

# Chapter 10

## Accounting and Billing in Computing Environments

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### ABSTRACT

*This chapter gives a comprehensive overview of the current status of accounting and billing for up-to-date computing environments. Accounting is the key for the management of information system resources. At this stage of evolution of accounting systems it is adequate not to separate computing environments into High Performance Computing and Grid Computing environments for allowing a “holistic” view showing the different approaches and the state of the art for integrated accounting and billing in distributed computing environments. Requirements resulting from a public survey within all communities of the German Grid infrastructure, as well as from computing centres and resource providers of High Performance Computing resources like HLRN, and ZIVGrid, within the German e-Science framework, have been considered as well as requirements resulting from various information systems and the virtualisation of organisations and resources. Additionally, conceptual, technical, economical, and legal questions also had to be taken into consideration. After the requirements have been consolidated and implementations have been done over one year ago, now the overall results and conclusions are presented in the following sections showing a case study based on the GISIG framework and the Grid-GIS framework. The focus is on how an integrated architecture can be built and used in heterogeneous environments. A prototypical implementation is outlined that is able to manage and visualise relevant accounting and billing information based on suitable monitoring data in a virtual organisation (VO) specific way regarding basic business, economic, and security issues.*

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## INTRODUCTION

Computation is based on counting. Making use of computing environments is based on accounting. The meaning of “accounting” has changed over the last decades as new computing paradigms evolved. So in the golden age of computing there was not much use of accounting as human operating could oversee the whole computing installation. With technology developing towards concurring users, multiple processes, many processing units, vast amounts of disk space the relevance of accounting got prominent to those people operating the computing resources. But lastly the triumphal procession of omnipresent computing facility on the average desktop made accounting one of the top issues on the list of challenges for making large and networked installations of resources and services feasible. Currently we are in a stage of development where billing of resources, meaning hardware, software, and services, gets into public interest. Society demands and huge branches of computing and software industry rely on the fact that their efforts remunerate. With this development the pricing and billing aspects form new interests.

The basic work consolidating the available mechanisms and building an integrated solution has been done in the last years (Rückemann, 2006; Rückemann, Göhner, & Baur, 2007). Various groups running computing environments rely on these preparatory work and customise them to their needs (D-Grid, 2008; HLRN, 2008). As systems evolve single or national solutions and fragmentation must be prevented in order to make integrated accounting and billing part of future system management for the next generation of computing environments including resources and services.

The objectives of this chapter are to reveal some “bleeding edge” aspects of accounting and billing strategies based on this preparatory work and to demonstrate the current and near future developments in the world of scientific and public

computing stepping into broadening of commercial interests. All trademarks and names used in this text copyright their respective owners. As resulting in management of information system resources, this includes load from information systems on these resources. Examples for using information systems based on accountable resources are given in connection with these topics.

## BACKGROUND

As the meaning of the terms monitoring, accounting and billing is not sharply delimited, with respect to computing environments the following conventions may be helpful:

- **Monitoring** means metering, gathering, analysing and reporting as well as management of information belonging to the state of computing resources and services.
- **Accounting** means gathering, analysing and reporting as well as management of information belonging to the usage of computing resources and services. The most important objectives are optimisation and journaling of resource usage. With appropriate basic implementations, accounting can extend monitoring for the mentioned purposes.
- **Billing** means pricing and charging, based on the calculation of certain quantities of computing resource usage on various economic foci. With appropriate basic implementations, billing can extend accounting for this purpose.

It must be emphasised that “resources” in this context does cover hardware resources as well as services. The chances for configuring an accounting for your specific information-related services will be shown in the comparison of existing systems and concepts. Services is just a specific type of resource. As services is much more heterogeneous



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