



# OXFORD HACK 2019

JULIAN BRENDL

PATRICK VAN HESTEREN

Friday 15 November 2019

# TALK BREAKDOWN

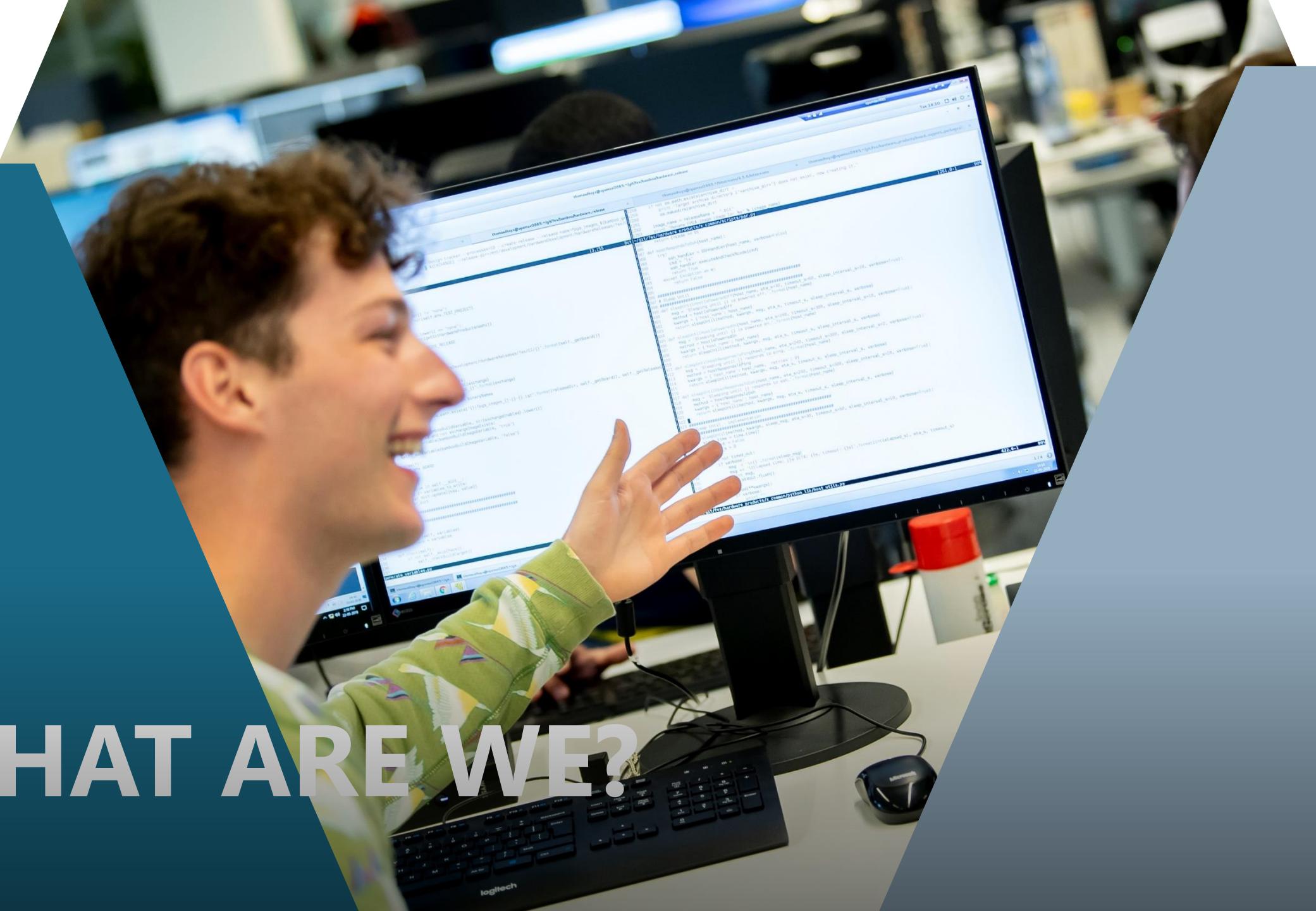
## PART 1

- Markets
- Market Makers

## PART 2

- Our challenge
