VENDOR UNIVERSE

EVALUATION OF IOT BACKEND PROVIDERS

LICENSED FOR **amazon** web services

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crisp RESEARCH
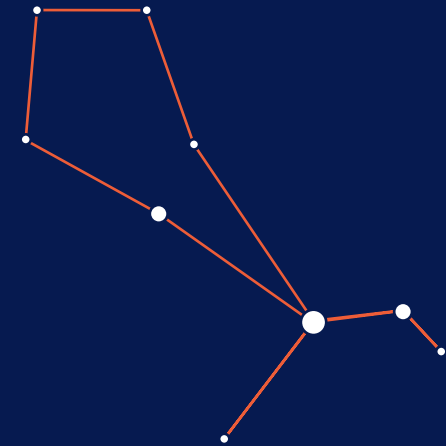
FOREWORD

Who should read this Report?

- CIOs and data center managers who are responsible for the development and operation of proprietary IoT or industry 4.0 applications and are in charge of evaluating the proper platforms for processing and analyzing the data.
- CxOs who want to investigate the relevant cloud and IoT platforms within the digital transformation of their enterprise, in order to be able to evaluate the right sourcing decisions and alliances.

Dear Reader,

Today the "Internet of Things" (IoT) holds a firm grip on all European companies. The question of how production, logistics and value chains can be further optimized, or reshaped into new business models by sensing technology and smart analytics, has become an important driver especially for the technology and industry sector ("Industry 4.0").

As a matter of fact, no less than approximately 40 % of the companies in Germany, Austria and Switzerland regard themselves as "active influencers" and or "beneficiaries" of the digital transformation.

The choice of an appropriate platform for processing and analyzing data, as well as the delivery of data in the form of mobile or cloud-based IoT services, represents a special challenge. To meet that challenge, IoT solutions need to be backed up by an extremely scalable, flexible and secure IT infrastructure.

That is why for many enterprises the selection of the so-called "IoT backend providers" is a strategic decision.

Crisp Research has carried out this research project in order to support CIOs, CTOs and CEOs with the selection and evaluation of relevant IoT backend providers.

In addition to a description of the backend providers, that are active in the German market, the "Crisp Vendor Universe" contains an analysis of their strengths and weaknesses.

I hope you enjoy reading this issue,

Yours Dr. Carlo Velten

CEO Crisp Research AG

CRISP VENDOR UNIVERSE IOT BACKEND PROVIDERS

AGENDA

Content of this Report

- Market definition and market overview concerning back-end infrastructure in the future market of the Internet of Things (IoT).
- Evaluation of IoT backend providers and their offerings, that companies should take into consideration for their IT strategy.
- Guidelines for the selection of IoT backend infrastructures that are suitable for the deployment in enterprise environments.

1 Introduction

2 Evaluation

3 Appendix

INTRODUCTION

CRISP VENDOR UNIVERSE IOT BACKEND PROVIDERS

MARKET OVERVIEW

The question of how production, logistics and value chains can be further optimized or reshaped into new business models by sensing technology and smart analytics is currently among the most important items on the agenda of decision-makers in the technology and industry segment.

The Internet of Things (IoT) is representative for the interconnection of physical objects, that besides human beings, also include sensors, household devices, cars, industrial equipment and much more. The IoT bridges the gap between the digital and the analog world as it aims for maximum interconnection and the largest possible exchange of information.

At breathtaking speeds and much faster than expected, the IoT is disrupting the agenda of CIOs und CTOs. While recently the "Big 4" i.e. Cloud, Big Data, Mobile and Social were the center of interest, now it is all about the connection of physical objects, the "smart" enhancement of existing products and the development of new IoT-driven business models.

In the era of the Internet of Things a significant part of the "Product Value Function" is defined by new software functions and data services. Additionally, this offers the opportunity to develop completely new business models and the exploration of new revenue sources.

This is especially apparent in the development phase of cloud infrastructure and platforms which are some of the central drivers behind IoT services since they offer ideal conditions and serve as crucial enablers for backend services. These in turn create value-added services for owners as well as for their customers and partners.

