

# CASE STUDY

Memory Failure Prediction  
Tencent Cloud Solutions



# Intel® Memory Failure Prediction at Tencent

Intel® Memory Failure Prediction substantially improves memory reliability through online machine learning and reduces downtime

## Tencent 腾讯

### Business:

Tencent is one of the biggest cloud solution providers in China with a presence throughout three continents.



Tencent Seafront Towers  
in Shenzhen, China

### Challenges

- Real-time visibility into memory health
- Effective DIMM replacement strategy
- Predictive insights into server memory uptime and workload transfer

### Solution

- Intel® Memory Failure Prediction

### Executive Summary

Tencent, a leading China-based global cloud-solutions provider with operations in APAC, Europe and North America, set up Intel® Memory Failure Prediction (Intel® MFP) for a test deployment with thousands of servers based on Intel® Xeon® Scalable Processors to reduce downtime caused by server memory failures.

Tencent's IT staff deployed Intel® MFP in their data center and integrated it into their existing management systems to analyze their server memory failures, predict potential future failures, reduce downtime, and improve their current Dual Inline Memory Module (DIMM) replacement and upgrade policies.

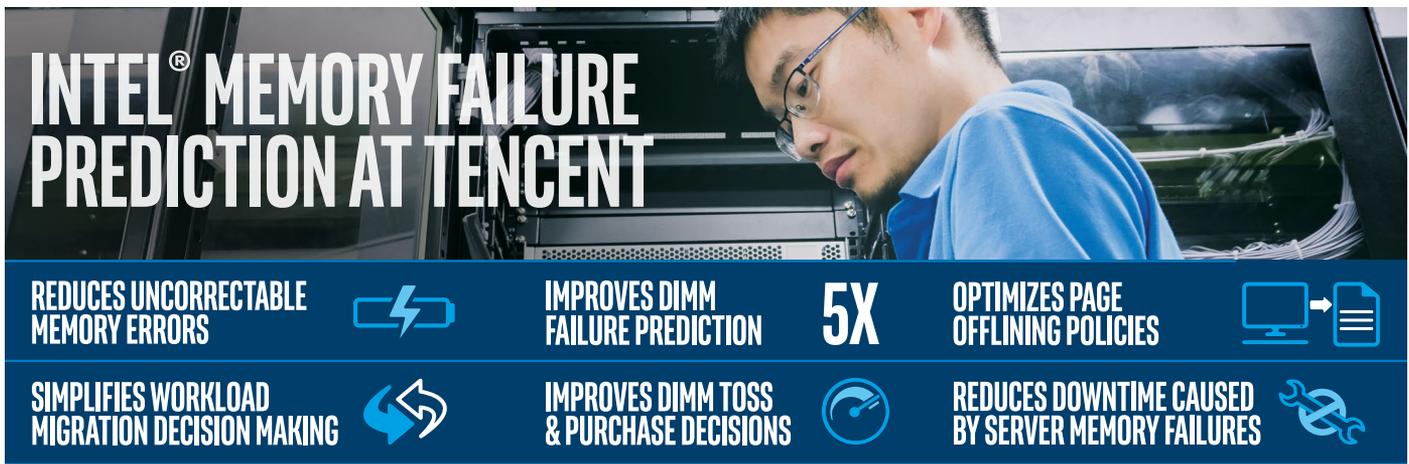
The Intel® MFP deployment resulted in improved memory reliability due to predictions based on the capture of micro-level memory failure information from the operating system's Error Detection and Correction (EDAC) driver which stores historical memory error logs. Intel® MFP also gave Tencent's IT staff enough information to proactively address potential memory issues, and replace failing DIMMs before they reach a terminal stage and cause server failures, and thus reducing downtime

This initial test deployment indicated 5X improvement on DIMM level failure prediction. If Tencent deployed Intel® MFP across its entire data centers, they would improve the effectiveness of server reliability aware workload management and decrease the percentage of Uncorrectable Errors (UEs) and therefore significantly reduce downtime. Additionally, Tencent's operational efficiency would improve and so would their expenses on unnecessary DIMM purchases.

