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Cloud Computing Research @ WSU

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School of Computing, Engineering and Mathematics

Research Team and Research Interests

Team

- 4 Academic Staff
- 5 PhD Students
- 1 Master Student

- **Resource Scheduling and Provisioning**
- **Reliability and Fault Tolerance**
- **Energy Efficiency**
- **Internet of Things and Fog Computing**
- **Performance Modeling and Evaluation**

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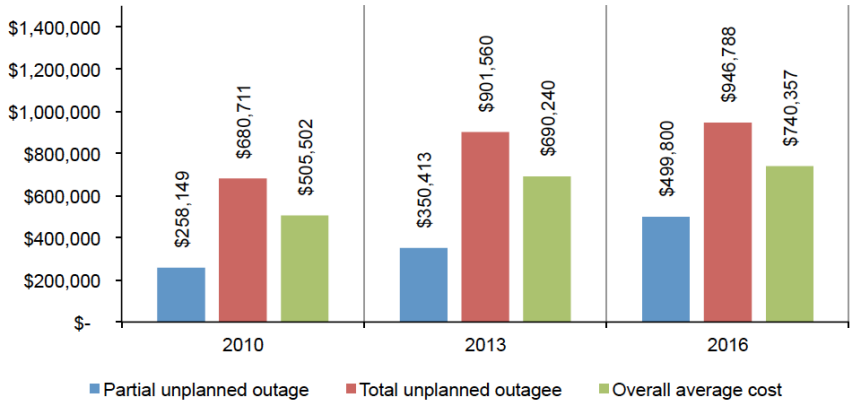
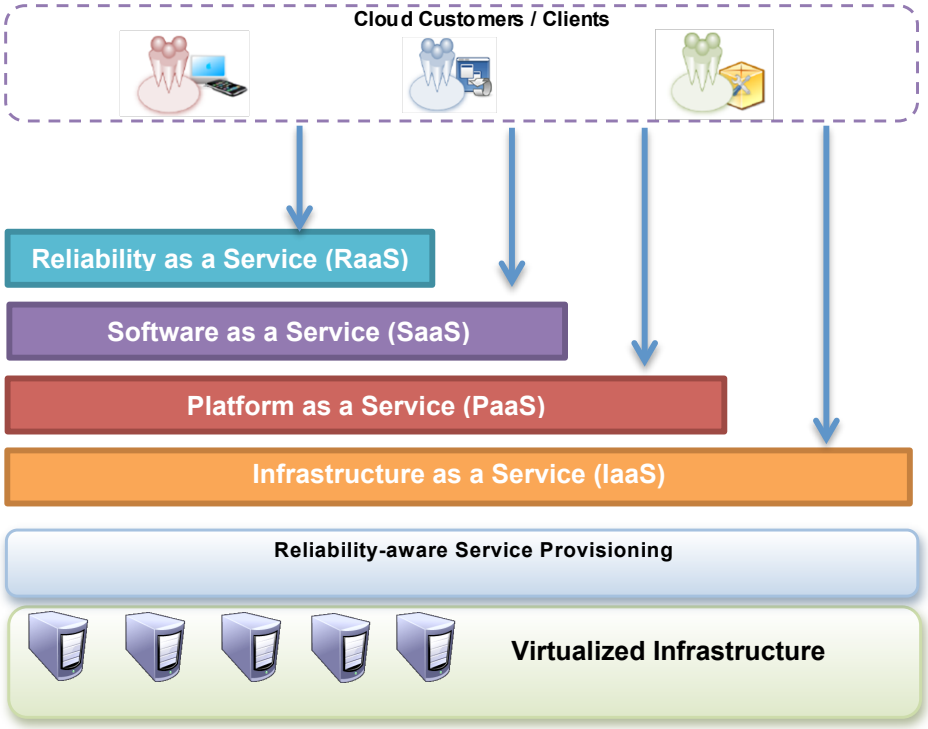
Challenges in Cloud Reliability



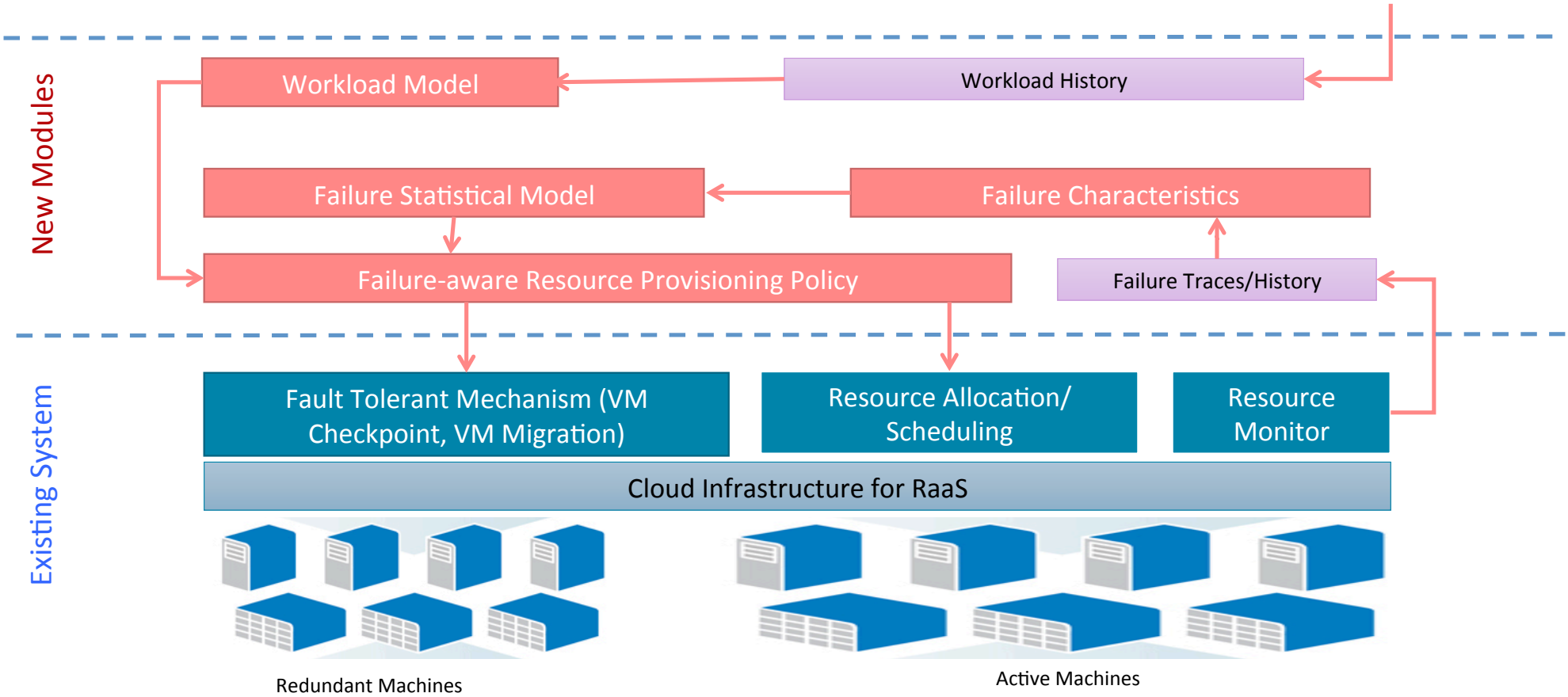
- **Resource Redundancy**
  Have more backup resources to tolerate failures
    - Power consumption
    - High operational cost
    - Hiding failures
- **Checkpointing**
  Continuously saving the state of applications to recover from the failures
    - Overhead
    - Complexity
- **Failure Model**
  Adapting the knowledge of failures pattern into resource provisioning and resource management
    - Robust and adaptive
    - Cost efficient

