



## **Getting Started Guide**

*Release 6.x*

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## PREFACE

### 1.1 About the Getting Started Guide

The *Getting Started Guide* is included with the Vortex OpenSplice Documentation Set. This Guide is the starting point for anyone using, developing or running applications with Vortex OpenSplice.

*This Getting Started Guide contains:*










- general information about Vortex OpenSplice
- a list of documents and how to use them
- initial installation and configuration information for the various platforms which *Vortex OpenSplice* supports (additional detailed information is provided in the *User* and *Deployment* Guides)
- details of where additional information can be found, such as the Vortex OpenSplice FAQs, Knowledge Base, bug reports, *etc.*

*Intended Audience*

The *Getting Started Guide* is intended to be used by anyone who wishes to use the Vortex OpenSplice product.

### 1.2 Conventions

The icons shown below are used to help readers to quickly identify information relevant to their specific use of Vortex OpenSplice.

<i>Icon</i>	<i>Meaning</i>
	Item of special significance or where caution needs to be taken.
	Item contains helpful hint or special information.
	Information applies to Windows ( <i>e.g.</i> XP, 2003, Windows 7) only.
	Information applies to Unix-based systems ( <i>e.g.</i> Solaris) only.
	Information applies to Linux-based systems ( <i>e.g.</i> Ubuntu) only.
	C language specific.
	C++ language specific.
	C# language specific.
	Java language specific.

## ABOUT VORTEX OPENSPLICE

### 2.1 Why Vortex OpenSplice

#### 2.1.1 What is Vortex OpenSplice?

The purpose of Vortex OpenSplice is to provide an infrastructure and middleware layer for real-time distributed systems. This is a realisation of the OMG-DDS-DCPS Specification for a Data Distribution Service based upon a Data Centric Publish Subscribe architecture.

#### 2.1.2 Why Use It?

Vortex OpenSplice provides an infrastructure for real-time data distribution and offers middleware services to applications. It provides a real-time data distribution service that aims at:

- reducing the complexity of the real-time distributed systems
- providing an infrastructure upon which fault-tolerant real-time systems can be built
- supporting incremental development and deployment of systems

#### 2.1.3 Vortex OpenSplice Summary

*Vortex OpenSplice* is the leading (commercial and Open Source) implementation of the Object Management Group's (OMG) *Data Distribution Service (DDS) for Real-Time Systems* datasharing middleware standard. Vortex OpenSplice is an advanced and proven data-centric solution that enables seamless, timely, scalable and dependable distributed data sharing. Vortex OpenSplice delivers the right data, in the right place, at the right time, every time—even in the *largest-scale mission- and business-critical systems*.

**Key features and benefits are:**

- Genuinely the fastest, most scalable and most reliable Open Source integration technology
- Deployed in the most challenging business- and mission-critical systems
- Genuine Open Source Apache 2.0 licensing for both the Community and Commercial editions
- Field-proven interoperability with other DDS implementations
- Largest ecosystem of plug-ins and tools for modeling, deployment and testing
- Richest set of QoS policies for controlling efficiency, determinism and fault-tolerance
- Supported by world-renowned professional services expertise from the developers of the DDS standard
- Unprecedented throughput of millions of samples/sec for typical 'stream' data

Please go to <https://www.adlinktech.com/en/data-distribution-service> to obtain evaluation copies of Vortex OpenSplice, and <https://www.adlinktech.com/en/data-distribution-service-dds-community> for free downloads of the DDS Community Edition.

## 2.2 Vortex OpenSplice Architecture

### 2.2.1 Overall

To ensure scalability, flexibility and extensibility, Vortex OpenSplice has an internal architecture that, when selected, uses shared memory to `interconnect` not only all applications that reside within one computing node, but also `hosts` a configurable and extensible set of services. These services provide `pluggable` functionality such as networking (providing QoS driven real-time networking based on multiple reliable multicast `channels`), durability (providing fault tolerant storage for both real-time `state` data as well as persistent `settings`), and remote control & monitoring `soap service` (providing remote web based access using the SOAP protocol from the Vortex OpenSplice Tuner tools).

### 2.2.2 Scalability

Vortex OpenSplice is capable of using a shared-memory architecture where data is physically present only once on any machine, and where smart administration still provides each subscriber with his own private `view` on this data. This allows a subscriber's data cache to be perceived as an individual `database` that can be content-filtered, queried, etc. (using the content-subscription profile as supported by Vortex OpenSplice). This shared-memory architecture results in an extremely small footprint, excellent scalability and optimal performance when compared to implementations where each reader/writer are `communication endpoints` each with its own storage (in other words, historical data both at reader and writer) and where the data itself still has to be moved, even within the same physical node.

### 2.2.3 Configuration

Vortex OpenSplice is highly configurable, even allowing the architectural structure of the DDS middleware to be chosen by the user at deployment time. Vortex OpenSplice can be configured to run using a *shared memory* architecture, where both the DDS related administration (including the optional pluggable services) and DDS applications interface directly with shared memory. Alternatively, Vortex OpenSplice also supports a *single process* library architecture, where one or more DDS applications, together with the Vortex OpenSplice administration and services, can all be grouped into a single operating system process. Both deployment modes support a configurable and extensible set of services, providing functionality such as:

- *networking* - providing real-time networking options allowing for trade-offs between `interoperability` (with other DDS vendors) and scalability (supporting ultra-large systems).
- *durability* - providing fault-tolerant storage for both real-time state data as well as persistent settings
- *remote control and monitoring SOAP service* - providing remote web-based access using the SOAP protocol from the Vortex OpenSplice Tuner tool
- *dbms service* - providing a connection between the real-time and the enterprise domain by bridging data from DDS to DBMS and *vice versa*

The Vortex OpenSplice middleware can be easily configured, on the fly, using its pluggable architecture: the services that are needed can be specified together with their optimum configuration for the particular application domain, including networking parameters, and durability levels for example).

There are advantages to both the single process and shared memory deployment architectures, so the most appropriate deployment choice depends on the user's exact requirements and DDS scenario.



### 2.3 Single Process Library Architecture

This deployment allows the DDS applications and Vortex OpenSplice administration to be contained together within one single operating system process. This single process deployment option is most useful in environments where shared memory is unavailable or undesirable. As dynamic heap memory is utilized in the single process deployment environment, there is no need to pre-configure a shared memory segment which in some use cases is also seen as an advantage of this deployment option.

Each DDS application on a processing node is implemented as an individual, self-contained operating system process (*i.e.* all of the DDS administration and necessary services have been linked into the application process). This is known as a *single process application*. Communication between multiple single process applications co-located on the same machine node is done via the (loop-back) network, since there is no memory shared between them.

An extension to the single process architecture is the option to co-locate multiple DDS applications into a single process. This can be done by creating application libraries rather than application executables that can be 'linked' into the single process in a similar way to how the DDS middleware services are linked into the single process. This is known as a *single process application cluster*. Communication between clustered applications (that together form a single process) can still benefit from using the process's heap memory, which typically is an order of magnitude faster than using a network, yet the lifecycle of these clustered applications will be tightly coupled.

The Single Process deployment is the default architecture provided within Vortex OpenSplice and allows for easy deployment with minimal configuration required for a running DDS system.

The figure *The Vortex OpenSplice Single Process Architecture* shows an overview of the single process architecture of Vortex OpenSplice.

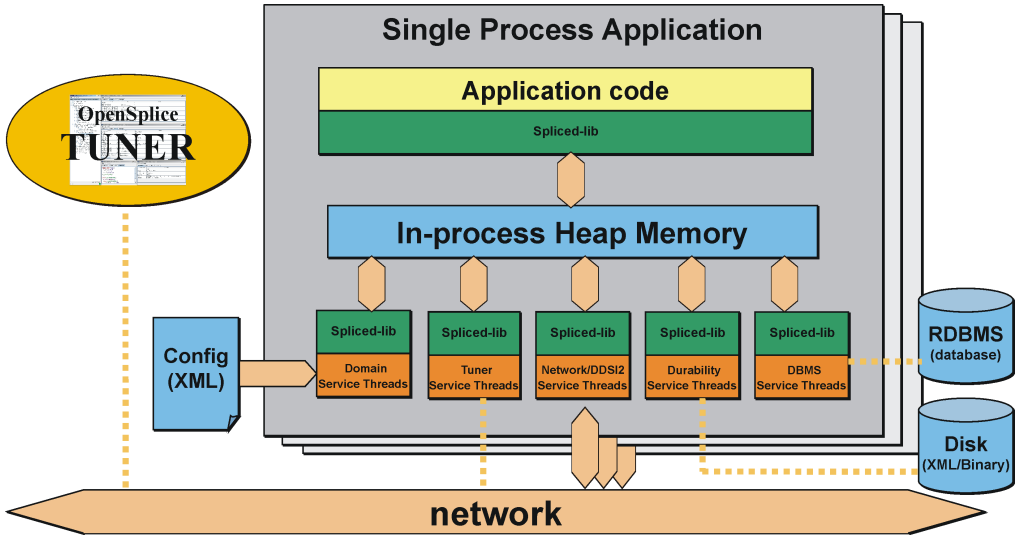


Fig. 1: The Vortex OpenSplice Single Process Architecture

## 2.4 Shared Memory architecture

In the shared memory architecture data is physically present only once on any machine but smart administration still provides each subscriber with his own private view on this data. Both the DDS applications and Vortex OpenSplice administration interface directly with the shared memory which is created by the Vortex OpenSplice daemon on start up. This architecture enables a subscriber’s data cache to be seen as an individual database and the content can be filtered, queried, etc. by using the Vortex OpenSplice content subscription profile.

Typically for advanced DDS users, the shared memory architecture is a more powerful mode of operation and results in extremely low footprint, excellent scalability and optimal performance when compared to the implementation where each reader/writer are communication end points each with its own storage (*i.e.* historical data both at reader and writer) and where the data itself still has to be moved, even within the same platform.

The figure *The Vortex OpenSplice Shared Memory Architecture* shows an overview of the shared memory architecture of Vortex OpenSplice on *one* computing node. Typically, there are *many* nodes within a system.

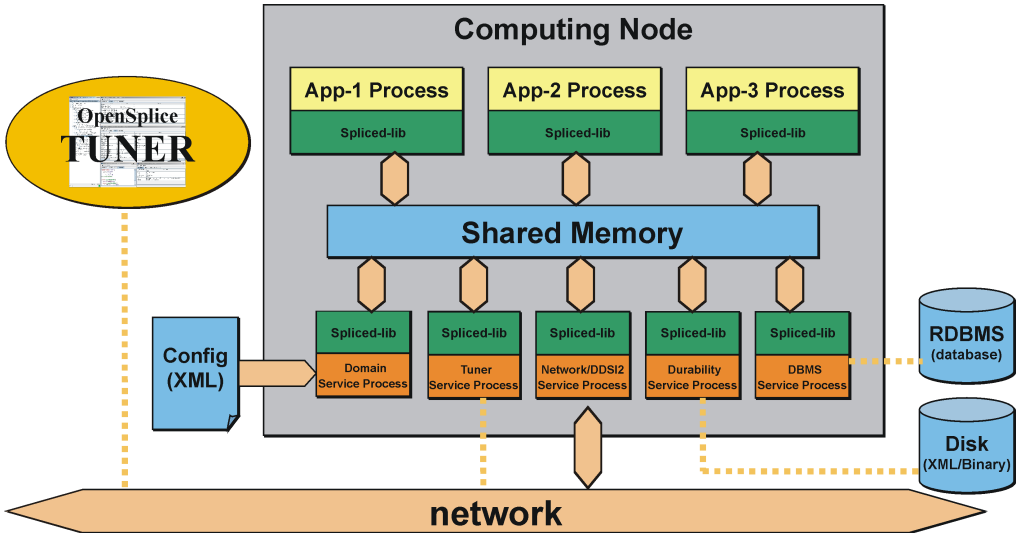


Fig. 2: The Vortex OpenSplice Shared Memory Architecture

## 2.5 Vortex OpenSplice Features and Benefits

The table below shows the following aspects of Vortex OpenSplice, where:

- Features* are significant characteristics of Vortex OpenSplice
- Advantages* shows why a feature is important
- Benefits* describes how users of Vortex OpenSplice can exploit the advantages

Features	Advantages	Benefits	=+!
<b>GENERAL</b>			
Information-centric	Enable dynamic, loosely-coupled system	Simplified and better scalable architectures	=
Open standard	'Off-the-shelf' solutions	Lower cost, no vendor lock-in	=
Built on proven technology	Intended for the most demanding situations	Assured quality and applicability	++
TNN/PT 'inheritance'	Decade of 'DDS' experience	Proven suitability in mission-critical domain	!!!
Open Source model	Strong and large user community	Security of supply of most widely-used DDS	!!!
<b>FUNCTIONAL</b>			
Real-time pub/sub	Dynamic/asynchronous data communication	Autonomous decoupled applications	=
Persistence profile	Fault-tolerant data persistence	Application fault tolerance and data high availability	!!!
Content-sub. Profile	Reduced complexity and higher performance	Easier application design and scalable systems	!!!
<b>PERFORMANCE</b>			
Shared memory	Small footprint, instant data availability	Processor scalability	++
Smart networking	Efficient data transport	Network scalability	++
Extensive IDL support	Includes unbounded strings and sequences	Data scalability	++
<b>USABILITY</b>			
Multiple languages	Any (mix) of C, C++, Java, C#	Supports legacy code, allows hybrid systems	++
Multiple platforms	Any (mix) of Enterprise and RTE OSs	Intercons, Enterprise and embedded systems	=
<b>INTEROPERABILITY</b>			
DDSI/RTPS	Interoperability between DDS vendors	Smooth integration with non-OpenSplice (legacy) DDS systems	!!!
<b>TOOLING AND EASE OF USE</b>			
All metadata at runtime	Dynamic discovery of all 'entity info'	Guaranteed data integrity	=
Powerful tooling	Support for complete system lifecycle	Enhanced productivity and System Integration	!!!
Remote connect	Web-based remote access and control	Remote diagnostics using standard protocols	!!!
<b>Legend:</b>		<i>Equal to the competition</i>	=
		<i>Better than the competition</i>	++
		<i>Far superior to the competition</i>	!!!

## 2.6 Conclusion

ADLINK's Vortex OpenSplice product complemented by its tool support together encompass the industry's most profound expertise on the OMG's DDS standard and products.

The result is unrivalled functional DDS coverage and performance in large-scale mission-critical systems, fault tolerance in information availability, and total lifecycle support including round-trip engineering. A complete DDS solution to ensure a customer's successful adoption of this exciting new technology and to support delivery of the highest-quality applications with the shortest time to market in the demanding real-time world.

## PRODUCT DETAILS

### 3.1 Key Components

Vortex OpenSplice includes the key components listed here.

#### 3.1.1 Services

- **Domain Service** (spliced) Manages a DDS domain.
- **Durability Service** Responsible for handling non-volatile data.
- **Networking Service** (RTNetworking or DDSI2) Responsible for handling communication between a node and the rest of the nodes on 'the network'.
- **Tuner Service** (cmsoap) Responsible for providing remote SOAP-based access to a deployed DDS system by providing a control-and-monitoring (C&M) API
- **Networking Bridge Service** Responsible for bridging DDS traffic between multiple networks (each with a related Networking Service)
- **Recording and Replay Service** Responsible for recording and replaying of real-time DDS data, controlled a topic-based API (as also used by the Vortex RnR Manager tool)
- **DBMS Connect Service** Responsible for bi-directional bridging between DDS and a relational database (RDBMS) system

#### 3.1.2 Tools

- **IDL Preprocessor** Generates topic types, type-specific readers and writers.
- **OpenSplice Tuner** Allows local and/or remote 'white-box' inspection and tuning of a deployed Vortex OpenSplice federation and/or application.
- **OpenSplice Tester** Allows for script-based 'black-box' regression-testing of locally or remotely deployed Vortex OpenSplice Systems.
- **OpenSplice Configurator** Simplifies the process for configuring the services.
- **mmstat** Helps to monitor the memory usage within Vortex OpenSplice.

