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A Fixed Network Transmission Based on Kerberos Authentication Protocol

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Abstract

We concentrated on cryptographic protocols aimed to procure authentication, confidentiality and data integrity over the networks. We wish to plan an end user authentication protocol that is not liable to password guessing attacks. We wish to present an authentication protocol depend on generally Kerberos protocol with a slight alteration in the Kerberos database contains all of our realm's Kerberos principals. We suggested in this paper the protocol is separate of the user password. The KDC supplies session tickets and temporary session keys to users Kerberos keys are created by KDC. These keys are used by the Kerberos client to communicate with the Kerberos KDC in a secure manner. The KDC will secure data for every instance in the realm. This data will be hashed and then, the output digest will be encrypted to generate the secret key. The lifetime of the secrete key is managed by system lifetime in this way we beaten weak password In here we come up with Triple DES, MD5 hashing technique and Fisher–Yates shuffle as a random number generator algorithm for Password strength is a measure of the effectiveness of a password in resisting guessing and brute-force attacks.

Key words: Access control, Key Management Encryption algorithm, Message Integrity, authentication.

1. Introduction

A protocol is full of challenges and meeting these challenges in a simplified and scalable manner lies at the heart of information security issues The technical mechanism to carry out information security is provided through cryptography. Cryptology is the science of coding and decoding secret messages associated to information security such as confidentiality, data integrity, access control, and authentication. Modern cryptology is based on ideas from theoretical computer science and increasingly Number Theory (the mathematics of integers) we consider confidentiality, i.e., the property of data being accessible only by authorized users. In a (idealized) distributed setting we might think of honest principals sharing secure communication channels. Thus, a simple way to achieve confidentiality might be to impose that high-confidential (or secret) data are only sent on secure channels. Data integrity ensures that the data has not been altered or manipulated. Authentication receiver can determine the origin of the message and an intruder cannot masquerade. Data manipulation consists of insertion, deletion and changing .Access control giving someone permission to do and protect data in transit or storage on an insecure medium safeguard against misuse by authorized users protect against covert channels. The base of paper is associated as follows: Let us begin with characterize the motivation for the Kerberos access and its surroundings in section 2.Then we will give summary of related possible work in section 3.After having that we go for knowing version 4 and version 5 Kerberos and their variations in section 4.We will discuss Kerberos deficiency in section 5. Then, we will explore authentication protocol, database, and existing verification methods in section 6. Finally section 7 concludes.

2. Motivation

Nowadays computer plays a vital role in the real world to access many people in their manner it should be recognized that computers are capable of identifying user making request can process information at extremely rapid rates. Authentication is that identity of a user. The most common in computer architecture is distributed architecture consisting of allotted multiple clients and rationalize servers Distributed services which are called on by clients. Servers that provide services are treated differently from clients that use services. Application security is very important so system provides a mechanism for authenticating a user's access to a channel at the point of subscription. In this region authentication is settled by Kerberos. It

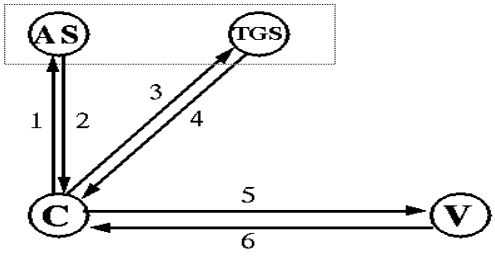
gives an idea in which users at workstations wish to access servers. Kerberos includes one or more Kerberos servers to provide an authentication service. It performs mutual authentication, where a client proves its identity to a server and a server proves its identity to the client and Kerberos is based upon Need ham-Schroeder-protocol [1]. The Kerberos server knows "secrets" (encrypted passwords) for all clients and servers under its control, or it is in contact with other secure servers that have this information. These "secrets" are used to encrypt all of the messages. Kerberos clients are applications acting on behalf of users who need access to a resource, such as opening a file, querying a database, or printing a document. Every Kerberos client requests authentication before the resource is accessed. Once the client is recognized as trusted, a secure session between the client and the service hosting the resource is established. Most secure protocol confides public key Infrastructure (PKI) represents asymmetric cryptography with such architecture each user has a pair of key, private key and public key. Where public key is published to users, the private key is kept secret. Private Key is used to generate a digital signature, while the public key is used to verify such signature. Public key certificates are required to protect the authenticity and integrity of public keys [2]. PKI based systems more affected to Denial of Service attacks [3].

