Introduction to Infinispan

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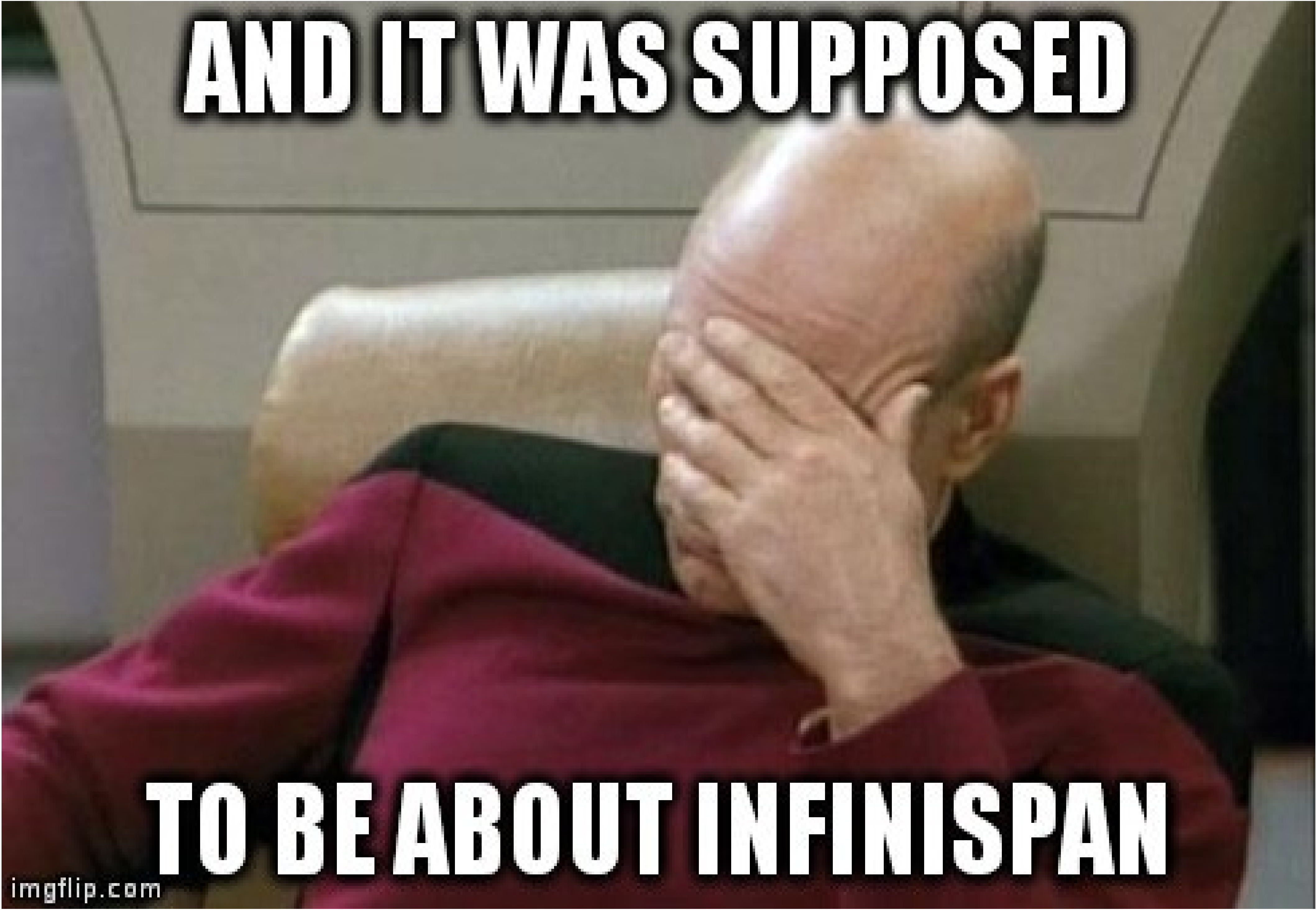
March 30th 2015

Don't work so hard... Beer? Parties? Nah, c'mon...

Source: http://bf4central.com/battlefield-4-wallpapers/

Fade Rift
In Hushed Whispers
Find a way back to Alexius's throne room.
6/8
0/5

In Hushed Whispers
Red Lyrium Shards Found
3 / 5
6/8


AND IT WAS SUPPOSED
TO BE ABOUT INFINISPAN
imgflip.com

Agenda

- NoSQL world
- What's Infinispan
- Why / When to use it
- How to plug it into your architecture
- Clustering modes
- Client / server access modes
- High level features
- Features in version 5.2, 6.0
- Brand new features in version 7.0

Why NoSQL? (viral applications / services)

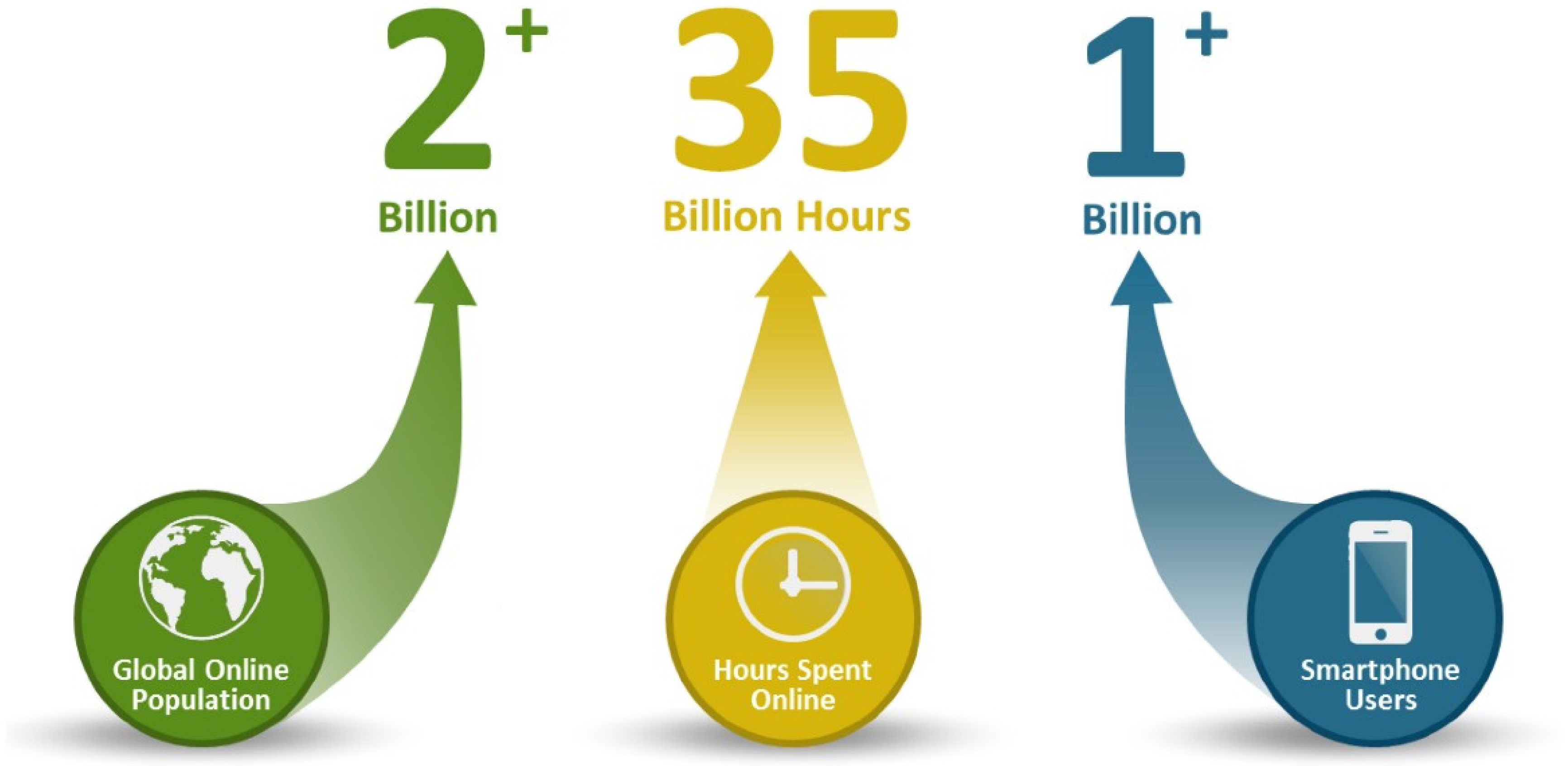


Figure 1. Big Users: With the growth in global internet use, the number of hours spent online, and the increase in smartphone users, it's not uncommon for apps to have millions of users per day.

From www.couchbase.com/sites/default/files/uploads/all/whitepapers/NoSQL-Whitepaper.pdf

Why NoSQL? (new types of data)

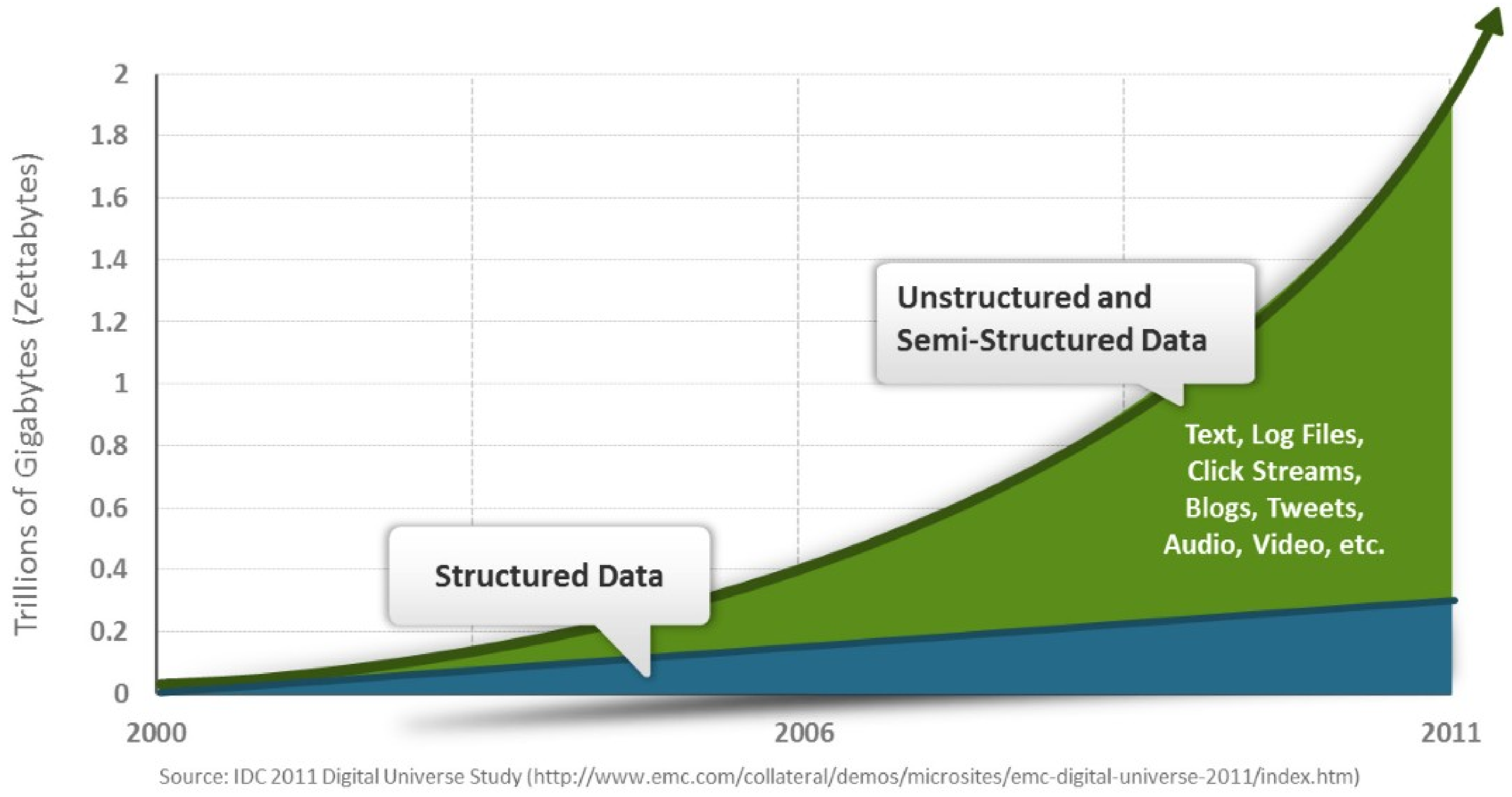


Figure 2. Big Data: The amount of data is growing rapidly, and the nature of data is changing as well. More than 80% of data generated today is unstructured or semi-structured.

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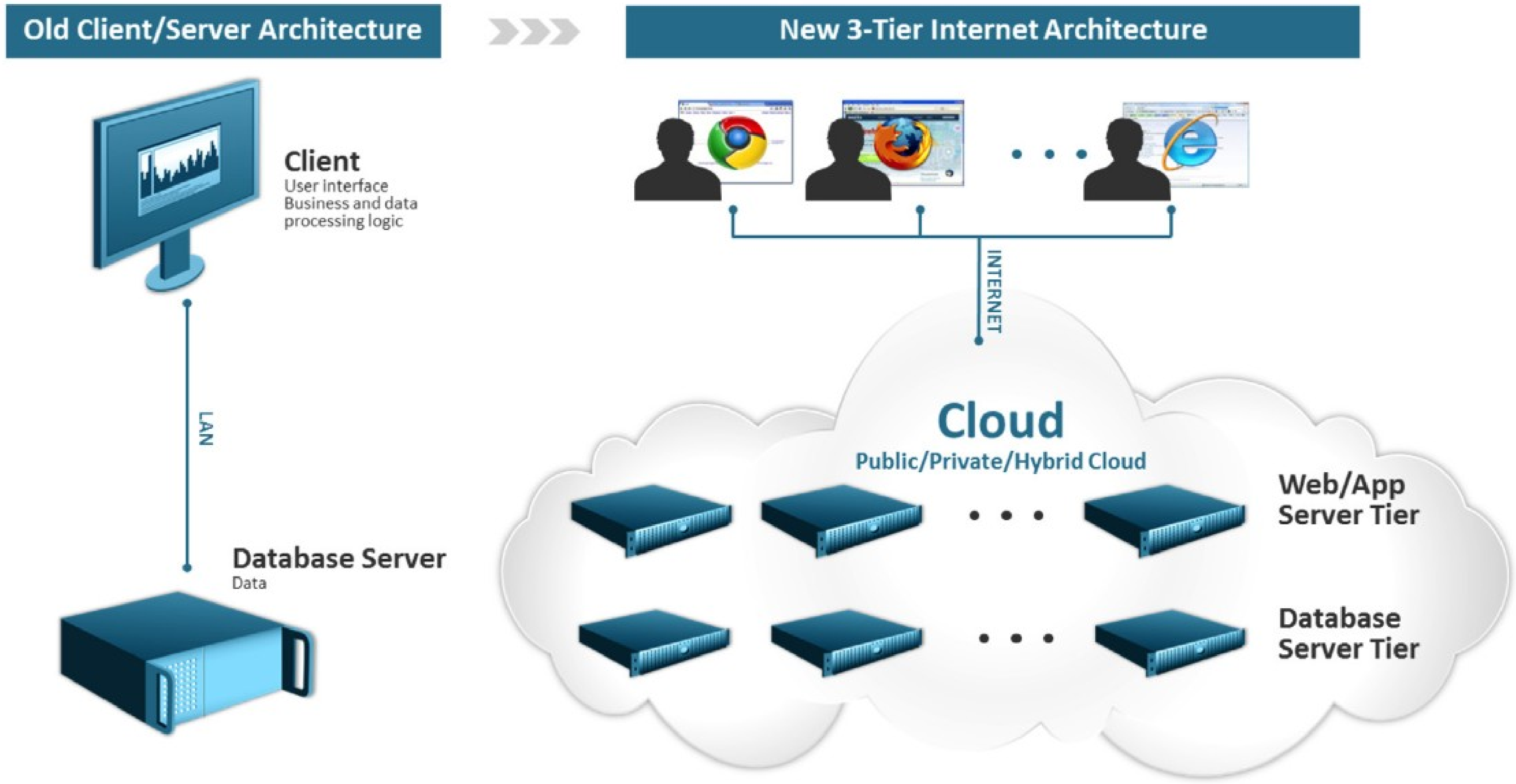
Why NoSQL? (dealing with traffic peaks)



Old Client/Server Architecture
New 3-Tier Internet Architecture
Client
User interface
Business and data processing logic
LAN
Database Server
Data
INTERNET
Cloud
Public/Private/Hybrid Cloud
Web/App Server Tier
Database Server Tier

Figure 3. Applications today are increasingly developed using a three-tier internet architecture, requiring a horizontally scalable database tier that easily scales with the number of users and amount of data your application has.

