifies that the [**plot area**](#gt_5bf6768b-586e-4869-8247-e0f9e899183c), **axis group** (section 2.2.3.5), and **chart group** are rendered in a 3-D scene, rather than a 2-D scene, and specifies properties of the 3-D scene. If this record exists in the **chart sheet substream**, the **chart sheet substream** MUST have exactly one **chart group**. This record MUST NOT exist in a bar of pie, bubble, doughnut, filled radar, pie of pie, radar, or scatter **chart group**.

 The sequence of records that conforms to the **LD** rule (section 2.1.7.20.1) specifies the **legend** (section [2.2.3.8](#Section_1832229b7d1945f488d455e9c07466f0)) on the **chart**. The sequence of records that conforms to the **LD** rule (section 2.1.7.20.1) MUST NOT exist in a **chart group** that is not the first **chart group** in the **chart sheet substream**.

 The sequences of records that conform to the **DROPBAR** rule (section 2.1.7.20.1) specify the [**up-down bars**](#gt_54f291c2-81aa-41b6-8831-88d180a09ea0) on the **chart group**.

 The **CrtLine** (section [2.4.68](#Section_c267eaa5224143d2bfebf851418b52ee)) **LineFormat** (section [2.4.156](#Section_1bff256238664b958a6bf3fea1659f6d)) record pairs and the sequences of records that conform to the **SHAPEPROPS** rule (section 2.1.7.20.1) specify the [**drop lines**](#gt_e8c745bf-646c-4acd-8b5e-5314fa4965fa), [**high-low lines**](#gt_56aec928-ddcc-4415-9d08-5d1dd3982bbc), [**series lines**](#gt_bda50b03-68fa-49f9-bd9e-d0dc289ac88a), and [**leader lines**](#gt_8b7c448e-82e3-4d22-a8ba-52e0a10b14fa) for the **chart**.

 The sequences of records that conform to the **DFTTEXT** rule (section 2.1.7.20.1), the **DataLabExtContents** record (section [2.4.76](#Section_9e2876c62d3049a7ac7eff01315e1418)), and the sequence of records that conforms to the **SS** rule (section 2.1.7.20.1) specify the **data label** and **data point** formatting for the **chart group**. Refer to the **data label** overview for details on the **chart group** **data label**.

#### 2.2.3.8 Legend

A **legend** identifies different groupings of information about the **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)). A **legend** consists of a set of [**legend entries**](#gt_6c27eb24-fb59-4bc8-8962-9cdac46a748e). Each legend entry, which consists of a [**legend key**](#gt_6981bc96-6d51-425c-9550-63c5b8b08e54) and a text label, identifies either the **data points** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)) in the **chart**, the **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)) and [**trendlines**](#gt_d5df9e9f-4c24-41e9-a015-44bd67d1a67c) in the **chart**, or the bands on a surface **chart group** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)).

A **legend** is specified by a sequence of records that conforms to an **LD** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) in a **chart group** as specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

A **legend** on a **chart** can contain three types of content:

 A **legend** can contain legend entries for each of the **series** and trendlines in the **chart**:

 Each legend entry represents a single **series** or trendline.

 The legend keys contain the same formatting as the corresponding **series** or trendline.

 The **legend** text labels contain the name of the corresponding **series** or trendline.

 This type of **legend** is used when the **chart group** type is not surface and one of the following conditions is satisfied:

 The **chart** has more than one included **series**.

 The **chart** has a single included **series**, no **data point** formatting exceptions on the included **series**, and either contains a trendline or contains a **ChartFormat** record (section [2.4.48](#Section_919bca437a814203b9b9b12e4315d5af)) associated with the included **series** that has the **fVaried** field equal to 0 or ignored.

 A **legend** can contain legend entries for each **data point** in the **chart**:

 Each legend entry represents a single **data point** on the **chart**.

 The legend keys contain the same formatting as the corresponding **data point**.

 The **legend** text labels contain the [**category (2)**](#gt_7d6acf13-ba4d-4a0a-930e-3eaee465c7f1) name or horizontal value of the corresponding **data point**.

 This type of **legend** is used when the **chart group** type is not surface and the conditions for a **legend** that contains legend entries for each of the **series** and trendlines in the **chart** are not satisfied.

 A **legend** can contain legend entries for each band on a surface **chart group** (which is formatted into different bands based on the value of the surface at any given **data point** in space):

 Each legend entry represents a single band that represents a range of values on a surface **chart group**.

 The legend keys contain the same formatting as the corresponding band.

 The **legend** text labels contain the value range of the corresponding band.

 This type of **legend** is used when the chart contains a surface **chart group**.

The following records and rules define the significant parts of a **legend**:

 The **Legend** record (section [2.4.152](#Section_03d359d915f94e7a8ad1d7b741ed2e21)) specifies the layout of the legend and specifies if the **legend** is automatically positioned.

 The **Pos** record (section [2.4.201](#Section_b2311d215bad4525b759cacc13d394cf)), **CrtLayout12** record (section [2.4.66](#Section_ff69b6f84d7943c5a983a1c8b9496665)), and the sequence of records that conforms to the **CRTMLFRT** rule (section 2.1.7.20.1), specify the position of the **legend**.

 The sequences of records that conform to the **ATTACHEDLABEL** (section 2.1.7.20.1) and **TEXTPROPS** (section 2.1.7.20.1) rules specify the default text formatting for the legend entries. The **Pos** record of the **attached label** (section [2.2.3.15](#Section_9ac44e58af9940f4a99ace470eff0f5a)) MUST be ignored. The **ObjectLink** record (section [2.4.182](#Section_50f2d49d1e5f416b866f057e0ab23ba9)) of the attached label MUST NOT exist. A **series** can specify formatting exceptions for individual legend entries.

 The sequence of records that conforms to the **FRAME** rule (section 2.1.7.20.1) specifies the fill and [**border formatting**](#gt_96ac39c1-e3ee-4485-b481-0553e5606cad) properties of the **legend**.

#### 2.2.3.9 Series

A **series** is of a set of related **data points** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)) that are plotted in a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)). In addition to specifying the **data points** of the **series** and the formatting properties of the **data points**, a **series** can also specify a series name and properties of the **data label** (section [2.2.3.11](#Section_cac7f43a3af142f58ff2814c2870427f)) and [**legend entries**](#gt_6c27eb24-fb59-4bc8-8962-9cdac46a748e) that are associated with the **series**.

A **series** is defined by a sequence of records that conforms to the **SERIESFORMAT** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf) that contains a **SerToCrt** record (section [2.4.256](#Section_34175aa2c0db4e4cbe2ebbe5abf61364)).

A **series** can either be of type included or excluded. Included **series** are **series** that are shown in the **chart**. Excluded **series** are not shown in the **chart**, but exist as **series** in the file. A **series** is an excluded **series** if both of the following conditions are satisfied:

 The **chart group** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)) type of the **series** is bar of pie, pie, or pie of pie.

 The **series** is not the first **series** in the **chart sheet substream** to be on the **chart group** and contain in the second sequence of records that conform to the **AI** rule (section 2.1.7.20.1) a **BRAI** record (section [2.4.29](#Section_c4e36e616c174a75b414f33803c7456b)) that contains an **ifmt** field that specifies a **formula** (section [2.2.2](#Section_e7625cc83da94154b44949cf1bbd9703)) that equals to a row or column that is not excluded from the **chart sheet**.

This occurs when the **chart group** is of type bar of pie, pie, or pie of pie, and the **chart sheet** contains multiple **series**, because these **chart group** types will only display the first **series** of data on the **chart**.

All other **series** are included **series**.

The following records and rules define the significant parts of a **series**:

The **Series** record (section [2.4.252](#Section_d6eec0192d634c1e8080442af941b462)) specifies the type and size of the data in the **series**.

 The four sequences of records that conform to the **AI** rule specify **formulas**. The meaning of the **formulas** are specified as follows:

1. In the first sequence, the value of the **formula** specifies the name of the **series**. The **SeriesText** record (section [2.4.254](#Section_e5d661c4bd7e4664a848495354b9fc3b)) specifies a cache of the name of the **series**.

2. In the second sequence, the value of the **formula** specifies:

 A set of coordinates along the vertical value **axis** (section [2.2.3.6](#Section_4117f73aa0f348d89c0f65864918ffb3)) if the series is in a bubble or scatter **chart group**.

 A set of coordinates along the value **axis** if the series is in any other **chart group** type.

3. In the third sequence, the value of the **formula** specifies:

 A set of coordinates along a horizontal value **axis** if the **series** is in a bubble or scatter **chart group**.

 A set of [**category (2)**](#gt_7d6acf13-ba4d-4a0a-930e-3eaee465c7f1) **axis** labels that are distributed evenly along the category (2) **axis** based on their order in the set or a set of dates along a date **axis** is in any other **chart group** type.

4. In the fourth sequence of records, the value of the **formula** specifies a set of scalar values used in a bubble **chart group** to define the size of the bubbles.

 The sequence of records that conform to the **SS** rule (section 2.1.7.20.1) specify the **data point** and **data label** properties for a **series** or individual **data points** of the **series**. If formatting is not specified for an individual **data point**, the **data point** inherits the formatting of the series. If formatting is not specified for the **series**, the **series** inherits the formatting of the **chart group** that contains the **series**. The **yi** field of the **DataFormat** record (section [2.4.74](#Section_02773c0de16b4d6d82f473c8fd18868e)) MUST specify the zero-based index of the **Series** record associated with this **series** in the collection of all **Series** records in the current **chart sheet substream** that contains the **series**. Refer to the **data label** overview for an explanation of the **data label** and the conditions on this collection of records.

 The **SerToCrt** record (section 2.4.256) specifies the **chart group** that contains the current **series**.

 The **LegendException** record (section [2.4.153](#Section_8c4e0829c6ee4b34b8affb95f9d70c86)) specifies a legend entry in the **legend** (section [2.2.3.8](#Section_1832229b7d1945f488d455e9c07466f0)) that corresponds to the **series**. If the **LegendException** record (section 2.4.153) specifies that the legend entry has non-default formatting, then the **attached label** (section [2.2.3.15](#Section_9ac44e58af9940f4a99ace470eff0f5a)) and the sequence of records that conforms to the **TEXTPROPS** rule (section 2.1.7.20.1) that follow the **LegendException** (section 2.4.153) and **Begin** (section [2.4.17](#Section_52d0d2c76cc540c4adf3aea158411ef3)) records specify the custom formatting of the legend entry. If the **fLabel** field of **LegendException** equals 0, the **attached label** MUST NOT exist.

#### 2.2.3.10 Data Point

A **data point** is a value plotted in a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)) and visually displayed as shapes, such as bars, columns and markers, as specified by the **chart group** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)) type of the **chart**.

A **data point** consists of a set of three values located on the same index of the second to fourth sequences of records that conform to the **AI** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) contained in the **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)) of the **data point**. For example, the set of three values for a **data point** in a bubble **chart group** consists of a coordinate of the **data point** along the vertical value **axis** (section [2.2.3.6](#Section_4117f73aa0f348d89c0f65864918ffb3)), the coordinate of the **data point** along the horizontal value **axis**, and the scalar value that defines the [**bubble size**](#gt_3a0cf938-5b61-4460-bdbb-3540d84d4180) of the **data point**.

#### 2.2.3.11 Data Label

A **data label** is a label on a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)) that is associated with a **data point** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)), or associated with a **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)) on an area or filled radar **chart group** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)). A **data label** contains information about the associated **data point**, such as the description of the **data point**, a [**legend key**](#gt_6981bc96-6d51-425c-9550-63c5b8b08e54), or custom text.

**Inheritance**

For any given **data point**, there is an order of inheritance that determines the contents of a **data label** associated with the **data point**:

 **Data labels** can be specified for a **chart group**, specifying the default setting for the **data labels** associated with the **data points** on the **chart group**.

 **Data labels** can be specified for a **series**, specifying the default setting for the **data labels** associated with the **data points** of the **series**. This type of **data label** overrides the **data label** properties specified on the **chart group** for the **data labels** associated with the **data points** in a given **series**.

 **Data labels** can be specified for a **data point**, specifying the settings for a **data label** associated with a particular **data point**. This type of **data label** overrides the **data label** properties specified on the **chart group** and **series** for the **data labels** associated with a given **data point**.

**Records**

The set of records that specifies a **data label**, and the requirements that exist on these records, differ if the **data label** is specified for a **chart group**, **series**, or **data point**. The set of records that represent a **data label** are as follows:

 For a **chart group**, properties of a data label are specified by the following collections of records that are specified in the **chart group**:

1. The sequence of records that conforms to the **DFTTEXT** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)).

2. The **DataLabExtContents** record (section [2.4.76](#Section_9e2876c62d3049a7ac7eff01315e1418)) that is not contained in the sequence of records that conforms to the **LD** rule (section 2.1.7.20.1) or the sequence of records that conforms to the **DFTTEXT** rule.

3. The **AttachedLabel** record (section [2.4.5](#Section_5ffc1bdab83b4d53a8604cf54f24cd75)) that is contained in the sequence of records that conforms to the **SS** rule (section 2.1.7.20.1).

 For a **series** or **data point**, properties of a data label are specified by the following collections of records that are specified in the **chart**:

1. The **attached label** (section [2.2.3.15](#Section_9ac44e58af9940f4a99ace470eff0f5a)) that corresponds to the **series** or **data point**. The **attached label** that corresponds to a **series** or **data point** appears in the **chart sheet substream** (section 2.1.7.20.1) after the **axis group** (section [2.2.3.5](#Section_578b739742624944b5a67ee6d4d3bb55)) and is specified by the following properties of the **attached label**:

1. The **wLinkObj** field of the **ObjectLink** record (section [2.4.182](#Section_50f2d49d1e5f416b866f057e0ab23ba9)) equals 0x0004.

2. The **wLinkVar1** field of the **ObjectLink** record equals the index to the corresponding **series**.

3. The **wLinkVar2** field of the **ObjectLink** record equals the index to the corresponding **data point** or equals 0xFFFF for a corresponding **series**.

2. The **AttachedLabel** record (section 2.4.5) that corresponds to the **series** or **data point**. The **AttachedLabel** record that corresponds to a **series** or **data point** appears in the sequence of records that conforms to the **SS** rule that has the following properties:

1. The **yi** field of the **DataFormat** record (section [2.4.74](#Section_02773c0de16b4d6d82f473c8fd18868e)) equals the index to the corresponding **series**.

2. The **xi** field of the **DataFormat** record equals the index to the corresponding **data point** or equals 0xFFFF for a corresponding **series**.

**Overrides**

Some properties of the records that specify the contents of a **data label** can overlap and conflict. For the information that overlaps between these records, there is a set of rules that specifies the relationships between these records and specifies the fields that need to be ignored in conflict situations.

In general, properties of the **DataLabExtContents** record (section 2.4.76) of the **data label** override properties of the **Text** record (section [2.4.324](#Section_362cfe7d650949fb81402ad59c16b4c4)) of the of the **data label**, which overrides the properties of the **AttachedLabel** record of the **data label**. Details of the relationships between individual fields are specified in the records.

The following section provides an explanation of how to interpret the **data label** and when the different records that specify the **data label** are relevant to the **data label**.

On a **data label** associated with a **chart group**:

 When the **chart group** has a data label, the following algorithm determines the **data label** contents. Once the set of records that represents the **data label** has been established, the data label information that overlaps across records is respected on the **DataLabExtContents** record and ignored on the **Text** and **AttachedLabel** records of the **data label**. In this algorithm, [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf) rules are used to specify the sequence of records that conform to the rule. In this algorithm, "DFTTEXT with id" specifies the sequence of records that conforms to the **DFTTEXT** rule that contains a **DefaultText** record (section [2.4.88](#Section_cda28b8e07614f108b656c38368f791d)) with and **id** field equal to the value specified.

//Define variables

X equals a DataLabExtContents record

Y equals a DataLabExtContents record

SS equals an to AttachedLabel record

SWAP equals a boolean

//Initialize SWAP

SET SWAP equal to FALSE

//Initialize SS

SET SS equal to AttachedLabel record in the sequence of records that conforms to

the SS rule

//Initialize X

IF DFTTEXT with id field equal to 0 exists

IF DFTTEXT with id field equals to 0 has a DataLabExtContents record

SET X equal to DataLabExtContents record in DFTTEXT with id field equal to

0

ELSE

IF chart group type equals area or filled radar

SET field fSerName of X equal to field fShowLabel of Text record in

DFTTEXT with id field equal to 0

SET field fCatName of X equal to 0

ELSE

SET field fCatName of X equal to field fShowLabel of Text record in

DFTTEXT with id field equal to 0

SET field fSerName of X equal to 0

END IF

SET field fValue of X equal to field fShowValue of Text record in DFTTEXT

with id field equal to 0

SET field fPercent of X equal to field (fShowPercent OR fShowLabelAndPerc)

of Text record in DFTTEXT with id field equal to 0

SET field fBubSizes of X equal to field fShowBubbleSizes of Text record in

DFTTEXT with id field equal to 0

SET field RgchSet of X equal to NULL

END IF

ELSE

SET field fCatName of X equal 1

SET fields fSerName, fValue, fPercent, fBubSizes of X equal to 0

SET field RgchSet of X equal to NULL

END IF

//Initialize Y

IF DFTTEXT with id field equal to 1 exists

IF DFTTEXT with id field equals to 1 has a DataLabExtContents record

SET Y equal to DataLabExtContents record in DFTTEXT with id field equal to

1

ELSE

IF chart group type equals area or filled radar

SET field fSerName of Y equal to field (fShowLabel OR

fShowLabelAndPerc)of Text record in DFTTEXT with id field equal to

1

SET field fCatName of Y equal to 0

ELSE

SET field fCatName of Y equal to field (fShowLabel OR

fShowLabelAndPerc) of Text record in DFTTEXT with id field equal to

1

SET field fSerName of Y equal to 0

END IF

SET field fValue of Y equal to field fShowValue of Text record in DFTTEXT

with id field equal to 1

SET field fPercent of Y equal to field (fShowPercent OR fShowLabelAndPerc)

of Text record in DFTTEXT with id field equal to 1

SET field fBubSizes of Y equal to field fShowBubbleSizes of Text record in

DFTTEXT with id field equal to 1

SET field RgchSet of X equal to NULL

END IF

ELSE

SET field fValue of Y equal to 1

SET fields fCatName, fSerName, fPercent, fBubSizes of Y equal to 0

SET field RgchSet of X equal to NULL

END IF

//Modify X, Y, and SS

IF (field fCatName of X equals 1) AND (fields fSerName, fValue, fPercent, AND

fBubSizes of X equal 0)

IF (field fShowValue of SS equals 1) AND (fields fShowPercent,

fShowLabelAndPerc, fShowLabel, fShowBubbleSizes, AND fShowSeriesName of

SS equal 0)

IF (field fValue of Y equals 1) AND (fields fSerName, fCatName,

fPercent, OR fBubSizes of Y equal 1)

SET SWAP equals to TRUE

SET field fValue of X equal to 1

SET fields fSerName, fCatName, fPercent, AND fBubSizes of X equal

to 0

SET field fShowValue of SS equal to field fValue of Y

SET field fShowPercent of SS equal to field fSPercent of Y

SET field fShowLabel of SS equal to field fCatName of Y

SET field fShowBubbleSizes of SS equal to field fBubSizes of Y

SET field fShowSeriesName of SS equal to field fSerName of Y

END IF

ELSE

IF ((field fShowPercent of SS equals 1) AND (field fShowBubbleSizes of

SS equals 0)) OR ((field fShowPercent of SS equals 0) AND (field

fShowBubbleSizes of SS equals 1)) AND (fields fShowLabelAndPerc,

fShowLabel, fShowValue, AND fShowSeriesName of SS equal 0)

SET SWAP equals to TRUE

SET field fValue of X equal to 1

SET fields fSerName, fCatName, fPercent, AND fBubSizes of X equal

to 0

SET field fShowValue of SS equal to field fValue of Y

SET field fShowPercent of SS equal to field fSPercent of Y

SET field fShowLabel of SS equal to field fCatName of Y

SET field fShowBubbleSizes of SS equal to field fBubSizes of Y

SET field fShowSeriesName of SS equal to field fSerName of Y

ELSE

IF (field fShowLabel of SS equals 1) AND (fields fShowPercent,

fShowLabelAndPerc, fShowValue, fShowBubbleSizes, AND

fShowSeriesName of SS equal 0)

IF chart group type equals area or filled radar

SET field fSerName of X equal to 1

SET fields fCatName, fValue, fPercent, AND fBubSizes equal

to 0

SET field fShowValue of SS to 1

SET fields fShowPercent, fShowLabelAndPerc, fShowLabel,

fShowBubbleSize, and fShowSeriesName of SS to 0

END IF

SET field fValue of Y equals to 1

SET fields fSerName, fCatName, fPercent, AND fBubSizes of Y

equal to 0

ELSE

IF fields fShowLabel, fShowPercent, fShowLabelAndPerc,

fShowValue, fShowBubbleSizes, AND fShowSeriesName of SS

equal 0

IF chart group type equals area or filled radar

SET fields fShowLabel of SS to 1

SET fields fShowPercent, fShowLabelAndPerc, fShowValue,

fShowBubbleSize, and fShowSeriesName of SS to 0

END IF

SET field fValue of Y equals to 1

SET fields fSerName, fCatName, fPercent, AND fBubSizes of Y

equal to 0

END IF

END IF

END IF

END IF

ELSE

IF (field fValue of Y equals 1) AND (fields fSerName, fCatName, fPercent,

AND fBubSizes of Y equal 0)

IF fields fShowLabel, fShowPercent, fShowLabelAndPerc, fShowValue,

fShowBubbleSizes, AND fShowSeriesName of SS equal 0

IF (chart group type equals area or filled radar) AND (field

fSerName of X equals 1) AND (fields fCatName, fValue, fPercent,

AND fBubSizes of X equal 0)

SET field fShowSeriesName of SS to 1

SET fields fShowPercent, fShowLabelAndPerc, fShowValue,

fShowBubbleSize, and fShowLabel of SS to 0

ELSE

SET field fCatName of X equals to 1

SET fields fSerName, fValue, fPercent, AND fBubSizes of X equal

to 0

END IF

ELSE

IF (field fShowValue of SS equals 1) AND (fields fShowLabel,

fShowPercent, fShowLabelAndPerc, fShowBubbleSizes, AND

fShowSeriesName of SS equal 0)

SET field fCatName of X equals to 1

SET fields fSerName, fValue, fPercent, AND fBubSizes of X equal

to 0

ELSE

SET field fShowValue of SS equal to field fValue of X

SET field fShowPercent of SS equal to field fSPercent of X

SET field fShowLabel of SS equal to field fCatName of X

SET field fShowBubbleSizes of SS equal to field fBubSizes of X

SET field fShowSeriesName of SS equal to field fSerName of X

END IF

END IF

END IF

END IF

//Determine if X or Y is used

IF (field fShowValue of SS equals 1) AND (fields fShowLabel, fShowPercent,

fShowLabelAndPerc, fShowBubbleSizes, AND fShowSeriesName of SS equal 0)

IF (SWAP equals FALSE)

IF DFTTEXT with id field equal to 1 exists

SET the data label equal to DFTTEXT with id field equal to 1

ELSE

SET the data label equal to the default formatting properties

END IF

SET the DataLabExtContents record of the data label equal to Y

ELSE

IF DFTTEXT with id field equal to 0 exists

SET the data label equal to DFTTEXT with id field equal to 0

ELSE

SET the data label equal to the default formatting properties

END IF

SET the DataLabExtContents record of the data label equal to X

END IF

ELSE

IF (SWAP equals FALSE)

IF DFTTEXT with id field equal to 0 exists

SET the data label equal to DFTTEXT with id field equal to 0

ELSE

SET the data label equal to the default formatting properties

END IF

SET the DataLabExtContents record of the data label equal to X

ELSE

IF DFTTEXT with id field equal to 1 exists

SET the data label equal to DFTTEXT with id field equal to 1

ELSE

SET the data label equal to the default formatting properties

END IF

SET the DataLabExtContents record of the data label equal to Y

END IF

END IF

On a **data label** associated with a **series** or **data point**:

 The **attached label** specifies an exception on the **data label** and indicates that the current **data label** differs from the **data label** inherited from the **chart group** for a **series**, or from the **chart group** and **series** for a **data point**. The **attached label** of the **data label** contains a **Text** record and can contain a **DataLabExtContents** record.

 On a **data label** associated with a **data point**, when the **attached label** exists and contains a **BRAI** record (section [2.4.29](#Section_c4e36e616c174a75b414f33803c7456b)) with field **formula** not equal to 0x0000, the **formula** field specifies the contents of the **data label**.

 On a **data label** associated with a **data point**, when the **attached label** exists and contains a **SeriesText** record (section [2.4.254](#Section_e5d661c4bd7e4664a848495354b9fc3b)) and a **BRAI** record with field **formula** equal to 0x0000, the **SeriesText** record specifies the contents of the **data label**.

 When the **attached label** exists and contains a **DataLabExtContents** record, the **data label** information specified by the **DataLabExtContents** record that overlaps across records is respected, and the information contained in the **Text** and **AttachedLabel** records of the **data label** that overlaps is ignored.

 When the **attached label** exists and does not contain a **DataLabExtContents** record, the **data label** specified by the **Text** record that overlaps across records is respected, and the information contained in the **AttachedLabel** record of the **data label** that overlaps is ignored.

 When the **data label** does not specify an **attached label**, the **AttachedLabel** record of the **data label** specifies the content properties of the **data label**.

**Restrictions**

The following requirements and restrictions exist on different parts of the collections of records that represent the **data label**.

If the **chart group** contains a **data label**:

 The **chart group** SHOULD[<13>](#Appendix_A_13" \o "Product behavior note 13) contain two sequences of records that conform to the **DFTTEXT** rule that have the same records with the same field values.

 If the **chart group** contains a **DataLabExtContents** record, the **DataLabExtContents** record in the sequences of records that conform to the **DFTTEXT** rule on the chart group and the **DataLabExtContents** record that is not specified in the sequences of records that conform to the **DFTTEXT** rule on the chart group SHOULD[<14>](#Appendix_A_14" \o "Product behavior note 14) contain the same field values.

 If the **chart group** contains a sequence of records that conforms to the **DFTTEXT** rule the following restrictions apply:

 The **fShowValue** field of the **AttachedLabel** record SHOULD[<15>](#Appendix_A_15" \o "Product behavior note 15) equal the **fShowValue** field of the **Text** record in the sequence of records that conforms to the **DFTTEXT** rule.

 The **fShowPercent** field of the **AttachedLabel** record SHOULD[<16>](#Appendix_A_16" \o "Product behavior note 16) equal the **fShowPercent** field of the **Text** record in the sequence of records that conforms to the **DFTTEXT** rule.

 The **fShowLabelAndPerc** field of the **AttachedLabel** record SHOULD[<17>](#Appendix_A_17" \o "Product behavior note 17) equal the **fShowLabelAndPerc** field of the **Text** record in the sequence of records that conforms to the **DFTTEXT** rule.

#### 2.2.3.12 Trendline

A **trendline** is a straight or curved line that graphically represents the general trend of the **data points** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)) of a **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)). In addition to specifying the data and formatting properties of the line, the **trendline** name and the **trendline** label can also be specified in the **trendline**.

A trendline is defined by a sequence of records that conforms to the **SERIESFORMAT** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf) that contains a **SerAuxTrend** record (section [2.4.250](#Section_c3ee0bb15a2145178ddda6c06c20e927)).

The following records and rules define the significant parts of a **trendline**:

 The **SeriesText** record (section [2.4.254](#Section_e5d661c4bd7e4664a848495354b9fc3b)) in the first sequence of records that conforms to the **AI rule** (section 2.1.7.20.1) specifies a custom **trendline** name to display in the **legend** (section [2.2.3.8](#Section_1832229b7d1945f488d455e9c07466f0)).

 The sequence of records that conforms to the **SS** rule (section 2.1.7.20.1) specifies the formatting properties of the **trendline**. The **yi** field of the **DataFormat** record (section [2.4.74](#Section_02773c0de16b4d6d82f473c8fd18868e)) MUST specify the zero-based index of the **Series** record (section [2.4.252](#Section_d6eec0192d634c1e8080442af941b462)) associated with this **trendline** in the collection of all **Series** records in the current **chart sheet substream**. Each **trendline** MUST contain zero or one sequences of records that conform to the **SS** rule.

 The **SerParent** record (section [2.4.255](#Section_30274589f3324004b09deb47856e6858)) specifies the **series** associated with the **trendline**.

 The **SerAuxTrend** record specifies properties of the **trendline**, such as the **trendline** type and the number of periods to [**forecast**](#gt_0a5478cf-8836-4a9a-a663-7684366646a3) forward and backward, and specifies properties of the content of the **trendline** label.

 The **LegendException** record (section [2.4.153](#Section_8c4e0829c6ee4b34b8affb95f9d70c86)) specifies the formatting of the [**legend entry**](#gt_6c27eb24-fb59-4bc8-8962-9cdac46a748e) in the **legend** (section 2.2.3.8) that corresponds to the **trendline**. This record is specified if the legend entry has been deleted or does not use the default formatting of the **legend**. When the legend entry has non-default formatting, the **attached label** (section [2.2.3.15](#Section_9ac44e58af9940f4a99ace470eff0f5a)) that follows the **LegendException** record and **Begin** records (section [2.4.17](#Section_52d0d2c76cc540c4adf3aea158411ef3)) specifies the custom formatting of the legend entry.

The following restrictions apply to a **trendline**:

 All fields except the **cValx** and **cValy** fields in the **Series** record (section 2.4.252) MUST be ignored. The **cValy** and **cValx** fields in the **Series** records MUST be greater than 0.

 The **BRAI** records (section [2.4.29](#Section_c4e36e616c174a75b414f33803c7456b)) in the sequence of records that conforms to the **AI** rule (section 2.1.7.20.1) MUST be ignored and the **ifmt** field of the **BRAI** records MUST equal 0x0000.

#### 2.2.3.13 Error Bar

An **error bar** is a set of lines displayed on a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)) that indicates a range of uncertainty in the measurement of each **data points** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)) in a **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)).

An **error bar** is specified by a sequence of records that conforms to the **SERIESFORMAT** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf) that contains a **SerAuxErrBar** record (section [2.4.249](#Section_13a7411278424d6fab97de3123ff4199)).

The following records and rules define the significant parts of an **error bar**:

 The sequence of records that conforms to the **SS** rule (section 2.1.7.20.1) specifies the formatting properties of the **error bar**. The **yi** field of the **DataFormat** record (section [2.4.74](#Section_02773c0de16b4d6d82f473c8fd18868e)) MUST specify the zero-based index of the **Series** record (section [2.4.252](#Section_d6eec0192d634c1e8080442af941b462)) associated with this **error bar** in the collection of all **Series** record in the current **chart sheet substream**. Each **error bar** MUST contain zero or one sequences of records that conform to the **SS** rule.

 The **SerParent** record (section [2.4.255](#Section_30274589f3324004b09deb47856e6858)) specifies the **series** associated with the **error bar**.

 The **SerAuxErrBar** record specifies properties of the **error bar**, including the direction and type of the **error bar**.

The following restrictions apply to **error bars**:

 All fields except the **cValx** and **cValy** fields in the **Series** record MUST be ignored.

 The **cValx** field MUST equal the **cValx** field of the **Series** record in the associated **series** specified by the **SerParent** record.

 If the **ebsrc** field of the **SerAuxErrBar** record equals 0x04 and the **sertm** field of the **SerAuxErrBar** equals 0x01 or 0x02, the **cValx** field MUST equal the number of values represented by the **formula** field of the second **BRAI** record (section [2.4.29](#Section_c4e36e616c174a75b414f33803c7456b)) in the sequence of records that conforms to the **AI** rule (section 2.1.7.20.1).

 If the **ebsrc** field of the **SerAuxErrBar** record equals 0x04 and the **sertm** field of the **SerAuxErrBar** equals 0x03 or 0x04, the **cValy** field MUST equal the number of values represented by the **formula** field of the second **BRAI** record in the sequence of records that conforms to the **AI** rule.

 If the **ebsrc** field of the **SerAuxErrBar** record does not equal 0x04, the **cValy** field MUST equal the **cValy** field of the **Series** record in the associated **series** specified by the **SerParent** record.

 The **BRAI** records in the first, third, and fourth sequences of records that conform to the **AI** rule MUST be ignored and the **ifmt** field of the **BRAI** records MUST equal 0x0000.

 If the **ebsrc** field of the **SerAuxErrBar** record equals 0x04, the **ifmt** field of the **BRAI** records contained in the second collection of records that conform to the **AI** rule specifies a **Formula** (section [2.4.127](#Section_8e3c69786c9f4915a82607613204b244)) that specifies custom values of the **error bar**.

 If the **ebsrc** field of the **SerAuxErrBar** record equals 0x04, the **BRAI** records in the second sequence of records that conforms to the **AI** rule MUST be ignored and the **ifmt** field of the **BRAI** records MUST equal 0x0000.

 The **LegendException** record (section [2.4.153](#Section_8c4e0829c6ee4b34b8affb95f9d70c86)) in the **chart sheet substream** MUST NOT exist.

#### 2.2.3.14 Data Table

A [**data table (2)**](#gt_9e13d7ee-50d6-40ae-8789-29ecafe24bd4) is a table on a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)) that contains a row for each **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)) and lists the values of each **data point** (section [2.2.3.10](#Section_9c986ad250d44fa1a157063ac5c971a0)) on the **chart**.

A data table (2) is specified by a sequence of records that conforms to a **DAT** rule (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) as specified by the **chart sheet substream** (section 2.1.7.20.1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

The following records and rules define the significant parts of a data table (2):

 The **Dat** record (section [2.4.73](#Section_9405c76f5e904146a7894910a5f58534)) specifies if the data table (2) shows [**legend keys**](#gt_6981bc96-6d51-425c-9550-63c5b8b08e54) next to the name of the **series** and specifies which data table (2) borders are displayed.

 The sequences of records that conform to the **ATTACHEDLABEL** (section 2.1.7.20.1) and **TEXTPROPS** (section 2.1.7.20.1) rules in the sequence of records that conforms to the **LD** rule (section 2.1.7.20.1) specify the text formatting for the data table (2). The **Pos** record (section [2.4.201](#Section_b2311d215bad4525b759cacc13d394cf)) of the **attached label** (section [2.2.3.15](#Section_9ac44e58af9940f4a99ace470eff0f5a)) MUST be ignored. The **ObjectLink** record (section [2.4.182](#Section_50f2d49d1e5f416b866f057e0ab23ba9)) of the **attached label** MUST NOT exist.

 The sequence of records that conforms to the **FRAME** rule (section 2.1.7.20.1) in the sequence of records that conforms to the **LD** rule specifies the formatting properties of the data table (2).

The following restrictions apply to the collection of records that represents a data table (2):

 The **fWasDataTable** field of the **Legend** record (section [2.4.152](#Section_03d359d915f94e7a8ad1d7b741ed2e21)) in the sequence of records that conforms to the **LD** rule MUST equal 1.

 The **Pos** record in the sequence of records that conforms to the **LD** rule MUST be ignored. A data table (2) is automatically positioned.

 The **CrtLayout12** record (section [2.4.66](#Section_ff69b6f84d7943c5a983a1c8b9496665)) and the sequence of records that conforms to the **CRTMLFRT** rule (section 2.1.7.20.1), in the sequence of records that conforms to the **LD** rule, MUST NOT exist in a data table (2).

