NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

Towards Mitigating Intermittency of Renewable Energy Supply in Large-Scale Infrastructures with Job Replication

Vladimir Marbukh & Brian Cloteaux, NIST

{vladimir.marbukh, brian.cloteaux}@nist.gov

Carbon Aware Networks Workshop, Oxford 2023

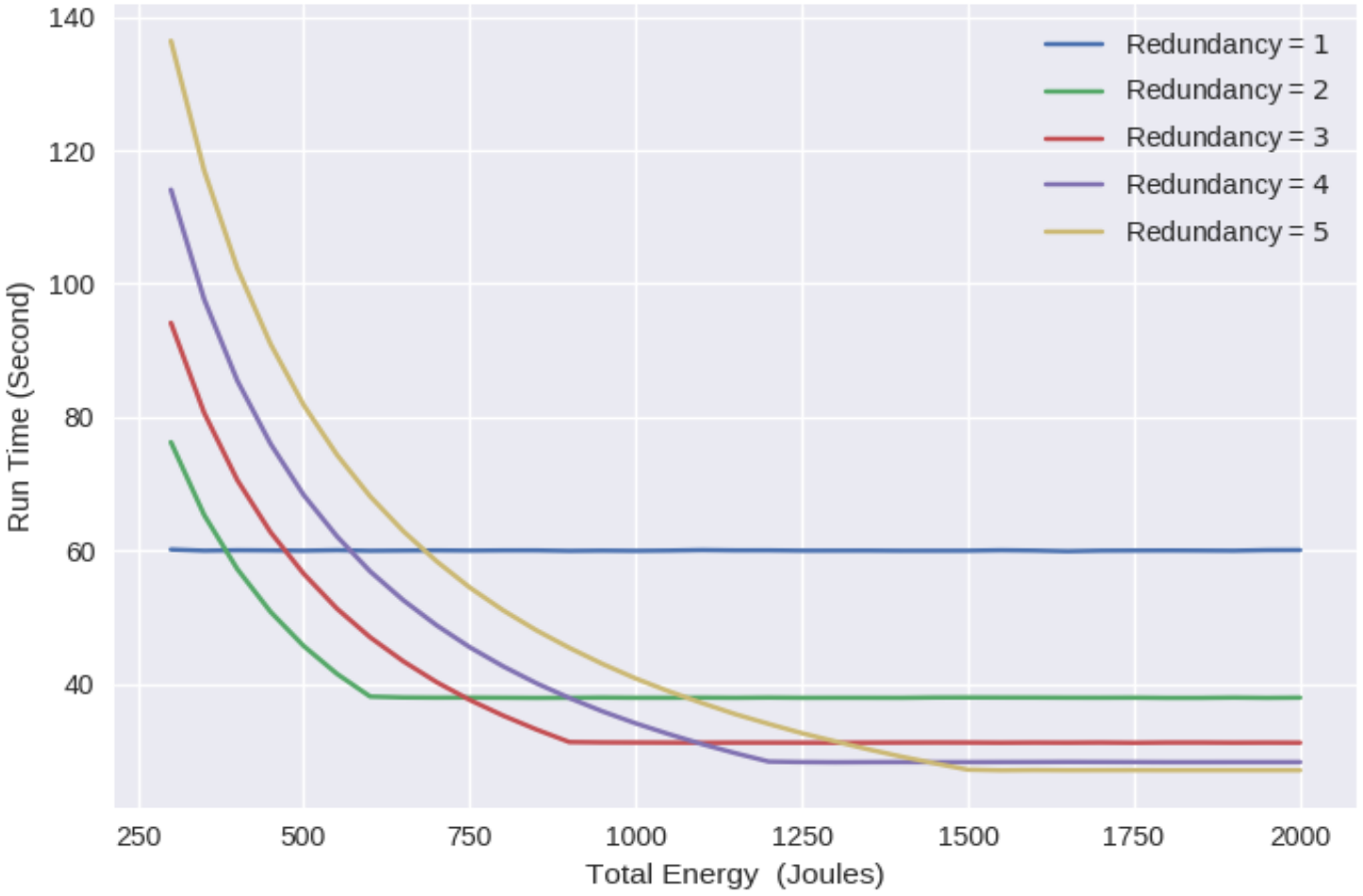
NIST (Seed) Project on Carbon Aware Computing/Communication

A major obstacle to broad acceptance of renewable energy for computing and communication, which has strict latency requirements, is the intermittency of green energy sources. This obstacle can be overcome by a combination of the following three strategies: (a) using batteries allowing for smoothing the energy supply by absorbing unpredictable fluctuations in renewable energy availability, (b) shaping demand to fit green energy supply, and (c) dynamic allocation of computationally extensive jobs according to the green energy availability in geographically distributed systems.

It is likely that the successful path to green energy acceptance will include some combination of all strategies (a), (b), and (c). This path will require balancing various tradeoffs between carbon footprint, cost, performance, and reliability. Additional complexity is due to the necessity of decentralized management of large-scale interconnected networked systems which are geographically distributed. Our initial focus on mitigation of intermittency of green energy sources via job replication is motivated by its successes in the mitigation of the effect of unpredictable service slowdowns/disruptions.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

Effect of Redundancy on Energy-Latency Tradeoff



Pareto Optimal Energy-Latency Frontier

Thank you!