Saphyr Networking and Setup Guide

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Table of Contents

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Revision History

Revision	Notes
A	Initial Release
B	Added Saphyr Instrument Controller configuration information
C	Addition of Compute Option B Steps, Access.txt, and Legacy image.
D	• Added port 3002 for Compute On Demand connectivity. • Added firewall configuration for ICS v5.2
E	Clarified that the Instrument controller can't be connected to the Access server if a proxy server is being used.in the Instrument Controller Network Connectivity Requirements section
F	Added clarity to Compute Configuration Steps. Added IT Requirements. Workflow improvements for customer and internal ease.
G	Updated Tables and removed irrelevant verbiage.

Introduction

This document provides guidelines and specifications for integrating the Bionano Genomics Saphyr® System into the customer's IT environment. The Saphyr System is composed of a Saphyr Instrument, Instrument Controller, Bionano Access Server and either a on premises Bionano Compute Server cluster or remote Bionano Compute On Demand.

Note: This document is intended to allow customer IT personnel to understand the architecture of the Saphyr system and its requirements for integration within their organization. Please contact Support@bionanogenomics.com prior to implementing steps within.

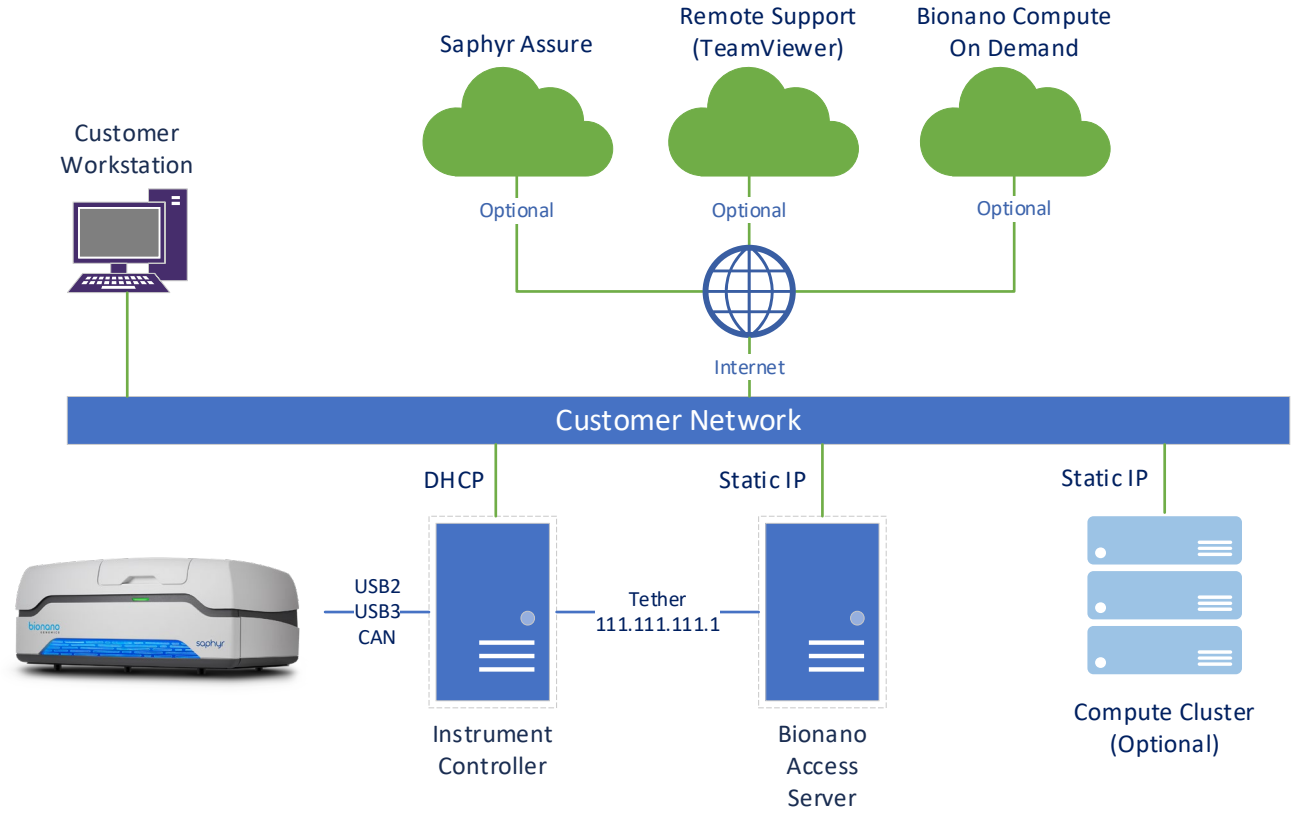


Figure 1 Saphyr System

References

See the document *Bionano Genomics Data Security Guidelines* (P/N 30292) for detailed information on Bionano Genomics' Saphyr System architecture, data handling and security policies.

See the document *Saphyr Site Preparation Guide* (P/N 30145) for physical space requirements.

IT Requirements

Laboratory Space

Needed are two(2) 1gb Data ports near the Saphyr system and Internet connectivity for:

- ICS Controller: DHCP
  - Remote Support
  - SaphyrAssure- Instrument Health/Run Support.
  - Software Upgrades
- Bionano Access Server: 1 Static IP assigned.
  - Compute on Demand, if applicable.
  - Software Upgrades

Data Center for Compute Server Solution

- Available rack space for 2U Server/s.
  - Saphyr Compute
  - Bionano Compute/s
- Network Switch.
- Networking Cabling
- Static IP assignments (configuration dependent)

Firewall Requirements

The Saphyr system requires access to the following ports and URLs to enable the Saphyr Assure, TeamViewer, Windows Update Services and connectivity between the ICS Controller, BAS, and Compute Server/s if applicable.

System	Service	Ports (outbound)	Required URL Access
ICS Controller	Saphyr Assure	TCP: 443 (SSL)	https://api.saphyrassure.com https://saphyrassure01.blob.core.windows.net https://us.bionanostratus.com:3000
ICS Controller	Windows Updates[1]	TCP: 443 TCP: 80	http://windowsupdate.microsoft.com http://*.windowsupdate.microsoft.com https://*.windowsupdate.microsoft.com http://*.update.microsoft.com https://*.update.microsoft.com http://*.windowsupdate.com http://download.windowsupdate.com https://download.microsoft.com http://*.download.windowsupdate.com http://wustat.windows.com

[1] https://docs.microsoft.com/en-us/windows-server/administration/windows-server-update-services/deploy/2-configure-wsus#211-connection-from-the-wsus-server-to-the-internet

			http://ntservicepack.microsoft.com http://go.microsoft.com http://dl.delivery.mp.microsoft.com https://dl.delivery.mp.microsoft.com
ICS Controller / Bionano Access Server	TeamViewer	*Primary:* TCP/UDP: Port 5938 *Secondary:* TCP: Port 443 TCP: Port 80	http://*.teamviewer.com https://*.teamviewer.com
Bionano Access Server / Compute Servers	Bionano Access	TCP: 3005 SSH: 22	http://<ipaddress>:3005 or https://<ipaddress>:3005*
Bionano Access Server	Bionano Compute On Demand	TCP: Port 3000 TCP: Port 3001 TCP: Port 3002	https://*.bionanostratus.com:3000 https://*bionanostratus.com:3001
		TCP: Port 443 TCP: port 587	https://*.rescale.com https://*.amazonaws.com

*Enabled using a valid SSL certificate

Saphyr Instrument Controller

Saphyr Instrument Controller Specification

The Instrument Controller is designed to be located adjacent to the Saphyr Instrument. The two systems are directly tethered for controlling the instrument and direct data transfer of image files. **NOTE**: The Saphyr Instrument Controller is a Windows Operating System that contains a series of embedded accounts, including SaphUser, which is the default account for User Instrument Operation. Do not modify the SaphUser windows account credentials.