A data table (2) is not displayed on a **chart** if the **chart** contains a bar of pie, bubble, doughnut, filled radar, pie, pie of pie, radar, or scatter **chart group** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)).

#### 2.2.3.15 Attached Label

An **attached label** is a generic text element that is used on a **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)). An **attached label** can specify properties of an **axis** (section [2.2.3.6](#Section_4117f73aa0f348d89c0f65864918ffb3)) title, **chart** title, **data label** (section [2.2.3.11](#Section_cac7f43a3af142f58ff2814c2870427f)), **data table** (section [2.2.3.14](#Section_69938f61d2e94da3af87e154edcb0d98)), [**display units**](#gt_7d807b62-cff1-4e03-a73f-840844345b83) label, **legend** (section [2.2.3.8](#Section_1832229b7d1945f488d455e9c07466f0)), [**legend entry**](#gt_6c27eb24-fb59-4bc8-8962-9cdac46a748e), **trendline** (section [2.2.3.12](#Section_61d74ebc36714d6dbdc0626db604530d)) label, or the default text properties of the entire **chart**.

The location of the **attached label** in the **chart sheet substream** (section [2.1.7.20.1](#Section_732ff614d939416bb7c76d983471ff11)) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf) and the properties of the **ObjectLink** record (section [2.4.182](#Section_50f2d49d1e5f416b866f057e0ab23ba9)) of the **attached label** specify the **chart** element to which the **attached label** applies. Refer to the **conceptual overviews** (section [2.2.3](#Section_3e15a76353f14118a8f45f4e42a981c2)) for explanation of the meaning of the **attached label** in each context that it is used.

An **attached label** is specified by a collection of records that conforms to an **ATTACHEDLABEL** rule (section 2.1.7.20.1) as specified by the **chart sheet substream** (section 2.1.7.20.1) ABNF.

 The **Text** record (section [2.4.324](#Section_362cfe7d650949fb81402ad59c16b4c4)) and the collection of records that conforms to the **TEXTPROPS** rule (section 2.1.7.20.1) specify properties of the text in the **attached label**. These properties include text options such as text rotation and reading order. On **attached labels** that represent **data labels**, the **Text** record also specifies content and layout properties of the **data labels**.

 The **Pos** (section [2.4.201](#Section_b2311d215bad4525b759cacc13d394cf)) and **CrtLayout12** (section [2.4.66](#Section_ff69b6f84d7943c5a983a1c8b9496665)) records specify the position of the **attached label** on the **chart**. The **Pos** record MUST be ignored if the **attached label** represents the **data labels** on a **series** (section [2.2.3.9](#Section_527ce4dfc9f84e50a314d4b07519593c)) or **chart group** (section [2.2.3.7](#Section_c91fdf3195e2495fa48a5546ce20c0c5)), a **data table**, the default text of the **chart**, or a [**legend key**](#gt_6981bc96-6d51-425c-9550-63c5b8b08e54).

 The **FontX** (section [2.4.123](#Section_8c065ab610d44029a20dac422620eed2)) and **AlRuns** (section [2.4.1](#Section_8ffd645fc00848d8aae1adbd10927e6d)) records specify the font and rich text formatting properties of the **attached label**.

 The collection of records that conforms to the **AI** rule (section 2.1.7.20.1) specifies custom text of the **attached label**.

 The collection of records that conforms to the **FRAME** rule (section 2.1.7.20.1) specifies the fill and border properties of the **attached label**.

 The **ObjectLink** record specifies the **chart** element the **attached label** applies to.

 The **DataLabExtContents** record (section [2.4.76](#Section_9e2876c62d3049a7ac7eff01315e1418)) specifies additional **data label** properties on **attached labels** that represent a **data label**. Refer to the **data label** overview for the conditions when this record can be written. This record MUST NOT exist unless the **attached label** specifies properties of a **data label**. An **attached label** specifies properties of a **data label** if the **wLinkObj** field of the **ObjectLink** record is equal to 0x0004 or the attached label is in the collection of records that conforms to the **DFTTEXT** rule (section 2.1.7.20.1) in a **chart group**.

 The collection of records that conforms to the **CRTMLFRT rule** (section 2.1.7.20.1) specifies **future records** (section [2.1.6](#Section_b660b67822684414839ed1ae9a4e4e85)) for the **attached label**.

#### 2.2.3.16 SPRC

A **SPRC** is a unit of measurement that is 1/4000th of the height or width of the **chart** (section [2.2.3.3](#Section_f9430fdccd0f40dd93243bdf4ce7cc4c)). If the field is being used to specify a width or horizontal distance, the **SPRC** is 1/4000th of the width of the **chart**. If the field is being used to specify a height or vertical distance, the **SPRC** is 1/4000th of the height of the **chart**.

#### 2.2.3.17 Chart Area

For non-embedded **charts**, the size of the area is specified by the **Chart** record (section [2.4.45](#Section_8f56b001f57445e0932f84cf30408323)) in points. For embedded **charts**, the **chart** is treated as a drawing and its size is calculated from the **OfficeArtClientAnchorSheet** record (section [2.5.193](#Section_fd656a2cd5ee41718f6517a08b9f2262)) that is contained in the **MsoDrawing** (section [2.4.170](#Section_1b0b0ea35e1d41ce8e79e27f1041331e)) preceding the **chart** stream. The **chart area** calculation is as follows:

1. Get **chart area width in pixels**

**chart area width in pixels** = (dx field of **Chart** record - 8) \* DPI of the display device / 72 for non-embedded **charts**.

**chart area width in pixels** is calculated from individual cell widths/heights that anchor the **chart** as indicated by **OfficeArtClientAnchorSheet** (section 2.5.193) for embedded charts.

If the **frt** field of the **Frame** record (section [2.4.128](#Section_0cb3e202342740b4b93b277c0bd977ff)) following the **Chart** record (section 2.4.45) is 0x0004 and the **chart** is not embedded, add the shadow size:

**chart area width in pixels** -= 2 \* line width of the display device in pixels

2. Get **chart area height in pixels**

**chart area height in pixels** = (dy field of **Chart** record - 8) \* DPI of the display device / 72 for non-embedded **charts**.

**chart area height in pixels** is calculated from individual cell widths/heights that anchor the **chart** as indicated by **OfficeArtClientAnchorSheet** (section 2.5.193) for embedded charts.

If the **frt** field of the **Frame** record (section 2.4.128) following the **Chart** record (section 2.4.45) is 0x0004 and the **chart** is not embedded, add the shadow size:

**chart area height in pixels** -= 2 \* line height of the display device in pixels

### 2.2.4 Metadata

**Metadata** is additional data associated with a particular [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) or its content. **Metadata** is recorded in [**BIFF8**](#gt_e60b71bb-c66c-4a44-ab07-0f9f20ee3dd5) for future extensibility purpose only.

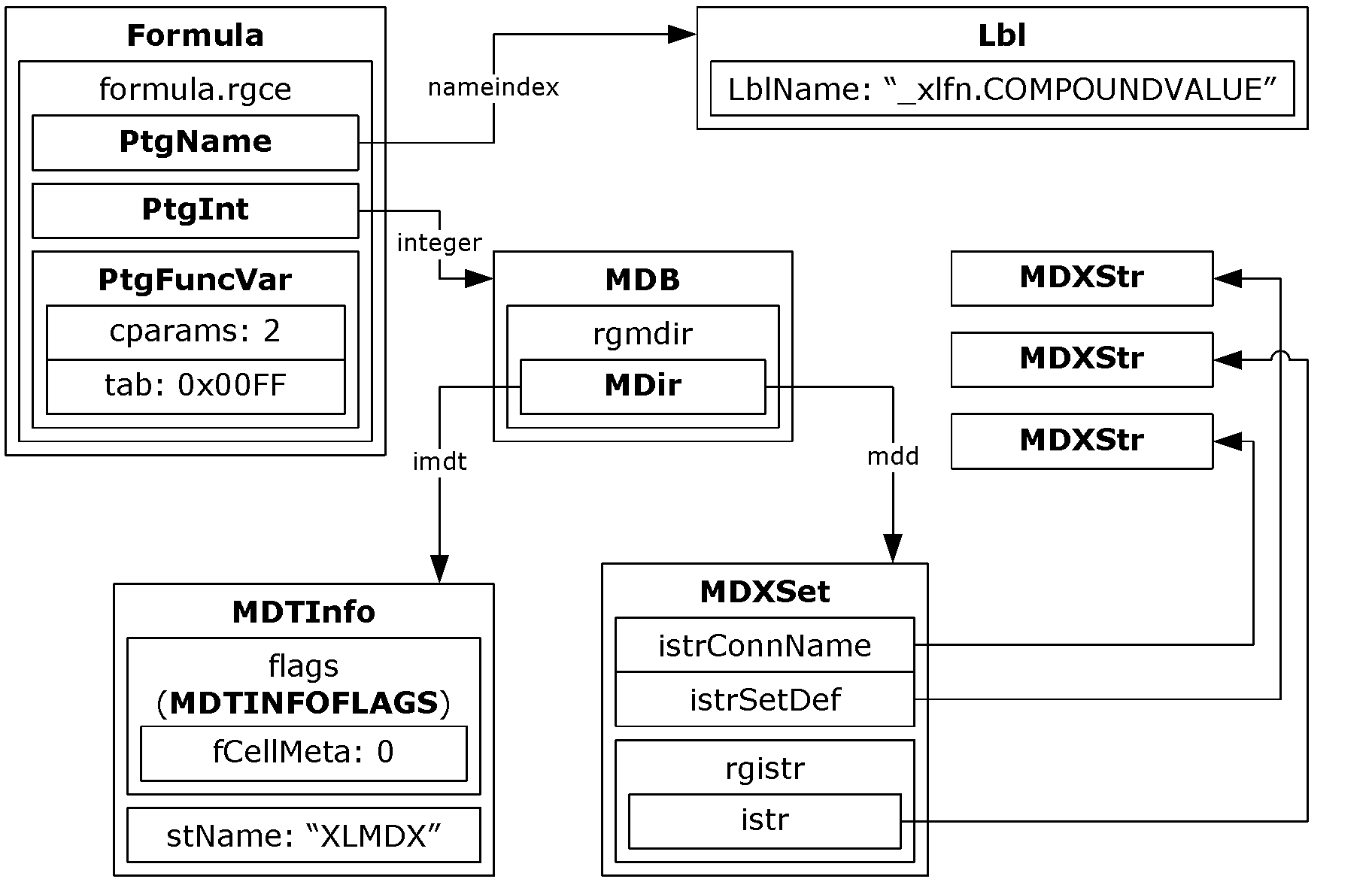


Figure 2: Metadata

The following sections define terms used in this diagram.

#### 2.2.4.1 Metadata Types

The architecture of the metadata allows for multiple types of metadata.

Each type of metadata has an associated collection of metadata records, a unique name, and a set of predefined properties. Those properties describe whether the metadata remains associated with the [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) or its content during runtime operations (for example, insert, shift, copy/paste, merge, or unmerge operations), as well as whether the metadata is **cell metadata** (section [2.2.4.2](#Section_c925f5199fe14b6ab01807fa18351e68)) or **value metadata** (section [2.2.4.3](#Section_e78bf5ba22754bad8e6cf4f59644efa6)).

A metadata type is represented by an **MDTInfo** record (section [2.4.162](#Section_915ac793a5364c45b699aa97a9d2bec5)).

#### 2.2.4.2 Cell Metadata

**Cell metadata** is metadata associated with a [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) itself. **Cell metadata** is not represented in [**BIFF8**](#gt_e60b71bb-c66c-4a44-ab07-0f9f20ee3dd5) format.

#### 2.2.4.3 Value Metadata

**Value metadata** is metadata associated with the value of a particular [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461). **Value metadata** is associated with a cell through a **formula** (section [2.2.2](#Section_e7625cc83da94154b44949cf1bbd9703)) containing a single special function, \_xlfn.COMPOUNDVALUE, whose single mandatory argument references a **metadata block** record (section [2.2.4.4](#Section_9fd157237cbe4334b4d10f23e3ed706c))[<18>](#Appendix_A_18" \o "Product behavior note 18).

The only **value metadata** type represented in [**BIFF8**](#gt_e60b71bb-c66c-4a44-ab07-0f9f20ee3dd5) is **MDX metadata** (section [2.2.4.5](#Section_0f7583182c0b4155bf75c7399f89305c)).

#### 2.2.4.4 Metadata Block

Cells are associated with actual metadata values using a metadata mapping table known as a **metadata block**. A **metadata block** contains a collection of indexes to metadata records, along with the corresponding **metadata types** (section [2.2.4.1](#Section_bbefb91d7be44ea69e2e707bae2c69ab)).

A **metadata block** is represented by an **MDB record** (section [2.4.161](#Section_8326750414ce425ea1b0497179f9bcbe)).

#### 2.2.4.5 MDX Metadata

The only type of metadata used is [**MDX**](#gt_9b631ff5-dc89-45f0-a1c2-db6981e4804f) metadata.

The **MDTInfo** record (section [2.4.162](#Section_915ac793a5364c45b699aa97a9d2bec5)) that specifies the **metadata type** (section [2.2.4.1](#Section_bbefb91d7be44ea69e2e707bae2c69ab)) for MDX metadata MUST have the following values:

| Field | Value |
| --- | --- |
| **fGhostRow** | 0 |
| **fGhostCol** | 0 |
| **fEdit** | 0 |
| **fDelete** | 0 |
| **fCopy** | 1 |
| **fPasteAll** | 1 |
| **fPasteFormulas** | 0 |
| **fPasteValues** | 1 |
| **fPasteFormats** | 0 |
| **fPasteComments** | 0 |
| **fPasteDataValidation** | 0 |
| **fPasteBorders** | 0 |
| **fPasteColWidths** | 0 |
| **fPasteNumberFormats** | 0 |
| **fMerge** | 1 |
| **fSplitFirst** | 1 |
| **fSplitAll** | 0 |
| **fRowColShift** | 1 |
| **fClearAll** | 0 |
| **fClearFormats** | 1 |
| **fClearContents** | 0 |
| **fClearComments** | 1 |
| **fAssign** | 1 |
| **fCoerce** | 1 |
| **fAdjust** | 0 |
| **fCellMeta** | 0 |
| **stName** | "XLMDX" |

An MDX metadata record references the connection name and the [**cube function**](#gt_02658bae-45d5-4aad-be23-d35b9d440af3) used or referenced in a [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461).

There are four types of MDX metadata records: **MDX tuple metadata** (section [2.2.4.5.1](#Section_277444ebcca34128b302b39de79eeb41)), **MDX set metadata** (section [2.2.4.5.2](#Section_84d4d0b542b6405ea07be3272dc517f8)), **MDX member property metadata** (section [2.2.4.5.3](#Section_722f7e05ca3e4a20b30fbbed1a597e88)), and **MDX KPI metadata (**section [2.2.4.5.4](#Section_db8664f2502b43d2aa88274035b52570)**)**.

##### 2.2.4.5.1 MDX Tuple Metadata

An [**MDX**](#gt_9b631ff5-dc89-45f0-a1c2-db6981e4804f) [**tuple**](#gt_e64f7e8a-c55b-47dc-9c6e-2afe5f13d448) is the intersection between two or more [**members (2)**](#gt_5d78ca78-a9b1-4791-8126-bf9494304b11) from different [**dimensions (1)**](#gt_70d18eb1-eb3c-48f8-b0cd-7140f206406c).

MDX tuple metadata is used by [**cube functions**](#gt_02658bae-45d5-4aad-be23-d35b9d440af3) returning a member (2) or a value.

MDX tuple metadata is represented by an **MDXTuple** record (section [2.4.167](#Section_d5cd418ff9c04542a5bd03dbb12c72fa)).

##### 2.2.4.5.2 MDX Set Metadata

An [**MDX**](#gt_9b631ff5-dc89-45f0-a1c2-db6981e4804f) set is an ordered collection of [**members (2)**](#gt_5d78ca78-a9b1-4791-8126-bf9494304b11) within the same [**dimension (1)**](#gt_70d18eb1-eb3c-48f8-b0cd-7140f206406c).

MDX set metadata is used by [**cube functions**](#gt_02658bae-45d5-4aad-be23-d35b9d440af3) returning a set or the number of items in a set.

MDX set metadata is represented by an **MDXSet** record (section [2.4.165](#Section_f9628c3f30f94072a4b0c11bf66c3cfc)).

##### 2.2.4.5.3 MDX Member Property Metadata

An [**MDX**](#gt_9b631ff5-dc89-45f0-a1c2-db6981e4804f) [**member property**](#gt_c7ddc1fa-c564-42c5-b755-aed72a0cb000) represents the property value of a [**member (2)**](#gt_5d78ca78-a9b1-4791-8126-bf9494304b11).

MDX member property metadata references a member (2) name and a property name.

MDX member property metadata is represented by an **MDXProp** record (section [2.4.164](#Section_a286d6eb77204abfb383c494c0db35e3)).

##### 2.2.4.5.4 MDX KPI Metadata

An [**MDX**](#gt_9b631ff5-dc89-45f0-a1c2-db6981e4804f) [**key performance indicator (KPI)**](#gt_1d2666f5-ffca-4053-868a-0cd4434ce5a8) represents the KPI property value of a KPI [**member (2)**](#gt_5d78ca78-a9b1-4791-8126-bf9494304b11).

MDX KPI metadata references a KPI name, a KPI property, and a member (2) name.

MDX KPI metadata is represented by an **MDXKPI** record (section [2.4.163](#Section_08059ef97776497aafa77f40c0b045f6)).

### 2.2.5 PivotTables

A PivotTable is a mechanism for summarizing **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)) to get an overview of the distribution of that data. In a PivotTable, applicable columns of the **source data** become fields that can be used to summarize data.

When the **source data** of the **PivotTable** is [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) **source data**, [**OLAP hierarchies**](#gt_1e0ca171-3095-4e3c-9c69-65148df00a9c) and some other OLAP entities become fields in the PivotTable.

A PivotTable has two major parts, a **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) and a **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)). These parts are described in the following sections. There can be multiple **PivotTable views** based on a single non-**OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)). An **OLAP PivotCache** MUST have exactly one **associated PivotTable view** (section [2.2.5.3.3](#Section_855483943345473bb926de5189fd664d)).

The values produced by a PivotTable are placed in cells of a [**sheet (2)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) and these cells make up a PivotTable report.

The PivotTable structures are not needed to obtain values from a **PivotTable** report because those values are available in the sheet (2) cells. The structures are needed for the following purposes:

 To show extra information related to a PivotTable report in an application, such as sort and filter information.

 To recalculate a **PivotTable view**, to incorporate changes such as sorting and filtering made to it, and to update the corresponding **PivotTable** report accordingly.

 To refresh a **PivotCache**, to incorporate changes made to the **source data**, and then recalculate any **PivotTable views** associated with the **PivotCache** and to update the corresponding **PivotTable** reports accordingly.

#### 2.2.5.1 PivotTable Records

For general information about records see section [2.1](#Section_2e6147d9e8ad48b09ff7bbfc51ca950d). **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) uses records from the **Worksheet Substream** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)), the **Globals Substream** (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)), and the [**streams**](#gt_f3529cd8-50da-4f36-aa0b-66af455edbb6) in the **Pivot Cache Storage (\_SX\_DB\_CUR)** (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687)).

Concepts specified for **PivotTables** can have multiple sequences of records specifying them. The sequences can be in different streams or substreams. In these cases additional information is specified for the concept in the **PIVOTFRT9** rule (section 2.1.7.20.5) or by **SXAddl** records (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)). See the individual records, the **QsiSXTag** record (section [2.4.211](#Section_3bb6727096504455944daa8e21dbb19f)) and section [2.2.5.1.1](#Section_db61fa8bdb7b4e1c99615c2f3ed1c369) for more information about how the additional information is connected to the concept.

##### 2.2.5.1.1 Usage of SXAddl Records

The **SXAddl** records (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) is a record used for storing additional **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)), **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) or [**query table**](#gt_ceb1ea2c-7b55-4a25-a7f0-79b1c1011289) information of a variety of types.

**SXAddl** records have an **hdr** field of type **SXAddlHdr** (section [2.5.253](#Section_fd41637ad9fe486b80101ed68fefc6db)) that specifies the current **class** (section [2.2.5.1.1.1](#Section_3450b26af2b247dd982c6b9eb2d448b0)) and the full type of record, see section 2.2.5.1.1.1 for details. The full record type specifies the meaning of the **data** field of the **SXAddl** record.

###### 2.2.5.1.1.1 Class

All **SXAddl** records (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) are grouped into classes. Each **SXAddl** record has a current class. An **SXAddl** record can be in other classes as well. The different classes and their specifications follow.

Unless the value of the **hdr.sxc** field of **SXAddl** is 0x09 and the value of the **hdr.sxd** field of **SXAddl** is 0xFF, the **hdr.sxc** field of the **SXAddl** record specifies the current class and MUST be a value from the following table:

| Name | Value | Current Class |
| --- | --- | --- |
| sxcView | 0x00 | **SxcView** class (section [2.2.5.1.1.1.1](#Section_a17d6dc32db74ec4b3cbeded2b7126c3)) |
| sxcField | 0x01 | **SxcField** class (section [2.2.5.1.1.1.2](#Section_51de615365d949198b2a537779e0a9f7)) |
| sxcHierarchy | 0x02 | **SxcHierarchy** class (section [2.2.5.1.1.1.3](#Section_6167aeb40d774815b3218d3f117c438d)) |
| sxcCache | 0x03 | **SxcCache** class (section [2.2.5.1.1.1.4](#Section_1681856cae2d4f64b8cc40d2702754e7)) |
| sxcCacheField | 0x04 | **SxcCacheField** class (section [2.2.5.1.1.1.5](#Section_102acda2fb58485d9a40a37d0a219103)) |
| sxcQsi | 0x05 | **SxcQsi** class (section [2.2.5.1.1.1.6](#Section_953f8be387154b688af387eef7855f27)) |
| sxcQuery | 0x06 | **SxcQuery** class (section [2.2.5.1.1.1.7](#Section_78ae192deccb4971bc9b33e46f7ab527)) |
| sxcGrpLevel | 0x07 | **SxcGrpLevel** class (section [2.2.5.1.1.1.8](#Section_86689e7b9d264225b6be580f86cea53e)) |
| sxcGroup | 0x08 | **SxcGroup** class (section [2.2.5.1.1.1.9](#Section_664bdb47dfb148b69cbd2d9b6bc48600)) |
| sxcCacheItem | 0x09 | **SxcCacheItem** class (section [2.2.5.1.1.1.10](#Section_23b4298b5a8e4357b2c07c2ea90d91c5)) |
| sxcSxrule | 0x0C | **SxcSXRule** class (section [2.2.5.1.1.1.11](#Section_dd12edef6e8747379bed6f4ceff33127)) |
| sxcSxfilt | 0x0D | **SxcSXFilt** class (section [2.2.5.1.1.1.12](#Section_22611924dd5649078c7ab385cd2ccdc0)) |
| sxcSxdh | 0x10 | **SxcSXDH** class (section [2.2.5.1.1.1.13](#Section_284c3ab876c54d36961f1e0006764807)) |
| sxcAutoSort | 0x12 | **SxcAutoSort** class (section [2.2.5.1.1.1.14](#Section_212512d2c740431f838b7ec651364e2f)) |
| sxcSxmgs | 0x13 | **SxcSXMgs** class (section [2.2.5.1.1.1.15](#Section_7081e96f74c24e339021305d28e3da1a)) |
| sxcSxmg | 0x14 | **SxcSXMg** class (section [2.2.5.1.1.1.16](#Section_7a80fae6884c401f8ecab68064099425)) |
| sxcField12 | 0x17 | **SxcField12** class (section [2.2.5.1.1.1.17](#Section_4bd42ced53544e2ea2665ea9f7787a85)) |
| sxcSxcondfmts | 0x1A | **SxcSXCondFmts** class (section [2.2.5.1.1.1.18](#Section_fdd787b53b0e43f888b9c86cb063a54f)) |
| sxcSxcondfmt | 0x1B | **SxcSXCondFmt** class (section [2.2.5.1.1.1.19](#Section_59cc4e9903ad43f395985be87afdcc92)) |
| sxcSxfilters12 | 0x1C | **SxcSXFilters12** class (section [2.2.5.1.1.1.20](#Section_38fb61e517e742219ea43f1e5a665bc2)) |
| sxcSxfilter12 | 0x1D | **SxcSXFilter12** class (section [2.2.5.1.1.1.21](#Section_9b54e335ef8846d28d19dfbfe2078154)) |

The current **class** and the **hdr.sxd** field of **SXAddl** specify the full type of the record, see the individual **classes** for details.

If the value of the **hdr.sxc** field of **SXAddl** is 0x09 and the value of the **hdr.sxd** field of **SXAddl** is 0xFF, then the current **class** is specified by **SxcCacheField** class and the full record type is **SXAddl\_SXCCacheItem\_SXDEnd** (section [2.4.273.20](#Section_2b57bfc845aa46b2afe30eba4c54497a)).

**Classes** can be nested inside other **classes** in a hierarchical manner as specified by the **Globals Substream** (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)) [**Augmented Backus-Naur Form (ABNF)**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf), **Worksheet Substream** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) ABNF, and **Common Productions** (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)) ABNF. Properties from the outer **classes** apply to the inner **classes** unless otherwise specified. Records in **classes** nested inside other **classes**, are [**members (1)**](#gt_5d78ca78-a9b1-4791-8126-bf9494304b11) of both the inner and outer **classes**, but their current **class** is given by the value of their **hdr.sxc** field. For example, **SXAddl\_SXCHierarchy\_SXDProperty** (section [2.4.273.57](#Section_263064a90d694646a45d2ba174495fe5)) is a member (1) of the **SxcView** class and the **SxcHierarchy** class and its current **class** is the **SxcHierarchy** class.

2.2.5.1.1.1.1 SxcView Class

The **SxcView** class specifies additional information for a **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)).

The **SxcView** class is specified by the sequence of records specified by the **PIVOTADDL** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The **PivotTable view** that the **SxcView** class specifies information for is specified by the **stName** field of the **SXAddl\_SXCView\_SXDId** record (section [2.4.273.105](#Section_b62c9dbcce0d430bab35fb2e310a36b7)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCVIEW (0x00), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCView\_SXDId** |
| sxdVerUpdInv | 0x01 | **SXAddl\_SXCView\_SXDVerUpdInv** (section [2.4.273.110](#Section_4ef665e54eb34c78a22e1f470bae4efe)) |
| sxdVer10Info | 0x02 | **SXAddl\_SXCView\_SXDVer10Info** (section [2.4.273.108](#Section_852f0dea13e84b8bae42ae9b09e76c5e)) |
| sxdCalcMember | 0x03 | **SXAddl\_SXCView\_SXDCalcMember** (section [2.4.273.100](#Section_ec60a3e765fc4431b322cb8f39595a08)) |
| sxdCalcMemString | 0x0A | **SXAddl\_SXCView\_SXDCalcMemString** (section [2.4.273.101](#Section_982c65e56e14423c8428be4eaa8cb2cd)) |
| sxdVer12Info | 0x19 | **SXAddl\_SXCView\_SXDVer12Info** (section [2.4.273.109](#Section_c4888328f46743bb8ad960ff62f1d364)) |
| sxdTableStyleClient | 0x1E | **SXAddl\_SXCView\_SXDTableStyleClient** (section [2.4.273.107](#Section_adade4ceaf6e4dd19d669080ebaec11d)) |
| sxdCompactRwHdr | 0x21 | **SXAddl\_SXCView\_SXDCompactRwHdr** (section [2.4.273.103](#Section_9a0c8b650f274f5db32e43e8bedb857c)) |
| sxdCompactColHdr | 0x22 | **SXAddl\_SXCView\_SXDCompactColHdr** (section [2.4.273.102](#Section_46eb5a733a1b420aac067082ab18a2fc)) |
| sxdSxpiIvmb | 0x26 | **SXAddl\_SXCView\_SXDSXPIIvmb** (section [2.4.273.106](#Section_a87914600ed4482dab8b378915cc6fad)) |
| sxdEnd | 0xFF | **SXAddl\_SXCView\_SXDEnd** (section [2.4.273.104](#Section_38d4685f17224c828bae3c9d008e5bfb)) |

2.2.5.1.1.1.2 SxcField Class

The **SxcField** class specifies additional information for a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)).

The **SxcField** class is specified by the sequence of records specified by the **SXADDLFIELD** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The **pivot field** that the **SxcField** class specifies information for is specified by the **stName** field of the **SXAddl\_SXCField SXDId** record (section [2.4.273.26](#Section_f09d5830e9da4f6698ee1274b20860bc)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCFIELD (0x01), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCField SXDId** |
| sxdVer10Info | 0x02 | **SXAddl\_SXCField\_SXDVer10Info** (section [2.4.273.27](#Section_90f9905b3ba2481995a11c5ff01d92d8)) |
| sxdEnd | 0xFF | **SXAddl\_SXCField\_SXDEnd** (section [2.4.273.25](#Section_2e1472baf3904c40a7a141523671fb09)) |

2.2.5.1.1.1.3 SxcHierarchy Class

The **SxcHierarchy** class specifies additional information for a **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)).

The **SxcHierarchy** class is specified by the sequence of records specified by the **SXADDLHIERARCHY** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The **pivot hierarchy** (section 2.2.5.4.5) that the **SxcHierarchy** class specifies information for is specified by the **stHierUnq** field of the **SXAddl\_SXCHierarchy\_SXDId** record (section [2.4.273.47](#Section_38febb32daf04ebca9aa2be359bcda3e)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals sxcHierarchy (0x02), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCHierarchy\_SXDId** |
| sxdVerUpdInv | 0x01 | **SXAddl\_SXCHierarchy\_SXDVerUpdInv** (section [2.4.273.60](#Section_55cf25c16dce48f2b30370421f8dbead)) |
| sxdProperty | 0x05 | **SXAddl\_SXCHierarchy\_SXDProperty** (section [2.4.273.57](#Section_263064a90d694646a45d2ba174495fe5)) |
| sxdFilterMember | 0x09 | **SXAddl\_SXCHierarchy\_SXDFilterMember** (section [2.4.273.44](#Section_6814aaca90cd45849413d70f047f54d2)) |
| sxdSxSetParentUnique | 0x1D | **SXAddl\_SXCHierarchy\_SXDSXSetParentUnique** (section [2.4.273.58](#Section_2c369ec54eee48509c966210514c3426)) |
| sxdUserCaption | 0x1F | **SXAddl\_SXCHierarchy\_SXDUserCaption** (section [2.4.273.59](#Section_553d53d763e145a9b07608d7946c009f)) |
| sxdIconset | 0x20 | **SXAddl\_SXCHierarchy\_SXDId record** (section 2.4.273.47) |
| sxdMeasureGrp | 0x24 | **SXAddl\_SXCHierarchy\_SXDMeasureGrp** (section [2.4.273.55](#Section_a49c775a7cb84c78a2a7969ed8b003b6)) |
| sxdDisplayFolder | 0x25 | **SXAddl\_SXCHierarchy\_SXDDisplayFolder** (section [2.4.273.42](#Section_d48d04ee81bc4ca0bef341ccf60a4cda)) |
| sxdParentKPI | 0x26 | **SXAddl\_SXCHierarchy\_SXDParentKPI** (section [2.4.273.56](#Section_003a3cca47e0424783233aaaac2c045b)) |
| sxdKPIValue | 0x27 | **SXAddl\_SXCHierarchy\_SXDKPIValue** (section [2.4.273.53](#Section_e25584427c5e4659929282d4e16dd295)) |
| sxdKPIGoal | 0x28 | **SXAddl\_SXCHierarchy\_SXDKPIGoal** (section [2.4.273.49](#Section_813f1500321f4b0682b2b7b2e684d6a7)) |
| sxdKPIStatus | 0x29 | **SXAddl\_SXCHierarchy\_SXDKPIStatus** (section [2.4.273.50](#Section_3cdc22c0161b4e34a6f04c0f6401e8c1)) |
| sxdKPITrend | 0x2A | **SXAddl\_SXCHierarchy\_SXDKPITrend** (section [2.4.273.52](#Section_c14151f1c30641bab8ba23510c4cf8e3)) |
| sxdKPIWeight | 0x2B | **SXAddl\_SXCHierarchy\_SXDKPIWeight** (section [2.4.273.54](#Section_41d7546e65cc42269e7f3c08be3c395d)) |
| sxdKPITime | 0x2C | **SXAddl\_SXCHierarchy\_sxdKPITime** (section [2.4.273.51](#Section_ea6c982c8f2d4bb49985d4e1899bf3cc)) |
| sxdFilterMember12 | 0x3F | **SXAddl\_SXCHierarchy\_sxdFilterMember12** (section [2.4.273.45](#Section_e38c0aa8e2e2448680ed5d230a53d17a)) |
| sxdInfo12 | 0x41 | **SXAddl\_SXCHierarchy\_SXDInfo12** (section [2.4.273.48](#Section_b14c6fae02be48fcb1aa858b61485b9d)) |
| sxdEnd | 0xFF | **SXAddl\_SXCHierarchy\_SXDEnd** (section [2.4.273.43](#Section_198666533b024f6da517f374646df2d7)) |

2.2.5.1.1.1.4 SxcCache Class

The **SxcCache** class specifies additional information for a **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)).

The **SxcCache** class is specified by the sequence of records specified by the **SXADDLCACHE** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The **PivotCache** that the **SxcCache** class specifies information for is specified by the **idCache** field of the **SXAddl\_SXCCache\_SXDId** record (section [2.4.273.6](#Section_21eb148497344b9d80952b1d7db4808e)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCCACHE (0x03), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| SxdId | 0x00 | **SXAddl\_SXCCache\_SXDId** |
| SxdVerUpdInv | 0x01 | **SXAddl\_SXCCache\_SXDVerUpdInv** (section [2.4.273.11](#Section_c24af34925b34117aaf2fa43af97d50b)) |
| SxdVer10Info | 0x02 | **SXAddl\_SXCCache\_SXDVer10Info** (section [2.4.273.9](#Section_38d95aa179c14ea697b37e460ff9a61c)) |
| SxdVerSxMacro | 0x18 | **SXAddl\_SXCCache\_SXDVerSXMacro (**section [2.4.273.10](#Section_fea88f2f921c4e8daae6a7f51b694287)**)** |
| SxdInvRefreshReal | 0x34 | **SXAddl\_SXCCache\_SXDInvRefreshReal** (section [2.4.273.8](#Section_03f3c75e743a42ec8d9a86600e2389d7)) |
| SxdInfo12 | 0x41 | **SXAddl\_SXCCache\_SXDInfo12** (section [2.4.273.7](#Section_029dff932a484fe1bcffc2dadc5a25b8)) |
| sxdEnd | 0xFF | **SXAddl\_SXCCache\_SXDEnd** (section [2.4.273.5](#Section_c88c0132c4be428bb83faad491cc3cac)) |

2.2.5.1.1.1.5 SxcCacheField Class

The **SxcCacheField** class specifies additional information for a **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)).

