



A CMI Business Brief White Paper:

The Not-So-Hidden, But Under-Publicized, Business Benefits of Virtual Ethernet

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By configuring computer networks with Virtual Ethernet technology, forward-thinking data center managers of every organizational size or stripe can achieve dramatic cost savings on hardware, software, labor and energy use, substantially reducing their “carbon footprint” while increasing employee productivity and data-processing efficiency. In recent years, however, the profound and obvious benefits of Virtual Ethernet have been drowned out by the hoopla and confusion surrounding other forms of virtualization. Here then, is a brief explanation of what Virtual Ethernet is, how it works, and why you should care about it.

When it comes to information technology spending, many data center managers are caught between a rock and a hard place – the “rock” of keeping pace with increased demand for data processing and the “hard place” of containing costs. Global IT spending is expected to reach \$3.7 trillion in 2012, a 5.2 percent increase over 2011, reports technology research firm Gartner Inc.¹ Though much of this spending increase is being driven by new technologies such as smartphones, media tablets, mobile networks and big data analytics, there is one technology that can actually help data centers achieve remarkable cost-savings and higher productivity – Virtual Ethernet technologies.

Over the last decade, the ever-lower cost of computer servers prompted many companies to meet the increased demand for data processing by purchasing new servers in droves. To connect those servers to the hundreds or thousands of PCs used by employees, data center managers also invested in enormous quantities of network connectivity equipment and paraphernalia. And all of those switches, routers, bridges, network cabling, racks to house the network switches, not to mention the electricity required to heat and cool the rooms stuffed with this equipment, came at a staggering price.

Even during economic booms, many business managers find it tempting to contain IT costs by trimming budgets with a metaphorical X-acto knife. Unfortunately, “gauging the return on investment of specific projects is an exercise fraught with peril, and whether a company does or does not green-light an ambitious initiative, there is still plenty of infrastructure to pay for. The need to keep basic IT services up and running while also exploring the potential of new technologies is challenging under any conditions; during a downturn it becomes downright herculean. [Because of this,] companies have concluded that to control costs, they must better understand them. Initial outlays for hardware, software, networks, and storage are far from the only costs. Maintenance, support, labor, and other expenses add to the total cost of ownership, or TCO. Increasingly, analyst firms are urging clients to get a grip on TCO as a useful benchmark by which to base purchasing decisions.”²



Virtual Ethernet Benefits “Lost in Translation”

Virtual Ethernet technology enables organizations to do more with less, significantly reducing TCO in ways that are easily measured. Virtual Ethernet helps: save energy; utilize servers to their full capacity; reduce hardware vendor lock-in; slash expenditures on new hardware and software, increase data center uptime; improve disaster recovery; and extend the life of older applications. Most important, it allows companies to quickly and smoothly move into the Cloud. In other words, Virtual Ethernet dramatically cuts the cost of computer networking.

Over the last few years, the IT community has been filled with a lot of excited arm waving about this or that virtualization layer or virtualization technology (see sidebar). Unfortunately, much of this news hasn't been translated from the alpha-numeric “geek-speak” of IT professionals to simple business English. Worse, because of the hype and noise about server virtualization, VLANs, Cloud solutions and so forth, many CEOs and CFOs have never heard about the business benefits of Virtual Ethernet or seen the words “Virtual” and “Ethernet” occur next to each other in a coherent sentence.

So what's the difference between a conventional computer network and one connected by a Virtual Ethernet – and, what's more, why should you care? Here's a brief explanation in plain business English:

Physical vs. Virtual Ethernet

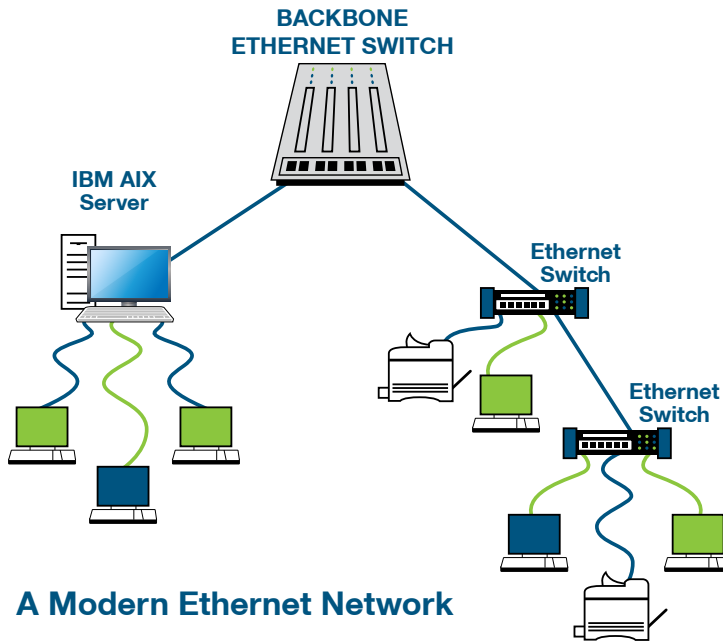
Physical Ethernet. Put simply: a PC has a network interface card (NIC) that “speaks Ethernet.” Scattered around the network are a number of boxes known as switches or routers or bridges, which connect to the Ethernet. If a computer wants to talk to another computer (e.g., another server), the Ethernet allows your computer to communicate through that switch, which works like a telephone operator. However, because each switch works in tandem with numerous PCs, a company using thousands of PCs must purchase a lot of switching/networking hardware and build an enormous physical infrastructure in order to create a viable computer network.

If Computer A wishes to communicate with the mainframe computer, a connection must be made through a physical switch. You have a PC and a mainframe computer, as well as a cable to connect Computer A to the switch, and a second cable to connect that switch to the mainframe. In other words, the simplest physical network requires a PC, a mainframe, a switch and two pieces of cable. Multiply this by the number of workstations needed by the typical company, and it becomes immediately obvious why this enormous infrastructure can become so expensive. Hardware, installation, maintenance and energy expenditures tend to skyrocket – and skyrocket



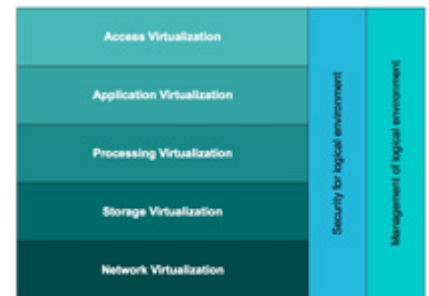
fast.

This “hard-wired” approach is how computer networks have been configured for decades, particularly since Ethernet became the dominant local area network (LAN) communication protocol in the early 1990s.



Understanding the 5 Layers of Virtualization⁶

There are essentially five layers of technology that virtualize some portion of a computing environment, depending on whether your company is prioritizing performance, reliability/availability, scalability, consolidation, agility, a unified management domain or some other goal.



Virtual Ethernet connections will link any two points inside the computer network, but puts the potential connections (the switches) inside the computer – on a chip that enables up to 4,096 connections per server. What’s more, when you combine the capability of a Virtual Ethernet with Server Virtualization (the ability to “slice” a given server into many smaller “virtual” servers), the you end up with a single server that can mirror an entire network – i.e., multiple computers (each of the virtual server “slices”) are able to connect to each other through one slice of the network.

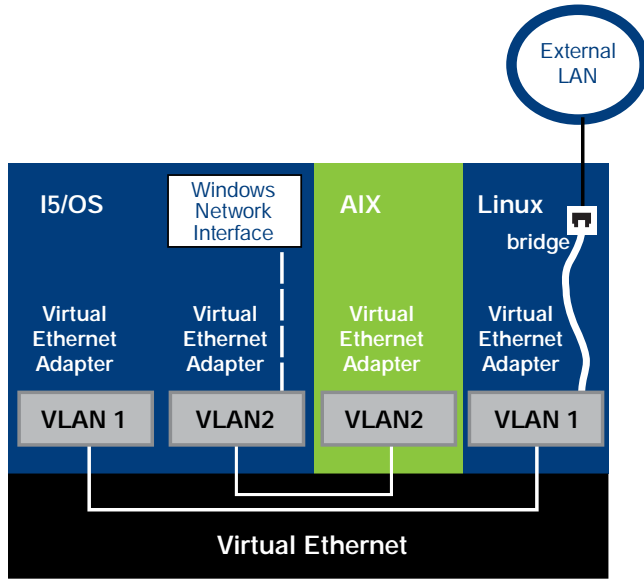
Today, the average server is woefully underused. Between 80 percent and 90 percent of a typical server’s capacity is sitting idle at any given moment. The average network connection between servers is also underutilized, with the net result being computer/network inefficiencies and under-utilized sunk costs.