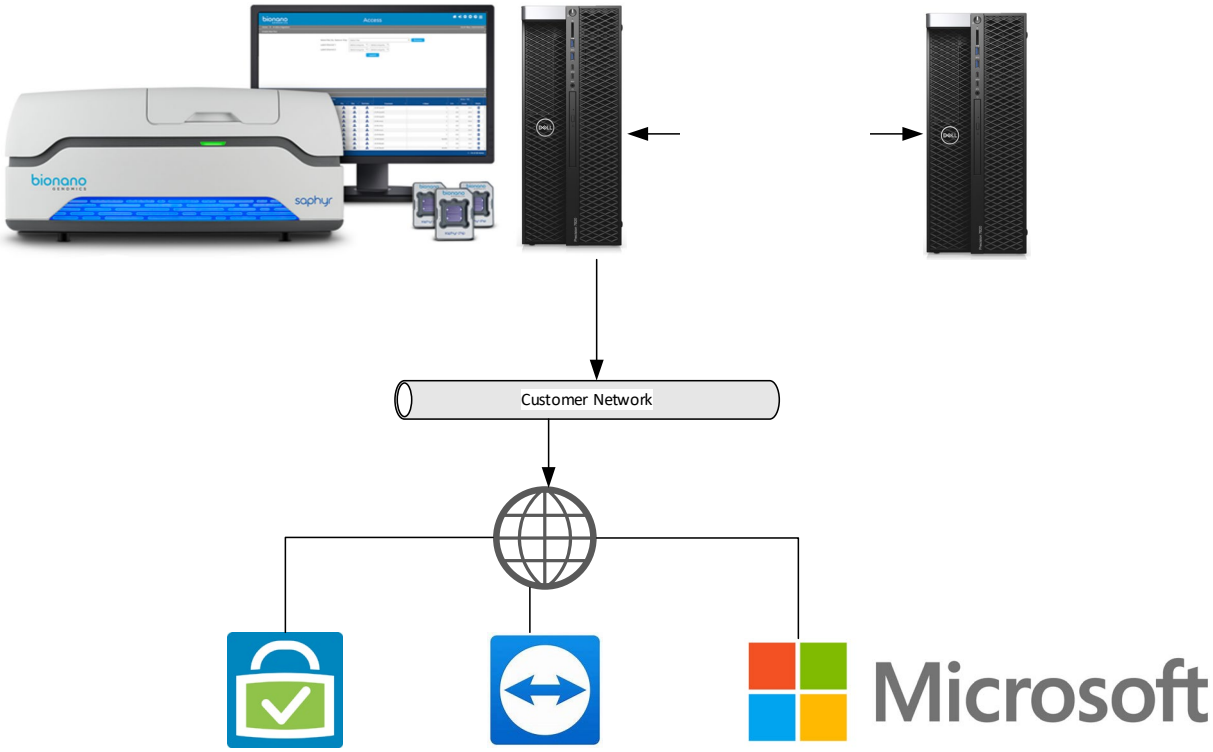
Type	Requirements/Specifications
Provided By	Bionano
Accessories	• Monitor • Keyboard • Mouse
Operating System	• Windows 10 IoT Enterprise LTSC 2019 1809 x64
Software	• Saphyr Instrument Controller Software (ICS) • TeamViewer (remote assistance, optional) • Microsoft Edge (not user accessible, service only)
Memory	• 32 GB RAM
Data Storage	• 8 TB (D drive) (x2) in RAID 1 • 256 GB (C drive)

Space	• Height: 46 cm (18 in) • Width: 18 cm (7 in) • Depth: 47 cm (18.5 in)
Power	• 100-240 VAC at 50-60 Hertz • Power Consumption ≤ 300 Watts • 2m long, IEC 60320-C13 power cord
Network	• 2 – 1 gigabit ethernets ports Port 1 (required): connected to the Bionano Access Server Port 2 (recommended): connected to customer network to provide connectivity to the Saphyr Assure service via the internet

Instrument Controller Network Connectivity Requirements

The Instrument Controller connectivity requirements are broken into two parts. The first is the required connection to the Bionano Access Server. The recommended connection is via a direct tether connection to eliminate the possibility of instrument downtime due to network issues. The system can optionally be connected via the customer's network though this is not preferred.

To maintain optimal performance, security, and reliability, it is strongly recommended that the Instrument Controller be connected to the customer network to provide access to the Saphyr Assure, TeamViewer and Windows update services. See the References section for links to more information about these services and the benefits that they provide.



Bionano Access Server

The Bionano Access Server (BAS), supplied with the Saphyr system, requires one customer-provided static IP address, and will come with two pre-configured static IP addresses (111.111.111.1, 222.222.222.2) for connection to Instrument Controller(s). Bionano Support personnel will configure the network for all Bionano systems during installation.

Bionano Access Server Specifications

Type	Requirements/Specifications
Provided By	Bionano
Software	• CentOS 7.x • Bionano Access • Bionano Tools • PostgresSQL • Nodejs • Perl • Python • R • Docker
Memory	128 GB RAM
Data Storage	40 TB with RAID Controller
Space	• Height: 46 cm (18 in) • Width: 18 cm (7 in)

	• Depth: 47 cm (18.5 in)
Power	• 100-240 VAC at 50-60 Hertz • Power Consumption ≤ 300 Watts • The server is shipped with a United States power cord. Users outside of the United States are required to supply a 2m long, country specific IEC 60320-C13 power cord (in some cases, the FSE may be able to provide the suitable power cord).
Network	• One port is connected to the Saphyr Instrument controller at 10 GB. • LAN connection can be done at 1 GB

BIONANO ACCESS PROXY SERVER COMPATIBILITY

Bionano Access is not compatible with proxy servers and should be excluded on all user workstations from proxy requirements. Proxy servers will often cache results and prevent dynamic pages, such as the dashboard, from updating properly.

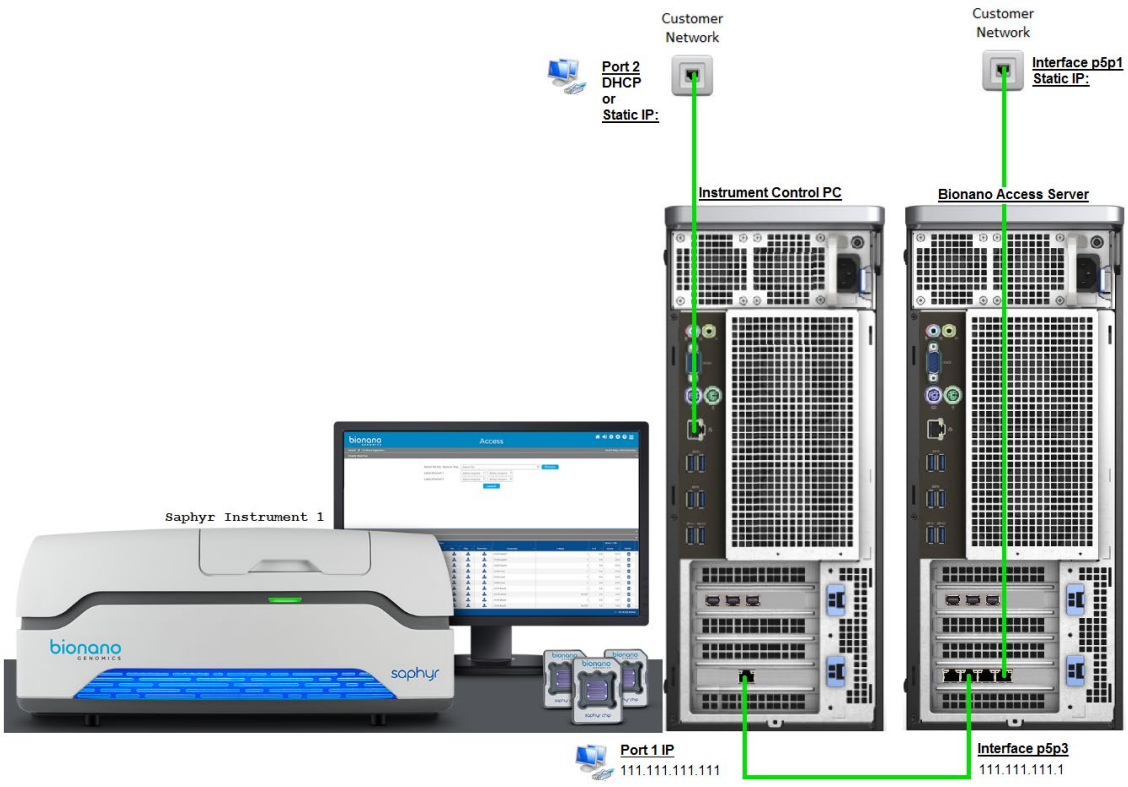
ICS Controller + BAS Setup and COD Activation Steps

Saphyr Instrument Controller and Bionano Access Server Cabling

NOTE: Bionano Support Personnel will perform cabling of the ICS Controller and BAS.

SINGLE SYSTEM

The Single System Configuration is comprised of one Saphyr instrument (left), Saphyr Instrument Controller (middle) and a Bionano Access Server (right). Actual physical placement may be modified to meet site specific needs; however, the units must be near each other. Network cables are connected according to the diagrams below.



