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KuppingerCole Report
LEADERSHIP COMPASS

by **Mike Small** | April 2018

Infrastructure as a Service – Global Providers

The KuppingerCole Leadership Compass provides an overview of vendors and their product or service offerings in a certain market segment. This Leadership Compass focusses on Infrastructure as a Service (IaaS) from Cloud Service providers (CSP) with a global presence and with a specific focus on security and compliance.

by **Mike Small**
mike.small@kuppingercole.com
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Leadership Compass
IaaS
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1   Introduction

The KuppingerCole Leadership Compass provides an overview of vendors and their product or service offerings in a certain market segment. This Leadership Compass focusses on Infrastructure as a Service (IaaS) from Cloud Service providers (CSP) with a global presence.

IaaS provides a form of IT hosting service which requires no up-front capital expenditure. IaaS provides basic computing resources that the customer can use over a network to run software and to store data. There are two distinct uses of IaaS services. In the first - organizations, start-ups especially, use the cloud for agile development without the need to acquire hardware. In the second – it allows a customer to transfer all or part of some existing workloads to the cloud; and this to the so called "Hybrid Cloud" where both cloud and on-premise services are in use. Each of this use cases have differing priorities of needs.

This leadership compass focusses on those IaaS services that cover both needs and that are delivered on a global scale. In this context, global scale means that the service is provided from and is available in multiple geopolitical regions. It has a specific focus on security and compliance aspects from a European perspective.

1.1   Market Segment

The market segments for IaaS services are defined by the scale of operation and the richness of the service provided. There are several well-known global IaaS service providers. In the past, these global providers have been mostly based in the USA. However, there are now new entrants in this field based in other parts of the world. The services provided by the global CSPs are now being complemented by CSPs that provide more specialized offerings. These may be based on geographic locality, regulatory compliance or the level of professional services and service management that are included.

This leadership compass focusses on those IaaS services that cover both needs described above and that are delivered on a global scale. In this context, global scale means that the service is provided from and is available in multiple geopolitical regions including the EU/EEA.

Infrastructure as a Service (IaaS) provides basic computing resources that the customer can use to run software (both operating systems and applications) and to store data. IaaS allows the customer to transfer an existing workload to the Cloud with minimal if any change needed. The customer does not manage or control the underlying Cloud infrastructure but remains responsible for managing the OS and applications.

Increasingly IaaS providers offer extensions beyond this basic functionality to support the development of new applications (DevOps) and to facilitate migrating existing workloads into their cloud service. To facilitate this service offerings may include pre-packaged middleware, databases and development tools.

The responsibility for security and compliance in the use of cloud services is shared between the customer and the cloud service provider (CSP). The customer does not manage or control the underlying cloud infrastructure but is responsible for managing the OS and applications. The customer also remains

responsible for compliance with laws and regulations governing the processing of data. The CSP is responsible for the management, security and compliance of the infrastructure providing the service.

1.2 Required Capabilities

The core features and functionalities that we are looking for include but are not limited to:

- Basic service functionality – the basic IaaS services provided such as compute, storage, deployment models etc.
- Hybrid cloud support - functionality provided for organizations to migrate and run all or part of existing workloads in the cloud service while integrating with on-premise IT services.
- Support for DevOps - support the development of new application functionality together with rapid transition of these into operational use.
- Availability - how the service ensures the continuity of the customers service. This includes the resilience of the service infrastructure plus the capabilities provided for the customer to maintain their service in the face of point failures.
- Compliance – how the service enables organizations using it to comply with laws and regulations.
- Data protection – how access to the service and the applications and data it contains are controlled through features such as identity and access management and encryption.
- Cyber-security - how the service is protected against cyber-security risks and the help provided to its customers to protect against these risks when using the service.
- Consulting services – to support customers in their migration to and use of the service.

1.2.1 Basic Service Functionality

Here we consider the basic functionality provided by the Cloud Service. This must include compute and storage and support for Public / Private / Hybrid delivery models. We also look at the range of OS types for which there are predefined images and middleware and application stacks with out-of-the-box support (e.g. Databases and Web). Also considered is the support provided for high performance features such as bare-metal servers, GPU and parallel processors such as Hadoop.

1.2.2 Enterprise and Hybrid Workload Support

Here we consider the functionality provided for organizations to migrate and run enterprise workloads in the cloud service. This includes the availability of consulting services to advise and assist with the migration of existing workloads and flexibility in service contract to support specific customer needs. Technical measures we look for include support for customer specific technical requirements such as IP address ranges and secured connections between the enterprise and the cloud. Also considered is the ability to specify that specific workloads can be physical co-located or separated from those of other tenants. To assist in migration, we also look for support for workloads based on hypervisors widely used on premise such as VMWare. We also look for support for rapid "cloud bursting" from on-premise equipment based on demand and hot and cold standby functionality.

1.2.3 Support for DevOps

Here we consider the functionality provided by the cloud service to support the development of new application functionality together with rapid transition to operational use. This includes the range of

development tools and methodologies supported by predefined library of ready to use functionality. For example: Java™ code, Spring, Ruby, Node.js, and custom frameworks. The range of predefined application components available in a ready to use form. For example: MySQL, MongoDB, PostgreSQL, Redis, RabbitMQ, and custom services. Support for containerization (e.g. Docker) and functionality to deploy, monitor, manage and roll back workloads. Also considered is the provision of tools to support the development of secure applications including code scanning, dynamic testing as well as web application firewalls.

1.2.4   Cloud Service Availability

Loss of access to the service or data can occur for a variety of reasons some of which are technical and some due to other causes such as takeover or financial failure of the CSP. This area covers the extent to which the availability of the IaaS is assured and the options for the customer. Factors considered include the SLA offered by the CSP and how well the historical level of service delivered in practice matches the SLA together with the measures taken by the CSP to ensure service resilience of the service to the range of natural disasters and failures.

Also considered are the options offered to the customer to maintain their service in the face of point failures by in the service or in their applications. These include backup and recovery functionality offered and for hot and cold standby functionality. Finally, we consider the non-technical risks to the service availability including the financial strength of the CSP and the extent to which the CSP is dependent on third parties to deliver the service.

1.2.5   Compliance

In this area, we consider how the service enables organizations using it to comply with laws and regulations. Specifically, we are looking at the kinds of functionality provided by the service to support compliance and the independent certifications and attestations provided. Also considered are apects around privacy and other legal issues such as the guarantees around the geographic location and processing of customers' data and the policies regarding disclosure to customers of legal access requests to their data as well as disclosure to customers of suspected and actual data breaches.

1.2.6   Data Protection

This area covers how access to the service and the applications and data it contains are controlled through features such as identity and access management and encryption. Specifically, we consider the Identity and Access controls for the customer's service administrators and for the customer's service users. We expect to see support for standards such as SAML, XACML, OAuth etc., as well as integration with directory services such as Microsoft Active Directory. Finally, we consider what support is provided for encryption of the customer's data held in the cloud service and how the keys to encrypt the data are managed.

1.2.7   Cyber Security

This area covers how the service is protected against cyber-security risks and the help provided to its customers to protect against these risks when using the service. Specifically, we are looking for a clear definition of how responsibility for cyber-security is shared between the CSP and the customer and the cyber-security controls that are designed and implemented in the service infrastructure. We consider the physical security aspects including controls over access by CSP employees to the infrastructure and to

customer data held in the service. We look at the network defences provided against external threats and the service controls that ensure separation between customers workloads and data, how the service is monitored to detect and respond to incidents. Finally, we consider the tools integrated with the service for the customer to meet their responsibilities for security such as vulnerability scanners, firewalls, intrusion detection, SIEM integration.

1.2.8   Consulting Services

This area covers the availability of consulting services provided to support customers in their migration to and use of the cloud service. We look at the range of consulting services are provided directly by the CSP as well as those provided by partners.

2   Leadership

Selecting a vendor of a product or service must not be only based on the comparison provided by a KuppingerCole Leadership Compass. The Leadership Compass provides a comparison based on standardized criteria and can help identifying vendors that shall be further evaluated. However, a thorough selection includes a subsequent detailed analysis and a Proof of Concept of pilot phase, based on the specific criteria of the customer.

Based on our rating, we created the various Leadership ratings. The Overall Leadership rating provides a combined view of the ratings for

- Product Leadership

- Innovation Leadership

- Market Leadership

Figure 1: The Overall Leadership rating for the IaaS Global market segment

We find several companies in the Leader section. AWS remains the leader as the CSP with the most comprehensive offering, continuing innovation and market leadership. Microsoft is also in the leadership section with a rich and evolving offering that also underpins its SaaS services. IBM Cloud has made significant investments in their cloud infrastructure, their cloud development platform Bluemix as well as a wide range of SaaS.

The companies in the challenger section all have strong offerings that are more focussed on specific market segments. These segments include enterprise workload migration and hybrid cloud services with a European bias. These are likely to be attractive to organizations moving to cloud services for flexibility but have strong needs for European regulatory compliance. For example, CloudSigma offers a 100% uptime guarantee and compliance with Swiss privacy laws.

Overall Leaders are (in alphabetical order):

- Amazon Web Services   - Microsoft
- IBM

Product Leadership is the first specific category examined below. This view is mainly based on the analysis of product/service features and the overall capabilities of the various products/services. Product Leadership, or in some cases Service Leadership, is where we examine the functional strength and completeness of products.
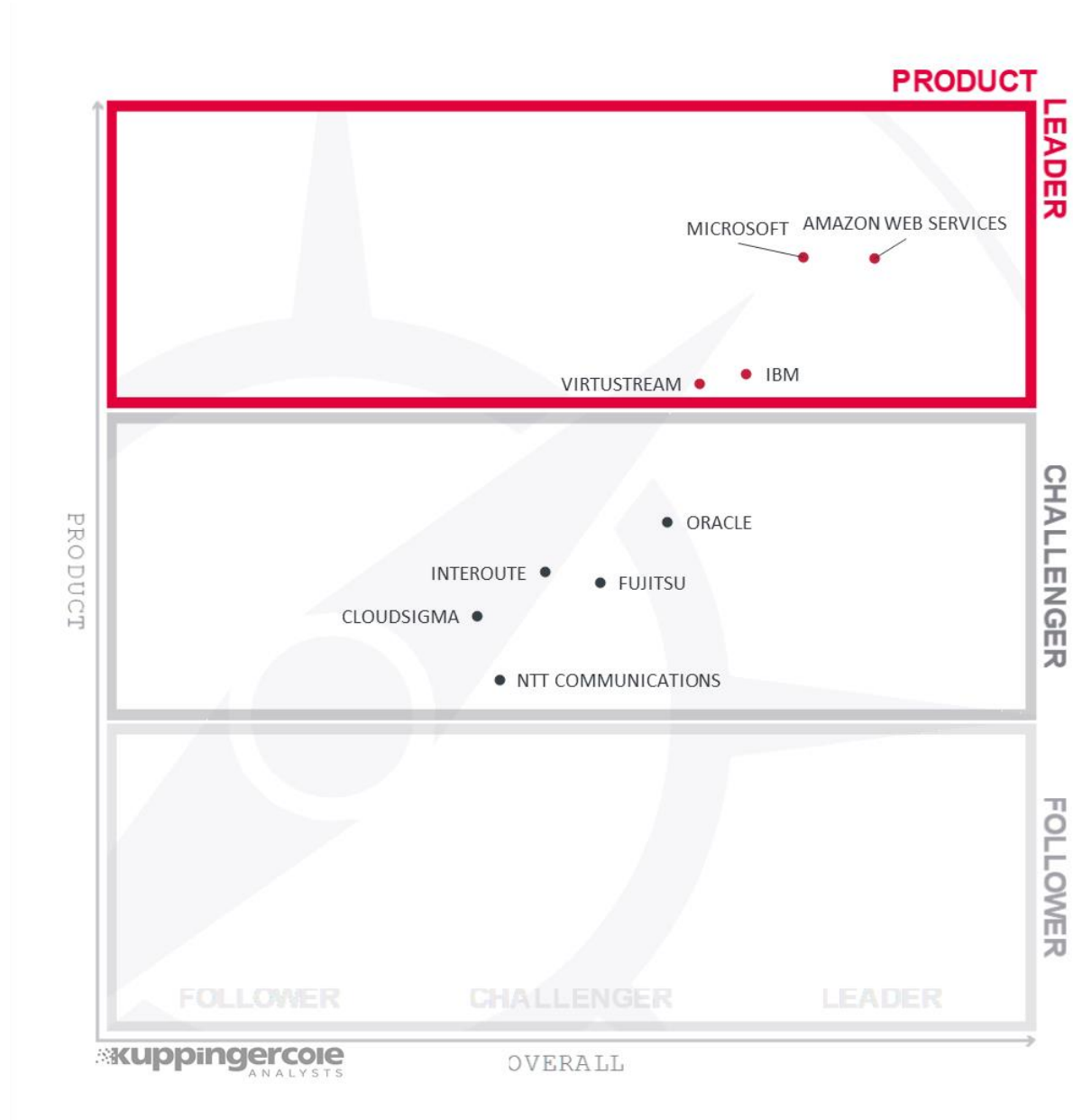
Figure 2: Product leaders in IaaS Global market segment