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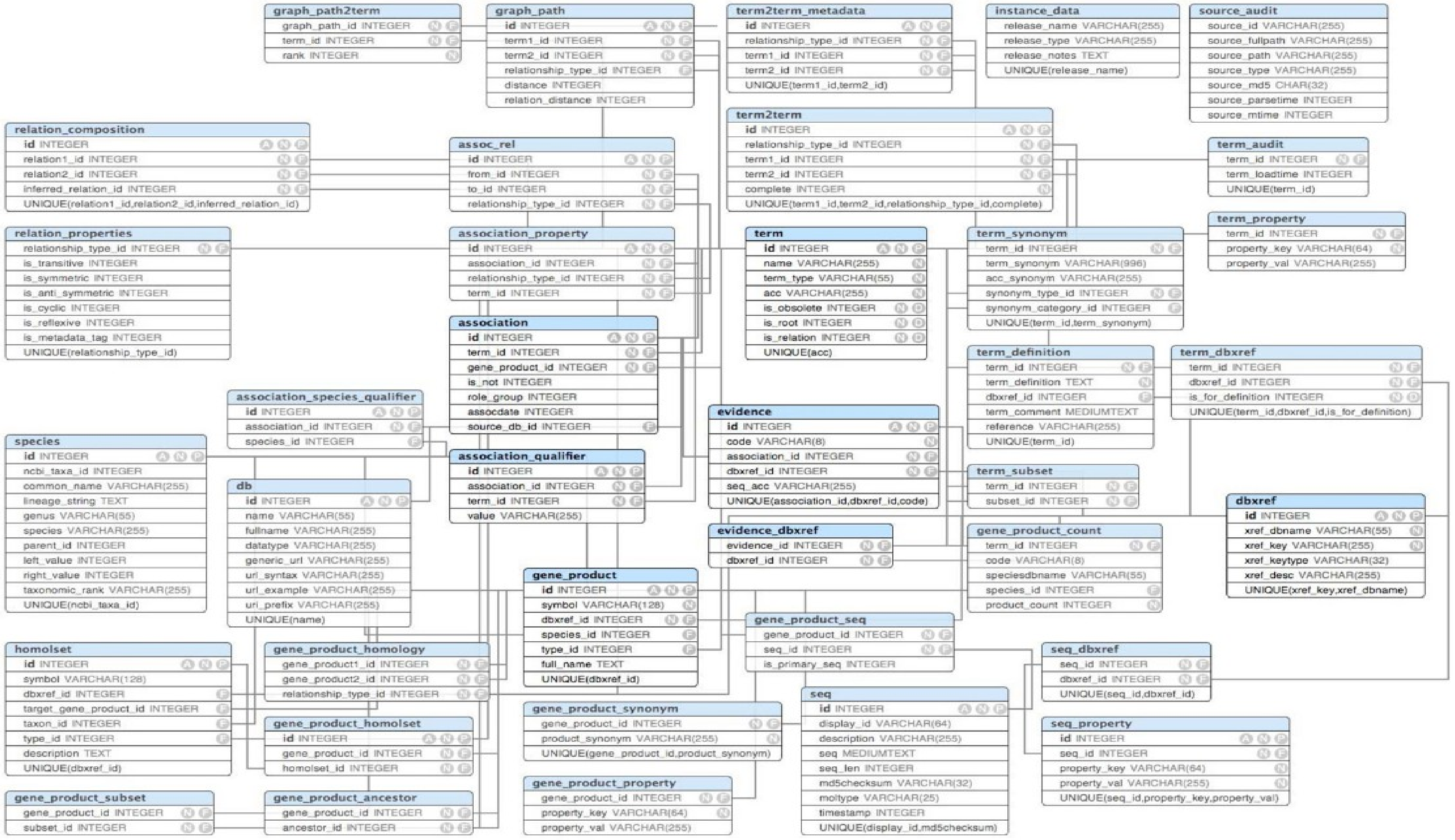
Why NoSQL? (More flexibility?)



graph_path2term: graph_path_id INTEGER; term_id INTEGER; rank INTEGER
graph_path: id INTEGER; term1_id INTEGER; term2_id INTEGER; relationship_type_id INTEGER; distance INTEGER; relation_distance INTEGER
term2term_metadata: id INTEGER; relationship_type_id INTEGER; term1_id INTEGER; term2_id INTEGER; UNIQUE(term1_id,term2_id)
instance_data: release_name VARCHAR(255); release_type VARCHAR(255); release_notes TEXT; UNIQUE(release_name)
source_audit: source_id VARCHAR(255); source_fullpath VARCHAR(255); source_path VARCHAR(255); source_type VARCHAR(255); source_md5 CHAR(32); source_parsetime INTEGER; source_mtime INTEGER
relation_composition: id INTEGER; relation1_id INTEGER; relation2_id INTEGER; inferred_relation_id INTEGER; UNIQUE(relation1_id,relation2_id,inferred_relation_id)
assoc_rel: id INTEGER; from_id INTEGER; to_id INTEGER; relationship_type_id INTEGER
term2term: id INTEGER; relationship_type_id INTEGER; term1_id INTEGER; term2_id INTEGER; complete INTEGER; UNIQUE(term1_id,term2_id,relationship_type_id,complete)
term_audit: term_id INTEGER; term_loadtime INTEGER; UNIQUE(term_id)
relation_properties: relationship_type_id INTEGER; is_transitive INTEGER; is_symmetric INTEGER; is_anti_symmetric INTEGER; is_cyclic INTEGER; is_reflexive INTEGER; is_metadata_tag INTEGER; UNIQUE(relationship_type_id)
association_property: id INTEGER; association_id INTEGER; relationship_type_id INTEGER; term_id INTEGER
term: id INTEGER; name VARCHAR(255); term_type VARCHAR(55); acc VARCHAR(255); is_obsolete INTEGER; is_root INTEGER; is_relation INTEGER; UNIQUE(acc)
term_synonym: term_id INTEGER; term_synonym VARCHAR(996); acc_synonym VARCHAR(255); synonym_type_id INTEGER; synonym_category_id INTEGER; UNIQUE(term_id,term_synonym)
term_property: term_id INTEGER; property_key VARCHAR(64); property_val VARCHAR(255)
association: id INTEGER; term_id INTEGER; gene_product_id INTEGER; is_not INTEGER; role_group INTEGER; assocdate INTEGER; source_db_id INTEGER
term_definition: term_id INTEGER; term_definition TEXT; dbxref_id INTEGER; term_comment MEDIUMTEXT; reference VARCHAR(255); UNIQUE(term_id)
term_dbxref: term_id INTEGER; dbxref_id INTEGER; is_for_definition INTEGER; UNIQUE(term_id,dbxref_id,is_for_definition)
association_species_qualifier: id INTEGER; association_id INTEGER; species_id INTEGER
evidence: id INTEGER; code VARCHAR(8); association_id INTEGER; dbxref_id INTEGER; seq_acc VARCHAR(255); UNIQUE(association_id,dbxref_id,code)
species: id INTEGER; ncbi_taxa_id INTEGER; common_name VARCHAR(255); lineage_string TEXT; genus VARCHAR(55); species VARCHAR(255); parent_id INTEGER; left_value INTEGER; right_value INTEGER; taxonomic_rank VARCHAR(255); UNIQUE(ncbi_taxa_id)
association_qualifier: id INTEGER; association_id INTEGER; term_id INTEGER; value VARCHAR(255)
term_subset: term_id INTEGER; subset_id INTEGER
db: id INTEGER; name VARCHAR(55); fullname VARCHAR(255); datatype VARCHAR(255); generic_url VARCHAR(255); url_syntax VARCHAR(255); url_example VARCHAR(255); uri_prefix VARCHAR(255); UNIQUE(name)
dbxref: id INTEGER; xref_dbname VARCHAR(55); xref_key VARCHAR(255); xref_keytype VARCHAR(32); xref_desc VARCHAR(255); UNIQUE(xref_key,xref_dbname)
evidence_dbxref: evidence_id INTEGER; dbxref_id INTEGER
gene_product_count: term_id INTEGER; code VARCHAR(8); speciesdbname VARCHAR(55); species_id INTEGER; product_count INTEGER
gene_product: id INTEGER; symbol VARCHAR(128); dbxref_id INTEGER; species_id INTEGER; type_id INTEGER; full_name TEXT; UNIQUE(dbxref_id)
gene_product_seq: gene_product_id INTEGER; seq_id INTEGER; is_primary_seq INTEGER
homolset: id INTEGER; symbol VARCHAR(128); dbxref_id INTEGER; target_gene_product_id INTEGER; taxon_id INTEGER; type_id INTEGER; description TEXT; UNIQUE(dbxref_id)
gene_product_homology: gene_product1_id INTEGER; gene_product2_id INTEGER; relationship_type_id INTEGER
seq_dbxref: seq_id INTEGER; dbxref_id INTEGER; UNIQUE(seq_id,dbxref_id)
seq: id INTEGER; display_id VARCHAR(64); description VARCHAR(255); seq MEDIUMTEXT; seq_len INTEGER; md5checksum VARCHAR(32); moltype VARCHAR(25); timestamp INTEGER; UNIQUE(display_id,md5checksum)
gene_product_synonym: gene_product_id INTEGER; product_synonym VARCHAR(255); UNIQUE(gene_product_id,product_synonym)
gene_product_homolset: id INTEGER; gene_product_id INTEGER; homolset_id INTEGER
seq_property: id INTEGER; seq_id INTEGER; property_key VARCHAR(64); property_val VARCHAR(255); UNIQUE(seq_id,property_key,property_val)
gene_product_property: gene_product_id INTEGER; property_key VARCHAR(64); property_val VARCHAR(255)
gene_product_subset: gene_product_id INTEGER; subset_id INTEGER
gene_product_ancestor: gene_product_id INTEGER; ancestor_id INTEGER

Figure 4: With relational databases, any operation requires the collection and processing of data from across tens or hundreds of interrelated tables, greatly hindering performance.

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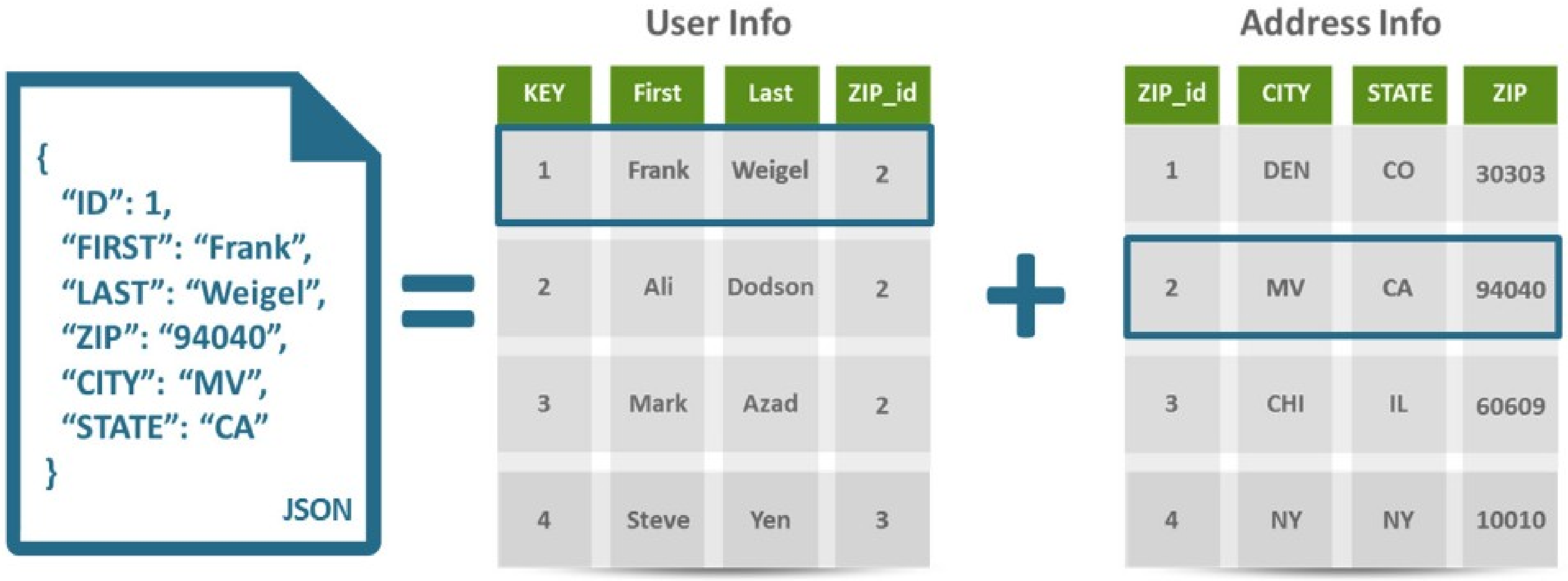
Why NoSQL? (Yes, more flexibility please)



```
{
  "ID": 1,
  "FIRST": "Frank",
  "LAST": "Weigel",
  "ZIP": "94040",
  "CITY": "MV",
  "STATE": "CA"
}
```

User Info

KEY	First	Last	ZIP_id
1	Frank	Weigel	2
2	Ali	Dodson	2
3	Mark	Azad	2
4	Steve	Yen	3

Address Info

ZIP_id	CITY	STATE	ZIP
1	DEN	CO	30303
2	MV	CA	94040
3	CHI	IL	60609
4	NY	NY	10010

Figure 5: Unlike relational databases, which must store and retrieve data from scores of interrelated tables, document databases can store an entire object in a single JSON document, making it faster to retrieve.

Developers: OOP vs RDBMS

From www.couchbase.com/sites/default/files/uploads/all/whitepapers/NoSQL-Whitepaper.pdf

Why developers are considering NoSQL databases?

- Better application development productivity through a more flexible data model

- Greater ability to scale dynamically to support more users and data

- Improved performance to satisfy expectations of users wanting highly responsive applications

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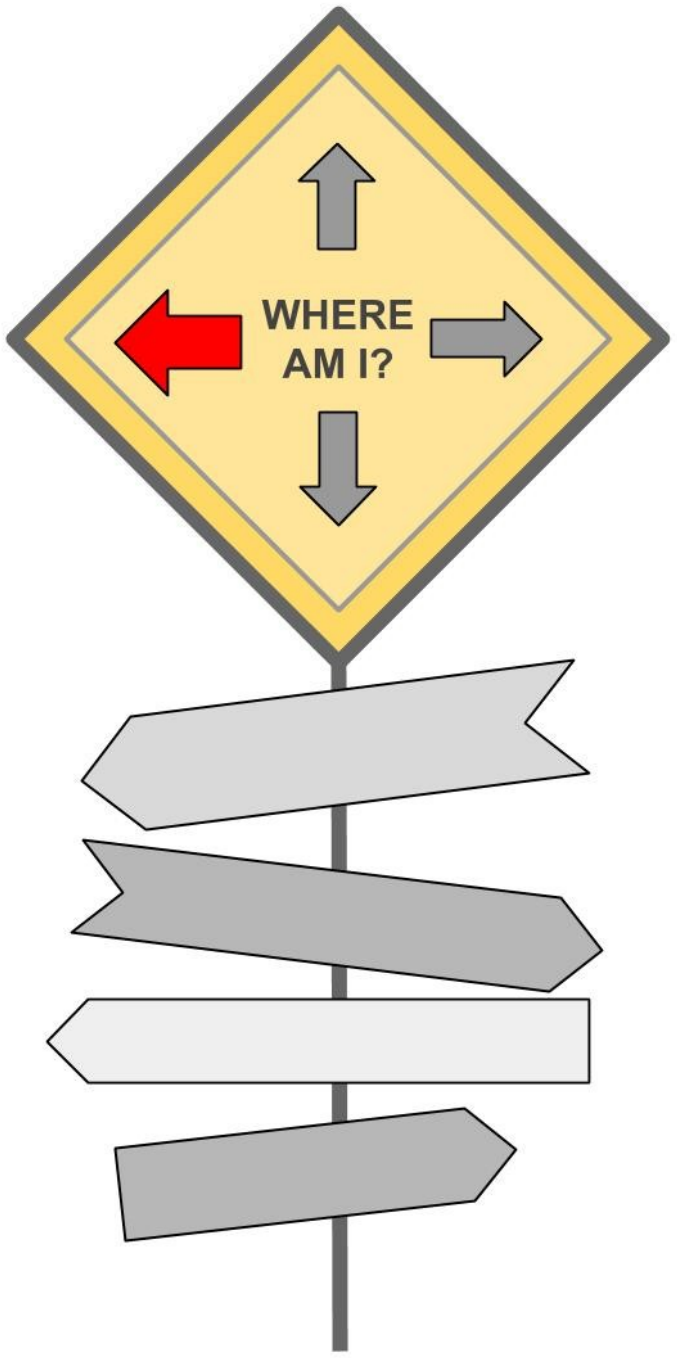

What's Infinispan?

Infinispan
isual Design team ... for everyone.

What's Infinispan?

- Open-source datagrid patform
- In-Memory, Schema-less, NoSQL key-value data store
- Distributed cache (offers massive heap)
- Scalable (goal: hundreds of nodes) + Elastic
- Higly available, resilient to node failures
- Concurrent (reads and writes at the same time)
- Transactional
- Queryable (also document store)

Red Hat productized version: **JBoss Data Grid**

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For Java users: it's a Map

Yes, just a Map – everything else is for free!

```
DefaultCacheManager cacheManager =
        new DefaultCacheManager("infinispan.xml");

Cache<String, Object> cache =
        cacheManager.getCache("namedCache");

cache.put("key", "value");

Object value = cache.get("key");
```

Configuration in XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<infinispan/>
```

Read more:
http://infinispan.org/docs/7.0.x/user_guide/user_guide.html#_configuring_cache_declaratively

Programmatic Configuration

```
Configuration c = new ConfigurationBuilder()
                  .clustering().cacheMode(CacheMode.REPL_SYNC)
                  .build();


