Architecture, Failover and Recovery

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Introduction

The nomorePAPER platform provides robust and secure functionality for the rapid creation and deployment of connected, data-driven business applications. Our application architecture and failover design leverages the world class capabilities of Microsoft Azure to deliver a massively scalable, highly available and cost effective software as a service offering.

Built on Microsoft Azure

nomorePAPER is hosted on Microsoft's Azure cloud infrastructure, which enables us to deliver highly scalable, available and fault tolerant services. Our application architecture has been designed to leverage Azure's powerful geo-redundancy, replication and recovery options, and is guided by Microsoft recommended best practices.

nomorePAPER Application Architecture
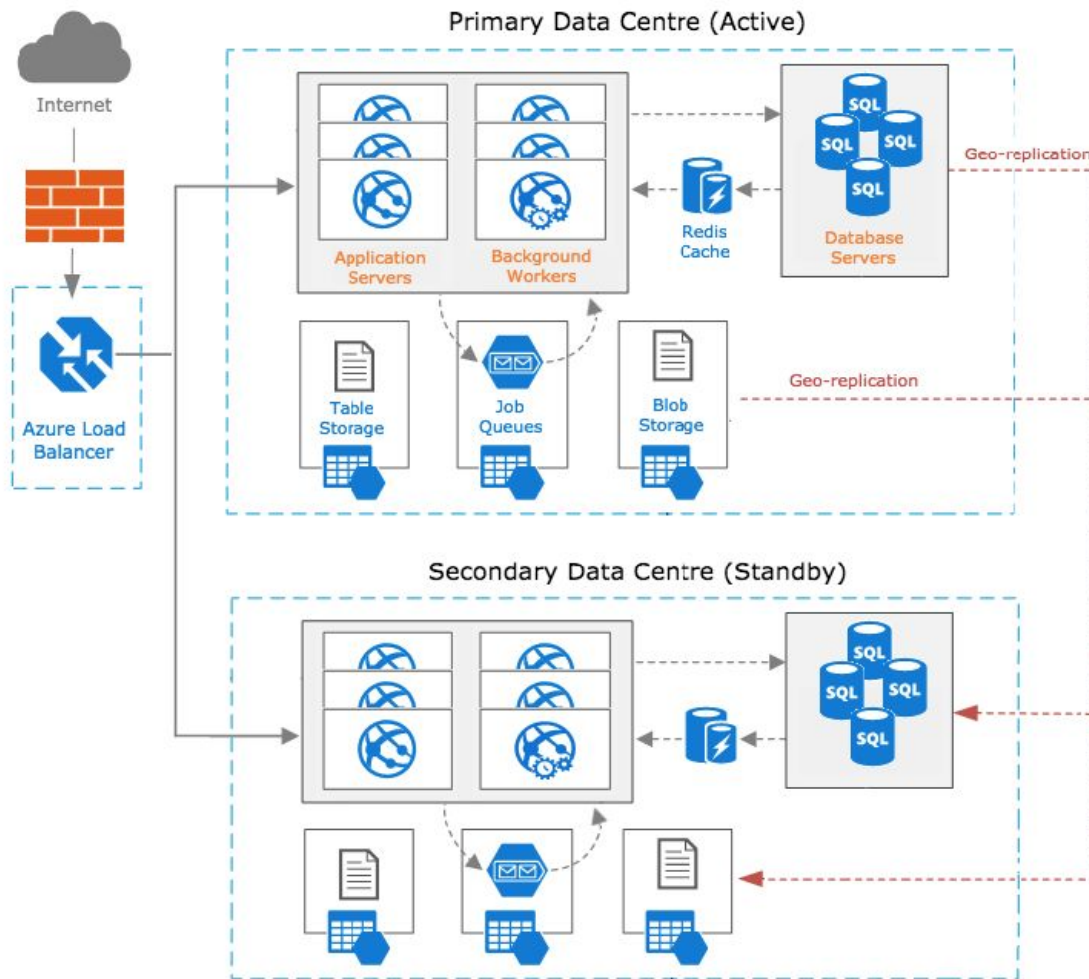
Platform Design and Scalability

The nomorePAPER platform employs industry standard tiered architecture concepts along with heavy utilisation of Azure components to extend robustness, scalability and availability. Scalability in particular is achieved at multiple levels, allowing independent scaling of resources at various tiers of the architecture for fast response to customer demand.

Application Tier

Application servers are routed incoming requests by the Azure Load Balancer on a round robin basis, ensuring an even distribution of load across available servers. Servers are dynamically deployed to meet system demand using a "scale out" approach. Auto-scaling features of Azure allow for an automated response to server demand via constant monitoring of server utilisation against key performance metrics. Our architecture features a separation of responsibilities between backend/background job processing and frontend web and API interfaces, provided via dedicated background worker and web application roles. This allows us to independently and massively scale role instances to meet frontend and/or backend processing demands.

Redis Cache

We make heavy use of Azure Redis Cache to cache data objects, session state and other semi-static transaction information. Cache scales easily and provides low latency data access with in-memory comparable performance to significantly boost response times and reduce load on SQL databases.

