Regression Testing of DDS-based Systems

“user-driven requirements for a ‘Tester’ tool”

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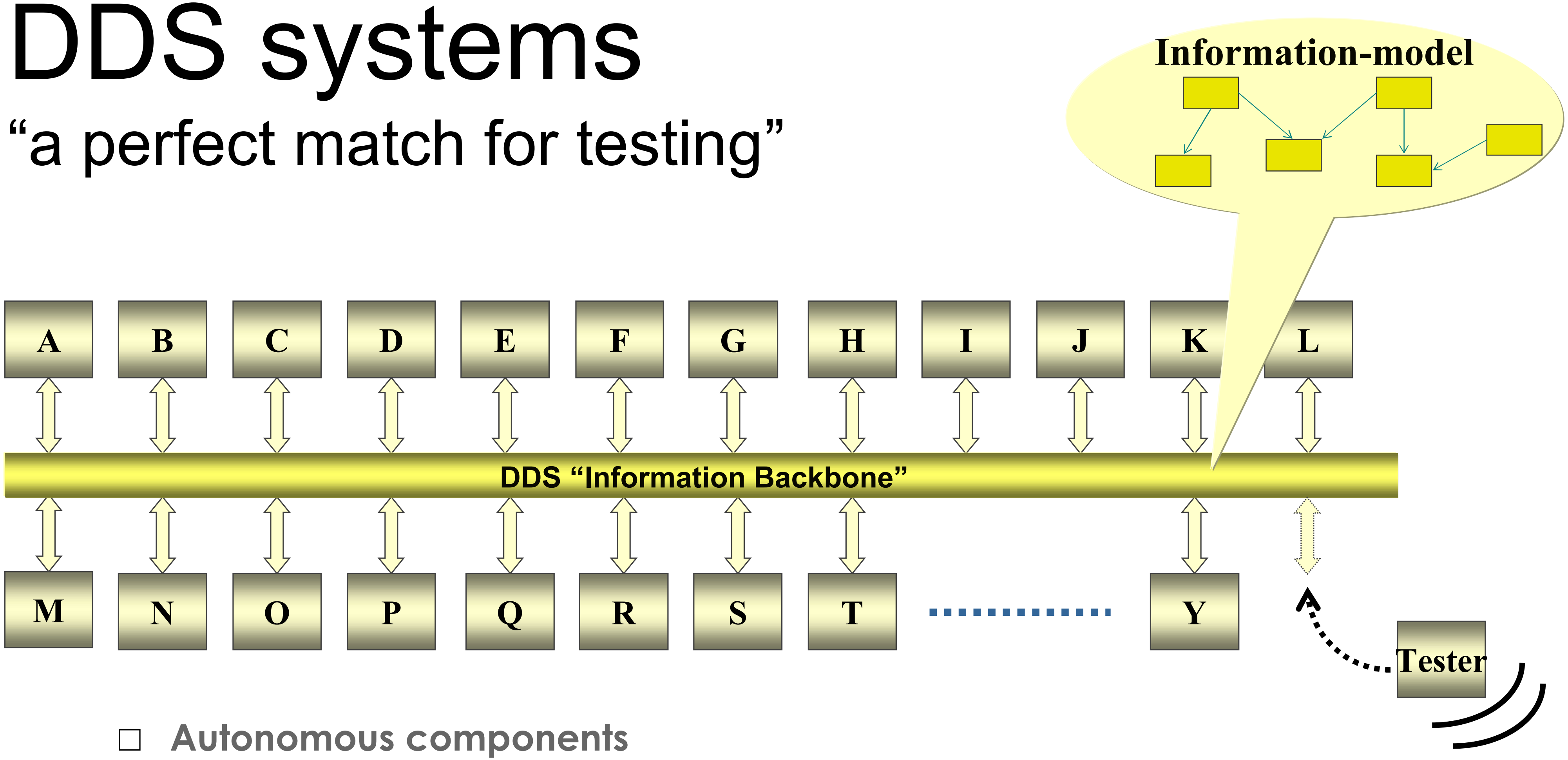
Introduction

- □ This presentation is about:
  - □ **Experiences of system-integrators** in the large-scale naval combat systems domain
    - □ Focussing on their needs w.r.t. regression testing
  - □ Separating **requirements** targeting:
    - □ Testing of individual applications
    - □ Integration of (3rd party) subsystems into the mission system
    - □ Analyzing system-wide data-flows
    - □ Capturing data and convert/use into repeatable test-scenario's
  - □ **Explaining concepts** using 'their' evolved tool-suite
    - □ Developed 'by testers for testers'
    - □ As a complementary tool to available white-box DDS-tooling (OpenSplice Tuner)
    - □ Based on the (open-source) Control &Monitoring API of OpenSplice DDS
    - □ Exploiting the Java-platform and related open-source plugins
  - □ Recently enhanced with a 'system browser' and now productized by PrismTech
    - □ Available as "**OpenSplice Tester**", part of OpenSplice V6.1

DDS systems

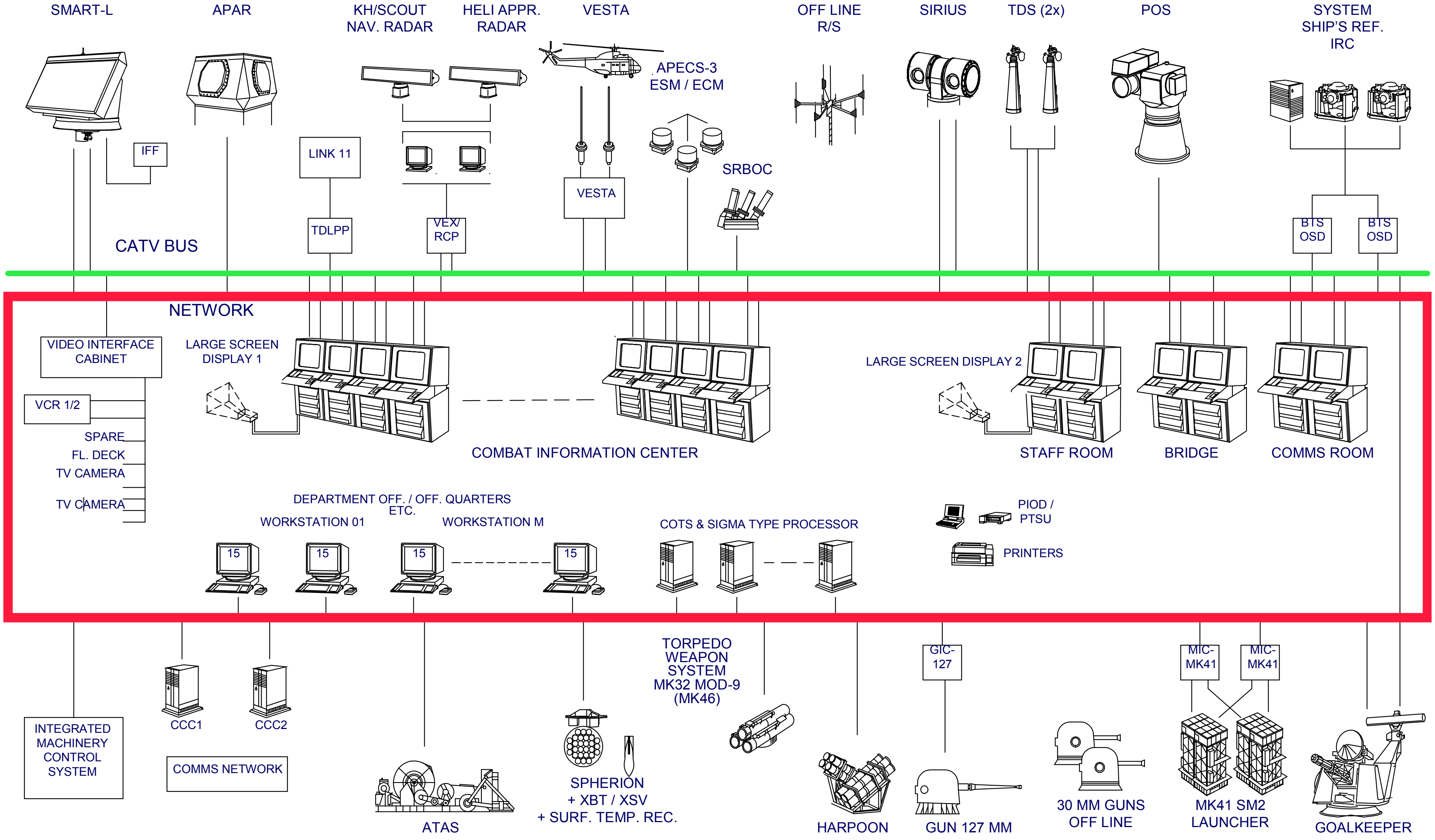
“a perfect match for testing”



- □ Autonomous components
- □ Interacting only with the information they exchange
- □ Dynamic discovery of (late joining) applications
- □ Standardized meta-data capturing discovered DDS-entities
- □ A ‘natural fit’ for a dynamic (regression-) test tool to ‘stimulate’ the system

1. BACKGROUND

1.1 Naval CMS - example



1.2 Large-Scale Naval CMS

- □ **>100 Application Developers (C/Java)**
  - □ Developing data-centric ‘autonomous’ DDS applications
  - □ HMI, generic business-logic, embedded Sensor/Weapon interfaces
  - □ Need tools for **debugging, tuning and testing (individual) applications**
- □ **Many 3rd party Sensor/Actuator subsystems**
  - □ Repeatable Subsystem (interface-) testing/validation is essential
  - □ Both ‘standalone’ as well as when integrated in the total system
  - □ Need tools to **test & verify (validate) correct subsystem interfacing & behaviour**
- □ **All integrated into a single large-scale mission-critical DDS system**
  - □ 2.200 of applications distributed over hundreds of computers
  - □ Up to 150 applications on a single node (6.000 writers, 2.000 readers per node)
  - □ Need tools to **explore/understand, stimulate/analyze, test/re-test**

1.3 Testing Needs

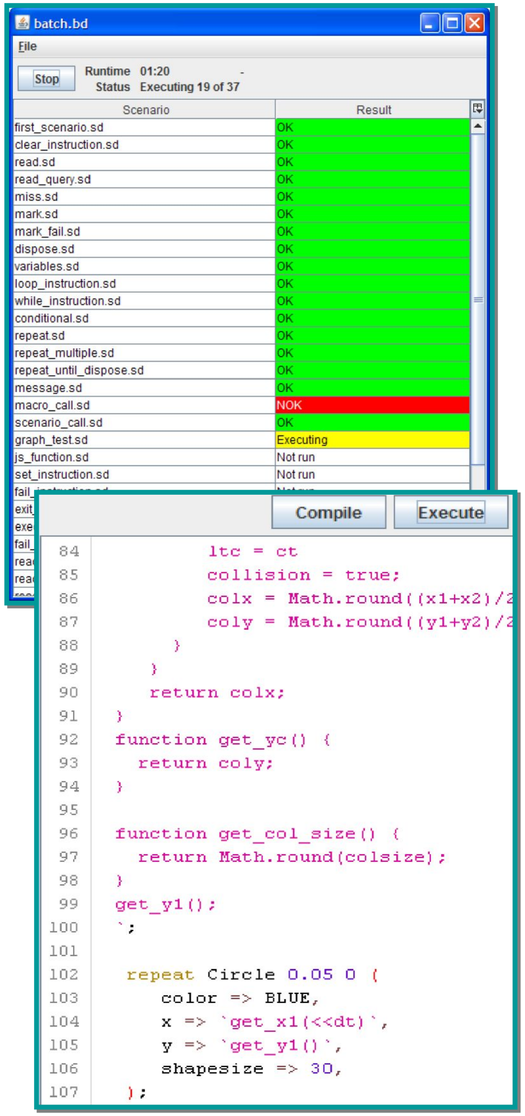
- □ Application **developers**
  - □ Want **Whitebox** debugging/tuning i.e. looking ‘inside’ an application, inspect data, modify QoS, ..
  - □ Want **Blackbox** testing i.e. stimulate inputs, monitor outputs, analyze behavior
  - □ Want an **integrated approach** to white-box and black-box testing
- □ Subsystem **integrators**
  - □ Want a **intuitive** / easy “language” to express DDS-based interactions with subsystems
  - □ Want to execute such **scripted interactions** in batch-mode to automate regression-testing
- □ System **testers**
  - □ Want to **browse** the distributed system from logical and/or physical perspective
  - □ Want to **observe** and **capture** DDS-based interactions between system components
  - □ Want aids to convert these observations in **repeatable scenario’s** (**scripts**) to test the system
- □ … and lets not forget.. **Middleware** developers (like us)
  - □ Want to perform **performance regression-testing** of OpenSplice DDS itself (as part of QA process)
  - □ Using the regression-test tool to ‘drive’ the open-source DDS Touchstone **benchmarking suite**

2. “Tester” Architecture

2.1 Major components

- Usage aspects concentrated in 'modules':
  - (remote) DDS **connection** module
    - Allows the tool to 'interact' with the DDS-system
  - System **browser** module
    - Allows the user to 'understand' the data-flows in the system
  - **Scripting** engine
    - Allows for creation/execution of test-scenario's
  - **Capture** module
    - Allows for the creation and visualization of a data-capturing time-line
  - **Regression-test** execution module
    - Allows for repeatable batch-execution of test-scripts
    - Allows for interactive as well as headless execution modes

