



Customer Case Study

Dolphin Express doubles performance of Teligent Application Server

Dolphin Interconnect Solutions

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1 THE EXECUTIVE SUMMARY

Teligent AB, a leading provider of value-added services to telecommunications carriers, recently conducted an independent benchmark of their MySQL database architecture. Using Dolphin Interconnect's Dolphin Express cards, Teligent achieved a performance improvement in the order of 120-130% without any changes to their application. This increase in performance means faster response times for their telecom customers, as well as requiring smaller HW configurations for their applications. Thus, the combination of Dolphin Express and MySQL improves margins for both the customer and for Teligent, and also enables Teligent to configure larger installations.

The tests were done using two different architectures. The first architecture used MySQL Cluster as the database engine. In this case the applications contact the DBR layer which in turn can use any MySQL Server to connect to the database. Internally in MySQL Cluster, the nodes communicate to perform a two-phase commit protocol when updating transactions. In this scenario Teligent documented a 118% performance increase due to both a radically reduced latency of the cluster interconnect as well as better efficiency in the use of the CPU.

The second architecture tested used MySQL with the InnoDB storage engine. In this scenario, the applications contact a DBR for all queries. The DBR then redirects reads to any MySQL Server while updates are performed on all MySQL Servers in parallel. The DBR layer ensures that only one update at a time takes place. In this case, Teligent witnessed a 128% performance increase that was achieved to a great extent by the very low latency characteristics of the Dolphin Express interconnect.

In both architectures the improvements were realized without software changes. This was made possible by using Dolphin SuperSockets™, the enabling software layer of the Dolphin Express interconnect. By combining normal application calls to the socket API in the OS with a preloaded Dolphin SuperSockets library, these calls are automatically redirected to the Dolphin Express driver.

2 SHORT PRESENTATION OF TELIGENT AND DOLPHIN

Teligent (TGNT, Stockholm Stock Exchange) is a global supplier of value added services to telecommunications carriers. The offering includes e.g. traditional and Next Generation Messaging and advanced IN solutions supporting data capabilities, such as Mobile Office/IP Centrex, Mobile Prepaid and Mass Calling. All solutions are based on the generic Teligent Application Server – a true single platform concept for convergent service development and conforming to the 3GPP IP Multimedia Subsystems (IMS). The company's solutions are currently utilized in various configurations by a large number of leading carriers worldwide, including BT, Deutsche Telekom, MTS, SingTel, SMART, Telenor, TeliaSonera, Verizon and Vodafone. For more information, please visit www.teligent.se.

Dolphin Interconnect Solutions (DOLP, Oslo Stock Exchange) of Oslo, Norway and Marlborough, Massachusetts (USA) accelerates enterprise applications by providing ultra low-latency, high-bandwidth computer interconnect solutions called Dolphin Express. Dolphin Express products provide very low overhead communication, extremely low latencies and high throughput, all vital factors for communication that requires frequent transfer of small data packets and are ideal for clustered enterprise database and web services applications. The Dolphin Express

SuperSockets™ library is fully transparent to applications making application integration easy. For more information, please visit www.dolphinics.com.

3 DESCRIPTION OF THE MYSQL CLUSTER ARCHITECTURE

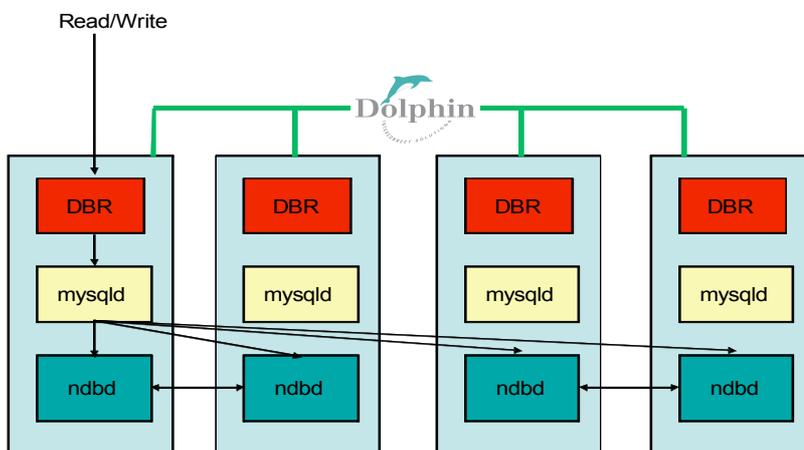
In this architecture, MySQL Cluster uses the standard MySQL Server with a clustered storage engine, NDB Cluster. This enables MySQL Cluster to deliver a highly available DBMS solution with excellent performance characteristics.

