

RTI Recording Service

for RTI Data Distribution Service

User's Manual

Version 4.5



The Global Leader in DDS



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Chapter 1 Welcome to RTI Recording Service

RTI[®] Recording Service includes:

- ❑ **Record**, an RTI Data Distribution Service application that records both RTI Data Distribution Service discovery and topic data. All recorded data is stored in one or more SQL database files.
- ❑ **Replay**, a tool that can ‘play back’ the recorded data. *Replay* injects the recorded data back into the DDS cloud; you even have the option of replaying the data with different data rates or QoS settings (see [Chapter 5: Using the Replay Tool](#)).
- ❑ **Convert**, a utility that enables serialized or deserialized data recorded with *Record* to be exported to CSV, HTML, SQL, or XML formats (see [Chapter 6: Viewing Recorded Data with SQLite](#)).
- ❑ A SQL command-line tool, **sqlite3**, which provides another way to view the data files. (*Not provided for Windows[®] CE and Yellow Dog[®] Linux[®] platforms.*)

Recording Features

- ❑ Records data from applications in multiple domains.
- ❑ Records entire Topics, or specific Topic fields, based on POSIX file-name matching expressions.
- ❑ Records all data types except bit-fields.
- ❑ Records to multiple files with configurable file-size limits. Optionally overwrites the oldest file when the maximum number of files has been reached.
- ❑ Records the DDS SampleInfo structure and a timestamp for both discovery data and user data.
- ❑ Records using either Best Effort or Reliable communications.
- ❑ Optionally records data from only specified partitions.

- Supports remote operation.

Replay Features

- Publishes data samples that were recorded in serialized format.
- Highly configurable—you can:
 - Choose which serialized topics to replay
 - Set the replay rate (faster or slower) or use the original rate
 - Change the QoS of the publications
 - Configure the QoS for the tool itself
 - Dynamically control the replay (start, stop, pause) and single-step through the data samples

This document assumes you have a basic understanding of DDS terms such as *Domain-Participants*, *Publishers*, *DataWriters*, *Topics*, and *Quality of Service (QoS) policies*. For an overview of DDS terms, please see the *RTI Data Distribution Service User's Manual*.

Chapter 2 Configuring the Record Tool

When you start the *Record* tool, you may specify a configuration file in XML format (it is not required). In that file, you can set properties that control what to record, how to record, and where to save the recorded data. This chapter describes how to write a configuration file.

2.1 How to Load the XML Configuration

The *Record* tool loads its XML configuration from multiple locations. This section presents the various approaches, listed in load order.

The first three locations only contain QoS Profiles and are inherited from *RTI Data Distribution Service* (see Chapter 15 in the *RTI Data Distribution Service User's Manual*).

- ❑ **\$NDDSHOME/resource/qos_profiles_4.5x¹/xml/NDDS_QOS_PROFILES.xml**
This file contains the *RTI Data Distribution Service* default QoS values; it is loaded automatically if it exists. (*First to be loaded.*)
- ❑ **File in NDDS_QOS_PROFILES**
The files (or XML strings) separated by semicolons referenced in this environment variable are loaded automatically.
- ❑ **<working directory>/USER_QOS_PROFILES.xml**
This file is loaded automatically if it exists.

1. x stands for the version letter of the current release.

The next locations are specific to *RTI Recording Service*.

- ❑ `<rtirecord executable location>../resource/xml/RTI_RECORDING_SERVICE.xml`

This file contains the default configuration for the *Record* tool; it is loaded if it exists. `RTI_RECORDING_SERVICE.xml` defines a configuration that records all topics on domain 0.

- ❑ `<working directory>/USER_RECORDING_SERVICE.xml`

This file is loaded automatically if it exists.

- ❑ File specified with the command-line option, `-cfgFile` (see [Table 3.1 on page 3-2](#)).

- ❑ File specified using the remote command 'configure'

The `configure` command (see [Table 3.1 on page 3-2](#)) allows loading an XML file remotely. The file loaded using this command replaces the file loaded using the `-cfgFile` command-line option. (*Last to be loaded.*)

You may use a combination of the above approaches.

2.2 General Format

The configuration file uses XML format. The main sections are:

- ❑ [General Properties for the Record Tool \(Section 2.3\)](#)
- ❑ [Database \(Output File\) Properties \(Section 2.4\)](#)—contained in the top-level tag, `<record_database>`
- ❑ [Domain Properties \(Section 2.5\)](#)—contained in the top-level tag, `<domain name="String">`
- ❑ [TopicGroup Properties \(Section 2.6\)](#)—contained in the top-level tag, `<topic_group>`
- ❑ [RecordGroup Properties \(Section 2.7\)](#)—contained in the top-level tag, `<record_group>`
- ❑ [Remote Access Properties \(Section 2.8\)](#)—contained in the top-level tag, `<remote_access>`
- ❑ [Domain Type Configuration \(Section 2.9\)](#)—contained in the top-level tag, `<domain_type_config>`

Let's look at a very basic configuration, just to get an idea of its contents. You will learn the meaning of each line as you read the rest of this chapter.

```

<dds>
  <!-- This simple configuration records all topics from domain ID 0 -->

  <recorder name="example">
    <!-- Specify where to store the recorded data. -->
    <record_database>
      <database_name> simple_config.dat </database_name>
    </record_database>

    <!-- Create a DDS DomainParticipant in domain 0 with default QoS -->
    <domain name="domain0">
      <domain_id> 0 </domain_id>
      <deserialize_mode>RTIDDS_DESERIALIZEMODE_ALWAYS</deserialize_mode>
    </domain>

    <!-- Create a TopicGroup. A TopicGroup is a collection of Topics
         whose names match the topic_expr. The field_expr specifies
         which fields in the Topics to record. Note that a TopicGroup is
         not bound to a particular domain yet. In this example, the
         TopicGroup All means all fields in all Topics -->

    <topic_group name="All">
      <topics>
        <topic_expr> * </topic_expr>
      </topics>
      <field_expr> * </field_expr>
    </topic_group>

    <!-- Create a RecordGroup. A RecordGroup controls which TopicGroups
         are recorded for a set of domains. Each recorded Topic is stored
         in a table with the format "record_group.domain.Topic"
         In this example, we want to record data from topics in TopicGroup
         "All" from "domain0." -->

    <record_group name="RecordAll">
      <!-- specify which domains to record from -->
      <domain_ref><element> domain0 </element></domain_ref>

      <!-- specify which topics to record -->
      <topic_ref><element> All </element></topic_ref>
    </record_group>
  </recorder>
</dds>

```

Example configuration files are provided in the **examples/record** directory:

❑ **simple_config.xml**

With this configuration, the *Record* tool will record all fields from all topics in a specified domain (domain ID 0).

❑ **advanced_config.xml**

With this configuration, the *Record* tool will record:

- The 'x' and 'y' fields from all Topics named Square in domains 0 and 1.
- The 'color' field from all Topics in domains 0 and 1.

❑ **remote_shell.xml**

This configuration file provides a configuration that can be used with the tutorial found in the *RTI Recording Service Getting Started Guide* to learn about how to modify the *Record* tool while it is running.

2.2.1 Configuration File Syntax

RTI Recording Service follows the same XML syntax rules as *RTI Data Distribution Service*. Please see the *RTI Data Distribution Service User's Manual* for details.

2.2.2 Supported Data Types

As you will see in the following sections, each property that can appear in the configuration file uses a specific data type. The *Record* tool converts between the value string in the XML file and the specified type. [Table 2.1](#) lists the supported types and the mappings used by the *Record* tool.

Table 2.1 **Property Value Data Types**

Type	Format	Notes
<i>char</i> and <i>octet</i> sequences and arrays	compact form	
DDS_Boolean	yes,1,true,on: TRUE no,0,false,off: FALSE	These values are not case sensitive.
DDS_Enum	A string.	Enum values are not case sensitive. Legal values are those listed for the property in the online (HTML) documentation for the <i>RTI Data Distribution Service C API</i> .

Table 2.1 Property Value Data Types

Type	Format	Notes
DDS_Long	-2147483648 - 2147483647 0x80000000 - 0x7fffffff	A 32-bit signed integer. You may include the following unit designations: KB — 2 ¹⁰ kB — 10 ³ MB — 10 ⁶ GB — 10 ⁹ KiB — 2 ¹⁰ MiB — 2 ²⁰ GiB — 2 ³⁰ For example, 100 kB is a legal value, meaning 100,000.
DDS_UnsignedLong	0 - 4294967296 0 - 0xffffffff	A 32-bit unsigned integer. You may include the following unit designations: KB — 2 ¹⁰ kB — 10 ³ MB — 10 ⁶ GB — 10 ⁹ KiB — 2 ¹⁰ MiB — 2 ²⁰ GiB — 2 ³⁰ For example, 100 kB is a legal value, meaning 100,000.

Table 2.1 Property Value Data Types

Type	Format	Notes
DDS_QoSPolicy	See the <i>RTI Data Distribution Service</i> online (HTML) C API documentation for the structure of each QoS policy, and the <i>RTI Data Distribution Service User's Manual's</i> chapter on Configuring QoS with XML.	<p>Each field in each QoS policy structure has a corresponding tag. The tag is the same as the field name in the DDS C API.</p> <p>For enumerations, the legal constants are those defined for the DDS C API.</p> <p>For example:</p> <pre><subscriber_qos> <presentation> <access_scope> DDS_TOPIC_PRESENTATION_QOS </access_scope> </presentation> <partition> <name> <element> rti </element> </name> </partition> </subscriber_qos></pre> <p>The above configuration will set (a) the Presentation QoS policy's <i>access_scope</i> field to DDS_TOPIC_PRESENTATION_QOS and (b) the Partition QoS policy's <i>name</i> field to "rti". (<i>name</i> is a sequence of strings, which requires using the <element> tag, also described in this table.)</p>
FileSize	64 bit integer	<p>You may include the following unit designations:</p> <ul style="list-style-type: none"> kB — 10³ MB — 10⁶ GB — 10⁹ KB — 2¹⁰ TB — 10¹² KiB — 2¹⁰ MiB — 2²⁰ GiB — 2³⁰ TiB — 2⁴⁰ <p>For example, 100 kB is a legal value, meaning 100,000.</p>
String	UTF-8 character string	All leading and trailing spaces are ignored between two tags.

2.3 General Properties for the Record Tool

Table 2.2 describes optional properties that control the *Record* tool's main module.

Table 2.2 General Properties

Property	Syntax	Description
auto_start	<pre><auto_start> DDS_Boolean </auto_start></pre>	<p>Whether or not the <i>Record</i> tool should start recording data when it is started. This option is mostly useful if the <i>Record</i> tool is usually controlled remotely.</p> <p>Default: True</p>
verbosity	<pre><verbosity> DDS_Long </verbosity></pre>	<p>The verbosity is a bit-map that specifies what type of logging information should be printed.</p> <p>The verbosity may be:</p> <ul style="list-style-type: none"> 0: silent (both <i>RTI Data Distribution Service</i> and the <i>Record</i> tool) 1: errors (both <i>RTI Data Distribution Service</i> and the <i>Record</i> tool) (default) 2: warnings (the <i>Record</i> tool only) 3: warnings (both <i>RTI Data Distribution Service</i> and the <i>Record</i> tool) 4: information (the <i>Record</i> tool only) 5: tracing (the <i>Record</i> tool only) 6: tracing (both <i>RTI Data Distribution Service</i> and the <i>Record</i> tool)

2.4 Database (Output File) Properties

Table 2.3 describes the Database properties. All database properties are optional except `database_name`. All database properties must be specified within `<record_database>` and `</record_database>` tags.

