Data Modeling for Scale with Riak Data Types

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QCon NYC 2014

I work for Basho

We make riak

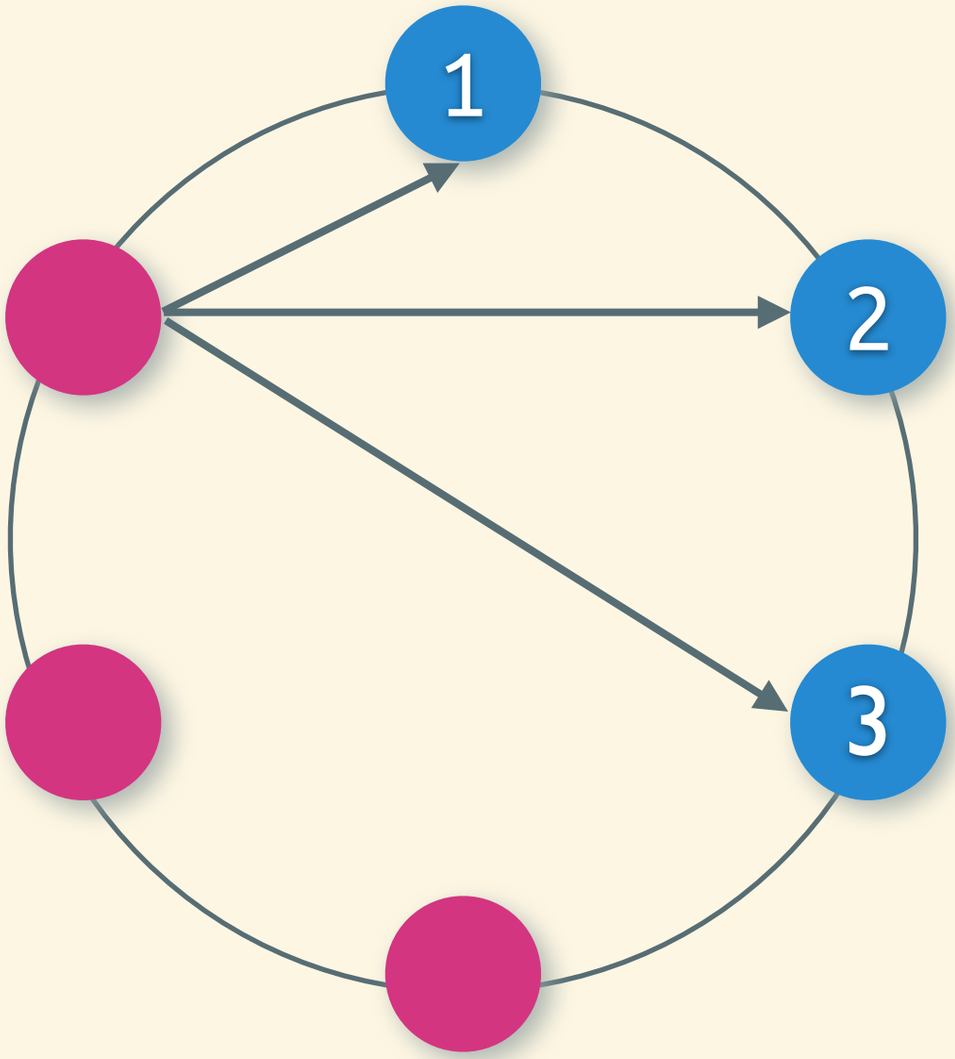
Visit our booth!