The **SxcCacheField** class is specified by the sequence of records specified by the **SXADDLCACHEFIELD** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The **cache field** that the **SxcCacheField** class specifies information for is specified by the **stSourceName** field of the **SXAddl\_SXCCacheField\_SXDId** record (section [2.4.273.14](#Section_cc65e97dd6ce446683dca1c3100f1412)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCCACHEFIELD (0x04), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCCacheField\_SXDId** |
| sxdProperty | 0x05 | **SXAddl\_SXCCacheField\_SXDProperty** (section [2.4.273.17](#Section_60f8c6f400b24c92a48f5801ae952872)) |
| sxdSxrmitmCount | 0x2D | **SXAddl\_SXCCacheField\_SXDSxrmitmCount** (section [2.4.273.19](#Section_2970bf54171e43a7900eb3e6c9cf1d7b)) |
| sxdCaption | 0x2F | **SXAddl\_SXCCacheField\_SXDCaption** (section [2.4.273.12](#Section_9bcf29f9cb65480e9ee09408caf2d8c9)) |
| sxdIfdbMempropMap | 0x30 | **SXAddl\_SXCCacheField\_SXDIfdbMempropMap** (section [2.4.273.15](#Section_b60cba0e29cc485fa3b73371b418423b)) |
| sxdIfdbMpMapCount | 0x31 | **SXAddl\_SXCCacheField\_SXDIfdbMpMapCount** (section [2.4.273.16](#Section_2c0324ea60f54fe2a8ff02cba81bec58)) |
| sxdPropName | 0x40 | **SXAddl\_SXCCacheField\_SXDPropName** (section [2.4.273.18](#Section_f2e0eace2d084a7a8ce5d4c733fbed30)) |
| sxdEnd | 0xFF | **SXAddl\_SXCCacheField\_SXDEnd** (section [2.4.273.13](#Section_5d9df75f465b45ab8515487b9747ce3d)) |

Additionally, **SXAddl\_SXCCacheItem\_SXDEnd** has a current class of **SxcCacheField** class, as specified in section [2.2.5.1.1.1](#Section_3450b26af2b247dd982c6b9eb2d448b0).

2.2.5.1.1.1.6 SxcQsi Class

The **SxcQsi** class specifies additional information for a [**query table**](#gt_ceb1ea2c-7b55-4a25-a7f0-79b1c1011289).

The **SxcQsi** class is specified by the sequence of records specified by the **SXADDLQSI** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The query table that the **SxcQsi** class specifies information for is specified by **stName** field of the **SXAddl\_SXCQsi\_SXDId** record (section [2.4.273.62](#Section_73eeb496e08f44ccac01ab9b822cb73e)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCQSI (0x05), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCQsi\_SXDId** |
| sxdEnd | 0xFF | **SXAddl\_SXCQsi\_SXDEnd** (section [2.4.273.61](#Section_f79404936ada46f5b81c317682d8253e)) |

2.2.5.1.1.1.7 SxcQuery Class

The **SxcQuery** class specifies additional information for an **external connection** (section [2.2.8](#Section_69df8d03b6fd45cda0a09b026e50a3d9)).

The **SxcQuery** class is specified by the sequence of records specified by the **SXADDLDBQUERY** rule (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)).

The **external connection** (section 2.2.8) the **SxcQuery** class specifies information for is specified by the **stURL** field of the **SXAddl\_SXCQuery\_SXDXMLSource** record (section [2.4.273.67](#Section_064af5ebb94e49ea8a24e90fdcd7f1cf)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCQUERY (0x06), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdXMLSource | 0x04 | **SXAddl\_SXCQuery\_SXDXMLSource** |
| sxdScrDataFile | 0x05 | **SXAddl\_SXCQuery\_SXDSrcDataFile** (section [2.4.273.66](#Section_394cb9a661c542f089d73748721e15fa)) |
| sxdSrcConnFile | 0x06 | **SXAddl\_SXCQuery\_SXDSrcConnFile** (section [2.4.273.65](#Section_f41f413611484186b271fde913611fd9)) |
| sxdReconnCond | 0x07 | **SXAddl\_SXCQuery\_SXDReconnCond** (section [2.4.273.64](#Section_bde80fdf9eb54b4295d39ff986a0a4a3)) |
| sxdEnd | 0xFF | **SXAddl\_SXCQuery\_SXDEnd** (section [2.4.273.63](#Section_120b91ae45344be8bf2a8d3cc7f34833)) |

2.2.5.1.1.1.8 SxcGrpLevel Class

The **SxcGrpLevel** class specifies information for an **OLAP group level** (section [2.2.5.3.10](#Section_1e04807706d14d4f961ecacb50a12a3d)).

The **SxcGrpLevel** class is specified by the sequence of records specified by the **SXADDLGRPLEVEL** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The **OLAP group level** the **SxcGrpLevel** class specifies information for is specified by the **stUnique** field of the **SXAddl\_SXCGrpLevel\_SXDId** record (section [2.4.273.41](#Section_af01cf328d8647c384536e73ba72a9ae)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCGRPLEVEL (0x07), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCGrpLevel\_SXDId** |
| sxdGrpLevelnfo | 0x06 | **SXAddl\_SXCGrpLevel\_SXDGrpLevelInfo** (section [2.4.273.40](#Section_5cd835b8d6dd464384660f90b7e801f8)) |
| sxdEnd | 0xFF | **SXAddl\_SXCGrpLevel\_SXDEnd** (section [2.4.273.39](#Section_8b3b1021f4ac4116abb8a86752f0f1a4)) |

2.2.5.1.1.1.9 SxcGroup Class

The **SxcGroup** class specifies information for an **OLAP grouping** (section [2.2.5.3.10](#Section_1e04807706d14d4f961ecacb50a12a3d)).

The **SxcGroup** class is specified by the sequence of records specified by the **SXADDLGROUP** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The **OLAP grouping** the **SxcGroup** class specifies information for is specified by the **stName** field of the **SXAddl\_SXCGroup\_SXDId** record (section [2.4.273.37](#Section_347f9d1820d4407cb61bbeefa6464c94)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCGROUP (0x08), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCGroup\_SXDId** |
| sxdGrpInfo | 0x07 | **SXAddl\_SXCGroup\_SXDGrpInfo** (section [2.4.273.36](#Section_8a29a91e723942699707d1c3ada10825)) |
| sxdMember | 0x08 | **SXAddl\_SXCGroup\_SXDMember** (section [2.4.273.38](#Section_e15240b22d9a45aa8698440f83c70821)) |
| sxdEnd | 0xFF | **SXAddl\_SXCGroup\_SXDEnd** (section [2.4.273.35](#Section_c8845e226cf84806a77a3fb0549b5fff)) |

2.2.5.1.1.1.10 SxcCacheItem Class

The **SxcCacheItem** class specifies additional information for a **cache item** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)).

The **SxcCacheItem** class is specified by the sequence of records specified by the **SXADDLCACHEITEM** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)).

The **cache item** that the **SxcCacheItem** class specifies information for is specified by the **dwItem** field of the **SXAddl\_SXCCacheItem\_SXDId** record (section [2.4.273.21](#Section_98df9861e79041788deab1e33e468d42)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCCACHEITEM (0x09), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCCacheItem\_SXDId** |
| sxdSxrmitmDisp | 0x2E | **SXAddl\_SXCCacheItem\_SXDSxrmitmDisp** (section [2.4.273.24](#Section_a395079f0c774506a17a079d6db1f910)) |
| sxdItmMpropMap | 0x32 | **SXAddl\_SXCCacheItem\_SXDItmMpropMap** (section [2.4.273.23](#Section_3b0d9180e64948a6ab1563e48acd8afe)) |
| sxdItmMpMapCount | 0x33 | **SxAddl\_SXCCacheItem\_SXDItmMpMapCount** (section [2.4.273.22](#Section_7d8e3a7982764592825792aae19861f8)) |
| sxdEnd | 0xFF | **SXAddl\_SXCCacheItem\_SXDEnd** (section [2.4.273.20](#Section_2b57bfc845aa46b2afe30eba4c54497a)) |

**SXAddl\_SXCCacheItem\_SXDEnd** is a part of the **SxcCacheField** class (section [2.2.5.1.1.1.5](#Section_102acda2fb58485d9a40a37d0a219103)) and is not a [**member (1)**](#gt_5d78ca78-a9b1-4791-8126-bf9494304b11) of the **SxcCacheItem** class. **SXAddl\_SXCCacheItem\_SXDEnd** specifies the end of a collection of **SxcCacheItem** classes.

2.2.5.1.1.1.11 SxcSXrule Class

The **SxcSXrule** class specifies a **PivotTable** rule (section [2.2.5.4.11](#Section_ce60432dda944422929fcf3f6a0a206f)).

The **SxcSXrule class** is specified by the sequence of records specified by the **SXADDLSXRULE** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCRULE (0x0C), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCSXrule\_SXDId** (section [2.4.273.98](#Section_ed2dd20d531445acaa2546a2069e97fa)) |
| sxdSxrule | 0x13 | **SXAddl\_SXCSXrule\_SXDSXrule** (section [2.4.273.99](#Section_4a44c5299646401e92b294601cef1455)) |
| sxdEnd | 0xFF | **SXAddl\_SXCSXrule\_SXDEnd** (section [2.4.273.97](#Section_4db556f78dcc4b149f0111b1dd6ea442)) |

2.2.5.1.1.1.12 SxcSXfilt Class

The **SxcSXfilt** class specifies information for a **PivotTable rule filter** (section [2.2.5.4.11](#Section_ce60432dda944422929fcf3f6a0a206f)).

The **SxcSXfilt** class is specified by the sequence of records specified by the **SXADDLSXFILT** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCSXFILT (0x0D), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCSXfilt\_SXDId** (section [2.4.273.76](#Section_07971f8c749546f48d93309b1fb05dbf)) |
| sxdSxfilt | 0x14 | **SXAddl\_SXCSXfilt\_SXDSXfilt** (section [2.4.273.77](#Section_c3dfcd7c1cbd4fea9140ab36ce97d1c6)) |
| sxdSxitm | 0x15 | **SXAddl\_SXCSXfilt\_SXDSXItm** (section [2.4.273.78](#Section_86aafb0ee3aa4864b5177ad3b372abc3)) |
| sxDEnd | 0xFF | **SXAddl\_SXCSXfilt\_SXDEnd** (section [2.4.273.75](#Section_912a41e2503a441c8593347818348045)) |

2.2.5.1.1.1.13 SxcSXDH Class

The **SxcSXDH** class specifies the [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) [**dimensions (1)**](#gt_70d18eb1-eb3c-48f8-b0cd-7140f206406c) for **pivot hierarchies** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) in the **associated PivotTable view** (section [2.2.5.3.3](#Section_855483943345473bb926de5189fd664d)) of the **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)). MUST NOT be present if the **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) is a non- **OLAP PivotCache**.

The **SxcSXDH** class is specified by the sequence of records specified by the **SXADDLSXDH** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCSXDH (0x10), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCSXDH\_SXDId** (section [2.4.273.73](#Section_4e8af2a8159144208d8bb595e4fe2836)) |
| sxdSxdh | 0x1A | **SXAddl\_SXCSXDH\_SXDSxdh** (section [2.4.273.74](#Section_9ae507e01e394d6fb8ae30864da3cc91)) |
| sxdEnd | 0xFF | **SXAddl\_SXCSXDH\_SXDEnd** (section [2.4.273.72](#Section_8a599af8114c4b6f873d4ab9ead60357)) |

2.2.5.1.1.1.14 SxcAutoSort Class

The **SxcAutoSort** class specifies **pivot field sorting** (section [2.2.5.4.3.1](#Section_6a008d4253834e13a1d06d8ee5d93b76)) information for a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)).

The **SxcAutoSort** class is specified by the sequence of records specified by the **SXADDLAUTOSORT** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCAUTOSORT (0x12), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCAutoSort\_SXDId** (section [2.4.273.4](#Section_fdf7cd46d880434d84191c1618005251)) |
| sxdEnd | 0xFF | **SXAddl\_SXCAutoSort\_SXDEnd** (section [2.4.273.3](#Section_207b19ebebad4dd199962e934d80b049)) |

2.2.5.1.1.1.15 SxcSXMgs Class

The **SxcSXMgs** class specifies [**OLAP measure groups**](#gt_a14d2b2b-03ca-40e2-a237-3d1a53f87261).

The **SxcSXMgs** class is specified by the sequence of records specified by the **SXADDLSXMGS** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCSXMGS (0x13), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCSXMgs\_SXDId** (section [2.4.273.95](#Section_3712162df02a442c886a78c6bbe65d95)) |
| sxdMgrpSxdhMap | 0x23 | **SXAddl\_SXCSXMgs\_SXDMGrpSXDHMap** (section [2.4.273.96](#Section_cea07034948b4520bd0a20f2498f0f50)) |
| sxdEnd | 0xFF | **SXAddl\_SXCSXMgs\_SXDEnd** (section [2.4.273.94](#Section_cdf59c7c7f77495b82167efc25f5b552)) |

2.2.5.1.1.1.16 SxcSXMg Class

The **SxcSXMg** class specifies information for an [**OLAP measure group**](#gt_a14d2b2b-03ca-40e2-a237-3d1a53f87261).

The **SxcSXMg** class is specified by the sequence of records specified by the **SXADDLSXMG** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)).

The OLAP measure group that the **SxcSXMg** class specifies information for is specified by the **stName** field of the **SXAddl\_SXCSXMg\_SXDId** record (section [2.4.273.92](#Section_48cb495cc5734b1dafb40bee8297103b)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCSXMG (0x14), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCSXMg\_SXDId** |
| sxdUserCaption | 0x1F | **SXAddl\_SXCSXMg\_SXDUserCaption** (section [2.4.273.93](#Section_bad319ae07e049b792757f98dc2d2e40)) |
| sxdEnd | 0xFF | **SXAddl\_SXCSXMg\_SXDEnd** (section [2.4.273.91](#Section_58731650e6424292abfe8654922c5f3c)) |

2.2.5.1.1.1.17 SxcField12 Class

The **SxcField12** class specifies additional information for a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)).

The **SxcField12** class is specified by the sequence of records specified by the **SXADDLFIELD12** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

The **pivot field** that the **SxcField12** class specifies information for is specified by **stName** field of the **SXAddl\_SXCField12\_SXDId** record (section [2.4.273.30](#Section_7bd7c0878533430eb4b8006baba84c01)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCFIELD12 (0x17), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCField12\_SXDId** |
| sxdVerUpdInv | 0x01 | **SXAddl\_SXCField12\_SXDVerUpdInv** (section [2.4.273.34](#Section_e2636920f93c48a38ca15b5b75b660ee)) |
| sxdMemberCaption | 0x11 | **SXAddl\_SXCField12\_SXDMemberCaption** (section [2.4.273.32](#Section_549a05915771454699749271cfd387b3)) |
| sxdVer12Info | 0x19 | **SXAddl\_SXCField12\_SXDVer12Info** (section [2.4.273.33](#Section_f7f523c98b2d4eea993b80f272c83a30)) |
| sxdIsxth | 0x1C | **SXAddl\_SXCField12\_SXDISXTH** (section [2.4.273.31](#Section_71bd6907aeab49b0ae61e49b0771bb51)) |
| sxdAutoshow | 0x37 | **SXAddl\_SXCField12\_SXDAutoshow** (section [2.4.273.28](#Section_7ce0424010cf4d009c2339250178183a)) |
| sxdEnd | 0xFF | **SXAddl\_SXCField12\_SXDEnd** (section [2.4.273.29](#Section_ea10673aaedd4b76a5e81147f2c01c6f)) |

2.2.5.1.1.1.18 SxcSXCondFmts Class

The **SxcSXCondFmts** class specifies information for **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) [**conditional formatting**](#gt_5a8a1e18-9f8c-48c6-9ad0-7975ade8d516) rules.

The **SxcSXCondFmts** class is specified by the sequence of records specified by the **SXADDLCONDFMTS** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCSXCONDFMTS (0x1A), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCSXCondFmts\_SXDId** (section [2.4.273.71](#Section_12bb9268279042f68f7884885ffeb86e)) |
| sxdEnd | 0xFF | **SXAddl\_SXCSXCondFmts\_SXDEnd** (section [2.4.273.70](#Section_683a7e047e9d4c269fbabb41140e8fe6)) |

2.2.5.1.1.1.19 SxcSXCondFmt Class

The **SxcSXCondFmt** class specifies information for a **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) [**conditional formatting**](#gt_5a8a1e18-9f8c-48c6-9ad0-7975ade8d516) rule.

The **SxcSXCondFmt** class is specified by the sequence of records specified by the **SXADDLCONDFMT** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCSXCONDFMT (0x1B), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdSxcondfmt | 0x35 | **SXAddl\_SXCSXCondFmt\_SXDSXCondFmt** (section [2.4.273.69](#Section_80ff6be32d15488bbb335b5ab529fb50)) |
| sxdEnd | 0xFF | **SXAddl\_SXCSXCondFmt\_SXDEnd** (section [2.4.273.68](#Section_e9b99640a51e4d0ca671e519458d2fab)) |

2.2.5.1.1.1.20 SxcSXFilters12 Class

The **SxcSXFilters12** class specifies **advanced filters** (section [2.2.5.4.8.1](#Section_d490d0634e074f0093389812040ebdff)).

The **SxcSXFilters12** class is specified by the sequence of records specified by the **SXADDLSXFILTERS12** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCSXFILTERS12 (0x1C), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCSXFilters12\_SXDId** (section [2.4.273.90](#Section_e0c0f6126586416f940a45beb1def18a)) |
| sxdEnd | 0xFF | **SXAddl\_SXCSXFilters12\_SXDEnd** (section [2.4.273.89](#Section_33a332d8401e493a94ca8a53b5a7850f)) |

2.2.5.1.1.1.21 SxcSXFilter12 Class

The **SxcSXFilter12** class specifies an **advanced filters** (section [2.2.5.4.8.1](#Section_d490d0634e074f0093389812040ebdff)).

The **SxcSXFilter12** class is specified by the sequence of records specified by the **SXADDLSXFILTER12** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

If the **hdr.sxc** field of an **SXAddl** record (section [2.4.273.2](#Section_54370a1209c34832a72c37d317bf069e)) equals SXCSXFILTER12 (0x1D), then the **hdr.sxd** field of the **SXAddl** record MUST be a value from the following table which specifies the full record type:

| Name | Value | Full record type |
| --- | --- | --- |
| sxdId | 0x00 | **SXAddl\_SXCSXFilter12\_SXDId** (section [2.4.273.81](#Section_66e9171ec67541a1920bb181cfce772d)) |
| sxdCaption | 0x2F | **SXAddl\_SXCSXFilter12\_SXDCaption** (section [2.4.273.79](#Section_4a5f2ee8f5f7449494e5a3a2560eb1d3)) |
| sxdSxfilter | 0x38 | **SXAddl\_SXCSXFilter12\_SXDSXFilter** (section [2.4.273.82](#Section_ef6b03f6ed464a42a2605f8f3369ba26)) |
| sxdSxfilterDesc | 0x39 | **SXAddl\_SXCSXFilter12\_SXDSXFilterDesc** (section [2.4.273.83](#Section_ca7c181ead0d413482c354c96d04e9f9)) |
| sxdSxfilterValue1 | 0x3A | **SXAddl\_SXCSXFilter12\_SXDSXFilterValue1** (section [2.4.273.84](#Section_be6cc64a607841adbd2e37ae14c9ee4f)) |
| sxdSxfilterValue2 | 0x3B | **SXAddl\_SXCSXFilter12\_SXDSXFilterValue2** (section [2.4.273.85](#Section_81ac6d1aa1de49eda3212b81ad1faa47)) |
| sxdXlsFilter | 0x3C | **SXAddl\_SXCSXFilter12\_SXDXlsFilter** (section [2.4.273.86](#Section_cd93d0c8bd1c4202b8cae98f16ab0c41)) |
| sxdXlsfilterValue1 | 0x3D | **SXAddl\_SXCSXFilter12\_SXDSXFilterValue1** (section [2.4.273.87](#Section_62bd1ee0e0144b8bb74cfe026660a144)) |
| sxdXlsfilterValue2 | 0x3E | **SXAddl\_SXCSXFilter12\_SXDXlsFilterValue2** (section [2.4.273.88](#Section_fcdb22068f4045479ff52a079b7507f4)) |
| sxdEnd | 0xFF | **SXAddl\_SXCSXFilter12\_SXDEnd** (section [2.4.273.80](#Section_d5364d1d0d7d4151b6d25123e9be05c3)) |

#### 2.2.5.2 Data Functionality Level

A **data functionality level** is a number that represents a set of features and run-time behaviors in the following areas related to data manipulation and display: **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)), [**query table**](#gt_ceb1ea2c-7b55-4a25-a7f0-79b1c1011289), and **external connections** (section [2.2.8](#Section_69df8d03b6fd45cda0a09b026e50a3d9)).

See section [2.2.5.3.1](#Section_e0fe44b1caf64739bf8fe51a96cd5ba8) for specific details about the **data functionality level** of a **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)).

#### 2.2.5.3 PivotCache

The **PivotCache** is a set of structures that contains information about the **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)) being summarized in the **PivotTable views** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) using that **PivotCache**. The information includes **source data** organization, data types, and the values. A PivotCache is specified by the records conforming to the following rules:

| Rule | Notes |
| --- | --- |
| **PIVOTCACHE** (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687)) | This is in a stream as specified in section 2.1.7.12. |
| **PIVOTCACHEDEFINITION** (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)) | The **SXStreamID** record (section [2.4.303](#Section_a4dc3f5438904e35aad080a16b4b4cff)) specifies the associated stream in section 2.1.7.12. |
| **PIVOTFRT9** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) | If an **associated PivotTable view** (section [2.2.5.3.3](#Section_855483943345473bb926de5189fd664d)) is specified by the **QsiSXTag** record (section [2.4.211](#Section_3bb6727096504455944daa8e21dbb19f)), then **PivotCache** properties specified in this rule apply to this **PivotCache**. |

##### 2.2.5.3.1 PivotCache Functionality Level

The **PivotCache functionality level** is the **data functionality level** (section [2.2.5.2](#Section_2bcedd76ef064e6084c718ea55042ed6)) associated with a **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)). The **PivotCache functionality level** is used in specification of restrictions for the **PivotCache** and **associated PivotTable views** (section [2.2.5.3.3](#Section_855483943345473bb926de5189fd664d)). It is specified as follows:

 If an **SXAddl\_SXCCache\_SXDVerSXMacro** record (section [2.4.273.10](#Section_fea88f2f921c4e8daae6a7f51b694287)) exists, then the value of the **dwVer** field of the **SXAddl\_SXCCache\_SXDVerSXMacro** specifies the **PivotCache functionality level**.

 If an **SXAddl\_SXCCache\_SXDVerSXMacro** record does not exist and an **SXAddl\_SXCView\_SXDVer10Info** record (section [2.4.273.108](#Section_852f0dea13e84b8bae42ae9b09e76c5e)) exists for an **associated PivotTable views**, then the value of the **bVerSxMacro** field of the **SXAddl\_SXCView\_SXDVer10Info** record specifies the **PivotCache functionality level**, except if that value is greater than or equal to 3, in which case the **PivotCache functionality level** is specified to be 1.

 If an **SXAddl\_SXCCache\_SXDVerSXMacro** record does not exist and an **SXAddl\_SXCView\_SXDVer10Info** record does not exist for an **associated PivotTable views**, then the **PivotCache functionality level** is specified to be 0.

##### 2.2.5.3.2 Source Data

A **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) can be based on four different types of **source data**. The type of **source data** is specified by the **sxvs** field of the **SXVS** record (section [2.4.317](#Section_386ddcb0d3f94370b60c2f05b2d371c7)).

When the **source data** type is SHEET as specified by **SXVS**, the data is read from the [**range**](#gt_c2c93fec-8d3e-45de-8010-c738cc1cea99) specified by a **DConRef** (section [2.4.86](#Section_589885b2fd4e4fcc9c8e37fbf7838716)), **DConName** (section [2.4.85](#Section_26ceabe5f33a442f9a0fa3def1c47948)), or **DConBin** (section [2.4.83](#Section_d83824fcad44477cbe327da0e694ffcb)) record. If the range is a [**table**](#gt_d3a7da8d-a597-4838-9756-25e30b640ba7), then the **PivotCache** will have one **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) for each column of the table using the column header captions for **cache field** names, and the [**data region**](#gt_6abb146e-d02e-45aa-a034-b25b23b0dd48) values of the table are used as **source data** values, specified by **cache records** (section [2.2.5.3.12](#Section_fe6e4ca0a9b646a4898124e4b61a770a)). Otherwise the **PivotCache** has one **cache field** for each column of the range, using the values in the first row of the range for **cache field** names, and all other rows are used as **source data** values, specified by **cache records**.

When the **source data** type is SCENARIO as specified by **SXVS**, no new **source data** is available for the **PivotCache** and the **PivotCache** cannot be refreshed. A snapshot of the **source data** might be available in the **cache records**.

When the **source data** type is EXTERNAL, as specified by **SXVS**, the **source data** is read from an external [**data source**](#gt_e091613c-6901-4874-b9b2-27273ead1075). There is an associated **external connection** (section [2.2.8](#Section_69df8d03b6fd45cda0a09b026e50a3d9)) that is used to obtain data from the external data source. The **external connection** is specified by the sequence of records that conforms to the **DQBUERY** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)) in the sequence of records that conforms to the **PIVOTCACHEDEFINITION** rule (section 2.1.7.20.3) and the combination of other records as specified in section 2.2.8. For a non-**OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)), the **source data** is a rectangular table and the **PivotCache** (section 2.2.5.3) has one **cache field** for each column of the table using the column header captions for **cache field** names, and the rows of the table are used as **source data** values, specified by **cache records**.

If the source data is external and the external connection is an **OLAP Connection** (section [2.2.8.3.1](#Section_068796f9e5154dab8e69f9a7b52aaa9a)) then the **PivotCache** MUST be an **OLAP PivotCache**. For an **OLAP PivotCache**, the **source data** is handled by the data provider specified by the associated **OLAP Connection** and the **PivotCache** MUST NOT have **cache records**.

When the **source data** type is CONSOLIDATION as specified by **SXVS**, the **source data** is read from one or more ranges. For more details, see the section [2.2.5.3.2.1](#Section_2535c296b76b4728b52c72fbabaf3047).

When a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) is on the **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)) of the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)), the **pivot field** is a server-based page field if the **fServerBased** field of the **SXVDEx** record (section [2.4.310](#Section_07ecd5c3e40e44ffbf1a0a473659a5cf)) is equal to 1 and the **fServerBased** field of the associated **SXFDB** record (section [2.4.283](#Section_e410a60fad0340c7a4fc9e9932339abe)) is equal to 1. A server-based page field is a **pivot field** on the **page axis** that causes the query that is used to retrieve **source data** for populating the **PivotCache** to be parameterized. The query is parameterized according to the page filter criteria, as specified in section 2.2.5.4.9.1. This feature can only be used for an [**ODBC**](#gt_7883fa02-8dc0-4154-894f-fe3a7bff153e) **PivotCache**.

###### 2.2.5.3.2.1 Multiple Consolidation Ranges

A **multiple** consolidation ranges **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) is used for summarizing multiple [**ranges**](#gt_c2c93fec-8d3e-45de-8010-c738cc1cea99) that contain [**source data**](#gt_ac56a86c-7f2f-4d8b-a4c0-d6c7df3e72e0) in cross-tab format. A **multiple consolidation ranges** **PivotCache** is a collection of ranges and page information that is specified by the sequence of records that conforms to the **SXTBL** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)). Each range is specified by one of the **DConName** (section [2.4.85](#Section_26ceabe5f33a442f9a0fa3def1c47948)), **DConBin** (section [2.4.83](#Section_d83824fcad44477cbe327da0e694ffcb)), or **DConRef** (section [2.4.86](#Section_589885b2fd4e4fcc9c8e37fbf7838716)) records.

The following figure shows an example of a range in cross-tab format. The first column of the range contains names of sales people ("George" and "Allan"). The first row in the range contains product groups ("Cars" and "Bikes"). The remaining [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) in the range contain numeric values representing how many products in a certain product group were sold by each sales person.

Example of a range in cross-tab format

Figure 3: Example of a range in cross-tab format

A **multiple** consolidation ranges **PivotCache** is used to summarize multiple cross-tab ranges as shown in the following figure, which shows eight cross-tab ranges.

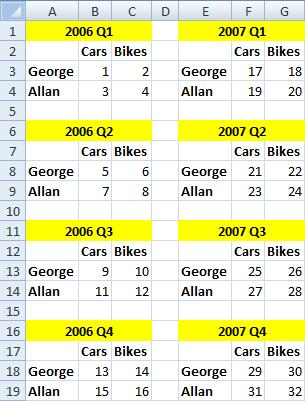


Figure 4: Example of eight ranges in cross-tab format

The values in the first column of each range are used to create a **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) with a default name specified by the application. Each **cache item** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)) of this **cache field** corresponds to one of the values in the first column of the range, eliminating duplicates. This **cache field** is the first **cache field** in the collection of sequences of records that conform to the **FDB** rule (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687)) in the sequence of records that conforms to the **PIVOTCACHE** rule.

The values in the first row of each range are used to create a **cache field** with a default name specified by the application. Each **cache item** of this **cache field** corresponds to one of the values in the first row of the range, eliminating duplicates. This **cache field** is the second **cache field** in the collection of **FDB** rules (section 2.1.7.12) in the **PIVOTCACHE** rule (section 2.1.7.12).

The values in all other cells of each range are used to create a **cache field** with a default name specified by the application. Each **cache item** of this **cache field** corresponds to one of the values in the other cells of the range, eliminating duplicates. This **cache field** is the third **cache field** in the collection of **FDB** rules in **PIVOTCACHE** rule.

A **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) associated with the **multiple** consolidation ranges **PivotCache** is added on creation. The **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) corresponding to the **cache fields** described previously are added to the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)), **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)), and **data axis** (section [2.2.5.4.9.5](#Section_4c5c2daa289746e1854b0ce04209f060)), respectively.

Up to four additional **cache fields** can optionally exist with default names specified by the application. The corresponding **pivot fields** are added to the **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)) of the **PivotTable view** on creation, enabling the user to summarize data from all or a subset of the ranges. The ranges to be summarized in the **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) are selected by adding a **manual filter** (section [2.2.5.4.7](#Section_b0b282651e334c86ad030f5693c1d1e4)) to one or more of these **pivot fields** on the **page axis**. The number of optional **cache fields** created is user-defined and is equal to the **cPages** field of the **SXTbl** record (section [2.4.305](#Section_39b109da8f3a498fbc2eb75e3d3c2cfc)). Each optional **cache field** corresponds to an **SXTBRGIITM** record.

The first **SXTBRGIITM** record (section [2.4.307](#Section_76b060579d98424c9b3b5e48ccaf0c03)) in the **SXTBL** collection (section 2.1.7.20.3) corresponds to the fourth **cache field** in the collection of **FDB** rules. Each **cache item** of this **cache field** corresponds to the **SXString** record (section [2.4.304](#Section_0b135d8b213f4d54970bd7a934a79f36)) in the collection of **SXString** records directly following this **SXTBRGIITM** record.

The second **SXTBRGIITM** record in the **SXTBL** collection corresponds to the fifth **cache field** in the collection of **FDB** rules. Each **cache item** of this **cache field** corresponds to the **SXString** record in the collection of **SXString** records directly following this **SXTBRGIITM** record.

The third **SXTBRGIITM** record in the **SXTBL** collection corresponds to the sixth **cache field** in the collection of **FDB** rules. Each **cache item** of this **cache field** corresponds to the **SXString** record in the collection of **SXString** records directly following this **SXTBRGIITM** record.

The fourth **SXTBRGIITM** record in the **SXTBL** collection corresponds to the seventh **cache field** in the collection of **FDB** rules. Each **cache item** of this **cache field** corresponds to the **SXString** record in the collection of **SXString** records directly following this **SXTBRGIITM** record.

The following figure shows a multiple consolidation ranges **PivotTable** report (section 2.2.5) with two **pivot fields** on the **page axis**. The **PivotTable** report is based on the eight ranges in the figure titled **Example of eight ranges in cross-tab format** and summarizes the values from all the ranges because no **manual filter** (section 2.2.5.4.7) has been applied to any of the **pivot fields** on the **page axis**.

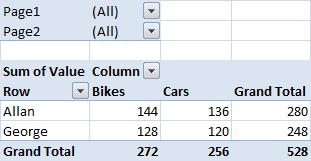


Figure 5: Multiple consolidation ranges PivotTable

The **rgiitem** field of the **SxTbpg** record (section [2.4.306](#Section_260ed10632ea4ffdb6fc6666208d6631)) specifies the relationship between each range and the **SXString** records that follow each **SXTBRGIITM** record.

##### 2.2.5.3.3 Associated PivotTable views

The set of **PivotTable views** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) that share an **associated PivotCache** (section [2.2.5.4.1](#Section_6f60301b107346d3b7ad0041566272a4)) are specified to be the **associated PivotTable views** of that **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)).

A **PivotCache** MUST have at least one associated PivotTable view, and an **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)) MUST have exactly one **associated PivotTable view**.

##### 2.2.5.3.4 OLAP PivotCache

A **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) is specified to be an [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) PivotCache if it has an **associated PivotTable view** (section [2.2.5.3.3](#Section_855483943345473bb926de5189fd664d)) that is an **OLAP PivotTable view** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)).

An OLAP PivotCache MUST have exactly one **associated PivotTable view**.

###### 2.2.5.3.4.1 OLAP Data Model

This section provides background information about the underlying data model for [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) entities.

The principal unit of scope is an [**OLAP cube**](#gt_11427e13-37ed-49dd-8f0d-5f2b21f7aa4c). See section [2.2.8](#Section_69df8d03b6fd45cda0a09b026e50a3d9) for information about how an OLAP cube is accessed. Items within an OLAP cube can be addressed by an [**MDX unique name**](#gt_d5d555be-1be8-4d7b-b16e-0b04bc337b3b) string. Within an OLAP cube, there are [**OLAP hierarchies**](#gt_1e0ca171-3095-4e3c-9c69-65148df00a9c), [**OLAP measures**](#gt_7431c051-4564-4476-ad00-39c66f169118) and [**OLAP sets**](#gt_bae9ed13-bcae-417e-a59c-d07f85116049).

An OLAP hierarchy consists of one or more [**OLAP levels**](#gt_00e48261-dfd3-4f32-b53f-91e2344d6168) and [**OLAP member properties**](#gt_b39deb4c-b405-40a9-90ed-1ba07e39ed9f). An OLAP level consists of one or more [**OLAP members**](#gt_c0dd6cb4-ad4b-45ef-bd4f-75c650f84f32). An OLAP member is an atomic unit of data, for example customer "Jim Smith", or a grouping of data, for example "customers in the city of Chicago". OLAP levels contain OLAP members of similar type within an OLAP hierarchy. OLAP members can have parent and child members in OLAP levels above and below them, for example "Jim Smith" might be a child of "customers in the city of Chicago". An OLAP member property can be associated with a single OLAP level or all OLAP levels of an OLAP hierarchy, for example a "Mayor" OLAP member property might be associated with a "City" OLAP level.

An [**OLAP tuple**](#gt_3a1a687f-d28b-485b-96a0-ba0b7eb4119e) is a way of combining multiple OLAP members to reference a particular point in an OLAP cube, for example "customers in the city of Chicago" and "2008" references data in the OLAP cube corresponding to the year 2008 and customers in Chicago.