### 3.1.3 Key Features

- Vortex OpenSplice is the most complete second generation OMG DDS implementation that supports all DCPS profiles.
- It is proven in the field for a decade of deployment in mission critical environments.
- It targets both real-time embedded and large-scale fault-tolerant systems.
- It is Highly optimised implementation from DDS users for DDS users.
- It offers total lifecycle support from prototyping through to remote maintenance.
- Vortex OpenSplice supports both Single Process (library) and Shared Memory (federated) deployment architectures, targeting either ease of use or advanced scalability and determinism scenarios.

## 3.2 Language and Compiler Bindings

The Vortex OpenSplice DCPS API is available for the following languages:

- C
- C++ (including OMG's latest ISO-C++ API)
- C#
- Java (including OMG's latest Java5 API)
- Python
- Node.js

With Vortex OpenSplice, there is also the ability to use the DDS and DCPS APIs in CORBA cohabitation mode. Cohabitation allows you to use objects in both DCPS and CORBA without copying them from one representation to the other. This means that CORBA objects can be published directly in DCPS and the other way around. There is no difference in the DDS API, only in the generated code produced by the `idlpp` tool in the development process. Vortex OpenSplice has CORBA cohabitation for C++ and Java, using (by default) OpenFusion TAO and OpenFusion JacORB. Other variations are available, please check the *Release Notes* for full platform and language ORB coverage.

The full range of language bindings available is:

- C (Standalone only) - `sac`
- C++ (Standalone and CORBA Cohabitation) - `isocpp2 / sacpp / ccpp`
- C# (Standalone only) - `sacs`
- Java (Standalone and CORBA Cohabitation) - `saj / saj5 / cj`
- Python
- Node.js

Vortex OpenSplice is delivered with a preset compiler for C++. Details of this can be found in the *Release Notes*.

These compilers are the officially-supported set, but we have experience of customers who will use the delivered libraries with slight variants of the compiler. In most cases this works, but ADLINK has provided the source code so that customers can rebuild the C++ APIs for their compiler of choice.



**NOTE:** ADLINK only provides support on the officially-supported platforms due to difficult-to-fix issues with compiler-generated code, but some customers will fund us to qualify OpenSplice on their platform. If you wish to use a variant of an official platform, then as long as the issue can be recreated on the official platform it will

be covered under an Vortex OpenSplice support contract. If you wish to request support on a specific platform then please contact ADLINK (<https://www.adlinktech.com/en/data-distribution-service>)

### 3.3 Interaction patterns

Apart from the DDS pub/sub interaction pattern (DCPS), Vortex OpenSplice also supports the following additional patterns modeled on top of DDS:

- RMI (a request-reply API based on modeled interfaces in IDL)
- Streams (a streaming-data API based on transparent batching of samples)

### 3.4 Support for evolutionary data models

Apart from the OMG IDL based data-modeling, Vortex OpenSplice also supports modeling of evolutionary types using the popular Google Protocol Buffers (GPB) technology (and the related .proto files).

### 3.5 Building your own C++

#### 3.5.1 Building your own ISO C++ API

The Vortex OpenSplice DCPS API for the ISO C++ language binding without CORBA cohabitation is delivered using a specific compiler.

To be able to use a different compiler with the Vortex OpenSplice ISO C++ API, we deliver the source code for this language with the OpenSplice DDS distribution. This is contained in a directory `<Vortex OpenSplice Installation directory>/custom_lib/isocpp` together with a README file describing how to generate the custom library.

#### 3.5.2 Building your own Standalone C++ API

The Vortex OpenSplice DCPS API for the C++ language binding without CORBA cohabitation is delivered using a specific compiler.

To be able to use a different compiler with the Vortex OpenSplice Standalone C++ API, we deliver the source code for this language with the Vortex OpenSplice distribution. This is contained in a directory `<Vortex OpenSplice Installation directory>/custom_lib/sacpp` together with a README file describing how to generate the custom library.

### 3.6 Platforms

The platforms supported by Vortex OpenSplice are listed in the Release Notes.

Please refer to *Platform-specific Information* for information about using Vortex OpenSplice on specific platforms.

## DOCUMENTATION AND SUPPORT

*The Vortex OpenSplice documentation set provides detailed information about Vortex OpenSplice, including its API, usage, installation and configuration.*

*The following table lists all of the documentation and manuals included with Vortex OpenSplice. The table includes brief descriptions of the documents and their likely users.*





## 4.1 Vortex OpenSplice Documentation Set

Document	Description and Use
Release Notes	Lists the latest updates, bug fixes, and last-minute information. For product installers, administrators, and developers, who need to be aware of the latest changes which may affect the Service's performance and usage. A link to the Release Notes is in <code>index.html</code> located in the directory where Vortex OpenSplice is installed.
Getting Started Guide	General information about Vortex OpenSplice, including installation instructions, initial configuration requirements and instructions for running the Opensplice examples on supported platforms. For managers, administrators, and developers to gain an initial understanding of the product, as well as for product installers for installing and administering Vortex OpenSplice. <i>Essential reading for users new to DDS.</i>
Evaluation Guide	A short guide to help new users evaluate Vortex OpenSplice.
Tutorial Guide	A short course on developing applications with Vortex OpenSplice. Includes example code in C, C++ and Java.
Deployment Guide	<i>A complete reference on how to configure and tune the Vortex OpenSplice service.</i>
Tuner Guide	Describes how to use the Tuner tool for monitoring and controlling Opensplice. For programmers, testers, system designers and system integrators using Vortex OpenSplice.
IDL Pre-processor Guide	Describes how to use the Vortex Opensplice IDL pre-processor for C, C++ and Java.
OpenSplice Automated Testing and Debugging Tool User Guide	Provides a complete reference on how to configure the 'Tester' tool and how to use it to test scenarios generated with Vortex OpenSplice
C Reference Guide	Each of these reference guides describes the Vortex OpenSplice Application Programmers Interface (API) for C, Classic C++ and Classic Java.
C++ Reference Guide	This is a detailed reference for developers to help them to understand the particulars of each feature of the Vortex OpenSplice API.
Java Reference Guide	
C# Reference Guide	Describes the Vortex OpenSplice APIs for C#, the new ISO C++ and Java 5 Supplied as HTML rather than PDF with the product Release Notes.
ISO C++ Reference Guide	
Java 5 Reference Guide	
RMI over DDS Getting Started Guide	Explains how to take advantage of the client/server interaction paradigm provided by Vortex OpenSplice RMI layered over the publish/subscribe paradigm of Vortex OpenSplice.
Streams User Guide	Explains the Streams API where continuous flows or streams of data have to be transported with minimal overhead and therefore maximal achievable throughput.
GPB User Guide	Explains how to use Google Protocol Buffers with the new ISO C++ and Java 5 APIs.
Record and Replay Service Guide	Explains how to configure and use the Record and Replay Service.
Security User Configuration Guide	Explains how to configure security when using the Real Time Native Networking Protocol.
Node Monitor	Explains how to the Node Monitor Tool to watch over the Vortex OpenSplice middleware.
Examples	Examples, complete with source code, demonstrating how applications using Opensplice can
<b>4.1. Vortex OpenSplice Documentation Set</b>	<b>14</b> Documentation for the examples can be found in the Vortex OpenSplice Release Notes.
White Papers and Data Sheets	Technical papers providing information about Vortex Opensplice. These technical papers are in PDF format and they can be obtained from the ADLINK web site

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## 4.2 Information Sources

### 4.2.1 Product Information

Links to useful technical information for ADLINK's products, including the Vortex OpenSplice and associated components, are listed below.



These links are provided for the reader's convenience and may become out-of-date if changes are made on the ADLINK Web site after publication of this guide. Nonetheless, these links should still be reachable from the main ADLINK Web page located at <https://www.adlinktech.com/en/data-distribution-service>.

### 4.2.2 Knowledge Base

The ADLINK Knowledge Base is a collection of documents and resources intended to assist our customers in getting the most out of the Vortex OpenSplice products. The Knowledge Base has the most up-to-date information about bug fixes, product issues and technical support for difficulties that you may experience.

The Knowledge Base can be found at:

<https://istkb.adlinktech.com/knowledge-base/>

### 4.2.3 Additional Technical Information

Information provided by independent publishers, newsgroups, web sites, and organisations, such as the Object Management Group, can be found on the ADLINK Web site:

<https://www.adlinktech.com/en/data-distribution-service>

## 4.3 Support

ADLINK provides a range of product support, consultancy and educational programmes to help you from product evaluation and development, through to deployment of applications using Vortex OpenSplice. The support programmes are designed to meet customers' particular needs and range from a basic Standard programme to the Gold programme, which provides comprehensive, 24 x 7 support.

Detailed information about ADLINK's product support services, general support contacts and enquiries are described on the ADLINK Support page reached via the ADLINK Home page at <https://www.adlinktech.com/en/data-distribution-service>.

## INSTALLATION AND CONFIGURATION

Follow the instructions in this chapter to install and configure Vortex OpenSplice and its tools. Information on running the Vortex OpenSplice examples are provided at the end of the chapter under *Examples*.

### 5.1 Vortex OpenSplice Development and Run-Time

Vortex OpenSplice is provided in two installers. The **HDE** (Host Development Environment) is the standard and the **RTS** (Run Time System).

The HDE contains all of the services, libraries, header files and tools needed to develop applications using Vortex OpenSplice, and the RTS is a subset of the HDE which contains all of the services, libraries and tools needed to deploy applications using Vortex OpenSplice.

### 5.2 Installation for UNIX and Windows Platforms

This section describes the normal procedure to install Vortex OpenSplice on a UNIX or Windows platform. The exception is the procedure to install Vortex OpenSplice on a UNIX ARM platform which is described in section *UNIX ARM platform*

#### Step 1

*Install Vortex OpenSplice.*

Run the installation wizard for your particular installation, using:

```
P<code>-VortexOpenSplice<version>-<E>-<platform>.<os>-<comp>-<type>-<target>-installer.<ext>
```

where, some being optional,

<code> - ADLINK's code for the platform <version> - the Vortex OpenSplice version number, for example V6.0

<E> - the environment, either HDE or RTS

<platform> - the platform architecture, for example sparc or x86

<os> - the operating system for example solaris8 or linux2.6

<comp> - the compiler or glibc version

<type> - release, debug or dev, which is release with symbols

<target> - the target architecture for host/target builds.

<ext> - the platform executable extension, either run or exe

The directories in the Vortex OpenSplice distribution are named after the installation package they contain. Each package consists of an archive and its installation procedure.

## Step 2

### Unix

*Configure the Vortex OpenSplice environment variables.*

(This is only necessary on UNIX, as the Windows environment is configured by the Vortex OpenSplice installer.)

Go to the `<install_dir>/<E>/<platform>` directory, where `<E>` is HDE or RTS and `<platform>` is, for example, `x86.linux2.6`.

Source the `release.com` file from the shell command line.

This step performs all the required environment configuration.

## Step 3

Usually not required, but install your desired ORB when the C++ language mapping is used with CORBA cohabitation. Ensure your chosen ORB and compiler is appropriate for the CCPP library being used (either Vortex OpenSplice's default library or other custom-built library). Refer to the *Release Notes* for ORB and compiler information pertaining to Vortex OpenSplice' default CCPP library.

## 5.3 Installation on Other Platforms

Please refer to *Platform-specific Information* for information about using Vortex OpenSplice on platforms other than Unix/Linux and Windows.

## 5.4 Configuration

Vortex OpenSplice is configured using an XML configuration file, as shown under *Example XML Configuration Settings*. It is advisable to use the `osplconf` tool (UNIX) or *Vortex OpenSplice Configurator Tool* (Windows *Start Menu*) to edit your xml files. The configurator tool provides explanations of each attribute and also validates the input.

The default configuration file is `ospl.xml` located in `$OSPL_HOME/etc/config` (alternative configuration files may also be available in this directory, to assist in other scenarios). The default value of the environment variable `OSPL_URI` is set to this configuration file.

The configuration file defines and configures the following Vortex OpenSplice services:

***spliced*** The default service, also called the domain service; the domain service is responsible for starting and monitoring all other services.

***durability*** This service is responsible for storing non-volatile data and keeping it consistent within the domain (optional).

***networking*** This service realizes user-configured communication between the nodes in a domain.

***tuner*** This service provides a SOAP interface for the Vortex OpenSplice Tuner to connect to the node remotely from any other reachable node.

The default deployment specified by the XML configuration file is for a *Single Process* deployment. This means that the Vortex OpenSplice Domain Service, database administration and associated services are all started within the DDS application process. This is implicitly done when the user's application invokes the `DDS create_participant` operation.

The deployment mode and other configurable properties can be changed by using a different OSPL\_URI file. Several sample configuration files are provided at the same location.



If using a shared memory configuration, a `<Database>` attribute is specified in the XML configuration. The default Database Size that is mapped on a shared memory segment is 10 Megabytes.



*Note:* The maximum user-creatable shared-memory segment is limited on certain machines, including Solaris, so it must either be adjusted or Vortex OpenSplice must be started as root.

A complete configuration file that enables durability as well as Real Time Native Networking is shown below. (The relevant lines are not enabled in the default configuration file, but editing them will allow you to enable support for *PERSISTENT* data (instead of just *TRANSIENT* or *VOLATILE* data) and to use multicast instead of broadcast.)

Adding support for *PERSISTENT* data requires you to add the `<Persistent>` element to the `<DurabilityService>` content (see the relevant lines in the XML example shown below). In this `<Persistent>` element you can then specify the actual path to the directory for persistent-data storage (if it does not exist, the directory will be created). In the example below this directory is `/tmp/Pdata`.

For the networking service, the network interface-address that is to be used is specified by the `<NetworkInterfaceAddress>` element. The default value is set to `first available`, meaning that Vortex OpenSplice will determine the first available interface that is broadcast or multicast enabled. However, an alternative address may be specified as well (specify as `a.b.c.d`).

The network service may use separate channels, each with their own name and their own parameters (for example the port-number, the queue size, and, if multicast enabled, the multicast address). Channels are either reliable (all data flowing through them is delivered reliably on the network level, regardless of QoS settings of the corresponding writers) or not reliable (all data flowing through them is delivered at most once, regardless of QoS settings of the corresponding writers). The idea is that the network service chooses the most appropriate channel for each DataWriter, *i.e.* the channel that fits its QoS settings the best.

Usually, networking shall be configured to support at least one reliable and one non-reliable channel. Otherwise, the service might not be capable of offering the requested reliability. If the service is not capable of selecting a correct channel, the message is sent through the default channel. The example configuration defines both a reliable and a non-reliable channel.

The current configuration uses broadcast as the networking distribution mechanism. This is achieved by setting the `Address` attribute in the `GlobalPartition` element to `broadcast`, which happens to be the default value anyway. This `Address` attribute can be set to any multicast address in the notation `a.b.c.d` in order to use multicast.



If multicast is required to be used instead of broadcast, then the operating system's multicast routing capabilities must be configured correctly.

See the *Vortex OpenSplice Deployment Manual* for more advanced configuration settings.

