Conductor: Distributed Adaptation for Heterogeneous Networks (The Springer International Series in Engineering and Computer Science)

Mark D. Yarvis, Peter Reiher, Gerald J. Popek

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Internet heterogeneity is driving a new challenge in application development: adaptive software. Together with the increased Internet capacity and new access technologies, network congestion and the use of older technologies, wireless access, and peer-to-peer networking are increasing the heterogeneity of the Internet. Applications should provide gracefully degraded levels of service when network conditions are poor, and enhanced services when network conditions exceed expectations. Existing adaptive technologies, which are primarily end-to-end or proxy-based and often focus on a single deficient link, can perform poorly in heterogeneous networks. Instead, heterogeneous networks frequently require multiple, coordinated, and distributed remedial actions.

Conductor: Distributed Adaptation for Heterogeneous Networks describes a new approach to graceful degradation in the face of network heterogeneity - distributed adaptation - in which adaptive code is deployed at multiple points within a network. The feasibility of this approach is demonstrated by conductor, a middleware framework that enables distributed adaptation of connection-oriented, application-level protocols. By adapting protocols, conductor provides application-transparent adaptation, supporting both existing applications and applications designed with adaptation in mind.

Conductor: Distributed Adaptation for Heterogeneous Networks introduces new techniques that enable distributed adaptation, making it automatic, reliable, and secure. In particular, we introduce the notion of semantic segmentation, which maintains exactly-once delivery of the semantic elements of a data stream while allowing the stream to be arbitrarily adapted in transit. We also introduce a secure architecture for automatic adaptor selection, protecting user data from unauthorized adaptation. These techniques are described both in the context of conductor and in the broader context of distributed systems. Finally, this book presents empirical evidence from several case studies indicating that distributed adaptation can allow applications to degrade gracefully in heterogeneous networks, providing a higher quality of service to users than other adaptive techniques. Further, experimental results indicate that the proposed techniques can be employed without excessive cost. Thus, distributed adaptation is both practical and beneficial.

Conductor: Distributed Adaptation for Heterogeneous Networks is designed to meet the needs of a professional audience composed of researchers and practitioners in industry and graduate-level students in computer science.

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