DEVOPS ENTERPRISE SUMMIT

Las Vegas
October 28–30, 2019

SLIDES: http://bit.ly/ForecastingDoes

Forecasting Using Data

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Using Historical Data for Demand, Capacity and Project Planning

How to forecast capacity or delivery dates using a team's historical data. Probabilistic forecasting allows planning to take into account uncertainty and things that might happen (risks) and help communicate those plans

Passions…

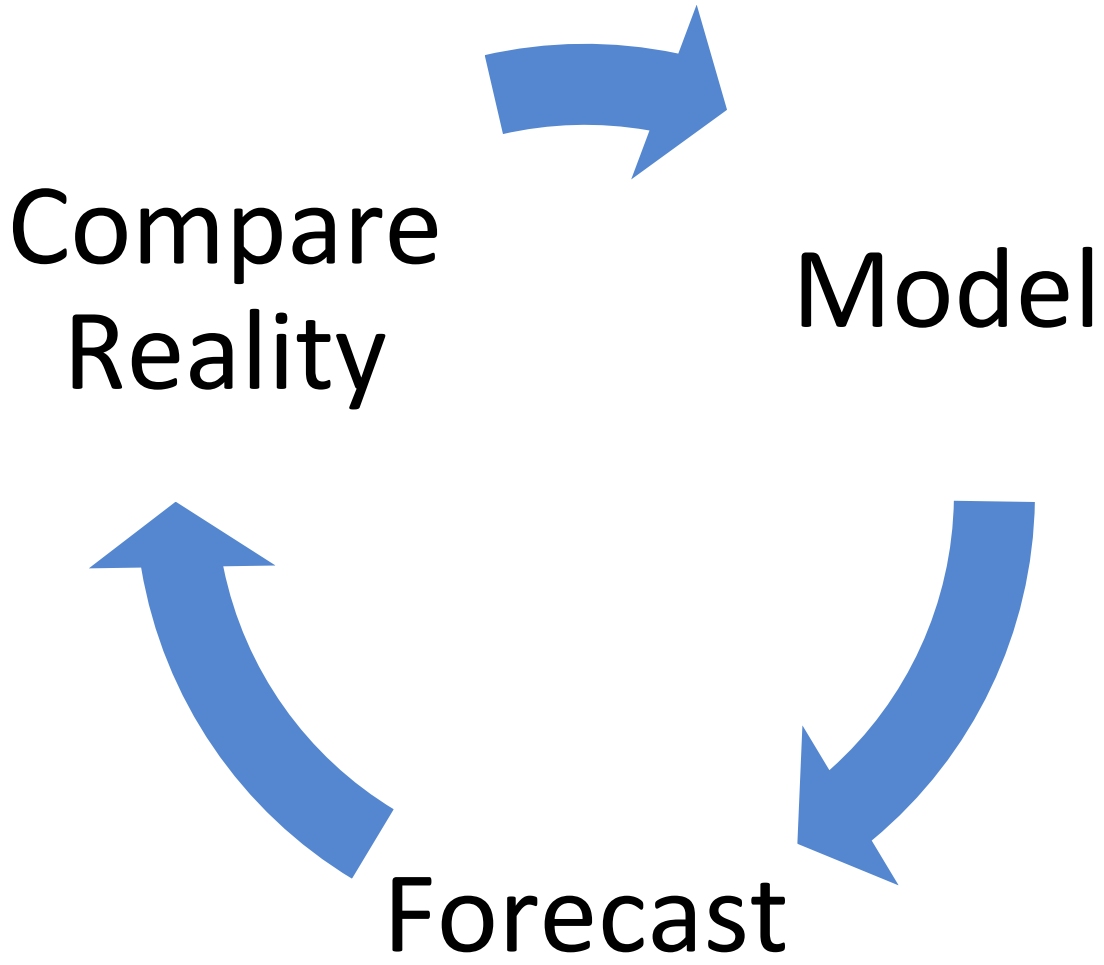
- Helping people SEE and USE their data without FEAR
- Helping people BALANCE predictability and value

SLIDES: http://bit.ly/ForecastingDoes

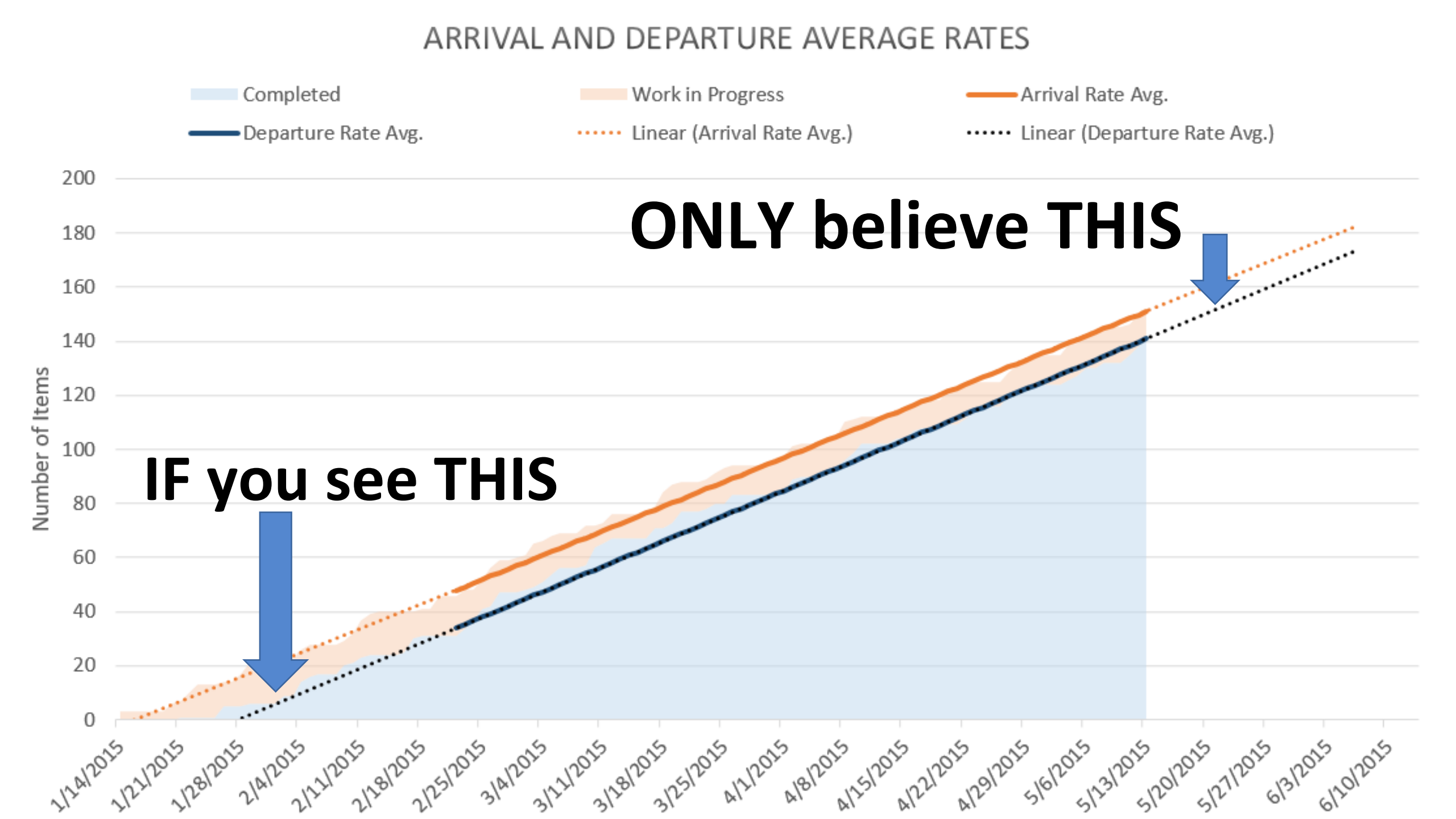
- The spreadsheets mentioned
  - http://bit.ly/DemandForecasting
  - http://bit.ly/ThroughputForecast
  - http://bit.ly/MultipleFeatureForecast

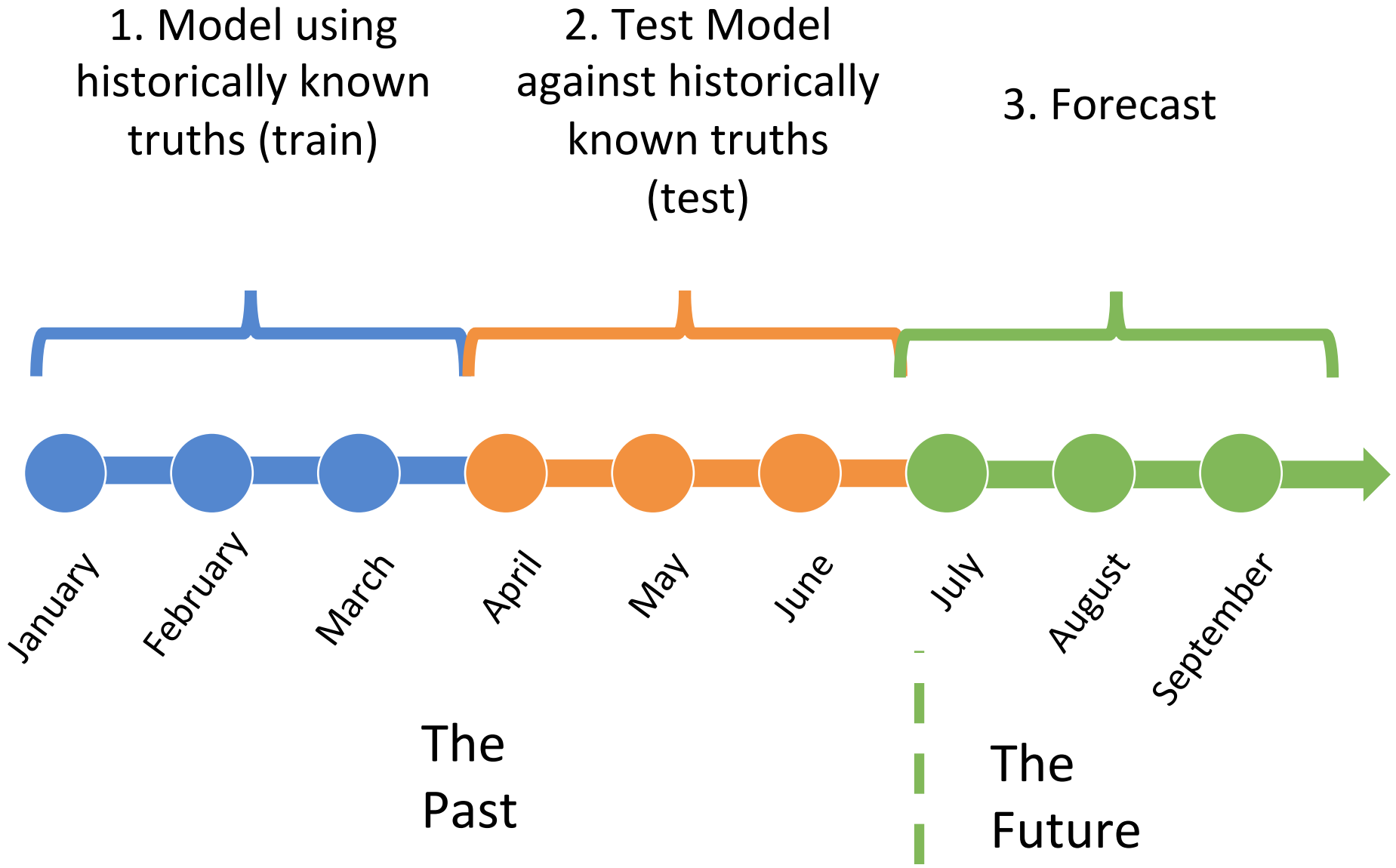
- Contact me
  - Twitter: @t_magennis
  - Email: troy.magennis@FocusedObjective.com


Forecast
Reality



Models are always wrong.
It’s all about understanding why.


ARRIVAL AND DEPARTURE AVERAGE RATES
Completed
Work in Progress
Arrival Rate Avg.
Departure Rate Avg.
Linear (Arrival Rate Avg.)
Linear (Departure Rate Avg.)
Number of Items
200
180
160
140
120
100
80
60
40
20
0
1/14/2015
1/21/2015
1/28/2015
2/4/2015
2/11/2015
2/18/2015
2/25/2015
3/4/2015
3/11/2015
3/18/2015
3/25/2015
4/1/2015
4/8/2015
4/15/2015
4/22/2015
4/29/2015
5/6/2015
5/13/2015
5/20/2015
5/27/2015
6/3/2015
6/10/2015
ONLY believe THIS
IF you see THIS



Back-testing: Using the data you have to predict something known

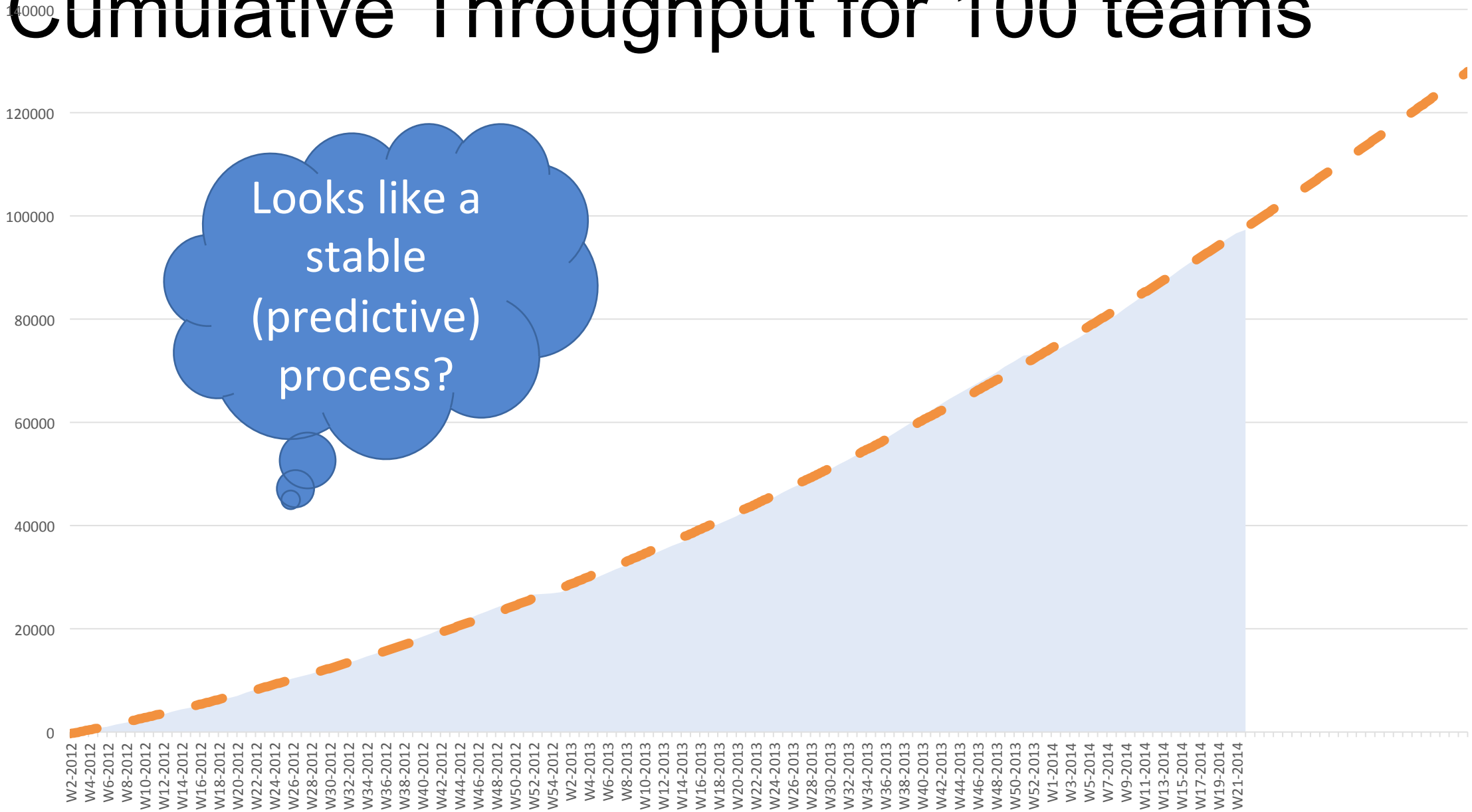
Forecasting is about detecting EARLIER that you are WRONG