GlobalConfiguration globalConfig = new GlobalConfigurationBuilder()
    .transport()
        .clusterName("qa-cluster")
        .addProperty("configurationFile", "jgroups-tcp.xml")
        .machineId("qa-machine").rackId("qa-rack")
    .build();
```

Read more:
http://infinispan.org/docs/7.0.x/user_guide/user_guide.html#_configuring_cache_programmatically

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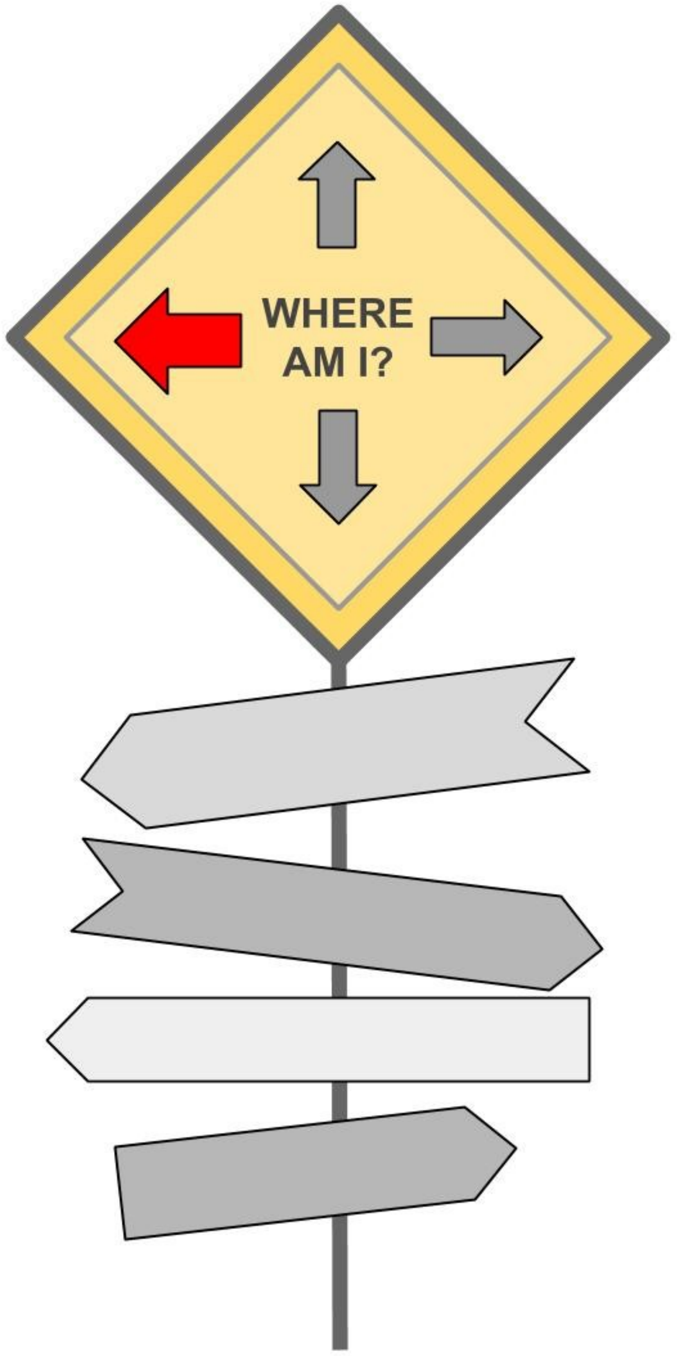
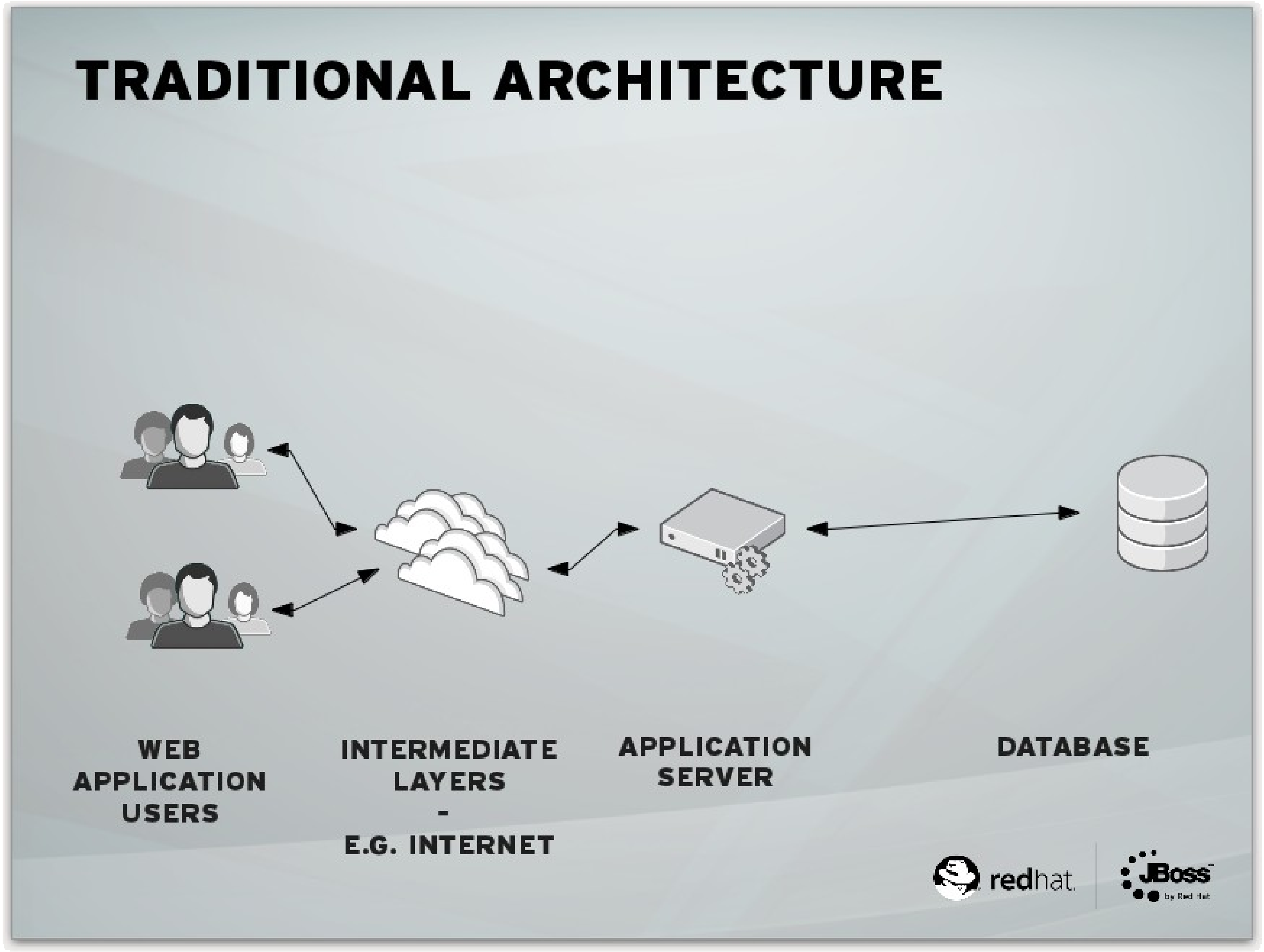


Why Datagrid?



From http://fhornain.wordpress.com/2012/04/21/jboss-data-grid-when-database-is-very-expensive/

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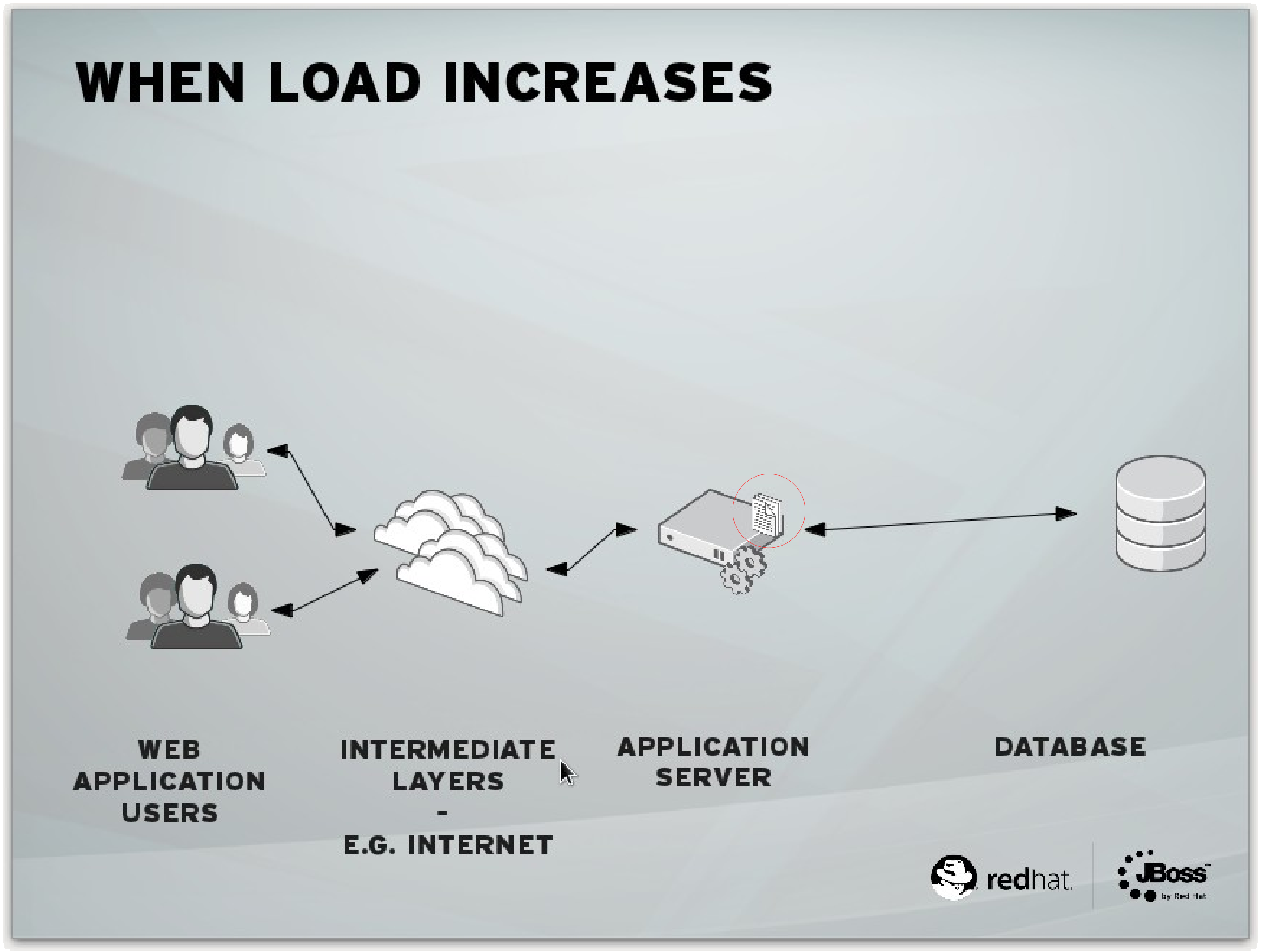

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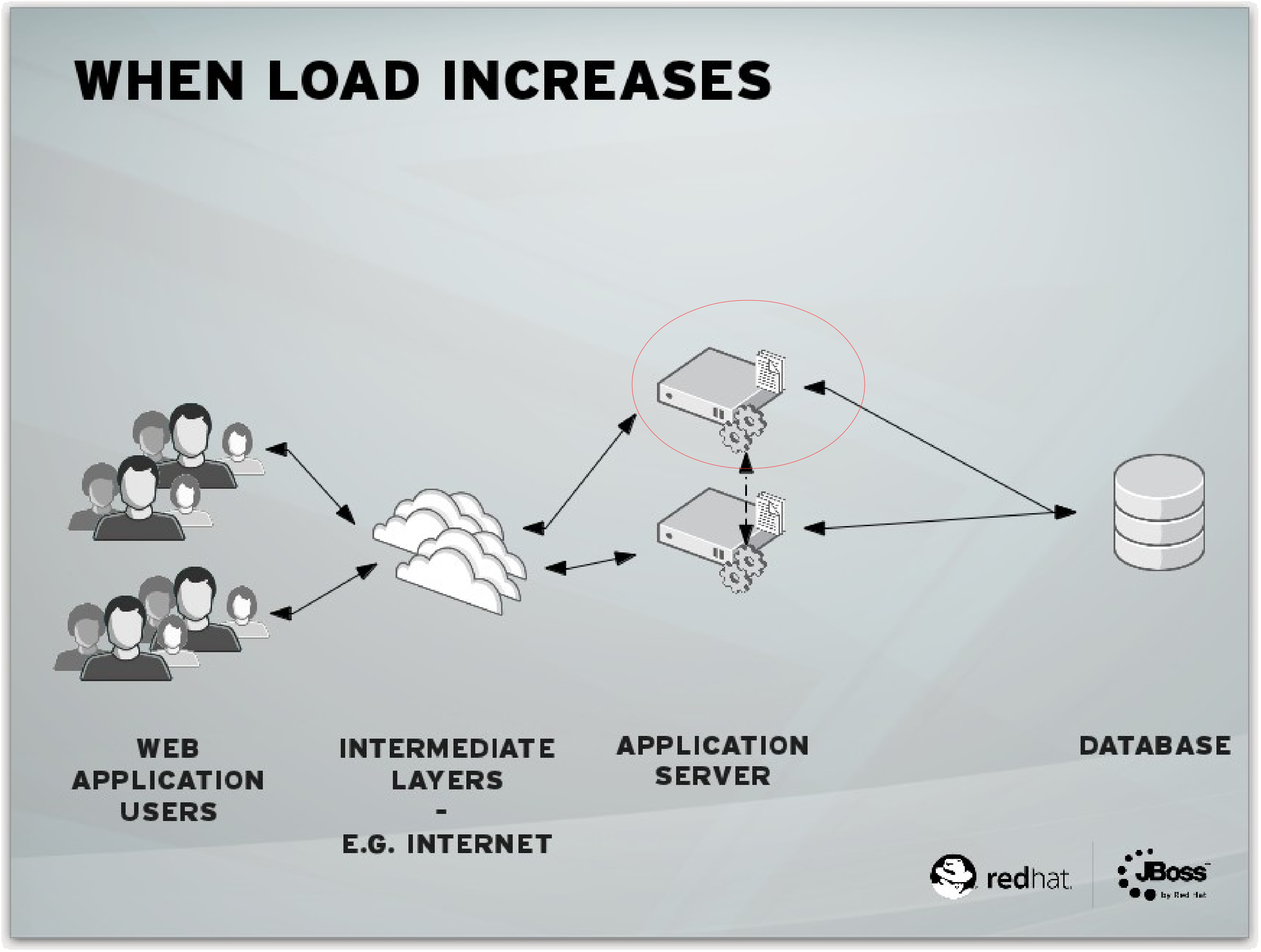
Why Datagrid? (Your business is successful)



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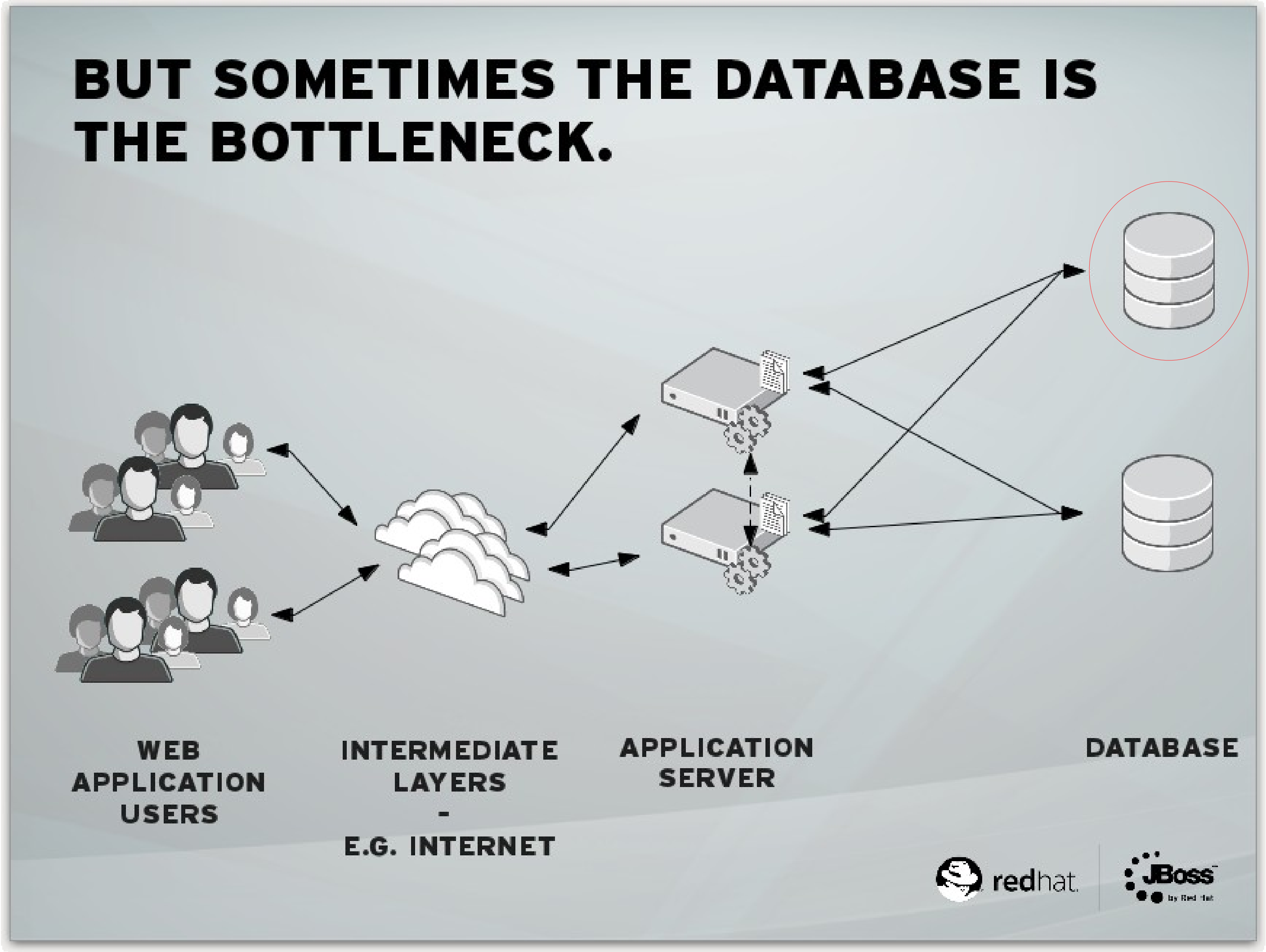
Why Datagrid? (You are even more successful)


BUT SOMETIMES THE DATABASE IS THE BOTTLENECK.
WEB APPLICATION USERS
INTERMEDIATE LAYERS - E.G. INTERNET
APPLICATION SERVER
DATABASE
redhat.
JBoss by Red Hat

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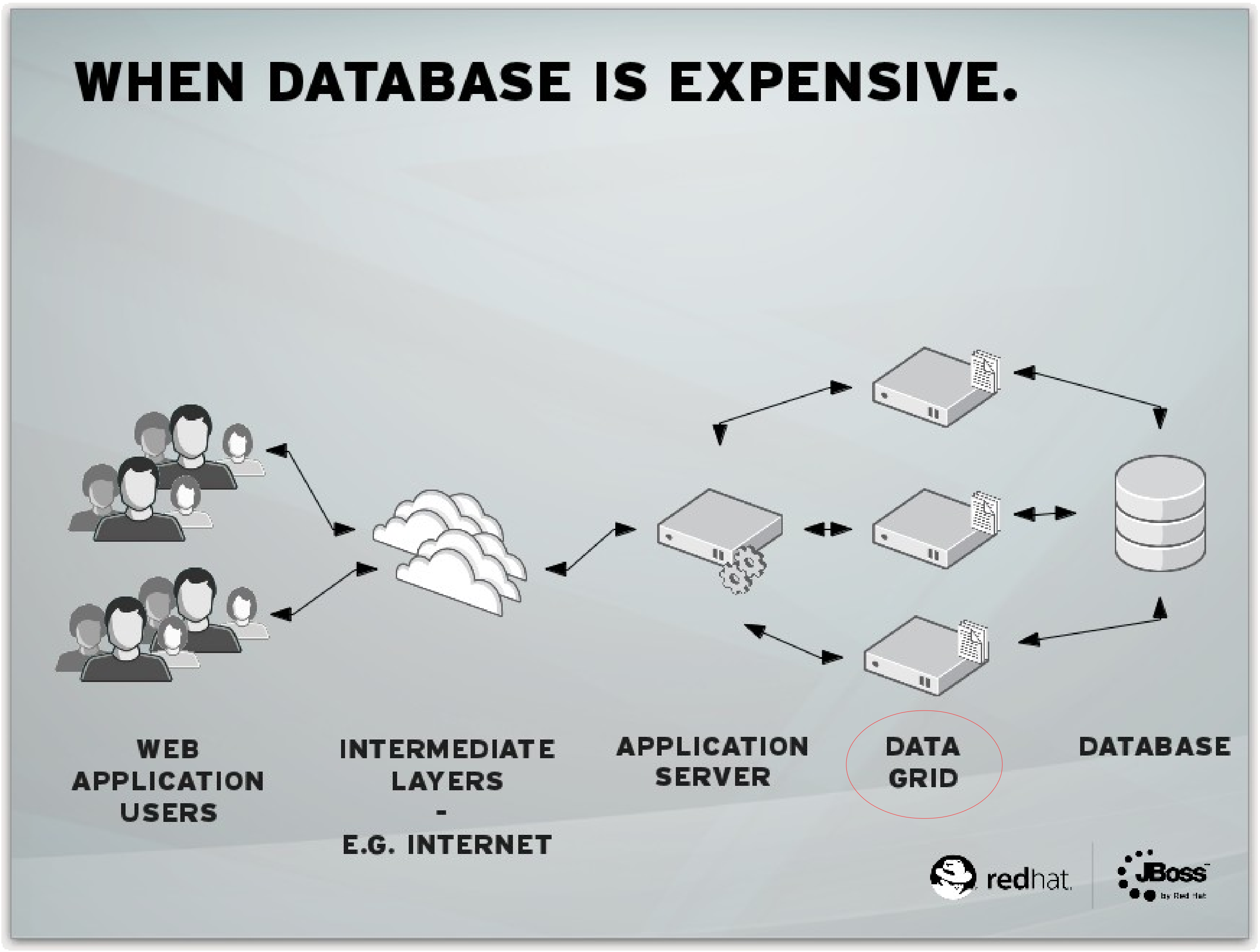
Why Datagrid?



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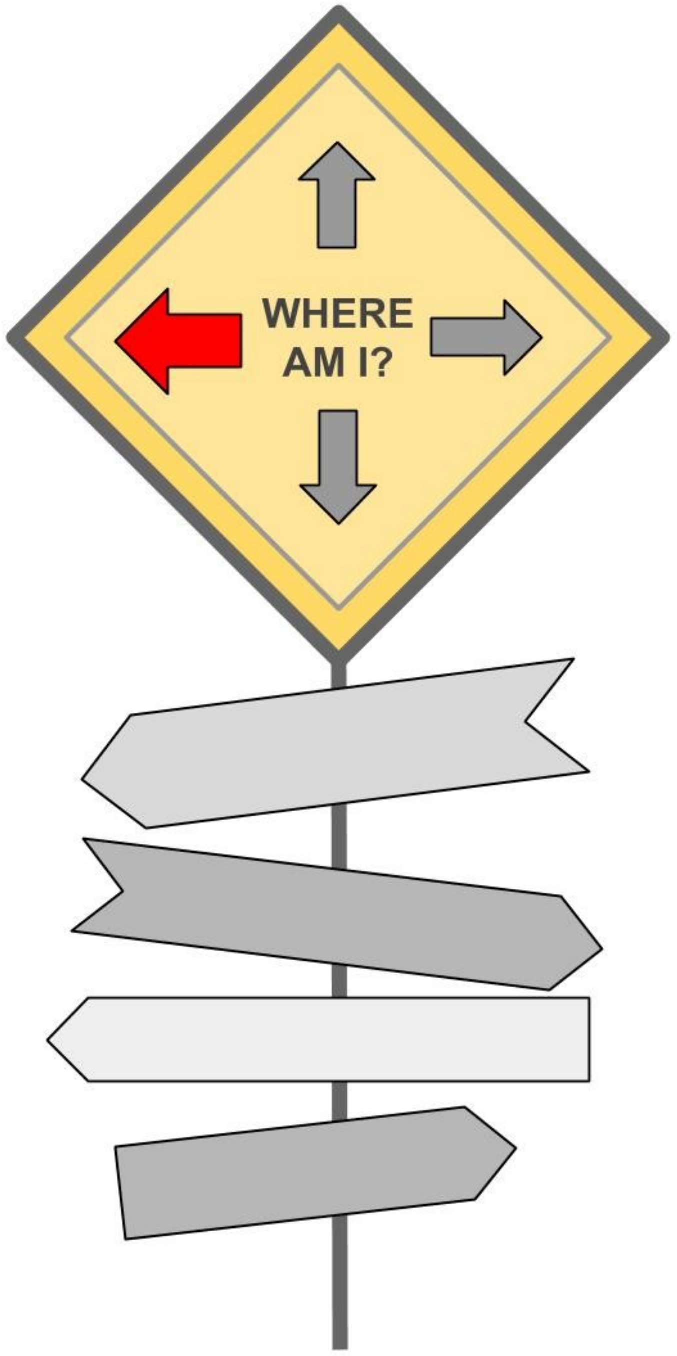
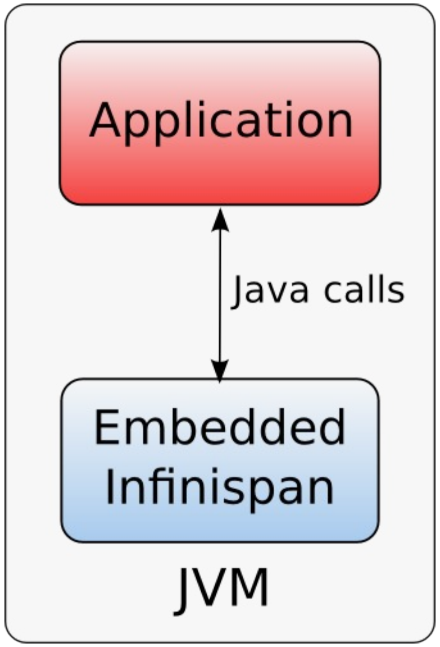


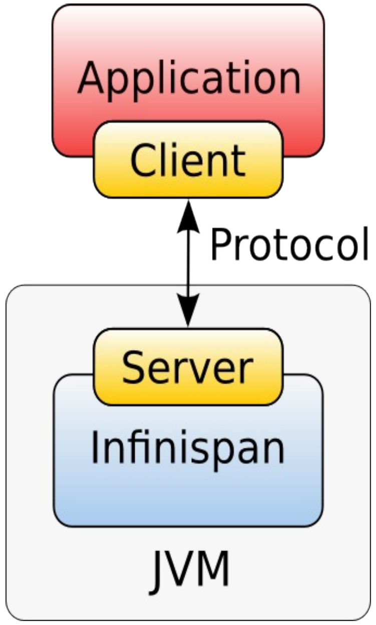
How to plug it into your architecture ?

Modes of access / usage

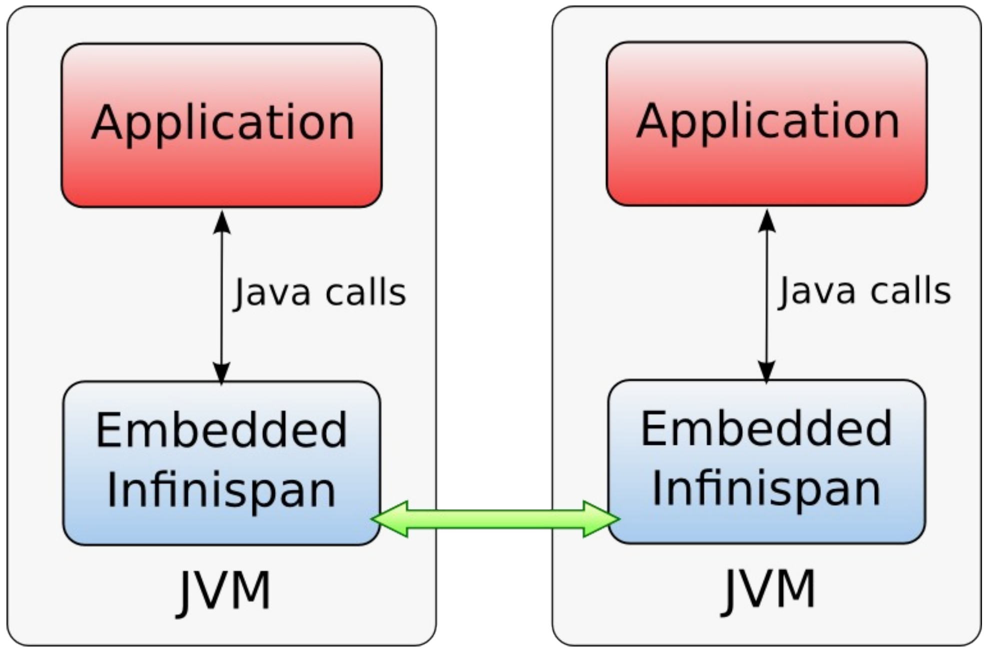
- Embedded (Library, In-VM mode)



- Remote (Client/Server mode)
  - REST (HTTP)
  - Hot Rod
  - Memcached
  - Websocket
  - OData



Embedded (In-VM) mode - clustered



