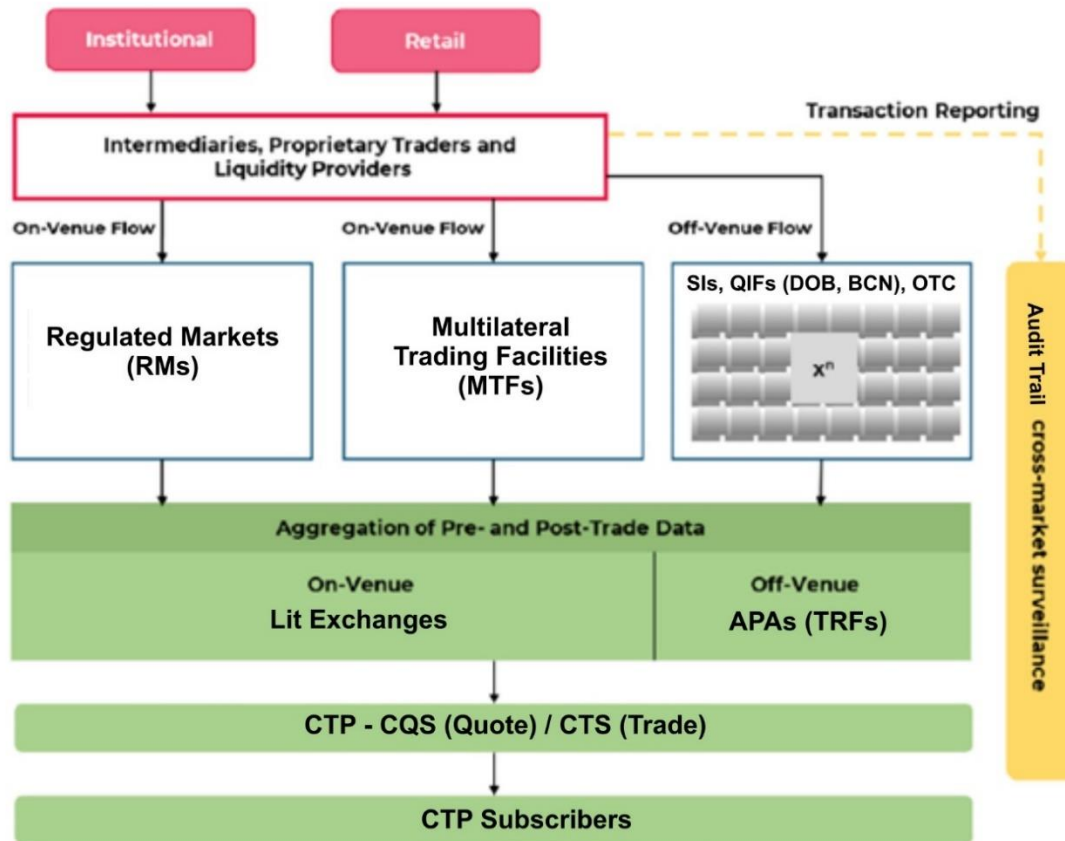


## The A-Z components of the EU Consolidated Tape for Equities and ETFs

In accordance with the mandate under [Article 22b\(3\) of MiFIR](#) regarding “data quality” (DQ), ESMA shall develop draft Regulatory Technical Standards (RTS) to specify the followings and the new RTS should ensure consistency with other MiFIR transparency requirements – [RTS 1](#) (equity) and [RTS 2](#) (non-equity):

- [1] Minimum requirements transmission protocols
- [2] Quality and substance of Consolidated Tape Provider (CTP) data
  - a) Substance and format of input data
  - b) Definition of real-time requirement (input data)
  - c) Presentation of output data
- [3] DQ measures and enforcement standards

Below is a Mock-up “Schematic of EU Equity Data Aggregation and Consolidation”, adopted from Fig. 27 of [the Study on the Creation of an EU Consolidated Tape](#)



Per Article 2 of the European Commission (EC) [Creating Act](#) in setting up the Expert Stakeholder Group on Equity and Non-Equity Core Market Data Quality and Transmission protocol, a.k.a. Data Expert Group (DEG), the task of the group shall be:

*(a) to provide advice to the Commission and to ESMA on the quality of the transmission protocols, measures to address erroneous trade reporting and enforcement standards in relation to data quality, including arrangements regarding cooperation between data contributors and the consolidated tape provider, the quality and the substance of the data for the operation of the consolidated tapes and the data needed to be transmitted to the consolidated tape in order for it to be operational, what constitutes the transmission of data as close to real time as technically possible;*

...

