



Implementation of MiFID II testing requirements by trading venues and investment firms

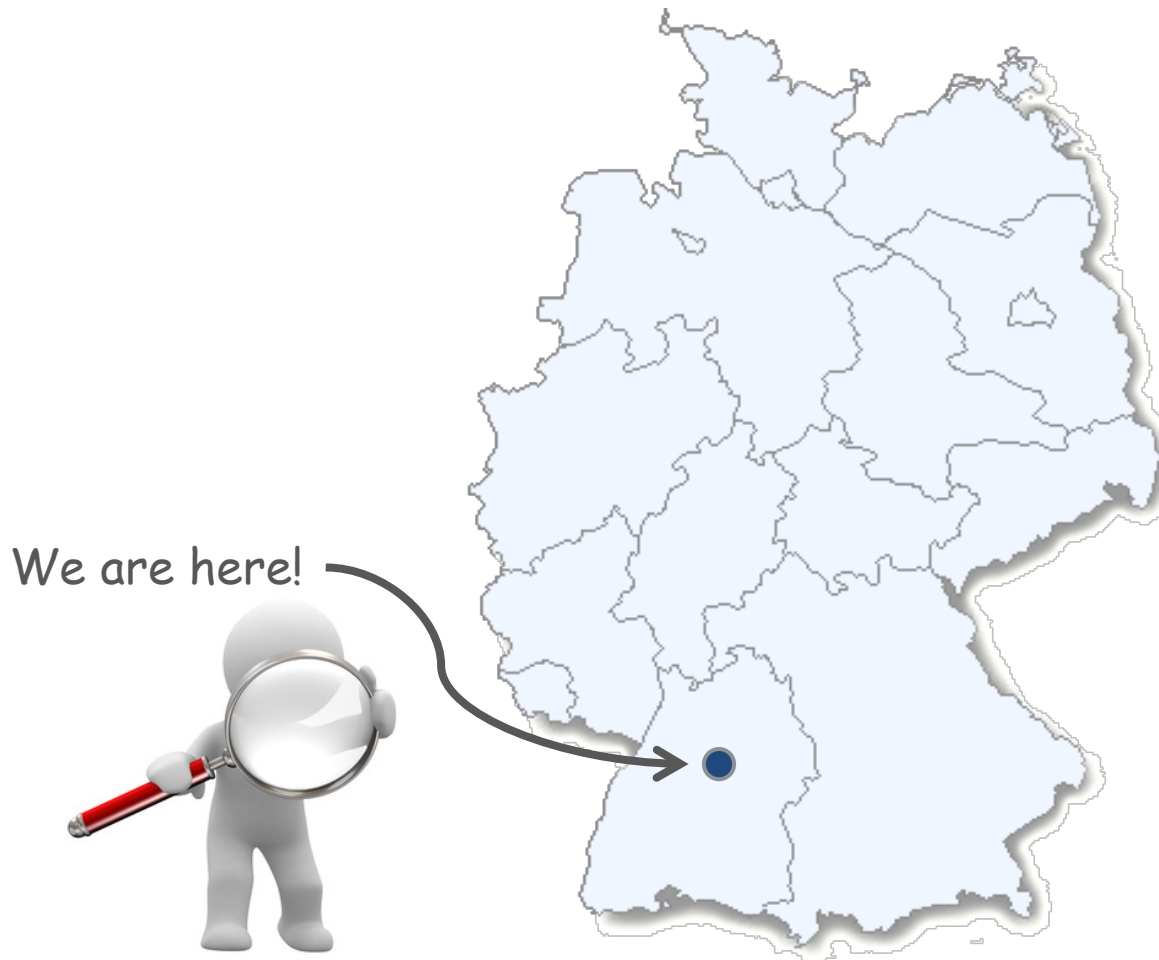
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London, 29 June 2017

Extent 2017 | Software Testing and Trading Technology Trends

- 1. About Boerse Stuttgart**
2. About the MiFID II implementation project
3. Overview of MiFID II Testing Requirements
4. Conclusion

Where exactly is Stuttgart?

