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Building a SAS® Grid Support Capability in the Enterprise

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ABSTRACT

Building SAS® Grid support capability within an organization's IT support function requires IT managers to consider many different aspects. There is a need for SAS support to fit seamlessly into the Enterprise IT support model and comply with IT policies based on standard frameworks such as ITIL, while maintaining a level of business engagement far beyond that which is required of traditional IT support teams. We will outline a practical framework including the policies and procedures required to support a SAS Grid in a way that provides a solid foundation that meets the immediate and ongoing business requirements. We will discuss how to embed SAS into an organization's standard IT processes and how to ensure that active business engagement is a standard activity.

INTRODUCTION

SAS software has a long history at the Co-operative Banking Group (the bank). Multiple business areas have been using departmental SAS environments for many years for Finance and regulatory reporting, Insurance, Marketing and Customer Insight. In the main, these departments have supported SAS themselves, with some help from IT to keep the physical UNIX servers up and running.

The implementation of SAS Grid Computing® at the bank created a need to change this approach. Now a single enterprise wide SAS infrastructure needed be shared by multiple departments, which meant that IT needed to do more to support the SAS Application itself. To this end, it was decided to build a SAS Grid support team in IT to support the SAS Grid on behalf of all users of SAS across the bank.

The SAS software being supported at the bank is SAS Grid Manager® and the SAS Banking Analytics Architecture®, which includes SAS Data Integration Server® and SAS Enterprise Business Intelligence Server®.

Supporting a SAS Grid that serves multiple business units requires a combination of rigorous management and flexibility in order to meet changing business needs, while reducing risk to business critical SAS processes. This paper will outline the steps taken to build and embed a support function to do just that.

EMBEDDING SAS SUPPORT INTO IT

Should SAS be treated differently to any other application in the bank? Yes and No.

Firstly, SAS can and should be integrated into the IT Service Operations function just like any other application. All the standard IT functions such as Incident, Problem, Change and Capacity Management should be in place and should use standard systems and processes

Where supporting SAS is slightly different to supporting many IT applications is because there are often highly experienced SAS programmers/developers working in many business departments outside IT. Their needs are therefore very different from users of Graphical User Interface (GUI) driven specialist applications.

The business will often perform business analysis, design, development and testing of SAS code and Data Integration jobs, functions which are traditionally the preserve of IT. This means that IT departments must be prepared to engage with the business at a peer to peer level in a way that goes beyond the standard service provider/service user model.

Where we came from

SAS Software has been used by multiple business areas within the bank for many years; this has led to a diverse range of SAS systems running on a variety of environments under differing approaches and governance models. SAS usage is individual to each business area and there had been little in the way of consistency across tools, development processes, data access, storage or reporting. There had also been little IT involvement beyond hardware maintenance on the legacy SAS environments.

Therefore, the challenge of embedding support responsibilities for the new SAS Grid into IT in many ways was an even greater challenge than it would have been for a green-field implementation as the business was used to having full control and flexibility.

The legacy SAS environment's had little formal change control and multiple inconsistencies and issues. For example, the open usage has led to users storing massive unnecessary amounts of data, resulting in storage capacity regularly breaching its thresholds.

Capacity Management was also not formally managed. As a result, CPU and Memory usage on the infrastructure regularly approached 100%. Any SAS service deterioration due to a lack of capacity has had a knock on effect to reporting delivery timescales with reporting packs and analysis not available until later in the business day.

What was our approach?

Crucially, the plan to create the SAS Grid support team was sponsored by senior IT and business leadership who understood the need and benefits of transitioning SAS support into IT following the successful implementation of the SAS Grid infrastructure project.

The agreed approach was to create a team of three SAS platform administrators under the guidance of an experienced IT Manager who would have a wide range of responsibilities related to the management and adoption of SAS Grid computing within the bank.

Together with SAS Professional Services, we created a plan to be executed over a year to recruit and train a team, embed the team into the wider IT organisation and develop the processes required to support SAS.

What are the benefits of supporting SAS in IT?

There are many benefits of having SAS support in IT.

Firstly, supporting any Enterprise Service usually involves services being provided by one or more teams, partners and/or suppliers managing an array of components. The growing demands placed on a scalable, flexible and reliable SAS Service requires central management and co-ordination of the multiple teams and stakeholders.

Secondly, keeping up with change across an organisation can be a challenge when not centrally managed. Having a dedicated SAS Grid support function in IT means that software, hardware and Operating Systems are kept up to date and therefore service is maintained and capability enhanced with the latest updates and upgrades.

Finally, business requirements such as regulatory change are constantly moving. Having operational support of SAS within IT ensures operational stability is maintained throughout, ensuring that the business teams can concentrate 100% on creating business value with the SAS solutions.

Implementing IT Support

Enterprise IT Organisations have 'standards': principles, policies and processes which are in place to ensure necessary governance, management and control. At the same time, it is important to ensure that these standards are not overly bureaucratic and unnecessarily hinder business agility and flexibility. Our experience is that in order to make a SAS support model work it is necessary to reach a mutual understanding and ultimately reach a compromise which meets the needs of both the business and IT.

