



A Reliable and Uncluttered Email Experience

FastMail Whitepaper

What defines reliability? Does reliability come from purchasing the finest computer equipment? Is it software, people, or simply a buzzword? Learn how FastMail achieves it's outstanding track record of reliability, and what it takes to keep it running.

# FastMail

## Slots, Stores and More

All the features, less cost, better communication.

Still running your own mail server?  
Would you run your own telephone service?



## Email - Simple to Setup, Hard to Master

Email Servers exist today in every corner of the world. The smallest are running in homes and small businesses. The largest handle millions of concurrent users. Some servers reside in a closet in the hallway, others in the most secure data centers.

The elegance of email is in its simplicity. Two servers find one another, exchange credentials, and delivery of the message is accomplished. Simple!

Because of this simplicity, email has become the dominant communications medium for business. Every person in business has an email address. This is also where the challenge begins. Email has become so important that business cannot survive without it. Downtime and lost messages can threaten any business' effectiveness. Companies now demand not just reliable email systems, but expect additional features like enhanced security, the ability to recover deleted messages, and a mechanism to journal all user's email for auditing or legal reasons.

FastMail recognizes how the simple concept of email must be matched by the expertise required to make all systems run effectively.

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*"We offer best-of-class service at very attractive rates. How is this possible? Our sophisticated infrastructure is very expensive to operate and maintain. Our advantage is our large and loyal customer base. We achieve tremendous economies of scale by creating an environment suitable for hundreds of thousands of simultaneous users. It would be cost prohibitive for a single business to replicate our environment."*

**Bruce Davey**  
Partner,  
FastMail

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## Reliability is Difficult

Server-class computers such as those utilized in FastMail's data center suffer many of the same challenges as every person's home computer. Disks fail, power supplies overheat, memory chips become damaged. All of these events happen regularly when servers are running every hour of the day continuously for years on end.

In addition, email servers are software. Like any other, software can contain bugs. Problems that cause services to stop running normally.

Malicious behavior is another cause for reliability problems. Email servers are regularly attacked by criminals attempting to flood email boxes with unwanted spam. The servers must protect themselves from attack while maintaining fast response time for legitimate users.

We would all love a world with hardware that doesn't fail, software that doesn't crash, and hackers that don't attack, but unfortunately that utopia hasn't occurred yet. Until then, we need to accept that failures will occur and a strategy for elegant recovery.

## Learning to Embrace Failure

FastMail has been in business for over 10 years. During that time email usage has skyrocketed; more messages, more users, more attacks, more junk-mail.

FastMail's original design handled many failure scenarios but the company has learned a great deal by recognizing that more complex failures will occur. FastMail has been enhanced to accept failure of critical systems and recover gracefully. Many of these failures are never noticed by users of the system.

FastMail's greatest success in terms of reliability was achieved when it started to embrace the idea that failure will happen. You can't prevent it, instead you must plan and recover from it.

## Traditional Methods to Improve Reliability

FastMail and other companies employ various methods to improve the reliability of systems. They include:

- Power Systems  
The data center provides independent power circuits. Servers have dual power supplies. All systems are monitored to ensure a power issue does not occur.
- RAID - Redundant Array of Independent Disks  
RAID ensures that any single disk failure in any of system has no effect on any running services. When a drive does fail, the alert triggers an immediate replacement of the failed disk and the system can immediately rebuild the redundant data again.
- Checksums  
It is important to regularly check the integrity of data to ensure there is no form of *silent* data corruption.
- Backups  
In case of a broad system failure, it is critical to have full backups of all data. These are stored on completely separate systems.
- Network Redundancy  
The data center provides multiple network routers, switches, and connections to the Internet. This helps to eliminate another single-point-of-failure in the infrastructure.

All of these steps should be performed, but unfortunately they will not guarantee a reliable and *highly available* email environment.



## The Key is to Increase Availability

Most users only care if a system is unreliable when their email is not *available*. We all use the telephone every day. As long as we can successfully make calls, we don't need to know if the telephone service has magically handled an internal failure. In effect, the telephone system is a great example of a service that is almost always available.

Early in FastMail's history, the company had implemented various techniques to improve reliability (RAID, Power, etc), but the company was still not happy with the results. The key is to understand why systems fail, what is the impact to the rest of the environment during a failure, and what steps can be performed to prevent or quickly recover from a failure.

Simplistic approaches would not be successful. For example, if a disk fails and a rebuild of the disk array is occurring, this can have a negative impact on overall system performance. All disk transactions will perform slower during this time, impacting overall response time, negatively impacting users.

Two major areas became the focus to improve system availability

### 1. Perfect Replication Systems

Every company creates backups of data. What happens if you make a backup of corrupt data? The result, no quality backups. Lost information, long recovery times. Standard replication and backup systems were not effective.

