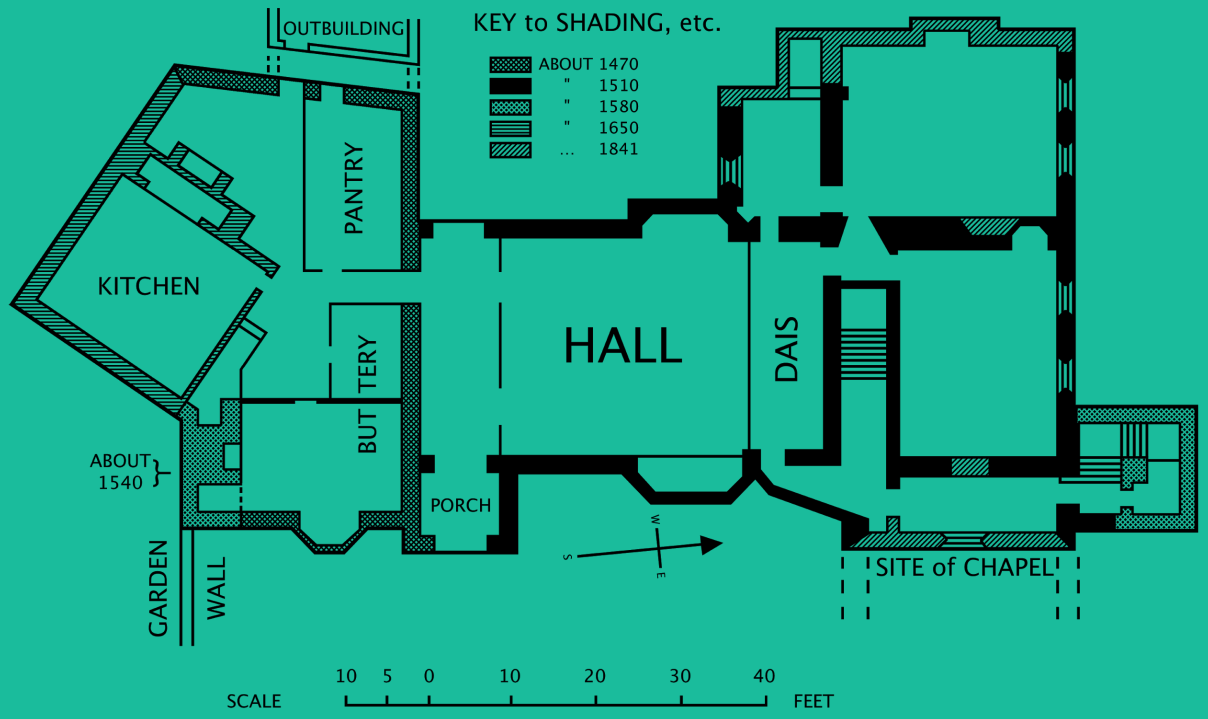
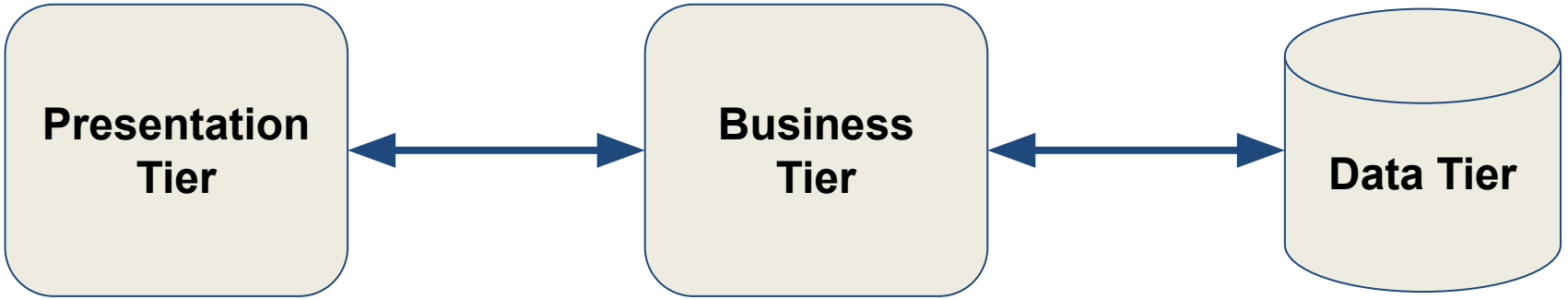


