



Payments for platform businesses.



Leveraging Big Data For Payment Risk Management

John Canfield,
VP Risk Management, WePay
@JCRisk

June 11, 2014

Outline

1. Payments opportunity for the bottoms-up economy

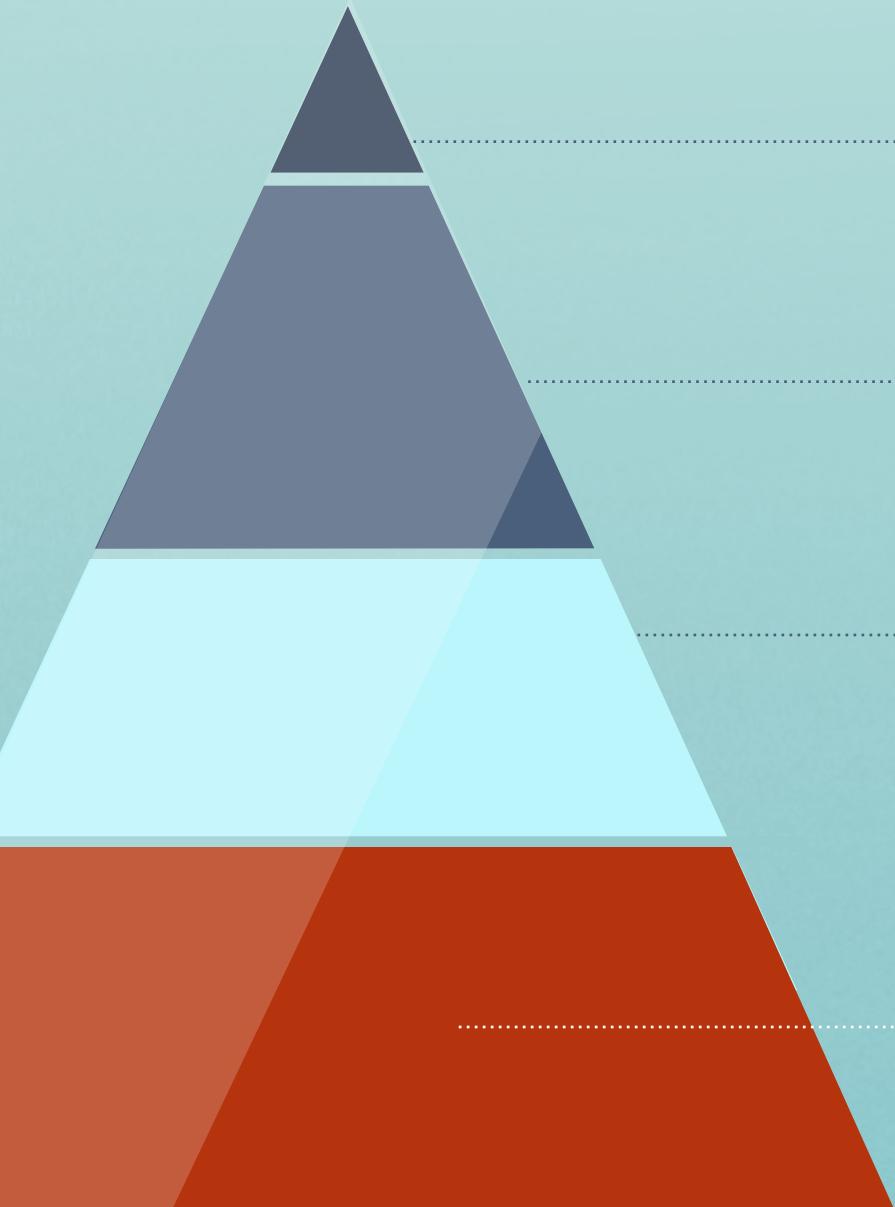
2. Requirements

3. Solution

- a) Big data collection
- b) Decisioning using machine learning, rules, and expert staff
- c) Metrics and feedback



What is the “Bottom Up” Economy?



Big Businesses (Enterprise)

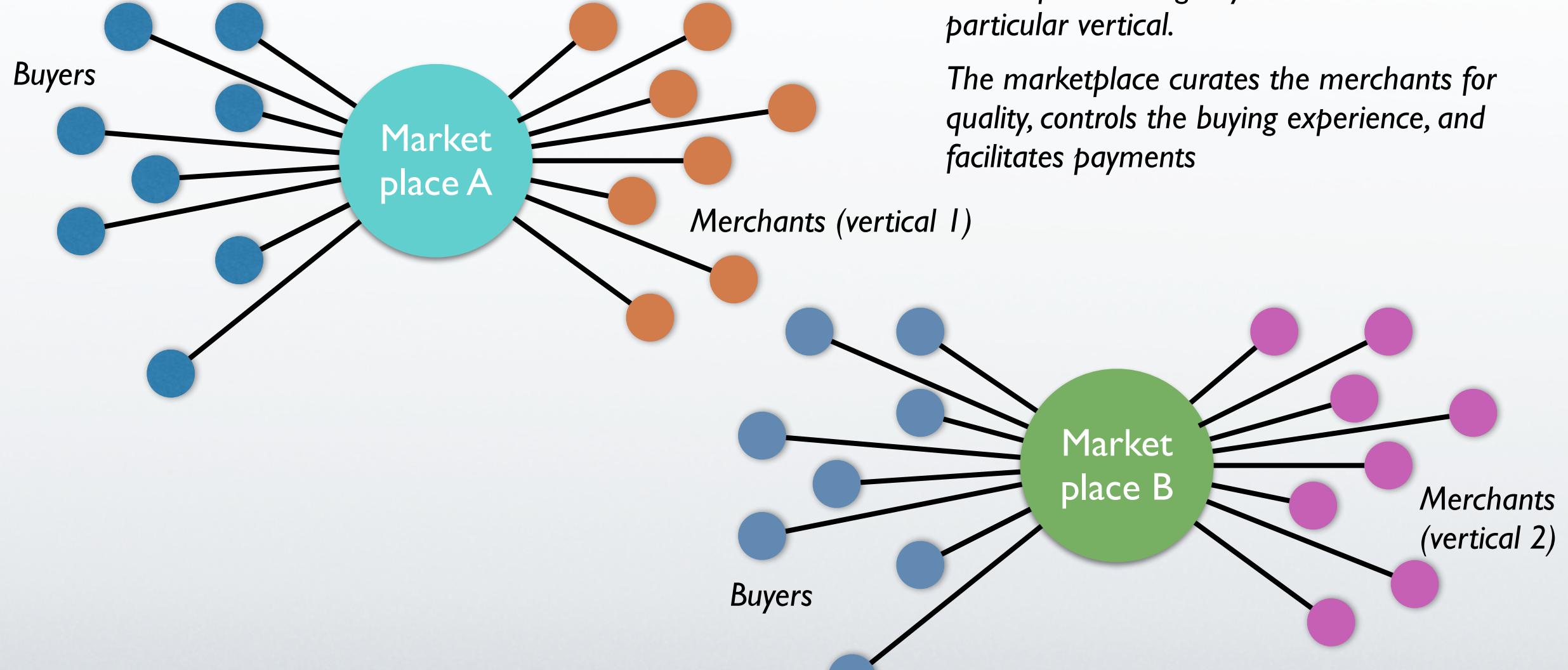
Medium-sized Businesses

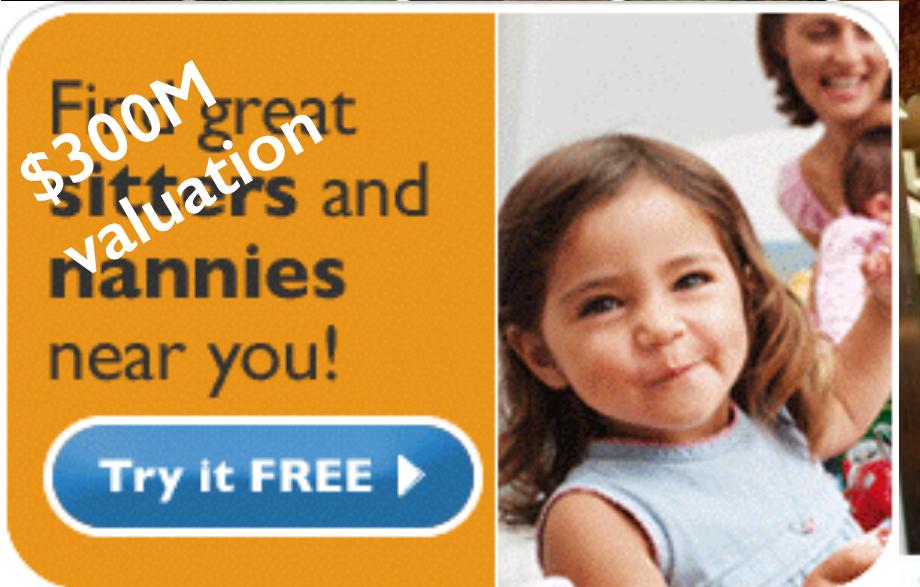
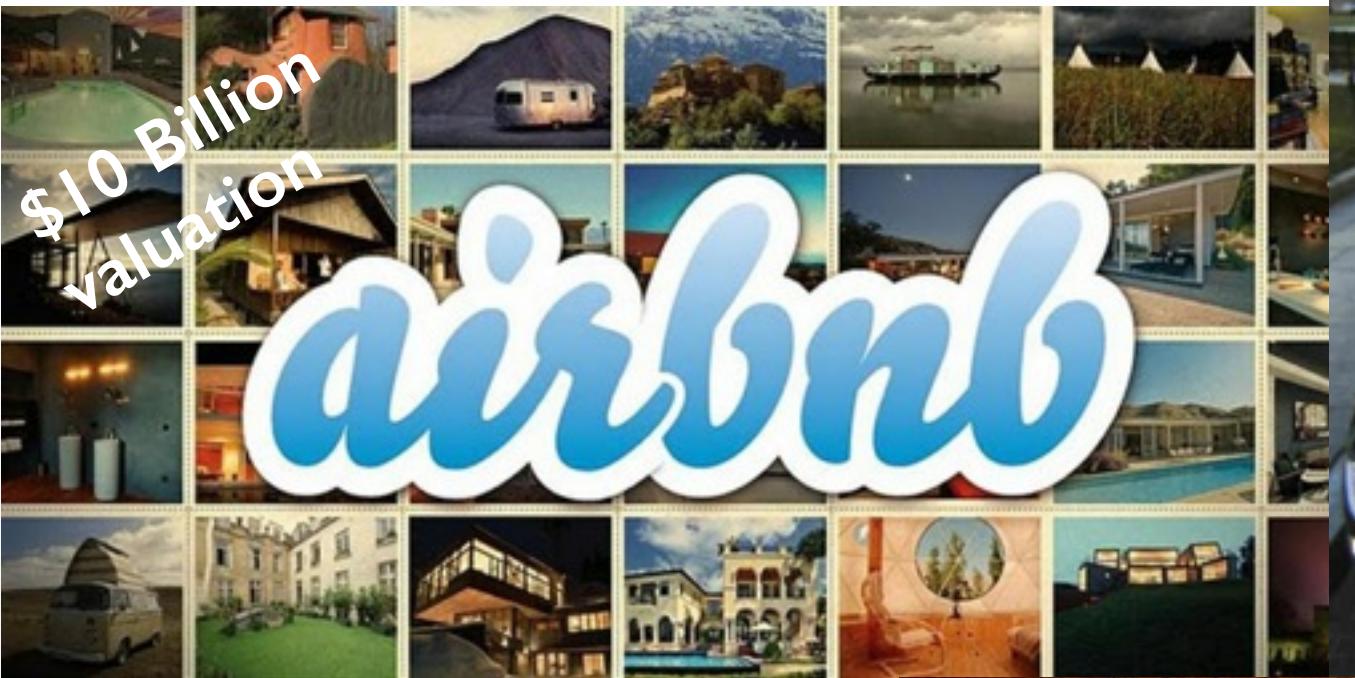
Small Businesses

