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MongoDB At Amadeus IT Group

Startup technology and the enterprise

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Budapest, 20/10/2015

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Agenda

1. Amadeus IT Group
2. MongoDB at Amadeus
3. Use-cases
4. Future plans

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Amadeus in a few words

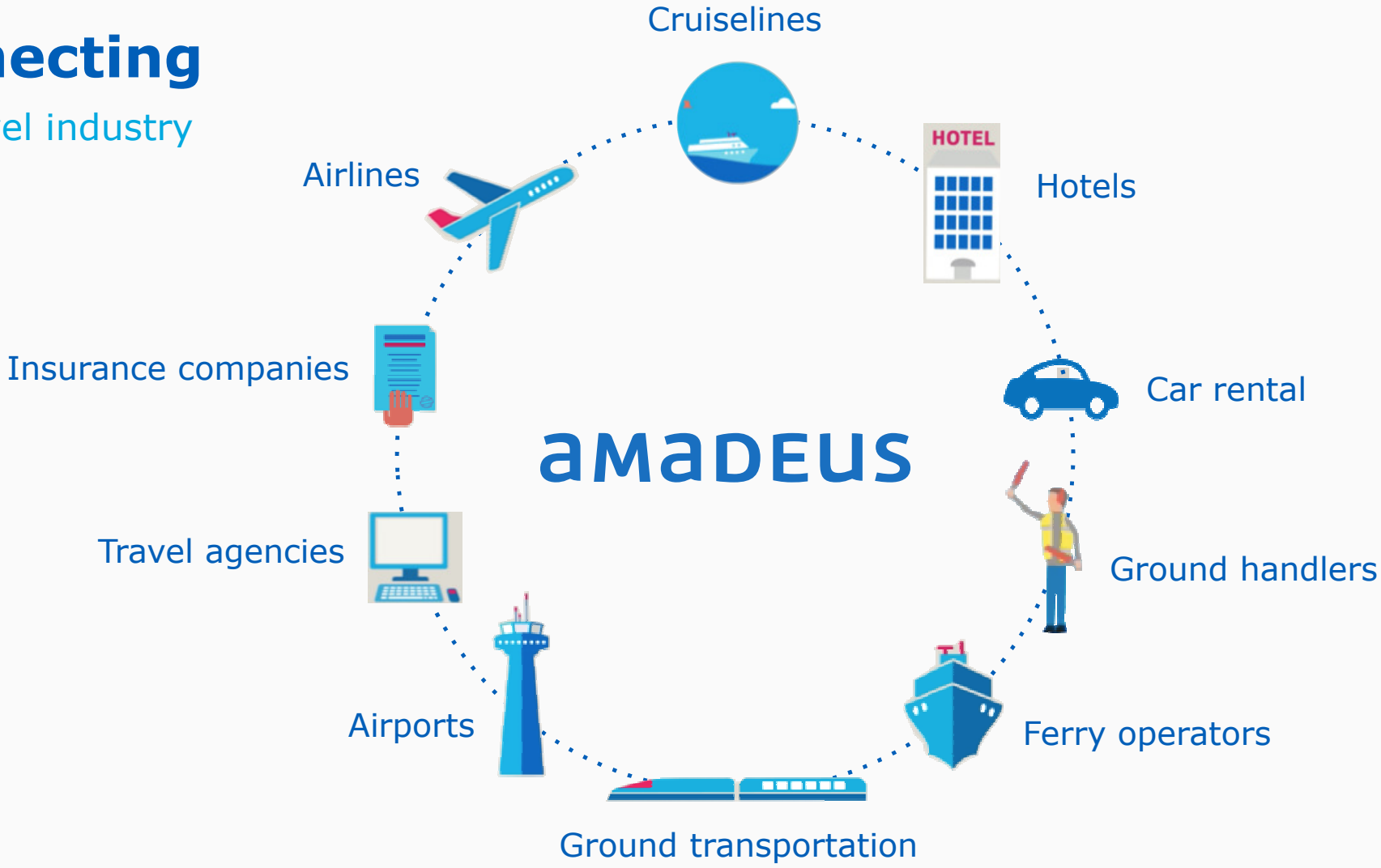
Amadeus is a technology company dedicated to the
global travel industry.