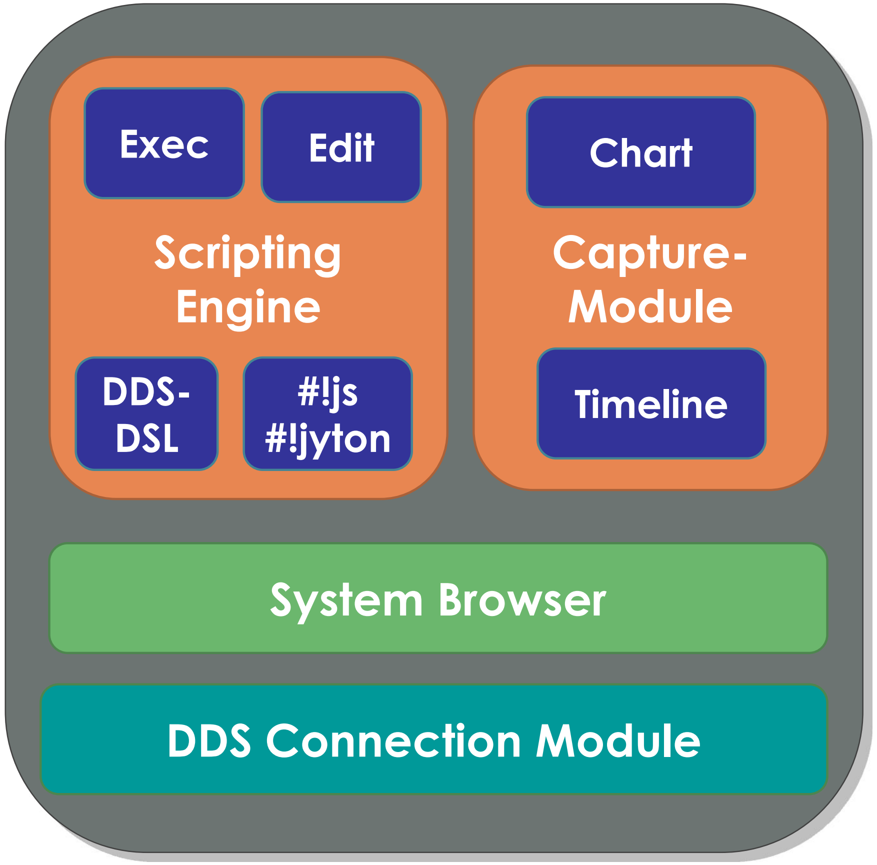
2.2 Architecture Overview

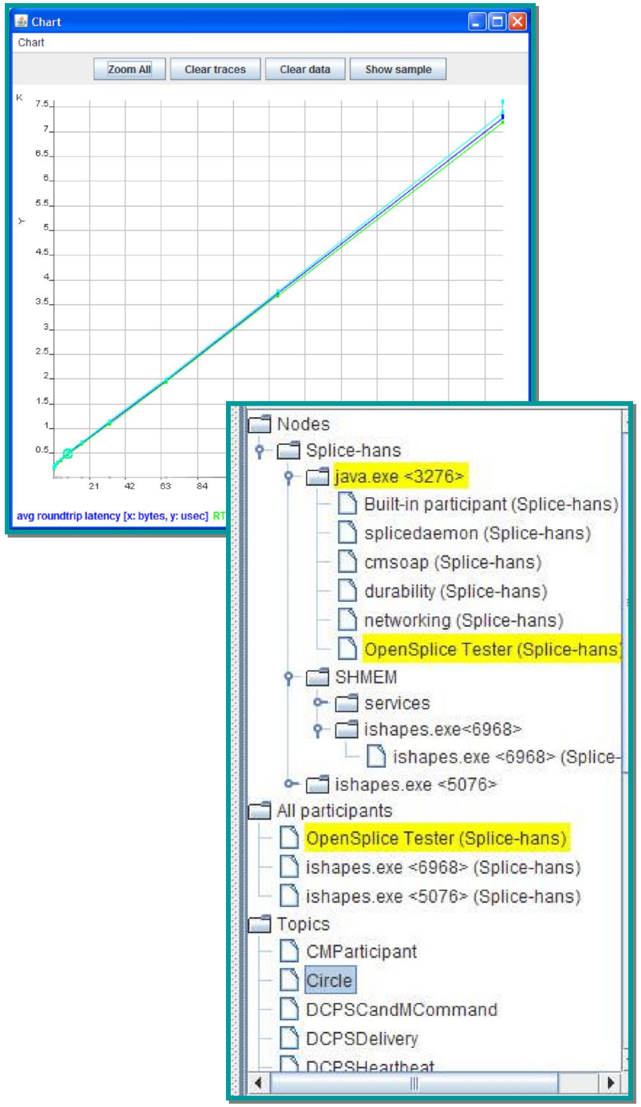


Runtime 01:20 -
Status Executing 19 of 37

Scenario	Result
first_scenario.sd	OK
clear_instruction.sd	OK
read.sd	OK
read_query.sd	OK
miss.sd	OK
mark.sd	OK
mark_fail.sd	OK
dispose.sd	OK
variables.sd	OK
loop_instruction.sd	OK
while_instruction.sd	OK
conditional.sd	OK
repeat.sd	OK
repeat_multiple.sd	OK
repeat_until_dispose.sd	OK
message.sd	OK
macro_call.sd	NOK
scenario_call.sd	OK
graph_test.sd	Executing
js_function.sd	Not run
set_instruction.sd	Not run
fail_	
exit_	
exe	
fail_	
rea	
rea	

```
            ltc = ct
            collision = true;
            colx = Math.round((x1+x2)/2
            coly = Math.round((y1+y2)/2
        }
    }
    return colx;
}
function get_yc() {
    return coly;
}

function get_col_size() {
    return Math.round(colsize);
}
get_y1();
`;

 repeat Circle 0.05 0 (
     color => BLUE,
     x => `get_x1(<<dt)`,
     y => `get_y1()`,
     shapesize => 30,
 );
```





```
Nodes
    Splice-hans
        java.exe <3276>
            Built-in participant (Splice-hans)
            splicedaemon (Splice-hans)
            cmsoap (Splice-hans)
            durability (Splice-hans)
            networking (Splice-hans)
            OpenSplice Tester (Splice-hans
        SHMEM
            services
            ishapes.exe<6968>
                ishapes.exe <6968> (Splice-
        ishapes.exe <5076>
All participants
    OpenSplice Tester (Splice-hans)
    ishapes.exe <6968> (Splice-hans)
    ishapes.exe <5076> (Splice-hans)
Topics
    CMParticipant
    Circle
    DCPSCandMCommand
    DCPSDelivery
    DCPSHeartbeat
```

3. Requirements

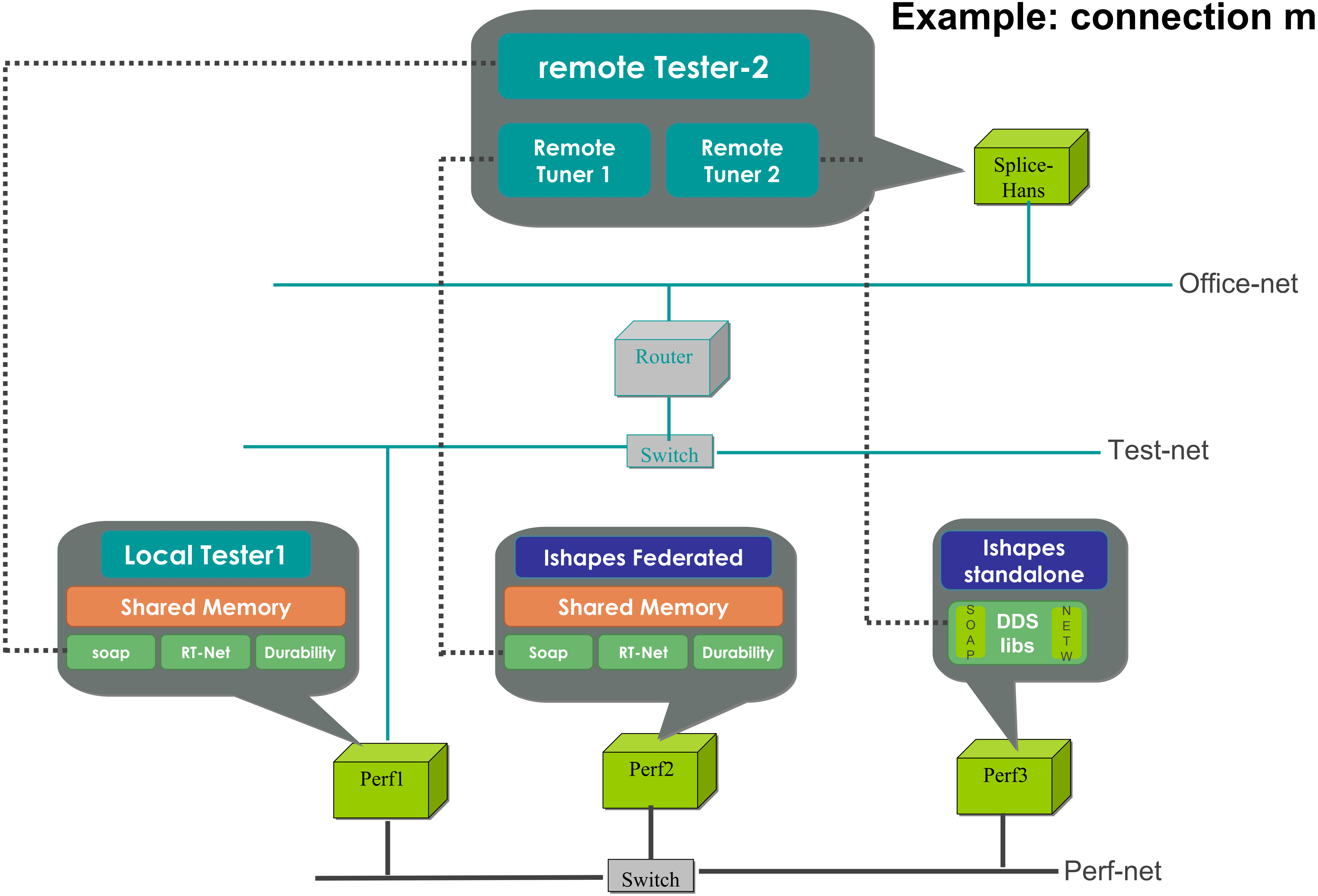
3.1 Non-Intrusiveness (1)

- **Requirement:** Black-box approach:
  - The DDS-system and its applications should be left '**untouched**' w.r.t.
    - Configuration : system shall NOT require any (pre-)configuration
    - Execution : execution order/location shall not be influenced
    - Performance : test tooling shall not degrade system performance
  - The test tool shall be **dynamic** e.g. not requiring and pre-configuration (of type-descriptions, etc.)
- **Analysis:** Generic DDS context
  - DDS components are **decoupled** (in space/time) 'by nature'
  - DDS dynamically **discovers** all (logical) DDS entities
  - DDS has standardized 'built-in topics' that capture that discovered '**meta-data**'
  - Yet DDS currently lacks (standardized) **dynamic API's** and runtime topic/type creation
- **Analysis:** OpenSplice DDS context
  - OpenSplice DDS has **extended meta-data** that includes type info
    - Allowing for dynamic creation of readers/writers/topics (XML-based dynamic API similar to X-types)
  - OpenSplice DDS built-in-topics include **mapping-info** between logical and physical entities
    - Additional `CMParticipant` built-in topic that relates participants to processes running on particular nodes

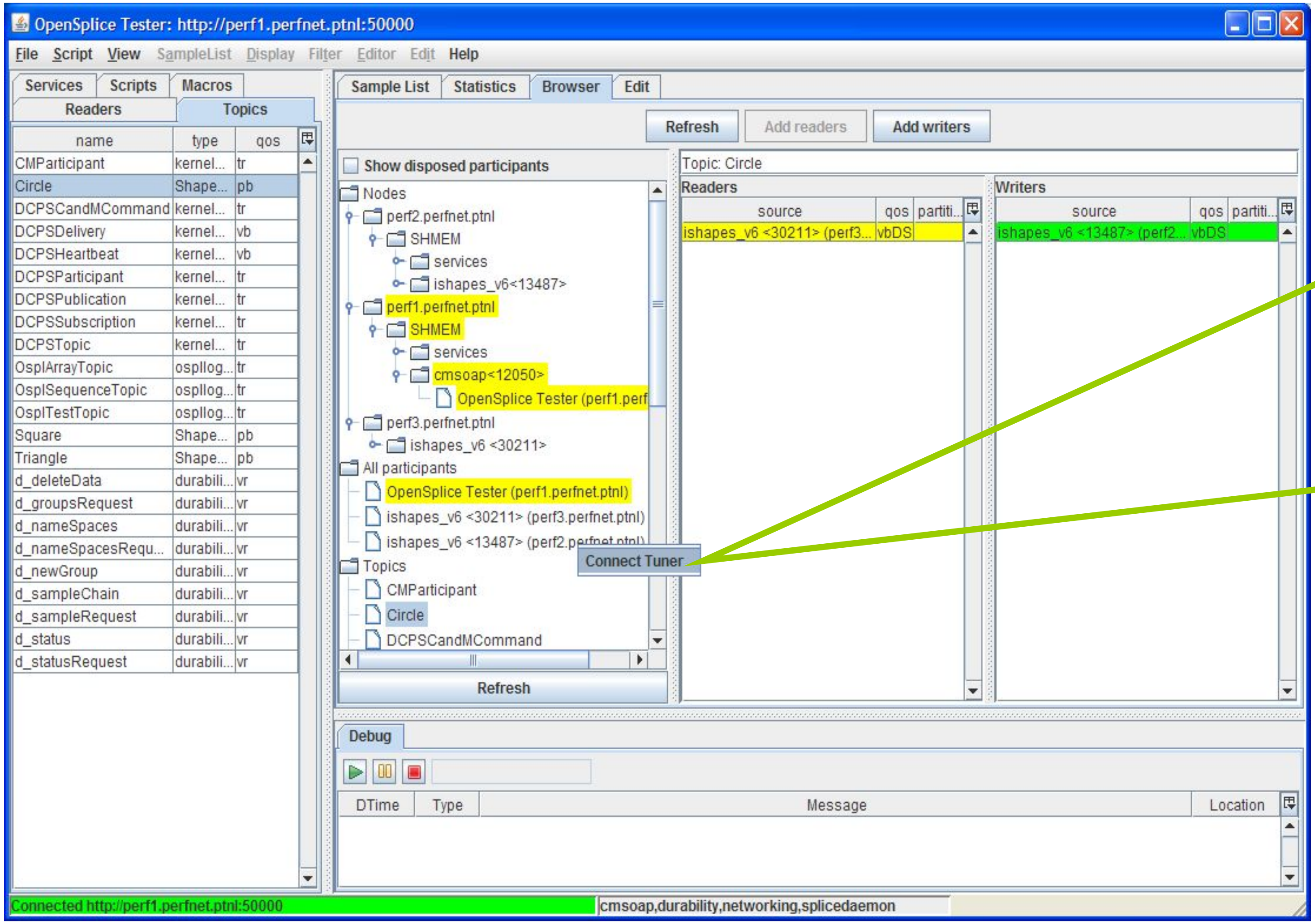
3.2 Non Intrusiveness (2)

