

Bloomberg Trade EMS

Overview



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Solutions Overview

High-Level Stack

Layer 3	Bloomberg Trade EMS (TEMS) Solutions	Order Execution & Client Trading
Layer 2	The Toc	Application Aggregation Platform & Workflow Engine
Layer 1	Greyspan	Co-Location, Hosting & Connectivity Solutions

The Toc

Application Aggregation Platform &
Workflow Engine

The Toc - Optimize Workflows Across Applications

Bloomberg Trade EMS (TEMS) is built on the Toc — a technology that has driven scalable, high-performance distributed computing and open data access for over 20 years. The Toc powers advanced trading systems for the world's largest financial institutions by enabling seamless interoperability among valuable tools — regardless of whether they are proprietary, third-party, or our own.

The Toc's open and rich data-centric architecture enables clients to integrate various sources of data and external/internal technologies. With the Toc, clients can develop multiple mission-critical applications leveraging their trading systems and integrate them seamlessly in real time. The Toc does the heavy lifting, enabling users to focus on high-ROI innovation.

- Interoperability between applications unlocks data in a way that fuels workflows and profitability.
- Flexible technology, code and APIs drive innovation during the next phase of market structure evolution.
- Gives institutions the flexibility to shape their own workflows and business rules, on top of a network of interconnected products and solutions.

Key Features & Benefits

Seamless Integration Through a Uniform API

- Buy and build – integrate any data and technologies together, regardless of origin
- Fastest way to run applications anywhere via local networking, with automatic discovery of optimal low-latency communication routes

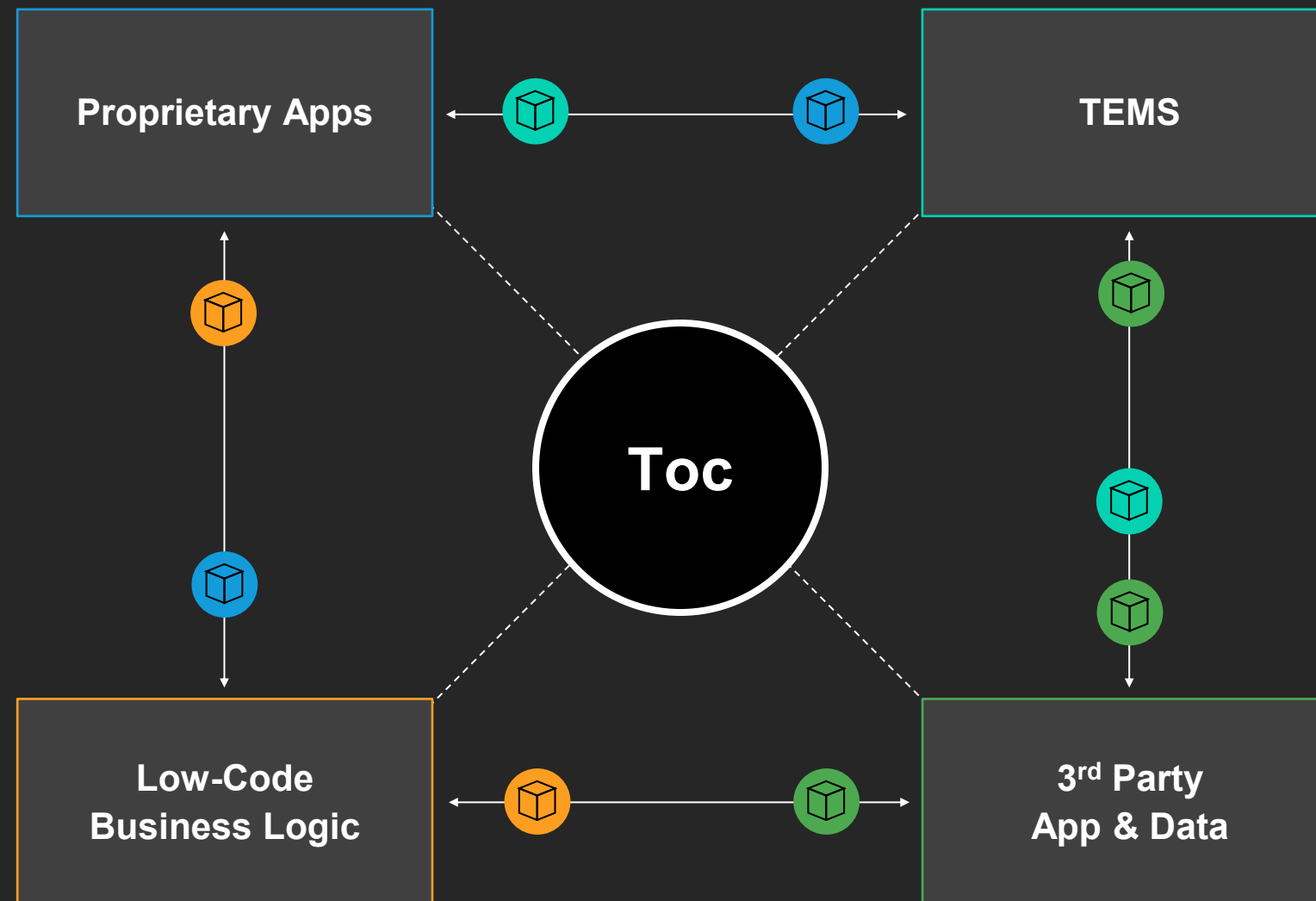
Data Normalized & Accessible Globally

- Descriptive and flexible data model incorporating fundamental object-oriented concepts
- High-performance caching, persistence, synchronization, and event processing

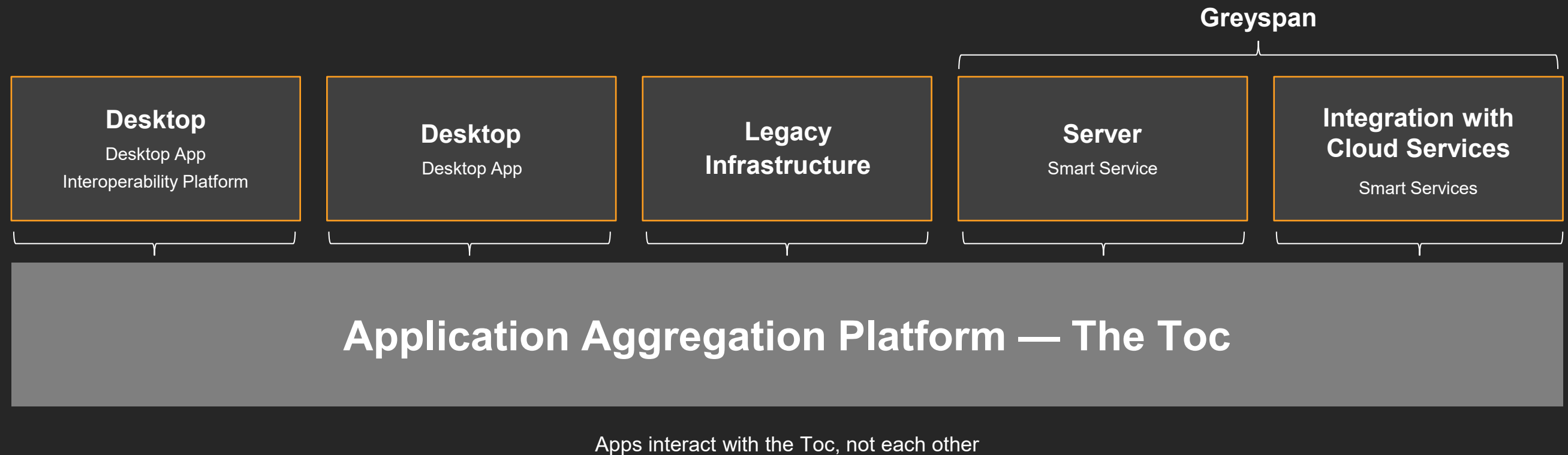
Workflows Designed for Innovation and Evolution

