# THE NEXT WEB

OPPORTUNITY

The most favorable time for investment in information technology is in transition period, when fundamental changes occur in computers. It is the time when architectural solutions and platforms are laid that determine the development of computing for decades to come. This is the perfect time for startups. Most of the giants of the computer industry arose precisely in such periods: Apple and Microsoft were created in the late 70s, simultaneously with the first personal computers. Amazon and Google - in the late 90s, just before the advent of the first computing clouds.
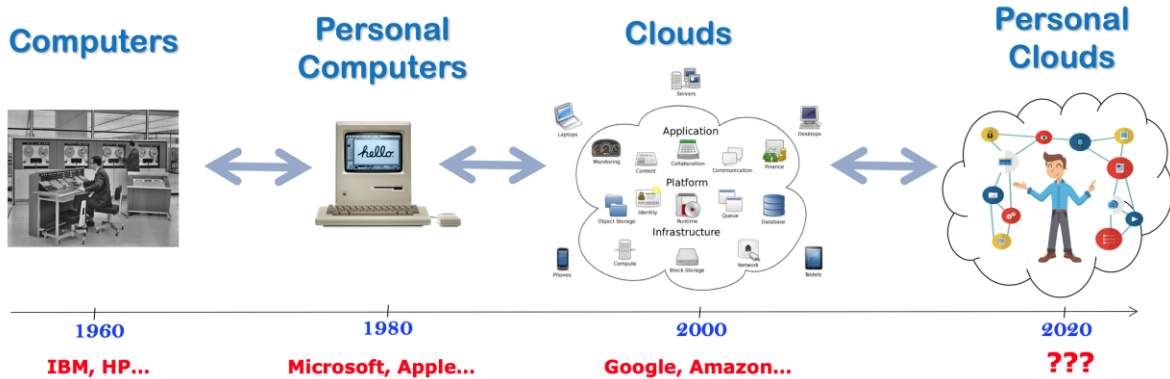
The year 2020 can be considered the starting point of a new stage in the evolution of computers. The development of information technologies in the near future will be determined by "smart" devices and various forms of communication: on the one hand, a person will be surrounded by a wide variety of personal devices, such as sensors, screens, microphones, gadgets, smartphones, etc., and on the other hand, there will be access to virtually unlimited resources in the "digital clouds". As a result, a new computing environment will appear in which artificial intelligence combines "Smart Home" and "Smart Health", "Professional Assistant" with "Personal Assistant", etc. This environment - the "Personal Cloud", will be capable of performing physical actions, communicating in a natural language, and most importantly, understanding a person. And as a result, the consumer will have the opportunity of direct communication with the producer, which is one of the key factors for individual industrial production, and telemedicine will become a routine component in the health care system.
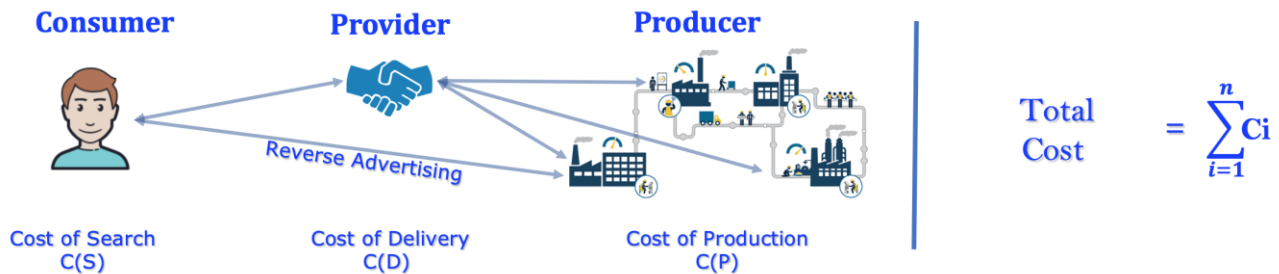
$$\text{Total Cost} = \sum_{i=1}^{n} C_i$$

The success of new solutions ultimately depends on economic advisability. One of the most important components is to minimize the total costs during the exchange between the Consumer, Producer and Intermediary in the global economic system.

In this market, fundamentally new tools will be needed to develop new components, such as, "skill factories" that will create thousands of "virtual assistants" on demand, communication infrastructure, local business support, and more.