- □ **Requirement**: Target Platform Execution & Connection
  - □ The tool shall **NOT** be required to run on the 'target-system'
    - □ From platform-support perspective (*platform might not support Java/HMI*)
    - □ From resource-usage perspective (*tool induced CPU and/or Memory load*)
  - □ The tool shall therefore be able to run on a **remote** computer
    - □ Yet without implying that all data is routed to that computer
- □ **Analysis**: Generic DDS context
  - □ Need to **decouple** the DDS_interactions from the scripting/analysis/visualization 'engine'
  - □ Currently **no standardized solutions** for '*remote DDS-access*' by a tool
- □ **Analysis**: OpenSplice DDS context
  - □ OpenSplice already has a **SOAP-based agent** (used by its 'tuner')
    - □ That exposes the dynamic "Control & Monitoring" **(C&M) API** to a remote application over SOAP
    - □ Which includes the 'normal' yet **dynamic** DCPS-API's for reading/writing that are sufficient for the test-tool
    - □ As well as **specialized C&M functions** to 'inspect' DDS-entities and even change their QoS settings (as used by the OpenSplice Tuner whitebox testing tool)

Example: connection modes



Black- & White-box



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

File Script View SampleList Display Filter Editor Edit Help
Services Scripts Macros
Readers Topics
Sample List Statistics Browser Edit
Refresh Add readers Add writers
Connect Tuner
Refresh
Debug

name	type	qos
CMParticipant	kernel...	tr
Circle	Shape...	pb
DCPSCandMCommand	kernel...	tr
DCPSDelivery	kernel...	vb
DCPSHeartbeat	kernel...	vb
DCPSParticipant	kernel...	tr
DCPSPublication	kernel...	tr
DCPSSubscription	kernel...	tr
DCPSTopic	kernel...	tr
OsplArrayTopic	ospllog...	tr
OsplSequenceTopic	ospllog...	tr
OsplTestTopic	ospllog...	tr
Square	Shape...	pb
Triangle	Shape...	pb
d_deleteData	durabili...	vr
d_groupsRequest	durabili...	vr
d_nameSpaces	durabili...	vr
d_nameSpacesRequ...	durabili...	vr
d_newGroup	durabili...	vr
d_sampleChain	durabili...	vr
d_sampleRequest	durabili...	vr
d_status	durabili...	vr
d_statusRequest	durabili...	vr

□ Show disposed participants

```
Nodes
  perf2.perfnet.ptnl
    SHMEM
      services
      ishapes_v6<13487>
  perf1.perfnet.ptnl
    SHMEM
      services
      cmsoap<12050>
        OpenSplice Tester (perf1.perf
  perf3.perfnet.ptnl
    ishapes_v6 <30211>
All participants
  OpenSplice Tester (perf1.perfnet.ptnl)
  ishapes_v6 <30211> (perf3.perfnet.ptnl)
  ishapes_v6 <13487> (perf2.perfnet.ptnl)
Topics
  CMParticipant
  Circle
  DCPSCandMCommand
```

Topic: Circle

Readers

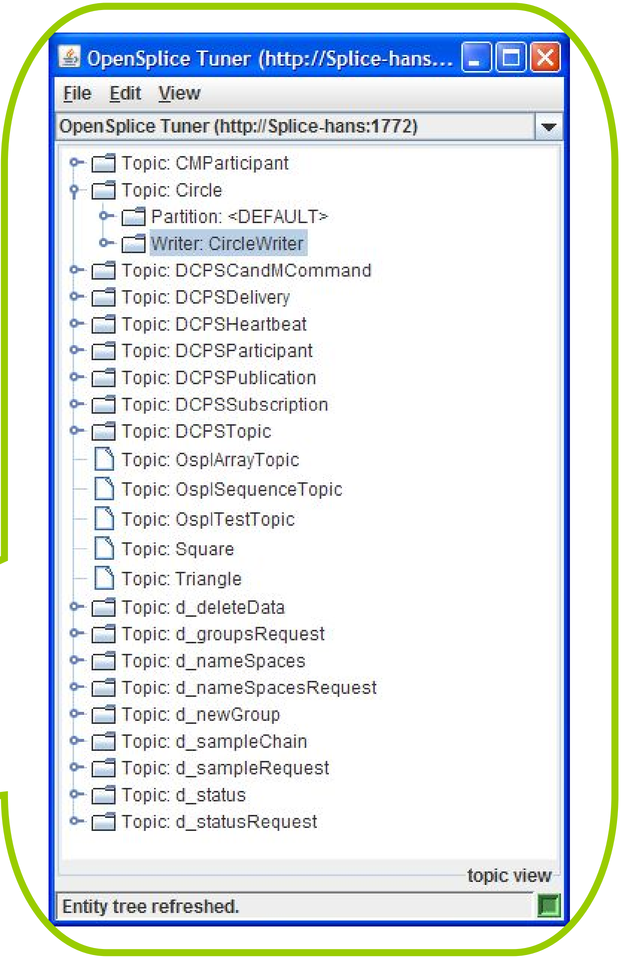
source	qos	partiti...
ishapes_v6 <30211> (perf3...	vbDS	

Writers

source	qos	partiti...
ishapes_v6 <13487> (perf2...	vbDS	

DTime	Type	Message	Location

Connected http://perf1.perfnet.ptnl:50000 | cmsoap,durability,networking,splicedaemon



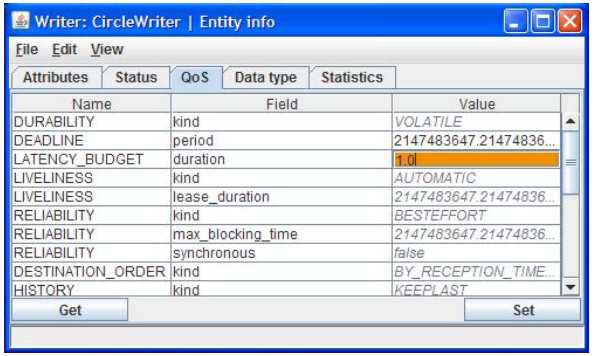
OpenSplice Tuner (http://Splice-hans...

OpenSplice Tuner (http://Splice-hans:1772)

```
Topic: CMParticipant
Topic: Circle
  Partition: <DEFAULT>
  Writer: CircleWriter
Topic: DCPSCandMCommand
Topic: DCPSDelivery
Topic: DCPSHeartbeat
Topic: DCPSParticipant
Topic: DCPSPublication
Topic: DCPSSubscription
Topic: DCPSTopic
Topic: OsplArrayTopic
Topic: OsplSequenceTopic
Topic: OsplTestTopic
Topic: Square
Topic: Triangle
Topic: d_deleteData
Topic: d_groupsRequest
Topic: d_nameSpaces
Topic: d_nameSpacesRequest
Topic: d_newGroup
Topic: d_sampleChain
Topic: d_sampleRequest
Topic: d_status
Topic: d_statusRequest
```

topic view

Entity tree refreshed.



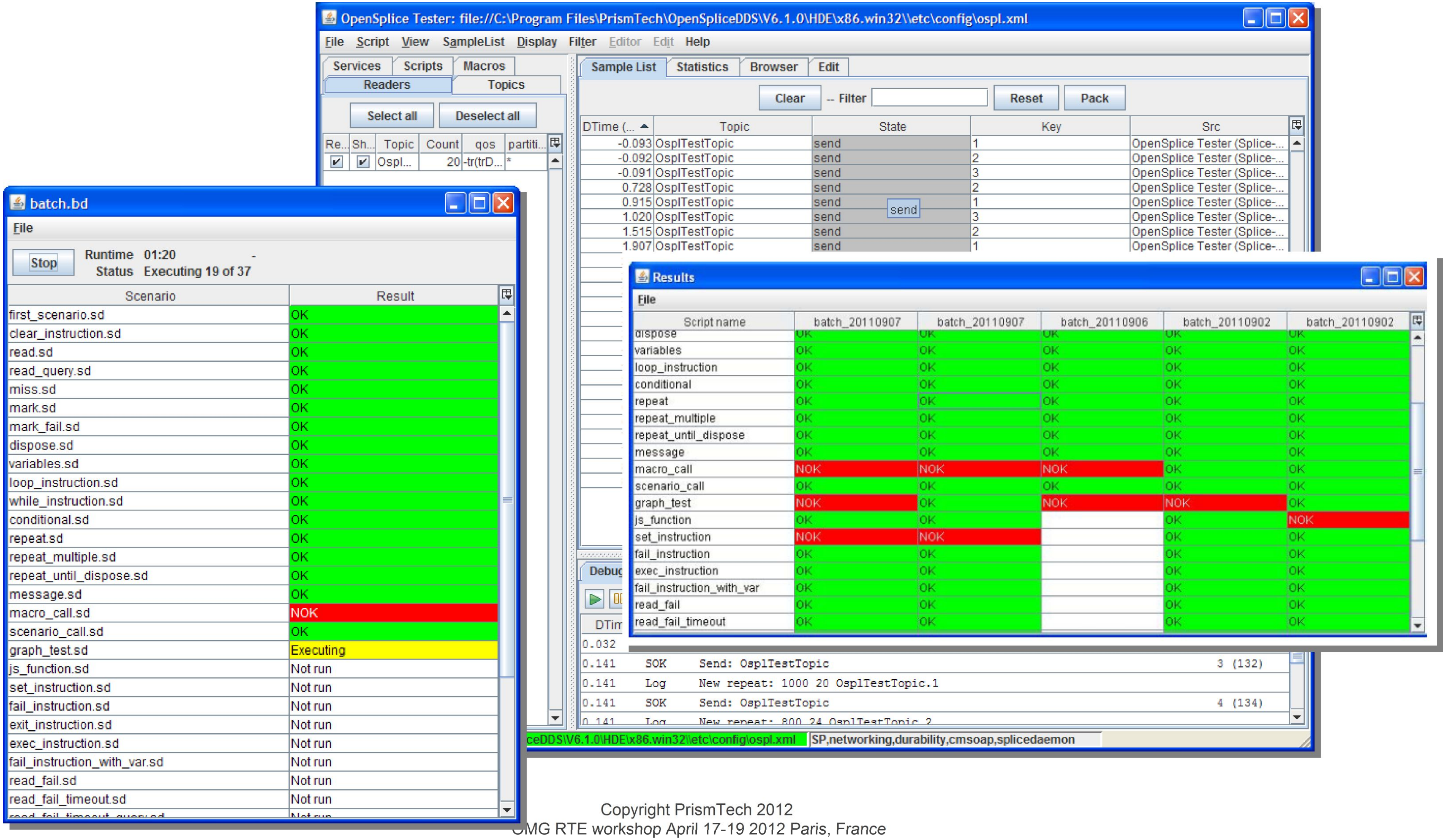
Writer: CircleWriter | Entity info

Name	Field	Value
DURABILITY	kind	VOLATILE
DEADLINE	period	2147483647.21474836...
LATENCY_BUDGET	duration	1.0
LIVELINESS	kind	AUTOMATIC
LIVELINESS	lease_duration	2147483647.21474836...
RELIABILITY	kind	BESTEFFORT
RELIABILITY	max_blocking_time	2147483647.21474836...
RELIABILITY	synchronous	false
DESTINATION_ORDER	kind	BY_RECEPTION_TIME...
HISTORY	kind	KEEPLAST

3.3 Overall Test Nature

- □ **Requirement:** Regression Testing
  - □ **Repeated** testing
    - □ The tool shall have the ability to create test-scripts
    - □ The tool shall have the ability to execute batches of scripts
    - □ The tool shall have the capability to capture/maintain regression results
- □ **Requirement:** Integrated Test environment
  - □ The tool shall **Integrate** browsing, capturing/manipulating, scripting
    - □ The tool shall have the ability to create test-scripts from interactions
    - □ The tool shall allow for one-clock monitoring
    - □ The tool shall integrate all components to an intuitive look&feel

Example: Regression (batch-)testing


OpenSplice Tester: file://C:\Program Files\PrismTech\OpenSpliceDDS\V6.1.0\HDE\x86.win32\\etc\config\ospl.xml
File Script View SampleList Display Filter Editor Edit Help
Services Scripts Macros
Readers Topics
Select all Deselect all
Sample List Statistics Browser Edit
Clear -- Filter Reset Pack
Debug
batch.bd
File
Stop
Results
File

Re..	Sh...	Topic	Count	qos	partiti...
☑	☑	Ospl...	20	-tr(trD...	*

DTime (...	Topic	State	Key	Src
-0.093	OsplTestTopic	send	1	OpenSplice Tester (Splice-...
-0.092	OsplTestTopic	send	2	OpenSplice Tester (Splice-...
-0.091	OsplTestTopic	send	3	OpenSplice Tester (Splice-...
0.728	OsplTestTopic	send	2	OpenSplice Tester (Splice-...
0.915	OsplTestTopic	send	1	OpenSplice Tester (Splice-...
1.020	OsplTestTopic	send	3	OpenSplice Tester (Splice-...
1.515	OsplTestTopic	send	2	OpenSplice Tester (Splice-...
1.907	OsplTestTopic	send	1	OpenSplice Tester (Splice-...

