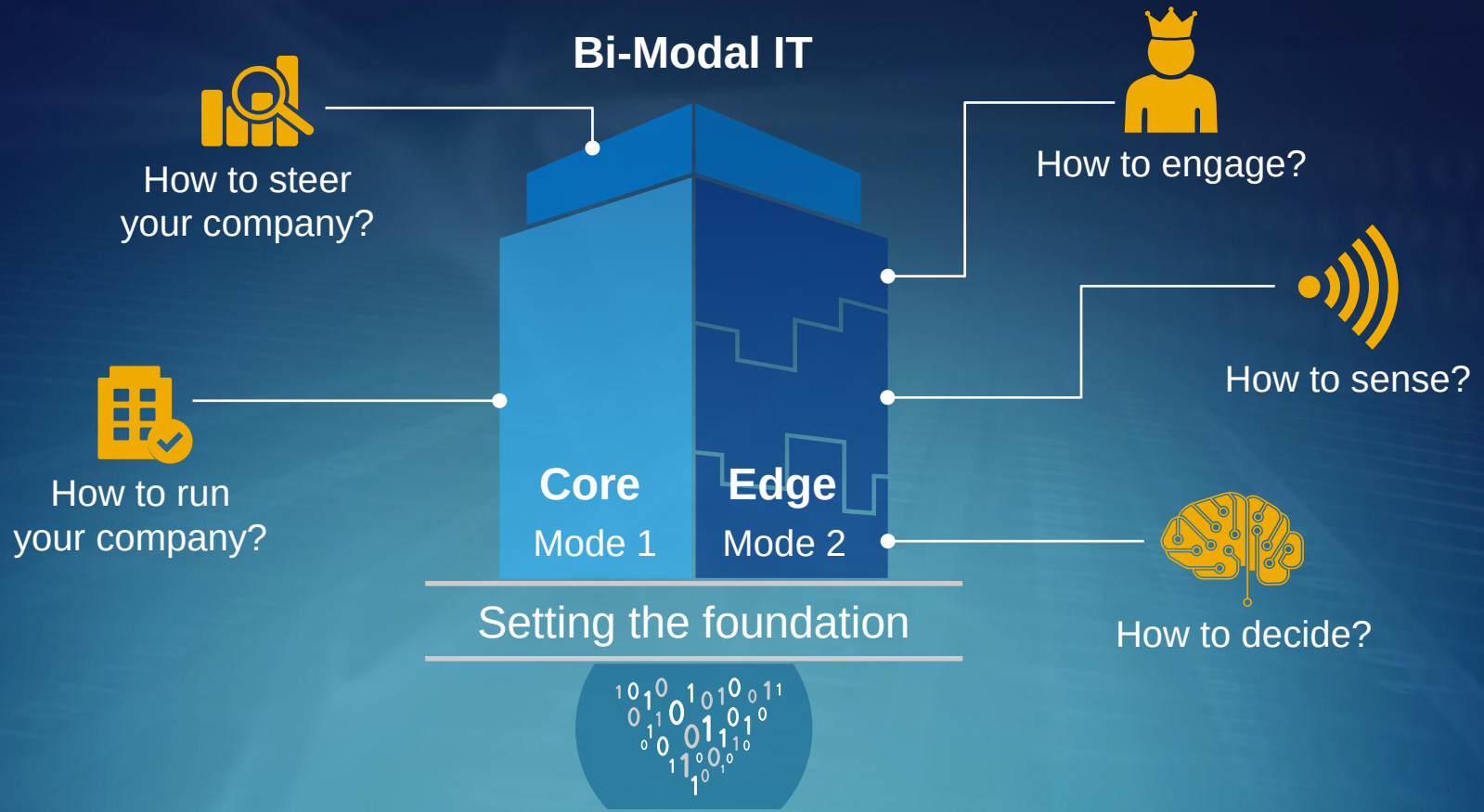
Acceleration, Innovation and Modernization using HANA as a Data Hub.

Anthony Antonello Vice President, SAP HANA COE Innovation to Value

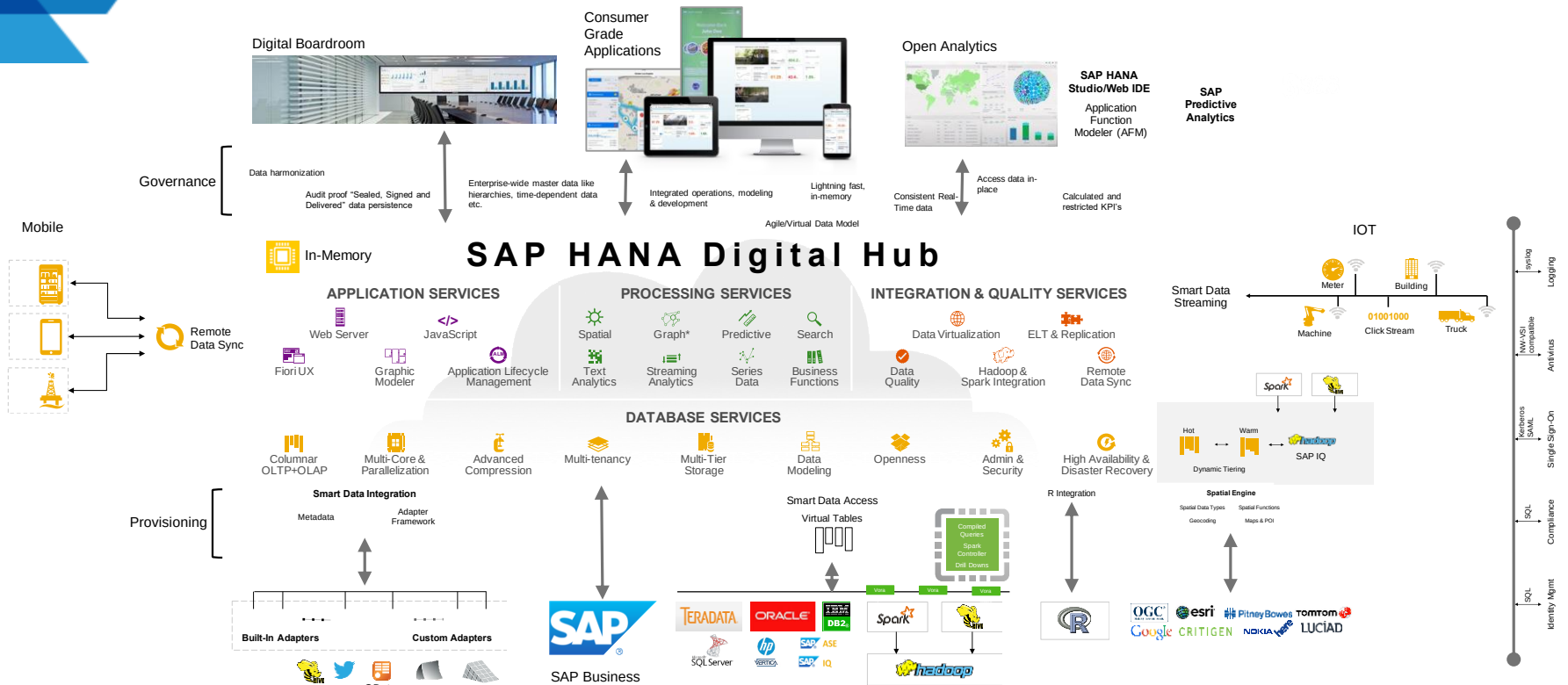
Modernize your core and innovate at the edge

