

ONLIM

More Knowledge For Chatbots And Voice Assistants.

Knowledge Graphs as the basis for meaningful
conversations between humans and machines.

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ABOUT ONLIM

Onlim supports companies in automating communication with customers, employees and suppliers via AI-based chatbots and voice assistants.

Customers benefit from an integrated software platform consisting of Knowledge Graphs, Conversational AI, analytics and multichannel connectors to voice assistants, telephone bots and chatbots. In addition, a multitude of already integrated data and services is available as knowledge.

Companies are accompanied from the analysis of their information, the preparation of knowledge with Knowledge Graphs, the integration of data and services, the development of Conversational AI up to the querying of knowledge through various channels and the analysis of these conversations. The broad and prominent customer base in the individual areas makes us not only a technology expert, but also a specialist for a wide variety of applications.

We build on existing infrastructure with our platforms, provide the connection to modern communication channels and transform information into knowledge in order to make it available via human-machine communication.

Your company thus benefits from two essential steps towards innovation: the goal-oriented preparation of knowledge and the simple possibility of querying this knowledge via natural language based communication channels.

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Introduction

Conversations and knowledge are closely linked: without knowledge there are no meaningful conversations, without conversations less knowledge can be generated, and no insights can be gained. What does this mean specifically?

When speaking to you about a topic that you are unaware of, no meaningful conversation will be possible. In the absence of knowledge, you cannot answer any questions meaningfully. In the same way, voice assistants or chatbots are only as good as the underlying knowledge to which they have access to.

At the same time, every interaction between machine and human generates knowledge which needs to be structured and transferred back into so-called Knowledge Graphs. This is also referred to as supervised learning.

When two people communicate with each other, new insights often arise, meaning we learn. This knowledge is stored and can therefore flow into the next conversation. The same happens when new services are integrated into a Knowledge Graph or new links and context are added to individual data sets. But let us first look at the basics.

This differentiates data from knowledge

DATA are raw facts in the shape of text, pictures, or videos, which need to be interpreted by the user (e.g. text in documents, a directory of pictures and videos).

INFORMATION is structured facts, which are already categorized (e.g. events have a date, a place, and a performer) and are therefore more accessible to the user.

KNOWLEDGE on the other hand offers the opportunity to give concrete answers or solve problems, since the context and meaning of the information are known conclusions can be made or algorithms applied.

This makes knowledge much more valuable than information.

The DIKW (Data Information Knowledge Wisdom) Pyramid, as described by IBM in the article "From data to knowledge"¹, is suitable for representing these individual levels and their transition.

