

## OSI AND TCP/IP REFERENCE MODELS IN ISLAMIC DEVELOPMENT AND THOUGHT AND THE HISTORY OF DISCOVERY IN THE HEYDAY OF ISLAM

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**Eka Ramdan Permana**

[Eka01ramdan@gmail.com](mailto:Eka01ramdan@gmail.com)

*Universitas Pamulang*

**Fajar Nugraha Wahyu**

[fajarnugraha06@gmail.com](mailto:fajarnugraha06@gmail.com)

*Universitas Pamulang*

**Handri Taufik**

[handrith@gmail.com](mailto:handrith@gmail.com)

*Universitas Pamulang*

**Thoyyibah T**

[dosen01116@unpam.ac.id](mailto:dosen01116@unpam.ac.id)

*Universitas Pamulang*

### *Abstract*

*In the development of information technology, the reference model of OSI (Open Systems Interconnection) and TCP / IP (Transmission Control Protocol / Internet Protocol) has become the main foundation in the design and implementation of computer networks. However, the relationship between these models and Islamic thought and the history of discovery in the heyday of Islam has not been discussed in much depth.*



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*In this journal, we examine both reference models and relate them to Islamic thought and the history of discovery in the heyday of Islam. We highlight concepts in the OSI and TCP/IP models that may have relevance to values, principles, or scholarly contributions established by Muslim scholars in the past. also reviews how these models can provide inspiration in developing contemporary Islamic thought, especially in the context of information and communication technology. In addition, we discuss the history of inventions in the heyday of Islam to provide an in-depth historical context related to the development of modern information technology. It is expected to contribute to the understanding of the relationship between Islamic thought and modern information technology, as well as stimulate further discussion and research in this field.*

***Keyword: OSI and TCP/IP Reference Models, Information Technology Development, Islamic Thought, History of Islamic Discovery, Islamic Heyday, Relationship Between Information Technology and Islam.***

#### A. Introduction

Since the dawn of Islamic civilization, Muslims have shown interest and prowess in science and technology. The heyday of Islam in the Middle Ages was mainly known for its major contributions in various fields, including mathematics, astronomy, medicine, and philosophy.<sup>1</sup> In the context of information technology, Islamic thought and the history of inventions in the heyday of Islam provide a strong foundation for understanding the relationship between Islamic values and the development of models such as OSI and TCP/IP.

Islamic thought in its heyday was not only limited to the field of religion, but also extended to science and technology.<sup>2</sup> Muslim scholars such as Al-Kindi, Al-Khwarizmi, and Ibn Sina have made significant contributions in the development of mathematics, astronomy, and medicine.<sup>3</sup> In addition, their contributions also formed the foundations of scientific and philosophical thought that became the forerunners of modern thought.<sup>4</sup>

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<sup>1</sup> Umar, U. (2016). The study of pie technology from Islamic history to the modern era. *Al-Qalam: Journal of Islamic Studies and Education*, 8(1), 108-123.

<sup>2</sup> Modern, D. S. I. H. E. Pie Technology Studies.

<sup>3</sup> Benefactor, Z. A. (2023). The Effectiveness of Youtube on Islamic Insights (Case Study of Students of Islamic Education Study Program Uin Ar-Raniry Banda Aceh) (Doctoral Dissertation, Uin Ar-Raniry Banda Aceh).

<sup>4</sup> Hamdi, S., Muslimah, M., Musthofa, K., & Sardimi, S. (2021). Elaborating on the history of Western philosophy and the contributions of its characters. *Journal of Islamic Thought*, 1(2), 151-166.

The history of inventions in the heyday of Islam also includes important achievements in technology, including the development of the Arabic numeral system, navigational tools, and papermaking techniques. This shows that Islamic societies at that time were very open to science and technology from various cultures, which they then developed and improved according to their needs.

In the context of developing OSI and TCP/IP reference models, Islamic thinking about science, rationality, and technological development can provide a unique view.<sup>5</sup> Concepts such as justice, truth, and knowledge gained through observation and experimentation, which are fundamental values in Islamic thought, can be applied in the understanding and development of such models.

Through this approach, the journal aims to link Islamic thought and the history of inventions in the heyday of Islam with the development of OSI and TCP/IP reference models in information technology.<sup>6</sup> Thus, it is expected to open new insights in understanding the relationship between Islamic values and the development of modern information technology.

