

Hortonworks DataFlow

Expression Language

(August 9, 2017)

Hortonworks DataFlow: Expression Language

Copyright © 2012-2017 Hortonworks, Inc. Some rights reserved.



Except where otherwise noted, this document is licensed under
Creative Commons Attribution ShareAlike 4.0 License.
<http://creativecommons.org/licenses/by-sa/4.0/legalcode>

Table of Contents

1. Apache NiFi Expression Language Guide	1
1.1. Overview	1
1.2. Structure of a NiFi Expression	2
1.3. Expression Language in the Application	3
1.3.1. Expression Language Editor	4
1.4. Functions	4
1.4.1. Data Types	4
1.5. Boolean Logic	5
1.5.1. isNull	5
1.5.2. notNull	6
1.5.3. isEmpty	6
1.5.4. equals	6
1.5.5. equalsIgnoreCase	7
1.5.6. gt	7
1.5.7. ge	7
1.5.8. lt	8
1.5.9. le	8
1.5.10. and	8
1.5.11. or	9
1.5.12. not	9
1.5.13. ifElse	9
1.6. String Manipulation	10
1.6.1. toUpper	10
1.6.2. toLower	10
1.6.3. trim	10
1.6.4. substring	11
1.6.5. substringBefore	11
1.6.6. substringBeforeLast	12
1.6.7. substringAfter	12
1.6.8. substringAfterLast	13
1.6.9. getDelimitedField	13
1.6.10. append	14
1.6.11. prepend	14
1.6.12. replace	15
1.6.13. replaceFirst	15
1.6.14. replaceAll	16
1.6.15. replaceNull	16
1.6.16. replaceEmpty	17
1.6.17. length	17
1.7. Encode/Decode Functions	17
1.7.1. escapeJson	17
1.7.2. escapeXml	18
1.7.3. escapeCsv	18
1.7.4. escapeHtml3	18
1.7.5. escapeHtml4	19
1.7.6. unescapeJson	19
1.7.7. unescapeXml	19
1.7.8. unescapeCsv	19

1.7.9. unescapeHtml3	20
1.7.10. unescapeHtml4	20
1.7.11. urlEncode	20
1.7.12. urlDecode	20
1.7.13. base64Encode	21
1.7.14. base64Decode	21
1.8. Searching	21
1.8.1. startsWith	21
1.8.2. endsWith	22
1.8.3. contains	22
1.8.4. in	22
1.8.5. find	23
1.8.6. matches	23
1.8.7. indexOf	24
1.8.8. lastIndexOf	24
1.8.9. jsonPath	25
1.9. Mathematical Operations and Numeric Manipulation	26
1.9.1. plus	26
1.9.2. minus	26
1.9.3. multiply	27
1.9.4. divide	27
1.9.5. mod	27
1.9.6. toRadix	27
1.9.7. fromRadix	28
1.9.8. random	29
1.9.9. math	29
1.10. Date Manipulation	30
1.10.1. format	30
1.10.2. toDate	31
1.10.3. now	31
1.11. Type Coercion	32
1.11.1. toString	32
1.11.2. toNumber	32
1.11.3. toDecimal	32
1.12. Subjectless Functions	33
1.12.1. ip	33
1.12.2. hostname	33
1.12.3. UUID	33
1.12.4. nextInt	34
1.12.5. literal	34
1.12.6. getStateValue	34
1.13. Evaluating Multiple Attributes	35
1.13.1. anyAttribute	35
1.13.2. allAttributes	35
1.13.3. anyMatchingAttribute	36
1.13.4. allMatchingAttributes	36
1.13.5. anyDelineatedValue	37
1.13.6. allDelineatedValues	37
1.13.7. join	38
1.13.8. count	39

List of Tables

1.1. Table 1. ifElse Examples	10
1.2. Table 2. Substring Examples	11
1.3. Table 3. SubstringBefore Examples	12
1.4. Table 4. SubstringBeforeLast Examples	12
1.5. Table 5. SubstringAfter Examples	13
1.6. Table 6. SubstringAfterLast Examples	13
1.7. Table 7. GetDelimitedField Examples	14
1.8. Table 8. Replace Examples	15
1.9. Table 9. ReplaceFirst Examples	16
1.10. Table 10. ReplaceAll Examples	16
1.11. Table 11. find Examples	23
1.12. Table 12. matches Examples	24
1.13. Table 13. indexOf Examples	24
1.14. Table 14. lastIndexOf Examples	25
1.15. Table 15. jsonPath Examples	25
1.16. Table 16. toRadix Examples	28
1.17. Table 17. toRadix Examples	29
1.18. Table 18. format Examples	30
1.19. Table 19. now Examples	32
1.20. Table 20. anyAttribute Examples	35
1.21. Table 21. allAttributes Example	36
1.22. Table 22. anyMatchingAttribute Example	36
1.23. Table 23. anyMatchingAttributes Examples	37
1.24. Table 24. anyDelineatedValue Examples	37
1.25. Table 25. allDelineatedValues Examples	38
1.26. Table 26. join Examples	38
1.27. Table 27. count Examples	39

1. Apache NiFi Expression Language Guide

- [Overview](#)
- [Structure of a NiFi Expression](#)
- [Expression Language in the Application](#)
- [Functions](#)
- [Boolean Logic](#)
- [String Manipulation](#)
- [Encode/Decode Functions](#)
- [Searching](#)
- [Mathematical Operations and Numeric Manipulation](#)
- [Date Manipulation](#)
- [Type Coercion](#)
- [Subjectless Functions](#)
- [Evaluating Multiple Attributes](#)

1.1. Overview

All data in Apache NiFi is represented by an abstraction called a FlowFile. A FlowFile is comprised of two major pieces: content and attributes. The content portion of the FlowFile represents the data on which to operate. For instance, if a file is picked up from a local file system using the GetFile Processor, the contents of the file will become the contents of the FlowFile.

The attributes portion of the FlowFile represents information about the data itself, or metadata. Attributes are key-value pairs that represent what is known about the data as well as information that is useful for routing and processing the data appropriately. Keeping with the example of a file that is picked up from a local file system, the FlowFile would have an attribute called `filename` that reflected the name of the file on the file system. Additionally, the FlowFile will have a `path` attribute that reflects the directory on the file system that this file lived in. The FlowFile will also have an attribute named `uuid`, which is a unique identifier for this FlowFile. For complete listing of the core attributes check out the FlowFile section of the [Developer's Guide](#).

However, placing these attributes on a FlowFile do not provide much benefit if the user is unable to make use of them. The NiFi Expression Language provides the ability to reference these attributes, compare them to other values, and manipulate their values.

1.2. Structure of a NiFi Expression

The NiFi Expression Language always begins with the start delimiter `${` and ends with the end delimiter `}`. Between the start and end delimiters is the text of the Expression itself. In its most basic form, the Expression can consist of just an attribute name. For example, `${filename}` will return the value of the "filename" attribute.

In a slightly more complex example, we can instead return a manipulation of this value. We can, for example, return an all upper-case version of the filename by calling the `toUpper` function: `${filename:toUpper()}`. In this case, we reference the "filename" attribute and then manipulate this value by using the `toUpper` function. A function call consists of 5 elements. First, there is a function call delimiter `:`. Second is the name of the function - in this case, "toUpper". Next is an open parenthesis `(`, followed by the function arguments. The arguments necessary are dependent upon which function is being called. In this example, we are using the `toUpper` function, which does not have any arguments, so this element is omitted. Finally, the closing parenthesis `)` indicates the end of the function call. There are many different functions that are supported by the Expression Language to achieve many different goals. Some functions provide String (text) manipulation, such as the `toUpper` function. Others, such as the `equals` and `matches` functions, provide comparison functionality. Functions also exist for manipulating dates and times and for performing mathematical operations. Each of these functions is described below, in the [Functions](#) section, with an explanation of what the function does, the arguments that it requires, and the type of information that it returns.

When we perform a function call on an attribute, as above, we refer to the attribute as the *subject* of the function, as the attribute is the entity on which the function is operating. We can then chain together multiple function calls, where the return value of the first function becomes the subject of the second function and its return value becomes the subject of the third function and so on. Continuing with our example, we can chain together multiple functions by using the expression `${filename:toUpper():equals('HELLO.TXT')}`. There is no limit to the number of functions that can be chained together.

