

# Hybrid Cloud Architectures for Operational Performance Management

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GLOBAL PRODUCT DATA  
INTEROPERABILITY  
**S U M M I T**  
2014



ELYSIUM

Parker

NORTHROP GRUMMAN

BOEING



# Delbert Murphy and Microsoft's Data Insights CoE

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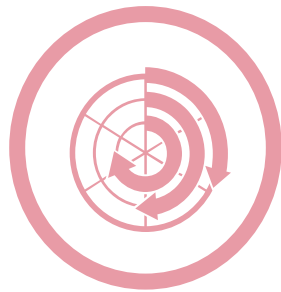
## Technologies



Microsoft Azure

SQL Server

Power BI



HDI Insight

Azure Machine Learning

## Areas of Expertise



Customer Analytics



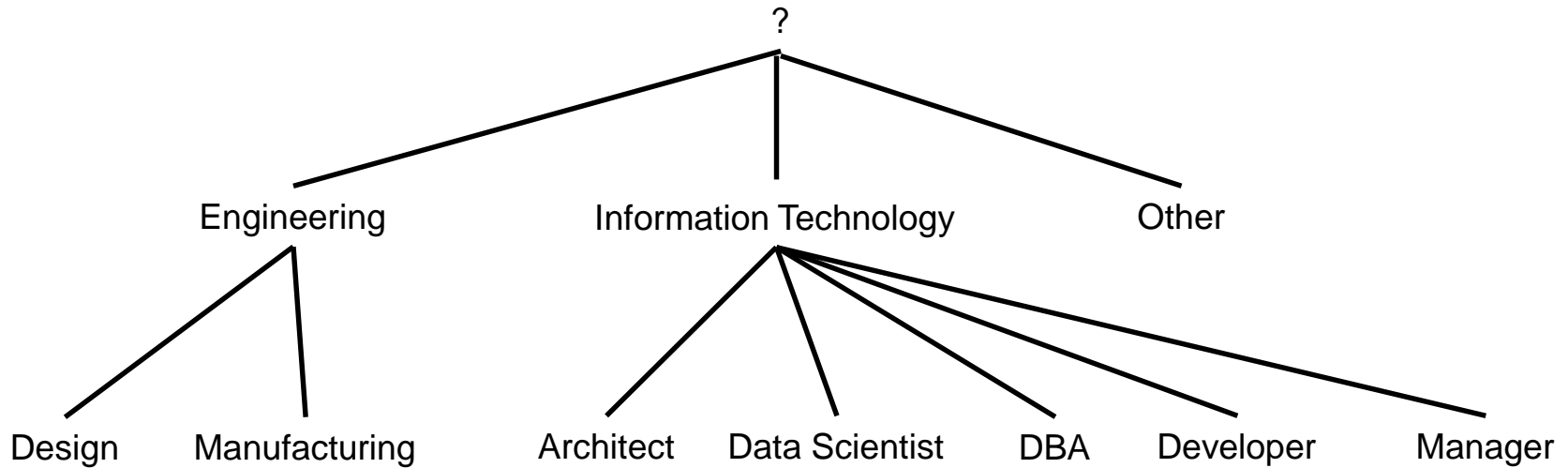
Operational Intelligence



Analytics for Finance

# Quick census

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# The NIST cloud definition framework

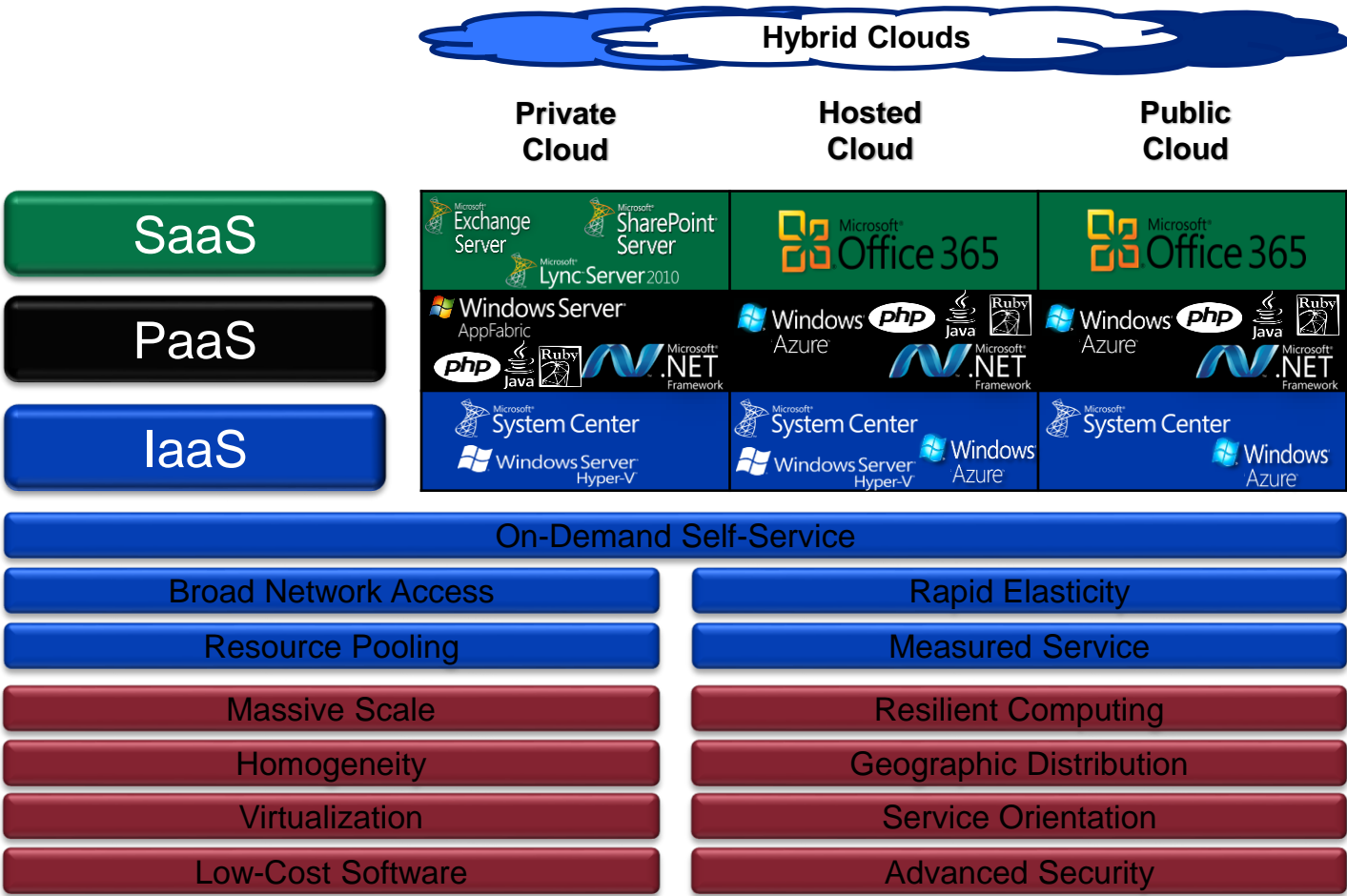
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Deployment  
Models

Service  
Models

Essential  
Characteristics

Common  
Characteristics

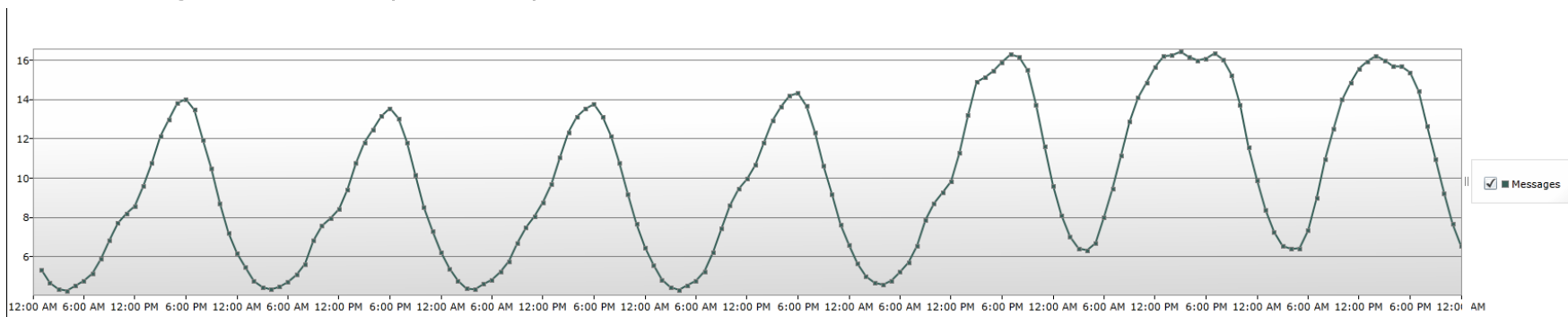


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## Variable rates unpredictable