http://www.gartner.com/it-glossary/bimodal/

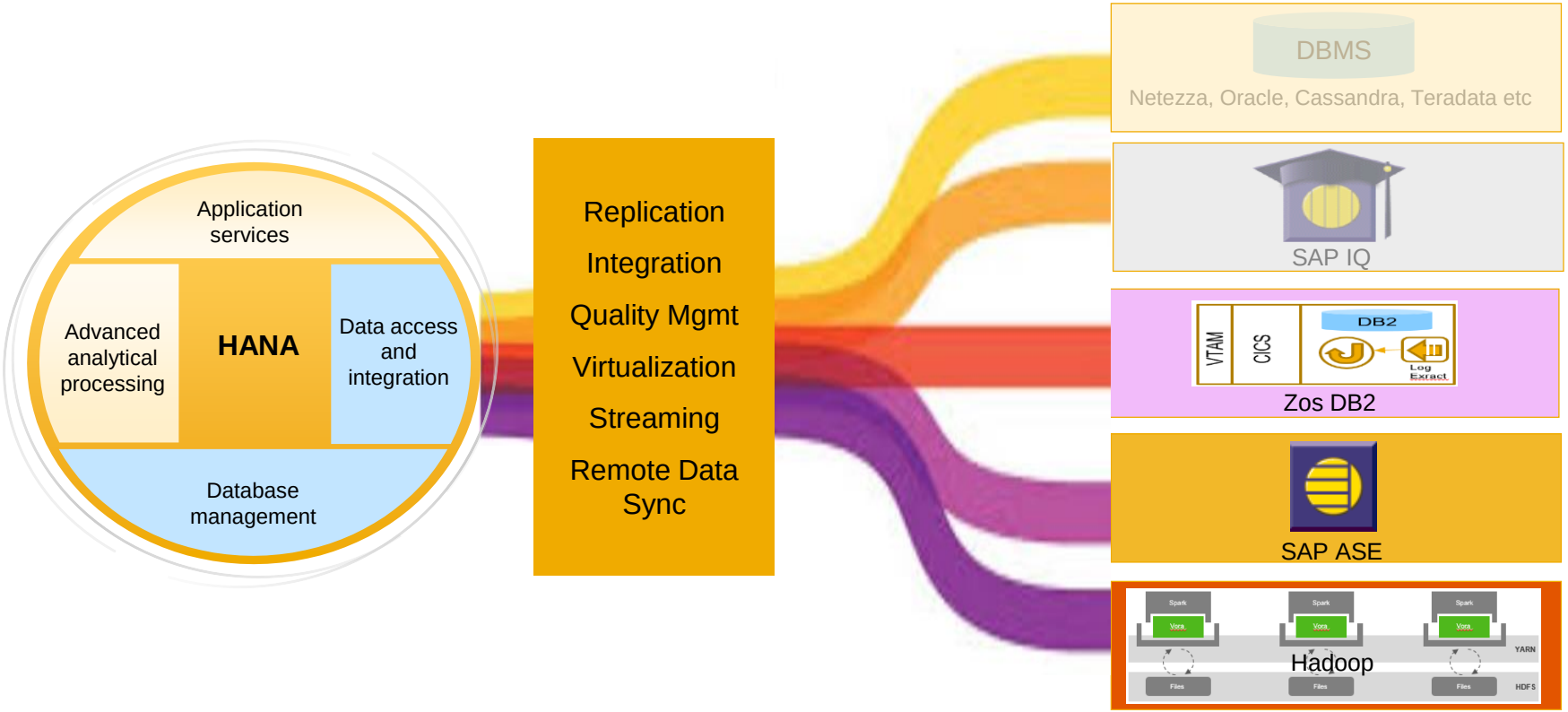


SAP HANA Data Hub

Providing a Business Data Model with Provisioning Services



Connect, Accelerate and Innovate



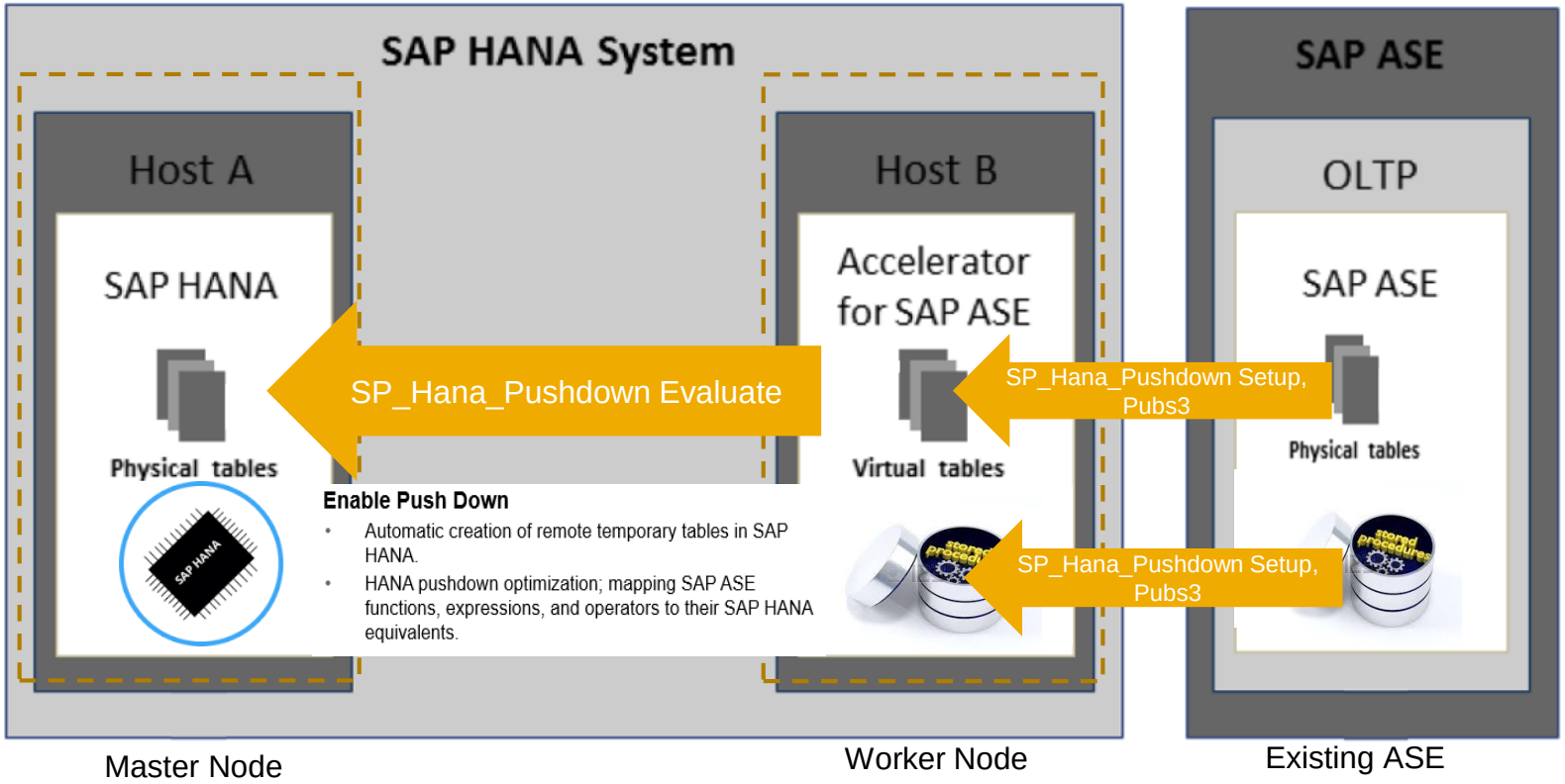
What is A4A? (Accelerator for ASE)

The SAP Accelerator for ASE provides native access to HANA for ASE TSQL queries and stored procedures. Transact-SQL queries and stored procedures are executed against a real-time replicated copy of ASE data managed in the HANA Accelerator instance.

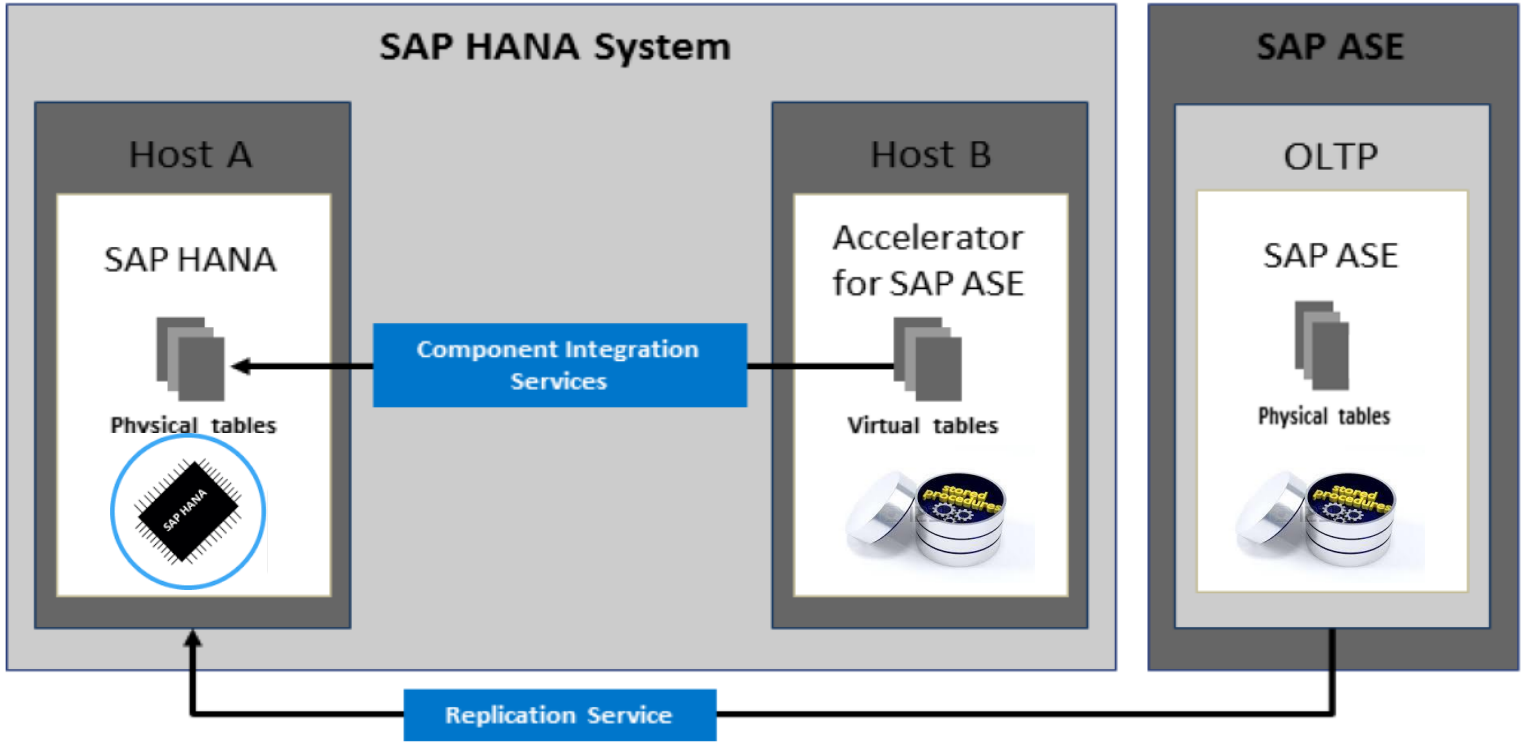
Benefits

1. Leverage Your Existing T-SQL Investment
2. Accelerate without Disruption
3. A New Innovative Platform
4. Extend use cases
5. Simplify
6. Innovate

Accelerator Overview



Accelerator Overview



Pushing TSQL to Hana

Execution in HANA

```
CREATE PROCEDURE dbo.TICK_QRY5 (@SIC_NAME VARCHAR(30)='COMPUTERS',
@FROM_DATE DATE='2005-11-14', @TO_DATE DATE='2005-11-14')
AS
BEGIN
```

```
CREATE TABLE #TS(
TRADING_SYMBOL     VARCHAR(15),
TRADESIZE          INTEGER)
```

CIS

```
CREATE LOCAL TEMPORARY TABLE A4A_DEMO."#TS_713965909"
(       TRADING_SYMBOL VARCHAR(15) NOT NULL,
        TRADESIZE INTEGER NOT NULL)
```

```
CREATE TABLE #TRADERANK(
RANKING            INTEGER IDENTITY,
TRADESIZE          INTEGER)
```

CIS

```
CREATE LOCAL TEMPORARY TABLE A4A_DEMO."#TRADERANK_729965966"
(       RANKING INTEGER NOT NULL,
        TRADESIZE INTEGER NOT NULL)
```

```
INSERT INTO #TS (TRADING_SYMBOL, TRADESIZE)
SELECT ST.TRADING_SYMBOL, SUM(TRADE_SIZE) AS TRADESIZE
-- DENSE_RANK() OVER (ORDER BY SUM(TRADE_SIZE) DESC) AS RANKING
FROM STOCK_TRADE ST
    INNER JOIN INSTRUMENT II
      ON II.INSTRUMENT_ID = ST.INSTRUMENT_ID
    INNER JOIN SCND_IDST_CLS SC
      ON II.SCND_IDST_CLS_ID = SC.SCND_IDST_CLS_ID
      AND SC.SIC_NAME = @SIC_NAME
WHERE  ST.TRADE_DATE BETWEEN @FROM_DATE AND @TO_DATE
GROUP BY ST.TRADING_SYMBOL
```

CIS

```
INSERT INTO A4A_DEMO."#TS_141824751" (TRADESIZE, TRADING_SYMBOL)
SELECT SUM(T2.TRADE_SIZE ) , T2.TRADING_SYMBOL
FROM A4A_DEMO.STOCK_TRADE T2,A4A_DEMO.INSTRUMENT T3,A4A_DEMO.SCND_IDST_CLS
T4
WHERE T2.TRADE_DATE  >= '2005-11-01' AND T2.TRADE_DATE  <= '2005-11-15' AND
T3.SCND_IDST_CLS_ID = T4.SCND_IDST_CLS_ID AND T4.SIC_NAME  = 'FINANCIAL' AND
T3.INSTRUMENT_ID = T2.INSTRUMENT_ID
GROUP BY T2.TRADING_SYMBOL
```

```
INSERT INTO #TRADERANK (TRADESIZE)
SELECT DISTINCT TRADESIZE
FROM #TS
ORDER BY TRADESIZE DESC
```

CIS

```
INSERT INTO A4A_DEMO."#TRADERANK_157824808" (TRADESIZE, RANKING)
SELECT  T3.*, A4A_DEMO.SEQ_#TRADERANK_157824808.NEXTVAL
FROM (SELECT DISTINCT T2.TRADESIZE  AS TRADESIZE
FROM A4A_DEMO."#TS_141824751" T2
ORDER BY 1 DESC )  T3
```

```
SELECT TS.TRADING_SYMBOL, TS.TRADESIZE, TR.RANKING
  FROM #TS TS
      INNER JOIN #TRADERANK TR
        ON TS.TRADESIZE = TR.TRADESIZE
ORDER BY RANKING ASC
```

CIS

```
SELECT T1.TRADING_SYMBOL , T1.TRADESIZE , T2.RANKING
FROM A4A_DEMO."#TS_141824751" T1, A4A_DEMO."#TRADERANK_157824808" T2
WHERE T1.TRADESIZE = T2.TRADESIZE  ORDER BY 3
```

```
DROP TABLE #TS
DROP TABLE #TRADERANK
```

CIS

```
DROP TABLE A4A_DEMO."#TS_713965909"
DROP TABLE A4A_DEMO."#TRADERANK_729965966"
```

```
END
go
```

Pushing TSQL to Hana

```
CREATE PROCEDURE dbo.TICK_QRY5 (@SIC_NAME VARCHAR(30)='COMPUTERS',
@FROM_DATE DATE='2005-11-14', @TO_DATE DATE='2005-11-14')
AS
BEGIN
   CREATE TABLE #TS(
   TRADING_SYMBOL     VARCHAR(15),
   TRADESIZE          INTEGER)

   CREATE TABLE #TRADERANK(
   RANKING            INTEGER IDENTITY,
   TRADESIZE          INTEGER)

   INSERT INTO #TS (TRADING_SYMBOL, TRADESIZE)
   SELECT ST.TRADING_SYMBOL, SUM(TRADE_SIZE) AS TRADESIZE
   -- DENSE_RANK() OVER (ORDER BY SUM(TRADE_SIZE) DESC) AS RANKING
   FROM STOCK_TRADE ST
      INNER JOIN INSTRUMENT II
        ON II.INSTRUMENT_ID = ST.INSTRUMENT_ID
      INNER JOIN SCND_IDST_CLS SC
        ON II.SCND_IDST_CLS_ID = SC.SCND_IDST_CLS_ID
        AND SC.SIC_NAME = @SIC_NAME
   WHERE  ST.TRADE_DATE BETWEEN @FROM_DATE AND @TO_DATE
   GROUP BY ST.TRADING_SYMBOL

   INSERT INTO #TRADERANK (TRADESIZE)
   SELECT DISTINCT TRADESIZE
   FROM #TS
   ORDER BY TRADESIZE DESC

   SELECT TS.TRADING_SYMBOL, TS.TRADESIZE, TR.RANKING
     FROM #TS TS
        INNER JOIN #TRADERANK TR
          ON TS.TRADESIZE = TR.TRADESIZE
   ORDER BY RANKING ASC

   DROP TABLE #TS
   DROP TABLE #TRADERANK
END
go
```

