NoSQL, But Even Less Security

Bryan Sullivan, Senior Security Researcher, Adobe Secure Software Engineering Team

Agenda

Eventual Consistency
REST APIs and CSRF
NoSQL Injection
SSJS Injection

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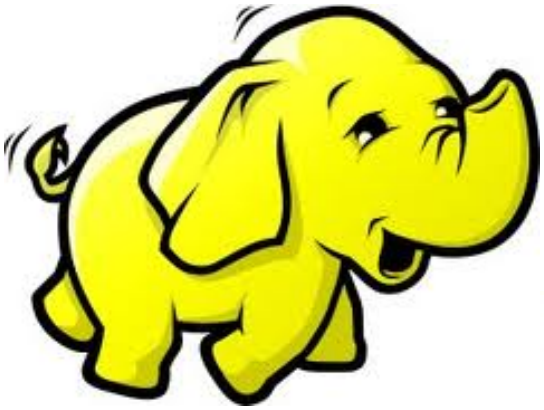
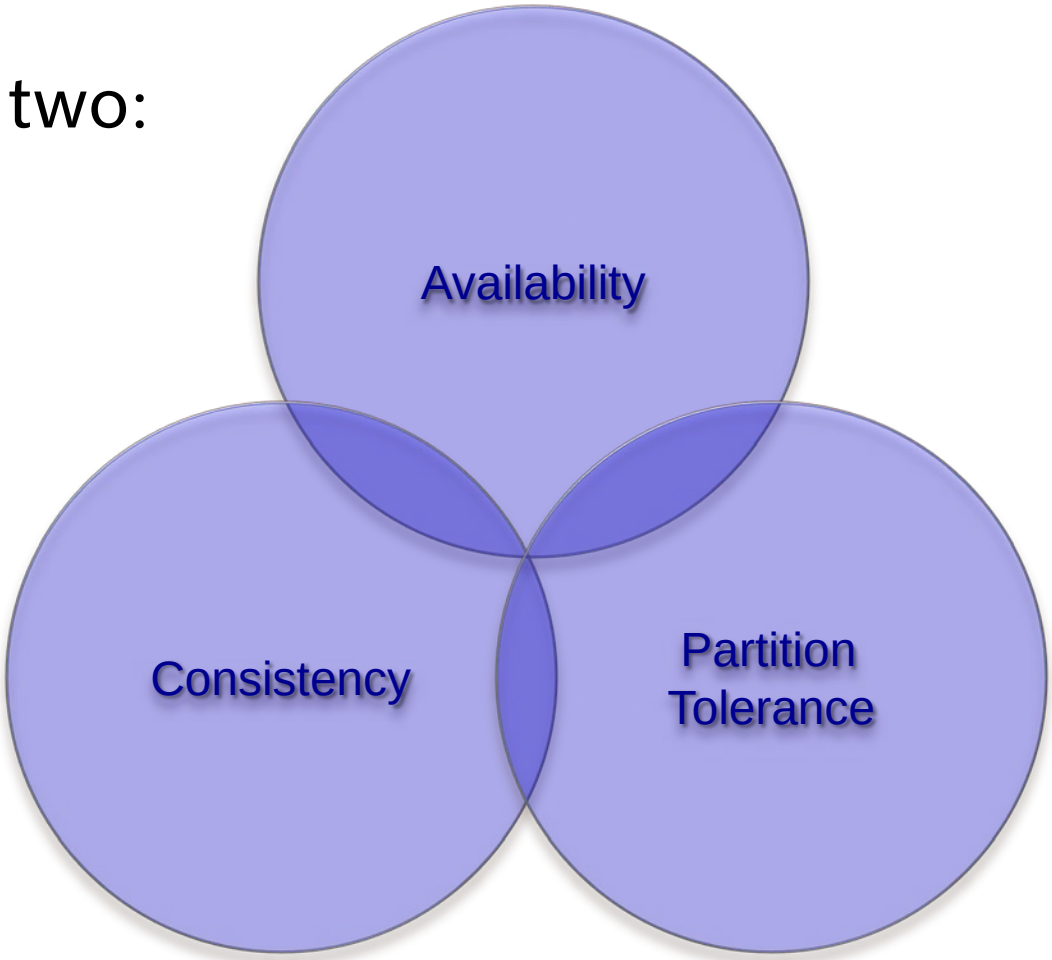
NoSQL databases



