An introduction to

Business Intelligence in the Cloud

MONTAGE

Published: July 2020

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This whitepaper provides an overview of the benefits of cloud computing services for Business Intelligence.

The cloud has enabled various 'as a service' offerings, including Business Intelligence as a Service for organisations who don't have internal end to end business intelligence capability, or don't want to develop and manage it.

Working with an experienced BI consultancy such as Montage will help you decide what level of cloud BI adoption and which specific BI services will bring the most benefit to your organisation.

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Introduction – The Rise of Cloud Computing

Organisations of all types and sizes are adopting cloud computing services at an ever-increasing pace. More and more functions are being supported by cloud computing services, including Business Intelligence (BI).

The potential benefits of adopting cloud services for BI are many. These include:

- cost savings
- easier administration
- greater flexibility
- infinite scalability
- access to powerful new BI technologies only available in the cloud.

Achieving these benefits requires taking the right approach to cloud BI adoption.

The options are multiple and complex and, to make the right choices for your organisation, you either need to bring on staff with prior experience and success with cloud BI adoption or partner with an external consultancy dedicated to BI, such as Montage, that possesses a deep understanding of cloud BI services as well as the pluses and minuses of various cloud BI solutions. In this article, we provide a high-level overview of the types of cloud BI services now available.

The Cloud

When we use the term "cloud", we're referring to the vast worldwide platforms operated by the three companies that dominate cloud computing: Amazon Web Services (AWS), Microsoft Azure (Azure), and Google Cloud Platform (GCP). Collectively, their platforms are referred to as the public cloud, so-called because the platforms are open for use by others.

While there are other smaller international and regional cloud service providers, the big three account for an ever-growing share of worldwide cloud computing infrastructure and services. The vast scale and profits associated with these three have enabled continuous and rapid evolution and innovation in cloud services, including those relevant to BI.

All three have data centres in Australia, and compatibility between New Zealand and Australian regulation in relevant areas such as privacy means that most New Zealand organisations including governmental entities can use Australia based cloud services. (Note: Microsoft recently announced plans to establish a data centre for Azure here in New Zealand).

In the area of BI, all three cloud platforms provide a wide range of services. We'll use Microsoft Azure for examples in this article, but there are similar services offered by Amazon AWS and Google GCP.

Understanding Cloud Services

A commonly used framework for understanding cloud computing services is to group them into three high-level categories:

- Infrastructure as a Service (IAAS)
- Software as a Service (SAAS)
- Platform as a Service (PAAS)

In addition to being useful ways to group similar services, these categories roughly correspond to evolutionary stages in cloud computing. First came IAAS, which enabled SAAS, which in turn made PAAS possible. You can also think of these as three different approaches to capitalising on what cloud computing platforms offer. We'll first briefly review the types of services grouped under each of these 'as a service' labels and then provide examples specific to cloud BI.

Infrastructure as a Service (IAAS) refers to what we normally think of as utility computing infrastructure: services such as virtual machines, networking, and storage. These were the first services offered by the public cloud providers and are those most similar to traditional data centre offerings. The main benefits organisations realise from IAAS are increased computing infrastructure flexibility and scalability. Costs savings may be realised, but in many cases the cost of similar infrastructure provided by a local data centre and the cloud turn out to be quite similar.

One IAAS innovation that's become of central importance to cloud computing's evolution is blob storage (named simply enough Azure Blob Storage on the Azure platform). "Blob" here refers to file objects of any type – text, data, images, video, structured, unstructured, you name it. Blob storage allows you to store all types of files in the cloud, and inexpensively. Unlike disk storage, where, in the cloud just like in the local data centre, you pay for a fixed capacity and get it all at once, blob storage scales as you need it, and you pay for only what you use. While blob storage does not have all of the features of the file systems that come with Windows and other operating systems, it has the core features needed for most storage applications. The unlimited scalability and low cost of blob storage have enabled many other cloud service innovations.

