## Paper 2883-2015

# How to Implement SAS 9.4 on an Amazon Web Services Cloud Server Instance Jeff Lehmann, Slalom Consulting, LLC

## ABSTRACT

This paper demonstrates a tactical scenario where a SAS® 9.4 test environment is installed and configured on an Amazon Web Services (AWS) Elastic Compute Cloud (EC2) instance running Linux Red Hat version 7.1. The best practice actions to complete this SAS® 9.4 implementation are based upon successful implementation techniques as well as existing customer installations.

### **INTRODUCTION**

The process to install SAS® 9.4 on an Amazon EC2 instance can be divided into the following steps:

- 1. Create an AWS EC2 instance using virtual private cloud (VPC)
- 2. Connect to the EC2 instance
- 3. Download a SAS® 9.4 software depot with SAS download manager
- 4. Perform SAS® 9.4 pre-installation tasks
- 5. Install SAS® 9.4 software with SAS Deployment Manager
- 6. Complete SAS® 9.4 post-installation tasks and configuration

While the majority of these installation actions are similar, even agnostic to the target operating system, the steps to complete a Windows or UNIX implementation may vary with what is proposed in this paper. Moreover, properly sizing an EC2 instance to replace an existing SAS® 9.4 data center installation is beyond the scope of this paper, as are discussions of potential issues and pitfalls to watch out for. Additionally, this paper assumes that the administrator has some familiarity with the AWS Management Console and its various networking, storage, database and security offerings.

SAS administrators and users who are interested in investigating solutions outside of the traditional data center environment will benefit from understanding this paper's installation and configuration exercise. As more enterprises using SAS® search for ways to experiment with new software, they will find that cloud service providers such as Amazon can help them reach their implementation goals at a faster pace and at a lower cost. Alleviating the SAS® enterprise of some labor and capacity planning constraints while allowing staff to refocus on more productive or innovative uses of SAS® will lead to notably higher ROI on new SAS® software investments.

### **CREATE AWS EC2 INSTANCE USING A VPC**

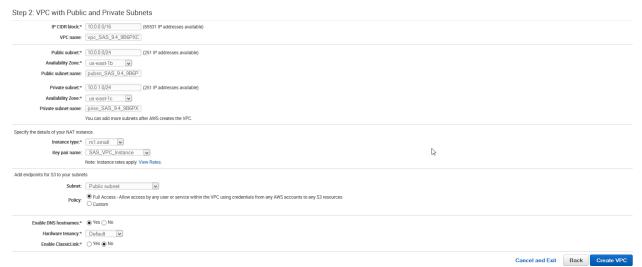
What follows is a series of steps to guide the SAS® administrator through the AWS Management Console VPC Wizard and EC2 Launch Instance interface.

1. Log into AWS Management Console and click the VPC icon. Then, click "Start VPC Wizard" and finally, click "VPC with Public and Private Subnets":

VPC with a Single Public Subnet	In addition to containing a public subnet, this configuration adds a private subnet whose instances are not addressable from the Internet. Instances	Learner 53
VPC with Public and Private Subney	in the private subnet can establish outboard connections to the Internet via the public subnet using Network Address Translation (NAT). Creates:	0ynam08, 595 505 vic
VPC with Public and Private Subnets and Hardware VPN Access	A /16 network with two /24 subnets. Public subnet instances use Elastic IP's to access the Internet. Private subnet instances access the Internet via a Network Address Translation (NAT) instance in the public subnet. (Notify charges for NAT instances apply)	Anaton Vitual Private Coud Public Subnet Private Subnet
VPC with a Private Subnet. Only and Hardware VPN Access	Select	

Display 1. "Select a VPC Configuration" ties in with "VPC with Public and Private Subnets" interface

Next, Specify: "IP CIDR block", "VPC Name", "Public subnet/name", "Private subnet/name", "Instance type", "Key pair name", S3 "Subnet/Policy" and then, click the "Create VPC" button.



Display 2. "Create VPC with Public and Private Subnets" details

The above step created a VPC instance ID, *vpc-466c6b23*, along with 2 subnets, a routing table, *rtb-83d137e7*, an internet gateway, *igw-362e5153*, an endpoint, *vpce-db2bcfb2*, a network ACL, *acl-0f0e096a* and most prominently, a new EC2 instance, *i-d057df79*.

 The next step is to launch a new EC2 instance into the VPC already created. Back in the AWS Management Console, click the EC2 icon. Choose "Launch instance". Then, select "Red Hat Enterprise Linux 7.1 (HVM) - ami-12663b7a (64-bit)"

	Amazon Machine Image (AMI) ains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your.	22 of 22 AMIs >
Quick Start	< < 11022¢	f 22 AMIs > >
My AMIs	Amazon Linux AMI 2015.03 (HVM), SSD Volume Type - ami-1ecae776	Select
AWS Marketplace	Amazon Linux The Amazon Linux AMI is an EBS-backed, AWS-supported image: The default image includes AWS command line tools, Python, Ruby, Perl, and Java. The repositories include Docker, PHP, MySQL, PostgreSQL, and other packages. Rec for eligible Root device type ets Virtualization type: htm	64-bit
Community AMIs	Red Hat Enterprise Linux 7.1 (HVM), SSD Volume Type - ami-12663b7a	Select
Free tier only (i)	Red Hat Enterprise Linux version 7.1 (HVM), EBS General Purpose (SSD) Volume Type Prector eligible Root device toole tool Virtualization hole thim	

#### Display 3. Amazon Machine Image (AMI) selection list prompted by the EC2 Launch Instance action

\*The compatible version of SAS® 9.4 for Red Hat 7.1 must be SAS 9.4 TS1M0 or later.

3. Select the following instance specifications for a SAS® test environment that will handle from 25 to 50 concurrent users and click "Next: Configure Instance Details":

EBS-	Js:	able:	Compute opti c3.4xlarge 16vCPUs 30GB memor 2x160GB Yes High							
	Compute optimized	c3.4xlarge	16	30	2 x 160 (SSD)		Yes		High	~
						Cancel	Previous	Review and Launch	Next: Configure Instance De	etails

#### Display 4. EC2 Launch Instance Type specification page

4. In the "Configure Instance Details" screen Network field, select the newly created VPC. This will also populate the Subnet field. Then, for the Auto-assign Public IP field, select "Enable". Finally, in the Enable termination protection field, click the box to "Protect against accidental termination". Click "Next: Add Storage":

1. Choose AMI 2. Choose Instance Type	3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review
Step 3: Configure Instance Configure the instance to suit your requirer	ce Details merrors. You can launch multiple instances from the same AMI, request Spot Instances to take advantage of the lower pricing, assign an access management role to the instance, and more.
Number of instances	0 1
Purchasing option	① Prequest Spot Instances
Network	I vpc-466c8b23 (100.0.0)(16) vpc_SAS_94_9867X v) C create new VPC
Subnet	subnet-aab02d81(10.0.0/24)   pubsn_SAS_94_9 v     Create new subnet 250 IP Addresses available     Create new subnet
Auto-assign Public IP	1 Enable v
Placement group	No placement group     v
IAM role	Image: None Contract of the second
Shutdown behavior	③ Stop v
Enable termination protection	1 Derotect against accidental termination
Monitoring	Denable CloudWatch detailed monitoring     Additional charges apply.
EBS-optimized instance	Launch as EBS optimized instance     Additional charges apply.
Tenancy	Shared tenancy (multi-tenant hardware)     Additional charges will apply for dedicated tenancy.
<ul> <li>Network interfaces</li> </ul>	
Device Network Interface Su	donet Primary IP Secondary IP addresses
eth0 New network interfac v st	ubnetaab02df v Auto-assign Add IP
Add Device	
	Cancel Previous Review and Launch Next: Add Storage

**Display 5. "Configure Instance Details" details** 

5. Click "Next: Add Storage" and it is recommended to type in a larger size than the 10GB default. Below, 300GB was chosen to start. In any event, if required, storage can be added later without stopping the instance:

### Step 4: Add Storage

Your instance will be launched with the following storage device settings. You can attach additional EBS volumes and instance store volumes to your instance, or edit the settings of the root volume. You can also attach additional EBS volumes after launching an instance, but not instance store volumes. Learn more about storage options in Amazon EC2.

Туре (ј	Device (j)	Snapshot (j)	Size (GiB)	Volume Type (j)	IOPS ()	Delete on Terminati (j
Root	/dev/sda1	snap-7d0526da	300	General Purpose (S v	30 / 3000	✓

Display 6. "Add Storage" details include customizable size and volume type

#### 6. Click "Next: Tag Instance" and enter in a unique key-value pair

### Step 5: Tag Instance

A tag consists of a case-sensitive key-value pair. For example, you could define a tag with key = Name and value = Webserver. Learn more about tagging your Amazon EC2 resources.