### Example XML Configuration Settings

```
<OpenSpliceDDS>
  <Domain>
    <Name>OpenSpliceDDSV6.6</Name>
    <Database>
      <Size>10485670</Size>
    </Database>
    <Lease>
      <ExpiryTime update_factor="0.05">60.0</ExpiryTime>
    </Lease>
    <Service name="networking">
      <Command>networking</Command>
    </Service>
  </Domain>
</OpenSpliceDDS>
```

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```

</Service>
<Service name="durability">
  <Command>durability</Command>
</Service>
</Domain>
<NetworkService name="networking">
  <General>
    <NetworkInterfaceAddress>
      first available
    </NetworkInterfaceAddress>
  </General>
  <Partitioning>
    <GlobalPartition Address="broadcast"/>
  </Partitioning>
  <Channels>
    <Channel name="BestEffort" reliable="false"
      default="true">
      <PortNr>3340</PortNr>
    </Channel>
    <Channel name="Reliable" reliable="true">
      <PortNr>3350</PortNr>
    </Channel>
  </Channels>
</NetworkService>
<DurabilityService name="durability">
  <Network>
    <InitialDiscoveryPeriod>2.0</InitialDiscoveryPeriod>
    <Alignment>
      <RequestCombinePeriod>
        <Initial>2.5</Initial>
        <Operational>0.1</Operational>
      </RequestCombinePeriod>
    </Alignment>
    <WaitForAttachment maxWaitCount="10">
      <ServiceName>networking</ServiceName>
    </WaitForAttachment>
  </Network>
  <NameSpaces>
    <NameSpace durabilityKind="Durable"
      alignmentKind="Initial_and_Aligner">
      <Partition>*</Partition>
    </NameSpace>
  </NameSpaces>
  <Persistent>
    <StoreDirectory>/tmp/Pdata</StoreDirectory>
  </Persistent>
</DurabilityService>
</OpenSplice>

```

### 5.4.1 Example configuration files

Vortex OpenSplice is delivered with a set of ready-made configuration files which provide a quick way of achieving different setups.

*ospl\_shmem\_dds.xml* Federated deployment using shared-memory and standard DDSI networking.

*ospl\_shmem\_dds2e.xml* Federated deployment using shared-memory and extended DDSI networking.

*ospl\_shmem\_nativeRT.xml* Federated deployment using shared-memory and RTNetworking.

*ospl\_shmem\_no\_network.xml* Federated deployment using shared-memory only (*i.e.* without networking).

*ospl\_shmem\_secure\_nativeRT.xml* Federated deployment using shared-memory and secure RTNetworking.

*ospl\_sp\_dds.xml* Stand-alone ‘single-process’ deployment and standard DDSI networking.

*ospl\_sp\_dds\_nativeRT\_cohabitation.xml* Stand-alone ‘single-process’ deployment using DDSI and RTNetworking in cohabitation mode.

*ospl\_sp\_nativeRT.xml* Stand-alone ‘single-process’ deployment using RTNetworking.

*ospl\_sp\_dds\_statistics.xml* Stand-alone ‘single-process’ deployment with DDSI networking and enabled statistics.

*ospl\_sp\_no\_network.xml* Stand-alone ‘single-process’ deployment without networking connectivity.

## 5.5 Examples

A great way to get started with Vortex OpenSplice is to try running the examples provided with the product. There are many examples in different languages and some with the CORBA cohabitation, showing different aspects of the DCPS API. To give you a feel for how powerful DDS is then we recommend trying *PingPong* and the *Tutorial*, as well as the *RoundTrip* and *Throughput*.

The way to build and run the examples is dependent on the Platform you are using. Each example has HTML documentation explaining how to build and run it on Unix/Linux and Windows systems.

For VxWorks and Integrity, please refer to *VxWorks 5.5.1*, *VxWorks 6.x RTP*, and *Integrity* in this *Guide*.

### 5.5.1 Using the Vortex OpenSplice Tools



*Note:* The following instructions apply only to the *shared memory* deployment of Vortex OpenSplice. When deploying in single process configuration, there is no need to manually start the Vortex OpenSplice infrastructure prior to running a DDS application process, as the administration will be created within the application process. Please refer to the Vortex OpenSplice *Deployment Guide* for a discussion of these deployment architectures.

The Vortex OpenSplice infrastructure can be stopped and started from the Windows *Start Menu*, as well as the Tuner and Configurator.

#### Step 1

*Manually start the Vortex OpenSplice infrastructure*

1. Enter `ospl start` on the command line<sup>1</sup>. This starts the Vortex OpenSplice services.

These log files may be created in the current directory when Vortex OpenSplice is started:

*ospl-info.log* - contains information and warning reports

*ospl-error.log* - contains error reports

<sup>1</sup> `ospl` is the command executable for Vortex OpenSplice.





If Vortex OpenSplice is used as a Windows Service then the log files are re-directed to the path specified by OSPL\_LOGPATH. (Use the *set* command in the Vortex OpenSplice command prompt to see the OSPL\_LOGPATH value.)

## Step 2

*Start the Vortex OpenSplice Tuner Tool*

1. Read the *Vortex OpenSplice Tuner Guide* (`TunerGuide.pdf`) before running the Tuner Tool.
2. Start the tool by entering `ospl tun` on the command line.



The URI required to connect is set in the OSPL\_URI environment variable (the default URI is: `file://$OSPL_HOME/etc/config/ospl.xml`).

The Vortex OpenSplice system can now be monitored.

## Step 3

*Experiment with the Vortex OpenSplice tools and applications*

Use the Vortex OpenSplice Tuner to monitor all DDS entities and their (dynamic) relationships.

## Step 4

*Manually stop the Vortex OpenSplice infrastructure*

1. Choose *File > Disconnect* from the Vortex OpenSplice Tuner menu.
2. Enter `ospl stop` on the command line; this stops all Vortex OpenSplice services.

## USING VORTEX OPENSPLICE WITH VORTEX LINK

If Vortex OpenSplice is deployed using the *DDSI2/DDSI2E* network-services in a LAN or a private cloud (multicast-enabled cloud) and Vortex Link is configured to discover user applications using UDP-multicast in the LAN/private cloud, then Vortex OpenSplice does not need to be configured with any particular configuration property as Vortex Link will discover and communicate with Vortex OpenSplice using the standardized multicast IP address and UDP ports. The only constraint is that both Vortex OpenSplice and Vortex Link are configured to participate in the same DDS domain (*domainID*).


If Vortex OpenSplice is deployed in a WAN (without multicast-support), then it needs to be configured to use the TCP transport. It also needs to be configured with the peers of one or several Discovery Services (DS) of the deployed Vortex Link. If multiple DS's are available, Vortex OpenSplice may be configured with several discovery service peers in a peers group.

### Example with a single discovery service locator:

```
<DDSI2Service name="ddsi2">
<General>
.....
  </General>
<TCP>
<Enable>True</Enable>
</TCP>
<Discovery>
<Peers>
<Peer>1.1.1.1:7400</Peer>
</Peers>
</Discovery>
```

### Example with two discovery service locators:

```
<Discovery>
<Peers>
<Peer>1.1.1.1:7400</Peer>
<Peer>2.2.2.2:7400</Peer>
</Peers>
</Discovery>
```

 **NOTE:** Unlike when deployed on a multicast LAN (where the *domainID* determines the multicast-address used for discovery), the addressed DS of Vortex Link will discover (and subsequently match) data from *any* DDS-domain utilized by Vortex OpenSplice. Utilizing multiple Vortex Link discovery services in the WAN (*i.e.* one per domain) allows for domain-specific discovery and subsequent routing if required.

## LICENSING VORTEX OPENSPLICE

*Vortex OpenSplice uses Reprise License Manager (RLM) to manage licenses. This section describes how to install a license file for Vortex OpenSplice and how to use the license manager.*

### 7.1 General

The licensing software is automatically installed on the host machine as part of the Vortex OpenSplice distribution. The software consists of two parts:

- ***Vortex OpenSplice binary files***

which are installed in `<OpenSplice_Install_Dir>/<E>/<platform>.<os>/bin`, where `OpenSplice_Install_Dir` is the directory where Vortex OpenSplice is installed.

- ***License files***

which determine the terms of the license. These will be supplied by ADLINK.



**Licenses:** ADLINK supplies an Vortex OpenSplice license file, `license.lic`. This file is *not* included in the software distribution, but is sent separately by ADLINK.

### 7.2 Development and Deployment Licenses

Development licenses are on a per Single Named Developer basis. This means that each developer using the product requires a license. Vortex OpenSplice is physically licensed for development purposes. Vortex OpenSplice is also physically licensed on enterprise platforms for deployment.



Some Vortex OpenSplice components are licensed individually and you will need the correct feature to be unlocked for you to use them.

## 7.3 Installing the License File

Copy the license file to `<OpenSplice_Install_Dir>/etc/license.lic` on the machine that will run the license manager. `<OpenSplice_Install_Dir>` is the directory where Vortex OpenSplice is installed.

This is the recommended location for the license file but you can put the file in any location that can be accessed by the license manager `rlm`.

If another location is used or the environment has not been setup, then an environment variable, either `RLM_LICENSE` or `ADLINK_LICENSE`, must be set to the full path and filename of the license file (either variable can be set; there is no need to set both). For example:

```
ADLINK_LICENSE=/my/lic/dir/license.lic
```

If licenses are distributed between multiple license files, the `RLM_LICENSE` or `ADLINK_LICENSE` variable can be set to point to the directory which contains the license files.

## 7.4 Running the License Manager Daemon

It is only necessary to run the License Manager Daemon for floating or counted licenses. In this case, the license manager must be running before Vortex OpenSplice can be used. The license manager software is responsible for allocating licenses to developers and ensuring that the allowed number of concurrent licenses is not exceeded.

For node-locked licenses, as is the case with all evaluation licenses, then it is not necessary to run the License Manager Daemon but the `RLM_LICENSE` or `ADLINK_LICENSE` variable must be set to the correct license file location.

To run the license manager, use the following command:

```
rlm -c <location>
```

where `<location>` is the full path and filename of the license file. If licenses are distributed between multiple files, `<location>` should be the path to the directory that contains the license files.

The `rlm` command will start the ADLINK vendor daemon `prismtech`, which controls the licensing of the Vortex OpenSplice software.

To obtain a license for Vortex OpenSplice from a License Manager Daemon that is running on a different machine, set either the `RLM_LICENSE` or `ADLINK_LICENSE` environment variable to point to the License Manager Daemon, using the following syntax:

```
RLM_LICENSE=<port>@<host>
```

where `<port>` is the port the daemon is running on and `<host>` is the host the daemon is running on.

The port and host values can be obtained from the information output when the daemon is started. The format of this output is as shown in the following example:

```
07/05 12:05 (rlm) License server started on rhel4e
07/05 12:05 (rlm) Server architecture: x86_12
07/05 12:05 (rlm) License files:
07/05 12:05 (rlm) license.lic
07/05 12:05 (rlm)
07/05 12:05 (rlm) Web server starting on port 5054
07/05 12:05 (rlm) Using TCP/IP port 5053
07/05 12:05 (rlm) Starting ISV servers:
07/05 12:05 (rlm) ... prismtech on port 35562
```

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```

07/05 12:05 (prismtech) RLM License Server Version 9.1BL3 for ISV "prismtech"
07/05 12:05 (prismtech) Server architecture: x86_12

Copyright (C) 2006-2011, Reprise Software, Inc. All rights reserved.

RLM contains software developed by the OpenSSL Project
for use in the OpenSSL Toolkit (http://www.openssl.org)
Copyright (c) 1998-2008 The OpenSSL Project. All rights reserved.
Copyright (c) 1995-1998 Eric Young (eay@cryptsoft.com) All rights
reserved.

07/05 12:05 (prismtech)
07/05 12:05 (prismtech) Server started on rhel4e (hostid: 0025643ad2a7) for:
07/05 12:05 (prismtech) opensplice_product1 opensplice_product2
07/05 12:05 (prismtech)
07/05 12:05 (prismtech) License files:
07/05 12:05 (prismtech) license.lic
07/05 12:05 (prismtech)

```

The <port> value should be taken from the first line of the output. The <server> value should be taken from the last line. From this example, the value for RLM\_LICENSE or ADLINK\_LICENSE would be:

```
35562@rhel4e
```

## 7.5 Utilities

A utility program, `rlmutil`, is available for license server management and administration. One feature of this utility is its ability to gracefully shut down the license manager. To shut down the license manager, preventing the checkout of licenses for the Vortex OpenSplice software, run either of the following commands:

```

rlmutil rlmshutdown -vendor prismtech

rlmutil rlmshutdown -c <location>

```

where <location> is the full path and filename of the license file.

The `rlmutil` program is also used to generate a host identification code which is used to generate your license key. To generate the code, run the following command on the license server:

### Linux

```
rlmutil rlmhostid
```

### Windows

```
rlmutil rlmhostid ether
```

This returns an ID code for the server, which will look similar to:

```
Hostid of this machine: 0025643ad2a7
```

This ID code must be supplied to ADLINK so that your license key can be generated.

## LAUNCHER

*The Launcher application provides easy access to all of the tools, documentation, configurations, and examples bundled with Vortex OpenSplice.*

### 8.1 The Launcher utility

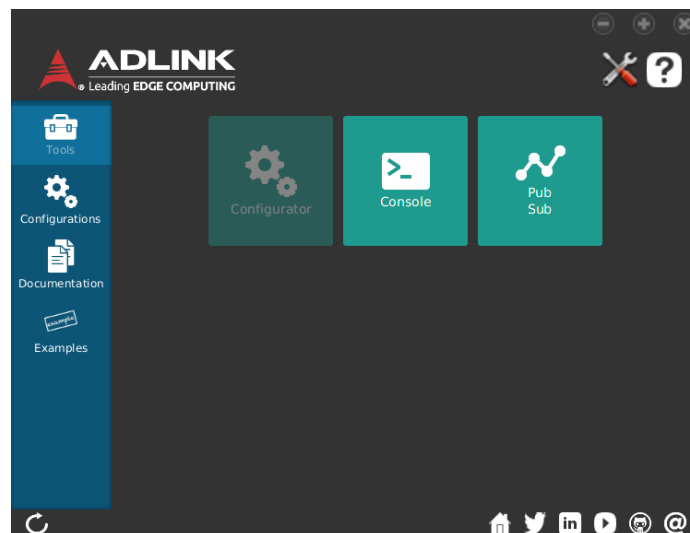


Fig. 1: The Launcher utility

### 8.2 Starting the Launcher

The Launcher's content is populated based on the environment variables available at the time it is started. If the command line is used then the correct release script must be sourced from the Vortex OpenSplice home directory before starting the Launcher.

#### Unix and Linux

**Unix**

**Linux**

Source the `release.com` file from the shell command line to set up the Vortex OpenSplice environment.

To start Launcher, enter the following command in the shell:

```
osp1launcher
```

## Windows

### Windows

Open an *Vortex OpenSplice Command Prompt* and enter the following command:

```
osp1launcher.bat
```

You can also start Launcher from the Windows *Start Menu*, which will set the environment variables of the Vortex OpenSplice instance appropriately.

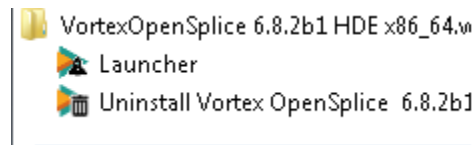


Fig. 2: Starting the Launcher from Windows Start menu

## 8.3 Stopping the Launcher

### Unix and Linux

#### Unix

#### Linux

In the terminal where the `osp1launcher` file was executed, enter `CTRL+C`, or close the Launcher application windows using the *X* button.

### Windows

#### Windows

Close the Launcher application windows using the *X* button.

## 8.4 Troubleshooting Improper Startup

### Launcher starts up with incorrect, missing, or no content at all

Check the following:

#### Linux

On Linux, ensure that the *release.com* was called prior to starting the Launcher.

#### Windows

On Windows, ensure you use the *Vortex OpenSplice Command Prompt*, or you can use the Windows command prompt if you call the *release.bat* script prior to starting the Launcher.

If previous versions of Vortex OpenSplice were used with Launcher, verify that `USER_HOME.olauncherprefs` does not contain any overridden values pointing to non-existent directories or files.

### Launcher starts up but cannot compile or clean example code

Ensure that you have permissions to modify the permissions of `OSPL_HOME/examples` and any user-specified configuration directories, or start Launcher with elevated privileges.

