RTI Code Generator

Release Notes

Version 4.0.0

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Chapter 1 Supported Platforms

You can run *RTI® Code Generator* as a Java application or, for performance reasons, as a native application that invokes Java. See the RTI Code Generator User's Manual.

- As a Java application, *Code Generator* is supported on all host platforms listed in the table of Supported Platforms, in the RTI Connext Core Libraries Release Notes by using the script *rtiddsgen*.
- As a native application, *Code Generator* is supported on the Windows and Linux platforms with x64 CPUs, by using the script *rtiddsgen_server*.

Chapter 2 Compatibility

For backward-compatibility information between this and previous releases, see the *Migration Guide* on the RTI Community Portal (https://community.rti.com/documentation).

Code Generator has been tested with OpenJDK JDK 11, which is included in the installation package.

Chapter 3 What's New in 4.0.0

3.1 New and Removed Platforms

See the RTI Connext Core Libraries What's New document for a list of new and removed platforms.

3.2 New Python Language Binding (Experimental)

Code Generator can now generate code and examples for Python from IDL, XML, and XSD. To use this new binding, use the command-line option **-language Python**.

For generating examples, the only available platform for Python is "universal". See the RTI Code Generator User's Manual for more information.

3.3 Use -language C++98 Instead of -language C++ to Generate Traditional C++ code

This release introduces the C++98 language option for traditional C++ code generation. From now on, use **-language C++98** to specify code generation for traditional C++. (Use **-language C++11** for modern C++, as before.) Using *Code Generator* without specifying a language, or specifying **-language C++**, may cause confusion since it does not specify the language standard. The use of **-language C++** or not using **-language** at all is not recommended and will generate a warning during code generation.

Note that C++98 and C++11 are the minimum C++ versions required for the traditional C++ and modern C++ APIs, respectively. Applications can use newer C++ standards.

3.4 Improve hashCode Function in Java Generated Code

Previously, the generated **hashCode** function was just the addition of all the members of the type, producing collisions. After this improvement, we have reduced the number of collisions, by using a prime number and multiplying it by each member before adding them all.

3.5 Code Generator now Fails for Optional Sequences in C#

Previously, the optional annotation was silently ignored for sequences in C#. Now, *Code Generator* will fail if the IDL/XML/XSD file contains an optional sequence.

For example, this IDL will now fail for C#:

```
struct MyStruct {
    @optional
    sequence<short, 4> m1[3][2];
};
```

This problem is a known issue that will be fixed in a future release. For now, the workaround is to use an empty sequence to emulate an unset optional. See 5.15 C# Code Generation for Optional Sequences not Supported on page 15 for details.

3.6 Deprecations and Removals

This section describes features that are *deprecated* or *removed* starting in release 7.0.0.

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3.6.1 Language C++03 option removed in this release

The *rtiddsgen* option **-language C++03** was deprecated starting in release 6.1.0. Starting in 6.1.0, *Code Generator* produced a warning message during code generation that C++03 support would be removed in a future release. That removal has happened as of release 7.0.0.

For the Modern C++ API, you now must use **-language C++11**; for the Traditional C++ API, you should use **-language C++98**, although you can continue to using **-language C++**.

The Modern C++ API now requires a C++11 compiler (or newer). The Traditional C++ API continues to support C++98 compilers (or newer).

3.6.2 Legacy C# language binding removed in this release

This release removes support for code generation for the legacy C# API and C++/CLI. Likewise, the **-dotnet** parameter (used to specify the legacy C# code generation) has also been removed. From release

7.0.0 forward, the **-language C#** command-line option will produce C# code using the latest C# API that was introduced in 6.1.0 (*rtiddsgen* 3.1.0).

Chapter 4 What's Fixed in 4.0.0

4.1 Possible Memory Leak in Builtin Types after Allocation Error

If an allocation error occurred during creation of a builtin type, some of the allocated memory for internal members mapped as pointers may not have been released. This issue has been fixed. Now all the allocated memory for builtin types is released when errors occur during memory allocation.

[RTI Issue ID CODEGENII-1624]

4.2 Using Batching for Types with Optional Members may have Caused Serialization/Deserialization Errors in Java

The serialization and deserialization of samples may have caused data corruption in types with optional members when the batching feature was enabled. The errors in the communication may have caused data corruption when samples were written and may have triggered exceptions on the Subscriber side. This issue affected Java code only. Since the issue affected both the serialization and deserialization methods, interoperability with other languages may have been affected too. This problem has been resolved.

