

Achieving Better Image Optimization

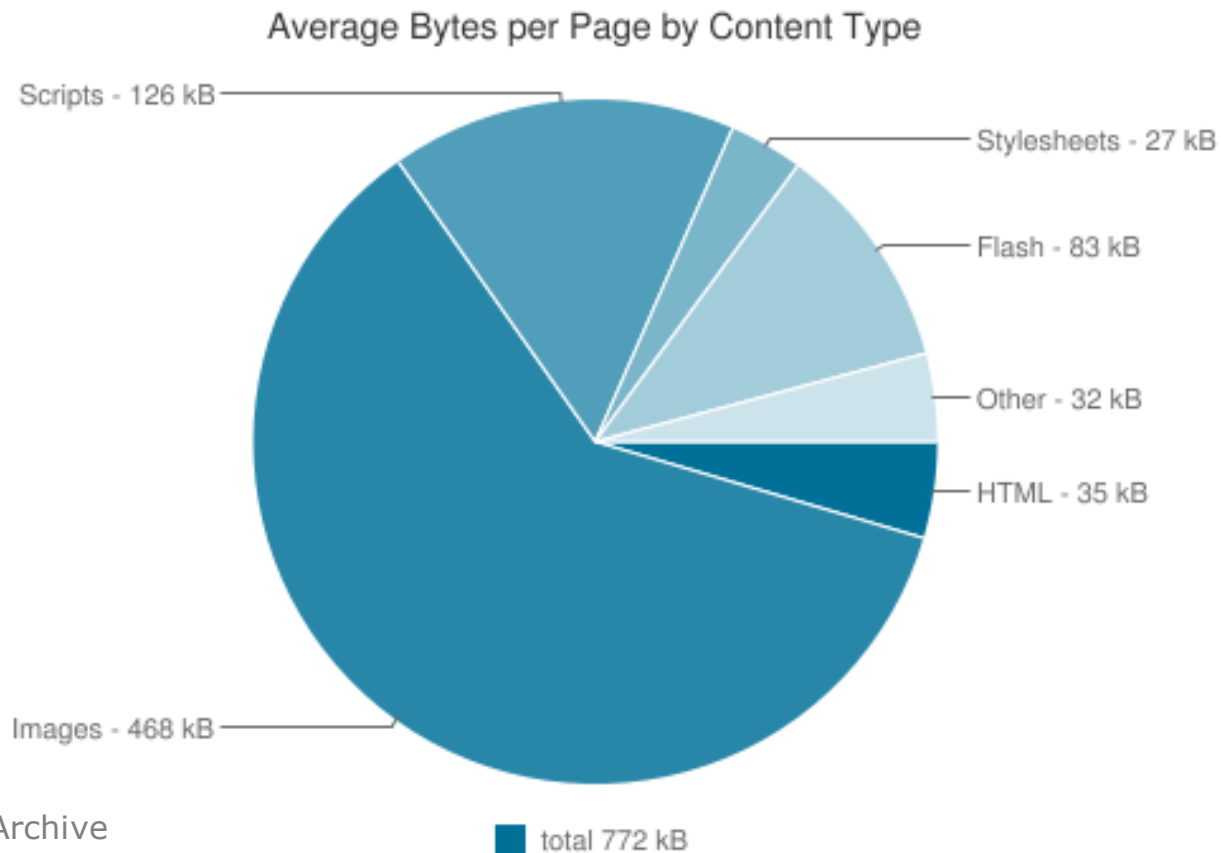
Billy Hoffman

billy@zoompf.com

@zoompf

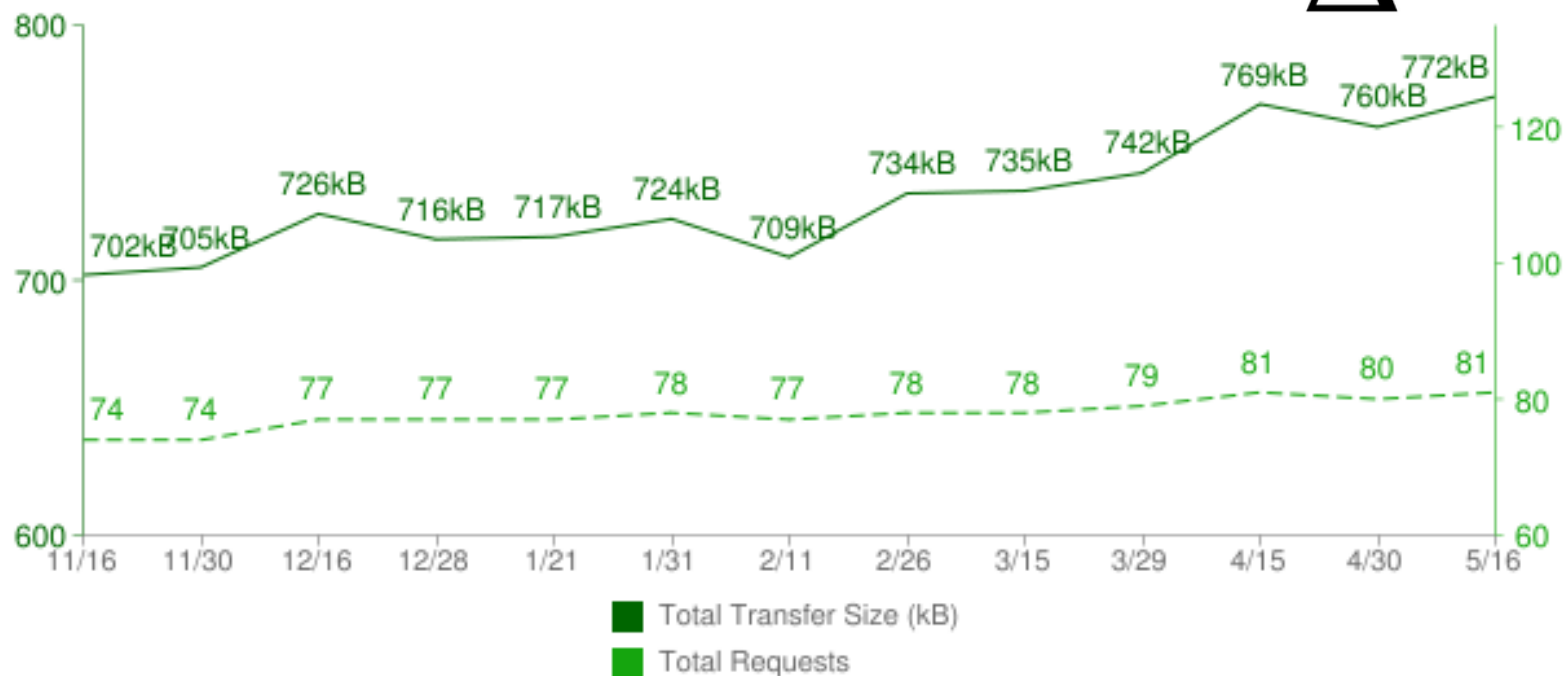


