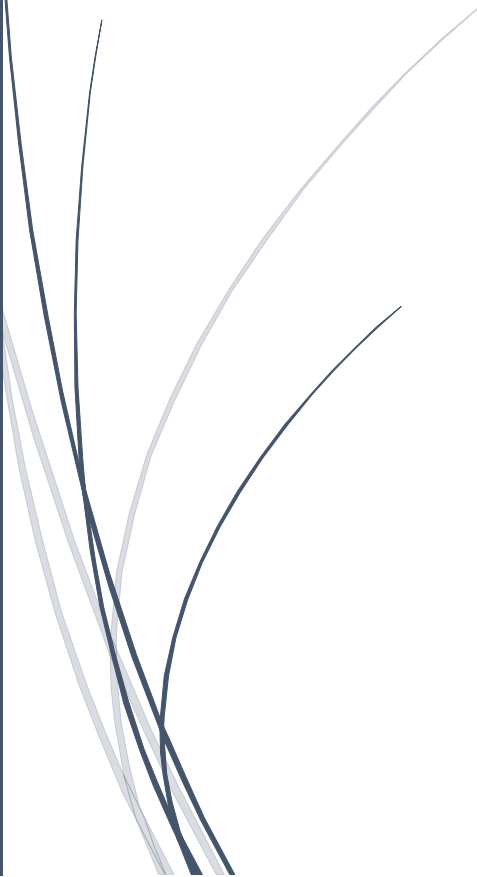


The logo consists of a dark blue vertical bar on the left and a blue arrow pointing right, containing the text "RADemics" in white.

RADemics

Enhanced Transport Protocols for High- Bandwidth Data Transmission in Smart City Healthcare Networks

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8. Enhanced Transport Protocols for High-Bandwidth Data Transmission in Smart City Healthcare Networks

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Abstract

The rapid advancement of smart city technologies has profoundly impacted healthcare systems, enabling enhanced data collection, real-time monitoring, and improved patient care. The integration of diverse technologies and the transmission of high-volume healthcare data across interconnected platforms present substantial challenges in terms of data privacy, security, and interoperability. This chapter explores the critical aspects of data transmission in smart city healthcare networks, focusing on the role of advanced transport protocols in facilitating efficient and secure information flow. Key challenges such as scalability, seamless integration across diverse systems, and the growing need for reliable data storage and retrieval mechanisms are discussed in depth. The chapter examines the increasing reliance on Big Data analytics and its influence on decision-making processes within healthcare environments. It emphasizes the need for robust security frameworks to protect sensitive healthcare data and ensure compliance with global regulations. The intersection of emerging technologies, healthcare applications, and smart city infrastructure was also explored, presenting a comprehensive view of the evolving landscape and offering insights into future directions for enhancing data transmission in smart healthcare networks.

Keywords: Smart City, Healthcare Data Transmission, Data Security, Interoperability, Big Data Analytics, Transport Protocols.

Introduction

The healthcare sector was undergoing a fundamental transformation, driven by the advancements in smart city infrastructure and the increasing reliance on data-driven technologies [1]. Smart cities utilize interconnected systems to enhance urban life, and healthcare was one of the most critical sectors impacted by this evolution [2]. High-bandwidth data transmission plays a central role in modern healthcare systems, enabling efficient real-time communication between patients, healthcare providers, and various medical devices [3]. As healthcare networks grow more complex and interconnected, the need for advanced transport protocols that ensure secure, reliable,

and scalable data exchange becomes paramount [4]. These protocols must address the challenges of managing large volumes of healthcare data while ensuring the privacy and security of sensitive information [5].

Data transmission in smart city healthcare networks involves the integration of numerous diverse technologies, such as Internet of Things (IoT) devices, electronic health records (EHR), and telemedicine systems [6]. These technologies generate massive amounts of data that must be transmitted quickly and accurately across various platforms, including cloud computing systems, mobile devices, and hospital databases [7]. This complex data exchange requires advanced transport protocols capable of supporting high-speed data transfers, low-latency communications, and the management of significant data loads [8]. Without these protocols, healthcare systems risk inefficiency, data corruption, or even breaches of sensitive patient information, which could undermine the trust and reliability of the entire healthcare network [9].

One of the most pressing concerns in healthcare data transmission was the issue of data security [10]. Healthcare data was highly sensitive, containing personal health information that was protected by various regulatory frameworks such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States and the General Data Protection Regulation (GDPR) in Europe [11]. These regulations mandate strict controls over the collection, storage, and transmission of health data to prevent unauthorized access and ensure patient privacy [12]. In smart city healthcare networks, where data flows continuously between multiple devices and systems, securing sensitive information from potential breaches becomes increasingly complex [13]. Security measures, including encryption, multi-factor authentication, and secure communication protocols, must be embedded within the transport protocols to ensure that data remains protected throughout its lifecycle [14].

In addition to security, interoperability was another critical challenge for healthcare data transmission in smart city environments [15]. Healthcare systems, particularly in large cities, often consist of numerous disparate platforms and devices, many of which do not adhere to the same standards or use compatible technologies [16]. This lack of uniformity can hinder the seamless flow of data between different systems, leading to inefficiencies and errors [17]. For example, a patient's health data stored on one system may not be accessible or understandable by another system, creating gaps in patient care [18]. Advanced transport protocols must therefore facilitate interoperability by enabling secure data exchange across different systems, ensuring that information flows smoothly between devices, hospitals, clinics, and remote care providers [19]. This interconnectedness not only improves healthcare delivery but also enhances the overall efficiency of healthcare networks [20].

The scalability of healthcare networks was a vital consideration as smart cities continue to expand [21]. As the number of connected devices and patients grows, so does the amount of data that needs to be transmitted [22]. Healthcare networks must be capable of scaling up to accommodate increasing data loads without compromising performance or security [23]. Transport protocols must be designed to handle the dynamic nature of healthcare data, which can vary in volume, velocity, and variety. For example, the real-time transmission of data from wearable devices monitoring patient vitals requires different handling than the transmission of large medical images or long-term health records [24]. Transport protocols must be flexible and adaptive, able to support a wide range of data types while maintaining efficiency and reliability [25]. Scalability must also extend to the underlying infrastructure, such as cloud computing

platforms and network architectures, to ensure that the network can grow alongside the expanding needs of a smart city healthcare system.