

Ovum Decision Matrix: Selecting an Intelligent Virtual Assistant Solution, 2020–21

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Summary

Catalyst

In the past half-decade, the intelligent virtual assistant (IVA) (Ovum uses the term interchangeably with digital assistant, automated virtual assistant, virtual digital assistant, intelligent chatbot, and intelligent agent) market has become transformed by the impact of artificial intelligence (AI). There is no leading player in the market that doesn't have some AI-related capability driving its solution. What is also evident is that the major high-tech players with AI interests see the IVA market as an opportunity to apply their technology, while incumbents with decades of experience in the field have embraced AI and used their domain expertise to stay ahead in the market. This Ovum Decision Matrix (ODM) focuses on the leading IVA solutions targeting the enterprise market.

Ovum view

The changing face of virtual assistants and the impact of AI

A key driver for adopting IVAs is the loss that many businesses are facing through poor customer service. The drive toward cost savings using contact center services with human agents that read prepared scripts and have limited freedom to act beyond this might be one reason for this. Another is first-generation virtual assistants that have serious limitations. Whatever the cause, end users (we use this term collectively for consumers, businesses, or employees initializing a conversation) vote with their feet toward the better experiences.

The legacy virtual assistants on the market are not intelligent, have single intents, and cannot conduct a natural conversation that requires retaining context and navigating intents. Unless specified, a conversation can be either text- or voice-based. The best IVAs today have a more natural, human-like conversational ability, can handle multiple intents, and can achieve customer satisfaction scores on a par with the best human agents. They can perform at this level because AI has made it possible to track conversational flow and to detect and manage multiple intents, so that the end user has as near as possible a natural human-like interaction.

There are, however, limits to this capability. IVAs can still struggle when confronted with very long and verbose sentences and unclear vocal utterances (but so can humans). Another feature of this market is that the state-of-the-art is improving year by year, so we expect IVAs to overcome some of their current limitations. This is on the back of a large research effort taking place in conversational AI in both academia and the commercial sector.

This begs the question of whether end users understand they are talking with a robot and how this changes their behavior. Organizations that deploy IVAs do make clear the person is interacting with a virtual assistant, but if a human-like image of an IVA is depicted, some end users can forget. This has both advantages and disadvantages. Speaking with the customers of the vendors assessed here, some of their end users have been found to be curt and less polite when interacting with IVAs and because the machine needs as much information as possible to ascertain the correct intent, this lack of verbosity can be a hindrance. On the other hand, too much verbosity can stress the natural language understanding (NLU) part of natural language processing (NLP) to the limit.

Despite the challenges, all the customers of this technology we spoke to said IVAs make a massive difference to customer engagements, and the organizations that have introduced this technology as a first in their industry sector end up being copied by their peers, which explains the speed with which IVA adoption is spreading.

The effectiveness of IVAs

Benchmarking the performance of IVAs by comparing the call metrics of different vendors and their customers is not possible. This is due to customers having different requirements in the given domain being assessed. For example, the customer will build the conversation flow models and decide at which point the IVA is to hand over to a human agent (called deflection). This point will vary case by case and the information knowledge base that the IVA uses to answer questions will vary from case to case. An IVA vendor customer example with 85% of all calls handled automatically is not therefore necessarily performing better than another of its customers with only 25% of calls handled automatically. Instead it's a question of what the customer wanted, so, for example, a bank would want certain call operations only handled by a human agent. But clearly, the more calls handled automatically, the greater the cost savings for the customer.

IVAs handle multiple calls simultaneously and can easily scale up or down depending on call density so are perfect in running campaigns and other irregular, burst-type activities. They are also perfect for fielding the bulk of calls that are not typically demanding, such as those to IT support for resetting passwords, allowing human agents to handle more demanding and satisfying work.

IVAs are also useful where a 24x7 call center operation is not yet in place but is desired, as was the case with one vendor customer we spoke to. Rather than go down the costly route of extending the hours of their existing human call center, they brought in IVAs. If the IVA hits a difficulty, the caller is requested to call back to the manned call center during opening hours. This resulted in 5,000 net new callers per month with a 72% automated call resolution rating (90% when including the request to call back).

We spoke to a major global IT services company that uses many different IVAs in its customer engagements. Its verdict on IVA technology is that on average it can fully and automatically handle some 20% to 25% of calls within the desired process without deflection to a human agent. There are examples where this could be as high as 90%, depending on the required task. For enterprises handling millions of contact center calls, even 75% to 80% deflection therefore amounts to a significant saving. The IT services company also said it preferred to work with a smaller and nimbler IVA vendor. No doubt the smaller IVA vendors are eager to please and perhaps a lesson for the larger vendors is that they need to think as a small player with their customer engagement approach.

A good balance between machines and humans in call center task allocations is to have IVAs automatically handle high-volume, low-value calls, and deflect to human agents for low-volume, high-value calls.

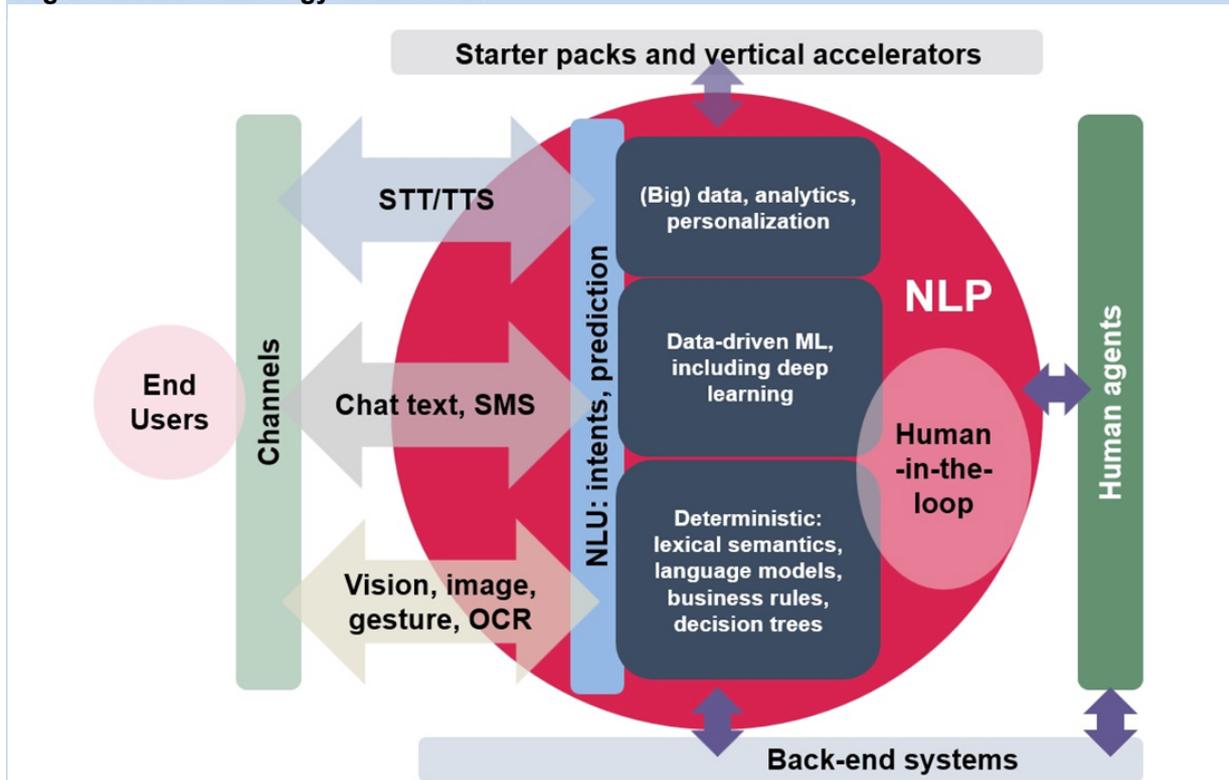
Technology view

To understand how the market splits between players, it is helpful to look at Figure 1, which provides a high-level IVA technology architecture diagram. End users connect through various channels and are processed by NLP technology that includes the key component NLU. This is driven by various approaches that typically combines data-driven ML models with deterministic systems. The IVA will deflect to human agents as designed in the conversation journey or if it faces problems.

Some vendors add a core human element, represented as human-in-the-loop in Figure 1, as distinct from the human agents who are business application-oriented. The human-in-the-loop can perform clarification functions, almost as a cog in the machine, when the robot part of the IVA is facing difficulties, such as when the confidence level is below a threshold. The human helps and then passes control back to the robot or to a qualified human agent as necessary. Some vendors have created large scale human-in-the-loop operations to support their IVAs.

Each player in the market is approaching the IVA challenge in a different way, placing different emphasis on the various components in Figure 1, and bringing in to play varying degrees of AI in terms of where the AI is applied (there is potential throughout the whole stack).

Figure 1: IVA technology architecture



Source: Ovum

Enterprise focus

This report focuses on enterprise solutions as opposed to the consumer market. Large enterprises with call centers servicing millions of end users around the globe, covering many languages, will need to have IVAs that integrate smoothly with back-end systems, and will want IVA vendors that offer an enterprise-grade level of customer support. Enterprises also need to be able scale IVAs in and out effectively. They need to have high levels of security and be compliant with data privacy regulations (and all the variations in the global jurisdictions they operate in). Not least, they need to work with IVA vendors that understand their business domain and can help them create workable solutions. While there are a lot of open source tools in the market and many new AI-focused startups with segments of the IVA technology stack, Ovum's selection of vendors here all offer enterprise-focused IVA products.

Key findings

- The IVA allows end users to interact in a natural way rather than conform to the limitations of a legacy (non-intelligent) virtual assistant.
- For voice interactions, the leading IVAs are vastly better in capturing speech first time than legacy solutions which frequently request utterances to be repeated.
- In the early days of chatbots, when something went wrong, they had no graceful exit leaving end users in a continuous loop. Today's IVA technology has learned from this and has various strategies to avoid these scenarios.
- IVA system training is essential because each customer use case is unique, having its own business jargon, as well as having to contend with the natural language vagaries of normal conversation that may be specific to the local region in which it is active.
- Sentiment analysis is mostly of interest to detect negative end-user conversation, so while the art is still in a fledgling state, some vendors are better in bringing in additional context to detect emotion or sentiment.
- Vendors in the customer experience space have built into their IVA features reflecting the best human agent commercial acumen, such as for example, cross-sell and upsell, which makes these IVAs high performers from the start.
- Customers of IVA technology find end-user satisfaction increases and their human agents can focus on higher priority or more demanding queries. In addition, cost savings can be made.
- In hearing the vendors' customer use cases in researching this report it was typical to hear of million-dollar range cost savings by introducing IVAs (calculated as cost per call), bringing ROI within the first year.
- While established in markets including customer care, technical support, and banking, some vendors are also targeting a wider spectrum of use cases, such as vision applications to extend IVAs to product or parts recognition with a host of applications from marketing to maintenance.
- The market is roughly divided into pure-play IVA vendors (with many years' experience in the virtual assistant industry) and relative newcomers, high-tech giants leveraging their AI expertise (some through acquisitions) into the IVA domain. Rationalization has been going on for some time and will continue.

