

CXL Market Outlook & Key Use Cases

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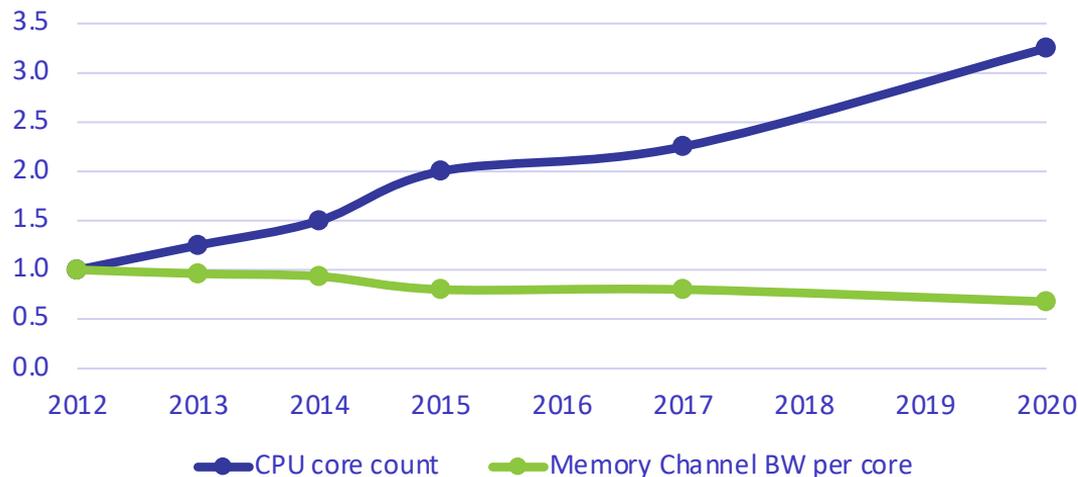
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The CPU/Memory Challenge