Creation of temp table
In HANA

Invoke temp table
In HANA

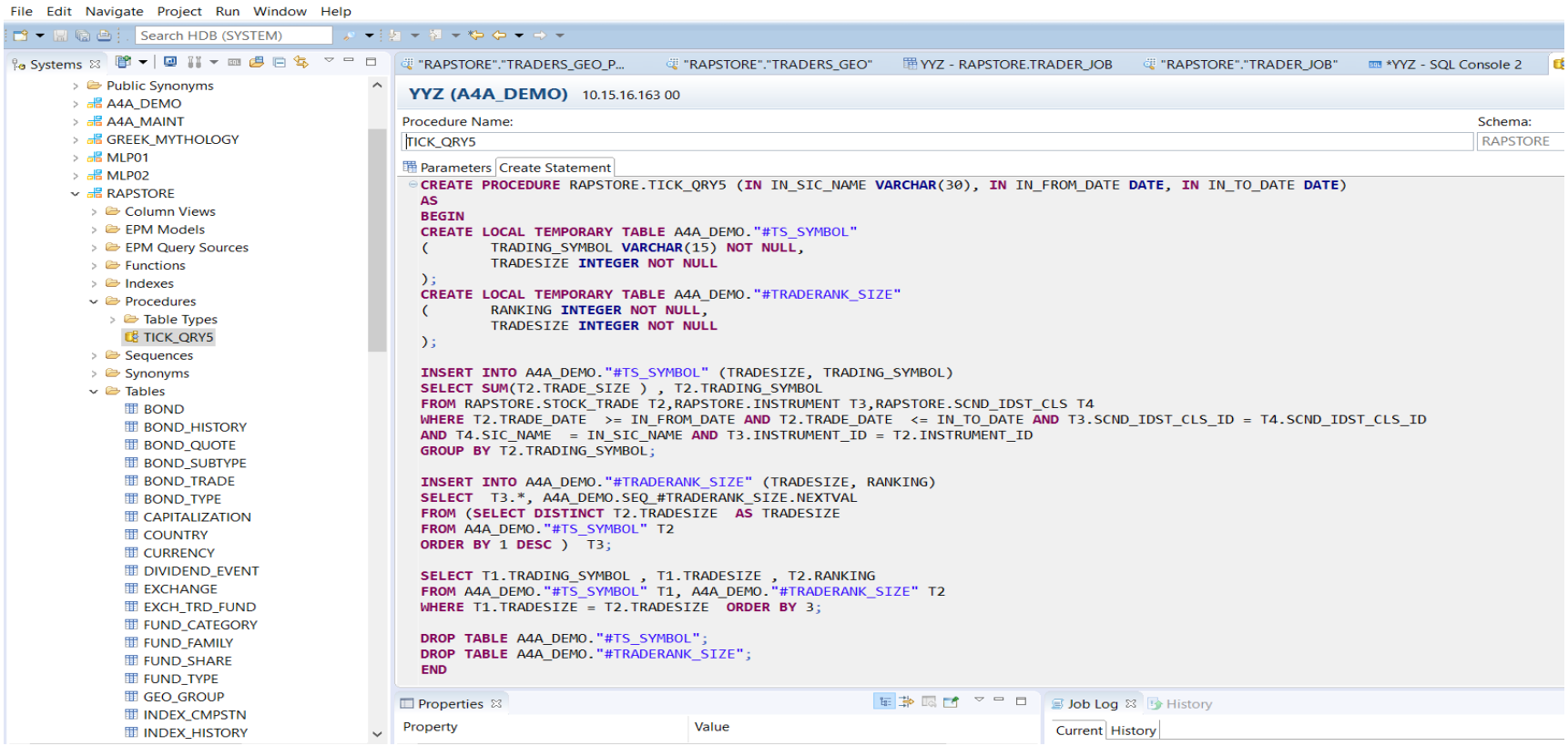
Invokef temp table
In HANA

Drop of temp table
In HANA

Execution in HANA

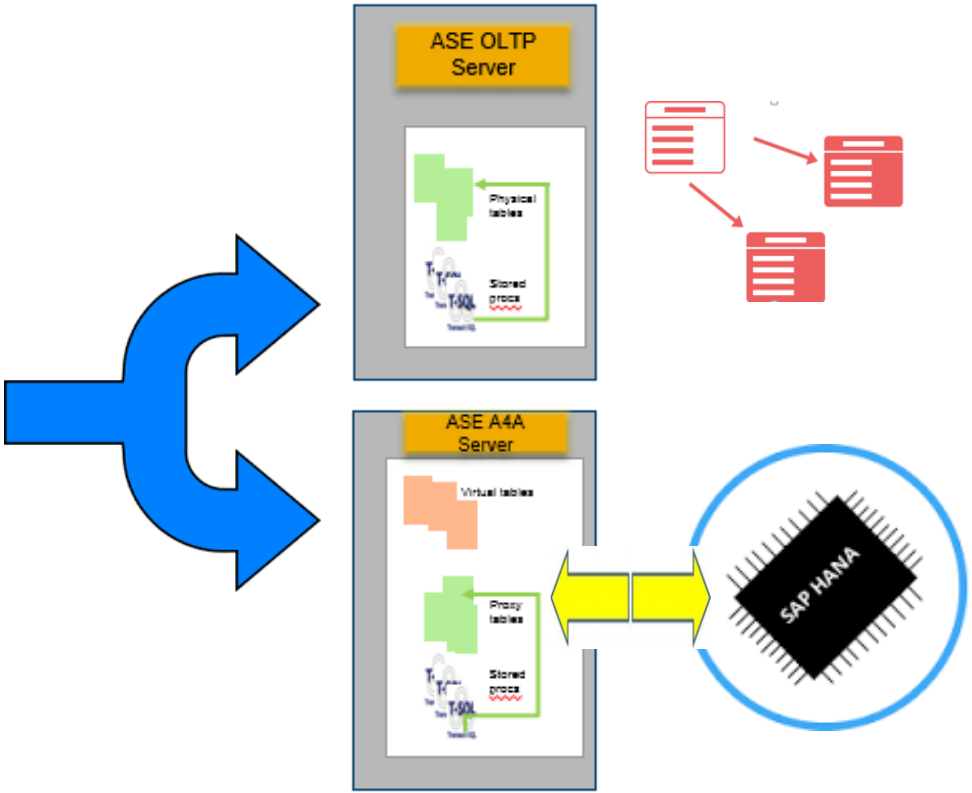
```
CREATE LOCAL TEMPORARY TABLE A4A_DEMO."#TS_713965909"
(      TRADING_SYMBOL VARCHAR(15) NOT NULL,
       TRADESIZE INTEGER NOT NULL)

CREATE LOCAL TEMPORARY TABLE A4A_DEMO."#TRADERANK_729965966"
(      RANKING INTEGER NOT NULL,
       TRADESIZE INTEGER NOT NULL)

INSERT INTO A4A_DEMO."#TS_141824751" (TRADESIZE, TRADING_SYMBOL)
SELECT SUM(T2.TRADE_SIZE ) , T2.TRADING_SYMBOL
FROM A4A_DEMO.STOCK_TRADE T2,A4A_DEMO.INSTRUMENT T3,A4A_DEMO.SCND_IDST_CLS
T4
WHERE T2.TRADE_DATE  >= '2005-11-01' AND T2.TRADE_DATE  <= '2005-11-15' AND
T3.SCND_IDST_CLS_ID = T4.SCND_IDST_CLS_ID AND T4.SIC_NAME  = 'FINANCIAL' AND
T3.INSTRUMENT_ID = T2.INSTRUMENT_ID
GROUP BY T2.TRADING_SYMBOL

INSERT INTO A4A_DEMO."#TRADERANK_157824808" (TRADESIZE, RANKING)
SELECT  T3.*, A4A_DEMO.SEQ_#TRADERANK_157824808.NEXTVAL
FROM (SELECT DISTINCT T2.TRADESIZE  AS TRADESIZE
FROM A4A_DEMO."#TS_141824751" T2
ORDER BY 1 DESC )  T3

SELECT T1.TRADING_SYMBOL , T1.TRADESIZE , T2.RANKING
FROM A4A_DEMO."#TS_141824751" T1, A4A_DEMO."#TRADERANK_157824808" T2
WHERE T1.TRADESIZE = T2.TRADESIZE  ORDER BY 3

DROP TABLE A4A_DEMO."#TS_713965909"
DROP TABLE A4A_DEMO."#TRADERANK_729965966"
```

From Hana SQL to HANA SQL Script Stored Procedure



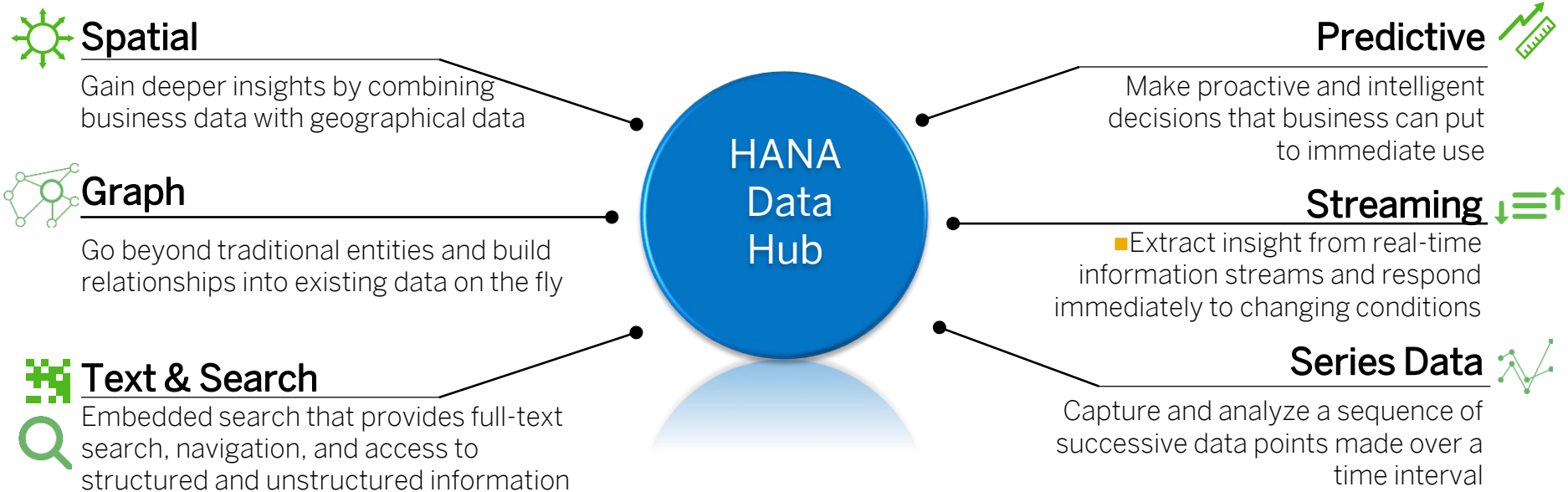
DEMO TSQL Acceleration using HANA Accelerator for ASE

```
CREATE PROCEDURE dbo.TICK_QRY5 (@SIC_NAME VARCHAR(30)='COMPUTERS',
@FROM_DATE DATE='2005-11-14', @TO_DATE DATE='2005-11-14')
AS
BEGIN
   CREATE TABLE #TS(
   TRADING_SYMBOL     VARCHAR(15),
   TRADESIZE          INTEGER)

   CREATE TABLE #TRADERANK(
   RANKING            INTEGER IDENTITY,
   TRADESIZE          INTEGER)

   INSERT INTO #TS (TRADING_SYMBOL, TRADESIZE)
   SELECT ST.TRADING_SYMBOL, SUM(TRADE_SIZE) AS TRADESIZE
   -- DENSE_RANK() OVER (ORDER BY SUM(TRADE_SIZE) DESC) AS RANKING
   FROM STOCK_TRADE ST
       INNER JOIN INSTRUMENT II
          ON II.INSTRUMENT_ID = ST.INSTRUMENT_ID
       INNER JOIN SCND_IDST_CLS SC
          ON II.SCND_IDST_CLS_ID = SC.SCND_IDST_CLS_ID
          AND SC.SIC_NAME = @SIC_NAME
   WHERE  ST.TRADE_DATE BETWEEN @FROM_DATE AND @TO_DATE
   GROUP BY ST.TRADING_SYMBOL

   INSERT INTO #TRADERANK (TRADESIZE)
   SELECT DISTINCT TRADESIZE
   FROM #TS
   ORDER BY TRADESIZE DESC

   SELECT TS.TRADING_SYMBOL, TS.TRADESIZE, TR.RANKING
    FROM #TS TS
        INNER JOIN #TRADERANK TR
           ON TS.TRADESIZE = TR.TRADESIZE
   ORDER BY RANKING ASC

   DROP TABLE #TS
   DROP TABLE #TRADERANK
END
```



Once Data is a part of the HANA Data Hub

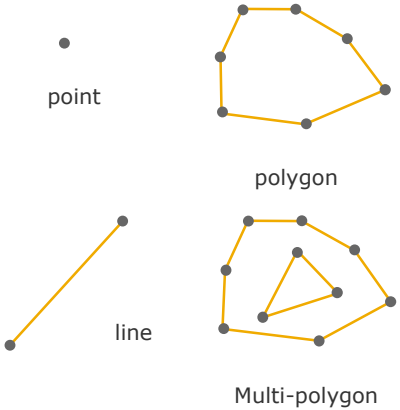
One platform for all advanced data needs

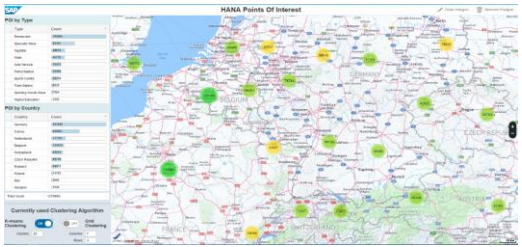


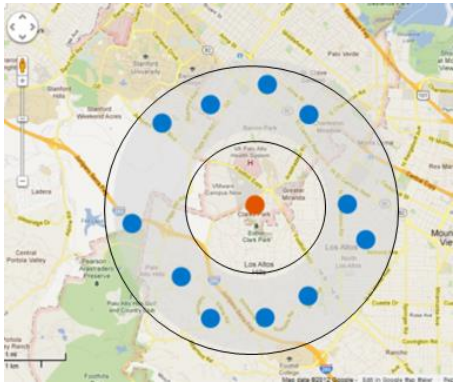
Innovation with Multi-Modal Development –Geospatial

Spatial data describes the position, shape, and orientation of objects in a defined space.

