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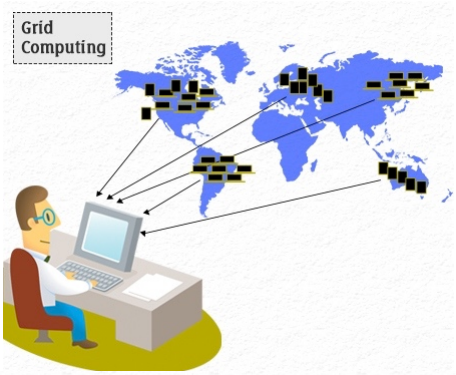
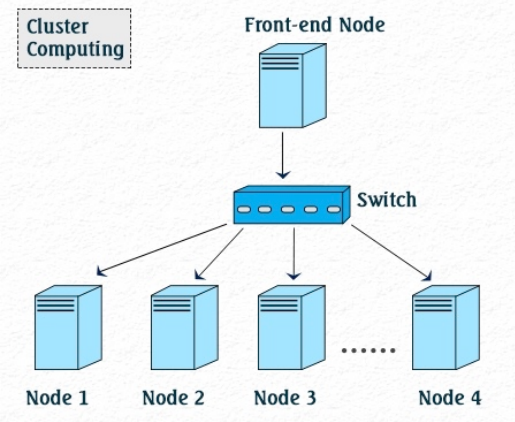
Alchemi
.NET GRID COMPUTING FRAMEWORK

the gridbus project

What is grid computing?

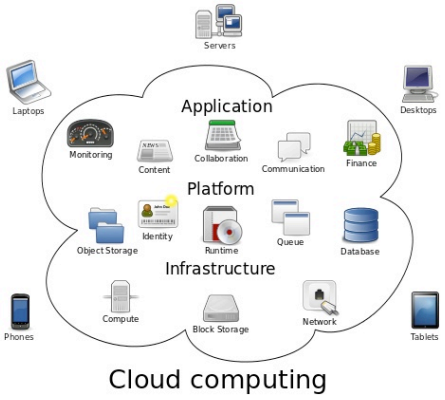


Grid computing is a distributed system that uses computers resources shared in the network to execute programming tasks using parallel execution. Computers as nodes in the network can work on a job together, to appear virtually as a **supercomputer**. The computers that are connected together with LAN network and execute the tasks by processing the power in parallel known as cluster computing [1].



The main difference between grid computing and cluster computing is the geographical distribution. In cluster computing all computers are located and connected by LAN network, on the other hand in grid computing all computers are distributed through LAN, WAN and internet networks. A grid computing user can get access to services by surfing through the applications available on the internet (**cloud computing**). For example, in "one Drive" application the user edits the document file and stores it in the server. Therefore, **cloud computing is a type of grid computing**[2].

Why do we need grid computing?



Cloud computing

Because of the increased number of distributions of the internet and their users, the amount of data in the companies or organisations has increased exponentially (**Big Data**). The analysis of methods became more complicated and has a high time complexity. Therefore, use of grid computing became important in order to reach higher performance in the execution time [3].

Enterprise Grid systems

Use of network resources as storage places caused a higher processing power of computers hence it becoming a major issue for technology industries and researchers. Many academic centres and technology companies eventually had to form enterprise grid systems. Such as Condor [4], SETI@home [5] , GridMP [6], Entropia [7], XtermWeb [8], and Alchemi [9]. All

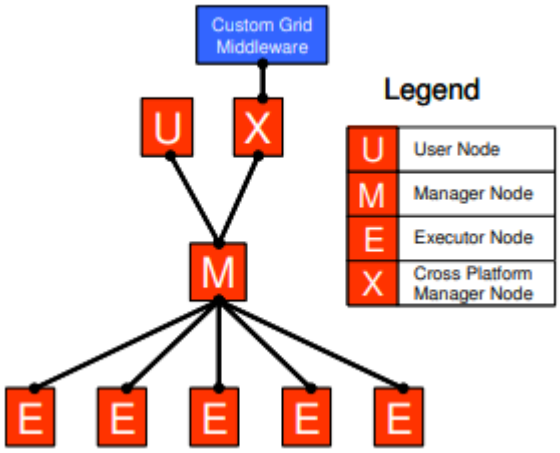
these enterprises support windows 32, but only Alchemi supports .Net framework as well as using thread programming model and Web Services Interface (WSI).

What is the Alchemi .Net framework?

