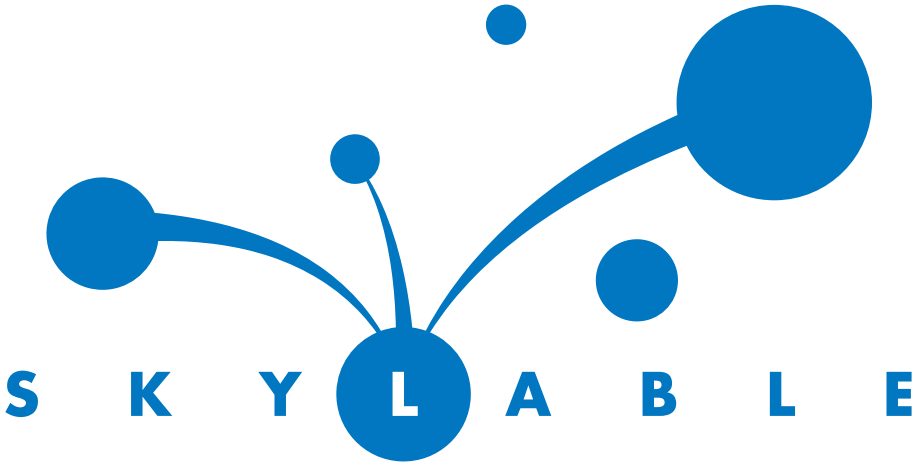

S^X Manual

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CHAPTER 1

INTRODUCTION

Welcome to Skylable S^X,...

USEFUL LINKS

- `http://cdn.skylable.com/packages/`
- `http://lists.skylable.com`
- `https://bugzilla.skylable.com`
- `http://wiki.skylable.com`

CHAPTER 2

INSTALLATION

REQUIREMENTS

Skylable S^X is tested on all popular UNIX platforms, including Linux, FreeBSD, and Mac OS X. We try to support as many platforms as possible, if you have troubles installing, compiling or running our software on your platform please open a bug report.

The latest binary packages are available at:

`http://cdn.skylable.com/packages/`

In order to compile S^X from source, you will need the following packages to be installed together with their development versions:

- OpenSSL/NSS
- libcurl >= 7.34.0 (otherwise the embedded one will be used)
- zlib

For example, on Debian run:

```
# apt-get install libssl-dev libcurl4-openssl-dev libz-dev
```

COMPILATION

The software is based on autoconf, so just follow the standard installation procedure. In this guide we will install S^X into `/opt/sx`.

```
$ ./configure --prefix=/opt/sx && make
# make install
```

CHAPTER 3

CLUSTER DEPLOYMENT

3.1 REQUIREMENTS

SX by default operates on the port 443 or 80, which needs to be available on a given IP address[1]. You can build just a single-node SX cluster, however for data safety reasons it is recommended to create at least two nodes and use replica higher than 1. You can add more nodes to the cluster at any time.

3.2 CREATING THE FIRST NODE

Setting up the first node initializes the cluster and makes SX ready to use. The `sxsetup` tool presented below performs an automated configuration of the SX server, which includes creating a local data storage, SSL certificate, and default admin account. You will only need to answer a few basic questions!

In the example we assume the IP address of the first node is **192.168.1.101**, the name of the cluster is **mycluster**, and SX was installed into `/opt/sx`. Also in some cases (eg. the path to SX storage) we assume default values, however your mileage may vary.

```
# /opt/sx/sbin/sxsetup
--- SKYLABLE SX CONFIGURATION SCRIPT ---

The script will help you to create or extend a Skylable SX data
cluster.

--- CLUSTER NAME ---

Clients will access your cluster using a sx://clustername/volume/path
URI. It is recommended to use a FQDN for clustername, but not
required. Refer to the documentation for more info.
Enter the cluster name (use the same across all nodes) []: mycluster

--- DATA STORAGE ---

Please provide the location where all incoming data will be stored.
Path to SX storage [default=/opt/sx/var/lib/sxserver]: <confirm default>

Please specify the maximum size of the storage for this node. You can
```

