

# SenseChain: Sense Contracts, Sense Currency

[P-S Standard]

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## **Abstract.**

Time is the most important asset of any living person on our planet. The presence of a digital personal financial and economic environment, ***decentralized to each of its users***, would significantly change the quality and standard of living of this user.

The main unit of measurement of the value of an individual user of the environment should be the **hours (minutes)** spent by him on the execution of any sense contract.

Our international team proposes a practical implementation of such an environment using the logic of the new mathematical theory for artificial intelligence Sense Theory [1].

## **1. Introduction**

In order to give a full-fledged definition of a sense chain (sensechain), we must give a number of definitions of such key concepts as *a sense object*, *a sense set*, and, finally, *a sense contract*.

Further, when it is clear what a sense contract is, we can proceed to the definition of blocks made up of these contracts, which form the actual sensechain.

## 2. Problem

At the current time, there is no full-fledged digital economic system-network that allows to practically implement not only the business and economic activities of a single company or person, but also of the whole country.

Our modest attempt to design such a system-network is rooted in the logical postulates of Sense Theory.

Below we present the first attempt to describe such a system-network.

## 3. Solution

In [1] defines a zero object, which can have both genetic attributes (properties) and general ones:

$$O_0\{G_N, C_N\} \quad (1)$$

where

$G_N$  – set of genetic attributes,

$C_N$  – set of generic attributes,

or

$$\odot_A \quad (2)$$

where  $A$  – sense set of attributes.

**Genetic attributes** of  $O_0$  are the properties of  $O_0$  that are inherent only and only to this object.

For example, a mechanical watch may have hour, minute, and second metal hands. These properties are unique to mechanical watches.

However, they may also have digits indicating the current time, which in turn may exist in different devices or software applications. Numbers in this context act as *generic attributes*.

**1. A sense object** is a zero object  $O_S$  that has at least one attribute, either genetic or generic.

A sense object, in turn, can have another sense (zero) object having at least one attribute as a genetic or generic attribute:

$$O_S\{O_G, b_1, b_2, b_3, \dots b_n\} \quad (3)$$

where

$$O_G = O\{a_1, a_2, a_3, \dots a_n\}_G,$$

$$b_1, b_2, b_3, \dots b_n = \text{generic set.}$$

For example, an electronic watch has a number of generic attributes such as a plastic case, an electronic dial, control buttons, etc. But the main microcircuit controls all the functionality of the watch, which, in turn, consists of many micro parts: transistors, diodes, resistors, etc. So, this microcircuit will define a zero object  $O_M$  with its specific attributes:

$$O_M\{\text{transistors, diodes, resistors, ...}\} \quad (4)$$

and, in general notation:

$$O_S\{O_G, b_1, b_2, \dots, O_M\} \quad (5)$$

or

$$O_S\{O_G, b_1, b_2, \dots, \{\text{transistors, diodes, resistors, ...}\}\} \quad (6)$$

## 2. Sense Set

To formulate the sense set, let us define a number of necessary essences.

Returning to the example of an electronic watch, let us add the list of generic attributes to 5:

$$O_W\{a_1, a_2, a_3, a_4, a_5\}_N \quad (7)$$

where

$$a_1 = \text{plastic case,}$$

$$a_2 = \text{electronic dial,}$$

$$a_3 = \text{control button,}$$

$$a_4 = \text{watchband,}$$

$a_5$  – black color,

$N \in A_n$ , where  $A_n$  – set of attributes of  $n$  – th quantity.

So, if any sequence  $A_n$  of  $n$ -elements is a set of  $n$ -attributes of some sense object  $O_0$ , then the sequence  $A_n$  is called *sense sequence*:

$$O_0\{A_n\} \quad (8)$$

In a rough approximation, in terms of classical mathematics, expression (8) can be written as follows:

$$y(A) = k_1a_1 + k_2a_2 + k_3a_3 + k_4a_4 + k_5a_5 \quad (9)$$

where

$a_{\{1,2,3,4,5\}}$  – attributes of the electronic watch,

$k_{\{1,2,3,4,5\}}$  –

coefficients determining the degree of implementation of the attribute.

In other words, if any set of elements of a different nature can describe any object of nature, then this set can be considered semantic (sense set), since it *is tied* to a specific object.

For obvious reasons, the same set of elements can be bound to multiple objects (zero object) [2]. And here, we need to understand by what method or algorithm the *sense sequence* is formed, namely:

*“Any two elements  $a$  and  $b$  are semantically related to each other if and only if they are a sense sequence for at least one zero object”*

$$O_0\{a, b\} \quad (10)$$

or

$$O_0\{\cup_{a,b}\} [2] \quad (11)$$

where

$\cup$  - semantic union

Thus, returning to the example of the electronic watch, we can increase the set of attributes until the following condition is met:

$$O_W \subset A_N \quad (12)$$

or

$$a_1 \stackrel{S}{=} a_2 \stackrel{S}{=} a_3 \stackrel{S}{=} a_4 \stackrel{S}{=} a_5 \quad (13)$$

where

$\subseteq$  - semantic inclusion,

$\stackrel{S}{=}$  - semantic equality.

