

# The Transition To Pure IP @ Novell

## A Beigepaper

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*[Author's Note: This is Rev. B. If you happened to get a hold of a copy of Rev. A, throw it away...we were just kidding. We've tweaked our architecture a bit, and we're smarter now. We promise...]*

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## 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.

## So, What Exactly Is “Pure IP?”

With the release of NetWare 5, you've probably heard us talking a lot about “Pure IP,” and I know what some of you are thinking. You're thinking, “‘Pure IP?’ Oh, come on! I thought

Novell was embracing open industry standards. Yet, here they are, shunning the perfectly serviceable, industry-standard buzzphrase ‘IP Only’ in favor of some sort of proprietary buzzphrase!”

But, while our marketing department was probably thrilled with the opportunity to come up with something even vaguely trademarkable (“Boy! ‘Pure IP™’ will look great on my resume!”), we’re really just using the phrase “Pure IP” to call attention to the fact that we are going beyond being able to operate in an “IP Only” environment. After all, we already have a product (NetWare/IP) that proves that we can operate in the “IP Only” world without actually reducing our reliance on IPX one whit.

“Pure IP” means that we’re not cheating. It means that we’re not encapsulating IPX inside of an IP packet just so we can say that we’re “IP Only.” That’s like encapsulating a box of Twinkies in a loaf of bread and then saying we’re “Whole Wheat Only.”

As it says in the official propaganda:

In NetWare 5, all NetWare Core Protocols can use the TCP/IP transport protocol giving customers the ability [to] run in a “Pure IP” environment — pure in the sense that it doesn’t retain an IPX-based encapsulation (or, in the case of NT Server, a NetBIOS encapsulation).

You’ve heard of “IPsec?” Well, this is “IPpur™.” No fillers, no artificial flavors, no preservatives, and no IPX necessary...period.

## Why Bother?

I don’t think that it would be an overstatement to say that, here @ Novell, we have had the most IPX-dependent network in the world. After all, we invented the protocol. So, of course we’re going to proactively leverage our core competencies to facilitate fundamental synergies within our intranetworking paradigm that will, net-net, provide a significant value-add that we, as empowered change agents, can employ to close the quality circle and deploy (using best practices) extensible, best-of-class solutions within our established metrics<sup>1</sup>.

But even though we’ve always been very IPX-dependent, the Internet has made us equally dependent on IP. That’s right, we’re codependent. In the past, we didn’t have a choice. *We had* to be codependent. Our intranet was completely dependent on IPX and the Internet was completely dependent on IP. But with the release of NetWare 5, we now have the option to be, as the bestseller claims, “Codependent No More.” You can, if you choose, get rid of IPX entirely.

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<sup>1</sup> My first beige paper was criticized for not containing enough comforting management buzzwords. Let it not be said that I don’t listen to my critics. However, I feel that I need to add one disclaimer. While most of the comforting management buzzwords in the featured sentence actually exist in the English language, the word “proactive” does not. It’s a bit of nonsense invented by those for whom the word “active” was not active enough. In reality (and English), the only word that is more active than “active” is “hyperactive.”

Why would you want to get rid of IPX?

- You might want to simplify your routing infrastructure by moving to a single protocol.
- Perhaps your router vendor charges you more for support and upgrades if you are using multiple protocols.
- You may want better, easier, or more uniform WAN and remote connectivity options.
- Maybe your CEO has based your salary on your ability to remove IPX from one of your network segments in a ridiculously short amount of time.
- Perhaps you simply dislike the letter “X.”

I'm sure there are some small- and medium-sized businesses that may be perfectly happy running in a dual-protocol environment. For them, running both IPX and IP may provide the ease-of-use and flexibility they need while requiring minimal support overhead. But for those who would rather only deal with a single protocol, at least now you have that choice.

## The Ideal Path To Pure IP™

Once you've decided to make the transition to Pure IP you really only need to ask yourself two questions:

1. What are my IPX dependencies?
2. How big of a hurry am I in?

The answers to these two questions are critical because they will dictate where you are going to spend your time and resources. The answer to the first question is important because your ultimate goal is to identify and eliminate your IPX dependencies. The answer to the second question is going to determine whether you can follow the holistic, Taoist, whole earth, organic, leisurely Ideal Path To Pure IP™ (IPTPIP™)...or not. Let me explain.