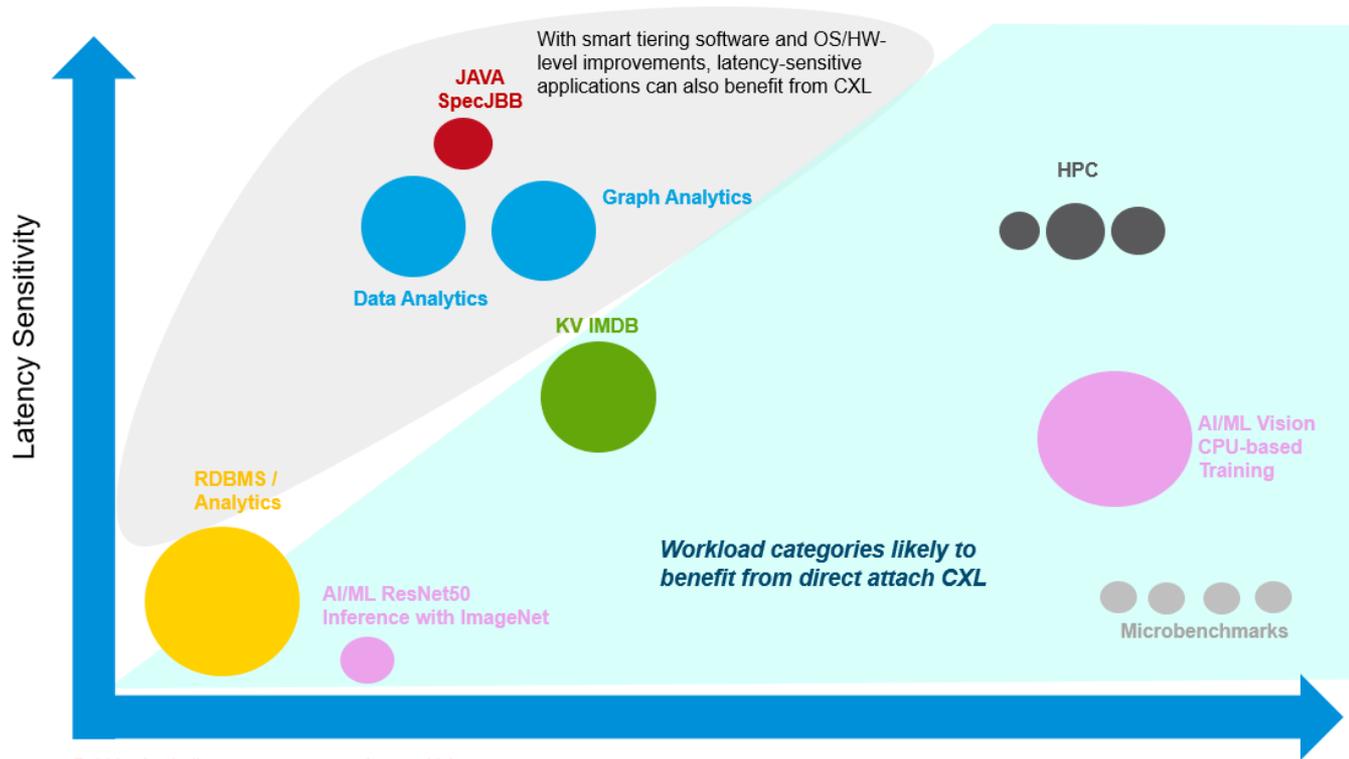


Normalized Growth Rate



- Increasing core counts drives memory demand
- Demanding more bandwidth and capacity
- Memory is not able to keep up -> more DDR channels
- YoY memory cost/GB reductions flattening
- Memory capacity scaling challenges expected to persist

CXL Memory Sensitivity by Workload



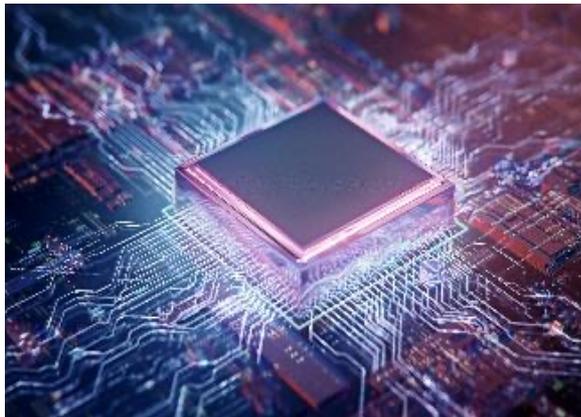
Bubble size indicates memory capacity sensitivity

Microbenchmarks: Stream, Intel Memory Latency Checker, GoogleStress and LM Bench

Bandwidth Sensitivity



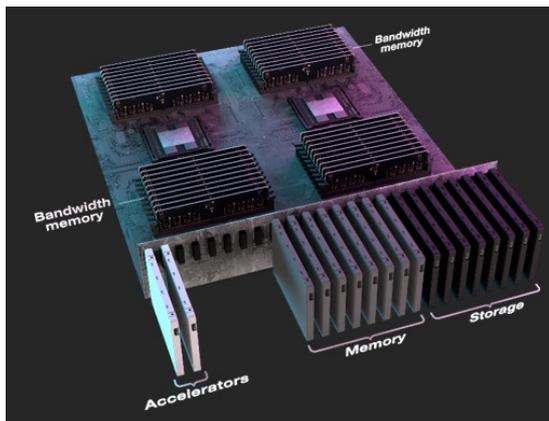
Type III Use Case: Bandwidth Expansion



- A single x8 CXL channel supported by PCIe Gen5 is capable of delivering ~30-35GB/s of memory bandwidth
- AI/ML, HPC, and In-memory database workloads could benefit from additional system memory bandwidth delivered through CXL



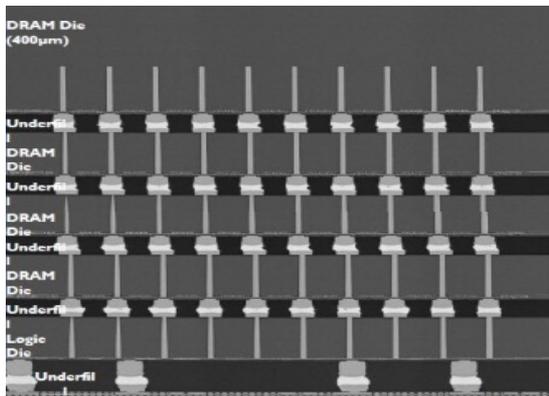
Type III Use Case: Enablement after 2DPC



- Higher memory transfer rates (DDR5 5600+) driving the need to reduce memory channel loading to maintain signal integrity
- Systems' inability to accommodate 2 DIMMs per channel driving significant increase in per-DIMM memory capacity