<b>Key</b> (127 ch	aracters maximum)	Value	(255 characters maximum)		
Name		SAS 9.4	9C4VEX RHEL	8	
Create Tag	(Up to 10 tags maximum)				

#### Display 7. "Tag Instance" useful key-value pairs can be the SAS® version, the SAS® order number or the OS

7. Click "Next: Configure Security Group" and enter in the firewall rules for your VPC. Refer to the <u>SAS® 9.4 pre-installation checklist for ports</u> [1] for inbound/outbound traffic instructions. NOTE: The below list of SAS ports is open only to the specified port. It is NEVER recommended to have the source be set to "Anywhere" at any port 0.0.0.0. Consider setting strict, specific IP address source origins, such as a VPN gateway IP address. Contact your network admin to confirm IP address(s). Step 6: Configure Security Group

Assi	gn a security group:	Create a new se	curity group			
		O Select an existing	g security group			
Se	curity group name:	secgrp-SAS-9.4-	Linux-RHEL			
	Description:	secgrp-SAS-9.4-	Linux-RHEL created 2015-06-10T18:44:32.918-	04:00		
ype (j)			Protocol (i)	Port Range (j)	Source (j)	
SSH 🗸		b	TCP	22	My IP v 72.28.157.179/32	
ustom TCP Rule 🔍			TCP	7980	My IP v 72.28.157.179/32	
ustom TCP Rule 🔍			TCP	21050	My IP v 72.28.157.179/32	
ustom TCP Rule 👻			TCP	8111	My IP v 72.28.157.179/32	
ustom TCP Rule 🔍			TCP	41415	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	9380-9384	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	8581	My IP v 72.28.157.179/32	
ITTPS v			TCP	443	My IP v 72.28.157.179/32	
ustom TCP Rule 🔍			TCP	11099	My IP v 72.28.157.179/32	
ustom TCP Rule 🔍			TCP	8811	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			тср	7080	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	8701	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	8631	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	10651	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	7541	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			тср	8801	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	9452	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	7551	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	5451	My IP v 72.28.157.179/32	
ustom TCP Rule 🗸			TCP	8591	My IP v 72.28.157.179/32	

#### Display 8. "Configure Security Group" details containing a list of firewall rules for required SAS® ports

Above, the listed ports are accessible from any source, anywhere. Select the "Review and Launch" button. The following warning message appears:

A Your instance configuration is not eligible for the free usage tier	
To launch an instance that's eligible for the free usage tier, check your AMI selection, instance type, configuration options, or storage devices. Learn more about free usage tier eligibility and usage restrictions.	
Don't show ma this spain	

#### Display 9. Warning message at "Review and Launch" time for the EC2 instance

Another less administratively intensive best practice would be to attach a virtual private gateway to the VPC, creating a custom route table and updating the security rules. The result would be a VPN connection between the VPC and an external corporate network. Setting up this VPN connection is beyond the scope of this paper, but the details can be found at this <u>AWS VPC user guide web page</u> [2].

Click the "Launch" button. Next, a popup requests to "Choose an existing key pair" or "create new key pair". AWS uses public-key cryptography to encrypt and a private key to decrypt login information. Together, they are known as a key pair [3]. If no key pair exists, it must be created. Below, an existing key pair was selected. Then, the "Launch Instances" button was clicked.

Select an existing key pair or create a new key pair	×
A key pair consists of a <b>public key</b> that AWS stores, and a <b>private key file</b> that you store. Togethe allow you to connect to your instance securely. For Windows AMIs, the private key file is required obtain the password used to log into your instance. For Linux AMIs, the private key file allows yo securely SSH into your instance.	d to
Note: The selected key pair will be added to the set of keys authorized for this instance. Learn m about removing existing key pairs from a public AMI.	ore
Choose an existing key pair	~
Select a key pair	
test1	~
I acknowledge that I have access to the selected private key file (test1.pem), and that wit this file, I won't be able to log into my instance.	hout
Cancel Launch Instat	nces

Display 10. Key pair selection/creation screen

L	aun	ch Status	
ſ	~	Your instances are now launching	
I		The following instance launches have been initiated: i-7dab20d4	View launch log

Display 11. Launch status message details

 Select VPC off the AWS Management Console menu and then select "Internet Gateways". An <u>internet gateway</u> [4] allows communication between a VPC instance and the internet. Review the previously created internet gateway attached to the earlier created VPC.

igw-3	2e5 attached	vpc-466c6b23 (10.0.0/16)   vpc_S	
<			
igw-362e5153			
Summary Tags			
ID:	igw-362e5153	Attached VPC ID:	vpc-466c6b23 (10.0.0.0/16)   vpc_SAS_9.4_9B6PXC_RHEL2
State:	attached	Attachment state:	available

#### Display 12. Internet gateway attached to a VPC

10. The steps leading up to now created a secure connectivity method to the internet, connecting from a Private Network EC2 residing in a Public Network <u>NAT (Network Address Translation) instance</u> [18]. A NAT instance can be enabled to receive Internet-bound traffic from instances in a private subnet (e.g. 10.0.1.0/24), as well as SSH traffic from your network. To review the connectivity to the internet, check the Routes tab on the Route Table *rtb-83d137e7*.

Ttb-83d137e	7 0 Subnets	Ye	s vpc-46	6c6b23 (10.0.0.0	0/16)   vpc_S
<					
rtb-83d137e7					
Summary Routes	Subnet Associations	Route Pr	opagation	Tags	
Edit					
Destination	Target	Status	Propagated		
10.0.0/16	local	Active	No		
pl-63a5400a (com.amazonaws.us-east-1.s3)	vpce-db2bcfb2	Active	No		
0.0.0.0/0	eni-f831f7d7 / i-d057df79	Active	No		

Display 13. Route table association with the internet gateway for the public subnet

11. Return to the AWS Management Console and select Elastic IP off the VPC menu. Click "Allocate New Address" and then "Yes, Allocate" to make it assignable to a VPC. Once allocated, the IP address can then be assigned back to the newly created EC2 instance ID. <u>Elastic IP</u> [5] addresses are very useful to provide users with a consistent IP address to use regardless of what dynamic cloud resource is implemented.

Allocate New Addres	is >	<		
Are you sure you want to alloca	ate a new IP address?			
EIP used in: 🔽	<u>°C</u> ✓			
Can	cel Yes, Allocate			
Associate Address				×
Select the instance OR network interface to which	you wish to associate this IP add	dress (52.6.249.	250)	
Instance	i-7dab20d4			
Network Interface	Or Search network interface ID or N	lame tag		
Private IP Address	10.0.0.34* - 52.0.174.145	~	(j)	
	Reassociation		()	
Warning If you associate an Elastic IP address wi IP addresses.	th your instance, your current pub	olic IP address is		Cancel Associate

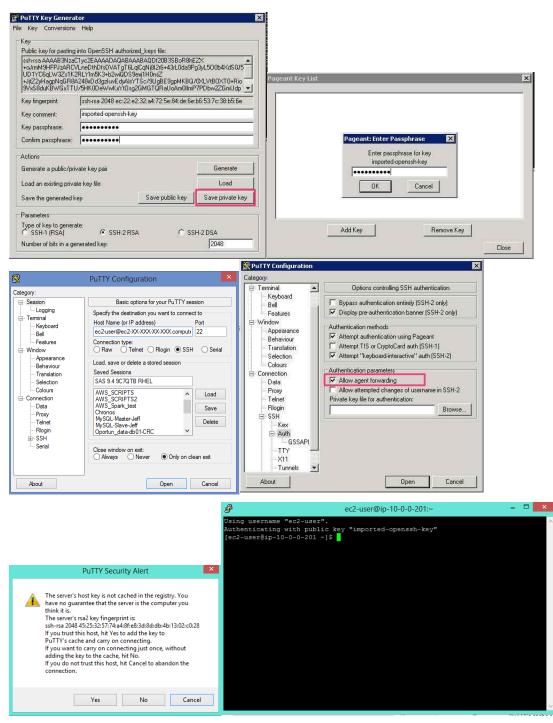
Display 14. Dialogue boxes for Elastic IP allocation and association

12. Select EC2 off the AWS Management Console and select the newly created EC2. Take note of the associated Public DNS: : ec2-XX-XXX-XXX.compute-1.amazonaws.com (XX-XXX-XXX-XXX is a mask for an IP Address. Your installation will have its own unique IP address)

# **CONNECT TO THE EC2 INSTANCE**

Now that an AWS EC2 instance has been launched in a VPC, permitting access to the internet as well as providing external access to specified SAS® 9.4 ports, the next step is to set up client connections using ssh, FTP and VNC as well as a Firefox web browser running on the EC2 instance.

13. Download and configure a new ssh client connection to the instance using putty [6]. Next, download Pageant and install from the same page in order to get the most secure SSH agent functionality. First, convert your AWS .pem credentials file to a .ppk file using PuttyGen. Next, open Pageant (running as a Windows service), click the "Add Key" button and enter in the AWS Passphrase. Close the Pageant window and then configure putty as shown below and check the "Allow agent forwarding" box. As long as the matching private key for the instance is loaded into Pageant, the connection will be successful. The NAT scenario described up to now where the SAS 9.4 instance resides in a private subnet also requires setting up a reverse ssh tunnel [19].



