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(54) **APPARATUS, SYSTEMS AND METHODS TO PROVIDE AUTHENTICATION SERVICES TO A LEGACY APPLICATION**

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(58) **Field of Classification Search**
None
See application file for complete search history.

(57) **ABSTRACT**

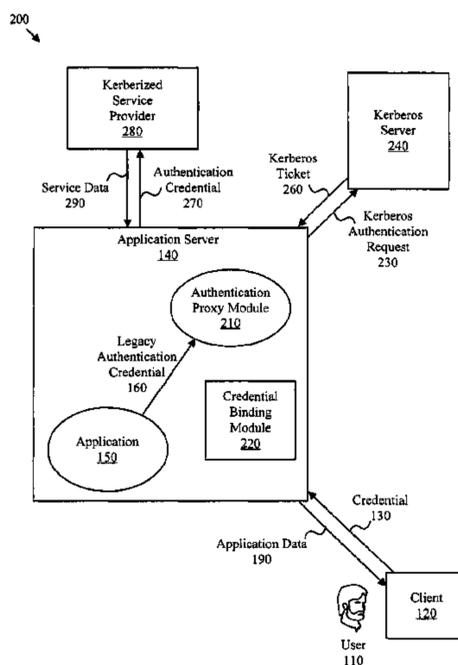
Authentication credentials from legacy applications are translated to Kerberos authentication requests. Authentication credentials from the legacy application are directed to an authentication proxy module. The authentication proxy module acts as a credential translator for the application by receiving a set of credentials such as a user name and password, then managing the process of authenticating to a Kerberos server and obtaining services from one or more Kerberized applications, including Kerberos session encryption. A credential binding module associates a user corresponding to authentication credentials from a legacy authentication protocol with one or more Kerberos credentials. Anonymous authentication credentials may be translated to authentication requests for a network directory services object, such as a computer object or service object.

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21 Claims, 4 Drawing Sheets



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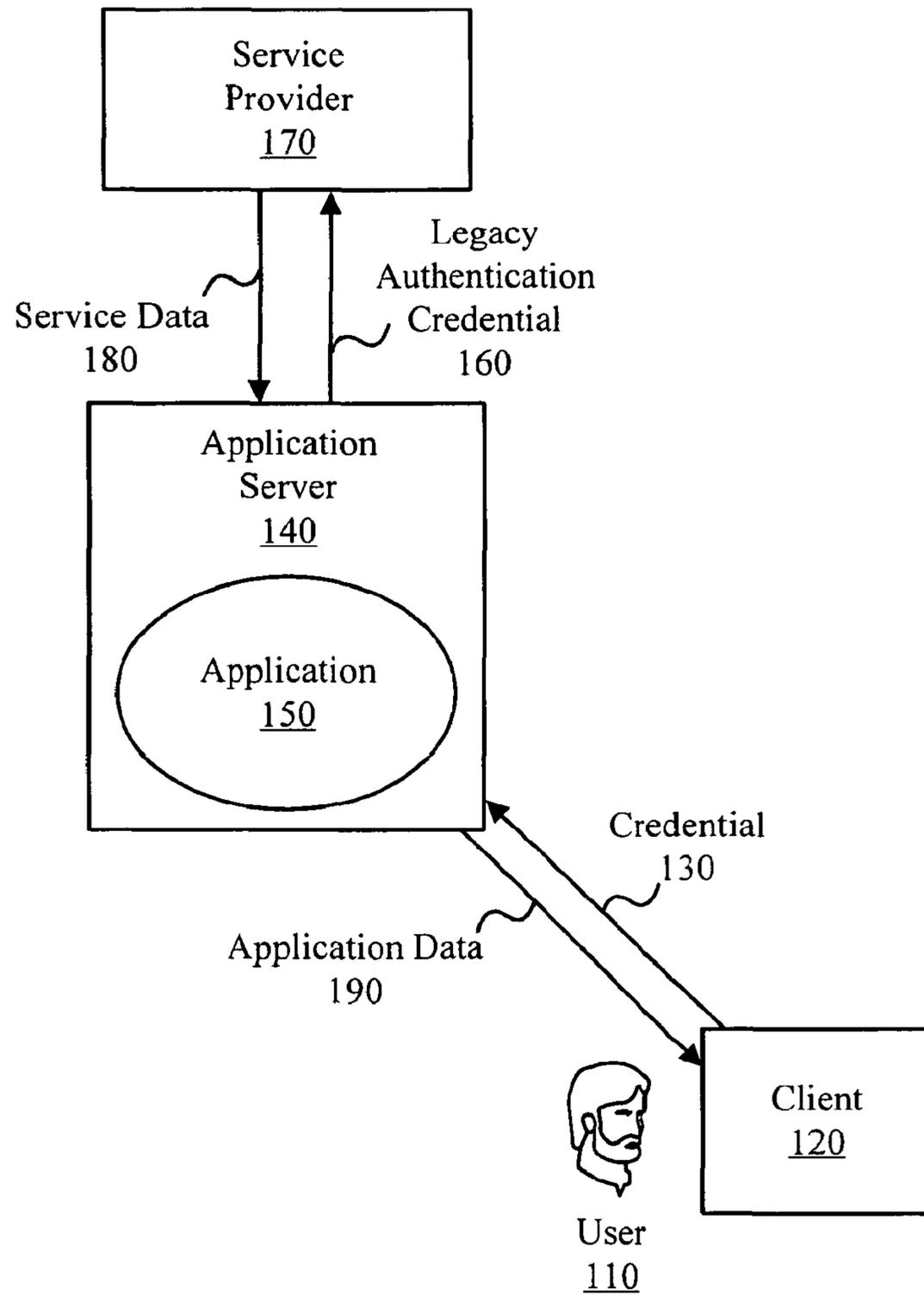
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(Prior Art)

