

Link Aggregation Interoperability

This Application Note relates to the following Dell PowerConnect™ products:

- PowerConnect 33xx
- PowerConnect 52xx

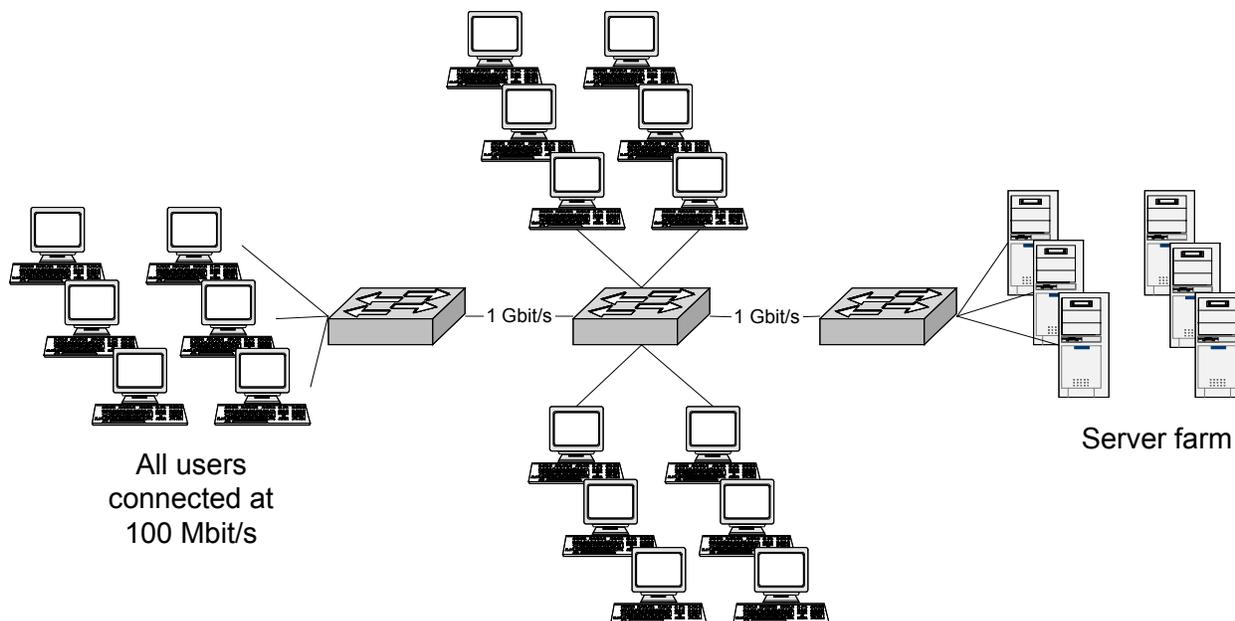
Abstract

Network managers face contradictory challenges: boost bandwidth and uptime while keeping within tight budget constraints. Cost and downtime considerations often rule out massive upgrades to network infrastructure. Further, such upgrades may be overkill given the order-of-magnitude increases in capacity involved. At the same time, doing nothing may not be a good option either, since existing infrastructure may not scale to meet bandwidth requirements.

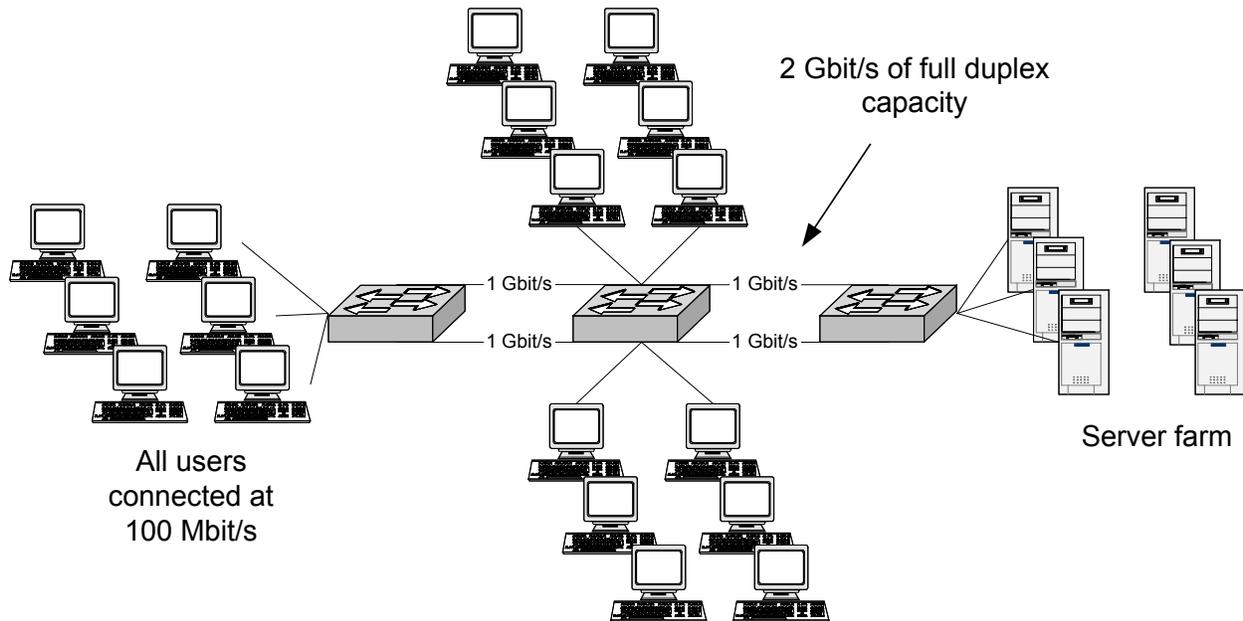
Link aggregation addresses all these problems by providing higher capacity and availability with little or no additional hardware. Because link aggregation is a standards-based solution, it allows interconnection of multiple vendors' equipment. This document will familiarize you with link aggregation and provide step-by-step instructions for implementing the technology in your network.