Reliability as a Service (RaaS)

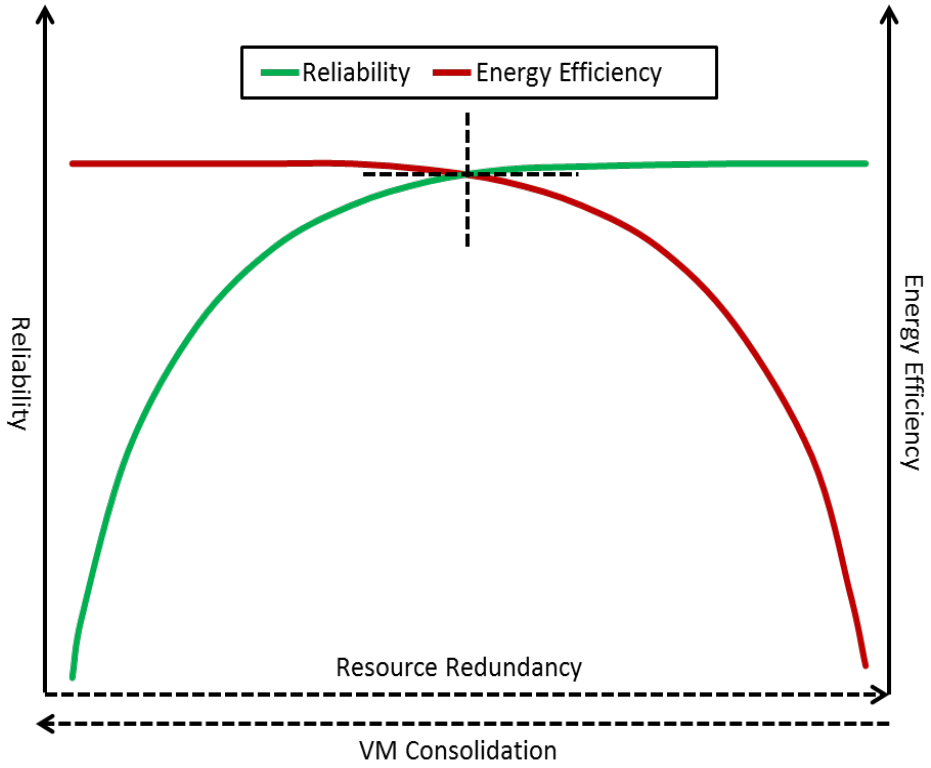
Innovative Cloud service that provides reliability and resilience with assured service performance

