Optimising Exchange and Client Connectivity

An Organisational Challenge
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Executive Summary

Connectivity is critical to all firms operating in the capital markets. It underpins many of the basic functions that they perform – from trading and investing, through to risk management and trade processing. Yet for such a crucial function, it is surprising that most firms do not have dedicated teams focused on managing and supporting connectivity.

Part of the challenge lies in simply understanding all of the interconnected components required to support this critical business function. To aid in that process, Citihub has defined a ‘connectivity stack’ that includes all of the functional, commercial, logical and physical aspects of connectivity.

The connectivity stack spans everything from business-focused requirements at the top, down to the tangible infrastructure used to carry electronic messages on the wire at the bottom. In between are various commercial, technical and logical aspects of connectivity – including management of entitlements, data distribution technologies (or middleware), gateways, sessions, APIs, protocols and logical services such as extranets and virtual private networks (VPNs).

Connectivity is critical to all firms operating in the capital markets. Citihub has defined a ‘connectivity stack’ that includes all of the functional, commercial, logical and physical aspects of connectivity.

Because of this diversity, managing connectivity requires a mix of operational, technical, commercial and compliance know-how. It requires co-ordination between teams focused on managing business applications, market data, distribution technologies, gateway interfaces, and core infrastructure (including networks and hosting). As a result, most firms manage connectivity services with a relatively fragmented organisational model.

The problem with fragmented organisational structures is that they make it harder to manage the full lifecycle of connectivity.

That makes strategic initiatives more difficult to mobilise, given the variety of stakeholders involved. Even relatively minor deliverables – such as new client and venue on-boarding or incident and problem management – can be complicated by having to navigate and coordinate resources across multiple teams. Finally, cost transparency and inventory management are more difficult to achieve. As a result, most firms will naturally accumulate unused circuits and logical sessions, resulting in unnecessary costs. From an operational perspective, having the right tooling in place and establishing centres of excellence can certainly help to shed light on inefficient practices.

From a business technology point of view, the challenge is establishing a connectivity architecture that offers required levels of performance and resilience, as well as meeting all functional capabilities.

In addition, a mix of tactical and longer term strategic projects may also be required. Tactical projects – such as identifying and cancelling unused services or benchmarking and renegotiating contracts with service providers – can generate significant cost savings. Longer term, initiatives like rationalising co-location and core infrastructure, consolidating connectivity to clients and venues, and making changes to organisational structure will also have a lasting impact.

From a business technology point of view, the challenge is establishing a connectivity architecture that offers required levels of performance (both in latency and throughput) and resilience (built-in failover capabilities), as well as meeting all functional capabilities (support for relevant protocols, APIs, etc.). From a commercial perspective, the challenge is meeting all of those requirements by the most cost effective means possible, eliminating any redundancies other than those that are specifically designed to enhance resilience.
Highlights

• The ‘connectivity stack’ is made up of functional, commercial, logical and physical characteristics, including business roles and functions, management of entitlements and permissions, distribution technologies, gateways, sessions, APIs, protocols, as well as logical and physical network connections.

• Management of connectivity at most financial institutions tends to be fragmented across asset class business silos and IT functions – with application owners, market data, network and infrastructure teams each owning unique pieces of the stack.

• This level of fragmentation typically results in significant inefficiencies, as a lack of transparency and ownership over costs can lead to unused connections, overlapping services and inefficient utilisation of resources.

• Having the right tooling in place and maintaining virtual teams to promote knowledge sharing across an organisation can help address some of the difficulties associated with a fragmented organisational model.

• Even so, there are typically plenty of measures that firms can take to further optimise their connectivity architecture and operations. These include both short term tactical projects such as cost benchmarking and connectivity rationalisation, as well as longer term initiatives such as re-architecture of co-location and core infrastructure, consolidating client and venue connectivity or organisational changes.
Introduction

Connectivity underpins all aspects of electronic trading. At every stage in the workflow – from the point orders are originated on the buy-side, routed through sell-side counterparts, posted or matched on execution venues and processed via clearing and settlement service providers – there are challenges around facilitating electronic message flows.

Yet the organisational structures that most global financial institutions place around this fundamental function are often fragmented, not only across asset class business silos, but also in the underlying IT operations supporting those businesses – with application owners, market data and network teams each owning unique pieces of the connectivity stack.

Fragmented ownership can result in inefficiencies by contributing to a lack of cost transparency and poor inventory management. Disparate technology teams are more likely to respond to requests for new connectivity from the business, without a full understanding of existing enterprise assets that could be used to service those requests.