In an ideal world, there would be no real rush to get IPX off the wire. After all, your IPX routing infrastructure is already in place, right? It's not necessarily costing you anything to keep it around for a while longer, is it? So, why not spend your time and energy identifying your IPX-dependent services and moving those services to IP? Eventually, IPX will become a non-issue; a vestigial protocol; a non-functioning reminder of a previous evolutionary incarnation. You'll no longer be routing any IPX packets; not because you can't, but because you don't have to.

To progress down this Ideal Path To Pure IP™, we are following these 15 simple steps (...if 15 steps can be called “simple”):

### 1. Implement TCP/IP Routing, Security, & Management

Obviously if you're going to make the transition to Pure IP, you're going to have to actually start routing the protocol. But before you route your first packet to or from the Internet, you

really should have a TCP/IP security infrastructure (firewalls, etc) in place. And you probably already have tools that allow you to manage and monitor the health and performance of your IPX network. You'll need the same kinds of tools to monitor your TCP/IP network. (Of course, many of the tools that you already have can probably handle both protocols.)

When we started this process, there were very few places within the company that didn't already have TCP/IP, though we did find a few isolated pockets of No IP™. Since we've been using TCP/IP for quite a while, our security and monitoring infrastructure has been in place for years, but we did need to tweak it a bit in order to accommodate the new TCP/UDP ports used by NetWare 5:

- TCP 524 - NCP Requests - Source port will be a high port (1024-65535).
- UDP 524 - NCP for time synchronization - Source port will be a high port.
- UDP 123 - NTP for time synchronization - Source port will be the same.
- UDP 427 - SLP Requests - Source port will be the same (427).
- TCP 427 - SLP Requests - Source port will be the same (427).
- TCP 2302 - CMD - Source port will be a high port.
- UDP 2645 - CMD - Source port will be the same (2645).

## 2. Implement DNS/DHCP

DNS makes the TCP/IP world a much nicer place because it allows you to refer to things by user-friendly DNS name (hvannadalshnukur.hafnarfjordur.com) rather than obscure IP address (207.46.131.137). And in NetWare 5 you can now access a server using its IP address or fully-qualified DNS name.

Anyone who has had to manage IP addresses on a large scale should already be familiar with the sanity-saving benefits of DHCP. But DHCP is especially useful with NetWare 5 because it not only simplifies the assignment and administration of client IP addresses, it also allows you to hand out Novell client configuration information such as Preferred Tree, Preferred Server, Directory and Migration Agent addresses, etc.

For example, we use DHCP to hand clients the name of the corporate tree, the name of a local server holding replicas, any local Directory Agents, etc. That allows me to fly out to Des Moines, plug my notebook in, and automatically be off and running. There's no piddling around with my IP settings or client configuration.

## 3. Upgrade Servers To NetWare 5 (Running Both IP & IPX)

You might want to read the first beigepaper in the "@ Novell" series, entitled "Implementing NetWare 5 @ Novell." It explains how we went about upgrading our servers @ Novell to NetWare 5.

When upgrading our servers to NetWare 5, we wanted to make sure that we were running both IP and IPX. Since we're going to be living in both worlds for a while, we wanted all of

the servers to be able to communicate with both our new IP-based clients and services and our old IPX-based clients and services during the transition.

#### **4. Upgrade Clients To NetWare 5 (Running Both IP & IPX)**

When upgrading our clients to NetWare 5, we wanted to make sure that we were running both IP and IPX. Since we're going to be living in both worlds for a while, we wanted all of the clients to be able to communicate with both our new IP-based servers and services and our old IPX-based servers and services during the transition.

(I love cut & paste...)

#### **5. Set Up DNS Entries For All NetWare 5 Servers**

This will allow DNS to provide name resolution when dealing with your new IP-based servers. (More on name resolution later...)

#### **6. Convert Server Names In Login Scripts To Fully-Qualified DNS Names**

Once you turn off IPX, referring to servers by their short name (i.e. hvannadalshnukur vs. hvannadalshnukur.hafnarfjordur.com) may no longer work. (I promise, more on name resolution later...)

#### **7. Identify IPX Dependencies & Transition Those Services To IP**

Well, that sounds easy enough, doesn't it? But, of course, this is where you're going to be spending most of your time and effort. And I'll even save you some time and effort. I can already tell you what your biggest IPX dependency is: NetWare. Or, more accurately, NDS on your old NetWare 4.x servers.