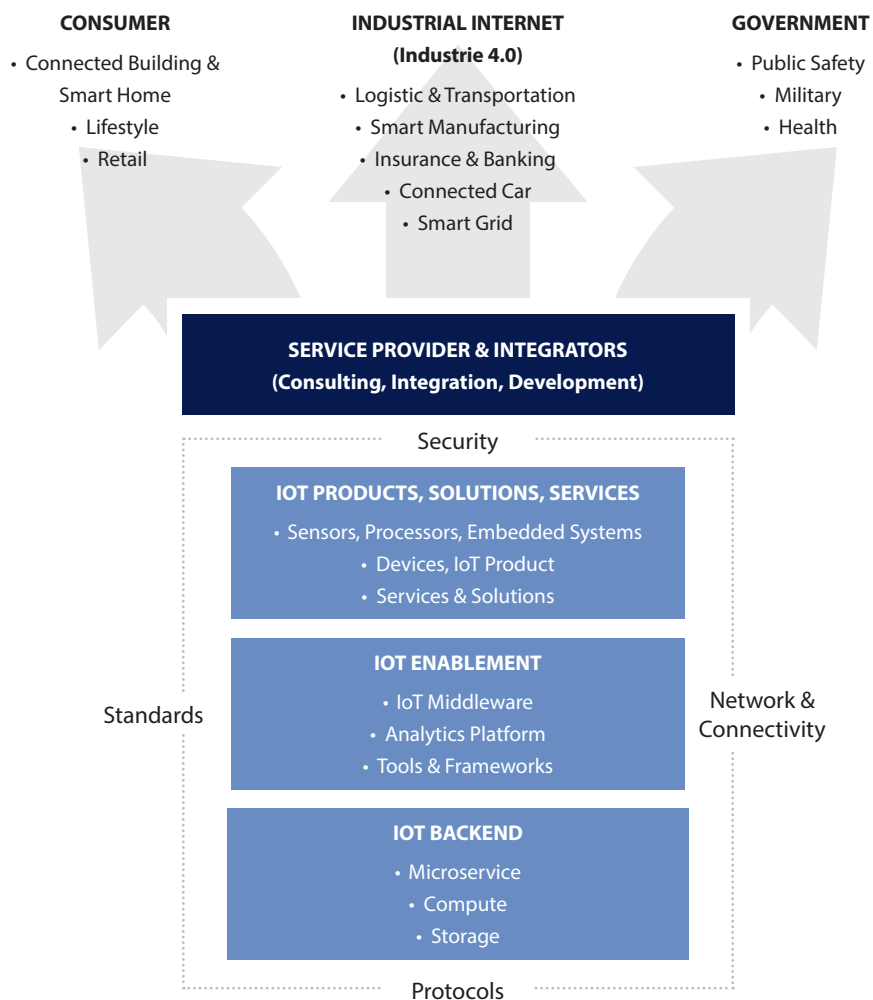## IoT Backend in a Nutshell

Features:

- Cloud platform with granular IaaS and PaaS services.
- Micro services for development, testing and operation of IoT applications.
- High scalability and multiple data center locations.
- Support for agile development and operation processes (DevOps, Continuous Delivery).
- Support for various connectivity and security strategies.
- IoT relevant standards and protocols (e.g. MQTT, OPC UA, AMQP) are supported.

Functions:

- Storage and processing of sensor & lock data.
- Embedding/communication of devices and endpoints.
- Support and provision of developer tools (GUI, SDK, Repositories etc.).
- Ready-made micro services which apart from their core functionality offer an interface to enablement services, for example:
  - Machine-Learning-as-a-Service
  - Analytics
  - Load Balancing
- Message Queue
- Monitoring, Backup & Recovery

IoT and Industry 4.0 – Market Overview

CONSUMER

- Connected Building & Smart Home
- Lifestyle
- Retail

INDUSTRIAL INTERNET (Industrie 4.0)

- Logistic & Transportation
- Smart Manufacturing
- Insurance & Banking
- Connected Car
- Smart Grid

GOVERNMENT

- Public Safety
- Military
- Health

SERVICE PROVIDER & INTEGRATORS (Consulting, Integration, Development)

Security

IOT PRODUCTS, SOLUTIONS, SERVICES

- Sensors, Processors, Embedded Systems
- Devices, IoT Product
- Services & Solutions

IOT ENABLEMENT

- IoT Middleware
- Analytics Platform
- Tools & Frameworks

IOT BACKEND

- Microservice
- Compute
- Storage

Standards

Network & Connectivity

Protocols

In order to be capable of creating process optimizations and business models by means of connected digital technologies, companies need to set up a holistic IoT stack.

This IoT stack consists of the IoT product layer that predominantly comprises tangible elements like sensors, processors, devices and (software) services.

The enablement layer provides middleware and other services that can be used to set up and interconnect the services or to evaluate the data.

The innermost layer of the IoT stack is the IoT backend. Here is where the computing and infrastructure capacities for the operation of IoT applications as well as data storage capabilities and initial microservices are provided.

The entire IoT stack is backed up by standards, protocols, security and connectivity services that are not only required to ensure the smooth operation of the system, but also have an impact on all levels.

Presently, a lot of companies are still laying the foundations of their IoT stack and evaluating the use of a suitable IoT backend that needs to be as efficient as possible, flexible and equipped with all required microservices.

Cloud environments – both infrastructure (IaaS) and platforms (PaaS) – offer ideal conditions to be used as supporting backend environments for IoT services and devices.

Storing and processing the huge amount of measuring, control and log data calls for an appropriate IT infrastructure. Since IoT applications require a high degree of scalability (number of interconnected devices initially low, but rapidly growing), in many cases cloud platforms can be used as an operational basis for the underlying infrastructure.

Also the necessity to flexibly reprogram IoT applications depending on the requirements of devices and sensors, or to quickly integrate new features, requires very agile infrastructure capabilities.

In addition to conventional IT infrastructure services, like computing power and storage capacity, IoT backend providers offer further microservices and platform services that support the development and the operation of IoT applications.

A suitable IoT backend as foundation of the IoT ecosystem of enterprises should be as efficient as possible, flexible and equipped with all required microservices.

Examples for microservices are machine learning processes in an 'as a service' model or even databases and analysis data that are well-suited for the processing of measuring data.

Definition of an IoT Backend Provider

In addition to conventional IT infrastructure services, like computing power and storage capacity, an IoT backend provider offers further microservices and platform services that support the development and the operation of IoT applications. Among these services belong e.g. machine learning solutions in an 'as a service' model as well as load balancers, databases, application services or granular analytics microservices, which can be used for processing measuring data. An IoT backend disposes of a high degree of scalability as well as high global reach on the basis of multiple data center locations.

