Vitess Topology & System Failures

Rafael Chacón

Vitess Meetup - July 2019

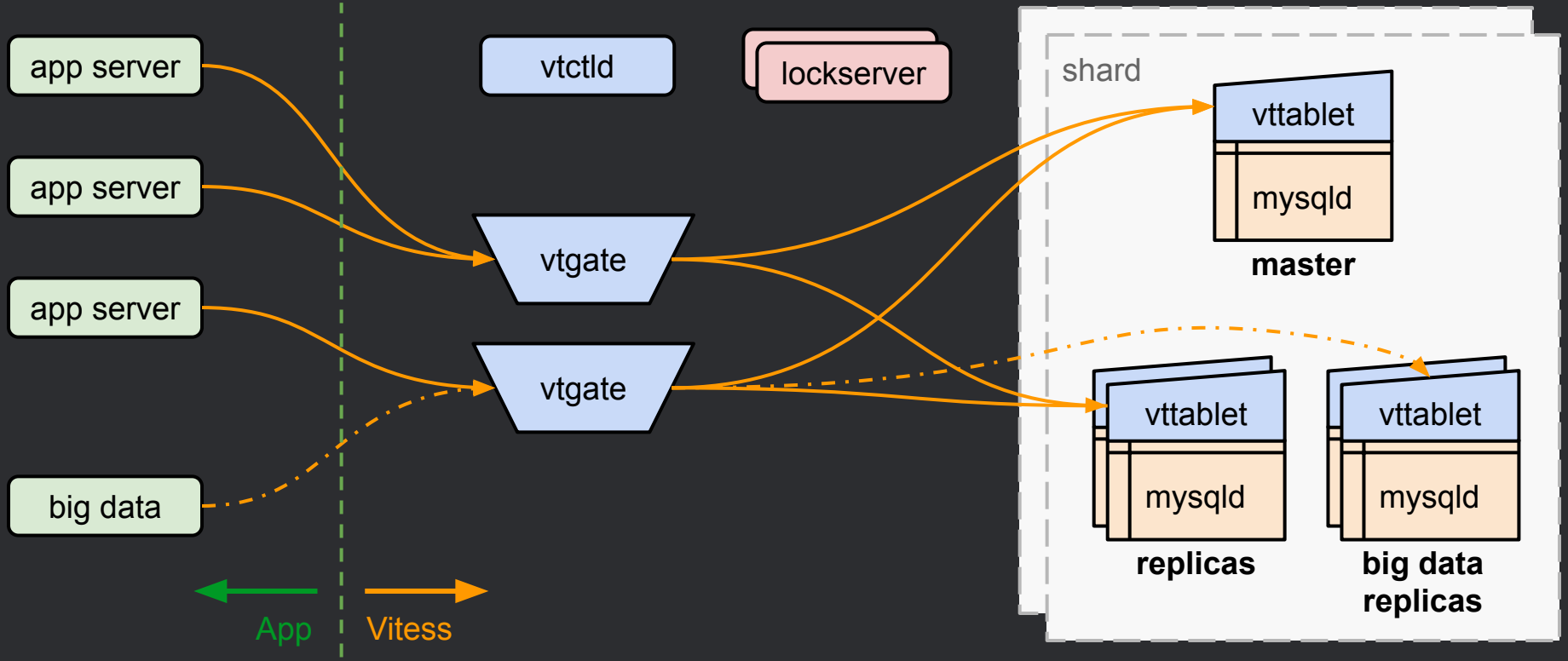
Rafael Chacón

Staff Engineer
Infrastructure

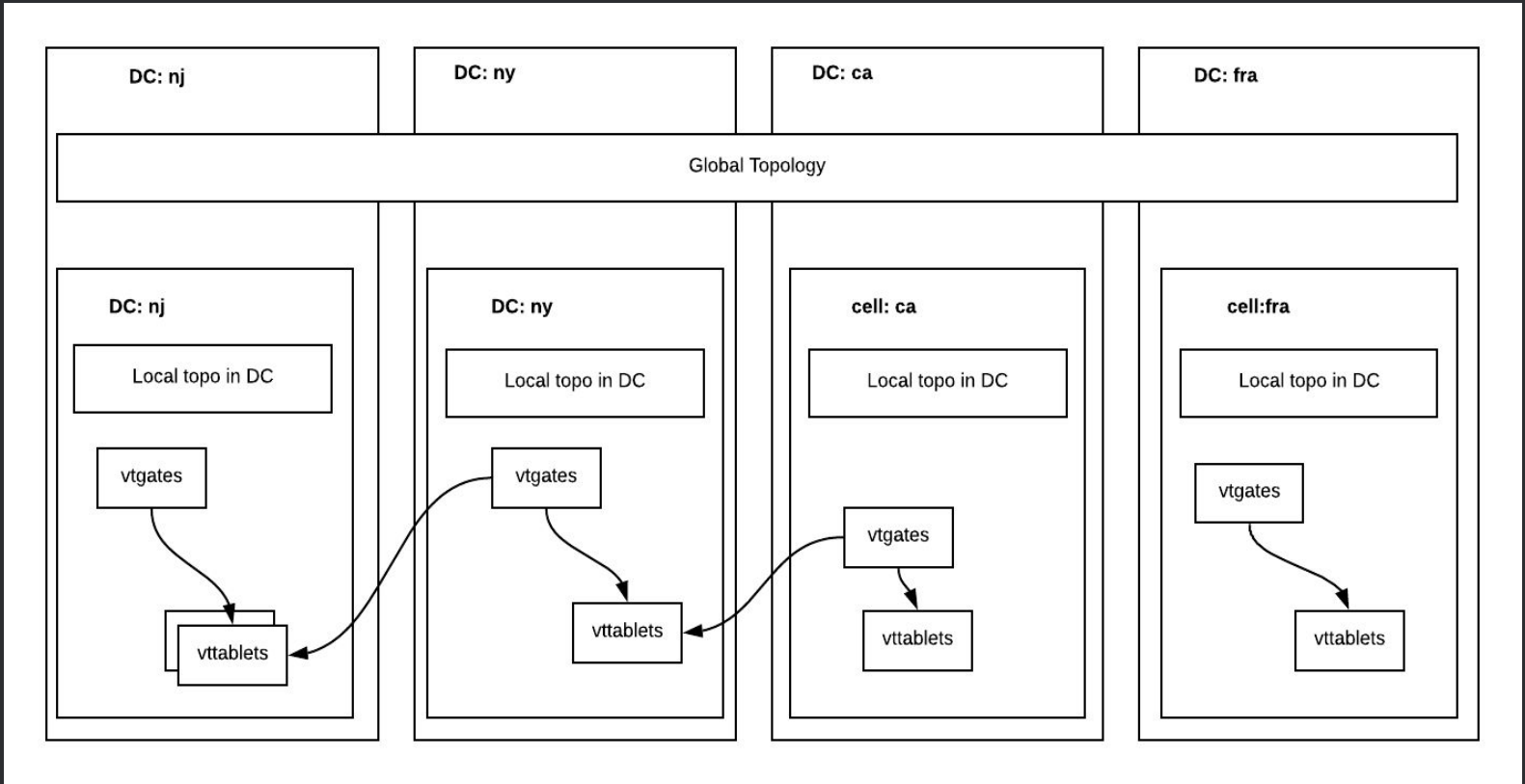
Agenda

- Vitess Topology.
- Slack Vitess deployment.
- System Failures.
- Topology refactor and new deployment.
- Results.
- Future Work.