That's why we bind both IP and IPX in Step Three. Depending on your tree design, NDS background processes might require all of the servers in your tree to be able to communicate with all of the other servers in your tree. That was the case for us. All of our DSMaster servers potentially needed to be able to talk with everyone else. So rather than trying to research, diagram, and coordinate who had to talk to whom and how, we simply made the rule that all of our servers had to be able to communicate via IPX until they could all communicate via IP.

So, to complete the first part of Step 7, we went back to Step 3. (How's that for circular logic?)

But, while upgrading all of our servers to NetWare 5 will take care of the largest of our IPX dependencies, we still had to take a good, hard look at all of the other services that we provide to see what IPX hooks they might have. Here's a list of some of the services that we looked at and the solutions on which we standardized:

Service	Product
Anti-Virus	McAfee NetShield 4.0.x
Backup	Seagate Backup Exec 8.0 (Build 251)
Caching/Proxy	Novell BorderManager 3.0
DNS/DHCP	Novell DNS/DHCP 3.0
E-Mail/Messaging	GroupWise 5.5
FTP	NetWare NFS 2.4
Network Management	ManageWise 2.6, HP OpenView 5.01
NFS	NetWare NFS 2.4
Printing	NDPS
Remote Access (RADIUS)	Novell BorderManager 3.0
Web Server	Netscape Enterprise/Fastrack Server for NetWare

Some applications made the transition to a Pure IP environment better than others. For instance, GroupWise was a breeze. We simply set the clients to use client/server mode and we were done. Ta da! Some were not quite as easy. One of the things that we've found is that even though some of our services may not use IPX on the client side, they may have IPX hooks in their management pieces. For instance, they may use IPX for dynamic discovery in order to show a list of available servers in a dialogue box. Or they may be able to communicate with the server via IP, but they may rely on SAP to actually discover the address of the server in the first place.

If you're really interested in getting into the nitty-gritty of what IPX dependencies you have, you can use the NetWare IPXCON utility to see what SAPs you've got out on the wire, though deciphering this information is not a trivial task. Two other tools that you can use are SAP List and SAP Snoop, available on the Novell Consulting Web site at:

[http://consulting.novell.com/toolkit/iw\\_tools.html](http://consulting.novell.com/toolkit/iw_tools.html)

Another thing that you'll need to check for is short name dependencies. Some applications may not be able to handle referring to servers by their fully-qualified DNS names. And, depending on your setup, short name resolution may not work enterprise-wide. Which brings us to...

## 8. Implement SLP

One of the challenges of running NetWare in a Pure IP environment is the absence of IPX SAP (Service Advertising Protocol) packets. Once SAP is gone, you'll realize that there are two benefits that it provided that you're really going to miss: dynamic discovery and the ability to use short names.

A lot of folks were spoiled by IPX. They relied on being able to open **Network Neighborhood** | **Entire Network** | **NetWare Servers** and see a nice, big, fat list of all of the

available file servers in the company. They loved having dialogue boxes filled with a list of network resources that they could browse. Without SAP or SLP, you can still browse the NDS tree to find resources, but that might not be as easy as it sounds.

As an administrator, I love the fact that our corporate tree was designed with administrators in mind. It makes my job much easier. But the cross-functional, multi-departmental, international task force that put so much time into designing the tree for ease-of-administration didn't give much thought to what it would be like for a novice user to negotiate the tree structure in search of a simple printer. (I'm pretty sure there is a printer in Bangalore, India with about five reams of printouts from the recipe collection of an administrative assistant in Orem, Utah.) So using SLP to provide dynamic discovery in a Pure IP environment can go a long way toward making the transition from IPX a little less painful.

In the IPX world, you could afford to be lazy. If you wanted to attach to a particular server, you didn't need to know where that server was located, its IP address, its domain, or the NDS context in which the server resided. You could simply refer to the server by its short name.

The same is not true in the world of Pure IP. For instance, if you want to get to Yahoo's Web site, you can't simply type the word "yahoo" into your browser and expect it to know what you're talking about<sup>2</sup>, you have to type the Yahoo Web server's fully-qualified DNS name: www.yahoo.com.

In a Pure IP environment, name resolution (something you never really had to think about before) suddenly becomes a big issue. After all:

*"A rose by any other name...  
would have a different IP address."*

*- Grettir Asmundarson*

And the opposite is also true; a single server can be referred to by any number of "names." If I want to use the Novell GUI Map utility to map a drive to the server that I have here at my desk, how should I do it?