Images Dominate the Web



Total Size is Increasing

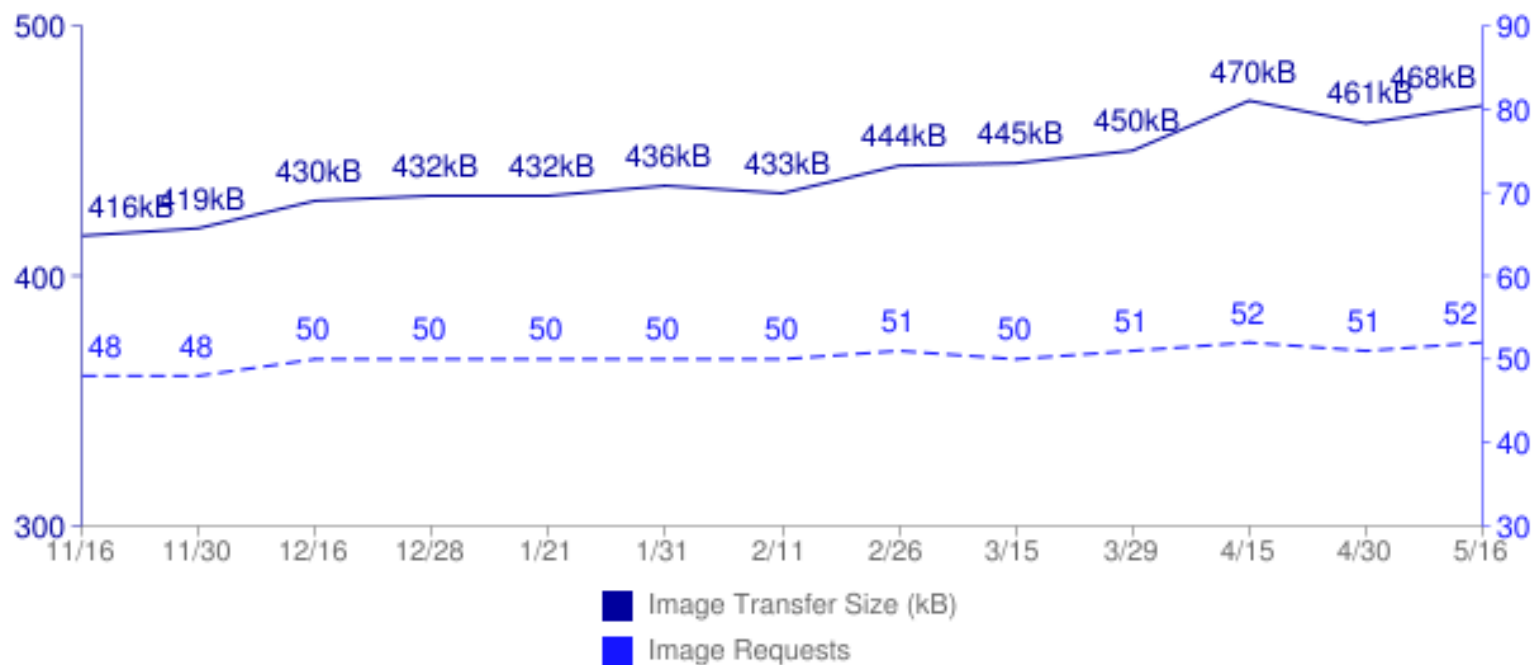
Total Transfer Size & Total Requests $\Delta 70$ kB



