ECS

Version EX300 and EX3000 (EX-Series)

Networks Guide for EX300 and EX3000 (EX-Series) Hardware

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02

DELL EMC

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CHAPTER 1

ECS Network Documentation

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Introduction

This document describes the ECS public, and private networks, and how they are used to connect to the customer networks, and connect within the ECS system.

This document is intended for use with systems running on EX300 and EX3000 (EX-Series) hardware.

This document assumes you have read, and are familiar with the ECS networking concepts and operations provided in the following documents.

For information about ECS:	See the ECS	Which is available from:
Network ports, and encryption	*Security Configuration Guide*	support.emc.com
Network cabling	*ECS EX-Series EX300 and EX3000 Hardware Guide*	ECS Product Documentation page
Switch configuration, and the steps to configure the static IP addresses	*ECS Software Installation Guide for EX300 and EX3000 (EX-Series) Hardware*	SolVE

CHAPTER 2

Public Network

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Public network

The default network of the appliance with connections to the front-end (public) switch. By default, all types of public traffic will use the public network unless explicitly defined.

Interface name: public (slave-0, slave-1)

The public network:

- Provides connectivity between the ECS traffic and the customer networks.
- Enables replication of data to other virtual data centers in an ECS geo environment.

Types of traffic on the public network

The following types of traffic run on the public network.

- Data — customer data and I/O requests
- Management — hosts the ECS web portal, all common infrastructure services such as NTP, DNS, DHCP as well as Secure remote services (SRS).
- Replication — data replicated to other nodes within a replication group.

Note

The gateway is always configured on the public network.

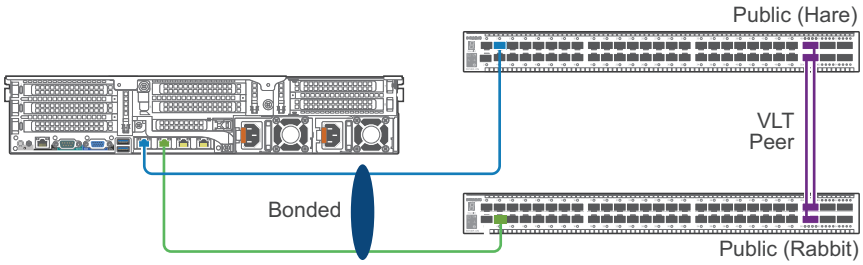
In a standard ECS deployment the data, management, and replication traffic runs through the public network. This chapter provides examples of a standard ECS deployment. Optionally, the traffic can be separated to run on dedicated networks as described in *ECS Network Separation Guide*, which is available in SolVe. Be sure to refer to the version of the guide that corresponds to the ECS software version you are running.

Front-end (public) switches

The switches that connect to the customer's network. This includes the default public network and any defined separated networks such as management, replication or data. The switches are stacked on top of each other, and are located on the top of the ECS rack, and are sometimes referred to as the "top-of-rack" switches. The terms hare (top) switch, and rabbit (bottom) switch are further used to differentiate between the two switches.

The two switches work in tandem using Virtual Link Trunking (VLT) to create a High Availability network for the nodes in the rack. By leveraging the ability of Link aggregations sub-second recovery time, the ECS has a near zero fault tolerant recovery time. Each node in the rack is connected to both rabbit and hare through two NICs which are aggregated together using a Linux bonding driver. The node is configured to bond the two NICs into a single LACP bonding interface also known as a "mode 4" bond. This bonding interface connects one port to hare and another port to the rabbit as demonstrated in the following image.

Figure 1 Physical Topology



Connecting the public network to the customer networks

Both hare (top) and rabbit (bottom) have twelve ports available to connect to the customer network.

Figure 2 Customer uplinks from front-end switches

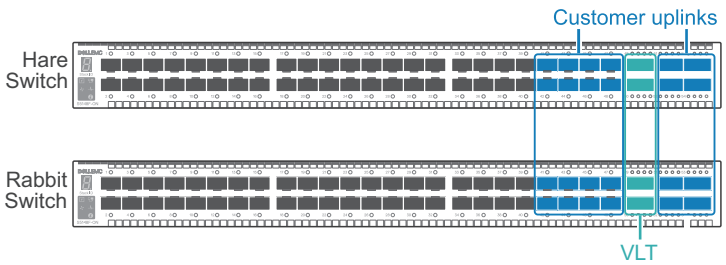


Table 1 Hare and rabbit port designation

Port(s)	Creates	Used for
41 - 48	port channel (po) 100	single LACP Uplink 8x10/25 Gb SFP per switch
51 - 54	port channel (po) 110	single LACP Uplink 4x100 Gb QSFP per switch

Spanning Tree in a customer environment

ECS public networks, when configured from EX-series hardware, will participate in the spanning-tree with the Rapid Spanning Tree Protocol (rstp).