Until you can forecast something you KNOW happened, stick clear of forecasting the FUTURE

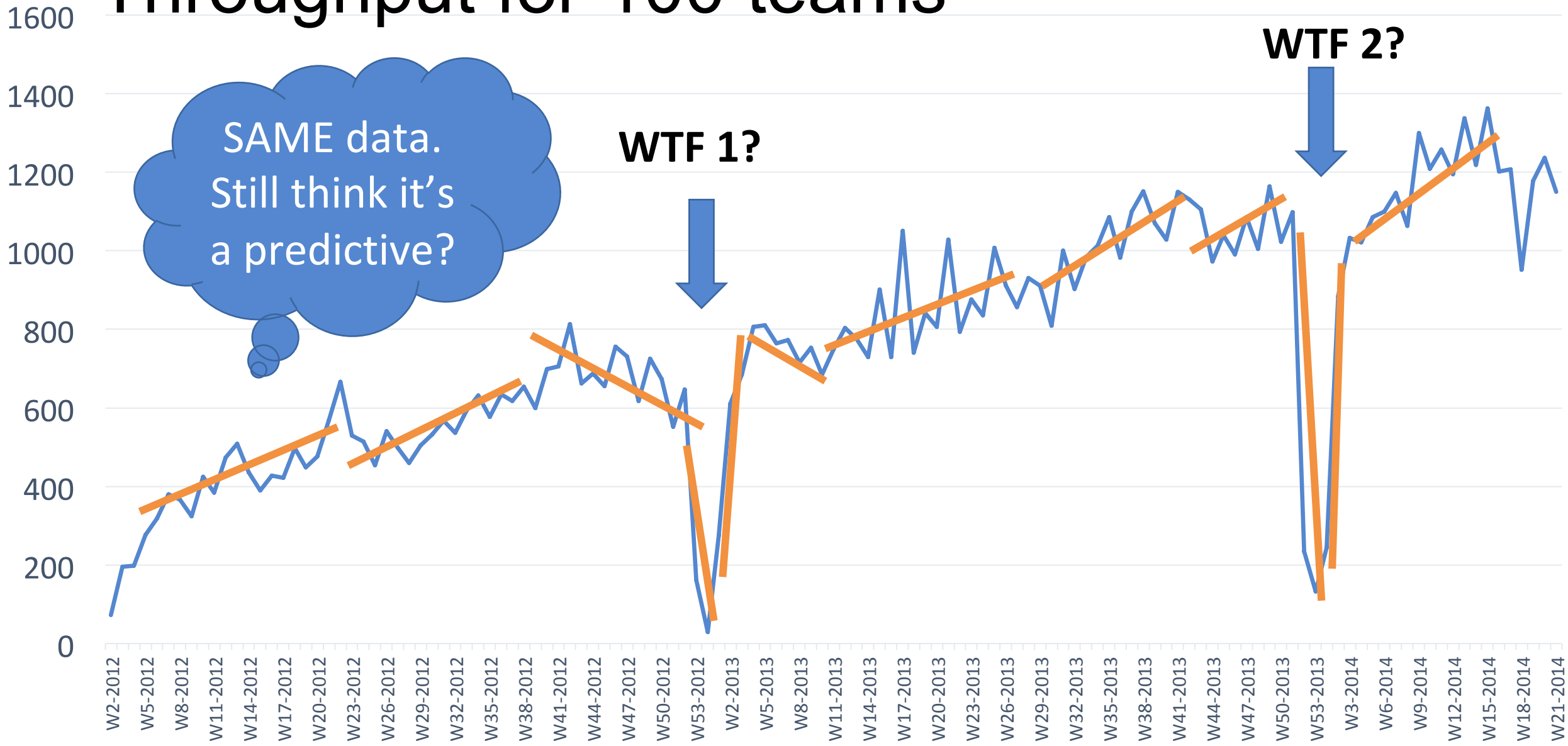
Forecasting Future Values

Time series forecasting

Cumulative Throughput for 100 teams



Throughput for 100 teams

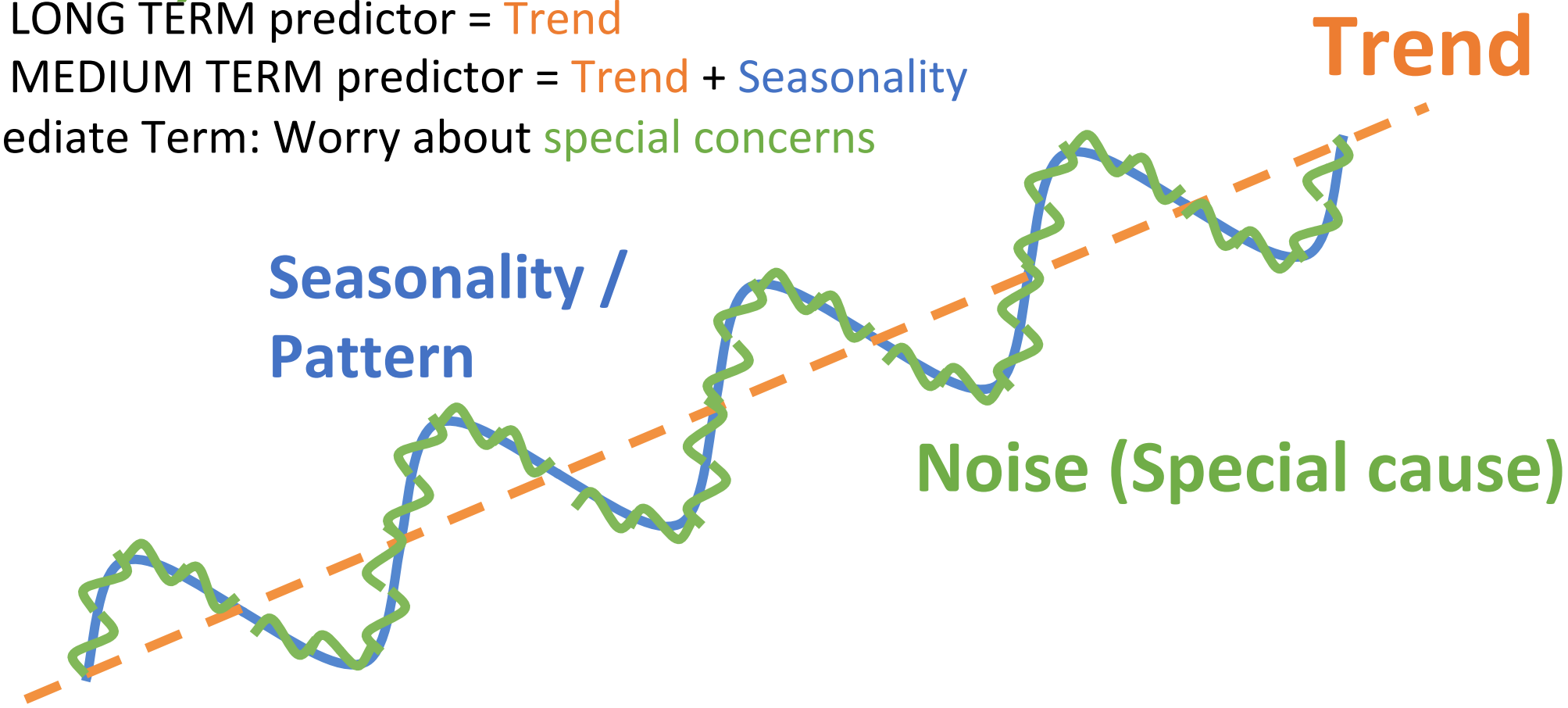


Trend – Seasonality – Noise (Special Cause)

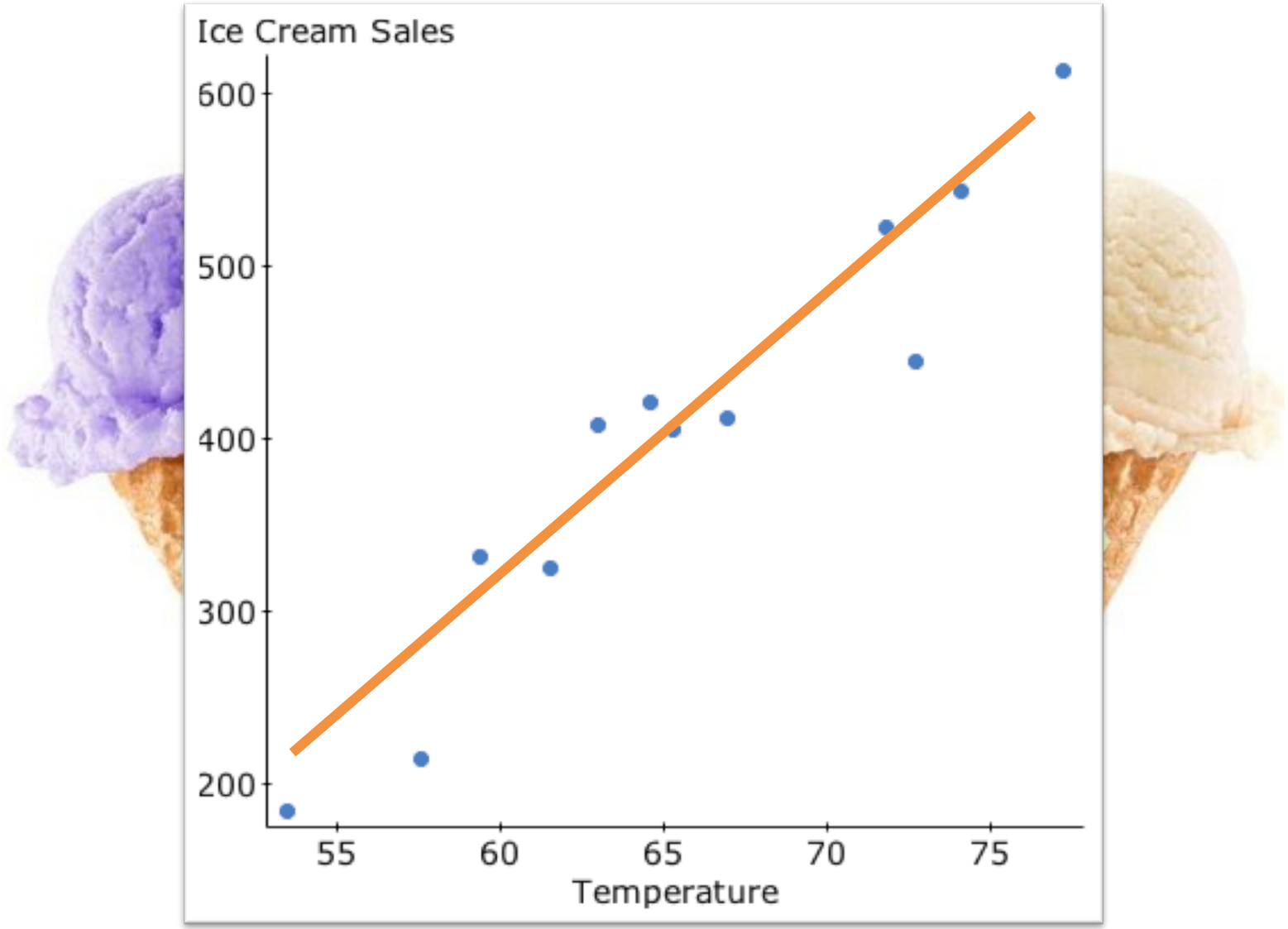
Best LONG TERM predictor = Trend

Best MEDIUM TERM predictor = Trend + Seasonality

Immediate Term: Worry about special concerns

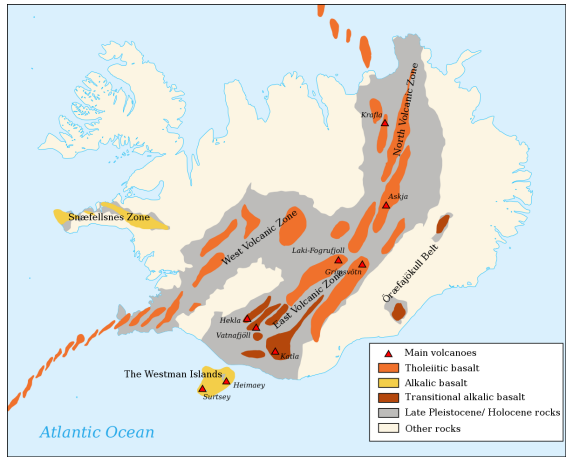


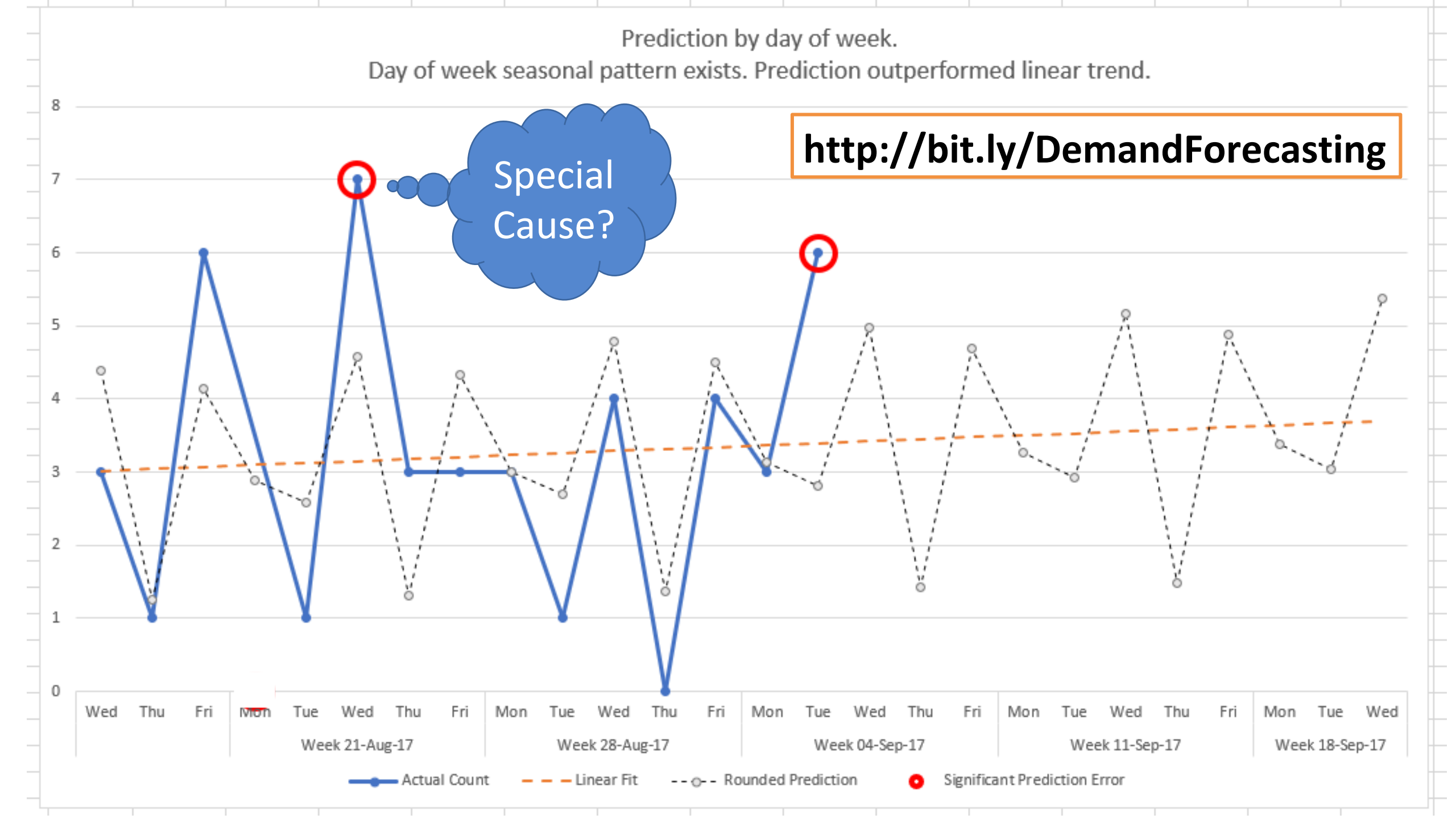
What factors might impact demand?