An OLAP measure is a value that is available in the OLAP cube. Usually it is numeric, "Sales" and "Head Count" are typical examples of OLAP measures. An OLAP measure is an OLAP member in a measures OLAP hierarchy. For a **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)), OLAP measures are stored differently from other OLAP members in this file format.

An OLAP tuple including an OLAP measure can be used to get a value, for example "customers in the city of Chicago", "2008" and "sales" might reference the value $659,000.

An [**OLAP named set**](#gt_8997311d-6027-4c9f-b739-9a2a00594f28) is a collection of OLAP tuples. OLAP named sets are typically used for specific analytical needs that require custom logic, for example an OLAP named set might be defined as the OLAP tuples corresponding to "the top 10 customers by month and sales".

##### 2.2.5.3.5 Cache Fields

A **cache field** represents an entity by which data can be summarized.

Consider a **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) based on the following **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)):

| Country | Product | Date | Sales |
| --- | --- | --- | --- |
| USA | Bicycle | 6/5/2007 | 500 |
| USA | Car | 8/3/2007 | 20000 |
| Canada | Bicycle | 9/2/2007 | 300 |
| Canada | Car | 10/5/2007 | 35000 |

In this example, four **cache fields** exist in the **PivotCache**. Each **cache field** corresponds to one of the columns in the **source data**: Country, Product, Date, and Sales.

The sequence of records that conforms to the **FDB** rule (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687)), and optionally the **SXADDLCACHEFIELD** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)), specify a **cache field**. A **cache field** is contained in a **PivotCache**.

A cache field index is a zero-based index of an **FDB** rule in the **PIVOTCACHE** rule (section 2.1.7.12).

A **cache** field typically corresponds to a **source data entity**. However, **grouping** (section [2.2.5.3.7](#Section_63e07ed20a764cb08cf446aaf25464c2)) **cache fields** and **cache fields** representing **calculated fields** (section [2.2.5.3.8](#Section_4594f2ac815740b381142e77ba8efb7d)) do not correspond to **source data entities** (section 2.2.5.3.2). Such **cache fields** are fully specified by information in the **PivotCache**.

The cfdbdb field of the **SXDB** record (section [2.4.275](#Section_f0e04937a8cf4a1c891bea1fa4b85fdc)) specifies the number of **cache fields** that correspond to **source data entities**. If the cache field index of an **SXFDB** record (section [2.4.283](#Section_e410a60fad0340c7a4fc9e9932339abe)) is less than cfdbdb, the cache field corresponds to a **source data entity**. Otherwise, the cache field does not correspond to a **source data entity**. A non- **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)) MUST have one or more **cache fields** corresponding to **source data columns**. An **OLAP PivotCache** MUST NOT have **cache fields** that do not correspond to **source data entities**.

In a non- **OLAP PivotCache**, a cache field typically corresponds to one column in the **source data** and contains information about that column. The **cache** field name is specified by the **stFieldName** field of the **SXFDB** record. The **cache** field name of a cache field corresponding to a **source data column** is derived from the name of that column in the **source data** and is used to associate the **cache** field with that **source data column**.

All **cache field** names MUST be unique, when using a case-insensitive comparison, within the associated **PivotCache**.

In an **OLAP PivotCache** each **cache field** can be associated with a **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)). For more information, see section [2.2.5.4.5.1](#Section_01a66b9be4a24396b55c28d6207fd28f).

##### 2.2.5.3.6 Cache Items

**Cache items** represent specific instances of the entities represented by **cache fields** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)). For example, an instance of a Country **cache field** might be the USA **cache item**. Having a USA **cache item** in the Country **cache field** enables **PivotTable views** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) associated with the **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) to display data by USA.

Each cache item specifies its value and a type. In some cases, a **cache item** can have additional information associated with it.

A **cache item** is contained in a **cache field**. A **cache field** can have zero **cache items** if the **cache field** is not in use in the **PivotTable view**.

For a **cache field** that corresponds to **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)), a collection of cache items is specified by a collection of sequences of records that conform to the **SRCSXOPER** rule (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687)), with each cache item being specified by a sequence of records that conforms to the **SXOPER** rule (section 2.1.7.12), which optionally has a sequence of records that conforms to the **SXADDLCACHEITEM** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)) associated with it. The sequence of records that conforms to the **SXOPER** rule specifies the value of the cache item.

For **grouping** (section [2.2.5.3.7](#Section_63e07ed20a764cb08cf446aaf25464c2)) **cache fields**, the collection of cache items is specified by a collection of sequences of records that conform to the **GRPSXOPER** rule (section 2.1.7.12) with each cache item being specified by an **SXOPER** rule.

**Calculated fields** (section [2.2.5.3.8](#Section_4594f2ac815740b381142e77ba8efb7d)) do not contain **cache items**.

A **cache item** index can be used to reference a **cache item** within the **cache field**. Referencing a **cache** item by index requires an implicit or explicit reference to that **cache field** because a **cache item** collection is associated with a specific **cache field**. A **cache field** can be referenced by a **cache field** index, as specified in section 2.2.5.3.5.

If a collection of **GRPSXOPER** rules exists in the cache field, a **cache item** index is a zero-based index into the collection of **GRPSXOPER** rules. Otherwise, a **cache item** index is a zero-based index into the collection of **SRCSXOPER** rules.

There can be multiple entries of **source data** that have the same combination of value and type for a **cache field**. Each **cache item** within a **cache field** MUST have a unique combination of value and type.

If there is one or more references by index to **cache** items of a particular **cache field**, that **cache field** MUST have a **cache items** collection. A **grouping** **cache field** MUST have a collection of **cache items** associated with it.

A **cache** item collection can contain unused **cache items**.

Unused **cache items** are values that did not exist in the **source data** when the **PivotCache** was last refreshed but existed when the **PivotCache** was refreshed previously. The **PivotCache** can retain such unused **cache items** to preserve information associated with them to reapply that information if the value corresponding to the **cache item** is added back to the **source data** at some later point in time.

For an **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)), a **cache field** associated with an [**OLAP measure**](#gt_7431c051-4564-4476-ad00-39c66f169118) MUST NOT have a **cache** item collection.

For an **OLAP PivotCache**, a **cache item** with a string value specifies the unique name of an [**OLAP member**](#gt_c0dd6cb4-ad4b-45ef-bd4f-75c650f84f32), unless the **cache field** is a **member property** (section [2.2.5.4.6](#Section_e5db3a66677f43db8fb038584797c95f)) **cache field**.

An example of **cache items** and their association with **source data** is provided here.

Consider a **PivotCache** based on the following **source data** table:

| Country | Product | Date | Sales |
| --- | --- | --- | --- |
| USA | Bicycle | 6/5/2007 | 500 |
| USA | Car | 8/3/2007 | 20000 |
| Canada | Bicycle | 9/2/2007 | 500 |
| Canada | Car | 10/5/2007 | 35000 |

Four **cache fields** exist, each corresponding to one of the columns: Country, Product, Date, and Sales. Each of the four **cache fields** can have **cache items** corresponding to the unique values in the **source data columns** as illustrated in the following tables:

| Cache items for the Country cache field |
| --- |
| Canada |
| USA |

| Cache items for the Product cache field |
| --- |
| Bicycle |
| Car |

| Cache items for the Date cache field |
| --- |
| 6/5/2007 |
| 8/3/2007 |
| 9/2/2007 |
| 10/5/2007 |

| Cache items for the Sales cache field |
| --- |
| 500 |
| 20000 |
| 500 |
| 35000 |

##### 2.2.5.3.7 Grouping

**Grouping** is used to combine a set of **cache items** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)), typically ones that are related in some logical way. There are three different types of **grouping**: numeric grouping, date grouping, and discrete grouping. Numeric grouping combines numeric **cache items** into ranges of values. Date grouping combines date **cache items** into date ranges. Discrete grouping combines specifically selected **cache items** into groups.

The **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) that contains the **cache items** that are to be grouped is called the base **cache field**. The resultant **cache field** that contains the groups of **cache items** is called the parent grouping **cache field**. Each group of **cache items** in the base **cache field** is associated with a single **cache item** in the parent grouping **cache field**. Often **cache items** in parent grouping **cache fields** can be further grouped, creating a hierarchy of parent grouping **cache fields**. The base **cache field** is at the lowest level of the hierarchy.

Numeric grouping is specified by records in the **PivotCache Storage part** (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687)) that conform to the **GRPSXOPER** (section 2.1.7.12) and **SXRANGE** (section 2.1.7.12) rules.

For numeric grouping, there is only one **cache field** associated with the grouping and it serves as both the parent grouping **cache field** and the base **cache field**. The numeric grouping is specified by the **fRangeGroup** and **fNumField** fields of the **SXFDB** record (section [2.4.283](#Section_e410a60fad0340c7a4fc9e9932339abe)) associated with the **cache field** being equal to 1. The **fHasParent** field of the **SXFDB** record MUST be 0.

The **cache items** that specify the groups are specified by **SXString** records (section [2.4.304](#Section_0b135d8b213f4d54970bd7a934a79f36)) that follow the **SXFDB** record. The grouping criteria is specified by the **SxRng** record (section [2.4.300](#Section_6f43f7d653fb4e2fa35a07b7dc56fa8f)) that follows the **SXFDB** record. The **iByType** field of the **SxRng** record MUST be 0. For more details, see section 2.4.300.

Date grouping is specified by records in the **PivotCache Storage part** that conform to the **GRPSXOPER** and **SXRANGE** rules.

For date grouping, there can be up to seven levels of grouping hierarchy. The grouping level for a **cache field** is specified by the **iByType** field of the **SxRng** record that follows the **SXFDB** record which specifies that **cache field**. The **cache field** with the lowest **iByType** value has the finest level of detail, the **cache field** with the next lowest **iByType** value has the next finest level of detail, and so on. Each **cache field** in the hierarchy MUST have an **SxRng** record with a unique **iByType** value.

The **cache field** corresponding to the finest level of detail of date information included serves as both a parent grouping **cache field** and the base **cache field**. Other parent grouping **cache fields** specify additional levels in the hierarchy. The date grouping is specified by the **fRangeGroup** and **fNumField** fields of the **SXFDB** record associated with the **cache field** being equal to 1 and 0 respectively for all **cache fields** in the grouping. The **ifdbBase** field of each **SXFDB** record associated with the date grouping, except for the **SXFDB** record corresponding to the base **cache field**, MUST specify a **cache field** index to the **SXFDB** record corresponding to the lowest level of the hierarchy.

The **cache items** that specify the groups are specified by **SXString** record that follow the **SXFDB** record for the parent grouping **cache fields**. The grouping criteria is specified by the **SxRng** record that follows the **SXFDB** record. The **iByType** field of the **SxRng** record MUST be greater than or equal to 1 (Seconds) and less than or equal to 7 (Years). For more details, see section 2.4.300.

Discrete grouping is specified by the **GRPSXOPER** rule, the **SxIsxoper** record (section [2.4.290](#Section_1847f42114de45f19663010ed231894b)), and the **Continue** records (section [2.4.58](#Section_999fae21d3d942e88290639782460c67)) in the **PivotCache Storage part**.

For discrete grouping, a hierarchy of parent grouping **cache fields** can exist, where each parent grouping **cache field** combines the **cache items** of the **cache field** at the next lower level. The discrete grouping is specified by the **fRangeGroup** field of the **SXFDB** record associated with the **cache field** being equal to 0 and the **csxoper** field of the **SXFDB** record being greater than 0. The **ifdbBase** field of the **SXFDB** record specifies a **cache field** index to the base **cache field** at the lowest level of the grouping hierarchy. The **ifdbParent** field of the **SXFDB** record specifies a **cache field** index to the parent grouping **cache field** at the next higher level of the hierarchy. If there is no higher level, then the **fHasParent** field of the **SXFDB** record MUST be 0 and **ifdbParent** MUST be ignored.

The **cache items** that specify the groups are specified by records that conform to the **GRPSXOPER** rule following the **SXFDB** record. The mapping between the **cache items** in the lower level **cache field** and the **cache items** in the parent grouping **cache field** is specified by the **SxIsxoper** record following the **SXFDB** record for the parent grouping **cache field**. The **rgSxIsxoper** field in the **SxIsxoper** record contains an array element for each **cache item** in the lower level **cache field**. The value of the array element is the index of the **cache item** in the parent grouping **cache field** that the **cache item** in the lower level **cache field** is grouped by. For more details, see section 2.4.290.

The following paragraphs explain the three different types of grouping and provide examples of them.

Numeric grouping combines numeric **cache items** into ranges of values. For example, consider the following PivotTable report where the number of people, represented by "Count of Name", of a certain age are listed.

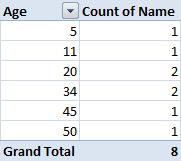


Figure 6: PivotTable report with ages

Analysis of specific ages might not be particularly meaningful. Instead, looking at age groups can be more interesting. The following **PivotTable** report (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) illustrates numeric grouping applied to the "Age" **cache field**. In this example, the numeric grouping is set to start at 0, end at 100, and have groups of 20 years.

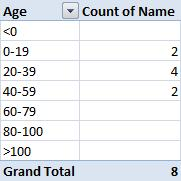


Figure 7: PivotTable report with age groups

Date grouping is similar to numeric grouping and is used to group **cache items** into date ranges.

One to seven parent grouping **cache fields** can exist when date grouping is applied to a **cache field**, each corresponding to a different level of detail of date and time information. The **cache field**, to which the date grouping is originally applied, is included in the set of parent grouping **cache fields** and is considered the base **cache field** of the parent grouping **cache fields**. For date grouping, the base **cache field** represents the finest level of detail of date and time information. The following levels of detail of date information are available, each corresponding to one **cache field**:

 Seconds

 Minutes

 Hours

 Days

 Months

 Quarters

 Years

For example, consider the following **PivotTable** report where the number of sales is listed for each individual date.



Figure 8: PivotTable report with dates

This information can be too detailed for some analytical purposes. With date grouping, a more useful higher level summary can be created. The following PivotTable report illustrates the result of applying date grouping to the "Date" **cache field** and including two levels of grouping ("Years" and "Quarters"). In this example, the "Quarters" **cache field** represents the finest level of date information included and is therefore the base **cache field** for this date grouping. The "Years" **cache field** is a parent grouping **cache field** with the "Quarters" **cache field** as its base **cache field**. The items "<1/1/2007" in the two **cache fields** represent dates before 1/1/2007, where the start date is specified by the first **SXNum** record (section [2.4.296](#Section_e16fd21368b54566886499600b002f4d)) following the **SxRng** record. The items ">12/13/2008" in the two **cache fields** represent dates after 12/13/2008, where the end date is specified by the second **SXNum** record following the **SxRng** record.

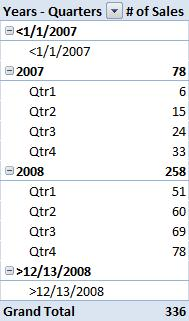


Figure 9: PivotTable report with date groups

Discrete grouping combines specifically selected **cache items** into groups. When discrete grouping is applied to a **cache field**, a separate parent grouping **cache field** is created and the **cache field** that the grouping is applied to will become the base **cache field** for that parent grouping **cache field**. Multiple parent grouping **cache fields** can exist for one base **cache field**, forming a hierarchy of parent grouping **cache fields**. A parent grouping **cache field** higher in the hierarchy is considered the parent of the **cache field** just below it in the hierarchy. For a parent grouping **cache field**, each **cache item** in the **cache items** collection represents one group.

For example, consider the following **PivotTable** report listing sales by state in the Unites States.



Figure 10: PivotTable report with state names

Discrete grouping can be used to group sets of states, for example, into geographical areas. The following PivotTable report illustrates the result of applying six groups ("Group1" through "Group6") to the **cache field** representing states. The **cache field** representing states is considered the base **cache field** for the discrete grouping in this example. Each group in the example, represented by a **cache item** in the parent grouping **cache field**, combines states in the same geographical area.

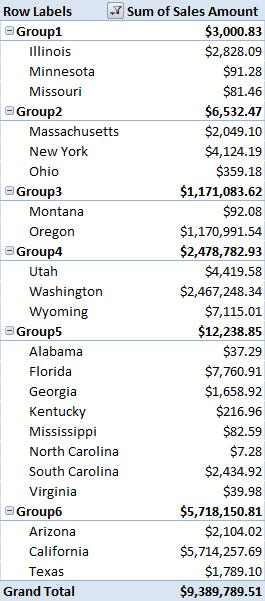


Figure 11: PivotTable report with state groups

##### 2.2.5.3.8 Calculated Fields

**Calculated fields** allow users to add calculations to a **PivotTable** report (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)). For example, if a **PivotTable** report contains values for sales and cost by products, but no profit values, a **calculated field** with the formula "=sales-cost" can be added so that profit values are calculated and can be analyzed in the **PivotTable** report.

A calculated field is a **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) and does not correspond to a column in the **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)). The values for a **calculated field** are calculated based on the formula specified for the **calculated field**. A **calculated field** is specified by the **fCalculatedField** field of the **SXFDB** record (section [2.4.283](#Section_e410a60fad0340c7a4fc9e9932339abe)) being equal to 1. The formula is specified by the **SXFormula** record (section [2.4.288](#Section_b7c4ebe61ade458fb78ca1d05ada9862)) following the **SXFDB** record.

A **pivot field** associated with a calculated field MUST NOT appear on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)), **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)), or **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)) of a **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)).

An **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)) MUST NOT have **calculated fields**.

##### 2.2.5.3.9 Calculated Items

**Calculated items** allow users to add a **cache item** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)) that does not exist in the **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)) to a **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)). For example, consider a **PivotTable** report (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) displaying sales for the four quarters of 2007. If there are **source data** rows for sales in 2008, a **calculated item** can be used to add an additional **cache item** as a calculated item that calculates the projected sales for the first quarter of the year 2008 as being 25% higher than the sales for the fourth quarter of 2007. The following figure illustrates a **PivotTable** report with such a **calculated item** (2008 Q1 projected).

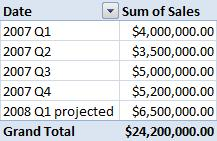


Figure 12: PivotTable report with a calculated item

The values for a **calculated item** are calculated based on the formula specified for the **calculated** item.

The sequence of records that conform to the **SXFORMULA** rule (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687)) specifies one calculation for a specific **calculated item**. Each **calculated item** can have multiple calculations associated with it and in that case, there are multiple sequences of records that conform to the **SXFORMULA** rule corresponding to the same **calculated item**. The **calculated item** that a calculation is associated with is specified by the sequence of records that conform to the **PIVOTRULE** rule (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)) in the **SXFORMULA** rule. The **PIVOTRULE** rule can also specify additional scoping information. For example, if one calculation for a calculated item named "2008 Q1 projected" only applies to the "Cars" product group, the **PIVOTRULE** rule will specify the **cache field** corresponding to "product group" and the **cache item** corresponding to "Cars".

An **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)) MUST NOT have **calculated items**.

##### 2.2.5.3.10 OLAP Grouping

Grouping in an **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)) is the associating of multiple [**OLAP members**](#gt_c0dd6cb4-ad4b-45ef-bd4f-75c650f84f32) that belong to the same [**OLAP level**](#gt_00e48261-dfd3-4f32-b53f-91e2344d6168) of an [**OLAP hierarchy**](#gt_1e0ca171-3095-4e3c-9c69-65148df00a9c) and have the same OLAP member parent. When OLAP members in a particular OLAP level are grouped, a parent grouping OLAP level exists. Each group is represented in the parent grouping OLAP level by one parent grouping OLAP member, and one or more child OLAP members in the OLAP level that the grouping is applied to.

A parent grouping OLAP level is specified by the sequence of records that conform to the **SXADDLGRPLEVEL** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

A parent grouping OLAP member is specified by the sequence of records that conform to the **SXADDLGROUP** rule (section 2.1.7.20.5).

##### 2.2.5.3.11 OLAP Calculated Members

A calculated [**member (2)**](#gt_5d78ca78-a9b1-4791-8126-bf9494304b11) is specified by the sequence of records that conform to the **SXADDLCALCMEMBER** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) and is used to create an [**OLAP calculated member**](#gt_16cb1b2a-a915-42c1-81ef-fcf221adb0fe) or an [**OLAP named set**](#gt_8997311d-6027-4c9f-b739-9a2a00594f28) with an associated user-specified [**MDX**](#gt_9b631ff5-dc89-45f0-a1c2-db6981e4804f) [**expression**](#gt_6d43b116-acad-45af-aea5-a8e7240a1106) for a custom calculation.

If the **fLongFormula** field of the **SXAddl\_SXCView\_SXDCalcMember** record (section [2.4.273.100](#Section_ec60a3e765fc4431b322cb8f39595a08)) is equal to one, then the **stMDXFormula** field of the **SXAddl\_SXCView\_SXDCalcMemString** record (section [2.4.273.101](#Section_982c65e56e14423c8428be4eaa8cb2cd)) specifies the user-specified MDX expression. If the **fLongFormula** field of the **SXAddl\_SXCView\_SXDCalcMember** record is equal to zero, then the **stMDXFormula** field of the **SXAddl\_SXCView\_SXDCalcMember** record specifies the MDX expression.

The **fSet** field of the **SXAddl\_SXCView\_SXDCalcMember** record specifies whether the associated calculated member (2) creates an OLAP named set or an OLAP calculated member.

If the user-specified MDX expression associated with a calculated member (2) defines an [**OLAP measure**](#gt_7431c051-4564-4476-ad00-39c66f169118), then this calculated member (2) is associated with a measure **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) as specified in section [2.2.5.4.5.2](#Section_4308b88c7f1e42bcb3dd8a1387b69c51).

If the user-specified MDX expression associated with a calculated member (2) specifies an [**OLAP member**](#gt_c0dd6cb4-ad4b-45ef-bd4f-75c650f84f32) in an [**OLAP hierarchy**](#gt_1e0ca171-3095-4e3c-9c69-65148df00a9c) other than the OLAP measure hierarchy, then this calculated member (2) can only be associated with a **cache item** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)).

If a calculated member specifies an OLAP named set, then this calculated member (2) is associated with a named set **pivot hierarchy** as specified in section [2.2.5.4.5.4](#Section_c7f4e861a4e846b28279670fc6edcf6f).

##### 2.2.5.3.12 Cache Records

**Cache records**, as defined by the **Pivot Cache Storage** (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687)), represent a copy of the **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)) for a **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) and allow for **PivotTable views** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) using a **PivotCache** to be recalculated without retrieving the **source data**.

Each **cache** record specifies values for one row of **source data**. Each value in a **cache** record is associated with a corresponding **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)). **Cache records** are specified by the sequence of records that conform to the **DBB** rule (section 2.1.7.12). The count of **cache records** MUST be equal to the **crdbdb** field of the **SXDB** record (section [2.4.275](#Section_f0e04937a8cf4a1c891bea1fa4b85fdc)). The **SXDBB** record (section [2.4.276](#Section_e38eeddd951449fd83398938219fcbe3)) specifies an array of **cache item** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)) indexes for the **cache fields** for which the **fAllAtoms** field of the **SXFDB** record (section [2.4.283](#Section_e410a60fad0340c7a4fc9e9932339abe)) is equal to 1. The values for the remaining **cache fields** that correspond to **source data** columns are specified by the sequence of records that conform to the **SXOPER** rule (section 2.1.7.12), with each record specifying a value. For each **cache** record, the number of records in the sequence of records that conforms to the **SXOPER** rule (section 2.1.7.12) MUST be the same as the count of **cache fields**, corresponding to **source data** columns, for which the **fAllAtoms** field of the **SXFDB** record is equal to 0.

The **cache records** in a **PivotCache** can be invalid, in which case the **cache records** MUST be ignored. The validity of the **cache records** is determined from the **SXAddl\_SXCCache\_SXDInvRefreshReal** record (section [2.4.273.8](#Section_03f3c75e743a42ec8d9a86600e2389d7)), if one is present and associated with this **PivotCache**, the **QsiSXTag** record (section [2.4.211](#Section_3bb6727096504455944daa8e21dbb19f)), if one is present and associated with this **PivotCache**, and the **SXDB** record. If the **SXAddl\_SXCCache\_SXDInvRefreshReal** record is present, then the **cache records** are not valid if the **fInvalid** field of the **SXAddl\_SXCCache\_SXDInvRefreshReal** record is 1 and valid if that field is 0. Otherwise, if the **QsiSXTag** record is present, then the **cache records** are not valid if the **fInvalid** field of the **QsiSXTag** record is 1 and valid if that field is 0. Otherwise, the **cache records** are not valid if the **fInvalid** field of the **SXDB** record is 1 and valid if that field is 0.

An **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)) MUST NOT have **cache records**. **Cache records** are optional for a non- **OLAP PivotCache**.

#### 2.2.5.4 PivotTable View

A PivotTable view is a set of structures that specify layout, filtering, and other properties. These properties are used to produce a **PivotTable** report (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) based on data from the associated **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)).

A **PivotTable view** is specified by the sequence of records that conform to the **PIVOTVIEW** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

Functionality specified by a **PivotTable view** includes:

 The arrangement of **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)), **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)), or both to produce a **PivotTable** report.

 Using **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)) on the **data axis** (section [2.2.5.4.9.5](#Section_4c5c2daa289746e1854b0ce04209f060)) to show summarized result values in the **PivotTable** report.

 Filtering the data in the **PivotTable** report by performing manual filtering (section [2.2.5.4.7](#Section_b0b282651e334c86ad030f5693c1d1e4)), filtering by criteria (section [2.2.5.4.8](#Section_5b29f1fa92f74d018648957cea96c4c2)), or filtering in the **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)).

 Determining the **PivotTable layout** (section [2.2.5.4.10](#Section_2f81b5b422d546778ec53c5dc1ad80d4)).

 Formatting the entire **PivotTable** report with a **table style** (section [2.4.320](#Section_32b77a6330c54885bc94434923002d6d)). See the **SXAddl\_SXCView\_SXDTableStyleClient** report (section [2.4.273.107](#Section_adade4ceaf6e4dd19d669080ebaec11d)) for details. Alternatively, for an [**AutoFormat**](#gt_f7e1ea19-1129-4519-a857-008db95c462f), see section [2.4.313](#Section_fcf246969b7b45a2b48a4199d26fb41b) and section [2.4.315](#Section_0afb49167a5243b6891742c07b8dc954) for details.

 Formatting an area of the **PivotTable** report in a way that logically tracks changes in the **PivotTable** report. For details, see the record specifications for records specified by the **PIVOTFORMAT** rule (section 2.1.7.20.5).

 [**Conditional formatting**](#gt_5a8a1e18-9f8c-48c6-9ad0-7975ade8d516) an area of the **PivotTable** report in a way that logically tracks changes in the **PivotTable** report and performs calculations based the fact that the area is in a **PivotTable** report. For details, see the record specifications for records specified by the **SXADDLCONDFMT** rule (section 2.1.7.20.5).

 Sorting **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) of **pivot fields** (section 2.2.5.4.3) within the **PivotTable** report. For details, see section [2.2.5.4.3.1](#Section_6a008d4253834e13a1d06d8ee5d93b76).

##### 2.2.5.4.1 Associated PivotCache

A **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) is associated with the **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) specified by the **iCache** field of the **SxView** record (section [2.4.313](#Section_fcf246969b7b45a2b48a4199d26fb41b)). **iCache** is a zero-based index of a sequence of records that conform to the **PIVOTCACHEDEFINITION** rule (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)) in the sequence of records that conform to the **WORKBOOKCONTENT** rule (section 2.1.7.20.3).

Each **PivotTable view** MUST be associated with exactly one **PivotCache**. A non- **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)) MUST be associated with one or more **PivotTable views**. An **OLAP PivotCache** MUST be associated with exactly one **PivotTable view**.

##### 2.2.5.4.2 OLAP PivotTable view

A **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) is specified to be an **OLAP PivotTable view** if a **QsiSXTag** record (section [2.4.211](#Section_3bb6727096504455944daa8e21dbb19f)) exists for the **PivotTable view** and the **fTensorEx** bit of the **QsiSXTag** record is 1. Otherwise, the **PivotTable view** is specified to be a non-**OLAP PivotTable view**. An **OLAP PivotTable view** has an **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)) as its associated **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)).

##### 2.2.5.4.3 Pivot Fields

A **pivot field** corresponds to a **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)). A **pivot field** specifies display information of the data in the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)).

A **pivot field** is specified by a sequence of records that conforms to the **PIVOTVD** rule (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) and optionally the **PIVOTVDTEX** (section 2.1.7.20.5) and **SXADDLFIELD** (section 2.1.7.20.5) rules. The **PIVOTVDTEX** rule specifies additional properties for **OLAP PivotTable** views (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)), and the **SXADDLFIELD** rule (section 2.1.7.20.5) specifies additional version specific properties. A pivot field is contained in the **PivotTable view**. A **PivotTable view** contains a collection of **pivot fields** which is specified by the sequence of records that conforms to the **PIVOTVIEW** rule (section 2.1.7.20.5).

A pivot field index, which identifies a pivot field, is specified as the zero-based index of a **PIVOTVD** rule in the collection specified by a **PIVOTVIEW** rule.

Each **pivot field** is associated with the **cache field** with a **cache field** index equal to the **pivot field** index of this **pivot field**. For more details, see section 2.2.5.3.5. The number of pivot fields in the sequence of records that conforms to a **PIVOTCORE** rule (section 2.1.7.20.5) MUST be equal to the number of **cache fields** in the **associated PivotCache** (section [2.2.5.4.1](#Section_6f60301b107346d3b7ad0041566272a4)) for the **PivotTable view**.

A **PivotTable view** is used to create a **PivotTable** report (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)). This can include information about **pivot fields** placed on **PivotTable axes** (section [2.2.5.4.9](#Section_89db73685e8e4324b592af85e4559e6c)) and **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)) referring to **pivot fields**.

A **pivot field** can have **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)). A **pivot field** can describe information such as **pivot field sorting** (section [2.2.5.4.3.1](#Section_6a008d4253834e13a1d06d8ee5d93b76)) and **subtotaling** (section [2.2.5.4.9.4.2](#Section_427438d9b8e34a5c8b678f158fbf680f)) settings.

The following figure shows a **PivotTable** report with three pivot fields displaying Sales by Country and Fiscal Year.

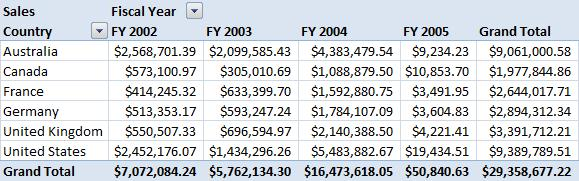


Figure 13: PivotTable report with three pivot fields: Sales, Country, and Fiscal Year

###### 2.2.5.4.3.1 Pivot Field Sorting

A **Pivot Field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) has a [**sort order**](#gt_58099001-70b9-4664-91fa-6035629bccb7) specified if the **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) is recalculated and the **Pivot Field** (section 2.2.5.4.3) is on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)) or **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)).

A **Pivot Field** is sorted depending on the setting of the **fAutoSort** field of **SXVDEx** (section [2.4.310](#Section_07ecd5c3e40e44ffbf1a0a473659a5cf)).

If the **fAutoSort** field of **SXVDEx** is equal to 0, then the sort order is specified depending on the value of the **fTensorSort** field of **SXVDTEx** record (section [2.4.311](#Section_1dcf2beeca2c4c3abd4278bc22c3043d)) of the **Pivot Field**.

| fTensorSort field of SXVDTEx | Meaning |
| --- | --- |
| 0 or **SXVDTEx** record not present | The order is determined by the order of the **SXVI** records (section [2.4.312](#Section_79769ad0d2134e6dbf34fb766907091c)) for this **Pivot Field**. |
| 1 | The order is determined by the [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) [**data source**](#gt_e091613c-6901-4874-b9b2-27273ead1075). Only valid for an **OLAP PivotTable view** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)). |

If the **fAutoSort** field of **SXVDEx** is equal to 1, then sorting is in ascending or descending order according to the **fAscendSort** field of **SXVDEx**.What is sorted depends on the following:

| SxcAutoSort class of pivot field presence | isxdiAutoSort field of SXVDEx | Meaning |
| --- | --- | --- |
| Not Present | Greater than or equal to 0 | Sorting is based on the values in the cells in the **PivotTable data area** (section [2.2.5.4.10.1.4](#Section_237a24905c614931923f7ee856f23c72)) that are specified by the **data item** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)) referenced by the **isxdiAutoSort** field of **SXVDEx**. |
| Not Present | -1 | Sorting is based on the values of the **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) themselves. |
| Present |  | Sorting is either based on the values in the cells in the **PivotTable data area** or on the values of **member properties** (section [2.2.5.4.6](#Section_e5db3a66677f43db8fb038584797c95f)) associated with this **pivot field** as specified by the **SxcSXRule** class (section [2.2.5.1.1.1.11](#Section_dd12edef6e8747379bed6f4ceff33127)) in the **SxcAutoSort** class (section [2.2.5.1.1.1.14](#Section_212512d2c740431f838b7ec651364e2f)). |

##### 2.2.5.4.4 Pivot Items

**Pivot items** represent specific instances of the entities represented by **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)). Each **pivot item** specifies its display properties. For example, it can contain the user defined caption for the **pivot item** or information about whether this **pivot item** is hidden or not.

A **pivot item** specifies view properties of a **cache item** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)) or of an aggregation value associated with a **pivot fields** (section 2.2.5.4.3).

A pivot item is specified by an **SXVI** record (section [2.4.312](#Section_79769ad0d2134e6dbf34fb766907091c)) in a sequence of records that conforms to the **PIVOTVD rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)), and optionally an **SXVIFlags structure** (section [2.5.263](#Section_ea598c0f7a8d4501be1cebc16f8c7a77)) specified by an element in the array specified by the **rgsxvi** field of the **SXVDTEx** record (section [2.4.311](#Section_1dcf2beeca2c4c3abd4278bc22c3043d)). The **SXVIFlags structure** (section 2.5.263) specifies additional properties for **OLAP PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)).

If the **itmType** field of **SXVI** (section 2.4.312) is 0x0000, then this **pivot item** is associated with the **cache item** (section 2.2.5.3.6) specified by the iCache field of the **SXVI** record (section 2.4.312). Each **pivot item** that is associated with a **cache item** (section 2.2.5.3.6) MUST be associated with a different **cache item** (section 2.2.5.3.6) than the other **pivot items** in the collection. If the **itmType** field of this **SXVI** record (section 2.4.312) is not 0x0000, then this **pivot item** MUST NOT have an associated **cache item** (section 2.2.5.3.6).

The number of **pivot items** where the **itmType** field of the **SXVI** record (section 2.4.312) of the **pivot item** is 0x0000 MUST equal zero or the number of **cache items** (section 2.2.5.3.6) in the **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) of the **pivot fields** (section 2.2.5.4.3).

A pivot item can be referenced by a pivot item index. A pivot item index is a zero-based index of **SXVI** records (section 2.4.312) in a **PIVOTVD rule** (section 2.1.7.20.5). Note that unlike pivot field index and cache field index, **pivot item** index and cache item index are not necessarily equal.