Any FlowFile attribute can be referenced using the Expression Language. However, if the attribute name contains a "special character," the attribute name must be escaped by quoting it. The following characters are each considered "special characters":

- `$` (dollar sign)
- `|` (pipe)
- `{` (open brace)
- `}` (close brace)
- `(` (open parenthesis)
- `)` (close parenthesis)
- `[` (open bracket)
- `]` (close bracket)
- `,` (comma)

- : (colon)
- ; (semicolon)
- / (forward slash)
- * (asterisk)
- ' (single quote)
- (space)
- \t (tab)
- \r (carriage return)
- \n (new-line)

Additionally, a number is considered a "special character" if it is the first character of the attribute name. If any of these special characters is present in an attribute is quoted by using either single or double quotes. The Expression Language allows single quotes and double quotes to be used interchangeably. For example, the following can be used to escape an attribute named "my attribute": `${ "my attribute" }` or `${ 'my attribute' }`.

In this example, the value to be returned is the value of the "my attribute" value, if it exists. If that attribute does not exist, the Expression Language will then look for a System Environment Variable named "my attribute." If unable to find this, it will look for a JVM System Property named "my attribute." Finally, if none of these exists, the Expression Language will return a `null` value.

There also exist some functions that expect to have no subject. These functions are invoked simply by calling the function at the beginning of the Expression, such as `${hostname()}`. These functions can then be changed together, as well. For example, `${hostname():toUpper()}`. Attempting to evaluate the function with subject will result in an error. In the [Functions](#) section below, these functions will clearly indicate in their descriptions that they do not require a subject.

Often times, we will need to compare the values of two different attributes to each other. We are able to accomplish this by using embedded Expressions. We can, for example, check if the "filename" attribute is the same as the "uuid" attribute: `${filename:equals(${uuid})}`. Notice here, also, that we have a space between the opening parenthesis for the `equals` method and the embedded Expression. This is not necessary and does not affect how the Expression is evaluated in any way. Rather, it is intended to make the Expression easier to read. White space is ignored by the Expression Language between delimiters. Therefore, we can use the Expression `${ filename : equals(${ uuid}) }` or `${filename:equals(${uuid})}` and both Expressions mean the same thing. We cannot, however, use `${file name:equals(${uuid})}`, because this results in `file` and `name` being interpreted as different tokens, rather than a single token, `filename`.

1.3. Expression Language in the Application

The Expression Language is used heavily throughout the NiFi application for configuring Processor properties. Not all Processor properties support the Expression Language,

however. Whether or not a Property supports the Expression Language is determined by the developer of the Processor when the Processor is written. However, the application strives to clearly illustrate for each Property whether or not the Expression Language is supported.

In the application, when configuring a Processor property, the User Interface provides an Information icon (



) next to the name of the Property. Hovering over this icon with the mouse will provide a tooltip that provides helpful information about the Property. This information includes a description of the Property, the default value (if any), historically configured values (if any), and whether or not this Property supports the expression language.

1.3.1. Expression Language Editor

When configuring the value of a Processor property, the NiFi User Interface provides help with the Expression Language using the Expression Language editor. Once an Expression is begin by typing `${`, the editor begins to highlight parentheses and braces so that the user is easily able to tell which opening parenthesis or brace matches which closing parenthesis or brace.

The editor also supplies context-sensitive help by providing a list of all functions that can be used at the current cursor position. To activate this feature, press `Ctrl+Space` on the keyboard. The user is also able to type part of a function name and then press `Ctrl+Space` to see all functions that can be used that start with the same prefix. For example, if we type into the editor `${filename:to` and then press `Ctrl+Space`, we are provided a pop-up that lists six different functions: `toDate`, `toLowerCase`, `toNumber`, `toRadix`, `toString`, and `toUpperCase`. We can then continue typing to narrow which functions are shown, or we can select one of the functions from the list by double-clicking it with the mouse or using the arrow keys to highlight the desired function and pressing `Enter`.

1.4. Functions

Functions provide a convenient way to manipulate and compare values of attributes. The Expression Language provides many different functions to meet the needs of a automated dataflow. Each function takes zero or more arguments and returns a single value. These functions can then be chained together to create powerful Expressions to evaluate conditions and manipulate values. See [Structure of a NiFi Expression](#) for more information on how to call and chain functions together.

1.4.1. Data Types

Each argument to a function and each value returned from a function has a specific data type. The Expression Language supports four different data types:

- **String:** A String is a sequence of characters that can consist of numbers, letters, white space, and special characters.
- **Number:** A Number is an whole number comprised of one or more digits (0 through 9). When converting to numbers from Date data types, they are represented as the number of milliseconds since midnight GMT on January 1, 1970.

- **Decimal:** A Decimal is a numeric value that can support decimals and larger values with minimal loss of precision. More precisely it is a double-precision 64-bit IEEE 754 floating point. Due to this minimal loss of precision this data type should not be used for very precise values, such as currency. For more documentation on the range of values stored in this data type refer to this [link](#). The following are some examples of the forms of literal decimals that are supported in expression language (the "E" can also be lower-case):
 - 1.1
 - .1E1
 - 1.11E-12
- **Date:** A Date is an object that holds a Date and Time. Utilizing the [Date Manipulation](#) and [Type Coercion](#) functions this data type can be converted to/from Strings and numbers. If the whole Expression Language expression is evaluated to be a date then it will be converted to a String with the format: "<Day of Week> <Month> <Day of Month> <Hour>:<Minute>:<Second> <Time Zone> <Year>". Also expressed as "E MMM dd HH:mm:ss z yyyy" in Java SimpleDateFormat format. For example: "Wed Dec 31 12:00:04 UTC 2016".
- **Boolean:** A Boolean is one of either `true` or `false`.

After evaluating expression language functions, all attributes are stored as type String.

The Expression Language is generally able to automatically coerce a value of one data type to the appropriate data type for a function. However, functions do exist to manually coerce a value into a specific data type. See the [Type Coercion](#) section for more information.

Hex values are supported for Number and Decimal types but they must be quoted and prepended with "0x" when being interpreted as literals. For example these two expressions are valid (without the quotes or "0x" the expression would fail to run properly):

- `${literal("0xF"):toNumber()}`
- `${literal("0xF.Fp10"):toDecimal()}`

1.5. Boolean Logic

One of the most powerful features of the Expression Language is the ability to compare an attribute value against some other value. This is used often, for example, to configure how a Processor should route data. The following functions are used for performing boolean logic, such as comparing two values. Each of these functions are designed to work on values of type Boolean.

1.5.1. isNull

Description: The `isNull` function returns `true` if the subject is null, `false` otherwise. This is typically used to determine if an attribute exists.

Subject Type: Any

Arguments: No arguments

Return Type: Boolean

Examples: `${filename:isNull() }` returns `true` if the "filename" attribute does not exist. It returns `false` if the attribute exists.

1.5.2. notNull

Description: The `notNull` function returns the opposite value of the `isNull` function. That is, it will return `true` if the subject exists and `false` otherwise.

Subject Type: Any

Arguments: No arguments

Return Type: Boolean

Examples: `${filename:notNull() }` returns `true` if the "filename" attribute exists. It returns `false` if the attribute does not exist.

1.5.3. isEmpty

Description: The `isEmpty` function returns `true` if the Subject is null or contains only white-space (new line, carriage return, space, tab), `false` otherwise.

Subject Type: String

Arguments: No arguments

Return Type: Boolean

Examples: `${filename:isEmpty() }` returns `true` if the "filename" attribute does not exist or contains only white space.

1.5.4. equals

Description: The `equals` function is very widely used and determines if its subject is equal to another String value. Note that the `equals` function performs a direct comparison of two String values. Take care not to confuse this function with the `matches` function, which evaluates its subject against a Regular Expression.

Subject Type: Any

Arguments:

- *value* : The value to compare the Subject to. Must be same type as the Subject.

Return Type: Boolean

Examples: We can check if the filename of a FlowFile is "hello.txt" by using the expression `${filename>equals('hello.txt')}`, or we could check if the value of the attribute `hello` is equal to the value of the `filename` attribute: `${hello>equals(${filename})}`.