*(c) to provide information to the Commission and to ESMA on activities and good practices in the field of market data transparency, taking into consideration the Commission’s objectives to reduce the administrative burden on companies and rationalise reporting requirements, and, in particular, to provide advice to the Commission on the possible adaptations to the transparency rules.”*

Original Source: MSP research, FINRA, CTA

The RTS is recommended to include at least the following list of “A-Z” components to comply with the mandate for “data quality” of the Equity CTP and APAs.

Table 1

items	Relevance	Topics
A	3	Capacity considerations – Volume (during and after trading hours) and Peak Time (Opening / Closing Auctions) – optimized for speed and reliability (CAP theorem / ACID compliance). To manage the influx of data ( <a href="#">surge</a> , <a href="#">spikes</a> ), load balancing techniques are employed to distributes the data processing workload in a high performance computing environment across multiple servers, preventing any single server from becoming a bottleneck (see Table 2).
B	2a	Transparency reporting of non-lit/ OTC trades from Systematic Internalisers (SIs), Qualified Investment Firms (QIFs) – Dark Order Books, Broker Crossing Networks to Approved Publication Arrangements (APAs)/ Trade Reporting Facilities (TRFs)
C	2a, 2b, 2c	Outgoing from APAs (TRFs) to CTP’s Consolidated Trade System (CTS)/ subscribers of non-lit/ OTC post-trade non-display transparency data
D	2c	Outgoing from APAs (TRFs) to subscribers of non-lit/ OTC post-trade display transparency data
E	2b	Integrating APAs (TRFs) non-lit/ OTC post-trade non-display transparency data with CTP’s CTS
F	2c	Outgoing from CTP to subscribers of comprehensive post-trade display data and/or non-core Historical display data in CTS
G	2c	Outgoing from CTP to subscribers of comprehensive post-trade non-display data and/or non-core Historical non-display data in CTS
H	2c	Outgoing from CTP to subscribers of pre-trade non-display data in <a href="#">Consolidated Quotation System</a> (CQS) – prioritize core non-display speed over non-core data (Market data is time sensitive. The value of time sensitive information deteriorates substantially overtime). <sup>1</sup>
I	2c	Outgoing from CTP to subscribers of pre-trade display core data in CQS – prioritize core display speed over non-core data
J	2c	Outgoing from CTP to subscribers of a <a href="#">CQS and CTS</a> combined feed for both pre- and post-trade non-display core and regulatory data
K	2c	Outgoing from CTP to subscribers of a CQS and CTS combined feed for both pre- and post-trade display core and regulatory data
L	2a, 2b	Incoming quotes data [and Lit Venue’s Best Bid and Offer (BBO) vs CTP centralized computing of EBBO for consistency] from Lit Venues to CTP’s CQS – prioritize speed over non-core data, and CTP computes the European <a href="#">Best Bid and Offer</a> (EBBO) – round lot price based tiers, <a href="#">odd lot</a> / fractional shares, <a href="#">latency</a> and <a href="#">reference price arbitrage</a> , <a href="#">adverse selection</a> , average size and % of time at the inside quote quality vs CT revenue sharing scheme for quotes contribution but the venue has little trade volume, EU has no ‘trade-through’ requirements
M	2a, 2b	Incoming trades data from Lit-Venues to CTP’s CTS (opening and closing price of the Primary Listing Market vs Most Relevant Market)
N	2a	CTP’s core data – Tier 1 (securities incl. in major indexes + certain ETPs, excl. ETNs & ETCs) vs <a href="#">Tier 2</a> (thinly traded Securities / illiquid ETPs)
O	2a	CTP’s non-core <a href="#">regulatory data</a> (e.g. restrictions, halts) vs market depth (5 price levels) <sup>2</sup> and odd-lot data, <sup>3</sup> [adopted in the US as core data] + “trading interest” in periodic auctions [to be determined] as non-core/ core/ outside scope (bandwidth latency + other complications)
P	2a, 2b	APAs (TRFs) collected data through <a href="#">Automated Confirmation of Transaction</a> (ACT) system. <sup>4</sup> Neither agree or disagree with <a href="#">MMT</a> for APAs (TRFs). while have bandwidth latency concerns if topology data in ACT is included in CTP’s CTS core data. FIX is commonly used for non-lit/ OTC <a href="#">trade reporting</a> , while Weblink ACT system is a web-based interface offered by FINRA in the US to allow firms to manually enter trade details. Non-lit/ OTC trades executed during the hours that the APAs (TRFs) are open should be reported within 90 seconds of execution. <sup>5</sup> <b>NOTE:</b> There are differences in market quality and preferencing for off-exchange trades reported between e.g., the NASDAQ TRF and NYSE TRF in the US. How TRFs handle and preference orders can impact execution quality, so policy makers should be alerted. <sup>6</sup>