Bottom Up
Economy

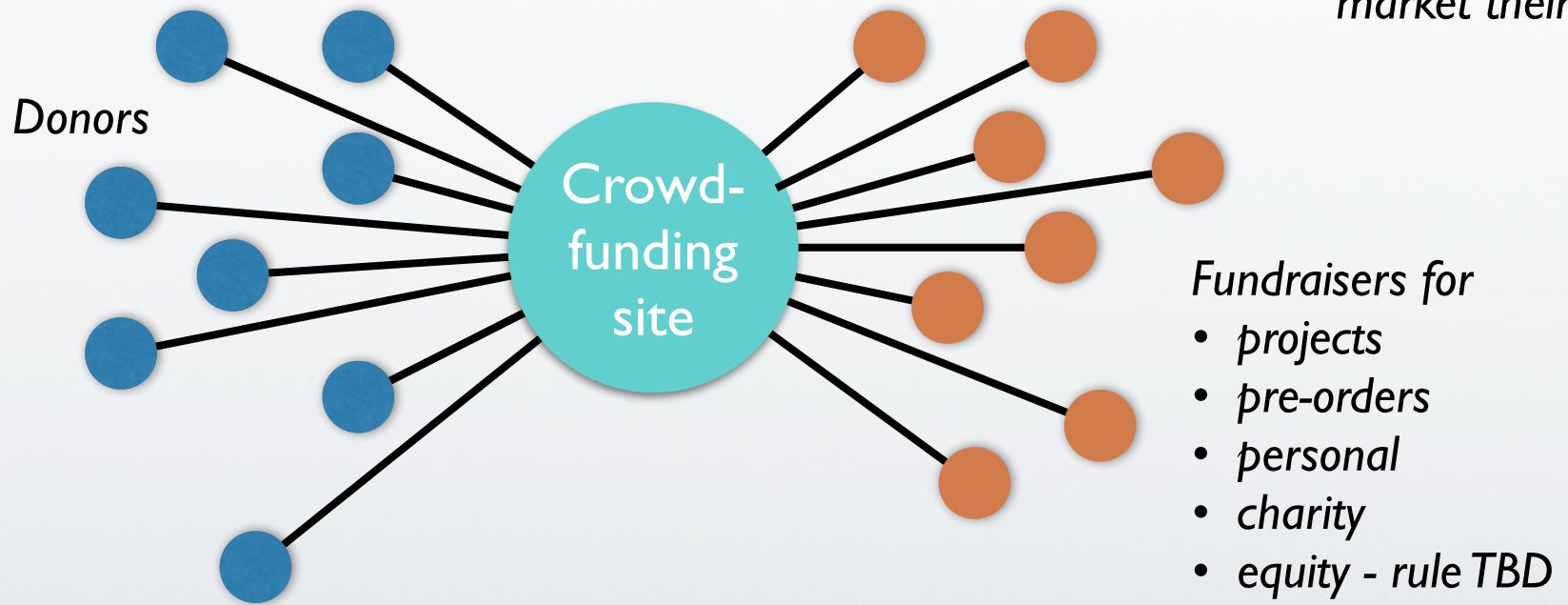
- ▶ According to IRS data, there are over 25 million businesses in the United States with less than 5 employees.
- ▶ They collectively take in over \$2 trillion annually - a tremendous opportunity for electronic payment conversion.
- ▶ Services (non-retail) is most of the market: 22m businesses & \$1.7 trillion in income.

Marketplaces





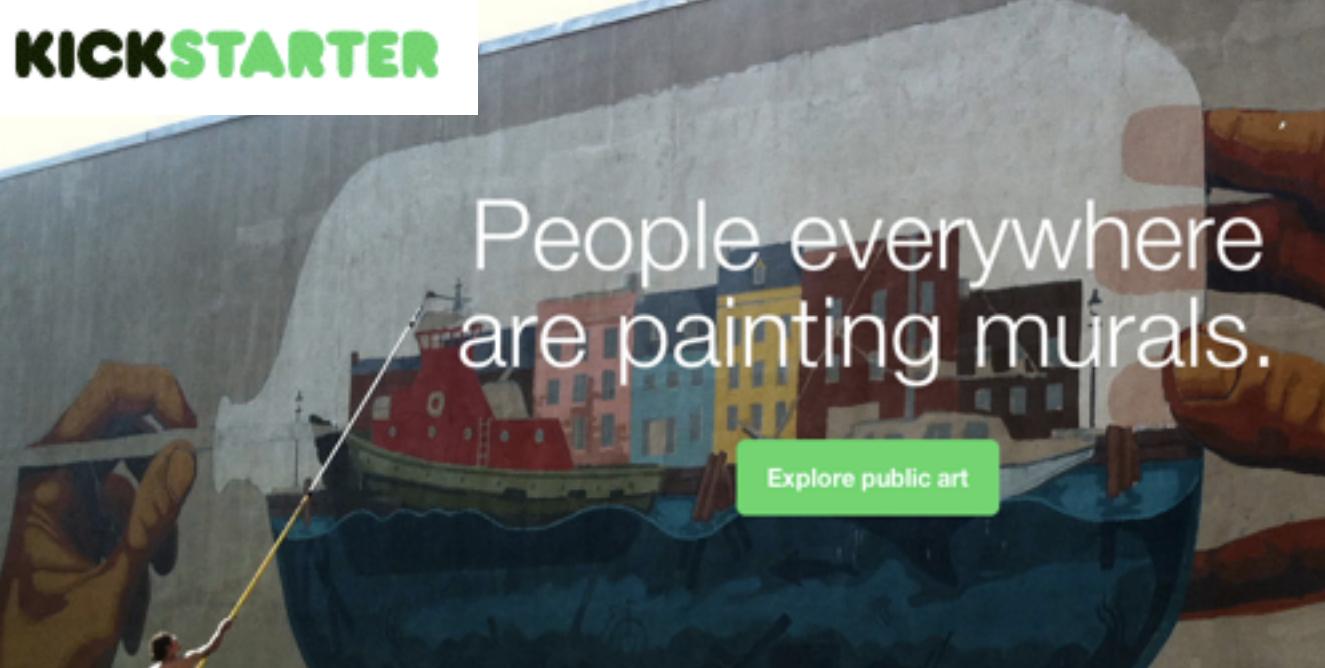
Crowdfunding sites



Crowdfunding sites are similar to marketplaces but instead of bringing buyers to sellers, they bring donors to fundraisers.

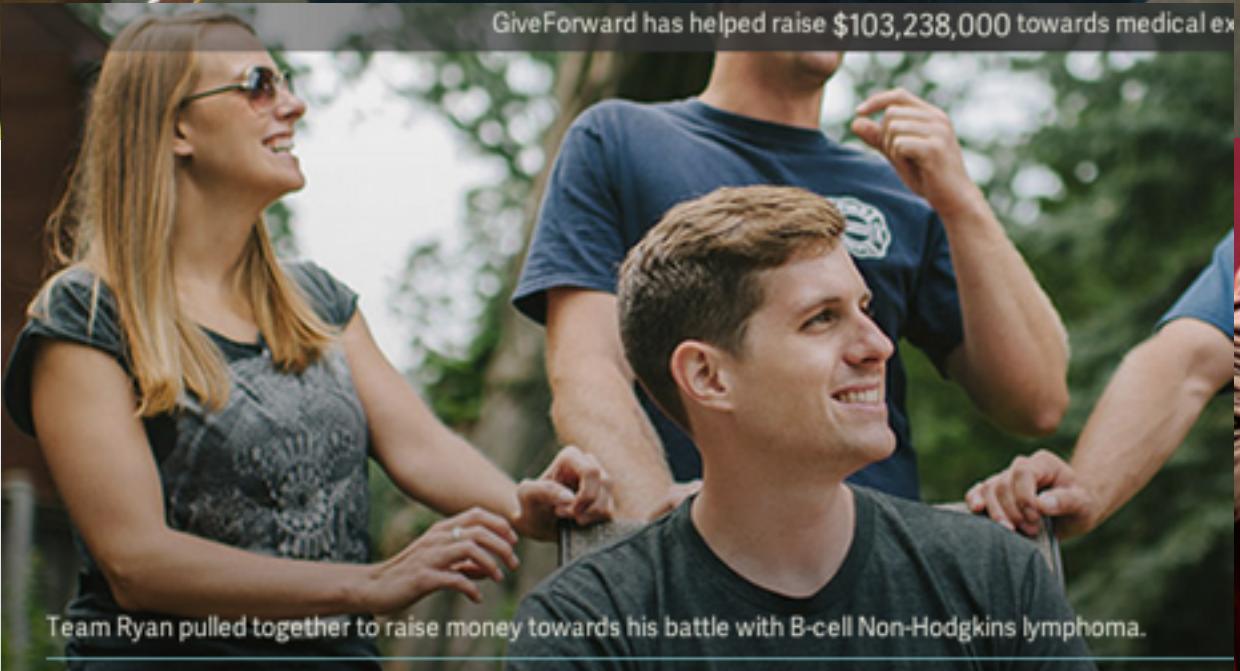
The crowdfunding site enables the fundraiser to market their campaign and accept payments

KICKSTARTER



People everywhere
are painting murals.

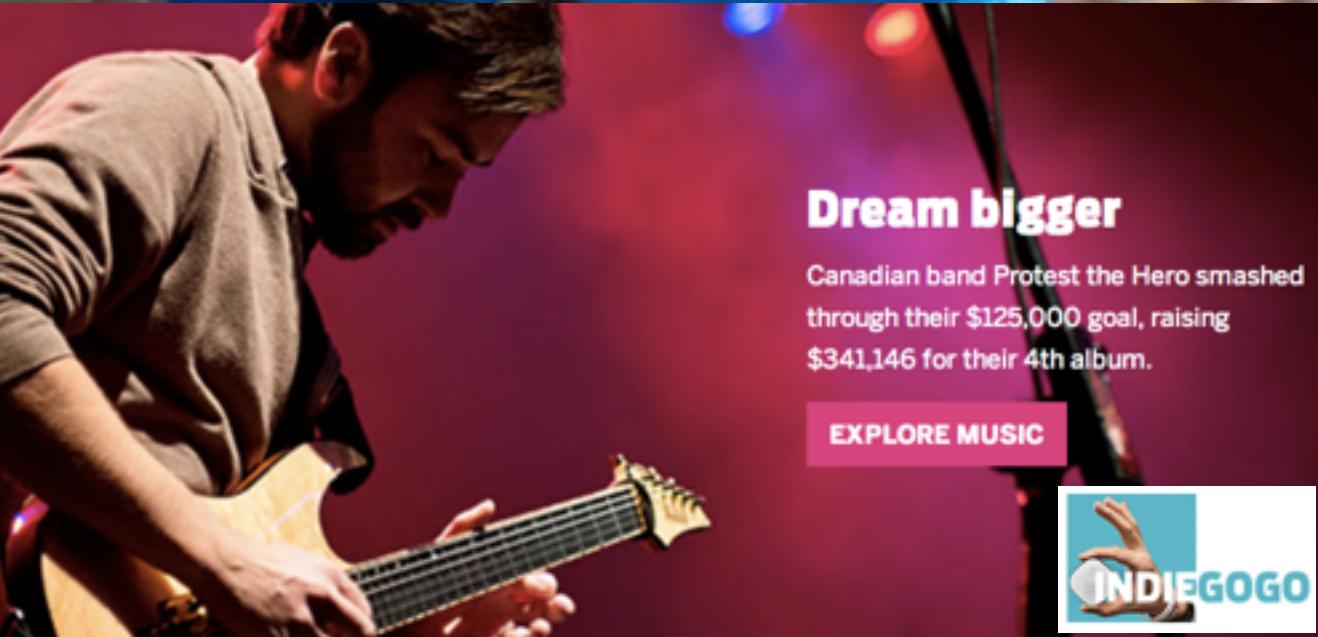
[Explore public art](#)



GiveForward has helped raise \$103,238,000 towards medical ex

Raise more money on GiveForward.