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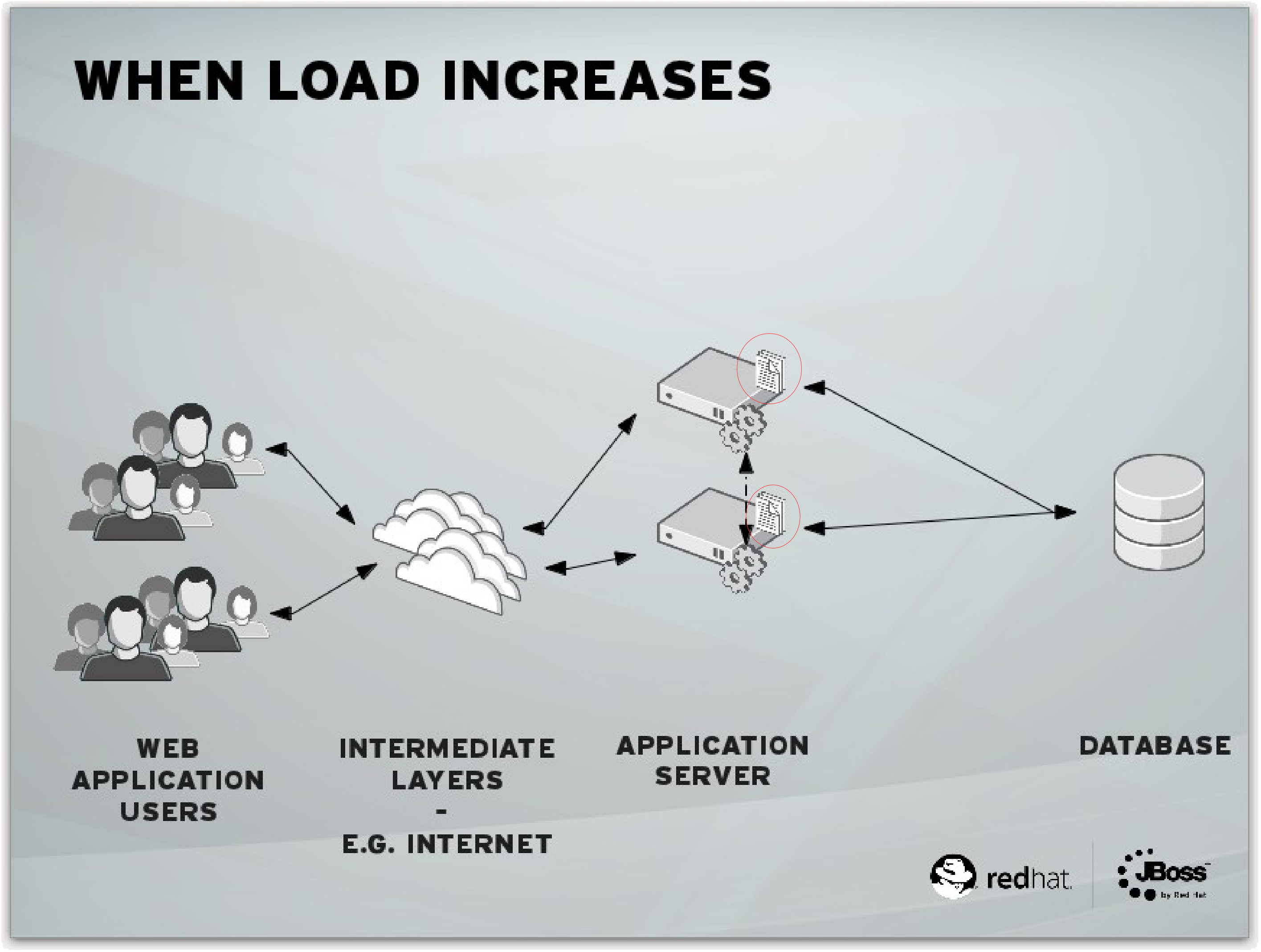

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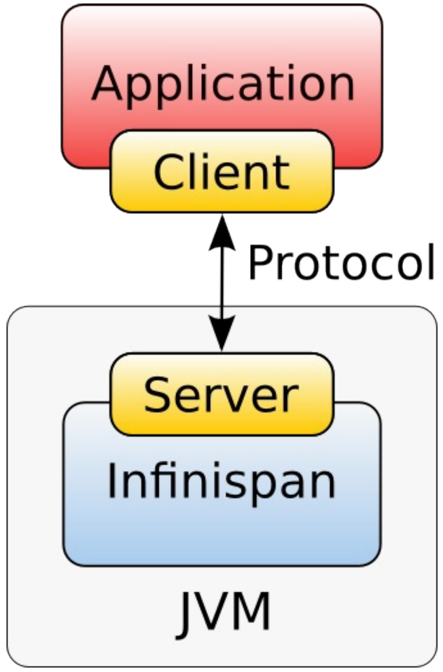
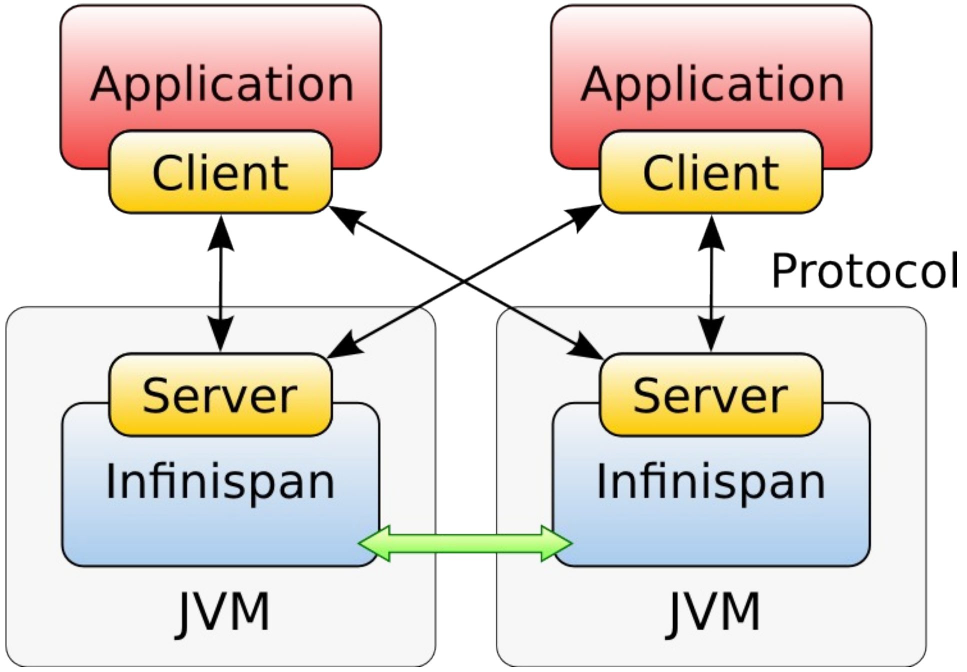
Client / Server mode



Protocols
- REST
- Hot Rod
- Memcached
- Websocket
- OData

Client / Server mode - clustered



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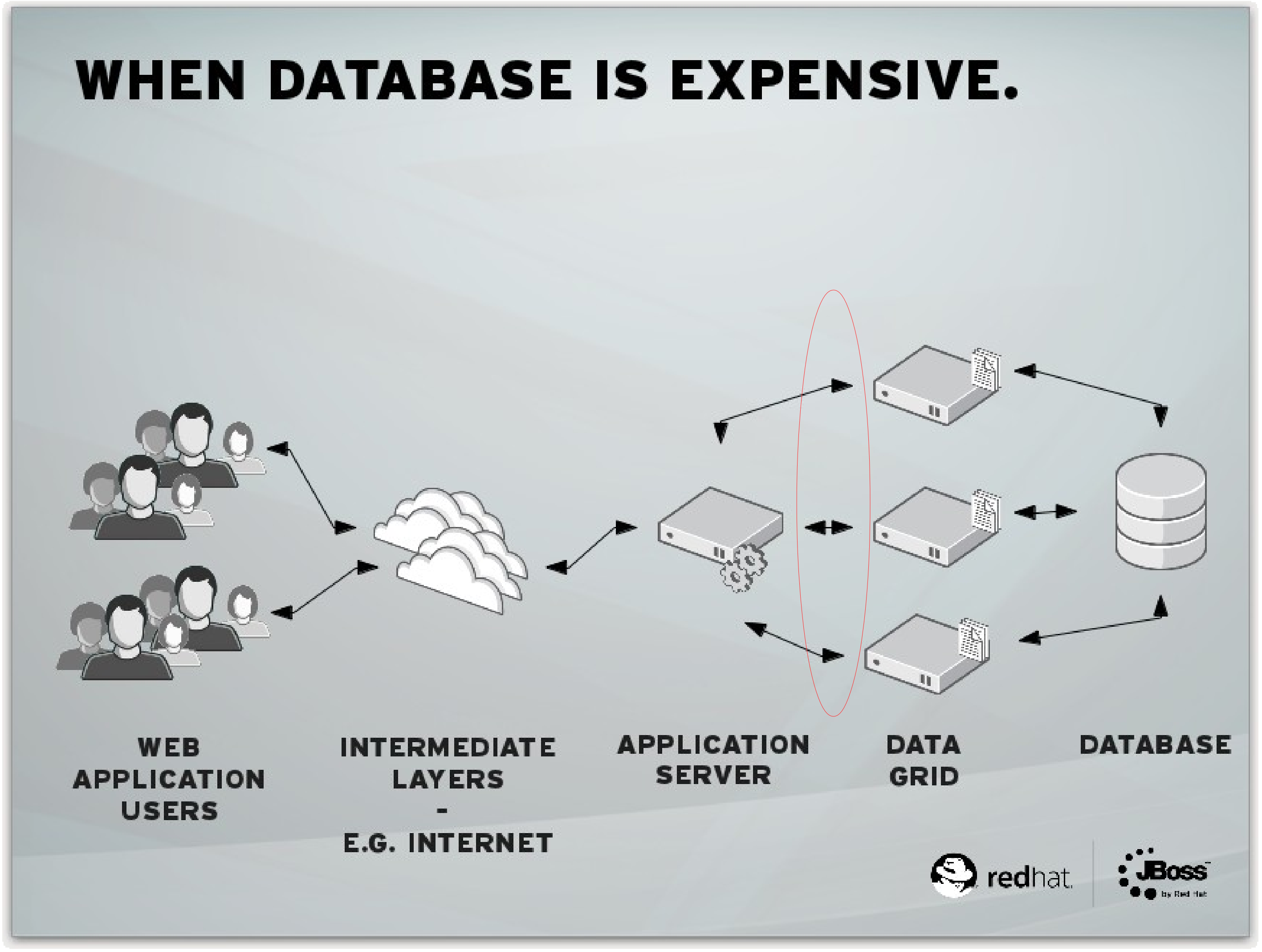

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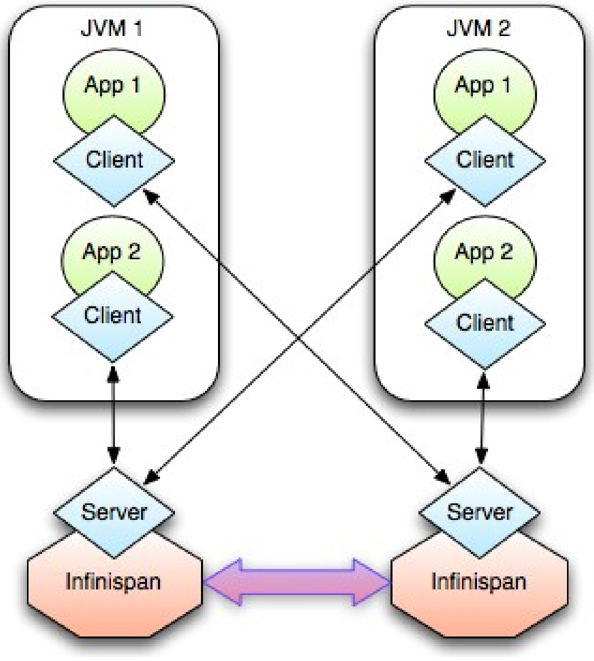
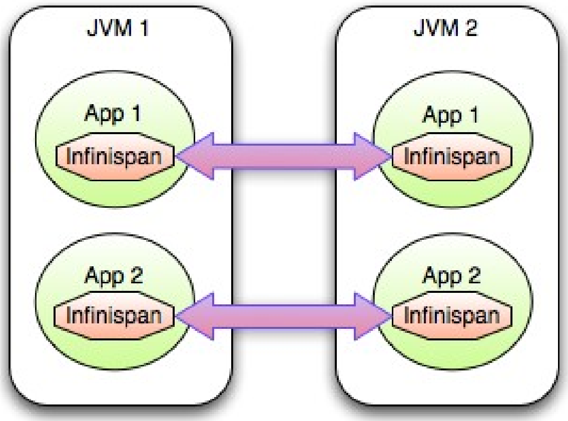
Client / Server mode - clustered

- Independent tier management
- Independently deploy new app version





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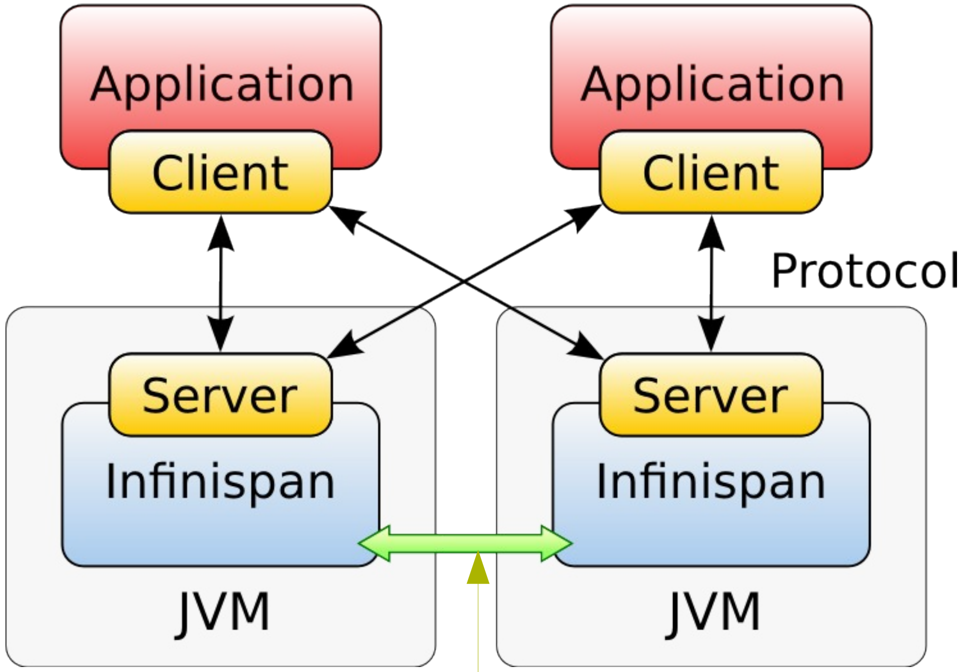
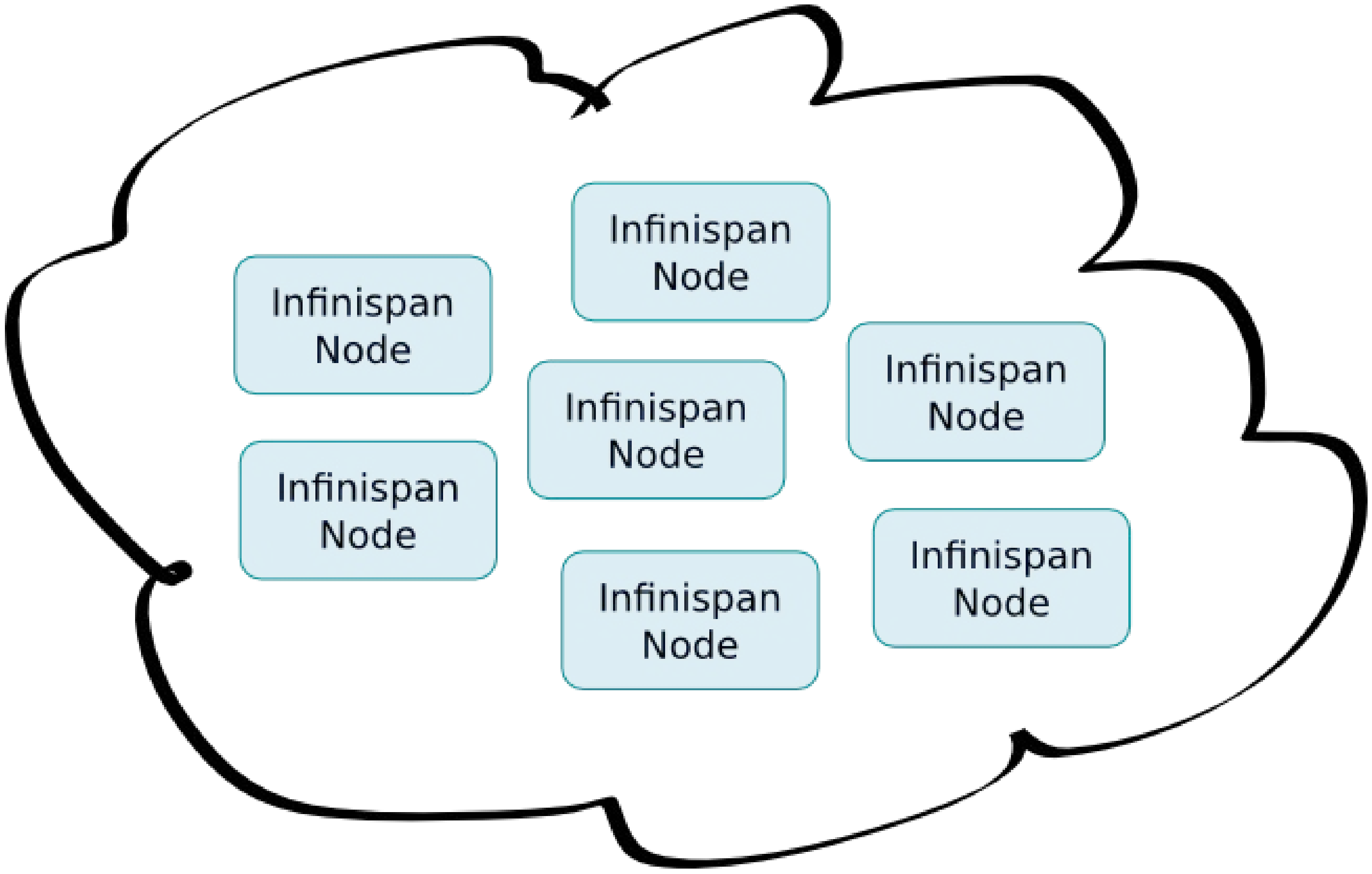


Big deal! JGroups

Toolkit for reliable messaging

What clustering / resilience / elasticity means



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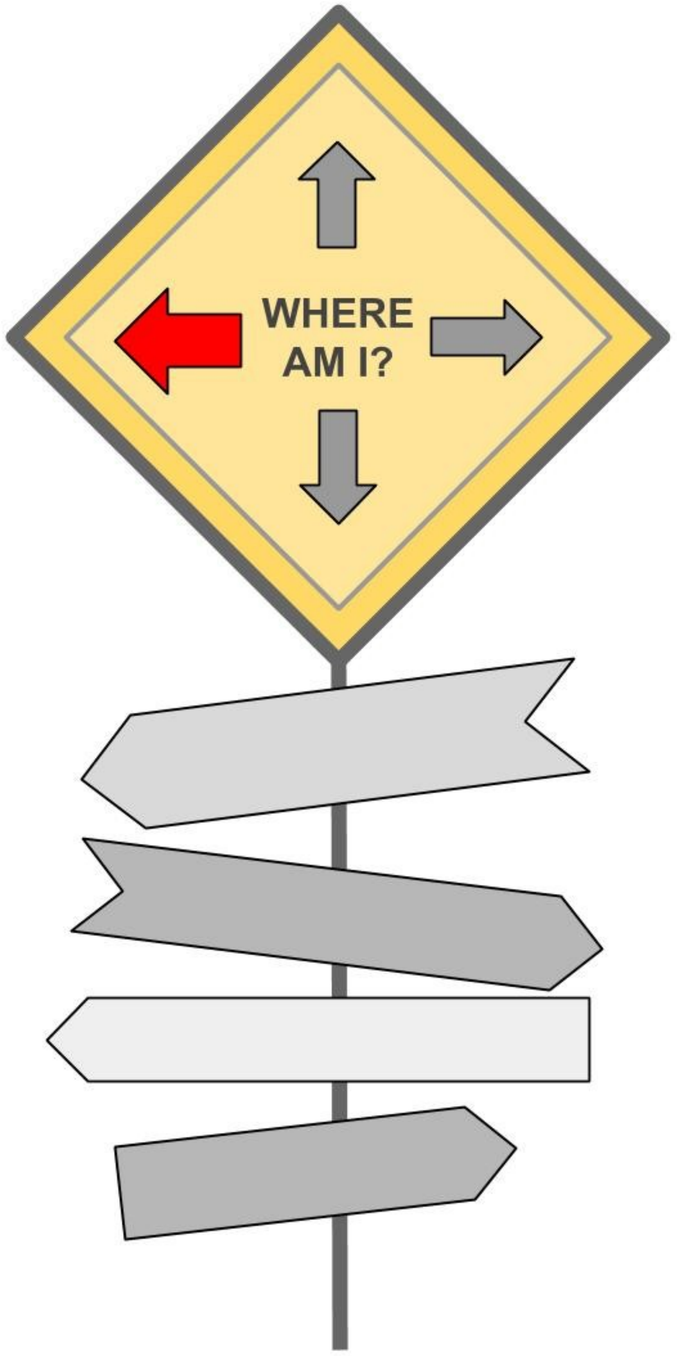
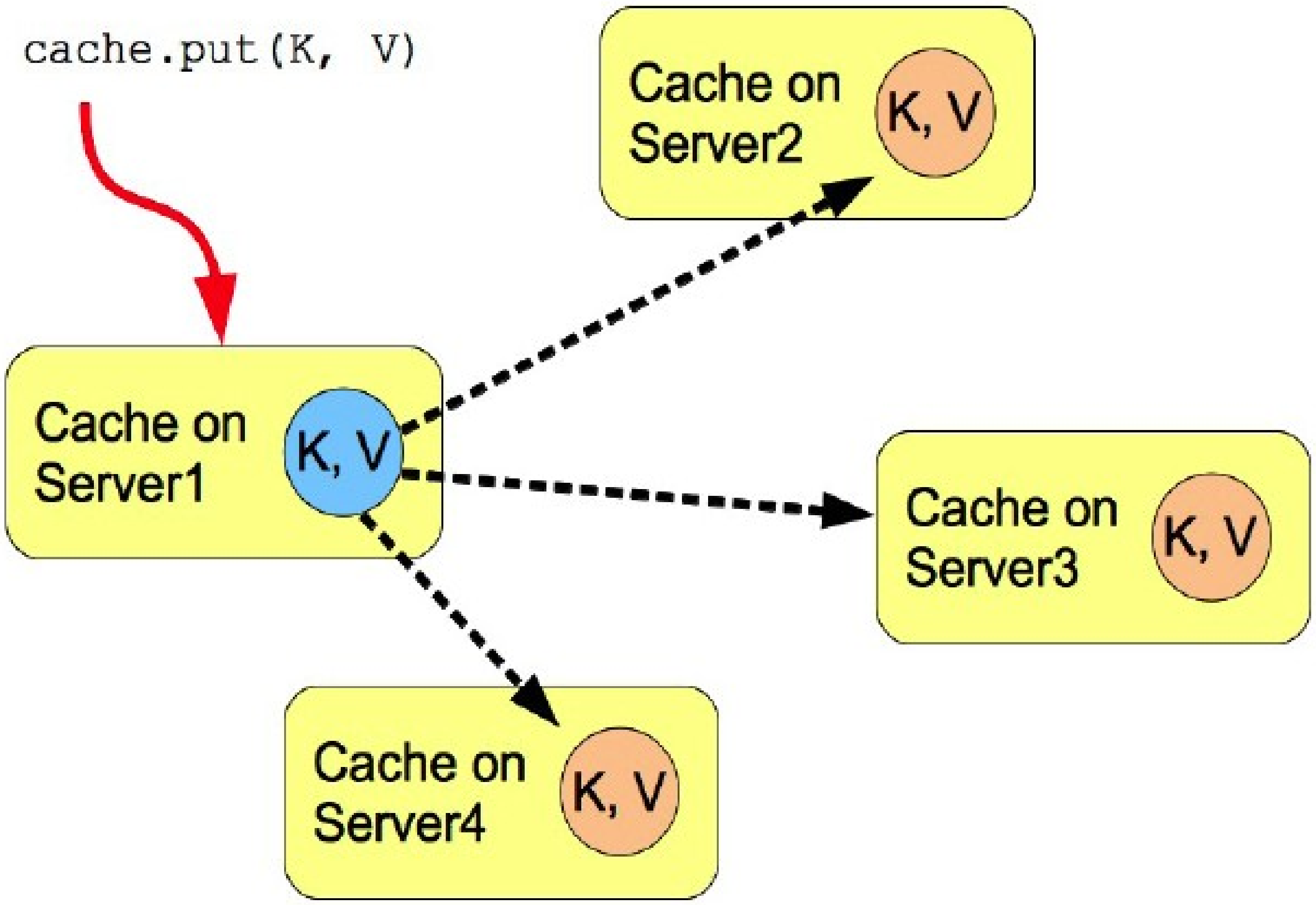


Clustering modes

- **Local** - no clustering
  - unaware of other instances on network
- **Replication** – each node contains all the entries
- **Distribution** – each entry is on x nodes
  - 1 <= x <= Number of nodes
- **Invalidation** – for use with shared cache store

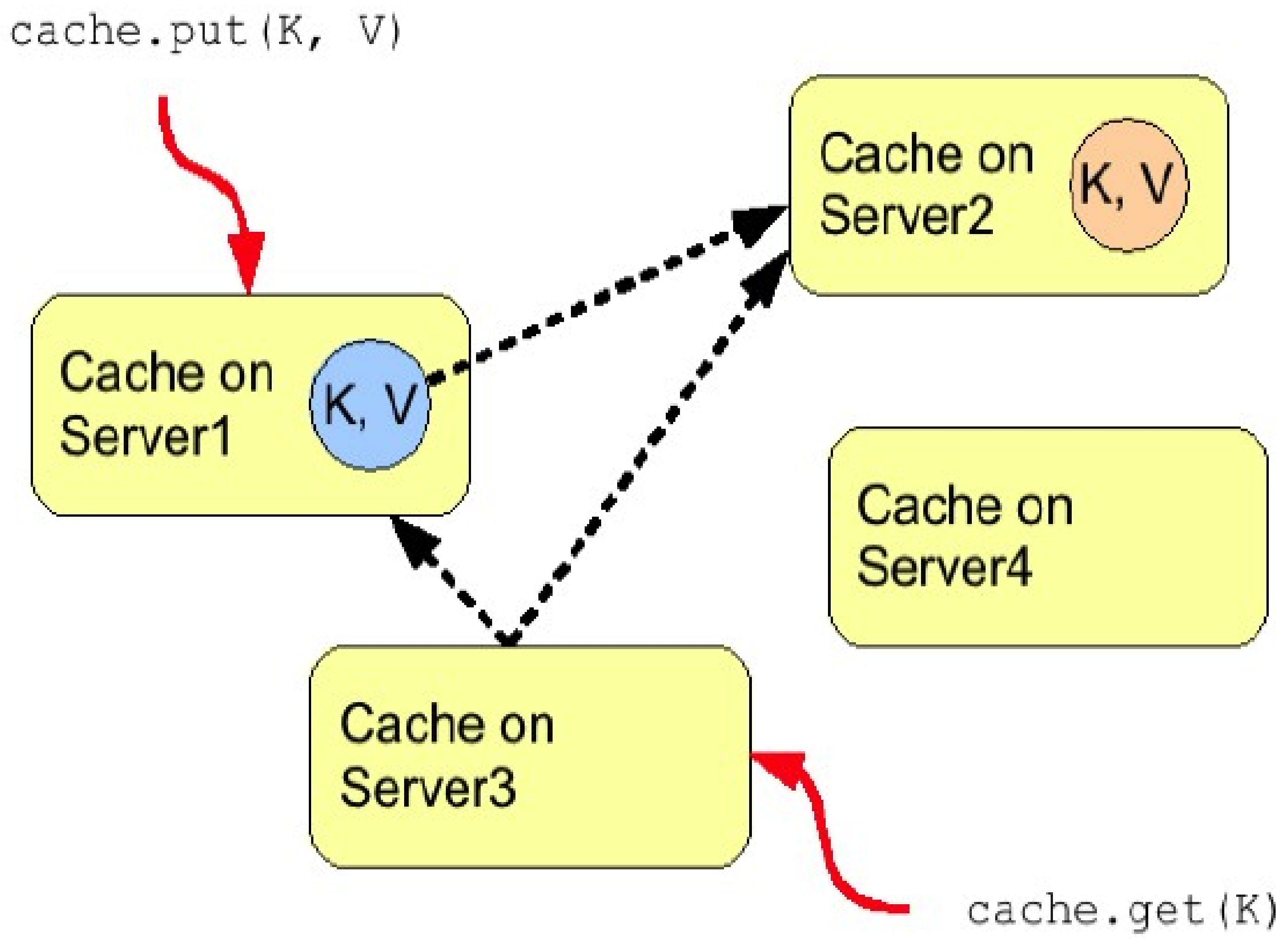
Replication mode



Replication mode

- Advantages
  - N node cluster tolerates **N-1 failures**
  - **Read friendly** – no need to fetch data from owner node
  - Instant scale-in, no state transfer on leave
- Disadvantages
  - **Write unfriendly**, put broadcast to every node
  - Doesn't scale well