Special Cause Variation (predictability varies)

lastminute.com




Prediction by day of week.
Day of week seasonal pattern exists. Prediction outperformed linear trend.
Special Cause?
http://bit.ly/DemandForecasting
8
7
6
5
4
3
2
1
0
Wed Thu Fri Mon Tue Wed Thu Fri Mon Tue Wed Thu Fri Mon Tue Wed Thu Fri Mon Tue Wed Thu Fri Mon Tue Wed
Week 21-Aug-17
Week 28-Aug-17
Week 04-Sep-17
Week 11-Sep-17
Week 18-Sep-17
Actual Count
Linear Fit
Rounded Prediction
Significant Prediction Error

Know what factors are important in YOUR CONTEXT

Trend – Patterns – Special Cause

Best LONG TERM predictor = Trend

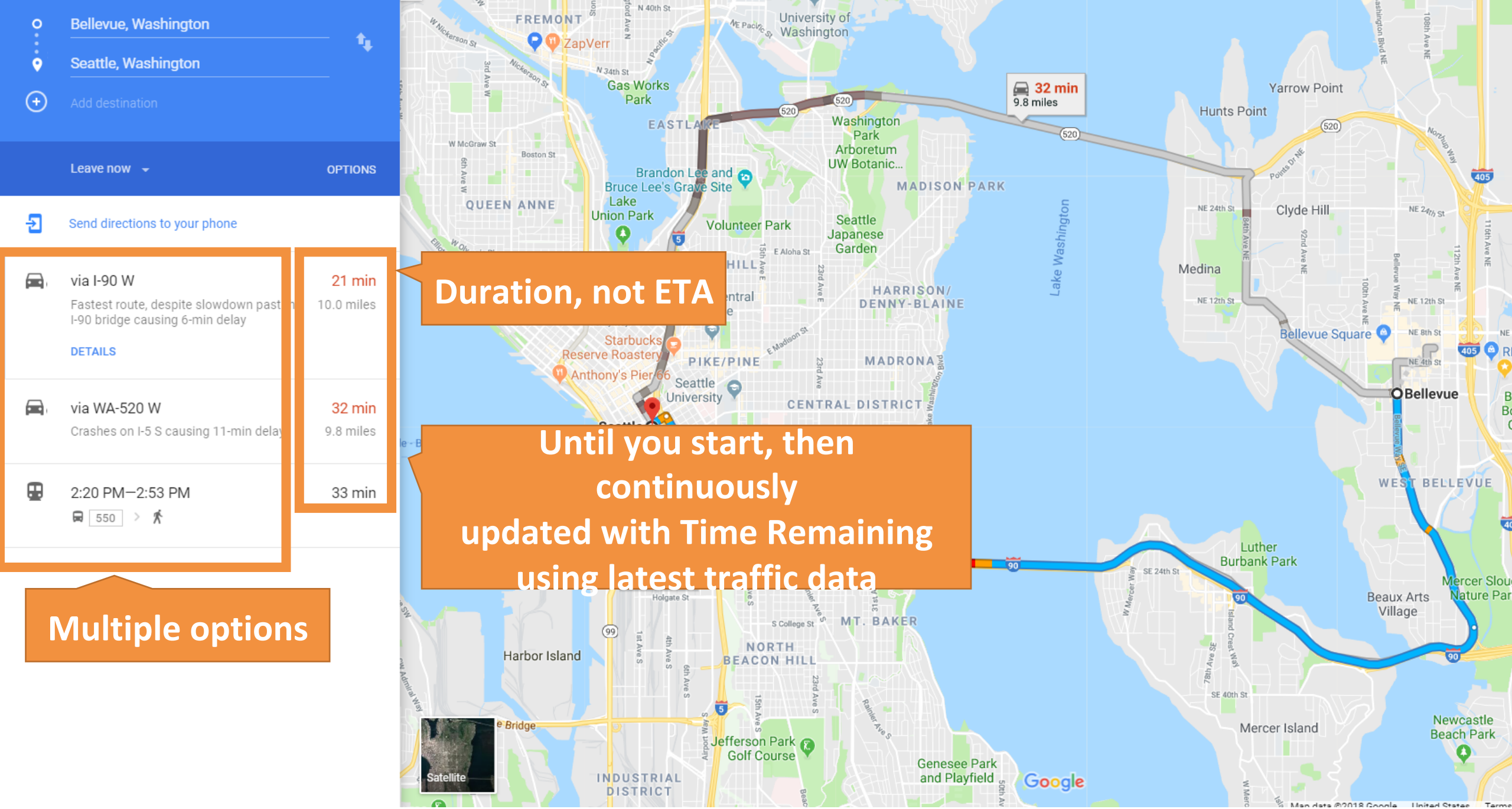
Best MEDIUM TERM predictor = Trend + Patterns

Immediate Term: Worry about special causes

Forecasting Duration and Dates

Probabilistic forecasting duration

Yeah, but how long will THIS feature take?


Bellevue, Washington
Seattle, Washington
Add destination
Leave now
OPTIONS
Send directions to your phone
via I-90 W
Fastest route, despite slowdown past
I-90 bridge causing 6-min delay
DETAILS
21 min
10.0 miles
via WA-520 W
Crashes on I-5 S causing 11-min delay
32 min
9.8 miles
2:20 PM–2:53 PM
550
33 min
Duration, not ETA
Until you start, then
continuously
updated with Time Remaining
using latest traffic data
Multiple options
32 min
9.8 miles
FREMONT
ZapVerr
University of
Washington
Gas Works
Park
EASTLAKE
Washington
Park
Arboretum
UW Botanic...
Yarrow Point
Hunts Point
Brandon Lee and
Bruce Lee's Grave Site
Lake
Union Park
QUEEN ANNE
MADISON PARK
Volunteer Park
Seattle
Japanese
Garden
Clyde Hill
Medina
Lake Washington
HARRISON/
DENNY-BLAINE
Starbucks
Reserve Roastery
PIKE/PINE
MADRONA
Anthony's Pier 66
Seattle
University
CENTRAL DISTRICT
Bellevue Square
Bellevue
WEST BELLEVUE
Luther
Burbank Park
Beaux Arts
Village
Harbor Island
MT. BAKER
NORTH
BEACON HILL
Jefferson Park
Golf Course
Genesee Park
and Playfield
INDUSTRIAL
DISTRICT
Mercer Island
Newcastle
Beach Park
Satellite
Google

Contrast Software Planning to Google Maps

If you currently…

- Give one forecast even though multiple approaches considered
- Give a calendar date for undefined “complete” & “start”
- If the original date is in doubt we find out near the end

Consider doing…

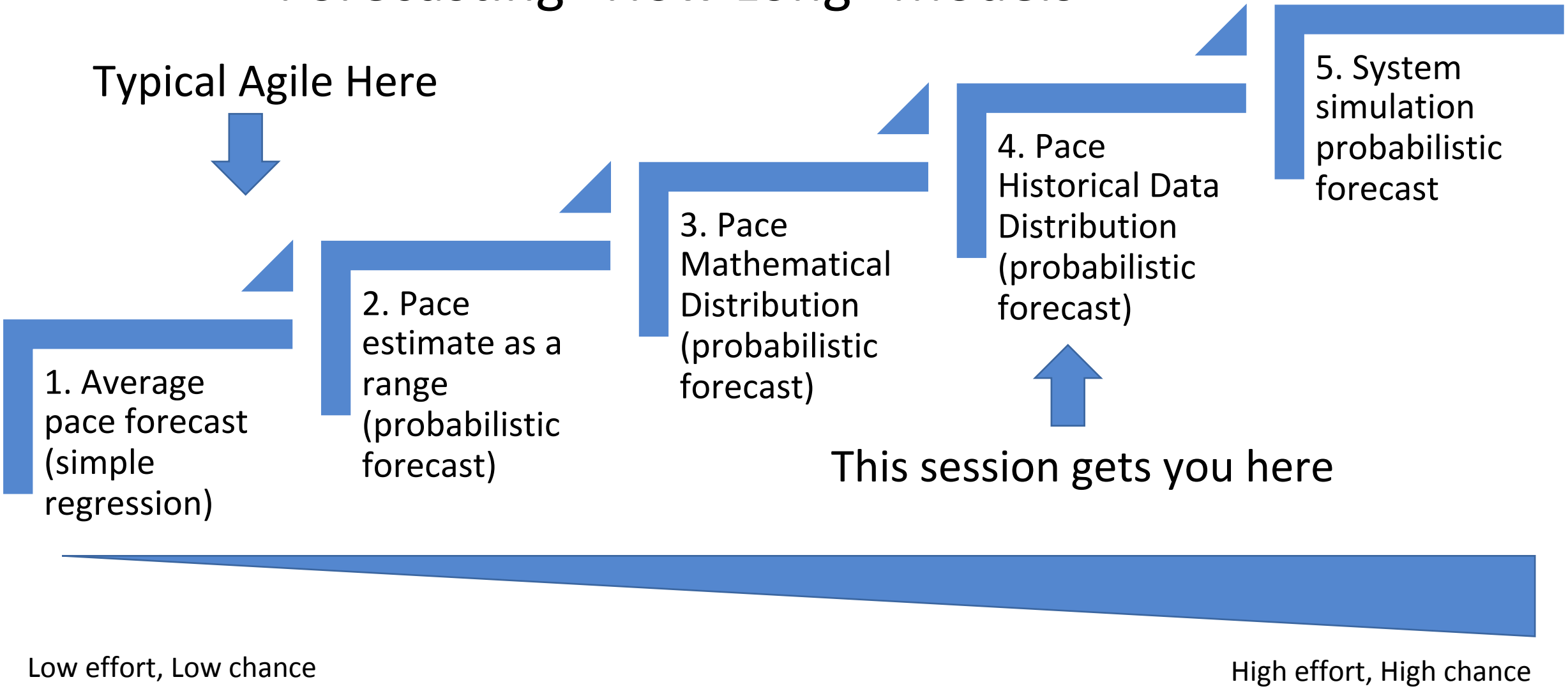
- Give multiple options of investment and implementation
- Give a duration and define what started & complete means
- If the original date is in doubt, know earlier and react faster

Forecasting is about knowing when to START

#1 Reason we miss deadlines

We START too

Forecasting “How Long” Models

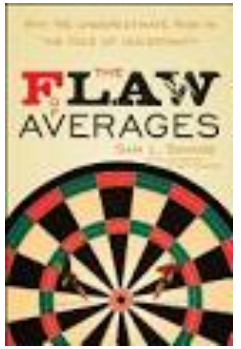


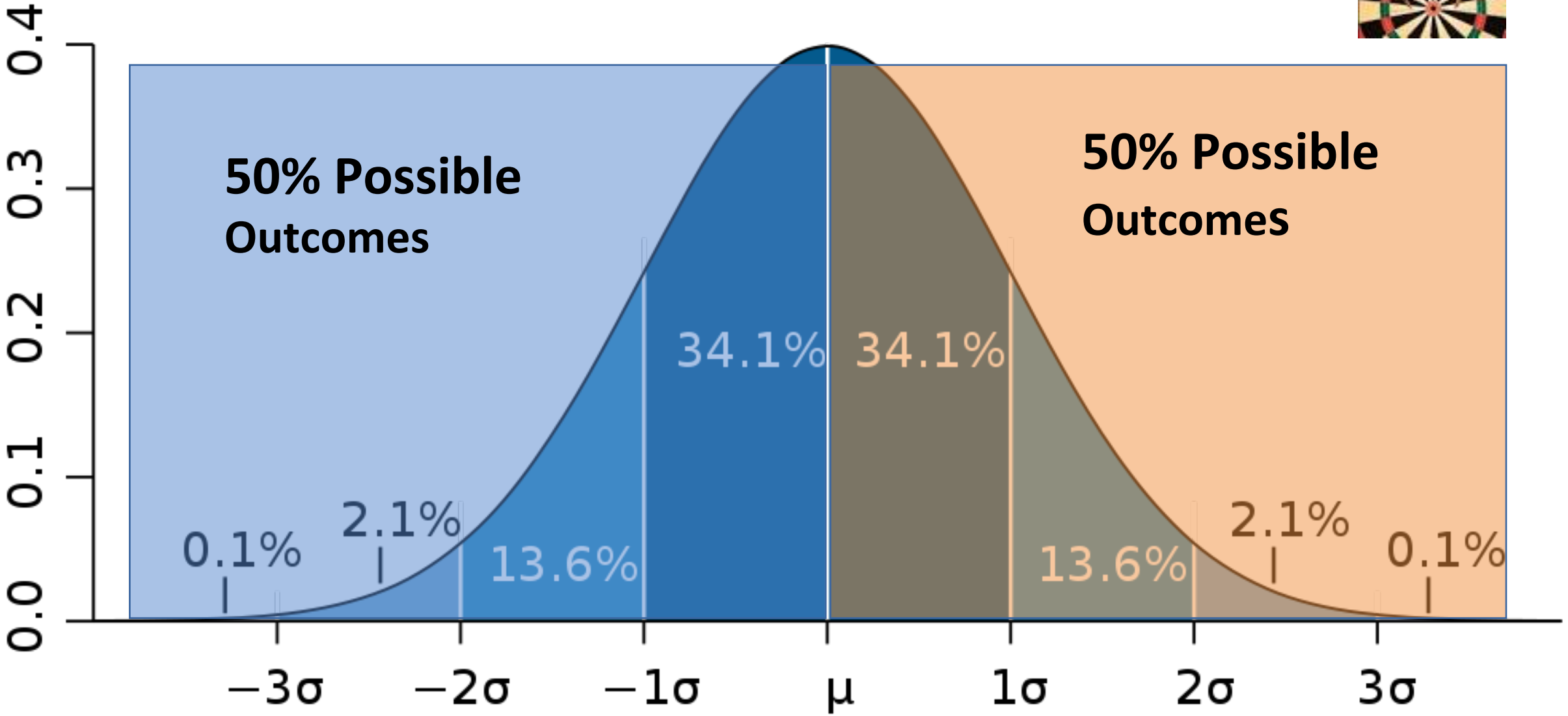
Low effort, Low chance

High effort, High chance

Effort AND how likely model represents actual outcome

Why Use Probabilistic Forecasting?





