Open Day 2019
Gearing up for future financial markets
Michael Girg
26 September 2019
Getting ready for the next level of cloud usage

Agenda

- Introduction to Deutsche Börse Group
- Ability to use public cloud is crucial for future success
- Setting up a Cloud Centre of Excellence
- Audit compliance - The Collaborative Cloud Audit Group
- Partnerships with Microsoft and Google
- Execute adoption in waves over next years
An overview of Deutsche Börse Group

Deutsche Börse Group covers the entire value chain in securities and derivatives trading.

1 Pre-IPO and listing
2 Trading
3 Clearing
4 Settlement
5 Custody
6 Collateral and liquidity mgmt
7 Market data
8 Indices
9 Technology

- Leading European Financial Infrastructure provider and – Marketplace with roots since 1585
- Early adopter: Fully automated electronic trading since 1997
- Operating lowest latency network & technology
- Largest European Data Centre due to Deutsche Börse network effects
- ~2,000 IT staff organized in Product Organization
- Most DBG business applications own developed and maintained
- Core element of European and Global Capital Market – therefore under highest regulatory supervision

Cloud adoption

Deutsche Börse Group

Share your thoughts! #ITOpenDay19 @DeutscheBoerse
Innovation is in our DNA – technology has been at the core of Deutsche Börse's success

Selected major technological milestones

Deutsche Börse IT established its leading position by

- Launching electronic trading system Xetra
- Founding derivatives exchange Eurex
- Launching commodity market trading platform
- Introducing risk management system Prisma
- Renewing the Trading and Clearing systems "T7" and "C7" (technology refresh)
- Establishing Distributed Ledger Technology (DLT) Center of Excellence
- Establishing strategic partnership with Microsoft Azure to enable migration of material workloads to cloud

Key strengths of Deutsche Börse IT

- Infrastructure technology leader with strong track record for high-volume market infrastructure and large scale data processing
- Operating excellence with high process reliability, stability and scalability
- Credible and reputable infrastructure provider qualifying as a strategic partner for innovative IT solutions

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Public cloud is one of the main technologies to support our Roadmap 2020

Operating IT workload from a public cloud environment offers proven benefits ...

... and lays the foundation for other Roadmap 2020 initiatives

<table>
<thead>
<tr>
<th>Agility</th>
<th>React dynamically to changing business demand with instant provisioning of new systems and hundreds of services readily available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>Leverage geographical spread of cloud service providers, improve quality with standardization, automation and repeatability</td>
</tr>
<tr>
<td>Cost</td>
<td>Reduce operations cost, especially for standard software, increase level of standardization and automation; optimize asset utilization</td>
</tr>
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</table>

Use public cloud technology to develop and run blockchain-based services

Include public cloud components in big data/ analytics solutions to analyze large data sets

Use specialized services for machine learning, e.g. complex GPU\(^1\) computing

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1 Graphics Processing Unit
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Multi-cloud, hybrid strategy unlocks cloud benefits whilst maintaining resiliency on-premise

### Cloud strategy drivers

**Multi-cloud**
- Access to scalability and agility of cloud
- Able to select best supplier for each use case
- Prevent vendor lock in and ensure portability

**Hybrid**
- Able to dynamically shift workload between on-premise and cloud
- Retain existing competitive advantages on-premise

### Cloud model

<table>
<thead>
<tr>
<th>Cloud model</th>
<th>Example services</th>
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<tbody>
<tr>
<td>SaaS¹</td>
<td>Office 365, including email and SharePoint</td>
</tr>
<tr>
<td>SAP</td>
<td>Concur travel booking, Ariba procurement</td>
</tr>
<tr>
<td>PaaS2</td>
<td>SAP cloud platform and supporting infrastructure for SAP solutions</td>
</tr>
<tr>
<td>IaaS3</td>
<td>Infrastructure for DBAG applications, e.g. EC2</td>
</tr>
<tr>
<td>Azure</td>
<td>Infrastructure provided via Azure IaaS</td>
</tr>
<tr>
<td>Google Cloud</td>
<td>Infrastructure such as compute and TensorFlow</td>
</tr>
</tbody>
</table>
Services offered by Cloud CoE circles around enabling the organisation to use Public Cloud services