Display 15. Putty configuration details using private key file

14. Configure <u>WinSCP</u> [7], an FTP client, to connect to the EC2 instance in a similar way, clicking the same Allow agent forwarding" box. Click "OK" to confirm "Advanced Site Settings", "OK" to save the session site name and "Yes" to the unknown server warning:

<b>5</b>	Login - WinSCP	- 🗆 🛛		Advanced Site	e Settings		? ×			
Nes Site MrdQ2, Aster-Kantu-Sart MrdQ2, Aster-Kantu-Sart MrdQ2, Aster-Kantu-Sart Constan_date-doi: Constan_date-doi: Parcus-2002-34-fode Parcus-2002-	Sesion Exportanti SITP V Bott name: Inc2-water Save V Cancel Login V	Pegthumber prems.com 22 © avord: Advanced ▼ Close Help	Environment Directories Breachers SHI Connection Heavy Tunnel Heavy Base Note Calor	Attempt keyboard-inte	using Pageant Card authentication (SSH-1) active authentication (SSH-2) word to the first prompt		Help	Save session as site SAS_9.4_LINUX_RHEL Eolder: Save password (not recommended) Create desktop shortcut OK Cancel	? × Help	
		a.			bin - SAS 9.4 Linux		51 W6-000		_ 0	×
					DIN - SAS 9.4_LINUX	Скні	EL - WINSCP			
			mmands Session Option					-		
		🕀 🔀 😂 Synchroniz		👔 Queue 🔻 Trar	nsfer Settings Default		- 6	<b>y</b> •		
			0 SAS 9.4_Linux_RHE							
		🌐 C: Local Disk	• 🚰 😨 🚺 🔶					😨 🛛 🗢 🔹 💼 🔁 🏠 🦉 🔚 Find Files		
		🛛 🗊 Upload 🗊 📝 Ec	lit 🗙 🛃 🕞 Properties	🗳 🕞 🗄 🗖	2			1 🔐 📝 Edit 🗶 🛃 🕞 Properties 📑 🔂 1	• - 🛛	
		C:\Users\JeffL					/bin			
		Name		Si	ze Type	^	Name		Size	e Ch^
Montine	, ? ×	<b>a</b>			Parent directory		<u>}</u> []			2/.
Warning		Downloads Links			File folder File folder		ksh ksh93		1 KB 1.468 KB	1/. 10
🛕 Continue connecting to an u	nknown server and add its	Saved Games			File folder		traceroute6			9/:
host key to a cache?		Documents			File folder		rnano		1 KB	
The server's host key was not found in	n the cache. You have no quarantee	Searches			File folder		csh		1 KB	9/.
that the server is the computer you th	iink it is.	Music			File folder		iptables-xm			9/.
The server's rsa2 key fingerprint is: ssh-rsa 2048 45:25:32:57:74:a4:8f:e8:3d		Favorites			File folder		iptables-xm	hl	1 KB	
		Contacts Pictures			File folder File folder		nail nail		1 KB 1 KB	9/. 9/.
If you trust this host, press Yes. To con cache, press No. To abandon the con	nnect without adding host key to the nection press Cancel.	<			> Ne ronder		<		T NO	> Y
		0 B of 13.154 KB in 0 of 42					0 B of 9.284 KB i	in 0 of 124		
Yes No Cano	cel Copy Key Help	0 0 01 10,104 10 11 0 01 42					0 0 01 0,204 KD1	SFTP-3	= 0:0	)1:55
						_			7. 0.0	//

Display 16. WinSCP configuration details using private key file

15. Return to the putty session to run the Red Hat Linux OS update (It may discover no new updates):

[ec2-user@ip-10-0-0-201 ~]\$ sudo yum install update
Loaded plugins: amazon-id, rhui-lb, security
rhui-REGION-client-config-server-6   2.9 kB 00:00
rhui-REGION-client-config-server-6/primary_db   4.0 kB 00:00
rhui-REGION-rhel-server-releases   3.7 kB 00:00
rhui-REGION-rhel-server-releases/primary_db   28 MB 00:00
rhui-REGION-rhel-server-releases-optional   3.5 kB 00:00
rhui-REGION-rhel-server-releases-optional/primary_db   2.8 MB 00:00
rhui-REGION-rhel-server-rh-common   2.9 kB 00:00
rhui-REGION-rhel-server-rh-common/primary_db   33 kB 00:00
rhui-REGION-rhel-server-rhscl   3.1 kB 00:00
rhui-REGION-rhel-server-rhscl/primary_db   584 kB 00:00
Setting up Install Process
No package update available.
Error: Nothing to do

16. Install Tiger VNC Server [8], on the EC2 instance. In putty, type the following commands separately: sudo yum groupinstall "Desktop" (It will prompt: Is this ok [y/N]: y; At the end, it shows: Complete!) sudo yum install pixman pixman-devel libXfont sudo yum install tigervnc-server vncpasswd (Set VNC Password) sudo vi /etc/sysconfig/vncservers (Edit VNC configuration file: add the following 2 lines at the end) VNCSERVERS="1:ec2-user"

# VNCSERVERARGS[1]="-geometry 1024x768"

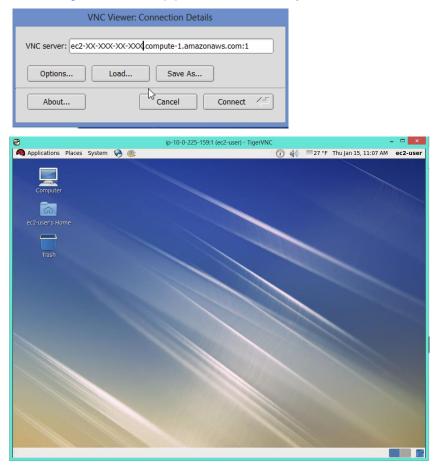
vncserver (Start the VNC server instance. The following lines show typical response entries)

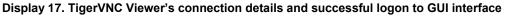
xauth: creating new authority file /home/ec2-user/.Xauthority

New 'ip-10-0-0-201:1 (ec2-user)' desktop is ip-10-0-0-201:1

Creating default startup script /home/ec2-user/.vnc/xstartup Starting applications specified in /home/ec2-user/.vnc/xstartup Log file is /home/ec2-user/.vnc/ip-10-0-0-201:1.log

17. Use the <u>TigerVNC viewer</u> [9] client to connect to your EC2 instance:

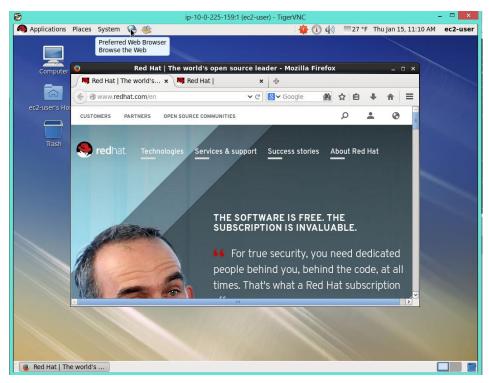




18. Download and install Firefox web browser on the EC2 instance:

## sudo yum install firefox

Start Firefox by clicking on the icon to the right of the System drop down menu:



Display 18. Firefox [10] web browser launched in EC2 instance GUI interface

# **DOWNLOAD A SAS® 9.4 SOFTWARE DEPOT**

Since there now is a GUI interface available running the Firefox web browser, a SAS software depot can be downloaded to the EC2 instance.

19. Browse to the <u>SAS Download Manager download page</u> [11]. Log into a SAS profile. First click on the Release 1.61 link and then click on the link for Linux for x64 and begin the download process:

		SAS Download Manager			
Platform	Description	Request Download	Size	Uncompressed	Release Date
64-bit enabled AIX	SAS Download Manager	esdclient_94250_r64_xx_web_1	117MB	534MB	2014-09
64-bit enabled Solaris	SAS Download Manager	esdclient_94250_s64_xx_web_1	88MB	534MB	2014-09
HP-UX IPF	SAS Download Manager	esdclient_94250_h6i_xx_web_1	109MB	534MB	2014-09
Linux for x64	SAS Download Manager	esticlient_94250_lax_xx_web_1	67MB	534MB	2014-09
Macintosh	SAS Download Manager	esdclient_94250_mac_xx_web_1.dmg	15MB	534MB	2014-09
Microsoft® Windows® for x64	SAS Download Manager	esdclient_94250_wx6_xx_web_1.exe	42MB	534MB	2014-09
Solaris for x64	SAS Download Manager	esdclient_94250_sax_xx_web_1	83MB	534MB	2014-09
Windows	SAS Download Manager	esdclient_94250_win_xx_web_1.exe	42MB	534MB	2014-09
z/OS	SAS Download Manager	esdclient_94250_mvs_xx_web_1.zos	17MB	534MB	2014-09

Display 19. SAS Download Manager download by platform

20. Start a terminal session. Create a new SAS software depot directory. Open up permissions on the depot directory and with the SAS download executable. Then, start SAS download manager to download SAS® 9.4 software with the commands below:.