Normal Math vs Probabilistic Math

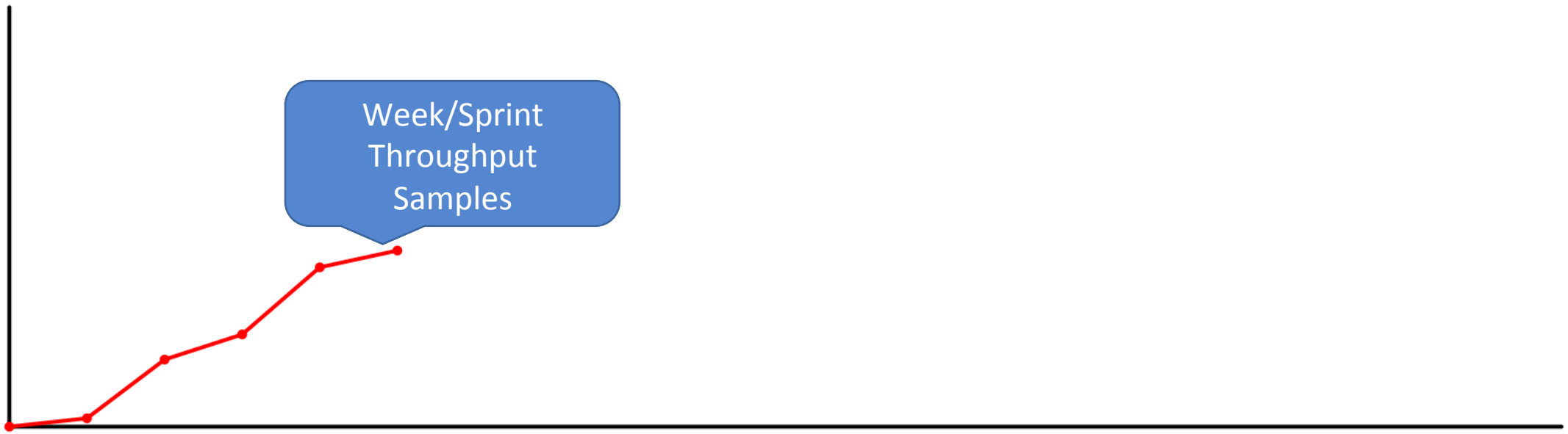
$$\textit{How long} = \textit{Amount of work} / \textit{Rate we do work} = 25 / 5 = 5 \textit{ weeks}$$

$$\textit{How long} = \textit{Amount of work} / \textit{Rate we do work} = 20 \textit{ to } 30 / 1 \textit{ to } 5 = 4 \textit{ to } 30 \textit{ weeks}$$

INSERT YOUR DATA HERE

Not secure | lumenize.com

http://maccherone.com/lumenize/



Thanks @maccherone ☺

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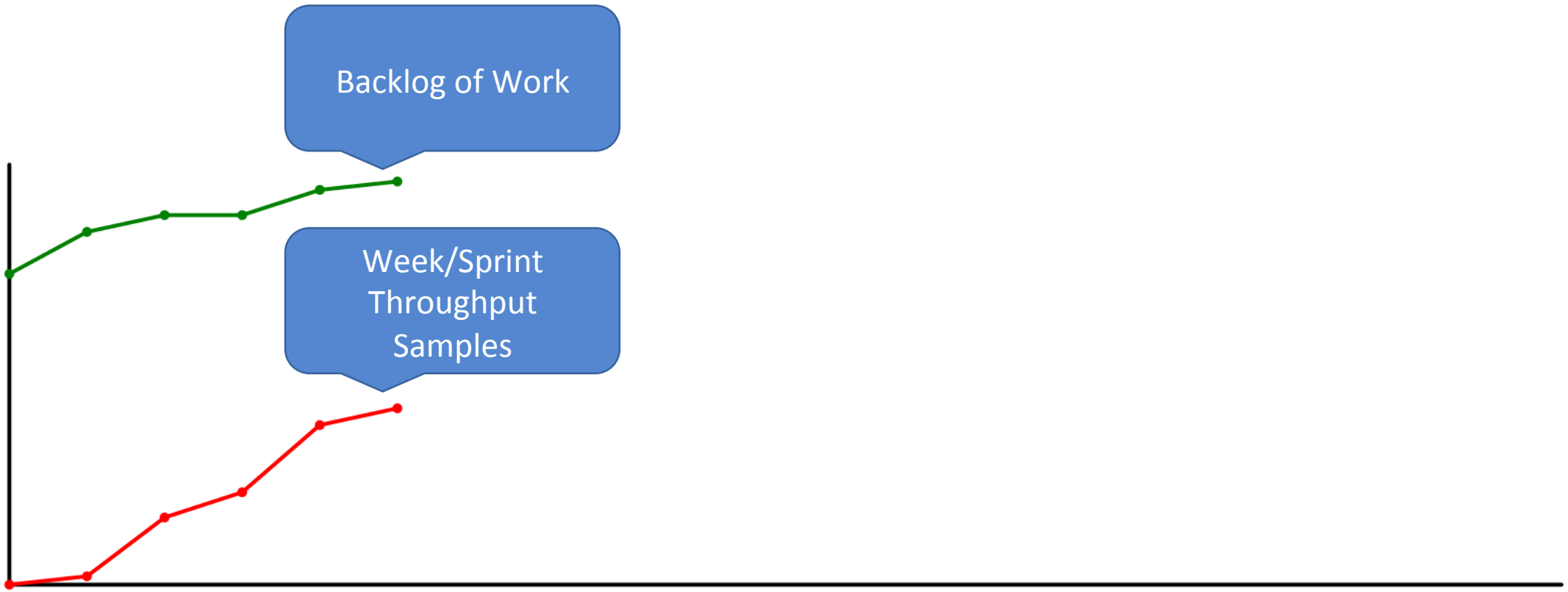

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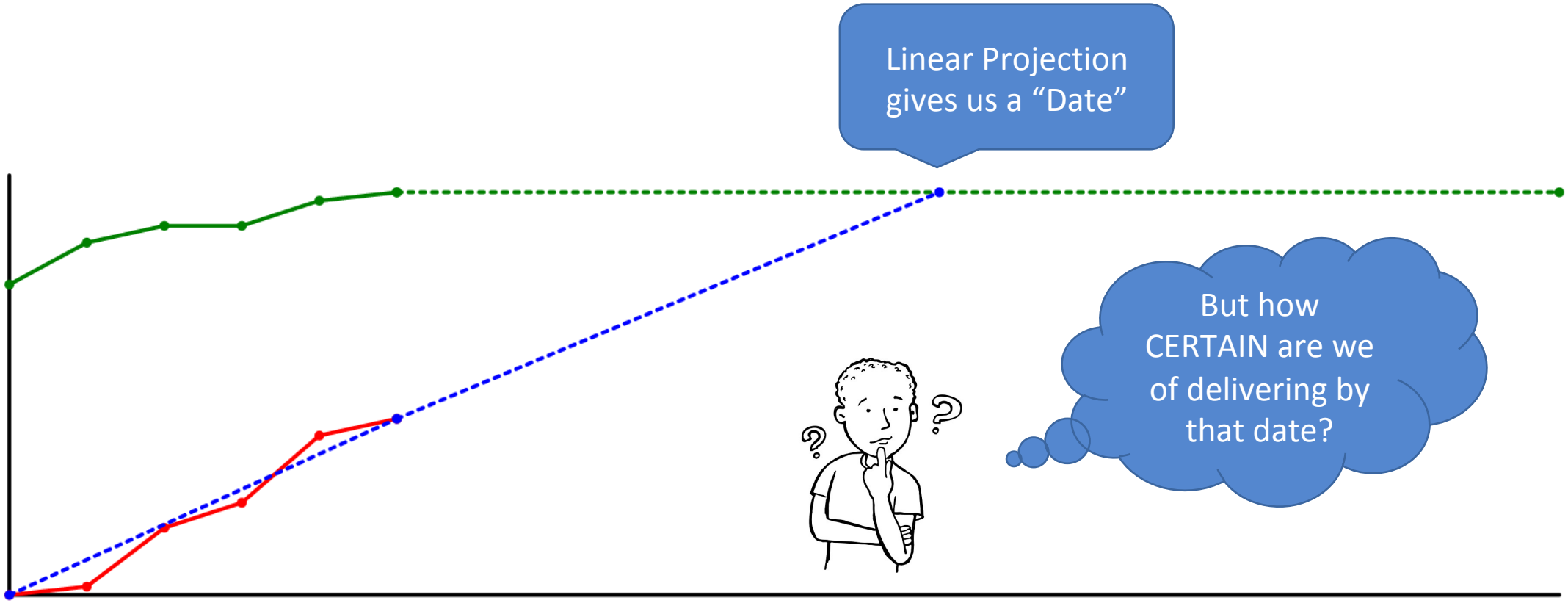

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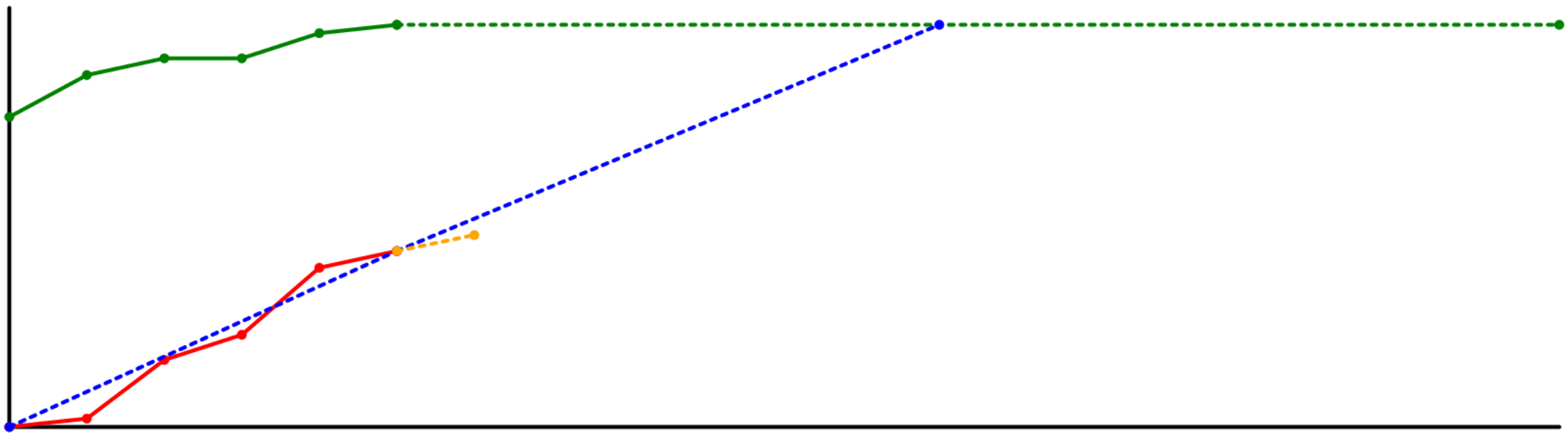

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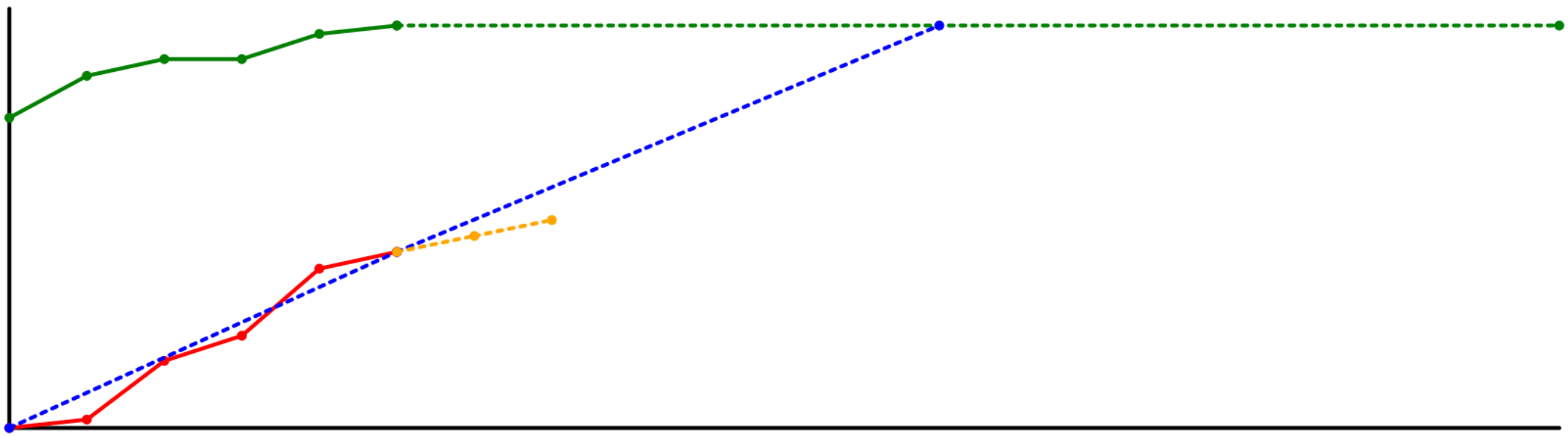

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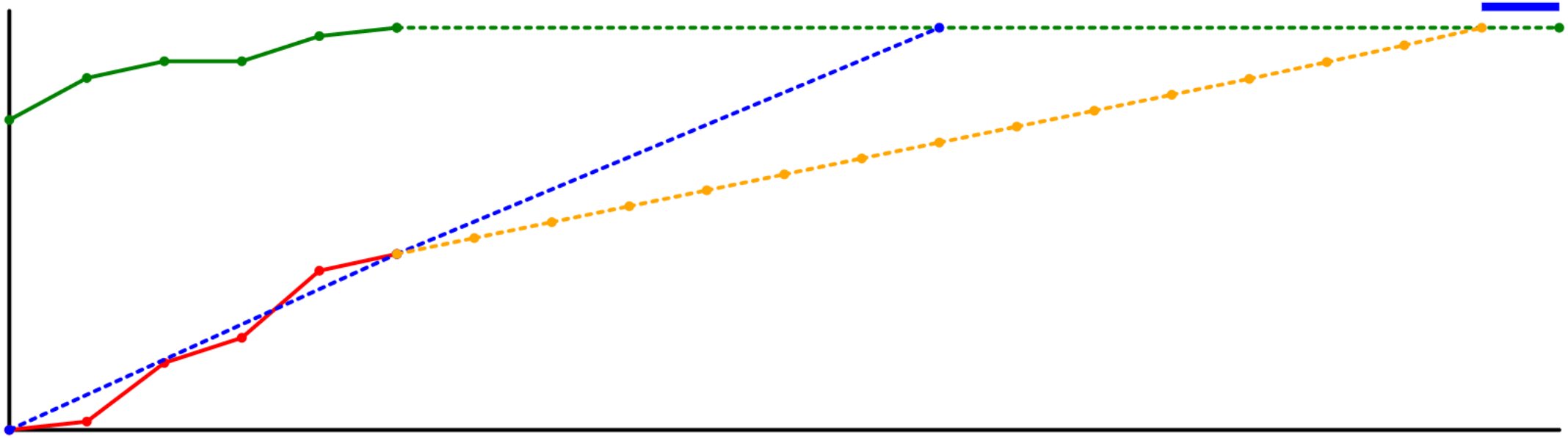

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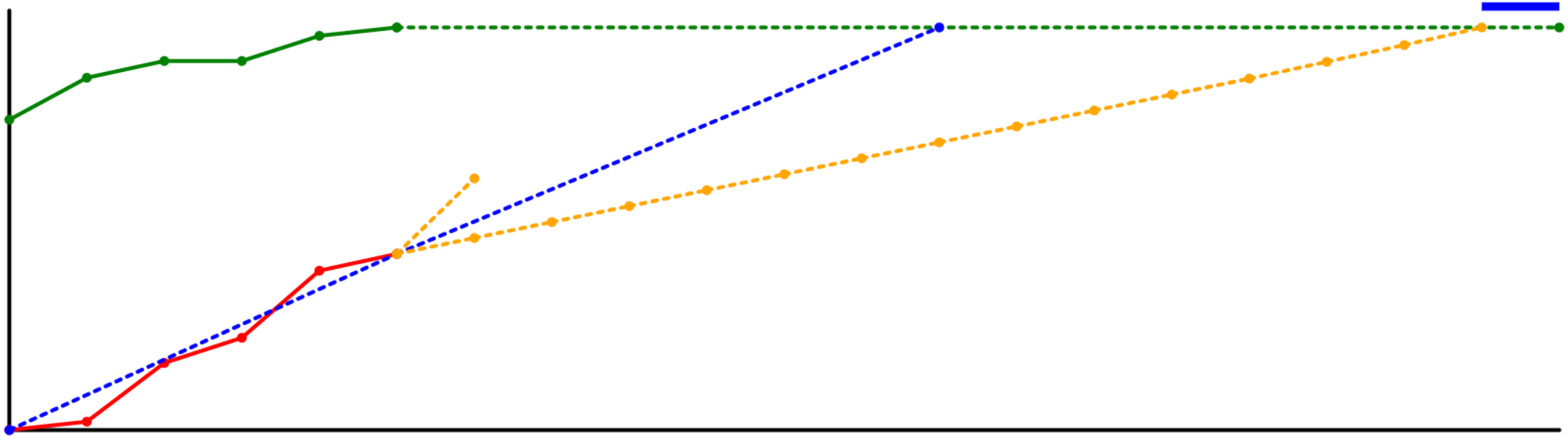

