

## Qualification Statement

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Since my Ph.D from the University of Washington in 1989, my research has been focused on interaction between computer architecture and system software including operating system and compilers. One research area of my recent interest is flash memory-based storage system. Although flash memory provides low power consumption, shock resistance, and other desirable properties suitable for mobile embedded system, many of which require survivability notably from power failure, it has its own shortcomings. For example, an overwrite operation cannot be performed without an erase operation, which takes a long time and consumes a significant amount of energy. Moreover, the unit of the erase operation called a block is much larger than that of the write operation called a page. These limitations of flash memory are handled by a software layer called FTL (Flash Translation Layer) to provide a hard disk like interface to the host system. In the FTL, one of important issues is recovery from a power failure since in an embedded system, the battery can be removed at any time without any notification from the host system. One of the questions I would like to bring to this workshop is the requirements of non-volatile storage devices for a survivable system, i.e., what kind of additional functionality is required from the storage system in addition to those provided by the conventional storage systems. This question leads to the second question – how such additional requirements can be implemented with a bounded amount of energy, which is stored in a secondary power source such as a super capacitance to be used in the case of power failure. For this purpose, the energy consumption by the software needs to be estimated to provide any survivability guarantee. The latter problem was addressed in a recent paper by my research group entitled “An Accurate Instruction-Level Energy Consumption Model for Embedded RISC Processors” and presented at the ACM SIGPLAN 2001 Workshop on Languages, Compilers, and Tools for Embedded System. By participating in ISW-2001, I would like to share my experience on a survivable storage system and get a broader perspective on survivability issues.