CLOUD PLATFORMS IN INDUSTRY

Cloud computing applications develops by leveraging platforms and frameworks. Various types of services are provided from the bare metal infrastructure to customize-able applications serving specific purposes.

AMAZON WEB SERVICES (AWS)

AWS provides different wide-ranging clouds IaaS services, which ranges from virtual compute, storage, and networking to complete computing stacks. AWS is well known for its storage and compute on demand services, named as Elastic Compute Cloud (EC2) and Simple Storage Service (S3). EC2 offers customizable virtual hardware to the end user which can be utilize as the base infrastructure for deploying computing systems on the cloud. It is likely to choose from a large variety of virtual hardware configurations including GPU and cluster instances. Either the AWS console, which is a wide-ranged Web portal for retrieving AWS services, or the web services API available for several programming language is used to deploy the EC2 instances. EC2 also offers the capability of saving an explicit running instance as image, thus allowing users to create their own templates for deploying system. S3 stores these templates and delivers persistent storage on demand. S3 is well ordered into buckets which contain objects that are stored in binary form and can be grow with attributes. End users can store objects of any size, from basic file to full disk images and have them retrieval from anywhere. In addition, EC2 and S3, a wide range of services can be leveraged to build virtual computing system

including: networking support, caching system, DNS, database support, and others.

GOOGLE APPENGINE

Google AppEngine is a scalable runtime environment frequently dedicated to executing web applications. These utilize benefits of the large computing infrastructure of Google to dynamically scale as per the demand. AppEngine offers both a secure execution environment and a collection of which simplifies the development if scalable and high-performance Web applications. These services include: in-memory caching, scalable data store, job queues, messaging, and corn tasks. Developers and Engineers can build and test applications on their own systems by using the AppEngine SDK, which replicates the production runtime environment, and helps test and profile applications. On completion of development, Developers can easily move their applications to AppEngine, set quotas to containing the cost generated, and make it available to the world. Currently, the supported programming languages are Python, Java, and Go.

MICROSOFT AZURE

Microsoft Azure is a Cloud operating system and a platform in which user can develop the applications in the cloud. Generally, a scalable runtime environment for web applications and distributed applications is provided. Application in Azure are organized around the fact of roles, which identify a distribution unit for applications and express the application's logic. Azure provides a set of additional services that

complement application execution such as support for storage, networking, caching, content delivery, and others.

Cloud Applications

- Scientific Applications
  - Health care Analysis in the Cloud
  - Biology
- Geo Science
- Business and Consumer Applications
- Productivity
- Social Networking
- Media Applications
- Multiplayer online gaming

Cloud Applications

- Cloud computing has gained huge popularity in industry due to its ability to host applications whose services can be delivered to consumers rapidly at minimal cost.

- This chapter discusses various application case studies detailing their architecture and how they leveraged various Cloud technologies.

Cloud Applications

- Applications from a range of domains from scientific to engineering, gaming, to social networking are considered.

Scientific Applications

- Scientific applications are a sector that is increasingly using Cloud computing systems and technologies.

- The immediate benefit seen by researchers and academics is the potentially infinite availability of computing resources and storage at sustainable prices if compared to a complete in-house deployment.

Scientific Applications

- Cloud computing systems meet the needs of different types of applications in the scientific domain: HPC (High Performance Computing) applications, HTC (High Throughput Computing) applications, and data-intensive applications.

- The opportunity for using Cloud resources is even more appealing since minimal changes need to be done to existing applications in order to leverage Cloud resources.

Healthcare : ECG Analysis in the Cloud

- Healthcare is a domain where computer technology has found several and diverse applications: from supporting the business functions to assisting scientists in developing solutions to cure diseases.

- An important application is the use of Cloud technologies for supporting doctors in providing more effective diagnostic processes.

Healthcare : ECG Analysis in the Cloud

- In particular, we discuss electrocardiogram (ECG) data analysis on the Cloud.

Healthcare : ECG Analysis in the Cloud

- The capillary development of Internet connectivity and its accessibility from any device at any time has made Cloud technologies an attractive option for developing health-monitoring systems.

- Electrocardiogram (ECG) data analysis and monitoring constitutes a case study that naturally fits in this scenario. ECG is the electrical manifestation of the contractile activity of the heart's myocardium.

