

Tech Focus

What is NLI?

Synopsis

Natural Language Interaction (NLI) technology allows people to communicate with any connected devices, and use them to perform tangible, helpful actions and functions. NLI is changing the way people use their mobile and other online devices, as it provides an intuitive and natural way to use speech or text to directly communicate with technology. This Tech Focus document explains how NLI works and how the complex principles behind it can be distilled into accessible and usable technology for consumers everywhere. [READ ON...](#)



What is NLI?

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NLI is the next generation of natural language technology

What is NLI?

Natural Language Interaction (NLI) enables people to interact with any connected devices using their own, everyday words and language. NLI is revolutionizing how people interact with online and mobile devices providing an intuitive, natural way to communicate with technology

Sometimes also referred to as NLP (Natural Language Processing), we like to think of NLI as the next generation of natural language technology as it utilizes what are probably the most advanced natural language principles commercially available.

In a nutshell

Artificial Solutions' Teneo Interaction Engine is the 'brains' behind the NLI capability of the Teneo Platform - it accepts spoken and textual inputs, processes this input and delivers a relevant output.

After the Teneo Interaction Engine has carried out the language dependent "tokenization" of the input – that is, splitting the input into sentences and words and handling spelling errors – language conditions are applied to determine the next system action.

These language conditions are powerful rules that are used to analyze the content and structure of the input as well as its context and dialogue history. They are structured in flows, the structure of which defines the dialogue management (or behavior) which is then executed automatically by the system.

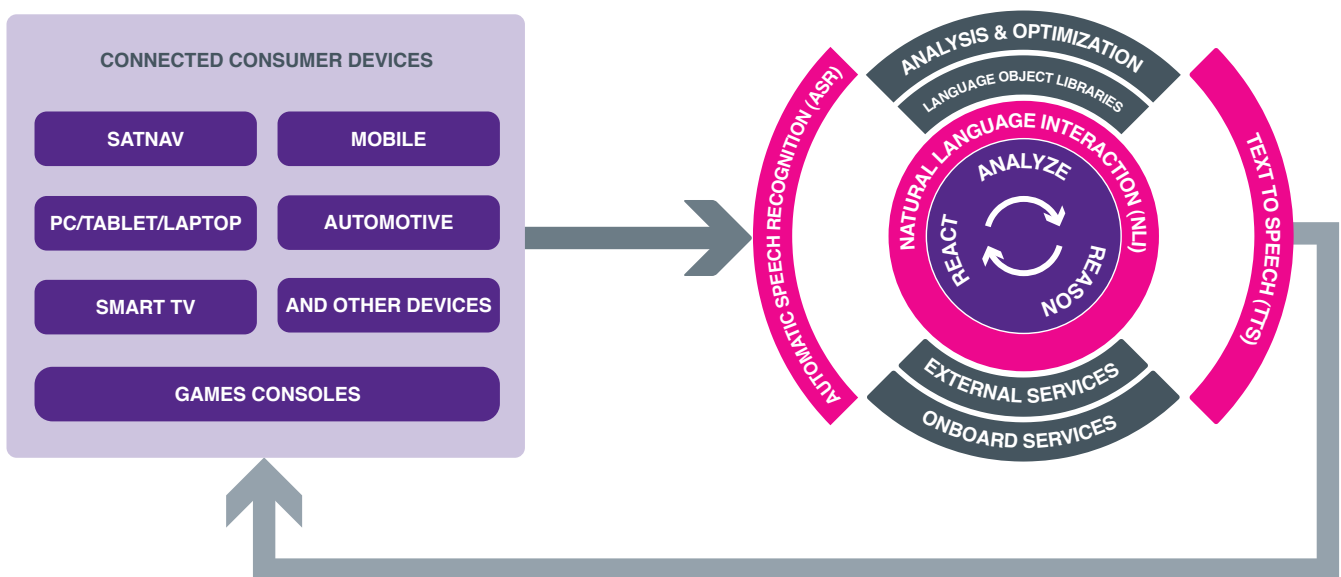
The set of flows makes a "solution" file (sometimes referred to as a knowledge base).

Teneo Studio – a powerful yet intuitive tool that puts non-technical users in charge of creating and developing NLI based solutions – combined with the modular structure of our solutions, which uses flow libraries as well as language object libraries, ensures that the creation of NLI solutions are a quick, straightforward process and can be carried out by non-linguists (and the non-developer).

How does it work?

A typical Natural Language Interaction sequence is illustrated below.

(Teneo supports a number of the Automatic Speech Recognition (ASR) and Text to Speech (TTS) technologies that are currently available, offering greater flexibility to our customers over their chosen solution.)



Analyze / NLU

The first step of the process is to use Natural Language Understanding (NLU) to understand and analyze the meaning of the words and sentences in the input.

Consider for example the sentence *"can I bring elephants on a plane."*

Now imagine what would happen if the key words in this sentence are replaced by lists of synonyms; so for example

"elephants" by a list of animals (say 1000 synonyms), *"plane"* by synonyms for aircrafts (maybe 4) and *"bring"* by equivalent verbs (4)¹.

In this scenario alone, there might be something like $1000 \times 4 \times 4 = 16000$ different combinations. So by combining these lists in an intelligent manner we are able to capture a potential 16000 sentence combinations.

