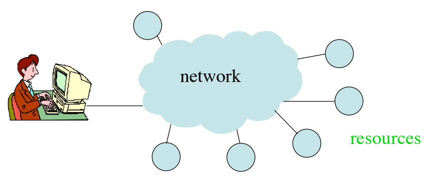
Kerberos (V4)

Introduction

- Kerberos is a secret key based authentication service
- Based on work by Needham and Schroeder
- First three versions no longer in use
- V4 and V5 are competing for market
  - V4 has a greater installation base, simpler, and performs better
  - V5 has enhanced functionalities
- We study V4
  - Refer to the text book for V5 to satiate your curiosity

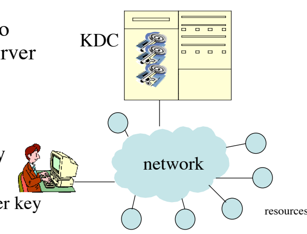
User Model

- A login session with multiple remote resource access sessions during the login session



Key Distribution Center

- Kerberos relies on a trusted key distribution center (KDC)
- At different context, also called ticket-granting server (TGS) or authentication server (AS)
  - No real distinction
- KDC shares a secret key with each principal
  - Also known as the master key
  - Stored in a database

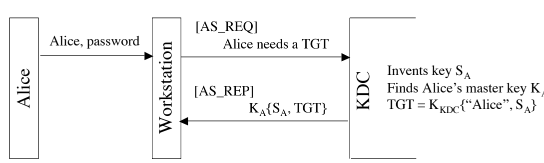


Main Idea of Kerberos

- When a user logs in, he will receive a session key and a ticket-granting ticket
  - The latter is called TGT
- Whenever the user needs access to some resource, his session key and TGT can help him to obtain a ticket for using that service

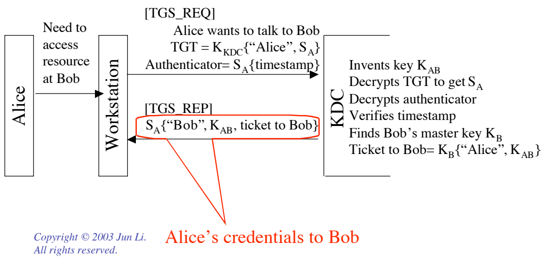
Obtaining a Session Key and TGT

When Alice logs in



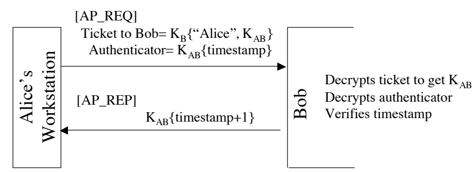
Getting a Ticket to Bob for Alice

Alice: Hi, KDC, I am Alice, I need Bob's service . . .



Logging into Bob from Alice's Workstation

Alice: Bob, I need your service. Here is my ticket!



Problems with a Single KDC

- Single point of failure
- Performance Bottleneck

- Solution: Replicated KDCs

Replicated KDCs

- Each KDC must be interchangeable with every other KDC
- They share the same K_{KDC}
- They have the same identical databases of principal names and master keys
  - One site to keep the master copy
    - Any updates must be made here
  - Other sites periodically synchronize their copies
  - Question: what if the master is down?

Can Everybody Trust a Single KDC (or multiple replicated ones)?

- The question can be rephrased as: can a single principal master key database work?
- A big network can have thousands of organizations and millions of users
- A KDC that everybody trusts seems unreasonable!
  - Remember that a KDC manages every registered principal's master key!

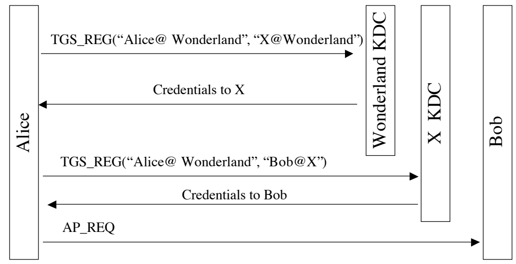
Realms

- Principals are divided into realms
- Each realm has its own KDC database
- There can be multiple replicated KDCs in the same realm

Inter-Realm Authentication

- Assume two realms: Realm Wonderland and Realm X
- If Realm X is willing to provide services to principals in Realm Wonderland, the KDC for X registers can be registered as a principal in realm Wonderland

Inter-Realm Authentication



Quiz 2

- Write what’s the contents for Alice’s credential to X and the credential to Bob

Quiz 2