Eric Brewer's CAP Theorem

Choose any two:



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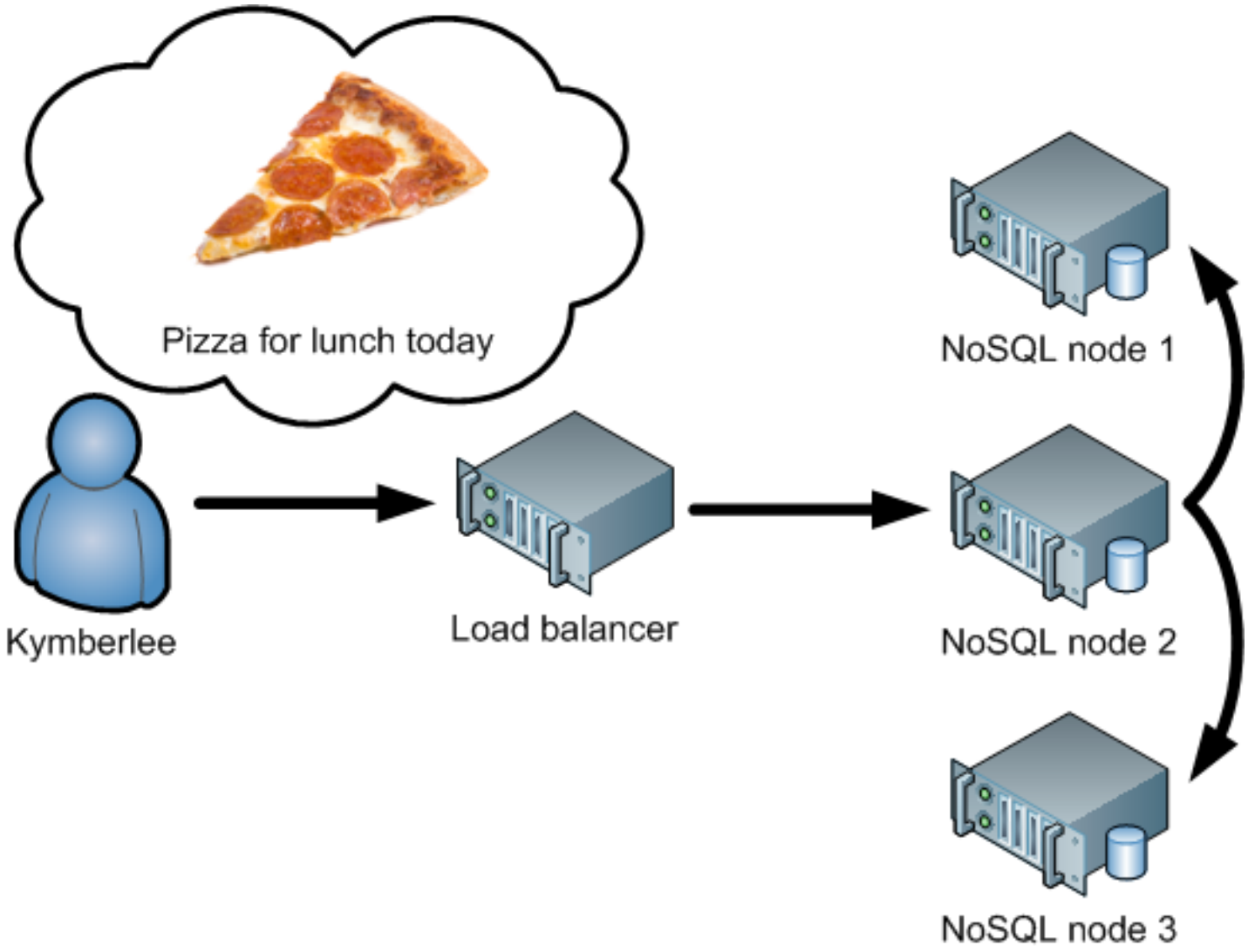
Eventual consistency in social networking