[RTI Issue ID CODEGENII-1638]

4.3 @copy Directives Resulted in Multiple Copies of Same Directive in Generated Code/Header in C++11

Copy directives (for example, copy directives related to modules) were generated multiples time, even if that didn’t make sense. This problem has been resolved. Now, a copy directive will be attached to an entity. The directive will only be generated when the related entity is generated.

For example, for the following IDL:

```
//@copy-c //Generated when the module moduleWithDirective is generated
module moduleWithDirective {
    //@copy-c #ifdef something generated with Foo
    struct Foo {
        //@copy-c // generated with  longWithDirective
        long longWithDirective;
    };
    //@copy-c #endif //generated with Bar
    //@copy-c #ifdef somethingNotDefined //generated with Bar
    struct Bar {
        long myLong;
    };
    //@copy-c #endif //generated with Bar as postfix directive because the closing module
};
```

The first line, `//@copy-c //Generated when the module moduleWithDirective is generated`, belongs to moduleWithDirective and will be copied only once (modules only generate code once).

The rest of the lines starting with `//@copy-c` will be generated multiple times when *Code Generator* creates code related to Foo and Bar.

[RTI Issue ID CODEGENII-1679]

4.4 Publisher Listeners not Functional in Advanced Example for C++98

When generating a C++98 advanced example, the listeners on the publisher side did not work due to an error in their parameters. This problem has been resolved. Now, publisher listeners in the advanced example for C++98 will work correctly.

[RTI Issue ID CODEGENII-1703]

4.5 Examples Generated with -advanced Option did not Assign QoS Profile to Publishers, Subscribers, or Topics

Because it does not set **is_default_qos** to true, the **-advanced** option for *rtiddsgen* creates entities with the QoS profile specified in **USER_QOS_PROFILES.xml**. *Code Generator*, however, did not apply that profile to Publishers, Subscribers, or Topics. This problem has been resolved. Now the **-advanced** option applies the specified QoS profile to all entities.

[RTI Issue ID CODEGENII-1706]

4.6 @DDSService Interface Worked only when Defined Last in IDL

You could only define a **@DDSService** interface if it was the last DataType defined in the IDL. This problem has been fixed. Now, you can define more than one **@DDSService** interface in the IDL, and you can define a **@DDSService** interface before other DataTypes in the IDL.

[RTI Issue ID CODEGENII-1708]

4.7 Unexpected Behavior when allocate_memory was False

When using C++98, *Code Generator* will create the functions **create_data_w_params()**, **create_data ()**, and **initialize_data()**; These functions will allow you to create and initialize the Types you had previously generated with *Code Generator*. These functions need a parameter of type DDS_ TypeAllocationParams_t, which has an attribute called **allocate_memory**. When calling these functions, **allocate_memory** must be true. If it was false, you may have had unexpected behavior, such as uninitialized members.

This problem has been resolved. Now these functions checks that **allocate_memory** is set to true when calling them. If it is not true, these functions will report an error and **create_data_w_params()** and **create_data()** will return NULL; **initialize_data()** will return DDS_RETCODE_ERROR.

[RTI Issue ID CODEGENII-1740]

Chapter 5 Known Issues

Note: For an updated list of critical known issues, see the Critical Issues List on the RTI Customer Portal at https://support.rti.com.

5.1 Classes and Types Defined in Some .NET Namespaces Cannot be used to Define User Data Types

The name of the classes and types defined in the following .NET namespaces cannot be used to define user data types:

- System
- System::Collections
- DDS

For example, if you try to define the following enumeration in IDL:

```
enum StatusKind{
    TSK_Unknown,
    TSK_Auto
};
```

The compilation of the generated CPP/CLI code will fail with the following error message:

```
error C2872: 'StatusKind' : ambiguous symbol
```

The reason for this error message is that the enumeration StatusKind is also defined in the DDS namespace and the generated code includes this namespace using the "using" directive:

```
using namespace DDS;
```

The rational behind using the "using" directive was to make the generated code shorter and more readable.