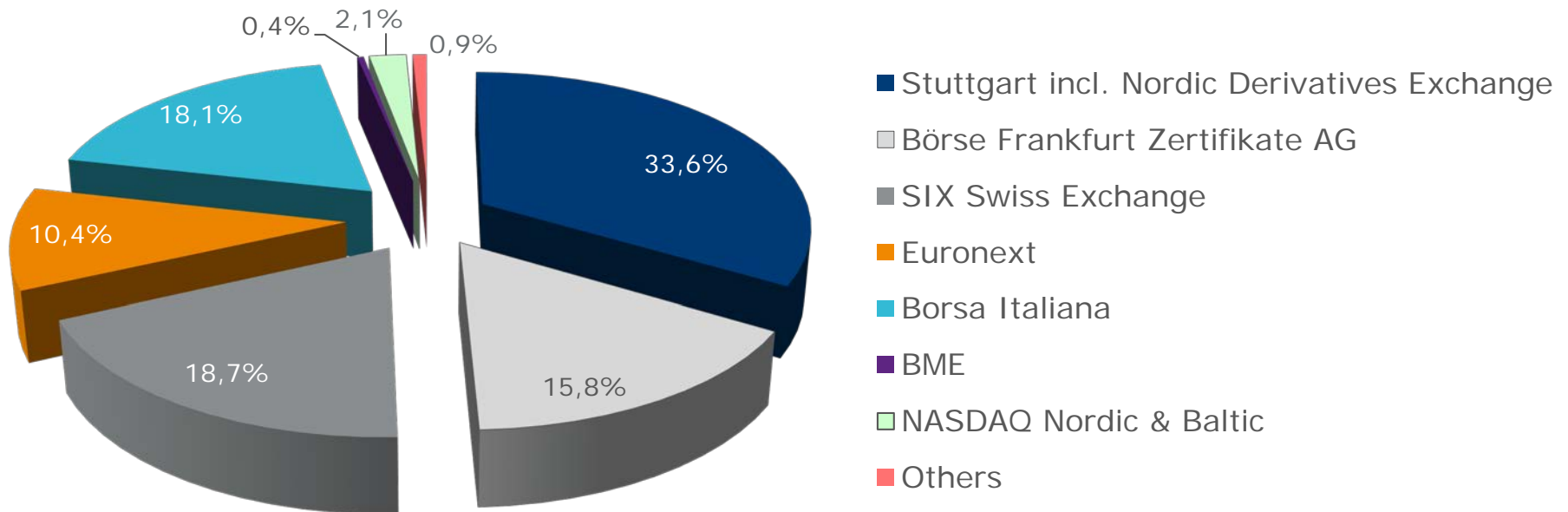


Stuttgart
is the capital and largest city
of the state of
Baden-Württemberg
in southwest
Germany.

What is Stuttgart known for?



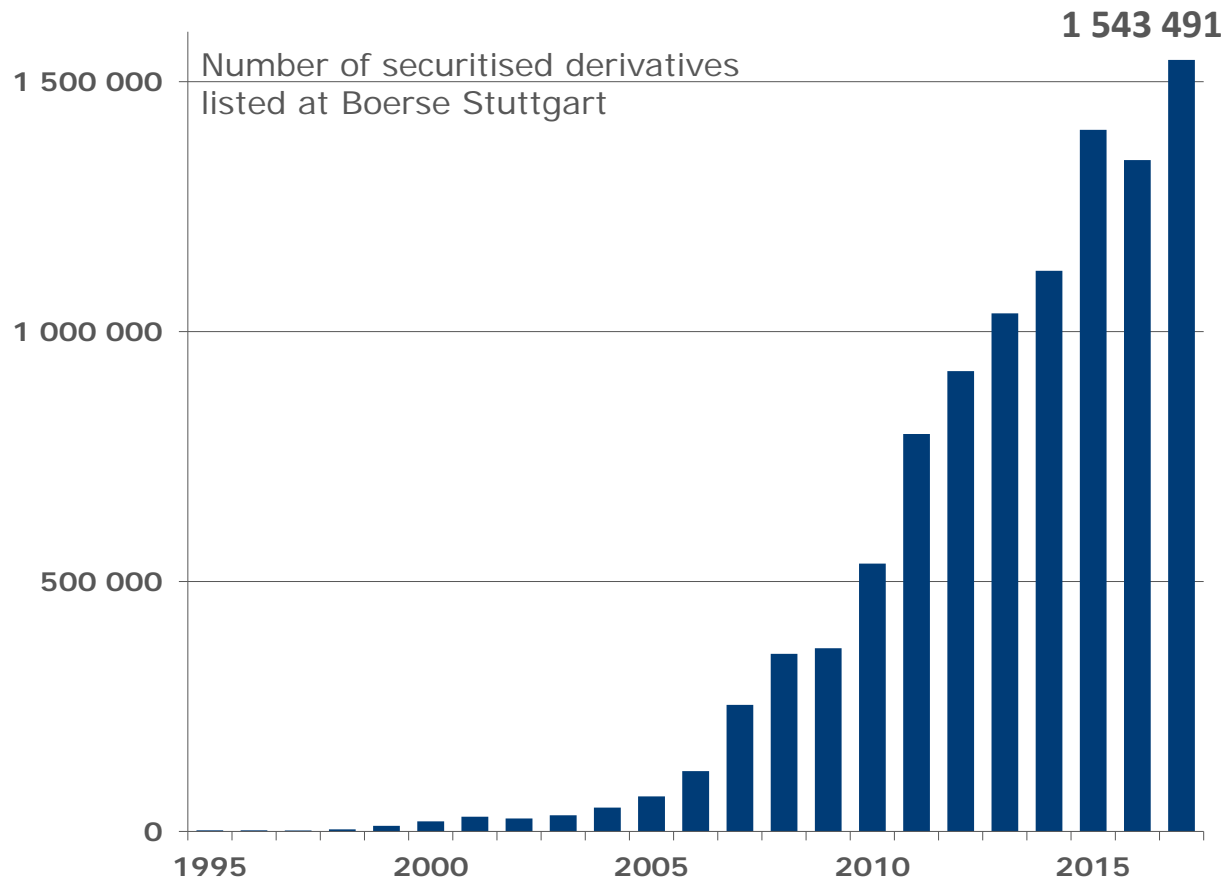
Boerse Stuttgart is Europe's leading market for securitised derivatives



Source: Respective Stock Exchange. Figures based on volume of securitised derivatives orders. Last updated: February 2017.