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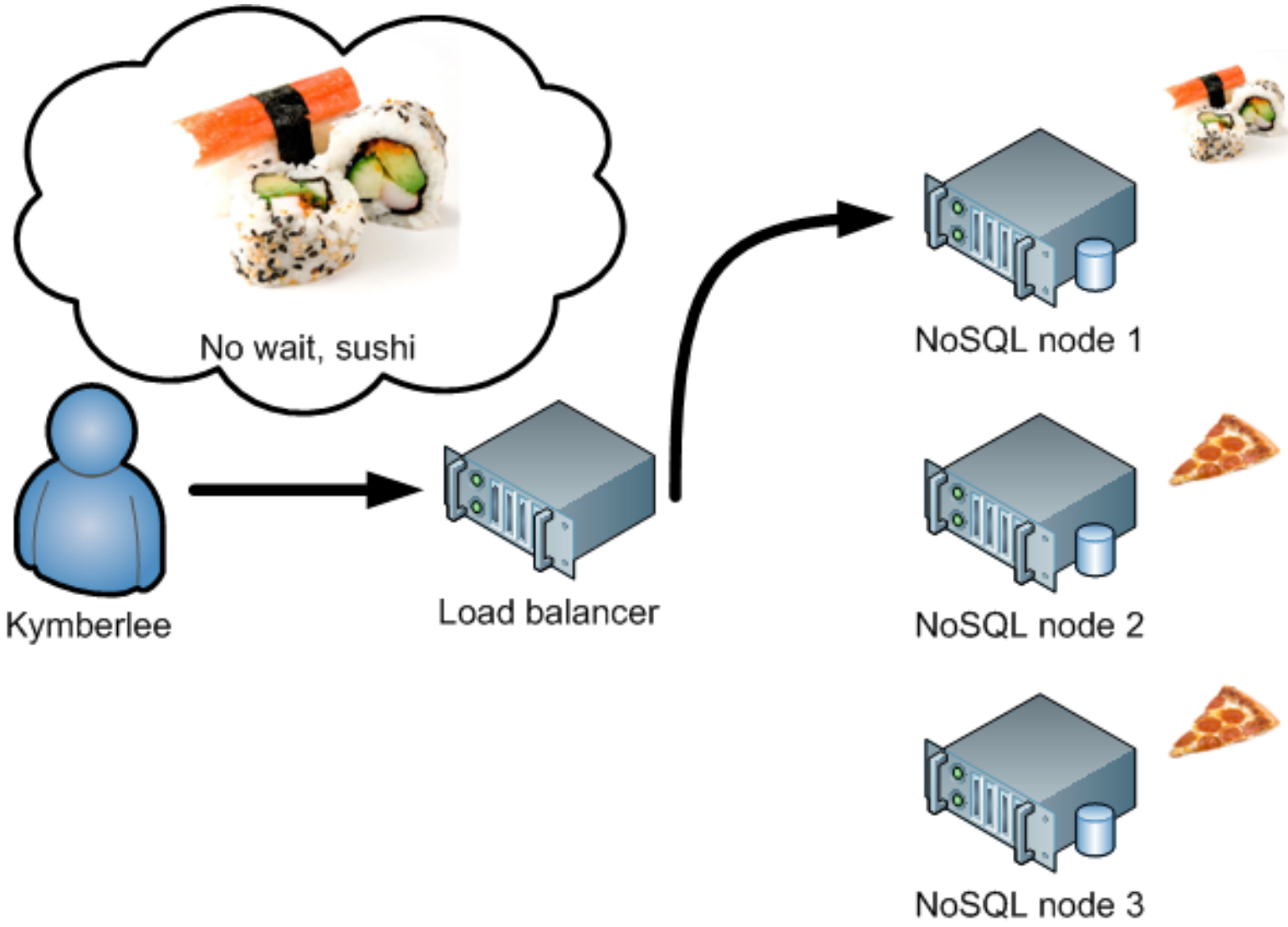
Writes don't propagate immediately



