OCP

Software Defined Memory: Workstream Update

SDM Team
(Manoj Wadekar)

Agenda

- FTI and SDM - introduction

- Team charter

- Operation methods

- Current activities and Status

- SDM Graduation!

FTI Focus Areas (Started in 2021)

- **AI HW-SW Design Collaboration**

- **Cloud Service model**

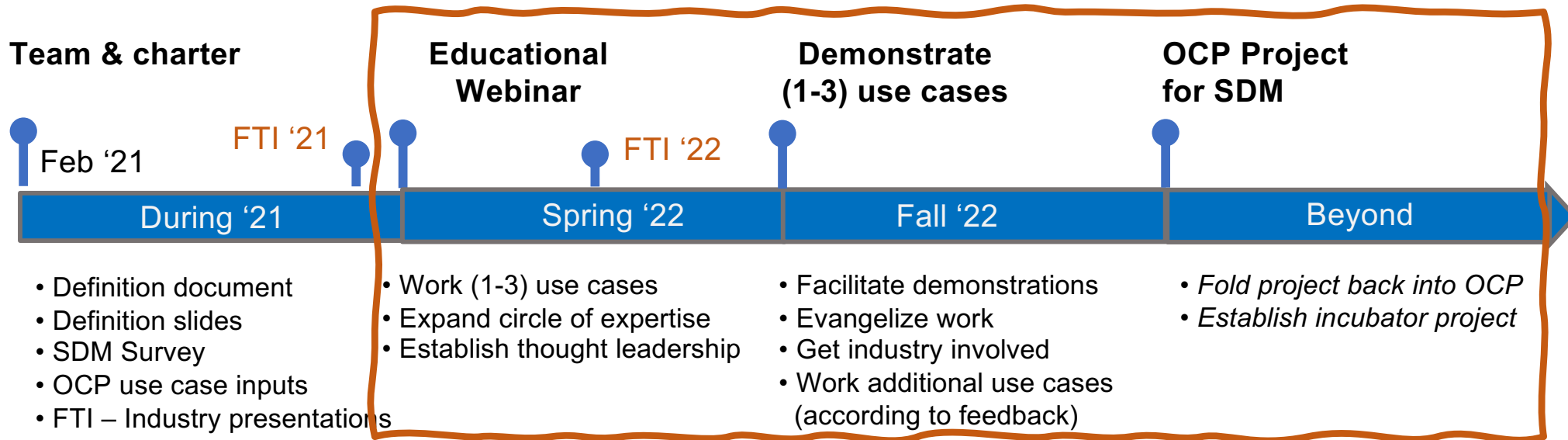- **Software Defined Memory**

SDM Team Charter

- **Identify** key applications driving adoption of Hierarchical/Hybrid memory use cases
- Establish architecture and **nomenclature** for such Systems
- Offer **benchmarks/metrics** that enable validation of novel ideas for HW/SW solutions for such systems

Drive HW-SW Co-design for SDM Use Cases

(Ad-hoc) Industry Participation

- **Device/System Vendors**: Intel, Micron, Samsung, SMART Modular, Cisco

- **CPU Vendors**: AMD, ARM, Intel

- **CSP**: Meta, Microsoft, Uber, VMware

- **ISVs**: Microsoft, Vmware, MemVerge

- **Analyst**: Informa

SDM 2022 plan

Team & charter

Feb '21

FTI '21

Educational Webinar

FTI '22

Demonstrate (1-3) use cases

OCP Project for SDM

| During '21 | Spring '22 | Fall '22 | Beyond |

- Definition document
- Definition slides
- SDM Survey
- OCP use case inputs
- FTI – Industry presentations

- Work (1-3) use cases
- Expand circle of expertise
- Establish thought leadership

- Facilitate demonstrations
- Evangelize work
- Get industry involved
- Work additional use cases (according to feedback)

- *Fold project back into OCP*
- *Establish incubator project*

Investigation approach:
○ **Evangelize**: SDM opportunities in industry with **SDM Solution Blueprint**
○ **Enable**: adoption through **"SDM_spec" Benchmarks** for work-load specific use cases
○ **Demonstrate**: OCP Community Lab POCs, White/Research Papers, Webinars, Spring workshop

Focus Area Teams

Databases/Caching	AI/ML & HPC	Virtualized Servers	University/Research	Industry/Analyst
•**Chagam Anjeneya (Reddy) (Intel)** •Meta (Manoj), Intel, Samsung (Rekha), Micron (Puja), Vmware (Renu), Microsoft(Jui-Hao), AMD (Alex)	• **Samir Mittal (Micron)** • Microsoft (Jui-Hao Chang, Daniel , Samir Rajadnya) • AMD (Alex Branover) • Micron (Puja Zalavadia) • Meta (Manoj W.) • Samsung (Rekha P) • Intel (Reddy) • Arm (Eddie)	•**Renu Raman (Vmware)** •Meta, Uber(Vikrant), Vmware, ARM, Microsoft (Daniel Berger, Samir Rajadnya), AMD (Alex), Intel (Reddy)	•**Rekha Pichumani (Samsung)** •Samsung, Meta, Micron (Samir)	•**Dennis Hahn (Informa)** •Informa, Meta, Cliff (OCP)

Focus teams

Focus Areas

Databases, AI/ML & HPC, Virtualized Servers

University/Research collab,
Industry/Analyst collab

Participation

SDM members can participate in any/all focus teams

Deliverables

Develop consistent blueprint that enables demonstration of SDM value for the focus application