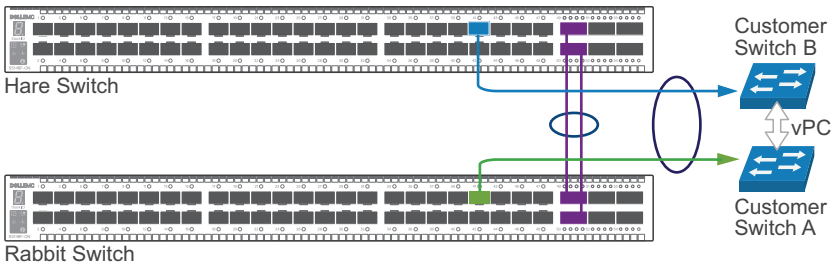
Note

It is recommended that only one of the port channels (100 or 110) be used for uplink to prevent a network loop on the customer network.

Multiport uplink connection to multiple customer switches using VLT or vPC

To connect the ECS rack to a multi-switch LAG, the customer will need to configure their switches with a port channel and both port channels will need to be connected together using a multi-switch LAG protocol like Dell EMC VLT or Cisco vPC to connect to the rabbit/hare uplink LAG port channel. All port channels that are participating in the multi-switch LAG must have LACP in either active or passive mode.

Figure 3 Example of a multi-switch LAG



Example configurations:

- ECS Hare preconfigured Dell EMC switch

```
interface port-channel100
 description "SFP Customer Connect"
 no shutdown
 switchport mode trunk
 switchport access vlan 1
 mtu 9216
 vlt-port-channel 100

interface ethernet1/1/41-1/1/48
 description "Customer Conn1"
 no shutdown
 channel-group 100 mode active
 no switchport
 mtu 9216
```

- ECS Rabbit preconfigured Dell EMC switch

```
interface port-channel100
 description "SFP Customer Connect"
 no shutdown
 switchport mode trunk
 switchport access vlan 1
 mtu 9216
 vlt-port-channel 100

interface ethernet1/1/41-1/1/48
 description "Customer Conn1"
 no shutdown
 channel-group 100 mode active
 no switchport
 mtu 9216
```

- Customer Cisco Switch A configuration

```
interface Ethernet1/1
channel-group 100 mode active
interface Ethernet1/2
channel-group 100 mode active
interface port-channel 100
vpc 100
```

- Customer Cisco Switch B configuration

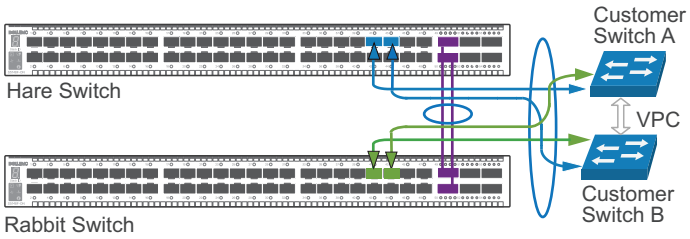
```
interface Ethernet1/1
channel-group 100 mode active
interface Ethernet1/2
channel-group 100 mode active
```

```
interface port-channel 100
vpc 100
```

Example of a multi-switch LACP with four ports

If more than two links are connected to each of the rabbit and hare switches then the links from each of the switches should spread to both of the customer switches in a bowtie fashion to provide optimal redundancy and performance during failures or scheduled downtime.

Figure 4 Example of a four port multi-switch LAG



CHAPTER 3

Private Networks

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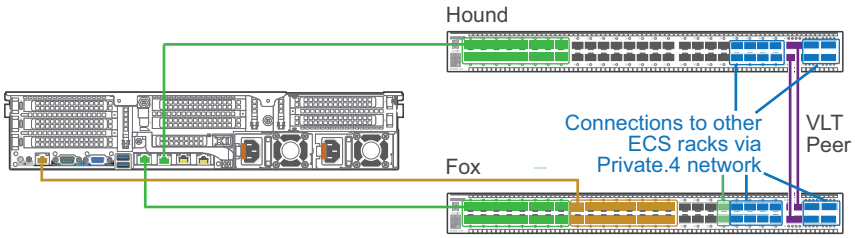
Back-end (private) switches

The back-end (private) switches are used for internal maintenance, and inter, and intra-rack connectivity.