We are present in **195 countries**
with a worldwide team of more than 13,200 people.

Our solutions help improve the
business performance
of travel agencies, corporations, airlines,
airports, hotels, railways and more.

Connecting

The travel industry



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Supporting

The traveler life cycle

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We have a clear purpose

Our solutions facilitate journeys and enrich the travel **experience** for hundreds of millions of people every year.

We are working together with our customers and partners **to shape the future of travel**

Close to our customers

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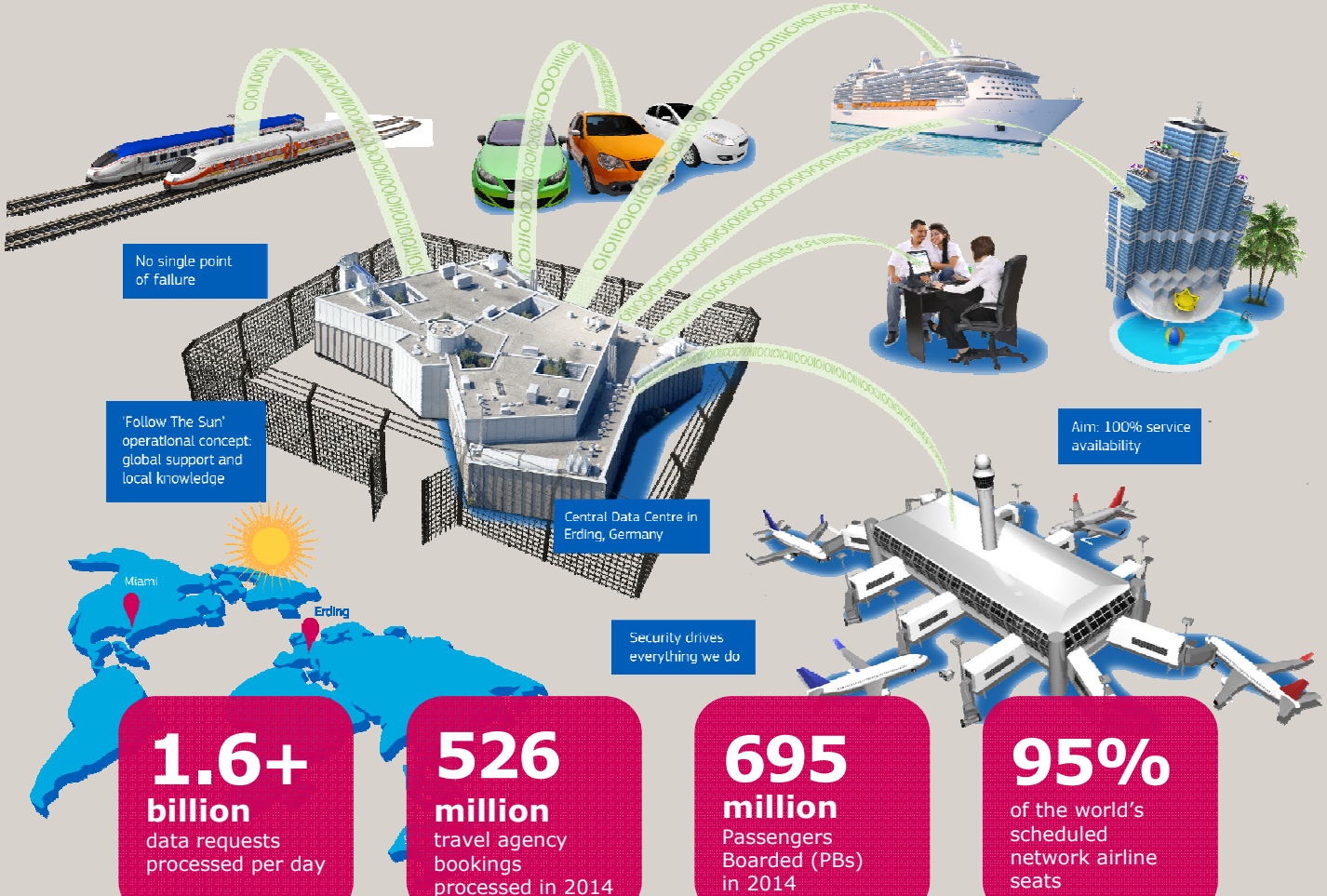
Robust global operations