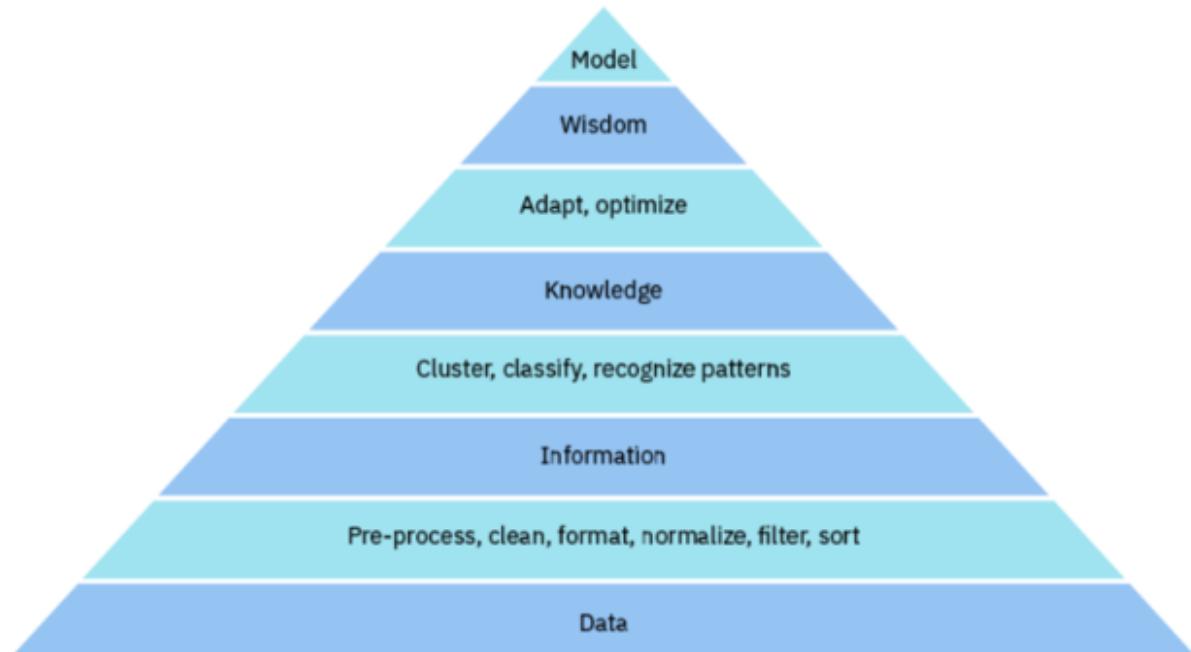


Illustration 1: DIKW (Data Information Knowledge Wisdom) Model from Russell Ackoff (1989)
applied to modern data science

Knowledge is described in Knowledge Graphs in the shape of knots and edges. Data lakes, data warehouses, or data hubs, can also structure information and provide metadata and semantic information by using data governance, data catalogues, or descriptions such as [schema.org](#).

However, only Knowledge Graphs offer the possibility to dynamically and quickly create new links and context between different types of information.²

While data lakes and data warehouses are used to evaluate and analyze data³

for classic Business Intelligence (BI) projects, Knowledge Graphs are amongst other things the ideal basis for Conversational AI.

Conversational AI is the query of knowledge in natural language, either through voice assistants or in the form of text. Knowledge Graphs represent the next generation of data lakes or data hubs.

"Knowledge Graphs represent the next generation of data lakes or data hubs."

The following image shows the exemplary modelling of a Knowledge Graph.

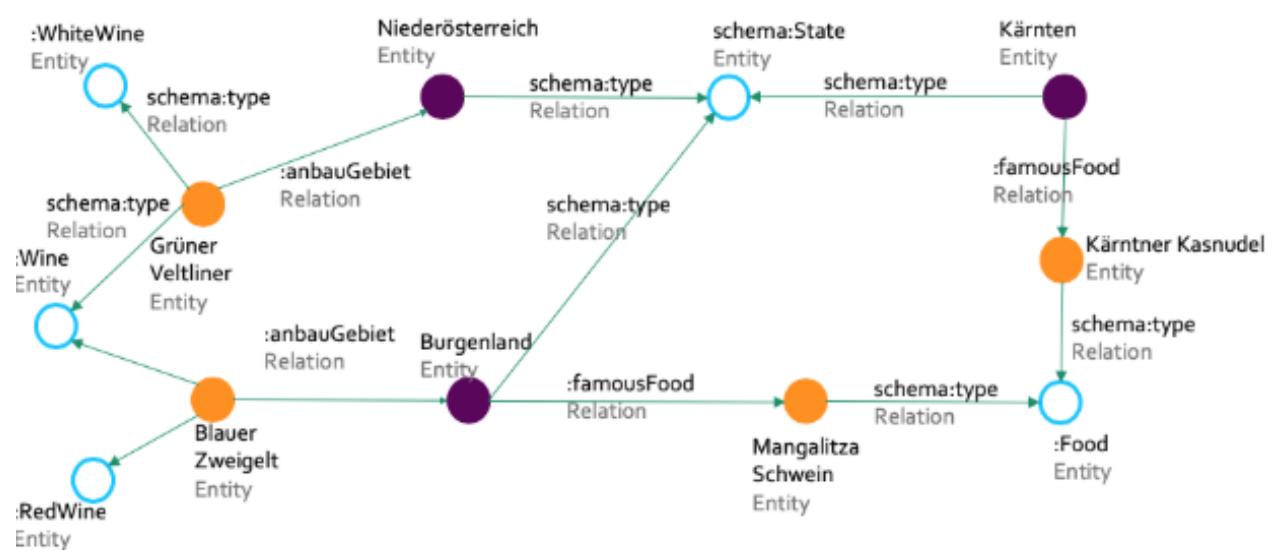


Illustration 2: Example of a Knowledge Graph showing how products (drinks, food) are modeled in relation to their origin



What can we do with this insight?