Chapter 3. Cloud Application Architectures

Bilkent University | CS443 | 2021, Spring | Dr. Orçun Dayıbaş

Reference Architectures

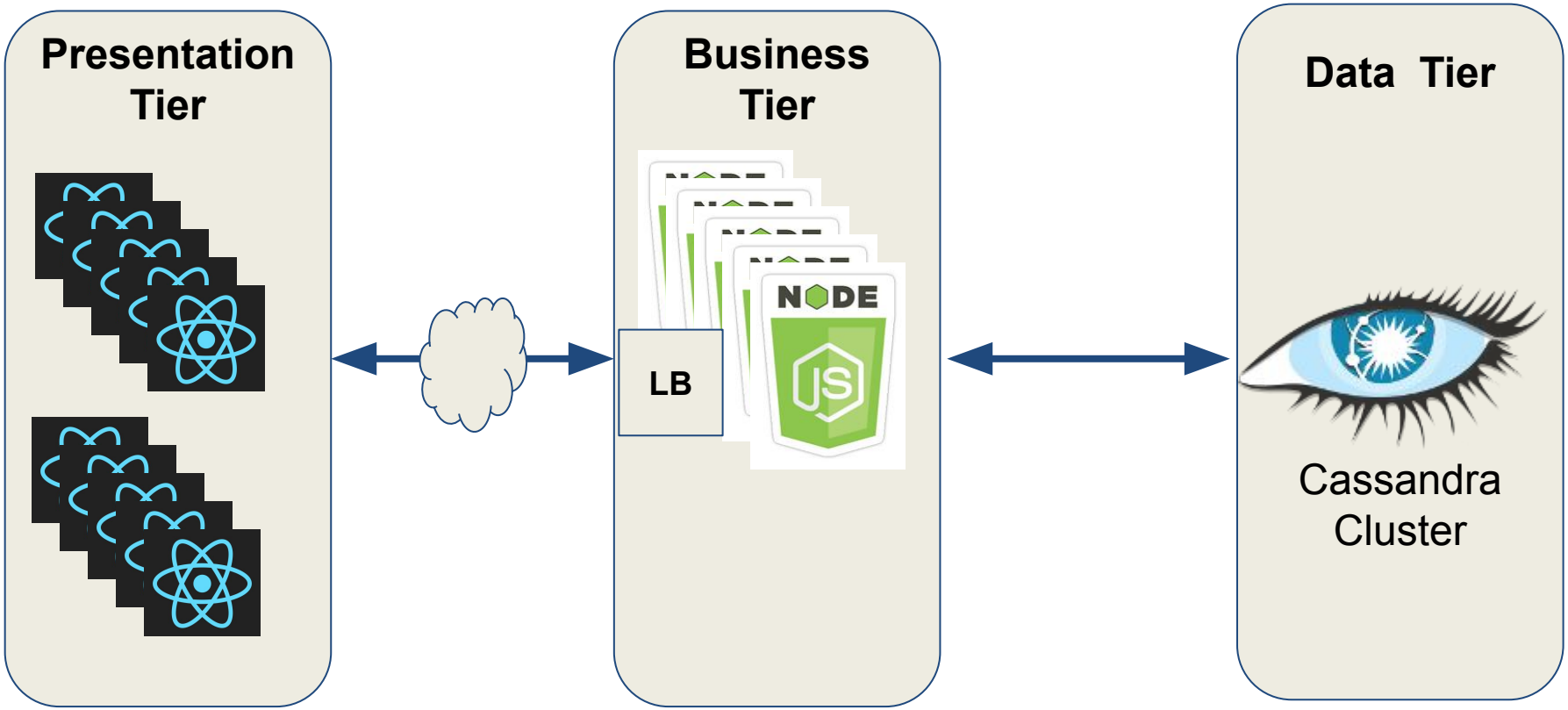
- **Ex.1: Modern 3-tier**



JSF/JSP	EJB / Servlet	Oracle
ASP	ASP.NET	MSSQL
JavaScript	PHP-CGI	MySQL
React.JS	**Node.JS**	**Cassandra**