Healthcare : ECG Analysis in the Cloud

- This activity produces a specific waveform that is repeated overtime and that represents the heartbeat.

- The analysis of the shape of the waveform is used to identify arrhythmias and it is the most common way for detecting heart diseases.
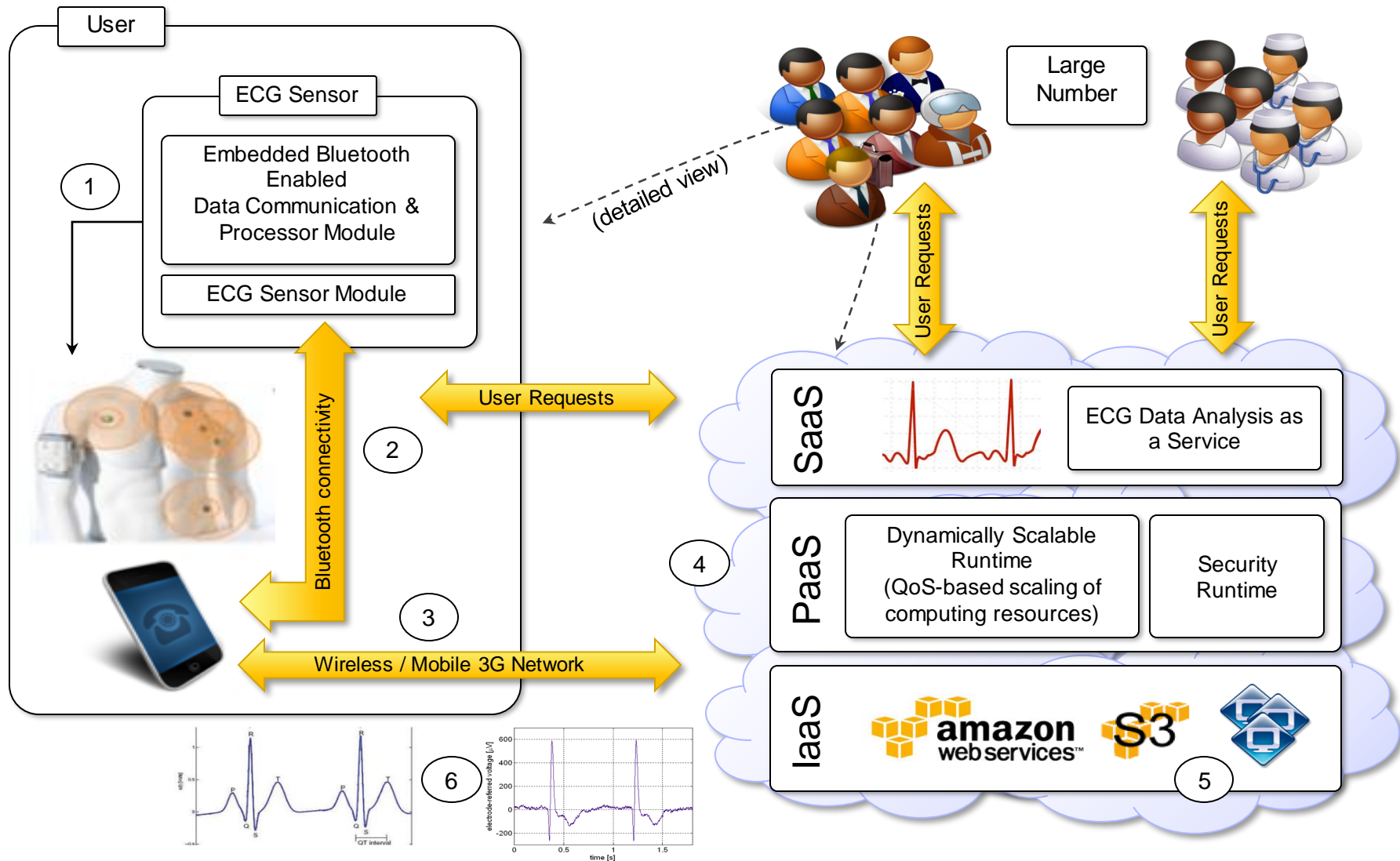
Healthcare : ECG Analysis in the Cloud

- Cloud computing technologies allow the remote monitoring of a patient's heartbeat data, its analysis in minimum time, and the notification of first-aid personnel and doctors should this data reveal potentially dangerous conditions.