One interesting aspect in the development of information technology is the discovery in the field of computer networks. Although models such as OSI and TCP/IP were developed in the modern era, the basic concept of networking has existed since ancient times, including in the heyday of Islam.<sup>7</sup>

History records that Muslim scholars such as *Ibn al-Haytham*, known as the "Father of Optics," made major contributions in the fields of optics and natural science. *Ibn al-Haytham* is also known for his work in the fields of measuring science and geometry, which were the basis for the development of modern network technology.<sup>8</sup>

The concept of networks in the context of Islamic history can also be found in the development of falak. Muslim astronomers such as *Al-Battani* and *Al-Biruni* developed highly accurate methods of observation and calculation, which allowed them to understand the motions of planets and stars

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<sup>5</sup> Nuryadi, A. Network Operation Center (NOC) Network Infrastructure Design at Faculty III Building with Campus II of Syarif Hidayatullah State Islamic University Jakarta.

<sup>6</sup> Indriani, D. (2022). *Contemporary Ulema's Views on the Law of Playing Tiktok for Muslim Women (Analysis of Law No. 19 of 2016, Amendments to Law No. 11 of 2008 concerning Electronic Information and Transactions)* (Doctoral Dissertation, Postgraduate State Islamic University of North Sumatra).

<sup>7</sup> Muksin, M. (2016). Islam and the Development of Science & Technology (Study of the Development of Science and Technology of the Abbasid Dynasty). *Journal of Information Technology and Management*, 2(1).

<sup>8</sup> Suwarna, I. P. (2010). Optics.

better. This shows that in building communication and knowledge networks, Islamic societies of that time had developed complex and well-coordinated systems.

In the context of modern information technology, thoughts and inventions in the heyday of Islam can be linked to the development of computer networks. Concepts such as order, rigor, and intelligence in scientific thought applied by Muslim scholars of the time could serve as inspiration in designing and managing complex computer networks as we have today.

Through this study, it is hoped that new insights can be opened about the relationship between the history of inventions in the heyday of Islam with the development of information technology, especially in the context of computer networks. By understanding the contributions made by Muslim scholars in the past, we can appreciate their intellectual heritage and apply their values and principles to the development of better information technology in the future.

## B. Research methodology

Qualitative approach with case study design. The qualitative approach was chosen because it allows researchers to understand complex phenomena,<sup>9</sup> such as the relationship between Islamic thought and the development of information technology, from a deep and comprehensive point of view.

The case study was chosen because it allows researchers to unearth rich and detailed information about concrete examples of discovery history in the heyday of Islam and their relationship to the OSI and TCP/IP reference models.<sup>10</sup> A case study will be conducted at SMK Merah Putih Bekasi to collect data on students' perceptions of their OSI and TCP/IP Model.

The collected data will be analyzed using regression analysis to identify patterns and relationships between the variables studied. This analysis will help in understanding the extent to which students have a positive perception of their OSI and TCP/IP Models, as well as identifying areas for improvement.<sup>11</sup>

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<sup>9</sup> Prihatsanti, U., Suryanto, S., & Hendriani, W. (2018). Using case studies as a scientific method in psychology. *Psychology Bulletin*, 26(2), 126-136.

<sup>10</sup> Adiwisesa, Y. N. (2014). Design a Web-Based Marriage Information System (Sikah): A Case Study of Kua Sukmajaya Sub-District Depok.

<sup>11</sup> Febriana, N. I. (2016). Analysis of the Bank's Service Quality on Customer Satisfaction at Bank Muamalat Indonesia Tulungagung Sub-Branch Office. *An-Nisbah: Journal of Sharia Economics*, 3(1), 1-145.

Using qualitative approaches and case study design, it is hoped that this research can provide a better understanding of the relationship between Islamic thought, the history of inventions in the heyday of Islam, and the development of OSI and TCP/IP reference models in information technology.<sup>12</sup> It is also expected to provide valuable input for the development of OSI and TCP/IP models and contributions to the literature on the history and development of technology in Islam.

This research methodology will use a qualitative approach with a focus on case studies. The qualitative approach was chosen because it allows researchers to understand in depth the relationship between the OSI Reference Model and TCP/IP with Islamic thought as well as the history of discovery in the heyday of Islam.

Case studies will be conducted to explore rich and detailed information on how concepts in the OSI and TCP/IP Reference Models can be linked to values, principles, or scholarly contributions built by Muslim scholars in the past. Case studies will also involve researching archives and primary sources to gain a better understanding of Muslim scholars' contributions to science and technology.<sup>13</sup>

The research will also involve interviews with Islamic information technology experts, historians, and scholars to gain diverse viewpoints on the relationship between Islamic thought and the development of information technology.<sup>14</sup> The collected data will be analyzed qualitatively to identify patterns, themes, and relationships between various concepts and findings.

