DESIDOC Journal of Library & Information Technology, Vol. 45, No. 1, January 2025, pp.16-21, DOI : 10.14429/djlit.19823

A Comparative Analysis of Single Sign-On and Proxy Solutions for Facilitating Remote Access to Electronic Resources in Academic Libraries

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ABSTRACT

In the era of internet-driven information, in libraries, the comparative analysis of Single Sign-On (SSO) and Proxy Technologies plays a vital role in understanding the features and importance of these technologies in providing information to patrons. The study investigated the SSO authentication systems that effectively provide users convenience in managing multiple login credentials and proxy technologies that enable remote access to library materials and extend services beyond physical library premises. Proxy authentication, which is decentralised and based on IP addresses. The study analyses the differences between the authentication methods. The challenges explored in the article are budget, lack of knowledge of the library professional, and user's disinterest in adapting to new technological advances. The study provided expert insights and recommendations, offering libraries a way to make decisions in choosing the right authentication system to provide remote access to e-resources. The study also suggested future trends aligning with the goals, scalability needs, and resource accessibility. The study offered insights into the changing landscape of authentication systems, helping libraries navigate the challenges of choosing the approach to enhance client satisfaction in today's digital era.

Keywords: Single sign-on; IP-authentication; Remote access service; Digital resources; Academic libraries

1. INTRODUCTION

The libraries emphasise the importance of technology. The analysis of Single Sign-On (SSO) and Proxy technologies in libraries highlights how they differ in streamlining user access and aiding in safeguarding assets[1]. Librarians who are information disseminators are well-versed with authorisation methods, and user experiences within platforms play a crucial role. Robust authentication mechanisms become essential as libraries transform into information-providing hubs[2].

The study on SSO and Proxy Authentication sheds light on their abilities, functions, applications, and implications within the field of libraries. The exploration helps understand various authentication systems' role in shaping libraries, focusing on characteristic features like ensured user convenience, security, and optimised accessibility to resources. The research aimed to provide information professionals and technology stakeholders insights for library decision-making. Technologies are revolutionising information centres, and libraries must comprehend the differences between SSO and proxy authentication to balance user access and stringent security measures.

2. LITERATURE REVIEW

Karfa Bizi[3] opined that libraries nurture simple security systems to protect and maintain informational resources. E-resources are provided to patrons remotely to ensure users' need for timely information. The librarian must ensure continuous library resource access beyond library walls. Nagra[4] observed that several concerns had been raised over the years regarding the security and access to library-subscribed e-resources beyond the organisation's premises. Corrado[5] stated that one explored solution is a Proxy IP-based solution that relies on IP address validation. Goff and Scofield[6] pointed out that proxy authentication needs a proxy server that acts as an intermediary between the user and the webserver to help prompt and provide access to remote users. Zhu[7] stated that proxy authentications have effectively expanded the accessibility to library resources beyond physical boundaries. Implementation of Proxy authentication is comparatively easy in a library with minimum technical resources.

Kondoj[8], *et al.* conducted a case study that depicted reliance on the proxy solution alone as possibly leading to dependency issues and impacting the remote access performance at the libraries. They concluded that a proxy authentication solution offers flexible pricing models and can be implemented gradually in libraries. Iles and Erturk[9] found in a case study evaluating proxy-based authentication that cloud-hosted software services help libraries in the long run, and the conversion to SSO depends on the security requirements of the respective institution.

Received : 11 January 2024, Revised : 02 July 2024
Accepted : 19 July 2024, Online published : 02 January 2025