- Order book

# WHAT ARE WE?



# TRADING COMPANY



# BUY AND SELL FINANCIAL PRODUCTS



# USING ALGORITHMS



**BUT...**

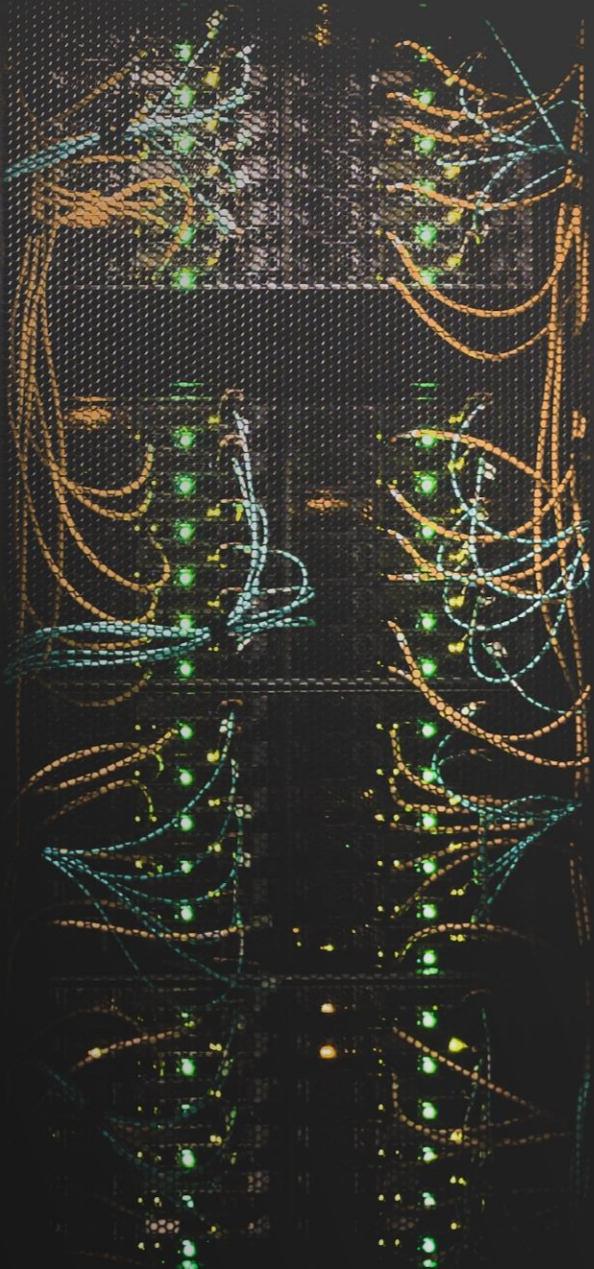
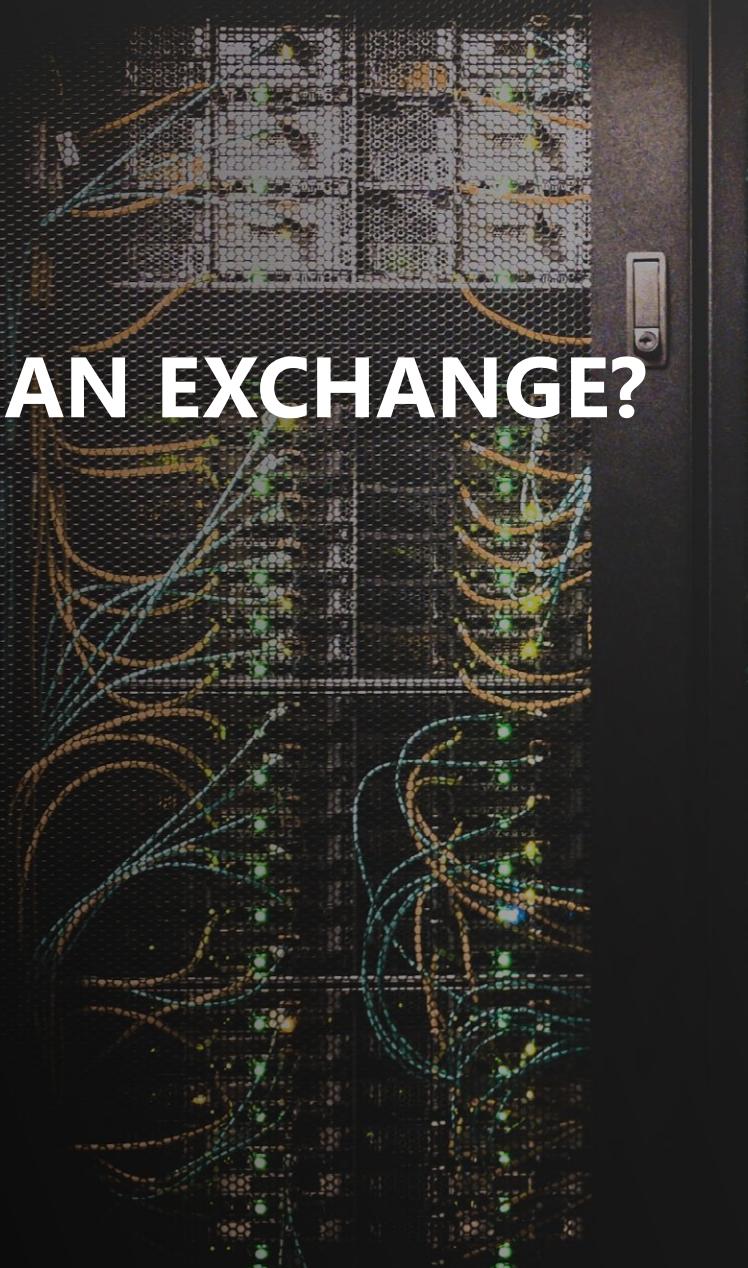
## BUT...