Runtime 01:20 -
Status Executing 19 of 37

Scenario	Result
first_scenario.sd	OK
clear_instruction.sd	OK
read.sd	OK
read_query.sd	OK
miss.sd	OK
mark.sd	OK
mark_fail.sd	OK
dispose.sd	OK
variables.sd	OK
loop_instruction.sd	OK
while_instruction.sd	OK
conditional.sd	OK
repeat.sd	OK
repeat_multiple.sd	OK
repeat_until_dispose.sd	OK
message.sd	OK
macro_call.sd	NOK
scenario_call.sd	OK
graph_test.sd	Executing
js_function.sd	Not run
set_instruction.sd	Not run
fail_instruction.sd	Not run
exit_instruction.sd	Not run
exec_instruction.sd	Not run
fail_instruction_with_var.sd	Not run
read_fail.sd	Not run
read_fail_timeout.sd	Not run
read_fail_timeout_query.sd	Not run

Script name	batch_20110907	batch_20110907	batch_20110906	batch_20110902	batch_20110902
dispose	OK	OK	OK	OK	OK
variables	OK	OK	OK	OK	OK
loop_instruction	OK	OK	OK	OK	OK
conditional	OK	OK	OK	OK	OK
repeat	OK	OK	OK	OK	OK
repeat_multiple	OK	OK	OK	OK	OK
repeat_until_dispose	OK	OK	OK	OK	OK
message	OK	OK	OK	OK	OK
macro_call	NOK	NOK	NOK	OK	OK
scenario_call	OK	OK	OK	OK	OK
graph_test	NOK	OK	NOK	NOK	OK
js_function	OK	OK		OK	NOK
set_instruction	NOK	NOK		OK	OK
fail_instruction	OK	OK		OK	OK
exec_instruction	OK	OK		OK	OK
fail_instruction_with_var	OK	OK		OK	OK
read_fail	OK	OK		OK	OK
read_fail_timeout	OK	OK		OK	OK

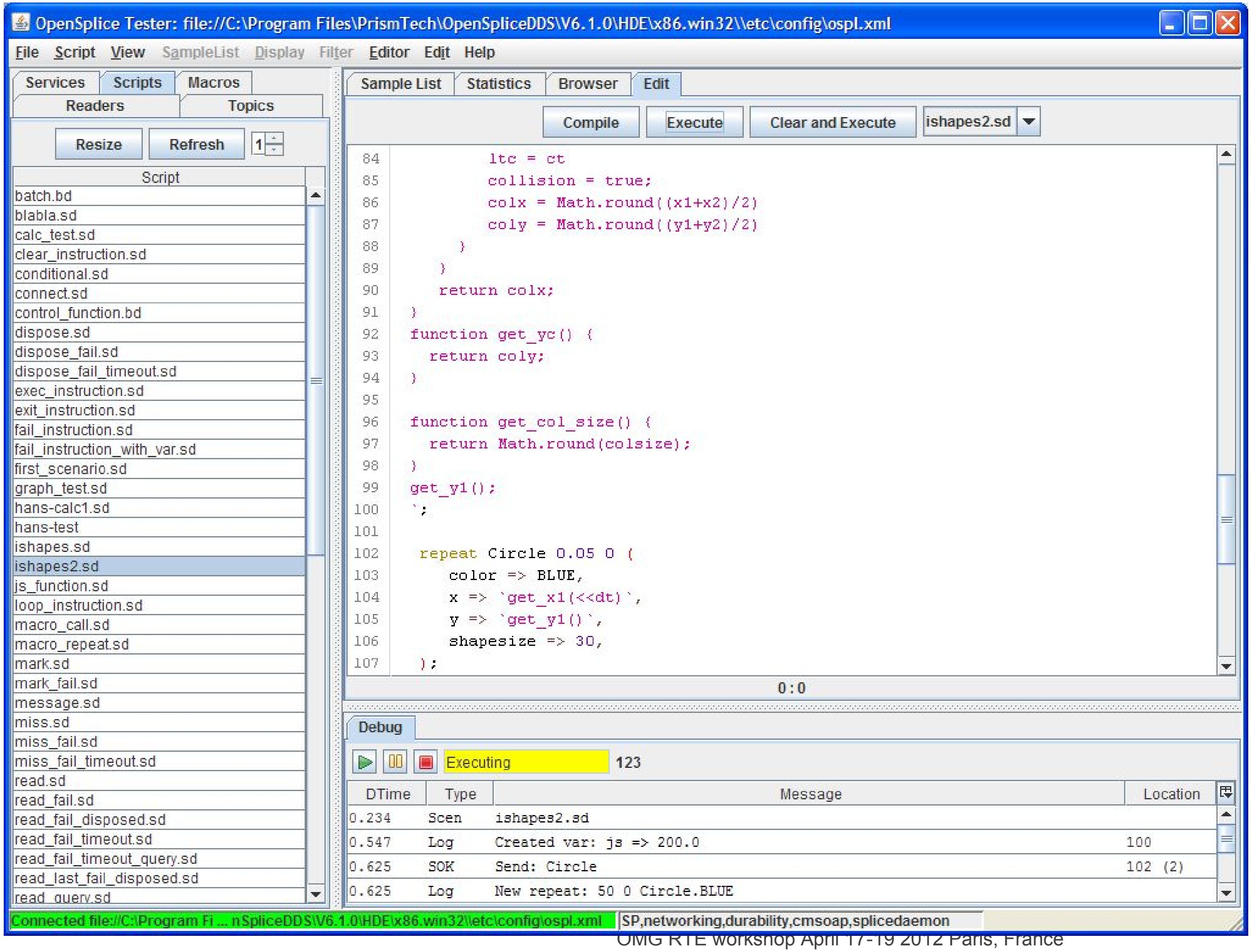
```
DTim
0.032
0.141   SOK   Send: OsplTestTopic                         3 (132)
0.141   Log   New repeat: 1000 20 OsplTestTopic.1
0.141   SOK   Send: OsplTestTopic                         4 (134)
0.141   Log   New repeat: 800 24 OsplTestTopic.2
```

ceDDS\V6.1.0\HDE\x86.win32\\etc\config\ospl.xml | SP,networking,durability,cmsoap,splicedaemon

3.4 Scripting

- **Requirements**: Script ‘engine’
  - The tool shall contain an **intuitive** and **powerful** scripting-engine
    - To capture, monitor and inject DDS-data
    - To define ‘business-logic’ to process the data
- **Analysis**: DDS ‘DSL’
  - There’s a need for **DDS-Domain Specific Language** (DSL)
  - Yet that can be ‘enhanced’ by available scripting languages such as **Javascript, Python, Ruby**
  - A java-based tool-suite greatly facilitates inclusion of free interpreters (Jython, JRuby)
- **Requirement**: Script generation
  - The tool shall facilitate **easy** script generation / editing
- **Analysis**
  - The tool shall facilitate creating scripts out of observations
  - Allowing to reproduce ‘live’ interactions for (regression-)test purposes

Scripting: JavaScript



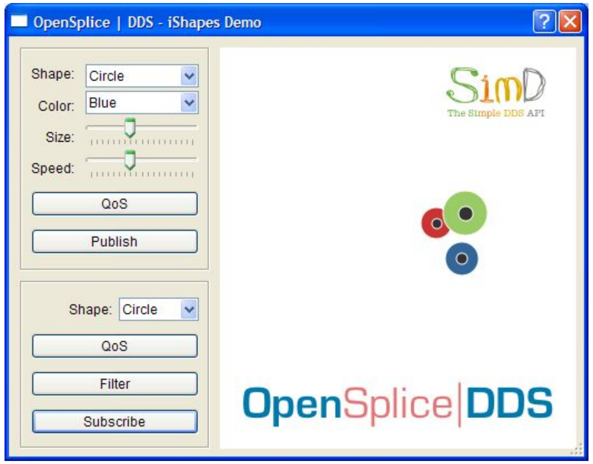
batch.bd
blabla.sd
calc_test.sd
clear_instruction.sd
conditional.sd
connect.sd
control_function.bd
dispose.sd
dispose_fail.sd
dispose_fail_timeout.sd
exec_instruction.sd
exit_instruction.sd
fail_instruction.sd
fail_instruction_with_var.sd
first_scenario.sd
graph_test.sd
hans-calc1.sd
hans-test
ishapes.sd
ishapes2.sd
js_function.sd
loop_instruction.sd
macro_call.sd
macro_repeat.sd
mark.sd
mark_fail.sd
message.sd
miss.sd
miss_fail.sd
miss_fail_timeout.sd
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

```
        ltc = ct
        collision = true;
        colx = Math.round((x1+x2)/2)
        coly = Math.round((y1+y2)/2)
      }
    }
    return colx;
  }
  function get_yc() {
    return coly;
  }

  function get_col_size() {
    return Math.round(colsize);
  }
  get_y1();
  `;

   repeat Circle 0.05 0 (
      color => BLUE,
      x => `get_x1(<<dt)`,
      y => `get_y1()`,
      shapesize => 30,
   );
```

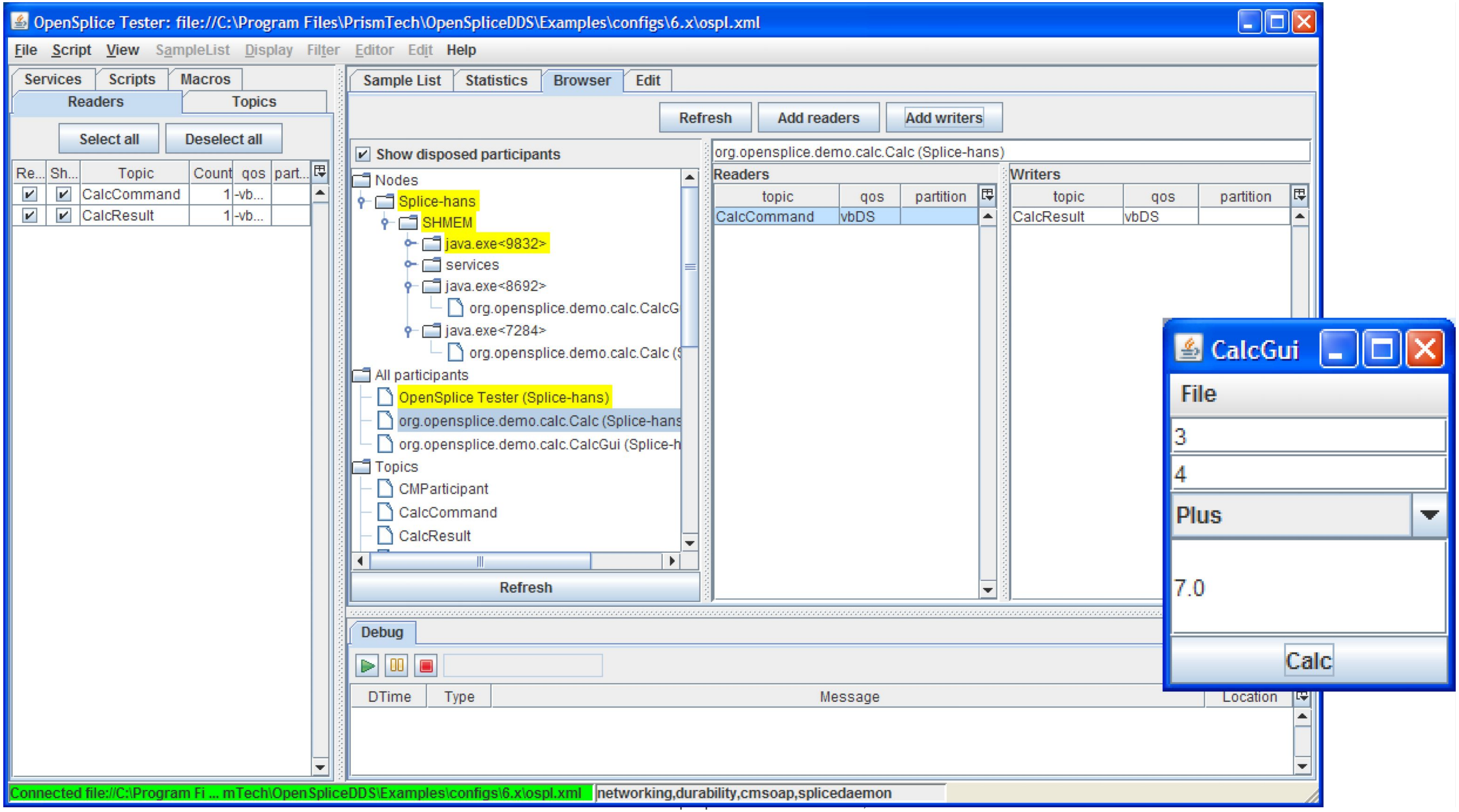
0:0

DTime	Type	Message	Location
0.234	Scen	ishapes2.sd	
0.547	Log	Created var: js => 200.0	100
0.625	SOK	Send: Circle	102 (2)
0.625	Log	New repeat: 50 0 Circle.BLUE	

