

CONNECTING THE DOTS: LEVERAGING SMART DATASETS AND TECHNOLOGY TO EFFECTIVELY DRIVE ANALYTICS, DATA AGGREGATION, AND REPORTING

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Contents

Introduction	3
Navigating the Changing Landscape	4
Laying the Foundation	7
Credit and Risk Analysis.....	11
Sales, Marketing, and CRM.....	18
Unstructured Data	20
Data Governance	21
Conclusion	24

Introduction

Historically, the financial services industry had predominantly relied on readily available public security and company level data (i.e., regulatory filings, broker research, pricing data) to make investment decisions. The industry depended on security level identifiers and siloed databases to consume and manage this content, making it challenging to aggregate and connect data in meaningful ways. Over time, two major shifts have drastically changed the investment landscape:

- Financial investing activities moved beyond single asset-class focused strategies while still relying on siloed security-level database architecture, introducing complexities in aggregating content across instruments and entities to identify exposure. The shortcomings of this model were exposed as the 2008 financial crisis proved that firms and global regulators did not have the necessary metadata or robust data connections available to effectively aggregate and measure risk exposures at an enterprise level.
- The introduction of Big Data and advancements in technology highlighted the growing importance of organizing and connecting diverse and disparate data in an intelligent way. The availability of alternative data sets, including unstructured content, and the need to visualize connectivity (i.e., Knowledge Graph) has expanded data-driven strategies beyond typical security level reference and market data to unique entity, individual, and company level content. In order to exploit the benefits of Big Data, organizations must transform operationally driven siloed databases into structured data models.
- Using this structured view of content, machine learning and artificial intelligence can drastically expand financial analysis and modeling capabilities. Some examples include leveraging machine learning and artificial intelligence to recommend investment opportunities, automate trade decisions, and enhance quantitative algorithmic trading models, as well as applying natural language processing to analyze earnings calls and other corporate events for sentiment analysis.

Given the increased sophistication of these trends, the underlying database infrastructure and identifiers used to represent securities, business entities, funds, and their corresponding relationships have failed to keep pace. The industry is in the midst of a data connectivity “arms race.” The financial institutions that can effectively leverage and connect conventional market and reference data with alternative and unstructured content assets, and aggregate these datasets at an enterprise level, will be at a significant advantage compared to their peers. The successful execution of a data and technology strategy that exploits connectivity and uncovers alpha generation opportunities provides more accurate risk exposure analysis and can ease compliance by effortlessly supporting regulatory reporting requirements. For these reasons, utilization of connected content sets, or “smart data”, can result in a significant competitive advantage.

FactSet can help firms manage and connect alternative and unstructured datasets across multiple asset classes and create a smart data network that can be exploited by all of the recent advances in technology. The examples presented throughout this white paper provide specific working scenarios that demonstrate how FactSet leverages the content and symbology of an entity-centric infrastructure to help financial professionals expose, integrate, and consume content.

Navigating the Changing Landscape

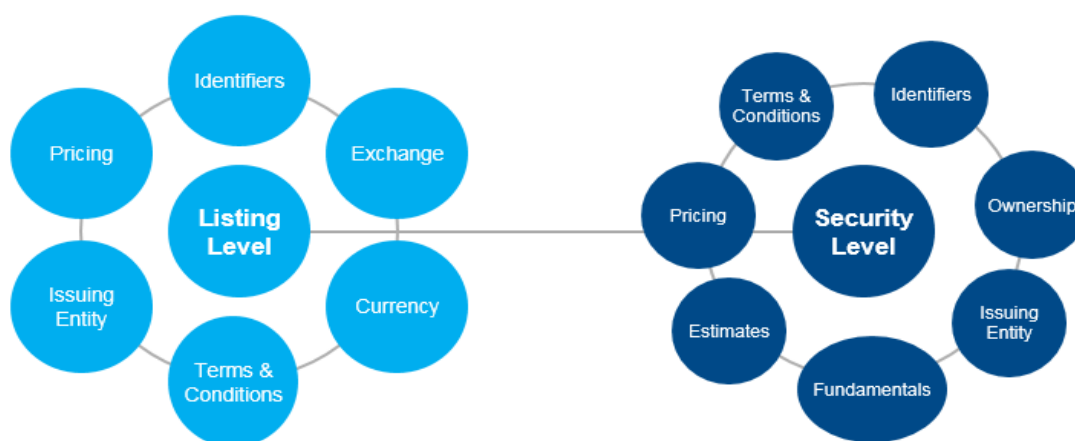
Today, we find ourselves in a much different marketplace than we saw a decade ago. There has been a shift in focus to deploy enterprise-level database architectures as a means to introduce efficiencies, realize cost savings, and satisfy regulatory reporting requirements. Investment strategies that cross multiple asset classes are becoming the rule rather than the exception. The creation of smart datasets to fulfill the promise of “big data” analytics is becoming increasingly important as organizations look to optimize their content resources to gain long-term value.

This evolution requires the deployment and execution of an effective data governance strategy and framework, that includes extended identification schemes to support and connect business entities, funds, and people, in addition to securities, on an enterprise-wide basis.

As a major financial data and technology partner with over 40 years of content integration experience, FactSet understands the value of creating an enterprise network of connected content and technology resources. As a result, FactSet made it a priority to deploy entity-centric database architecture designed to logically and consistently connect listings, securities, entities, funds, and people. As that data model has evolved, FactSet has been seamlessly able to incorporate and connect unstructured data and alternative data sets including Shipping Transactions, Sanctions Lists, and Transcripts. FactSet’s highly connected network of content coupled with FactSet’s various delivery options provides a distinct opportunity for institutions to tap into FactSet’s smart data offering to aid in the organization and management of their content assets as well as to fully exploit the promise of alternative data sets, machine learning, and artificial intelligence.

Security-Based Architecture

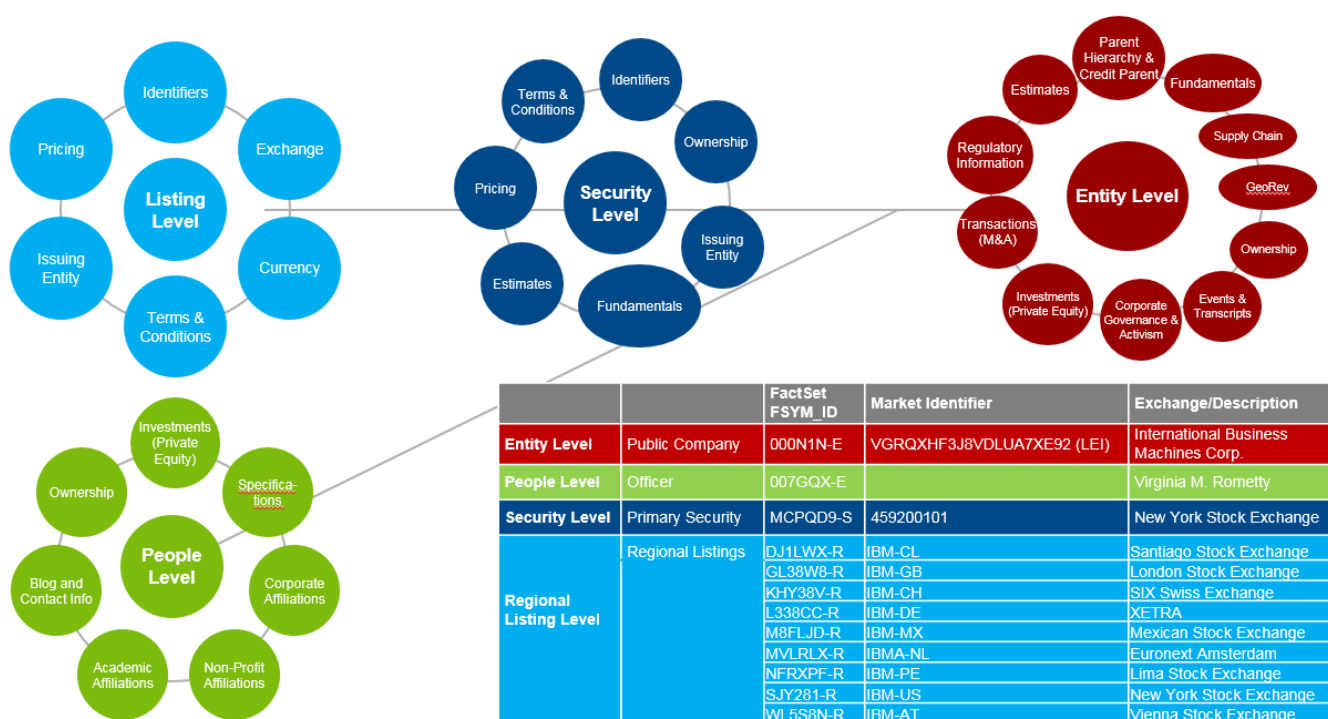
This example illustrates security-level organization previously used to organize, integrate, and consume content. The enterprise view was represented using security-level symbology at the core, limiting the ability to support and connect business entities, funds, people, and securities.