## Large amounts of data

# bursts



# Event velocity

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## Device telemetry

Thermostats report data every 15 minutes

Cars send telemetry data every minute

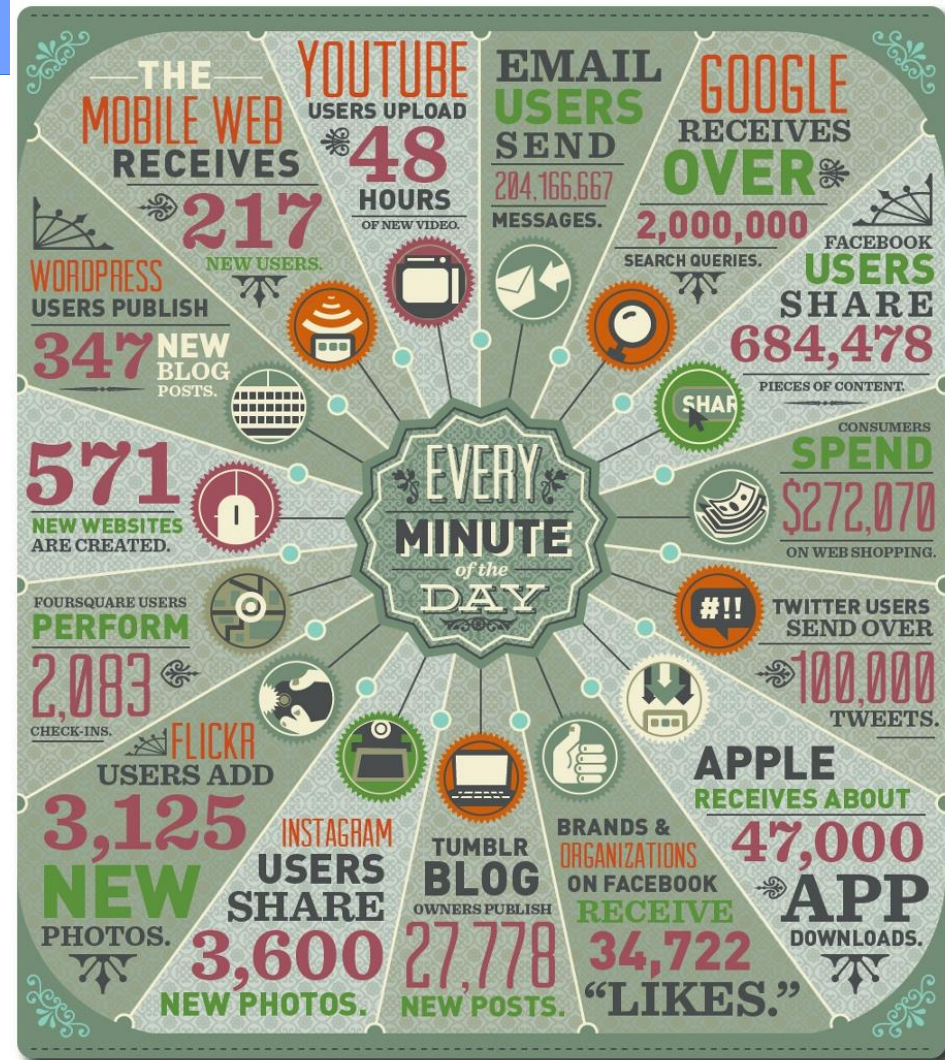
## Application telemetry

Application perf counters are measured every second per server

Mobile app telemetry is captured for every action on your app!

## App and operational events

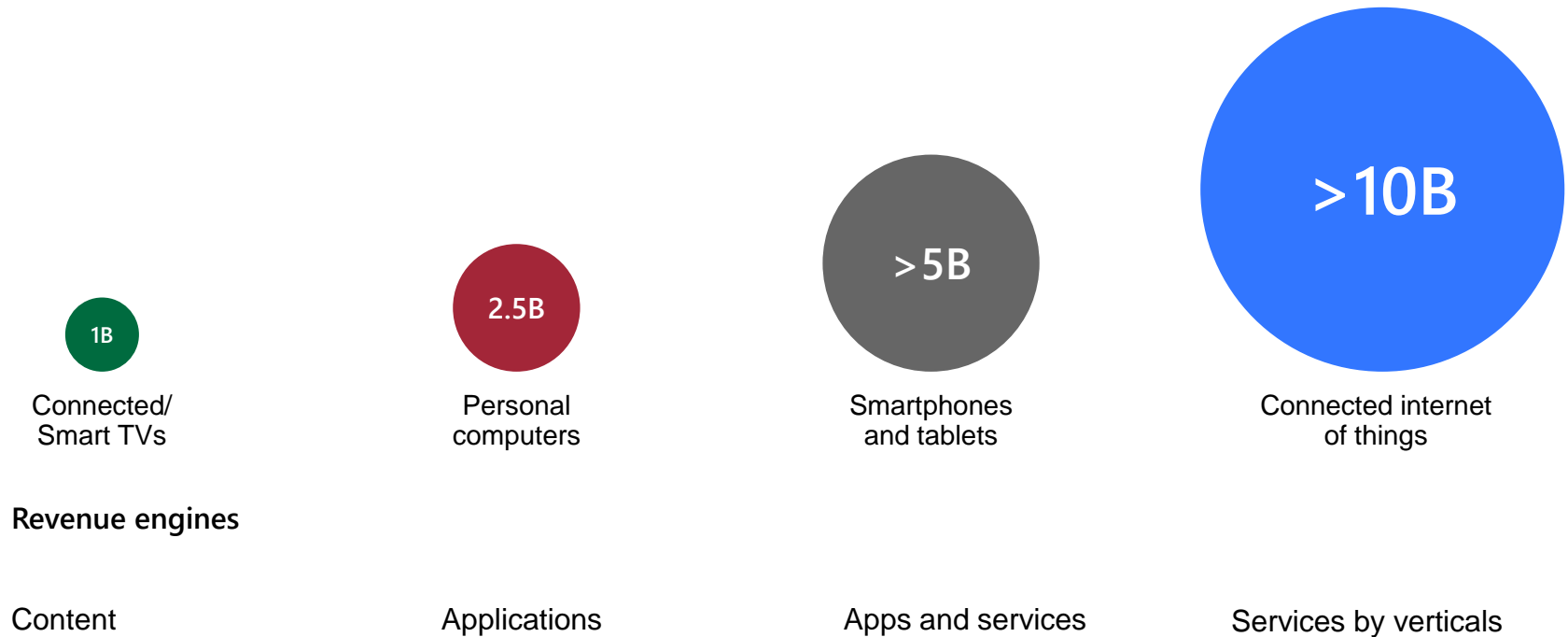
Halo game engine estimate 1,000,000 msg/s





# Event source variety

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Source: Gartner, IDC, Strategy Analytics, Machina Research, Company filings, BI Intelligence, Accenture analysis  
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# Event veracity

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ve·rac·i·ty

1. **Devotion to the truth: truthfulness**
2. **Power of conveying or perceiving the truth**
3. **Conformity with truth or fact: accuracy**

