# Infrastructure

All of us were DBAs or developers. We were familiar with managing hardware, and configuring systems. We decided that we could handle our own infrastructure early on, and rarely regretted the decision. However we learned over time that hardware and software have much different management requirements and it became a constant challenge for me over the years to manage them.

## Hardware

We started this company on a virtual infrastructure. Not on a virtual machine as we think of them now, but by renting an actual server from a large hosting company. Brian Knight originally set it up on a low budget hosting account that was typically offered for small businesses. It cost us $30 or $40 a month and we got a small server with Windows installed on it and administrative permissions. We had control of the system and installed SQL Server. We set up IIS, created a web site powering with classic ASP, and we were off and running. Brian paid for it initially, but we reimbursed him once we formed the company and everyone had contributed their $50.

This worked fine for almost a year. During this time a few of us wrote ASP code to expand the site, incorporating new features as we had time. We were adding new members constantly, and it

The load grew and the server slowly started to tip over. At the time we argued about whether we should continue on and lease a bigger machine from the hosting company or build our own set of systems. This was late 2001, and it was a hard decisions. Moving to multiple machines was a fairly good premium for remote web hosting companies, and it would have meant a significant expense on our part.

However building our own infrastructure had other issues. We needed equipment, which was a large capital expenditure. We could have to find a good connection to the Internet, as already our bandwidth need was growing, and we needed a place to put the servers. Up to this point Brian had been using his own computer to send the newsletter, but that brought with it various issues, not the least of which was a manual process, limited bandwidth, and the inability of one of us to back him up.

Fortunately I had worked for a couple startups in Colorado and had some experience finding colocation space. I had an idea of what equipment we’d need, I had friends that had experience in networking, and I knew what kinds of costs we might face.

Mostly I knew we couldn’t afford even a third of a rack. Despite the overbuilding of colocation space in the Denver area, the rack and bandwidth costs were more than we could afford. However we had some alternatives.

A good friend of mine was a networking engineer and part time consultant. I had called him into my company for help with networking issues, and he had called me a few times to help with database consulting at a few places. While talking with him one day about our desire to find a place to host at a reasonable cost, he told me he had an idea.

One of his clients was a consulting company that maintained their own T-1 line to their office. It was used by the staff and consultants, but it wasn’t heavily used. Especially at night, which was the time when we needed the most bandwidth. In tracking our network utilization on both our server and Brian’s machine, we realized that our newsletter easily consumer twice the bandwidth of the website.

The owner of the company was a good friend of my friend and agreed to rent us some rack space and allow us the network bandwidth for a couple hundred dollars a month. This was found money for the company and it nicely offset their T-1 cost. My friend had a key to the office and we could use the existing firewall (which he maintained for the company) to protect our servers.

A good solution all around, so we purchased a nice, large 4U DELL server and promptly did the thing that we typically cautioned most site users against. We installed IIS and SQL Server 2000 on the box and migrated the website.

A business has to be practical in how it builds infrastructure. We all have an ideal way to set up systems, but we might not be able to do that. We can’t necessarily buy as many servers as we want, or even as much CPU/RAM/Disk as we think we need. We make an estimate, knowing that it is probably wrong. However external factors come into play.

In our case, we had limited funds, and we planned to separate the database from IIS, but in the short term we had to make do. That doesn’t mean we threw all best practices out the window. We did write code with the expectation that we would separate the database out, so no “(local)” in the connection strings. We tried to keep code contained in certain folders and built the system to keep things as clean as possible. We had to make do with remote backups, copying the data to our local machines once a week or so and keeping our fingers crossed in between.

We were earning money month by month, and as soon as we could afford it, we planned to reinvest in the business and add a second server. Fortunately we had no major incidents during this time. No hardware problems, no bandwidth issues, and no complaints from our host. The only issue was a 2-3 hour power outage one day when a large section of Boulder had a power pole get taken out in an accident.

As we progressed along, we got lucky in another way. My friend bought a house, moving north of Denver and was looking for high speed bandwidth. He wanted a T-1, but couldn’t afford the $1,000 or so a month that would cost at the time. However he did have another alternative. Spring began looking to test a new high speed like that would give about 6MB/s to residences. Back in 2001 this was a huge amount of bandwidth, and it’s actually more than I still get in 2010!