Healthcare : ECG Analysis in the Cloud

- This way a patient at risk can be constantly monitored without going to hospital for ECG analysis. At the same time, doctors and first-aid personnel can instantly be notified with cases that require their attention.

Healthcare : ECG Analysis in the Cloud

Healthcare : ECG Analysis in the Cloud

- Even though remote ECG monitoring does not necessarily require Cloud technologies, Cloud computing introduces opportunities that would be otherwise hardly achievable.

Healthcare : ECG Analysis in the Cloud

- The first advantage is the elasticity of the Cloud infrastructure that can grow and shrink according to the requests served. As a result, doctors and hospitals do not have to invest in large computing infrastructures designed after capacity planning, thus making a more effective use of budgets. The second advantage is ubiquity.

Healthcare : ECG Analysis in the Cloud

- Cloud computing technologies have now become easily accessible and promise to deliver systems with minimum or no downtime. Computing systems hosted in the Cloud are accessible from any Internet device through simple interfaces (such as SOAP and REST based web services).

Healthcare : ECG Analysis in the Cloud

- This makes not only these systems ubiquitous but they can also be easily integrated with other systems maintained in the hospital's premises. Lastly, cost savings constitute another reason.

Healthcare : ECG Analysis in the Cloud

- Cloud services are priced on a pay-per-use basis and with volume prices in case of large numbers of service requests. These two models provide a set of flexible options that can be used to price the service, thus actually charging costs based on effective use rather than capital costs.

Biology : Protein Structure Prediction

- Applications in biology often require high computing capabilities and often operate on large datasets that cause extensive I/O operations.

- Because of these requirements, they have often made extensive use of supercomputing and cluster computing infrastructures. Similar capabilities can be leveraged on-demand by using Cloud computing technologies in a more dynamic fashion thus opening new opportunities for bioinformatics applications.

Biology : Protein Structure Prediction

- Protein structure prediction is a computationally intensive task fundamental for different types of research in the life sciences.

Biology : Protein Structure Prediction

- Among these is the design of new drugs for the treatment of diseases. The geometrical structure of a protein cannot be directly inferred from the sequence of genes that compose its structure, but it is the result of complex computations aimed at identifying the structure that minimizes the required energy.

Biology : Protein Structure Prediction

- This task requires the investigation of a space with a massive number of states, and consequently creating a large number of computations for each of these states.

Biology : Protein Structure Prediction

- The computational power required for protein structure prediction can now be acquired on demand, without owning a cluster or doing all the bureaucracy for getting access to parallel and distributed computing facilities. Cloud computing grants the access to such capacity on a pay-per-use basis.

