

Monitor, Control, Record and Replay Your DDS System

OpenSplice DDS Tools-Ecosystem - Overview & Demo

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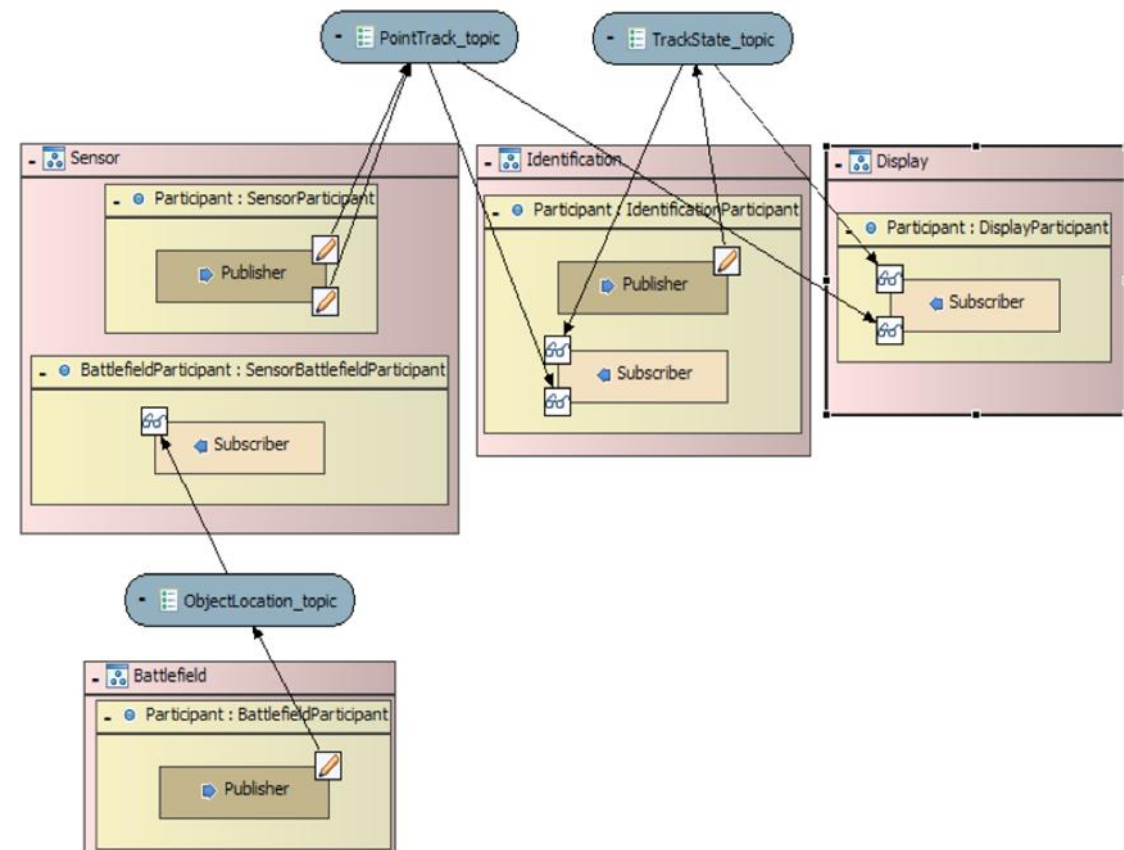
Abstract

- Integrating, Operating and Troubleshooting large-scale distributed systems can be quite hard if you are not equipped with the right set of tools. OpenSplice DDS provides an ecosystem of tools that allow (1) monitoring the key resource and performance indicators of a DDS-based system, (2) controlling the behaviour of your distributed system by dynamically changing the key QoS parameters, and (3) controlling the record and replay of any data flowing in your system. This presentation will highlight and demonstrate how OpenSplice DDS tooling ecosystem can greatly simplify the integration, operation and troubleshooting of distributed applications