The leaders in this segment all have products that excel in several aspects. AWS continues to invest and innovate in the cloud services that it offers. These have evolved to include sophisticated tools for development including machine learning capabilities, a wide range of storage options, IoT and mobile platforms and others. The Microsoft Azure provides an Integrated IaaS and PaaS cloud offering with a vision for a seamless hybrid cloud platform. During 2017 IBM has invested heavily in a major infrastructure evolution to create availability zones with a global services footprint. IBM also offers its Watson AI / Cognitive Platform as a cloud service. Virtustream Enterprise Cloud offers assured

application level SLAs with up to 99.999% availability. High levels of security are provided as standard including: 2-Factor authentication, Intel TXT Trusted Computing, isolated application zones, integrated GRC and continuous compliance monitoring.

The challengers all have good products that excel in one or more areas. For example, most services analysed offered excellent compute and storage options, but some provided only limited DevOps capabilities out-of-the-box. These services should be considered as they could meet customer requirements for specific use cases.

Product Leaders (in alphabetical order):

- Amazon Web Services
- IBM
- Microsoft

- Virtustream

Next, we examine **innovation** in the marketplace. Innovation is, from our perspective, a key capability in all IT market segments. Customers require innovation to meet evolving and even emerging business requirements. Innovation is not about delivering a constant flow of new releases. Rather, innovative companies take a customer-oriented upgrade approach, delivering customer-requested cutting-edge features, while maintaining compatibility with previous versions.
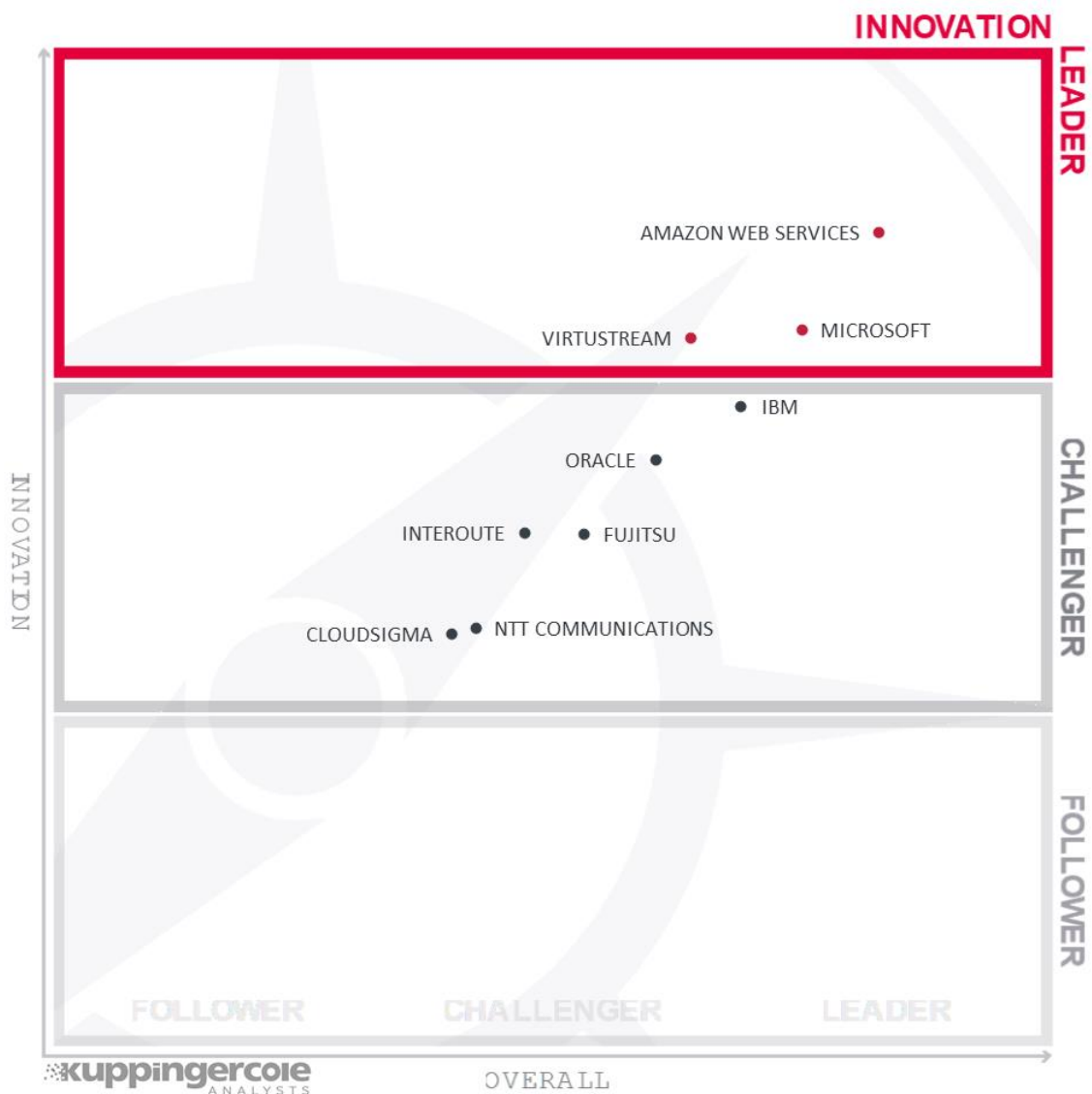
Figure 3: Innovation leaders in the IaaS Global market segment

AWS has a unique approach to innovation with a strong focus on identifying and delivering those innovations that provide real business benefits. For example, during the first 10 months of 2017, AWS released 1,300 new services and features.   Microsoft, has a more visionary approach with a focus on new technologies such as quantum computing.   Virtustream Enterprise Cloud uses patented xStream cloud

resource management technology (µVM), to create secure, multi-tenant cloud environments that deliver assured SLA levels for business-critical applications and services.

In the challenger section IBM and Oracle are close to the border. IBM through the reengineering of its cloud infrastructure and its Watson platform and Oracle for the design of their cloud infrastructure.

Innovation Leaders (in alphabetical order):

● Amazon Web Services
● Microsoft
● Virtustream

Lastly, we analyse **Market** Leadership. This is an amalgamation of the number of customers, the geographic distribution of customers, the size of deployments and services, the size and geographic distribution of the partner ecosystem, and financial health of the participating companies. Market Leadership, from our point of view, requires global reach.
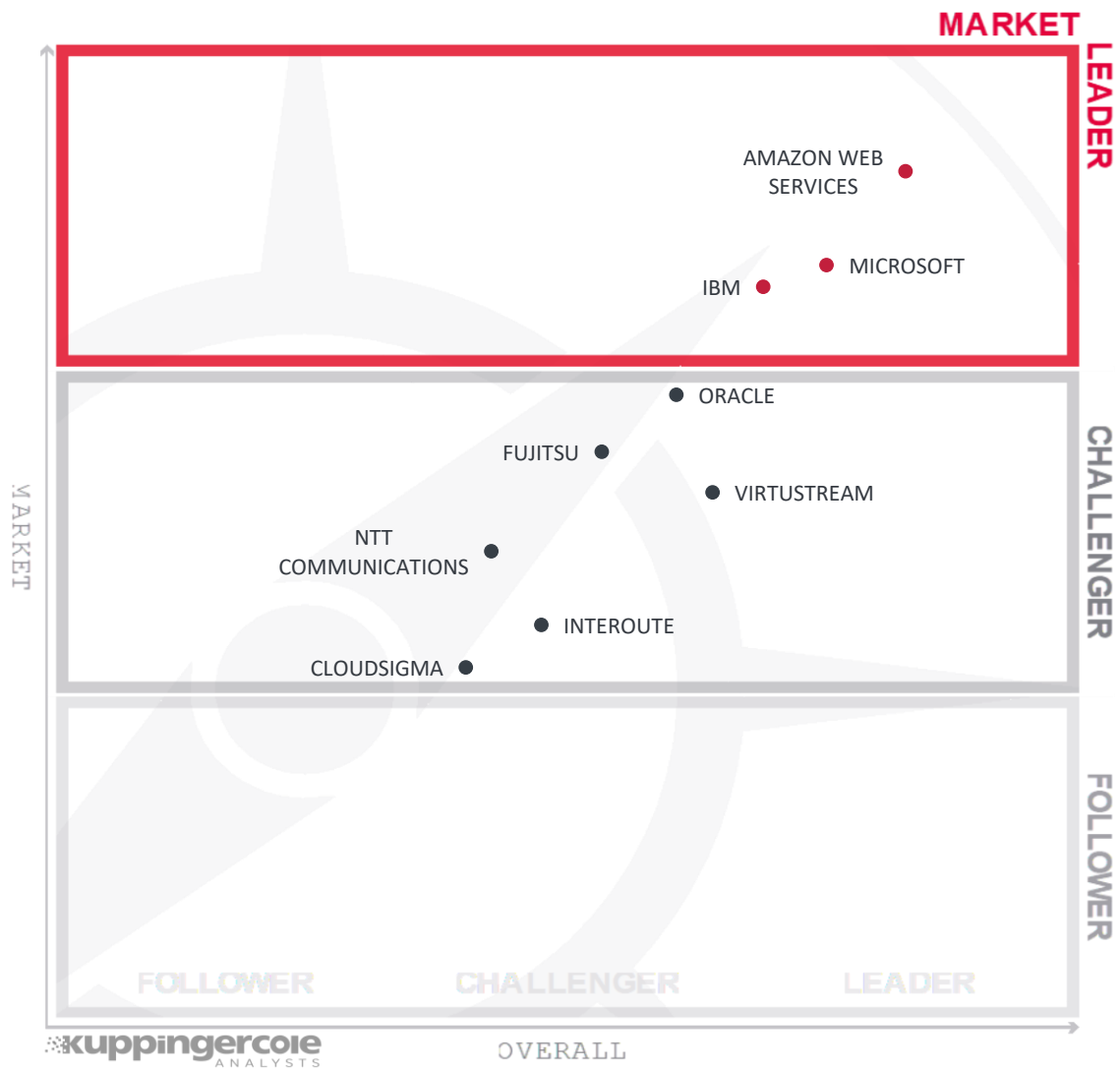
Figure 4: Market leaders in the IaaS Global market segment

Once again, the dominant players in the IaaS market worldwide are AWS, Microsoft and IBM. The important challenger for this market is Oracle.

