Information as Object of Computer Science in Maritime Transport

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Abstract

In our paper we make a connection between the notion of information and the economic, strategic, and security value that it have in the maritime domain.

In the last decades increasing the degree of computerization of industrial processes and increasing the use of information in solving human problems has made information considered as an economic resource.

The sea is a resource for the transport of goods and people to its real capacity. The transport policy aims at transferring the quantities of goods in efficient forms, which can be accomplished by using informatics means such as: optimized databases, algorithms aimed at smart routes, data encoding for a good communication between actors.

The use of Information Technology infrastructures and the Internet, in addition to economic, social and political benefits, may also lead to tensions. The issue of cyber security can be addressed by promoting international maritime cyber security interests in international alliances.

Key words: information, economic resource, maritime transport, Information Technology, cyber security
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1. Introduction

The word information -taken from Latin (informatio) through the French language (information) - is polysemantic, and it can get more meaning (sometimes totally different or even contradictory) that are determined by the very varied domains (Benamati *et al*, 2007, p.48) and contexts in which it is used. Apart from the meanings of common language, he also has other meanings, attributed either to his definition as a term (scientific or technical) or as a concept within branches of philosophy or of sciences and technologies whose subject matter is information. The term "information" is also related to an informational process (the sequence of actions to be informed), but also to the outcome of this process (volume, variety of information obtained) as well as specific phenomena (information phenomenon, information explosion, etc.). Information has also begun to be considered as the primordial ontological factor that is at the origin of the universe, together with matter and energy.

None of the existing definitions or concepts for information are unanimously accepted, which creates confusion, ambiguity, and sometimes even economic loss.

Lately, more and more scientists and scientists have questioned whether it is possible to build a single, generally valid theory of information. On the other hand, due to the pressure exerted by the breakdown of research in some areas (cognition, biology, psychology, robotics, artificial intelligence, etc.), there is a growing number of attempts to combine and overlap the various

meanings and interpretations in a single universally accepted concept.

The apparent contradiction between the various concepts of information (Wallace, 1968, p.187) existing today is due to the fact that most of them are developed only for a certain domain, and to be defined, information must always be reported to a system specific to the domain, such as DNA, spoken language, computers and so on.

What is the information? In a definition - as brief as informal and therefore inaccurate - it can be said that information is a representation of reality, but also of reflection and projection - which are typical to the human intellect - through a well-defined and structured set of symbols - usually accessible to human senses and reason, but also to some devices, such as automatic computing (computers). Information is neither content (but the state of a system can be assimilated to it), nor an agent (but the signals transmitted through a channel can be assimilated to it), neither ownership, nor instruction, nor process nor method, it is constituted in a stand-alone category, having an abstract and subtle existence - that is, immaterial - a category which is reflected by states, signals, etc. and is an essential element in the knowledge process.

Shannonian information - Claude Shannon, in his work published in 1948, "A Mathematical Theory of Communications", gave a new meaning to the term "information". Shannon highlighted the objective, quantitative aspect of information, (Shannon, 2001, p. 21) considered completely independent of the transmitter and receiver, as a natural reflection of the structure and ordering of the real world. To him, information is a mathematical term, abstract, which designates a magnitude that can be measured and treated mathematically just like mass, energy or other physical size. The term is related to the intuitive idea of predictability and choice.

In this theory, the semantic aspect of communication is irrelevant, it does not matter the meaning of the message, but the fact that it has been selected from a set of possible messages. What is important to evaluate is the amount of information emitted and received.

Initially, the term was defined in the Theory of Information as a size that expresses the uncertainty removed by realizing an event from a set of possible events. This definition is currently used in the statistical theory of communication to express the uncertainty of the occurrence of a set of symbols defining a multi-possible state of an element in a communication network.

Subsequently, the meaning of the term extended to knowledge in general, to the appearance - either for man or for a computing system - of every new element, previously unknown on the surrounding reality, contained in the meaning of a symbol or a group of symbols (written text, message spoken, plastic images, musical portative, indication of a tool etc.).

The unit of measure of the amount of information is 1 bit, (which comes from the words: Binary digIT). An 8-bit group forms a byte (or 1 bait, a name that comes from the English byte). A current personal computer can include in its quick work memory a quantity of information of the order of gigabytes.