1. The numbers used here are for illustrative purposes only



Teneo's language objects achieve a significantly more robust level of NLU than simple keyword matching

Moreover, we are only looking for meaningful words, hence the user may use whatever additional filler words they like, for example big/small/blue/pink/old/baby/etc without affecting the meaning of the sentence.

This technique allows us to understand a wide variety of different user inputs. Note that we neither need to list all possible inputs nor list all combinations of meaningful words. The underlying code used within our Teneo NLI solution automatically handles the multiple combinations hence the resulting code used to achieve the above is compact and easy to read.

This however is only the start. We have taken this concept much further and way beyond lists of keywords with associated meaning.

To achieve this we use **language objects** to detect the meaning of a user input. These language objects test the input for its content by looking for words and word combinations and can even exclude words by looking for special word forms, stems or particular spellings.

As a rule, the language conditions provide "robust parsing" – in other words, only what is absolutely needed to assign a certain meaning to an input is tested. This guarantees that a wide range of inputs can be correctly interpreted, even if their full syntactic/grammatical structure is highly varied (and would typically require significantly more work in a more traditional syntax/grammar representation approach used

by many other technologies).

If required, language object can be designed to follow stricter rules. For example, they can operate on overlapping or disjointed parts of the user input. They can be ordered or not. Language objects can contain other language objects. Language objects are in fact semantic classifiers, capable of representing syntax and semantic relations.

So through our **language objects** we achieve an extremely robust Natural Language Understanding (NLU), which significantly exceeds keyword matching.

Reason / Dialogue Management

However, our Teneo technology does not stop with NLU; we also need to control what happens in each conversation and to achieve this we use NLI.

Within NLI, language conditions control the responses or actions that are delivered by Teneo. A particular response is given (or more generally: the system executes an action) if - and only if - the user input, the dialogue history and the context meet the respective requirements.

For example:

- A Virtual Assistant only asks for the age of a user, if it hasn't already asked the age before.
- A question about price is assumed to relate to the product that has just been referred to in the conversation



A key element of NLI is the ability to do real things for the user

That a given action can only be performed if the conditions are completely fulfilled helps deliver a humanlike and intuitive behavior in Teneo based solutions. Within Teneo there are currently language object libraries for 21 languages, and tools that allow the rapid creation of new language object libraries, domain specific language objects and language conditions.

Language conditions are visualized in dialog flows, but this is not just a visual representation. The flow structure allows for automatic “dialog management” elements, like the resumption of abandoned tasks and the dynamic ranking of language conditions based on dialogue context.

The interaction engine is not just a simple state machine either: It can handle multiple tasks at the same

time, and it can switch between tasks and capture extra information from input (what we call listeners). The flow structure is actually a specification for how the dialogue proceeds.

React / Integration and Actions

We strongly believe that a solution that merely refers a user to a place or service where information can be found has very little value. A key element of NLI is the capability to do real things for the user. The engine has an API to execute scripts, lookup or send data through web services or to execute actions through other (on device) applications.

An essential part of the platform therefore is the integration manager. The integration manager makes it easy to hook-up pre-defined integrations to solutions and also makes it easy to define new connection to services.

[Get in touch to ask how NLI can benefit your organization](#)

Spain

Artificial Solutions Iberia, S.L.

Tel. +34 93 245 13 01

www.artificial-solutions.es

Brazil

Artificial Solutions Brazil

Tel. +55 21 7910 3637

www.artificial-solutions.com

United Kingdom

Artificial Solutions UK

Tel. +44 (0)1635 523267

www.artificial-solutions.co.uk

Denmark

Artificial Solutions Denmark

Tel. +45 8851 0286

www.artificial-solutions.dk

Benelux

Artificial Solutions BV

Tel. +31 (0)35-646 26 02

www.artificial-solutions.nl

Sweden

Artificial Solutions Scandinavia AB

Tel. +46 8 663 54 50

www.artificial-solutions.se

France

Artificial Solutions France

Tel. +33 (0)1 53 62 90 36

www.artificial-solutions.com

Norway

Artificial Solutions Norway

Tel. +46 8 663 54 50

www.artificial-solutions.com

Germany

Artificial Solutions Germany GmbH

Tel. +49 (0)40 35085-39

www.artificial-solutions.de

Japan

Interwork Corporation (via partner)

Tel. +81 (0)3 3414 0008

www.intwk.co.jp/CSO

Italy

Artificial Solutions Italy

Tel. +39 02 78 62 11 04

www.artificial-solutions.it

About Artificial Solutions

Artificial Solutions is the leading specialist in Natural Language Interaction (NLI). The company's patented technology enables people to hold two-way meaningful conversations with applications and services running on computers, mobile technology and other electronic devices in a humanlike, intelligent manner.

Typically deployed as web-based Virtual Assistants for customer service and sales, and as embedded speech-enabled applications for mobile computing, Artificial Solutions enables organizations to increase customer satisfaction and direct revenues, whilst reducing costs. Platform and device independent, Artificial Solutions' NLI technology is available in 21 languages and includes powerful analytics that deliver valuable insight into customers' needs and behavior.

With development centers in Barcelona, Hamburg, London and Stockholm and offices across Europe, Asia-Pacific and South America, Artificial Solutions' technology is deployed by hundreds of public and private sector organizations and used by millions of people every year. For more information, visit www.artificial-solutions.com