Saphyr Instrument Controller NIC Card: Two ports, Adaptor 1, and Adaptor 2(ascending order, left to right)

Ethernet Adaptor 1: Tether to Bionano Access Server NIC Card p5p3

Ethernet Adaptor 2: Tether to Customer Network

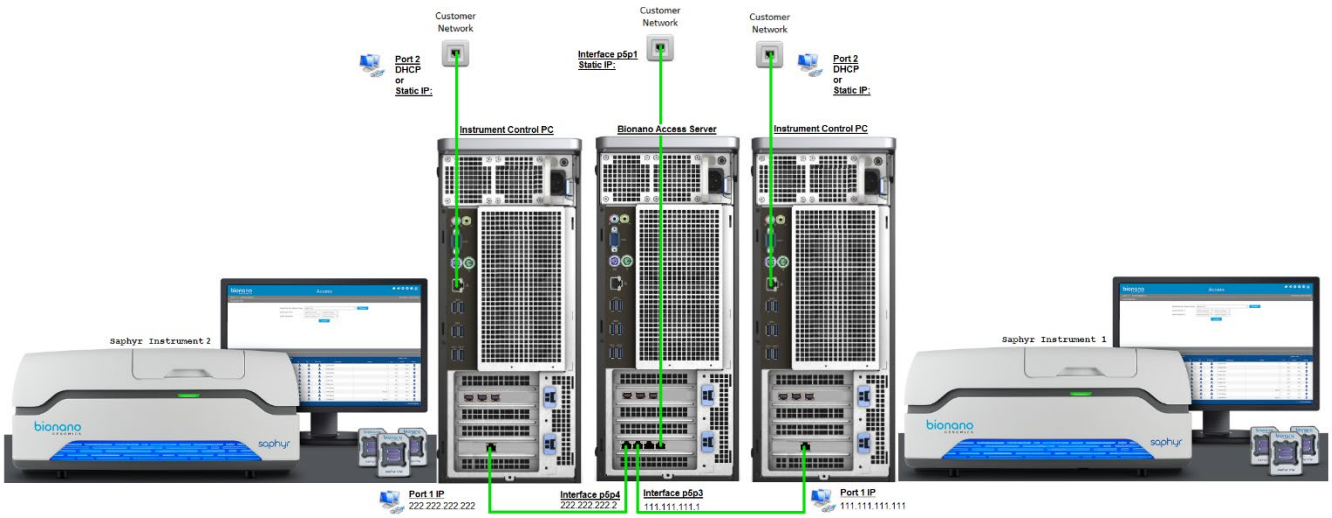
Bionano Access Server NIC Card: Four ports, p5p4 to p5p1 (descending order, left to right)

P5p3: Tether to Saphyr Instrument Controller (60368) NIC Card Adaptor 1

P5p1: To Customer Network

DUAL SYSTEM

The Dual System Configuration is an example of connecting two Saphyr Systems to a single Bionano Access Server. This Dual System Configuration illustration includes two Saphyrs, two Saphyr Instrument Controllers (60368) and one Bionano Access Server (middle).



Bionano Access Server NIC Card: Four ports, p5p4 to p5p1 (descending order, left to right)

P5p4: To Saphyr Instrument Controller 2 (60368) NIC Card Adaptor 1

P5p3: To Saphyr Instrument Controller 1 (60368) NIC Card Adaptor 1

P5p1: To Customer Network

Saphyr Instrument Controller 1 NIC Card: Two ports, Adaptor 1, and Adaptor 2 (ascending order, left to right)

Ethernet Adaptor 1: Tether to Bionano Access Server NIC Card p5p3

Ethernet Adaptor 2: To Customer Network

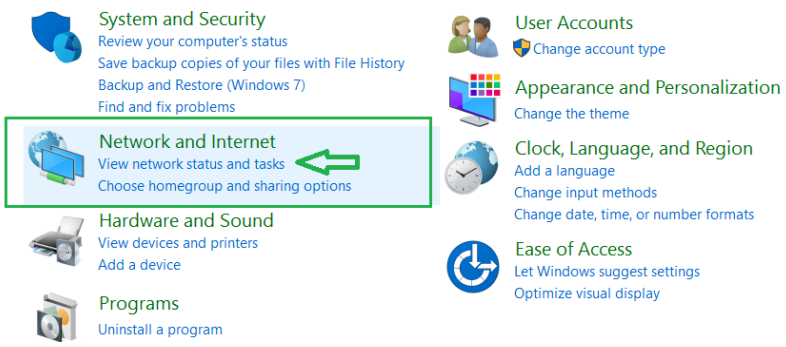
Saphyr Instrument Controller 2 NIC Card: Two ports, adaptor 1 and adaptor 2 (ascending order, left to right)

Ethernet Adaptor 1: Tether to Bionano Access Server NIC Card p5p4

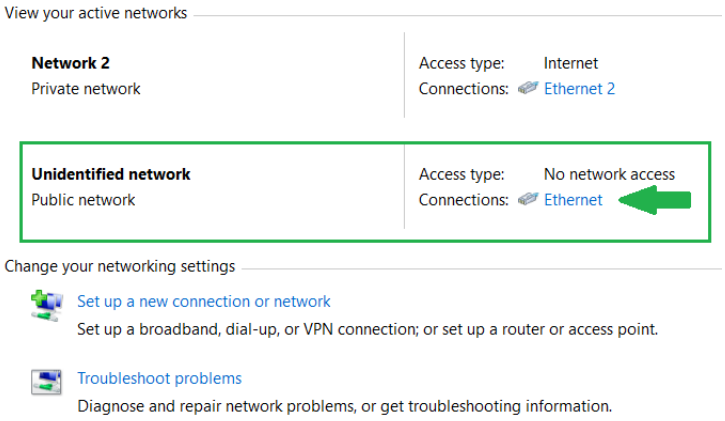
Ethernet Adaptor 2: To Customer Network

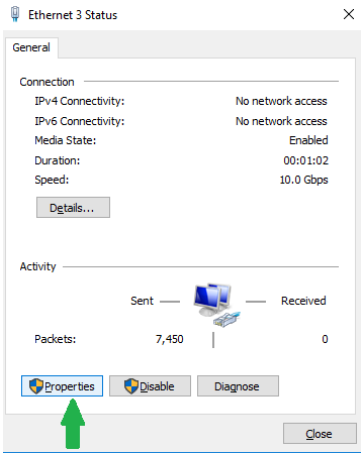
Saphyr Instrument Controller and Bionano Access Tethering

Configure ICS Controller to Bionano Access Server network. On the ICS PC desktop, navigate to **Control Panel** > **Network & Internet** and click **View network status and tasks**.

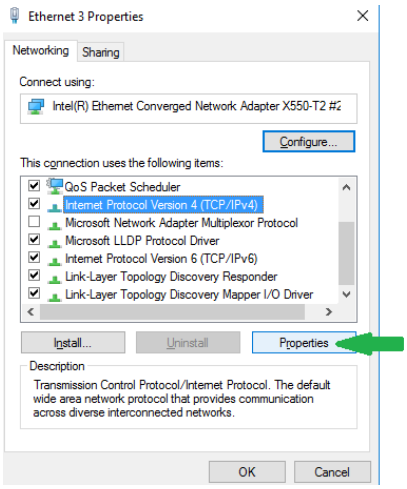


Select the BAS Ethernet Connection and click **Properties**. Disconnect the ICS Controller network cable from the wall to confirm correct BAS Network connection.

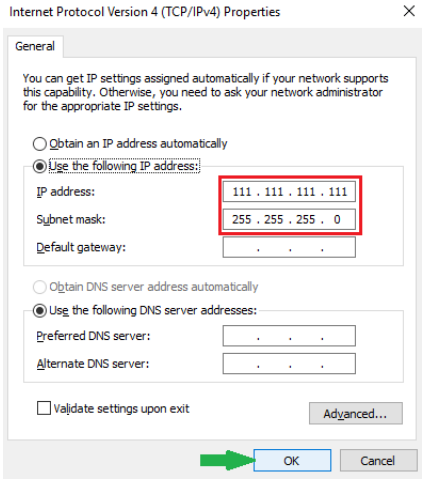




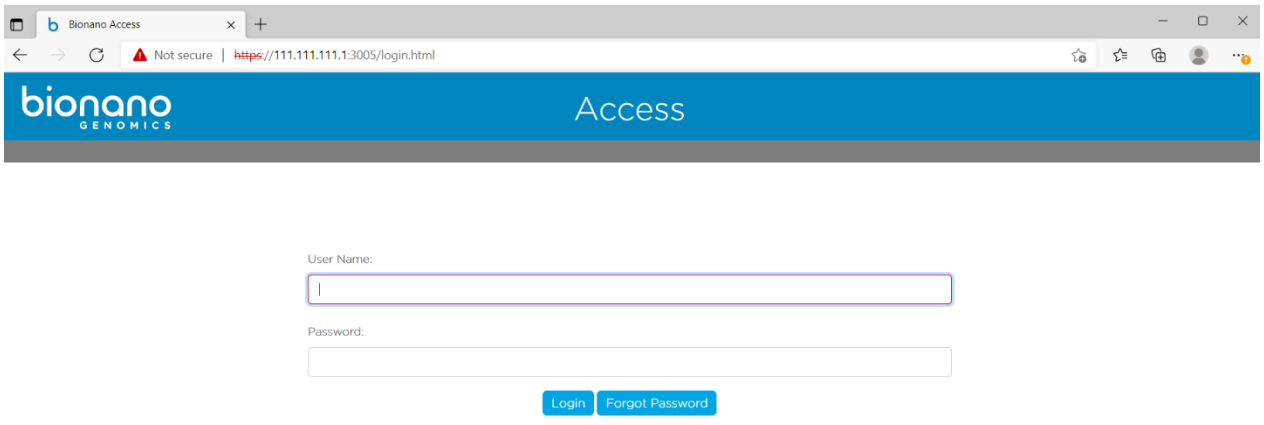
Select Internet Protocol Version 4(Ipv4) and click **Properties**.



