



Financial Industry Regulatory Authority

Consolidated Audit Trail



The FINRA Team's Strengths

We Know the Business

- Decades of experience building, operating and using audit trails
- Decades of experience processing customer and account data
- Operator of the GMEI Utility, the worlds largest utility for Legal Entity Identifiers (LEI)

Proven Operating Model

- Industry-accepted business and technical reporting specifications
- Highly-skilled regulatory staff; business and technology help desks
- Proven data validation, correction, and cleansing
- Preventative compliance tools

Premier Technology Solution

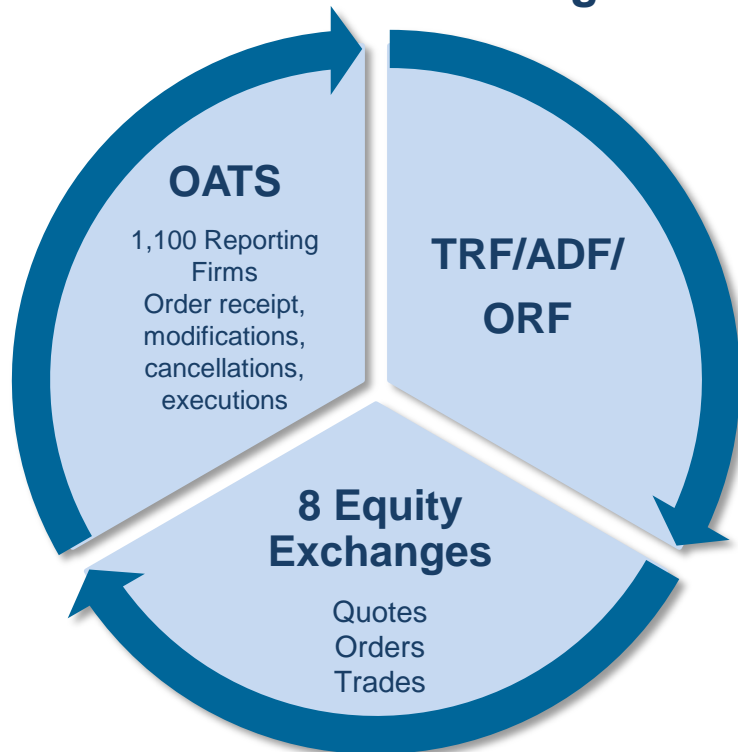
- Hybrid solution balances demands of Big Data processing with need for highly secure environment for customer and account data
- AWS cloud provides cost effective, scalable and flexible solution
- Multi-layer encryption for PII in a secure hosted datacenter

Minimizes Industry Impacts

- Solution designed to mitigate industry impact by leveraging existing business processes and data formats, including LEI
- Industry input will be central to development of reporting requirements and technical specifications