Fig. 1

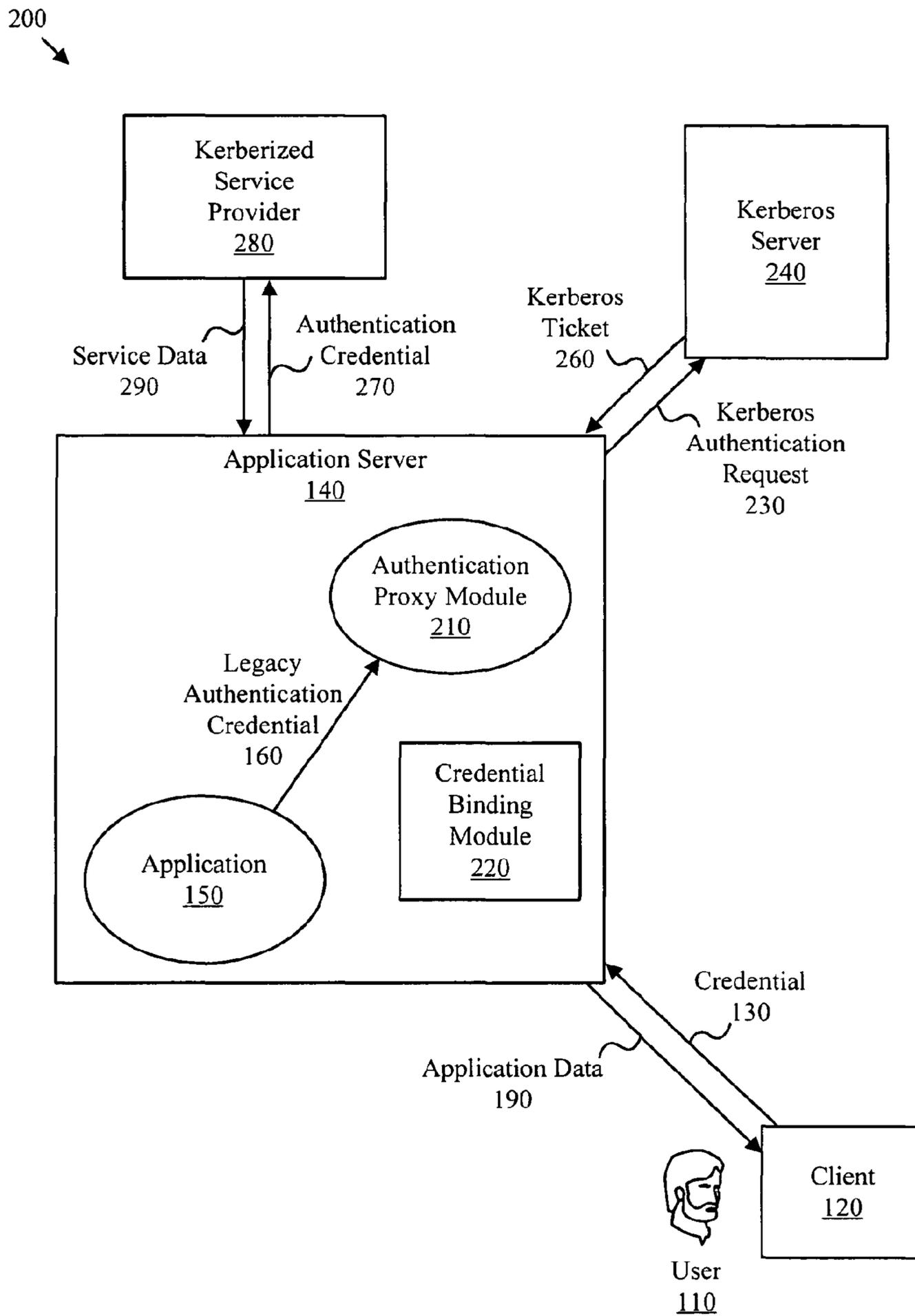


Fig. 2

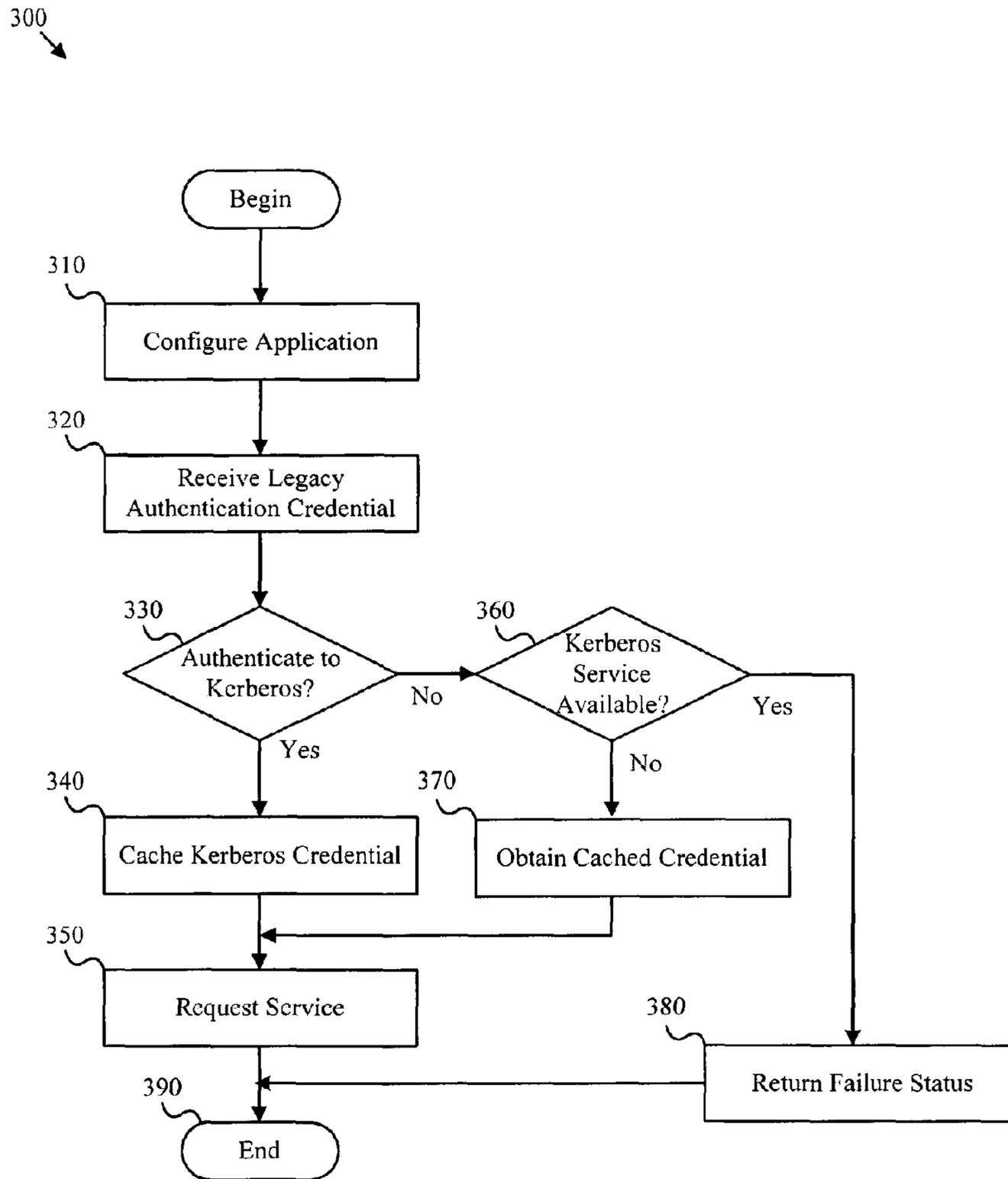


Fig. 3

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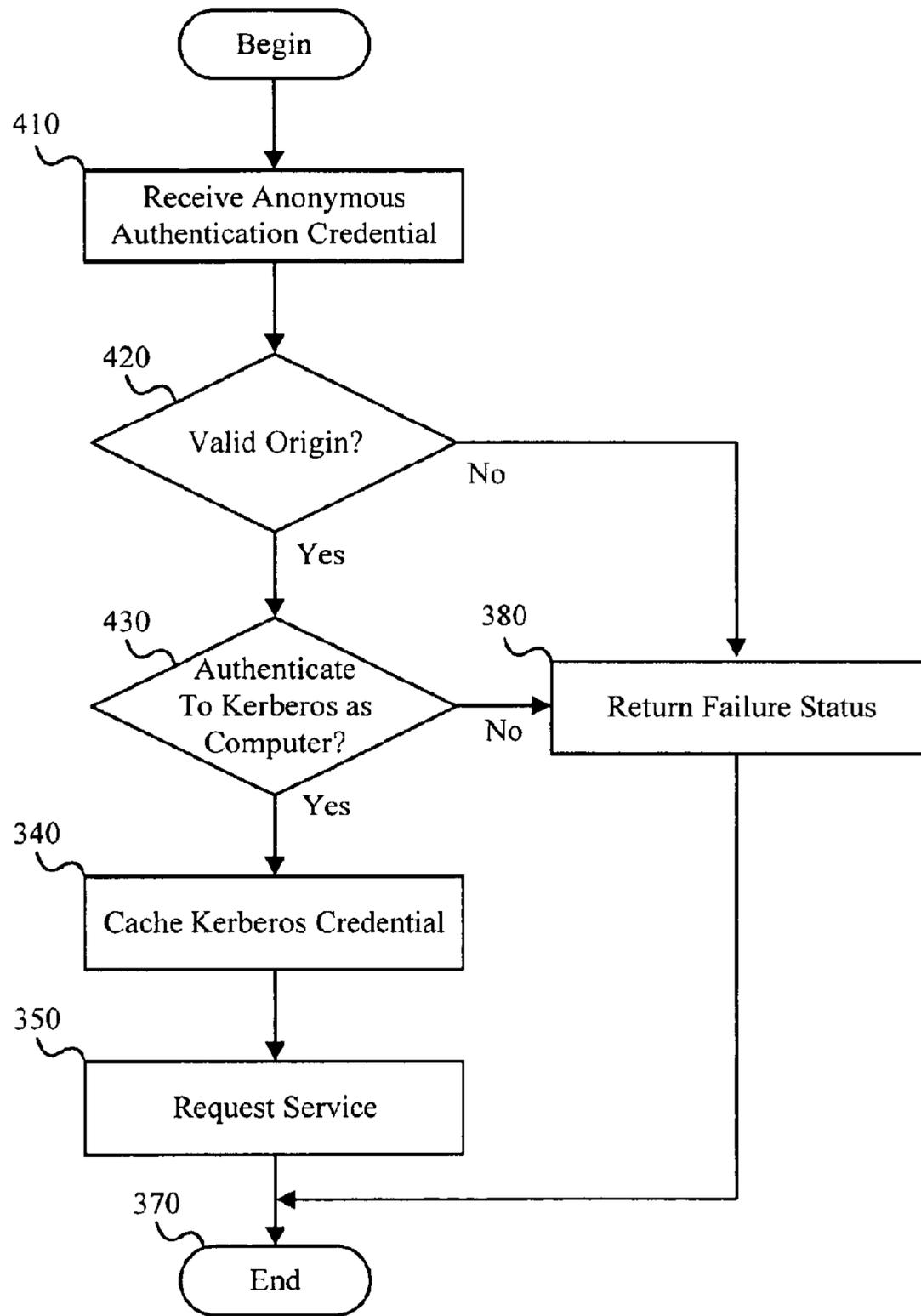


Fig. 4

**APPARATUS, SYSTEMS AND METHODS TO
PROVIDE AUTHENTICATION SERVICES TO
A LEGACY APPLICATION**

Matter enclosed in heavy brackets [] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to computer network authentication services. Specifically, the invention relates to apparatus, methods, and systems for providing authentication services to legacy applications.

2. Description of the Related Art

In recent years, computer networks have been increasingly significant in terms of the quantity and sensitivity of the data communicated. Once used primarily for academic purposes, the Internet has become a vehicle for communicating such confidential information as credit card transactions, bank account transactions, and corporate intellectual property. The same applies to proprietary corporate networks. As the quantity and value of the data being communicated has increased, the threats to the security of this data have increased proportionately.

One of the technologies developed to address data security threats is Kerberos authentication. Kerberos provides a means for sensitive data to be communicated securely across an insecure network. Kerberos authentication relies on the existence of a Kerberos server that certifies a user's identity to network services utilized by an application the user is running. Services that use Kerberos to authenticate users are said to be "Kerberized."

Many organizations use legacy applications that are not capable of using Kerberized services. These organizations face the dilemma of undergoing an expensive upgrade or rewriting of their legacy applications, or facing the increasing threats to the security of their data.

