



**Could the cloud be the solution
to addressing technical debt?**

Abstract

Five years ago, as part of its annual Tech Trends report, Deloitte identified technical debt reversal¹ as one of the key trends of that year. Global organizations have embarked on multi-billion-dollar programs to address technical debt issues in their technology architecture.

Organizations in the UAE are doing the same, and are proactively pursuing better methods to address technical debt and its underlying implications.

The adoption of cloud services have created an opportunity for entities to address technical debt issues. This whitepaper identifies the types of technical debt, the cloud's ability to address technical debt, and key considerations for migrating to the cloud.

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Defining technical debt and its implications

The accumulation of technical debt adversely affects an organization's ability to innovate, and employ new technologies (e.g. digital channels), which makes it harder for the organization to retain its market share, secure clients, and stay on track with market trends.

Technical debt is a metaphor that is defined as the result of an IT department's preference to taking shortcuts, using basic techniques, not considering long-term consequences when developing and implementing code, and delaying the upgrade of infrastructure on a timely basis. Examples of technical debt include:

- Utilizing legacy software development platforms that require a high number of lines of code vs. rapid application development platforms. Legacy platforms generate technical debt due to their coding complexity and lack of standardization, while rapid application development platforms (such as low-code or no-code) provide a visual development approach, which can save up to 40-50% of coding effort.
- Delaying timely upgrades of an IT infrastructure stack causes a compounding increase in technical debt. This is because unsupported hardware and software components become more expensive to maintain and operate, and this exposes business to both availability and security risk.
- Prolonging the time to provision capacities and systems with legacy infrastructure. This negatively affects time to market and increases operational cost in comparison to modern infrastructure provisioning approaches.

Often technical debt can be the result of dealing with complex requirements with a limited capacity and capability of IT teams, which leads to selecting short-term solutions that can have detrimental consequences in the long term. For example, implementing a solution that does not centralize and unify integrations, or does not support horizontal scaling by design, may have a significant impact on future upgrades and transformation initiatives that organizations may take. With each action and decision technical debt increases, and in a similar vein to financial debt, if the technical debt is not addressed promptly, compounding will kick in.

The accumulation of technical debt adversely affects an organization's ability to innovate, and employ new technologies (e.g. digital channels), which makes it harder for the organization to retain its market share, secure clients, and stay on track with market trends. Additionally, technical debt prevents an organization from operating at high efficiency, which affects new products/service time to market, and increases the cost of providing products/services, impacting profit margins.

Types of technical debt

There are different forms of technical debt² that adversely impact an organization. The most common ones are listed below:

- **Design debt:** debt formed by an IT department's architectural model. Often, organizations do not use a holistic approach to overall architecture design and solution design, which places an organization's future innovation plans at risk. The design phase of a project is often expedited by leaving it at the courtesy of a solution vendor, or it is skipped in favor of meeting pressing project deadlines. Management of documentation within the IT department contributes to designing debt. Poor management governance often leads to unfit implementations, for example, untested or unused functionality, which would have to be addressed during future upgrade and modification plans.
- **Software/code debt:** debt formed through poorly written, complex, obsolete, unused, duplicated, not tested automatically, and/or premature code. For example, a developer could opt to copy and paste blocks of code without assessing the longer-term consequences, therefore if the code ever requires an update, someone would have to remember to fix it in each instance. This leads to inefficiency and makes it harder in the future for other developers to work with the code, as occasional refactoring would not solve a problem. Ultimately, an organization would find itself in a position of having to mobilize developers to fix the current code schema rather than focus on innovating and enhancing future services.

As organizations grow in complexity, the effort required to maintain and update underlying IT infrastructure on a timely basis increases.

- **Infrastructure debt:** debt often accumulated by aging IT infrastructure components, which are foundational to host applications and services. As organizations grow in complexity, the effort required to maintain and update underlying IT infrastructure on a timely basis increases. More often than not, organizations fail to upgrade the components due to limited time and budget. This results in the current hardware going out of support, becoming irrelevant to growing business expectations, and impacts the ability of an organization to respond to changing market conditions and customer expectations.

Impact of technical debt

Financial impact

Technical debt has a stagnating financial cost on an organization. Studies³ have identified that around US\$3.61 of technical debt exists per line of code, equating to roughly more than US\$1 million per system. This technical debt has led Gartner to estimate the total global IT debt in 2015 to be around US\$1 trillion, and for large public sector agencies to have an average technical debt of more than US\$200 million. The financial cost implicated by technical debt ultimately equates to the accumulation of financial liabilities.

