SeaScale Meetup
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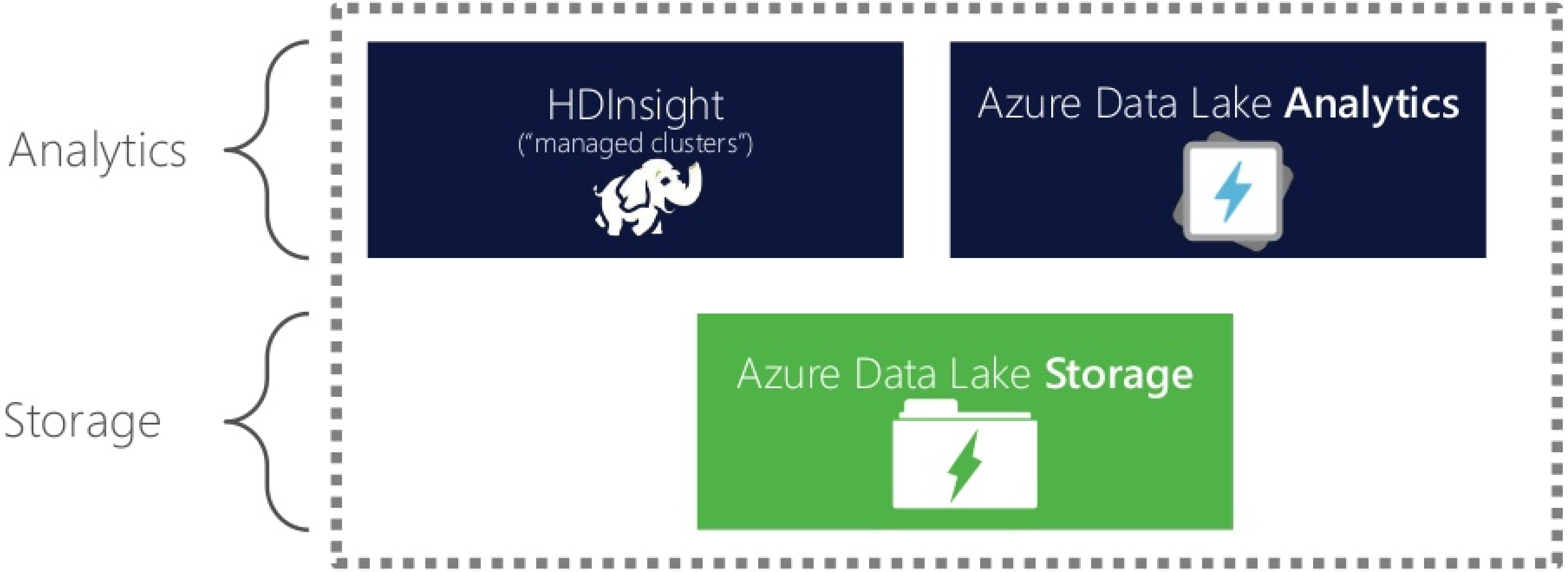
Azure Data Lake & U-SQL

Michael Rys, @MikeDoesBigData

http://www.azure.com/datalake
{mrys, usql}@microsoft.com

Microsoft

Azure Data Lake



Analytics

HDInsight
("managed clusters")

