From Shared-All to Shared-Nothing

Successfully used Patterns in application and table design with Hbase

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HBASE-Patterns

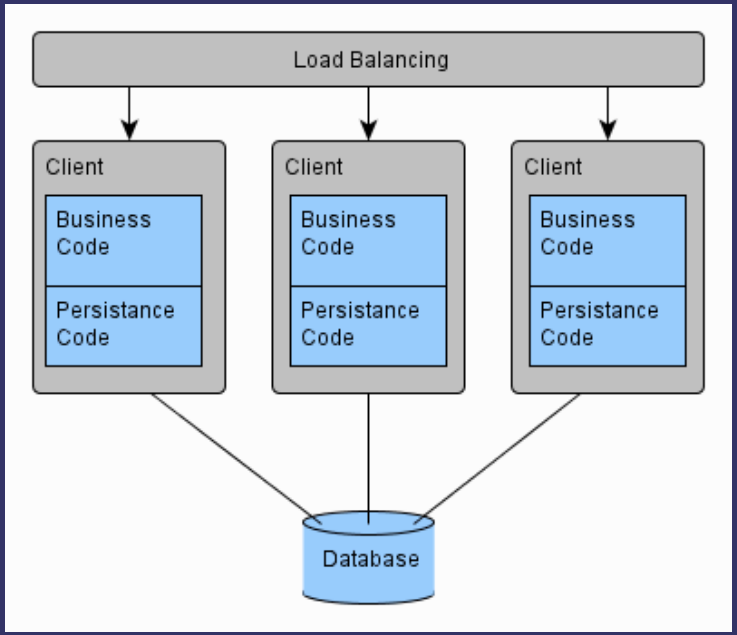
Audience

- You have Big Data
- Your Organization needs predictable scaling options
- You need to be flexible with your Data
- You are a Techie Person

Content

- What is shared?
- Recap RDBMS vs HBase/BigTable
- Example: Credid-Card Processing
- Storage Patterns
- Application Design Proposal
- Missing: Call for Features
- HbaseExplorer

Shared ..somewhat



- Representation and Business Layers have well known scaling patterns
- Many of these patterns rely on a transactional database underneath
- Distributed transactions are expensive

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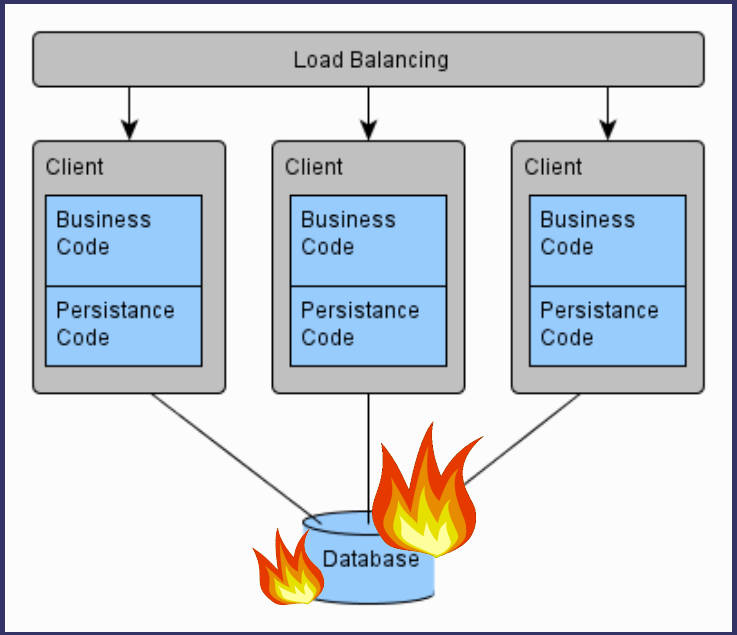

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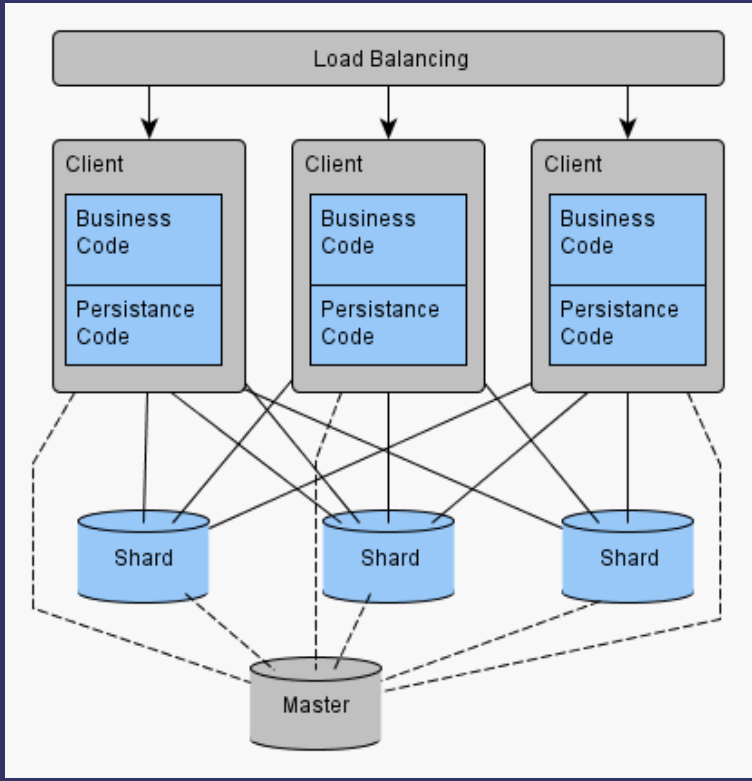
- Many of these patterns rely on a transactional database underneath
- Distributed transactions are expensive

