数字签名是什么? - 阮一峰的网络日志

今天,我读到一篇好文章。

它用图片通俗易懂地解释了,"数字签名" (digital signature)和"数字证书" (digital certificate)到底是什么。

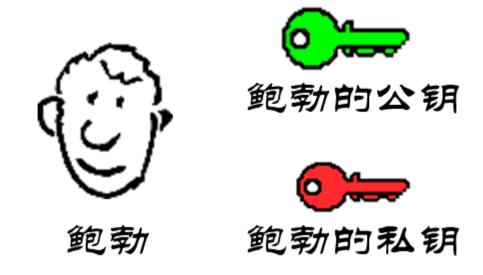
我对这些问题的理解,一直是模模糊糊的,很多细节搞不清楚。读完这篇文章后,发现思路一下子就理清了。为了加深记忆,我把文字和图片都翻译出来了。

文中涉及的密码学基本知识,可以参见我以前的笔记。

作者: David Youd

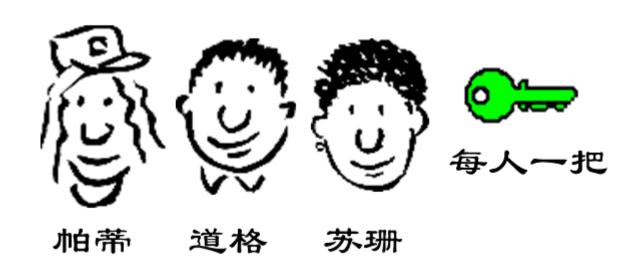
翻译:阮一峰

原文网址: http://www.youdzone.com/signature.html



鲍勃有两把钥匙,一把是公钥,另一把是私钥。

2.



鲍勃把公钥送给他的朋友们----帕蒂、道格、苏珊----每人一把。



"Hey Bob, how about lunch at Taco Bell. I hear they have free refills!"



公钥加密

HNFmsEm6Un BejhhyCGKO KJUxhiygSBC EiC0QYIh/Hn 3xgiKBcyLK1 UcYiYlxx2lCF HDC/A

苏珊

苏珊要给鲍勃写一封保密的信。她写完后用鲍勃的公钥加密,就可以达到保密的效果。

4.



鲍勃

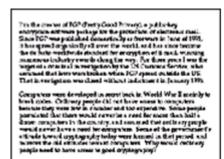
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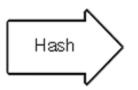


UcYiYlxx2lCF 私钥解密

"Hey Bob, how about lunch at Taco Bell. I hear they have free refills!"

鲍勃收信后,用私钥解密,就看到了信件内容。这里要强调的是,只要鲍勃的私钥不泄露,这封信就是安全的,即使落在别人手里,也无法解密。





Digest

鲍勃给苏珊回信,决定采用"数字签名"。他写完后先用Hash函数,生成信件的摘要(digest)。

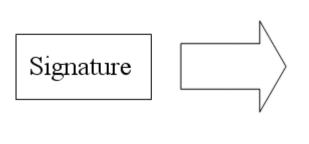
6.

Digest



Signature

然后,鲍勃使用私钥,对这个摘要加密,生成"数字签名"(signature)。



First the creation of RGP directly Good Provings is published software partiags for the protections of electronic mail. Since PGP was published documentally as the event in June of 1991, the signal drop which had for over the world, and has come become the first hade weekful of placed to five the world, and has come become the first hade weekful of standard for energythen of it mail, whenting assumes to larghe the register of its mail, whenting the DG Customer Service, who can had been supported by the DG Customer Service, who can had been weekful out with Customer Service, who can had been weekful out with Customer Service, who had been weekful out with Customer Service and the DG Customer Service.

Comparison were developed in record back in World War II metally be break colors. Collinary people (M) and have worse to comparison because that you are in remainer and too expenditure. Some people portuited that there would revert be a read for more than half a drawn comparison in the country, and seems and that excitant people result is are above a read for exceptions. Some of the prevention of a citizent have a cost for exceptions. Some of the prevention of a citizent have a cost for exceptions. Some of the prevention of a citizent have a cost for exception seems of the prevention of a citizent when the contract contract were the citizent of the contract contract was the following people asset to have seems to good cryptography.