Citihub has worked with many Tier-1 financial institutions, helping them optimise trading and client connectivity and drive operational efficiencies. During those engagements, our consultants have typically encountered a number of common themes. These include:

- Poor cost transparency leading to inadequate understanding of all cost components for market and client connectivity
- Underutilised and in some cases completely unused circuits
- Proliferation of logical venue connectivity sessions
- Fragmented information and organisational structure to manage connectivity

These inefficiencies can easily be overlooked in buoyant markets. However, with continued focus on trading costs stemming from both macroeconomic and structural factors, financial services institutions have been pushed to find a better balance between the cost and performance of their trading infrastructure.

As this paper demonstrates, financial institutions can optimise their market and client connectivity in a number of ways. The lowest hanging fruit are found simply by identifying unutilised or underutilised circuits, which can be cancelled or rationalised for quick wins. Looking longer term, strategic projects to re-architect core infrastructure or change org structures can leave a more lasting impact on the bottom line, but take longer to realise.
Managing connectivity requires a range of skill sets – including operational, technical and commercial discipline. In order to better understand the challenges involved, CitiHub has defined a ‘connectivity stack’ that outlines the key functional, commercial, logical and physical aspects of connectivity – whether to clients, markets or other parties (service providers, CCPs, regulatory reporting repositories etc.) – all of which contribute towards total cost of ownership (TCO) in supporting this function.

At the top of the stack are business-focused connectivity requirements, either to support specific roles (trading, risk management, back office processing, software development, compliance etc.) or organisational functions (by asset class, transaction type or geography). At the bottom is the tangible infrastructure that supports connectivity – the physical circuits or local datacentre cross-connects. In between are various commercial, technical and logical aspects of connectivity – including management of entitlements, data distribution technologies (or middleware), gateways, sessions, APIs and protocols, and logical service providers such as Extranets, which leverage a single physical connection to establish connectivity with many logical end points.

**Figure 1: A visual representation of the connectivity stack**

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**Examining the Connectivity Stack**

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**Business Role**

Different roles have different requirements when it comes to connectivity. In that respect, trading roles have the most exigent requirements, needing access to client flow, full depth of market data from relevant venues, support for a full range of order-types and connectivity with venue gateways. Other roles, such as risk managers may potentially need access to aggregated positions and flows broken down by trader, desk and/or clients (alongside historical tick data for analytics), while back office personnel typically have the simplest connectivity requirements.

**Distribution**

The distribution layer serves to communicate between applications that require connectivity (such as order / execution management systems or smart order routers), and the gateways that those applications need to connect with. Having a common distribution architecture can help facilitate cross-asset aggregation of flows, which is becoming increasingly relevant from the perspective regulatory compliance.

**Gateway**

The gateway layer includes the cost of software connectors used to establish sessions with external parties (such as trading venues). Gateways translate from internal formats to external protocols, and may be provided by independent software vendors (ISVs) or developed internally – both of which incur costs.

**Business Function**

Business function can be influenced both by the nature of the instrument and the type of business supported. Different asset classes support different market structures and models. More liquid instruments like equities may require ultra-low latency access to lit order books, complemented by dark pool crossing networks. In other less liquid markets, like fixed income, request-for-quote and indication-of-interest connectivity would be more appropriate. Similarly, the nature of the business will also impact connectivity requirements, with different trading strategies being more or less sensitive to latency.

**Session**

Sessions cover all point-to-point gateway connections to external venues, including associated port charges when running across one or more logical connections. Individual connection sessions can be associated with different phases in the software development lifecycle, including development, UAT and production gateways. Although individual session charges are relatively small, they can mount up across an enterprise and provide opportunities for optimisation.

**Entitlements & Permissioning**

Managing user accesses and permissions is a complex exercise, particularly when it comes to market data entitlements. Given the significant cost of market data, expertise in this area is often concentrated within market data commercial teams that are adept at keeping spend under control by profiling user requirements, identifying unused accesses, and taking advantage of on-demand entitlement capabilities.

**API / Protocol**

There can often be a diverse range of APIs and protocols to support trading connectivity. Although the trend towards adoption of standards continues, with increased use of the FIX, OUCH andITCH protocols by many exchanges, there are still many native exchange and proprietary internal protocols that need to be managed, with associated costs in maintaining appropriate skill sets.
Logical Service

Some physical connections, such as those provided by Internet and Extranet Service Providers, can be split into multiple logical point-to-point connections. Each of those point-to-point connections incur costs, and depending on the service provider, there can be less transparency into whether those MPLS and/or VPN connections are being utilised – causing challenges when it comes to identifying unused or underutilised circuits.