 **crowdrise**



Dream bigger

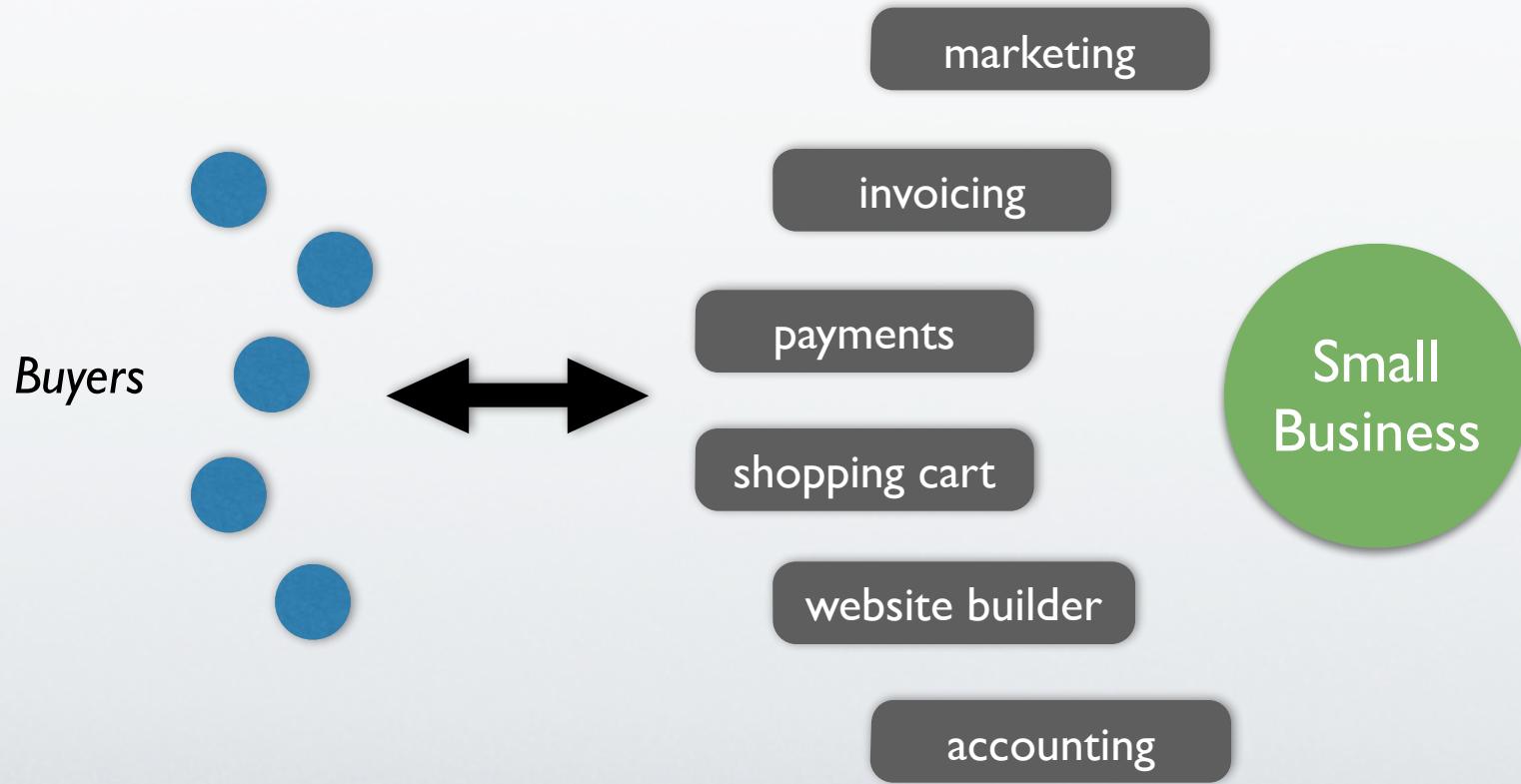
Canadian band Protest the Hero smashed through their \$125,000 goal, raising \$341,146 for their 4th album.

[EXPLORE MUSIC](#)



Small Business Platforms

Small business platforms offer online services to small businesses like marketing, invoicing, shopping cart, accounting and payments

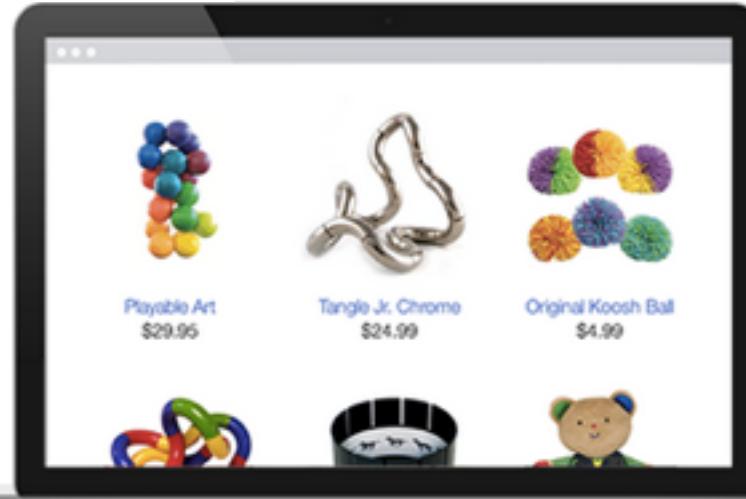


iPod 5:22 PM

invoiceASAP

- Invoices >
- Estimates >
- Sales Receipts >
- Customers >
- Reports >
- Manage Account >

YAHOO! SMALL BUSINESS



LabStar
Cloud-Based Dental Lab Software

FRESHBOOKS
cloud accounting

Home People Invoices Estimates Expenses Time Tracking Reports More

Invoices Recurring Received Items Payments

Invoice paid in full on November 19, 2012.

Invoice: 0000001

nickberlett
3/22 Home St
Eskewwick
MELBOURNE VIC 3185

James Burf
Level 3/22 Home St
Eskewwick
MELBOURNE VIC

Tax Invoice # 0000001
Tax Invoice Date November 19, 2012
Amount Due \$0.00 AUD

© 2014, W...

Requirements

Traditional payments do not work for bottoms-up economy

Long application form + day/weeks to approve + approval difficult for individuals

The form includes the following sections:

- Business Information:** Merchant's BBA Name, Physical Street Address, City, State, Zip, DBA Name, DBA Phone, Contact Name, Merchant Contact Person, Merchant's Legal Name, Legal Address, City, State, Zip, Corp Phone, Contact Name, Corp Email.
- Merchant Profile:** Number of locations, Type of Ownership (Sole Proprietor, Partnership, Corporation, Tax Exempt (501C), LLC, Professional Assoc.), Type of goods or service sold, Years in business under current ownership, Corporate Tax ID#.
- Annual Visa/MasterCard/Discover Sales:** Sales by Month, Sales by Product Category, Sales by Service Category.
- P.O.D. Application:** Questions about P.O.D. terminals, software, and gateway applications.

Poor conversion rate for micro-businesses and fundraisers

Payments requirements for bottoms-up economy

- Easy and fast merchant onboarding
- Underwrite individuals or micro-businesses with little or no traditional business history
- Prevent collusion and takeover fraud

Fraud threats are everywhere

Information Week

Target Confirms Hackers Stole 40 Million Credit Cards

The New York Times

Neiman Marcus Data Breach Worse Than First Said

The New York Times

Michaels Stores' Breach Involved 3 Million

The Register

Krebs: Lexis-Nexis, D&B and Kroll hacked

CyberSource Online Fraud Report

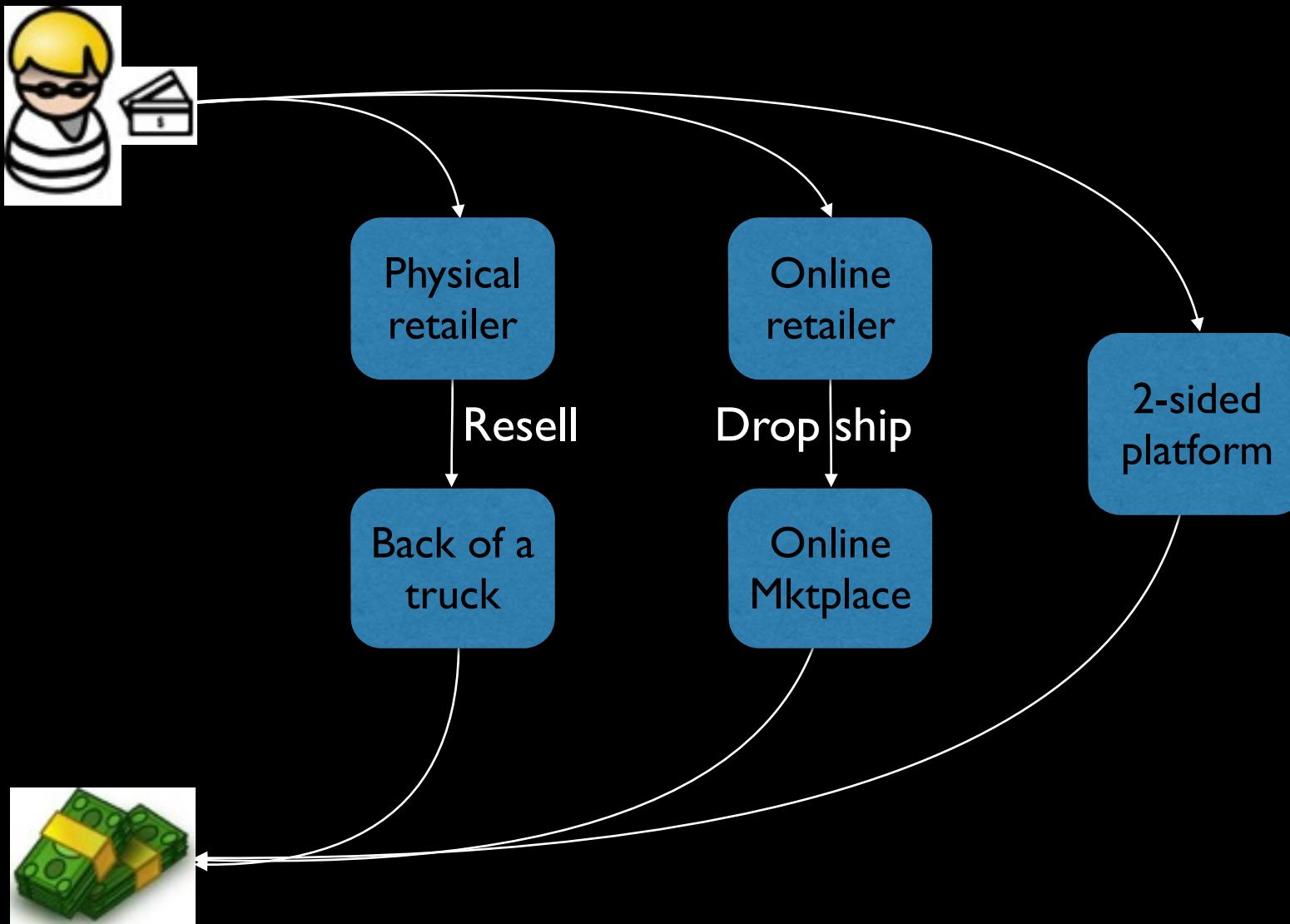
Estimated \$3.5 Billion Lost to Online Fraud

Entrepreneur,

April 18 2014

Online Debit, Credit Fraud Will Soon Get Much Worse. Here's Why.

Fraudsters want to monetize their stolen cards



Solution outline

1. Lots of risk data from many sources

- a) What data
- b) How to collect
- c) What infrastructure

2. Multi-level risk decisioning

- a) Machine learning
- b) Rules
- c) Manual

3. Metrics & feedback

Data

Data approach

data

- Predictive of loss / fraud
- Compliance
- More data is better if you have scalable data arch and decisioning
- No silver bullet, so move towards big data

Know-Your-Customer (KYC) checks

data

Tell us more about you
This is used to confirm that you're authorized to act on behalf of the organization listed above. [Learn more.](#)

Full legal name

Social security number

First name Last name 000-00-0000

Why do I need to provide this?