Riak is

Eventually Consistent

key-value + indexes + search + MapReduce

Eventual Consistency



Replicated

Loose coordination

Convergence

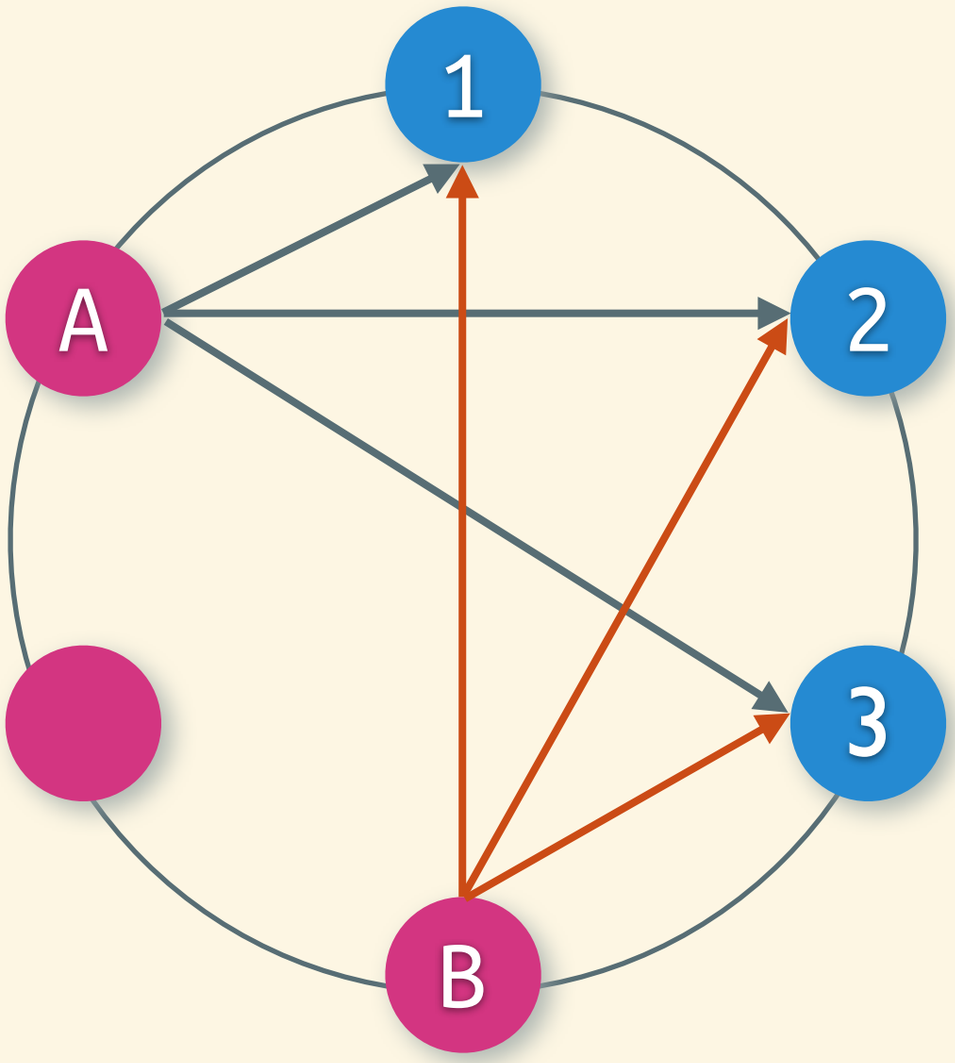
Eventual is Good

✔ Fault-tolerant

✔ Highly available

✔ Low-latency

Consistency?

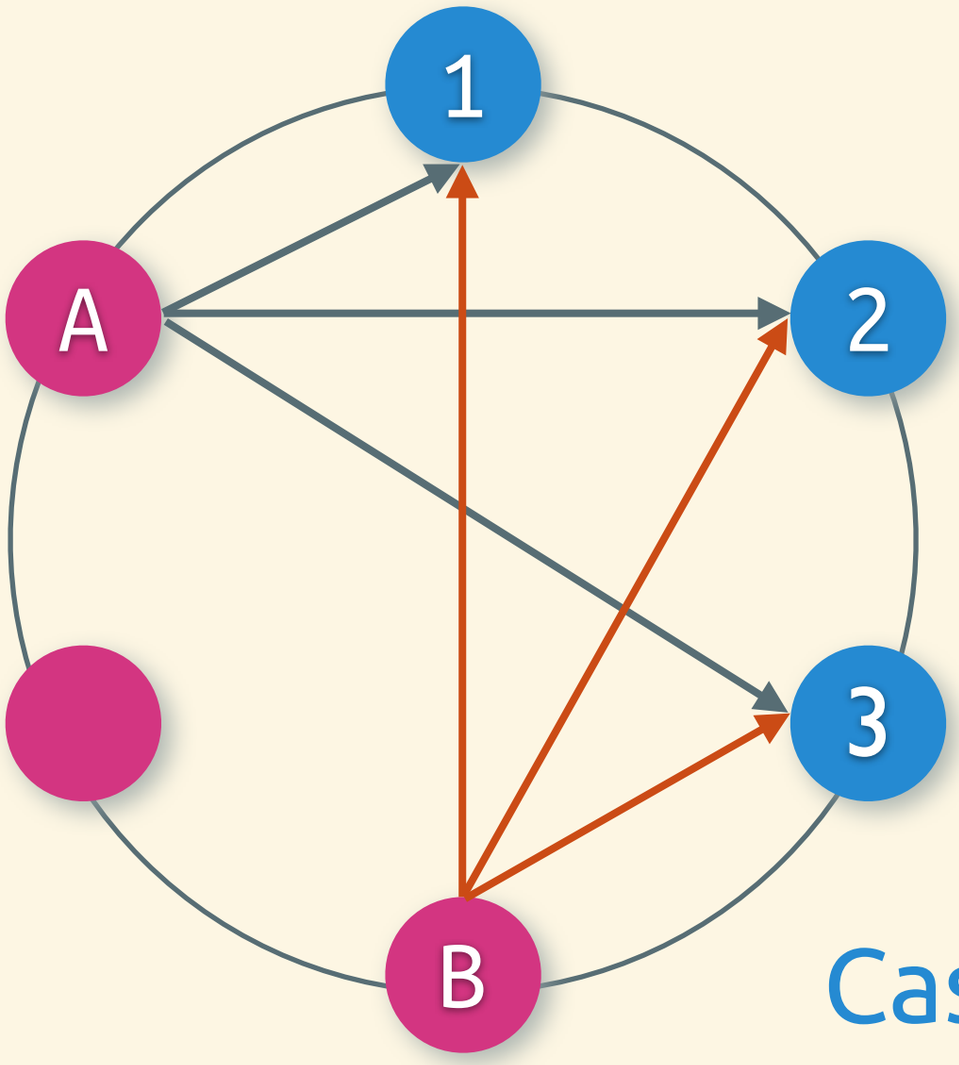


No clear winner!

Throw one out?

Keep both?

Consistency?