Physical

The physical layer includes the tangible infrastructure used to support connectivity, either in the form of data centre cross connects or leased line connectivity, both for point-to-point connections and to logical connectivity service providers.
Most organisations support a relatively complex mesh of connectivity that has evolved organically in response to business requirements – new venues launched, new clients on-boarded, new applications supported, or existing venues launching new gateway interfaces – and further complicated by inorganic growth through mergers and acquisitions.

Whenever ‘new’ connectivity requests come in from the business, they are normally treated with relative urgency, but whether existing resources are in place that could satisfy those requirements may often be overlooked. Equally, decommissioning legacy connections can be a slow process, resulting in a mix of overlapping or redundant APIs, gateways, logical services and physical connections being used to support connectivity to the same end points – be they markets, clients or service providers.

Part of the reason that organisations have evolved in this way is that the ownership of the connectivity function tends to be fragmented – with responsibilities shared by application, market data and infrastructure teams, across asset classes and between production and development functions.

Although every firm is unique and has its own set of challenges to overcome, this chapter provides some visual representations of typical organisational structures that Citihub has encountered as part of our engagements to optimise exchange and client connectivity services. These help to highlight some of the differing challenges that firms face in managing connectivity.

**Organisational Challenges**

**Organisation A**

Organisation A is representative of firms that have already looked to consolidate parts of their connectivity operations. In addition to maintaining a centralised compliance function for managing entitlements and a core enterprise transport infrastructure across asset classes, the remaining aspects of the connectivity stack are also organised centrally, with one team managing non co-located exchange access (servicing the majority of a firm’s requirements) and another team supporting the most latency sensitive functions that require exchange co-location (such as market making, statistical arbitrage and some prime services).

**ADVANTAGES**
- Better cost transparency
- Common enterprise transport provides better visibility into cross-asset flows
- Centralised compliance function to keep track on enterprise data spend
- Central x-asset excon team can respond more quickly to large-scale initiatives

**DISADVANTAGES**
- Potential for central teams to focus on the most demanding business areas (e.g. equities)
- Smaller change requirements and niche asset classes slip to back of queue
Organisation B

Organisation B represents firms that are more fragmented in their organisational structure. Typically, these firms have not undergone a major change project to consolidate aspects of their IT estate across asset classes. Although they may have a single network team looking after physical and logical connectivity services (leased lines, extranet, VPNs etc.), the rest of the stack will be distributed across multiple application, platform and market data teams. These types of organisations are likely to support a greater number of protocols, gateways and distribution platforms. Their decentralised governance structure can empower business lines to make their own procurement decisions, but makes strategic cross-asset initiatives more difficult to manage, and also provides less transparency across the enterprise, making it harder to maintain an accurate inventory of IT assets and obscuring costs.

| Multiple Business Units each owning these areas through entitlements |
| Multiple middleware and distribution mechanism |
| Multiple current and legacy gateways |
| Session ownership fragmented |
| Protocol "ownership" distributed |

**ADVANTAGES**

- Business-aligned IT functions may help expedite tactical projects
- Greater freedom to choose specialised vendor systems for each asset class

**DISADVANTAGES**

- Fragmented org leads to poor cost transparency
- Difficult to co-ordinate enterprise resources for strategic initiatives
- X-asset view of flows requires significant tooling
- Difficulty managing multiple legacy and current gateways
Organisation C

Organisation C represents firms that are somewhere in between A and B. They have made some effort to consolidate aspects of their IT organisation – for example, within some business silos they have undergone projects to rationalise their application landscape. However, other than their network team, which in this case has taken on added responsibility for supporting market data infrastructure, they have not undergone any significant cross-asset consolidation of IT operations. They therefore support multiple protocols, gateways and distribution platforms, particularly within asset classes where no effort has been made to rationalise these assets. As with Organisation B, the structure of the organisation would naturally provide less transparency into enterprise IT assets and their associated costs, unless efforts are made to develop the right tooling that can consolidate the required information.

ADVANTAGES
- Business-aligned teams with varying degrees of success in rationalising landscape
- Network services team owns aspect of market data distribution to share competencies

DISADVANTAGES
- Organisation is still fragmented resulting in poor cost transparency
- Some asset classes still support multiple legacy and current gateways
- X-asset view of flows requires significant tooling
Is there an Ideal Operating Model for Connectivity Services?

Looking at the different organisational structures for managing connectivity services, it may be tempting to determine which is optimal. In other words, is there an operating model that all firms should strive for, and if so, what is it?