##### 2.2.5.4.5 Pivot Hierarchies

A **pivot hierarchy** is specified to be contained by a **PivotTable axis** (section [2.2.5.4.9](#Section_89db73685e8e4324b592af85e4559e6c)) when all **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) associated with that pivot hierarchy are placed on that **PivotTable axis** (section 2.2.5.4.9). **Pivot fields** (section 2.2.5.4.3) MUST NOT be placed on a **PivotTable axis** (section 2.2.5.4.9) different from the pivot axis that any other **pivot field** (section 2.2.5.4.3) associated with the same pivot hierarchy is placed on. Additional restrictions can apply, as specified by the **SXTH rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) and the PivotTable Axes section.

A **pivot hierarchy** corresponds to one of the following entities in the [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)) associated with an **OLAP PivotCache** (section [2.2.5.3.4](#Section_fb16dbf9cbe543b1aaa3f970c5107e7b)):

 [**OLAP hierarchy**](#gt_1e0ca171-3095-4e3c-9c69-65148df00a9c)

 [**OLAP measure**](#gt_7431c051-4564-4476-ad00-39c66f169118)

 [**OLAP named set**](#gt_8997311d-6027-4c9f-b739-9a2a00594f28)

 OLAP [**key performance indicator (KPI)**](#gt_1d2666f5-ffca-4053-868a-0cd4434ce5a8)

A **pivot hierarchy** is associated with an OLAP hierarchy in the **source data** (section 2.2.5.3.2). A pivot hierarchy is specified by the sequence of records that conform to the **PIVOTTH rule** (section 2.1.7.20.5) and, optionally, the **SXADDLHIERARCHY rule** (section 2.1.7.20.5).

Pivot hierarchies MUST NOT exist if the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) is a non- **OLAP PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)). At least one **p**ivot hierarchy MUST exist if the **PivotTable view** (section 2.2.5.4) is an **OLAP PivotTable views** (section 2.2.5.4.2).

A **pivot hierarchy** specifies OLAP hierarchy information and has one or more associated **pivot fields** (section 2.2.5.4.3) associated with [**OLAP levels**](#gt_00e48261-dfd3-4f32-b53f-91e2344d6168) of the OLAP hierarchy, an OLAP named set, an [**OLAP KPI**](#gt_d49d8fc7-18d5-4e3d-b6ab-547944dba3ca), or an OLAP measure.

A pivot hierarchy can be referenced by pivot hierarchy index. A pivot hierarchy index is the zero-based index of a **PIVOTTH rule** (section 2.1.7.20.5) in the associated **PIVOTVIEW rule** (section 2.1.7.20.5).

A pivot hierarchy is associated with an OLAP object as specified in the following table:

| fMeasure field of SXTH | fSet field of SXTH | fKPI field of SXTH | Meaning |
| --- | --- | --- | --- |
| 0 | 0 | 0 | OLAP hierarchy |
| 0 | 1 | 0 | OLAP named set |
| 0 | 0 | 1 | OLAP KPI |
| 1 | 0 | 0 | OLAP measure |

###### 2.2.5.4.5.1 Association of Pivot Hierarchies and Pivot Fields and Cache Fields

A **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) is associated with the **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) specified by either the **isxth** field of the **SXVDTEx record** (section [2.4.311](#Section_1dcf2beeca2c4c3abd4278bc22c3043d)) of that **pivot field** (section 2.2.5.4.3), or the **isxth** field of the **SXAddl\_SXCField12\_SXDISXTH record** (section [2.4.273.31](#Section_71bd6907aeab49b0ae61e49b0771bb51)) of that **pivot field** (section 2.2.5.4.3).

If a **pivot field** (section 2.2.5.4.3) has an **SXAddl\_SXCField12\_SXDISXTH record** (section 2.4.273.31), the **isxth** field of the **SXVDTEx record** (section 2.4.311) MUST be -1 and the association is specified by **isxth** field of the **SXAddl\_SXCField12\_SXDISXTH record** (section 2.4.273.31).

A **pivot hierarchy** (section 2.2.5.4.5) associated with a **pivot field** (section 2.2.5.4.3) is associated with the **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) the **pivot field** (section 2.2.5.4.3) is associated.

If a **pivot hierarchy** (section 2.2.5.4.5) is on the **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)) or **data axis** (section [2.2.5.4.9.5](#Section_4c5c2daa289746e1854b0ce04209f060)), the **isxvd** field of **SXTH** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)) is a reference to an associated **pivot field** (section 2.2.5.4.3).

If the **pivot hierarchy** (section 2.2.5.4.5) is not a **measure** (section [2.2.5.4.5.2](#Section_4308b88c7f1e42bcb3dd8a1387b69c51)), **named set** (section [2.2.5.4.5.4](#Section_c7f4e861a4e846b28279670fc6edcf6f)), **KPI** (section [2.2.5.4.5.3](#Section_239d9d6560154f06a8359f2868568a33)), there can be more than one **pivot field** (section 2.2.5.4.3) associated with it and each array elements in the **rgisxvd** field of **SXTH** (section 2.4.308) is a reference to the associated **pivot field** (section 2.2.5.4.3) for the **pivot hierarchy** (section 2.2.5.4.5) level.

If a **pivot field** (section 2.2.5.4.3) has an **SXAddl\_SXCField12\_SXDISXTH record** (section 2.4.273.31) **sxaxis.sxaxisData**, **sxaxis.sxaxisRw**, **sxaxis.sxaxisCol** and **sxaxis.sxaxisPage** fields of the **Sxvd record** (section [2.4.309](#Section_6f48271ee32547ea9efe9c197d0fb8e6)) of the **pivot field** (section 2.2.5.4.3) MUST be 0.

If a **pivot hierarchy** (section 2.2.5.4.5) is a **measure** (section 2.2.5.4.5.2), **named set** (section 2.2.5.4.5.4), or **KPI** (section 2.2.5.4.5.3), there can be no more than one **pivot field** (section 2.2.5.4.3) associated with it.

###### 2.2.5.4.5.2 Measures

A measure pivot hierarchy is a pivot hierarchy that is associated with an [**OLAP measure**](#gt_7431c051-4564-4476-ad00-39c66f169118). The **fMeasure** field of the **SXTH** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)) specifies if a pivot hierarchy is a **measure** pivot hierarchy. An OLAP measure MUST NOT have more than one **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) associated with it. A **measure** pivot hierarchy MUST NOT be located on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)), **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)), or **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)).

###### 2.2.5.4.5.3 KPIs

A [**key performance indicator (KPI)**](#gt_1d2666f5-ffca-4053-868a-0cd4434ce5a8) **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) is a **pivot hierarchy** (section 2.2.5.4.5) that is associated with an [**OLAP KPI**](#gt_d49d8fc7-18d5-4e3d-b6ab-547944dba3ca). A **KPI** **pivot hierarchy** (section 2.2.5.4.5) includes the four main components of an OLAP KPI; value, goal, status and trend. The **fKPI** field of the **SXTH record** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)) specifies if a pivot hierarchy is a KPI **pivot hierarchy** (section 2.2.5.4.5).

###### 2.2.5.4.5.4 Named Sets

A **named set** **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) is a **pivot hierarchy** (section 2.2.5.4.5) that is associated with an [**OLAP named set**](#gt_8997311d-6027-4c9f-b739-9a2a00594f28). The **fSet** field of the **SXTH record** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)) specifies if a **pivot hierarchy** (section 2.2.5.4.5) is a **named set** **pivot hierarchy** (section 2.2.5.4.5). An OLAP named set MUST NOT have more than one **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) associated with it. A **named set** **pivot hierarchy** (section 2.2.5.4.5) MUST NOT be located on the **data axis** (section [2.2.5.4.9.5](#Section_4c5c2daa289746e1854b0ce04209f060)) or **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)).

##### 2.2.5.4.6 Member Properties

A **member property** is the **PivotTable** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) representation of an [**OLAP member property**](#gt_b39deb4c-b405-40a9-90ed-1ba07e39ed9f). **Member properties** can have properties that are associated with the **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) and a **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)).

A **member property** is specified by the **SXAddl\_SXCHierarchy\_SXDProperty record** (section [2.4.273.57](#Section_263064a90d694646a45d2ba174495fe5)) in the sequence of records that conform to the **SXADDLHIERARCHY rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)). A **member property** is contained in a **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)).

A **member property** is associated with one OLAP member property of the [**OLAP hierarchy**](#gt_1e0ca171-3095-4e3c-9c69-65148df00a9c) specified by the **pivot hierarchy** (section 2.2.5.4.5) of the **member property**.

A **member property** can be associated with a **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)) and a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)). If there is a **cache field** (section 2.2.5.3.5) with an **stFieldName** field of the [SXFDB](#Section_e410a60fad0340c7a4fc9e9932339abe) record equal to the **stProperty** field of the **SXAddl\_SXCHierarchy\_SXDProperty record** (section 2.4.273.57), then this specifies that the **member property** is associated with that **cache field** (section 2.2.5.3.5), and the **cache field** (section 2.2.5.3.5) is specified to be a **member property** **cache field** (section 2.2.5.3.5). The associated **pivot field** (section 2.2.5.4.3) of a **member property** **cache field** (section 2.2.5.3.5) is specified to be a **member property** **pivot field** (section 2.2.5.4.3).

It is not required that a **member property** is associated with any **cache field** (section 2.2.5.3.5) or **pivot field** (section 2.2.5.4.3). If there is no **cache field** (section 2.2.5.3.5) with a **stFieldName** field of the **SXFDB record** (section 2.4.283) equal to the **stProperty** field of the **SXAddl\_SXCHierarchy\_SXDProperty record** (section 2.4.273.57), then this specifies that the **member property** is not associated with any **cache field** (section 2.2.5.3.5) or **pivot field** (section 2.2.5.4.3). Such a **member property** does not participate in the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)) or **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)).

A **member property** **pivot field** (section 2.2.5.4.3) can be shown only in the **row area** (section [2.2.5.4.10.1.1](#Section_5594c95e6819461e80706f4b4fdfa091)) or **column area** (section [2.2.5.4.10.1.2](#Section_03aced8c25864e83982a1e3551a563d6)) of a **PivotTable view** (section 2.2.5.4). A **member property** **pivot field** (section 2.2.5.4.3) can only be shown after the last visible level of the corresponding **pivot hierarchy** (section 2.2.5.4.5). The order of **member property** fields shown in the **PivotTable view** (section 2.2.5.4) is the same as the order of **SXAddl\_SXCHierarchy\_SXDProperty records** (section 2.4.273.57) in the corresponding **pivot hierarchy** (section 2.2.5.4.5).

##### 2.2.5.4.7 Manual Filters

A manual filter enables specific **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) or [**OLAP members**](#gt_c0dd6cb4-ad4b-45ef-bd4f-75c650f84f32) associated with **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) to be shown or hidden in the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)). **Manual filtering** affects calculations when **pivot fields** (section 2.2.5.4.3) that have **manual filters** are located on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)), **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)), or **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)). The **pivot items** (section 2.2.5.4.4) that are hidden for such **pivot fields** (section 2.2.5.4.3) are not included when calculating values for the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)).

At least one **SXVI record** (section [2.4.312](#Section_79769ad0d2134e6dbf34fb766907091c)) following an **Sxvd record** (section [2.4.309](#Section_6f48271ee32547ea9efe9c197d0fb8e6)) MUST have the **fHidden** field equal to 0x0.

Details about manual **filtering** for **pivot fields** (section 2.2.5.4.3) on the **page axis** (section 2.2.5.4.9.1) are covered in the Page Axis section.

###### 2.2.5.4.7.1 Non-OLAP Manual Filters

For non-**OLAP** **PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)), the state of the **manual filter** (section [2.2.5.4.7](#Section_b0b282651e334c86ad030f5693c1d1e4)) on a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) can be determined by the value of the **fHidden** field of the **SXVI records** (section [2.4.312](#Section_79769ad0d2134e6dbf34fb766907091c)) directly following the corresponding **Sxvd record** (section [2.4.309](#Section_6f48271ee32547ea9efe9c197d0fb8e6)). This field specifies whether the corresponding **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) is shown or hidden in the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)).

For non-[**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) **PivotTable** (section 2.2.5) with **PivotCache functionality level** (section [2.2.5.3.1](#Section_e0fe44b1caf64739bf8fe51a96cd5ba8)) greater than or equal to 3, the **fFilterInclusive** field of the **SXAddl\_SXCField12\_SXDVer12Info record** (section [2.4.273.33](#Section_f7f523c98b2d4eea993b80f272c83a30)) specifies whether new **pivot items** (section 2.2.5.4.4) in the **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)) are shown or hidden by default when the **PivotTable report** (section 2.2.5) is refreshed in addition to the **pivot items** (section 2.2.5.4.4) that are already shown in the **PivotTable report** (section 2.2.5) as the result of an applied **manual filter** (section 2.2.5.4.7).

###### 2.2.5.4.7.2 OLAP Manual Filters

For **OLAP** **PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)), **manual filtering** (section [2.2.5.4.7](#Section_b0b282651e334c86ad030f5693c1d1e4)) operates on **pivot hierarchies** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)). **OLAP manual filtering** uses filtering lists to determine what filtering to apply. The **OLAP manual filtering** operation depends on the **PivotCache Functionality Level** (section [2.2.5.3.1](#Section_e0fe44b1caf64739bf8fe51a96cd5ba8)) of the **associated PivotCache** (section [2.2.5.4.1](#Section_6f60301b107346d3b7ad0041566272a4)) of the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)).

The list of excluded [**OLAP members**](#gt_c0dd6cb4-ad4b-45ef-bd4f-75c650f84f32) is specified by the **rgHiddenMemberSets** field of the **SXTH record** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)). If the **fFilterInclusive** field of the **SXTH record** (section 2.4.308) of the **pivot hierarchy** (section 2.2.5.4.5) is equal to 0x1, the list of excluded OLAP members MUST be empty.

The list of included OLAP members is specified by a collection of **SXAddl\_SXCHierarchy\_SXDFilterMember12 records** (section [2.4.273.45](#Section_e38c0aa8e2e2448680ed5d230a53d17a)) of the **pivot hierarchy** (section 2.2.5.4.5). If the **PivotCache Functionality Level** (section 2.2.5.3.1) of the **associated PivotCache** (section 2.2.5.4.1) of the **PivotTable view** (section 2.2.5.4) is less than 3, the selected **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) list MUST be empty. If the **fFilterInclusive** field of the **SXTH record** (section 2.4.308) of the **pivot hierarchy** (section 2.2.5.4.5) is equal to 0x0, the list of included OLAP members MUST be empty.

The selected **pivot items** (section 2.2.5.4.4) list is specified to be the list of **pivot items** (section 2.2.5.4.4), with the **fOlapFilterSelected** field of the **SXVIFlags structure** (section [2.5.263](#Section_ea598c0f7a8d4501be1cebc16f8c7a77)) that corresponds to each **pivot item** (section 2.2.5.4.4) equal to 0x1, in the **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) associated with the **pivot hierarchy** (section 2.2.5.4.5). If the **PivotCache Functionality Level** (section 2.2.5.3.1) of the **associated PivotCache** (section 2.2.5.4.1) of the **PivotTable view** (section 2.2.5.4) is less than 3, the selected **pivot items** (section 2.2.5.4.4) list MUST be empty.

If all of the lists of excluded OLAP members, included OLAP members and the selected **pivot items** (section 2.2.5.4.4) are empty, then no **manual filtering** (section 2.2.5.4.7) is specified for the **pivot hierarchy** (section 2.2.5.4.5). Otherwise, the value of the **fFilterInclusive** field of the **SXTH record** (section 2.4.308) of the **pivot hierarchy** (section 2.2.5.4.5) determines how the lists are used.

If the **fFilterInclusive** field of the **SXTH record** (section 2.4.308) of the **pivot hierarchy** (section 2.2.5.4.5) is equal to 0x1, the [**members (2)**](#gt_5d78ca78-a9b1-4791-8126-bf9494304b11) of the included OLAP members list and their ascendants and descendants are included in the **manual filter** (section 2.2.5.4.7). The **pivot items** (section 2.2.5.4.4) in the selected **pivot items** (section 2.2.5.4.4) list, and their ascendants and descendants are also included in the **manual filter** (section 2.2.5.4.7). New OLAP members in the **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)) will be excluded by default when the **PivotTable view** (section 2.2.5.4) is refreshed.

If the **fFilterInclusive** field of the **SXTH record** (section 2.4.308) of the **pivot hierarchy** (section 2.2.5.4.5) is equal to 0x0, the members (2) of the excluded OLAP members list and their descendants are excluded in the **manual filter** (section 2.2.5.4.7). The **pivot items** (section 2.2.5.4.4) in the selected **pivot items** (section 2.2.5.4.4) list and their descendants are also excluded in the **manual filter** (section 2.2.5.4.7). New OLAP members in the **source data** (section 2.2.5.3.2) will be included by default when the **PivotTable view** (section 2.2.5.4) is refreshed.

The filtering lists do not include OLAP members which are parent or child members of other OLAP members in the lists.

##### 2.2.5.4.8 Filtering by Criteria

**Filtering by criteria** is the ability to conditionally show **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) of **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) based on user-defined criteria. For example, a criteria [**filter**](#gt_ffbe7b55-8e84-4f41-a18d-fc29191a4cda) might be defined to show all products that sold for more than $30,000.

###### 2.2.5.4.8.1 Advanced Filters

An **advanced filter** specifies a user-defined criterion that is used to determine the **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) of a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) that are included when calculating values for the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) and that are displayed in the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)).

Only **advanced filters** that are associated with **pivot fields** (section 2.2.5.4.3) that are located on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)) or the **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)) are applied when the **PivotTable view** (section 2.2.5.4) is calculated.

An **advanced filter** is specified by the [SXCSXFilter12 class](#Section_9b54e335ef8846d28d19dfbfe2078154) section. The **isxvd** field of the **SXAddl\_SXCSXFilter12\_SXDSXFilter record** (section [2.4.273.82](#Section_ef6b03f6ed464a42a2605f8f3369ba26)) specifies the **pivot field** (section 2.2.5.4.3) associated with the **a**dvanced filter.

**Advanced filters** MUST NOT be applied to **pivot fields** (section 2.2.5.4.3) of a **PivotTable view** (section 2.2.5.4) if the **PivotCache functionality level** (section [2.2.5.3.1](#Section_e0fe44b1caf64739bf8fe51a96cd5ba8)) of the **associated PivotCache** (section [2.2.5.4.1](#Section_6f60301b107346d3b7ad0041566272a4)) is less than 3. **Advanced filters** MUST NOT be applied to an **OLAP** **PivotTable view** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)) with a value of 0 for the **fSrvSupportSubquery** field of the **SXAddl\_SXCCache\_SXDInfo12 record** (section [2.4.273.7](#Section_029dff932a484fe1bcffc2dadc5a25b8)) of the **associated PivotCache** (section 2.2.5.4.1).

There are three types of **advanced filters**: **label filter** (section [2.2.5.4.8.1.1](#Section_f221b81b892c4b5c91722d4ed17c937c)), **date filter** (section [2.2.5.4.8.1.2](#Section_2b9377c5055e4efcbcf587fb13c513bd)), and **value filter** (section [2.2.5.4.8.1.3](#Section_05a1c98e21cd4941979880f4bf301bb2)).

A **pivot field** (section 2.2.5.4.3) MUST NOT have more than one associated **advanced filter** of the same type.

2.2.5.4.8.1.1 Label Filters

A **label filter** specifies a criterion that is applied to **pivot item** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) captions to determine which **pivot items** (section 2.2.5.4.4) are included in the calculation of values for the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) and displayed in the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)).

A **label filter** is specified by an **SXAddl\_SXCSXFilter12\_SXDSXFilter record** (section [2.4.273.82](#Section_ef6b03f6ed464a42a2605f8f3369ba26)) with the **sxft** field equal to a value in the range 0x00000004 through 0x00000011.

**Label filters** are applied before any **value filters** (section [2.2.5.4.8.1.3](#Section_05a1c98e21cd4941979880f4bf301bb2)), but the order of **label filters** is not specified.

If a caption is specified, the **label filter** is applied to the **stName** field in the **SXVI records** (section [2.4.312](#Section_79769ad0d2134e6dbf34fb766907091c)) associated with the **pivot items** (section 2.2.5.4.4). If captions are not specified for the **pivot items** (section 2.2.5.4.4), the **label filter** is applied to the values of the **cache items** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)) associated with these **pivot items** (section 2.2.5.4.4).

A **label filter** can be applied to **member properties** (section [2.2.5.4.6](#Section_e5db3a66677f43db8fb038584797c95f)). The **isxvdMProp** field of the **SXAddl\_SXCSXFilter12\_SXDSXFilter record** (section 2.4.273.82) specifies the **member property** (section 2.2.5.4.6) on which this **label filter** is applied.

2.2.5.4.8.1.2 Date Filters

A **date filter** specifies a criterion that is applied to date type **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) of a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)). A **date filter** determines which **pivot items** (section 2.2.5.4.4) are included in the calculation of the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) and are displayed in the **PivotTable view** (section 2.2.5.4) report.

**Date filters** are specified by **SXAddl\_SXCSXFilter12\_SXDSXFilter records** (section [2.4.273.82](#Section_ef6b03f6ed464a42a2605f8f3369ba26)) with the **sxft** field in the range from 0x0000001A through 0x00000041.

For non-**OLAP** **PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)), a **date filter** can be applied if and only if the **SXFDB record** (section [2.4.283](#Section_e410a60fad0340c7a4fc9e9932339abe)) associated with the corresponding **pivot field** (section 2.2.5.4.3) has the **fDateInField** field equal to 0x1, and the **fNonDates** field is equal to 0. For **OLAP** **PivotTable views** (section 2.2.5.4.2), a date filter can be applied if the **fTimeHierarchy** field of the **SXTH record** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)) that specifies the **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) is equal to 1.

**Date filters** are applied before **value filters** (section [2.2.5.4.8.1.3](#Section_05a1c98e21cd4941979880f4bf301bb2)) and in no specific order.

2.2.5.4.8.1.3 Value Filters

A **value filter** specifies a criterion that is applied to values of a **data item** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)) for **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) of the **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) that the **value filter** is applied to. The **value filter** determines which **pivot items** (section 2.2.5.4.4) are included when calculating values for the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) and displayed in the **PivotTable view** (section 2.2.5.4) report.

A **value filter** is specified by the **SXAddl\_SXCSXFilter12\_SXDSXFilter records** (section [2.4.273.82](#Section_ef6b03f6ed464a42a2605f8f3369ba26)) with the **sxft** field equal to a value in one of the following the ranges: from 0x00000001 through 0x00000003 or from 0x00000012 through 0x00000019.

**Value filters** are applied after **manual filters** (section [2.2.5.4.7](#Section_b0b282651e334c86ad030f5693c1d1e4)), **date filters** (section [2.2.5.4.8.1.2](#Section_2b9377c5055e4efcbcf587fb13c513bd)) and **label filters** (section [2.2.5.4.8.1.1](#Section_f221b81b892c4b5c91722d4ed17c937c)) are applied. **Value filters** are applied in the order in which they are specified in the [SXCSXFilter12 class](#Section_9b54e335ef8846d28d19dfbfe2078154) section. **Value filtering** takes previous filtering into account when evaluating filters.

###### 2.2.5.4.8.2 Simple Filters

A **simple filter** is a [**top N filter**](#gt_0f30d3fd-cc8f-4c20-ab45-4ccbb3f834d9) which is also known as [**AutoShow**](#gt_42126923-0aed-4547-8761-95a0ce2badde). The **fAutoShow** field of the **SXVDEx record** (section [2.4.310](#Section_07ecd5c3e40e44ffbf1a0a473659a5cf)) specifies whether a **simple filter** is applied for a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)). The **fTopAutoShow** field of the **SXVDEx record** (section 2.4.310) specifies whether a **simple filter** applies to the top or bottom *n* items. The **citmAutoShow** field of the **SXVDEx record** (section 2.4.310) specifies the number of **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) displayed.

**Simple filters** MUST only be applied to **pivot fields** (section 2.2.5.4.3) of a **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) with **data functionality level** (section [2.2.5.2](#Section_2bcedd76ef064e6084c718ea55042ed6)) less than or equal to 2, or to **pivot fields** (section 2.2.5.4.3) of an **OLAP** **PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)) with the **fSrvSupportSubquery** field of the **SXAddl\_SXCCache\_SXDInfo12 record** (section [2.4.273.7](#Section_029dff932a484fe1bcffc2dadc5a25b8)) of the corresponding **PivotCache** (section [2.2.5.3](#Section_a8496208d8334015938a56a0e97f9f0e)) equal to zero.

##### 2.2.5.4.9 PivotTable Axes

A **PivotTable axis** is the set of **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) or **pivot hierarchies** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) in a **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) used to populate an area of the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)). The placement and positions of **pivot fields** (section 2.2.5.4.3) on the axes are used to determine the **PivotTable Layout** (section [2.2.5.4.10](#Section_2f81b5b422d546778ec53c5dc1ad80d4)). The four axes of a **PivotTable view** (section 2.2.5.4) are the **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)), the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)), the **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)), and the **data axis** (section [2.2.5.4.9.5](#Section_4c5c2daa289746e1854b0ce04209f060)). For non- **OLAP** **PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)), a **pivot field** (section 2.2.5.4.3) MUST NOT appear more than once on the **PivotTable view** (section 2.2.5.4), with the exception of the **data axis** (section 2.2.5.4.9.5). For non-**OLAP** **PivotTable views** (section 2.2.5.4.2), a **pivot field** (section 2.2.5.4.3) can be placed one or more times on the **data axis** (section 2.2.5.4.9.5) independently of whether it was placed on any other axis. For **OLAP** **PivotTable views** (section 2.2.5.4.2), a **pivot field** (section 2.2.5.4.3) MUST NOT be placed more than once on any axis. For both [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) and non-**OLAP** **PivotTable views** (section 2.2.5.4.2), **pivot fields** (section 2.2.5.4.3) do not have to be placed on any **PivotTable axis**.

###### 2.2.5.4.9.1 Page Axis

The **page axis** contains the **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) or **pivot hierarchies** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) that populate the **page area** (section [2.2.5.4.10.1.3](#Section_f10ef7d86c044d35a5830d6f2ce92063)) of the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)), as specified by **PivotTable Layout** (section [2.2.5.4.10](#Section_2f81b5b422d546778ec53c5dc1ad80d4)), and that are intended for use as [**filters**](#gt_ffbe7b55-8e84-4f41-a18d-fc29191a4cda). These **pivot fields** (section 2.2.5.4.3) and **pivot hierarchies** (section 2.2.5.4.5) do not affect the layout of the other areas of the **PivotTable report** (section 2.2.5), but rather filter the data used by the entire **PivotTable view** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)).

The **page axis** is specified by the sequence of records that conform to the **PIVOTPI rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) and optionally by the collection of **SXPIEx records** (section [2.4.299](#Section_bb443ec342004b388f93a4654df874a8)) in the sequence of records that conform to the **PIVOTVIEWEX rule** (section 2.1.7.20.5). For non-**OLAP** **PivotTable views** (section 2.2.5.4.2), the **SXPI\_Item structure** (section [2.5.260](#Section_d60b13f8534b40f2b40a5c8739ec2b76)) specified by each array element of the **rgsxpi** field of the **SXPI record** (section [2.4.298](#Section_ab19ef2ad06e4dccb6e936c36a6af22f)) specifies one **pivot field** (section 2.2.5.4.3) on the page axis. For **OLAP** **PivotTable views** (section 2.2.5.4.2), each **SXPIEx record** (section 2.4.299) specifies one **pivot hierarchy** (section 2.2.5.4.5) on the **page axis**. The order of the **pivot fields** (section 2.2.5.4.3) and **pivot hierarchies** (section 2.2.5.4.5) in these collections for the non-[**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) and OLAP cases specifies the order in which the **pivot fields** (section 2.2.5.4.3) and **pivot hierarchies** (section 2.2.5.4.5) appear on the **page axis**.

For non-**OLAP** **PivotTable views** (section 2.2.5.4.2), the **isxvd** field of the **SXPI\_Item structure** (section 2.5.260) specifies the associated **pivot field** (section 2.2.5.4.3). For **OLAP** **PivotTable views** (section 2.2.5.4.2), the **isxth** field of the **SXPIEx record** (section 2.4.299) specifies the associated **pivot hierarchy** (section 2.2.5.4.5).

2.2.5.4.9.1.1 Non-OLAP Page Filtering

A non-**OLAP** **PivotTable view** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)) can be filtered to not include some **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) from the **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) on the **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)). The **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) only includes values specified by **cache items** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)) that are associated with **pivot items** (section 2.2.5.4.4) that are filtered in.

The following table specifies how the filtering of **pivot items** (section 2.2.5.4.4) of a **pivot field** (section 2.2.5.4.3) is specified.

In the following table, the first column is the value of the **rgsxpi**.**isxvi** field of the **SXPI record** (section [2.4.298](#Section_ab19ef2ad06e4dccb6e936c36a6af22f)), and the second column is the value of the **fSubtotalHiddenPageItems** field of the **SXEx record** (section [2.4.282](#Section_a758cb8447e340398a6cbbe32a3120ba)).

| Value of rgsxpi.isxvi | Value of fSubtotalHiddenPageItems | Filtering Behavior |
| --- | --- | --- |
| Not 0x7FFD | Any | Specifies that the **rgsxpi**.**isxvi** field of the **SXPI record** (section 2.4.298) specifies a **pivot item** (section 2.2.5.4.4) index, as specified by the Pivot Items section, of the one **pivot item** (section 2.2.5.4.4) of a **pivot field** (section 2.2.5.4.3) that is filtered in. |
| 0x7FFD | 0 | Specifies that **pivot items** (section 2.2.5.4.4) are filtered in if and only if the **fHidden** field of the corresponding **SXVI records (**section [2.4.312](#Section_79769ad0d2134e6dbf34fb766907091c)**)** is equal to 0. However, all **pivot items** (section 2.2.5.4.4) are factored into the subtotal. |
| 0x7FFD | 1 | Specifies that **pivot items** (section 2.2.5.4.4) are filtered in if and only if the **fHidden** field of the corresponding **SXVI records (**section 2.4.312**)** is equal to zero. Only **pivot items** (section 2.2.5.4.4) that are filtered in are factored into the subtotal. |

2.2.5.4.9.1.2 OLAP Page Filtering

In an **OLAP** **PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)) the filtering on the **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)) is specified using the **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) that the **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) is associated with, as specified in the [Association of Pivot Hierarchies and Pivot Fields and Cache Fields](#Section_01a66b9be4a24396b55c28d6207fd28f) section.

If the value of the **fEnableMultiplePageItems** field of the **SXTH record** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)) of the **pivot hierarchy** (section 2.2.5.4.5) is 0, the **stUnique** field of the **SXPIEx record** (section [2.4.299](#Section_bb443ec342004b388f93a4654df874a8)) specifies an [**OLAP member**](#gt_c0dd6cb4-ad4b-45ef-bd4f-75c650f84f32) to filter by.

If the value of the **fEnableMultiplePageItems** field of the **SXTH record** (section 2.4.308) of the **pivot hierarchy** (section 2.2.5.4.5) is 1, then the specification depends on the **PivotCache Functionality Level** (section [2.2.5.3.1](#Section_e0fe44b1caf64739bf8fe51a96cd5ba8)) of the **associated PivotCache** (section [2.2.5.4.1](#Section_6f60301b107346d3b7ad0041566272a4)) of the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)), as specified in the following table:

| PivotCache Functionality Level | Filtering Behavior |
| --- | --- |
| Less than 3 | Specifies that the **SXAddl\_SXCHierarchy\_SXDFilterMember records** (section [2.4.273.44](#Section_6814aaca90cd45849413d70f047f54d2)) of the **pivot hierarchy** (section 2.2.5.4.5) specify the OLAP members to filter by. |
| Greater than or equal to 3 | Specifies that the filtering is applied as specified by **Manual Filters** (section [2.2.5.4.7](#Section_b0b282651e334c86ad030f5693c1d1e4)) and **OLAP Manual Filters** (section [2.2.5.4.7.2](#Section_bd4665ebb56a44e690b9ceaf7ec55389)) for this **pivot hierarchy** (section 2.2.5.4.5). |

###### 2.2.5.4.9.2 Row Axis

The **row axis** contains the **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) and an optional **data field** (section [2.2.5.4.9.5.2](#Section_b4187a6caa2d4a9789bd26f394d67592)) used to populate the **row area** (section [2.2.5.4.10.1.1](#Section_5594c95e6819461e80706f4b4fdfa091)) of the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)), as specified by the [PivotTable Layout](#Section_2f81b5b422d546778ec53c5dc1ad80d4) section.

The **pivot fields** (section 2.2.5.4.3) on the **row axis** are specified by the first **SxIvd record** (section [2.4.292](#Section_72c54b06c9254140b6dbdf133439e596)) in the sequence of records that conform to the **PIVOTCORE rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) as defined by the Worksheet Substream [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf), which specifies an array of **SxIvdRw structures** (section [2.5.258](#Section_1d9d8a26acf84281bbc8816ced4926a7)). The order that the **pivot fields** (section 2.2.5.4.3) and the optional **data field** (section 2.2.5.4.9.5.2) are referenced from the **SxIvd record** (section 2.4.292) specifies the order that the **pivot fields** (section 2.2.5.4.3) and the optional **data field** (section 2.2.5.4.9.5.2) display on the row axis. The order that the **pivot fields** (section 2.2.5.4.3) and the optional **data field** (section 2.2.5.4.9.5.2) display on the row axis corresponds to the order that the **pivot fields** (section 2.2.5.4.3) and the optional **data field** (section 2.2.5.4.9.5.2) are placed in the **row area** (section 2.2.5.4.10.1.1) of the **PivotTable report** (section 2.2.5).

For adjacent **SxIvdRw structures** (section 2.5.258) in the **rgSxivd** field of the **SxIvd record** (section 2.4.292), the **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) that the first **SxIvdRw references** (section 2.5.258) is defined to be an outer field with respect to the **pivot field** (section 2.2.5.4.3) or the **data field** (section 2.2.5.4.9.5.2) that the second **SxIvdRw references** (section 2.5.258). The **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) that the second **SxIvdRw references** (section 2.5.258) is defined to be an inner field with respect to the **pivot field** (section 2.2.5.4.3) or the **data field** (section 2.2.5.4.9.5.2) that the first **SxIvdRw references** (section 2.5.258).

For [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) **PivotTables** (section 2.2.5), all **SxIvdRw records** (section 2.5.258) in the **rgSxivd** field of the **SxIvd record** (section 2.4.292) that reference **pivot fields** (section 2.2.5.4.3) that are associated with the same **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) MUST be adjacent. **Pivot fields** (section 2.2.5.4.3) associated with **member properties** (section [2.2.5.4.6](#Section_e5db3a66677f43db8fb038584797c95f)) of the **pivot hierarchy** (section 2.2.5.4.5) MUST be located on the row axis after other types of **pivot fields** (section 2.2.5.4.3) associated with the same **pivot hierarchy** (section 2.2.5.4.5). **Pivot fields** (section 2.2.5.4.3) not associated with **member properties** (section 2.2.5.4.6) of the **pivot hierarchy** (section 2.2.5.4.5) MUST appear on the row axis in an order such that the zero-based ordinal of the [**OLAP level**](#gt_00e48261-dfd3-4f32-b53f-91e2344d6168) of each **pivot field** (section 2.2.5.4.3) associated with the same **pivot hierarchy** (section 2.2.5.4.5) is ascending. The zero-based ordinal of the OLAP level of a **pivot field** (section 2.2.5.4.3) is specified by the **isxtl** field of the **SXVDTEx record** (section [2.4.311](#Section_1dcf2beeca2c4c3abd4278bc22c3043d)).