) Internet	> ec2-user@ip-10-0-0-201:~	_ = ×
System Tools	> 🗐 File Browser	<u>دا</u>
- 1	🔽 Tegninal	
	Use the command line	
	×	
		1

Display 20. Select System Tools drop down menu to start the "Terminal" (ssh) session

sudo mkdir /SAS_9.4_Software_Depot
sudo chmod 777 /SAS_9.4_Software_Depot
cd /home/ec2-user/Downloads
sudo chmod 777 esdclient94250laxxxweb
./esdclient94250laxxxweb1
ec2-user@ip-10-0-0-201:~/Downloads       _ D X         File Edit View Search Terminal Help       [ec2-user@ip-10-0-201 ~]5 cd Downloads]         [ec2-user@ip-10-0-201 Downloads] 5 ls         sdollent_94250_lax_xx_web       [ec2-user@ip-10-0-201 Downloads] 5 ./esdclient_94250_lax_xx_web_1         [ec2-user@ip-10-0-0-201 Downloads] 5 ./esdclient_94250_lax_xx_web_1       [ec2-user@ip-10-0-0-201 Downloads] 5 ./esdclient_94250_lax_xx_web_1         [ec2-user@ip-10-0-0-201 Downloads] 5 ./esdclient_94250_lax_x_x_web_1       [ec2-user@ip-10-0-0-0-201 Downloads] 5 ./esdclient_94250_lax_x_x_web_1         [ec2-user@ip-10-0-0-0-201 Downloads] 5 ./esdclient_94250_lax_x_x_web_1       [ec2-user@ip-10-0

Display 21. Start SAS® Download Manager

21. After clicking OK for English on the Language prompt, obtain the SAS® 9.4 order information from the SAS orders ESD e-mail sent to the SAS site representative and type in the Order Number and SAS Installation Key on the Order Information dialogue box. Click the "Next" button and confirm the order details on the next screen. Click "Next" and opt to include the entire order or a subset. Click "Next" and select the depot directory. Click "Next" and confirm that disk space requirements are met and click "Download" to start the process. If the process is interrupted, the administrator has the opportunity to restart the download where it left off or to start again.

esume the download	oftware, select the Stop D ing process the next time				to
		1996			
Devenload Statu Downloaded: 5 Rate: 2 (34-24-31) Starting dov (34-24-32)Finished (34-26-44) -Starting dov (34-26-44) -Starting dov (34-26-44) -Starting dov (34-26-31) Starting dov (34-26-31) Starting dov (34-26-31) Starting dov (34-26-32)Finished (34-26-32)Finished (34-26-32)Finished (34-26-32)Finished (34-26-32)Starting dov	832.1 of 20,474.9 MB 5 MB/sec whoad of file 362 of 746 files straction on file 362 raction on file 362 of 746 files whoad of file 363 of 746 files draction on file 363 sentiad of file 363 raction on file 363 of 746 files whoad of file 364 of 746 files whoad of file 364 of 746 files whoad of file 364 of 746 files		 iction Statu 6: 6:350-1 0:0 KB/	of 21,392.2	MB

Display 22. The SAS Download Manager progress bar

At the end of the download process, if successful, a "Download Complete" confirmation dialogue box appears. Click "Finish".

## **PERFORM SAS® 9.4 PRE-INSTALLATION TASKS**

In order to complete a successful deployment of SAS® 9.4, the <u>pre-installation tasks</u> [12] must be completed:

22. In the instance's Firefox browser, point to the following SAS® 9.4 QuickStart guide [13] URL :

file:///SAS\_9.4\_Software\_Depot/install\_doc/9B6PXC/quickstart.html

This web page contains useful URLs for SAS pre-installation and migration/installation/configuration documentation.

23. Run the following commands to install SAS® 9.4-required Linux packages:

sudo yum install libXp

sudo yum install numactl

sudo yum install glibc

sudo yum install compat-glibc (required [14] for SAS® 9.4to run on Linux Redhat 7.1)

24. Create the following required local users for the SAS® 9.4 installation and assign them to the new SAS user groups sas\_user and sas:

sudo groupadd sas\_user

sudo useradd sas sudo passwd sas sudo usermod -G sas\_user sas id sas (verify success of user sas creation and assignment to group sas\_user)

Perform the next 5 commands again, substituting sassrv with Isfadmin, Isfuser and sasdemo) sudo useradd sassrv sudo passwd sassrv sudo usermod -G sas\_user sassrv sudo usermod -g sas sassrv id sassrv

- 25. Verify the install SAS software depot. Substitute the name of your software depot directory below: sudo chmod 755 /your\_software\_depot\_directory/\*.\* sudo chmod 755 /your\_software\_depot\_directory/hot\_fix/\*.xml sudo chmod 755 /your\_software\_depot\_directory/hot\_fix/\*.zip sudo chmod 755 /your\_software\_depot\_directory/order\_data/9B6PXC/\*.xml sudo chmod 755 /your\_software\_depot\_directory/download\_data/\*.xml cd /your\_software\_depot\_directory/utilities/depotchecker ./SASDepotCheck.sh
- 26. Create and provide the appropriate write access to the following directory /etc/opt/vmware/vfabric: cd /etc/opt sudo mkdir vmware cd vmware sudo mkdir vfabric sudo chgrp -R sas /etc/opt/vmware/ sudo chown sas /etc/opt/vmware/vfabric sudo chown sas /etc/opt/vmware/vfabric
- 27. <u>Increase open files limit</u> [15] for all processes. Check **ulimit** and increase open file descriptors to **20480** and number of processes (RHEL) to **10240**:

#### ulimit -a

core file size	(blocks, -c) 0
data seg size	(kbytes, -d) unlimited
scheduling priority	/ (-e) 0
file size (	blocks, -f) unlimited
pending signals	(-i) 239355
max locked memo	ory (kbytes, -l) 64
max memory size	(kbytes, -m) unlimited

(-n) **1024** open files pipe size (512 bytes, -p) 8 POSIX message queues (bytes, -q) 819200 real-time priority (-r) 0 stack size (kbytes, -s) 10240 cpu time (seconds, -t) unlimited (-u) **1024** max user processes virtual memory (kbytes, -v) unlimited file locks (-x) unlimited

sudo vi /etc/security/limits.conf (Add the following to the end of the file):

- \* soft nproc 10240
- \* hard nproc 10240
- \* soft nofile 20480
- \* hard nofile 20480

sudo vi /etc/security/limits.d/91-nofile.conf (Add the following to the end of the file):
\* - nofile 20480

sudo vi /etc/security/limits.d/90-nproc.conf (Add the following to the end of the file):

\* soft nofile 20480

\* hard nofile 20480

Exit out of the user session in putty, etc. to view the changes. Log back in and type the following: [ec2-user@ip-10-0-0-98 ~]\$ ulimit -a

core file size (blocks, -c) 0 (kbytes, -d) unlimited data seg size scheduling priority (-e) 0 (blocks, -f) unlimited file size (-i) 239355 pending signals max locked memory (kbytes, -I) 64 max memory size (kbytes, -m) unlimited open files (-n) **20480** (512 bytes, -p) 8 pipe size POSIX message queues (bytes, -q) 819200 real-time priority (-r) 0

stack size	(kbytes, -s) 10240
cpu time	(seconds, -t) unlimited
max user process	ses (-u) <b>10240</b>
virtual memory	(kbytes, -v) unlimited
file locks	(-x) unlimited

28. Create SAS 9.4 install home and configuration home: (e.g. /sas\_install/9.4 /sas\_config/9.4) sudo mkdir /sas\_install
sudo mkdir /sas\_install/9.4
sudo mkdir /sas\_config
sudo mkdir /sas\_config/9.4
sudo chgrp -R sas /sas\_install
sudo chown -R sas /sas\_install
sudo chown -R sas /sas\_config
sudo chown -R 777 /sas\_install
sudo chowd -R 777 /sas\_config

- 29. Download junit [16] and copy to the SAS install directory (e.g. /sas\_install) directory using WinSCP FTP
- 30. Download and install C compiler and python:
   sudo yum install gcc
   sudo yum install python (python may already be installed)

Find where python is already installed: **sudo find . -name "python\*" -print** (e.g. /usr/lib64/python2.6, /usr/lib/python2.6, /usr/bin/python)

- 31. The following components are required to be installed to run ./sasbatch.sh (SAS base): sudo yum install ksh (Korn shell) sudo yum install libXp.so.6
- 32. In order to avoid a setuid permissions error later on in the installation process, run these commands: cd /sas\_install/9.4/SASFoundation/9.4/utilities/bin sudo ./setuid.sh

## **INSTALL SAS® 9.4 SOFTWARE WITH SAS DEPLOYMENT MANAGER**

Now that the Linux RedHat 7.1 environment has been properly prepared, SAS® 9.4 software can be installed. What follows is a series of approximate steps showing via screen prints the SAS® 9.4 Deployment Wizard installation process in its entirety. These steps vary considerably based upon the SAS® 9.4 software order and as well as on requirements for additional configuration (authentication, migration, third-party software, etc.).

