

Designing Production Systems A Braindump

...

Piyush Goel

Design

*... with proper design, the features come cheaply.
This approach is arduous, but continues to succeed.*

-- Dennis Ritchie

Design ... but for what?

Features ... currently at hand

Features ... currently at hand and future

Ask Questions? What's next for the feature

Design ... for Users

Design ... for Smart users



Design ... for Dumb users

Never make assumptions



Design ... for Failure

Design ... for Failure

Never make assumptions



Werner Vogels ✓

@Werner

Following

I guess it is now time for me to really go get this tattoo

Everything Fails,
All the Time

RETWEETS

215

LIKES

491



11:19 PM - 2 Mar 2017



17



215



491

Design ... for Constraints

Fallacies

- Peter Deutsch's
8 Fallacies
of
Distributed
Computing
1. The network is reliable
 2. Latency is zero
 3. Bandwidth is infinite
 4. The network is secure
 5. Topology doesn't change
 6. There is one administrator
 7. Transport cost is zero
 8. The network is homogeneous

Design ... for Scalability

Design ... for Scalability

Premature
optimisation
is the root
of all evil

Donald Knuth

Design ... for Scalability

*Don't over optimize.. But know when
your design will fail.*

Premature
optimisation
is the root
of all evil

Donald Knuth

Design ... for Testability

Design ... for Testability

Unit Testing

Integration Testing

Manual Testing

Automation Testing

Design ... for Deployment

Single server, multi server, rolling restarts, database scripts.

Design ... for Monitorability

Design ... for Monitorability

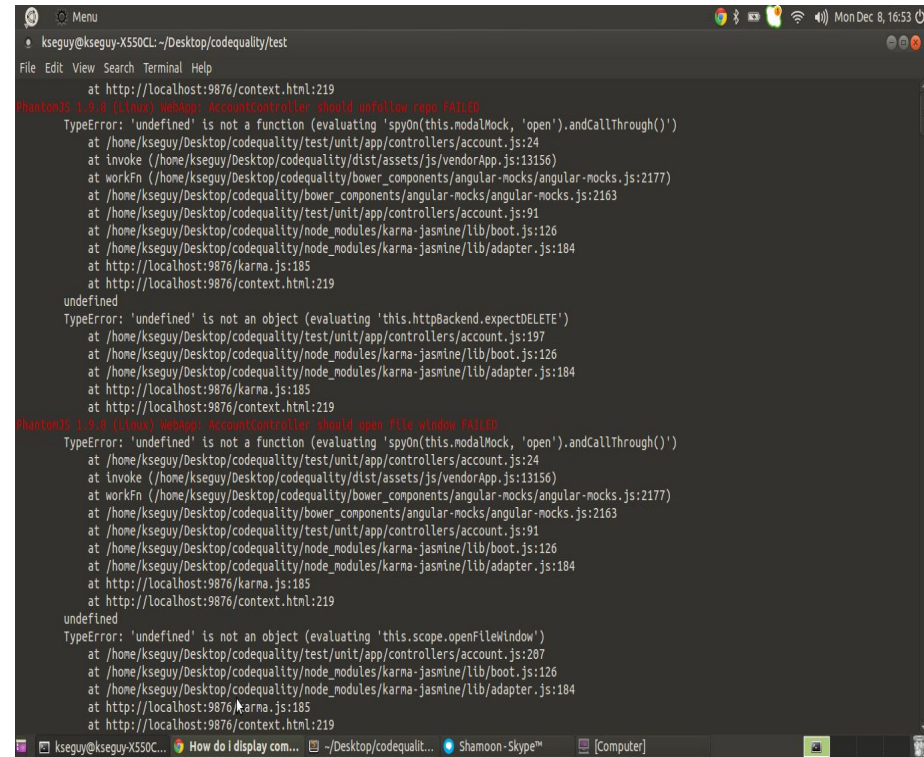
Emit meaningful metrics!



ALERT

Design ... for Debuggability

Design ... for Debuggability?