Biology : Protein Structure Prediction
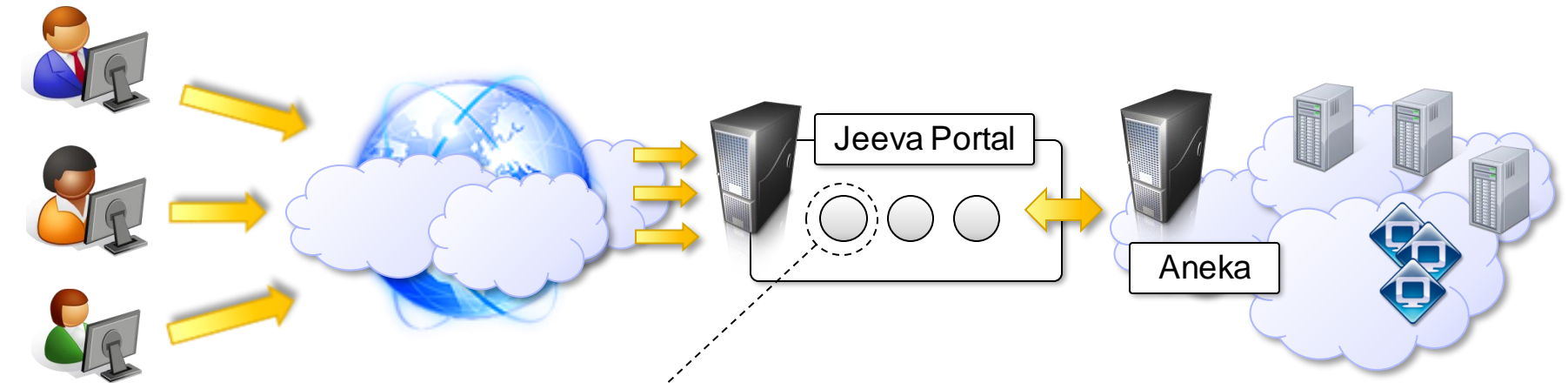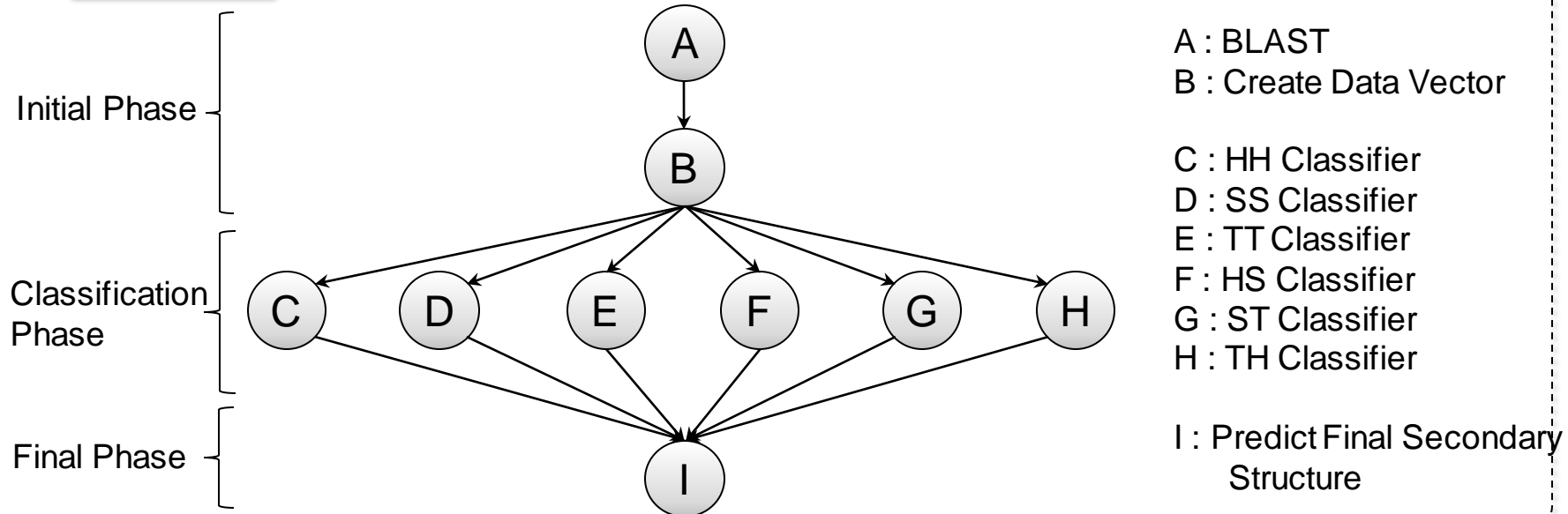
Biology: Gene Expression Data Analysis for Cancer Diagnosis

- Gene expression profiling is the measurement of the expression levels of thousands of genes at once. It is used to understand the biological processes that are triggered by the treatment at a cellular level.

- Together with protein structure prediction, this activity is a fundamental component of drug design since it allows scientists to identify the effects of a specific treatment.

Biology: Gene Expression Data Analysis for Cancer Diagnosis

- Another important application of gene expression profiling is cancer diagnosis and treatment. Cancer is a disease characterized by uncontrolled cell growth and proliferation.

- This behavior occurs because of genes regulating the cell growth mutate. This means that all the cancerous cells contain mutated genes.

- In this context, gene expression profiling is utilized to provide a more accurate classification of tumors.

- The classification of gene expression data samples into distinct classes is a challenging task.

- The dimensionality of typical gene expression data sets ranges from several thousands to over ten thousands genes. However, only small sample sizes are typically available for analysis.