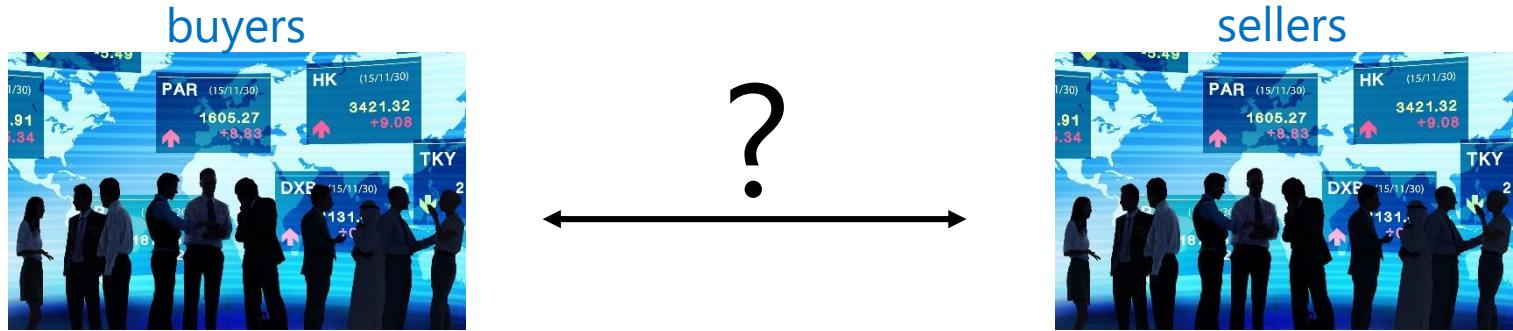
- How do we trade?
- Who do we trade with?
- Where do we trade?