Table 2.3 Database Properties

Property	Syntax	Description
create_index	<pre><create_index> DDS_Boolean </create_index></pre>	<p>Specifies whether or not the <i>Record</i> tool will index the database on the <code>reception_timestamp</code> column to allow for efficient replay. Disable for maximum recording performance.</p> <p>Default: False</p>

Table 2.3 Database Properties

Property	Syntax	Description
database_name	<pre><database_name> String </database_name></pre>	<p>Required.</p> <p>The name of the fileset used to store recorded data. The <i>Record</i> tool appends a set number and a segment number to the filename.</p> <p>Default: undefined</p> <p>Example: <pre><database_name> myfile </database_name></pre></p>
flush_period	<pre><flush_period> DDS_Long </flush_period></pre>	<p>Specifies how often (in seconds) to flush data to disk.</p> <p>Note: increasing this value causes the <i>Record</i> tool to use additional memory.</p> <p>Default: 1 second Minimum: 1 second</p>
max_file_segments	<pre><max_file_segments> DDS_Long </max_file_segments></pre>	<p>Specifies how many file segments may be created. Each time the max_file_size limit is reached for a file segment, a new file is created if this number of segments has not been exceeded.</p> <p>Default: 1</p> <p>Example: <pre><max_file_segments> 100 </max_file_segments></pre></p>
max_file_size	<pre><max_file_size> FileSize </max_file_size></pre>	<p>Specifies the maximum size for a file segment.</p> <p>The <i>Record</i> tool records data to one or more files. This property specifies the maximum file size. This is not an absolute value, but a threshold value. As soon as the threshold is exceeded, no more data is written to file.</p> <p>Default: 2 GB</p> <p>Maximum: imposed by the operating system</p> <p>Example: <pre><max_file_size> 1 GB </max_file_size></pre></p>

Table 2.3 Database Properties

Property	Syntax	Description
overwrite	<pre><overwrite> DDS_Boolean </overwrite></pre>	<p>Specifies whether or not the <i>Record</i> tool should delete all existing file segments in the fileset before it starts recording. This is useful if you want to reuse a data-file name between recording sessions, but do not want to keep any old data.</p> <p>True: if the file segments already exist, they are deleted; otherwise, the file segments are created as needed.</p> <p>False: if the file segments already exist, the <i>Record</i> tool exits; otherwise, the file segments are created as needed.</p> <p>Example:</p> <pre><name> test </name> <max_file_segments> 4 </max_file_segments> <overwrite> yes </overwrite></pre> <p>In this case, the <i>Record</i> tool will delete test_0_0, test_0_1, and test_0_2 before starting to record to test_0_0.</p> <p>Default: False</p>
path_separator	<pre><path_separator> DDS_Char </path_separator></pre>	<p>Specifies the path separator character that the <i>Record</i> tool will use when creating table and column names.</p> <p>For instance, table names follows the "TopicName\$Record-GroupName\$DomainName" convention and fields in Topics uses \$ to navigate hierarchical types, such as a\$b\$c.</p> <p>'\$' is used as the default path separator instead of the more conventional. ',' because \$ does not require quotes when used in SQLite SQL statements.</p> <p>For example, to use '_' as the path separator:</p> <pre><path_separator> _ </path_separator></pre> <p>Note: this property cannot be empty.</p>
rollover	<pre><rollover> DDS_Boolean </rollover></pre>	<p>Specifies whether or not the <i>Record</i> tool should overwrite existing file segments in the fileset once the file size limit (max_file_size) has been reached for the last file segment.</p> <p>True: the <i>Record</i> tool overwrites existing file segments as needed (starting with the first one).</p> <p>False: the <i>Record</i> tool stops recording data.</p> <p>Default: False</p>

Table 2.3 Database Properties

Property	Syntax	Description
segment_number	<pre><segment_number> DDS_Long </segment_number></pre>	<p>Specifies the first segment to use in the fileset.</p> <p>If the segment number is ≥ 0, that is the first segment number in the fileset.</p> <p>Default: -1. The next available segment number will be used, starting at 0.</p> <p>Note: the set number is determined first, then the segment number.</p>
set_number	<pre><set_number> DDS_Long </set_number></pre>	<p>Specifies the set number to use in the fileset.</p> <p>If the set_number is ≥ 0, that specific fileset number is used. In this case, the <code><overwrite></code> property takes effect.</p> <p>Default: -1. The next available set number will be used, starting at 0.</p>

The *Record* tool stores data in a set of SQL database files. (Note, however, that you do *not* need to install any database software to use the *Record* tool.)

A *fileset* is a named collection of file segments which belong to the same recording session. Each of these file segments contains discovery and user-data, and the format is determined by SQLite.

The *Record* tool uses a fixed file-naming scheme:

name_set-number_segment-number

Where:

- name* is the base filename for the fileset, specified in the configuration file with the `<name>` property.
- set-number* is an integer identifying the fileset, specified in configuration file with the `<set-number>` property.
- segment-number* is an integer identifying the file-segment within the fileset. The first segment number to use, and the maximum number of segments are specified in the configuration file with the `<segment_number>` and `<max_file_segments>` properties, respectively.

For example: `mydata_5_3` means this file belongs to fileset 5 and is the 3rd segment in that fileset.

The maximum size of a file segment, whether to overwrite existing files, and whether to overwrite the oldest file can all be set in the configuration file.

2.5 Domain Properties

Table 2.4 describes the Domain properties. All Domain properties are optional.

Table 2.4 Domain Properties

Property	Syntax	Description
deserialize_mode	<pre><deserialize_mode> DDS_Enum </deserialize_mode></pre>	<p>Determines how topic data is stored in a database (serialized or deserialized).</p> <p>The following values are allowed:</p> <ul style="list-style-type: none"> <input type="checkbox"/> RTIDDS_DESERIALIZEMODE_AUTOMATIC —deserialize data if possible, otherwise store data in serialized format. <input type="checkbox"/> RTIDDS_DESERIALIZEMODE_NEVER —Do not deserialize the data; store data in serialized format. <input type="checkbox"/> RTIDDS_DESERIALIZEMODE_ALWAYS —Only store data if it can be deserialized first. <p>Default: RTIDDS_DESERIALIZEMODE_NEVER See Recording Large User Data Types (Section 2.5.1).</p>
domain_id	<pre><domain_id> DDS_Long </domain_id></pre>	<p>Sets the domain ID.</p> <p>Default: 0</p>
participant_qos	<pre><participant_qos> DDS_QoSPolicy </participant_qos></pre>	<p>Configures the DomainParticipant's QoS policies.</p> <p>Default: default DomainParticipant QoS settings</p> <p>See the <i>RTI Data Distribution Service User's Manual</i> for details. (See the chapter on Configuring QoS with XML.)</p>

Domain properties must be specified inside `<domain name="String">` and `</domain>` tags. If you want to use a RecordGroup ([Section 2.7](#)), you must assign a domain name with these tags, even if you do not specify any domain properties (because the domain name is needed in the RecordGroup's domain_ref property).

You may specify more than one Domain. Each one must have a unique name, with its own `<domain name="String">` and `</domain>` tags.

Note: Transports are configured through the Property QoS under the participant_qos tag.

For example, the following creates a Domain named “mydomain” using domain ID 68. The data will be recorded in serialized format. The DomainParticipant will use default QoS settings, except for the Discovery QoS policy’s *accept_unknown_peers* field:

```
<domain name="mydomain">
  <domain_id> 68 </domain_id>
  <deserialize_mode> RTIDDS_DESERIALZEMODE_NEVER
</deserialize_mode>
  <participant_qos>
    <discovery>
      <accept_unknown_peers> false</accept_unknown_peers>
    </discovery>
  </participant_qos>
</domain>
```

2.5.1 Recording Large User Data Types

When the *Record* tool records serialized user data, each primitive type in the topic’s data structure will have its own column in the table. The maximum number of columns is approximately 1,950.

Therefore, if you have a data-type that would require more than 1,950 columns, you must set the *deserialize_mode* property to *RTIDDS_DESERIALZEMODE_NEVER*. (Disregarding this limit will cause recording to fail.)

Note: *each primitive type is considered a column.* For example, the following would require 3,000 columns:

```
long Array[3000];
```

As another example, the following would require separate columns for *y[0].x.a,y[0].x.b,y[1].x.a,y[1].x.b*, etc.

```
struct X {
    long a;
    long b;
};
struct Y {
    X x;
};
struct Z {
    Y y[10];
}
```

2.6 TopicGroup Properties

A TopicGroup is an *optional* logical collection of Topics. If you are not going to have a RecordGroup in the configuration file, you do not need a TopicGroup. (See [Section 2.7](#).)

Table 2.5 describes the TopicGroup properties. The following properties are required:

- [field_expr](#)
- [shared_table](#)
- [topics](#)

Table 2.5 TopicGroup Properties

Property	Syntax	Description
auto_detect_reliability	<code><auto_detect_reliability> <i>DDS_Boolean</i> </auto_detect_reliability></code>	If set to true, use the same reliability as the Publisher of the matched Topic. Default: false.
compact_char_array	<code><compact_char_array> <i>DDS_Boolean</i> </compact_char_array></code>	Store array of char in a single column. The default (true) saves the most space. While it is possible to store individual elements in separate columns, it is not recommended as the number of columns stored can become very large. Default: true.
compact_octet_array	<code><compact_octet_array> <i>DDS_Boolean</i> </compact_octet_array></code>	Store array of octet in a single column. The default (true) saves the most space. While it is possible to store individual elements in separate columns, it is not recommended as the number of columns stored can become very large. Default: true.
compact_char_sequence	<code><compact_char_sequence> <i>DDS_Boolean</i> </compact_char_sequence></code>	Store sequence of char in a single column. The default (true) saves the most space. While it is possible to store individual elements in separate columns, it is not recommended as the number of columns stored can become very large. Default: true.

Table 2.5 TopicGroup Properties

Property	Syntax	Description
compact_octet_sequence	<pre><compact_octet_sequence> DDS_Boolean </compact_octet_sequence></pre>	<p>Store sequence of octet in a single column. The default (true) saves the most space. While it is possible to store individual elements in separate columns, it is not recommended as the number of columns stored can become very large.</p> <p>Default: true.</p>
datareader_qos	<pre><datareader_qos> DDS_DataReaderQos </datareader_qos></pre>	<p>Specifies the QoS settings for all DataReaders created for this TopicGroup. A DataReader is created for each discovered Topic that matches <code>topic_expr</code>. All the DataReaders for the TopicGroup will use the same set of QoS policies. You can specify all of the QoS policies with the <code>datareader_qos</code> property. See the <i>RTI Data Distribution Service User's Manual</i> for more information. (See the chapter on Configuring QoS with XML.)</p> <p>See the <i>RTI Data Distribution Service User's Manual</i> for details. (See the chapter on Configuring QoS with XML.)</p>
field_expr	<pre><field_expr> POSIX fn expressions </field_expr></pre>	<p>Required.</p> <p>A list of comma-separated POSIX expressions that specify which fields in the Topics to record. (The Topics are specified with <code><topics></code>, see Table 2.6.)</p> <p>This parameter is ignored when recording serialized data.</p>

Table 2.5 TopicGroup Properties

Property	Syntax	Description
shared_table	<pre><shared_table> DDS_Boolean </shared_table></pre>	<p>Required.</p> <p>Specifies whether the tables of recorded data are shared or exclusive.</p> <p>The <i>Record</i> tool stores Topic data in tables; those tables can be Shared or Exclusive. An Exclusive table means that each Topic recorded in a RecordGroup is stored in its own table. The name of the table follows the convention:</p> <p style="text-align: center;">TopicName\$RecordGroupName\$DomainName</p> <p>(The '\$' separator can be changed with the path_separator database property.)</p> <p>Thus, two topics with the same name but from two different TopicGroups are stored in separate tables.</p> <p>A shared table means that Topics with the same name are stored in the same table, regardless of where it was recorded from. In this case the table has an additional column, 'table_prefix', which stores the table prefix in the form: RecordGroupName\$DomainName.</p> <p>Default: False (exclusive).</p>
topics	<pre><topics> POSIX fn expressions </topics></pre>	<p>Required.</p> <p>Specifies a topic expression and any exemptions to that expression. See Table 2.6.</p>

Table 2.6 Topics Properties

Property	Syntax	Description
exemption	<pre><exemption> POSIX fn expressions </exemption></pre>	<p>Specifies a comma-separated list of expressions that should <i>not</i> be recorded.</p> <p>Default: nothing is exempt.</p>
topic_expr	<pre><topic_expr> POSIX fn expression </topic_expr></pre>	<p>Required.</p> <p>A POSIX expression that specifies the names of the Topics to be included in the TopicGroup.</p> <p>The syntax and semantics are the same as for Partition matching.</p> <p>Default: null.</p>

TopicGroup properties must be specified inside `<topic_group name="String">` and `</topic_group>` tags.