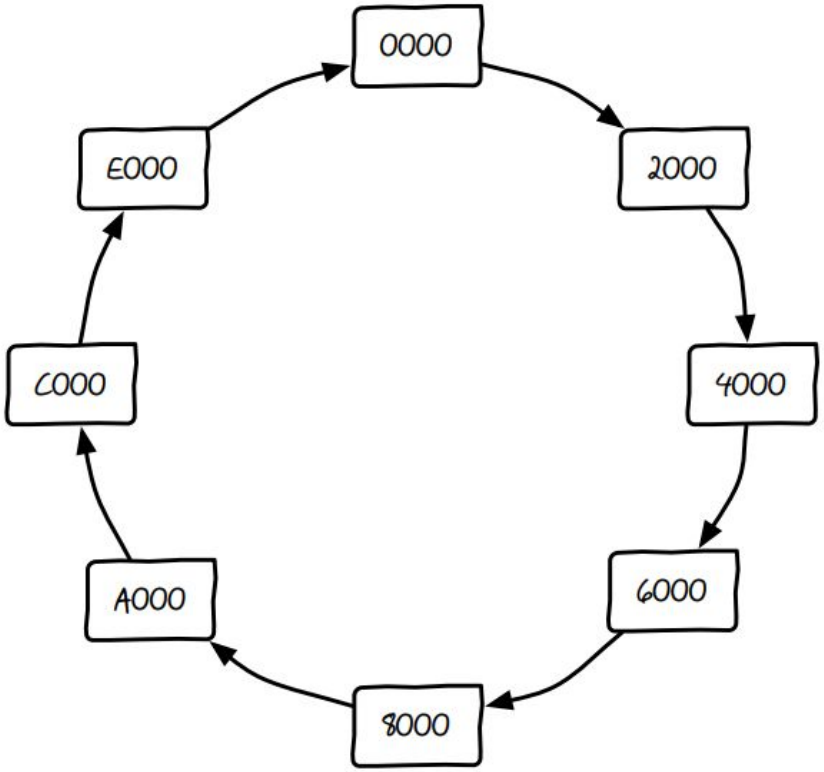
Reference Architectures

- **Ex.1: Modern 3-tier**
  - How this system scales?



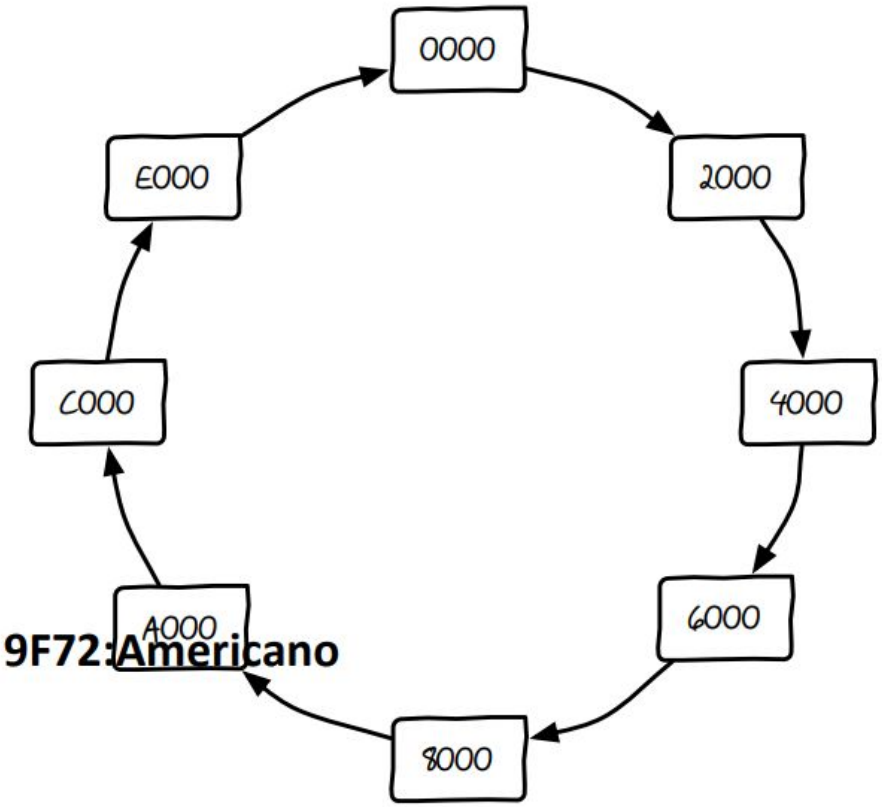
Reference Architectures

- **Ex.1: Modern 3-tier**
  - Cassandra Cluster
    - Each node has a unique token
    - Ring structure: the cluster work in a Ring fashion.
  - Write: use `hash(key)` to find the corresponding node and send to it.
  - Read: same idea.