Purwinarko[10], *et al.* explained that single sign-on is a centralised authentication system with a user-centric design. Kodam[11] elaborated that authentication reduces the hassle of multiple login credentials. The centralised authentication model simplifies access to library-subscribed resources. The SSO is popularly known for granular usage statistics and custom personalisation features. Shastri and Chudasma[12] found that analysing SSO and Proxy Technologies in libraries shows advantages and challenges. Jayakanth[13], *et al.* explained that SSO dramatically enhances user experiences for Proxy Authentication to meet the needs and demands for off-site access. Pham[14], *et al.* suggested that SSO implementation often requires an initial investment. Shi[15], *et al.* believed that the preferred authentication system for a library is contingent upon its specific library system. Implementation challenges usually arise due to financial constraints, as libraries face limitations in allocating funds for robust authentication measures. Furthermore, a shortage of skilled professionals and a lack of awareness about authentication systems impede successful implementation. Felts and Carpenter[16] concluded that with careful consideration of user requirements and parent organisational needs, the libraries could decide on a solution for picking proxy or SSO authentication systems to provide remote access services in academic libraries. Tej and Rao[17] conducted a case study on implementing OpenAthens, a single sign-on authentication system; the study provided guidelines and pointers for the smooth operation of single sign-on authentication in response to the challenges encountered.

3. PROBLEM STATEMENT

The present study is entitled "a comparative analysis of single sign-on and proxy solutions for facilitating remote access to electronic resources in academic libraries."

4. OBJECTIVES

1. To explore and contrast Single Sign-On (SSO) and Proxy Authentication models for accessing library e-resources.
2. To address the challenges experienced when implementing Proxy Authentication and Single sign-on in libraries.
3. To examine the instrumental factors in deciding on authentication and the future trends in providing e-resources with libraries.

5. METHODOLOGY

The literature from recent years was reviewed, which mentioned the theoretical frameworks to contrast how SSO and Proxy technologies were chosen and used in libraries. Aspects such as functionalities and practical uses of Single Sign On (SSO) and Proxy Authentication were covered by many research articles, conference proceedings, and reports and, hence, were considered in this study. The study is classified into 2 phases. In the initial phase of the study, literature review is conducted to establish a solid theoretical foundation. This review focused on published journal articles from scholarly databases to gain insights into the progress, technological foundations, and conceptual differences between SSO and Proxy Authentication within library contexts.

After the literature review, in phase 2 of the study, frameworks obtained in the literature review are combined to create an organised comparison between SSO and proxy technologies. The synthesis of the combination mainly revolved around organising and categorising literature focused on user experience, security concerns, and practical implications for libraries. The perspectives are evaluated to bridge the gaps and discrepancies between SSO (Single Sign On) and Proxy Technologies. The insights of various libraries that have implemented the authentication systems are evaluated and analysed to provide solutions to challenges faced to enable remote access to electronic resources.

6. SINGLE SIGN-ON AND PROXY AUTHENTICATION IN ACADEMIC LIBRARIES

Libraries are actively changing from time to time. As libraries grow, authentication systems become mandated to provide security and accessibility to library users. There are several authentication systems, but the widely used authentication systems that provide protection and accessibility are SSO and IP-based authentications.

Implementing Single Sign On technology has changed user authentication methods and access control. SSO simplifies the login process by offering an approach that allows users to explore resources[18]. The SSO is a centralised authentication solution that does not streamline the network of library resources. The increased adoption of SSO authentication among library professionals is founded on practical merits. It helps reduce the hassle of remembering and managing multiple login credentials, significantly saving the users' time[19]. The SSO aids the librarians as it helps provide granular usage statistics, which are instrumental in developing the inventory on demand.

One of the top authentication systems, Proxy authentication, has gained massive popularity within the library profession due to its ability to grant access to various digital materials. Due to its decentralised authentication approach, Proxy authentication extends its services beyond library premises due to its reliance on IP addresses for user authentication. The Proxy server connects the remote user by verifying their IP address and grants authorised access by safeguarding the integrity of resources[20]. Proxy authentication is significant because it balances between user convenience and content protection. The proxy is considered an advanced method, ensuring that libraries have access to information while still adhering to security protocols and licensing agreements.

7. ANALYSIS

To compare SSO and Proxy authentication, examining the aspects of both methods is essential before discussing their features; it's important to understand the installation process to determine what works best for the library. SSO-

based authentications can be costly. One may need the knowledge to implement it in a library configuration, even though proxy authentications are readily accessible on forums.