An IoT backend provides users with the possibility of developing appropriate IoT ecosystems and applications, which can be used to interconnect end devices, sensors and applications and to process relevant data which are then prepared for further visualization.

CRISP VENDOR UNIVERSE IOT BACKEND PROVIDERS

MARKET DEFINITION & PROVIDER SELECTION

Due to the fact that the market of IoT backend providers is not yet mature, it is difficult to get a clear overview. At the same time, the present hype about the Internet of Things fuels a very dynamic development on the side of the providers. One indicator of this trend is the multitude of new functions and platforms that are being launched.

Thus, the identification, evaluation and selection of suitable IoT backend providers proves to be a difficult task for CIOs and those in charge of digitalization projects. In this context, the IoT backend providers that are portrayed and evaluated in this Crisp Vendor Universe meet the following criteria:

- Proprietary data center and IT infrastructure for the implementation of IoT applications
- Portfolio containing a large number of compute, storage, database and analytics services as well as microservices and platform services like machine learning, rules engine, message broker and other high-level services, that support the development and operation of IoT applications
- Availability of products and support in the EMEA market
- Existing customer base with IoT projects

Decision-makers currently can choose between a variety of different providers that dominate the market for IoT backends today. These are usually large public cloud providers, telecommunication companies and emerging Asian IT providers who offer and further develop a substantially complete IoT backend.

———

The main players in the market for IoT backends are public cloud providers, telecommunication companies and Asian IT providers who have adapted their infrastructure to the IoT.

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Due to their individual situations, each provider needs to fine-tune very different aspects in order to be able to turn a conventional product offering into an IoT backend.

In this context, a cloud infrastructure can provide an ideal foundation for an IoT ecosystem due to its agility, flexibility and geographical scalability. As a consequence those providers who previously had an IaaS offering in their portfolio, had just to change the focus to the setup and further develop IoT specific microservices to ensure the creation of an IoT ecosystem on their infrastructure platform.

Telecommunication companies also rely more and more on the cloud as the basis of their infrastructure. In this area, however, a lot more services must be developed from scratch to make sure that the standard catalog of an IoT backend meets their basic requirements. The Asian providers have reached out beyond their home market and setup a global portfolio that in many cases was designed exclusively for the Internet of Things.

Still, a growing number of traditional industrial companies are trying to establish themselves in the IoT market. These industrial companies however have very specific expertise, not only for the industrial Internet of Things, but also for the development of smart products. They mostly rely on the infrastructure of large IT providers. Those who have their own proprietary data centers and infrastructure capacities usually don't offer them as a service to other companies. For this reason, companies like GE Software or Bosch SI eventually don't qualify as relevant IoT backend providers.

According to the selection criteria described above, the following providers were taken into consideration for a detailed analysis and evaluation:

Amazon Web Services	NTT / NTT Data
Atos	Oracle
Bosch Software Innovations	OVH
BT	QSC
Cisco	Rackspace
Dimension Data	Salesforce
Fujitsu	SAP
GE Software	Software AG
Google	TCS
HEG	Telefónica
HP	T-Systems
Huawei	VMware
IBM	Vodafone
Microsoft	

■ Qualified and evaluated IoT backend providers

□ IoT backend providers that did not qualify after evaluation

CRISP VENDOR UNIVERSE IOT BACKEND PROVIDERS

EVALUATION CRITERIA

The assessment criteria consist of the two main categories "Product Value Creation" and "Vendor Performance", each having five subcategories. The subcategories comprise the defining characteristics that are weighted per percentage.

The "Product Value Creation" focuses on the market maturity of the IoT backend. This includes:

- Product range and range of functions as well as the portfolio completeness.
- Capability of the portfolio in terms of implementation and user experience as well as handling of the solution from the customer's perspective.
- Ability to be integrated with backend systems and other IT and cloud services (APIs see table), applications and solutions from competitors.
- Value for money ratio and financial competitiveness.
- Innovation potential of the solution to create a competitive edge for the customer.

Product Value Creation

Features	Feature Set
	Portfolio Completeness
	Product Capabilities
Product Experience	Performance
	User Experience
	Service & Process Design
Integration	Integration Capabilities & Services
	APIs
	Openness
	Blueprints
	Documentation
Economics	Business Model
	Pricing Model
	Pricing
Disruption Potential	New Business Creation
	Additional Customer Value Add
	New Insights
	New Data

Vendor Performance

Strategy

Market Understanding
Focus
Thought Leadership

Footprint

Sales & Support Organization
Delivery Infrastructure
Market Awareness & Visibility
References
Regional Go-to-Market Strategy

Ecosystem

Number & Quality of Partners
Partner Enablement
Developer Support
Community

Customer Experience

Service & Support
Customer Feedback & Satisfaction
Digital Customer Experience
Onboarding

Agility

Market Responsiveness
Innovation Capabilities
Innovation Budget
Release Management
Organizational Set up

The „Vendor Performance" encompasses:

- Strategy and market insights.

- Competitiveness and market presence with respect to customers, reach, visibility and go-to-market.

- Size and vigor of the partner ecosystem.

- Handling of customers with regard to consulting and support services.

- Responsiveness and innovativeness of the provider, evaluated according to organizational structure, release frequency and market responsiveness.