### Background

Memory failures are one of the most critical hardware failures that occur in data centers today. Intel® MFP is a perfect solution for organizations such as online and cloud service providers that depend heavily on server reliability, availability and serviceability (RAS). Intel® MFP predicts memory failure events by analyzing historical data to prevent potential catastrophic events before they happen.

Intel® MFP is vendor agnostic and works in conjunction with other data center management solutions including Intel® Data Center Manager (Intel® DCM). Once

A banner image featuring a man in a blue shirt looking at server racks in a data center. Overlaid on the image is the title 'INTEL® MEMORY FAILURE PREDICTION AT TENCENT' in large white letters. Below the title is a dark blue bar containing eight icons and their corresponding benefits: 1. Reduces uncorrectable memory errors (lightning bolt icon). 2. Improves DIMM failure prediction (5X icon). 3. Optimizes page offlining policies (server and document icon). 4. Simplifies workload migration decision making (curved arrows icon). 5. Improves DIMM toss & purchase decisions (gauge icon). 6. Reduces downtime caused by server memory failures (wrench and screwdriver icon).

deployed, the resulting data can be used to analyze and predict server memory issues before they happen.

Tencent deployed Intel® MFP in a test environment containing thousands of servers with Intel® Xeon® Scalable Processors to gain better insights into their memory health. Intel® MFP monitored the health of the servers' Dynamic Random Access Memory (DRAM) modules and provided administrators with critical information about them including a health-score based on their historical data.

#### Intel® MFP Provides Real-time Memory Health Insights

Intel® MFP uses online machine learning to analyze the historical data collected on server memory down to the DIMM, bank, column, row, and cell levels and gives a memory health score to predict potential future failures.

The resulting analysis and health scores indicated the potential for a large number of memory issues within Tencent's test environment including both Correctable Errors (CE) and Uncorrectable Errors (UE).

A burst in the number of CEs could result in the performance degradation of a server and even denial-of-service, while UEs can lead to catastrophic failures, typically resulting in system crashes.

Using the results from Intel® MFP, memory failure locations at the micro-level were predicted, allowing Tencent to decide on how to migrate critical tasks running on the servers with identified memory issues to other servers and mitigate the potential impact of UE events that could reduce server availability and uptime.

#### Intel® MFP Improves Workload Migration and DIMM Replacement Decisions

By predicting potential memory failures before they happen, Intel® MFP can help improve DIMM level failure predictions 5

times up. As a result, Tencent was able to reduce unexpected server downtime by proactively migrating workload away from unreliable server, and reduce annual DIMM purchases by only purchasing replacement DIMMs that could have CE bursts or UEs that could lead to catastrophic failures.

#### Intel® MFP Optimizes Page Offlining

Tencent took advantage of Intel® MFP's page offlining algorithm when memory failure predictions at the cell level accelerated in a relatively short time frame. Because Intel® MFP is able to predict issues at the memory cell level, it can automatically avoid using certain cells or pages, a feature called Page Offlining which has become very important for large scale data center operations.

#### Intel® Memory Failure Prediction Deployment Results

Using Intel® MFP, the number of UE failures were significantly reduced, and server memory health was analyzed and given scores based on cell level EDAC data. These scores allowed Tencent to make informed decisions on page offlining, replacing DIMMs, and migrating critical workloads away from servers with problematic DIMMs. All of which helped in significantly reducing server downtime.

The capabilities of Intel® MFP revealed that if deployed across their entire data centers would yield a significant benefit and substantially improve Tencent's operational efficiency, and overall reliability, availability and serviceability of its cloud services.

#### Where to Get More Information

For more information on Intel® Data Center Manager and Memory Failure Prediction, visit [intel.com/dcm](https://intel.com/dcm) or contact [dcmsales@intel.com](mailto:dcmsales@intel.com)



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