Nowadays, most companies possess vast amounts of data and information, which should ideally be converted into knowledge at the push of a button.

Questions that arise from customers regarding products, service times, availability, invoices, prices, etc. or from colleagues regarding financial data, product data, regulations and more often remain unanswered and have to be evaluated afterwards using painful research methods and other applications for data evaluation.

The answers to all these questions usually serve as a decision basis for product purchases, strategic decisions or other procedures, which all have economic and risky implications.

If this knowledge were represented in a Knowledge Graph and was retrievable via natural language, this would save everyone involved a lot of time and work and could open up new potential.

Why we cannot just turn all information into Knowledge Graphs

If this was so easy, all the Googles and Amazons and Microsofts in the world would have already done it for us.

These companies do have one thing in common though: They already built their knowledge on Knowledge Graphs.

Google uses the competitive edge of its search engine data to generate knowledge, process data, and to create connections including context.

Microsoft has already implemented conversational functions based on their Knowledge Graph in the newest Office 365 Version.⁴

Since not all data is publicly available or very specific to a company, it is up to the companies and organizations to process their data, convert it into knowledge and make it available in private or public communication or marketing channels

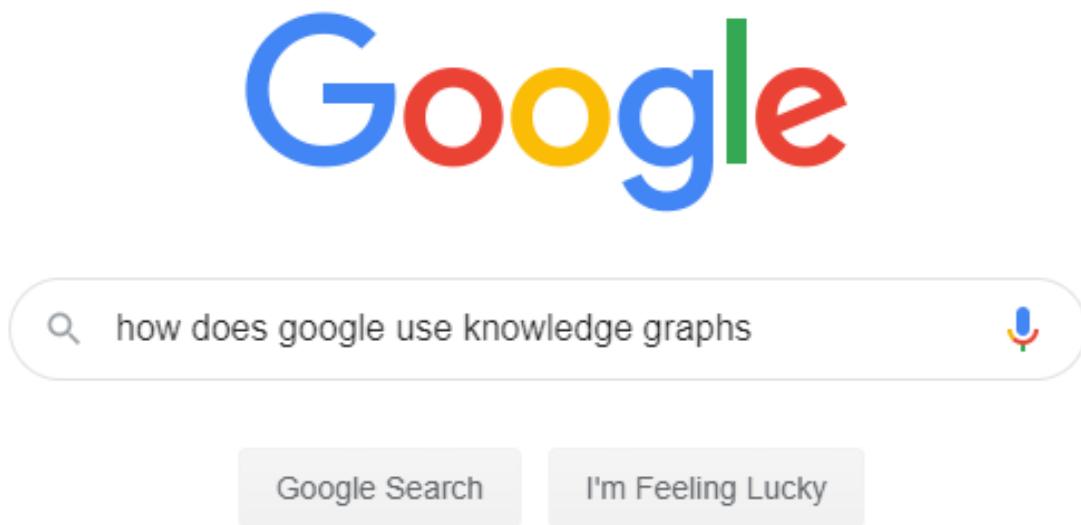


Illustration 3: Google



Knowledge Graphs and their importance for companies

Are data lakes, data warehouses, and data hub projects a thing of the past?

Partially. Let's start with the general objective.

Every company has to ask themselves: What do I want to achieve with my data? What is the value of my data? Do we digitalize in order to create archives?

Or do we provide knowledge to support us with decision making in many situations or even just to get one correct answer to a specific question for solving a problem?

According to IBM⁵, data is valuable if:

- it is immediately available
- it is precise, well organized, and relevant
- it contains meaning (semantics) and experience-based context
- sources are aggregated from different data.

Summarized: Data is valuable if it reduces the amount of time, effort, and resources needed to solve problems or make good decisions.

This is exactly what we achieve with the combination of Knowledge Graphs and Conversation AI!



Illustration 4: Schematic description of the relationship between Knowledge Graph and dialogues

In order to work in a goal-oriented way, we must control the creation of knowledge by merging a BOTTOM-UP and TOP-DOWN APPROACH.

Specifically, this means building on existing data, but at the same time defining goals that should be achieved with knowledge generation ("Which knowledge do we actually want to generate?").