Our Current Capabilities Align with CAT Requirements

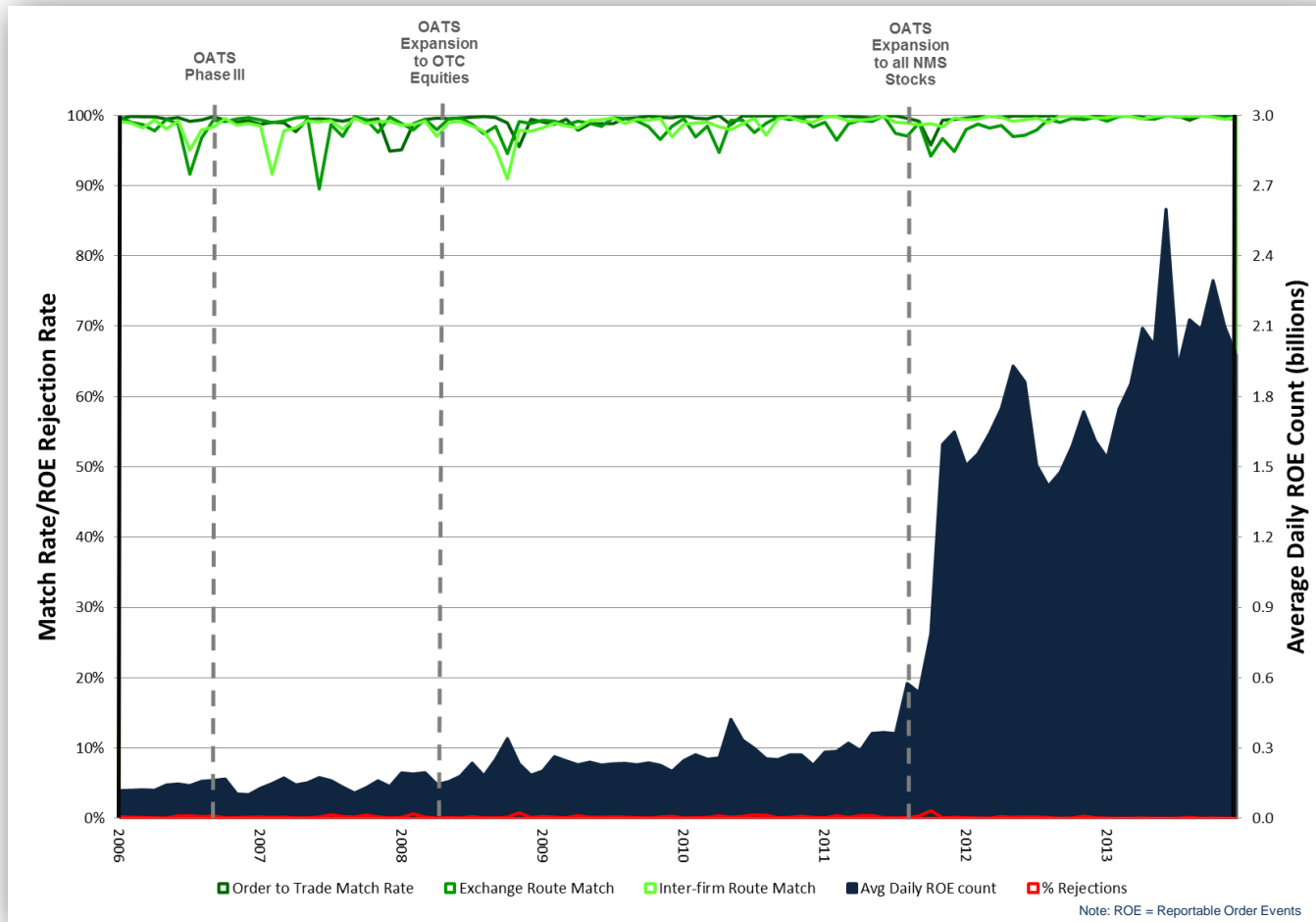
FINRA's Audit Trail Linkages



- **FINRA collects, links and stores over 30 billion market events per day covering over 90% of the equity market**
- **FINRA maintains over 2PB of historical data**
- **FINRA provides data access to**
 - 5,000 Registered OATS Users
 - 1,600 Registered Users of the FINRA Online Query Tool

- **DTCC assigns and maintains LEIs for more than 140,000 global customers**
 - The GMEI utility has issued 99% of U.S. entities' LEIs, about 70,000 to date
- **DTCC's subsidiaries:**
 - Process securities transactions valued at approximately \$1.6 quadrillion, and
 - Hold custody securities valued at approximately \$43 trillion

Sustained High Compliance Rates during Extensive Growth



FINRA Understands the Challenges of CAT

Key Challenges Addressed by FINRA's Solution

Market Data

Four hour window to process over 50 billion records and complete all lifecycle linkages

Cloud Architecture

Linkages for aggregated orders, multi-product orders and allocations that do not exist today

New Linkage Keys & Identifiers

Correction of unlinked events between CAT Reporters which is not required by OATS