For OLAP **PivotTables** (section 2.2.5), the **SXTH record** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)) specifies information about a **pivot hierarchy** (section 2.2.5.4.5), including which axis the **pivot hierarchy** (section 2.2.5.4.5) is on.

See the [Nesting](#Section_7268e3daa5474b95a707fdcfc9f68c64) section for more information.

###### 2.2.5.4.9.3 Column Axis

The column axis contains the **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) and an optional **data field** (section [2.2.5.4.9.5.2](#Section_b4187a6caa2d4a9789bd26f394d67592)) used to populate the **column area** (section [2.2.5.4.10.1.2](#Section_03aced8c25864e83982a1e3551a563d6)) of the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)), as specified by the [PivotTable Layout](#Section_2f81b5b422d546778ec53c5dc1ad80d4) section.

The **pivot fields** (section 2.2.5.4.3) on the row axis are specified by the second **SxIvd record** (section [2.4.292](#Section_72c54b06c9254140b6dbdf133439e596)) in the sequence of records that conform to the **PIVOTCORE rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) as defined by the Worksheet Substream [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf), which specifies an array of **SxIvdCol structures** (section [2.5.257](#Section_03b867b9584a4e89b0991e90fab1b304)).

The order that the **pivot fields** (section 2.2.5.4.3) and the optional **data field** (section 2.2.5.4.9.5.2) are referenced from the **SxIvd record** (section 2.4.292) specifies the order that the **pivot fields** (section 2.2.5.4.3) and the optional **data field** (section 2.2.5.4.9.5.2) display on the column axis. The order that the **pivot fields** (section 2.2.5.4.3) and the optional **data field** (section 2.2.5.4.9.5.2) display on the column axis corresponds to the order that the **pivot fields** (section 2.2.5.4.3) and the optional **data field** (section 2.2.5.4.9.5.2) are placed in the **column area** (section 2.2.5.4.10.1.2) of the **PivotTable report** (section 2.2.5).

For adjacent **SxIvdCol structures** (section 2.5.257) in the **rgSxivd** field of the **SxIvd record** (section 2.4.292), the **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) that the first **SxIvdCol references** (section 2.5.257)is defined to be an outer field with respect to the **pivot field** (section 2.2.5.4.3) or the **data field** (section 2.2.5.4.9.5.2) that the second **SxIvdCol references** (section 2.5.257). The **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) that the second **SxIvdCol references** (section 2.5.257) is defined to be an inner field with respect to the **pivot field** (section 2.2.5.4.3) or the **data field** (section 2.2.5.4.9.5.2) that the first **SxIvdCol references** (section 2.5.257).

For [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) **PivotTables** (section 2.2.5), all **SxIvdCol structures** (section 2.5.257) in the **rgSxivd** field of the **SxIvd record** (section 2.4.292) that reference **pivot fields** (section 2.2.5.4.3) that are associated with the same **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) MUST be adjacent. **Pivot fields** (section 2.2.5.4.3) associated with **member properties** (section [2.2.5.4.6](#Section_e5db3a66677f43db8fb038584797c95f)) of the **pivot hierarchy** (section 2.2.5.4.5) MUST be located on the column axis after other types of **pivot fields** (section 2.2.5.4.3) associated with the same **pivot hierarchy** (section 2.2.5.4.5). **Pivot fields** (section 2.2.5.4.3) not associated with **member properties** (section 2.2.5.4.6) of the **pivot hierarchy** (section 2.2.5.4.5) MUST appear on the column axis in an order such that the zero-based ordinal of the [**OLAP level**](#gt_00e48261-dfd3-4f32-b53f-91e2344d6168) of each **pivot field** (section 2.2.5.4.3) associated with the same **pivot hierarchy** (section 2.2.5.4.5) is ascending. The zero-based ordinal of the OLAP level of a **pivot field** (section 2.2.5.4.3) is specified by the **isxtl** field of the **SXVDTEx record** (section [2.4.311](#Section_1dcf2beeca2c4c3abd4278bc22c3043d)).

For OLAP **PivotTables** (section 2.2.5), the **SXTH record** (section [2.4.308](#Section_a1b4c45f245d474da2e2c087b572846f)) specifies information about a **pivot hierarchy** (section 2.2.5.4.5), including which axis the **pivot hierarchy** (section 2.2.5.4.5) is on.

See the [Nesting](#Section_7268e3daa5474b95a707fdcfc9f68c64) section for more information.

###### 2.2.5.4.9.4 Nesting

This section applies to both the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)) and **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)) unless otherwise specified. Within this section, axis means the **row axis** (section 2.2.5.4.9.2) or the **column axis** (section 2.2.5.4.9.3) as appropriate; fields means **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)), the **data field** (section [2.2.5.4.9.5.2](#Section_b4187a6caa2d4a9789bd26f394d67592)), or both on the axis; area means the in **row area** (section [2.2.5.4.10.1.1](#Section_5594c95e6819461e80706f4b4fdfa091)) and **column area** (section [2.2.5.4.10.1.2](#Section_03aced8c25864e83982a1e3551a563d6)) as appropriate; items means **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) or **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)) as appropriate.

The axes specify an order that the fields are represented in the areas, see the [PivotTable layout](#Section_2f81b5b422d546778ec53c5dc1ad80d4) section for more information about the areas. **Pivot lines** (section [2.2.5.4.10.3](#Section_76610990666f492791b6d2280f607464)) within the areas have references to items. Usually a **pivot line** (section 2.2.5.4.10.3) including an item of an outer field only includes items in the inner fields that exist with the item of the outer field in the **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)), subject to the filtering on the PivotTable view. Usually all the instances of an item in the area are grouped together, with grouping on the outer fields taking precedence over grouping on the inner fields. This process is called **nesting**.

A nested item group is specified to be the contiguous set of **pivot lines** (section 2.2.5.4.10.3) that have the same item in an outer field.

The following example shows nested item groups for Country, State and City.

| Country | State | City |
| --- | --- | --- |
| USA | Illinois | Chicago |
| USA | Illinois | Springfield |
| USA | Louisiana | New Orleans |
| USA | Louisiana | Baton Rouge |
| Mexico | Jalisco | Guadalajara |

The first two lines are a nested item group for Illinois. The next two lines are a nested item group for Louisiana. The first four lines are a nested item group for USA. The last line is both a nested item group for Jalisco and Mexico. Note that often in a **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) the repeated item labels will be omitted.

For an [**OLAP PivotTable view**](#Section_bbdb91f53cc644e4a812d5e06c977f6f) (section 2.2.5.4.2), nesting can be the result of either:

 Items in the inner field that are in a different **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)), or,

 Items in an inner pivot field that is associated with the same **pivot hierarchy** (section 2.2.5.4.5) and that are child OLAP members.

2.2.5.4.9.4.1 Collapsing

Settings in the file format can specify that a **pivot item** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) of an outer **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)), rather than having inner nested **pivot items** (section 2.2.5.4.4) of inner **pivot fields** (section 2.2.5.4.3), is collapsed. Usually when a **pivot item** (section 2.2.5.4.4) on an outer **pivot field** (section 2.2.5.4.3) is collapsed, it does not have a nested **pivot item** (section 2.2.5.4.4) group and when it appears in a **pivot line** (section [2.2.5.4.10.3](#Section_76610990666f492791b6d2280f607464)), the **pivot items** (section 2.2.5.4.4) of the inner **pivot fields** (section 2.2.5.4.3) for the collapsed **pivot item** (section 2.2.5.4.4) do not appear in the **pivot line** (section 2.2.5.4.10.3).

If Illinois and Mexico were collapsed in the preceding table, the result might look like the following table.

| Country | State | City |
| --- | --- | --- |
| USA | Illinois |  |
| USA | Louisiana | New Orleans |
| USA | Louisiana | Baton Rouge |
| Mexico |  |  |

For a non-**OLAP** **PivotTable view** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)), the collapsed state is specified by the **fHideDetail** field of the **SXVI record** (section [2.4.312](#Section_79769ad0d2134e6dbf34fb766907091c)).

For an **OLAP** **PivotTable views**(section 2.2.5.4.2), there are two types of collapsing: child **collapsing** and [**attribute hierarchy**](#gt_8f75d668-e8c6-4f42-ba44-d90604d3b9dc) **collapsing**.

Child **collapsing** is when the child **pivot items** (section 2.2.5.4.4), corresponding to child [**OLAP members**](#gt_c0dd6cb4-ad4b-45ef-bd4f-75c650f84f32), of a **pivot item** (section 2.2.5.4.4) corresponding to a parent OLAP member in an [**OLAP hierarchy**](#gt_1e0ca171-3095-4e3c-9c69-65148df00a9c) are not shown.

If a **pivot field** (section 2.2.5.4.3) is the first **pivot field** (section 2.2.5.4.3) of the **pivot hierarchy** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) on the axis then the **fDrilledLevel** field of the **SXVDTEx record** (section [2.4.311](#Section_1dcf2beeca2c4c3abd4278bc22c3043d)) **pivot field** (section 2.2.5.4.3) MUST be 1.

If a **pivot field** (section 2.2.5.4.3) is not the first **pivot field** (section 2.2.5.4.3) of the **pivot hierarchy** (section 2.2.5.4.5) on the axis and if the **fDrilledLevel** field of the **SXVDTEx record** (section 2.4.311)of the **pivot field** (section 2.2.5.4.3) is 1, then there is no child collapsing for the preceding **pivot field** (section 2.2.5.4.3) of the **pivot hierarchy** (section 2.2.5.4.5) on the axis and the **fDrilledMember** field of the **SXVIFlags structure** (section [2.5.263](#Section_ea598c0f7a8d4501be1cebc16f8c7a77)) for the **pivot items** (section 2.2.5.4.4) of the preceding **pivot field** (section 2.2.5.4.3) of the **pivot hierarchy** (section 2.2.5.4.5) on the axis MUST be 0. If a **pivot field** (section 2.2.5.4.3) is followed by another **pivot field** (section 2.2.5.4.3) of the same **pivot hierarchy** (section 2.2.5.4.5) on the axis, and the **fDrilledLevel** field of the **SXVDTEx record** (section 2.4.311) of the inner **pivot field** (section 2.2.5.4.3) is equal to 0 and the **fDrilledMember** field of the **SXVIFlags structure** (section 2.5.263) of the **pivot item** (section 2.2.5.4.4) of the outer **pivot field** (section 2.2.5.4.3) is 0, then the **pivot item** (section 2.2.5.4.4) associated with the **SXVIFlags structure** (section 2.5.263) is collapsed using child **collapsing**.

Attribute hierarchy **collapsing** only occurs when a **pivot field** (section 2.2.5.4.3) is associated with a **pivot hierarchy** (section 2.2.5.4.5) that is an attribute hierarchy and the **pivot field** (section 2.2.5.4.3) immediately following that outer **pivot field** (section 2.2.5.4.3) is associated with a different **pivot hierarchy** (section 2.2.5.4.5) that is an attribute hierarchy. In that case, if a **pivot item** (section 2.2.5.4.4) is attribute hierarchy collapsed, **pivot items** (section 2.2.5.4.4), corresponding to OLAP members, will not be shown for the inner **pivot field** (section 2.2.5.4.3). The attribute hierarchy collapsed state of a **pivot item** (section 2.2.5.4.4) is specified by the **fCollapsedMember** flag of the **SXVIFlags structure** (section 2.5.263). The **fItemsDrilledByDefault** flag of the **SXVDTEx record** (section 2.4.311) provides a default value for **pivot items** (section 2.2.5.4.4) in the **pivot field** (section 2.2.5.4.3).

For an **OLAP** **PivotTable view** (section 2.2.5.4.2), there can be **pivot items** (section 2.2.5.4.4) for an inner **pivot field** (section 2.2.5.4.3) on the **pivot line** (section 2.2.5.4.10.3) if either the outer **pivot field** (section 2.2.5.4.3) is collapsed and the inner **pivot field** (section 2.2.5.4.3) and outer **pivot field** (section 2.2.5.4.3) are in different **pivot hierarchies** (section 2.2.5.4.5) and attribute hierarchy **collapsing** is not being used or if the **pivot items** (section 2.2.5.4.4) are **member properties** (section [2.2.5.4.6](#Section_e5db3a66677f43db8fb038584797c95f)).

2.2.5.4.9.4.2 Subtotalling

A nested item group, as specified in the [Nesting](#Section_7268e3daa5474b95a707fdcfc9f68c64) section, can have summaries of the values for the items in the nested item group, called subtotals. A subtotal is typically an aggregation such as a sum, count or average of the values of the items.

The creation of subtotals is specified by the **fDefault**, **fSum**, **fCounta**, **fAverage**, **fMax**, **fMin**, **fProduct**, **fCount**, **fStdev**, **fStdevp**, **fVariance** and **fVariancep** fields of the **Sxvd record** (section [2.4.309](#Section_6f48271ee32547ea9efe9c197d0fb8e6)) of the **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)). If none of the fields are equal to 1, then no subtotals exist for the **pivot field** (section 2.2.5.4.3). If the **fDefault** field is equal to 1 the subtotal calculation for each item is done according to the [**aggregation functions**](#gt_f9b44a9d-68c4-4a28-b347-cce9eb5f8845) of the **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)) on the **data axis** (section [2.2.5.4.9.5](#Section_4c5c2daa289746e1854b0ce04209f060)), as specified by the **iiftab** field of the **SXDI record** (section [2.4.278](#Section_4143b9eec91a443c83e82185e75cb7b5)) for each **data item** (section 2.2.5.4.9.5.1).

For example, the subtotal is calculated as the sum of the relevant values of the nested item group for a **data item** (section 2.2.5.4.9.5.1) with a sum aggregation function and subtotal is calculated as the average of the relevant values of the nested item group for a **data item** (section 2.2.5.4.9.5.1) with an average aggregation function.

The other subtotal fields are called custom subtotals because they override the **data item** (section 2.2.5.4.9.5.1) aggregation function when calculating subtotals.

In some cases, such as for certain **OLAP** **PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)), the **source data** (section [2.2.5.3.2](#Section_e65bff19ea464f3b9798d8d2db9202b4)) is not able to provide a requested subtotal.

The **fOutline** field of the **SXVDEx record** (section [2.4.310](#Section_07ecd5c3e40e44ffbf1a0a473659a5cf)) specifies that an extra **pivot line** (section [2.2.5.4.10.3](#Section_76610990666f492791b6d2280f607464)) is added at the logical top of the nested item groups if the **pivot field** (section 2.2.5.4.3) is on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)). This **pivot line** (section 2.2.5.4.10.3) contains the item and any items of **member properties** (section [2.2.5.4.6](#Section_e5db3a66677f43db8fb038584797c95f)) **pivot fields** (section 2.2.5.4.3), if they are shown, but no other items for inner **pivot fields** (section 2.2.5.4.3) of this **pivot field** (section 2.2.5.4.3).

The **fOutlineData** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section [2.4.273.109](#Section_c4888328f46743bb8ad960ff62f1d364)) specifies that an extra **pivot line** (section 2.2.5.4.10.3) is added at the logical top of the nested item groups if the **data field** (section [2.2.5.4.9.5.2](#Section_b4187a6caa2d4a9789bd26f394d67592)) is on the **row axis** (section 2.2.5.4.9.2). This **pivot line** (section 2.2.5.4.10.3) contains the **data item** (section 2.2.5.4.9.5.1), but no other items for inner **pivot fields** (section 2.2.5.4.3) of this **data field** (section 2.2.5.4.9.5.2).

If the **fDefault** field of the **Sxvd record** (section 2.4.309) of the **pivot field** (section 2.2.5.4.3) is equal to 1, the **fOutline** field of the **SXVDEx record** (section 2.4.310) of the **pivot field** (section 2.2.5.4.3) is equal to 1, the **pivot field** (section 2.2.5.4.3) is on the **row axis** (section 2.2.5.4.9.2), and the **data field** (section 2.2.5.4.9.5.2) is not placed inner of the **pivot field** (section 2.2.5.4.3) on the **row axis** (section 2.2.5.4.9.2), then the following is specified for the **fSubtotalAtTop** field of the **SXVDEx record** (section 2.4.310) of the **pivot field** (section 2.2.5.4.3):

| Value of fSubtotalAtTop | Meaning |
| --- | --- |
| 0x0 | Specifies that subtotal **pivot lines** (section 2.2.5.4.10.3) are added at the bottom of the nested item groups. See the **subName.stSubName** field of the **SXVDEx record** (section 2.4.310) for details of the label used. |
| 0x1 | Specifies that the **pivot lines** (section 2.2.5.4.10.3) added as specified by the **fOutline** flag of the **SXVDEx record** (section 2.4.310) being equal to 1 are used for displaying the subtotals in the **data area** (section [2.2.5.4.10.1.4](#Section_237a24905c614931923f7ee856f23c72)). |

In the following figure, the Category, Subcategory, and Product columns represent **pivot fields** (section 2.2.5.4.3) on the **row axis** (section 2.2.5.4.9.2) and the Color column represents a **member properties** (section 2.2.5.4.6) **pivot field** (section 2.2.5.4.3) associated with the Product **pivot field** (section 2.2.5.4.3). Subtotals are displayed at the logical top of the nested item groups for Clothing, Caps, and Gloves.



Figure 14: PivotTable report with Category and Subcategory pivot fields with fOutline and fSubtotalAtTop fields of the SXVDEx record equal to 1

###### 2.2.5.4.9.5 Data Axis

The **data axis** contains the **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) values that are used to populate the **data area** (section [2.2.5.4.10.1.4](#Section_237a24905c614931923f7ee856f23c72)) of the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) as specified by the [PivotTable Layout](#Section_2f81b5b422d546778ec53c5dc1ad80d4) section. The **data axis** also specifies additional information related to summarizing and presenting the values as specified by the [Data Items](#Section_b51aa7b309b34aa78cb4964ad24d1679) section. The **data axis** is specified by the collection of **SXDI records** (section [2.4.278](#Section_4143b9eec91a443c83e82185e75cb7b5)) that conform to the **PIVOTCORE rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) as defined by the Worksheet Substream [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

2.2.5.4.9.5.1 Data Items

A **data item** is a **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) placed on the **data axis** (section [2.2.5.4.9.5](#Section_4c5c2daa289746e1854b0ce04209f060)). Each **data item** is specified by an **SXDI record** (section [2.4.278](#Section_4143b9eec91a443c83e82185e75cb7b5)).

The **isxvdData** field of the **SXDI record** (section 2.4.278) specifies a reference to the **pivot field** (section 2.2.5.4.3) that is associated with a **data item**. It also specifies additional information that is used to produce or present summarized values.

A **data item** can be referenced by a data item index, which is the zero-based index of an **SXDI record** (section 2.4.278) in the sequence of records that conforms to the **PIVOTCORE rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) as defined by the Worksheet Substream [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf).

2.2.5.4.9.5.2 Data Field

The **data field** is a conceptual field that represents all **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)) and enables them to be referenced as a single object. The **data field** is intended to enable all **data items** (section 2.2.5.4.9.5.1) to be placed on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)) or **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)).

If the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) has more than one **data item** (section 2.2.5.4.9.5.1), then the **data field** MUST be located on either the **row axis** (section 2.2.5.4.9.2) as specified by the **rgSxivd** field of the first **SxIvd record** (section [2.4.292](#Section_72c54b06c9254140b6dbdf133439e596)), or the **column axis** (section 2.2.5.4.9.3) as specified by the **rgSxivd** field of the second **SxIvd record** (section 2.4.292).

##### 2.2.5.4.10 PivotTable Layout

The **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) in the [**sheet (2)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) has four main areas: the **row area** (section [2.2.5.4.10.1.1](#Section_5594c95e6819461e80706f4b4fdfa091)), the **column area** (section [2.2.5.4.10.1.2](#Section_03aced8c25864e83982a1e3551a563d6)), the **data area** (section [2.2.5.4.10.1.4](#Section_237a24905c614931923f7ee856f23c72)), and the **page area** (section [2.2.5.4.10.1.3](#Section_f10ef7d86c044d35a5830d6f2ce92063)).

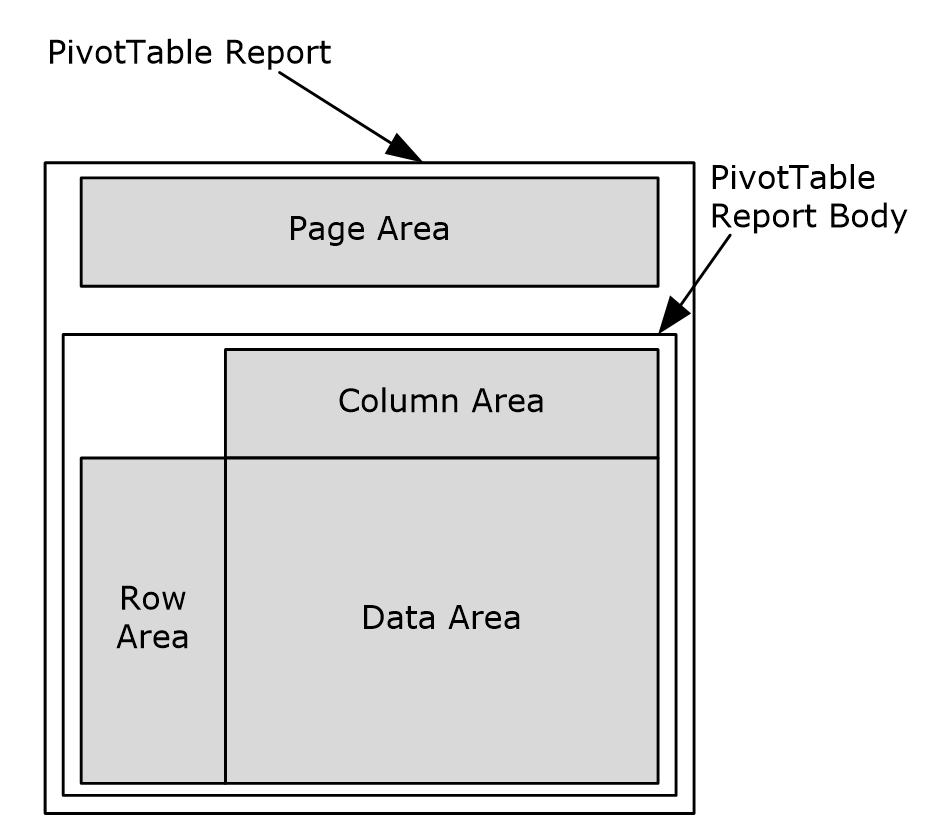


Figure 15: PivotTable report illustrating the four different areas

All the records described here MUST exist in the same **worksheet substream** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)).

###### 2.2.5.4.10.1 Location and Body

The **column area** (section [2.2.5.4.10.1.2](#Section_03aced8c25864e83982a1e3551a563d6)) is located immediately above the **data area** (section [2.2.5.4.10.1.4](#Section_237a24905c614931923f7ee856f23c72)). The [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) in the **column area** (section 2.2.5.4.10.1.2) containing the **pivot item** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) [**caption**](#gt_81d81412-1575-4084-ba61-742de406b418) or **data item** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)) caption to the farthest [**logical left**](#gt_ccc2ab6c-db9b-4c67-9b95-21ce79e7358d) is in the same column as the [**logical top-left**](#gt_88b25c47-61c2-44de-abb0-12ea3348a412) cell of the **data area** (section 2.2.5.4.10.1.4).

The **row area** (section [2.2.5.4.10.1.1](#Section_5594c95e6819461e80706f4b4fdfa091)) is located immediately to the logical left of the **data area** (section 2.2.5.4.10.1.4). The cell in the **row area** (section 2.2.5.4.10.1.1) containing the top-most **pivot item** (section 2.2.5.4.4) caption or **data item** (section 2.2.5.4.9.5.1) caption is in the same row as the logical top-left cell of the **data area** (section 2.2.5.4.10.1.4).

The **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) body is the rectangular area defined by the union of the **row area** (section 2.2.5.4.10.1.1), **column area** (section 2.2.5.4.10.1.2), and **data area** (section 2.2.5.4.10.1.4).

The **page area** (section [2.2.5.4.10.1.3](#Section_f10ef7d86c044d35a5830d6f2ce92063)), if it is not empty, is located above the **PivotTable report** (section 2.2.5) body. There is one row between the top-most cell of the **PivotTable report** (section 2.2.5) body and the bottom-most cell of the **page area** (section 2.2.5.4.10.1.3).

The **PivotTable report** (section 2.2.5) is a [**non-contiguous range**](#gt_3c4e66c6-ccfd-405c-ad82-5d30098d09d6) containing the union of the **PivotTable report** (section 2.2.5) body and the **page area** (section 2.2.5.4.10.1.3).

An [SxView](#Section_fcf246969b7b45a2b48a4199d26fb41b) record and the **SXEx record** (section [2.4.282](#Section_a758cb8447e340398a6cbbe32a3120ba)) specify details about the location of the **PivotTable report** (section 2.2.5) in the [**sheet**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) and the sizes of the areas of the **PivotTable report** (section 2.2.5) as specified by the following. All fields are of the **SxView record** (section 2.4.313) unless otherwise specified.

The **column area** (section 2.2.5.4.10.1.2) of the **PivotTable report** (section 2.2.5) is specified to be the following range of cells:

| Column Area | Row or Column Index |
| --- | --- |
| Top row | **ref.rwFirst** |
| Bottom row | **rwFirstData** – 1 |
| Logical left column | **colFirstData** |
| Logical right column | **ref.colLast** |

If **colFirstData** is greater than **ref**.**colLast**, the **column area** (section 2.2.5.4.10.1.2) does not exist for this **PivotTable report** (section 2.2.5).

The **row area** (section 2.2.5.4.10.1.1) of the **PivotTable report** (section 2.2.5) is specified to be the following range of cells:

| Row Area | Row or Column Index |
| --- | --- |
| Top row | **rwFirstData** |
| Bottom row | **ref.rwLast** |
| Logical left column | **ref.colFirst** |
| Logical right column | **colFirstData** – 1 |

If **colFirstData** – 1 is less than **rfxGeom**.**colFirstData**, the **row area** (section 2.2.5.4.10.1.1) does not exist for this **PivotTable report** (section 2.2.5).

The **data area** (section 2.2.5.4.10.1.4) of the **PivotTable report** (section 2.2.5) is specified to be the following range of cells:

| Data Area | Row or Column Index |
| --- | --- |
| Top row | **rwFirstData** |
| Bottom row | **ref.rwLast** |
| Logical left column | **colFirstData** |
| Logical right column | **ref.colLast** |

If the **row area** (section 2.2.5.4.10.1.1) or the **column area** (section 2.2.5.4.10.1.2) does not exist for this **PivotTable report** (section 2.2.5), the **data area** (section 2.2.5.4.10.1.4) does not exist for this **PivotTable report** (section 2.2.5).

The **page area** (section 2.2.5.4.10.1.3) of the **PivotTable report** (section 2.2.5) is specified to be the following range of cells. The **cRwPage** field and the **cColPage** field are of the **SXEx record** (section 2.4.282):

| Page Area | Row or Column Index |
| --- | --- |
| Top row | **ref.rwFirst** – **cRwPage** – 1 |
| Bottom row | **ref.rwFirst** – 2 |
| Logical left column | **ref.colFirst** |
| Logical right column | **ref.colFirst** + **cColPage** – 1 |

If the **cRwPage** field of the **SXEx record** (section 2.4.282) is equal to 0 and the **fNewDropZones** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section [2.4.273.109](#Section_c4888328f46743bb8ad960ff62f1d364)) is equal to 1 the **page area** (section 2.2.5.4.10.1.3) does not exist for this **PivotTable report** (section 2.2.5).

If the **cRwPage** field is equal to 0 and the **fNewDropZones** field is equal to 0, then the **page area** (section 2.2.5.4.10.1.3) of the **PivotTable report** (section 2.2.5) is specified to be the following [**range**](#gt_c2c93fec-8d3e-45de-8010-c738cc1cea99) of cells:

| Page Area | Row or Column Index |
| --- | --- |
| Top row | **ref.rwFirst** - 2 |
| Bottom row | **ref.rwFirst** - 2 |
| Logical left column | **ref.colFirst** |
| Logical right column | **ref.colLast** |

2.2.5.4.10.1.1 Row Area

The **row area** contains **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)), the optional **data field** (section [2.2.5.4.9.5.2](#Section_b4187a6caa2d4a9789bd26f394d67592)), or both that are placed on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)), along with associated **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) and **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)). The first row of the **row area** can contain **pivot field** (section 2.2.5.4.3) captions, **data field** (section 2.2.5.4.9.5.2) captions, or both as specified by the **fNoHeaders** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section [2.4.273.109](#Section_c4888328f46743bb8ad960ff62f1d364)). If the **fNoHeaders** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section 2.4.273.109) is equal to 0 or the **SXAddl\_SXCView\_SXDVer12Info record** (section 2.4.273.109) is not present, the **pivot field** (section 2.2.5.4.3) and **data field** (section 2.2.5.4.9.5.2) captions are located above their **pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1).

**Pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1) of the **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) that has a position of 0 on the **row axis** (section 2.2.5.4.9.2) are placed in the first column of the **row area**. For every other **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) on the **row axis** (section 2.2.5.4.9.2), placement of **pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1) are calculated as follows:

 If the previous **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) is not in [**compact axis**](#gt_87303118-9ef7-437d-914a-2ad9964b5e81) mode, then **pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1) of the current **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) are placed in the next column of the **row area**. **Pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1) are grouped by the parent **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1), which is the **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1) on the immediate [**logical left**](#gt_ccc2ab6c-db9b-4c67-9b95-21ce79e7358d). To achieve this, **pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1) of the parent **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) can be repeated multiple times. In this case, when **pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1) are repeated, the caption is not necessarily displayed in every [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) that contains a **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1). For more details, see the [Pivot Lines](#Section_76610990666f492791b6d2280f607464) section.

 If the previous **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) is in compact axis mode, then the **pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1) of the current **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) are placed in the same column as **pivot items** (section 2.2.5.4.4) of the previous **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2). **Pivot items** (section 2.2.5.4.4) or **data items** (section 2.2.5.4.9.5.1) are grouped by the parent **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1) and placed immediately under the parent **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1).

For the **data field** (section 2.2.5.4.9.5.2), if the **fCompactData** field and the **fOutlineData** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section 2.4.273.109) are equal to 1, this specifies that the **data field** (section 2.2.5.4.9.5.2) is in compact axis mode. If the **SXAddl\_SXCView\_SXDVer12Info** (section 2.4.273.109) is not present, the **data field** (section 2.2.5.4.9.5.2) is not in compact axis mode.

For **pivot fields** (section 2.2.5.4.3), if the **fCompact** flag on the **SXAddl\_SXCField12\_SXDVer12Info record** (section [2.4.273.33](#Section_f7f523c98b2d4eea993b80f272c83a30)) is equal to 1 and **fOutline** field of the [SXVDEx](#Section_07ecd5c3e40e44ffbf1a0a473659a5cf) record is equal to 1, this specifies that the **pivot field** (section 2.2.5.4.3) is in compact axis mode. If the **SXAddl\_SXCField12\_SXDVer12Info record** (section 2.4.273.33) is not present, the **pivot field** (section 2.2.5.4.3) is not in compact axis mode.

The **row area** can have special entries at the end for [**grand totals**](#gt_417eeaf5-caef-4fc3-afe1-048db5482eb7). If there are no **pivot fields** (section 2.2.5.4.3) and no **data field** (section 2.2.5.4.9.5.2) on the **row axis** (section 2.2.5.4.9.2), then the **row area** is empty.

2.2.5.4.10.1.2 Column Area

The **column area** contains **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)), the optional **data field** (section [2.2.5.4.9.5.2](#Section_b4187a6caa2d4a9789bd26f394d67592)), or both placed on the **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)), along with associated **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) or **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)). The first row of the **column area** can contain **pivot field** (section 2.2.5.4.3) captions, **data field** (section 2.2.5.4.9.5.2) captions, or both as specified by the **fNoHeaders** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section [2.4.273.109](#Section_c4888328f46743bb8ad960ff62f1d364)).

If the **fNoHeaders** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section 2.4.273.109) is equal to 0, and no **pivot fields** (section 2.2.5.4.3) are in [**compact axis**](#gt_87303118-9ef7-437d-914a-2ad9964b5e81) mode, and the **data field** (section 2.2.5.4.9.5.2) is not in compact axis mode, then the **pivot field** (section 2.2.5.4.3) and **data field** (section 2.2.5.4.9.5.2) captions are placed sequentially in [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) of the first row of the **column area** according to their placement on the **column axis** (section 2.2.5.4.9.3).

If the **fNoHeaders** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section 2.4.273.109) is equal to 0, and any **pivot field** (section 2.2.5.4.3) is in compact axis mode or the **data field** (section 2.2.5.4.9.5.2) is in compact axis mode, the **pivot field** (section 2.2.5.4.3) and **data field** (section 2.2.5.4.9.5.2) captions are placed in the top [**logical left**](#gt_ccc2ab6c-db9b-4c67-9b95-21ce79e7358d) cell of the **column area**.

For the **data field** (section 2.2.5.4.9.5.2), if the **fCompactData** field and the **fOutlineData** field of the **SXAddl\_SXCView\_SXDVer12Info record** (section 2.4.273.109) are equal to 1, this specifies that the **data field** (section 2.2.5.4.9.5.2) is in compact axis mode. If the **SXAddl\_SXCView\_SXDVer12Info record** (section 2.4.273.109) is not present, the **data field** (section 2.2.5.4.9.5.2) is not in compact axis mode.

For **pivot fields** (section 2.2.5.4.3), if the **fCompact** flag on the **SXAddl\_SXCField12\_SXDVer12Info record** (section [2.4.273.33](#Section_f7f523c98b2d4eea993b80f272c83a30)) is equal to 1 and **fOutline** field of the [SXVDEx](#Section_07ecd5c3e40e44ffbf1a0a473659a5cf) record is equal to 1, this specifies that the **pivot field** (section 2.2.5.4.3) is in compact axis mode. If the **SXAddl\_SXCField12\_SXDVer12Info record** (section 2.4.273.33) is not present, the **pivot field** (section 2.2.5.4.3) is not in compact axis mode.

The second row in the **column area** contains **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1) labels for the **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) placed first on the **column axis** (section 2.2.5.4.9.3), and each subsequent row contains the **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1) labels for **pivot fields** (section 2.2.5.4.3) or **data fields** (section 2.2.5.4.9.5.2) that occur later on the **column axis** (section 2.2.5.4.9.3). The row containing **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1) labels for the **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) at position *n* is row (*n* +1) of the **column area**.

If the **fNoHeaders** field is equal to 1, the **pivot field** (section 2.2.5.4.3) and **data field** (section 2.2.5.4.9.5.2) captions are not displayed. The row containing **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1) labels for the **pivot field** (section 2.2.5.4.3) or **data field** (section 2.2.5.4.9.5.2) at position *n* on the **column axis** (section 2.2.5.4.9.3) is row *n* of the **column area**.

The **column area** can have special entries at the end for [**grand totals**](#gt_417eeaf5-caef-4fc3-afe1-048db5482eb7).