Market Leaders (in alphabetical order):

- Amazon Web Services
- IBM

- Microsoft

3   Correlated View

While the Leadership charts identify leading vendors in certain categories, many customers are looking not only for a product leader, but for a vendor that is delivering a solution that is both feature-rich and continuously improved, which would be indicated by a strong position in both the Product Leadership ranking and the Innovation Leadership ranking. Therefore, we provide the following analysis that correlates various Leadership categories and delivers an additional level of information and insight.

3.1   The Market/Product Matrix

The first of these correlated views contrasts Product Leadership and Market Leadership
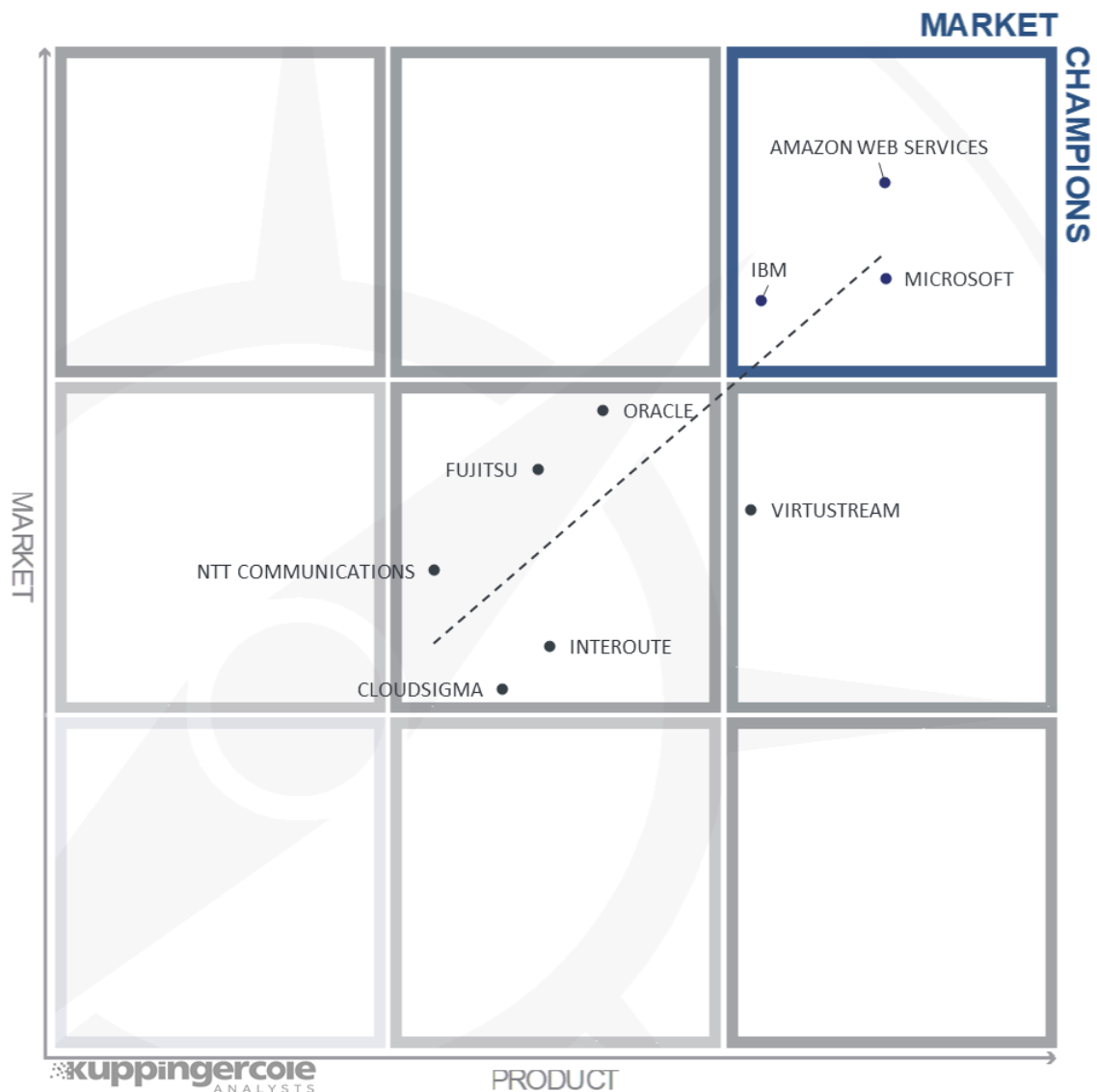
Figure 5: The Market/Product Matrix. Vendors below the line have a weaker market position than expected according to their product maturity. Vendors above the line are sort of "overperformers" when comparing Market Leadership and Product Leadership.

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In this comparison, it becomes clear which vendors are better positioned in our analysis of Product Leadership compared to their position in the Market Leadership analysis. Vendors above the line are sort of "overperforming" in the market. It comes as no surprise that these are mainly the very large vendors, while vendors below the line frequently are innovative but focused on specific regions.

The matrix shows a picture that is typical for evolving market segments, with a rather broad distribution of the various players across the quadrants and a weak correlation between Market Leadership and Product Leadership. The vendors below the line have services with the potential to increase their market share. Virtustream stands out in this respect.

3.2   The Product/Innovation Matrix

This view shows how Product Leadership and Innovation Leadership are correlated. It is not surprising that there is a pretty good correlation between the two views with few exceptions. This distribution and correlation is tightly constrained to the line, with a significant number of established vendors plus some smaller vendors.
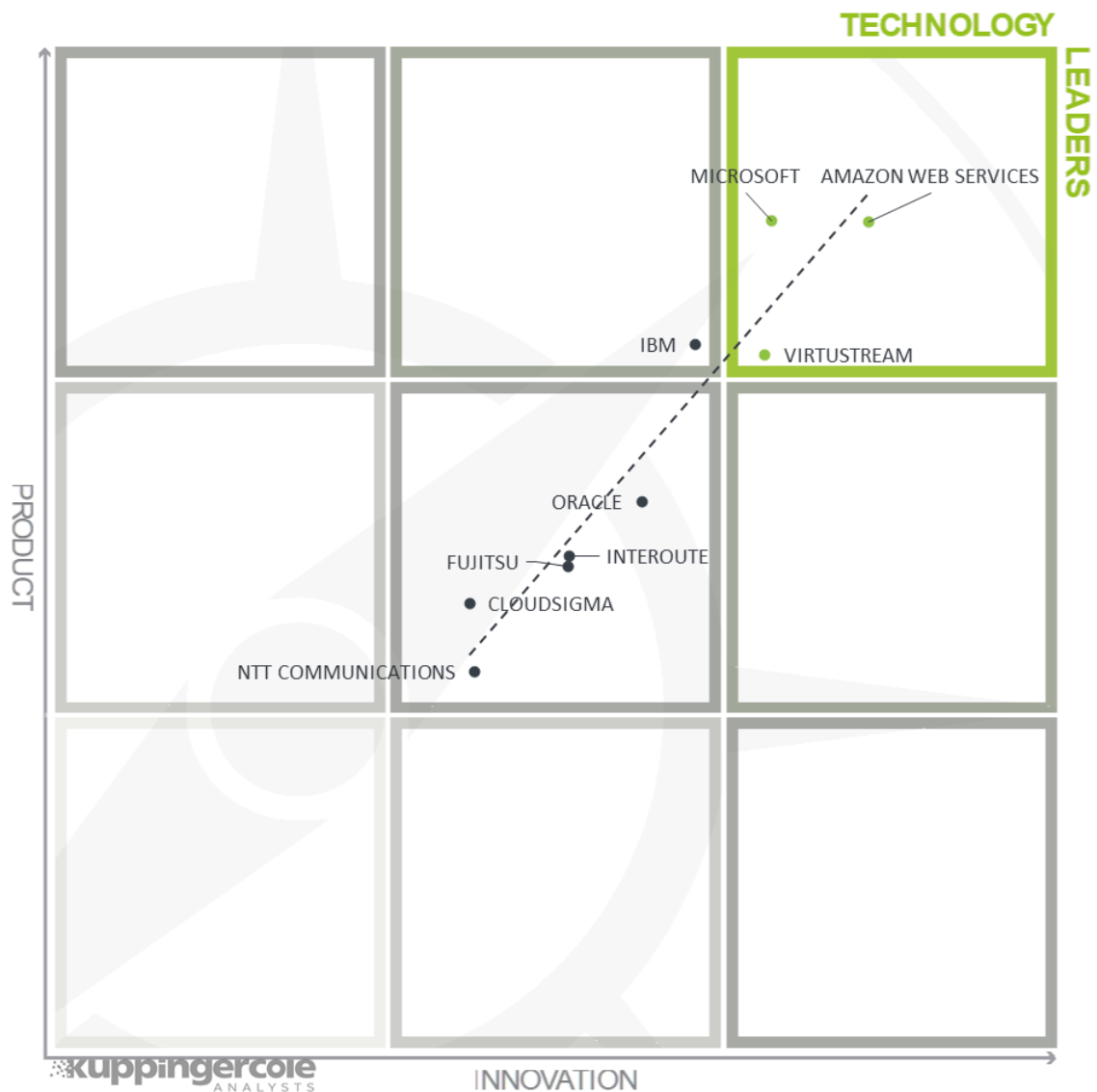
Figure 6: The Product/Innovation Matrix. Vendors below the line are more innovative, vendors above the line are, compared to the current Product Leadership positioning, less innovative.

This chart shows a quite interesting picture. Most vendors are near the line, showing a balanced ratio of product capabilities and innovation.

