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NATIVE AMERICAN HERITAGE MONTH

Tara Astigarraga

Predicting When Memory Wears Out

The Engineer Who Started With Language

Tara Astigarraga is a citizen of the Choctaw Nation of Oklahoma who was born and raised in Arizona. At the University of Arizona she double-majored in communication and Spanish linguistics, planning a career as a bilingual teacher or social worker. An internship at IBM's Tucson site during her senior year changed her direction, and IBM hired her full-time after graduation.

Much of her work involves **enterprise storage** — the systems that hold data for banks, hospitals, and governments. Her first patent, granted in 2008, was for **end-of-life prediction for flash memory**. Flash memory, used in phones, USB drives, and solid-state drives, stores data in tiny cells. Each cell can only be erased and rewritten a limited number of times, called **program/erase cycles**, before it becomes unreliable. If a system can predict when that limit is near, it can move data to safety before anything is lost.

Engineers also use **wear leveling**, which spreads writes across many cells so no single cell wears out early — like rotating the tires on a car.

Astigarraga has since earned more than 70 patents in storage, networking, security, and blockchain. IBM named her a Master Inventor and a Distinguished Engineer. She has served as vice president of the Tucson Native American Diversity Network and builds mentoring connections for Native American students and employees.

Part 1 • Reading Comprehension

1. How did Astigarraga's path into engineering differ from what she originally planned?

2. Why does flash memory eventually wear out?

3. What does end-of-life prediction allow a storage system to do?

4. Explain wear leveling in your own words and why it helps.

Part 2 • Critical Thinking

Hospitals and banks store data that cannot be lost. Why might predicting a failure be more valuable than simply fixing it after it happens?

Part 3 • STEM Challenge

How Long Will the Memory Last?

Example numbers: suppose each block of flash memory can survive 3,000 program/erase cycles. A program rewrites the same block 10 times per day. Show your work.

1 How many days will that one block last before it reaches 3,000 cycles?

2 About how many years is that? (Use 365 days in a year.)

3 Now the device uses wear leveling and spreads those 10 daily writes evenly across 100 blocks. How many writes does each block get per day?

4 With wear leveling, how many days until a block reaches 3,000 cycles? About how many years?