Unit 5 : Objectives

After completing this unit you should be able to

- *Cloud Applications*
- *Scientific Applications*
- *Healthcare : ECG Analysis in the Cloud*
- *Biology : Protein Structure Prediction*
- *GeoScience : Satellite Image Processing*
- *Business and Consumer Applications*
- *Productivity*
- *Cloud Desktops : EyeOS and XIOS/3*
- *Social Networking*
- *Media Applications*
- *Multiplayer Online Gaming*
- *Summary*

Business and Consumer Applications

- The business and consumer sector is the one that probably benefits the most from Cloud computing technologies.

- On the one hand the opportunity of transforming capital cost into operational costs makes Clouds an attractive option for all enterprises that are IT centric.

Business and Consumer Applications

- On the other hand, the sense of ubiquity that Cloud offers for accessing data and services makes it interesting for end users as well.

Business and Consumer Applications

- Moreover, the elastic nature of Cloud technologies does not require huge upfront investments, thus allowing new ideas to be quickly translated into products and services that can comfortably grow with the demand.

Business and Consumer Applications

- The combination of all these elements has made Cloud computing the preferred technology for a wide range of applications: from CRM and ERP systems to productivity and social networking applications

CRM and ERP

- *Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP)* applications are market segments that are flourishing in the Cloud, with CRM applications being more mature than ERP implementations.

CRM and ERP

- Cloud CRM applications constitute a great opportunity for small enterprises and start-ups to have a fully functional CRM software without large upfront costs and by paying subscriptions.

CRM and ERP

- Moreover, customer relationship management is not an activity that requires specific needs and it can be easily moved to the Cloud. Such a characteristic, together with the possibility of having access to your business and customer data from everywhere and any device, has fostered the spread of Cloud CRM applications. ERP solutions on the Cloud are less mature and have to compete with well-established in-house solutions.

CRM and ERP

- ERP systems integrate several aspects of an enterprise: finance and accounting, human resources, manufacturing, supply chain management, project management, and customer relationship management.

SalesForce.com

- Salesforce.com is probably the most popular and developed CRM solutions available today. As of today more than 100 thousands customers have chosen Safesforce.com to implement their CRM solutions.

- The application provides customizable CRM solutions that can be integrated with additional features developed by third parties. Salesforce.com is based on the *Force.com* Cloud development platform.

SalesForce.com

- This represents the scalable and high-performance middleware executing all the operations of all Salesforce.com applications.

