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Technical Report 97-3-3 March 1997

Clock Discipline Algorithms for the Network Time Protocol Version 4

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Abstract

This report describes the analysis, implementation and performance of engineered algorithms to discipline a computer clock to a source of standard time, such as a GPS receiver or another computer synchronized to such a source. The algorithms are designed for the Network Time Protocol (NTP) Version 4, the successor to NTP Version 3, which is in widespread use to synchronize computer clocks in the global Internet. The report includes an overview of the new NTP architecture and process decomposition as related to the clock discipline algorithm, which is implemented as a hybrid phase/frequency-lock feedback loop. An extensive engineering analysis of this algorithm is presented along with the results of a detailed simulation to evaluate and validate its performance using both synthetic data and real measurements with Internet time servers in Europe, Asia and the Americas.

Keywords: computer network time synchronization, clock discipline algorithm, oscillator error modelling, feedback control loop

Sponsored by: DARPA Information Technology Office Contract DABT 63-95-C-0046, NSF Division of Network and Communications Research and Infrastructure Grant NCR 93-01002, Northeastern Center for Electrical Engineering Education Contract A303 276-93, Army Research Laboratories Cooperative Agreement DAA L01-96-2-002, and Digital Equipment Corporation Research Agreement 1417.

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