Given the aforementioned issues and challenges related to providing authentication services and the shortcomings of currently available solutions, a need exists for an apparatus, method, and system for providing authentication services to legacy applications. Beneficially, such an apparatus, method, and system would translate legacy authentication services to Kerberos authentication services.

SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available authentication services. Accordingly, the present invention has been developed to provide an apparatus, method, and system for providing authentication services to legacy applications that overcome many or all of the above-discussed shortcomings in the art.

In one aspect of the present invention, an apparatus for providing authentication services to legacy applications includes an authentication translation module that receives authentication credentials corresponding to a legacy authentication protocol with the authentication proxy module further configured to authenticate the user corresponding to the received credentials using the Kerberos authentication protocol. The authentication proxy module may be further config-

ured to authenticate users in circumstances where Kerberos authentication services are temporarily unavailable. In some embodiments, the apparatus for providing authentication services to legacy applications includes a credential binding module configured to associate legacy authentication credentials with corresponding Kerberos credentials.

In another aspect of the present invention, a method for providing authentication services to legacy applications includes directing authentication legacy authentication protocol credentials to a local authentication process that authenticates the user corresponding to the credentials, using the Kerberos authentication protocol. In one embodiment, the method further includes associating a plurality of users with corresponding legacy authentication credentials and Kerberos credentials. In another embodiment, the method further includes translating anonymous authentication requests to authentication requests for network directory services computer objects or service objects. This embodiment provides additional network security benefits by facilitating configuring network directory servers to prevent anonymous users from searching the network directory.

Various elements of the present invention may be combined into a system arranged to carry out the functions or steps presented above. In one embodiment, the system includes a client configured to authenticate using a legacy authentication protocol, an application configured to receive credentials from the client and direct them to an authentication proxy module, the authentication proxy module, a Kerberos server, and an application server that provides a Kerberos-secured service. Legacy authentication credentials are transmitted from the client to the authentication proxy module, which authenticates the user to the Kerberos server and passes the Kerberos credentials corresponding to the user to the Kerberos-secured service.

In some embodiments, the system may further include a credential binding module that associates each user with the corresponding legacy authentication credentials and one or more Kerberos credentials. In various embodiments, the legacy authentication credentials may include a user name, password, biometric, or the like. In various embodiments, the legacy authentication protocol may be RADIUS, TACACS, or the like, or may be a data access protocol that involves authentication such as ftp, LDAP, SQL, ODBC, or the like.

The present invention facilitates providing authentication services to legacy applications. These and other features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

It should be noted that reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment.

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention can be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional fea-

tures and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

FIG. 1 is a block diagram illustrating a typical prior art authentication system;

FIG. 2 is a block diagram illustrating an authentication protocol translation system in accordance with the present invention;

FIG. 3 is a flow chart diagram illustrating one embodiment of an authentication protocol translation method of the present invention; and

FIG. 4 is a flow chart diagram illustrating an anonymous user authentication protocol translation method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

It will be readily understood that the components of the present invention, as generally described and illustrated in the Figures herein, may be arranged and designed in a wide variety of different configurations. Thus, the following more detailed description of the embodiments of the apparatus, method, and system of the present invention, as represented in FIGS. 2 and 3, is not intended to limit the scope of the invention, as claimed, but is merely representative of selected embodiments of the invention.

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code could be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices, such as a computer readable storage medium. Similarly, operational data may be identified and illustrated herein within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may be distributed over

different locations including over different storage devices, and may exist, at least partially, merely as electronic signals on a system or network.

In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention can be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

The features, structures, or characteristics of the invention described throughout this specification may be combined in any suitable manner in one or more embodiments. For example, reference throughout this specification to “one embodiment,” “an embodiment,” or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases “in one embodiment,” “in an embodiment,” or similar language throughout this specification do not necessarily all refer to the same embodiment and the described features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

The present invention sets forth an apparatus, system and method for providing authentication services to legacy applications. Authentication requests from legacy applications are directed to an authentication proxy module that translates authentication requests to authenticate to Kerberized services. From the user’s standpoint, there is no change in the authentication process, nor is any modification required to the legacy application.

FIG. 1 is a block diagram illustrating a typical prior art authentication system 100. The prior art authentication system 100 includes a user 110, a client 120, a credential 130, an application server 140, an application 150, an authentication credential 160, a service provider 170, service data 180, and application data 190. The authentication credential 160 typically uses an authentication protocol less secure than Kerberos, such as LDAP, TACACS, or RADIUS, and may even involve passing a user name and password to the service provider 170 in clear text via an unsecured network.

The user 110 enters a credential 130 at the client 120 at the request of the application 150 running on the application server 140. The credential 130 typically consists of a user name and password. The application 150 utilizes services provided by the service provider 170 and authenticates to it by passing the authentication credential 160. The service provider returns service data 180 to the application 150. The cycle completes when the application 150 returns application data 190 to the client 120. In other embodiments, application data 190 may be stored in a database or directed to another process or service.

Because the authentication credential 160 may be transmitted across an unsecured network, it is subject to eavesdropping attacks in which an unauthorized user copies the authentication credential 160 as it is transmitted, or spoofing attacks in which an unauthorized user intercepts the authentication credential 160 by emulating the service provider 170. Replacing the service provider 170 with a Kerberized service may prevent such attacks, but the legacy application 150 is not configured to authenticate using Kerberos. Because the Kerberos authentication algorithm is more complex than older

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authentication protocols, it is typically not possible to reconfigure a legacy application 150 to use Kerberos authentication, and rewriting a legacy application 150 to authenticate using Kerberos typically involves a considerable investment of cost and time. A further advantage to replacing service provider 170 with a Kerberized service is that duplicate user accounts on servers in an organization's network may be consolidated, thereby reducing the administrative overhead required.

FIG. 2 is a block diagram illustrating an authentication protocol translation system 200 in accordance with the present invention. The authentication protocol translation system 200 may include components of the prior art authentication system 100 and may additionally include an authentication proxy module 210, a credential binding module 220, a Kerberos authentication request 230, a Kerberos server 240, a Kerberos ticket 260, an authentication credential 270, a Kerberized service provider 280, and service data 290. The authentication protocol translation system 200 facilitates translation of the credential 130 to an authentication request 230 that allows authentication to the Kerberized service provider 280. In some embodiments, the Kerberos ticket 260 may be a Kerberos identity.