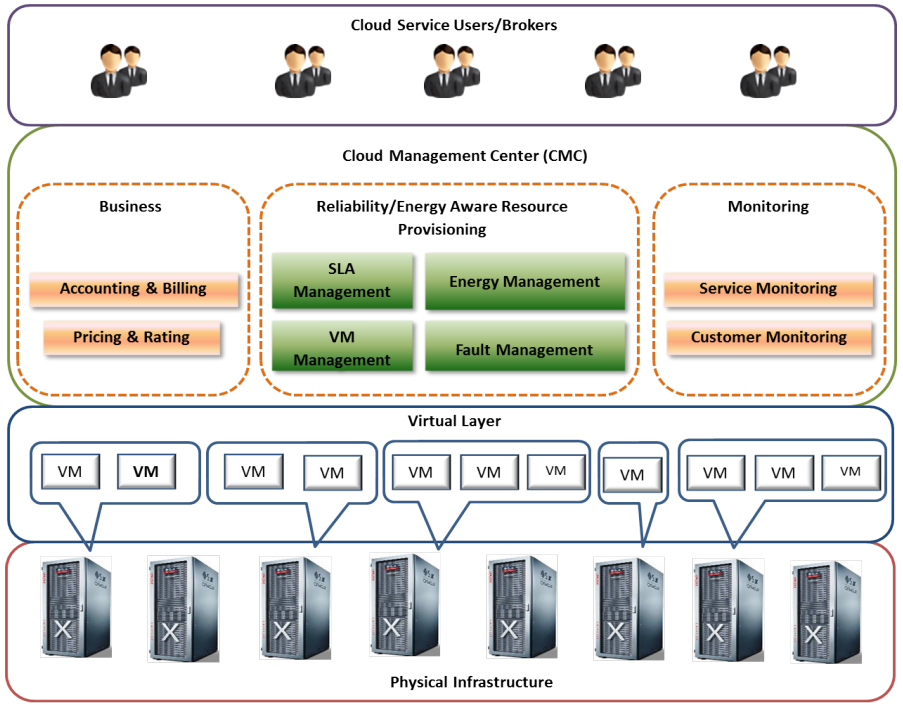


Failure-aware Resource Provisioning Policy

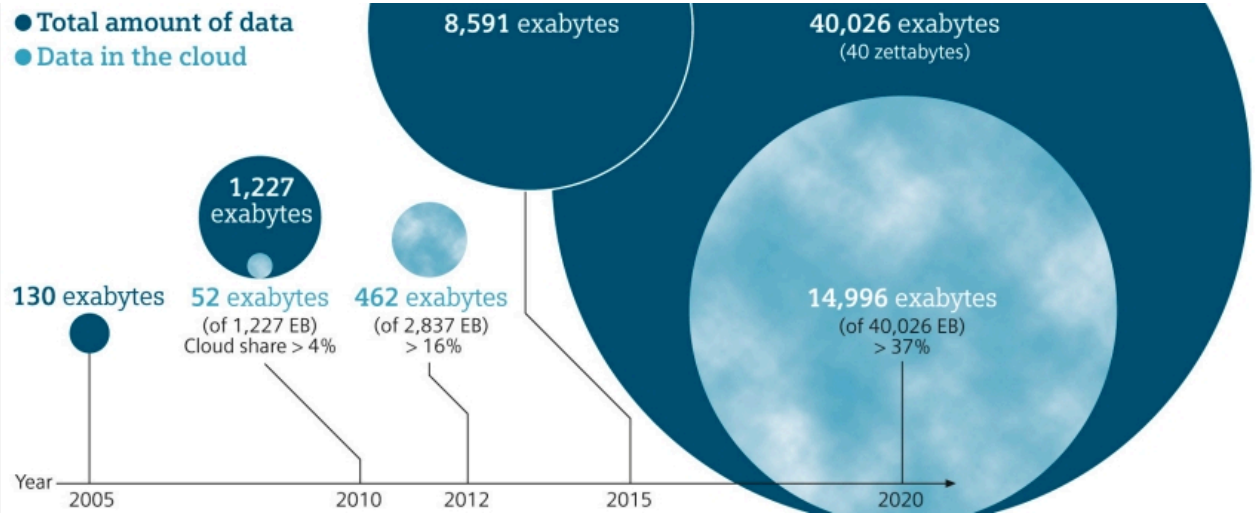


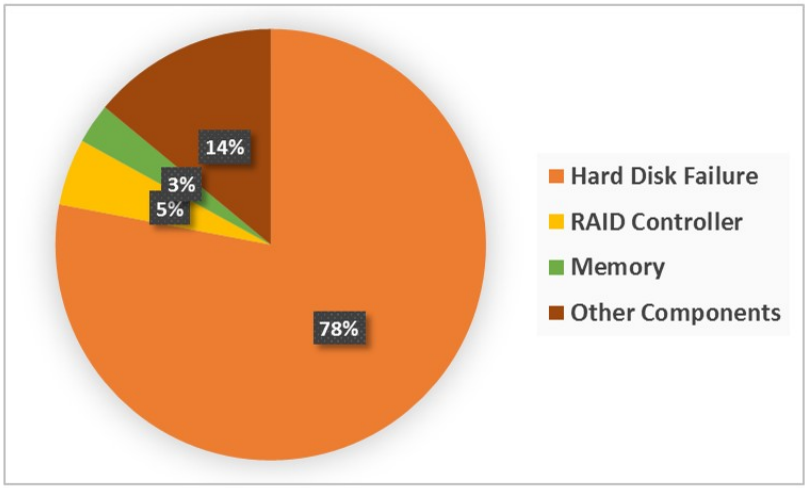
Reliability and Energy Efficiency Tradeoff in Cloud Computing





Data Reliability Management of Cloud Storage for Big Data Applications





Redundancy Techniques:

- Replication
- Erasure Coding

Conceptual Architecture for Hybrid Technique

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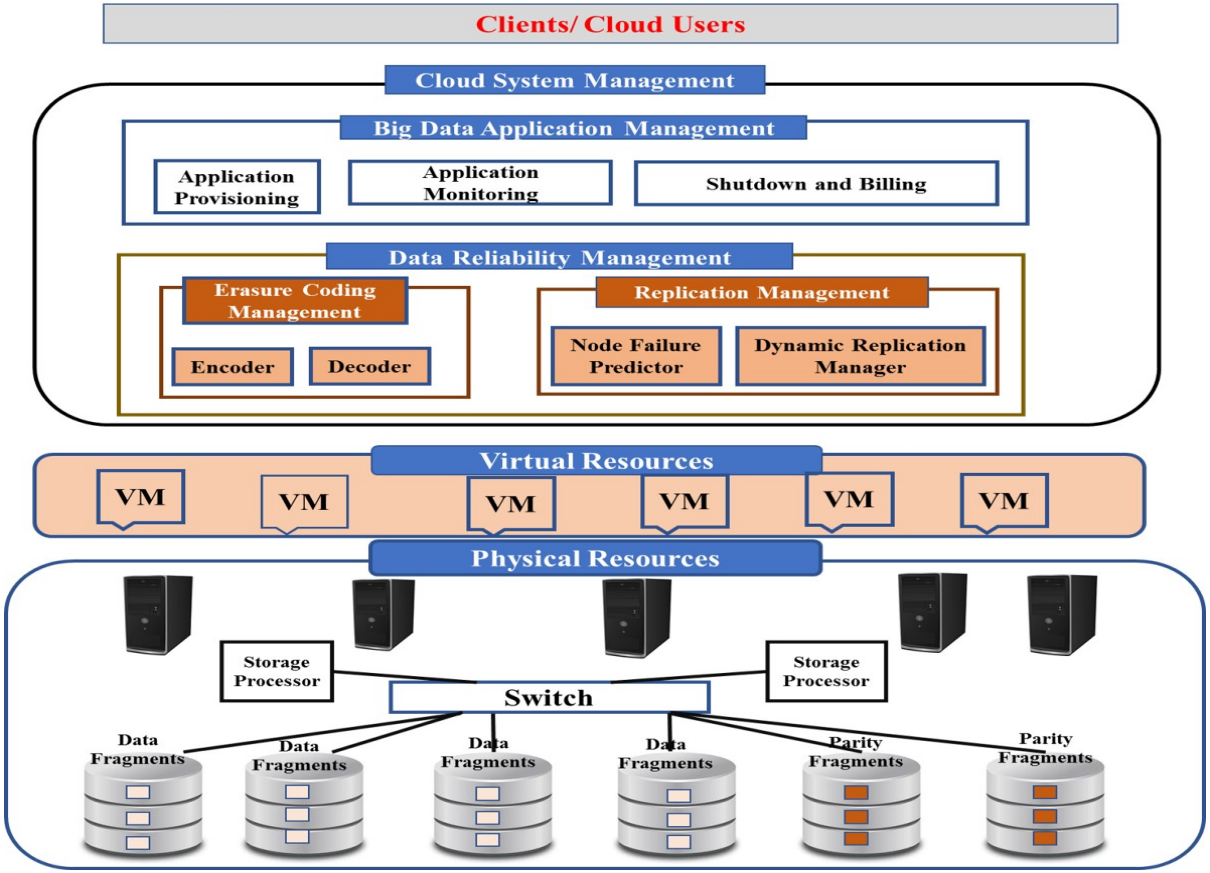