Virtual Ethernet runs on IBM Power servers such as the pSeries and iSeries servers, and is included with the server itself. Depending on which side of the

1. Access Virtualization: Hardware and software technology that allows nearly any device to access any application without either having to know too much about the other. The application sees a device it’s used to working with. The device sees an application it knows how to display. In some cases, special purpose hardware



argument you stand on, therefore, Virtual Ethernet is either 'free' or 'included in the price of the server'. In addition, you have eliminated the need to purchase, install and configure/reconfigure hundreds, thousands or tens of thousands of cables, plugs, switches, racks to hold all of those switches, as well as the need and/or build data centers to hold the additional (underutilized) servers.



Immediate Benefits of Virtual Ethernet

The most obvious and immediate benefit of Virtual Ethernet is lower hardware expenditures, which includes the actual purchase price of physical switches and other network infrastructure. Other benefits include:

- Less physical floor space needed to house racks after rack of switches. The cost of constructing a new data center is approximately \$1,000 per square foot (\$40,000 per rack or \$2,400 for a typical server).³
- Substantially less money is needed to heat and cool data centers. The electricity used to heat and cool U.S. data centers from 2005 to 2010 equaled 1.7 percent to 2.2 percent of the power used nationwide.⁴
- Cost-effective security. Because Virtual Ethernet is located inside the server, there is no exposed infrastructure to be hacked. The result: IT security is more cost-effective and less expensive in absolute terms.

is used on each side of the network connection to increase performance, allow many users to share a single client system or allow a single individual to see multiple displays.

2. Application

Virtualization:

Software technology that lets applications run on many different operating systems and hardware platforms. This usually means that an application has been written to use an application framework. It also means that applications running on the same system that do not use this framework do not get the benefits of application virtualization.

3. Processing

Virtualization:

Hardware and software technology that hides physical hardware configuration from system services, operating systems or applications. This type of virtualization technology can make one system appear to be many systems, or many systems



- Virtual Ethernet is arguably faster than physical Ethernet because: (a) Virtual Ethernet uses inter-memory bus as the connection medium; and (b) there is less competition among users for available bandwidth. In addition, companies can buy less equipment, but still increase network capacity and speed. Virtual Ethernet emulates a 1 GB Ethernet connection. It provides a fast and convenient communication method, enhancing the ability to integrate separate applications running on different server partitions.

- Reduced network congestion. Using Virtual Ethernet for inter-partition communication, you can also reduce traffic on the external LAN, which helps prevent impaired service for other LAN users.

- Maintenance costs are reduced because Virtual Ethernet can be serviced by lower-cost technicians – e.g., computer operators charge a fraction of what network engineers charge.

- With less physical infrastructure comes less physical infrastructure to manage, producing IT operations that are more effective and efficient. There are fewer “moving parts” to monitor and replace, fewer devices to upgrade and “patch,” and fewer devices requiring service contracts. Hardware acquisition, maintenance, upgrades and troubleshooting tend to gobble up staff time, resulting in a higher TCO. But with Virtual Ethernet, most of these costs are eliminated while valuable staff time is freed up. According to The Hackett Group, companies with less-complex IT infrastructures are more effective and efficient, and spend less on IT as a percent of revenue.⁵

- Fewer ‘oops’ moments (human errors) requiring expensive re-work in network configurations – errors that can suck up huge amounts of time as IT staffers and outside technicians reconfigure yards of physical cable and plug in hardware, assuming that additional equipment and hardware doesn’t need to be ordered and rush delivered from the manufacturers for additional money!

- More “Greening” of the Data Center. Put simply, you have less equipment plugged into the walls, meaning less heating and cooling is needed, as well as fewer boxes and shipping costs, reducing your carbon footprint.

- Fewer vendors to negotiate with, which also leads to less “finger pointing” when a glitch occurs in the computer environment. The result: fewer operational/maintenance costs. Because Virtual Ethernet replaces some of the

appear to be a single computing resource in order to achieve goals ranging from raw performance, high levels of scalability, reliability/availability, agility or consolidation of multiple environments onto a single system.

4. Storage Virtualization: Hardware and software technology that hides where storage systems are located and the type of device that’s actually storing the applications and data. This technology also makes it possible for many systems to share the same storage devices without knowing that others are also accessing them. It also makes it possible to take a snapshot of a live system so that it can be backed up without hindering online or transactional applications.