For example, the following creates a TopicGroup called AllTopics, which will include all discovered Topics. From those Topics, all fields will be recorded. This example does not specify the optional `datareader_qos` property, so it will use default DataReader QoS settings:

```
<topic_group name="AllTopics">
  <topics>
    <topic_expr> * </topic_expr>
  </topics>
  <field_expr> * </field_expr>
</topic_group>
```

This next example creates a TopicGroup called ColorsOfSquares that will only include Topics named "Square." For the recorded Topics, only the "color" field will be recorded. The DataReaders for the matching Topics will have default QoS settings, except that the Reliability QoS's *kind* will be `DDS_RELIABLE_RELIABILITY_QOS`:

```
<topic_group name="ColorsOfSquares">
  <topics>
    <topic_expr> Square </topic_expr>
  </topics>
  <field_expr> color </field_expr>
  <datareader_qos>
    <reliability>
      <kind> DDS_RELIABLE_RELIABILITY_QOS </kind>
    </reliability>
  </datareader_qos>
</topic_group>
```

The following example creates a TopicGroup called AllMinusCircleAndSquare that will include all Topics except "Circle" and "Square." For the recorded Topics, all fields will be recorded:

```
<topic_group name="AllMinusCircleAndSquare">
  <topics>
    <topic_expr> * </topic_expr>
    <exemption> Circle, Square </exemption>
  </topics>
  <field_expr> * </field_expr>
</topic_group>
```

Note: Topics are never removed from a TopicGroup. The resources used to create DataReaders for discovered Topics are not released if/when the Topics are deleted.

Note: The *Record* tool will ignore Topics published with a type that conflicts with an already discovered type.

2.7 RecordGroup Properties

A RecordGroup is a binding between a TopicGroup and a Domain. It controls which TopicGroup members are recorded for each Domain. Any Topic that is part of a TopicGroup in the RecordGroup is recorded from the specified Domains.

RecordGroups are optional. If you do not create one, the *Record* tool will not record any data. This is useful if you want to start the *Record* tool in “stand-by” mode—then you can use remote access (see [Section 2.8](#)) to switch to a different configuration file (one that does have a RecordGroup) and start recording.

[Table 2.7](#) describes the RecordGroup properties. The following properties are required:

- [domain_ref](#)
- [topic_ref](#)

Table 2.7 RecordGroup Properties

Property	Syntax	Description
domain_ref	<code><domain_ref> StringSequence </domain_ref></code>	Required. Specifies a sequence of references to domains. Default: null.
topic_ref	<code><topic_ref> StringSequence </topic_ref></code>	Required. Specifies a sequence of references to TopicGroups. Default: null.
subscriber_qos	<code><subscriber_qos> DDS_SubscriberQos </subscriber_qos></code>	Configures the Subscriber used by the RecordGroup. Default: default Subscriber QoS settings See the <i>RTI Data Distribution Service User's Manual</i> for details. (See the chapter on Configuring QoS with XML.)

RecordGroup properties must be specified inside `<record_group name = "String">` and `</record_group>` tags. The name that you assign (“String”) will be used in the table name(s) in the database (output) file(s).

For example, the following creates a RecordGroup called RecordAll, which will include all members of TopicGroup All that are discovered on Domain MyDomain. This example does not specify the optional subscriber_qos property, so it will use default Subscriber QoS settings:

```
<record_group name="RecordAll">
  <topic_ref>
    <element> AllTopics </element>
  </topic_ref>
  <domain_ref>
    <element> MyDomain </element>
  </domain_ref>
</record_group>
```

Note: A RecordGroup can refer to multiple domains and multiple TopicGroups. However, a RecordGroup will only record one of each matching Topic from a Domain. If multiple matches occur, only the first one will be recorded. (If you need to record the same Topic from the same domain using different QoS policies, you should use different TopicGroups and RecordGroups.)

2.8 Remote Access Properties

As you will see in [Chapter 9: Accessing the Record Tool from a Remote Location](#), you can create an *RTI Data Distribution Service* application that can remotely control the *Record* tool.

By default, Remote Access is turned off in the *Record* tool for security reasons.

The Remote Access section of the configuration file is used to enable Remote Access and configure its behavior. A Remote Access section is not required in the configuration file.

The remote application can send commands to the *Record* tool that will:

- Start/stop recording.
- Shutdown the *Record* tool.
- Reconfigure the *Record* tool.

[Table 2.8](#) describes the Remote Access properties. All Remote Access properties must be specified inside `<remote_access>` and `</remote_access>` tags. All remote access properties are optional unless otherwise noted.

Table 2.8 Remote Access Properties

Property	Syntax	Description
accept_broadcast_commands	<code><accept_broadcast_commands> <i>DDS_Boolean</i> </accept_broadcast_commands></code>	Specifies if the <i>Record</i> tool will accept commands that have been broadcast to any <i>Record</i> tool or only accept commands addressed specifically to it. (See Chapter 9: Accessing the Record Tool from a Remote Location.) Default: true
enabled	<code><enabled> <i>DDS_Boolean</i> </enabled></code>	Enables or disables remote access to the <i>Record</i> tool from another application. (See Chapter 9: Accessing the Record Tool from a Remote Location.) Default: false (remote access disabled)
datareader_qos	<code><datareader_qos> <i>DDS_DataReaderQos</i> </datareader_qos></code>	Configures the QoS for the DataReader created by the <i>Record</i> tool's Remote Access module. Default: default DataReader QoS settings.
datawriter_qos	<code><datawriter_qos> <i>DDS_DataWriterQos</i> </datawriter_qos></code>	Configures the QoS for the DataWriter created by the <i>Record</i> tool's Remote Access module. Default: default DataWriter QoS settings.
publish_status_period	<code><publish_status_period> <i>DDS_Long</i> </publish_status_period></code>	Specifies, in seconds, the period between each status message sent by the <i>Record</i> tool. Default: 1. Minimum value: 1.
publisher_qos	<code><publisher_qos> <i>DDS_PublisherQos</i> </publisher_qos></code>	Configures the QoS for the Publisher created by the <i>Record</i> tool's Remote Access module. Default: default Publisher QoS settings.
remote_access_domain	<code><remote_access_domain> <i>String</i> </remote_access_domain></code>	Required if enabled is true. Specifies which domain the <i>Record</i> tool will use to enable remote access. Only one domain can be specified. Note that this is a String, not a Domain ID. It is the same String used in the <code><domain name="String"> </domain></code> line. Default: false
subscriber_qos	<code><subscriber_qos> <i>DDS_QosPolicy</i> </subscriber_qos></code>	Configures the QoS for the Subscriber created by the <i>Record</i> tool's Remote Access module. Default: default Subscriber QoS settings.

2.9 Domain Type Configuration

The Domain Type Config allows you to pass DDS type configuration information to the *Record* and *Convert* tools in the form of XML type-configuration files.

[Table 2.9](#) describes the Domain Type Config properties. All Domain Type Config properties are optional.

Table 2.9 **Record Type Configuration Properties**

Property	Syntax	Description
domain_type_config	<pre><domain_type_config> Domain Type Config Properties </domain_type_config></pre>	Type configuration for specific domains. See Table 2.10 , “Domain Type Configuration Properties”.

Table 2.10 **Domain Type Configuration Properties**

Property	Syntax	Description
domain_group	<pre><domain_group> <element> Domain Group Properties </element> </domain_group></pre>	A list of type configuration elements. The elements tag can be repeated. See Table 2.11 , “Domain Group Type Configuration Properties”.

Table 2.11 **Domain Group Type Configuration Properties**

Property	Syntax	Description
domain_filter	<pre><domain_filter> <element> POSIX fn expression </element> </domain_filter></pre>	A list of expressions for the domains for which these Domain Group Properties should apply. The element tag can be repeated.
type_config	<pre><type_config> XML Properties </type_config></pre>	The type configuration for this Domain Group. See Table 2.12 , “Type Configuration Properties”.

Table 2.12 Type Configuration Properties

Property	Syntax	Description
xml	<pre><xml> XML Type Config. Properties </xml></pre>	The XML type configuration for this domain group. See Table 2.13, "XML Properties" .

Table 2.13 XML Properties

Property	Syntax	Description
register_top_level	<pre><register_top_level> Boolean </register_top_level></pre>	Whether or not to register the top-level types with their canonical names
max_string	<pre><max_string> Integer </max_string></pre>	The default values to use when there are unbounded strings in a type.
max_sequence	<pre><max_sequence> Integer </max_sequence></pre>	The default values to use when there are unbounded sequences in a type.
path	<pre><path> <element> Path </element> </path></pre>	A list of the paths to be used when searching for XML type-configuration paths. The <i>element</i> tag can be repeated.
file_group	<pre><file_group> <element> File Group Properties </element> </file_group></pre>	A list of file groups associated with this domain group. A file group is parsed into a single Document Object Module. The element tag can be repeated. See Table 2.14, "File Group Properties" .

Table 2.14 File Group Properties

Property	Syntax	Description
register_top_level	<pre><register_top_level> Boolean </register_top_level></pre>	Whether or not to register the top-level types with their canonical names. This overrides the parent
max_string	<pre><max_string> Integer </max_string></pre>	The default values to use when there are unbounded strings in a type. This overrides the parent.
max_sequence	<pre><max_sequence> Integer </max_sequence></pre>	The default values to use when there are unbounded sequences in a type. This overrides the parent.
file_name	<pre><file_name> <element> File Name </element> </file_name></pre>	A list of the files that contain XML type-definitions. The element tag can be repeated.

Chapter 3 Using the Record Tool

This chapter describes how to start and stop the *Record* tool.

3.1 Starting the Record Tool

The executable for the *Record* tool is in `<install directory>/bin/<architecture>`. A script to run the executable is in `<install directory>/scripts`.

To see a list of available arguments, enter `rtirecord -help`.

To run the tool you must select a configuration name with `-cfgName`.

For example:

```
$ cd rtirecord.4.5.x/scripts
$ rtirecord -cfgName default
```

To see which configurations are available, use the `-listCfgs` option:

```
$ cd rtirecord.4.5.x/scripts
$ rtirecord -listCfgs
```

To use your own configuration file:

```
$ cd rtirecord.4.5.x/scripts
$ rtirecord -cfgFile config-file.xml -cfgName my_record_cfg
```

[Table 3.1](#) describes the command-line options.

[Chapter 2: Configuring the Record Tool](#) describes the contents of the configuration file. Example files are provided in the `<installation directory>/examples` directory.

Table 3.1 Record Tool's Command-Line Options

Command-line Option	Description
-appName <name>	Assigns an application name to the DomainParticipants created by the <i>Record</i> tool. If not specified, the same name used in -cfgName will be used.
-cfgFile <file>	Required. Specifies the XML configuration file (path and filename). In addition to the file provided using this command-line option, the <i>Record</i> tool can load other XML files—see Section 2.1 .
-cfgName <name>	Required. This name is used to find the matching <recorder> tag in the configuration file.
-dbName	Names the fileset to use for storing recorded data. Default: rtirecord.dat
-help	Prints version information and list of command-line options.
-licenseFile <file>	Specifies the license file (path and filename). Only applicable to licensed versions of the <i>Record</i> tool. If not specified, the <i>Record</i> tool looks for the license as described in Section 0 in the <i>Getting Started Guide</i> .
-listCfgs	Lists the available configuration profiles.
-verbosity	Specifies what type of logging information should be printed. 0: silent (both <i>RTI Data Distribution Service</i> and the <i>Record</i> tool) 1: errors (both <i>RTI Data Distribution Service</i> and the <i>Record</i> tool) (default) 2: warnings (the <i>Record</i> tool only) 3: warnings (both <i>RTI Data Distribution Service</i> and the <i>Record</i> tool) 4: information (the <i>Record</i> tool only) 5: tracing (the <i>Record</i> tool only) 6: tracing (both <i>RTI Data Distribution Service</i> and the <i>Record</i> tool) This property can also be set in the configuration file. However, this command-line option overrides the value specified in the configuration file.

3.2 Stopping the Record Tool

To stop the Record tool: Press **Ctrl-C**. The *Record* tool will close all files and perform a clean shutdown.

You can also start, stop, and even reconfigure the *Record* tool remotely—see [Chapter 9: Accessing the Record Tool from a Remote Location](#).