Business impact

Technical debt can impact an organization's business by hindering the ability of the organization to innovate and to provide customers with enhanced and new services. Further examples of the impact of technical debt on an organization's business include:

- Decreasing the ability to adapt to opportunities or market trends
- Reducing the ability to convert data into information to make informative decisions to enhance services and operations

- Decreasing the number of productive staff members due to a prioritized focus on maintenance and operations, rather than on innovation and development
- Loss of service due to system outages
- Inefficient use of resources and time to maintain existing systems and bring about new capabilities

Technical debt in the UAE

We estimate from extrapolation of prior global studies that technical debt in the public sector of the UAE is upwards of US\$2 billion⁴. Examples of the technical debt incurred by the public sector in the UAE, that have generated this financial cost include:

- IT infrastructure virtualization ratios being significantly below industry benchmarks of c.75%
- Approximately 30% of infrastructure hardware components are end of support and require immediate replacement

- Lack of integration/middleware systems and poor Application Programming Interface (API) governance impacts scalability, reuse and architectural integrity
- 30% to 50% of custom-built applications are based on retiring technology⁵

Technical debt in UAE government entities may lead to a roadblock in the country's pursuit of achieving the UAE Vision 2021 and the UAE Centennial 2071. Both strategies require UAE entities to implement leading technologies (e.g.

artificial intelligence, block chain, and Internet of Things). With the presence of technical debt and an organization's scrambling to address the issues, the success of the overall strategy may be jeopardized.



Addressing technical debt using cloud

Cloud provides an organization with the ability to reduce its infrastructure debt by removing the burden of maintaining and upgrading the underlying infrastructure of data centers, while empowering it to focus on developing new and innovative solutions.

A solution that can help organizations, including UAE government entities, address the underlying issues of technical debt is a cloud platform. Cloud providers offer organizations distinct services that can address the various components of technical debt (design, software/code, and infrastructure). Cloud services enable an organization to:

- Trade capital expense for variable expense
- Utilize a pay-as-you-go schema
- Benefit from massive economies of scale
- Continuously innovate underlying components and introduce new services
- Increase speed and agility
- Stop guessing about capacity
- Stop spending on the maintenance of running and maintaining data centers and IT infrastructure

Cloud provides an organization with the ability to reduce its infrastructure debt by removing the burden of maintaining and upgrading the underlying infrastructure of data centers while empowering it to focus on developing new and innovative solutions. Ultimately, cloud will reduce the capital cost for organizations as they will be able to leverage cloud services, utilize a pay-as-you-go schema, and decrease time to market and pay for what they use.

Furthermore, cloud providers enable organizations to address design and software/code debt through the various cloud services they offer. These services provide organizations with options to have prepacked components (code) to develop their applications, and monitor any updates made to the code to ensure utilization of best practices.

There are examples in the Middle East of governments migrating to the cloud to utilize its offerings, enhance their services, and address technical debt. These include:

- The UAE, under the guidance of HH Sheikh Mohammed Bin Rashid Al Maktoum, is accelerating the development of a new regional hub for cloud computing. For example, there is currently a strategic action to have federal entities migrate to TRAs FEDnet vCloud⁶.
- In 2017, Bahrain's government adopted a cloud-first policy in the public sector,

making it the first Arab country to adopt such a policy. Bahrain aimed to reduce the cost of government ICT by eliminating the duplication of solutions and fragmentation in the technology environment, and by increasing productivity and agility to improve its services⁷.

- The Bylaw and the Communications and Information Technology Commission Ordinance, the authority in charge of regulating the ICT sector in the Kingdom of Saudi Arabia (KSA), adopted a regulatory framework on cloud computing to provide government agencies with an understanding of cloud computing⁸.
- Kuwait's Communication and Information Technology Regulatory Authority (CITRA) and Bahrain's Information and eGovernment Authority (IGA) signed a cloud computing Memorandum of Understanding (MoU) in 2018. The MoU was signed to assist Kuwait's effort in achieving Kuwait's Vision 2035⁹.

Cloud as a mean to address technical debt is also witnessed in countries across Europe, America and Asia Pacific:

- Followed by its Cloud Policy release in 2013, the United Kingdom established a government cloud (G-Cloud) digital marketplace that provides ICT services to the public sector. The Cloud Policy stipulated entities should consider and evaluate potential public cloud solutions before considering any other option. This is mandatory for central government¹⁰.
- Followed by the success of the UK, in 2015 the Australia government established a Whole-of-Australian Government (WoAG) Cloud Services

Panel to serve as a centralized panel of cloud service providers for public sector entities. In 2016, Australia's Digital Transformation Agency (DTA) set up a digital marketplace for governments to procure digital services¹¹.