Organisations today operate in dynamic environments and therefore there is a constant need to learn and adapt. It was vital that both the business and IT collaborated to meet these ever changing needs and subsequently a 'Virtual Team' was created in order to drive through continual improvements while managing trade-offs between cost and risk. This is covered further in the section "working with the business".

A dedicated SAS Grid support team, known as The "Analytical Centre of Excellence" was created to ensure closer focus on the day-to-day activities and infrastructure that is used to deliver services. The new support team required processes and support tools to allow them to have an overall view of the end to end service from a business perspective and to detect any threats or failures to service availability and quality.

Well planned, implemented, properly conducted, controlled and managed processes are required to optimise efficiency, service availability and quality. Enterprise IT environments usually have existing frameworks which are used to manage, control and govern service provision. Frameworks in use at the bank include CoBIT, CMMI, PRINCE2, M_o_R, TOGAF and ITIL. ITIL is the key framework used for managing IT Services within the bank.

ITIL (Information Technology Infrastructure Library)

Adoption of ITIL at the bank provides us with a systematic and professional approach to the management of IT service provision, enabling reduced costs, improved service, improved customer satisfaction and improved productivity. The bank has leveraged ITIL best practice in order to be successful in the management of IT. Each organisation is different, so ITIL is essentially a framework which should be adopted and adapted to fit the particular organisation. ITIL version 3 is made up of five core publications (books) which are divided by stages within a lifecycle. For the auspices of support the key book is 'Service Operations' and secondary key book is 'Service Transition', both of these books refer to processes such as Incident Management, Problem Management, Change Management and

Release & Deployment. The below sections outline some of the key processes and how they are implemented to support SAS at the bank.
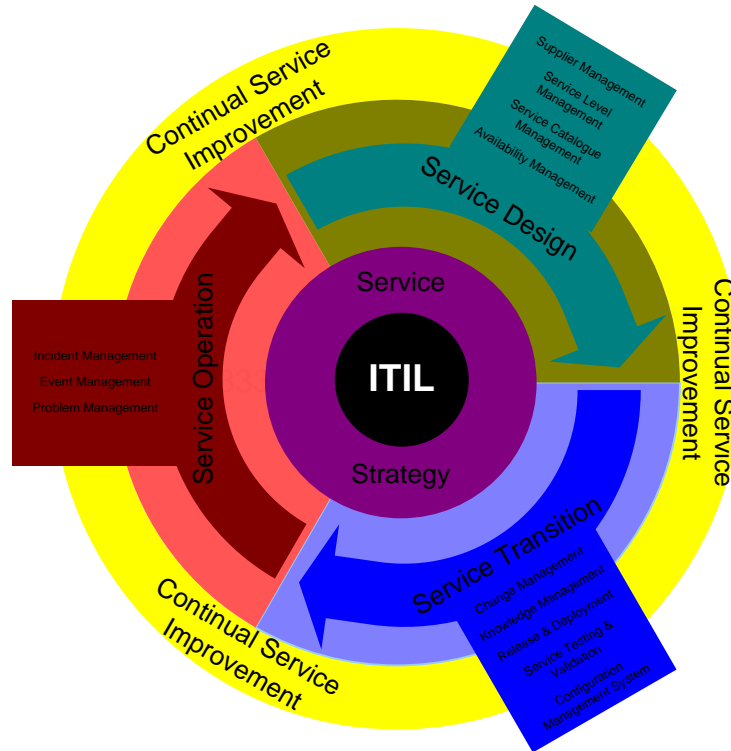

Figure 1. ITIL Version 3 Service Lifecycle

Incident Management

An incident is defined as "an unplanned interruption to an IT Service or reduction in the quality of an IT Service". Incident Management is "the process responsible for managing the lifecycle of all incidents. Incident management ensures that normal service operation is restored as quickly as possible and the business impact is minimized" (© Crown copyright 2011. Reproduced with permission from the Cabinet Office).

In the bank, all SAS users are able to raise an incident via an online portal or via telephone to the IT Service Desk. The Service Desk will log, categorise, prioritise and assign the incident to the SAS Grid support team for investigation, diagnosis and resolution, involving other IT teams when required (e.g. UNIX support) before being closed.

Problem Management

A problem is defined as "a cause of one or more incidents. The cause is not usually known at the time a problem record is created, and the problem management process is responsible for further investigation." Problem Management is the "process responsible for managing the lifecycle of all problems. Problem management proactively prevents incidents from happening and minimizes the impact of incidents that cannot be prevented. (© Crown copyright 2011. Reproduced with permission from the Cabinet Office).

At the bank, if a major incident (high impacting incident) is raised or multiple incidents are raised with a noticeable trend a Problem Record is opened, a Problem Manager is then assigned to coordinate a Root Cause Analysis (RCA) with all the second and third line support teams and if found, a permanent 'fix' is implemented to avoid the reoccurrence of a incident. The SAS Grid support team are able to open and work on problem records in order to improve the SAS Grid platform and the underlying technologies that enable it (e.g. AIX, Websphere, Networks)..

