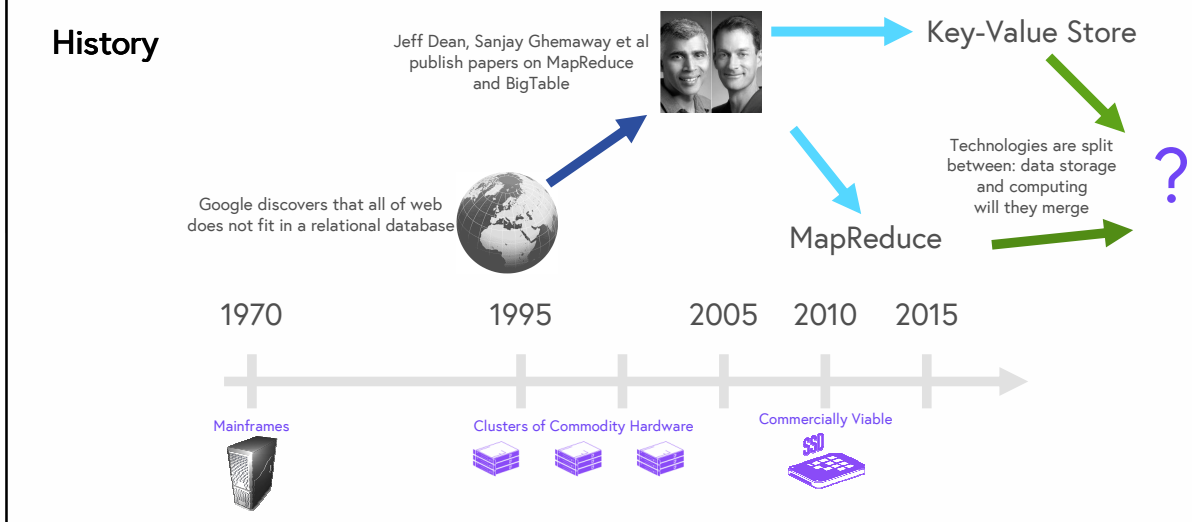
Clusterpoint Database V4

CLUSTERPOINT

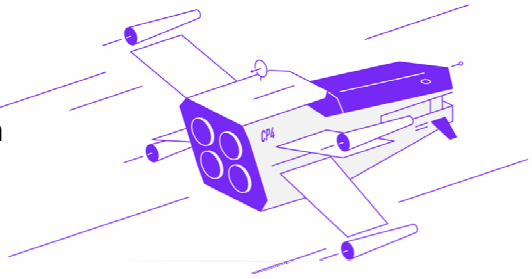
Evolution of Computing Infrastructure



Clusterpoint

Distributed Database, Search and Computing platform with REST API

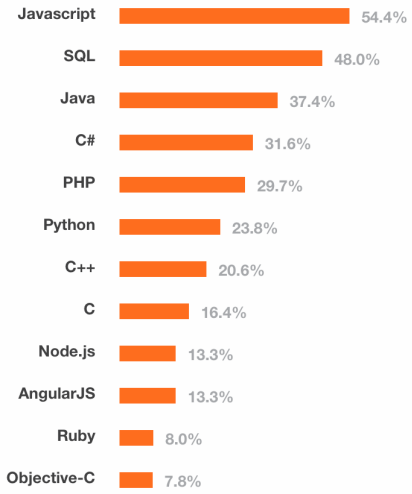
- Document oriented (JSON/XML/Binary)
- Distributed (sharded + replicated)
- Schema less; Rich Free Text search built-in
- Transactional (ACID)
- Cloud enabled
- **v4 introduces distributed computing engine**