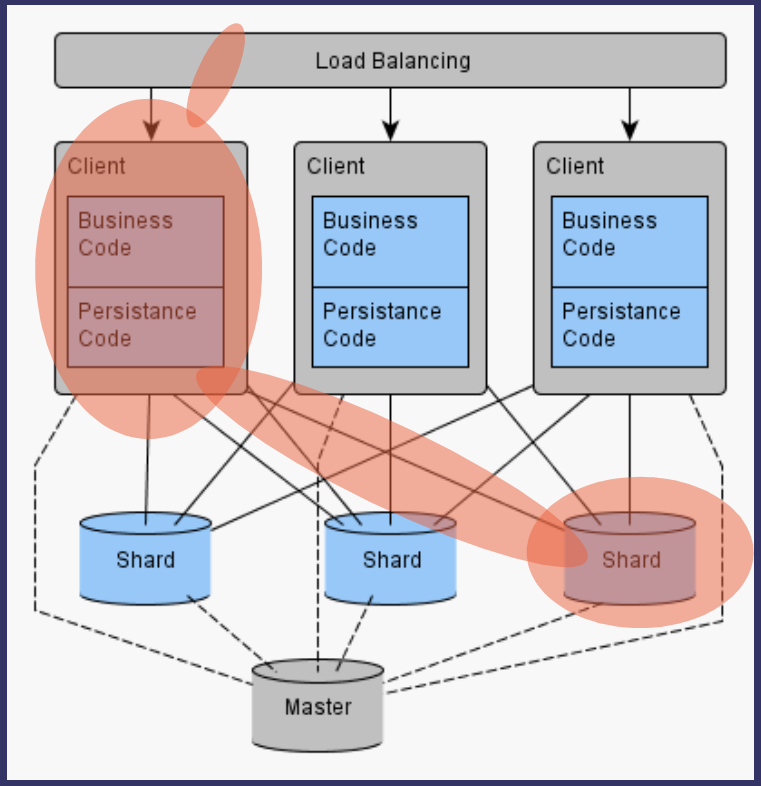
Shared ..almost nothing



- All Business Threads can run independently a long way
- Contention only within one Shard → More Shards, Less Contention
- Highly Available and Consistent
- Give away perfection:Transactions must be hand-made

HBase-Patterns

Shared ..almost nothing



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HBase-Patterns

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RDBMs Solutions

- Transactions
- Access Rules
- Types
- FK's
- Fixed structure
- History?
- Rows?

HBase-Patterns

Alternative: HBase

- Key/Value with structure in the „fat“ values
  - Arbitrary keys, but retain sortability
- Data stored in Shards (regionserver) by splitting up the key range
- Values are organized in Families
- All Data has history

HBase-Patterns

Hbase: Key-Value

Card Number
1233.45.33-23

TS	Card	Transaction	Owner	Support	Notes
t5	registerCode=<..> model=<model> pinHash=<md5(pin)> ValidFrom=<md5(f)> ValidTo=<...>				A new card was issued to the customer
t4		<DealerId>= <amount> Location=<..>	pinAttempts=<.>		A Transaction was made
t3				Reason=<...> <ReqId>= <status> Supporter=<..>	Support Request from Customer
t2			City=<...> Addressid=<..> src=byTel operator=<...>	Reason=<...> <ReqId>= Solved Supporter=<>	Address-Change by support
t1			Email= <md5(email)> src=web		Email-Change from WebSite

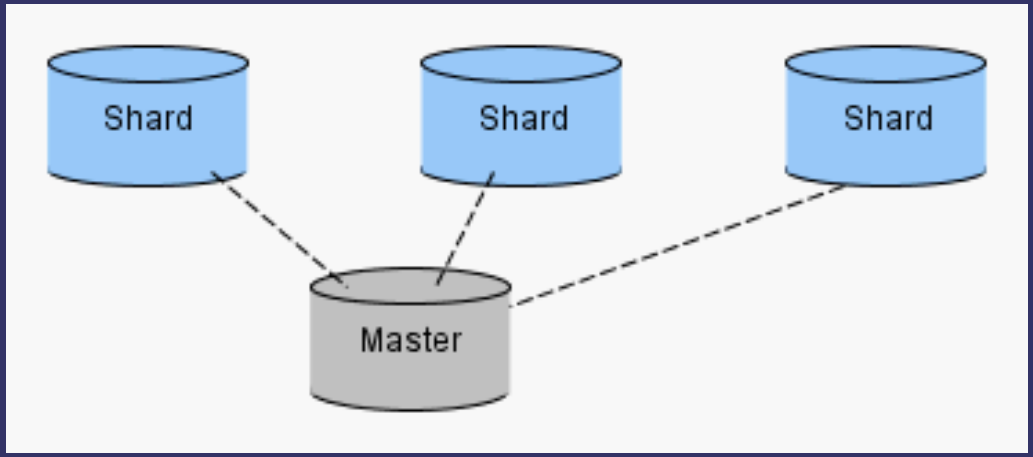
Card Number
1233.45.33-24

TS	Card	Transaction	Owner	Support	Notes
t5	registerCode=<..> model=<model> pinHash=<md5(pin)> ValidFrom=<md5(f)> ValidTo=<...>				A new card was issued to the customer
t4		<DealerId>= <amount> Location=<..>	pinAttempts=<.>		A Transaction was made
t3				Reason=<...> <ReqId>= <status> Supporter=<..>	Support Request from Customer