Change Management

A Change is defined as "the addition, modification or removal of anything that could have an effect on IT services. The scope should include changes to all architectures, processes, tools, metrics and documentation, as well as changes to IT services and other configuration items." Change Management is "the process responsible for controlling the lifecycle of all changes, enabling beneficial changes to be made with minimum disruption to IT

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For the SAS Grid Service, an IT change is raised for all platform changes that could potentially result in an incident. The support team agree with the business when a change can be raised that will result in planned downtime.

SAS content (Data Integration Jobs, Web Reports, etc.) promotions (Release & Deployments) go through a balanced business/IT change process, which the support team participate fully with and perform all final promotions and deployments to the Production environments as defined in the next section, "Release and Deployment".

This balanced approach aims to give IT the control and governance that is required and the flexibility and agility the business areas desire.

Release and Deployment

Release and Deployment is a collection of hardware, software, documentation, processes or other components required to implement one or more approved changes to IT services. The contents of each release are managed, tested, and deployed as a single entity.

Release and Deployment Management is "the process responsible for planning, scheduling and controlling the build, test and deployment of releases, and for delivering new functionality required by the business while protecting the integrity of existing services" (© Crown copyright 2011. Reproduced with permission from the Cabinet Office).

For the SAS Grid Service, we define a collection of SAS development (code, job, flows, etc.) as a package. A "Promotion Request" is completed by the SAS development team and submitted to the SAS Grid support team to review and schedule deployment from the Test environment to Production using standard SAS Metadata import/export tools.

To ensure any changes can be backed out, all target content is backed up before any promotion and all packages to be promoted are archived to a secure network location.
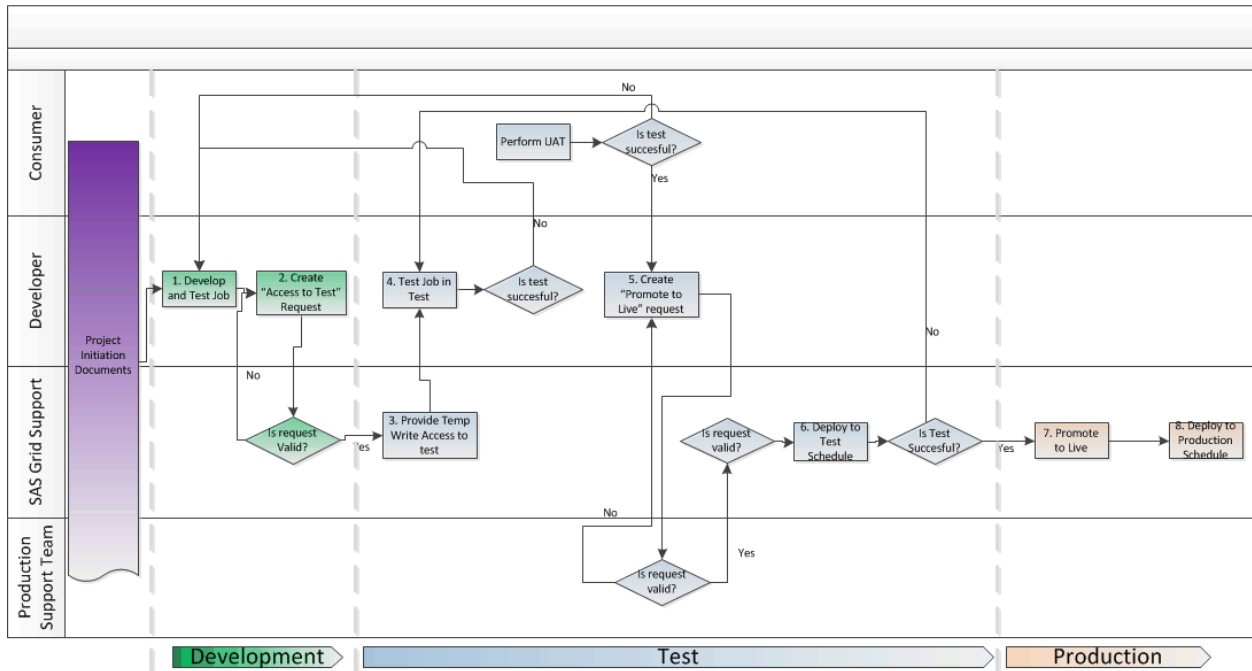

Figure 2. Release & Deployment Management process

Request Fulfillment

Request Fulfilment is "the process responsible for managing the lifecycle of all Service Requests" (© Crown copyright 2011. Reproduced with permission from the Cabinet Office). A Service Request is a request from a user for information, or advice, or for a Standard Change or for Access to an IT Service.

For the SAS Grid support team this either comes via an online portal submission or via the team mailbox.

Access Management

Access Management is "the process responsible for allowing users to make use of IT services, data or other assets. Access management helps to protect the confidentiality, integrity and availability of assets by ensuring that only authorized users are able to access or modify them." (© Crown copyright 2011. Reproduced with permission from the Cabinet Office).

