



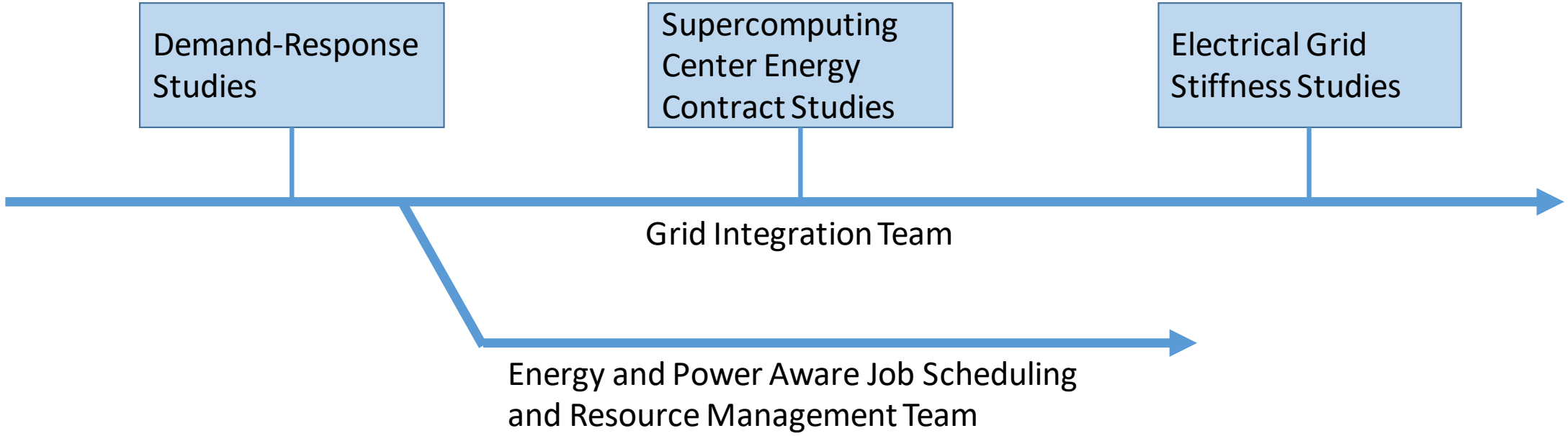
Grid Integration Team Update

SC19 – Energy Workshop

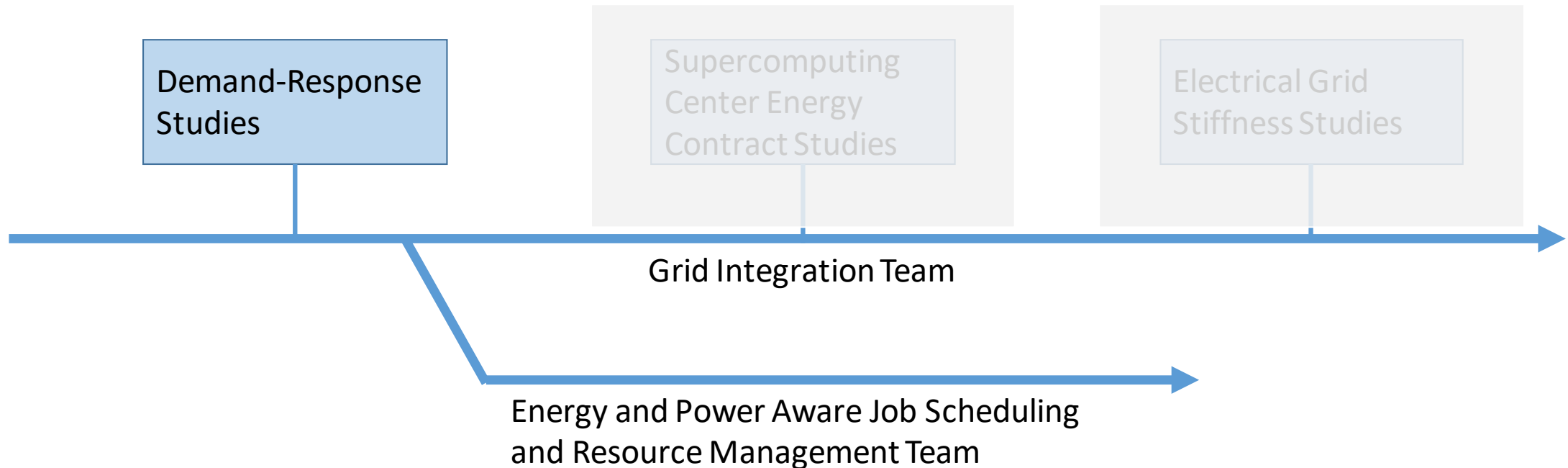
Denver, Colorado – November 18, 2019

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Team History and Timeline

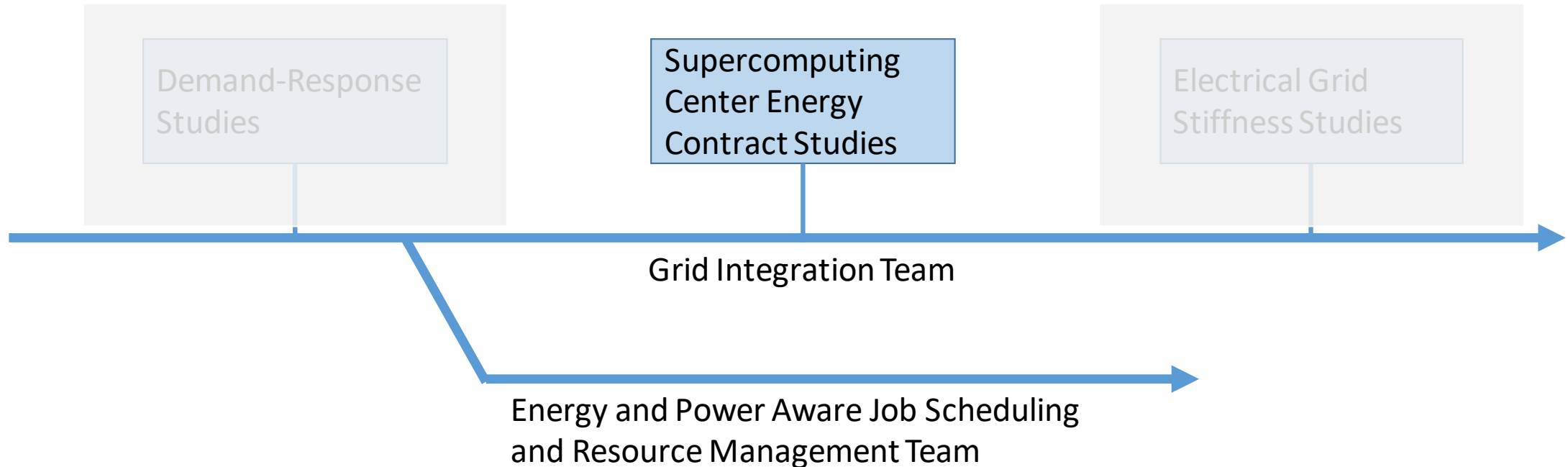


Team History and Timeline



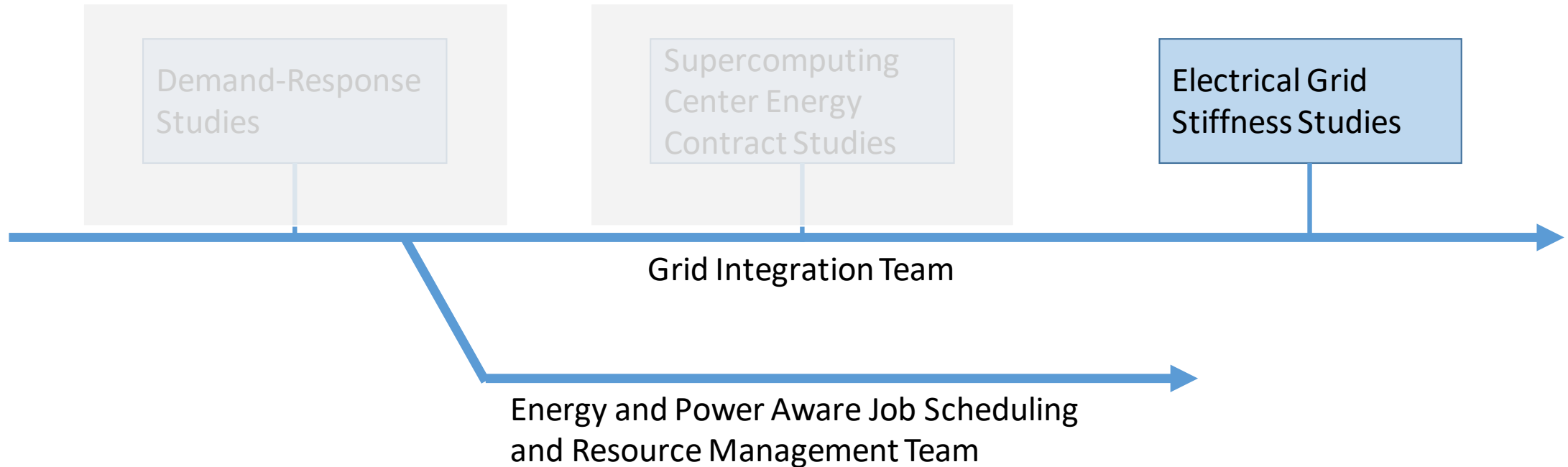
- N. Bates, G. Ghatikar, G. Abdulla, G. Koenig, S. Bhalachandra, M. Sheikhalishahi, T. Patki, B. Rountree, S. Poole, "The Electrical Grid and Supercomputing Centers: An Investigative Analysis of Emerging Opportunities and Challenges," *Energiinformatik 2014*, Springer Publications, Zurich, Switerland, 2014.
- T. Patki, N. Bates, G. Ghatikar, A. Clausen, S. Klingert, G. Abdulla, M. Sheikhalishahi, "Supercomputing Centers and Electricity Service Providers: A Geographically Distributed Perspective on Demand Management in Europe and the United States," *Proceedings of ISC High Performance 2016*, Frankfurt, Germany, June 2016.