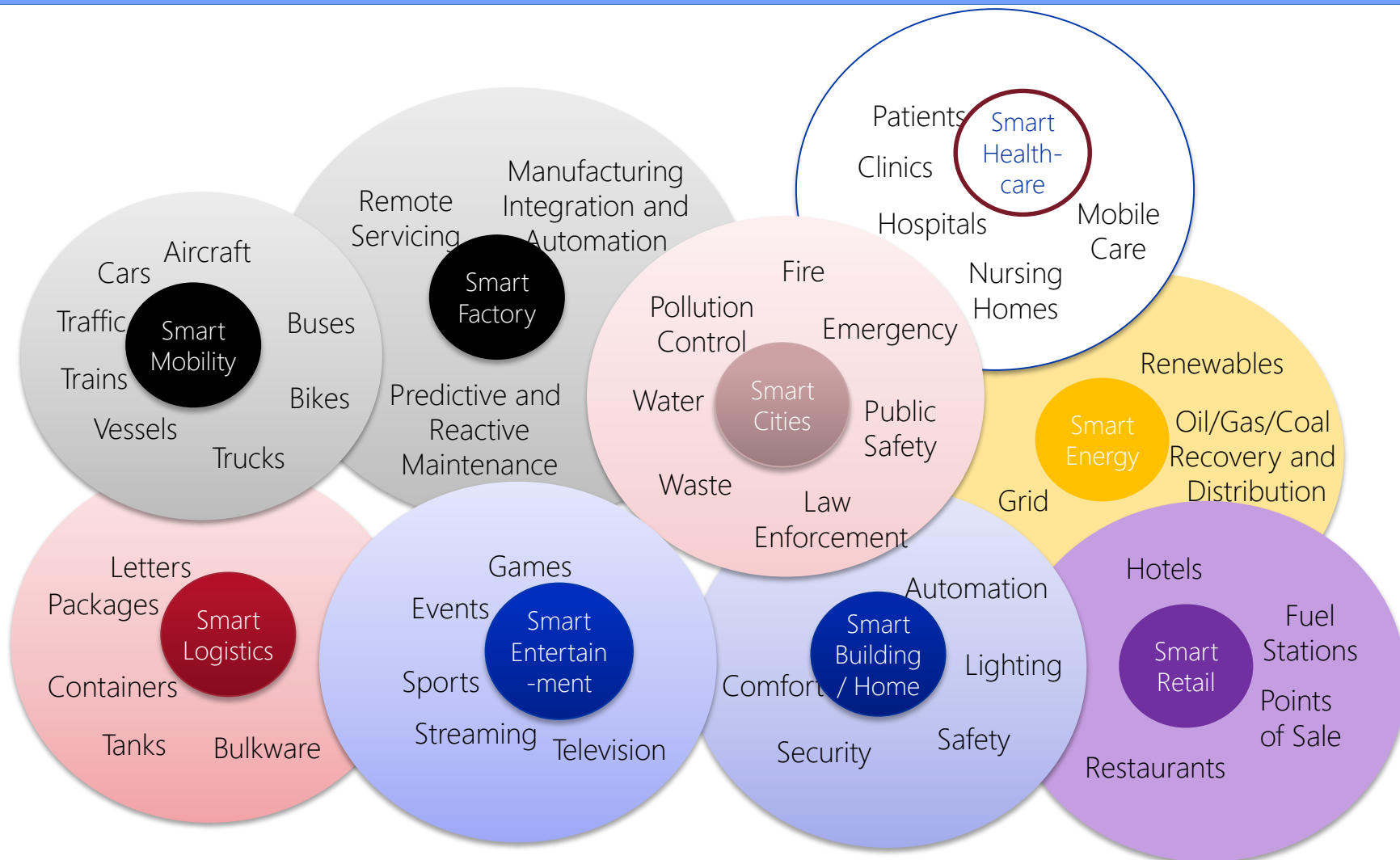
Record the confidence a source system has in the event value

Use a large enough N to confident in the value



# Event impact

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# Scenarios for operational performance management

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## *Predictive Maintenance*

- Avoid costly asset downtime and reduce maintenance costs
- Reduce warranty claims due to unexpected failures
- Improve inventory management of spare parts by predicting failures

## *Performance Management*

- Improve Production Quality Assurance and Yield

## *Event and Incident Management and Monitoring*

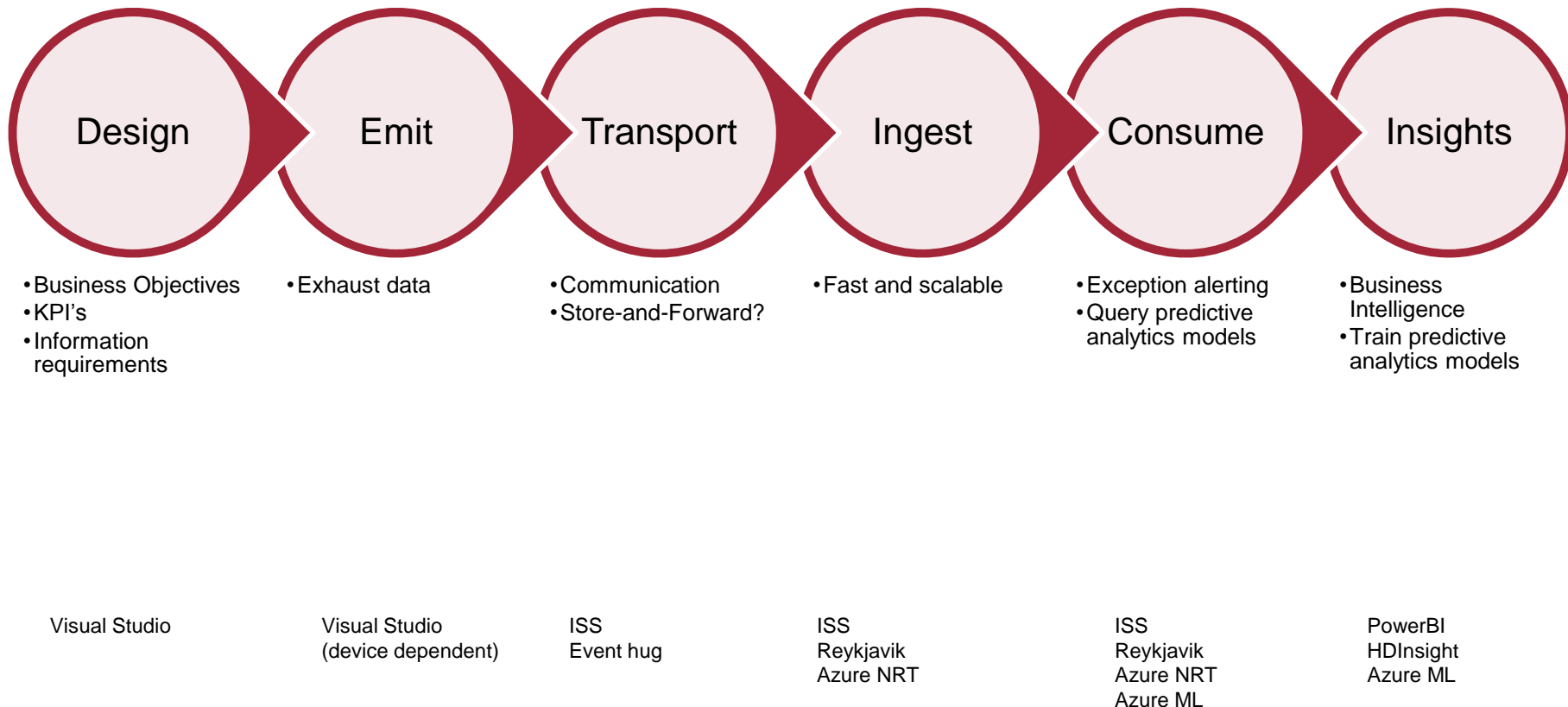
- Better protect Health, Safety and Environment
- Improve Situational Awareness, Security and Tracking

