Principles and properties		Structures	
✓	Versatility	✓	Module
✓	Conceptual integrity	✓	Dependency
✓	Independently changeable	✓	Process
✓	Automatic propagation	✓	Data access
	Buildability		
✓	Growth accommodation		
✓	Entropy resistance		

Guardian: A Fault-Tolerant Operating System Environment

Greg Lehey

ARCHITECTURE IS NOTHING NEW. REAL BUILDING ARCHITECTURE has been around for thousands of years, and some of the most beautiful examples of building architecture are also thousands of years old. Computers haven't been around that long, of course, but here too there have been many examples of beautiful architectures in the past. As with buildings, the style doesn't always persist, and in this chapter I describe one such architecture and consider why it had so little impact.

Guardian is the operating system for Tandem's fault-tolerant "NonStop" series of computers. It was designed in parallel with the hardware to provide fault tolerance with minimal overhead cost.

This chapter describes the original Tandem machine, designed between 1974 and 1976 and shipped between 1976 and 1982. It was originally called "Tandem/16," but after the introduction of its successor, "NonStop II," it was retrospectively renamed "NonStop I." Tandem frequently used the term "T/16" both for the system and later for the architecture.

I worked with Tandem hardware full-time from 1977 until 1991. Working with the Tandem machine was both exhilarating and unusual. In this chapter, I'd like to bring back to life some of the feeling that programmers had about the machine. The T/16 was a fault-tolerant machine, but that wasn't its only characteristic, and in this discussion I mention many aspects that don't