

Forging a Future in Memory:
New Technologies, New Markets, New
Applications

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Environmental Trends

Ripe for Change

Source: Numonyx B.V.

Enterprise

(Servers / Storage)

- Power, performance, reliability is the name of the game
- SSD's providing breakthrough performance improvement
- Creates a battle ground for HDD providers

Compute

(Desktop / Laptops)

- Threatened by cloud computing
- Processors throttled by storage
- Promise of "instant on" has not emerged



Mobile

(Laptops / MID's)

- Threatened by Smart Phone
- Multiple names for different screen sizes
- Processing battle ground



Cellular

(Phones)

- H/W feature slow down → Differentiation via S/W & FF
- H/W & market consolidation beginning
- Smart Phone challenging "mobile"



Characteristics

Challenges are different

Enterprise
(Servers / Storage)

- Performance driven (generally not CPU limited)
- “Green” focus brought into foreground
- Reliability vs. cost is the trade off

Compute
(Desktops / Laptops)

Mobile
(Laptops / MID's)

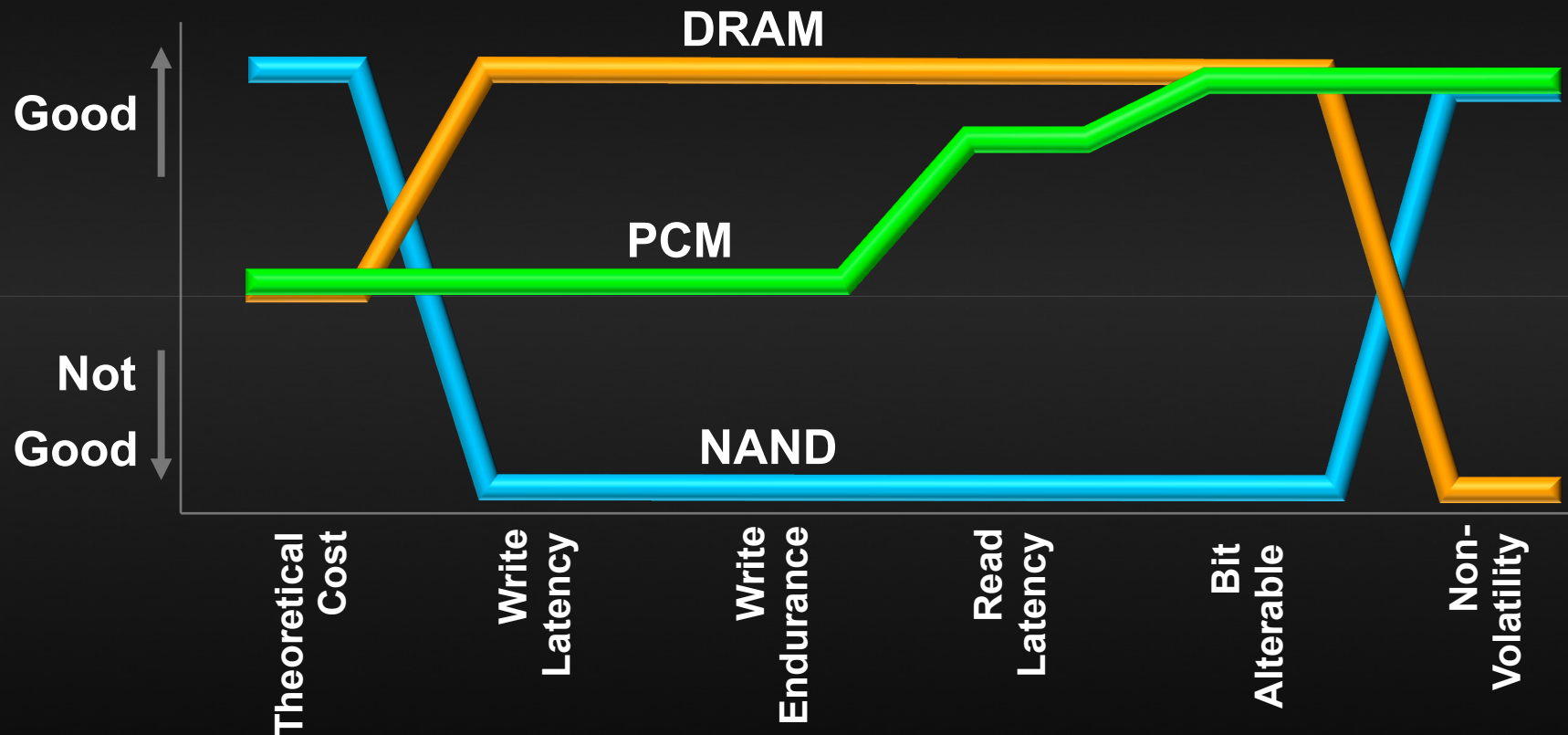
- Ease of use
- Instant On / Consumption