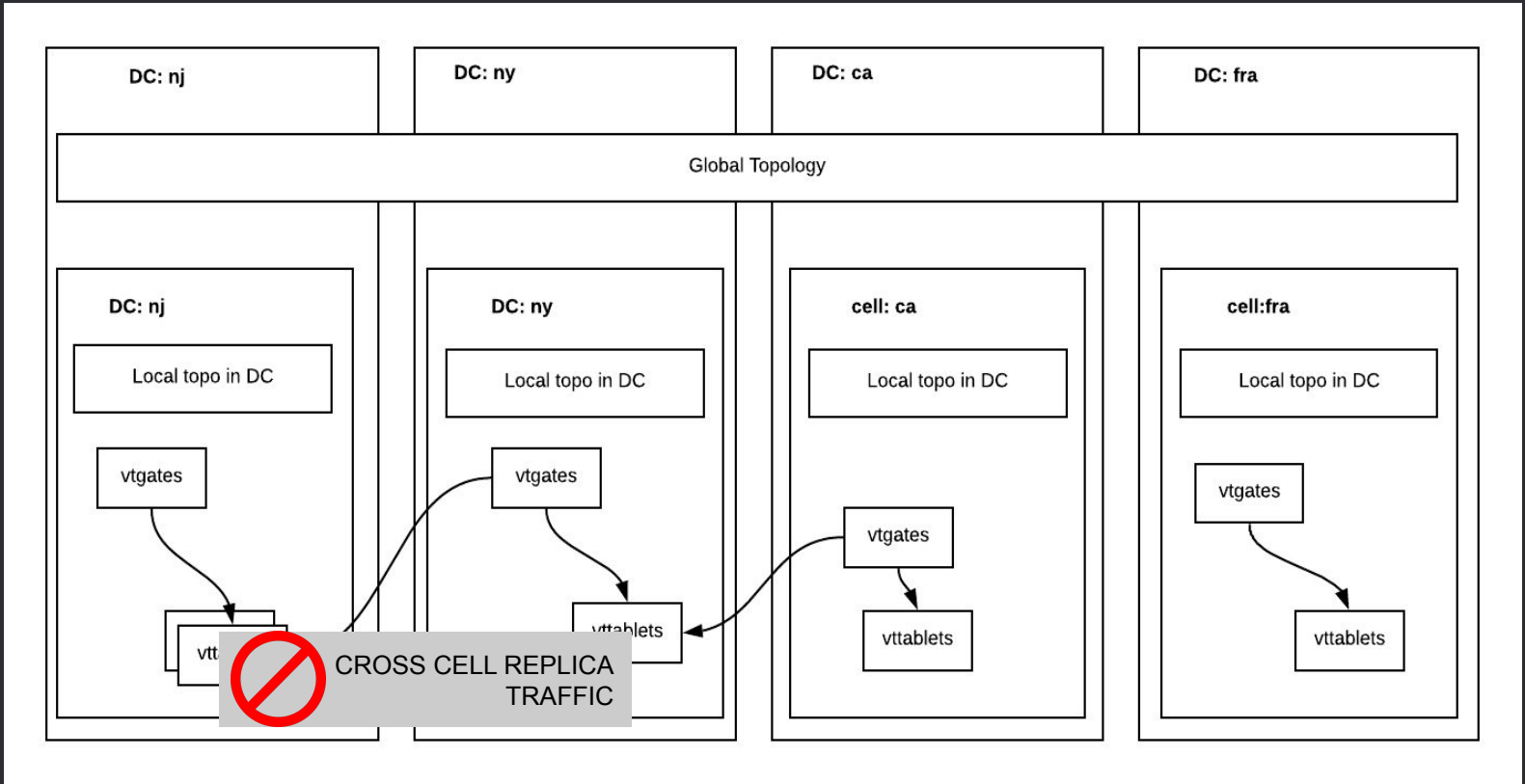
Architecture



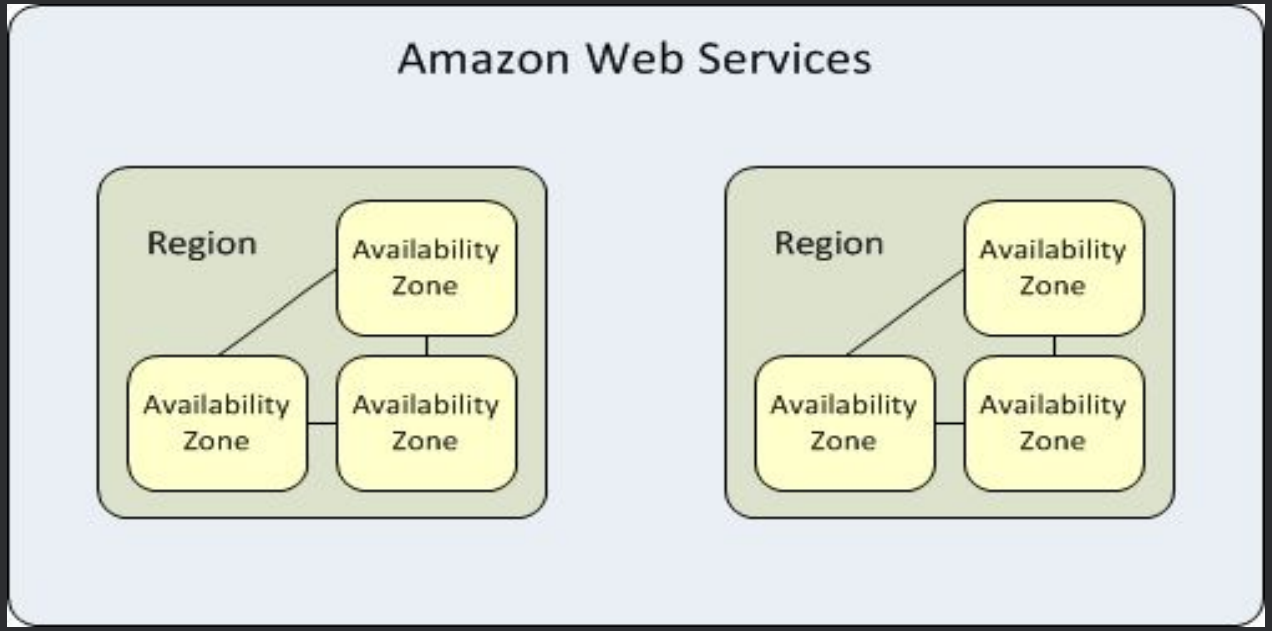
Vitess Canonical Deployment



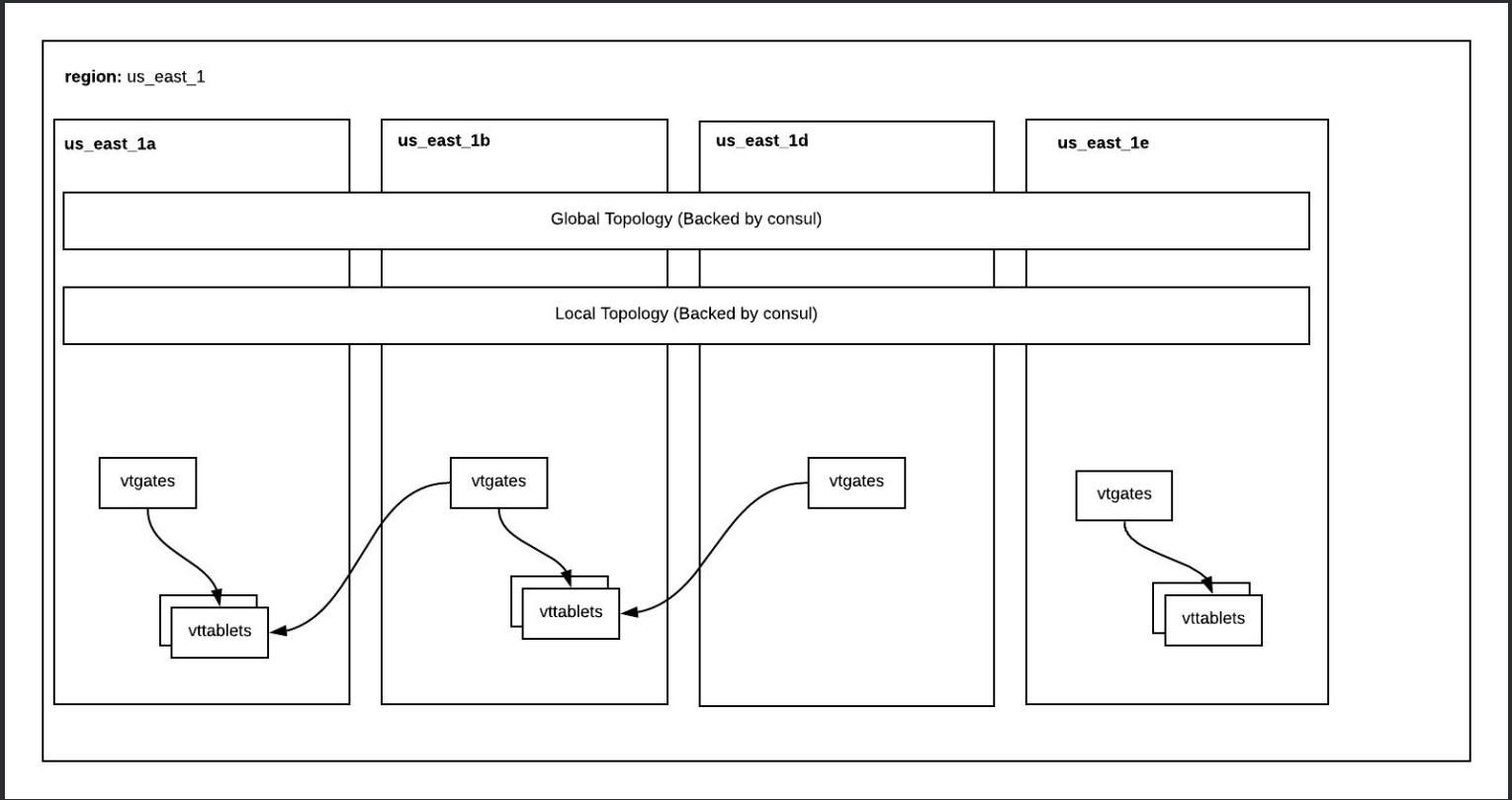
Vitess Canonical Deployment



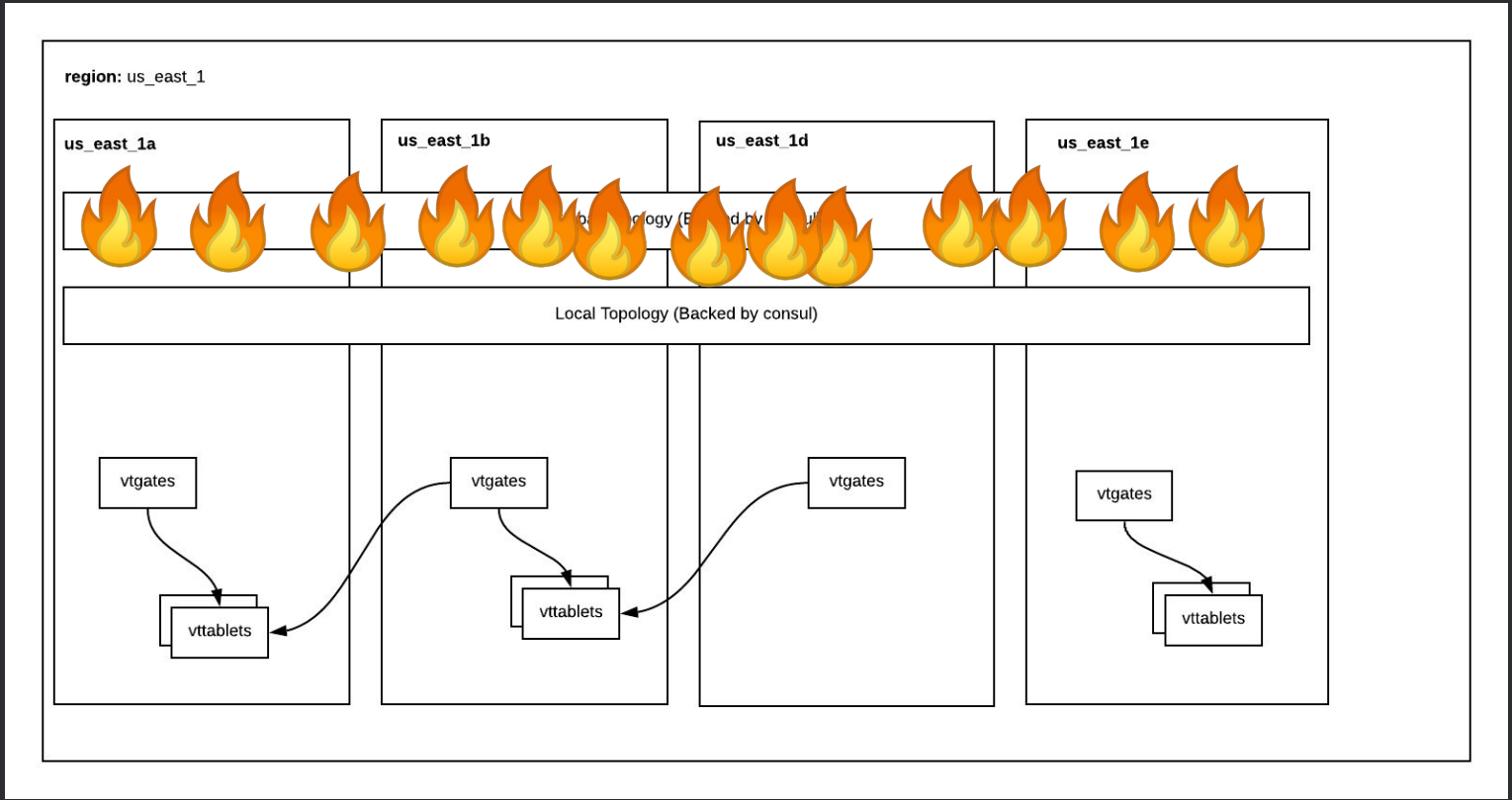
Vitess Slack Deployment



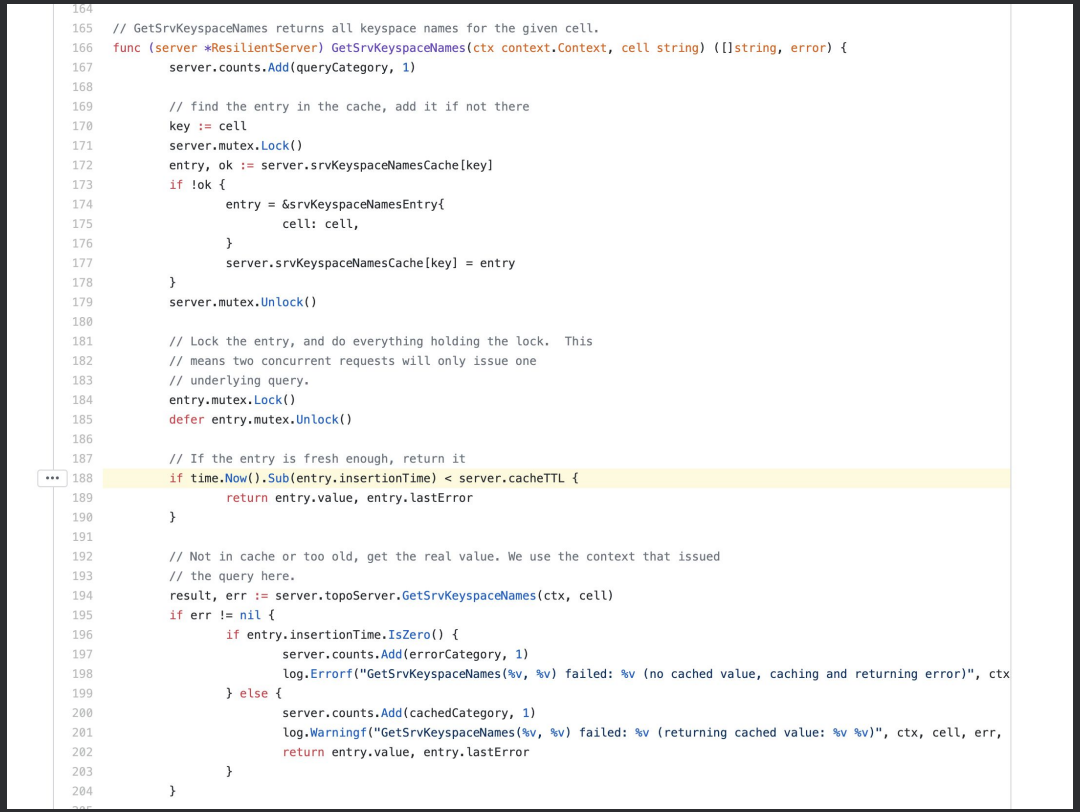
Slack topology setup



The unexpected happened

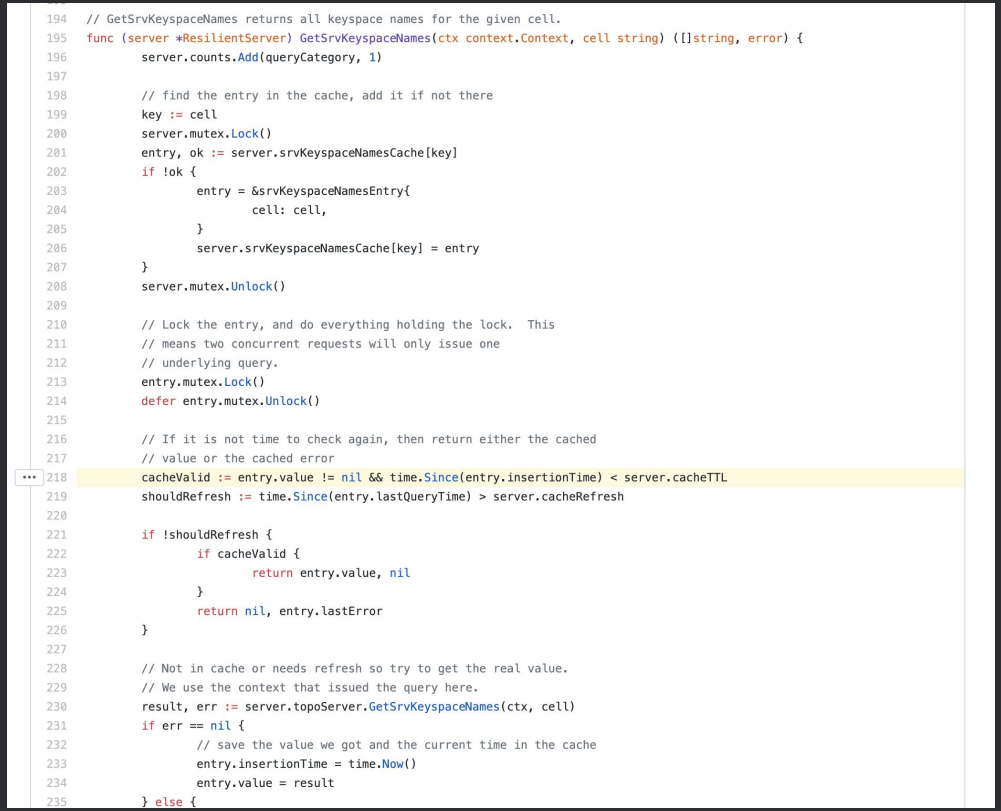


The unexpected happened



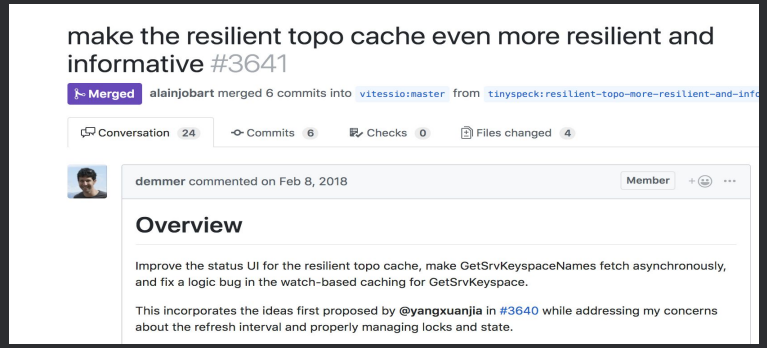
```
164
165 // GetSrvKeyspaceNames returns all keyspace names for the given cell.
166 func (server *ResilientServer) GetSrvKeyspaceNames(ctx context.Context, cell string) ([]string, error) {
167         server.counts.Add(queryCategory, 1)
168
169         // find the entry in the cache, add it if not there
170         key := cell
171         server.mutex.Lock()
172         entry, ok := server.srvKeyspaceNamesCache[key]
173         if !ok {
174                 entry = &srvKeyspaceNamesEntry{
175                         cell: cell,
176                 }
177                 server.srvKeyspaceNamesCache[key] = entry
178         }
179         server.mutex.Unlock()
180
