ADLINK
Leading EDGE COMPUTING

Vortex DDS Whitepaper

Intelligent Data Sharing for the Business Critical Internet of Things



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1. Introduction

The real value of the Internet of Things (IoT) and the Industrial Internet of Things (IIoT) are ubiquitous information availability and consequently the decisions that can be made from it.

If we take as an example a Smart City application, real-time access to information about pollution, weather forecasts, traffic conditions, parking and public transportation use, can enable smarter decisions when considering the adoption of traffic control policies, such as reducing speed limits or prohibiting traffic in certain areas.

Likewise, in a Smart Grid application, real-time access to energy production and demand can help match production to demand, improve energy trading strategies, and allow micro-power generators to decide whether to sell or store their energy surplus.

In brief, the real value of the IoT and the IIoT is in efficient, ubiquitous and timely access to information.

Looking at the technology landscape, there is not a single platform that provides efficient, timely and ubiquitous data sharing across network-connected devices. Well… there wasn't until now!

ADLINK's Vortex DDS is the first platform to enable seamless, ubiquitous, efficient and timely data sharing across mobile, embedded, desktop, web, cloud and edge applications.

The remainder of this whitepaper introduces the elements that make up the Vortex DDS platform and describe its applicability in real world applications.

2. Vortex DDS Overview

Vortex DDS is an open and standards-based polyglot platform for ubiquitous, efficient, secure and real-time data sharing.

Vortex DDS applications generally produce and consume one or more kinds of data, such as, pollution levels, amount of produced electricity, or stocks values. Vortex DDS takes care of delivering data from producers to consumers, across networks, devices, platforms, ubiquitously and in the most efficient, scalable and timely manner.

Additionally, Vortex DDS can retain data in a distributed and fault-tolerant manner for late-joining consumers, providing full temporal decoupling between the production and consumption of data.

Figure 1 shows Vortex's DDS support for mobile, web, desktop, enterprise, edge and cloud applications.

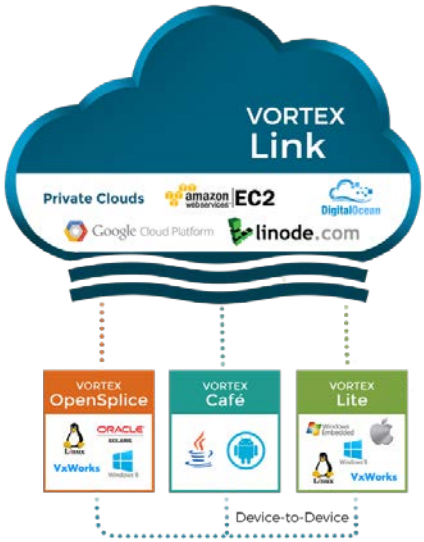


Figure 1 – Vortex enables data to flow across any kind of device

Vortex DDS Key Benefits:

- Device to Device, Device to Cloud, and Device to Device via the Cloud real-time data sharing
- Platform independent interoperable solution for Embedded, Mobile and Enterprise environments
- Operating system and programming language independent
- Built on the Object Management Group (OMG) Open standards to enable application portability, interoperability and component re-use
- LAN or WAN deployment over private or public networks, Clouds and Edge networks.
- Seamless integration with legacy and 3rd party application, providing connectors to over 100 different protocols and endpoint technologies. Open architecture APIs enable integration of 3rd party development environments/IDEs, frameworks and analytics software
- End-to-end qualities of service providing superior performance, scalability, reliability, determinism, interoperability, security and network efficiency
- Information-centric security model is supported by a modular security framework.
- Dynamic discovery for applications publishing and subscribing to data
- Plug-and-play for applications enabling systems to evolve more easily

To understand what makes Vortex DDS unique, let us examine some of its unique features.

2.1 Peer-to-Peer

Vortex DDS applications with direct network connectivity can communicate peer-to-peer without requiring a broker. Peer-to-peer communication facilitates deployments and improves performance. In addition, Vortex DDS peer-to-peer communication enables use cases, such as peer-to-peer mobile applications that are traditionally not supported by other technologies.

2.2 Cloud & Edge Enabled

When peer-to-peer communication is not possible, Vortex DDS applications and systems can transparently take advantage of Vortex Link to efficiently exchange data between subsystems connected over a WAN or across the Internet. They can also be used to overcome the communication hurdles posed by NAT's and Firewalls and when sharing data between UDP (multicast and unicast) and TCP enabled applications. Vortex DDS applications transparently and intelligently decide between peer-to-peer and cloud or edge mediated communication depending on their connectivity and Quality-of-Service (QoS) requirements.

2.3 Plug and Play

Vortex DDS applications require very little or no configuration as they are equipped with dynamic discovery. Vortex DDS dynamic discovery matches interest and optimizes communication paths.

2.4 Data Centric

Vortex DDS provides a high-level data sharing abstraction. This removes the mismatch introduced by traditional messaging technologies between the natural representation of your domain data and the un-typed representation handled by the messaging platform. Additionally, Vortex DDS understands the data and can use this knowledge to tailor and optimize its distribution and access.

2.5 Content and Temporal Filtering

Vortex DDS applications, along with expressing the kind of data they are interested in, can declare filters to limit the distribution of data to the subset that matches the filter. Vortex DDS applications can use temporal filters to also express the interest in receiving data at a given pace – for instance to limit incoming throughput.

