

Chapter 1

Introduction

1.1 WHAT IS ELECTRONIC POSTAGE

In general, postage is a special payment instrument that is used to get access to certain postal services such as having mail pieces transported from a sender to an intended recipient. As such, postage is a special currency, which is minted by the respective *postal operator*, distributed to consumers of postal services, and eventually applied to mail pieces in order to serve as evidence of prepayment for a postal service. Unused postage, for which no postal service has been provided, is guaranteed by the respective postal operator to be converted back into cash in the amount of its face value. Certain restrictions may apply to the redemption of unused postage.

Postage has come to mailers for more than a century in the flavor of physical stamps that need to be affixed to mail envelopes. Since the 1920s, businesses have used postage meters in order to apply postage faster to their mail and to give it a more professional and customized look. Most postal operators have created additional flavors of postage, e.g. permit mail, to meet the needs of bulk mailers such as publishers, catalogue distributors and direct mailers.

Electronic postage is a contemporary flavor of postage with a variety of advantages over traditional stamps and traditional postage meter imprints: Electronic postage is distributed in electronic form from a postal operator to mailers and, before it is applied to mail pieces, it is converted into individually verifiable and printable evidence of prepayment for postal products or services. Cryptographic mechanisms are used to secure electronic postage both in its electronic and printed form. Moreover, using electronic postage can be integrated into the mailing process such that postal operators can harvest almost complete usage profiles about which of their postal products and services are used and when.

The term ‘electronic postage’ or ‘e-mail postage’ has also been used for payment instruments to prepay for electronic document or e-mail delivery and additional value-added services such as delivery notifications. The electronic evidence of such payments has been standardized as *electronic postmarks* by the Universal Postal Union (UPU) [108] and the International Post Corporation (IPC) [42]. In 2001, Microsoft went so far as to propose a universal system of mandatory electronic postage fees for sending e-mail in order to alleviate the spam problem. The proposal appears to be appealing for some

reason and recurs with some frequency in usenet groups and the press. Bill Gates promoted the idea again at the world economic forum in Davos, Switzerland, in January 2004 as reported by CNN [20]. John Levine, an anti-spam advocate, considers the approach as economically unrealistic: Such an approach implies the setup of a worldwide micropayment system, which is prohibitively expensive to develop, test, deploy and maintain [49]. As Andrew Odlyzko, head of the Digital Technology Center at the University of Minnesota, pointed out, it will hardly be acceptable to users because people generally prefer flat rated over metered communication [61]. As is common in the communications industry, new services tend not to replace existing services entirely, but develop into co-existence with established ways of communication. Companies like Microsoft, America Online and Yahoo are likely to start niche markets for priority e-mail by using e-mail postage, which may gain some market share if their benefits become apparent [31]. In the following, we will focus on electronic postage to be used for physical mail delivery, not for electronic documents.

An important aspect of electronic postage are the *digital postmarks*, i.e., the secure imprints attached to envelopes or labels bearing evidence that a mailer has pre-paid for postal transportation. The significance of digital postmarks cannot be overestimated because they constitute the direct communication interface between the mailer's equipment and the postal operator's mail processing equipment. Thus, the quality of the digital postmark is key to the quality of an entire electronic postage system. This explains why digital postmarks are the subject of important standardization efforts like CEN EN 14615 [19] and UPU S36-4 [114] of more than one standards body. We shall see, however, that digital postmarks are only the tip of the iceberg, if we deal with electronic postage systems. There are many other important aspects that we need to address, among them postage meters, PC clients for online postage, background servers in different locations, hardware security modules, public key infrastructures, secure communication protocols, and cryptography.

1.2 SHORT HISTORY OF POSTAGE

The first documented use of an organized courier service for the distribution of written documents is in Egypt, where Pharaohs used couriers for the diffusion of their decrees on papyrus rolls in the territory of the State 2400 BC. One of the better known couriers in ancient Greece was the runner who in 490 BC brought the message from Marathon to Athens (42,195 km) that the Greek army had won the fight against the Persian king Darios I. The ancient