[1] You can choose a custom port when running sxsetup with in advanced mode

```
use M, G and T suffixes, eg. 100T for 100 terabytes.
Maximum size [default=1T]: 500G

--- NETWORKING ---

Enable SSL? (use the same setting for all nodes in the cluster) (Y/n)
<confirm default>
Enter the IP address of this node [default=192.168.1.101]: <confirm default>
Checking port 443 on 192.168.1.101 ... OK

--- CLUSTER CONFIGURATION ---

Is this (192.168.1.101) the first node of a new cluster? (Y/n)
<confirm default>

--- SSL CONFIGURATION ---

Generating default SSL certificate and keys in
/opt/sx/etc/ssl/private/sxkey.pem /opt/sx/etc/ssl/certs/sxcert.pem
Generating a 2048 bit RSA private key
..............................+++
.........................................+++
writing new private key to '/opt/sx/etc/ssl/private/sxkey.pem'

--- YOUR CHOICES ---

Cluster: sx://mycluster
Node: 192.168.1.101
Use SSL: yes
Storage: /opt/sx/var/lib/sxserver
Run as user: nobody

Is this correct? (Y/n) <confirm default>

--- CLUSTER INITIALIZATION ---

+ /opt/sx/sbin/sxadm node --new --batch-mode --owner=nobody:nogroup /opt/sx/
    var/lib/sxserver/data
[runas]: Switched to nobody:nogroup (65534:65534)
+ /opt/sx/sbin/sxadm cluster --new --port=443 --batch-mode --node-dir=/opt/
    sx/var/lib/sxserver/data --ssl-ca-file=/opt/sx/etc/ssl/certs/sxcert.pem
     500G/192.168.1.101 sx://mycluster
Starting SX.fcgi
Starting sxhttpd
HashFS Version: SX-Storage 1.5
Cluster UUID: 01dca714-8cc9-4e26-960e-daf04892b1e2
Cluster authentication: CLUSTER/ALLNODE/ROOT/
    USERwBdjfz3tKcnTF2ouWIkTipreYuYjAAA
Admin key: 0DPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5y0SOi3IMawAA
Internal cluster protocol: SECURE
Used disk space: 17568768
Actual data size: 463872
List of nodes:
         * ec4d9d63-9fa3-4d45-838d-3e521f124ed3 192.168.1.101
             (192.168.1.101) 536870912000

--- CONFIGURATION SUMMARY ---

SSL private key (/opt/sx/etc/ssl/private/sxkey.pem):
-----BEGIN PRIVATE KEY-----
MIIEvAIBADANBgkqhkiG9w0BAQEFAASCBKYwggSiAgEAAoIBAQCYNdtHyNglHZQ8
vaO1HJWtZ/eerB2H8OXyQTZpDFRS87qGUNcrRudDN09EypcueXaW1UN/3L8KKn7t
tGhLe6quG8QuKw//UiJDDGTDEICOndtYfBhO7zNR9zgaQRi9loqQB6Iqfe4K/T9F
EONMjVji1OF5JI/3SgxEDwoQ4+1eghDuMGME1zJ4VJCojXhiEtvwo1ZruFX+Xogd
rq4Ys6Pch7n9FowdOc2n+IRxPXKb6CqnHC1t9AKEBmbaoP+OzhM8ZFCl3WFRChvb
JF8T9ZZ5q3nol668NILNN1f4RRe07+pb9ubfWqNABhuI5hQUnG81wKjcIzjWK4HZ
+3bMwg6PAgMBAAECggEAQ+fTGmV6OKTHm4mnXYeRJzm4+SskSaC41elOEvOTMybV
UlMCi6YoSo6EaNZROESsKYKfiI29FRX8ZqQT24kijmaIOWgYzPmhm3QOCBB2qim2
```

```
z/UdHB4TMUAv4ValaP+edb9SE872wiRVc8SjA2YT/66loNw09kgszLhA72QgZAbG
xmxVwCNTRFd7dg4Wmy1OQz3YVOnlC3Qs8C8LoGoO0Mci85quhBUw9s7J12skXGbu
ZGDtpJylgwtfc1q7nojaFkWenGCA9D1HB8zCqKPkhMh+HtA26g8VdFaHPVBzw/pz
avv5r9gLnBETwHfM3XuIYv7h3wowE5uAKVhgvL8w0QKBgQDJs2avbYOwgcEEOf7L
nPRqmb5XjJE329KsyIzo4YwOrZDjQXSYrBjifoBIJzUReDDB7ww5lt0Xy3MExeS4
ngLO/oWotjd7jGU+EdABozKwW3bZuyUTSqTeQJwo+aIhjNtiyMrnpFy3vjYrJKGy
W/9cnv1WjqxpqnQgDjE/yJt36wKBgQDBL7p7iCWjIf+LH1/caFgPchJENd4YZZrB
bhGA/tuo6VtJcarc/Etx3DGbKhnJq13LxRRLjyHlPhw/k7oZBdaVK27I+vNfw5Lj
c2KZCYbFnF3kbP5ryuMW0QqGbkZZ/FExzwgFyAOUuCTw9L2VmKtPgbP9ywDTJc0Z
Jq/pdzOe7QKBgFOpxn4dvvIH4DgQ1k9+2yMcgoduFw5EcC6bQVeXtrCf7elVzTdG
q0vHjQ5gtPJ6GD9ZGIkKusqT6TGhpC2v3SoiKO7CJmFo6tXELbOALhZY2gOWTNqj
q59EzYFxin7AHn/rKb7Lvmm4zF844plI77NLf2nX5EwwF9r0CBmc7F/hAoGAUctH
ha4rYVqvu9PY3pU/U6rUmRTFqEa8s1FLD/bYQjgrcnkyAsa/msHELxIwQPbRi8kx
wpwjmdAmXbTKgnW6WQY+rdGy4cUImEzuXiVubpS6HFEZl8IbTDnN3wUpvEfciN5D
YO9AVONyoKK+8mvlfJBKCRa+jqfeotuCd7MEpDECgYAhWcDt6aXSsUOtq+jgVNtC
oi9Cnm4FNW7Z/VVgCCRFIwHxpqqAau63/naSGxkLUlK+UOStReiLC2D4FPrqs9Jh
scUH9hTIp3hxwznZBRFkuvUOm3h6CwQ0t3km7AffLRsGQZ9EMlvNb4T5mR/Izgxy
smcEPJfJgX61fx7c//bU6Q==
-----END PRIVATE KEY-----

SSL certificate (/opt/sx/etc/ssl/certs/sxcert.pem):
-----BEGIN CERTIFICATE-----
MIIDpzCCAo+gAwIBAgIJAODcwxKZHi35MA0GCSqGSIb3DQEBCwUAMDsxCzAJBgNV
BAYTAkdCMQswCQYDVQQIEwJVSzELMAkGA1UEChMCU1gxEjAQBgNVBAMTCW15Y2x1
c3RlcjAeFw0xNDAzMjExNDU2NTdaFw0xOTAzMjAxNDU2NTdaMDsxCzAJBgNVBAYT
AkdCMQswCQYDVQQIEwJVSzELMAkGA1UEChMCU1gxEjAQBgNVBAMTCW15Y2x1c3Rl
cjCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJg120fI2CUdlDy9o7Uc
la1n956sHYfzRfJBNmkMVFLzuoZQ1ytG50M3T0TKly55dpbVQ3/cvwoqfu20aEt7
qq4bxC4rD/9SIkMMZMMQgI6d21h8GHTvM1H3OBpBGL2WipAHoip97gr9P0UQ40yN
WOLU4Xkkj/dKDEQPChDj7V6CEO4wYwSXMnhUkKiNeGIS2/CjVmu4Vf5eiB2urhiz
o9yHuf0WjBO5zaf4hHE9cpvoKqccLW30AoQGZtqg/7TOEzxkUKXdYVEKG9skXxP1
lnmreeiXrrw0gs03V/hFF7Tv6lv25t9ao0AGG4jmFBScbzXAqNwjONYrgdn7dszC
Do8CAwEAAaOBrTCBqjAdBgNVHQ4EFgQUs7Zs8qeEtPdNQ7l3zs3f2v+MTrswawYD
VR0jBGQwYoAUs7Zs8qeEtPdNQ7l3zs3f2v+MTruhP6Q9MDsxCzAJBgNVBAYTAkdC
MQswCQYDVQQIEwJVSzELMAkGA1UEChMCU1gxEjAQBgNVBAMTCW15Y2x1c3RlcoIJ
AODcwxKZHi35MA8GA1UdEwEB/wQFMAMBAf8wCwYDVR0PBAQDAgEGMA0GCSqGSIb3
DQEBCwUAA4IBAQBGwoULuHM5svPvV7c0tdsBmxovrhCYkMg4MwtPJ8eJQckyrCP3
fIU1VMXXeHKegaZ4q3QzIV9DDO1XB9TzifZ8yKm7a2/NlUnvgLQCGu82H/226YLE
abqoipcJsAANo5+2qGYEmYDODmLOnToaCX5bcmbLc1tcG4uf/x88O+PGLgh/h5+9
MUMlffyJWAE5eJN1rk9T5k0Onm5PElQLP/ZQecodHGL9XxzgjO9kLfwbRmUruGu/
ft4Ru0oOrQDIDWxQuiBitawQKX/tyaGkpX+g38gyFwDiPINo2q/IHeckxX5EHgF3
YGgPNaWwBnH3jfsJ/kMXcJS52q/zPOIvUCzO
-----END CERTIFICATE-----

Cluster: sx://mycluster
This node: 192.168.1.101
HashFS Version: SX-Storage 1.5
Cluster UUID: 01dca714-8cc9-4e26-960e-daf04892b1e2
Cluster authentication:
CLUSTER/ALLNODE/ROOT/USERwBdjfz3tKcnTF2ouWIkTipreYuYjAAA
Admin key: 0DPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5y0SOi3IMawAA
Internal cluster protocol: SECURE
Used disk space: 17568768
Actual data size: 463872
List of nodes:
         * ec4d9d63-9fa3-4d45-838d-3e521f124ed3 192.168.1.101
             (192.168.1.101) 536870912000
Storage location: /opt/sx/var/lib/sxserver
Run as user: nobody
Sockets and pidfiles in: /opt/sx/var/run/sxserver
Logs in: /opt/sx/var/log/sxserver/sxfcgi.log

--- END OF SUMMARY ---

Congratulations, the new node is up and running!
You can control it with '/opt/sx/sbin/sxserver'

You can add a new node to the cluster by running 'sxsetup' on another
```

```
server. When prompted, enter the 'admin key', 'SSL private key' and
'SSL certificate' printed above.

You can run 'sxacl useradd joe sx://admin@mycluster' to add a new user.
To create a new volume owned by user 'joe' run:
'sxvol create --owner joe --replica N --size SIZE sx://admin@mycluster/
    VOLNAME'
```

