

# Decentralized Software Architecture

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ISR Technical Report # UCI-ISR-02-6

**Abstract:** A centralized (or even distributed) system admits only one correct answer to a question at a time. In contrast, a decentralized one allows several agents to hold different opinions, all equally valid. While the term ‘decentralization’ is familiar from political and economic contexts, it has been applied extensively, if indiscriminately, to describe recent trends in software architecture towards integrating services across organizational boundaries.

This technical report investigates how ‘decentralization’ can be defined in the context of software architecture; provide a formal model of two causes of decentralization: latency and agency; review historical trends forcing decentralization in software; as well as design, implement, and evaluate a proposed software architectural style called DECentralized Event Notification Transfer (DECENT).

We believe its principal contributions will include: formally exposing the often-tacit requirement for simultaneity between components; novel rationales for adopting event-based communication, standardized application protocols, and stateless messaging; describing application-layer internetworking of software services across several routers, (rather than a central bus); a microkernel-like refactoring of traditional messaging middleware on top of a basic event model; techniques for using consistent hashing to increase reliability, availability, and scalability of decentralized services; and evaluation of the effectiveness of DECENT-style architecture for enabling 3<sup>rd</sup> and 4<sup>th</sup>-parties to add properties such as security and interoperability without modifying the original services.