7.1 Single Sign-On Configuration and Software Components for Installation

Single Sign-On software packages are readily available for download on the websites. After the download, run the software installer and follow the instructions on screen[21]. The following are the steps to configure SSO installation:

- Choose installation options such as installation directory and server settings.
- Configure the identity provider (IdP) settings, including organisation details and certificates.
- Set up user authentication methods such as username/password or federated identity providers.
- Define attribute mappings to map user attributes between the IdP and Service Providers (SPs).
- Configure access policies to control user resource access based on roles or attributes.
- Test the SSO setup by logging in with different user accounts and accessing protected resources.

7.2 Proxy Configuration and Software Components

Proxy authentication software can be downloaded from the vendor's website, most of which are Open-Source software. Run the proxy authentication installer as directed on the screen installation wizard to install the software[22].

The following are the steps to configure proxy installation:

- Specify the installation directory and server settings during installation.
- Configure network settings such as IP addresses and port numbers for incoming connections.
- Set up Access Control Lists (ACLs) to define which users or IP addresses can access resources through the proxy.
- Configure authentication methods such as IP-based authentication or LDAP integration.
- Enable logging and monitoring features to track user activities and resource access.
- Test the proxy server setup by accessing resources through the proxy from different devices and locations[23].

Fig.1 below shows a flowchart illustrating the Single Sign-On (SSO) and Proxy authentication steps involved in installation.

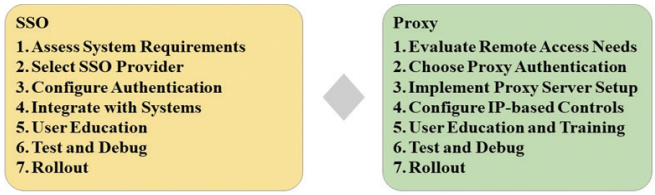

Figure 1. Installation steps: sso vs. proxy.

Table. 1 Below depicts the differences in features between single sign-on and proxy authentication. The differences help the professional choose the authentication preferred by the libraries based on the number of digital resources, size of the library, and scalability[24-25].

The centralised SSO authentication and decentralised proxy authentication approaches provide ease in setting integrated functions and remote access to subscribed digital resources. The single sign-on has federated search capabilities, unlike proxy authentication. SSO provides a resource link generator to those digital resources that are not integrated into the authentication system. Although both authentication systems have dashboard facilities, the SSO maintains global standards that give user group statistics, individual user statistics, and resource usage statistics[26].

Table 1. Differences between sso and proxy based authentication

S. No.	Features	SSO	Proxy
1.	Model of Authentication	Centralised	Decentralised
2.	User Experience	Uniform and seamless user experience	Focuses on remote users
3.	Considerations of Security	Robust security procedures to minimise vulnerabilities and secure user credentials.	A layer of protection by authenticating users based on IP addresses
4	Scalability	Ability to handle a rising user base	Needs an upgrade for an expanding user base
5.	Access to e-resources	Smooth between services without re-logging	Users in regions with non-standard IP addresses may have difficulties.
6.	Integration Difficulty	Complicated during the initial setup	Integrating Proxy Authentication systems is simple
7.	Compatibility Across Platforms	Interoperability with various operating systems and devices is smooth	It is critical to ensure that users may safely connect from diverse platforms
8.	Iterative Improvement and User Feedback	Continuous review and changes based on user feedback contribute to the authentication system's	Libraries should set up systems for gathering feedback.
9.	Data Privacy and Compliance	Compliance with data protection standards is critical	Compliance with applicable data protection legislation must be maintained.

8. CHALLENGES AND CONSIDERATIONS

Implementing Single Sign-On (SSO) or proxy authentication in libraries to access electronic resources may be challenging and require expertise and careful attention. Even though SSO and proxy-based authentications benefit the stakeholders, the task can be intricate and requires detailed analysis[27]. A significant obstacle is possible resistance from users who have grown accustomed to authentication techniques and may need time to adjust to new techniques[28]. Implementation of SSO is possible with the latest computer specifications, but integrating the existing library applications can be a tedious job and might require technical assistance from an expert. SSO implementation can be possible for more extensive libraries with more significant patron numbers[29].