Market and solution analysis

Ovum Decision Matrix: Intelligent Virtual Assistant, 2020–21

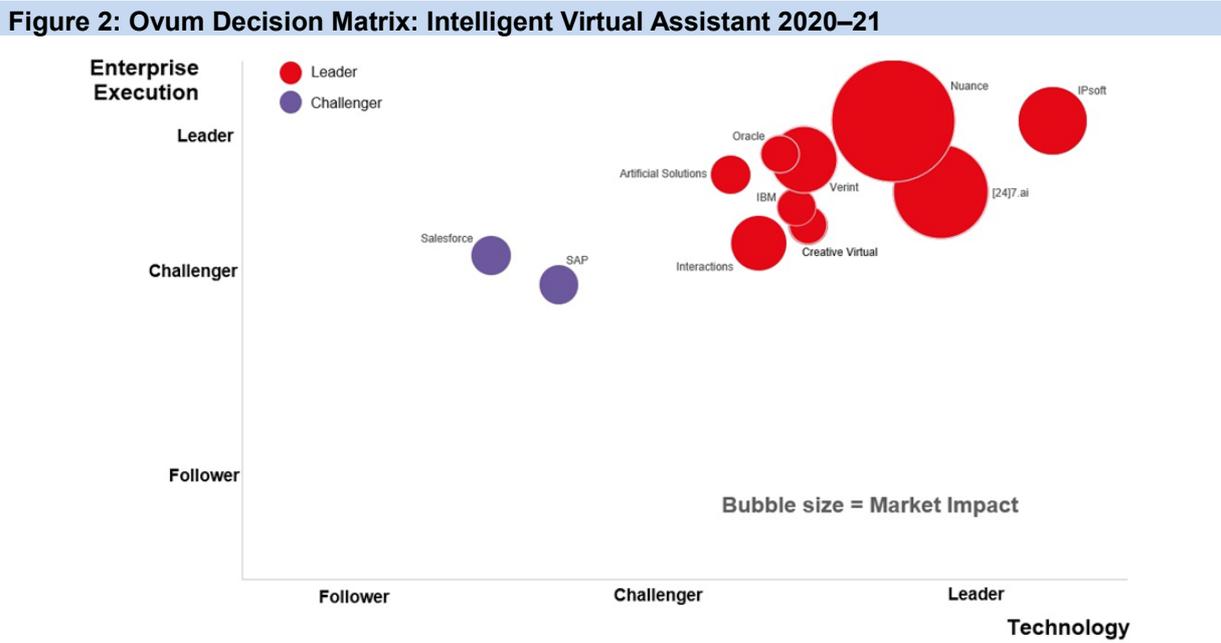
The market splits into two types of player: dedicated IVA pure-plays and large technology players with investment in AI entering the IVA space. In this report, the former group includes Artificial Solutions, Creative Virtual, IPsoft, Interactions, and Verint. The latter group includes IBM, Oracle, Salesforce, and SAP. The latter group is also a relative newcomer to IVAs whereas many in the former group have a long history in the virtual assistant space with deterministic NLP models and have combined these with AI as the field has improved and made an impact in the space. The former group can also boast possession of many years of data in the field, and a lot of data is a must-have for training AI applications.

Pure-play vendor [24]7.ai, which launched in 2000, formed an alliance agreement with Microsoft in 2012 that involved ongoing technology transfer, mostly for voice technology, with Microsoft taking an equity stake in it, so the company sits in the middle of this dual grouping of the market.

While several vendors here have an everything-all-in IVA package, there are aspects to this technology that lend themselves to modularization, such as, for example, speech to text (STT) and text to speech (TTS). This enables IVA customers to opt for a best-of-breed approach, exploiting an IVA vendor for its NLU, NLP, and AI technology, and then perhaps using another solution for the TTS/STT function.

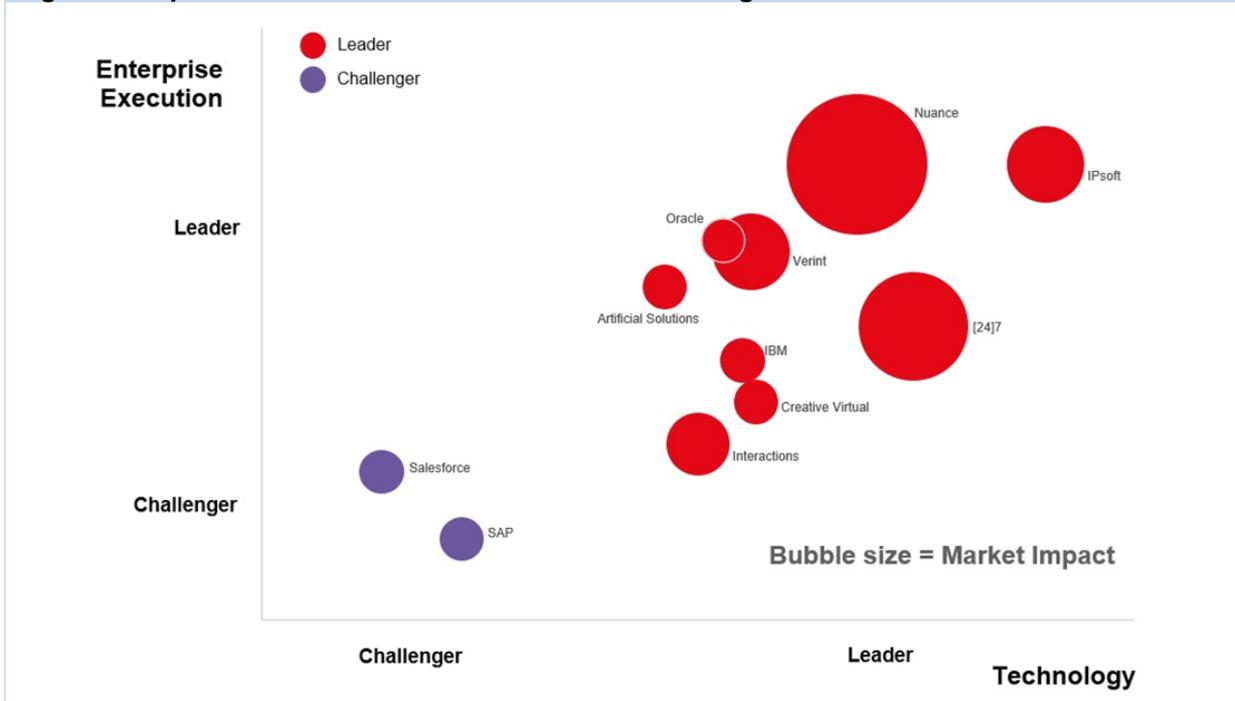
Automatic speech recognition (ASR) and natural language recognition (NLR) are terms that are also used for STT. Similarly, somewhat related to TTS is interactive voice response (IVR). Unrelated (and not covered here) is natural language generation (NLG) technology that takes structured data and converts it into natural language.

The vendors included in this report do not represent an exhaustive coverage of the market but a selection that covers the leading vendors. Figure 2 shows the results of our evaluation, the ODM on IVAs, and an expanded view is shown in Figure 3. We have ranked the vendors accordingly in Table 1 (see Appendix for further details about the evaluation process).



Source: Ovum

Figure 3: Expanded view of Ovum Decision Matrix: Intelligent Virtual Assistant 2020–21



Source: Ovum

Table 1: Ovum Decision Matrix: Intelligent Virtual Assistant 2020–21

Market leaders	Market challengers	Market followers
[24]7.ai	Salesforce	
Artificial Solutions	SAP	
Creative Virtual		
IBM		
Interactions		
IPsoft		
Nuance		
Oracle		
Verint		

Source: Ovum

Vendor solutions

Rankings

In this ODM we rated as leaders the pure-play vendors: Artificial Solutions, Creative Virtual, Interactions, IPsoft, Nuance, Verint, and [24]7.ai (partly owned by Microsoft). Interactions and [24]7.ai have significant investment in human-in-the-loop NLP augmentation. In the case of Interactions, these humans are trained to clarify utterances flagged as unclear by the IVA robot. This is their sole function and they are not otherwise involved in the conversation, passing control back to the robot, or, if they are also unclear about the utterance, to the human agents. [24]7.ai uses human-in-the-loop to handle chat and SMS when the robot is having difficulties with the query. The other vendors can also introduce human-in-the-loop, but these two vendors have large-scale operations in place to provide the manpower.

The high-tech vendors, IBM and Oracle, also rated as leaders, have seized the opportunity to enter the IVA market on the back of their AI expertise. IBM has for many years developed its Watson cognitive technology in-house and applied it to conversational AI. Its solution went live in 2018 with well-known brands as customers. Similarly, Oracle has for many years been quietly developing its AI technology in-house and only went public with its IVA solution in 2019, also with many well-known brands as customers.

We rated Salesforce and SAP as challengers, and we expect them to continue to improve. Both have relatively new solutions on the market, have a large customer base for their other core solutions that generate a huge amount of data, and are well placed to have an impact with their IVA technologies.

Technology

AI has had a huge impact on the virtual assistant market, and today no vendor can compete without moving to the IVA. Of course, there are still many legacy virtual assistant systems in place, and anyone encountering them often must endure a poor customer service as a result. The conversational AI startup space is highly active with venture capital investment, with many startups focusing on segments of the IVA stack rather than end-to-end provision. Some large enterprises with research resources have picked up open source tools and tried to build their own IVA from these pieces, but the net result typically falls short of desired performance. The missing factor is knowledge of the conversational journey: how to construct conversational flows that are relevant for the business as well as how to combine the right mix of data-driven ML with deterministic methods and models, augmented by human-in-the-loop when necessary. Vendors with many years' experience in the field have amassed a huge amount of data that they can use in starter packs and vertical accelerators. The vendors in this report all understand the complexities of an IVA and how to design and build conversation flows.

Some of the vendors have decided not to offer STT and TTS, including leaders Artificial Solutions, Creative Virtual, and Verint, and challengers Salesforce and SAP. These are specialized technologies and these vendors have deferred to a best-of-breed approach. The other vendors offer a complete end-to-end solution, and IVA customers must decide for themselves in proof-of-concept trials whether they need to mix and match or buy one end-to-end solution.

Enterprise execution

The leaders all have exceptional NLP capabilities. What might attract a customer to one versus another could be the ability of a vendor to reach that customer (some of the leaders have more global

offices and partners than others). Having good relationships with SIs and specialist consultancies is also essential to be visible in the market. Some of the vendors have excelled in the breadth of business starters and vertical accelerators they offer.

Market impact

Our market impact metric, the ODM chart bubble size, is based on revenue earnings (in a few cases our own estimates). We have created a bubble size metric that is normalized to relative earnings, based on the largest player in the market, and used a floor cut-off to represent the lower end of the scale.

Vendors not in this report

There are two high-tech players in the IVA space who have not participated in this report but are also pressing at the heels of the others covered here: Amazon with Lex and Polly, and Google with Dialogflow. Both Amazon Lex and Google Dialogflow came up in conversations with IVA customers, but neither provides a full end-to-end IVA package. Missing is designing the conversation journey and managing the whole lifecycle of an IVA. The IVA field is continually evolving and improving, and these vendors and others from the VC space could emerge with an end-to-end IVA offering.

We have not examined IVA solutions pre-built for specific industries, but worth mentioning as a good example is Symphony RetailAI. It has developed a turnkey ready-built solution for the retail and consumer packaged goods (CPG) industry, comprising the IVA called Conversational Insights and Decision Engine (CINDE), and Eureka, a comprehensive data platform that feeds CINDE. The company is beginning to explore creating similar turnkey IVA solutions in other industries.

Vendor analysis

[24]7.ai (Ovum recommendation: Leader)

Product: [24]7 AIVA

Availability: Cloud SaaS or managed service

Introduction

[24]7.ai is a private company based in Silicon Valley and has R&D centers around the globe. It offers an IVA called [24]7 AIVA, an AI-powered virtual agent for voice, text, and visual interactions across customer channels, including web, mobile, messaging, advertisements, and phone calls. [24]7.ai includes contact center agents in the loop to improve AI models and enhance the customer experience. These agents can be the company's own agents or provided by [24]7.ai as an outsourced service. The company has been running since 2000 and has developed expertise in virtual assistants by building AI models trained on large datasets of human agent conversations. [24]7.ai holds more than 150 patents and patent applications, including several specifically related to artificial intelligence and customer experience. It has an understanding of communications between consumers and businesses, and its customer journey analytics provides insights into intents and journeys.

In 2012 [24]7.ai formed an alliance with Microsoft. This included Microsoft merging its interactive self-service assets (clients, people, and technologies) into [24]7.ai, as well as an R&D partnership, long-term IP licensing, and Microsoft taking an equity stake in [24]7.ai. AIVA's TTS and STT interface is based on Microsoft's deep neural networks research in this space.