[RTI Issue ID CODEGEN-547]

5.2 Code Generation for Inline Nested Structures, Unions, and Valuetypes not Supported

Code generation for inline nested structures, unions, and valuetypes is not supported. For example, *Code Generator* will produce erroneous code for these structures:

IDL:

```
struct Outer {
    int16 outer_short;
    struct Inner {
        char inner_char;
        int16 inner_short;
    } outer_nested_inner;
};
```

XML:

```
<struct name="Outer">
    <member name="outer_short" type="int16"/>
    <struct name="Inner">
        <member name="inner_char" type="char"/>
        <member name="inner_short" type="int16"/>
    </struct>
</struct>
```

[RTI Issue ID CODEGEN-54]

5.3 .NET Code Generation for Multi-Dimensional Arrays of Sequences not Supported

The .NET code generated by *Code Generator* for multi-dimensional arrays of sequences is not correct and will not compile.

For example:

```
struct MyStruct {
    sequence<short, 4> m1[3][2];
};
```

[RTI Issue IDs CODEGENII-317, CODEGEN-376]

5.4 Request and Reply Topics Must be Created with Types Generated by Code Generator—C API Only

When using the C API to create Request and Reply Topics, these topics must use data types that have been generated by *Code Generator.* Other APIs support using built-in types and DynamicData types.

[RTI Issue ID REQREPLY-37]

5.5 To Declare Arrays as Optional in C/C++, They Must be Aliased

When generating C or C++ code, arrays cannot be declared as optional unless they are aliased.

[RTI Issue ID CODEGEN-604]

5.6 Error Generating Code for Type whose Scope Name Contains Module Called "idl"

When generating code for a file that has a member whose scope contains a module called "idl," *Code Generator* will report an error and will not generate code.

For example, *Code Generator* will not generate code for IDL with a module called "idl" such as this:

```
module idl {
    struct test{
        int32 m3;
    };
};
struct myStruct {
    idl::test m4;
};
```

The above produces this error:

```
Foo.idl line 11:4 no viable alternative at character ':'
ERROR com.rti.ndds.nddsgen.Main Foo.idl line 11:1 member
type 'dl::test' not found
```

The workaround for this issue is to prepend an underscore character ('_') to the idl module name.

[RTI Issue ID CODEGENII-661]

5.7 Examples and Generated Code for Visual Studio 2017 and later may not Compile (Error MSB8036)

The examples provided with *Connext* and the code generated for Visual Studio 2017 and later will not compile out of the box if the Windows SDK version installed is not a specific number like 10.0.15063.0. If that happens, you will see the compilation error MSB8036. To compile these projects, select an installed version of Windows SDK from the Project menu -> Retarget solution.

Another option is to set the environment variable RTI_VS_WINDOWS_TARGET_PLATFORM_VERSION to the SDK version number. For example, set RTI_VS_WINDOWS_TARGET_PLATFORM_VERSION to 10.0.16299.0. (Note: the environment variable will not work if you have already retargeted the project via the Project menu.)

For further details, see the Windows chapter of the *RTI Connext Core Libraries Platform Notes*.

[RTI Issue ID CODEGENII-800]

5.8 Invalid XSD File from an IDL/XML File if Input File Contains a Range Annotation inside a Structure and a typedef of that Structure

Code Generator generates an invalid XSD file from an IDL/XML file if the input file contains a range annotation (@min, @max, @range) inside a structure (struct/valuetype/union) and a typedef of that structure

For example, consider the following IDL file:

```
module M1 {
        struct VT1 {
                @min(0)
                int32 vt1_m1;
        };
};

typedef M1::VT1 myVT1;
```

This IDL file generates the following XSD file, which cannot be validated because the myVT1 complexType contains the same elements as its base M1.VT1, and that's not compliant with the XSD grammar:

```
<xsd:schema ...>
  <xsd:complexType name= "M1.VT1">
    <xsd:sequence>
                <xsd:element name="vt1_m1" minOccurs="1" maxOccurs="1">
          <xsd:simpleType>
            <xsd:restriction base="xsd:int">
              <xsd:minInclusive value="0"/>
            </xsd:restriction>
          </xsd:simpleType>
          </xsd:element>
</xsd:sequence>
</xsd:complexType>
 <!-- @struct true -->
  <xsd:complexType name="myVT1">
    <xsd:complexContent>
      <xsd:restriction base="tns:M1.VT1">
        <xsd:sequence>
                      <xsd:element name="vt1_m1" minOccurs="1" maxOccurs="1">
              <xsd:simpleType>
                <xsd:restriction base="xsd:int">
                  <xsd:minInclusive value="0"/>
                </xsd:restriction>
              </xsd:simpleType>
              </xsd:element>
        </xsd:sequence>
      </xsd:restriction>
    </xsd:complexContent>
  </xsd:complexType>
```

```
</xsd:schema>
```