Progressive Linkage & Auto Correction

Customer & Account Data

Assignment of a single CAT Customer ID across multiple broker-dealers

GMEI business process & tech

Resolution of inconsistencies across broker-dealers

DTCC/Avox data cleansing

Security of highly sensitive customer and account data

PII data stored in a secure FINRA datacenter

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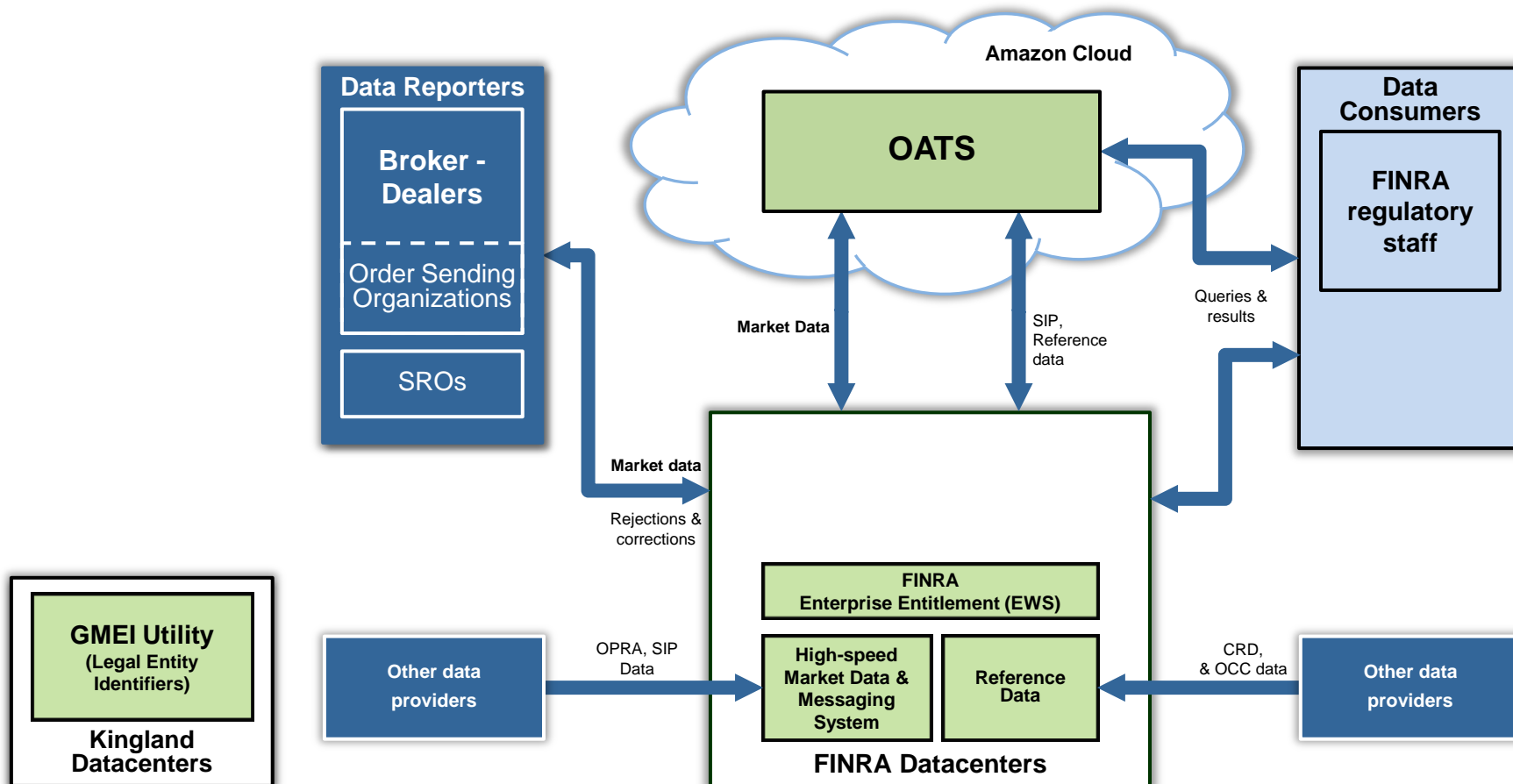
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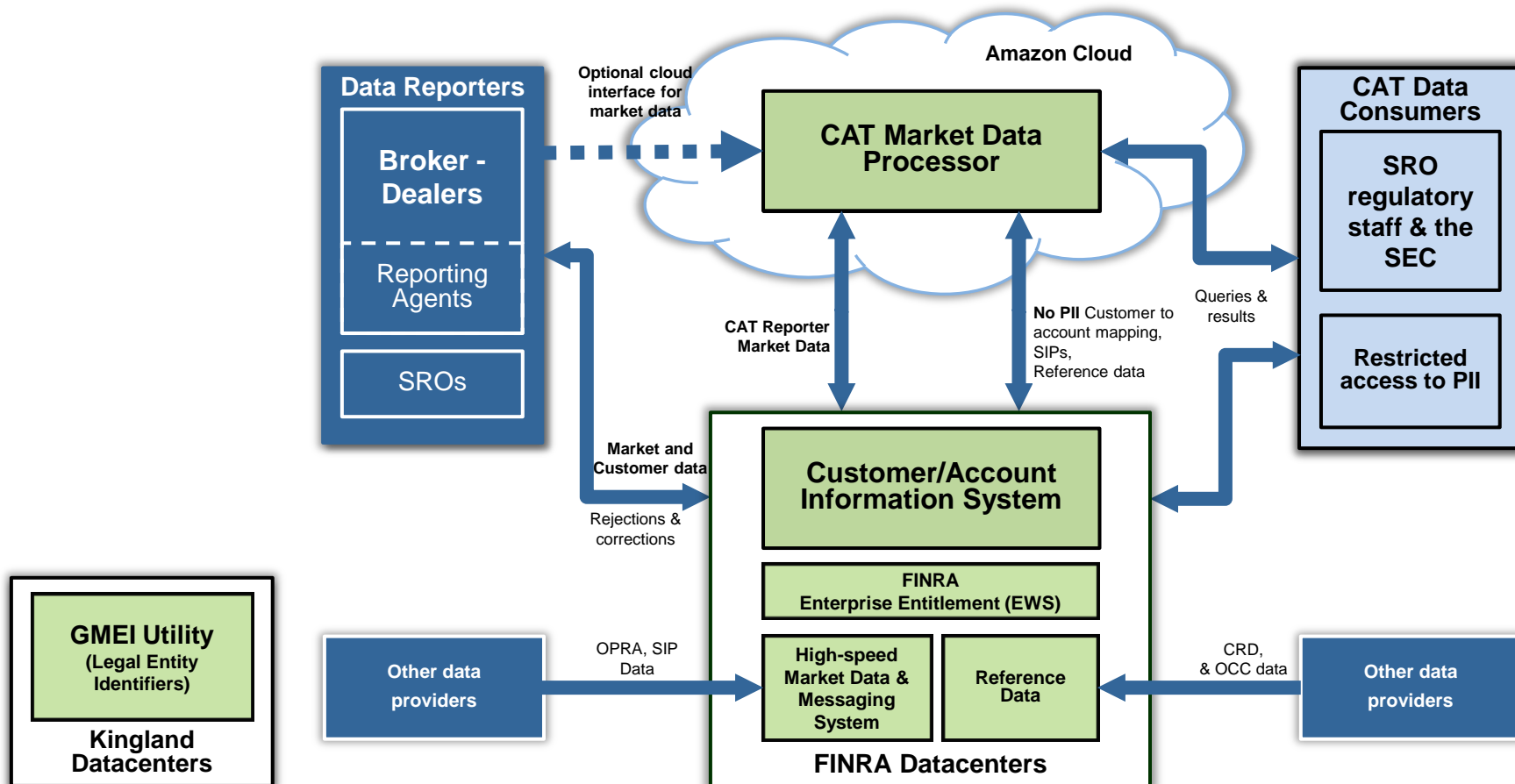
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2015