Date of birth

Month Day Year

PAYMENTS SECURED BY **WePAY**

Back

User

- Typical vendors:
- Experian
 - Equifax
 - Lexis Nexis
 - ID Analytics
 - IDology

Financial Admin Name	John Canfield
Financial Admin SSN	XXX-XX-[REDACTED]
Financial Admin DOB	10/28 [REDACTED]
Business Legal Name	Nimbler World, Inc.
Financial Admin Legal Personal Name	[REDACTED]
Business Tax ID	45474 [REDACTED]
Business URL	http://www.nimbler.com
Business Description	Developer of mobile transportation apps
Address	1350 Hull Drive, San Carlos, CA 94070, US
Phone	(650) 52 [REDACTED]
1099-K TIN Verified	<button>Mark Verified</button> <button>Mark Declined</button>

Traditional business credit reports

data

Risk Dashboard		
Risk Scores and Credit Limit Recommendation		Days Beyond Terms
Intelliscore Plus 1 HIGH RISK	Financial Stability Risk 3 HIGH RISK	Company DBT 55 Industry DBT: 16
Score range: 1 - 100 percentile		
Credit Limit Recommendation: \$20,400		

Business Facts		
Years on File:	5 (FILE ESTABLISHED 09/2008)	SIC Code: C
State of Incorporation:	CA	
Date of Incorporation:	08/14/2008	SUBDI

Risk Dashboard		
Risk Scores and Credit Limit Reocommendation		Days Beyond Terms
Intelliscore Plus 75 LOW-MEDIUM RISK	Financial Stability Risk 83 LOW RISK	Company DBT 0 Industry DBT: 4
Score range: 1 - 100 percentile		
Credit Limit Recommendation: \$53,300		

Risk Dashboard		
Risk Scores and Credit Limit Recommendation		Days Beyond Terms
Intelliscore Plus Score unavailable. Information on file not proven to predict serious future risk.	Financial Stability Risk Score unavailable. Information on file not proven to predict financial stability risk.	Company DBT DBT Unavailable
Credit Limit Recommendation: N/A		

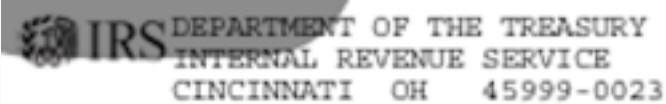
Business Facts		
Years on File:	2 (FILE ESTABLISHED 04/2012)	
State of Incorporation:	DE	
Date of Incorporation:	03/12/2012	
Business Type:	Institutions - Profit	

- Typical vendors:
- D&B
 - Experian
 - Equifax

vendor → API

Business Incorporation Docs

data



IT ONLINE TRAINING LLC
1621 CENTRAL AVE
CHEYENNE, WY 82001

WE ASSIGNED YOU AN EMPLOYER IDENTIFICATION NU

Thank you for applying for an Employer Identification Number.

Date

Employer
46-09

Form:

Number

For a
1-800

IF YO
STUB

Corp No. 583210

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES
— O —
CHARLOTTE AMALIE, ST. THOMAS, VI 00802

CERTIFICATE OF EXISTENCE

To All To Whom These Presents Shall Come:

I, GREGORY R. FRANCIS, Lieutenant Governor of the Virgin Islands do hereby certify that I am, by virtue of the laws of the Virgin Islands, the custodian of the corporate records and the proper officer to execute this certificate.

I further certify that the records of this office disclose that

vendor



API

User

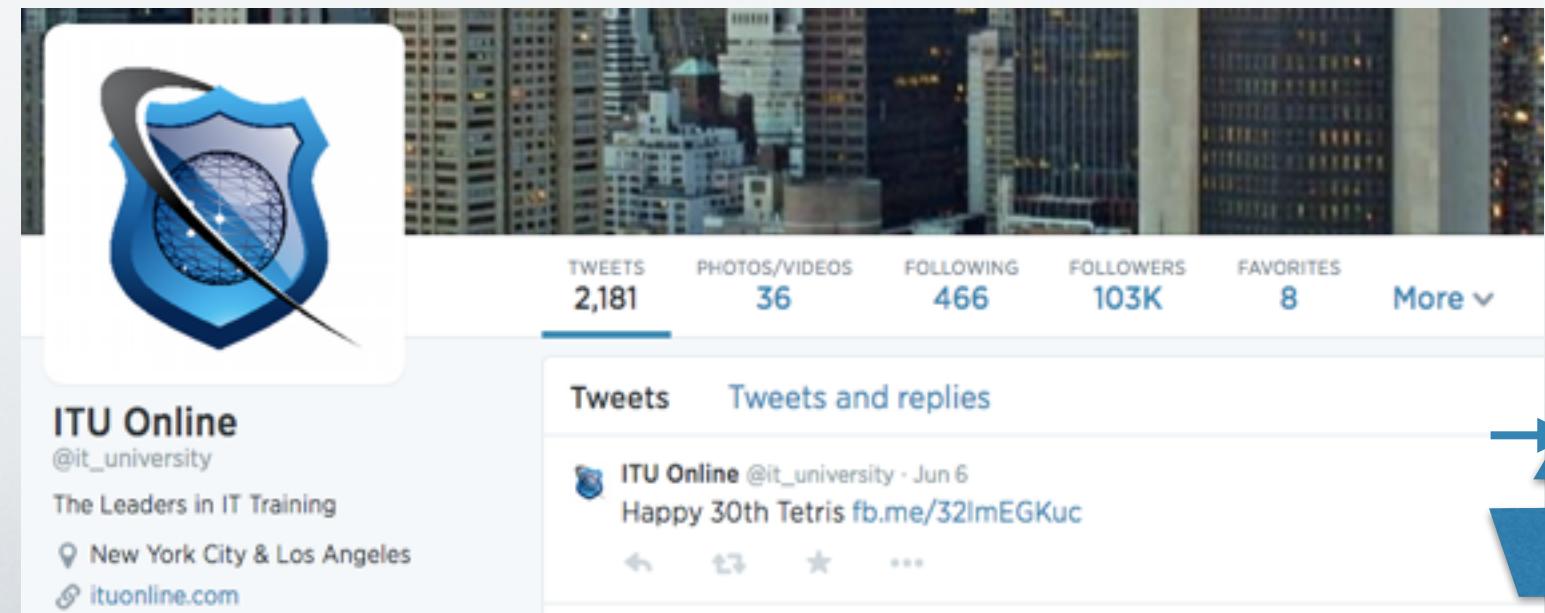
manual

Business social media

data



The screenshot shows the Facebook profile of 'ITU Online'. The cover photo is a blue globe with network lines. The page name is 'ITU Online' with 4.0 stars and 51 ratings. It has 133,276 likes, 104 people talking about it, and 132 people here. A status update says: 'Computer Training The best cert training you'll find online anywhere but priced so you can afford it. Our high volume of students means we can lower prices.' Below the status are links for 'About - Suggest an Edit', 'Photos', 'Reviews', and 'Likes'. The 'Likes' section shows a star icon with '4.0' and a thumbs-up icon with '133k'.



The screenshot shows the Twitter profile of 'ITU Online'. The profile picture is a blue shield with a globe and a stylized 'I'. The bio reads: 'The Leaders in IT Training' and includes locations 'New York City & Los Angeles' and a website 'ituonline.com'. The stats show 2,181 tweets, 36 photos/videos, 466 following, 103K followers, and 8 favorites. A link to 'More' is available. Below the profile, there are two tabs: 'Tweets' and 'Tweets and replies'. A recent tweet from 'ITU Online @it_university' on June 6, 2014, says: 'Happy 30th Tetris fb.me/32lmEGKuc'. To the right of the profile, there are two blue callout boxes: one pointing right labeled 'API' and another pointing down labeled 'manual'.

Editorial Reviews and Ratings

data



Planning Tools Vendors Forums Dresses Photos

Wedding Planners in Virgin Islands >



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Island Bliss Weddings

Planning Gorgeous Destination Weddings on St. John

102 Reviews

4605 Tutu Park Mall
Ste 133, PMB 150
St Thomas, VI 00802 | [map](#)

Website: [Visit my website »](#)

Blog: [Visit my blog »](#)

Services: Day-of Coordinator, Full Planning, Pa

Weddings: Civil, Destination, Double Weddin

[more details »](#)

[Profile](#) [Reviews \(102\)](#) [Photos](#) [Videos](#) [FAQ](#) [Blog](#) [Map](#)

This story is part of TRAVEL TIPS

Machu Picchu, Peru Escorted Tours Machu Picchu & Galapagos Tours Machu Picchu Tours I Lima

All-Inclusive Tours of Machu Picchu, Peru

TRAVEL TIPS by Sue Gabel, Demand Media

Amazing Peru

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THE INCAS

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(30)

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Telephone: 1-817-230-4971

Destinations: South America

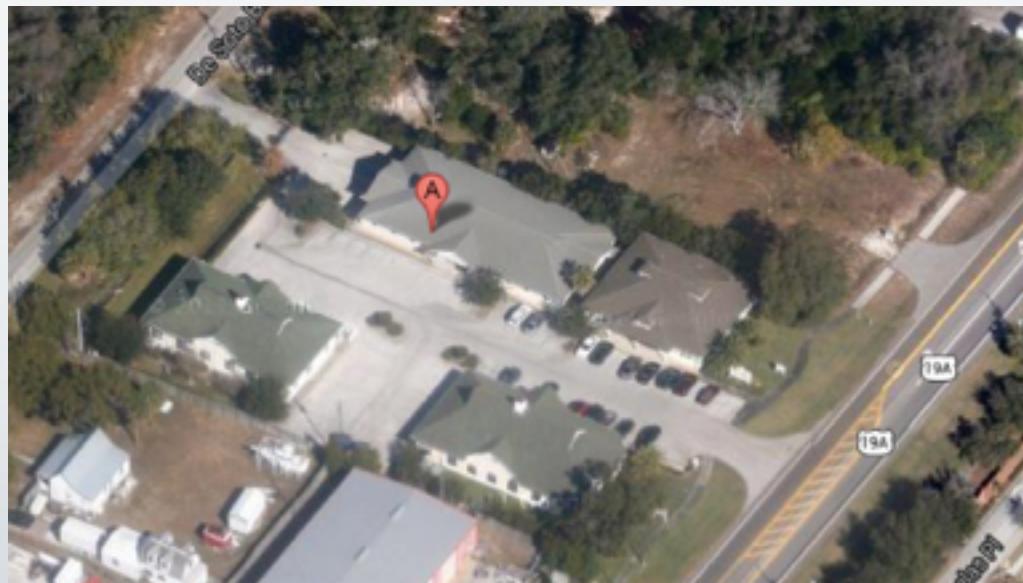
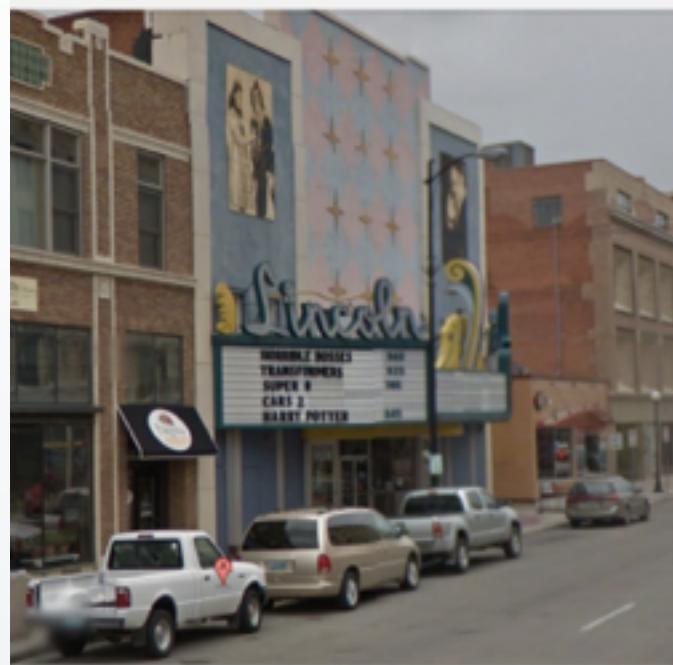
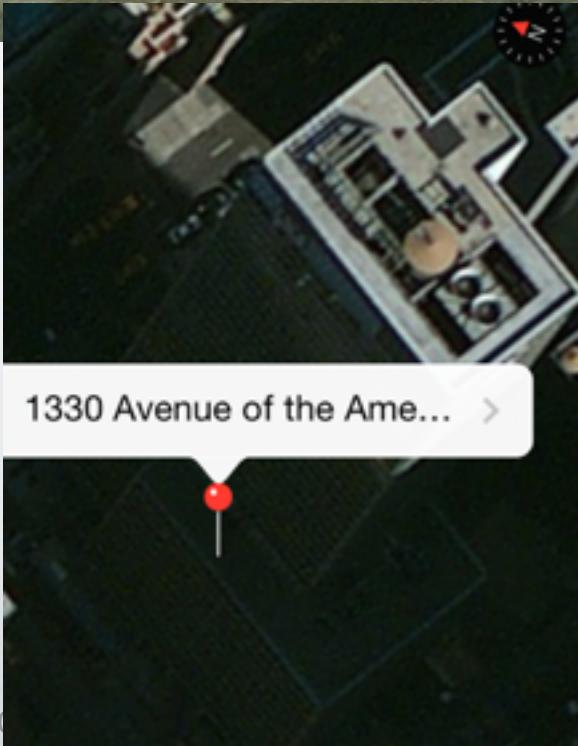
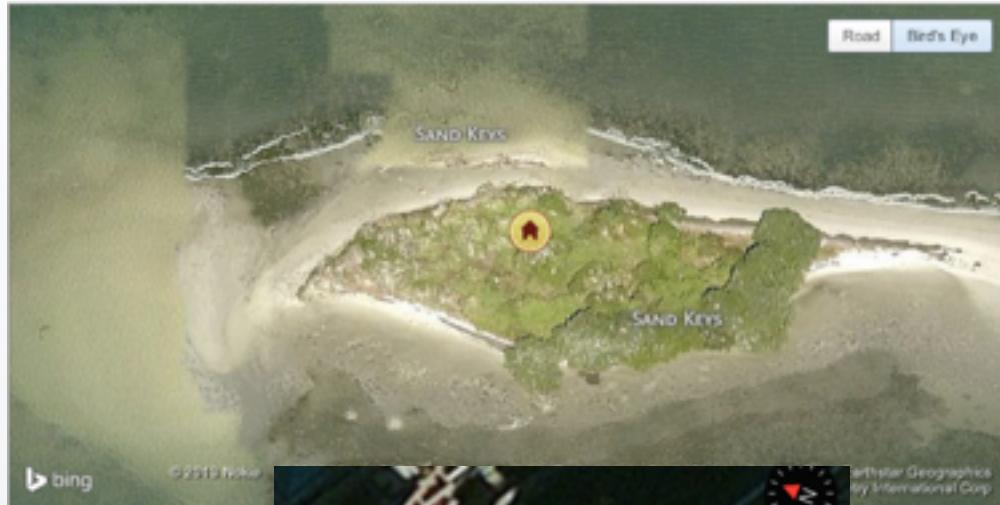
Activities: Accommodations, Beach & Watersport, Bicycling, Canopy, Cultural, Educational, Expedition Cruising, Family, Hiking & Trekking, Multiport, Nature, Overland, Rafting, Sailing & Cruise, Voluntourism, Walking, Wellness