  - When node joins all state has to be transfered to new node
  - **Heap size** stays the **same** when we add nodes

Distribution mode

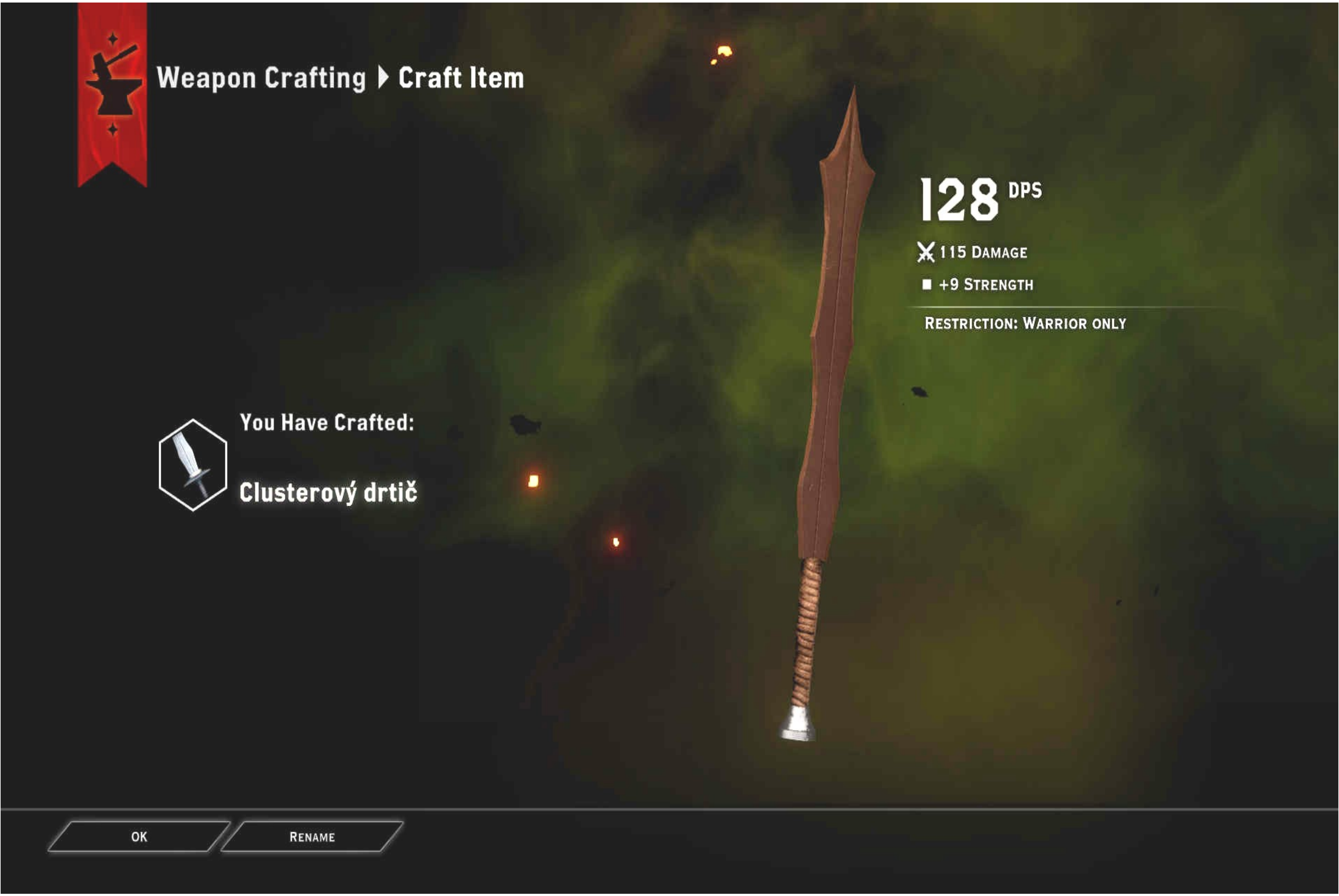


Distribution mode

- Advantages
  - **Scalability** – number of replication RPCs independent of cluster size – depends only on numOwners
  - Set numOwners to compromise between failure tolerance and performance
  - **Virtual heap size** = numNodes * heapSize / numOwners
- Disadvantages
  - Not every node is an owner of the key, **GET** may require **network hops**
  - Hash function is not perfect (in 5.1+ virtual nodes improved this greatly)
  - Node join/leave => **State transfer** (rehash)

Sync vs Async mode

- Sync
  - All operations get confirmation that the other relevant cluster nodes reached the desired state
- Async
  - All operations block only until they perform local changes, we don't wait for JGroups responses.
  - Better throughput but no guarantees on data integrity in cluster.


Weapon Crafting ▸ Craft Item
128 DPS
115 DAMAGE
+9 STRENGTH
RESTRICTION: WARRIOR ONLY
You Have Crafted:
Clusterový drtič
OK
RENAME

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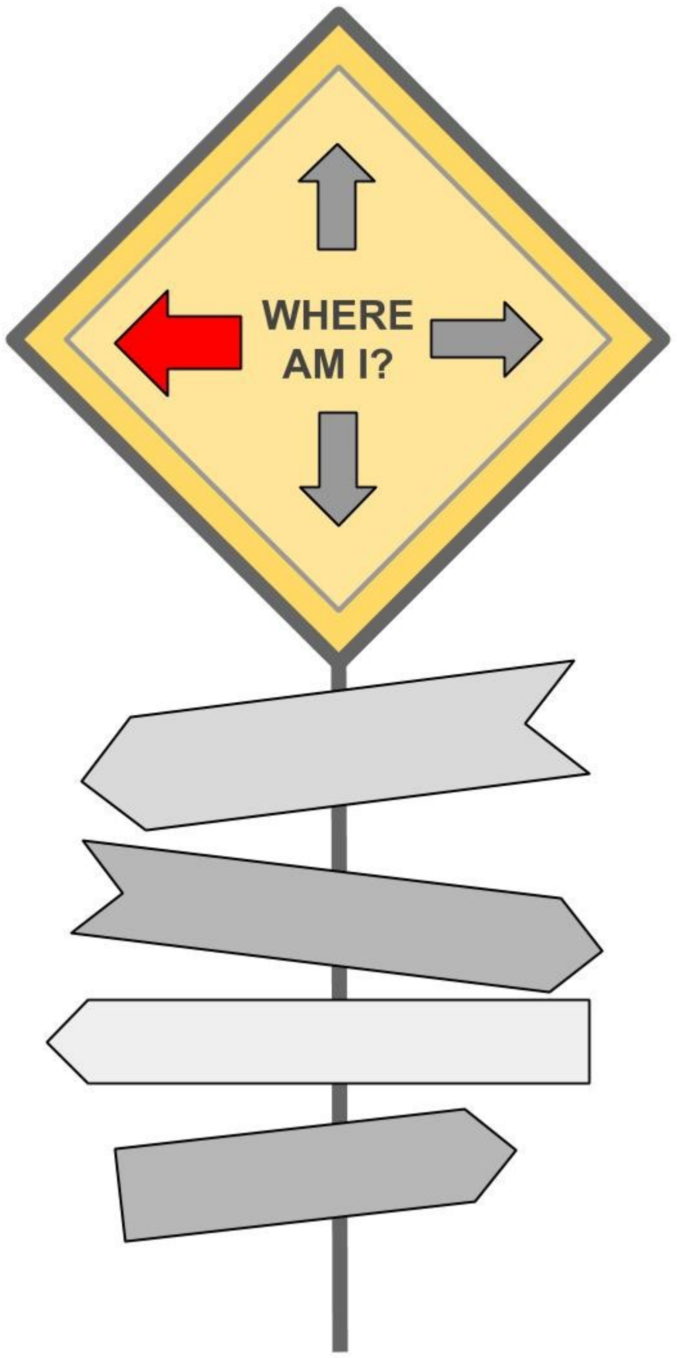
- Features in version 5.2, 6.0
- Brand new features in version 7.0



REST Server

http://<hostname>[:<port>]**/rest/**<cache_name>**/**<key>

e.g.

http://localhost:8080/rest/default/abcd

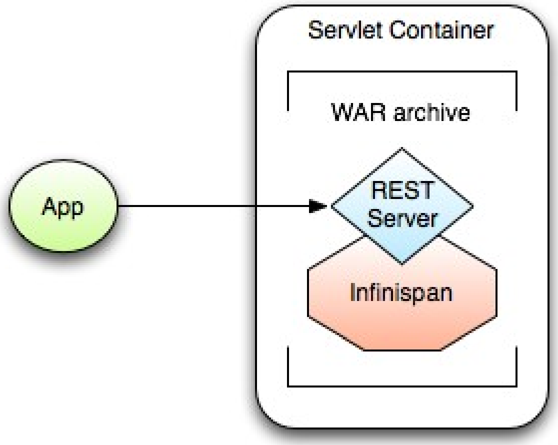
HTTP Methods supported:

HEAD, GET, PUT, POST, DELETE

Standard headers supported:

Content-Type
Last-Modified

Former: war deploy to AS



Now we have standalone Infinispan-server which is starting endpoints for clients.

REST Server access via Python