Source: HTTP Archive

Images Are 74% of the Increase

Image Transfer Size & Image Reques $\Delta 52$ kB

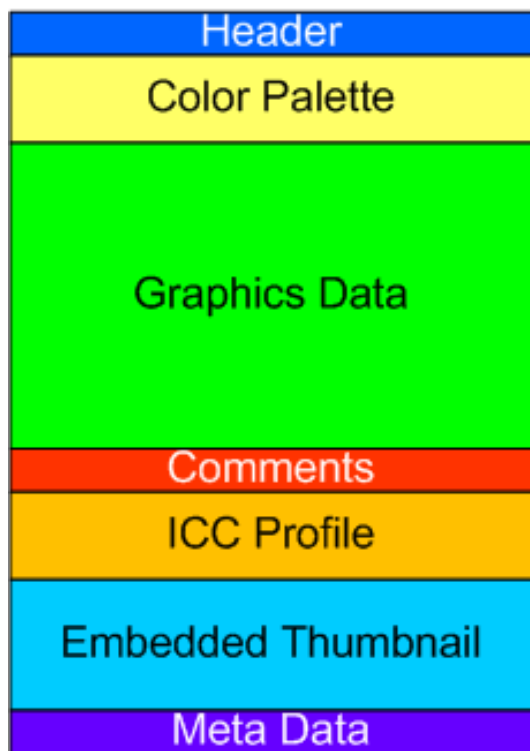


Source: HTTP Archive

Reducing Content Size

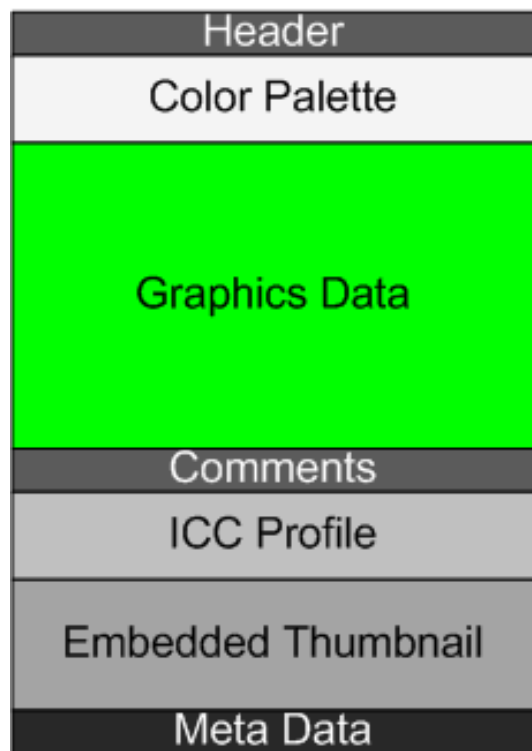
- HTTP Compression isn't the king
 - JS, CSS, HTML = 188 kB
 - Only 24% of total content size
 - Reducing 24% of web content by 66% is not great
- Images
 - Reduce image size by 25% results in more total savings than text optimizations

Lossless Optimization (Bloat)



- Removes anything not needed to draw the image
- Optimized image is pixel perfect copy
- Saves 5-20%
- Occasionally 70-80%

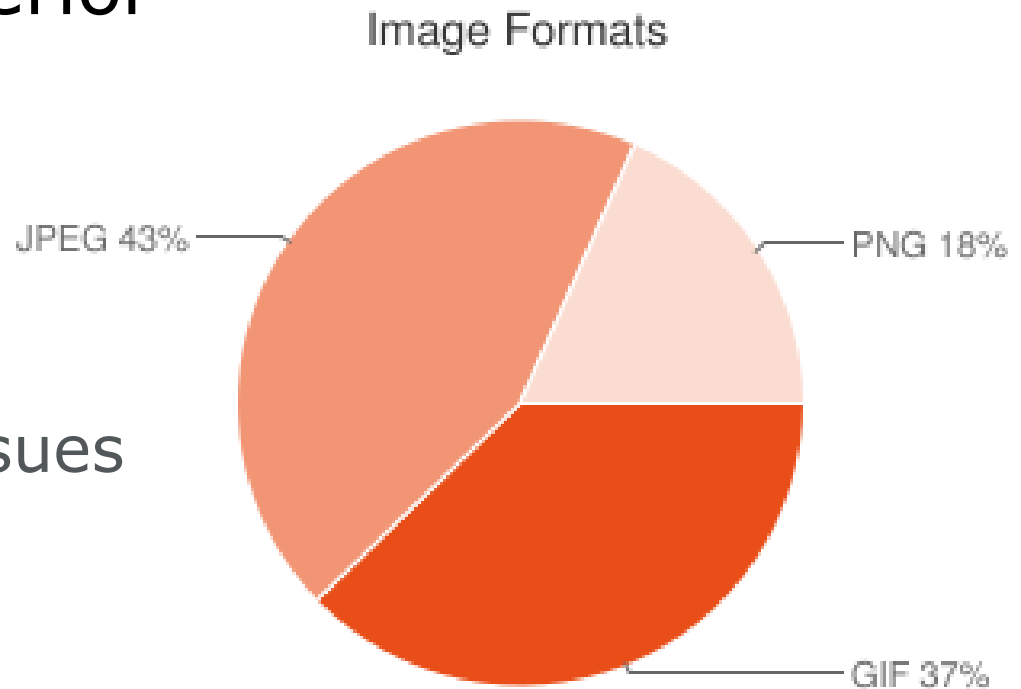
Lossless Optimization (Efficiency)



- Store graphics data more efficiently
 - Convert GIF to PNG (LZW vs. DEFLATE)
 - Beyond stock zlib DEFLATE implementation
- Optimized image is pixel perfect copy
- Saves 5-20%

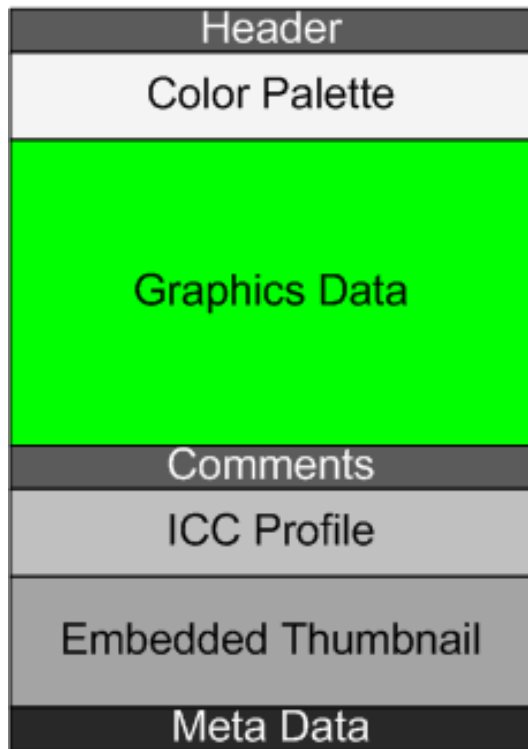
Aside: Always Use PNG

- DEFLATE is superior to LZW
- All browsers support PNG
 - Those with transparency issues are near dead
- Only keep animated GIFs



Source: HTTP Archive

Losing Graphics Data?



