## Chapter XIV Accounting and Charging: Guarantees and Contracts

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#### ABSTRACT

Charging for IP-based communications determines the overall term for metering or monitoring, accounting, pricing, charge calculation, and billing. These five actions are detailed in this chapter to provide a clear view on their interdependencies as well as their relations to distributed computing. Since an ubiquitous computing approach does require communication means between all entities involved, the provisioning of these communication channels is supported typically by commercial service providers—covering network, transport, and value-added services. Thus, the legal and contractual relationships between customers and providers as well as technological choices of protocols, mechanisms, and parameters define the area of interest here.

## INTRODUCTION

Services being offered in a networking environment may range from traditional network access services through to value-added services provided by third party providers. The focus in this chapter has been placed on Internet and Internet Protocol (IP)-based services due to their great importance for basic communication as well as value-added services. In the case of ubiquitous computing, the areas of distributed communications as well as distributed computing merge to form an integrated approach in which those services mentioned provide an integrated portfolio to users and customers. As soon as these service providers and customers are identified, a contractual relation becomes necessary to formulate this contract in a legally enforceable manner. These contracts cover in general any type of service specification to be delivered from a provider to a customer. Specifications must be represented in an automatically interpretable manner in Service Level Agreements (SLAs) and may include computing cycles on a computing cluster, memory in storage area networks, value-added Web services representing business applications, network access, or Quality-of-Service (QoS) support, all of which showing a possible service guarantee level (if at all), numerical values for certain parameters to be monitored, and predefined delivery conditions. While SLAs for overall Information Technology (IT) services in a more traditional sense have been established for quite some time, SLAs in a communications and computing environment which can be interpreted without human interaction still face the problem of being hard to achieve.

The basis for these SLAs and their enforcement can be found in respective accounting mechanisms and protocols, which specify the set of essential operations and functions to be offered in a network. Note that accounting in this context addresses technical accounting questions, and it is not focused on financial accounting means. Since multiple providers may compete in a market-like situation in their service offerings, the need for such a technical service differentiation has to be complemented with suitable mechanisms which enable a service provider to account for these services and—optionally—their service usage. This type of accounting may serve a number of different purposes, such as network management supervision, determining resource bottlenecks in given topologies, or summarizing resource usage in view of subsequent charging. Typically, in a distributed computing environment all of these purposes are highly relevant, since a steady update and change of an existing networking infrastructure takes place, driven by networking equipment vendors, Internet Service Providers (ISP), and third party providers offering alternative valueadded services.

Thus, a combination of traditionally pure technology-driven enhancements in network functionality with more recent economically controlled mechanism additions becomes essential for an operable, efficiently manageable, and future-proof communications and networking approach. The basics of each of these two fields, their application in a highly distributed environment, and a number of selected mechanisms will be laid out in this chapter.

### Outline

This chapter on accounting and charging as well as guarantees and contracts has been structured into five main sections. While key terminology is defined first, the section "Technologies and Services" provides an overview of relevant technologies and services, which includes roles, accounting, and contracts. "Charging Approaches" extends this view into key charging, sometimes termed billing in public networks, covering basic charging principles, network and transport charging, and Web services and value-added service charging. Finally, "Future Research Directions" 33 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-

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