ISSN: 2450-8160

Herald pedagogiki. Nauka i Praktyka

wydanie specjalne

Warszawa
2021

Editorial Team

(wydanie specjalne) Volume-2, № 4 July 2022

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DIGITAL FOOTPRINTS AND SOME QUESTIONS RELATED TO THEIR FORENSIC RESEARCH

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Abstract: This article discusses the scientific and theoretical foundations of the concept of digital footprints. At the same time, various concepts proposed in theory were critically examined, up to the concept of digital footprints. At the same time, the content of digital traces, their types, form and technical characteristics are described.

The article was prepared on the basis of scientific and practical research conducted in the field of working with digital footprints, reviews of theoretical scientists and practitioners, as well as technical research, on which the author's conclusions were formed.

Keywords: electronic traces, digital traces, information traces, binary traces, virtual traces

In the theory of traditional criminalistics, mainly material and ideal types of traces have been studied a lot [1, 66-c]. However, conceptual issues related to digital footprints are practically not found in scientific research conducted in our country. This situation creates certain difficulties in determining the sources of digital evidence by law enforcement agencies, while at the same time forming theoretical knowledge in this area. Hence, there is a need for certain forensic investigations in order to meet the requirements of the industry with evidence-based methodologies.

As a result of the development of digital technologies, it is no secret that the volume of digital footprints is increasing compared to physical footprints. After all, digital technologies have become one of the most active means of meeting everyday needs in almost all areas of public life. Daily tasks of a person, lifestyle, interests, plans, actions and activities in general have become closely connected with digital technologies. Humanity is simultaneously active in the virtual universe, as well as in the material world. Naturally, this process also leaves certain traces of itself. And when searching for justice in this case, it is from these traces that digital evidence is extracted [2, 263 p.]. Therefore, when working with cybercrime, law enforcement officers must first of all have basic knowledge about the concept, content, types and characteristics of digital traces.

Forensic investigation of the traces of a crime has its own specifics. Unlike traditional crimes, most cybercrimes are committed remotely. Criminals influence the subject of criminal encroachment by digital means and hide the traces of the crime. In other words, a characteristic feature of working with digital traces is the possibility of active resistance to the investigation of these crimes, the impressive and dynamic nature of the traces of crimes.

General theoretical views on digital traces

There are various views on digital footprints in the forensic literature. In particular, a number of concepts have been put forward in theory, such as "electronic traces" [3, P 77 p], "information traces" [4, 55 p], "binary traces" [5, 163 p], "virtual traces" [6, 15; 7, 152; 8, 45; 9, 125; 10, 87; 11, 30; 12, 129 p] or "digital traces" [13, 117; 14, 23; 15, 61]. In order to determine which of these concepts is logical and general in nature, it is necessary to conduct an in-depth study of their essence and characteristics in theory.

Electronic traces

In the studies of V.Vekhov, the concept of electronic trace is put forward. The scientist considers electronic traces as electronic information carriers and information of forensic importance stored in their memory. According to him, electronic traces are also stored in objects that receive and reflect the trace. The object receiving the trace not only reflects the trace, but is also its carrier. In this case, information passes from one system to another in the form of a signal on certain material carriers.

Signal is the most physical medium, especially electromagnetic signals. It includes information content and form. A specific property of the object or reflection of the event constitutes the content of the signal. Reflecting, storing or transmitting means, which are its material basis, are the form of the signal [16, 78 p].

In fact, all kinds of digital devices now run on electricity. It is the orderly movement of charged particles that serves as the main resource - tool in the creation, processing, storage, transfer or implementation of certain other functions of digital information. However, the processor "remembers" the numbers, not the signal, that is, encodes it.

At the same time, there is no specific form of electric current (signal, electromagnetic signal, magnetic field) in nature. V. B. Vekhov did not show the technical aspects of this in his research. Therefore, it can be considered that the concept of electron does not have a sufficient scientific basis.

Logically, how can you see, read or remove a trace from an object that has no shape?!

Addressing these issues is fundamentally important in cybercrime investigations! The reason is that the inquirer, investigator, prosecutor, judge, lawyer assess the circumstances that are important for the case from a legal point of view, and administer justice. Lack of understanding of the nature of digital evidence and their specific characteristics hinders the verification and assessment of the true state of affairs.

In the course of scientific and technical research, it was found that the concept of "electronic" is a logically wrong concept. In this case, it was concluded that electric

current participates only as atool in the processes related to the creation, processing, storage, transmission and transportation of digital information [17, 256 p]. Accordingly, the author puts forward the idea that any information on a digital device is only in a single form, that is, in digital form.

Information traces

The concept of "information traces" is also not accepted by most legal scholars. This is because this concept does not actually reflect the technical nature of digital footprints, but is merely used as a metaphor in theory. Accordingly, it can be considered that this concept is also inappropriately applied.

