Dynamic Voltage and Frequency Scaling (DVFS), a widely adopted technique to ensure safe thermal characteristics while delivering superior energy efficiency, is rapidly becoming inefficient with technology scaling due to two critical factors: a) inability to scale the supply voltage due to reliability concerns; and b) dynamic adaptations through DVFS cannot alter underlying power hungry circuit characteristics, designed for the nominal frequency. In this paper, we show that DVFS scaled circuits substantially lag in energy efficiency, by 22—86%, compared to ground up designs for target frequency levels. We propose Topologically Homogeneous Power-Performance Heterogeneous multicore systems (THPH), a fundamentally alternate means to design energy efficient multicore systems. Using a system level CAD approach, we seamlessly integrate architecturally identical cores, designed for different voltage-frequency (VF) designs. We use a combination of standard cell library based CAD flow and full system architectural simulation to demonstrate 11—22% improvement in energy efficiency using our design paradigm.

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