Cellular
(Phones)

- Power vs. “good enough” performance trade off

Memory Characteristics

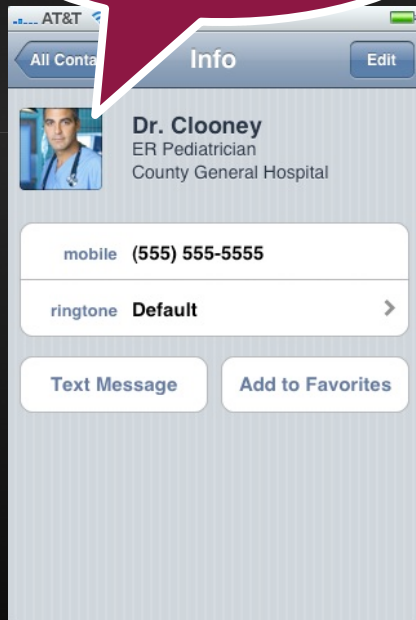
PCM Offers Attributes of RAM & NAND



Bit Alterability

Ridiculously Simple

“I have a new mobile number:
(555) 555-5554”



NAND

1. Read 4KB from NAND w/ECC
2. Write to RAM
3. Modify RAM
4. Locate new NAND page
5. Write new NAND page
6. Calculate & Write ECC
7. Mark old NAND page “dirty”
8. Eventually erase NAND block

PCM

1. Write 1 bit in PCM

Much less bus traffic

“Hidden” Power

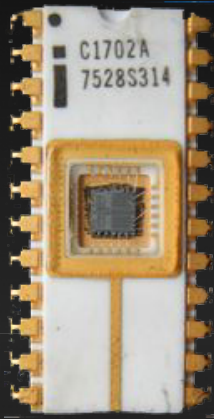
Ridiculously Simple

Data Retention

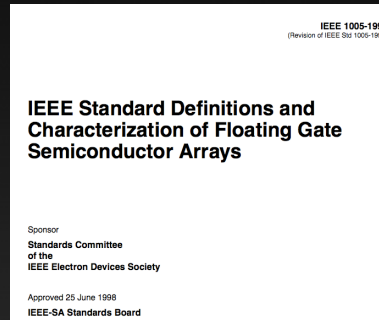
Historical View



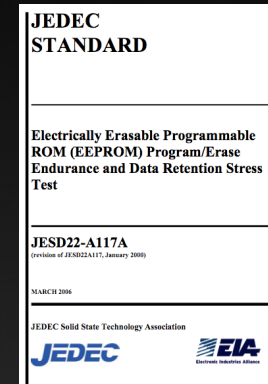
200k year?



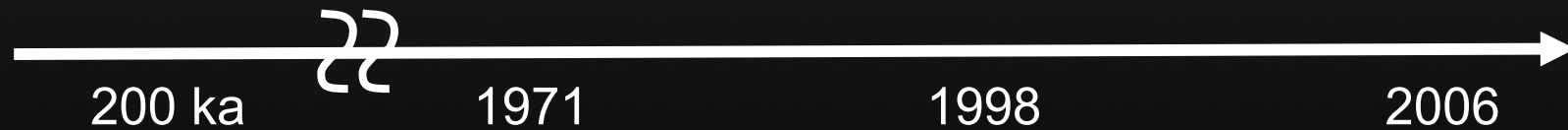
10 year
(with sticker)



“Endurance is a measure of the ability of a nonvolatile memory device to meet its data sheet specifications as a function of accumulated nonvolatile data rewrites or program/erase cycles.”