- Reliability
- Storage Efficiency
- Energy Savings
- Cost Savings

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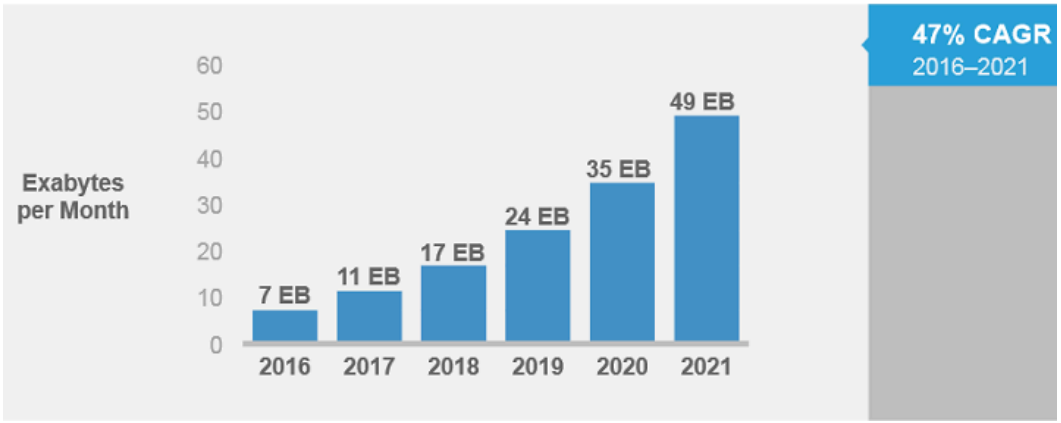
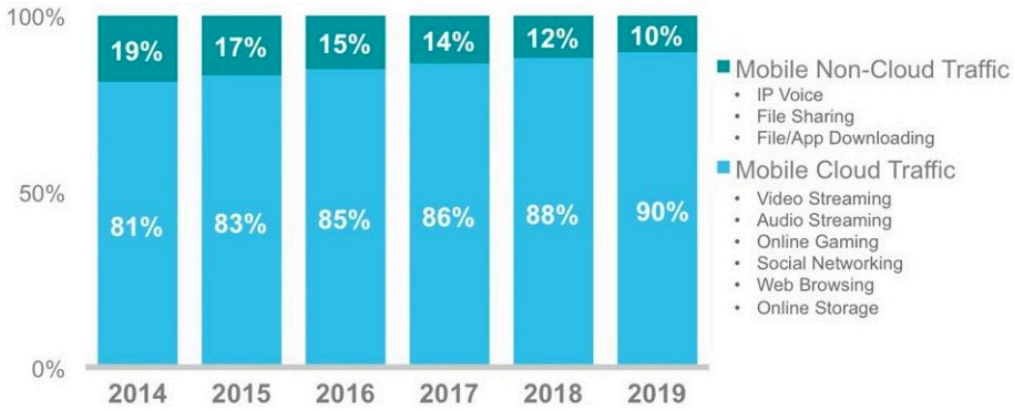
Mobile Cloud Computing

