



Scaling the Windows Stack

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PICC '12

Agenda

- What is Stack Exchange?
- Growth this Year
- Our Technology Stack
- How we scale
- Dealing with Windows stack scaling pain

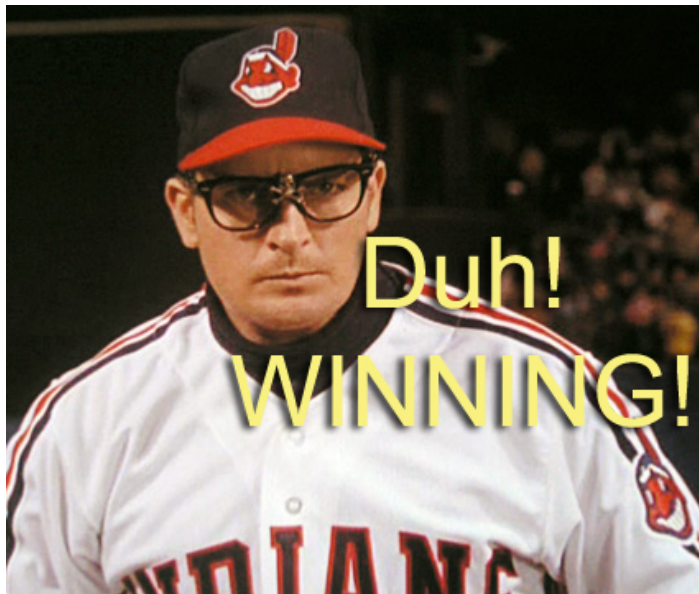
Stack Exchange

Stack Exchange is a fast-growing network of [87 question and answer sites](#) on diverse topics from software programming to cooking to photography and gaming. We build libraries of high-quality questions and answers, focused on the most important topics in each area of expertise. From our core of Q&A, to community blogs and real-time chat, we provide experts with the tools they need to make The Internet a better place.

stackexchange.com

Growth this Year

- Quantcast rank: 250 (April 2011) -> 132 (May 2012)
- Pageviews / month: 120M (April 2011) -> 271M (May 2012)
- HTTP Requests/s: 800 (April 2011) -> 900 (May 2012)
- “Visits”: 1.5M (April 2011) -> 2.9M (May 2012)
- SSL: <1%% of requests (April 2011) -> ~3% of requests (May 2012)



Our Core Technology Stack



- ASP.NET MVC 3 (RAZOR)
- IIS 7.5
- Windows Server 2008 R2
- Microsoft SQL Server 2008 R2
- C# (.net 4)

HAMPSTERS!



Reference: <http://meta.stackoverflow.com/q/96354>

Important Infrastructure

- Load Balancing
 - Haproxy (currently 1.5dev6)
- Network Caching
 - Redis (2.4.10)
- Search
 - Lucene.NET
- Monitoring
 - SolarWinds Orion
 - Custom Status Console (uses Orion data)

Database Servers

Server	CPU	Memory	Network
NY-DB01	10 %	133.51 GB / 144.01 GB (92.72%)	240.77 Kb/s
NY-DB02	0 %	113.24 GB / 144.01 GB (78.64%)	152.23 Kb/s
NY-DB03	14 %	177.43 GB / 288.00 GB (61.61%)	54.49 Mb/s
NY-DB04	0 %	135.69 GB / 288.00 GB (47.12%)	1020.76 Kb/s
NY-DB05	17 %	70.67 GB / 128.00 GB (55.22%)	3.94 Mb/s
NY-DB07	13 %	9.19 GB / 12.02 GB (76.59%)	9.50 Mb/s
OR-DB01	0 %	5.52 GB / 96.00 GB (5.75%)	136.78 Kb/s
OR-DB02	0 %	22.93 GB / 24.02 GB (95.55%)	1.22 Mb/s
OR-DB11	2 %	19.97 GB / 48.01 GB (41.61%)	5.38 Mb/s

