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An ADLINK Industry White Paper

Vortex OpenSplice Core – DCPS & DDSI2



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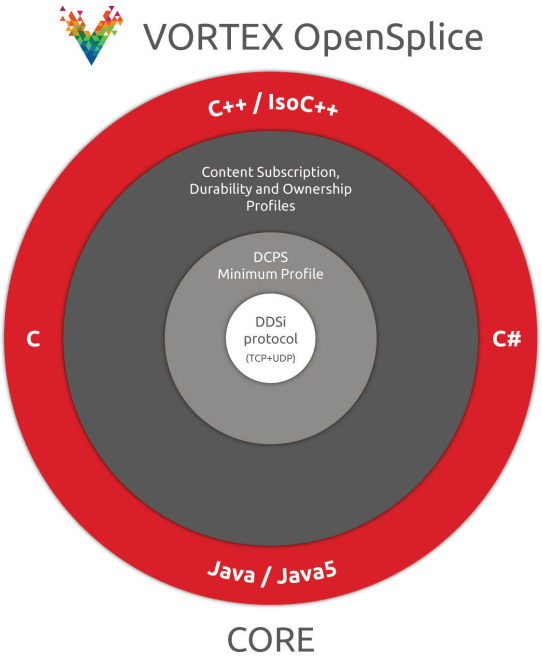
Vortex OpenSplice is part of the Adlink DDS offering - it is a fully featured DDS implementation targeted for enterprise platforms and devices. It is fully interoperable with Cyclone DDS, Vortex Link and Vortex Insight products. Vortex OpenSplice product offering is made of the Core offering and a set of Commercially available Add-ons and extra-features. The Vortex OpenSplice Core is a full implementation of the Object Management Group (OMG) Data Distribution Service for Real-time Systems (henceforth DDS) rev1.4 standard (DCPS profiles) and the OMG-DDSI-RTPS v2.3 interoperable wire-protocol. The Fully list of Vortex OpenSplice Add-ons and extra features is available in a separate white paper.

Overview

The Vortex OpenSplice Core is the foundation of the Vortex OpenSplice DDS product. The Vortex OpenSplice Core is available under Commercial license and an open source LGPLv3 license. Our choice of an LGPLv3 license ensures that none of our deployment software poses an open source copy left contamination risk to developers. The Vortex OpenSplice Core is made of the OMG DDS DCPS API standard and the wire protocol DDSi-RTPS. The Fully featured Vortex OpenSplice Edition with all the Add-ons requires an active support subscription or alternatively an ADLINK Commercial License.

Vortex OpenSplice Core Architecture

The Vortex OpenSplice Core is a full implementation of the DDS rev1.4 standard (DCPS profiles) and the DDSI-RTPS v2.3 interoperable wire-protocol. The DCPS API standard guarantees source code portability across different vendor implementations, while the DDSI standard ensures interoperability wire protocol across DDS implementations from different vendors.



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Vortex OpenSplice Core includes the following features:

- OMG DDS rev1.4 DCPS profiles, namely:
  - » Minimum Profile
  - » Content Subscription Profile
  - » Durability/Persistence Profile
  - » Ownership Profile
- DCPS APIs, with the following language binding(*):
  - » C99, C++, ISO C++, Java, Java 5, C# and Python.
- OMG DDSI-rev2.3 support
  - » DDSI2 networking service with UDP and TCP/IP support
- Architecture:
  - » Standalone mode (Single process)

(*) : Note that the javascript language binding is available as an Add-on.

The DCPS Profiles and APIs

The DDS DCPS layer is a set of APIs that present a coherent set of standardized profiles that target real-time information availability for domains ranging from small-scale embedded control systems right up to large-scale enterprise information management systems.

Each DDS DCPS profile adds distinct capabilities that define the service-levels offered by DDS in order to realize 'the right data at the right place at the right time' every time paradigm.

The four DCPS profiles are:

- **Minimum Profile:** This profile defines a publish/subscribe abstraction for highly efficient information-dissemination between multiple publishers and subscribers sharing common interest in so-called Topics. A Topic represents the subject of information sharing and is defined by a unique name, a data type and a set of QoS characterizing its non-functional properties. Topic types define the data structure and can be expressed in the OMG's IDL-language allowing for automatic generation of dedicated typed-readers and 'typed-writers' of those 'topics' for any mix of languages desired. This profile also includes the Quality of Service (QoS) framework that allows the middleware to 'match' requested and offered QoS parameters such as 'reliability', 'ordering' or 'urgency'.
- **Ownership Profile:** This "replication" profile offers support for replicated publishers of the same information by allowing a 'strength' to be expressed by each publisher so that only the 'highest-strength' information will be made available to the interested parties.

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- **Content Subscription Profile:** This 'content awareness' profile offers powerful features to express fine-grained interest in specific information content (content-filters). This profile also allows applications to specify projection-views and aggregation of data, as well as dynamic queries for subscribed 'topics' by utilizing a subset of the well-known SQL language whilst preserving the real-time requirements for the information-access.