PROBLEMS

1. **Big Web Data**. The contemporary Web is a combination of the Surface Web (data on pages) and the Deep Web (data available upon requests to internal databases). Since its inception, the complexity of the Web has been growing, and at the same time, the amount of data accumulated on pages and in databases has grown as well. When accessing the Web, end users have no need to formally understand the structure and complexity of the environment they interact with, but similarly to the library, to navigate and to gather the desired information, the user needs help of a "reference desk" and a "librarian".
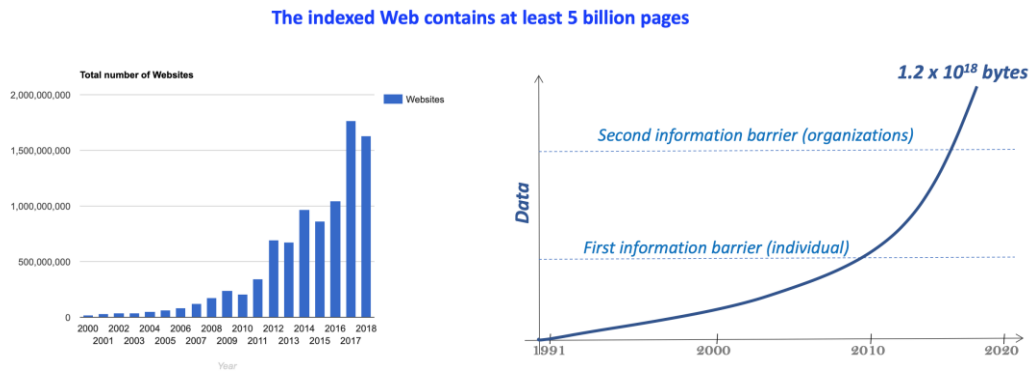
The information barrier is a threshold of complexity that exceeds the capacity of one person or any given socio-economic system

   Today it is obvious that Web is reaching the limit. About 2 billion websites contain such a huge amount of data, that universal "librarians" such as Google are becoming unable to perceive, organize and filter all these information for personal need.

2. **Big Garbage**. Another problem is related to "recommendations" and "web advertising". Most of these services "pretend" to provide free advice to the end user. In reality, they push ads and promote only those who paid more. As a result, they overload the user's capacity to perceive information with a massive stream of commercial data, which, instead of bringing useful information, delivers garbage. And the end the user gets a very distorted picture of what he/she is really looking for.
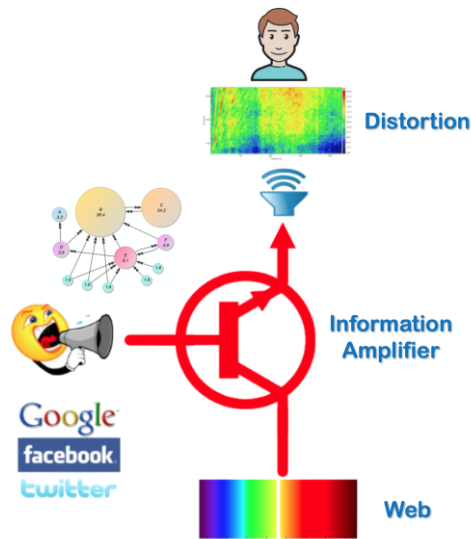
"If you're not paying for it, you're not the customer, you are the product." A. Lewis

3. **Communication Barrier**. The original Web was great for representing hypertext, but it is almost useless to govern interactions. HTML and HTTP are fundamentals of the Web and at the same time its limitation. Web servers and SQL databases use "stateless" protocols that do not preserve the context of the dialogue. So today we are trying to use essentially a static Web as interactive environment for dynamic conversations. The future Web must be conversational, interactive in nature, capable simultaneously to send and receive data in both directions.
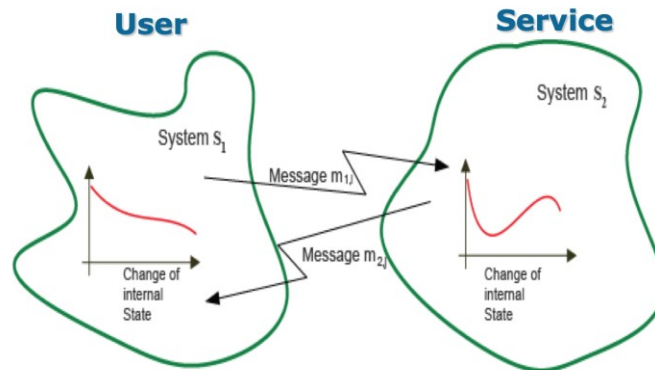