Azure Data Lake **Analytics**

Storage

Azure Data Lake **Storage**

ADLA complements HDInsight

Target the same scenarios, tools, and customers

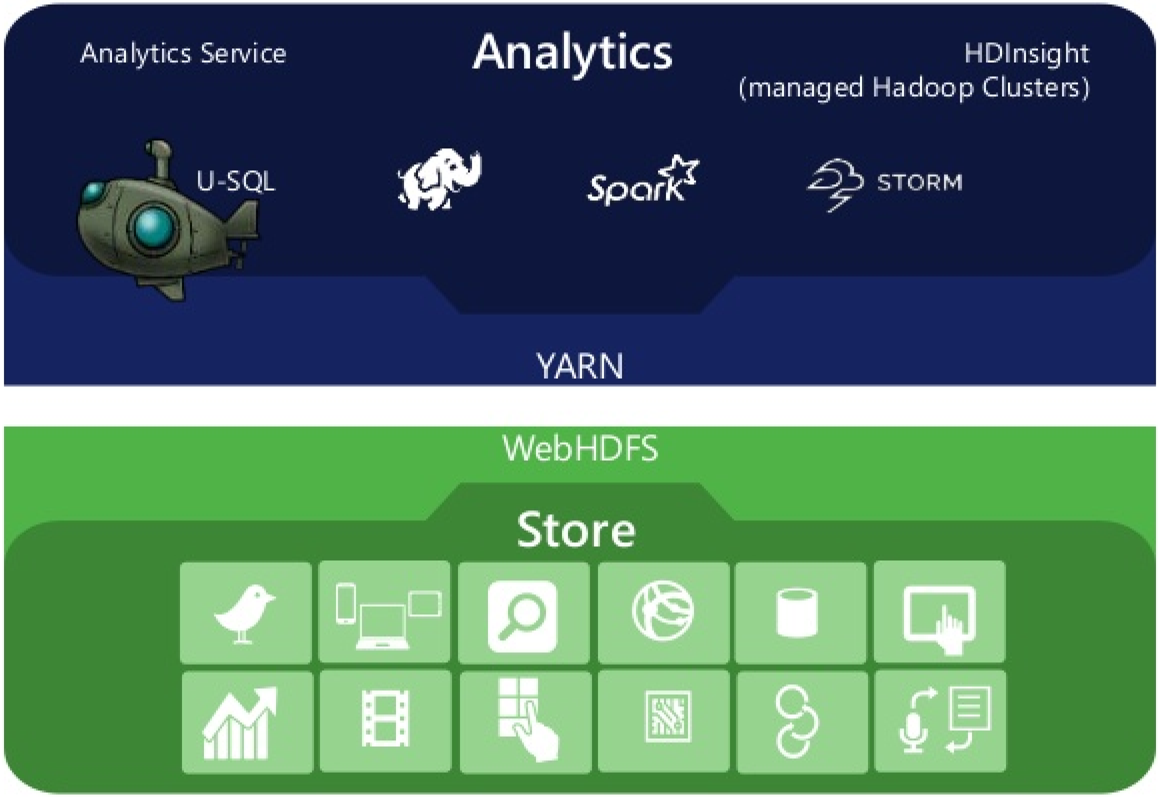
HDInsight

- For developers familiar with the Open Source: Java, Eclipse, Hive, etc.
- Clusters offer customization, control, and flexibility in a managed Hadoop cluster

ADLA

- Enables customers to leverage existing experience with C#, SQL & PowerShell
- Offers convenience, efficiency, automatic scale, and management in a "job service" form factor

Azure Data Lake



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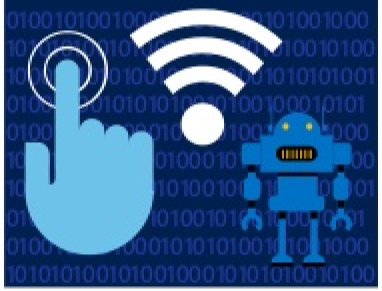
Azure Data Lake