OpenSplice Tools

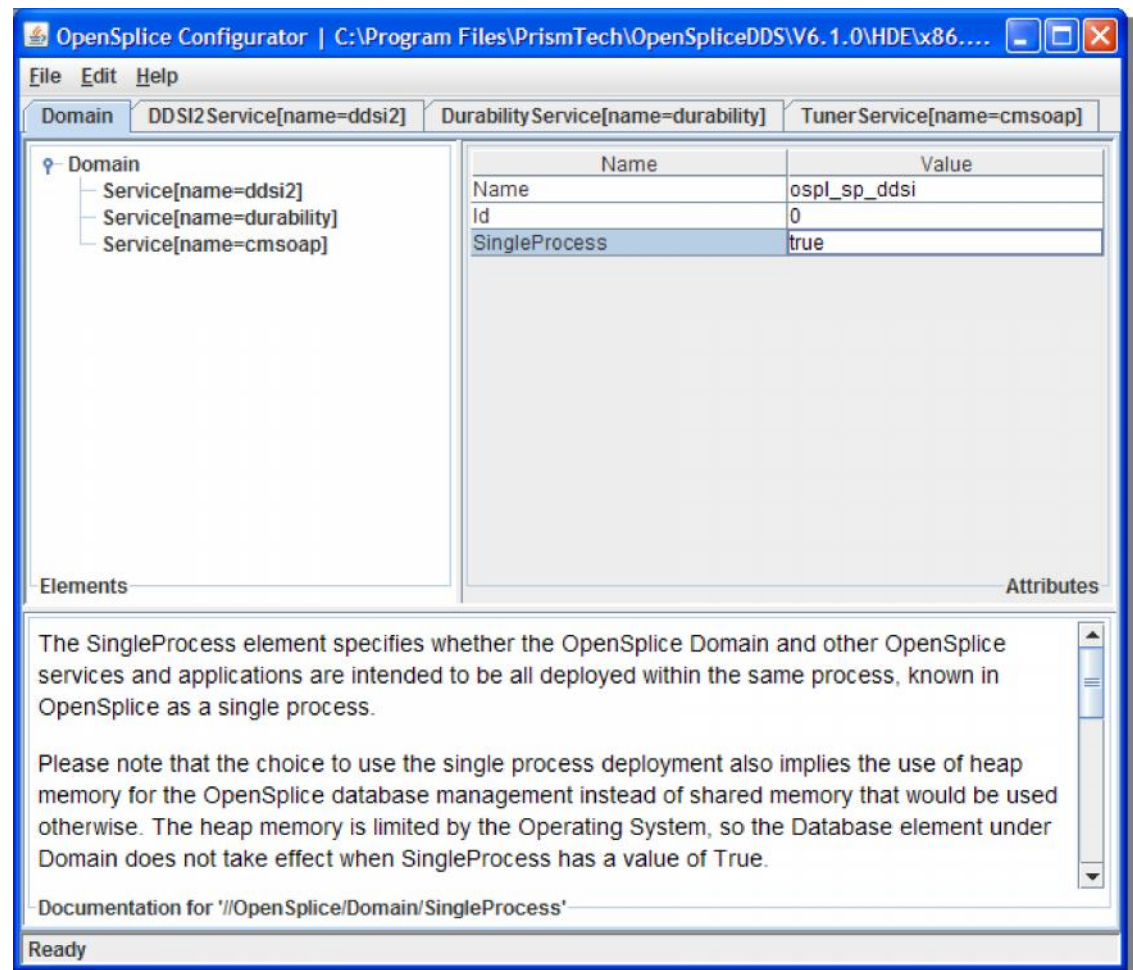
OpenSplice Modeler

- ❑ Eclipse-based MDD tool
- ❑ Information Modeling
 - ❑ Importing IDL
 - ❑ Modeling topics (with type and QoS)
 - ❑ Annotating Topics with QoS
- ❑ Application Modeling
 - ❑ Graphical Modeling of DDS entities →
 - ❑ C++ / Java code-generation
- ❑ Videos on OpenSpliceTube
 - ❑ <http://www.youtube.com/user/OpenSpliceTube>



Total Control: OpenSplice Configurator

- ❑ **The** reference tool for configuring OpenSplice DDS
- ❑ Rich **online guide** to configuration options
- ❑ **Context help** and parameter validation
- ❑ **100% Java**



OpenSplice Tester

“Black-Box” DDS system testing

□ Automated testing of DDS systems

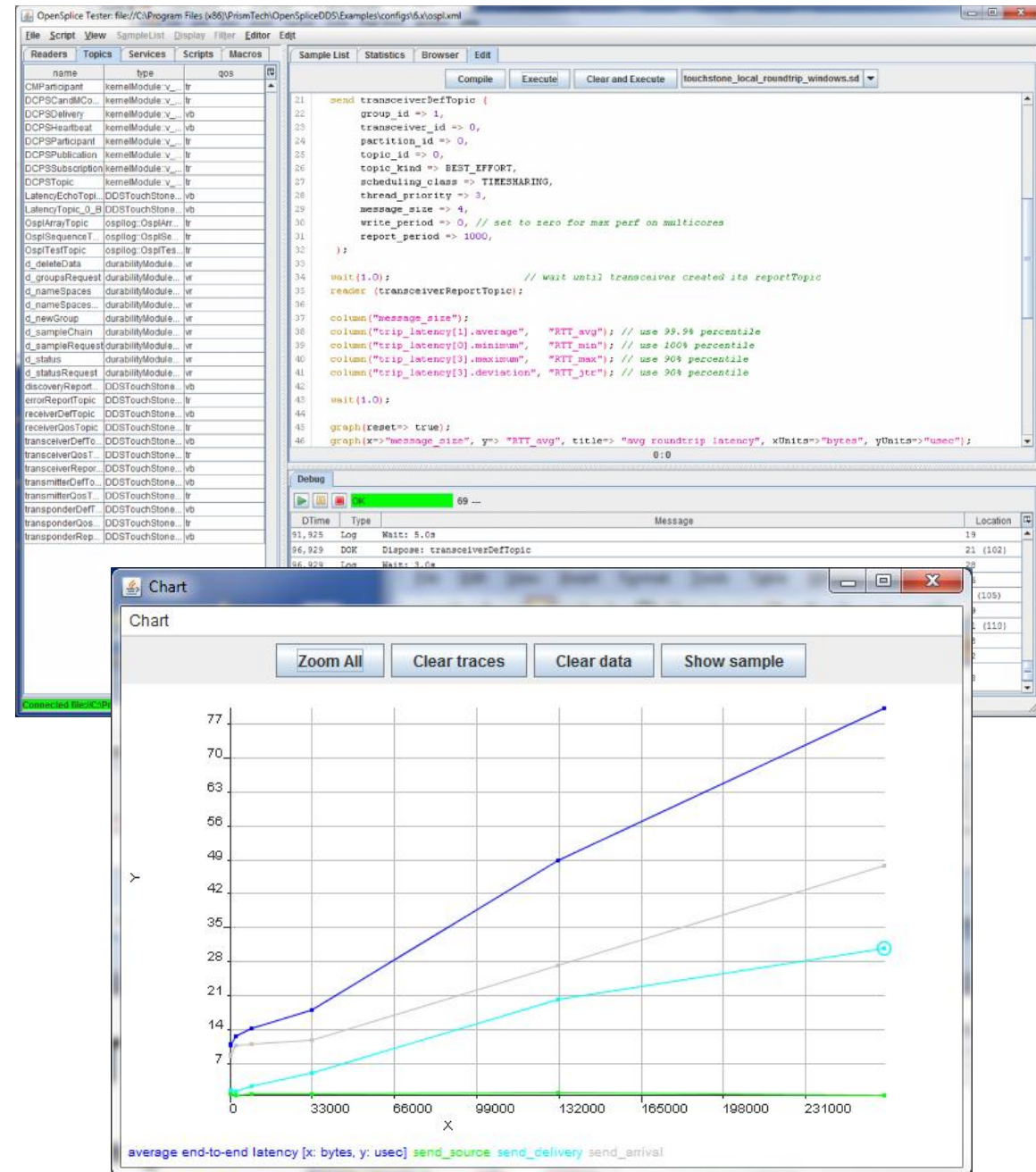
- Dynamic Discovery of DDS Entities
- Domain-specific scripting languages
- Batch execution of regression tests

□ Debugging of distributed DDS systems

- System browser of DDS participants
 - Connectivity & QoS conflict monitoring
- One-click definition of monitoring timeline
 - Analysis/comparison of topic data
 - Virtual topic-attributes to ease analysis
- Statistics monitoring
- 1-click spawning of Tuner to ‘attach’ to a remote process / federation

□ Integrated IDE

- Syntax highlighting editor
- One-click relations between script/logs/timeline



OpenSplice Tuner

□ “Whitebox” debug/tuning Tool

- Looking ‘inside’ a federation and/or application
- Different perspectives (participant, topic, partition)