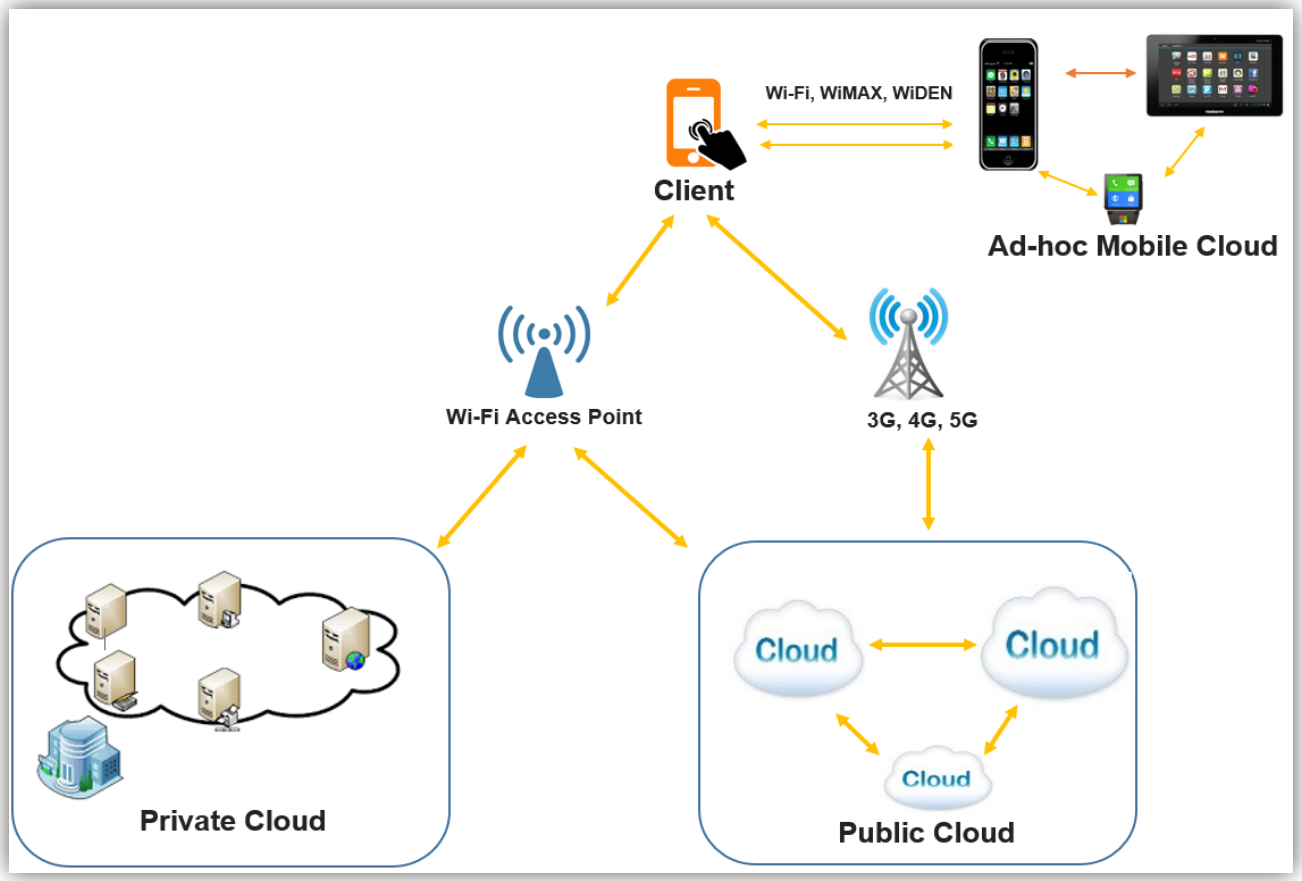
Global Mobile Data Traffic Growth / Top-Line

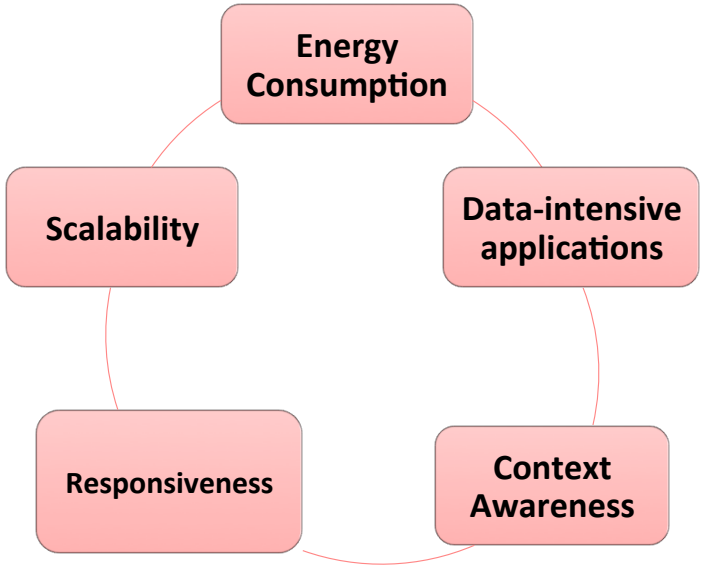
Global Mobile Data Traffic will Increase 7-Fold from 2016–2021