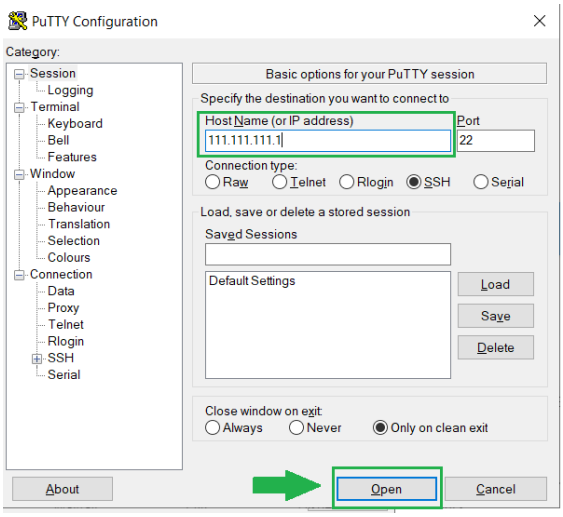
Input ICS PC IP address **111.111.111.111** and Subnet Mask **255.255.255.0**. Click **OK**.



Confirm ICS Controller to Bionano Access Server connectivity. Open a web browser and input **https://111.111.111.1:3005** to confirm that the Bionano Access page loads.



If not successful, open Putty by double clicking **Putty.exe** and login with BAS credentials to confirm Access connection. **NOTE**: Contact Support for BAS login credentials.



Enter the following command to ensure Access is running:

```
systemctl status access
```

```
bionano@access:~$ systemctl status access
● access.service - Access "Bionano Genomics" http://localhost:3005
   Loaded: loaded (/usr/lib/systemd/system/access.service; enabled; vendor prese
t: disabled)
   Active: active (running) since Wed 2021-11-17 10:37:48 PST; 2 months 16 days
ago
 Main PID: 89265 (StartAccess.sh)
    Tasks: 12
```

If not running, enter the following to start Access:

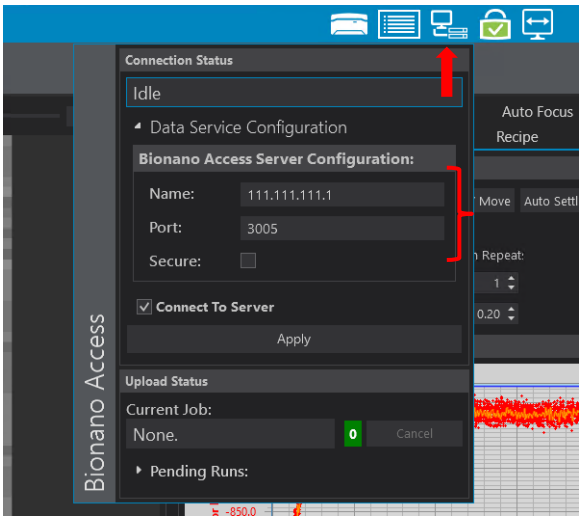
```
systemctl start access
```

Test the connection by repeating this step.

ICS Network Configuration Connection to BAS

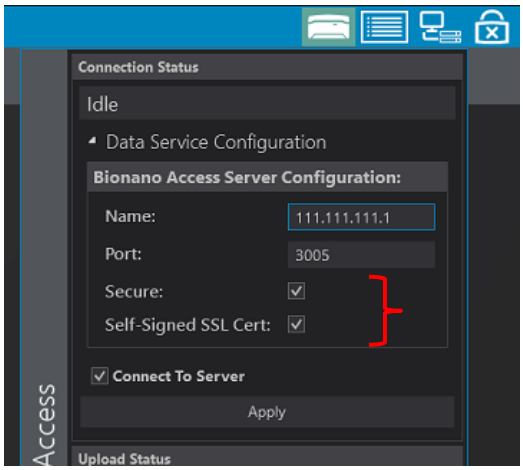
In Saphyr ICS, select the Bionano Access icon and input the Bionano Access configuration:

- Server Name: **111.111.111.1**
- Port: **3005**



Important! If Bionano Access has been configured for https (encrypted) traffic, check the **Secure** checkbox. If not, leave the secure checkbox unchecked.

If a customer does not have a verifiable certificate, check the box for **Self-Signed SSL Cert**. A Self-Signed SSL Certificate results in a warning when the customer logs into access. See *How to enable HTTP in Bionano Access* (P/N 30377) for additional guidance.



Click **Apply** to update any previously stored information or **Save Configuration** when connecting for the first time. A warning message should appear. The software will be restarted after the changes are applied. Do you want to continue? Click **Yes**. If ICS does not restart, restart ICS. **Note:** Runs can now be started in Standalone mode (no downstream analysis).

BAS Server Static IP Configuration

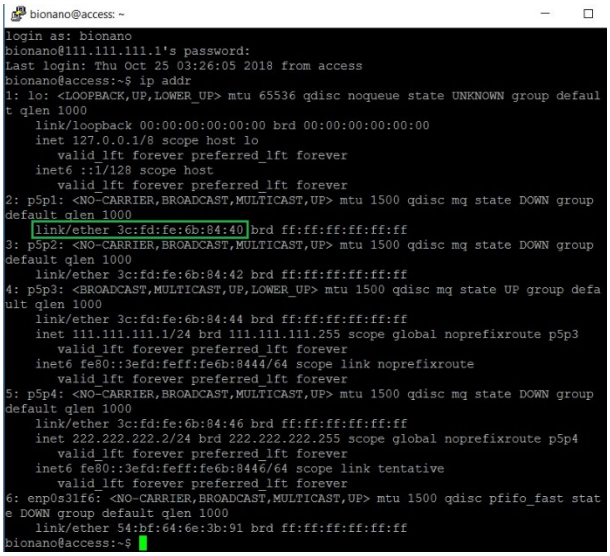
Below are the steps to obtain the Bionano Access Server p5p1 MAC address for static IP assignment.

1. Connect to the BAS terminal. This can be done by connecting a monitor and keyboard to the BAS system or connecting via Putty from the ICS Controller. **NOTE:** Contact Bionano Support for login steps, if needed.

2. Identify the Bionano Access Server MAC address.

3. Input the line command: `ip addr`

4. The following file will be displayed. The port pointing to the customer network will be listed under **p5p1** adapter. Provide the customer's IT Department with the p5p1 MAC address and request the **Static IP** assignment, **Netmask**, **Gateway,** and **DNS1/2** addressing.



5. Connect the Bionano Access Server to the customer Network.

6. Putty into the Bionano Access Server.

7. Edit the current ifcfg-p5p1 file with the following line command:

```
sudo nano /etc/sysconfig/network-scripts/ifcfg-p5p1
```

8. Change BOOTPROTO to "static" and input the customer provided Access static IP, Netmask/Gateway/DNS addresses. The file should look like the following:

```
# Generated by dracut initrd
NAME="p5p1"
DEVICE="p5p1"
ONBOOT=yes
NETBOOT=yes
UUID="cb151102-05fd-449b-90d7-251763951f17"
IPV6INIT=yes
BOOTPROTO=static
TYPE=Ethernet
IPADDR=xxx.xxx.xx.xxx
NETMASK=xxx.xxx.xxx.x
GATEWAY=xxx.xxx.xx.x
DNS1=xxx.xxx.xx.xx
DNS2=xxx.xxx.xx.xx
```

9. Save edits with **Ctrl X.** Select **Y** for yes and keyboard **Enter**.

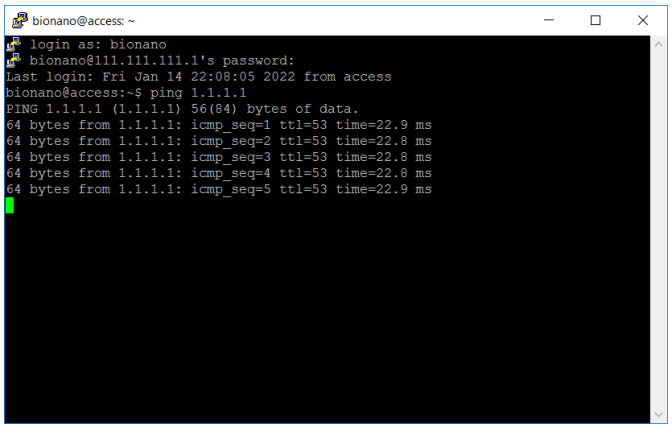
10. Any edits require a Network Service restart. Enter the following command:

```
systemctl restart network
```

11. Test BAS internet access. Enter the following command to ping Google.

```
ping 8.8.8.8
```

NOTE: If successfully networked, the Google server will be pinged continuously. If the server cannot be pinged, contact customer IT to ensure required ports are opened; see Saphyr System Firewall Requirements. Select **Cntrl + c** to stop pinging.



12. Confirm Access is running. Enter the following command:

```
systemctl status access
```

NOTE: If Access is not running, enter the following command to start Access:

```
systemctl start access
```

Connect Bionano Access Server to Compute on Demand

NOTE: Complete this step only if the customer is not utilizing the Saphyr Computer Server solution.

NOTE: The BAS will require internet access to connect to Compute on Demand (COD).