Access to the SAS Grid at the bank is provisioned via a Service Request submission, which is reviewed by the SAS Grid support team and then validated by business area manager before been fulfilled. The actual execution of this involves multiple IT teams, such as the UNIX team. The Grid support team manage this process and send out the UNIX request to the UNIX team, ensuring that business users have only one form to fill in to gain access to the Grid.

Capacity Management

Capacity is defined as "the maximum throughput that a configuration item or IT service can deliver. For some types of CI, capacity may be the size or volume – for example, a disk drive."

Capacity Management is the "process responsible for ensuring that the capacity of IT services and the IT infrastructure is able to meet agreed capacity- and performance-related requirements in a cost-effective and timely manner. Capacity management considers all resources required to deliver an IT service, and is concerned with meeting both the current and future capacity and performance needs of the business." (© Crown copyright 2011. Reproduced with permission from the Cabinet Office).

In the SAS Grid at the bank, the Capacity Management team create a standard set of reports that report on historical capacity metrics gathered from the SAS Grid, including disk, CPU and memory usage. These reports are then regularly reviewed between the capacity managers and the SAS Grid support team. The Information gained from this and the regular forums with the business is used to look at the trends, estimate future workloads and make a judgement on whether there is enough capacity to fulfil future demand. At the point where the answer is "no", the bank will look to either reduce workload or increase capacity in the SAS Grid

Interactions with other IT Teams

In order to provide the SAS Grid service, a number of specialist support teams are required. At the bank, key support teams that are essential to the running of the SAS Grid service include Unix, Database (DBAs), WebSphere, Storage, Networks, Desktop Support and Systems Management.

Challenges

The SAS Grid support team was created after the SAS Grid Infrastructure project was complete. This led to a number of challenges related to funding some of the business as usual activities needed to pro-actively support a SAS Grid.

It was difficult to obtain funding once the SAS Grid Service was operational, either to resolve design flaws in the overall infrastructure or deliver unforeseen requirements. Consequently, issues have been resolved primarily through Incident and Problem Management.

It was also challenging to obtain additional funding for changes, support tools or training aimed at improving the efficiency and robustness of the SAS Grid Service. Examples of this type of requirement would include the provision of web content areas, packaging and deployment of desktop hotfixes and improvements to the security model. This has improved in year 2 of the service as the expected costs are much better known and were budgeted for.

WORKING WITH THE BUSINESS

Supporting SAS in the enterprise IT environment is different to many applications due to the very high levels of communication required with the business in order to understand how the business intends to use the platform. We have found it challenging to manage multiple competing business needs from different departments and have put in place a number of initiatives to deal with this.

Virtual Analytics Centre of Excellence

At the bank, the concept of the "Virtual Analytics Centre of Excellence" has been introduced. This recognises the symbiotic partnership approach that is needed at the bank in order for the SAS Grid service to be successful.
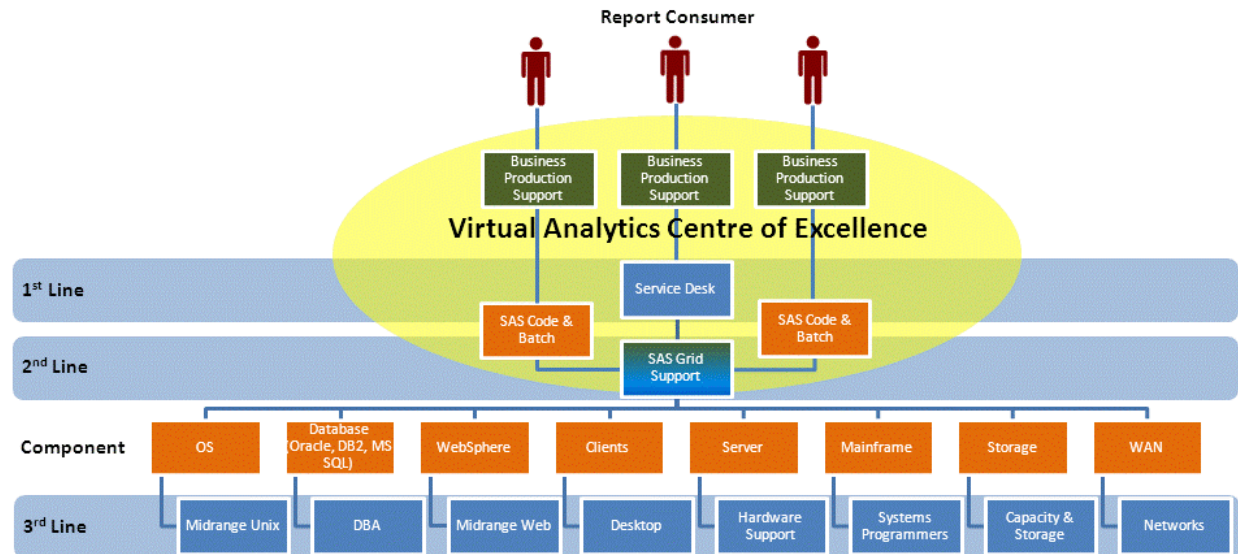
Figure 3. Virtual Analytical Centre of Excellence

The "Embedding Support in to IT" section discussed the ways in which the support team handles all incidents related to the SAS Grid infrastructure. In the bank's overall SAS support model, the business areas each have Production support teams who are responsible for monitoring and controlling their batch jobs. It's vital that these teams work very closely with the SAS Grid support team so that problems that are the result of the Infrastructure can be swiftly dealt with without impacting batch times.