- As part of the IT modernization agenda of the US government, a cloud-first policy was released in 2011 to help organizations address modernization challenges including technical debt. The initiative stated that the Federal Government had to move to the cloud, and that it was created to accelerate the value realization of cloud computing, such as operational efficiencies and a shared-services model¹².

Regulatory bodies, both local and federal, play crucial roles in cloud adoption.

Apart from individual organizations taking steps towards addressing technical debt, vendors act as catalysts by bringing cloud hosting options closer to their customers:

- Amazon Web Services (AWS) is establishing three availability zones in Bahrain by the second quarter of 2019¹³, and the Bahrain government has established a goal to migrate all ministries IT infrastructure to AWS¹⁴.
- Oracle built a data center in Abu Dhabi in early 2019, to offer public cloud applications services to customers in the UAE and to ensure data is kept local for governance requirements¹⁵.
- SAP built the first public cloud data center in KSA in April 2018 to empower Saudi Vision 2030 and beyond¹⁶.
- Microsoft is planning to open its first Middle East data centers in the UAE in 2019, to deliver cloud services and empower organizations and governments¹⁷.

Regulatory bodies, both local and federal, play crucial roles in cloud adoption.



AWS case study

Amazon Web Services (AWS), a leading global cloud provider, has enabled organizations to decrease their technical debt while enhancing their services and capabilities. This is possible as AWS allows organizations to:

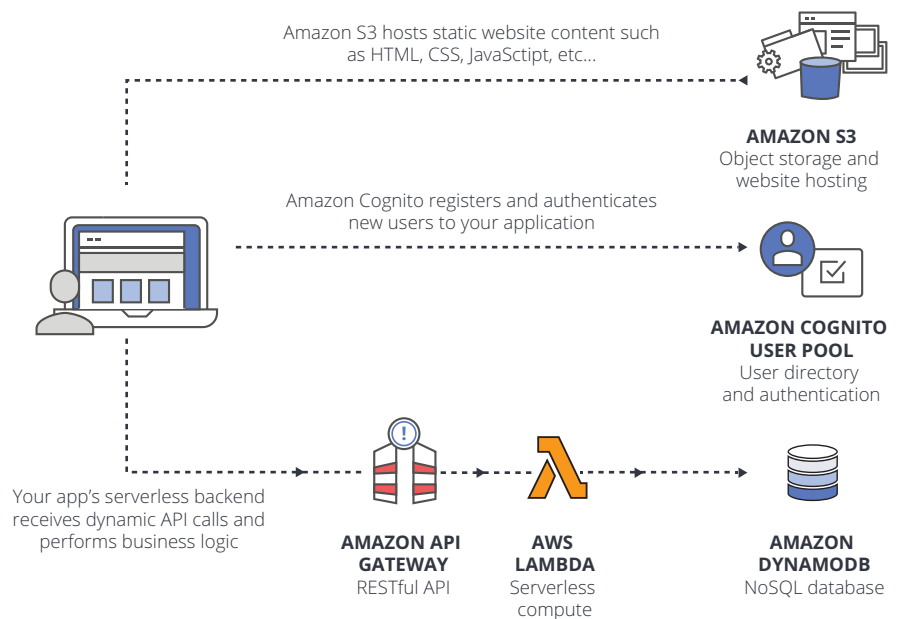
- Use a cutting-edge architecture approach
- Scale resources on-demand
- Leapfrog technology upgrades

AWS takes responsibility for the underlying service platform and manages some of the operations on behalf of the customer. AWS' shared responsibility model describes the details.

Amongst many of the AWS services, Figure 1 provides an illustration of specific services that assist an organization to build future-proof approaches to applications architecture, such as serverless application architecture.

The above architecture relies on AWS-offered services that follow a transaction-based model (where the tenant is charged for every processed transaction) and does not require significant upfront technology investment, which leaves technology debt behind. For instance, if the number of integration requests is in the range of 300 million a month, the customer would have to pay US \$3.5 per million of requests¹⁹.

Figure 1: Example of server less application architecture



AWS offers various rent options for computing capacity, where a customer may benefit from long-term commitment. Savings can be in the range of 30% to 60% when compared to an on-demand model²⁰.

Ultimately, by utilizing the AWS cloud platform, an organization can effectively leapfrog design, software/code, and infrastructure debt in a number of effective ways.