2.2.5.4.10.1.3 Page Area

The **page area** contains **pivot fields** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) that are placed on the **page axis** (section [2.2.5.4.9.1](#Section_ff63f3d9274542878e6e11120ecf30b7)) for non-**OLAP** **PivotTable views** (section [2.2.5.4.2](#Section_bbdb91f53cc644e4a812d5e06c977f6f)) and **pivot hierarchies** (section [2.2.5.4.5](#Section_54818c671590494084e0c3ff8b433c33)) that are placed on the **page axis** (section 2.2.5.4.9.1) for **OLAP** **PivotTable views** (section 2.2.5.4.2). For each **pivot field** (section 2.2.5.4.3) or **pivot hierarchy** (section 2.2.5.4.5) on the **page axis** (section 2.2.5.4.9.1), the page area contains a caption and information about the current filtering associated with the **pivot field** (section 2.2.5.4.3) or **pivot hierarchy** (section 2.2.5.4.5) in the next [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) at the [**logical right**](#gt_ef86cf61-a2e3-4130-abc4-9e92dae5a2a7). The relative position of pairs of caption and filtering information is specified by the **SxView record** (section [2.4.313](#Section_fcf246969b7b45a2b48a4199d26fb41b)) and the **SXEx record** (section [2.4.282](#Section_a758cb8447e340398a6cbbe32a3120ba)). For more details, see the [Location and Body](#Section_7f7d9d76a55041d9ae9f0d8539cc09f8) section.

2.2.5.4.10.1.4 Data Area

The **data area** contains summarized values for the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)). [**Cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) in the **data area** contain summarized values for associated **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)). The summarized value in a cell is restricted by all the **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)) in the **column area** (section [2.2.5.4.10.1.2](#Section_03aced8c25864e83982a1e3551a563d6)) that are located in the same column, by all the **pivot items** (section 2.2.5.4.4) in the **row area** (section [2.2.5.4.10.1.1](#Section_5594c95e6819461e80706f4b4fdfa091)) that are located in the same row, and by any page filter applied, as specified in the [Page Axis](#Section_ff63f3d9274542878e6e11120ecf30b7) section.

If the **row area** (section 2.2.5.4.10.1.1) has a [**grand total**](#gt_417eeaf5-caef-4fc3-afe1-048db5482eb7), then the value in that row is not restricted by **pivot items** (section 2.2.5.4.4) from the **row area** (section 2.2.5.4.10.1.1). If the **column area** (section 2.2.5.4.10.1.2) has a grand total, then the value in that column is not restricted by **pivot items** (section 2.2.5.4.4) from the **column area** (section 2.2.5.4.10.1.2). If the **PivotTable view** (section 2.2.5.4) has more than one **data item** (section 2.2.5.4.9.5.1), then the associated **data item** (section 2.2.5.4.9.5.1) is the one that is located in the same column in the **column area** (section 2.2.5.4.10.1.2) or the same row in the **row area** (section 2.2.5.4.10.1.1) as the cell with the summarized value.

If a **PivotTable view** (section 2.2.5.4) has zero **data items** (section 2.2.5.4.9.5.1) then the **data area** is empty.

###### 2.2.5.4.10.2 Truncation

When a **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)) does not fit within the boundaries of the [**sheet (2)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) it is truncated from the [**logical right**](#gt_ef86cf61-a2e3-4130-abc4-9e92dae5a2a7) and the bottom. It is truncated such that a part of the **PivotTable report** (section 2.2.5) is displayed within the sheet boundaries.

###### 2.2.5.4.10.3 Pivot Lines

A **pivot line** specifies a collection of **pivot line entries** (section [2.2.5.4.10.4](#Section_ecba812f4a31495ebeb46749e5897f2d)) for a single row or column in the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)).

A **pivot line** in the **column area** (section [2.2.5.4.10.1.2](#Section_03aced8c25864e83982a1e3551a563d6)) is the [**range**](#gt_c2c93fec-8d3e-45de-8010-c738cc1cea99) defined by the intersection of:

 A column.

 A set of [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) in the **column area** (section 2.2.5.4.10.1.2). These are cells that contain **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)), **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)), blank cells, or a [**grand total**](#gt_417eeaf5-caef-4fc3-afe1-048db5482eb7).

A **pivot line** in the **row area** (section [2.2.5.4.10.1.1](#Section_5594c95e6819461e80706f4b4fdfa091)) is the range defined by the intersection of:

 A row.

 A set of cells in the **row area** (section 2.2.5.4.10.1.1). These are cells that contain **pivot items** (section 2.2.5.4.4), **data items** (section 2.2.5.4.9.5.1), blank cells, or a grand total.

A **pivot line** is specified by a sequence of records that conforms to the **PIVOTLI rule** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)). If either the **cRw** field or the **cCol** field of the associated **SxView record** (section [2.4.313](#Section_fcf246969b7b45a2b48a4199d26fb41b)) is greater than 0, then two **PIVOTLI rules** (section 2.1.7.20.5) MUST exist in the sequence of records that conforms to the **PIVOTCORE rule** (section 2.1.7.20.5), otherwise a **PIVOTLI rule** (section 2.1.7.20.5) MUST NOT exist in the **PIVOTCORE rule** (section 2.1.7.20.5).

If **PIVOTLI rules** (section 2.1.7.20.5) for a **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)) exist, the first **PIVOTLI rule** (section 2.1.7.20.5) specifies the collection of **pivot lines** for the **row area** (section 2.2.5.4.10.1.1). The order of the **SXLIItem structures** (section [2.5.259](#Section_f978b7c5d80f415dbea83922ccbcb723)) in the **rgsxli** field of the **SXLI record** (section [2.4.293](#Section_ecd011a31ac1437997888aace5299d40)) specifies the top to bottom order of the **pivot lines** of the **row area** (section 2.2.5.4.10.1.1).

If **PIVOTLI rules** (section 2.1.7.20.5) for a **PivotTable view** (section 2.2.5.4) exist, the second **PIVOTLI rule** (section 2.1.7.20.5) specifies the collection of **pivot lines** for the **column area** (section 2.2.5.4.10.1.2). The order of the **SXLIItem structures** (section 2.5.259) in the **rgsxli** field of the **SXLI record** (section 2.4.293) specifies the [**logical left**](#gt_ccc2ab6c-db9b-4c67-9b95-21ce79e7358d) to [**logical right**](#gt_ef86cf61-a2e3-4130-abc4-9e92dae5a2a7) order of the **pivot lines** of the **column area** (section 2.2.5.4.10.1.2).

Each individual **pivot line** is specified by an **SXLIItem structure** (section 2.5.259) in the **rgsxli** field of the associated **SXLI record** (section 2.4.293). Each **pivot line** contains a number of **pivot line entries** (section 2.2.5.4.10.4). **Pivot line entries** (section 2.2.5.4.10.4) are specified by the **rgisxvi** field of the **SXLIItem structure** (section 2.5.259).

The first **pivot line** in the **row area** (section 2.2.5.4.10.1.1) or the **column area** (section 2.2.5.4.10.1.2) MUST have a **cSic** field of its associated **SXLIItem structure** (section 2.5.259) equal to 0.

The following shows an example of a **PivotTable report** (section 2.2.5) and the pivot lines corresponding to each row in the **row area** (section 2.2.5.4.10.1.1).

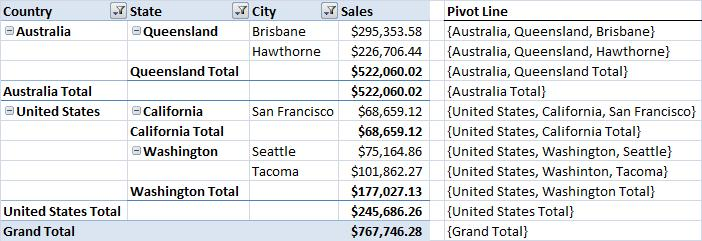


Figure 16: PivotTable and a table illustrating each pivot line

###### 2.2.5.4.10.4 Pivot Line Entries

**Pivot line entries** specify references to the **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)), **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)), or blank items of a **pivot line** (section [2.2.5.4.10.3](#Section_76610990666f492791b6d2280f607464)). **Pivot line entries** are specified by the records that conform to the **PIVOTLI rules** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)) in the **PIVOTCORE rule** (section 2.1.7.20.5). A **pivot line entry** is an element in the array specified by the **rgisxvi** field of the **SXLIItem structure** (section [2.5.259](#Section_f978b7c5d80f415dbea83922ccbcb723)).

All **pivot line entries** that have an index less than the value specified by the **cSic** field of the **SXLIItem structure** (section 2.5.259) of a given **pivot line** (section 2.2.5.4.10.3) are identical to those of the **pivot line** (section 2.2.5.4.10.3) preceding the given **pivot line** (section 2.2.5.4.10.3).

For the purposes of the rest of this section, *n* specifies a position of the **pivot line entry** of a given **pivot line** (section 2.2.5.4.10.3).

If the value of *n* is less than the **cSic** field of the **SXLIItem structure** (section 2.5.259) of a given **pivot line** (section 2.2.5.4.10.3), then the **pivot line entry** at position *n* is identical to the corresponding **pivot line entry** of the **pivot line** (section 2.2.5.4.10.3) preceding the given **pivot line** (section 2.2.5.4.10.3).

If the value of *n* is greater than or equal to the **cSic** field of the **SXLIItem structure** (section 2.5.259) of a given **pivot line** (section 2.2.5.4.10.3), then the value of *n* is equal to the sum of the **cSic** field of the **SXLIItem structure** (section 2.5.259) and the current index in the **rgisxvi** field of the **SXLIItem structure** (section 2.5.259) of the given **pivot line** (section 2.2.5.4.10.3).

If a **pivot line entry** is in a **pivot line** (section 2.2.5.4.10.3) in the **row area** (section [2.2.5.4.10.1.1](#Section_5594c95e6819461e80706f4b4fdfa091)), each **pivot line entry** at a position *n* specifies a **pivot item** (section 2.2.5.4.4) index of a **pivot item** (section 2.2.5.4.4) in the *n*th **pivot field** (section [2.2.5.4.3](#Section_1edf7f2294084945b2de56526c14fca5)) on the **row axis** (section [2.2.5.4.9.2](#Section_3f46e7207706400cba9473cb829f869a)) or specifies a **data item** (section 2.2.5.4.9.5.1) index, if the *n*th field of the **row axis** (section 2.2.5.4.9.2) is the **data field** (section [2.2.5.4.9.5.2](#Section_b4187a6caa2d4a9789bd26f394d67592)).

If a **pivot line entry** is in a **pivot line** (section 2.2.5.4.10.3) in the **column area** (section [2.2.5.4.10.1.2](#Section_03aced8c25864e83982a1e3551a563d6)), each pivot line entry at a position *n* specifies the **pivot item** (section 2.2.5.4.4) index of a **pivot item** (section 2.2.5.4.4) in the *n*th **pivot field** (section 2.2.5.4.3) on the **column axis** (section [2.2.5.4.9.3](#Section_00d9d88b8fa74bf08446584bf651677f)) or specifies a **data item** (section 2.2.5.4.9.5.1) index, if the *n*th field on the **column area** (section 2.2.5.4.10.1.2) is the **data field** (section 2.2.5.4.9.5.2).

If the *n*th **pivot field** (section 2.2.5.4.3) on the **row axis** (section 2.2.5.4.9.2) or **column axis** (section 2.2.5.4.9.3) is the **data field** (section 2.2.5.4.9.5.2), the **pivot line entry** is a **data items** (section 2.2.5.4.9.5.1) index, as specified by the Data Items section.

**Pivot items** (section 2.2.5.4.4) are specified sequentially from [**logical left**](#gt_ccc2ab6c-db9b-4c67-9b95-21ce79e7358d) to [**logical right**](#gt_ef86cf61-a2e3-4130-abc4-9e92dae5a2a7) for row **pivot lines** (section 2.2.5.4.10.3), and from top to bottom for column **pivot lines** (section 2.2.5.4.10.3).

A value of 0x7FFF is used to specify the absence of a **pivot item** (section 2.2.5.4.4) or **data item** (section 2.2.5.4.9.5.1).

##### 2.2.5.4.11 PivotTable Rules

A **PivotTable rule** is used to specify [**ranges**](#gt_c2c93fec-8d3e-45de-8010-c738cc1cea99) of [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) in the **PivotTable report** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)). A **PivotTable rule** is specified by the sequence of records that conform to the **PIVOTRULE rule** (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)) or by an **SxcSXRule class** (section [2.2.5.1.1.1.11](#Section_dd12edef6e8747379bed6f4ceff33127)). Each **PivotTable rule** has references to specific area of a **PivotTable report** (section 2.2.5), [**pivot fields**](#Section_1edf7f2294084945b2de56526c14fca5)  (section 2.2.5.4.3), **pivot items** (section [2.2.5.4.4](#Section_58891cc5dd9b4293a97831070779524f)), **data items** (section [2.2.5.4.9.5.1](#Section_b51aa7b309b34aa78cb4964ad24d1679)), or **cache items** (section [2.2.5.3.6](#Section_bdf43e0d59a04111aec09b0a6d3882a0)). These references are used to determine the ranges of cells in the **PivotTable report** (section 2.2.5). The various areas of the **PivotTable report** (section 2.2.5) specified in the [Location and Body](#Section_7f7d9d76a55041d9ae9f0d8539cc09f8) section and the **pivot lines** (section [2.2.5.4.10.3](#Section_76610990666f492791b6d2280f607464)) can be used in this determination.

The **SxRule** (section [2.4.301](#Section_1f7e8f8c74ff4a6587476faf9b4c58a9)) or **SXAddl\_SXCSXrule\_SXDSXrule** (section [2.4.273.99](#Section_4a44c5299646401e92b294601cef1455)) records specify information for a **PivotTable rule**, including restrictions such as what areas of the **PivotTable report** (section 2.2.5) the **PivotTable rule** applies to. In the case of the **SxRule record** (section 2.4.301) the fCacheBased field specifies whether the **PivotTable rule** specifies **cache items** (section 2.2.5.3.6) instead of **pivot items** (section 2.2.5.4.4).

A **PivotTable rule** can have PivotTable rule filters. A PivotTable rule filter is specified by the sequence of records that conform to a **PRFILTER rule** (section 2.1.7.20.6) or an **SxcSXFilt class** (section [2.2.5.1.1.1.12](#Section_22611924dd5649078c7ab385cd2ccdc0)). A PivotTable rule filter specifies a set of **pivot items** (section 2.2.5.4.4), **data items** (section 2.2.5.4.9.5.1), or **cache items** (section 2.2.5.3.6) for an individual **pivot field** (section 2.2.5.4.3), **data field** (section [2.2.5.4.9.5.2](#Section_b4187a6caa2d4a9789bd26f394d67592)), or **cache field** (section [2.2.5.3.5](#Section_6497eb794042445780e75959c9f0583c)).

Ranges of cells that are associated, in the **PivotTable report** (section 2.2.5), with any **pivot item** (section 2.2.5.4.4), **data item** (section 2.2.5.4.9.5.1), or **cache item** (section 2.2.5.3.6) from a PivotTable rule filter and that meet other restrictions as specified by the **SxFilt** (section [2.4.285](#Section_c7274a7468334fcebf62d4d4091e243d)) or **SXAddl\_SXCSXfilt\_SXDSXfilt** (section [2.4.273.77](#Section_c3dfcd7c1cbd4fea9140ab36ce97d1c6)) record are associated with the PivotTable rule filter. Ranges of cells that are associated with every PivotTable rule filter of the PivotTable **rule** and that meet other restrictions of the **PivotTable rule** are the ranges of cells specified by the **PivotTable rule**.

A range of cells is associated with a particular **cache item** (section 2.2.5.3.6) if it is associated with the **pivot item** (section 2.2.5.4.4) that has an association with that **cache item** (section 2.2.5.3.6).

### 2.2.6 Styles

This overview describes how formatting and protection information for [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) in a [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) is specified.

Cell formatting is composed of several sets of properties:

 [**Font**](#gt_f8aa3f46-99d1-49bb-858f-b4bfa546c1c2) properties (bold, italic, font color, font size, etc…)

 [**Fill**](#gt_215c1c51-d5ef-46af-8596-d7ef63c1fe89) properties ([**foreground color**](#gt_6710b91a-10b4-4df0-885f-99e53e7f816a), [**background color**](#gt_8e2b1aa9-87f0-4a42-aa3d-9e3a5d5a826c), pattern, gradient, etc…)

 Alignment properties (left, center, right alignment, etc…)

 [**Border**](#gt_85bbea8d-a9f4-40a2-b4f8-68b587d21a4c) properties (left, right, top, bottom, thick or thin, color, etc…)

 Number formatting properties (date, time, number of decimal places, etc…)

 [**Protection**](#gt_dbeb9653-2ab1-4ec4-b64e-e77a8951c499) properties ([**locked**](#gt_7795ac77-550e-4531-9ce5-327bbde6fa81), [**hidden**](#gt_6928fba3-3deb-453c-82ed-ecac33026ffd), etc…)

These properties, as a whole, describe how a particular cell is displayed and printed.

There are two types of objects that contain formatting properties. They are **XFs** (section [2.2.6.1](#Section_4fe94af3cd05427ab32d1f27a85c412a)) and **DXFs** (section [2.2.6.2](#Section_f0b6070c31f54d3dbcb719612da8b8f6)). In general, **XFs** (section 2.2.6.1) describe the formatting directly associated with a cell, and **DXFs** (section 2.2.6.2) describe additional formatting properties that can be applied to one or more cells.

#### 2.2.6.1 XFs

**XFs** specify formatting for [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) and **cell styles** (section [2.2.6.1.2](#Section_f9425d3f127545be8389bf80f65b56b7)). **XFs** are specified by records in the **XFS collection** (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)). This collection contains **XF** (section [2.4.353](#Section_993d15c4ec0443e9ba36594dfb336c6d)) and **XFExt** (section [2.4.355](#Section_8a19848536094bcb87e741894d48b76a)) records, which specify formatting properties.

##### 2.2.6.1.1 Cell XFs

A **cell XF** is specified by an **XF** record (section [2.4.353](#Section_993d15c4ec0443e9ba36594dfb336c6d)) (and an optional **XFExt record** (section [2.4.355](#Section_8a19848536094bcb87e741894d48b76a))) where the **fStyle** field of the **XF** record (section 2.4.353) equals 0. Each [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) MUST reference a **cell XF**. These records specify the complete set of formatting properties for the cells that reference them.

##### 2.2.6.1.2 Cell Styles

**Cell styles** specify a set of formatting properties that can be associated with one or more [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461). **Cell styles** provide two benefits:

 The set of formatting properties in a **cell style** can be applied to one or more cells in a single operation.

 After a **cell style** is applied to a cell, subsequent changes to the formatting properties in the **cell style** can be propagated to the cell automatically.

For example, if it is desired that multiple cells in a [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) share a common set of formatting properties, like bold [**font**](#gt_f8aa3f46-99d1-49bb-858f-b4bfa546c1c2) with a blue [**fill**](#gt_215c1c51-d5ef-46af-8596-d7ef63c1fe89), then **cell styles** make it convenient to apply this set of formatting, and potentially modify the set later.

Supporting information for a **cell style** is specified in a **Style** record (section [2.4.269](#Section_13bec5ebe6ec4dc192350e7f9e5426a1)) (and optional **StyleExt** record (section [2.4.270](#Section_88f1dded37b146239b6f9f7eb333f54f))). This information includes a [**friendly name**](#gt_3dafc161-8c9d-406a-8cbd-c61e7f925eea) for the **cell style** and an index to the **cell style XF** (section [2.2.6.1.2.1](#Section_3d5348ded9df4c31b1fd9f9377273152)) that specifies the formatting for the **cell style**.

###### 2.2.6.1.2.1 Cell Style XFs

A **cell style XF** is specified by an **XF** record (section [2.4.353](#Section_993d15c4ec0443e9ba36594dfb336c6d)) (and an optional **XFExt record** (section [2.4.355](#Section_8a19848536094bcb87e741894d48b76a))) where the **fStyle** field of the **XF** record (section 2.4.353) equals 1. Each [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) MUST reference a **cell XF** (section [2.2.6.1.1](#Section_518a740d71c640c8bb97e7df6915861a)), and each **cell XF** (section 2.2.6.1.1) MUST reference a **cell style XF** with the **ixfParent** field.

###### 2.2.6.1.2.2 Normal Style

At least one **cell style** (section [2.2.6.1.2](#Section_f9425d3f127545be8389bf80f65b56b7)) MUST be included in the **STYLES collection** (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)) and this **cell style** (section 2.2.6.1.2) is called the **Normal style**. The **Normal style** MUST reference the first **XF** record (section [2.4.353](#Section_993d15c4ec0443e9ba36594dfb336c6d)) in the **XFS collection** (section 2.1.7.20.3), and this **XF** record (section 2.4.353) MUST be a **cell style XF** (section [2.2.6.1.2.1](#Section_3d5348ded9df4c31b1fd9f9377273152)), where the **fStyle** field equals 1.

The **Normal style**, being the only required **cell style** (section 2.2.6.1.2), ensures that all [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) have a **cell style** (section 2.2.6.1.2) to reference. The **Normal style** also provides a convenient object in which to store default cell formatting properties for an entire [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe), because all cells will typically reference the **Normal style** by default, until they are modified to reference a different **cell style** (section 2.2.6.1.2).

#### 2.2.6.2 Differential Formatting (DXFs)

Like **XFs** (section [2.2.6.1](#Section_4fe94af3cd05427ab32d1f27a85c412a)), **DXFs** define a set of formatting properties. Unlike **XFs** (section 2.2.6.1), **DXFs** can define any number of formatting properties, from just one to all of them.

**DXFs** provide a way for features to reference a set of formatting properties. How those properties are used depends on the feature. The subsections that follow describe each of these features and how they use **DXFs**.

**DXFs** can be specified in several different ways. The following records and structures specify a **DXF**:

 **DXF** (section [2.4.97](#Section_ea2a96e15ec343d08b979fa0b7e9fc27))

 **DXFN** (section [2.5.95](#Section_a1141f1df60745efb8dd4a1f2b27b4f9))

 **DXFN12** (section [2.5.96](#Section_d25951d951fb48f2863aa53d6508c96a))

 **DXFN12List** (section [2.5.97](#Section_bb221dc1261a41f4a5b416e480b428e6))

 **DXFN12NoCB** (section [2.5.98](#Section_30d7a5a8b5cf4fb3abc85a90942d7021))

**DXF records** (section 2.4.97) are saved into a collection as specified by [Globals Substream](#Section_ca4c174887294a93abb94602b3a01fb1) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf) and referenced with a **DXFId** (section [2.5.94](#Section_16e1a74f3ad340afb5f39f931536d8d9)).

The remaining structures are saved within containing records, such as **CF** (section [2.4.42](#Section_d6dcadf27e074f7da60a0f643780225d)) and **SxDXF** (section [2.4.280](#Section_2a8a126ca0bb4ba59ef125e7420aec58)). **DXFN12** (section 2.5.96), **DXFN12List** (section 2.5.97), and **DXFN12NoCB** (section 2.5.98) are extensions of the **DXFN structure** (section 2.5.95).

##### 2.2.6.2.1 Conditional Formatting

Some [**conditional formatting**](#gt_5a8a1e18-9f8c-48c6-9ad0-7975ade8d516) rules, as specified by the records in the **CONDFMT collection** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)), reference a **DXF** (section [2.2.6.2](#Section_f0b6070c31f54d3dbcb719612da8b8f6)). That **DXF** (section 2.2.6.2) describes additional formatting applied to [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) within the bounds of the rule, if the rule’s condition is TRUE for those cells.

##### 2.2.6.2.2 Table Style Elements

**Table style elements**, as specified by **TableStyleElement** (section [2.4.321](#Section_5c1d12a901db4471897ae2d2875980c5)), can reference a **DXF** (section [2.2.6.2](#Section_f0b6070c31f54d3dbcb719612da8b8f6)). That **DXF** (section 2.2.6.2) describes additional formatting applied to [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) within the bounds of the **table style element**.

##### 2.2.6.2.3 Table Block-Level Formatting

**Table block-level formatting**, as specified by **List12BlockLevel** (section [2.5.174](#Section_41a5cec9e6d14a1bb50e9cc33d80be7c)), can reference one or more **DXFs** (section [2.2.6.2](#Section_f0b6070c31f54d3dbcb719612da8b8f6)). These **DXFs** (section 2.2.6.2) represent formatting that can be applied to the [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) within the appropriate regions of the [**table**](#gt_d3a7da8d-a597-4838-9756-25e30b640ba7).

##### 2.2.6.2.4 PivotTable Areas

A **PivotTable format** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)), as specified by an **SxFormat** record (section [2.4.287](#Section_1bf196bf9b3440db8d3787d204b2f8e7)), can specify a **DXF** (section [2.2.6.2](#Section_f0b6070c31f54d3dbcb719612da8b8f6)). This **DXF** (section 2.2.6.2) represents formatting that can be applied to the [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) within the appropriate area of the **PivotTable view** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)).

##### 2.2.6.2.5 Sorting and Filtering

Sorting, as specified by **SortCond12** (section [2.5.242](#Section_aead0d48db9045009e5638cb2b259622)), and filtering, as specified by **AutoFilter12** (section [2.4.7](#Section_8238f9cb97974cff9b8a180d2b025c31))**,** can include formatting properties as part of their criteria. These properties are stored as **DXFs** (section [2.2.6.2](#Section_f0b6070c31f54d3dbcb719612da8b8f6)). For example, a [**filter**](#gt_ffbe7b55-8e84-4f41-a18d-fc29191a4cda) criteria that is "filter only [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) with red [**font**](#gt_f8aa3f46-99d1-49bb-858f-b4bfa546c1c2) color" will reference a **DXF** (section 2.2.6.2) with the property "font color = red".

#### 2.2.6.3 Table Styles

**Table styles** specify additional formatting for [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) inside [**tables**](#gt_d3a7da8d-a597-4838-9756-25e30b640ba7) or **PivotTable views** (section [2.2.5.4](#Section_09410dfbaac84a719ecf177ffba12c37)).

Tables can specify an applied **table style** with the **List12TableStyleClientInfo** record (section [2.5.176](#Section_7b5bf4e9a7f049ffa8d6da8e92b33144)). **PivotTable views** (section 2.2.5.4) specify an applied **table style** with the **SXAddl\_SXCView\_SXDTableStyleClient** record (section [2.4.273.107](#Section_adade4ceaf6e4dd19d669080ebaec11d)). These two records reference a **table style** by name with the **stListStyleName** and **stName** fields, respectively.

**Table styles** are either built-in or custom. Built-in **table styles** are specified in [[ECMA-376]](https://go.microsoft.com/fwlink/?LinkId=200054) part 4, 3.8.40. Custom **table styles** used in a [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe) are specified in the collection of records beginning with **TableStyles** (section [2.4.322](#Section_292315200e4f429ebe5e1e5d39d6a2f3)).

A **table style** consists of a collection of **table style elements** (section [2.2.6.2.2](#Section_84f2f67849214e8c83eb10d4fff7e935)). For custom **table styles**, these elements are specified by the collection of **TableStyleElement** records (section [2.4.321](#Section_5c1d12a901db4471897ae2d2875980c5)) following the **TableStyle** record (section [2.4.320](#Section_32b77a6330c54885bc94434923002d6d)).

Each **table style element** (section 2.2.6.2.2) specifies the formatting to be applied to cells in a particular region of the table or **PivotTable view** (section 2.2.5.4). These regions are specified by the possible values of the **tseType** field of the **TableStyleElement** record (section 2.4.321).

#### 2.2.6.4 Format Conflicts

As described previously, the formatting to be displayed or printed for a particular [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) can be specified in several independent records. It is up to the application to resolve conflicting formatting properties for a particular cell.

As an example, say a cell has a **conditional format** (section [2.2.6.2.1](#Section_abb828767c9c4377858fb1a6be7fe8f9)) applied and also falls within the bounds of a [**table**](#gt_d3a7da8d-a597-4838-9756-25e30b640ba7) with a **table style** (section [2.2.6.3](#Section_4ac7212b4aa74ece962526c58224ae80)). Furthermore, say the **cell XF** (section [2.2.6.1.1](#Section_518a740d71c640c8bb97e7df6915861a)), **conditional format** (section 2.2.6.2.1) and **table style element** (section [2.2.6.2.2](#Section_84f2f67849214e8c83eb10d4fff7e935)) all specify a different [**font**](#gt_f8aa3f46-99d1-49bb-858f-b4bfa546c1c2) color. It is up to the application to decide the appropriate font color to use in this situation.

### 2.2.7 External References

The **external references** infrastructure exists to support **formulas** (section [2.2.2](#Section_e7625cc83da94154b44949cf1bbd9703)) which reference [**data sources**](#gt_e091613c-6901-4874-b9b2-27273ead1075) outside the scope of the [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) on which the **formula** (section 2.2.2) resides. These sources could be other sheets (1) in the same [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe), data in another workbook, [**DDE**](#gt_c24a2630-38ed-45a5-b15a-b29992007ccc) links or [**Object Linking and Embedding (OLE)**](#gt_171744b8-3f44-4198-b7b9-1c0147282d2c) links. A workbook that uses **external references** contains a collection of **XTI records** (section [2.5.344](#Section_5adbad90093d4bc6acc1b662270bc0d7)) that in turn reference **SupBook records** (section [2.4.271](#Section_31ed3738e4ff4b60804cac49ac1ee6c0)) that specify the source of the data.

#### 2.2.7.1 External Reference Consumers

Within the formula, only certain **formula elements** (section [2.2.2.6](#Section_9f95ff16743f4882bbb4242d6e560069)) can contain external references. These specific **formula elements** (section 2.2.2.6) contain an **XtiIndex structure** (section [2.5.198.119](#Section_9ded1bd948814b77b32fc77b93df03fd)) specifying an **XTI** (section [2.5.344](#Section_5adbad90093d4bc6acc1b662270bc0d7)), which in turn specifies the location and type of the external reference data. Only the following **Ptg structures** (section [2.5.198.25](#Section_9310c3bbd73f4db0834228e1e0fcb68f)) can be **external r**eference **consumers**:

 **PtgRef3d** (section [2.5.198.85](#Section_1ca817be8df34b808d3546b5eb753577))

 **PtgRefErr3d** (section [2.5.198.87](#Section_307f13dbe5d24b358309d5452908a2d4))

 **PtgArea3d** (section [2.5.198.28](#Section_869033ad63044b9ab2ba1e7794ae345a))

 **PtgAreaErr3d** (section [2.5.198.30](#Section_e91dfca47b5e4e4486a5e6621222a3a2))

 **PtgNameX** (section [2.5.198.77](#Section_f9eba5de1ff64d529753f9c1e446c774))

#### 2.2.7.2 Supporting Link

Each **formula element** (section [2.2.2.6](#Section_9f95ff16743f4882bbb4242d6e560069)) which references external data refers to a **XTI** (section [2.5.344](#Section_5adbad90093d4bc6acc1b662270bc0d7)). The **XTI** (section 2.5.344) references a **SupBook record** (section [2.4.271](#Section_31ed3738e4ff4b60804cac49ac1ee6c0)) that specifies the type of **supporting link** and, in certain cases, specifies additional data about the **supporting link**.

There are several types of **supporting links**. The type of the **supporting link** used is specified by the **cch** and **virtPath** fields of the **SupBook record** (section 2.4.271). **Supporting link** types are specified in the following table:

| Supporting Link Type | Meaning |
| --- | --- |
| Self-Referencing | A reference to the current [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe).  This **supporting link** type supports cross-[**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) references, where the target sheets (1) are specified by the **XTI** (section 2.5.344). This record also supports [**defined name**](#gt_5bb97b28-4adc-48ec-b544-02542753a933) or User Defined Function ([**UDF**](#gt_5068e37f-372c-41df-9357-1072e12ed970)) references on the same book. |
| Same-Sheet Referencing | A reference to the [**active sheet**](#gt_767d2df7-5efd-40a1-9e58-4b6a597cc389) in the context of the consuming **formula** (section [2.2.2](#Section_e7625cc83da94154b44949cf1bbd9703)).  This **supporting link** type is used by formulas in [**macro sheets**](#gt_410f5dd1-4217-4d31-ab16-48271bd25491) and in defined names to reference the sheet (1) of the caller. |
| [**Add-in**](#gt_a3be101e-9d37-484a-a5e6-b70d559146c6) Referencing | A reference to a UDF on any [**Excel Linked Library (XLL)**](#gt_3d6e3f45-91e7-46d5-871c-0b2fde20b5f5) or [**COM**](#gt_ef2ebebc-1760-407a-9ace-af48f9050e02) add-in. |
| External Workbook Referencing | A reference to an **External Workbook** (section [2.2.7.3](#Section_c8bd9cdbb0784622a3bffb87f35a36cc)). |
| DDE Data Source Referencing | A reference to a **DDE Data Source** (section [2.2.7.6](#Section_b11538fba8244cc3bf8834a1cf5f3559)). |
| OLE Data Source Referencing | A reference to an **OLE Data Source** (section [2.2.7.8](#Section_2318e95632614d72a28e412392b8c919)). |
| Unused | An unused **supporting link**. A reference to this type of **supporting link** can be specified by an **XTI** (section 2.5.344), but that **XTI** (section 2.5.344) MUST NOT be used by any **external reference consumer** (section [2.2.7.1](#Section_70b28c8b29cb4aff89f5d6023c28fbf6)). |

#### 2.2.7.3 External Workbook

An external workbook link is a reference to a [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe) other than the one in which the source **formula** (section [2.2.2](#Section_e7625cc83da94154b44949cf1bbd9703)) resides. It contains the referencing [**expression**](#gt_6d43b116-acad-45af-aea5-a8e7240a1106), and data relating to that expression. This data includes the workbook location, [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) names, **external defined names** (section [2.2.7.4](#Section_3a459d7b05f54d7a9e0d0d62c5b2fbb2)), and an **external cell cache** (section [2.2.7.5](#Section_b985d1a223f3483ebebdbd0e882d4c89)) for referenced cells in that workbook.

#### 2.2.7.4 External Defined Name

Anexternal defined name is a reference to a [**defined name**](#gt_5bb97b28-4adc-48ec-b544-02542753a933) in an **external workbook** (section [2.2.7.3](#Section_c8bd9cdbb0784622a3bffb87f35a36cc)). The records specifying the external defined name will provide the name, scope, and **formula** (section [2.2.2](#Section_e7625cc83da94154b44949cf1bbd9703)) of the defined name on that [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe). The restrictions on the types of **formulas** (section 2.2.2) supported in **external defined names** are described in **ExtNameParsedFormula** (section [2.5.198.10](#Section_bcdeb72504eb4432ab350d38dd06a7cf)).

#### 2.2.7.5 External Cell Cache

To allow external cell references to be calculated without opening the referenced [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe), an **external** cell **cache** is stored in the file which contains cached values for cells in a [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) in an **external workbook** (section [2.2.7.3](#Section_c8bd9cdbb0784622a3bffb87f35a36cc)). The **external** cell **cache** contains [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) values of the specific cells that are referenced in that sheet (1). The beginning of an **external** cell **cache** is specified by the **XCT** record (section [2.4.352](#Section_7b5ed322cc93451da553846066fe2f8c)).

The **external** cell **cache** is composed of a collection of sequences of cells that correspond to cells in the source sheet (1). Each cell sequence is specified by a **CRN** record (section [2.4.65](#Section_049bee32923041a9ab401cf5de41d563)).