	FactSet FSYM_ID	Identifier	Exchange
Security Level	MCPQD9-S	459200101	New York Stock Exchange (primary)
Regional Listing Level	DJ1LWX-R	IBM-CL	Santiago Stock Exchange
	GL38W8-R	IBM-GB	London Stock Exchange
	KHY38V-R	IBM-CH	SIX Swiss Exchange
	L338CC-R	IBM-DE	XETRA
	M8FLJD-R	IBM-MX	Mexican Stock Exchange
	MVLRXL-R	IBMA-NL	Euronext Amsterdam
	NFRXPF-R	IBM-PE	Lima Stock Exchange
	SJY281-R	IBM-US	New York Stock Exchange
	WL5S8N-R	IBM-AT	Vienna Stock Exchange

Entity-Based Architecture

This example displays the entity-level organization used today. The primary key is entity-centric, which allows the full scope of FactSet content to be connected with a single master entity table and to be deployed on an enterprise-wide basis. FactSet's symbology can be used to logically connect listings, securities, entities, funds, and people, as well as unique and alternative content and unstructured data.



Laying the Foundation

Backed by more than 40 years of experience integrating data through desktop analytics, mobile applications, and comprehensive data feeds, FactSet provides the reliable infrastructure needed to meet evolving analytical, risk management, identifier mapping and cross reference (also referred to as concordance), and regulatory needs.

FactSet focuses on relevant entities and affiliates that are engaged in global economic and financing activities. This table provides a breakdown of the number and types of entities covered by FactSet as of September 2017.

Entity Types	Number of Entities
Public Company	56,519
Private Company	2,815,944
Subsidiary	1,297,501
Government (Sovereign, Regional, Local, etc.)	72,729
Financial Sponsors	
Buy Side Institution	23,666
Sell Side Institution	6,629
Exchange Traded Funds (ETF)	7,978
Hedge Funds	30,362
Closed-End Funds	9,047
Open-End Funds	257,644
Private Equity	48,357
Venture Capital	22,541
Trust/Trustee	33,227
Pension Fund	13,271
Special Purpose Entity	10,068
Ports, Vessels, Aircrafts	204,890
Other (Commodity, Currency, Foreign Exchange, Index)	2,976
Academic (College/University)	21,752
Non-Profit (Foundations, Endowments, Charities, etc.)	85,974
Individuals	3,308,834

Entity Relationships and Metadata

FactSet currently covers more than 347,000 unique parent/subsidiary relationships involving more than 1.87 million entities. The infrastructure allows for limitless levels within each entity hierarchy, allowing for significant flexibility in aggregating content. Relationships are updated on a daily basis, as global investment activity, mergers and acquisitions, and corporate action events are tracked through FactSet's connected content architecture.

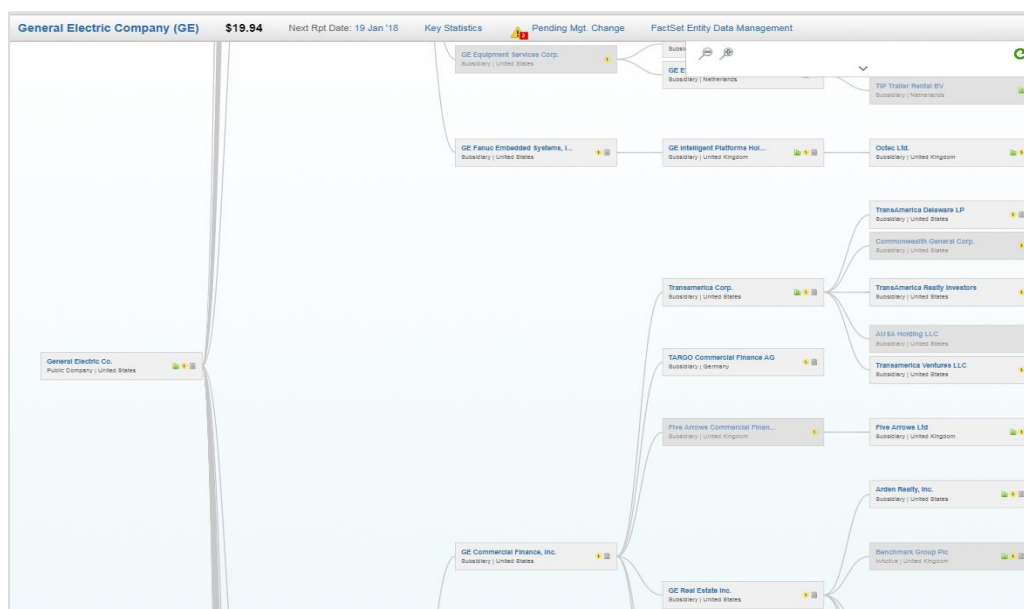
FactSet has identified the following major relationship types that can be cross-referenced against relevant entities:

- Debt and Equity Capital Structure
- Entity Structure/Hierarchy Relationships
- Credit Parent Relationships
- Supply Chain Relationships and Shipping Transactions
- Competitors
- Estimates (Broker Detail and Consensus)
- Fundamentals
- Investments (Private Equity, Venture Capital, Funds, ETF)
- Issuance/Terms & Conditions + Ownership (Equity and Fixed Income)
- Documents (Filings, Transcripts, Research Reports)
- Pricing
- Securities
- Sanctions Lists
- Corporate Governance and Activism
- Sector/Industry Taxonomies (RBICS and Hierarchy)
- People (Corporate Executives, Financial Professionals)
- Transactions (M&A, PIPEs, Share Repurchase)
- Identifier Mappings (SWIFT BIC, LEI, Credit Ratings)

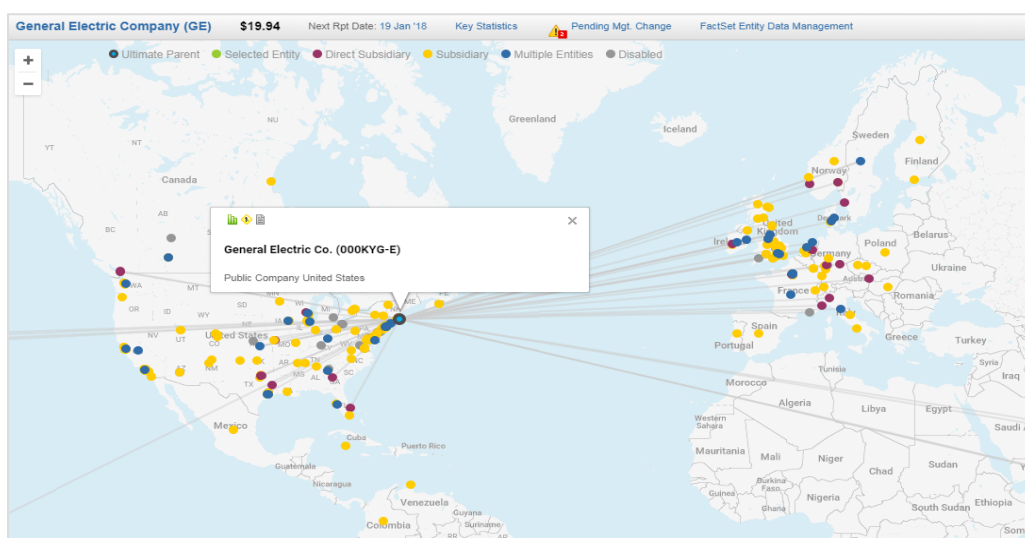
Entity Hierarchies

FactSet's architecture makes it easy to expose metadata, as well as entities that roll up under a single parent, in order to provide the information necessary for evaluating risk exposure and aggregation.