2. Information - economic resource and service of first necessity

In the last decades of the XX century, increasing the degree of computerization of industrial processes and increasing the use of information in solving human problems has made information considered as an economic resource, somewhat equal to other resources such as labor, raw material and capital. This perspective highlights that possession, manipulation and use of information can improve cost-effectiveness in many physical or cognitive processes. As an individual and social resource, information has some characteristics that distinguish it from the traditional notion of economic resource. Unlike other economic resources, information is virtually unlimited, with apparently time-bound limits and human cognitive capability. This feature comes from the fact that information as an economic resource diffuses naturally (it can propagate itself), the rate of reproduction of information is higher than the consumption rate, and the information does not undergo changes in the transactions (it can only be shared, used in common). At the same time, information is compressible, both syntactically and semantically. Her ability to substitute other economic resources, her transportability at a very high speed, and her ability to deliver an asset to her own, underpin the remodeling of social industries (such as research, education, editorial activity, trade) and even of politics. The social concern (Manole, 2015, p.58) about the management of information resources has expanded into the traditional field of libraries and

archives and has included organizational, institutional and governmental information in what has become the name of information resource management.

The second perception of information (dating back to the same period) is that of a prime necessity that has led to the development of a new segment of national economies worldwide: the Information Technology (IT) sector (Manole *et al*, 2016, p.85). Benefiting from the advantages of information assets and building a perception of its utility and individual and social value, this sector provides a wide range of IT products and services.

Classification of information (Wallace, 1968, p.190) by its nature:

a) Information in the form of data: numerical, alphanumeric, participating in the execution of a wide range of mathematical and logical operations with wide applicability in economic activities, scientific research, technological design, statistics, administration;

b) Information in the form of texts - that information organized in the form of documents, pages of texts, paragraphs, phrases, words, characters. This type of information is intended for processing with appropriate text editing and editing programs, grammatical and semantic control of words, putting into shape and then in the page of the text to be edited;

c) Information in the form of graphic documents - intended for human perception by displaying on the computer's electronic monitor by writing to the printer or the plotter. A document may contain graphically processed images, data in the form of reports and situations, explanatory texts, graphic representations, drawings, technical drawings, photographed images;

d) Information in the form of audio sequences generated by the human voice, phenomena from reality, musical instruments or electronic synthesizing of voice and acoustics;

e) Information in the form of video sequences - of animated or film nature, perceived by specialized camera-type devices or generated by two-dimensional or three-dimensional graphics programs that are often accompanied by sound information: voice or sound.

3. Maritime transport

The oceans connect large centers globally through a network of interdependent economic, financial, social and political relationships. The shipping environment (Utureanu *et al*, 2016, 399) includes trade routes, ports and infrastructures such as pipelines, oil platforms, natural gas, trans-ocean telecommunication cables.

The transport system currently in place will not be able to cope with predictable traffic increases, so it has become essential to develop informatized transport systems to eliminate bottlenecks that will harm the world economy.

Informatized transport provides a solution by combining different modes of transport for a single journey and by making the most efficient use of available infrastructure with generally low costs of society along the maritime coasts.

The sea is a resource (Purcel, 2016, p. 275) for the transport of goods and people to its real capacity. The transport policy aims at transferring the quantities of goods in efficient forms, which can be accomplished by using informatics means such as: optimized databases, algorithms aimed at smart routes, data encoding for a good communication between actors.

Transferring traffic waterways is an effective alternative to road transport, increasing the role of maritime ports as distribution chain nodes. Ensuring security is one side of the process of securing the entire distribution chain.

For Risk Management, (Mălescu, 2016, p.1) Critical Maritime Infrastructure Protection and Crisis Response, the primary objective is to enhance conflict prevention and crisis response capacity.

4. Data Encoding

Information cannot be conceived outside an exchange process between two partners - one that generates it (the source) and another that receives it (the receiver). The exchange of information raises specific problems arising from the form of expression, i.e. the physical and formal expression of the content. The receiver can only retain and interpret the information received when it has access to the physical support and knows the code used by the transmitter.

Example: Although we live in a "big" wave of electromagnetic waves, the information they carry can be obtained only by those who have a radio or TV receiver and can decode the received signals. Additionally, in the case of verbal messages, it is necessary to know the language in which the message was made.

Information and encoding are inseparable entities. Information cannot exist without formal support, just as a coding that does not serve to record and transmit information is meaningless.

Running the automatic data processing cycle involves the existence of different types of data encoding.

1) External encoding of information - it occurs both in the process of collecting data when each information entity is put in correspondence with a symbol consisting of letters, numbers and special signs, as well as extracting the results.

The problem of encoding input data is particularly important on the one hand for increasing the yield of subsequent processing and on the other hand for a simpler manipulation by humans. If, from the point of view of man, it is preferable to associate symbols as close as possible to natural language, from the computer point of view, it is preferable for an "optimal" coding, that is, a minimum number of symbols chosen so as to allow processing with a minimum number of operations. Sometimes such encodings already exist in the industry where the data originates, being required in current business.