**Launcher starts up but cannot save edited configuration files opened in Configurator that has been started from Launcher**

Ensure that you have modify permissions in the `OSPL_HOME/etc/config/` directory, or start Launcher with elevated privileges.

**Launcher starts up but cannot write log files**

Ensure that you have modify permissions in the `OSPL_HOME/` and its subdirectories, start Launcher with elevated privileges, or start `ospllauncher` from a non-write-protected directory.



## PLATFORM-SPECIFIC INFORMATION

*The remainder of this Guide contains information about using Vortex OpenSplice on platforms other than Unix/Linux and Windows.*

*VxWorks 5.5.1*

*VxWorks 6.x RTP*

*VxWorks 6.x Kernel Mode*

*Integrity*

*Windows CE*

*PikeOS POSIX*

*ELinOS*

## VXWORKS 5.5.1

*This chapter provides a brief description of how to deploy Vortex OpenSplice on VxWorks 5.5.1.*

### 10.1 VxWorks and Tornado

This chapter provides a brief description of how to build the kernel and the supplied examples, and how to run those examples, using VxWorks 5.5.1 and the Tornado *‘front end’*. For more information about VxWorks 5.5.1 and Tornado, please refer to WindRiver’s documentation.



**NOTE:** The examples given here assume that a Solaris-hosted system is being used, and that Vortex OpenSplice is installed in `/usr/local/vxworks5.5.1`.

### 10.2 Building a VxWorks Kernel

#### Required modules

The following modules are the core system components needed to build the Vortex OpenSplice runtime. Please refer to WindRiver’s documentation for additional information describing how VxWorks kernels can be built.

- Operating system components
  - POSIX components
    - \* POSIX timers
    - \* POSIX threads
  - File System and Disk Utilities
    - \* File System and Disk Utilities

#### Additional modules

The modules listed below are optional but are useful for HDE (Host Development Environment) development. These modules are required if deploying from the Tornado front end:

- Development tool components
  - WDB agent components
    - \* WDB agent services
  - WDB target server file system
    - \* symbol table components

- Platform-specific Information
  - synchronize host and target symbol tables
  - target shell components
    - \* target shell

## 10.3 Scenarios for Building the OpenSplice Examples

There are two scenarios included for building and deploying the OpenSplice examples.

- You can build one DKM (Downloadable Kernel Module) containing the example, OpenSplice, and all of its required services and support libraries, as well as a default configuration file. (*This is the recommended approach.*)
- Alternatively, separate DKMs are supplied for each of the OpenSplice libraries and services, and each example can be built as a separate DKM (containing only the example), which we refer to as 'AppOnly' style.

## 10.4 The OpenSplice Examples (All linked in one complete DKM - recommended)

To build the standalone C PingPong example



At the prompt, cd to `examples/dcps/PingPong/c/standalone/`` and run `make`.

### 10.4.1 Note about the example projects

The example builds by linking the object produced by compiling the output of `osplconf2c` along with the example application, the `splice` daemon, and services enabled in the configuration XML, into one single downloadable kernel module.

Users producing their own application could of course decide to link the object and library files into a monolithic kernel image instead.

### 10.4.2 The `osplconf2c` tool

`osplconf2c` is required for example and user applications.

`osplconf2c` is a tool which processes the OpenSplice configuration XML, and produces a source file to be compiled and linked into the final image. It contains the data from the XML file, as well as any environment variables that you require to configure OpenSplice and references to the symbols for the entry points of the OpenSplice services.

Environment variables can be added using the `-e` option. For example, you would use the option `-e "OSPL_LOGPATH=/xxx/yyy"` if you wanted the logs to be placed in `/xxx/yyy`.

The example `makefiles` runs `osplconf2c` automatically.

## 10.5 Overriding OpenSplice configuration at runtime

You can override the OpenSplice configuration XML provided to `osplconf2c` at runtime by specifying the URI of a file when starting `ospl_spliced` on the target. For example:

```
ospl_spliced "file:///tgtsvr/ospl.xml"
```

It should be noted, however, that the `osplconf2c` will have generated references to the symbols for the services which are specified in the xml file when it started, and only those services may be used in the new configuration, as other services will not be included in the image. As an exception to this, if the `-d` option is specified then dynamic loading is supported, and DKMs for additional services will be automatically loaded; DKMs for any required 'libraries' must be pre-loaded by the user.



**NOTE:** Symbol table support will be required in the kernel if the `-d` option is used. Without the `-d` option it should still be possible to statically link OpenSplice with a kernel even if symbol table support is not included, for example for final deployment.

## 10.6 Running the Examples

If you included the additional modules listed above (see *Building a VxWorks Kernel*) in the kernel, deployment is done *via* the target server setup from the Tornado shell connection.

## 10.7 Background

All Vortex OpenSplice tools or services have unique entry points. These entry points all take a string; the string is parsed into the necessary arguments and passed on.

To start `ospl` on a Unix system, the command would be:

```
ospl start file:///ospl.xml
```

and on VxWorks:

```
ospl "start file:///ospl.xml"
```

Note that the arguments are separated by spaces.

Other commands:

```
ospl -> ospl(char *)
spliced -> ospl_spliced(char *)
networking -> ospl_networking(char *)
durability -> ospl_durability(char *)
cmssoap -> ospl_cmssoap(char *)
mmstat -> ospl_mmstat(char *)
shmdump -> ospl_shmdump(char *)
```

The standard 'main' equivalent entry points are:

```

ospl -> ospl_unique_main(int argc, char ** argv)
spliced -> ospl_spliced_unique_main(int argc, char ** argv)
networking -> ospl_networking_unique_main(int argc, char ** argv)
durability -> ospl_durability_unique_main(int argc, char ** argv)
cmsoap -> ospl_cmsoap_unique_main(int argc, char ** argv)
mmstat -> ospl_mmstat_unique_main(int argc, char ** argv)
shmdump -> ospl_shmdump_unique_main(int argc, char ** argv)

```

You can use the standard `argv argc` version entry when you need to use arguments with embedded spaces. For example, for `ospl` you would use:

```

osplArgs = malloc(12)
*osplArgs = "ospl"
*(osplArgs+4) = "start"
*(osplArgs+8) = "file:///tgtsvr/etc/config/ospl.xml"
ospl_unique_main (2, osplArgs)

```

## 10.8 How to start spliced and related services

For the example below the target server filesystem must be mounted as `/tgtsvr` on the target.

To start the `spliced` service and other additional OpenSplice services open a *windsh* and enter the following commands.

```

cd "$OSPL_HOME/examples/dcps/PingPong/c/standalone"
ld 1,0,"sac_pingpong_kernel.out"
ospl_spliced

```

Note that `spliced` will block when invoked by `ospl_spliced` so open a new *windsh* to run the following Pong command:

```
pong ("PongRead PongWrite")
```

After the Pong application has started you can open another *windsh* and start Ping. However, if you are running the Ping application on another target board you must load and start `spliced` on that target also, as described above.

```

ping("100 100 m PongRead PongWrite")
ping("100 100 q PongRead PongWrite")
ping("100 100 s PongRead PongWrite")
ping("100 100 b PongRead PongWrite")
ping("100 100 f PongRead PongWrite")
ping("1 10 t PongRead PongWrite")

```

The `ospl-info.log` file can be inspected to check the deployment has been successful. By default, this is written to the `/tgtsvr` directory.

The `moduleShow` command can be used within the VxWorks shell to see that the service modules have loaded, and the `i` command should show that tasks have started for these services.

## 10.9 The `osplconf2c` command

### Usage

```
osplconf2c -h

osplconf2c [-d [-x]] [-u <URI>] [-e <env=var> ]... [-o <file>]
```

### Options

- h, -?** List available command line arguments and give brief reminders of their functions.
- u <URI>** Specifies the configuration file to use (default: `${OSPL_URI}`).
- o <file>** Name of the generated file.
- e <env=var>** Environment setting for configuration of OpenSplice; *e.g.* `-e "OSPL_LOGPATH=/xxx/yyy"`.
- d** Enable dynamic loading.
- x** Exclude xml.

## 10.10 The OpenSplice Examples (Alternative scenario, with multiple DKMs)



Loading separate DKMs is not recommended by ADLINK.

### Note about the example projects

Please ensure that any services called by a configuration XML contain an explicit path reference within the command tag; for example:

```
<Command>/tgtsvr/networking</Command>
```

### 10.10.1 To build the standalone C pingpong example



At the prompt, `cd` to `examples/dcps/PingPong/c/standalone/` and run

```
make -f Makefile\_AppOnly
```

### 10.10.2 How to start spliced and related services

To start the `spliced` service and other additional OpenSplice services, load the core OpenSplice shared library that is needed by all Vortex OpenSplice applications, and then the `ospl` utility symbols. This can be done using a VxWorks shell on as many boards as needed. The `ospl` entry point can then be invoked to start OpenSplice.

```
cd "$OSPL_HOME"
ld 1,0,"lib/libddscore.so"
ld 1,0,"bin/ospl"
os_putenv("OSPL_URI=file:///tgtsvr/etc/config/ospl.xml")
ospl("start")
```



Please note that in order to deploy the cmssoap service for use with the Vortex OpenSplice Tuner, it must be configured in `ospl.xml` and the libraries named `libbcmxml.so` and `libddsrrstorage.so` must be pre-loaded:

```
ld 1,0,"lib/libddscore.so"
ld 1,0,"lib/libddsrrstorage.so"
ld 1,0,"lib/libbcmxml.so"
ld 1,0,"bin/ospl"
os_putenv("OSPL_URI=file:///tgtsvr/etc/config/ospl.xml")
os_putenv("PATH=/tgtsvr/bin")
ospl("start")
```

### To run the C PingPong example from winsh

**C**

After the `spliced` and related services have started, you can start Pong:

```
cd "$OSPL_HOME"
ld 1,0,"lib/libdcpsgapi.so"
ld 1,0,"lib/libdcpsac.so"
cd "examples/dcps/PingPong/c/standalone"
ld 1,0,"sac_pingpong_kernel_app_only.out"
pong("PongRead PongWrite")
```

After the Pong application has started you can open another `windsh` and start Ping. However, if you are running the Ping application on another target board you must load and start `spliced` on that target also, as described above.

```
ping("100 100 m PongRead PongWrite")
ping("100 100 q PongRead PongWrite")
ping("100 100 s PongRead PongWrite")
ping("100 100 b PongRead PongWrite")
ping("100 100 f PongRead PongWrite")
ping("1 10 t PongRead PongWrite")
```

The `ospl-info.log` file can be inspected to check the deployment has been successful. By default, this is written to the `/tgtsvr` directory.

The `moduleShow` command can be used within the VxWorks shell to see that the service modules have loaded, and the `i` command should show that tasks have started for these services.

### 10.10.3 Load-time Optimisation: pre-loading OpenSplice Service Symbols

Loading `spliced` and its services may take some time if done exactly as described above. This is because the service Downloadable Kernel Modules (DKM) and entry points are dynamically loaded as required by OpenSplice.



It has been noted that the deployment may be slower when the symbols are dynamically loaded from the Target Server File System. However, it is possible to improve deployment times by optionally pre-loading service symbols that are known to be deployed by OpenSplice.

In this case OpenSplice will attempt to locate the entry point symbols for the services and invoke those that are already available. This removes the need for the dynamic loading of such symbols and can equate to a quicker deployment. When the entry point symbols are not yet available (*i.e.* services have not been pre-loaded), OpenSplice will dynamically load the services as usual.

For example, for an OpenSplice system that will deploy `spliced` with the networking and durability services, the following commands could be used:

```
cd "$OSPL_HOME"
ld 1,0,"lib/libddscore.so"
ld 1,0,"bin/ospl"
ld 1,0,"bin/spliced"
ld 1,0,"bin/networking"
ld 1,0,"bin/durability"
os_putenv("OSPL_URI=file:///tgtsvr/etc/config/ospl.xml")
os_putenv("PATH=/tgtsvr/bin")
ospl("start")
```

The `ospl-info.log` file describes whether entry point symbols are resolved having been pre-loaded, or the usual dynamic symbol loading is required.

### 10.10.4 Notes

In this scenario `osplcon2c` has been used with the `-x` and `-d` options to create an empty configuration which allows dynamic loading, and the resulting object has been included in the provided `libddsos.so`.

If desired the end user could create a new `libddsos.so` based on `libddsos.a` and a generated file from `osplconf2c` without the `-x` option, in order to statically link some services but also allow dynamic loading of others if the built-in xml is later overridden with a file URI. (See *Overriding OpenSplice configuration at runtime*.)



## VXWORKS 6.X RTP

*This chapter provides a brief description of how to deploy Vortex OpenSplice on VxWorks 6.x as a Real Time Process.*

### 11.1 VxWorks Real Time Processes

Vortex OpenSplice is deployed on the VxWorks 6.x operating system as Real Time Processes (RTPs). For more information about RTPs please refer to WindRiver's VxWorks documentation.

### 11.2 Installation

The following instructions describe installing Vortex OpenSplice for VxWorks 6.x on the Windows host environment.

Start the installation process by double-clicking the Vortex OpenSplice Host Development Environment (HDE) installer file. Follow the on-screen instructions and complete the installation. When asked to configure the installation with a license file, choose *No*. The installer will create an Vortex OpenSplice entry in *Start > Programs* which contains links to the Vortex OpenSplice tools, documentation, and an Uninstall option.



Please note that WindRiver's Workbench GUI must be run in an environment where the Vortex OpenSplice variables have already been set. If you chose to set the Vortex OpenSplice variables globally during the installation stage, then Workbench can be run directly. Otherwise, Workbench must be run from the Vortex OpenSplice command prompt. Start the command prompt by clicking *Start > Programs > Vortex OpenSplice menu entry > Vortex OpenSplice command prompt*, then start the Workbench GUI. On VxWorks 6.6 the executable is located at

```
<WindRiver root directory>\workbench-3.0\wrwb\platform\eclipse\wrwb-x86-win32.exe
```

This executable can be found by right-clicking on the WindRiver's Workbench *Start* menu item and choosing *Properties*.

### 11.3 VxWorks Kernel Requirements

The VxWorks kernel required to support Vortex OpenSplice on VxWorks 6.x is built using the development kernel configuration profile with the additional posix thread components enabled. A kernel based on this requirement can be built within Workbench, by starting the Workbench GUI and selecting *File > New > VxWorks Image Project*.

Type a name for the project then select the appropriate Board Support Package and Tool Chain (for example cpn805 and gnu). Leave the kernel options to be used as blank, and on the *Configuration Profile* dialog choose PROFILE\_DEVELOPMENT from the drop-down list.

Once the kernel configuration project has been generated, the additional required functionality can be enabled:

- POSIX threads (INCLUDE\_POSIX\_PTHREADS)
- POSIX thread scheduler in RTPs (INCLUDE\_POSIX\_PTHREAD\_SCHEDULER)
- built-in symbol table (INCLUDE\_STANDALONE\_SYM\_TBL)

Note that the Workbench GUI should be used to enable these components so that dependent components are automatically added to the project.

## 11.4 Deploying Vortex OpenSplice

As described in the *Configuration* section, Vortex OpenSplice is started with the Vortex OpenSplice domain service `spliced` and a number of optional services described within the Vortex OpenSplice configuration file (`ospl.xml`). On VxWorks 6.x, a Real Time Process for each of these services is deployed on to the target hardware. The sample `ospl.xml` configuration file provided with the VxWorks 6.x edition of Vortex OpenSplice has particular settings so that these RTPs can operate effectively.

The instructions below describe how to deploy these RTPs using the Workbench GUI and the Target Server File System (TSFS), although the processes can be deployed by using commands and other file system types.

### Step 1

Start the Workbench and create a connection to the target hardware using the *Remote Systems* view.