This example displays FactSet entity relationships and associated metadata as seen in the Entity Structure report available via the FactSet workstation. This report provides a visual representation of an entity's hierarchy, including immediate and ultimate parents, as well as any subsidiaries.



FactSet also supports geocoding, which allows the geographical distribution of an entity's organizational structure to be viewed.



Example

The following view of selected Altice NV subsidiaries can be created with FactSet Data Management solutions premium entity content, providing an accurate picture of entities that roll up under Altice NV, the single ultimate parent.

FactSet Entity ID	Entity Proper Name	ISO Country	Entity Type	Entity Sub Type	factset_parent_entity_id	Immediate Parent Proper Name	factset_ultimate_parent_entity_id	Ultimate Parent Proper Name
0CTHN5-E	Altice International SARL	LU	Subsidiary	Corporate	0FPWN5-E	Altice NV	0FPWN5-E	Altice NV
0CL3JD-E	mLibris SAS	FR	Subsidiary	Corporate	0FPWN5-E	Altice NV	0FPWN5-E	Altice NV
0C92WQ-E	Intelcia Group SA	MA	Subsidiary	Corporate	0FPWN5-E	Altice NV	0FPWN5-E	Altice NV
0DF1BX-E	Auberimmo SAS	FR	Subsidiary	Corporate	0DJPDH-E	Altice SA	0FPWN5-E	Altice NV
0GP6JH-E	Ma Chaine Sport SAS	FR	Subsidiary	Corporate	0DJPDH-E	Altice SA	0FPWN5-E	Altice NV
0CMYVK-E	Audience Partners LLC	US	Subsidiary	Corporate	0GD3XW-E	Altice USA, Inc.	0FPWN5-E	Altice NV
09PH8H-E	6933971 Canada, Inc.	CA	Subsidiary	Corporate	0CMYVK-E	Audience Partners LLC	0FPWN5-E	Altice NV
00BMQ5-E	CampaignGrid LLC	US	Subsidiary	Corporate	0CMYVK-E	Audience Partners LLC	0FPWN5-E	Altice NV
079WVN-E	4Connections LLC	US	Subsidiary	Corporate	079WVP-E	Cablevision Lightpath, Inc. (Ne...	0FPWN5-E	Altice NV
0BW01M-E	News 12 Co.	US	Subsidiary	Corporate	0020GS-E	Cablevision Systems Corp.	0FPWN5-E	Altice NV
0BW03M-E	News 12 Networks LLC	US	Subsidiary	Corporate	0020GS-E	Cablevision Systems Corp.	0FPWN5-E	Altice NV
0CHWW6-E	Newsday LLC	US	Subsidiary	Corporate	0020GS-E	Cablevision Systems Corp.	0FPWN5-E	Altice NV
0GH5YB-E	CSC T Holdings III, Inc.	US	Subsidiary	Corporate	0020GS-E	Cablevision Systems Corp.	0FPWN5-E	Altice NV
0GTX7P-E	CSC T Holdings I, Inc.	US	Subsidiary	Corporate	0020GS-E	Cablevision Systems Corp.	0FPWN5-E	Altice NV
000ZPX-E	Cablevision of Boston Ltd. P...	US	Subsidiary	Corporate	0020GS-E	Cablevision Systems Corp.	0FPWN5-E	Altice NV
0020CN-E	CSC Holdings LLC	US	Subsidiary	Corporate	0020GS-E	Cablevision Systems Corp.	0FPWN5-E	Altice NV
05TK08-E	Newsday Holdings LLC	US	Subsidiary	Corporate	0020GS-E	Cablevision Systems Corp.	0FPWN5-E	Altice NV

Credit and Risk Analysis

As the industry has progressed, financial investing activities have moved beyond asset-class focused strategies. This environment has made it more complicated to analyze risk and quantify exposure to a security, issuer, industry, country, and ultimate parent. FactSet's framework establishes a basis for cross-referencing various types of datasets so you can quickly identify important connections.

Using Security-to-Issuer Mapping and Understanding Exposure

FactSet provides full details on issues that can be related back to ultimate parents to help represent true exposure.

- Over 9.8 million securities linked to 500,000+ original issuing entities
- Immediate Parents, Ultimate Parents, Credit Parents, Affiliates
- Full support for special purpose vehicles
- U.S. Municipal Issuers
- Structured Finance Deals
- Bankruptcy Information
- Debt Capital Structure

Example

The scope of FactSet's security-to-security and security-to-entity linkages allows for various types of exposure analysis. The below example illustrates that a fixed income security can have a number of different related entities. In addition to the standard issuer, parent, ultimate parent, and guarantor relationships, FactSet assigns a credit parent to active entities that have issued corporate debt (including bonds, notes, loans, etc.). The credit parent can differ from the ultimate parent if the ultimate parent will not inherit the credit risk associated with an issuer's debt offerings. Registered instrument level data items are also supported.

The following view includes issuer, parent, and credit parent relationships for selected fixed income security issues where the ultimate parent is the Government of Russia.

isin	instrument_name	144a_flag	regs_flag	issue_date	linked_id	issuer_entity_id	issuer_name	credit_parent_id	credit_parent_name	factset_ultimate_parent_entity_id	ultimate_parent_name
US368266AG77	Gaz Capital SA 5.44% 02-NOV-2017	1	0	2007-03-07	-896196	060VSS-E	Gaz Capital SA	05HWBM-E	Gazprom PJSC	05HLLS-E	Government of Russia
US368266AQ59	Gaz Capital SA 5.999% 23-JAN-2021	1	0	2011-11-23	-530121	060VSS-E	Gaz Capital SA	05HWBM-E	Gazprom PJSC	05HLLS-E	Government of Russia
US89354FAE16	TransCapitalInvest DAC 8.7% 07-AUG-2018	1	0	2008-08-07	-927286	06NYBM-E	TransCapitalInvest DAC	05HZ97-E	Transneft PJSC	05HLLS-E	Government of Russia
XS0381439305	TransCapitalInvest DAC 8.7% 07-AUG-2018	0	1	2008-08-07	-927286	06NYBM-E	TransCapitalInvest DAC	05HZ97-E	Transneft PJSC	05HLLS-E	Government of Russia
XS0848530977	SB Capital SA 5.125% 29-OCT-2022	0	1	2012-10-29	-988014	008RHY-E	SB Capital SA	05JSWV-E	Sberbank Russia OJSC	05HLLS-E	Government of Russia
XS0366630902	RSHB Capital SA 7.75% 29-MAY-2018	0	1	2008-05-29	-925749	06RNJ9-E	RSHB Capital SA	05SJ3K-E	Russian Agricultural Bank OJSC	05HLLS-E	Government of Russia
XS0955232854	RSHB Capital SA 5.1% 25-JUL-2018	0	1	2013-07-25	251976	06RNJ9-E	RSHB Capital SA	05SJ3K-E	Russian Agricultural Bank OJSC	05HLLS-E	Government of Russia
CH0205819441	RZD Capital Plc 2.73% 26-FEB-2021	0	1	2013-02-26	-1730476	09MR0K-E	RZD Capital Plc	05VSL7-E	Russian Railways OJSC	05HLLS-E	Government of Russia
XS0764253455	RZD Capital Plc 8.3% 02-APR-2019	0	1	2012-04-02	-829716	09MR0K-E	RZD Capital Plc	05VSL7-E	Russian Railways OJSC	05HLLS-E	Government of Russia

FactSet also is able to link securities to finance subsidiaries or special purpose vehicles. This type of analysis is important when analyzing credit and risk, specifically where debt associated with these entities is overlooked and not aggregated under the ultimate parent.

The following example illustrates how you can expose selected securities linked to special purpose vehicles that roll up to ultimate parent entities that are classified as governments.

