Adv. ML Sys: CS839 Spring ‘22 Project Check-in Ashwin Poduval, Rajesh Shashi Kumar

1. Goal: Demonstrate and characterize GPU power variations in ML parallel workloads. This could enable power-aware time/space-sharing and placement performance optimizations
   1. **Profiling**: Measurable metricsthat affect variability at devicelevel
      1. Jetson:
         1. SGEMM metrics with/without DVFS. Measurements with fine-grained frequency control is a good approximation to understand range of variations
         2. Fine-grained sensor measurements contrasted with nvprof reporting
      2. V100:
         1. Testbench: Automated toolchain install, runs and reporting
         2. Concurrent SGEMM runs across 4xV100 (space locality), Multiple jobs on a single GPU (to represent time locality). Extend this to future measurements
      3. Obtain power, frequency, temperature metrics across all GPUs using nvprof
   2. **Characterization**: Create stressmark suite to demonstrate variability by picking workloads that span applications/bottlenecks representing realistic usage in space-sharing systems
      1. SGEMM/DGEMM
      2. RESNET (Language)
      3. BERT (Vision)
      4. DLRM (Recommender systems)
   3. **Mitigation**: Decided to defer to future work post project-proposal.
2. Challenges
   1. C4130 nodes require force reboot after 30m or so with CUDA installation. This seems to be a known issue, but the provided workaround isn’t working yet. This limits long running simulations [Mailing list link](https://groups.google.com/u/3/g/cloudlab-users/c/Or-wYwEY5xM)
   2. SGEMM kernel fails for matrix dimensions larger than 16k x 16k
   3. More than 4 GPU variation study likely not possible. Even if we get two nodes of c4130, the relative placement in cluster is unknown to have reproducible effects
3. Timeline

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| **Week starting** | **Goals** |
| April 10 | * Co-locate cross combinations of the following from the [Nvidia DL repository](https://github.com/NVIDIA/DeepLearningExamples) with SGEMM (base vs test)  1. RESNET (Vision) 2. BERT (Language) 3. DLRM (Recommender)  * Collect metrics for same scenarios with GPU-boost disabled * Collate database with metrics captured across all runs include 1-4 GPU combinations * Formalize variation using model properties and trends/anomalies from profiling |
| April 17 |
| April 24 | Analysis, documentation, and presentation |

1. Resource request from course staff
   1. We have c4130 node reserved until the 20th. It might be helpful if we can get an extension on this for a week or 2 nodes of c4130.
   2. Guidance on analysis plan since the data collection part feels open ended