Background

Cardiff University Information Services division identified that for quite a lot of the time their departmentally owned Windows “Open Access” workstations (workstations that are used by students) were being underutilised (especially during the night when they were left switched on).

A project was conceived to distribute Condor to the previously identified “Open Access” workstations, and to provide a centrally managed High Throughput Computing service to all researchers throughout the University.

Typically Condor installations in UK Universities are owned, maintained and serviced by individual research groups or academic departments. The Condor project at Cardiff University is unusual in that it is driven by a service department (Information Services).

The Welsh e-Science Centre based in Cardiff University is the project sponsor.

Design

Cardiff University has many years of experience delivering and distributing large scale applications to the desktop via the network. From the outset, the goal of the project was to deploy Condor on 800 nodes, and to run one large scale real life application (over 600 jobs).

The principle design aim for the Condor project was to use Novell’s ZenWorks to “push” the Condor application onto each and every “Open Access” workstation using a technique known as “lights out distribution”. This technique installs applications to a workstation (via a Windows service), without the need of a user being logged.

ZenWorks is a suite of utilities designed to centrally manage Windows workstations and amongst other things offers facilities for remote control, assigning printers to workstations or rooms and to distribute applications to Windows desktop.

Cardiff University uses ConsoleOne for the version control of distributed applications such as Condor, forcing the re-distribution to every Windows workstation on campus, with just one click of a mouse.

ZenWorks manages workstations using a directory service (Novell e-Directory). Workstation objects are created in selected containers in the directory according to their location. It is possible to target the distribution of applications either to specific workstations or all workstations in a container e.g. a group of departmental workstations. It is therefore possible to assign and manage an individual Condor_Config file tailored for the department’s particular needs.

To provide a University wide IT service, it was important to prove both the security and the stability of Condor on our workstations. The project had staged distribution targeting incremental workstation groups. These workstation groups were monitored by “local support staff” noting any “odd” behaviour as jobs were submitted to the pool.
A Web based graphing tool (MRTG) was used to chart the output from standard Condor tools, producing Web based statistics.

[Example MRTG graph – Daily usage]

[Example MRTG graph – Weekly usage]
To submit a Condor job the user has to add their Windows local user account credentials to the Condor installation.

The Windows XP workstation service at Cardiff University use Novell’s Dynamic Local User. When the user logs into the workstation, they are authenticated against the Novell e-Directory. A local Windows account is then created using the same username as the Novell network account.

Since Dynamic Local User is being used to create the local Windows workstation account, and Condor makes use of the locally stored username and password, there is an indirect e-Directory authentication when a user submits a job to the Condor pool. Therefore this added feature of ZenWorks is improving Condor for Windows.

The Condor pool at Cardiff University is Windows based, however a significant number of researchers develop or use applications / utilities that run on Linux. The next stage of our project, and where we see our biggest challenge, is converting these applications to Windows (providing compiler support), or offering Linux emulators to run on Windows (such as Cygwin).

It is the medium term goal for the Condor project that departments can “opt” into the Condor pool, increasing the number of execute nodes throughout the University campus. A future stage of the project may be for all Windows workstations to have Condor installed as part of the standard build, and that departments can “opt” out of the pool (if required).

**Technical**

Cardiff University has a large scalable Windows Condor pool. These workstations are all “Open Access”, and are distributed throughout the whole of the University campus.

The workstations are all Windows XP SP1, and all access our main Novell NetWare network. There are currently 800 “Open Access” workstations owned by Information Services throughout the University.

Novell uses a product called e-Directory which is an X500 compliant object orientated database. This database is the primary mechanism for user authentication and general network security.
The e-Directory contains details about Users, along with other useful objects such as Printers, Workstations and Applications.

Every “Open Access” workstation has a Workstation Object. The Workstation Objects are grouped in a Workstation Container. The group can be determined by physical locality, IP address range and / or departmental ownership.
The management of the workstations, which includes software distribution from the network, is controlled via a Novell “add on” suite of products called ZenWorks.

Condor is distributed from the Novell file servers to each “Open Access” workstation using Application Objects.

The Application Objects are also held within the e-Directory. Each Application Object has configurable properties instructing what application settings are written to the workstation e.g. ini files, system files and registry settings.
The Condor Application Object performs the following tasks:

- Removes the Condor service if Condor has already been installed onto the system
- Copies the Condor files from the network to the workstation
- Updates the Windows registry settings
- Re-Installs the Condor service
- Change the Condor service settings to auto start
- Starts the Condor service

The Condor Application Object is associated to each Workstation Container and is set to distribute on “force run”. Thus, when the ZenWorks service is started the Condor application is automatically distributed to every associated workstation.

Simply by associating the Application Object to an additional Workstation Container, hundreds of new workstations can be added to the Condor pool and automatically configured ready for use.

Summary

- Large scale Condor pool (now 650 nodes with ambitions to roll out more widely)
- Central service perspective providing useful tools such as the Web based MRTG graphs
- Centrally managed pool (including updates of the Condor distribution)
- Diagnose problems on the Condor nodes (by the use of remote control)
- Distributing modified configuration files to enable departments to prioritise their own jobs on their own workstations