Currently more than 1.4m instruments are listed at Boerse Stuttgart

This number is driven by the large amount of securitised derivatives



of instruments of other asset classes listed at Boerse Stuttgart

Debt instruments:	14.355
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Equities:	8.460
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Investment fund units:	3.354
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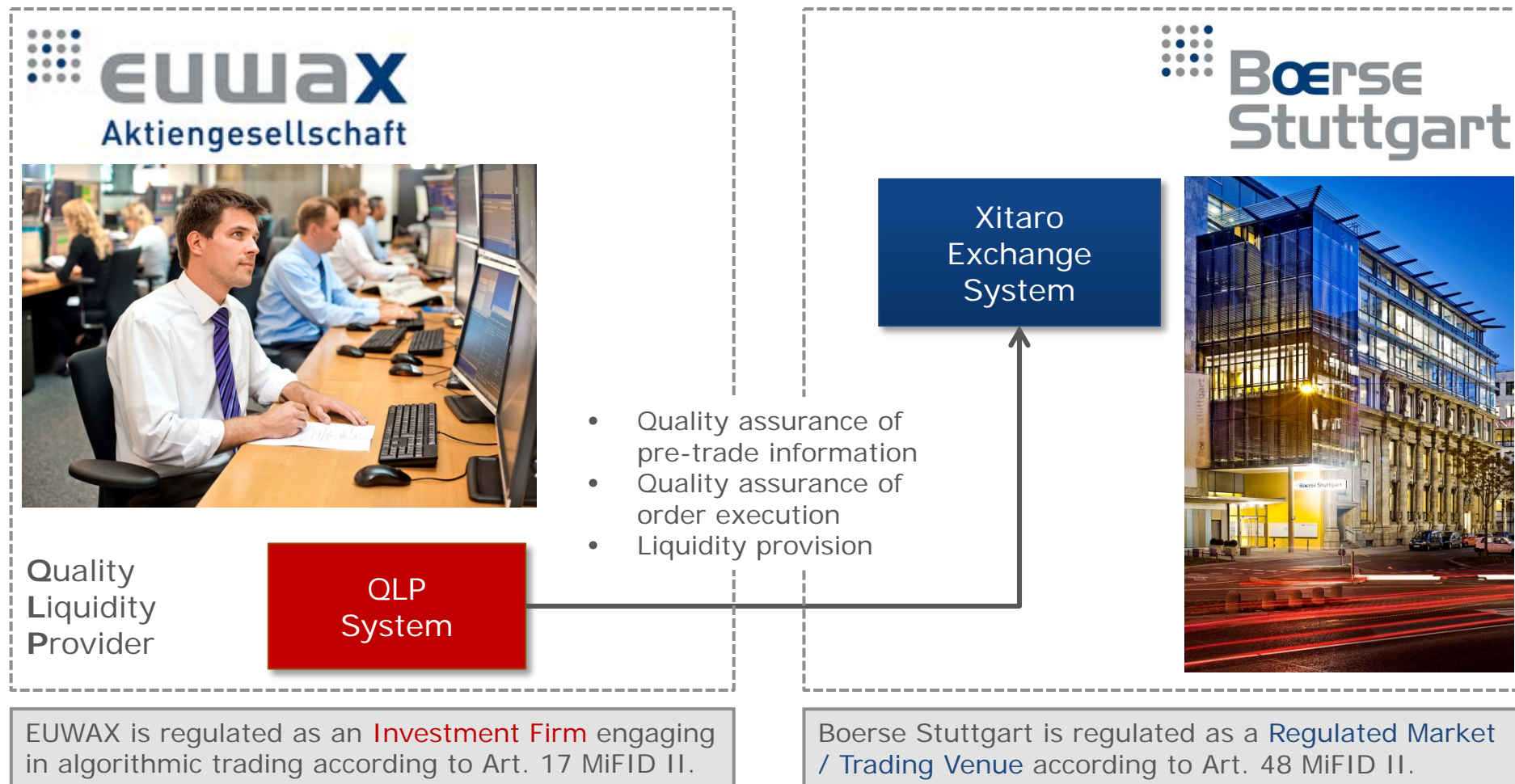
Source: Boerse Stuttgart. Last updated: May 2017

Boerse Stuttgart ranks among Europe's Top 10 Stock Exchanges in terms of turnover

Rank	Stock Exchange	Turnover (2016) in billion €*
1	London Stock Exchange Group	3 076.9
2	Euronext	1 709.2
3	Deutsche Börse	1 367.7
4	SIX Swiss Exchange	869.3
5	BME (Spanish Exchanges)	775.2
6	NASDAQ OMX Nordic Baltics	666.3
7	Borsa Istanbul	407.0
8	Oslo Børs	120.7
9	Boerse Stuttgart	91.1
10	Warsaw Stock Exchange	41.6
11	Vienna Stock Exchange	28.3
12	Irish Stock Exchange	23.5
13	Athens Stock Exchange	13.0
14	Prague Stock Exchange	6.4

