

Cloud Computing as a Cyber-Infrastructure for Mass Customization and Collaboration



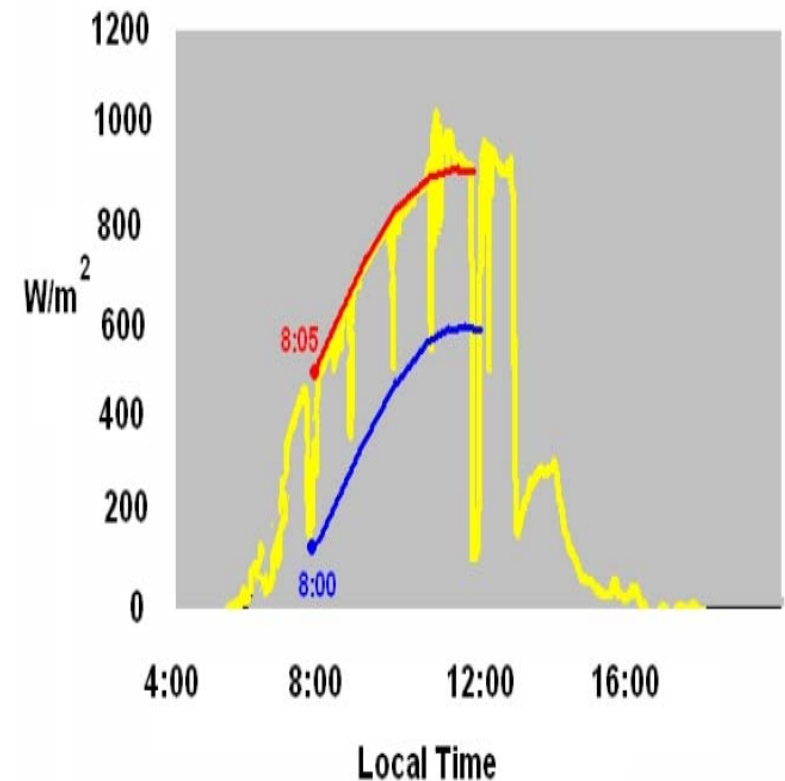
May 7, 2012
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Outline

- I. Renewable Energy Forecasting
- II. FaaS (Forecast-as-a-Service)
Framework
- III. Mass Customization and
Collaboration
- IV. Conclusions

I. Renewable Energy Forecasting

- Uncertain, intermittent, fluctuating sources
- Accurate forecasting is important for effective utilization
- Impact on economics and deployment
- Forecast over different time horizons



Diversity in Data

Data sources

- Federal Agencies
- National Databases
- Private Organizations
- Universities
- International Institutions
- Companies
- Own Measurement

Data Types

- Satellite Image
- Sensor Data
- Computer Model Data
- Human Expertise
- Vendor Product Data
- Diverse Data Format

Diverse Approaches and Needs

Diverse Approaches

- Physical Models
- Statistical Models
- Heuristic Models
- Hybrid Models
- Uncertainty Management Methods