Binary traces

The concept of "binary traces" is not erroneous, but technically in modern digital devices the processor works with combinations of "0" and "1" binary or "0", "1", "2" ternary codes. From a practical point of view, the concept of "binary traces" is typical for most digital devices, but this category is not the only one in theory.

Virtual traces

The analysis of scientific studies shows that the concept of "virtual footprints" has been hotly debated in theory. Before starting the discussion, let's briefly dwell on the meaning of the term "virtual".

Sources indicate that the origin of the term "virtual" dates back to the 15th century. In English literature, the term "virtual" is derived from the Latin words "virtus", "virtualis", which means "having an effect without having any form or appearance" [18]. However, since 1959, this term has been used in the field of digital technologies in the sense of "something that does not exist materially, but is created with the help of a program."[19].

According to V.B. Vekhov, the concept of "virtual" comes from the Latin word "virtualis", which means something that does not have a material scope or is perceived differently than it is actually realized [20, 84 p].

A.B. Smushkin believes that virtual traces are the traces left by any movement made in the information environment of computers and other digital devices, their systems and networks [21, 44 p].

V.A. Meshcheryakov defined the concept of "virtual traces" as any change in the automated information system related to the crime event, recorded in the form of computer information [22, 101 p]. Each of the above definitions is associated with digital resources.

In the Russian-Uzbek explanatory dictionary of terms related to operating systems and computer networks, the word "virtual" is defined as "an object or state that does not actually exist, but can appear under certain conditions."[23, 98 p]. It is noteworthy that in all three cases aspects of the concept such as "without material appearance" or "non-existent in practice" form a commonality. Therefore, the word virtual can be understood as a reality or property that does not have materiality, but actually exists.

Currently, this concept is used in the field of information technology as a place - an environment where digital information is created, stored, processed or other actions

related to it are performed. Therefore, the concept of virtual footprints does not essentially reflect the shape and characteristics of digital footprints. In our opinion, this concept is inappropriate in relation to this situation, since the theoretical basis is not sufficiently substantiated.

Digital traces

There are different opinions in the scientific community about digital footprints. For example, S.A. Zaitsev and V.A. Smirnov define digital traces as a set of certain actions performed by a user in the global network or associated with other digital media [24, 81 p.].

N.I. Malykhina described these traces as changes in the memory of telecommunication systems as a result of a crime [25, 205 p].

In foreign sources, active and passive types of digital traces are distinguished [26, 39; 27].

Active footprints are footprints voluntarily left on a system or network of digital devices. For example, a user leaves comments on social networks or websites, publishes articles or data left in a keylogger. The keylogger records any changes made by the user to the clipboard.For example, akeylogger stores information that auser copies passwords or takes screenshots of confidential information.

Passive footprints are traces that are automatically left on web resourc0es when a user accesses the network. For example, cookies, user IP address, search history, etc.

It should be noted that digital footprints are caused not only by the human factor, but can also occur as a result of a certain cyber process. The reason is that now malware has the ability to change its code and leave various traces.

When establishing the truth in a case, it is necessary to collect, verify and evaluate the traces left in digital sources. Such digital resources include information processing systems or individual functional units of such systems; personal computers, laptops, netbooks, system blocks and networks; digital media (hard and soft magnetic disks, flash drives, memory cards, optical disks, etc.); navigators, trackers; may include mobile communication devices and SIM cards, digital radios, plastic payment cards and skimmers, slot machine cards, VCRs and other similar sources.

Digital information is the basis of digital footprints. Digital information functions with the help of certain programs. Therefore, its functionality is built on the basis of the software architecture.

Engineers have divided the system into "Frontend" and "Backend" parts so that the software works correctly.

The "Frontend" part is the presentation part of the software and is the user interface. Typically, this section covers the components that are visible to the user when the digital device is turned on.

The "Backend" part is the backbone of the software system. At the same time, the codes are written in such a way that the functions in the presentation part of the software work correctly. Typically, these codes consist of a specific letter, number, and symbol. These codes are converted into combinations of "0" and "1" by the assembler or compiler for reading by the processor.

Both parts store the history of the user's action. However, it is not always possible to obtain data from Frontend in forensic investigations. Therefore, experts use special programs to study traces in the Backend.

Conculusion

An analysis of the studies allows us to conclude that the concept of a digital footprint should be defined based on its specific characteristics. The concept is based on the technical characteristics of traces. These traces appear in the information environment of digital sources, and they are considered the main means of establishing the truth in the investigation process.

Digital footprints can be created not only by the user, but also as a result of a cyber process. Accordingly, digital footprints should be understood as the result of any action taken in the digital environment.

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