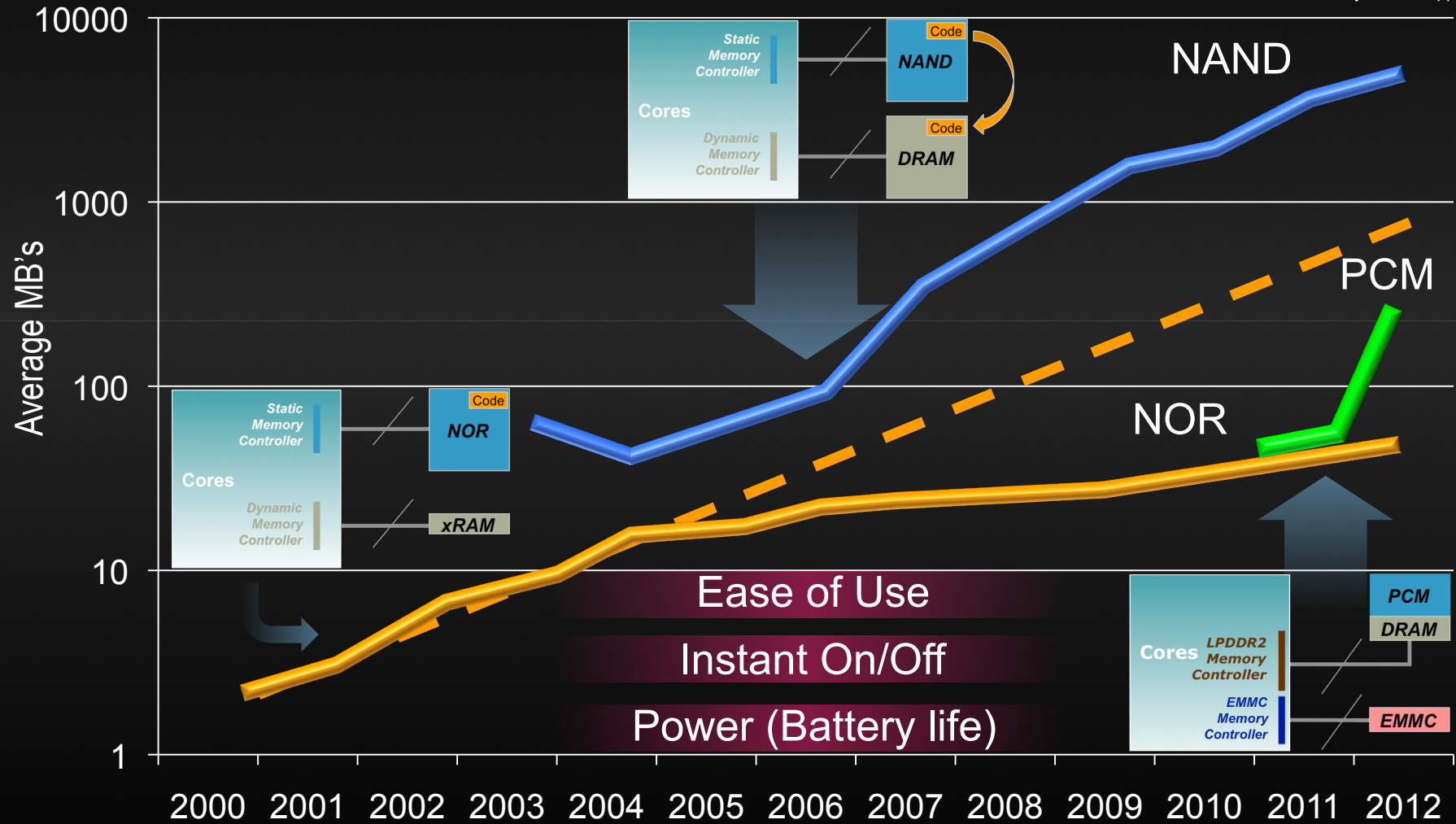
10 yr at “low cycles”
1 yr at data sheet



News Flash: PCM Intrinsic Data Retention exceeds 200k years at 35C post 1M cycles

Consumption Cellular Architecture

Source: Numonyx B.V, iSuppli



Consumption

Mobile

Mobile
(Laptops / MID's)

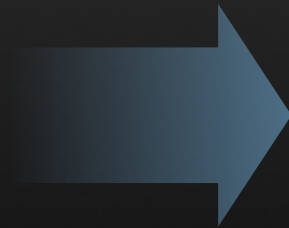
- Threatened by Smart Phone
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Ease of Use

Instant On/Off

Power (Battery life)



What's Really Required for
Email / Browsing / Music / Video?

How do you architect for this?
(This is not a trick question)

Simple: Requires "Cell Phone" Architecture
"If you build it they will come"

Content

Mind boggling exponential information growth



Source: <http://www.kurzweilai.net/articles/art0134.html?printable=1>

2009: 1.5 EB's per year

2009: 50GB's per second

2020: 500GB's per u-second

YouTube Mobile Uploads Up 400% Since iPhone 3GS Launch

by Jason Kincaid on June 25, 2009



Performance

Bandwidth vs. Latency



Bandwidth
"Add More"



0-60mph → 10.4s
\$20,000

Latency
"Add Something Faster"