That is, as long as the newly added element does not change the semantic relationship with its object remaining its attribute.

Now we can formulate the definition of a **sense set**:

$$S = \{ \bigcirc_N \subseteq S_k \} \quad (14)$$

where

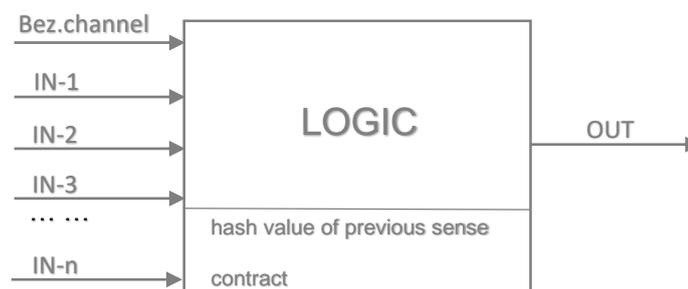
$N, K \in \{1, 2, 3, \dots, n\}$ ,  $K \geq N$ ,  $K, N$  – finite numbers,

$N$  - number of objects that can have the same number of  $k$ -attributes or can be described by  $k$ -attributes.

For example, element  $a_3$  (control button) can be an attribute for a large number of objects of various nature.

### 3. Sense Contract

To formulate a sense contract, we write the structure of a smart box [3] as follows:



“IN-n” – input a sense contract channel

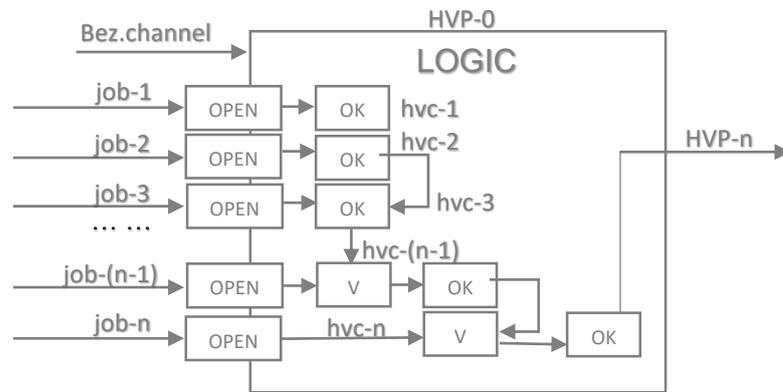
“Bez.channel” – Byzantine channel

“LOGIC” – list of procedures based on active sense contracts

“OUT” – output a sense contract channel

Fig.1.

For example, in terms of the implementation of a sense contract, say, for the assembly of an electronic watch, we can write a smart box in the following form:



“job-(1,2,3,...n)” – a job of 1,2,3,...n sense contract

“open” – open channel for 1,2,3,...n sense contract participant

“OK” – accepted job from 1,2,3,...n sense contract

“hvc-n” – a hash value of 1,2,3,...n sense contract

“V” – a verification procedure of the executed job of 1,2,3,...n sense contract

“HVP-n” – a hash value of n participant in SenseChain

Fig.2.

The jobs can be performed by one or different Sensechain participants:

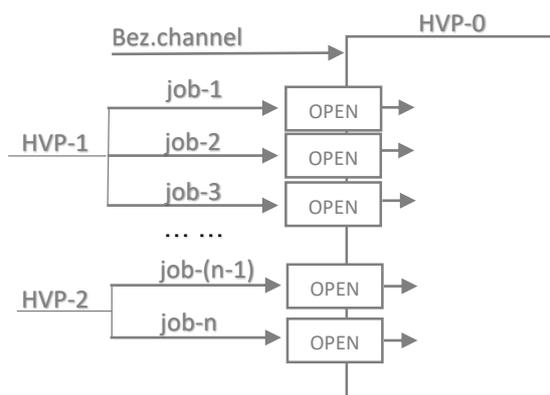


Fig.3.

*Moreover, any of the participants in the sensechain can have one or more open channels if and only if he is a participant under one or several sense contracts, respectively.*

Now we can give a preliminary definition of a **sense contract**:

“A set  $A_{(n+1)}$  consisting of a set of  $n + 1$  smart boxes, one of which has  $n$  open channels with all other  $k$  smart boxes, is called a *local sense contract*”,

where  $k \leq n, n \in N, N - \text{set of contract jobs}$

A smart box that has  $n$  open channels with other  $k$  smart boxes is called a **master box**.

Each smart box from the set of  $k$  smart boxes is called a **slaver box**.

