data science and enterprise engineering

how data scientists and engineers work in tandem to achieve real-time personalization at overstock.com

overstock

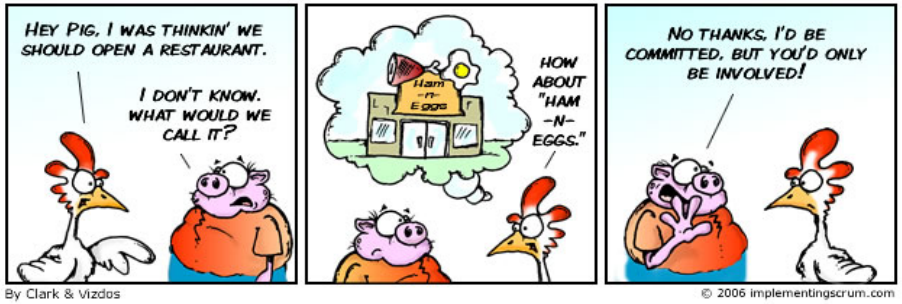
- pushing boundaries of retail since 1999
- Midvale, Utah
- 5 million unique products for sale
- billions of visits and page views
- 160+ countries

overstock marketing dev

remember animal farm?

team in the beginning.....

- pigs
  - data science team – 3 data scientists
  - engineering team - 2 developers, 1 QA, and a product owner
- chickens
  - plenty of business owners
  - lots of channel managers



overstock marketing dev

the problems we were up against

- data scientists were not working with the business to solve business problems
- engineers were not working with data scientists
- engineering was in a relational data mindset
- not regularly delivering business value
- solving yesterday's problems - today

days
minutes
seconds

business problem

This is where I add text. If I want it to keep going, it looks like this.

1st problem we came together to solve

- **real-time bidding** (RTB) is a means by which **advertising** inventory is bought and sold on a per-impression basis via real-time bidding, similar to financial markets
  - low-latency operation – need to bid >10ms
  - pre-compute scores nightly
  - push scored to cache in AWS
  - partnered with Bees Wax
  - replace existing 3rd party partners

problem to solve

This is where I add text. If I want it to keep going, it looks like this.

propensity to purchase

- identifying unique patterns and tendencies that indicate a user is ready to purchase
  - **user score**: represents a customer's likelihood of purchase
  - collected at the visit/user level
  - basic steps
    - turn raw user interactions into 'features'
    - train classifiers on months of data with label = purchase vs. no purchase
    - predict on new users/visits

challenges

data science

class imbalance

- **many new customers**
  - billions of unique page views in a calendar year
  - many users we are seeing for the first time (potentially)
- **low conversion**
  - a small percentage of sessions end in a purchase
  - sparse web logs mean we have to digest an enormous amount of data to generate useful features
- **we are interested in accuracy on the positive label**
  - recall over precision

challenges

what the team was up against

- **Constraints with current infrastructure and processes**
- **used to pulling data instead of streaming it**
- **data scientists are a scarce resource**
  - working on many non-relative tasks
  - not a lot of experience with the care and feeding of enterprise software
  - a bit set in the academia mindset