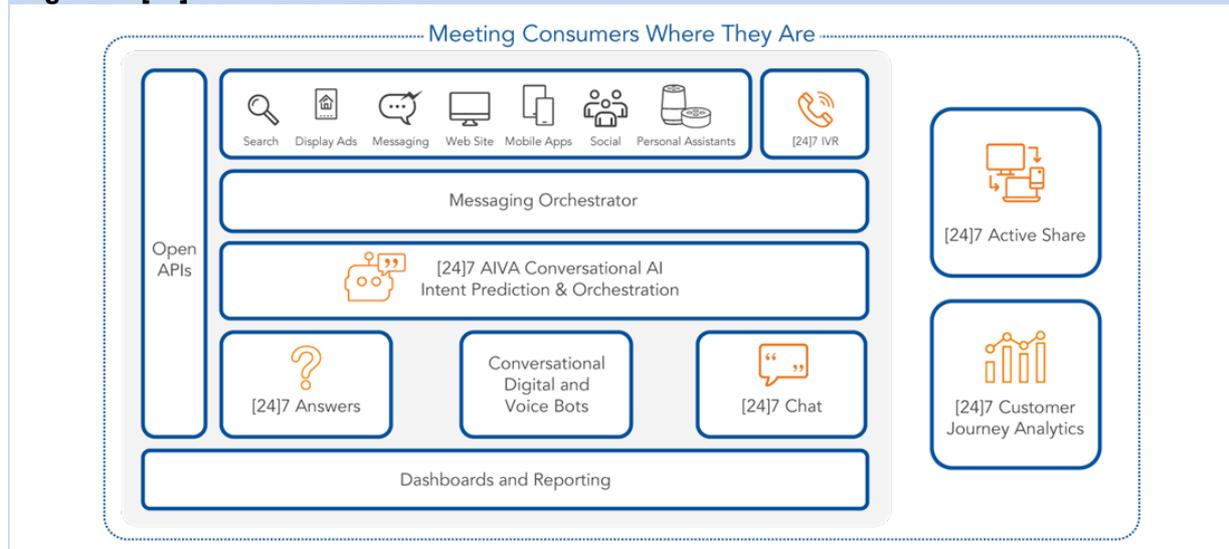
[24]7.ai has also formed an agreement with IBM whereby clients can plug IBM Watson into [24]7.ai, so that the Watson NLP can be used within [24]7 AIVA if desired.

[24]7 AIVA blends AI with live agents, where the human agents can be provided by the client or [24]7.ai. The advantage of the [24]7.ai human agents is that they are specialized on digital channels (live chat and messaging) and trained to work with AIVA, reducing average handle time and boosting efficiency. According to [24]7.ai, typical call centers are focused on voice communications and lack the capabilities to manage chat and messaging communications. [24]7.ai provides the technology and know-how to run agent operations for synchronous and asynchronous digital channels, from agent recruiting to development to performance management. In addition, [24]7.ai has professional services that help a client to roll out AIVA.

Some of the advantages of AIVA include:

- Unified voice and digital: A single platform for connecting voice and digital channels.
- Bot-agent collaboration: The blend of AI and human agents (agents helping bots, bots helping agents) to improve customer experience.
- Deep intent prediction: AIVA goes beyond NLP to use all data signals (behavior, transaction, preferences) to anticipate and understand customer intent.
- Vertical domain expertise: [24]7.ai has predefined, extensible intent ontologies and flows for major verticals.
- Journey management: AIVA maintains context across time, devices, and channels, allowing customers to pause and continue conversations on their own terms.
- Development and management tools:[24]7.ai has design tools to take its clients through the development cycle when implementing a conversational solution.

According to [24]7.ai, the performance to expect from AIVA will depend on the tasks a client decides to automate. Informational requests can be fully automated and represent some 10% to 20% of typical call center workloads. The remainder are transactional requests that require execution of business rules and integration with back-end systems. [24]7.ai recommends a phased rollout that starts with the more common transactions (leading to 50% to 60% automation), followed by the less common transactions (increasing automation to 70% to 80%). Depending on the complexity of transactions and the availability of data, some clients can reach 90% of full automation.

Figure 4: [24]7 AIVA architecture

Source: [24]7.ai

Ovum strength and weakness assessment

Strengths

- **Strong intent analysis:** [24]7.ai uses the conversation source plus external signals, such as web history, CRM data, and the [24]7 big data platform, to understand a user's intent. The company says to understand true customer intent, an IVA must go beyond intent classification by NLP. NLP classification relies only on the words or expressions used in the customer's query. [24]7.ai adds intent prediction based on non-language data, including behavioral data, transactional data, user profile data, and environmental data to determine the true intent.
- **Outcome-based pricing:** [24]7.ai uses an outcome-based pricing model, paying only for results as agreed with the customer when specific performance targets are met or exceeded. Possible metrics include resolved chats and improved NPS and CSAT scores.
- **Offers STT and TTS:** [24]7.ai has its own STT/TTS solution through a privileged technology relationship with Microsoft, giving it direct access to its complete stack of speech recognition technology. This includes advanced deep neural networks algorithms, providing [24]7.ai with best-in-class speech recognition.

Weaknesses

- **Image and facial recognition:** In line with most of the vendors in this ODM, there is no image or facial recognition offered. However, for a leader in IVAs we believe it will be necessary in future. Passing documents and images between end users and IVAs will become normal, as it is with human agents where it is possible to send such materials by email or via cloud drive folders. There are also applications in fraud detection.
- **Safety-critical use cases:** [24]7.ai was one of four IVA vendors in this research not able to say its technology could be used in safety-critical scenarios where human life could be at risk. An example would be fielding end user calls to an emergency service.

Artificial Solutions (Ovum recommendation: Leader)

Product: Teneo Fusion (5.1): Teneo Studio, Teneo Interaction Engine, Teneo Data, and Teneo Language Resources

Availability: On-premises, private cloud, and SaaS (Teneo developers)

Introduction

Artificial Solutions was founded in Sweden in 2001 that went live on Nasdaq earlier this year. Today it is an international company with offices worldwide. The company is enterprise-focused. For example, global organizations covering multiple languages are handled by Artificial Solutions IVA's ability to converse natively in 35 languages. The company works with leading Sis, including Deloitte, Accenture, Capgemini, Wipro, and Cognizant.

Artificial Solutions brings to IVA an approach that combines linguistic learning (LL) models and ML models, combining deterministic and data-driven approaches in Teneo, a hybrid solution (the runtime is called Teneo Interaction Engine). LL has been developed at the company from its earliest research in multilingual conversational solutions creating rules-based models that can be built from a small data set, so it can be used in new domains where data is scarce, as well as domains rich in data. The Teneo-based IVA fuses LL and ML in any conversation to enhance NLU and NLG. Both the LL and ML models learn and improve in production use, so improve over time. Unlike a purely ML based system that can only improve with more data being used to train or retrain the solution, with Teneo users can break into the syntax rules to improve the response.

The ML part of Teneo was built using in-house classifiers as well as classifiers that Teneo licenses from several suppliers. Due to the modular nature of the solution architecture, customers can plug in their own ML system if they wish. For example, in Japanese it can be difficult to know when a word ends and another begins (this task is called tokenization), and although Artificial Solutions has a solution for this, there are specialists that produce software for tokenization only, and this can be plugged into Teneo. Another example is a customer who had invested heavily in distinguishing between "Swiss German" and "German German", which was able to plug its solution into Teneo and reuse that investment. These solutions go into the pre-processing stage that has an open API.

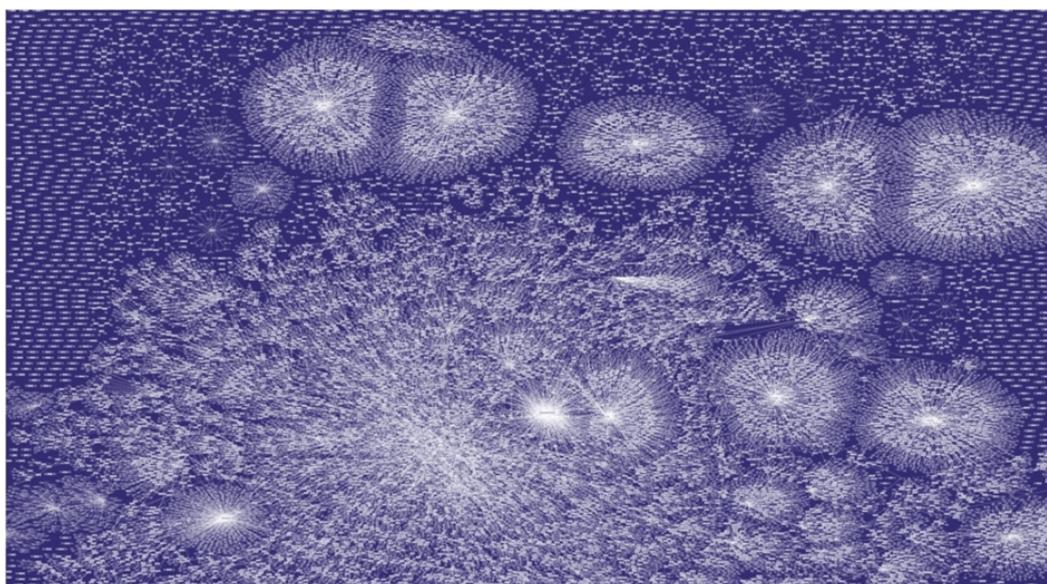
Teneo uses billions of real-world conversations to create Teneo Language Resources (TLRs). These are pre-built NLU blocks used to build custom solutions in more than 35 languages and across many application domains. A TLR captures all the different ways language expressions are used. TLRs are themselves built with ML at Artificial Solutions by expert linguists. TLRs map a language's relationships across words, phrases, sentences, synonyms, lexical entities, and concepts (see Figure 5). From a given utterance, Teneo will use this map to understand intent and trigger the next step in the flow. This map technology has been patented by the company (which tells us it has aroused interest from high-tech players).

An example that Artificial Solutions cites that differentiates its product in the market is how to correctly interpret between sentences with very different meanings. For example, in the two queries "If I cancel my flight can I get a refund?" and "You cancelled my flight can I get a refund?" While there is only one change of word, Teneo can detect the difference. This is important because the refund policy would depend on "I" or "you".

Another advantage of Teneo is that it doesn't require specialized hardware to run, just standard CPUs. Artificial Solutions explains that in creating the TLRs internally there is also no need for specialized AI hardware acceleration, just CPUs.

The benefit of TLRs is that they boost the performance of IVAs from the start, requiring less intervention from humans-in-the-loop. They are also wide-ranging in application domains, where big data sets may not yet be available. With this approach, each TLR is specific to a native language and the company has built support for more than 35 languages. The solution can also capture local language differences in any given language. Artificial Solutions has also built domain-specific TLRs that take the TLRs to the next level, focused on an industry to help kick-start an implementation with some 70% of the training already done.

Figure 5: TLR map of the English language's internal relationships across linguistic entities



Source: Artificial Solutions

Teneo customers have a conversation dashboard that provides a graphical interpretation of conversations. Big data analytics capture end user conversations which are then analyzed by Teneo, breaking unstructured information into useable data. Two tools are provided: Teneo Discovery and Teneo Enquire. Teneo Discovery collects raw unstructured data from multiple sources and in real time classifies it into visual representations of key issues and questions. Teneo Enquire is a tool that monitors Teneo operations, performs optimizations, and monitors KPIs. It also provides conversation data mining that can help with understanding end users and can drive personalized responses.

Artificial Solutions tells us it has cut deals with large clients (including a major auto maker) that prefer to work with a company that lets them own all the data (data ownership is a major concern), as well as work with a small specialist that can't become their competitor in future.

Apart from enterprise conversational AI use cases, clients use Teneo in diverse ways, such as, for example, to strip out personal identifiable information (PII) in data streams, because Teneo can identify PII out of the box, which it can anonymize, pseudonymize, or mask. AT&T has used Teneo for its intelligent home solution, and a major games console player has used Teneo to give game characters a voice. Being able to run on standard CPUs enables Teneo to work in edge computing scenarios.

Ovum strength and weakness assessment

Strengths

- **Business model and tools:** Teneo includes a shared success element in the customer engagement and has developed a host of innovative tools to help customers maximize the use of IVAs, such as, for example, creating a net of bots that can share information.
- **Linguistic learning:** The ML part of the platform is augmented with patented advanced linguistic modeling technology that enhances the IVA performance. This was developed in-house and is an important asset that helps in many ways, such as, for example, in sentiment analysis, an aspect of conversation that is challenging for many IVAs.
- **Small footprint:** Teneo can run on standard CPU hardware without requiring AI accelerators. This has multiple advantages, such as being able to be deployed in edge computing scenarios.

Weaknesses

- **Speech-to-text and text-to-speech:** This component relies on third-party technology. While there is an advantage in interactions making use of best-of-breed devices (as well as ubiquitous devices such as Amazon Alexa and Google Home), there is a reliance/dependence on a third party for this provision.
- **Capturing end-user feedback:** The customers' end users' satisfaction is not captured in any direct way, only by analyzing the chat logs or building feedback capabilities into the IVA during deployment. We believe there should be direct methods introduced to capture end-user satisfaction.
- **Self-serve access model.** The company's background has been focused on selling to larger enterprises and until recently, it had neglected a "self-serve" capability to enable SMEs and software developers to easily gain access to Teneo. While we recognize this is being addressed, it is still early days for this model.