Signature

鲍勃将这个签名,附在信件下面,一起发给苏珊。

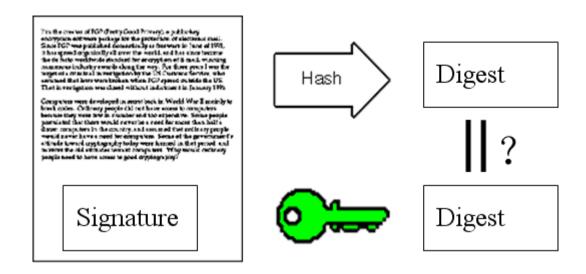
8.

Signature

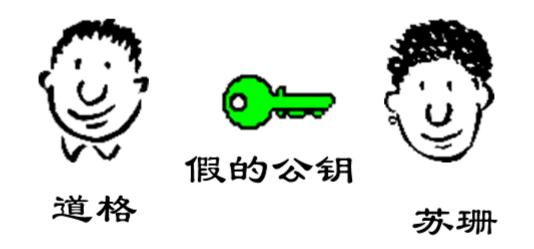


Digest

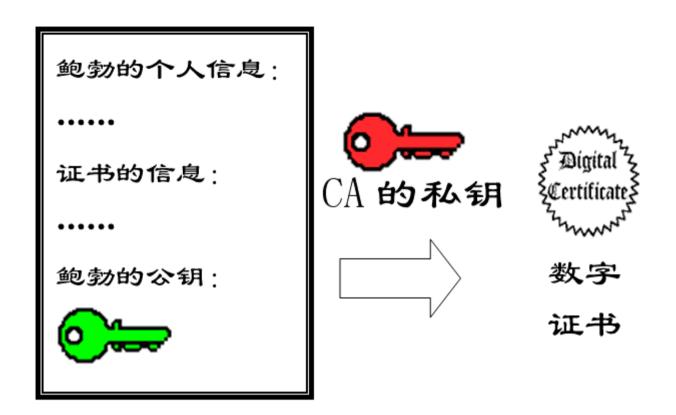
苏珊收信后,取下数字签名,用鲍勃的公钥解密,得到信件的摘要。由此证明,这封信确实是鲍勃发出的。



苏珊再对信件本身使用Hash函数,将得到的结果,与上一步得到的摘要进行对比。如果两者一致,就证明这封信未被修改过。 10.



复杂的情况出现了。道格想欺骗苏珊,他偷偷使用了苏珊的电脑,用自己的公钥换走了鲍勃的公钥。此时,苏珊实际拥有的是道格的公钥,但是还以为这是鲍勃的公钥。因此,道格就可以冒充鲍勃,用自己的私钥做成"数字签名",写信给苏珊,让苏珊用假的鲍勃公钥进行解密。



后来,苏珊感觉不对劲,发现自己无法确定公钥是否真的属于鲍勃。她想到了一个办法,要求鲍勃去找"证书中心"(certificate authority,简称CA),为公钥做认证。证书中心用自己的私钥,对鲍勃的公钥和一些相关信息一起加密,生成"数字证书"(Digital Certificate)。

The the creates of 160 directy Good Proversit a publishery encryption actives particip for the protestion of electronic mail.

Since 160 was published decreasing as become in land of 100, it has agreed original liyed over the world, and has since become the de later weather de standard for encryption of it mail, washing an accuracy industry excells changing measures industry excells changing measures industry excells changing may. For these years I was the very so it is not to it in recipitation by the 100 excells the US. That is verigition was closed without indictions t in famous 1992.

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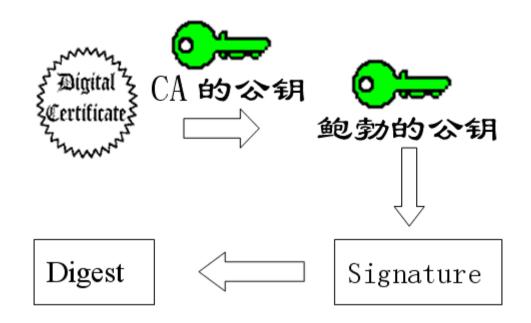
Signature

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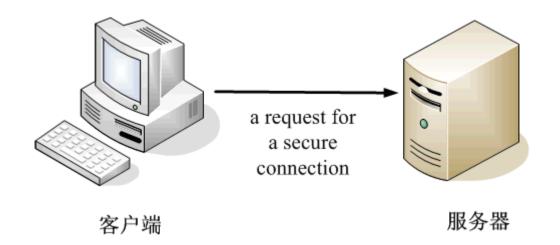
鲍勃拿到数字证书以后,就可以放心了。以后再给苏珊写信,只要在签名的同时,再附上数字证书就行了。