When the script finishes successfully, the node is already functional. Please notice the admin key listed at the end of the summary: it will be needed for both adding more nodes and accessing the cluster. You can always retrieve the admin key with the following command:

```
# /opt/sx/sbin/sxserver status
--- SX STATUS ---
sx.fcgi is running (PID 14394)
sxhttpd is running (PID 14407)

--- SX INFO ---
Cluster name: mycluster
Cluster port: 443
HashFS Version: SX-Storage 1.5
Cluster UUID: 01dca714-8cc9-4e26-960e-daf04892b1e2
Cluster authentication: CLUSTER/ALLNODE/ROOT/
    USERwBdjfz3tKcnTF2ouWIkTipreYuYjAAA
Admin key: 0DPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5yOSOi3IMawAA
Internal cluster protocol: SECURE
Used disk space: 17568768
Actual data size: 463872
List of nodes:
         * ec4d9d63-9fa3-4d45-838d-3e521f124ed3 192.168.1.101 (192.168.1.101)
             536870912000
Storage location: /opt/sx/var/lib/sxserver/data
SSL private key: /opt/sx/etc/ssl/private/sxkey.pem
SX Logfile: /opt/sx/var/log/sxserver/sxfcgi.log
```

That's it - your SX storage is already up and running! You can now go to the next step and add more nodes or go to the next chapter and learn how to perform basic client operations.