181         // Lock the entry, and do everything holding the lock.  This
182         // means two concurrent requests will only issue one
183         // underlying query.
184         entry.mutex.Lock()
185         defer entry.mutex.Unlock()
186
187         // If the entry is fresh enough, return it
188         if time.Now().Sub(entry.insertionTime) < server.cacheTTL {
189                 return entry.value, entry.lastError
190         }
191
192         // Not in cache or too old, get the real value. We use the context that issued
193         // the query here.
194         result, err := server.topoServer.GetSrvKeyspaceNames(ctx, cell)
195         if err != nil {
196                 if entry.insertionTime.IsZero() {
197                         server.counts.Add(errorCategory, 1)
198                         log.Errorf("GetSrvKeyspaceNames(%v, %v) failed: %v (no cached value, caching and returning error)", ctx
199                 } else {
200                         server.counts.Add(cachedCategory, 1)
201                         log.Warningf("GetSrvKeyspaceNames(%v, %v) failed: %v (returning cached value: %v %v)", ctx, cell, err,
202                         return entry.value, entry.lastError
203                 }
204         }
```

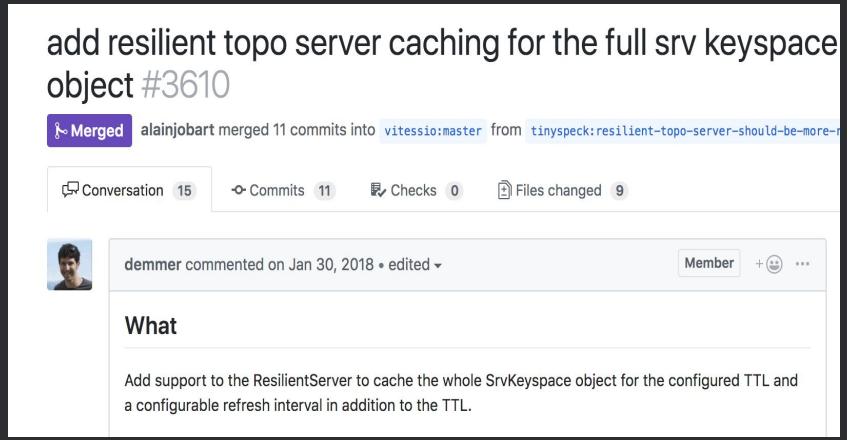
The unexpected happened



```
// GetSrvKeyspaceNames returns all keyspace names for the given cell.
func (server *ResilientServer) GetSrvKeyspaceNames(ctx context.Context, cell string) ([]string, error) {
        server.counts.Add(queryCategory, 1)

        // find the entry in the cache, add it if not there
        key := cell
        server.mutex.Lock()
        entry, ok := server.srvKeyspaceNamesCache[key]
        if !ok {
                entry = &srvKeyspaceNamesEntry{
                        cell: cell,
                }
                server.srvKeyspaceNamesCache[key] = entry
        }
        server.mutex.Unlock()

        // Lock the entry, and do everything holding the lock.  This
        // means two concurrent requests will only issue one
        // underlying query.
        entry.mutex.Lock()
        defer entry.mutex.Unlock()

        // If it is not time to check again, then return either the cached
        // value or the cached error
        cacheValid := entry.value != nil && time.Since(entry.insertionTime) < server.cacheTTL
        shouldRefresh := time.Since(entry.lastQueryTime) > server.cacheRefresh

        if !shouldRefresh {
                if cacheValid {
                        return entry.value, nil
                }
                return nil, entry.lastError
        }

        // Not in cache or needs refresh so try to get the real value.
        // We use the context that issued the query here.
        result, err := server.topoServer.GetSrvKeyspaceNames(ctx, cell)
        if err == nil {
                // save the value we got and the current time in the cache
                entry.insertionTime = time.Now()
                entry.value = result
        } else {
```

We fixed things!





Incomplete Approach

- Defensive programming.
- Fixing bugs.
- Multi tenant is an issue (shared consul cluster).

Complex Systems Fail

- Complex systems are intrinsically hazardous systems.
- Complex systems are heavily and successfully defended against failure.
- Catastrophe is always just around the corner.
- Complex systems contain changing mixtures of failures latent within them.