Connected file://C:\Program Fi ... nSpliceDDS\V6.1.0\HDE\x86.win32\\etc\config\ospl.xml | SP,networking,durability,cmsoap,splicedaemon



Example: auto-scripting (1)



Re...	Sh...	Topic	Count	qos	part...
☑	☑	CalcCommand	1	-vb...	
☑	☑	CalcResult	1	-vb...	

org.opensplice.demo.calc.Calc (Splice-hans)

Readers

topic	qos	partition
CalcCommand	vbDS	

Writers

topic	qos	partition
CalcResult	vbDS	

DTime	Type	Message	Location

3

4

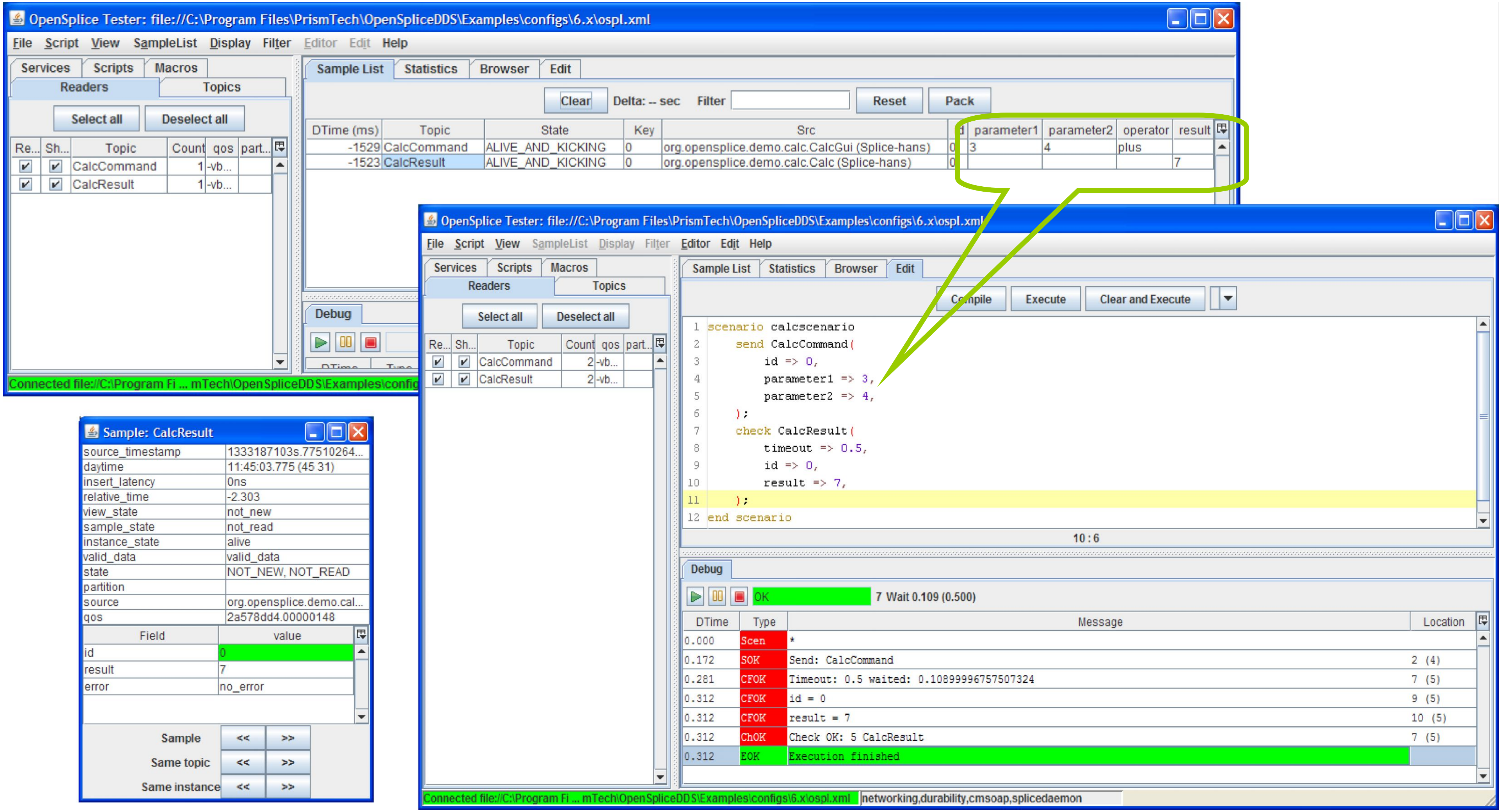
Plus

7.0

Connected file://C:\Program Fi ... mTech\OpenSpliceDDS\Examples\configs\6.x\ospl.xml

networking,durability,cmsoap,splicedaemon

Example: auto-scripting (2)


OpenSplice Tester: file://C:\Program Files\PrismTech\OpenSpliceDDS\Examples\configs\6.x\ospl.xml
File Script View SampleList Display Filter Editor Edit Help
Services Scripts Macros
Readers Topics
Select all Deselect all
Sample List Statistics Browser Edit
Clear Delta: -- sec Filter Reset Pack
Debug
Connected file://C:\Program Fi ... mTech\OpenSpliceDDS\Examples\configs\6.x\ospl.xml
networking,durability,cmsoap,splicedaemon
Compile Execute Clear and Execute
10 : 6
Sample: CalcResult
Sample Same topic Same instance << >>

Re...	Sh...	Topic	Count	qos	part...
☑	☑	CalcCommand	1	-vb...	
☑	☑	CalcResult	1	-vb...	

DTime (ms)	Topic	State	Key	Src	d	parameter1	parameter2	operator	result
-1529	CalcCommand	ALIVE_AND_KICKING	0	org.opensplice.demo.calc.CalcGui (Splice-hans)	0	3	4	plus	
-1523	CalcResult	ALIVE_AND_KICKING	0	org.opensplice.demo.calc.Calc (Splice-hans)	0				7

Re...	Sh...	Topic	Count	qos	part...
☑	☑	CalcCommand	2	-vb...	
☑	☑	CalcResult	2	-vb...	

```
scenario calcscenario
    send CalcCommand(
        id => 0,
        parameter1 => 3,
        parameter2 => 4,
    );
    check CalcResult(
        timeout => 0.5,
        id => 0,
        result => 7,
    );
end scenario
```

OK 7 Wait 0.109 (0.500)

DTime	Type	Message	Location
0.000	Scen	*	
0.172	SOK	Send: CalcCommand	2 (4)
0.281	CFOK	Timeout: 0.5 waited: 0.10899996757507324	7 (5)
0.312	CFOK	id = 0	9 (5)
0.312	CFOK	result = 7	10 (5)
0.312	ChOK	Check OK: 5 CalcResult	7 (5)
0.312	EOK	Execution finished	

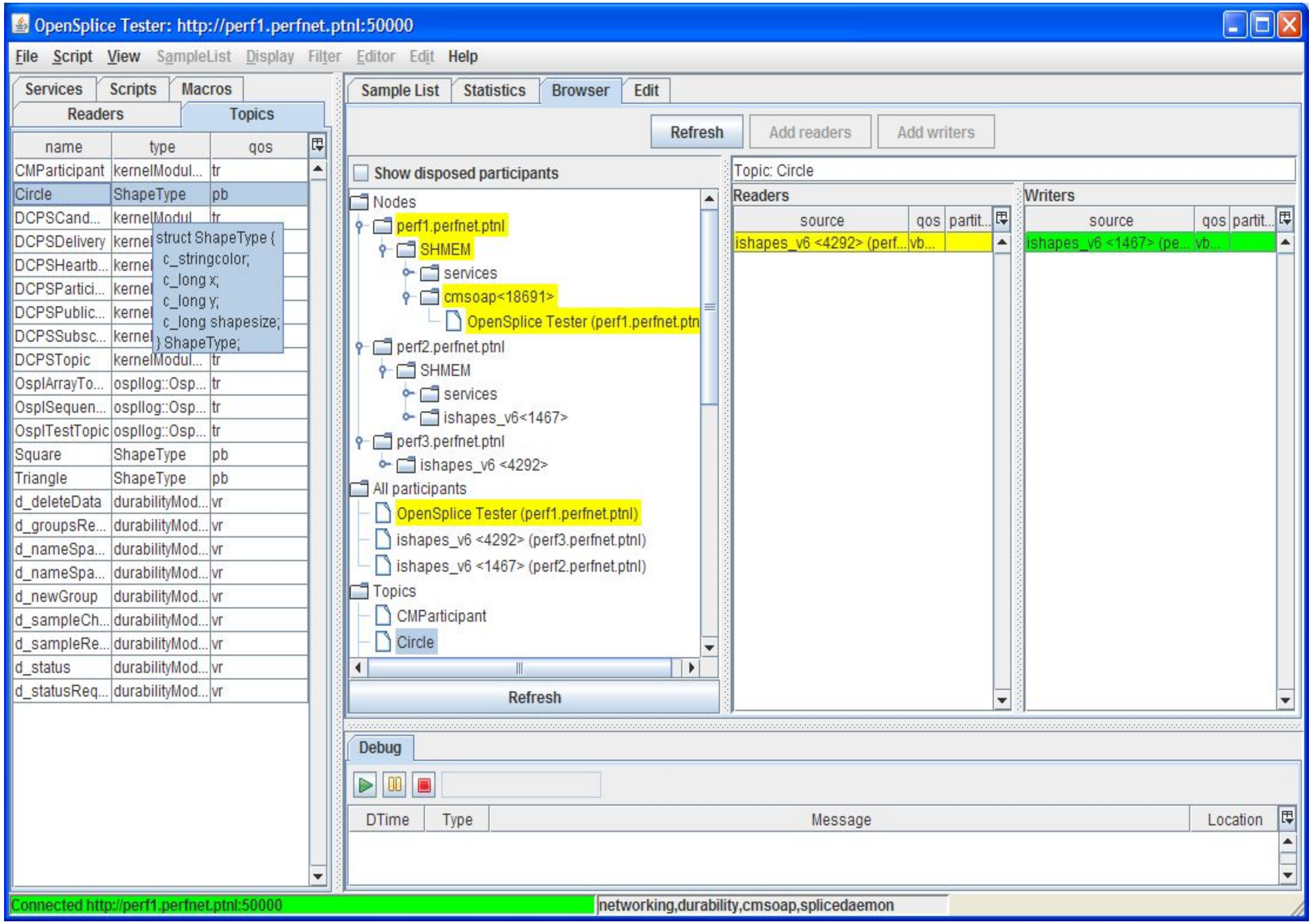
source_timestamp	1333187103s.77510264...
daytime	11:45:03.775 (45 31)
insert_latency	0ns
relative_time	-2.303
view_state	not_new
sample_state	not_read
instance_state	alive
valid_data	valid_data
state	NOT_NEW, NOT_READ
partition	
source	org.opensplice.demo.cal...
qos	2a578dd4.00000148

Field	value
id	0
result	7
error	no_error

3.5 Browsing

- **Requirement**: system browsing
  - The tool shall allow **browsing** of the system-under test
    - From a logical perspective: “what participants publish/subscribe what”
    - From a physical perspective: “what applications are running where”
  - The tool shall allow detection of **QoS conflicts** that prevent communication
- **Analysis**: DDS context (using standard built-in topics)
  - Built-in topics provide all information for Building **logical views**
    - Topic ➔ participants ➔ publishers/writers or subscriber/readers
    - Participant ➔ publishers/writers or subscriber/readers ➔ Topics
  - Built-in topics provide all information to detection of **QoS conflicts**
- **Analysis**: OpenSplice DDS context
  - The dedicated OpenSplice `CMParticipant` built-in topic allows to create a **physical view**
  - Discovered advertised port-numbers of our SOAP-agent allow to **spawn white-box ‘tuners’**
    - That ‘connect’ to individual and/or groups of federated applications

Example: Testing ishapes: browser



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

name	type	qos
CMParticipant	kernelModul...	tr
Circle	ShapeType	pb
DCPSCand...	kernelModul...	tr
DCPSDelivery	kernel	
DCPSHeartb...	kernel	
DCPSPartici...	kernel	
DCPSPublic...	kernel	
DCPSSubsc...	kernel	
DCPSTopic	kernelModul...	tr
OsplArrayTo...	ospllog::Osp...	tr
OsplSequen...	ospllog::Osp...	tr
OsplTestTopic	ospllog::Osp...	tr
Square	ShapeType	pb
Triangle	ShapeType	pb
d_deleteData	durabilityMod...	vr
d_groupsRe...	durabilityMod...	vr
d_nameSpa...	durabilityMod...	vr
d_nameSpa...	durabilityMod...	vr
d_newGroup	durabilityMod...	vr
d_sampleCh...	durabilityMod...	vr
d_sampleRe...	durabilityMod...	vr
d_status	durabilityMod...	vr
d_statusReq...	durabilityMod...	vr

```
struct ShapeType {
  c_stringcolor;
  c_long x;
  c_long y;
  c_long shapesize;
} ShapeType;
```