By using qualitative approaches and case studies, it is hoped that this research can provide a better understanding of the relationship between Islamic thought, the history of inventions in the heyday of Islam, and the development of OSI and TCP/IP Reference Models in information technology.<sup>15</sup>

In addition to interviews with information technology experts and Islamic scholars, the research will also involve historians who have expertise in the history of inventions in the heyday of Islam. Historians will provide deep insight into the historical and cultural context in which such

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<sup>12</sup> Armas, A. (2005). Biblical Methodology in Quranic Studies: A Critical Study. Human Echo.

<sup>13</sup> Sudewi, S., & Nugraha, S. M. (2018). The history of Islamic pharmacy and the work of its characters. Aqlam: Journal Of Islam And Plurality, 2(1).

<sup>14</sup> Charity, T. A. (2013). Reconstruction of the History of the Quran. Alvabet Library.

<sup>15</sup> Ibrahim, A. (2023). Islamic Economic and Business Research Methodology. Earth Literacy.

discoveries took place.<sup>16</sup> They will also assist in interpreting how the contributions of Muslim scholars of the time can be connected to concepts in the OSI and TCP/IP Reference Models.<sup>17</sup>

Archival research and primary sources will be an integral part of this methodology, where researchers will access relevant historical documents to unearth information about discoveries and scientific contributions from the heyday of Islam. Historians will help in analyzing and interpreting these documents to gain a better understanding of how Islamic thought has influenced the development of science and technology at that time.

In addition, focus group discussions with historians, information technology experts, and Islamic scholars will also be held to discuss findings and interpretations from case studies and archival research. This discussion will assist in testing the validity of the findings and gaining a more comprehensive understanding of the relationship between Islamic thought, the history of inventions in the heyday of Islam, and the development of the OSI and TCP/IP Reference Models in the context of modern information technology.

### C. Discussion

#### Understanding OSI and TCP/IP Reference Models

The OSI (Open Systems Interconnection) Reference Model is a standard model used to design and understand how computer networks work.<sup>18</sup> This model consists of seven layers, each of which has its own function. These layers include the physical, data link, network, transport, session, presentation, and application layers. Each layer is responsible for providing services to the layer above it and using the services of the layer below it. Meanwhile, TCP / IP (*Transmission Control Protocol / Internet Protocol*) is a collection of communication protocols used to connect computer networks to the Internet. The TCP protocol is responsible for ensuring reliable and orderly

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<sup>16</sup> Alifuddin, M. S. A. (2024). *Ta: Design of an illustrated book about Muslim scientists for ages 13-15 years at Mts Negeri Sidoarjo* (Doctoral Dissertation, University of Dynamics).

<sup>17</sup> Indriani, D. (2022). *Contemporary Ulema's Views on the Law of Playing Tiktok for Muslim Women (Analysis of Law No. 19 of 2016, Amendments to Law No. 11 of 2008 concerning Electronic Information and Transactions)* (Doctoral Dissertation, Postgraduate State Islamic University of North Sumatra).

<sup>18</sup> Mother Earth, A. (2017). Identify problems in OSI model-based computer networks.

transmission of data between computers, while the IP protocol is responsible for directing data to the correct destination in the network.<sup>19</sup>

#### Contribution of Islamic History in Network Development and OSI and TCP/IP Reference Models

Islamic history is known as the golden period of science and technology, during which Muslim scholars made significant contributions in various fields, including mathematics, astronomy, medicine, and philosophy. These contributions not only helped build the foundations for modern science, but also had a significant impact in the development of computer networks and OSI and TCP/IP reference models.<sup>20</sup>

One example of an important contribution in Islamic history is the development of the Arabic numeral system, which is used as the basis for the modern number system and complex mathematical calculations in computer networks. In addition, Muslim scholars also made great advances in astronomy, which were important in the development of navigation and timing technologies essential in computer networks.

In addition, philosophical thought and scientific methodology developed by Muslim scholars such as Al-Kindi, Al-Khwarizmi, and Ibn Sina were also influential in the development of concepts and models in computer networks. Concepts such as logic, algorithms, and experimental methodology have formed the basis for the development of models such as OSI and TCP/IP.

Thus, the development of computer networks and models such as OSI and TCP/IP cannot be separated from the contributions and thoughts of Muslim scholars in the heyday of Islam. A deep understanding of the history of inventions in the heyday of Islam can provide valuable insights in developing modern information technology by considering values, principles, and scientific contributions from the past.