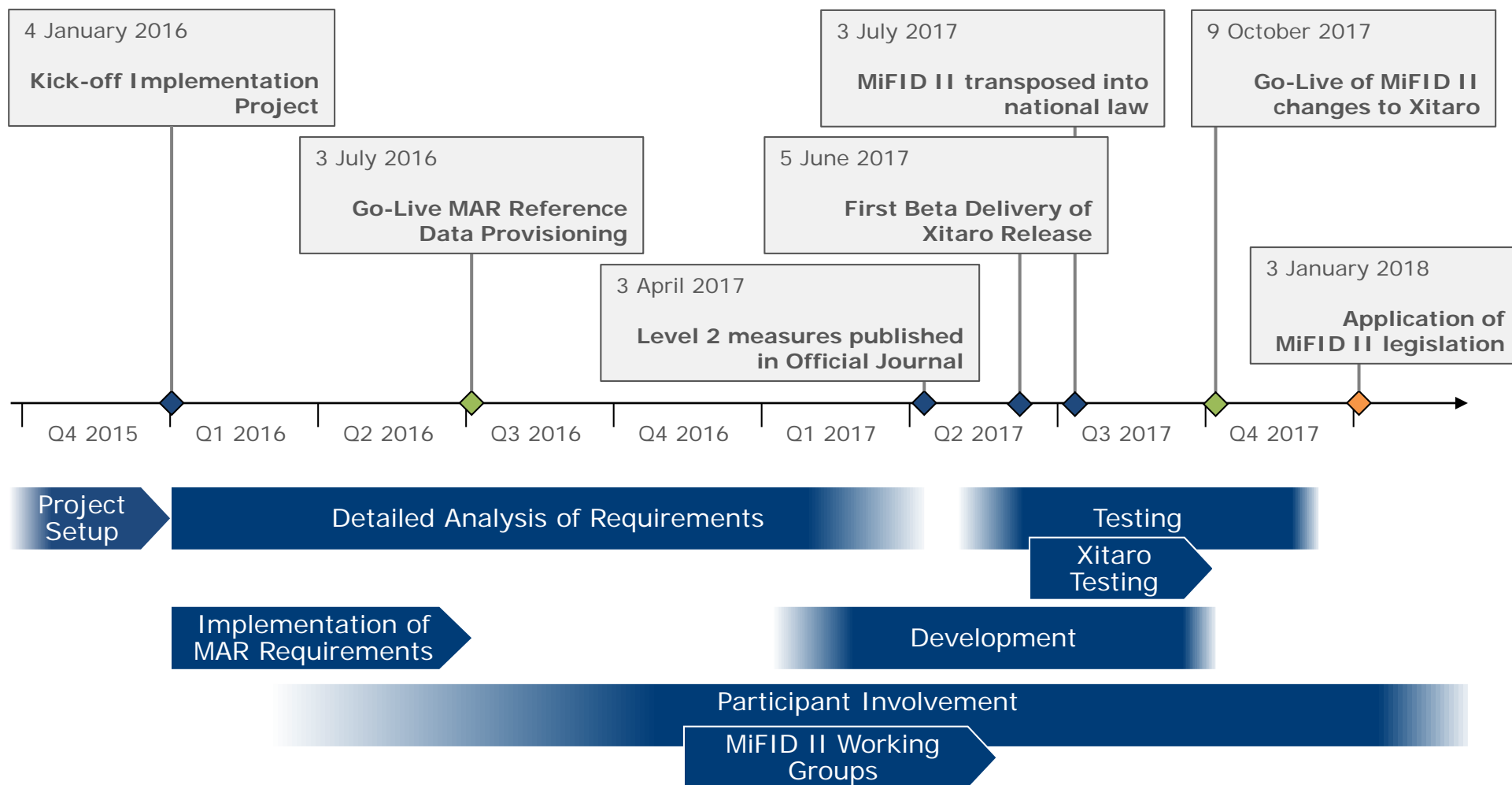
Source: Federation of European Securities Exchanges, London Stock Exchange, Borsa Italiana Basis: Order book turnover for whole of 2016 in all asset classes, electronic order book trades

In Boerse Stuttgart's market model, Quality Liquidity Providers assure execution quality and liquidity for all 1.5M instruments

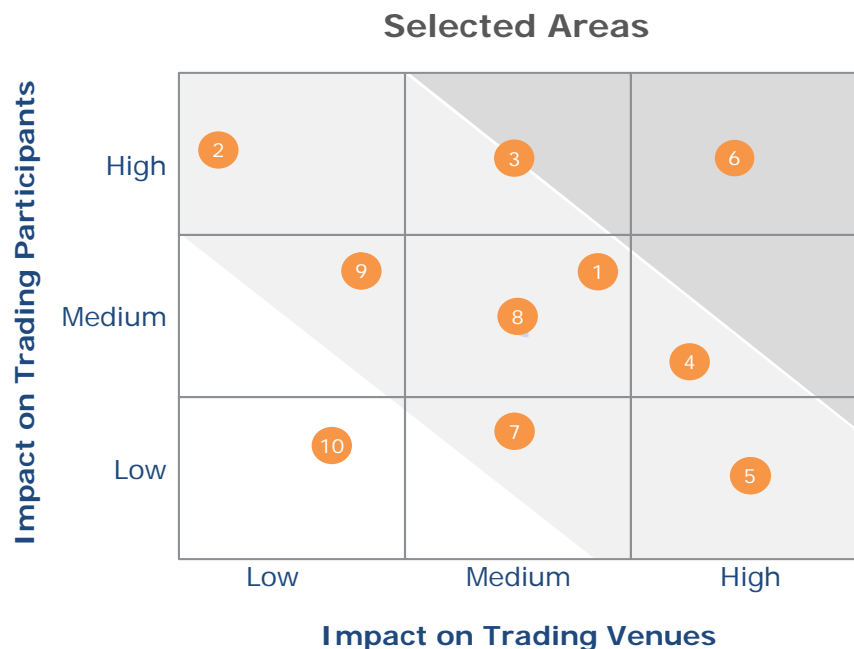


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Boerse Stuttgart now approaches the last quarter of its two-year MiFID II project which is dominated by development and testing activities



MiFID II / MiFIR requires trading venues and investment firms to implement substantial changes in existing technology and processes