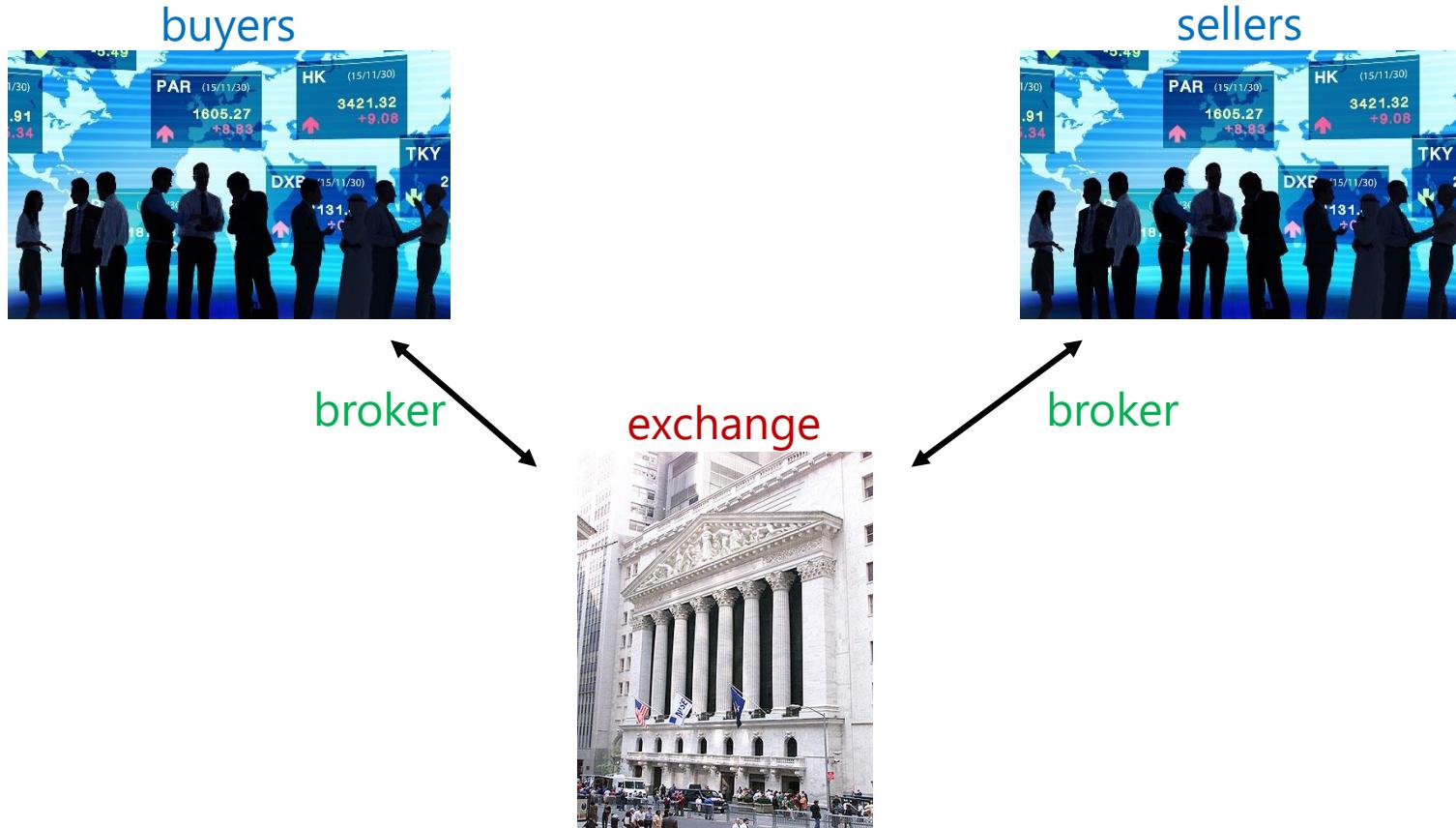
## BUT...

- How do we trade?
- Who do we trade with?
- Where do we trade?
- **What value do we provide?**

# WHAT IS AN EXCHANGE?







## ADVANTAGES OF AN EXCHANGE



## ADVANTAGES OF AN EXCHANGE

- Central place to trade



## ADVANTAGES OF AN EXCHANGE

- Central place to trade
- Reliable



## ADVANTAGES OF AN EXCHANGE

- Central place to trade
- Reliable
- Trustworthy



## ADVANTAGES OF AN EXCHANGE

- Central place to trade
- Reliable
- Trustworthy
- **Liquidity providers/market makers**