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CAT Solution



Big Data Technology and Advantages to CAT

What is Big Data Technology?

- An ecosystem of software that allows the harnessing of massively parallel computing hardware.
- This provides applications with access to virtually infinite data storage and computing power without increasing application complexity.
- 2003 & 2004: Google publishes description of Google File System and MapReduce to demonstrate technical leadership.
- 2006- 2008: Yahoo builds an open-source technology (Hadoop) based on the Google papers to solve their search index scale issues.
- 2008 on: Growth of Hadoop support vendors and adoption in mainstream product lines.



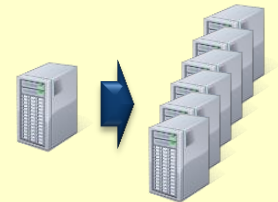
Advantages to CAT:

- Big data software “scales out” by subdividing large problems into smaller segments.
- Provides large scale performance on low cost commodity servers.

Scale Up



Scale Out



- Benefits:
 - ◆ Processing occurs simultaneously across all segments
 - ◆ Large virtual disk which can be scaled indefinitely to accommodate growing data needs.
 - ◆ There are no practical scale limits.

Cloud Computing and Advantages to CAT

What is Cloud Computing?

- An automated provisioning of virtual computing and data storage resources.
- Enables rapid and cost-effective reallocation of computing power between applications in response to shifting demands.



Advantages to CAT:

- Pay only for capacity actually used rather than sizing for peaks and managing for growth (hardware, space, power, cooling, network, bandwidth, etc)
- Disaster Recovery costs are reduced by only paying for full DR capacity in the event of a disaster (and short periods for DR rehearsals).
- Reduced costs (observed savings in excess of 40%)
- Time to market is improved because no procurement lead time is required for new computing capacity and technical refreshes of capacity constrained and/or obsolete hardware.
- Security is equal to or better than can be provided with self-managed data centers.

Premier Technology Solution



Why Amazon Web Services (AWS)?

- Scalable and elastic
 - Massive scalability at commodity costs
 - Ability to scale up and down to match demand
 - Usage based billing
- Reduced time to market and less capital
 - No hardware procurement cycle
 - Technology refresh is “free”
 - Continued Price Improvement
- Resilient infrastructure for extreme availability and geographic diversity
- Highly secure
- Mature
 - Amazon has more than fifteen years of experience delivering large-scale, global infrastructure in a reliable, secure fashion
- AWS is 5 times larger than next largest 13 competitors combined

Gartner places AWS well ahead of the competition in both vision and ability to execute



Data is Secure and Protected

Oversight and Improvement

- **Established and effective program**

- Formal CISO role for 15+ years
- Privacy Office for 7+ years
- Established and mature security