Analytics Service

Microsoft

Azure Data Lake Analytics

All data



Productivity from day one

Easy and powerful data preparation

Limitless scale

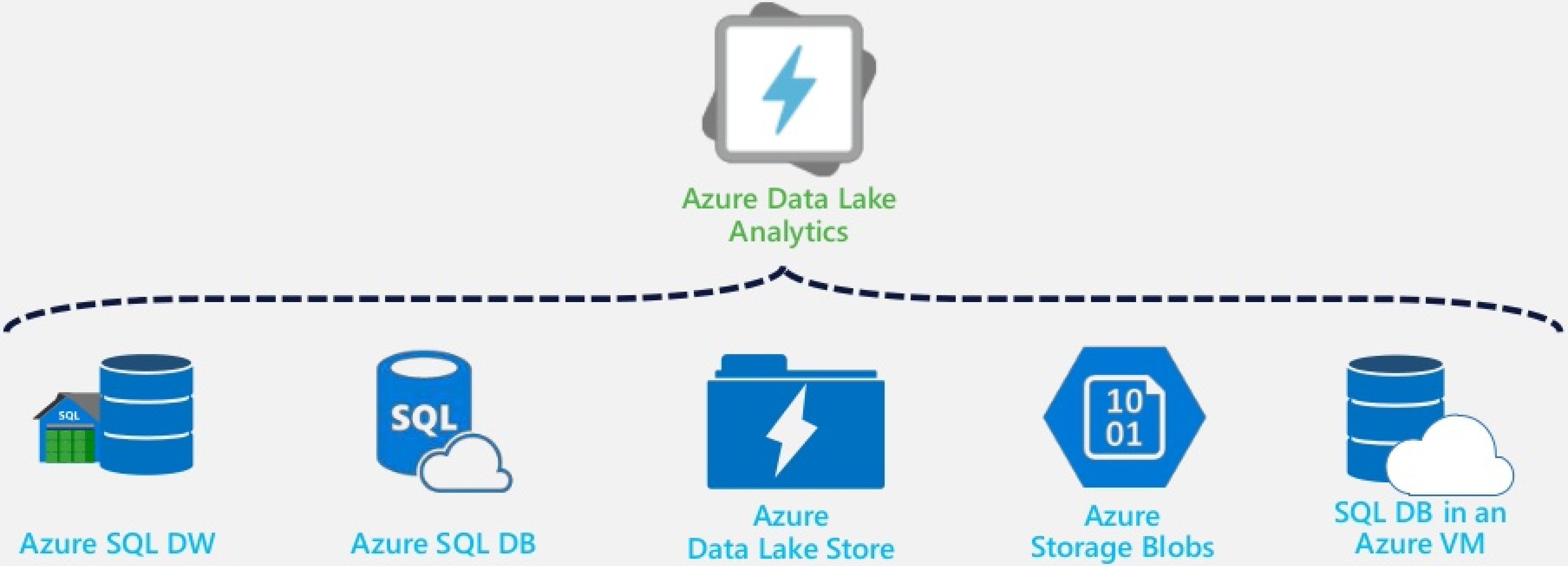
Enterprise-grade

Azure Data Lake Analytics Service

A new distributed analytics service

- Built on **Apache YARN**
- **Scales dynamically** with the turn of a dial
- **Pay by the query**
- Supports **Azure AD** for access control, roles, and integration with on-prem identity systems
- Built with **U-SQL** to unify the benefits of SQL with the power of C#
- Processes data **across Azure**