- Combine automated and human processes through modular data-oriented interfaces

Universal Interoperability



Application Aggregation



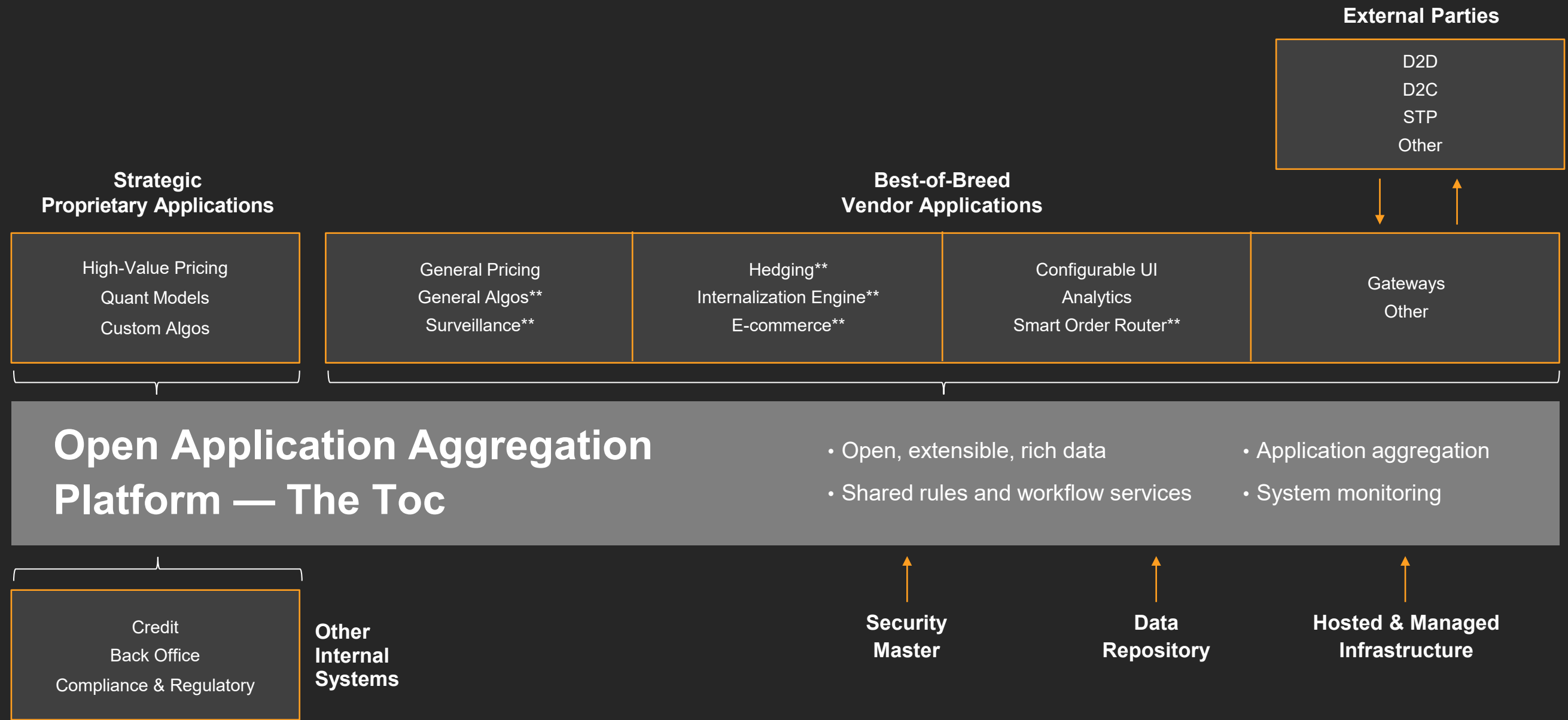
Toc for Application Aggregation

Data-Oriented Architecture

Provides normalized and structured data objects, relationships, and workflows for aggregated applications

Apps	Toc	Data
Produce & Interact with Data	Modular Design	Universal Access
“Applications are their data”	Configurable Workflow & Rules	Rich Modeling of Real-World Relationships

Optimal Dealer Solution



Bloomberg Trade EMS (TEMS)

Execution, Pricing,
Settlement & More

Bloomberg Trade EMS (TEMS) Overview

Bloomberg Trade EMS (TEMS) is a complete, single-vendor, enterprise-class electronic trading infrastructure that meets both the stringent performance standards of automated trading and the functional requirements of global dealing. Its components are successfully and profitably used for both automated and manual trading at top-tier global banks and hedge funds.

TEMS a collection of best-of-breed trading components built on the Toc, our middleware for building tightly integrated, low-latency trading systems. This model eliminates age-old buy-or-build questions – clients can collaborate with us to create a proprietary trading environment that fuels robust out-of-the-box functionality.