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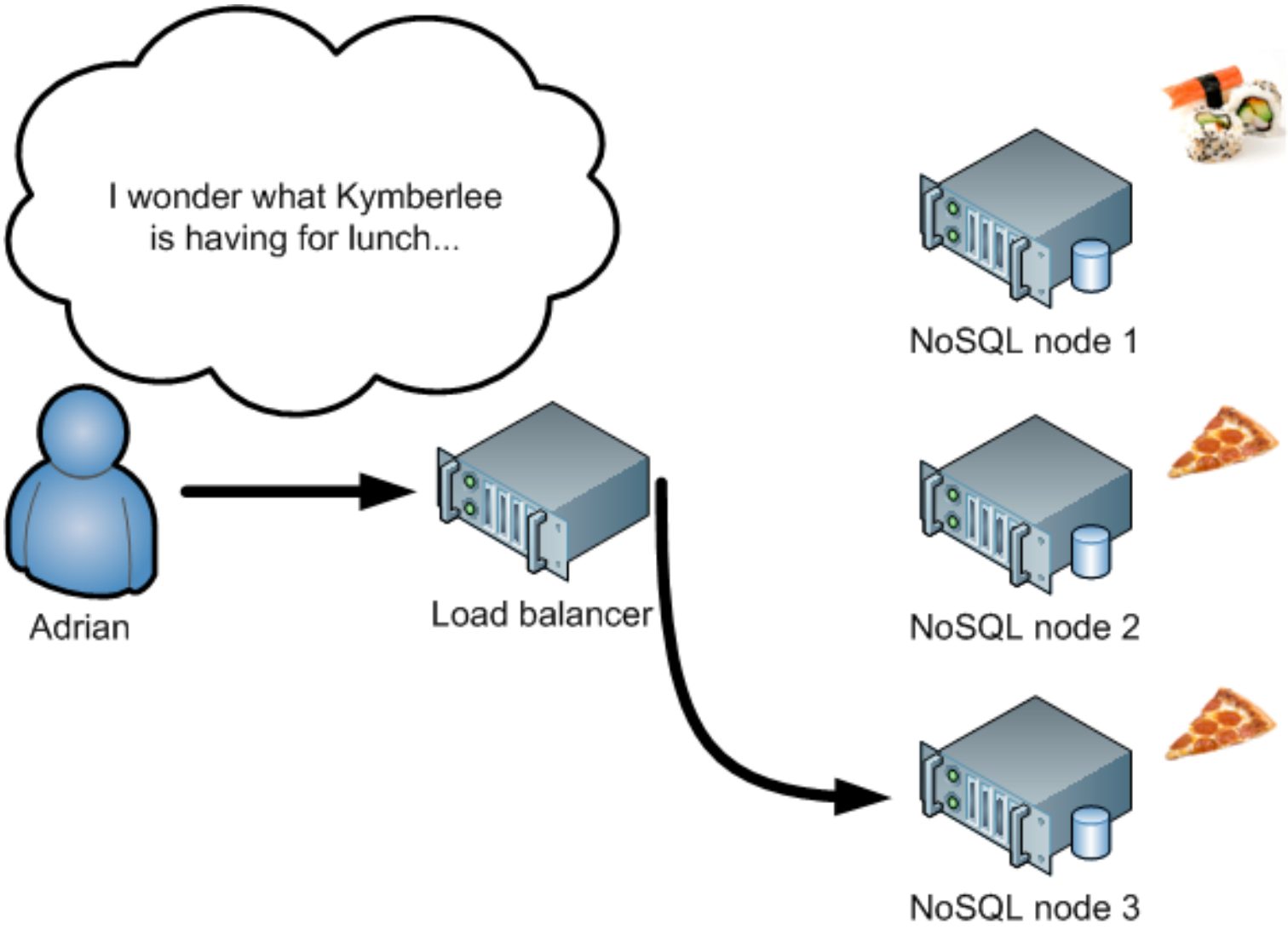