manual

spider

Maps / Street View

data



→ API

manual

Facebook profile

data

A screenshot of a Facebook profile page for "John Canfield". The profile picture shows a man with a beard smiling. The name "John Canfield" is displayed prominently. Below the name are navigation links: Timeline, About, Photos 8, Friends 97, More, Update Info, View Activity Log, and three dots. To the right, there's a sidebar with "Recent" and a timeline: 2010s, 2000s, 1999, and Born.

Payee FB data (score: 70 / 100)

Type	Facebook	Score	70
3rd Party ID	1177872345	Name	Louis Sirico
Age (months)	83.9310277777778	Update Ts	03/17/2013 23:06 UTC

[Raw Data](#)



manual

Google john canfield wepay

Web News Videos Shopping Images More Search tools

About 28,600 results (0.47 seconds)

John Canfield | LinkedIn
www.linkedin.com/in/johncanfieldbayarea ▾
San Francisco Bay Area - VP, Risk Management at WePay
View John Canfield's professional profile on LinkedIn. LinkedIn is the ... VP, Risk Management at WePay ... Join LinkedIn and access John Canfield's full profile.

WePay Hires eBay Veteran as Vice President of Risk ...
www.marketwired.com/.../wepay-hires-ebay-veteran-as-vice-... ▾ Marketwire ▾
May 30, 2013 - PALO ALTO, CA--(Marketwired - May 30, 2013) - WePay, the ... John Canfield Joins WePay on the Heels of Social Risk Engine Introduction.

WePay Hires eBay Veteran as Vice President of Risk ...
online.wsj.com/.../PR-CO-20130530-907631.htm... ▾ The Wall Street Journal ▾
May 30, 2013 - John Canfield Joins WePay on the Heels of Social Risk Engine ...
Canfield's appointment is critical to the future growth and success of WePay, ...

About - WePay
<https://www.wepay.com/about> ▾ WePay ▾
John Canfield, VP of Risk. John leads all of our risk strategy, processes and tactics at WePay. Prior to WePay, John founded his own start-up - Nimbler – a ...



manual

Device ID

data

Device	
Exact ID	a2d51953ab82465187038dd13 a6a012e
Exact ID Match Result	success
Smart ID	6e638addb0c94bd78f342ab45 531e350
Smart ID Confidence	100
Local Time Offset	0
Local Time Offset Range	0
Offset Measure Time	
OS	Windows NT
OS Anomaly	

Typical vendors:

- ThreatMetrix
- iovation
- Experian / 41st Parameter

	For Group Admin	Total Users	Blacklisted Users	Blacklisted Groups
By IP:	26	10	7	10
By True IP:	23	8	5	6
By Device ID:	2	4	3	3
By Fuzzy Device ID:	2	4	3	3

Control Verification

data

We now need to confirm your identity.

Please select the phone number which is most convenient for you at this time, followed by your preferred contact method.

Home
xxxxxx1721

Mobile
xxxxxx5300

By selecting to send a text message (SMS) to your registered phone number you certify that for the phone number you a) are the account holder, or b) have the account holder's permissions to do so.

Message and data rates may apply. We will send you a text message only once, and only with your explicit agreement as indicated by selecting "Text Me" above.

Please [click here](#) for more information or contact SVB's [Client Support Center](#) for immediate assistance.

■ ■



ENTER AUTHENTICATE CODE
Step 2 of 2 X

We are calling **Mobile** at xxxxxx5300.
This might take up to 30 seconds.

When prompted, speak or enter **1580** into the phone.

If you can't take this call right now, please [click here](#) to cancel.
If your phone still rings, don't answer it. The authentication process will stop and you'll be returned to your Online Banking session.

■ ■

Typical vendors:

- Authentify
- Telesign
- Twilio

Transaction History

data

Payment Stats To Account (60 days)

State	Count	Count %	TPV	TPV %
Captured	53	100%	89559.73	100%
Chargebacks	0	0%		0%
Refunds	1	1.89%	215.68	0.24%
Unauthorized	0	0%		0%
Total:	53		89559.73	

Payment Stats To Account (60 days)

State	Count	Count %	TPV	TPV %
Captured	220	97.78%	499089.87	99.06%
Failed	4	1.78%	2029.10	0.4%
InReview	1	0.44%	2697.00	0.54%
Chargebacks	0	0%		0%
Refunds	2	0.89%	1368.83	0.27%
Unauthorized	10	4.44%	35984.00	7.14%
Total:	225		503815.97	

Unauthorized Payment Stats To Account (60 days)

State	Count	Count %	TPV	TPV %
Total:	0		0	

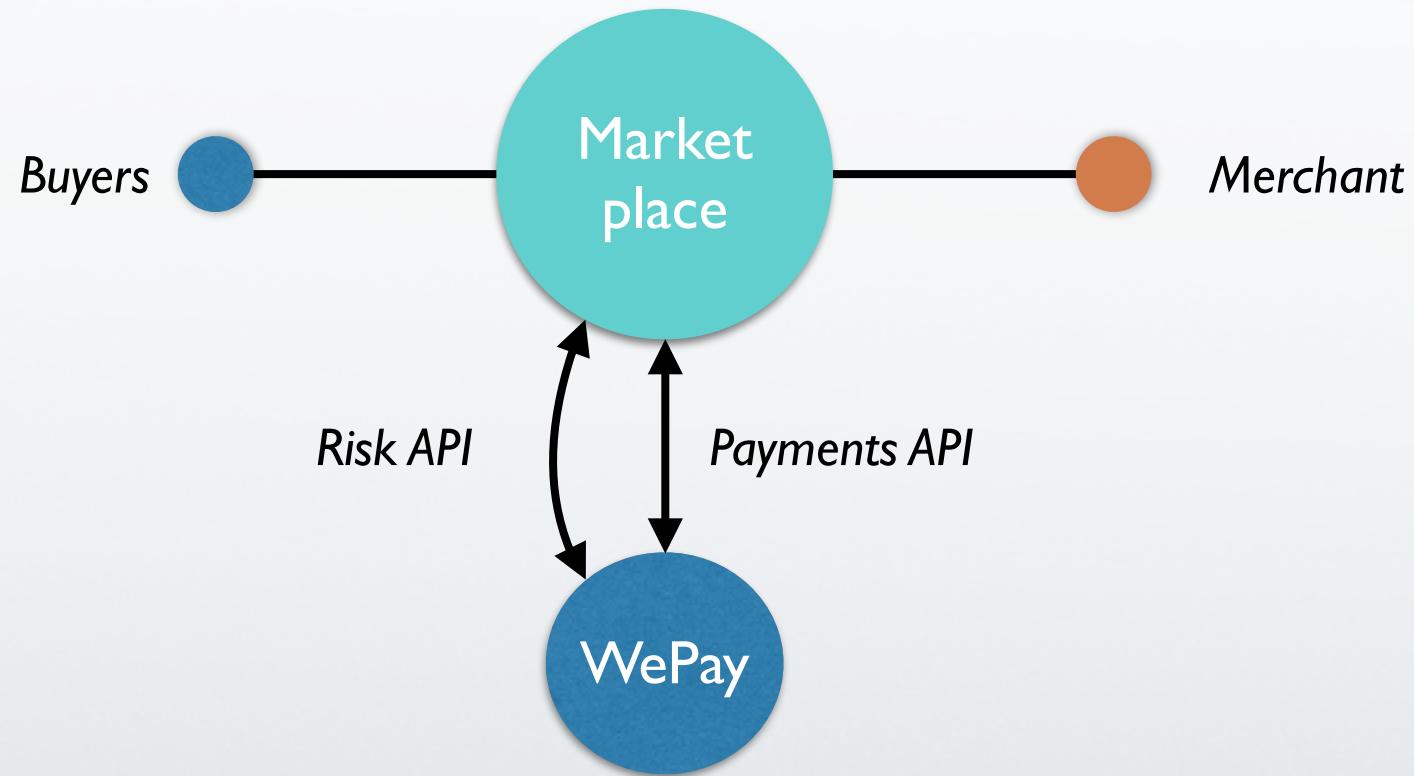
Unauthorized Payment Stats To Account (60 days)

State	Count	Count %	TPV	TPV %
User_CID	2	6.06%	9116.00	7.67%
Decline_InsufficientFunds	7	21.21%	27526.40	23.16%
Decline_General	20	60.61%	73656.40	61.97%
ExcessiveAuthorizations	1	3.03%	2448.00	2.06%
UndefinedResponseCode	3	9.09%	6106.00	5.14%
Total:	33		118852.8	



Data from Partners

data

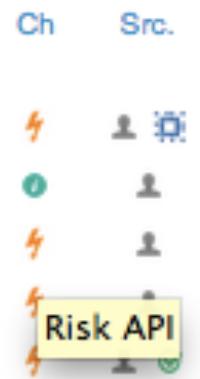


Risk API Account Information

data

Personal

Address:	380 Portage Ave, Palo Alto, CA 94306
EIN:	20-4449703
Office Phone:	(855) 469-3729
Mobile Phone:	(650) 800-3303
Personal Email:	april@yahoo.com



Work Email:	april@armarketing.com
Years in Business:	3
Revenue (USD):	\$40,000
Revenue Fraction:	partial
Invoice ASAP account age:	1.2 years



Example Risk API data types

- person
- email
- business_name
- address
- phone
- tax_id
- website_uri
- employment
- industry_code
- business_description
- risk_score
- comment
- project
- fundraising_event
- fundraising_team
- acquisition_channel
- partner_service
- member_to_member_message
- external_account
- editorial_review
- other_web_content
- revenue
- conversation
- business_legal
- business_report
- other_document
- device_info
- control_verification
- risk_review
- risk_review_steps
- transaction_details

Risk API Transaction Information

data

Transaction Type: Services

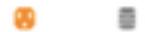
Ch Src.