If 80-95% of the bytes in an image are graphics data...

... perhaps we should look at reducing the size of the graphics data

Lossy Optimizations!

“Do Not Touch My Art!”



- Lots of push back
- “Losing” data is scary
- “Won’t that look bad?”
- “We spent a long time to make it look like this.”

Everything is Lossy!

- Telephone calls (8kHz w/ 8bit Samples)
- CDs (44kHz w/ 16 bit samples)
- Conversion to Color Television
 - Eye more sensitive to brightness than color
 - Chroma Sub-sampling (Y'CbCr 4:2:2)
 - 33% less bandwidth, no perceivable difference
- MP3 files
 - Frequency Masking

... In the Eye of the Beholder



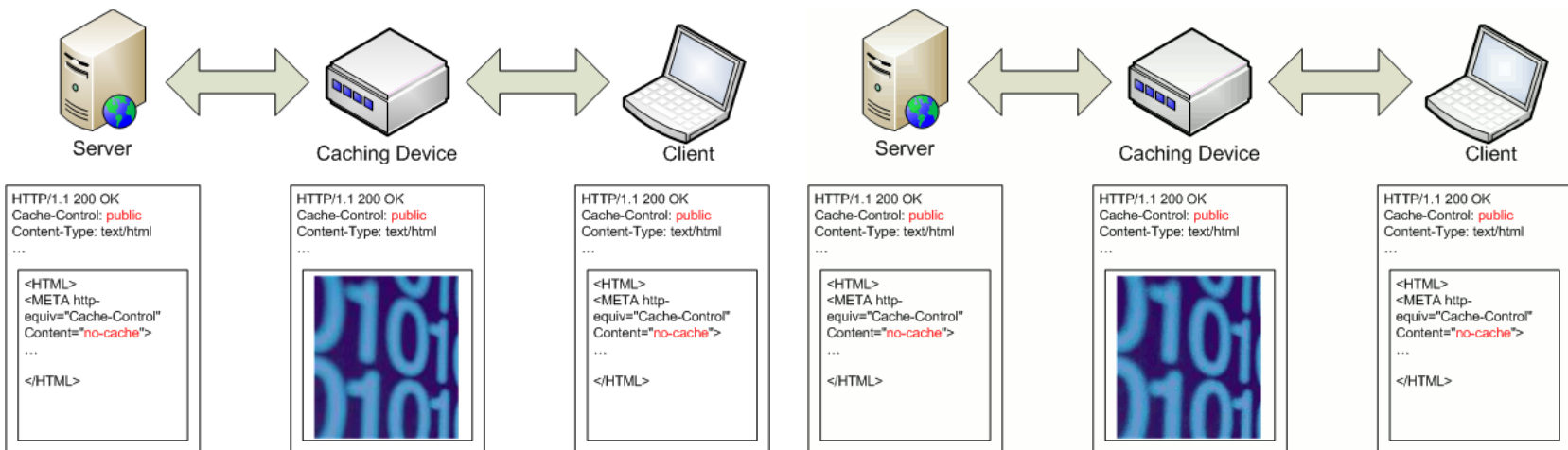
- This is all subjective!
 - “Noticeable”
 - “Perceptible”
 - “Nearly the same”
- Beware *philes
 - CDs vs. Vinyl
 - MP3 vs. FLAC
- Find a middle ground for average viewer

PNG24 to PNG8

- From millions of colors to 256
- The human eye is not well suited to detecting subtle color changes
- Discard them!