There are two back-end switches, which are also referred to as the hound (top) and fox (bottom) switches. All server nodes in an ECS intra-rack have two connections going to a back-end switch. Both connections are to bonded into a single LACP bonding interface ("mode 4" bond).

Figure 5 Private (hound/fox) switch



Note

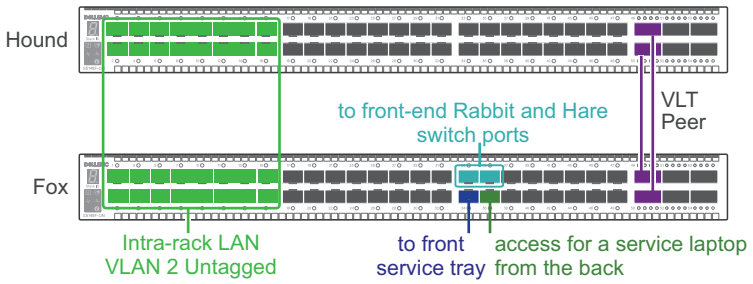
Spanning tree is enabled on all ports. This is to ensure that a loop free environment can be created in the private.4 topology.

Private network

The private network is an intra-rack only network used for service operations such as; Install, reinstall, and expansion. The private network connects all nodes and switches to a local area network to limit traffic to members of the intra-rack. Limiting the traffic to the intra-rack allows for easy management of all the nodes in the intra-rack and to reduce scalability issues.

All the nodes in an intra-rack are connected to the private switch through an Ethernet port. IP addresses 192.168.219.0/24 are reserved for the private network. The physical Ethernet port on the nodes are configured with a private IP address based on the associated switch ethernet port ID, for example; `192.168.219.port_number`. This port number is also used as a node ID.

Figure 6 Private network ports

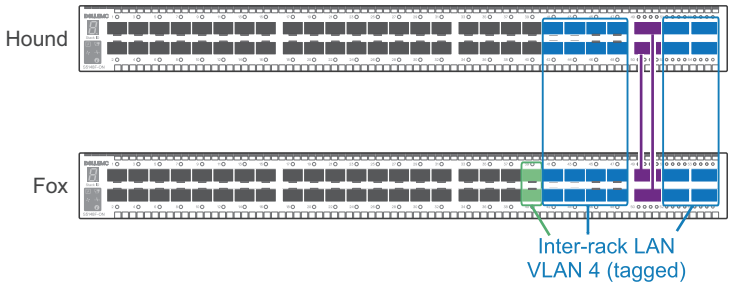


The subnet is non-routable and is reused by all intra-racks in an ECS inter-rack network.

Private.4 network

The private.4 network interconnects multiple, co-located ECS intra-rack networks into a single inter-rack network through VLAN 4.

Figure 7 Private.4 ports within an intra-rack network



Inter-rack LAN

All intra-rack participants in the inter-rack LAN will tag their IP traffic with VLAN ID 4, and communicate using the IPv4 link local subnet 169.254.0.0/16.

All nodes in the rack will be assigned an address in the inter-rack LAN once the intra-rack has been given a color designation. This color is mapped to the rack ID. The rack ID along with the node ID will make up the new inter-rack IP address for every node belonging to the inter-rack for example:

(169.254.{RackID}.{NodeID))

Inter-rack port and port channel connectivity

The ports used for private.4 to connect intra-rack segments to form an inter-rack network are designated as follows.

Figure 8 Intra-rack port designation

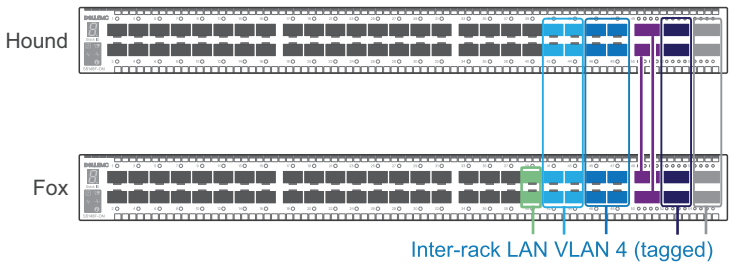


Table 2 Intra-rack port designation

Port(s)	Creates	Used for
39	N/A	Connectivity from the turtle (port 52 on the Arista switch in a D- or U-series ECS) into the fox private switch.
40	N/A	Connectivity out of the fox private switch into the turtle (port 51 on the Arista switch in a D- or U-series ECS) .