There are also multiple forums with the business as described below:

Forums with the business

There are three main types of forum with the business areas:

1. SAS Users Group (strategic focus): A forum for the SAS Grid support team and all business users to discuss all aspects of SAS in the enterprise IT infrastructure, share skills, gather user feedback and present new initiatives.

2. Business Specific Change Management Forums (operational change focus): an opportunity for a specific business area to discuss upcoming changes with the SAS Grid support team to ensure that the team are ready for when jobs will be ready to promote to Production, that the Development, Test and Production environments are set up for the development cycle (e.g. all required 3rd Party Database connections are set up) and that the SAS Grid support team are able to feed in the upcoming changes into their Capacity Management framework.
3. SAS Support Clinics (operational support focus): A drop-in session where SAS Grid users can discuss, any issues with the Analytics Centre of Excellence.

GRID MANAGEMENT

Organisations with existing SAS 9 administration and support functions who are considering moving to Grid will be pleased to note that the majority of activities and skills are the same or similar. There are some additional things to consider when managing the Grid, both from a SAS support point of view and the fact from an IT Infrastructure point of view that you will now have many more physical or logical servers and an enterprise class storage infrastructure to manage.

Let's revisit the reasons the bank procured SAS Grid. The aim was to modernise the SAS estate and to allow effective workload management, high availability and improved performance.
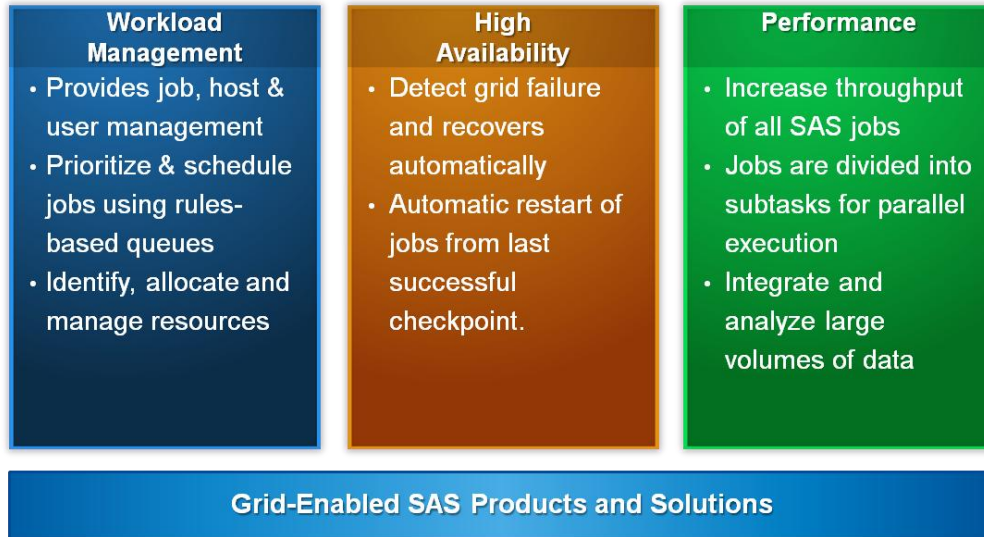
Workload Management

Use of the Grid falls into several categories:

- SAS Foundation® and SAS Enterprise Guide® analysts
- SAS Data Integration® Developers
- Scheduled Batch Jobs
- SAS Enterprise Business Intelligence® Developers
- SAS Enterprise Business Intelligence® Consumers

The management of the workload on the Grid must take account of all of these different types of user across Development, Test and Production environments. For example, in the case of Data Integration developers, it's key that the development and test platforms are being managed effectively, as these are, effectively, production environments for these developers and large volumes of data are processed in these environments.

The SAS Grid deployed at the bank is available to multiple business units, including Finance, Marketing and Operations. Therefore, the Grid policies must be able to differentiate between these workloads, and also within these workloads between standard and high priority jobs.

The primary way of categorising different types of workload on a SAS Grid is through the use of Queues. Each queue can be configured to run jobs at certain times of day and on certain servers within the Grid.