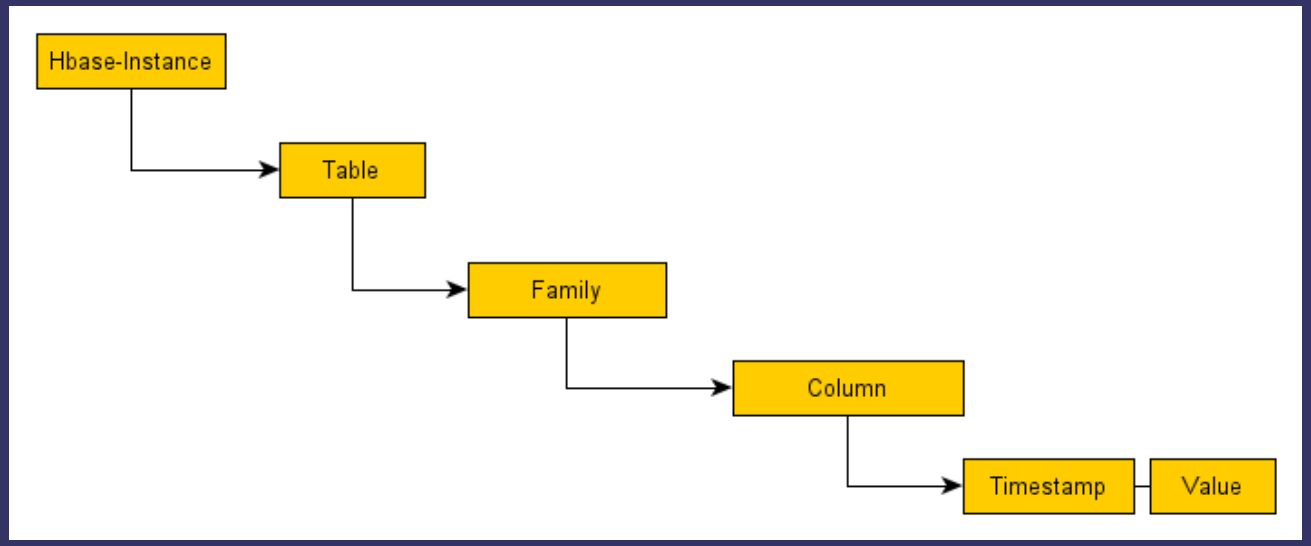
HBase-Patterns

Hbase: Regionserver hold Shards

a...k l...m n...z



Recap: Hbase/BigTable Data Model



- family+Column=Column Qualifier

Column Families

- Stored in own Files
  - Important for retrieval
- Have own Settings
  - Compression
  - Versions
  - Timed Deletions (TTL)
  - Size Constraints
  - Counters

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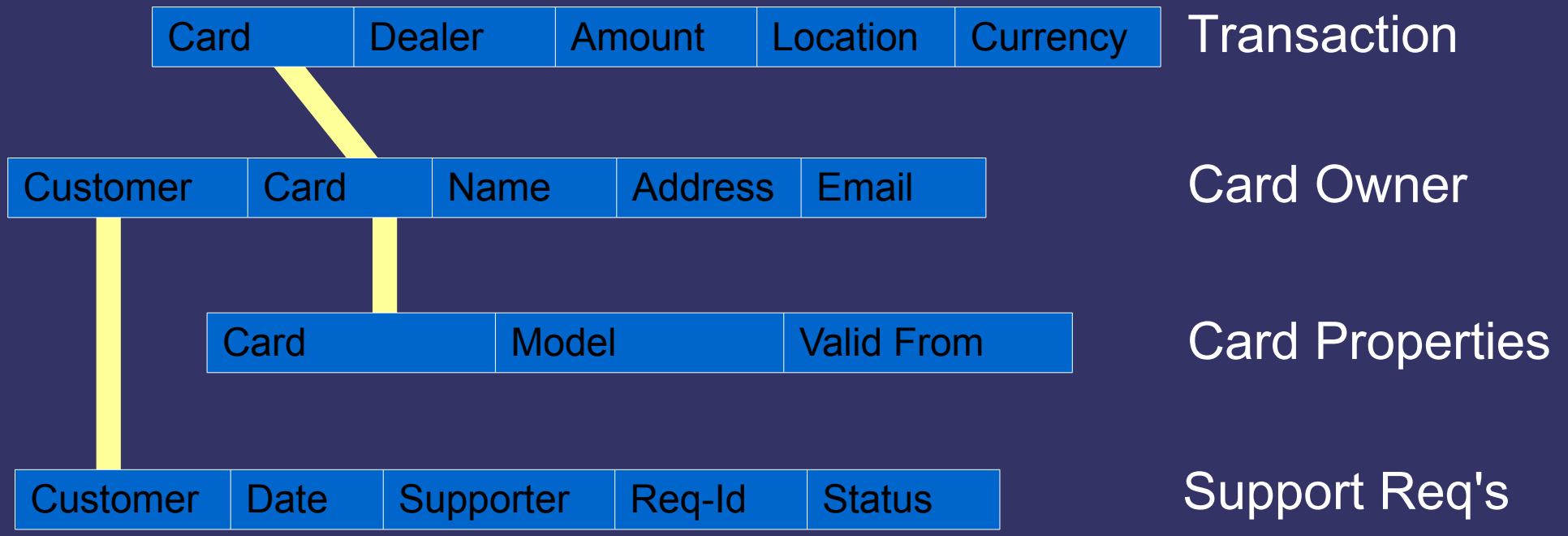
Example: Credit Card Processing



Hbase main table Layout

RowKey: Card Number

TS	Card	Transaction	Owner	Support	*Notes*
t5	registerCode=<..> model=<model> pinHash=<md5(pin)> ValidFrom=<md5(f)> ValidTo=<...>				*A new card was issued to the customer*
t4		<DealerId>= <amount> Location=<..>	pinAttempts=<.>		*A Transaction was made*
t3				Reason=<...> <ReqId>= <status> Supporter=<..>	*Support Request from Customer*
t2			City=<...> Addressid=<..> src=byTel operator=<...>	Reason=<...> <ReqId>= Solved Supporter=<>	*Address-Change by support*
t1			Email= <md5(email)> src=web		*Email-Change from WebSite*

HBase-Patterns

Supplementary (index-) Tables

- Email to Card Mapping

  RowKey: md5(email)

Card
<card> <card>

  Allows to do lookups by a given email
  Index can be maintained without transaction!