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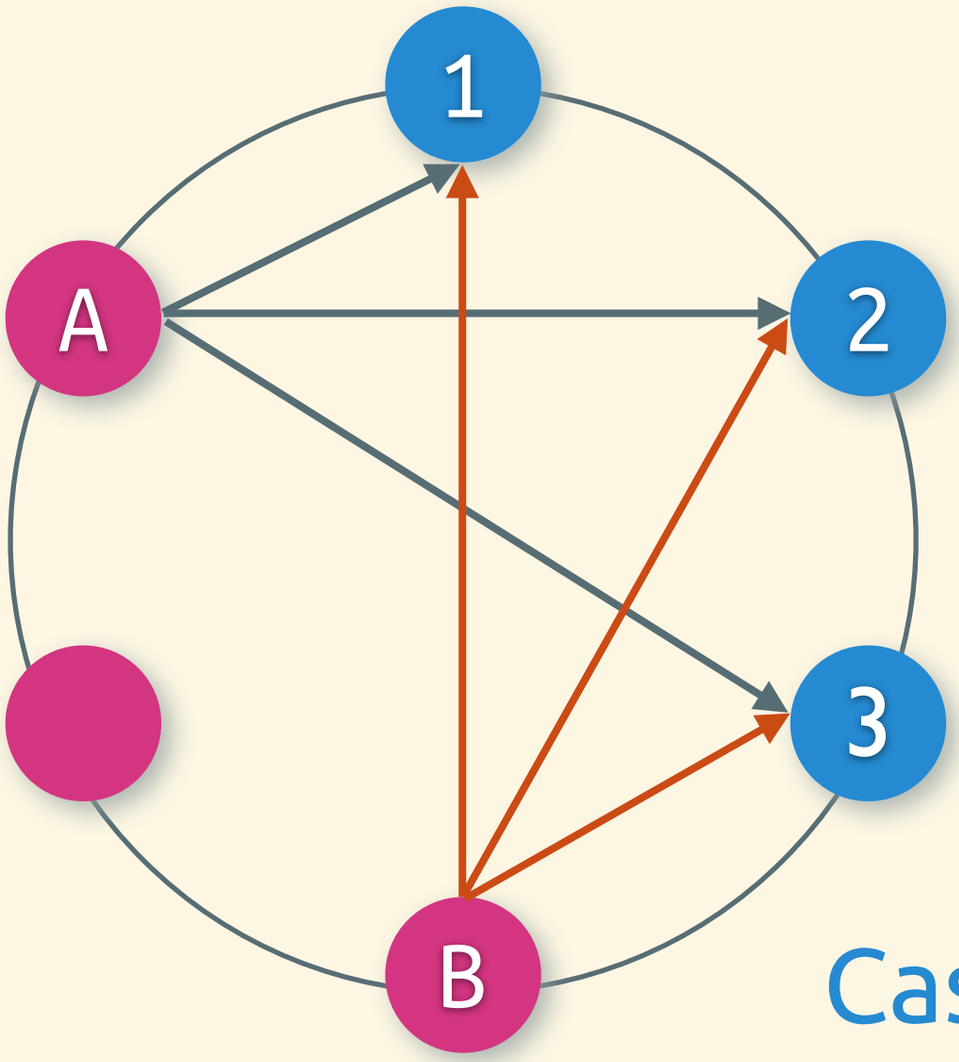
Cassandra

Consistency?



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Cassandra

Riak

Conflicts!

A!

B!

Semantic Resolution

- Your app knows the domain - use business rules to resolve
- Amazon Dynamo’s shopping cart

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"Ad hoc approaches have proven brittle and error-prone"

Convergent Replicated Data Types

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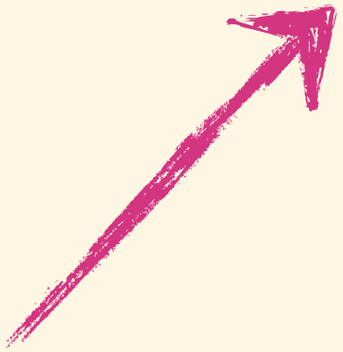
useful abstractions

Convergent Replicated Data Types



multiple independent copies

useful abstractions

resolves automatically
toward a single value

Convergent Replicated Data Types

multiple independent
copies

useful abstractions

How CRDTs Work

- A partially-ordered **set of values**
- A **merge** function
- An **identity** value
- **Inflation** operations

How CRDTs Work

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- A **merge** function
- An **identity** value
- **Inflation** operations