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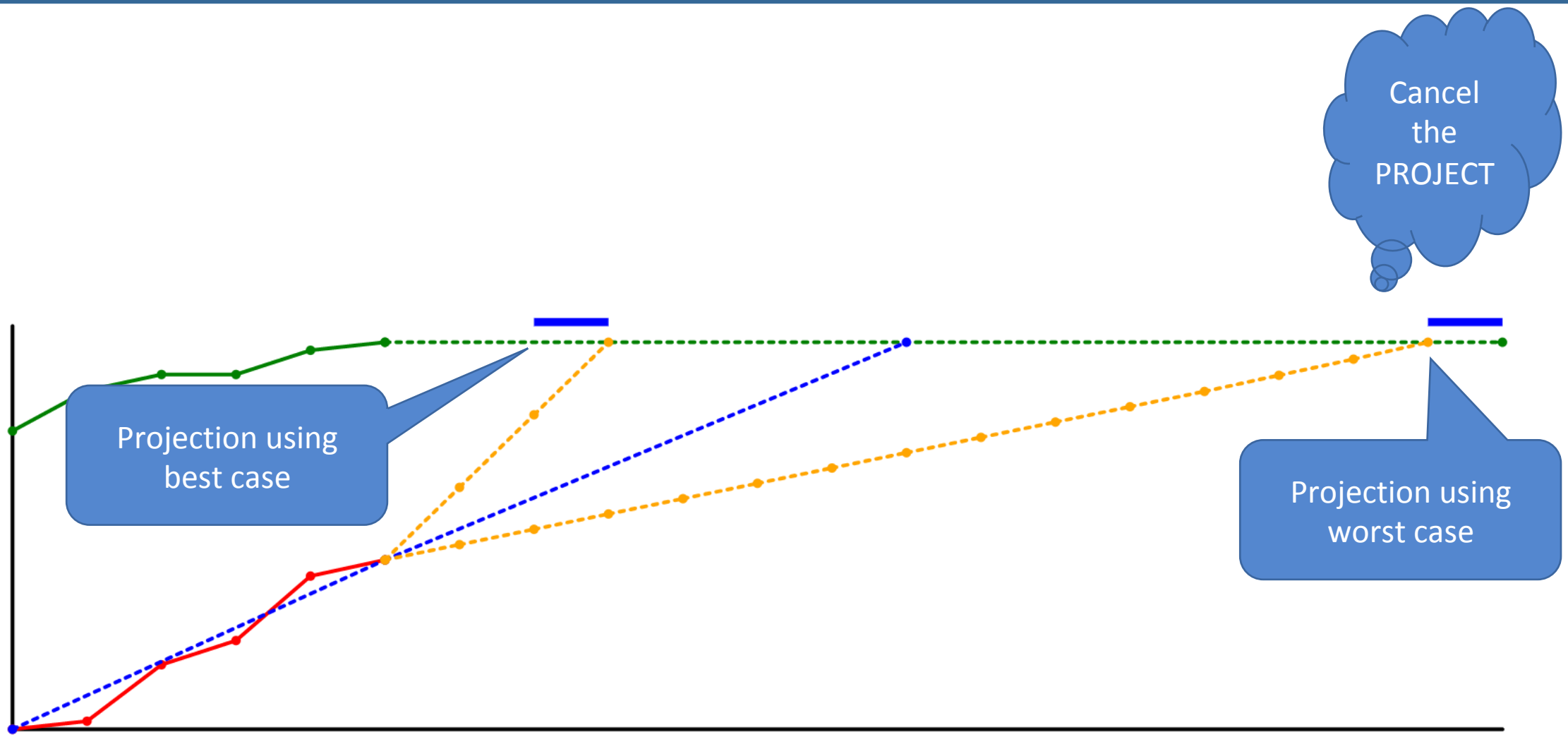

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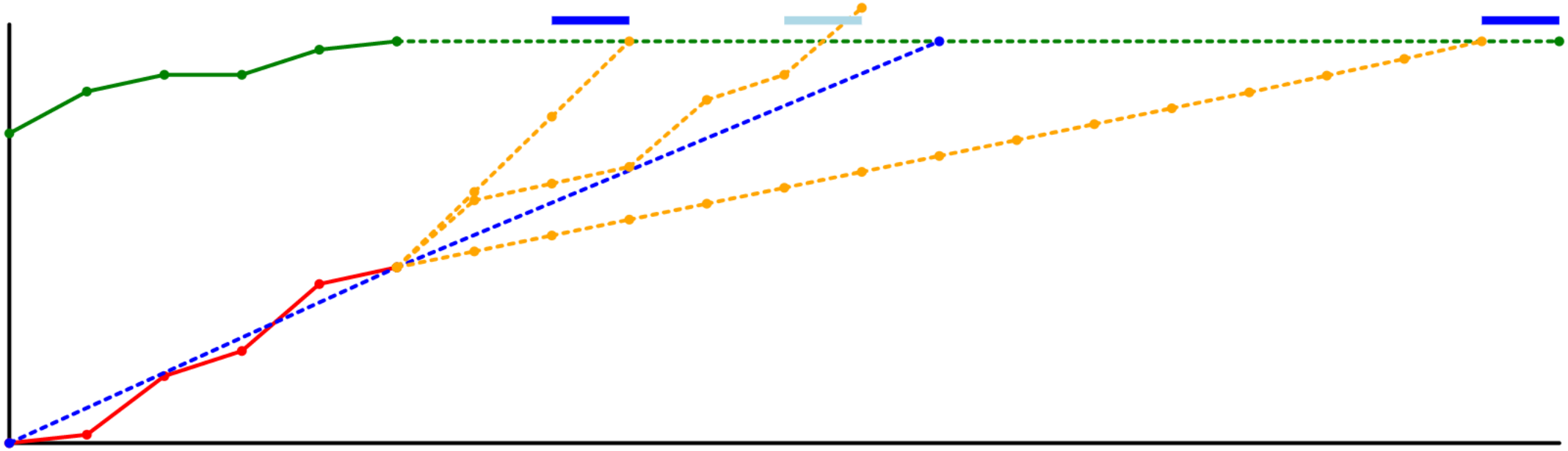

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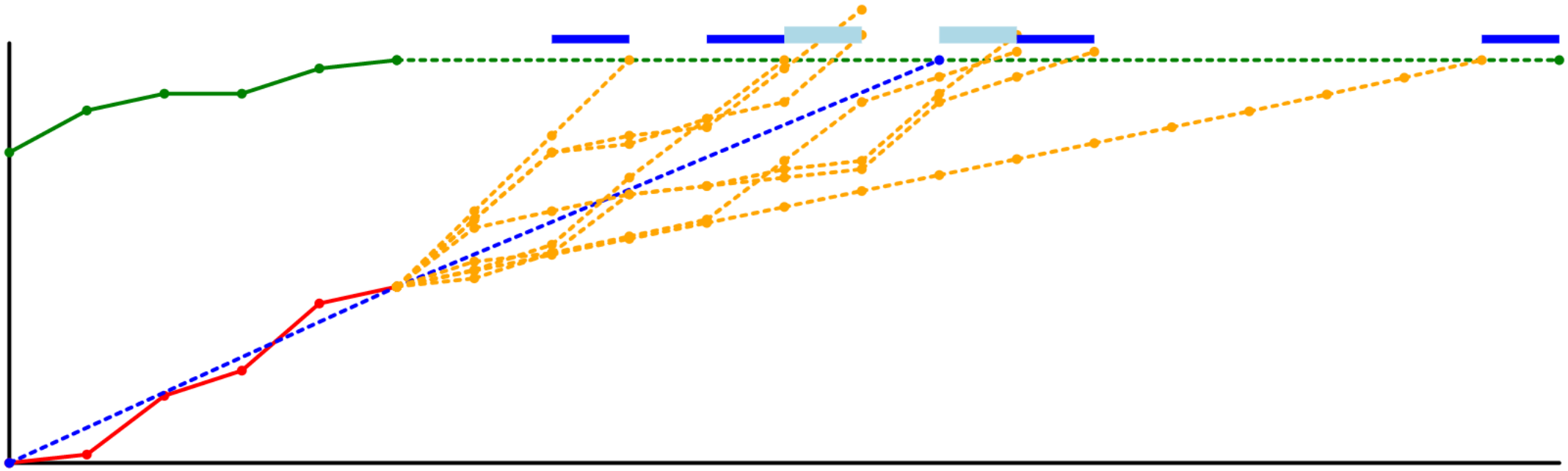

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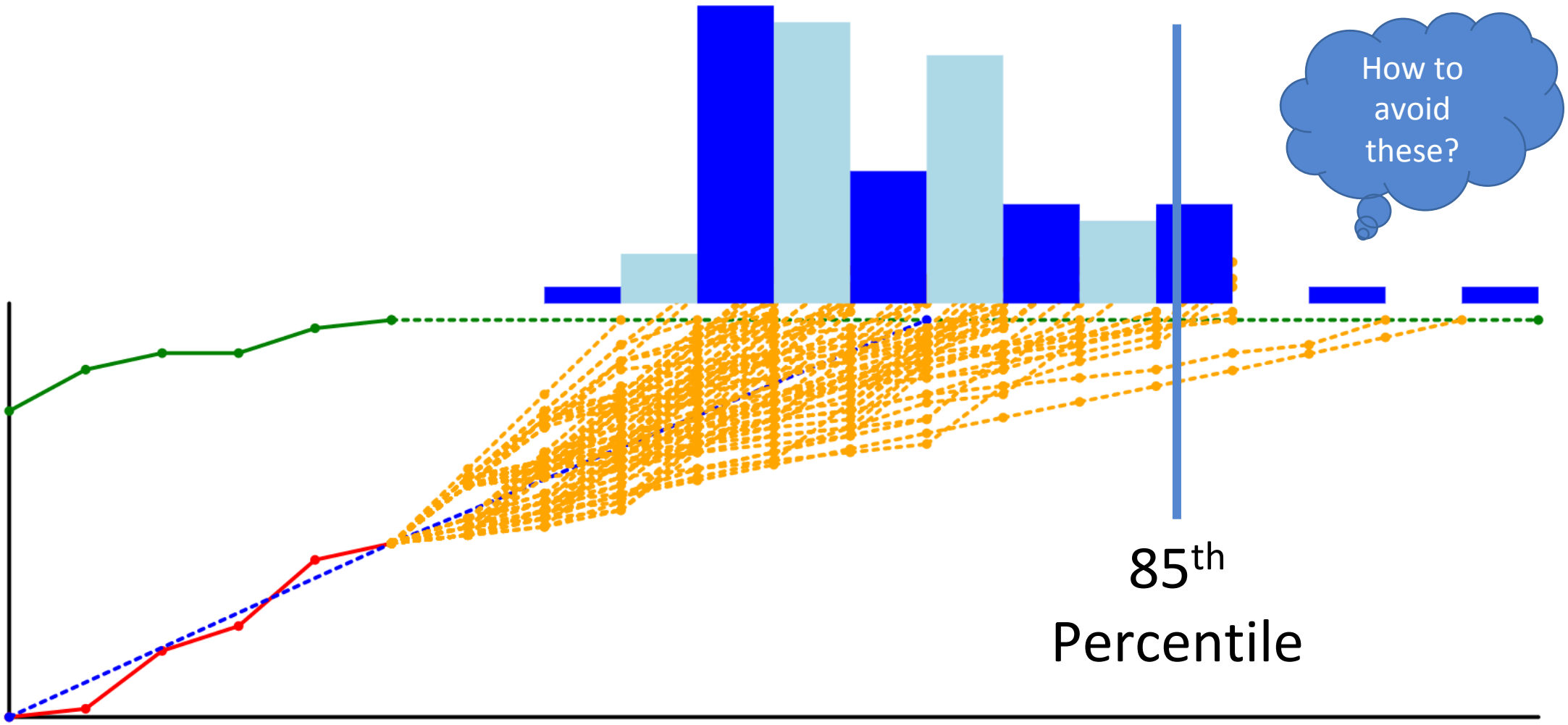


Forecast Completion Date

1. Start Date 11/1/2019

2. How many stories are remaining to be completed?

(enter the range estimate of stories. Tip: start wide and narrow as certainty increases)

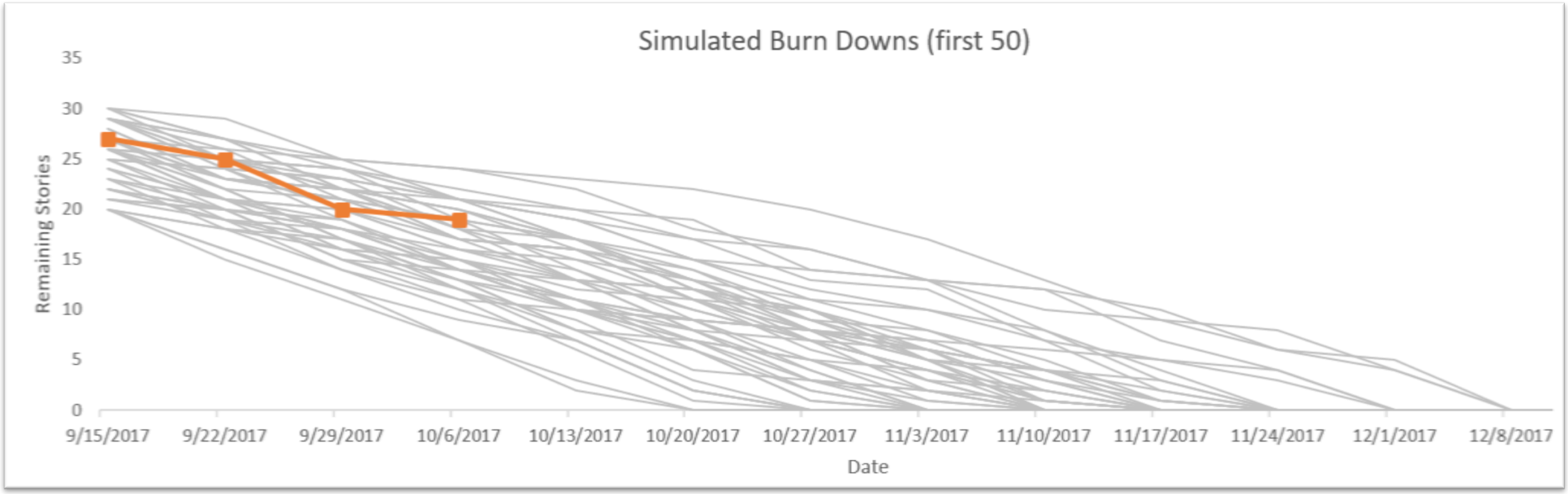
Low guess 20 Highest guess 30

3. Throughput. How many completed stories per week or sprint do you estimate low and high bounds?

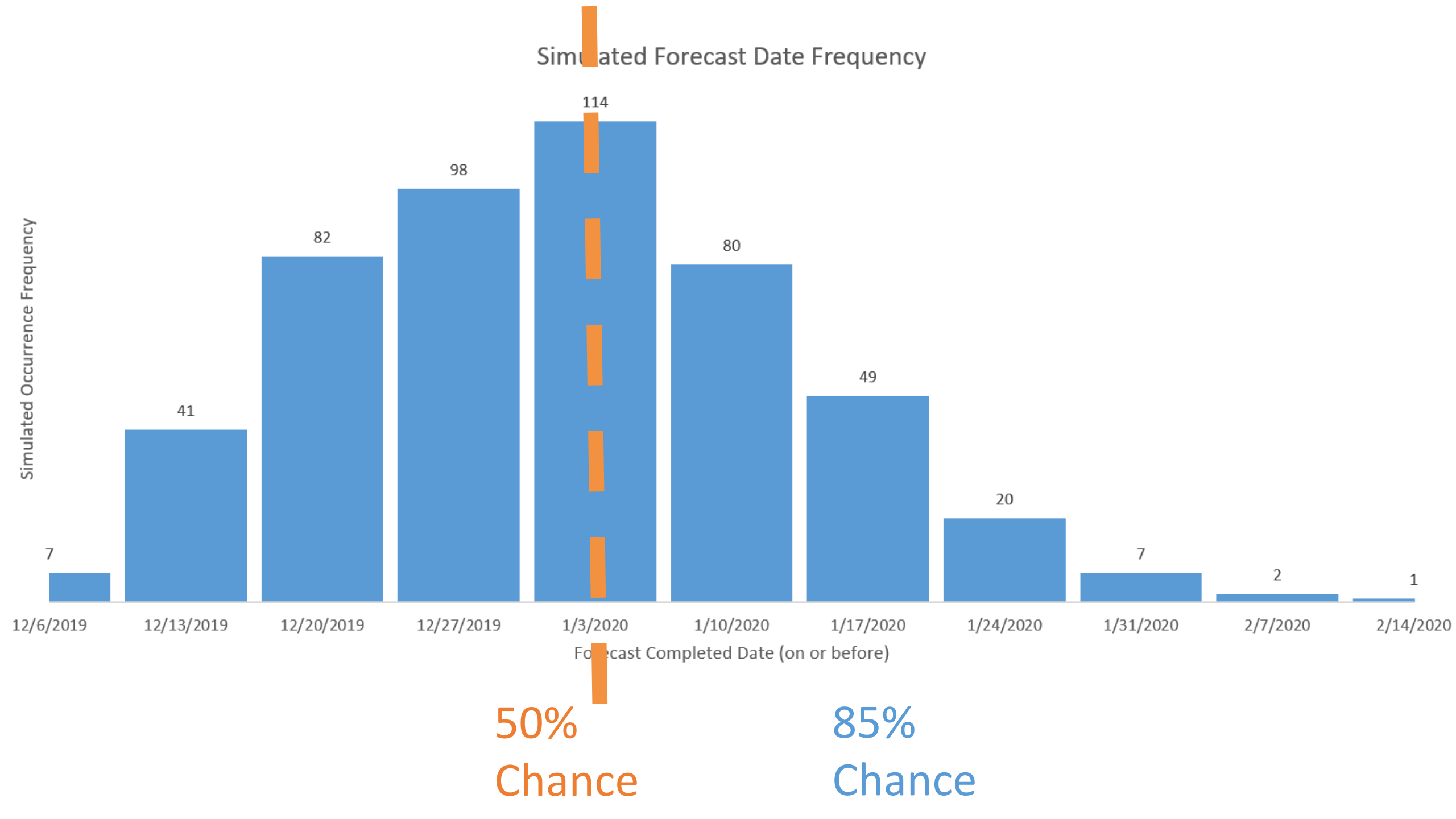
Use historical throughput data **OR** enter a low and high estimate below. Use: Estimate