Chapter 4 Configuring the Replay Tool

When you start the *Replay* tool, you must specify a configuration file in XML format. In that file, you can set properties that control the data source, which topics to replay, and attributes such as the replay speed. This chapter describes how to write a configuration file.

4.1 How to Load Replay's XML Configuration File

The *Replay* tool loads its XML configuration from multiple locations. This section presents the various approaches, listed in load order.

- ❑ `<rtiReplay executable location>/../resource/xml/RTI_REPLAY_SERVICE.xml`

This file contains the default configuration for the *Replay* tool; it is loaded if it exists. `RTI_REPLAY_SERVICE.xml` defines a configuration that Replays all topics on domain 0.

- ❑ `<working directory>/USER_REPLAY_SERVICE.xml`

This file is loaded automatically if it exists.

- ❑ The file specified with the command-line option, `-cfgFile` (see [Table 5.1 on page 5-2](#)).

You may use a combination of the above approaches.

4.2 General Format

The Replay configuration file uses XML format. The main sections use the following top-level tags:

Top-level Tag	Reference Section
<replay_service>	General Properties for Replay (Section 4.3)
<replay_database>	Database (Input File) Properties (Section 4.4)
<session>	Session Properties (Section 4.5)
<replay_topic>	Replay Topic Properties (Section 4.6)
<time_control>	Time Control Properties (Section 4.7)
<administration>	Remote Administration Properties (Section 4.8)
<domain_type_config>	Type Configuration (Section 4.9)

The XML configuration file used by *Replay* has a simple hierarchical format. The **replay_service** is configured to replay data contained in one or more **replay_database**. Each **replay_database** is associated with a *DomainParticipant*, and must contain one or more *session*. Each **session** is associated with a *Publisher*, and corresponds to a unique execution thread. Each *session* contains one or more **replay_topic**, each of which is associated with a *DataWriter*, and contains a filter expression that specifies what information contained in the data base should be replayed. Each of the four major levels - **replay_service**, **replay_database**, **session**, and **replay_topic** - may contain a **time_control** element that allows control over such features as the rate of replay, how much of the available data to be replayed, and for coordination.

Much of *Replay*'s configuration has been designed to be compatible with the *Record* tool, so familiarity with the *Record* tool's concepts and configuration will be helpful. See [Chapter 2: Configuring the Record Tool](#).

Let's look at a very basic configuration, just to get an idea of its contents. You will learn the meaning of each line as you read the rest of this chapter.

```
<dds>
<replay_service name="default">

    <!-- Optional remote administration configuration -->
    <administration>
        <domain_id> 1 </domain_id>
    </administration>
    <time_control>
```



```

    <start_time> 6 </start_time>
  </time_control>
  <auto_exit> yes </auto_exit>

  <replay_database name="simple_config">

    <filename> replay_database.dat </filename>
    <!-- Optional ParticipantQos -->
    <participant>
      <domain_id> 0 </domain_id>
    </participant>

    <session name="simple_session">

      <time_control>
        <rate> 2 </rate>
      </time_control>
      <!-- Optional PublisherQos -->
      <publisher_qos></publisher_qos>

      <replay_topic name="all_topics">

        <time_control>
          <stop_time> 26 </stop_time>
        </time_control>
        <input>      <!-- Required Values -->
          <topic_name> * </topic_name>
          <type_name> * </type_name>
          <record_group_name> * </record_group_name>
          <domain_name> * </domain_name>
        </input>
        <!-- Optional Values for writing data -->
        <output>
          <!-- Optional DataWriterQos -->
          <datawriter_qos></datawriter_qos>
        </output>
      </replay_topic>
    </session>
  </replay_database>
</replay_service>
</dds>

```

4.3 General Properties for Replay

Table 4.1 describes optional properties that control the *Replay* tool's main module.

All `<replay_service>` properties are optional except `replay_database`.

These properties must be specified inside `<replay_service name="String">` and `</replay_service>` tags, where *String* is the name to be assigned to the service entity when it is created. This name will be used during remote administration unless it is overridden by the `<administration>` `<name>` element.

Table 4.1 **Replay Service Properties**

Property	Syntax	Description
administration	<pre><administration> Remote Administration Properties </administration></pre>	Configures the <i>DDS Participant</i> that can be used to remotely control <i>Replay</i> via the <i>rtireplaysh</i> utility. See Remote Administration Properties (Section 4.8) . The Remote Administration Properties must specify a <code>domain_id</code> . You may also specify a name, <code>participant_qos</code> , <code>publisher_qos</code> , <code>subscriber_qos</code> , <code>datareader_qos</code> , and <code>datawriter_qos</code> .
auto_exit	<pre><auto_exit> DDS_Boolean </auto_exit></pre>	Controls whether or not the <i>Replay</i> tool should terminate when all the available data specified in the initial configuration has been replayed. Default: False
replay_database	<pre><replay_database> Replay Database Properties </replay_database></pre>	Required. Specifies configuration properties that describe how to replay the information from a database. This element can be repeated. See Database (Input File) Properties (Section 4.4)
time_control	<pre><time_control> Time Control Properties </time_control></pre>	Specifies time configuration properties to be applied to the <i>Replay</i> tool as a whole. See Time Control Properties (Section 4.7) .

4.4 Database (Input File) Properties

Table 4.2 describes the source of the data that *Replay* will replay.

All `<replay_database>` properties are optional except `session`.

These properties must be specified inside `<replay_database name="String">` and `</replay_database>` tags, where *String* is the name to be assigned to the database entity when it is created. This name will be used during remote administration.

Table 4.2 **Replay Database Properties**

Property	Syntax	Description
filename	<code><filename></code> <i>String</i> <code></filename></code>	Specifies the name of the fileset that contains the data to be replayed. Default: undefined
participant	<code><participant></code> <i>Participant Properties</i> <code></participant></code>	See Table 4.3, "Participant Properties"
readonly	<code><readonly></code> <i>DDS_Boolean</i> <code></readonly></code>	Specifies if <i>Replay</i> should open the data file in read-only mode (true), or read-write mode (false). Setting this option to false is useful to enable indexing of older database files. Default: False See Performance and Indexing (Section 5.4) .
session	<code><session></code> <i>Session Properties</i> <code></session></code>	Required. The configuration properties that describe how to replay the information in a session. This element can be repeated. See Table 4.4, "Session Properties"
time_control	<code><time_control></code> <i>Time Control Properties</i> <code></time_control></code>	The time configuration properties to be applied to the replay database.
type_config	<code><type_config></code> <i>XML Properties</i> <code></type_config></code>	Optional XML type configuration for this <i>replay_database</i> . This option is useful when type codes have not been recorded in the database, or when specifying types that are too large to be recorded in the database. See Table 4.13, "Type Properties"

Table 4.3 Participant Properties

Property	Syntax	Description
domain_id	<pre><domain_id> DDS_Long </domain_id></pre>	Sets the domain ID. Default: 0
participant_qos	<pre><participant_qos> DDS_QosPolicy </participant_qos></pre>	Configures the DomainParticipant's QoS policies. See the <i>RTI Data Distribution Service User's Manual's</i> chapter on Configuring QoS with XML. Defaults: See the <i>RTI Data Distribution Service</i> online (HTML) documentation on DomainParticipants.

4.5 Session Properties

Table 4.4 describes the Session's properties.

All <session> properties are optional except `replay_topic`.

These properties must be specified inside <session name="String"> and </session> tags, where *String* is the name to be assigned to the session entity when it is created. This name will be used during remote administration.

Table 4.4 Session Properties

Property	Syntax	Description
publisher_qos	<pre><publisher_qos> DDS_QosPolicy </publisher_qos></pre>	Configures the Publisher's QoS policies. See <i>RTI Data Distribution Service User's Manual's</i> chapter on Configuring QoS with XML. Defaults: See the <i>RTI Data Distribution Service</i> online (HTML) documentation on Publishers.
thread	<pre><thread> Thread Properties </thread></pre>	Configures the properties for the execution thread.
time_control	<pre><time_control> Time Control Properties </time_control></pre>	Configures the time control properties to be applied to the Session.
replay_topic	<pre><replay_topic> Replay Topic Properties </replay_topic></pre>	Required. The configuration properties that describes the topics to be replayed, and the associated <i>DDS_DataWriter</i> configuration. This element can be repeated. See Table 4.5, "Replay Topic Properties"

4.6 Replay Topic Properties

Table 4.5 describes the Topics' properties.

All <replay_topic> properties are optional except **input**.

These properties must be specified within <replay_topic name="String"> and </replay_topic> tags, where *String* is the name to be assigned to the replay topic entity when it is created. This name will be used during remote administration.

Table 4.5 **Replay Topic Properties**

Property	Syntax	Description
time_control	<time_control> <i>Time Control Properties</i> </time_control>	Specifies time configuration properties to be applied to the Session.
input	<input> <i>Input Properties</i> </input>	Required. Configures the topics that are to be replayed from the database. See Table 4.6, "Input Properties".
output	<output> <i>Output Properties</i> </output>	Configures the attributes to be used in writing the replayed topics. See Table 4.7, "Output Properties".

All input properties (Table 4.6) are required, except for *type_name*, which is optional.

Table 4.6 **Input Properties**

Property	Syntax	Description
topic_name	<topic_name> <i>String</i> </topic_name>	Required. Specifies the name of the <i>topic_name</i> that was specified in the <i>Record</i> tool's configuration file or a regular or wildcard expression.
type_name	<topic_name> <i>String</i> </topic_name>	Specifies the name of the <i>type_code</i> to be used in writing matching topics. This parameter will default to "*" if not specified. <i>Replay</i> will search for a matching type name only within matching topic records.
record_group_name	<record_group_name> <i>String</i> </record_group_name>	Required. Specifies the name of the <i>record_group</i> that was specified in the <i>Record</i> tool's configuration file or a regular or wildcard expression.
domain_name	<domain_name> <i>String</i> </domain_name>	Required. Specifies the name of the <i>domain_name</i> that was specified in the <i>Record</i> tool's configuration file or a regular or wildcard expression.

All output properties (Table 4.7) are optional.

Table 4.7 Output Properties

Property	Syntax	Description
topic_name	<pre><topic_name> String </topic_name></pre>	Specifies the name to be assigned to the topic when creating a <i>DataWriter</i> to write the data to be replayed.
type_name	<pre><topic_name> String </topic_name></pre>	Specifies the name to be assigned to the type when creating a <i>DataWriter</i> to write the data to be replayed.
datawriter_qos	<pre><datawriter_qos> DDS_DataWriterQos </datawriter_qos></pre>	Specifies the QoS settings for all <i>DataWriters</i> created for this <i>Replay_Topic</i> . A <i>DataWriter</i> is created for each <i>Topic</i> that matches the <i>topic_expr</i> . All the <i>DataWriters</i> for the <i>Replay_Topic</i> will use the same set of QoS policies. You can specify all of the QoS policies with this <i>datawriter_qos</i> property. See the <i>RTI Data Distribution Service User's Manual's</i> chapter on Configuring QoS with XML.
topic_qos	<pre><topic_qos> DDS_TopicQos </topic_qos></pre>	Specifies the QoS settings to be applied to the topic when creating a <i>DataWriter</i> to write the data to be replayed.

4.7 Time Control Properties

The `<time_control>` element can be applied to any of *Replay's* major entities: `<replay_service>`, `<replay_database>`, `<session>`, and `<replay_topic>`.

- ❑ The *index time* of the `<replay_service>` is the earliest *index time* of all of its component `replay_database` entities.
- ❑ The *index time* of a `<replay_database>` is the earliest timestamp of the database, taken from its creation log.
- ❑ The *index time* of a `<replay_topic>` is the earliest timestamp of the topic, taken from the first recorded sample of the topic.

All time control properties are optional.

The **start_time** and **stop_time** values of a child entity are constrained by the **start_time** and **stop_time** settings of its parent entities. If a **start_time** or **stop_time** value is explic-

itly specified and constrained by one of its parent entities, *Replay* will issue a warning that the value has been truncated.

The **start_mode** of a child entity overrides the **start_mode** setting of its parent entities.

The **time_mode** value of a child entity cannot be applied to a parent entity (e.g., TOPIC_RELATIVE cannot be applied to the **time_control time_mode** element of a `<session>`, `<replay_database>`, or `<replay_service>`).