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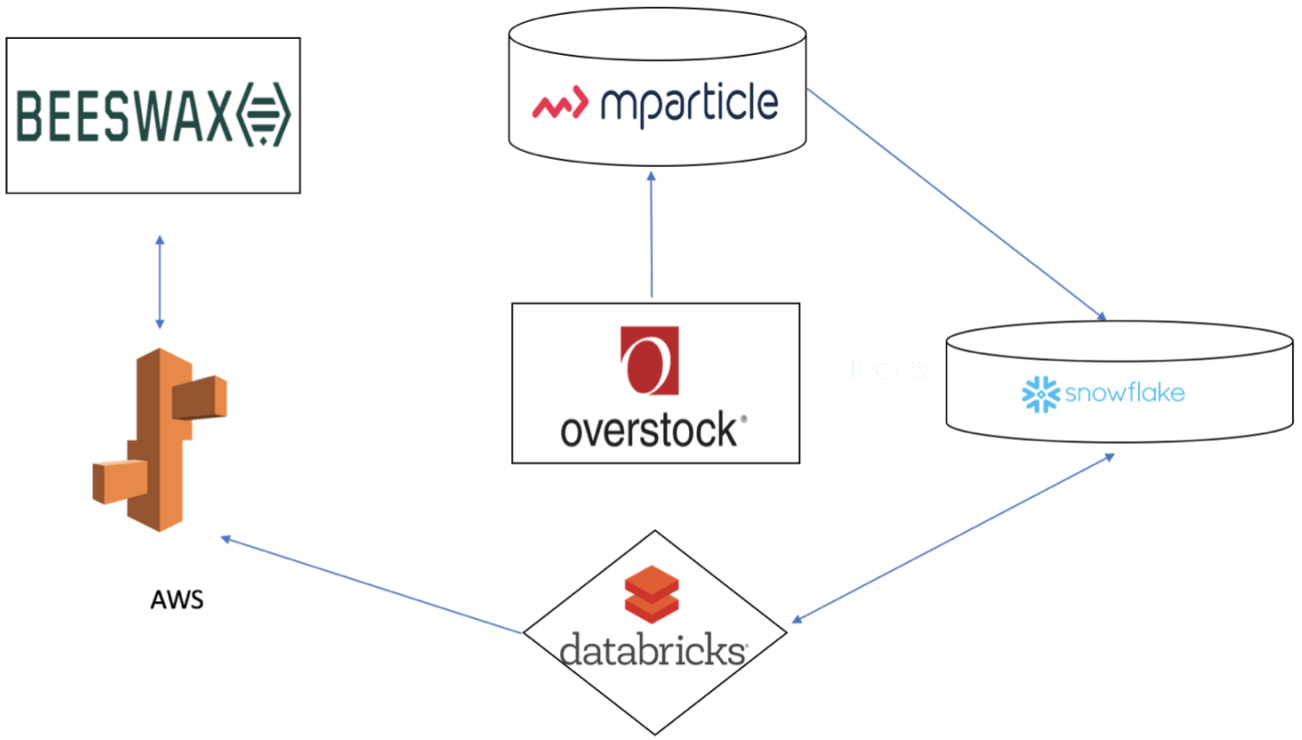

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recap

Faster Scotty

what we accomplished in 6 months

- we were solving today's problems... by the end of the day
- engineering was thinking about streaming data
- had the pieces in place to start scoring users in minutes

days
minutes
seconds

business challenges

data science + engineering

needed to move faster

- score users faster
  - moved from daily to hourly
- picked up a fraud project
  - assign fraud score within 5 mins

challenges

data science + engineering

moving from daily batches to more regular micro-batches

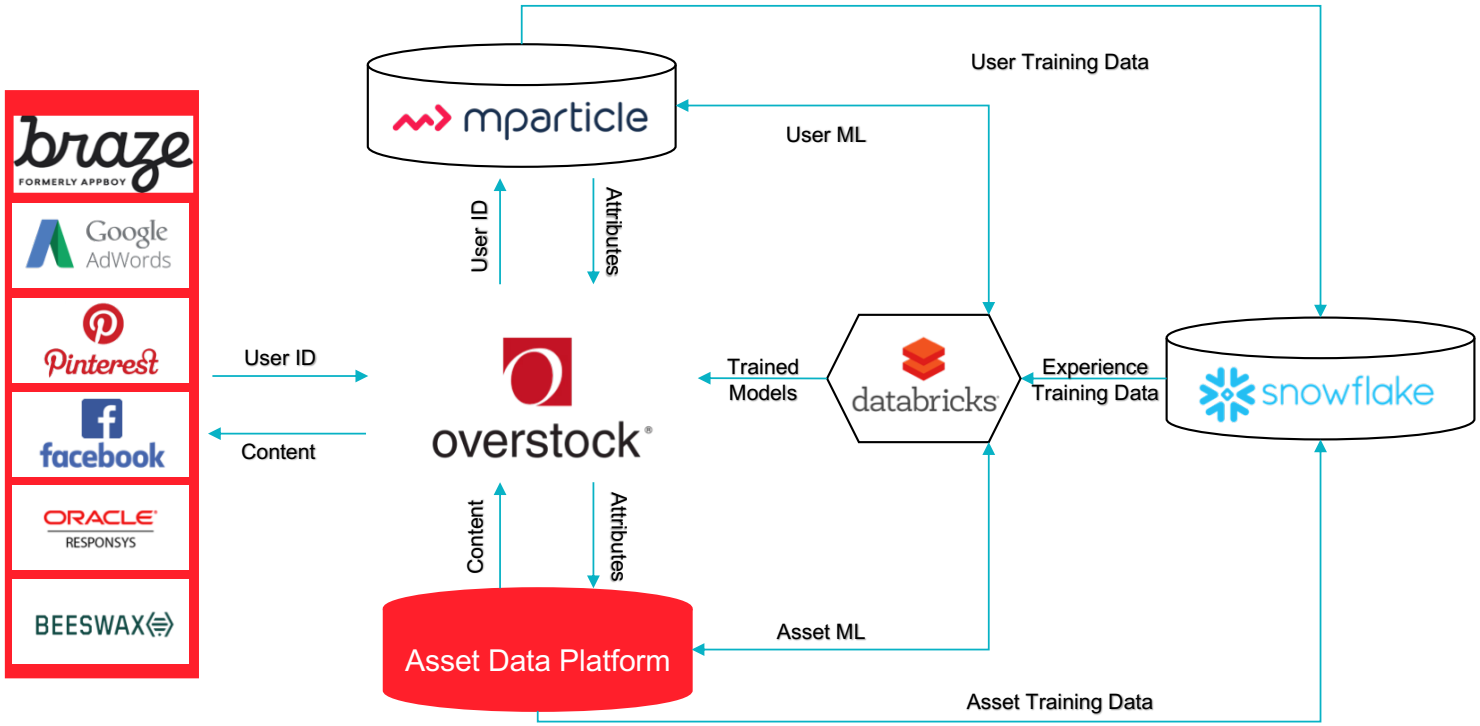
- **hourly jobs**
  - much more responsive scoring = larger server footprint
  - can still train offline in batch, but must have pipelines better tuned.
- **every 5 minutes**
  - ETL must be tightly honed
  - at this point you hit the edge of what is possible in the batch setting
  - feedback loops become critical for success