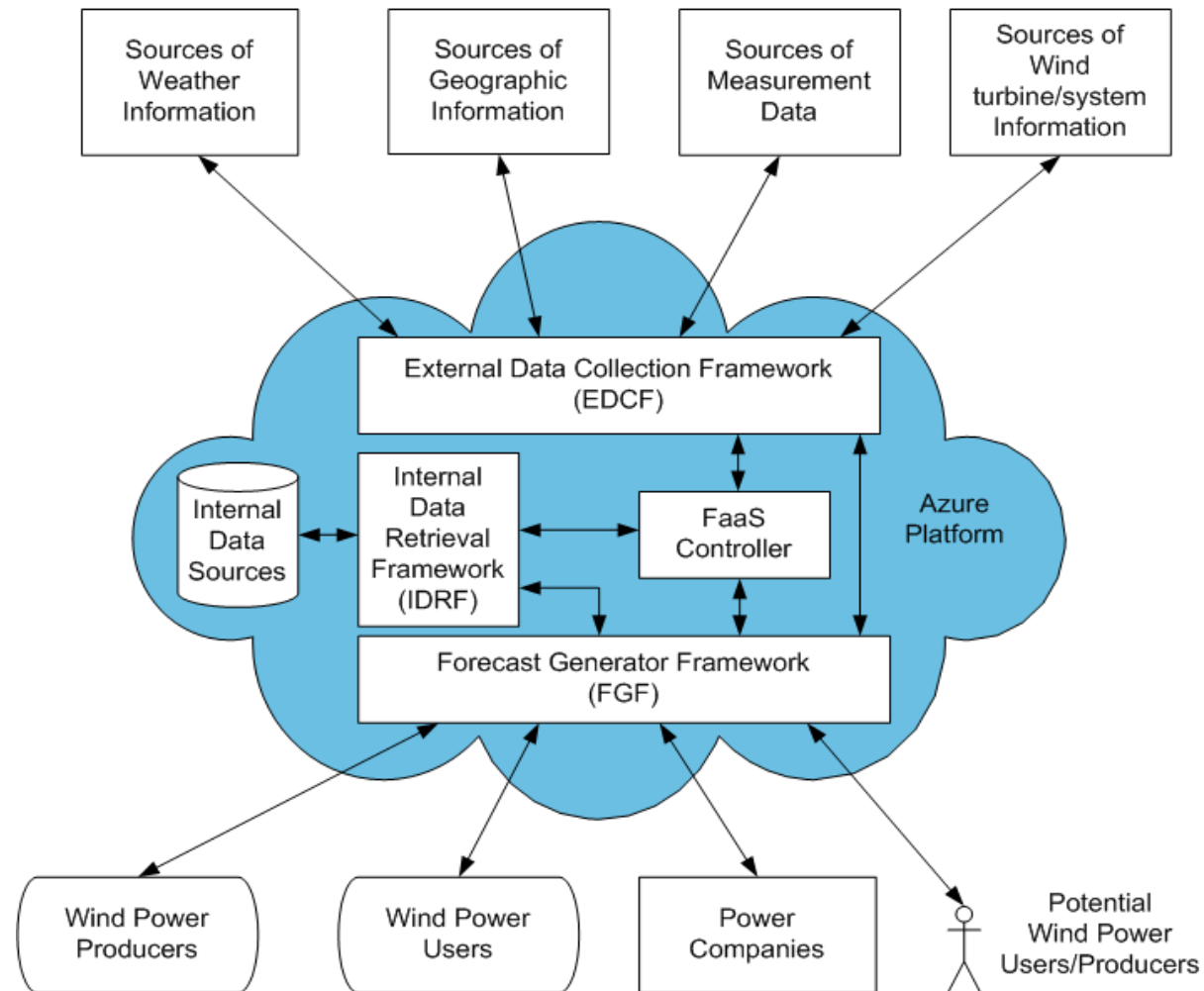
Diverse Needs

- Design Decisions
- Operation Decisions
- Planning Decisions
- Investment Decisions
- Different Level of Details