2.6 High Performance

Vortex is capable of delivering, on state of the art hardware and on Gbps Ethernet networks, end-to-end latencies of 40-50 usec and node-to-node throughput of several millions of messages per second.

2.7 Platform Independent

Along with providing support for mainstream platforms, the technology at the foundation of Vortex DDS is independent of the processor architecture, Operating System and the Programming Language. As such, it can be run (or ported if needed) on virtually anything, including extremely constrained devices.

2.8 Standard Protocol

At its core, Vortex DDS uses the Object Management Group's (OMG) Data Distribution Service Interoperability Wire Protocol (DDSI) and exposes its functionalities through the latest DDS APIs. Thus, Vortex DDS uses a single and interoperable protocol to share data from very constrained embedded devices to high-end servers. This means that no protocol bridging is required when you integrate the different elements of your system – making your life simpler, improving performance, and providing the ability to really control the end-to-end properties of your data flows.

3. Platform Organization

Vortex is organized into Device Platforms, Cloud Platforms and Tools (see Figure 2). The Device Platform provides Vortex DDS connectivity for mobile, web, enterprise, highly embedded applications, and third-party technologies.

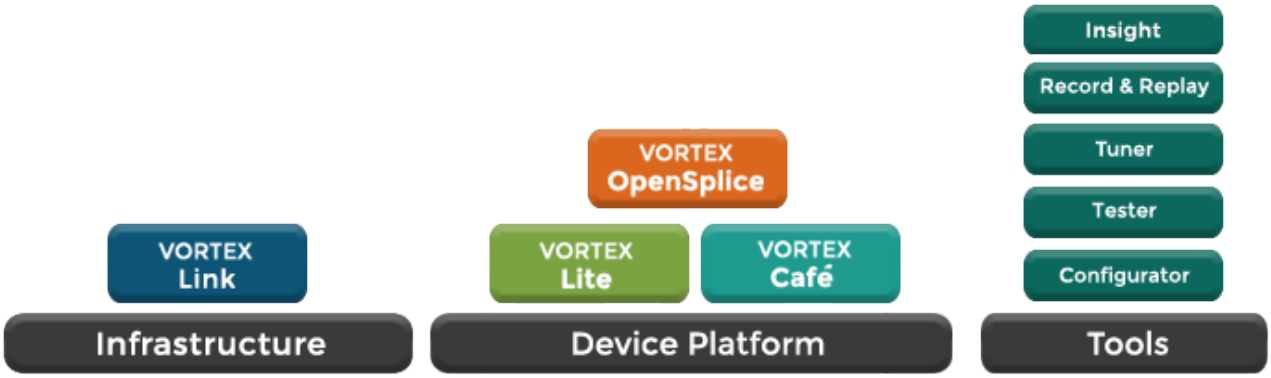


Figure 2 – Vortex DDS Intelligent Data Platform

The infrastructure provides a ubiquitous and universally accessible "Internet Service" for sharing data between Vortex DDS-enabled applications along with seamless Cloud integration of Vortex DDS applications. Vortex Link enables data sharing between applications running on UDP (multicast and unicast) and TCP networks.

Finally, Vortex DDS Tools provide different kinds of runtime tooling for monitoring, managing, recording and replaying, testing and configuring Vortex based distributed systems.

The remainder of this whitepaper will provide an overview of the main Vortex elements.

3.1 Vortex OpenSplice

Vortex OpenSplice is a very high performance and highly scalable implementation of the Data Distribution Service for Real-time Systems (DDS) standard. Vortex OpenSplice today powers some of the most challenging mission- and business-critical distributed applications in Air Traffic Control and Management, Large Scale SCADA, Financial Trading, Smart Cities and Smart Energy.

Along with providing a proven infrastructure for mission- and business-critical LAN-based systems, Vortex OpenSplice seamlessly integrates with the rest of the Vortex Platform.

3.2 Vortex Café

Vortex Café is a pure Java and highly efficient DDS implementation for J2SE, J2SE Embedded and Android.

3.3 Vortex Lite

Vortex Lite is a very small footprint and highly efficient DDS implementation targeting resource constrained embedded devices.

3.4 Vortex Link

Vortex Link provides universally accessible Routing and Discovery Services that enable ubiquitous data sharing and WAN connectivity for Vortex systems or any other system/device that uses a compliant Data Distribution Service (DDS) software stack. Vortex Link provides transparent discovery and routing between data readers and data writers regardless of location. Vortex Link supports a number of different deployment and connectivity scenarios, including individual device to cloud, system to cloud and also system federation.

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Vortex link can also distribute data, services, storage and applications to the edge of the network much closer to the devices and users as a way to complement and optimize traditional cloud architectures. Keeping the data at the edge of the network where the connected devices are creating the data offers the possibility to create new and innovative services and process efficiencies not possible with cloud computing alone.

3.8 Tools

Insight is a web-based tool to monitor and manage a system from any location and on any device. It provides (1) a runtime view of a Vortex DDS system including statistics associated with each element, (2) a configurable dashboard for monitoring system behavior through graphs and charts of statistics and resource usage.

Finally, Insight allows users to control the configuration and the QoS of Vortex DDS applications, services and systems.

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