Spatial







1. Provides the ability to answer an entirely new set of business questions with an additional location dimension
2. Goes beyond just postal/zip codes for precise location intelligence
3. Processes spatial data types and business data rapidly to deliver results to applications and BI tools in the form of maps, reports and charts
4. GIS (Geospatial Information Systems) are becoming more common in most organizations and industries. The benefits include:
   - Cost Savings and Increased Efficiency
   - Better Decision Making
   - Improved Communication
   - Better Record Keeping
   - Managing Geographically

Innovation with Multi-Modal Development –Geospatial

Spatial data describes the position, shape, and orientation of objects in a defined space.

Trader Address (from Source)

TRADERNO	STREET	CITY	STATE	ZIP
1,904	5 Williams St	Johnston	RI	2919
3,054	37855 Nolan Rd	Bangor	ME	4401
630	34 Saint George Ave #2	Bangor	ME	4401
1,033	46314 Route 130	Bridgeport	CT	6610
4,223	49440 Dearborn St	Norwalk	CT	6854
2,052	4 Cowesett Ave	Kearny	NJ	7032
209	4 Stovall St #72	Union City	NJ	7087
4,874	4671 Alemany Blvd	Jersey City	NJ	7304
3,193	8 Sheridan Rd	Jersey City	NJ	7304
1,465	2726 Charcot Ave	Paterson	NJ	7501

=

Zip Code Master (from US Postal Service)

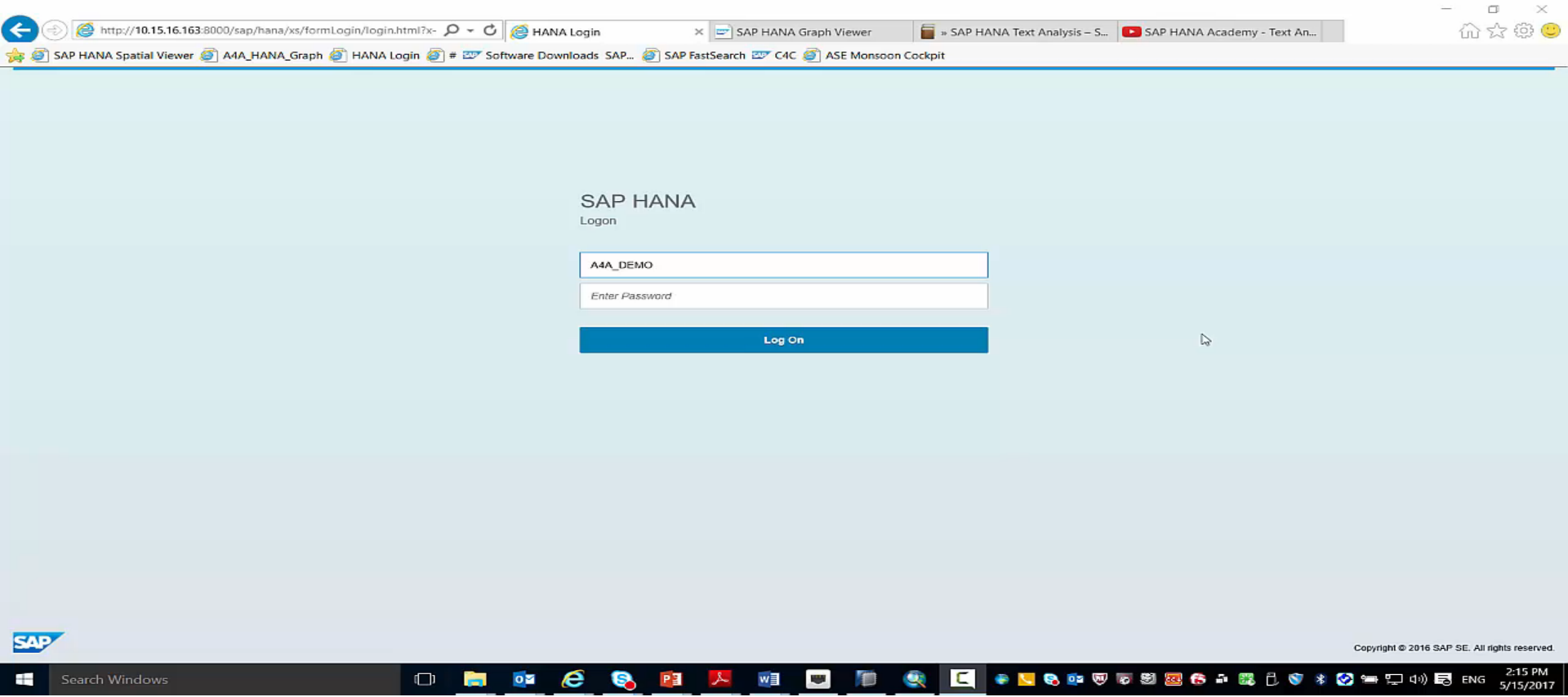
ZIP	XLAT	YLONG
70522	29.76	-91.42
70643	29.76	-92.97
77001	29.76	-95.38
77002	29.76	-95.38
77003	29.76	-95.38
77004	29.76	-95.38
77005	29.76	-9[illegible]

Hana generated view containing spatial point geometry from latitude and longitude data

Trader Spatial data type ST_POINT generated by HANA

	TRADERNO	XY_POINT4326	XY_POINT4326.ST_ASEWKT()
1	1,904	0101000000000000018AEE74440000000A470DD51C0	SRID=4326;POINT (41.8[illegible]004196167 -71.46000003814697)
2	3,054	01010000000000000703D6A464000000084EB3151C0	SRID=4326;POINT [illegible]4.829999923706055 -68.77999973297119)
3	630	01010000000000000703D6A464000000084EB3151C0	SRID=4326;POINT (44.829999923706055 -68.77999973297119)
4	1,033	0101000000000000400A974440000000F4284C52C0	SRID=4326;POINT (41.18000030517578 -73.1899995803833)
5	4,223	0101000000000000020858B444000000048E15A52C0	SRID=4326;POINT (41.09000015258789 -73.42000007629395)
6	2,052	010100000000000000006044400000003C0A8752C0	SRID=4326;POINT (40.75 -74.10999965667725)
7	209	0101000000000000B04761444000000084EB8152C0	SRID=4326;POINT (40.760000228881836 -74.02999973297119)
8	4,874	01010000000000048E15A44400000000CD78352C0	SRID=4326;POINT (40.71000003814697 -74.0600004196167)
9	3,193	01010000000000048E15A44400000000CD78352C0	SRID=4326;POINT (40.71000003814697 -74.0600004196167)

Innovation with Multi-Modal Development -Geospatial



Innovation with Multi-Modal Development – Time Series

```
CREATE COLUMN TABLE "RAPSTORE"."STOCK_TRADE"
("INSTRUMENT_ID" INTEGER NOT NULL ,
    "TRADE_DATE" DATE NOT NULL ,
    "TRADE_SEQ_NBR" INTEGER NOT NULL ,
    "TRADING_SYMBOL" VARCHAR(15) NOT NULL ,
    "TRADE_TIME" LONGDATE,
    "TRADE_PRICE" DECIMAL(18, 4),
    "TRADE_SIZE" INTEGER,
    PRIMARY KEY INVERTED VALUE ("TRADE_DATE",
    "TRADE_SEQ_NBR",
    "INSTRUMENT_ID",
    "TRADING_SYMBOL"))
```

Accelerating and Extending TSQL with A4A

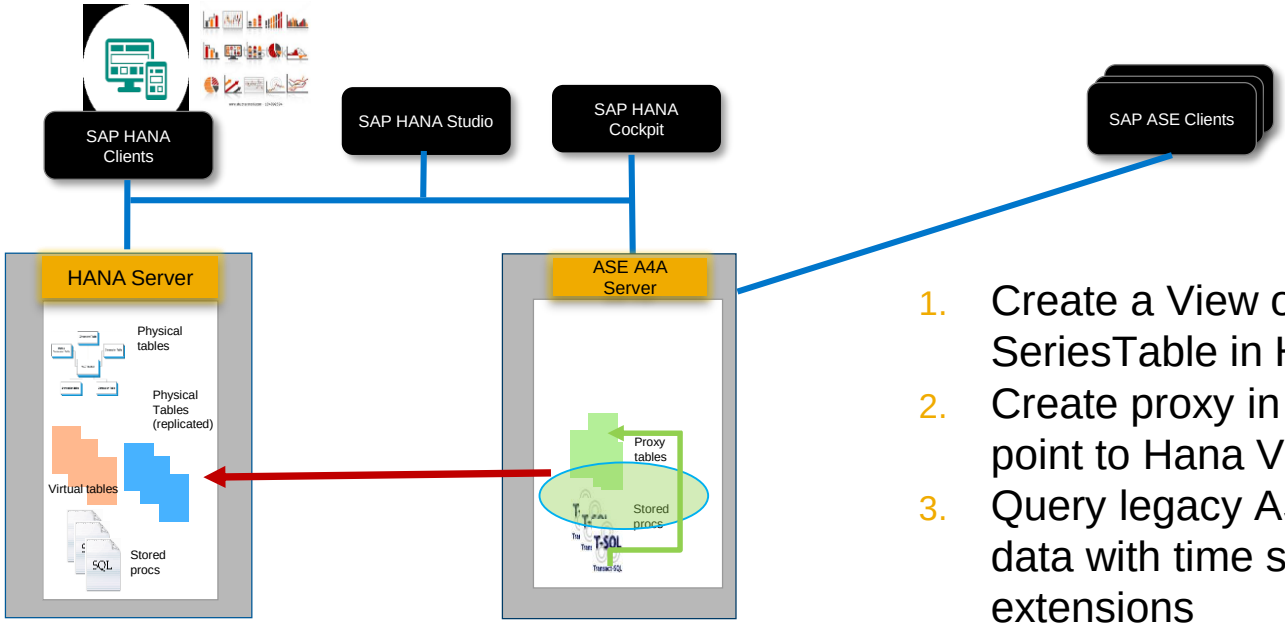
```
CREATE COLUMN TABLE "RAPSTORE"."STOCK_TRADE"
("INSTRUMENT_ID" INTEGER NOT NULL ,
      "TRADE_DATE" DATE NOT NULL ,
      "TRADE_SEQ_NBR" INTEGER NOT NULL ,
      "TRADING_SYMBOL" VARCHAR(15) NOT NULL ,
      "TRADE_TIME" LONGDATE,
      "TRADE_PRICE" DECIMAL(18, 4),
      "TRADE_SIZE" INTEGER,
      PRIMARY KEY INVERTED VALUE ("TRADE_DATE",
      "TRADE_SEQ_NBR",
      "INSTRUMENT_ID",
      "TRADING_SYMBOL"))
SERIES ( SERIES KEY ("TRADING_SYMBOL")
PERIOD FOR SERIES("TRADE_TIME") NOT EQUIDISTANT
MINVALUE '2016-05-03' MAXVALUE '2018-01-01' )
```