The flexible, scalable computing infrastructure brought about by IAAS enabled the next stage of cloud computing: **Software as a Service (SAAS).** The basic innovation of SAAS is to make software available for use by any number of individuals and organisations, without those individuals and organisations needing to install and manage that software locally. Instead, the creators of the software are responsible for maintenance, upgrades, ensuring capacity for new users, etc., leaving the user free of such concerns. SAAS now encompasses a vast array of personal and business software, some developed by the public cloud providers, but the majority developed by software companies around the world leveraging the cloud providers' IAAS platforms. Some of the resulting services are so common they are becoming near universal: cloud-based files stores like Dropbox and OneDrive, email services like Gmail, cloud-based financial services like Xero and MYOB, and even complete bundles of business software like Office 365. Tools used by developers

are also available as SAAS. Azure offers Azure Notebooks, a multi-language rapid development environment modelled on the popular Jupyter Notebooks, and Azure DevOps for source control and project management modelled on GitHub (which is also SAAS). Increasingly, these offerings make it possible to access any type of software needed using just an internet connection and web browser.

The breadth of today's SAAS offerings have enabled another wave of cloud computing: **Platform as a Service (PAAS).** SAAS has now made available the full set of tools and resources needed to construct and deploy complete end-to-end solutions entirely within the cloud platform. This complete tool and resource kit, all available in the cloud environment, is what's meant by PAAS. The benefits of PAAS for organisations are: speed of application development (often solutions can be assembled from existing SAAS components), ease of deployment (using scalable and flexible IAAS components or increasingly so-called "serverless" solutions where the application runs without reference to virtual machines), and ease of maintenance (changes can be made rapidly and deployed instantly). At Montage, we've adopted PAAS to create and offer our clients a complete cloud BI managed service for our customers, which we'll discuss more later.

Cloud Services for Business Intelligence

With this framework for understanding cloud computing services in mind, let's now turn to cloud IAAS, SAAS, and PAAS offerings for BI. Along the way, we'll also highlight a couple of potential pitfalls in cloud BI adoption.

Infrastructure as a Service - Avoid a solely "Lift and Shift" Approach

As discussed above, IAAS provides cloud-based core computing infrastructure – virtual servers, networks, storage – that enables cloud platforms to replicate the services provided traditionally by on-premise or local data centres. Since the cloud can serve as a replacement data centre, many organisations view the cloud from this perspective, leading to a "lift and shift" methodology for cloud adoption. Applied to BI, this approach focuses on shifting an organisation's current BI infrastructure to the cloud. Underlying this approach is the assumption that the move to the cloud will result in cost savings and other efficiencies. However, as noted earlier, costs for the required cloud IAAS components in many cases turn out to be similar to what local data centres charge. Also, planning for and implementing such a shift can be quite costly. Thus, the main outcome for BI of a "lift and shift" approach alone – unless paired with a strategy to change the existing BI infrastructure to take advantage of other cloud innovations for BI such as those outlined below – may simply be a costly and disruptive location change.

Infrastructure as a Service – Potential Benefits of the Data Lake

One IAAS innovation that offer many benefits for BI is blob storage. The low cost and near infinite scalability of blob storage has made it feasible for organisations to gather and store in one place all BI-related data artefacts. The result is called a 'Data Lake', an increasingly standard component of cloud-based BI.

Data Lakes combine the centralised storage of all data important to the organisation with "metadata" – data about the data – including data catalogues and data dictionaries. Typically, organisations using a Data Lake aim to store the complete data pipeline used to create BI end-products such as data warehouse fact and dimension tables, starting with the original input data sources through whatever transformations are applied, with the goal of being able to reproduce each step if required.

This end-to-end data storage can be particularly important when, as is often the case, the original source data is not persistent (e.g. data feeds from external organisations that get replaced on some periodic basis, or business software that only retains historical data for some limited time period). A Data Lake can provide a solution to the current state of affairs in many organisations where source data are scattered across various computers, spreadsheets, and folders. Retaining the complete BI data pipeline also provides increased transparency for BI operations that can help with functions such as auditing and regulatory compliance. An obvious danger with Data Lakes is that without proper organisation they can become overwhelming, but best practices in this area are emerging as Data Lake use becomes more and more common.

Software as a Service – Data Visualisation and Business Analytics

We now turn to SAAS offerings for BI. These now span the entire BI software stack, including data movement and transformation (ETL/ELT), the relational database, data visualisation and reporting, and data analysis including machine learning.

Looking first at end-user/business analyst tools, the market leaders in this space have all developed SAAS offerings.

- **Tableau** offers Tableau Online, a SAAS version of Tableau Server, which provides users with all the BI functionality of Tableau Server without any need to install or maintain the software locally. A cloud-based version of Tableau's data wrangling tool, Tableau Prep, is coming soon.
- **Microsoft** currently uses a mixed approach for Power BI, with the locally installed Power BI Desktop paired with the cloud Power BI Service for editing, sharing and collaboration. The Power BI Service is a SAAS offering bundled with some editions of Office 365 or available by separate subscription.