0-60mph → 3.5s
\$200,000

Application to Content

Approach is Changing



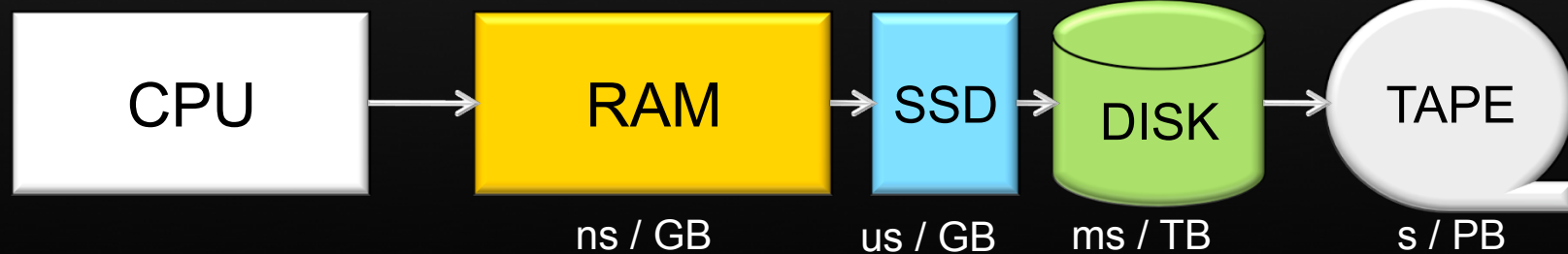
Bandwidth Improvement



Latency Improvement



or



Performance

Relatively Speaking

PCM

If Random Latency = 1 day

SSD

Then... latency = 17 days

HDD

Then... latency = 9 years

SCM PCM

Then... latency = 30 min

**Storage Class PCM can perform >800 data
base searches in the time it takes an SSD to do 1**

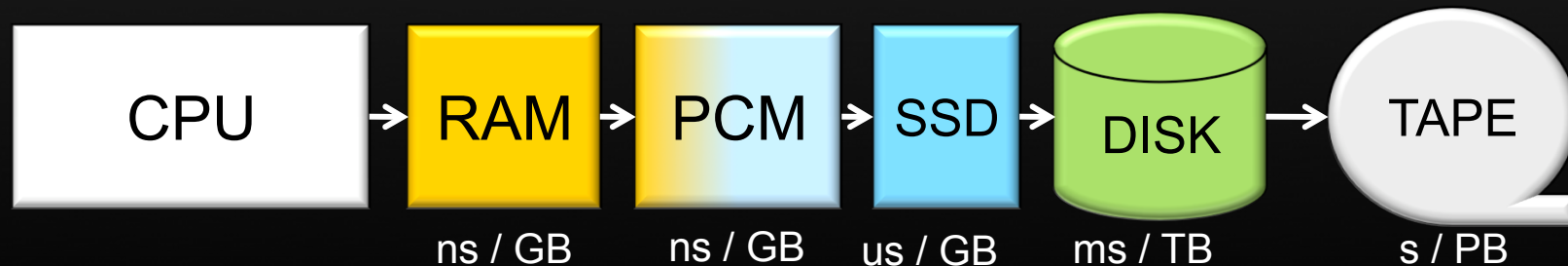
Latency

Value goes up with information growth

amazon.com “... every 100ms of latency cost them 1% in sales”
Source: <http://highscalability.com>

Google™ “...an extra 500ms in search page generation time dropped traffic by 20%”
Source: <http://royal.pingdom.com>

TABB GROUP “... a broker could lose \$4 Million Dollars per millisecond if their electronic trading platform is 5ms behind the competition”
Source: <http://highscalability.com>



Latency

Still Not Convinced?

