

## **Apache Xalan-J's, XSLT 3.0 specification implementation status (as of, 2024-06-22)**

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### **(1) XSLT 3.0 & XPath 3.1**

Following are details of Xalan-J, "XSL 3.0 family of languages" features, whose working implementation is available on Xalan-J XSLT 3.0 dev repos branch 'xalan-j\_xslt3.0' (ref, [https://github.com/apache/xalan-java/tree/xalan-j\\_xslt3.0](https://github.com/apache/xalan-java/tree/xalan-j_xslt3.0)).

#### **(1.1) XSLT 3.0 features**

XSLT 3.0 language home page : <https://www.w3.org/TR/xslt-30/>

- 1) xsl:for-each-group instruction
- 2) xsl:analyze-string instruction
- 3) xsl:iterate instruction
- 4) xsl:for-each instruction implementation is modified, to handle few XSLT 3.0 requirements.
- 5) xsl:function instruction
- 6) xsl:sequence instruction
- 7) xsl:attribute element can now have "select" attribute as well in addition to mutually exclusive child content as well, as specified by XSLT 3.0 spec.
- 8) xsl:import-schema instruction

Currently, the XML Schema simple types imported via xsl:import-schema instruction within an XSLT stylesheet, can be used with "as" attribute of XSLT xsl:variable elements to enforce schema type constraints on xsl:variable data contents.

- 9) xsl:variable instruction evaluation to node set instead of result tree fragment (RTF). This is a XSLT spec change first introduced within XSLT 2.0 language, as compared to XSLT 1.0.
- 10) The sequence type expression "as" attribute on XSLT elements xsl:variable, xsl:template, xsl:function, xsl:param, xsl:with-param.
- 11) Function implementations
  - a) New function implementations : fn:current-grouping-key, fn:current-group, fn:regex-group
  - b) Function implementation enhancements : fn:system-property

## (1.2) XPath 3.1 expression language features

XPath 3.1 language home page : <https://www.w3.org/TR/xpath-31/>

- 1) Range "to" expression
- 2) Value comparison operators eq, ne, lt, le, gt, ge
- 3) Function item "inline function expression"
- 4) Dynamic function calls
- 5) "if" expression
- 6) "for" expression
- 7) Quantified expressions 'some', 'every'
- 8) "let" expression
- 9) Sequence constructor expression, using comma operator

For e.g, XPath expressions like (1, 2, 3) etc.

- 10) String concatenation operator "||"
- 11) Node comparison operators "is", "<<", ">>"
- 12) Simple map operator "!"
- 13) Instance Of expression

14) Implementation of various new XML Schema built-in data types for use within XSLT 3.0 stylesheets and XPath 3.1 expressions. Implementation of, XPath constructor function calls (for e.g, `xs:string('hello')`, `xs:date('2005-10-07')` etc) for these supported XML Schema data types.

Currently, following XML Schema built-in data types are supported (depicted with XML Schema data type and subtype hierarchy as specified by “W3C XML Schema” data types specification), for this work :

```
xs:anyType
  xs:anySimpleType
    xs:anyAtomicType
      xs:anyURI
      xs:boolean
      xs:date
      xs:dateTime
      xs:decimal
```

- xs:integer
- xs:long
- xs:int
- xs:double
- xs:duration
  - xs:dayTimeDuration
  - xs:yearMonthDuration
- xs:float
- xs:QName
- xs:string
  - xs:normalizedString
  - xs:token
  - xs:Name
  - xs:NCName
- xs:time

In addition to above mentioned XML Schema built-in data types, an XML Schema type `xs:untyped` specified by XPath 3.1 specification has also been implemented.

## 15) Collation support

As specified by XPath 3.1 F&O spec, implementations of following collations are supported:

### 15.1) The Unicode Codepoint Collation

### 15.2) The Unicode Collation Algorithm

Support for following collation uri query parameters is available : 'fallback', 'lang', 'strength'

For the collation's query "lang" parameter, all languages as those supported by Java's 'java.util.Locale' class are available within Xalan-J's XSLT 3.0 implementation (ref, <https://docs.oracle.com/javase/8/docs/api/java/util/Locale.html>).

For the collation's query "strength" parameter, following values are supported : 'primary', 'secondary', 'tertiary', 'identical'.