1.5.5. equalsIgnoreCase

Description: Similar to the `equals` function, the `equalsIgnoreCase` function compares its subject against a `String` value but returns `true` if the two values differ only by case (upper case vs. lower case).

Subject Type: `String`

Arguments:

- *value* : The value to compare the Subject to.

Return Type: `Boolean`

Examples: `${filename:equalsIgnoreCase('hello.txt')}` will evaluate to `true` if filename is equal to "hello.txt" or "HELLO.TXT" or "HeLlLo.TxT".

1.5.6. gt

Description: The `gt` function is used for numeric comparison and returns `true` if the subject is Greater Than its argument. If either the subject or the argument cannot be coerced into a `Number`, this function returns `false`.

Subject Type: `Number`

Arguments:

- *value* : The number to compare the Subject to.

Return Type: `Boolean`

Examples: `${fileSize:gt(1024)}` will return `true` if the size of the FlowFile's content is more than 1 kilobyte (1024 bytes). Otherwise, it will return `false`.

1.5.7. ge

Description: The `ge` function is used for numeric comparison and returns `true` if the subject is Greater Than Or Equal To its argument. If either the subject or the argument cannot be coerced into a `Number`, this function returns `false`.

Subject Type: `Number`

Arguments:

- *value* : The number to compare the Subject to.

Return Type: `Boolean`

Examples: `${fileSize:ge(1024)}` will return `true` if the size of the FlowFile's content is at least (is greater than or equal to) 1 kilobyte (1024 bytes). Otherwise, it will return `false`.

1.5.8. lt

Description: The `lt` function is used for numeric comparison and returns `true` if the subject is Less Than its argument. If either the subject or the argument cannot be coerced into a Number, this function returns `false`.

Subject Type: Number

Arguments:

- *value* : The number to compare the Subject to.

Return Type: Boolean

Examples: `${fileSize:lt(1048576)}` will return `true` if the size of the FlowFile's content is less than 1 megabyte (1048576 bytes). Otherwise, it will return `false`.

1.5.9. le

Description: The `le` function is used for numeric comparison and returns `true` if the subject is Less Than Or Equal To its argument. If either the subject or the argument cannot be coerced into a Number, this function returns `false`.

Subject Type: Number

Arguments:

- *value* : The number to compare the Subject to.

Return Type: Boolean

Examples: `${fileSize:le(1048576)}` will return `true` if the size of the FlowFile's content is at most (less than or equal to) 1 megabyte (1048576 bytes). Otherwise, it will return `false`.

1.5.10. and

Description: The `and` function takes as a single argument a Boolean value and returns `true` if both the Subject and the argument are `true`. If either the subject or the argument is `false` or cannot be coerced into a Boolean, the function returns `false`. Typically, this is used with an embedded Expression as the argument.

Subject Type: Boolean

Arguments:

- *condition* : The right-hand-side of the *and* Expression

Return Type: Boolean

Examples: We can check if the filename is both all lower-case and has at least 5 characters by using the Expression

```
${filename:toLowerCase():equals( ${filename} ):and(
    ${filename:length():ge(5)}
)}
```

1.5.11. or

Description: The `or` function takes as a single argument a Boolean value and returns `true` if either the Subject or the argument is `true`. If both the subject and the argument are `false`, the function returns `false`. If either the Subject or the argument cannot be coerced into a Boolean value, this function will return `false`.

Subject Type: Boolean

Arguments:

- *condition* : The right-hand-side of the *and* Expression

Return Type: Boolean

Examples: The following example will return `true` if either the filename has exactly 5 characters or if the filename is all lower-case.

```
${filename:toLowerCase():equals( ${filename} ):or(
    ${filename:length():equals(5)}
)}
```

1.5.12. not

Description: The `not` function returns the negation of the Boolean value of the subject.

Subject Type: Boolean

Arguments: No arguments

Return Type: Boolean

Examples: We can invert the value of another function by using the `not` function, as `${filename:equals('hello.txt'):not()}`. This will return `true` if the filename is NOT equal to "hello.txt" and will return `false` if the filename is "hello.txt."

1.5.13. ifElse

Description: Evaluates the first argument if the Subject evaluates to `true`, or the second argument if the Subject evaluates to `false`.

Subject Type: Boolean

Arguments:

- *EvaluateIfTrue* : The value to return if the Subject is true
- *EvaluateIfFalse* : The value to return if the Subject is false

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", the "nullFilename" attribute has the value null, and the "bool" attribute has the value "true", then the following expressions will provide the following results:

Table 1.1. Table 1. ifElse Examples

Expression	Value
<code>\${bool:ifElse('a','b')}</code>	a
<code>\${literal(true):ifElse('a','b')}</code>	a
<code>\${nullFilename:isNull():ifElse('file does not exist', 'located file')}</code>	file does not exist
<code>\${nullFilename:ifElse('found', 'not_found')}</code>	not_found
<code>\${filename:ifElse('found', 'not_found')}</code>	not_found
<code>\${filename:isNull():not():ifElse('found', 'not_found')}</code>	found

1.6. String Manipulation

Each of the following functions manipulates a String in some way.

1.6.1. toUpper

Description: This function converts the Subject into an all upper-case String. Said another way, it replaces any lowercase letter with the uppercase equivalent.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "filename" attribute is "abc123.txt", then the Expression `${filename:toUpper() }` will return "ABC123.TXT"

1.6.2. toLower

Description: This function converts the Subject into an all lower-case String. Said another way, it replaces any uppercase letter with the lowercase equivalent.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "filename" attribute is "ABC123.TXT", then the Expression `${filename:toLower() }` will return "abc123.txt"

1.6.3. trim

Description: The `trim` function will remove any leading or trailing white space from its subject.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the attribute `attr` has the value " 1 2 3 ", then the Expression `${attr:trim() }` will return the value "1 2 3".

1.6.4. substring

Description: Returns a portion of the Subject, given a *starting index* and an optional *ending index*. If the *ending index* is not supplied, it will return the portion of the Subject starting at the given *start index* and ending at the end of the Subject value.

The *starting index* and *ending index* are zero-based. That is, the first character is referenced by using the value 0, not 1.

If either the *starting index* is or the *ending index* is not a number, this function call will result in an error.

If the *starting index* is larger than the *ending index*, this function call will result in an error.

If the *starting index* or the *ending index* is greater than the length of the Subject or has a value less than 0, this function call will result in an error.

Subject Type: String

Arguments:

- *starting index* : The 0-based index of the first character to capture (inclusive)
- *ending index* : The 0-based index of the last character to capture (exclusive)

Return Type: String

Examples:

If we have an attribute named "filename" with the value "a brand new filename.txt", then the following Expressions will result in the following values:

Table 1.2. Table 2. Substring Examples

Expression	Value
<code>\${filename:substring(0,1)}</code>	a
<code>\${filename:substring(2)}</code>	brand new filename.txt
<code>\${filename:substring(12)}</code>	filename.txt
<code>\${filename:substring(\${filename:length():minus(2)})}</code>	

1.6.5. substringBefore

Description: Returns a portion of the Subject, starting with the first character of the Subject and ending with the character immediately before the first occurrence of the argument. If the argument is not present in the Subject, the entire Subject will be returned.

Subject Type: String

Arguments:

- *value* : The String to search for in the Subject

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will result in the following values:

Table 1.3. Table 3. SubstringBefore Examples

Expression	Value
<code>\${filename:substringBefore('.')}</code>	a brand new filename
<code>\${filename:substringBefore('')}</code>	a
<code>\${filename:substringBefore(' n')}</code>	a brand
<code>\${filename:substringBefore('missing')}</code>	a brand new filename.txt

1.6.6. substringBeforeLast

Description: Returns a portion of the Subject, starting with the first character of the Subject and ending with the character immediately before the last occurrence of the argument. If the argument is not present in the Subject, the entire Subject will be returned.

Subject Type: String

Arguments:

- *value* : The String to search for in the Subject

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will result in the following values:

Table 1.4. Table 4. SubstringBeforeLast Examples

Expression	Value
<code>\${filename:substringBeforeLast('.')}</code>	a brand new filename
<code>\${filename:substringBeforeLast('')}</code>	a brand new
<code>\${filename:substringBeforeLast(' n')}</code>	a brand
<code>\${filename:substringBeforeLast('missing')}</code>	a brand new filename.txt

1.6.7. substringAfter

Description: Returns a portion of the Subject, starting with the character immediately after the first occurrence of the argument and extending to the end of the Subject. If the argument is not present in the Subject, the entire Subject will be returned.