In one embodiment, legacy authentication credentials 160 are configured to be submitted from the application 150 to the authentication proxy module 210. The authentication proxy module 210 receives the authentication credential 160 from the application 150 and invokes a corresponding Kerberos authentication request 230 for the Kerberos server 240. The Kerberos server 240 returns a Kerberos ticket 260 to the authentication proxy module 210, which then submits an authentication credential 270 to the Kerberized service provider 280. Once authentication to the Kerberized service provider 280 has completed successfully, service data 290 may be returned to the legacy application 150. In the embodiment depicted in FIG. 2, the authentication proxy module 210 runs on the application server 140. In other embodiments, the authentication proxy module 210 resides on a separate server.

The Kerberos protocol is actually more complex than represented in FIG. 2. For example, in response to the Kerberos authentication request 230, the Kerberos server 240 issues a service key to both the Kerberized service provider 280 and the issuer of the Kerberos authentication request, the authentication proxy module 210 in this embodiment. For purposes of simplicity, some details of the Kerberos authentication protocol are not depicted in FIG. 2, but are represented by the Kerberos ticket 260 and the authentication credential 270 that the authentication proxy module 210 submits to the Kerberized service provider 280.

In some embodiments, a credential binding module 220 includes an association between the legacy authentication protocol credentials for each user 110 and the corresponding Kerberos authentication credentials. In other embodiments, the association between the legacy and corresponding Kerberos credentials for each user 110 may be intrinsic to the authentication proxy module 210. In some embodiments, the credential binding module associates credentials corresponding to a legacy authentication protocol with a Kerberos identity, rather than a cached Kerberos ticket 260.

FIG. 3 is a flow chart diagram illustrating one embodiment of an authentication protocol translation method 300 of the present invention. The authentication protocol translation method 300 includes a configure application operation 310, a receive legacy authentication credential operation 320, an authenticate to Kerberos test 330, a cache Kerberos credential operation 340, a request service operation 350, a Kerberos service available test 360, an obtain cached credential opera-

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tion 370, and a return failure status operation 380. The authentication protocol translation method 300 facilitates translation of an authentication credential 160 issued by a legacy application 150 into a Kerberos authentication request 230 resulting in authentication to a Kerberized service provider 280.

The configure application operation 310 initializes the authentication proxy module 210 by directing the authentication credential 160 from the service provider 170 to the authentication proxy module 210. The authentication proxy module 210 thereafter is configured to receive a legacy authentication credential from the application 150 and intermediate between the legacy application 150 and the Kerberized service provider 280. In some embodiments, the legacy application 150 is configured to submit the authentication credential 160 to the authentication proxy module 210, rather than the service provider 170. In some embodiments, the configure application operation 310 is a setup program for the authentication protocol translation apparatus comprising the authentication proxy module 210 and the credential binding module 220.

The receive legacy authentication credential operation 320 receives an authentication credential 160 directed to the authentication proxy module 210. The authentication credential 160 may include a user name and password passed in clear text. In some embodiments, the receive legacy authentication credential operation 320 enters the authentication credential 160 into a table or database for later association with the corresponding Kerberos ticket 260. In some embodiments, the authentication credential 160 is stored in encrypted form. In some embodiments, the authentication credential 160 may be associated with a Kerberos identity.

In some embodiments, the authentication credential 160 may be stored in a database in clear text or encrypted form or be newly-assigned for the user 110. The receive legacy authentication credential operation 320 may receive the legacy authentication credential 160 from a database or user account initialization process to obtain a corresponding Kerberos ticket 260. Although the Kerberos ticket 260 may be expired when the user 110 subsequently authenticates, successfully decrypting the Kerberos ticket 260 using the authentication credential 160 submitted by the user 110 demonstrates that the authentication credential provided is correct. Generating the Kerberos ticket 260 prior to user 110 authentication facilitates subsequent authentication of the user 110 when the Kerberos server 240 is not available, even though the user 110 may never have previously authenticated to the network.

The authenticate to Kerberos test 330 determines whether the user 110 can be authenticated to the Kerberos server 240 after submitting a Kerberos authentication request 230. If the Kerberos server 240 returns a Kerberos ticket 260 to the authentication proxy module 210, the authentication protocol translation method 300 continues with the cache Kerberos credential operation 340. Otherwise, the authentication protocol translation method 300 continues with the return failure status operation 380.

The cache Kerberos credential operation 340 associates the Kerberos ticket 260 with the authentication credential 160 corresponding to the user 110. In some embodiments, the cache Kerberos credential operation 340 enters the Kerberos ticket 260 into the table or database utilized by the legacy authentication credential operation 320. In various embodiments, the table or database may be intrinsic to the authentication proxy module 210 or may be included in the credential binding module 220.

The request service operation **350** submits an authentication credential **270** in accordance with the Kerberos authentication protocol to the Kerberized service provider **280** and receives any service data **290** returned by the Kerberized service provider **280**. The service data **290** is then redirected to the legacy application **150**. The service data **290** returned by the Kerberized service provider **280** is returned in encrypted form, using a temporary service key provided by the Kerberos server **240**. Transmitting the service data in encrypted form increases the security of the service provided by the Kerberized service provider **280**. In some embodiments, the authentication proxy module **210** receives service data **290** and returns the service data **290** to the application **150** as a proxy for the non-Kerberized service provider **170**. Upon completion of the request service operation, the authentication protocol translation method **300** ends **390**.

The Kerberos service available test **360** determines whether Kerberos authentication failed because the Kerberos server did not respond, due to a network error, hardware failure, or the like. If authentication failed because the Kerberos service was not available, the authentication protocol translation method **300** continues with the obtain cached credential procedure **370**. Otherwise, the authentication protocol translation method **300** continues with the return failure status operation **380**.

The obtain cached credential operation **370** obtains the cached Kerberos ticket **260** with the authentication credential **160** corresponding to the user **110**. The authentication credential **160** may be considered valid if the cached Kerberos ticket **260** can be successfully decrypted using the authentication credential **160**. Using the cached Kerberos ticket **260** facilitates uninterrupted access to services provided by the Kerberized service provider **280** when the Kerberos server **240** is unavailable due to network failure or the like. In some embodiments, the authentication protocol translation method **300** provides the cached Kerberos ticket **260** as long as the ticket remains valid, thus reducing the number of authentication requests submitted to the Kerberos server **240**.