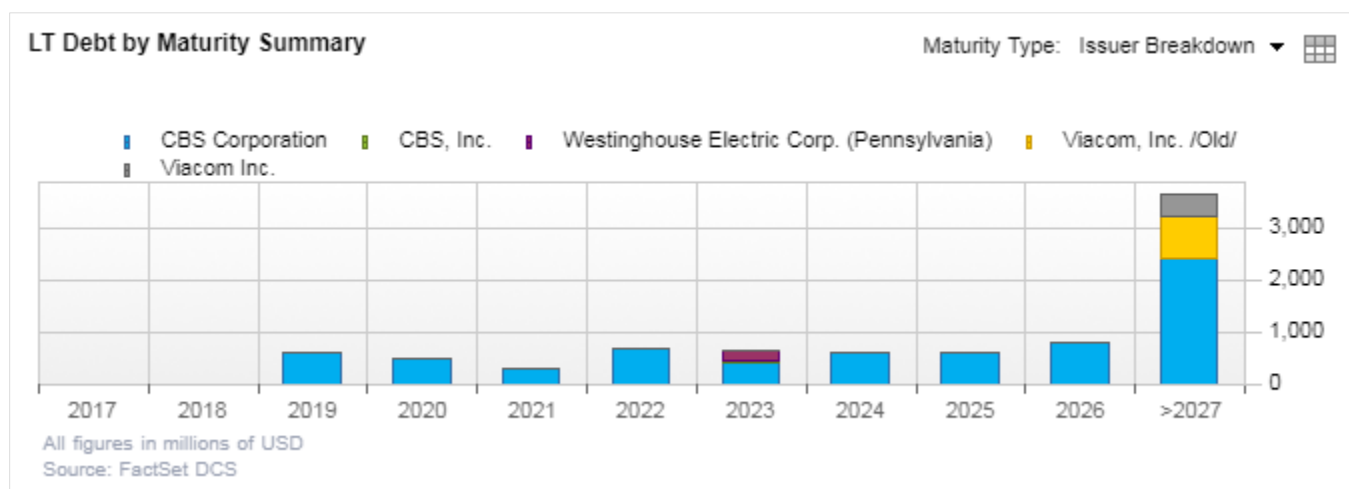
isin	factset_issuer_entity_id	issuer_proper_name	factset_ultimate_parent_entity_id	ultimate_parent_proper_name
XS0860854966	0CWB29-E	Amber Circle Funding Ltd.	05LT05-E	Government of China
XS0860855344	0CWB29-E	Amber Circle Funding Ltd.	05LT05-E	Government of China
XS1261825621	09P8N6-E	Biz Finance Plc	05S5RV-E	Government of Ukraine
XS1261826439	09P8N6-E	Biz Finance Plc	05S5RV-E	Government of Ukraine
XS1608624166	0H2QWB-E	CNAC (HK) Synbridge Co., Ltd.	05LT05-E	Government of China
US12623TAB44	0CHPQD-E	CNPC General Capital Ltd.	05LT05-E	Government of China
US706448AH03	004N7W-E	Pemex Finance Ltd.	05HPGS-E	Government of Mexico
USG69852AD68	004N7W-E	Pemex Finance Ltd.	05HPGS-E	Government of Mexico
XS0543744535	06P13N-E	UK SPV Credit Finance Plc	05S5RV-E	Government of Ukraine
US90277VAB45	06P13N-E	UK SPV Credit Finance Plc	05S5RV-E	Government of Ukraine

The power of integrating Debt Capital Structure data with FactSet's Fundamentals and Estimates data is illustrated with General Electric Company (GE). FactSet's Debt Capital Structure helps you thoroughly examine a company's sources of debt with access to public and private company debt financing.

Debt Capital Structure Summary					LTM	
	30-Sep-2017	LTM /EBITDA	30-Jun-2017	LTM /EBITDA		
<input checked="" type="checkbox"/> ST Debt Total	28,127.0	1.23x	30,044.0	1.35x		
Commercial Paper - Unsec.	7,021.0		7,012.0			
Other Borrowings - Unsec.	12,657.0		14,703.0			
Adjustments	-11,801.0		-13,660.0			
Current Portion of LTD	20,250.0		21,989.0			
Revolving Credit	0.0	0.00x	0.0	0.00x		
<input checked="" type="checkbox"/> Term Loans	35,433.0	1.55x	39,044.0	1.75x		
Other Borrowings	35,433.0		39,044.0			
<input checked="" type="checkbox"/> Notes/Bonds	106,023.0	4.64x	102,101.0	4.59x		
Senior Unsec.	101,781.0		97,626.0			
Senior Subordinated	210.9		210.9			
Subordinated	2,941.1		2,842.1			
Other Rec.	708.0		682.0			
Trust Preferred	382.0		740.0			
<input checked="" type="checkbox"/> Other	-33,191.0	-1.45x	-36,787.0	-1.65x		
Adjustments	-33,191.0		-36,787.0			
LT Debt Total	108,265.0	4.74x	104,358.0	4.69x		
Net LT Debt Total	108,265.0	4.74x	104,358.0	4.69x		
Total Debt	136,392.0	5.97x	134,402.0	6.04x		

All figure in millions of USD
Long term debt amounts for this issuer are reported NET of current portion.
Source: FactSet DCS, FactSet Fundamentals, FactSet Estimates

Connect Debt Capital Structure data to FactSet's entity hierarchy to aggregate issuer-level data for a comprehensive view of total risk, or dig into the details by breaking out long-term debt by issuer for an ultimate parent.



Single Name Exposure/Risk Aggregation

FactSet lets you look across all portfolios or a subset of portfolios to quantify your exposure to a security, issuer, industry, country, or specific set of securities. Simply put, using FactSet's content, security, and entity linkages lets you examine how much you own and where you own it.

FactSet's industry-leading Ownership content is tightly woven into FactSet's entity hierarchies. Leveraging the entity as the "primary key" enables FactSet to integrate ownership and hierarchy data into an aggregated risk view.

The Ownership database includes the following:

- Institutional Level Ownership
- Fund Level Ownership
- Insider/Strategic Ownership
- Private Company Ownership

This example displays the direct holders that roll up to the Government of China. Looking at the direct holder detail and the linkage to the Government of China, it is apparent that the Government of China would have controlling interests in Chinese-listed equities.

Direct Holder Name	Direct Holder % Held	ISIN	Security Name	Government of China % Held
China State-Owned Assets Supervision & Admin Comm...	0.859	CNE0000015N3	JIANGXI HONGDU AVIATION INDS ORD A	46.111
China Life Asset Management Co., Ltd.	1.178	CNE0000015N3	JIANGXI HONGDU AVIATION INDS ORD A	46.111
AviChina Industry & Technology Co., Ltd.	44.029	CNE0000015N3	JIANGXI HONGDU AVIATION INDS ORD A	46.111
Guotai Asset Management Co., Ltd.	0.045	CNE0000015N3	JIANGXI HONGDU AVIATION INDS ORD A	46.111
China State-Owned Assets Supervision & Admin Comm...	76.678	CNE0000015R4	BAOSHAN IRON & STEEL CO LTD ORD A	76.711
Guotai Asset Management Co., Ltd.	0.033	CNE0000015R4	BAOSHAN IRON & STEEL CO LTD ORD A	76.711
China Life Asset Management Co., Ltd.	0.370	CNE000001P37	INDUSTRIAL&COMMERCIAL BK CHINA ORD A	94.499
Government of China	46.973	CNE000001P37	INDUSTRIAL&COMMERCIAL BK CHINA ORD A	94.499
Guotai Asset Management Co., Ltd.	0.007	CNE000001P37	INDUSTRIAL&COMMERCIAL BK CHINA ORD A	94.499
Everbright Pramerica Fund Management Co. Ltd.	0.002	CNE000001P37	INDUSTRIAL&COMMERCIAL BK CHINA ORD A	94.499

Country Exposures

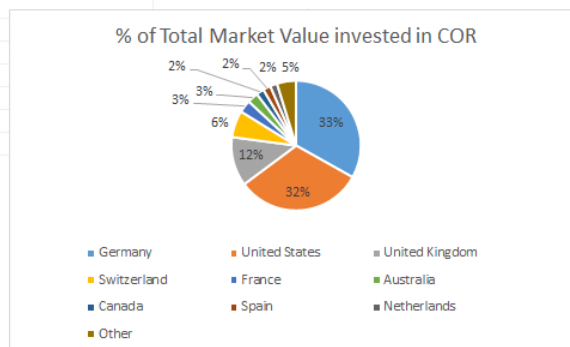
FactSet supports multiple country exposures, including headquarter location, country of incorporation, and country of risk.