### Step 2

Create a connection to the host machine. In the *Properties* for the connection, make part of the host's file system available to VxWorks using the TSFS by specifying both the `-R` and `-RW` options to `tgtsvr`. For example, connecting with the option `-R c:\x -RW` will enable read and write access to the contents of the `c:\x` directory from the target hardware under the mount name `/tgtsvr`.

### Step 3

Activate the new connection by selecting it and clicking *Connect*.

### Step 4

With a connection to the target hardware established, create a new RTP deployment configuration for the connection by right-clicking on the connection and choosing *Run > Run RTP on Target...*

### Step 5

Create a new configuration for the *spliced* deployment that points to the `spliced.vxe` executable from the Vortex OpenSplice installation. The following parameters should be set in the dialog:

RTP configuration for <code>spliced.vxe</code>	
Exec Path on Target	<code>/tgtsvr/spliced.vxe</code>
Arguments	<code>file://tgtsvr/ospl.xml</code>
Environment	<code>LD_BIND_NOW=1</code> <code>OSPL_URI=file://tgtsvr/ospl.xml</code> <code>PATH=/tgtsvr</code>
Priority	<code>100</code>
Stack Size	<code>0x10000</code>

For simplicity it has been assumed that `spliced.vxe` and the other executables (located in the `bin` directory of the installation) and `ospl.xml` (located in the `etc/config` directory of the installation) have been copied to the directory made available as `/tgtsvr` described above. It is possible, if required, to copy the entire Vortex OpenSplice installation directory to the `/tgtsvr` location so that all files are available, but please be aware that log and information files will be written to the same `/tgtsvr` location when the `spliced.vxe` is deployed.

The screen shot from Workbench in *Workbench showing spliced deployment configuration* shows this configuration.

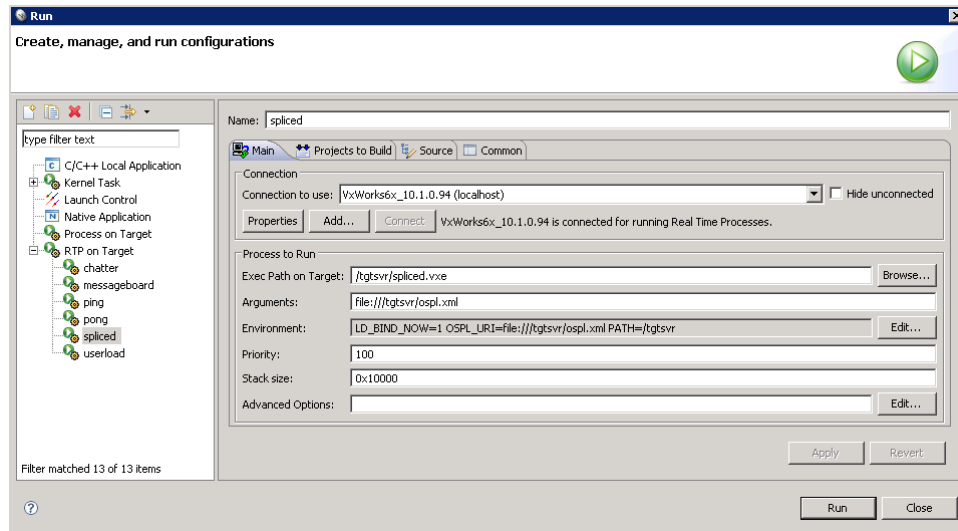


Fig. 1: Workbench showing spliced deployment configuration

The configuration can be deployed by clicking *Run*, where an RTP for each service described in the configuration file should be created. These can be seen in Workbench in the Real Time Processes list for the target connection. An example is shown below in *Workbench showing deployed Vortex OpenSplice RTPs*. (The list may need to be refreshed with the *F5* key.)

Deployment problems are listed in `ospl-error.txt` and `ospl-info.txt`, which are created in the `/tgtsvr` directory if the configuration described above is used.

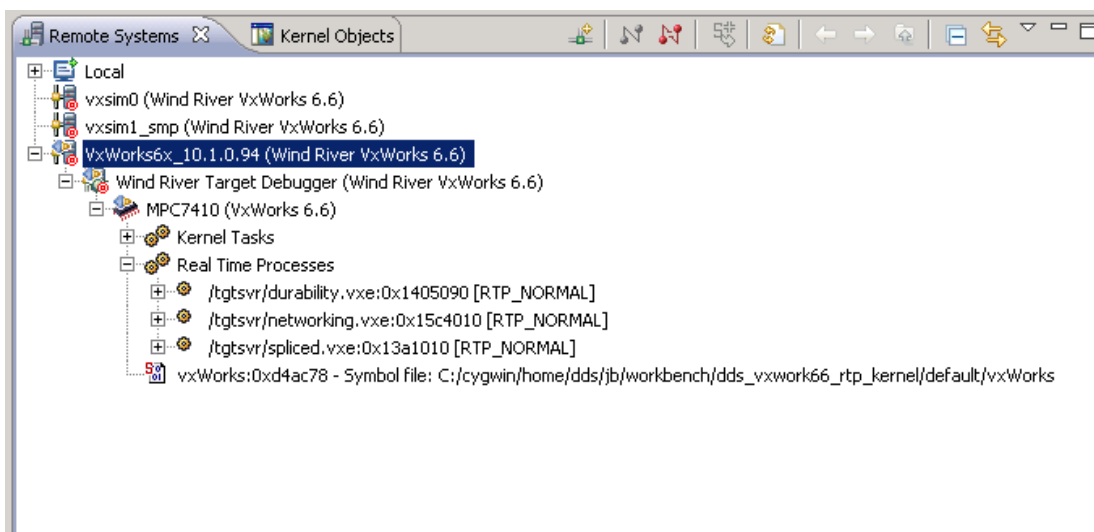


Fig. 2: Workbench showing deployed Vortex OpenSplice RTPs

## 11.5 Vortex OpenSplice Examples

ADLINK provides a number of examples both for C and C++ that are described in the *Examples* section. These examples are provided in the form of Workbench projects which can be easily built and then deployed on to the target hardware in a similar process to that described above.

Each project contains a README file briefly explaining the example and the parameters required to run it.

### 11.5.1 Importing Example Projects into Workbench

The example projects can be imported into Workbench by clicking *File > Import... > General > Existing Projects into Workspace*.

In the *Import Projects* dialog, browse to the `examples` directory of the Vortex OpenSplice installation. Select the required projects for importing from the list that Workbench has detected.

Ensure that the *Copy projects into workspace* box is un-checked.

### 11.5.2 Building Example Projects with Workbench

Projects in a workspace can be built individually or as a group.

- Build a single project by selecting it and then clicking *Project > Build Project*.
- Build all projects in the current workspace by clicking *Project > Build All*.

### 11.5.3 Deploying Vortex OpenSplice Examples

The PingPong and the Tutorial examples are run in identical ways with the same parameters for both C and C++. These should be deployed onto the VxWorks target with the arguments described in the README files for each project.

#### Deploying PingPong

The PingPong example consists of the `ping.vxe` and `pong.vxe` executables. If these executables have been copied to the directory made available as `/tgtsvr` as described in *Deploying Vortex OpenSplice*, RTP configurations should have the following parameters:

RTP configuration for pong	
Exec Path on Target	<code>/tgtsvr/pong.vxe</code>
Arguments	<code>PongRead PongWrite</code>
Environment	<code>LD_BIND_NOW=1</code> <code>OSPL_URI=file://tgtsvr/ospl.xml</code>
Priority	<code>100</code>
Stack Size	<code>0x10000</code>

RTP configuration for ping	
Exec Path on Target	/tgtsvr/ping.vxe
Arguments	10 10 s PongRead PongWrite
Environment	LD_BIND_NOW=1 OSPL_URI=file://tgtsvr/ospl.xml
Priority	100
Stack Size	0x10000

When deployment is successful, the console shows output from both the `ping` and `pong` executables. The console view can be switched to show the output for each process by clicking the *Display Selected Console* button.

### Deploying the Chat Tutorial

The Chat Tutorial consists of the `chatter.vxe`, `messageboard.vxe` and `userload.vxe` executables. If these executables have been copied to the directory made available as `/tgtsvr` as described in *Deploying Vortex OpenSplice*, RTP configurations should have the following parameters:

RTP configuration for userload	
Exec Path on Target	/tgtsvr/userload.vxe
Arguments	
Environment	LD_BIND_NOW=1 OSPL_URI=file://tgtsvr/ospl.xml
Priority	100
Stack Size	0x10000

RTP configuration for messageboard	
Exec Path on Target	/tgtsvr/messageboard.vxe
Arguments	
Environment	LD_BIND_NOW=1 OSPL_URI=file://tgtsvr/ospl.xml
Priority	100
Stack Size	0x10000

RTP configuration for chatter	
Exec Path on Target	/tgtsvr/chatter.vxe
Arguments	1 User1
Environment	LD_BIND_NOW=1 OSPL_URI=file://tgtsvr/ospl.xml
Priority	100
Stack Size	0x10000

When deployment is successful, the console will show output from each RTP. In particular the message board will show the messages sent by the `chatter` process. The console view can be switched to show the output for each process by clicking the *Display Selected Console* button.

## VXWORKS 6.X KERNEL MODE

*This chapter provides a brief description of how to build the kernel and the supplied examples, and how to run those examples, using VxWorks 6.x kernel and the Workbench front end. For more information about VxWorks 6.x, please refer to WindRiver's documentation.*

### 12.1 VxWorks Kernel Requirements

The VxWorks kernel required to support Vortex OpenSplice on VxWorks 6.x is built using the development kernel configuration profile with the additional posix thread components enabled. A kernel based on this requirement can be built within Workbench, by starting the Workbench GUI and choosing *File > New > VxWorks Image Project*.

### 12.2 Deploying Vortex OpenSplice

Type a name for the project then select the appropriate Board Support Package and Tool Chain (for example pcPentium4 and gnu).

Leave all of the kernel options to be used blank except for the *SMP* option, which must match the Vortex OpenSplice build you are working with.



The *SMP* option must *only* be checked for SMP builds of OpenSplice.

On the *Configuration Profile* dialog choose PROFILE\_DEVELOPMENT from the drop-down list.

Once the kernel configuration project has been generated, the additional required functionality can be enabled:

- POSIX threads (INCLUDE\_POSIX\_PTHREADS)
- built-in symbol table (INCLUDE\_STANDALONE\_SYM\_TBL)
- synchronize host and target symbol tables
- target shell components
  - target shell

To successfully complete the C++ examples you will also require

- C++ components > standard library (FOLDER\_CPLUS\_STDLIB)

Note that the Workbench GUI should be used to enable these components so that dependent components are automatically added to the project.

### 12.2.1 Special notes for this platform



If any kernel tasks which will call onto OpenSplice API's are to be created before `ospl_spliced` is started then the user must ensure that the function `os_procInstallHook` (which takes no parameters) is called *before* they are started. There only needs to be one call to `os_procInstallHook`; however, multiple calls are harmless.

## 12.3 OpenSplice Examples

ADLINK provides the *pingpong* example both for C and C++ that are described in the *Examples* section. These examples are provided in the form of Workbench projects which can be easily built and then deployed on to the target hardware in a similar process to that described above.

Each project contains a README file briefly explaining the example and the parameters required to run it.

### 12.3.1 Importing Example Projects into Workbench

The example projects can be imported into Workbench by choosing *File > Import... > General > Existing Projects into Workspace*.

In the *Import Projects* dialog, browse to the `examples` directory of the OpenSplice installation. Select the required projects for importing from the list that Workbench has detected.

Ensure that the *Copy projects into workspace* box is un-checked.

### 12.3.2 Building Example Projects with Workbench

Projects in a workspace can be built individually or as a group.

- Build a single project by selecting it and then clicking *Project > Build Project*.
- Build all projects in the current workspace by clicking *Project > Build All*.

## 12.4 Running the Examples (All linked in one complete DKM – *recommended*)

### Scenarios for building the OpenSplice examples

There are two included scenarios for build and deployment of the OpenSplice examples.

- You can build one DKM (Downloadable Kernel Module) containing the example, OpenSplice, and all of its required services and support libraries, as well as a default configuration file. (*This is the recommended approach.*)
- Alternatively, separate DKMs are supplied for each of the OpenSplice libraries and services, and each example can be built as a separate DKM (containing only the example), which we refer to as *'AppOnly'* style.



## 12.4.1 Running the examples on two targets

### The C pingpong example

**C**

#### Step 1

Right-click on `wb_sac_pingpong_kernel` and then choose *Rebuild Build Project*.

#### Step 2

Next configure the targets to use the target server filesystem, mapped as on the target as `/tgtsvr`.

#### Step 3

Copy the newly-built `wb_sac_pingpong_kernel/PENTIUM4gnu/sac_pingpong_kernel/Debug/sac_pingpong_kernel.out` to the target server for each board as `sac_pingpong_kernel.out`.

#### Step 4

Open a target shell connection to each board and in the C mode shell run:

```
ld 1,0,"/tgtsvr/sac_pingpong_kernel.out"
ospl_spliced
```

#### Step 5

Open another target shell connection to one board and run:

```
pong "PongRead PongWrite"
```

#### Step 6

Open another target shell on the other board and run:

```
ping "100 100 m PongRead PongWrite"
ping "100 100 q PongRead PongWrite"
ping "100 100 s PongRead PongWrite"
ping "100 100 b PongRead PongWrite"
ping "100 100 f PongRead PongWrite"
ping "1 10 t PongRead PongWrite"
```

### The C++ pingpong example

**C++**

#### Step 1

Right-click on `wb_sacpp_pingpong_kernel` and then choose *Rebuild Build Project*.

#### Step 2

Next configure the targets to use the target server filesystem, mapped as on the target as `/tgtsvr`.

#### Step 3

Copy the newly-built `wb_sacpp_pingpong_kernel/PENTIUM4gnu/sacpp_pingpong_kernel/Debug/sac_pingpong_kernel.out` to the target server for each board as `sacpp_pingpong_kernel.out`.

**Step 4**

Open a target shell connection to each board and in the C mode shell run:

```
ld 1,0, "/tgtsvr/sacpp_pingpong_kernel.out"
ospl_spliced
```

**Step 5**

Open another target shell connection to one board and run:

```
pong "PongRead PongWrite"
```

**Step 6**

Open another target shell on the other board and run:

```
ping "100 100 m PongRead PongWrite"
ping "100 100 q PongRead PongWrite"
ping "100 100 s PongRead PongWrite"
ping "100 100 b PongRead PongWrite"
ping "100 100 f PongRead PongWrite"
ping "1 10 t PongRead PongWrite"
```

## 12.4.2 Running the examples on one target

### The C pingpong example

**C****Step 1**

Right-click on `wb_sac_pingpong_kernel` and then choose *Rebuild Build Project*.

**Step 2**

Next configure the targets to use the target server filesystem, mapped as on the target as `/tgtsvr`.

**Step 3**

Copy the newly-built `wb_sac_pingpong_kernel/PENTIUM4gnu/sac_pingpong_kernel/Debug/sac_pingpong_kernel.out` to the target server as `sac_pingpong_kernel.out`.

**Step 4**

Open a target shell connection and in the C mode shell run:

```
ld 1,0, "/tgtsvr/sac_pingpong_kernel.out"
ospl_spliced
```

**Step 5**

Open another target shell connection and run:

```
pong "PongRead PongWrite"
```

**Step 6**

Open another target shell and run:

```
ping "100 100 m PongRead PongWrite"
ping "100 100 q PongRead PongWrite"
ping "100 100 s PongRead PongWrite"
ping "100 100 b PongRead PongWrite"
ping "100 100 f PongRead PongWrite"
ping "1 10 t PongRead PongWrite"
```

## The C++ pingpong example

**C++**

### Step 1

Right-click on `wb_sacpp_pingpong_kernel` and then choose *Rebuild Build Project*.

### Step 2

Next configure the targets to use the target server filesystem, mapped as on the target as `/tgtsvr`.