Creative Virtual (Ovum recommendation: Leader)

Product: V-Person (most recent production version: 2.2.2.x). This comprises V-Person (V-Engine, V-Portal, V-Stats), Live Chat, and Transcript Analysis.

Availability: SaaS and on-premises

Introduction

Creative Virtual is a privately owned company founded in 2003. Based in London, it has a global presence around the globe, and has a professional consulting arm to support its V-Person IVA product. The company has a strong presence in financial services and telecoms, with extensive projects within some very large global enterprises as well as many other verticals.

The company places emphasis on both front-end and back-end integrations, using Python-based API for event-driven scripting. The IVA platform combines NLP, a semantic engine, and ML, augmented with intent libraries built for industry sectors. The IVA continuously learns in production, updating all aspects of the solution. For example, when a conversation is escalated to a human, this creates information that is used to teach and update the solution. A customer's existing live contact center chat scripts are used to train the IVA using a transcript tool that reports on which aspects can be automated, and then forms part of the IVA's training data.

The IVA technology uses several techniques to respond to queries, especially short and ambiguous inputs, such as when the intent is not clear, the response will be to give examples of the closest intents. One of the techniques is a neural network-based tool to find the best fit. It was developed in-house and makes use of synonym-matching technology. Other algorithms include semantic search, statistical/best next action, and NLP continuation.

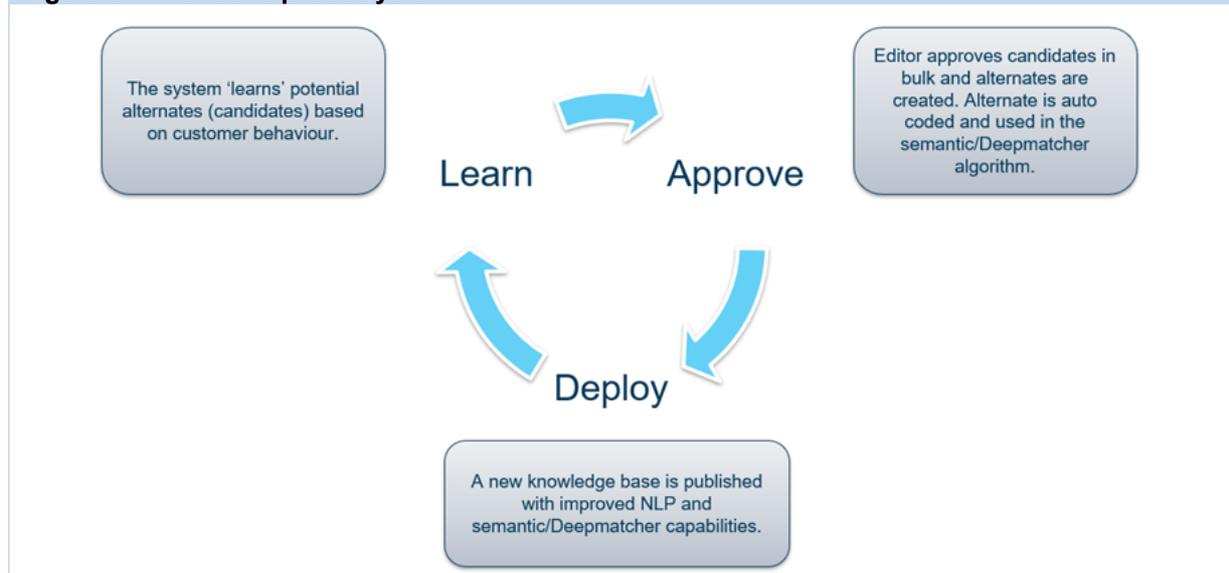
When giving end users a set of options to dig deeper, every time a selection click is performed it forms part of new training data to update the system. When another end user makes a similar query, the system goes straight to the selection previously reinforced, having learned the best response. The value of the training data is also rated to ensure that the best data is used for training, employing automated checks and balances. Regression tests are performed to ensure that new data is performing correctly, and humans are involved in signing off all new data before a system is updated. The update cycle varies with customer needs, but a two-weekly cycle is typical.

The interface of the IVA is both text and speech (from multiple channels, including mobile, web, and Alexa) and the speech element can perform speech recognition directly or use speech-to-text devices. The IVA supports 35 languages. The company employs language engineers to train the system in new languages, combined with macro synonym (rule) sets. It can also perform translation to English as a first step and the choice depends on the volume expected to be handled.

Sentiment analysis is offered with in-house rule-based and classifier algorithms, or there is the option of using the API to plug in a third-party provider, such as, for example, the NLP open source tool spaCy. Creative Virtual says it can tell if an end user is angry and this is used to guide the conversation, such as to escalate to live chat. Humans can monitor a conversation and jump in and out of control by the IVA.

Multiple intents and topics are captured and saved for reintroducing at a later point when the current thread ends and it's normal to ask for any other questions, or they can be answered instantly and when completed, the original flow is brought back. Topics are also recognized and set by the IVA to head a flow so that the IVA relates all subsequent questions to that topic.

Creative Virtual professional services are available to help customers deploy a solution. The balance of how much curated training data is required versus the industry vertical packages with pre-built ML will determine whether an implementation takes a few days (the latter case) or weeks (the former case). The company makes a clear line between generic data that it owns and client-specific data, so there is clear ownership to respect privacy and compliance. Solutions can be deployed in multiple options, such as hosted by Creative Virtual or hosted by the client on-premises or on its secure cloud. IVAs are increasingly being deployed in internal systems, such as employee-facing websites, helping users to navigate internal resources such as HR, IT, and pensions. Through V-Person's support for Python and open APIs, integrations are possible with any external system, including CRM systems and messaging systems. These APIs are also exploited by the SIs working with Creative Virtual that build connections to their systems. In addition, there is also integration with RPA systems such as UiPath.

Figure 6: V-Person update cycle

Source: Creative Virtual

Ovum strength and weakness assessment

Strengths

- **IVA technology:** Proprietary AI and NLP technology are used for NLU/NLP, exploiting a range of techniques from semantic analysis to neural networks-based ML. Creative Virtual blends more traditional NLP with newer technologies from AI, and uses its experience in the industry to create high-performance IVAs.
- **Open API:** The open Python based API enables customers and SIs to build extensions and integrations with V-Person. These include enterprise systems (CRM, messaging) and RPA applications.
- **Flexible business model:** Customers are offered flexible options, from perpetual enterprise licenses to (success-based) transactions-based payments. The solution can also be deployed by customers on-premises, in their secure cloud, or hosted by Creative Virtual.

Weaknesses

- **Voice technology:** Any use of voice technology in the solution requires a third-party tool to be connected via the API. This creates an external dependency on the solution (where voice is required), but Creative Virtual argues that it gives clients the flexibility to use best-of-breed solutions.
- **Image and facial recognition:** The solution lacks image and facial recognition as part of the core product. For most traditional IVA deployments this is not a hindrance, but we see scope for adding these features as enterprise interest in IVAs grows and application use cases expand, and of course a human has these abilities. Creative Virtual has a deployment that integrates its IVA with AI image recognition technology (Australia's Transport for NSW in their Facebook Messenger deployment).
- **Fraud detection:** With the rise of cybercrime the ability to detect fraud is a priority for enterprises and we think Creative Virtual should look to add fraud detection features in its

business starter packages. However, Creative Virtual's NLP and machine learning capabilities can be deployed to pick up on intents related to fraud.

IBM (Ovum recommendation: Leader)

Product: IBM Watson Assistant

Clients typically use Watson Assistant with: Watson Assistant for Voice Interaction, Watson Discovery (search), Watson Speech (STT/TTS), and Watson Studio (advanced analytics).

Availability: IBM Watson Anywhere strategy allows clients to take Watson AI to wherever their data resides, including offering IBM public cloud (multitenant or single-tenant for data isolation) or any public cloud, on-premises, or managed hosted service

Introduction

Launched in 2016, IBM Watson Assistant sits in the Watson AI application layer of the overall Watson technology stack, and benefits from all the other elements in the stack (see Figure 7). At the bottom of the stack is the Watson Anywhere capability, making use of Red Hat OpenShift to deploy the solution on any cloud and on-premises. The middle layer is used by customers of Watson Assistant to extend the solution, for example with STT and TTS, and IBM also offers ML and analytics best-practice notebooks to make use of this layer in Watson, targeting data scientists. Watson Assistant is a full end-to-end IVA solution that can be deployed anywhere (IBM Cloud, private cloud, or other vendors' clouds),

Watson Assistant is designed as a low-code environment with a simple interface so that line-of-business users with limited technical experience can build an Assistant. Because of the skills needed to train an Assistant on domain-specific content, IBM believes that non-technical users are critical for widespread adoption. IBM therefore makes it easy not only to build an IVA, but also to integrate it into back-end contact center systems. Deployment is simplified with its newly announced, pre-built, web chat user interface. Some IBM customers, however, have data scientists who want to dig deep into the analytics of the IVA, and they will use Watson Assistant's built in analytics and if needed, the Watson notebooks for more advanced analytics.

IBM maps the end-user call journey. Starting with a multitude of supported channels, the resolution process moves to Assistant's NLP, which then draws on "dialog skills", understood predefined transactions that can then provide explicit answers. For other kinds of transactions there is a search capability where Watson seeks out the answer from the resources available to it. This search feature is powered by Watson Discovery, an advanced search solution. Ultimately, there is deflection to a human agent if the confidence levels in possible answers are too low or the topic being queried has not been modeled.

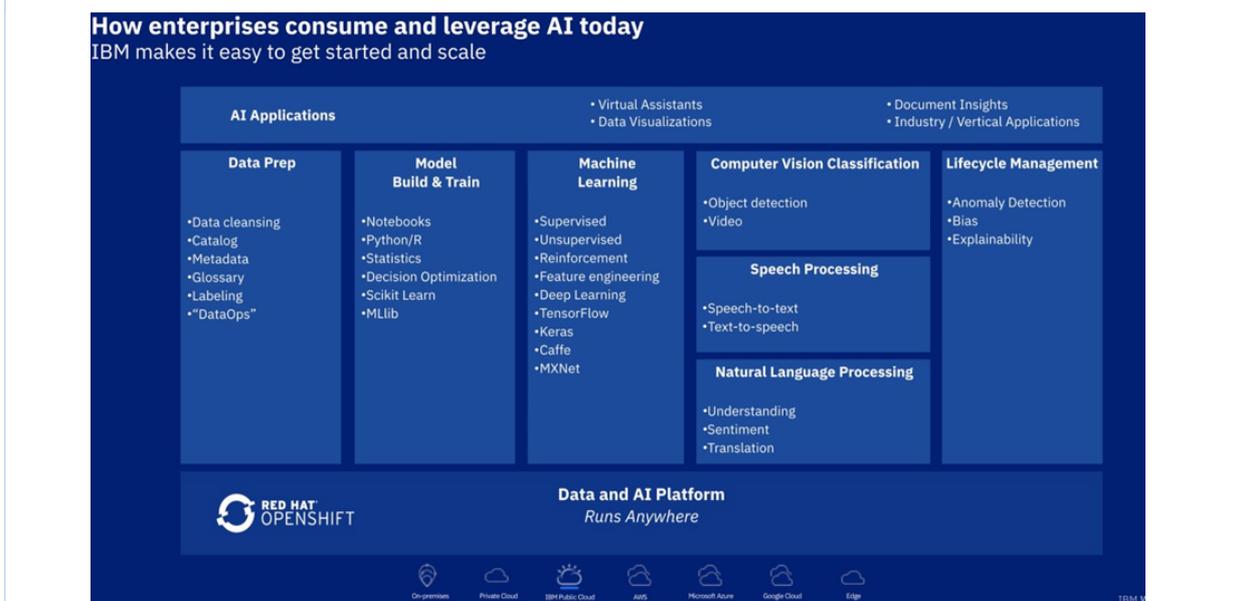
IBM Watson customers can implement an IVA solution in weeks. IBM recommends rolling out a solution as soon as possible rather than trying to model every conceivable question that could be asked. The model is then updated as new questions arise. Clients with customer care IVA requirements already know some 60% to 65% of the common questions that will be asked, so these are the starting points to build out. Having the solution deployed quickly also helps the customer become more self-sufficient in using the IVA. They get to understand the effort required to build a Q&A model and can decide whether they will do that themselves or bring in IBM or a systems integrator.