5. Network Virtualization: Hardware and software technology that presents a view of the network that differs from the physical view. For example, a PC



underlying hardware with virtual hardware, IT managers gain more flexibility when it comes to the equipment they can use. This can be a handy negotiating tool with vendors when it's time to renew or purchase more equipment.

- Virtual Ethernet runs on IBM Power servers such as pSeries and iSeries servers, and is included with the server itself. Depending on how you look at it, therefore, Virtual Ethernet is either “free” or “included in the price of the server.”
- Virtual Ethernet networks are more scalable than traditional networks, because each installation of Virtual Ethernet comes with 4,096 connections built-in. There's no need to scale-up to that. And regardless of whether your partitions are running on IBM's iSeries, pSeries or Linux, they can all be connected to the same Virtual Ethernet.
- More bandwidth availability between server platforms means faster reaction to sustained network demand at a lower total-cost-of-ownership (TCO).
- Faster deployment becomes possible, thanks to a shorter learning curve. Better yet, the system manages connectivity and load balancing with no human intervention at all.
- There is no cabling to install, maintain, replace and inventory. In addition, no extra networking hardware may be required. You can add partitions to the system and communicate with an external LAN without installing extra physical cards. And if your current system has limited card slots in which to install more LAN cards, the Virtual Ethernet gives you the ability to operate LAN-attached partitions without having to upgrade the system.
- Reduced licensing costs. For example: with Virtual Ethernet, you won't need to pay a VPN (virtual private network) client a fee for each user in your company. Even a smaller company – one with 300 users (paying \$20 apiece) – would instantly save \$6,000 on licensing fees.
- Finally, by “abstracting away” much of your underlying hardware, you are better prepared for a move into the cloud. The first step may be to move from a simple virtualized data center to a private cloud. But as the public cloud matures, and the technology around it advances, you will have had a head start in getting there.

may be allowed to only “see” systems it is allowed to access. Another common use is making multiple network links appear to be a single link. Each of these technologies has been available in data centers in one form or another for nearly 30 years. What's new is that these technologies are increasingly available for industry standard, high volume systems and operating system software.



Network Cost Comparison

How does a migration from physical Ethernet to Virtual Ethernet translate into dollars and cents? As a network cost comparison, consider the hypothetical case of a mid-sized company whose network comprises 100 physical servers and 500 PCs, which requires 17 Ethernet switches, each with 48 ports, associated cables, procurement, installation, and configuration, as well as other data center labor, and other equipment (racks to hold the switches, patch panels, etc.) to build-out their network. Consider also the electrical and HVAC costs associated with the Ethernet switch environment. Simply put, we're talking significant dollars.

On the other hand, when this company migrates to a Virtual Ethernet network, it will typically view the infrastructure not by physical server but by the resources required by the applications and services. Investments may have to be made in new hardware and software, however those investments will be to a resource pool that can be shared. In many cases, such as environments that contain a current model IBM pSeries or iSeries server(s), (also known as IBM Power servers) investments may well be lower, because Virtual Ethernet is included with the purchase of the operating system on these platforms. That's right – you may already own a Virtual Ethernet network.

In a virtual Ethernet environment, the organization will also realize benefits that include ease of management and speed of delivery to its business units. Physically, just consolidating server hardware, can yield reductions in the number of servers alone from 100 to 30. This move alone, even without Virtual Ethernet, would deliver cost savings for reduced IT staff hours, hardware, software, space, and HVAC which would conservatively total of around \$1.1MM savings across a \$970K three-year investment -- that's a 12% ROI on 3 years. Add in the reduction in the number of physical Ethernet switches (~\$1250 to \$4,000 apiece), and the fact that Virtual Ethernet can be administered by computer operations labor, not more expensive network operations labor, and the case gets even better.

Clearly, the business case for Virtual Ethernet is worth looking at.

“Virtual” Networks; Tangible Cost Savings

According to a 2010 Gartner survey of IT spending, the top three technologies in which respondents planned to invest were server virtualization, application consolidation and rationalization and blade servers. It's only because the benefits of Virtual Ethernet have been so poorly publicized and explained that this technology isn't even on the radar of most CEOs and CFOs -- much less their data center managers. In sum, while your new network's connections may be “virtual,” the cost savings and increased productivity that you'll realize are both immediate and extremely tangible.