Table 2 Intra-rack port designation (continued)

Port(s)	Creates	Used for
41 to 44	25 GB port channel (po)100	In coming inter-rack connectivity between Ex-series intra-racks.
45 to 48	25 GB port channel (po)101	Outgoing inter-rack connectivity between Ex-series intra-racks.
49 and 50	100 GB port channel (po) 110	VLT peer connectivity between fox and hound.
51 and 54	100 GB port channel (po) 111	Not designated.

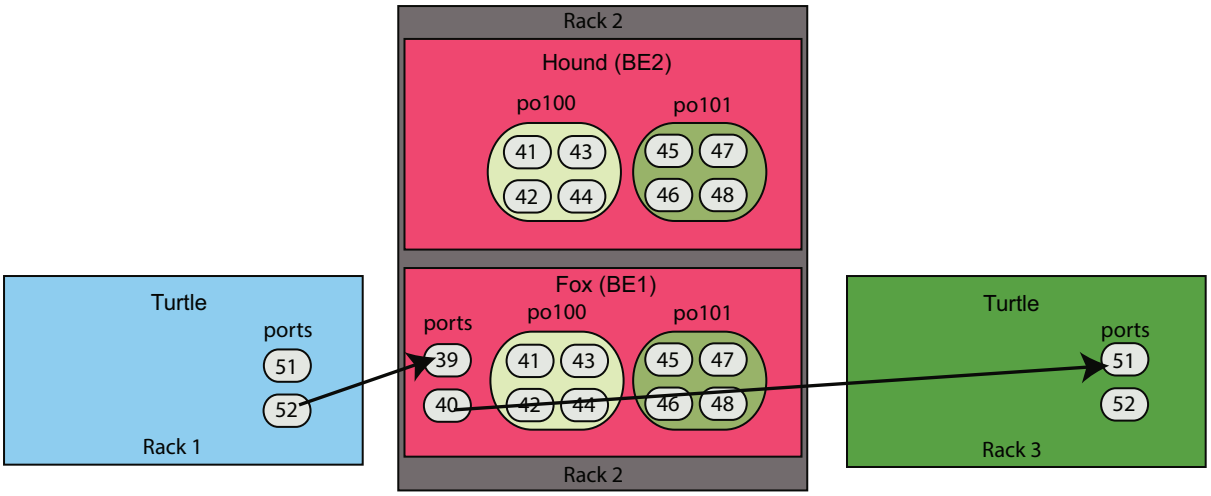
Private.4 topology connecting EX-series intra-racks

The ECS intra-rack backend management networks are connected together to create the inter-rack topology. Through these connections nodes from any intra-rack can communicate to any other node on the inter-rack network.

Inter-rack connectivity between EX-series and D- or U-series racks

Inter-rack connectivity between EX-series Dell switches and D- or U-series Arista switches is created by connecting the turtle (Arista) switch and the fox (Dell switch) switches. Connectivity is only created between the fox switch and the turtle switch. The hound switch is not directly connected to the turtle switch.

Figure 9 Inter-rack connectivity between EX-series and D- or U-series racks



Inter-rack connectivity between two or more ECS EX-series racks

By connecting either port channel 100 or 101 to another private switch from another ECS EX-series intra-rack, an ECS EX-series inter-rack network is created.

When connecting ECS EX-series intra-racks, at a minimum, hound-to-hound, and fox-to-fox connections must be made. It is further recommended that additional hound-to-fox, and fox-to-hound connections are made as demonstrated below.

Figure 10 Inter-rack connectivity between two ECS EX-series racks

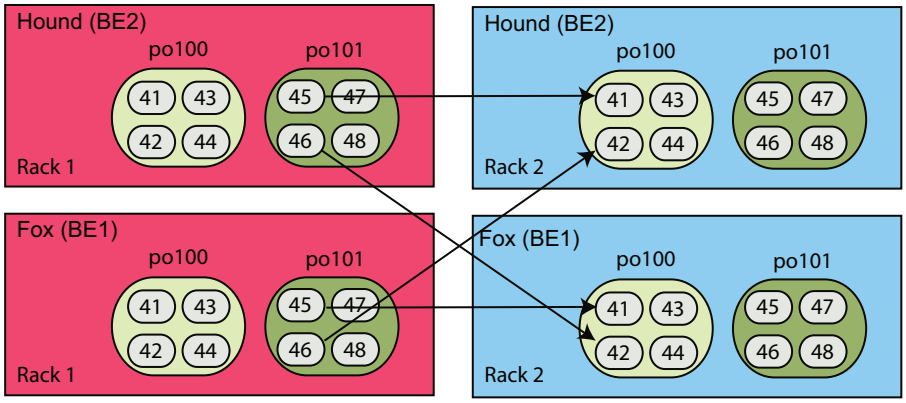


Table 3 Ex-series port inter-connectivity

Switch connection	out of port	into port
hound to hound fox to fox	45	41
hound to fox fox to hound	46	42