Work across all cloud data



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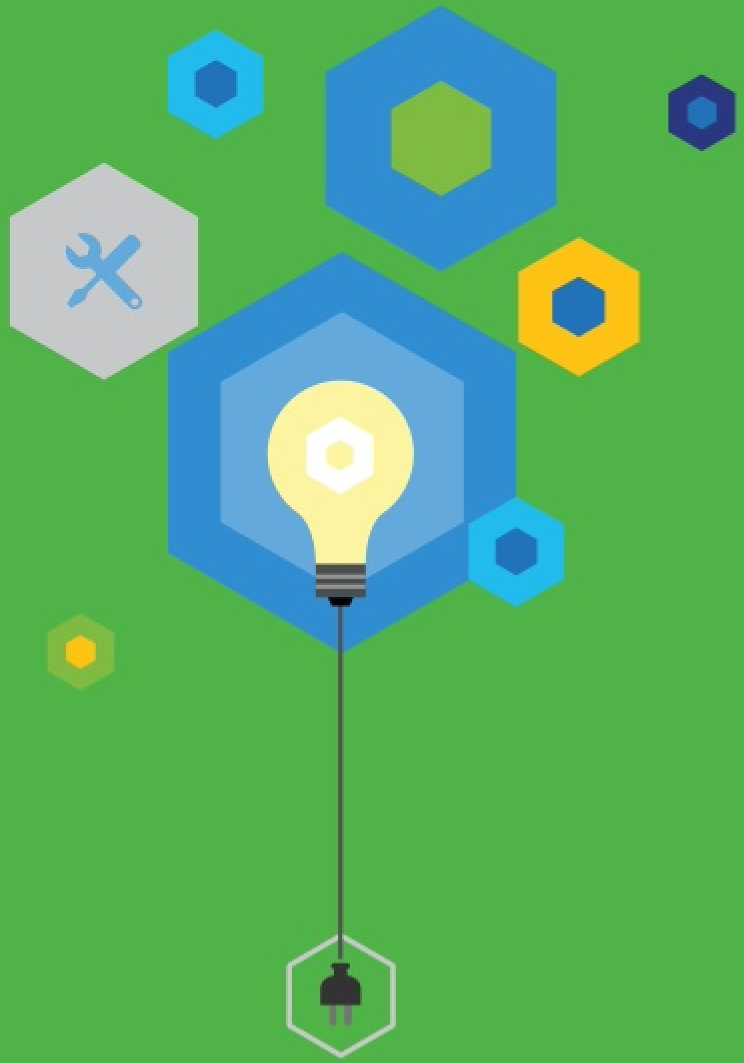
Demo
Show me ADL!



Azure Data Lake

U-SQL

Microsoft

Why U-SQL?

Characteristics of Big Data Analytics

- Requires processing of any type of data
- Allow use of custom algorithms
- Scale to any size and be efficient

Some sample use cases

Digital Crime Unit – Analyze complex attack patterns to understand BotNets and to predict and mitigate future attacks by **analyzing log records with complex custom algorithms**

Image Processing – **Large-scale** image feature extraction and classification using **custom code**

Shopping Recommendation – Complex pattern analysis and prediction over shopping records using **proprietary algorithms**

Status Quo: SQL for Big Data

- ☺ **Declarativity does scaling and parallelization for you**
- ☹ **Extensibility is bolted on and not “native”**
  - ☹ hard to work with anything other than structured data
  - ☹ difficult to extend with custom code

Status Quo: Programming Languages for Big Data

- ☺ **Extensibility through custom code is "native"**
- ☹ **Declarativity is bolted on and not "native"**
  - ☹ User often has to care about scale and performance
  - ☹ SQL is 2nd class within string
  - ☹ Often no code reuse/ sharing across queries

Why U-SQL?

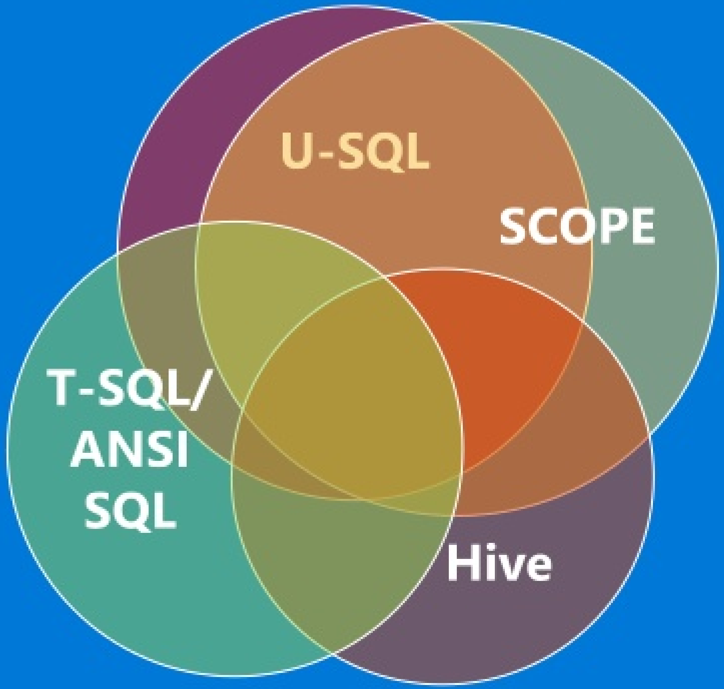
☺☺ **Declarativity and Extensibility are equally native to the language!**

Get benefits of both!