3.3 ADDING MORE NODES TO THE CLUSTER

Follow these steps to add a new node to the cluster:

- Run 'sxserver status' on one of the nodes of the cluster
- Collect the following information:
  - Cluster name
  - Admin key
  - One of the IP addresses from the list of nodes
  - The content of the SSL private key file (not the path itself!)
- Configure, compile and install S^X by running `./configure --prefix=/opt/sx && make install`
- Run `/opt/sx/sbin/sxsetup` and provide the collected information. Below we assume the new node is 192.168.1.102 and it's size is 250 GBs.

```
# /opt/sx/sbin/sxsetup
--- SKYLABLE SX CONFIGURATION SCRIPT ---

The script will help you to create or extend a Skylable SX data
cluster.

--- CLUSTER NAME ---

Clients will access your cluster using a sx://clustername/volume/path
URI. It is recommended to use a FQDN for clustername, but not
required. Refer to the documentation for more info.
Enter the cluster name (use the same across all nodes) []: mycluster

--- DATA STORAGE ---

Please provide the location where all incoming data will be stored.
Path to SX storage [default=/opt/sx/var/lib/sxserver]: <confirm default>

Please specify the maximum size of the storage for this node. You can
use M, G and T suffixes, eg. 100T for 100 terabytes.
Maximum size [default=1T]: 250G

--- NETWORKING ---

Enable SSL? (use the same setting for all nodes in the cluster) (Y/n)
<confirm default>
Enter the IP address of this node [default=192.168.1.102]: <confirm default>
Checking port 443 on 192.168.1.102 ... OK

--- CLUSTER CONFIGURATION ---

Is this (192.168.1.102) the first node of a new cluster? (Y/n) n
Please provide the IP address of a working node in 'mycluster'.
IP address: 192.168.1.101

The admin key is required to join the existing cluster.
If you don't have it, run 'sxserver status' on 192.168.1.101.
Below you can provide the key itself or path to the file
containing the key.
Admin key or path to key-file:
ODPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5yOSOi3IMawAA

--- SSL CONFIGURATION ---

Please paste the SSL private key below (and press CTRL+D when
done) or provide a path to it.
SSL private key:
<below paste the private key from 192.168.1.101>
-----BEGIN PRIVATE KEY-----
MIIEvAIBADANBgkqhkiG9w0BAQEFAASCBKYwggSiAgEAAoIBAQCYNdtHyNglHZQ8
va01HJWtZ/eerB2H80XyQTZpDFRS87qGUNcrRudDN09EypcueXaW1UN/3L8KKn7t
tGhLe6quG8QuKw//UiJDDGTDEICOndtYfBh07zNR9zgaQRi9loqQB6Iqfe4K/T9F
EONMjVji1OF5JI/3SgxEDwoQ4+1eghDuMGMElzJ4VJCojXhiEtvwo1ZruFX+Xogd
rq4Ys6Pch7n9FowdOc2n+IRxPXKb6CqnHC1t9AKEBmbaoP+OzhM8ZFCl3WFRChvb
JF8T9ZZ5q3nol668NILNN1f4RRe07+pb9ubfWqNABhuI5hQUnG81wKjcIzjWK4HZ
+3bMwg6PAgMBAAECggEAQ+fTGmV6OKTHm4mnXYeRJzm4+SskSaC41elOEvOTMybV
UlMCi6YoSo6EaNZROESsKYKfiI29FRX8ZqQT24kijmaI0WgYzPmhm3QOCBB2qim2
z/UdHB4TMUAv4ValaP+edb9SE872wiRVc8SjA2YT/66loNw09kgszLhA72QgZAbG
xmxVwCNTRFd7dg4Wmy1OQz3YVOn1C3Qs8C8LoGoO0Mci85quhBUw9s7J12skXGbu
ZGDtpJylgwtfc1q7nojaFkWenGCA9D1HB8zCqKPkhMh+HtA26g8VdFaHPVBzw/pz
avv5r9gLnBETwHfM3XuIYv7h3wowE5uAKVhgvL8w0QKBgQDJs2avbYOwgcEEOf7L
nPRqmb5XjJE329KsyIzo4Yw0rZDjQXSYrBjifoBIJzUReDDB7ww5lt0Xy3MExeS4
ngLO/oWotjd7jGU+EdABozKwW3bZuyUTSqTeQJwo+aIhjNtiyMrnpFy3vjYrJKGy
W/9cnv1WjqxpqnQgDjE/yJt36wKBgQDBL7p7iCWjIf+LH1/caFgPchJENd4YZZrB
bhGA/tuo6VtJcarc/Etx3DGbKhnJq13LxRRLjyHlPhw/k7oZBdaVK27I+vNfw5Lj