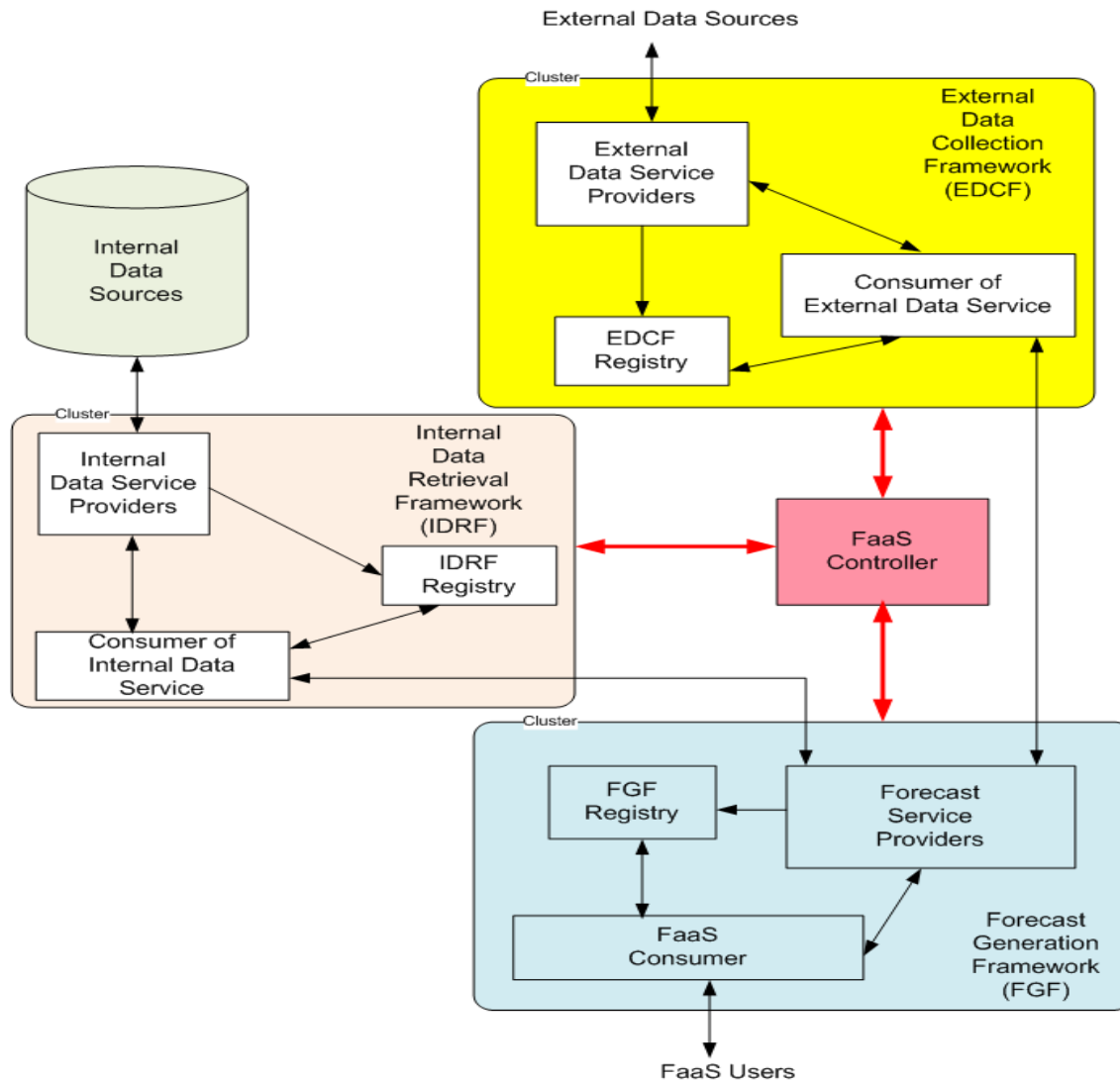
II. FaaS Framework

- The purpose is to support on-demand delivery of renewable energy forecasts of different types and at different levels of detail for different prices.
- Widespread utilization of renewable energy can be enhanced by making forecast information available to current or potential renewable energy users with different needs and different budgets.

