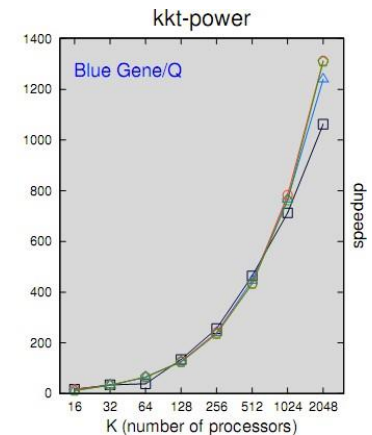
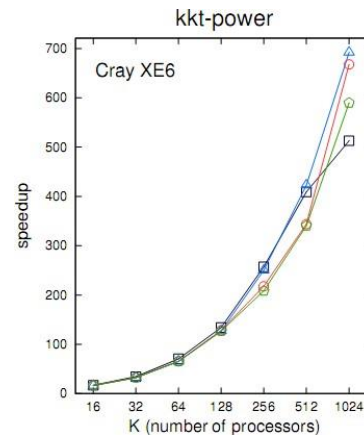


## High Performance Computing (HPC)

- Recent research interest and expertise
  - Combinatorial scientific computing**
  - Iterative solvers:** novel partitioning models, algorithms and software utilities for development of parallel iterative methods for linear-system solutions
  - Optimizing latency-centric communication metrics for petascaling **sparse solvers**
  - Partitioning **irregular domains** for large-scale parallel processing
  - Locality aware scheduling of irregular applications on **Many Core** architectures
  - Partitioning models for scaling 1D-, 2D- and 3D-parallel **sparse matrix-matrix multiply**
  - Partitioning large scale **social networks** and **graph databases**
  - Parallel graph analytics** kernels for big data applications
- HPC for Machine Learning and ML for HPC**
- Partitioning methods for scalable sparse **Tensor decomposition**
- Scaling parallel **stochastic gradient descent** algorithms for **ML**
- Fast and efficient model parallelism for **Deep CNNs**
- Task leader in FP7 / Horizon2020 **PRACE** projects: 1IP, 2IP, 3IP, 4IP, 5IP



Speedup curves of Conjugate Gradientsolver for different methods on a Cray and BlueGene/Q machine (kkt-power matrix: 2 million rows, 12 million nonzeros)

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# Recent Publications (2018-2021)

- True Load Balancing for Matricized Tensor Times Khatri-Rao Product, *Nabil Abubaker, Seher Acer, Cevdet Aykanat*, **IEEE Transactions on Parallel and Distributed Systems** vol. 32, no. 8, pp. 1974-1986, 2021.
- Fast Shared-Memory Streaming Multilevel Graph Partitioning *Oguz Selvitopi, Nazanin Jafari, and Cevder Aykanat*, **Journal of Parallel and Distributed Computing**, vol. 31, no. 8, pp. 140-151, 2021.
- Partitioning Models for General Medium-Grain Parallel Sparse Tensor Decomposition *M. Ozan Karsavuran, Seher Acer and Cevder Aykanat*, **IEEE Transactions on Parallel and Distributed Systems**, vol. 32, no. 1, pp. 147-159, 2021.
- Cartesian Partitioning Models for 2D and 3D Parallel SpGEMM Algorithms, *Gunduz V. Demirci and Cevder Aykanat*, **IEEE Transactions on Parallel and Distributed Systems**, vol. 31, no 12, pp. 2763-2775, 2020.
- Reordering Sparse Matrices into Block-Diagonal Column-Overlapped Form, *Seher Acer and Cevder Aykanat*, **Journal of Parallel and Distributed Computing**, vol. 140, pp. 99-109, 2020.
- Reduce Operations: Send Volume Balancing While Minimizing Latency, *M. Ozan Karsavuran, Seher Acer, and Cevder Aykanat*, **IEEE Transactions on Parallel and Distributed Systems**, vol. 31, no. 6, pp. 1461-1473, 2020.
- The Effect of Various Sparsity Sturcuters on Parallelism and Algorithms to Reveal Those Structures, *Oguz Selvitopi, Seher Acer, Murat Manguoglu and Cevdet Aykanat*, **Parallel Algorithms in Computational Science and Engineering**, 35-62, 2020.
- Regularizing irregularly sparse point-to-point communications, *Oguz Selvitopi and Cevdet Aykanat* **Proceedings of the International Conference for High Performance Computing**, Networking, Storage and Analysis. ACM, 2019.
- A Hypergraph Partitioning Model for Profile Minimization, *Seher Acer, Enver Kayaaslan, Cevdet Aykanat*, **SIAM Journal on Scientific Computing**, vol. 41, no. 1, pp. A83-A108, 2019.
- Locality-aware and load-balanced static task scheduling for MapReduce, *Oguz Selvitopi, Gunduz V. Demirci, Ata Turk, Cevdet Aykanat*, **Future Generation Computer Systems**, vol. 90, pp. 49-61, 2019.
- Scaling Sparse Matrix-Matrix Multiplication in the Accumulo Database, *Gunduz V. Demirci, Cevdet Aykanat*, **Distributed and Parallel Databases**, pp 1-32, 2019.
- Spatiotemporal Graph and Hypergraph Partitioning Models for Sparse Matrix-Vector Multiplication on Many-Core Architectures, *Nabil Abubaker, Kadir Akbudak, Cevder Aykanat*, **IEEE Transactions on Parallel and Distributed Systems**, vol. 30, no. 2, pp. 445-458, 2019.
- A novel partitioning method for accelerating the block cimmino algorithm, *Sukru Torun, Murat Manguoglu, Cevdet Aykanat*, **SIAM Journal on Scientific Computing**, 40(6) C827-C850, 2018.
- Cascade-aware partitioning of large graph databases, *Gunduz V. Demirci, Hakan Ferhatosmanoglu, Cevdet Aykanat*, **The VLDB Journal**, pp. 1-22, 2018.
- Optimizing nonzero-based sparse matrix partitioning models via reducing latency, *Seher Acer, Oguz Selvitopi, Cevdet Aykanat*, **Journal of Parallel and Distributed Computing**, vol122, pp145-158, 2018.
- Improving medium-grain partitioning for scalable sparse tensor decomposition, *Seher Acer, Tugba Torun, Cevdet Aykanat*, **IEEE Transactions on Parallel and Distributed Systems**, vol. 29, no. 12, pp. 2814-2825, 2018.
- 1.5 D parallel sparse matrix-vector multiply, *Enver Kayaaslan, Cevdet Aykanat, Bora Ucar*, **SIAM Journal on Scientific Computing**, vol. 40, no. 1, pp. C25-C46, 2018.
- Partitioning models for scaling parallel sparse matrix-matrix multiplication, *Kadir Akbudak, Oguz Selvitopi, Cevdet Aykanat*, **ACM Transactions on Parallel Computing (TOPC)**, vol. 4, no. 3, pp. 13, 2018.