"The Telephone is the Best Metaphor for the Web" J. Nielsen

4. **Logical Barrier**. Another significant problem is a lack of effective technology for building expandable intelligent interactive systems. There is a big gap between dialogue flowcharts and NLP based recognition. Developers encode "knowledge models" with IF-THEN constructions inside a program, which makes it practically impossible to learn organically - to add or update "knowledge" without reprogramming. Recently, Apple and Amazon introduced two advanced approaches to creating "smart" extensions to Siri and Alexa. Apple proposed a solution in the form of local "conversational shortcuts with parameters" which can start from any platform devices. Amazon decided to move the conversation logic into the AWS Cloud, using lambda platform and node.js.
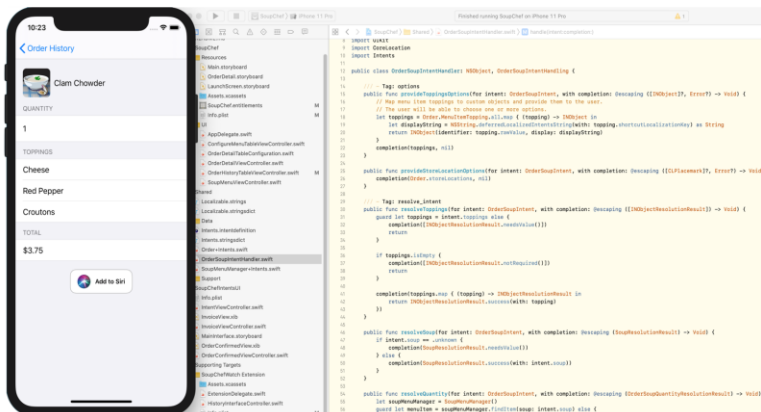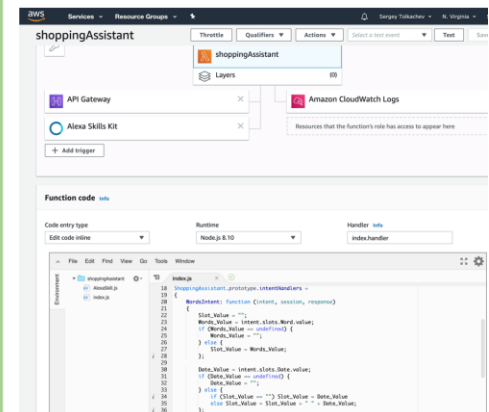
But both of these solutions are still based on complex and hard-coded logic, which programmers must reprogram each time a product's new properties or conditions are updated. Ultimately, the cost of such extensions is a fundamental barrier to scaling and widespread use.

5. **Personal Health**. Personal health data, the most important data for an individual, is now widely distributed among various sources but it is hardly available to a person as an entire aggregated medical history. Many software developers and health providers are rushing to create yet another "universal" database of health records in the clouds. For example, Israel has an advanced and centralized health system. All its hospitals use the same electronic medical records platform, with

access to patient records. *"But the difference in Israel is that the country of just 8 million people!"*.

"Ideal Health System" in Israel

- ❖ Electronic Medical Record
- ❖ Every transaction computerized
- ❖ The Central Medical Record
- ❖ Electronic laboratory results, prescriptions and consultations
- ❖ Telemedicine
- ❖ Alerts and Reminders
- ❖ Patient Website

Clearly, such centralization is unrealistic globally, considering the variety of sources, cultural and technological differences, etc. So far, all attempts to develop a "centralized" system for health data have failed to scale. But "*the structured, problem-oriented medical record provides a focus for constructive action in a variety of "trouble" areas in medicine. (L. Weed):*