- Manage CSP Enterprise Agreements
- Execute Central Cloud Purchasing
- CSP Invoice Management
- Cost Distribution / Charge Back
- CSP Compliance Monitoring

- Setup Base Infrastructure
- Manage Network Connectivity
- Manage Role Based Access
- Setup Security Controls/guardrails
- Perform Platform Risk Assessment

- Infrastructure & Security Monitoring
- Incident Management
- 24x7 Support / Help Desk
- Reserved Instance Handling
- KPI / SLA Dashboarding
- Manage List of Allowed Services

- Create / Maintain Virtual Trainings
- Provide access to Classroom Trainings
- Execute Well Architected Reviews
- Support Project Teams
- Share Knowledge

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Core idea: Collaborative Audit Group to execute unrestricted audit rights

- Maximises efficiency and effectiveness
- Based on audit best-practices
- Executes individual audit rights in a group format
- Open format – all interested financial institutions can join

**Individual audit scope**

- Financial Service Provider 1: 100
- Financial Service Provider 2: 100

**Effort**

- Vendor: 100 + 100 = 200
- Outsourcer: 100

**Collaborative audit scope**

- Financial Service Provider 1: 20
- Financial Service Provider 2: 80

**Effort**

- Vendor: 20 + 20 + 80 = 120
- Outsourcer: 20 + small collaboration group share

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Focus of group audit on “security OF the cloud”

Security IN the cloud
- Securing access
- Defining User / Roles / Policies
- Data protection
- Logging & monitoring
- ...

Security OF the cloud
- Datacentre compound
- Physical hardware / network
- Up to hypervisor level
- CSP platform & services
- Access management
- CSP staff

Security OF the cloud
- Optimized Network/OS/App Controls
- Service-specific Controls
- Cross-service Controls

Security IN the cloud
- Cloud Service Provider (CSP) Controls
- External Certifications
  - ISO, SOC, ...

Focus of collaborative audit group

Focus of collaborative audit group

External Certifications

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Our newly announced partnership with Microsoft and Google will streamline planned cloud migration initiatives and pave the way for a broad cloud adoption.
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Partnership with Microsoft and Google

Execute adoption in waves over next years
We are committed to use public cloud as a driver for innovation and efficiency

Cloud strategy
- Established partnership with Microsoft Azure, addressing regulatory requirements
- Partnerships with other leading cloud service providers in negotiation
- First wave: migrating test and development systems to cloud, migrating material enterprise workloads
- Prepare 2020 moves to cloud

Expected benefits
- Agility and faster time to market
- Higher reliability and global scale
- Higher quality, better security, lower risk
- Efficiency through more automation and standardization
- Leverage native cloud capabilities like machine learning services to benefit from ecosystem

2019
- Move now to benefit fast, work with market leaders, execute in waves over next years
- We expect to increase speed, automation and resilience
- We will invest a high double-digit million euro amount (expected payback after ~3 years) and take a leading position

2020
- Migrate substantial share of business apps and production workloads to cloud, reduce on premise footprint
- Drive agility, innovation and cost efficiency
- Increase performance and stability of core products through cloud features
- Prepare 2021 moves to cloud
Thank you for your attention.

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<tbody>
<tr>
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Disclaimer

Deutsche Börse AG opens up international capital markets for its customers. Its product and service portfolio covers the entire process chain – from pre-IPO services and the admission of securities, through securities and derivatives trading through the settlement of transactions and the provision of market information to the development and operation of electronic trading, clearing and settlement systems. With its process-oriented business model, Deutsche Börse increases the efficiency of capital markets. Committed employees are the key factor for innovation and further growth: without them, Deutsche Börse Group would not have developed into one of the most modern exchange organisations in the world. More than 5,000 employees work for the Group – a dynamic, motivated and international team.