

# The OpenLink Virtuoso Universal Server

*Orri Erling*

*Program Manager, Virtuoso*





# Virtuoso Universal Server

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- n SQL, SQL Federation, Web Services
- n RDF Storage, SPARQL, RDB to RDF Mapping
- n Scale Out and High Availability



# Database

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- n SQL, SPARQL, XML
- n Full ACID, all isolations, no lock waiting for read committed
- n Data rows stored as leaves of PK, no row IDs, all indices independent



# RDF Storage

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- n Default index scheme with index support for all combinations of SPOG
- n Sparse indices for cases where predicate not specified
- n Graph level role based security
- n Key compression



# Full Text and Spatial

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- n All text literals Full Text indexed
- n Text Contains-predicate in SPARQL
- n SQL MM Geometry data type in RDF
- n Apply SQL MM Geometry predicates in SPARQL
- n Cost model support for Text and Spatial



# RDF Inferencing

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- n Subclass / Subproperty
- n Transitive / Inverse
- n Inverse Functional Property, SameAs for Identity
- n Transitivity for arbitrary subqueries
- n All done at run time, backward chained, no load time materialization
- n Materialization is possible with SPARUL



# Cluster

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- n All nodes offer identical service on single logical database, full ACID
- n Hash Partitioning index-by-index
- n Shipping functions to data, co-located joins, filtering and aggregation
- n Vectored execution, optimized message flow
- n Parallel extensions to SQL, similar to Map-Reduce



# High Availability

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- n Partitions can optionally be kept in duplicate or triplicate
- n Parallel Updates, 2 Phase Commit for consistency
- n Continuous read/write operation, full ACID, as long as at least one copy of each partition is online
- n Automatic exclusion and recovery/re-sync of failed servers



# Next

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- n More compression and parallelism
- n Datalog/RIF rules in the engine
- n Dynamic repartitioning
- n Going Towards RDF performance parity with relational database



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