

## Recent and Expected Advances in HPC

Dr. Josip Loncaric

HPC Performance Futures Lead, LANL

Dennard scaling and Moore's law delivered decades of high performance computing gains, but CMOS progress is expected to stall in early 2020s for both physical and economic reasons. DOE and NNSA investments in exploring future technologies reveal that physics of computation is forcing HPC into a design corner involving heterogeneity in both processing and memory, as described by abstract machine models. Continued exponential growth in delivered functionality requires comparable improvements in energy efficiency, or else information technology is poised to consume the entire global electricity supply. Capability growth also requires budgets and scale, forcing defensive measures to deliver reliable results despite the constant stream of component failures. While there are no compelling alternatives to CMOS today, alternative technologies have a chance to enter the HPC ecosystem by 2030. Prudent planning is required to prepare aerospace engineering applications in time to intercept HPC technology evolution, starting with the machines available today.