Networking @ Novell
A Beigepaper

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Last Revised: January 24, 2000

A Service Of Novell's Information Services & Technology Technical Architecture Group

About The "@ Novell" Series

Most documentation starts as hastily scrawled notes from sleep-deprived developers who weren't necessarily hired for their keen communication skills. Those notes are then fleshed out by recently graduated English majors who have spent their last four years immersed in works of fiction. The results are then passed on to the marketing department whose job it is to make sure that no word or phrase, even if it's true, will reflect unfavorably on the product ("I don't think that the word 'Basic' properly communicates the exciting nature of the product. Why don't we call it 'Visual Zesty!?!'"). It is then beset by lawyers who finish the job by making sure that they haven't explicitly promised that the product will actually do anything.

By the time the documentation gets into your hands, it has been so sanitized for your protection and generalized beyond recognition that you usually have to go out and buy a 3rd-party manual (that was, more likely than not, written by the same non-technical technical writer who wrote the original documentation) in a vain attempt to get an unbiased, unexpurgated, and/or unfiltered view of just how you're really supposed to use the stuff.

That's where the "@ Novell" series comes in. Rather than the vague, generalized, and wholly fictional examples found in most documentation, we're going to tell you exactly how we use our own products to run our own company. After all, we are not a small, tidy computing environment suitable for documentation. We are a big, sprawling, untidy environment made up of over 500 production servers and 20,000 workstations in 130 locations throughout the world. In other words, we're probably an awful lot like you.

And it's not that we're necessarily any smarter than you are, we just have a distinct advantage. By the time you get your hands on one of our released products, we've already been using it to run our business for quite some time. For instance, a month before NetWare 5 shipped, well over half of our 500 production file servers had already been upgraded to NetWare 5. (Keep in mind that these were production servers. These were not test servers that we had safely tucked away in antiseptic labs. These were real-world servers in a real-world environment solving real-world problems.) And two months before NetWare 5 shipped, we'd already converted one of our buildings to IP Only. That means that we've probably gained some insights into implementing our products in a big, sprawling, untidy environment, and this paper is an attempt to share those big, sprawling, untidy insights with our customers.

But keep in mind that this document may be a little rough. It wasn't conceived by a committee, written by a committee, or approved by a committee, so it hasn't been edited, re-edited, tidied up, sanitized, and whitewashed. Don't think of this as an official whitepaper. It's more like a beigepaper.

Yes, Virginia, There Is A Backhoe

I *love* WAN outages. I find them endlessly entertaining. I love the fact that a wrestling aficionado with tattoo coverage approaching 50% can, with nothing more than a rented backhoe,

bring a Fortune 500 company to its knees. I love the sight of Router Czars, who firmly believed that they were Masters of their Digital Domain, wandering the halls as if suddenly aware of their own mortality. It's probably the same look that I had on my face the day I found out that <spoiler> there was no Santa Clause </spoiler>.

You see, we sometimes forget, as we get caught up in this cozy little digital universe that we've created for ourselves, that our cozy little digital universe is inescapably tied to the physical one. The folks who baby-sit our WANs are keenly aware of this fact. They work at the intersection of the physical and digital worlds every day…and it's not an easy job.

Take for instance the outage in August where the frame relay connections to all of our U.S. and Canadian sales sites was interrupted for 10 day, followed shortly thereafter by two separate backhoe incidents outside of Denver. I'm surprised that anyone in our networking group still has hair.

Provo, Utah: Hub O' The Universe

All of our incoming and outgoing Internet traffic is routed through our main site in Provo, Utah. It may seem strange that if a user in Sydney, Australia wants to browse a Web site located in Canberra, they would actually come all the way across the Pacific and then be routed right back again. But in a number of ways, it's the logical thing to do.

