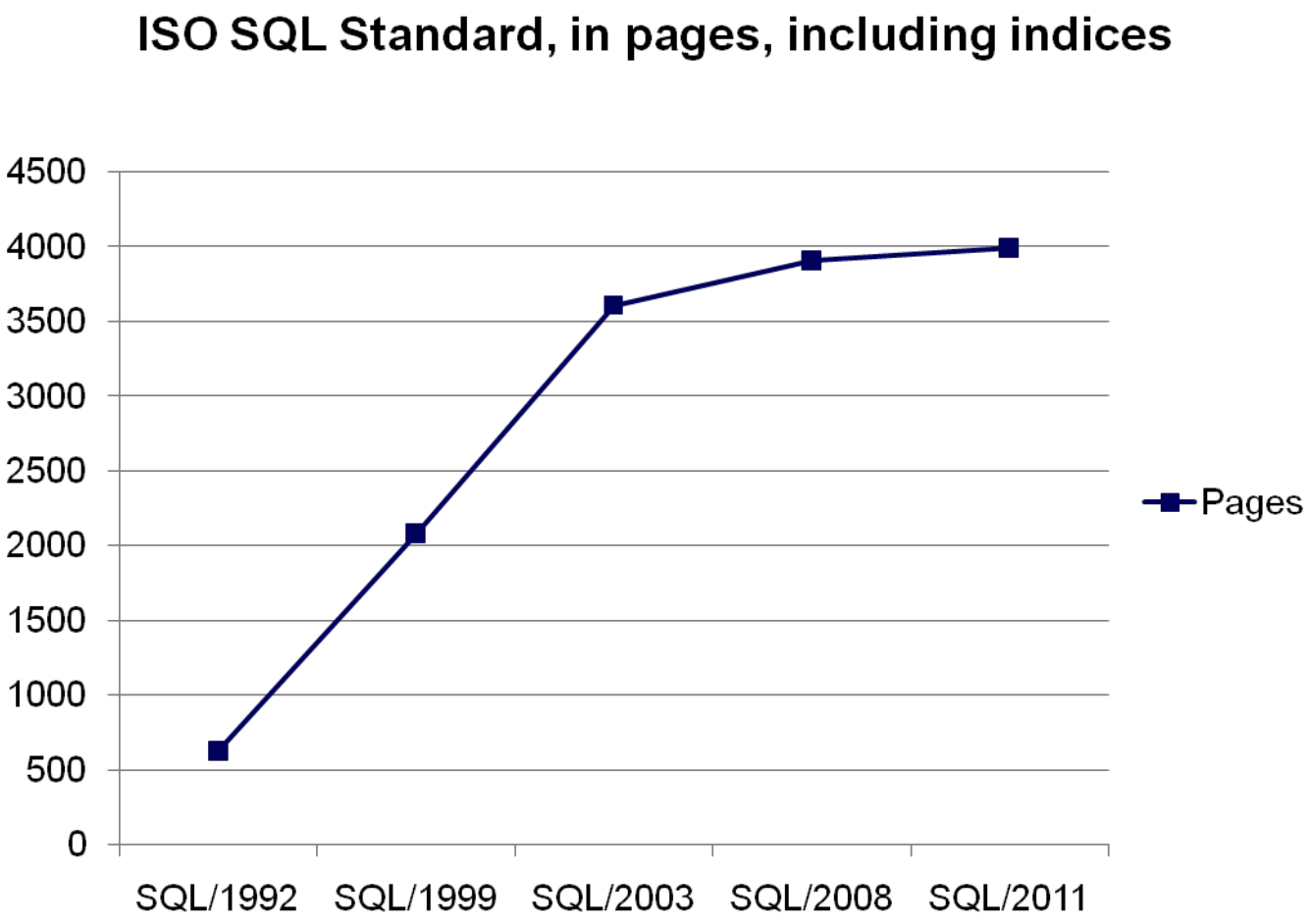
Panel: Grand Challenges in Testing Data-intensive Computing Systems