IBM Watson Assistant currently supports 13 languages. IBM is unique in its direct approach of capturing cultural differences that are embedded in a language. The AI technology powering Watson Assistant includes deep learning and the ML-based Natural Language Classifier, a Watson service. IBM has tuned this technology to achieve real-time training of between 30 and 45 seconds, while maintaining a high-performance accuracy. It says it has conducted internal and external benchmarks and is confident it leads in the NLP space at the performance levels it has set. Even with the release of models such as BERT in the open NLU community, IBM says Watson Assistant surpasses these. Real-time training has the benefit of enabling customers to make a change, update the system, and test it straight away.

Another aspect is the use of AI that spans the whole build and improve process. AI is used to cluster data that is streaming through the chats and logs, extracting contextual entities for recommendations, or detecting specific SKUs. AI is also used to detect conflicts in the training data through semantic, lexical understanding. There is an AI-powered spell check in the IVA. IBM is looking to exploit AI in all aspects of NLP, not only supervised but also unsupervised AI models. There is further potential for AI use in personalization and self-learning. There is also a sophisticated lifecycle management system in place for versioning and quality control. IVA "skills" can be swapped in and out while the IVA is running live, without bringing it down. The lifecycle also supports managing the data that is gathered through the IVA streams. Lifecycle management is built into every instance of Watson Assistant to manage all aspects the IVA's activity.

IBM's customers are represented in all the usual industry users of IVAs, such as banks, telecommunications, healthcare, and retail. There are also some less typical examples. IBM cites a high-tech customer, where Watson Assistant is used to handle very complex technical queries at a support desk. The IVA's intent entity extractor is used to refine the nature of the query, perhaps with some further questions put to the caller, and having understood the precise nature of the call, it then acts as the deflector to the right technical engineer. IBM quotes 82 million end-user conversations a day using Watson Assistant through the IBM Public Cloud SaaS version.

Figure 7: IBM Watson overview



Source: IBM

IBM has a vision for how enterprises should handle their end-user queries across all possible channels and contexts, which is to unify on a single IVA that then connects to all the back-end systems that may exist in the organization. There are clear benefits in asset reuse and skills resourcing, with all the benefits that IVAs bring, including greater efficiency, high-end user satisfaction, and cost reduction. This extends to both internal and external-facing end users. The additional benefit is that data across all channels is collected in a consistent way and made useful, not just for IVAs but also for analytics opportunities.

Ovum strength and weakness assessment

Strengths

- **Built on Watson:** IBM has invested heavily in Watson's AI, and Watson Assistant is an example application of this technology. It combines multiple ML techniques including NLP, decision trees, and support vector machines. IBM Watson Anywhere strategy also applies to Assistant, making deployment highly flexible (single-tenant or multitenant cloud, hosted, on-premises). This is a key differentiator because many peers in the market offer only a managed cloud option, whereas with Watson Anywhere the IVA can be deployed on-premises. On-premises is particularly attractive to public sector customers.
- **Advanced intent processing:** Customers can take existing chat transcripts from their call center or customer inquiries and reuse the data with Watson Assistant. Sharing real customer utterances with Watson helps it recommend the best intents. IBM has sophisticated NLP capabilities and believes it outperforms any other technology on the market. It also extends its use of AI beyond typical NLU use cases.
- **Image recognition and dialog:** Ovum found that image recognition is not common in IVAs but offers advantages in non-typical IVA applications. IBM can offer the Watson Visual Recognition module for image recognition. In addition, the dialog technology is powerful and flexible, allowing for simple or advanced conversational flows, handling disambiguation and digressions.

Weaknesses

- **Lack of facial recognition:** Having facial recognition in IVAs is not common but does open a host of opportunities and is likely to become a must-have for human-machine interfaces (personalization, fraud detection, and more). Third-party tools can be integrated.
- **Proactive IVA conversation:** Watson Assistant has no proactive functions and we think this is an area to improve on. For example, cross-sell or upsell are examples of where proactive IVA prompts can outperform human agents.

Interactions (Ovum recommendation: Leader)

Product: Interactions Intelligent Virtual Assistant

Availability: Managed, cloud-based service

Introduction

Interactions, founded in 2004, claims to be "the largest standalone AI company on the planet" and applies its AI to the customer experience and care space. Its adaptive understanding approach is to combine a conversational AI stack with real-time human intelligence, built on the strength of more than 1,200 patents covering AI, natural language understanding, ML, and automatic speech

recognition. The original solution was the development of a real-time human intelligence model. When AI technology improved to the point of being useful in the last six years, it was introduced into the stack. Interactions' AI technology started with the acquisition of AT&T's speech and language suite and included the entire research team behind it. This technology is now called the Curo Speech and Language engine, which runs as a unified AI suite on a single platform.

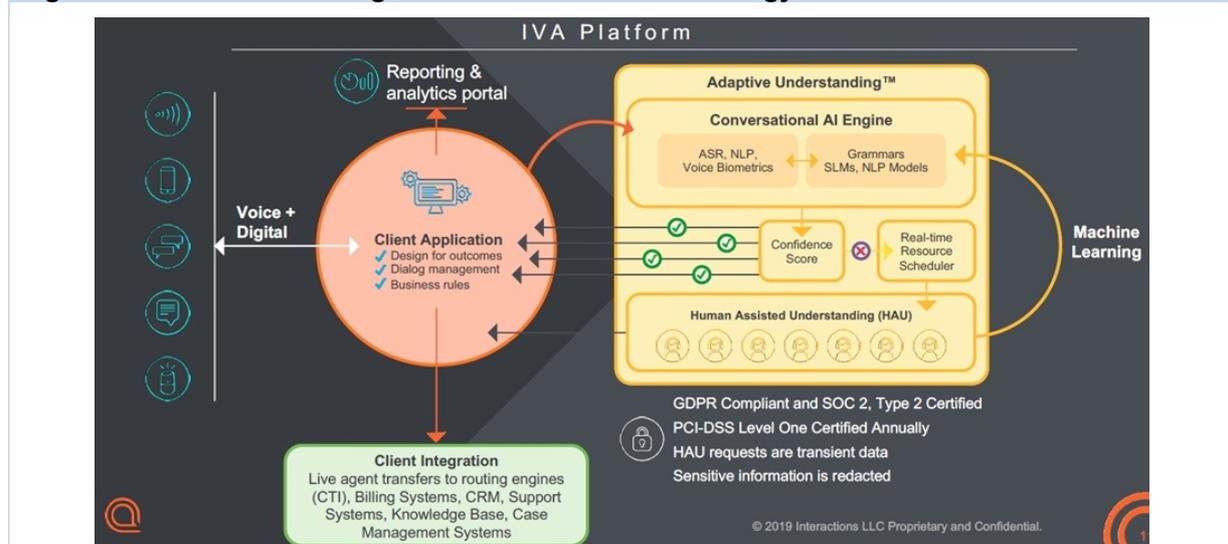
Interactions Curo conversational AI falls into several core segments: automatic speech recognition (ASR), natural language understanding (NLU), natural language generation, dialog management, and deep learning. Client engagements start with Interactions designers and solution consultants working to build the right IVA persona and dialog flow. Curo processes all communications channels, including voice, text, and smart speaker. Deep integration with back-end services enables more self-service actions to be performed by end users.

The solution is offered as a managed cloud service, so the customer has no AI-related hardware requirements to consider. The business model is success-based. There is no minimum annual commitment by the customer because the customer pays for each successful transaction. Interactions works with each customer to create the persona they want and the kind of transactions and business rules to implement. The two parties agree what constitutes a complete transaction, and the billing system will monitor its completion. Any incomplete transactions are not charged.

The IVA calculates a confidence score and determines if it is high enough to guarantee understanding by the IVA. If the AI is unsure, the specific audio or text string is forwarded in real time to an Intent Analyst (IA), who listens to the audio or reads the text to guarantee the correct response is generated for the customer. The IA corrects the dialogue flow and returns to the IVA for continuation. This also allows for human-tagged data to accumulate and help train the IVA, helping to improve the performance of the AI model over time. IAs are an integral part of the platform solution. Until 2016 they were employees of Interactions but have since been transferred to BPOs.

The IA is not engaged in the conversation, but only sees the utterance or phrase in question and responds with an answer. Depending on client needs, any failure by the IA to clarify an utterance can flow the conversation to a live human agent or request a repeat to the end user. All data seen by the IAs is transient (it disappears after 20 seconds), and any sensitive data is redacted as required by compliance rules and/or client requests.

The use of IAs in the loop varies by interaction type. Interactions says 90% of voice or text "how can we help you" type of exchanges can be handled by AI, whereas emails, which are typically more challenging, require greater human assistance. IAs are trained for the application and have an Intent Analyst Desktop specific to the application. They can work on multiple applications concurrently depending on volume. A customer example (written up in the Wall Street Journal) is MetLife, which started out with 90% calls fielded by the IAs and over time reduced this to 10% fielded by IAs as the solution stabilized. This is a unique (as far as Ovum understands) approach in the IVA industry, Interactions says, for example, that one large client fields 300 million calls per annum, and with the use of BPOs, it can scale to these volumes.

Figure 8: Interactions Intelligent Virtual Assistant technology architecture

Source: Interactions

Ovum strength and weakness assessment

Strengths

- **Business model:** The business model based on success per transaction means Interactions is heavily vested in ensuring that the customer succeeds. Of Interactions customers, 95% use this business model, which demonstrates Interactions' strength of commitment in engagements.
- **Managed service:** The fully managed service (on Interaction's cloud) means the customer does not need in-house skills in IVA technology, and does not need to bring in partners or SIs to help with an implementation, because Interactions provides a complete solution.
- **Advanced IVA technology:** The company holds patents in how it blends its conversational AI stack with real-time human understanding (Nuance Adaptive Understanding) to deliver high levels of understanding, simultaneously automating the training of data models. The IVA solution also blends multiple intents, classification, and deep learning algorithms, using declarative and imperative techniques to achieve optimum performance.

Weaknesses

- **Partner strategy:** Interactions' partner network is nascent and is on its roadmap for enhancement in 2020. Partners are an important channel. Many large enterprises have SIs they work with and Interactions is aware of this pattern and is working on improving its partner network.
- **IVA integration with other bots:** Interactions does not allow any other systems to work with its IVA to preserve the integrity of its IVA performance, but this can be limiting for a customer that has IVA related technology of its own to exploit. This includes lack of RPA support.
- **Data mining tools:** The availability of tools to mine the data streaming from IVAs is lacking and would be useful for the customer. Interactions has this on its roadmap.

IPsoft (Ovum recommendation: Leader)

Product: Amelia

Availability: Amelia can be hosted on-premises, private cloud, or public cloud (IPsoft Cloud, Amazon EC2, Microsoft Azure, Oracle Cloud, Cloud Foundry). It can be deployed on standard images or containers/Kubernetes. It can also be deployed for redundancy in different datacenters.

Introduction

IPSoft was founded in 1998 by its CEO Chetan Dube, a mathematics professor at NYU specializing in AI. The mindset at IPSoft has been about exploiting AI, starting with IT service operations, and eventually focusing on IVAs. The company is global with its R&D centered in New York city, and other research centers worldwide. The focus is on large enterprises with high IVA concurrency needs and on fielding large-scale end-user numbers.

Amelia was first released in 2014 and is at version 3.7. Its biggest customer industry is financial services. Some examples of Amelia deployments that IPsoft quotes are beginning to reach thousands of concurrent Amelias. Amelia runs on any cloud or on-premises. To provide such large-scale customer support, it has all the failover between data centers and resiliency expected. IPsoft also has its own robotic process automation (RPA) solution, 1RPA, and has combined it with Amelia in 1Desk, its cloud-native product deployed on containers and managed by Kubernetes.