EVALUATION

CRISP VENDOR UNIVERSE IOT BACKEND PROVIDERS

POSITIONING OF THE IOT BACKEND PROVIDERS

For the final evaluation of the "Crisp Vendor Universe IoT backend providers" Crisp Research has taken a total of 16 providers into account, who were evaluated according to the criteria described in the previous chapter.

Currently **Amazon Web Services (AWS)** sticks out as the most attractive IoT backend provider, profiting vastly from its strong public cloud portfolio. Especially its large spectrum of granular infrastructure and microservices, that in part had been especially developed for the IoT, the market and customer driven focus and high speed of innovation make AWS the leading provider with respect to product attractiveness.

With the launch of the Azure IoT-Suite in September 2015, **Microsoft** has built the foundation for its activities in the Internet of Things, thus positioning Azure as an IoT backend. A constantly growing portfolio of specifically developed microservices earns Microsoft a place among the leading providers. So far Microsoft

Crisp Vendor Universe – IoT Backend Providers
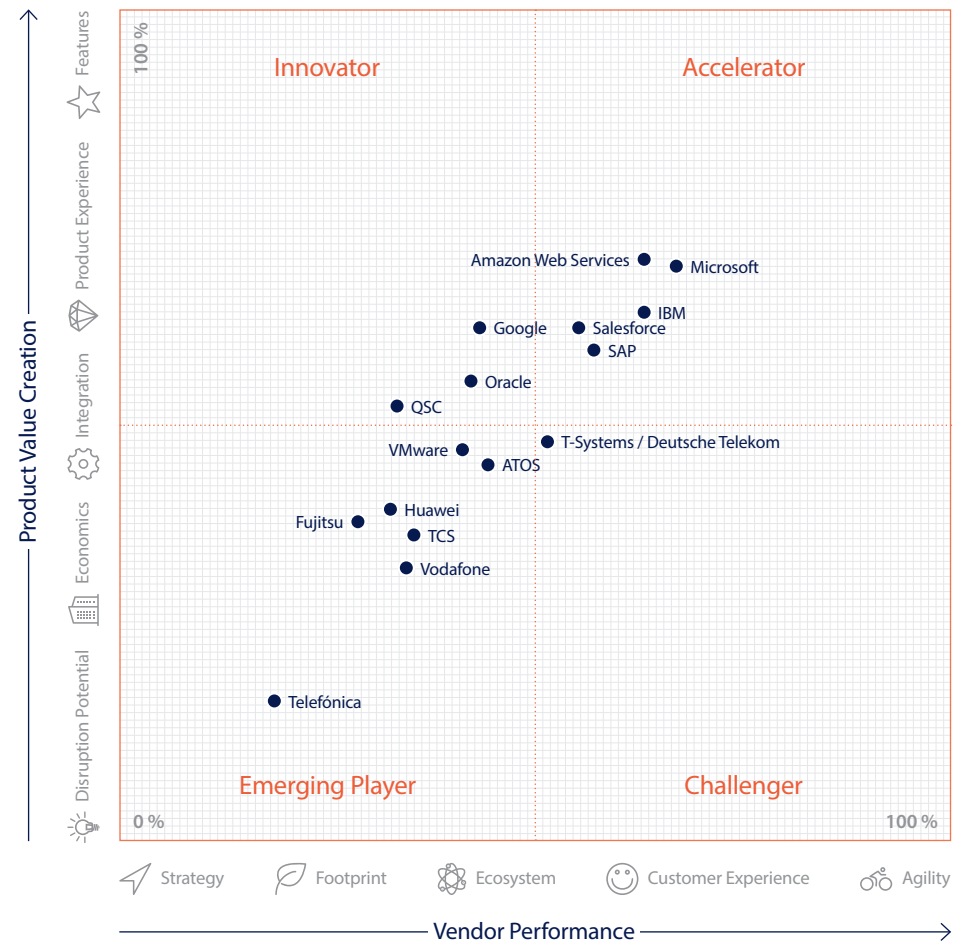
Source: Crisp Research AG, 2016

admittedly has not presented many entirely new IoT services for Azure. Nevertheless, Microsoft is currently the leader when it comes to vendor performance. One reason for this is that Microsoft has a more focused IoT marketing strategy than its direct competitors. Furthermore, the Azure IoT Suite is expected to have a high development potential.

In October 2014 **IBM** launched Bluemix and its IoT Foundation Services for the IoT market. IBM, who is expanding its portfolio with Watson and other cognitive analytics services, is going to play an important role in the Internet of Things.

Salesforce aligns its IoT portfolio as much as possible to companies that maintain intense (end) customer contact. However, because of the predominantly proprietary nature of the approach, it is advisable to integrate Salesforce's IoT backend into an existing Salesforce architecture.

Since May 2015 **SAP** is expanding its HANA cloud platform with IoT related services with the goal to provide holistic support for the entire IoT supply chain, from sensors through data analysis and application development to integration. In this way it is possible to setup IoT backends for HANA that are especially well-suited for the integration with other SAP solutions.

Oracle is well known to be reluctant when it comes to new technologies and trends. With its PaaS, the cloud service portfolio and a strong presence within the enterprise environment through typical Oracle products like databases, middleware and application servers, Oracle has prepared the ground to gain its share also in the IoT market.