c2KZCYbFnF3kbP5ryuMW0QqGbkZZ/FExzwgFyAOUuCTw9L2VmKtPgbP9ywDTJc0Z
Jq/pdzOe7QKBgFOpxn4dvvIH4DgQ1k9+2yMcgoduFw5EcC6bQVeXtrCf7elVzTdG
```

```
q0vHjQ5gtPJ6GD9ZGIkKusqT6TGhpC2v3SoiKO7CJmFo6tXELbOALhZY2gOWTNqj
q59EzYFxin7AHn/rKb7Lvmm4zF844plI77NLf2nX5EwwF9r0CBmc7F/hAoGAUctH
ha4rYVqvu9PY3pU/U6rUmRTFqEa8s1FLD/bYQjgrcnkyAsa/msHELxIwQPbRi8kx
wpwjmdAmXbTKgnW6WQY+rdGy4cUImEzuXiVubpS6HFEZl8IbTDnN3wUpvEfciN5D
Y09AVONyoKK+8mvlfJBKCRa+jqfeotuCd7MEpDECgYAhWcDt6aXSsUOtq+jgVNtC
oi9Cnm4FNW7Z/VVgCCRFIwHxpqqAau63/naSGxkLUlK+U0StReiLC2D4FPrqs9Jh
scUH9hTIp3hxwznZBRFkuvUOm3h6CwQ0t3km7AffLRsGQZ9EMlvNb4T5mR/Izgxy
smcEPJfJgX61fx7c//bU6Q==
-----END PRIVATE KEY-----
<press CTRL+D>

Successfully obtained SSL certificate from 192.168.1.101

--- YOUR CHOICES ---

Cluster: sx://mycluster
Node: 192.168.1.102
Storage: /opt/sx/var/lib/sxserver
Run as user: nobody

Is this correct? (Y/n) <confirm default>

--- CLUSTER INITIALIZATION ---

Connecting to 127.0.0.1
Server certificate:
        Subject: C=UK; L=London; O=SX; CN=mycluster
        Issuer: C=UK; L=London; O=SX; CN=mycluster
        SHA1 fingerprint: 627917198424168ad0c144e721567eb4ebc90db1

Do you trust this SSL certificate? [y/N] y
+ /opt/sx/sbin/sxadm node --new --batch-mode --owner=nobody:nogroup --
    cluster-uuid=01dca714-8cc9-4e26-960e-daf04892b1e2 --cluster-key=/opt/sx
    /var/lib/sxserver/cluster.key /opt/sx/var/lib/sxserver/data
Starting SX.fcgi
Starting sxhttpd
SX node started successfully
+ /opt/sx/sbin/sxadm cluster --mod 536870912000/192.168.1.101/ec4d9d63-9fa3
    -4d45-838d-3e521f124ed3 250G/192.168.1.102 sx://admin@mycluster
HashFS Version: SX-Storage 1.5
Cluster UUID: 01dca714-8cc9-4e26-960e-daf04892b1e2
Cluster authentication:
CLUSTER/ALLNODE/ROOT/USERwBdjfz3tKcnTF2ouWIkTipreYuYjAAA
Admin key: 0DPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5y0SOi3IMawAA
Internal cluster protocol: SECURE
Used disk space: 17568768
Actual data size: 463872
List of nodes:
    - ec4d9d63-9fa3-4d45-838d-3e521f124ed3 192.168.1.101 (192.168.1.101)
        536870912000
    * 02e01f5d-80d8-4a01-b1f7-a56eecb8aef5 192.168.1.102 (192.168.1.102)
        268435456000

--- CONFIGURATION SUMMARY ---

SSL private key (/opt/sx/etc/ssl/private/sxkey.pem):
-----BEGIN PRIVATE KEY-----
MIIEvAIBADANBgkqhkiG9w0BAQEFAASCBKYwggSiAgEAAoIBAQCYNdtHyNglHZQ8
vaO1HJWtZ/eerB2H8OXyQTZpDFRS87qGUNcrRudDN09EypcueXaW1UN/3L8KKn7t
tGhLe6quG8QuKw//UiJDDGTDEICOndtYfBhO7zNR9zgaQRi9loqQB6Iqfe4K/T9F
EONMjVji1OF5JI/3SgxEDwoQ4+1eghDuMGMElzJ4VJCojXhiEtvwo1ZruFX+Xogd
rq4Ys6Pch7n9Fowd0c2n+IRxPXKb6CqnHC1t9AKEBmbaoP+0zhM8ZFC13WFRChvb
JF8T9ZZ5q3nol668NILNN1f4RRe07+pb9ubfWqNABhuI5hQUnG81wKjcIzjWK4HZ
+3bMwg6PAgMBAAECggEAQ+fTGmV6OKTHm4mnXYeRJzm4+SskSaC41elOEvOTMybV
UlMCi6YoSo6EaNZROESsKYKfiI29FRX8ZqQT24kijmaI0WgYzPmhm3QOCBB2qim2
z/UdHB4TMUAv4ValaP+edb9SE872wiRVc8SjA2YT/66loNw09kgszLhA72QgZAbG
xmxVwCNTRFd7dg4Wmy1OQz3YVOnlC3Qs8C8LoGoOOMci85quhBUw9s7J12skXGbu
ZGDtpJylgwtfc1q7nojaFkWenGCA9D1HB8zCqKPkhMh+HtA26g8VdFaHPVBzw/pz
```

```
avv5r9gLnBETwHfM3XuIYv7h3wowE5uAKVhgvL8w0QKBgQDJs2avbYOwgcEEOf7L
nPRqmb5XjJE329KsyIzo4YwOrZDjQXSYrBjifoBIJzUReDDB7ww5lt0Xy3MExeS4
ngLO/oWotjd7jGU+EdABozKwW3bZuyUTSqTeQJwo+aIhjNtiyMrnpFy3vjYrJKGy
W/9cnv1WjqxpqnQgDjE/yJt36wKBgQDBL7p7iCWjIf+LH1/caFgPchJENd4YZZrB
bhGA/tuo6VtJcarc/Etx3DGbKhnJq13LxRRLjyHlPhw/k7oZBdaVK27I+vNfw5Lj