This
presentation's
focus

- 1 **Clock Synchronisation**
Synchronisation of business clocks. Requirements on granularity and precision. Impact on trading venues and their members
- 2 **Approved Publication Arrangements (APA)**
Reporting and transparency requirements on transactions in bilateral trading between Systematic Internalisers (SIs) and Investment Firms
- 3 **Transaction Reporting**
New requirements on transaction reporting to NCAs by investment firms, including requirements on trading venues for non-EEA and ESCB participants
- 4 **New Transparency & Order Record Keeping Requirements**
Trading venues are required to implement new fields for order related messages and keep records for five years; make them available to NCAs
- 5 **Reference Data**
Extended reference data sets need to be gathered by trading venues and reported to NCAs (also part of Art. 4 MAR)
- 6 **Position limits and -reporting for commodity derivatives**
New infrastructure needs to be implemented to fulfil new requirements on the management and reporting of commodity derivatives positions
- 7 **Prevention of disorderly trading conditions**
Extended requirements on trading venues to prevent disorderly trading conditions, e.g. Pre-/Post-Trade Controls, Throttling, etc.
- 8 **Quality of Execution Report**
Publication of reports by trading venues on the quality of order execution
- 9 **Testing Requirements**
New requirements on trading venues and investment firms regarding algorithm testing, test environments, and testing procedures
- 10 **Tick Size Requirements**
Introduction of a new tick size regime for the trading of equity shares and ETFs

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MiFID II Testing Requirements on Investment Firms and Trading Venues are further specified in the regulatory technical standards (RTS) 6 and 7

	Requirements on Investment Firms	Requirements on Trading Venues
Level 1	<p>MiFID II Art. 17</p> <p>(1) An investment firm that engages in algorithmic trading [...] shall ensure its systems are fully tested [...].</p>	<p>MiFID II Art. 48</p> <p>(1) [...] to ensure its trading systems [...] are able to ensure orderly trading under conditions of severe market stress, are fully tested [...].</p> <p>(6) [...] requiring members or participants to carry out appropriate testing of algorithms and providing environments to facilitate such testing</p>



Applies only to **investment firms** engaged in algorithmic trading



Applies not only to regulated markets but **all trading venues** (RM, MTF, OTF)¹.

1) Art. 18 (5) determines the application of Art. 48 and 49 to MTFs and OTFs.

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Level 2	<p>RTS 6 - Organisational requirements of investment firms engaged in algorithmic trading</p> <p>Art. 3 Staffing</p> <p><i>Testing and deployment of trading algorithms systems and strategies</i></p> <p>Art. 5 General methodology</p> <p>Art. 6 Conformance testing</p> <p>Art. 7 Testing environments</p> <p>Art. 9 Annual self-assessment and validation</p> <p>Art. 10 Stress testing</p> <p>Art. 18 Security and limits to access</p>	<p>RTS 7 - Organisational requirements of trading venues</p> <p>Art. 2 Self-assessments of compliance with Article 48</p> <p>Art. 5 Staffing</p> <p>Art. 7 Due diligence for members of trading venues</p> <p>Art. 8 Testing of the trading systems</p> <p>Art. 9 Conformance testing</p> <p>Art. 10 Testing the members' algorithms to avoid disorderly trading conditions</p> <p>Art. 14 Periodic review of the performance and capacity of the algorithmic trading systems</p>

Implementation of MiFID II Testing Requirements

There are many similarities between RTS 6 and 7 requirements but also some differences to be acknowledged

RTS 6 - Organisational requirements of investment firms engaged in algorithmic trading	RTS 7 - Organisational requirements of trading venues
Art. 3 Staffing	Art. 2 Self-assessments of compliance with Article 48
Art. 5 General methodology	Art. 5 Staffing
Art. 6 Conformance testing	Art. 7 Due diligence for members of trading venues
Art. 7 Testing environments	Art. 8 Testing of the trading systems
Art. 9 Annual self-assessment and validation	Art. 9 Conformance testing
Art. 10 Stress testing	Art. 10 Testing the members' algorithms to avoid disorderly trading conditions
Art. 18 Security and limits to access	Art. 14 Periodic review of the performance and capacity of the algorithmic trading systems

In this presentation, we focus on...

- Dependencies between requirements for investment firms and trading venues
- Commonalities and differences among the requirements groups
- Examples of implementation measures at Boerse Stuttgart (trading venue) and EUWAX (investment firm)

Six areas of testing requirements will be presented today

RTS 6 - Organisational requirements of investment firms engaged in algorithmic trading

RTS 7 - Organisational requirements of trading venues

1

Staffing

Art. 3 Staffing

Art. 5 Staffing

2

General Testing Methodology

Art. 5 General methodology

Art. 8 Testing of the trading systems

3

Conformance Testing

Art. 6 Conformance testing

Art. 7 Due diligence for members of trading venues

Art. 9 Conformance testing

4

Testing Environments

Art. 7 Testing environments

Art. 10 Testing the members' algorithms to avoid disorderly trading conditions

5

Stress Testing

Art. 10 Stress testing

Art. 18 Security and limits to access

Art. 14 Periodic review of the performance and capacity of the algorithmic trading systems

6

Self-assessments

Art. 9 Annual self-assessment and validation

Art. 2 Self-assessments of compliance with Article 48

You need to have a sufficient number of staff qualified to manage your trading systems and trading algorithms

RTS 6 and 7 impose quite similar requirements regarding staffing:

*[...] shall employ a **sufficient number of staff** with the **necessary skills** to manage [...] algorithmic trading systems and trading algorithms and with **sufficient (technical) knowledge** of:*

- a) the relevant trading systems and algorithms;*
- b) the monitoring and **testing of such systems and algorithms**;*
- c) the **trading strategies** that the investment firm deploys through its algorithmic trading systems and trading algorithms; / the **types of trading** undertaken by the members, participants or clients of the trading venue ('members');*
- d) [...] legal obligations*



Investment firms need to have an adequate number of staff with especially technical knowledge of the trading systems, algorithms and strategies

Trading venues need to have an adequate number of staff with knowledge of the trading systems and algorithms and the types of trading undertaken by the members

MiFID II requirements on the general testing methodology may not be new, but you may want to check your processes and documentation

Investment firms shall...