Google has converted its existing cloud services into an IoT backend. Yet until today it has not introduced any specific IoT services. With BigQuery or Pub/Sub there are functions available that can be used as IoT modules. However, it shouldbe noted that

Google is not perceived to be an important player within the enterprise environment and with respect to its role as an IoT backend provider.

Amazon AWS and Microsoft are the accelerators in the IoT backend providers market. With a high release frequency and a stringent marketing strategy these providers currently lead the market.

The enterprise group consisting of **T-Systems** and **Deutsche Telekom** offers a proprietary IoT backend platform that can be used by companies of different sizes and from various industries, to set up their own IoT ecosystems. Real life experience though

tells a different story as especially for individual IoT projects the IoT strategy is closely coordinated between customer and provider. The close ties with business customers make T-Systems and Deutsche Telekom important business partners for enterprise specific IoT scenarios.

When **Vodafone** became a shareholder of Device Insight in December 2012, it marked their entry into the M2M market, where they use a white label approach to offer services for machine communication as well as for the interconnection of sensors and end devices. There is no meaningful IoT backend portfolio and one can only speculate if and how Vodafone will be able to shake off its image as a pure telecommunication provider.

VMware is a latecomer in the IoT market. Its offering, called vCloud Air, is attractive to potential IoT customers only on the basis of partnerships with Pivotal and Kinvey. Furthermore, it is

unclear how vCloud Air will evolve in the future. An investment halt and a downsize in jobs indicates a negative trend.

Fujitsu appeared on the market for IoT backends at a rather late point in time. Based on its cloud infrastructure the company gradually extends the IoT backend portfolio that currently maps only a few productive scenarios.

Atos presents itself as a strategic partner especially for individual IoT projects of global industry and automotive companies. Its portfolio that encompasses standard services, individual consulting and integration is mainly designed for large enterprises.

TCS has developed a special PaaS for IoT, called Connected Universe Platform. The global delivery and service capacity is an important asset. However, visibility and diversity of services leave room for enhancement.

Q-Loud, a subsidiary of **QSC**, has successfully launched single modules for an IoT backend that follow a local strategy. The product is suited mainly for IoT ecosystems that are based on conventional sensor technology.

The market for IoT is still very young. Presently no provider portfolio is able to completely convince in all evaluation categories.

Due to its diversified portfolio and thanks to its market strategy, that meanwhile has grown to a global scale, **Huawei** is capable of mapping nearly all workloads and IT projects. At the same time, however the lack of a focus is also a negative aspect, as eventually the full potential of the provider cannot be tuned to satisfy specific needs of the customers.

Currently **Telefónica** is not able to offer a viable, and most of all competitive, IoT backend portfolio. It has put their focus exclusively on the connection of sensors and end devices.

The evaluation according to the criteria described in the previous chapter clearly shows that a critical look during the assessment of IoT backends is indispensable.

With many providers it quickly becomes obvious that they cannot live up to their glittery "IoT promise". For instance, some of the providers, that at first glance could have been qualified as end to end service providers, were no longer taken into consideration for the evaluation or were put on a lower ranking due to the "in"-completeness of their portfolios.

Furthermore, it has become clear that there are still no dominant players in the market for IoT backends. As the market is still in an early phase the providers are not yet able to deliver convincing results with respect to all criteria.

At the same time, it is true that those providers whose portfolios contain IoT services for an IoT backend based on their existing cloud infrastructure offerings, are well prepared, thus only a few providers are lagging far behind.

Nevertheless, it has to be said that in respect to the product value creation the providers make varied progress regarding range of functions, portfolio design as well as product experience. Also, there are sometimes significant differences in the degree of freedom the customers have on the individual platforms and thus the disruptive potential the customer can achieve. The same applies to the vendor performance in terms of strategic alignment, market insight as well as agility and innovative potential.

The categories in which the providers show nearly identical performance are typically the footprint (most of them are renowned global providers or local market leaders) or integration capabilities (APIs are mostly available, yet there is a lack of profound integration capability, blueprints and documentation).

With many providers it becomes obvious, that their promised "IoT package" does not always contain a comprehensive product.