Extending SQL Through HANA Time Series

Create HANA Calc View on Time Series enabled table

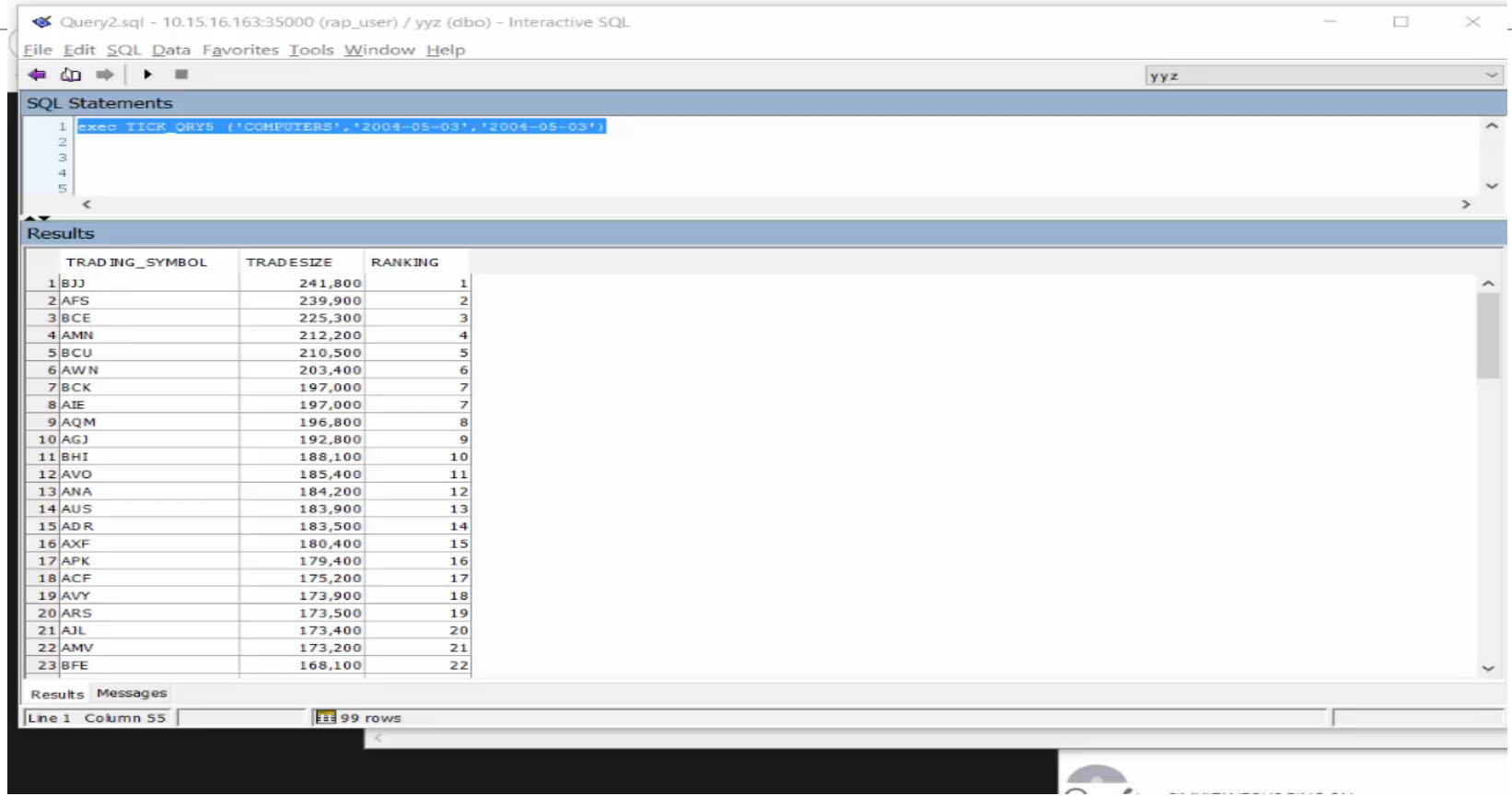
```
CREATE CALCULATION SCENARIO "_SYS_BIC"."a4a/STOCK_TRADE_HOURLY" USING '[{"__CalculationNode__": true,"name": "STOCK_TRADE_SERIES","operation": {"__TableDSNodeData__":
true,"source": "RAPSTORE:STOCK_TRADE_SERIES","dataSourceFlags": 0},"attributeVec": [{"__Attribute__": true,"name": "INSTRUMENT_ID","role": 1,"datatype": {"__DataType__":
true,"type": 73,"sqlType": 42,"sqlLength": 4},"attributeType": 0},{"__Attribute__": true,"name": "TRADE_DATE","role": 1,"datatype": {"__DataType__": true,"type": 101,"sqlType":
63,"sqlLength": 4},"attributeType": 0},{"__Attribute__": true,"name": "TRADE_SEQ_NBR","role": 1,"datatype": {"__DataType__": true,"type": 73,"sqlType": 42,"sqlLength":
4},"attributeType": 0},{"__Attribute__": true,"name": "TRADING_SYMBOL","role": 1,"datatype": {"__DataType__": true,"type": 83,"sqlType": 36,"sqlLength": 15},"attributeType":
0},{"__Attribute__": true,"name": "TRADE_TIME","role": 1,"datatype": {"__DataType__": true,"type": 64,"sqlType": 61,"sqlLength": 8},"attributeType": 0},{"__Attribute__":
true,"name": "TRADE_PRICE","role": 1,"datatype": {"__DataType__": true,"type": 66,"length": 18,"scale": 4,"sqlType": 34,"sqlLength": 18},"attributeType": 0},{"__Attribute__":
true,"name": "TRADE_SIZE","role": 1,"datatype": {"__DataType__": true,"type": 73,"sqlType": 3,"sqlLength": 5},"attributeType": 0}]},{"__CalculationNode__": true,"name":
"Projection_1","inputVec": [{"__Input__": true,"name": "STOCK_TRADE_SERIES","mappingVec": [{"__Mapping__": true,"type": 1,"target": "INSTRUMENT_ID","source":
"INSTRUMENT_ID","length": 0},{"__Mapping__": true,"type": 1,"target": "TRADING_SYMBOL","source": "TRADING_SYMBOL","length": 0},{"__Mapping__": true,"type": 1,"target":
"TRADE_TIME","source": "TRADE_TIME","length": 0},{"__Mapping__": true,"type": 1,"target": "TRADE_PRICE","source": "TRADE_PRICE","length": 0},{"__Mapping__": true,"type":
1,"target": "TRADE_SIZE","source": "TRADE_SIZE","length": 0}]}],"operation": {"__ProjectionOpNodeData__": true},"attributeVec": [{"__Attribute__": true,"name":
"INSTRUMENT_ID","role": 1,"datatype": {"__DataType__": true,"type": 73,"sqlType": 42,"sqlLength": 4},"attributeType": 0},{"__Attribute__": true,"name": "TRADING_SYMBOL","role":
1,"datatype": {"__DataType__": true,"type": 83,"sqlType": 36,"sqlLength": 15},"attributeType": 0},{"__Attribute__": true,"name": "TRADE_TIME","role": 1,"datatype":
{"__DataType__": true,"type": 64,"sqlType": 61,"sqlLength": 8},"attributeType": 0},{"__Attribute__": true,"name": "TRADE_PRICE","role": 1,"datatype": {"__DataType__":
true,"type": 66,"length": 18,"scale": 4,"sqlType": 34,"sqlLength": 18},"attributeType": 0},{"__Attribute__": true,"name": "TRADE_SIZE","role": 1,"datatype": {"__DataType__":
true,"type": 73,"sqlType": 3,"sqlLength": 5},"attributeType": 0},{"__Attribute__": true,"name": "HOURLY_TRADE_TIME","role": 1,"datatype": {"__DataType__": true,"type":
64},"attributeType": 1,"expression": "longdate(series_round(\"TRADE_TIME\",''INTERVAL 1 HOUR''))"}],"debugNodeDataInfo" :  {"__DebugNodeDataInfo__": true,"nodeName":
"Projection_1"}},{"__CalculationNode__": true,"name": "finalAggregation","isDefaultNode": true,"inputVec": [{"__Input__": true,"name": "Projection_1","mappingVec":
[{"__Mapping__": true,"type": 1,"target": "TRADING_SYMBOL","source": "TRADING_SYMBOL","length": 0},{"__Mapping__": true,"type": 1,"target": "HOURLY_TRADE_TIME","source":
"HOURLY_TRADE_TIME","length": 0},{"__Mapping__": true,"type": 1,"target": "MAX_TRADE_PRICE","source": "TRADE_PRICE","length": 0},{"__Mapping__": true,"type": 1,"target":
"MIN_TRADE_PRICE","source": "TRADE_PRICE","length": 0},{"__Mapping__": true,"type": 1,"target": "AVG_TRADE_PRICE","source": "TRADE_PRICE","length": 0},{"__Mapping__":
true,"type": 1,"target": "MAX_TRADE_SIZE","source": "TRADE_SIZE","length": 0},{"__Mapping__": true,"type": 1,"target": "MIN_TRADE_SIZE","source": "TRADE_SIZE","length":
0},{"__Mapping__": true,"type": 1,"target": "AVG_TRADE_SIZE","source": "TRADE_SIZE","length": 0}]}],"operation": {"__AggregationOpNodeData__": true},"attributeVec":
[{"__Attribute__": true,"name": "TRADING_SYMBOL","role": 1,"datatype": {"__DataType__": true,"type": 83,"sqlType": 36,"sqlLength": 15},"description":
"TRADING_SYMBOL","attributeType": 0},{"__Attribute__": true,"name": "HOURLY_TRADE_TIME","role": 1,"datatype": {"__DataType__": true,"type": 64},"description":
"HOURLY_TRADE_TIME","attributeType": 0},{"__Attribute__": true,"name": "MAX_TRADE_PRICE","role": 2,"datatype": {"__DataType__": true,"type": 66,"length": 18,"scale":
4,"sqlType": 34,"sqlLength": 18},"description": "MAX_TRADE_PRICE","kfAggregationType": 8,"attributeType": 0},{"__Attribute__": true,"name": "MIN_TRADE_PRICE","role":
2,"datatype": {"__DataType__": true,"type": 66,"length": 18,"scale": 4,"sqlType": 34,"sqlLength": 18},"description": "MIN_TRADE_PRICE","kfAggregationType": 4,"attributeType":
0},{"__Attribute__": true,"name": "AVG_TRADE_PRICE","role": 2,"datatype": {"__DataType__": true,"type": 66,"length": 18,"scale": 4,"sqlType": 34,"sqlLength": 18},"description":
"AVG_TRADE_PRICE","kfAggregationType": 16,"attributeType": 0},{"__Attribute__": true,"name": "MAX_TRADE_SIZE","role": 2,"datatype": {"__DataType__": true,"type": 73,"sqlType":
3,"sqlLength": 5},"description": "MAX_TRADE_SIZE","kfAggregationType": 8,"attributeType": 0},{"__Attribute__": true,"name": "MIN_TRADE_SIZE","role": 2,"datatype":
{"__DataType__": true,"type": 73,"sqlType": 3,"sqlLength": 5},"description": "MIN_TRADE_SIZE","kfAggregationType": 4,"attributeType": 0},{"__Attribute__": true,"name":
"AVG_TRADE_SIZE","role": 2,"datatype": {"__DataType__": true,"type": 66,"length": 16,"scale": 6},"description": "AVG_TRADE_SIZE","kfAggregationType": 16,"attributeType":
0},{"__Attribute__": true,"name": "row.count","role": 2,"datatype": {"__DataType__": true,"type": 66,"length": 18},"isVisible": false,"kfAggregationType": 2,"attributeType":
4,"specialAttrType": 4}],"debugNodeDataInfo" :  {"__DebugNodeDataInfo__": true,"nodeName": "Aggregation"}},{"__Variable__": true,"name": "$$language$$","typeMask": 512,"usage":
0,"isGlobal": true},{"__Variable__": true,"name": "$$client$$","typeMask": 512,"usage": 0,"isGlobal": true},{"__CalcScenarioMetaData__": true,"externalScenarioName":
"a4a::STOCK_TRADE_HOURLY"}]'
;
CREATE COLUMN VIEW "_SYS_BIC"."a4a/STOCK_TRADE_HOURLY" WITH PARAMETERS (indexType=11,
 'PARENTCALCINDEXSCHEMA'='_SYS_BIC',
'PARENTCALCINDEX'='a4a/STOCK_TRADE_HOURLY',
'PARENTCALCNODE'='finalAggregation')
```