- Address references

  RowKey: addressid

Address
Name=<name> City=<city> Street=<street>

  Sample for a simple relation
  Can be further encrypted

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Patterns to Store Data, why?

- We can talk about it
- Based on Space efficiency
  - Even if space is cheap, data has to be searched through and has to be moved
- Based on Lookup efficiency
  - Most Data is stored sorted
- Used for direct lookups as well as in MR aggregations

Pattern: swim-above

- Most recent value at top (in API)
  - Where was the last Transaction?

    get(Cardid: 123.22.34-24, Family: Transaction, Column: Location)

TS	Card	Transaction	Owner	Support	*Notes*
t5	registerCode=123 model=superFlash pinHash=aw3224hhds ValidFrom=se344qq1 ValidTo=12esdrf43q.q				*A new card was issued to the customer*
t4		D123376=123E Location=Berlin	pinAttempts=1		*A Transaction was made*
t3		D2231=82.22E Location=Munich	pinAttempts=2		*A Transaction was made*

  - What is the current model?

    get(Cardid: 123.22.34-24, Family: Card, Column: model)

Pattern: swim-above

- Most recent value at top (in API)
  - Where was the last Transaction?

    get(Cardid: 123.22.34-24, Family: Transaction, Column: Location)

TS	Card	Transaction	Owner	Support	*Notes*
t5	registerCode=123 model=superFlash pinHash=aw3224hhds ValidFrom=ss344qq1 ValidTo=12esdrf43q.q				*A new card was issued to the customer*
t4		D123370=123E Location=Berlin	pinAttempts=1		*A Transaction was made*
t3		D2231=82.22E Location=Munich	pinAttempts=2		*A Transaction was made*

  - What is the current model?

    get(Cardid: 123.22.34-24, Family: Card, Column: model)

Pattern: Data grouped by Timestamp

- Who changed the Address to „Munich“ ?

  1. Figure out the Timestamp(s)

     get(Cardid: 123.22.34.24, City=Munich) → ts2

  2. get the fields for this TS

     get(Cardid: 123.22.34-24, timestamp: t2)

TS	Card	Transaction	Owner	Support	*Notes*
t3				Reason=<...> <ReqId>= <status> Supporter=<..>	*Support Request from Customer*
t2			City=Munich Addressid=<..> src=byTel operator=<...>	Reason=Call-In R213=Solved Supporter=PaulG	*Address-Change by support*
t1			Email= <md5(email)> src=web		*Email-Change from WebSite*

Pattern: Data grouped by Timestamp

- Who changed the Address to „Munich“ ?

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TS	Card	Transaction	Owner	Support	*Notes*
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HBASE-Patterns

Pattern: ColumnName-Is-Value

- No value, Often useful for indexes

RowKey: md5(email)

Card
123.23662-21 123.23452-24

RowKey: 123.23452-24

TS	Card	Transaction	Owner	Support	*Notes*
t3				Reason=<...> <ReqId>= <status> Supporter=<..>	*Support Request from Customer*
t2			City=Munich Addressid=<..> src=byTel operator=<...>	Reason=Call-In R213=Solved Supporter=PaulG	*Address-Change by support*

Pattern: ColumnName-Is-Value

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RowKey: md5(email)

Card
123.23662-21 123.23452-24

RowKey: 123.23452-24

TS	Card	Transaction	Owner	Support	*Notes*
t3				Reason=<...> <ReqId>= <status> Supporter=<..>	*Support Request from Customer*
t2			City=Munich Addressid=<..> src=byTel operator=<...>	Reason=Call-In R213=Solved Supporter=PaulG	*Address-Change by support*

- Where did al.lias@gmx.com use his cards?
  index.get(9fc81d4292e6a404c2d64c9eaa66e43a) → Cardids
  cards.get(123.23452-24,...)

HBase-Patterns

Pattern: Column-Enum

- What is the status of Support-Request R213

  (status is one of: Opened, Reviewed, Assigned, Pending, Solved)

  get(Cardid: 123.22.34.24, Family: Support, Column: R213)

TS	Card	Transaction	Owner	Support	*Notes*
t3				Reason=<...> <ReqId>= <status> Supporter=<..>	*Support Request from Customer*
t2			City=Munich Addressid=<..> src=byTel operator=<...>	Reason=Call-In R213=Solved Supporter=PaulG	*Address-Change by support*
t1			Email= <md5(email)> src=web		*Email-Change from WebSite*