Meetings

Focus teams will meet/work offline to develop the content

Bi-weekly Joint meeting assess progress

Blueprint for HW-SW Co-design: SDM

- Description of the use cases
  - What's the application and how SDM fits into
- HW Solutions
  - Different HW components necessary to demonstrate
- SW Solutions
  - SW components necessary to demonstrate
- How to test: Benchmark (open source): SDM_bench_<app>
  - Workload/Profiles
- How to measure: Monitoring/Metrics
- Identify co-travelers: Associated Standards/Research Bodies

Collaboration: details

- Bi-weekly Project progress meeting
  - Coordinating industry discussions, presentations, OCP activity within FTI
    - SDM Webinar (May'22)
    - FMS Round Table and presentations - (Aug '22)
    - SNIA presentation, Global OCP SDM group meeting (Sept '22)

- Bi-weekly Use case discussion meeting
  - AI/ML and HPC Use case:
    - Meta: "Memory Requirements of Meta AI Workloads"
    - Microsoft: "Azure DL/ML use cases"
    - AMD: "Composable Architecture for Data centers and ML"
  - Virtualized Server Use case:
    - Microsoft: "First-generation Memory Disaggregation for Cloud Platforms"
    - Uber: "CXL memory pooling for deploying containerized microservices"
    - VMware: "Introducing Project Capitola: Software defined memory for data centric workloads"
  - Cache and Database Use case:
    - Intel/Meta:" Memache use case and Cachebench "
    - Meta: Transparent Page Placement

SDM Workstreams

- **Local Memory Expansion**
  - Devices: CXL Memory Buffer, CXL Memory, Device Form Factors
  - System Configuration: GP Servers with CXL, GPU/Accelerator systems with CXL
  - SW Subsystem: Kernel support for memory tiering, Applications with memory tiering support,
  - Use Cases: Cache/DB, Inference servers (Meta, Uber?)
    - Benchmarks: Cachebench, db_bench, mlc

- **Pooled Memory Expansion**
  - Devices: CXL Memory Buffer, CXL Memory : with multi port support
  - System Configuration: Pooled memory systems
  - SW Subsystem:
  - Use Cases: Virtualized Servers (Microsoft, VMware, Uber)
  - Benchmarks: mlc

- **Memory Switches/Systems**
  - Devices: CXL Switches, Memory Systems with multi-port
  - System Configuration: CXL Switches, Memory Systems
  - SW Subsystem:
  - Use Cases: Virtualized Servers
  - Benchmarks: TBD

- **Near Memory Compute**

Workstream Contributions (planned)

- **HW Specs**:
  - OCP Memory Module Spec :
    - Memory Expansion Board,
    - Memory Module (Form Factors, connectors – pointers/additions)
  - **Benchmarks**: Use Case based Benchmarks and Metrics
- **SW Specs**:
  - Kernel SW:
    - E.g. Kernel/User Space page placement (TPP)
    - E.g. Instrumentation Spec (TBD)
  - BIOS/FW
  - Tools
  - Orchestration, manageability, etc.

SDM is graduating from FTI

- SDM graduates as an OCP subproject under Server Track

- **Composable Memory Systems**

Call to Action

- Help us tackle Memory Challenges through Hardware and Software innovation!

- Develop TCO-optimized CXL memory

- Please join CMS community as it is formalized as a sub-project under Server track

  - CMS Group meets to plan for the details, Wednesday 10/19/2022

    - **2.30-5.00pm, SJCC - Lower Level - LL20BC**
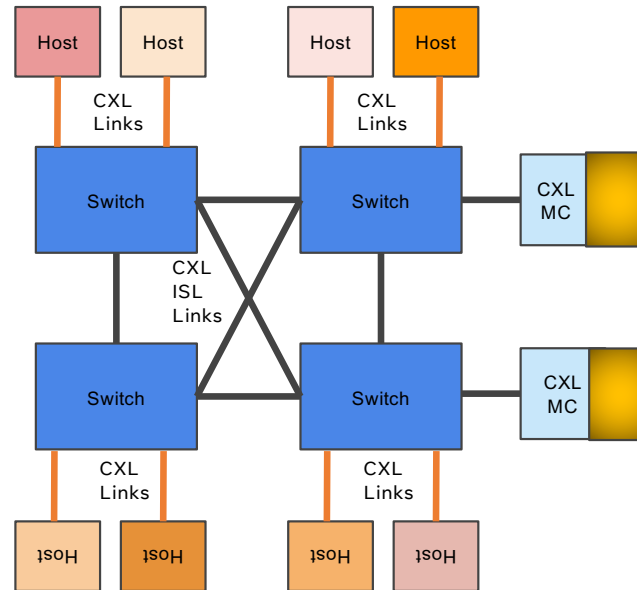
  - CMS Workgroup: Link

Backup

CMS Workstreams
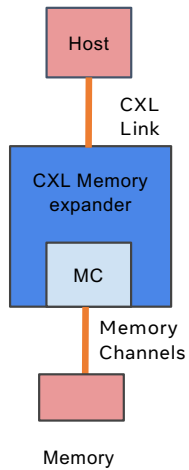
Local Memory
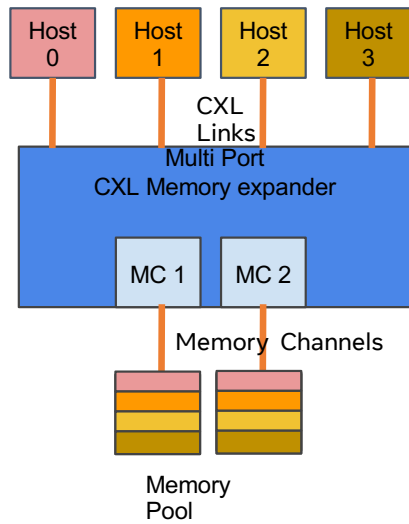
Pooled Memory

Memory Switches/Systems