Reference Architectures

- **Ex.1: Modern 3-tier**
  - `Tim:Americano` as KV
  - `9F72:Americano`
  - Replicate data to next N node
    - Is fav. coffee type an immutable?
      - No → Problem: Consistency (more on this later)

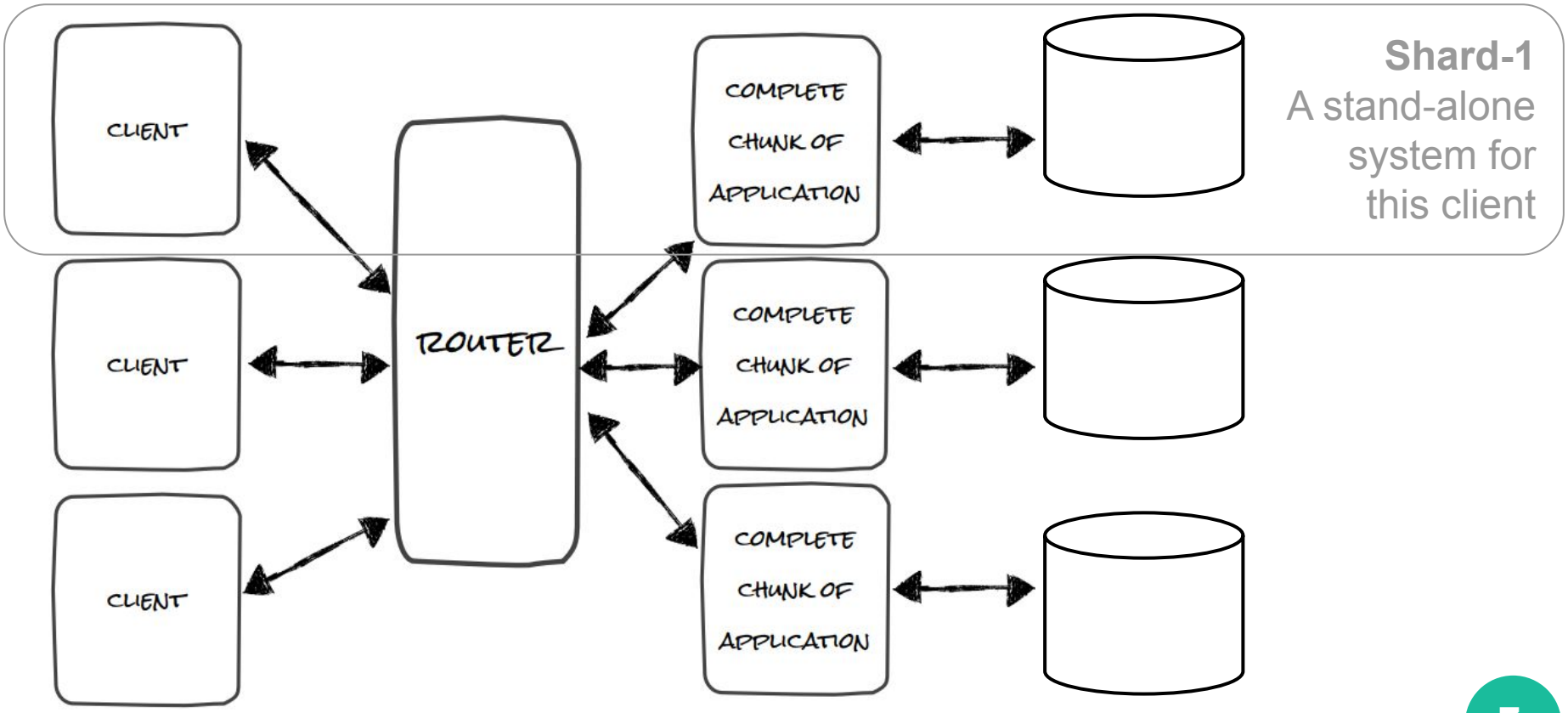


Reference Architectures

- **Ex.1: Modern 3-tier**
  - Pros
    - Lots of options for front-end (you can push many functionality to there).
    - Scaling middle tier is not that hard (FWs, etc.)
    - Data tier is highly scalable.
  - Cons
    - State in the middle tier (with low latency req.)
      - All you have HTTP req. + Data tier

Reference Architectures

- **Ex.2: Sharded**
  - Motto: “Do not build distributed systems if you don’t have to”