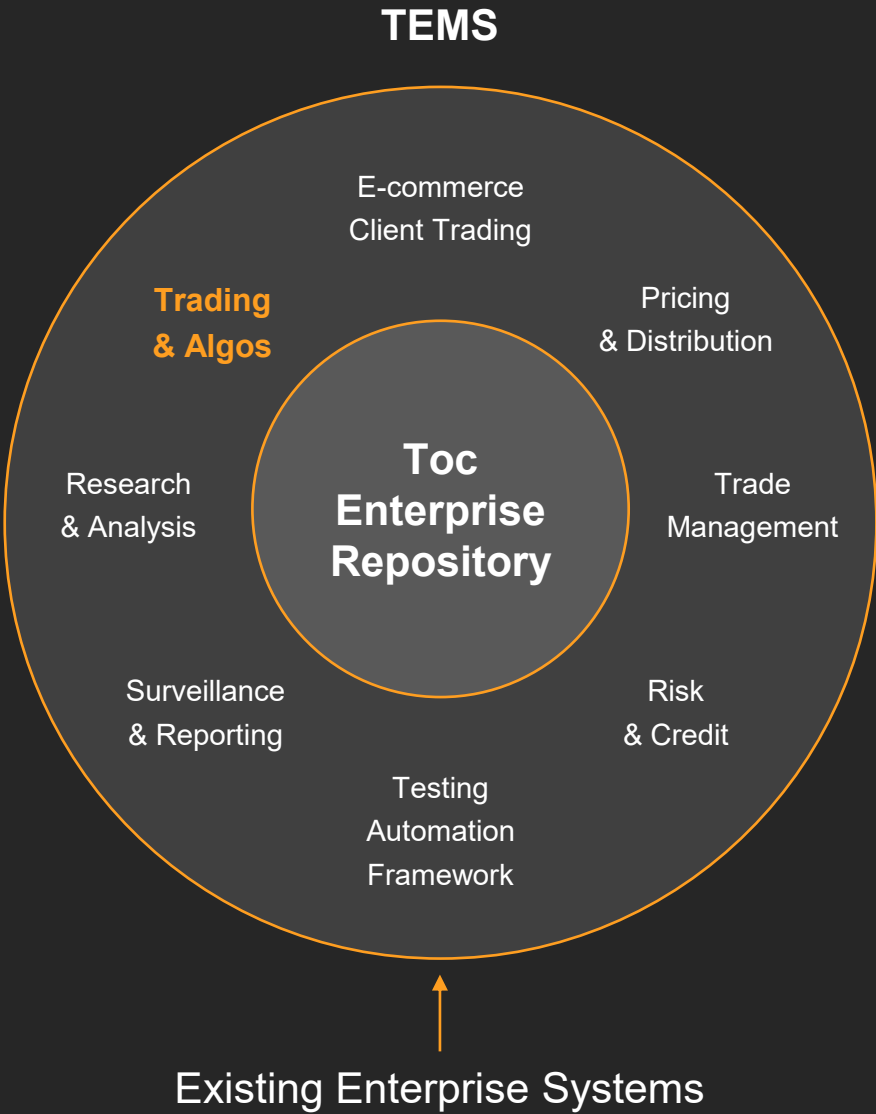
Order Execution – Trading & Algos

Market connectivity:	Connectivity to markets, venues, and liquidity providers ensures price discovery (order books, banded price streams, auction and linker platforms, high-performance feeds, market making)
Liquidity aggregation:	Consolidated market data and pricing from multiple sources, captured in real time (traded and non-traded pricing), auditable, and available for use in TCA and best execution
Dynamic smart order routing:	Configurable market watching rules, rebalancing, prioritization, arrival time, liquidity grouping, full-size only, dynamic replacement, and advanced algos to optimally work orders over time across all liquidity
Configurable execution algorithms:	Composable algos assembled via rules, including limit, IOC, iceberg/sniper, stop-loss, TWAP with randomization, pegged, pay-up, and rules-based triggers and signal automation
Custom algorithms:	Framework and API for writing complex custom algorithms, powered by the Toc and TEMS Securities Suite
Bulk order manager:	Ability to efficiently handle large numbers of orders, particularly designed for daily Repo funding and inventory management
Internal matching engine:	Internal pools for inter-desk matching or internalization



Order Execution – Trading & Algos

Spreader:	Cutting-edge spreading tool to create custom spread strategies with bonds, futures, basis, and interest rate swaps, designed specifically for relative value trading and hedging. Supports n-legged price and yield spreads, with highly flexible execution parameterization, including automated pay-up / miss-handling features
Duration Trader:	Trading sophisticated duration baskets to hedge large blocks with minimal market impact
Synthetic Futures Fungibility:	Advanced workflow to generate synthetic equivalence between ICE and CurveGlobal futures contracts, increasing liquidity on CG and reducing execution fees



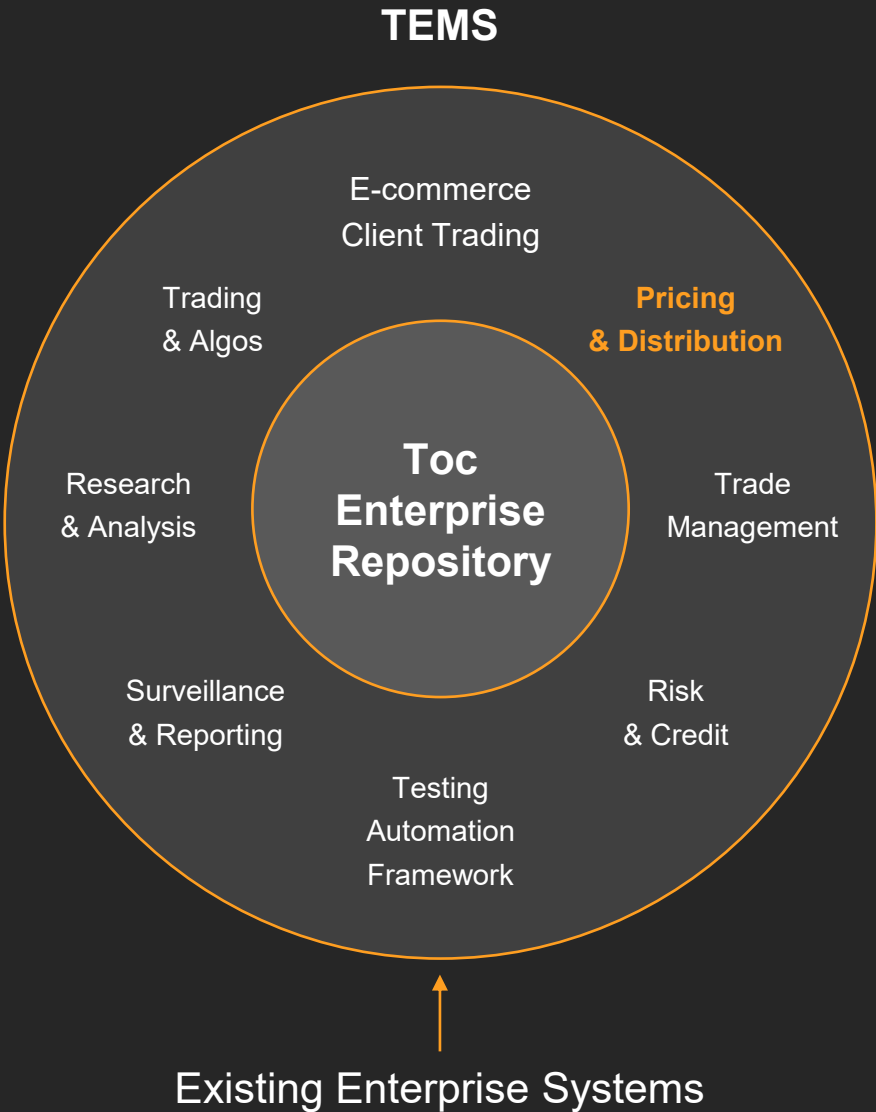
E-commerce – Client Trading & Negotiation