Evaluation of Providers

	Weighting	AWS	Atos	Fujitsu	Google	Huawei	IBM	Microsoft	Oracle	QSC	Salesforce	SAP	TCS	Telefónica	T-Systems	VMware	Vodafone	Average
Product Value Creation		**71 %**	**46 %**	**39 %**	**62 %**	**40 %**	**64 %**	**70 %**	**56 %**	**53 %**	**62 %**	**60 %**	**37 %**	**17 %**	**48 %**	**48 %**	**33 %**	
Features	30 %	75 %	55 %	45 %	50 %	40 %	60 %	75 %	60 %	55 %	70 %	60 %	40 %	20 %	50 %	50 %	30 %	**52 %**
Product Experience	20 %	70 %	45 %	40 %	75 %	40 %	65 %	75 %	50 %	65 %	60 %	55 %	35 %	20 %	40 %	40 %	30 %	**50 %**
Integration	20 %	60 %	45 %	45 %	60 %	40 %	70 %	55 %	50 %	50 %	50 %	55 %	40 %	10 %	65 %	45 %	40 %	**49 %**
Economics	10 %	60 %	30 %	20 %	50 %	30 %	50 %	50 %	35 %	50 %	60 %	55 %	30 %	20 %	40 %	55 %	30 %	**42 %**
Disruption Potential	20 %	80 %	40 %	30 %	75 %	45 %	70 %	80 %	70 %	40 %	65 %	70 %	35 %	15 %	40 %	50 %	35 %	**53 %**
Vendor Performance		**63 %**	**44 %**	**28 %**	**43 %**	**32 %**	**63 %**	**67 %**	**42 %**	**33 %**	**55 %**	**57 %**	**35 %**	**18 %**	**51 %**	**41 %**	**34 %**	
Strategy	20 %	65 %	40 %	20 %	50 %	30 %	50 %	70 %	30 %	55 %	60 %	50 %	35 %	10 %	60 %	35 %	40 %	**44 %**
Footprint	20 %	70 %	50 %	25 %	40 %	30 %	75 %	75 %	65 %	20 %	50 %	70 %	30 %	30 %	55 %	50 %	30 %	**48 %**
Ecosystem	20 %	70 %	20 %	45 %	35 %	30 %	70 %	75 %	40 %	20 %	60 %	60 %	30 %	20 %	50 %	50 %	40 %	**45 %**
Customer Experience	20 %	40 %	70 %	30 %	40 %	30 %	50 %	50 %	45 %	40 %	45 %	50 %	40 %	10 %	50 %	30 %	40 %	**41 %**
Agility	20 %	70 %	40 %	20 %	50 %	40 %	70 %	65 %	30 %	30 %	60 %	55 %	40 %	20 %	40 %	40 %	20 %	**43 %**

COMPARISON OF IOT BACKEND PROVIDERS

AMAZON WEB SERVICES
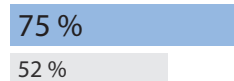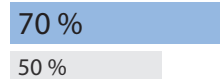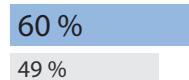
Accelerator

Product Value Creation

☆ Features

75 %

52 %

◇ Product Experience

70 %

50 %

⚙ Integration

60 %

49 %

🏢 Economics

60 %

42 %

💡 Disruption Potential

80 %

53 %

Vendor Performance

➤ Strategy

65 %

44 %

🍃 Footprint

70 %

48 %

⚛ Ecosystem

70 %

45 %

☺ Customer Experience

40 %

41 %

🚲 Agility

70 %

43 %

■ IoT Backend Provider Value   ▢ Average Value
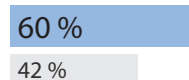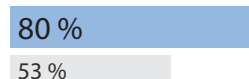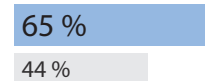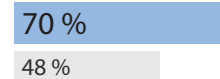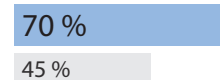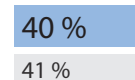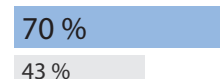
IoT Backend Offering

For companies of any size, Amazon Web Services (AWS) operates a public cloud infrastructure platform currently comprised of 12 regions around the world. One of these regions is in Germany with two data centers in Frankfurt. In addition to infrastructure services like Amazon EC2 (computing power) and Amazon S3 (storage), AWS provides a broad spectrum of platform services like Amazon Kinesis (Streaming Analytics) or Amazon SQS (Message Queue) that can be used to develop cloud and IoT applications. As of December 2015 AWS IoT is available. This suite consists of special IoT platform services like IoT Rules Engine, IoT Message Broker or IoT Device Gateway.

Strengths

- Broad cloud portfolio containing various platform services for the development of IoT applications.
- Good understanding of the market that is oriented towards the needs of the user's business.
- High release frequency and innovation leadership in the cloud area also contribute to the advance of IoT.
- Global delivery infrastructure that is constantly being expanded.

Analyst View

Amazon Web Services (AWS) has a diverse cloud services portfolio that can be used to develop a wide range of IoT applications. Thanks to a customer driven market understanding and a high speed of innovation deriving from the public cloud market, AWS is also top-notch in the market for IoT backend providers. Currently AWS is regarded as the company with the most attractive IoT backend portfolio.

Weaknesses

- Successful usage requires extensive knowledge/expertise of customers or AWS partners.
- Considerable increase of the risk of service lock ins due to the usage of AWS IoT platform services.
- Costs depend on the total of all used services depending on their rate of use. This makes it difficult to gain and transparent understanding of the total costs.
- Infrastructure performance is only average when compared to competitors.

Products: **Amazon Web Services, AWS IoT**

APPENDIX

CRISP VENDOR UNIVERSE IOT BACKEND PROVIDERS

PROCEDURE & METHODOLOGY

From June until November 2015 Crisp Research has evaluated the IoT backend platforms and infrastructure of the relevant providers in EMEA using a standardized method. The assessment has been carried out by experienced senior analysts by means of assessment criteria that were transparent for the providers. The assessment resulted in:

- Assessment and positioning of vendors in "Crisp Vendor Universe" quadrants
- Detailed analysis of the scoring model within the market comparison
- Assessment of strengths and weaknesses of the company, its portfolio and the impact on the IoT
- Analyst statements concerning IoT strategy and IoT offering

The decision-making basis consists of user interviews, vendor data, as well as expert interviews and results from studies carried out by Crisp Research. The project included four phases:

Research

A comprehensive secondary research was carried out that in addition to the review of the offerings of the individual providers also included the evaluation of the specifications from the Internet, product specifications and marketing documents.

Provider Survey

Another element of assessment was a survey of the providers by means of a standardized questionnaire. The questionnaire contained 23 questions that covered strategy, technology product offering, service offering and support services.