If you try to use the generated XSD file, *Code Generator* will fail to validate the XSD file and throw one of the following errors:

```
ERROR com.rti.ndds.nddsgen.xml.XSDParser File couldn't be validated
ERROR com.rti.ndds.nddsgen.xml.XSDParser file:<...> Line: 24 Column: 33;rcase-Recurse.2:
There is not a complete functional mapping between the particles.
```

```
ERROR com.rti.ndds.nddsgen.xml.XSDParser File couldn't be validated
ERROR com.rti.ndds.nddsgen.xml.XSDParser file:///<...> Line: 16 Column: 33;rcase-
NameAndTypeOK.7: The type of element 'vt1_m1', 'null', is not derived from the type of the
base element, 'null'.particles.
```

The workaround for this issue is to disable XSD validation in *Code Generator* by enabling the option -disableXSDValidation.

Note: If the structure doesn't contain any range annotations, the generated XSD file will be validated.

[RTI Issue ID CODEGENII-1217]

5.9 Warnings when Compiling Generated Code for Traditional C++ with -O3 flag and IDL Contains FlatData types

Some C++ compilers will generate -Wmaybe-uninitialized warnings when compiling traditional C++ code (-language C++98) with the compiler's -O3 optimization, if the IDL file contains a FlatData type with multiple sequences using FlatData, such as:

```
@language_binding(FLAT_DATA)
@mutable struct test {
    sequence<char, 3> myCharSeq;
    sequence<uint16, 7> myUnsignedShortSeq;
};
```

To avoid this warning, you can define **RTI_FLAT_DATA_CXX11_RVALUE_REFERENCES**. This preprocessor option turns on C++11 rvalue references in the FlatData headers, disabling a pre-C++11 workaround where the warning occurs. You can define this option through the gcc command line (**-DRTI_FLAT_DATA_CXX11_RVALUE_REFERENCES**) or at the beginning of the type implementation file (if the IDL is Foo.idl, this file is Foo.cxx).

This warning doesn't not occur when generating code for the Modern C++ API (**-language C++11**).

[RTI Issue ID CODEGENII-1327]

5.10 Recursive Structures not Supported

The OMG 'Interface Definition Language' specification, version 4.2 allows forward declarations to implement recursion: "Structures may be forward declared, in particular to allow the definition of recursive structures." While *Connext* supports forward declarations, it does not currently support recursive structures.

[RTI Issue ID CODEGENII-1411]

5.11 Code Generator Server Cannot be Parallelized

Each execution of *Code Generator* server is attached to a port where it receives requests, and it can only generate code for one request at a time. Therefore, if you try to send multiple requests simultaneously, *Code Generator* server will process them sequentially.

[RTI Issue ID CODEGENII-666]

5.12 Standalone Types not Supported

Standalone types are not supported in *Code Generator* for Modern C++ (**-language C++11**).

[RTI Issue ID CODEGENII-1412]

5.13 uint8 and int8 Types not Fully Supported

Code Generator allows IDL and XML definitions that include uint8 and int8 types. Note, however, that the *Connext* language bindings use the same underlying, native 8-bit integer to represent both types. This native 8-bit integer is signed or unsigned depending on the language binding. For example:

- In Java and .NET, both uint8 and int8 map to a byte, which is signed.
- In C++, both uint8 and int8 map to a uint8, which is unsigned.
- In C and traditional C++, both uint8 and int8 map to an "unsigned char".

[RTI Issue ID CORE-8865]

5.14 64-bit Discriminator Values Greater than (2^31-1) or Smaller than (-2^31) Supported only in Java, no Other Languages

Unions with a 64-bit integer discriminator type containing discriminator values that cannot fit in a 32-bit value are not supported when using the following language bindings:

- C
- Traditional C++
- Modern C++
- New .NET
- DynamicData (regardless of the language)

They are also not supported with ContentFilteredTopics, regardless of the language binding.

Using label values greater than 32-bit may lead to receiving samples with invalid content or to filtering samples incorrectly.