## *Route and Capacity optimization*

- Optimize Power grids and networks
- Optimize Traffic and Goods movement

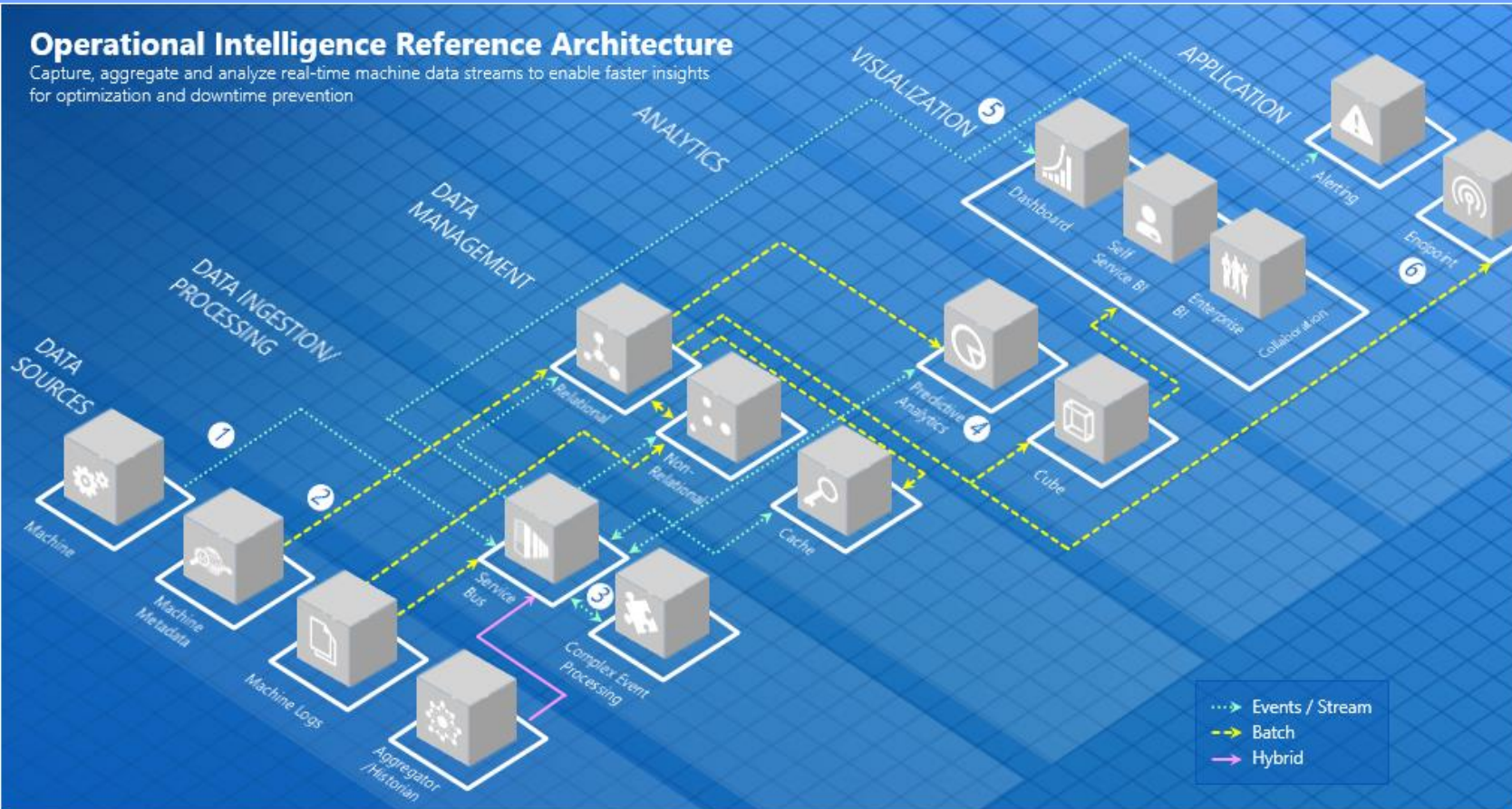
# Process

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## Operational Intelligence Reference Architecture

Capture, aggregate and analyze real-time machine data streams to enable faster insights for optimization and downtime prevention



1. Machine / application telemetry streams are securely consumed via a large-scale, durable event processing service.
2. Machine Metadata is persisted and referenced to enrich operational analytics and maintenance prediction.
3. CEP enables temporal aggregations and queries for critical pattern or outlier detection in real-time.
4. Predictive Analytics enables real-time or periodic insights to potential machine downtime or adverse behavior.
5. Operators can derive deep insights from visualizations as well as perform ad-hoc "what-if" analysis through Self-Service BI tools.
6. Custom alerts can notify operators of potential issues, whilst endpoint enable additional application integration to satisfy machine-to-machine scenario's.

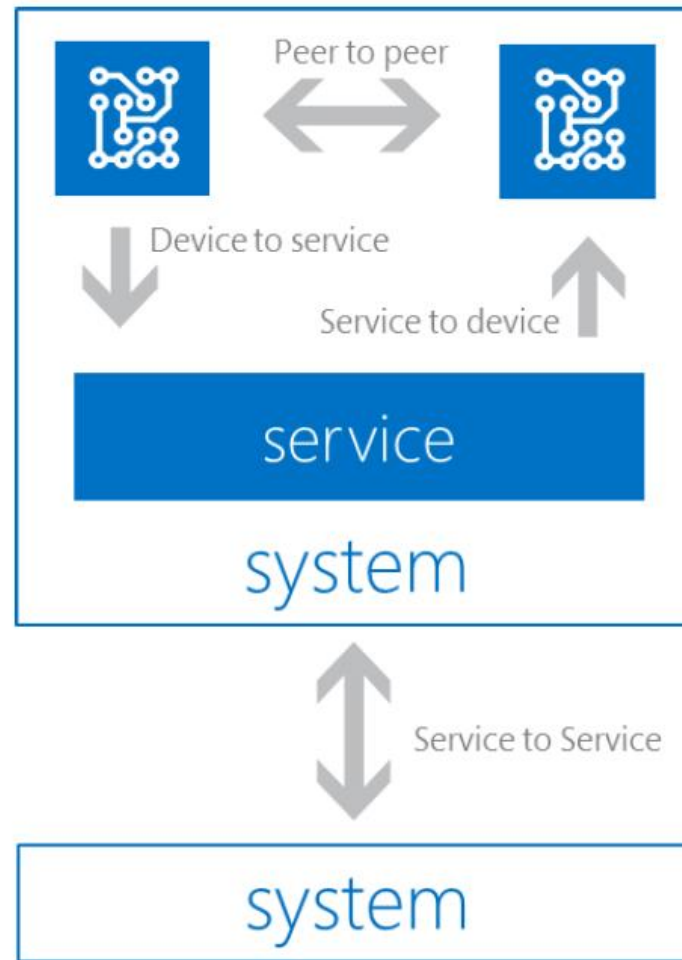
# Device communication patterns

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# Device communication styles

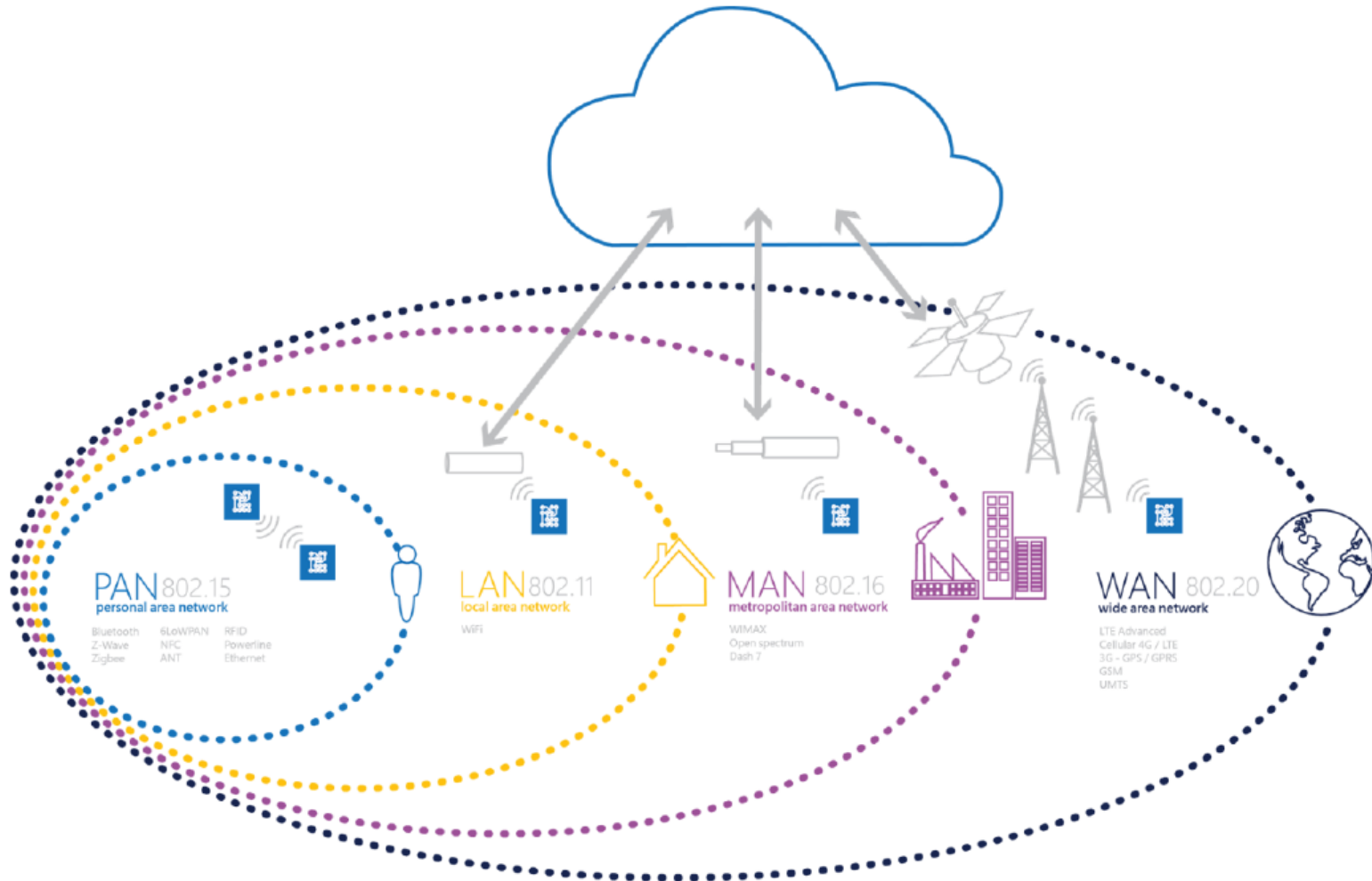
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# Device communication scope