Software as a Service – Relational Databases for BI

Moving on to the relational database, still the main data processing component of most BI infrastructures, that too is available as SAAS.

- For those who use Microsoft SQL Server, the Azure cloud platform offers the SAAS **Azure SQL Database**, which provides (almost) all the features of traditional SQL Server but without the need to worry about installation, upgrades, operating systems, server hardware, etc. Instead, you choose how much performance and storage you need for your database, and Azure creates a new database instance ready to use. If your performance and storage needs change, you can easily change the database specs in a matter of minutes. Many other databases are also available as SAAS.
- **Snowflake** is another SAAS database available on Azure that was purpose-built for BI in the cloud. Snowflake combines high performance and cost containment. With Snowflake, you pay for compute resources only when queries are actually running, which can dramatically reduce costs compared to the majority of other data platforms where you pay for compute resources 24-7 regardless of whether the database is actually in use. Snowflake can also scale compute resources on demand, enabling fast performance for larger workloads without ballooning costs. Another benefit of Snowflake is that it runs on all three public cloud platforms, of importance to organisations that use multiple platforms or for anyone that wants to avoid being locked into one cloud platform.

SAAS offerings for data movement and transformation include **Data Factory** on Azure; **Databricks** (available on Azure and AWS) for big data transformation and analysis; and others for machine learning and working with streaming data.

Software as a Service – The Complexity Challenge

Since there are now so many SAAS offerings for BI, a challenge for many organisations is finding a combination of offerings that work well together while minimizing complexity and new skill requirements.

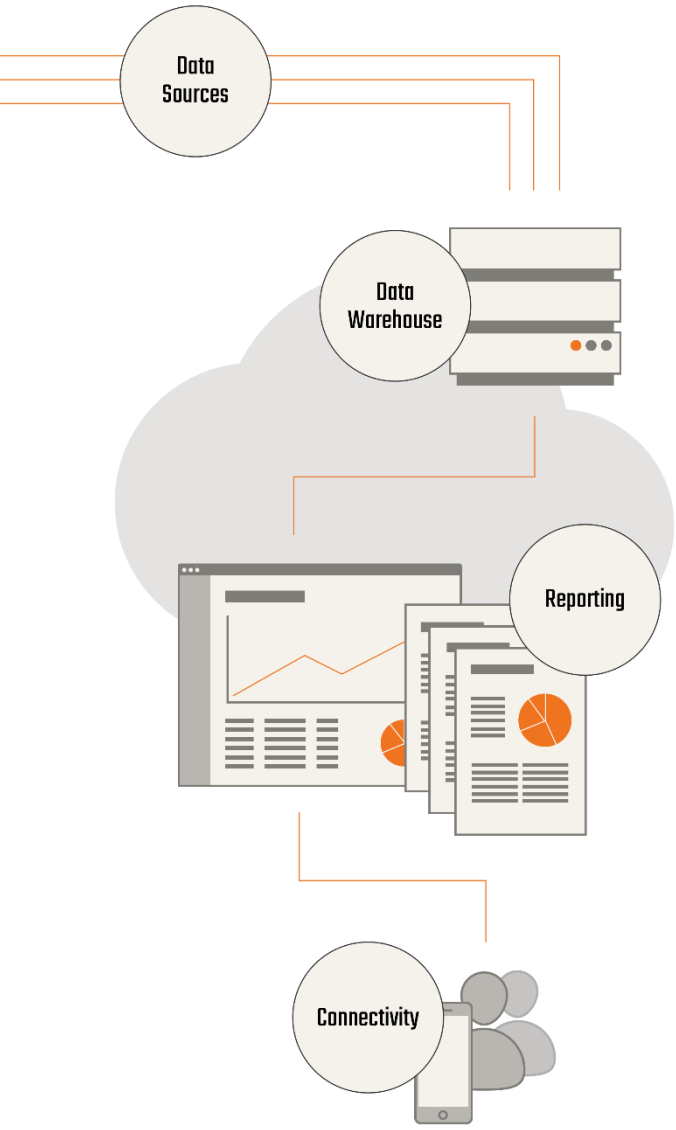
Evaluating individual SAAS offerings and combinations of offerings for goodness-of-fit with your organisations' requirements and in-house skill sets is another area where your BI partner, such as Montage, can be of assistance.