□ Monitoring & Tuning

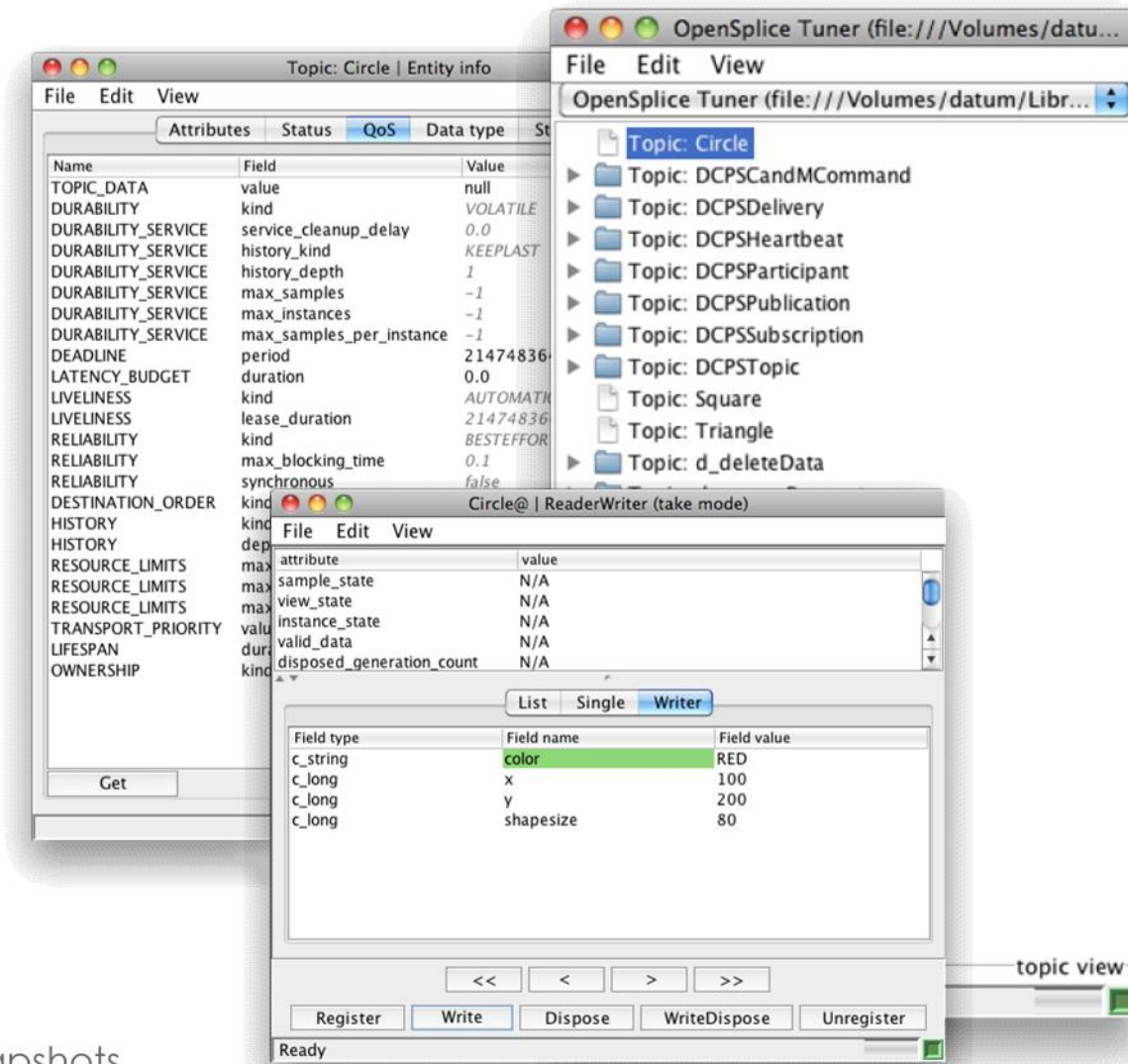
- Inspect and Tune the app’s DDS entities
- Make snapshots of reader-caches
- Detect and resolve QoS Mismatch
- Inspect Statistics

□ Reading & Writing

- Read/Write data for arbitrary topics

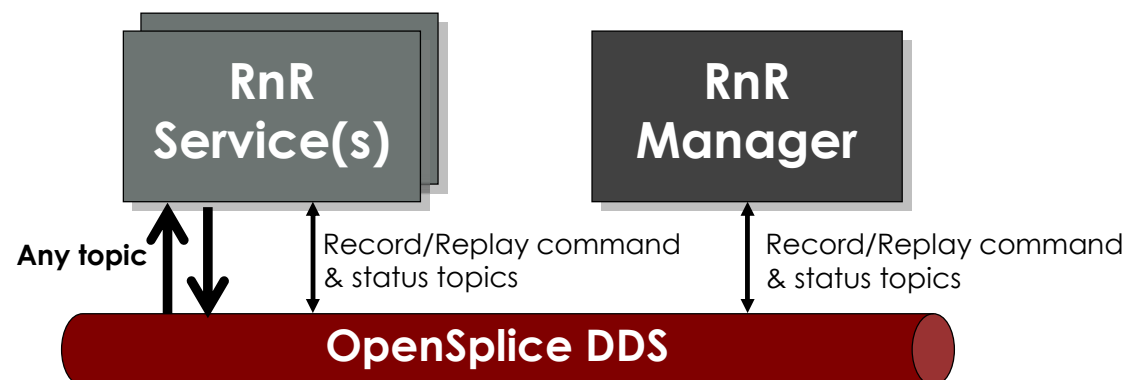
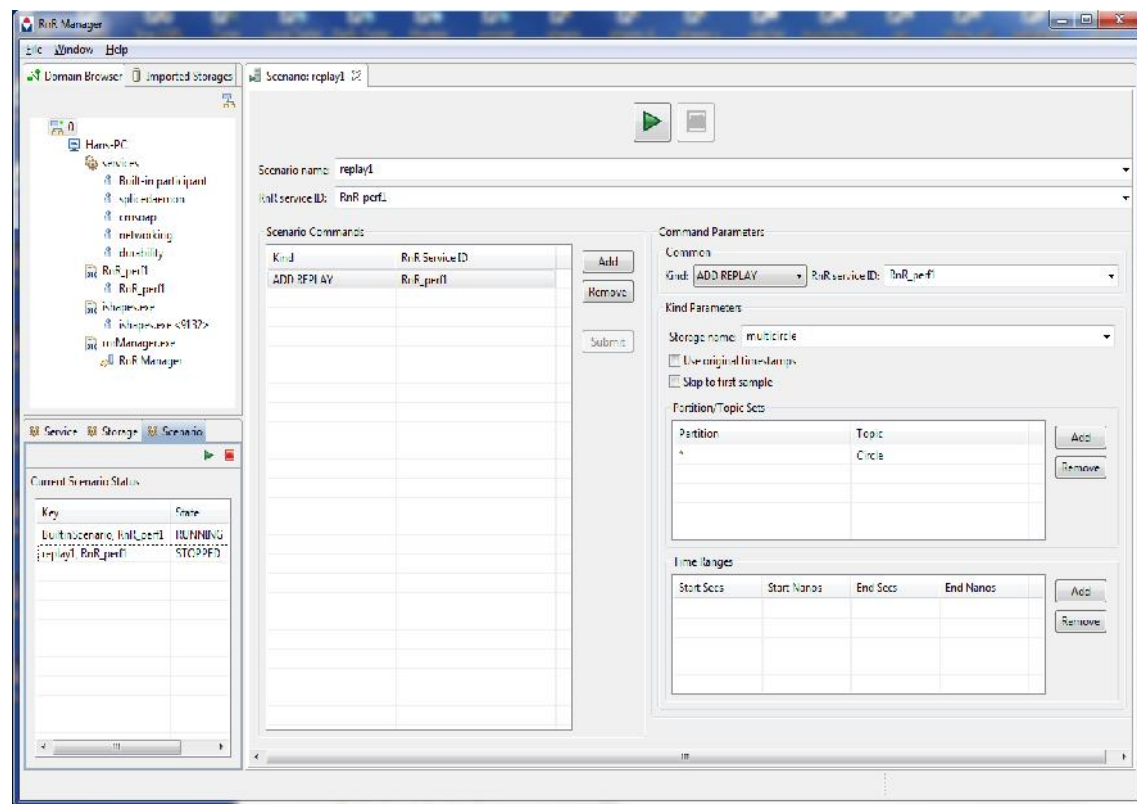
□ Import & Export