Sources of Medical Data
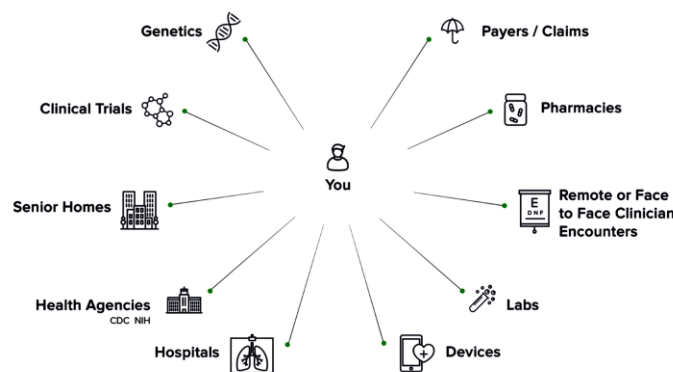
6. **Developers Stereotype.** Computers are always being perceived as a "device", but Clouds have brought us the paradigm of "deviceless", reliable and scalable services. When the concept of Clouds appeared in the early 2000s, many developers were confused with the abstraction: "Cloud is not a computer". It took some time for developers to switch from a centralized server-based architecture to the "Service on Demand" model. A similar situation is occurred today with Personal Clouds. The development of traditional "mobile applications" continue to be based on device-oriented architecture, and programmers continue to build applications for devices. But Personal Clouds has an unreliable, ever-changing, fuzzy configuration of many fundamentally different devices. It may or may not be connected to the Internet, and even more, these devices are in constant move: sometimes on-site, sometimes far away, crossing borders and cultures. The simplest configuration may contain only one smartphone, but normally, it includes dozens of interconnected devices.