The return failure status operation **380** reports a failure to authenticate to the Kerberos server **240** to the legacy application **150**. In some embodiments, the return failure status operation **380** may delete the authentication credential **160** from the table or database in which it was stored by the receive legacy authentication credential operation **320**. Upon completion of the return failure status operation **360**, the authentication protocol translation method **300** ends **390**.

FIG. 4 is a flow chart diagram illustrating an anonymous user authentication protocol translation method **400** of the present invention. The anonymous user authentication protocol translation method **400** includes procedures of the authentication protocol translation method **300**. In addition, the anonymous user authentication protocol translation method **400** includes a receive anonymous authentication credential operation **410**, a valid origin test **420**, and an authenticate to Kerberos as computer test **430**.

The anonymous user authentication protocol translation method **400** translates anonymous bind requests into Kerberos authentication requests for the computer object or service object associated with the client **120** from which the anonymous bind request originates. The Kerberos server **240** can be configured to not accept anonymous bind requests, thus protecting the Kerberos server **240** from attack from foreign network addresses. Once the client **120** has authenticated as a computer object or service object, the client **120** may then be permitted to search the network directory. For example, the user **110** may enter a common name and password, which the authentication proxy module **210** may use to

search the directory to obtain the distinguished name associated with the common name, so that the user **110** may be authenticated using the associated distinguished name and password.

Since there are no network directory objects associated with anonymous binds, there is no mechanism for the network administrator to manage computers that connect using anonymous binds. Converting anonymous binds to computer object authentications facilitates management of the associated computers using network directory services prior to authentication. For example, a computer object can be assigned to an organizational unit, so that a login script associated with the organizational unit is executed when the computer object authenticates. Additionally, converting anonymous binds to computer object authentications increases network security by allowing only a trusted client **120** to access network directory services. For example, when unauthorized users are permitted to bind to the network directory service anonymously, they may obtain user names that may be used with a dictionary attack to obtain unauthorized access to the network.

The receive anonymous authentication credential operation **410** receives an anonymous authentication credential corresponding to the authentication credential **160**. In some embodiments, an anonymous authentication credential **160** may include a common name and network password of a user to be authenticated using the distinguished name associated with the common name.

The valid origin test **420** verifies that the authentication credential **160** originated from a trusted source. In some embodiments, the application server **140** may be configured such that the authentication credential **160** is received from a secure network. If the authentication credential **160** originated from a trusted source, the anonymous user authentication protocol translation method **400** continues with the authenticate to Kerberos as computer test **430**. Otherwise, the anonymous user authentication protocol translation method **400** continues with the return failure status procedure **380**.

The authenticate to Kerberos as computer test **430** determines whether the authentication proxy module **210**, acting as a proxy for the client **120**, can authenticate to Kerberos as a computer object. In some embodiments, the authentication proxy module **210** uses one service account for a plurality of clients **120**. Authentication may not be possible if the Kerberos server is unavailable due to a network failure. If the authentication proxy module **210** authenticates to Kerberos, the anonymous user authentication protocol translation method **400** continues with the cache Kerberos credential procedure **340**. Otherwise, the anonymous user authentication protocol translation method **400** continues with the return failure status procedure **380**.

The present invention facilitates providing authentication services to legacy applications. The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

- [1. A system to provide authentication services to legacy applications, the system comprising:
 - one or more legacy applications executing on an application server and configured to authenticate a user based on one or more user credentials received from a client

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using a legacy authentication protocol, wherein the one or more legacy applications are not configured to authenticate using a Kerberos authentication protocol; an authentication proxy module executing on a computing device and configured to receive legacy authentication credentials from the one or more legacy applications corresponding to the legacy authentication protocol, wherein the legacy authentication credentials are associated with the one or more user credentials; and a credential binding module in communication with the authentication proxy module and configured to associate the legacy authentication credentials with a cached Kerberos credential, and wherein the authentication proxy module is further configured to: (i) authenticate the user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the cached Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable.]

2. [The system of claim 1,] *A system to provide authentication services to legacy applications, the system comprising:*

one or more legacy applications executing on an application server and configured to authenticate a user based on one or more user credentials received from a client, wherein the one or more legacy applications are not configured to authenticate using a Kerberos authentication protocol;

an authentication proxy module executing on a computing device and configured to receive legacy authentication credentials from the one or more legacy applications, wherein the legacy authentication credentials are associated with the one or more user credentials; and

a credential binding module in communication with the authentication proxy module and configured to associate the legacy authentication credentials with a cached Kerberos credential,

wherein the authentication proxy module is further configured to: (i) authenticate the user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the cached Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable;

wherein the cached Kerberos credential comprises a previously-generated Kerberos credential, and wherein the authentication proxy module is further configured to use the previously-generated Kerberos credential to authenticate a user that has not previously been authenticated by the one or more legacy applications, when the Kerberos server is temporarily unavailable.

3. [The system of claim 1,] *A system to provide authentication services to legacy applications, the system comprising:*

one or more legacy applications executing on an application server and configured to authenticate a user based on one or more user credentials received from a client using a legacy authentication protocol, wherein the one or more legacy applications are not configured to authenticate using a Kerberos authentication protocol; an authentication proxy module executing on a computing device and configured to receive legacy authentication credentials from the one or more legacy applications corresponding to the legacy authentication protocol,

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wherein the legacy authentication credentials are associated with the one or more user credentials; and a credential binding module in communication with the authentication proxy module and configured to associate the legacy authentication credentials with a cached Kerberos credential,

wherein the authentication proxy module is further configured to: (i) authenticate the user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the cached Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable;

and wherein the authentication proxy module is further configured to eliminate anonymous binds by authenticating as a network directory services object as a proxy for an anonymous user.

[4. The system of claim 1, wherein the legacy authentication credentials comprise a user name and password.]