Complex Systems Fail

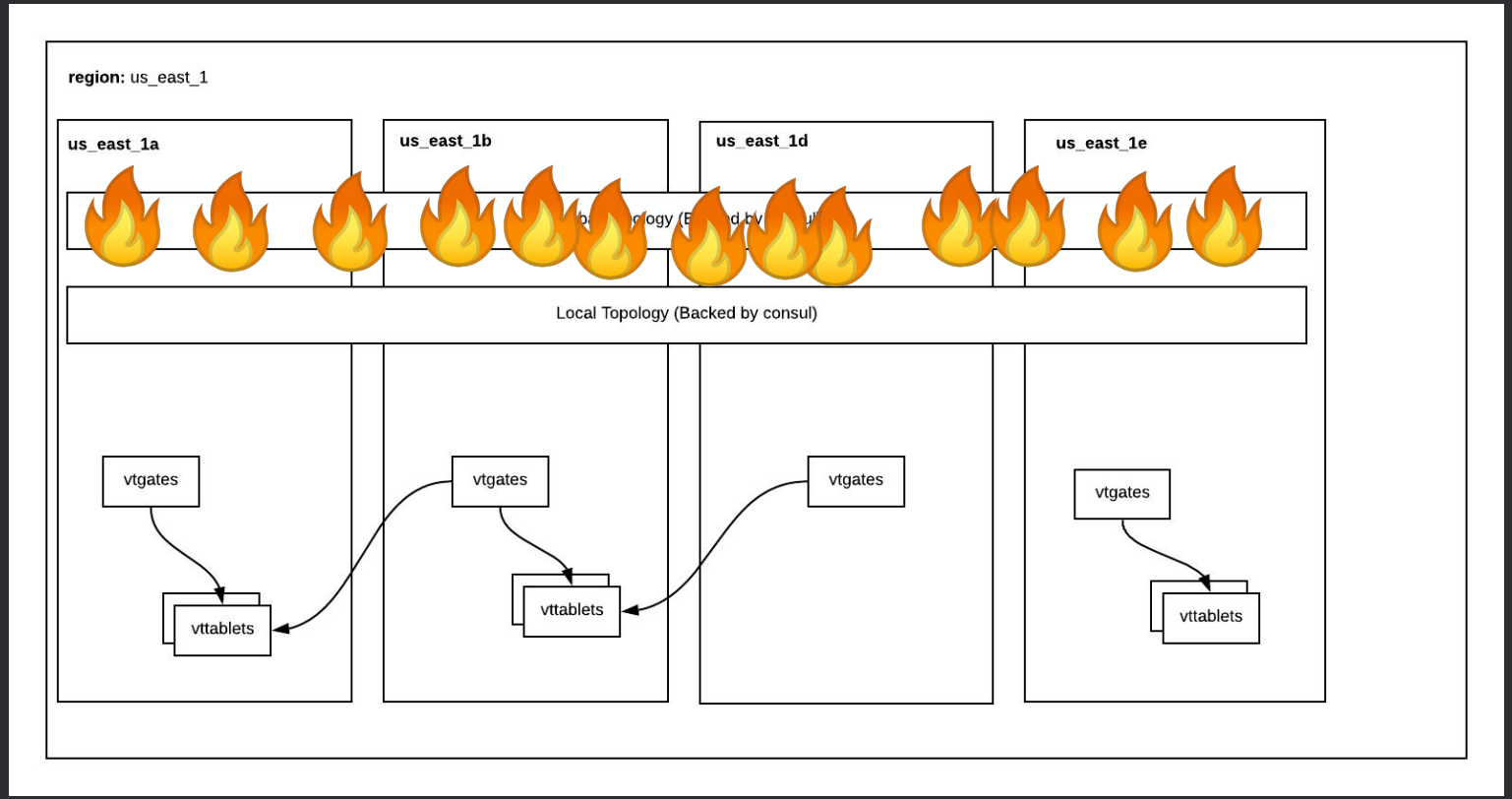
- Complex systems are intrinsically hazardous systems.
- Complex systems are heavily and successfully defended against failure.
- Catastrophe is always just around the corner.
- Complex systems contain changing mixtures of failures latent within them.

A Short Treatise on the Nature of Failure; How Failure is Evaluated; How Failure is Attributed to Proximate Cause; and the Resulting New Understanding of Patient Safety - Richard I. Cook, MD (2000)

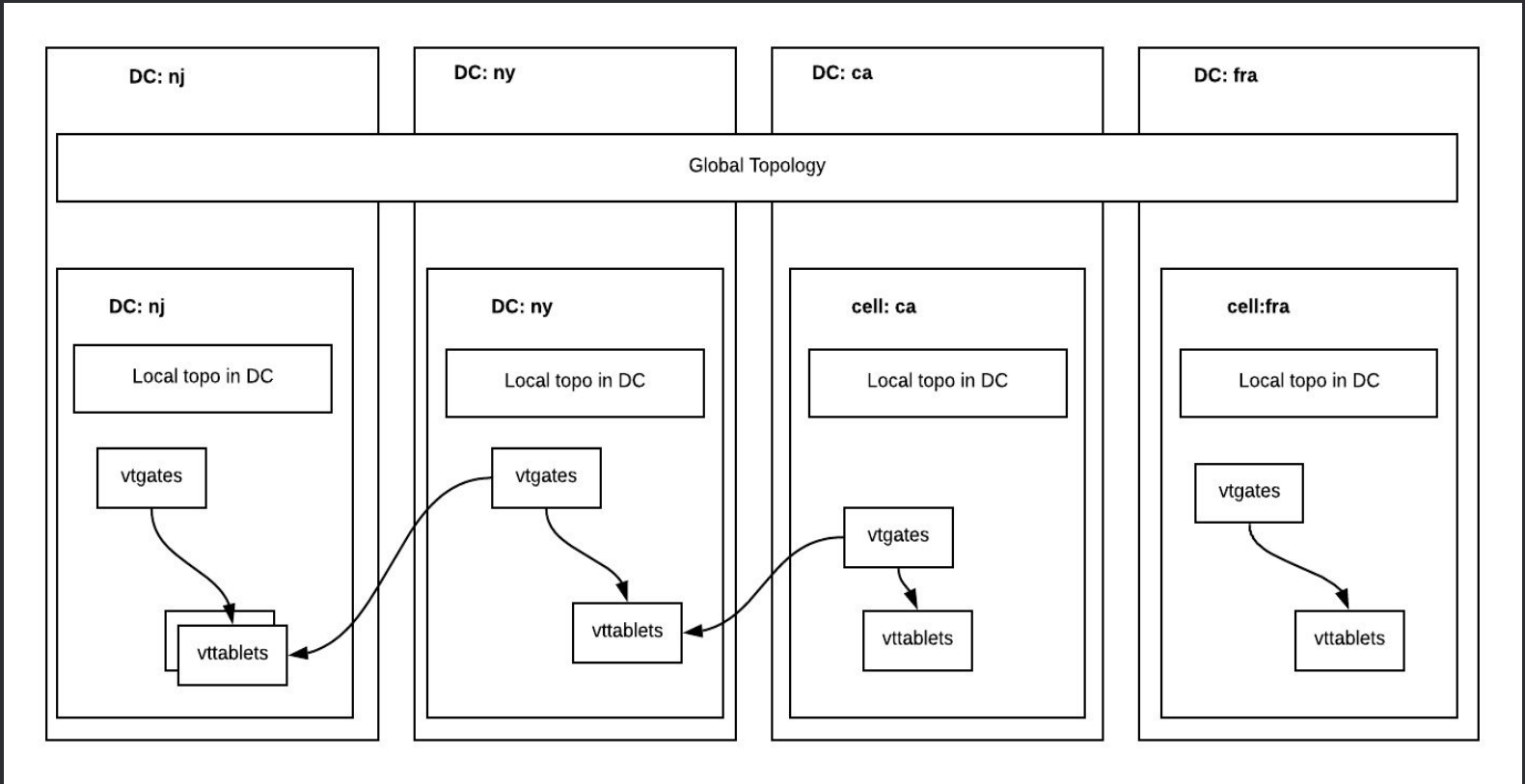
Designing Resilient Systems

- **Isolation is key.**
  - Minimize blast radius when the unexpected happens.
  - Think about your dependencies.
  - Let it crash!