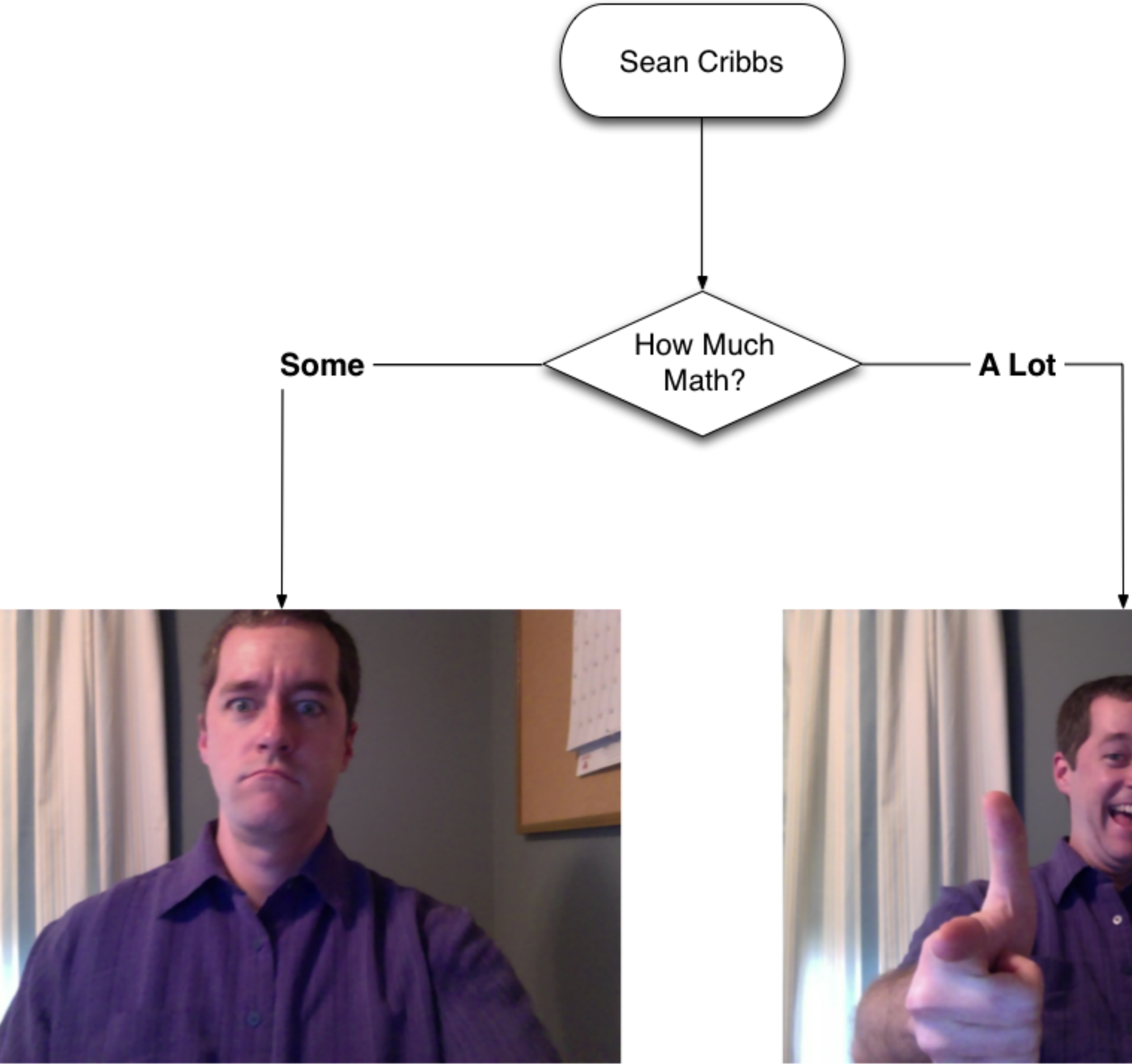
What CRDTs Enable

- Consistency **without coordination**
- **Fluent**, rich interaction with data

SyncFree

This research is supported in part by European FP7 project 609 551 SyncFree http://syncfree.lip6.fr/ (2013--2016).

by @joedevivo



Forget CRDTs

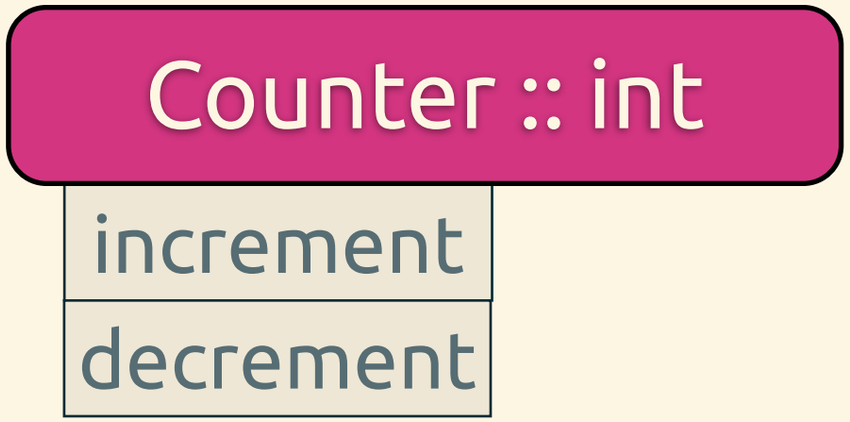
Do Data Modeling

Data Modeling for Riak

- Identify needs for both **read** and **write**
- Design around **key as index**
- **Denormalize** relationships if possible
- Weigh **data size** against **coherence**

