IN THIS WEEK'S ISSUE: The WAN Future Is 5G, Technology Prognostication, and Learning About CAP Theorem And Databases. Please remember to enable the images; the magazine looks a lot better that way!

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(aka The Project Plan)

Issue Number 29

04/15/2016

The "future-looking, career-considering, CAP theorem" issue.

Thought For The Week:
Cenosillicaphobia is the fear of an empty beer glass.

1. The WAN Future Is 5G

by Greg Ferro

Most network professionals rely on fixed lines to provision bandwidth for their wide-area networks. The very idea of using any type of wireless network for a corporate WAN is anathema because of the history of poor performance and low traffic predictability. At the same time, the cost of renting physical cable from monopoly-like telcos is expensive and inflexible.

But as I read whitepapers about the possible future of 5G networking, I predict that the larger part of any private WAN (if you have one at all) is going to be wireless in the next ten years.

In the "Ten key rules of 5G deployment" whitepaper from Nokia Networks:

A 5G small cells deployment in 6-30 GHz band (cmWave) with a 500 MHz carrier bandwidth can provide hundreds of Gb/s/km^2 for 2025 and beyond.

That's hundreds of gigabits per second per kilometer.

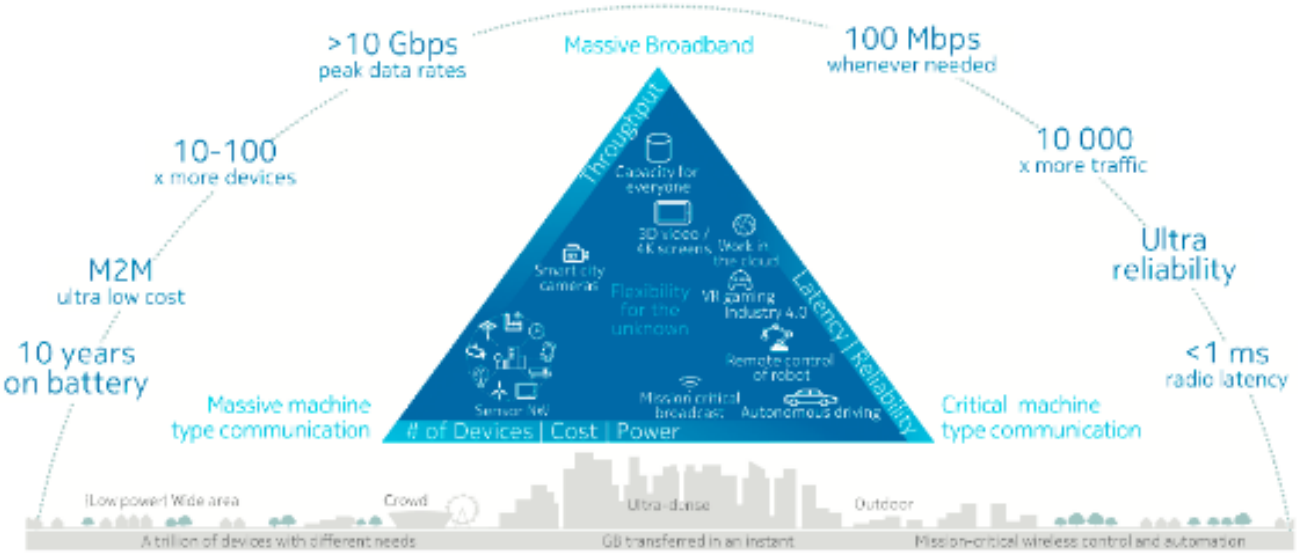


Figure 1. 5G will enable very diverse use cases with extreme range of requirements

The 5G standard uses an array of technologies to improve signal performance and reliability. Let's pick a few points:

- Spreading signal across 1 GHz of aggregated spectrum
- Small cell deployments - (a 5G small cells deployment in up to 100 GHz with 2 GHz carrier bandwidth can provide a Tb/s/km^2 for 2030 and beyond)
- Very large antenna arrays can be used to effectively compensate for the higher path loss at higher frequency bands

The current pre-standard work on 5G includes the ability to use wireless to build WAN connections between towers and small cells. This means that even the mobile networks will use less fixed-line networking and be able to deploy dedicated, indoor small cell deployments to satisfy indoor capacity requirements beyond 2020. Yes, you can expect to install small cellular equipment inside your buildings with in the next ten years.