SOLUTION

The disclosed architecture is based on combination of patented artificial neural network (U.S. Patent 9,305,050) and available state-of-the-art technologies: NLP, ML, asynchronous communication protocols such as WebSocket and other open-source components. The pillars of this solution are Personal Virtual Assistants and Business Virtual Representative, Library of Models, Skills Factory and Local Broadcasters:
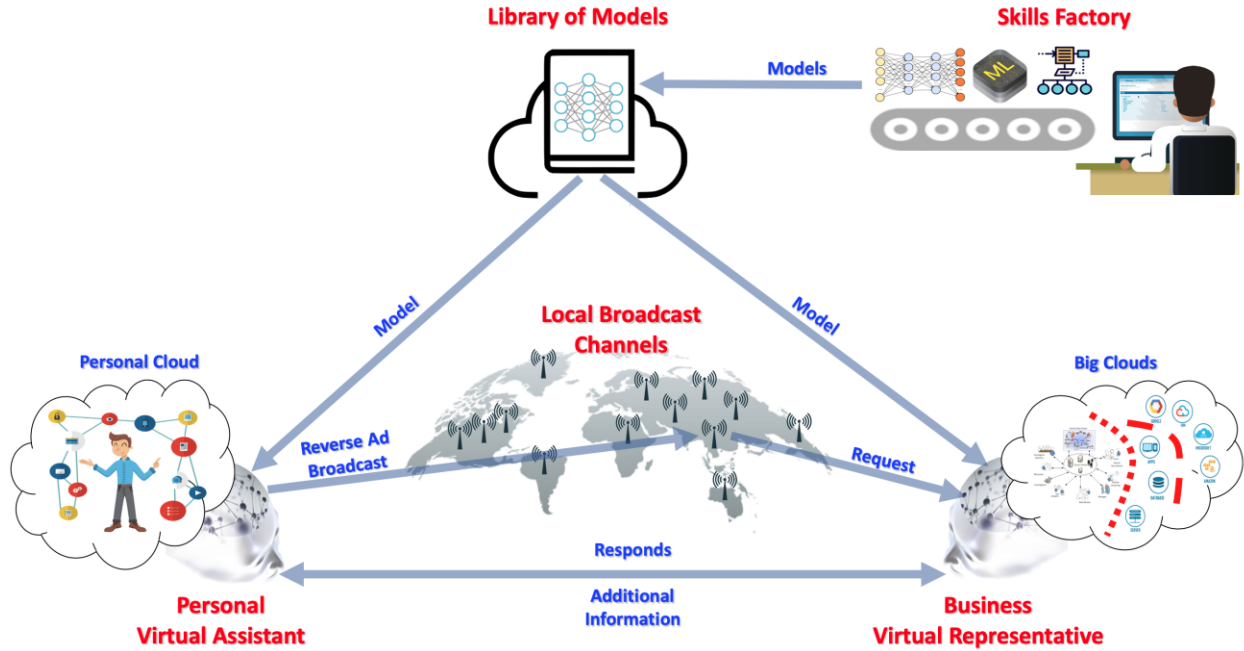
Considering that Personal Clouds may have very fuzzy configuration, the architecture supports a variety of modes: from simple assistance in stand-alone device to advanced mode, when the user can be involved in complex interaction with the internal and external agents. The Business Virtual Representative could act as chatbot addition to the website and/or respond to direct requests from another Virtuals. Example of chatbot Virtual Representative for BestBuy is available in GitHub and online demo is here.
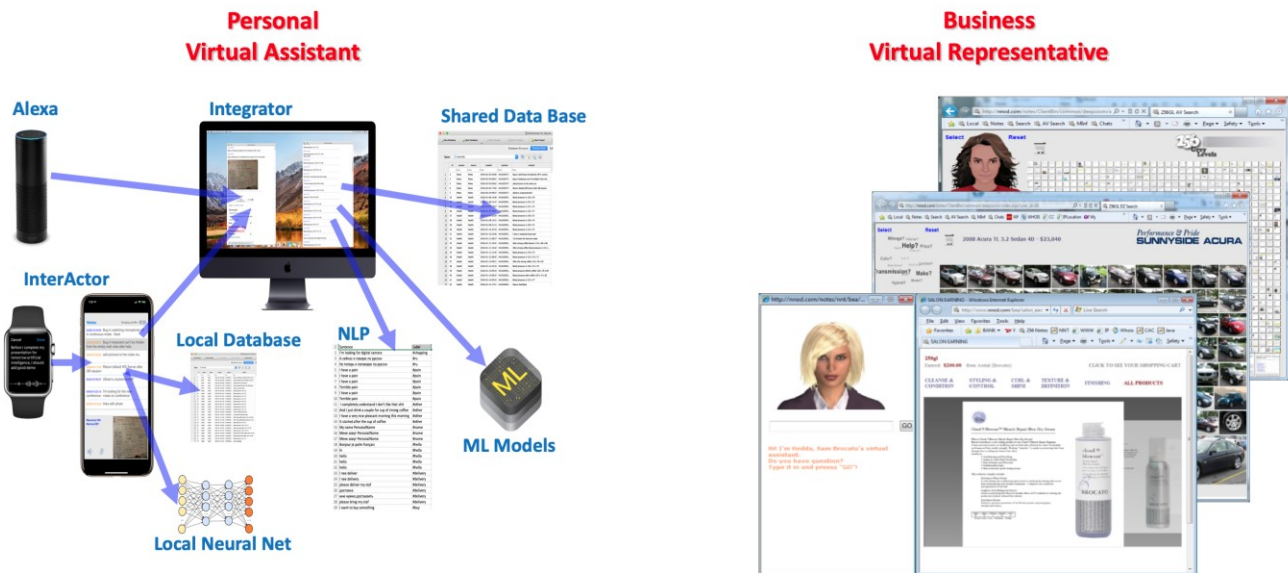
Personal Assistant is a service in the Personal Cloud which can be an application or a process, listening to the user's inputs, interpret them according to the context and invoke various functions locally or externally. It can also communicate with correspondent Virtual Representatives or other Assistants.

There is a latest version of the Personal Assistant available for iPhones – InterActor, and there is also a developer version of PA/VR skills for Alexa.

The unique property of Personal Assistant is the Personal Profile - a collection of traditional data stored in the local shared database and models - the artificial neural networks (active data), which represents the state and context of the user's particular intents. The Personal Profile, together with the library of "NN models", plays a key role in assisting the user by interpreting data, asking additional questions to eliminate uncertainty, generating requests and much more.

In stand-alone mode, Personal Assistant uses Personal Profile to help the user keep health records in a form of diary, make notes, etc. In online mode, it uses Personal Profile to crawl the Web or directly communicate with Virtual Representatives.

