10 Key Digital Infrastructure Considerations

As digital becomes ever-more essential to revenue growth and market relevance, underlying infrastructure must be made as efficient as possible to realize its true potential. By prioritizing foundational technology modernization and simplification, organizations can accelerate their transformation into the digital era.

Executive Summary

For businesses gearing up to embrace digital transformation, applying traditional infrastructure designs or patterns can prove detrimental. Any well-architected application architecture needs to carefully consider advancements in the infrastructure space and leverage them to be truly effective.

While there are numerous issues to work through, what follows are 10 key infrastructure considerations for digital transformation projects. Please note that while this white paper focuses on Amazon Web Services (AWS), organizations can apply similar services provided by other cloud service providers such as Microsoft Azure or Google based on the cloud platform of their choice.
CONTINUOUS IMPROVEMENT IS KEY

As the delivery of new iterations of applications becomes increasingly crucial, applying the DevOps construct of continuous delivery (CD) needs to be at the heart of the application design. CD determines the speed at which organizations can respond to threats, risks and opportunities. For more, read our white paper, “Continuous Integration and Continuous Delivery to Facilitate Web Service Testing.”

AWS services such as CodeBuild, CodePipeline, Elastic Beanstalk and CloudFormation can play a pivotal role in ensuring faster, more consistent delivery of the application.

CONSIDER BEING SERVERLESS

Wherever possible, consider using serverless architectures in application design. Leveraging content delivery network services such as CloudFront helps in delivering content (static and dynamic) to end-users worldwide with minimal latency.

Utilizing a combination of AWS services such as Simple Storage Service (S3), API gateway, Lambda and DynamoDB/Aurora DB to host completely serverless web applications on the cloud can reduce costs and efforts, while providing excellent availability and durability. Compared to the traditional approach, using services such as S3, CloudFront and Lambda can reduce efforts (and, thereby costs) for building and managing multiple app/web servers.

ADVOCATE LOOSE COUPLING

Adopt loose coupling in the application architecture to ensure that dependencies between the application tiers/components is minimal. Achieving loose coupling will enable different tiers/components to scale independently based on the demand. Simple queue services (SQS) makes it easy and cost-effective to decouple application components.

When loosely coupled applications (such as web tiers, Hadoop, Stateless applications, etc.) leverage Spot instances, this improves the application’s robustness while also reducing costs significantly. As a best practice, we can have a script that will run every minute or so to check for the two-minute-warning we receive for Spot instances and remove the instance from elastic load balancers (ELB) accordingly. Using batching with SQS will significantly reduce costs while improving throughput.
Thinking about failure while architecting the application will result in resilience and recovery strategies to be considered and included in the design, bringing about a much more stable application.

This can lead to performance optimization or make it the least of your concerns. Using services such as DynamoDB and Elasticache in the application design eliminates the need for dedicated server setup and configuration.

Also, using services such as Amazon RDS (for horizontally scaling the DB tier) and Elastic Load Balancing will go a long way toward achieving the desired level of scalability, while satisfying other operational requirements.

Continuous monitoring of applications can have a profound impact on the performance and availability of applications. AWS Config enables IT organizations to assess, audit and evaluate the configurations of the resources. If any of the Config rules are triggered, AWS Config invokes the rule’s Lambda function defined to simplify compliance auditing, security analysis, change management and operational troubleshooting.

Integrating monitoring (CloudWatch) with services such as simple queue services (SQS), simple notification services (SNS) and Lambda helps identify and remediate issues at a very early stage, preventing failures, breaches or downtime.
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Block access by default and implement defense in depth. Consider granting access by roles instead of individual users. Along with securing data at rest, architect the application to secure data in transit, thereby moving toward end-to-end security.

Avoid using access keys and never create access keys for the root account. If you are using access keys — public key and private key — consider designing the application such that these values can be passed as parameters while accessing the application through an application programming interface (API) rather than storing the private key as a part of the application’s source code repository. Incorporating Multi-factor Authentication (MFA) can provide an additional layer of security. Define a process to change access keys on a regular basis and delete unused ones.

As application logs can often hold sensitive information, it is crucial that they are stored in a secure location with access restricted to auditing/incident response teams. Consider storing logs on S3 bucket with access allowed through IAM roles for auditing account.

Logging can provide organizations with actionable intelligence when responding to requests or even attacks. At times, logging can come in handy in responding to regulators. Though logging is predominantly used for troubleshooting errors or performance issues, logs have evolved to become the primary source of information about events related to application security.

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PRIORITIZE COST OPTIMIZATION

Identify and eliminate costs where possible. Cloud platforms are best suited for exploratory approaches as organizations only pay for what is used. Hosting the development/test/PoC environments on a pay-as-you-go model lowers costs. Features such as auto scaling can help scale optimally based on performance and increase in the number of users per application.

For workloads (such as web servers and test servers), which do not often need to use the full CPU consistently, use burstable performance instances (T2) since they could deliver significant savings while providing the ability to burst occasionally simultaneous with usage spikes. Consider using tools such as cost calculators, detailed billing reports and trusted advisor recommendations to understand cost savings and stay on top of spending.

LOAD BALANCE WISELY

Achieve segmentation while reducing the number of elastic load balancers (ELBs) by using application load balancers (ALBs). NGINX or NGINX Plus can come to the rescue if caching or multiple load balancing methods are required (as ELB/ALB only supports AWS’s Round-Robin). A combination of ELB and NGINX can also be used where ELB is primarily Internet-facing and handles secure socket layer (SSL) termination, while multiple NGINX nodes can handle caching and routing requests to the application servers.
LOOKING FORWARD

Having an IT infrastructure that supports the business’s digital transformation journey will require adequate foresight, planning, investment and innovation. Cloud offerings have been disruptive in transforming IT from being a cost center to business enabler. Addressing the aforementioned considerations will help your organization avoid many typical pitfalls or anti-patterns that have undermined previous digital journeys.

While infrastructure-as-a-service (IaaS) cloud offerings such as compute, storage and database can seem like a good fit for the traditional tiered/layered application architectures, utilizing various PaaS and SaaS cloud offerings can help organizations deploy applications based on event-driven or microkernel or microservices-based architectures cost-effectively – with additional benefits such as agility, scalability and robustness. As always, evaluate before you commit completely.
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