The screenshot shows a terminal window titled 'Menu' with a menu bar containing 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The terminal output shows a series of PhantomJS error logs. The first log is a 'TypeError: 'undefined' is not a function' at line 219 of context.html, triggered by 'AccountController should unfollow repo FAILED'. This is followed by a stack trace listing various files and line numbers. The second log is a 'TypeError: 'undefined' is not an object' at line 197 of account.js, triggered by 'AccountController should open File window FAILED'. This is also followed by a stack trace. The terminal window has a taskbar at the bottom with several icons, including a file explorer, a terminal, and a Skype icon.

```
Menu
kseguy@kseguy-X550CL: ~/Desktop/codequality/test
File Edit View Search Terminal Help
  at http://localhost:9876/context.html:219
PhantomJS 1.9.8 (Linux) Webapp: AccountController should unfollow repo FAILED
  TypeError: 'undefined' is not a function (evaluating 'spyOn(this.modalMock, 'open').andCallThrough())'
    at /home/kseguy/Desktop/codequality/test/unit/app/controllers/account.js:24
    at invoke (/home/kseguy/Desktop/codequality/dist/assets/js/vendorApp.js:13156)
    at workFn (/home/kseguy/Desktop/codequality/bower_components/angular-mocks/angular-mocks.js:2177)
    at /home/kseguy/Desktop/codequality/bower_components/angular-mocks/angular-mocks.js:2163
    at /home/kseguy/Desktop/codequality/test/unit/app/controllers/account.js:91
    at /home/kseguy/Desktop/codequality/node_modules/karma-jasmine/lib/boot.js:126
    at /home/kseguy/Desktop/codequality/node_modules/karma-jasmine/lib/adaptor.js:184
    at http://localhost:9876/karma.js:185
    at http://localhost:9876/context.html:219
  undefined
  TypeError: 'undefined' is not an object (evaluating 'this.httpBackend.expectDELETE')
    at /home/kseguy/Desktop/codequality/test/unit/app/controllers/account.js:197
    at /home/kseguy/Desktop/codequality/node_modules/karma-jasmine/lib/boot.js:126
    at /home/kseguy/Desktop/codequality/node_modules/karma-jasmine/lib/adaptor.js:184
    at http://localhost:9876/karma.js:185
    at http://localhost:9876/context.html:219
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    at /home/kseguy/Desktop/codequality/test/unit/app/controllers/account.js:24
    at invoke (/home/kseguy/Desktop/codequality/dist/assets/js/vendorApp.js:13156)
    at workFn (/home/kseguy/Desktop/codequality/bower_components/angular-mocks/angular-mocks.js:2177)
    at /home/kseguy/Desktop/codequality/bower_components/angular-mocks/angular-mocks.js:2163
    at /home/kseguy/Desktop/codequality/test/unit/app/controllers/account.js:91
    at /home/kseguy/Desktop/codequality/node_modules/karma-jasmine/lib/boot.js:126
    at /home/kseguy/Desktop/codequality/node_modules/karma-jasmine/lib/adaptor.js:184
    at http://localhost:9876/karma.js:185
    at http://localhost:9876/context.html:219
  undefined
  TypeError: 'undefined' is not an object (evaluating 'this.scope.openFileWindow')
    at /home/kseguy/Desktop/codequality/test/unit/app/controllers/account.js:207
    at /home/kseguy/Desktop/codequality/node_modules/karma-jasmine/lib/boot.js:126
    at /home/kseguy/Desktop/codequality/node_modules/karma-jasmine/lib/adaptor.js:184
    at http://localhost:9876/karma.js:185
    at http://localhost:9876/context.html:219
```

Understand & Embrace Logs

Design ... for Recovery

Design ... for Recovery

Systems will Fail ... Plan how to recover!

Design ... for Security

Users will abuse your system .. Deliberately or by Mistake!

How do I design?

How do I design?

What is my product stack?

How do I design?

What is my product stack?