Low Power

Low power is also a big issue. Current standards include Low Power Technologies to run an IoT device on a single battery for 10 years.

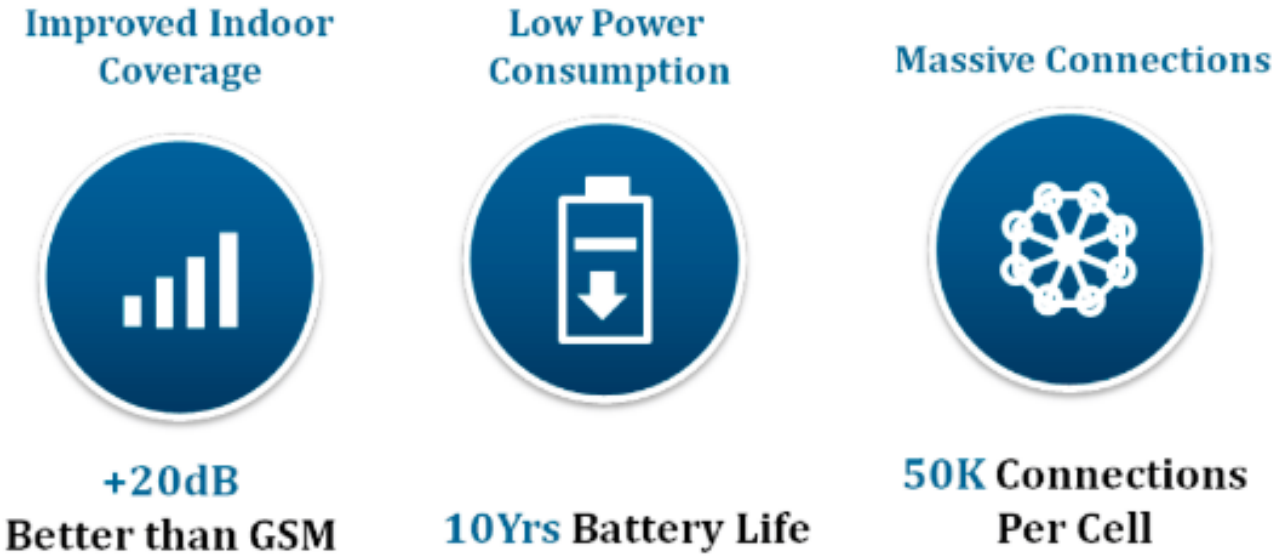


Figure 3: Inherent capabilities of NB-IOT

Viable Today

In a recent podcast with Viptela customers, one customer spoke about using SD-WAN connected to a private MPLS circuit with a 3G Internet connection as backup. In real life operation, this customer got better performance and reliability from the 3G connection in most sites, and now sends critical data over the 3G network first. (Long term, the customer's private MPLS network will be discontinued to reduce costs and be replaced with DSL Internet.)

The EtherealMind View

Here's a couple of thoughts:

1. Don't sign 10-year contracts on private WAN services. WAN prices are falling rapidly and you are locking your company into high prices.
2. Look for opportunities to test 3G/4G networks for new sites, even if only temporarily to get practical information. This means getting new routers, or maybe even trialing an SD-WAN solution.
3. Be flexible about the future. Networking hasn't changed much in the last 20 years, but it seems highly likely it will change a lot in the next 5 years.

Besides the Future of Networking Summit, Interop is assembling a full slate of independent, top-notch content on security, virtualization, IT leadership, SDN, and more.

Make your plans now to join us at Interop Las Vegas, May 2nd through the 6th, at Mandalay Bay. Use the code PPUSHERS when you register and get 25% off 5-Day, 3-Day, and 2-Day conference passes.

2. Which New Technology Should I Investigate?

by Ethan Banks

At Packet Pushers, we get a lot of questions along the lines of “What new technology should I learn to future-proof my career?” It’s a fair question, because disruptive technologies are emerging from all corners of the industry; some are likely to stick around, and others will wither and die.

Unfortunately, it’s not an easy question. There’s no longer a simple educational path. Hyperconvergence, software-defined whatever, and cloud are all changing how IT is consumed, and that’s having a massive bearing on the vendors, products, and operational techniques we see in networking.

My advice? Let me start with a general comment that’s appropriate for the near future: **Learn the technology that makes business sense to you, because it**

solves a problem your organization has.