3.3 The Innovation/Market Matrix

The third matrix shows how Innovation Leadership and Market Leadership are related. Some vendors might perform well in the market without being Innovation Leaders. This might impose a risk for their future position in the market, depending on how they improve their Innovation Leadership position. On the other hand, vendors which are highly innovative have a good chance for improving their market position. However, they might also fail, especially in the case of smaller vendors.
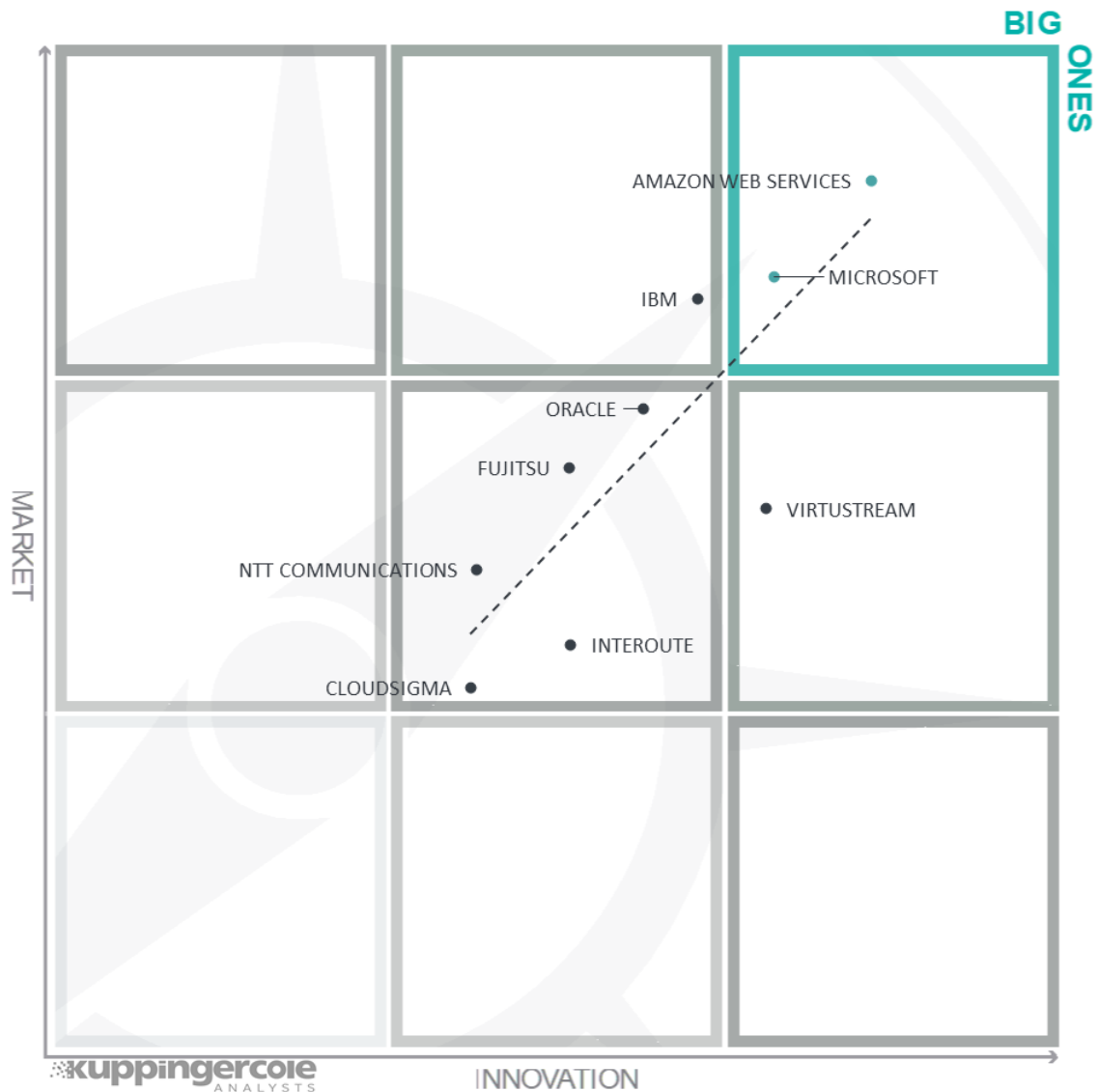
Figure 7: The Innovation/Market Matrix

Vendors above the line are performing well in the market compared to their relatively weak position in the Innovation Leadership rating; while vendors below the line show an ability to innovate, and thus the biggest potential for improving their market position.

This section provides an overview of the various products we have analyzed within this KuppingerCole Leadership Compass on IaaS Global Service Providers. Aside from the rating overview, we provide additional comparisons that put Product Leadership, Innovation Leadership, and Market Leadership in relation to each other. These allow identifying, for instance, highly innovative but specialized vendors or local players that provide strong product features but do not have a global presence and large customer base yet.

4.1   Ratings at a glance

Based on our evaluation, a comparative overview of the ratings of all the products covered in this document is shown in table 1.

Product	Security	Functionality	Integration	Interoperability	Usability
AMAZON WEB SERVICES	strong positive	strong positive	strong positive	strong positive	strong positive
CLOUDSIGMA	strong positive	neutral	neutral	positive	positive
FUJITSU	strong positive	positive	positive	neutral	positive
IBM	strong positive	strong positive	strong positive	strong positive	positive
INTEROUTE	strong positive	neutral	positive	positive	positive
MICROSOFT	strong positive	strong positive	strong positive	strong positive	positive
NTT COMMUNICATIONS	positive	neutral	positive	neutral	neutral
ORACLE	positive	positive	positive	positive	positive
VIRTUSTREAM	strong positive	neutral	strong positive	positive	strong positive

Table 1: Comparative overview of the ratings for the product capabilities

In addition, we provide in table 2 an overview which also contains four additional ratings for the vendor, going beyond the product view provided in the previous section. While the rating for Financial Strength applies to the vendor, the other ratings apply to the product.

Vendor	Innovativeness	Market Position	Financial Strength	Ecosystem
AMAZON WEB SERVICES	strong positive	strong positive	strong positive	strong positive
CLOUDSIGMA	neutral	neutral	positive	neutral
FUJITSU	positive	positive	strong positive	positive
IBM	positive	strong positive	strong positive	strong positive
INTEROUTE	positive	neutral	positive	neutral
MICROSOFT	positive	strong positive	strong positive	strong positive
NTT COMMUNICATIONS	neutral	neutral	strong positive	neutral
ORACLE	positive	positive	strong positive	strong positive
VIRTUSTREAM	strong positive	positive	strong positive	positive

Table 2: Comparative overview of the ratings for vendors

Table 2 requires some additional explanation regarding the "critical" rating.

In Innovativeness, this rating is applied if vendors provide none or very few of the more advanced features we have been looking for in that analysis, like support for multi-tenancy, shopping cart approaches for requesting access, and others.

These ratings are applied for Market Position in the case of vendors which have a very limited visibility outside of regional markets like France or Germany or even within these markets. Usually the number of existing customers is also limited in these cases.

In Financial Strength, this rating applies in case of a lack of information about financial strength or for vendors with a very limited customer base but is also based on some other criteria. This doesn't imply that the vendor is in a critical financial situation; however, the potential for massive investments for quick growth appears to be limited. On the other hand, it's also possible that vendors with better ratings might fail and disappear from the market.

Finally, a critical rating regarding Ecosystem applies to vendors which have no or a very limited ecosystem with respect to numbers and regional presence. That might be company policy, to protect their own consulting and system integration business. However, our strong belief is that growth and successful market entry of companies into a market segment relies on strong partnerships.

5   Product/service evaluation

This section contains a quick rating for every product/service we've included in this KuppingerCole Leadership Compass document. For many of the products there are additional KuppingerCole Product Reports and Executive Views available, providing more detailed information.

5.1 Amazon Web Services

AWS continues to invest and innovate in the cloud services that it offers. It has evolved to include sophisticated tools for development including machine learning capabilities, a wide range of storage options, IoT and mobile platforms and others. Its global footprint in terms of data centres continues to expand apace. It has taken a very proactive approach to compliance with GDPR.

Strengths	Challenges
● Strong basic IaaS platform;	● While AWS has made great progress in attracting enterprise customers, to retain this leadership position, it must continue to enhance its attractiveness to these customers
● Rich DevOps capabilities;	
● Speed of innovation of new services;	
● Global footprint for availability and compliance;	● Competition from other CSPs that are evolving to challenge AWS position.
● Hybrid / Private deployment support to cloud enable existing workloads;	
● Independent certifications for a wide range of compliance;	
● Strong security.	

Table 3: AWS's major strengths and challenges

AWS's global footprint continues to expand to satisfy the needs of its expanding customer base and services offered. It now has: 53 availability zones across 18 geographic regions, one local region, and has announced plans for 12 new availability zones and 4 more regions: Bahrain, Sweden, Hong Kong, and a second US GovCloud region.

AWS and Microsoft recently announced Gluon which is a deep learning library to prototype, build, train and deploy machine learning for cloud, edge and mobile devices which provides high performance and is integrated with Microsoft deep learning tools.

The AWS Migration Acceleration Program (MAP) is designed to help enterprises migrating existing workloads to AWS. MAP provides consulting support, training and services credits to reduce risk, to build a strong foundation and to help offset the initial costs. It includes a methodology as well as a set of tools to automate and accelerate common migration scenarios.

AWS has a clear and open approach to security and compliance. It has a very wide range of independent certifications for compliance. AWS has led the CISPE code of conduct to provide clarity to cloud customers around the shared responsibilities for compliance with GDPR and to confirm the steps they are taking to support this.

Security	Strong Positive
Functionality	Strong Positive
Integration	Strong Positive
Interoperability	Strong Positive
Usability	Strong Positive

Table 4: AWS's rating

AWS remains the leading IaaS Global service provider, offering the widest range of services across the greatest number of geographies.

5.2 CloudSigma

CloudSigma is a pure play IaaS service provider that was founded in 2009 with headquarters in Zurich Switzerland. The service is delivered from data centres in Switzerland, Germany, Poland, USA, Saudi Arabia, the Philippines and Australia. One of the key selling points is high service availability, CloudSigma guarantees 100% network availability in any given calendar month.

Strengths	Challenges
● High service availability guarantee;	● Lack of some exotic server types (GPU etc.);
● Good range of basic services	● Limited range of independent compliance certifications.
● Compliance with EU privacy;	
● Worldwide data centre delivery options;	
● Support for enterprise grade workloads;	
● Public, private and hybrid offerings	
● Partnership with Standing Cloud for PaaS.	

Table 5: CloudSigma's major strengths and challenges

CloudSigma offers a range of IaaS services that feature high availability, high performance servers, storage and networking. The services include crypto-currency miners but not some other forms of specialized hardware like GPUs.

CloudSigma services are hosted in Equinix data centres and offer a 100% uptime guarantee for the availability of their service at the network interface. This is backed in the SLA by a credit of 50 times the fees for any period of lack of availability for a virtual server or network uptime lasting more than 15 minutes as measured. During 2018, CloudSigma expect to open at least 3 new cloud locations. The services hosted in the European data centres conform with EU and Swiss data protection regulations. However, the range of independent certifications for compliance, covering ISO 27001, PCI-DSS and SOC 2 reports, is rather limited in comparison with other CSPs.

The service is based KVM virtualization and offers both public cloud, private cloud, virtual private cloud and hybrid deployment options. The service supports a wide range of OS types and Databases. The CloudSigma IaaS supports a wide range of DevOps platforms. Any x86/x64 operating system will run on the CloudSigma platform, as long as it is compatible with standard Intel/AMD architecture. The platform also offers users to upload their own custom OS as long as it is a raw ISO image.

