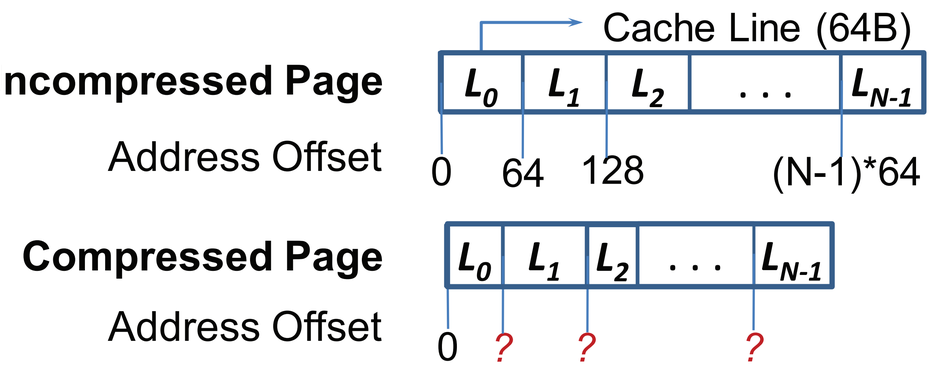
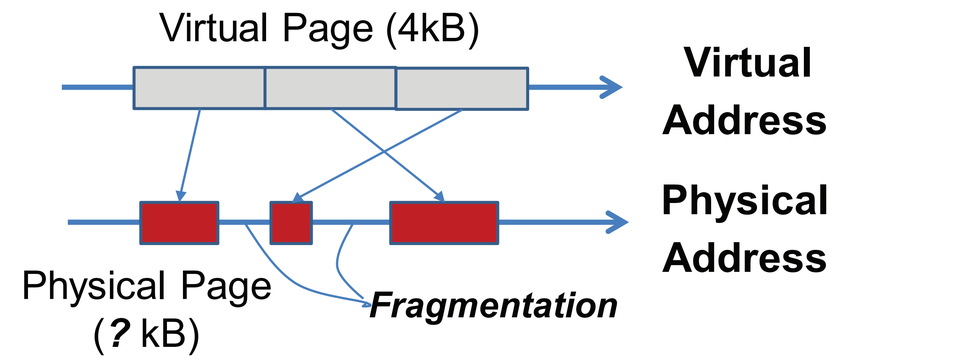
# LINEARLY COMPRESSED PAGES: A MAIN MEMORY COMPRESSION FRAMEWORK WITH LOW COMPLEXITY AND LOW LATENCY

Gennady Pekhimenko, Vivek Seshadri, Yoongu Kim, Hongyi Xin, Onur Mutlu, Todd C. Mowry (CMU),
Phillip B. Gibbons, Michael A. Kozuch (Intel)

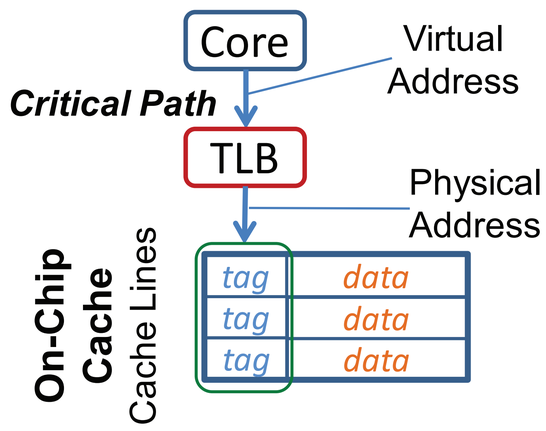
## CHALLENGES IN MAIN MEMORY COMPRESSION