Country of Risk

In this view of country exposure, country of risk refers to the probability that changes in the business environment in a certain country may adversely impact an entity's operations. FactSet has determined a methodology that takes into account multiple factors when assigning a country of risk to publicly traded entities.

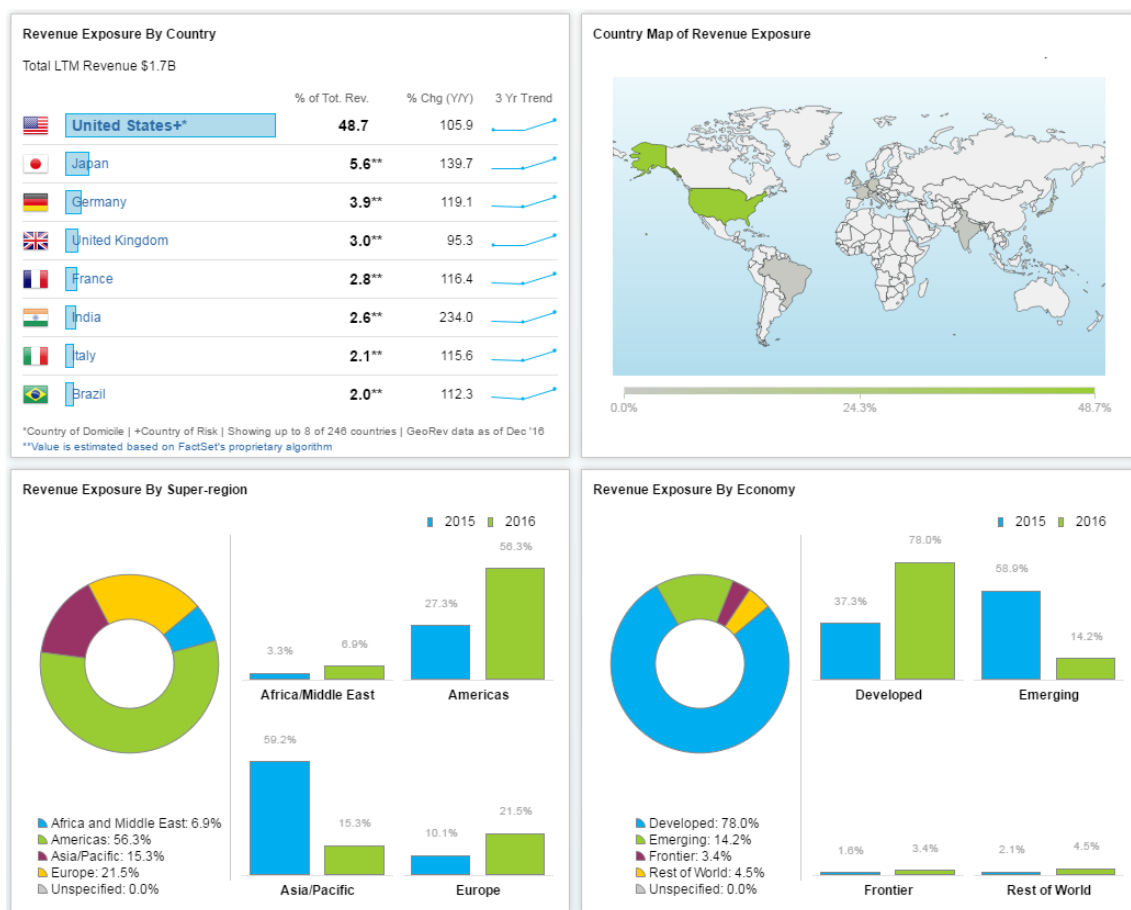
This example shows an aggregated view of Reuss Private Deutschland AG's portfolio based on underlying securities' country of risk.

FactSet Holder Entity ID	Holder Name	ISO Country of Risk	% of Total Market Value invested in COR
09QBDD-E	Reuss Private Deutschland AG	Germany	21.614
09QBDD-E	Reuss Private Deutschland AG	United States	20.720
09QBDD-E	Reuss Private Deutschland AG	United Kingdom	7.994
09QBDD-E	Reuss Private Deutschland AG	Switzerland	4.363
09QBDD-E	Reuss Private Deutschland AG	France	2.037
09QBDD-E	Reuss Private Deutschland AG	Australia	1.768
09QBDD-E	Reuss Private Deutschland AG	Canada	1.270
09QBDD-E	Reuss Private Deutschland AG	Spain	1.239
09QBDD-E	Reuss Private Deutschland AG	Netherlands	1.146



Geographic Revenue Exposure (GeoRev)

FactSet's GeoRev data provides normalized geographic revenue data that can be used to uncover previously unknown exposures. Analyze a company's revenue by geography to better evaluate its exposure to geopolitical risk, macroeconomic factors, and market conditions around the world. The example below shows the views that can be creating for Yum Brands, Inc.



Supply Chain and Shipping Transactions

FactSet's Supply Chain Relationships was built to uncover business relationship interconnections among companies globally. No company operates in isolation; all are part of an ecosystem consisting of competitors, suppliers, customers, and strategic partners. Identifying the nature of a company's business relationships is crucial to understanding its business opportunities and risk exposure.

Using FactSet's GeoRev and Supply Chain data, a user is able to identify companies that are generating more than 50% of their revenue outside of their country of incorporation or headquarters. In the example below, entities that are not headquartered in the Ukraine are returned if more than 50% of their revenue comes from the Ukraine.

FactSet Entity ID	Entity Proper Name	ISO Country of HQ	Estimated Ukraine GeoRev Percent
06LW08-E	MHP SE	Luxembourg	100
0CBTCQ-E	Cub Energy, Inc.	United States	100
0CK48F-E	Misen Energy AB	Sweden	100
004JZF-E	Regal Petroleum Plc	United Kingdom	100
06SGBB-E	Agromino A/S	Denmark	93.348
006SMW-E	Frontera Resources Corp.	United States	81.641
002ZD1-E	JKX Oil & Gas Plc	United Kingdom	74.255
0BWH2M-E	Ovostar Union NV	Netherlands	69.157
07H3NP-E	AgroGeneration SA	France	67.587

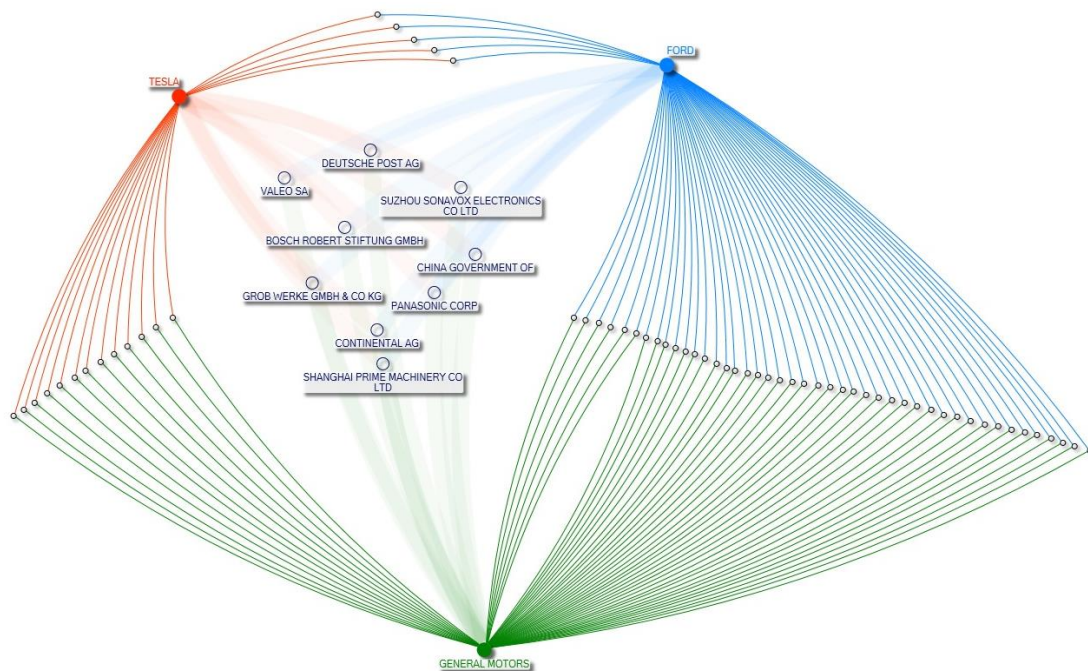
In the example below, the GeoRev example above is expanded upon by integrating Supply Chain data. Here we can see a subset of the non-Ukrainian based customers of the entities above.