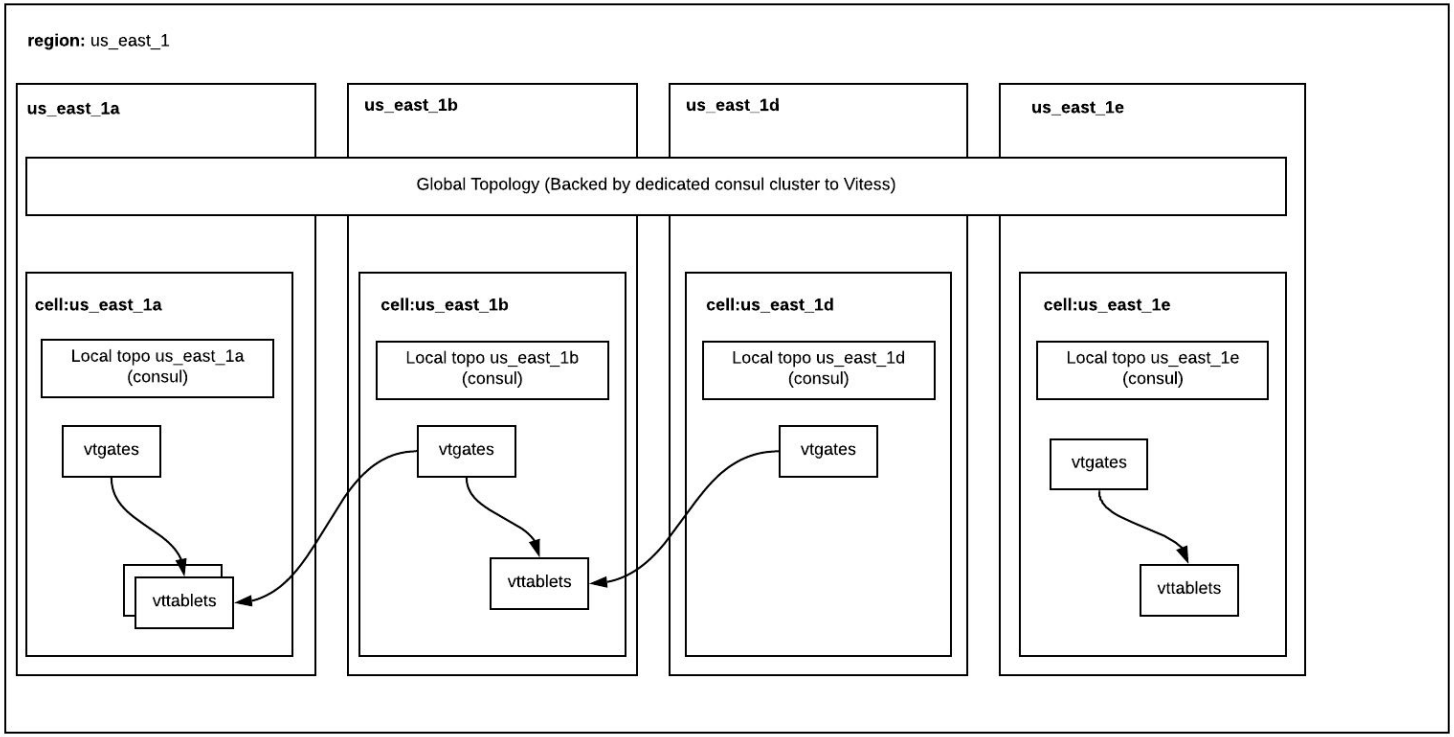
How can we improve it?



Vitess cells



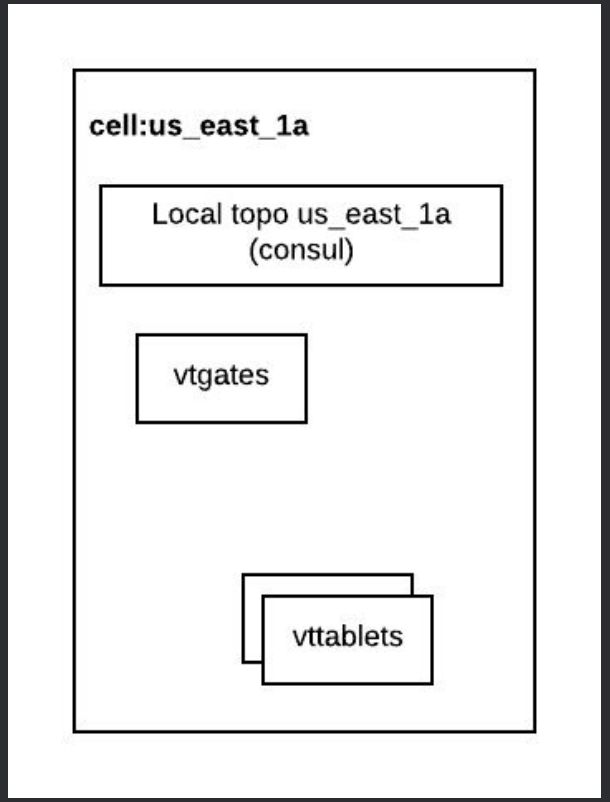
Expanding the cell concept



Did it work?

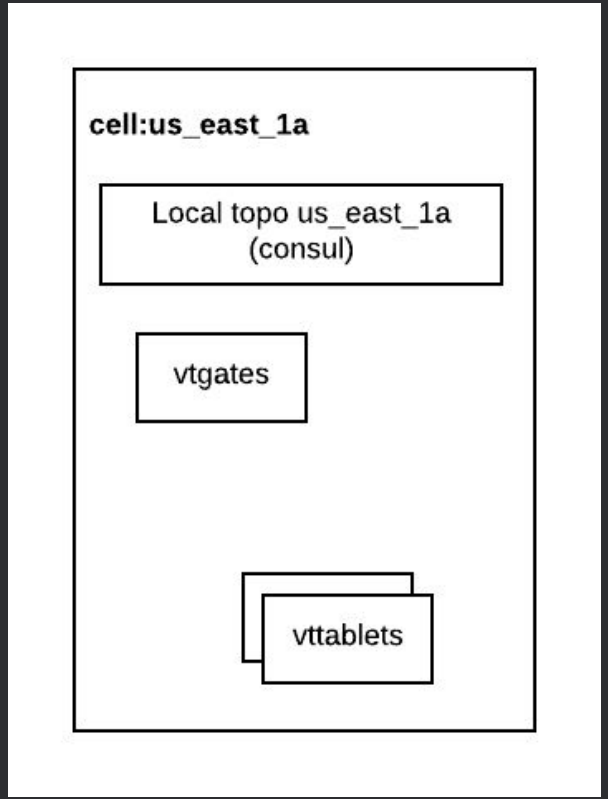
- Huge refactor of Vitess topology.
- We successfully migrated all our cluster to this new setup with no hiccups.
- More than three months.