Additional types of inter-racks

Additionally, you can create multiple racks to create the following types of inter-racks:

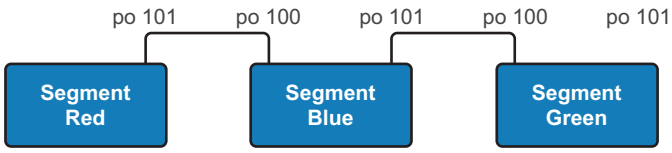
- Daisy chain or line topology
- Ring topology
- Star topology

Daisy chain or line topology

The simplest topology to connect the intra-racks together does not require any extra equipment. All the private switches can be connected together a linear or daisy chain fashion as demonstrated below.

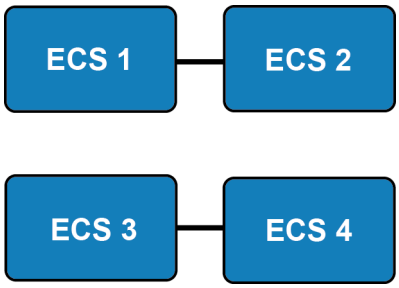
With a daisy chain, or linear topology, the intra-racks (segments) are connected together end-to-end using port channels 100 and 101 on VLAN 4 (tagged) as demonstrated below.

Figure 11 Linear/Daisy chain topology with ports



This linear or daisy-chain topology is the least dependable setup and is easily susceptible to split-brain topologies as demonstrated below.

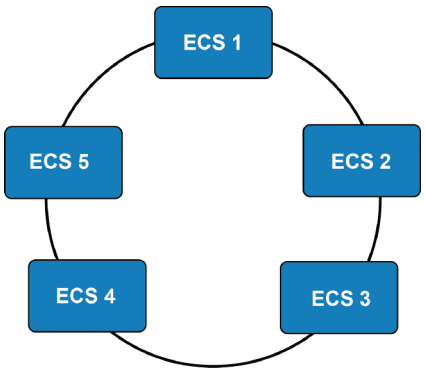
Figure 12 Split-brain topology



Ring topology

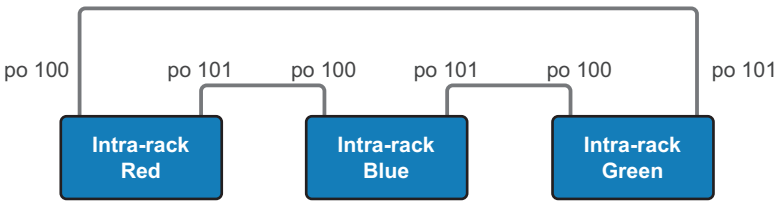
For a more reliable network, the ends of the daisy chain topology can be connected together to create a ring network as demonstrated below. The ring topology would require two physical link breaks in the topology to create split-brain issue in the private.4 network.

Figure 13 Ring topology



The ring topology is very similar to the daisy chain/line topology, except that it is more robust since it requires two points of failure to break the topology which would cause a split-brain issue. Ports 100 and 101 are used to daisy chain all the intra-racks (segments) on VLAN 4 (tagged)

Figure 14 Ring topology with ports



Star topology

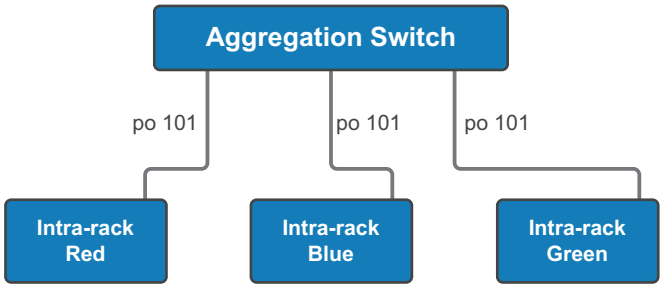
The limitation with the daisy chain or ring topologies is that they do not scale well for large installations. For ten or more ECS racks an aggregation switch should be added support the large installation.