- Inject Topic Definitions
- export and import XML-based reader/writer snapshots



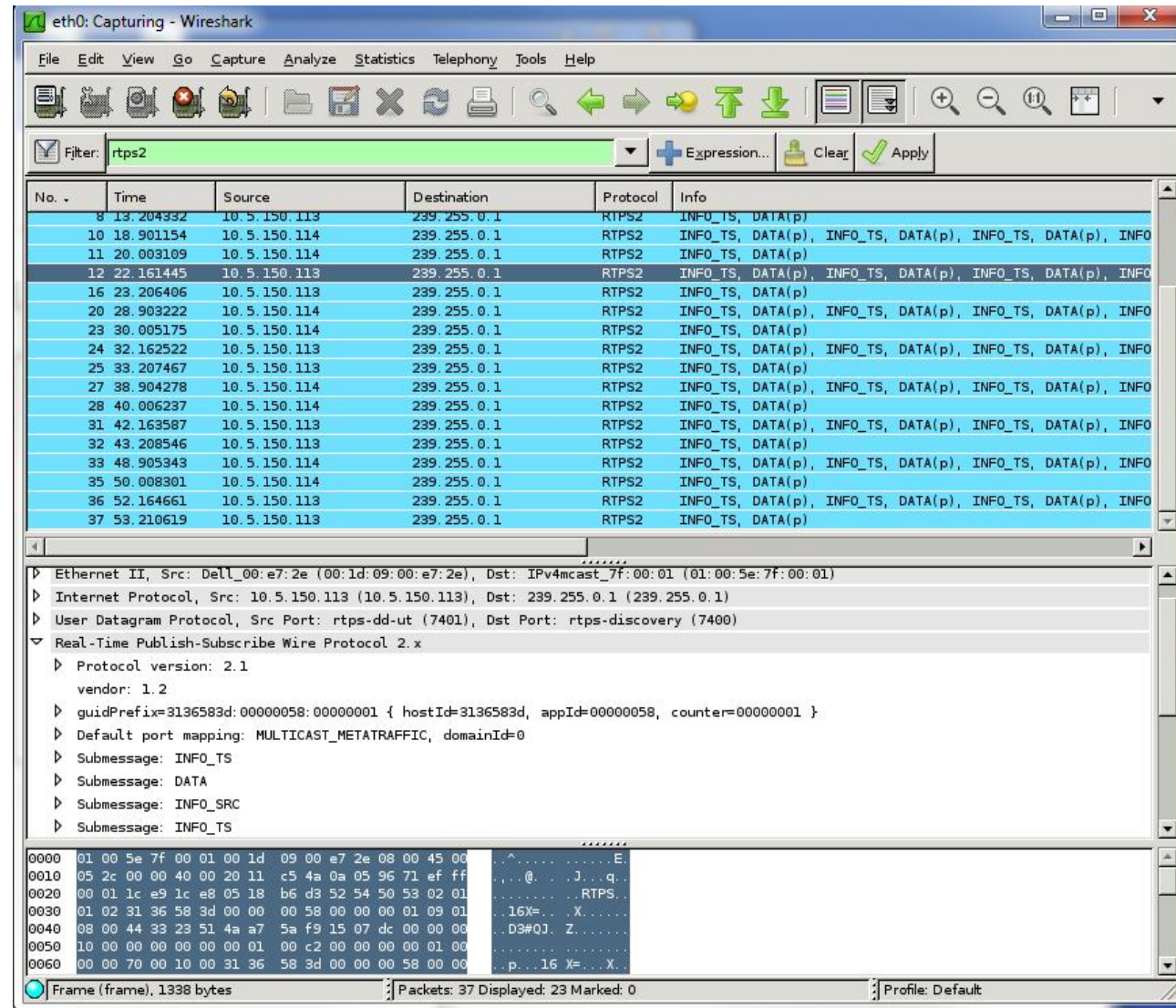
OpenSplice RnR

- **Dynamic recording** of any topic-data in a DDS system
- **Selective replay** with variable speed
- **Distributed control** by topic-based API ('command' & 'status' topics)
- **Seamless integration** with OpenSplice Tester (topic-based API)
- Dedicated **RnR-Manager** graphical GUI for scenario-definition and data import/analysis