c2KZCYbFnF3kbP5ryuMW0QqGbkZZ/FExzwgFyAOUuCTw9L2VmKtPgbP9ywDTJc0Z
Jq/pdzOe7QKBgFOpxn4dvvIH4DgQlk9+2yMcgoduFw5EcC6bQVeXtrCf7elVzTdG
q0vHjQ5gtPJ6GD9ZGIkKusqT6TGhpC2v3SoiKO7CJmFo6tXELbOALhZY2gOWTNqj
q59EzYFxin7AHn/rKb7Lvmm4zF844plI77NLf2nX5EwwF9r0CBmc7F/hAoGAUctH
ha4rYVqvu9PY3pU/U6rUmRTFqEa8s1FLD/bYQjgrcnkyAsa/msHELxIwQPbRi8kx
wpwjmdAmXbTKgnW6WQY+rdGy4cUImEzuXiVubpS6HFEZl8IbTDnN3wUpvEfciN5D
Y09AVONyoKK+8mvlfJBKCRa+jqfeotuCd7MEpDECgYAhWcDt6aXSsUOtq+jgVNtC
oi9Cnm4FNW7Z/VVgCCRFIwHxpqqAau63/naSGxkLUlK+U0StReiLC2D4FPrqs9Jh
scUH9hTIp3hxwznZBRFkuvUOm3h6CwQ0t3km7AffLRsGQZ9EMlvNb4T5mR/Izgxy
smcEPJfJgX61fx7c//bU6Q==
-----END PRIVATE KEY-----


SSL certificate (/opt/sx/etc/ssl/certs/sxcert.pem):
-----BEGIN CERTIFICATE-----
MIIDpzCCAo+gAwIBAgIJAODcwxKZHi35MA0GCSqGSIb3DQEBCwUAMDsxCzAJBgNV
BAYTAkdCMQswCQYDVQQIEwJVSzELMAkGA1UEChMCU1gxEjAQBgNVBAMTCW15Y2x1
c3RlcjAeFw0xNDAzMjExNDU2NTdaFw0xOTAzMjAxNDU2NTdaMDsxCzAJBgNVBAYT
AkdCMQswCQYDVQQIEwJVSzELMAkGA1UEChMCU1gxEjAQBgNVBAMTCW15Y2x1c3Rl
cjCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJg120fI2CUdlDy9o7Uc
la1n956sHYfzRfJBNmkMVFLzuoZQ1ytG50M3T0TKly55dpbVQ3/cvwoqfu20aEt7
qq4bxC4rD/9SIkMMZMMQgI6d21h8GHTvM1H3OBpBGL2WipAHoip97gr9P0UQ40yN
WOLU4Xkkj/dKDEQPChDj7V6CEO4wYwSXMnhUkKiNeGIS2/CjVmu4Vf5eiB2urhiz
o9yHuf0WjBO5zaf4hHE9cpvoKqccLW30AoQGZtqg/7TOEzxkUKXdYVEKG9skXxP1
lnmreeiXrrw0gs03V/hFF7Tv6lv25t9ao0AGG4jmFBScbzXAqNwjONYrgdn7dszC
Do8CAwEAAaOBrTCBqjAdBgNVHQ4EFgQUs7Zs8qeEtPdNQ7l3zs3f2v+MTrswawYD
VR0jBGQwYoAUs7Zs8qeEtPdNQ7l3zs3f2v+MTruhP6Q9MDsxCzAJBgNVBAYTAkdC
MQswCQYDVQQIEwJVSzELMAkGA1UEChMCU1gxEjAQBgNVBAMTCW15Y2x1c3RlcoIJ
AODcwxKZHi35MA8GA1UdEwEB/wQFMAMBAf8wCwYDVR0PBAQDAgEGMA0GCSqGSIb3
DQEBCwUAA4IBAQBGwoULuHM5svPvV7c0tdsBmxovrhCYkMg4MwtPJ8eJQckyrCP3
fIU1VMXXeHKegaZ4q3QzIV9DDO1XB9TzifZ8yKm7a2/NlUnvgLQCGu82H/226YLE
abqoipcJsAANo5+2qGYEmYDODmLOnToaCX5bcmbLc1tcG4uf/x88O+PGLgh/h5+9
MUM1ffyJWAE5eJN1rk9T5kOOnm5PElQLP/ZQecodHGL9XxzgjO9kLfwbRmUruGu/
ft4Ru0oOrQDIDWxQuiBitawQKX/tyaGkpX+g38gyFwDiPINo2q/IHeckxX5EHgF3
YGgPNaWwBnH3jfsJ/kMXcJS52q/zPOIvUCzO
-----END CERTIFICATE-----


Cluster: sx://mycluster
This node: 192.168.1.102
Port number: 443
HashFS Version: SX-Storage 1.5
Cluster UUID: 01dca714-8cc9-4e26-960e-daf04892b1e2
Cluster authentication: CLUSTER/ALLNODE/ROOT/
    USERwBdjfz3tKcnTF2ouWIkTipreYuYjAAA
Admin key: 0DPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5y0SOi3IMawAA
Internal cluster protocol: SECURE
Used disk space: 17568768
Actual data size: 463872
List of nodes:
    - ec4d9d63-9fa3-4d45-838d-3e521f124ed3 192.168.1.101 (192.168.1.101)
        536870912000
    * 02e01f5d-80d8-4a01-b1f7-a56eecb8aef5 192.168.1.102 (192.168.1.102)
        268435456000
Storage location: /opt/sx/var/lib/sxserver
Run as user: nobody
Sockets and pidfiles in: /opt/sx/var/run/sxserver
Logs in: /opt/sx/var/log/sxserver/sxfcgi.log

--- END OF SUMMARY ---

Congratulations, the new node is up and running!
You can control it with '/opt/sx/sbin/sxserver'
```

```
You can add a new node to the cluster by running 'sxsetup' on another
server. When prompted, enter the 'admin key', 'SSL private key' and
'SSL certificate' printed above.

You can run 'sxacl useradd joe sx://admin@mycluster' to add a new user.
To create a new volume owned by user 'joe' run:
'sxvol create --owner joe --replica N --size SIZE sx://admin@mycluster/
    VOLNAME'
```