33. Start the SAS® 9.4 Deployment Manager wizard and then begin and continue to process the installation:

su sas (The SAS® 9.4 can only be installed using a sas installer id and not the root id)

cd /SAS\_9.4\_Software\_Depot (Switch to the SAS® 9.4 software depot directory)

./setup.sh -record -deploy (-record allows the wizard to capture your inputs into a response file)



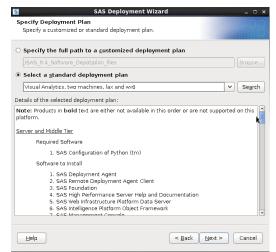
Display 23. Select SAS deployment task

9	SAS Deploym	ent Wizard			_ = ×
Specify SAS Home Specify the location whe machine.	re SAS software will	be installed	on this		00
<u>S</u> AS Home: (/sas_install/9.4	l .				Browse
Help			< <u>B</u> ack	<u>N</u> ext >	Cancel

Display 24. Select SAS home directory



Display 25. Select SAS deployment type



Display 26. Select SAS deployment plan

Deployment Step: Step 1: Server and Middle Tier		
Product	Info	
SAS Deployment Agent	0	
SAS Remote Deployment Agent Client		
SAS Foundation		
SAS High Performance Server Help and Documentation		
SAS Web Infrastructure Platform Data Server		
🗹 SAS Intelligence Platform Object Framework	0	
🗹 SAS Management Console	0	
SAS Web Infrastructure Platform Data Server Configuration		
🗹 SAS Configuration Manager	0	
SAS Deployment Tester Plug-in for SAS Management Console	6	
🗹 SAS Visua A SAS Management Console plug-in that you can use	to view and modify the	e se
SAS Visual Analytics Explorer Configuration Data	0	
SAS Visual Analytics Graph Builder Configuration Data		
🗹 SAS Visual Data Builder Configuration Data	0	
SAS Web Infrastructure Platform Scheduling Services	0	
SAS Visual Analytics High-Performance Configuration	0	
SAS Information Retrieval Studio for SAS	0	

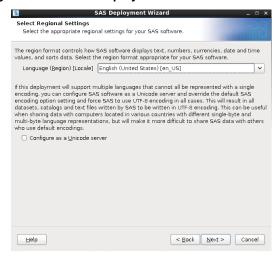
Display 27. Select SAS products to install

AS installation data file: (example: SAS94_12345		
SAS_9.4_Software_Depot/sid_files/SAS94_	_70153959_LINUX_X86-64.txt	Browse.
etails of the selected SAS installation data file:		
Product: SAS 9.4		
Platform: Linux for X64		
Order: Licensed SAS Foundation Software	Expiration Date	
ase SAS	30jUN2015	
SAS LASR Analytic Server Non-Distributed Mode		
SAS Metadata Server	30JUN2015	
SAS Visual Analytics	30JUN2015	
SAS/ACCESS Interface to Hadoop	30JUN2015	

Display 28. Select SAS installation data file and take note of expiration dates

SAS Deployment Wizard	_ 🗆 ×
Select Language Support Select the languages for your software to support.	00
Select the languages you would like to install for the products listed below.	
SAS Foundation	
Arabic     Chinese Simplified     Chinese Traditional (Taiwan)     Danish     Dutch     Dutch     German     Hebrew     Hungarian     talian     Japanese     Korean     Norwegian     Polish     Portuguese (Brazil)	
Select All	
Help Sack M	ext > Cancel

Display 29. Select SAS deployment task



**Display 30. Select Regional Settings** 

SAS Deployment V	Vizard _ □ ×
Select Authentication Type Select the type of authentication for this system.	99
Select this option if the system is using Pluggable Au authentication. This option should not be used if the authentication.	
PAM configuration files may need to be updated in or via PAM. Refer to the "Post-Installation Configuration chapter of the Configuration Guide for SAS Foundatio information.	for User Authentication and Identification"
Use PAM Authentication	
	k
Help	< Back Next > Cancel

Display 31. Select Authentication Type

SAS Deployment Wizard	_ 0 ×
Specify Remote Communication Configuration The SAS Deployment Agent must be configured in order to perform configuration management operations.	89
Enter a port number and your security preference for SAS Deployment Agent remote communications.	
Port:	
5660	
Specify how to secure the remote connection:	
Generate credentials to secure the connection	~
k	
Help (Seck Next >	Cancel

Display 32. Specify Remote Communication Configuration

SAS Deployment W	Vizard _ 🗆 🛪
Checking System	
Tooling initialization complete	
309 / 309 (10	00%)
Examining File System	
214,916 / 214,91	6 (100%)
Required disk space: 12,943 MB f any files are shown below, your installation cannot p to be added/modified/deleted are either locked or do installer has finished scanning your file system, stop t quit any SAS applications that might be running, and not wrtable. When you have made these changes, cli the problem at this time, click Cancel to quit. Unwritable files: 0	not have write permissions. When the the SAS servers and SAS Windows services, add write permissions to those files that are
	k
Help	< Back Next > Cancel

Display 33. Checking File System

Review Required Software Review software that is required on this r deployment.	machine to complete your
oftware. This third-party software may alreat numbers are listed; however, certain combin	selected to install requires the following third-party ady be installed on your machine. Minimum version nations of software versions, for example with web (is, may be unsupported. This link provides detailed d supported versions.
Name	Versio
SAS Configuration of Python (tm)	2.6
	k

Display 34. Review Required Software

SAS SAS	Deployment Wizard		_ 0 ×
Specify Software Location Specify the location for required	software.		
The following software is required on	this machine to complete you	r deployment:	
SAS Configuration of Python	(tm) 2.6		
If the SAS Deployment Wizard can fi If nothing is listed, specify the full pa		ire, the path to it is	listed below.
/usr/bin			Browse
		k	
Help	< <u>B</u>	ack <u>N</u> ext >	Cancel

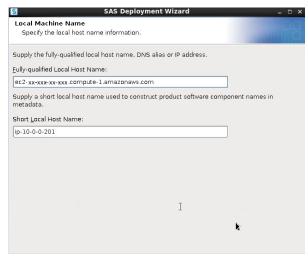
Display 35. Specify Software Location

SAS Deployment W	izard _ 🗆 ×
Select Configuration Prompting Level Select the level of prompting for configuration inform dialogs.	mation
Configuration is the final stage of deployment and is no deployment. The remaining dialogs gather information machine.	
<ul> <li>Express</li> <li>Display the minimum set of required dialogs to con</li> <li>Typical</li> <li>Display the basic set of configuration dialogs, exclu</li> </ul>	
<ul> <li><u>Custom</u></li> <li>Display all configuration dialogs and custom setting</li> </ul>	js.
	k
Help	< Back Next > Cancel

Display 36. Select Configuration Prompting Level

SAS Deployment Wiz	ard	- 0 ×
Specify Configuration Information Specify the configuration directory and the level withi configuration directory to create your SAS software c		DQ
The configuration directory indicates the path to the con identifies a unique instance of your configuration. The cr and level constitute a complete software configuration, or operate the instance of the software.	ombination of a configuration d	irectory
Configuration Directory:		
/sas_config/9.4		Browse
Configuration Level:		
Lev1 V		
	k	
Help	< <u>B</u> ack <u>N</u> ext >	Cancel

**Display 37. Specify Configuration Information** 



**Display 38. Specify Local Host Name** 



**Display 39. Migration Information** 

	Windows Auth ther to use Integ ections		authenticatio	n for		
	ated Windows au	ithentication (s	ingle sign-on)	1		
- lose Tursâr	ated windows at	amendication (s	ingle sign-on)	J		
					k	

**Display 40. Integrated Windows Authentication** 



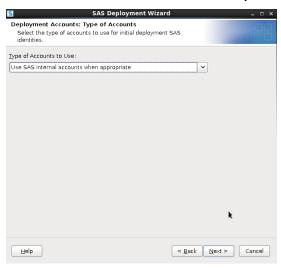
**Display 41. Integrated Windows Authentication** 

SAS	5 Deployment Wizard	>
SAS Metadata Server Specify SAS Metadata Server co	onnection information.	
Hos <u>t</u> Name:		
ec2-xx-xxx-xx-xxx.compute-1.ama	azonaws.com	
2ort:		
8561	I	
		k
Help	< Back	vext > Cancel

Display 42. SAS Metadata Server details

SAS Metad	ata Server: Ov	SAS Deployr erride Backup		d		_ 0
Select who backup dir	ther to override ectory.	the default SAS	Metadata Se	irver		
onfigure a m	adata Server kee letadata server o ide the default if	luster, you mus	t override this	s default. For a	n uncluster	
Override t	he <u>d</u> efault SAS N	1etadata Server	backup direc	tory		
						k:
Help				< <u>B</u> ack	<u>N</u> ext >	Cancel