Wireshark

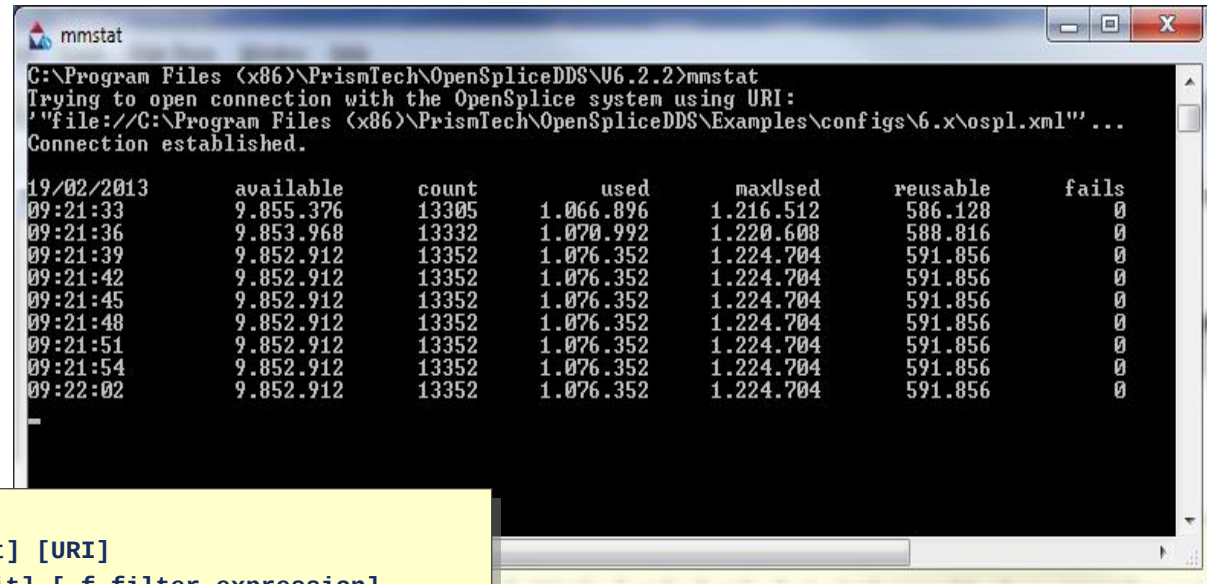
- ❑ **Wireshark Packet Dissector**
- ❑ Watch what goes on the **wire**
- ❑ Inspect **DDSI-RTPS** and/or **RT-Networking** packets being exchanged between applications
- ❑ Native Rtnetworking dissector support available in **source-distribution**



❑ OpenSpliceDDS\V6.3.0\HDE\x86.win32\tools\wireshark-plugins\ospl (see README)

mmStat

Shared-Memory Statistics viewer



```

C:\Program Files (x86)\PrismTech\OpenSpliceDDS\U6.2.2>mmstat
Trying to open connection with the OpenSplice system using URI:
'file:///C:/Program Files (x86)/PrismTech/OpenSpliceDDS/Examples/configs/6.x\ospl.xml' ...
Connection established.

```

	available	count	used	maxUsed	reusable	fails
19/02/2013						
09:21:33	9.855.376	13305	1.066.896	1.216.512	586.128	0
09:21:36	9.853.968	13332	1.070.992	1.220.608	588.816	0
09:21:39	9.852.912	13352	1.076.352	1.224.704	591.856	0
09:21:42	9.852.912	13352	1.076.352	1.224.704	591.856	0
09:21:45	9.852.912	13352	1.076.352	1.224.704	591.856	0
09:21:48	9.852.912	13352	1.076.352	1.224.704	591.856	0
09:21:51	9.852.912	13352	1.076.352	1.224.704	591.856	0
09:21:54	9.852.912	13352	1.076.352	1.224.704	591.856	0
09:22:02	9.852.912	13352	1.076.352	1.224.704	591.856	0

```
mmstat -h
```

```
mmstat [-M|m] [-e] [-a] [-i interval] [-s sample_count] [URI]
```

```
mmstat [-t|T] [-i interval] [-s sample_count] [-l limit] [-f filter_expression]
[URI]
```

Mode:

- m Show memory statistics (default mode)
- M Show memory statistics difference
- t Show meta object references
- T Show meta object references difference
- h Show this help
- e Extended mode, shows bar for allocated memory
- a Show pre-allocated memory as well.
- i interval Display interval (in milliseconds)
- s sample_count Stop after sample_count samples
- l limit Show only object count >= limit
- f filter_expr Show only meta objects which name passes the filter expression

Demo's

Tester: QoS conflict detection

OpenSplice Tester: http://perf1.perfnet.ptnl:50000

File Script View SampleList Display Filter Editor Edit

Readers Topics Services Scripts Macros

name	type	qos
CMPParticipant	kernelModule:v_part...	tr
Circle	ShapeType	pb
DCPSCandMComma...	kernelModule:v_con...	tr
DCPSDelivery	kernelModule:v_deli...	vb
DCPSHeartbeat	kernelModule:v_hear...	vb
DCPSParticipant	kernelModule:v_part...	tr
DCPSPublication	kernelModule:v_pub...	tr
DCPSSubscription	kernelModule:v_sub...	tr
DCPSTopic	kernelModule:v_topi...	tr
OspiArrayTopic	ospiLog:OspiArrayTo...	tr
OspiSequenceTopic	ospiLog:OspiSeque...	tr
OspiTestTopic	ospiLog:OspiTestTo...	tr
Square	ShapeType	pb
Triangle	ShapeType	pb
d_deleteData	durabilityModule2:d...	vr
d_groupsRequest	durabilityModule2:d...	vr
d_nameSpaces	durabilityModule2:d...	vr
d_nameSpacesRequ...	durabilityModule2:d...	vr
d_newGroup	durabilityModule2:d...	vr
d_sampleChain	durabilityModule2:d...	vr
d_sampleRequest	durabilityModule2:d...	vr
d_status	durabilityModule2:d...	vr
d_statusRequest	durabilityModule2:d...	vr
rr_scenario	RnR:Command	pr
rr_scenarioStatus	RnR:ScenarioStatus	tr
rr_serviceStatus	RnR:ServiceStatus	tr
rr_storageStatus	RnR:StorageStatus	tr

Sample List Statistics Browser Edit

Refresh Add readers Add writers

Show disposed participants

Nodes

- perf1.perfnet.ptnl
 - SHMEM
 - services
 - cmsoap<5508>
 - OpenSplice Tester (perf1 pe
 - RnR_perf1<5509>
- perf2.perfnet.ptnl
 - SHMEM
 - services
 - ishapes<18161>
- perf3.perfnet.ptnl
 - ishapes<27761>

All participants

- RnR_perf1 (perf1.perfnet.ptnl)
- OpenSplice Tester (perf1.perfnet.ptnl)
- ishapes <27761> (perf3.perfnet.ptnl)
- ishapes <18161> (perf2.perfnet.ptnl)

Topics

- CMPParticipant
- Circle
- DCPSCandMCommand
- DCPSDelivery
- DCPSHeartbeat
- DCPSParticipant
- DCPSPublication