# THE BIGGER PICTURE

## CONSTRUCTION OF A MARKET ENVIRONMENT

# THE BIGGER PICTURE

## CONSTRUCTION OF A MARKET ENVIRONMENT

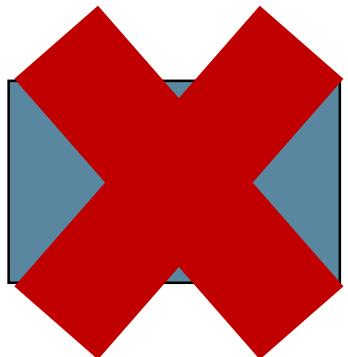
Buyer

Exchange

Seller

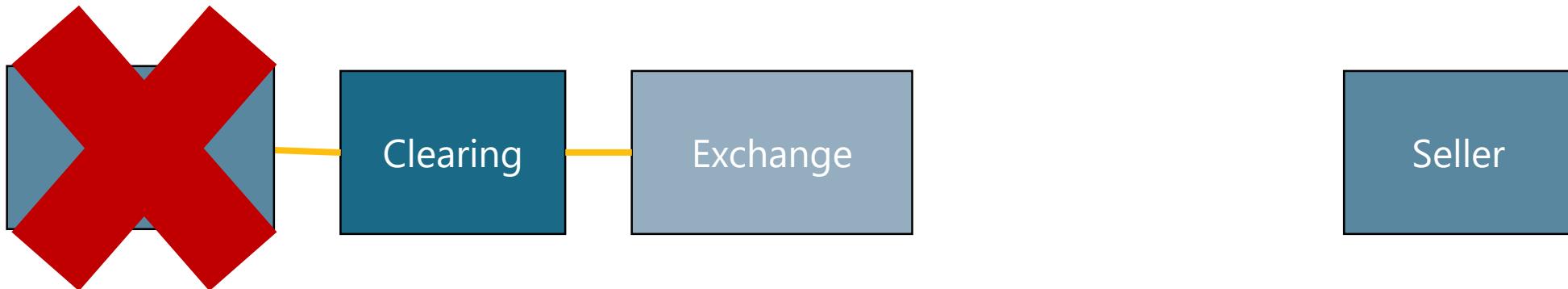
# THE BIGGER PICTURE

## CONSTRUCTION OF A MARKET ENVIRONMENT



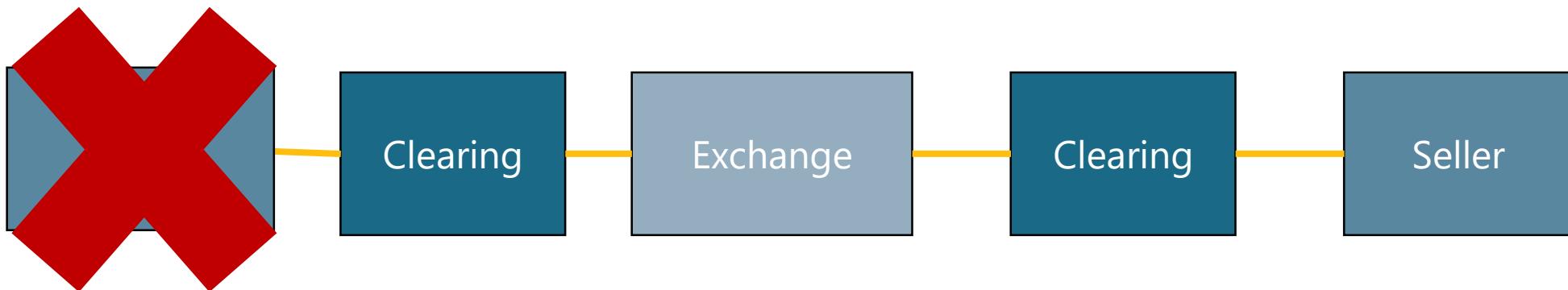
# THE BIGGER PICTURE

## CONSTRUCTION OF A MARKET ENVIRONMENT



# THE BIGGER PICTURE

## CONSTRUCTION OF A MARKET ENVIRONMENT



# WHO ARE THE MARKET PARTICIPANTS?

## *Directional*

- Big banks
- Pension fund



# WHO ARE THE MARKET PARTICIPANTS?

## *Directional*

- Big banks
- Pension fund

## *Non-directional (market neutral)*

- Brokers
- Market makers



# WHAT IS MARKET MAKING?

[HTTPS://WWW.YOUTUBE.COM/WATCH?V=GM7SRS9BS3S](https://www.youtube.com/watch?v=GM7SRS9BS3s)