NN (Neural Network) Model is another important component in this solution. Each model is associated with user's intent. For example, a user has a headache, which may happen once or be recurrent. The very first time, when the user mentioned this symptom, the Personal Assistant will recognize it as an "intent" and will check if there is an available correspondent NN model in the library. If there is an available appropriate NN Model, it will be added to the Personal Profile and the conversation with the user will be started to gather information about his/her headache – location, severity and other symptoms.
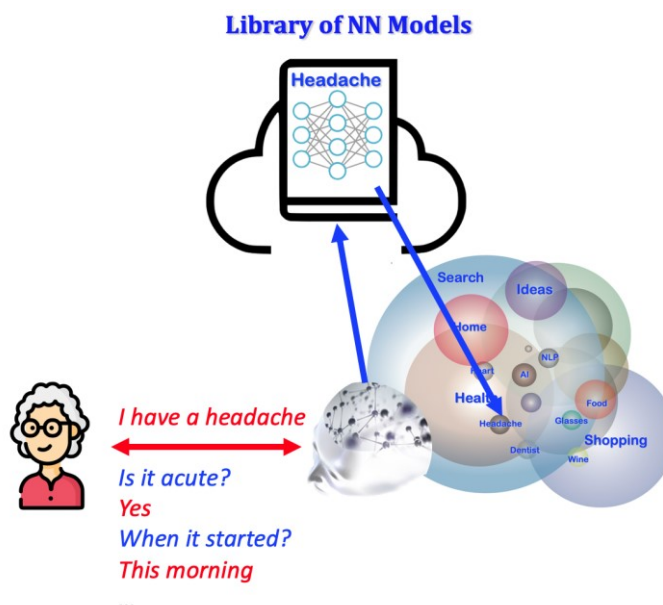
This event will be recorder in the local database and when headaches happen again, the NN model will continue the conversation having already previously collected symptoms as well as general information about the user: gender, age, etc. As a result, the Personal Assistant, using the history and specific symptoms, will come with recommendation, sometimes generic, sometimes specific, and if the set of current symptoms looks critical, the Personal Assistant will issue an alert.

In another example: the user wants to replace prescription glasses. When asked, the Personal Assistant will recognize the intent and will download NN model "Eyeglasses". This model will ask the user about type of glass, price range, prescription, etc., then will create a "purchase request" and send it to local eyeglass stores.


Layer with key context triggers
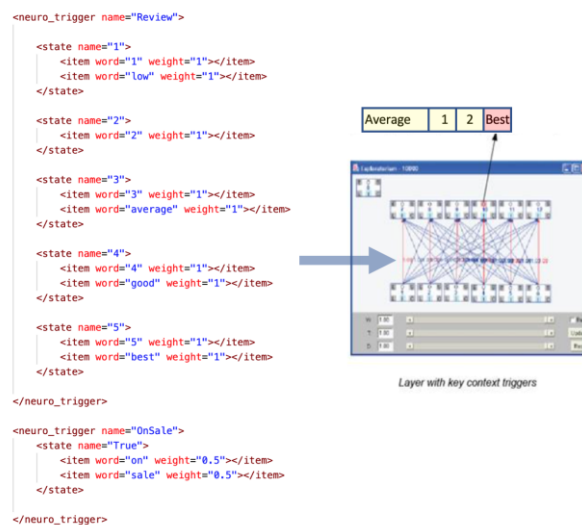
As the result of this short conversation, Personal Profile will "learn" about the user's preference and then will use this parametrical definition of intent when crawling the Web and/or if connected, sending request to Local Broadcast Channel. If some of provider's web pages have Chatbots or Virtual Representatives, the conversation with them will happen automatically, and the user will get responses from multiple sources without wasting his/her time.

There will be a great demand of Virtual Representatives for millions of local business. Our goal is to connect users with any business, small or big, which can serve the user's need. And this goal is realistic, considering that today there are about 25 million programmers in the world, most of them supports and develop Web sites. Skills Factory is a place where programmers can build skills for business around the world, specifically small local shops, stores, restaurants, etc. Our solution includes set of tools which will let programmers build a skill for specific business and also to support it with content. When a model is

created, it can be published in the library. Library is a collection of royalty based and free NN models, created by experts using NN Knowledge and Dialogue Editors.