Low guess 1 Highest guess 5

http://bit.ly/ThroughputForecast



http://bit.ly/ThroughputForecast


Simulated Forecast Date Frequency
Simulated Occurrence Frequency
7
41
82
98
114
80
49
20
7
2
1
12/6/2019
12/13/2019
12/20/2019
12/27/2019
1/3/2020
1/10/2020
1/17/2020
1/24/2020
1/31/2020
2/7/2020
2/14/2020
Forecast Completed Date (on or before)
50%
Chance
85%
Chance

Results

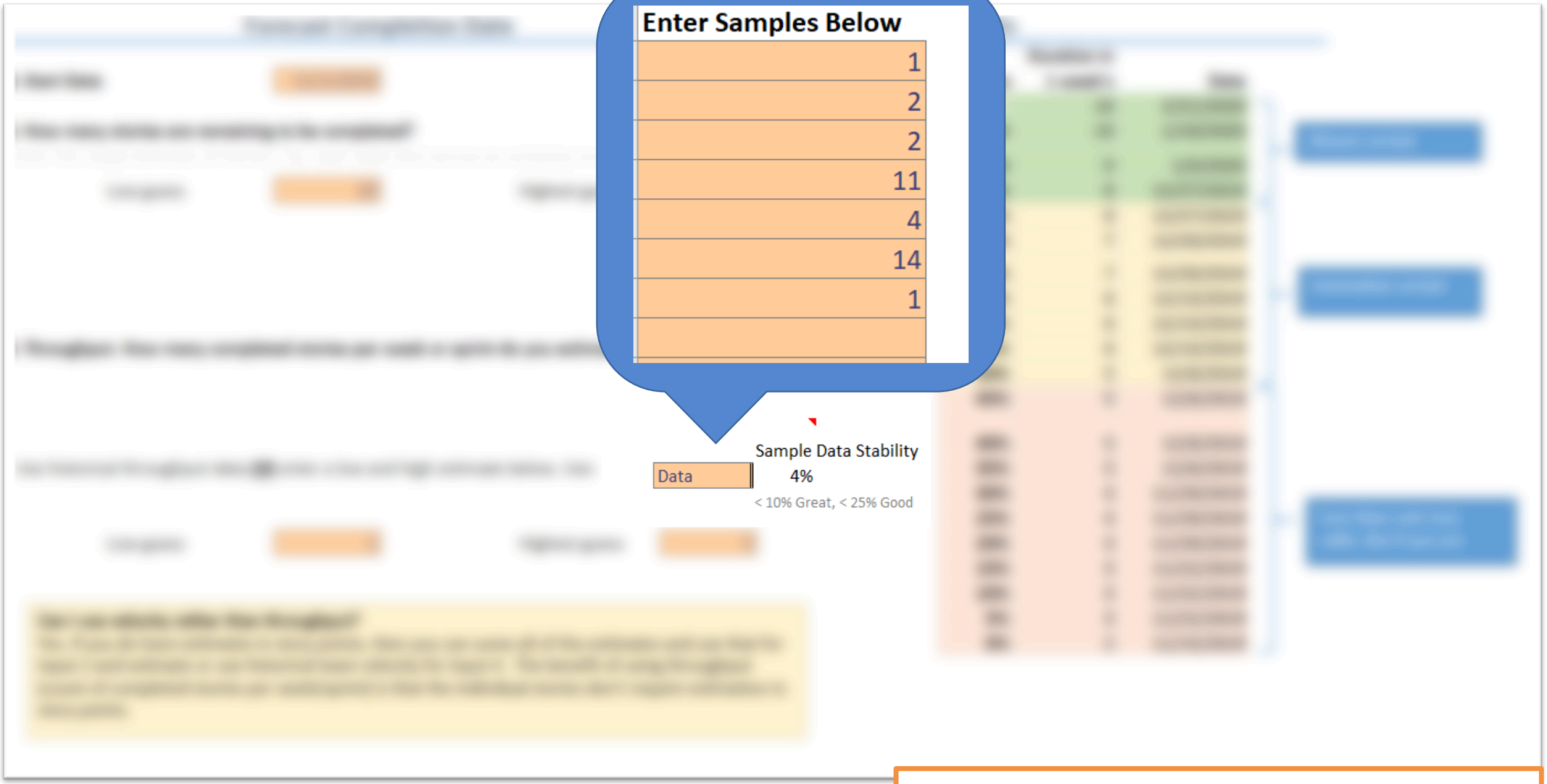
http://bit.ly/ThroughputForecast

Likelihoo	Duration in 1 week's	Date
100%	15	2/14/2020
95%	12	1/24/2020
90%	11	1/17/2020
85%	11	1/17/2020
80%	10	1/10/2020
75%	10	1/10/2020
70%	10	1/10/2020
65%	9	1/3/2020
60%	9	1/3/2020
55%	9	1/3/2020
50%	9	1/3/2020
45%	8	12/27/2019

Almost certain

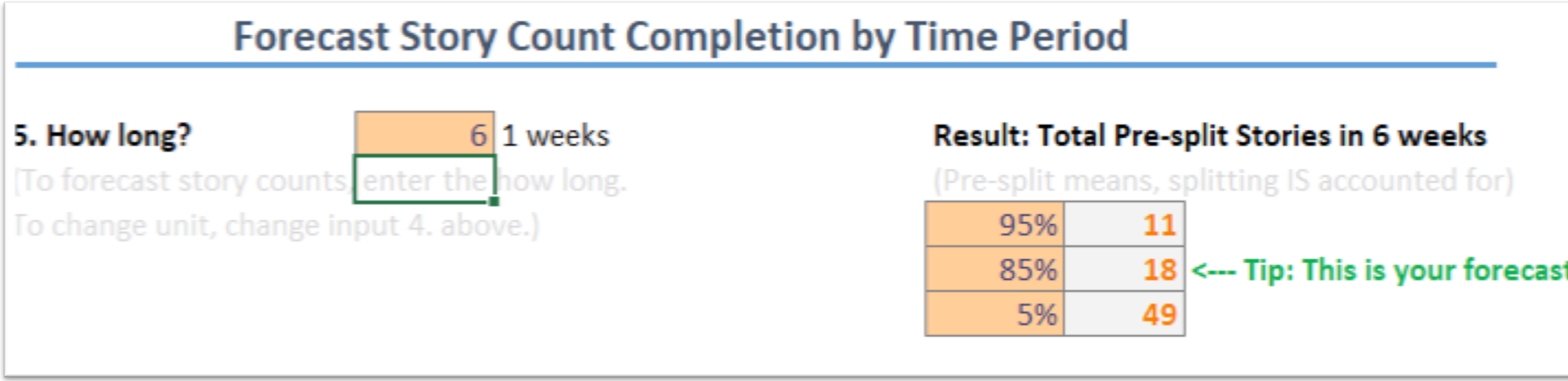
Somewhat certain

Date you get using AVERAGE



http://bit.ly/ThroughputForecast

Realistic Capacity Setting Using history



Forecast Story Count Completion by Time Period

5. How long? 6 1 weeks

(To forecast story counts, enter the how long.
To change unit, change input 4. above.)

Result: Total Pre-split Stories in 6 weeks

(Pre-split means, splitting IS accounted for)

95%	11
85%	18
5%	49

<--- Tip: This is your forecast

- BRING historical capacity INTO the room…
- What else absorbs capacity?
  - Planned vs Un-planned capacity
  - Cool industry conferences (DOES as a random example)

http://bit.ly/ThroughputForecast

http://bit.ly/MultipleFeatureForecast

				Start date: 01/01/2017	
Start Order	Feature Name	Story Count Low Guess	Story Count High Guess	Forecast Feature Duration in Weeks	Forecast Completion Date (85% CI)
1	Feature 1	5	10	4 ✓	1/29/2017
2	Feature 2	8	15	5 ✓	3/5/2017
3	Feature 3	15	25	8 ✓	4/30/2017
4	Feature 4	20	30	10 ✗	7/9/2017
5	Feature 5	10	40	11 ✗	9/24/2017

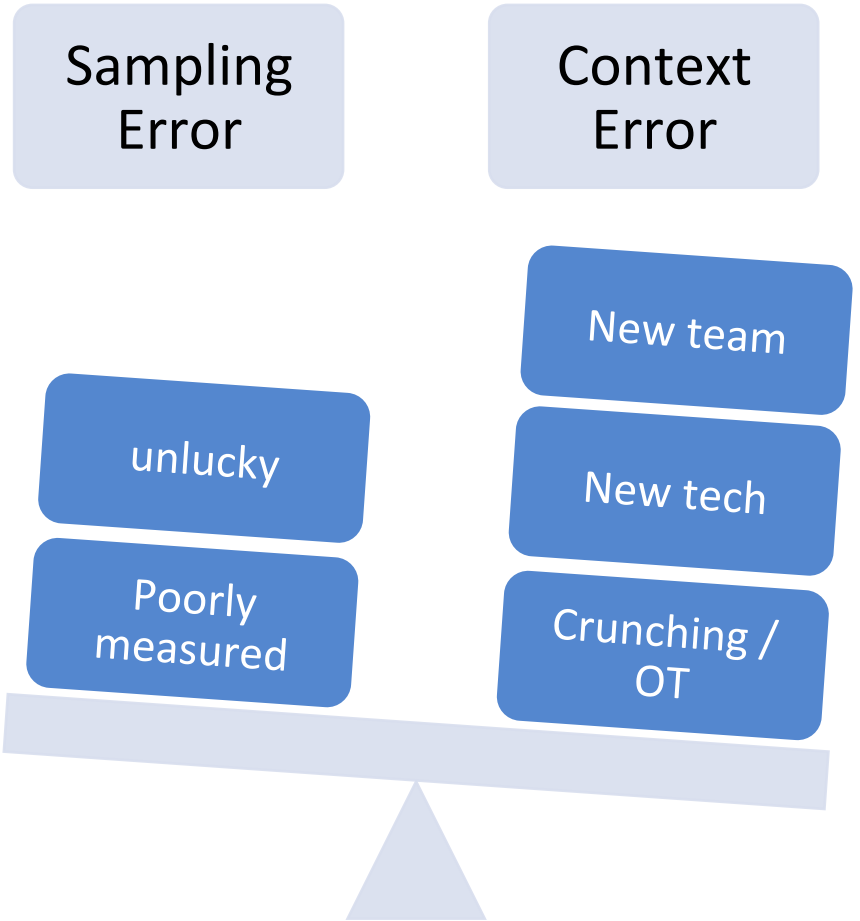
IMMEDIATE feedback BEFORE promises

Bring CAPACITY based on DATA into the ROOM

How many samples to use?

- < 3 samples
  - Guess the range, go wide
- 4-7 samples
  - Narrow guessed range using relevant data
- 7-15 samples
  - Use relevant data
- > 15 samples, delete the oldest and use the newest still relevant data

- **Always – look for reasons historical data is no longer relevant – delete it**



Avoid the FLAW of AVERAGES

There NEVER is ONE answer
in an uncertain world

Balance Recency with Sample Size
Use DATA after 7 samples

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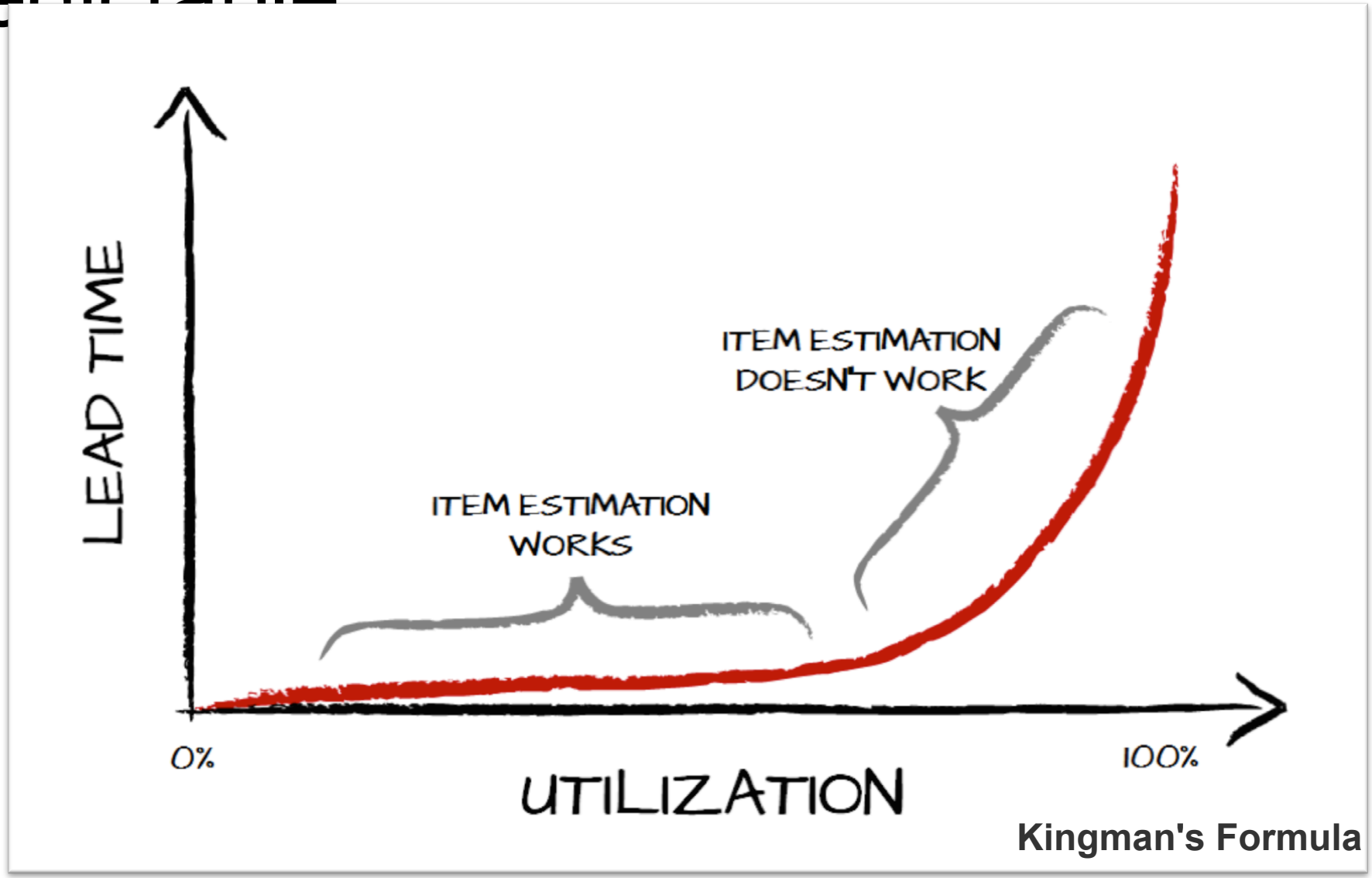
Two BIGGEST impact on predictability