In the context of the development of computer networks and the current OSI and TCP/IP reference models, ideas and inventions in the heyday of Islam have significant relevance. The contributions of Muslim scholars of that time not only provided the foundation for the development of modern science, but also enriched our understanding of how information technology could be developed

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<sup>19</sup> Fergina, A., Kom, M., Simatupang, D. S., St, M., Dewi, D. D., Stat, M., ... & Mat, M. (2024). Textbook of Computer Networking and Security. Kaizen Media Publishing.

<sup>20</sup> Sari, M. W. (2024). Computer Network Basics Book.

taking into account the values of ethics, justice, and knowledge gained through observation and experimentation.<sup>21</sup>

Islamic thought in its heyday emphasized the importance of knowledge, truth, and justice, which are values that are also relevant in the development of modern information technology. By understanding the contributions of Muslim scholars of the time, we can take inspiration in developing better information technology, which is not only technically efficient but also promotes human values and justice.<sup>22</sup>

In the development of current OSI and TCP/IP reference models, an understanding of the history of invention in the heyday of Islam can provide a broader perspective on how information technology can be developed by taking into account aspects of culture, history, and values built by society at that time. Thus, the history of inventions in the heyday of Islam has not only historical, but also philosophical and practical relevance in the development of modern information technology.

The glorious history of Islam includes many inventions and contributions related to computer networks and information technology. Some of the discoveries that can be attributed to the development of the TCP/IP reference model include:

1. Arabic Numeral System

The invention of the Arabic numeral system was an important contribution to the development of mathematics and information technology. This number system, together with the concept of zero, allowed the development of more efficient and complex calculation systems, which became the basis for calculations in modern computer networks.<sup>23</sup>

2. Algorithm

The contributions of Muslim scholars such as Al-Khwarizmi in the development of algorithms became the foundation for the development of communication protocols such as

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<sup>21</sup> Reiza, A. J. (2021). Ta: Vlan-based computer network design on West Onion Bone BPS using Cisco Packet Tracer (Doctoral Dissertation, Lampung State Polytechnic).

<sup>22</sup> Nurhalisa, U., & Ibrahim, I. (2021, June). Point To Point Wireless Network Design By Utilizing Frame Relay On Lan Network At Pt. Bumi Sawindo Permai. In Proceedings of Seminar on Vocational Research Results (Semhavok) (Vol. 3, No. 1, pp. 203-209).

<sup>23</sup> Agussalim, A., Baso, Y. S., & Zuhriah, Z. (2024). Measuring the Dimension of Cognition: An Algorithmic Approach in Language Analysis. *Journal of Undergraduate Humanities*, 4(01), 73-82.



TCP/IP. Algorithms help in organizing and transmitting data between computers in an organized and efficient manner.

### 3. Falak Science

The development of science by Muslim scholars such as Al-Battani and Al-Biruni made an important contribution to the development of navigation technology. A deep understanding of the motion of planets and stars helps in the development of accurate navigation systems, which become important in the regulation and transmission of data in computer networks.

### 4. Scientific Methodology

The philosophical thinking and scientific methodology developed by Muslim scholars such as Ibn Sina influenced the development of the OSI and TCP/IP reference models. Concepts such as observation, experimentation, and logical reasoning formed the basis for modern scientific thinking that is also used in the development of information technology.

Thus, the discoveries of the Islamic heyday have a strong link to the development of computer networks and TCP/IP reference models. The contributions of Muslim scholars in mathematics, astronomy, and scientific methodology have provided a solid foundation for the development of modern information technology.<sup>24</sup>

The Influence of Discovery History in the Islamic Golden Age on the Development of OSI and TCP/IP Reference Models, History records that the heyday of Islam in the Middle Ages was a very important period in the development of science and technology. Muslim scholars of the time made significant contributions in many fields, including mathematics, astronomy, medicine, and philosophy. These contributions not only established the foundation for modern science, but also had a significant impact in the development of computer networks and OSI and TCP/IP reference models.<sup>25</sup>

One of the most important contributions of the heyday of Islam was the development of the Arabic numeral system. This number system, together with the concept of zero, allowed the development of more efficient and complex calculation systems, which became the basis for calculations in modern computer networks. Without these contributions, the development of OSI and TCP/IP

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<sup>24</sup> Julia, A. (2023). Numeration literacy ability of PGMI students in solving mathematical problems (doctoral dissertation, Uin Raden Intan Lampung).

