|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Challenge | Tradeoff | THM | HMA | MemPod |
| Page Relocation | *Flexibility / Time* | Only 1 Candidate  *Min / Very Low* | No Restrictions  *Max / High* | Intra-Pod Migration  *High / Medium* |
| Remap Table Size | *Flexibility / Area* | 1 entry per fast page (~2.4MB)  *Min / Medium* | No remap table  *Max / Min* | 1 entry per page (~54MB)  *High / Max* |
| Activity Tracking | *Accuracy / Area* | 8 bits per fast page (64kB)  *Medium / Low* | 16 bits per page (9MB)  *Max / Max* | 128 MEA entries (640B)  *High / Very Low* |
| Migration Trigger | *N/A* | Threshold | Interval | Interval |
| Tracking Organization | *Simplicity / Parallelization* | Fully centralized (Serialized requests)  *High / Min* | Fully distributed  *High / Max* | Semi-distributed (Pods operate independently)  *High / High* |
| Migration Driver | *Latency* | CPU  *High* | CPU (OS)  *Max* | Pod  *Low* |
| Migration Cost | *Time* | HW cost + CPU time  *Medium* | HW + SW + cold TLBs + CPU  *Max* | HW  *Min* |

|  |  |
| --- | --- |
| **Processor** | |
| Cores | 8 @ 3.2GHz |
| Width | 4 wide out-of-order |

|  |  |
| --- | --- |
| **Caches** | |
| L1 I-Cache(private) | 64KB, 2 way, 4 cycles |
| L1 D-Cache (private) | 16KB, 4 way, 4 cycles |
| L2 Cache (shared) | 8MB, 16 way, 11 cycles |

|  |  |  |
| --- | --- | --- |
|  | **HBM** | **DDR4-1600** |
| Bus Frequency | 1 GHz | 800 MHz |
| Bus Width (bits) | 128 | 64 |
| Channels | 8 | 4 |
| Ranks | 1 | 1 |
| Banks | 16 | 16 |
| Row Buffer Size | 8KB | 8KB |
| tCAS-tRCD-tRP-tRAS | 7-7-7-17 | 11-11-11-28 |

|  |
| --- |
| **Simulation Workloads** |

|  |  |
| --- | --- |
| **Homogeneous** | |
| **astar** | 8x astar |
| **bwaves** | 8x bwaves |
| **bzip** | 8x bzip |
| **cactus** | 8x cactus |
| **dealII** | 8x dealII |
| **gcc** | 8x gcc |
| **gems** | 8x gems |
| **lbm** | 8x lbm |
| **leslie** | 8x leslie |
| **libquantum** | 8x libquantum |
| **mcf** | 8x mcf |
| **milc** | 8x milc |
| **omnetpp** | 8x omnetpp |
| **soplex** | 8x soplex |
| **sphinx** | 8x sphinx |
| **xalanc** | 8x xalanc |
| **zeusmp** | 8x zeusmp |

|  |  |
| --- | --- |
| **Mixed** | |
| **mix1** | lbm, leslie, mcf, omnetpp, gcc, gems, milc, zeusmp |
| **mix2** | mcf, gems, astar, leslie, gcc, sphinx, omnetpp, zeusmp |
| **mix3** | gcc, mcf, lbm, sphinx, soplex, libquantum, milc, leslie |
| **mix4** | milc, dealII, mcf, dealII, gcc, cactus, mcf, bzip |
| **mix5** | mcf, dealII, cactus, bwaves, soplex, bzip, xalanc, cactus |
| **mix6** | mcf, gcc, libquantum, bzip, lbm, soplex, gcc, cactus |
| **mix7** | leslie, xalanc, gems, bzip, astar, dealII, zeusmp, bwaves |
| **mix8** | omnetpp, bwaves, xalanc, dealII, astar, bzip, bwaves, cactus |
| **mix9** | astar, leslie, sphinx, dealII, zeusmp, gems, astar, bwaves |
| **mix10** | mcf, milc, libquantum, gcc, soplex, libquantum, gcc, lbm |
| **mix11** | gems, zeusmp, astar, omnetpp, leslie, sphinx, astar, leslie |
| **mix12** | bwaves, xalanc, cactus, dealII, bzip, cactus, dealII, bzip |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **mix1** | **mix2** | **mix3** | **mix4** | **mix5** | **mix6** | **mix7** | **mix8** | **mix9** | **mix10** | **mix11** | **mix12** |
| **astar** |  | **** |  |  |  |  | **** | **** | **** |  | **** |  |
| **bwaves** |  |  |  |  | **** |  | **** | **** | **** |  |  | **** |
| **bzip** |  |  |  | **** | **** | **** | **** | **** |  |  |  | **** |
| **cactus** |  |  |  | **** | **** | **** |  | **** |  |  |  | **** |
| **dealII** |  |  |  | **** | **** |  | **** | **** | **** |  |  | **** |
| **gcc** | **** | **** | **** | **** |  | **** |  |  |  | **** |  |  |
| **gems** | **** | **** |  |  |  |  | **** |  | **** |  | **** |  |
| **lbm** | **** |  | **** |  |  | **** |  |  |  | **** |  |  |
| **leslie** | **** | **** | **** |  |  |  | **** |  | **** |  | **** |  |
| **libquantum** |  |  | **** |  |  | **** |  |  |  | **** |  |  |
| **mcf** | **** | **** | **** | **** | **** | **** |  |  |  | **** |  |  |
| **milc** | **** |  | **** | **** |  |  |  |  |  | **** |  |  |
| **omnetpp** | **** | **** |  |  |  |  |  | **** |  |  | **** |  |
| **soplex** |  |  | **** |  | **** | **** |  |  |  | **** |  |  |
| **sphinx** |  | **** | **** |  |  |  |  |  | **** |  | **** |  |
| **xalanc** |  |  |  |  | **** |  | **** | **** |  |  |  | **** |
| **zeusmp** | **** | **** |  |  |  |  | **** |  | **** |  | **** |  |