1.6+ billion data requests processed per day

526 million travel agency bookings processed in 2014

695 million Passengers Boarded (PBs) in 2014

95% of the world's scheduled network airline seats

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2 MongoDB at Amadeus

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Business needs

Gathered from customers

user-friendly way to **query any data**
in our main operational databases

- **Unpredictable** ad-hoc search
- Many **advanced reporting** requirements

A way to store orders of magnitude more different data from various sources, but still maintain **low latency and high throughput**

Sustain Organic growth of data and throughput (time-to-time 2X or more a year) without degradation

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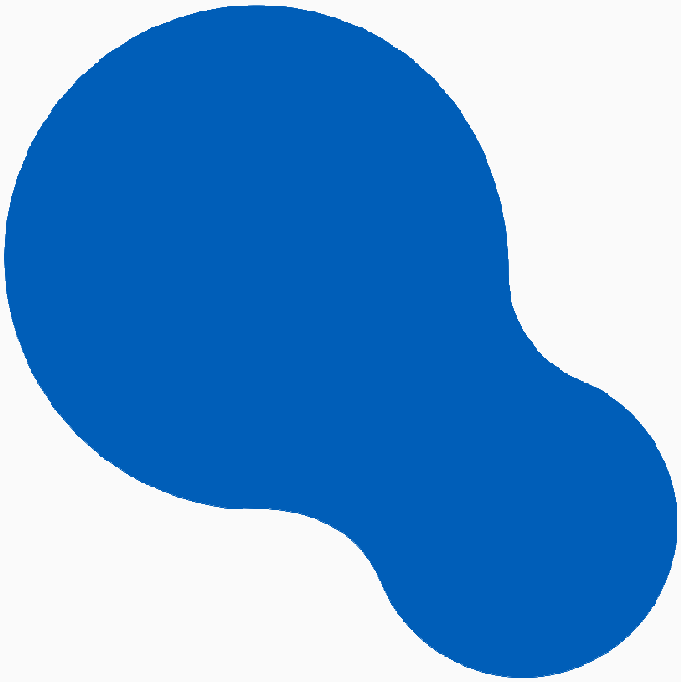
Integration

In the Amadeus standards



Runs on **standard x86 architecture**

C++, **Python** & Java **drivers**

Enterprise-grade **security**

- **SSL** encryption
- **Kerberos** authentication
- **Data-at-rest encryption**
- **Advanced tooling for backup and monitoring**
- **Enterprise support**

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Considered alternatives

To MongoDB

Oracle

Mounting all data in memory is **irrelevant** for **cost** & **hardware** reasons: 90TB for our biggest prospect.

MySQL cluster

Technical & functional **limitations**, **complex** to implement & maintain.

Impala

Still **young**, with a **steep learning curve.**

Distributed data analysis not exactly matching our use-case.

Couchbase

Slightly behind MongoDB for document search (**index mandatory**).

N1QL not finalized.

Key-value store not exactly matching our use-case.

Crescando

Amadeus in-house R&D database engine (**index-less**, **main-memory only**, partitioning data at CPU core level).

Project terminated.

2 First Use-case

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Passenger Revenue Accounting

What for?