Market connectivity:	Low-latency market gateways to D2C venues
Real-time dynamic rules engine:	Decision-making and workflow direction via characteristics of request, customer, signal and market, inventory, time of day, region, activity, protection (e.g. hit rate and liquidity debiting), credit, and any other variables, all audited and timestamped
Workflow management:	Full range of intrafirm response and coverage workflows, including automated, manual, and hybrid involving different workflow stages (including heavily negotiated package or trade-at-close workflows, multi-desk and multi-trader coverage and pricing model interrogation)
Numerous quoting styles:	Request for quote, single-leg, market-standard, market leg (curves, butterflies, basis), package trading, multi-asset list trading, executable streaming price, last look, portfolio execution, fixing, request for market, trade at close, PIT/PAT, Hikene
Last look capabilities:	Rules-based and quote monitoring, 0-click and 1-click trading
Custom external gateway:	Direct client access or internal workflows from other applications (sales tools, other regions, etc.)
Risk hedging:	Rules-driven automated hedging for principal and agency trading, including aggregated hedging metrics (e.g. PV01 risk levels), multi-asset hedge execution (e.g. execute on futures when PV01 bond risk hits trigger levels), and trade hedger to unwind individual trade-by-trade risk (e.g. hedge risk of any trade above a specific size or DV01 threshold)



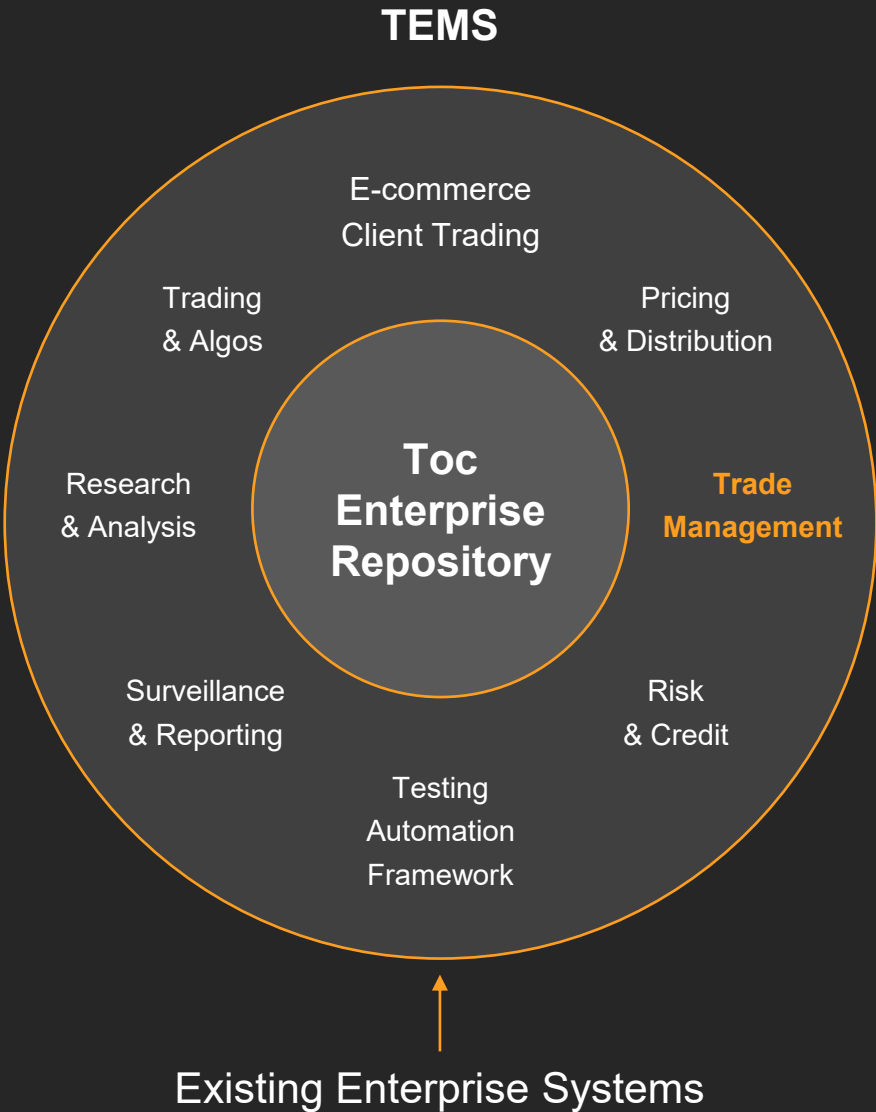
E-commerce – Pricing & Distribution

Market data:	Low-latency access to market data sources and valuable distribution channels
Matrix pricing engine:	Multiple benchmark, yield change on day, minimum spread, maximum spread, composite feed, and other pricing methodologies for cash bonds
Quant models:	Rich integration into proprietary and third-party quantitative curve or other models
Pricing-distribution connectivity:	Access to top D2C venues: Bloomberg, Tradeweb, MarketAxess, BondVision and more
Rules-based & internal price sharing:	Classification of clients into groups to demonstrate fair and equitable pricing for each
Rules-based distribution:	Rules-based routing of request handling (trade request, RFQ, lists) enabling automatic response, manual response, or routing to an independent API-based handler
Safety mechanism:	Automated price protection and checks



Trade Management

Global trade repository:	Ability to audit every event regarding orders, instructions, trades, decisions, transactions, and other events in the system with detailed timestamps and data relationships
Trade capture:	Stateful data captured and stored. Easy to access order, quote, trade, and transactions
Allocation management:	Pre-trade and post-trade allocation management
Collateral allocation:	GUI support for Repo GC allocation
Trade and risk transfer:	Transfer across legal entities and national boundaries (e.g. UK vs EU)
Straight-through processing (STP):	Rules for trade routing, enrichment, and validation
Real-time & rules-based trade reporting:	Reporting on real-time or delayed basis. Capture records of trade reporting
Back-office integration:	Full access via Toc integration