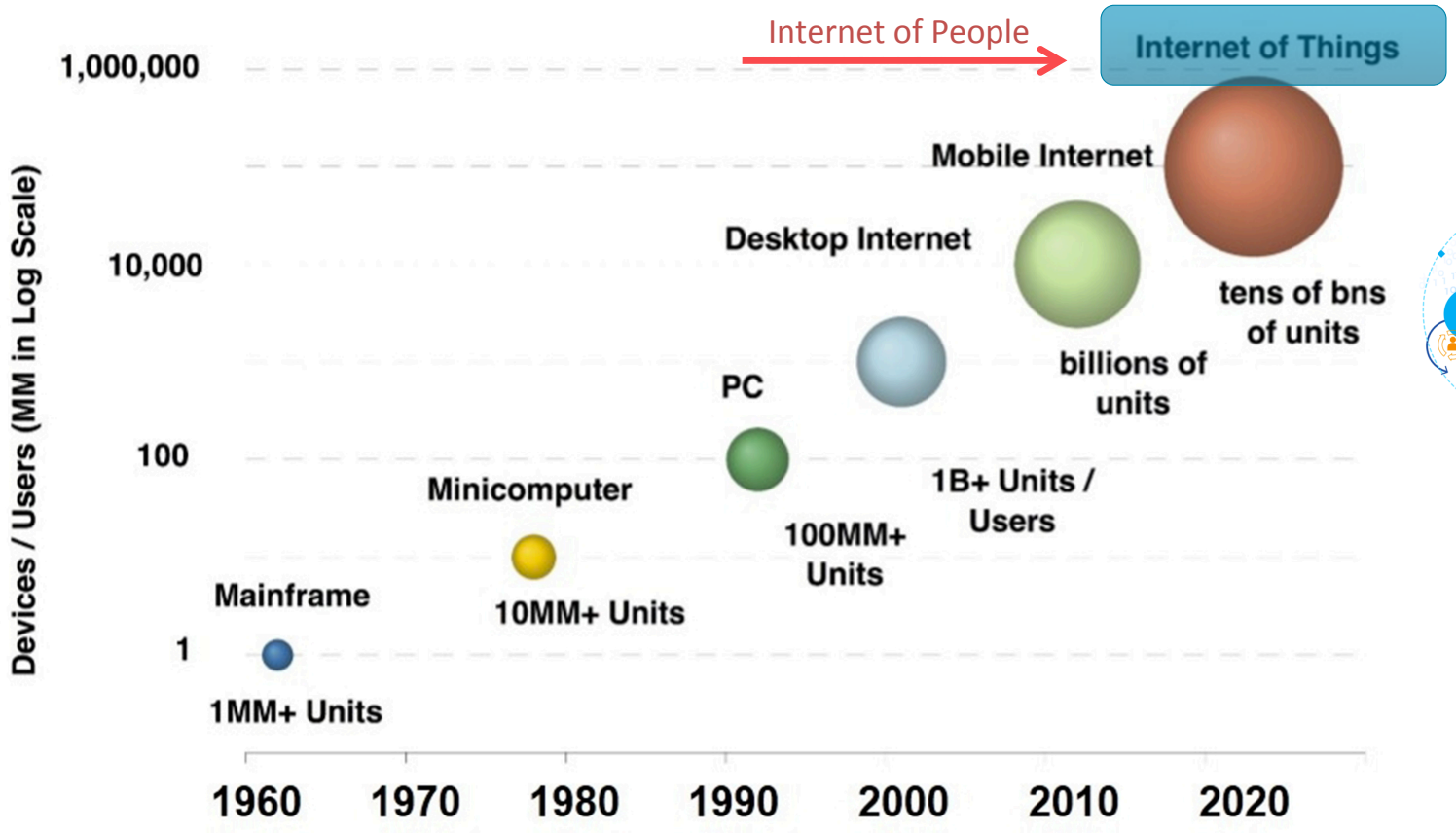


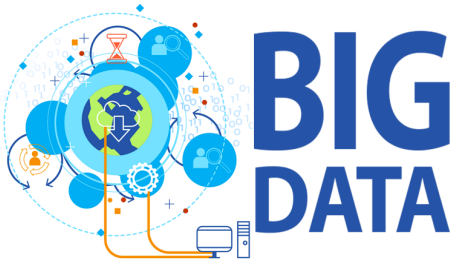
QoS-Based Data-Intensive Hybrid Mobile Cloud Computing Framework



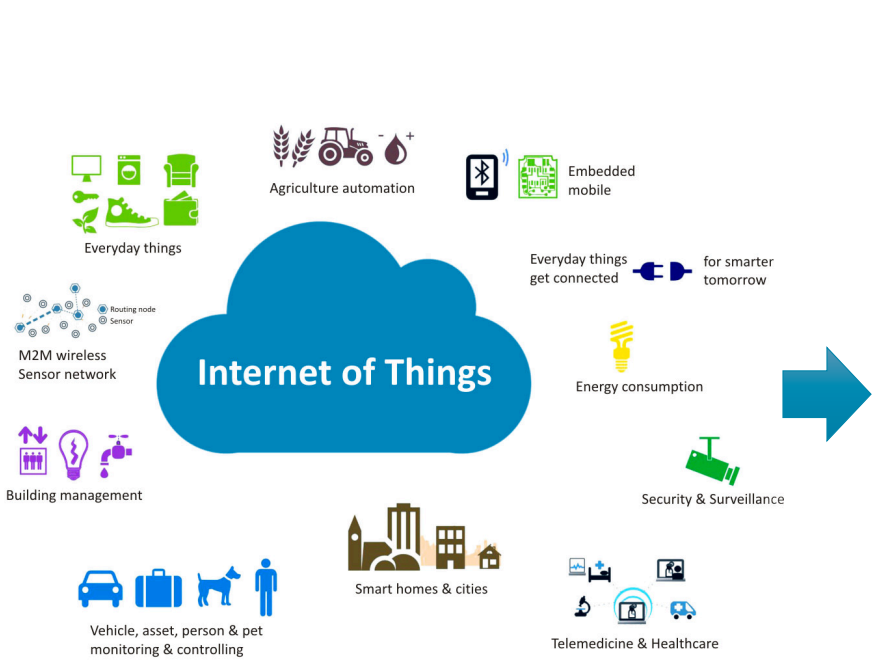


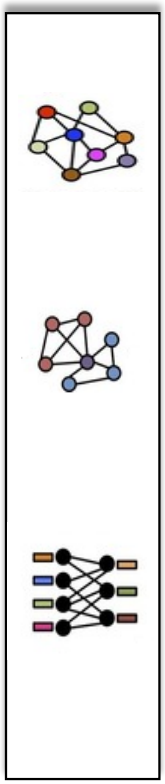
Internet of Things

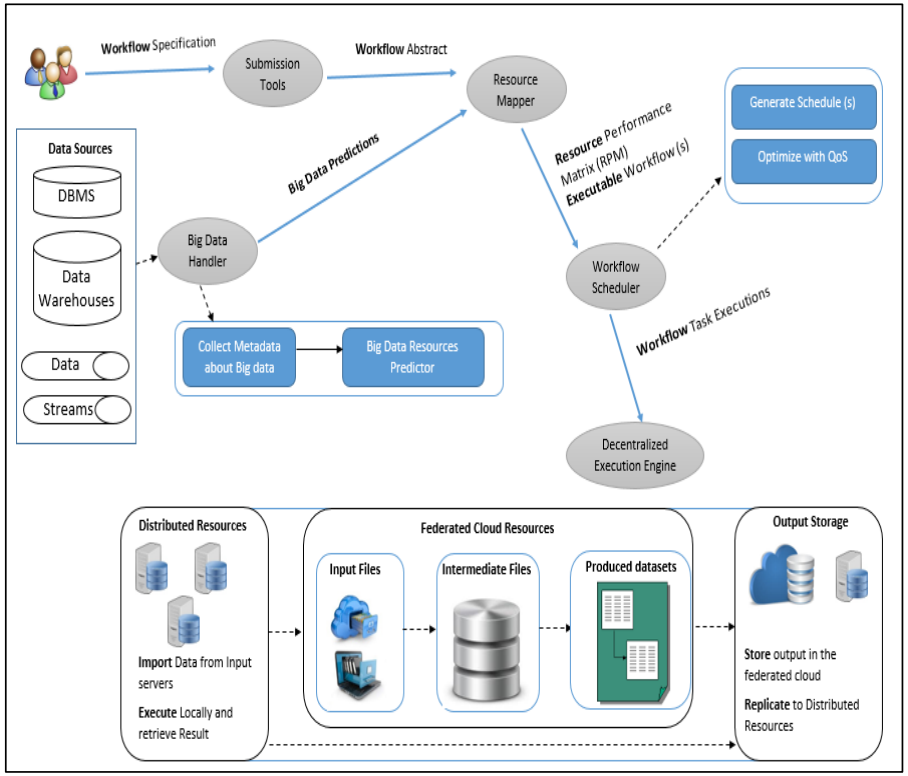




A QoS-based Big Data Workflow Scheduling in Federated Cloud Computing Environment