NN Editors are authoring tool allowing to build context dependent conversational NN models and instantaneously use them in almost any programming environments.
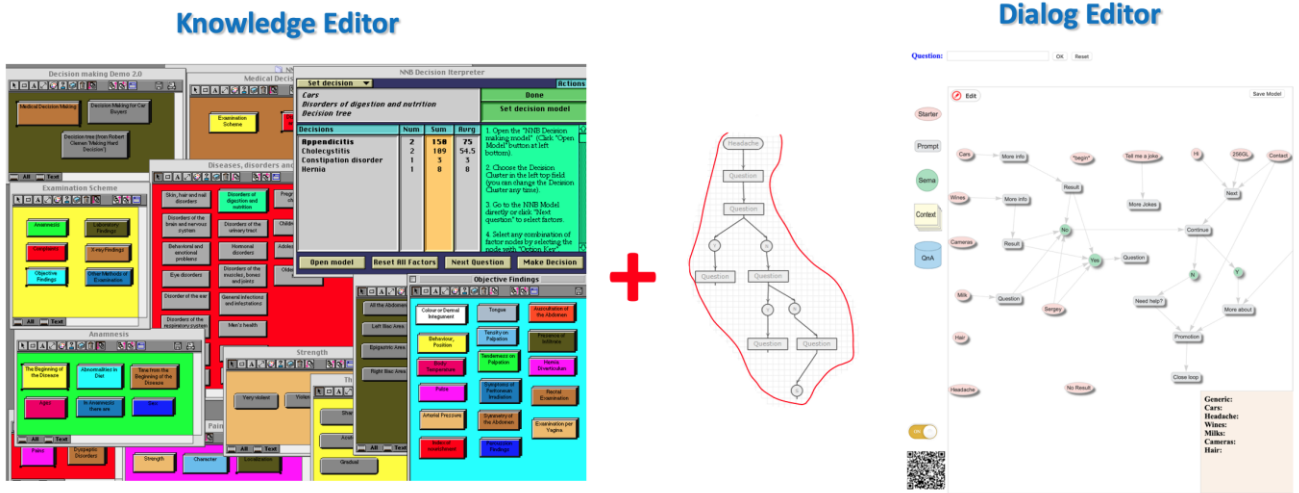
There are variety interpreters which can run NN models in Java, C#, Swift and JavaScript, which means that models can be interpreted in all major environments: Windows, iOS, MacOS and Android.

The concept of Broadcast Channel is based on the old fashion radio broadcasting, peer-to-peer connection, live chat and state of the art technologies allowing to convert voice to text almost instantaneously. There are many stations broadcasting audio, live chats, tweets, etc. We've created the model which put the user in position of broadcaster.
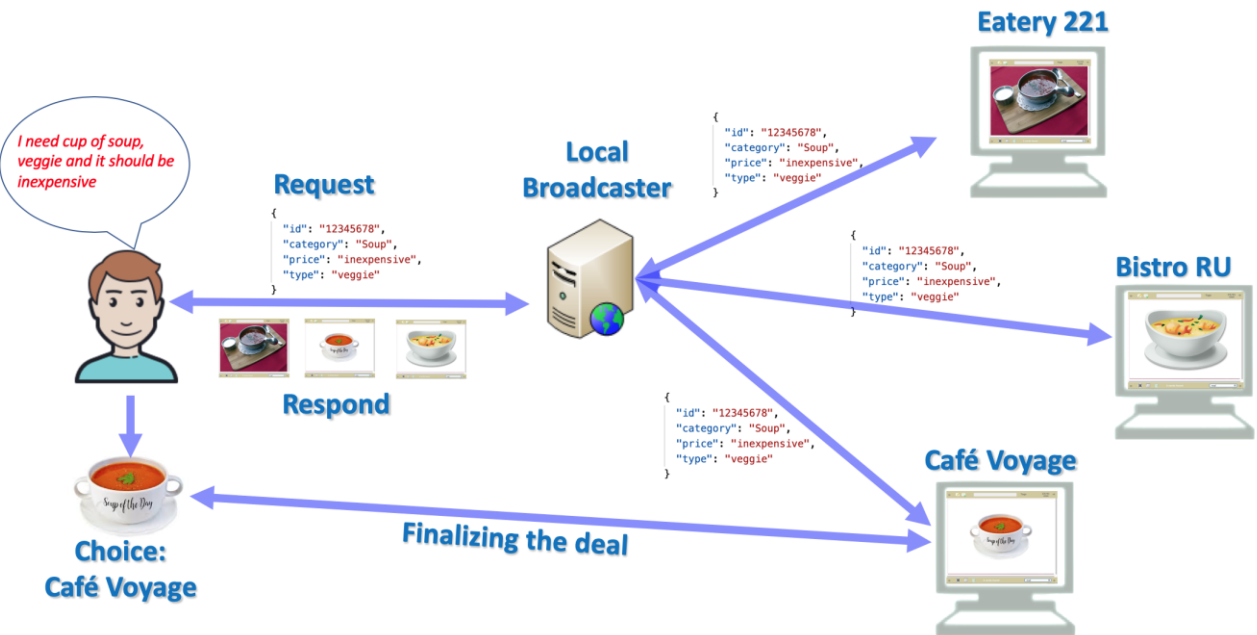
Basically, our implementation is similar to Tim Berners-Lee proposal for the WWW - the pair of language and protocol (HTML/HTTP). In his proposals HTML defines the structure of the Web page and HTTP protocol defines the communication between client and server. Our architecture is "conversational" and instead of the stateless HTTP, we use WebSocket – a high level analog of duplex