3. Literature Survey

The MIT Kerberos & Internet trust (MIT-KIT) Consortium is the home of MIT Kerberos -- one of the universal authentication platforms for the world's computer networks. Kerberos, originally developed for MIT's Project Athena, has grown to become the most widely deployed system for authentication and authorization in modern computer networks. Kerberos is currently shipped with all major computer operating systems and is uniquely positioned to become a universal solution to the distributed authentication and authorization problem of permitting universal "single sign-on" within and between federated enterprises and peer-to-peer communities. Many people are contributed to design Kerberos [4]. For more than two decades researchers have put much effort in developing security methodologies, models and standard definitions of security services. However, we still experience systems insecurity. The need for user authentication has become mandatory in e-government, e-commerce, and e-business applications. There are multiple instances where two unknown parties in different branches of the public administration need to securely exchange documents. Several proto-cols, such as Kerberos [5], have been proposed to provide authentication over public networks using symmetric cryptography. Those systems are not easily scalable for large groups of users (possibly belonging to different organizations). Some researchers have put efforts to solve this problem, like Davis [6], Ganesan [7], and Schiller etal [8], but the resulting systems are not widely deployed. On the other hand, public key cryptography, as introduced by Die et al.[9], is a very powerful technology and seems to be well suited to satisfy the requirements of the global Internet. In fact, it is commonly agreed that this technology is fundamental for an outrushing e-commerce and e business in Internet, and has become the foundation for many such applications. The widespread use of public key cryptography requires a Public Key Infrastructure (PKI)[10]. The aim of a PKI is to make sure that a public key in use really belongs to the claimed entity. Without a PKI, public key cryptography would not be superior to traditional private key cryptography. Users of Kerberos such as Sun Microsystems, Apple, Google, Microsoft, Intel, Red Hat, Sun/Oracle, SAP R3,NetApp,etc., to foster continued development The Kerberos protocols invented and popularized by MIT have become fundamental building blocks of major desktop and server operating systems, core networking infrastructure, global file systems, global messaging systems, and much more. While users need a secure single sign-on infrastructure that is ubiquitous, flexible, and unobtrusive, vendors and system administrators do not yet have the tools to provide it. Kerberos not only provides a single sign-on environment, but also has the potential to integrate other security frameworks (e.g., public key infrastructure) and password-less initial authentication mechanisms to form a complete solution that spans across federated realms. After many years of developing Kerberos internally at MIT, it has become clear that the needs and requirements of the wider Kerberos community exceed the ability of MIT to fund future Kerberos development. The success of Kerberos has caused it to grow far beyond the original user community and the original scope of MIT's own Kerberos efforts. Although MIT could continue to fund Kerberos development at a level that would meet its own needs, a wide variety of issues that are important to operating system vendors, application vendors, and end customers. Institute could reasonably afford on its own.MIT is prepared to continue its investment. Kerberos used 3DES, AES, MD5 and SHA-1.Image based Authentication is allowed in Kerberos and facilitate in wireless communications. Kerberos is imported to be used in InternetProtocolv6 networks.

4. Message Authentication Exchange in Kerberos

Kerberos functioning is shown in Figure 1.The client contacts the Key Distribution Center's authentication service for a short-lived ticket (a message containing the client's identity and—for Windows clients—SIDs) called a ticket-granting ticket (TGT). This happens at logon in message 1.The authentication service (AS) constructs the TGT and creates a session key the client can use to encrypt communication with the ticket-granting service (TGS). The TGT has a limited lifetime. At the point that the client has received the TGT, the client has not been granted access to any resources, even to resources on the local computer in me4ssage 2.The client wants access to local and network resources. To gain access, the client sends a request to the TGS for a ticket for the local computer or some network server or service. This ticket is referred to as the service ticket or session ticket. To get the ticket, the client presents the TGT, an authenticator, and the name of the target server (the Server Principal Name or SPN) in message 3.The TGS examines the TGT and the authenticator. If these are acceptable, the TGS creates a service ticket. The client's identity is taken from the TGT and copied to the service ticket. Then the ticket is sent to the client in message 4. After the client has the service ticket, the client sends the ticket and a new authenticator to the target server, requesting access. The server will decrypt the ticket, validate the authenticator, and for Windows services, create an access token for the user based on the SIDs in the ticket in message 5. Optionally, the client might request that the target server verify its own identity. This is called mutual authentication. If mutual authentication is requested, the target server will take the client computer's timestamp from the authenticator, encrypt it with the session key the TGS provided for client-target server messages, and send it to the client in message 6. The ticket to the KDC and ask for a new ticket. That new ticket will generally have a fresh ticket lifetime dating from the current time, although constrained by the renewable ticket lifetime. Life Time Prevents replays after ticket has expired. Life time is minimum of requested life time max lifetime for requesting principal max lifetime for requesting service max lifetime of ticket granting ticket Max lifetime is 21.5 hours.