Subject Type: String

Arguments:

- *value* : The String to search for in the Subject

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will result in the following values:

Table 1.5. Table 5. SubstringAfter Examples

Expression	Value
<code>\${filename:substringAfter('.')}</code>	txt
<code>\${filename:substringAfter('')}</code>	brand new filename.txt
<code>\${filename:substringAfter(' n')}</code>	ew filename.txt
<code>\${filename:substringAfter('missing')}</code>	a brand new filename.txt

1.6.8. substringAfterLast

Description: Returns a portion of the Subject, starting with the character immediately after the last occurrence of the argument and extending to the end of the Subject. If the argument is not present in the Subject, the entire Subject will be returned.

Subject Type: String**Arguments:**

- *value* : The String to search for in the Subject

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will result in the following values:

Table 1.6. Table 6. SubstringAfterLast Examples

Expression	Value
<code>\${filename:substringAfterLast('.')}</code>	txt
<code>\${filename:substringAfterLast('')}</code>	filename.txt
<code>\${filename:substringAfterLast(' n')}</code>	ew filename.txt
<code>\${filename:substringAfterLast('missing')}</code>	a brand new filename.txt

1.6.9. getDelimitedField

Description: Parses the Subject as a delimited line of text and returns just a single field from that delimited text.

Subject Type: String**Arguments:**

- *index* : The index of the field to return. A value of 1 will return the first field, a value of 2 will return the second field, and so on.

- *delimiter* : Optional argument that provides the character to use as a field separator. If not specified, a comma will be used. This value must be exactly 1 character.
- *quoteChar* : Optional argument that provides the character that can be used to quote values so that the delimiter can be used within a single field. If not specified, a double-quote (") will be used. This value must be exactly 1 character.
- *escapeChar* : Optional argument that provides the character that can be used to escape the Quote Character or the Delimiter within a field. If not specified, a backslash (\) is used. This value must be exactly 1 character.
- *stripChars* : Optional argument that specifies whether or not quote characters and escape characters should be stripped. For example, if we have a field value "1, 2, 3" and this value is true, we will get the value 1, 2, 3, but if this value is false, we will get the value "1, 2, 3" with the quotes. The default value is false. This value must be either true or false.

Return Type: String

Examples: If the "line" attribute contains the value "Jacobson, John", 32, Mr. and the "altLine" attribute contains the value Jacobson, John|32|Mr. then the following Expressions will result in the following values:

Table 1.7. Table 7. GetDelimitedField Examples

Expression	Value
<code>\${line:getDelimitedField(2)}</code>	_(space)_32
<code>\${line:getDelimitedField(2):trim()}</code>	32
<code>\${line:getDelimitedField(1)}</code>	"Jacobson, John"
<code>\${line:getDelimitedField(1, ',', '"', '\\', true)}</code>	Jacobson, John
<code>\${altLine:getDelimitedField(1, ' ')}</code>	Jacobson, John

1.6.10. append

Description: The `append` function returns the result of appending the argument to the value of the Subject. If the Subject is null, returns the argument itself.

Subject Type: String

Arguments:

- *value* : The String to append to the end of the Subject

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the Expression `${filename:append('.gz')}` will return "a brand new filename.txt.gz".

1.6.11. prepend

Description: The `prepend` function returns the result of prepending the argument to the value of the Subject. If the subject is null, returns the argument itself.

Subject Type: String

Arguments:

- *value* : The String to prepend to the beginning of the Subject

Return Type: String

Examples: If the "filename" attribute has the value "filename.txt", then the Expression `${filename:prepend('a brand new ')}` will return "a brand new filename.txt".

1.6.12. replace

Description: Replaces **all** occurrences of one literal String within the Subject with another String.

Subject Type: String

Arguments:

- *Search String* : The String to find within the Subject
- *Replacement* : The value to replace *Search String* with

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will provide the following results:

Table 1.8. Table 8. Replace Examples

Expression	Value
<code>\${filename:replace('.', '_')}</code>	a brand new filename_txt
<code>\${filename:replace('.', '.')}</code>	a.brand.new.filename.txt
<code>\${filename:replace('XYZ', 'ZZZ')}</code>	a brand new filename.txt
<code>\${filename:replace('filename', 'book')}</code>	a brand new book.txt

1.6.13. replaceFirst

Description: Replaces **the first** occurrence of one literal String or regular expression within the Subject with another String.

Subject Type: String

Arguments:

- *Search String* : The String (literal or regular expression pattern) to find within the Subject
- *Replacement* : The value to replace *Search String* with

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will provide the following results:

Table 1.9. Table 9. ReplaceFirst Examples

Expression	Value
<code>\${filename:replaceFirst('a', 'the')}</code>	the brand new filename.txt
<code>\${filename:replaceFirst('[br]', 'g')}</code>	a grand new filename.txt
<code>\${filename:replaceFirst('XYZ', 'ZZZ')}</code>	a brand new filename.txt
<code>\${filename:replaceFirst('\w{8}', 'book')}</code>	a brand new book.txt

1.6.14. replaceAll

Description: The `replaceAll` function takes two String arguments: a literal String or Regular Expression (NiFi uses the Java Pattern syntax), and a replacement string. The return value is the result of substituting the replacement string for all patterns within the Subject that match the Regular Expression.

Subject Type: String

Arguments:

Arguments:

- *Regex* : he Regular Expression (in Java syntax) to match in the Subject
- *Replacement* : The value to use for replacing matches in the Subject. If the *regular expression* argument uses Capturing Groups, back references are allowed in the *replacement*.

Return Type: String

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will provide the following results:

Table 1.10. Table 10. ReplaceAll Examples

Expression	Value
<code>\${filename:replaceAll('\. .*', '')}</code>	a brand new filename
<code>\${filename:replaceAll('a brand (new)', '\$1')}</code>	new filename.txt
<code>\${filename:replaceAll('XYZ', 'ZZZ')}</code>	a brand new filename.txt
<code>\${filename:replaceAll('brand (new)', 'somewhat \$1')}</code>	a somewhat new filename.txt

1.6.15. replaceNull

Description: The `replaceNull` function returns the argument if the Subject is null. Otherwise, returns the Subject.

Subject Type: Any

Arguments:

- *Replacement* : The value to return if the Subject is null.

Return Type: Type of Subject if Subject is not null; else, type of Argument

Examples: If the attribute "filename" has the value "a brand new filename.txt" and the attribute "hello" does not exist, then the Expression `${filename:replaceNull('abc')}` will return "a brand new filename.txt", while `${hello:replaceNull('abc')}` will return "abc".

1.6.16. replaceEmpty

Description: The `replaceEmpty` function returns the argument if the Subject is null or if the Subject consists only of white space (new line, carriage return, tab, space). Otherwise, returns the Subject.

Subject Type: String

Arguments:

- *Replacement* : The value to return if the Subject is null or empty.

Return Type: String

Examples: If the attribute "filename" has the value "a brand new filename.txt" and the attribute "hello" has the value "", then the Expression `${filename:replaceEmpty('abc')}` will return "a brand new filename.txt", while `${hello:replaceEmpty('abc')}` will return "abc".

1.6.17. length

Description: Returns the length of the Subject

Subject Type: String

Arguments: No arguments

Return Type: Number

Examples: If the attribute "filename" has a value of "a brand new filename.txt" and the attribute "hello" does not exist, then the Expression `${filename:length() }` will return 24. `${hello:length() }` will return 0.

1.7. Encode/Decode Functions

Each of the following functions will encode a string according the rules of the given data format.

1.7.1. escapeJson

Description: This function prepares the Subject to be inserted into JSON document by escaping the characters in the String using Json String rules. The function correctly escapes quotes and control-chars (tab, backslash, cr, ff, etc.)