Delivery Type: Fully Delivered



Amount: \$5000



Receipt URL: <https://view.invoiceasap.com/view.php?invoi...> [show full]



Terms URL: <https://view.invoiceasap.com/view.php?invoi...> [show full]



Shipping Addr:

Ch Src.

Shipping Info:

Line Item 1

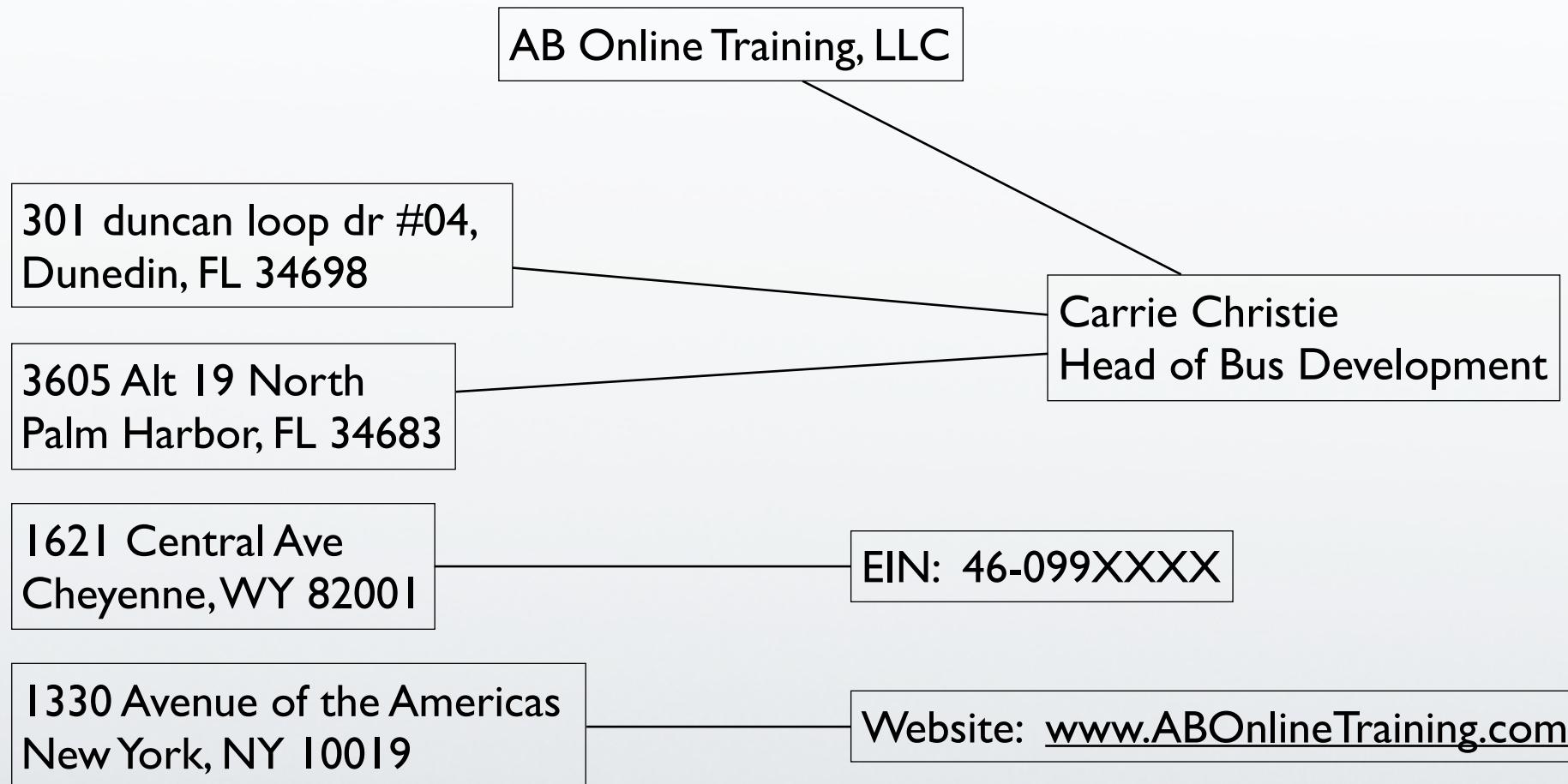
Description:	Search Engine Optimization - hourly	Ch	Src.
	Search Engine Optimization - home page and product page	Ch	Src.
Qty:	20.00	Ch	Src.
Price:	\$100	Ch	Src.
Total:	\$2,000	Ch	Src.

Line Item 2

Description:	Social media marketing - February	Ch	Src.
	Twitter, Facebook, Google+ social marketing of Nimbler app	Ch	Src.
Qty:	1	Ch	Src.
Price:	\$3,000	Ch	Src.
Total:	\$3,000	Ch	Src.

How to effectively organize this data?

data



Data storage systems

data

SQL databases:

- MySQL
- Oracle
- ...

No-SQL databases:

- Document (MongoDB...)
- Key-value (Redis...)
- Graph (Neo4J...)
- Column (Cassandra...)

Other:

- Hadoop
- ...

Decisioning

What is Machine Learning?

decisioning

2) Supervised learning

Txn #	BL accts by IP	BL accts by True IP	BL accts by Device ID	BL accts by fuzzy Device ID	Txn Amount	IP to Address miles
100000001	0	0	0	0	20.00	22
100000002	8	5	3	3	499.00	15
100000003	0	0	0	0	35.00	539
100000004	0	0	0	0	85.00	0
100000005	0	0	0	0	90.23	2

Txn #	BL accts by IP	BL accts by True IP	BL accts by Device ID	BL accts by fuzzy Device ID	Txn Amount	IP to Address miles
100000016	0	0	0	0	400.00	13
100000010	0	0	0	0	20.00	1
100000011	0	0	0	0	75.00	5
100000012	0	0	0	0	80.00	8
100000013	0	0	0	0	50.00	0
100000014	1	0	0	0	25.00	2
100000015	0	0	0	0	30.00	1

Label: is Fraud?
0
1
0
0
0
0
0
0
0
0
0
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+

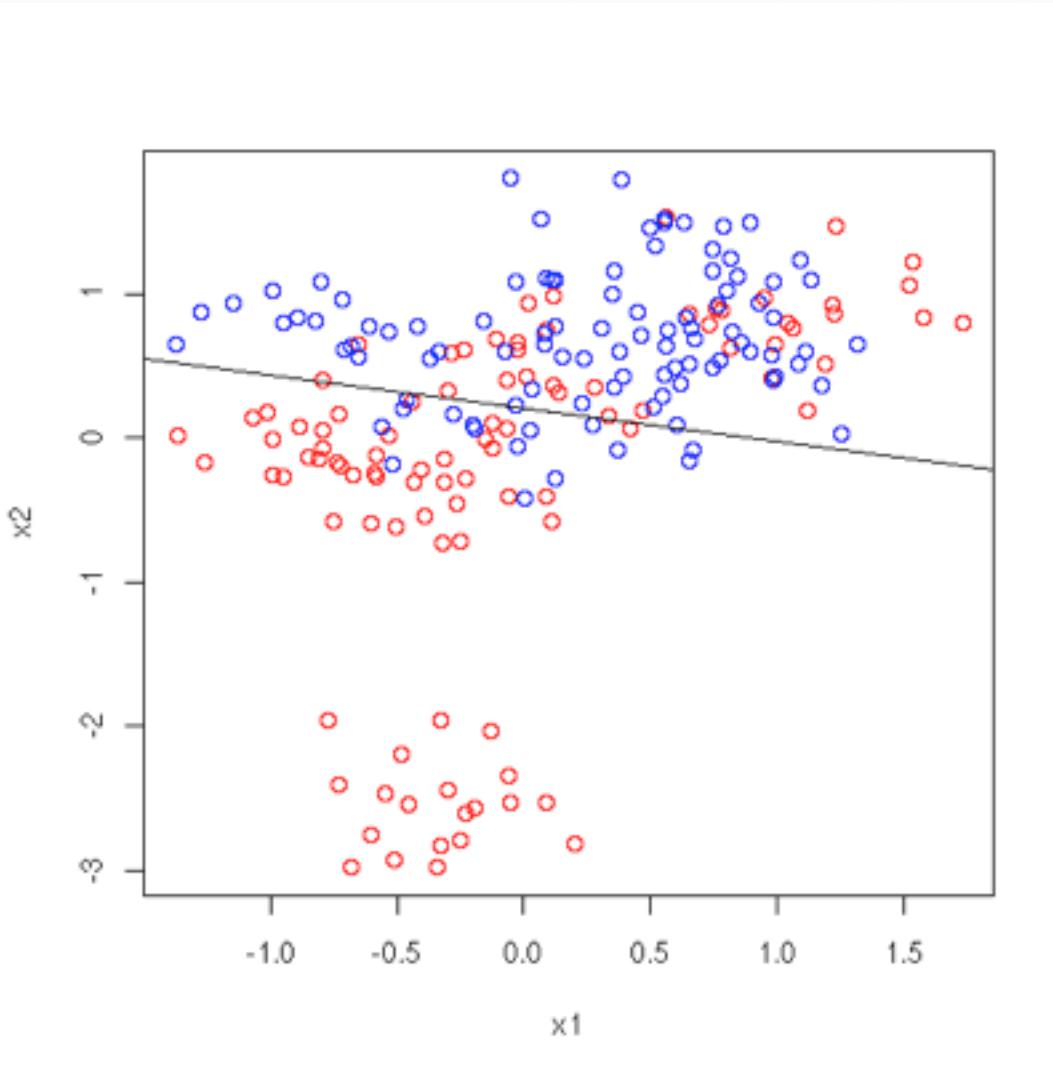
Training →

Machine
Learning
Model

How does machine learning work?