1. as_req: c, tgs, $time_{exp}$, n
2. as_rep: $\{K_{c,tgs}, tgs, time_{exp}, n, \ldots\}K_c$, $\{T_{c,tgs}\}K_{tgs}$
3. tgs_req: $\{ts, \ldots\}K_{c,tgs}$ $\{T_{c,tgs}\}K_{tgs}$, v, $time_{exp}$, n
4. tgs_rep: $\{K_{c,v}, v, time_{exp}, n, \ldots\}K_{c,tgs}$, $\{T_{c,v}\}K_v$
5. ap_req: $\{ts, ck, K_{subsession}, \ldots\}K_{c,v}$ $\{T_{c,v}\}K_v$
6. ap_rep: $\{ts\}K_{c,v}$ (optional)

Figure 1: Kerberos Authentication Protocol

4.1. Summary of Kerberos version 4 Message Exchange

(a) Authentication Service Exchange: to obtain ticket-granting ticket
(1) C → AS: $ID_c \| ID_{tgs} \| TS_1$
(2) AS → C: $E_{K_c}\left[K_{c,tgs} \| ID_{tgs} \| TS_2 \| Lifetime_2 \| Ticket_{tgs}\right]$
$Ticket_{tgs} = E_{K_{tgs}}\left[K_{c,tgs} \| ID_C \| AD_C \| ID_{tgs} \| TS_2 \| Lifetime_2\right]$
(b) Ticket-Granting Service Exchange: to obtain service-granting ticket
(3) C → TGS: $ID_v \| Ticket_{tgs} \| Authenticator_c$
(4) TGS → C: $E_{K_{c,tgs}}\left[K_{c,v} \| ID_v \| TS_4 \| Ticket_v\right]$
$Ticket_{tgs} = E_{K_{tgs}}\left[K_{c,tgs} \| ID_C \| AD_C \| ID_{tgs} \| TS_2 \| Lifetime_2\right]$
$Ticket_v = E_{K_v}\left[K_{c,v} \| ID_C \| AD_C \| ID_v \| TS_4 \| Lifetime_4\right]$
$Authenticator_c = E_{K_{tgs}}\left[ID_C \| AD_C \| TS_3\right]$
(c) Client/Server Authentication Exchange: to obtain service
(5) C → V: $Ticket_v \| Authenticator_c$
(6) V → C: $E_{K_{c,v}}\left[TS_5 + 1\right]$ (for mutual authentication)
$Ticket_v = E_{K_v}\left[K_{c,v} \| ID_C \| AD_C \| ID_v \| TS_4 \| Lifetime_4\right]$
$Authenticator_c = E_{K_{c,v}}\left[ID_C \| AD_C \| TS_5\right]$

4.2. Summary of Kerberos version 5 Message Exchange

(a) Authentication Service Exchange: to obtain ticket-granting ticket
(1) C → AS: $Options \| ID_c \| Realm_c \| ID_{tgs} \| Times \| Nonce_1$
(2) AS → C: $Realm_c \| ID_C \| Ticket_{tgs} \| E_{K_c}\left[K_{c,tgs} \| Times \| Nonce_1 \| Realm_{tgs} \| ID_{tgs}\right]$
$Ticket_{tgs} = E_{K_{tgs}}\left[Flags \| K_{c,tgs} \| Realm_c \| ID_C \| AD_C \| Times\right]$
(b) Ticket-Granting Service Exchange: to obtain service-granting ticket
(3) C → TGS: $Options \| ID_v \| Times \| \| Nonce_2 \| Ticket_{tgs} \| Authenticator_c$
(4) TGS → C: $Realm_c \| ID_C \| Ticket_v \| E_{K_{c,tgs}}\left[K_{c,v} \| Times \| Nonce_2 \| Realm_v \| ID_V\right]$
$Ticket_{tgs} = E_{K_{tgs}}\left[Flags \| K_{c,tgs} \| Realm_c \| ID_C \| AD_C \| Times\right]$
$Ticket_v = E_{K_v}\left[Flags \| K_{c,v} \| Realm_c \| ID_C \| AD_C \| Times\right]$
$Authenticator_c = E_{K_{c,tgs}}\left[ID_C \| Realm_c \| TS_1\right]$
(c) Client/Server Authentication Exchange: to obtain service
(5) C → V: $Options \| Ticket_v \| Authenticator_c$
(6) V → C: $E_{K_{C,V}}[\, TS_2 \| Subkey \| Seq\# \,]$
$Ticket_v = E_{K_v}\left[Flags \| K_{c,v} \| Realm_c \| ID_C \| AD_C \| Times\right]$
$Authenticator_c = E_{K_{c,v}}\left[ID_C \| Realm_c \| TS_2 \| Subkey \| Seq\#\right]$