Each business area that uses the Grid has a queue for running their defined batch workload.
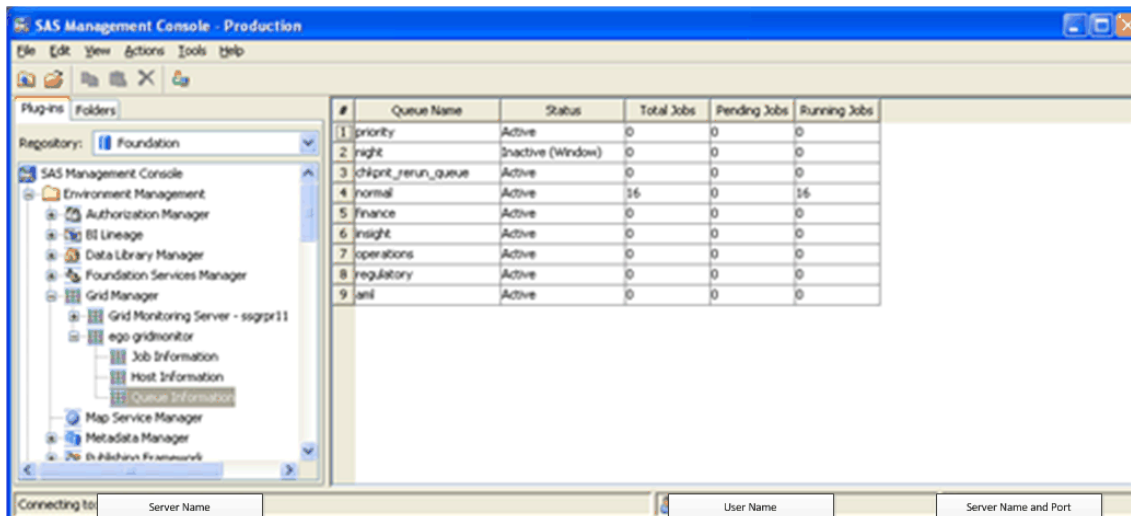

Figure 4. Grid Queues (actual server and user names removed)

Each flow scheduled for that business unit is assigned their specific queue and their specific batch user ID. The high priority queue can be used where, for example, a feed has not arrived in time overnight and the jobs needs to be run during the day. By using a high priority queue, the business can ensure that the critical jobs can run before other jobs. For example, there will be situations where a regulatory report needs to go out by a specific deadline and will need to be treated as a higher priority to all other workloads on the SAS Grid. The high priority queues can be used to meet this business need. This is likely to become more important over time as demands on the Grid grow.

Each business unit can manage their own batch jobs independently using Platform flow manager, although the SAS Grid support team is responsible for all content deployment to Production via the Release and Deployment Management process.

Interactive usage on the Grid is load balanced across all of the nodes, with Workspace servers using the Grid algorithm (http://support.sas.com/documentation/cdl/en/biasag/61237/HTML/default/loadalg.htm). While this doesn't use the queues to allocate work locations it does use the Grid servers for information about where on the Grid is the most appropriate place to send this work.

Monitoring of the SAS Grid at the bank is done in four ways:

1. Observing current systems loads using Operating System and Platform tools

Currently, AIX and Grid tools are used to monitor load in real time. For example, the command bhosts shows how loaded each of the Grid nodes currently are. In this example, the Grid is under extremely light load:
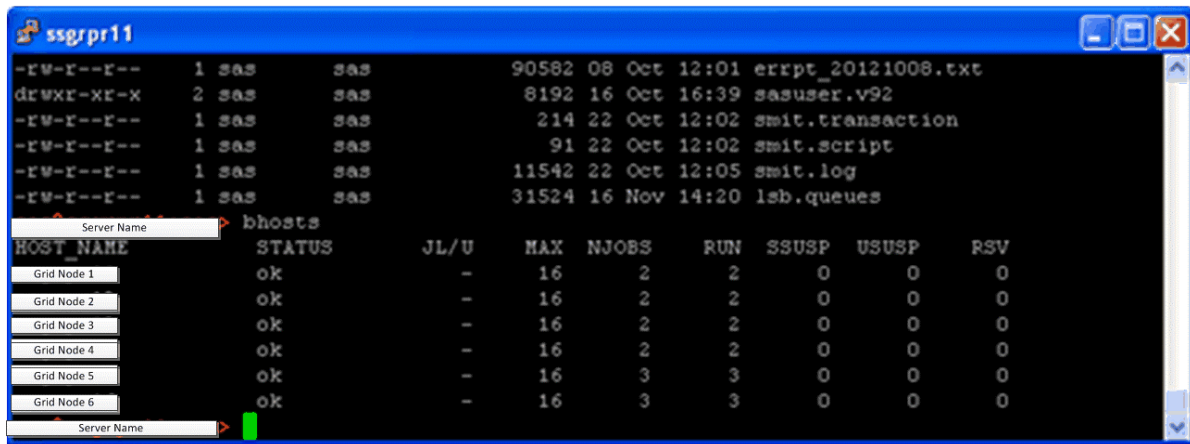

Figure 5. bhosts output (server names removed)