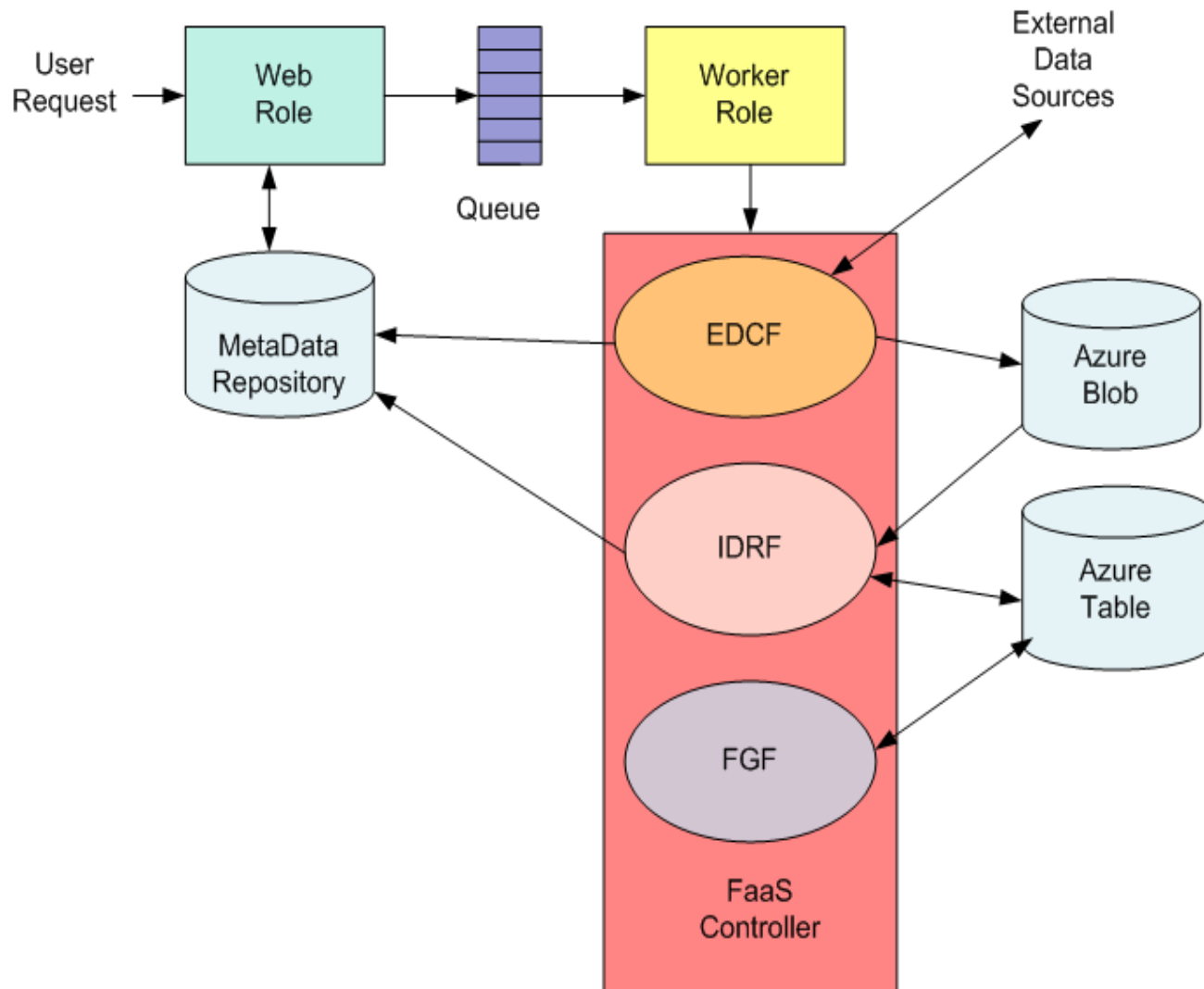
FaaS Framework For Wind Power



Architecture of the FaaS Framework



FaaS Implementation using Azure



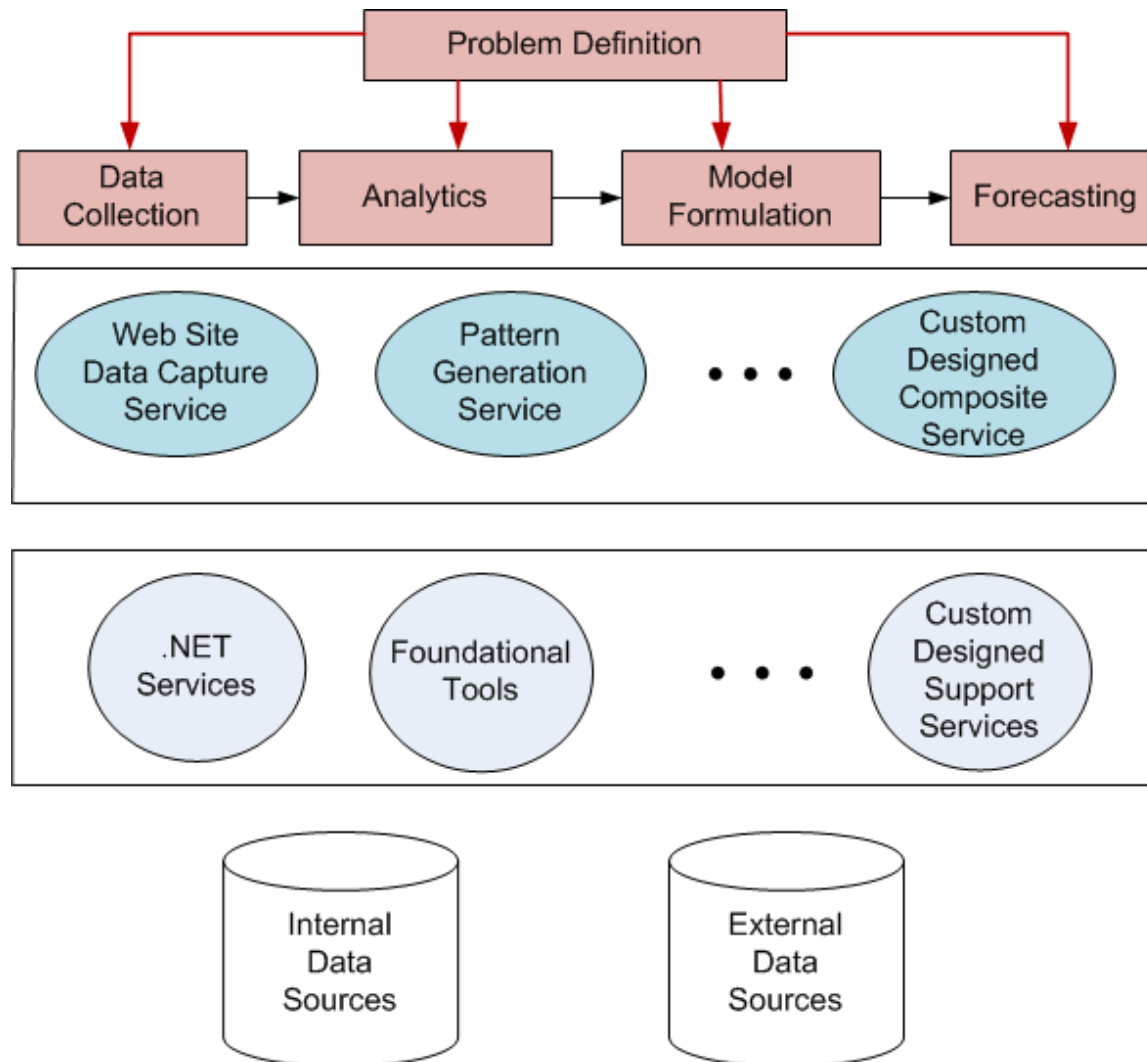
Data Handling Strategy

- *CloudWebSiteDataCapture* WCF service in EDCF transfer data from external sources to Azure Blob storage
- IDRf processes data in diverse types and formats in Azure Blob using different procedures and stores standardized data in Azure Table
- Standardized data in Azure Table are used in analysis and forecasting procedures
- FaaS controller monitors and controls the workflow
- Updates are sent to metadata repository

Frequency Domain Approach

- Information contained in time-domain data is converted to frequency-domain components
- Computations are mostly performed using the frequency-domain components