HBase-Patterns

Pattern: Atomic Counters

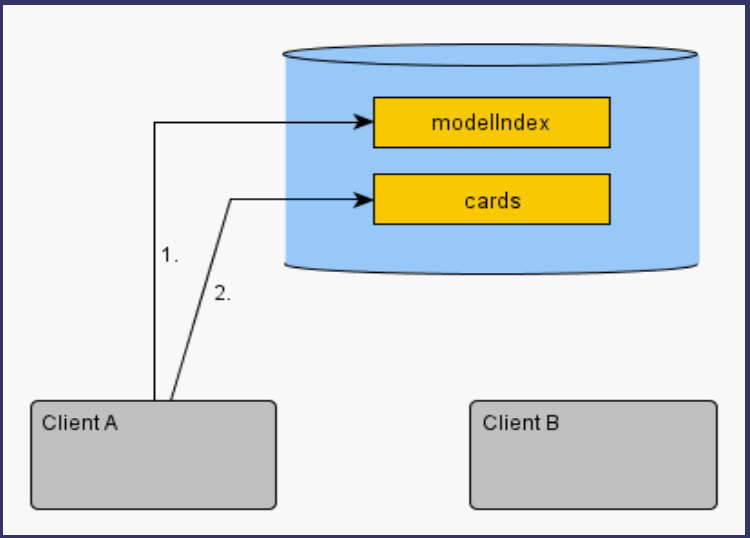
- Solves the common Problem when many clients try to update one/few rows in a RDBMS table
- Use a separate table/family/column, use the key or family to partition the load
- Example: Write a Record and add up some stats

  1. cards.insert(key: 123.22.34.24, Column: R213, Value=Solved,...)
  2. stats.increment(key: 123.22.34.24, Column: SREGSPERMONTH,+1)

- Small overhead even on excessive use:
  <terminal-id>:year-month-date=<cnt>
  <terminal-id>:year-month=<cnt>
- timestamps!

Pattern: index table

- Constant Costs
  - Always one more insert to (another sharded) index table
- Lock Free
  - Versions=1
- Only „eventually“ consistant
  - But on our control!



Pattern Summary

- Swim-above
- Data grouped by timestamp
- ColumnName-is-Value
- Column-Enum
- Atomic Counter
- Index table

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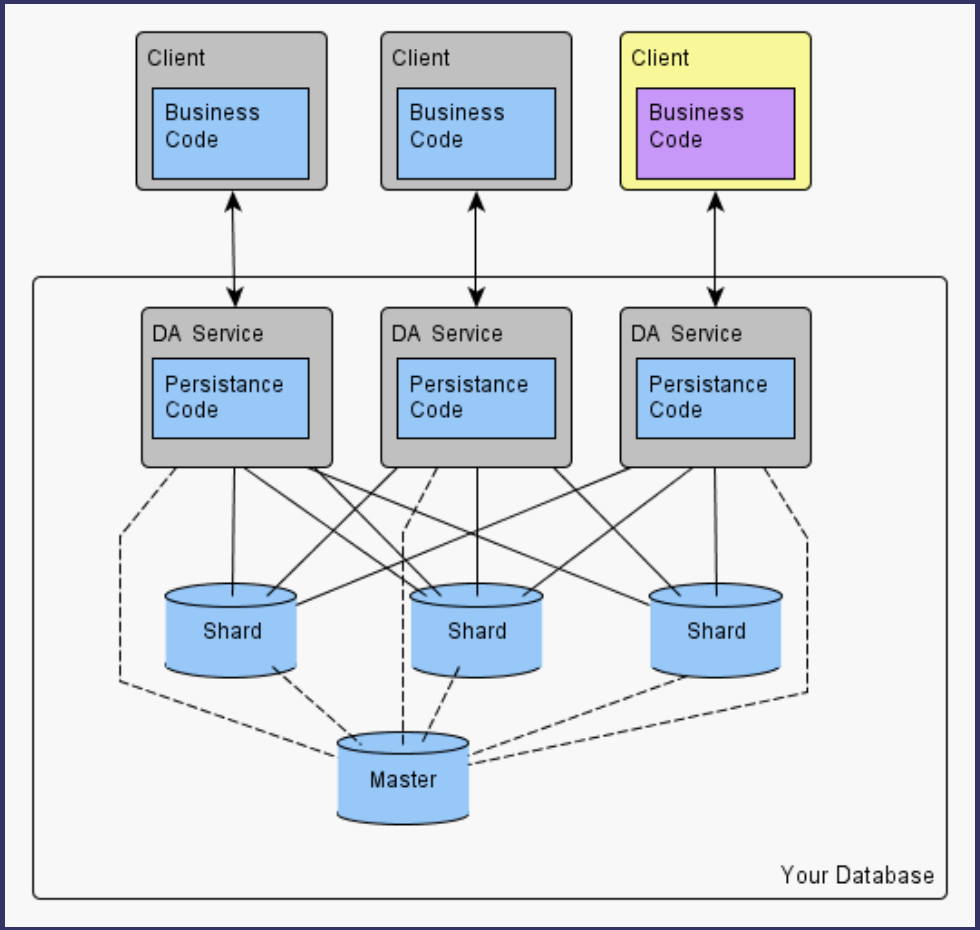
Application Design



- Persistance Code moves out of App
  - Gets reusable!
  - Easy to test
- Fix what's missing
  - Security / Access Control
  - Firewall
  - Index Handling
  - Transactions
  - ORM mappings