- **Continuous improvement:**

- Track multiple intelligence sources
- Training & Awareness

- **Independent Assessment and Standards**

- 3rd party assessment of security
- SOC2/3 and ISO 27001 compliance

Protection and Mitigation

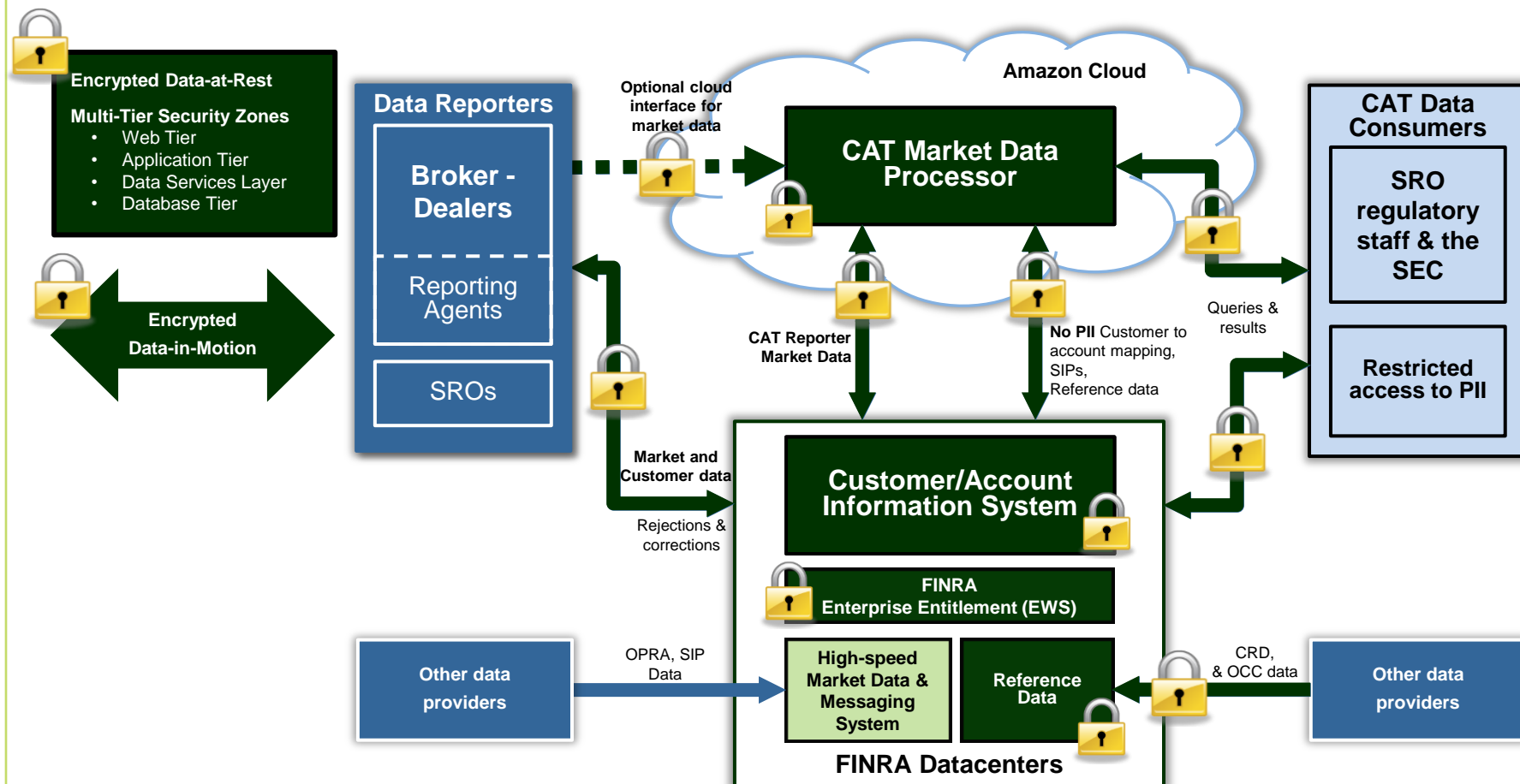
- **These practices are a result of FINRA already hosting and protecting industry sensitive and PII data such as:**

- OATS data (no-PII)
- Registered Reps PII in CRD
- Customer and Account PII data received in Bluesheets (EBS)

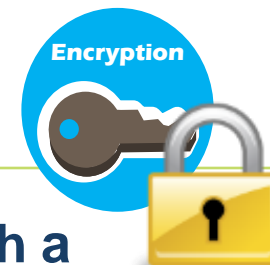
- **Secure with a proven security track record protecting sensitive industry data**

Security Architecture

Encryption



What Does Encryption Mean?



- An encryption key (or password) of 20 characters with a reasonably good password scheme
- A Brute Force attack would require trying 2^{119} possibilities
- At best a typical computer could attempt 2^{30} passwords per second and require billions of years to stumble onto the correct password

More akin to “attacking the system with a subtely of a slow witted gorilla”

Cloud Security Strategy



AWS Security:

- AWS has the security “building blocks” needed to construct a secure virtual infrastructure
- AWS Controls, Practices, & 3rd Party Certifications
- Scale and virtualization enhance physical security
- AWS Shared Responsibility Model
- Data-at-Rest Encryption
- Data-in-Motion Encryption
- Network security features like those found in traditional data centers
- Access Control Policies

FINRA's Additional Security:



- **Additional Data-at-Rest Encryption**
 - Elastic Compute Cloud (EC2) Ephemeral Disk & Elastic Block Store employ encrypted file sys
- **Additional Data-in-Motion Encryption**
 - Connections encrypted (i.e. HTTPS, Secure FTP)
- **Multi-Factor Authentication**
- **Multi-Tier Security Zones**
- **Unified Threat Manager (UTM) software on “at risk” EC2 instances**
- **Web Application Firewall (WAF) protects web sites/services**
- **Other security controls/services extended into the Cloud (i.e. Verisign, Splunk SIEM etc)**
- **AWS Compliance Monitoring**