# PRICING IS KEY



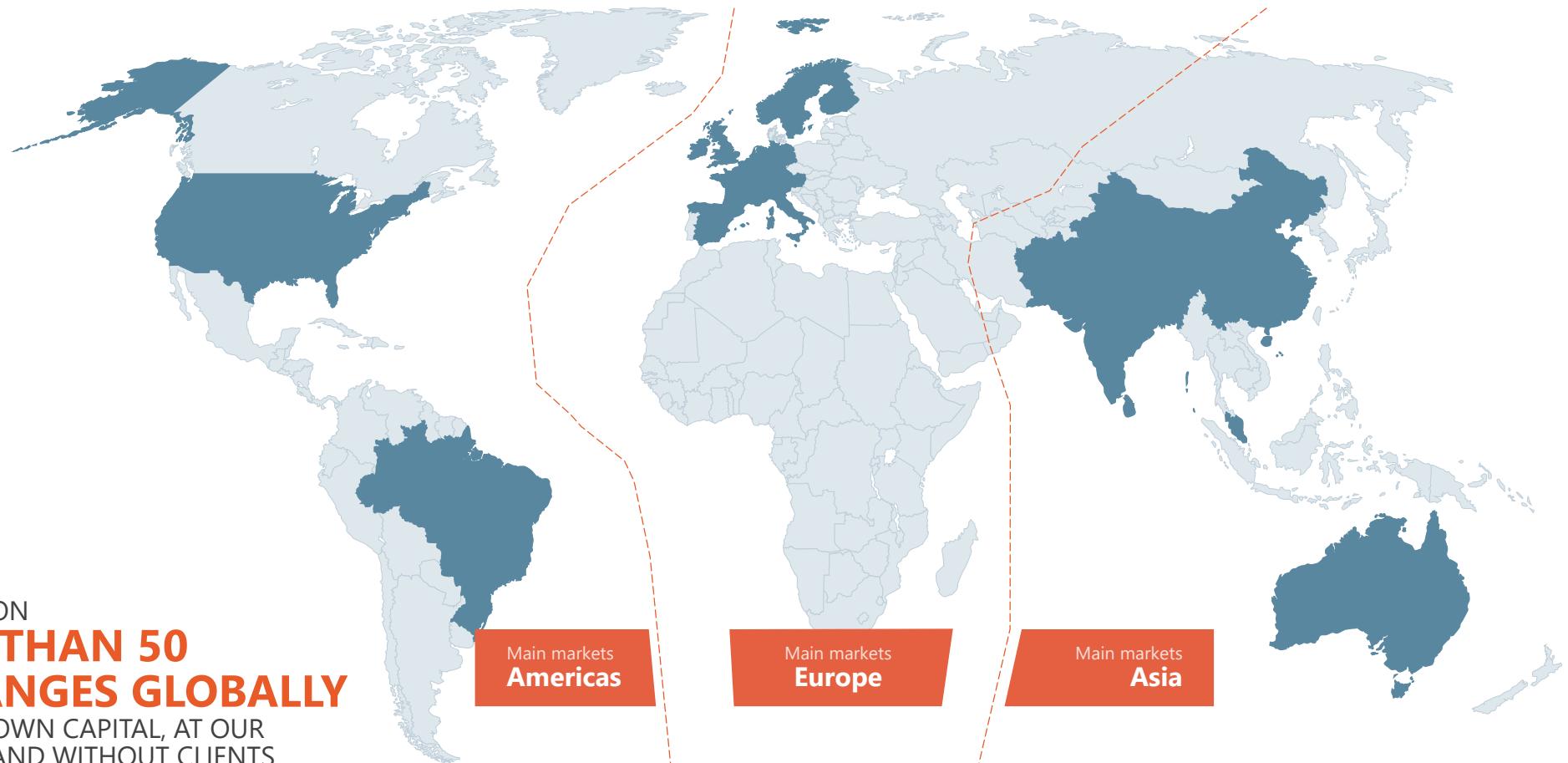
RATHER  
CHEAP...