HBase-Patterns

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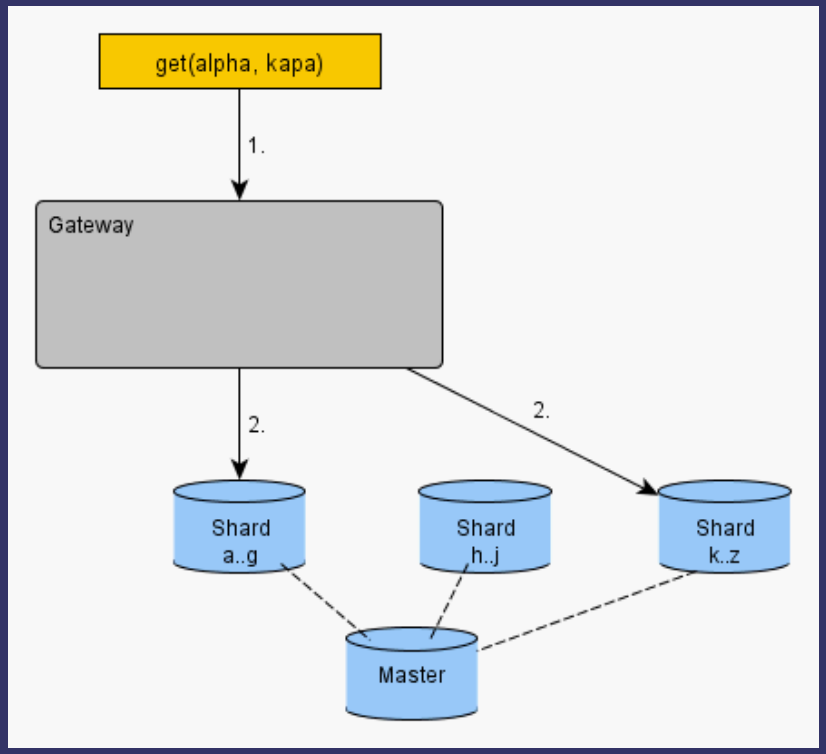
Hbase: missing pieces



- Multi-Get/Scan would allow to read data from multiple Region Servers in parallel to one client
- Same with Multi-Put
- Patches avail., 0.21

HBase-Patterns

Hbase: missing pieces

- Server Side Processing reduces data transfer and distributes computing
  - Scan transfers only matches
    scan rowkey=<cardid>, dealer=<d1234>
  - Allows aggregations on server side (1st map already on region server)
  - Some server-side Scan-Filters help already today
  - Java Expression Language?

Hbase: missing pieces

- Bloomfilter
  - Reduce key-lookup time
  - Disappeared in 0.20.x, planned to be reanimated in 0.21
- Hfile persistant internal value index
  - Value indexes / Value compression
  - Timestamp Index