The catch was that this service cost almost $200 a month, which was more than even a single, geeky network engineer wanted to spend. So he approached me about moving our servers to his house, with the intention that we could cover his bandwidth cost. He knew how much bandwidth we needed, and since we were mostly upstream, we wouldn’t interfere with his downstream usage.

He had plenty of spare equipment, having undertaken the task of studying for the CCIE exam. He had a rack, and would be happy to host things. We decided to make the move as our bandwidth was growing and it was only a matter of time before we were causing issues with the T-1 at our host consulting company. One weekend I headed to Boulder to help carry equipment and get it setup in its new home.

Installation was a breeze, setting it on a shelf in a rack that was in my friend’s basement. He had already setup a firewall and switch behind the Sprint router and we assigned one of his static IPs to our box, updated the DNS entries at ZoneEdit and we were alive after only being down for a few hours.

Over the next couple of years, this was a great hosting location for us. I had a key to my friend’s house, and while it was still a distant location (50 miles from my house), it was still accessible in an emergency. We also had essentially unlimited space and power in a climate controlled area. Denver basements tend to be dry and stable in terms of temperature. My only concern sometimes was the large tangle of wires that tend to accumulate near any rack that a geek has complete control over in their house. Any networking changes required careful tracing of cables and timid steps to be sure that you didn’t accidently disconnect something.

We still knew that we needed another server and shortly after the move to the basement, we finally had enough money to get another machine. We ordered it from Dell, sending it to my house. That was the standard practice for years. We would order equipment, ship it to my house for configuration. I’d drag it to the basement, connect a keyboard, monitor, mouse, and try to configure it in a place where the kids couldn’t cause issues. I could add memory, install software, and move at a leisurely pace around the rest of my busy life.

In this case I installed SQL Server and then packed up the machine for a trip up North. I had scheduled a few hours one weekend to move the database, which meant moving full and transaction log backups to get the second server ready. I moved 2 or 3 transaction log backups while I prepped a static site for maintenance. I switched the configuration in IIS so that only my static page was up and then made one last transaction log backup and restore. The various connection strings were repointed to the new server and the site was back up.

Or mostly back up. As much as we’d tried to centralize all connection strings, I spent the next few days cleaning up a few static ones that were on various pages or in jobs and refactoring them back to a central location. Even months later, I’d stumble on an obscure page for some rare function that needed to be fixed.

This was one of the smoother moves I’ve had in SQL Server and finally we felt protected. And we could actually say that were had implemented the system correctly. We had a dedicated SQL Server and a dedicated IIS server.

However two servers don’t protect you from everything. Both servers were configured with a single RAID 5 array because that was the most economical way to set them up. This was also before BAARF and it was how many of my employers built servers as well. We didn’t have the load, or budget, to justify RAID 10, so RAID 5 was the next best thing.

We recognized this was less than ideal, so while I stopped the SQL Server services on our IIS box, I left them alone. They would be our emergency backup. Over a period of the next few weeks, I also moved a copy of our IIS code to the database server and configured IIS on that system to be ready to take over in the event we had a hardware failure. This wasn’t perfect, and I had jobs to periodically copy our articles from one server to the next. We had built an interesting article publishing system, which I’ll explain later.

I also used the same scripting jobs I’d written at my day job to copy database and log backups from the database server to the other server. In essence we had each server acting as the backup for the other one. If we had a hardware failure, we would have to fail over manually and everything would be running on one machine. But it would be running, which was important. We were at the point where we were making commitments to advertisers and needed to be able to deliver.

Over the next year or so we had minor issues. There were a few power outages. We learned that a UPS was a good investment, even for a small operation. After I had to drive to north Denver a few times on my lunch break to restart a server that had cut off from a short power outage, I would gladly have bought a few UPSes out of my own pocket.

I took an old desktop up there and used that as my spare backup server, building automated jobs to copy backups to this machine as additional protection. I also took a second switch up there and connected it to our spare network cards, leaving it unplugged. In the event our primary switch failed, which happened one day, my friend could easily unplug it and power up the secondary switch instead of calling me for remote hands work about which machines needed to connect to what. It doesn’t sound like you’d need this, but remember the tangle of wires mentioned above? When you’re in a hurry, tracing cables is the last thing you want to do.

Overall this was a great hosting environment for us for a couple years. We had great bandwidth, and lots of it, fairly stable power, and plenty of space. However it wasn’t perfect and eventually we had to move.

