1. Problems

- Dynamic Voltage & Frequency Scaling: Widely used to boost performance, lower power, and improve energy efficiency.
- Challenge: How to predict performance and power across DVFS states?
- Difficulties brought by modern processors: Multiple clock domains, multiple power planes.

2. Platform and Tools

- HW Platform: AMD FX-8320 (4 cores per unit, 2 cores per core, 5 states, 3.5GHz to 1.7GHz)
- Power Measurement: PCIe 3.0, LTI Desktop
- SW Tools: Linux 3.20-24
- Tools: Taskset, A2C Mapping, CPUFreq, Voltage

3. Performance (CPI) Prediction across VF States

- The leading loads model: CPI reduces when instructions are issued faster.
- CPI = CCPI + MCPI;
- CPI = CCPI + MCPI;
- CPI = CCPI + MCPI;
- CPI = CCPI + MCPI;

4. Power Prediction across VF States

- Building the power model: P_idle = P_idle + P_dyn;
- P_dyn: 10.6% error
- P_idle: 2.8%
- Power Prediction Error: Average 3.2%

5. Putting them together: PPEP

- CPI Prediction: P_idle = P_idle + P_dyn;
- Power Prediction Error: Average 3.2%

6. Conclusion

- On AMD Commercial Processors:
  - Implemented an across-VF CPI predictor “LL-MAB”
  - Implemented an across-VF power predictor
  - Combining them together: PPEP
- Support online PPE information of each VF state
- Software method w/o requiring hardware or operating system modifications