The node successfully joined the cluster - at the end of the summary you can see the current list of nodes in the cluster. Repeat the same steps to add more nodes to the cluster.

CHAPTER 4

CLUSTER MANAGEMENT

4.1 LOCAL NODE STATUS

You can check status of a specific node by running `sxserver status` on that node:

```
# /opt/sx/sbin/sxserver status
--- SX STATUS ---
sx.fcgi is running (PID 14394)
sxhttpd is running (PID 14407)

--- SX INFO ---
Cluster name: mycluster
Cluster port: 443
HashFS Version: SX-Storage 1.5
Cluster UUID: 01dca714-8cc9-4e26-960e-daf04892b1e2
Cluster authentication: CLUSTER/ALLNODE/ROOT/
    USERwBdjfz3tKcnTF2ouWIkTipreYuYjAAA
Admin key: ODPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5yOSOi3IMawAA
Internal cluster protocol: SECURE
Used disk space: 17568768
Actual data size: 463872
List of nodes:
        * ec4d9d63-9fa3-4d45-838d-3e521f124ed3 192.168.1.101 (192.168.1.101)
            536870912000
Storage location: /opt/sx/var/lib/sxserver/data
SSL private key: /opt/sx/etc/ssl/private/sxkey.pem
SX Logfile: /opt/sx/var/log/sxserver/sxfcgi.log
```

This gives you the information about local services and disk usage, but also provides the admin key, which is needed for accessing the cluster itself.

4.2 ADMINISTRATOR ACCESS

During cluster deployment a default admin account gets created and initialized. You should be able to access the cluster from any node using `sx://admin@mycluster` profile. In order to manage the cluster remotely or from another system account, you need to initialize access to the cluster using `sxinit`. In the example below we use the default admin account created during cluster setup. Since "mycluster" is not a DNS name, we need to point sxinit to one of the nodes of the cluster. It will automatically discover the IP addresses of the other nodes.

Additionally, we create an alias `@cladm`, which later can be used instead of `sx://admin@mycluster`.

```
$ sxinit -l 192.168.1.101 -A @cladm sx://admin@mycluster
Warning: self-signed certificate:

        Subject: C=GB, ST=UK, O=SX, CN=mycluster
        Issuer: C=GB, ST=UK, O=SX, CN=mycluster
        SHA1 Fingerprint: 84:EF:39:80:1E:28:9C:4A:C8:80:E6:56:57:A4:CD:64:2E
            :23:99:7A

Do you trust this SSL certificate? [y/N] y
Trusting self-signed certificate
Please enter the user key:
ODPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5yOSOi3IMawAA
```

4.3 USER MANAGEMENT

SX similarly to UNIX systems supports two types of users: regular and administrators. A new cluster has only a single 'admin' user enabled by default. The administrators can perform all cluster operations and access all data in the cluster, while the regular users can only work with volumes they have access to. It is recommended to only use the admin account for administrative purposes and perform regular operations as a normal user. Use `sxacl useradd` to add new users to the cluster:

```
$ sxacl useradd joe @cladm
User successfully created!
Name: joe
Key : Fqm1Td9CWZUuPBGMdjE46DaT1/3kx+EYbahlrhcdVpy/9ePfrtWCIgAA
Type: normal

Run 'sxinit sx://joe@mycluster' to start using the cluster as user 'joe'.
```

By default a regular user account gets created. In order to list existing users run:

```
$ sxacl userlist @cladm
admin (admin)
joe (normal)
```

To retrieve the current authentication key for a specific user run:

```
$ sxacl usergetkey joe @cladm
5tJdVr+RSpA/IPuFeSwUeePtKdbDLWUKqoaoZLkmCcXTw5qzPg5e7AAA
```

Finally, to permanently delete a user from the cluster run the following command:

```
$ sxacl userdel joe @cladm
User 'joe' successfully removed.
```

All volumes owned by the user will be reassigned to the cluster administrator performing the removal.

4.4 VOLUME MANAGEMENT

Volumes are logical partitions of the SX storage of a specific size and accessible by a particular group of users. Additionally, the volumes can be connected with client side filters to perform additional operations, such as compression or encryption. Only cluster administrators can create and remove volumes.

