

# The Vector Fabrics™ vfCloud™ Environment

Vector Fabrics is launching a series of tools for creating multicore implementations of sequential programs much more quickly and efficiently than is possible by current manual methods. Several aspects of the computing associated with those tools can benefit from the availability of a large number of computing resources. While some companies that would use such tools could theoretically use their own resources for the tools, it would put the reasonable use of the tools out of the reach of the large majority of companies that could benefit from the technology simply because they wouldn't be able to provide large compute farms, and the execution times would be too long without such farms.

In addition to capacity, the use of cloud computing provides other cost benefits. Principally, license costs are dramatically lower. With traditional licensing models, one must purchase enough licenses to handle peak usage even though most of those licenses will remain unused most of the time. With a cloud implementation, there are no licenses per se, and, with the exception of the nominal subscription charge, one only pays for actual usage. In addition, management costs are reduced since the typical issues that demand management, like platform compatibility and version upkeep, simply do not exist.

As a result, Vector Fabrics has created an environment using Amazon's EC2™ computing services and is implementing the rollout of the tools in that environment. The purpose of this paper is to describe the basics of the vfCloud environment and address some of the obvious questions that might arise in using the environment.

## The basic architecture

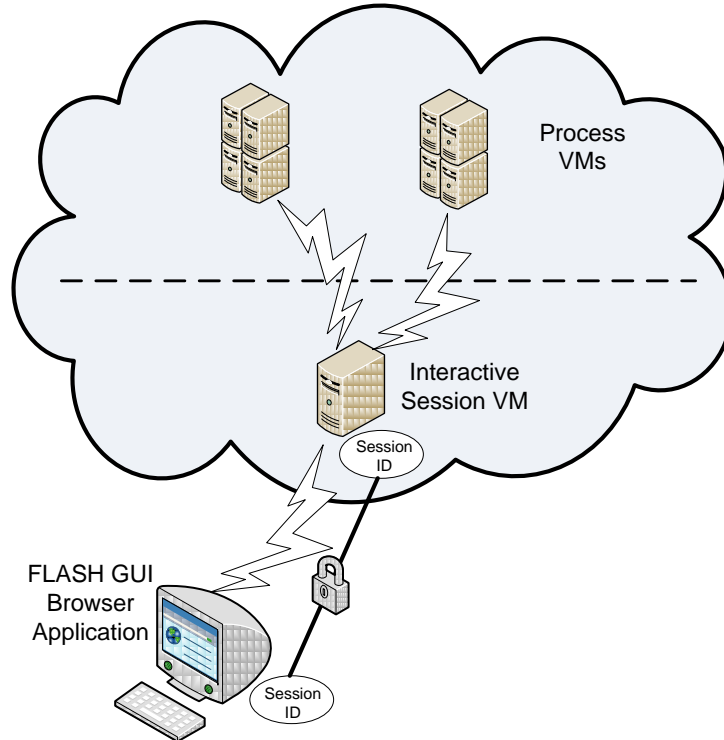
The structure of the vfCloud environment takes into account two fundamental activities. The first is the activity associated with simply opening the tool interfaces in the browser, managing a project, and browsing the results of various processing steps. This activity is handled by a virtual machine (VM) and a session, with session IDs created on the user's computer and in the VM. VMs are allocated by the vfCloud infrastructure to facilitate good response.

The second activity is execution of compute-intensive processes at the request of the user during the normal use of the tools. The session VM can open additional VMs, potentially on different machines, as necessary for handling the load. It will be possible to use a session to launch a compute-intensive process and then end the browser session while the process continues. A future login would then allow you to view the status or results of that process.

The GUI is handled by a FLASH application that safely executes within the user's browser and communicates with the session VM over a strongly-encrypted SSL link.

The browsing session is characterized by low-bandwidth interactive use; the process activity is characterized by heavy duty batch use. The resources commandeered for the two kinds of process will be allocated in a manner that provides good response to all users.

A simplified depiction of this structure is shown in Figure 1.



**Figure 1. Cloud Computing Architecture**

### Capacity

One of the benefits of using cloud infrastructure is that, for practical purposes, capacity is unlimited. In particular, extremely large storage and compute resources can be made available, far beyond that which is reasonably expected to be used.

Amazon's storage infrastructure is focused on reliability, with multiple volumes being written to ensure that the data will be accessible.

Computing capacity is provided by high-uptime systems. While failure of a VM isn't completely impossible, it's unlikely enough that a failover mechanism is not warranted. If a process does terminate unexpectedly, a new VM can be started up extremely quickly, and on a different machine if necessary. The machines used for the VMs are managed transparently, meaning that you need not be aware of which machine is being used, and, because VMs only start on fully operational machines, you are protected from any boot times on a particular machine.

The only capacity element that can't be considered virtually limitless is the I/O bandwidth. However, at 1 Gbps per machine, it is faster than any connection to it except perhaps fiber. The net effect of this is that the I/O capacity of the vfCloud environment itself will not be a

limiting factor. A further mitigating consideration is the fact that data upload and download occur infrequently, typically at the beginning and end of a project, and therefore should not have a measurable impact on productivity.

### **Security**

The most important aspect of setting up a cloud environment that is acceptable for mission-critical design projects is to ensure that security is in place such that design information stored and managed in the vfCloud environment is no less secure than it would be on a typical secure corporate internal network. This security, which comprises both Amazon's security, which has garnered a favorable SAS 70, Type II audit report, and Vector Fabrics' VM implementations, covers four critical elements.

#### Communication

Data communications between the user and the vfCloud environment will be handled using the highest level of SSL encryption.