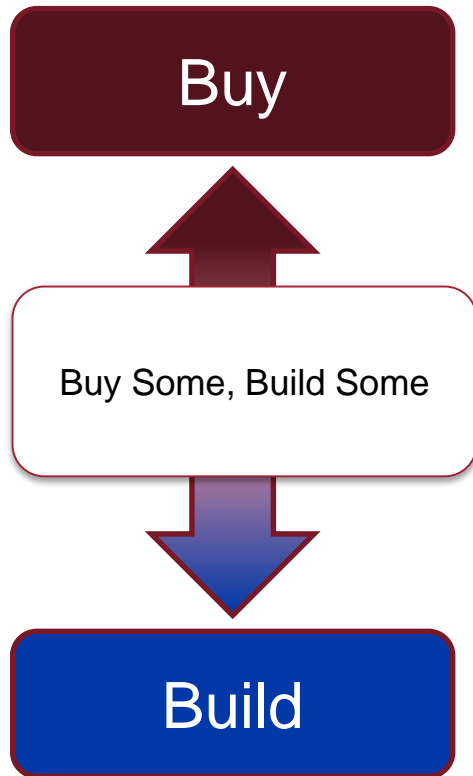
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# Selecting the right components

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Focus on Business Result and Time To Value

Mix and Match

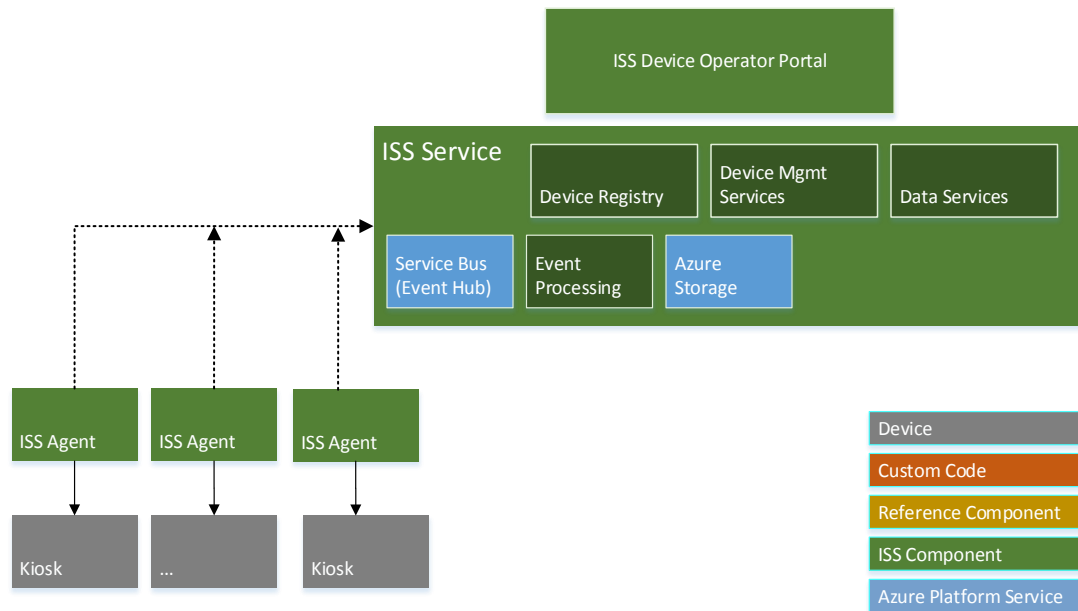
- Custom protocols & security models
- Custom analytics and data processing

Core Competency in building software & Services

- Focus on flexibility & control
- Strategic investment in service platform

# Azure ISS, no custom code

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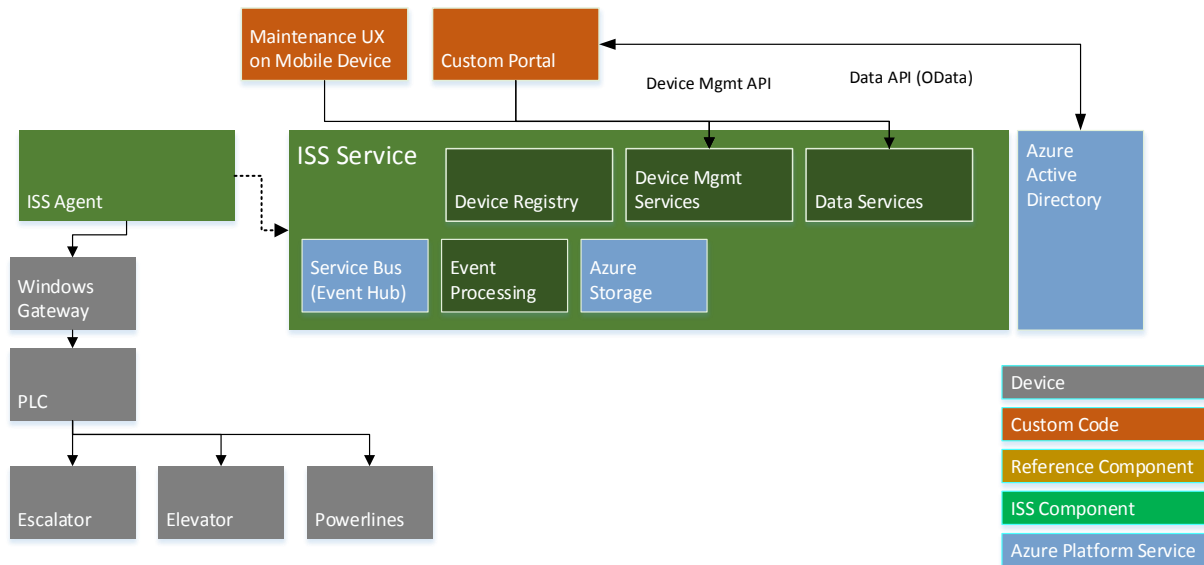
- Limited experience in software and service development
- Very sensitive to time to market and budget
- Connect remote kiosks to ISS via Windows agents for basic device management

## Scenarios and Workloads:

- Entire System Management
- Station Management
- Mobile Maintenance Worker Tasking and Support