Key considerations when moving to the cloud

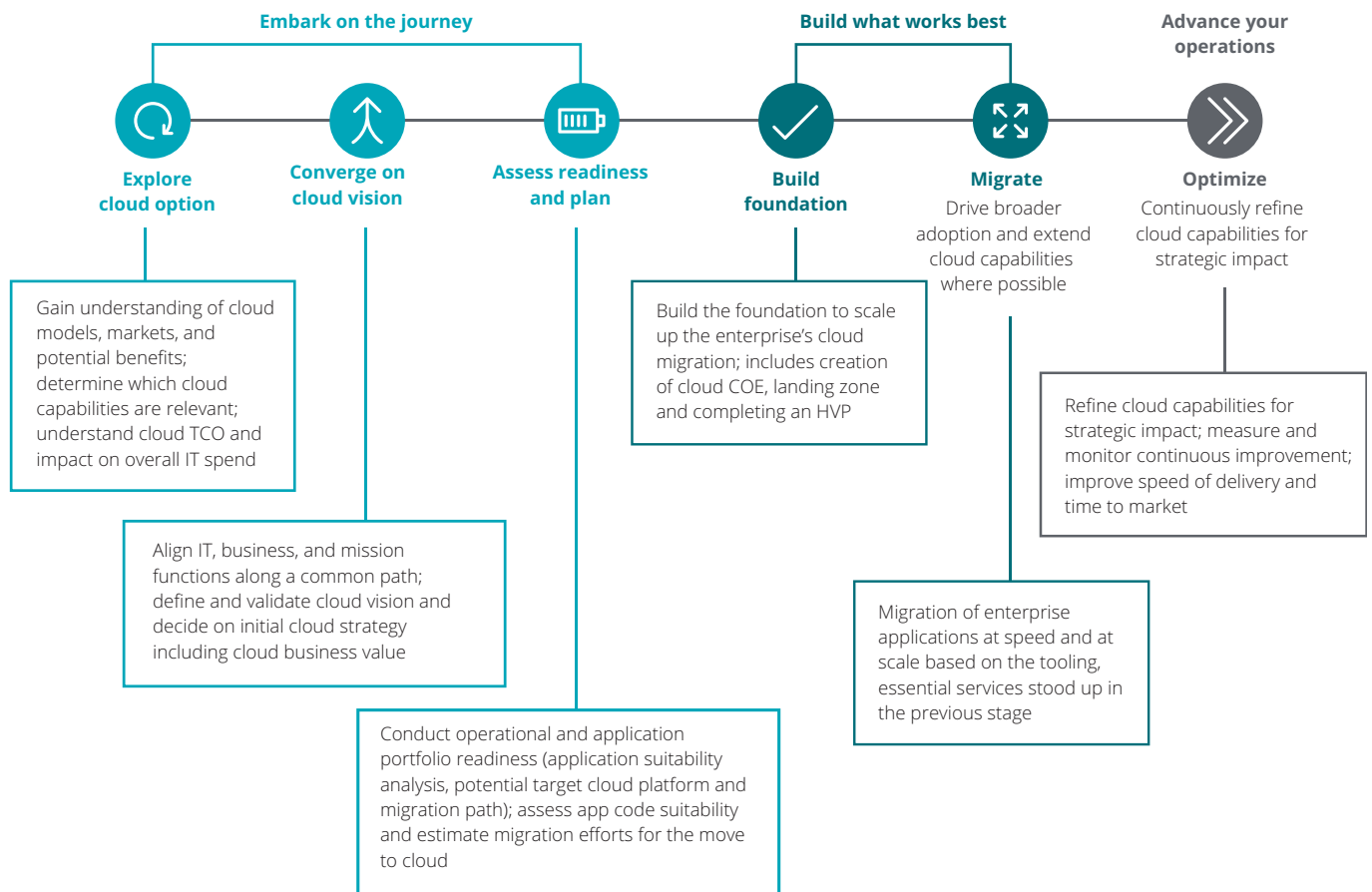
Simply migrating to the cloud will not address the prevalent issues of technical debt for an organization. Key considerations are required to ensure a successful migration that both addresses the organization's technical debt and places the organization in a position to progress to become more agile, innovative, and efficient. Below is a sample approach that can be utilized to develop a cloud strategy and migration plan to begin to address technical debt.

The "embark on the journey" phase is essential as it permits an organization to

assess its IT footprint. Once understanding and pain points are understood, a cloud strategy and roadmap can be put together to address technical debt by moving to the cloud. As the environment maturity increases, footprint modernization strategies take place to utilize the cloud services to make it future proof.