Riak Data Types

Riak Data Types



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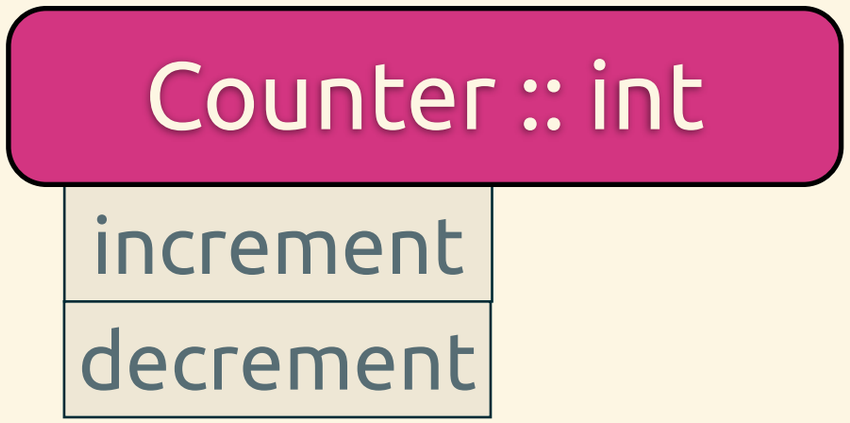
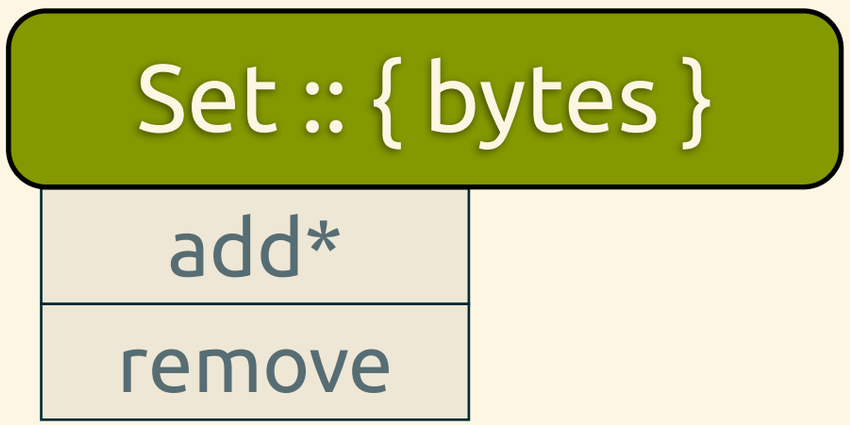




