OpenAPIs as a digital business platform enabler for investment and trading

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Open APIs and platforms – key points

**Opening up your business using open APIs allows you to**
- Become more digital and transform your business model
- Open up for agility, deep integration, innovation
- Transform into a platform (think Amazon), business as service model
- Take on business you haven't considered or wasn't open to before

**Is a strategic and long term decision requiring**
- Executive support
- Stakeholder management and buyin on all levels to succeed
Agenda

- Saxo Bank Intro
- Establishing the Vision:
  - Take 1: Technology driven
  - Take 2: Enterprise driven
- Architecture decisions and trade offs
- Status:
  - Sample client cases
  - Cost of offering OpenAPI as a product
- Lessons learned:
  - Secondary benefits
  - Additional complexities
- Towards an Open Banking infrastructure
Saxo Bank – introduction

- Global online investment bank – facilitator/broker setup - offices in 20+ countries and clients in 190 countries
- Specialises in online trading and investment, servicing retail clients, corporations and financial institutions
- A leading presence in online trading due to client service, competitive pricing and industry-leading trading platforms.
- Enables private investors and institutional clients to trade FX, CFDs, ETFs, Stocks, Futures, Options and other derivatives via multi-award winning online trading platform.
- 4th generation technical platform and evolving – Microsoft based, mostly custom developed in house
- **15000 concurrent users, 400000 price updates/sec, very high transaction peaks (2000+ trades/orders/sec) around numbers and market state changes.**
Saxo Bank – Operating model/facilitator – Digital core

<table>
<thead>
<tr>
<th>Products</th>
<th>Tools / Services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distribution to the market place</strong></td>
<td><strong>Aggregating liquidity from the global financial market place</strong></td>
</tr>
<tr>
<td>Unparalleled suite of capital markets products - listed and OTC</td>
<td>Investment banks</td>
</tr>
<tr>
<td>- FX (Spot, Forwards, Vanilla and Binary Options)</td>
<td></td>
</tr>
<tr>
<td>- CFDs (Single Stock, Stock Indices and Commodities)</td>
<td></td>
</tr>
<tr>
<td>- Stocks, Futures, Fixed Income, EFTs Options and Contract Options</td>
<td></td>
</tr>
<tr>
<td>Award-winning trading platforms</td>
<td>Back-office &amp; risk management</td>
</tr>
<tr>
<td>Portfolio management, reporting &amp; monitoring</td>
<td>Client administration and service</td>
</tr>
</tbody>
</table>

Trade and Invest - Anything, Anywhere, Anytime
The Case for a Unified Modern API in Saxo Bank…

Take 1

Current

Backend core services shared

Future

Backend core services shared

**Warning… Old Style**

• Siloed approach leads to duplication and proliferation of features
  • Different feature implementation
  • Drives up TCO
  • Non scalable

**Common shared services oriented backend based on open standards**
• Open ended mash up arch.
  Easier and more open ended support for devices and different form factors
• Integration of saxo trading into other uis
• Enables regional distribution of platform and UI
But then TradingFloor happened
And next generation client experience GO came on the radar...
New business driven opportunity to introduce Open API
External drivers and forces – DRIVING TECHNOLOGY
- And Implementation Choices for GO/Open API

- Data volumes growing exponentially
- Near real time analytics and customization key success factor
- Regulatory/compliance demands push boundaries for data collection and access
- Standards emerge and are maturing
- Social networking and connected mashup is the norm
- All major players will support industry specific open APIs
- Commoditization of standard technology and LOB systems
- Mobile/tablets will be the new normal, decline of desktop
- Internet access and reach abundant and ubiquitous
- Cloud solutions is standard
- Internet of things
- Low latency is the new normal
- Real-time/near real-time is the expected
- Volumes will demand greater processing capability
- Compute power will still increase or become cheaper
- Data volumes growing exponentially
- Need for speed
- Anywhere, Anything, Anytime
- Share and conquer
- It’s all about data
- Scalability
- Stability
- Security
- Flexibility
1. FASTER  Faster Time To Market:
   ✓ Devs. are more effective when API is solid and well documented.
   ✓ 3rd party devs. and companies can be on-boarded faster.
   ✓ 3rd parties can be hired to make completely separate custom apps.

2. BROADER  More applications, more value for Saxo Bank clients:
   ✓ WLC’s can seamlessly embed Saxo functionality in their own portals.
   ✓ Niche companies and semi-pros can develop targeted applications.
   ✓ Advanced traders can use MathLab/R/StatPro for algo trading.
   ✓ Established trading platforms and data portal vendors may now hook up to Saxo Bank.

3. CHEAPER  One interface instead multiple:
   ✓ Replacing several front end servers, front end protocols and duplicated logic. Faster to develop, easier to test and maintain.
Saxo Bank’s Open API – Project Charter

OpenAPI exposes enough data and functionality that you can build a complete trading platform from scratch.