¹ <http://www.gartner.com/technology/research/it-spending-forecast/>

² Bob Violino, "Less Bleeding, More Edge: Runaway IT Spending is Out, Creative Cost Control is In." CFO Magazine, June 1, 2008.

³ IDC, "Enterprise Class Virtualization 2.0—Application Mobility, Recovery, and Management," Document #DR2007_5MEW, February 2007

⁴ Jonathan Koomey. 2011. Growth in Data center electricity use 2005 to 2010. Oakland, CA: Analytics Press. August 1.

⁵ Kate O'Sullivan, "Going for the Other Green." CFO Magazine, September 1, 2011.

⁶ Dan Kusnetzky, "Sorting Out the Different Layers of Virtualization." ZDNet, June 28, 2007



Status Check: By Kris Neely, CMI's Chief Technology Officer

Network virtualization often gets lost in the shuffle when the IT folks are discussing VMWare virtualization, server virtualization, hypervisors, storage virtualization, and the rest.

Too bad – Virtual Ethernet, as just one form of network virtualization, can be, as we have seen, a major cost saver in contemporary business environments. Let's say you have a current model IBM iSeries server. It comes with 4,096 Virtual Ethernet connections as part of the operating system.

Now imagine you have a traditional three-tier (web server, application server, and database server) customer-facing web application. Perhaps it is your on-line order entry/catalog system that your customers use to order products from your firm. Now imagine it's Christmas time and people are inundating your order entry system with orders – they love your products, but are threatening to bury the application under the crush of their enthusiasm.

Now in most traditional manifestations of this type of application, each of the three tiers of this stack might be connected by as many as thirty-six (36) gigabit physical Ethernet connections.

In a gross simplification of a longer discussion, imagine being able to assign three-hundred-sixty (360) Virtual Ethernet gigabit connections between each of those same three tiers, with a system that manages and load balances across all those connections for you. Need to add some connections or take some connections away? Your computer operator can do that for you in less than 60 seconds. No need to schedule, pay for, and train network engineers to do that.

Let me be clear – while I am a huge fan of Virtual Ethernet (largely because I have used it in “The Real World” and it performed flawlessly, and I like its price) – it's not for everybody. But it is worth a look – technically and on a business level.

Best of Luck,
Kris Neely



Reality Check: A CFO Comments on This White Paper

In my first job where I oversaw the IT department, I learned the valuable lesson of standardization. I walked into the server room for the first time and saw a mass of different servers, a rats nest of cables and even some of the hardware stacked on a kitchen rack. The head of IT was proud of his ability to put this all together, and the attitude in those days was if something looked this complicated, it had to be good. A few major system failures later, including the loss of E-mail for 3 days, and I knew there had to be a better way. My new head of IT taught me an important word to describe his objective when it came to the IT infrastructure – “vanilla”.

Fast forward a few years and you expect to see quiet, no frills rooms with neat racks of identical looking servers. As the cloud technologies start to permeate, those onsite server rooms are starting to shrink and in some cases move away. Moving to the cloud brings other benefits in terms of flexibility and scalability under the buzzword of “virtualization”. But servers and desktops are only the ends of the line. In between, there is usually a mass of other technology, cables and boxes. In my experience, those routers and switches can often be an after-thought, in fact they are often stored in separate rooms. In the VFX industry, where cutting edge technology is an important differentiator, we would often proudly show clients our server rooms, but we would never show them a network switch closet!

The good news is that you can now do away with almost everything between the servers and the desktop. The hardware benefits are obvious – switches and routers are expensive. When they go wrong the first response is usually “replace it”. But the benefits of combining a virtual Ethernet with virtualization of your servers and storage are potentially larger. If your systems can dynamically place data anywhere on your network, you want the routes that data travels to be dynamic too. The key statistic in this White Paper for me is “Today...[b]etween 80 percent and 90 percent of a typical server’s capacity is sitting idle at any given moment.” Solving that makes obvious sense, but you won’t solve it without opening up your whole network to virtualization, and that includes the all the pieces between the client and server.

I see the physical network infrastructure the same way as the server farm. You want your Ethernet to be “vanilla” and virtual, because in the IT world that means cheaper, safer, more flexible and more scalable. And if that vanilla Ethernet is in the same box as the vanilla server in the virtual server room, that is even better.

Best,
Kevin

Mr. Kevin Weston, is the former CFO of Digital Domain Productions, as well as former VP Finance and Operations of LucasArts, and was CFO/SVP Finance and Operations at Eidos Interactive Inc.