TELECOM ParisTech

Une école de l'IMT

# BABYLON CODE

## A new code for Distributed Storage Systems

**Key Words**

Distributed Storage

Node Failure Repair

Erasure Code


**Contact**

Pierre Viste

Technology Transfer Officer

Mail :

pierre.viste @telecom-paristech.fr

Phone :

+33 (0)1 45 81 76 83


## DESCRIPTION

- Internet companies (Google, Amazone, Facebook…) handle multiple petabytes (1PB = 1015 bytes) of data. Data is stored over multiple cheap storage nodes in a distributed way. However, the storage nodes are subject to failures. A major challenge is to maintain data availability. The general solution is to use Redundancy Schemes : Replication and Erasure Code.
- The efficiency of the node failure repair operation is valued by metrics : Storage efficiency (ratio of the amount of the original data to the actual amount of data stored on disks), Repair bandwidth (number of bits transmitted through the network during failure repair), Repair Input/Output Overhead (number of bits read/written during one node repair), Access latency (Delay due to decoding operations).
- Replication: n-multiple copies of a file are stored on different nodes with a low disk storage efficiency (1/n) and high storage overhead. Erasure codes : the data is divided into k blocks and a parity function, which is a linear combination of original data, is added. Any k data blocks out of n are required to recover all data. The storage efficiency for a (k,r) replication code is k/(k+r). The storage overhead is reduced compared to replication but the bandwidth overhead is increased.
- BABYLON Code is based on Erasure Codes and inspired from Hierarchical Codes. The parity functions are adapted in order to reduce the required data to repair a failure.

## COMPETITIVE ADVANTAGES

- BABYLON Code maintains same Storage efficiency as Erasure Codes and same fault tolerance while improving Repair bandwidth and Disk Input/Output.
- BABYLON Code provides significant gains by reducing both Repair bandwidth and Input/Output overhead by 50% to 60% for a (10,4) code configuration such as Facebook warehouse used code. The average Repair bandwidth can be reduced from 150 TB to attend around 64 TB.

## APPLICATIONS

- BABYLON Code can be integrated in a large spectrum of systems :
  - All systems integrating a storage system with redundancy : Distributed storage systems, Data centers, Cloud systems,…
  - Distributed File Systems
  - Distributed Object Systems
  - Non distributed storage systems (Disk arrays)
  - Storage systems : Network Attached Storage, Software Defined Storage

## DEVELOPMENT STAGE

- TRL 3 – Proof-of-Concept Demonstrated :
  - Numerical performance testing completed
  - Benchmarking analysis completed
- Validation in simulated environment in progress

## INTELLECTUAL PROPERTY

- French Patent Application (april 2018) and PCT Application in 2019