- Browser
- Mobile
- DNS Servers
- Load Balancer
- Nginx
- Web Server
- Internal ELB
- Rails
- Redis/Varnish
- ElasticSearch
- MySQL
- Wordpress
- — Postfix

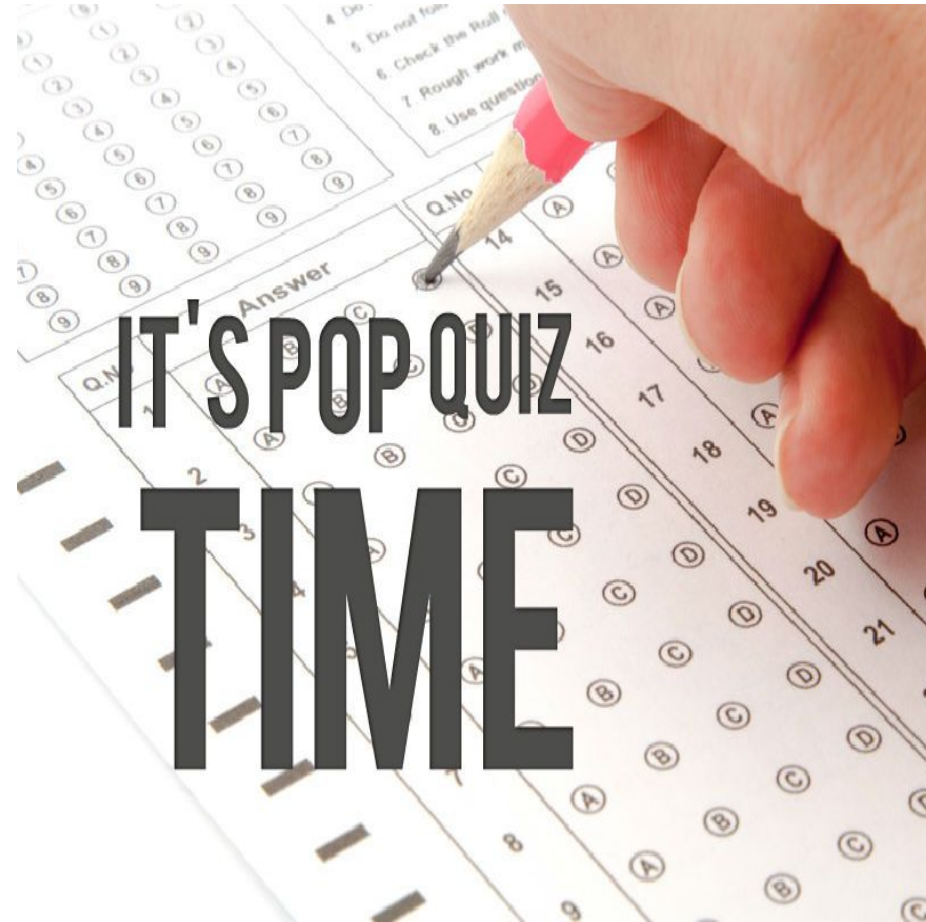
How do I design?

Use & Understand the modules!

How do I design?

Modules should be designed to
handle failures in dependee
modules!

How do I design?