Riak Data Types

Map :: bytes → DT

- update*
- remove

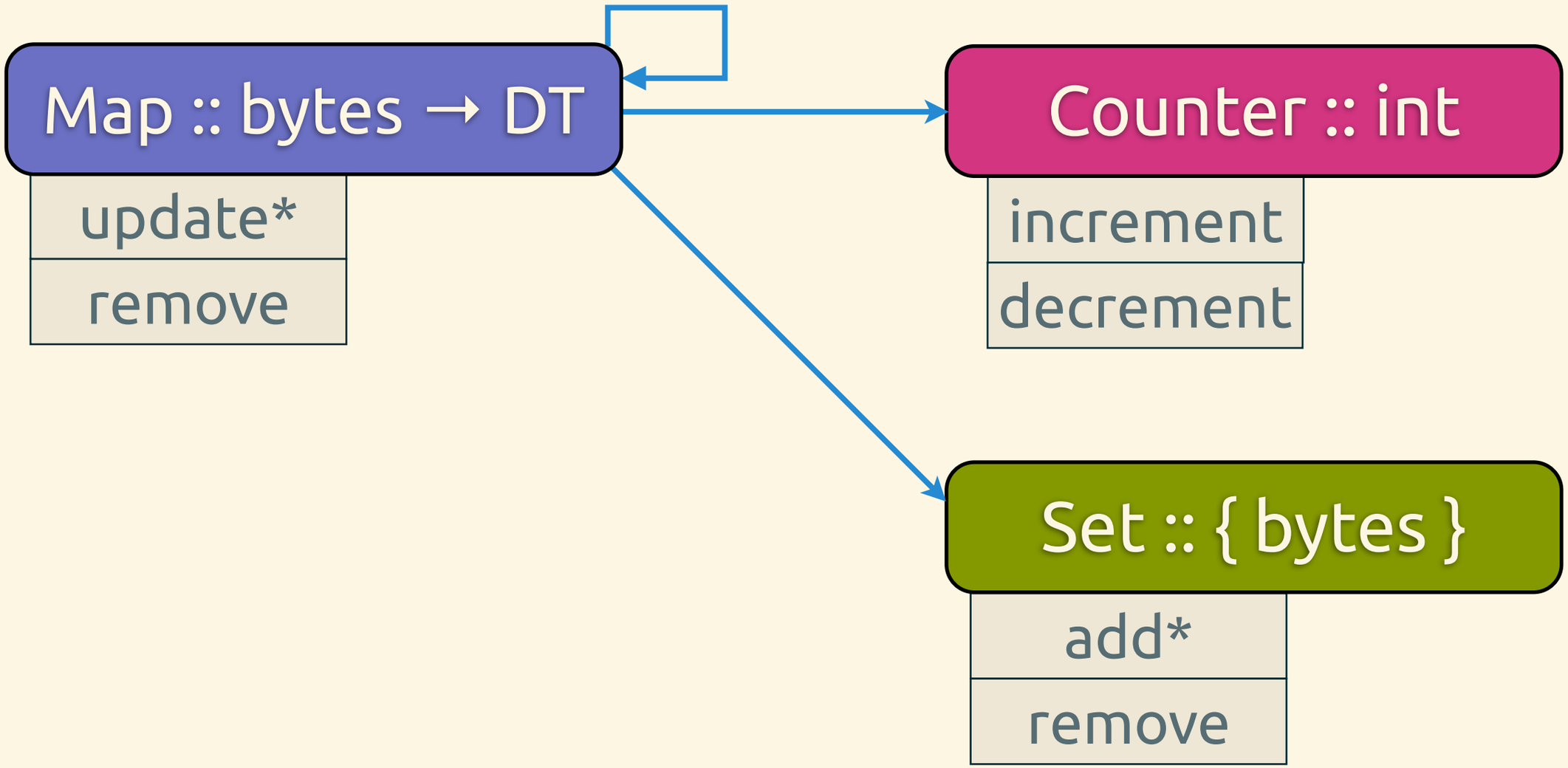
Counter :: int

- increment
- decrement

Set :: { bytes }

- add*
- remove

Riak Data Types



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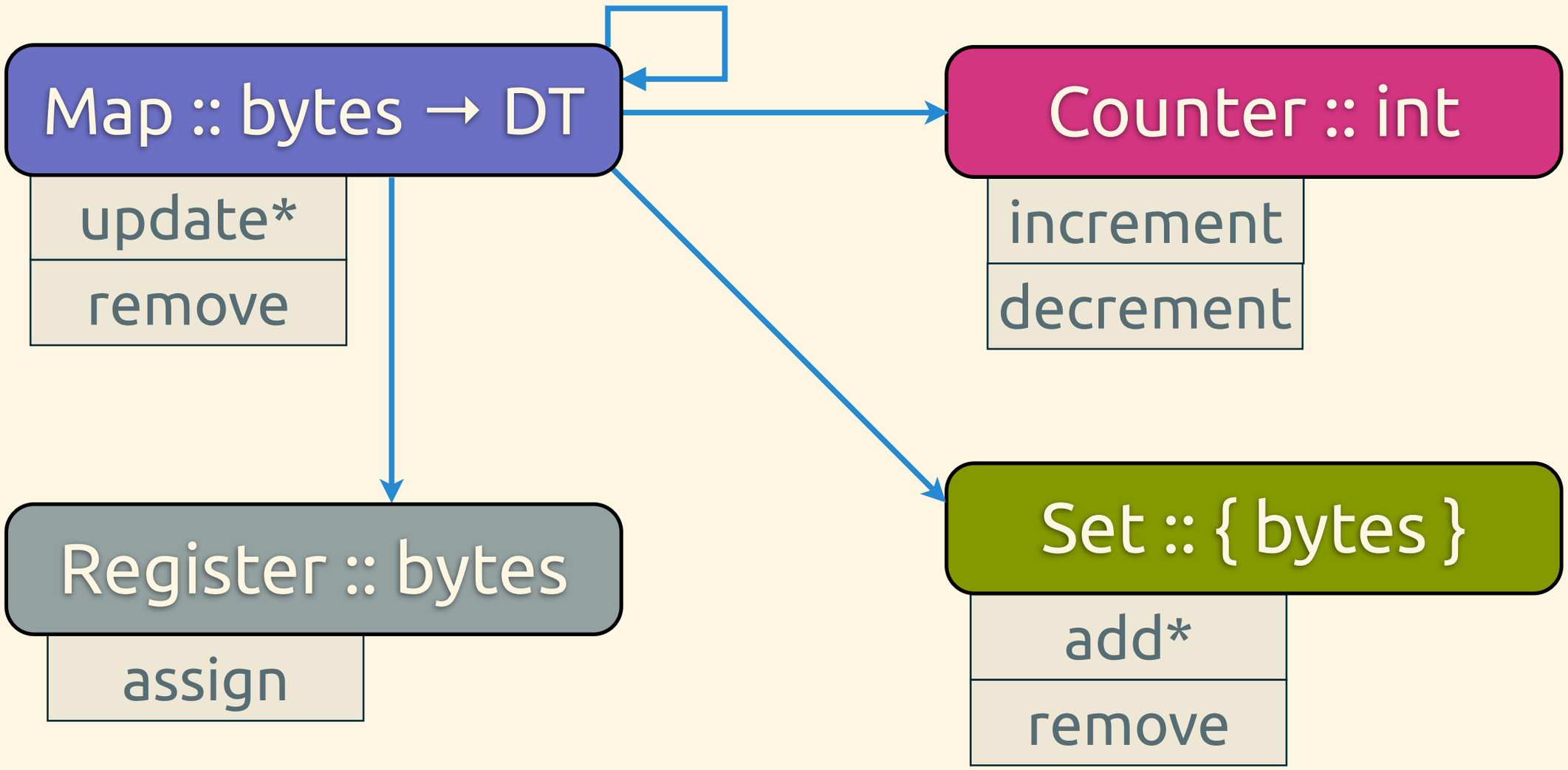