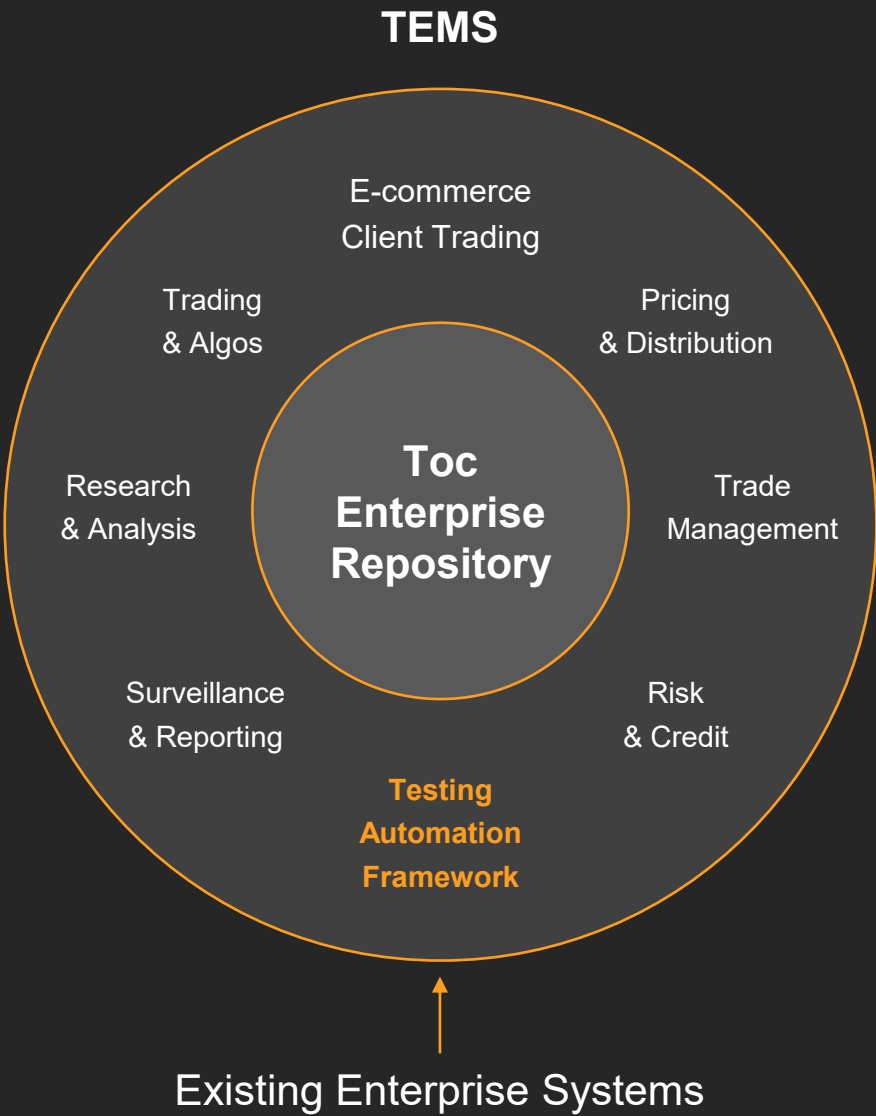
Risk & Counterparty Credit System

Risk engine:	Universal, customizable, powerful, real-time interest rate risk engine, including real-time monitoring and control of exposure, credit, and limits with optional off-setting
Position and P&L:	Real-time position and P&L calculation and monitoring, including realized and unrealized profits and losses, integration and synchronization with external booking, and inventory systems
Extensible risk checks & intervention:	Pre-trade, post-trade, portfolio, regulatory, fat-finger/price collar
Limits, intervention and halts:	Full control of outgoing orders based on complex configurable rules; limits and halts can be applied at many levels simultaneously, including trader, account, entity, counterparty
Counterparty credit system:	Monitoring of pre-trade counterparty credit and exposure in real time, with ability to route to external credit limit tools
Aggregable custom risk models:	Ability to use pre-built models (e.g. PV01, currency, NOP, margin, etc.), in-house, or external risk models



Testing Automation Framework

Quality Control Center:	Framework and set of tools for automating end-to-end testing in non-production environments
Web Interface:	Easy-to-use web interface is the home base of all environment testing
Customize New Testing Cases:	Tools that enable developers to easily write, verify, and publish new automated tests
Back-End Service:	Customizable test schedules to automatically run a selection of tests. Ad-hoc immediate execution of tests
Health Metrics:	Statistics to check current day's test performance (pass rate, remaining, scheduled). Visual breakdown of scheduled test results over a longer period