OpenAPI uses REST, JSON and WebSockets with graceful fallback to long-polling.

SAML2 + Oauth 2.0 for access control.

Can be used by web and native applications.

* Google vs. Amazon Rant : https://plus.google.com/112678702228711889851/posts/eVeouesvaVX
Open API – time lines and false starts 😊
Architecture
API Challenges & Non-Standard Design Choices

The System:
- Around 15,000 concurrent online clients - operational and open 5.5 days * 24 hours
- In excess of 400,000 price feed updates per second
- Intraday execution of more than 2000 trades per second
- Over 500,000 trades booked and processed daily
- 160,000 unique users monthly to our trading portal
- While maintain latencies in the single digit millisecond range throughout

The Design:
- Centralized streaming server accessed through high performance message bus.
- Snapshot + streaming of Δ’s
- Limited Bus. Logic in API servers (vs pure gateway)
- Adding convenience data to key resources.
- Supporting BATCH requests
- Considering adding extended projections & compact JSON serialization

The front-end/Saxo Trader GO
- 4 price updates/second.
- Latency to client app: 30 ms + Network distance.
- Fast application startup.
- Fast User Experience.
- HTML5/shared across form factors/devices – Mobile first
To overcome scalability issues we separated business servers from streaming servers.

Deltas from Snapshot are calculated & streamed.
The architecture provides a reasonable separation of responsibility while supporting low latency and high throughput.

HTTP / REST:
- Atomic Operations,
- Subscriptions

Streaming Server
- Unified DataStream

Reference Data
- Security, Interface Monitoring, Protection/Throttling, CORS support

https://opeapi.saxobank.com/...

Message Bus

Security, Interface Monitoring, Protection/Throttling, CORS support
- Streaming, Pub/Sub, Serialization, Deltaing, Caching, Logging, Session, Type Regist.

Internal Network

DB 1
- App Svr 1
- App Svr 2
- App Svr 3
- App Svr 4
- App Svr xxx
- DB 2
- DB 3

DMZ
The architecture provides a reasonable separation of responsibility while supporting low latency and high throughput through HTTP/REST: Atomic Operations, Subscriptions. This includes features such as Streaming Server, Unified DataStream, Security, Interface Monitoring, Protection/Throttling, CORS support, and Reference Data. The diagram illustrates the integration of these components, with reference to specific servers (App Svr 1, App Svr 2, App Svr 3, App Svr 4, App Svr xxx, DB 1, DB 2, DB 3) and the Message Bus, which facilitates communication between different parts of the system.
Other Design Considerations
(Remember Design == Choice + Decision)

- Adding convenience data to key resources.
- Supporting BATCH requests.
- Considering adding extended projections & compact JSON serialization.

Speed

"Purity"

APX
Other Design Considerations - Example

Get a single net position

![Image of API request parameters]

Request parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>netPositionId</td>
<td>String</td>
<td>Route</td>
</tr>
<tr>
<td>clientKey</td>
<td>ClientKey</td>
<td>Query-String</td>
</tr>
<tr>
<td>accountGroupKey</td>
<td>AccountGroupKey</td>
<td>Query-String</td>
</tr>
<tr>
<td>accountKey</td>
<td>AccountKey</td>
<td>Query-String</td>
</tr>
<tr>
<td>fieldGroups</td>
<td>NetPositionGroupSpec</td>
<td>Query-String</td>
</tr>
</tbody>
</table>

Sample response

```
{
  "DisplayAndFormat": {
    "Currency": "USD",
    "Description": "Euro/US Dollar",
    "DisplayDecimals": 5,
    "Format": "ModernFractions",
    "Symbol": "EUR/USD"
  },
  "NetPositionBase": {
    "accountId": "192135141T",
    "AssetType": "FxForwards",
    "clientId": "2142728701",
    "expiryDate": "2015-01-01T00:00:00Z",
    "fixedIncomeData": {
      "CloseAccruedInterest": 0.0,
      "Duration": 0.3,
      "EffectiveYield": 0.0,
      "OpenAccruedInterest": 0.0
    },
    "MarketValueOpen": 0.0,
    "OptionsData": {
      "canBeExercised": false,
      "exerciseStyle": "American",
      "expiryCut": "None",
      "expiryDate": "2015-01-01T00:00:00Z",
      "lowerBarrier": 0.0,
      "putCall": "Put",
      "settlementStyle": "cashDelivery",
      "strike": 0.0,
      "upperBarrier": 0.0
    },
    "sic": 11
  }
}
```
A flexible security model enables widespread API (re)-use while retaining control.