Table 4.8 Time Control Properties

Property	Syntax	Description
rate	<pre><rate> Real Number </rate></pre>	<p>Specifies the replay rate, expressed as a multiple of the original rate at which the data was recorded. (Therefore 1 means the same as the original rate, 2 means twice as fast, etc.)</p> <p>Although this rate may be specified as a real decimal number, the internal resolution of the rate value is stored as a percentage with two decimal places. The rate may also be configured with the special value "AS_FAST_AS_POSSIBLE", which directs <i>Replay</i> to replay the data without any intervening time between samples.</p> <p>The minimum value is 0.01 (1% of the original rate.)</p> <p>Default: 1</p>
start_mode	<pre><start_mode> Start Mode </start_mode></pre>	<p>Sets the starting mode of the entity, as described in Table 4.9, "Start Mode Values". Default: AUTOMATIC</p>
time_mode	<pre><time_mode> Time Mode </time_mode></pre>	<p>Describes how the start_time and stop_time parameters should be interpreted. See Table 4.10, "Time Mode Values". Default: DATABASE_RELATIVE, except when applied to a replay_service entity, whose default is SERVICE_RELATIVE.</p>
start_time	<pre><start_time> DDS_Duration </start_time></pre>	<p>The time of the recorded data at which replay is to begin. The time is interpreted based on the setting of time_mode.</p> <p>Although expressed as <code><sec></code> and <code><nanosec></code>, the internal resolution of <i>Replay</i> is limited to milliseconds. Default: 0</p>

Table 4.8 Time Control Properties

Property	Syntax	Description
stop_time	<pre><stop_time> DDS_Duration </stop_time></pre>	<p>The time of the recorded data at which replay is to stop. The time is interpreted based on the setting of <code>time_mode</code>.</p> <p>Although expressed as <code><sec></code> and <code><nanosec></code>, the internal resolution of <i>Replay</i> is limited to milliseconds.</p> <p>Default: Infinity</p>
start_offset	<pre><start_offset> DDS_Duration </start_offset></pre>	<p>The time to offset the selected entity's starting time from its parent entity. This value is used for synchronizing data that is replayed from different sources.</p> <p>When applied to the <code><replay_service></code>, <i>Replay</i> will delay for the number of seconds specified between the creation of the entities and the start of replay. (To allow for discovery, for example).</p> <p>When applied to a <code><replay_database></code>, this time is the amount of offset between the <i>index time</i> of the <code>replay_service</code> and the <i>index time</i> of the database.</p> <p>When applied to a <code><replay_database></code>, this time allows an additional <i>DDS_Boolean</i> element, <code><auto_offset></code>, which if set <i>TRUE</i> directs <i>Replay</i> to automatically calculate the offset between the <i>index time</i> of the <code><replay_database></code> and the <i>index time</i> of the <code><replay_service></code>. This value should not be applied to <code><session></code> or <code><replay_topic></code>.</p> <p>Default: 0</p>

Table 4.9 Start Mode Values

Enumeration Value	Description
AUTOMATIC	Replay of the entity begins automatically. For subordinate entities, replay begins when parent replay starts.
MANUAL	Replay of the entity begins when explicitly directed by remote administration. When an entity is manually started, all of its child entities with AUTOMATIC start_mode will also be started at the same time, and so forth continuing to the lowest child.
LOOP	<p>Replay of the selected section begins automatically, and is restarted immediately after the last data sample of the <i>entity</i> has been replayed. For example, replay_topics with start_mode LOOP will each restart as soon as each topic has completing its replay, while a session with start_mode LOOP will restart only when <i>all</i> of its topics have completed replay.</p> <p>Note: Currently this mode is operational only for session and replay_topic entities.</p>

Table 4.9 Start Mode Values

Enumeration Value	Description
MATCHED	Replay begins after each child <code>DataWriter</code> has detected at least one matched reader. CURRENTLY NOT SUPPORTED.

Table 4.10 Time Mode Values

Enumeration Value	Description
ABSOLUTE	The <code>start_time</code> and <code>stop_time</code> values are in absolute timestamps and will be used without modification.
SERVICE_RELATIVE	The <code>start_time</code> and <code>stop_time</code> values are relative to the <code>replay_service</code> 's <i>index time</i> (i.e., the <i>index time</i> of the <code>replay_service</code> will be added to the <code>start_time</code> and <code>stop_time</code> values, if specified).
DATABASE_RELATIVE	The <code>start_time</code> and <code>stop_time</code> values are relative to the <code>replay_database</code> 's <i>index time</i> (i.e., the <i>index time</i> of the <code>replay_database</code> will be added to the <code>start_time</code> and <code>stop_time</code> values, if specified).
TOPIC_RELATIVE	The <code>start_time</code> and <code>stop_time</code> values are relative to the earliest timestamp of the topic (i.e., the <i>index time</i> of the topic will be added to the <code>start_time</code> and <code>stop_time</code> values, if specified).

4.8 Remote Administration Properties

The *Replay* tool can be controlled remotely, by either the *rtireplaysh* utility, or by an *RTI Data Distribution Service* application that reads and writes the remote administration topic.

For security reasons, Remote Administration is turned off in the *Replay* tool by default.

The Remote Administration section of the configuration file is used to enable Remote Administration and configure its behavior. This section is not required in the configuration file.

The *rtireplaysh* utility or a remote application can send commands to the *Replay* tool to:

- Start/stop/pause/resume/step the *Replay* tool or any of its individual entities.
- Change the speed of replay of the *Replay* tool or any of its individual entities.
- Query the status of the *Replay* tool or any of its individual entities.

Section [Using the Replay Shell \(Section 5.3\)](#) describes the command format and individual commands available in *rtireplaysh*, *Replay*'s remote administration utility.

[Table 4.11](#) describes the Remote Administration properties. All remote administration properties are optional.

All Remote Administration properties must be specified inside `<administration>` and `</administration>` tags.

Table 4.11 **Remote Administration Properties**

Property	Syntax	Description
name	<code><name></code> <i>String</i> <code></name></code>	Assigns a name to the replay service. You can use this name when sending commands via <i>RTI Replay Shell</i> (see Section 5.3).
domain_id	<code><domain_id></code> <i>DDS_Long</i> <code></domain_id></code>	Sets the domain ID. Default: 0
participant_qos	<code><participant_qos></code> <i>DDS_ParticipantQos</i> <code></participant_qos></code>	Configures the QoS for the Participant created by the <i>Replay</i> tool's Remote Access module. Defaults: See the <i>RTI Data Distribution Service</i> online (HTML) documentation on DomainParticipants.
publisher_qos	<code><publisher_qos></code> <i>DDS_PublisherQos</i> <code></publisher_qos></code>	Configures the QoS for the Publisher created by the <i>Replay</i> tool's Remote Access module. Defaults: See the <i>RTI Data Distribution Service</i> online (HTML) documentation on Publishers.
subscriber_qos	<code><subscriber_qos></code> <i>DDS_QosPolicy</i> <code></subscriber_qos></code>	Configures the QoS for the Subscriber created by the <i>Replay</i> tool's Remote Access module. Defaults: See the <i>RTI Data Distribution Service</i> online (HTML) documentation on Subscribers.
datareader_qos	<code><datareader_qos></code> <i>DDS_DataReaderQos</i> <code></datareader_qos></code>	Configures the QoS for the DataReader created by the <i>Replay</i> tool's Remote Access module. Defaults: See the <i>RTI Data Distribution Service</i> online (HTML) documentation on DataReaders.
datawriter_qos	<code><datawriter_qos></code> <i>DDS_DataWriterQos</i> <code></datawriter_qos></code>	Configures the QoS for the DataWriter created by the <i>Replay</i> tool's Remote Access module. Defaults: See the <i>RTI Data Distribution Service</i> online (HTML) documentation on DataWriters.

4.9 Type Configuration

The `<type_config>` element allows you to pass DDS type configuration information to the *Replay* tools in the form of XML type-configuration files.

Table 4.12 describes the Type Configuration properties. All Type Config properties are optional.

Table 4.12 Type Configuration Properties

Property	Syntax	Description
xml	<pre><xml> XML Type Configuration Properties </xml></pre>	The XML type configuration for this domain group. See Table 4.13, “Type Properties”.

Table 4.13 Type Properties

Property	Syntax	Description
register_top_level	<pre><register_top_level> Boolean </register_top_level></pre>	Whether or not to register the top-level types with their canonical names.
max_string	<pre><max_string> Integer </max_string></pre>	The default values to use when there are unbounded strings in a type.
max_sequence	<pre><max_sequence> Integer </max_sequence></pre>	The default values to use when there are unbounded sequences in a type.
path	<pre><path> <element> Path </element> </path></pre>	A list of the paths to be used when searching for XML type-configuration paths. The <i>element</i> tag can be repeated.
file_group	<pre><file_group> <element> File Group Properties </element> </file_group></pre>	A list of file groups associated with this domain group. A file group is parsed into a single Document Object Module. The <i>element</i> tag can be repeated. See Table 4.14, “XML Type Properties”.

Table 4.14 XML Type Properties

Property	Syntax	Description
register_top_level	<pre><register_top_level> Boolean </register_top_level></pre>	Whether or not to register the top-level types with their canonical names. This overrides the parent
max_string	<pre><max_string> Integer </max_string></pre>	The default values to use when there are unbounded strings in a type. This overrides the parent.
max_sequence	<pre><max_sequence> Integer </max_sequence></pre>	The default values to use when there are unbounded sequences in a type. This overrides the parent.
file_name	<pre><file_name> <element> File Name </element> </file_name></pre>	A list of the files that contain XML type-definitions. The element tag can be repeated.

Chapter 5 Using the Replay Tool

This chapter describes how to use the *Replay* tool included with *RTI Recording Service*. This tool replays the recorded data by publishing it just like the original DDS application did. You can use the original domain ID, QoS settings and data rate, or make changes to test different scenarios.

5.1 Recording Data for Replay

The *Replay* tool can replay information that has been stored in either serialized or deserialized form. If *Replay* is to be used to replay deserialized data, ensure that *all* of the fields of the sample data are recorded, as *Replay* is unable to replay partial data.

Note: SQLite is unable to look at the individual fields in the sample data of files recorded in serialized mode.

5.2 Starting and Stopping the Replay Tool

The *Replay* tool's executable is in `<install directory>/bin/<architecture>`. A script to run the executable is in `<install directory>/scripts`.

On Linux systems:

Open a command prompt, change to the `<install-dir>/scripts` directory and enter:

```
> rtireplay -cfgFile <file> -cfgName <configuration>
```

On Windows systems:

From the **Start** menu, select **RTI, RTI Recording Service <version>, Replay**. At the resulting command prompt, enter the following command:

```
> rtireplay -cfgFile <file> -cfgName <configuration>
```

Note: You may see the following messages in the command shell, they are benign:

```
Replay 2.x initializing ...
PLAYBACKCfgFileParser_loadCfgFile:No configuration file found
PLAYBACKService_initialize:!load configuration file
PLAYBACKService_new:!init replay service
main:!create replay service
Terminating service...
C:\Program Files\RTI\RTI Recording Service <version>\scripts>
```

Table 5.1 lists the command-line options.

5.2.1 Stopping the Replay Tool

To stop the *Replay* tool, use **<Control-c>**.

Table 5.1 **Replay Tool's Command-line Options**

Command-line Option	Description
-appName <name>	Specifies an application name which is used to identify the application for remote administration. Default: -cfgName
-cfgFile <file>	Required. Used to identify the XML configuration file.
-cfgName <name>	Required. Identifies the configuration within the XML configuration file. The <i>Replay</i> tool will load the <replay_service> with the same name as this value.
-domainIdBase <int>	Adds this value to the domain IDs in the configuration file. Default: 0
-forceXmlTypes	When used with XML Type Configuration, this option instructs <i>Replay</i> to always use type code from the XML file, even if an alternate is available from recorded data.
-help	Displays this information.