Display 43. SAS Metadata Server: Override Backup Location



Display 44. Deployment Accounts: Type of Accounts



Display 45. External Account: Installer

SAS Deployment Wiza	ird _ 🗆 ×
Automatic Script Execution Specify your preference for automatic script execution	
The products you have selected require that setuid.sh be SAS Deployment Wizard to attempt to run this script usir option below. If you would prefer to run the script yourself	ig sudo and your password, select the
Run setuid.sh with my ID and password	
k	
Help	< Back Next > Cancel

Display 46. Automatic Script Execution

SAS Deployment Wizar	rd _ 🗆 ×
SAS Internal Account: Unrestricted Administrator Specify the metadata password for the first Unrestricte Administrator identity. The Unrestricted Administrator H unrestricted administrative access to metadata.	
The Unrestricted Administrator is a SAS internal account s	stored in metadata.
Display Name:	
SAS Administrator	]
Name:	
sasadm	]
Internal User ID:	
sasadm@saspw	]
New Internal Password:	
жиникиники	]
⊆onfirm New Internal Password:	
*****	]
	k
Help	< Back Next > Cancel

Display 47. SAS Internal Account: Unrestricted Administrator

SAS Deployment Wizar	rd _ 🗆 >
SAS Internal Account: Trusted User Specify the metadata password for the Trusted User id Trusted User is a privileged service account that can ac of other users on a connection to the metadata server.	st on behalf
The Trusted User is a SAS internal account stored in meta	data.
Display Name:	
SAS Trusted User	]
Name:	
sastrust	1
Internal User ID:	
sastrust@saspw	)
New Internal Password:	
******	1
Confirm New Internal Password:	
*******	1
	4
Help	< Back Next > Cancel

Display 48. SAS Internal Account: Trusted User

Anonymous Web Access				
Select whether to enable anonym applications.	ous access to web	services and		CONTRACT.
Enable anonymous web access (0	optional)			
,				
				k
Help		< Back	Next >	Cancel

### Display 49. Anonymous Web Access

SAS Deployment Wizard	_ = ×
SAS Internal Account: Anonymous Web User Specify the metadata password for the anonymous web u identity.	ser
The anonymous web user is a SAS internal account stored in	metadata.
Display Name:	
SAS Anonymous Web User	
N <u>a</u> me:	
webanon	
Internal User ID:	
webanon@saspw	
New Internal Password:	
<del>หองสองสองผู้ใ</del> สะ	
Confirm New Internal Password:	
xxxxxxxxxxx	
Help	< Back Next > Cancel

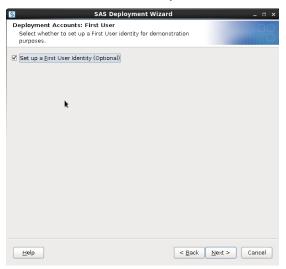
Display 50. SAS Internal Account: Anonymous Web Access



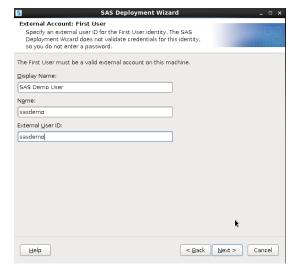
Display 51. SAS Visual Analytics: Allow Guest Access

SAS Deployment Wi	zard _ 🗆 ×
External Account: SAS Spawned Servers Account Specify credentials for the SAS Spawned Servers ac to launch back-end stored process and pooled works servers.	count, used
The SAS Spawned Servers account must be a valid ext	ernal account on this machine.
External User ID:	
sassrv	
External <u>P</u> assword:	
**********	
Confirm External Password:	
*****	
	*
	*
Help	< Back Next > Cancel

Display 52. External Account: SAS Spawned Servers Account



Display 53. Deployment Account: First User



Display 54. External Account: First User

SAS Deployment V	Wizard _ 🗆 >
Server Encryption Select the encryption settings to use when comm the SAS Metadata Server.	nunicating with
Server Encryption Level:	
Credentials	~
Server Encryption Algorithm:	
SAS Proprietary	✓
	<b>k</b> .
	k

Display 55. Server Encryption

SAS Deployment Wizar	d _ 🗆 ×
Estimated System Size Specify the size of the system to be configured based o expected number of users and the size of the workload.	n the
Size Estimate:	
Medium System	]
	k
Help	< Back Next > Cancel

Display 56. Estimated System Size

SAS Deployment Wizard	_ 0 ×
E-mail Server Specify e-mail server information.	DO
An unauthenticated SMTP e-mail server is used to send alert e-ma Metadata Server encounters problems.	ail messages when the SAS
Host Name:	
ec2-xx-xxx-xxx.compute-1.amazonaws.com	
Port:	
25	
k	
Help	Back Next > Cancel

Display 57. E-mail Server details

SAS Deploymen	t Wizard _ 🗆 ×
E-mail Addresses Specify the e-mail addresses that will be used w communicating with the system administrator.	
Sender E-mail Address:	
SAS_Server@ec2-xx-xxx-xxx.compute-1.amaz	onaws.com
Recipient E-mail <u>A</u> ddress:	
SAS_Server@ec2-xx-xxx-xxx.compute-1.amaz	zonaws.com
Specify whether your e-mail server requires author credentials if you select this option. E-mail server requires authentication E-mail server requires authentication	ication. You will be prompted for e-mail server
Help	< Back Next > Cancel

### Display 58. E-mail Addresses

SAS Deployment Wizard	_ O X
SAS Object Spawner Specify SAS Object Spawner information.	00
Operator Port:	
8581	
	k
Help	Back Next > Cancel

Display 59. SAS Object Spawner port selection

SAS Deployment Wiz	ard _ 🗆 X
SAS Object Spawner: Port Bank Specify SAS Object Spawner port bank ports.	80
Port Bank Port <u>1</u> :	
8801	
Port Bank Port 2:	
8811	
Port Bank Port 3:	
8821	
	k
Help	< <u>B</u> ack <u>N</u> ext > Cancel

Display 60. SAS Object Spawner port bank

SAS Application Server: Server Context Specify the SAS application server context name	e. 00
SAS Application Server Context Name:	
SASApp	
	k.
	k
Help	< Back Next > Cancel

Display 61. SAS Application Server: Server Context

SAS Deployment	Wizard _ 🗆 ×
SAS Workspace Server Specify SAS Workspace Server information.	
Port:	
8591	]
	k
Help	< Back Next > Cancel

Display 62. SAS Workspace Server port

SAS Deployment Wizar	- □ ×
SAS Pooled Workspace Server Specify SAS Pooled Workspace Server information.	99
Port:	
8701	
	k
	N,
Help	< Back Next > Cancel

Display 63. SAS Pooled Workspace Server port

SAS Deployment Wi SAS Stored Process Server	zard _ 🗆 ×
Specify SAS Stored Process Server information.	
Bridge <u>P</u> ort:	
8601	
	k
Help	< <u>Back</u> Next > Cancel

Display 64. SAS Stored Process Server port

SAS Deployment Wiza	ard _ 🗆 ×
Stored Process Server: Multibridge Connections Specify multibridge connection information for the SA Process Server.	5 Stored
Multibridge Port <u>1</u> :	
8611	
Multibridge Port 2:	
8621	
Multibridge Port <u>3</u> :	
8631	
	k
Help	< Back Next > Cancel

Display 65. SAS Stored Process Server: MultiBridge Connections

SAS Deployment Wizard	i _ 🗆 ×
SAS Web Infrastructure Platform Data Server Specify information for SAS Web Infrastructure Platform D Server.	Data
Host Name:	
ec2-xx-xxx-xxx.compute-1.amazonaws.com	
Port:	
9432	
Data Server Administrator:	
dbmsowner	
Data Server Administrator Password:	
******	
Confirm Password:	
*****	
Help	< Back Next > Cancel T

Display 66. SAS Web Infrastructure Platform Data Server details

SAS Deployment Wizard	 _ 0 ×
SAS DATA Step Batch Server Specify SAS DATA Step Batch Server information.	
specily and bring step batch beiver information.	
Deployed Jobs Directory:	
/sas_config/9.4/Lev1/SASApp/SASEnvironment/SASCode/Jobs	Browse
Deployed Jobs Directory Name:	
Batch Jobs	
	k

Display 67. SAS Data Step Batch Server

SAS Deployment	Wizard _ 🗆 🗙
Operating System Services Scheduling Serv Specify the Operating System Services Scheduli information.	
Port:	
8451	]
	k
Help	< Back Next > Cancel

Display 68. Operating System Services Scheduling Server

S	SAS Deployment Wizard	_ = ×
SAS Deployment Teste Specify SAS Deploymen	er Server nt Tester Server connection information.	PB
Port: [10021 JUnit JAR File: [/sas_install/junit-4.8.1.jar		Erowse
		k
Help	< <u>B</u> a	ack Next > Cancel

Display 69. SAS Deployment Tester Server details

SAS Deployment Wiza	rd _ 🗆 ×	
SAS Web Server: Automated or Manual Configura Specify whether to configure SAS Web Server automati manually.		
You can automatically configure SAS Web Server to work with your SAS products. If you do not choose to configure SAS Web Server automatically, you are still prompted for server configuration information. You must manually configure SAS Web Server, the web application server, and deploy applications manually. You should follow the manual instructions that describe how to perform these tasks.		
	k	
Help	< Back Next > Cancel	