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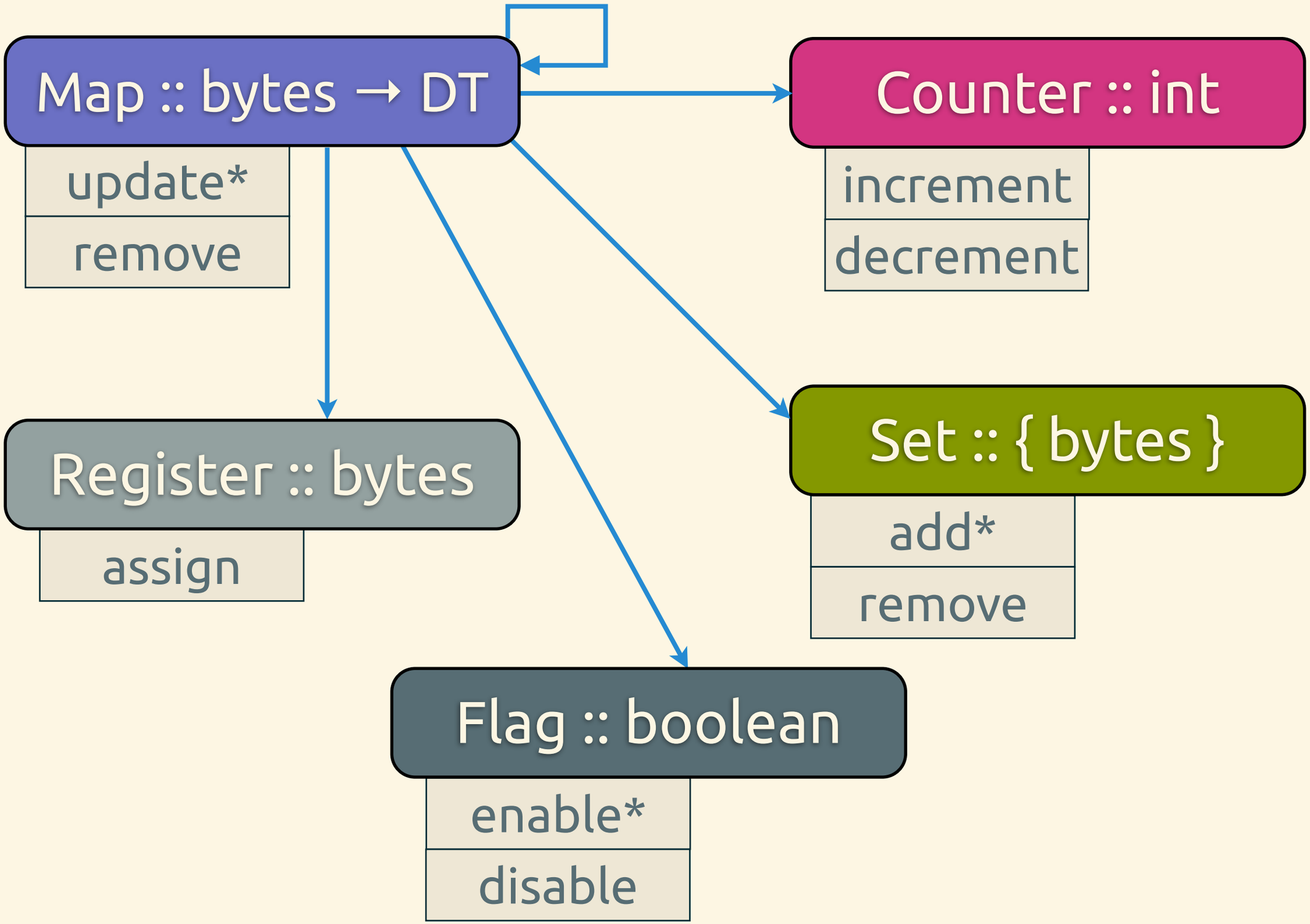


MAD DATA

Counters

Ad Network

- **Impressions** - when someone sees an ad
- **Click-through** - when someone clicks on an ad
- Hourly rollups `ad-metrics/<campaign>/<type>-<hour>`

Ad Network

```
$ riak-admin bucket-type create ad-metrics \
  '{"props":{"datatype":"counter"}}'
ad-metrics created

$ riak-admin bucket-type activate ad-metrics
ad-metrics has been activated

$ riak-admin bucket-type list
ad-metrics (active)
```

Ad Network

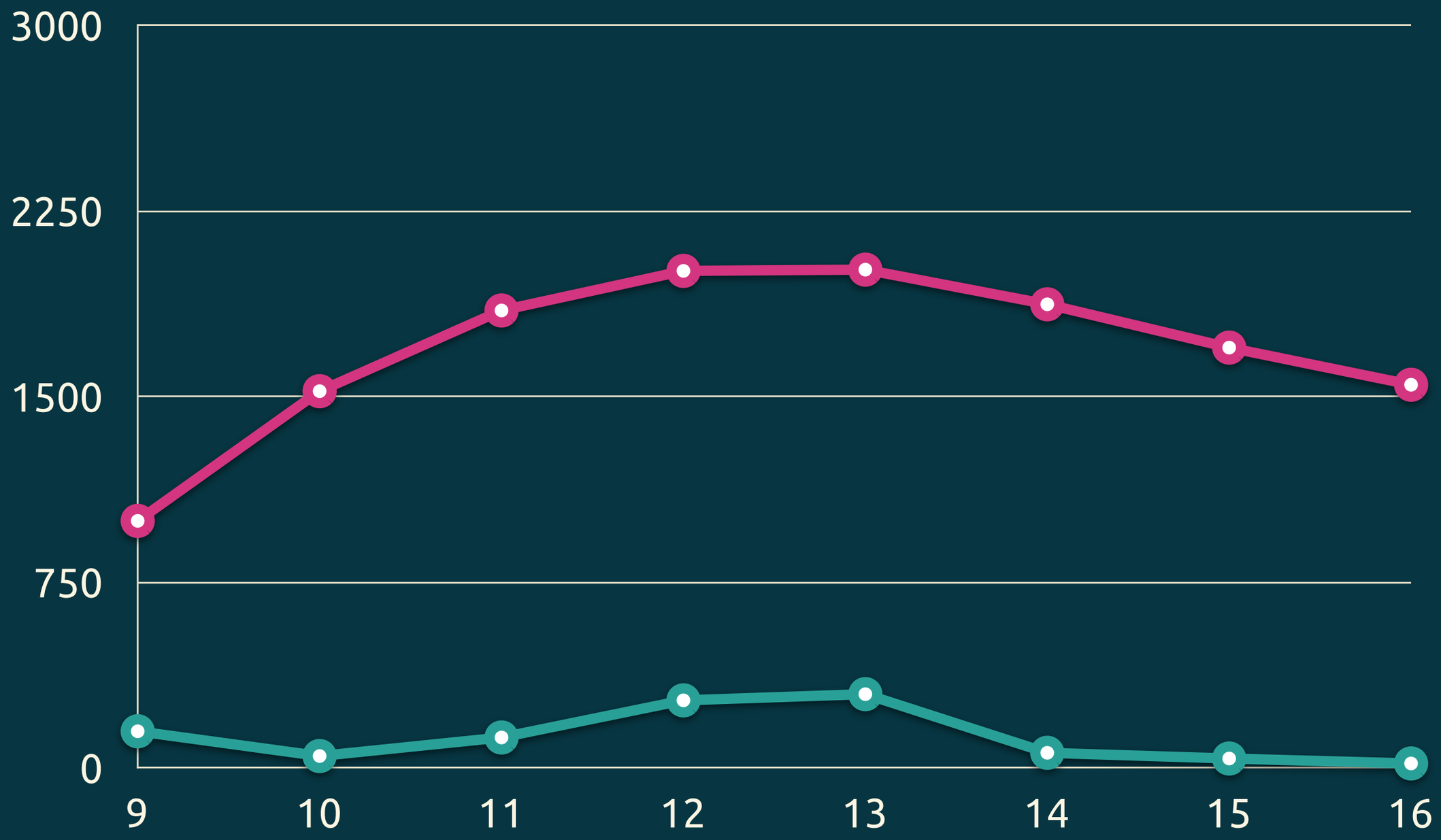
```
from riak import RiakClient
from rogersads import RIAK_CONFIG
from time import strftime

client = RiakClient(**RIAK_CONFIG)

metrics = client.bucket_type('ad-metrics')

def record_metric(campaign, metric_type):
    key = metric_type + strftime('-%Y%m%d-%H')
    counter = metrics.bucket(campaign).new(key)
    counter.increment()
    counter.store()
```