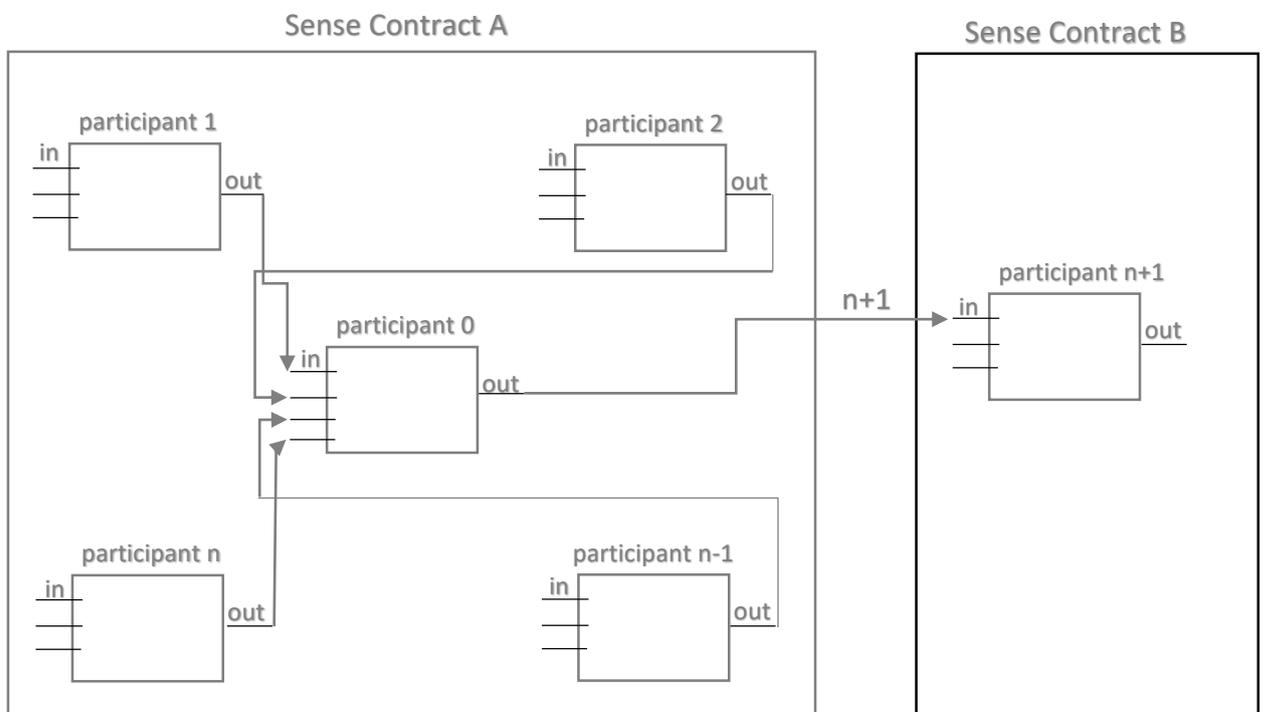


Fig.4.

The **locality** of the sense contract means the existence of *only one master box* in the contract, that is, the existence of  $n$  open channels with  $n+1$  participants of the contracts.

Now let us give a complete definition of the sense contract:

“A set  $A_{(n+k)}$  consisting of a set of  $n + k$  smart boxes, two or more of which are master boxes, where  $n, k > 1$ , is called a *global sense contract*”

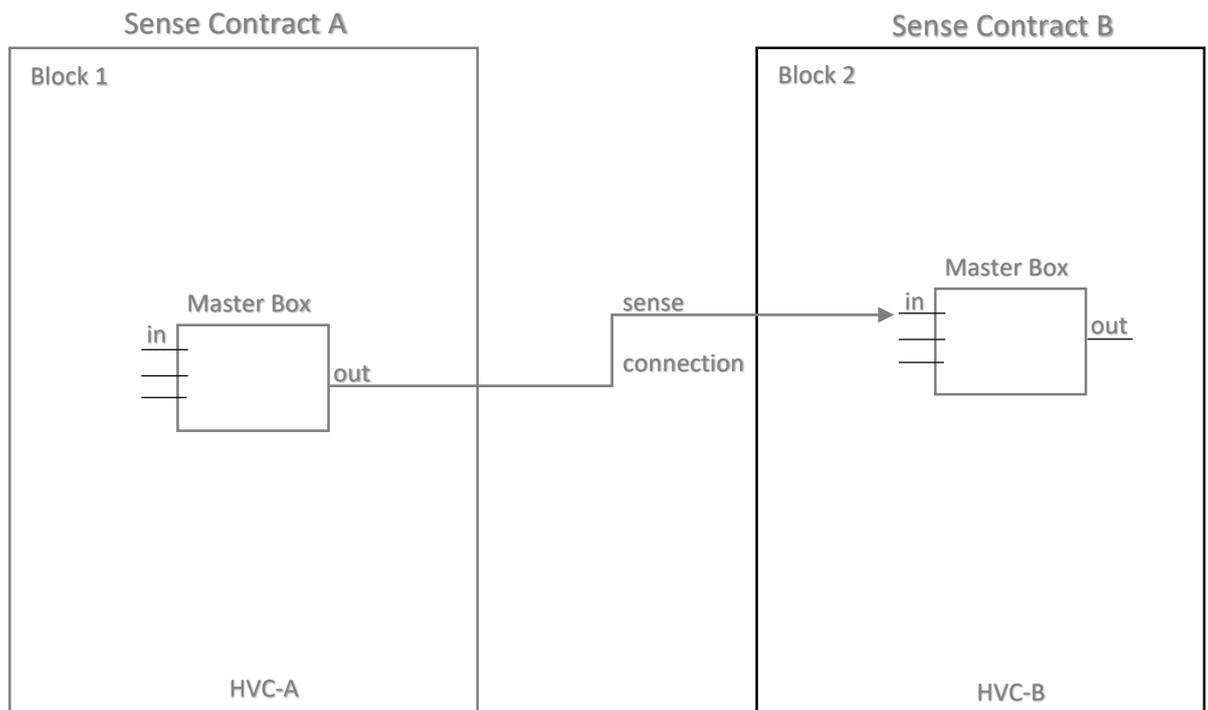
For a particular case  $(n + k) = 2$ , we have the following definition:

“The set  $A_n$  consisting of smart boxes, where  $n = 2$ , both of which are master boxes, is called a *prime sense contract*”

#### 4. Sense Chain (sensechain)

"Sense" in the context of the Sense Theory and its practical implementation in the field of Internet technologies "ArLLecta: A Decentralized Sense-To-Sense Network" [5] defines a zero object  $Z_0$  that has one or more attributes that define it. In the context of sense contracts, such a zero object can be a master box. **Each master box defines a specific set of jobs under the current sense contract.** Full execution by all participants of their jobs under this contract activates the output channel of the master box. *A given channel can be contract-bound to either another slave box or a master box.* The connection "master box - master box" forms a **sensechain**.

Accordingly, a schematic sensechain can look like this:



“HVC-A” – a hash value of sense contract A

“HVC-B” – a hash value of sense contract B

Fig.5.

Above-mentioned blocks can be formed from the number of sense contracts interrupted by the rightmost sense contract that does not have an activated output channel to the next other master box:

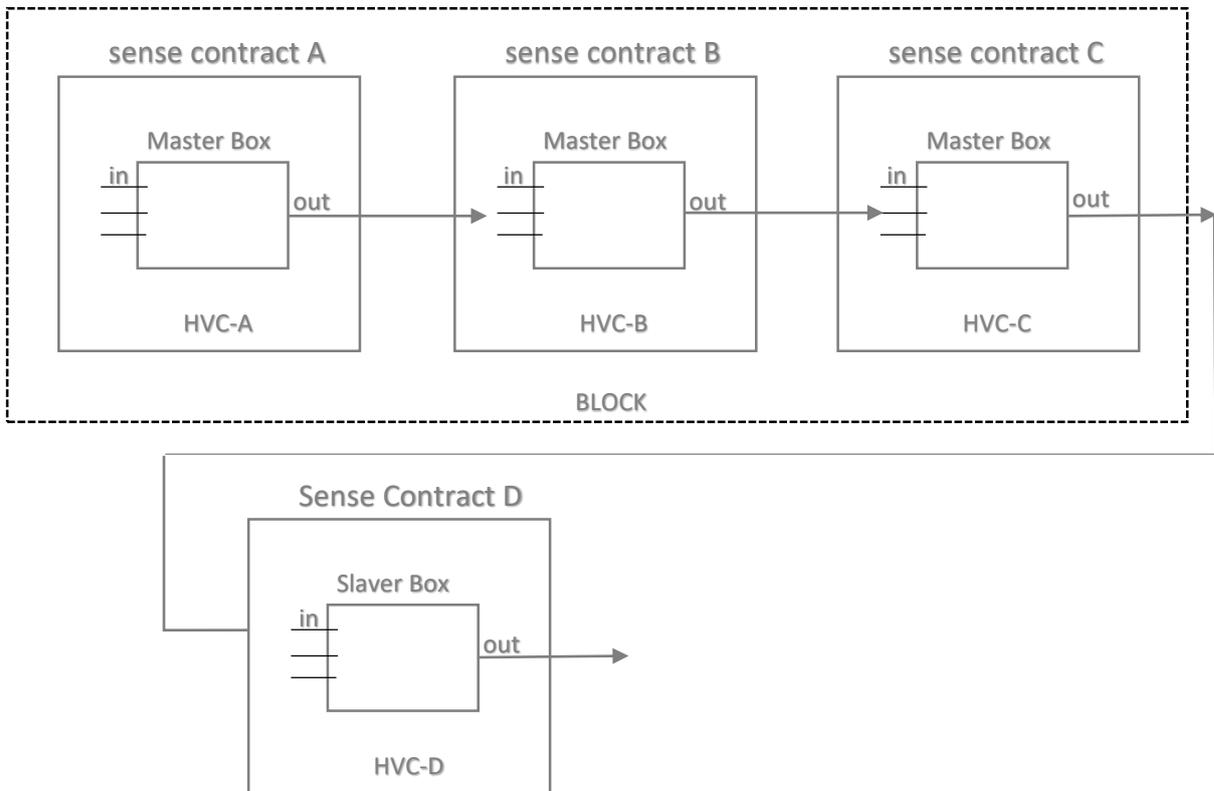


Fig.6.

A separate sense contract may contain, but is not limited to, such data as:

1. name of the contract
2. contract opening date
3. number of contractors
4. contract value (contract cost)
5. contract deadline
6. contract status
7. contract acceptance criteria
8. etc.