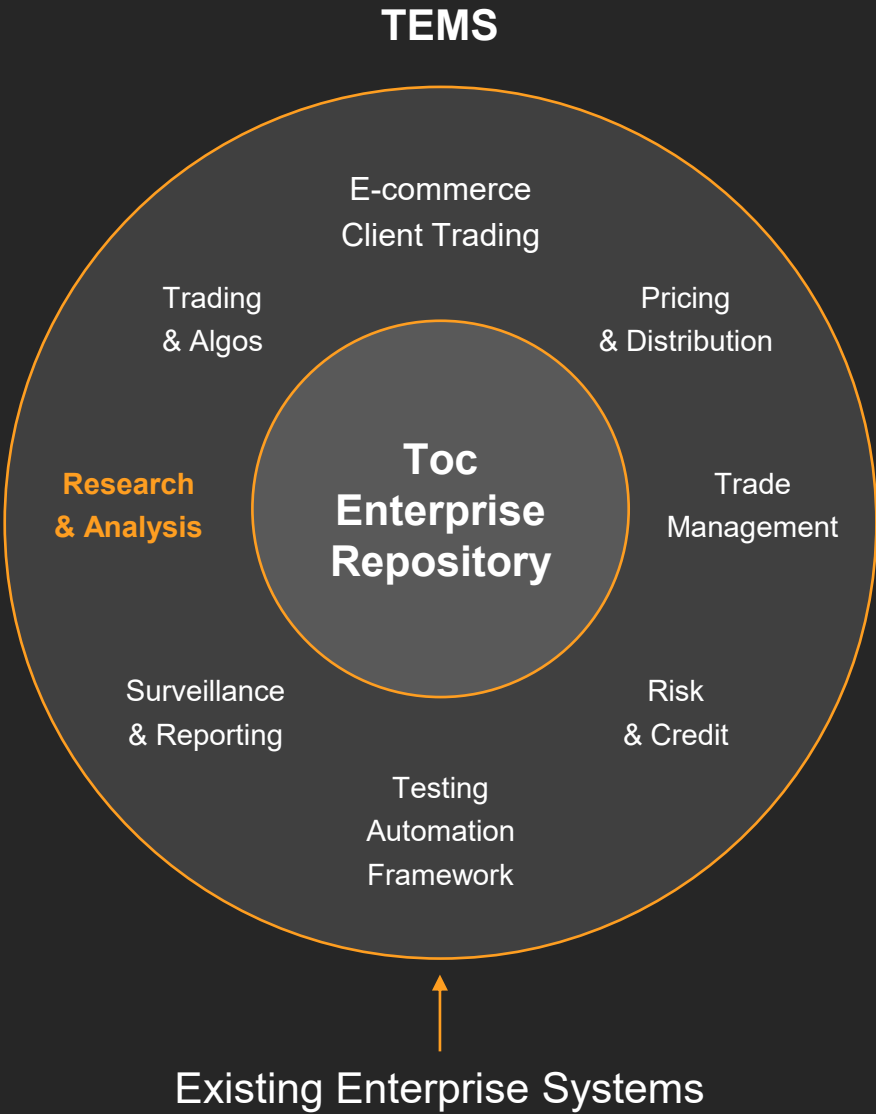


Surveillance & Reporting

Audited enterprise data repository:	Ability to audit every event regarding orders, instructions, trades, decisions, transactions, and other events in the system with detailed timestamps and data relationships
Reference data:	Repository and sourcing (EU trade data, ISIN, legal entity identifiers, taxonomy, instrument data). Rich data dictionary and taxonomies via Toc Typescape
Regulatory rules engine:	Compliance workflow embedded in the order execution and client trading tools to enforce compliance techniques or prevent unauthorized trades
Algo stress testing annual reports:	MiFID II algorithm trading reports as per RTS 6
Regulatory reporting:	Fully accessible database to complete transaction and trade reporting, reference data, and best execution
Regulatory generic:	Infrastructure applicable to any regulation: MIFID, SFTR, FRTB, Dodd-Frank, CCAR, etc.
Enterprise-wide surveillance:	Real-time and rules-based surveillance, including time-series and statistic-based types
Safety tools:	Integrated halts, kill switches, and tripwires
Active trade alerting and monitoring:	Real-time, on-demand global visibility, pop-up alerting, feed alerting



Kdb+ & OneTick:	Out-of-the-box integration
Order Expectation:	Detailed data capture for each order on expected vs actual fill at each component
Algo and Market Analysis:	Analysis of all algos, including those from third parties
Real-Time Visibility:	Every event on TEMS systems is captured in the Toc and can be accessed and viewed in real time by any analysis tool or dashboard
Custom Research:	Framework for writing quantitative analysis, powered by the Toc and TEMS Securities Suite



Greyspan

Learning &
Connections

Greyspan Offerings & Services

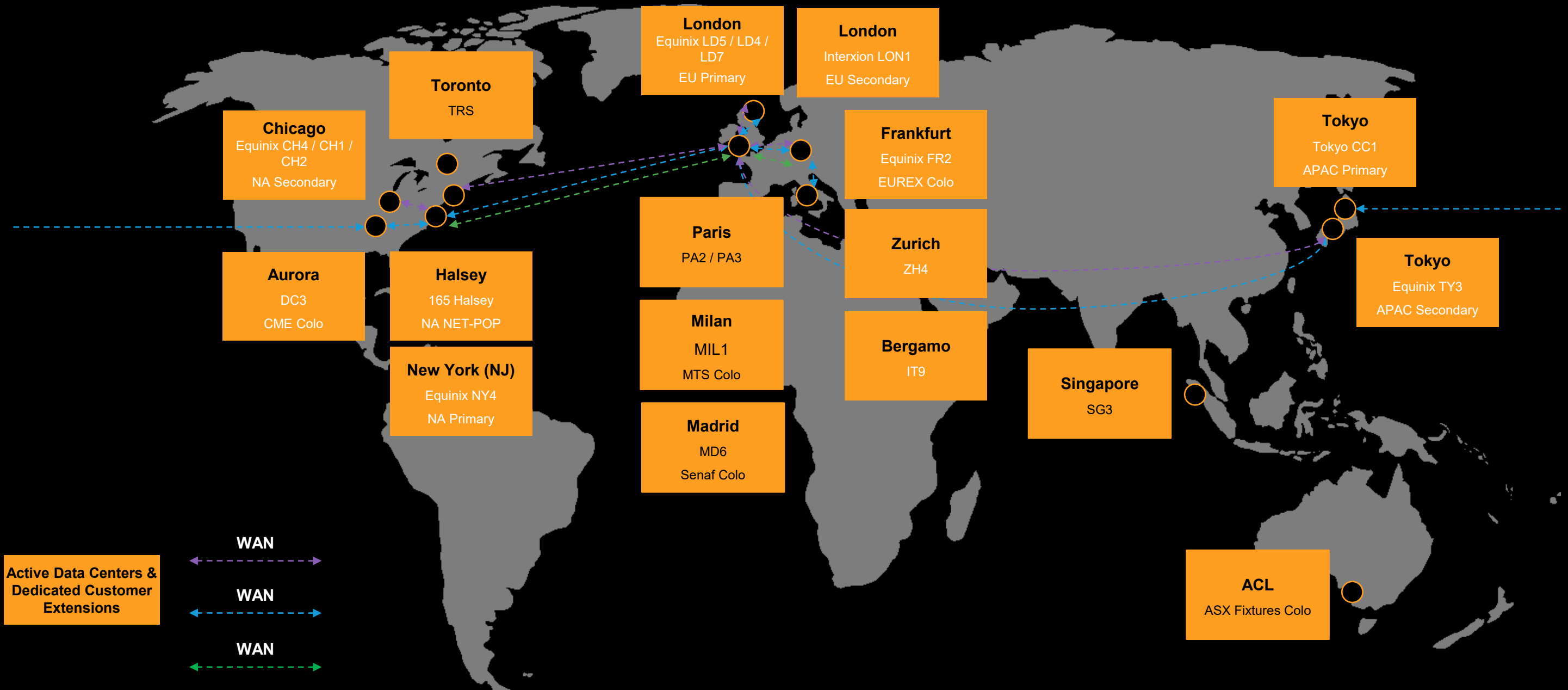
Global Colocation & Cloud Hosting

- Fully managed turnkey infrastructure solutions
- Physical, virtual, and connected to public cloud (AWS, Azure, GCP)
- Available for any software, not limited to Bloomberg's
- 16 colocation facilities in New York, Chicago, London, Frankfurt, Tokyo and others
- Active monitoring and maintenance by an expert team
- SOC 2 Type II certified

Global Liquidity Network

- 70+ fixed income destinations
- 50+ FX destinations (venues and LPs)
- New York, Chicago, London, Frankfurt, Bergamo, and Tokyo
- Low latency, high bandwidth WAN
- Redundancy on all connections
- POP facilitation
- PTP clock synchronization