Accelerating and Extending TSQL with A4A

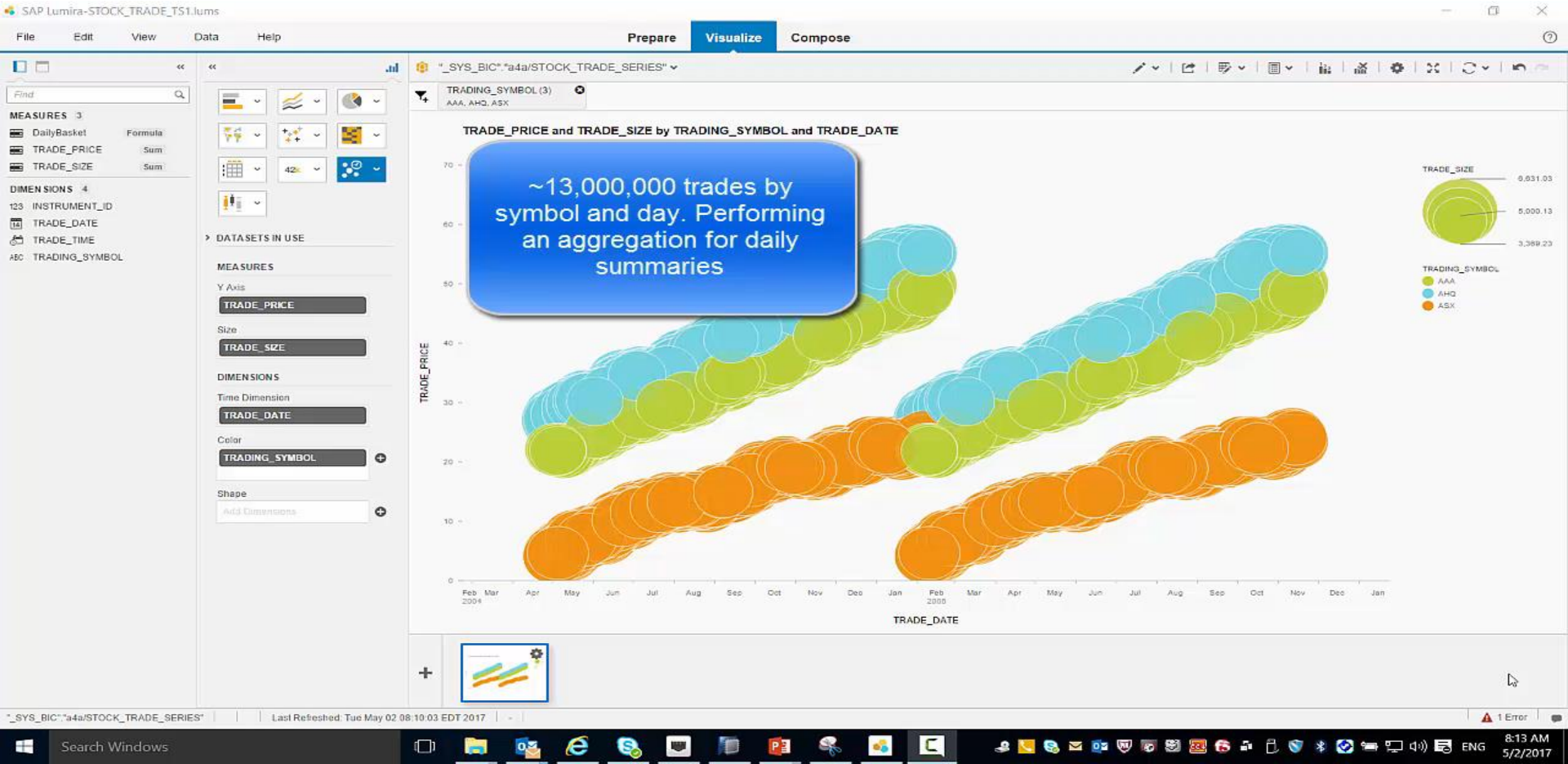


1. Create a View of Time SeriesTable in Hana
2. Create proxy in ASE to point to Hana View
3. Query legacy ASE OLTP data with time series SQL extensions

Innovation with Multi-Modal Development

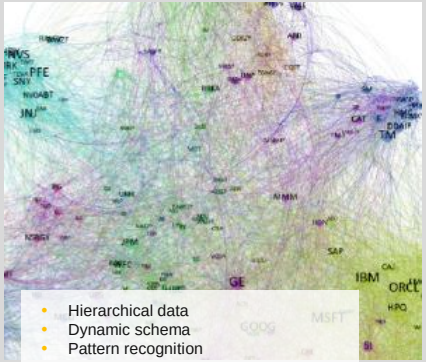


Innovation with Multi-Modal Development

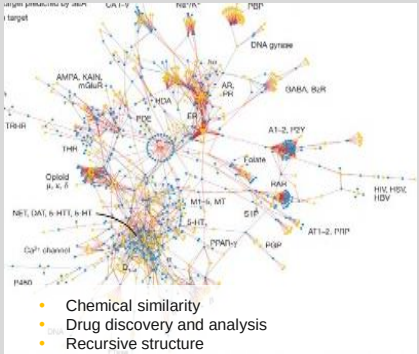


Innovation with Multi-Modal Development - Graph

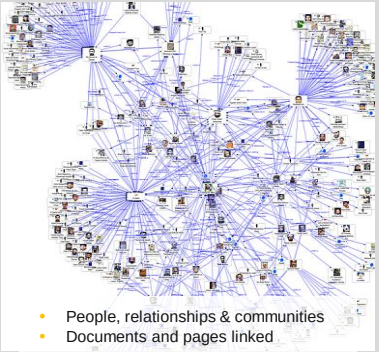
Graph



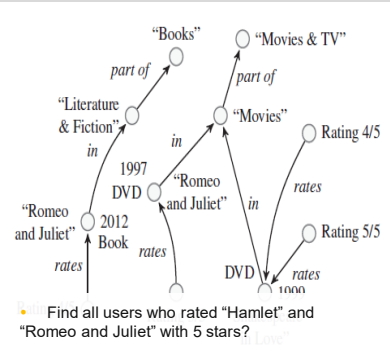
Enterprise Data



Chemical & Biological



Social Networks & the Web



Catalogs, product recommendation engines

1. Provides the ability to find hidden answers to an entirely new set of business questions which otherwise was not possible before

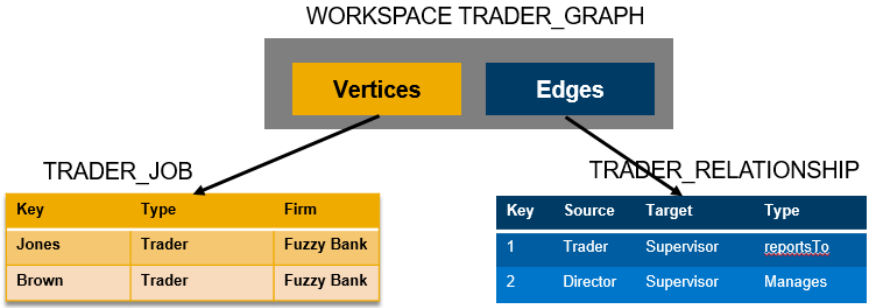
2. Goes beyond traditional entities and builds relationships into existing data on the fly

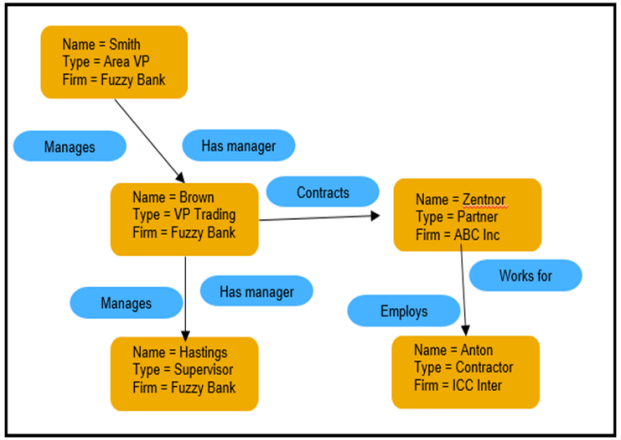
3. Finds interconnected data much faster using scalable traversal method without requiring huge table joins in relational database systems

4. With ever growing massively connected data businesses requires easy way to find relationships for building next level business operations
   - Takes advantage of in-memory
   - Complements existing reporting capabilities
   - No need for separate data repositories
   - Proven technology and used by existing SAP solutions

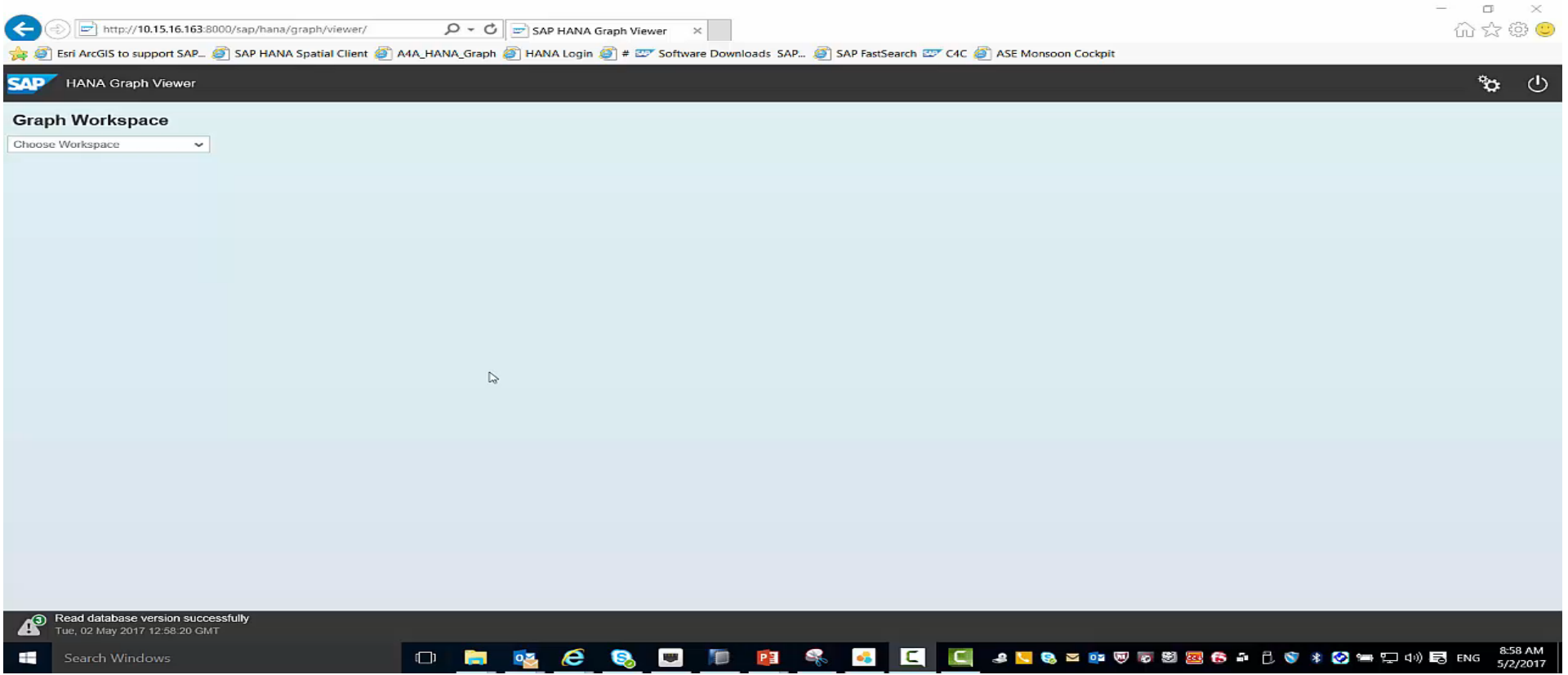
Innovation with Multi-Modal Development – Graph Algorithms

```
CREATE GRAPH WORKSPACE "RAPSTORE"."TRADER_GRAPH"
        EDGE TABLE "RAPSTORE"."TRADER_RELATIONSHIP"
                SOURCE COLUMN "SOURCE_TITLE"
                TARGET COLUMN "TARGET_TITLE"
                KEY COLUMN "KEY"
        VERTEX TABLE "RAPSTORE"."TRADER_JOB"
                KEY COLUMN "JOBTITLE";
```



