Existing cloud applications can be divided into several broad categories: (i) processing pipelines;

(ii) batch processing systems; and (iii) Web applications [360].

Processing pipelines are data-intensive and sometimes compute-intensive applications and represent

a fairly large segment of applications currently running on the cloud. Several types of data processing

applications can be identified:

• Indexing. The processing pipeline supports indexing of large datasets created by Web crawler

engines.

• Data mining. The processing pipeline supports searching very large collections of records to locate

items of interests.

• Image processing. A number of companies allow users to store their images on the cloud (e.g., Flickr

(www.flickr.com) and Google (http://picasa.google.com/)). The image-processing

pipelines support image conversion (e.g., enlarging an image or creating thumbnails). They can also

be used to compress or encrypt images.

• Video transcoding. The processing pipeline transcodes from one video format to another (e.g., from

AVI to MPEG).

• Document processing. The processing pipeline converts very large collections of documents from

one format to another (e.g., from Word to PDF), or encrypts the documents. It could also use optical

character recognition (OCR) to produce digital images of documents.

Batch processing systems also cover a broad spectrum of data-intensive applications in enterprise

computing. Such applications typically have deadlines, and the failure to meet these deadlines could have serious economic consequences. Security is also a critical aspect for many applications of batch

processing. A nonexhaustive list of batch processing applications includes:

• Generation of daily, weekly, monthly, and annual activity reports for organizations in retail, manufacturing,

and other economic sectors.

• Processing, aggregation, and summaries of daily transactions for financial institutions, insurance

companies, and healthcare organizations.

• Inventory management for large corporations.

• Processing billing and payroll records.

• Management of the software development (e.g., nightly updates of software repositories).

• Automatic testing and verification of software and hardware systems.

Finally, and of increasing importance, are cloud applications in the area of Web access. Several

categories of Web sites have a periodic or a temporary presence, such as the Web sites for conferences

or other events. There are also Web sites that are active during a particular season (e.g., the holiday

season) or that support a particular type of activity, such as income tax reporting with the April 15

deadline each year. Other limited-time Web sites used for promotional activities “sleep” during the

night and auto-scale during the day.

It makes economic sense to store the data in the cloud close to where the application runs; as we saw

in Section 3.1, the cost per GB is low and the processing is much more efficient when the data is stored

close to the computational servers. This leads us to believe that several new classes of cloud computing

applications could emerge in the years to come – for example, batch processing for decision support

systems and other aspects of business analytics. Another class of new applications could be parallel

batch processing based on programming abstractions, such as MapReduce, discussed in Section 4.6.

Mobile interactive applications that process large volumes of data from different types of sensors and

services that combine more than one data source (e.g., mashups2) are obvious candidates for cloud

computing.

Science and engineering could greatly benefit from cloud computing because many applications

in these areas are compute- and data-intensive. Similarly, a cloud dedicated to education would be

extremely useful. Mathematical software such as MATLAB and Mathematica could also run on the

cloud.