4.3 Difference between Version 4 & 5

Environmental shortcomings encryption system dependence any encryption algorithms can be used in v5 but only DES is possible in v4 internet protocol dependence only IP is possible to use any internet protocol environmental shortcomings Ticket Lifetime 1280 minutes (maximum time) any length of time authentication Forwarding V4 does not allow credentials issued to one client to be forwarded to some other host and used by some other client. V5 provides this capability technical deficiencies Double encryption in V4. PCBC encryption (a new mode of operation) in v5, Standard CBC is used. Kerberos version 5 fixes many shortcomings of version 4, and is described here by explaining major differences with respect to V4.

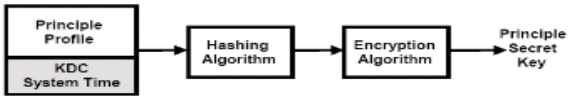
5. Disadvantages of Kerberos

Although Kerberos removes a common and severe security threat, it may be difficult to implement for a variety of reasons: Migrating user passwords from a standard UNIX password database, such as /etc/shadow, to a Kerberos password database can be tedious, as there is no automated mechanism to perform this task. Kerberos has only partial compatibility with the Pluggable Authentication Modules (PAM) system used by most Red Hat Enterprise Linux servers. For more information about this issue, refer to Section 19.4, “Kerberos and PAM”. Kerberos assumes that each user is trusted but is using an un trusted host on an un trusted network. Its primary goal is to prevent unencrypted passwords from being sent across that network. However, if anyone other than the proper user has access to the one host that issues tickets used for authentication — called the key distribution center (KDC) — the entire Kerberos authentication system is at risk. For an application to use Kerberos, its source must be modified to make the appropriate calls into the Kerberos libraries. Applications modified in this way are considered to be kerberized. For some applications, this can be quite problematic due to the size of the application or its design. For other incompatible applications, changes must be made to the way in which the server and client side communicate. Again, this may require extensive programming. Closed-source applications that do not have Kerberos support by default are often the most problematic. Kerberos is an all or nothing solution. Once Kerberos is used on the network, any unencrypted passwords transferred to a non-kerberized service are at risk. Thus, the network gains no benefit from the use of Kerberos. To secure a network with Kerberos, one must either use kerberized versions of *all* client/server applications which send unencrypted passwords or not use *any* such client/server applications at all.

6. Proposed work

Kerberos is exposed to password tracing attacks. Now present an AP (authentication protocol) based on Kerberos with a slight change in the Kerberos database. It will be separate of the end user password. The KDC will save every principal in the realm. The data may be audio, video, image, or text. The KDC database has different data contents. The realm is associated with client and server in the network communication. The occurrence of principle must be registered in Kerberos database. The principle is registered with server ID. The KDC invokes ID to the profile. The server will produce a secrete key by hashing algorithm. In hashing input is profile principle and output is encrypted principle. Sometimes the input to the hashing algorithm will change, and thus the secret key will change too. The master machine maintains database which is made

up of realms of Kerberos the running of each principle is noted and stored in database each request and response of machine is come up between the client and server systems for their mutual exchange of message they use secrete key that will retrieve from the KDC we secure the message during the run of Kerberos authentication protocols.



6.1 proposed systems

The authentication is done using the encrypted data set. Hence no identity of the client or the server is revealed to each other. The computations are carried out in the randomized Manner .Hence no imposter can gain the password of the client in plain. It provides provable protection against replay and client side attacks below stating that the comparison between pre existed versions of Kerberos such as version 4 and version 5 with proposed system.