Makes it **easy** for you by **unifying**:

- Unstructured and structured data processing
- Declarative SQL and custom imperative Code
- Local and remote Queries
- Increase productivity and agility from Day 1 and at Day 100 for **YOU**!

The origins of U-SQL



SCOPE – Microsoft's internal Big Data language

- SQL and C# integration model
- Optimization and Scaling model
- Runs 100'000s of jobs daily

Hive

- Complex data types (Maps, Arrays)
- Data format alignment for text files

T-SQL/ANSI SQL

- Many of the SQL capabilities (windowing functions, meta data model etc.)

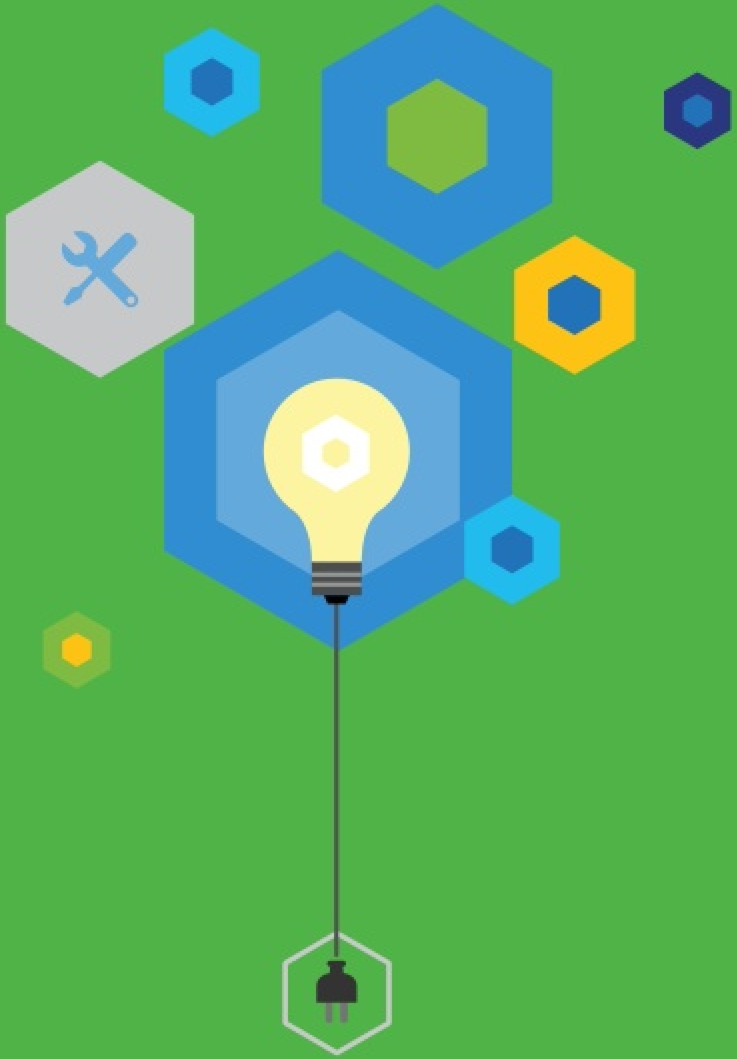
U-SQL extensibility

Extend U-SQL with C#/.NET

Built-in operators, function, aggregates

- C# expressions (in SELECT expressions)
- User-defined operators (UDOs)
- User-defined functions (UDFs)
- User-defined aggregates (UDAGGs)

Demo
Show me U-SQL!