Revenue of a flight ticket is **shared**

- Travel agent
- Governments
- Airlines: many can be involved (marketing & operating)

Amadeus Revenue Accounting handles cash flows **on behalf of airlines**

- Tracking
- Error handling & optimisation
- Reporting: analysis & audit

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Business needs

Gathered from a launch partner

One of our launch partners is a **large European airline**

- transporting **35m+ passengers** a year
- **key player** in the revenue accounting industry

Migrating

- from their **in-house** data warehouse
- to our **cloud-based** solution

They requested a **user-friendly way** to **query any data** in our main operational database

- **Unpredictable** ad-hoc search
- Many **advanced reporting** requirements

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Metadata Search

The main promises

- **Graphical** user interface
  edit, import, save & share queries
- **Data warehouse**
  fed in **real time**
  4 years history (**500m+ documents**, versioned)
- **Interactive** response times
- Search further using
  chained queries (patent pending)

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Expecting fast answer

to unpredictable queries

No index, no hint *(almost)*

- Fields to be scanned **unknown**
- **Main-memory full scans** to decrease response time

Need to **scale out**
for **sustainable performances**

Support **mainstream SQL DML** statements

- Aggregation
- Cross-column comparison, Boolean logic
- Sort

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Project milestones

And possible impacts

November **2013** **User acceptance** testing

December **2014** Migration & parallel running **validation** on **production**

Summer **2015** **Production cut-over**

Post **cut-over** **SLA** & **optimisation** based on **usage statistics**

Any **delay** or **functional gap** may
impact the whole project
as application is used to **validate**
migration and parallel running phases.

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Production response times

And their lessons learnt

Full scan aggregation is **CPU-bound**, with a **fixed entry cost** for unwinds.

- **no** unwind **3s**
- **unwinds** on 1, 2 or 3 levels **70s**

Interactive response times promise is complied with on **basic use-cases**

In the **absence of concurrency**, response times are **consistent** across all tests.

Indexes have a **linear impact** on response times.

Complex query with 4 match criteria

- **full scan** **100s**
- **index**, 40% selectivity **40s**

Complex query with 4 match criteria, including field-on-field comparison

- **full scan** **190s**
- **index**, 40% selectivity **70s**
- **index**, 75% selectivity **145s**

Position of the **match operator** in the aggregation pipeline can **impact index usage**.