Security	Strong Positive
Functionality	Neutral
Integration	Neutral
Interoperability	Positive
Usability	Neutral

Table 6: CloudSigma's rating

CloudSigma offers an IaaS service owned, hosted and operated in Europe as well as delivered worldwide. It should be considered by organizations looking to run enterprise workloads with a guarantee of high availability.
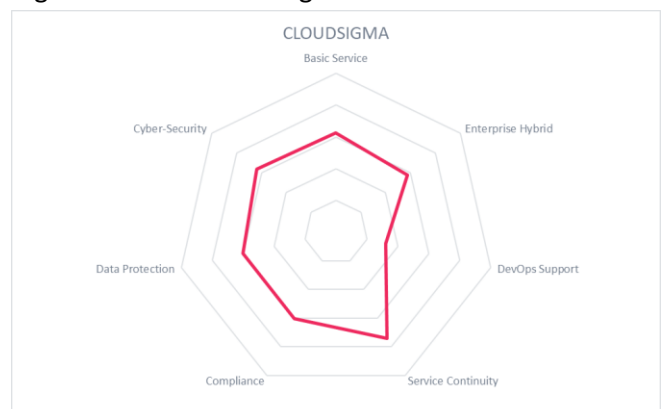
5.3 Fujitsu Cloud Service K5

Fujitsu is an information and communication technology company with its headquarters in Tokyo Japan. It is the world's fifth-largest IT services provider and No.1 in Japan. Fujitsu Cloud Service K5 is a cloud platform, specifically created to enable enterprise level digital transformation.

Strengths	Challenges
● Good range of basic services	● Lack of some exotic server types (GPU etc.);
● Worldwide data centre delivery options;	● Limited range of OS and databases supported out-of-the-box;
● Support for enterprise grade workloads;	● Limited range of independent compliance certifications.
● Public, private and hybrid offerings	
● Managed services to support migration and deployment.	

Table 7: Fujitsu's major strengths and challenges

The Fujitsu Cloud Service K5 is provided via a standardized platform and common architecture. It was launched at the end of 2015 and is now available in in Japan, UK, Finland, Germany, Spain and the USA. It underpins the Fujitsu Digital Business Platform MetaArc which is Fujitsu's tool for delivering digital transformation.

It provides both IaaS and PaaS functionality. The IaaS supports high-reliability, high-performance systems as well as systems requiring physical isolation. The customer can select infrastructure from Public, Virtual Dedicated and Physical Dedicated according to their needs.

The PaaS provides several features: CF - An application execution environment service based on the open source Cloud Foundry. PF - A service that supports agile development of applications and provides an application execution environment. API Management platform that manages and publishes various web service APIs. SF - a feature that automates the design and build of an infrastructure configuration according to the requirements. IoT Platform that enables the usage of data from various sensors and gateways using a standard procedure.

The range of independent certifications for compliance covering ISO 27001, with PCI-DSS and SOC 2 reports planned[1], is rather limited in comparison with the market leaders.

Security	Strong Positive
Functionality	Positive
Integration	Positive
Interoperability	Neutral
Usability	Positive

Table 8: Fujitsu's rating

Fujitsu Cloud Service K5 provides a good range of IaaS and PaaS functionality for enterprises looking for worldwide delivery and managed services support.

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[1] http://www.fujitsu.com/global/about/resources/featurestories/whitepaper33.html
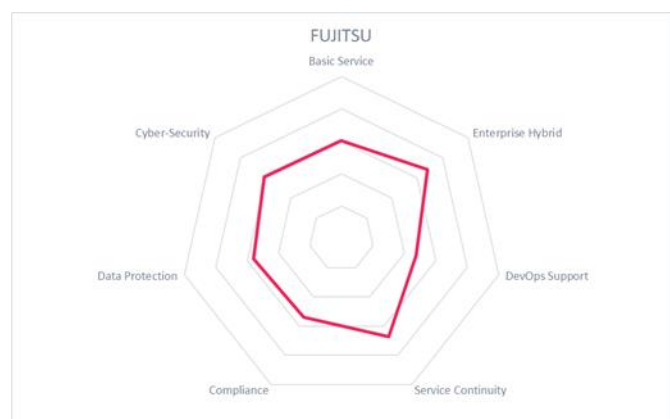
5.4   IBM Cloud

IBM Cloud has made significant investments in their cloud infrastructure, their cloud development platform as well as a wide range of SaaS.   IBM offers its Watson AI / Cognitive Platform as a cloud service. It also offers a range of managed services for its cloud offerings to help organizations to migrate enterprise workloads to the cloud in a secure and compliant manner where this is appropriate. During 2017 IBM has invested heavily in a major infrastructure evolution to create availability zones with a global services footprint.

Strengths	Challenges
● Strong IaaS platform based on SoftLayer;	● DevOps capabilities still less attractive to "born on the cloud" organizations;
● Global footprint for availability and compliance;	● Competition from other CSPs that are evolving to match IBM's strengths;
● Hybrid / Private deployment support to cloud enable existing workloads;	
● Strong security;	
● Managed services,	

Table 9: IBM's major strengths and challenges

IBM Cloud's IaaS platform provides a strong foundation for customers looking for an IaaS service as well as for all of the other IBM cloud offerings. The IBM Cloud platform has now matured to provide strong support for DevOps. In addition, IBM now offer a new private cloud using Kubernetes and Containers as the infrastructure.

Application modernisation: IBM are providing support for customers to modernise and cloud enable existing on premises applications by cloud enabling the IBM middleware to make this easier. This is supported by managed services to analyse and automate cloud migrations processes as well as supporting private, hybrid and public cloud deployment models.

IBM's global footprint and evolving availability zones enable customers to assure the continuity of their cloud services while at the same time remaining compliant with laws and regulations that require specific geographic location of data. IBM Cloud infrastructure offers a high level of security based on IBM's long experience in this area together with the option of managed security services for those areas that remain the responsibility of the customer.

Security	Strong Positive
Functionality	Strong Positive
Integration	Strong positive
Interoperability	Strong Positive
Usability	Positive

Table 10: IBM's rating

IBM has enormous experience of delivering high quality services to enterprise and government customers. IBM Cloud should be on the shortlist for those organizations looking to modernize their existing on-premises applications as well as reinventing their processes to exploit the cloud.

5.5   Interoute

On February 26th, 2018 GTT Communications, Inc. announced[2] an agreement to acquire Interoute Communications Ltd. This report relates to the situation prior to this announcement. Interoute Communications Ltd, is a privately held telecommunications company that operates Europe's largest cloud services platform. It was founded in 1995 and underwent extensive restructuring in 2003 to focus on network and internet services. As well as network services, Interoute offers their Virtual Data Centre (VDC) IaaS solution. This can be used to deploy public, private and hybrid clouds.

Strengths	Challenges
● European network and data centres;	● Limited DevOps functionality out-of-the-box;
● Integrated high-speed network;	● Limited market place offerings;
● Virtual data Centre rather than isolated servers;	● Limited range of certifications;
● Hybrid / Private deployment support;	
● Strong security;	
● Managed services.	

Table 11: Interoute's major strengths and challenges

Interoute's Virtual Data Centre (VDC) service enables the customer to design, provision and manage cloud resources in VDC Zones (physical data centres) in Amsterdam, Berlin, Frankfurt, Geneva, London (two data centres), Paris, Stockholm, Slough, Milan, Madrid, Zurich, Istanbul, Hong Kong, Singapore, New York and Los Angeles.

These resources include compute, storage, and network services with complete customer control. The customer can upload and use their own VM images or chose from the range of native VDC templates provided, with additional templates available through the Interoute CloudStore. Services can be deployed onto physically separate servers to ensure resilience. Interoute also offers dedicated compute resources for a customer's virtual machines that are physically separated from other tenants of the VDC zone. For Interoute VPN customers the IaaS capability is automatically integrated into their corporate WAN and can exist inside this private corporate network architecture. There is no charge for data transfers in or out of the VDC zones.

As well as offering persistent storage for applications and data, Interoute Object Storage is an independent storage platform which offers resilient, scalable distributed storage.

Interoute can guarantee that data is hosted in Europe and is transferred across European networks which is important for some customer use cases. In addition, the service, infrastructure and the data centres are engineered to a high level of security. However, Interoute has a limited number of certifications in comparison with the market leaders.

Security	Strong Positive
Functionality	Neutral
Integration	Positive
Interoperability	Positive
Usability	Positive

Table 12: Interoute's rating

Interoute's VDC provides a flexible IaaS service that should be attractive to enterprises wishing to deploy workloads to a European cloud with global connectivity.

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[2] **https://www.interoute.com/press-release/gtt-acquire-interoute**
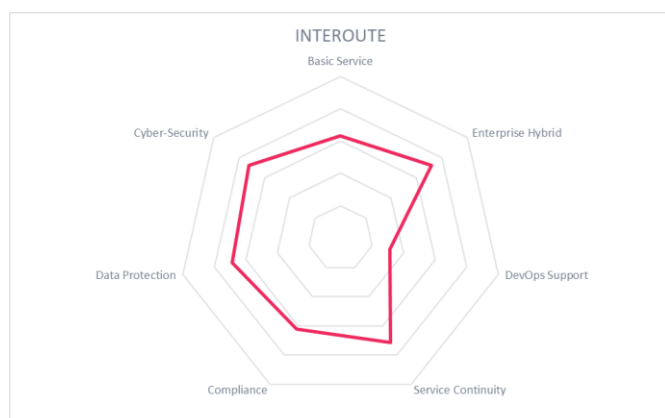
5.6 Microsoft Azure

Microsoft Azure is a comprehensive set of cloud services that can be used to build, deploy, and manage applications. It includes IaaS providing compute and storage, PaaS which offers a wide range of development services including Artificial Intelligence / Machine Learning, and SaaS services that include Office 365 as well as others. This report is focused on Microsoft Azure IaaS and PaaS offering.

Strengths	Challenges
● Microsoft vision for a seamless hybrid cloud platform;	● Building on current success to become the overall market leader;
● Integrated IaaS and PaaS offering;	● Providing support for Cloud Service Provider Codes of Conduct.
● Rich additional services such as AI / ML;	
● Wide range of independent certifications;	
● Strong brand and market presence.	

Table 13 Microsoft's major strengths and challenges

Microsoft Azure IaaS supports a wide range of compute environments, application stacks and development tools in addition to those from Microsoft.   Microsoft Azure includes several services that provide the capabilities needed to help build and deliver Web and Mobile applications. There are also specific features to support enterprise critical workloads such as SAP HANA.

Microsoft Azure is delivered from 42 regions globally. Each region contains multiple data-centres providing a high degree of resilience. The Azure services and the datacentres have a wide range of third party certifications covering security and compliance.   However, in recognition of the compliance challenges for data processing and storage in certain jurisdictions, Microsoft have released their Azure Stack. This is a packaged cloud appliance that can be used by partners to deliver an Azure compliant cloud service in jurisdictions with geographic limitation on processing and storage, and by organizations wishing to run sensitive Azure workloads on premises.

There are 3 independent Codes of Conduct for cloud service providers, none of which has received formal approval in the context of GDPR. Unlike many other leading IaaS providers, Microsoft is not a member of European CSP Codes of Conduct CISPE or C-SIG. Microsoft believes that their contractual commitment to all customers provides stronger and more meaningful assurance.