Reasonable Number of Colors



PNG24

Size: 77964 Kb

Colors: 12769

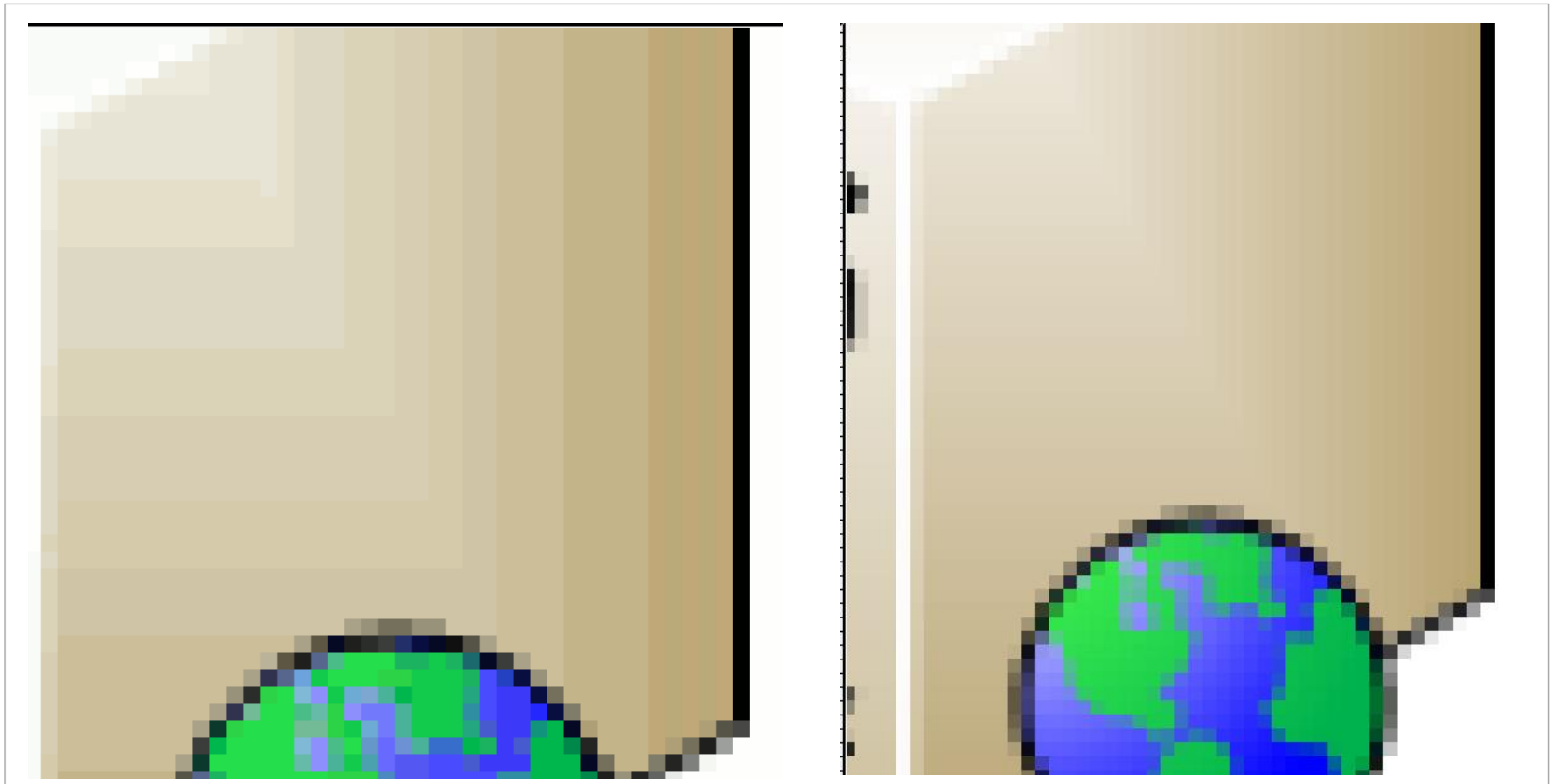
PNG8

Size: 26980 Kb

Colors: 256

65% smaller

Differences



What About Lots of Colors?



PNG24
Size: 512110
Colors: 148279

**63%
smaller**



PNG24
Size: 188342
Colors: 256

Differences

- 99.82% less colors!
- Skin tone transition is not smooth...
- Only noticeable on larger images or extreme zoom



Smaller Images



PNG24

100x100

Size: 19772

Colors: 9138

PNG8

100x100

Size: 8734

Colors: 256

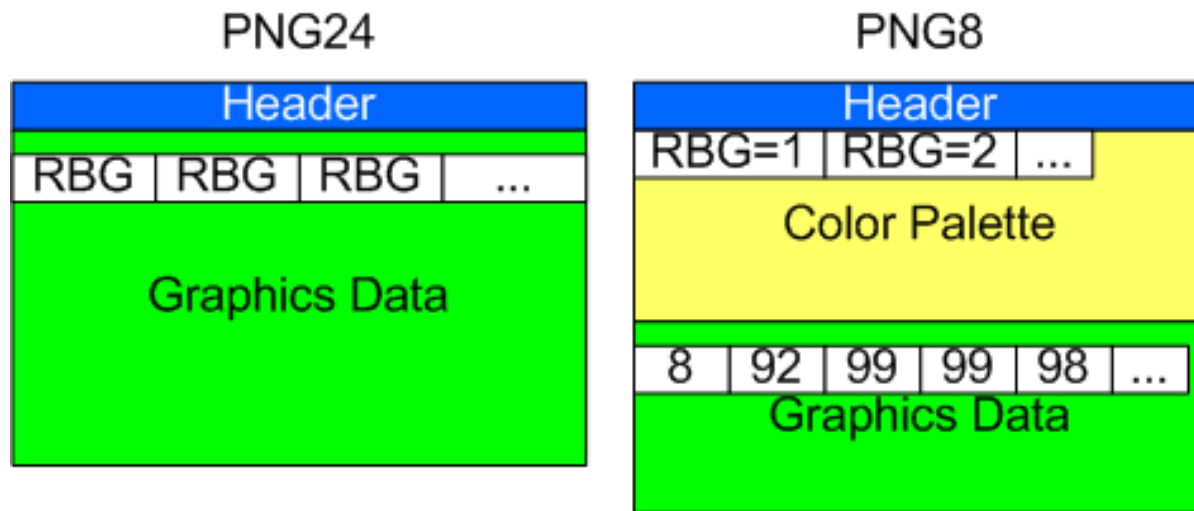
55.8%
smaller

PNG24 to PNG 8 Guidelines

- Convert images with low unique color counts and verify
 - identify –format "%k" image.png
 - Zoompf recommends < 5000 colors
- Always convert small dimensional images
 - Zoompf recommends < 10,000 pixel area
- You can push these limits
- Tools
 - Zoompf free scan/WPO

PNG24 to PNG8: Caveats

- Tool support for alpha transparency
 - Online converter
- Not always smaller for small images



Lossless to Lossy (PNG to JPEG)

- Lots of images are saved as lossless when lossy will work
 - Photos
 - Screen shots
 - Logos
 - Icons
 - Diagrams
- Changing formats reduces file size