### Step 3

Copy the newly-built `wb_sacpp_pingpong_kernel/PENTIUM4gnu/sacpp_pingpong_kernel/Debug/sacpp_pingpong_kernel.out` to the target server as `sacpp_pingpong_kernel.out`.

### Step 4

Open a target shell connection and in the C mode shell run:

```
ld 1,0, "/tgtsvr/sacpp_pingpong_kernel.out"
ospl_spliced
```

Open another target shell connection and run: `pong "PongRead PongWrite"`

```
Open another target shell and run:
ping "100 100 m PongRead PongWrite"
ping "100 100 q PongRead PongWrite"
ping "100 100 s PongRead PongWrite"
ping "100 100 b PongRead PongWrite"
ping "100 100 f PongRead PongWrite"
ping "1 10 t PongRead PongWrite"
```

## 12.4.3 Using a different path



If you want or need to use a path other than `/tgtsvr` (e.g. if you are using a different filesystem) then you need to change the path set by the `-e` options of `osplconf2c` in the `.wrmakefile`.



You can also set other environment variables with additional `-e` options.

## 12.4.4 Note about the example projects

The example builds by linking the object produced by compiling the output of `osp1conf2c` along with the example application, the `splice` daemon, and services enabled in the configuration XML, into one single downloadable kernel module. Users producing their own application could of course decide to link the object and library files into a monolithic kernel image instead.

NOTE for VxWorks kernel mode builds of OpenSplice the single process feature of the OpenSplice domain must not be enabled. i.e. “<SingleProcess>true</SingleProcess>” must not be included in the OpenSplice Configuration xml. The model used on VxWorks kernel builds is always that an area of kernel memory is allocated to store the domain database ( the size of which is controlled by the size option in the Database configuration for opensplice as is used on other platforms for the shared memory model. ) This can then be accessed by any task on the same VxWorks node.

## 12.5 Running the Examples (Alternative scenario, with multiple DKMs – ‘AppOnly’ style)



Loading separate DKMs is not recommended by ADLINK.



**C++**

*NOTE:* There are no C++ examples provided for the AppOnly style and there is no `libdcpssacpp.out` DKM because VxWorks only supports C++ modules that are self-contained. However, it should still be possible to link your C++ application with the `libdcpssacpp.a`, and then load the complete DKM after the other OpenSplice DKMs.

### 12.5.1 The C pingpong example



#### Step 1

Right-click on `wb_sac_pingpong_kernel_app_only` for the C example or `wb_sacpp_pingpong_kernel_app_only` for C++, then choose *Rebuild Project*.

#### Step 2

Next configure the targets to use the target server filesystem, mapped on the target as `/tgtsvr` (use different host directories for each target).

#### Step 3

Copy the `osp1.xml` file from the distribution to the target server directories, and adjust for your desired configuration.

#### Step 4

Copy all the services from the `bin` directory in the distribution to the target server directories (for example, `spliced.out`, `networking.out`, *etc.*).

To run the examples on two targets, start the OpenSplice daemons on each target.

#### Step 5

Open a *Host Shell* (`windsh`) connection to each board, and in the C mode shell enter:

```
cd "<path to opensplice distribution>"
ld 1,0,"lib/libddscore.out"
ld 1,0,"bin/ospl.out"
os_putenv("OSPL_URI=file:///tgtsvr/ospl.xml")
os_putenv("OSPL_LOGPATH=/tgtsvr")
os_putenv("PATH=/tgtsvr/")
ospl("start")
```

Please note that in order to deploy the `cmssoap` service for use with the OpenSplice DDS Tuner, it must be configured in `ospl.xml` and the libraries named `libcmxml.out` and `libddsrstorage.out` must be pre-loaded:

```
cd "<path to opensplice distribution>"
ld 1,0,"lib/libddscore.out"
ld 1,0,"lib/libddsrstorage.out"
ld 1,0,"lib/libcmxml.out"
ld 1,0,"bin/ospl.out"
os_putenv("OSPL_URI=file:///tgtsvr/ospl.xml")
os_putenv("OSPL_LOGPATH=/tgtsvr")
os_putenv("PATH=/tgtsvr/")
ospl("start")
```

### Step 6

To load and run the examples:



For the C example:

```
ld 1,0,"lib/libdcpsgapi.out"
ld 1,0,"lib/libdcpsac.out"
cd "examples/dcps/PingPong/c/standalone"
ld 1,0,"sac_pingpong_kernel_app_only.out"
```

### Step 7

Open a new *Host Shell* connection to one board and run:

```
pong "PongRead PongWrite"
```

### Step 8

Open another new *Host Shell* on the other board and run:

```
ping "100 100 m PongRead PongWrite"
ping "100 100 q PongRead PongWrite"
ping "100 100 s PongRead PongWrite"
ping "100 100 b PongRead PongWrite"
ping "100 100 f PongRead PongWrite"
ping "1 10 t PongRead PongWrite"
```

## 12.5.2 Running the examples on one target

Proceed as described in the section above, but make all windsh connections to one board, and only load and run `ospl` once.

### Load-time Optimisation: pre-loading OpenSplice Service Symbols

Loading `spliced` and its services may take some time if done exactly as described above. This is because the service DKMs (Downloadable Kernel Modules) and entry points are dynamically loaded as required by OpenSplice.

**i** It has been noted that the deployment may be slower when the symbols are dynamically loaded from the Target Server File System. However, it is possible to improve deployment times by pre-loading the symbols for the services that are required by OpenSplice.

On startup, OpenSplice will attempt to locate the entry point symbols for the services and invoke them. This removes the need for the dynamic loading of the DKMs providing the symbols, and can equate to a quicker deployment. Otherwise, OpenSplice will dynamically load the service DKMs.

For example, for an OpenSplice system that will deploy `spliced` with the networking and durability services, the following commands could be used:

```
cd "<path to opensplice distribution>"
ld 1,0,"lib/libddscore.out"
ld 1,0,"bin/ospl.out"
ld 1,0,"bin/spliced.out"
ld 1,0,"bin/networking.out"
ld 1,0,"bin/durability.out"
os_putenv("OSPL_URI=file:///tgtsvr/ospl.xml")
os_putenv("PATH=/tgtsvr/bin")
os_putenv("OSPL_LOGPATH=/tgtsvr")
ospl("start")
```

The `ospl-info.log` file records whether entry point symbols were pre-loaded, or a DKM has been loaded.

### Notes



In this scenario `osplconf2c` has been used with the `-x` and `-d` options to create an empty configuration which allows dynamic loading. The resulting object has been included in the supplied `libddsos.out`. If desired, the end user could create a new `libddsos.out` based on `libddsos.a` and a generated file from `osplconf2c` without the `-x` option, in order to statically link some services, but also allow dynamic loading of others if the built-in xml is later overridden using a file URI. (See *Overriding OpenSplice configuration at runtime*.)

### 12.5.3 The osplconf2c tool

osplconf2c is required for example and user applications. osplconf2c is a tool which processes the OpenSplice configuration XML, and produces a source file to be compiled and linked into the final image. It contains the data from the XML file, as well as any environment variables that you require to configure OpenSplice and references to the symbols for the entry points of the OpenSplice services.

Environment variables can be added using the `-e` option. For example, you would use the `-e "OSPL_LOGPATH=/xxx/yyy"` option if you wanted the logs to be placed in `/xxx/yyy`.

osplconf2c is run automatically by the example projects.

#### Overriding OpenSplice configuration at runtime

You can override the OpenSplice configuration XML provided to osplconf2c at runtime by specifying the URI of a file when starting ospl\_spliced on the target; for example: `ospl_spliced "file:///tgtsvr/ospl.xml"`



It should be noted, however, that the osplconf2c will have generated references to the symbols for the services which are specified in the xml file when it started, and only those services may be used in the new configuration, as other services will not be included in the image.

#### The osplconf2c command

##### Usage

```
osplconf2c -h
osplconf2c [-u <URI>] [-e <env=var> ]... [-o <file>]
```

##### Options

- h, -?** List available command line arguments and give brief reminders of their functions.
- u <URI>** Identifies the configuration file to use (default: `${OSPL_URI}`).
- o <file>** Name of the generated file.
- e <env=var>** Environment setting for configuration of OpenSplice e.g. `-e "OSPL_LOGPATH=/xxx/yyy"`

*This chapter provides a brief description of how to deploy Vortex OpenSplice on Integrity.*

## 13.1 Integrity and GHS Multi

The `ospl_projgen` tool is in the `HDE/bin` directory of the DDS distribution. It is a convenience tool provided for the Integrity platform in order to aid in the creation of GHS Multi projects for running the DDS-supplied PingPong example, the Touchstone performance suite, and the Chatter Tutorial. If desired, these generated projects can be adapted to suit user requirements by using Multi and the `ospl_xml2int` tool, which is also described in this chapter.


## 13.2 The `ospl_projgen` Command

### Usage

```
ospl_projgen -h
ospl_projgen [-s <flash\|ram>\|-d] [-n] [-v] [-t <target>]
              [-l <c\|c++>\|c++onc] [-u <URI>] -b <bsp name>
              [-m <board model>] -o <directory> [-f]
```

Arguments shown between square brackets `[ ]` are optional; other arguments are mandatory. Arguments may be supplied in any order. All of the arguments are described in detail below.

### Arguments

- h** List the command line arguments and give brief reminders of their functions.
- s <flash | ram>** Use this argument if you wish to generate a project that will be statically linked with the kernel. The two options for this argument determine whether the resulting kernel image will be a flashable image or a loadable image. If both this argument and the `-d` argument are omitted the default of a statically-linked ram-loadable image will be generated.
- d** Use this argument to produce a project file that will yield a dynamic download image.
-  Arguments `-s` and `-d` are mutually exclusive.
- n** Use this argument if you want to include the GHS network stack in your project.
- v** Use this argument if you want to include filesystem support in your project.



- t <target>** Use this argument to specify which address spaces to include in your project. Use `-t list` to show a list of available targets. (Targets available initially are examples supplied with Vortex OpenSplice and Integrity itself.)
- l <c | c++ | c++onc>** Use this argument to specify the language for your project. The default is `c++`.
- u <URI>** Use this argument to identify which configuration file to use. You can omit this argument if you have the environment variable `OSPL_URI` set, or use it if you want to use a different configuration file from the one referred to by `OSPL_URI`. The default is `$OSPL_URI`. The `xml2int` tool uses this configuration file when generating the Integrate file for your project.
- b <bsp name>** Use this argument to specify the BSP name of your target board. Use `-b list` to show a list of supported target boards.
- m <board model>** Use this argument to specify the model number for the target board. Use `-b <bsp name> -m list` to show a list of supported model numbers. (There are no separate model numbers for *pcx86* boards.)
- o <directory>** Use this argument to specify the output directory for the project files. The name you supply here will also be used as the name for the image file that will be downloaded/flashed onto the Integrity board.
- f** Use this argument to force overwrite of the output directory.

When you run the tool, the output directory specified with the `-o` argument will be created. Go into this directory, run GHS Multi, and load the generated project.

If the output directory already exists and the `-f` argument has been omitted, `ospl_projgen` will exit without generating any code and will notify you that it has stopped.



**NOTE:** The `NetworkInterfaceAddress` configuration parameter is **required** for Integrity nodes which have more than one ethernet interface, as it is not possible to determine which are broadcast/multicast enabled. (See sections 3.5.2.1 and 3.9.2.1 *Element NetworkInterfaceAddress* in the *Vortex Deployment Guide*.)

### 13.2.1 Using mmstat and shmdump diagnostic tools on Integrity

When `mmstat` or `shmdump` targets are specified to `ospl_projgen` an address space will be added to the generated project. There will also be an appropriate `mmstat.c` or `shmdump.c` file generated into the project. In order to configure these, the command line arguments can be edited in the generated `.c` files. The `mmstat` tool can be controlled *via* telnet on port 2323 (by default).

## 13.3 PingPong Example

(Please refer to the *Examples* section for a description of this example application.)



To generate a project for the C++ PingPong example, follow these steps:

### Step 1

The `I_INSTALL_DIR` environment variable must be set to point to the Integrity installation directory on the host machine before running `ospl_projgen`. For example:

```
export I_INSTALL_DIR=/usr/ghs/int509
```

### Step 2

Navigate to the `examples/dcps/standalone/C++/PingPong` directory

**Step 3**

Run `ospl_projgen` with the following arguments:

```
ospl_projgen -s ram -v -n -t pingpong -l c++ -b pcx86 -o projgen
```

**Step 4**

Go into the `projgen` directory, which contains `default.gpj` and a `src` directory. (`default.gpj` is the default Multi project that will build all the sub-projects found in the `src` directory, and the `src` directory contains all the sub-projects and generated files produced by the tool.)

**Step 5**

Start Multi:

```
multi default.gpj
```

You should see a screen similar to the screenshot *Integrity: project defaults* below:

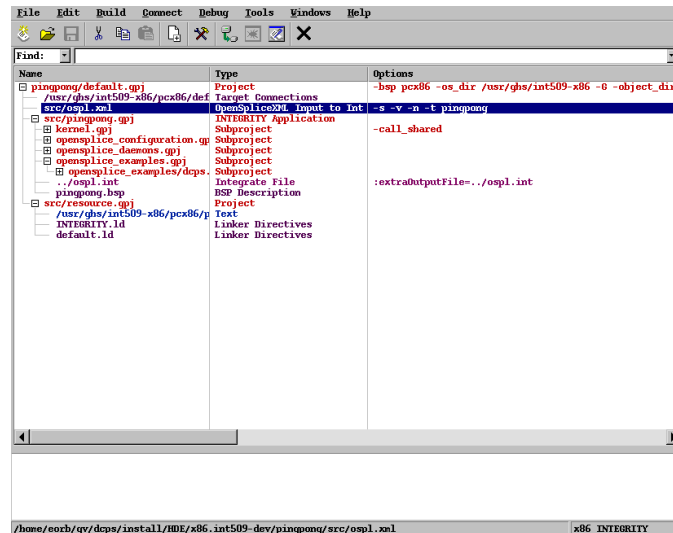


Fig. 1: Integrity: project defaults

If no changes are required to the project, right-click on `default.gpj` and then click *Build* to build the project.

Upon successful completion of the build process, an image is generated (in our case called `projgen`) in the `src` directory and you are now ready to either dynamically download the resulting image to the board or to load the kernel image onto the board (depending on the arguments you have specified) and run the PingPong example.

If `ospl_projgen` is run and the project built as described above, the generated image will contain:

- GHS Integrity OS (Kernel, Networking, and Filesystem support)
- Vortex OpenSplice (including `spliced` and the services described in the `ospl.xml` file)
- The PingPong example

Once the image has been downloaded to the board, the pong “Initial task” should be started and then the `ping AddressSpace` can be started in the same way, so that the example begins the data transfer. Parameters are not required to be passed to the Integrity processes because the `ospl_projgen` tool generates code with particular values that simulate the passing of parameters.



This also applies to the Chat Tutorial (see *Examples*), if `ospl_projgen` is run with the `-t chat` argument.

## 13.4 Changing the ospl\_projgen Arguments

If changes are subsequently required to the arguments that were originally specified to the `ospl_projgen` tool, there are two choices:

- a) Re-run the tool and amend the arguments accordingly

or

- b) Make your changes through the Multi tool.

The first method guarantees that your project files will be produced correctly and build without needing manual changes to the project files. To use this method, simply follow the procedure described above but supply different arguments.

The second method is perhaps a more flexible approach, but as well as making some changes using Multi you will have to make other changes by hand in order for the project to build correctly.

The following section describes the second method.

### 13.4.1 Changing the generated Vortex OpenSplice project using *Multi*

You can make changes to any of the settings you specified with `ospl_projgen` by following these steps:

#### Step 1

Right-click on the highlighted `ospl.xml` file (as shown above) and click *Set Options...*

#### Step 2

Select the *All Options* tab and expand the *Advanced* section.