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# Recent Funded Projects

- **TUBITAK/COST Projects**

- 119E035: Parallel Stochastic Gradient Descent Algorithms for Large-Scale Recommendation Systems, 15/09/2019 - 15/02/2022
- 116E043: High Performance Tensor Decomposition Methods for Distributed and Shared Memory Parallel Systems, 01/05/2017 – 1/11/2019
- 115E212/COST-CA15109: Improving Sparse Matrix Based Graph Analytics Kernels for Big Data Applications, 01/09/2015 - 01/03/2018
- 114E545/COST-IC1406: Petascaling Sparse Iterative Solvers via Optimizing Multiple Communication Metrics, 01/04/2015 - 01/10/2017
- 112E120: Partitioning, Replication and Query Processing in Social Networks, 01/09/2012 - 01/09/2014

- **FP7/HORIZON-2020 Projects**

- PRACE 6IP 01/05/2019 – 01/05/2021
  - Task 7.4: Evaluation of Benchmark Performance
- PRACE 5IP 01/01/2017 – 01/05/2019
  - Task 7.2: Preparing for PRACE Exascale Systems
- PRACE 4IP 01/02/2015 - 01/05/2017
  - Task 7.2: Preparing for Future PRACE Exascale Systems
  - Task 4.3: On-line Training. Subtask: Evaluation of platforms for the CodeVault
- PRACE 3IP 01/08/2012 - 01/08/2014
  - D7.2.1 HPC Tools and Techniques
- PRACE 2IP 01/07/2011 - 01/07/2014
  - D12.5 Summary of Novel Programming Techniques Results (Taskleader)
- PRACE 1IP-Extension 01/07/2013 - 01/07/2014
  - D7.1.3 Application Enabling for Capability Science in the MICArchitecture
- PRACE 1IP 01/07/2010 - 01/07/2013
  - D7.5 HPC Programming Techniques (Task leader)

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## Current Positions of Some Former PhD. Students

- Dr. Nabil Abubaker, 2022. **Bilkent University**, **Postdoctoral Researcher**
- Dr. Ozan Karsavuran, 2020. **Lawrence Berkeley Nat. Lab.**, **Postdoc. Researcher**
- Dr. G. Vehbi Demirci, 2019. **University of Warwick**, **Postdoctoral Researcher**
- Dr. Seher Acer, 2017. **Google**, **Software engineer**
- Dr. Oguz Selvitopi, 2017. **Lawrence Berkeley Nat. Lab.**, **Research Scientist**
- Dr. Şükrü Torun, 2017. **Yıldırım Beyazıt University**, **Assistant Professor**
- Dr. Kadir Akbudak, 2015. **University of Tennessee**, **Research Scientist**
- Dr. Enver Kayaaslan, 2013. **Google Switzerland**, **Researcher**
- Dr. Ertuğrul Tabak, 2013. **Aurea Software**, **Software engineering manager**
- Dr. Eray Özkural, 2013. **Celestial Intellect Cybernetics**, **Software engineer**
- Dr. Tayfun Küçükylmaz, 2012. **TED University**, **Assistant Professor**
- Dr. Ata Türk, 2010. **Boston University**, **Research Scientist**,
- Dr. Engin Demir, 2009. **Hacettepe University**, **Assistant Professor**
- Dr. Barla Cambazoğlu, 2006. **RMIT University**, **Senior Research Fellow**
- Dr. Bora Uçar, 2005. **LIP ENS-LYON**, **CNRS researcher**.
- Dr. Ümit Çatalyürek, 1999. **Georgia Institute of Technology**, **Professor**
- Dr. Tahsin Kurc, 1997. **Stony Brook University**, **Associate Professor**