items	Relevance	Topics
Q	2c	Define data that are outside scope of CTP's CQS and CTS in Consolidated Audit Trail/ Clearing and Settlement systems (e.g., Order Lifecycle Data, Customer Information, Detailed Event Data)
R	1	CTP's incoming and outgoing transmission protocols <sup>7</sup> (Private line, SFTP, Synchronized Encryption, FAST/SBE vs JSON) – time sensitive data available SECURELY in SYNCHRONIZED time, <a href="#">time-lock encryption</a> protects data from being decrypted prematurely and eliminates the problem of where the CT data centre is located (Frankfurt, Zurich, Stockholm, Madrid, Bergamo) vs <a href="#">multicast</a> is NOT readily available in public <a href="#">cloud</a> due to security, latency, jitter and other complex issues (lost packets) affecting scalability and performance.
S	1	Timestamp Granularity (0.1 microsecond, depending on the firm's system capabilities and up to nanoseconds if available; <a href="#">NTP vs PTP</a> ; a de facto Atomic clock vs a "chorum" of clocks); + <a href="#">potential differences in sequencing of information</a> (latency, <a href="#">normalization</a> to accommodate aggregation distance) – practical as proven by High frequency Trading (HFT) firms / self-aggregators.
T	1, 3	CTP's encoding and decoding (100 messages at any given point in time vs 100K messages, lossless vs lossy, optimizing richness of information and minimize latency) and management of incomplete or potentially erroneous information ( <a href="#">RTS 13 Article 10</a> )
U	3	CTP's CQS – specific validation processes (quotes, BBO, NBBO, price bands), automated alerts and error handling. <sup>8</sup> + <a href="#">Volatility Interruption Mechanisms</a> (e.g., US CTA - <a href="#">Berkshire</a> price was published erroneously down 90+%, quality assurance to avoid <a href="#">system glitch</a> ).
V	3	CTP's CTS – specific validation processes (real time, consistency check), automated alerts, error handling, and regulatory review
W	3	APA (TRF) – specific <a href="#">validation processes</a> (automated monitoring, cross-checks against other APAs/ TRFs, error rate threshold and permissible corrections)
X	1	CTP's CQS and CTS <a href="#">data centre redundancy</a> ( <a href="#">outage</a> ), <a href="#">operational resilience</a> (some see the price some don't), and <a href="#">cybersecurity</a>
Y	1	CTP's <a href="#">governance</a> and outsourcing arrangements (conflict of interest, cross subsidization)
Z	3	CTP's uptime (99.95%) and Performance Metrics (Better than or at least on par with the <a href="#">US Securities Information Processors</a> )

Policy makers' consideration should **NOT** be based solely on cost, nor solely on mass adoption network effect. In general, we are supportive of standardization and harmonization for economy of scale and efficiency purposes. It is important that the defined standard, open access, and interoperability does not lead to a monopoly or oligopoly that hinder innovation or exacerbate unfairness in markets.<sup>9</sup>