Refresh

Debug

DTime Type Message

Connected http://perf1.perfnet.ptnl:50000 | networking.cmsoap.durability.R ... 1.spliceddaemon

OpenSplice | DDS - iShapes Demo

simd-cxx

Shape: Circle

Color: Blue

Size: [Slider]

Speed: [Slider]

QoS

Publish

Shape: Circle

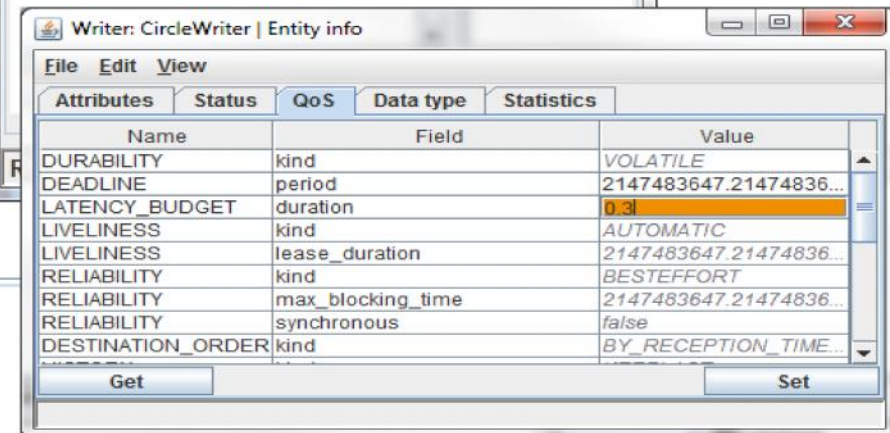
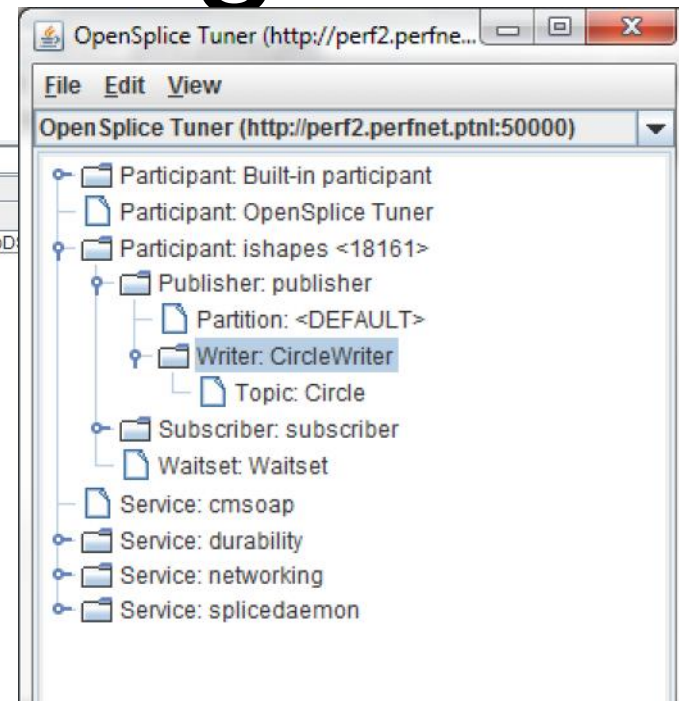
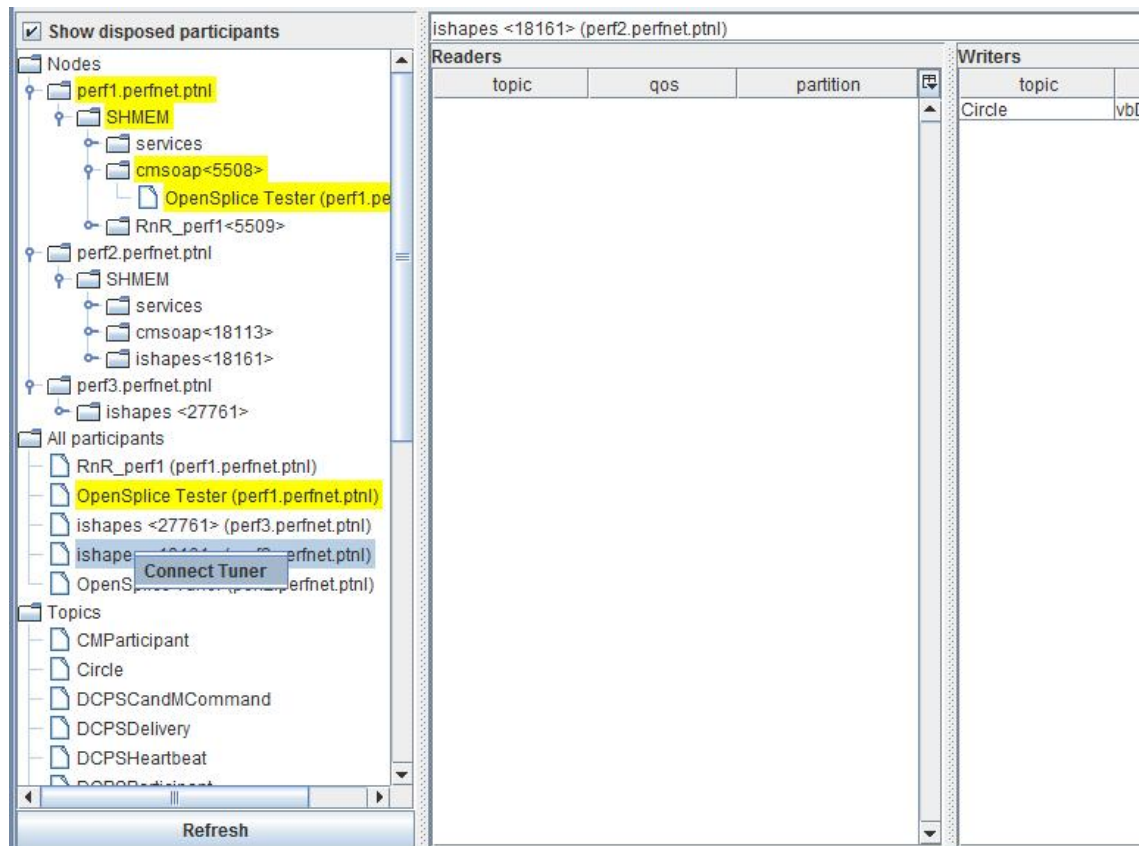
QoS