# Custom devices & portal on Azure ISS

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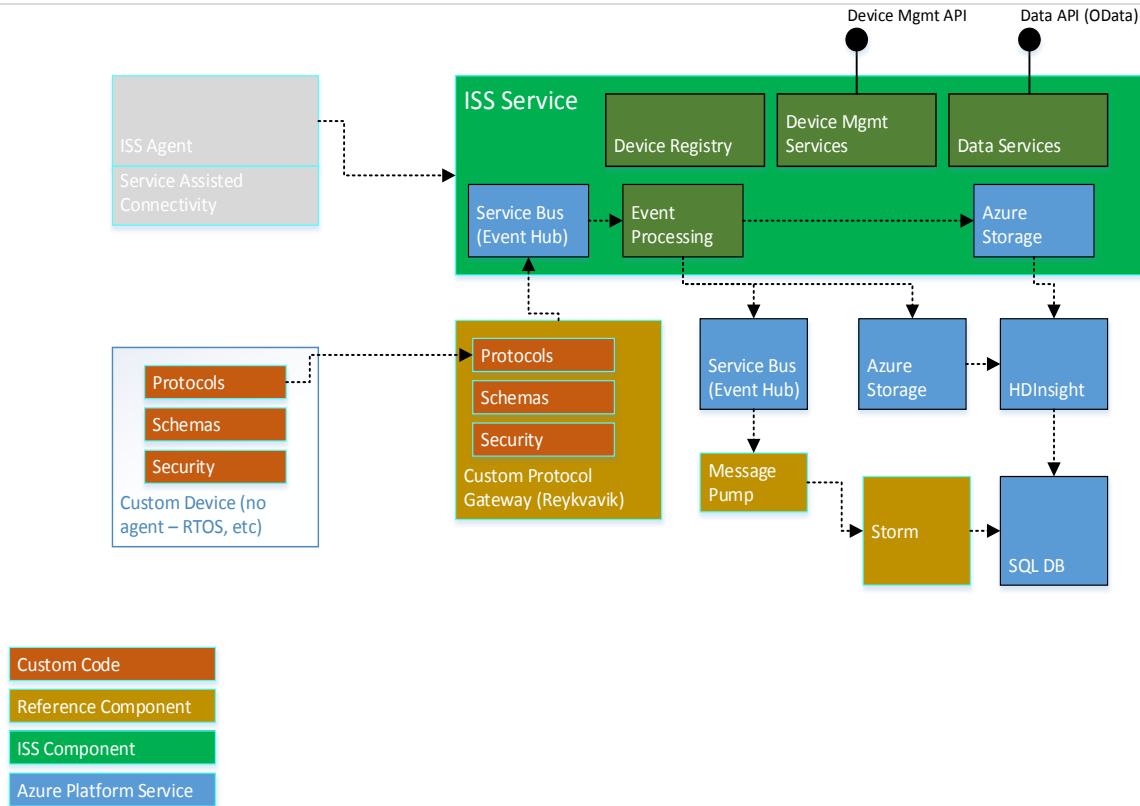
- Depth and experience in software and service development
- Very sensitive to time to market (more buy than build)
- Connect sensors to ISS agents, push data to ISS
- Command and control from ISS
- Other Azure services used - AAD

## Scenarios and Workloads:

- Entire System Management
- Station Management
- Mobile Maintenance Worker Tasking and Support

# Custom protocol, to cloud gateway to ISS

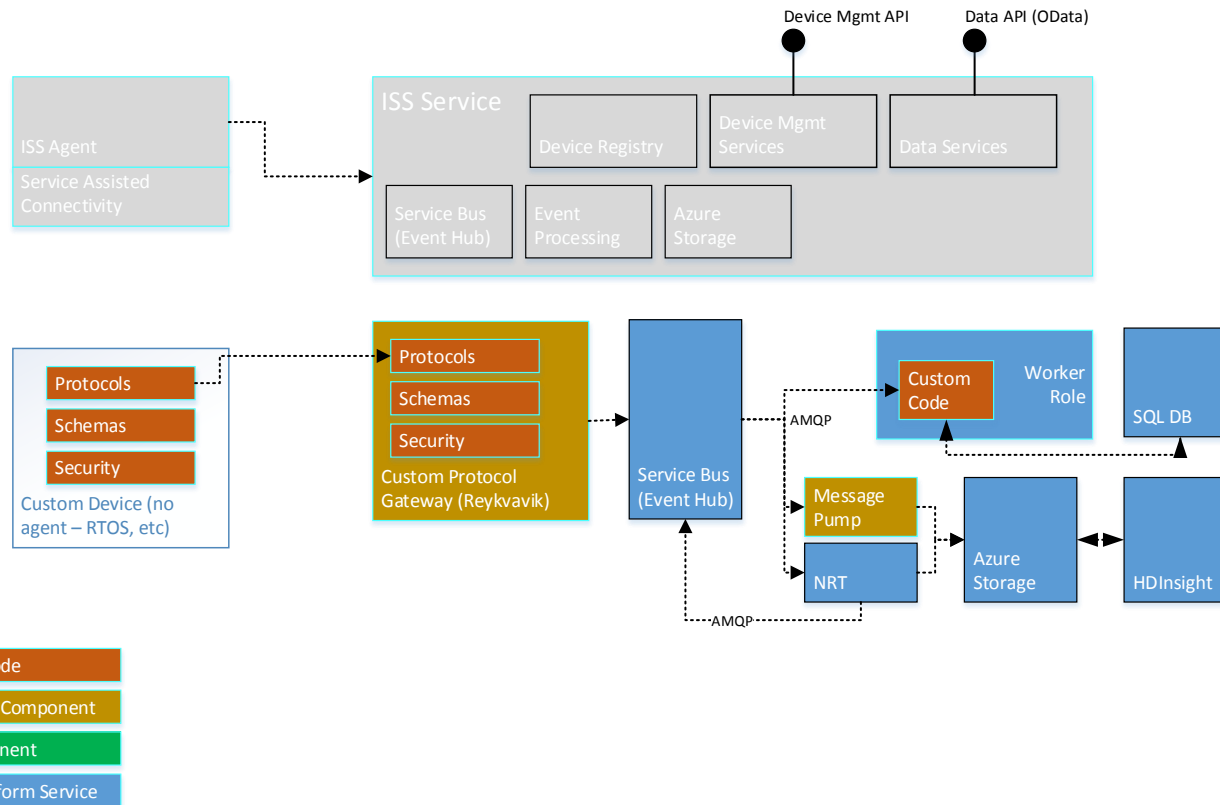
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- Limited depth and experience in software development
- Good fit for turn-key service platform
- Front end connectivity and data flow with Reykjavik
- Flow data into ISS for processing, device management
- ISS publishes data to customer storage account for batch processing
- ISS publishes copy of live data stream to customer Event Hub for custom processing

# Custom protocols and Azure building blocks

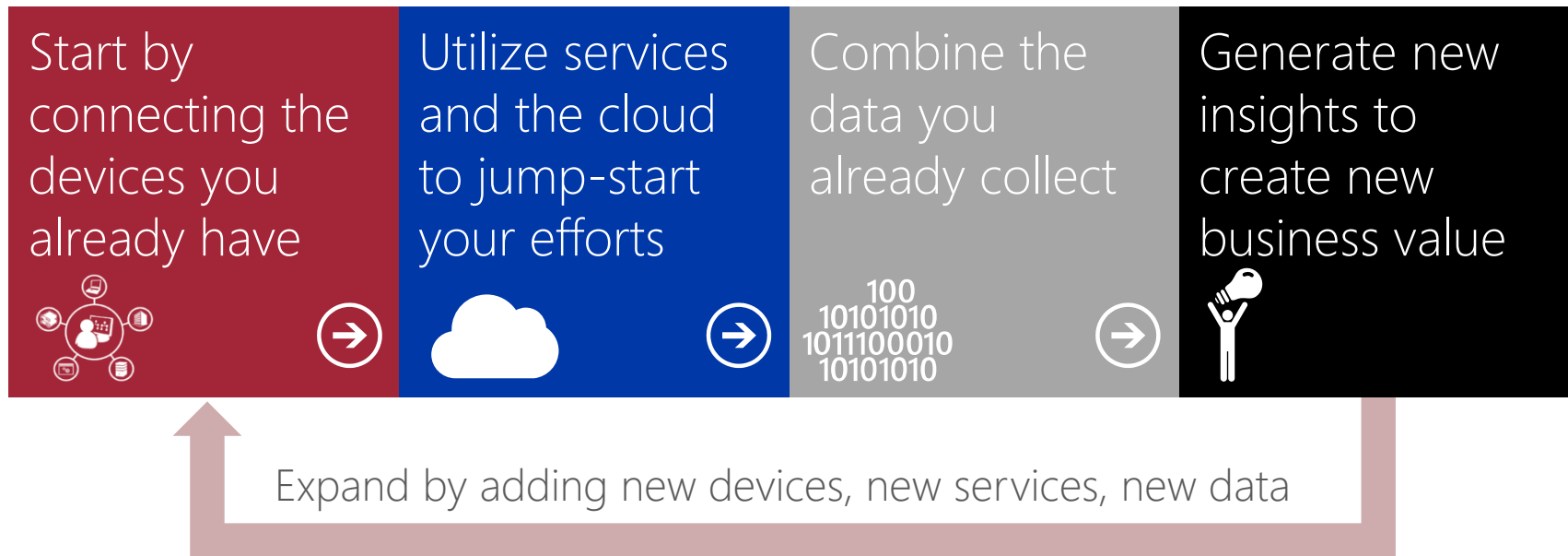
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- Depth and experience in software and service development
- High demand for control and flexibility (more build than buy)
- Needs custom protocol support for extant devices
- Build out on Azure services using Reykjavik components to streamline delivery