Per the US SEC Commissioner Hester Peirce on her speech<sup>10</sup> about Financial Data Transparency Act Joint Data Standards Proposal, she stated *"Hardwiring a technology into a rule runs the risk of preserving that requirement far after that technology's expiration date... could inhibit data standards from evolving over time or force firms to maintain parallel data systems... affords some flexibility in data transmission and schema and taxonomy format standards, while specifying other data standards... Would the balance the proposal strikes allow data standards to be updated in a timely manner? If not, what would work better? How often should regulators revisit the mandated standards to ensure that they remain current? ... How, if at all, will artificial intelligence or other technologies influence the need for structured data? How should we take these potential future developments into account..."*

Collocation ≠ Latency Equalization ≠ Market Data Available SECURELY in SYNCHRONIZED TIME. The former SEC Chair Mary Jo White has stated the need to ["deemphasize speed as a key to trading success."](#) Pre-trade Equity CT should be a reasonable compromise, if not a close substitute, to the trading venues' (TVs) Proprietary Products (PPs). Ecosystem degradation can take the form of under developing the CT feeds in favour of self-interest. The TVs' PPs and APAs' / CTP's

value-added services should have [FAIR ACCESS](#) if one is willing to pay a premium. The goal of “*affecting competitive pressures for existing sellers of market data, resulting in cheaper, higher quality and more accessible data for its users*” should be preserved to strike balance between private rights and [social costs](#).

Table 2

Categories	Electronic Order Book - Lit Markets	Off-Electronic Order Book - Lit Markets	Systematic Internalisers (SIs), Dark Pools, Auctions	Over the Counter
Equity Trade Count <sup>11</sup> as %	~66.5% - 70%	>0.5%	~30%	2%
Characteristics	~60-75% generated through algorithmic trading <sup>12</sup> i.e., low touch, happening faster than a blink of a human eye, thousands to hundreds of thousands of messages at any given point in time.	Request for quotes (RFQ) and trade arrangements here are manual orders. i.e., high touch, involves significant amount of human interaction that is not as automated or electrified as low touch equity trading.	Predominately low touch. Include odd lots. <sup>13</sup> Non-lit markets bid/ask quotes are <u>NOT</u> reflected on the CT. Transparency through post-trade reporting. Spike in auctions data + EBBO impact	OTC securities not listed on lit exchange, trade bilaterally, quotes and negotiate prices are conveyed by phone, e-mail and text messages. Customer market (‘Dealer-run’, bulletin board) vs interdealer market <sup>14</sup>
Objectives/ Priorities	A <b>single source of access</b> to provide both pre- and post-trade market data in <b>real time</b> consumed by low touch (non-display) and high touch traders (display) with EBBO indication, essential fields only to minimize latency impact.	Post-trade <b>transparency</b> via Approved Publication Arrangement (APA)/ Trade Reporting Facility (TRF)/ Designated Publishing Entity (DPE). Essential trade data of Auction are included in CT / Securities Information Processor (SIP) to provide comprehensive view of market activity. Multilateral Trading Facilities (MTFs) volume may report through Stock Exchanges’ affiliated APAs/ TRFs (e.g. FINRA NYSE TRF / FINRA NASDAQ TRF in context of US) or a general TRF (FINRA TRF), then parse and put together with the CT/ SIP. However, OTC trades are <u>NOT</u> included in CT/ SIP because they are privately negotiated. APAs (TRFs) do publish post-trade transparency report with topology flags, separately from the CT/ SIP, to cover the OTC volume.		
	<b>NOTE:</b> The centralized data vault that encompasses pre-and post-trade data and order lifecycle information, personal information, and detailed event data is called the Consolidated Audit Trail ( <b>CAT</b> ). CAT presumably is a ‘ <b>single source of truth</b> ’ or ‘ <b>golden source</b> ’ for <b>market monitoring</b> purpose, which should <u>NOT</u> be confused or convoluted with the functionalities and purposes of the CT / SIP feed or TRFs transparency regime. CAT is limited to regulatory and Self-Regulatory Organizations (SROs) access only at T+5 in the US. CAT is currently challenged by industry groups in the US Court. <sup>15</sup>			

<sup>1</sup> [https://www.hbs.edu/ris/Publication%20Files/21-016\\_d5cc4876-c029-4540-8092-16a23778d86f.pdf](https://www.hbs.edu/ris/Publication%20Files/21-016_d5cc4876-c029-4540-8092-16a23778d86f.pdf) ; [https://itlaw.fandom.com/wiki/Time-sensitive\\_information](https://itlaw.fandom.com/wiki/Time-sensitive_information) ; <https://statisticseasily.com/glossario/what-is-time-sensitive-data-explained-in-detail/>