```
#
# Sample python code using the standard http lib only
#

import httplib


#putting data in
conn = httplib.HTTPConnection("localhost:8080")
data = "SOME DATA HERE !" #could be string, or a file...
conn.request("POST", "/infinispan/rest/Bucket/0", data, {"Content-Type": "text/plain"})
response = conn.getresponse()
print response.status

#getting data out
import httplib
conn = httplib.HTTPConnection("localhost:8080")
conn.request("GET", "/infinispan/rest/Bucket/0")
response = conn.getresponse()
print response.status
print response.read()
```

REST Server access via Ruby

```ruby
#
# Shows how to interact with Infinispan REST api from ruby.
# No special libraries, just standard net/http
#
# Author: Michael Neale
#
require 'net/http'

http = Net::HTTP.new('localhost', 8080)

#Create new entry
http.post('/infinispan/rest/MyData/MyKey', 'DATA HERE', {"Content-Type" => "text/plain"})

#get it back
puts http.get('/infinispan/rest/MyData/MyKey').body

#use PUT to overwrite
http.put('/infinispan/rest/MyData/MyKey', 'MORE DATA', {"Content-Type" => "text/plain"})

#and remove...
http.delete('/infinispan/rest/MyData/MyKey')

#Create binary data like this... just the same...
http.put('/infinispan/rest/MyImages/Image.png', File.read('/Users/michaelneale/logo.png'), {"Content-Type" => "image/png"})


#and if you want to do json...
require 'rubygems'
require 'json'

#now for fun, lets do some JSON !
data = {:name => "michael", :age => 42 }
http.put('/infinispan/rest/Users/data/0', data.to_json, {"Content-Type" => "application/json"})
```

REST Server access via command line (curl)

PUT

```
curl -X PUT -d "aaa" http://localhost:8080/rest/my_cache/my_key
```

GET

```
curl -X GET http://localhost:8080/rest/my_cache/my_key
```

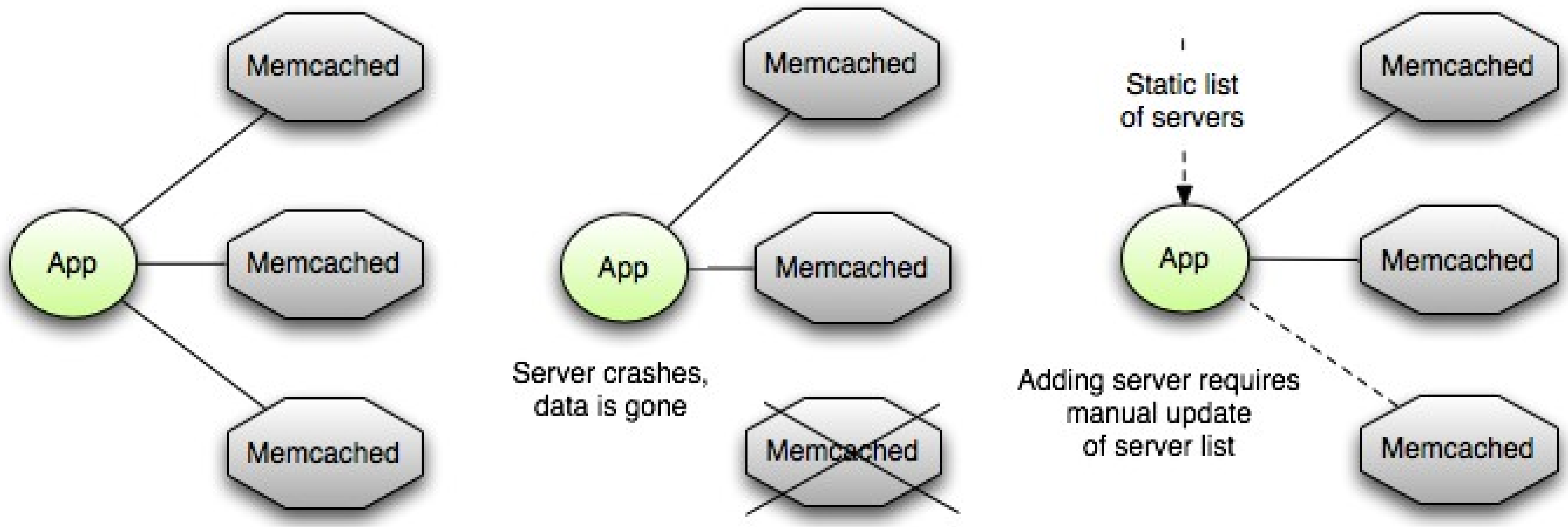
DELETE