By using an aggregation switch to connect to all intra-racks, the star topology provides better protection against the split-brain issue than both the daisy chain/line,

or ring topologies. With an aggregation switch, link failures are isolated to a single intra-rack in the private.4 network.

The aggregation switch connecting to the intra-racks must be setup as a trunk and allow VLAN traffic to flow between all ports in the inter-rack. Port 100 connects the intra-racks to the aggregation switch on VLAN 4 (tagged).

Figure 15 Start topology with aggregation switch ports



Example 1 Sample aggregation switch configuration for Dell EMC

```
interface port-channel100
 description "NAN Connect1A"
 no shutdown
 switchport mode trunk
 switchport access vlan 6
 switchport trunk allowed vlan 4
 mtu 9216
 vlt-port-channel 100
!
interface ethernet1/1/41-1/1/44
 description "NAN Connect1A"
 no shutdown
 channel-group 100 mode active
 no switchport
 mtu 9216
```

CHAPTER 4

Access to Switches and Configuration Files

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Access to the switches

The ECS switches are used for pure layer 2 purposes and therefore cannot be reached directly.

To access the switches you must log into Node 1 of the ECS as the admin user. Once logged in, the admin user can lock down ssh access. After logging into the node, you can validate the switch names as follows:

```
nslookup hare.rack
Server:         192.168.219.254
Address:        192.168.219.254#53

Name:   hare.rack
Address: 192.168.219.253

admin@ecsparis1:~> nslookup rabbit
Server:         192.168.219.254
Address:        192.168.219.254#53

Name:   rabbit.rack
Address: 192.168.219.252

nslookup fox.rack
Server:         192.168.219.254
Address:        192.168.219.254#53

Name:   hound.rack
Address: 192.168.219.251
```

After collecting the information you can use another ssh session, for example `ssh admin@hare`, to perform more commands. You can also change to enable mode to access more of the commands.

ECS switch configuration files

The switch configuration files are located on the appliance in the following directory. `/usr/share/emc-dell-firmware/config/ecs/`, and include the following

- ECSv3-fox-dell-s5148-v1.0.xml
- ECSv3-hare-dell-s5148-v1.0.xml
- ECSv3-hound-dell-s5148-v1.0.xml
- ECSv3-rabbit-dell-s5148-v1.0.xml
- fox.txt
- hare.txt
- hound.txt
- rabbit.txt

Note

The text files are for viewing only and are not used to configure the switches.

APPENDIX A

ECS Networking Glossary of Terms

This appendix lists and describes the common terminology used for ECS networking.

back-end switches
Private switches used for internal maintenance including the ECS private network, the private.4 network (also known as Nile area network (NAN)). The customary names for these physical switches are hound and fox.

Note

For ECS D- and U-series hardware models, the private switch is referred to as the turtle.

---

data network
An optional separated network dedicated to the transfer and operations of all customer data. Up to two data networks maybe be defined.

The initial interface name is public.data, subsequent data networks are named as follows public.dataN, where "N" is the number used to differentiate the data network, when there are multiple data networks. For example when two data networks are configured for data traffic the names are:

- public.data
- public.data2

fox
See back-end switches.

front-end switches
Public, or Top of Rack (ToR) switches that connect to the customer's network. This includes the default public network and any defined separated networks such as management, replication or data. The customary name for the two physical components in this switch complex are rabbit and hare.

hare
See front-end switches.

hound
See back-end switches.

management network
An optional separated VLAN network dedicated to hosting the ECS web portal, all common infrastructure services such as NTP, DNS, DHCP as well as DEll EMC's secure remote services (SRS).

Interface name: public.mgmt

nile area network (NAN)
See private.4 network.

private network
A rack only network used for service operations such as install, reinstall, and expansion.

private.4 network
A network which interconnects all co-located ECS racks through their private switches onto a single VLAN, which is VLAN 4 by default. Also referred to as the nile area network (NAN).

private switches
See back-end switches.

public network
The default network of the appliance that consists of two bonded interfaces with connections to the public (front-end) switch. By default, all types of public traffic will use the public network unless explicitly defined.

Interface name: public (slave-0, slave-1)

public switches
See front-end switches.

rabbit
See front-end switches.

replication network
An optional separated network dedicated to replicating objects between virtual data centers.

Interface name: public.repl

turtle
See private switches.