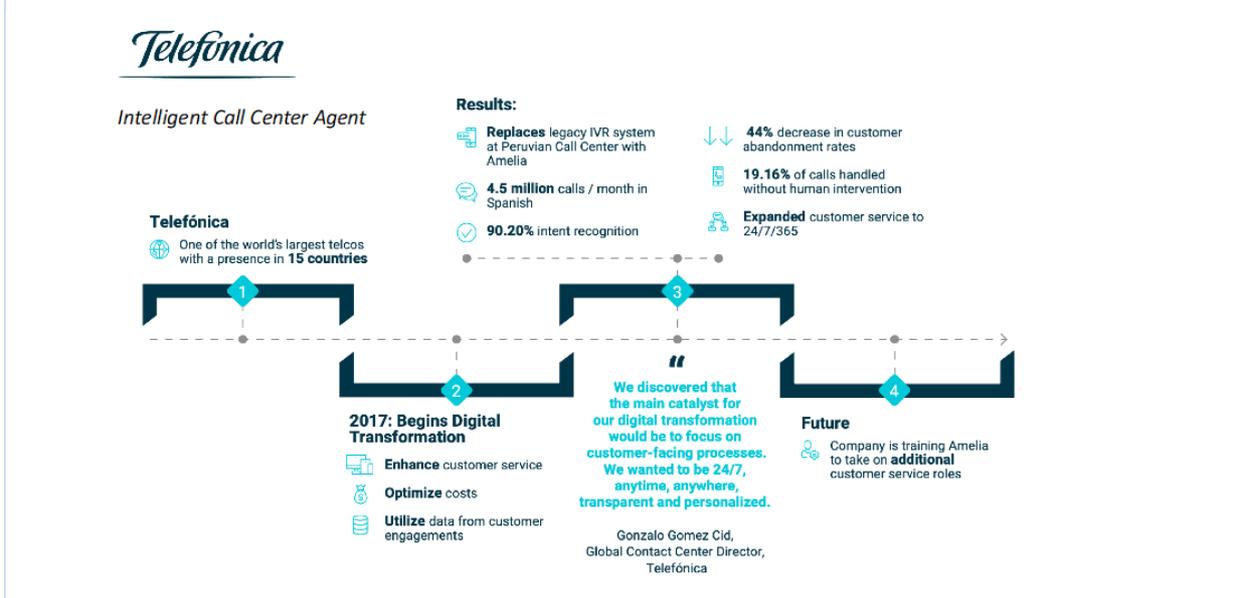
IPsoft is aiming to make Amelia able to complete tasks end-to-end with minimal human intervention, and this requires integration with back-end systems via APIs, built-in process automation, or an RPA solution. The company also places high value on the implementation methodology, with a range of experts to draw on, from cognitive engineers and linguists, to conversation journey designers. On the customer side, it expects business domain experts and integration experts to be made available to build out a solution. Many of IPsoft's larger customers have built their own team of experts including linguistics and even neuroscientists to implement Amelia and to understand how the mind of an end user works and interacts with a robot. Ideally, the client should have a "conversational experience designer" that combines linguistics knowledge and business domain expertise. The longer-term aim is to achieve a citizen developer-style of implementation approach so subject matter experts can handle 80% of the work.

Many of IPsoft's early customer implementations were internal-facing, but in the past 18 months the predominant deployments are external customer-facing, where the scalability of Amelia is an important factor and can offer a better ROI.

Another recent trend is greater use of voice over text-based chat. In the world of NLP research, the models are named after Sesame Street characters. Amelia's NLU is based on ELMo (embedding for language models), which uses not only individual words in the conversation but also context through surrounding words being spoken. The result is that less data is required to train the cognitive model, making it easier to deploy a customer solution (IPsoft says 50% less data). When Amelia is trained for a language it's always natively direct to model, with no intermediate language translation to an existing model. IPsoft develops language packs that plug into Amelia together with other components such as sentiment analysis. It also classifies conversation using a neural network trained on the psychological pleasure, arousal, dominance (PAD) emotional state model used to represent all emotions to provide additional context.

IPsoft has an advanced bot-of-bots capability, where Amelia is trained to orchestrate intents across other specialized Amelias that are handling individual queries, offering an advanced method for managing conversations with multiple intents. This works behind the scenes and does not need to be explicitly trained by a customer.

Figure 9: IPsoft implementation at Telefonica Peru



Source: IPsoft

Ovum strength and weakness assessment

Strengths

- **Language support:** Amelia boasts 40 supported languages, which are trained from the native language, not through English as an intermediary language. Amelia's NLU engine is powered by ELMo, a deep neural network algorithm that allows for contextual understanding of utterances. IPsoft says it has better than 95% accuracy.
- **Key differentiators:** Amelia has advanced voice technology developed by IPsoft for both STT and TTS functions. IPsoft is also the only vendor in this ODM to offer facial recognition out-of-the-box. An example use case is kiosks with a human-like avatar to provide more personalized experiences. IPsoft also has different Amelias that can work in concert, including an IT service desk Amelia, an HR Amelia, a back-office Amelia, forming groups of individual Amelias and then connecting them across domains.
- **RPA:** IPsoft offers its own RPA solution, 1RPA, which incorporates NLP/NLU capabilities, and can be tightly integrated with Amelia for automating processes and retrieving information as needed as part of the dialog and resolution process. It also integrates with third-party vendors: Automation Anywhere, Blue Prism, and UiPath.

Weaknesses

- **Vertical accelerators:** IPsoft has many Amelia business starters that are applicable horizontally across industries but compared with its peers it lacks the range of vertical industry accelerators that can help kick-start an implementation. It does, however, have a significant presence in the telco, banking, financial services, and insurance sectors.

- **Global presence:** IPsoft's 15 office locations worldwide might be challenged by the bigger global footprint of its some of its rivals, especially from the high-tech sector.
- **Supporting partner network:** The partner network includes some of the major SIs and service consultancies, but these also serve IPsoft's rivals. A wider dedicated partner network might provide a better path to market.

Nuance (Ovum recommendation: Leader)

Product: Nuance Intelligent Engagement Platform (IE)

Availability: Available as a managed hosted service on its cloud or on-premises

Introduction

Since forming in 2001, Nuance has become the largest (by revenue) dedicated voice recognition and NLU vendor in the market. The company reported revenue of \$2bn in 2018 across all its activities.

Nuance has customers spanning a wide range of industries, including the most common buyers of IVA technology across banking, healthcare, retail, government, and telecommunications. Nuance's global operations span 60 locations, with a sales presence in more than 48 countries. As Nuance acquires new customers in industry verticals, it gains more data that feeds back into updating its machine learning models and creates a continuous IE performance improvement. All applications are based on the same core technology but pretrained for the industry segment. There are some vertical packaging options available "out of the box" but Nuance professional services can tune the starter solution specific to the customer. Nuance recently spun out its automotive-focused business, which now operates as Cerence.

The Nuance partner and system integrator (SI) network includes Avaya, IBM, Cisco, Accenture, Genesys, Presidio, ConvergeOne, Five9, and Deloitte, with more than 700 conversational design experts on global professional services team, and 1,800 voice and language scientists, developers, and engineers worldwide. Nuance says 31 billion customer interactions flow through its technology annually. It cites more than 200 healthcare IT partnerships that enable the integration of Nuance solutions with the industry's most prevalent platforms, including Epic, Cerner, Allscripts, and Meditech.

Nuance offers ASR, NLU, dialog and information management, biometric authentication, and fraud prevention across voice and digital channels, optical character recognition capabilities, and domain knowledge, along with professional services and implementation support.

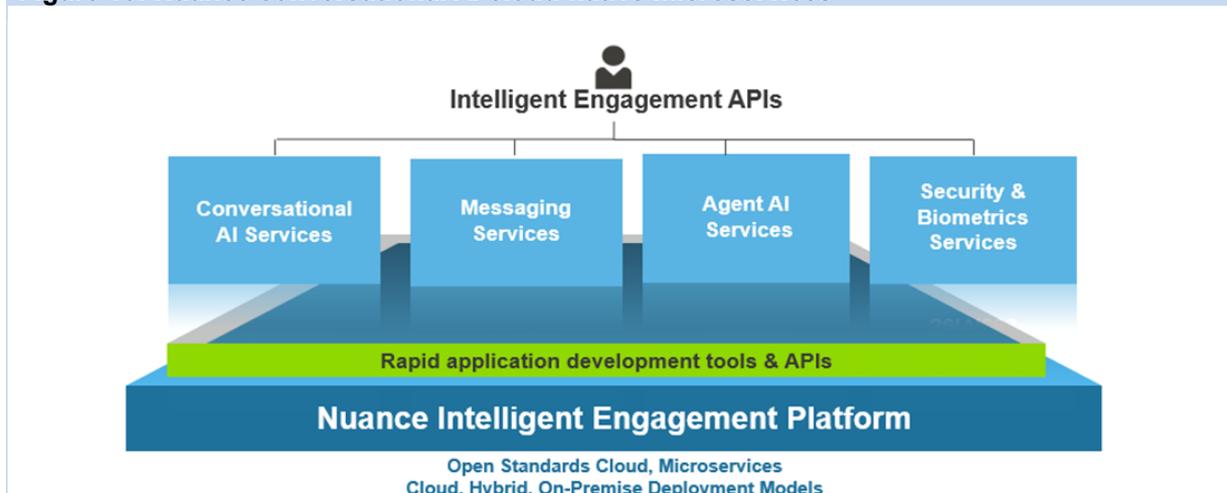
The Nuance Intelligent Engagement Platform offers organizations the flexibility to deploy STT in various ways, including as part of a broader integrated virtual assistant, analytics, and security solutions for text and phone channels, as a containerized microservice engine available via Conversational AI Services, and through the Speech Suite 11 offering (Nuance Recognizer and Dragon Voice). Nuance's STT can produce real-time transcription output that can be integrated into a captioning solution. Its Large Vocabulary Continuous Speech Recognition (LVCSR) operates across both word and sentence boundaries. More than 86 dialects and languages are supported. STT is also key to Nuance's biometrics technology, which is baked into the IE platform. It combines biometric results with conversation content to identify a caller by their word choice and patterns, improving fraud detection rates and indexing for search and enhanced identity detection. The TTS engine has 119 voices.

The company uses its own innovations in AI to create its smart IVA, investing heavily in R&D with approximately 1,400 researchers and developers. It holds about 3,000 patents and patent applications.

Nuance's approach is to augment its AI capability with human-in-the-loop capability when escalation is required and to assist the human with predictive features for anticipating the next steps in the conversation. Nuance sees its technology in three categories: conversational AI, which mimics human conversation; human-assisted AI, which adds humans in the loop; and cognitive AI, for knowledge, targeting, prediction, learning, classification, sentiment, and analytics features. Depending on the customer need, it will bring into play one or all three of these capabilities.

The IE technology stack is built with a microservices architecture (see Figure 10). At the bottom is the ML layer that exploits deep learning. Above that is a cloud-native platform that can connect with any cloud, such as Azure, AWS, or private cloud, and uses microservices that can be easily updated. The next layer is a DIY facility for building speech apps, which has all the tools in one studio with design graphics, code generation, and tuning features. There is significant automation built in so that ML experts are not required to build an IVA solution.

Figure 10: Nuance conversational AI cloud-native microservices



Source: Nuance

Ovum strength and weakness assessment

Strengths

- **Advanced NLU technology:** The Nuance NLU understands multilingual speech and text, understands data and extracts valuable information, uses third-party inputs such as visual/gesture, uses context and knowledge and learns from/about a user (forming predictions), and analyzes voice characteristics and conversation/behavioral patterns to identify and validate. It uses linguistics and machine learning models to recognize meaning structure. The NLU produces a complex model that understands context. Language-specific tokenization, word stems, unigrams, bigrams, trigrams, synonyms, presence/absence of concepts, and frequency of occurrence are all exploited.
- **Advanced ML engine:** IE leverages both probabilistic (ML) and deterministic systems to obtain insights. Probabilistic systems include the Nuance Transcription Engine (NTE), which is at the core of Nuance Analytics within IE. It is a large vocabulary continuous speech

recognizer (LVCSR)-based transcription engine. This feeds rule-based categories, which reflect what the business analysts have discovered from searches.

- **Humans in the loop:** IE has seamless connection with humans. Conversations start with intelligent automation. If IE gets stuck or doesn't know the answer, it can ask for help from a live contact center agent who then selects the correct intent so the IVA can continue. If the answer is not available or the customer requires a human touch for upsell or customer satisfaction, the IVA can seamlessly escalate to a contact center agent, using the understood context to prioritize and route to the human agent with the best skill set. Once the agent takes over, the IVA continues to assist the live agent by delivering recommendations, fraud indicators, and next best action suggestions. The insights from these interactions are then evaluated to make IE more confident, improve the recommendations, and identify new areas for automation.

Weaknesses

- **Image and facial recognition:** Ovum believes that image and facial recognition are the next steps in the evolution of IVAs. We recommend that as a leader in the IVA space, Nuance should consider adding these interface features. Nuance does, however, partner with other security vendors to bring its customers this technology.
- **Knowledge management:** The mining of IVA logs generates a lot of information and with data mining and analytics tools creates a need for managing the knowledge gained. Nuance will integrate with a third-party knowledge management solution but could benefit from having a native capability for enterprise customers.