The 5MB/s my friend enjoyed in 2002 was beyond anything that most residences would have until 2009 when FIOS started to be deployed. Eventually Sprint must have decided that they just couldn’t get enough people to spent $200 a month for this Internet thing. So they sent a notice of cancellation to my friend. We were on a clock to move our systems, which at this time needed lots, and lots of bandwidth.

By this time, in late 2003 I had also moved my residence. If I had still been in suburban Highlands Ranch outside Denver we might have just purchased a T-1 for my house. I certainly wouldn’t have complained. However I had moved to Centennial, to a 2 acre property. While my wife got her horses, we struggled for Internet. We hadn’t checked the connectivity when we moved in, thinking that we were still “in town” and close to services. After all, the Broncos fooball training facility was two miles away.

Unfortunately our neighborhood was on the edge of the city of Aurora. We were at the farthest distance we could be from the Qwest central office (CO), over 25,000 feet. Much too far for DSL at the time. Just across Parker Road, literally a few hundred yards, was another CO, but the wires buried in the ground aren’t easily moved. At first we installed an ISDN line for my wife. She worked at home and needed high speed bandwidth. However that proved too slow for her and we found a wireless internet company that would provide close-to-DSL bandwidth via a microwave antenna on our house. We installed that and it worked fine, but it wasn’t anywhere close to something I could use for SQLServerCentral.

I did call a number of places about a T-1 line, but because of the 2acre properties, it would have been over $1500 a month. This was more than renting a rack at a co-location facility. I half-heartedly argued that having it at my house would be worth it because of the unlimited space, and great bandwidth for me, but I’m glad we didn’t do that as I would move again in 3 years.

We debated about moving the servers down to Florida, either Orlando where Andy lived, or Jacksonville with Brian. However the annual hurricanes that rolled through Florida, and had caused serious power issues with both of them over the years made that seem like a bad idea.

So I was back on the colocation search.

Over the years I had visited 6 or 7 facilities with my companies, looking for a good hosting provider. This time I was looking for a smaller scale, but more bandwidth than I typically needed. We were averaging just above a T-1 line, and could easily peak at better than 3MB/s when sending newsletters. We were also making money at this time in the 2004/2005 time frame, so I had room to negotiate. I traveled all around Denver, visiting 4 or 5 facilities. I preferred something near my house since I did go to the servers every few months for some reason, but price mattered.

One thing I’ve learned is that most of these operations provide about the same service. No matter what they say to you or try to sell you, most of the decent sized data centers know what they’re doing and provide a very reliable service. They might run into an emergency they can’t handle, or they might have patch issues, but those are usually few and far between. If you can afford the minimal rack price, then they are all about the same.

I ended up getting a good deal because of contacts at a facility that one of my former employers had actually used. I knew some people there, and they agreed to give me a good deal on bandwidth and a full rack. They had space, having not completely recovered from the bubble burst in 2000/2001 and I was asking for a good amount of bandwidth.

We ended up getting a full rack with 4MB/s of bandwidth for around $1,500 a month. At the time that was a good deal, since going above the 1MB/s tended to command a premium at many places. We could burst to 10MB/s, though we used network equipment to limit and prevent overages.

I took a weekend to shut things down, leave my desktop in the basement serving a static page, and I drove everything down to Centennial. Setup was easy, especially as I ignored the firewall at first. I needed help getting that setup and for the time being I dropped a switch in the cabinet with our two servers. There was the usual reconfiguration hassles of changing IPs, asking for ARP tables to clear, and we were live in our new home.

A few days later we took another short outage as we reconfigured the network to add a firewall and secure things from the outside world. Port redirects were added to allow us to connect to the SQL Server and RDP in. These were security holes, but we used non-standard ports, and our hosting provider was on the lookup for port scans, so we felt fairly secure.

A full rack is 42U, but somehow ours felt crowded. I’d added two shelves and stacked our servers on one of them. I had an old KVM unit from a failed startup that was mounted along with a switch. The firewall was stacked on top of a server and we had a monitor on the other shelf to allow us to connect to the servers and get work done. While the colocation facility had a spare monitor a rolling stand, I’d learned that it was often in use and I couldn’t count on it.

We had two UPSes in the bottom of the rack along with a large plastic bucket that kept odds and ends. Spare mouse, spare network cables, spare KVM cable, and more were stacked in there. On one hand we could have racked a dozen more servers in there, on the other hand it didn’t feel like there was a lot of free space.

Issues with sprint

A real rack

Moving to a half rack

Transition to the UK