### 15.3) The HTML ASCII Case-Insensitive Collation

## 16) Sequence type expressions

## 17) Map expressions

## 18) Array expressions

## 19) Cast expression

## 20) Castable expression

## 21) Arrow operator ( $\Rightarrow$ )

### (1.3) XPath 3.1 functions

XPath 3.1 F&O home page : <https://www.w3.org/TR/xpath-functions-31/>

Implementation of built-in functions namespace uri : <http://www.w3.org/2005/xpath-functions>

Implementation of built-in math functions namespace uri : <http://www.w3.org/2005/xpath-functions/math>

#### 1) String functions that use regular expressions

fn:matches  
fn:replace  
fn:tokenize  
fn:analyze-string

#### 2) Functions on numeric values

fn:abs  
fn:round (implementation of an optional second argument, that's used to specify 'precision')

#### 3) Functions giving access to external information

fn:doc  
fn:unparsed-text

#### 4) Functions on strings

fn:string-join  
fn:upper-case  
fn:lower-case  
fn:codepoints-to-string  
fn:string-to-codepoints  
fn:compare (with support for collation argument)  
fn:codepoint-equal  
fn:contains-token (with support for collation argument)

#### 5) Context functions

fn:current-dateTime  
fn:current-date  
fn:current-time  
fn:implicit-timezone  
fn:default-collation

#### 6) Functions that compare values in sequences

fn:distinct-values (with support for collation argument)

fn:index-of (with support for collation argument)  
fn:deep-equal (with support for collation argument)

## 7) Mathematical trigonometric and exponential functions

math:pi  
math:exp  
math:exp10  
math:log  
math:log10  
math:pow  
math:sqrt  
math:sin  
math:cos  
math:tan  
math:asin  
math:acos  
math:atan  
math:atan2

## 8) Component extraction functions on durations

fn:years-from-duration  
fn:months-from-duration  
fn:days-from-duration  
fn:hours-from-duration  
fn:minutes-from-duration  
fn:seconds-from-duration

## 9) Constructing xs:dateTime value

fn:dateTime

## 10) Component extraction functions on dates and times

fn:year-from-dateTime  
fn:month-from-dateTime  
fn:day-from-dateTime  
fn:hours-from-dateTime  
fn:minutes-from-dateTime  
fn:seconds-from-dateTime  
fn:timezone-from-dateTime  
fn:year-from-date  
fn:month-from-date  
fn:day-from-date  
fn:timezone-from-date  
fn:hours-from-time  
fn:minutes-from-time  
fn:seconds-from-time

fn:timezone-from-time

## 11) Built-in higher-order functions

fn:for-each

fn:filter

fn:fold-left

fn:fold-right

fn:for-each-pair

fn:sort (with support for collation argument)

## 12) Functions on sequences

### 12.1 General functions on sequences

fn:empty

fn:exists

fn:head

fn:tail

fn:insert-before

fn:remove

fn:reverse

fn:subsequence

fn:unordered

### 12.2 Aggregate functions

fn:avg

fn:max

fn:min

## 13) Parsing and serializing

fn:parse-xml

fn:parse-xml-fragment

## 14) Accessors

fn:node-name

fn:data

fn:base-uri

fn:document-uri

## 15) Functions related to QNames

fn:resolve-QName

fn:QName

## 16) Functions related to maps

map:merge

map:size  
map:keys  
map:contains  
map:get  
map:put  
map:entry  
map:remove  
map:for-each

#### 17) Functions related to arrays

array:size  
array:get  
array:put  
array:append  
array:subarray  
array:remove  
array:insert-before  
array:head  
array:tail  
array:reverse  
array:join  
array:for-each  
array:filter  
array:fold-left  
array:fold-right  
array:for-each-pair  
array:sort (with support for collation argument)

#### 18) Functions on JSON data

fn:parse-json  
fn:json-doc  
fn:json-to-xml  
fn:xml-to-json

Other than the above mentioned newly implemented XPath 3.1 functions, all the functions that are already available within XPath 1.0 (all of them are common with XPath 3.1 function library as well) are available within Xalan-J's XPath 3.1 implementation as well.

Please refer to the web link <https://www.w3.org/TR/1999/REC-xpath-19991116/> (section "4 Core Function Library"), for XPath 1.0 functions that shall work with Xalan-J's XSLT 3.0 implementation as well.

## **(2) Xalan-J XSLT 3.0 & XPath 3.1 test suite**

For the Xalan-J XSLT 3.0 & XPath 3.1 implementations described within this document, a working test suite is available at the location : [https://github.com/apache/xalan-java/tree/xalan-j\\_xslt3.0/tests](https://github.com/apache/xalan-java/tree/xalan-j_xslt3.0/tests), and the results of these Xalan-J XSL tests are available at the location : [https://xalan.apache.org/xalan-j/xsl3/tests/AllXsl3Tests\\_20240622-124238.xml](https://xalan.apache.org/xalan-j/xsl3/tests/AllXsl3Tests_20240622-124238.xml).

Apache Xalan-J home page : <https://xalan.apache.org/xalan-j/>

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