Glenn Paulley, Director, Engineering

The issue is complexity



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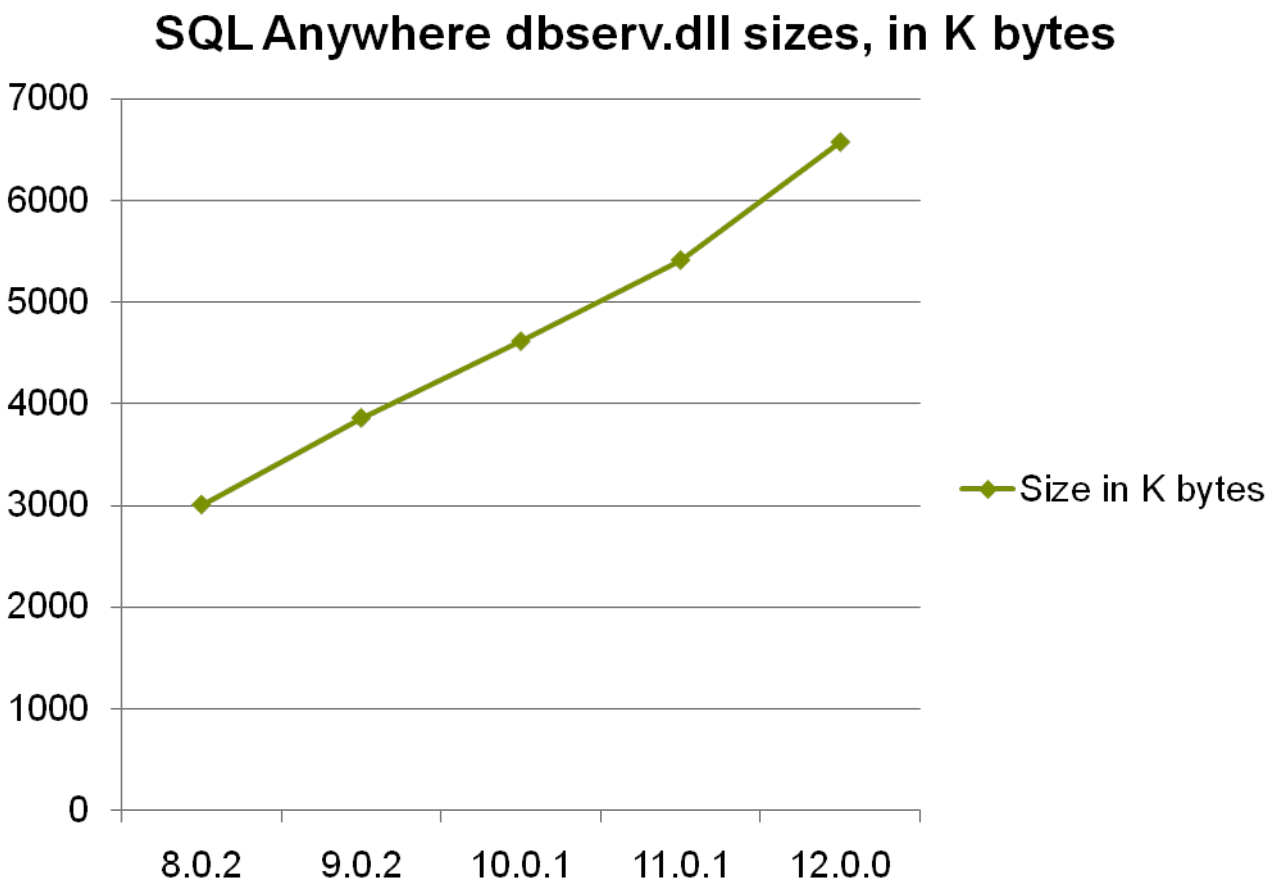
Complexity grows with each product release



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Object-relational mapping toolkits

- **Object-relational mapping toolkits are designed to address the impedance mismatch between OO and relational models**
  - 61 different ORM toolkits are listed in Wikipedia for Java, C++, Delphi, Ruby, .NET, PHP, Python, Perl
- **Example: Java Hibernate 3.2.6**
  - 266 packages, 1938 classes, 18,680 functions, over 118K LOC
  - Debugging problems requires real understanding of the Hibernate architecture and source code
  - Other toolkits (eg. EntityFramework) offer even greater complexity
  - Problem determination and performance analysis is difficult