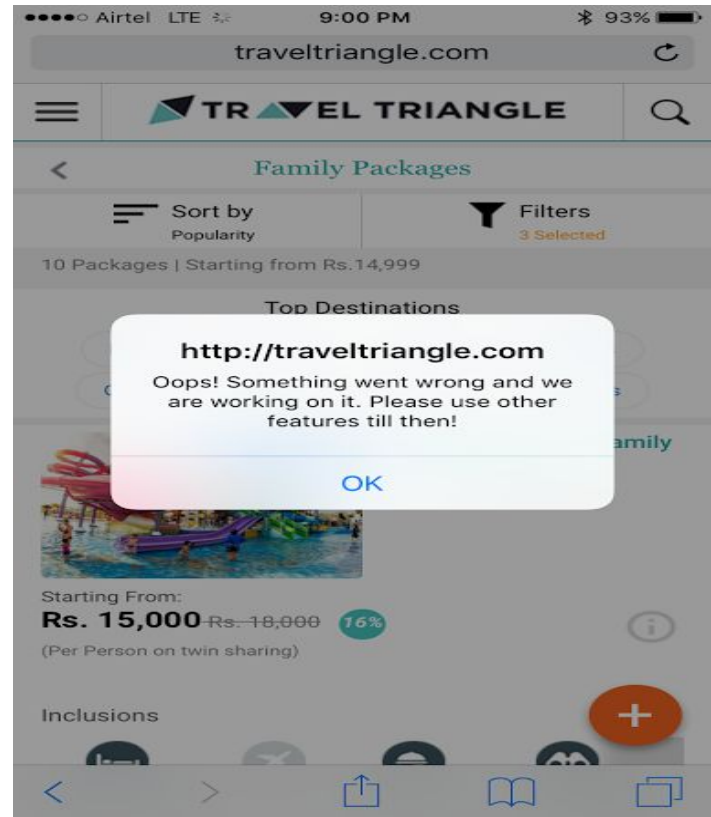


How do I design?

What is my product stack?

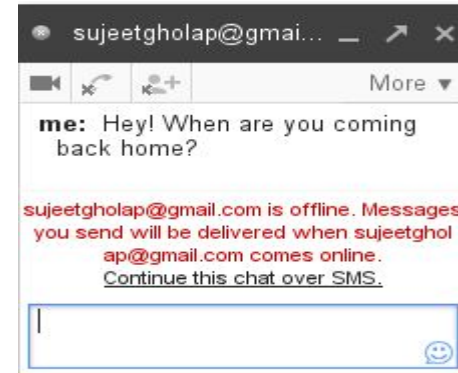
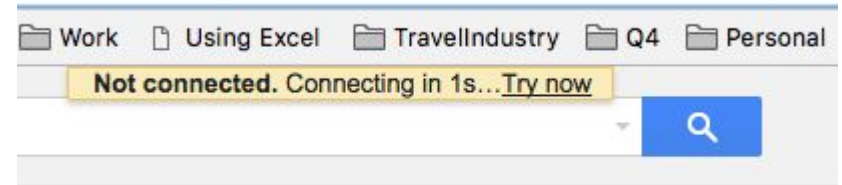
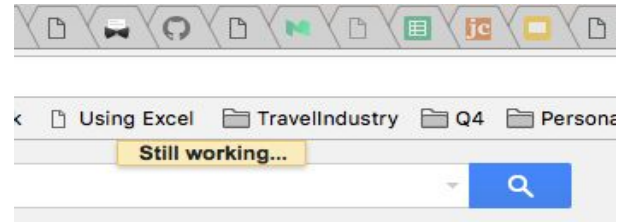
- Browser
- Mobile
- DNS Servers
- Load Balancer
- Nginx
- Web Server
- Internal ELB
- Rails
- Redis/Varnish/SideKiq
- ElasticSearch
- MySQL
- Wordpress
- — Postfix

How do I design?



Handle Failures Gracefully!

How do I design?



Don't let UX deteriorate!
Frontend and Design Team

How do I design?

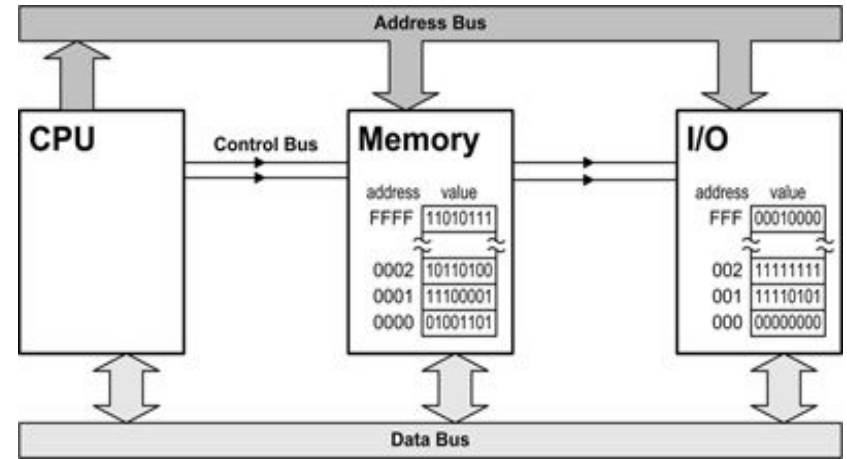
Fail Individual Components!