CREATING A PLAIN VOLUME

Below we create a basic volume of size 50G owned by the user 'joe' and fully replicated on two nodes.

```
$ sxvol create -o joe -r 2 -s 50G @cladm/vol-joe
Volume 'vol-joe' (replica: 2, size: 50G, max-revisions: 1) created.
```

By default, a volume will only keep a single revision of each file (`max-revisions` parameter set to 1). The revisions are previous versions of the file stored when the file gets modified. For example, when a volume gets created with `max-revisions` set to 3, and some file gets modified multiple times, then the latest 3 versions of the file will be preserved. All revisions are accounted for their size. See FIXME for more information on how to manage file revisions.

CREATING A FILTERED VOLUME

Filters are client side plugins, which perform operations on files or their contents, before and after they get transferred from the S^X cluster. When a filter gets assigned to a volume, all remote clients will be required to have that filter installed in order to access the volume. Run the following command to list the available filters:

```
$ sxvol filter --list
Name            Ver     Type        Short description
----            ---     ----        -----------------
undelete        1.1     generic     Backup removed files
zcomp           1.0     compress    Zlib Compression Filter
aes256          1.4     crypt       Encrypt data using AES-256-CBC-HMAC-512
attribs         1.1     generic     File Attributes
```

We will create an encrypted volume for user 'joe'. To obtain more information about the `aes256` filter run:

```
$ sxvol filter -i aes256
'aes256' filter details:
Short description: Encrypt data using AES-256-CBC-HMAC-512 mode.
Summary: The filter automatically encrypts and decrypts all data using
         OpenSSL's AES-256 in CBC-HMAC-512 mode.
Options:
        nogenkey (don't generate a key file when creating a volume)
        paranoid (don't use key files at all - always ask for a password)
        salt:HEX (force given salt, HEX must be 32 chars long)
UUID: 35a5404d-1513-4009-904c-6ee5b0cd8634
Type: crypt
Version: 1.4
```

By default, the `aes256` filter asks for the password during volume creation. Since we're creating a volume for another user, we pass the `nogenkey` option, which delays the key creation till the first data transfer.

```
$ sxvol create -o joe -r 2 -s 50G -f aes256=nogenkey @cladm/vol-joe-aes
Volume 'vol-joe-aes' (replica: 2, size: 50G, max-revisions: 1) created.
```

LISTING VOLUMES

To get a list of all volumes in the cluster run `sxls` with the cluster argument as an administrator. When the same command is run by a normal user, it will list all volumes, which the user has access to.

```
$ sxls -l @cladm
  VOL   r:2  -         0  53687091200    0% sx://admin@mycluster/vol-joe
  VOL   r:2  aes256    0  53687091200    0% sx://admin@mycluster/vol-joe-aes
```

When the `-l (--long-format)` flag is used, the command also provides information about the volume settings and the current space usage.

CHAPTER 5

CLIENT OPERATIONS

ACCESSING THE CLUSTER

To access the cluster you need to have credentials for an existing account. In this example we will use the default admin account created during cluster setup.The following command sets up the admin access to the SX cluster "mycluster" for the client tools. Because "mycluster" is not a DNS name, we need to point sxinit to one of the nodes of the cluster. It will automatically discover the IP addresses of the other nodes. Additionally, we create an alias `@cluster`, which later can be used instead of `sx://admin@mycluster`.

```
$ sxinit -l 192.168.1.101 -A @cluster sx://admin@mycluster
Warning: self-signed certificate:

        Subject: C=GB, ST=UK, O=SX, CN=mycluster
        Issuer: C=GB, ST=UK, O=SX, CN=mycluster
        SHA1 Fingerprint: 84:EF:39:80:1E:28:9C:4A:C8:80:E6:56:57:A4:CD:64:2E
            :23:99:7A

Do you trust this SSL certificate? [y/N] y
Trusting self-signed certificate
Please enter the user key:
ODPiKuNIrrVmD8IUCuw1hQxNqZfIkCY+oKwxi5zHSPn5yOSOi3IMawAA
```

SX allows creating additional users of your choice and assigning them appropriate privileges. In this Quick Start Guide we will only use the default admin account, though. Please refer to `sxacl useradd --help` on how to add new users to the cluster.

CREATING NEW VOLUMES

Volumes are logical partitions of the SX storage assigned to particular groups of users and managed with the `sxvol` tool. Below we create a basic volume of size 50G owned by admin and fully replicated on two nodes. We're also making use of the `@cluster` alias, which stands for `sx://admin@mycluster`.

```
$ /opt/sx/bin/sxvol create --owner=admin --replica=2 --size=50G
  @cluster/mydata
Volume 'mydata' (replica: 2, size: 50G, max-revisions: 1) created.
```

WORKING WITH FILES

SX provides easy to use file tools, which resemble typical UNIX commands. Below we show how to upload a file to the 'mydata' volume, display it, and list files in the volume.

```
$ echo Hello World! > /tmp/hello.txt
$ sxcp /tmp/hello.txt @cluster/mydata/
$ sxcat @cluster/mydata/hello.txt
Hello World!
$ sxls @cluster/mydata/
sx://admin@mycluster/mydata/hello.txt
$ sxrm @cluster/mydata/hello.txt
Deleted 1 file(s)
```

Use `sxcp -r` to recursively upload directories to SX. See the man pages (eg. `man sxcp`) for examples and usage details.

CHAPTER 6

TROUBLESHOOTING

FILL ME