3 One other Use-case

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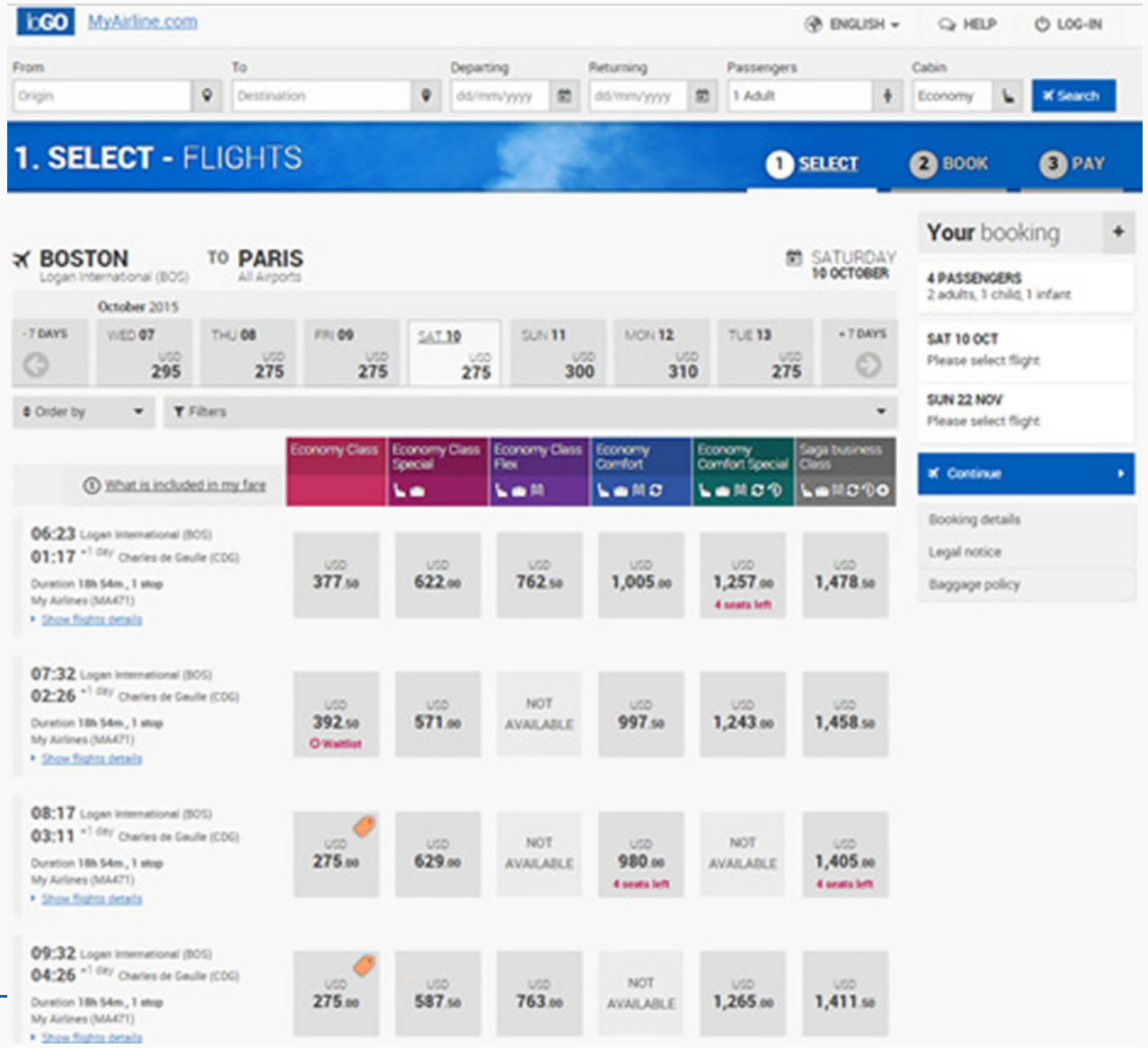
MyAirline.com
ENGLISH
HELP
LOG-IN
From
Origin
To
Destination
Departing
dd/mm/yyyy
Returning
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Passengers
1 Adult
Cabin
Economy
Search
1. SELECT - FLIGHTS
1 SELECT
2 BOOK
3 PAY
BOSTON
Logan International (BOS)
TO PARIS
All Airports
SATURDAY
10 OCTOBER
October 2015
-7 DAYS
WED 07 USD 295
THU 08 USD 275
FRI 09 USD 275
SAT 10 USD 275
SUN 11 USD 300
MON 12 USD 310
TUE 13 USD 275
+7 DAYS
Order by
Filters
What is included in my fare
Economy Class
Economy Class Special
Economy Class Flex
Economy Comfort
Economy Comfort Special
Saga business Class
06:23 Logan International (BOS)
01:17 +1 day Charles de Gaulle (CDG)
Duration 18h 54m, 1 stop
My Airlines (MA471)
Show flights details
USD 377.50
USD 622.00
USD 762.50
USD 1,005.00
USD 1,257.00
4 seats left
USD 1,478.50
07:32 Logan International (BOS)
02:26 +1 day Charles de Gaulle (CDG)
Duration 18h 54m, 1 stop
My Airlines (MA471)
Show flights details
USD 392.50
Waitlist
USD 571.00
NOT AVAILABLE
USD 997.50
USD 1,243.00
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08:17 Logan International (BOS)
03:11 +1 day Charles de Gaulle (CDG)
Duration 18h 54m, 1 stop
My Airlines (MA471)
Show flights details
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NOT AVAILABLE
USD 980.00
4 seats left
NOT AVAILABLE
USD 1,405.00
4 seats left
09:32 Logan International (BOS)
04:26 +1 day Charles de Gaulle (CDG)
Duration 18h 54m, 1 stop
My Airlines (MA471)
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USD 587.50
USD 763.00
NOT AVAILABLE
USD 1,265.00
USD 1,411.50
Your booking
4 PASSENGERS
2 adults, 1 child, 1 infant
SAT 10 OCT
Please select flight
SUN 22 NOV
Please select flight
Continue
Booking details
Legal notice
Baggage policy