SalesForce.com
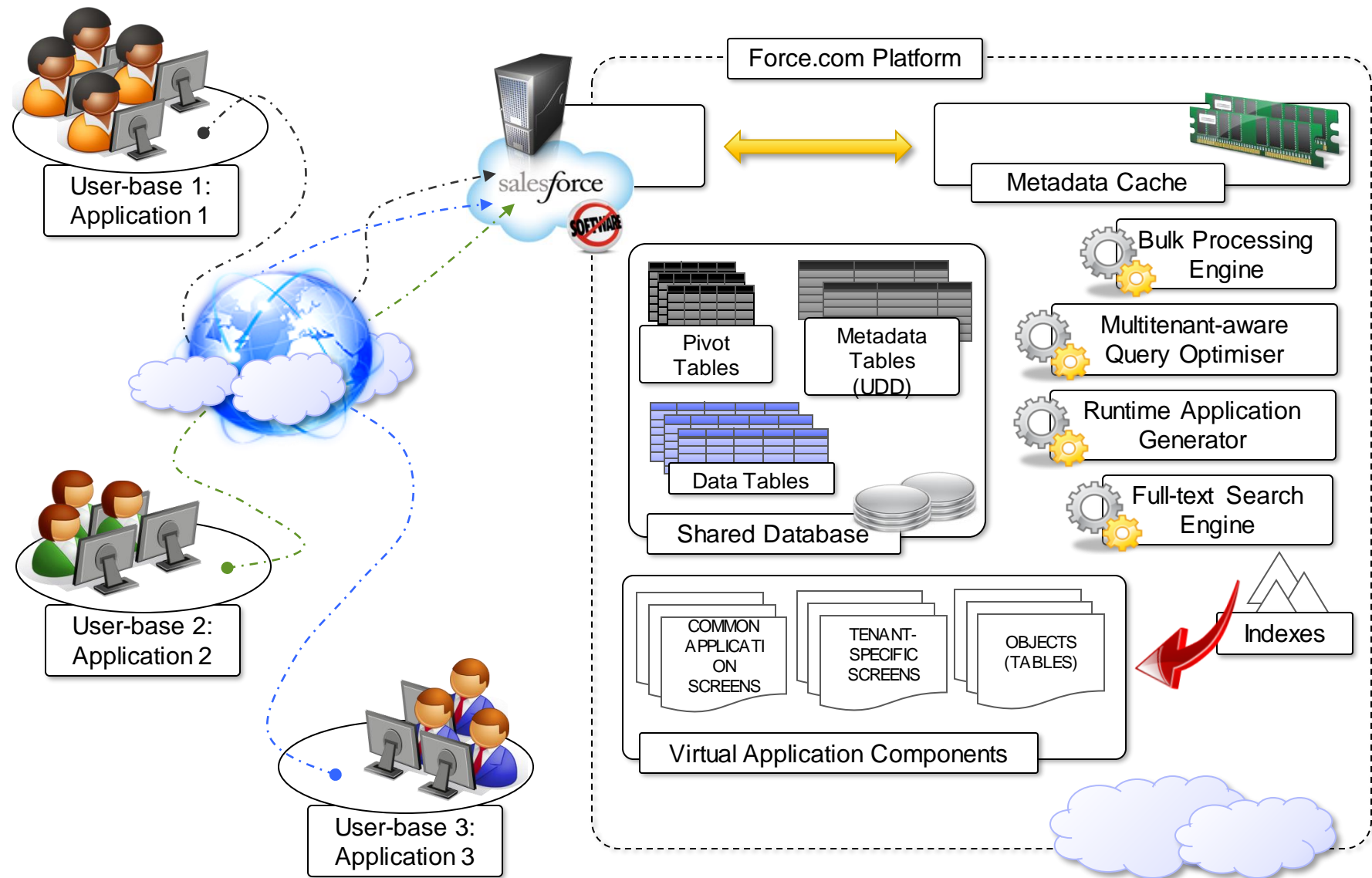
Microsoft Dynamics CRM

- Microsoft Dynamics CRM is the solution implemented by Microsoft for customer relationship management. Dynamics CRM is available either for installation on the enterprise's premises or as an online solution priced with a monthly per user subscription.

- The system is completely hosted in Microsoft's data center across the world and offers to customers a 99.9% SLA, with bonus credits in case the system does not fulfill the agreement.

Microsoft Dynamics CRM

- Each CRM instance is deployed on a separate database, and the application provides users with facilities for marketing, sales, and advanced customer relationship management.

- Dynamics CRM Online features can be accessed either through a web browser interface or programmatically by means of SOAP and RESTful web services.

Microsoft Dynamics CRM

- This allows Dynamics CRM to be easily integrated with both other Microsoft products and line of business applications.

Microsoft Dynamics CRM

- Dynamics CRM can be extended by developing plug-ins that allow implementing specific behaviors triggered on the occurrence of given events. Dynamics CRM can also leverage the capability of Windows Azure for the development and integration of new features.

NetSuite

- NetSuite provides a collection of applications that help customers manage every aspect of the business enterprise. Its offering is divided in three major products: *NetSuite Global ERP*, *NetSuite Global CRM+*, and *NetSuite Global Ecommerce*. Moreover, an all-in-one solution integrates all the three products together: *NetSuite One World*.

NetSuite

- The services delivered by the company are powered by two large datacenters on the opposite coasts (east and west coasts) of the United States connected by redundant links. This allows NetSuite to guarantee 99.5% of uptime to its customers.

- Besides the pre-packaged solutions, NetSuite also provides and infrastructure and a development environment for implementing customized applications. The *NetSuite Business Operating System (NS-BOS)* is a complete stack of technologies for building Software-as-a-Service business applications that leverage the capabilities of NetSuite products.

NetSuite

- On top of the SaaS infrastructure, the NetSuite Business Suite components offer accounting, ERP, CRM, and e-commerce capabilities. An online development environment, *SuiteFlex*, allows integrating such capabilities into new web applications, which are then packaged for distribution by *SuiteBundler*.

NetSuite

- The entire infrastructure is hosted in the NetSuite datacenters, which provide the warranties about the application uptime and availability.