#### 2.2.7.6 DDE Data Source

A **DDE data source** specifies information about the [**DDE server**](#gt_aa46dc6a-247b-459b-8acd-af7550514fee) and [**DDE topic**](#gt_c1335a84-baa7-4fc6-904c-cccdbf74bc2a) name of a [**Dynamic Data Exchange (DDE)**](#gt_c24a2630-38ed-45a5-b15a-b29992007ccc) connection. A **DDE data source** is specified by the **SupBook record** (section [2.4.271](#Section_31ed3738e4ff4b60804cac49ac1ee6c0)).

#### 2.2.7.7 DDE Data Item

A **DDE data i**tem specifies the name and properties of a [**DDE**](#gt_c24a2630-38ed-45a5-b15a-b29992007ccc) item. It also contains cached values from the most recent DDE data update. A **DDE data** item is specified by the **ExternName** record (section [2.4.105](#Section_9549558214654bdd8183b16f8e8eaf74)).

#### 2.2.7.8 OLE Data Source

An **OLE data source** specifies information about an [**OLE2**](#gt_0b0e3a28-4780-4123-9bfd-f933b01d64a4) data connection. It specifies the path to the OLE2 [**data source**](#gt_e091613c-6901-4874-b9b2-27273ead1075) file and the [**ProgID**](#gt_06b2ae3d-4106-49f3-9ca0-e2bcd649e75a) of the application handler. An **OLE data source** is specified by the **SupBook record** (section [2.4.271](#Section_31ed3738e4ff4b60804cac49ac1ee6c0)).

#### 2.2.7.9 OLE Data Item

An **OLE data i**tem specifies the name and properties of a connection to an [**OLE2**](#gt_0b0e3a28-4780-4123-9bfd-f933b01d64a4) data object. Unlike **DDE Data Sources** (section [2.2.7.6](#Section_b11538fba8244cc3bf8834a1cf5f3559)), **OLE Data Sources** (section [2.2.7.8](#Section_2318e95632614d72a28e412392b8c919)) do not store cached data returned by OLE2 data objects. An **OLE data** item is specified by the **ExternName** record (section [2.4.105](#Section_9549558214654bdd8183b16f8e8eaf74)).

### 2.2.8 External Connections

A [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe) often pulls in data from external [**data sources**](#gt_e091613c-6901-4874-b9b2-27273ead1075), such as a database or an [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) [**cube**](#gt_a0c8d97b-322c-4117-8525-37e5f26751e7). An **external connection** represents a link between a workbook and a particular external data source. It contains properties about the way that the application establishes the connection to the data source and retrieves the data, such as the type of [**data provider**](#gt_33fa4cdc-ae58-4a6c-8111-31377e1d292e) ([**OLE DB**](#gt_333f4fb1-4882-48df-bce6-f9961b408f31), [**ODBC**](#gt_7883fa02-8dc0-4154-894f-fe3a7bff153e), and so on), a [**server name**](#gt_854f54be-1a9d-40d2-82e5-55cf9e48e2c2), security information, and a command to execute on the server. In addition, the **external connection** contains details about the way the connection is used in the workbook, such as how often to refresh the data.

A data connection object contains **external connection** information for an external data source that a workbook uses. Data connection objects are independent of the constructs in the workbook that display data, such as [**tables**](#gt_d3a7da8d-a597-4838-9756-25e30b640ba7) or **PivotTables** (section [2.2.5](#Section_a5f57198f2af40b2ba07e4b1836d73f3)).

A connection definition can be established in an **external connection** file for easier sharing and reuse, but this overview describes the representation for external data connections that are directly embedded within a workbook file. This embedded representation is required whenever external data is used, and ensures portability of the document and continued operation of the external query in the most cases.

An **external** connection is specified by a combination of the records defined in **DBQUERY\_WORKBOOK** (section [2.1.7.20.3](#Section_ca4c174887294a93abb94602b3a01fb1)), **DBQUERY\_WORKSHEET** (section [2.1.7.20.5](#Section_f41c06f2905749a18c3fa4a4d211fc56)), **DBQUERYEXT** (section 2.1.7.20.5) and **SXADDLDBQUERY** (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)), and the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)).

If an **external** connection is not used by any workbook object, it is represented only by a **DConn** record (section 2.4.84) and the **fStandAlone** field of the **DConn** record (section 2.4.84) is set to 1.

#### 2.2.8.1 Connection Name

Each external connection has a unique name, which can be used by the application as a user-friendly name for the connection, for example, for UI purposes. The **c**onnection **name** is specified by the **rgchConnectionName** field of the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)).

#### 2.2.8.2 External Connection Files

An **external connection** file specifies an external connection in a separate file (external to the [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe)). An **external connection** file enables managing connection information separately from a specific workbook and sharing it among multiple workbooks. It is used for creating a new data connection in a workbook or for restoring a lost connection. The **stSourceConnectionFile** fieldof the **SXAddl\_SXCQuery\_SXDSrcConnFile record** (section [2.4.273.65](#Section_f41f413611484186b271fde913611fd9)) and the **rgchSourceConnectionFile** field of the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)) specify a path to an external connection file.

#### 2.2.8.3 OLE DB Connections

An **OLE DB connection** is a connection to an [**OLE DB**](#gt_333f4fb1-4882-48df-bce6-f9961b408f31) [**data provider**](#gt_33fa4cdc-ae58-4a6c-8111-31377e1d292e). An external connection is an **OLE DB connection** if the **dbt** field of the **DbQuery** record (section [2.4.80](#Section_6d819178e06142acae5a7cced9ee3653)) is 0x5, the **dbt** field of the **DBQueryExt** record (section [2.4.81](#Section_1b04b35c1f20475aadac424a664509dd)) is **DBT\_OLEDB** (section [2.5.64](#Section_0f3cdf2ce91645f7899cbbbe2180126a)), and the **dbt** field of the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)) is **DBT\_OLEDB** (section 2.5.64). For more information about OLE DB, see [[MSDN-OLEDBP-OI]](https://go.microsoft.com/fwlink/?LinkId=119666).

##### 2.2.8.3.1 OLAP Connections

An **OLAP connection** is a connection to an [**OLE DB**](#gt_333f4fb1-4882-48df-bce6-f9961b408f31) for [**OLAP**](#gt_055c223a-52f1-4d41-b95b-d7c60eaa388f) [**data provider**](#gt_33fa4cdc-ae58-4a6c-8111-31377e1d292e). An OLE DB connection is an **OLAP connection** if the **dbost** field of the **ConnGrbitDbtOledb** structure (section [2.5.59](#Section_b6e55e1249014c8f827e3110cfee247c)) is 0x1.

#### 2.2.8.4 ODBC Connections

An **ODBC connection** is a connection to an [**ODBC**](#gt_7883fa02-8dc0-4154-894f-fe3a7bff153e) [**data provider**](#gt_33fa4cdc-ae58-4a6c-8111-31377e1d292e). An external connection is an **ODBC connection** if the **dbt** field of the **DbQuery** record (section [2.4.80](#Section_6d819178e06142acae5a7cced9ee3653)) is 0x1, the **dbt** field of the **DBQueryExt** record (section [2.4.81](#Section_1b04b35c1f20475aadac424a664509dd)) is **DBT\_ODBC** (section [2.5.64](#Section_0f3cdf2ce91645f7899cbbbe2180126a)), and the **dbt** field of the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)) is **DBT\_ODBC** (section 2.5.64). For more information about ODBC, see [[MSFT-ODBCODCO]](https://go.microsoft.com/fwlink/?LinkId=119665).

#### 2.2.8.5 Web Connections

A **Web connection** pulls the content of a Web page, or part of a Web page (an [**HTML**](#gt_549c4960-e8be-4c24-bc2b-b86530f1c1bf) table), into the [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe). An external connection is a **Web** connection if the **dbt** field of the **DbQuery** record (section [2.4.80](#Section_6d819178e06142acae5a7cced9ee3653)) is 0x4, the **dbt** field of the **DBQueryExt** record (section [2.4.81](#Section_1b04b35c1f20475aadac424a664509dd)) is **DBT\_WEB** (section [2.5.64](#Section_0f3cdf2ce91645f7899cbbbe2180126a)), and the **dbt** field of the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)) is **DBT\_WEB** (section 2.5.64).

#### 2.2.8.6 Text Import Connections

A **text import connection** pulls in data from a structured text file into the [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe). An external connection is a **text import connection** if the **dbt** field of the **DbQuery** record (section [2.4.80](#Section_6d819178e06142acae5a7cced9ee3653)) is 0x6, the **dbt** field of the **DBQueryExt** record (section [2.4.81](#Section_1b04b35c1f20475aadac424a664509dd)) is **DBT\_TXT** (section [2.5.64](#Section_0f3cdf2ce91645f7899cbbbe2180126a)), and the **dbt** field of the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)) is **DBT\_TXT** (section 2.5.64).

#### 2.2.8.7 ADO Recordset Connections

An [**ADO**](#gt_3477d72a-874b-4a2a-b6a9-1431c128df49) recordset pulls in data from a set of records in an ADO [**data provider**](#gt_33fa4cdc-ae58-4a6c-8111-31377e1d292e). An external connection is an **ADO recordset connection** if the **dbt** field of the **DbQuery** record (section [2.4.80](#Section_6d819178e06142acae5a7cced9ee3653)) is 0x7, the **dbt** field of the **DBQueryExt** record (section [2.4.81](#Section_1b04b35c1f20475aadac424a664509dd)) is **DBT\_ADO** (section [2.5.64](#Section_0f3cdf2ce91645f7899cbbbe2180126a)), and the **dbt** field of the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)) is **DBT\_ADO** (section 2.5.64).

Note: For this type of connection, the file format does not contain sufficient information for establishing the connection and fetching a recordset. Data is provided to the application through another mechanism, for example by script code using an [**object model**](#gt_91bed4f8-fc06-4d55-b040-7a84c42e4973).

#### 2.2.8.8 DAO Recordset Connections

A DAO recordset pulls in data from a set of records in a DAO [**data provider**](#gt_33fa4cdc-ae58-4a6c-8111-31377e1d292e). An external connection is a **DAO recordset connection** if the **dbt** field of the **DbQuery** record (section [2.4.80](#Section_6d819178e06142acae5a7cced9ee3653)) is 0x2, the **dbt** field of the **DBQueryExt** record (section [2.4.81](#Section_1b04b35c1f20475aadac424a664509dd)) is **DBT\_DAO** (section [2.5.64](#Section_0f3cdf2ce91645f7899cbbbe2180126a)), and the **dbt** field of the **DConn** record (section [2.4.84](#Section_a2ace8d3019445709bc5a865e0d78a21)) is **DBT\_DAO** (section 2.5.64).

Note: For this type of connection, the file format does not contain sufficient information for establishing the connection and fetching a recordset. Data is provided to the application through another mechanism, for example by script code using an [**object model**](#gt_91bed4f8-fc06-4d55-b040-7a84c42e4973).

### 2.2.9 Password Verifier Algorithm

Several records (**Password** (section [2.4.191](#Section_1d0e4db7cc6a4143b72c27d972f72f05)), **FileSharing** (section [2.4.118](#Section_e434c31d60bb4559b89d0c0d5fc66796)), **Prot4RevPass** (section [2.4.206](#Section_7ea7d419fec14f9295bbad6e3b3582c6)), **FeatProtection** (section [2.5.124](#Section_6a97383237384ea0b435f876766cf8ad)), and **FilePass** (section [2.4.117](#Section_cf9ae8d54e8c40a295f13b31f16b5529))) use a password verifier to provide a locking and unlocking system for viewing or editing parts of the [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe). This password verifier 验证器is used to prevent 防止accidental 意外editing, and is not designed to be used as a security feature. The verifier value is calculated in two stages阶段. First, the provided [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) password string is converted to a new character string in the[**American National Standards Institute (ANSI) character set**](#gt_100cd8a6-5cb1-4895-9de6-e4a3c224a583) code page of the current system using the algorithm specified in the **revisionsPassword** attribute in [[ECMA-376]](https://go.microsoft.com/fwlink/?LinkId=200054) part 4, 3.2.29. Second, this string is input into the [**XOR obfuscation**](#gt_cbfd1a35-e8c9-4c5a-bc26-e618633d2f50) algorithm specified in [[MS-OFFCRYPTO]](file:///C:\Users\Administrator\Desktop\OfficeEncryption\%5bMS-OFFCRYPTO%5d.pdf#Section_3c34d72a1a614b52a893196f9157f083), 2.3.7.1, Binary Document Password Verifier Derivation Method 1 to produce a 16-bit password verifier value.

See the [Security Considerations](#Section_6df63a1fecd54d13801ea5321aa39caa) section for information about security concerns related to the use of this algorithm for password verification in this file format.[<19>](#Appendix_A_19" \o "Product behavior note 19)

### 2.2.10 Encryption (Password to Open)

[**Workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe) files can contain sensitive 敏感的information that needs to be protected. A file can be protected by **encrypting** it using a password[<20>](#Appendix_A_20" \o "Product behavior note 20). Once a file is **encrypted**, the data can only be accessed by decrypting the file using the same password.

If a file in this format is saved with **encryption** it MUST be saved with [**XOR obfuscation**](#gt_cbfd1a35-e8c9-4c5a-bc26-e618633d2f50)[<21>](#Appendix_A_21" \o "Product behavior note 21) as specified in [[MS-OFFCRYPTO]](file:///C:\Users\Administrator\Desktop\OfficeEncryption\%5bMS-OFFCRYPTO%5d.pdf#Section_3c34d72a1a614b52a893196f9157f083) section 2.3.7, or RC4 **encryption** as specified in [MS-OFFCRYPTO] section 2.3.6, or one of a number of RC4 CryptoAPI **encryption**[<22>](#Appendix_A_22" \o "Product behavior note 22) algorithms as specified in [MS-OFFCRYPTO] section 2.3.5. The specific obfuscation or **encryption** method being used, and the associated obfuscation or **encryption** information, is specified in the **FilePass** record (section [2.4.117](#Section_cf9ae8d54e8c40a295f13b31f16b5529)).

If RC4 CryptoAPI **encryption** is used, certain storages and [**streams**](#gt_f3529cd8-50da-4f36-aa0b-66af455edbb6) are stored in the **Encryption Stream** (section [2.1.7.6](#Section_3ff73530461c45079b669e18aba3124e)) as specified in [MS-OFFCRYPTO] section 2.3.5.3. See the following table for details.

| Storage/Stream | XOR obfuscation or RC4 encryption | RC4 CryptoAPI encryption |
| --- | --- | --- |
| **Component Object Stream** (section [2.1.7.1](#Section_0259345a59e34ab0b489a467b7c19498)) | Not encrypted | Not encrypted. |
| **Control Stream** (section [2.1.7.2](#Section_ce07d64476c84d368badb6419bd152fe)) | Not encrypted | Encrypted in **encryption stream** (section 2.1.7.6). |
| **Data Spaces Storage** (section [2.1.7.3](#Section_2d2a5085fa014807b232f39878b399ce)) | Not encrypted | Not encrypted. |
| **Document Summary Information Stream** (section [2.1.7.4](#Section_a9dabd4a684845a689f40ce0caa11c75)) | Not encrypted | Encrypted in **encryption stream** (section 2.1.7.6) if and only if flag is set \*\* |
| **Embedding Storage** (section [2.1.7.5](#Section_b406ade0fb1c4512bff2b576fdfff545)) | Not encrypted | Encrypted in **encryption stream** (section 2.1.7.6). |
| **Link Storage** (section [2.1.7.7](#Section_a05f262bbc9a44be88b4eba16b41ac6b)) | Not encrypted | Encrypted in **encryption stream** (section 2.1.7.6). |
| **List Data Stream** (section [2.1.7.8](#Section_914f09bd8c944c099e8631dfe058f037)) | Not encrypted | Encrypted in **encryption stream** (section 2.1.7.6). |
| **Office Data Store Storage** (section [2.1.7.9](#Section_ab70c85c1750466f8887c2f343ae4b4f)) | Not encrypted | Not encrypted. |
| **Office Toolbars Stream** (section [2.1.7.10](#Section_3c0ad5b8a61e486c802e282c02c1897a)) | Not encrypted | Not encrypted. |
| **OLE Stream** (section [2.1.7.11](#Section_77f7aefa1bd44d0a970b809503c38bee)) | Not encrypted | Not encrypted. |
| **Pivot Cache Storage** (section [2.1.7.12](#Section_c5fb3f663ef64308ae3de59244159687))\* | Encrypted | Encrypted. |
| **Protected Content Stream** (section [2.1.7.13](#Section_a1671bd186fc480a885152d714a5cc02)) | Not encrypted | Not encrypted. |
| **Revision Stream** (section [2.1.7.14](#Section_d120a1ffd2e6488381a507236f1994b0))\* | Encrypted | Encrypted. |
| **Signatures Stream** (section [2.1.7.15](#Section_23a8b9bf5ae447a7ad42a9aa7d84f75b)) | Not encrypted | Not encrypted. |
| **Summary Information Stream** (section [2.1.7.16](#Section_d604544ba58044ad99d6ca20855a9036)) | Not encrypted | Encrypted in **encryption stream** (section 2.1.7.6) if and only if flag is set \*\* |
| **User Names Stream** (section [2.1.7.17](#Section_1b98bc4df7c640a088dba99426635acd))\* | Not encrypted | Not encrypted. |
| **VBA Storage** (section [2.1.7.18](#Section_27d93f33eaa941d49ec07f2a69d8ff5f)) | Not encrypted | Not encrypted. |
| **Viewer Content Stream** (section [2.1.7.19](#Section_120ab19d71cd43a3be1b88828891cc6a)) | Not encrypted | Not encrypted |
| **Workbook Stream** (section [2.1.7.20](#Section_f682f4b08c6b444e83f852d156f1e8ba))\* | Encrypted | Encrypted. |
| **XML Signatures Storage** (section [2.1.7.21](#Section_f8e1068d19e04fe890720dbb4ff75de7)) | Not encrypted | Not encrypted. |
| **XML Stream** (section [2.1.7.22](#Section_e25e01370b9c4429bd260eed92e01c35)) | Not encrypted | Encrypted in **encryption stream** (section 2.1.7.6) |

\* The indicated 表示items specify either streams that contain [**BIFF**](#gt_f9965de8-cd18-4e26-a9c6-adfee3d67517) records as specified in **Record** (section [2.1.4](#Section_170e90ce87d747589331dcf14cd72388)) or storages that contain streams that contain BIFF records as specified in **Record** (section 2.1.4). When obfuscating or **encrypting** BIFF records in these streams the record type and record size components MUST NOT be obfuscated or encrypted. In addition the following records MUST NOT be obfuscated or **encrypted**: **BOF** (section [2.4.21](#Section_4d6a3d1ed7c5405fbbaed01e9cb79366)), **FilePass** (section 2.4.117), **UsrExcl** (section [2.4.339](#Section_5b35e115e4e64dfc914868fa02f7a4e9)), **FileLock** (section [2.4.116](#Section_a710a2aeb88944d5968f9c21c42a8076)), **InterfaceHdr** (section [2.4.146](#Section_38ca272ef4b944a5946929f7a18ab3e2)), **RRDInfo** (section [2.4.227](#Section_7605dea102c9430c8038ae56e9497315)), and **RRDHead** (section [2.4.226](#Section_3ada910097fd42adbebcfdacc9a44542)). Additionally, the **lbPlyPos** field of the **BoundSheet8 record** (section [2.4.28](#Section_b9ec509a235d424e871df8e721106501)) MUST NOT be **encrypted**.

\*\* The indicated streams for the indicated **encryption** method MUST be **encrypted** if and only if the 0x08 bit of **EncryptionHeader.flags** is equal to 0. **EncryptionHeader.flags** is specified in [MS-OFFCRYPTO] section 2.3.5.1.

For XOR obfuscation, the obfuscation key is generated as specified in the [Password Verifier Algorithm](#Section_e8a5fbec6cdc40d89fef9ad80e4172f4) section. The algorithm for XOR obfuscation is specified in [MS-OFFCRYPTO] section 2.3.7. The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) password string is converted to a new character string in the ANSI code page of the current system using the algorithm specified in the **revisionsPassword** attribute in [[ECMA-376]](https://go.microsoft.com/fwlink/?LinkId=200054) part 4, 3.2.29. The new string is then provided as input into the XOR obfuscation array initialization as specified in [MS-OFFCRYPTO] section 2.3.7.2. The initialized array is then used by the algorithm specified in [MS-OFFCRYPTO] section 2.3.7.3 to obfuscate the file data.

For RC4 **encryption** and RC4 CryptoAPI **encryption**, the Unicode password string is used to generate the **encryption** key as specified in [MS-OFFCRYPTO] section 2.3.6.2 or [MS-OFFCRYPTO] section 2.3.5.2 depending on the RC4 algorithm used. The record data is then **encrypted** by the specific RC4 algorithm in 1024-byte blocks. The block number is set to zero at the beginning of every BIFF record stream, and incremented by one at each 1024-byte boundary. Bytes to be encrypted are passed into the RC4 **encryption** function and then written to the stream. For unencrypted records and the record headers consisting of the record type and record size, a byte buffer of all zeros, of the same size as the section of unencrypted bytes, is passed into the RC4 **encryption** function. The results are then ignored and the unencrypted bytes are written to the stream.

See the [Security Considerations](#Section_6df63a1fecd54d13801ea5321aa39caa) section for information about security concerns relating to file **encryption** for this file format.

### 2.2.11 Shared Workbooks

The **shared workbook** infrastructure is used to enable multiple users to make changes to a [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe) at the same time as well as track changes that certain users make. A **shared workbook** contains a collection of users that currently have the document open and a set of **revision logs** (section [2.2.11.2](#Section_2cbd26e86f7e4195ada414c8b7e595b8)) that contain the changes that users have made to the workbook. Each of these logs has a corresponding revision header associated with it and contains either a set of **revision records** (section [2.2.11.3](#Section_9e91e8bce4f249b897d4741481349d1b)) that have been made to the **shared workbook** because it has been shared or no **revision records** (section 2.2.11.3). A workbook is a **shared workbook** if and only if the **user names stream** (section [2.1.7.17](#Section_1b98bc4df7c640a088dba99426635acd)) exists.

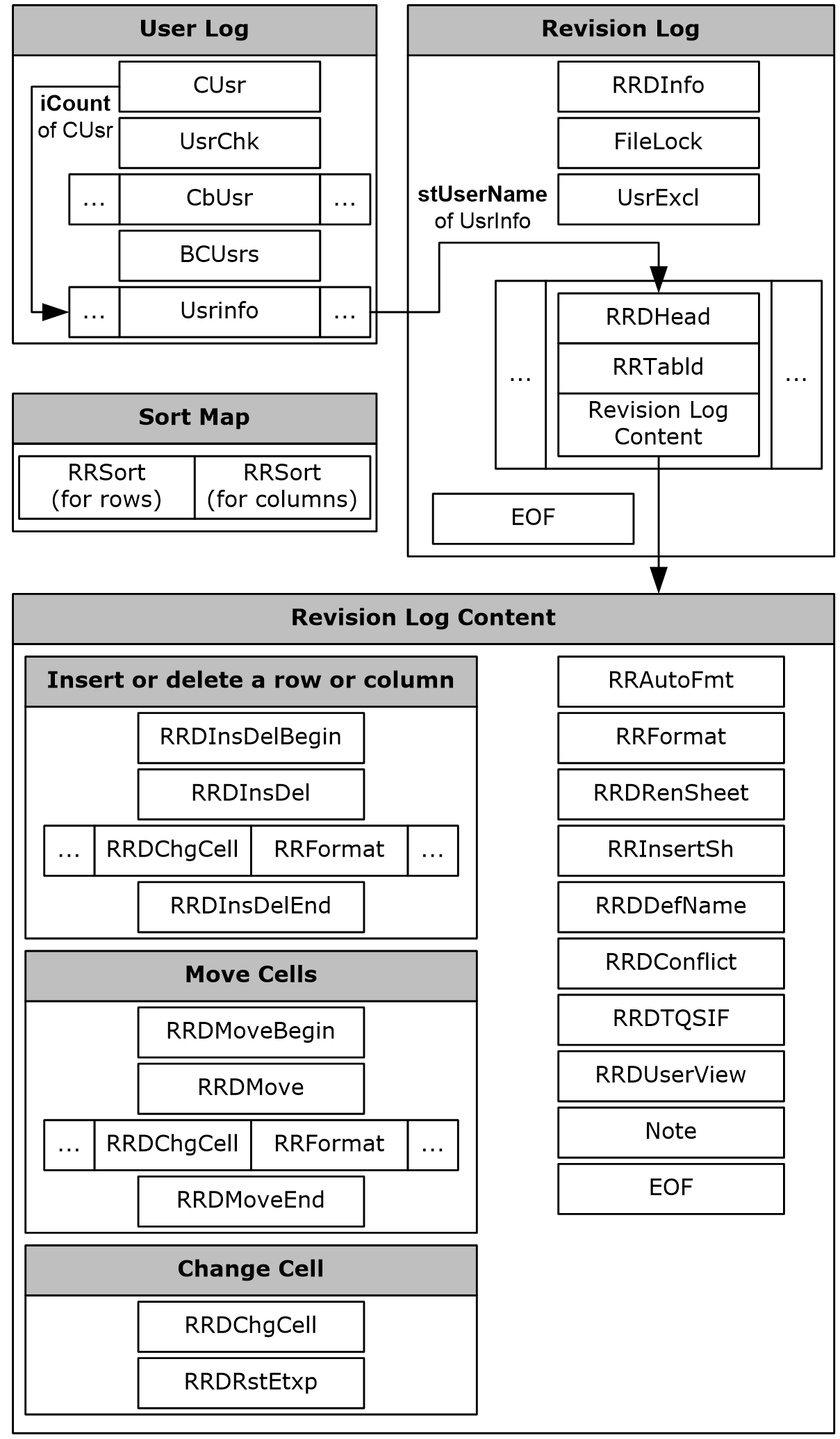


Figure 17: Structure of shared workbooks

The following sections define terms used in this diagram.

#### 2.2.11.1 User Log

The **user log** contains the set of users who currently have the [**workbook**](#gt_343c4660-90e1-4d86-b9cc-5007075d9dfe) open. The **iCount** field of **CUsr** (section [2.4.72](#Section_a51b97cb3c2644aa80180580808050da)) specifies the number of **UsrInfo records** (section [2.4.340](#Section_0c543b9fc6d441d8ad3a9332486c37fc)) that this section contains. Each **UsrInfo** record (section 2.4.340) corresponds to a user that currently has the workbook open. The **guid** field of the **UsrInfo maps** (section 2.4.340) to the **guid** field of **RRDHead** (section [2.4.226](#Section_3ada910097fd42adbebcfdacc9a44542)) that specifies which **revision log** (section [2.2.11.2](#Section_2cbd26e86f7e4195ada414c8b7e595b8)) the user is currently synchronized to.

#### 2.2.11.2 Revision Logs

The revision **logs** section contains a set of revision **logs**. Each revision **log** contains various **revision records** (section [2.2.11.3](#Section_9e91e8bce4f249b897d4741481349d1b)) that a single user has made to a **shared workbook** (section [2.2.11](#Section_e45a62c4490f4304a09668908b57dacc)) or a user action. Each revision **log** has a revision header (**RRDHead** (section [2.4.226](#Section_3ada910097fd42adbebcfdacc9a44542))) and a tab identifier map (**RRTabId** (section [2.4.241](#Section_e1b235b2c9554d38b7adfab84d93d4bc))) that describes general information. The **stUserName** field of **RRDHead** (section 2.4.226)is the name of the user who made changes or performed an action for that particular log. If the revision **log** is meant to describe user changes (and not a user action), it will also contain other revision **log** content that will describe all the changes made by that user. This **revision log** [**stream**](#gt_f3529cd8-50da-4f36-aa0b-66af455edbb6) [**ABNF**](#gt_24ddbbb4-b79e-4419-96ec-0fdd229c9ebf) also contains general information about the **shared workbook** (section 2.2.11) in **RRDInfo** (section [2.4.227](#Section_7605dea102c9430c8038ae56e9497315)), **FileLock** (section [2.4.116](#Section_a710a2aeb88944d5968f9c21c42a8076)), and **UsrExcl** (section [2.4.339](#Section_5b35e115e4e64dfc914868fa02f7a4e9)).

#### 2.2.11.3 Revision Records

A **revision record** describes changes, or revisions, that a single user has made to a **shared workbook** (section [2.2.11](#Section_e45a62c4490f4304a09668908b57dacc)). The following changes can be recorded by the **shared workbook** (section 2.2.11):

 Inserting or deleting a row or column (**RRDInsDel** (section [2.4.228](#Section_fe37df682d0e4d89a213cc4ebd9ac138)))

 Moving a [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) (**RRDMove** (section [2.4.231](#Section_335c3e38c8b6460298238e3e02eae66f)))

 Changing a cell (**RRDChgCell** (section [2.4.223](#Section_f7c1ffa25ac54cccb1e941d556ff4b75)))

 Adding or removing a [**custom view**](#gt_2370d0f5-2cbd-4ded-8572-ef25f6e25cf4) (**RRDUserView** (section [2.4.237](#Section_b1f25beb8ebd439a8298d89f976adba4)))

 Renaming an existing [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) (**RRDRenSheet** (section [2.4.234](#Section_f4f9c63e14184bb3b3b24fc7cf0803fe)))

 Inserting a new sheet (1) (**RRInsertSh** (section [2.4.239](#Section_57b2d502ae46461f9156ad7868a57f9d)))

 Changing a [**defined name**](#gt_5bb97b28-4adc-48ec-b544-02542753a933) (**RRDDefName** ()section [2.4.225](#Section_3393f8cdcedc46cababa3cf614f8a77a))

 Changing a [**comment**](#gt_c8a897b9-522f-4b7a-8df6-40b65ac09f4d) (**Note** (section [2.4.179](#Section_0e5d02566d864628a6face2e948673b0)))

 Conflict resolution from previous conflicting changes (**RRDConflict** (section [2.4.224](#Section_7026f410d71c474ab133aabdb636e112)))

 Removing a [**query table**](#gt_ceb1ea2c-7b55-4a25-a7f0-79b1c1011289) (**RRDTQSIF** (section [2.4.236](#Section_ed21ae3595354dec88f1c44ed1967614)))

 Changing the format (**RRFormat** (section [2.4.238](#Section_c5933975af274629a6c518055a26684c)))

 Changing the [**AutoFormat**](#gt_f7e1ea19-1129-4519-a857-008db95c462f) information for a [**table**](#gt_d3a7da8d-a597-4838-9756-25e30b640ba7) (**RRAutoFmt** (section [2.4.222](#Section_65dea3f4d61b46e4b6739e7d95559f35)))

#### 2.2.11.4 Insertion / Deletion of Rows / Columns Revision

This revision corresponds to an insertion or deletion of a row or column. In between **RRDInsDel** (section [2.4.228](#Section_fe37df682d0e4d89a213cc4ebd9ac138)) and **RRDInsDelEnd** (section [2.4.230](#Section_70539822f7634024b8635ab70e777c5f)), any number of **RRFormat** (section [2.4.238](#Section_c5933975af274629a6c518055a26684c)) and **RRDChgCell records** (section [2.4.223](#Section_f7c1ffa25ac54cccb1e941d556ff4b75)) can appear as well as the other records associated with **RRDChgCell** (section 2.4.223) (**RRDRstEtxp** (section [2.4.235](#Section_7851645890124f128987457ffb1272f8))). These records describe the [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461) and format changes as a result of inserting or deleting the row or column.

#### 2.2.11.5 Move Cells Revision

This revision corresponds to moving a [**range**](#gt_c2c93fec-8d3e-45de-8010-c738cc1cea99) of [**cells**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461). In between **RRDMove** (section [2.4.231](#Section_335c3e38c8b6460298238e3e02eae66f)) and **RRDMoveEnd** (section [2.4.233](#Section_09a9b9d9db234b2b8a22180d91031d99)), any number of **RRFormat** (section [2.4.238](#Section_c5933975af274629a6c518055a26684c)) and **RRDChgCell records** (section [2.4.223](#Section_f7c1ffa25ac54cccb1e941d556ff4b75)) can appear as well as the other records associated with **RRDChgCell** (section 2.4.223) (**RRDRstEtxp** (section [2.4.235](#Section_7851645890124f128987457ffb1272f8))). These records describe the cell and format changes as a result of moving a range of cells.

#### 2.2.11.6 Change Cells Revision

This revision (**RRDChgCell** (section [2.4.223](#Section_f7c1ffa25ac54cccb1e941d556ff4b75))) corresponds to a change or edit of a [**cell**](#gt_43d1e51e-4f26-493b-b7c9-e84e920d7461). It can be followed by any number of **RRDRstEtxp records** (section [2.4.235](#Section_7851645890124f128987457ffb1272f8)). These specify [**font**](#gt_f8aa3f46-99d1-49bb-858f-b4bfa546c1c2) information for the [**formatting run**](#gt_10031ac8-2a26-4200-beee-cd8d9420ca96) as specified in **RRDChgCell** (section 2.4.223).

#### 2.2.11.7 Sort Map

The **Sort Map** contains changes to sorting done on the [**sheet (1)**](#gt_0b356926-f9cb-4dc2-a859-71441d62503d) level in a **shared workbook** (section [2.2.11](#Section_e45a62c4490f4304a09668908b57dacc)). Each sheet (1) can have a **Sort Map**. The **Sort Map** is made of up to two sorts (**RRSort** (section [2.4.240](#Section_e2f8f20ce1ef4da696cbcbe03b716aaa))). One specifies sheet (1) level sort changes in rows followed by sheet (1) level sort changes in columns. If there are no changes in sort for rows or columns, the sort map does not exist for rows or columns respectively.

### 2.2.12 Shared Feature

A **shared feature** is a mechanism that enables different application features to share a common set of record types. For an enumeration of the types of **shared features**, see **SharedFeatureType** (section [2.5.237](#Section_4dc13a80f10a46e6b55d1df4c90508e8)). For each type of **shared feature** the required records vary. All **shared features** use the following:

 Common information stored in a **FeatHdr** (section [2.4.112](#Section_5748f6334a5c4b2c9f452d21c06f753d)) or **FeatHdr11** (section [2.4.113](#Section_45a7d5ac82e142d0a2290c4dc8446d43)) record. There MUST be one **FeatHdr** (section 2.4.112) or **FeatHdr11** (section 2.4.113) record for each type of **shared feature** used in one of the **Workbook substreams** (section [2.1.7.20](#Section_f682f4b08c6b444e83f852d156f1e8ba)).

 Instance specific feature data stored in a **Feat** (section [2.4.111](#Section_f8800f12d3ff4fa790a4a505e26e5608)), **Feature11** (section [2.4.114](#Section_4c78a7d3a3ff48e28e2cc89785519322)), or **Feature12** (section [2.4.115](#Section_4c95f0ddd35745758b77792dbe2c0d5e)) record. There MUST be one or more **Feat** (section 2.4.111), **Feature11** (section 2.4.114), or **Feature12** (section 2.4.115) records for each instance of a **shared feature**.

Some **shared features** require other feature-specific records. See **FEAT** (section [2.1.7.20.6](#Section_a1b3d8b4744241fd9c57bbd2a6394082)) and **FEAT11** (section 2.1.7.20.6) records for additional records used for **shared features**.