**... OR VERY  
EXPENSIVE!**



# OPERATING **WORLDWIDE**



# SPEED



< 1 MICROSECOND



**MANY DECISIONS  
+ VERY FAST  
= RISK!!**

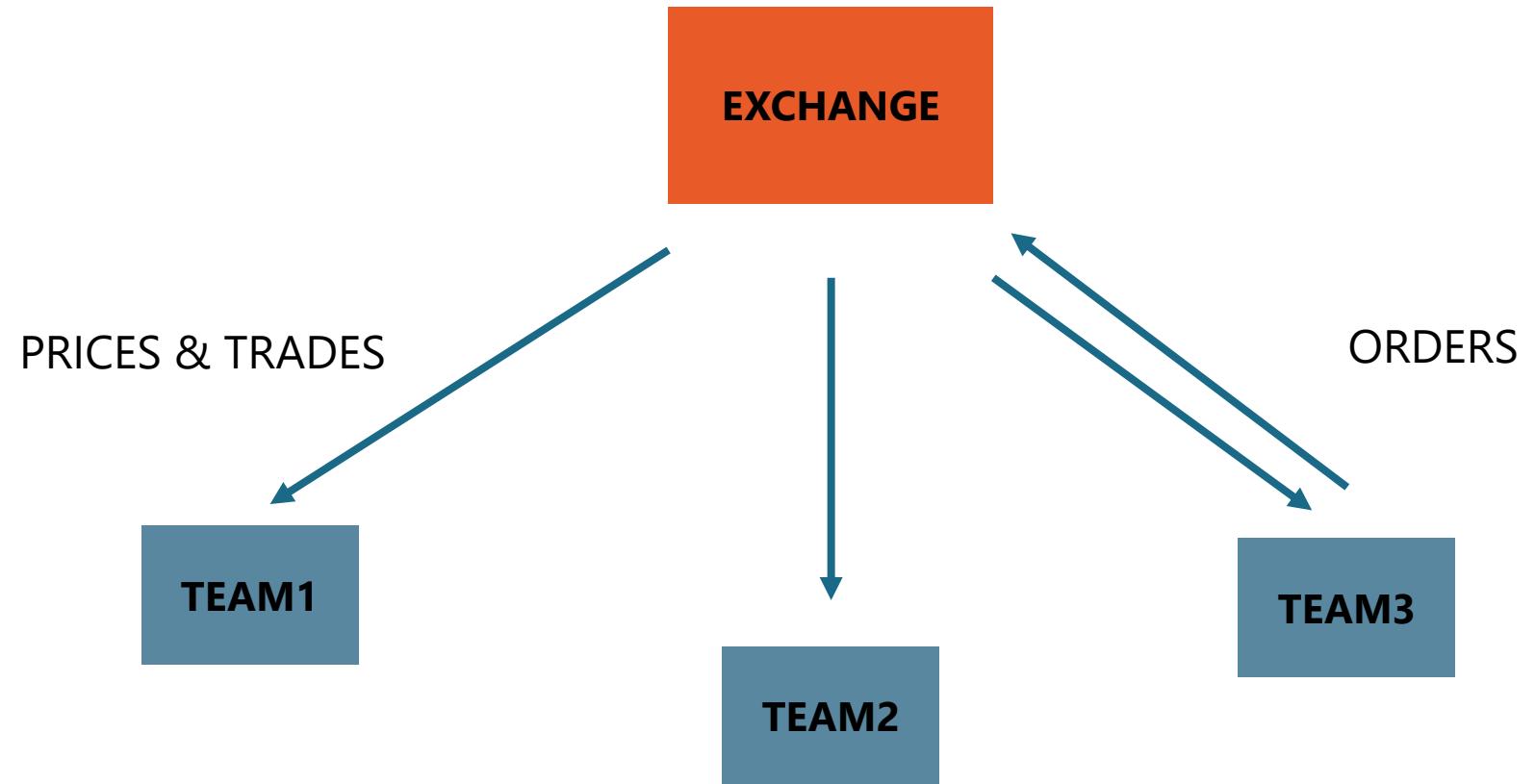


# THE CHALLENGE

# DESIGN YOUR OWN TRADING ALGORITHM

- Virtual exchange
- 2 financial instruments
- Sample python client provided





# TRADING FINANCIAL INSTRUMENTS

Various market participants are willing to buy and sell  
Prices depend on their willingness to trade

## **There is not just one price!**



# ORDER BOOK

1. Patrick is willing to **buy** 12 lots for 196 euros

# bid	price	# ask
	202	
	201	
	200	
	199	
	198	
	197	
<b>12</b>	<b>196</b>	

# ORDER BOOK

1. Patrick is willing to **buy** 12 lots for 196 euros
2. Julian is willing to **sell** 33 lots for 202 euros

# bid	price	# ask
	202	<b>33</b>
	201	
	200	
	199	
	198	
	197	
12	196	

# ORDER BOOK

1. Patrick is willing to **buy** 12 lots for 196 euros
2. Julian is willing to **sell** 33 lots for 202 euros
3. Serena is willing to **sell 10** lots of 201 euros

# bid	price	# ask
	202	33
	201	<b>10</b>
	200	
	199	
	198	
	197	
12	196	

# ORDER BOOK

Priority is based on

1. Best price (highest bid, lowest ask)
2. Time of arrival (earliest order)

# bid	price	# ask
	202	33
	201	<b>10</b>
	200	
	199	
	198	
	197	
12	196	

# ORDER BOOK

1. Patrick is willing to **buy** 12 lots for 196 euros
2. Julian is willing to **sell** 33 lots for 202 euros
3. Serena is willing to **sell 10** lots of 201 euros
4. Jinre wants to **buy** 20 lots

# bid	price	# ask
	202	33 (-10)
	201	10 (-10)
	200	
	199	
	198	
	197	
12	196	

She needs to buy 10 lots for 201 and another 10 lots for 202 euros

# BID-ASK SPREAD

The difference between the highest bid and lowest ask is called the bid-ask **spread**

# bid	price	# ask
	202	23
	201	
	200	
	199	
	198	
	197	
12	196	

# LIQUIDITY

On which order book would you trade?

**illiquid**

# bid	price	# ask
	202	23
	201	
	200	
	199	
	198	
	197	
12	196	

**liquid**

# bid	price	# ask
	202	745
	201	1733
	200	1867
2049	199	
5176	198	
1090	197	
5000	196	

# LIQUIDITY

On which order book would you trade?

Market participants are better off trading in liquid order books!