FOG-Engine: Decentralized Hierarchical Big Data Processing on the Edge

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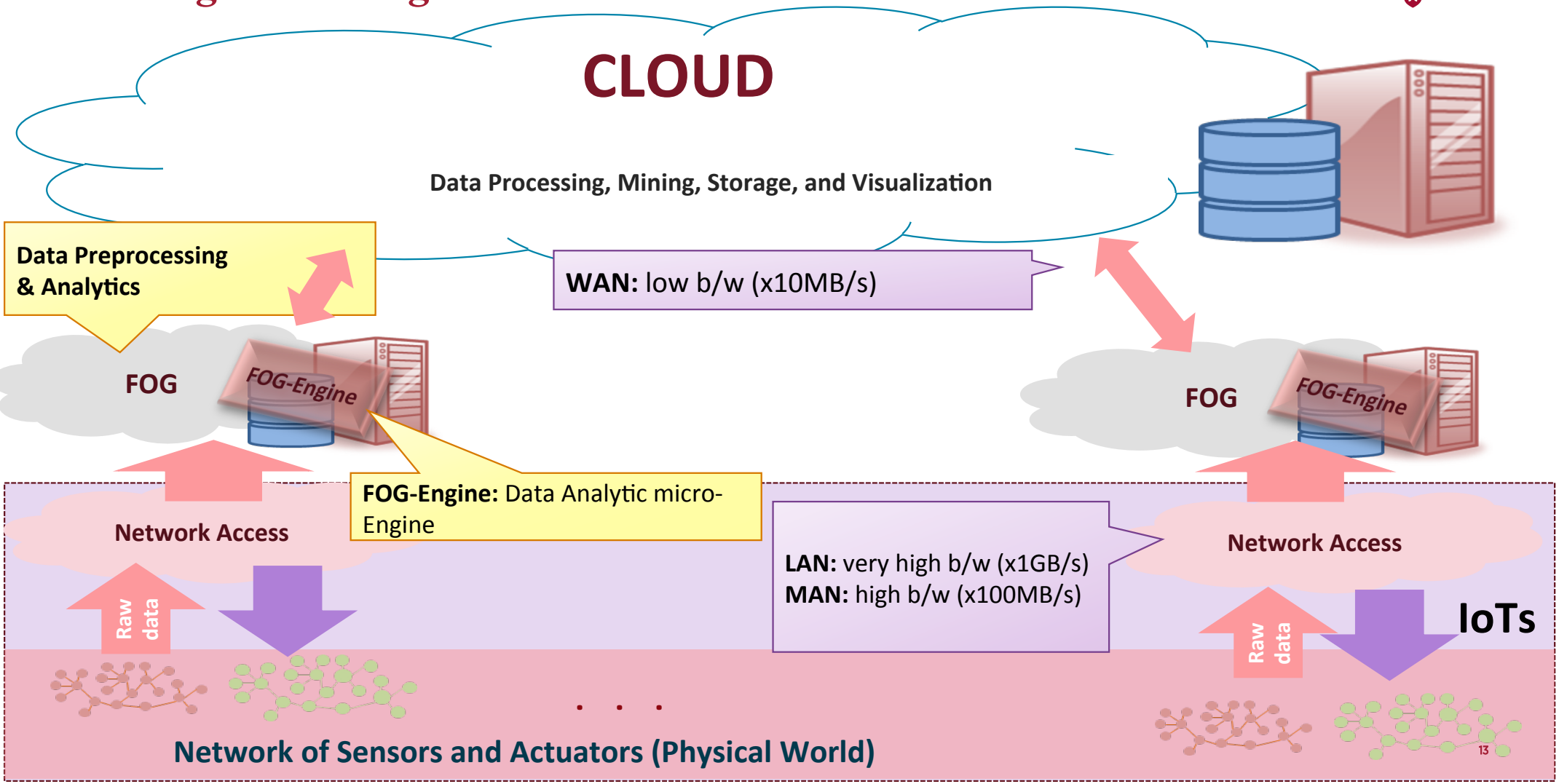

FOG-Engine vs. Cloud

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Characteristics	FOG-Engine	Cloud platform
Processing hierarchy	Local data analytics	Global data analytics
Processing fashion	In-stream processing	Batch processing
Computing power	GFLOPS	TFLOPS
Network Latency	Miliseconds	Seconds
Data storage	Gigabytes	Infinite
Data lifetime	Hours/Days	Infinite
Fault-tolerance	High	High
Processing resources	Heterogeneous (e.g. CPU, FPGA)	Homogeneous (Data center)
Versatility	Only exists on demand	Intangible servers
Provisioning	Limited by the number of FOG-engines in the vicinity	Infinite, with latency
Mobility of nodes	May be mobile (e.g. in the car)	None