```
curl -X DELETE http://localhost:8080/rest/my_cache/my_key
```

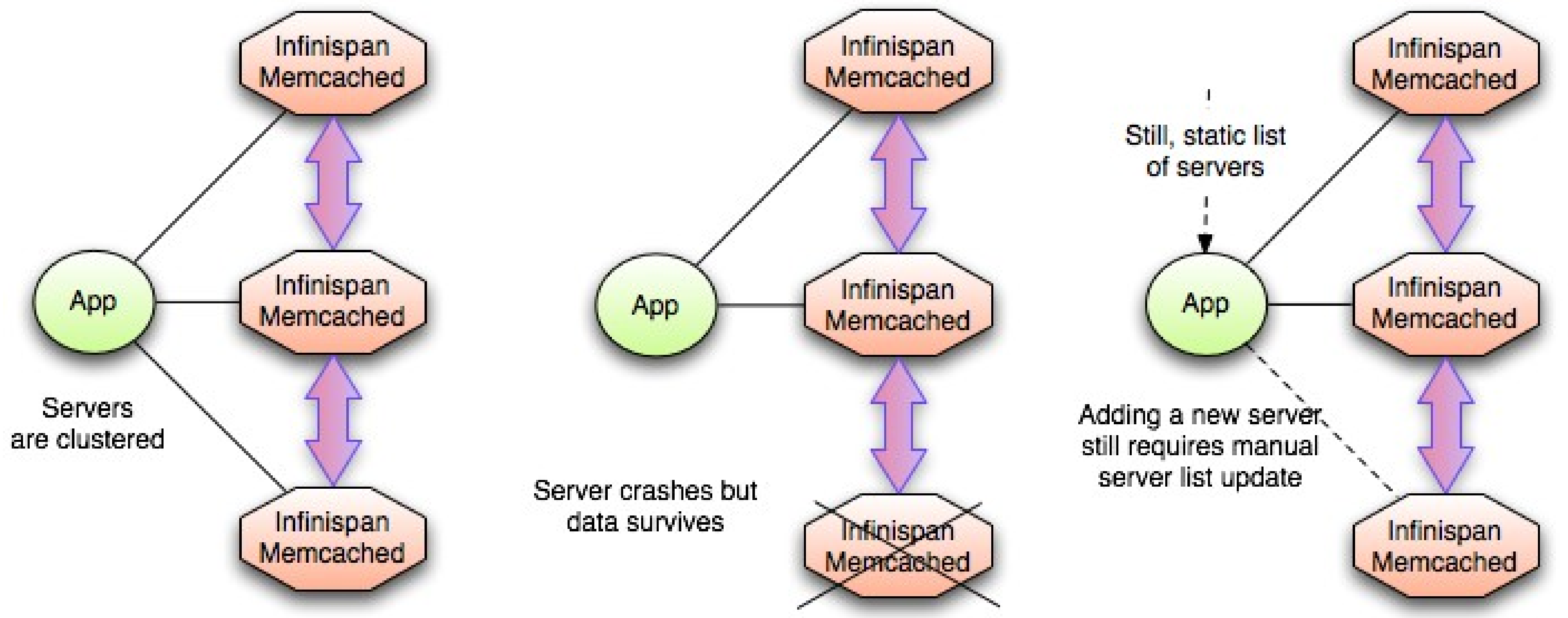
Memcached

- Open protocol for popular memcached server: http://memcached.org/
- Python
  - Python-memcached client library
- Java
  - Spymemcached client
- There is Binary and Text protocol version
- Infinispan supports text protocol only

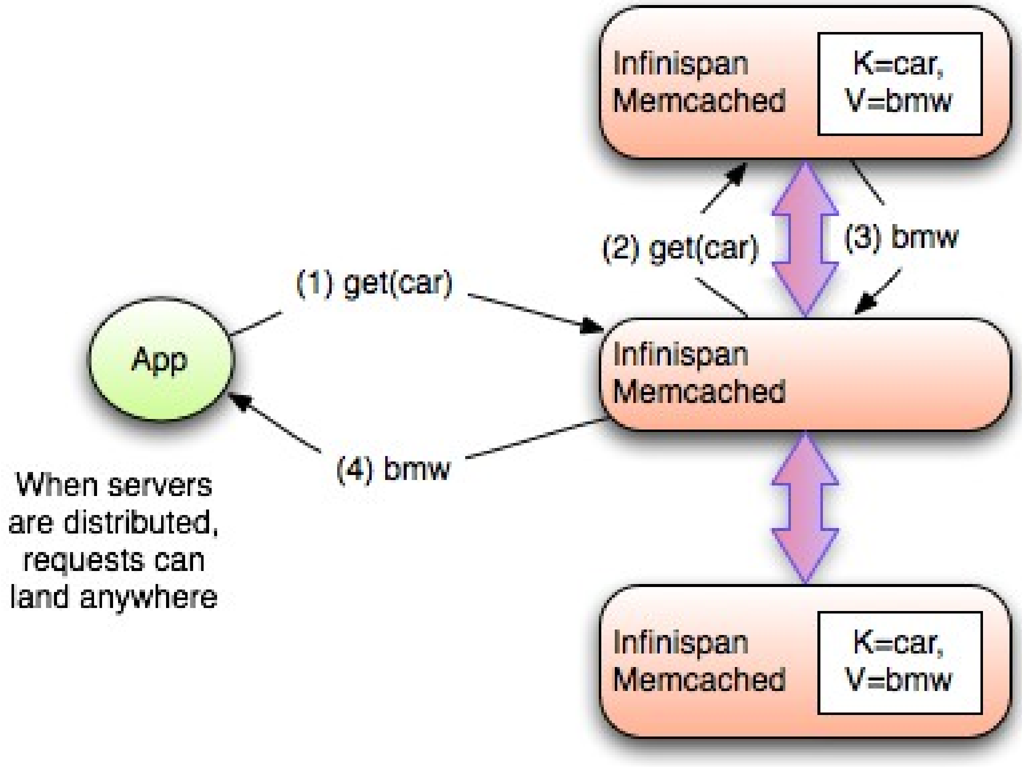
Memcached server (original version)



Memcached server (Infinispan implementation)

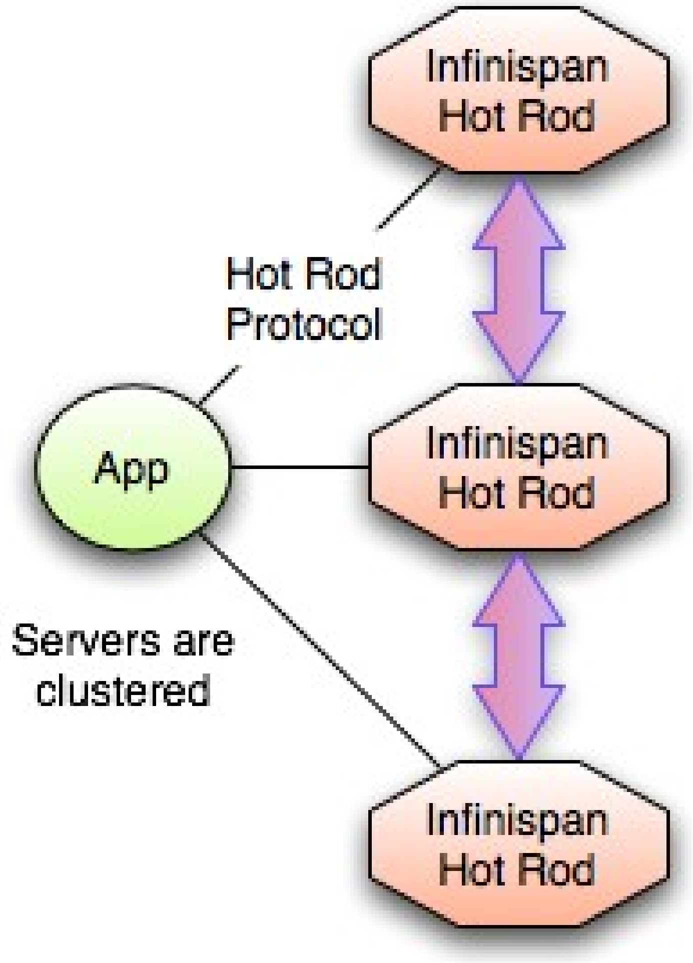


Routing not so smart

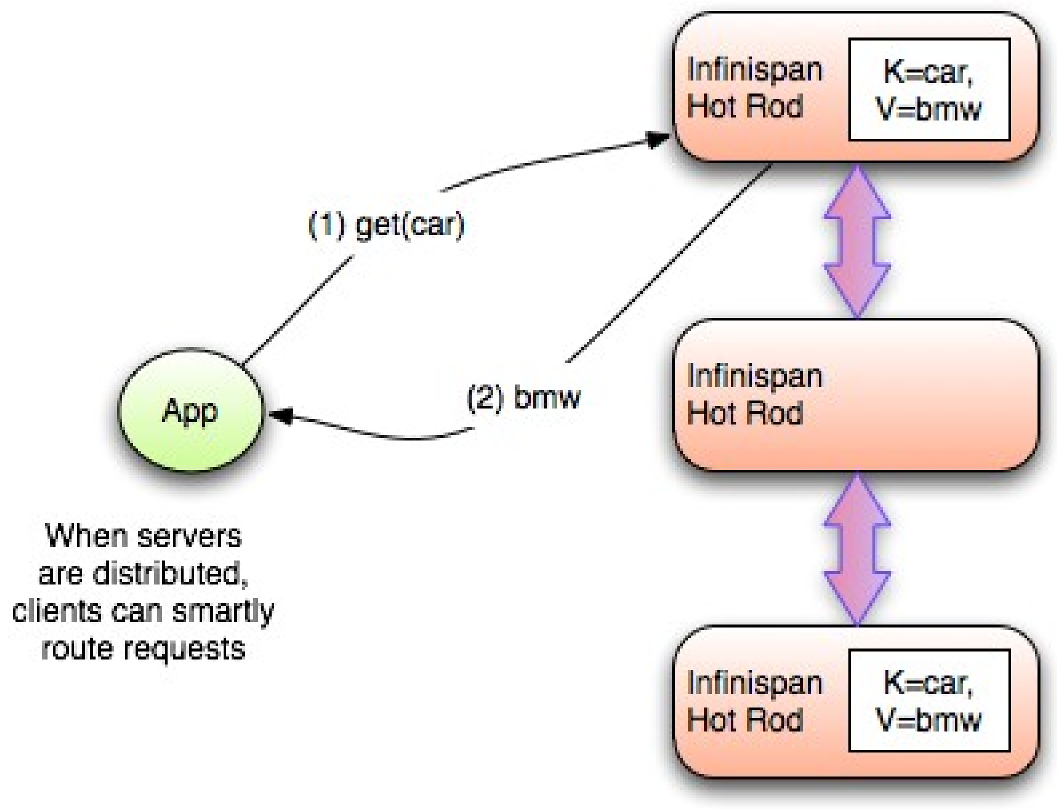


Hot Rod

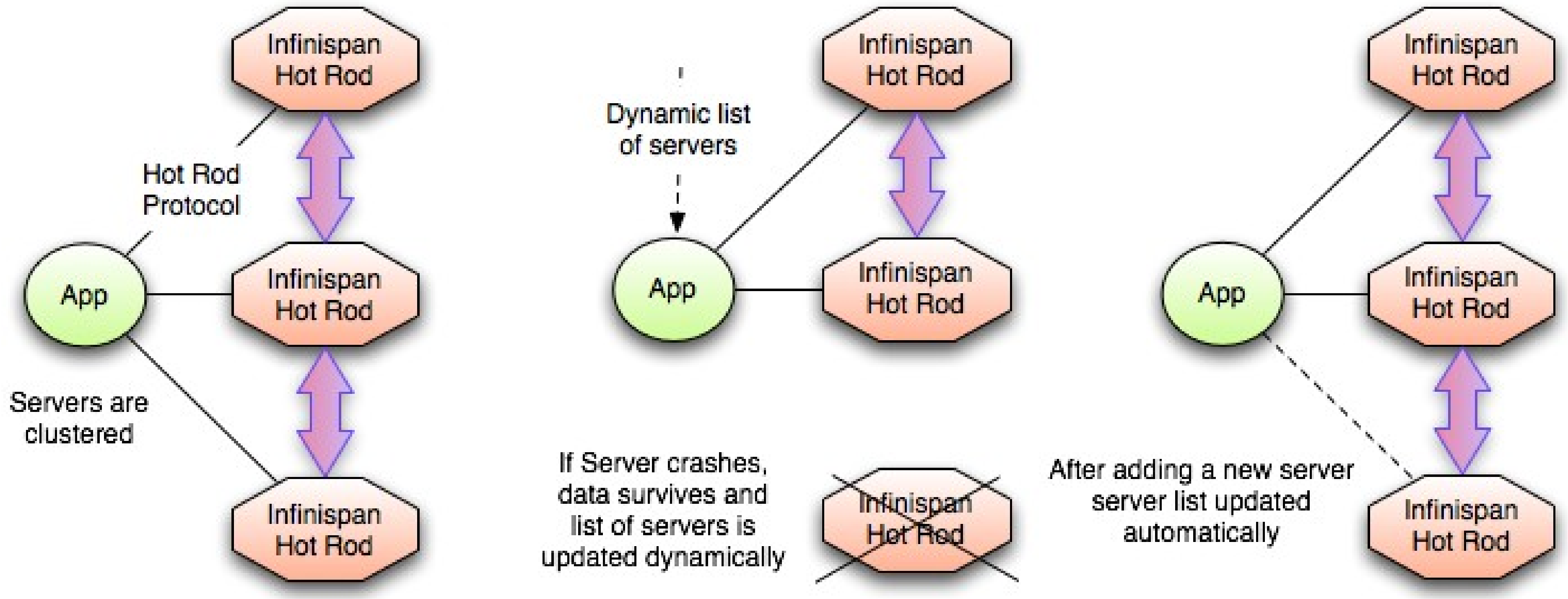
- Infinispan's own binary wire protocol
- Open and language independent
- Built-in dynamic failover and load balancing
- Smart routing
- Fast



Smart routing with Hot Rod



Dynamic routing with Hot Rod



Clients - comparison

	Protocol	Client libraries	Clustered ?	Smart routing	Load balancing / Failover
REST	Text	standard HTTP clients	Yes	No	Any HTTP load balancer
Memcached	Text	Plenty	Yes	No	Only with predefined server list
Hot Rod	Binary	Java, python, C++ on the way	Yes	Yes	Dynamic

+ OData: http://tsykora-tech.blogspot.cz/2014/02/introducing-infinispan-odata-server.html

For Java users: it's a Map (again)

```
// DefaultCacheManager cacheManager =
        new DefaultCacheManager("infinispan.xml");

RemoteCacheManager cacheManager =
        new RemoteCacheManager("localhost:11222");

cacheManager.start();

Cache<String, Object> cache =
        cacheManager.getCache("namedCache");

cache.put("key", "value");

Object value = cache.get("key");
```

Find your path...

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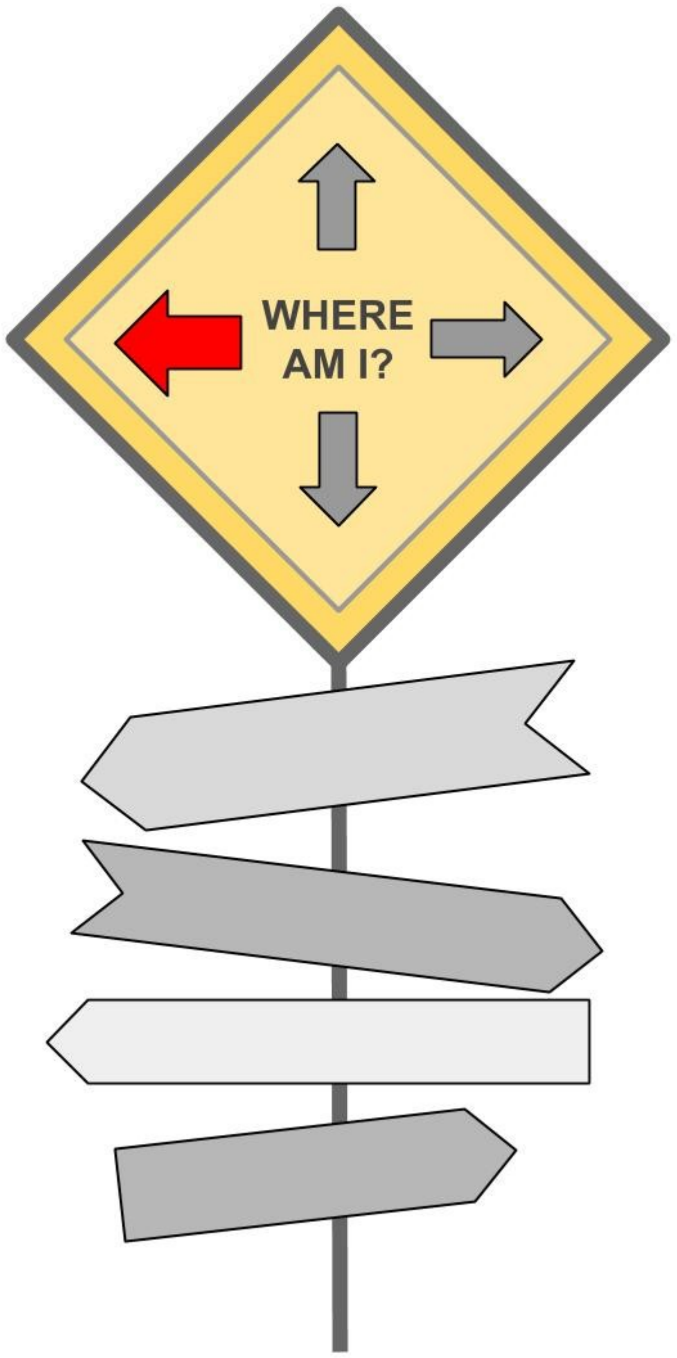

Closer look on special features

- Eviction
- Expiration
- Cache stores
- Queries

Features – Eviction

- Specify maximal number of entries to keep in cache
- Heap-load based eviction (being worked on)
- Eviction strategies
  - UNORDERED
  - FIFO
  - LRU – Least recently used
  - LIRS - Low Inter-reference Recency Set

    S.Jiang and X.Zhang's 2002 paper: LIRS: An efficient low inter-reference recency set replacement policy to improve buffer cache performance

Read more: http://infinispan.org/docs/7.0.x/user_guide/user_guide.html#eviction_anchor

Features – Expiration

- Specify maximal time entries are allowed
  - stay in cache (lifespan)
  - stay in cache untouched (maxIdle)
- Default expiration – specify in cache config
- Explicitly set lifespan or maxIdle with every PUT

```
cache.put("Grandma", "I'll stay only a minute", 1, TimeUnit.MINUTES);

cache.put("Tamagochi", "Watch me or I'll die", -1, TimeUnit.SECONDS,
                        1, TimeUnit.SECONDS);
```

Read more: http://infinispan.org/docs/7.0.x/user_guide/user_guide.html#_expiration

Features – Cache stores

- Store data from memory to other kind of storage
  - File System
    - SingleFileStore – basic FS store implementation
    - SoftIndexFileStore
  - Relational Database
    - JdbcBinaryCacheStore – hash of whatever
    - JdbcStringBasedCacheStore – String (needs mapping)
  - Other NoSQL stores
    - Cassandra
    - RemoteCacheStore – store to another Infinispan grid

Features – Cache stores

Passivation	Eviction	Behaviour
OFF	OFF	**P = M (Write through)** whenever an element is modified, added or removed, then that modification is persisted in the backend store
OFF	ON	**P ⊇ M (Write behind)** P includes all entries while M may contain fewer entries (some of them might have been evicted)
ON	OFF	This is an invalid configuration and Infinispan logs a warning
ON	ON	**P ∩ M = ∅** Writes to the persistent store via the cache store only occur as part of the eviction process. Data is deleted from the persistent store when read back into memory.

P = set of keys kept in **persisted storage**
M = set of keys kept in **memory**

Passivation is a mode of storing entries in the cache store **only when** they are **evicted** from memory.

Features - Querying

Map / Key-Value approach:

Key1 --> Value1
Key2 --> Value2 (dictionary like)

Querying mechanism allows you to query Infinispan over the values!

? “data where name='infinispan' and ...” --> **Value1, Value2**

(Apache Lucene, Hibernate search)

Features - Querying

```
// example values stored in the cache and indexed:
import org.hibernate.search.annotations.*;

//to be indexed the object needs @Indexed annotation:
@Indexed
public class Book {
    @Field String title;
    @Field String description;
    @Field @DateBridge(resolution=Resolution.YEAR) Date publicationYear;
    @IndexedEmbedded Set<Author> authors = new HashSet<Author>();
}

public class Author {
    @Field String name;
    @Field String surname;
    // hashCode() and equals() omitted
}
```

Read more: http://infinispan.org/docs/7.0.x/user_guide/user_guide.html#_querying_infinispan

Features - Querying

```
// get search manager from cache
SearchManager searchManager = org.infinispan.query.Search.getSearchManager( cache );

QueryBuilder queryBuilder = searchManager.buildQueryBuilderForClass( Book.class ).get();

// the queryBuilder has a nice fluent API which guides you through all options
org.apache.lucene.search.Query luceneQuery = queryBuilder.phrase()
                                    .onField( "description" )
                                    .andField( "title" )
                                    .sentence( "a book on highly scalable query engines" )
                                    .createQuery();

// the query API itself accepts any Lucene Query, and on top of that
// you can restrict the result to selected class types:
CacheQuery query = searchManager.getQuery( luceneQuery, Book.class );