Oracle (Ovum recommendation: Leader)

Product: Oracle Digital Assistant (ODA). There is just one ODA all-in package, but several licensing options: ODA Pay as you go, ODA for Oracle SaaS, and ODA for Oracle SaaS – Additional Requests pack.

Availability: Oracle cloud managed service

Introduction

Oracle is very much an enterprise-focused company, so it looks at what the next engagement channel will be, whether it is internal employee-facing interfaces, consumers apps and B2B engagements, and intelligent conversation interfaces. It sees the next interface as removing the artificial ones necessary to connect with machines and moving to natural interfaces, forcing the machines to change and interact as humans do.

An enterprise example is an employee self-service IVA that performs an IT help desk function that can make appointments, read emails, and perform collaborations where the data is abstracted and pulled from multiple resources, connecting with front-end and back-end systems, on-premises, or on cloud, through an enterprise integration layer. This kind of customer service was the lowest-hanging fruit that Oracle initially focused on, and quickly saw take-up internally at Oracle for an employee-facing IT help desk.

Currently between 85% and 90% of ODA customers use it for customer service and human capital management because this is where the easiest ROI and scale opportunities exist. The other areas Oracle targets are ERP and CRM. Oracle is attracting new customers to its ODA product beyond its

existing customer base (although most large enterprises have some Oracle database, net new customers are not from that background, but instead from other parts of the business).

Oracle makes the point that just a conversation or text interface is great for many types of requests, but for documents or where images are useful, a web view gathers information far better, and ODA can integrate these channels and use them as appropriate in a conversation while maintaining context. There is an OCR capability to process images.

The technology behind ODA, especially the AI, is in-house grown with some use of open source libraries, and one acquisition, Speak.ai, which gave ODA TTS capability, and a semantic parser for enhancing NLP. Natural conversation with superlatives, negation, and verbosity can challenge NLP, and the semantic parser improves its performance. The ODA team is around 100 strong. In training ODA, it uses an ensemble of models running linguistic models and deep learning models. The latter uses complex word embedding that creates a language-independent model.

A differentiator for ODA is that a business process engine sits beneath it and is tightly integrated to perform tasks emerging from the conversation. For example, when an end user informs the ODA of a change of address, several relevant processes kick in. Oracle's ODA and business process management R&D teams are also tightly integrated because of the overlap in functions.

ODA resides on Oracle cloud, which carries the GPU compute power necessary to train and run deep neural networks. There is no on-premises version of ODA, but it is Oracle's strategy to roll out its technology stack on-premises as an Oracle cloud presence running on Oracle Exadata machines. Oracle says its customers are not requesting to run ODA on-premises, because as a cloud service it is fully managed and the many skill sets required to build and test IVA systems are all provided.

Figure 11: Oracle digital assistant and skills



Source: Oracle

Ovum strength and weakness assessment

Strengths

- **Easy to build solutions:** ODA offers a no-code "design-by-example" prototype design tool for non-developer users and fully declarative administration to build, train, test, deploy and monitor large-scale bots across channels.

- **Enterprise-ready:** Oracle can offer a secure and scalable platform on its cloud, with "government cage" data centers for the public sector. It can integrate with existing processes, routing rules, and contact center agents. Oracle also offers a large catalog of ready-built bots that support enterprise functions, including sales, customer service, HR, ERP, supply chain, and transportation. These bots are maintained by Oracle, but customers can also extend them.
- **Deep learning powered NLP:** Advanced linguistic and deep learning-based NLP models combine to perform advanced intent resolution and understanding.

Weaknesses

- **Multifactor authentication (MFA):** MFA should be a standard security feature, especially for enterprises, but Ovum believes that at least two-factor authentication should be standard everywhere and we recommend that Oracle adds this.
- **End-user feedback:** We think there should be more features out-of-box for capturing an enterprise customers' end-user feedback.
- **Data mining capabilities:** IVAs generate huge amounts of data and there is a good opportunity to mine this. We think Oracle should add more analytics capabilities.

Salesforce (Ovum recommendation: Challenger)

Product: Salesforce Einstein Bots as add-on to Service Cloud Enterprise, or Unlimited license plus Digital Engagement add-on. Einstein Bots for Chat is a freemium model with Service Cloud Unlimited Edition. Many bot sessions are included based on the number of Service Cloud unlimited edition licenses a customer has.

Availability: Salesforce Cloud SaaS

Introduction

The introduction of Einstein Bots is part of Salesforce's omnichannel digital strategy, with add-on knowledge products and productivity tools for Salesforce Service Cloud. Einstein Bots fits with the plans for greater use of automation and AI, and addresses the explosion in digital channels through which end users interact with a platform. The scenarios that Einstein has been built for include:

- **Automate common service interactions:** Quickly resolve end-user routine requests across all channels. Gathers insights for agent handoff with AI-powered chatbots Einstein Bots and Lightning Flow.
- **Assist agents with intelligence:** Use ML analytics on past cases: Einstein Case Classification and Routing, Einstein Article Recommendations (currently in pilot), Einstein Reply Recommendations (in pilot).
- **Optimize service with actionable insights:** Predictive KPIs and recommendations using deep learning: Einstein Next Best Action, Service Analytics, Einstein Discovery.

The advantages of Einstein are that it is pre-integrated into the customer's CRM data and digital channels, and the native Salesforce UI is out-of-the-box.

Einstein uses specific NLU language models that are not translated from an intermediate language (English). Using Einstein requires both knowledge of Salesforce CRM and business domain

knowledge related to the data being mined and the questions being asked. The automated nature of Einstein means that data scientists are not required to operate it.

Salesforce is researching the use of AI across three fronts: vision, language, and voice. The vision capability is relatively new in the IVA space and Salesforce sees opportunities, such as, for example, using pictures of products for marketing applications. It is one of only a few IVA vendors to offer this.

Einstein Sentiment is the sentiment analysis which classifies text as positive, negative, and neutral. Einstein Intent is part of the NLU processing to detect the intent in text. Einstein uses recurrent neural networks for these tasks (sentiment analysis and intent detection). The key differentiator with Einstein is to make it very easy to use without requiring specialist ML skills.

A benefit of the Salesforce AppExchange marketplace is that solutions built on top of Einstein can extend its functionality and be shared with the Salesforce user community. Figure 12 shows the Einstein Bots platform in the context of the wider Salesforce platform. The top shows the digital channels supported and the bottom layer shows the features built into Salesforce that support Einstein. For example, Flow is a business automation tool for manipulating data in Salesforce (Lightning Flow is a visual version of Flow).

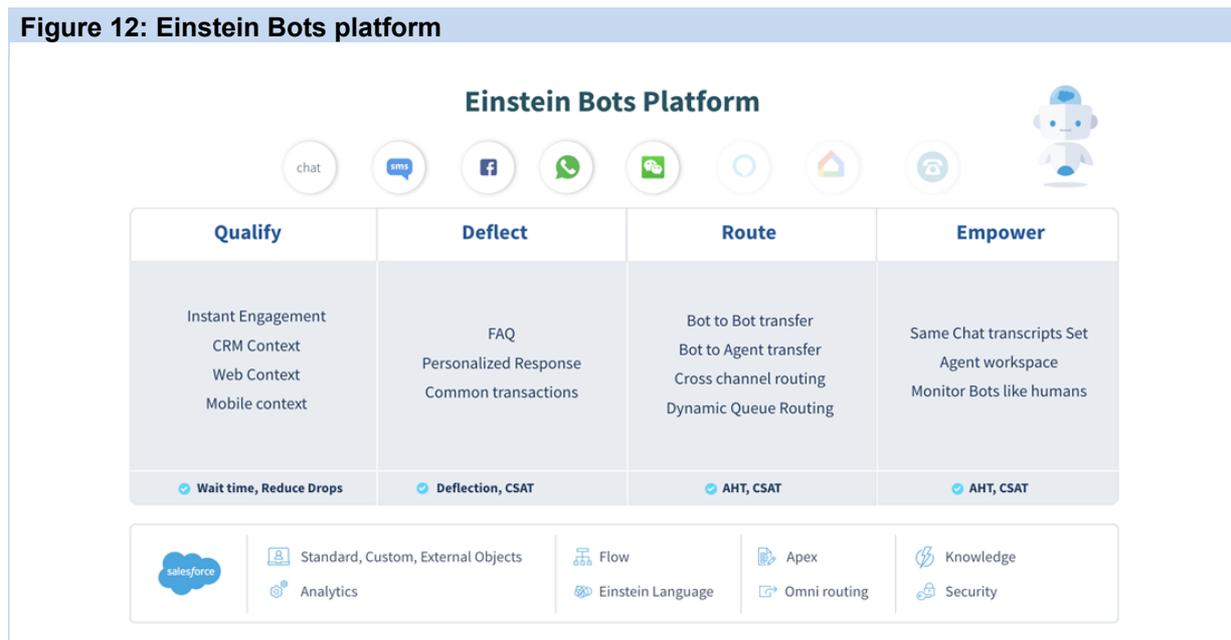
Einstein is built into and integrated with the Salesforce platform under the hood, and is a Java-based application like the rest of Salesforce.

The IVA features of the Einstein Bots are shown in the middle of Figure 12. The first step is to qualify the end user's message or query and understand the intent. Deflection then takes place to FAQ, personalized response, or common transactions, and it can route calls to a contact center across multiple channels if necessary. The fourth strand under "empower" is to work with human agents and assist their activities.

For customers that wish to use a different NLP engine, Salesforce will introduce in 2020 Einstein Bots powered by external options from Google, IBM, and Amazon. The solution is relatively new on the market and Salesforce has enhancements to Einstein on its roadmap.

The use of SIs is an important channel for Salesforce. Some 50% of its implementations are through partners such as Deloitte, and these have invested in creating pre-built IVA building blocks for their key industries.

Figure 12: Einstein Bots platform



Source: Salesforce

Ovum strength and weakness assessment

Strengths

- **Ease of use:** Einstein is designed to be used by CRM users and not data scientists. It automates the challenging aspects of working with data and it automates the AI learning that takes place, so the user can focus on the application. The end user builds the dialog screen and selects the training data and therefore needs to have the relevant business domain knowledge.
- **Salesforce integration:** It provides tight integration with the CRM platform. It has the multichannel and omnichannel capabilities of Salesforce with the development, API, and other developer-related benefits.
- **Integrated routing and agent hand-off:** Offering a close integration between agent and human agent, the bot interactions can drive dynamic routing to the appropriate agents in Salesforce and pass all context to the agent when picking up the conversation and processes in the Service Cloud console.

Weaknesses

- **Voice interface:** Einstein Bot does not offer any voice interface. Compared with leading peers this is a weakness, but this only matters if the client is looking for voice-enablement. Einstein can connect with third-party tools to offer voice using the open API.
- **Unstructured conversation flows created around an objective/goal:** Einstein Bot is more limited in its conversation flows, requiring pre-built structures compared with peer technology.
- **No data mining tools:** There are no analytics data mining tools that can be applied to conversational data. Salesforce has plans to introduce this in 2020.

SAP (Ovum recommendation: Challenger)

Product: SAP Conversational AI

Availability: SAP Cloud

Introduction

SAP's IVA technology, SAP Conversational AI (SAP CAI), originated with the January 2018 acquisition of Recast.ai, a company founded in 2015. The SAP CAI team has grown and now has 120 people in four different locations (France, Germany, India, and the US). Conversational interfaces are an increasing part of the consumer and employee experience, the two focus areas for the team behind SAP CAI. SAP CAI is native to the SAP ecosystem and provides all the tools necessary to build a complete end-to-end IVA. SAP's major use of this technology is the building of IVAs to act as a bridge between operational data, such as data that originates from sales, leads, and opportunities in the CRM, and the employee's SAP interface.

A challenge that many employees face when using company intranets (many organizations now use web-based HR systems to offer information, forms, and holidays) is that they are difficult to navigate for newcomers. An IVA can instantly take an employee to the information they require. The IVA, whether interfacing via voice or text, can be thought of in this context as an intelligent search engine. If the material being sought is not precisely enough stated, the IVA will conduct a dialog with the end user to locate the exact material. SAP SuccessFactors is an HR system that is used in these types of corporate intranets and is introducing a conversational interface built with SAP CAI for this purpose.