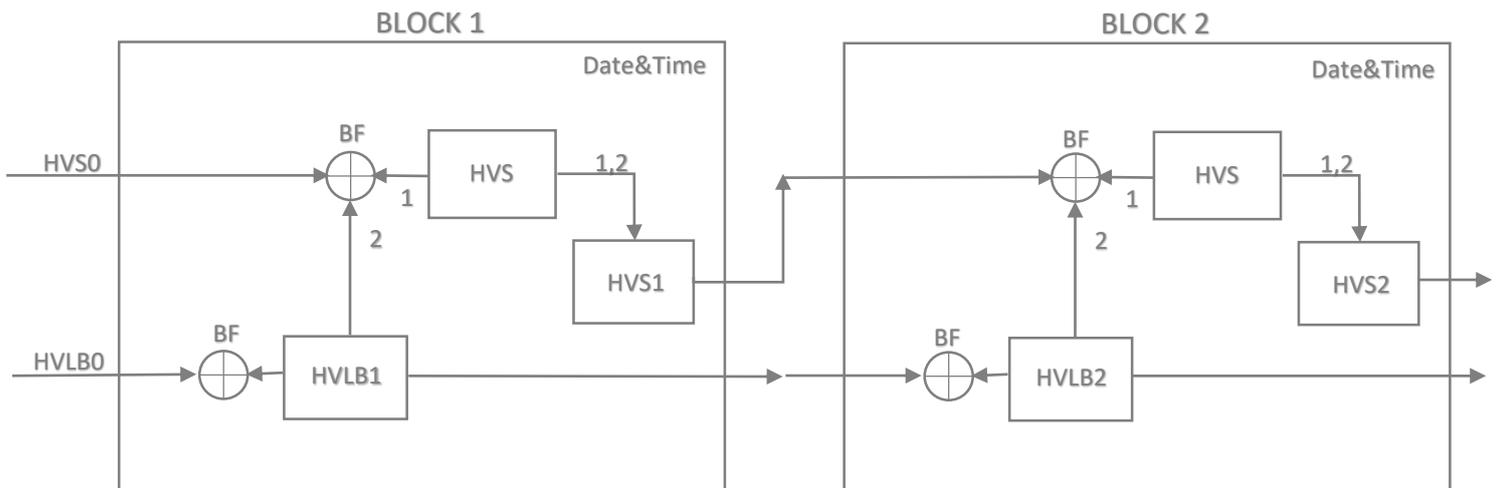
For practical purposes, a block of sense contracts can only contain:

1. hash value of each sense contract
2. hash value of each participant of each sense contract
3. closing date of each contract (if all contracts are closed at the time of block formation)
4. opening date of each contract (if one, several or all contracts are opened at the time of block formation)
5. the cost of each contract in hours and digital currency

6. date and time of block formation
7. hash value of previous block

The above values can be used to quickly find the necessary sense contracts or their participants.

The sensechain itself might look like this:



“HVLB1” – hash value of the sum of the rightmost sense contracts of the block 1 and HVLB0

“HVS” – hash value of the sum of sense contracts of the block (excluding rightmost contract)

“HVS1” – hash value of the sum of the HVS and HVLB1

“BF” - boolean function

“Date&Time” - date and time of block formation (not joining it to other blocks)

Fig.7.

*It is important to note that any block can contain both closed (executed) sense contracts and active ones.*

If there are open (active) sense contracts in the block, the sensechain takes the following form:

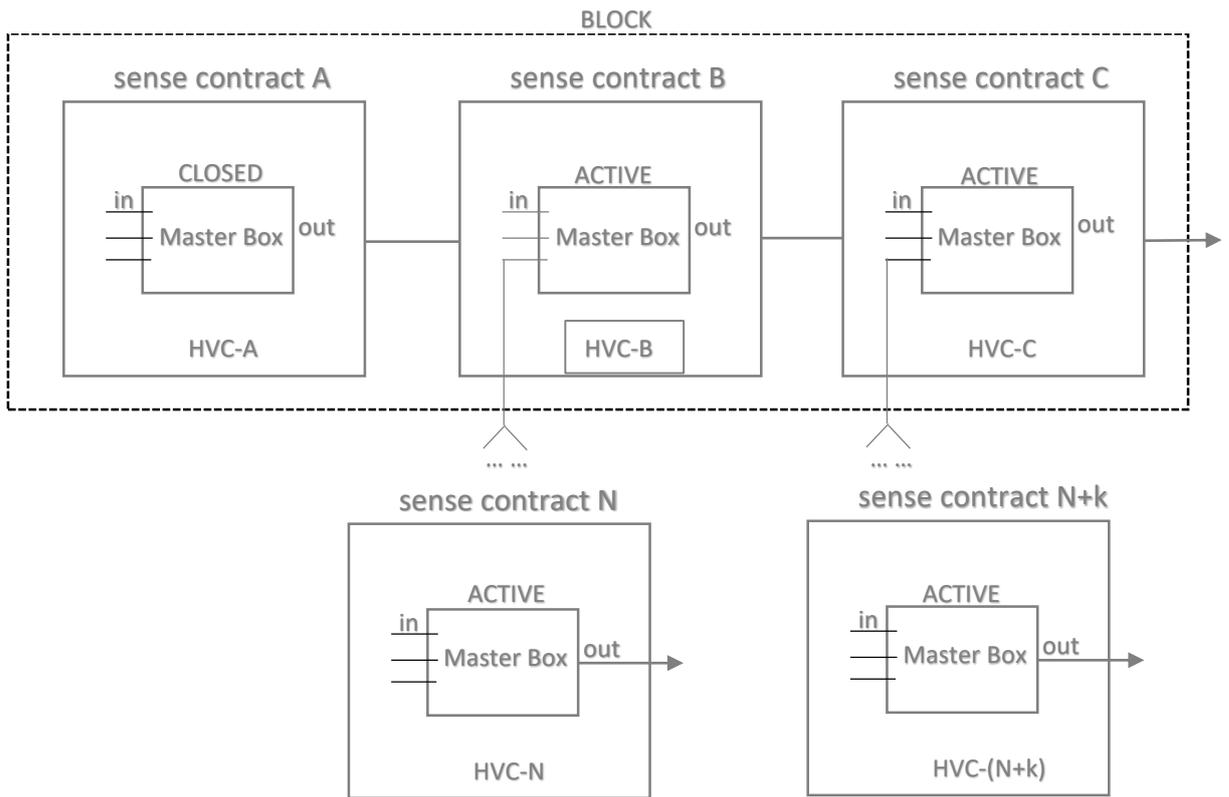
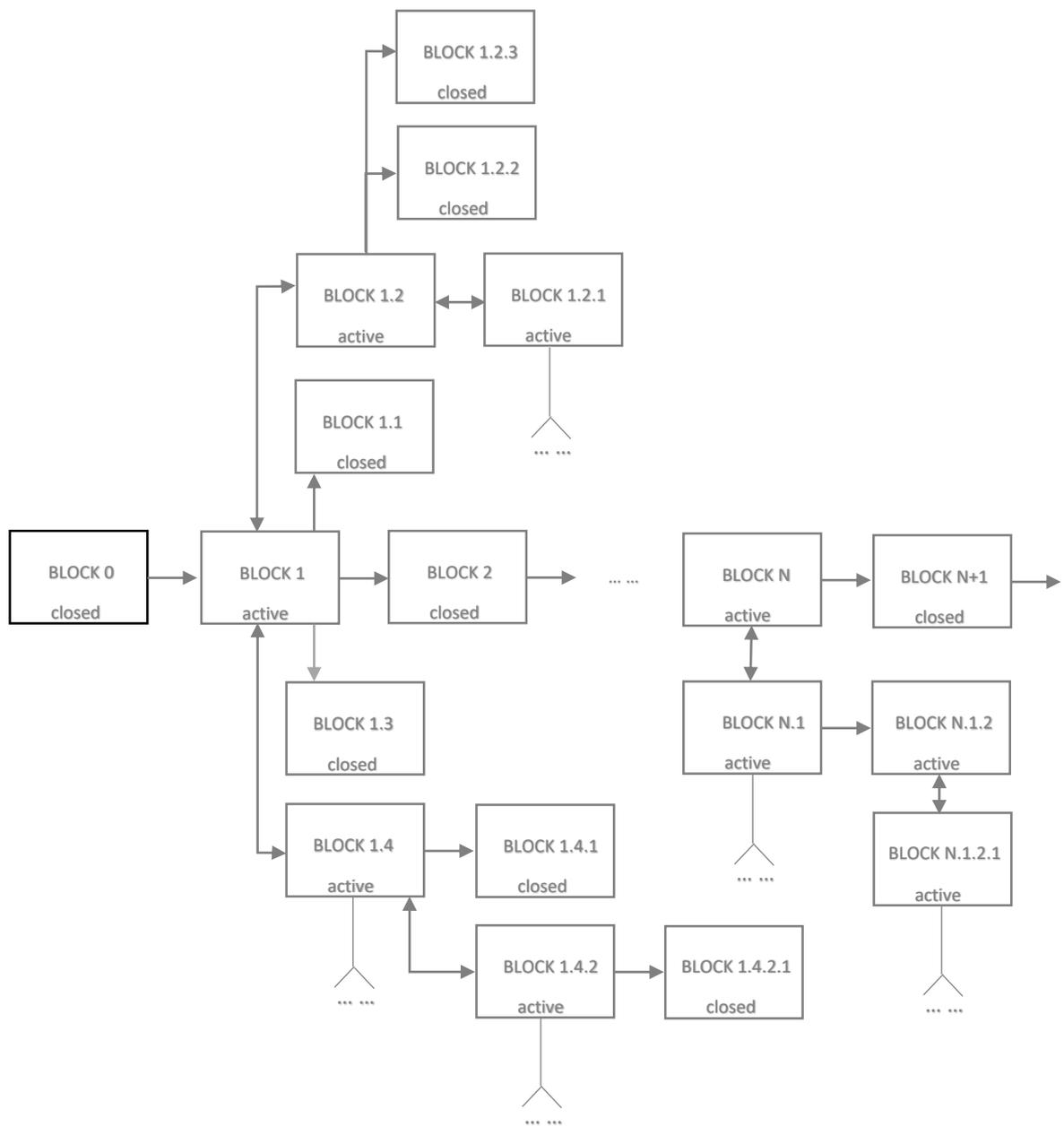


Fig.8.