### CHALLENGE 1: ADDRESS COMPUTATION

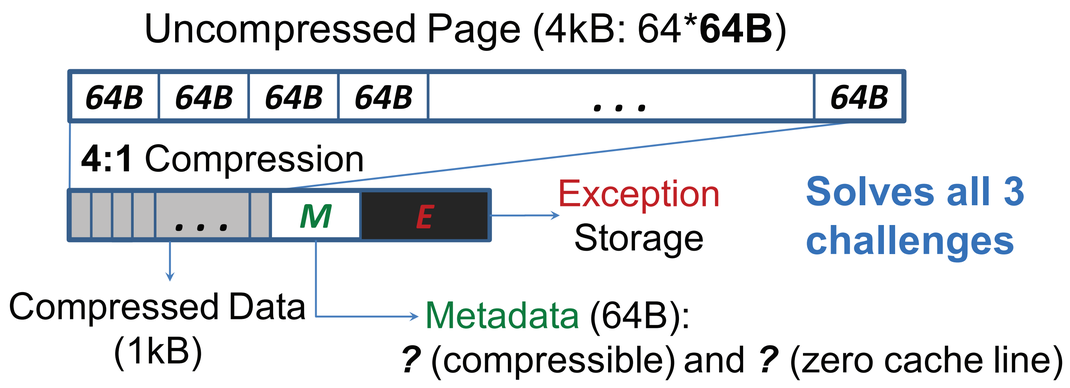



### CHALLENGE 2: MAPPING AND FRAGMENTATION




### CHALLENGE 3: PHYSICALLY TAGGED CACHES

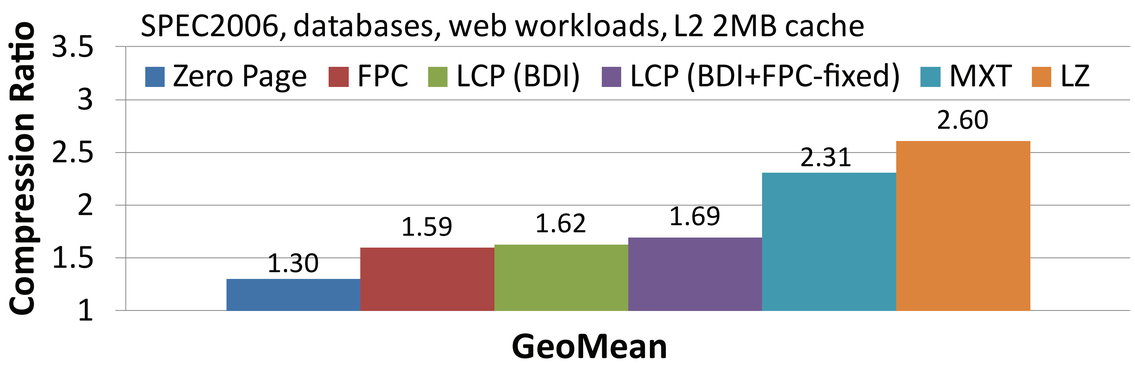
## LINEARLY COMPRESSED PAGES (LCP)

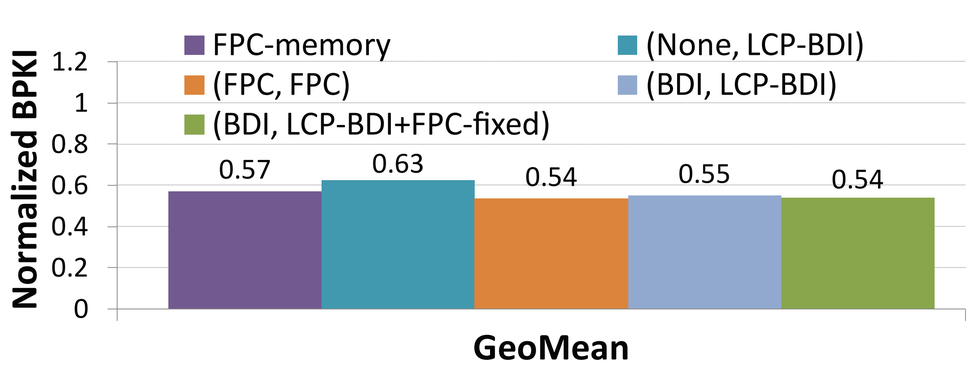



## LCP OVERVIEW AND OPTIMIZATIONS

- Page Table entry extension: compressed type, size
- Operating System management support: 4 memory pools
- Changes to cache tagging logic
- Handling page overflows
- Compression algorithms: BDI and FPC
- Metadata cache: Avoids additional requests to metadata
- Memorybandwidth reduction
- Zero pages and zero cache lines

## KEY RESULTS: COMPRESSION RATIO, BANDWIDTH, PERFORMANCE




| Cores | LCP-BDI | (BDI, LCP-BDI) |
|---|---|---|
| 1 | 6.1% | 9.5% |
| 2 | 13.9% | 23.7% |
| 4 | 10.7% | 22.6% |

Average performance improvement

Intel Science & Technology Center for Cloud Computing

Carnegie Mellon University · Georgia Tech · intel · Princeton University · UC Berkeley