Supplier Entity ID	Entity Proper Name	Supplier ISO Country	Ukraine Est. Percent	customer_factset_entity_id	Customer Proper Name	Customer ISO Country
07H3NP-E	AgroGeneration SA	France	67.587	000C8L-E	Archer-Daniels-Midland Co.	United States
07H3NP-E	AgroGeneration SA	France	67.587	08CYT5-E	Louis Dreyfus Co. BV	Netherlands
07H3NP-E	AgroGeneration SA	France	67.587	00161G-E	Cargill, Inc.	United States
0BWH2M-E	Ovostar Union NV	Netherlands	69.157	001XQ4-E	Nestlé SA	Switzerland
0BWH2M-E	Ovostar Union NV	Netherlands	69.157	05QFBX-E	REWE Handelsgruppe GmbH	Germany
0BWH2M-E	Ovostar Union NV	Netherlands	69.157	06NDR7-E	Anthousa Ltd.	United Kingdom
0BWH2M-E	Ovostar Union NV	Netherlands	69.157	0GWZQH-E	CECONOMY AG	Germany
0BWH2M-E	Ovostar Union NV	Netherlands	69.157	000PLS-E	McDonald's Corp.	United States
0BWH2M-E	Ovostar Union NV	Netherlands	69.157	002RNG-E	Mondelez International, Inc.	United States
0BWH2M-E	Ovostar Union NV	Netherlands	69.157	05HHHQ-E	Auchan Holding SA	France
004JZF-E	Regal Petroleum Plc	United Kingdom	100	06F413-E	Smart Group Ltd.	Singapore

With FactSet's recent shipping transactions collection efforts, previously unknown supply chain relationships have been able to be inferred through shipper and consignee relationships disclosed to the CBP. In the example below, FactSet has been able to define shipper/consignee relationships where the Government of Singapore is the ultimate parent:

shipper_id	shipper_iso	shipper_name	ship_ult	consignee_id	consign_iso	consign_name	consign_ult	consign_ult_iso	consign_ult_name	tran_count	first_tran_date	last_tran_date
0BQYKF-E	CN	Sam Meerkat Suzhou Co. Ltd.	001LKM-E	07C260-E	US	GKN Aerospace, Inc.	003LFR-E	GB	GKN Plc	45	2014-07-24	2017-10-09
0D943C-E	AU	Olam Orchards Australia Pty. Ltd.	001LKM-E	07PL04-E	US	Sun Valley Nut, Inc.	07PL04-E	US	Sun Valley Nut, Inc.	44	2014-04-30	2014-09-02
0BQYKF-E	CN	Sam Meerkat Suzhou Co. Ltd.	001LKM-E	07Y1BW-E	US	ELG Utica Alloys, Inc.	07Y1BW-E	US	ELG Utica Alloys, Inc.	43	2013-11-19	2016-07-05
0D9441-E	TZ	Olam Tanzania Ltd.	001LKM-E	07RN7P-E	US	Olam Americas, Inc.	001LKM-E	SG	Government of Singapore	38	2014-10-29	2017-09-20
0CT85L-E	NG	Olam Nigeria Ltd.	001LKM-E	07STYK-E	US	Dipasa USA, Inc.	07STYK-E	US	Dipasa USA, Inc.	37	2016-03-03	2017-09-07
0D944R-E	CO	Outspan Colombia S.A.S. Ci	001LKM-E	07Y931-E	US	Massimo Zanetti Beverage USA, Inc.	06X2L2-E	IT	Massimo Zanetti Beverage Group SpA	36	2014-01-09	2015-08-22
0GQ2TB-E	NI	Olam Nicaragua SA	001LKM-E	0GL983-E	US	Olam International Ltd. (United States)	001LKM-E	SG	Government of Singapore	35	2015-09-22	2017-10-09
0HH5Q-E	BR	Olam Agricola Ltda.	001LKM-E	0GL983-E	US	Olam International Ltd. (United States)	001LKM-E	SG	Government of Singapore	34	2016-11-22	2017-10-17
0D944R-E	CO	Outspan Colombia S.A.S. Ci	001LKM-E	000WW4-E	US	Starbucks Corp.	000WW4-E	US	Starbucks Corp.	34	2013-10-30	2015-04-10
0CT1NQ-E	VN	Olam Vietnam Ltd.	001LKM-E	00DVRD-E	US	Kraft Foods Group, Inc.	0FFB5P-E	US	The Kraft Heinz Co.	32	2013-10-31	2015-08-17
0GQ2TW-E	HN	Olam Honduras SA de CV	001LKM-E	0GL3YV-E	US	International Coffee Corp.	0GL3YV-E	US	International Coffee Corp.	32	2014-06-17	2017-03-29
0CT1NQ-E	VN	Olam Vietnam Ltd.	001LKM-E	0GHJVP-E	US	Glendale Warehouse & Distribution Corp.	0GHJVP-E	US	Glendale Warehouse & Distribution ...	31	2014-05-29	2015-09-28
0CT1NQ-E	VN	Olam Vietnam Ltd.	001LKM-E	001JWB-E	US	TreeHouse Private Brands, Inc.	0072XZ-E	US	TreeHouse Foods, Inc.	30	2017-06-14	2017-10-16

In this graphic we are able to interrogate the US Customs shipping data set and expose the top suppliers aggregated at the ultimate parent level that are common to Ford, GM, and Tesla.



Sales, Marketing, and CRM

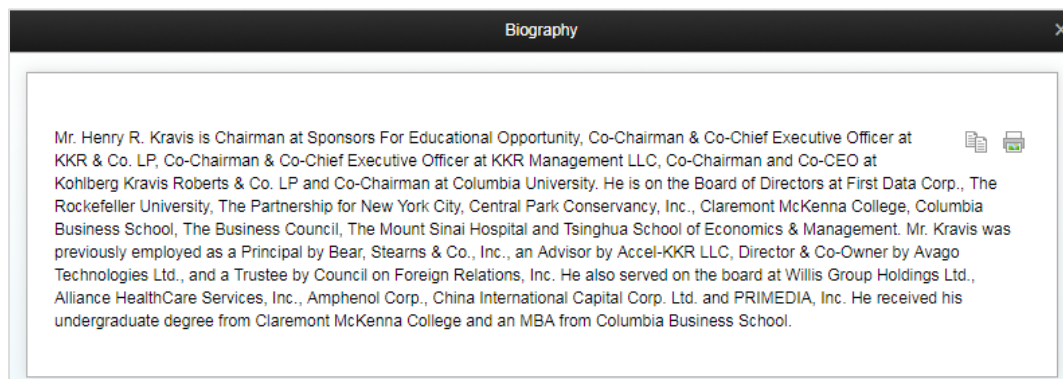
People-related metadata and linking people to transactions are becoming increasingly important in today's business environment. Knowing who to contact, how to contact, and when to contact offers a competitive edge. The ability to directly link People content to Global M&A, Private Equity, and Venture Capital transactions provides unique insight into potentially hidden and untapped social connections and uncovers potential conflicts of interest.

The FactSet People database focuses on entities that are material to global economic and financing activities. The database covers public companies, private companies, and financial sponsors (Buy-Side, Sell-Side, Private Equity, and Venture Capital). With a growing database of more than 3.1 million unique individuals and their professional and academic connections, the number of possible third-party connections is well over 2.5 billion connections.

Introducing the FactSet Social Graph

In addition to global scope across different business segments, one of the most compelling features of FactSet's People content is the highly structured nature of its biographical metadata.

This is an example of a typical unstructured biography.



