Liangliang Xu

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Education

- **University of Science and Technology of China** — Hefei, China
  Computer Science; Working toward the Ph.D. degree; Advisors: Yinlong Xu & Min Lyu — *2017.09 - Now*
- **Anhui University** — Hefei, China
  Information and Computer Science; B.S. degree; GPA: 3.69/4.0 — *2013.09 - 2017.06*

Research interests

My research interests include **distributed storage system**, **data recovery** and **erasure coding**.

Work experience

- **Huawei Technologies Co., Ltd** — Shenzhen, China
  The memory storage group in Huawei CloudBU; Software Engineer Intern — *2020.10 - 2021.01*

Projects

- **PDL.** This project proposes an efficient PBD-based (Pairwise Block Design) Data Layout, PDL, to speed up data repair for single node failure in mixed erasure-coded distributed storage systems. It achieves almost uniform distribution, and higher repair performance due to reduced cross-rack traffic and load balance of read and write I/Os during repair process. I design the data distribution method, and the corresponding failure recovery scheme. And I also implement them in Hadoop 3.1.1.
- **SelectiveEC.** This project proposes a balanced scheduling module, SelectiveEC, to dynamically select some stripes to be reconstructed in a batch, and select source and replacement nodes for each reconstruction task. It achieves balanced network recovery traffic, computing resources and disk I/Os against single node failure in erasure-coded storage systems. I design the scheduling algorithm, build the SelectiveEC prototype and validate it by simulation.
- ***D*^{3}.** The proposed distribution D^3 uniformly distributes data/parity blocks among nodes in large scale erasure-coded distributed storage systems, and minimizes the cross-rack repair traffic against a single node failure. I integrate the distribution D^3 into HDFS-EC module of Hadoop 3.1.0 and evaluate the repair performance over Reed-Solomon codes. In the journal version, I extend it to locally repairable codes, provide efficient strategy to maintain the D^3 data layout after recovery, and conduct more experimental evaluations.
- **A note on one weight and two weight projective Z_4-codes.** This is the work in my undergraduate. I solve the open problems about algebraic codes, moreover, I work out the diophantine problem and then give the sufficient conditions for the nonexistence of two-Lee weight projective codes over Z_4 with type $4^{k_1}2^{k_2}$.

Publications

- SelectiveEC: Selective Recovery in Erasure-coded Storage Systems.
  Liangliang Xu, Min Lyu, Qiliang Li, Lingjiang Xie, Yinlong Xu and Cheng Li.
  Submitted to 2021 USENIX Annual Technical Conference (USENIX ATC 2021).
- A Data Layout and Fast Failure Recovery Scheme for Distributed Storage Systems with Mixed Erasure Codes.
  Liangliang Xu, Min Lyu, Zhipeng Li, Cheng Li and Yinlong Xu.
  Submitted to IEEE Transactions on Computers (TC 2021).

- PDL: A Data Layout towards Fast Failure Recovery for Erasure-coded Distributed Storage Systems.
  Liangliang Xu, Min Lv, Zhipeng Li, Cheng Li and Yinlong Xu.
  IEEE International Conference on Computer Communications (INFOCOM 2020) accepted.
  (AR: 268/1354 = 19.8%, CCF RANK A)

- Deterministic Data Distribution for Efficient Recovery in Erasure-Coded Distributed Storage Systems.
  Liangliang Xu, Min Lyu, Zhipeng Li, Yongkun Li and Yinlong Xu.
  IEEE Transactions on Parallel and Distributed Systems (TPDS 2020), 31.10: 2248-2262.
  (CCF RANK A)

- SelectiveEC: Selective Reconstruction in Erasure-coded Storage Systems.
  Liangliang Xu, Min Lyu, Qiliang Li, Lingjiang Xie and Yinlong Xu.
  12th USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage 2020) accepted.
  (AR: 26/64 = 40.6%)

- D3: Deterministic Data Distribution for Efficient Data Reconstruction in Erasure-Coded Distributed Storage Systems.
  Zhipeng Li, Min Lv, Yinlong Xu, Yongkun Li and **Liangliang Xu**.
  33rd IEEE International Parallel & Distributed Processing Symposium (IPDPS 2019).
  (AR: 102/372 = 27.7%, CCF RANK B)

- A note on one weight and two weight projective Z_4-codes.
  Minjia Shi, **Liangliang Xu** and Gang Yang.
  IEEE Transactions on Information Theory (TIT 2017), 63.1: 177-182.
  (CCF RANK A)

Patents

- A load balancing repair scheduling method based on erasure code storage system.
  Min Lyu, **Liangliang Xu**, Qiliang Li, Lingjiang Xie and Yinlong Xu.
  Chinese patent No. 202010313968.5, time of application: 2020-04-20.

Selected Awards

- Shenzhen Stock Exchange Scholarship, 2020.
- INFOCOM Student Conference Award, 2020.
- Graduate with Excellent Character and Learning in AHU, 2017.
- Award of Excellent B.E. Thesis in AHU, 2017.
- First-class Scholarship for Academic Science and Technology in AHU, 2016.
- Meritorious Winner of The MCM/ICM contest, 2016.
- AHU Merit Student, 2016.
- National Encouragement Scholarship, 2014/2015/2016.
- Scholarship for Group Study, 2015.
- Second Prize of The Challenge Cup in AHU, 2014.

Programming Skills

- **Programming Languages** : Java. C/C++. Matlab. Python. Linux Shell.
- **Distributed systems** : HDFS. Ceph.

Talks

- **2020.07:** Paper Presentation in INFOCOM 2020, PDL: A Data Layout towards Fast Failure Recovery for Erasure-coded Distributed Storage Systems, Online.
- **2020.07:** Paper Presentation in HotStorage 2020, SelectiveEC: Selective Reconstruction in Erasure-coded Storage Systems, Online.
- **2020.06:** Invited Talk in the 18th ChinaSys workshop, PDL: A Data Layout towards Fast Failure Recovery for Erasure-coded Distributed Storage Systems, Online.