Teligent uses an application architecture where the applications use normal MySQL clients connected to a DBR layer. This architecture enables the DBR layer to perform soundness checks on the SQL queries. In addition it enables handling of replication and routing of queries to the proper database nodes.

When this layer is used in conjunction with MySQL Cluster, it can efficiently load balance requests onto all MySQL Servers since any MySQL Server is capable of handling all queries towards the cluster. Given that MySQL Cluster has a wealth of high availability features internally, there is no specific need to handle replication within the DBR layer. In cases with several clusters, the DBR layer can also perform routing of the queries towards the proper cluster dependent on the type of query.

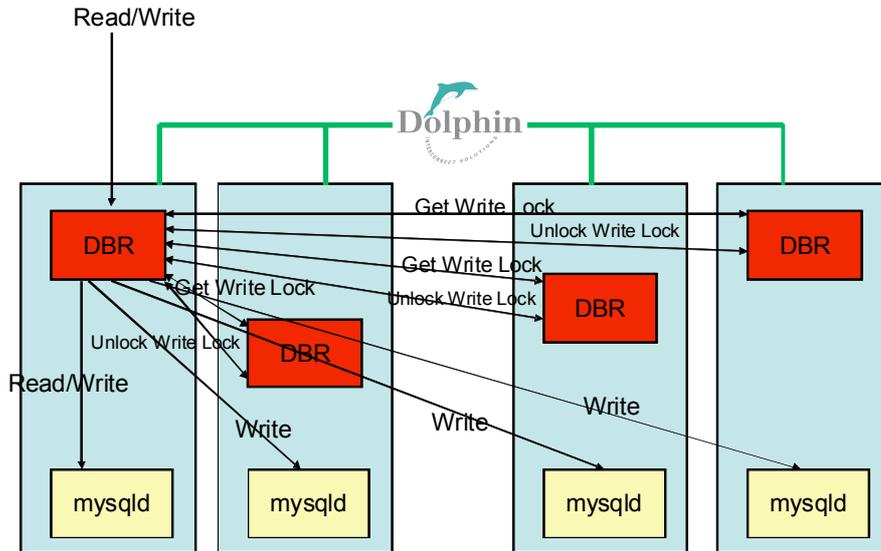
As shown in the figure below, the DBR, the MySQL Server (mysqld) and the data nodes of the MySQL Cluster (ndbd) are usually co-located on the same server. This makes it possible to use local communication for requests between the DBR layer and the MySQL Server. Communication between MySQL Server and the ndbd's most often depends on where the data of the query reside such that the MySQL Server immediately contacts the proper ndbd to ensure that routing in the cluster is as direct as possible.

The Dolphin Express interconnect ensures that communication between the ndbds, and between MySQL Server and the ndbds is very efficient with very low latency. Dolphin Express also increases the performance of communications internally within a node. This combination of very high efficiency with ultra-low latency is the product of Dolphin's long history of developing similar solutions for high performance servers and database clusters.



4 DESCRIPTION OF THE MYSQL INNODB ARCHITECTURE

In the InnoDB architecture the DBR has the responsibility to ensure that all writes are performed one at a time and that these writes happen on all MySQL Servers. This means that the performance in this architecture is very dependent on the latency of the cluster interconnect between the DBR nodes. Reads are performed locally on the same machine as the DBR that receives the request. Writes will be performed on all MySQL Servers on all computers in parallel after acquiring a lock on all DBR nodes in the cluster.



5 BENCHMARK RESULTS

In the first, MySQL Cluster architecture, database inserts were **118% faster with Dolphin Express. Thus, with no application changes, simply adding the Dolphin Express interconnect more than doubled the performance of the application.**

In the second, InnoDB solution, where the DBR makes sure that there is only one writer at a time towards the cluster, the following performance improvements were measured for inserts into the cluster:

<u>Case</u>	<u>Result</u>
Without Dolphin Express	533 inserts per second
With Dolphin Express between DBRs but not to the MySQL Servers	720 inserts per second
With Dolphin Express everywhere	1214 inserts per second

Thus the biggest improvement was measured when using Dolphin Express between the DBRs and between the DBRs and the MySQL Server. In this case, the total performance gain is **128%**.

6 CONCLUSIONS

Teligent's clustered database solutions benefit greatly from the use of Dolphin Express. In both architectures tested, the performance improvement is more than twofold without any changes to the application or underlying database. This proves the value that Dolphin's interconnect products bring to solutions where low latency is critical to driving dramatically faster application performance and significantly enhanced hardware efficiency.