Ultimately, migrating to the cloud can be seen to be in the best interests of organizations to address technical debt.

Figure 2: Cloud strategy for migration



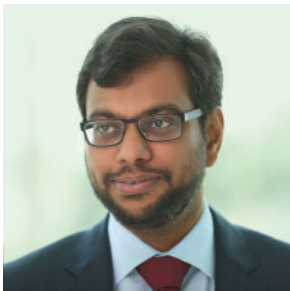
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References

1. Tech Trends 2014. (2014). Retrieved 2019, from https://www2.deloitte.com/content/dam/insights/us/articles/2014-tech-trends-introduction/Tech-Trends-2014_FINAL-ELECTRONIC_single.2.24.pdf
2. A Primer on Technical Debt. (2018). Retrieved 2019, from <https://www.gartner.com/document/3467217?ref=solrAll&refval=218997247&qid=>
3. Technical Debt Estimation. (n.d.). Retrieved 2019, from <https://www.castsoftware.com/research-labs/technical-debt-estimation>
4. UAE GDP comparison to global GDP as a proxy ratio to estimate UAE technical debt based on global technical debt estimates of US \$500 billion
5. Based on Deloitte analysis
6. "Cloud First Policy Strategy and Guidelines – to establish the United Arab Emirates as Regional Data Hub". (2018, October 7). Retrieved 2019, from <https://www.tra.gov.ae/userfiles/assets/QqQulA0SR5C.pdf>
7. Cloud-First Policy. (n.d.). Retrieved 2019, from <http://www.nea.gov.bh/Cloud-First-Policy>
8. Government Agencies' Guide to Cloud Computing Service. (n.d.). Retrieved 2019, from http://www.citc.gov.sa/en/RulesandSystems/RegulatoryDocuments/Documents/GovernmentAgenciesGuideToCloudComputingService_en.pdf
9. "News." Switch to Arabic, www.iga.gov.bh/en/article/bahrain-and-kuwait-sign-mou-for-collaboration-in-cloud-computing.
10. Government Digital Service. "Government Cloud First Policy." GOV.UK, GOV.UK, 3 Feb. 2017, www.gov.uk/guidance/government-cloud-first-policy.
11. Department of Finance. "Whole of Government Cloud Services Panel." Department of Finance, Department of Finance, 13 Apr. 2018, www.finance.gov.au/policy-guides-procurement/cloud-services-panel/.
12. "Cloud Smart Strategy." U.S. Department of the Interior, 24 Oct. 2018, www.doi.gov/cloud/strategy.
13. "AWS Region to Open in the Middle East by Early 2019 | Amazon Web Services." Amazon, Amazon, 27 Sept. 2017, aws.amazon.com/blogs/publicsector/aws-region-to-open-in-the-middle-east-by-early-2019/.
14. "Bahrain Embraces the Cloud: A Look at Almoayyed Computers | Amazon Web Services." Amazon, Amazon, 21 Nov. 2018, aws.amazon.com/blogs/publicsector/bahrain-embraces-the-cloud-a-look-at-almoayyed-computers/.
15. Bhatnagar, Gaurav. "Oracle Enhances Cloud Capability in the UAE." Oracle Middle East, Oracle, 7 Feb. 2019, www.oracle.com/middleeast/corporate/pressrelease/oracle-cloud-data-centre-abu-dhabi-2019-02-07.html.
16. News, SAP. "SAP Cloud Data Center Live in Saudi Arabia To Empower Saudi Vision 2030." SAP MENA Press Room, 9 July 2018, news.sap.com/mena/2018/04/saps-data-center-live-in-saudi/.
17. King, Neil, and Neil King. "Why Microsoft's New UAE Data Centres Will Boost Economic Growth and Accelerate Digitization in the Region." Gulf Business, Gulf Business, 31 Dec. 2018, gulfbusiness.com/microsofts-new-uae-data-centres-will-boost-economic-growth-accelerate-digitization-region/.
18. "Build Your First Serverless Web App | Amazon Web Services." Amazon, Amazon, aws.amazon.com/serverless/build-a-web-app/.
19. Amazon API Gateway Pricing - Amazon Web Services." Amazon, Amazon, aws.amazon.com/api-gateway/pricing/
20. "How AWS Pricing Works." Amazon, Amazon, June 2018, d0.awsstatic.com/whitepapers/aws_pricing_overview.pdf.



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