Security	Strong Positive
Functionality	Strong Positive
Integration	Strong positive
Interoperability	Strong Positive
Usability	Positive

Table 14 Microsoft's rating

Microsoft have comprehensive, secure and compliant cloud offering that will be attractive to organizations worldwide to develop and deploy new applications as well as to migrate existing enterprise workloads.
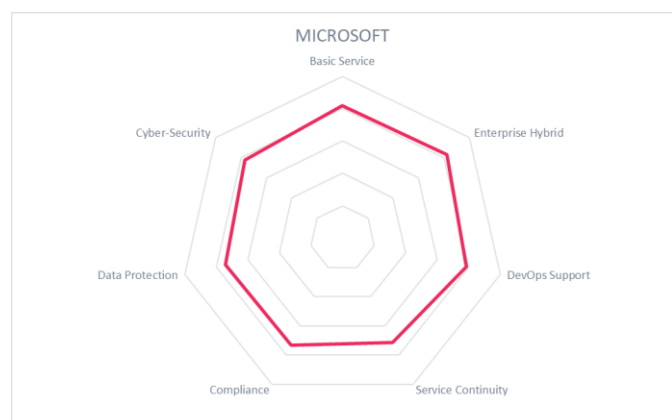
5.7 NTT Communications Enterprise Cloud

NTT Communications is a part of NTT (Nippon Telegraph and Telephone Corporation), a Japanese telecommunications company headquartered in Tokyo, Japan. It offers the NTT Communications Enterprise Cloud.

Strengths	Challenges
● Based on global network and datacentres;	● Multiple cloud service offerings;
● European Datacentres;	● Limited independent compliance certifications in comparison with other vendors;
● Integrated IaaS and PaaS offering;	
● PaaS Based on Cloud Foundry;	
● Consulting services;	● Lack of inbuilt advanced functionality such as analytics.
● String market presence in Japan and Asia	

Table 15: NTT's major strengths and challenges

NTT Communications (NTT Com) Enterprise Cloud combines hosted private, public, multi-tenant and third-party cloud infrastructures. Clouds can connect at Layer 2, using secure software-defined networking (SDN) technology, and integrate with on-premises infrastructure, creating a hybrid cloud. This provides the flexibility to locate compute resources close to specific markets, or if data sovereignty is important, restrict deployment to a specified country. The service is provided from worldwide data-centres, including those in the UK, Germany, France and Spain as well as those in the US, Asia and Australia.

It offers free direct connection the NTT Com network and 10Gbps connectivity between data centres and the cloud. The hosted private cloud offers on-demand bare metal servers, multi-hypervisors (VMware vSphere, Microsoft Hyper-V) and network mapping to replicate on-premises network topology and configuration onto the cloud service.

Enterprise Cloud is built on OpenStack and incorporates Cloud Foundry platform-as-a-service (PaaS) for creating virtual private PaaS. Its Cloud Management Platform (CMP) provides management, operational governance and orchestration of the NTT Com Enterprise Cloud and third-party cloud solutions including AWS and Microsoft Azure.

The service is engineered to provide a high level of security at the infrastructure layer and includes a range of tools for the customer to secure their applications running in the service. However, independent compliance certifications offered are very limited in comparison with the market leaders.

Security	Positive
Functionality	Neutral
Integration	Positive
Interoperability	Neutral
Usability	Neutral

Table 16: NTT's rating

The service offers flexibility to migrate existing workloads to the cloud and to for enterprise DevOps with a focus on Asia Pacific. See also recent announcement in chapter 6.
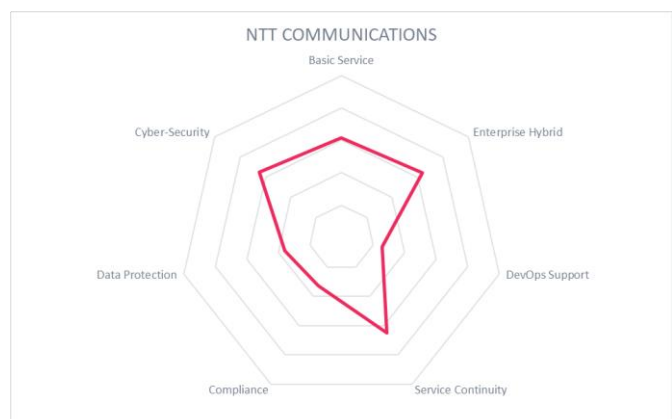
5.8 Oracle Cloud

Oracle is a well-known major IT software and hardware vendor. In March 2016, Oracle announced an expanded cloud portfolio, releasing new Oracle Cloud services offering new services across all layers of the stack—SaaS, PaaS, and IaaS. Oracle Cloud is intended to offer secure infrastructure and platform services for use by Oracle customers to run their mission-critical enterprise workloads and store their data.

Strengths	Challenges
● Vision for an enterprise grade hybrid cloud platform;	● More limited range of services out-of-the-box than leading competitors;
● Integrated IaaS and PaaS offering;	● More limited compliance certifications;
● Strong database and development tools;	● Proprietary management interfaces make it easier to become locked-in
● Based on an innovative platform.	
● Strong brand and market presence.	

Table 17 Oracle's major strengths and challenges

Oracle's IaaS portfolio delivers a set of core services for running enterprise workloads like elastic compute, networking, and storage. The IaaS services include: Oracle Compute Cloud, Oracle Network Cloud – Virtual Private Network and Fast Connect, Oracle Storage Cloud – Bulk Data Transfer, and Oracle Messaging Cloud.

In October 2017, Oracle announced new integrated PaaS offerings. In addition to new autonomous data management cloud services, big data analytics, and AI capabilities, these include the additions to its application development platform, data integration platform, and security and systems management portfolio. These include: Oracle Container Native Application Development Platform for developers to build, deploy and manage container-native applications. Oracle Blockchain Cloud Service, an enterprise-grade distributed ledger cloud platform enabling developers to extend applications to deliver tamper-resistant B2B transactions. Oracle Mobile Cloud portfolio expanded to simplify development and deployment of Artificial-Intelligence (AI)-powered chatbots and operational analytics. Oracle AI Platform Cloud Service combines a complete AI development environment and compute infrastructure.

The Oracle Cloud is designed with security in mind from the ground up. The Oracle IaaS and PaaS services have less published independent certifications for compliance than many of their competitors. There is also less support out-of-the-box for many of the popular NoSQL databases and range of tools than from other services.

Security	Strong Positive
Functionality	Positive
Integration	Positive
Interoperability	Positive
Usability	Positive

Table 18: Oracle's rating

A visionary offering that should be considered by enterprises looking to exploit business critical workloads.
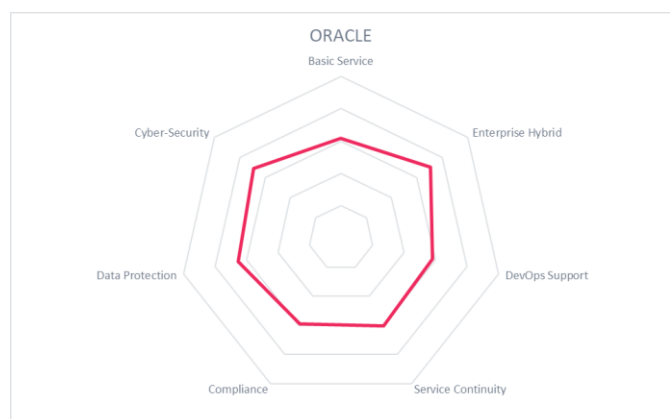
5.9 Virtustream

Virtustream, a Dell Technologies Business, is a cloud service and software provider focussed on the migration and delivery of business-critical applications in the cloud. Virtustream's xStream cloud management platform and Infrastructure-as-a-Service (IaaS) are intended to meet the requirements of complex production applications in the private, public and hybrid cloud. Virtustream is headquartered in New York, NY with major operations in 10 countries.

| Strengths	Challenges
● Innovative platform for migration and deployment of complex applications;	● Focus on enterprise workload migration rather than DevOps;
● Managed services available to support this migration and deployment;	● Differentiating their offering against the major CSPs evolution towards enterprise solutions.
● Strong growth of customer base;	
● Strong security and compliance characteristics;	
● Strong backing from Dell Technologies.	

Table 19 Virtustream's major strengths and challenges

Virtustream Enterprise Cloud uses patented xStream cloud resource management technology (µVM), to create secure, multi-tenant cloud environments that deliver assured SLA levels for business-critical applications and services. Virtustream provides managed services to help organizations to migrate legacy applications to their cloud platform. It also enables production and mission-critical applications to take advantage of technologies such as Big Data analytics such as: SAP HANA and Hadoop, as well the advantages like agility, backup and disaster recovery offered by cloud computing. Virtustream further provides a path for digital transformation with a managed Pivotal Cloud Foundry offering that enables the enterprise to realize the benefits of a cloud-native application development and management platform alongside mission-critical application estates.

Virtustream Enterprise Cloud offers assured application level SLAs with up to 99.999% availability. High levels of security are provided as standard including: 2-Factor authentication, Intel TXT Trusted Computing, isolated application zones, integrated GRC and continuous compliance monitoring. Flexible deployment options from private cloud (on-premises), virtual private cloud, public cloud, public plus private cloud (hybrid) and trusted federated cloud exchange. The Virtustream offering is SAP certified and is independently certified as being compliance with a wide range of regulations and laws.

Security	Strong Positive
Functionality	Neutral
Integration	Strong positive
Interoperability	Positive
Usability	Strong Positive

Table 20: Virtustream's rating

Virtustream have a strong set of services for enterprises looking to migrate or run enterprise, business-critical workloads securely and compliantly in the cloud.
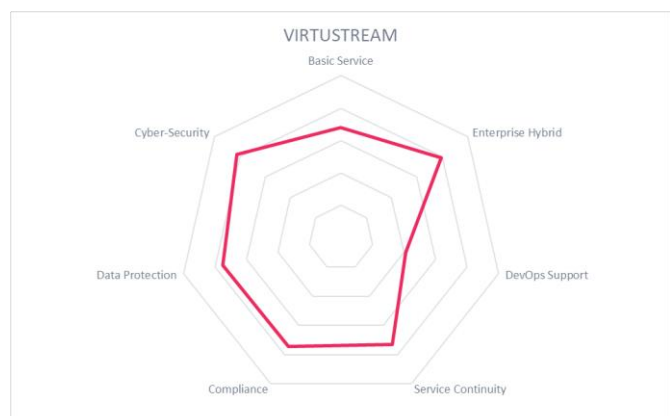
6 Vendors and Market Segments to watch

Aside from the vendors covered in detail in this Leadership Compass document, we also observe other vendors in the market that we find interesting. Some decided not to participate in this KuppingerCole Leadership compass for various reasons, while others are interesting vendors but do not fully fit into the IaaS Global market segment or are not yet mature enough to be considered in this evaluation. We provide short abstracts below on these vendors.

