Imagine rewriting Cassandra from Java to C++. Cassandra is already one of the most highly available NoSQL databases, although its maximum latency under load can run on the high side, because the Java VM needs to garbage collect global memory (GC) and Cassandra needs to compact its SSTables, both at what are often inopportune times.

People try to get around the inconsistent latency problem by combining Cassandra with Memcached or Redis. So while you’re doing the rewrite, give the new database its own cache, and allow full-scan operations to bypass the cache to avoid flushing it.

Now imagine making every significant I/O operation in the new database asynchronous, to eliminate waits and spin locks. While you’re worrying about I/O, give the database its own I/O scheduler and load balancer. Finally, introduce a shard-per-core architecture and auto-tuning. Now you’ve got Scylla.

Scylla has additional capabilities beyond Cassandra: materialized views, global and local secondary indexes, workload prioritization, and a DynamoDB-compatible API. The DynamoDB API is in addition to CQL (Cassandra Query Language) and a Cassandra-compatible API.

Scylla also lacks a few capabilities available in DataStax Enterprise, the commercial version of Cassandra, such as the integrated graph database DSE Graph. (Janus Graph, which forked from TitanDB when DataStax took over the latter, can use Scylla as its data store, so the lack of a Scylla graph component isn’t as crucial as it might be.)

Scylla automatically replicates data according to a user-selected replication strategy. The replication factor should be at least three to guarantee that a quorum will exist and the data will still be accessible to a read with quorum consistency if the node containing one copy goes down.

The consistency level determines how many replicas in a cluster must acknowledge read or write operations before they are considered successful. Some of the most common consistency levels used are ANY, QUORUM, ONE, LOCAL_ONE, LOCAL_QUORUM, EACH_QUORUM, and ALL. If you had geographically distributed data centers, you might read using the LOCAL_QUORUM consistency level for performance reasons, at the possible cost of missing the latest updates from the remote DCs.

Like Cassandra, Scylla uses the Sorted Strings Table (SSTable)
as its persistent file format. SSTables need periodic compaction to maintain performance, and Scylla has four strategies for doing so: size-tiered, leveled, time-window, and date-tiered (now deprecated in favor of time-window). Exactly which compaction strategy will give you the best performance depends on your workload.

In Cassandra, SSTable compaction will often cause a large bump in latency when it occurs. In Scylla, compaction occurs in the background and has a much smaller effect on latency.

A Scylla deployment optionally includes a monitoring stack (Prometheus to collect and store metrics, Alertmanager to handle alerts, and Grafana to display the dashboard) and Scylla Manager (cluster administration) in addition to the Scylla cluster.

Scylla deployment options

You can run Scylla on top of Docker, CentOS, RHEL, Ubuntu, or Debian. If you choose to run Scylla Enterprise on AWS, you can use a pre-built AMI for your chosen region. These AMIs are tuned for i3 and i3en instances, but you can run scylla_io_setup if you wish to use a different kind of instance.

You can install Scylla open source or Scylla Enterprise either on-premises or in a cloud of your choice. You can also create a cluster in the Scylla Cloud, a fully managed database as a service, as shown in the screenshots below. Currently Scylla Cloud only runs on AWS.

Scylla case studies and benchmarks

Scylla has done a number of benchmarks against competing databases. That typically is not an easy thing to get right, but Scylla has explained the issues they encountered fairly well. In addition, Scylla has several customer case studies to tout, the most impressive of which is from Comcast.

Comcast

At the 2019 Scylla Summit, Philip Zimich gave a 20-minute talk on Comcast’s transition from Cassandra to Scylla for the X1 DVR platform. Comcast was able to replace 962 m4.2xlarge EC2 nodes of Cassandra with 78 i3.4xlarge and i3.8xlarge nodes of Scylla, for a total savings of 53 percent. Note that Cassandra is unable to make full use of all the cores in i3 instances because of the thread scalability limit in the Java VM, while Scylla can use as many cores as you give it.

Scylla 2.2 vs Cassandra 3.11

A benchmark that Scylla ran comparing a four-node Scylla cluster running on i3.metal instances with a 40-node Cassandra cluster running on i3.4xlarge instances helps to clarify why the Comcast migration achieved such a large reduction in nodes and costs. Also note that the four-node cluster has a tenth of the probability of a concurrent double failure of the 40-node cluster in a two-year period, while the 40-node cluster with smaller instances costs 2.5x the four-node cluster with larger instances.
Scylla benchmarked a four-node i3-metal Scylla cluster against a 40-node i3.4xlarge Cassandra cluster using cassandra-stress loads. The chart above shows the configurations.

According to Scylla’s tests, Scylla Cloud costs much less than Amazon DynamoDB and also delivers superior performance.

Scylla Cloud vs. Google Cloud Bigtable
Similarly, Scylla benchmarked Scylla Cloud against Google Cloud Bigtable. Again, Scylla exhibited better latency at much lower cost.

Learning Scylla
I used Docker on my iMac to follow the free tutorials in Scylla University. I didn’t encounter any issues, and the performance of the Scylla database was noticeably better than Cassandra or DataStax Enterprise run in the same environment.
The session above represents the first lesson. I went on to follow more lessons and take some quizzes, but I found no deviances from the tutorials.

**Scylla stands apart**

Overall, Scylla is a very impressive NoSQL database. While rewriting a database (Cassandra) from Java to C++ seems like an obvious thing to do to achieve better scalability and more consistent latency, Scylla has additional optimizations, such as self-tuning. It's the rare product that exceeds my expectations.

Whether Scylla will serve your application’s needs is a complicated question. I’d recommend following the rubric I laid out in “How to choose a database for your application”: Start with your requirements and use those as a sieve to eliminate the databases that won’t work for you. If Scylla makes your short list, then spend the time to perform a proof of concept.

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**Cost:** Open source: Free for unlimited nodes, but Scylla Manager is limited to five nodes. Enterprise: Contact Scylla.

Cloud: $191 to $17,520 per server per month, depending on server size. Minimum three servers.

**Platform:** Docker, AWS, RHEL 7, CentOS 7, Debian, Ubuntu, VirtualBox.

Martin Heller is a contributing editor and reviewer for InfoWorld. Formerly a web and Windows programming consultant, he developed databases, software, and websites from 1986 to 2010. More recently, he has served as VP of technology and education at Alpha Software and chairman and CEO at Tubifi.