Obvious: Photographic Data



PNG24

Size: 512110
Colors: 148279

**89%
smaller**



JPEG

Size: 52015
Colors: 72060

Logos/Icons/Buttons



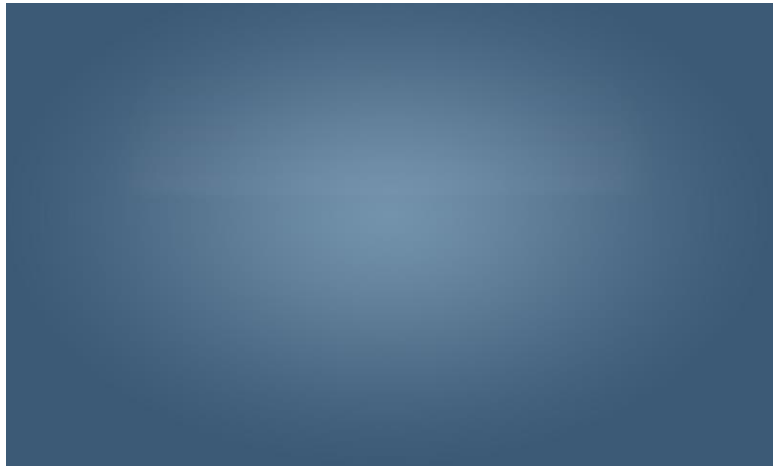
PNG24
Size: 35503
Colors: 728

**55%
smaller**



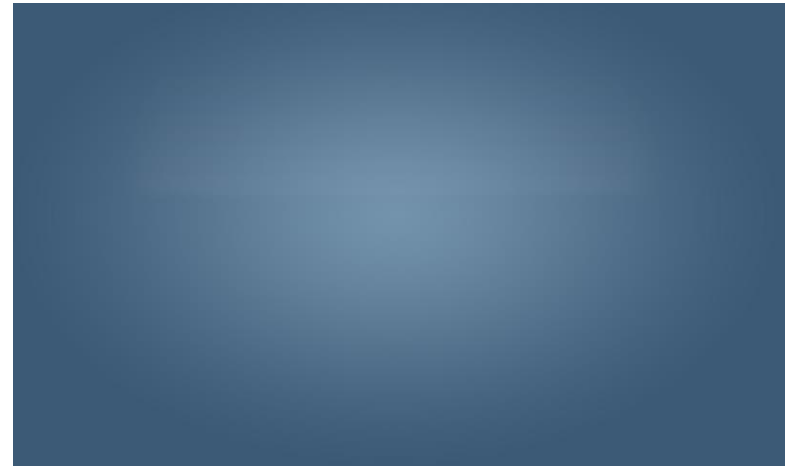
JPEG
Size: 16123
Colors: 12224

Backgrounds



PNG24
1623x967
Size: 76,135

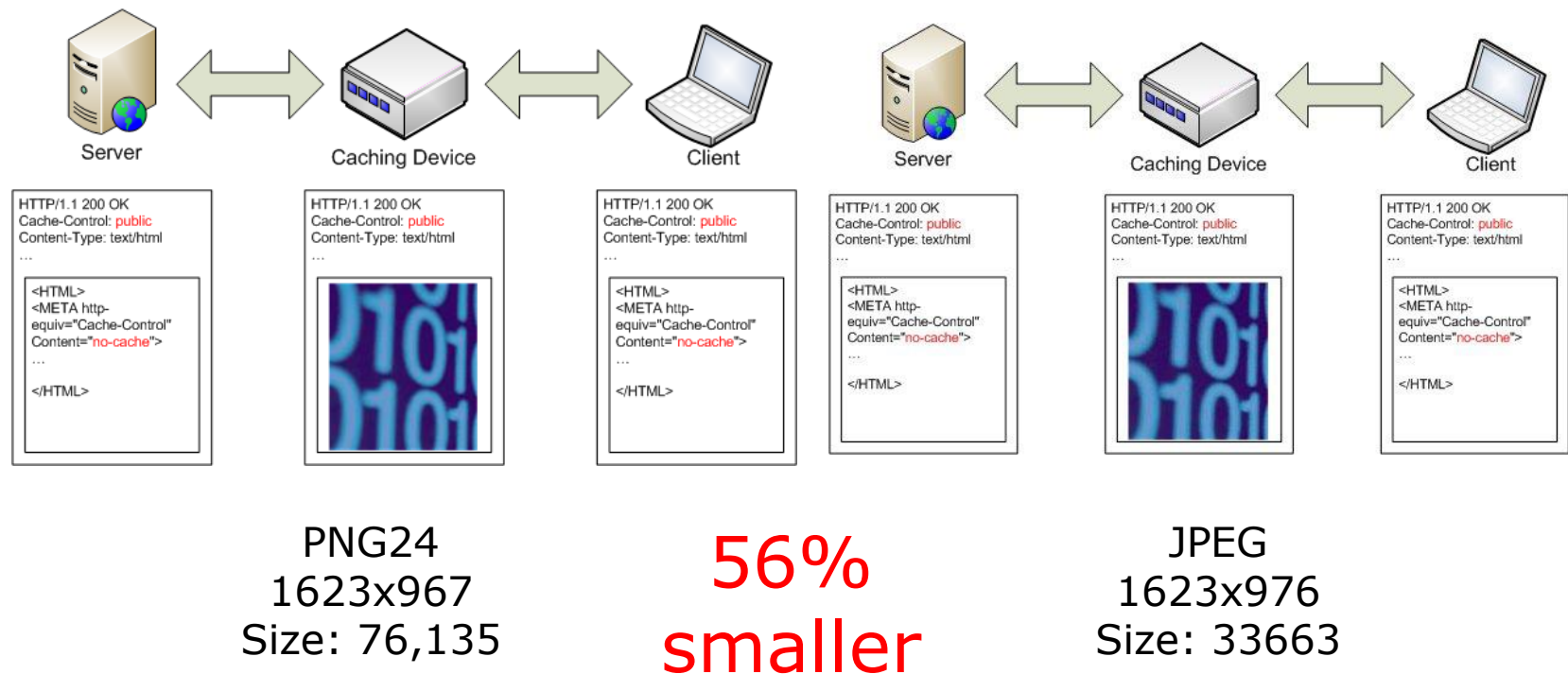
**56%
smaller**



JPEG
1623x976
Size: 33663

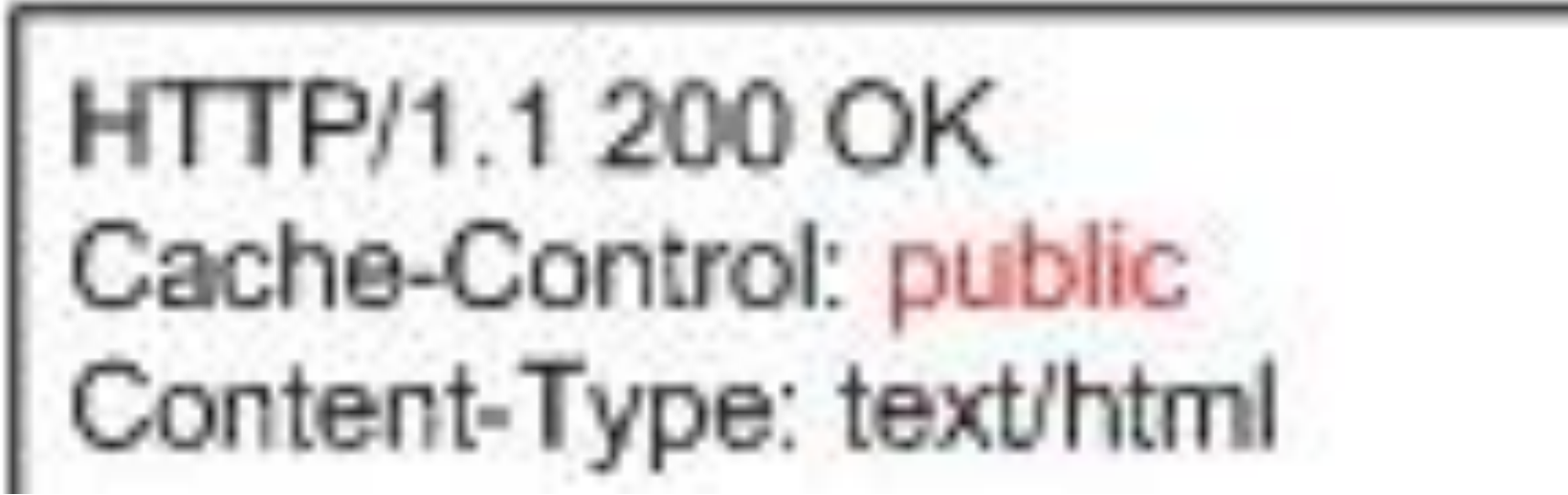
Figures/Line art?

- PNG is supposed to be better than JPEG



Figures/Line art?

- Transition artifacts are remarkably low impact



```
HTTP/1.1 200 OK
Cache-Control: public
Content-Type: text/html
```

PNG to JPEG Caveats

- Different formats with different features
- Transparency
 - JPEG does not support it
 - Not as big of a deal as you think
 - Flatten onto background color
 - *convert input.png -background white -flatten output.JPEG*
- Generational losses
 - Don't keep editing the same JPEG...

PNG to JPEG Guidelines

- Review images to discover what is PNG and what is JPEG
 - .jpg does not mean JPEG...