I could use the fully-qualified DNS name:

\\prv-botanica.provo.novell.com\sys

I could use the fully-qualified NDS name:

\\novell\_inc\prv-botanica\_sys.gta.prv.novell

---

<sup>2</sup> OK, I lied. Your browser probably *will* find the Yahoo Web site just by typing the word "yahoo." But that isn't because the name "Yahoo" is known to every system in the IP world. It's due to the fact that the latest versions of most browsers will add a "www." and a ".com" to any entry that it can't resolve. That, in combination with Autosearch and RealNames, blows my example out of the water.



I could even use the IP address:

```
\\207.46.131.137\sys
```

And SLP gives me the option of doing it the same way I always have, with the server's short name:

```
\\prv-botanica\sys
```

But, perhaps it's time for a change...

Even though we've implemented SLP at Novell, we're only doing it on a per site basis. At our smaller sites (with less than 100 clients), we are not installing a Directory Agent at all. We will simply allow the individual systems to use multicasting to advertise their presence and look for services. At our larger sites we are installing two Directory Agents (for redundancy and load balancing), but that SLP information will only be replicated locally.

During the process of setting up SLP between several of our large sites, we had an epiphany: It just wasn't worth it. Why were we setting up an entire global infrastructure to collect, store, and replicate all of that SLP information everywhere in the world just so we could approximate the world of SAPs? And if we didn't roll out an enterprise-wide SLP implementation, it would allow each site to migrate from IPX to IP independently of other sites on the network. In the end, we decided that we're much better off using SLP locally, where it can provide dynamic discovery of local resources (the resources users are most likely to need), and then training users to use fully-qualified DNS names to login, map drives, etc.

[**Note:** For a complete description of SLP and how it works, see the recommended links at the end of this document.]

The reason that we standardized on fully-qualified DNS names is that DNS is the only naming standard that will work no matter where you are. Whether you're mapping a drive locally, across the Internet from a customer site, via a VPN client, or dialing in with RADIUS...fully-qualified DNS names work everywhere. Therefore DNS is our primary name resolver, followed by NDS, SLP, and then, if all else fails, local host files.

DNS resolves short names by taking the name and concatenating your current DNS sub-domain onto the end (i.e. prv-botanica becomes prv-botanica.provo.novell.com). Service Pack 1 for the NetWare Clients (which should be released in May) will also make things easier with its support for "Domain Suffix Search Order." This will allow you to specify a number of domain names that will be appended to the end of any short name that the client is unable to resolve. For instance, if I had the following specified in the "Domain Suffix Search Order":

```
sjf.novell.com
```

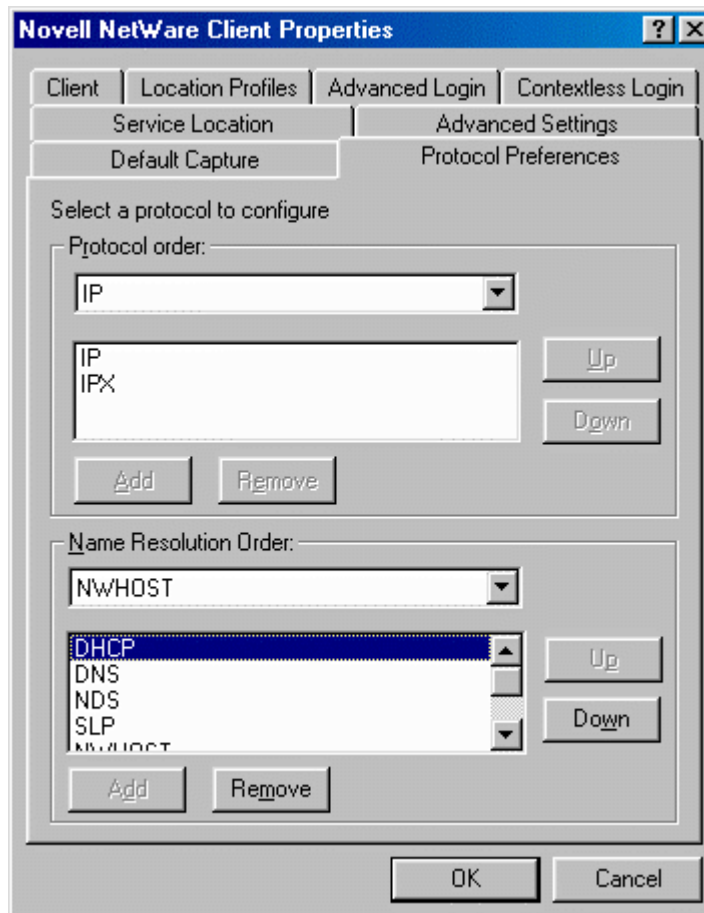
novell.com  
neticus.com  
tinypineapple.com