and asynchronous TCP; and instead of HTML we introduce "neural network state" as foundation for understanding of incoming messages and generating responses. Instead of HTTP cookie we introduce the "NN Cake" – a much more complete and direct definition of the user's need.

"Virtual to Virtual" model solves "information barrier" problem as well as protects user from advertising data pollution. Because Virtuals are having parallel conversations and keeps state of the dialogue the time and, accordingly, the cost of the search, significantly minimized:

$$C_s = \sum_{i=1}^{n} t_i \qquad C_p = \max(t_i)$$

$$C_s << C_p$$
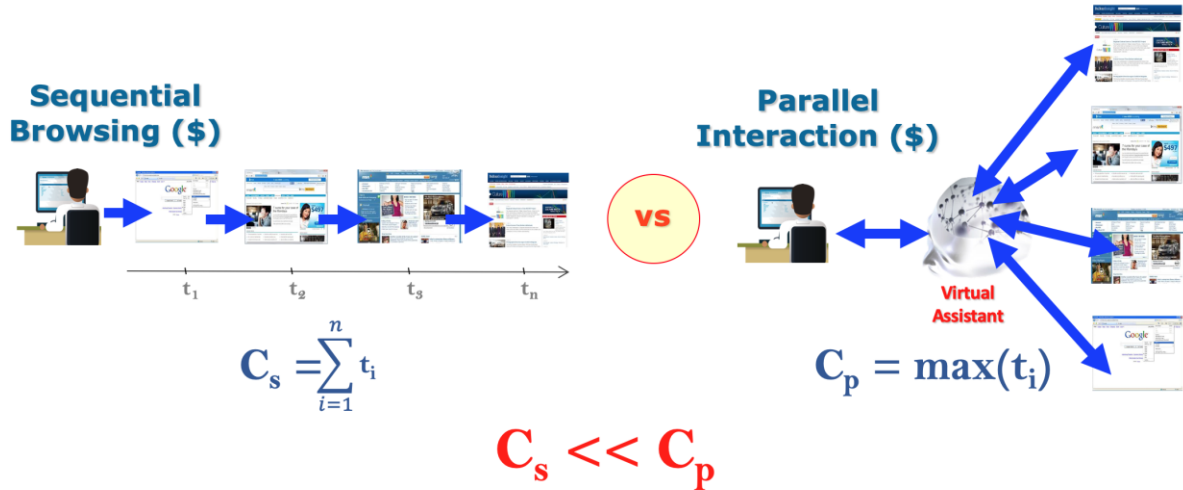
In the long-term the proposed solution can potentially solve all of the global problems mentioned above, and at the same time, provides immediate practical results, solving separate problems both at the user's level as well as for commercial enterprises.

Please let me know if you require any further information regarding the Business Plan.

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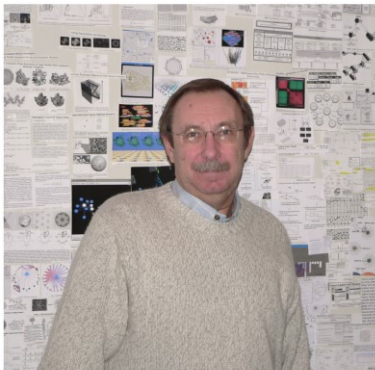
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