For the case of N blocks, where N is an infinitely large value, the sensechain can look graphically like a biological neural network:



“active” - at least one of the block sense contracts is active

“” - An open channel to search for new performers under the current active contract

Fig.9.

As you can see from Fig. 9, the date and time value of block 2 can be much earlier than the date and time of block 1.2, for example.

## 5. Credibility

In any data storage system, one of the main characteristics is the reliability of data over time. In other words, each user of this system must be able to

authenticate data at any time. In the sensechain, this possibility is implemented by two algorithms:

1. checking the *continuity* of the “block 0 - block U” chain (block U – current user block).
2. checking the *sense connection* between sense contracts of different blocks.

Checking continuity means that there are no semantic gaps between blocks if you move from the checked block in the opposite direction until block 0 is reached.

Checking the sense connection means that there is a conformity between two separate blocks in terms of the hash values of the blocks (HVS) and the last contracts (HVLB).

## **6. Search**

In the sensechain, a flexible data search algorithm is provided both for a separate block and for a separate sense contract of a block.

The search is implemented by the basic open attributes of the sense contract (contract name, contract cost, contract opening date, etc.) that are set in the sensechain.

## **7. Decentralized Storage**

With an increase in the number of users of the sensechain, the number of sense contracts, as well as the number of blocks, will increase exponentially. To maintain the high speed of the sensechain, we have developed the following simple scheme:

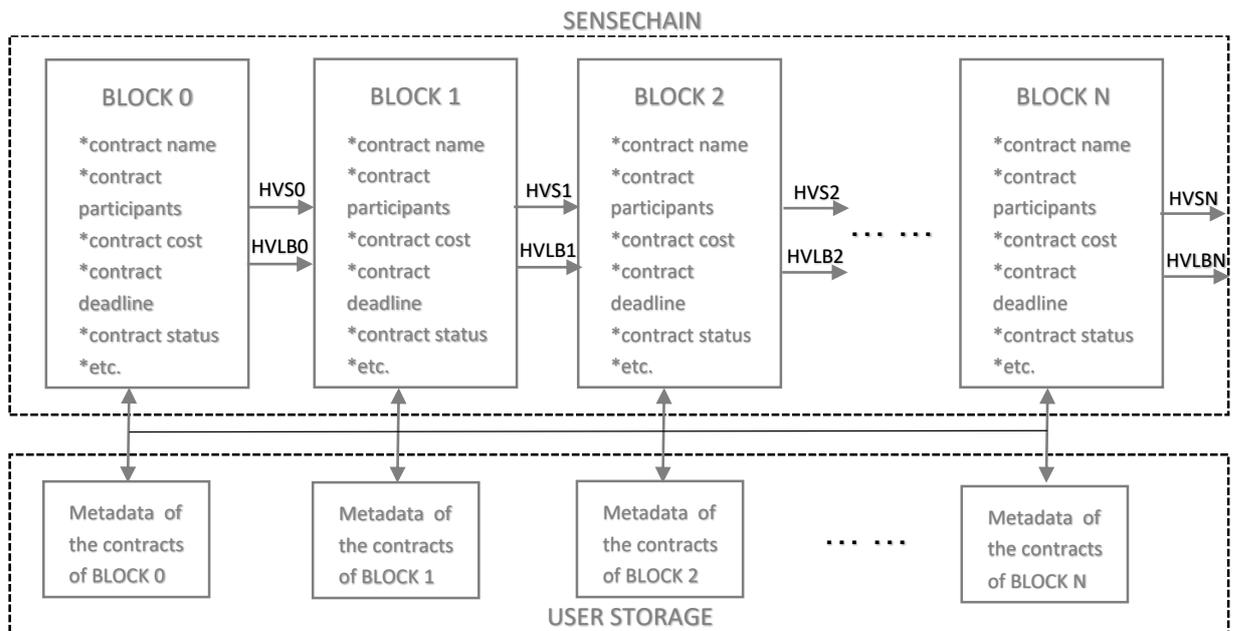


Fig.10.

Figure 10 shows that the sensechain consists only of consecutive hash values of blocks and the last rightmost contracts of these blocks. *The full data of the sense contracts themselves is stored on the users side.*

**To obtain additional information on a particular sense contract that is not in the sensechain, each user can form a direct search request to any participant in this contract (through the value – *contract participant*).**

*Thus, in order to preserve the reliability of the information of the sensechain, it is enough for the user to save only sequences of hash values to his computer.*

This approach is attractive, first of all, from a practical point of view, since even with more than one billion users, the volume of downloading the sequence of hash values of the sensechain will remain optimally small.