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *He didn't say, "Stop!"*, then the Expression ``${message:escapeJson()}` will return *He didn't say, \"Stop!\"*

1.7.2. escapeXml

Description: This function prepares the Subject to be inserted into XML document by escaping the characters in a String using XML entities. The function correctly escapes quotes, apostrophe, ampersand, <, > and control-chars.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *"bread" & "butter"*, then the Expression ``${message:escapeXml()}` will return *"bread" & "butter"*

1.7.3. escapeCsv

Description: This function prepares the Subject to be inserted into CSV document by escaping the characters in a String using the rules in RFC 4180. The function correctly escapes quotes and surround the string in quotes if needed.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *But finally, she left*, then the Expression ``${message:escapeCsv()}` will return *"But finally, she left"*

1.7.4. escapeHtml3

Description: This function prepares the Subject to be inserted into HTML document by escaping the characters in a String using the HTML entities. Supports only the HTML 3.0 entities.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *"bread" & "butter"*, then the Expression ``${message:escapeHtml3()}` will return *"bread" & "butter"*

1.7.5. escapeHtml4

Description: This function prepares the Subject to be inserted into HTML document by escaping the characters in a String using the HTML entities. Supports all known HTML 4.0 entities.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *"bread" & "butter"*, then the Expression `${message:escapeHtml4()}` will return *"bread" & "butter"*

1.7.6. unescapeJson

Description: This function unescapes any Json literals found in the String.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *He didn't say, \"Stop!\",* then the Expression `${message:unescapeJson()}` will return *He didn't say, "Stop!"*

1.7.7. unescapeXml

Description: This function unescapes a string containing XML entity escapes to a string containing the actual Unicode characters corresponding to the escapes. Supports only the five basic XML entities (gt, lt, quot, amp, apos).

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *"bread" & "butter"*, then the Expression `${message:unescapeXml()}` will return *"bread" & "butter"*

1.7.8. unescapeCsv

Description: This function unescapes a String from a CSV document according to the rules of RFC 4180.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *"But finally, she left"*, then the Expression `#{message:unescapeCsv()}` will return *But finally, she left*

1.7.9. unescapeHtml3

Description: This function unescapes a string containing HTML 3 entity to a string containing the actual Unicode characters corresponding to the escapes. Supports only HTML 3.0 entities.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *"bread" & "butter"*, then the Expression `#{message:unescapeHtml3()}` will return *"bread" & "butter"*

1.7.10. unescapeHtml4

Description: This function unescapes a string containing HTML 4 entity to a string containing the actual Unicode characters corresponding to the escapes. Supports all known HTML 4.0 entities.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If the "message" attribute is *"bread" & "butter"*, then the Expression `#{message:unescapeHtml4()}` will return *"bread" & "butter"*

1.7.11. urlEncode

Description: Returns a URL-friendly version of the Subject. This is useful, for instance, when using an attribute value to indicate the URL of a website.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: We can URL-Encode an attribute named "url" by using the Expression `#{url:urlEncode()}`. If the value of the "url" attribute is "https://nifi.apache.org/some value with spaces", this Expression will then return "https://nifi.apache.org/some%20value%20with%20spaces".

1.7.12. urlDecode

Description: Converts a URL-friendly version of the Subject into a human-readable form.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If we have a URL-Encoded attribute named "url" with the value "https://nifi.apache.org/some%20value%20with%20spaces", then the Expression `${url:urlDecode() }` will return "https://nifi.apache.org/some value with spaces".

1.7.13. base64Encode

Description: Returns a Base64 encoded string. This is useful for being able to transfer binary data as ascii.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: We can Base64-Encoded an attribute named "payload" by using the Expression `${payload:base64Encode() }` If the attribute payload had a value of "admin:admin" then the Expression `${payload:base64Encode() }` will return "YWRtaW46YWRtaW4=".

1.7.14. base64Decode

Description: Reverses the Base64 encoding on given string.

Subject Type: String

Arguments: No arguments

Return Type: String

Examples: If we have a Base64-Encoded attribute named "payload" with the value "YWRtaW46YWRtaW4=", then the Expression `${payload:base64Decode() }` will return "admin:admin".

1.8. Searching

Each of the following functions is used to search its subject for some value.

1.8.1. startsWith

Description: Returns `true` if the Subject starts with the String provided as the argument, `false` otherwise.

Subject Type: String

Arguments:

- *value* : The value to search for

Return Type: Boolean

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the Expression `${filename:startsWith('a brand')}` will return true. `${filename:startsWith('A BRAND')}` will return false. `${filename:toUpperCase():startsWith('A BRAND')}` returns true.

1.8.2. endsWith

Description: Returns true if the Subject ends with the String provided as the argument, false otherwise.

Subject Type: String

Arguments:

- *value* : The value to search for

Return Type: Boolean

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the Expression `${filename:endsWith('txt')}` will return true. `${filename:endsWith('TXT')}` will return false. `${filename:toUpperCase():endsWith('TXT')}` returns true.

1.8.3. contains

Description: Returns true if the Subject contains the value of the argument anywhere in the value.

Subject Type: String

Arguments:

- *value* : The value to search for

Return Type: Boolean

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the Expression `${filename:contains('new')}` will return true. `${filename:contains('NEW')}` will return false. `${filename:toUpperCase():contains('NEW')}` returns true.

1.8.4. in

Description: Returns true if the Subject is matching one of the provided arguments.

Subject Type: String

Arguments:

- *value1* : First possible matching value
- *valueN* : Nth possible matching value

Return Type: Boolean

Examples: If the "myEnum" attribute has the value "JOHN", then the Expression `${myEnum:in("PAUL", "JOHN", "MIKE")}` will return `true`. `${myEnum:in("RED", "GREEN", "BLUE")}` will return `false`.

1.8.5. find

Description: Returns `true` if the Subject contains any sequence of characters that matches the Regular Expression provided by the argument.

Subject Type: String

Arguments:

- *Regex* : The Regular Expression (in the Java Pattern syntax) to match against the Subject

Return Type: Boolean

Examples:

If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will provide the following results:

Table 1.11. Table 11. find Examples

Expression	Value
<code>\${filename:find('a [Bb]rand [Nn]ew')}</code>	<code>true</code>
<code>\${filename:find('Brand.*')}</code>	<code>false</code>
<code>\${filename:find('brand')}</code>	<code>true</code>

1.8.6. matches

Description: Returns `true` if the Subject exactly matches the Regular Expression provided by the argument.

Subject Type: String

Arguments:

- *Regex* : The Regular Expression (in the Java Pattern syntax) to match against the Subject

Return Type: Boolean

Examples:

If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will provide the following results:

Table 1.12. Table 12. matches Examples

Expression	Value
<code>\${filename:matches('a.*txt')}</code>	true
<code>\${filename:matches('brand')}</code>	false
<code>\${filename:matches('.+brand.+')}</code>	true

1.8.7. indexOf

Description: Returns the index of the first character in the Subject that matches the String value provided as an argument. If the argument is found multiple times within the Subject, the value returned is the starting index of the **first** occurrence. If the argument cannot be found in the Subject, returns `-1`. The index is zero-based. This means that if the search string is found at the beginning of the Subject, the value returned will be `0`, not `1`.

Subject Type: String

Arguments:

- *value* : The value to search for in the Subject

Return Type: Number

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will provide the following results:

Table 1.13. Table 13. indexOf Examples

Expression	Value
<code>\${filename:indexOf('a.*txt')}</code>	<code>-1</code>
<code>\${filename:indexOf('.')}</code>	<code>20</code>
<code>\${filename:indexOf('a')}</code>	<code>0</code>
<code>\${filename:indexOf('')}</code>	<code>1</code>

1.8.8. lastIndexOf

Description: Returns the index of the first character in the Subject that matches the String value provided as an argument. If the argument is found multiple times within the Subject, the value returned is the starting index of the **last** occurrence. If the argument cannot be found in the Subject, returns `-1`. The index is zero-based. This means that if the search string is found at the beginning of the Subject, the value returned will be `0`, not `1`.