- establish **clearly delineated methodologies** to develop and test such systems, algorithms or strategies
- **adapt its testing methodologies to the trading venues and markets** where the trading algorithm will be deployed.

When?

- prior to the **deployment or substantial update** of an algorithmic trading system, trading algorithm or algorithmic trading strategy

Trading venues shall...

- make use of **clearly defined development and testing methodologies**

When?

- prior to **deploying or updating** a trading system

But also...

- be able to **demonstrate at all times** that they have taken all reasonable steps to avoid that their trading systems contribute to disorderly trading conditions

Testing goals: Trading systems...

- do not behave in an unintended manner
- **comply with a) the investment firm's obligations and b) the trading venue's rules and systems**
- **do not contribute to disorderly trading conditions (incl. switching off)**
- compliance and risk management controls work as intended
- continue to work effectively in case of a significant increase of the number of messages

Investment firms and trading venues must work together to ensure conformance of the investment firm's trading algorithms with the trading system

What needs to be done?

- Conformance of the investment firm's algorithmic trading systems with the system of the trading venue¹
 - Interact as expected
 - Verify basic functionalities
 - Test connectivity and recovery

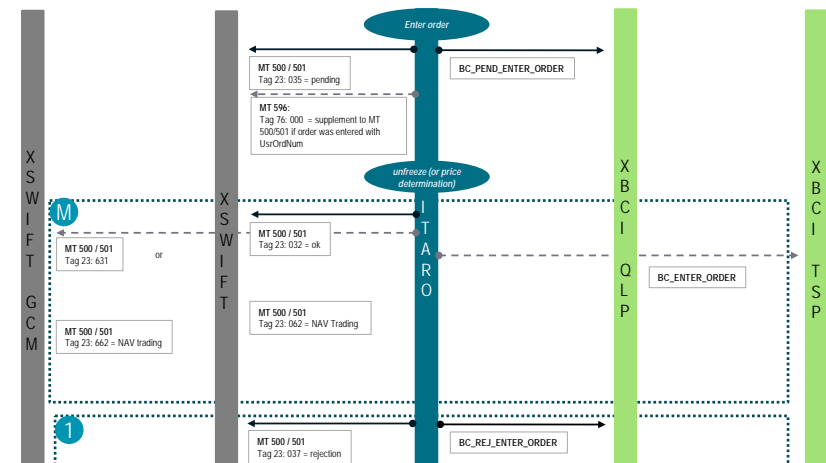
Interaction

- Focus on Xitro message flows
- Describe and test correct message flows in different situations

Example

ENTER ORDER (PENDING) BY QLP VIA GIW (XSWIFT)

UC-QLP-012



1) if applicable, alternatively the system of the DMA provider

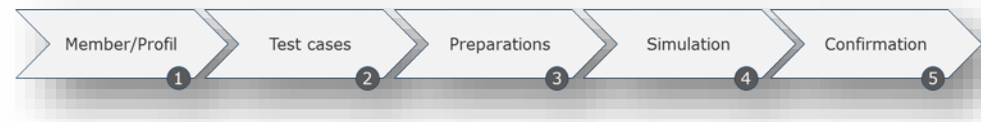
Investment firms and trading venues must work together to ensure conformance of the investment firm's trading algorithms with the trading system

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- Conformance of the investment firm's algorithmic trading systems with the system of the trading venue¹
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Basic functionalities

- Basic functionalities were verified as part of the **Member Readiness Check** in Xitaro
 - *Enter, modify, cancel order*
 - *Event driven orders*
 - *OTC trade entry*
 - *Primary market orders*
 - *Reception of execution confirmations, contracts notes, and reports*
- List of test cases in selected instruments
- Pro-active customer support during preparation and simulation – duration of test session about 2 hours
- Successful Member Readiness Check as requirement for admission to Go-Live



1) if applicable, alternatively the system of the DMA provider

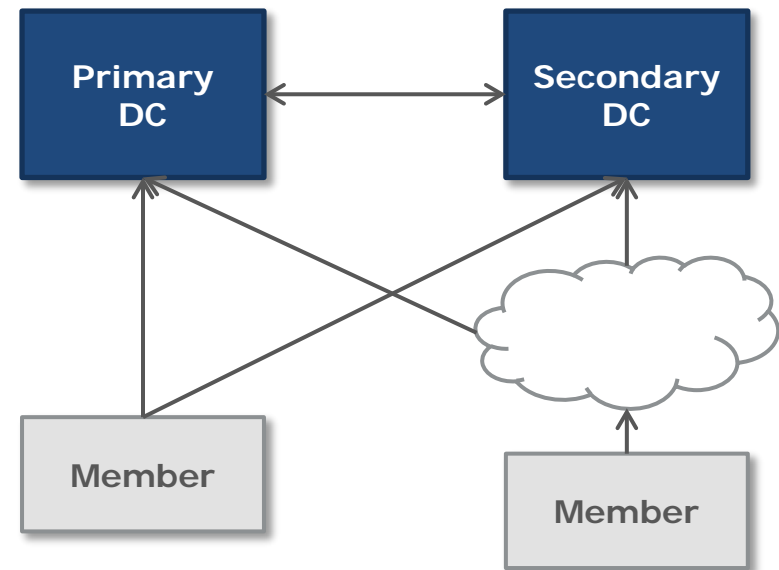
Investment firms and trading venues must work together to ensure conformance of the investment firm's trading algorithms with the trading system

What needs to be done?