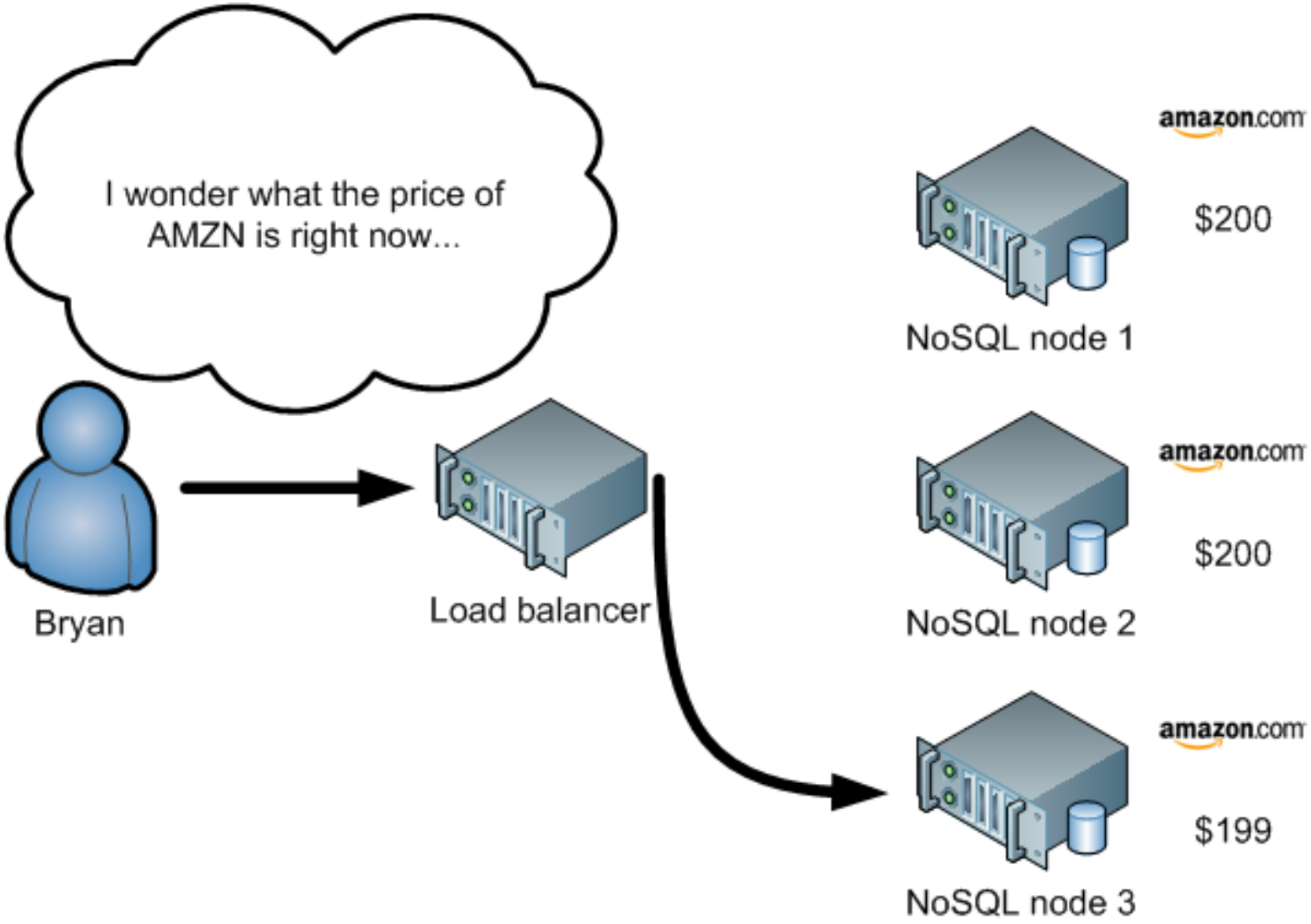
Reading stale data