Although proxy authentication doesn't require higher system configuration, it needs a stable internet connection and minimum computer specifications to provide the service smoothly[30]. Managing the IP of the users is a difficult task, and providing remote access to e-resources becomes an uphill task. SSO and proxy authentication require security measures to address data privacy and policy adherence[31]. In choosing the library, it is essential to analyse the authentication abilities and other features like scalability, cost, requirement, size, and customisation capability.

9. SUGGESTIONS

Several factors come into play when deciding which approach is best for a library, including scalability, cost-benefit analysis, and more. The user experience evaluation is the most crucial step in identifying the right impact solution for electronic resources. Accessibility of the resources facilitated by the SSO and Proxy solutions should consider ease of access from remote locations and compatibility with various browsers and devices regardless of their technical capabilities. They are ensuring the evaluation of SSO and Proxy in scaling to support user-increasing needs without compromising performance and security. Using usage metrics can help understand the effectiveness of SSO and proxy solutions. Evaluating statistics, such as login frequency and user satisfaction score, helps optimise and improve. Vulnerability scanning can be conducted regularly for security assessment. Additionally, compliance requirements, such as meeting the industry standards for data protection, must be considered. Continuous user education, educating library staff about best practices and risks in providing remote access provision, and feedback inclusion will enhance these authentication systems over time, ultimately improving the user experience while ensuring secure access to library resources. Fig. 2 presents a flow chart illustrating the considerations involved in making decisions.

10. FUTURE TRENDS

The libraries' potential and future trends depend on the field's shifting user preferences and new technological developments. Many libraries have transformed from traditional authentication systems to advanced ones, such as SSO. In addition to operational efficiency, future authentication systems improve the user experience by including artificial intelligence and machine learning techniques. It is believed that library collection security and authentication processes would be enhanced using such technologies. Utilising XR technology is expected to bring about fully immersive experiences and might aid in effectively promoting library usage. Patron confidentiality will influence library practices, and technologies such as biometrics with real-time reliable verification may take over to provide security to the patrons who are accessing the resources remotely. An emphasis on security, data ethics, and sustainability will lead to expanding remote access alternatives, and the shift depends on the strategies the skilled librarians use.

Factors	Suggestion
User Experience Prioritization	Evaluate how each authentication method, whether Single Sign-On (SSO) or Proxy Authentication, aligns with the preferences and expectations of library patrons.
Security Measures	Consider the robustness of security protocols, potential vulnerabilities, and the ability of the chosen solution to safeguard user data.
Scalability And Future Growth	Choose an authentication method that scales effectively, accommodating an increasing number of users and evolving library services.
Cost-benefit Analysis	Consider not only the initial implementation costs but also ongoing maintenance, licensing fees, and potential costs associated with user training and support.
Integration Complexity	Evaluate the ease of integration with existing library systems and applications. Consider the technical complexities associated with implementing each authentication method.
Adaptability To Remote Access Needs	Given the increasing importance of remote access, especially in the wake of evolving work and study patterns, assess how each authentication model caters to off-site users.

Figure 2. Factors involved in decision-making.

11. CONCLUSION

The study investigated the distinctions between Single Sign On (SSO) systems and Proxy Technologies, which are IP-based in the context of library systems. The study depicted that both authentication systems are helpful and user-centered. The right choice for the library depends on its size; a small library with a limited budget can use IP-based authentication to reach out to users remotely from all locations. An enormous library with numerous databases without budgetary issues can opt for SSO to reduce the burden of remembering multiple login credentials and provide remote and secure access to e-resources. The implementation problems that libraries constantly face are budget problems, authentication mechanisms, lack of knowledge, user experiences, security, scalability, and resource accessibility. Some advantages of authentication systems are user experience for more straightforward navigation, remote access provision, and granular usage statistics to provide insights to stakeholders on acquisition. Within the realm of library technology, the study highlighted the significance of user authentication procedures, providing libraries with insights that can assist them in making educated decisions on implementing customised authentication systems.

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