Table 5.1 Replay Tool's Command-line Options

Command-line Option	Description
<code>-identifyExecution</code>	Appends the host name and process ID to the <code>appName</code> to help using unique names.
<code>-noAutoEnable</code>	Use this option if you plan to enable the <i>Replay</i> tool remotely.
<code>-remoteAdministrationDomainId</code> <int>	Enables remote administration and sets the domain ID for the communication. Default: remote administration is not enabled.
<code>-srvName</code> <name>	Specifies a name that will be used to identify the service.
<code>-verbosity</code> <value>	Specifies what type of logging information should be printed. 0: Silent 1: Exceptions (both <i>RTI Data Distribution Service</i> and the <i>Replay</i> tool) 2: Warnings (the <i>Replay</i> tool only) 3: Information (the <i>Replay</i> tool only) 4: Warnings (both <i>RTI Data Distribution Service</i> and the <i>Replay</i> tool) 5: Tracing (the <i>Replay</i> tool only) 6: Tracing (both <i>RTI Data Distribution Service</i> and the <i>Replay</i> tool) Default: 1
<code>-version</code>	Prints the <i>Replay</i> tool's version.

5.3 Using the Replay Shell

The *Replay Shell* is an *RTI Data Distribution Service* application that can remotely control the *Replay* tool.

To start the Replay Shell:

- ❑ On Linux systems, enter:

```
> <install dir>/scripts/rtireplaysh [options]
```

- ❑ On Windows systems: From the **Start** menu, select **RTI, RTI Recording Service <version>, RTI Recording Service -- Replay Shell <version>**. Or to run from the command-line, enter the following:

```
$ <install dir>\scripts\rtireplaysh [options]
```

Table 5.2 lists the command-line options you can use when starting the *Replay Shell*. Once it is started, you can use the commands in Table 5.3.

Table 5.2 **Replay Shell's Command-Line Options**

Command-line Option	Description
-cmdFile <file>	A file that contains commands to be run.
-domainId <integer>	Specifies the domain ID, an integer between 0 and 99. Default: 0
-help	Prints version information and a list of options.
-timeout <seconds>	Maximum number of seconds to wait for a remote response. Default: 15 seconds
-verbosity <value>	Specifies what type of logging information should be printed. 0: Silent 1: Exceptions (both <i>RTI Data Distribution Service</i> and the <i>Replay</i> tool) 2: Warnings (the <i>Replay</i> tool only) 3: Information (the <i>Replay</i> tool only) 4: Warnings (both <i>RTI Data Distribution Service</i> and the <i>Replay</i> tool) 5: Tracing (the <i>Replay</i> tool only) 6: Tracing (both <i>RTI Data Distribution Service</i> and the <i>Replay</i> tool) Default: 1

Table 5.3 **Replay Shell's Commands**

Command	Description
stop	Stops replay of an entity.
start	Starts replay of an entity.
pause	Pauses replay of an entity.
query	Returns the status of an entity. The leading portion of the status is a compacted field of the form "[cccc dd dd]", suited to machine parsing, where each 'c' is either 'T' or 'F', and 'dd' is a decimal number. The meanings of each 'T'/'F' entry are: enabled, started, pending, paused, and completed. The decimal numbers are the number of child topics owned by the entity and the number of active child topics owned by the entity.
resume	Resume replay of an entity.
step	Replays a single sample from the entity.
rate	Changes the replay rate of an entity. The rate is a multiplier from 0.1 to 4 billion. It replays at the speed of the multiplier (2 = 2x, 0.5 = 1/2x, etc.) Default: 1
exit	Exits the shell.

The *Replay Shell* commands use this format:

```
<command> <replay_service> <entity> [value]
```

where:

- ❑ **<command>** is one of the supported commands (see [Table 5.3](#)).
- ❑ **<replay_service>** is the name given to the *Replay* service by one of the following, in descending order of precedence:
 - The value specified with the **-appName** command-line option used when starting the *Replay* tool (*highest precedence*)
 - The value for the <replay_service><administration><name> element (see [page 2-12](#))
 - The value for the <replay_service> name attribute (*lowest precedence*) (see [Section 4.3](#))
- ❑ **<entity>** is any one of the service entities expressed in this hierarchical form: <database-name>[::<session-name>[::<topic-name>]].

Note: *In this release, not all commands are supported for all entity levels. Please see the RTI Recording Service [Release Notes](#) for details on which modes are currently supported.*

The database-name must match a name from a <replay_database> tag in the configuration file that you specified when starting the *Replay* tool , such as:

```
<replay_database name="simple_config">
```

Similarly, if you specify a session-name, it must match a name from a <session> tag within the specified database, such as:

```
<session name="A_Session">
```

If you specify a topic-name, it must match a name from a <replay_topic> tag within the specified session, such as:

```
<replay_topic name="All_Topic">
```

- ❑ **value** depends on the command, see [Table 5.3](#). Not all commands require a value.

5.4 Performance and Indexing

The *Replay* tool replays stored samples in the same order in which they were received, using SQLite indexes to retrieve the samples in sorted order. SQLite automatically builds indexes when opening an SQLite table for sorted access, and for large tables the process of building the index may take some time.

To improve *initialization* performance, the *Replay* tool attempts to create and store indexes (rather than depend upon automatic indexing) for the tables that it will be replaying; this saves initialization time on subsequent replays.

The *Replay* tool's ability to store indexes is controlled by the <readonly> parameter under <replay_database> (see [Database \(Input File\) Properties \(Section 4.4\)](#)). The default value for <readonly> is false; this allows the *Replay* tool to write the table indices to the database. If you change <readonly> to true, the *Replay* tool will display a message during initialization for each table opened, stating that it was unable to store the table index.

In summary, the *replay* performance of the *Replay* tool is not affected by the <readonly> parameter. The *Replay* tool will use the fastest means of retrieving samples in either case. But setting the <readonly> option to false (the default) may help improve *initialization* performance.

Chapter 6 Viewing Recorded Data with SQLite

The *Record* tool stores data in a SQL database. This chapter describes how the data is stored and how to view the data with the provided SQL command-line tool, **sqlite3**. (Not provided for Windows® CE and Yellow Dog® Linux® platforms.)

Important: For information on SQL commands, please visit www.sqlite.org.

To open a recorded file, start **sqlite3**. For example:

```
$ cd rtirecord.4.5.x-ndds.4.5y/bin/<architecture>
$ sqlite3 <recorded file>
```

Then you can list all the available topics by entering:

```
sqlite> .tables
```

This will list the tables (one per topic) in the database file. For example:

```
Circle$MyGroup$MyDomain
DCPSParticipant
DCPSPublication
DCPSSubscription
RTILog
RTIVersion
Square$RecordAll$MyDomain
Square$RecordXY$SquaresinMyDomain$MyDomain
Triangle$RecordAll$MyDomain
```

You can query the tables using standard SQL syntax. For example, assume that the Topic Circle was recorded in RecordGroup, MyGroup, in domain MyDomain. In this case, the *Record* tool creates a table called Circle\$MyGroup\$MyDomain to store all data published on Topic Circle. To list all data received on Topic Circle, enter:

```
sqlite> select * from Circle$MyGroup$MyDomain;
```

Note: For more example commands, please see the [Chapter 3 in the Getting Started Guide](#).

To exit `sqlite3`, enter:

```
sqlite> .exit
```

6.1 Format of the Recorded Data

6.1.1 Discovery Data

The *Record* tool stores discovery-related data in these tables:

- DCPSParticipant — corresponds to the Participant Built-in Topic
- DCPSPublication — corresponds to the Publication Built-in Topic
- DCPSSubscription — corresponds to the Subscription Built-in Topic

Please refer to [RTI Data Distribution Service C API documentation](#) for the fields in each of the corresponding builtin topics. (In the HTML documentation for the C API, select Modules, Domain Module, Built-in Topics.)

The *Record* tool stores the following information, in this order:

- A timestamp (in microseconds since Jan. 1st, 1970).
- State (internal information, can be ignored)
- Type (internal information, can be ignored)
- The domain ID from which the sample was received.
- The BuiltinTopicData.
- The SampleInfo information, as described in the *RTI Data Distribution Service* documentation.

6.1.2 User Data

- Deserialized Data

When the *Record* tool stores data in deserialized form, it creates a mapping from a Topic to a table. Each individual scalar is stored in a column named with the fully qualified name.

For example, the following will create a column, **bar\$x**:

```
struct Bar {
    long x;
};

struct Foo {
    Bar bar;
};
```

❑ Topic Data

The *Record* tool creates a table called "TopicName\$RecordGroupName\$DomainName" for each recorded topic (unless the `shared_table` property is true).

The *Record* tool stores topic data as specified in the subscription properties.

For each topic, the *Record* tool also stores the following, in this order:

- A timestamp (in microseconds since Jan. 1st, 1970). (Note that the column name is `__timestamp`, with 3 underscores.) This is the time that the data was committed to the database.
- The domain ID from which the sample was received.
- `Table_prefix` - `RecordGroupName$DomainName` (only if `<shared_table>` is specified)
- Whether the data is stored in serialized or deserialized format.
- The `SampleInfo` information, as described in the *RTI Data Distribution Service* documentation.
- Topic data.

If the topic data is saved in serialized form, a special table is used with the following columns:

- `serialized_sample`: raw data
- `serialized_length`: length of the raw data
- `serialized_endian`: 1 — little endian, 0 — big endian

6.1.3 Other Tables

You will notice that the *Record* tool creates two additional tables, *RTILog* and *RTIVersion*. You do not need to use these tables, they are for internal use by the *Record* tool.

Chapter 7 Exporting Recorded Data

RTI Recording Service includes a conversion utility that enables serialized or deserialized data recorded with the *Record* tool to be exported to CSV, HTML, SQL, or XML formats. The utility merges the data from all the segments in a fileset. It converts recorded data (either serialized or deserialized) into one of the available formats. The output data is deserialized.

The executable, **rtireconv**, is located in `<install dir>/bin/<architecture>`. The script to launch the *Convert* tool is in `<install dir>/scripts/rtireconv`.

To see a list of available options, enter:

```
$ rtireconv -help
```

You will see the following:

```
rtireconv [options] fileset
Options:
-help                - Print out this text
-version             - Print out the version
-verbosity [0..6]   - verbosity from 0 to 6
-forceXMLTypes      - Always use XML type definitions, if available
-compact <mode>    - How to read octet/char arrays and sequences. Default: auto
                    auto - Detect automatically how data is stored and compact/do not compact
                        each type of data accordingly.
                    yes  - Show the structures with compact data regardless of how they are
                        stored.
                    no  - Do not compact the structures regardless of how they are stored.
-tableExpr <expr>  - POSIX fn-name expressions, Can be repeated
-includeInfo        - Include the DDS_SampleInfo structure for each sample
-includeDiscovery   - Include discovery traffic
-includeNonData     - Include non-data samples
-decodeUnknown      - Try to decode samples from DDS_DataWriters with no typecode
-format <format>   - Output format. Default: xml
                    xml  - Output in XML format
                    csv  - Output CSV format
```

```
    html - Output in HTML table format
-decodeChar <format> - Decode char data in this format. Default: text
    hex - Decode char data as hex
    text - Decode char data as ASCII text
-decodeOctet <format> - Decode octet data in this forma. Default: hex
    hex - Decode octet data as hex
    text - Decode octet data as ASCII text
-time <format> - Format for timestamp
    epoch - Show timestamp in microsec from January 1 1970
    gmt - Show timestamp in GMT
-filePrefix <prefix> - Create one file per table called <prefix>_<Table>
-outputFile <file> - Name of output file, cannot be used with file_prefix
-typeConfig <file> <cfgName> - Name and configuration of the XML
                             type-configuration file
```

For example, assume that recorded data is stored in a file named **mydata.dat_0**. The command to convert the recorded data into XML format is:

```
$ rtirecconv mydata.dat_0
```

An output file called **mydata.dat_0.xml** will be created.

To convert to an HTML table instead, the command is:

```
$ rtirecconv -format html mdata.dat_0
```

This will create an output file called **mydata.dat_0.html**.

Note: The *Convert* tool cannot process partially recorded deserialized data. If you want to record only a subset of the fields in the data structure, you should record in *serialized* format. For deserialized recorded data, it is better to use *sqlite* to output the data instead of *rtirecconv*.

Chapter 8 Example Configuration Files

This chapter shows how to configure the *Record* tool for a variety of situations:

- ❑ [How to Record All Topics in a Single Domain \(Section 8.1\)](#)
- ❑ [How To Record a Subset of Data from Multiple Domains \(Section 8.2\)](#)
- ❑ [How To Record Data to Multiple Files \(Section 8.3\)](#)
- ❑ [How To Record Serialized Data \(Section 8.4\)](#)
- ❑ [How To Record Using Best-Effort Reliability \(Section 8.5\)](#)
- ❑ [How To Enable Remote Access \(Section 8.6\)](#)

8.1 How to Record All Topics in a Single Domain

Scenario

You have a DDS system with several nodes using domain ID 54. You want all the data in this system to be recorded to a single file called **mydomaindata**. When the file is full, recording should stop. The typecodes are available from the DDS system.