苏珊收信后,用CA的公钥解开数字证书,就可以拿到鲍勃真实的公钥了,然后就能证明"数字签名"是否真的是鲍勃签的。

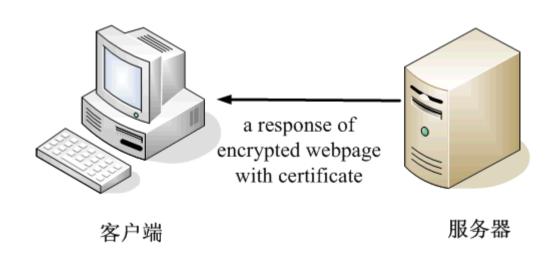


下面,我们看一个应用"数字证书"的实例:https协议。这个协议主要用于网页加密。

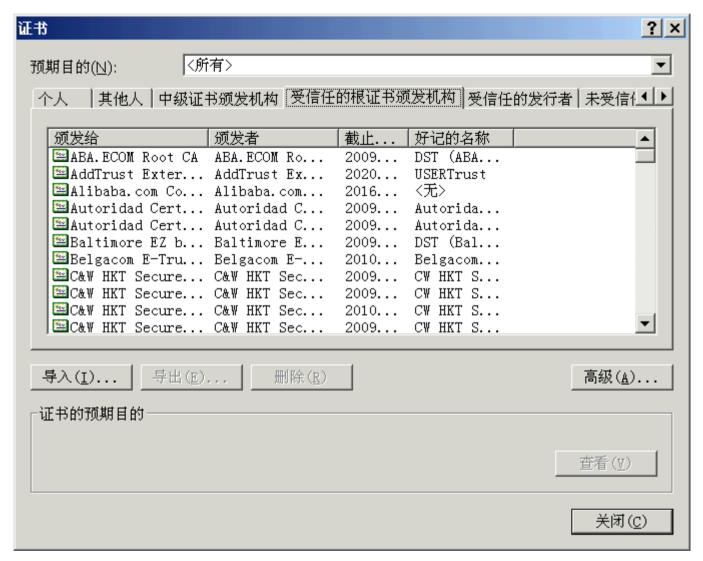


首先,客户端向服务器发出加密请求。

16.



服务器用自己的私钥加密网页以后,连同本身的数字证书,一起发送给客户端。



客户端(浏览器)的"证书管理器",有"受信任的根证书颁发机构"列表。客户端会根据这张列表,查看解开数字证书的公钥是否在列表之内。



此网站的安全证书有问题。

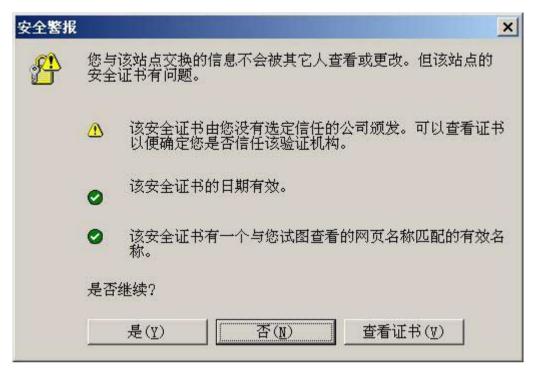
此网站出具的安全证书是为其他网站地址颁发的。

安全证书问题可能显示试图欺骗您或截获您向服务器发送的数据。

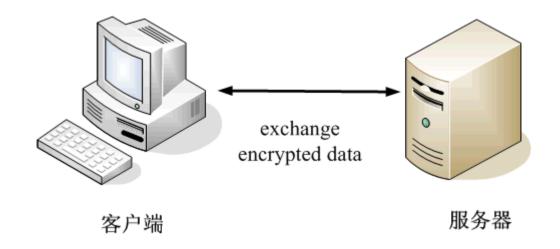
建议关闭此网页,并且不要继续浏览该网站。

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如果数字证书记载的网址,与你正在浏览的网址不一致,就说明这张证书可能被冒用,浏览器会发出警告。



如果这张数字证书不是由受信任的机构颁发的,浏览器会发出另一种警告。



如果数字证书是可靠的,客户端就可以使用证书中的服务器公钥,对信息进行加密,然后与服务器交换加密信息。

(完)

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