Platform as a Service – End-to-End BI Solutions in the Cloud

We now turn to PAAS and its benefits for BI. Just as in other domains, PAAS offerings in the BI space have become mature and broad enough that it is now quite feasible to build complete cloud-resident BI solutions. One can architect these solutions by assembling SAAS components, customising their behaviour only as needed to meet customer-specific BI requirements. On Azure, a common combination is Azure Blob Storage, Azure Data Factory for data movement and some transformation, Azure SQL Database or Snowflake for dimensional modelling and data mart hosting, and Power BI Service for reports and data visualisation.

However, success with PAAS requires considerable experience with the component SAAS offerings and specialised background knowledge to use them correctly individually and in combination. One must still monitor the various components and fix problems when they occur as with traditional non-cloud solutions. Hence, these tools do not eliminate the need for highly skilled BI employees, contractors or consultants, at least not yet!

BIAAS: Business Intelligence As A Service



At Montage, we've leveraged the PAAS approach to create an end-to-end BI SAAS solution for customers: our Managed BI Service. Currently running on Azure, the service employs a set of Azure components to provide a complete BI data pipeline, from extraction of data from customers' business systems to secure cloud-based data storage and transformation into dimensionally modelled data marts ready for analysis.

Customers can then access the data marts directly using the tool(s) of their choice, or Montage can assist with development and delivery of data visualisations, reports and dashboards using either Power BI or Tableau.

Stakeholders and end users interact with reports, dashboards and analysis via mobile apps and/or via a web browser. Everything is managed securely using the industry-standard security and access control mechanisms provided by Azure.

We view the Managed BI Service as a good option for organisations who want the benefits of BI (outlined below) but do not have the resources needed internally, or do not want to build and manage a solution themselves. This is a flexible service; currently we have clients using our Managed BI service to simply provide them clean data for their own analysis, and other clients where Montage uses the clean data to provide insights via reports and dashboards.

In 2019, Gartner identified the below **business benefits achieved by investing in BI & Analytics**:

- Increased revenue
- Better, faster decisions
- Improved customer satisfaction
- Reduced IT head count
- Reduced external IT costs
- Reduced non-IT costs
- Expansion of types of analysis
- Availability of better insights to more people
- Linking of KPIs to corporate objectives
- Monetisation of data

[*Source: 2019 Gartner Magic Quadrant for BI & Analytics*]

For Montage, the PAAS approach has allowed us to leverage our BI expertise and provide a new BI solution for our customers without having to operate our own data centre. It allows us to focus on what we're good at, and not have to invest in areas that are non-core for our company.

Summary

I've hoped to convey in this article that cloud computing services for BI have matured to the point where some level of adoption can benefit most organisations. To realise those benefits, however, depends on taking the right approach and thinking beyond simply moving your existing BI infrastructure to the cloud.

One side effect of the current breadth of cloud computing service offerings is that it can be difficult to fully understand what's available and which of the various options will best benefit your organisation. Talking to an experienced BI specialist such as Montage will help you decide what level of cloud BI adoption and which specific BI services will bring the most benefit to your organisation.

Montage offers a full range of cloud BI services, range from advice and guidance for organisations thinking about adopting cloud BI to a fully managed cloud BI service for organisations wanting the benefits of BI but don't want to develop and manage a solution themselves.

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Useful Links

Montage

- Montage www.montage.co.nz
- Business Intelligence as a Service www.montage.co.nz/cloud
- Cloud Analytics for Retail www.montage.co.nz/rpm

Montage Technology Partners

- Snowflake https://www.snowflake.com/
- Microsoft Azure https://azure.microsoft.com/en-us/overview/
- Tableau https://www.tableau.com/products/cloud-bi
- Power BI https://powerbi.microsoft.com/en-us/power-bi-pro/

Other

- 2019 Gartner Magic Quadrant for Data Management Solutions for Analytics https://www.snowflake.com/blog/snowflake-recognized-as-a-leader-by-gartner-third-consecutive-year-positioned-in-the-magic-quadrant-report/
- 2020 Gartner Magic Quadrant for BI & Analytics https://www.tableau.com/reports/gartner
- Google Cloud https://cloud.google.com/
- Amazon Web Services https://aws.amazon.com/