Configuration File

```
<dds>
  <recorder name="scenario1">
    <record_database>
      <database_name> mydomaindata </database_name>
      <max_file_size> 1 GB </max_file_size>
    </record_database>
    <domain name="mydomain">
      <domain_id> 54 </domain_id>
    </domain>
  </recorder>
</dds>
```

```
<topic_group name="All">
  <topics>
    <topic_expr> * </topic_expr>
  </topics>
  <field_expr> * </field_expr>
</topic_group>
<record_group name="sub0">
  <domain_ref>
    <element> mydomain </element>
  </domain_ref>
  <topic_ref>
    </element> All </element>
  </topic_ref>
</record_group>
</recorder>
</dds>
```

Expected Outcome

The expected outcome is a single file about 4 GB with all the data in a file called **mydomaindata_0_0**. By default, the *Record* tool will store deserialized data, so the file will have one column for each field in the topic.

8.2 How To Record a Subset of Data from Multiple Domains

Scenario

You have a DDS system with multiple domains, including domain IDs 54 and 98, and hundreds of topics whose names contain “Sensor” (such as TemperatureSensor, HeatSensor, SensorTypes, etc.), in addition to hundreds of other topics. You only want to record the topics that start with “Sensor”, and from each of these topics, you only want to record the fields whose name includes “value” (such as value_max, value_min, current_value).

Configuration File

```
<dds>
<recorder name="scenario2">
  <record_database>
    <database_name> mydomaindata </database_name>
    <max_file_size> 1 GB </max_file_size>
  </record_database>
  <domain name="mydomain54">
```

```

    <domain_id> 54 </domain_id>
  </domain>
  <domain name="mydomain98">
    <domain_id> 98 </domain_id>
  </domain>
  <topic_group name="Sensor">
    <topics>
      <topic_expr> Sensor* </topic_expr>
    </topics>
    <field_expr> *value* </field_expr>
  </topic_group>
  <record_group name="sub0">
    <domain_ref>
      <element> mydomain54 </element>
    </domain_ref>
    <topic_ref>
      </element> All </element>
    </topic_ref>
  </record_group>
  <record_group name="sub1">
    <domain_ref>
      <element> mydomain98 </element>
    </domain_ref>
    <topic_ref>
      </element> All </element>
    </topic_ref>
  </record_group>
</recorder>
</dds>

```

Expected Outcome

The expected outcome is a single file about 4 GB, with all the data in a file called `mydomaindata_0_0`. By default, the *Record* tool will store deserialized data; so the file will have one column per field in the topic.

8.3 How To Record Data to Multiple Files

Scenario

The *Record* tool is recording data on a system that supports files up to 4 GB in size. However, you want to record more than 4 GB of data.

Configuration File

```
<dds>
<recorder name="scenario3">
  <record_database>
    <database_name> mydomaindata </database_name>
    <max_file_size> 2000 kB </max_file_size>
    <max_file_segments> 1000 </max_file_segments>
    <rollover> yes </rollover>
  </record_database>
  ...
</recorder>
</dds>
```

Expected Outcome

Up to 1,000 files will be created if necessary, named **mydomaindata_0_0**, **mydomaindata_0_1**, etc., up to **mydomaindata_0_999**.

8.4 How To Record Serialized Data

Scenario

Due to space limitations and speed, you want to store serialized data.

Configuration File

```
<dds>
<recorder name="scenario4">
  ...
  <domain name="mydomain">
    <domain_id> 98 </domain_id>
    <deserialize_mode>
      RTIDDS_DESERIALZEMODE_NEVER
    </deserialize_mode>
  </domain>
```

```

...
</recorder>
</dds>

```

Expected Outcome

All samples will be stored in a single column, along with SampleInfo and other meta-data.

8.5 How To Record Using Best-Effort Reliability

Scenario

You have a DDS system with multiple DataWriters of the same topic. Some of these use best-effort reliability, while others use strict reliability. You want to minimize the impact that the *Record* tool has on the system.

Configuration File

```

<dds>
<recorder name="scenario5">
...
  <topic_group name="Sensor">
    <topics>
      <topic_expr> Sensor* </topic_expr>
    </topics>
    <field_expr> *value* </field_expr>
    <datareader_qos>
      <reliability>
        <kind> BEST_EFFORT_RELIABILITY_QOS </kind>
      </reliability>
    </datareader_qos>
  </topic_group>
...
</recorder>
</dds>

```

Expected Outcome

The *Record* tool will use DataReaders with best-effort Reliability to record all data.

8.6 How To Enable Remote Access

Scenario

The *Record* tool is part of a larger system that must reach a steady state before it starts recording. The *Record* tool should use domain ID 54 and partition “rti” for communication with the controller.

Configuration File

```
<dds>
<recorder name="scenario6">
...
  <remote_access>
    <enabled> yes </enabled>
    <publish_status_period> 10 </publish_status_period>
    <remote_access_domain> domain54 </remote_access_domain>
    <subscriber_qos>
      <partition>
        <name>
          <element> rti </element>
        </name>
      </partition>
    </subscriber_qos>
  </remote_access>
  <domain name="domain54">
    <domain_id> 54 </domain_id>
  </domain>

...
</recorder>
</dds>
```

Expected Outcome

The *Record* tool will communicate with a remote controller on domain ID 54 using partition “rti.” Status information will be published every 10 seconds.

Chapter 9 Accessing the Record Tool from a Remote Location

Perhaps you want to start/stop the *Record* tool from another machine, or even reconfigure it to change what is being recorded. You can create an *RTI Data Distribution Service* application that can remotely control the *Record* tool. This chapter explains how.

To control the *Record* tool from a remote location:

1. Configure the *Record* tool to allow remote access (see [Remote Access Properties \(Section 2.8\)](#)).
2. Create an *RTI Data Distribution Service* application using the provided **rtirecord.idl** file. You will use *rtiddsgen* to generate the basics and then add code to send your desired remote commands.

9.1 Overview

If the *Record* tool is configured to allow remote access, it creates a *DataReader* for a “command” Topic (named `RTI_RECORD_CMD_TOPIC`) and a *DataWriter* for “status” Topic (named `RTI_RECORD_STATUS_TOPIC`). So the *Record* tool will write status updates and read commands.

These topics’ types and names are specified in the IDL file, **resource/idl/rtirecord.idl**.

When the *Record* tool detects a remote *DataReader* and *DataWriter* of these special topics from the same participant, the *Record* tool will be in a ‘connected’ state, which means it will accept remote commands.

Your remote-access application will use the following constants:

- ❑ **RTI_REMOTECTX_MSG_TYPE** Register a type of this name, as seen in [Figure 9.1](#).
- ❑ **RTI_RECORD_CMD_TOPIC** Create a DataWriter with this Topic name, as seen in [Figure 9.2](#).
- ❑ **RTI_RECORD_STATUS_TOPIC** Create a DataReader with this Topic name, as seen in [Figure 9.2](#).

See [Remote Control Messages \(Section 9.3\)](#) for more information.

Figure 9.1 **Registering the Message Type**

```
RTIRemoteCtxMsgTypeSupport_register_type  
(self->dds_participant, RTI_REMOTECTX_MSG_TYPE);
```

9.2 Establishing a Connection with the Record Tool

To establish a connection with the *Record* tool, your remote-access application needs:

- ❑ 2 DDS Topics (one for commands, one for status)
- ❑ 1 DDS DataReader
- ❑ 1 DDS DataWriter

When creating the DataReader and DataWriter, use the following QoS settings:

- ❑ `history.kind = DDS_KEEP_ALL_HISTORY_QOS`
- ❑ `reliability.kind = DDS_RELIABLE_RELIABILITY_QOS`

[Figure 9.2](#) shows how to create the Entities in your remote-control application using the C API. (A general knowledge of DDS is assumed.)

Figure 9.2 Creating the Required DDS Entities

```
dds_topic_cmd =
    DDS_DomainParticipant_create_topic(
        dds_participant, RTI_RECORD_CMD_TOPIC,
        RTI_REMOTECTX_MSG_TYPE, &tqos,
        NULL, DDS_STATUS_MASK_NONE);
dds_topic_status =
    DDS_DomainParticipant_create_topic(
        dds_participant, RTI_RECORD_STATUS_TOPIC,
        RTI_REMOTECTX_MSG_TYPE, &tqos,
        NULL, DDS_STATUS_MASK_NONE);
...

rqos.reliability.kind = DDS_RELIABLE_RELIABILITY_QOS;
rqos.history.kind = DDS_KEEP_ALL_HISTORY_QOS;

dds_reader = (RTIRemoteCtxMsgDataReader*)
    DDS_Subscriber_create_datareader(
        dds_subscriber,
        DDS_Topic_as_topicdescription(
            dds_topic_status), &rqos,
        NONE, DDS__STATUS_MASK_NONE);

wqos.reliability.kind = DDS_RELIABLE_RELIABILITY_QOS;
wqos.history.kind = DDS_KEEP_ALL_HISTORY_QOS;

dds_writer = (RTIRemoteCtxMsgDataWriter*)
    DDS_Publisher_create_datawriter(
        dds_publisher, dds_topic_cmd, &wqos,
        NULL, DDS_STATUS_MASK_NONE);
```

9.3 Remote Control Messages

The *Record* tool exchanges messages with your remote-access application by publishing and subscribing to two special remote-access topics. Both topics use the same message format, shown in [Figure 9.3](#).

Figure 9.3 **Top Level Structure for Remote Control Messages**

```
struct RTIRemoteCtxMsg {
    long destination_mask;
    RTIRemoteCtxAddress destination;
    long msg_id;
    RTIRemoteCtxMsgUnion msg;
};
```

For complete details, see the IDL file, `rtirecord.idl` in the `examples` directory.

destination_mask — A field used by other RTI tools; can be ignored.

destination — The *Record* tool application for which the message is intended. If `accept_broadcast_commands` is turned off, this structure must match that of the *Record* tool. If `accept_broadcast_commands` is turned on, this structure can be a specific destination or all 0's.

msg_id — A user-specified integer that identifies a particular message exchange. When the *Record* tool sends a response to a command, it will include the same `msg_id` that was received in the command.

msg — A union of different message types. The discriminator must be set to one of the message types listed in [Table 9.1](#).

The code fragment in [Figure 9.4](#) shows how to set the message type in the remote-access application.

Depending on the message type, the correct union member must also be filled in. For example, [Figure 9.5](#) shows how to construct a message to the *Record* tool to read a new configuration from a file. In this example, the new configuration is to be read from a file on the same file-system as the *Record* tool.