...and I tried to map a drive to “prv-botanica,” after trying my current DNS sub-domain it would try the following:

prv-botanica.sjf.novell.com  
prv-botanica.novell.com  
prv-botanica.neticus.com  
prv-botanica.tinypineapple.com

NDS resolves shorts names by taking the name and tagging on your current NDS context (i.e. prv-botanica becomes prv-botanica.gta.prv.novell). And SLP resolves short names by looking for an SLP object type of “bindery.novell” with that particular name.

The Windows NT client requests information from all of the Name Service Providers at once and uses whichever one responds first. The Windows 95/98 client allows you to actually specify the Name Resolution Order to use:



(**Note:** If you want to hand configuration information to the client, such as Preferred Tree, Preferred Server, etc., DHCP needs to come first.)

## 9: Train Employees To Use Fully-Qualified DNS Names To Login, Map Drives, Etc.

How does a user know what the fully-qualified DNS name of a server is? We've hacked together a simple but effective CGI script that allows a user to type in the short name of any server and it will return the fully-qualified DNS name to use.

## 10: Convert Login Scripts To Use Fully-Qualified DNS Names

For instance, change this:

```
map z:=s16:=\\prv-botanica\sys\public
```

...to this:

```
map z:=s16:=\\prv-botanica.provo.novell.com\sys\public
```

## 11: Change Timesync Time Sources To Use IP Addresses

Having just finished my numerous lectures on the importance of using fully-qualified DNS names, I need to note one exception. Timesync currently can't resolve fully-qualified DNS names, so this is one case where you're going to have to specify an IP address.

## 12. Turn Off IPX SAP At The Routers

Don't jump the gun. We're not shutting down IPX entirely at this point. We're only turning off IPX SAP. We'll need to continue to route IPX RIP until every server in the tree has been upgraded to NetWare 5. This may be confusing to some, since they've come to think of SAP packets and IPX packets as being synonymous. But SAP is merely the aspect of the protocol that provides service advertisement. Try thinking of SAP as being a phone book. It allows you to take a server name and find an address for that server. But it is IPX RIP that actually allows you to get from point A to point B.

Here's the best way to make sure that everything is still working after SAP has been turned off:

- ❑ Turn off SAP at the routers.
- ❑ Wait for 5-10 minutes.
- ❑ At the server console, enter RESET ROUTER a few times.
- ❑ Wait for a few more minutes.
- ❑ At the server console, enter DISPLAY SERVERS. You should only see a list of IPX servers from the local site.

- At the server console, enter DISPLAY NETWORKS. You should see the full list of IPX networks on both sides of the router, not just the IPX networks from the local site.

This will also be the good test of your IPX dependencies. Once you've turned off SAP at the routers, you may find that some applications that you assumed didn't have IPX dependencies, *do*. At that point you should call the vendor and politely ask what their timetable is for full support of Pure IP.

### 13. Check NDS Synchronization

Go into DSRepair and force a synchronization to make sure that NDS is synchronizing without SAP.

### 14. Verify Client Logins

I know some network administrators who feel that things would run much smoother if users would simply stay off the network, but you should probably make sure that users can log in at this point. Also make sure both container and personal login scripts are working properly.

### 15. Turn Off IPX RIP At The Router

And, finally, turn off IPX entirely (but only after every server in the tree has been upgraded to NetWare 5)...and we're done.

That's it. That is the Ideal Path To Pure IP™. I've appended a diabolically clever Ideal Path To Pure IP™ flowchart to the end of this document. It shows the relationship between all of the different steps in the process. Make a copy and put it in your wallet. It makes a good placemat or coaster...

## But For Those Of Us Who Don't Live In An Ideal World...

It has been my experience that IT departments don't often get to dabble in the world of the "ideal." A more likely scenario would have you halfway through the planning stages of your Ideal Path To Pure IP™ when the Router Czars, who you didn't realize were really calling the shots, burst into your office, eyes ablaze, and announce, "Nyet! We will no longer route your bourgeois IPX packets! You have until the end of the quarter! Long live Cisco! Huzzah!" And then leave, muttering obscure passages from router configuration manuals under their breath.