- Less vulnerability to noises and outliers
- More structured representation of information
- More suitable for automated machine processing

Layers of Services



III.A. Mass Customization

- New trend in business
- Basic concept is to increase the variety of individually tailored product/service to meet customer needs without a large increase in production costs
- Cloud computing enables delivery of mass customized services/information in the
“ Data → Information → Knowledge “ chain

Service-Oriented Architecture (SOA) Mass Customization (MC)

SOA

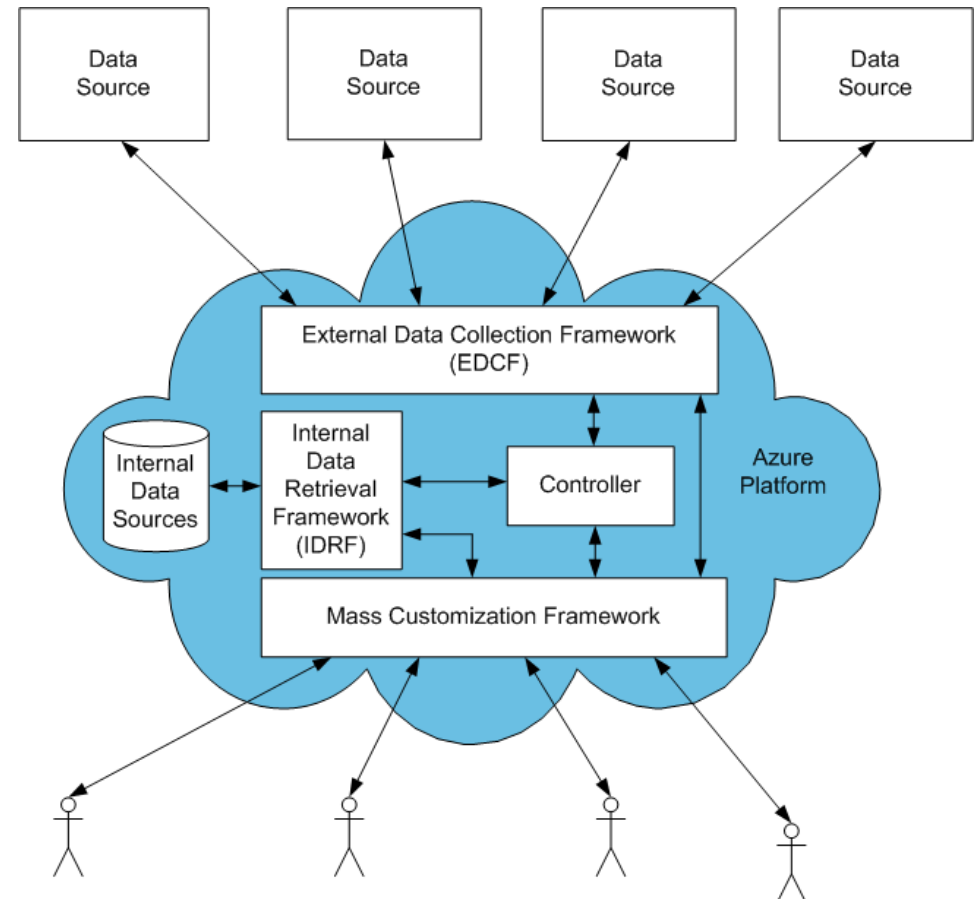
- Service Granularity
- Service Autonomy
- Service Reusability
- Service Composability
- Loose Coupling
- Standardized Contracts
- Service Metadata and Discoverability