Frustration with difficult to use systems is not only a waste of time for the employees but also creates a bad image for the organization and is a factor when trying to retain young talent. As part of the training for such a use case, the SAP CAI can be trained on specific business terms. A large global customer of SAP will have many different instances of the SAP platform in use across different groups and lines of business (LOBs), and each of these would have a SAP CAI that is tuned to the needs of that specific group/LOB.

IVAs built with SAP CAI will integrate not only with SAP systems but also with other enterprise software in the environment, whether from third-party suppliers or built in-house, to provide a full solution. SAP sees interest in employee experience solutions across all industries, with a contrast between the casual SAP user employee and the professional SAP user employee. The former will spend little time on the intranet and the SAP IVA will be useful as a guide when they do access it. The latter will have use cases, such as migrating SAP systems, where they find the SAP IVA a useful guide to get to speed on the new system. Once employees begin to use the SAP IVA, its use begins to be sticky and used in many other scenarios. In the customer care experience case, key SAP CAI customers are in telecommunications, banking, insurance, retail, and energy suppliers, all large businesses with help desk services.

The SAP CAI bot building platform has advanced context understanding and can handle multiple intents. It weights possible answers with confidence levels and relates these to the context of a conversation. SAP finds that in building chatbot solutions, customers might fall over with their methodology. They might start with insufficient questions to be answered, when in practice end users will ask a much wider variety of questions so that customers have a learning curve to grow through in how best to build a solution. The team normally involved in building a chatbot solution comprises a bot developer/designer with skills in modeling the intents (the main role) and building the conversation flows, a business expert for reviewing the design, and a communications design expert who specializes in how SAP IVA replies and the design of the graphical UI. SAP CAI has safeguards in place to ensure that the training data is not broken during design.

For enterprise production use, customers can choose between a subscription or a pay-per-use model via the SAP extensive Cloud Platform Enterprise Agreement, which encompasses a variety of cloud and machine learning services. SAP is also planning for a marketplace, where partners and customers can publish and share content (intents, skills, bots). In parallel, SAP LOB teams are building most commonly requested skills for their LOB solutions that are planned to be shipped as standard and can be extended by customers or partners.

Ovum strength and weakness assessment

Strengths

- **Native integration with SAP platform:** SAP CAI is native in the SAP portfolio. Each SAP solution provides standard chatbots and intents that give users a head start and which they can expand and customize. Kick-off use cases are easy to build and there is a large active SAP developer community that shares knowledge.
- **Business vision:** SAP CAI is available to any SAP user for testing and basic bot-building for free. Customers can roll out in a business setting with extensive usage then step up with licensing.
- **Integration with enterprise systems:** SAP CAI is available on the SAP platform but can integrate with other systems in the environment and provide IVA capability across customer experience and employee experience scenarios.

Weaknesses

- **Data mining analytics:** We found a lack of data mining analytics tools out-of-the-box for analyzing IVA logs and performance. For example, it would be useful to mine conversations for understanding the customer (likes, dislikes), profiling, and trend detection.
- **Voice technology:** SAP CAI relies on third parties such as Amazon Alexa or Google Dialogflow to supply the voice capability. This feature could be important for contact center agents who prefer to use voice over text.
- **Facial and image recognition:** SAP CAI currently has no facial or image recognition. While these features might not be a priority in most use cases today, as IVAs become more commonly used, these features will become differentiators.

Verint (Ovum recommendation: Leader)

Product: Verint Intelligent Virtual Assistant (Next IT Alme v6.0), comprising: Alme Intelligent Virtual Assistant, Alme Enterprise Assistant, Alme Starter Bundle, Alme Platform, Cue AI, Prompt AI, Trace AI, Author AI, Alme Reports, ActiveLab, AI Blueprint, and Alme Voice.

Availability: Cloud, hybrid cloud, managed services, and on-premises.

Introduction

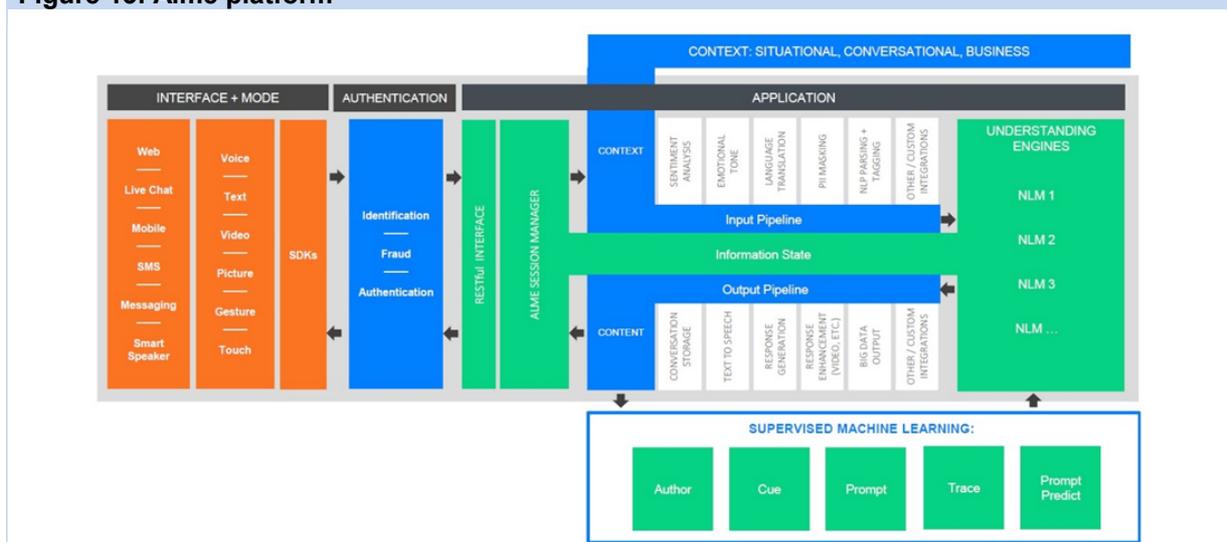
Verint Systems is a Melville, New York-based analytics company founded in 1994. It is listed on Nasdaq, and acquired Next IT in 2017, which sits in its intelligent self-service, customer engagement portfolio that covers voice self-service, knowledge management, IVA, conversational AI, and behavioral fraud. Next IT is one of six acquisitions Verint has made in its self-service coverage (Next IT, VoiceVault, Contact Solutions, SmartCare, Telligent, and Kana) and the company is integrating these acquisitions into a cohesive offering. Verint has a global presence with 55 offices and has customers in 180 countries.

Next IT started out in 2002 with a contract for the US Department of Defence, emulating human conversations in internet relay chat (IRC) chatrooms to catch bad guys. From this beginning, the company took its technology commercial in 2006, developing its first IVA, Sgt. Star, for use by the US Army web site (goarmy.com) in support of recruitment (still in use today), as well as adding a female IVA in 2019 called First Lt Stripe for recruiting women. This initiated NLU innovation to support dialects and slang, because, for example, in chat, using numbers for letters in words (numeronyms) can be challenging for NLP. It performed the job that previously took 65 recruiters. Next IT further expanded into various sectors. Today it is strongest in financial services, healthcare, and telecommunications. These customers have varying needs and complexities, and Next IT says its success is due to not being one-size-fits-all. Another factor is that it can work well in highly regulated industries where the IVA must conform to certain standards.

A key differentiator is its language model, which uses a real-world, subject matter expert-validated data library containing 750,000 unique terms, more than 1.6 million user intent patterns (amassed over the past two decades working across 11 different industries and hundreds of use cases), 90,000 business intents, and 165 unique actions that an IVA can perform. This wealth of data improves the time to market in deploying a new customer IVA solution. Next IT tools suite is designed to support the business user, so customers only need to be expert in their business domain. Next IT also has an advanced integration platform that is modular and facilitates connections with back-end systems. Customers can vary in the degree to which they are active in building an IVA, and in how much of the daily monitoring they perform when the IVAs are rolled out. Training customers to work with IVAs can therefore vary from hours to weeks. First engagements can take longer, because the customer has to learn about the different configurations.

An interesting customer case was when Next IT deployed a supervisor IVA and customer-facing IVA on the same NLU with tailored responses to help improve first-contact resolution, reduce call time, and improve efficiency. This "super IVA" was acting purely internally. A challenge for another customer was that its financial traders had too much information on the multiple screens laid out in front of them and so an IVA proved useful to quickly get at information. This resulted in 98% adoption rate by the traders. The IVA integrates with 400 back-end systems, supporting more than 15,000 financial analysts and traders, and answers 27,000 questions daily. The finance house saved over \$1m in "how to" costs alone with this solution.

Figure 13: Alme platform



Source: Verint

Ovum strength and weakness assessment

Strengths

- **Technological lead:** Verint combines advanced ML techniques with its NLU/NLP semantic models to offer the advantages of both approaches. For example, it offers AI Blueprint for uncovering intent and mapping automation strategies to business goals and user needs. The Alme platform is shown in Figure 13.
- **Depth of tools and service:** Verint brings many tools such as Verint Knowledge Management suite to the table, enhancing the range of tools Verint can offer, and a voice of the customer (VOC) solution that gathers and mines enterprise customer feedback. This is coupled with a professional services arm to help deployment.
- **Modular architecture:** Alme has a modular, extensible, platform with an open API that allows for easy integration with back-end systems. Any enterprise with existing bots can use Alme's natural language model and act as an orchestration platform. Alternatively, Alme can be integrated with third-party applications or RPAs to launch actions.

Weaknesses

- **Common project database:** Keeping project and production assets in separate repositories can lead to a drift between the most recent available components and those in live production. We recommend Verint to use a single repository to avoid such gaps.
- **English is the core language:** Verint uses English as the core language for its solution and other languages are translated from/to English. This can be challenging where cultural idioms are significantly different from English. However, Verint says that when such language models go wrong, they do so consistently, and these instances can be captured and corrected.
- **Text to speech (TTS):** There is no TTS out of the box. If this is required a third-party solution would need to be integrated. Verint's preferred TTS partner is ReadSpeaker. Verint says that with IVAs there is a tendency to turn off the sound, making TTS less important.

Appendix

Vendor solution selection

Inclusion criteria

This ODM required vendors to offer an IVA platform targeting enterprises wanting to build IVA solutions, either for internal or external facing (B2C or B2B) applications. We invited the leading players to participate, able to demonstrate end-to-end conversational journey technology features. Our research has shown that AI has had a huge impact on improving the performance of virtual assistants and hence we focused on players that used AI to power their platforms.

Exclusion criteria

In general, the ODM is not designed to exhaustively cover all the players in a market but a representative set of the leading players. Ovum also invites smaller, possibly niche, vendors that have innovative solutions and are on a fast growth path. With this flexibility we consider each participant on its merits as a good fit to the ODM topic. This ODM does exclude vendor solutions that are complete out-of-the-box IVA solutions for specific use cases. The project also excludes solutions not targeting enterprises, such as consumer market virtual assistants.

Methodology

- Vendors complete a comprehensive capability questionnaire in a spreadsheet, covering the three dimensions of the ODM. The resultant matrix of responses is appropriately scored (not all questions score, for example some are purely informational, and some have higher weighting), and run through our ODM algorithm that scores and ranks the solutions.
- There is a series of comprehensive, structured briefings with all key vendors, including a demonstration where possible.
- We requested customer references and followed up with customer conversations on a selection.
- Supplemental information is obtained from vendor literature and websites and from the results of Ovum surveys.
- The report is peer reviewed by Ovum analysts.

Definition of the ODM

The ODM spans three assessment dimensions.

Technology

In this assessment dimension, Ovum analysts develop a series of features and functionality that provide differentiation between the leading solutions in the marketplace.

Market execution

In this dimension, Ovum analysts review the capability of the solution around key areas such as: enterprise fit, business vision and innovation, interoperability, language support, product roadmap, business starters, and partner ecosystem.

Market impact

The global market impact of a solution is assessed in this dimension. Market impact is a metric normalized to the market leader and is mainly based on the solution's global revenue.

Ovum ratings

- **Market leader.** This category represents the leading solutions that Ovum believes are worthy of a place on most technology selection short lists. The vendor has established a commanding market position with a product that is widely accepted as best of breed.
- **Market challenger.** The solutions in this category have a good market positioning, and the vendors are selling and marketing the product well. The products offer competitive functionality and good price-performance proposition and should be considered as part of the technology selection.
- **Market follower.** Solutions in this category are typically aimed at meeting the requirements of a narrower range of customers. As tier-1 offerings, they should be explored as part of the technology selection.

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