 - Imagemagick's *identify*, Linux/Unix's *file*
- Bulk convert and verify
 - Tedious
- Only consider when savings > 30%
 - Zoompf free scan/WPO flags these candidates

JPEG Quality

- JPEG images have a “quality” setting
 - 1-100
 - 0-10
- Quality 90 \neq discarding 10% of data
- Quality scale is purely arbitrary
 - it's not a percentage of anything
- Best Practices for web
 - 50-80, 75, depends on source

Reducing JPEG Quality



JPEG
Size: 52015
Quality: 85

**29%
smaller**



JPEG
Size: 37121
Quality 75

Going Further



JPEG
Size: 52015
Quality: 85

**55%
smaller**



JPEG
Size: 23488
Quality 50

Differences

- Differences
 - Some blurring
 - Feather edges affected
 - Only visible when zoomed
- Quality 50:
 - little differences
- Quality 75:
 - Virtually no differences



Smaller Images



JPEG
100x100
Size: 3964
Quality: 85

46%
smaller

JPEG
100x100
Size: 2159
Quality: 50

Real Life: Facebook

 Friends

Friends



Elonka Dunin



Daniel Keeling



Karim Hijazi



Nathan Abraham



Victoria Oliver

- All those thumbnails?
- 95 Quality!
 - Seriously. 95!
- Reducing to 70?
 - 44% Savings!