Additional real time information can be obtained from the Grid Manager plug-in in SAS Management Console.
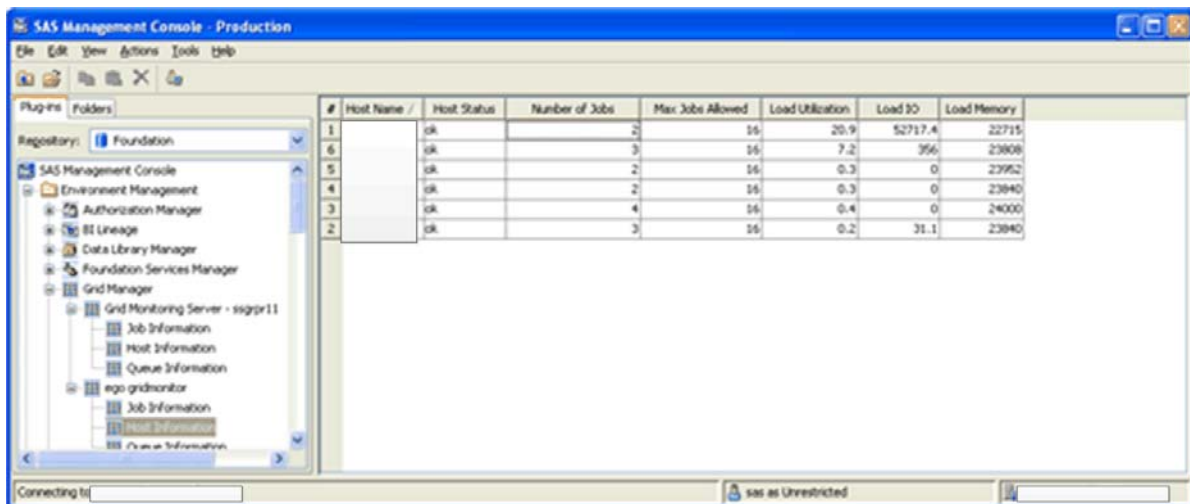

Figure 6. SAS Management Console Grid Hosts view (actual server names removed)

In future, RTM (http://support.sas.com/rnd/scalability/grid/RTM.html) will be used to monitor the Grid in real time.

2. Reports produced by the Capacity Management team

These reports, which show CPU, disk and memory usage amongst other things, are used by the support team to gauge how busy the Grid has been and what the trends are. In future, the reports generated here will be used to justify increasing capacity on the Grid to cope with current and future workloads.
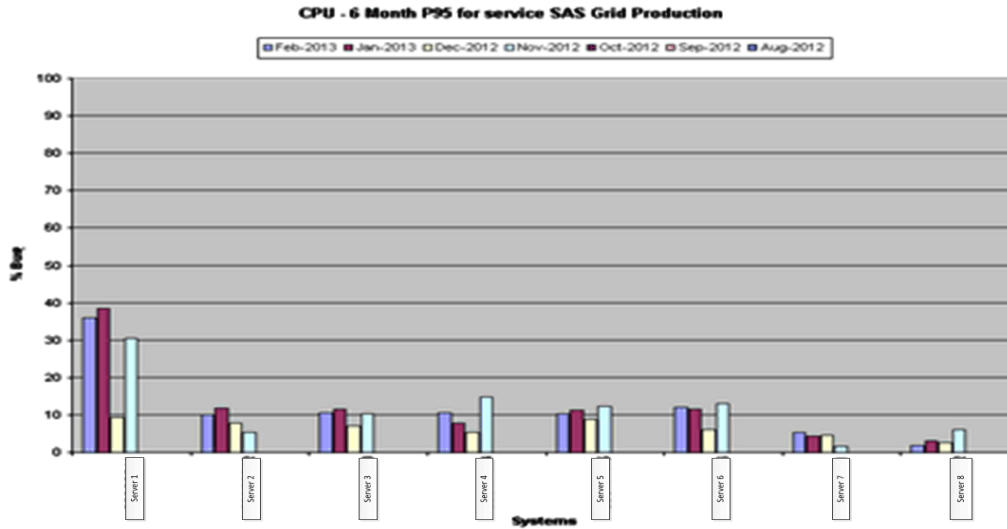

Figure 7. CPU report (actual server names removed)

3. Reports from the Audit and Performance Management system

These reports show usage at the SAS application level (http://support.sas.com/rnd/emi/EbiApm92/index.html) and raise automatic alerts if a SAS service goes down

Figure 8. SAS Server Status

4. Real Time Alerting

Scheduled jobs check file system usage across the environments. Warnings and alerts are sent to the SAS Grid support team's inbox to indicate excessive storage use of the install, logs, and data or work file systems.

To support the numbers and types of users creating data on the system, and to allow for flexibility in the managing of file systems, IBM GPFS quotas have been used. This means that, in a single file system, multiple teams can have pre-defined areas with storage limits that they cannot exceed, and even if they do, they do not impact other user areas.

Even though GPFS quotas are set at a UNIX group level, a team or individual may not be aware that their file system is becoming full hence the need to continually monitor file system usage.

All production batch jobs have failure email alerts sent to the relevant production support teams.

High Availability

High availability of the Grid servers is managed through a combination of IBM HACMP for the SAS Metadata Server and the Websphere Server (which fail over to each other), and the built in high availability of the SAS IOM (Workspace, Stored Process, OLAP) Servers and LSF, and Platform Process Manager and the Grid Manager through Enterprise Grid Orchestrator (EGO) software.