Team History and Timeline



- G. Koenig, et al., “An Analysis of Contracts and Relationships Between Supercomputing Centers and Electricity Service Providers,” invited talk, ISC High Performance 2018, Frankfurt, Germany, June 2018.
- A. Clausen, G. Koenig, S. Klingert, G. Ghatikar, P. Schwartz, N. Bates, “An Analysis of Contracts and Relationships Between Supercomputing Centers and Electricity Service Providers”, Energy Efficient State of the Practice Workshop, Proceedings of *48th Annual International Conference on Parallel Processing*, Kyoto, Japan, 2019.

Team History and Timeline



- G. Stewart, A. Clausen, G. Koenig, S. Klingert, J. Liu, N. Bates, "Grid Accommodation of Dynamic HPC Demand", Energy Efficient State of the Practice Workshop, Proceedings of *48th Annual International Conference on Parallel Processing*, Kyoto, Japan, 2019.

Ideas for Future Work

HPC Center Policies

- HPC Centers typically operate their machines using a set of center-wide policies
 - “Overall system utilization should be at least 80%”
 - “25% of the jobs run should be Leadership Class jobs”
- Enacting these policies often intersects with the energy-aware work taking place throughout EE HPC WG (e.g., PowerStack)

Approach & Challenges

- Our approach is to convert policies into a set of constraints that define hard and soft operating parameters under which the Center operates
- Sometimes constraints may be at odds with one another
 - “Leadership Class jobs should have N% efficiency”
 - “Jobs should remain below X power envelope”

Optimization Solution

- An optimization process can find “good” (or “best”) ways of fulfilling all constraints simultaneously





Thank you!

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