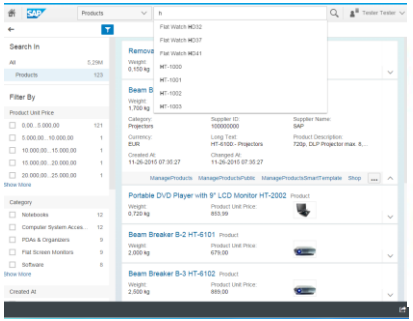


Innovation with Multi-Modal Development -Graph



Innovation with Multi-Modal Development – Text Search, Analysis and Mining

Text Analytics



Intuitive Search via Fiori

Document Mining and Extraction

Multi-language support

Immediate Analysis via Analytics

1. A powerful search solution that provides full-text search and navigation across multiple sources

2. All data – structured and unstructured in a single high-performance platform

3. Global ready – text analysis support for 32 languages with translation and customization capabilities

4. Direct navigation into source systems, transactions, third-party integration via API's, and immediate results via SAP Analytics

Innovation with Multi-Modal Development - Text Search and Analytics

```
CREATE FULLTEXT INDEX FEEDBACK_IDX ON FEEDBACK(TWEET) TEXT ANALYSIS ON CONFIGURATION
'EXTRACTION_CORE_VOICEOFCUSTOMER';
```

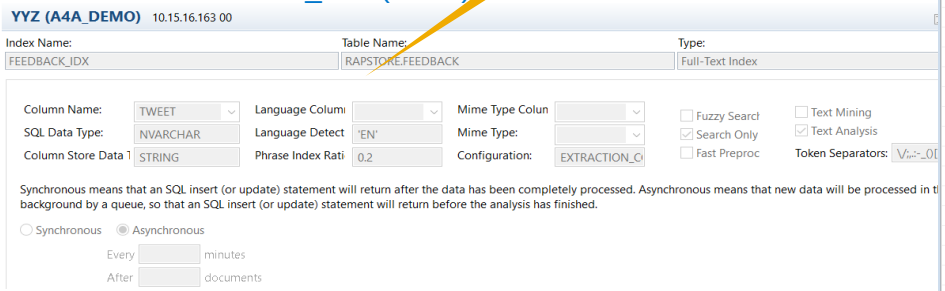
Used for full-text search. Attached to column

Results of text anlysis stored in $TA_index_name

FEEDBACK (Base Table)

TW...	TWEET	
55	I love this thing!	
1	So there is no way for me to plug it in here in the US unless I go by a converter	
5	The mic is great.	F
8	If you are Razr owner...you must have this!	F
9	Needless to say I wasted my money.	M
10	What a waste of money and time!.	M
14	Very good quality though	F

FEEDBACK_IDX (Index)



$TA_FEEDBACK_IDX (Analytics Index Table)

Raw Data | Distinct values | Analysis | Show Log

Filter pattern | 2000 rows retrieved - 306 ms | Execute | Add filter | Sort er

TWEETNO	TA_RULE	TA_COUNTER	TA_TOKEN	TA_...	TA_TYPE	TA_NORMALIZED	TA_STEM
6	Entity Extraction	3	volume	en	Topic	?	?
7	Entity Extraction	1	several dozen	en	NOUN_GROUP	?	?
7	Entity Extraction	2	the fun	en	Sentiment	?	?
7	Entity Extraction	3	fun	en	WeakPositiveSentim...	?	?
13	Entity Extraction	1	5+ ft	en	MEASURE	?	?
13	Entity Extraction	2	excessive static	en	Sentiment	?	?
13	Entity Extraction	3	excessive	en	MinorProblem	?	?
13	Entity Extraction	4	static	en	Topic	?	?
13	Entity Extraction	5	garbled sound	en	NOUN_GROUP	?	?
15	Entity Extraction	1	The design is v...	en	Sentiment	?	?
15	Entity Extraction	2	design	en	Topic	?	?
15	Entity Extraction	3	odd	en	StrongNegativeSenti...	?	?
15	Entity Extraction	4	the ear clip i...	en	Sentiment	?	?
15	Entity Extraction	5	ear clip	en	Topic	?	?
15	Entity Extraction	6	ear clip	en	NOUN_GROUP	?	?
15	Entity Extraction	7	comfortable	en	WeakNegativeSenti...	?	?
22	Entity Extraction	1	Kindle Fire	en	PRODUCT	?	?
22	Entity Extraction	2	loved	en	Sentiment	?	?
22	Entity Extraction	3	loved	en	StrongPositiveSenti...	?	?
24	Entity Extraction	1	new battery	en	NOUN_GROUP	?	?
24	Entity Extraction	2	three days	en	TIME_PERIOD	?	?
25	Entity Extraction	1	a problem with...	en	Sentiment	?	?

Innovation with Multi-Modal Development - Text Search and Analytics

```
CREATE FULLTEXT INDEX TRADER_EXPENSES_IDX ON TRADER_EXPENSES(FILE_CONTENT)
TEXT ANALYSIS ON CONFIGURATION 'EXTRACTION_CORE_PUBLIC_SECTOR
```

TRADER_EXPENSES (Base Table)

Used for full-text search. Attached to column

Results of text anlysis stored in $TA_index_name

Raw Data | Distinct values | Analysis

Filter pattern — 3 rows retrieved - 982 ms

TRADERNO	FILE_NAME	FILE_CONTENT
1,904	Itin_Dec1_16.pdf	255044462D312E340D0A25B4B5B6B70D0A312030206F626A0D0A3C…
1,904	Itin_Dec5_16.pdf	255044462D312E340D0A25B4B5B6B70D0A312030206F626A…
1,904	Itin_Apr10_17.pdf	255044462D312E340D0A25B4B5B6B70D0A312030206…

TRADER_EXPENSES_IDX (Index)

Index Name: TRADER_EXPENSES_IDX | Table Name: RAPSTORE.TRADER_EXPENSES | Type: Full-Text Index

Column Name: FILE_CONTENT | SQL Data Type: BLOB | Column Store Data T: LOB | Language Colum | Language Detect: 'EN' | Phrase Index Rati: 0.0 | Mime Type Colun | Mime Type: | Configuration: EXTRACTION_C | Fuzzy Searcl | Search Only | Fast Preproc

Synchronous means that an SQL insert (or update) statement will return after the data has been completely processed. Asynchronous means that new dat background by a queue, so that an SQL insert (or update) statement will return before the analysis has finished.

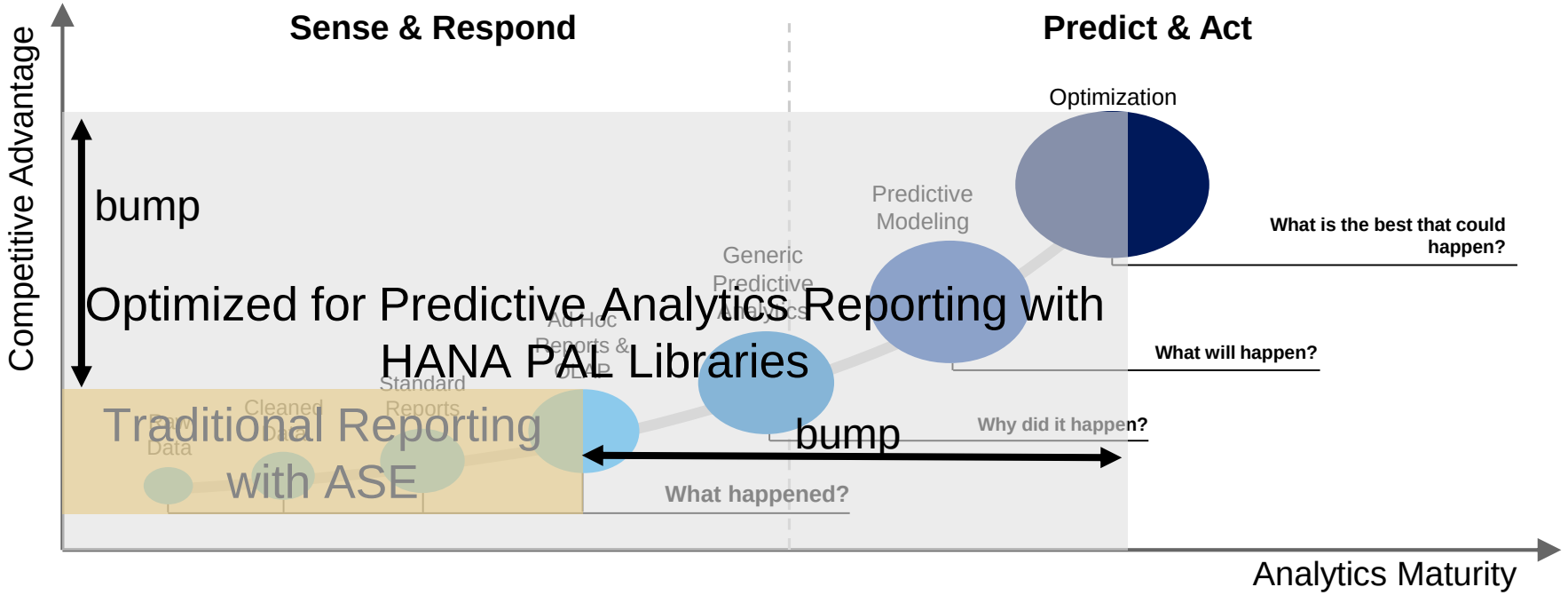
Synchronous | Asynchronous — Every minutes — After documents

$TA_TRADER_EXPENSES_IDX (Analytics Index Table)

```
SELECT TOP 1000 * FROM "RAPSTORE"."$TA_TRADER_EXPENSES_IDX"
```

	FILE_NAME	TA_RULE	TA_COUNTER	TA_TOKEN	TA_LA…	TA_TYPE	TA_NORMALIZED
116	Itin_Apr10_17.pdf	Entity Extraction	116	RESTRICTIONS-THIS TICKET	en	PROP_MISC	?
117	Itin_Apr10_17.pdf	Entity Extraction	117	NON-REFUNDABLERESTRICTIONS-CH…	en	NOUN_GROUP	?
118	Itin_Apr10_17.pdf	Entity Extraction	118	PENALTY-AIRLINE FEE	en	NOUN_GROUP	?
119	Itin_Apr10_17.pdf	Entity Extraction	119	CAD75.00	en	CURRENCY	?
120	Itin_Apr10_17.pdf	Entity Extraction	120	TRANSACTIONPENALTY-IN ADDITION	en	PROP_MISC	?
121	Itin_Apr10_17.pdf	Entity Extraction	121	TAX DIFFERENCE	en	NOUN_GROUP	?
122	Itin_Apr10_17.pdf	Entity Extraction	122	Monday	en	DAY	?
123	Itin_Apr10_17.pdf	Entity Extraction	123	April 10 2017	en	DATE	?
124	Itin_Apr10_17.pdf	Entity Extraction	124	Agency Record Locator	en	ORGANIZATION/GOVERNMENT	?
125	Itin_Apr10_17.pdf	Entity Extraction	125	Air Canada	en	ORGANIZATION/COMMERCIAL	?
126	Itin_Apr10_17.pdf	Entity Extraction	126	Air Canada Flight AC441	en	VEHICLE/AIR	?
127	Itin_Apr10_17.pdf	Entity Extraction	127	Ottawa International Airport	en	FACILITY/AIRPORT	?
128	Itin_Apr10_17.pdf	Entity Extraction	128	Ottawa	en	LOCALITY	?
129	Itin_Apr10_17.pdf	Entity Extraction	129	Ontario	en	LOCALITY	?
130	Itin_Apr10_17.pdf	Entity Extraction	130	Canada	en	COUNTRY	?
131	Itin_Apr10_17.pdf	Entity Extraction	131	07:00 AM	en	TIME	?
132	Itin_Apr10_17.pdf	Entity Extraction	132	Monday	en	DAY	?