#### Data storage

Data stored in the vfCloud environment is protected using a number of mechanisms whose details are not being disclosed. The effect is to ensure that any data stored is effectively in a walled-off area that no one else can access.

#### Session

Each session causes a session ID to be placed on the user's computer. If any other computer were to try to hijack the session, it would not have the appropriate session ID, and would not be able to successfully appropriate the session. In addition, a session will automatically time out if the user remains logged in without using the tool for too long.

Note that in the case of a timeout, only the browsing session will be terminated; any compute-intensive processes that are underway will not be terminated and will proceed to completion. Access to the results will be possible by re-logging in and starting a new browsing session.

#### Account

Your password is your main defense against unauthorized access to your account. The stronger your password, the better you protect yourself. When creating a password, Vector Fabrics gives you an indication of how strong your password is so that you can ensure that you have the security you need.

When setting up your account, you can also elect to restrict logons to the IP address of the computer you are using to create the account. This will prevent any other computers from logging in. Because this also restricts your ability to log in from other computers, it is left as an option.

Your account is also protected from automated hacking attempts. Four consecutive login failures will result in your account being locked out for one hour. You may reset your

password during that hour in order to get going more quickly; the new password will be sent to your email address of record on the account.

In order to protect the intellectual property contained in the designs you are working, you will not be able to change the email address on the account if you change companies. This prevents the transfer of design information from the old company to the new company via the cloud. If you wish to use the Vector Fabrics tools from your new company, you will need to open a new account under the new email address.

Your account will contain a record of the tokens you purchase to execute the Vector Fabrics tools. The record of these tokens is not stored in the cloud; it is stored in separate computers and is protected in the same way that other critical Vector Fabrics accounting information is protected.

### **Tool updates**

Design tool updates face unique constraints in a cloud environment. While updating tools becomes much easier both for users and for Vector Fabrics, it is common for designers not to want to change tool revisions in the middle of a project. Vector Fabrics is aware of these concerns, and has put in place the following policies for tool updates.

#### vfAnalyst™

The vfAnalyst tool is unlike the other Vector Fabrics tools in that it does not transform a design description into an implementation; it only provides information about the nature of that design description. Therefore there is no concern about consistency of generation from version to version. As a result, users are not able to defer updates for vfAnalyst. When an update occurs, users will be notified, and use of the updated tool will be automatic.

#### Other tools

The other tools create implementations of designs, and therefore there is flexibility with respect to accepting updates. The policy is as follows:

- New projects must start with the latest revision of the tools in place when the project is created.
- Once a project is underway, when a new update occurs, users will have the option either to accept the update or to maintain the current version. Note that it is only possible to maintain a current tool version or update to the latest version. If several updates are deferred, it is not possible later to move to one of the intermediate deferred updates; once updating, the latest version must be used.

### **Specific questions**

The following are typical questions that may be asked. The answers may replicate information in the preceding narrative.

### Can any other users access my files?

No users can access your files except you, with proper login. By using a strong password, you further protect your account.

### Can Vector Fabrics access my files?

There are only two situations in which Vector Fabrics can access your files. The first is for support purposes, and is strictly by your permission only, case by case. If, in the course of obtaining technical support, you wish to allow the support person access to your files, you may provide such permission. You may, for example, give permission as part of the process of opening a support ticket. That permission will be for a single issue, only for files related to the issue, only for as long as required to resolve the issue, and can be revoked at any time.

It is also possible for the Vector Fabrics system administrator to access files, but it is strict Vector Fabrics policy that a system administrator will not access any files unless absolutely necessary for the maintenance of the system or if legally required to do so, and, if possible, with express permission. The system administrator can only access the cloud infrastructure by logging in using a strong password over a high-level SSL connection.

### Can anyone else that's logged in somehow tap into my session?

No. Each session launch places a session ID on your computer; no one else will have that session ID, and therefore no one else will be able to use your session.

### What happens if someone else tries to log into my account?

Your primary defense against unauthorized access is a strong password. If someone tries to guess your password and fails on four consecutive attempts, your account will be locked out for an hour unless the password is reset. The reset password will be sent to you at your email address of record with the account, and so is of no value to someone trying to guess your password.

### Can anyone snoop my traffic?

No. Vector Fabrics sets up communication links using the highest level of SSL security.

### Is it possible that I lose my data?

It is extremely unlikely, and is less likely than the possibility of losing your data in a corporate networked storage system. Amazon has put in place a highly reliable storage system.

### What happens if I delete my account?

If you delete your account, your project data and membership information will be deleted. Records of your financial transactions will remain for accounting and audit purposes.

### Is my personal registration information stored in the cloud?

No, your registration information is not stored in the vfCloud environment. It is stored in separate Vector Fabrics secure, high-availability computers.

### Is my credit card or other payment information stored in the cloud?

No. Vector Fabrics uses established trusted third-party payment providers to handle your payments directly. Vector Fabrics never even sees the credit card information. In the case of invoicing, information is stored in a Vector Fabrics computer protected by such measures as high security, limited access, and physical isolation.

### Are my tokens stored in the cloud?

No, your tokens are not stored in the vfCloud environment. They are stored in separate Vector Fabrics secure, high-availability computers protected by such measures as high security, limited access, and physical isolation.

### Am I forced to accept updates in the middle of my project?

No, not for any of the tools that generate design implementations. Whenever a new update is available, you have the option of staying with your current version or moving to the latest version. New projects will always start with the latest version.

vfAnalyst will be updated automatically, with no option to defer updates, since it doesn't generate any design implementations.