At that point there probably isn't enough time to even identify all of your IPX dependencies, let alone transition those services to IP. So rather than the holistic, Taoist, whole earth, organic, leisurely Ideal Path To Pure IP™, you're going to have to compromise. Because, at the end of the quarter, the Router Czars are going to start moving systematically from segment to segment, cutting off the IPX air supply, until they've finally throttled the network into submission and eradicated every trace of that "chatty" protocol.

So, you've got two choices. You're either going to have to rally the proletariat or you're going to have to create some sort of temporary, parallel routing infrastructure that will allow your IPX-dependent services to still function in a world where IPX doesn't exist anymore.

That's the situation we found ourselves in. We desperately needed to remove IPX from one of our network segments as soon as possible. And why did we desperately need to remove IPX from one of our network segments as soon as possible? Because three months before NetWare 5 shipped, our CEO came to us and said, "I want one building @ Novell to be IP Only by the end of the month." That's why.

Since we were dealing with beta code at the time, we decided that the best place to test NetWare 5's native IP capabilities would be in the building that houses our Core OS developers. (You'd be amazed at how promptly you get bug fixes when the team that is developing the product isn't able to log in to the network.) But there was no way we were going to be able to get rid of our rather heavy IPX dependencies in time. So we had to come up with some way to make the IPX services outside of the building available to the IP Only segment inside the building, and vice versa. (Remember our rule that every NetWare server in the tree must be able to communicate with every other server in the tree.) And, wouldn't you know it, NetWare 5 has the perfect solution to problems like this.

To keep both sides communicating through this protocol-based Berlin Wall, you'll need to set up some kind of oracle. No, not *that* Oracle™. I'm talking in the classic Greek sense. An oracle was someone who acted as an intermediary between the humans and the gods. They would take the humans' requests and present them to the gods, then receive answers back from the gods and present those answers to the humans. Sort of the Greek equivalent of middle management<sup>3</sup>.

The oracle in this case is a Migration Agent: a NetWare 5 server running Compatibility Mode Drivers (CMD) with the Migration Agent option enabled. A Migration Agent sits out in the IPX world and allows IP Only clients and servers in their IP Only rampart to communicate with their IPX-based counterparts on the other side of the wall, and vice versa. It acts as the intermediary between the two different worlds.

How does it do this? Well, first, you'll also need to be running IPX Compatibility Mode Drivers (IP/CMD) on all of the clients and servers that reside in the IP Only world. If applications on these IP Only devices attempt to make an IPX call or communicate with other IPX devices, the CMD drivers will intercept the IPX call, encapsulate it in an IP packet, and route it through the wall to the Migration Agent. The Migration Agent will take that request and then make the IPX call on their behalf, receive an IPX response back, and then deliver that response to the original requestor via IP.

The Migration Agent also translates between IPX SAPs and SLP. It takes IPX SAPs and registers those advertised services with your Directory Agents so that they are available via SLP to your IP Only devices. It also takes the SLP information from your IP Only devices and broadcasts SAPs on their behalf so that they are visible to your IPX folks.

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<sup>3</sup> The common denominator of all failed civilizations.

This is what made it possible for us to move into our new San Jose campus without any IPX on the production network. We simply placed two Migration Agents on the backbone that connected San Jose with the rest of the world and every IP device could instantly see every IPX device. It was beautiful.

Almost *too* beautiful. I know some people who, when they heard about Compatibility Mode, said, “Great, I don’t have to give up IPX after all. I can just set up a bunch of Migration Agents everywhere and I can still run both protocols just fine.”

No, no, no.

We called it a *Migration Agent*, not a *Set-It-Up-And-Leave-It-There-Forever-Sucking-Up-Support-Resources Agent*. It’s a tool to help you get from one point to another, not a final destination. Again, the idea of standardizing on a single protocol is to simplify things. Why would you want to go from supporting two protocols on a single routing infrastructure to supporting two protocols on *two* routing infrastructures?

I’m sure that there may be a few instances where someone simply isn’t able to move all of their servers to NetWare 5 for one reason or another, and yet still need to be able to access those resources in areas that are Pure IP. In such cases, you may need to run Compatibility Mode long-term to support that small pocket of IPX, but the idea is to use it only when you have to.

In our case, there will be some testing and support labs within the company that will, for testing and support reasons, need to use IPX, but our involvement will be minimal. Each lab will be responsible for setting up and maintaining their own IPX Compatibility Mode Migration Agents.