Innovation with Multi-Modal Development – Predictive Analytics Libraries



The key is unlocking data to move decision making from sense & respond to predict & act

Innovation with Multi-Modal Development – Predictive Analytics Libraries

Classification Analysis

- CART
- C4.5 Decision Tree Analysis
- CHAID Decision Tree Analysis
- K Nearest Neighbour
- Logistic Regression Elastic Net
- Back-Propagation (Neural Network)
- Naïve Bayes
- Support Vector Machine
- Random Forests
- **Gradient Boosting Decision Tree***
- **Linear Discriminant Analysis (LDA)***
- Confusion Matrix
- Area Under Curve (AUC)
- Parameter Selection / Model Evaluation

Regression

- Multiple Linear Regression Elastic Net
- Polynomial, Exponential, Bi-Variate Geometric, Bi-Variate Logarithmic Regression
- **Generalized Linear Model***
- **Cox Proportional Hazards Model***

Cluster Analysis

- ABC Classification
- DBSCAN
- K-Means
- K-Medoid Clustering
- K-Medians
- Kohonen Self Organized Maps
- Agglomerate Hierarchical
- Affinity Propagation
- Latent Dirichlet Allocation (LDA)
- Gaussian Mixture Model (GMM)
- Cluster Assignment

Time Series Analysis

- Single/Double/ Brown /Triple Exp.Smoothing
- Forecast Smoothing
- Auto - ARIMA/ Seasonal ARIMA
- Croston Method
- Forecast Accuracy Measure
- Linear Regression with Damped Trend and Seasonal Adjust
- Test for White Noise, Trend, Seasonality
- **Fast Fourier Transform (FFT)***
- **Correlation Function***

Association Analysis

- Apriori
- Apriori Lite
- FP-Growth
- KORD – Top K Rule Discovery
- **Sequential Pattern Mining***

Probability Distribution

- Distribution Fit/ Weibull analysis
- Cumulative Distribution Function
- Quantile Function
- Kaplan-Meier Survival Analysis

Outlier Detection

- Inter-Quartile Range Test (Tukey's Test)
- Variance Test
- Anomaly Detection
- Grubbs Outlier Test

Link Prediction

- Common Neighbors
- Jaccard's Coefficient
- Adamic/Adar
- Katzβ

Statistic Functions

- Mean, Median, Variance, Standard Deviation, Kurtosis, Skewness
- Covariance Matrix
- Pearson Correlations Matrix
- Chi-squared Tests:
  - Test of Quality of Fit
  - Test of Independence
- F-test (variance equal test)
- **Data Summary***

Data Preparation

- Sampling
- Binning
- Scaling
- Partitioning
- Principal Component Analysis (PCA) / PCA Projection

Other

- Weighted Scores Table
- Substitute Missing Values

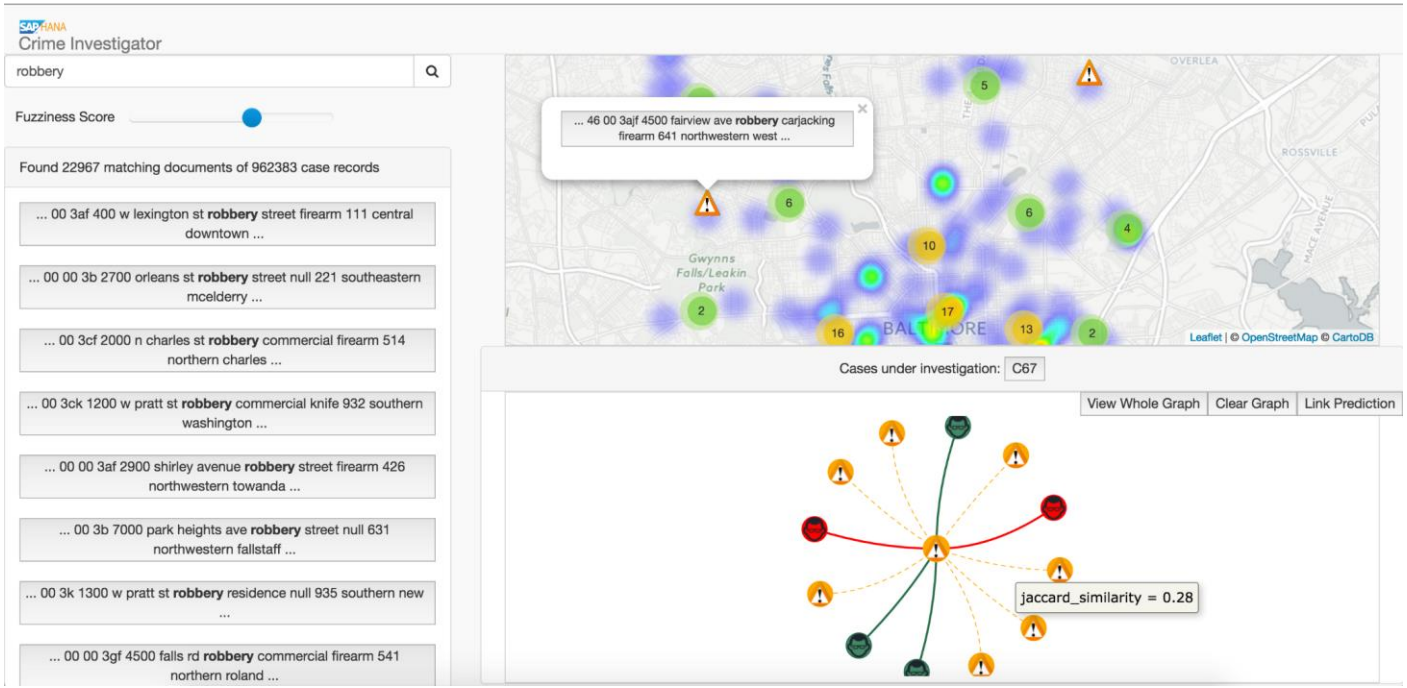
*** New in SAP HANA 2 SPS00**

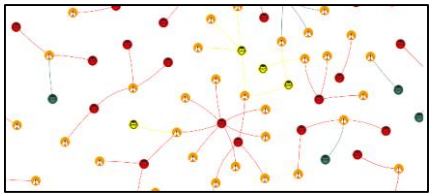
Digital Policing

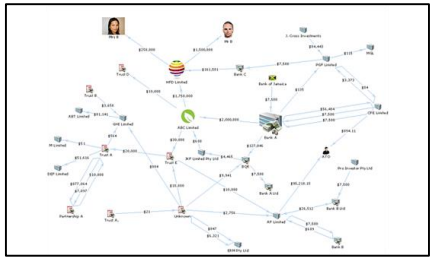
Text Search: HANA Fuzzy Search + XSJS + UI

Geospatial: Heatmap viz + Spatial search + XSJS + UI

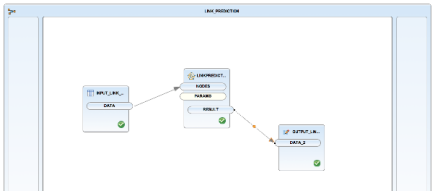
Graph: Modeling + Algorithms + XSJS + UI







PAL: Link Prediction + XSJS + UI



Preprocessing: Spark Core (RDD), SparkSQL

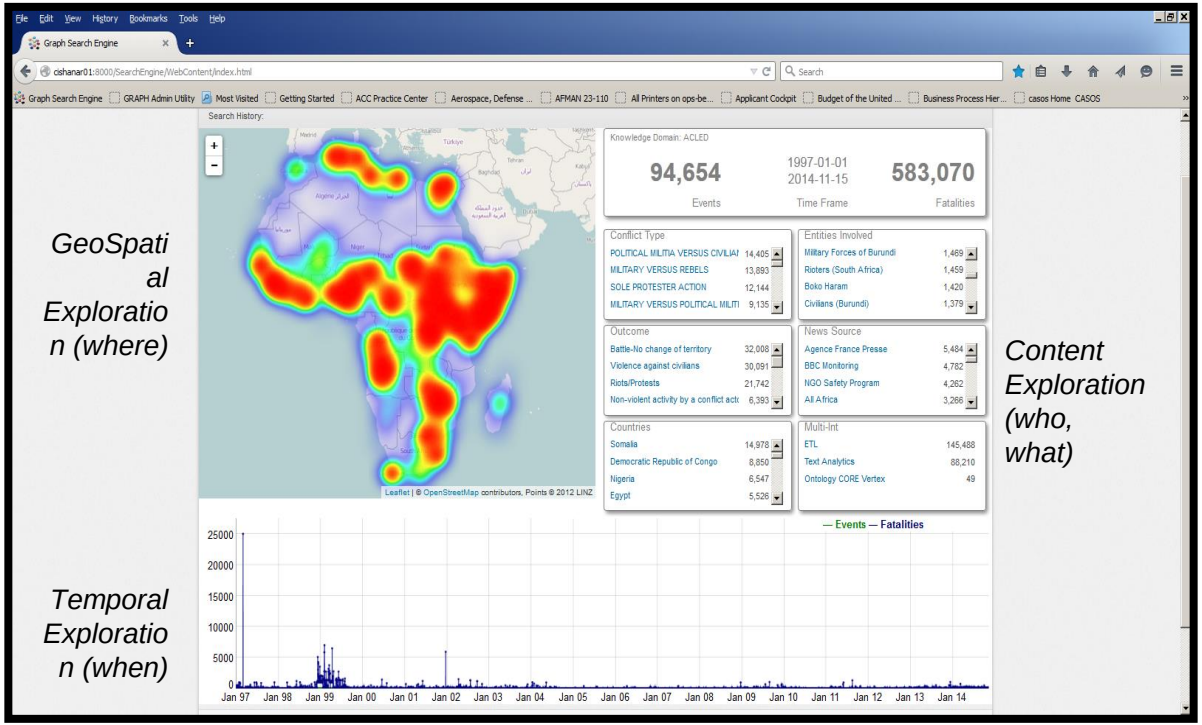
Staging: Vora, SDA (virtual table)

Moreno Crime Network: Graph dataset (Crime → Suspect, Victim, Witness)

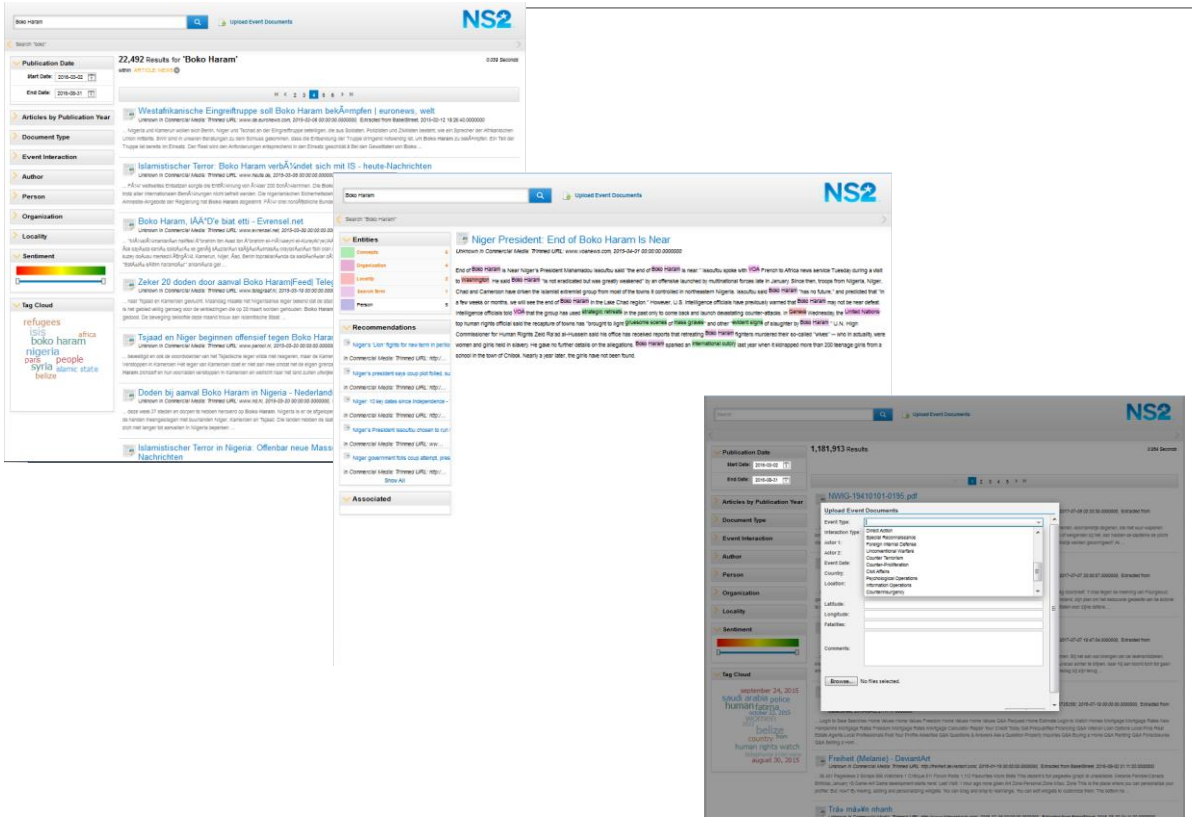
Crime reports: JSON, Location

Please start with this 4 minute video

https://youtu.be/tRD70AxUftI



- Information is processed and combined into a knowledge base in HANA.
- Free form, multi-modal navigation allows exploration into any aspect of the knowledge base.
- All of the information is connected, for example a location may be referenced in a number of documents, and the tweets of a person from that location are now all presented together at the speed of thought.
- Information can be ingested from a wide variety of feeds, from databases in applications, social media, and communications infrastructure.



- Facts are automatically categorized and linked to provide instant search and navigation.
- SAP HANA Text Engine extract facts from documents, applications text fields, and social media streams.
- Extracted metadata is part of the process to generate relationships between people, places, things and events.

Thank You

Anthony Antonello
Vice President, SAP Global Center of Excellence
Innovation to Value
Anthony.antonello@sap.com