This example displays the professional and educational records for Henry R. Kravis stored as separate rows in a relational table. Effectively leveraging the structured nature of this content is unique to FactSet.

FactSet Person ID	FactSet Entity ID	Entity Name	Job ID	Title	Active
05HK88-E	05X5WB-E	Accel-KKR LLC	658910	Advisor	0
05HK88-E	065BHK-E	The Rockefeller University	3033517	Chairman-Emeritus	1
05HK88-E	05G05N-E	Columbia University	4784056	Co-Chairman	1
05HK88-E	00C7P7-E	KKR Management LLC	4424839	Co-Chairman & Co-Chief Executive Officer	1
05HK88-E	05HJDG-E	Kohlberg Kravis Roberts & Co. LP	27679	Co-Chairman & Co-Chief Executive Officer	1
05HK88-E	088LTZ-E	KKR & Co. LP	5344637	Co-Chairman & Co-Chief Executive Officer	1
05HK88-E	08596Y-E	KKR Private Equity Investors LP	2918046	Co-Chairman & Co-Founder	0
05HK88-E	06Z8TR-E	KKR Capital Markets LLC	1116138	Co-Founder, Co-Chairman & Co-CEO	1
05HK88-E	000BRC-E	Alliance HealthCare Services, Inc.	170782	Director	0
05HK88-E	000C3J-E	Amphenol Corp.	170783	Director	0
05HK88-E	000JR2-E	First Data Corp.	2351993	Director	1
05HK88-E	001458-E	RentPath, Inc.	3033546	Director	0
05HK88-E	002N81-E	Wills Group Holdings Ltd.	170781	Director	0
05HK88-E	06M850-E	Avago Technologies Ltd.	2263608	Director & Co-Owner	0
05HK88-E	0663CJ-E	The New York City Investment Fund Manager, Inc.	664559	Founding Chairman	1
05HK88-E	000CPH-E	Bear, Stearns & Co., Inc.	4143739	Principal	0
05HK88-E	0611FD-E	Claremont McKenna College	3033532	Trustee	1
05HK88-E	06478P-E	The Mount Sinai Hospital	3033499	Trustee	1

Discovering Networks that Intertwine

In addition to information such as employment history and compensation, FactSet provides information for relationships, both corporate and non-corporate. You can seamlessly plot the paths between people and firms and display relationships that may uncover conflicts of interest.

This example displays third-party connections between IG Metall and Siemens AG.

IG Metall Employee ID	IG Metall Employee Name	Siemens AG Employee ID	Siemens AG Employee Name	Shared Employer Entity ID	Shared Employer Entity Name
06WPC8-E	Jürgen Kemer	0679DZ-E	Heinz Hawreluk	0679GV-E	Airbus Helicopters Deutschland GmbH
06798V-E	Berthold Huber	06799P-E	Wolfgang Müller	05HDYH-E	AUDI AG
06798V-E	Berthold Huber	08252X-E	Sibylle Wankel	05HDYH-E	AUDI AG
09RHZL-E	Christiane Benner	0DM90R-E	Marco Feuerstein	05HF3F-E	Bayerische Motoren Werke AG
09RHZL-E	Christiane Benner	0BFDTS-E	Michael Süß	05HF3F-E	Bayerische Motoren Werke AG
09RHZL-E	Christiane Benner	07HSRS-E	Jörg Traub	05HF3F-E	Bayerische Motoren Werke AG
067VLX-E	Bertin Eichler	0DM90R-E	Marco Feuerstein	05HF3F-E	Bayerische Motoren Werke AG
067VLX-E	Bertin Eichler	0BFDTS-E	Michael Süß	05HF3F-E	Bayerische Motoren Werke AG
067VLX-E	Bertin Eichler	07HSRS-E	Jörg Traub	05HF3F-E	Bayerische Motoren Werke AG
09GP7W-E	Werner Neugebauer	0DM90R-E	Marco Feuerstein	05HF3F-E	Bayerische Motoren Werke AG
09GP7W-E	Werner Neugebauer	0BFDTS-E	Michael Süß	05HF3F-E	Bayerische Motoren Werke AG
09GP7W-E	Werner Neugebauer	07HSRS-E	Jörg Traub	05HF3F-E	Bayerische Motoren Werke AG
00BX0H-E	Hartmut Meine	05G67B-E	Wolfgang W. Reitzle	003JMZ-E	Continental AG
09HK9H-E	Sabine Maaßen	0679DZ-E	Heinz Hawreluk	0025F0-E	Daimler AG
09HK9H-E	Sabine Maaßen	06R40M-E	Josef Käser	0025F0-E	Daimler AG

The below example displays how FactSet leverages its structured biographical metadata to visualize the web of Mr. Diller's connections in a coherent, digestible view.

Barry Charles Diller Age: 74 President & Director			
Relationships			
Organization (11)	Role	Relationships	Sector / Industry
11 PRIVATE	379 MGT 184 BOARD	548 TOTAL	5 SECTORS 5 INDUSTRIES
Expedia, Inc.	Chairman	20	Consumer Services
Management		7 MGT 14 BOARD	OTHER CONSUMER SERVICES
		7	
Mark D. Okerstrom, MBA	President, Chief Executive Officer & Director		
Alan Pickerill	Chief Financial Officer, Treasurer & Executi...		
Robert J. Dzielak	Secretary, Executive VP & General Counsel		
Gary Morrison	Vice President		
Lance A. Soliday, CPA	Chief Accounting Officer, VP & Controller		
Cyril Ranque	Senior Vice President-Global Market Mana...		
Nikki Krishnamurthy	Chief People Officer		
Board Members		14	
The Coca-Cola Co.	Independent Director	50	Consumer Non-Durables
		38 MGT 13 BOARD	BEVERAGES: NON-ALCOHOLIC
IAC/InterActiveCorp.	Chairman	20	Technology Services
		10 MGT 11 BOARD	INTERNET SOFTWARE/SERVICES
The Diller-Von Furstenberg Family Foundation	President & Director	1	Miscellaneous
		1 MGT 1 BOARD	INVESTMENT TRUSTS/MUTUAL FU...
Superfoods Tour LLC	Director	1	Finance
		0 MGT 1 BOARD	FINANCIAL CONGLOMERATES
Thirteen/WNET	Director	3	-
		1 MGT 2 BOARD	
The Paley Center for Media	Director	20	-
		4 MGT 16 BOARD	

With over 25 million+ direct connections and 2.5+ billion mutual connections (friend of a friend), The FactSet Social Graph is a core component of FactSet's global knowledge graph that is helping to drive the next generation of CRM based analytics.

Unstructured Data

More and more asset managers are looking beyond traditional data sets in search of alpha-generating signals. In order to get an edge on the market and competitors, looking beyond structured data into the world of unstructured data is no longer an option, but a must for systematic and quantitative investors. FactSet is uniquely positioned as a collector and aggregator of both structured and unstructured data and has been working diligently to create structure in an unstructured world.

The entity centric data model FactSet has built over the past 40 years has brought to light insight into financial entities beyond just securities. This is important in unstructured data where often, the content or data is better suited to be tied to an entity than a security.

Take for example earnings call transcripts, which FactSet transcribes through the CallStreet service. During an earnings call, management from the company hosting the call speaks in regards to the firm's performance and sell side analysts from various brokerage firms have the opportunity to ask questions. FactSet has tagged not only the brokerages involved in the call but also each individual analyst with an entity ID from the Data Management Solutions database. These linkages allow users to easily track analysts across company calls or link the analysts from an unstructured earnings call, to more structured data such as analysts' estimates or price targets for a given company.

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Data Governance

As more information becomes available in the market, managing and organizing multiple sources of data has become a challenging process. Data silos introduce redundancies and inconsistencies that limit productivity and increase cost. Implementing an enterprise-wide smart data solution allows for increased efficiency and scalability while also providing flexibility.

FactSet's Data Management Solutions (DMS) packages expose consistent symbology that can be used to seamlessly integrate multiple content sources. DMS also provides an execution path to help break down data silos and aid in the creation of smart data sets. FactSet's symbology is a by-product of FactSet's data collection process, which ensures accuracy, consistency, and transparency.