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Hbaseexplorer: scan

HBase Explorer

Home | CloudInstance List | 500/Backup100

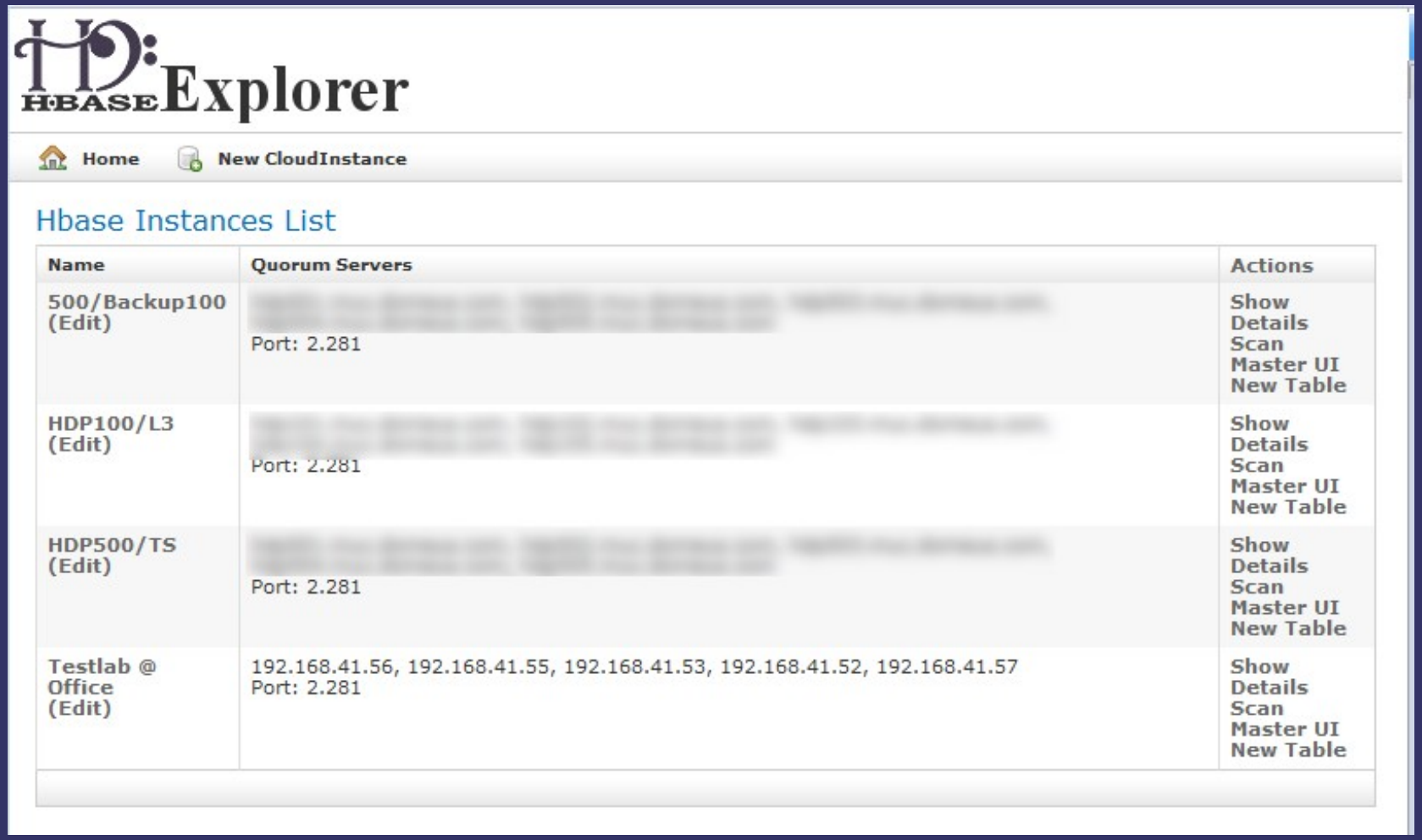
SCAN on *500/Backup100*

Table	user	RowKey	2000-2018986274
Versions	100	Rows	2

Scan

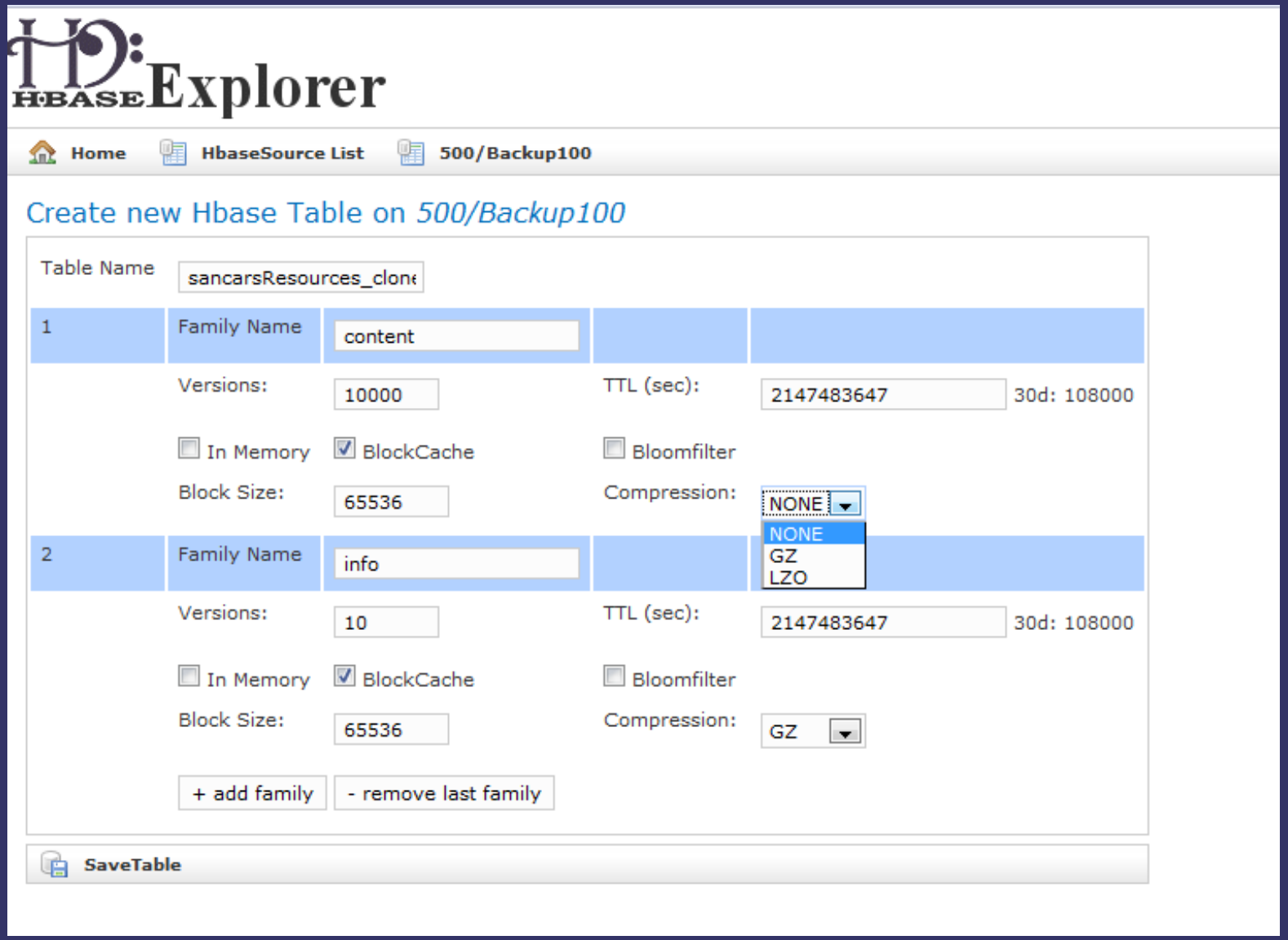
RowKey/Timestamp	member	profile	sent	src	tmp	track
2000-2018986274 Show all 15 Timstamps		**domainmd5**: 5c01fa90ff459b9a2a6d60f49143 **emailmd5**: f29ff826ff92fe67b5929f9ff6d2681 **tld**: fm **ua**: Mozilla/5.0 (Windows; U; Windows NT 5.1; pl; rv:1.9.0.17) Gecko/2009122116 Firefox/3.0.17	**200148270**: 200000833 **200152993**: 200000833 **200165627**: 200000833 **200168103**: 200000833 **200171309**: 200000833 **200174044**: 200000833 **200177666**: 200000833 **200179957**: 200000833 **200183124**: 200000833 **channel**: email **messagetype**: group **rfc822mid**: <723060021.168216051267273585946@ecmessenger> **transport**: ecm-mta-normal-2	**app59**: **app67**: **host**: app68	**email**: **ip**: 83.22.	**200165627**: read **200166790**: read **200168103**: read **200171309**: read **200177666**: read
2000-2018986275 Hide Timestamps		**domainmd5**: b1e94d6d1335dc023ee387cfaf46fc1 **emailmd5**: 25d956984ea01b5c7895cb733852b2ed **tld**: ru	**200148270**: 200000833 **200152993**: 200000833 **200165627**: 200000833 **200168103**: 200000833 **200171309**: 200000833 **200174044**: 200000833 **200177666**: 200000833 **200179957**: 200000833 **200183124**: 200000833 **channel**: email **messagetype**: group **rfc822mid**: <1599935178.168216081267273585962@ecmessenger> **transport**: ecm-mta-normal-2	**app59**: **app67**: **host**: app68	**email**:	
Wed Dec 16 12:20:25 CET 2009 (1260962425185)		**domainmd5**: b1e94d6d1335dc023ee387cfaf46fc1 **tld**: ru	**200148270**: 200000833 **channel**: email **messagetype**: group **rfc822mid**: <1403064828.339200721260962425173@ecmessenger> **transport**: ecm-mta-normal-2	**app59**:		
Wed Dec 16 12:28:45 CET 2009 (1260962925663)		**emailmd5**: 25d956984ea01b5c7895cb733852b2ed				
Thu Dec 24 16:44:44 CET 2009 (1261669484464)			**200152993**: 200000833 **channel**: email **messagetype**: group **rfc822mid**: <1668206159.537520821261669484451@ecmessenger> **transport**: ecm-mta-normal-2	**app67**:		
Mon Jan 25 17:46:21 CET 2010 (1264437981118)			**200165627**: 200000833 **channel**: email **messagetype**: group **rfc822mid**: <1080769139.131450577126443798110 2@ecmessenger> **transport**: ecm-mta-normal-2	**host**: app88		