Applicable Network Scenarios

Enterprise networks typically connect large numbers of users with one another and with server farms over a backbone such as Gigabit Ethernet. As the enterprise grows, two things become increasingly likely. First, equipment from different vendors is often implemented in different parts of the network. Second, as

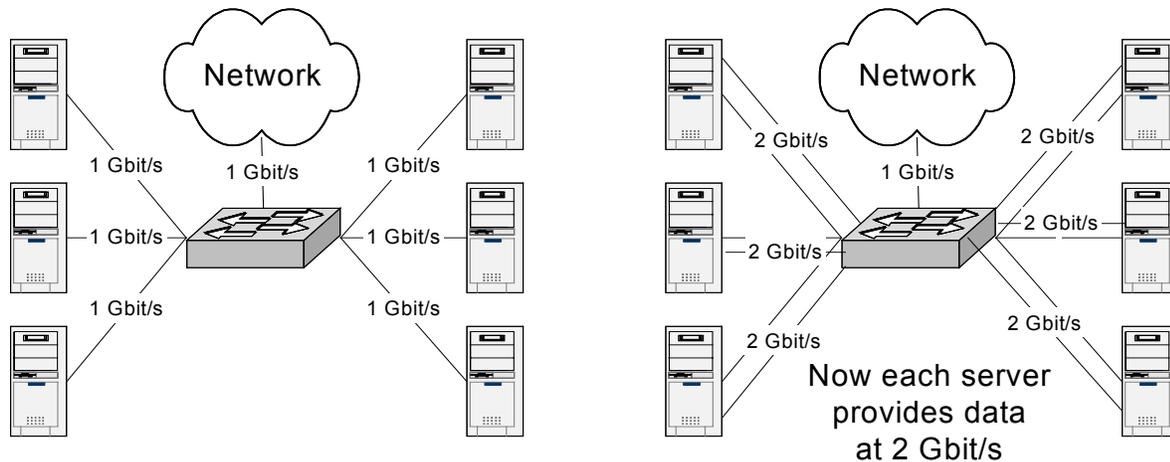


the number of users grows, so too does the likelihood of backbone saturation. A tenfold increase in backbone capacity would provide more than enough bandwidth, but also would require the replacement of some equipment. In many cases, simply doubling backbone capacity would provide sufficient capacity, and allow the use of current hardware.



By aggregating two links between each of the switches in the core of the network, we have now doubled network capacity with no additional hardware.

Next we look specifically at a server farm. Here we have several high-end servers providing content to the network. High-end servers today can saturate a single Gigabit Ethernet link, but aren't quite up to 2-Gbit/s rates. The low-cost addition of a second Gigabit Ethernet network interface card (NIC), along with link aggregation support in the NIC driver, provides twice the bandwidth as well as redundancy. If one NIC fails or a cable is cut, traffic automatically moves across to the remaining active link(s).



Technology Background

Link aggregation, defined in IEEE standard 802.3ad, is a method through which multiple physical links are combined into a single logical link. This provides two very important features: increased link capacity and redundancy.

With an upper bound of 8 links in a group, link aggregation with Gigabit Ethernet can provide a single logical link capable of achieving an aggregate theoretical 8 Gbit/s in each direction with full duplex operation. Link aggregation does not modify the 802.3 frame structure, allowing for backward compatibility with devices that don't support the technology, and it is also completely transparent to all upper-layer protocols.

The standard uses the link aggregation control protocol (LACP) to automatically establish the link aggregation groups (LAGs). Once implemented, link aggregation can be configured and reconfigured quickly and automatically, usually on the order of 1 second or less, with a low risk of duplication or reordering of frames.

