

# 1 Implementation and evaluation of the 2 Multi-connection Tactile Internet Protocol and API

3 **Delia Rico** ✉

4 ITIS Software, Universidad de Málaga, Spain

5 **Anna Brunstrom** ✉

6 Computer Science, Karlstad University, Sweden

7 **Karl-Johan Grinemmo** ✉

8 Computer Science, Karlstad University, Sweden

9 **Pedro Merino** ✉

10 ITIS Software, Universidad de Málaga, Spain

## 11 — **Abstract** —

---

12 Tactile Internet defines applications for remotely controlling and manipulating critical devices that  
13 require perceived real-time operation with additional demanding requirements like reliability. These  
14 use cases with stringent requirements demand adequate transport protocols to take advantage of  
15 the underlying possibilities. Traditional transport-layer solutions like TCP and UDP are no longer  
16 sufficient, hence novel protocols are being developed to support these applications. In this paper,  
17 we present an implementation and evaluation of the Multi-connection Tactile Internet Protocol  
18 (MTIP), a transport layer proposal to support these communications. MTIP uses application and  
19 network status information to perform an intelligent selection of the paths which are used to send  
20 redundant data, in order to improve reliability and latency. In our evaluations, we study how the  
21 different configurations of the MTIP sending algorithm affect this selection and we observe how  
22 more restrictive thresholds reduce the amount of lost and late packets but increase the number  
23 of duplicates, while less restrictive thresholds do the opposite. Moreover, we notice that a proper  
24 selection of the paths could reduce significantly the number of duplicate packets, especially in fairly  
25 good scenarios.

26 **Keywords and phrases** Multi-connectivity, Transport Protocols, Context Awareness, Tactile Internet,  
27 API.

28 **Related Version** D. Rico et al, Implementation and evaluation of the Multi-connection Tactile  
29 Internet Protocol and API, in proceedings of the 2nd International workshop on “Fully-Flexible  
30 Internet Architectures and Protocols for the Next-Generation Tactile Internet” (FlexNGIA 2022),  
31 NOMS 2022 Workshops, Budapest, Hungary

32 **Acknowledgements** This work was supported by the EVOLVED5G Project (European Union Horizon  
33 2020) under grant agreement No.101016608 and by the Ministry of Education of Spain through grant  
34 FPU17/04292 and RTI2018-099777-B-I00 (the RFOG Project). This work was part of the research  
35 internship of Delia Rico in Karlstad University, Sweden, supported by the Ministry of Education of  
36 Spain through grants EST19/00930 and EST21/00446.