Hbaseexplorer: cluster setup



HBase-Patterns

Hbaseexplorer; Table Definition



HBase-Patterns

Hbaseexplorer: statistics

HBase Explorer

Home | HbaseSources -> 500/Backup100

HbaseTableStats for Table user on 500/Backup100

Creation	Number of Timestamps	Column Count	Column Size	Value Count	Value Size	Data Size
2010-02-17 21:23:17.584 247.274.340 Rows 263 min for 2041 Regions	2.258.920.782	4.200.423.173	31.962.681.498	11.104.865.871	176.232.229.513	241.798.296.395
Family **member**	1.063.774.125	322.934.846	2.786.692.983	1.063.774.125	7.974.420.927	13.344.592.678
Family **profile**	950.519.329	752.862.525	5.012.671.029	950.519.306	35.225.817.464	46.261.388.693
Family **sent**	6.362.412.873	2.029.965.448	17.993.312.944	6.350.042.133	98.758.669.455	132.991.705.983
Family **src**	1.433.498.658	579.384.791	2.680.059.875	979.076.044	4.895.380.220	12.210.518.423
Family **tmp**	1.289.389.037	234.166.446	1.037.121.366	1.289.389.037	27.583.889.900	30.494.342.834
Family **track**	472.146.926	281.109.117	2.452.823.301	472.065.226	1.794.051.547	6.495.747.784
2010-02-24 23:27:54.618 264.146.383 Rows 377 min for 2441 Regions	2.699.830.594	4.698.326.343	36.093.342.890	12.992.919.855	205.216.982.775	278.896.936.409
Family **member**	1.262.086.055	361.962.833	3.130.177.327	1.262.086.055	9.457.776.450	15.483.656.441
Family **profile**	1.047.879.062	816.629.737	5.459.122.758	1.047.879.037	39.813.360.502	51.805.521.156
Family **sent**	7.600.105.108	2.338.086.033	20.737.297.653	7.585.058.359	117.880.667.276	157.322.653.193
Family **src**	1.574.709.961	599.968.926	2.762.396.415	1.120.287.347	5.601.436.735	13.163.584.558
Family **tmp**	1.419.218.194	249.796.169	1.104.132.703	1.419.218.194	30.338.790.165	33.441.292.220
Family **track**	558.488.541	331.882.645	2.900.216.034	558.390.863	2.124.951.647	7.680.228.841
2010-03-01 15:24:56.592 271.809.632 Rows 296 min for 2663 Regions	2.967.993.962	4.961.247.594	38.344.244.141	13.990.144.242	219.658.514.154	297.692.739.047
Family **member**	1.380.515.870	383.981.831	3.323.718.075	1.380.515.870	10.342.958.610	16.738.531.333
Family **profile**	1.096.227.854	845.802.753	5.665.059.833	1.096.227.827	42.292.289.499	54.723.771.356
Family **sent**	8.327.982.740	2.513.601.808	22.294.754.722	8.311.349.793	128.946.392.432	171.349.961.618
Family **src**	1.651.126.959	609.059.276	2.798.757.815	1.196.704.345	5.983.521.725	13.654.753.748
Family **tmp**	1.392.640.438	245.320.540	1.083.045.815	1.392.640.438	29.760.239.231	32.805.849.366
Family **track**	612.812.420	363.481.386	3.178.907.881	612.705.969	2.333.112.657	8.419.871.626

Vorherige | 1 | 2 | Start a new Stats Collection

hbaseexplorer

- Complements Ruby-Shell
  - Visual Data Representations
  - UI Tools for Table Creation
  - Embedded M/R Jobs for Table Copy or Statistics collection
- Open Source @ SourceForge
  - Java, WebApp, Grails
  - Coders needed!
- More info
  - http://althelies.wordpress.com/hbaseexplorer/

eCircle AG

- Biggest Direct Email-Marketing Company in Europe
- 10 yrs, 200 Employees, now in 6 Countries
- Lots of data
  - 100Mio permission Emails / Day
  - Individualized Emails stored, trackings, hosting
  - Privacy challanges → even more data
  - We went through the classic RDBMS scaling story
- We hire!
  - Java, UI (JSP, Ajax)

eCircle
Inside Digital Marketing

HBase-Patterns

Thank you!

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