Interviews with Users

One important contribution were interviews with technology experts and customers of the providers. On the basis of consulting tasks that were carried out on behalf of users, Crisp Research in addition has a profound wealth of experience in order to assess the actual capability of the provider in question.

Assessment

The three previous steps formed the basis for the final assessment and positioning of the providers. The information and insights gathered in the individual steps were consolidated and evaluated on the basis of the predefined criteria.

Assessment Criteria

The assessment criteria include three definition levels that consist of two main categories "Product Value Creation" and "Vendor Performance", each having five subcategories.

The subcategories (second definition level) comprise the defining characteristics that are weighted per percentage. The "Product Value Creation" focuses on the market maturity of the range of services thus predominantly evaluating the product respectively to the service offerings of the supplier. These include the user experience and the usability of the solutions as well as the price point and the potential added value for the user.

The "Vendor Performance" focuses on the strategical and tactical requirements that apply to the company with regard to the relevant market cultivation.

Among those requirements are for instance a thought leadership in the relevant market, a good network of partners as well as responsiveness and a proper speed of innovation in the IoT environment. The first two definition levels have been standardized independently of the analyzed submarket and represent the assessment basis in every Vendor Universe. These always include the following criteria:

Product Value Creation

- Features
- Product Experience
- Integration
- Economics
- Disruption Potential

Vendor Performance

- Strategy
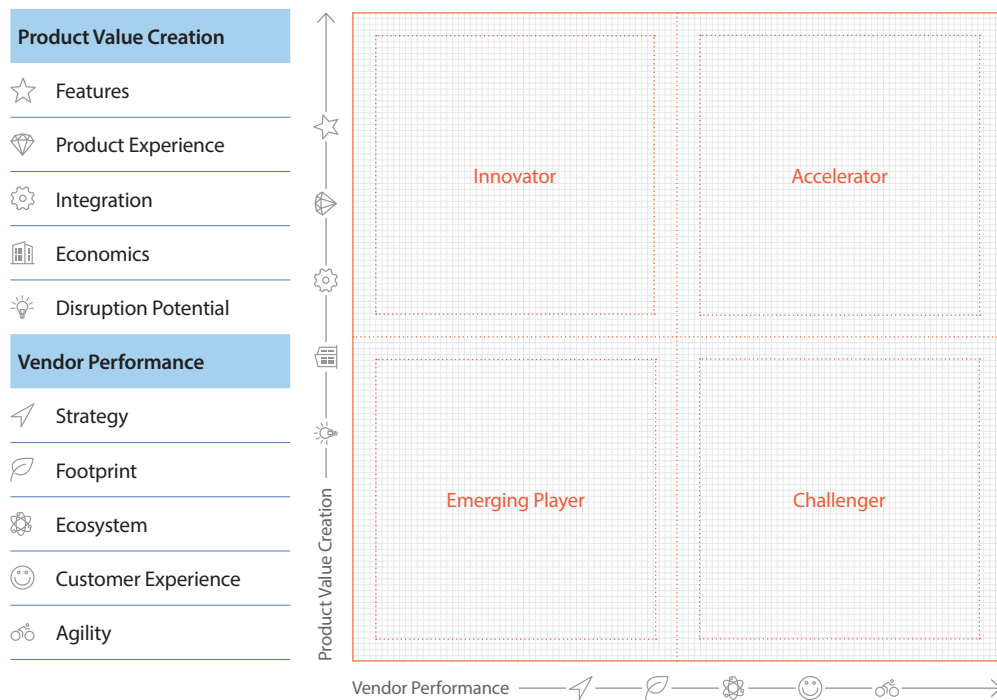- Footprint
- Ecosystem
- Customer Experience
- Agility

On the third definition level the respective criteria receive an even more concrete definition in relation to the market that is assessed.

Specific value creation criteria for IoT backends are for example the supported standards, protocols and APIs, or the ability of companies to set up proprietary IoT ecosystems.

Specific vendor performance criteria are eventually the dedicated IoT backend strategy, the timing of the market entry, innovation budgets for the IoT as well as IoT partnerships.

Strategic Classification in the "Crisp Vendor Universe"

For each of the evaluated providers the Crisp Vendor Universe for IoT backend providers takes a scoring according to 10 subcriteria into consideration. These criteria are weighted depending on the relevant main category and result in the assessment of the technical maturity of the IoT backend platform or infrastructure ("Product Value Creation") as well as at the market strength of the provider ("Vendor Performance"). The Crisp Research "IoT backend providers" quadrant comprises of four fields the providers are assigned to:

Product Value Creation

☆ Features

◇ Product Experience

⚙ Integration

🏛 Economics

💡 Disruption Potential

Vendor Performance

✈ Strategy

🍃 Footprint

⚛ Ecosystem

☺ Customer Experience

🚲 Agility

	Innovator	Accelerator
	Emerging Player	Challenger

Product Value Creation

Vendor Performance ✈ — 🍃 — ⚛ — ☺ — 🚲 →

Accelerator

Providers that are classified as "Accelerators" have at their disposal technically advanced IoT backend platforms or infrastructure, as well as a strong market position and competitive edge, which is why they meet all prerequisites for a successful market cultivation. They have to be regarded as strategic trailblazers and opinion leaders in the IoT backend market.