Filter

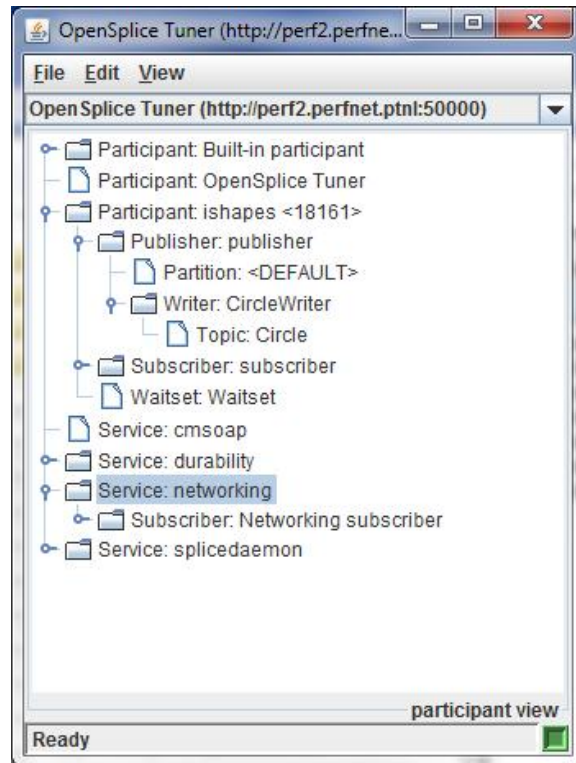
Subscribe

OpenSplice|DDS

Tuner: QoS Tuning



Tuner: Statistics Monitoring



The screenshot shows the "Statistics" tab for the "networking" service. The table displays various performance metrics:

Name	Field	Value
numberOfErrors	lastReset	0s. 0 ns. (...)
channelsCount		2
channels.size		64
channels.[Reliable].numberOfMessagesSent		390
channels.[Reliable].numberOfBytesSent		145160
channels.[Reliable].numberOfPacketsSent		388
channels.[Reliable].numberOfMessagesFragmented		28
channels.[Reliable].numberOfMessagesPacked		50
channels.[Reliable].numberOfKnownNodes		
channels.[Reliable].numberOfBytesResent		
channels.[Reliable].numberOfPacketsResent		
channels.[Reliable].numberOfBytesInResendBuffer		
channels.[Reliable].numberOfPacketsInResendBuffer		
channels.[Reliable].maxNumberOfBytesResentToOne...		
channels.[Reliable].maxNumberOfPacketsResentToO...		
channels.[Reliable].numberOfMessagesReceived		
channels.[Reliable].numberOfBytesReceived		
channels.[Reliable].numberOfPacketsReceived		
channels.[Reliable].numberOfPacketsLost		
channels.[Reliable].numberOfAcksSent		
channels.[Reliable].numberOfMessagesDelivered		

The screenshot shows the "Statistics" tab for the "networking" service, displaying detailed channel statistics:

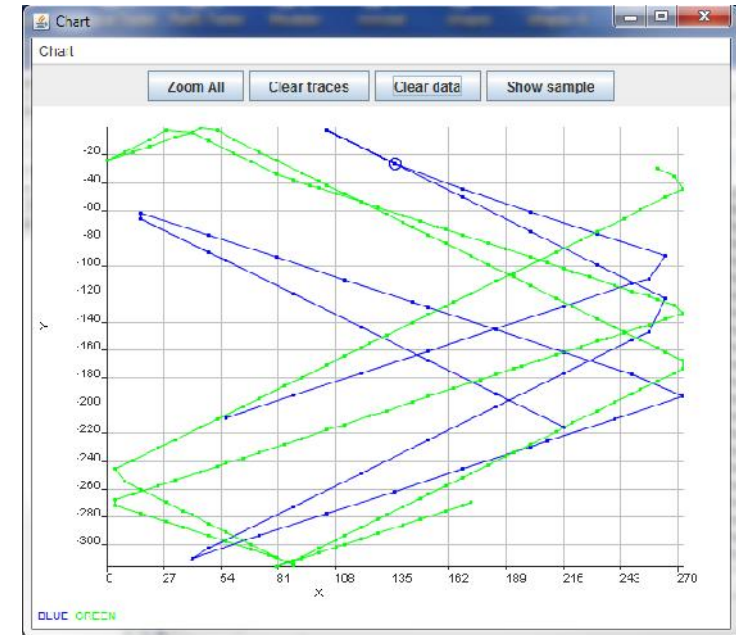
Name	Field	Value
channels.[BestEffort].numberOfMessagesSent		13839
channels.[BestEffort].numberOfBytesSent		1822404
channels.[BestEffort].numberOfPacketsSent		7020
channels.[BestEffort].numberOfMessagesFragmented		0
channels.[BestEffort].numberOfMessagesPacked		6819
channels.[BestEffort].numberOfKnownNodes		0
channels.[BestEffort].numberOfBytesResent		0
channels.[BestEffort].numberOfPacketsResent		0
channels.[BestEffort].numberOfBytesInResendBuffer		1300
channels.[BestEffort].numberOfPacketsInResendBuffer		1
channels.[BestEffort].maxNumberOfBytesResentToOn...		0
channels.[BestEffort].maxNumberOfPacketsResentTo...		0
channels.[BestEffort].numberOfMessagesReceived		571
channels.[BestEffort].numberOfBytesReceived		109632
channels.[BestEffort].numberOfPacketsReceived		571
channels.[BestEffort].numberOfPacketsLost		0
channels.[BestEffort].numberOfAcksSent		0
channels.[BestEffort].numberOfMessagesDelivered		571
channels.[BestEffort].numberOfBytesDelivered		0
channels.[BestEffort].numberOfMessagesNotInterested		0
channels.[BestEffort].numberOfBytesNotInterested		0
channels.[BestEffort].nofFreePacketBuffers		1

Tester: Data-Capture

```
ishapes_fields.txt - Notepad
File Edit Format View Help
#!js
miny
Circle
sample.getFieldvalue("y") * -1

nextfield
miny
Square
sample.getFieldvalue("y") * -1

nextfield
miny
Triangle
sample.getFieldvalue("y") * -1
```



OpenSplice Tester: http://perf1.perfnet.ptnl:50000

File Script View SampleList Display Filter Editor Edit

Services Scripts Macros

Headers Topics

Select all Deselect all

Re	Sh	Topic	Count	qos	partition
☒	☒	Circle	1320	-vuDS(...)	