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U-SQL Language Philosophy

Declarative Query and Transformation Language:

- Uses SQL's SELECT FROM WHERE with GROUP BY/Aggregation, Joins, SQL Analytics functions
- Optimizable, Scalable

Expression-flow programming style:

- Easy to use functional lambda composition
- Composable, globally optimizable

Operates on Unstructured & Structured Data

- Schema on read over files
- Relational metadata objects (e.g. database, table)

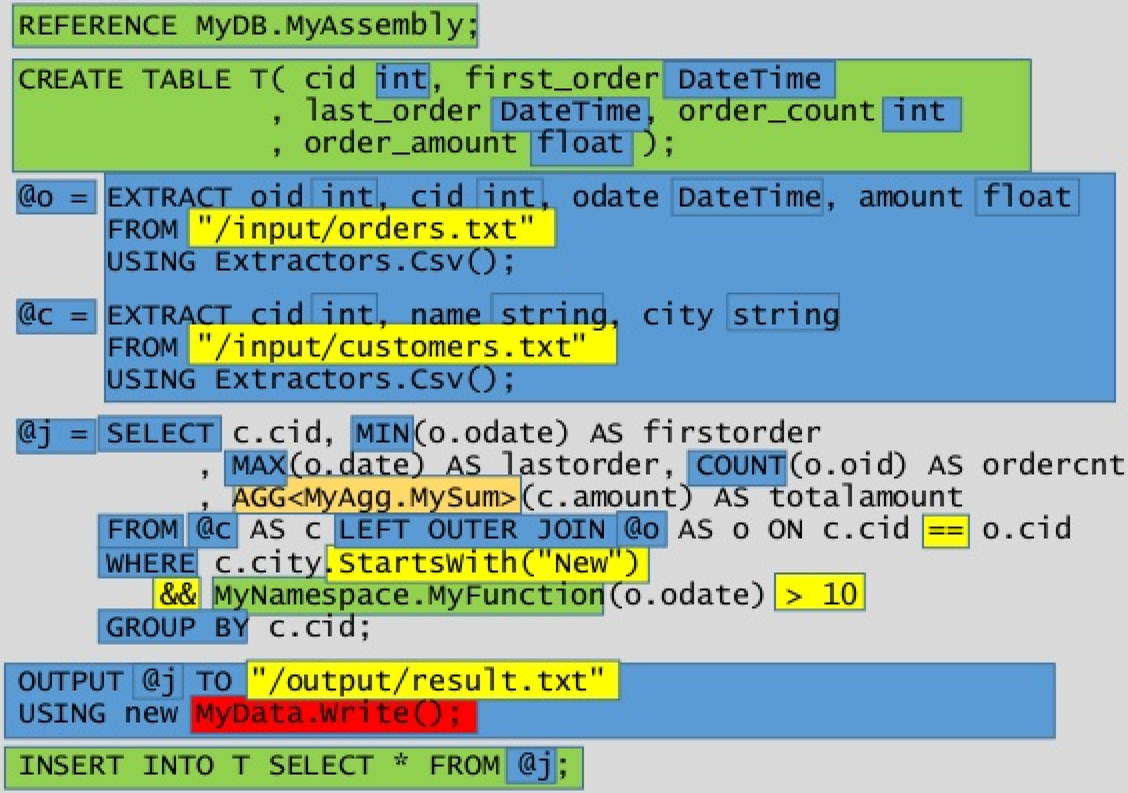
Extensible from ground up:

- Type system is based on C#
- Expression language IS C#
- User-defined functions (U-SQL and C#)
- User-defined Aggregators (C#)
- User-defined Operators (UDO) (C#)