5. [The system of claim 1,] *A system to provide authentication services to legacy applications, the system comprising:*

one or more legacy applications executing on an application server and configured to authenticate a user based on one or more user credentials received from a client using a legacy authentication protocol wherein the one or more legacy applications are not configured to authenticate using a Kerberos authentication protocol;

an authentication proxy module executing on a computing device and configured to receive legacy authentication credentials from the one or more legacy applications corresponding to the legacy authentication protocol, wherein the legacy authentication credentials are associated with the one or more user credentials; and

a credential binding module in communication with the authentication proxy module and configured to associate the legacy authentication credentials with a cached Kerberos credential,

wherein the authentication proxy module is further configured to: (i) authenticate the user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the cached Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable;

and wherein the legacy authentication credentials comprise a biometric.

[6. The system of claim 1, wherein the legacy authentication protocol is selected from the group consisting of RADIUS, TACACS, ftp, LDAP, SQL and ODBC.]

[7. The system of claim 1, wherein the application server comprises the computing device.]

[8. The system of claim 1, wherein the cached Kerberos credential comprises a Kerberos ticket.]

[9. The system of claim 1, wherein the authentication proxy module is further configured to determine availability of the Kerberos server.]

[10. An apparatus to provide authentication services to legacy applications, the apparatus comprising:

an authentication proxy module executing on a computing device and configured to receive from one or more legacy applications executing on an application server legacy authentication credentials corresponding to a legacy authentication protocol, wherein the one or more

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legacy applications are not configured to use a Kerberos authentication protocol to authenticate a user; and
 a credential binding module in communication with the authentication proxy module and configured to associate the legacy authentication credentials with a Kerberos credential,
 and wherein the authentication proxy module is further configured to: (i) authenticate a user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable.]

11. [The apparatus of claim 10,] *An apparatus to provide authentication services to legacy applications, the apparatus comprising:*

one or more legacy applications executing on an application server and configured to authenticate a user based on one or more user credentials received from a client using a legacy authentication protocol, wherein the one or more legacy applications are not configured to authenticate using a Kerberos authentication protocol;

an authentication proxy module executing on a computing device and configured to receive legacy authentication credentials from the one or more legacy applications corresponding to the legacy authentication protocol, wherein the legacy authentication credentials are associated with the one or more user credentials; and

a credential binding module in communication with the authentication proxy module and configured to associate the legacy authentication credentials with a cached Kerberos credential,
wherein the authentication proxy module is further configured to: (i) authenticate the user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the cached Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable;

wherein the Kerberos credential comprises a previously-generated Kerberos credential, and wherein the authentication proxy module is further configured to use the previously-generated Kerberos credential to authenticate a user that has not previously been authenticated by the one or more legacy applications, when Kerberos authentication services are temporarily unavailable.

12. [The apparatus of claim 10,] *An apparatus to provide authentication services to legacy applications, the apparatus comprising:*

one or more legacy applications executing on an application server and configured to authenticate a user based on one or more user credentials received from a client using a legacy authentication protocol, wherein the one or more legacy applications are not configured to authenticate using a Kerberos authentication protocol;

an authentication proxy module executing on a computing device and configured to receive legacy authentication credentials from the one or more legacy applications corresponding to the legacy authentication protocol, wherein the legacy authentication credentials are associated with the one or more user credentials; and

a credential binding module in communication with the authentication proxy module and configured to associate the legacy authentication credentials with a cached Kerberos credential,

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wherein the authentication proxy module is further configured to: (i) authenticate the user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the cached Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable;

and wherein the authentication proxy module is further configured to eliminate anonymous binds by authenticating an anonymous user as a network directory services object.

[13. The apparatus of claim 10, wherein the legacy authentication credentials comprise a user name and password.]

14. [The apparatus of claim 10,] *An apparatus to provide authentication services to legacy applications, the apparatus comprising:*

one or more legacy applications executing on an application server and configured to authenticate a user based on one or more user credentials received from a client using a legacy authentication protocol, wherein the one or more legacy applications are not configured to authenticate using a Kerberos authentication protocol;

an authentication proxy module executing on a computing device and configured to receive legacy authentication credentials from the one or more legacy applications corresponding to the legacy authentication protocol, wherein the legacy authentication credentials are associated with the one or more user credentials; and

a credential binding module in communication with the authentication proxy module and configured to associate the legacy authentication credentials with a cached Kerberos credential,
wherein the authentication proxy module is further configured to: (i) authenticate the user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the cached Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable;

and wherein the legacy authentication credentials comprise a biometric.

[15. The apparatus of claim 10, wherein the legacy authentication protocol is selected from the group consisting of RADIUS, TACACS, ftp, LDAP, SQL and ODBC.]

[16. A method of providing authentication services to legacy applications, the method comprising:

directing from one or more legacy applications executing on an application server legacy authentication credentials corresponding to a legacy authentication protocol to a local authentication process executing on a computing device, wherein the one or more legacy applications are not configured to use a Kerberos authentication protocol to authenticate a user;

receiving the legacy authentication credentials with the local authentication process;

associating with a binding module the legacy authentication credentials with a Kerberos credential; and

with the local authorization process: (i) when a Kerberos server coupled to the computing device is available, authenticating a user corresponding to the legacy authentication credentials using a Kerberos authentication protocol in response to receiving the authentication credentials by invoking a Kerberos authentication request to the Kerberos server, and (ii) using the Ker-

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beros credential received from the binding module to authenticate the user when the Kerberos server is unavailable.]

17. [The method of claim 16, further comprising] *A method of providing authentication services to legacy applications, the method comprising:*

directing from one or more legacy applications executing on an application server legacy authentication credentials corresponding to a legacy authentication protocol to a local authentication process executing on a computing device, wherein the one or more legacy applications are not configured to use a Kerberos authentication protocol to authenticate a user;

receiving the legacy authentication credentials with the local authentication process;

associating with a binding module the legacy authentication credentials with a Kerberos credential;

with the local authorization process: (i) when a Kerberos server coupled to the computing device is available, authenticating a user corresponding to the legacy authentication credentials using a Kerberos authentication protocol in response to receiving the authentication credentials by invoking a Kerberos authentication request to the Kerberos server, and (ii) using the Kerberos credential received from the binding module to authenticate the user when the Kerberos server is unavailable; and

eliminating anonymous binds by authenticating an anonymous user as a network directory services object.