DTime (ms)	Topic	State	Key	Src	color	x	miny
57701	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	90	-10.0
57801	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	92	-7.0
57881	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	34	-1.0
57961	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	40	-217.0
57961	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	34	-3.0
58001	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	38	-3.0
58081	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	96	-12.0
58161	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	104	-18.0
58201	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	108	-21.0
58281	Circle	alive	BLUE	ishapes <181f1> (perf2.perfnet.ptnl)	BLUE	16	-241.0
58281	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	110	-27.0
58361	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	124	-33.0
58401	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	128	-36.0
58401	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	136	-42.0
58561	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	144	-48.0
58601	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	148	-51.0
58601	Circle	alive	BLUE	ishapes <181f1> (perf2.perfnet.ptnl)	BLUE	16	246.0
58681	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	150	-57.0
58761	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	164	-53.0
58801	Circle	alive	GREEN	ishapes <181f1> (perf2.perfnet.ptnl)	GREEN	168	-56.0

Debug

DTime Type Message Location

Connected http://perf1.perfnet.ptnl:50000 | networking.cmscap.durability.R... 1.spliceddaemon

OpenSplice | DDS - iShapes Demo

simd-cxx

Shape: Circle

Color: Blue

Size: [Slider]

Speed: [Slider]

QoS

Publish

Shape: Circle

QoS

Filter

Subscribe

OpenSplice|DDS

Tester: Scripted Record/Replay

OpenSplice Tester: http://perf1.perfnet.ptnl:50000

File Script View SampleList Display Filter Editor Edit

Readers Topics Services Scripts Macros

Script

miss_fail.sd
miss_fail_timeout.sd
pingpong1
pingpong10
read.sd
read_fail.sd
read_fail_disposed.sd
read_fail_timeout.sd
read_fail_timeout_query.sd
read_last_fail_disposed.sd
read_query.sd
repeat.sd
repeat_multiple.sd
repeat_simple.sd
repeat_until_dispose.sd
rmi-1.sd
rmi-2.sd
rmi-3.sd
rnr_init_default
rnr_init_multicircle
rnr_record_all
rnr_record_multicircle
rnr_replay_all
rnr_replay_multicircle
rnr_stop_record_all
rnr_stop_record_multicircle
rnr_stop_replay_all
rnr_stop_replay_multicircle
rr_conditional_shapes
scenario_call.sd
scripts.zip
send_periodic.md
set_instruction.sd
test1.sd
test_interface.sd
timeout_fail.sd
timeout_var_fail.sd
touchstone.sd
touchstone_init_local_linux.sd
touchstone_init_local_roundtrip_linux.sd
touchstone_init_local_roundtrip_windows.sd
touchstone_init_local_windows.sd
touchstone_local_linux.sd
touchstone_local_roundtrip_linux.sd
touchstone_local_roundtrip_windows.sd

Sample List Statistics Browser Edit

Compile Execute Clear and Execute rnr_init_multicircle

```
1 scenario init_multicircle
2
3 // create readers for relevant topics so we can observe them on the timeline
4 reader (rr_serviceStatus);
5 reader (rr_scenarioStatus);
6 reader (rr_storageStatus);
7
8 // create scenario (-sample) for recording circles
9 send rr_scenario(
10     scenarioName => record_multicircle,
11     rnrId => RnR_perf1,
12     kind.switch => RR_RECORD_COMMAND,
13     kind.record.storage => multicircle_record,
14     kind.record.interestExpr[0] => "*.Circle",
15     kind.record.interestExpr[1] => "_BUILT-IN PARTITION_.DCPSTopic", // allows topic to be re-
16 );
17
18 // create scenario (-sample) for replaying circles
19 send rr_scenario(
20     scenarioName => replay_multicircle,
21     rnrId => RnR_perf1,
22     kind.switch => RR_REPLAY_COMMAND,
23     kind.replay.storage => multicircle,
24     kind.replay.interestExpr[0] => "*.Circle",
25     kind.replay.interestExpr[1] => "_BUILT-IN PARTITION_.DCPSTopic", // re-create topics (such as Circle) on replay
26 );
27
28 end scenario
29
```

8:5

Debug

OK 19

DTime	Type	Message	Location
0,030	Scen	rnr_init_multicircle	
0,500	SOK	Send: rr_scenario	9 (5595)
0,553	SOK	Send: rr_scenario	19 (5600)
0,553	EOK	Execution finished	

Connected http://perf1.perfnet.ptnl:50000 networking.cmssoap.durability.R... 1,splicedamon

Sample: rr_scenario

source_timestamp	1361268033s.478335132ns
daytime	11:00:33.478 (00 19)
insert_latency	-83041ns
relative_time	0,450
view_state	new
sample_state	not_read
instance_state	alive
valid_data	valid_data
state	NEW, NOT_READ
partition	RecordAndReplay
source	OpenSplice Tester (perf1.perfnet.ptnl)
qos	2a75a9dc.00000296

Field	value
scenarioName	record_multicircle
rnrId	RnR_perf1
kind.switch	RR_RECORD_COMMAND
kind.record.storage	multicircle_record
kind.record.interestExpr[0]	* Circle
kind.record.interestExpr[1]	BUILT-IN PARTITION_.DCPSTopic
kind.record.max_samples_per_instanc...	0
kind.record.max_samples_per_second	0
kind.record.max_samples	0

Sample	<<	>>
Same topic	<<	>>
Same instance	<<	>>

RnR-Manager: Graphical Recording & Replay

The screenshot displays the RnR Manager application interface, which is used for recording and replaying DDS data. The interface is divided into several panes and sections:

- Domain Browser:** A tree view on the left showing the network structure, including services like RnR_perfl, ishapes.exe, and OpenSpice Tester.
- Scenario Configuration:** The main area for setting up a scenario. It includes fields for Scenario name (replay_multicircle), RnR service ID (RnR_perfl), and Command Parameters (Kind: REPLAY SPEED, RnR service ID: RnR_perfl). It also has a table for Scenario Commands with columns Kind and RnR Service ID.
- Current Scenario Status:** A table showing the status of various scenarios. The table has columns Key and State.
- Current Storage Status:** A table showing the status of storage locations. The table has columns Key, State, and File Name.
- Query Parameters:** A section for configuring query parameters, including Field Selection (a list of fields to be displayed in the data table), Time Range (message.writeTime), Load (specify the number of samples to incrementally load into memory), and ORDER BY (specify the fields to order the data).

Key	State
BuiltinScenario, RnR_perfl	RUNNING
record_multicircle, RnR_perfl	STOPPED
replay_multicircle, RnR_perfl	RUNNING

Key	State	File Name
default, RnR_perfl	READY	../RnR_storages/default.dat
multicircle, RnR_perfl	OPEN	../RnR_storages/multicircle.dat

Visualization Options

Tuner/Tester/Scada-'Osp|Vis'/Excel