Subject Type: String

Arguments:

- *value* : The value to search for in the Subject

Return Type: Number

Examples: If the "filename" attribute has the value "a brand new filename.txt", then the following Expressions will provide the following results:

Table 1.14. Table 14. lastIndexOf Examples

Expression	Value
<code>\${filename:lastIndexOf('a.*txt')}</code>	-1
<code>\${filename:lastIndexOf('.')}</code>	20
<code>\${filename:lastIndexOf('a')}</code>	17
<code>\${filename:lastIndexOf('')}</code>	11

1.8.9. jsonPath

Description: The `jsonPath` function generates a string by evaluating the Subject as JSON and applying a JSON path expression. An empty string is generated if the Subject does not contain valid JSON, the `jsonPath` is invalid, or the path does not exist in the Subject. If the evaluation results in a scalar value, the string representation of scalar value is generated. Otherwise a string representation of the JSON result is generated. A JSON array of length 1 is special cased when `[0]` is a scalar, the string representation of `[0]` is generated.¹

Subject Type: String

Arguments: `jsonPath` : the JSON path expression used to evaluate the Subject.

Return Type: String

Examples: If the "myJson" attribute is

```
{
  "firstName": "John",
  "lastName": "Smith",
  "isAlive": true,
  "age": 25,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021-3100"
  },
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    }
  ],
  "children": [],
  "spouse": null
}
```

Table 1.15. Table 15. jsonPath Examples

Expression	Value
<code>\${myJson:jsonPath('\$.firstName')}</code>	John

<code>\${myJson:jsonPath('\$.address.postalCode')}</code>	10021-3100
<code>\${myJson:jsonPath('\$.phoneNumbers[?(@.type=="home")].number')}¹</code>	212 555-1234
<code>\${myJson:jsonPath('\$.phoneNumbers')}</code>	[{"type":"home","number":"212 555-1234"}, {"type":"office","number":"646 555-4567"}]
<code>\${myJson:jsonPath('\$.missing-path')}</code>	<i>empty</i>
<code>\${myJson:jsonPath('\$.bad-json-path..')}</code>	<i>exception bulletin</i>

An empty subject value or a subject value with an invalid JSON document results in an exception bulletin.

1.9. Mathematical Operations and Numeric Manipulation

For those functions that support Decimal and Number (whole number) types, the return value type depends on the input types. If either the subject or argument are a Decimal then the result will be a Decimal. If both values are Numbers then the result will be a Number. This includes Divide. This is to preserve backwards compatibility and to not force rounding errors.

1.9.1. plus

Description: Adds a numeric value to the Subject. If either the argument or the Subject cannot be coerced into a Number, returns `null`.

Subject Type: Number or Decimal

Arguments:

- *Operand* : The value to add to the Subject

Return Type: Number or Decimal (depending on input types)

Examples: If the "fileSize" attribute has a value of 100, then the Expression `${fileSize:plus(100)}` will return the value 1100.

1.9.2. minus

Description: Subtracts a numeric value from the Subject.

Subject Type: Number or Decimal

Arguments:

- *Operand* : The value to subtract from the Subject

Return Type: Number or Decimal (depending on input types)

Examples: If the "fileSize" attribute has a value of 100, then the Expression `${fileSize:minus(100)}` will return the value 0.

1.9.3. multiply

Description: Multiplies a numeric value by the Subject and returns the product.

Subject Type: Number or Decimal

Arguments:

- *Operand* : The value to multiply the Subject by

Return Type: Number or Decimal (depending on input types)

Examples: If the "fileSize" attribute has a value of 100, then the Expression `${fileSize:multiply(1024)}` will return the value 102400.

1.9.4. divide

Description: Divides the Subject by a numeric value and returns the result.

Subject Type: Number or Decimal

Arguments:

- *Operand* : The value to divide the Subject by

Return Type: Number or Decimal (depending on input types)

Examples: If the "fileSize" attribute has a value of 100, then the Expression `${fileSize:divide(12)}` will return the value 8.

1.9.5. mod

Description: Performs a modular division of the Subject by the argument. That is, this function will divide the Subject by the value of the argument and return not the quotient but rather the remainder.

Subject Type: Number or Decimal

Arguments:

- *Operand* : The value to divide the Subject by

Return Type: Number or Decimal (depending on input types)

Examples: If the "fileSize" attribute has a value of 100, then the Expression `${fileSize:mod(12)}` will return the value 4.

1.9.6. toRadix

Description: [.description]#Converts the Subject from a Base 10 number to a different Radix (or number base). An optional second argument can be used to indicate the

minimum number of characters to be used. If the converted value has fewer than this number of characters, the number will be padded with leading zeroes.

If a decimal is passed as the subject, it will first be converted to a whole number and then processed.#

Subject Type: Number

Arguments:

- *Desired Base* : A Number between 2 and 36 (inclusive)
- *Padding* : Optional argument that specifies the minimum number of characters in the converted output

Return Type: String

Examples: If the "fileSize" attributes has a value of 1024, then the following Expressions will yield the following results:

Table 1.16. Table 16. toRadix Examples

Expression	Value
<code>\${fileSize:toRadix(10)}</code>	1024
<code>\${fileSize:toRadix(10, 1)}</code>	1024
<code>\${fileSize:toRadix(10, 8)}</code>	00001024
<code>\${fileSize:toRadix(16)}</code>	400
<code>\${fileSize:toRadix(16, 8)}</code>	00000400
<code>\${fileSize:toRadix(2)}</code>	10000000000
<code>\${fileSize:toRadix(2, 16)}</code>	0000010000000000

1.9.7. fromRadix

Description: [.description]#Converts the Subject from a specified Radix (or number base) to a base ten whole number. The subject will converted as is, without interpretation, and all characters must be valid for the base being converted from. For example converting "0xFF" from hex will not work due to "x" being a invalid hex character.

If a decimal is passed as the subject, it will first be converted to a whole number and then processed.#

Subject Type: String

Arguments:

- *Subject Base* : A Number between 2 and 36 (inclusive)

Return Type: Number

Examples: If the "fileSize" attributes has a value of 1234A, then the following Expressions will yield the following results:

Table 1.17. Table 17. toRadix Examples

Expression	Value
<code>\${fileSize:fromRadix(11)}</code>	17720
<code>\${fileSize:fromRadix(16)}</code>	74570
<code>\${fileSize:fromRadix(20)}</code>	177290

1.9.8. random

Description: Returns a random whole number (0 to $2^{63} - 1$) using an insecure random number generator.

Subject Type: No subject

Arguments: No arguments

Return Type: Number

Examples: `${random():mod(10):plus(1)}` returns random number between 1 and 10 inclusive.

1.9.9. math

Description: ADVANCED FEATURE. This expression is designed to be used by advanced users only. It utilizes Java Reflection to run arbitrary `java.lang.Math` static methods. The exact API will depend on the version of Java you are running. The Java 8 API can be found here: <https://docs.oracle.com/javase/8/docs/api/java/lang/Math.html>

In order to run the correct method, the parameter types must be correct. The Expression Language "Number" (whole number) type is interpreted as a Java "long". The "Decimal" type is interpreted as a Java "double". Running the desired method may require calling "toNumber()" or "toDecimal()" in order to "cast" the value to the desired type. This also is important to remember when cascading "math()" calls since the return type depends on the method that was run.

Subject Type: Subjectless, Number or Decimal (depending on the desired method to run)

Arguments: - *Method* : The name of the Java Math method to run - *Optional Argument* : Optional argument that acts as the second parameter to the method.

Return Type: Number or Decimal (depending on method run)

Examples:

- `${math("random")}` runs `Math.random()`.
- `${literal(2):toDecimal:math("pow", 2.5)}` runs `Math.pow(2D,2.5D)`.
- `${literal(64):toDouble():math("cbrt"):toNumber():math("max", 5)}` runs `Math.maxDouble.valueOf(Math.cbrt(64D).longValue(), 5L)`. Note that the `toDecimal()` is needed because "cbrt" takes a "double" as input and the "64" will get interpreted as a long. The "toDecimal()" call is necessary to correctly call the method. that the

"toNumber()" call is necessary because "cbrt" returns a double and the "max" method is must have parameters of the same type and "5" is interpreted as a long.

- `${literal(5.4):math("scalb", 2)}` runs `Math.scalb(5.4, 2)`. This example is important because NiFi EL treats all whole numbers as "longs" and there is no concept of an "int". "scalb" takes a second parameter of an "int" and it is not overloaded to accept longs so it could not be run without special type handling. In the instance where the Java method cannot be found using parameters of type "double" and "long" the "math()" EL function will attempt to find a Java method with the same name but parameters of "double" and "int".
- `${first:toDecimal():math("pow", ${second:toDecimal()})}` where attributes evaluate to "first" = 2.5 and "second" = 2. This example runs `Math.pow(2.5D, 2D)`. The explicit calls to `toDecimal()` are important because of the dynamic nature of EL. When creating the flow, the user is unaware if the expression language values will be able to be interpreted as a whole number or not. In this example without the explicit calls "toDecimal" the "math" function would attempt to run a Java method "pow" with types "double" and "long" (which doesn't exist).