- **Persistence Profile:** This 'data durability' profile offers transparent and fault-tolerant availability of 'non-volatile' data that may either represent persistent 'settings' (to be stored on mass-media throughout the distributed system) or 'state' preserved in a fault-tolerant manner outside the scope of the publishers . This profile allows late-joining applications to obtain the last state of the system from any place in the network with the appropriate history of the state changes. This profile is mainly implemented within the so-called Durability Service. Vortex OpenSplice has 2 durability service implementations. A default implementation that is part of the Vortex OpenSplice Core, and a new commercial add-on called **Lite Durability Service** implementation. **Lite Durability Service is designed for or ultra-large-scale systems where applications are frequently disconnected and reconnected or have intermittent connection.**

The New ISO C++ PSM Support

The latest ISO C++ PSM (API) is available with Vortex OpenSplice. This API is now globally available as an alternative to the previous 2006 C++ API. The benefits include:

- A simple, safe, efficient, extensible and portable C++ API

- Well defined, simple and safe allowing for increased productivity

- Use of C++ templates to ensure type-safety and compile-time error detection

- Consistent use of standard ISO C++ types and idioms (string/vector/iterators, smart pointers, etc.)

Force legacy code, the classical C++ language binding is also supported.

The New Java 5 PSM

The latest Java 5 PSM (API) is available with Vortex OpenSplice as an improved alternative to the original Java API. It is more user friendly, and simpler to use. The benefits include:

- API is more natural for Java developers as it uses native language constructs like exceptions and generics instead of following the IDL mapping.

- The API is simpler resulting in less code, reduced complexity and higher productivity

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- Provides support for Google Protocol Buffer data types next to the well-known existing IDL data type support

Force legacy code, the classical Java language binding is also supported.

The DDSI2 UDP based Layer

The DDSI2 (Data Distribution Service Interoperability) service is part of the Vortex OpenSplice Core and provides a basic and fully compliant implementation of the OMG-DDSI/RTPS rev2.3 interoperable wire-protocol standard. The DDSI2 Vortex OpenSplice implementation offers out-of-the-box interoperability with other DDS vendors without any configuration needs. With Vortex OpenSplice DDS TCP/IP support is now provided for use with the DDSI2 networking service.

DDSI2 can be used both as an alternative as well as in conjunction with the optional Vortex OpenSplice **RTNetworking** service that offers additional capabilities regarding deterministic communication in large-scale networks with on the protocol wire compression and static discovery.

Vortex OpenSplice also offers an enhanced version of DDSI2 networking service, named DDSI2E (DDSI Enhanced) that:

- implements the network scheduling pattern as well as the transport priority channels and lanes,
- extra DDS security features,
- supports traffic shaping,
- supports traffic confinement whilst preserving interoperability with other OMG DDSI Rev2.3 implementations.

The Enhanced DDS2E is part of the commercial Add-ons , only the basic DDSi Service is part of the Vortex Core.

The DDSI2 TCP/IP Layer

Vortex OpenSplice introduces TCP/IP based point-to-point communication to DDSI based applications, extending the existing standardized DDSI discovery with unicast-locators for use with TCP/IP. TCP/IP is available as part of the Vortex OpenSplice Core.

The benefits of TCP/IP support include the following:

- Allows for discovery and communication between DDS participants that are not able to utilize multicast UDP-based communication,
- Enables WAN-based communication through NATs and firewalls.

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Benefits of Vortex OpenSplice

Vortex OpenSplice sets itself apart from superficially similar technology, such as messaging products, due to the rich set of functional and non-functional properties it brings to the systems. Specifically, Vortex OpenSplice is:

- **Data Centric**, enabling applications to focus on the most valuable part of the system, which is the data the applications produce and consume, instead of interacting through a set of Service oriented APIs each application is forced to build and externalise. The data model can evolve and be enriched overtime. Data Centricity promotes also end-to-end type safety, and time and space efficiency. In addition, it promotes time and space de-coupling leading to systems that are easier to integrate, evolve and reuse.

- **Real-time**, meaning that the right information is delivered at the right place at the right time, all the time. Failing to deliver key information within the required deadlines can lead to life, mission or business threatening situations.

- **Dependable**, thus ensuring availability, reliability, safety and integrity in spite of hardware and software failures.

- **High-Performance**, hence able to distribute very high volumes of data with very low latencies.

- **Scalable**, scaling from single board to ultra-large-scale systems, and from smart sensors to high end servers.

- **Extensible**, support for Google Protocol Buffers enables data models to be dynamically extended so that systems can evolve without the need for applications to be recompiled.

- **Secure**, thus maintaining confidentiality, integrity and authenticity of exchanged data.

- **Connectivity**, enabling data to be shared and integrated across a wide spectrum of technologies.

Support/Maintenance

ADLINK provides world class support, delivering a timely, reliable service to ensure every customer's business success. We offer Standard and Silver annual Support and Maintenance Programs for Vortex OpenSplice which can be tailored to a customer's specific requirements if needed.

References and For More Information

For further information regarding Vortex OpenSplice, please e-mail: ist_info@adlinktech.com
or visit: www.adlinktech.com

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