Greyspan Data Centers



Greyspan Today

16+ Data Centers

750+ Servers

140+ Customers
Low-Latency Switched

1250+ Managed Devices

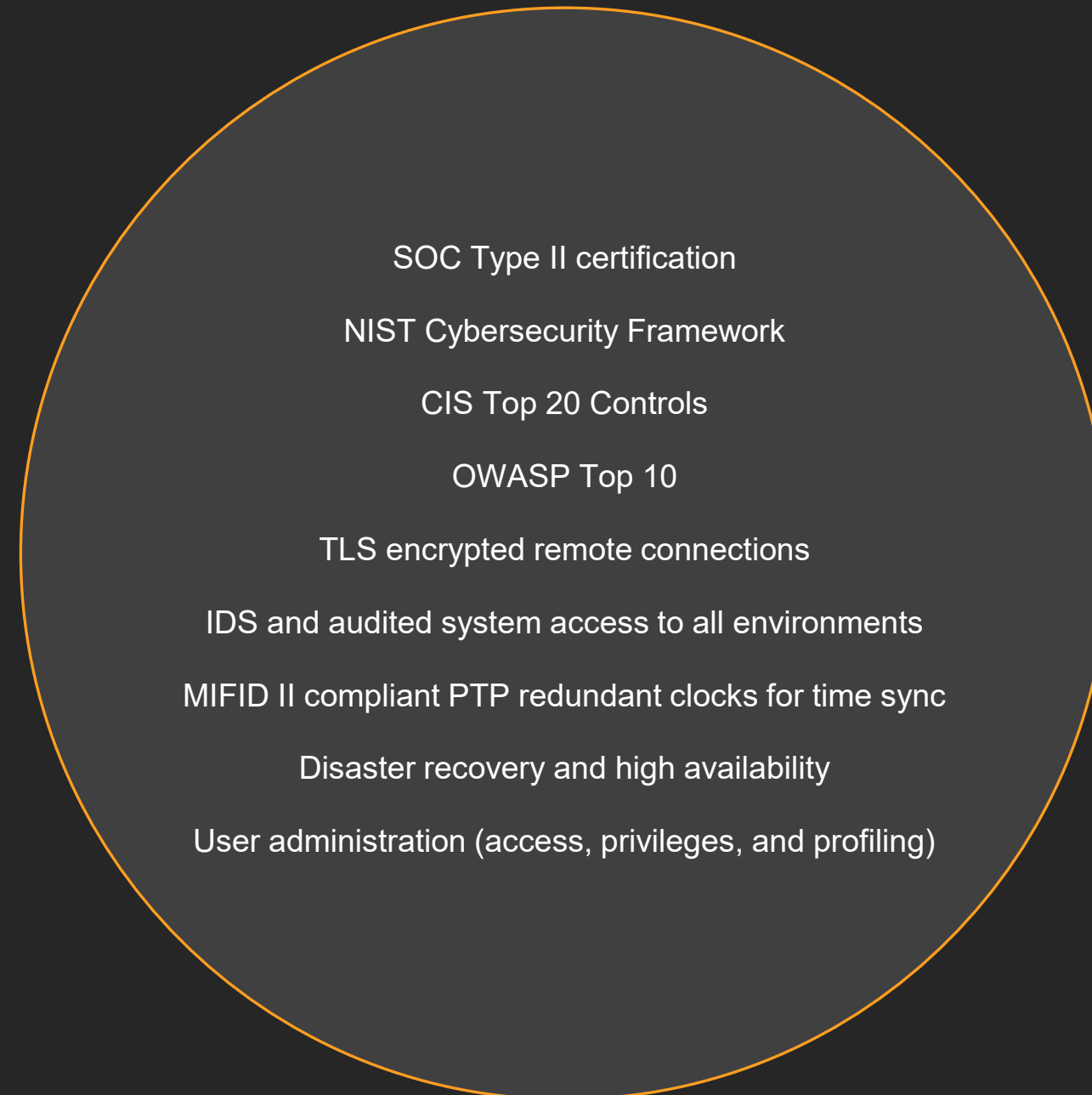
120+ Venue Connections

Dedicated Engineering Team

Greyspan Benefits

Flexibility	Reduced TCO	Managed Services	Security
Bespoke technical solutions	Time to market	Proven fully managed redundant infrastructure	Vulnerability and penetration testing
Dedicated or shared cabinet space	Competitive	Real-time monitoring and reporting	Secure and segregated environments
Physical, virtual, and Connectivity to customer cloud	Extensive liquidity network	Full-stack troubleshooting	Fully audited environment