6.1   Alibaba

Alibaba Cloud is the cloud computing arm and a business unit of Alibaba Group (NYSE: BABA). The Alibaba Cloud is the dominant cloud provider in the Chinese market and is expanding worldwide to provide a suite of cloud computing services.   The cloud services provided cover a basic IaaS including ECS elastic compute service with block storage; a range of web server stacks; load balancing and auto-scaling services, and an elastic GPU compute service. An Object Storage System (OSS) is also offered plus an on-demand database service Alibaba Cloud ApsaraDB that is offered on MySQL, SQL Server and PostgreSQL. A container-based DevOps services is also provided.

Alibaba Cloud is growing at a high rate outside of China and is becoming an emerging contender in the worldwide market for cloud services. However, it will need to overcome suspicions from customers outside of China and provide strong assurances around compliance and the sovereignty of data.

6.2   Armor

Armor is a privately held company that has grown out of Firehost with its headquarters in Richardson TX, in the US.   In 2009 Firehost was launched as a cloud service provider offering IaaS with a focus on security. In 2015 Firehost became Armor marking a strategic evolution from the FireHost brand. Armor is a cyber security services company that provides security and compliance solutions for businesses around the world. It provides security monitoring, protection, response and compliance for cloud workloads and hybrid IT.

6.3   CenturyLink

CenturyLink is the second largest U.S. communications provider to global enterprise customers. The company is listed on the NYSE and has its headquarters in Monroe Louisiana, USA. It delivers a range of cloud services from its worldwide datacentres to customers in more than 60 countries.

CenturyLink provides IaaS, PaaS, and a range of managed cloud services from data centres around the world. As well as those in the Canada and the USA, there are data centres in Tokyo, Singapore, Hong Kong, Australia as well as in Germany and the UK.   CenturyLink offers a portfolio of cloud technologies to develop and deploy business applications deployed as public, private, hybrid and managed services. Slightly less functionality is offered "out-of-the-box" than that provided by the market leaders.

6.4   Google

The Google Cloud Platform™ is a set of cloud services that are based on the same infrastructure used by Google to deliver its end-user products, such as Google Search and YouTube. It provides a set of cloud services that include compute, data storage, data analytics and machine learning. The Google Cloud Platform Compute Engine was first generally available during 2013 and the platform has evolved considerably since then.

The Google Cloud Platform is delivered from an expanding number of data centres around the world. The Google Compute Engine provides customizable virtual machines and the option to deploy code directly or via containers. Google Kubernetes Engine provides fully-managed Kubernetes clusters to deploy, manage, and orchestrate containers at scale.   The Google App Engine provides a platform-as-a-service.

Consulting and support services are provided by Google and an increasing number of partners.

6.5   Joyent

Joyent is a cloud service provider based in San Francisco CA, that was acquired by Samsung[3] in June 2016. It offers the Triton Cloud service that is 100% open source and designed to eliminate cloud provider lock-in. It provides compute, storage and analytics capabilities with public, private and hybrid deployment models.

Joyent claims that Triton is engineered to run more efficiently than other clouds, and the savings from this are passed on to the customers. It offers per minute billing and claims that the container-native infrastructure means customers requires less compute capacity.

The service is delivered from six data centres across the US and one in Amsterdam in the Netherlands.

The service is independently certified to PCI-DSS and HIPAA and has and SSAE 16 SOC 1 attestation.

6.6   NTT Communications

In November 2017, Dimension Data, the global technology solutions and services provider, and NTT Communications, the ICT solutions and international communications business within NTT Group, announced[4] that they will create a single 'cloud powerhouse' by bringing together their cloud infrastructure-as-a-service (IaaS) capabilities under the management of NTT Communications to deliver transformative, cloud-based solutions and innovation to clients of both organizations around the world.

6.7   OVH

OVH is a French company that was founded in 1999. It offers a range of cloud services for storing, managing and processing data and applications. These services are hosted in 13 datacentres in France and 2 Canada that are owned by OVH. In May 2017, OVH acquired vCloud Air's business from VMware, and OVH continues to provide the acquired service as "vCloud Air Powered by OVH," and will leverage VMware's hybrid cloud technology.

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3 **https://www.joyent.com/about/press/samsung-to-acquire-joyent**
4 **http://www.ntt.com/en/about-us/press-releases/news/article/2017/1110_2.html**

OVH's range of IaaS cloud services include Private Cloud, VPS (Virtual Private Sever), Public Cloud and Dedicated servers where the customer can install and run their own OS and application stack. This is based around OpenStack which provides customers with portability to move to other providers.

Through the vCloud Air acquisition, OVH offers high-performance secure hybrid cloud solutions as well as Disaster Recovery, Data Centre Extension, and Data Centre Replacement. These services include: a VPC multi-tenant compute service with enterprise-focused functionality and security; private cloud with dedicated compute nodes; and disaster recovery. OVH will continue to partner with VMware on go-to-market and customer support around the vCloud Air use cases.

6.8   Rackspace

Rackspace is a public company listed on the NYSE. It offers a range of services that include managed hosting and managed cloud. Rackspace differentiates its offering through what it describes as "fanatical support".

While Rackspace offers its own private cloud supporting VMWare, Microsoft and OpenStack, its focus is now more on providing managed cloud services. Most large organizations are using cloud services from multiple vendors and this can incur significant management overheads. In addition, these clouds may need to be integrated with on-premise or hosted workloads. Rackspace offers services to manage all of these deployments for the customer. Rackspace offers its fanatical support for: VMWare – as a premier partner; AWS as a Certified partner with AWS certified staff; Google as the first premier managed services partner for Google Cloud Platform™; Microsoft and OpenStack as a founder of OpenStack with NASA in 2010, and as operator of the world's largest OpenStack cloud.

6.9   SAP HANA Enterprise Cloud

SAP is a world leader in enterprise applications and, based on market capitalization, SAP is the world's third largest independent software manufacturer. SAP has its headquarters in Waldorf Germany with office locations in 130 countries.

SAP HANA Enterprise Cloud is a fully managed, private cloud that offers elasticity and flexibility with optional subscription-based pricing. It provides a SAP compliant platform and is not a generic Infrastructure as a Service offering. It is intended to support mission-critical SAP applications such as SAP Business Suite, SAP NetWeaver Business Warehouse and custom SAP HANA applications. It can be used both for the deployment of SAP production systems and to accelerate SAP development projects. SAP HANA Enterprise Cloud runs in the data centres of SAP and its certified partners.

In addition, SAP offers SAP HANA Cloud Platform, Platform as a Service. This is intended for organizations to build and run brand new SAP cloud applications or extend existing applications to the cloud.

The SAP HANA Enterprise Cloud runs in data centres[5] in the US East and West coast, Europe, Japan and Australia.

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[5] list-of-data-centers-for-cloud-services.pdf

6.10 Skytap

Skytap is a privately-owned company based in Seattle WA, in the US. It offers a form of cloud service Skytap Cloud that delivers what it calls Environments. Each Skytap Cloud Environment is a software-defined data centre (SDDC) supporting a wide range of configurations, including VMware virtualizations of Linux, Solaris, or Windows running on x86, AIX running on IBM Power Systems, Docker, and Kubernetes. This service is delivered from its own data centres in North American, Europe and Asia. In addition, it has recently become available[6] through IBM Bluemix as IBM Cloud for Skytap Solutions.

Skytap Cloud Environments encapsulate applications, infrastructure, networking, operating system, software, storage, data, and VM memory state. By using these Skytap Cloud Environments, rather than the regular IaaS components, Skytap claims that its customers realize better business value as part of their software development lifecycle (SDLC).   These Environments can be configured to exactly match the on-premises ones and this allows customers to migrate traditional applications to Skytap Cloud unchanged and deliver on-demand access to production-ready resources. Skytap provide four deployment options:

- Multi-Tenant - Public data-centre regions and shared hosts used by the majority of Skytap Cloud customers.
- Single-Tenant, Dedicated Regions for customers with more stringent compliance requirements.
- Single-Tenant, Dedicated Hosts – provide a dedicated host in an existing region.
- AIX on IBM Power Systems – providing native support for AIX on IBM Power Systems alongside VMware virtualizations on x86.

6.11 Telefonica Open Cloud

Telefonica is a publicly listed Telecommunications company its headquarters in Spain and with revenues of over 52 Billion Euros in the year ending December 2016[7]. Telefonica Cloud offers private, public and hybrid cloud services that allow enterprises of all sizes to manage IT infrastructure more effectively, supporting companies at every stage of the IT life cycle. Its approach is based on an end-to-end management, from the devices to the data source, data center services and cloud-based applications, through best-in-class technology, service guarantees and engineering expertise. All this integrated with Telefonica's secure communications services.

Specially for Infrastructure as a Service, Telefonica has a comprehensive value proposition with their Virtual Data Center service based on VMware that facilitates the migration of existing applications to the cloud. Telefonica's Virtual Data Centre (VDC) allows the customer to create the virtual cloud infrastructure they require with the networking capabilities (VLANs, multi-layer architectures) and topologies, security and reliability. Telefonica continues to strengthen cloud offering extending our partners ecosystem with Rightscale and Abiquo to launch multi-cloud brokering services a broad set of compute, storage, networking, database, analytic, application and deployment services based on OpenStack.

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[6] **https://www.skytap.com/partners/ibm-cloud-skytap-solutions/**
[7] **https://www.telefonica.com/en/web/shareholders-investors/financial_reports**

In addition, Telefonica offers managed cloud services that cover a variety of requirements of IT and security management. These include a fully managed SAP service, managed Hybrid Cloud and managed infrastructure.

6.12   T-Systems Open Telekom Cloud

T-Systems is a leading vendor independent provider of digital services with its headquarters in Europe. It has a footprint in more than 20 countries, 43,700 employees, and external revenue of 7.9 billion euros in 2016. In the same year Deutsche Telekom achieved revenues of about 1.6 billion euros in cloud business, and more than two-thirds of that figure was accounted for by T-Systems[8].

T-Systems public IaaS cloud offering is the Open Telekom Cloud. This combines the cost-efficiency and scalability of public-cloud services with the strict German data-protection standards. It is hosted in the company's data centre in Biere, near the German city of Magdeburg. As this has already reached its capacity limits, a second data centre is currently under construction scheduled for completion in 2018.

The Open Telekom Cloud meets the data security and privacy requirements of corporate customers, with German legislation governing the data, the contracts, and the services themselves. Resources from the Open Telekom Cloud can be integrated into existing IT environments via standard interfaces. The offering includes computing, storage, network, security, and management services.

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[8] **T-Systems-DL_Company_Profil.pdf**

7 Methodology

KuppingerCole Leadership Compass is a tool which provides an overview of a particular IT market segment and identifies the leaders within that market segment. It is the compass which assists you in identifying the vendors and products/services in that market which you should consider for product decisions. It should be noted that it is inadequate to pick vendors based only on the information provided within this report.

Customers must always define their specific requirements and analyse in greater detail what they need. This report doesn't provide any recommendations for picking a vendor for a specific customer scenario. This can be done only based on a more thorough and comprehensive analysis of customer requirements and a more detailed mapping of these requirements to product features, i.e. a complete assessment.

7.1 Types of Leadership

We look at four types of leaders:

- Product Leaders: Product Leaders identify the leading-edge products in the IaaS Global Service Providers market. These products deliver most of the capabilities we expect from IaaS Global Service Providers. They are mature.

