= Xgrid =

Xgrid is a proprietary program and distributed computing protocol developed by the Advanced Computation Group subdivision of Apple Inc that allows networked computers to contribute to a single task .

It provides network administrators a method of creating a computing cluster , which allows them to exploit previously unused computational power for calculations that can be divided easily into smaller operations , such as Mandelbrot maps . The setup of an Xgrid cluster can be achieved at next to no cost , as Xgrid client is pre @-@ installed on all computers running Mac OS X 10 @.@ 4 to Mac OS X 10 @.@ 7 . The Xgrid client was not included in Mac OS X 10 @.@ 8 . The Xgrid controller , the job scheduler of the Xgrid operation , is also included within Mac OS X Server and as a free download from Apple . Apple has kept the command @-@ line job control mechanism minimalist while providing an API to develop more sophisticated tools built around it .

The program employs its own communication protocol layered on top of a schema to communicate to other nodes . This communication protocol interfaces with the BEEP infrastructure , a network application protocol framework . Computers discovered by the Xgrid system , that is computers with Mac OS X 's Xgrid service enabled , are automatically added to the list of available computers to use for processing tasks .

When the initiating computer sends the complete instructions , or job , for processing to the controller , the controller splits the task up into these small instruction packets , known as tasks . The design of the Xgrid system consists of these small packets being transferred to all the Xgrid @-@ enabled computers on the network . These computers , or nodes , execute the instructions provided by the controller and then return the results . The controller assembles the individual task results into the whole job results and returns them to the initiating computer .

Apple modeled the design of Xgrid on the Zilla program , distributed with NeXT 's OPENSTEP operating system application programming interface (API) , which Apple owned the rights to . The company also opted to provide the client version of Mac OS X with only command @-@ line functions and little flexibility , while giving the Mac OS X Server version of Xgrid a GUI control panel and a full set of features .

= = History = =

Xgrid 's original concept can be traced back to Zilla.app , found in the OPENSTEP operating system , created by NeXT in the late 1980s . Zilla was the first distributed computing program released on an end @-@ user operating system and which used the idle screen @-@ saver motif , a design feature since found in widely used projects such as Seti @ Home and Distributed.net. Zilla won the national ComputerWorld Smithsonian Award (Science Category) in 1991 for ease of use and good design . Apple acquired Zilla , along with the rest of NeXT , in 1997 and later used Zilla as inspiration for Xgrid . The first beta version of Xgrid was released in January 2004 .

Several organizations have adopted Xgrid in large international computing networks . One example of an Xgrid cluster is MacResearch 's OpenMacGrid , where scientists can request access to large amounts of processing power to run tasks related to their research . Another was the now defunct Xgrid @ Stanford project , which used a range of computers on the Stanford University campus and around the world to perform biochemical research .

In a pre @-@ release promotional piece , MacWorld cited Xgrid among the Unix features in " 10 Things to Know about TIGER " , calling it " handy if you work with huge amounts of experimental data or render complex animations " . After Xgrid 's introduction in 2004 , InfoWorld noted that it was a " ' preview ' grade technology " which would directly benefit from the Xserve G5 's launch later that year . InfoWorld commentator Ephraim Schwartz also predicted that Xgrid was an opening move in Apple 's entry into the enterprise computing market .

Apple discontinued Xgrid with OS X v10.8 (Mountain Lion) , along with dependent services such as Podcast Producer .

= = Protocol = =

The Xgrid protocol uses the BEEP network framework to communicate with nodes on the network . The system 's infrastructure includes three types of computers which communicate over the protocol . One is the client , which communicates the calculation . Next is the controller , which starts and segregates the calculation . Finally , the agents process their own allocated part of the calculation .

A computer can act as one or all three of these components at the same time . The Xgrid protocol provides the basic infrastructure for computers to communicate , but is not involved in the processing of the specified calculation . Xgrid is targeted towards time consuming computations that can be easily segregated into smaller tasks , sometimes called embarrassingly parallel tasks . This includes Monte Carlo calculations , 3D rendering and Mandelbrot maps .

Within the Xgrid protocol , three types of messages can be passed to other computers on the same cluster : requests , notifications and replies . Requests must be responded to by the recipient with a reply , notifications do not require a reply , and replies are responses to sent messages . They are identified by their name , type (request / notification / reply) and contents . Each message is encapsulated in a BEEP message (BEEP MSG) and is acknowledged on receipt by an empty reply (RPY) . Xgrid does not leverage BEEPs message / reply infrastructure . Any received message which requires a response merely generates an independent BEEP message containing the reply . The Xgrid messages are encoded as dictionaries of key / value pairs which are converted to XML before being sent across the BEEP network .

= = Architecture = =

The architecture of the Xgrid system is designed around a job based system ; the controller sends agents jobs , and the agents return the responses . The actual computation that the controller executes in an Xgrid system is known as a job . The job contains all the files required to complete the task successfully , such as the input parameters , data files , directories , executables and / or shell scripts , the files included in an Xgrid job must be able to be executed either simultaneously or asynchronously , or any benefits of running such a job on an Xgrid is lost . Once the job completes , the controller can be set to notify the client of the task 's completion or failure , for example by email . The client can leave the network while the tasks are running . It can also monitor the job status on demand by querying the controller , although it cannot track the ongoing progress of individual tasks .

The controller is central to the correct function of an Xgrid , as this node is responsible for the distribution , supervision and coordination of tasks on agents . The program running on the controller can assign and reassign tasks to handle individual agent failures on demand . The number of tasks assigned to an agent depend on two factors : the number of agents on an Xgrid and the number of processors in each node . The number of agents on an Xgrid determines how the controller will assign tasks . The tasks may be assigned simultaneously for a large number of agents , or queued for a small number of agents . When a node with more than one processor is detected on an Xgrid , the controller may assign one task per processor ; this only occurs if the number of agents on the network is lower than the number of tasks the controller has to complete .

Xgrid is layered upon the Blocks Extensible Exchange Protocol (BEEP) , an IETF standard comparable to HTTP , but with a focus on two @-@ way multiplexed communication , such as that found in peer @-@ to @-@ peer networks . BEEP , in turn , uses XML to define profiles for communicating between multiple agents over a single network or internet connection .

= = Interface = =

While it is possible to access Xgrid from the command line , the Xgrid graphical user interface , a program bundled with Mac OS X Server and , as of March 2009 , available online , is a much more efficient way of administering an Xgrid system . Originally , the Xgrid agent was included in all Mac OS X version 10 @.@ 4 installations but the GUI was reserved for users of Mac OS X Server . This

decision limited the efforts of the computer community to embrace the platform . Eventually , Apple released the Mac OS X Server Administration Tools to the public , which included the Xgrid administration application bundled with Mac OS X Server .

Despite the lack of a graphical controller interface in the standard (non @-@ server) Mac OS X distribution , it is possible to set up an Xgrid controller via the command line tools xgridctl and xgrid . Once the Xgrid controller daemon is running , administration of the grid with Apple 's Xgrid Admin tool is possible . Some applications , such as VisualHub , provided Xgrid controller capability through their user interfaces .