Looking ahead a few years, I'll venture some suggestions based on where I see the industry going. Please keep in my mind that my job is to cover new technology: to research it, record shows about it, and write about. That doesn't imply the new technology is automatically right for you. It just means that it might be right for someone -- maybe you, maybe not.

With those caveats in mind, here's some general advice on where to direct your investigations:

1. Get comfortable with another silo or two. It's important to have deep, domain-specific expertise in networking, but it's also not enough. Virtualization started the trend of munging technology domains together, and that train is only going to get faster in age of clouds, convergence, and automation. It behooves a good engineer to get handy with compute or storage or applications so that you can troubleshoot problems, design better solutions, and be informed about technology decisions and strategies that will affect the network even if those decisions aren't about routers and switches.

2. Go virtual. Virtual switches, virtual routers, virtual network functions, overlays: more and more networking is going to happen inside tunnels with packets pushed through software applications running on general-purpose CPUs on off-the-shelf servers. So go deep on Open vSwitch, Linux networking, and efforts like DPDK and FD.io. You're already bringing strong networking knowledge to this party, so don't be shy.

3. Automate and orchestrate. The term "software-defined" has been beaten into meaningless noise, but it's important to recognize the import of those words, especially the "defined" part. There's no way to build a useful private cloud, or a set of containerized applications, without an arsenal of pre-defined scripts, programs, and policies to instantiate services, get them properly plumbed, and make sure they're tied into monitoring and management systems. You don't need to become a programmer, but you would be wise to

get familiar with programmatic interfaces, scripts, and repositories, and orchestration tools to wrap it all together.

There's no guarantee that following this advice will propel you up the career ladder, but it's my best approximation of where the industry is going and how skillsets will have to evolve. Now it's up to you to do your own research and chart your own path.

Sponsor: Viptela

Eat, Drink, And SD-WAN With The Packet Pushers At Interop!

Come and join the Packet Pushers team for a merry evening of food, drinks, and conversation on Monday May 2nd at the Skyfall Lounge in Mandalay Bay.

You can chat with attendees from the Future of Networking Summit, and meet Greg and Ethan live and in person. And if you've got questions about SD-WAN, network architects from some of the largest SD-WAN deployments in banking, retail, and healthcare will be there to talk shop and share their experiences.

Register here for The Big SD-WAN Mixer with the Packet Pushers!

Skyfall Lounge, which offers amazing views of the Vegas skyline, is located in the Delano Las Vegas (formerly THEhotel) in the Mandalay Bay resort complex. See you there!

3. What Network Engineers Need To Know About CAP Theorem And Databases

by Russ White

What do network engineers need to know about databases? As it turns out, a lot more than you might think.

For starters, routing protocols are actually specialized cases of eventually consistent, near-real-time distributed databases. Beyond this factoid, a large number of the applications running on your network are probably databases of one sort or another, or they contain embedded databases of information they're processing.

To get a good grasp on databases it helps to understand the CAP theorem, one of the theoretical constructs that much database design revolves around.

First described as Brewer’s Conjecture, computer scientist Eric Brewer argued

that a network-shared data system (like a database) has three properties: consistency, accessibility, and partition tolerance.

Like the expression “fast, cheap, or good: pick two” the CAP theorem explores how only two of its properties can be fully met.

The conjecture was accompanied by a mathematical proof in 2002 in this paper (which you'll need an ACM membership to access).

Brewer later disputed the designation of CAP as a theorem in a 2012 paper. The paper also explains why the “pick two out of three” formulation can be misleading.

A good description of CAP can be found in this post at Port twenty two. An application of CAP to DevOps can be found on Mark Burgess’ site, and an application to routing can be found at 'netWork.

Once you understand CAP, you can think about the "other side" of database design—learning the actual operation and design of databases.

While database access methods such as Structured Query Language (SQL) are interesting, it's more important to learn the structures and background information than to learn access methods. As with all things in the technical world, if you know how it works, understanding how to configure it becomes that much easier.

There are several free resources that will help you understand database technology. A good place to start is this post by Coding Geek, which will give you a general idea.

From there, check out the database training available at the Microsoft Virtual Academy. It is Microsoft-centric, but it's still a good resource to gain a basic understanding.

Once you're through these, the Red Book is a useful resource to understand where things currently stand in the world of database technologies. It's currently in its fifth edition; the authors tend to keep it pretty well up to date.

Happy databasing!

Network Break is a weekly podcast that delivers news & analysis on the networking industry in a fun, fast-paced style.

