This thesis presents Harmony Oriented Architecture: a novel architectural paradigm that applies the principles of Harmony Oriented Programming to the architecture of scalable and evolvable distributed systems. It is motivated by research on Ultra Large Scale systems that has revealed inherent limitations in human ability to design large-scale software systems that can only be overcome through radical alternatives to traditional object-oriented software engineering practice that simplify the construction of highly scalable and evolvable system.

HOP eschews encapsulation and information hiding, the core principles of object-oriented design, in favor of exposure and information sharing through a spatial abstraction. This helps to avoid the brittle interface dependencies that impede the evolution of object-oriented software. HOA extends these concepts to distributed systems resulting in an architecture in which application components are represented by objects in a spatial database and executed in strict isolation using an embedded application server. Application components store their state entirely in the database and interact solely by diffusing data into a space for proximate components to observe. This architecture provides a high degree of decoupling, isolation, and state exposure allowing highly scalable and evolvable applications to be constructed.

A proof-of-concept prototype of a non-distributed HOA middleware platform supporting JavaScript application components is implemented and evaluated. Results show remarkably good performance considering that little effort was made to optimize the implementation.