decisioning

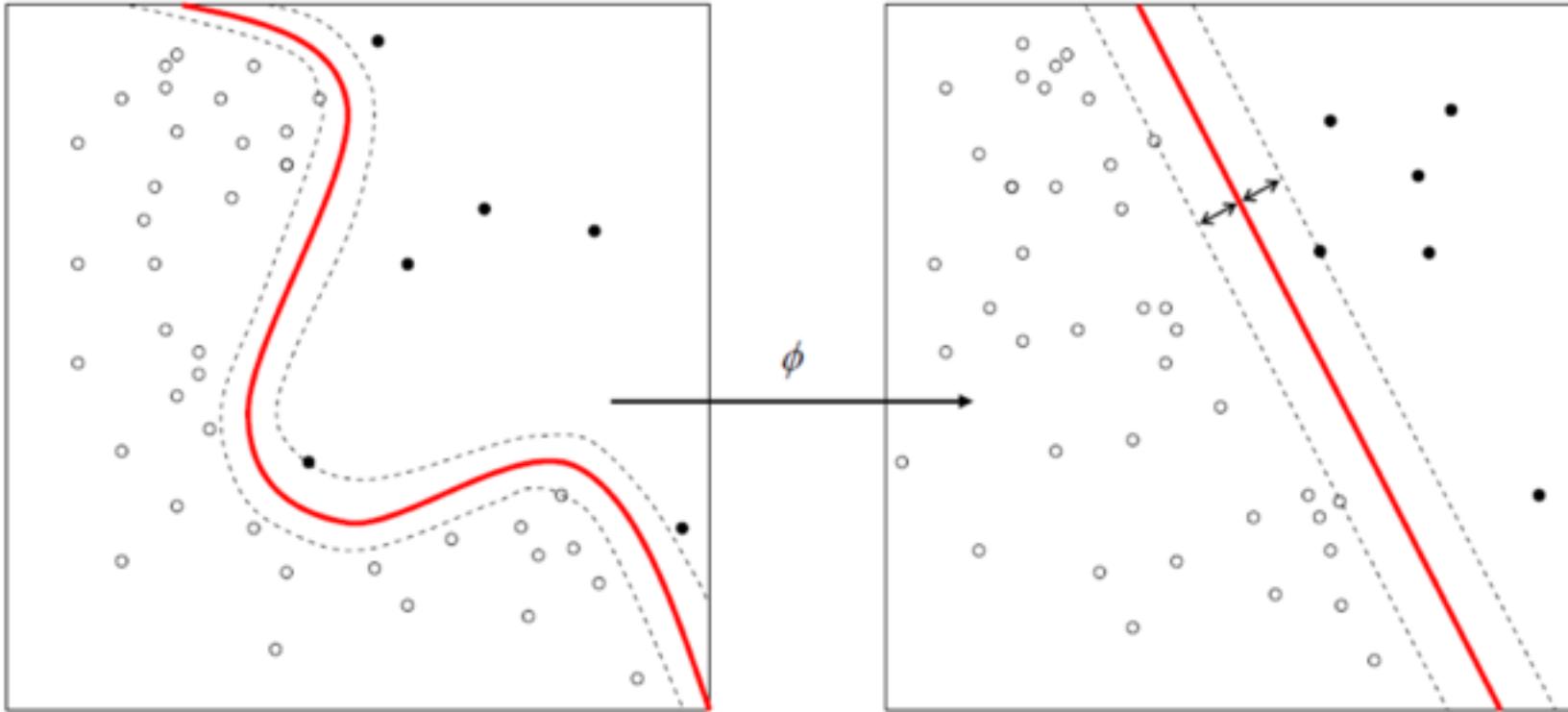
Linear regression classifier



$$y = f(\vec{w} \cdot \vec{x}) = f \left(\sum_j w_j x_j \right)$$

Support Vector Machine

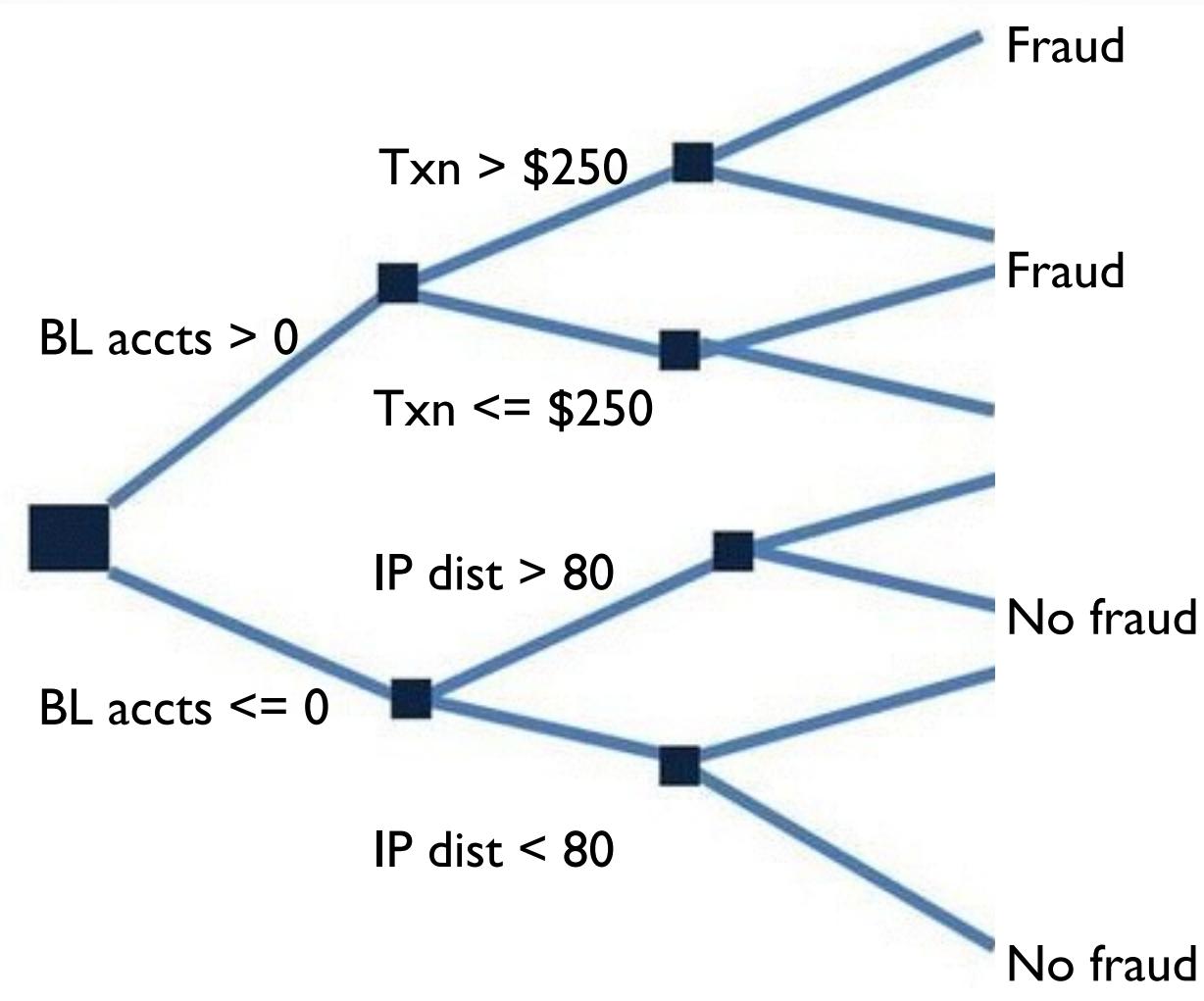
decisioning



- Polynomial (homogeneous): $k(\mathbf{x}_i, \mathbf{x}_j) = (\mathbf{x}_i \cdot \mathbf{x}_j)^d$
- Polynomial (inhomogeneous): $k(\mathbf{x}_i, \mathbf{x}_j) = (\mathbf{x}_i \cdot \mathbf{x}_j + 1)^d$
- Gaussian radial basis function: $k(\mathbf{x}_i, \mathbf{x}_j) = \exp(-\gamma \|\mathbf{x}_i - \mathbf{x}_j\|^2)$, for $\gamma > 0$. Sometimes parametrized using $\gamma = 1/2\sigma^2$
- Hyperbolic tangent: $k(\mathbf{x}_i, \mathbf{x}_j) = \tanh(\kappa \mathbf{x}_i \cdot \mathbf{x}_j + c)$, for some (not every) $\kappa > 0$ and $c < 0$

Decision Trees

decisioning



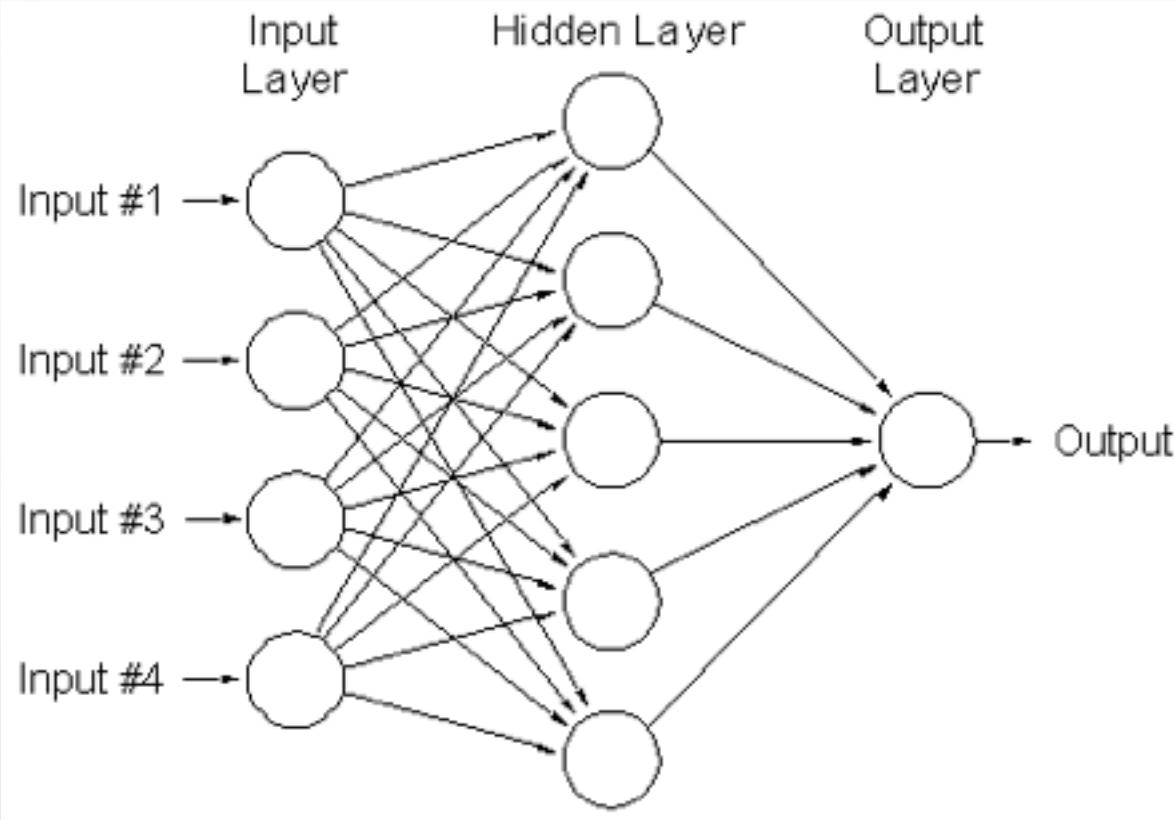
ID3 Training algorithm

Recurse and choose attribute that minimizes entropy:

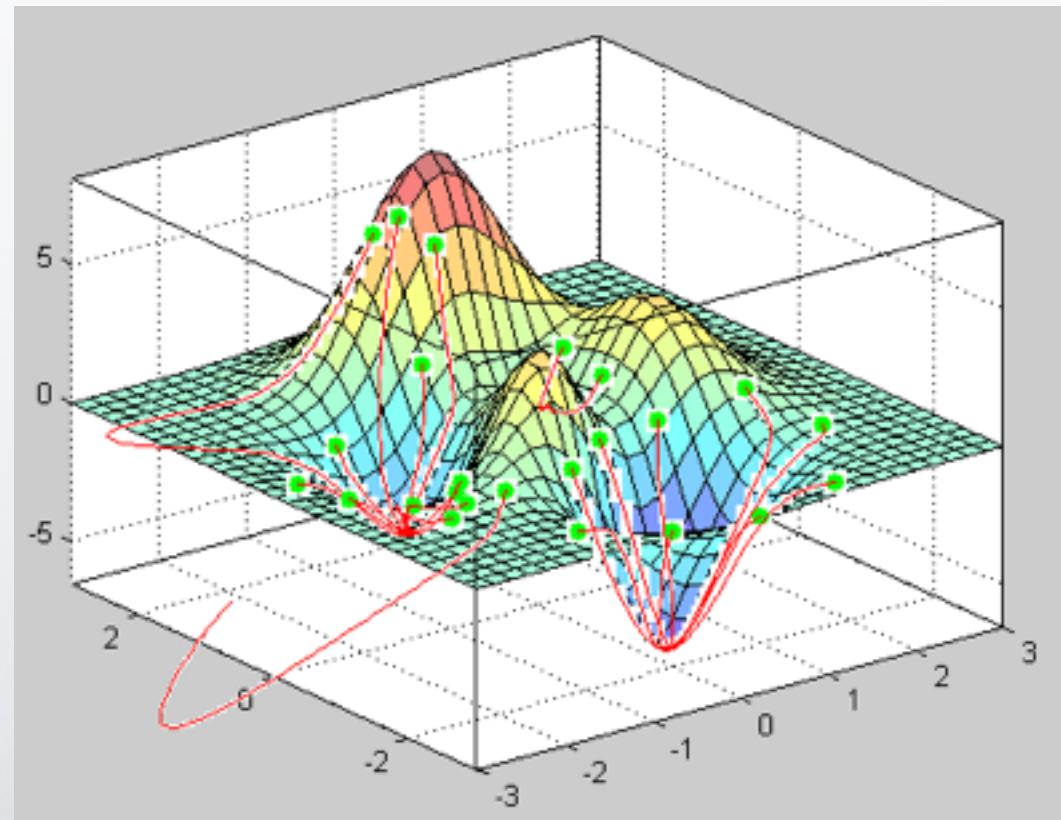
$$H(S) = - \sum_{x \in X} p(x) \log_2 p(x)$$