challenges

business vs engineering

balancing business goals with enterprise engineering

- as adoption increases visibility increases
  - need standardized data representations
  - have to make sure architecture is hardened and robust
  - need fail-safe mechanisms for critical processes
- MOST IMPORTANT
  - you can never, ever slow down overstock.com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overstock
Trained Models
databricks
Experience Training Data
snowflake
Content
Attributes
Asset Data Platform
Asset ML
Asset Training Data

recap

data science + engineering

needed to move faster

- what was accomplished in 6 months
  - fraud scores in a minute or less
  - users were being scored in a minute
- what was left
  - still not fast enough for real time personalization on overstock.com

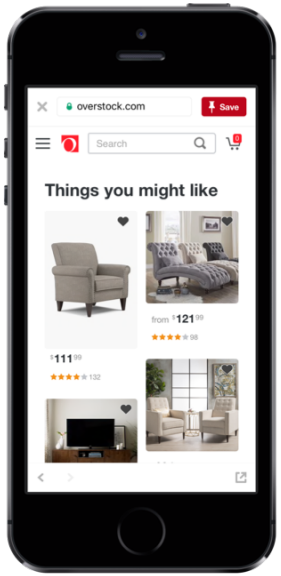
days
minutes
seconds

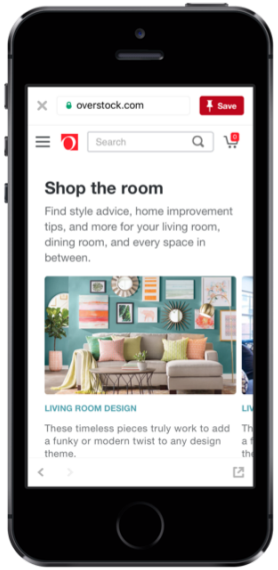
business problem

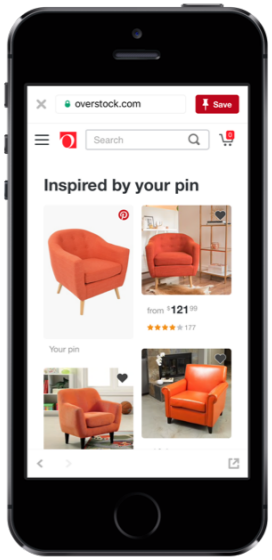
This is where I add text. If I want it to keep going, it looks like this.

near real-time personalization on the shopping site

- **near real-time personalization on overstock**
  - putting custom recs in front of the user.
  - can't slow the site down







overstock

challenges

data science +
engineering +
business

from micro-batches to near real-time

- near real-time can limit the size of models and complexity of calculations
  - we aren't trading stocks, we sell home goods
- we may not know much about a user we are trying to personalize for
  - what can you personalize for a new user as they initially interact with your site
    - heuristics moving towards full models