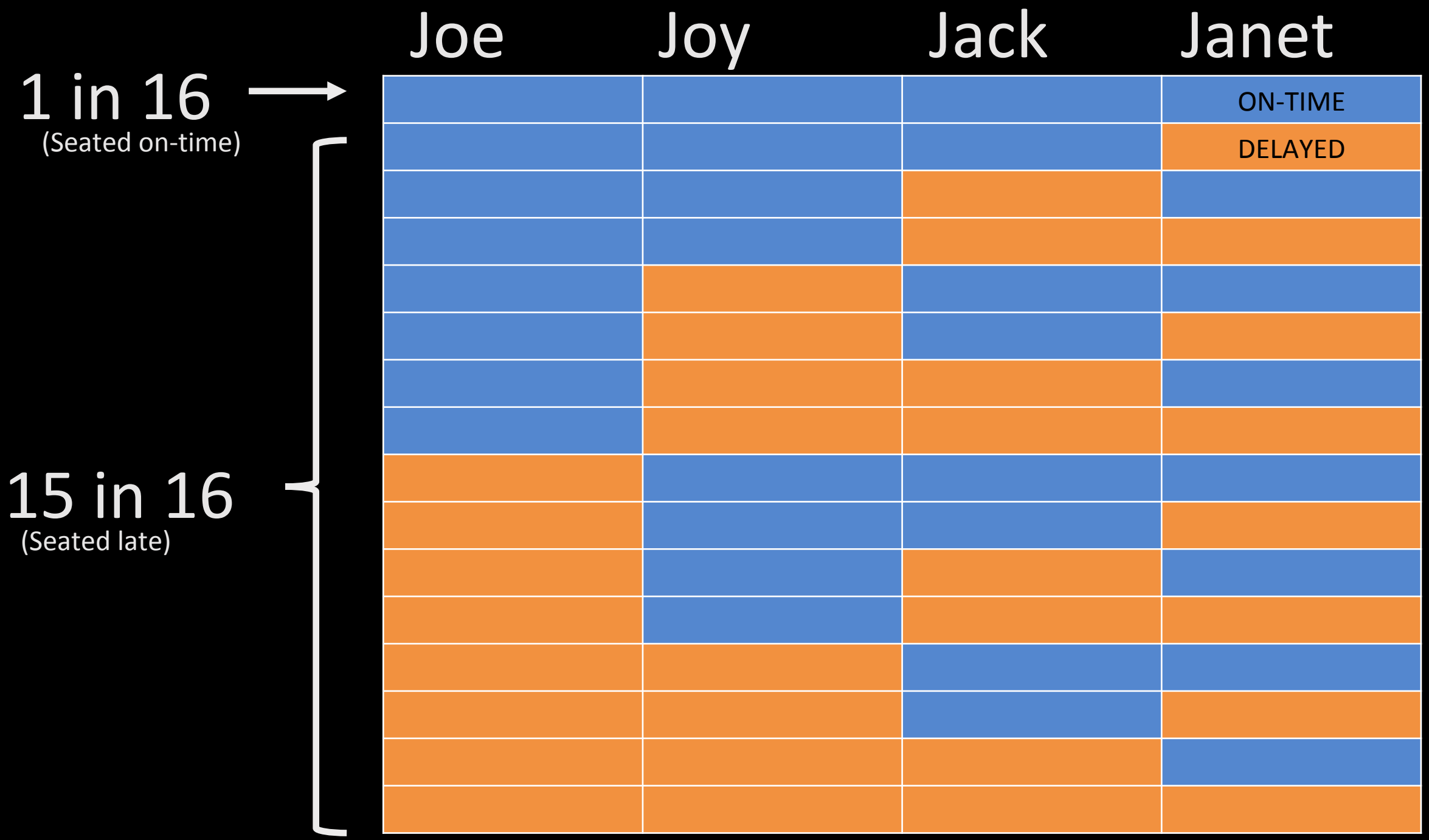
Why estimating is a rounding error

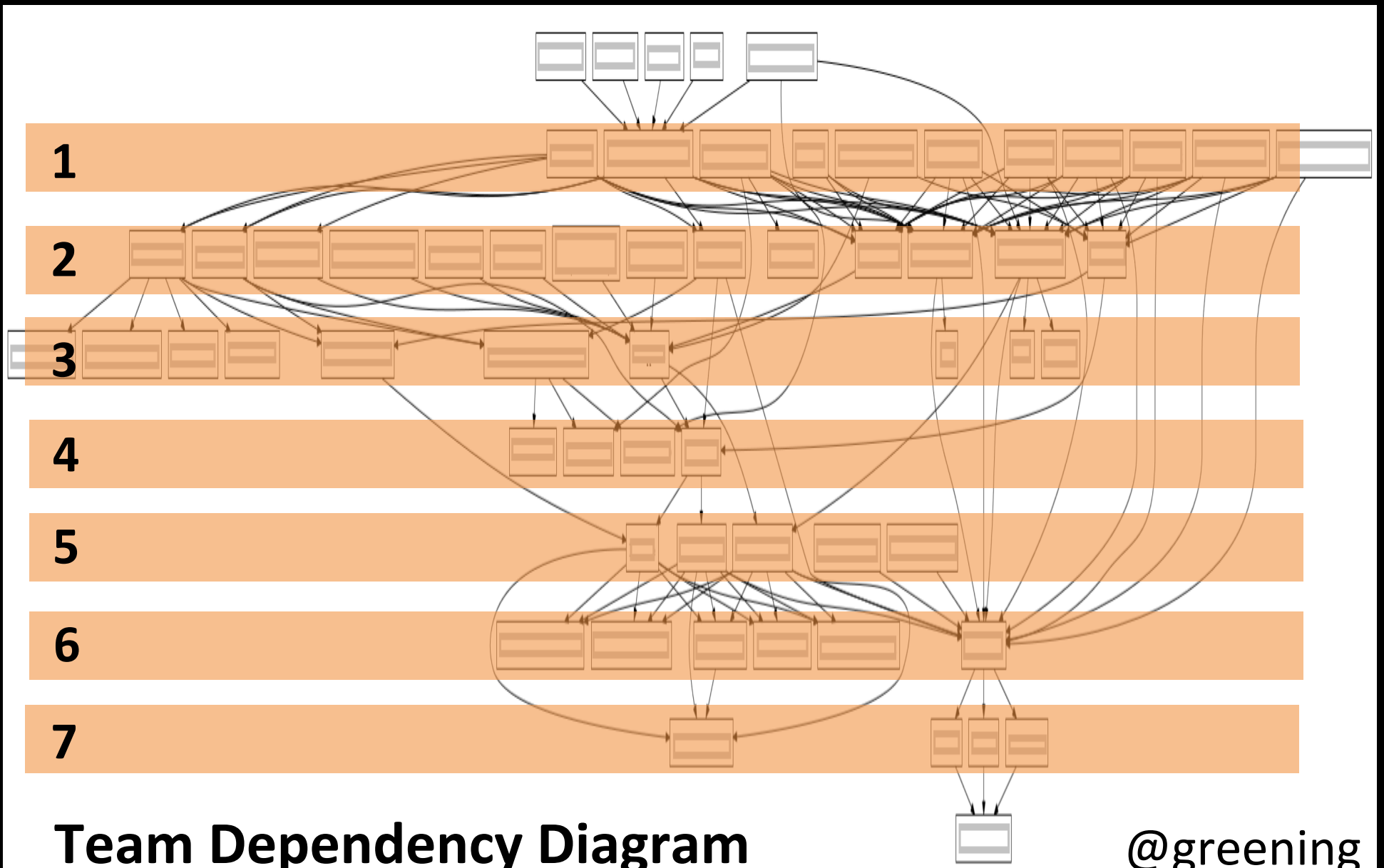

heapsoffun.com

High Utilization Systems are NOT-Predictable



Kingman's Formula


Joe
Joy
Jack
Janet
1 in 16
(Seated on-time)
ON-TIME
DELAYED
15 in 16
(Seated late)



Team Dependency Diagram

@greening

Chances at least one team not delayed

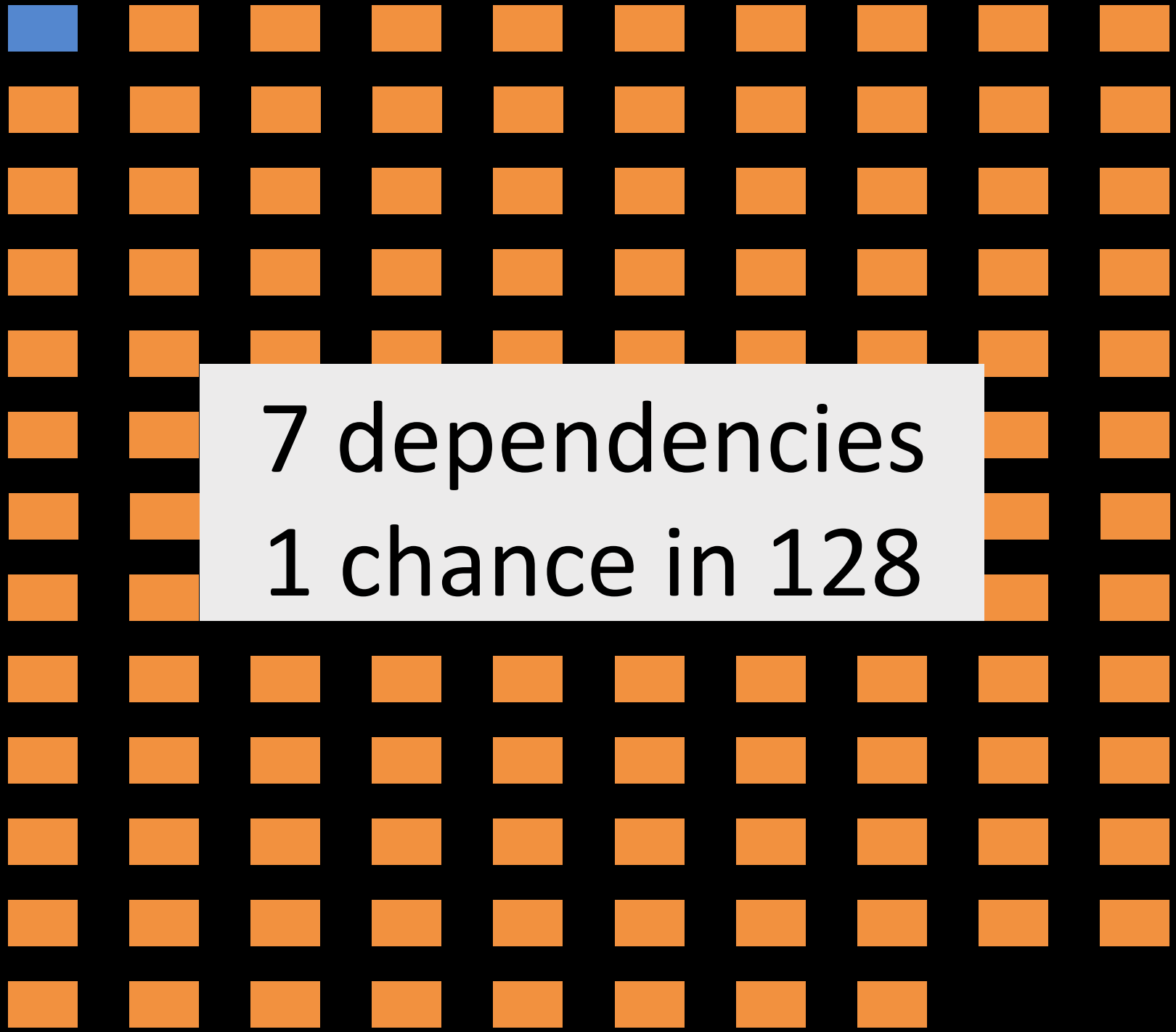
$1 \text{ in } 2^n$

or

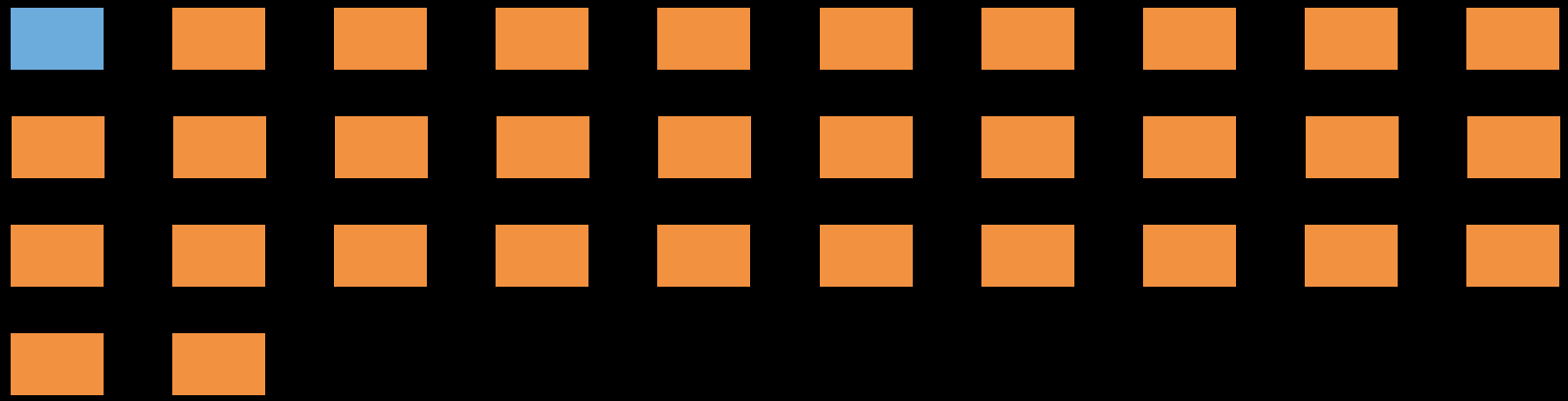
$1 \text{ in } 2^7$

or

1 in 128


7 dependencies
1 chance in 128

6 dependencies
1 chance in 64



5 dependencies
1 chance in 32

Manage Utilization (especially in innovative domains)

Every Dependency you REMOVE
Doubles the Odds of ONTIME

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This 30 Minute session will cover

- Probability and Probabilistic Forecasting basics
- How much data is needed for reliable forecasting
- Predicting the arrival rate on incoming work
- Predicting the capacity of teams receiving work
- Building achievable plans across one or multiple teams
- Tracking progress and communicating status

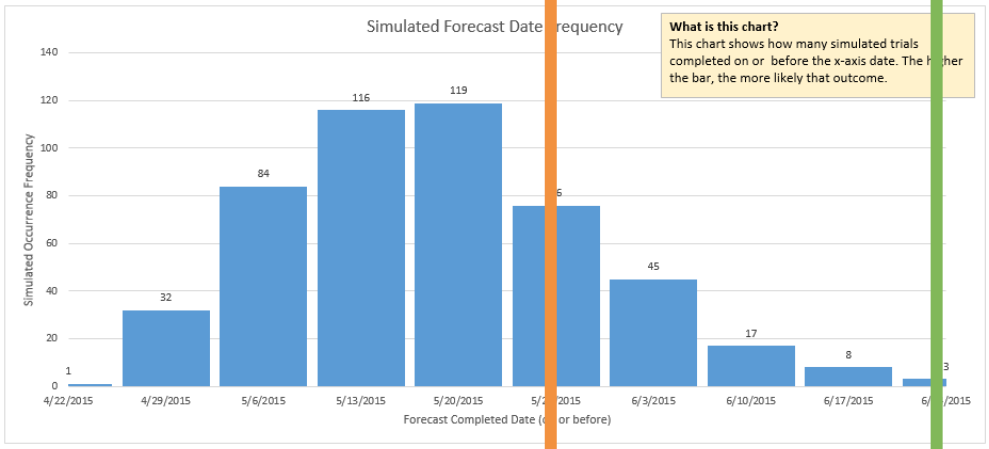
You don't do forecasts and estimates to know you are right; you do forecasts and estimates to **detect you are wrong**