MC

- Component Modularity
- Component Independence
- Component Reusability
- Component Configurability
- Loose Coupling
- Standardized Interfaces
- Component Metadata and Discoverability

Framework for Mass Customization

- Mass-customized Products
- Mass-customized Data/Information/Knowledge Services
- Mass-customized Learning



III.B. Collaboration

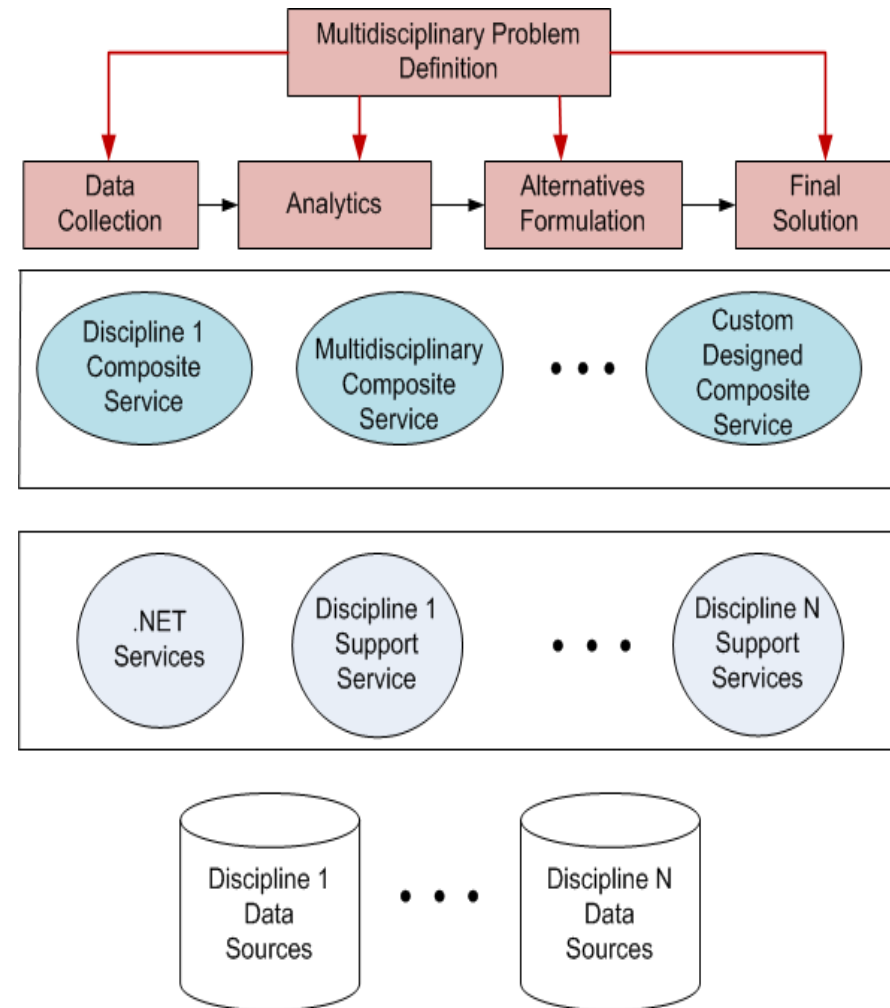
New Trend Driven by

- Preference of Funding Sources
- Sharing of Resources and Expertise
- Division Of Labor/Separation of Concerns
- Enabled by Advances in Communication and Collaboration Technologies

Cloud Computing can play an important role

Collaboration Framework in the Cloud

- Enterprise SOA expanded into Community SOA
- Standardization
- Discoverability
- Reusability
- Composability



Conclusions

- On-demand customer-specified renewable energy forecasts can be delivered by the FaaS framework implemented by using the Azure platform
- FaaS framework can be viewed as a framework for mass customization in the cloud and a framework for collaboration in the cloud

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