One thing that I should mention about our Compatibility Mode implementation is that we didn’t stick with the default CMD IPX network number. Why? Because, like every other IT department, we are control freaks.

At our Provo site, we currently have about 300 production file servers. We also happen to have another 4,700 servers scattered in various labs, developers’ offices, broom closets, etc., that are used for development, testing, and propping open doors. That’s 4,700 servers over which we have no control. And the last thing we want is to have some goofball bring up a Migration Agent using the default CMD IPX network number and start dynamically routing all of the IPX packets between Provo and San Jose through something they’ve hobbled together with spare parts. By using something other than the default CMD IPX network number, there’s less of a chance of someone causing problems without even knowing it.

## Where Are We Today?

So, we sound pretty smart on paper, but you’re probably interested in knowing exactly where we are in our own transition to Pure IP?

As of this writing, we've done the following:

- ✓ Implemented DNS/DHCP 3.0 at all of our sites.
- ✓ Upgraded all but 56 of our production servers to NetWare 5.
- ✓ Upgraded all of our clients to IP-capable NetWare 5 versions, using the client ACU process.
- ✓ Registered all of our production servers in DNS.
- ✓ Converted two of the buildings at our Provo campus and a number of international offices to IP Only using Compatibility Mode as a temporary measure.
- ✓ Moved into our new San Jose campus without any IPX on the production network, again using Compatibility Mode as a temporary measure.

And here's what we have yet to do:

- Upgrade the remaining 56 servers to NetWare 5.
- Finish identifying services with IPX or short name dependencies and either upgrade, replace, or remove those services.
- Finish converting login script entries from short names to fully-qualified DNS names.
- Finish training users to use fully-qualified DNS names when accessing servers.
- Remove IPX SAP from the routers. (We've already turned off SAP to some of our smaller offices that no longer have IPX dependencies.)
- Remove IPX RIP from the routers.

By the end of Q4 (Oct '99) we will no longer support or maintain any sort of IPX routing or tunneling on the Novell production network and, for us, the transition to Pure IP will be complete.

Then, in a generous display of appreciation, we'll probably receive that ultimate reward of IT departments everywhere: free clothes. A T-shirt, a jacket, a mustard/baby-poop-colored polo shirt that makes everyone look even pastier than they already do...something like that. And it's a good thing, too. I swear, if it weren't for the free clothing items that sometimes come our way, the state of fashion within the IT industry would go from merely being poor to being downright deplorable.

Now if we can just get some people to shower...

## Where To Look For More (Or Better) Information

I would recommend taking a look at the following AppNotes:

### **Migrating to Pure IP with NetWare 5**

<http://developer.novell.com/research/appnotes/1998/septembe/a3frame.htm>

### **Configuration Parameters for the Compatibility Mode Driver**

<http://developer.novell.com/research/appnotes/1999/april/a4frame.htm>

**Migrating from NetWare/IP to NetWare 5 and Pure IP**

<http://developer.novell.com/research/appnotes/1999/february/a6frame.htm>

**Novell DNS/DHCP Services: Design Issues and Troubleshooting**

<http://developer.novell.com/research/appnotes/1998/november/a1frame.htm>

**Dynamically Discovering Services on an IP Network with SLP**

<http://developer.novell.com/research/appnotes/1999/march/a2frame.htm>

And the following TIDs are quite helpful, too:

**SCMD: Frequently Asked Questions**

<http://support.novell.com/cgi-bin/search/tidfinder.cgi?2949348>

**Overview of Service Location Protocol (SLP)**

<http://support.novell.com/cgi-bin/search/tidfinder.cgi?2943641>

**SLP Console and Set Commands**

<http://support.novell.com/cgi-bin/search/tidfinder.cgi?2943611>

**SLP, How to use it with DNS and DHCP**

<http://support.novell.com/cgi-bin/search/tidfinder.cgi?2945263>

**NW5 IP Discovery Options in Protocol Prefs**

<http://support.novell.com/cgi-bin/search/tidfinder.cgi?2948684>

**Protocols and ports used by NetWare 5 IP**

<http://support.novell.com/cgi-bin/search/tidfinder.cgi?2943773>

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And please note that Grettir Asmundarson is just a ridiculous pseudonym, so don't bother trying to call. You'll only confuse our receptionist.

# The Ideal Path To Pure IP™ : A Diabolically Clever Flowchart