U-SQL provides the Parallelization and Scale-out Framework for Usercode

- EXTRACTOR, OUTPUTTER, PROCESSOR, REDUCER, COMBINER, APPLIER

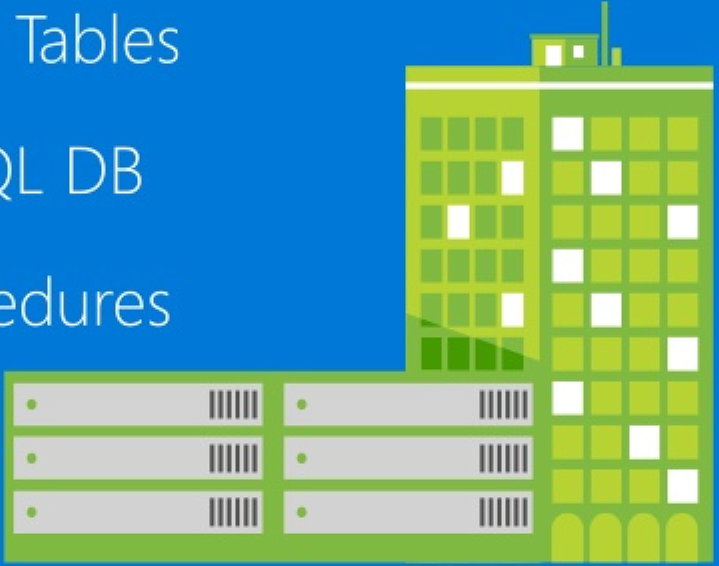
Federated query across distributed data sources



```
REFERENCE MyDB.MyAssembly;

CREATE TABLE T( cid int, first_order DateTime
              , last_order DateTime, order_count int
              , order_amount float );

@o = EXTRACT oid int, cid int, odate DateTime, amount float
     FROM "/input/orders.txt"
     USING Extractors.Csv();

@c = EXTRACT cid int, name string, city string
     FROM "/input/customers.txt"
     USING Extractors.Csv();

@j = SELECT c.cid, MIN(o.odate) AS firstorder
          , MAX(o.date) AS lastorder, COUNT(o.oid) AS ordercnt
          , AGG<MyAgg.MySum>(c.amount) AS totalamount
     FROM @c AS c LEFT OUTER JOIN @o AS o ON c.cid == o.cid
     WHERE c.city.StartsWith("New")
        && MyNamespace.MyFunction(o.odate) > 10
     GROUP BY c.cid;

OUTPUT @j TO "/output/result.txt"
USING new MyData.Write();

INSERT INTO T SELECT * FROM @j;
```

Lots of additional interesting features

- ✓ Set of files with patterns, Partitioned Tables
- ✓ Federated Queries against Azure SQL DB
- ✓ Views, Table-Valued Functions, Procedures
- ✓ SQL Windowing Functions
- ✓ Complex Types (MAP, ARRAY)



Intro Blog entry: http://aka.ms/usql-intro
Blog entry on UDFs: http://aka.ms/usql-udf
U-SQL Reference Doc (beta): http://aka.ms/usql_reference
U-SQL Community & Team site: http://usql.io/
Videos: https://channel9.msdn.com/Series/AzureDataLake

Additional Resources

- Blogs and community page:
  - http://usql.io
  - https://blogs.msdn.microsoft.com/azuredatalake/
  - http://blogs.msdn.com/b/visualstudio/
  - http://azure.microsoft.com/en-us/blog/topics/big-data/
  - https://channel9.msdn.com/Search?term=U-SQL#ch9Search
- Documentation:
  - http://aka.ms/usql_reference
  - https://azure.microsoft.com/en-us/documentation/services/data-lake-analytics/
- ADL forums and feedback
  - http://aka.ms/adlfeedback
  - https://social.msdn.microsoft.com/Forums/azure/en-US/home?forum=AzureDataLake
  - http://stackoverflow.com/questions/tagged/u-sql

This is why U-SQL!

- ✓ Unifies natively SQL's declarativity and C#'s extensibility
- ✓ Unifies querying structured and unstructured
- ✓ Unifies local and remote queries
- ✓ Increase productivity and agility from Day 1 forward for YOU!

→ Sign up for an Azure Data Lake account and join the Public Preview http://www.azure.com/datalake and give us your feedback via http://aka.ms/adlfeedback or at http://aka.ms/u-sql-survey!