Reading stale data – a more serious case



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Eventual Consistency

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Authentication is unsupported or discouraged

- From the MongoDB documentation
  - "One valid way to run the Mongo database is in a trusted environment, with no security and authentication"
  - This "is the default option and is recommended"
- From the Cassandra Wiki
  - "The default AllowAllAuthenticator approach is essentially pass-through"
- From CouchDB: The Definitive Guide
  - The "Admin Party": Everyone can do everything by default
- Riak
  - No authentication or authorization support

Port scanning

- If an attacker finds an open port, he's already won…

Database	Default Port
MongoDB	27017 28017 27080
CouchDB	5984
Hbase	9000
Cassandra	9160
Neo4j	7474
Riak	8098

Port Scanning Demo

Port scanning

- If an attacker finds an o… already won…

Databa…	… Port
MongoDB	27017 2801… 27…
CouchDB	
Hbase	…0
Cassandra	…9160
Neo4j	7474
Riak	

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REST document API examples (CouchDB)

Retrieve a document

```
GET /mydb/doc_id HTTP/1.0
```

Update a document

```
PUT /mydb/doc_id HTTP/1.0
{
 "album" : "Brothers",
 "artist" : "The Black Keys"
}
```

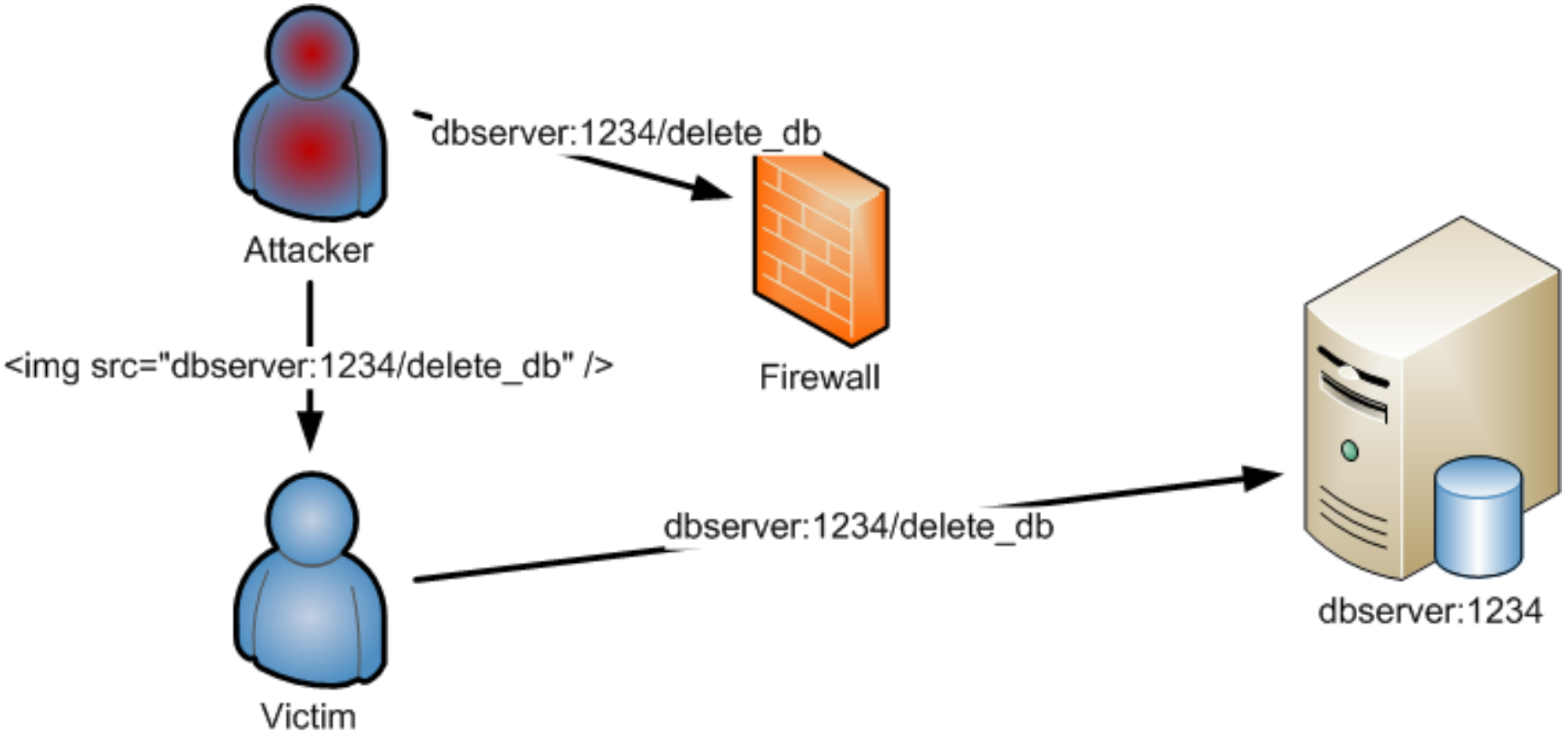
Create a document

```
POST /mydb/ HTTP/1.0
  {
   "album" : "Brothers",
   "artist" : "Black Keys"
  }
```