1.10. Date Manipulation

1.10.1. format

Description: Formats a number as a date/time according to the format specified by the argument. The argument must be a String that is a valid Java SimpleDateFormat format. The Subject is expected to be a Number that represents the number of milliseconds since Midnight GMT on January 1, 1970. The number will be evaluated using the local time zone unless specified in the second optional argument.

Subject Type: Number

Arguments:

- *format* : The format to use in the Java SimpleDateFormat syntax
- *time zone* : Optional argument that specifies the time zone to use (in the Java TimeZone syntax)

Return Type: String

Examples: If the attribute "time" has the value "1420058163264", then the following Expressions will yield the following results:

Table 1.18. Table 18. format Examples

Expression	Value
<code>\${time:format("yyyy/MM/dd HH:mm:ss.SSS'Z' ", "GMT")}</code>	2014/12/31 20:36:03.264Z
<code>\${time:format("yyyy/MM/dd HH:mm:ss.SSS'Z' ", "America/Los_Angeles")}</code>	2014/12/31 12:36:03.264Z
<code>\${time:format("yyyy/MM/dd HH:mm:ss.SSS'Z' ", "Asia/Tokyo")}</code>	2015/01/01 05:36:03.264Z
<code>\${time:format("yyyy/MM/dd ", "GMT")}</code>	2014/12/31

<code>\${time:format("HH:mm:ss.SSS'Z'", "GMT")}</code>	20:36:03.264Z
<code>\${time:format("yyyy", "GMT")}</code>	2014

1.10.2. toDate

Description: Converts a String into a Date data type, based on the format specified by the argument. The argument must be a String that is a valid Java SimpleDateFormat syntax. The Subject is expected to be a String that is formatted according the argument. The date will be evaluated using the local time zone unless specified in the second optional argument.

Subject Type: String

Arguments:

- *format* : The current format to use when parsing the Subject, in the Java SimpleDateFormat syntax.
- *time zone* : Optional argument that specifies the time zone to use when parsing the Subject, in the Java TimeZone syntax.

Return Type: Date

Examples: If the attribute "year" has the value "2014" and the attribute "time" has the value "2014/12/31 15:36:03.264Z", then the Expression `${year:toDate('yyyy', 'GMT')}` will return a Date data type with a value representing Midnight GMT on January 1, 2014. The Expression `${time:toDate("yyyy/MM/dd HH:mm:ss.SSS'Z'", "GMT")}` will result in a Date data type for 15:36:03.264 GMT on December 31, 2014.

Often, this function is used in conjunction with the [format](#) function to change the format of a date/time. For example, if the attribute "date" has the value "12-24-2014" and we want to change the format to "2014/12/24", we can do so by chaining together the two functions: `${date:toDate('MM-dd-yyyy'):format('yyyy/MM/dd')}`.

1.10.3. now

Description: Returns the current date and time as a Date data type object.

Subject Type: No Subject

Arguments: No arguments

Return Type: Date

Examples: We can get the current date and time as a Date data type by using the `now` function: `${now()}`. As an example, on Wednesday December 31st 2014 at 36 minutes after 3pm and 36.123 seconds EST `${now()}` would be evaluated to be a Date type representing that time. Since whole Expression Language expressions can only return Strings it would formatted as `Wed Dec 31 15:36:03 EST 2014` when the expression completes.

Utilizing the [toNumber](#) method, `now` can provide the current date and time as the number of milliseconds since Midnight GMT on January 1, 1970. For instance, if instead of executing

`${now() }` in the previous example `${now():toNumber() }` was run then it would output 1453843201123. This method provides millisecond-level precision and provides the ability to manipulate the value.

Table 1.19. Table 19. now Examples

Expression	Value
<code>\${now() }</code>	A Date type representing the current date and time to the nearest millisecond
<code>\${now():toNumber() }</code>	The number of milliseconds since midnight GMT Jan 1, 1970 (1453843201123, for example)
<code>\${now():toNumber():minus(86400000) }</code>	A number presenting the time 24 hours ago
<code>\${now():format('yyyy') }</code>	The current year
<code>\${now():toNumber():minus(86400000):format('E') }</code>	The day of the week that was yesterday, as a 3-letter abbreviation (For example, Wed)

1.11. Type Coercion

1.11.1. toString

Description: Coerces the Subject into a String

Subject Type: Any type

Arguments: No arguments

Return Type: String

Examples: The Expression `${fileSize:toNumber():toString() }` converts the value of "fileSize" attribute to a number and back to a String.

1.11.2. toNumber

Description: Coerces the Subject into a Number

Subject Type: String, Decimal, or Date

Arguments: No arguments

Return Type: Number

Examples: The Expression `${fileSize:toNumber() }` converts the attribute value of "fileSize" to a number.

1.11.3. toDecimal

Description: Coerces the Subject into a Decimal

Subject Type: String, Whole Number or Date

Arguments: No arguments

Return Type: Decimal

Examples: The Expression `${ fileSize:toDecimal() }` converts the attribute value of "fileSize" to a decimal.

1.12. Subjectless Functions

While the majority of functions in the Expression Language are called by using the syntax `${ attributeName:function() }`, there exist a few functions that are not expected to have subjects. In this case, the attribute name is not present. For example, the IP address of the machine can be obtained by using the Expression `${ ip() }`. All of the functions in this section are to be called without a subject. Attempting to call a subjectless function and provide it a subject will result in an error when validating the function.

1.12.1. ip

Description: Returns the IP address of the machine.

Subject Type: No subject

Arguments: No arguments

Return Type: String

Examples: The IP address of the machine can be obtained by using the Expression `${ ip() }`.

1.12.2. hostname

Description: Returns the Hostname of the machine. An optional argument of type Boolean can be provided to specify whether or not the Fully Qualified Domain Name should be used. If `false`, or not specified, the hostname will not be fully qualified. If the argument is `true` but the fully qualified hostname cannot be resolved, the simple hostname will be returned.

Subject Type: No subject

Arguments:

- *Fully Qualified* : Optional parameter that specifies whether or not the hostname should be fully qualified. If not specified, defaults to `false`.

Return Type: String

Examples: The fully qualified hostname of the machine can be obtained by using the Expression `${ hostname(true) }`, while the simple hostname can be obtained by using either `${ hostname(false) }` or simply `${ hostname() }`.

1.12.3. UUID

Description: Returns a randomly generated UUID.

Subject Type: No Subject

Arguments: No arguments

Return Type: String

Examples: `${UUID()}` returns a value similar to `de305d54-75b4-431b-adb2-eb6b9e546013`

1.12.4. nextInt

Description: Returns a one-up value (starting at 0) and increasing over the lifetime of the running instance of NiFi. This value is not persisted across restarts and is not guaranteed to be unique across a cluster. This value is considered "one-up" in that if called multiple times across the NiFi instance, the values will be sequential. However, this counter is shared across all NiFi components, so calling this function multiple times from one Processor will not guarantee sequential values within the context of a particular Processor.

Subject Type: No Subject

Arguments: No arguments

Return Type: Number

Examples: If the previous value returned by `nextInt` was 5, the Expression `${nextInt():divide(2)}` obtains the next available integer (6) and divides the result by 2, returning a value of 3.

1.12.5. literal

Description: Returns its argument as a literal String value. This is useful in order to treat a string or a number at the beginning of an Expression as an actual value, rather than treating it as an attribute name. Additionally, it can be used when the argument is an embedded Expression that we would then like to evaluate additional functions against.

Subject Type: No Subject

Arguments:

- *value* : The value to be treated as a literal string, number, or boolean value.

Return Type: String

Examples: `${literal(2):gt(1)}` returns `true`

`${literal(${allMatchingAttributes('a.*'):count()}):gt(3)}` returns `true` if there are more than 3 attributes whose names begin with the letter `a`.