Display 70. SAS Web Server: Automated or Manual Configuration Op

SAS Deployment Wizard 💄 _	□ ×
SAS Web Server: Configuration Specify SAS Web Server configuration options.	
If you are using a UNIX system and you specify ports lower than 1024 in the fields below, you restart your server manually outside of the SAS Deployment Wizard as root. HTTP Port:	must
7980	
HTTPS Port:	
8343	
Configured Protocol:	
HTTP Protocol	
Administrator Mail Address:	
SAS Server@ec2-xx-xxx-xxx.compute-1.amazonaws.com	
×	
Help     < Back	cel

Display 71. SAS Web Server: Configuration

SAS Deployment Wiz	zard _ 🗆 ×
Web Application Server: JMS Configuration Specify the port for your JMS server.	
IMS Server Port:	
61616	
JMS Server JMX Port:	
11099	
	k
	R.
Help	< <u>B</u> ack <u>N</u> ext > Cancel

Display 72. SAS Web Application Server: JMS Configuration

<u>5</u>	SAS Deployment V		_ 0 :
	Server: Cache Locator Confi for your cache locator.	iguration	
Cache Locator Port:			
41415		]	
		k	
Help		< Back Next >	Cancel

Display 73. SAS Web Application Server: Cache Locator Configuration



Display 74. SAS Web Application Server: Server Configuration

SAS Deployment Wiza	nrd _ 🗆 🗙
Web Application Server: Server Ports Specify the web application server information.	80
HTTP Port:	
8080	
JMX Port:	
6969	
Cluster <u>M</u> ember Multiplier:	
1	
	k:
Help	< Back Next > Cancel

Display 75. SAS Web Application Server: Server Ports

SAS Deployment Wi	zard _
Web Applications: Automatic Deployment Specify whether to deploy the web applications auto the web application server.	matically to
You can automatically deploy the SAS web applications choose to deploy the applications manually, you should describe how to perform these tasks.	
Deploy web applications automatically	
	k
Help	< Back Next > Cancel

Display 76. SAS Web Application Server: Automatic Deployment

SAS Deployment	Wizard _ 🗆 ×
Scheduling Services Cache Locator Specify the Scheduling Services Cache locator in	formation.
Port:	
41415	]
	k:
Help	< Back Next > Cancel

Display 77. Scheduling Services Cache Locator

SAS Deployment Wizar	d _ 🗆 ×
Scheduling Services DIP JobRunner Toggle startup state for the Scheduling Services DIP Job	Runner.
Start Scheduling Service DIP JobRunner	
	k
Help	< Back Next > Cancel

Display 78. Scheduling Services DIP JobRunner

SAS Deployment Wiza	ard _ 🗆 ×
SAS Web Application Themes Specify information for SAS Web Application Themes	
Host Name:	
ec2·xx-xxx-xxx.compute-1.amazonaws.com	
Port:	
7980	
⊆onfigured Protocol:	
HTTP Protocol	~
	k
Helb	< Back Next > Cancel

Display 79. Web Application Themes

P Multicast Version Specify the IP Version to use for the IP Multicast address. Multiple IP versions are detected on this machine. Select the version appropriate for your environment. IP Version: IP V4 ✓	SAS Deployment Wizard	_ = ×
enviranment. IP Versian: IP V4 V4 V		
IP∨4 ✓		or your
k		
k		
k		
k		
k		
		k
Help Cancel	Help < Back Next >	Cancel

Display 80. IP Multicast Version

SAS Deployment Wizard _ 🗆 🗙	
IP Multicast Specify IP Multicast information to allow status communication amongst applications.	
A multicast group communications protocol is used to communicate among middle tier SAS applications in a single SAS deployment (the set of applications connected to the same SAS Metadata Server). The combination of multicast IP address and multicast UDP port should be different for each SAS deployment and also different from those used by other multicast applications at your site. The TTL and authentication token choices have security implications. The multicast group communication includes all information needed to bootstrap SAS mid-tier applications. Because this includes sending the SAS environment credentials (such as the "sasadm" account name and its password), scoping and encryption options are provided. The defaults are most appropriate for deployments in a firewall-isolated data center environment. See the help for more details.	
IP Multicast Address:	
239.0.0.201	
IP Multicast UDP Port:	
8561	
IP Mul <u>t</u> icast TTL:	
1	
Use an authentication token to connect.	
Help Cancel Cancel	

Display 81. IP Multicast details

SAS Deployment Wi	zard _ 🗆 >
SAS Content Server: Repository Directory Specify the SAS Content Server repository directory	
Repository Directory:	
/sas_config/9.4/Lev1/AppData/SASContentServer/Repo	bsitory Browse
☑ Start initial node as clustered. See Help for more de	etails.
	k
Help	< Back Next > Cancel

Display 82. SAS Content Server: Repository Directory

SAS Deployment Wizar	d	_ 🗆 ×
SAS Web Infrastructure Platform Database: JDBC Specify the connection information for the SAS Web Infr Database JDBC connection.		
Database Name:		
SharedServices		
User ID:		
SharedServices		
Password:		
*******		
Confirm Password:		
*******		
Help	< Back Next >	Cancel

Display 83. SAS Web Infrastructure Platform Database: JDBC Properties

SAS Deployment Wizard	d	_ 0 ×
SAS Environment Manager: Administration Databa Specify the SAS Environment Manager Administration d information.		00
User ID:		
adminowner		
Password:		
жноннонност		
Confirm Password:		
*********		
Help	< Back Next > C	ancel

Display 84. SAS Environment Manager: Administration Database ID

SAS Deployment Wizard	>
SAS Internal Account: SAS Environment Manager Service Specify the metadata password for the service identity for SAS Environment Manager Service.	
The SAS Environment Manager Service Account is a SAS internal account stor	red in metadata.
Display Name:	
SAS Environment Manager Service Account	
N <u>a</u> me:	
sasevs	
Internal User ID:	
sasevs@saspw	
SAS Environment Manager Service Account <u>P</u> assword:	
*****	
Confirm Password:	
********	
Help < Back Nex	<t> Cancel</t>

Display 85. SAS Internal Account: SAS Environment Manager Service

SAS Deployment Wi	zard .	- ¤ ×
SAS Environment Manager: Configuration Specify the server information to administer the SA Environment Manager.	S	
HTTP Port:		
7080		
HTTPS Secure Port:		
7443		
Administrator E-mail Address:		
SAS_Server@ec2-xx-xxx-xxx .compute-1.amazona	ws.com	
	k	
Неір	< Back Next > Ca	ncel

Display 86. SAS Environment Manager: Configuration

SAS Deployment Wiza	ard _ 🗆 ×
SAS Environment Manager: Database Configurat Specify the SAS Environment Manager database infor	
Database N <u>a</u> me:	
EVManager	
Database <u>U</u> ser:	
EVManager	
Database User Password:	
************ I	
Confirm Password:	
******	
Database Encryption Passphrase:	
xxxxxxxxxxxxxxx	
Confirm Database Encryption Passphrase:	
*****	
Help	< <u>Back</u> <u>N</u> ext > Cancel

Display 87. SAS Environment Manager: Database Configuration

AS Environment Man	aner Anert Confin	wation		
AS Environment Man Specify the SAS Enviro				
Speen,7 1110 0110 211110				Langerter L
AS Environment Manage	r Agent <u>L</u> istening Port	:		
144				
				k
				×.
			ack Next	> Cancel

Display 88. SAS Environment Manager Agent Configuration

SAS Deploym	nent Wizard		_ = ×
SAS Flex Application Themes Specify information for SAS Flex Application	Themes		
Hos <u>t</u> Name:			
ec2-xx-xxx-xxx.compute-1.amazonaws.com	m		
Port:			
7980			
⊆onfigured Protocol:			
HTTP Protocol		~	
	I		
			k
Help		< <u>B</u> ack <u>N</u> ex	d > Cancel

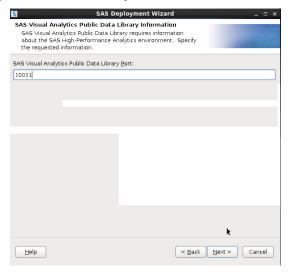
**Display 89. SAS Flex Application Themes** 

8	SAS Deployment Wizard	_ 🗆 🗙
SAS Visual An information ab	Nytics High-Performance Configuration Inf alytics High-Performance Configuration requires yout the SAS High-Performance Analytics Specify the requested information.	00
SAS High-Perforn	nance Analytics <u>E</u> nvironment Host:	
ec2-xx-xxx-xx-xx	x.compute-1.amazonaws.com	
SAS High-Perforn	nance Analytics Environment Port:	
10010		
Signature <u>f</u> iles loc	ation:	
/sas_install/tmp		
k		
Help	< Back Ne	xt > Cancel