<sup>2</sup> <https://www.sec.gov/files/rules/final/2020/34-90610.pdf>

<sup>3</sup> <https://www.sec.gov/files/rules/final/2024/34-101070.pdf>

<sup>4</sup> <https://www.finra.org/filing-reporting/trace/technical-notice/trace-corporate-agency-re-platform-and-data-feed-protocol-changes> Build on [INET platform](#) and uses MOLD/UDP 64 Protocol for data transmission. Large data sets are broken down into smaller packets through ‘data segmentation’ process. Suitable for computing environments where large volumes of data need to be transmitted quickly over User Datagram Protocol (UDP). Although UDP is inherently unreliable, MOLD/UDP 64 adds mechanisms to ensure data integrity and reliability. Each packet is assigned a unique sequence number to help the receiver track and detect any missing packets. The receiver sends back acknowledgments to confirm the receipt of data packets. If a packet is missing or corrupted, the receiver can request a retransmission.

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- <sup>5</sup> <https://www.sec.gov/files/rules/sro/finra/2009/34-60960.pdf> If an OTC trade is executed outside of normal market hours (After-Hours Reporting), it must be reported as soon as the facilities reopen (i.e. submission deadline by 8 a.m. Central Europe Time (CET)).
- <sup>6</sup> [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3369025](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3369025)
- <sup>7</sup> Other notable proprietary protocols: Xetra and ETS (Deutsche Börse); UTP (Euronext); SWXess (SIX); OBX (Oslo Børs); Mercato Telematico Azionario (Borsa Italiana); OUCH/ITCH (NASDAQ); Millennium (London Stock Exchange).
- <sup>8</sup> For duplicate trades and the role of CTP, in the US there is a "DUPE POS" flag used by those reporting the data and processing it. If one has an issue when reporting and are unsure if they sent the trade in already it is marked "DUPE POS", notifying the CTP and regulator that the trade may have been reported already. The CTP may forward the "DUPE POS" along to recipients (subscribers of CT) as they may be unable or unaware if the trade was actually reported. Recipients then process the information as potentially questionable. If there is an issue, often the CUSIP is paused (trading halt), data is examined, and erroneous trade are taken down (cancelled) all done at the direction of the regulators.
- <sup>9</sup> <https://www.yalelawjournal.org/article/open-access>
- <sup>10</sup> <https://www.sec.gov/newsroom/speeches-statements/peirce-statement-financial-data-transparency-act-080224>
- <sup>11</sup> [https://www.esma.europa.eu/sites/default/files/2024-05/ESMA50-524821-3149\\_EU\\_Securities\\_Markets\\_2023.pdf](https://www.esma.europa.eu/sites/default/files/2024-05/ESMA50-524821-3149_EU_Securities_Markets_2023.pdf) ; <https://www.fese.eu/app/uploads/2024/08/240808-European-Exchange-Report-2023.pdf> ; [https://www.cboe.com/europe/equities/market\\_share/market/venue/](https://www.cboe.com/europe/equities/market_share/market/venue/)
- <sup>12</sup> <https://www.quantifiedstrategies.com/what-percentage-of-trading-is-algorithmic/>
- <sup>13</sup> <https://www.bmlitech.com/news/market-insight/inside-the-sip-and-the-microstructure-of-odd-lot-quotes/>
- <sup>14</sup> <https://www.imf.org/en/Publications/fandd/issues/Series/Back-to-Basics/Financial-Markets>
- <sup>15</sup> <https://www.sifma.org/resources/news/a-safer-cat-for-investors/> ; <https://www.tradersmagazine.com/am/cat-how-can-a-new-government-program-that-most-americans-have-never-heard-of-cost-more-than-the-annual-budget-of-half-the-federal-agencies/> ; <https://www.congress.gov/116/chrg/CHRG-116shrg39415/CHRG-116shrg39415.pdf> ; <http://www.americansecurities.org/post/asa-citadel-securities-file-lawsuit-against-sec-challenging-consolidated-audit-trail>