Figure 9.4 **Assigning a Message Type (C Language)**

```
RTIRemoteCtxMsg *msg;
msg = RTIRemoteCtxMsgPlugin_create_sample();
msg->msg._d = RTI_REMOTECTX_MSG_RECORD_START;
```

Figure 9.5 Sending a Command to the Record Tool to Read a New Configuration File

```

RTIRemoteCtxMsg *msg;
DDS_ReturnCode_t retcode;
Struct DDS_SampleInfo info;
msg = RTIRemoteCtxMsgPlugin_create_sample();
msg->msg._d = RTI_REMOTECTX_MSG_RECORD_CONFIGURE;
/* This is the last part of the configuration. If the
 * configuration spans multiple samples, then only the last
 * one should have this set to TRUE.
 */
msg->msg._u.config.final_config = DDS_BOOLEAN_TRUE;

/* Tell the Record Tool that the filename to read from follows
 * in the config_from_string text string
 */
msg->msg._u.config.config_from_file = DDS_BOOLEAN_TRUE;

/* copy the name of file that the Record tool shall read from */
strncpy(msg->msg._u.config.config_from_string, filename, 512);

/* copy the configuration name of the <recorder> tag to load */
strncpy(msg->msg._u.config.config_name, cfname, 512);

/* Send the configuration message to the Record tool.
 * (dds_writer has been created elsewhere)
 */
retcode = RTIRemoteCtxMsgDataWriter_write(
                                dds_writer, msg, &DDS_HANDLE_NIL);
/* check for errors here ... */

while (no response) {
    retcode = RTIRemoteCtxMsgDataWriter_read_next_sample(
                                dds_reader, msg,
                                &info, &DDS_HANDLE_NIL);
    if (retcode != DDS_RETCODE_NO_DATA) {
        /* response received */
    }
    sleep(1);
}

```

Table 9.1 Messages Types Exchanged Between Record Tool and Remote Access Application

Direction	Message Type (add prefix: RTI_REMOTECTX_ MSG_)	Description
From: Your RTI Data Distribution Service Remote- Control Application To: The Record tool	RECORD_START	Instructs the <i>Record</i> tool to start recording.
	RECORD_STOP	Instructs the <i>Record</i> tool to stop recording.
	RECORD_CONFIGURE	Instructs the <i>Record</i> tool to reconfigure according to the contents of the message. Stop the <i>Record</i> tool before sending this message: If the <i>Record</i> tool has already been stopped, it will read the new configuration and restart. It will not automatically start recording unless <i>auto_start</i> (see Table 2.2, “General Properties”) is true (the default case). If the <i>Record</i> tool has not already been stopped, an error is returned.
	RECORD_SHUTDOWN	Instructs the <i>Record</i> tool to shutdown and exit.
	RECORD_ADD	Instructs the <i>Record</i> tool to add entities based on the contents of the message.
	RECORD_UPDATE	Instructs the <i>Record</i> tool to update entities based on the contents of the message.
	RECORD_MODIFY	Instructs the <i>Record</i> tool to add OR modify entities based on the contents of the message.
	RECORD_DELETE	Instructs the <i>Record</i> tool to delete entities based on the contents of the message.
	RECORD_PAUSE	Instructs the <i>Record</i> tool to pause entities based on the contents of the message.
	RECORD_RESUME	Instructs the <i>Record</i> tool to resume recording of previously paused entities based on the contents of the message.
To: Your RTI Data Distribution Ser- vice Remote- Control Application From: The Record tool	RECORD_PING	Instructs the <i>Record</i> tool to send the recording model ^a to the Remote Control application.
	RECORD_INFO	When the <i>Record</i> tool publishes statistics, it periodically sends out this message type.
	RECORD_RESPONSE	Indicates that this message is a response to a command.

a. The *recording model* is an XML representation of two aspects of the *Record* tool: (1) The configuration model: the XML configuration (similar to the XML configuration file used to configure the *Record* tool.) and (2) The run-time model: an XML description of the DDS entities that have been created based on the configuration. Note that only a minimal model is returned; the QoS are not returned.

9.4 Using the Example Remote-Access Application—Record Shell

The *Record Shell* is an *RTI Data Distribution Service* application that can remotely control (start, stop, and reconfigure) the *Record* tool. The *Record Shell* is not meant as a complete solution to remotely controlling the *Record* tool. Its purpose is just to give you an idea of what can be done.

The *Record Shell*, `rtirecsh`, is in `<install directory>/bin/<architecture>`.

For example, to start the *Record Shell*, enter:

```
cd <install directory>/scripts
rtirecsh -domain <domain ID>
```

Table 9.2 lists the command-line options you can use when starting the *Record Shell*. Once it is running, you can use the commands described in [Record Shell's Commands](#) (Section 9.4.1).

Table 9.2 Record Shell's Command-Line Options

Command-line Option	Description
<code>-domain <domain ID></code>	Required. Specifies the domain ID (an integer between 0 and 99).
<code>-partition <names></code>	Specifies an optional, comma-separated list of partition names. This option is necessary if the <i>Record</i> tool is configured to enable remote access in a particular partition.
<code>-noudpv4</code>	Disables the UDPv4 transport.
<code>-updv6</code>	Enables the UDPv6 transport.
<code>-shmem</code>	Enables the shared memory transport.
<code>-multicast</code>	Enables multicast.
<code>-verbosity <mask></code>	The verbosity is a bit-map that specifies what type of logging information should be printed. The verbosity may be: 0 — No messages 1 — Exceptions (default) 2 — Warnings 4 — Information 7 — All types
<code>-help</code>	Prints version information and a list of options.

9.4.1 Record Shell's Commands

- ❑ `add` (Section 9.4.1.1)
- ❑ `configure` (Section 9.4.1.2)
- ❑ `delete` (Section 9.4.1.3)
- ❑ `exit` (Section 9.4.1.4)
- ❑ `info` (Section 9.4.1.5)
- ❑ `model` (Section 9.4.1.6)
- ❑ `modify` (Section 9.4.1.7)
- ❑ `pause` (Section 9.4.1.8)
- ❑ `resume` (Section 9.4.1.9)
- ❑ `shutdown` (Section 9.4.1.10)
- ❑ `start` (Section 9.4.1.11)
- ❑ `status` (Section 9.4.1.12)
- ❑ `stop` (Section 9.4.1.13)
- ❑ `update` (Section 9.4.1.14)

Several of the commands accept a `<model>` argument. A *model* is an XML representation of two aspects of the *Record* tool:

- ❑ The configuration model: the XML configuration (similar to the XML configuration file used to configure the *Record* tool.)
- ❑ The run-time model: an XML description of the DDS entities that have been created based on the configuration.

The format of this XML is the same as the configuration format for the *Record* tool (see [Chapter 2: Configuring the Record Tool](#)). **The top-level tag must be `<dds>` followed by `<recorder>`.**

Some examples for `<model>` are:

```
<dds>
  <recorder>
    <record_group name="RecordAll"></record_group>
  </recorder>
</dds>
```

```

<dds>
  <recorder>
    <topic_group>name="RTI Shapes Demo">
      <topics>
        <topic_expr>Square</topic_expr>
      </topics>
      <field_expr>color</field_expr>
    </topic_group>
  </recorder>
</dds>

```

9.4.1.1 add

This command adds entities to the *Record* tool.

The **add** command has the following format:

```
add <model>
```

9.4.1.2 configure

The *Record* tool can be reconfigured remotely with the `configure` command. There are two ways to reconfigure the *Record* tool; using a local file or a remote file.

Note that the *Record* tool must be stopped before it can be reconfigured. When the *Record* tool is reconfigured, it will shut down completely. The *Record Shell* will lose its connection with the *Record* tool until the *Record* tool re-establishes remote access. If remote access is not enabled in the new configuration, *Record Shell* will not reconnect to the *Record* tool.

The **configure** command has the following format:

```
configure <cfg_name> [-localfile | -remotefile ] <file>
```

The configuration name **<cfg_name>** is used to find the matching `<recorder>` tag to load.

❑ -localfile <filename>

Example: Assume that you want to the *Record* tool to use a configuration file called **myconfig.xml**, which is local to the *Record Shell*:

```

RTI Record Shell> stop
RTI Record Shell> configure myrecord -localfile myconfig.xml

```

The *Record Shell* will read the contents of **myconfig.xml** and send it to the *Record* tool, which will search for a tag `<record name="myrecord">`. If **auto_start** (see Table 2.2, “General Properties”) is true (the default case), it is not necessary to run the `start` command to start the *Record* tool. If **auto_start** is false in the new configuration, then issue the `start` command in the *Record Shell* to start recording:

```
RTI Record Shell> start
```

❑ **-remotefile <filename>**

To configure the *Record* tool with the contents of a file that is local to the *Record* tool, use the **-remotefile <filename>** option.

For example, assume that you want reconfigure the *Record* tool with a file called **remotemyconfig.xml**, which resides on the same file-system as the *Record* tool.

```
RTI Record Shell> stop
RTI Record Shell> configure -myrecord -remotefile remotemyconfig.xml
```

The *Record* tool will read the contents of **remotemyconfig.xml** and reconfigure with the contents of the tag `<record name="myrecord">`. Depending on the configuration file, it may be necessary to start it:

```
RTI Record Shell> start
```

9.4.1.3 **delete**

This command deletes entities from the *Record* tool.

The **delete** command has the following format:

```
delete <model>
```

9.4.1.4 **exit**

This command exits the *Record Shell*.

```
RTI Record Shell> exit
```

9.4.1.5 **info**

This command shows you which *Record* tool session the *Record Shell* is connected to. The output looks similar to this:

```
STATE ...: Connected to [0a0a64fe.006bbe00]
GUID ...: 0a0a64fe.006bbb00
```

❑ **STATE** Which DomainParticipant the *Record* tool is connected to (HOSTID.APPID).

❑ **GUID** The GUID of the *Record Shell* itself.

9.4.1.6 model

This command prints the current model of the *Record* tool.

```
RTI Record Shell> model
```

9.4.1.7 modify

This command adds new entities to the *Record* tool, or updates existing entities.

The **modify** command has the following format:

```
modify <model>
```

9.4.1.8 pause

This command pauses the recording of entities in the *Record* tool.

The **pause** command has the following format:

```
pause <model>
```

9.4.1.9 resume

This command resumes the recording of already paused entities in the *Record* tool.

The **resume** command has the following format:

```
resume <model>
```

9.4.1.10 shutdown

This command causes the *Record* tool to shut down and terminate.

This command can only be issued when the *Record* tool has been stopped.

9.4.1.11 start

The **start** command is used to start the *Record* tool. Note that this command only works after stopping the *Record* tool first, since the tool is started when it is launched.

When the start command is given, the *Record* tool will shut down completely, delete all state and objects and start from scratch. By default, the *Record* tool will create a new file-set each time it is started.

9.4.1.12 status

When the *Record* tool is configured with remote access enabled, it will periodically send its current status. The *Record Shell* stores the most recent status. The current status is displayed with the **status** command:

```
RTI Record Shell> status
```

The output is similar to the following:

```
Version .....: 1.4.2.v20080528205153
Timestamp .....: Mon Apr 28 20:02:48 2008 (1182222168.58877000)
State .....: STOPPED
Config file .....: simple_config.xml
Database file ....: simple_config.dat_34_3
Received bytes ...: 86653952
Saved bytes .....: 2127872 (2 %)
```

- Version** The *Record* tool's version
- Timestamp** The timestamp of the *Record* tool when status message was sent.
- State** The *Record* tool's state. The following states are possible:
 - IDLE
 - RECORDING
 - STOPPED (the *Record* tool has been stopped and is not recording any user data)
 - RECONFIGURE
 - SHUTDOWN
 - RESTART
 - DOWNLOAD (the *Record* tool is downloading a new configuration)
- Config file** The name of the file from which the *Record* tool read its configuration. If the configuration was received with **configure -localfile**, this field is not available.
- Database file** The file-segment currently being written to.
- Received bytes** Total amount of data that has been written to file.
- Saved bytes** Total number of data that has is currently saved to file. Note that if the rollover property is true, then Saved bytes may be less than Received bytes.

9.4.1.13 stop

This command stops the *Record* tool from recording user data.

```
RTI Record Shell> stop
```

9.4.1.14 update

This command updates entities in the *Record* tool.

The **update** command has the following format:

```
update <model>
```

9.4.2 Running Multiple Record Tools in the Same Domain

The *Record Shell* can only keep track of one instance of the *Record* tool. To control multiple copies of the *Record* tool in the same domain with the *Record Shell*, run each *Record* tool instance in a separate partition.

For the first instance of the *Record* tool, change the configuration file as follows:

```
<remote_access>
  <enabled> true </enabled>
  <domain> domain0 </domain>
  <subscriber_qos>
    <partition>
      <name>
        <element> RecordA </element>
      </name>
    </partition>
  </subscriber_qos>
  <publisher_qos>
    <partition>
      <name>
        <element> RecordA </element>
      </name>
    </partition>
  </publisher_qos>
</remote_access>
```

For the second instance of the *Record* tool, change the configuration file as follows:

```
<remote_access>
  <enabled> true </enabled>
  <domain> domain0 </domain>
  <subscriber_qos>
    <partition>
      <name>
        <element> RecordB </element>
      </name>
    </partition>
  </subscriber_qos>
  <publisher_qos>
    <partition>
      <name>
        <element> RecordB </element>
      </name>
    </partition>
  </publisher_qos>
```

```
        </name>  
    </partition>  
</publisher_qos>  
</remote_access>
```

Then you can run the *Record Shell* for each partition:

```
rtirecsh -partition RecordA  
rtirecsh -partition RecordB
```