- Conformance of the investment firm's algorithmic trading systems with the system of the trading venue¹
 - Interact as expected
 - Verify basic functionalities
 - Test connectivity and recovery

Connectivity and recovery

- Connectivity tests (leased line, frontend)
- Failover tests (intrasite, intersite failover)
- Functional tests if applicable, e.g. Cancel on Disconnect (COD) command



1) if applicable, alternatively the system of the DMA provider

Investment firms and trading venues must work together to ensure conformance of the investment firm's trading algorithms with the trading system

What needs to be done?

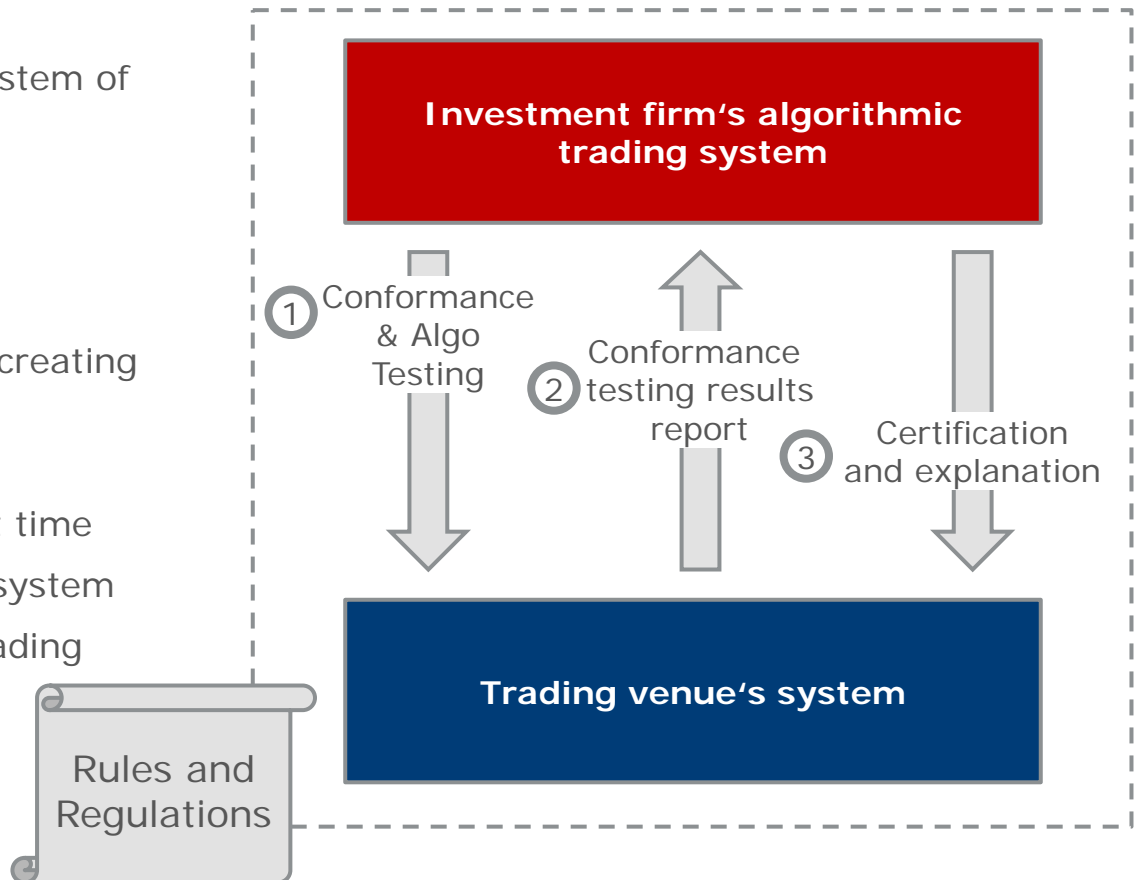
- Conformance of the investment firm's algorithmic trading systems with the system of the trading venue¹
 - Interact as expected
 - Verify basic functionalities
 - Test connectivity and recovery
- Algo testing to avoid contributing to or creating disorderly trading conditions

When?

- Access to the trading venue for the first time
- Material change of the trading venue's system
- New or material updated algorithmic trading system

How?