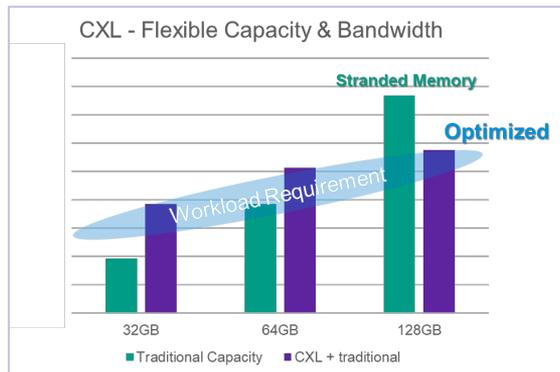
Type III Use Case: Alternative to Stacking



- DDR5 transfer rates drive the need for advanced stacking technologies like through-silicon-VIAs (TSVs) for high capacity DIMMs
- Use of TSVs drive non-linear cost per bit increase versus monolithic (non-stacked) DRAM packages



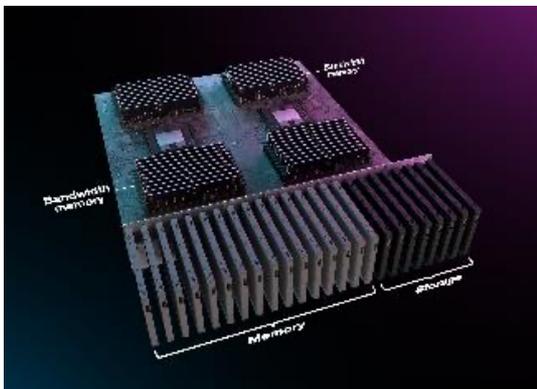
Type III Use Case: Granularized BW/Capacity Expansion



- Datacenter operators employ well-defined system requirements for deterministic workloads
- Additional memory capacity and bandwidth can be “dialed in” with CXL when combined with main memory, potentially offering greater flexibility in delivering these requirements



Type III Use Case: Ultra-High Capacity



- CXL extends the usable memory footprint beyond system main memory
- TBs of additional memory capacity can be made available via CXL, enabling significantly larger data sets and expanding possibilities for in-memory data base workloads



Type III Use Case: Reduce System Complexity



- All use cases do not require the maximum memory capacity and bandwidth available from main memory
- System TCO can be optimized by leveraging CXL to work alongside main memory to reduce thermal load or system complexity



Type III Use Case: Memory Pooling

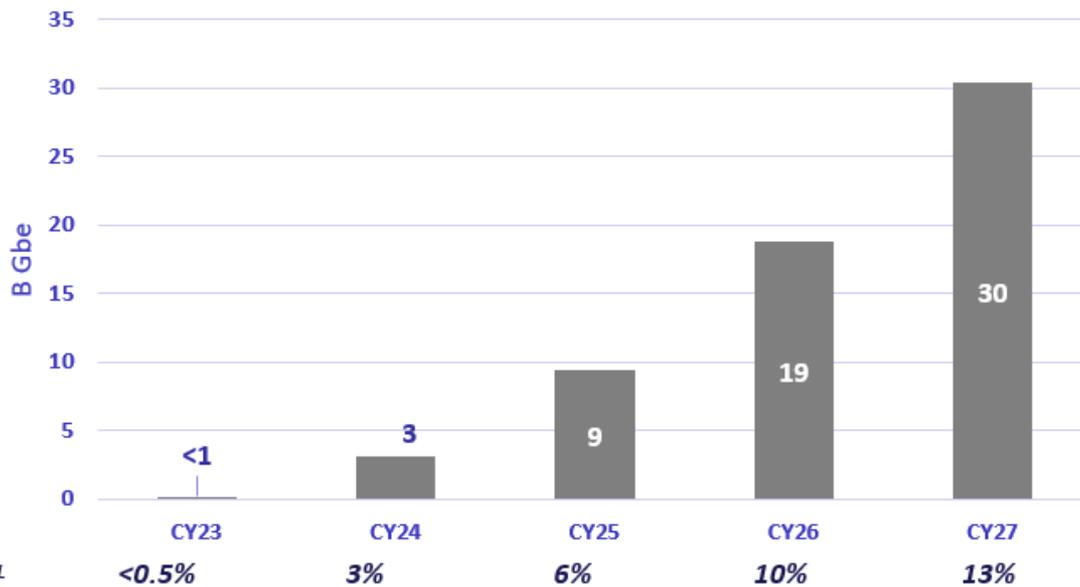


- Without CXL systems must be provisioned to efficiently operate under the most extreme workload requirements, driving underutilization of resources like memory in “non-surge” situations
- CXL enables multiple CPU hosts to access a common memory “pool” when surge capacity is needed, potentially enabling servers to be deployed with less local memory



CXL Type III Memory Outlook

CXL DRAM TAM Forecast



Thank you!



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