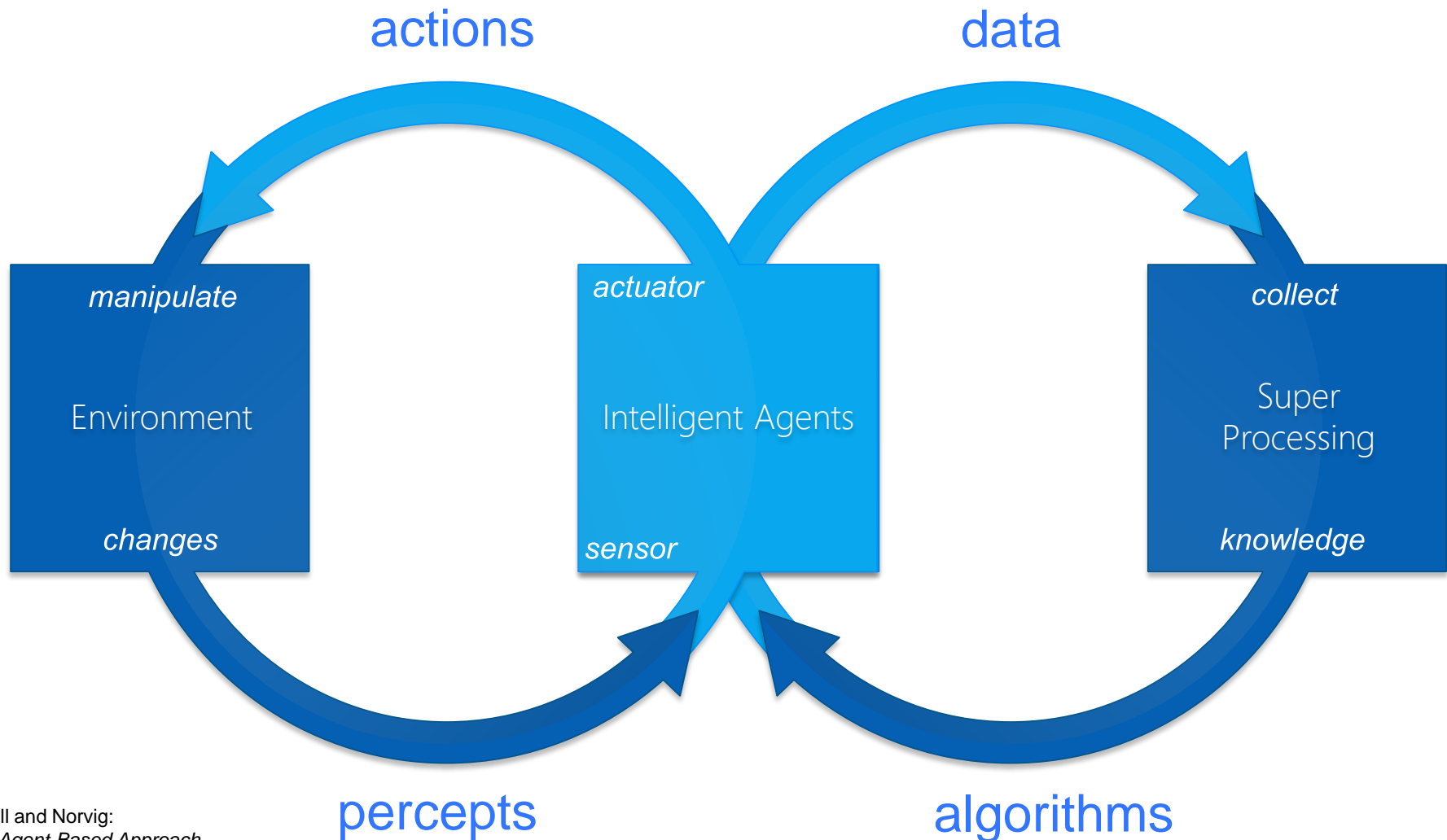
# The right strategy

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# Intelligent (cognitive) systems

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Russell and Norvig:  
*AI An Agent-Based Approach*



# Lidberg's law

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**Data born in the cloud, stays in the cloud. Data born on premises stays on premises.**

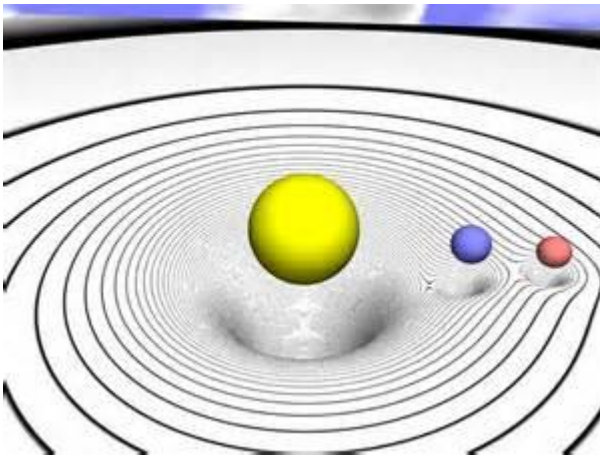
Simon Lidberg, Microsoft

# Homan's law

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**Think carefully about where you place your data: it forms a gravity well. A data storage mechanism will attract other data in direct proportion to the amount of data it currently holds.**

Uli Homan, Microsoft



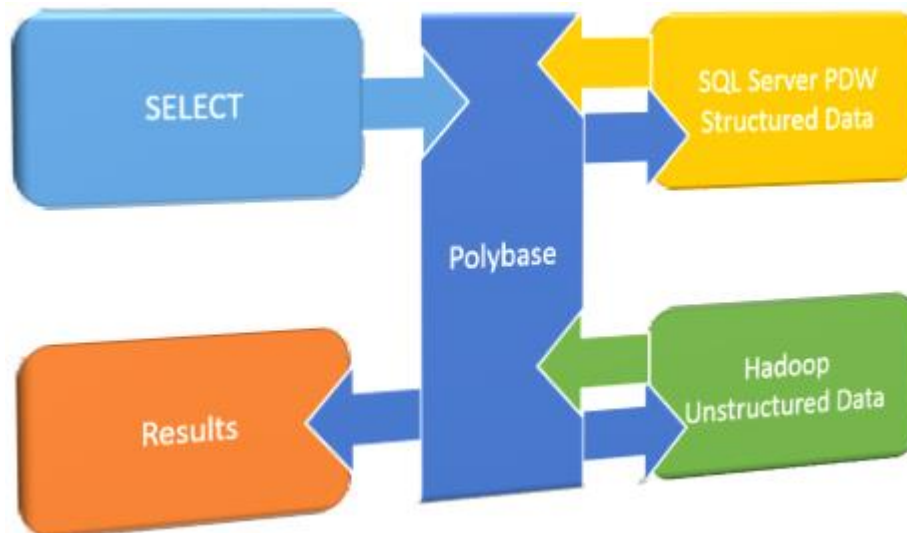
# Murphy's law of distributed data

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**Don't distribute your data. ☺**