Neural Network models

decisioning



Gradient descent training



Meta-algorithms: grid search, bagging, etc

decisioning

You can do:

Or you can do:

Decision
Tree

Decision
Tree 1

Decision
Tree 2

Decision
Tree 3

Decision
Tree 4

Decision
Tree 5

SVM 1

SVM 2

SVM 3

SVM 4

SVM 5

Neural
Network 1

Neural
Network 2

Neural
Network 3

Neural
Network 4

Neural
Network 5

Logistic
Regression 1

Logistic
Regression 2

Logistic
Regression 3

Logistic
Regression 4

Logistic
Regression 5

Rules Engine

decisioning

Rule 1 (Transaction threshold):

```
If (signal.Group_30Day_txn_volume > account(tpv_review_threshold_t30d and  
fact.tpv_review_threshold_t30d > 0)  
then Refer_for_Review
```

Rule 2 (Model Score):

```
If (model.fraud_score > 0.85)  
then Refer_for_Review
```

Rule 3 (Re-require KYC):

```
If (signal.IDR <= 0) and (signal.MQR <= 0) and (signal.Group_30Day_txn_volume > 1000.00) and  
(signal.name_address_match = false)  
then Request_Address_Remedy
```

Manual Review

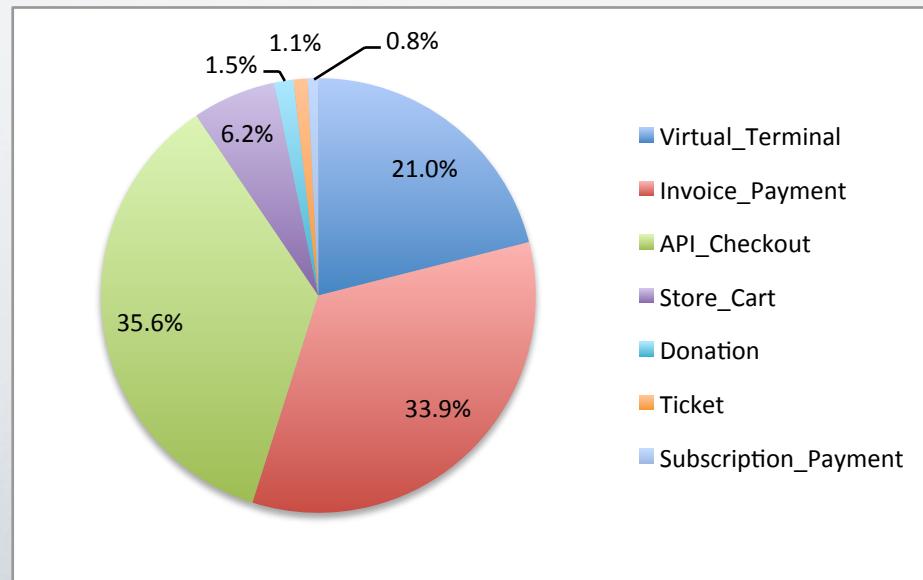
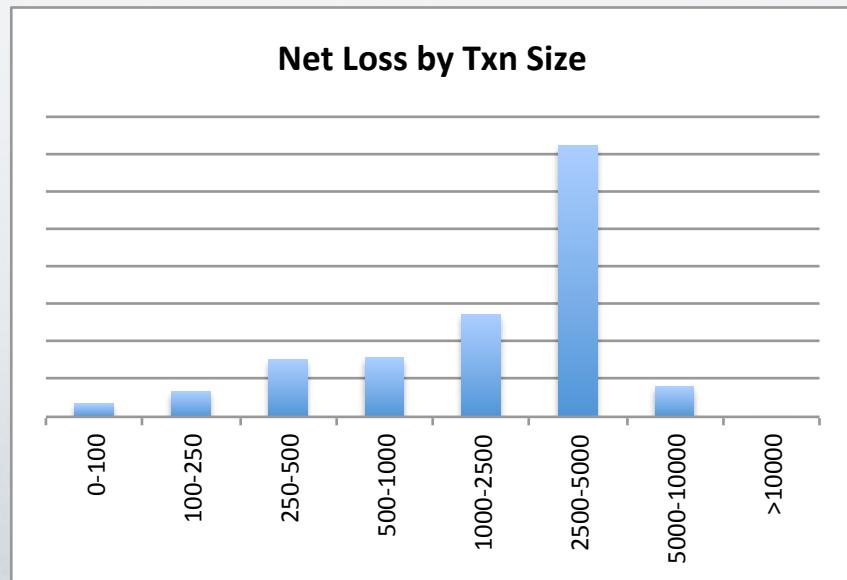
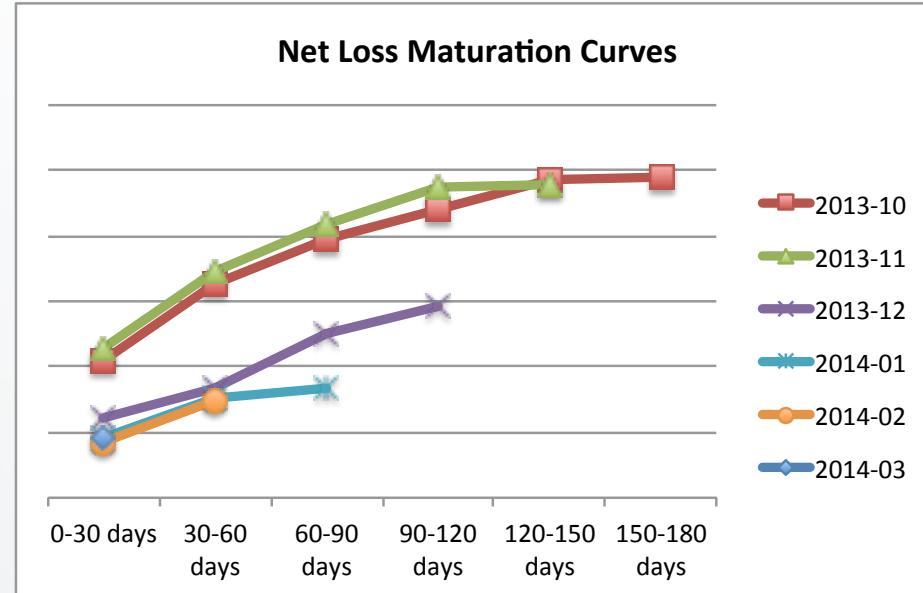
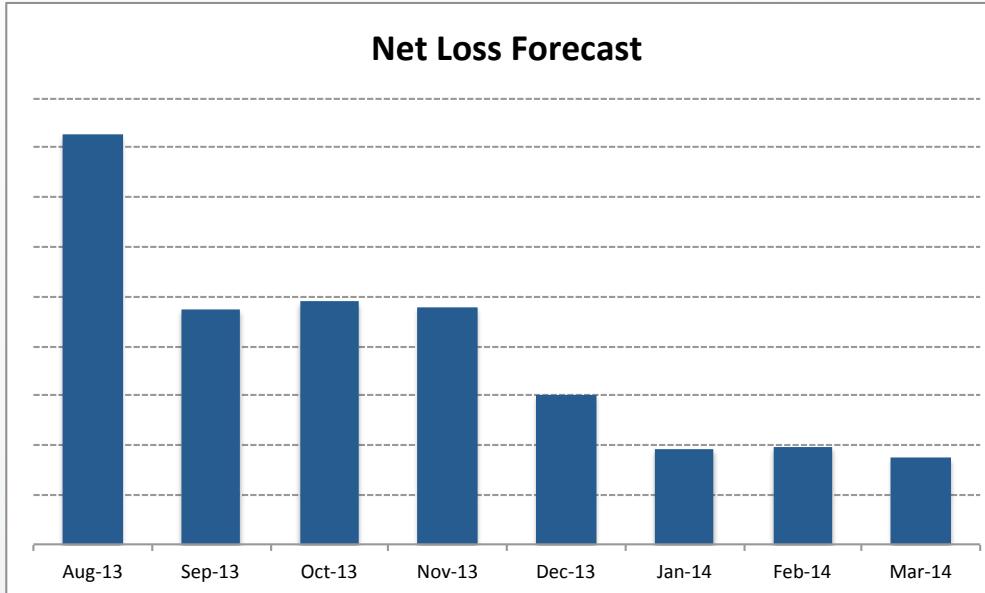
decisioning

April Rassa		Ch. Src.
Merchant Quality Risk Score 65 [view data]	Identity Risk Score 85 [view data]	Employment
IDR Level: Low	MQR Level: Medium	Employer: Rassa Marketing Consulting Business Name: Rassa Marketing Consulting Title: Principal Work Email: april@marketing.com Years in Business: 3 Revenue (USD): \$40,000 Revenue Fraction: partial Invoice ASAP: 1.2 years account age:
Personal		Social
Address: 380 Portage Ave, Palo Alto, CA 94306 EIN: 20-4449703 Office Phone: (855) 469-3729 Mobile Phone: (650) 800-3303 Personal Email: april@yahoo.com DOB: 5/15/78 SSN: XXX-XX-8947	LinkedIn URL: https://www.linkedin.com/in/arassa Facebook URL: www.facebook.com/arassa FB account age: 7 years Facebook friends: 825 Twitter: @arassa	
Credit		
Experian Bus IQ: 60 Intellicore: Experian Bus IQ: 40 FSR Score: Experian Report: www.experian.com/xxxxxx		
» Payer		
Actions		
Rules Triggered: Date Modified: 04/08/2014 14:34 UTC Rolling Reserve Weekly: Rolling Reserve Delay (weeks): Lock Levels: Comments: Remove from Queue: KYC: Require KYC Manually Retry KYC Update	Blacklist: Account 44598456-USD Fraud (STSD) Add to Blacklist Blacklist account founder/admin and their other accounts too	Message for merchant
	Lockdown: Compromised Lockdown Message for risk records	Refund Multiple Payments: Refund Payments TOS Whitelist: (word1, word2) Add Word(s)
» KYC		
QCo		Approve

Metrics & Feedback

Metrics & Feedback

metrics



Top Net Loss Accounts

Loss Week	2014-17
Orig Month	(All)
Store_Cart	\$187
988052845	\$115
78252	\$72
Invoice_Payment	\$1,820
1426156	\$1,166
1953717721	\$505
1373219397	\$134
190996	\$15
API_Checkout	\$10,156
846171008	\$1,698
1692429545	\$1,208
1570348118	\$674
858508144	\$663

Net Loss

Row Labels	Total
Store_Cart	\$187
988052845	\$115
78252	\$72
Invoice_Payment	\$1,820
1426156	\$1,166
1953717721	\$505
1373219397	\$134
190996	\$15
API_Checkout	\$10,156
846171008	\$1,698
1692429545	\$1,208
1570348118	\$674
858508144	\$663

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Summary

1. Bottoms-up economy is growing and is the high-growth frontier for electronic payments
2. Big data needs to be pieced together bit by bit using flexible infrastructure
3. Machine learning, rules, and manual review when combined properly gives enables correct decisions on big data