ORM-generated SQL

```
SELECT
[Project9].[ContactID] AS [ContactID],[Project9].[C1] AS [C1],[Project9].[C2] AS [C2],[Project9].[ContactID1] AS [ContactID1],[Project9].[SalesOrderID] AS
        [SalesOrderID],
[Project9].[TotalDue] AS [TotalDue]
FROM ( SELECT       [Distinct1].[ContactID] AS [ContactID],      1 AS [C1],      [Project8].[ContactID] AS [ContactID1],      [Project8].[SalesOrderID] AS
        [SalesOrderID],
      [Project8].[TotalDue] AS [TotalDue],      [Project8].[C1] AS [C2]
      FROM
(SELECT DISTINCT   [Extent1].[ContactID] AS [ContactID]
        FROM  [DBA].[Contact] AS [Extent1]
                INNER JOIN [DBA].[SalesOrderHeader] AS [Extent2]
ON  EXISTS (SELECT   cast(1 as bit) AS [C1]
                FROM    ( SELECT cast(1 as bit) AS X ) AS [SingleRowTable1]
                LEFT OUTER JOIN  (SELECT [Extent3].[ContactID] AS [ContactID]
                    FROM [DBA].[Contact] AS [Extent3]  WHERE [Extent2].[ContactID] = [Extent3].[ContactID] )AS [Project1] ON cast(1 as bit) = cast(1 as bit)
                LEFT OUTER JOIN  (SELECT  [Extent4].[ContactID] AS [ContactID]
                    FROM [DBA].[Contact] AS [Extent4]  WHERE [Extent2].[ContactID] = [Extent4].[ContactID] ) AS [Project2] ON cast(1 as bit) = cast(1 as bit)
                WHERE ([Extent1].[ContactID] = [Project1].[ContactID]) OR (([Extent1].[ContactID] IS NULL) AND ([Project2].[ContactID] IS NULL))  )
) AS [Distinct1]
 LEFT OUTER JOIN
 (SELECT  [Extent5].[ContactID] AS [ContactID],  [Extent6].[SalesOrderID] AS [SalesOrderID],  [Extent6].[TotalDue] AS [TotalDue],   1 AS [C1]
          FROM  [DBA].[Contact] AS [Extent5]
           INNER JOIN [DBA].[SalesOrderHeader] AS [Extent6]
  ON  EXISTS (SELECT    cast(1 as bit) AS [C1]
                FROM    ( SELECT cast(1 as bit) AS X ) AS [SingleRowTable2]
                LEFT OUTER JOIN  (SELECT  [Extent7].[ContactID] AS [ContactID]
                    FROM [DBA].[Contact] AS [Extent7]  WHERE [Extent6].[ContactID] = [Extent7].[ContactID] )AS [Project5] ON cast(1 as bit) = cast(1 as bit)
                LEFT OUTER JOIN  (SELECT  [Extent8].[ContactID] AS [ContactID]
                    FROM [DBA].[Contact] AS [Extent8]  WHERE [Extent6].[ContactID] = [Extent8].[ContactID] )AS [Project6] ON cast(1 as bit) = cast(1 as bit)
               WHERE ([Extent5].[ContactID] = [Project5].[ContactID]) OR (([Extent5].[ContactID] IS NULL) AND ([Project6].[ContactID] IS NULL))
          )
) AS [Project8]
ON ([Project8].[ContactID] = [Distinct1].[ContactID]) OR (([Project8].[ContactID] IS NULL) AND ([Distinct1].[ContactID] IS NULL))
)  AS [Project9]
ORDER BY [Project9].[ContactID] ASC, [Project9].[C2] ASC
```

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Forthcoming technologies

- Data streaming support, continuous queries
- Analytics, CEP integration
- Row-pattern matching in standard SQL
- Greater exploitation of distributed, multi-core hardware
- Solid-state storage
- Temporal data support
- Cloud computing requirements: robust query processing
- Greater penetration of ORM technologies

and the list continues to grow….

Our panelists

- Phyllis Frankl (Polytechnic Institute of NYU)
- Leo Giakoumakis (Microsoft)
- Harumi Kuno (Hewlett-Packard Laboratories)
- Ken Salem (University of Waterloo)
- Florian Waas (Greenplum)