Abusing NoSQL Databases

Ming Chow
Email: mchow@cs.tufts.edu
Twitter: @tufts_cs_mchow
Why Care?

- That was then: a few SQL database options for any application
- This is now: a plethora of database options, you have to choose the right database for the right job
- Many NoSQL databases are built for performance, scalability, and flexibility
- Security of NoSQL databases? Weak, inconsistent, the wild wild west
Why Am I Here?

- I talked on abusing HTML5 back at DEF CON 19
- Bryan Sullivan scratched the surface with his BlackHat 2011 work "Server-Side JavaScript Injection"
- The rise of client and server-side JavaScript
- There is a lot to just the database side of things
Straight Out-of-the-Box General Issues: The Defaults

- Easy win: know the database vendor, IP address, and an open port number. The default open port numbers:
  - Mongo: 27017, 28017, 27080
  - CouchDB: 5984
  - Hbase: 9000
  - Cassandra: 9160
  - Neo4j: 7474
  - Redis: 6379
  - Riak: 8098
Straight Out-of-the-Box General Issues: Authentication and Encryption

- (Almost) No NoSQL database enables an administrator user or authentication by default
  - Even if users are enabled, weak password storage
    - Mongo uses md5
    - Plaintext for Redis
    - Weak salt or plaintext for CouchDB
- Client communicates with server via plaintext
- Database encryption and auditing features are generally not available
- Emphasis on "trusted environments"
New Classes of Injection Attacks

1. **Schema**: inserting a record into a schema that does not exist will automatically create the new schema

2. **Query**: creating unsafe queries via string concatenation

3. **JavaScript**: `db.eval()`, `$where` clause take in JavaScript *functions* as parameters
A Heterogeneous Problem

- RTFM for each database system
- Different for each system:
  - Terminologies and analogies
  - Methods of granting permissions and user control
  - Flavors of query types, including: Cassandra Query Language (CQL), command-based queries, JavaScript
  - Flavors of query results, including: JSON, BSON (Binary JSON)
Vendor-Specific Items

- **MongoDB:**
  - The `run()` command can act as a shell
  - Easy information gathering by simply looking at the `startup_log` in the local collection (shows pid, OS details, paths)
  - `mongosniff` tool comes with mongo installation for "tracing/sniffing view into database activity in real time"

- **CouchDB:**
  - HTTP document REST API exposed by default
Old Security Matters

- Defense in depth and perhaps, even more costly
- Architecturing becomes more important:
  - Since many NoSQL databases have weak security, more controls may be necessary
- Validation becomes even more important
  - No longer are we just validating input strings but also results and JavaScript functions
The Takeaways

1. No longer a one-size-fits-all game
2. Plenty of new attack vectors, contrary to the idea that SQL injection is practically gone thus eliminating many concerns
3. Technologies being deployed naively
4. The reports of the death of database administrators are greatly exaggerated
References

- Chow, M. "JavaScript Pitfalls" SOURCE Boston Conference 2013
  http://www.slideshare.net/gavinholt/no-sql-no-security-20074309
  https://secuerosis.com/blog/nosql-and-no-security