Innovator

The IoT backend of "Innovators" provide evidence of their high technical maturity, however their standing in the market and competitive position are not as strong as the ones of the providers that are classified as "Accelerators". The reason for this is very often the size of the provider or its weak footprint in the respective market.

Challenger

"Challengers" are in a high competitive market position, but have enormous room for improvement when it comes to their technical resources. That is why they are lagging behind those vendors that are positioned as "Accelerators".

Emerging Player

Companies positioned as "Emerging Players" are currently still lacking sophisticated technology. At the same time shortfalls and weaknesses regarding their market and competitive position are obvious.

CRISP VENDOR UNIVERSE IOT BACKEND PROVIDERS

RELATED RESEARCH

- Analyst View „IoT-Backend: Die Evolution der Public Cloud Anbieter im Internet of Things (IoT)", März 2015

  http://www.crisp-research.com/iot-backend-die-evolution-der-public-cloud-anbieter-im-internet-iot/

- Analyst View „Microservice: Cloud- und IoT-Applikationen zwingen den CIO zu neuartigen Architekturkonzepten", April 2015

  http://www.crisp-research.com/microservice-cloud-und-iot-applikationen-zwingen-den-cio-zu-neuartigen-architekturkonzepten/

- Analyst View „API-Economy als Wettbewerbsfaktor: iPaaS im Zeitalter des Internet of Things (IoT) und Multi-Cloud-Umgebungen", April 2015

  http://www.crisp-research.com/api-economy-als-wettbewerbsfaktor-ipaas-im-zeitalter-des-internet-iot-und-multi-cloud-umgebungen/

- Report „Vermessung der IoT-Welt: Die IoT-Wertschöpfungs- und Anbieterlandschaft", Juni 2015

  http://www.crisp-research.com/report/vermessung-der-iot-welt-die-iot-wertschopfungs-und-anbieterlandschaft/

- Analyst View „Analyst Report: Die Vermessung der IoT-Welt",Juni 2015

  http://www.crisp-research.com/analyst-report-die-vermessung-der-iot-welt/

CRISP VENDOR UNIVERSE IOT BACKEND PROVIDERS

ABOUT CRISP RESEARCH

Die Crisp Research AG is an independent IT research and consulting company. Backed by a team of experienced analysts, consultants and software developers, Crisp Research analyzes current and future technology and market trends. Crisp Research supports companies with the digital transformation of their IT and business processes.

The assessments and comments by Crisp Research are published and discussed by numerous financial magazines, specialized journals for the IT business and social media. As contributing editors for leading IT publications (Computerwoche, CIO, Silicon et al.), BITKOM enthusiasts and sought-after keynote speakers, our analysts not only actively contribute to the debates about new technologies, standards and market trends, they are also among the relevant influencers of the industry.

Crisp Research was founded in 2013 by Steve Janata and Dr. Carlo Velten. The company focuses its research and consulting services on "Emerging Technologies" such as Cloud, Analytics or Digital Marketing and their strategic and operational implications for CIOs and decision-makers in companies.

CRISP VENDOR UNIVERSE IOT-BACKEND-PROVIDER

INTERNET OF THINGS – RESEARCH TEAM

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Rene Buest is Senior Analyst and Cloud Practice Lead at Crisp Research, covering cloud computing, IT infrastructure, IT platforms, Internet of Things and IT strategy. Prior to that he was Principal Analyst at New Age Disruption and member of the worldwide Gigaom Research Analyst Network.

Rene Buest is top cloud computing analyst in Germany and one of the worldwide top analysts in this area. In addition, he is one of the world's top cloud computing influencers and belongs to the top 100 cloud computing experts on Twitter and Google+.

Since the mid-90s he is focused on the strategic use of information technology in businesses and the IT impact on our society as well as disruptive technologies.

Rene Buest is the author of numerous professional cloud computing and technology articles. He regularly writes for well-known IT publications like Computerwoche, CIO Magazin, LANline as well as Silicon.de and is cited in German and international media – including New York Times, Forbes Magazin, Handelsblatt, Frankfurter Allgemeine Zeitung, Wirtschaftswoche, Computerwoche, CIO, Manager Magazin and Harvard Business Manager.

Furthermore, Rene Buest is speaker and participant of experts rounds. He is founder of CloudUser. de and writes about cloud computing, IT infrastructure, technologies, management and strategies. He holds a diploma in computer engineering from the Hochschule Bremen (Dipl.-Informatiker (FH)) as well as a M.Sc. in IT-Management and Information Systems from the FHDW Paderborn.

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Maximilian Hille is analyst and mobile practice lead at Crisp Research AG, an IT research and consulting company.

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Before that Maximilian Hille worked as a research manager in "Cloud Computing & Innovation Practice" of Experton Group AG.

He is also a product manager of the research Web service Crisp Analytics. His main subjects are mobile user experience, mobile application performance, mobile development platforms, enterprise mobility and mobile collaboration. Maximilian Hille is a member of the jury at the Global Mobile Awards 2016.

Julia Michel

Julia Michel is Junior analyst at Crisp Research AG, an IT research and consulting company.

Her tasks include research work as well as the handling of customer projects in connection with the Internet of things, applications within industry 4.0 and networking.

During her bachelor degree course Julia Michel had already worked for several IT companies, one of them being Stemmer GmbH in Olching, a BT subsidiary, where she was responsible for projects that dealt with process modeling and optimization.

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