Protecting Customer and Account data



Additional Security for Customer/Account Info:



- **PII Data will be stored in a separate physical FINRA hosted system**
 - Only non-PII data will be replicated to the cloud hosted Market Data Processor (i.e., CAT Customer ID to Account Number mapping)
- **Restricted User Access to PII**
 - Only accessible through the CAIS secure website
 - Require a special user role
 - Anticipate only a small number of users with access to PII
- **Additional Authentication**
 - Access requires connectivity from a known network
 - Access is granted through an adaptive authentication model
- **Additional Data Query restrictions and monitoring**
 - Authorized users will not have the ability to request bulk download of PII
 - Security monitoring of requests will alert on misuse/abuse

Premier Technology Solution

Proven architecture based on hybrid hosting approach

- ✓ The technology architecture is proven, running today and having been validated by external parties
- ✓ Benefits by leveraging an ecosystem of supporting systems in place supporting OATS today
- ✓ Uses cloud and open source for an extremely cost efficient solution
- ✓ Continuously marked to market with continuous economic benefits as a result
- ✓ Supported by key vendors with strong relationships with FINRA
- ✓ Positioned to take advantage of new and emerging technologies as they are proven
- ✓ Secure with a proven security track record protecting sensitive industry data

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Minimize Industry Impact

**Leverage
Existing
Systems,
Standards
and
Reference
Data**

**Minimize
Disruption to
Existing
Market and
Business
Practices**

**Preventative
Compliance**

**Industry
Involvement**

Minimize Industry Impact

Leverage Existing Systems, Standards and Reference Data

Leverage Existing Systems

- Allow use of OATS interfaces and transmission methods
- Use DTCC's GMEI technology for CAT Customer ID Assignment

Use Existing Standards

- Use OATS data formats
- Use DTCC/Avox's LEI data cleansing process for legal entity data
- Use OATS linkage methodology (daisy chain)

Use Existing Reference Data

- LEI
- SRO Assigned Identifiers (e.g., MPIDs, User Acronyms)
- OSI Symbolology

Minimize Industry Impact

Minimize Disruption to Existing Market and Business Practices

Options

- Option reporting formats similar to equity format with addition of option specific fields
- Complex and multi-product order linkages preserve independence of each component leg as appropriate

Aggregated and Representative Order Linkages

- Do not require direct linkage of individual street side executions to specific allocations
- Focus on correlation of customer order(s) and related street side activity on a pre-trade basis

Unmodeled Trading Practices

- Anticipate unmodeled but permissible trading practices

Future Expansion & Retirement of Existing Systems

- Flexibility to add additional elements that are in retiring systems but not in Rule 613.
- Flexibility to accommodate different product types (e.g., Fixed Income)

Minimize Industry Impact

Preventative Compliance

System Design

Continuous validation
allowing for error correction
prior to 8:00 am T+1

Progressive linkage
providing warnings prior to
8:00 a.m. T+1

Auto Acceptance/Correction
of Rejected/Unlinked
Records Where Possible

Compliance Tools

Daily Report Card Information
including Peer Group and Industry
Compliance Rates

Proactive Surveillance Function to
Monitor Data Quality and Call Firms
to Alert of Potential Issues