In Production there are 6 Grid servers, each on IBM Blade Servers. Each of these servers acts as a Grid node, and one acts additionally as the LSF Master, Platform Process Manager Server and Grid Manager Server.

If a Grid node goes down, the remaining 5 servers continue to act as a Grid with no loss of service.

If the Grid Master Goes down, then EGO starts Platform Process Manager and the Grid Manager on one of the other Grid nodes. SAS clients are able to connect to these new masters because they use Domain Name Server (DNS) names independent of the physical server location. This is managed by a DNS hosted locally on the Grid, which is used to manage SAS Grid DNS names processmanager.xxx.com and gridmanager.xxx.com.

Performance

Improved performance for individual users has been achieved to date primarily through the improvements brought about by the use of an enterprise-class clustered file system (in this case, GPFS).

In future, we will look to work with the business to allow them to parallelise their jobs so that a single job can work across multiple Grid nodes.

Regular Maintenance

In addition to managing the Grid workloads, managing a SAS Grid environment requires both re-active and pro-active support of the environment, together with robust change management procedures for both the SAS Software (binaries and configuration) and the SAS Content (Data Integration Jobs, OLAP Cubes, Web Reports, etc.).

Pro-active support of the environment is where real value starts to be added by a support team. As well as the process of Problem Management, which was described earlier and is all about looking for the root cause of incidents, forward planning of all maintenance is used to ensure that the Grid is kept up to date, that unplanned downtime is kept to a minimum, and so that the business has a long range view of planned downtime. To this end, a maintenance calendar was created, which detailed when the following tasks would be undertaken during the year. Some of the tasks performed regularly are below:

Daily	Weekly	Monthly	Quarterly	Yearly
Clean up SAS Work areas*	Clear down orphaned jobs*	Review Audit reports from APM	Install SAS hot-fixes	License update
		Review Capacity Management reports	Patch Operating Systems	SSL certificate refresh
		Review upcoming projects	Backup and restore test	Disaster Recovery test
		Manual housekeeping review of user data,		

*Unlike a single machine install, these clear down processes must be run on all Grid nodes. At a UNIX level, a process running on one host creating a work file on a clustered GPFS file system will not be visible to the other hosts.

RECRUITMENT AND DEVELOPMENT

Job Description

We ideally wanted to attract people with specific SAS administration skills. Failing that, we wanted either solid SAS development skills or good, solid enterprise support skills with related technologies (other analytics technologies) or underlying technologies (WebSphere, UNIX). The summary text of the job description is below:

The SAS Administrator will be responsible for the provision of administration, support and maintenance of the Co-operative Banking Group's SAS Grid Platform as part of a SAS support team within IT Service Operations Function, Application Support & Maintenance area. They will become an expert of every aspect of the SAS environment and its underlying technologies within the Co-operative Banking Group.

The SAS Administrator will work collaboratively with IT and all users of SAS across the bank to ensure that the SAS Service is available, resilient, secure and performant.

Challenges

Skilled platform administrators are well remunerated and highly sought after. The bank made the decision to recruit less experienced people and train and develop them in partnership with SAS. We are extremely pleased with the results so far and will look for this to be our model going forward for any team expansion.

Development Plans

When setting up the team, the following was put in place for their development:

Training

All new employees are able to go on the SAS Platform Administration, Data Integration and Business Intelligence Fast Track courses, with the goal of SAS certification.

On-the-job learning

Each new member of the team had to be signed off as having gone through each existing process/work instruction with a more experienced colleague. These included processes such as Change and Incident Management, as well as more technical pieces of work such as license application and hot-fix deployment.

Master-classes

SAS were on site during the creation of this team and ran a series of informal learning sessions to complement formal training on aspects such as SAS Architecture, Grid Manager, Business Intelligence and Data Integration.

CONCLUSION

Co-operative Banking Group has benefitted from having a well-managed, stable, resilient and performant SAS infrastructure that frees business teams from having to spend time and resources managing the infrastructure.

Within the IT department SAS can and should be subject to the same rigour and the same processes as any other enterprise application. Supporting SAS does however require active engagement with the business and IT managers should have a strong stakeholder management approach to support this.

It is possible to support SAS without huge investments in people. While each SAS customer will be different, the team at the bank runs with three employees and is able to support multiple business areas effectively.

REFERENCES

Office of Government Commerce (OGC), Cabinet Office. 2012. ITIL® Foundation Handbook. The Stationery Office (TSO). United Kingdom: The Stationery Office (TSO). © Crown copyright 2012. All rights reserved.

A Best Management Practice - ITIL Official Site. Managed and published by TSO in conjunction with the Cabinet Office (part of HM Government) and APMG. "ITIL® glossary and abbreviations - English". © Crown Copyright 2011. Available at http://www.best-management-practice.com/IT-Service-Management-ITIL/.

RECOMMENDED READING

- *Grid Computing in SAS® 9.2*
- *SAS® 9.2 Intelligence Platform System Administration Guide*

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