- Trading venues must require their members to do conformance testing²



1) if applicable, alternatively the system of the DMA provider 2) need to be included in the due diligence for members acc. to RTS 7 Art. 7

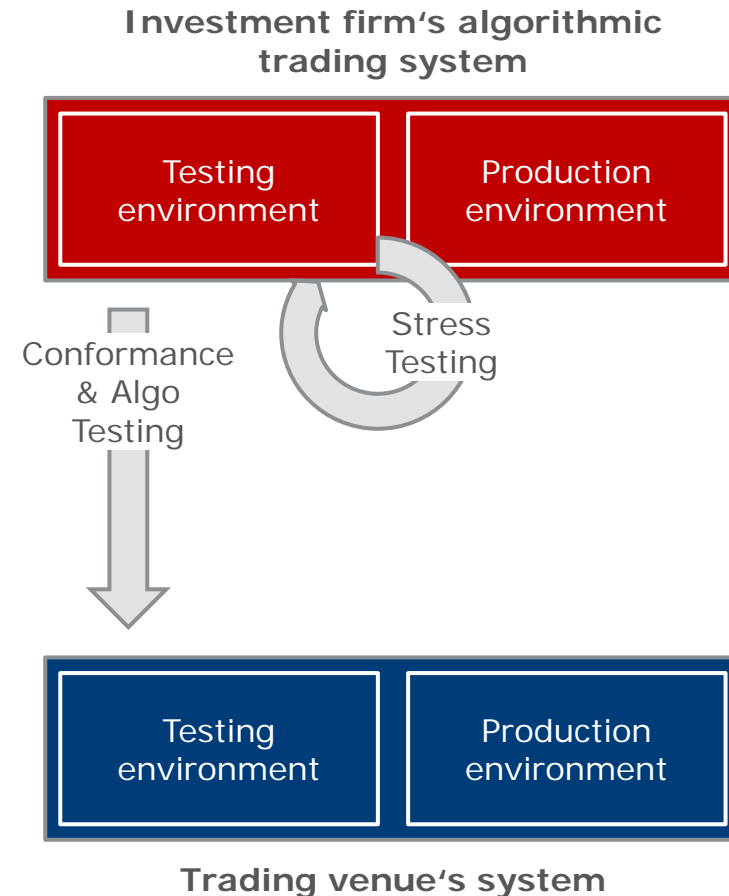
Both investment firms and trading venues are required to strictly separate testing from production environments

Investment firms shall...

- use **own testing environment**¹ separated from production; including all necessary surrounding systems
- use **testing environment for stress tests**

Trading venues shall...

- provide a **conformance testing environment** and require members to use it
 - Accessibility
 - List of financial instruments
 - Availability
 - Support
- provide access to an **algo testing environment**
 - “as realistic as possible”
 - no strict requirement for members to use it²
- effectively separate test from production³



1) Firms may also use testing environments provided by a trading venue, DEA provider or vendor, but need to retain full responsibility

2) RTS 7 Rec. 13 3) alternatively, testing is only allowed outside trading hours (RTS 7 Rec. 10)

Stress tests shall be used by investment firms and trading venues, respectively, to verify their systems' performance

Investment Firms

When?

- As part of its annual self-assessment

What?

- Test that algorithmic trading systems can withstand increased order flows or market stresses
 - High message volume tests¹
 - High trade volume tests¹
- In addition, penetration tests and vulnerability scans shall be undertaken annually to simulate cyber-attacks (Art. 23)



Trading Venues

When?

- In the context of its self-assessment, as part of the performance evaluation

What?

- Simulate adverse scenarios, incl. members' activities, in all trading phases, segments and instruments
 - Increased number of messages received²
 - Unexpected behaviour
 - Random combination of normal and stressed market conditions

Stress tests are done **separately** by investment firms and trading venues with a different focus. There is no requirement regarding common stress testing activities.

1) Using twice the numbers/volume of the last 6 months maximum 2) Baseline is the highest number of msg/s during the last 5 years

6 Self-assessments (1/2)

Self assessments – investment firms and trading venues should see this as an opportunity to determine their MiFID II implementation needs

Investment Firms	Trading Venues
<p>RTS 6 - Recital 8</p> <p>Compliance with the specific organisational requirements for an investment firm should be determined according to a self-assessment [...]</p>	<p>RTS 7 - Recital 5</p> <p>Requirements should be laid down with respect to the systems of trading venues [...]. However, their specific application should take place in conjunction with a self-assessment [...] since not all trading models present the same risks.</p> <p>Therefore, some organisational requirements may not be appropriate for certain trading models [...]</p> <p>In particular, the specific requirements to be set [...] should be considered according to the nature, scale and complexity of the algorithmic trading activity [...]</p> <p>Equally, more stringent requirements should be established by the trading venues where appropriate.</p>

In other words: ESMA acknowledges that...

- investment firms and markets are not necessarily equal in terms of nature, scale and complexity
- the specific application of requirements may take these differences into consideration
- Self-assessments could be considered a chance to explain the trading venues' specific implementation measures

6 Self-assessments (2/2)

Self assessments – investment firms and trading venues should see this as an opportunity to determine their MiFID II implementation needs

Investment Firms

When?

- Annually

What?

- Perform self-assessment
 - Considering nature, scale and complexity of its business (according to Annex I)
- Perform validation process
 - Among others, overall compliance with Art. 17 MiFID II
- Issue validation report
 - Approval by senior management



Trading Venues

When?

- At least once a year
- Before the deployment of a trading system

What?

- Perform self-assessment of compliance with Art. 48 MiFID II
 - Considering nature, scale and complexity of its business (according to Annex)
 - Including an analysis of all parameters set out in the Annex
 - Keep record for at least five years

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If you consider fulfilling the MiFID II testing requirements a challenge, you might already have a problem with your established processes today...

- 1 Most of the requirements are probably already fulfilled by markets and their participants
- 2 MiFID II imposes the same standards on each investment firm and on each trading venue making it a level playing field
- 3 Requirements on investment firms are comparably higher than on trading venues
- 4 You probably do not have to implement completely new processes, but you may need to verify this and update your documentation
- 5 Self-assessments need to be performed at least annually, but they are also a chance to explain your MiFID II compliance to your regulator





Thank you for your attention!

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