How do I design?

Fail Individual Components!

- Circuit Breaking
- Bulk Heading
- Timing Out
- Retries
- Asynchronous Flows

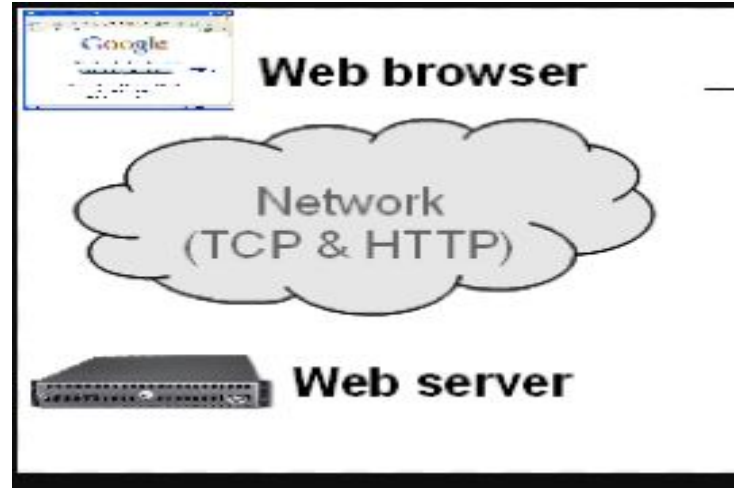
How do I design?



CPU, RAM & I/O (Disk, Network)

Understand the basic components
... duh!!

How do I design?



Understand the nuts and bolts!

- TCP
- HTTP
- Headers/Proxies

How do I design?

```
john@john-desktop: ~  
john@john-desktop:~$ vmstat 5 10  
procs -----memory----- ---swap-- ----io---- -system-- ----cpu----  
r  b   swpd   free   buff   cache   si   so    bi   bo    in   cs   us   sy   id   wa  
2  0       0 423772 338596 1164768    0    0   260   104   317 1391  24    5  67    5  
0  0       0 425128 338604 1164692    0    0     0    35   147  222    2    0  97    0  
0  0       0 425996 338604 1164696    0    0     0     0   131  193    1    0  98    0  
0  0       0 425748 338604 1164920    0    0     0     0   136  184    1    0  99    0  
0  0       0 426864 338612 1164620    0    0     0     2   131  194    1    0  98    1  
0  0       0 426864 338612 1164628    0    0     0     0   140  216    1    0  99    0  
0  0       0 426616 338620 1164852    0    0     0     6   128  173    1    0  98    1  
0  0       0 426740 338620 1164628    0    0     0    18   140  216    1    1  99    0  
0  0       0 426740 338628 1164628    0    0     0     5   133  195    0    0  98    1  
0  0       0 426740 338628 1164852    0    0     0     0   134  193    1    0  99    0  
john@john-desktop:~$
```

Learn tools and how to read numbers

- Htop
- Iotop
- Vmstat
- Netstat
- Lsof
- Chrome Dev Tools
- & more...

How do I design?

Numbers Everyone Should Know

L1 cache reference	0.5 ns
Branch mispredict	5 ns
L2 cache reference	7 ns
Mutex lock/unlock	100 ns
Main memory reference	100 ns
Compress 1K bytes with Zip	10,000 ns
Send 2K bytes over 1 Gbps network	20,000 ns
Read 1 MB sequentially from memory	250,000 ns
Round trip within same datacenter	500,000 ns
Disk seek	10,000,000 ns
Read 1 MB sequentially from network	10,000,000 ns
Read 1 MB sequentially from disk	30,000,000 ns
Send packet CA->Netherlands->CA	150,000,000 ns



Numbers every engineers should know.

Talk by [Jeffrey Dean, Google](#).

<https://www.youtube.com/watch?v=modXC5IWTJI>

How do I design?

Read Read Read!!

- Blogs
- YouTube videos
- Books
- Papers
- - Talk to your friends