1) Authentication:
   - SAML2 SSO/Federated SSO
   - Certificates

2) Authorization:
   - Oauth 2 (var. Profiles/Flows)
   - Application identified by "client_id" and "client_secret"

Oauth 2.0 provides the client application with an access token and a refresh token.

Access token includes: appId, userId, and claims.

Access token required on all calls to API
Sample Client Cases

- [Image: 华尔街见闻](Complete trading Platform)
- [Image: X] (Options Strategy)
- [Image: Custom Code]

OpenAPI - Trading

Saxo platform Engine/Core

*Can also be done through CMS*
Trade and invest

- Anytime, anywhere, anything
- Intuitive, award winning interface
- Unified experience
- Mobile first
- Share everything
- HTML5 core technology on top of open api – thin native shells/wrappers in appstore
Saxo Trader GO/Open API - has quickly become the top earning platform
Excel is now much more flexible (Full trading XP) - do you also want it?
Another interesting 3rd party platform - OptionsDynamics
Another interesting 3rd party platform - Updata – algo chart trading

Avanced chart, algo trading with bespoke programming/macro language
SAXO BANK STRENGTHENS ITS GREATER CHINA PRESENCE, ANNOUNCES STRATEGIC FINTECH PARTNERSHIP

Half a year after setting up its first Shanghai office, Copenhagen-based global bank and forex broker announces a tri-party agreement with Wallstreet CN and LeanWork which will significantly strengthen Saxo Bank’s presence in Greater China.

According to the agreement, the users of Wallstreet CN will be able to access global capital markets from WEEX (an online trading service platform created by Wallstreet CN) with trading system developed by LeanWork and Open API powered by Saxo Bank.

Kim Fournais, co-founder and CEO of Saxo Bank, commented: “This unique partnership underlines the strength of Saxo’s Open API which with limitless customization options will increase the power of trading technology now and in the future. This truly is a win-win for all parties and at Saxo Bank we are excited to be working with two exceptionally successful start-ups which empower Chinese speaking investors.”
2015: Open Bank – seamless integration of retail financial services

Via Open API
Lessons Learned – non technical issues

**Data entitlements - Ensure you own and control data**
- Exchanges have different rules re. redistribution some simply say NO.
- Exchanges have different definitions of client type
  - private/retail
  - professional/institutional
- Pricing may vary by intended usage
  - Display only
  - Algo trading – btw what is the definition of algo trading (it differs 😊)?
- Different requirements to our controls of data recipient not violating agreements
- Single Screen/Multi screen display rights.

**Legal/compliance**
- Classification/Mifid – guides what and can and cannot be done
  - Retail – restricted and protected
  - Professional – more access
- Who is the client?
  - Saxo direct/IB
  - White label
- Who is providing the application?
  - Saxo
  - White label/IB
  - Third party
- Who provides support and on what level?
  - Saxo?
  - Provider?
  - Client owner?

Granular access/rights matrix (User class x App x Exchange)

Complexity (accidental?)
Administration overhead
Configuration overhead
Lessons learned – technical side

- Streaming and delta updates has costed a lot (up to 1/3 of the total resource spend in framework)
  - Complex recovery/disconnect/reset/reconnect scenarios
- Throtthling and business protection needed on endpoints
  - Apis get abused/missunderstood and misused both by accident and by intent
- Session state is your friend???
  - Necessary for effective throtthling
  - User/session specific caching
  - Handling state in underlying systems
  - Managing/controlling subscriptions
  - Avoid IO/cross process jumps utilize speed of RAM

- Security
  - On one hand more open available for “hackers”
  - On the other hand more a top priority
  - Built on open standards/frameworks endorsed by (Eg the OppenBank.org and The Open Banking Standard)
  - Boundaries pushed by giants like facebook and google, (that have more surveillance features detection of suspicious activity and maybe dont carry financial data etc)
In Conclusion...on apis

- Financial institutions have always used API’s.
- While HTTP/REST/JSON (+WebSockets) is “the new Black”, FIX and POF (Plain Old Files) will be around for a long time.
- API’s will benefit both your IT development and Business development. Make sure to formulate a charter which appeal to both.
- Latency and throughput requirements have guided us to a non-standard implementation, but you may not need this level of complexity.
- API security is always a challenge, especially for a Bank, but SAML and OAUTH 2.0 are adequate solutions.
- A successful API project requires good people but also the right organizational structure.

Check out
http://institutional.saxobank.com/api-trading/open-api/
Providing *open, standardized* and *secure* access to *all processes, functions* and data across the value chain to provide deep *integration ability* and flexibility at all levels through open interfaces and access points.

- All solutions in an open first mindset
- Dogfooding – we use our own integration points and APIs
- We make our API and end points accessible externally
Questions

E-mail: man@saxobank.com
Twitter: @michelandre71

And check out the developer portal:
https://developer.saxobank.com/sim/openapi/portal