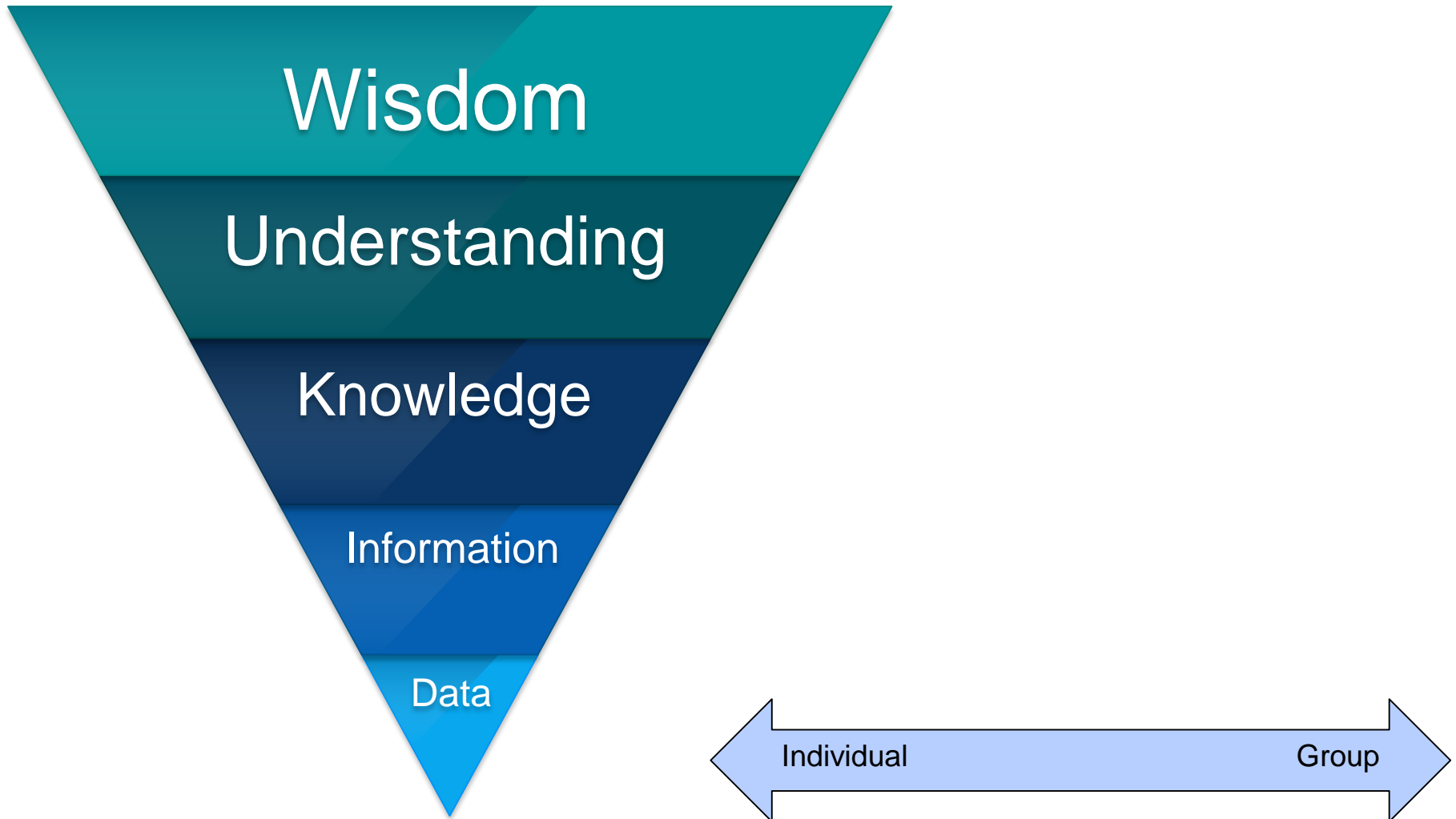
**Compute locally, to join globally.**

Delbert Murphy, Microsoft



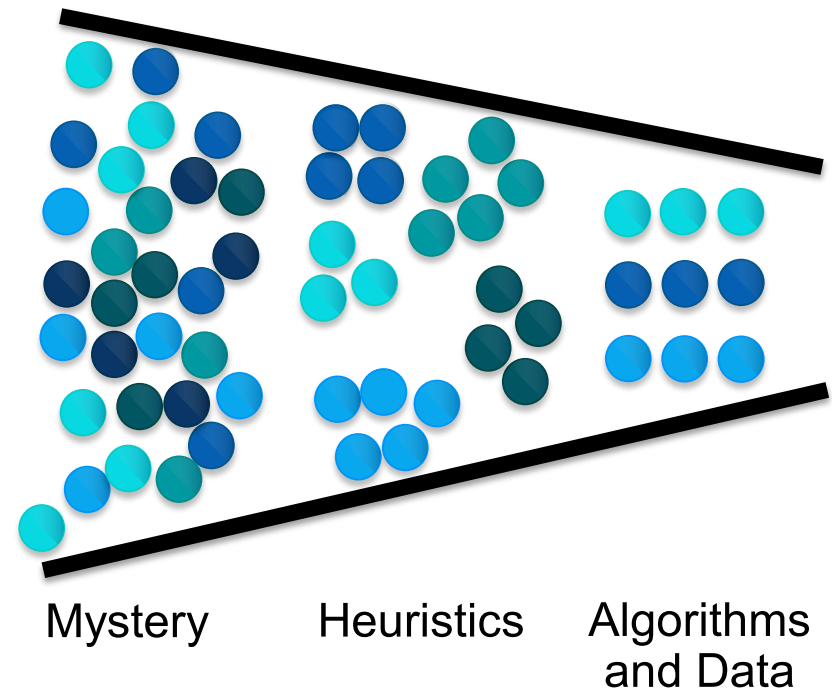
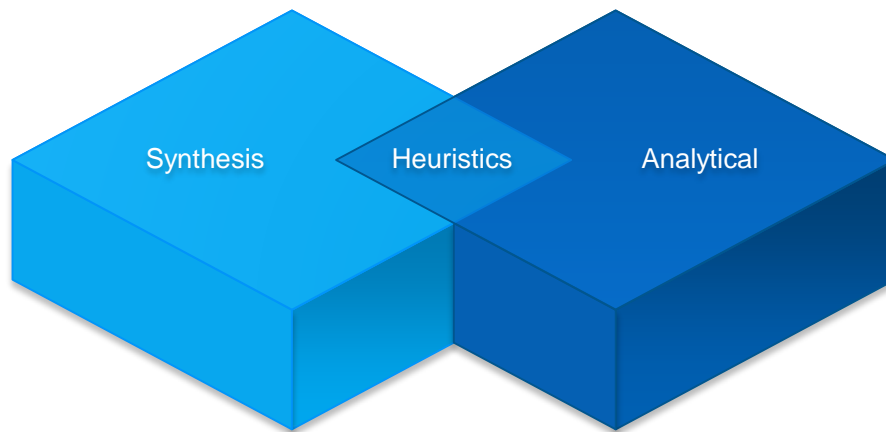
# Information hierarchy

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# Heuristics

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# Questions and answers

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# Appendix

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# Microsoft's data platform stack

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## BI & ANALYTICS



Self-service



Corporate



Collaboration



Mobile



Predictive

## DATA ENRICHMENT AND FEDERATED QUERY



Single query model



Extract, transform, load



Data quality



Master data management

## DATA MANAGEMENT & PROCESSING



Relational



Non-relational



Analytical



Streaming



Internal & External

## INFRASTRUCTURE



Scalability



Virtualization



Security and Identity



Quality of service

# Microsoft's data warehouse stack

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## DATA MANAGEMENT & PROCESSING



Relational



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Internal & External

## INFRASTRUCTURE

### Data sources



OLTP ERP CRM LOB

### Non-Relational Data



Devices Web Sensors Social

# Microsoft's modern data platform

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## BI & ANALYTICS



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## INFRASTRUCTURE

### Data sources



OLTP ERP CRM LOB

### Non-Relational Data



Devices Web Sensors Social

# Microsoft data platform and types of data

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