[18. The method of claim 16, wherein the Kerberos credential comprises a Kerberos identity.]

[19. The method of claim 16, wherein the Kerberos credential comprises a Kerberos ticket.]

[20. The method of claim 19, wherein using the Kerberos credential received from the binding module to authenticate the user comprises decrypting the Kerberos ticket using user-submitted credentials associated with the legacy authentication credentials.]

21. [The method of claim 20, further comprising] *A method of providing authentication services to legacy applications, the method comprising:*

directing from one or more legacy applications executing on an application server legacy authentication credentials corresponding to a legacy authentication protocol to a local authentication process executing on a computing device, wherein the one or more legacy applications are not configured to use a Kerberos authentication protocol to authenticate a user;

receiving the legacy authentication credentials with the local authentication process;

associating with a binding module the legacy authentication credentials with a Kerberos credential that comprises a Kerberos ticket;

with the local authorization process: (i) when a Kerberos server coupled to the computing device is available, authenticating a user corresponding to the legacy authentication credentials using a Kerberos authentication protocol in response to receiving the authentication credentials by invoking a Kerberos authentication request to the Kerberos server, and (ii) using the Kerberos credential received from the binding module to authenticate the user when the Kerberos server is unavailable; and

using the Kerberos ticket received from the binding module to authenticate the user following expiration of the Kerberos ticket, wherein using the Kerberos credential received from the binding module to authenticate the

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user comprises decrypting the Kerberos ticket using user-submitted credentials associated with the legacy authentication credentials.

[22. The method of claim 16, further comprising determining with the local authorization process when the Kerberos server is unavailable.]

[23. A computer readable storage medium comprising computer readable program code configured to execute on a processor to carry out a method to providing authentication services to legacy applications, the method comprising:

directing from one or more legacy applications on an application server legacy authentication credentials corresponding to a legacy authentication protocol to a local authentication process executing on a computing device, wherein the one or more legacy applications are not configured to use a Kerberos authentication protocol to authenticate a user;

receiving the legacy authentication credentials with the local authentication process;

associating with a binding module the legacy authentication credentials with a Kerberos credential; and

with the local authorization process: (i) when a Kerberos server coupled to the computing device is available, authenticating a user corresponding to the legacy authentication credentials using a Kerberos authentication protocol in response to receiving the authentication credentials by invoking a Kerberos authentication request to the Kerberos server, and (ii) using the Kerberos credential received from the binding module to authenticate the user when the Kerberos server is unavailable.]

24. [The computer readable storage medium of claim 23, wherein the method further comprises] *A computer readable storage device comprising computer readable program code configured to execute on a processor to carry out a method to providing authentication services to legacy applications, the method comprising:*

directing, from one or more legacy applications on an application server, legacy authentication credentials corresponding to a legacy authentication protocol, to a local authentication process executing on a computing device, wherein the one or more legacy applications are not configured to use a Kerberos authentication protocol to authenticate a user;

receiving the legacy authentication credentials with the local authentication process;

associating with a binding module the legacy authentication credentials with a Kerberos credential;

with the local authorization process: (i) when a Kerberos server coupled to the computing device is available, authenticating a user corresponding to the legacy authentication credentials using a Kerberos authentication protocol in response to receiving the authentication credentials by invoking a Kerberos authentication request to the Kerberos server, and (ii) using the Kerberos credential received from the binding module to authenticate the user when the Kerberos server is unavailable; and

eliminating anonymous binds by authenticating an anonymous user as a network directory services object.

25. *A system to provide authentication services to legacy applications, the system comprising:*

an application server comprising computer hardware including at least one computer processor and executing one or more legacy applications configured to authenticate a user based on one or more user credentials received from a client using a legacy authentication

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protocol selected from the group consisting of RADIUS, TACACS, LDAP, SQL and ODBC, wherein the one or more legacy applications are not configured to authenticate using a Kerberos authentication protocol;

at least one computing device comprising computer hardware, including at least one computer processor, that: executes an authentication proxy module stored in computer memory, thereby causing the computer hardware to receive legacy authentication credentials from the one or more legacy applications corresponding to the legacy authentication protocol, wherein the legacy authentication credentials are associated with the one or more user credentials; and executes a credential binding module stored in computer memory and in communication with the authentication proxy module, thereby causing the computer hardware to associate the legacy authentication credentials with a cached Kerberos credential;

and wherein execution of the authentication proxy module further causes the computer hardware to: (i) authenticate the user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the cached Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable.

26. The system of claim 25, wherein the legacy authentication protocol is RADIUS.

27. The system of claim 25, wherein the legacy authentication protocol is TACACS.

28. The system of claim 25, wherein the legacy authentication protocol is LDAP.

29. The system of claim 25, wherein the legacy authentication protocol is SQL.

30. The system of claim 25, wherein the legacy authentication protocol is ODBC.

31. An apparatus to provide authentication services to legacy applications, the apparatus comprising:

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at least one computing device comprising computer hardware, including at least one computer processor, that: executes an authentication proxy module stored in computer memory, thereby causing the computer hardware to receive, from one or more legacy applications executing on an application server, legacy authentication credentials corresponding to a legacy authentication protocol selected from the group consisting of RADIUS, TACACS, LDAP, SQL and ODBC, wherein the one or more legacy applications are not configured to use a Kerberos authentication protocol to authenticate a user; and executes a credential binding module stored in computer memory and in communication with the authentication proxy module, thereby causing the computer hardware to associate the legacy authentication credentials with a Kerberos credential;

and wherein execution of the authentication proxy module by the computing device further causes the computer hardware to: (i) authenticate a user corresponding to the legacy authentication credentials using a Kerberos authentication protocol by invoking a Kerberos authentication request to a Kerberos server, and (ii) use the Kerberos credential received from the credential binding module to authenticate the user when the Kerberos server is temporarily unavailable.

32. The apparatus of claim 31, wherein the legacy authentication protocol is RADIUS.

33. The apparatus of claim 31, wherein the legacy authentication protocol is TACACS.

34. The apparatus of claim 31, wherein the legacy authentication protocol is LDAP.

35. The apparatus of claim 31, wherein the legacy authentication protocol is SQL.

36. The apparatus of claim 31, wherein the legacy authentication protocol is ODBC.

* * * * *