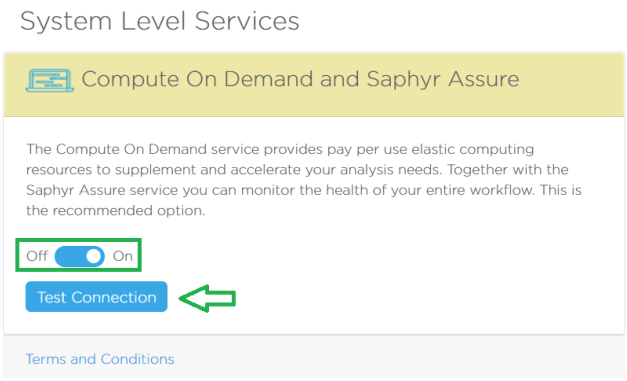
1. Open a web browser and connect to Access with the assigned static IP or tethered IP.

```
https//:xxx.xxx.xxx.xxx:3005 or https://111.111.111.1:3005
```

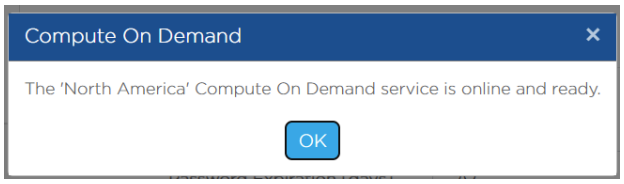
2. Log into Access with administrative rights.

3. Navigate to **Settings** > **System Settings**.

4. Toggle on COD and Assure (with customer's permission). Click **Test Connection**. **Note:** Newly registered systems will require the appropriate Region input.



5. Confirm connection status. **NOTE:** If COD is unable to connect, contact customer IT Dept to ensure required COD ports are open, see Firewall requirements.



Saphyr/Bionano Compute Server/s Cabling and Operation

The customer may adopt one of the following networking options if not utilizing a Compute on Demand solution.

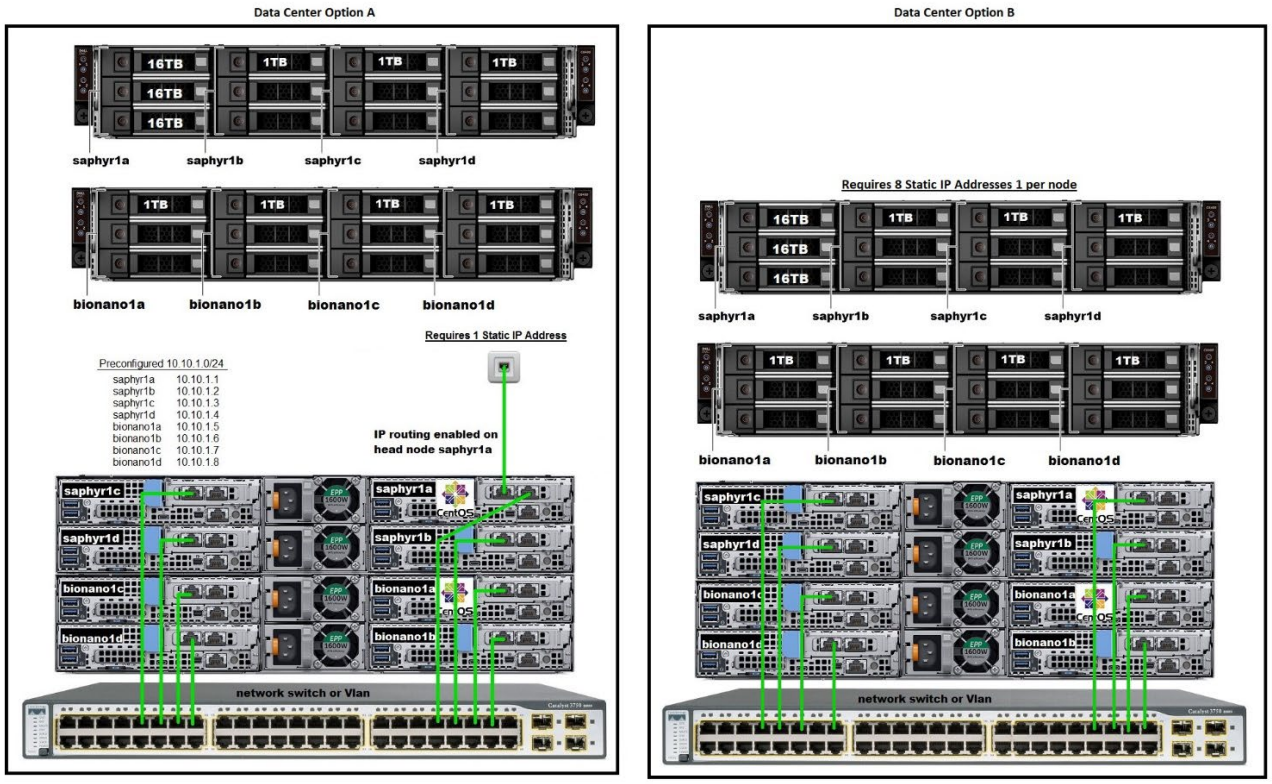


***Figure 2**. Compute Server Data Center Options*

INTRODUCTION OF DATA CENTER OPTION A

This default compute configuration requires **one static IP address** for the Saphyr1a Compute Node in the data center. The remaining compute nodes will be on a separate custom subnet. The Saphyr1a node will be dual homed. It will have one static IP accessible to the Bionano Access server and one IP address on the subnet with the other compute nodes. IP routing will be used on Saphyr1a to direct responses from the compute nodes back to the Bionano Access Server. The internal subnet addressing will come preconfigured as 10.10.1.0/24.

INTRODUCTION OF DATA CENTER OPTION B

This configuration requires one static IP address **per node** and the following must be provided by the customer:

- Network Switch
- Network Cabling
- The static IP addresses, netmask, gateway, and DNS for Compute Servers.

INTRODUCTION OF SAPHYR AND BIONANO COMPUTE SERVER(OPTIONAL)

The number of Compute servers required for installation will be determined based on customer compute requirements and environmental conditions. The Compute servers work together as a cluster to perform various bioinformatic operations including *de novo* assembly, variant annotation, and scaffolding. Each compute cluster must have at least one Saphyr Compute which serves as the head node with storage and the SGE master installed. Additional Bionano Computes are added to scale the cluster to fit specific demands. A single Bionano Access Server can be configured to interact with multiple Compute clusters if required.

Each Compute server has four nodes, each having two network ports and a separate iDRAC port for remote management.

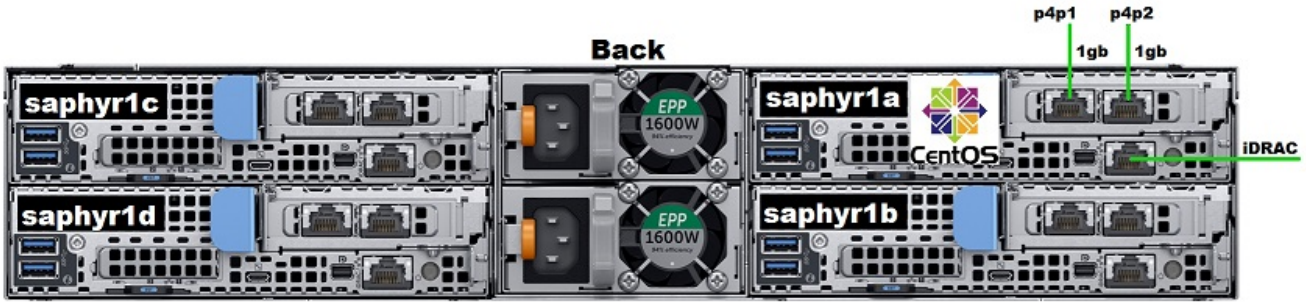


***Figure 3**. Saphyr Compute Ports (Similar for Bionano Compute)*

Type	Requirements/Specifications
Provided By	Bionano (additional purchase)
Software	• CentOS 7.x • Python • Perl • R • Sun Grid Engine (SGE) • Docker
Space	• 2U rackmount server (to be provided by customer)

	• Rails and cords supplied with server
Power	• Dual 2600 W Hot-plug Redundant Power Supplies (Recommended: APC Smart-UPS 3000VA LCD RM 2U UPS -rack mounted). • 2 6' IEC320-C19/C20 250V power cables. Users outside of the United States are required to supply two 2m long, country specific IEC 60320-C19/C20 power cords (in some cases, the FSE may be able to provide the suitable power cord).
Network	5 X 1 GB Ethernet connection

INTRODUCTION OF BIONANO COMPUTE SERVERS (OPTIONAL PURCHASE)

The recommended configuration includes one Bionano Compute Server. Customers must have at least one Saphyr Compute Server before adding any Bionano Compute systems. See Saphyr Compute Networking Options section for more details.

Type	Requirements/Specifications
Provided By	Bionano (additional purchase)
Software	• CentOS 7.x • Python • Perl • R • Sun Grid Engine (SGE)
Space	• 2U rackmount server (to be provided by customer) • Rails and cords supplied with server
Power	• Dual 2600 W Hot-plug Redundant Power Supplies (Recommended: APC Smart-UPS 3000VA LCD RM 2U UPS -rack mounted). • 2 6' IEC320-C19/C20 250V power cables. Users outside of the United States are required to supply two 2m long, country specific IEC 60320-C19/C20 power cords (in some cases, the FSE may be able to provide the suitable power cord).
Network	• 5 X 1 GB Ethernet connection

INTRODUCTION OF COMMANDS USED DURING COMPUTE SERVER INSTALLATION

Powering On: It is required that the Saphyr1A node be powered on before all other nodes. It should take about a minute to completely boot Saphyr1a after pressing the power button. Attach a monitor to Saphyr1a and ensure that the powerup was successful. Once Saphyr 1A is booted up, remaining nodes from Saphyr1b to Saphyr1d can be powered on.