Here's a recipe:

1. Top-down:

Convert existing data processed as information that is structured and available in data lakes, data warehouses, and data hub projects into Knowledge Graphs with unified models.

This can be done by so-called mappings, which define the transition from the old to the new model. Further details about the knowledge creation and the knowledge hosting processes can also be taken from Fensel et al. 2020.⁶

2. Top-down:

In case that there are already evaluations and insights from data analytics and business intelligence projects, they can be utilized for the derivation of data relevance, description of application scenarios and therefore the prioritization in the development of the Knowledge Graph and the corresponding knowledge curation, as well as knowledge deployment.

Knowledge curation refers to the different methods used for the refinement of data and therefore the creation of knowledge. Knowledge deployment on the other hand defines the applications and algorithms for the concrete problem solving of requests. For details see Fensel et al. 2020.

3. Bottom-up:

If there are no indications for use cases and relevant data available from historical analyses, they must be developed through interviews with specialist departments based on their know-how.

This knowledge and the need to digitize such knowledge is always there. Top-down and bottom-up approaches are of course combinable.

4. Bottom-up:

Collect data and expand the Knowledge Graph with insights from respective applications. Relevant applications are for instance chatbots or voice assistants, since conversations offer data about the needs of users which directly flow into the development of the Knowledge Graph.

Even if chatbots or voice assistants do not yet deliver the desired results, they produce valuable data sets for building up the knowledge and thus the relevance of the data.



Use Cases

To be a little more specific, use cases from different industries are now described.

Some of the examples given have already been implemented, others serve as sources of ideas and better understanding for the respective experts.



Tourism

Tourism was an early industry to deal with innovations in the sector of digitalization and the internet.

The Virtual Tourist used to be a popular website in the early phase of the internet, which showed tourist destinations as a map with pictures and descriptions. First booking systems, i.e. e-commerce systems were implemented for hotel bookings. Additionally, the transmission of live pictures via webcams was a great innovation.

Tourist information merged with citizen information in many places, since opening hours of restaurants and cultural offers are relevant for all target groups.

A lot of tourist information is provided by public organizations on websites, which then predestines Google to be the first address for finding information such as addresses, opening hours, events, etc. Bookings have been taken over by large booking portals in many places.

Nevertheless, there is a lot of knowledge in tourism that has not been processed yet and therefore entails a lot of research effort for guests.

One of the main challenges in tourism is to link local, up-to-date knowledge with existing data and to make it available through relevant channels.

Avalanche forecast

During winter there is often a high risk of avalanches in various regions. Ski touring and free riding enjoy increased popularity. Despite warnings and detailed forecasts, there are regular avalanches where people get buried.

A connection of regional avalanche forecasts with the geography of slopes (location, incline etc.) including historical local data would deliver very clear localized forecasts.

At least the machine would make the right decisions - whether all people do the same depends on their wisdom, meaning that questions of liability must be transferred to the user in this context. (Use case is to be coordinated with experts, but represents the connection between data and knowledge very well).

Hiking

Hiking is one of the most popular leisure activities. There is already a good data pool of tour descriptions that is available via natural language if they are part of a Knowledge Graph, e.g.: "I am looking for a hiking tour within a 10 km radius of Vienna that takes maximum 2h".

A frequently asked, relevant question is whether there are refreshment possibilities on the way and whether they are open. This means that a link of refreshment services with the hiking tours and the current opening hours provides relevant knowledge for all hikers. Chatbots also show that these are popular requests.

In addition, it also shows that connections with public traffic data make sense, since the start and end point of the hike are not always identical and therefore transport is necessary. Of course, you want to know in advance whether you may have to take an expensive taxi ride or whether there are public buses with adequate operation times.

Vacations

Vacations are often booked spontaneously and depend on data such as hotel offers, weather conditions, snow situation, traffic, available event tickets, wellness offers, etc.

Quick access to this knowledge can affect that decision and lead to new guests. These queries require contextual knowledge and are therefore predestined for the use of Knowledge Graphs.

Through the analysis of queries, the context and the offers, as well as the knowledge itself can be continually extended.