Internets Of Interest

A collection of pre-loved links that might interest you. "Pre-loved" because I liked them enough to put into this newsletter. It's not *true* love.

By Greg Ferro and Drew Conry-Murray

Why the Network Industry has been Stuck in the

1980s: Cisco's Embrace of Complexity

Now, where have you heard this before?

From **Joe Howard:** *"Ethernet and IP networking is embarrassingly complex, unreliable, arcane, and parochial. That results in very high operational costs, poor security/high vulnerability, and nothing close to five nines reliability. In almost any other product category this would be considered unacceptable. Network technology has changed very little since the late 1980s, with the exception of faster speeds/feeds and some additional protocols and features."*

LINK

What should IETF “standard track” actually mean?

Russ White blogs about the purpose of IETF Standards Track.

"Second, when you’re reading IETF documents, ***don’t take the status of the document as a guide to the usefulness or adoption of a protocol or technology.*** *Document status often doesn’t relate to the usefulness of a technology in the real world, but is rather the result of internal political struggles within the IETF itself. Another instance of this same thing is the wild warnings sometimes attached to specific individual informational drafts for no reason other than internal political considerations.*"

LINK

Global PC shipments drop to lowest level since 2007

A timely reminder that Enterprise IT doesn't drive the technology market. A 10% drop in sales in the last quarter after FIVE previous quarters of large declines.

From Seeking Alpha: "*According to research firm Gartner, global shipments of personal computers fell 9.6% to 64.8M units during Q1, marking the sixth consecutive quarter of declines and the first time since 2007 that shipments dropped below 65M units (IDC reported similar results worldwide).*

In the U.S., PC shipments totaled 13.1M units, representing a 6.6% decline from a year earlier and the lowest volume in three years.

The sector has faced headwinds in recent quarters which include an economic slowdown in China, the strong U.S. dollar and the growing popularity of smartphones."

LINK

Can F5 Networks Get Its Growth Back?

The link below is to a financial article from Seeking Alpha that looks at the business of F5 Networks. Its share price has dropped 27% in the last few months as investors believe that load balancers and WAFs are a shrinking market. At the same time, F5 Networks is like Cisco - it makes vast profits from its customers who are loyal and locked into their product strategy. Like Cisco, F5 uses short-term growth on hardware refreshes to drive short revenue cycles.

The convergence of network functions virtualization (NFV) is going to crush F5 if it doesn't change. Load balancing is a feature, not a product. And competing with security products is a limited growth opportunity because security professionals don't like networking companies.

LINK

Driving To Safety - How Many Miles of Driving Would It Take to Demonstrate Autonomous Vehicle Reliability?

A new report from the RAND Corporation estimates that it would take hundreds of millions, and perhaps hundreds of billions, of test miles for autonomous vehicles to be declared reliable. Because racking up all those test miles could take years, RAND recommends developing new technologies that can show evidence of the safety of autonomous vehicles.

From the **RAND report**: "*Our findings demonstrate that developers of this technology and third-party testers cannot simply drive their way to safety. Instead, they will need to develop innovative methods of demonstrating safety and reliability. And yet, it may still not be possible to establish with certainty the safety of autonomous vehicles. Therefore, it is imperative that autonomous vehicle regulations are adaptive — designed from the outset to evolve with the technology so that society can better harness the benefits and manage the risks of these rapidly evolving and potentially transformative technologies*."

LINK

Hmm. I think *I'd* like to drive this one instead of letting the computer do it.

Computerized Performance Reviews

Let's face it, real-life performance reviews are nearly always crap. A machine couldn't do any worse, could it? Or will we be taking lessons on how to lie to algorithm-based syntax checks for reviews?

From **Fortune:** *Kanjoya, a Silicon Valley-based startup, has proposed one of the more unique and insightful solutions. The company has built a sophisticated computer program called "Perception." Kanjoya claims the program can interpret the intent and the emotions behind written text, which allows companies to quickly analyze thousands of written employee responses in seconds instead of days and at a fraction of the cost of traditional methods.*