Power Down: Login into each node in reverse order from power on sequence and input the following command:

```
sudo shutdown now
```

Restarting Nodes: Enter the following command line:

```
sudo reboot
```

Hard Reset on Server: Depress power button for five seconds.

Compute Server Configuration

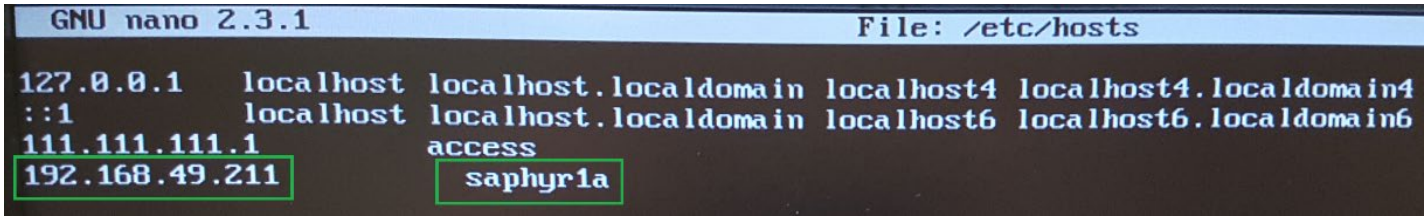
Connect Bionano Access Server to Saphyr/Bionano Compute Servers

Update the BAS host file to contain the assigned Static IP for Saphyr Compute Saphyr1A, then Putty into the Bionano Access Server.

1. Enter the following line command to edit Bionano Access Server Hosts.

```
sudo nano /etc/hosts
```

2. Edit to include Saphyr1A static IP. Enter "**xxx.xxx.xxx.xxx saphyr1a**".



3. **Ctrl x** to save. **Y** for yes and **Enter**.

Saphyr Compute Server Configuration Steps

OPTION A CONFIGURATION

1. Configure Saphyr1A p4p1 port settings.
2. Attach a monitor to the MiniDP port, and the keyboard/mouse to usb ports on the rear of Saphyr1A.
3. Log into Saphyr1A, input login/PW. **NOTE:** Contact Support for login credentials, if needed.
4. Enter the following command to identify the MAC address of p4p1.

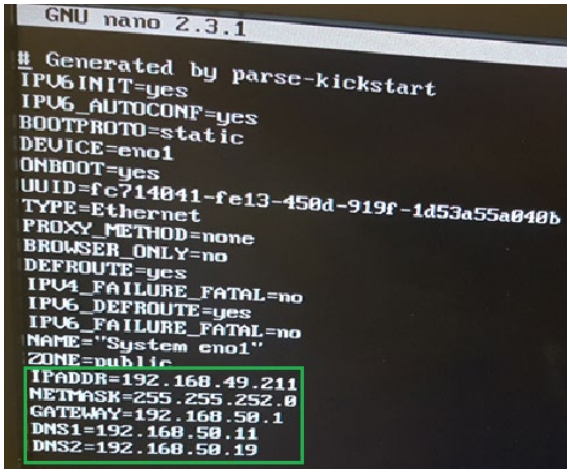
```
ip addr
```

5. Enter the following command:

```
cd /etc/sysconfig/network-scripts
```

6. Enter "`ls -l`" to locate the ifcfg-p4p1 file.
7. Add the Saphyr static IP, Netmask/Gateway, and DNS IPs. Edit the ifcfg-p4p1 file with the following command:

```
sudo nano ifcfg-p4p1
```



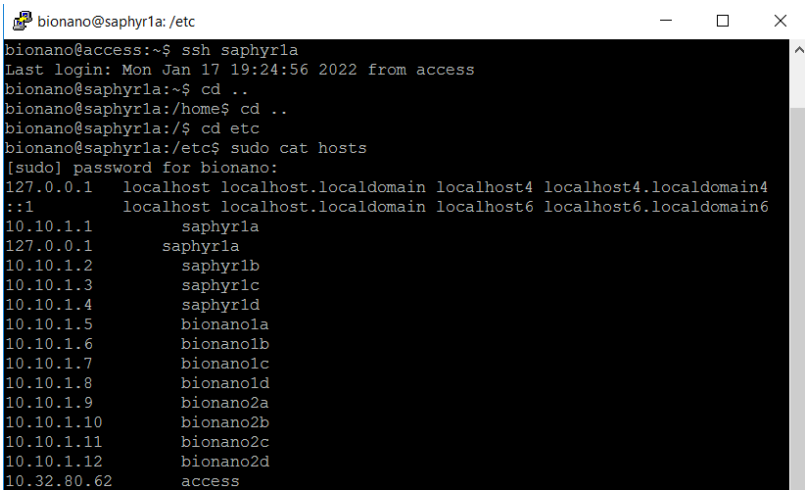
8. Cntl x to save. Y for yes and Enter. Restart the network with the following command:

```
sudo systemctl restart network
```

9. Edit the Saphyr1a Host file with the following command:

```
sudo nano /etc/hosts
```

10. Add the assigned Bionano Access Server static IP to the Saphy1a Host file. **Important:** Only add Bionano Access Server static IP. **NOTE:** The file should look like the image below. Option A will display preconfigured addressing: 10.10.1.1 to 10.10.1.4 (single Saphyr Compute) – 10.10.1.12(two Bionano Computes).



11. **Cntl x** to save. **Y** for yes and **Enter**. Once the Host file is updated and saved, perform a network restart with the command:

```
systemctl restart network
```

12. Add the Bionano Access Server assigned Static IP to all remaining nodes.

13. Proceed to Section 3. Verify SGE.

OPTION B CONFIGURATION

1. Perform all steps within the section for Option A Configuration. **NOTE**: Once Option A steps are completed, the FSE can access the Compute server/s from the Bionano Access Server, mitigating the need to stand in front of the server rack to complete setups if the nodes are properly cabled.

2. From the Saphyr Controller, open Putty, and log into BAS with Bionano login credentials.

3. SSH to Saphyr1a with the line command:

```
ssh saphyr1a
```

4. SSH to Saphyr1b:

```
ssh saphyr1b
```

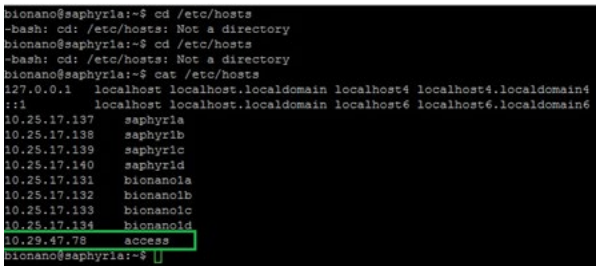
5. Navigate to the **etc** folder.

```
cd /etc
```

6. Edit Hosts files and modify all IPs to their assigned addresses. Enter the command:

```
sudo nano /etc/hosts
```

7. Input all nodes and BAS **Static IPs** provided by customer IT Dept.



8. Exit and save with the following command, then enter Y.

```
ctrl x
```

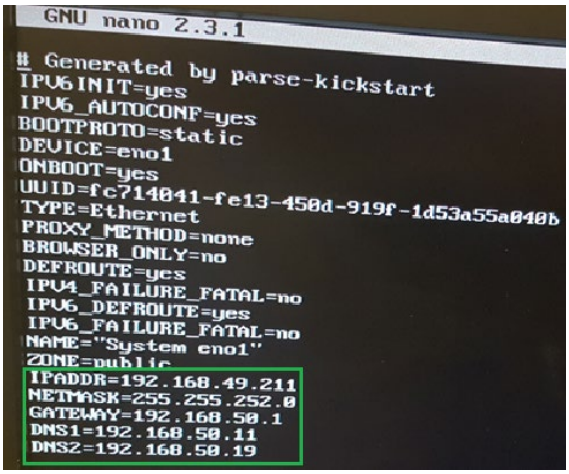
9. Enter the following command.

```
cd /etc/sysconfig/network-scripts
```

10. Enter "`ls -l`" to locate the ifcfg-p4p1 file.

11. Add the Saphyr static IP, **Netmask**, **Gateway**, and **DNS** addresses. Enter the command below then modify the IP as needed.

```
sudo nano ifcfg-p4p1
```



12. Enter the command below. **Note:** the connection will be interrupted.

```
sudo reboot
```

13. After rebooting, the user should be redirected to Saphyr1A.

14. SSH to remaining nodes and perform steps 5 – 13. For example: ssh saphyr1c, ssh saphyr1d, ssh bionano1a, ssh bionano1b, etc.

15. Edit saphyr1a Hosts file. From saphyr1a, edit saphyr1a Host file.

16. Enter the following command and input all the Node Static IPs provided by customer IT Dept.
```
sudo nano /etc/hosts
```

17. Exit and save with **ctrl x**. Enter **Y**.

SGE

Perform this section for both Option A and Option B configurations.