Russian Arrested For Allegedly Stealing Goldman's Secret Trading Formula

John Carney | Jul. 6, 2009, 9:37 AM | 18

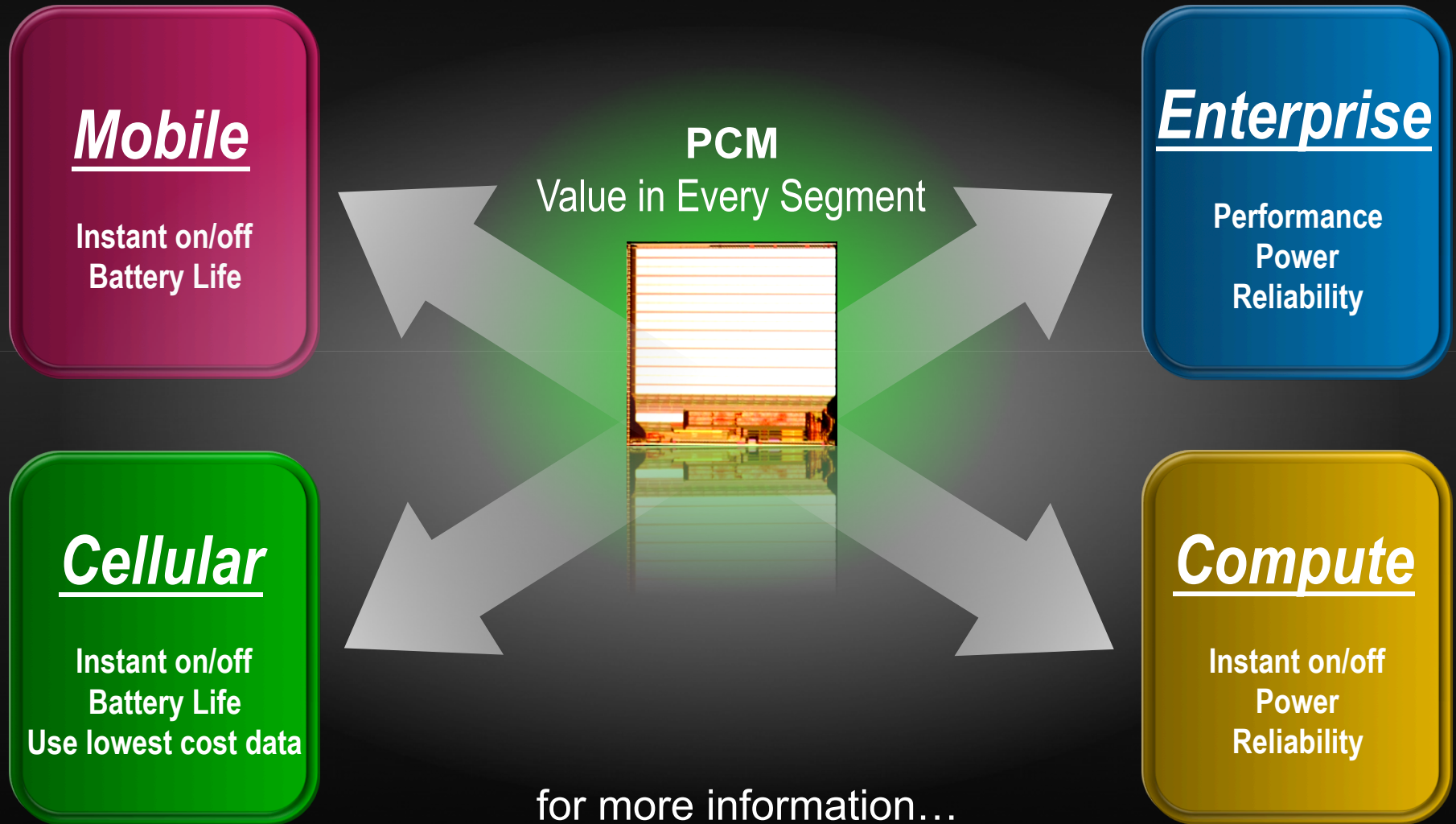
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Tags: Wall Street, Goldman Sachs, Markets, Stocks, Legal, Stock Market, Hires And Fires, UBS, Bonus, Finance, Investing, S&P 500, Editors' Picks, Depression, Economy, Hedge Funds

Goldstein looked up Aleynikov's Linked-In page, discovering that he joined Goldman in May 2007 and was vice president for equity strategy. His bio says he was responsible for "development of a distributed real-time co-located high-frequency trading platform." That seems to be Goldman's proprietary program trading options, which Aleynikov describes as "a very low latency (microseconds) event-driven market data processing, strategy and order submission engine."

PCM

Industry Demands Will Drive Change



for more information...

Numonyx[®] Phase Change Memory Early Access Program

What: Members-only access to Numonyx[®] PCM technical information:

- Preliminary data sheets
- Technical presentations
- White papers
- Sample requests

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- Numonyx PCM Technical Overview Presentation
- Quick Links to Numonyx PCM documentation, white papers, demos, tutorials

Upon validation of NDA:

- Specifications on next-generation products
- Advance information and access to new product datasheets, sample requests

Advance notification via e-mail:

- Future products
- Preliminary documentation, design guides, etc.

The screenshot shows the Numonyx website's 'PCM Early Access Program' page. The page features a navigation bar with links for System Solutions, Memory Products, Resource Center, About Numonyx, Where to Buy, and Community. A central banner reads 'Imagine the new features that come from innovative memory solutions.' Below this, the 'PCM Early Access Program' section explains that the program is for designers interested in evaluating PCM technology. It lists benefits such as access to preliminary data sheets, technical presentations, white papers, and sample requests. A 'Join now >>' button is visible at the bottom of the page.

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