Delete a document

```
DELETE /mydb/doc_id?
 rev=12345 HTTP/1.0
```

Cross-Site Request Forgery (CSRF) firewall bypass



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Delete a document

```
DELETE /mydb/doc_id?
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```

Traditional GET-based CSRF

```
<img src="http://nosql:5984/_all_dbs"/>
```

- Easy to make a potential victim request this URL
- But it doesn't do the attacker any good
- He needs to get the data back out to himself

RIA GET-based CSRF

```
<script>
    var xhr = new XMLHttpRequest();
    xhr.open('get', 'http://nosql:5984/_all_dbs');
    xhr.send();
</script>
```

- Just as easy to make a potential victim request this URL
- Same-origin policy won't allow this (usually)
- Same issue for PUT and DELETE

POST-based CSRF

```
<form method=post action='http://nosql:5984/db'>
    <input type='hidden' name='{"data"}' value='' />
</form>
<script>
    // auto-submit the form
</script>
```

- Ok by the same-origin policy!

REST-CSRF Demo

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POST is all an attacker needs

Insert arbitrary data

Insert arbitrary script data

Execute any REST command from inside the firewall

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NoSQL injection

- Most developers believe they don't have to worry about things like this

> "…with MongoDB we are not building queries from strings, so traditional SQL injection attacks are not a problem."
>
> -MongoDB Developer FAQ

- They're *mostly* correct

MongoDB and PHP

- MongoDB expects input in JSON array format

```
find( { 'artist' : 'The Black Keys' } )
```

- In PHP, you do this with associative arrays

```
$collection->find(array('artist' => 'The Black Keys'));
```

- This makes injection attacks difficult
- Like parameterized queries for SQL

MongoDB and PHP

- You also use associative arrays for query criteria

```
find( { 'album_year' : { '$gte' : 2011} } )
find( { 'artist' : { '$ne' : 'Lady Gaga' } } )
```

- But PHP will automatically create associative arrays from querystring inputs with square brackets

```
page.php?param[foo]=bar
param == array('foo' => 'bar');
```

NoSQL Injection Demo

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$where queries

- The $where clause lets you specify script to filter results

```
find( { '$where' : 'function() { return artist == "Weezer"; }}' )


find ( '$where' : 'function() {
        var len = artist.length;
        for (int i=2; i<len; i++) {
          if (len % I == 0) return false;
        }
        return true; }')
```

NoSQL Injection Demo #2

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Browser war fallout

- Browser wars have given us incredibly fast and powerful JS engines

V8

WebKit
Nitro

SpiderMonkey
Rhino

- Used for a lot more than just browsers
- Like NoSQL database engines…

Server-side JavaScript injection vs. XSS

- Client-side JavaScript injection (aka XSS) is #2 on OWASP Top Ten

- Use it to steal authentication cookies
- Impersonate victim
- Create inline phishing sites
- Self-replicating webworms ie Samy

- It's really bad.
- But server-side is much worse.

Server-Side Javascript Injection (SSJI)

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SSJI red flags

- $where clauses
  - Built with user input
  - Injected from querystring manipulation
- eval() clauses
- Map/Reduce
- Stored views/design docs
  - More CSRF possibilities here

Wrapping Up

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Conclusions

1. Always use authentication/authorization.
   - Firewalls alone are not sufficient
   - Sometimes you may have to write your own auth code
   - This is unfortunate but better than the alternative

2. Be extremely careful with server-side script.
   - Validate, validate, validate
   - Escape input too

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