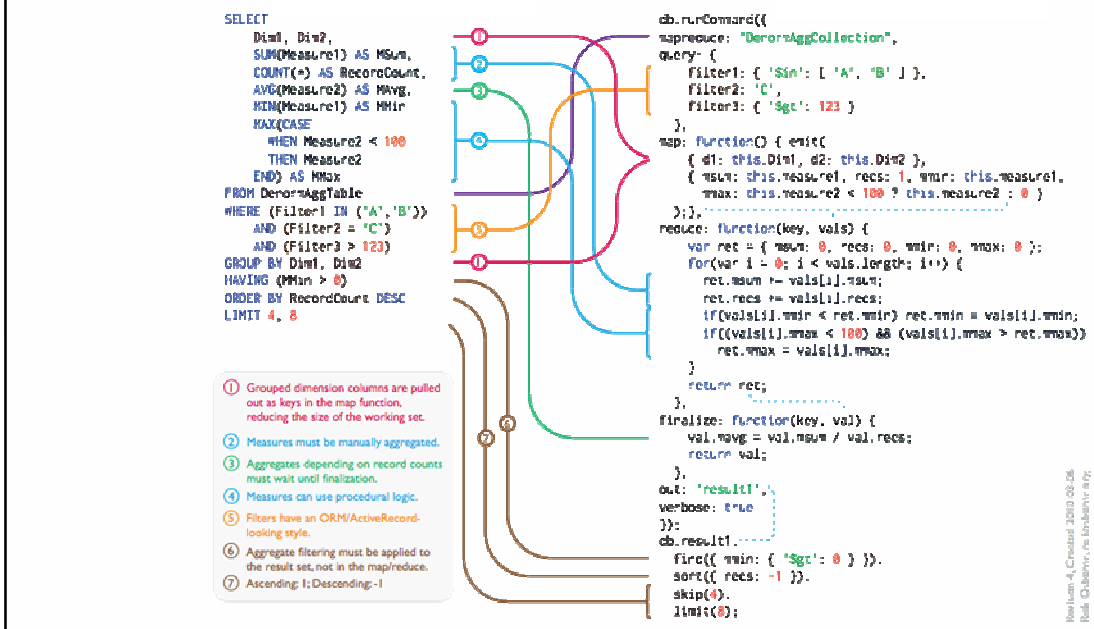
New query language: JavaScript/SQL

Query language you have never heard of
but you are already an expert?!

Technology top 2015 (StackOverflow)




JS
5
+
SQL


SELECT
Dim1, Dim2,
SUM(Measure1) AS MSum,
COUNT(*) AS RecordCount,
AVG(Measure2) AS MAvg,
MIN(Measure1) AS MMin
MAX(CASE
WHEN Measure2 < 100
THEN Measure2
END) AS MMax
FROM DerormAggTable
WHERE (Filter1 IN ('A','B'))
AND (Filter2 = 'C')
AND (Filter3 > 123)
GROUP BY Dim1, Dim2
HAVING (MMin > 0)
ORDER BY RecordCount DESC
LIMIT 4, 8
1 Grouped dimension columns are pulled out as keys in the map function, reducing the size of the working set.
2 Measures must be manually aggregated.
3 Aggregates depending on record counts must wait until finalization.
4 Measures can use procedural logic.
5 Filters have an ORM/ActiveRecord-looking style.
6 Aggregate filtering must be applied to the result set, not in the map/reduce.
7 Ascending: 1; Descending: -1
db.runCommand({
mapreduce: "DerormAggCollection",
query: {
filter1: { '$in': ['A', 'B'] },
filter2: 'C',
filter3: { '$gt': 123 }
},
map: function() { emit(
{ d1: this.Dim1, d2: this.Dim2 },
{ msum: this.measure1, recs: 1, mmin: this.measure1,
mmax: this.measure2 < 100 ? this.measure2 : 0 }
);},
reduce: function(key, vals) {
var ret = { msum: 0, recs: 0, mmin: 0, mmax: 0 };
for(var i = 0; i < vals.length; i++) {
ret.msum += vals[i].msum;
ret.recs += vals[i].recs;
if(vals[i].mmin < ret.mmin) ret.mmin = vals[i].mmin;
if((vals[i].mmax < 100) && (vals[i].mmax > ret.mmax))
ret.mmax = vals[i].mmax;
}
return ret;
},
finalize: function(key, val) {
val.mavg = val.msum / val.recs;
return val;
},
out: 'result1',
verbose: true
});
db.result1.
find({ mmin: { '$gt': 0 } }).
sort({ recs: -1 }).
skip(4).
limit(8);