CAT Technical Specifications to include
Business Scenarios

Minimize Industry Impact

Industry Involvement

CAT Reporter
Focus Group for
design of CAT
Secure Website

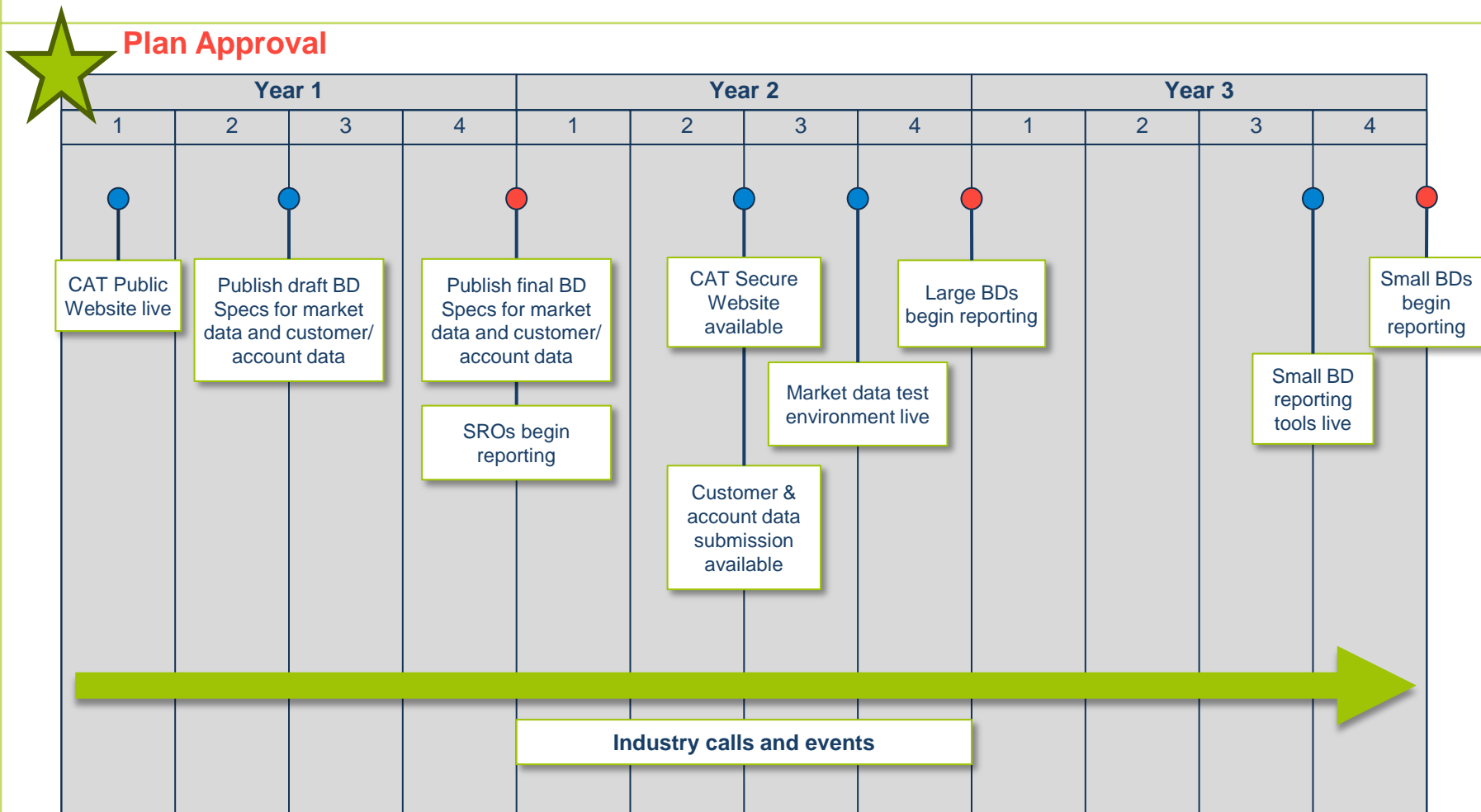
Frequent Industry
Calls and Events

Small Firm
Advisory Group

Solicit Comment
on Firm-Impacting
Releases

Automated
Feedback Tools to
Receive Industry
Comment

FINRA's Recommended Implementation Timeline



Closing Summary

**We Know the
Business**

**Proven Operating
Model**

**Premier Technology
Solution**

**Minimizes Industry
Impacts**

- FINRA and DTCC are proven commodities
- We can ensure the delivery of a solution that fully complies with Rule 613
- We understand how to communicate and work with the industry
- Our approach builds upon experience with similar systems and minimizes the amount of greenfield development
- We can ensure the smooth and efficient transition from OATS and EBS to a CAT solution
- We can more quickly achieve high data quality and compliance rates

Q&A