For example, this is not supported:

```
union union_uint64 switch (uint64) {
    case 0x100000000:
              char m_char;
    case 0x200000000:
              int32 m_int32;
    case 0x300000000:
              string<5> m_string;
};
```

This is supported:

```
union union_uint64 switch (uint64) {
    case 1:
              char m_char;
    case 2:
              int32 m_int32;
    case 3:
              string<5> m_string;
};
```

[RTI Issue ID CORE-11437]

5.15 C# Code Generation for Optional Sequences not Supported

For optional annotation in C#, *Code Generator* will fail and not produce any code.

For example, this IDL will fail for C#:

```
struct MyStruct {
@optional
sequence<short, 4> m1[3][2];
};
```

This issue will be addressed in a future release. For now, the workaround is to use an empty sequence to emulate an unset optional.

For example, for the following IDL:

```
struct Foo {
    sequence<long, 5> mySquence;
};
```

Suppose *Connext* published the following:

```
1.  var sample = new Foo();
2.  sample.mySquence.Add(5);
3.  writer.Write(sample);
4.  sample.mySquence.Clear();
5.  writer.Write(sample);
```

After clearing the sequence in line 4, line 5 will publish an empty sequence, which will emulate an unset optional.

[RTI Issue ID CODEGENII-1503]

5.16 C# Code Generation for @copy Annotation not Supported

The @copy annotation, which allows copying lines of code from the IDL to the generated files, is not supported

[RTI Issue ID CODEGENII-1668]

Chapter 6 Limitations

6.1 XSD Limitation: Struct with Inheritance can't have Member with Same Name as a Member in Parent

In an IDL file, it is possible for a struct with inheritance to have a member with the same name as a member of its parent, for example:

```
struct MutableV1Struct {
    string m2; //@key
}; //@Extensibility MUTABLE_EXTENSIBILITY

struct MutableV3Struct : MutableV1Struct {
    int32 m2;
}; //@Extensibility MUTABLE_EXTENSIBILITY
```

The translation of that to XSD would generate invalid XSD because it does not allow having two members with the same name. You would see the following error message:

> "Elements with the same name and same scope must have same type"

Example invalid XSD:

```
<xsd:complexType name="XTypes.MutableV1Struct">
    <xsd:sequence>
        <xsd:element name="m2" minOccurs="1" maxOccurs="1"
         type="xsd:string"/>
        <!-- @key true -->
    </xsd:sequence>
</xsd:complexType>

<!-- @extensibility MUTABLE_EXTENSIBILITY -->
<xsd:complexType name="XTypes.MutableV3Struct">
    <xsd:complexContent>
        <xsd:extension base="tns:XTypes.MutableV1Struct">
            <xsd:sequence>
                <xsd:element name="m2" minOccurs="1"
                 maxOccurs="1" type="xsd:int"/>
```

```
            </xsd:sequence>
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
```

If you need to generate code from invalid XSD such as seen above, you can run *rtiddsgen* with the **-disableXSDValidation** option to skip the validation step.

[RTI Issue ID CODEGENII-490]

6.2 Generated Code for Nested Modules in Ada May Not Compile

Code Generator follows the Object Management Group (OMG) IDL-to-Ada specification in order to map modules:

> Top level modules (i.e., those not enclosed by other modules) shall be mapped to child packages of the subsystem package, if a subsystem is specified, or root library packages otherwise. Modules nested within other modules or within subsystems shall be mapped to child packages of the corresponding package for the enclosing module or subsystem. The name of the generated package shall be mapped from the module name.

The generated code produced by following this specification does not compile when referencing elements from a nested module within the top-level module, as shown in the following example:

```
module Outer
{
        module Inner
        {
                struct Structure
                {
                        int32 id;
                };
        };

        struct Objects
        {
                Inner::Structure nest;
        };
};
```

This failure to compile happens because Ada does not allow a parent package to reference definitions in child packages.

[RTI Issue ID CODEGENII-813]

6.3 Mixing Different Versions of Code Generator Server is not Supported

If you run different versions of **rtiddsgen_server** in the same port, the generated code could be generated by a different version than the one expected. **rtiddsgen_server** starts a server that generates code. If this server is still up when you run another version of **rtiddsgen_server**, your code is generated by the server that was already up, which is a different version than the one you wanted.

For example, if you run *Code Generator* server 2.5.0, then in the same port you run *Code Generator* server 3.0.1, *Code Generator* 2.5.0 might generate your code when you wanted *Code Generator* 3.0.1 to generate it.