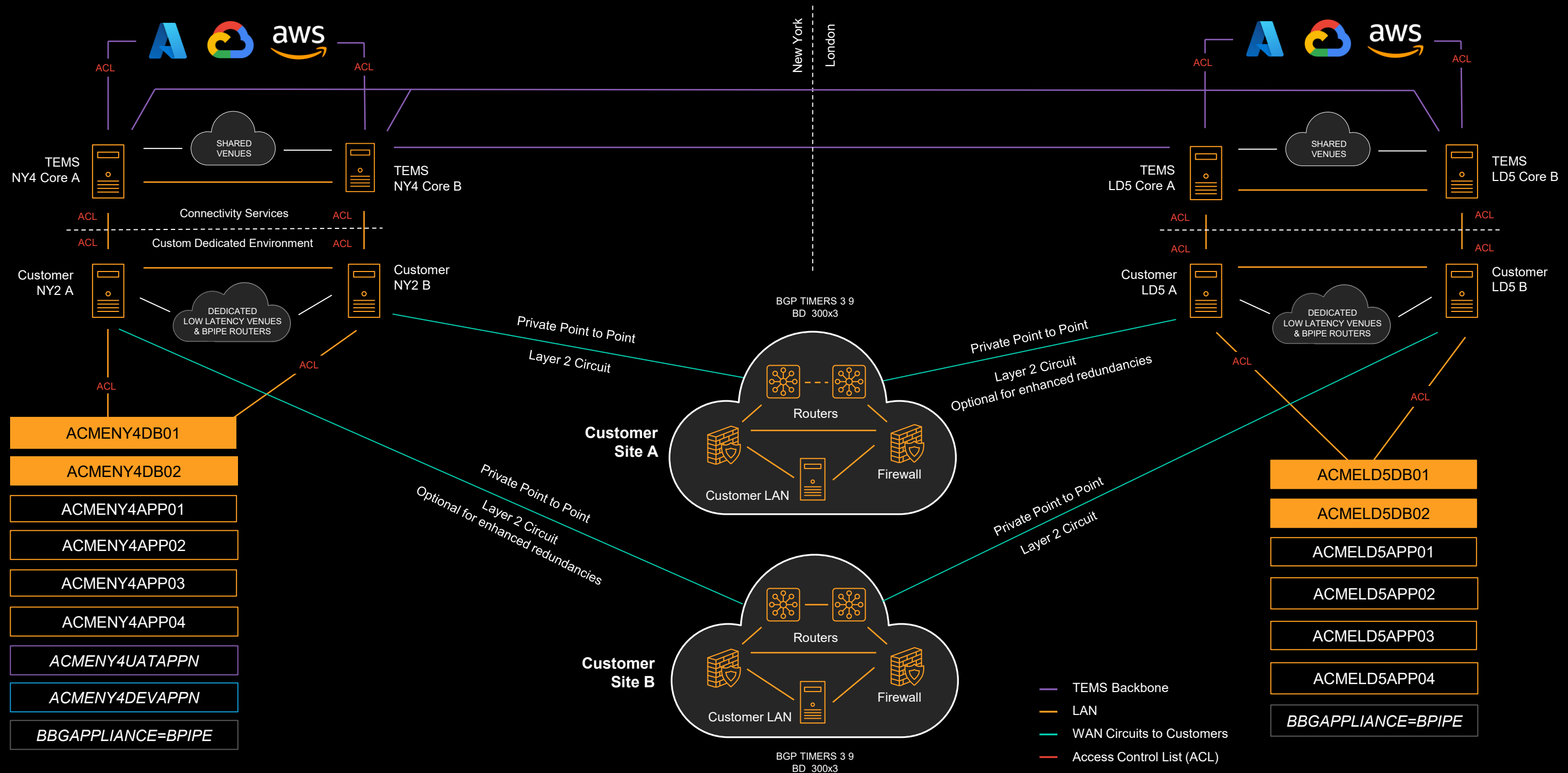
Compliance & Data Protection



Hosting Security Controls

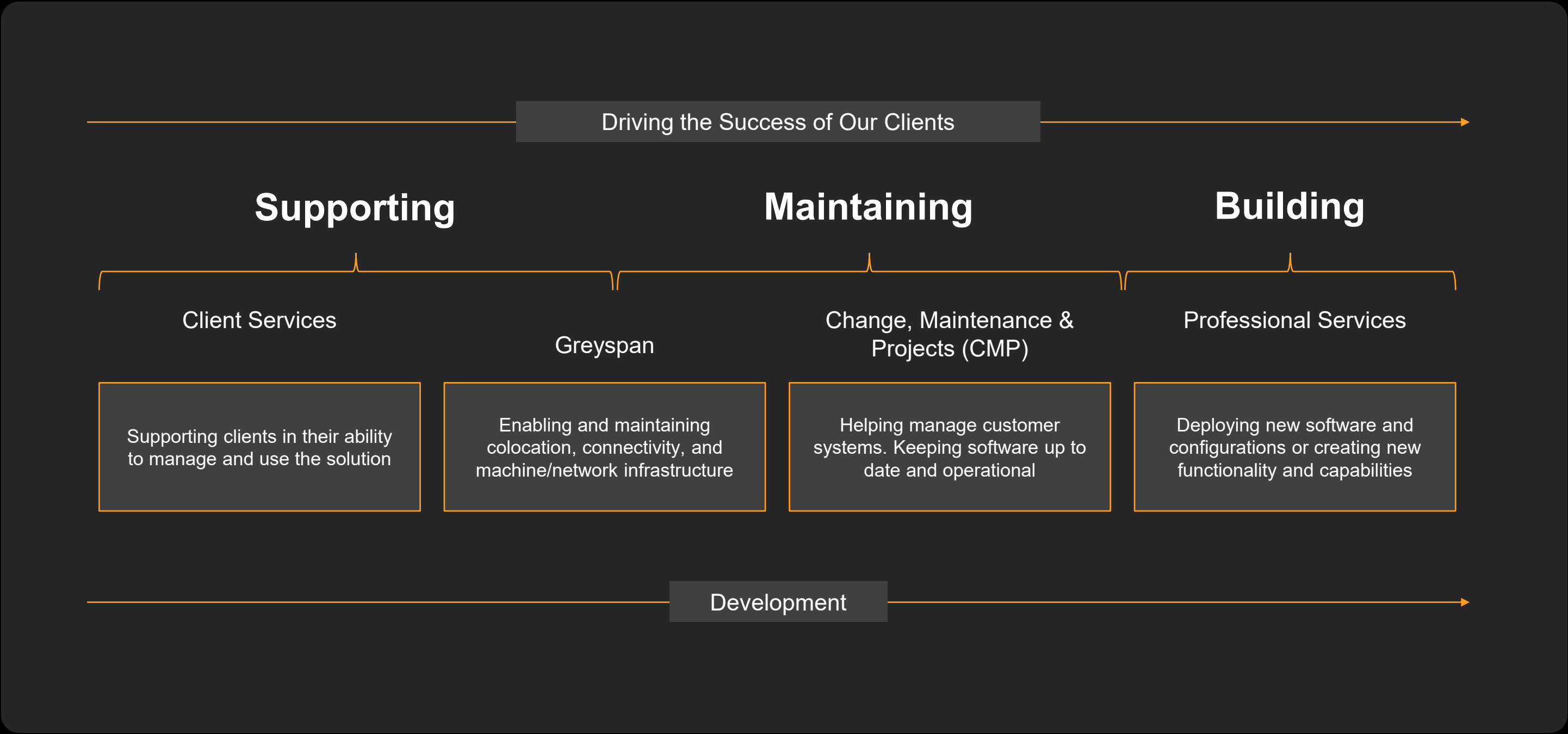
Secure Administration Zone	Physical Security	Network Security	System Security	Application Security	Access Authorization & Revalidation	Change Management & Auditing
	Secure Facilities	Penetration Testing	CIS System Hardening	OWASP Top 10	Least Privilege Principle	Change Management Process
	Biometric	Vulnerability Management	Risk Assessment	Penetration Testing	Quarterly Credential Review	Application-Level Change Auditing
	24/7 Security Monitoring	Threat Surface Monitoring	Asset Management	Encryption at Rest	Role-Based Access Control	Technology Platform-Level Change Auditing
	SOC 2 Type 2 & ISO 27001	Firewall Policy Audit	Patch Management	Segregation of Environments	Active Directory Security Group	Network Change Auditing
Secure Network Access	Audited Access	IPS/DOS	Secure Data Destruction	Toc Database Backup	HR Security Controls	Access Auditing
GPO Restrictions						
MFA Jump Box						

Typical Client Network Architecture (multi-site)



Client Engagement

Client Engagement Model



Deploying new software
and configurations or
creating new functionality
and capabilities



Building

- Dedicated project-based and timeline-driven team, including Project Manager, Engagement Lead, and skilled system experts
- Installation and configuration of Bloomberg systems
- New deployments and customizations to provide additional workflows and functionality, as well as dedicated premium support

Helping manage customer systems. Keeping software up-to-date and operational



Maintaining

- Optional value-add services
- Management of TEMS system and software, including upgrades of existing software
- Migration of existing software to new machines

Supporting clients in
their ability to manage
and use the solution



Supporting

- Included as part of the standard services
- Follow-the-sun global support team, available via phone and email to clarify usage questions and expected behaviors
- Access to new product releases with maintenance patches

Let's keep the conversation going

Thank you!

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