challenges

data science +
engineering +
business

from micro-batches to near real-time

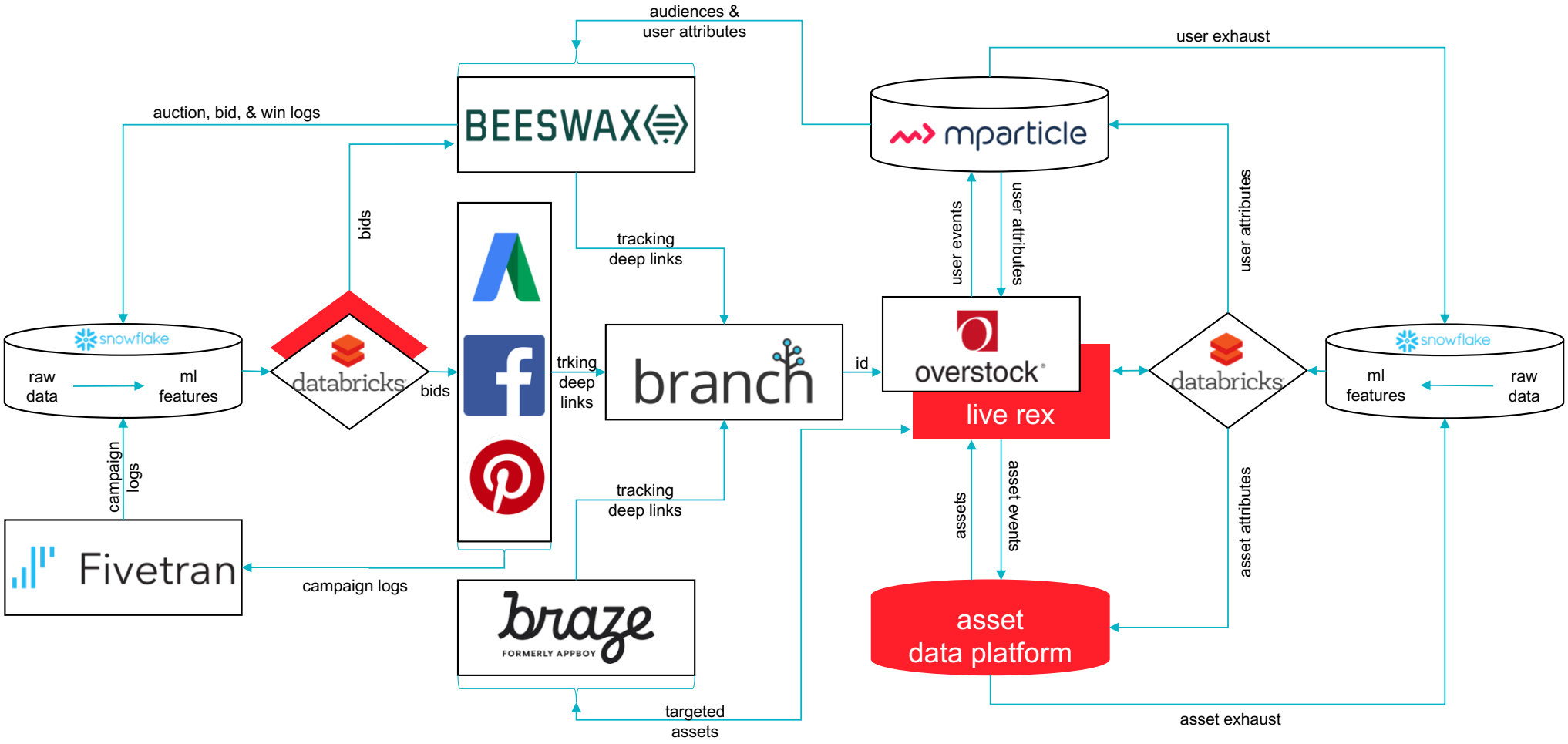
- real-time data flow requires rea-time analytics and strategy
  - introspection into processes becomes critical
  - must have automated process control to prevent algorithms from running wild
  - empower business owners to operate strategically without suffering from information overload

challenges

data science +
engineering +
business

from micro-batches to near real-time

- every piece of the process needs to function as a cohesive flow
  - do we need to wait for the data to get there, then act (fraud?)
  - or act on the data we have (recommendations for a shopping site)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recap

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business

what was done and undone

- still not quite to near-real-time/low-latency recs for shopping site
- fraud score and email recommendations are fast enough

where we are going

data science +
engineering +
business

roadmap

- page-less personalization
- deep learning for fraud
- balancing real-time needs with efficient gains

We all need to be daring and collaborative to accelerate innovation!

take always

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business

lessons learned

- the cloud presents a whole new set of problems
- tech is hard, politics are harder
- we can’t operate in silos
- we must be aligned with the business
- the process must be iterative

questions?

and of course, we are hiring!

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