Display 90. SAS Visual Analytics High-Performance Configuration details

SAS De	eployment Wizard			×
SAS Visual Analytics Public Data SAS Visual Analytics library definition data provider.		d		
Data Reload Library Name:				
Visual Analytics Public Data Provider				
Da <u>t</u> a Reload Libref:				
DPPUBLIC				
Data Reload P <u>a</u> th:				
as_config/9.4/Lev1/AppData/SASVisua	lAnalytics/VisualAnalytics/	Administrato	or/PublicDataP	rovider
			k	
Help	<	Back N	ext > Ca	incel

Display 91. SAS Visual Analytics Public Data Provider



Display 92. SAS Visual Analytics Data Library Information



Display 93. SAS Visual Analytics Autoload Location

S.	SAS E	Deployment Wizar	d	>
SAS Information F Specify informatio		o ation Retrieval Studio	ı.	
Hos <u>t</u> Name:				
ec2-xx-xxx-xx-xxx .co	mpute-1.amazo	naws.com		
Port:				
10651				
				k
Help			< Back Next :	Cancel

Display 94. SAS Information Retrieval Studio

SAS Dep	loyment Wizar	d	_ = ×
Search Interface to SAS Content Fe Specify feeder information for Search			00
Index Loader Interval In Minutes:			
60			
Help		< Back Next >	Cancel

Display 95. Search Interface to SAS Content Feeder Configuration

SAS Deployment Wizard 🛛 💷 🗆	×
SAS Internal Account: Search Interface to SAS Content U Specify the metadata password for the Search Interface to SAS Content User identity.	8
The Search Interface to SAS Content User is a SAS internal account stored in metadata.	
Display Name:	
Search Interface to SAS Content User	
N <u>a</u> me:	
sassearch	
Internal User ID:	
sassearch@saspw	
New Internal Password:	
workersteinersteiner	
Confirm New Internal Password:	
*******	
×ç	
	_
Help < Back Next > Cancel	

Display 96. SAS Internal Account: Search Interface to SAS Content

SAS D	eployment Wizard		>
SAS Visual Analytics Administrat Specify the library information.	or: SAS LASR Analy	rtic Se	
Library Name:			
Visual Analytics LASR			
Libref:			
VALIBLA			
			k
Help		< Back Next	> Cancel

Display 97. SAS Visual Analytics Administration: SAS LASR Analytic Server

SAS De	eployment Wizard	l.		_ 0 X
SAS Visual Analytics Services Dat Specify the connection information Services Database JDBC connection	for the SAS Visual An			
User ID:				
vatadm				
Password:				
******				
Confirm Password:				
*****				
·				
	k			
Helb		< <u>B</u> ack	<u>N</u> ext >	Cancel

Display 98. SAS Visual Analytics Services Database Credentials

SAS De	ployment Wizard	_ 🗆 🗙
SAS Visual Analytics Transport Se Specify whether to enforce whitelisti		-08
A deployment enforces either the black If the whitelist is enforced, only those do Enforce whitelist for mabile devices		
		k
Help	< <u>B</u>	ack Next > Cancel

Display 99. SAS Visual Analytics Transport Service: Mobile Whitelist

	tocol for OpenStreetMap Server n protocol for use in connecting to the ap Server.	
SAS-hosted <u>O</u> penStreetMap HTTP Protocol	Server Communication Protocol:	
		k
Help	< Back	< <u>N</u> ext > Cancel

Display 100. SAS Visual Analytics: Protocol for OpenStreetMap Server

SAS De	eployment Wizard	_ = ×
SAS Visual Analytics: Configure A Specify whether to configure an Arco		
Configure ArcGIS Server details now. If details about the ArcGIS Server.	this option is selected, you will i	se prompted for further
		k
Help	< Back	Next > Cancel

Display 101. SAS Visual Analytics: Configure ArcGIS Server

SAS De	ployment Wizard	1	_ 🗆 🗙
SAS Visual Data Builder Database Specify the connection information fi Builder Database JDBC connection.		ata	
User ID:			
vdbadm			
Password:			
****************** I			
Confirm Password:			
*********			
Help		< Back Next	> Cancel

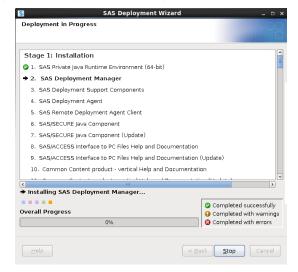
Display 102. SAS Visual Data Builder Database Credentials

SAS De	eployment Wizard		_ = ×
SAS Deployment Backup and Recovery Tool: Enable Cent Specify whether to override the default values of the shared centralized valid directory and the retention period.			
Select this option to enable central storage of backup files by specifying a network-accessible vault directory. The feature of storing backups at a centralized location is disabled by default. To enable the feature, select this option and then specify a directory that is shared across all the tiers. The default retention period for central backups is thirty days. You can specify a different retention period.			
Enable central vault storage of back	up files		
			k
Help		< <u>B</u> ack	Next > Cancel

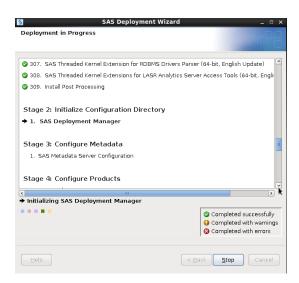
Display 103. SAS Deployment Backup and Recovery Tool: Enable Storage

SAS Deployment W	izard _ 🗆 ×
Deployment Summary Review the software selected for deployment. If you change the selections, you should go back and mal changes. When the software you wish to deploy is li Start to begin the deployment.	ke those
Stage 1: Installation	
1. SAS Private Java Runtime Environment (64-bit)	=
2. SAS Deployment Manager	
3. SAS Deployment Support Components	
4. SAS Deployment Agent	
5. SAS Remote Deployment Agent Client	
6. SAS/SECURE Java Component	
7. SAS/SECURE Java Component (Update)	
8. SAS/ACCESS Interface to PC Files Help and Do	cumentation
9. SAS/ACCESS Interface to PC Files Help and Do	cumentation (Update)
10 Common Contant product vartical Halo and	Decumentation V
Overall Progress	Completed successfully
0%	G Completed with warnings
	🙁 Completed with errors
Help	< Back Start Cancel

Display 104. Deployment Summary



Display 105. Deployment in Progress (Installation steps occur in Stage 1)



Display 106. Deployment in Progress (Configuration steps at Stage 2)

## **COMPLETE SAS® 9.4 POST-INSTALLATION TASKS AND CONFIGURATION**

The last remaining to do items to complete the SAS installation have to do with both efficiencies as well as practical items such as how to connect to a few of the SAS® 9.4 software clients.

- 34. Complete all the tasks and validations that are required in *instructions.html*, which is produced at the end of SAS® 9.4 deployment wizard installation/configuration process. Also, maintain a copy in your records of *DeploymentSummary.html*.
- 35. Review the following logs in the directory, \$HOME/.SASAppData/SASDeploymentWizard/9.4:

SDW.log, SDW\_<date>.log, sdwprefs.txt

- 36. Create a home directory for each user to store SAS data and programs. For example, create a directory named /users and add a sub-directory for all users individually. Provide appropriate read/write permissions for each user.
- 37. Change the temp file WORK location for SAS users logged onto SAS clients from its default /tmp location to another chosen directory location. Create that new directory and provide appropriate permissions for SAS software to write to that directory. Add a new line at the bottom of the sasv9.cfg file in /sas\_config\_directory/Lev1/SASApp:

-work /temp\_files\_work\_dir

40. <u>Set appropriate SAS option settings</u> [17] for the following:

MEMSIZE, SORTSIZE, BUFFSIZE, IBUFFSIZE, UBUFFSIZE, SGIO, WORKTERM, WORKINIT

These settings can be effected in the sasv9.cfg in /sas\_config\_directory/Lev1/SASMeta/MetadataServer

The sub-optimal default for MEMSIZE, for example, is MAX. (max memory setting is not efficient)

41. Install and configure SAS® 9.4 clients on your laptop. Here is a sample configuration setup for SAS® Enterprise Guide 7.1:

Name: SAS9.4\_Linux Port: 8561

Machine: ec2-XX-XXX-XXX-XXX.compute-1.amazonaws.com

(XX-XXX-XX-XXX is a mask for an IP Address. Your installation will have its own IP address)

1 Modify Profile		-		
Name:				_
SAS_9.4_Linux				
Description:				
Machine				
Remote     Cocal		Port:		
ec2-XX-XXX-XX-XXX.compute-1.amazonaws.com		8561		
Use Integrated Windows Authentication           Advanced           ✓ Save login in profile				
User:	Password:			
lehmann				
Authentication Domain:				
	Save		Cancel	

Display 107. SAS® Enterprise Guide 7.1 client profile configuration

### CONCLUSION

SAS administrators now have an additional, low-cost method to deploy a new test environment. The AWS method of deployment allows for quick, autonomous implementation of SAS® 9.4 by an informed SAS administrator. This paper's tactical, step-by-step perspective will hopefully be a helpful guide in setting up an AWS cloud instance of SAS® 9.4 for those looking beyond an enterprise data center's offerings.

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