LINK

Why a Chip That's Bad at Math Can Help Computers Tackle Harder Problems

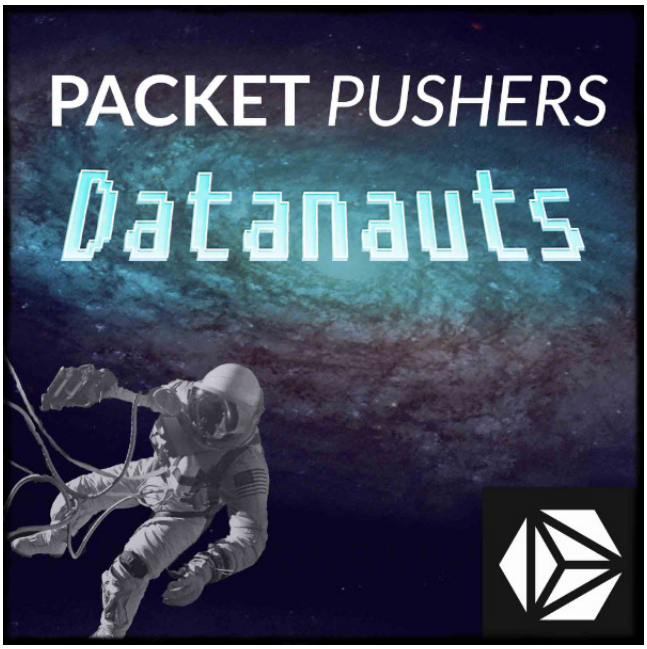
Technology Review has an interesting story on how DARPA is putting money in a company that specializes in fuzzy computing, using chips that are "hardwired to be incapable of performing mathematical calculations correctly," according to the story.

Apparently, these chips are useful for tasks such as identifying visual images in video, and they can do such tasks faster using less power than conventional CPUs.

LINK

PACKET PUSHERS
WEEKLY SHOW
Where Too Much Networking Would *NEVER* Be Enough

The Weekly Show channel is our one-hour deep dive on networking technology.



Datanauts Podcast: Build data centers and bust silos with Chris Wahl and Ethan Banks.

Product News

We don't often get new products worth talking about, so that makes it nice to have something to say.

Rackspace Simplifies Cloud Adoption for Companies by Delivering Managed Private Cloud Everywhere

Rackspace is launching a new managed service for private clouds based on OpenStack. The offering combines hardware, software, and services for companies that want a private cloud but aren't quite ready to do it on their own. Customers can deploy the private cloud in their own data center, a Rackspace data center, or a colo facility that's Rackspace-supported. Rackspace manages the software, hardware, and networking on behalf of the customers.

From **Rackspace's press release:** "*By delivering OpenStack as a managed service in any data center the customer chooses, Rackspace helps companies adopt private cloud to increase performance, simplify compliance and improve data sovereignty and security*."

LINK

Recent Articles

The last five articles published on EtherealMind and Packet Pushers

EtherealMind.com Latest

Logical Razors Can Take on Corporate Babble

Canned Response to BGP Networking Questions – Reddit

IETF RFC 8374 BGPsec Design Choices and Summary of Supporting Discussions

Net Neutrality Hasn't Ended, We Don't Know When

Next Market Transition ? Cheaper Buying, Less Selling

PacketPushers.net - The Last Five

Network Break 182: BGP Hijacked For Cryptocurrency Heist; Juniper, Big Switch Unveil New Products

Show 387: AWS Networking – A View From The Inside

PQ 147: Connecting Security And GDPR Compliance (Sponsored)

Datanauts 131: Masters And Mentorship

Network Break 181: Russia Accused Of Infrastructure Attacks; US Targets ZTE

Watch This!

Where we collect some videos that make us reflect, think about our inner lives, or just entertain us.

There's some science behind this question. And it doesn't stink...

A young woman is reunited with gorillas that were raised in captivity when she was a child and then released back into the wild. It's an older video, but still touching.

Link Propagation Newsletter

Our weekly newsletter delivering essential headlines, announcements, and useful news to your inbox

Can't get enough newsletters? Check out Link Propagation, our newest publication. We send you a free weekly digest with tech news, interesting blogs, and industry announcements, all curated by the Packet Pushers. It's an easy way to keep up and stay informed. Subscribe at packetpushers.net/link-propagation.

Did We Miss Something?

Got an link or an article to share? Email it to humaninfrastructure@packetpushers.net

On average, how many computing devices do you interact with in a day? 1-3 4–6 7–10 Too many to count

The End Bit

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Human Infrastructure is bi-weekly newsletter with view, perspectives, and opinions. It is edited and published by Greg Ferro and Drew Conry-Murray from PacketPushers.net. If you'd like to contribute, email Drew at drew.conrymurray@packetpushers.net.

We don't give away your email address or personal details because that would suck.