### 2.Reducing the number of users within any given database or server.

Email software can handle many simultaneous users. If the email software has a problem, you simply cannot reboot the server. Too many users are impacted. The restart time is too long. FastMail needed to develop a method to create smaller pools of users, their data, and their runtime environment.

## Would a Cluster Solve These Issues?

Many companies utilize computational clusters to provide high availability systems. These technologies were considered, but they still would not resolve the two major challenges: data corruption and pooling users in an optimal manner.

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*“FastMail.FM is an email service for people who want something more powerful and reliable than what they get from their internet service provider, search provider, web host, or other company that specializes in something other than email.*

*Because FastMail.FM has specialized in email for over 10 years, we've built a service that appeals to people who really care about their email”*

**Jeremy Howard**  
Co-Founder,  
FastMail

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## Cyrus, Slots, Stores and Other Strange Terms

The solution is unique to FastMail. It leverages the best open source technologies, but is customized for the environment.

FastMail divides up all the data into small groupings of users called a **Slot**. Each of these user groups is stored and run as a separate Cyrus **mini-service**, with all of its associated data and email replicated to a completely separate Slot. When paired this way, the result is something called a **Store**.

FastMail's replication is also different to how many others attempt duplication of data. Most systems create an exact binary replica of the disk where the data is stored. Unfortunately this doesn't protect against data corruption introduced into either email data, or worse, the data structures on disk. FastMail's replication works at the logical level, replicating each email separately, and checking the checksum on each Slot to ensure that no corruption has occurred.

This combination of dividing up data into Slots and replicating among many different machines with checksums is what achieves FastMail's very high reliability. There's no single point of failure, and each Store pair can be started and stopped separately. The master and replica roles can be switched quickly if there are any issues.

The checksums provide a mechanism for FastMail to constantly verify that data has never been corrupted, and allows the system to detect and recover from corruptions. Due to the redundant copies of data, FastMail can always find the correct data.

The benefit of all this custom technology? FastMail customers enjoy email that is highly *available*. A failure to one component will rarely cause an issue with the entire system.

Every time a FastMail user receives a new email message, they are using computational resources on two independent servers and two independent storage systems.

In addition, FastMail maintains a completely separate backup system of all email data. This provides another level of data protection.

## Other Duplicate Systems

Slots and Stores provide only one piece of the email puzzle. In addition, FastMail has other redundant systems to increase the availability of the email service.

These include:

- Multiple web servers to keep the webmail interface fast and available.
- Multiple database servers to store account credentials, accounting data, and other control mechanisms
- Multiple incoming and outgoing servers (known as SMTP servers) to process the high-volume of email sent and received by FastMail customers.



## Continuous Enhancement to Monitoring Systems

The only way to guarantee that all systems are operating effectively is to continuously monitor all components.

FastMail takes advantage of both internal integrity checks as well as 3rd-party monitoring tools to insure that all systems are running optimally. A failure of a critical component will alert the appropriate engineer. Tests are performed every 2 minutes every day of the year. Literally thousands of tests take place to guarantee all components are functioning properly.

FastMail is always working to improve its systems by continually adding new monitoring tools to detect faults sooner so that recovery becomes more automatic.

Constant improvement yields more available email service for customers.

## Keeping Customers Informed - The Status Blog

Another key to keeping customers happy is open and honest communication. FastMail maintains a status website, <http://status.fastmail.fm>, to make all users aware of any issues.

In addition, FastMail utilizes a 3rd-party uptime service, Pingdom. Anyone can view the system uptime statistics at: <http://www.pingdom.com/reports/lzdx4pr0pdhk/>

In reality, many of the issues described on the blog are only experienced by a fraction of FastMail's users. This is due to the slots and stores architecture. This helps minimize the impact of any system failure.

## Highly Available, Unique Design, Open Communication

Redundant systems, intelligent system architecture, intensive monitoring all combine to make FastMail a reliable email solution for businesses that demand excellence.

A single stand-alone small business server is simply not capable of meeting the reliability of the FastMail email solution. Email providers that promise co-location for customer servers are not addressing the redundancy and monitoring requirements.

FastMail's evolution is the result of years of experience with email systems.



## Moving Forward

Choosing an email solution is a critical decision for every business. Email is the communications tool of choice in today's markets. Don't lose touch with your most important customers.

Focus on your business, choose a provider that has expertise running reliable email systems. In-House systems are unreliable, complex, and trap you in an expensive ongoing maintenance and upgrade cycle.

The right email partner will support your needs and provide secure and easy access to your email. The best choice will save your company money yet provide the greatest protection for your email data. Your company will work smarter, have fewer email-related hassles, and be able to focus on the business at hand.

## About FastMail

FastMail is a leading provider of email services. Founded in 1999 and headquartered in Melbourne, Australia, FastMail provides service to businesses of all size, as well as some of the world's most demanding individuals. FastMail has built its reputation by providing one of the most compliant, reliable, and junk-free systems in the industry.

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