Database Tier

Horizontal scaling of our SQL database tier is achieved through the use of best practice horizontal partitioning (also known as "sharding"). This allows us to achieve better transaction throughput and faster database queries due to smaller data subsets spread across multiple databases.

Storage and Queues

nomorePAPER leverages the massively scalable Table and Blob Storage components of Azure to provide persistent storage of files, logs and other semi-static data. Additionally we leverage Azure Queues to handle asynchronous scheduling and processing of connector and other background process jobs.

Monitoring

We utilise New Relic, Pingdom and Azure tools to continuously monitor our platform services for potential issues such as reduced performance, unavailability and/or failure of specific functions. These tools have been configured with rules to alert and notify relevant personnel in our Australian and South African teams such that a rapid and effective response can be made. Common metrics that we monitor include CPU, memory and disk load as well as average response times, HTTP error code rates, job processing speed and aggregate transaction volumes.

Operating Environment and Software Use

nomorePAPER utilises and integrates with a number of open source and proprietary software components, libraries and tools. These components change regularly as our feature set, customer requirements and general maintenance operations evolve. We have listed key components and required operating software below.

• Microsoft Windows Server

• Microsoft SQL Server

• Microsoft IIS 8

• Microsoft .NET Framework 4.6 and ASP.NET

• Redis Cache

• New Relic monitoring tools

• ELMAH (Error Logging Modules and Handlers) library

Redundancy, Failover and Recovery

We have architected the nomorePAPER platform to leverage Azure replication features to provide failover and recovery options at multiple levels and to cater for increasingly disastrous scenarios.

Primary/Secondary Data Centre Separation

Our architecture involves deployment across two physically separate data centres to achieve higher availability. During normal operations, network traffic is routed to our primary data centre. If that becomes unavailable, traffic is re-routed to our secondary data centre where duplicated application servers, geo-replicated secondary databases and storage facilities are activated as needed. These data centres are physically distant from each other to reduce the likelihood of natural disasters, civil unrest, power outages, or physical network outages affecting both regions at once.

Application Tier

We maintain a large cluster of application and background worker instances across multiple Azure fault and upgrade domains. This qualifies our platform for Azure's cloud service SLA which guarantees our Internet facing roles will have external connectivity at least 99.95% of the time (https://azure.microsoft.com/en-us/support/legal/sla/cloud-services). Additionally the Azure Load Balancer and Azure Fabric systems actively detect availability issues with our application servers and take relevant action to route around, alert or recycle problem instances.

Redis Cache

Azure Redis Cache provides a 99.9% SLA covering connectivity to Cache endpoints and the Azure Internet Gateway (https://azure.microsoft.com/en-us/support/legal/sla/cache). Cache also includes a primary read/write and secondary read-only replica node. In the event that the primary node fails or becomes unavailable, Azure automatically promotes the secondary to primary status and provisions a new secondary node. This ensures our caching functionality is highly available and maintains platform performance levels even through cache failures.

Database Tier

Microsoft's SQL Database SLA guarantees that at least 99.99% of the time nomorePAPER will have connectivity between our databases and Azure's Internet gateway (https://azure.microsoft.com/en-us/support/legal/sla/sql-database). We also use Azure's active geo-replication option to ensure that our primary SQL databases have readable secondaries in our secondary data centre. If a primary database fails, or simply needs to be taken offline, we are able to rapidly failover to our secondary database. Additionally Azure automatically provides geo-replicated restore points for all SQL databases, which we can fall back upon as a slower recovery option should the secondary database be unviable or unavailable.

Storage and Queues

We use Azure's geo-redundant Storage (GRS) which Microsoft backs with a 99.9% SLA for read requests to Storage accounts (https://azure.microsoft.com/en-us/support/legal/sla/storage). With GRS storage, all data is triple replicated within our primary data centre and then triple replicated again in our secondary data centre. In the event of the primary data centre becoming unavailable, Microsoft's Azure Storage team will perform a geo-failover to the secondary data centre which will allow us to maintain access to storage objects. For Queue storage, backup queues in the secondary data centre are automatically created in the event of a failover. The platform will then use these backup queues until the primary data centre becomes available again.

nomorePAPER: Modern Cloud-first Architecture

The nomorePAPER platform has been designed to take advantage of modern cloud architecture paradigms and features. We are able to "scale out" various tiers of our platform rapidly, independently and with near limitless capacity thanks to Azure's cloud infrastructure.

Our cloud-first application architecture provides us with a significant technology advantage over more traditional software platforms that suffer from "scale up" issues such as database bottlenecks and inability to separate slow background processing from frontend applications.

We have also followed best practice and Microsoft reference guidance to ensure that we have strong failover and redundancy capabilities. Our expertise with Azure components and services allows us to leverage Azure geo-replication, SLA grants and provisioning features for a coherent recovery strategy for everything from an application server failure through to outright data centre disaster.

nomorePAPER is a new breed of business application platform that embraces cloud capabilities to provide customers with powerful functionality backed by strong, thoughtful architecture.