Time-Critical Systems

Real-Time for the Real World

E. Douglas Jensen's Manifesto

"The problem is never how to get new, innovative thoughts into your mind, but how to get old ones out."
-- Dee Hock, The Birth of the Chaordic Age

This site is primarily an introduction to my personal manifesto about a generalization of traditional "real-time." "*Time-critical*" includes traditional "real-time" as a simple special case limited to static systems. It also encompasses the many dynamic, non-deterministic systems, especially distributed ones, in which acceptable timeliness is a correctness criterion (just as much as it is in ordinary real-time systems).

Discussing time-critical systems also provides an opportunity and indeed the necessessity to deal with the problem that there is little if any consensus among real-time practitioners (i.e., users, vendors) on even the most fundamental concepts and terms -- e.g., "real-time," "hard real-time," "soft real-time," "predictable/predictability," "determinism/deterministic." The practitioners each have their own vague, inaccurate interpretations -- they seem content to paraphrase Justice Potter Stewart's famous quote:

> *"I don't know how to define ["real-time," "hard real-time," "soft real-time," "predictable" "deterministic"] but I know it when I see it."*

Even the real-time research community has consensus on only the term "hard real-time," and it differs from almost all the various interpretations in the practitioner community. Leaving "soft real-time" to be defined as "not hard real-time" is like defining all colors as "black" and "not black." Since most colors are not black, it is essential to have a vocabulary to describe, and be able to reason about and manipulate, their properties.

Likewise, most real-time systems are soft and thus are outside the traditional real-time subset of time-critical systems. Principles, properties, best practices, a vocabulary, and timeliness metrics are essential for engineering and procuring them to meet any specific requirements.

The time-critical paradigm introduced here, although evolving, has been successfully demonstrated to be an expressive framework with a rich vocabulary supporting formal reasoning about timeliness in general, including probablistic models, and the special case of traditional deterministic real-time (as it is defined in the real-time research community).

This site also has an (always out of date) list of some relevant publications my co-authors and I have published.

You can also learn a little about me and what I do at MITRE
Most of my research is public, but my work developing and transitioning distributed time-critical concepts and technologies to defense systems is classified.

REAL-TIME MANIFESTO
Doug's Perspective on Time-Critical Systems

PUBLICATIONS
Doug's Annotated Bibliography of Published Papers by his Colleagues and Himself

REAL-TIME RESOURCES
Doug's Evolving List of Recommended Books Related to Time-Critical Systems

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