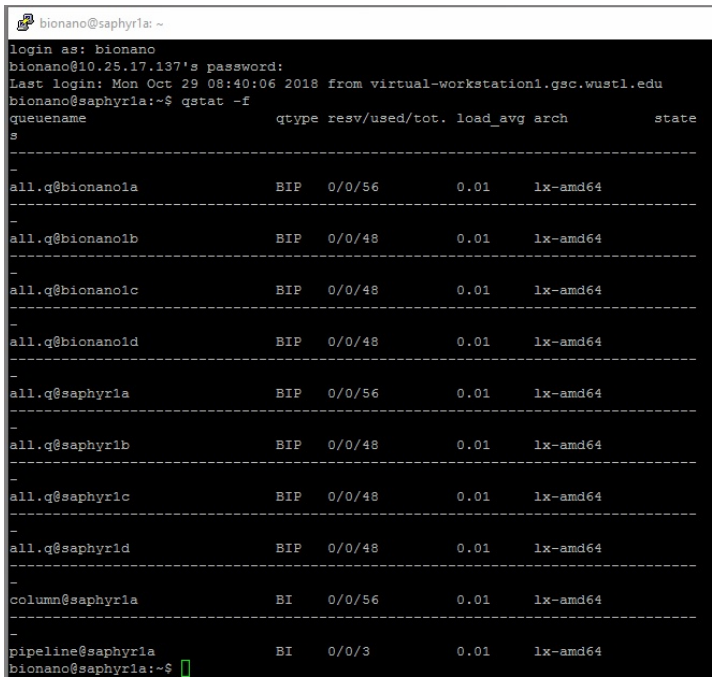
VERIFY SGE

1. Putty into Bionano Access Server.

2. SSH into Saphyr1A, enter line command:

```
qstat -f
```

The file will list the status of all the connected nodes. Ensure the nodes do not list “NA” under the **state** column; if so, there may be a cabling error or no power.



3. To setup/verify RSA keys,connect to the Bionano Access Server terminal.
4. Copy the saphyr1a RSA key by entering the following command:

```
ssh-copy-id saphyr1a
```

5. Verify keyless SSH to the Saphyr1a node IP address. Enter command:

```
ssh saphyr1a
```

NOTE: If a password prompt displays please contact Bionano Technical Support.

6. Enter "`exit`" to return to Access.

Configure Bionano Access Server access.txt file

Note: This is not required for Compute on Demand. It is required for Options A and B.

1. Edit access.txt. by opening Putty and connecting to the Bionano Access Server.
2. Edit the Access.txt file with the following command:

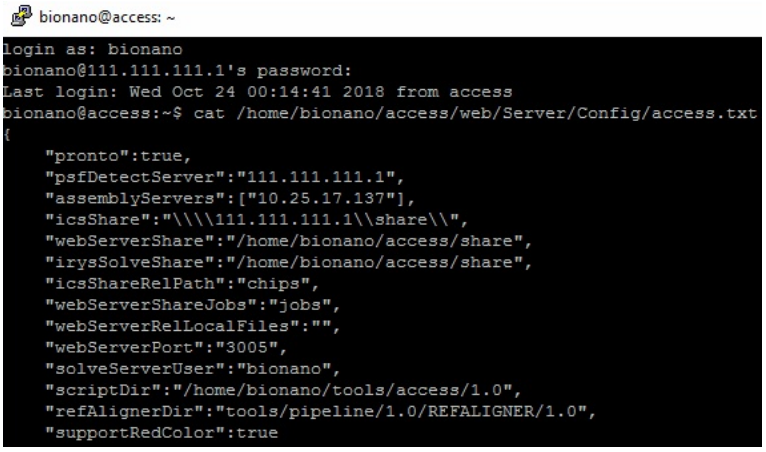
```
sudo nano /home/bionano/access/web/Server/Config/access.txt
```

3. Verify the following in the file:

- assemblyServers includes the IP address for Saphyr1a.
- icsShare reflects the static IP for the Bionano Access Server.
- irysSolveListenIP reflects the customer static IP for the Bionano Access Server.

```
"psfDetectServer":"111.111.111.1",
"assemblyServers": ["xxx.xxx.xx.xx"], *Add Saphyr1A Static IP
"icsShare":"\\\\111.111.111.1\\share",
"webServerShare":"/home/bionano/access/share",
"irysSolveShare":"/home/bionano/access/share",
"irysSolveListenIP":"xxx.xxx.xx.xx", *Add Access Static IP
"icsShareRelPath":"chips",
"webServerShareJobs":"jobs",
"webServerRelLocalFiles":"",
"webServerPort":"3005",
"solveServerUser":"bionano",
"scriptDir":"/home/bionano/tools/access/1.0",
"refAlignerDir":"tools/pipeline/1.0/REFALIGNER/1.0",
"pronto": true
```

The file should look like the image below.



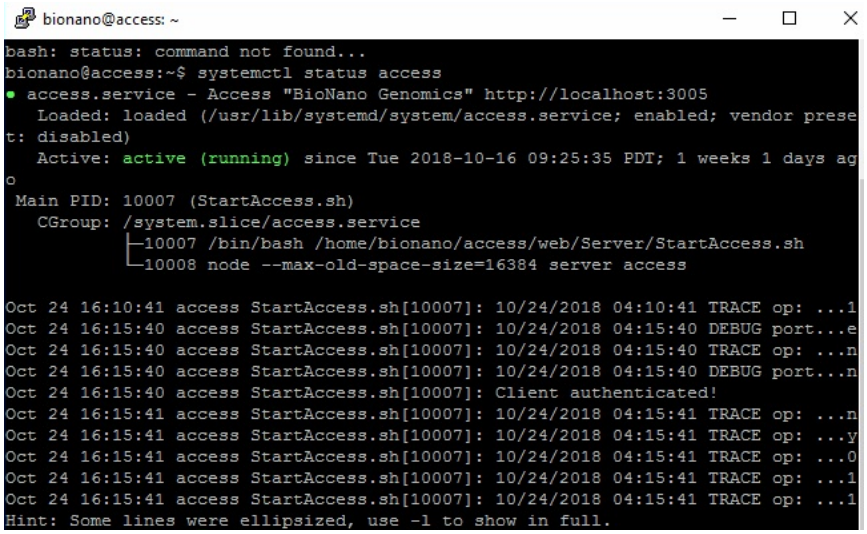
4. **Ctrl x** to save. **Y** for yes and **Enter**.
5. Restart Access with the following command:

```
sudo systemctl restart access
```

6. Check Access Status to ensure it is running with no errors. Enter the following command:

```
systemctl status access
```

The file should look like the image below.



7. Exit Putty.

Create BAS sudo User Login Account

NOTE: This is an account having sudo/root privileges that can be shared with the customer. Never share Bionano credentials with customers.

1. Putty into the BAS with Bionano login credentials.
2. Create a username login that is unique to the user's specific institution. Input line command:

```
sudo useradd username
```

3. Create the user password. Input line command:

```
sudo passwd username
```

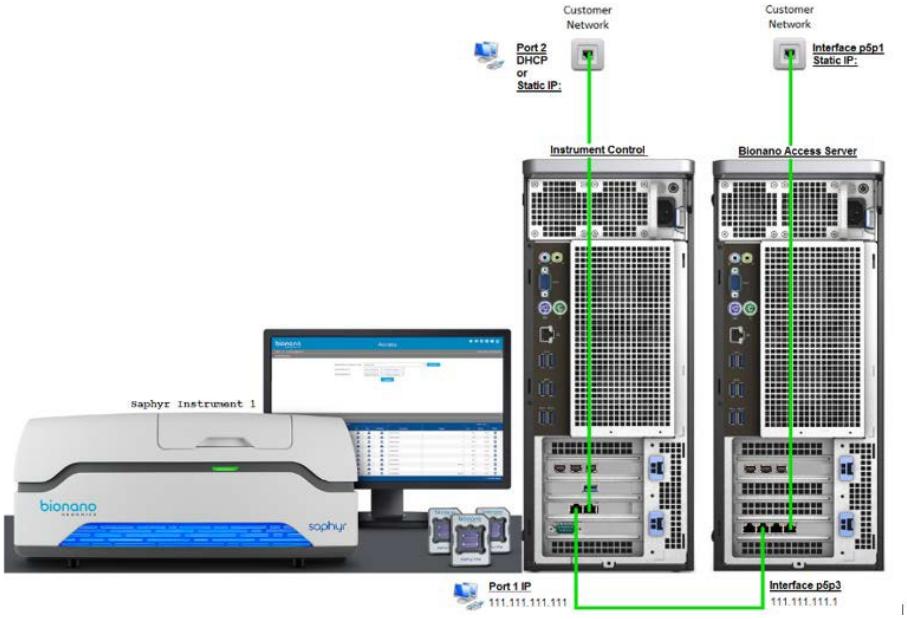
NOTE: Chose a password preferred by the customer. One will be prompted to type the new password twice.