Example: In a collections of data on students of a faculty, it is possible to use in the coding of information not the name and surname of the students, but the identification number, given that each student corresponds to a unique identification number. Such coding has the advantage of eliminating any ambiguity in identifying students but involving the return to the natural form of human representation for human use.

Nowadays, given the possibilities offered by modern computer systems, it is preferable to introduce data using specially designed models or using languages as close as possible to natural ones. In addition, drawing formats are preferred, including multimedia elements that are easy to interpret, as much as possible encodings have been removed, making it possible to read documents only by specialists with experience in the field.

2) Internal coding of information - It is specific to the data processing process because the computer only works in binary representation. Coding can be done according to large circulation standards (ASCII, binary, binary-decimal, etc.) or based on local conventions that provide the best performance for a specific case. The quality of internal encoding depends on the processing time, the portability of the programs, the possibility of using the data by several categories of users.

3) Redundant coding- It is characteristic of the processes of transmission and storage of information on various internal or external media. In principle, redundancy coding implies that besides the useful symbols (also called informational symbols), which encode the information itself, a number of additional symbols (also called control symbols), which are in certain relations preset with the information symbols, are also introduced. Detecting reception of violation of one of these relationships allows detection and sometimes even correction of errors. The best-known example is the parity control bit, so chosen to provide the same parity type for all the bit groups composing a message. A particular case of internal data encoding is compression of data widely used, especially in archiving operations and the representation of images and sounds due to the large amount of information involved. The main objective of data compression is to reduce the amount of data memory occupied. The use of data compression has besides the definite advantages of much less memory and a number of drawbacks such as increasing the overall working time, decreasing the portability of application programs, lowering reliability, increasing processing complexity, etc. Despite these disadvantages, multimedia data collections cannot be designed without the use of data compression.

A special aspect of data encoding is the encryption of information, that is, its representation in a special form so that it can only be recognized by those who know the encryption rule. Encryption can be done at the external encoding (for example, when the operator should not know the meaning of the data he is handling) and in the internal encryption to prevent theft of information. Encryption should be used with care and only where it is really necessary, as it complicates the processing, increases working time and can lead to storable data loss in the event of accidents.

The use of Information Technology (IT) infrastructures and the Internet, in addition to economic, social and political benefits, may also lead to political or military tensions, misperceptions or even conflicts among actors of international society, thus becoming a new national and international security challenge.

In the context of technological development, the role of IT infrastructures has changed from tools that facilitate day-to-day operations to strategic foreign policy instruments, arguing that the cyber war would be one of the most important military issues (Williams, 2013, p. 365) developed in recent history. Increased Internet dependence and interdependence of maritime transport has prompted a process of increasing insecurity for states, (Euronaval, 2015, p.1) in terms of increasing vulnerabilities to unconventional threats of cybernetic nature.

5. Conclusions

As the share of unconventional threats (U.S. Transportation Dept., 2013, p.1) has increased over the last decade, cyber attacks are a growing threat (Roussouw, 2013, p.101) to national and international security, economy and maritime transport (of goods and persons), both quantitatively and qualitatively, cyber attacks being more sophisticated and more complex. Therefore, the new vision of security must also capture the aspects of the massive development of information and communication technology, which determines the widening of the maritime economic security agenda by including the cyber dimension of national and international security. Together with terrorism and the non-proliferation of nuclear weapons or mass destruction, cyber space is one of the unconventional areas of interest for international security.

Interdependence in international relations in general and in cyberspace, in particular, makes international society more accountable through international cooperation to identify a comprehensive approach to cyber security. The peculiarities of the cyberspace and the multinational impact of cyber attacks call for the adoption of a public policy with a strong international component. Due to the nature of the cyberspace, as well as the asymmetric and transnational character, we believe that the cyber threat poses for political leaders a similar challenge to terrorism in terms of the need for a diplomatic effort to regulate the field.

The development of international cooperation requires the first step to agree universally accepted definitions of terms that are circumscribed to the cyberspace, and at present there is no consensus at the level of the international society on specific terminology.

The issue of cyber security (Panc, 2017, p.251) can be addressed through the internal balancing process, which involves increasing its own technical capabilities and human resource competence to reduce vulnerabilities but also through external systemic balance, by promoting international maritime cyber security interests in international alliance formats that share perception on the issue.

Since cyber security is important for all the security areas (including maritime domain), defined by the new broad security concept, covering the economic, social, political and environmental sectors, and cyber incidents can have a major impact on stability in multiple security sectors, we appreciate the need for cross-sectorial security.

The involvement of states and international intergovernmental maritime organizations is essential, being strengthened by close collaboration with the private economic sector. In the process of minimizing cyber-security risks, the state can have a coordinating and assistance role, by creating an appropriate legislative framework, by participating in policy definition and implementation, by developing legal instruments and by undertaking specific actions and measures.

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