- Market Leaders: Market Leaders are vendors which have a large, global customer base and a strong partner network to support their customers. A lack in global presence or breadth of partners can prevent a vendor from becoming a Market Leader.

- Innovation Leaders: Innovation Leaders are those vendors which are driving innovation in the market segment. They provide several of the most innovative and upcoming features we hope to see in the market segment.

- Overall Leaders: Overall Leaders are identified based on a combined rating, looking at the strength of products, the market presence, and the innovation of vendors. Overall Leaders might have slight weaknesses in some areas, but they become Overall Leaders by being above average in all areas.

For every area, we distinguish between three levels of products:

- Leaders: This identifies the Leaders as defined above. Leaders are products which are exceptionally strong in certain areas.

- Challengers: This level identifies products which are not yet Leaders but have specific strengths which might make them Leaders. Typically, these products are also mature and might be leading-edge when looking at specific use cases and customer requirements.

- Followers: This group contains vendors whose products lag in some areas, such as having a limited feature set or only a regional presence. The best of these products might have specific strengths, making them a good or even best choice for specific use cases and customer requirements but are of limited value in other situations.

Our rating is based on a broad range of input and long experience in that market segment. Input consists of experience from KuppingerCole advisory projects, feedback from customers using the products, product documentation, and a questionnaire completed by the vendor or extensive research by our

analysts as well as other sources. Prior to the publication of the KuppingerCole Leadership Compass, vendors with products featured in Chapter 5 check the factual content related to their own products.

7.2 Product rating

KuppingerCole as an analyst company regularly does evaluations of products/services and vendors. The results are, among other types of publications and services, published in the KuppingerCole Leadership Compass Reports, KuppingerCole Executive Views, KuppingerCole Product Reports, and KuppingerCole Vendor Reports. KuppingerCole uses a standardized rating to provide a quick overview on our perception of the products or vendors. Providing a quick overview of the KuppingerCole rating of products requires an approach combining clarity, accuracy, and completeness of information at a glance.

KuppingerCole uses the following categories to rate products:

- Security
- Functionality
- Integration
- Interoperability
- Usability

Security is measured by the degree of security within the product. Information Security is a key element and requirement in the KuppingerCole IT Model (#70129 Scenario Understanding IT Service and Security Management[9]). Thus, providing a mature approach to security and having a well-defined internal security concept are key factors when evaluating products. Shortcomings such as having no or only a very coarse-grained, internal authorization concept are understood as weaknesses in security. Unresolved security vulnerabilities and hacks are also understood as weaknesses. This rating is based on the severity of such issues and the way a vendor deals with them.

Functionality is a measure of three factors. One is what the vendor promises to deliver. The second is the state of the art in industry. The third factor is what KuppingerCole expects vendors to deliver to meet customer requirements. In mature market segments, the status of the industry and KuppingerCole expectations usually are virtually the same. In emerging markets, they might differ significantly, with no single vendor meeting the expectations of KuppingerCole, thus leading to relatively low ratings for all products in that market segment. Not providing what customers can expect on average from vendors in a market segment usually leads to a degradation of the rating, unless the product provides other features or uses another approach which appears to provide customer benefits.

Integration is measured by the degree in which the vendor has integrated the individual technologies or products in their portfolio. Thus, when we use the term integration, we are referring to the extent in which products within each vendor's portfolio interoperate with each other. This detail can be uncovered by looking at what an administrator is required to do in the deployment, operation, management, and discontinuation of the product. The degree of integration is then directly related to how much overhead this process requires. For example: if each product maintains its own set of names and passwords for every person involved, it is not well integrated. If products use different databases or different administration tools with inconsistent user interfaces, they are not well integrated. On the other hand, if a single credential can allow the admin to deal with all aspects of the product suite, then a better level of integration has been achieved.

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[9] http://www.kuppingercole.com/report/mksecnario_understandingiam06102011

Interoperability can have several elements. We use the term "interoperability" to refer to the ability of a product to work with other vendors' products, standards, or technologies. In this context, it means the degree to which the vendor has integrated the individual products or technologies with other products or standards that are important outside of the product family. Extensibility is related to interoperability, and is measured by the degree to which a vendor allows its technologies and products to be extended for the purposes of its constituents. We think Extensibility is so important that it is given equal status to insure its importance is understood by both the vendor and the customer. As we move forward, simply providing good documentation is inadequate. We are moving to an era when acceptable extensibility will require programmatic access through a well-documented and secure set of APIs. Refer to the Open API Economy Document (#70352 Advisory Note: The Open API Economy[10]) for more information about the nature and state of extensibility and interoperability.

Usability refers to the degree in which the vendor enables the accessibility to its technologies and products to its constituencies. This typically addresses two aspects of usability – the end user view and the administrator view. Sometimes good documentation can facilitate adequate accessibility. However, we have strong expectations that user interfaces will be logically and intuitively designed. Moreover, we expect a high degree of consistency across user interfaces of a product or different products of a vendor. We also believe that vendors should follow common, established approaches to user interface design.

We focus on security, functionality, integration, interoperability, and usability for the following key reasons:

● Increased People Participation—Human participation in systems at any level is the highest area of cost and highest potential for breakdown for any IT endeavour.

● Lack of Security, Functionality, Integration, Interoperability, and Usability—Lack of excellence in any of these areas will result in increased human participation in deploying and maintaining IT systems.

● Increased Identity and Security Exposure to Failure—Increased People Participation and Lack of Security, Functionality, Integration, Interoperability, and Usability not only significantly increase costs, but inevitably lead to mistakes and breakdowns. This will create openings for attack and failure.

Thus, when KuppingerCole evaluates a set of technologies or products from a given vendor, the degree of product Security, Functionality, Integration, Interoperability, and Usability which the vendor has provided is of highest importance. This is because lack of excellence in any or all areas will lead to inevitable identity and security breakdowns, and will result in weak infrastructure.

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[10] http://www.kuppingercole.com/report/cb_apieconomy16122011

7.3 Vendor rating

We also rate vendors on the following characteristics

- Innovativeness
- Market position
- Financial strength
- Ecosystem

Innovativeness is measured as the capability to add technical capabilities in a direction which aligns with the KuppingerCole understanding of the market segment(s). Innovation has no value by itself, but needs to provide clear benefits to the customer. However, being innovative is an important factor for trust in vendors, because innovative vendors are more likely to remain leading-edge. Vendors must support technical standardization initiatives. Driving innovation without standardization frequently leads to lock-in scenarios. Thus, active participation in standardization initiatives adds to the positive rating of innovativeness.

Market position measures the position the vendor has in the market or the relevant market segments. This is an average rating over all markets in which a vendor is active. Therefore, being weak in one segment doesn't lead to a very low overall rating. This factor considers the vendor's presence in major markets.

Financial strength even while KuppingerCole doesn't consider size to be a value by itself, financial strength is an important factor for customers when making decisions. In general, publicly available financial information is an important factor therein. Companies which are venture-financed are in general more likely to either fold or become an acquisition target, which present risks to customers considering implementing their products.

Ecosystem is a measure of the support network vendors have in terms of resellers, system integrators, and knowledgeable consultants. It focuses mainly on the partner base of a vendor and the approach the vendor takes to act as a "good citizen" in heterogeneous IT environments.

Again, please note that in KuppingerCole Leadership Compass documents, most of these ratings apply to the specific product and market segment covered in the analysis, not to the overall rating of the vendor.

7.4 Rating scale for products and vendors

For vendors and product feature areas, we use a separate rating with five different levels, beyond the Leadership rating in the various categories. These levels are

Strong positive   Outstanding support for the subject area, e.g. product functionality, or outstanding position of the company for financial stability.

Positive   Strong support for a feature area or strong position of the company, but with some minor gaps or shortcomings. Using Security as an example, this can indicate some gaps in fine-grained access controls of administrative entitlements. For market reach, it can indicate the global reach of a partner network, but a rather small number of partners.

Neutral   Acceptable support for feature areas or acceptable position of the company, but with several requirements we set for these areas not being met. Using functionality as an example, this can indicate that some of the major feature areas we are looking for aren't met, while others are well served. For Market Position, it could indicate a regional-only presence.

Weak   Below-average capabilities in the product ratings or significant challenges in the company ratings, such as very small partner ecosystem.

Critical   Major weaknesses in various areas. This rating most commonly applies to company ratings for market position or financial strength, indicating that vendors are very small and have a very low number of customers.

7.5   Spider graphs

In addition to the ratings for our standard categories such as Product Leadership and Innovation Leadership, we add a spider chart for every vendor we rate, looking at specific capabilities for the market segment researched in the respective Leadership Compass. For the LC IaaS Global Service Providers, we look at the following seven areas:

Basic service functionality	How well the service provides the basic functionality expected from an IaaS service: compute, storage, deployment models etc.
Enterprise Hybrid	How well the service supports organizations to migrate and run all or part of existing workloads in the cloud service while integrating with on-premise IT services. This includes the availability of consulting services.
DevOps Support	How well the service supports the development of new application functionality out-of-the-box, together with rapid transition of these into operational use.
Service Continuity	How well the service ensures the continuity of the customers service. This includes the resilience of the service infrastructure plus the capabilities provided for the customer to maintain their service in the face of point failures in the service or in their applications.
Compliance	How well the service enables organizations using it to comply with laws and regulations. This looks especially for independent certification and attestation.
Data Protection	How well access to the service, the applications and the data it contains are controlled through features such as identity and access management and encryption. It also considers the support for legal requirements such as the upcoming GDPR.
Cyber Security	How well the service is protected against cyber-security risks and the help provided to its customers to protect against these risks when using the service.

The spider graphs provide comparative information by showing the areas where services are stronger or weaker. Some services show gaps in some areas, while being strong in other areas. These services might be a good fit if only the specific features are required. Other services deliver strong capabilities across all areas, thus being a better fit for strategic choice of IaaS Service.

7.6   Inclusion and exclusion of vendors

KuppingerCole tries to include all vendors within a specific market segment in their Leadership Compass documents. The scope of the document is global coverage, including vendors which are only active in regional markets such as Germany, Russia, or the US.

However, there might be vendors which don't appear in a Leadership Compass document due to various reasons:

● Limited market visibility: There might be vendors and products which are not on our radar yet, despite our continuous market research and work with advisory customers. This usually is a clear indicator of a lack in Market Leadership.

● Declined to participate: Vendors might decide to not participate in our evaluation and refuse to become part of the Leadership Compass document. KuppingerCole tends to include their products anyway if sufficient information for evaluation is available, thus providing a comprehensive overview of leaders in the market segment.

● Lack of information supply: Products of vendors which don't provide the information we have requested for the Leadership Compass document will not appear in the document unless we have access to sufficient information from other sources.

● Borderline classification: Some products might have only small overlap with the market segment we are analysing. In these cases, we might decide not to include the product in that KuppingerCole Leadership Compass.

The target is providing a comprehensive view of the products in a market segment. KuppingerCole will provide regular updates on their Leadership Compass documents.

We provide a quick overview about vendors not covered and their IaaS Service offerings in chapter Vendors *and Market Segments to watch*. In that chapter, we also look at some other interesting offerings around the IaaS Service market and in related market segments.

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For further information, please contact **clients@kuppingercole.com**