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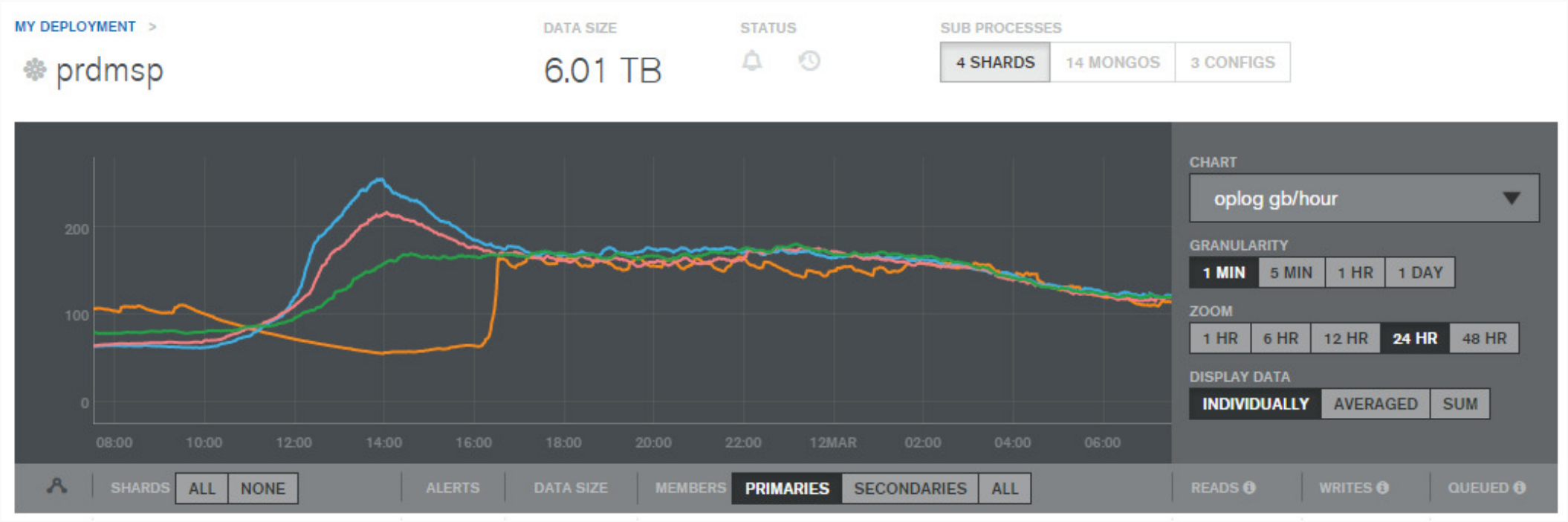
MY DEPLOYMENT >
prdmsp
DATA SIZE
6.01 TB
STATUS
SUB PROCESSES
4 SHARDS
14 MONGOS
3 CONFIGS
200
100
0
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
12MAR
02:00
04:00
06:00
CHART
oplog gb/hour
GRANULARITY
1 MIN
5 MIN
1 HR
1 DAY
ZOOM
1 HR
6 HR
12 HR
24 HR
48 HR
DISPLAY DATA
INDIVIDUALLY
AVERAGED
SUM
SHARDS
ALL
NONE
ALERTS
DATA SIZE
MEMBERS
PRIMARIES
SECONDARIES
ALL
READS
WRITES
QUEUED

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4 Future plans

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~10 use-cases running currently
So far no showstopper issues identified

We still miss some features:

- Cross cluster replication
  - Filtered / delayed / batched
- Multimaster (AP operation)
- Multithreaded queries
- Transactions
  - On multi update

Thank you!
Questions?

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