Market makers provide liquidity and decrease the bid-ask spread

**illiquid**

# bid	price	# ask
	202	23
	201	
	200	
	199	
	198	
	197	
12	196	

**liquid**

# bid	price	# ask
	202	745
	201	1733
	200	1867
2049	199	
5176	198	
1090	197	
5000	196	

# PROFIT & LOSS

When you hold financial instruments you have an **open position**

Market moves affect your profit & loss

Side	Price per lot	Volume
<b>BUY</b>	10	2

# PROFIT & LOSS

When you hold financial instruments you have an **open position**

Market moves affect your profit & loss

Side	Price per lot	Volume
BUY	10	2
SELL	11	2

You **close** your **position** by selling the instruments

Market moves no longer affect your profit & loss

Your profit & loss is definitive (**locked-in** profit & loss)

# DESIGN YOUR OWN TRADING ALGORITHM

1. Connect to the exchange and listen to the incoming trades & prices
2. Analyze the data
3. Develop a trading strategy
4. **Test** your algorithm
5. Evaluate and improve its performance
6. Repeat!

We're here to help you!



# CHALLENGE STARTING CONDITIONS

- You may start trading straight away
- Start with 20.000 EUR
- When you're out of money, you'll be declared **bankrupt**

Remember to keep track of your position!



Team Filter: (use ! to exclude a team)

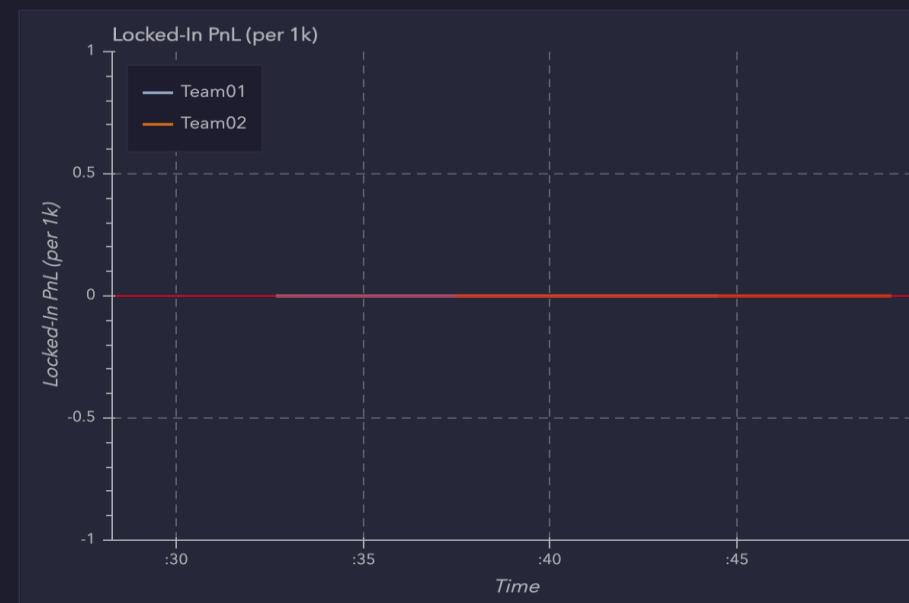
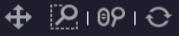
e.g. t=team1, !team2

# OPTITRADE



## Leaderboard

Rank	Teams	PnL (per 1k)	Bankruptcies	Blocked
0	Team02	9.43	0	No
1	Team01	-0.04	0	No



# FOOD FOR THOUGHT

## DESIGNING YOUR TRADING ALGORITHM

What does your algorithm need to do if 'undefined situations' occur, like...

If you are out of capital and can no longer buy any lots?

If you build up a large position?

If you receive 1000 messages per second from the exchange?

If you have sent 1000 orders to the exchange?

If none of your orders get acknowledged by the exchange?

If the exchange sends you an error message?

If your algorithm is much more profitable than you thought it would be?

If your algorithm is much less profitable than you thought it would be?

## JUDGING CRITERIA

- Performance of your strategy
- Risk-reward balance of your strategy
- Novelty of the strategy
- Presentation



# INSTRUCTIONS

Instructions & Python template

<https://github.com/jundl77/optiver-optitrade-challenge>

**Drop by our booth for instructions & login credentials**



# EXPAND YOUR KNOWLEDGE

Come talk to us to learn more about

- Financial markets
- Algorithmic trading
- Technology

Participate in our quiz to win a trip to  
**Amsterdam!**





TWITTER

[TWITTER.COM/OPTIVEREUROPE](https://twitter.com/optivereurope)



LINKEDIN

[LINKEDIN.COM/COMPANY/OPTIVER](https://www.linkedin.com/company/optiver/)



INSTAGRAM

[INSTAGRAM.COM/OPTIVEREUROPE](https://www.instagram.com/optivereurope)



FACEBOOK

[FACEBOOK.COM/OPTIVEREUROPE/](https://www.facebook.com/optivereurope/)



YOUTUBE

OPTIVER EUROPE

**THANK YOU.  
STAY IN TOUCH!**