1.12.6. getStateValue

Description: Access a processor's state values by passing in the String key and getting the value back as a String. This is a special Expression Language function that only works with processors that explicitly allow EL to query state. Currently only `UpdateAttribute` does.

Subject Type: No Subject

Arguments:

- *Key* : The key to use when accessing the state map.

Return Type: String

Examples: UpdateAttribute processor has stored the key "count" with value "20" in state. `${getStateValue("count")}` returns 20.

1.13. Evaluating Multiple Attributes

When it becomes necessary to evaluate the same conditions against multiple attributes, this can be accomplished by means of the `and` and `or` functions. However, this quickly becomes tedious, error-prone, and difficult to maintain. For this reason, NiFi provides several functions for evaluating the same conditions against groups of attributes at the same time.

1.13.1. anyAttribute

Description: Checks to see if any of the given attributes, match the given condition. This function has no subject and takes one or more arguments that are the names of attributes to which the remainder of the Expression is to be applied. If any of the attributes specified, when evaluated against the rest of the Expression, returns a value of `true`, then this function will return `true`. Otherwise, this function will return `false`.

Subject Type: No Subject

Arguments:

- *Attribute Names* : One or more attribute names to evaluate

Return Type: Boolean

Examples: Given that the "abc" attribute contains the value "hello world", "xyz" contains "good bye world", and "filename" contains "file.txt" consider the following examples:

Table 1.20. Table 20. anyAttribute Examples

Expression	Value
<code>\${anyAttribute("abc", "xyz"):contains("bye")}</code>	true
<code>\${anyAttribute("filename", "xyz"):toUpper():contains("e")}</code>	false

1.13.2. allAttributes

Description: Checks to see if any of the given attributes, match the given condition. This function has no subject and takes one or more arguments that are the names of attributes to which the remainder of the Expression is to be applied. If all of the attributes specified, when evaluated against the rest of the Expression, returns a value of `true`, then this function will return `true`. Otherwise, this function will return `false`.

Subject Type: No Subject

Arguments:

- *Attribute Names* : One or more attribute names to evaluate

Return Type: Boolean

Examples: Given that the "abc" attribute contains the value "hello world", "xyz" contains "good bye world", and "filename" contains "file.txt" consider the following examples:

Table 1.21. Table 21. allAttributes Example

Expression	Value
<code>\${allAttributes("abc", "xyz"):contains("world")}</code>	true
<code>\${allAttributes("abc", "filename", "xyz"):toUpper():contains("e")}</code>	false

1.13.3. anyMatchingAttribute

Description: Checks to see if any of the given attributes, match the given condition. This function has no subject and takes one or more arguments that are Regular Expressions to match against attribute names. Any attribute whose name matches one of the supplied Regular Expressions will be evaluated against the rest of the Expression. If any of the attributes specified, when evaluated against the rest of the Expression, returns a value of true, then this function will return true. Otherwise, this function will return false.

Subject Type: No Subject

Arguments:

- *Regex* : One or more Regular Expressions (in the Java Pattern syntax) to evaluate against attribute names

Return Type: Boolean

Examples: Given that the "abc" attribute contains the value "hello world", "xyz" contains "good bye world", and "filename" contains "file.txt" consider the following examples:

Table 1.22. Table 22. anyMatchingAttribute Example

Expression	Value
<code>\${anyMatchingAttribute("[ax].*"):contains("bye")}</code>	true
<code>\${anyMatchingAttribute(".*"):isNull()}</code>	false

1.13.4. allMatchingAttributes

Description: Checks to see if any of the given attributes, match the given condition. This function has no subject and takes one or more arguments that are Regular Expressions to match against attribute names. Any attribute whose name matches one of the supplied Regular Expressions will be evaluated against the rest of the Expression. If all of the

attributes specified, when evaluated against the rest of the Expression, return a value of `true`, then this function will return `true`. Otherwise, this function will return `false`.

Subject Type: No Subject

- *Regex* : One or more Regular Expressions (in the Java Pattern syntax) to evaluate against attribute names

Return Type: Boolean

Examples: Given that the "abc" attribute contains the value "hello world", "xyz" contains "good bye world", and "filename" contains "file.txt" consider the following examples:

Table 1.23. Table 23. anyMatchingAttributes Examples

Expression	Value
<code>\${allMatchingAttributes("[ax].*"):contains("world")}</code>	<code>true</code>
<code>\${allMatchingAttributes(".*"):isNull()}</code>	<code>false</code>
<code>\${allMatchingAttributes("f.*"):count()}</code>	<code>1</code>

1.13.5. anyDelineatedValue

Description: Splits a String apart according to a delimiter that is provided, and then evaluates each of the values against the rest of the Expression. If the Expression, when evaluated against any of the individual values, returns `true`, this function returns `true`. Otherwise, the function returns `false`.

Subject Type: No Subject

Arguments:

- *Delineated Value* : The value that is delineated. This is generally an embedded Expression, though it does not have to be.
- *Delimiter* : The value to use to split apart the *delineatedValue* argument.

Return Type: Boolean

Examples: Given that the "number_list" attribute contains the value "1,2,3,4,5", and the "word_list" attribute contains the value "the,and,or,not", consider the following examples:

Table 1.24. Table 24. anyDelineatedValue Examples

Expression	Value
<code>\${anyDelineatedValue("\${number_list}", ","):contains("5")}</code>	<code>true</code>
<code>\${anyDelineatedValue("this that and", ","):equals("\${word_list}")}</code>	<code>false</code>

1.13.6. allDelineatedValues

Description: Splits a String apart according to a delimiter that is provided, and then evaluates each of the values against the rest of the Expression. If the Expression, when

evaluated against all of the individual values, returns `true` in each case, then this function returns `true`. Otherwise, the function returns `false`.

Subject Type: No Subject

Arguments:

- *Delineated Value* : The value that is delineated. This is generally an embedded Expression, though it does not have to be.
- *Delimiter* : The value to use to split apart the *delineatedValue* argument.

Return Type: Boolean

Examples: Given that the "number_list" attribute contains the value "1,2,3,4,5", and the "word_list" attribute contains the value "those,known,or,not", consider the following examples:

Table 1.25. Table 25. allDelineatedValues Examples

Expression	Value
<code>\${allDelineatedValues("\${word_list}", ","):contains("o")}</code>	true
<code>\${allDelineatedValues("\${number_list}", ","):count()}</code>	4
<code>\${allDelineatedValues("\${number_list}", ","):matches("[0-9]+")}</code>	true
<code>\${allDelineatedValues("\${word_list}", ","):matches('e')}</code>	false

1.13.7. join

Description: Aggregate function that concatenates multiple values with the specified delimiter. This function may be used only in conjunction with the `allAttributes`, `allMatchingAttributes`, and `allDelineatedValues` functions.

Subject Type: String

Arguments:

- *Delimiter* : The String delimiter to use when joining values

Return Type: String

Examples: Given that the "abc" attribute contains the value "hello world", "xyz" contains "good bye world", and "filename" contains "file.txt" consider the following examples:

Table 1.26. Table 26. join Examples

Expression	Value
<code>\${allMatchingAttributes("[ax].*"):substringBefore("good join("-")}</code>	file.txt
<code>\${allAttributes("abc", "xyz"):join("now")}</code>	hello world nowgood bye world now

1.13.8. count

Description: Aggregate function that counts the number of non-null, non-false values returned by the `allAttributes`, `allMatchingAttributes`, and `allDelineatedValues`. This function may be used only in conjunction with the `allAttributes`, `allMatchingAttributes`, and `allDelineatedValues` functions.

Subject Type: Any

Arguments: No arguments

Return Type: Number

Examples: Given that the "abc" attribute contains the value "hello world", "xyz" contains "good bye world", and "number_list" contains "1,2,3,4,5" consider the following examples:

Table 1.27. Table 27. count Examples

Expression	Value
<code>\${allMatchingAttributes("[ax].*"):substringBefore(""):count()}</code>	2
<code>\${allAttributes("abc", "xyz"):contains("world"):count()}</code>	1
<code>\${allDelineatedValues(\${number_list}, ","):count()}</code>	5
<code>\${allAttributes("abc", "non-existent-attr", "xyz"):count()}</code>	2
<code>\${allMatchingAttributes(".*"):length():gt(10):count()}</code>	0