Web Servers

Server	CPU	Memory	Network
NY-WEB01	12 %	7.12 GB / 16.00 GB (44.53%)	11.76 Mb/s
NY-WEB02	15 %	8.01 GB / 16.00 GB (50.13%)	16.27 Mb/s
NY-WEB03	16 %	7.21 GB / 16.00 GB (45.09%)	19.58 Mb/s
NY-WEB04	14 %	11.61 GB / 16.00 GB (72.63%)	15.15 Mb/s
NY-WEB05	17 %	11.21 GB / 16.00 GB (70.12%)	13.05 Mb/s
NY-WEB06	14 %	12.04 GB / 16.00 GB (75.33%)	13.28 Mb/s
NY-WEB07	9 %	12.57 GB / 16.00 GB (78.63%)	9.47 Mb/s
NY-WEB08	8 %	12.96 GB / 16.00 GB (81.06%)	11.60 Mb/s
NY-WEB09	14 %	12.91 GB / 16.00 GB (80.76%)	18.94 Mb/s
NY-WEB10	1 %	6.06 GB / 16.00 GB (37.91%)	1.62 Mb/s
NY-WEB11	1 %	8.87 GB / 16.00 GB (55.48%)	1.89 Mb/s
NY-WEB14	31 %	1.43 GB / 4.02 GB (35.67%)	2.25 Mb/s
NY-WEB15	30 %	1.30 GB / 4.02 GB (32.51%)	3.00 Mb/s
NY-WEB16	34 %	1.37 GB / 4.02 GB (34.32%)	3.00 Mb/s
NY-WEB17	26 %	1.53 GB / 4.02 GB (38.14%)	2.51 Mb/s
OR-WEB01	0 %	2.82 GB / 24.00 GB (11.77%)	218.05 Kb/s
OR-WEB02	0 %	1.93 GB / 24.00 GB (8.04%)	40.62 Kb/s
OR-WEB03	0 %	2.49 GB / 24.00 GB (10.37%)	46.10 Kb/s
OR-WEB04	0 %	2.30 GB / 24.00 GB (9.61%)	887.38 Kb/s
OR-WEB05	1 %	1.07 GB / 8.01 GB (13.42%)	48.75 Kb/s
OR-WEB06	7 %	1.60 GB / 8.01 GB (19.95%)	3.92 Mb/s
OR-WEB12	4 %	1.46 GB / 8.01 GB (18.27%)	2.79 Mb/s
OR-WEB13	0 %	1.66 GB / 8.01 GB (20.75%)	1.11 Mb/s
OR-WEB14	0 %	1.12 GB / 8.01 GB (14.00%)	32.55 Kb/s
NY-PROMOWEB01	1 %	1.47 GB / 4.02 GB (36.65%)	26.62 Kb/s
NY-PROMOWEB02	1 %	1.36 GB / 4.02 GB (33.99%)	26.45 Kb/s

How have we Scaled?

1. AWESOME Devs
2. CACHE ALL THE THINGS!
3. Always be planning for the future
4. Vertical vs Horizontal
5. Right Tool, Right Job

Step Back

Last Year

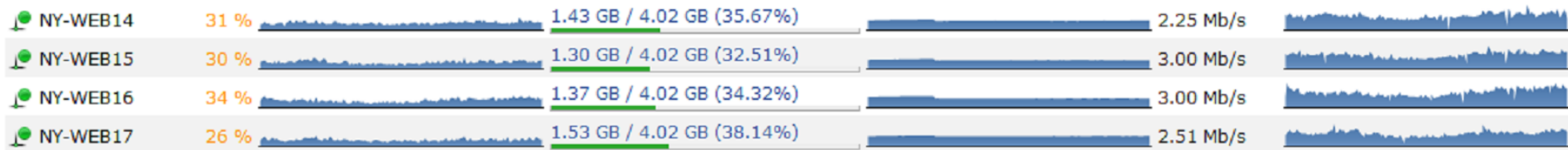
9 Production, 1 Dev Web Server
2 DB (Hot/Warm Pair) - Stack Overflow Dedicated

This Year

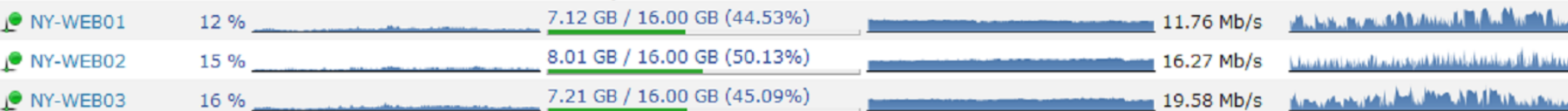
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Awesome Devs