#### Step 3

Select *Advanced Vortex OpenSplice XML To Int Converter Options*. In the right-hand pane you will see the options that you have set with the `ospl_projgen` tool with their values, similar to *Integrity: changing project options in Multi* below.

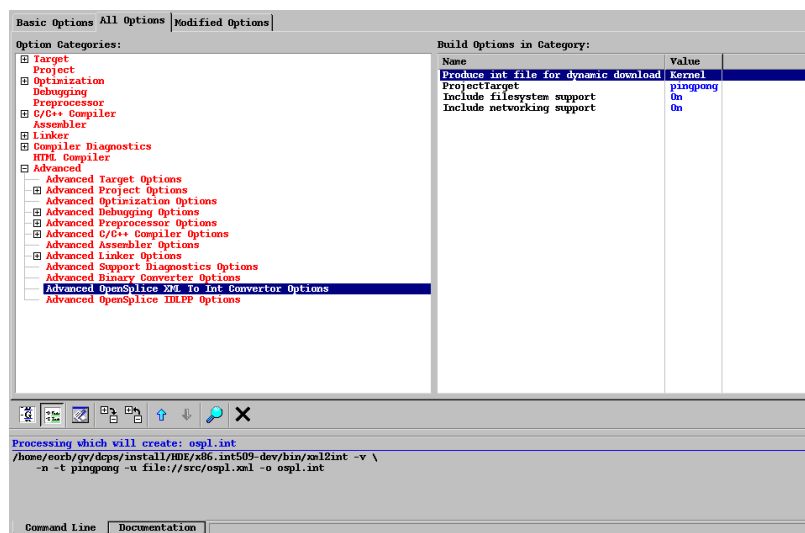


Fig. 2: Integrity: changing project options in Multi

Right-click on the parameter that you want to change. For example, if you don't need filesystem support to be included in the kernel image, right-click on *Include filesystem support* and set the option to *Off*.

The arguments for `xml2int` in the bottom pane are updated to reflect any changes that you make. If you switch off filesystem support, the `-v` argument is removed from the arguments. (The `xml2int` tool is used to generate the `ospl.int` Integrate file that will be used during the Integrate phase of the project. For more information on `xml2int` please see section *The `ospl_xml2int` command*.)



Note that if you do remove filesystem support from the kernel image you should also remove all references to the `ivfs` library, and make appropriate changes to the `ospl_log.c` file as well. See section *Amending Vortex OpenSplice Configuration with Multi* for information about `ospl_log.c`.

Similarly you can change any other option and the changes are applied instantly.

When the changes are complete, rebuild the project by right-clicking on `default.gpj` and then click *Build* to build the project.

### 13.4.2 The `ospl_xml2int` Tool

The `ospl_xml2int` tool is used to inspect your Vortex OpenSplice configuration file (`ospl.xml`) and generate an appropriate Integrate file (`ospl.int`). For more information on Integrate files please consult the Integrity manual.

### 13.4.3 The `ospl_xml2int` command

#### Usage

```
ospl_xml2int -h

ospl_xml2int [-s|-d] [-v] [-n] [-t <target>] [-u <URI>]
              [-o <file>]
```

Arguments shown between square brackets `[ ]` are optional; other arguments are mandatory. Arguments may be supplied in any order. All of the arguments are described in detail below.

#### Arguments

- h** List the command line arguments and give brief reminders of their functions.
- s** Generate for static linkage with kernel.
- d** Use this argument to generate an Integrate file that will yield a dynamic download image. If both this argument and the `-s` argument are omitted the default of a statically-linked image will be generated.



The arguments `-s` and `-d` are mutually exclusive.

- v** Include filesystem support.
- n** Include network support.
- t <target>**

#### Available targets:

```
chat include chat tutorial
pingpong include PingPong example
touchstone include Touchstone
mmstat include mmstat
shmdump include shmdump
```

Multiple `-t` arguments may be given. This enables you to use `mmstat` and/or `shmdump` (see *Using mmstat and shmdump diagnostic tools on Integrity*) in conjunction with one of the examples.

`-u <URI>` Identifies the configuration file to use (default: `${OSPL_URI}`).

`-o <file>` Name of the generated Integrate file.

Applications linking with Vortex OpenSplice must comply with the following requirements:

- The `First` and `Length` parameters must match those of `spliced` address space (these are generated from `ospl.xml`).
- The address space entry for your application in the Integrate file must include entries as shown in the example below.

Have a look at the `ospl.int` for the PingPong example if in doubt as to what the format should be. (Make sure that you have built the project first or else the file will be empty.)

Example `ospl.int` contents:

```
AddressSpace
.
.
.
Object 10
    Link          ResourceStore
    Name          ResCon
    OtherObjectName DDS_Connection
EndObject

Object 11
    Link          ResourceStore
    Name          ConnectionLockLink
    OtherObjectName DDS_ConnectionLock
EndObject

Object 12
    MemoryRegion  your_app_name_database
    MapTo         splice_database
    First 0x20000000
    Length 33554432
    Execute true
    Read true
    Write true
EndObject
.
.
.
EndAddressSpace
```



*Note:* If you make any changes to the `ospl.int` file generated by the project and then you make any changes to the `ospl.xml` file and rebuild the project, the changes to the `ospl.int` file will be overwritten.

Make sure that you also edit the `global_table.c` and `mounttable.c` files to match your setup. These files can be found under `src/projgen/kernel.gpj/kernel_kernel.gpj` and `src/projgen.gpj/kernel.gpj/ivfs_server.gpj` as shown in *Integrity: changing global\_table.c and mounttable.c* below:

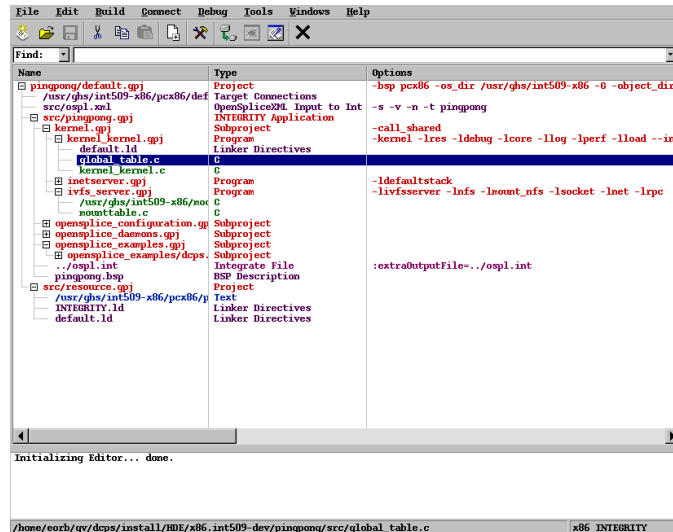


Fig. 3: Integrity: changing global\_table.c and mounttable.c

Once you have made all of the required changes to osp1.int, you must rebuild the whole project. Your changes will be picked up by Vortex OpenSplice automatically.

## 13.5 Critical Warning about Object 10 and Object 11



We have used Object 10 and Object 11 in various address spaces to declare a semaphore and a connection object, but they may already be in use on your system.

You *can* change these numbers in the osp1.int file, but if you do then you **must** change **all** of the address spaces where Object 10 and Object 11 are defined (except those for ResourceStore as noted below). The value replacing 10 must be the same for every address space, and likewise for the value replacing 11. You **must** change **all** references in order for Vortex OpenSplice to work correctly.

*The only exception is the ResourceStore address space. Object 10 and Object 11 are unique to the Vortex OpenSplice ResourceStore and they **MUST NOT** be altered. If you do change them, Vortex OpenSplice **WILL NOT WORK!***



## 13.6 Amending Vortex OpenSplice Configuration with Multi

You can make changes to the Vortex OpenSplice configuration from Multi by editing the files under the project src/projgen.gpj/opensplice\_configuration.gpj/libospl\_cfg.gpj. See *Integrity: changing Vortex OpenSplice configuration in Multi* below:



There are five files here but you may *only* change osp1.xml and osp1\_log.c. The others must **NOT** be altered!

**osp1.xml** This is your Vortex OpenSplice configuration file. (See *Configuration* for more information about the options an Vortex OpenSplice configuration file may have.)

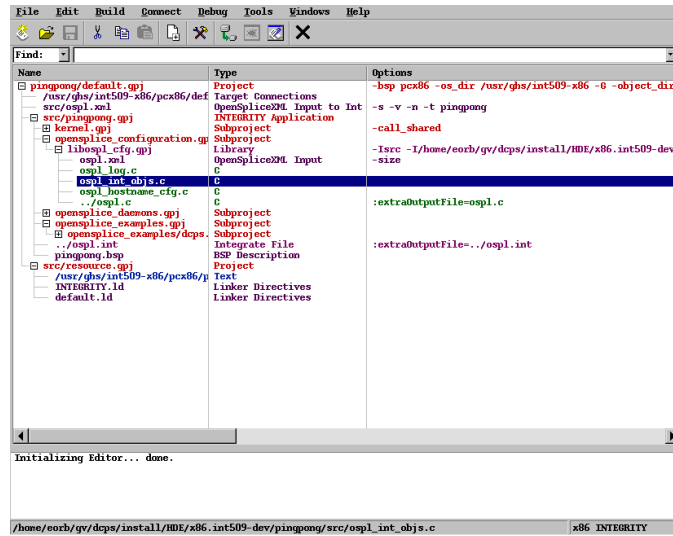


Fig. 4: Integrity: changing Vortex OpenSplice configuration in Multi

**ospl\_log.c** This file determines where the log entries (errors, warnings and informational messages) from Vortex OpenSplice go. The way the default file is generated by `ospl_projgen` depends on whether you have specified filesystem support or not. (See comments within the file for more information.)

## WINDOWS CE

*This chapter provides a brief description of how to deploy Vortex OpenSplice on Windows CE.*

### 14.1 Prerequisites

Vortex OpenSplice requires certain environment variables to be present; as Windows CE does not support traditional environment variables, these are simulated by creating registry entries which contain the required data. References in this chapter to 'environment variables' are therefore actually references to values in the Windows CE registry.

The environment variables expected by Vortex OpenSplice are:


**PATH** The *PATH* variable must include the directory containing the Vortex OpenSplice executables that may be launched by the *ospl* utility.

**OSPL\_URI** This variable contains the location of the default *ospl.xml* configuration file which is used when not otherwise specified.

The descriptions in this chapter assume that the values shown in the table below have been added to the registry key `HKEY_LOCAL_MACHINE\Software\ADLINK Technology Inc.\OpenSpliceDDS\<OpenSpliceVersion>`

#### Windows CE Registry keys

Name	Type	Data
PATH	REG_SZ	NAND FlashOpenSpliceDDS\<OpenSpliceVersion>\HDE\armv4i.wince
OSPL_URI	REG_SZ	file://NAND Flash/OpenSpliceDDS/<OpenSpliceVersion>/HDE/armv4i.wince/etc/config/ospl.xml

 All Vortex OpenSplice dynamic link library (dll) files must also be copied into the `\Windows` directory on the Windows CE device *prior to* deployment.

### 14.2 Setting Registry Values with a CAB File

In development, a CAB file can be used to register the necessary variables in the registry. Place the CAB file in the Cold Boot directory on the target device (*i.e.* `\NAND Flash\ColdBootInit`) to make the registry settings available as soon as the device has booted.



### 14.2.1 Alternatives to CAB file

Microsoft's Windows CE Remote Registry Editor can be used instead of a CAB file to set the necessary registry values. Alternatively, ADLINK also provides a convenient method of editing the registry variables by way of the `ospl` utility using the `getenv` and `putenv` parameters (described below).

Please refer to Microsoft's Windows CE documentation for detailed information about CAB files and the Remote Registry Editor.

## 14.3 The Vortex OpenSplice Environment

Vortex OpenSplice requires the contents of the `bin`, `lib` and `etc` directories from within the Vortex OpenSplice installation to be available on the Windows CE target hardware. For development purposes, Microsoft's ActiveSync can be used to load these on to the target system. The following description assumes that the `bin`, `lib` and `etc` directories have been copied from the Vortex OpenSplice installation onto the target at the following location:

```
\NAND Flash\OpenSpliceDDS\\HDE\armv4i.wince
```

For simplicity the whole OpenSpliceDDS installation directory can be copied to the `\Nand Flash` directory.

The following description explains deployment on Windows CE by using the Windows CE console. It is assumed that the console's `PATH` variable has been set to point to the directory containing the Vortex OpenSplice executables. For example:

```
PATH "\NAND Flash\OpenSpliceDDS\\
HDE\armv4i.wince\bin";%PATH%
```

(All Vortex OpenSplice dynamic link library (dll) files must have been copied into the `\Windows` directory on the Windows CE device prior to deployment.)

When running Vortex OpenSplice executables on the command prompt, it is useful to redirect any output to text files by using the `>` operator.

If the `PATH` and `OSPL_URI` variables have not already been set *via* a CAB file on device boot up, use the following commands to set those values manually:

```
ospl putenv PATH "\NAND Flash\OpenSpliceDDS\\
HDE\armv4i.wince\bin" > osplputenv-path.txt

ospl putenv OSPL_URI "file://NAND Flash/OpenSpliceDDS//
HDE/armv4i.wince/etc/config/ospl.xml" > osplputenv-ospluri.txt
```

The values can be checked if required by using Microsoft's Windows CE Remote Registry Editor, or by running the `ospl getenv` command:

```
ospl getenv PATH > osplgetenv-path.txt
```

## 14.4 Secure Networking

The secure networking service uses OpenSSL for cryptography support. To use this feature, the library `libeay32.dll` is required; it must be copied to the `\Windows` directory on the Windows CE device.

Vortex OpenSplice is tested against OpenSSL version 0.9.8i. This may be built as described below.

### 14.4.1 Building OpenSSL for Windows CE 6.0

This section describes the steps required to get an OpenSSL build for Windows CE. The version of OpenSSL used is 0.9.8i. The third-party library `wcecompat` is used, which also has to be built manually for Windows CE 6.0.

(The description that follows is based on the one given at <http://blog.csdn.net/sooner01/archive/2009/06/22/4289147.aspx>.)

#### Prerequisites

The following are needed to make an OpenSSL build for Windows CE 6.0:

- **Microsoft Visual Studio 2005** (VS2008 might also work but it has not been tested)
- **An installed WinCE 6.0 SDK to be targeted** In this description the target SDK is 'WinCE-GS3Target'
- **Perl** You will need to install Active Perl, from <http://www.activestate.com/ActivePerl>. (Note that perl by MSYS does not create correct `makefiles`.)
- **OpenSSL** The OpenSSL sources can be downloaded from <http://www.openssl.org/>. In this description we use version 0.9.8i. Other versions might not work with the steps described here.
- **wcecompat compatibility library** The `wcecompat` library adds the functionality to the C Runtime Library implementation of Windows CE which is needed in order to build OpenSSL for Windows CE. Obtain this from <http://github.com/mauricek/wcecompat>. Note that you should *not* download the latest version; browse the history and download the version committed on November 21, 2008 named *updates for OpenSSL 0.9.9* with commit number `f77225b...`

#### Build `wcecompat`

Extract the `wcecompat` download to an appropriate location. In this description the location `C:\wcecompat` is used, but you can use any location you want.

##### Step 1

Start Visual Studio 2005 and open a Visual Studio 2005 command prompt.

##### Step 2

Go to the `wcecompat` directory (`C:\wcecompat`).