Events

A combination of cuisine and tourist attractions or events is important knowledge for many guests on-site or when planning their vacation

In regard to tourist attractions, tickets and prices, waiting times and opening hours are most important, whereas for restaurants, the type of cuisine and table reservations are the center of attention.

Often, the connection with local offers makes sense. The management and expansion of knowledge can then again take place dynamically.

Context-based search

The search for e.g. restaurants allows for a dynamic dialogue management according to existing selection criteria. This way, contextual questions such as "a la carte" or "Italian dining" can be done based on existing data.

This cannot only be used for search, but also for recommendations. A concrete restaurant nearby can for example be recommended after a sport activity. Context-based search can be applied to all data.

In tourism, there are many possible uses for the preparation of knowledge and the implementation of Knowledge Graphs, as well as for the provision of knowledge via voice assistants and chatbots.

They all just depend on the nature of the offer. The detailed knowledge of tourism experts in combination with data analysis from conversations or BI projects will provide further information about the relevant topics.

The cooperation between private service providers, touristic businesses, and local and national organizations are also relevant.

Good team work between all of them allows for an ideal processing of knowledge. While the service providers offer technology and services, which are then used by touristic businesses, we see the role of local and national organizations in the processing of data. And Knowledge Graphs enable the linking of national and local knowledge.



Energy

Given the energy transition and the increasing importance of developments such as climate change, electromobility, green energy, etc., energy companies gain an increasing significance as knowledge carriers and service providers.

Topics such as registration /cancellation

of electricity and questions about invoices are currently still the most dominant queries. However, the range of topics constantly expands, especially with innovations such as the smart meter or photovoltaics.

Here are some examples:

Customer service

Customer service requests are a high cost factor for every sector. In the energy sector, a lot of questions about registration/cancellation, energy/gas, district heating, invoices, but also malfunctions, products and tariffs are asked repetitively. Due to the range of products and services, these questions can already contain thousands of questions to be modeled as knowledge.

If the individual user is known these inquiries can be linked to services and thus provide specific information about invoices, balances or malfunctions, or also perform specific tasks such as changing bank accounts and so on.

Knowledge Graphs may also contain algorithms that can answer questions such as "What is the average energy consumption of a 100m² apartment?" In that case, the current energy tariff and the size of the apartment are dynamic parameters.

The combination with a smart meter offers further application scenarios. For instance, data from the smart meter can be directly retrieved via chatbot or voice assistant. The transition of households to smart meters will likely lead to an increase of customer service effort, especially with questions about privacy etc. In regions that still manually read the electricity meters, a phone assistant can support the reading process.

Electromobility

The transition to electromobility represents a huge change for many. The decision for electromobility is very often connected with many cross-company knowledge questions.

While built-in applications support the loading logistics in the operative sector, there is little information available about connections, loading stations, electricity tariffs of loading stations and many other things in advance.

Questions, such as "How long does Model X take to charge at my closest loading station?", "How much does it cost?", are very hard to answer. If the loading station is part of a hotel, additional parking fees need to be researched.

Well-prepared knowledge on these topics provides leads for all companies involved and supports the introduction of electromobility through to CO2-neutral mobility.

Green energy

Questions about green energy, but also about the possibilities of photovoltaic systems will increase with a higher environmental awareness.

Well-prepared knowledge is therefore relevant. It is not just a matter of providing specific product knowledge and linking specialist companies that can carry out appropriate installations with products, but also of preparing general questions on the topics.

The energy supplier thus becomes a source of knowledge, which in turn promotes customer loyalty.

Internal knowledge

Due to the complexity of tasks and their technology, energy companies have extensive internal knowledge, which needs to be processed and made available for employees.



Retail

Brands and retailers are especially affected by future changes in digitalization.

On the one hand, it is about positioning the brand in the increasingly complex digital marketing systems, on the other hand, based on the new channels, customers have to be offered an optimal shopping experience that leads to new

sales and satisfied customers.

Therefore, retailers in particular have to deal with new technologies such as voice assistants or chatbots in order to collect data and first experiences with their use at an early stage.

In retail, we see three relevant areas:

Customer service

Customer Service chatbots are starting to become the norm for e-commerce providers. Many providers are first offering the possibility to get in touch via live chat. Some providers have already integrated chatbots that automatically offer information on different customer requests such as returned goods, delivery logistics, damaged goods, missing parts etc. Product manuals are also a big topic.

