



*“Chipkill Memory or Advanced ECC memory offers around 99.94% reliability, keeping your mission critical applications running longer”*

*“IBM is currently the only major vendor to offer this innovative solution”*

## What is Chipkill Memory?

Chipkill or *Advanced ECC* memory is an IBM  xSeries memory subsystem technology that increases memory reliability many times over. *This radically reduces the chances of system downtime caused by memory failures.* This technology was developed specifically for the NASA pathfinder mission to Mars. Where memory errors would have proved disastrous. It is now available in xSeries servers.

## Why is it important?

Standard ECC (Error Correcting Code) memory is a proven industry standard technology that has had a considerably positive impact on server reliability over the past 5 years. ECC memory is able to detect and correct single bit memory errors, which make up the vast majority of memory errors.

However the increase of memory capacity (up to 32GB), the density of memory on a single DIMM (up to 1GB) and the increase in speed of the memory subsystem has significantly increased the risks of multi-bit memory errors that cannot be corrected by standard ECC memory and result in the system hanging.

Chipkill memory has the ability to correct multi-bit memory errors and in doing so, increases system availability considerably.

## How does it actually work?

The fundamentals of Chipkill operations are essentially the same as RAID for disk subsystems. When writing data to the DIMM, a duplicate set of data in the form of a checksum is written to another part of the memory subsystem. If a memory failure occurs then the data is immediately recovered by re-calculating the data from the checksum information. This procedure allows the system to mask not only the single bit errors that standard ECC memory can correct but also 2,3 & 4 bit errors. In some cases, even a whole DRAM Chip failure.

In initial Chipkill releases these advanced ECC functions were implemented through a special ASIC (Application Specific Integrated Circuit) embedded in the memory DIMM itself. Newer Chipkill designs have seen the Chipkill functionality moved to the memory controller board allowing the use of standard SDRAM DIMMS.

## How reliable is it?

No memory sub-system is completely fail proof, however simulated 3 year workloads\* carried out in IBM's development labs compared failure rates of both ECC memory and Chipkill. The reliability rate of standard ECC memory was measured at 91% versus 99.94% reliability of Chipkill.

\*Results of BMRS simulation of continuous operation (720 power-on hours) over 36 Months using 8x128MB DIMMs with 4 x 64MB DRAMs)