// and there are your results!
List<Book> objectList = query.list();

for ( Book book : objectList ) {
            System.out.println( book.getTitle() );
}
```

Read more: http://infinispan.org/docs/7.0.x/user_guide/user_guide.html#_querying_infinispan

Features – Others

- Management via RHQ (http://rhq-project.org)
- JMX Statistics (writes, reads, hits, misses)
- CDI, injection of Cache, RemoteCache
- Tree API (storing in hierarchical way, /persons/john)
- ... and more on next slides (v5.2, v6.0 & v7.0)

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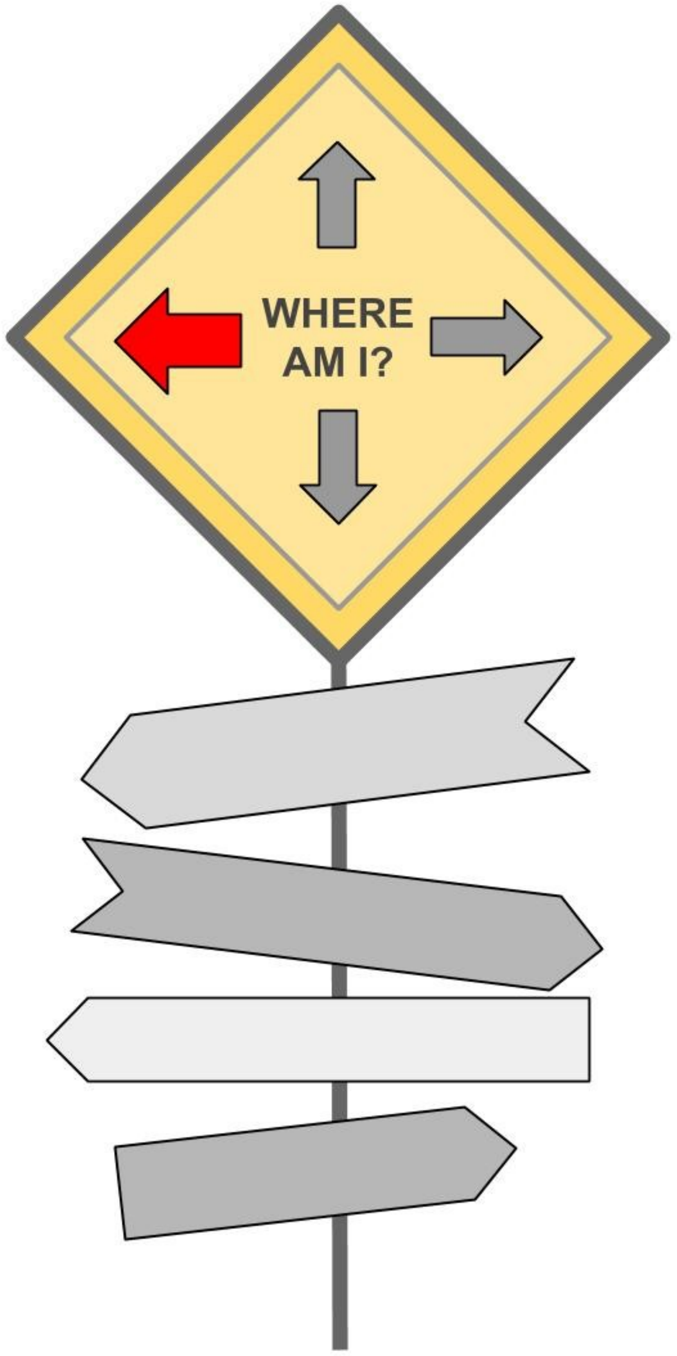


Interesting features in version 5.2

- Command line interface (ispn-cli.sh)

See next slides for:

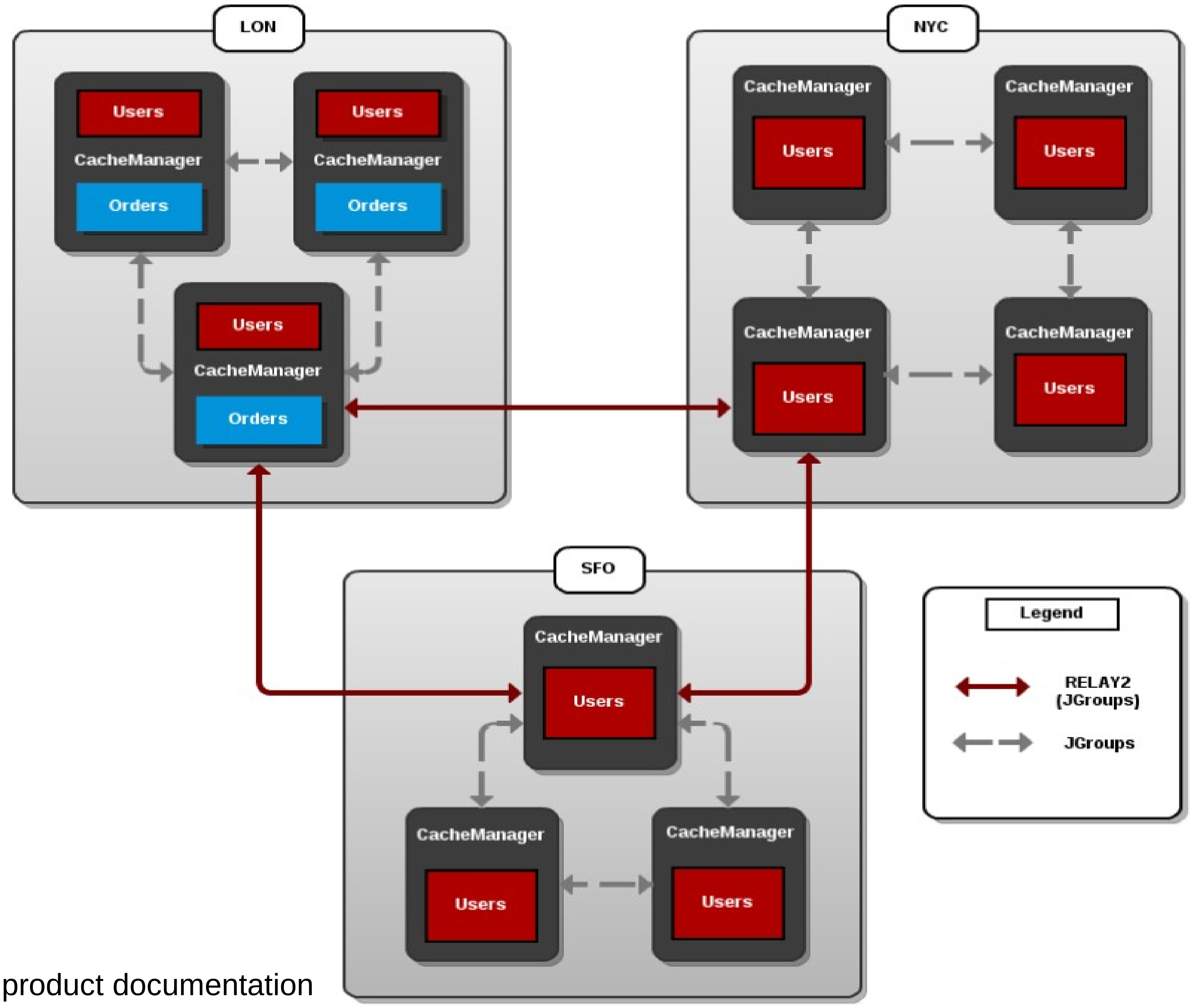
- Non-blocking state transfer
- Cross site replication
- Rolling upgrades (HotRod only)

Non-blocking state transfer

- State transfer
  - Auto view change: any join, leave or merge of nodes
  - Adjusting internal cache's state during view change

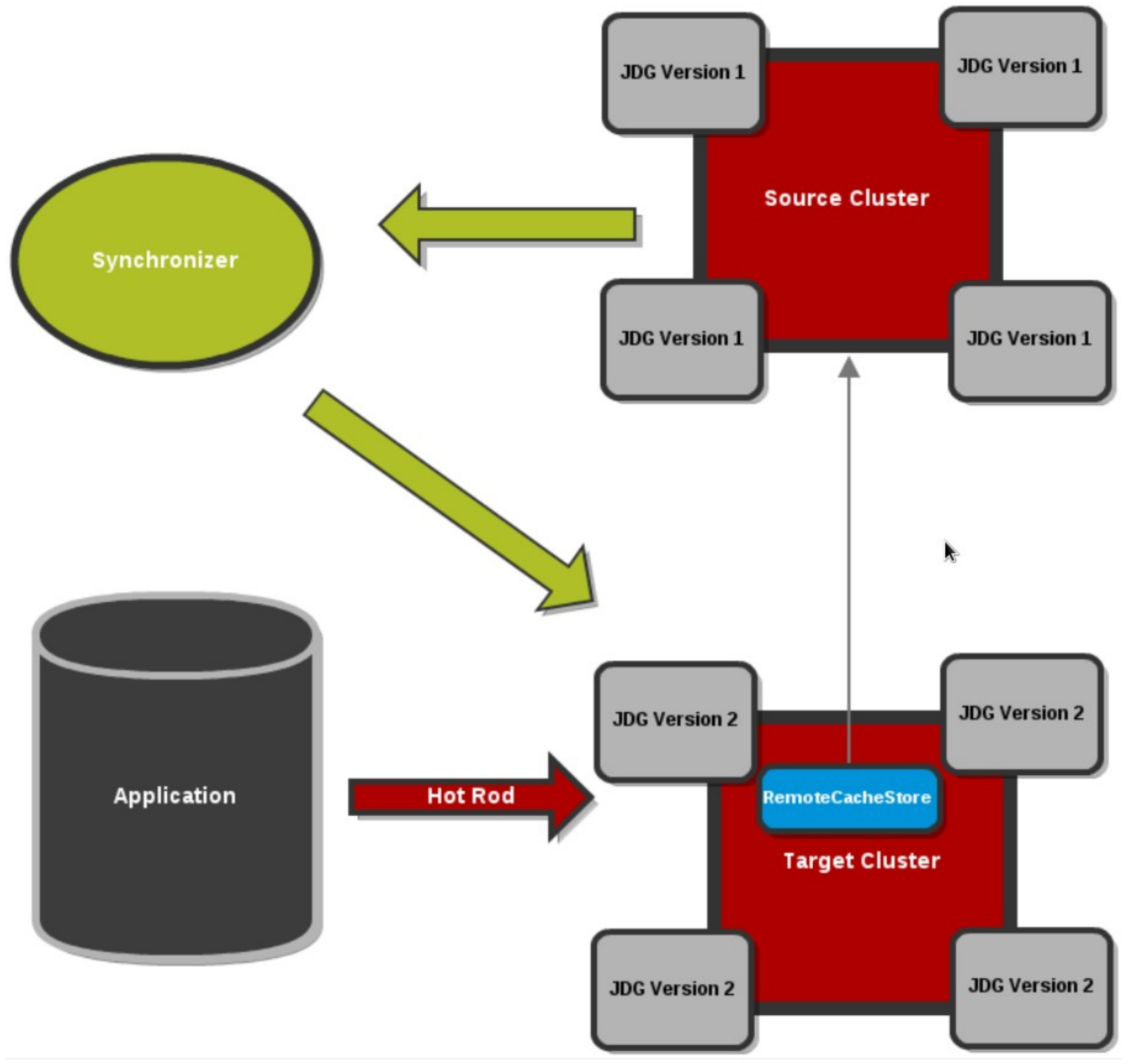
- Non-blocking
  - Allow writes during state transfer
  - Minimize interval where cluster can't respond
  - Minimize interval where member stops responding

Cross site replication



Source: JDG product documentation

Rolling upgrades



Source: JDG product documentation

New features in version 6.0

- Rolling upgrades for REST clusters
- C++ HotRod client
  - C++ apps can read and write data to remote cluster
- New high performance file cache store
  - in-memory indexes of keys for persisted entities
- Cross data center replication scalability
  - Multiple site-masters, replication between clusters

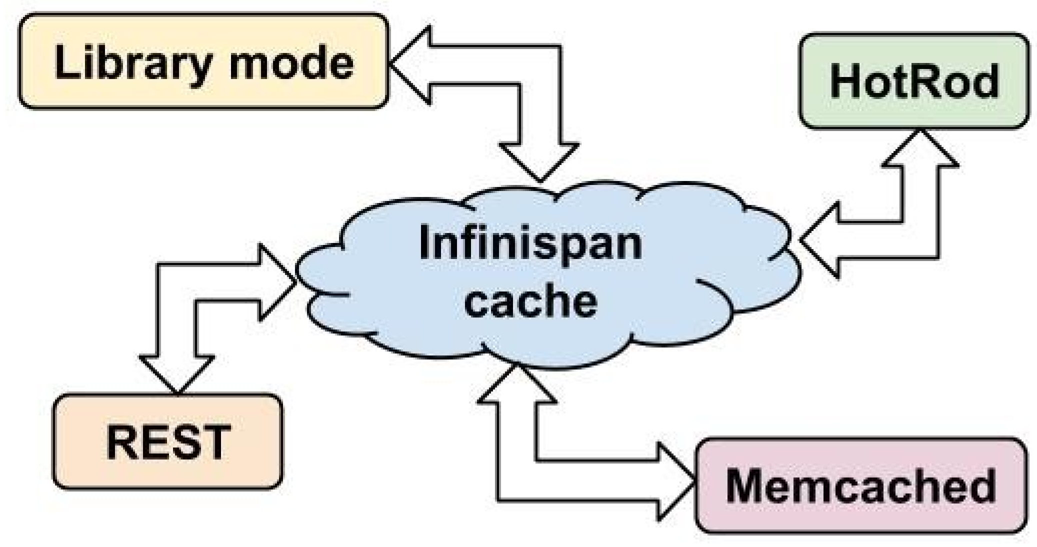
New features in version 6.0

See next slides for:

- Compatibility mode
- Remote queries via Java HotRod client

Compatibility mode

- Interoperability between Embedded and Remote Server Endpoints
- **Put** using REST, **get** using HotRod? No problem!
- Disabled by default (conversion has its cost)



Remote queries via HotRod

- It **was** possible to index and search **only** Java entities...

- **Now**, we have support for:
  - Remote and language neutral querying
- New query language (DSL – Domain Specific Language)
- Structure of entities is known to both server and client
  - Google's Protocol Buffers encoding format
  - Entities declared by using .proto files

Read more:

https://developers.google.com/protocol-buffers/docs/overview
http://infinispan.org/docs/7.0.x/user_guide/user_guide.html#_querying_via_the_java_hot_rod_client

Remote queries via HotRod (data structure definition)

```
library.proto

package book_sample;

message Book {
  required string title = 1;
  required string description = 2;
  // no native Date type available in Protobuf
  required int32 publicationYear = 3;
  repeated Author authors = 4;
}

message Author {
  required string name = 1;
  required string surname = 2;
}
```

```
import org.infinispan.client.hotrod.*;
import org.infinispan.query.dsl.*;
...

RemoteCacheManager remoteCacheManager = ...;
RemoteCache<Integer, Book> remoteCache = remoteCacheManager.getCache();

Book book1 = new Book();
book1.setTitle("Hibernate in Action");
remoteCache.put(1, book1);

Book book2 = new Book();
book2.setTile("Infinispan Data Grid Platform");
remoteCache.put(2, book2);

QueryFactory qf = Search.getQueryFactory(remoteCache);
Query query = qf.from(Book.class)
            .having("title").like("%Infinispan%").toBuilder()
            .build();

List<Book> list = query.list(); // Voila! We have our book back from the cache!
```

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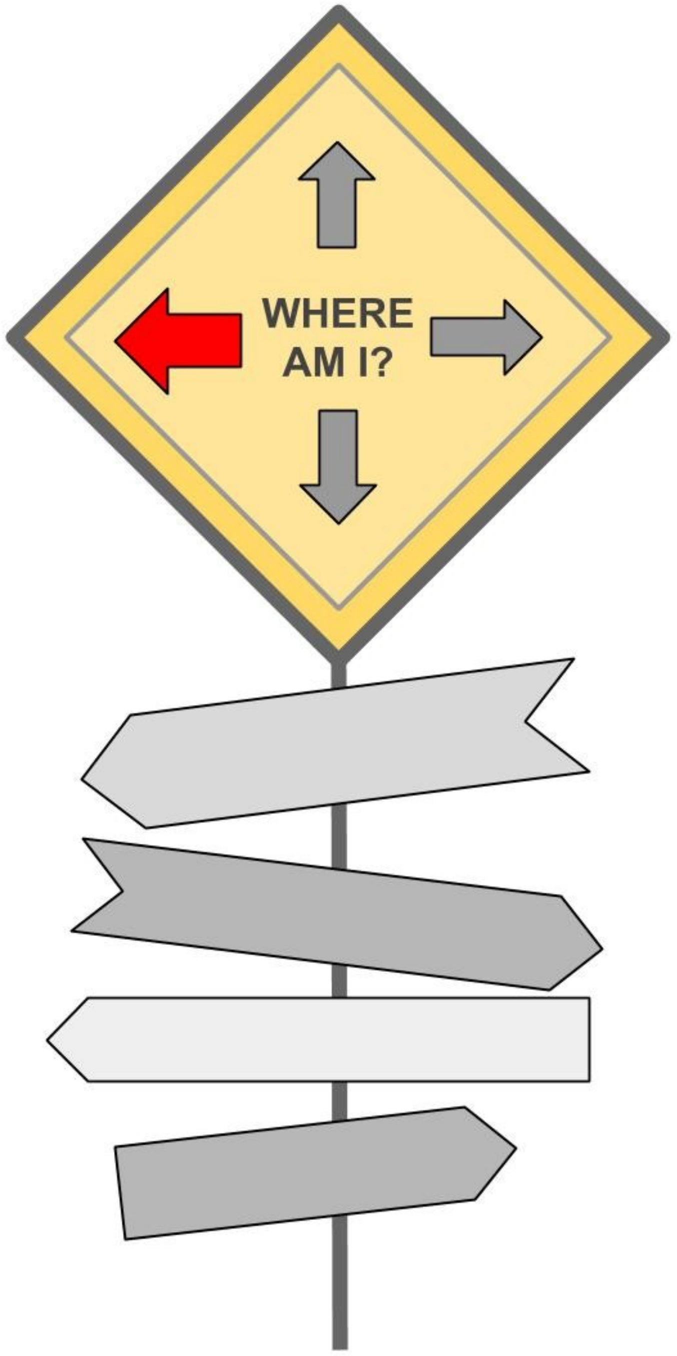

New features in version 7.0

- X-Site clustering
  - Former: when node joins, only new updates was replicated
  - It is possible to do state-transfer of existing data (in cache)
- Partitioning handling
  - Countermeasures against cluster split-brain and handling
- Security
  - Role based access
- Uber JARs (comfortable usability)

Uber JARs

infinispan-commons.jar

infinispan-core.jar

infinispan-cachestore-jdbc.jar

infinispan-embedded.jar

infinispan-cdi.jar

infinispan-cachestore-jpa.jar

infinispan-cachestore-leveldb.jar

```
<dependency>
   <groupId>org.infinispan</groupId>
   <artifactId>infinispan-embedded</artifactId>
   <version>${infinispan.version}</version>
</dependency>
```

Uber JARs

```
<dependency>
    <groupId>org.infinispan</groupId>
    <artifactId>infinispan-embedded</artifactId>
    <version>${infinispan.version}</version>
</dependency>
```

```
<dependency>
    <groupId>org.infinispan</groupId>
    <artifactId>infinispan-embedded-query</artifactId>
    <version>${infinispan.version}</version>
</dependency>
```

```
<dependency>
    <groupId>org.infinispan</groupId>
    <artifactId>infinispan-remote</artifactId>
    <version>${infinispan.version}</version>
</dependency>
```

Quick review... the end is coming...

- NoSQL world
- What's Infinispan
- Why / When to use it
- How to plug it into your architecture
- Clustering modes
- Client-server access modes / protocols
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Questions?

Thank you!