SE 1.0 – equivalent to pre-optimized SE 2.0



Optimized SE 2.0



Caching, Caching, Caching

Tier 0

Client Cache

Tier 1

IIS Cache

Tier 2

REDIS

Tier 3

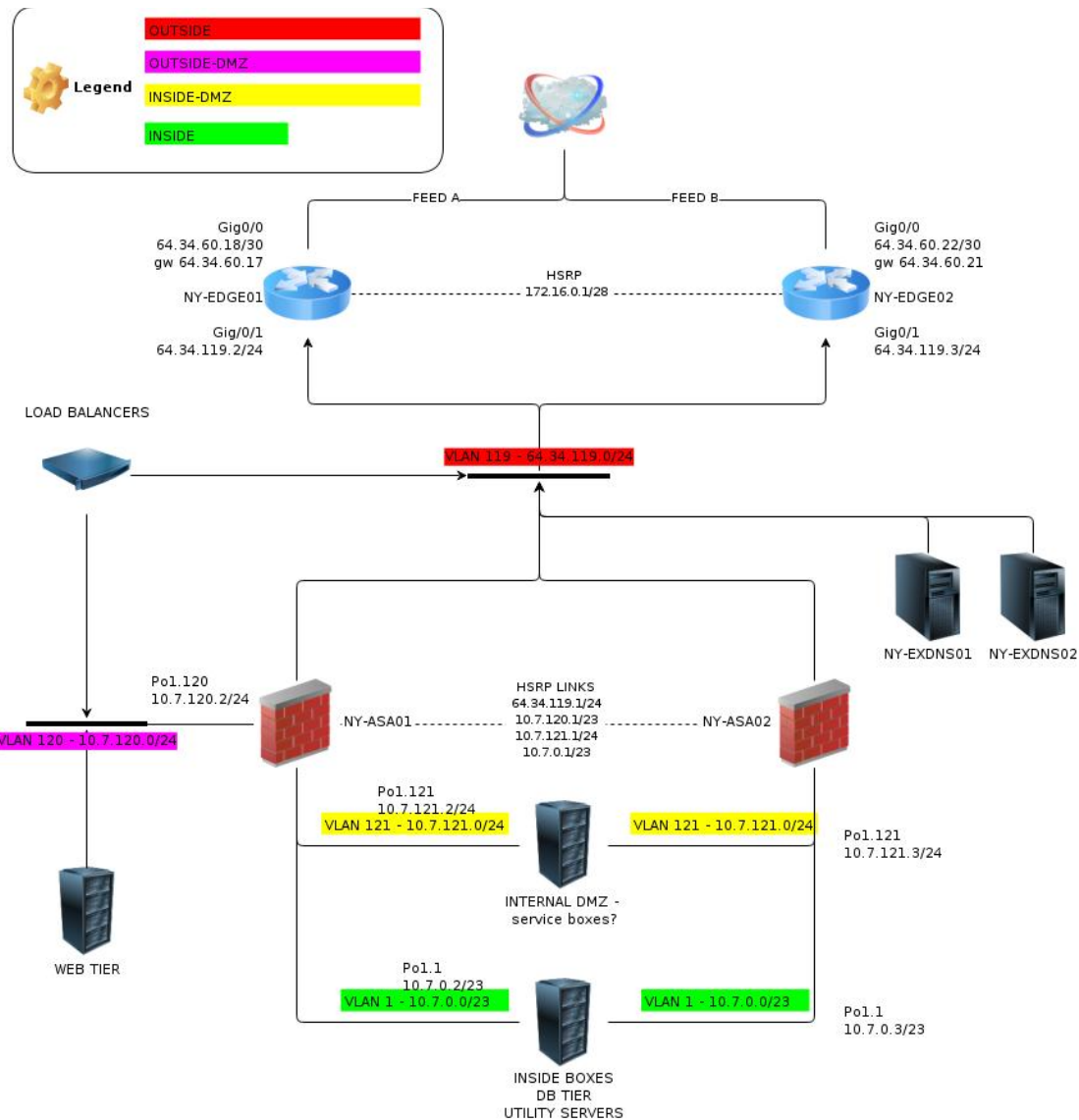
SQL Cache

A little more on Caching

- Not All Users are equal
- 90+% of our page views are anonymous
 - Much more aggressive Caching for anonymous users
 - Very few anonymous user requests hit the database

Future Planning, it's IMPORTANT

- Game plan what you expect your growth to look like
 - You'll be wrong
- Design for a reasonable amount of growth – avoid over engineering AND under engineering



Vertical and Horizontal

- They aren't mutually exclusive
- We grow primarily up, but also out when needed
- We have scaled our SQL servers up
 - Added RAM (Currently 144GB / 288 GB)
 - SSDs (Moved to Intel 710 200GB SSDs)
- If we needed we would scale our Web servers out

Always Use the right tool

- Don't Use Ports
- Don't try and force a piece of software to be everything
- Use specific tools for specific jobs



Scaling Windows can be painful

- 2008 Does not respect GARP out of the box (there is a hotfix)
- \$\$\$\$
- Garbage Collection Pain
- Deployment can be harder

Wait, no GARP?!

“First, a Windows Vista or Windows Server 2008 will not update the Neighbor cache if an ARP broadcast is received unless it is part of a broadcast ARP request for the receiver. What this means is that when a gratuitous ARP is sent on a network with Windows Vista and Windows Server 2008, these systems will not update their cache with incorrect information if there is an IP address conflict.”

<http://blogs.technet.com/b/networking/archive/2009/03/30/tcp-ip-networking-from-the-wire-up.aspx>

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Garbage Collection

- 3 tiers
 - Gen-0
 - Gen-1
 - Gen-2
- Under Certain situations this can kill you

For more information:

<http://marcgravell.blogspot.com/2011/10/assault-by-gc.html>

Deployment

- Imaging ... sucks
- Scripted installs are MUCH better now (kickstart/preseed like installs)
- Network configuration is still generally painful
- WDS + GPO will get you 95% of the way there

Questions?