## 8. Sense Currency (sensecoin)

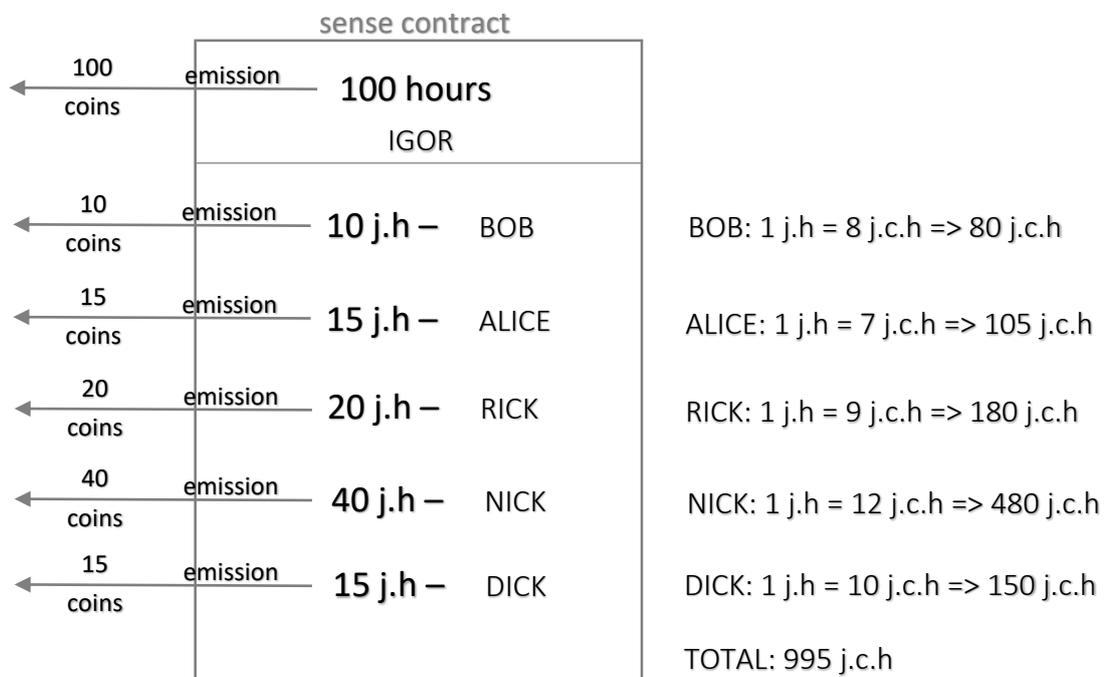
The logical structure of the sensechain allows users to implement a digital currency that, at a minimum, has the following main characteristics:

1. No inflation
2. No unemployment
3. 100% decentralized

The absence of inflation is dictated by the decentralized nature of the sensechain, since *first*, each individual sense contract does not depend on the cost of another sense contract with a similar (same) work performed, *second*, each minimum unit of the internal digital currency is **tied and backed by completed (lived) hours** under a specific sense contract.

The absence of unemployment is dictated by the functional structure of the sensechain, since *the first*, the activity of each registered participant in the sensechain directly depends on the desire of such a participant to maintain his activity in the sensechain, *second*, the internal system of currency incentives for users of the sensechain allows the latter to work offline, *third*, any action in the sensechain is associated with a specific sense contract, which, in turn, is estimated in hours spent on the execution of this contract.

As an example, the following scheme of one contract can be given:



“j.h” – job hours (hours required to perform specific job under the sense contract)

“j.c.h” – job contract hours (the cost of one hour of job of the sense contract participant)

Fig.11.

As can be seen from Figure 11, the job hours earned by each of the contract executors can be converted into digital currency (sensecoins) and only once. It is important to note that ***the hours earned (job hours) cannot be transferred to another user of the sensechain, they remain***

***forever with the user who earned them under the sense contract and are frozen when this user is deactivated.***

The conversion of hours earned (job hours) into digital currency (sensecoins) is called *local currency issuance (LCI)*. The total volume of digital currency supply in the sensechain is calculated by summing the volume of currency converted from the total volume of hours earned under sense contracts in sensechain. A decrease in the total volume of digital currency in the sensechain occurs in the event of deactivation of user accounts for the amount of hours earned by these users.

*The decentralization of the sense currency* lies in the algorithm of its emission. The issuer of digital currency in the sensechain is each of its users. In turn, each user of the sensechain has **the same opportunities in live time**, in terms of the volume of issue of the sense currency.

## **9. The Law of Zero Sense**

One of the indicators of the depth and importance of the sensechain is the law of zero sense (essence):

*“Sense A describing (characterizing) another sense B introduces a percentage of distortion in the reliability of the description of sense B equal to  $(n-k)\%$ , where  $k$  is the percentage describing sense A,  $n$  is the sum of the percentages of possible  $n$ -senses describing sense B”*

The importance of this law becomes apparent as soon as the researcher begins to apply it in practice to describe economic, physical and other phenomena.

## **4. Conclusion**

Above, we presented the first attempt at a practical solution that can be applied to the tasks of digitizing any business activity, not only an individual company, but the entire global economy.

We hope that our decent work will help other researchers in their life endeavors.

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