802.3ad link aggregation works in a manner similar to the proprietary EtherChannel technology from Cisco Systems, Inc. Both link aggregation and EtherChannel can scale capacity and provide redundancy; but only 802.3ad link aggregation allows an open standard for construction of aggregated links between multiple vendors' devices (including devices from Cisco, as we will see in the example later). Cisco's EtherChannel and 802.3ad link aggregation are not compatible.

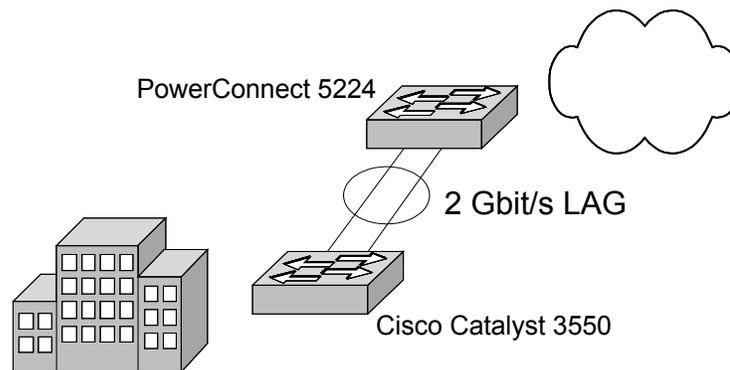
Proposed Solution

Overview

Adding link aggregation to your network is simple and straightforward. In the following example, we configure a Dell PowerConnect 5224 to interoperate with a Cisco Catalyst® 3550 using a two-port link aggregation group (LAG). All interfaces in the LAG must operate at the same line speed – we will use 1 Gbit/s – and must run in full duplex mode. This configuration might be used as the uplink to the core of a Metropolitan Area Network (MAN) where 1 Gbit/s is not sufficient and a link failure could be catastrophic.

Typical Network Designs

For this example, the Cisco Catalyst 3550 acts as the building switch and the Dell PowerConnect 5224 is in the core of the network.



Step-By-Step Instructions

As noted, the actual configuration of link aggregation is very straightforward. First we configure ports 23 and 24 of the PowerConnect 5224 to act as LAG members.

```
Dell-5224# configure
```

```
Dell-5224 (config)# interface ethernet 1/23-24
Dell-5224 (config-if)# lacp
Dell-5224 (config-if)# exit
Dell-5224 (config)# exit
```

Now the PowerConnect 5224 is ready to negotiate a LAG with another link aggregation-enabled device.

The next step is configuring the Catalyst 3550, on which we use Gigabit Ethernet interfaces 0/1 and 0/2.

```
Cat-3550# configure terminal
Cat-3550 (config)# interface gigabitEthernet 0/1
Cat-3550 (config-if)# no ip address
Cat-3550 (config-if)# channel-protocol lacp
Cat-3550 (config-if)# channel-group 1 mode active
Cat-3550 (config-if)# exit
Cat-3550 (config)# interface gigabitEthernet 0/2
Cat-3550 (config-if)# no ip address
Cat-3550 (config-if)# channel-protocol lacp
Cat-3550 (config-if)# channel-group 1 mode active
Cat-3550 (config-if)# exit
Cat-3550 (config)# exit
```

This concludes the configuration. Once the interfaces are physically connected, we can now verify on the PowerConnect that the devices have successfully negotiated a LAG.

```
Dell-5224# show interfaces status port-channel 1
```

This should bring up, among other things, the current status of the LAG.

```
Current status:
  Created by: Lacp
  Link status: Up
  Port operation status: Up
  Operation speed-duplex: 1000full
  Flow control type: None
  Member Ports: Eth1/23, Eth1/24,
```

We have now created a 2-Gbit/s full-duplex link aggregation group between a Dell PowerConnect 5224 and a Cisco Catalyst 3550.

Now we will set up the same configuration between a PowerConnect 33xx and a Cisco Catalyst 3550. We use a PowerConnect 3348 in this example, but the commands are identical for a PowerConnect 3324. We will use ports 1/g1 and 1/g2 on the PowerConnect 3348. The configuration of the Catalyst 3550 remains the same. Use the following procedure to configure the PowerConnect 3348.

```
Dell-3348#
Dell-3348# configure
Dell-3348 (config)# interface range ethernet 1/g1,1/g2
Dell-3348 (config-if)# channel-group 1 mode auto
Dell-3348 (config-if)# exit
Dell-3348 (config)# exit
Dell-3348#
```

Once the configuration is complete, connect the PowerConnect 3348 to the Catalyst 3550. Type the following command on the PowerConnect 3348 to verify that the channel is up.

```
Dell-3348# show interfaces status port-channel 1
```

The output should show that the link state of the port channel is up, signifying the LACP negotiation has completed.

Conclusion

We have now successfully created a 2-Gbit/s full-duplex link aggregation group between a Dell PowerConnect 3348 and a Cisco Catalyst 3550.

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