Ad Network



Sets

PartyOn

- **RSVPs** - guest lists
- **Connections** - friends lists per-user
- **Likes** - expressing interest

PartyOn

```
$ riak-admin bucket-type create partyon-sets \
  '{"props":{"datatype":"set"}}'
partyon-sets created

$ riak-admin bucket-type activate partyon-sets
partyon-sets has been activated

$ riak-admin bucket-type list
partyon-sets (active)
```

PartyOn

- **RSVPs**
  `partyon-sets/rsvps/<eventid>`
- **Connections**
  `partyon-sets/friends/<userid>`
- **Likes**
  `partyon-sets/likes/<eventid>`

PartyOn

```
from riak.datatypes import Set

sets = client.bucket_type('partyon-sets')

rsvps = sets.bucket('rsvps')
friends = sets.bucket('friends')
likes = sets.bucket('likes')
```

PartyOn

```
def rsvp_get(event):
    return rsvps.get(event) # Returns a Set

def rsvp_add(event, user):
    guests = rsvps.new(event)
    guests.add(user)
    guests.store(return_body=True)
    return guests.context

def rsvp_remove(event, user, context):
    guests = Set(rsvps, event, context=context)
    guests.remove(user)
    guests.store()
```

Maps
(and the rest)

GameNet

- **User profiles** - demographic data
  `users/profiles/<userid>`
- **Achievements** - trophies per game
  `users/trophies/<userid>`
- **Game state** - progress and stats
  `users/<gameid>/<userid>`

GameNet

```
$ riak-admin bucket-type create users \
  '{"props":{"datatype":"map"}}'
users created

$ riak-admin bucket-type activate users
users has been activated

$ riak-admin bucket-type list
users (active)
```

GameNet

```
users = client.bucket_type('users')

def update_profile(user, fields):
    profile = users.bucket('profiles').get(user)
    for field in fields:
        if field in USER_FLAGS:
            if fields[field]:
                profile.flags[field].enable()
            else:
                profile.flags[field].disable()
        else:
            value = fields[field]
            profile.registers[field].assign(value)

    profile.store()
```

GameNet

```
def add_trophy(user, game, trophy):
    trophies = users.bucket('trophies').get(user)
    trophies.sets[game].add(trophy)
    trophies.store()

def get_trophies(user, game):
    trophies = users.bucket('trophies').get(user)
    return trophies.sets[game].value
```

GameNet

```
def build_structure(user, game, structure, gold,
                    wood, stone):
    gamestate = users.bucket(game).get(user)
    gamestate.sets['structures'].add(structure)
    gamestate.counters['gold'].decrement(gold)
    gamestate.counters['wood'].decrement(wood)
    gamestate.counters['stone'].decrement(stone)
    gamestate.store(return_body=True)
    return gamestate.value
```

GameNet

```
client.create_search_index('asteroids')
users.bucket('asteroids').set_property('search_index',
                                       'asteroids')
```

```
def find_asteroids_opponents(min_score=0):
    query = "score_counter:[{} to *]".format(min_score)
    results = client.fulltext_search(
                    'asteroids', query,
                   fl=['userid_register',
                       'score_counter'])
    return results['docs']
```

Benefits

- **Richer interactions**, familiar types
- Write **mutations**, not state
- No **merge function** to write
- Same **reliability** and **predictability** of vanilla Riak

Caveats

- **Value size** still matters
- Updates **not idempotent** (yet)
- Cross-key atomicity **not possible** (yet)

Future

- Riak 2.0 due out this summer - betas available now!
- Richer querying, lighter storage requirements, more types

C.R.D.T.

TO RESIST BUGS
AND WRITE LOSS.