4. Input line command:

```
sudo usermod -a -G wheel username
```

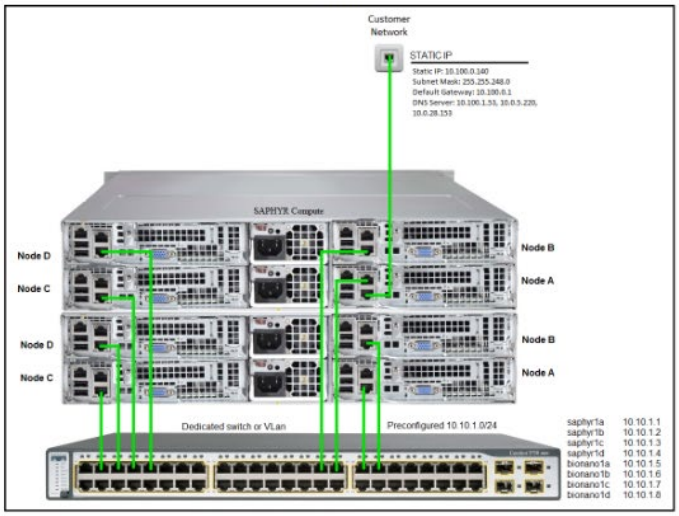
Appendix A - Legacy Saphyr Compute Options

Below is the configuration for Dell with two port network cards.

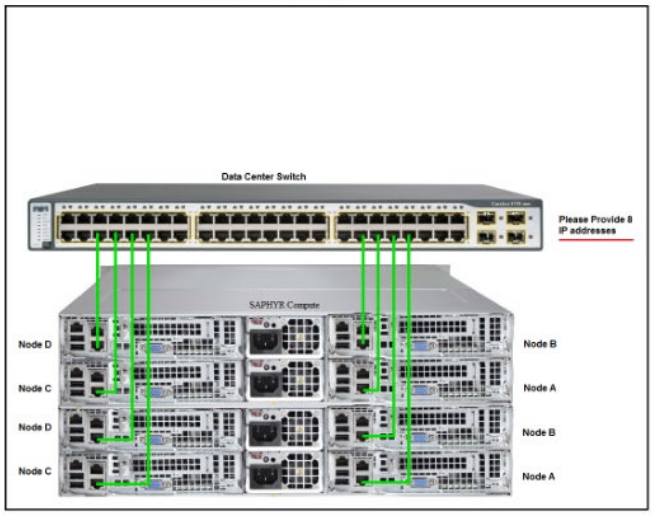


Below are the configuration options for the supermicro platform.

Data Center Option A

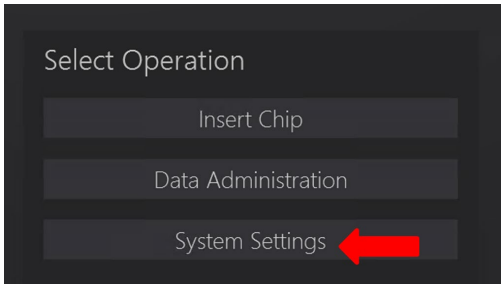


Data Center Option B

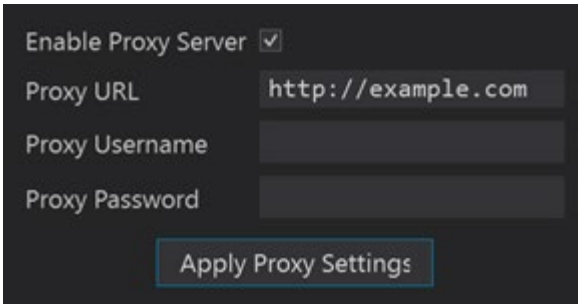


Appendix B- Customer Network Connection Configuration

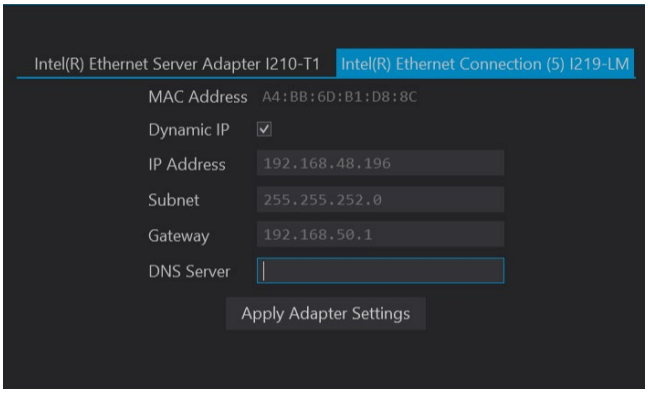
1. Log in to Saphyr ICS using the SysAdmin credentials.
2. In Saphyr ICS Main Menu, select System Settings.



3. If a proxy server is required to connect to the customer network, check Enable Proxy Server, provide the full proxy URL (and optionally, the proxy credentials) and click Apply Proxy Settings. HTTPS proxy URLs are not supported. **NOTE:** There must be a tethered connection between the Instrument Controller and the Bionano Access Server when using a proxy server. Connecting to the Bionano Access Server through a proxy server is not supported.



4. Select the Ethernet Server Adapter tab. **NOTE:** The ethernet port will only show up if there is an active connection on the port. Ensure the Instrument Controller is connected to the customer network.

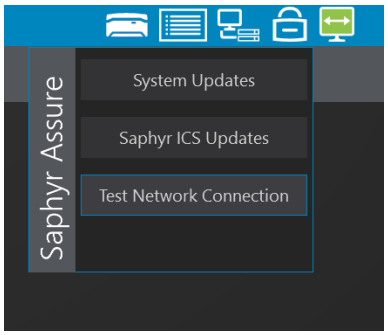


5. The I219-LM connection is used to connect to the customer network. This port is located on the motherboard and can be configured for static IP or DHCP. The MAC Address is available on this screen.

Enter the correct network settings and click Apply Adapter Settings. **NOTE:** The I210-T1 connection is used for the direct tethered connection to the Bionano Access Server and will have been configured by Bionano support personnel during installation.

Appendix C- Verifying Firewall Configuration for Saphyr ICS

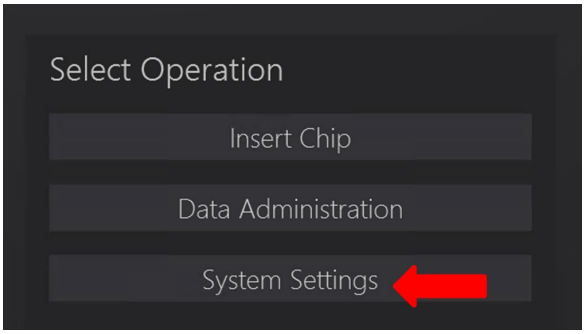
1. Log in to Saphyr ICS using the SysAdmin credentials.
2. Select the lock icon in the top toolbar to display the Saphyr Assure dropdown and select the **Test Network Connection** button. The network test can result in several possible messages.

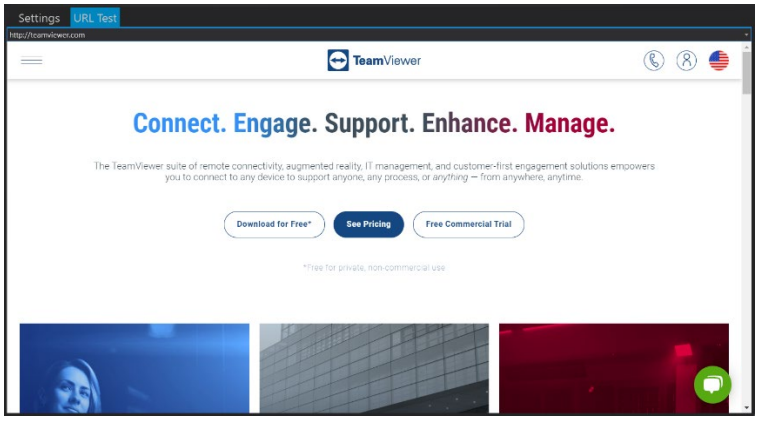


No network problems detected.	Success
Ethernet connection failed.	No physical ethernet cable network connection
Bionano Access connection failed.	Could not reach Access server (<ipaddress>:3005)
Saphyr Assure connection failed.	Could not reach api.saphyrassure.com
Saphyr Assure storage connection failed.	Could not reach blob.core.windows.net
TeamViewer connection failed.	Could not reach teamviewer.com
Windows Update connection failed.	Could not reach microsoft.com

3. This step is applicable only to Saphyr ICS version 5.2 and higher.

   If the network test was successful but Saphyr ICS connections still aren't functional, an internal DNS server may be interfering. To test this, in the Saphyr ICS Main Menu, select **System Settings**, then select the **URL Test** tab. Select a URL and verify that the embedded web browser does not show an internal DNS page (some URLs will display a blank page, and this is expected).





Technical Assistance

For technical assistance, contact Bionano Genomics Technical Support.

You can retrieve documentation on Bionano products, SDS's, certificates of analysis, frequently asked questions, and other related documents from the Support website or by request through e-mail and telephone.

TYPE	CONTACT
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Website	www.bionanogenomics.com/support
Address	Bionano Genomics, Inc. 9540 Towne Centre Drive, Suite 100 San Diego, CA 92121