Table1. Elements of the Proposed Protocol

1	Message(1)	Client requests ticket-granting ticket
2	options	flags be set in the returned TGS ticket
3	IDc	Tells AS identity of user from this client
4	ID tgs	Tells AS that user requests access to TGS
5	TS1	Allows AS to verify that client's clock is synchronized with that of AS
6	Nonce	Prevent replay attacks
7	Message(2)	AS returns ticket-granting ticket
8	IDc	User identity
9	Kc	Encryption is based on user's password, enabling AS and client to verify password, and protecting contents of message (2)
10	Kc,tgs	Copy of session key accessible to client created by AS to permit secure exchange between client and TGS without requiring them to share a key

Table 1(a). Authentication Service Exchange

1	Message(3)	Client requests ticket-granting ticket
2	options	flags be set in the returned TGS ticket
3	IDv	Tells AS identity of user from this client
5	TS	Allows AS to verify that client's clock is synchronized with that of AS
6	Nonce	Prevent replay attacks
7	ticketing	TGS authenticated byAS
8	IDc	User identity
9	Kc	Encryption is based on user's password, enabling AS and client to verify password, and protecting contents of message (2)
10	Kc,tgs	Copy of session key accessible to client created by AS to permit secure exchange between client and TGS without requiring them to share a permanent key
11	message	TGS returns ticket granting ticket
12	IDc	Client identity
13	KC tgs	Shaed key between C and tgs
14	KCv	Session key for server access
15	Nonce	Repeat random value
16	IDv	Server Ticket
17	Ticketv	
18	Ekv	Encrypted key

Table 1(b) Ticket Granting Service Exchange

Message (5)	Client requests service
$Ticket_V$	Assures server that this user has been authenticated by AS
$Authenticator_C$	Generated by client to validate ticket
Message (6)	Optional authentication of server to client
$K_{C,V}$	Assures C that this message is from V
$TS_5 + 1$	Assures C that this is not a replay of an old reply
$Ticket_V$	Reusable so that client does not need to request a new ticket from TGS for each access to the same server
K_V	Ticket is encrypted with key known only to TGS and server, to prevent tampering
$K_{C,V}$	Copy of session key accessible to client; used to decrypt authenticator, thereby authenticating ticket
ID_C	Indicates the rightful owner of this ticket
AD_C	Prevents use of ticket from workstation other than one that initially requested the ticket
ID_V	Assures server that it has decrypted ticket properly
TS_4	Informs server of time this ticket was issued
$Lifetime_4$	Prevents replay after ticket has expired
$Authenticator_C$	Assures server that the ticket presenter is the same as the client for whom the ticket was issued; has very short lifetime to prevent replay
$K_{C,V}$	Authenticator is encrypted with key known only to client and server, to prevent tampering
ID_C	Must match ID in ticket to authenticate ticket
AD_C	Must match address in ticket to authenticate ticket
TS_5	Informs server of time this authenticator was generated

Table 2 .Comparison of V4, V5 and Proposed System

Comparison Item	KV4	KV5	Proposed Protocol
Password attacks	Vulnerable	Vulnerable	Keys are independent of password
Times	No times	From till	From till
Double encryption	found	Not found	Not found
DES mode of operation	PCBC	CBC	CBC
Session Key	1/lifetime for sub session key	Client and server may negotiate	Client and server may negotiate
Network address	IPV4	Any	IPV4
Ticket lifetime	1280 minutes	Arbitrary	Arbitrary

6.2 Testing Process

The KDC is functionally typed into AS and TGS. There produce session key for the granting ticket that typical data is maintained in the database The AS access to the KDC's database for a key connected with service which is done by the client or server the type of service is nominated in the realm. In our testing area we have five client activators: client1, client2, client3, client4 and client 5 .We present 3 servers: server X, and server Y and server Z. In system we used Triple-DES, Message Digest-5 Hashing algorithm, and Fisher–Yates shuffle as a random number generator algorithm shrub as a random number generator algorithm. As per analysis, the lifetime of the TGS is 1 day, the lifetime of the server ticket is 9 hours, and the lifetime of the authenticator is 7 minutes.

7. Conclusion

Authentication is critical for the security of computer systems. Without knowledge of the identity of a principal requesting an operation, it is difficult to decide whether the operation should be allowed. Traditional authentication methods are not suitable for use in computer networks where attackers monitor network traffic to intercept passwords .The use of strong authentication methods that do not disclose password imperative. The Kerberos authentication system is well suited for authentication of users in such environments.

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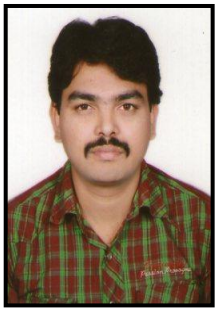

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