##### Step 3

Set the building environment:

```

set OSVERSION=WCE600

set TARGETCPU=ARMV4I

set PLATFORM=VC-CE

set PATH=C:\Program Files\Microsoft Visual Studio 8\VC\ce\bin\x86_arm;
C:\Program Files\Microsoft Visual Studio 8\Common7\IDE;%PATH%

set INCLUDE=C:\Program Files\Windows CE Tools\wce600\WinCE-GS3Target\
include\ARMV4I

set LIB=C:\Program Files\Windows CE Tools\wce600\WinCE-GS3Target\lib\
ARMV4I;C:\Program Files\Microsoft Visual Studio 8\VC\ce\lib\armv4

```

If you target a different SDK, replace the text *WinCE-GS3Target* in the lines above with your own SDK.

#### Step 4

Call *perl config.pl* to create the makefile configuration.

#### Step 5

Call *nmake* to build the *wcecompat* library.

#### Step 6

Exit the command prompt and exit Visual Studio to be sure of starting with a clean environment in the next stage.

### Build OpenSSL

#### Step 1

Extract *OpenSSL* to any location you like.

#### Step 2

Apply the OpenSSL WinCE patch which can be found at <http://marc.info/?l=openssl-dev&m=122595397822893&w=2>.

#### Step 3

Start Visual Studio 2005 and open a command prompt.

#### Step 4

Go to your openssl directory.

#### Step 5

Set the building environment:

```

set OSVERSION=WCE600

set TARGETCPU=ARMV4I

set PLATFORM=VC-CE

set PATH=C:\Program Files\Microsoft Visual Studio

```

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```

8\VC\ce\bin\x86\_arm;C:\Program Files\Microsoft Visual Studio
8\VC\bin;C:\Program Files\Microsoft Visual Studio
8\VC\PlatformSDK\bin;C:\Program Files\Microsoft Visual Studio
8\Common7\Tools;C:\Program Files\Microsoft Visual Studio
8\Common7\IDE;C:\Program Files\Microsoft Visual Studio
8\Common\Tools;C:\Program Files\Microsoft Visual Studio
8\Common\IDE;C:\Program Files\Microsoft Visual Studio 8\;%PATH%

set INCLUDE=C:\Program Files\Microsoft Visual Studio
8\VC\ce\include;C:\Program Files\Windows CE
Tools\wce600\WinCE-GS3Target\include\ARMV4I;C:\Program
Files\Windows CE Tools\wce600\WinCE-GS3Target\include;C:\Program
Files\Microsoft Visual Studio 8\VC\ce\atlmfc\include;C:\Program
Files\Microsoft Visual Studio 8\SmartDevices\SDK\SQL
Server\Mobile\v3.0;

set LIB=C:\Program Files\Windows CE
Tools\wce600\WinCE-GS3Target\lib\ARMV4I;C:\Program Files\Microsoft
Visual Studio 8\VC\ce\atlmfc\lib\ARMV4I;C:\Program
Files\Microsoft Visual Studio 8\VC\ce\lib\ARMV4I

set WCECOMPAT=C:\wcecompat

```

If you target a different SDK, replace the text `WinCE-GS3Target` in the lines above with your own SDK. Also, change the `wcecompat` directory to your own if you used a different location.

**Step 6**

Type `perl Configure VC-CE` to set up the compiler and OS.

**Step 7**

Type `ms\do_ms` to build the makefile configuration.

**Step 8**

Type `nmake -f ms\cedll.mak` to build the dynamic version of the library.

**Troubleshooting**

If you get the following error message:

```

PT0 -c .\crypto\rsa\rsa\_pss.c

cl : Command line warning D9002 : ignoring unknown option '/MC'
rsa\_pss.c

f:\openssl\openssl198\crypto\rsa\rsa\_pss.c(165) : error C2220:
warning treated as error - no 'object' file generated

f:\openssl\openssl198\crypto\rsa\rsa\_pss.c(165) : warning C4748:
/GS can not protect parameters and local variables from local buffer
overrun because optimizations are disabled in function

```

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```
NMAKE : fatal error U1077: '"F:\Program Files\Microsoft Visual Studio
8\VC\ce\bin\x86\_arm\cl.EXE"' : return code '0x2'
```

```
Stop.
```

Remove /WX in the makefile (ce.mak).

## 14.5 Deploying Vortex OpenSplice

**ospl start** This command will start the Vortex OpenSplice `splicedaemon` and Vortex OpenSplice services specified within the configuration referred to by the `OSPL_URI` variable:

```
ospl start > osplstart.txt
```

A different configuration file can be specified as an additional parameter; for example:

```
ospl start "file://NAND Flash/OpenSpliceDDS/<OpenSpliceVersion>/
HDE/armv4i.wince/etc/config/ospl.xml" > osplstart.txt
```

**ospl list** This command will list all the Vortex OpenSplice configurations that are currently running on the node.

```
ospl list > ospllist.txt
```

**ospl stop** This command will stop the Vortex OpenSplice `splicedaemon` and Vortex OpenSplice services specified within the configuration referred to by the `OSPL_URI` variable:

```
ospl stop > osplstop.txt
```

A different configuration to be stopped can be specified as an additional parameter; for example:

```
ospl stop "file://NAND Flash/OpenSpliceDDS/<OpenSpliceVersion>/
HDE/armv4i.wince/etc/config/ospl.xml" > osplstop.txt
```

## 14.6 Using the *mmstat* Diagnostic Tool on Windows CE

To run `mmstat`, use this command:

```
start mmstat > mmstat.txt
```

To see the full list of options, use this command:

```
start mmstat -h > mmstat-help.txt
```

The mechanism for terminating `mmstat` on Windows CE is different from other operating systems. All running instances of `mmstat` can be terminated with this command:

```
start mmstat -q > mmstat-quit.txt
```

If there are multiple instances of `mmstat` running, a particular instance can be terminated by specifying the process identifier:

```
start mmstat -q -x <process id> > mmstat-quit.txt
```

where *<process id>* is displayed in the output for the particular instance of `mmstat`.

## 14.7 Vortex OpenSplice Examples

Please refer to the *Examples* section for descriptions of the Vortex OpenSplice examples.

### 14.7.1 Building the examples

There is a shortcut to load the examples into Microsoft Visual Studio which can be accessed from *Start > Programs > OpenSpliceDDS <OpenSpliceVersion> armv4i.wince HDE > Examples*.

Once the projects are open in Microsoft Visual Studio, click *Build/Rebuild Solution* at the appropriate level to build the required examples.

Copy the produced executable files to the Vortex OpenSplice bin directory (*i.e.* `\NAND Flash\OpenSpliceDDS\  
<OpenSpliceVersion>\HDE\armv4i.wince\bin`) on the Windows CE device. For the PingPong example the executable files are `Ping.exe` and `Pong.exe`. For the Tutorial example the files are `Chatter.exe`, `MessageBoard.exe`, and `UserLoad.exe`.

As an alternative to using the shortcut, to set up the environment for a new project perform the following steps:

#### Step 1

Run the Vortex OpenSplice command prompt from the *OpenSplice* entry under the Windows *Start* button:

*Start > Programs > OpenSpliceDDS <OpenSpliceVersion> armv4i.wince HDE > OpenSpliceDDS command prompt*

#### Step 2

Copy the Windows Microsoft Visual Studio environment variables to the new command prompt. To obtain these, right-click on the *Properties* for the *Visual Studio 2005 Command Prompt* entry located at *Start > Programs > Microsoft Visual Studio 2005 > Visual Studio Tools > Visual Studio 2005 Command Prompt*, and paste the *Shortcut Target* entry into the Vortex OpenSplice command prompt. For example this could be

```
%comspec% /k ""C:\Program Files\Microsoft Visual Studio 8\VC\vcvarsall.bat""
x86
```

#### Step 3

Start Microsoft Visual Studio in this prompt:

```
devenv
```

#### Step 4

Open the solution file at

```
<OpenSpliceDDSInstallation>/examples/examples.sln
```

### 14.7.2 Deploying the PingPong example

Start Vortex OpenSplice as described above. The Ping and Pong executables can then be started as follows:

```
start pong PongRead PongWrite > pong.txt  
start ping 100 100 m PongRead PongWrite > ping.txt
```

The ping.txt file produced should contain the expected Ping Pong measurement statistics for 100 cycles. The Pong executable can be shut down by running the ping shutdown command:

```
start ping 1 1 t PongRead PongWrite > ping-shutdown.txt
```

### 14.7.3 Deploying the Tutorial example

Start Vortex OpenSplice as described above. The Tutorial executables can then be started as follows:

```
start UserLoad > userload.txt  
start MessageBoard > messageboard.txt  
start Chatter 1 John > chatter.txt
```

The messageboard.txt file produced should contain the messages received from the Chatter executable. The MessageBoard executable can be terminated by running Chatter again with the -1 option:

```
start Chatter -1 > chatter-shutdown.txt
```

## PIKEOS POSIX

*This chapter provides a brief description of how to deploy Vortex OpenSplice on PikeOS.*

### 15.1 How to Build for PikeOS

For this target, Vortex OpenSplice must be configured in the single-process mode and executables must be statically linked. Also, to avoid requiring filesystem support, the `ospl.xml` configuration file is built into the executable. A tool named `osplconf2c` is provided to generate the code required for this.

When executed with no arguments, `osplconf2c` takes the configuration file specified by `OSPL_URI` (only `file:` URIs are supported) and generates a C source file named `ospl_config.c`. The URI and filename can be specified using the `-u` and `-o` options respectively. The generated code should be compiled and linked with each executable. It comprises an array representing the configuration file and also the entry points which allow the configured services to be started as threads.

Vortex OpenSplice is built against the BSD POSIX support in PikeOS (`bposix`), and it also uses the `lwIP` networking facility. When linking an executable for PikeOS deployment it is necessary to specify the system libraries as follows:

```
-llwip4 -lsbuf -lm -lc -lp4 -lvm -lstand
```

The Vortex OpenSplice libraries for each configured service (`networking`, `cmssoap`, *etc.*) also have to be linked in.

### 15.2 Deployment Notes

When setting up an integration project in which to deploy an OpenSplice executable the following items should be configured:

- Networking should be enabled using the `LwIP` stack.
- The amount of available memory will generally need to be increased.



We recommend a minimum of **48MB** available memory for OpenSplice partitions.

#### Steps in CODEO:

1. Create a new integration project based on the `devel-posix` template.
2. Edit `project.xml.conf`:
  - a. Configure networking for the `muxa` in the service partition, if required.
  - b. Enable `LwIP` in the `POSIX` partition, set its device name and IP addresses.
  - c. Add a dependency in the `POSIX` partition on the network driver file provider.



3. Edit `vmit.xml`:

In the POSIX partition, set the `SizeBytes` parameter in `Memory Requirement->RAM\[partition]` to at least `0x03000000`.

## 4. Copy your Vortex OpenSplice executable into the project's target directory and build the project.

## 15.3 Limitations



Multicast networking is not supported on PikeOS POSIX partitions. Consequently, the DDSI networking service is not supported.



The native networking service is supported in a *broadcast* configuration.

## 15.4 PikeOS on Windows Hosts

Developing with Vortex OpenSplice for PikeOS on Windows differs from Vortex OpenSplice on other Windows-hosted platforms. This is because PikeOS uses Cygwin to present a Unix-like environment for cross-development. OpenSplice development therefore follows similar practice to the Unix-hosted editions; for example, you would start a session by entering a bash shell and sourcing the `release.com` file.

However, the Vortex OpenSplice tools (`idlpp`, `osplconf2c`, `ospltun`, *etc.*) are built as Windows executables or will be running in Java for Windows and so need to be run with Windows-style pathnames. This is handled using the `cygpath` command as seen in the `release.com` script and the example `makefiles`. Tuner and Configurator may be launched from the Start menu as usual.

### 15.4.1 Building the examples

This proceeds as would be expected in a Unix environment. Assuming that Vortex OpenSplice and PikeOS are installed in the default locations:

Start Cygwin bash

```
declare -x PIKEOS_HOME=/opt/pikeos-3.1
declare -x PATH=$PATH:$PIKEOS_HOME/cdk/ppc/oea/bin
. /opt/OpenSpliceDDS-V6.2.3/HDE/ppc.pikeos3/release.com
cd $OSPL_HOME/examples
make
```

### 15.4.2 Using a custom LwIP

The example `makefiles` are set up by default to link against the build of LwIP distributed with PikeOS, but in some circumstances it may be useful to rebuild LwIP.

In this case, before building the examples, set the environment variable `LWIP_HOME` to a directory containing `liblwip4.a`, `lwipconfig.o` and `lwipopts.h`.

## UNIX ARM PLATFORM

*This chapter provides a brief description of how to deploy Vortex OpenSplice on a UNIX ARM platform*

### 16.1 Installation for UNIX ARM platform

The installation of the Vortex OpenSplice HDE or RTS on a UNIX ARM platform is depended on the type of installer that has been provided. Dependent on the platform the installer is either an executable or a tar file. An executable installer has either the extension `.run` or `.exe`. A tar file installer has the extension `.tar`.

The following combinations may be provided - both the HDE and RTS installers are executables - the HDE installer is an executable and the RTS is an tar file - both the HDE and RTS installers are tar files.

When the installer is provided as an executable follow the normal install procedure as described in section [Installation for UNIX and Windows Platforms](#).

When the installer is provided as an tar file follow the procedure described below.

#### Step 1

*Untar the installer tar file,*

go to the directory where Vortex OpenSplice has to be installed.

untar the tar file in this directory

```
tar xf P<code>-VortexOpenSplice<version>-<E>-<platform>.  
<os>-<comp>-<type>-<target>-installer.tar
```

where, some being optional,

*<code>* - ADLINK's code for the platform *<version>* - the Vortex OpenSplice version number, for example `V6.0`

*<E>* - the environment, either HDE or RTS

*<platform>* - the platform architecture, for example `sparc` or `x86`

*<os>* - the operating system for example `solaris8` or `linux2.6`

*<comp>* - the compiler or glibc version

*<type>* - release, debug or dev, which is release with symbols

*<target>* - the target architecture for host/target builds.

#### Step 2

*Configure the Vortex OpenSplice environment.*

Go to the `<install_dir>/<E>/<platform>` directory, where `<E>` is HDE of RTS and `<platform>` is for example `armv7l.linux`.

When bash is used as shell:

Source the `release.com` file from the shell command line.

Otherwise:

First set the `OSPL_HOME` variable to the directory in which OpenSplice was installed and then source the `release.com` file.

*This chapter provides notes about deploying Vortex OpenSplice on ELinOS.*

## 17.1 Deployment notes

OpenSplice may be deployed in an ELinOS system.

The following ELinOS features should be enabled:

- Kernel support for System-V IPC
- Use full `shmem` filesystem
- `tmpfs`

The following system libraries are required:

- `stdc++`
- `pthread`
- `rt`
- `dl`
- `z`
- `m`
- `?`



We do not recommend running with less than **32M** of system memory.

## 17.2 Limitations



ELinOS partitions within PikeOS are supported, but DDSI networking will not function as it requires a multicast-capable interface.



The native networking service is supported in a *broadcast* configuration.

## CONTACTS & NOTICES

### 18.1 Contacts

#### **ADLINK Technology Corporation**

400 TradeCenter  
Suite 5900  
Woburn, MA  
01801  
USA  
Tel: +1 781 569 5819

#### **ADLINK Technology Limited**

The Edge  
5th Avenue  
Team Valley  
Gateshead  
NE11 0XA  
UK  
Tel: +44 (0)191 497 9900

#### **ADLINK Technology SARL**

28 rue Jean Rostand  
91400 Orsay  
France  
Tel: +33 (1) 69 015354

Web: <https://www.adlinktech.com/en/data-distribution-service>

Contact: <https://www.adlinktech.com/en/data-distribution-service>

E-mail: [ist\\_info@adlinktech.com](mailto:ist_info@adlinktech.com)

LinkedIn: <https://www.linkedin.com/company/79111/>

Twitter: [https://twitter.com/ADLINKTech\\_usa](https://twitter.com/ADLINKTech_usa)

Facebook: <https://www.facebook.com/ADLINKTECH>

## 18.2 Notices

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