Cell Affinity

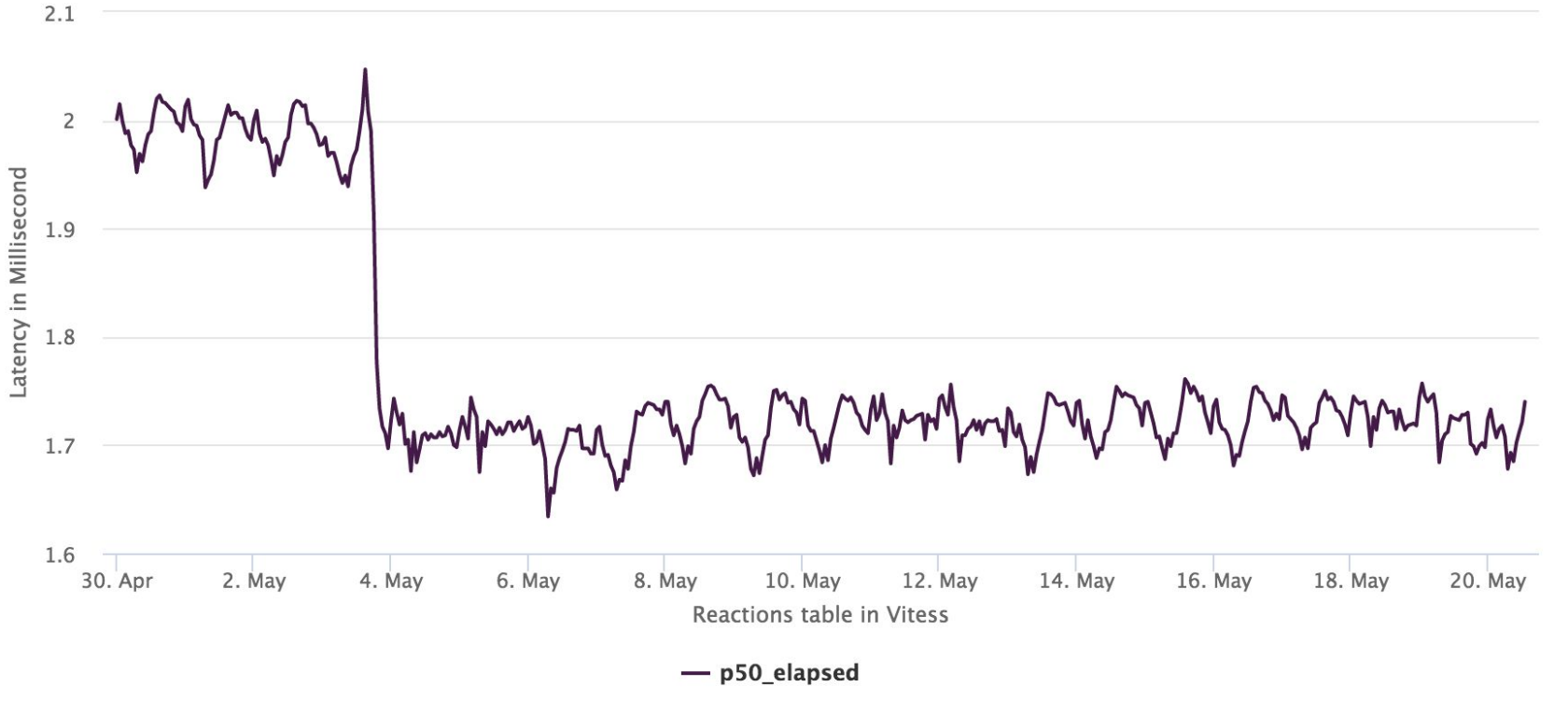


Cell Affinity

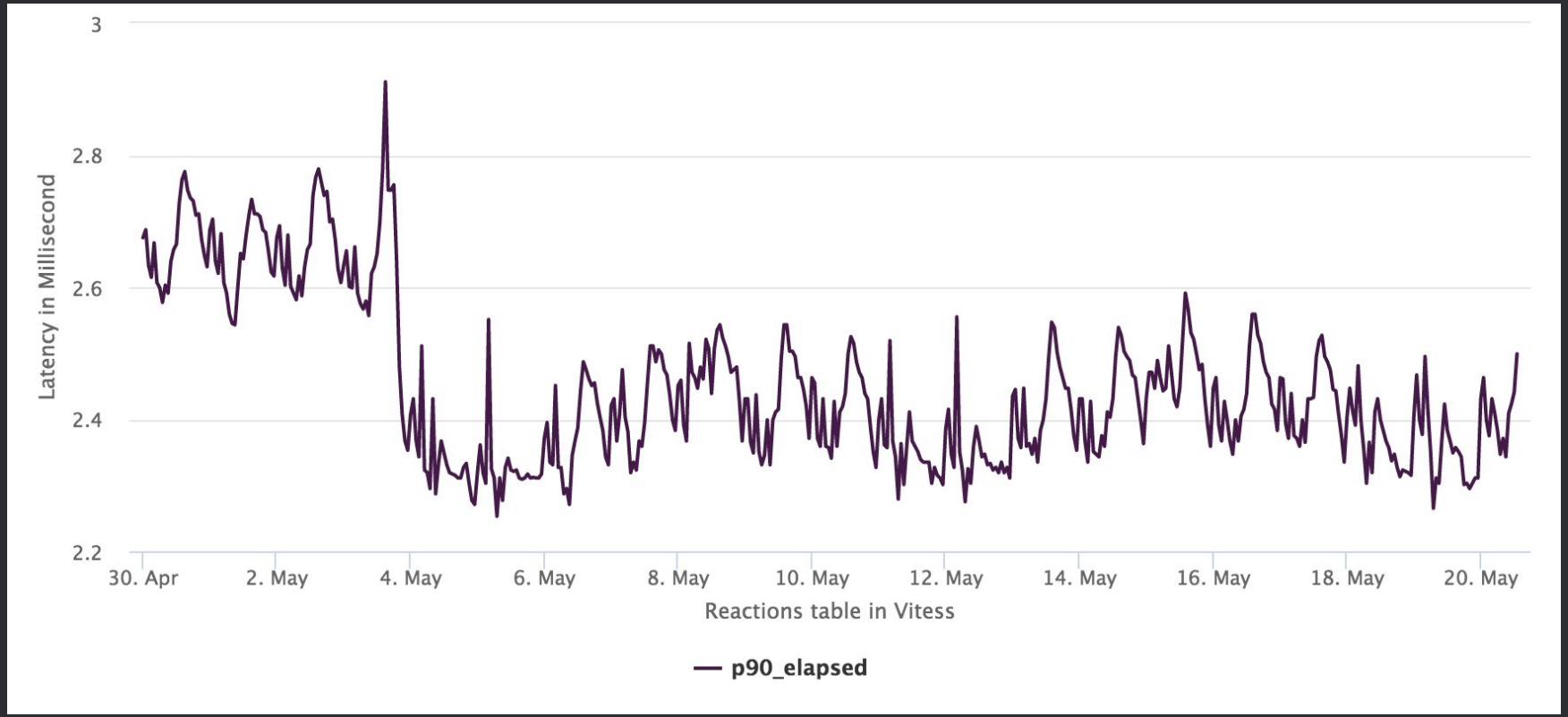
- In AWS this around 300 micros improvement in latency.
- For some of our tables, this represents at 15% improvement in the the P50.



Cell Affinity



Cell Affinity



Future Work

- Enabling more replicas than zones per shard.
- Remove dependencies from topo for normal operations.
- Deployments per Cell.

Questions?