Alchemi's enterprise grid system was created using the 'Cloud Computing and Distributed Systems (CLOUDS)' Laboratory at the University of Melbourne, Australia in 2004. It was designed following a master-worker parallel programming model in which a central component sends the independent parts of parallel execution 'grid thread' to workers and managers when finished with them.

Alchemi Components:

The Alchemi consists of four types of components:



The Owner / User:

The owner is the user of the grid application executed in the computer node, or the user that requests the grid service executed in the network. As shown in the Alchemi architecture the owner is connected to the manager node in the network topology to transmit the threads to the manager. The result of the parallel executed thread is received when ordered to do so from the manager.

The Manager:

The manager is located in the centre between user/owner and the executors. The manager receives the grid threads from the user and organises them using some database rules then schedules it to resend in order to let the available executors to execute them in their machine. And again, when the executor is done, the manager receives the result and organises it in order to return it to the user/ owner.

The Executor:

The executor is connected to the manager, it receives the parallel execution threads and executes them in its machine (computer network node). When the result is generated the executor resends the result to the manager.

Cross-Platform Manager -Web Services:

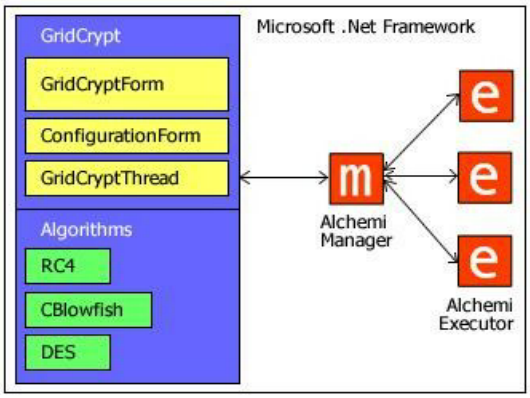
The Cross-Platform Manager is a web services interface to enable Alchemi to manage the execution of grid tasks.

Applications

Alchemi was used in different fields of science and commercial applications for enterprise Grids. Explained below are the three case studies of applications that used Alchemi and achieved a much higher performance than without Alchemi [10] [11] [12].

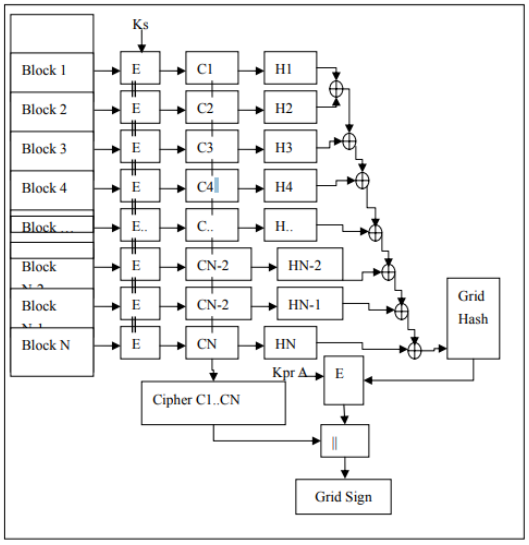
GridCrypt:

Grid crypt is an encryption/decryption security application. It uses a set of encryption/decryption algorithms such as the block cipher DES (Data Encryption Standard) and Blowfish, it also uses the stream cipher RC4. This approach made it inviting for the businesses to secure their documents using Alchemi [10].



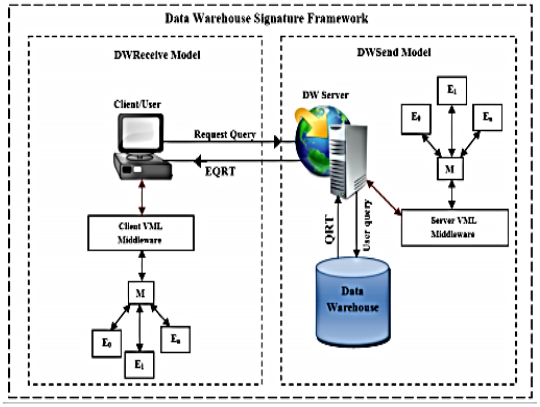
Grid signature:

Grid signature separates a message into blocks and computes the encryption/decryption for each block in parallel execution using Alchemi grid computing. It develops the digital signature design by computing the hash function. The result for each hash thread is operated with a XOR logic gate that computes it with the next one and so on, producing what's known as "Grid Hash" [11].



Data Warehouse Signature (DWS):

It is a new framework made to help solve security issues with Data Warehouse (DWs). DWS consists of two models: DWSend and DWReceive model. It helps with the flow of large scale data transmitted between a client and DWServer [12].



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