General Architecture of FOG-Engine

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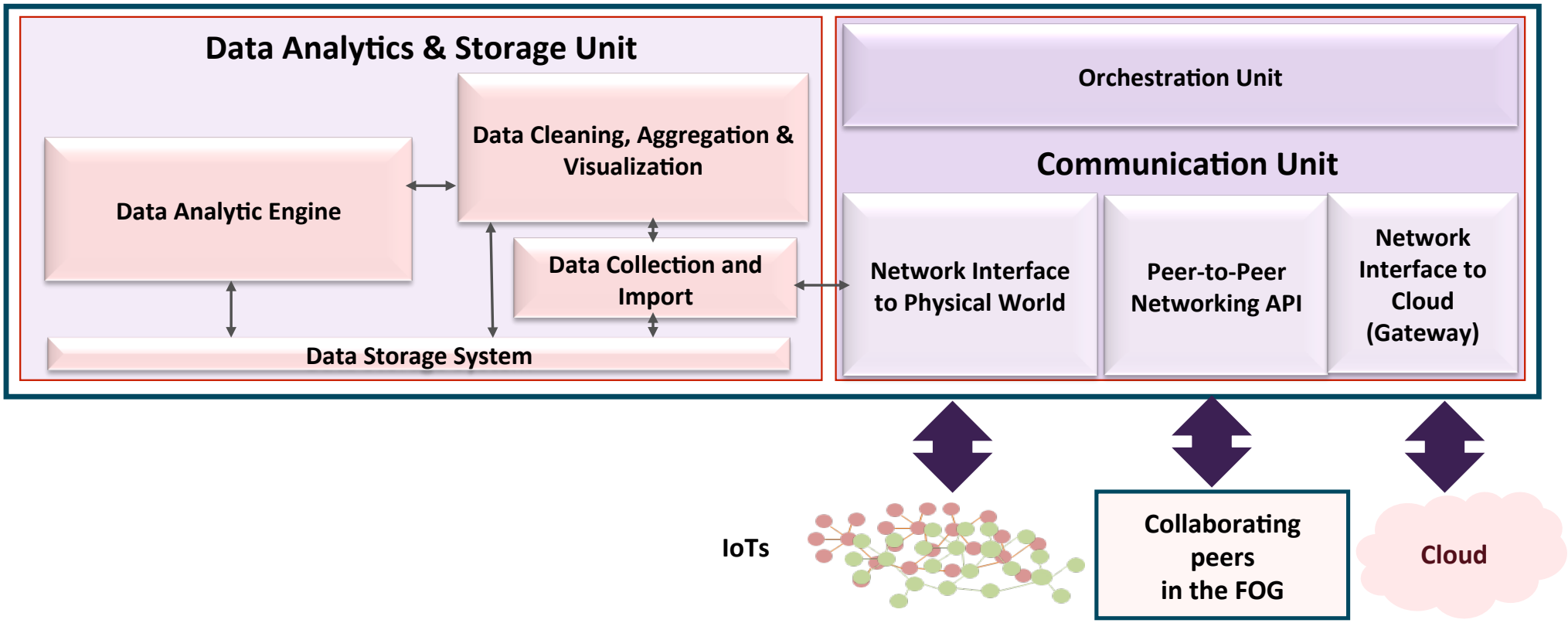

Smart Nutrition Monitoring System using Fog Computing

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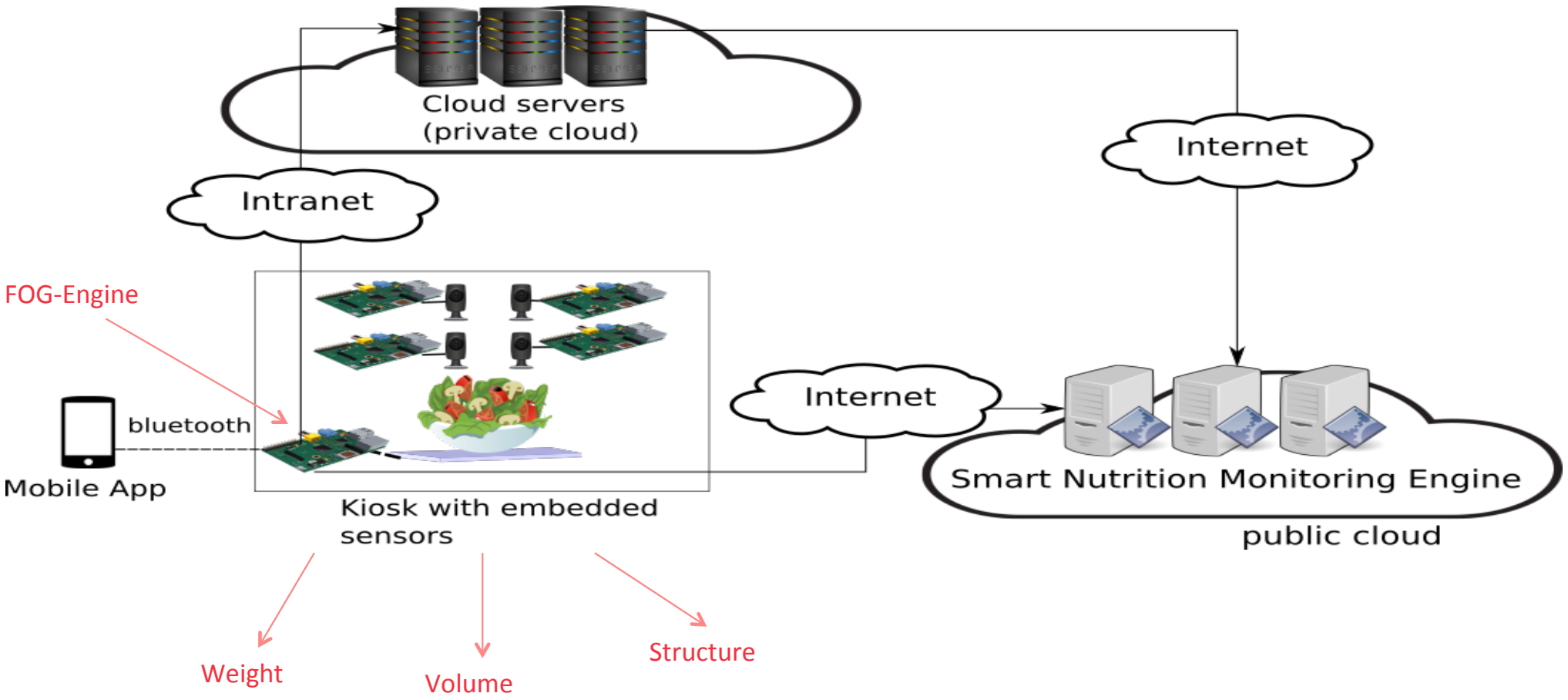

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Thank You!