If you look at a chart of network traffic @ Novell, you'll notice a few interesting things. Here's a recent graph showing the traffic on our most heavily used DS3:
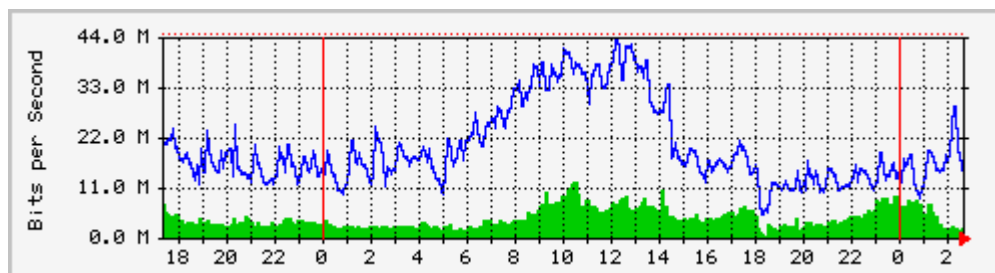
Max In: 12.7 Mb/s (28.3%)   Average In: 4514.4 kb/s (10.1%)   Current In: 2208.6 kb/s (4.9%)

Max Out: 43.3 Mb/s (96.9%)   Average Out: 20.1 Mb/s (45.0%)   Current Out: 16.0 Mb/s (35.8%)

From this graph, you can tell that I'm writing this document at 2:51 a.m. But in addition to that little insight into my writing habits, you'll notice that at our main site, traffic out is greater than traffic in. That means that many more people are pulling information from us than we pull from other people. Because of this, our pricing in Provo is such that we really only pay for outgoing traffic. Incoming traffic is essentially free.

In Sydney, the opposite is true They would have to pay for all incoming traffic, while outgoing traffic would be free. And networking connections in Australia are not inexpensive. And their

network traffic pattern is such that incoming traffic outweighs outgoing. So by routing traffic through Provo, where incoming traffic is free, we save quite a bit of money.

In addition to that, the destination of most Internet traffic is in U.S. And since we have *much* wider pipes in Provo than we have elsewhere, we're routing the majority of our requests where we have the greatest bandwidth and where they are destined anyway.

And finally, routing all traffic in Provo simplifies security and management since we can concentrate on our main connections in Provo rather than having to configure and monitor every site around the world.

We have four DS3s coming in to Provo, each capable of handling 45Mb/sec.
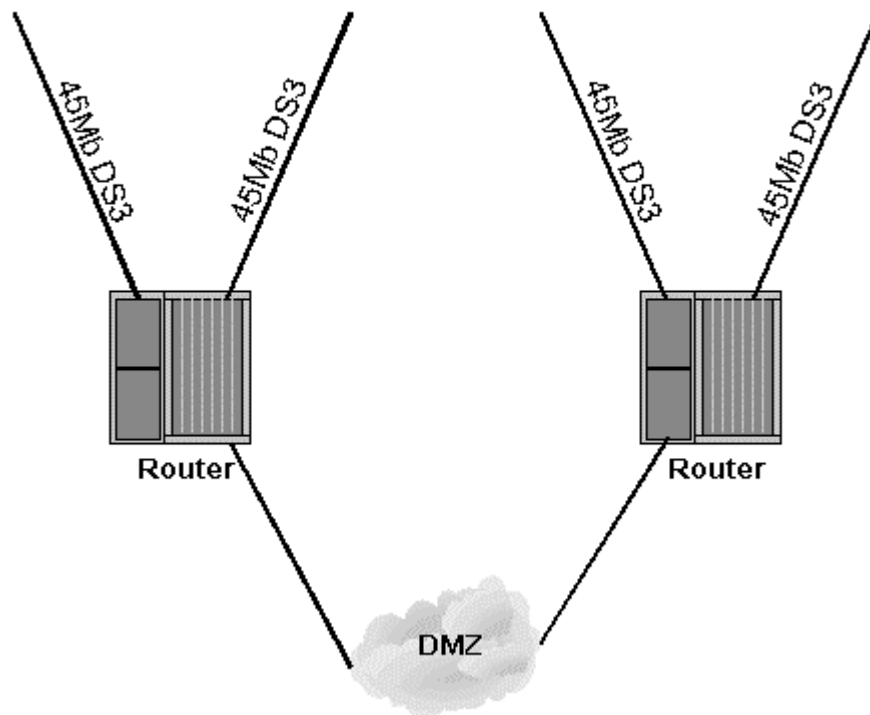
We use four different vendors for our four different DS3s. Going with four different vendors complicates things to some degree, but there are distinct advantages:

1. We're not likely to suffer catastrophic backhoe disasters on four DS3s from four different vendors at the same time.

2. Since peering connections tend to slow things down, we can provide faster access to our customers if we are on the same network that they are on. For instance, if a customer is on UUNET's network, we route their traffic on our UUNET DS3, AT&T customers will have their traffic routed on our AT&T DS3, etc.

We have two DS3s coming in to one router and two DS3s coming in to another. That way if one router gives up the ghost, we're still OK. And speaking of routers, we've standardized on a single vendor for all of our routers. The main reason for this is to ensure interoperability.

We also try and maintain bandwidth equal to 2x our normal run rate. For instance, our current run rate is averaging 70Mb/sec. Therefore, we should have at least 140Mb/sec of capacity to handle surges in traffic and backhoe incidents. As it stands, we have 180Mb/sec of capacity, which is more than enough[1].

When it comes to contracts, we used to sign 3-year contracts with our providers, but that is no longer the case. The discount that we were given for 2 and 3 year contracts was not really that great, and rates have usually fallen so fast during that 2nd and 3rd year that it eroded any savings that we had achieved by signing the longer contract. Our longest contracts are now one year long.

It might be interesting for some to know that we are now Pure IP on our WAN connections. (It's funny to think back about four years when we had 56k circuits to a lot of our offices and almost 26k was being used for SAP traffic alone.)

Connectivity To Outlying Sites

Connectivity to our outlying sites can get pretty interesting.   Our connection to the Novell office in Bangalore, India is probably the most convoluted example. If I want to send a packet to Bangalore, it must first travel to New York via fiber, then to London via transatlantic cable, then to Mumbai via satellite, then to downtown Bangalore via fiber, and finally it makes three microwave hops to get to our office 13 miles away. As if that wasn't complicated enough, during the rainy season the humidity is so great that it actually warps the signal as it tries to get from one microwave dish to the next. That is, if the wind and the water haven't already knocked the dishes out of alignment.

Most of the connections to our outlying sites are at least 256k, either frame relay or dedicated lines. The slowest connection that we allow is 128k[2].

At more and more sites we are implementing backup connections that are at least 50% of the standard connection.   For instance, if a sales site has a 256k frame relay connection, we might install a 128k ISDN connection as a backup. These backup connections are tested at least once

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[1] I hate to see all that bandwidth go to waste, however, so it looks like it's time for me to set up my streaming QuickTime server. I'm planning on broadcasting my life, live, 24-hours a day. It think it would be a great boon to insomniacs who would be lulled into a deep slumber by the monotony and tedium.

[2] Sometimes this can be very costly. For instance, we have one foreign 128k connection for which we are paying about $1,700/month. But it was decided that this particular connection was worth the outrageous cost.

every quarter to ensure that they are still operational.[3] For added security, our critical sites have a permanent backup connection that is live at all times.

And we now have one office in Lisbon, Portugal that connects to us via a site-to-site VPN. This is probably something that we'll be looking at more and more since generic Internet connections can be much more cost-effective than dedicated lines.

Acknowledgments

Nothing in this beigepaper represents original thought on my part. I couldn't have written a word without the generous help and input from everyone in Novell's IS&T Global Technical Architecture group. (I'd name them all individually but they'd probably get spammed.)

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[3] We implemented the quarterly tests because of Pac Bell's rich history of stealing the IP addresses of our backup ISDN connections.