□ Show disposed participants

```
Nodes
  perf1.perfnet.ptnl
    SHMEM
      services
      cmsoap<18691>
        OpenSplice Tester (perf1.perfnet.ptn
  perf2.perfnet.ptnl
    SHMEM
      services
      ishapes_v6<1467>
  perf3.perfnet.ptnl
    ishapes_v6 <4292>
All participants
  OpenSplice Tester (perf1.perfnet.ptnl)
  ishapes_v6 <4292> (perf3.perfnet.ptnl)
  ishapes_v6 <1467> (perf2.perfnet.ptnl)
Topics
  CMParticipant
  Circle
```

Topic: Circle

Readers

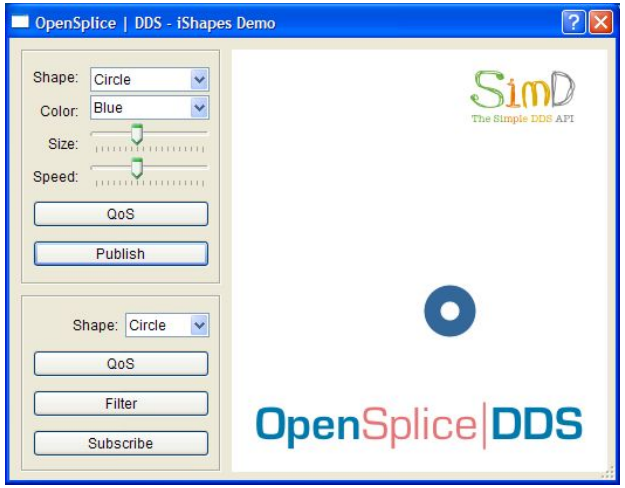
source	qos	partit...
ishapes_v6 <4292> (perf...	vb...	

Writers

source	qos	partit...
ishapes_v6 <1467> (pe...	vb...	

DTime	Type	Message	Location

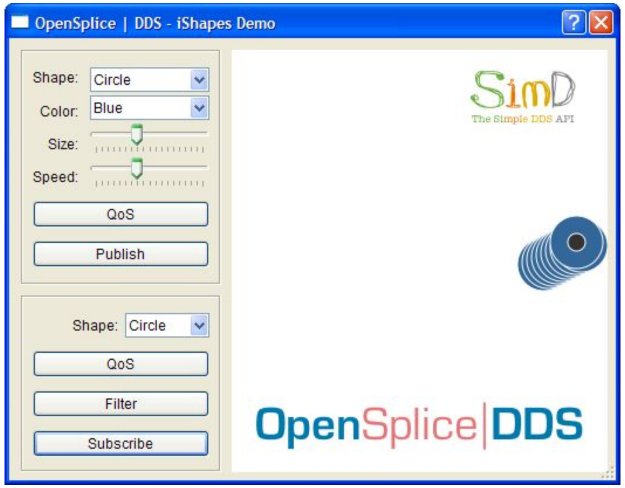
Connected http://perf1.perfnet.ptnl:50000 networking,durability,cmsoap,splicedaemon



OpenSplice | DDS - iShapes Demo

Shape: Circle
Color: Blue
Size:
Speed:

Shape: Circle

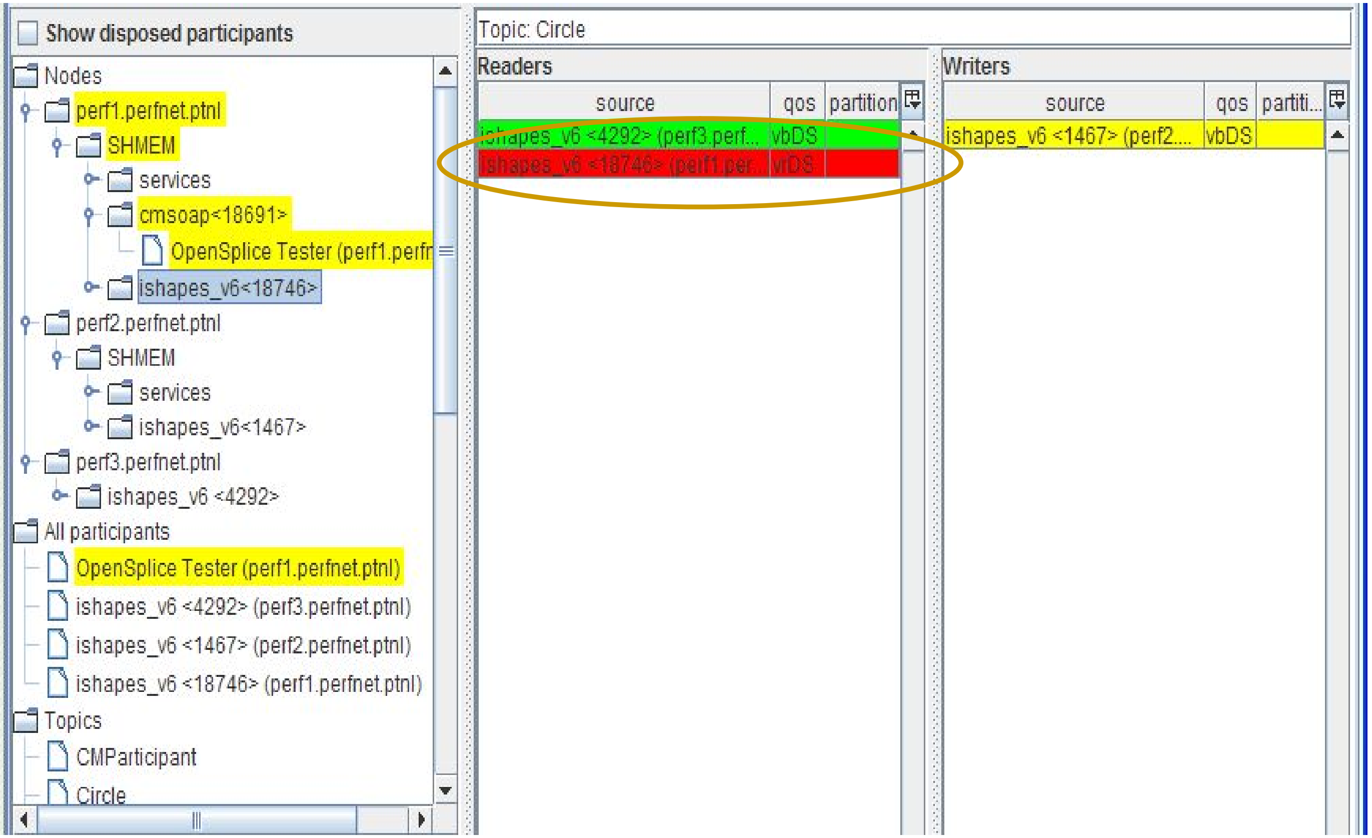


OpenSplice | DDS - iShapes Demo

Shape: Circle
Color: Blue
Size:
Speed:

Shape: Circle

Example: QoS conflict detection



□ Show disposed participants

- Nodes
  - perf1.perfnet.ptnl
    - SHMEM
      - services
      - cmsoap<18691>
        - OpenSplice Tester (perf1.perfn
      - ishapes_v6<18746>
  - perf2.perfnet.ptnl
    - SHMEM
      - services
      - ishapes_v6<1467>
  - perf3.perfnet.ptnl
    - ishapes_v6 <4292>
- All participants
  - OpenSplice Tester (perf1.perfnet.ptnl)
  - ishapes_v6 <4292> (perf3.perfnet.ptnl)
  - ishapes_v6 <1467> (perf2.perfnet.ptnl)
  - ishapes_v6 <18746> (perf1.perfnet.ptnl)
- Topics
  - CMParticipant
  - Circle

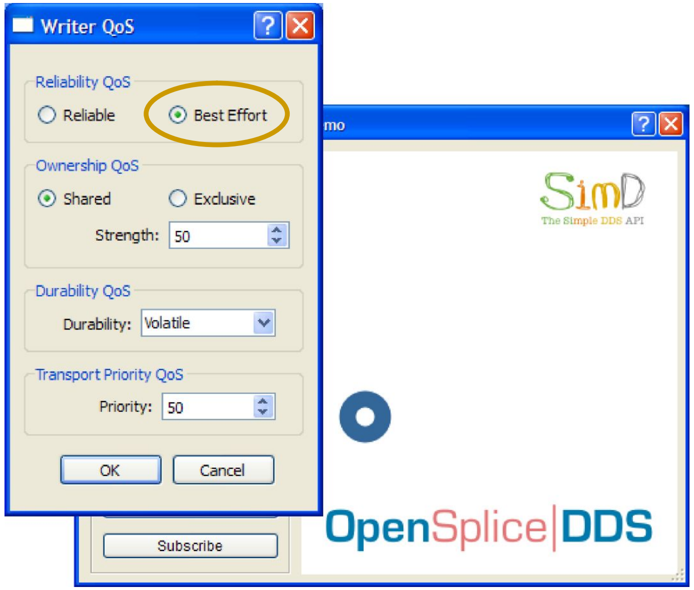
Topic: Circle

Readers

source	qos	partition
ishapes_v6 <4292> (perf3.perf...	vbDS	
ishapes_v6 <18746> (perf1.per...	vrDS	