<sup>25</sup> Sanjayanti, N. P. A. H., Darmayanti, N. W. S., & Mahayasa, K. E. (2021). Basic Natural Sciences. Nilacakra.

reference models would probably not have been compatible with modern mathematical developments.<sup>26</sup> Muslim scholars also made great advances in astronomy. Muslim astronomers such as Al-Battani and Al-Biruni developed highly accurate methods of observation and calculation, which allowed them to understand the motion of planets and stars better. This understanding helped in the development of accurate navigation technology, which became important in the organization and transmission of data in computer networks.

No less important contribution was the development of algorithms by Muslim scholars such as Al-Khwarizmi. Algorithms are the basis for the development of communication protocols such as TCP/IP. Algorithms help in organizing and transmitting data between computers in an organized and efficient manner, which is becoming key in the development of modern computer networks.

In addition, philosophical thought and scientific methodology developed by Muslim scholars such as Ibn Sina were also influential in the development of the OSI and TCP/IP reference models. Concepts such as observation, experimentation, and logical reasoning formed the basis for modern scientific thinking that is also used in the development of information technology.

Thus, the discoveries of the Islamic heyday have a strong link to the development of computer networks and TCP/IP reference models. The contributions of Muslim scholars in mathematics, astronomy, and scientific methodology have provided a solid foundation for the development of modern information technology. By understanding the history of inventions in the heyday of Islam, we can appreciate their intellectual heritage and apply it in the development of better information technology in the future.

The OSI (Open Systems Interconnection) and TCP/IP (Transmission Control Protocol/Internet Protocol) Reference Models are two models used to design and manage communication between computer systems. Although both have the same goal, which is to provide a framework for data communication in computer networks, they both have differences in structure and functional layers that they have.

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<sup>26</sup> Ahmad, A., Perwira, H., & Wijayanti, H. N. (2023). Unraveling the mysteries of numbers: traces of the relationship between mathematics and numbers in Arabic.

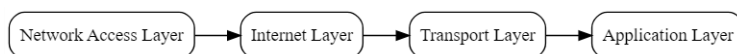
## 1. OSI Reference Model



The OSI Reference Model consists of seven distinct layers, ranging from the physical layer to the application layer. Each layer is responsible for performing certain functions in the communication process. Here are the layers in the OSI Reference Model:

- **Physical Layer:** Responsible for transmitting bits of data through a physical transmission medium such as cables or radio waves.
- **Data Link Layer:** Manages access to the transmission medium and manages data transmission between two connected nodes in the same network.
- **Network Layer:** Manages logical addressing, routing, and addressing on the network.
- **Transport Layer:** Handles data transmission between two connected nodes, ensuring reliable and sequential data transmission.
- **Session Layer:** Manages connections and sessions between applications on two communicating nodes.
- **Presentation Layer:** Handles data formatting and encryption for secure data exchange.
- **Application Layer:** Provides an interface between user applications and the network.

## 2. TCP/IP Reference Model



The TCP/IP Reference Model has four main layers, which conceptually intersect with the layers in the OSI Reference Model. Here are the layers in the TCP/IP Reference Model:

- **Network Access Layer:** Responsible for managing the physical connection between devices and the network.
- **Internet Layer:** Ensures the transmission of data packets between different networks through routing.

- Transport Layer: Responsible for reliable data transmission between two nodes in the network.
- Application Layer: Provides network services for user applications, such as HTTP for web browsing or SMTP for email.

Despite differences in the number and names of layers, they share the same purpose, which is to provide a framework for data communication in computer networks. The OSI Reference Model is more commonly used in educational and research contexts, while the TCP/IP Reference Model is more commonly used in practical computer network implementations.

#### D. Conclusion

The OSI (Open Systems Interconnection) and TCP/IP (Transmission Control Protocol/Internet Protocol) Reference Models are two models used to design and manage communication between computer systems. Although both have the same goal, which is to provide a framework for data communication in computer networks, they both have differences in structure and functional layers that they have.

The OSI Reference Model consists of seven distinct layers, ranging from the physical layer to the application layer. Each layer has its own function and is responsible for performing certain functions in the communication process. The OSI Reference Model is more commonly used in educational and research contexts.

Meanwhile, the TCP/IP Reference Model has four main layers, conceptually intersecting with the layers in the OSI Reference Model. Although the number of layers is smaller, the TCP/IP Reference Model is more commonly used in practical computer network implementations.

Both models have strong relevance to the history of discovery in the heyday of Islam. The contributions of Muslim scholars in mathematics, astronomy, and scientific methodology have provided a solid foundation for the development of modern information technology. By understanding the history of inventions in the heyday of Islam, we can appreciate their intellectual heritage and apply it in the development of better information technology in the future.

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