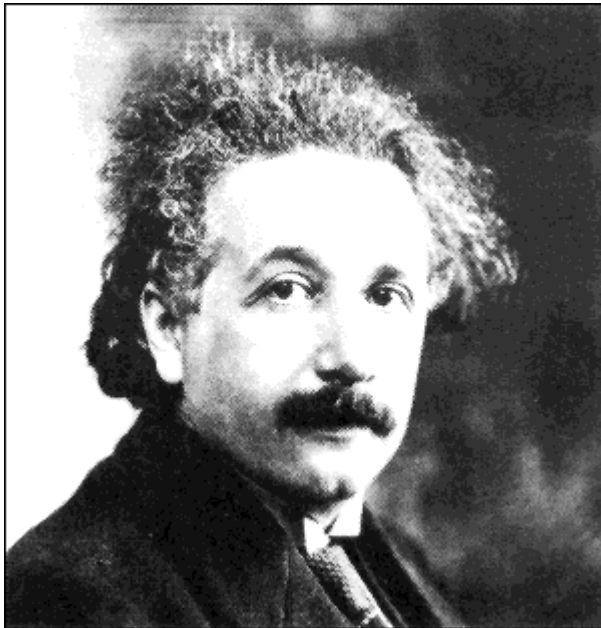
Zoompf Savings Table

URL	Original Size	Optimized Size	Savings
http://static.ak.fbcdn.net/rsrc.php/v1/zX/r/4PIot2bO7ET.jpg	398	349	12.312%
http://static.ak.fbcdn.net/rsrc.php/v1/zs/r/1HX6ENG455b.jpg	8,938	6,729	24.715%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/186810_1038056801_91485_q.jpg	2,515	1,122	55.388%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/212003_1016033580_5190845_q.jpg	2,584	1,079	58.243%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/41636_706785383_7495_q.jpg	2,544	1,121	55.936%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/186053_33007924_5970618_q.jpg	2,712	1,219	55.052%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/195319_729110379_2784779_q.jpg	2,784	1,242	55.388%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/211627_1503020179_2783745_q.jpg	2,694	1,177	56.310%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/161431_874435458_1560599_q.jpg	2,349	1,003	57.301%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/41710_1602017253_3685_q.jpg	2,703	1,201	55.568%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/195552_5024573_2390878_q.jpg	2,567	1,106	56.915%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/49871_1205905151_492_n.jpg	7,441	5,413	27.254%
http://profile.ak.fbcdn.net/hprofile-ak-snc4/49147_1093405517_3717837_q.jpg	2,549	1,100	56.846%
		Average Savings:	44.221%

JPEG Quality Guidelines

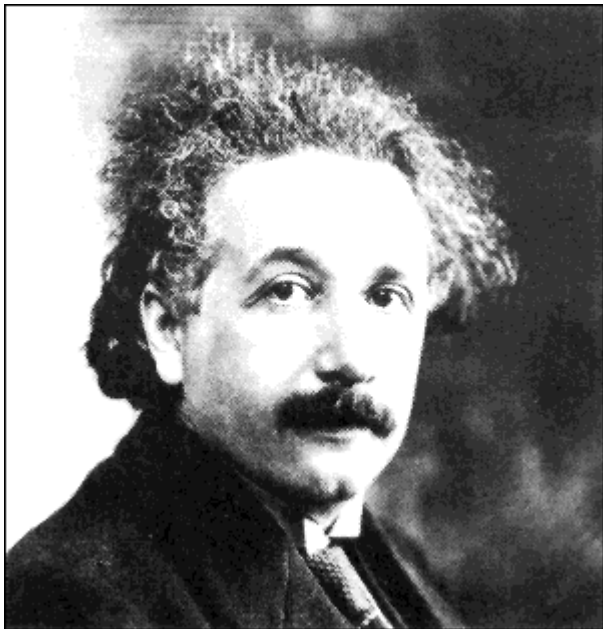
- if $q > 85$
 - Reduce to 85 always (> 90 has no benefits)
 - Consider Q 75 if it saves more than 30%
- If pixel area $< 10,000$
 - Always reduce to 60. Lower if possible
- Consider tweaking
 - Blurs, softens, sharpens, etc
- Tools
 - WebPageTest, Zoompf, Imagemagick

Conclusions



- Images dominate the web
 - In Size
 - In Count
- Image domination is growing larger
- Huge, untapped area, needs more attention

Conclusions



- Don't be scared about lossy
 - Be intelligent about how you apply lossy
- Lossy achieves substantial savings
 - 40-60%, 80% spikes
- Lossy can be automated

Lossy Guidelines Summary

- **PNG24 to PNG8**
 - When < 5000 colors
 - When $< 10,000$ pixel area
- **PNG to JPEG**
 - Per case, apply when $> 30\%$ savings
- **JPEG Quality**
 - Target a 70-85 quality settings
 - Always 50-60 when for $< 10,000$ pixel area


Free Performance Assessment

- Free performance scan
- Finds lossy candidate images
 - And 380+ issues
- zoompf.com/free

Performance Issues
Additional Analysis
Upgrade to Zoompf WPO

Assessment Overview

Scan: www.whitehouse.gov 5/24/2011 3:08:05 PM



Zoompf Score

75

Conservative Bandwidth Savings

21.8%

Aggressive Bandwidth Savings

67.1%

Visited URLs	250
Pending URLs	0
Total Issues	715
Issues per URL	2.86
Start Time	5/24/2011 3:08:05 PM
End Time	5/24/2011 3:08:47 PM

Summary of Issues

Severity	Issue Name	Affected pages
🔴	Content Served Without HTTP Compression	5
🟡	Image Without Caching Information	43
🟡	JPEG Candidate Image (GIF)	13
🟡	JPEG Candidate Image (PNG)	11
🟡	Single Color Image	3
🟡	Unoptimized Image (Animated GIF)	1
🟡	Unoptimized Image (GIF)	60
🟡	Unoptimized Image (JPG)	17
🟡	Unoptimized Image (PNG)	60
🟡	Unoptimized Image (Progressive JPG)	42

Achieving Better Image Optimization

Billy Hoffman

billy@zoompf.com

@zoompf