Concordance

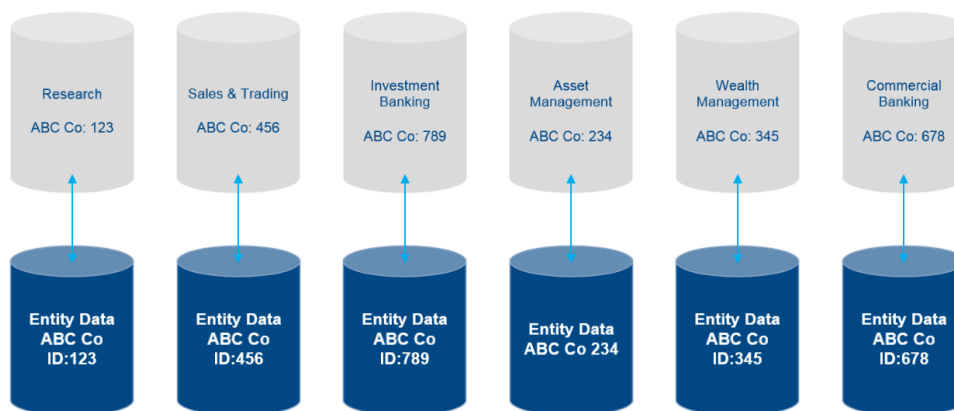
Financial clients globally are challenged to aggregate operational, financial, and third-party content at an enterprise level. Both entity-level and security-level resolution and integration are becoming increasingly strategic from a data governance and data management perspective.

FactSet provides dedicated third party and proprietary identifier mapping support and services, referred to as concordance. Superior entity resolution best practices will continue to yield smart datasets that can continue to extend alpha generation, reporting, and compliance at financial institutions globally.

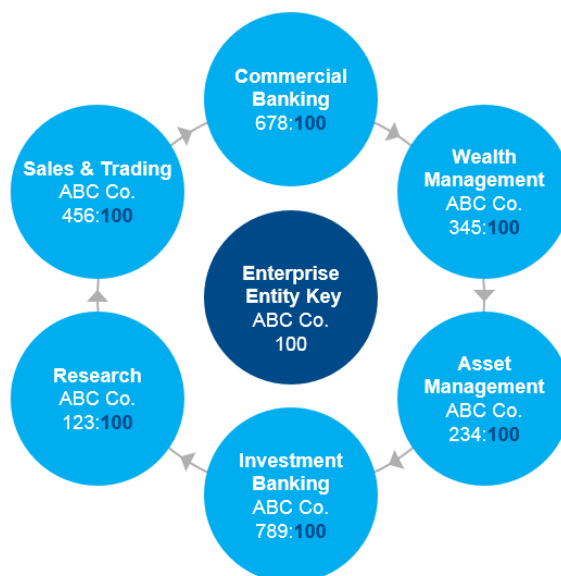
Link Data Silos and Integrate Content

FactSet's content model connects disparate sources of information by mapping many heterogeneous sources to a single entity identifier. This model provides the foundation to integrate and manage information while optimizing the organization of your firm's internal content assets and third-party data.

From siloed, disparate databases...



...to a centralized entity master with common symbology.



Disparate data silos can be consolidated into a master database that can be used across a firm to ensure consistency and timeliness. Data redundancies and discrepancies are eliminated, which leads to cleaner and more accurate data. FactSet's solution can be deployed across your firm, in the back, middle, and front office, to assist in the linking and aggregation of various content sources and satisfy the needs of multiple workflows.

This example presents a subset of instrument-level identifiers mapped to FactSet's entity-level Symbology for Honda. These mappings can be used to link various FactSet and third-party content sets.

FSYM_ID	TICKER_EXCHANGE	ISIN	SEDOL	SECURITY_NAME	FSYM_REGIONAL_ID	FSYM_SECURITY_ID	FACTSET_ISSUER_ENTITY_ID	ISSUER_LEI	ISSUER_PROPER_NAME
HIM6YWQ-L	HMC-ADF	US4381283088	2435279	Honda Motor Co., Ltd. Sponsored ADR	RGV9XD-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
HIMQ1CL-L	HMC-EDAR	US4381283088	2435279	Honda Motor Co., Ltd. Sponsored ADR	RGV9XD-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
BLND8Z-L	HMC-CHI	US4381283088	2435279	Honda Motor Co., Ltd. Sponsored ADR	RGV9XD-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
K1BMB7-L	HMC-EDGA	US4381283088	2435279	Honda Motor Co., Ltd. Sponsored ADR	RGV9XD-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
PM8Q9M-L	HMC-BATS	US4381283088	2435279	Honda Motor Co., Ltd. Sponsored ADR	RGV9XD-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
CBVRWP-L	HMC-BTSR	US4381283088	2435279	Honda Motor Co., Ltd. Sponsored ADR	RGV9XD-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
R3XDKC-L	HDMA-BER	US4381283088	B1HHYT7	Honda Motor Co., Ltd. Sponsored ADR	VDP49Z-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
PY36MZ-L	HDMA-DEU	US4381283088	B1HHYT7	Honda Motor Co., Ltd. Sponsored ADR	VDP49Z-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
Q15TLX-L	HDMA-FRA	US4381283088	B1HHYT7	Honda Motor Co., Ltd. Sponsored ADR	VDP49Z-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
PHG8RT-L	HDMA-TGAT	US4381283088	B1HHYT7	Honda Motor Co., Ltd. Sponsored ADR	VDP49Z-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
V74CBD-L	HDMA-STU	US4381283088	B1HHYT7	Honda Motor Co., Ltd. Sponsored ADR	VDP49Z-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
CX8FDD-L	HNDD-LON	US4381283088	B155MW1	Honda Motor Co., Ltd. Sponsored ADR	VZV9DH-R	X426Y7-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
JDP56Y-L	HOND-SWX	JP3854600008	B247ZM7	Honda Motor Co., Ltd.	MMF1VX-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
C477L-L	HDM-FRA	JP3854600008	5326273	Honda Motor Co., Ltd.	N6L6YF-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
HNSNC0-L	HDM-DEU	JP3854600008	5326273	Honda Motor Co., Ltd.	N6L6YF-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
TGGL85-L	HDM-DUS	JP3854600008	5326273	Honda Motor Co., Ltd.	N6L6YF-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
F9MJYV-L	HDM-HAM	JP3854600008	5326273	Honda Motor Co., Ltd.	N6L6YF-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
QH3L6N-L	HDM-TGAT	JP3854600008	5326273	Honda Motor Co., Ltd.	N6L6YF-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
M851CJ-L	HDM-STU	JP3854600008	5326273	Honda Motor Co., Ltd.	N6L6YF-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
FBMQF3-L	HDM-MUN	JP3854600008	5326273	Honda Motor Co., Ltd.	N6L6YF-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.
LW77ZC-L	HDM-BER	JP3854600008	5326273	Honda Motor Co., Ltd.	N6L6YF-R	XBVTLW-S	003JW8-E	549300P7ZYCQJ36CCS16	Honda Motor Co., Ltd.

Conclusion

There are many advantages to connecting, managing, and enabling the creation of a smart data network (i.e., Knowledge Graph). The ability to connect disparate datasets and support the connectivity of these datasets yields significant benefits, including lower cost of ownership, increased productivity, and long-term strategic value creation via enterprise innovation. FactSet's Data Management Solutions can provide the following benefits to your firm:

- Leverage FactSet as your data integration partner to fully optimize the integration of you internal and third-party content sets.
- Drive Alpha: Exploit data structure and connectivity to uncover actionable insights.
- Risk Aggregation: Leverage data connections to create summary views to more effectively manage security-level and counter-party risk
- Regulatory Reporting: Significantly reduce the costs associated with regulatory reporting requirements

FactSet has invested significant resources to develop this Knowledge Graph of connected content. What has been presented in this document is not a proof of concept or a collection of mocked-up sample data views. What has been shown in the whitepaper is smart datasets delivered directly from FactSet's production-level data environment. The transition of the primary key from security to entity is a relatively simple concept but requires focus and discipline to effectively execute. FactSet can be a valuable partner in enabling organizations to build out connected content to fully leverage emerging technologies and drive long-term competitiveness. The race to fully connect content is just beginning, and FactSet stands ready to meet the challenge. To request a meeting, e-mail sales@factset.com.