WITHOUT RISKS INCLUDED

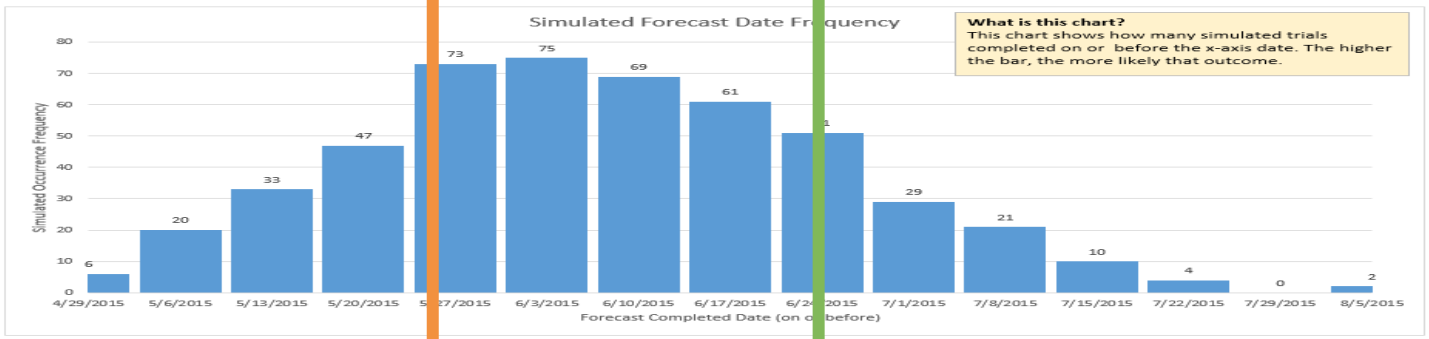
27th May (highest late June)

24th June (highest early August)

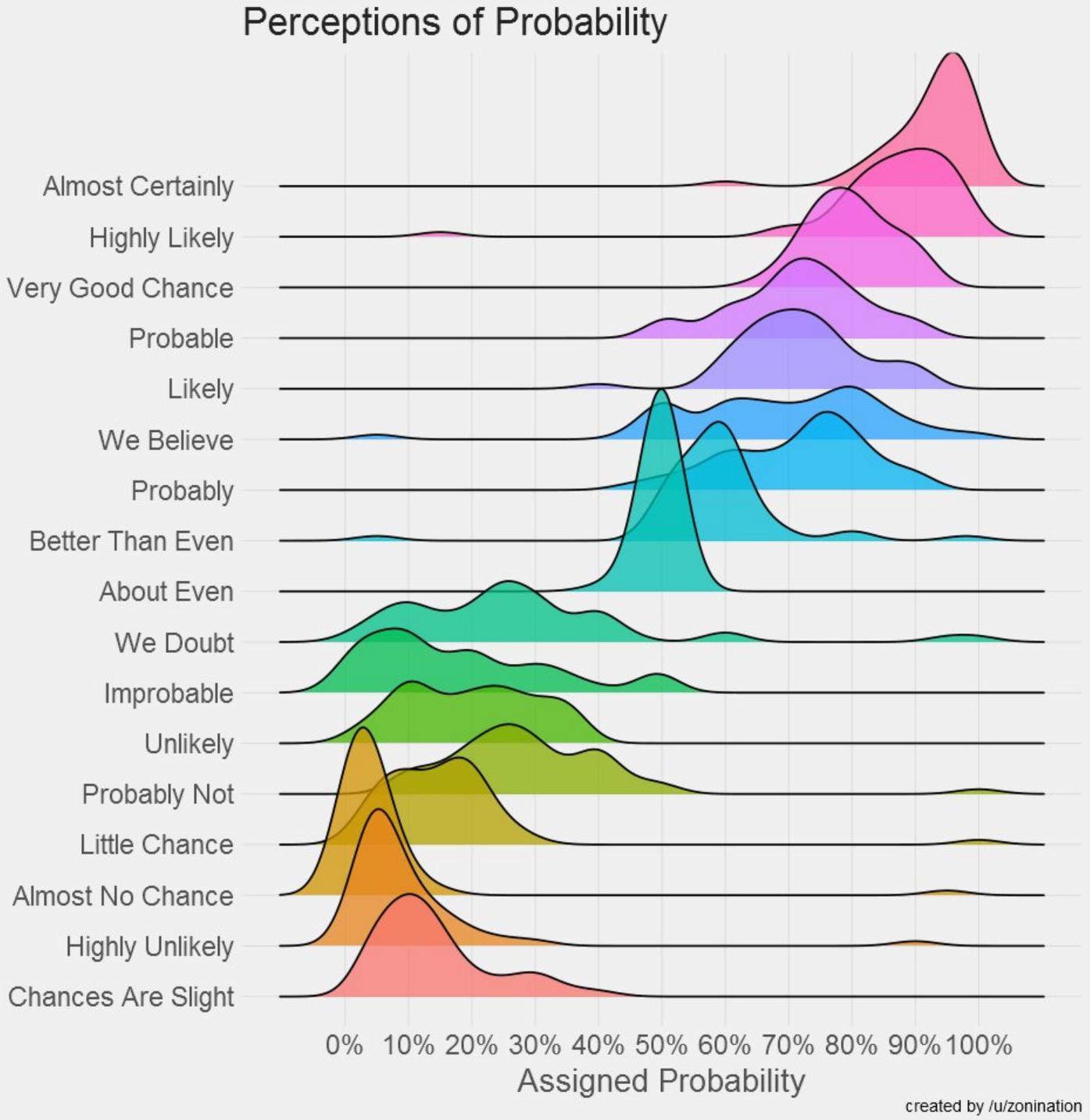
WITH RISKS INCLUDED



Likelihood	Impact Low	Impact High	Description
50%	7	10	Browser compatibility issues
40%	3	7	Performance under load
30%	5	10	Production configuration



Forecasts shown at 85th Percentile


Perceptions of Probability
Almost Certainly
Highly Likely
Very Good Chance
Probable
Likely
We Believe
Probably
Better Than Even
About Even
We Doubt
Improbable
Unlikely
Probably Not
Little Chance
Almost No Chance
Highly Unlikely
Chances Are Slight
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Assigned Probability
created by /u/zonination

Story Points or Throughput?

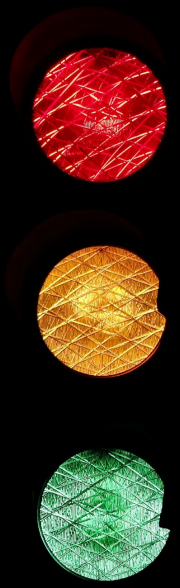
1 point

13 points

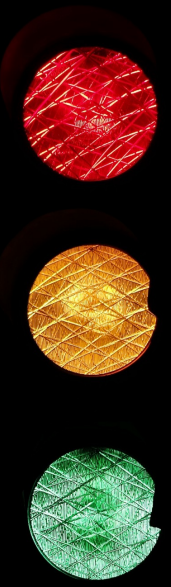
https://pxhere.com/en/photo/775063

1 point

13 points

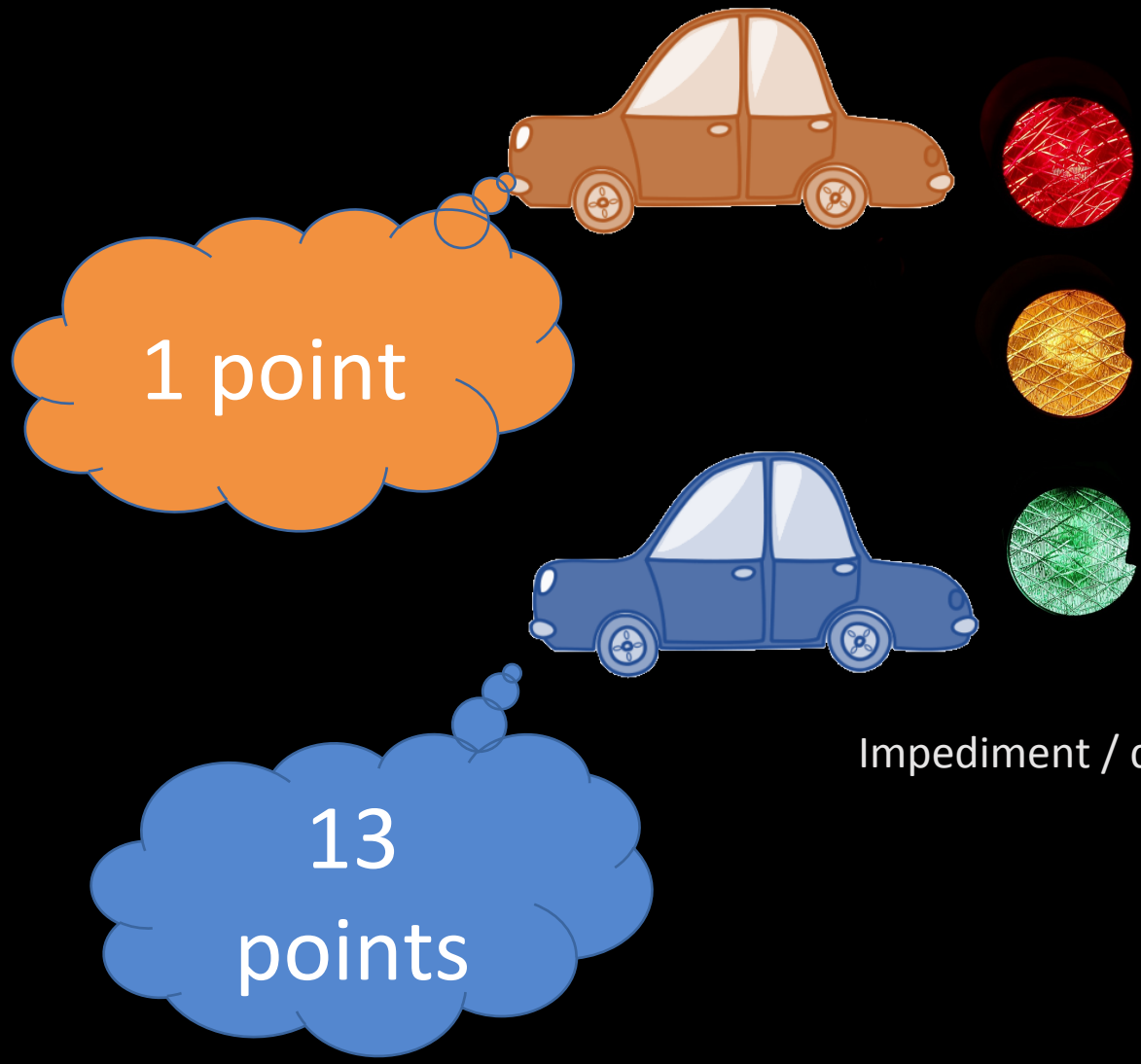


Impediment / dependency

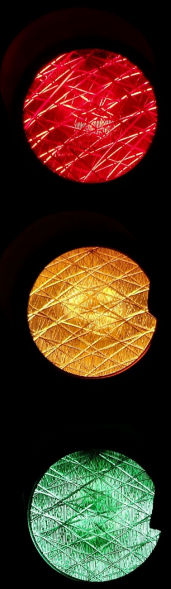


Impediment / dependency

https://pxhere.com/en/photo/775063

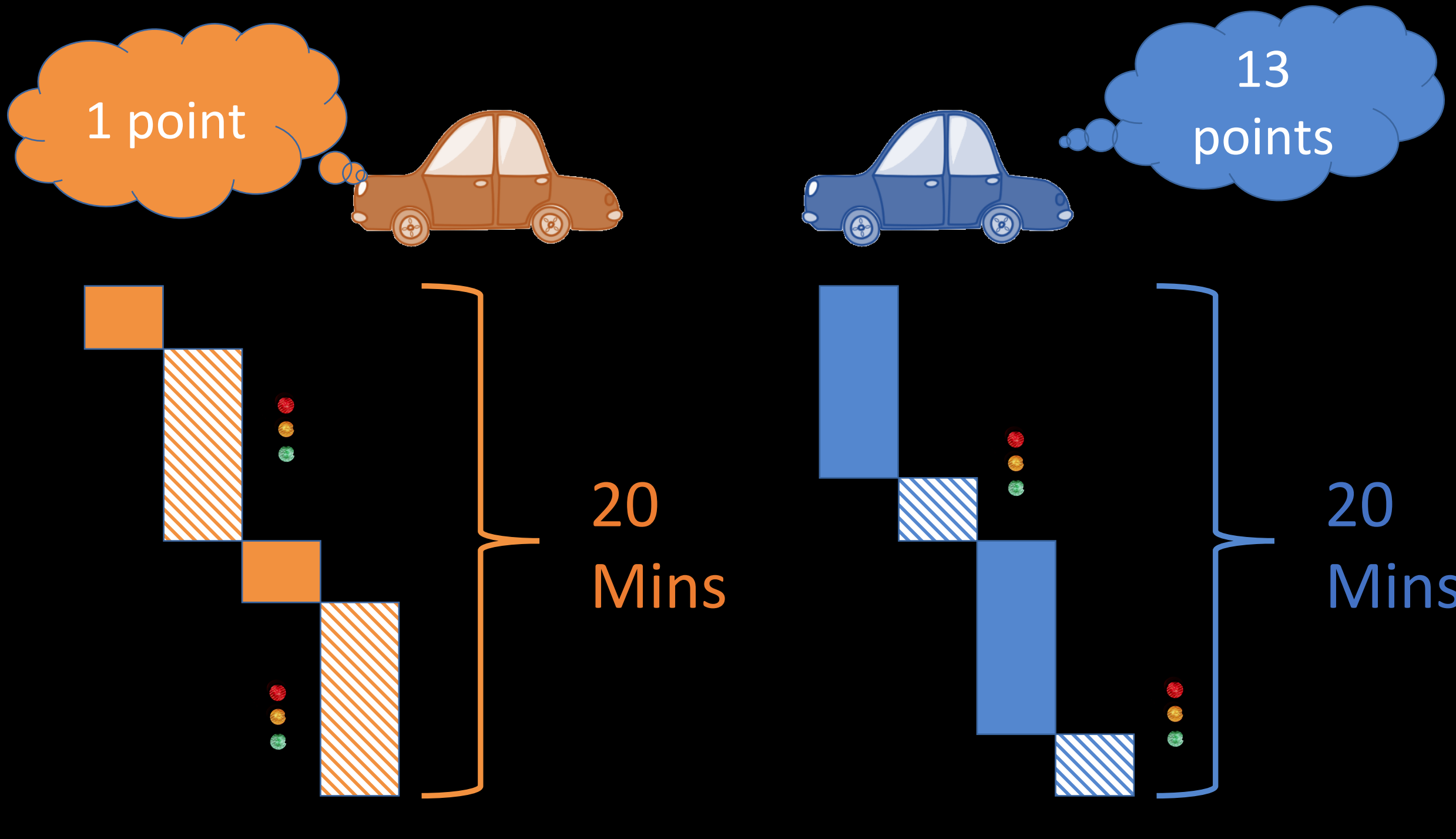


Impediment / dependency



Impediment / dependency

https://pxhere.com/en/photo/775063


1 point
13 points
20 Mins
20 Mins

Story Points or Item Count Forecast Better?

Story Points Work Better…

- Development Time > Delays
  - Few Dependencies
  - Flexible capacity / Dedicated staff

Item Count Works Better…

- Delays > Development Time
  - Many Dependencies
  - Constrained capacity / Shared staff

Why?

- Development time dominates the lead time to release
- Error introduced by assuming all similar sized items can be huge

Why?

- Delay time(s) dominates the lead time to release
- Error introduced by story point size estimates can be huge

Experiment

Hide last “months” data

See if you can predict where you are now