Writers

source	qos	partiti...
ishapes_v6 <1467> (perf2....	vbDS	



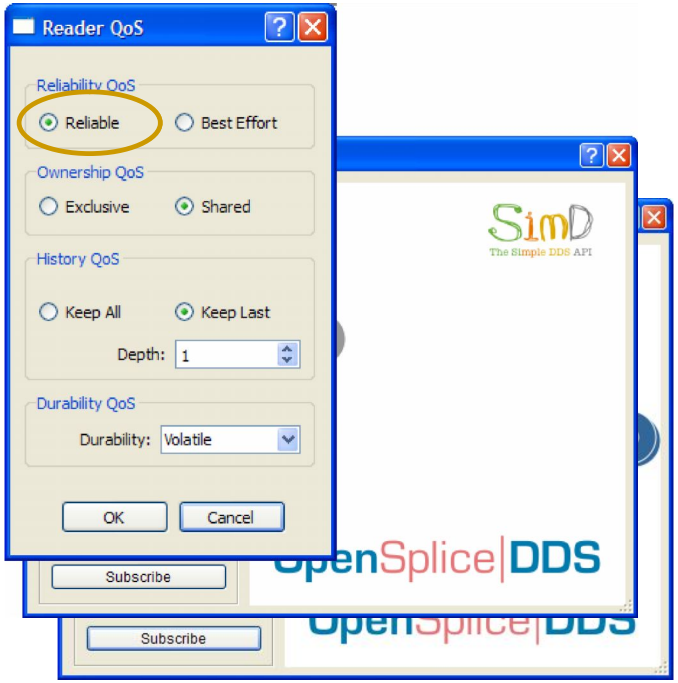
Writer QoS

Reliability QoS
○ Reliable ● Best Effort

Ownership QoS
● Shared ○ Exclusive
Strength: 50

Durability QoS
Durability: Volatile

Transport Priority QoS
Priority: 50



Reader QoS

Reliability QoS
● Reliable ○ Best Effort

Ownership QoS
○ Exclusive ● Shared

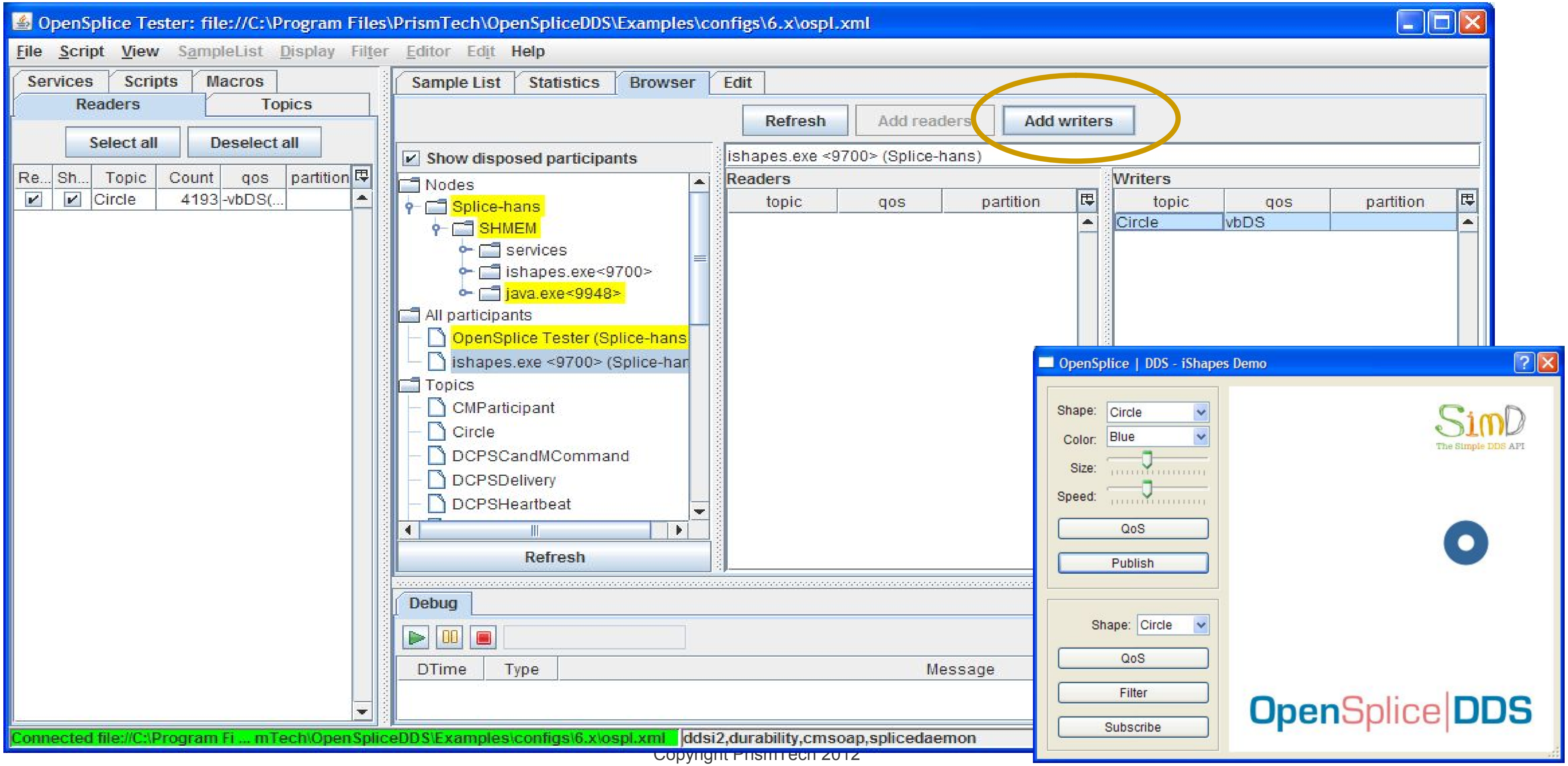
History QoS
○ Keep All ● Keep Last
Depth: 1

Durability QoS
Durability: Volatile

3.6 Capture & Presentation

- **Requirement**: Capturing interactions
  - The tool shall support **one-click** monitoring
  - the tool shall create a **timeline** of all monitored data
  - The tool shall provide manual or scripted **charting** of monitored data
- **Analysis**: generic DDS context
  - Built-in topics provide the basic information for one-click monitoring
    - The topics and their default topic/QoS policies
    - The readers/writers and the QoS they've applied (including `Partition` QoS)
    - The tool can then either use the topic-defaults or query for specific QoS settings
- **Analysis**: OpenSplice DDS context
  - OpenSplice C&M API allows **dynamic creation** of readers/writers
- **Analysis**: free/open-source visualization options
  - The Java environment offers libraries such as **Jchart2D** for visualization

Example: one-click monitoring (1)



OpenSplice Tester: file://C:\Program Files\PrismTech\OpenSpliceDDS\Examples\configs\6.x\ospl.xml

File Script View SampleList Display Filter Editor Edit Help
Services Scripts Macros
Readers Topics
Select all Deselect all
Sample List Statistics Browser Edit
Refresh Add readers Add writers
☑ Show disposed participants

Re...	Sh...	Topic	Count	qos	partition
☑	☑	Circle	4193	-vbDS(...	

```
Nodes
  Splice-hans
    SHMEM
      services
      ishapes.exe<9700>
      java.exe<9948>
All participants
  OpenSplice Tester (Splice-hans
  ishapes.exe <9700> (Splice-han
Topics
  CMParticipant
  Circle
  DCPSCandMCommand
  DCPSDelivery
  DCPSHeartbeat
```

ishapes.exe <9700> (Splice-hans)

Readers

topic	qos	partition

Writers

topic	qos	partition
Circle	vbDS	

DTime	Type	Message

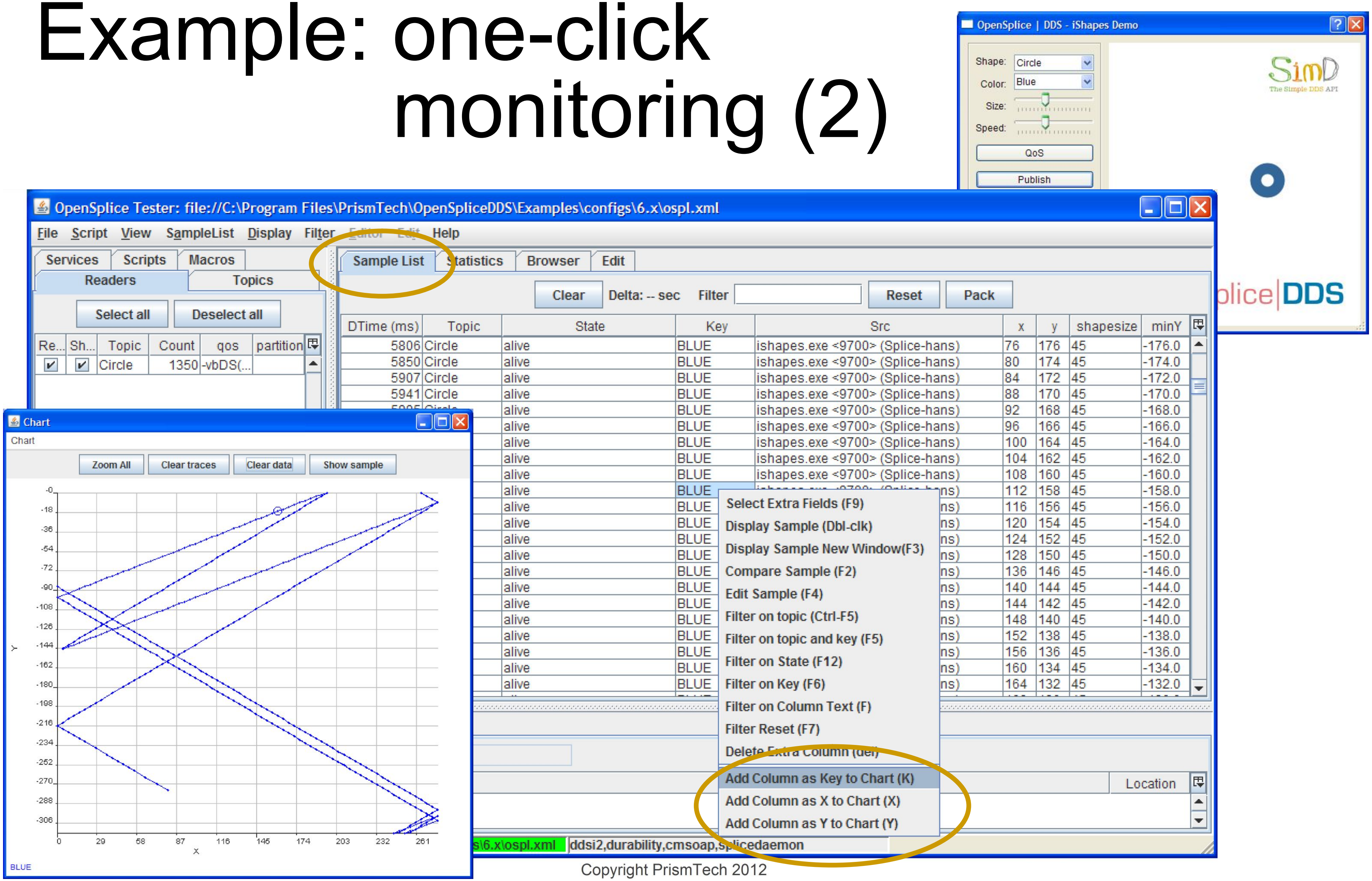
Connected file://C:\Program Fi ... mTech\OpenSpliceDDS\Examples\configs\6.x\ospl.xml | ddsi2,durability,cmsoap,splicedaemon

OpenSplice | DDS - iShapes Demo

Shape: Circle
Color: Blue

Shape: Circle

Example: one-click monitoring (2)



OpenSplice | DDS - iShapes Demo
Shape: Circle
Color: Blue
Size:
Speed:
QoS
Publish
SimD
The Simple DDS API
plice|DDS

OpenSplice Tester: file://C:\Program Files\PrismTech\OpenSpliceDDS\Examples\configs\6.x\ospl.xml

File Script View SampleList Display Filter Editor Edit Help
Services Scripts Macros
Readers Topics
Select all Deselect all
Sample List Statistics Browser Edit
Clear Delta: -- sec Filter Reset Pack

Re...	Sh...	Topic	Count	qos	partition
☑	☑	Circle	1350	-vbDS(...	

DTime (ms)	Topic	State	Key	Src	x	y	shapesize	minY
5806	Circle	alive	BLUE	ishapes.exe <9700> (Splice-hans)	76	176	45	-176.0
5850	Circle	alive	BLUE	ishapes.exe <9700> (Splice-hans)	80	174	45	-174.0
5907	Circle	alive	BLUE	ishapes.exe <9700> (Splice-hans)	84	172	45	-172.0
5941	Circle	alive	BLUE	ishapes.exe <9700> (Splice-hans)	88	170	45	-170.0
		alive	BLUE	ishapes.exe <9700> (Splice-hans)	92	168	45	-168.0
		alive	BLUE	ishapes.exe <9700> (Splice-hans)	96	166	45	-166.0
		alive	BLUE	ishapes.exe <9700> (Splice-hans)	100	164	45	-164.0
		alive	BLUE	ishapes.exe <9700> (Splice-hans)	104	162	45	-162.0
		alive	BLUE	ishapes.exe <9700> (Splice-hans)	108	160	45	-160.0
		alive	BLUE	ns)	112	158	45	-158.0
		alive	BLUE	ns)	116	156	45	-156.0
		alive	BLUE	ns)	120	154	45	-154.0
		alive	BLUE	ns)	124	152	45	-152.0
		alive	BLUE	ns)	128	150	45	-150.0
		alive	BLUE	ns)	136	146	45	-146.0
		alive	BLUE	ns)	140	144	45	-144.0
		alive	BLUE	ns)	144	142	45	-142.0
		alive	BLUE	ns)	148	140	45	-140.0
		alive	BLUE	ns)	152	138	45	-138.0
		alive	BLUE	ns)	156	136	45	-136.0
		alive	BLUE	ns)	160	134	45	-134.0
		alive	BLUE	ns)	164	132	45	-132.0

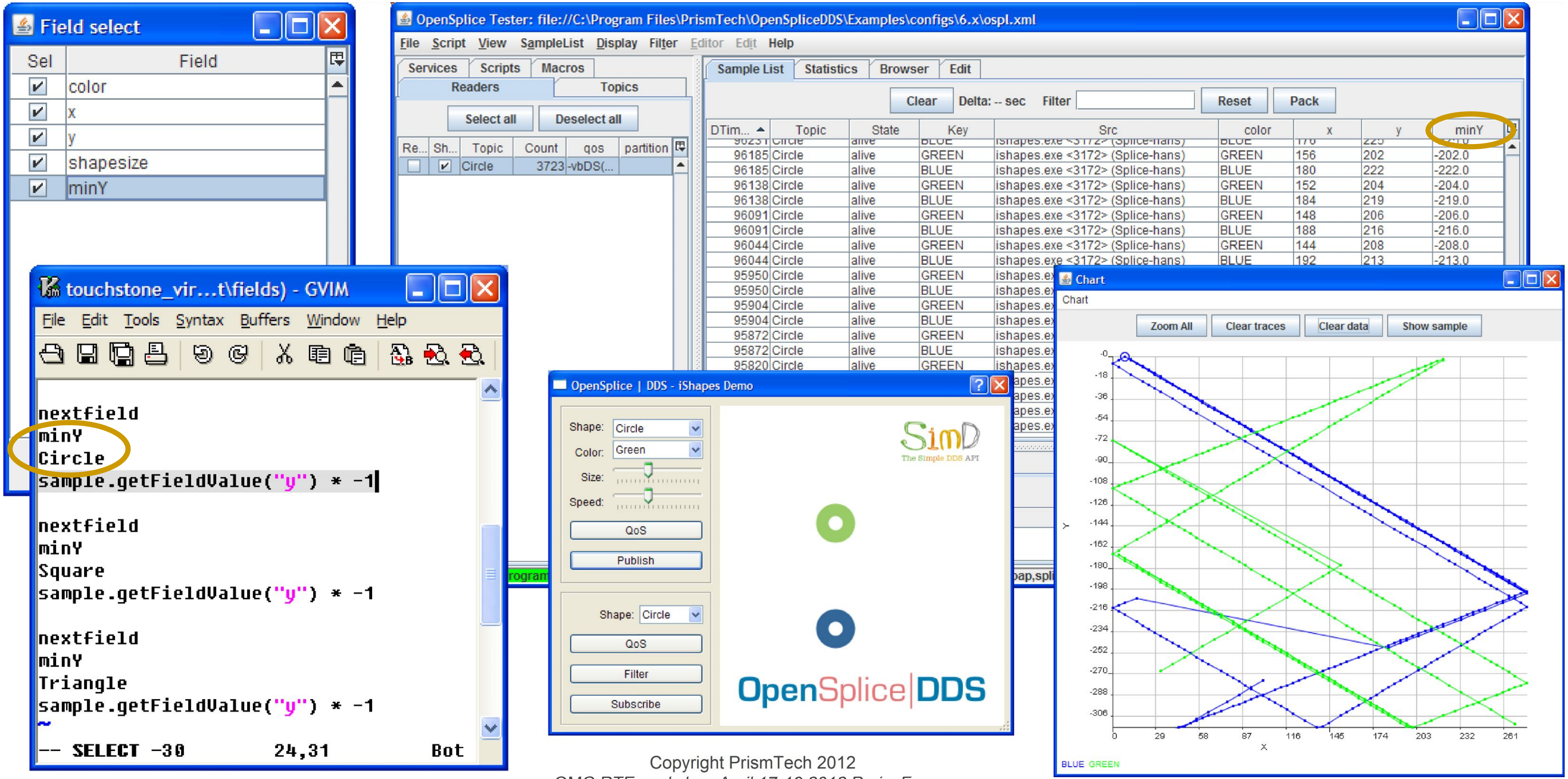
Select Extra Fields (F9)
Display Sample (Dbl-clk)
Display Sample New Window(F3)
Compare Sample (F2)
Edit Sample (F4)
Filter on topic (Ctrl-F5)
Filter on topic and key (F5)
Filter on State (F12)
Filter on Key (F6)
Filter on Column Text (F)
Filter Reset (F7)
Delete Extra Column (del)
Add Column as Key to Chart (K)
Add Column as X to Chart (X)
Add Column as Y to Chart (Y)
Location
s\6.x\ospl.xml
ddsi2,durability,cmsoap,splicedaemon
Chart
Chart
Zoom All Clear traces Clear data Show sample
Y
-0
-18
-36
-54
-72
-90
-108
-126
-144
-162
-180
-198
-216
-234
-252
-270
-288
-306
0
29
58
87
116
145
174
203
232
261
X
BLUE