SQL	JavaScript
flexible to express queries	hard to express queries
executes in parallel	difficult to execute in parallel
static	dynamic
hard to define expressions	easy to define expressions
bad with custom routines	great with custom routines

Javascript - V8

Made for browsers but not only

- Chrome
- Node.js
- MongoDB
- Google BigQuery UDF

Javascript - V8

Produces machine code (IA-32, x64, ARM)

```
function g () { return 1; }
function f () {
  var ret = 0;
  for (var i = 1; i < 10000000; i++) {
    ret += g ();
  }
  return ret;
}
```

```
push rbp          ;; Save the frame pointer.
movq rbp,rsp      ;; Set the new frame pointer.
push rsi          ;; Save the callee's "context object".
push rdi          ;; Save the callee's JSFunction object.
subq rsp,0x28     ;; Reserve space for 5 locals.
```

Javascript - V8

Performance - Problem

Compute the 25,000th prime

Javascript - V8

Performance - Algorithm

For x = 1 to infinity: if x not divisible by any member of an initially empty list of primes, add x to the list until we have 25,000

Javascript - V8

Performance - Contenders

C++

```
class Primes {
 public:
  int getPrimeCount() const { return prime_count; }
  int getPrime(int i) const { return primes[i]; }
  void addPrime(int i) { primes[prime_count++] = i; }

  bool isDivisibe(int i, int by) { return (i % by) == 0; }

  bool isPrimeDivisible(int candidate) {
    for (int i = 1; i < prime_count; ++i) {
      if (isDivisibe(candidate, primes[i])) return true;
    }
    return false;
  }

 private:
  volatile int prime_count;
  volatile int primes[25000];
};

int main() {
  Primes p;
  int c = 1;
  while (p.getPrimeCount() < 25000) {
    if (!p.isPrimeDivisible(c)) {
      p.addPrime(c);
    }
    c++;
  }
  printf("%d\n", p.getPrime(p.getPrimeCount()-1));
}
```

JAVASCRIPT

```
function Primes() {
  this.prime_count = 0;
  this.primes = new Array(25000);
  this.getPrimeCount = function() { return this.prime_count; }
  this.getPrime = function(i) { return this.primes[i]; }
  this.addPrime = function(i) {
    this.primes[this.prime_count++] = i;
  }

  this.isPrimeDivisible = function(candidate) {
    for (var i = 1; i <= this.prime_count; ++i) {
      if ((candidate % this.primes[i]) == 0) return true;
    }
    return false;
  }
};

function main() {
  p = new Primes();
  var c = 1;
  while (p.getPrimeCount() < 25000) {
    if (!p.isPrimeDivisible(c)) {
      p.addPrime(c);
    }
    c++;
  }
  print(p.getPrime(p.getPrimeCount()-1));
}

main();
```

Javascript - V8

Performance - Results (only 17% slower)

C++

```shell
% g++ primes.cc -o primes -O3
% time ./primes
287107

real    0m1.564s
user    0m1.560s
sys     0m0.002s
```

JavaScript

```shell
% time d8 primes-2.js
287107

real    0m1.829s
user    0m1.827s
sys     0m0.010s
```

JS/SQL

Language structure

- Based on SQL-like structure
- Allows to execute arbitrary JavaScript in any clause of the SELECT or UPDATE statement.
- Native support of JSON and XML data types.
- Joins, nested documents (in 4.1, stay tuned!)

SELECT * FROM product

JS/SQL

Insert statement

```
INSERT INTO product JSON VALUE {
  "name": "Schwinn S29 Full Suspension Mountain Bike",
  "image_url": "schwinn_s29.jpeg",
  "description": "...",
  "color": ["black","red"],
  "order_price": 211.16,
  "price": 259.16,
  "packaging": {
    "height": 23,
    "width": 25,
    "depth": 12,
    "weight": 54
  },
  "availability": "In Stock"
}
```

JS/SQL

Insert statement

```
INSERT INTO product
(name, image_url, description, color, price, availability)
VALUES ("Schwinn S29 Full Suspension Mountain Bike",
       "schwinn_s29.jpeg",
       "...",
       "black",
       259.16,
       "In Stock")
```

JS/SQL

Price buckets

Condition
Collectible (69)
New (436,499)
Refurbished (96)
Used (4,349)