In our view, there are certainly significant benefits in managing connectivity via a unified team with the right blend of commercial and technical skills. Such a model provides greater clarity into firms’ existing IT inventory across business silos, and by proxy, better cost transparency. Equally, centralised ownership makes it easier to co-ordinate the various moving parts required to mobilise strategic projects. The key drawback to this model is that a centralised management structure has greater potential to prioritise resources towards larger projects, thus relegateing smaller tactical projects (which may still be significant from the perspective of a specific business unit) to the back of the queue. Equally, centralised org structures can be more prone to inertia, particularly when it comes to new technologies or approaches in how best to manage those technologies.

By contrast, a more decentralised, or fragmented model, may be better suited to serving the interests of individual business silos, with greater flexibility to prioritise resources and make procurement decisions to suit each asset class. However, such a model would tend to make large strategic initiatives, which require co-ordination at an enterprise level, more difficult to execute. Equally, this type of structure would typically provide less clarity into enterprise IT assets, and make cost transparency at an enterprise level more difficult to attain. That said, from the perspective of each business silo, decentralised org structures can promote better cost transparency, as services get billed directly rather than through central allocations or via a chargeback model.

Citihub is of the opinion that an optimal operating model would be more akin to Organisation A in the previous chapter. However, we would not advise that Organisations B and C should necessarily strive to look like Organisation A. Doing so would involve a significant IT change project that may prove so costly that it would more than negate its benefits. Instead, Organisations B and C could mirror the benefits of Organisation A’s operating model by having the right tooling in place, and maintaining virtual teams – or centres of excellence – that promote knowledge sharing across the organisation.
**Tooling**

As noted in the previous chapter, the unique challenges arising from a fragmented approach to managing connectivity can be overcome in more than one way. In particular, having the right tooling can help achieve desired levels of transparency into enterprise IT assets, as well as business and commercial metrics.

Over the years, Citihub has been engaged in a number of projects to improve transparency into our customers’ connectivity operations. Invariably, those projects have involved development of tooling to support the aggregation and reporting of data relating to various aspects of connectivity – from utilisation statistics through to commercial benchmarking.

**Business Reporting and CIO Dashboards**

Business reporting systems are a vital tool in managing spend, as well as helping to identify and capture cost saving opportunities. Such systems should provide regular and detailed visibility into enterprise IT costs, with views that are tailored to the user in question – business heads and IT managers alike. Business managers should be provided with clearer insights into centrally managed resources (such as networks and infrastructure), with utilisation and performance statistics to determine whether value is being derived from a particular set of services, along with chargeback models that incentivise the right kind of behaviour. Equally, IT managers should be given access to consolidated views of fragmented operations, helping to benchmark cross-divisional spend, promote procurement best practices and highlight opportunities where existing resources can be used to service new business requirements.

**Data Capture and Scripting**

Reporting tools help users to visually analyse data. But simply getting hold of all relevant data can be a challenge in itself. Decentralised organisations often have pertinent data stored in different formats across a variety of different systems. Aggregating that content will often require developing a full library of data models and scripting tools to efficiently extract, store, process and analyse information relevant to different layers of the connectivity stack.

**Commercial Data and Benchmarking**

In addition to maintaining transparency into their own connectivity operations, firms also look to benchmark their operations against their peers. Doing so tends to require the help of a third party with relevant experience. Efficiency programs will typically require a large amount of benchmark data, including commercial models and price lists for exchange and vendor services, along with high level peer spending comparisons.
Optimising Exchange and Client Connectivity: An Organisational Challenge

Identifying and Prioritising Cost Efficiencies

Given the complex nature of managing connectivity, and the difficulty that most firms face in finding the right target operating model to support this function, there are typically a wide range of opportunities to realise cost savings.

Operating Model

Changing a firm’s operating model is a highly complex exercise and requires time. Typically, moving from a decentralised or fragmented model to a more consolidated governance structure will also involve an underlying technology change project, in an effort to retire legacy systems and rationalise onto fewer strategic solutions that service multiple roles and functions across the enterprise.

Benchmark and Negotiate Cost of Existing Connectivity

Perhaps one of the simplest and least time-consuming ways to save costs lies in renegotiating existing contracts. Given broad decreases in the cost of bandwidth over the last decades resulting from increased competition and supply, long term contracts that are due to expire can potentially yield significant savings when they are up for renewal. However, capitalising on those opportunities requires a thorough evaluation of the vendor landscape and peer benchmarking analysis. We would recommend analysis to identify and cease unused connections to be carried out before renegotiation begins, given that signing a new contract typically results in services being locked in for at least the first year.

