Scientific Research Priorities – 2019: theoretical and practical value

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Edited by

Dariusz Woźniak

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CONTENT

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THE SYSTEM FOR ANALYSES OF DATA PACKAGES ROUTING IN MOBILE AUTOMOTIVE TELEMATICS SYSTEMS

Keywords: *mobile network, IPv6, NEMO, VANET*

The architecture of Web-oriented systems largely determined by the architecture of the TCP/IP protocol stack. The data in such systems pass through four levels - convenient, transport, network and channel. The problem of mobility on the Internet arises at a time when part of the network changes the entry point to the network relative to the general topology. Note that this problem is due to the internal structure of Internet protocols that did not anticipate such changes during the data transfer process [1, 2].

The Internet identifies domains that belong to certain organizations and managed by ISP. Domains consist of nodes and links between them. Nodes come in two main types - routers and hosts. The hosts connect to the network (subnetworks) on the same communication layer (Ethernet or 802.11 WLAN, etc.). Routers interconnect networks. Hosts that initiate or interrupt packet transmissions are end systems. In our case, the end systems are the onboard telematics system and the logistic or telematics operator's server.

In the context of our problem, the biggest problems arise at the network level, where IPv4 and IPv6 packet routing protocols are used [1, 2], which differ in the large address space and methods of packet routing. In terms of mobile networking, IPv6 is more adapted, which theoretically allows you to close a unique address from a 2^{48}-address pool to any device.

The universal mobile vehicle must meet the following functional requirements:

- reachable anytime, anywhere;
- permanent connection to the service provider's server;
- reliability, which should guarantee the transmission of data in any architectures of networks with the possibility of failures of intermediate nodes of data transmission;
- datasecurity transmission on external networks, which guarantees protection against possible interruptions of data streams.
- data privacy, which guarantees the protection of data (data flows) from external interference at any level;
- real-time mode, which provides algorithms for managing high-risk systems;
- multimedia data transmission capability, which provides additional levels of control on-line;
- ease of use, which ensures the use of the system by untrained users in the field of information technology.

There are currently several options for building mobile telematics systems - NEMO, Mobile IP, etc., that need to address the problem of moving a host from one network to another.

Mobile IP allows the mobile node to move from one network to another while storing the IP address. There are two implementations of this technology for IPv4 (RFC5944) and IPv6 (RFC 6275). Given that IPv6 is now beginning to displace IPv6, which is primarily concerned with the development of the Internet of Things (IoT), new systems need to support IPv6 addressing[1-2].The development of NEMO technology is VANET (Vehicle ad-hoc networks) technology, which allows for the creation of direct network connections between mobile subscribers [3-4].InternetCAR is a technology for accessing the car's LAN devices from the Internet [5]. This technology is a development of NEMO and focuses on the effective implementation of NEMO for a large number of onboard devices connected to the Internet.

Let us discuss a structure of the mobile automotive telematics system (MATS) for testing and development purposes.MTAS based on a single-board computer (SBC) and a sensor network.SBC performs the functions of a router of requests from the external network to the internal one. The software of such a system is oriented towards the use of web technologies and wireless terminals (telephones or tablets). No levels of PC OS support for mobile IPv6, device drivers (sensors), and client application interaction. As a hardware for such systems single-core Raspberry Pi 2/3 computers used with OC Linux with a modified kernel to support NEMO. Such a stricter.

The sensor network consists of any equipment that supports one of the standard industrial exchange protocols: Modbus, Profibus, CAN, etc. Depending on the destination, the computer hardware has several Modbus ports, analog inputs (± 20mA, 0-20mA, 4-20mA) and outputs, digital inputs and outputs that allow you to connect not only hardware but also various sensors. If necessary, I/O extension modules (InteliSys NT, Siemens, Aries, etc.) and protocol converters used.

As a system prototype, we use SoC with iMX6ULL CPU, two serial RS485 ports, USB and RS232. As communication modules, we use SIMCOM SIM7600 and SIM5630 for 4G and 3G networks respectively because they have a compatible system of command. The Linux kernel 4.15 is used as OS for SCB with native IPv6 support. Such a system used for obtaining data from some sensors, transform data to internal protocol, and prepare data to transmit to a server. Also on SBC diagnostic software for traffic and coordinate analyses used. It is possible to collect any additional info about network exchange process with embedded capabilities of communication modules. As a result, we have a lot ofstatistic data for network protocols and data exchange protocols.

Web-based SCADA solution used for collect data from mobile SCB. The architecture of the server part contains a set of three base services – accumulation, processing and communications. The latter provides communication with the operator (person) and the integration and communication controller. These services run on an Intel Core i5, 32 Gb RAM, 4x500 Gb HDD RAID server. Now the system is simple and may only collect data into database, in the future we are planning to extend server functionality with a user-friendly graphical interface based on the widget concept. We also use R and Octave to process the data.

To communicate between the server and the controller, the MQTT protocol selected, which runs on TCP / IP and provides four levels of quality of service. Client-server interaction is organized on the basis of REST architecture, which provides easy integration into the web-services system and use of standard protocols.

In the research phase of the effectiveness of the decisions taken, the TLS protocol is used to ensure data security between the client and server, server and communication controller. In the future, it is planned to add additional levels of security, such as 2-step authentication.

The proposed system can be used for development and testing purposes, for studying how to network protocols and data routing between various segments of mobile networks.

Conclusion:

1. Functional requirements for mobile telematics systems are defined.
2. The methods of construction of mobile telematics systems and methods of packet routing in them are analyzed.
3. The structure of a mobile Web-based telematics system based on the use of single-board computers running Linux is proposed.
4. The structure of the integrated universal system of remote control and management based on the use of REST architecture is offered. The kernel of the server part of the system is implemented, as well as the integration and communication controller (SCB with SIMCOM modules).
5. The prospects for further research are to build an integrated cloud-oriented telematics system.

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