3.7 Analysis & Manipulation

- **Requirements**: analyze **TimeLine** of obtained data
  - The tool shall allow to analyze & manipulate individual samples
    - Display Sample Data and sample Info (meta-data)
    - Read / Modify / Write samples
  - The tool shall allow to analyze **streams** of topic samples
    - Browse the timeline of samples
  - The tool shall allow to **Chart** captured (read/written) data
    - Interactive as well as from script
    - Including 'scatter plots'

- **Analysis:**
  - Configurable **time-line**
    - Selectable fields of monitored topic exchange (inclusive time & source of publication)
    - **time**-based, **topic**-based, **key**-based browsing through timeline
  - **Virtual attributes** can greatly enhance interpretation of timeline
    - Use script-engine power to define virtual attributes (out of existing attributes)
  - **Real-time** charting
    - Using existing open-source charting-libraries such as Jchart2D

Example: virtual fields



Field select

Sel	Field
☑	color
☑	x
☑	y
☑	shapesize
☑	minY

touchstone_vir…t\fields) - GVIM

```
nextfield
minY
Circle
sample.getFieldValue("y") * -1

nextfield
minY
Square
sample.getFieldValue("y") * -1

nextfield
minY
Triangle
sample.getFieldValue("y") * -1
~
-- SELECT -30          24,31          Bot
```

OpenSplice Tester: file://C:\Program Files\PrismTech\OpenSpliceDDS\Examples\configs\6.x\ospl.xml

File Script View SampleList Display Filter Editor Edit Help
Services Scripts Macros
Readers Topics
Select all Deselect all
Sample List Statistics Browser Edit
Clear
Delta: -- sec
Filter
Reset
Pack

Re...	Sh...	Topic	Count	qos	partition
□	☑	Circle	3723	-vbDS(...	

DTim...	Topic	State	Key	Src	color	x	y	minY
96185	Circle	alive	GREEN	ishapes.exe <3172> (Splice-hans)	GREEN	156	202	-202.0
96185	Circle	alive	BLUE	ishapes.exe <3172> (Splice-hans)	BLUE	180	222	-222.0
96138	Circle	alive	GREEN	ishapes.exe <3172> (Splice-hans)	GREEN	152	204	-204.0
96138	Circle	alive	BLUE	ishapes.exe <3172> (Splice-hans)	BLUE	184	219	-219.0
96091	Circle	alive	GREEN	ishapes.exe <3172> (Splice-hans)	GREEN	148	206	-206.0
96091	Circle	alive	BLUE	ishapes.exe <3172> (Splice-hans)	BLUE	188	216	-216.0
96044	Circle	alive	GREEN	ishapes.exe <3172> (Splice-hans)	GREEN	144	208	-208.0
96044	Circle	alive	BLUE	ishapes.exe <3172> (Splice-hans)	BLUE	192	213	-213.0
95950	Circle	alive	GREEN	ishapes.ex				
95950	Circle	alive	BLUE	ishapes.ex				
95904	Circle	alive	GREEN	ishapes.ex				
95904	Circle	alive	BLUE	ishapes.ex				
95872	Circle	alive	GREEN	ishapes.ex				
95872	Circle	alive	BLUE	ishapes.ex				
95820	Circle	alive	GREEN	ishapes.ex				

OpenSplice | DDS - iShapes Demo

Shape: Circle
Color: Green
Size:
Speed:

Shape: Circle

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OMG RTE workshop April 17-19 2012 Paris, France

4. Summary

- □ Tool developed ‘by testers for testers’
- □ As a complementary tool to available white-box tuning
- □ Based on the open-source C&M API of OpenSplice DDS
- □ Exploiting the Java-platform and open-source plugins
  - □ Javascript, jPython, jRuby script engines
  - □ Jchart2D, Log4J, Swingx and RSyntaxTextArea libraries
- □ Enhanced with a ‘browser’ and productized by PrismTech
  - □ Available as “OpenSplice Tester” with V6.1

4. “Tester” Live Demo

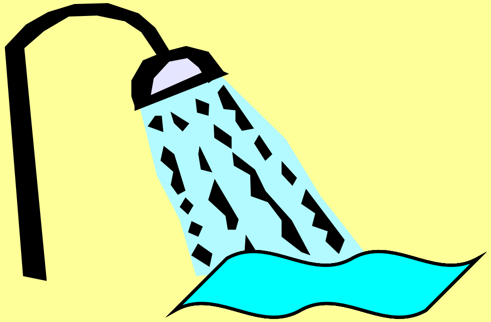
DDSTouchStone: DDS benchmarking suite

- **One generic DDS application called ‘touchstone’**
  - Configured with two parameters only:
    - Application-Id for identification of the touchstone
    - Group-Id for identification of the group the touchstone belongs to
  - Assures easy deployment
    - Interfacing done by means of DDS topics
    - Input settings (“..DefTopics” in the TouchstoneCommands partition)
    - Output results (“..ReportTopics” in the TouchstoneReports partition)
    - Assures location, platform and language independence of deployment
- **A Container for the four key players:**

The four key players

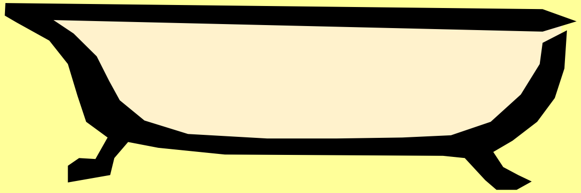
Transceiver

Transponder



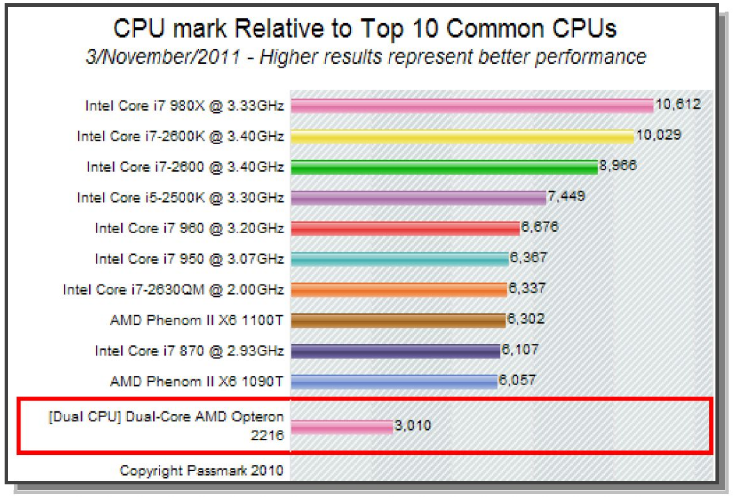
Transmitter

Receiver



Inter-Nodal Roundtrip Latency

- □ 2006 ‘reference platform’
  - □ Dell blade-server (Opteron)
  - □ Dell-powerconnect 5324 Gbit LAN
- □ Metrics
  - □ X-axis = Kbytes
  - □ Y-axis = uSec
- □ Regression-test graph by Tester


CPU mark Relative to Top 10 Common CPUs
3/November/2011 - Higher results represent better performance
Intel Core i7 980X @ 3.33GHz 10,612
Intel Core i7-2600K @ 3.40GHz 10,029
Intel Core i7-2600 @ 3.40GHz 8,966
Intel Core i5-2500K @ 3.30GHz 7,449
Intel Core i7 960 @ 3.20GHz 6,676
Intel Core i7 950 @ 3.07GHz 6,367
Intel Core i7-2630QM @ 2.00GHz 6,337
AMD Phenom II X6 1100T 6,302
Intel Core i7 870 @ 2.93GHz 6,107
AMD Phenom II X6 1090T 6,057
[Dual CPU] Dual-Core AMD Opteron 2216 3,010
Copyright Passmark 2010

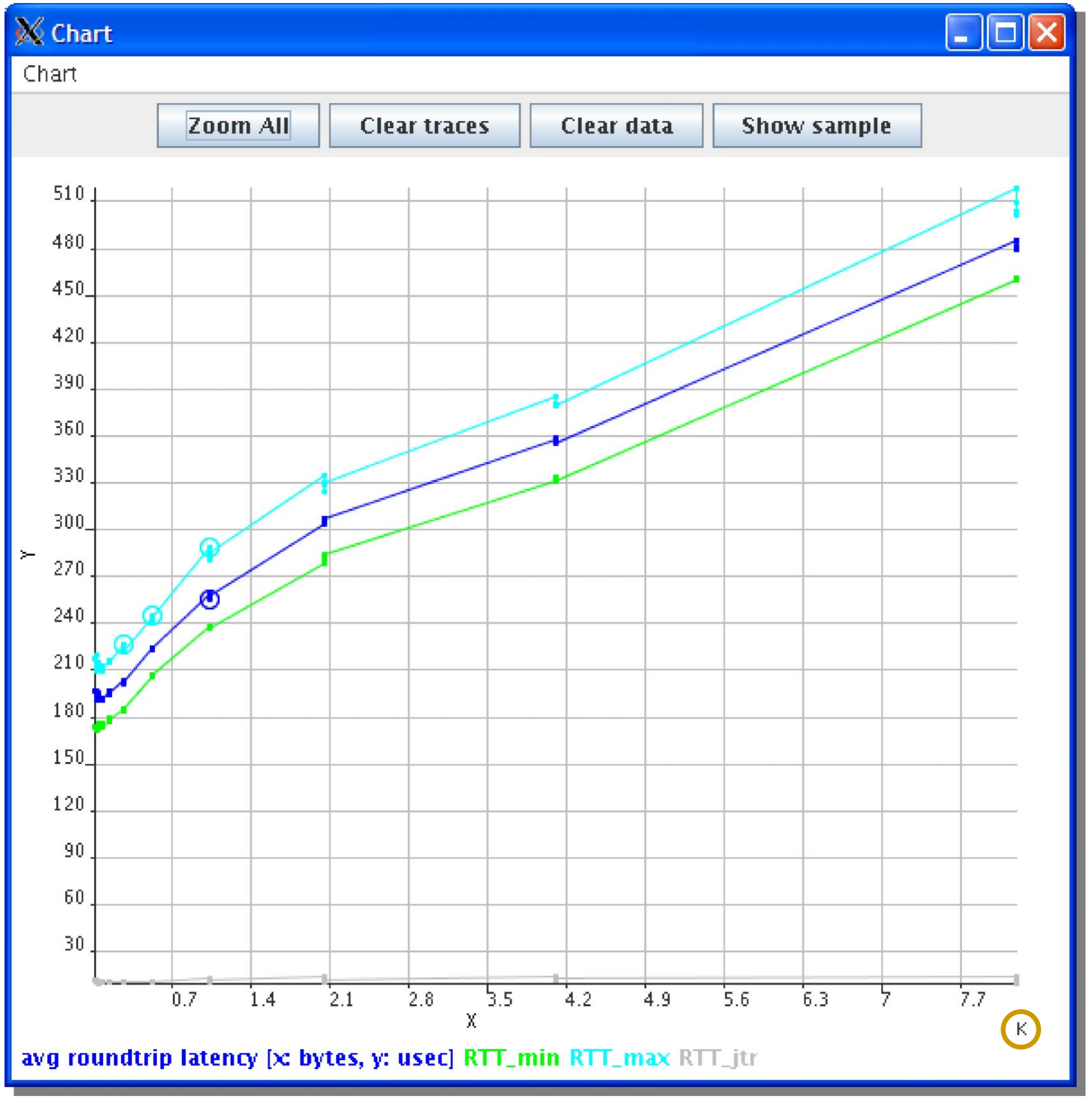


Chart
Chart
Zoom All
Clear traces
Clear data
Show sample
510
480
450
420
390
360
330
300
270
240
210
180
150
120
90
60
30
Y
0.7
1.4
2.1
2.8
3.5
4.2
4.9
5.6
6.3
7
7.7
X
avg roundtrip latency [x: bytes, y: usec] RTT_min RTT_max RTT_jtr