Extreme Scale Resilience Home

The Argonne National Laboratory/MCS/Extreme Scale Resilience group covers fault tolerance and resilience for HPC simulations and data analytics at extreme scale

Lead: Franck Cappello, ANL

News

July. 2016  F. Cappello (and George Bosilca) Tutorial on Resilience for HPC at DSN 2016
Mar. 2016  F. Cappello plenary session, CODA 2016, Santa Fe
Jan 2016: SZ lossy compressor available here
May 2015  F. Cappello Keynote on Trust in results of numerical simulations and scientific data analytics at HIPEAC CSW & BR, Oslo (cancelled)
April 2015 White paper on Trust in results of numerical simulations and scientific data analytics
April 2015 AID (Adaptive Impact-Driven Detection) library for SDC detection
Jan. 2015 Using Data Analytics to Detect Corruptions in Numerical Simulations, BDEC Barcelona, short presentation
Nov. 2014 FTI 0.9.5 release
Nov. 2014 2nd workshop of the Joint-Laboratory on Extreme Scale Computing
Nov. 2014 FTI Demo on the DoE booth at SC14
Nov. 2014 FTI presented at Journée thématique «Impact des nouveaux calculateurs pour l’océan et l’atmosphère » by Julien Bigot (CEA – Maison de la Simulation)
July 2014 Our journal article "Toward exascale resilience: 2014 update" is presented in HPC wire
April 2014 Inria-UIUC/NCSA-ANL-BSC Join-lab workshop, June 9-11
March 2014 Presentation of the G8 ECS project results at Kobe
Feb. 2014 BDEC workshop at Fukuoka (Japan): The Need for Resilience Research in Workflows of Big Compute and Big Data Scientific Application

Nov. 2013 Data compression algorithm based on masking presented at the DoE SC Associate Director's meeting
Nov 2013 Mini workshop on Resilience at the 10th workshop of the INRIA-Illinois-ANL joint laboratory on Petascale computing
Nov 2013 Large presence of the ESR group at SC13: 2 Papers, 1 Panel, 2 bird of feather (BOF), 1 Emerging Technology Demo + Chairing the Test of time award
Oct 2013: PUF (Partnership University Fund) project “Preparing for Next Generation Numerical Simulation Platforms” accepted
Oct. 2013: F. Cappello invited talk at the Extreme Scale CoDesign Meeting in China October, 2013
Oct 2013: The Paris project on Silent soft errors/data corruptions detection funded for 3 years

Topics and people

- **Multi-level Checkpoint / Restart**: Franck Cappello, Sheng Di (Postdoc ANL), Leonardo Bautista Gomez (Postdoc now at BSC)
- **Lossy compression for checkpointing**, Sheng Di (Postdoc ANL), Jon Calhoun (UIUC), Franck Cappello.
- **Silent soft errors/data corruptions detectors and compression**: Sheng Di (Postdoc ANL), Pierre-Louis Guhur (ANL), Franck Cappello
- **Failure characterization and prediction**: Sheng Di (Postdoc ANL), Rinku Gupta (ANL), Ana Gainaru (Ph. D. UIUC, now at Mallanox),
- **Failure modeling and fault tolerance optimizations**: Sheng Di (Postdoc Inria)
- **Fault tolerance protocols**: F. Cappello (ANL)

Main collaborators: Marc Snir (ANL and UIUC), Bill Kramer (UIUC), Bogdan Nicolae (IBM Dublin), Thomas Ropars (EPFL), Amina Guermouche (UVSQ), Frederic Vivien (Inria), Yves Robert (LIP), Satoshi Matsuoka (Titech), Mitsuhisa Sato (U. Tsukuba), Omer Subasi (BSC), Osman Unsal (BSC), Leonardo Bautista Gomez (BSC)

Tools and software

- **SZ (Error Bounded Lossy Compressor for floating point data sets)**
- **Z-checker (An lossy data compression assessment tool)**
- **AID (Adaptive Impact-Driven Detection) library for SDC detection**
- **FTI (operational prototype): Fault Tolerance Interface for multi-level checkpoint/restart (in memory checkpointing, checkpointing on remote nodes, erasure encoding, etc.)**
- **HELO/ELSA (operational prototypes): System event clustering and Failure predictor**
- **MPICH-HFT (prototype under development): Fault tolerant MPI with hierarchical fault tolerant protocol**

Main collaborative activities

- **Illinois-Inria-ANL-BSC-JSC-Riken Joint Laboratory on Petascale Computing**
- **G8 Extreme Scale Climate Simulations** with France, Germany, Spain, Japan and Canada
- **EESI2: European Exascale Software Initiative 2, EESI2 Resilience Working Group**
- **Partnership University Fund “Preparing for Next Generation Numerical Simulation Platforms”**
Recent Publications (from 2013)

- W. He, H. Guo, T. Peterka, S. Di, F. Cappello, HW Shen, **Parallel Partial Reduction for Large-Scale Data Analysis and Visualization**, in The 8th IEEE Symposium on Large Data Analysis and Visualization (IEEE LDAV) in conjunction with IEEE VIS 2018, Berlin, Germany, October 21, 2018.
- C. Wang, N. Dryden, F. Cappello, and M. Snir, **Neural Network Based Silent Error Detector**, in IEEE CLUSTER 2018, 2018. [best paper award (in the programming and system softwaretrack)]
- X. Liang, S. Di, D. Tao, Z. Chen, and F. Cappello, **Efficient Transformation Scheme for Lossy Data Compression with Point-wise Relative Error Bound**, in IEEE CLUSTER 2018. [best paper award (in the Data, Storage, and Visualization track)]
- S. Di, F. Cappello, **Fixed-error-bounded Lossy HPC Data Compression with SZ.** IEEE IPDPS 2016
- L. Bautista Gomez and F. Cappello, **Detecting Silent Data Corruption for Extreme-Scale MPI Applications**, EuroMPI 2015
- L. Bautista-Gomez and F. Cappello, **Detecting and Correcting Data Corruption in Stencil Applications through Multivariate Interpolation**, FTS 2015 workshop at IEEE Cluster 2015
- L. Bautista-Gomez and F. Cappello, **Exploiting Spatial Smoothness in HPC Applications to Detect Silent Data Corruption**, IEEE HPCC 2015


L. Bautista-Gomez, Franck Cappello, et. al, GPGPUs: How to Combine High Computational Power with High Reliability (Embedded Tutorial), Design, Automation & Test in Europe, DATE’14

S. Di, S. Bouguera, L. Bautista Gomez, F. Cappello, Optimization of Multi-level Checkpoint Model for Large Scale HPC Applications, IEEE IPDPS 2014


L. Bautista Gomez and F. Cappello, Detecting Silent Data Corruption through Data Dynamic Monitoring for Scientific Applications, Poster, to appread in Proceedins of ACM PPoPP 2014


L. Bautista Gomez, F. Cappello, Improving Floating Point Compression through Binary Masks, Proceedings of IEEE BigData 2013


S. Di, D. Kondo, F. Cappello, Characterizing Cloud Applications on a Google Data Center, short paper, Proceedings fo ICPP2013


M. El Mehdi Diouri, O. Gluck, L. Lefevre, F. Cappello, Towards an energy estimator of fault tolerance protocols, Poster, in Proceedings of ACM PPoPP 2013