Price
Under $25 (173,356)
$25 to $50 (97,659)
$50 to $100 (77,298)
$100 to $200 (44,941)
$200 & Above (45,587)
$ to $ GO

Discount
10% Off or More (114,200)
25% Off or More (73,886)
50% Off or More (28,619)
70% Off or More (4,818)

Seller

Dynacraft 8108-91ZTJ Girls Hello Kitty Cruiser Bike, Black/Pink/White, 20-Inch
by Dynacraft

$54.77 ~~$139.99~~ Prime

FREE Shipping on orders over $35

Show only Dynacraft items

7

JS/SQL

Grouping/Aggregation

```
function PriceBucket(price) {
  var boundaries = [0, 1, 5, 10, 50, 100, 200, 500, 1000];
  for (var i = 1; i < boundaries.length; i++) {
    if (price >= boundaries[i - 1] && price < boundaries[i])
      return boundaries[i - 1].toString() + " to " + boundaries[i].toString();
  }
  return "above " + boundaries[boundaries.length - 1].toString();
}

SELECT PriceBucket(price), COUNT()
FROM product
GROUP BY PriceBucket(price);
```

JS/SQL

Aggregating nested documents

```
{
  "user": "3e9cde95-8077-4386-a35b-fc3b4489dec3",
 "items": [
 {
  "name": "Orange",
  "price": 5,
  "descr": "Special for juice",
  "count": 25
 },
 {
  "name": "Orange",
  "price": 5,
  "descr": "Special for juice",
  "count": 25
 }
}
```

JS/SQL

Aggregating nested documents

```
function sum_items()
{
  var sum = 0;
  for (var i = 0; i < items.length; i++)
      sum += items[i].count * items[i].price;
  return sum;
}
SELECT SUM(sum_items()), AVG(sum_items()), MIN(sum_items()), MAX(sum_items())
FROM baskets
GROUP BY 1
```

JS/SQL

Nested documents (v4.1)

```
{
  name: "Schwinn S29 Full Suspension Mountain Bike",
  price: 259.16,
  inventory : [
     {location: “Warehouse-East", items: 17},
     {location: “Warehouse-West", items: 50}
  ]
};
```

JS/SQL

Nested documents (v4.1)

```
INSERT INTO product["34A40855"] JSON VALUE {
  name: "Schwinn S29 Full Suspension Mountain Bike",
  price: 259.16
};

INSERT INTO product["34A40855"].inventory JSON VALUE {
  location: "Warehouse-East",
  items: 17
};

INSERT INTO product["34A40855"].inventory JSON VALUE {
  location: "Warehouse-West",
  items: 17
};
```

JS/SQL

Nested documents (v4.1)

```
SELECT price, inventory
FROM product

SELECT location, items, SUPER().name
FROM inventory
WHERE SUPER().price > 30
```

```
{
  name: "Schwinn S29 Full Suspension Mountain Bike",
  price: 259.16,
  inventory : [
     {location: “Warehouse-East", items: 17},
     {location: “Warehouse-West", items: 50}
  ]
};
```

JS/SQL

Joins (v4.1)

```
INSERT INTO product["34A40855"] JSON VALUE {
  name: "Schwinn S29 Full Suspension Mountain Bike",
  price: 259.16
};

INSERT INTO order JSON VALUE {
  product_key: "34A40855",
  delivery_address: "My Office"
};

SELECT delivery_address, product[product_key].price
FROM order
WHERE product[product_key].price > 20
```

API

REST & more APIs coming soon!

```
$.ajax({
  url      : 'https://api-eu.clusterpoint.com/v4/ACCOUNT_ID/DATABASE/_query',
  type     : 'POST',
  dataType  : 'json',
  data     : 'SELECT * FROM DATABASE',
  beforeSend: function (xhr) {
    xhr.setRequestHeader('Authorization', 'Basic ' + btoa('USERNAME:PASSWORD'));
  },
  success   : function (data) {
    if (typeof success != 'undefined') {
      success(data);
    }
  },
  fail     : function (data) {
    alert(data.error);
    if (typeof fail != 'undefined') {
      fail(data);
    }
  }
});
```


Thank you!