Well-prepared knowledge serves two purposes: firstly, there are quick answers that satisfy the customer, secondly, upsellings and other product recommendations can be made. Queries can be personalized by linking to the e-commerce account. This enables the checking of specific tasks, such as delivery time or availability, but also the submission of personalized offers.

Active chatbots in the retail sector are very popular; natural language based communication is primarily used for product searches.

RETAIL

Product search

The connection of e-commerce systems with Knowledge Graphs leads to new possibilities in product search.

It offers a better understanding of the data and thus new possibilities for interaction for the user. Inquiries such as "Recommend me brown high heels in size 38, which cost a maximum of € 100" can be answered without any problems, since the specific assignment is made in advance by the structure of the Knowledge Graph. Thus better results can be delivered.

Customers are increasingly asking for recommendations. Through dialogues and good underlying data material, these recommendations can be mapped with the quality of a good salesperson.

The Knowledge Graph can be expanded continuously and thus provide product recommendations or context-related data on manufacturers, materials, etc. By analyzing the conversations, customer interests can be identified and this knowledge continuously be built up.

RETAIL

Multi-channel presence

It is essential for retailers to be present in the various voice assistance and messaging channels as early as possible.

It is not just about brand protection, but above all to promote brand awareness and adoption by offering customers contact possibilities on all relevant platforms.

It is important here that the customer is given the opportunity to conduct initial dialogues on these channels, which are continuously expanded with knowledge and services.

For the sake of completeness, it shall be mentioned that this list of use cases and sectors could be endlessly extended.

Knowledge Graphs and Conversational AI are also used in the FINANCIAL SECTOR (service requests, product search, internal knowledge), EDUCATIONAL SECTOR – schools, universities (search for studies, questions about admission exams, etc.), HR-SECTOR (information about employees,

applications), INSURANCE SECTOR (service requests, product search, internal knowledge), HEALTH SECTOR (service requests, therapy, care information) and so on.

The problems to be solved are usually identical for all companies. The differences lie in the processed knowledge and the dialogues that need to be conducted.

Conclusion

Those who trust in the future of voice assistants and chatbots (all forecasts point to this) will sooner or later have to deal with the processing of knowledge for these systems.

When websites and search engines offer a variety of choices, it is in the nature of communication, no matter if between humans or human and machine, that we expect specific answers or at least correct contextual questions for the continuation of the conversation.

This in turn means that we have to generate knowledge from information. Knowledge Graphs are the right tool for this. They describe the value and relevance of the data based on meaning and context from different insights and apply algorithms based on that.

Knowledge now represents the next level in the digitization process so that the value of data can be determined and knowledge made accessible as easily as possible.

Conversational AI enables the access to knowledge with natural language

queries (text, voice), just like with the symbiosis (in the biological sense) of Knowledge Graphs and Conversational AI.

This whitepaper provides an overview of the different levels of data preparation and, above all, the difference between knowledge and information. At the same time, we describe what a practical approach for the realization of projects and the implementation of Knowledge Graph and Conversational AI projects look like.

Companies and organizations have new opportunities to make their data available in the form of knowledge for automated communication!

The conclusions in this whitepaper are a result of many discussions with colleagues, partners, and customers. A special thanks goes to my colleagues: Ioan, Jürgen, Marc, Filip, Cornelius, Eckart. Our advisors: Dieter, Ramtin, Jürgen, but also our partner and investor feratel and especially Markus, Ferdinand, Martin & Thomas.

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Let us help you automate your customer communication!

Is Onlim right for your business?

Onlim is a pioneer in Conversational AI solutions in the DACH region and works on joint research projects with the University of Innsbruck to provide state-of-the-art technology. With over 60 successfully implemented chatbot projects, major companies trust Onlim with the support and guidance through every stage of their chatbot projects and the implementation of effective chatbots and voice assistants that don't require any additional integrations.

What is the next step?

We want to learn more about your business and the challenges you are facing. Together we can determine if our chatbot and voice assistant solution is the right choice for your business.



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Request a free and non-binding online consultation right here or call us at +43 1 997 44 31 in order to get an immediate response.

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