Cease Unused Trading Sessions / Ports

New trading sessions and ports can often be opened to support a variety of trading applications and users, including firm’s own traders as well as direct market access services on behalf of clients. The more complex the business mix, the more challenging the housekeeping effort to ensure all unused sessions and ports are identified and cancelled.

Cease Unused Client Connections

Sell-side firms connect with their clients using many different electronic channels, including leased line point-to-point connections, financial extranet services, VPNs, through to FIX order routing networks supported by specialist vendors such as Fidessa, Sungard, Orc, Ulink etc. It is very common for the same institution to deploy many of these options to support connectivity with its larger customers.

Identify Unused / Redundant Connections

There are many reasons why connections become redundant. Firms migrate onto new trading platforms, change business focus or clients of prime services may change their preferred brokers. However, those events are often poorly communicated between business execs and IT operations so redundant connections are not cancelled immediately or are not cancelled end-to-end. Simply identifying which connections are redundant is a huge step in being able to achieve cost savings.

Doing so effectively requires network traffic analysis. This is easier with leased line connections, but requires support from service providers when analysing logical extranet and VPN connections.

Regular Remodelling and Negotiation of Inventory

Benchmarking and negotiating the cost of existing connectivity can yield significant savings on a one-off basis, but doing so on a regular basis can also be a quick and effective way of promoting sound sourcing practices and ensuring unnecessary costs do not mount up.

Consolidate Connectivity for Lower Tier Venues

Some lower tier venues, which do not have exigent performance requirements and are not core to the business, may be adequately serviced via a financial extranet provider.
or VPN connection rather than a leased line. Being able to consolidate connectivity to multiple venues via a logical service provider can yield savings, although such projects are not simple to execute and require thorough planning to ensure the migration can be undertaken without any significant degradation of service quality or impact on availability.

**Rationalise Co-location and Core Infrastructure**

Rationalising co-location and core infrastructure can potentially yield large savings given the high costs involved, both due to the premium rates commanded by exchange co-location cabinets and cross-connects, and the significant costs that result from running parallel connectivity operations for high performance trading operations and other less latency sensitive requirements. However, such projects are inherently complex and will involve significant re-architecture, particularly when looking to rationalise latency sensitive and non-latency sensitive operations. Issues such as the creation of demilitarised zones, given that latency imposed by firewalls typically needs to be removed for high performance trading strategies, will require careful consideration.

**Merge Client Connections Across Regions and Asset Classes**

Merging client connections can yield significant savings. However, it requires a lot of groundwork up front to establish an inventory of connections for each client, along with relevant utilisation statistics. That data can then be used to support client conversations to ensure full cooperation in the process. For large clients that connect using multiple channels the goal would be to rationalise onto a primary and back-up set of connections that can carry consolidated order flows across asset classes.

**Cease Unprofitable Client Connections**

Ceasing connectivity with a client is typically only a last resort. Certain clients may be deemed unprofitable when their trading activity is measured over a certain period of time, only for a few large orders to suddenly change the equation. Decisions to cease connectivity entirely should therefore take into account analysis of trading patterns over a long period and projections of whether that business could experience an uptick given the right circumstances.
Conclusion

Managing connectivity requires a mix of operational, technical, commercial and compliance know-how. From an organisational perspective, it requires co-ordination between teams focused on managing business applications, market data, distribution technologies, gateway interfaces, and core infrastructure (including networks and hosting).

Because of the breadth of skill sets and personnel involved, most firms are likely to support the function of connectivity with a fragmented organisational model. The problem with a fragmented organisational structure is that it makes cost transparency and inventory management harder to achieve.

However, establishing a single team responsible for all enterprise connectivity is not always realistic, although that is not to say the benefits of a more joined up approach are out of reach. Through the right tooling, and by promoting cross-team collaboration, firms may be able to yield the benefits of shared ownership, without significant reorganisation.

Moreover, targeted projects can help to ensure good housekeeping by identifying significant opportunities to save costs. Even the best-run organisations stand to reap efficiencies, as the vendor landscape continues to evolve and changing business profiles require periodic re-evaluation of IT assets.
About Citihub Consulting

Citihub Consulting is a global, independent IT advisory firm with deep domain expertise across every layer of the technology stack – from business applications and data platforms down to core infrastructure. From IT strategy, architecture and solution development, through to cost optimisation, risk assessment and implementation – our trusted experts deliver the right results for your business.

For us consultancy is personal. We have a relentless commitment to great execution, integrity and client success. We aim to redefine perceptions of our industry and our commitment to delivering the right results for our clients has never changed, even as the business has grown consistently over the last decades.

2014/15 clients include 7 of the top 10 investment banks and 2 of the top 5 hedge funds.

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