Reference Architectures

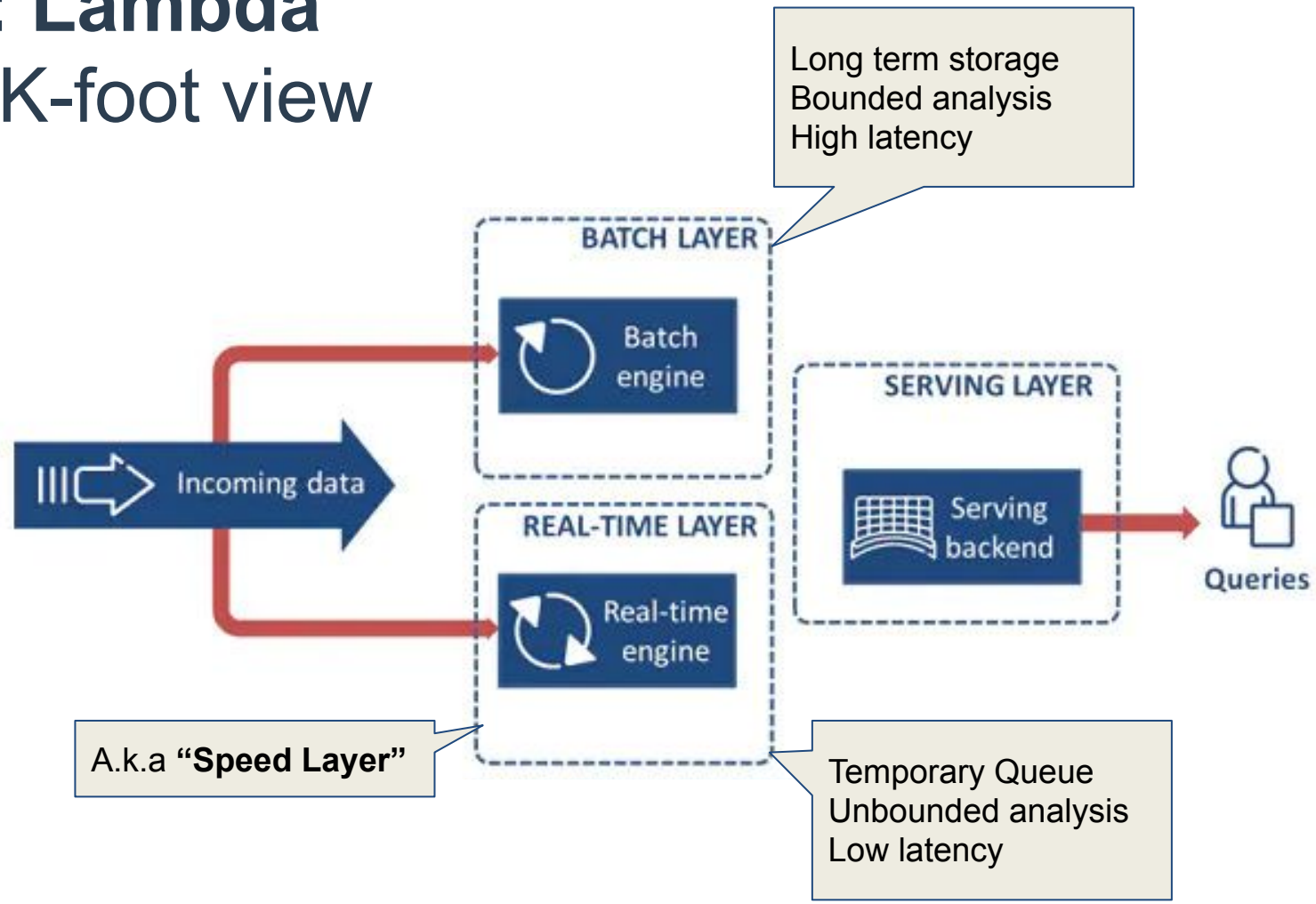
- **Ex.2: Sharded**
  - Pros
    - Client isolation easy (e.g. GDPR/KVKK)
    - Simple technologies
  - Cons
    - Complexity (esp. general monitoring/logging, implementing routing)
    - No comprehensive view of data (Data model, ETL, etc.)
    - Oversized shards
      - HW limits may create an inner dist.sys.

Reference Architectures

- **Ex.3: Lambda**
  - Not a general purpose architecture but …
  - **Focus:** dealing with data analysis
  - Streaming vs. Batch process
    - Batch: Data in rest (Bounded)
    - Stream: Data in motion (Unbounded)
  - Lambda assumes unbounded, immutable data
    - Events are immutable

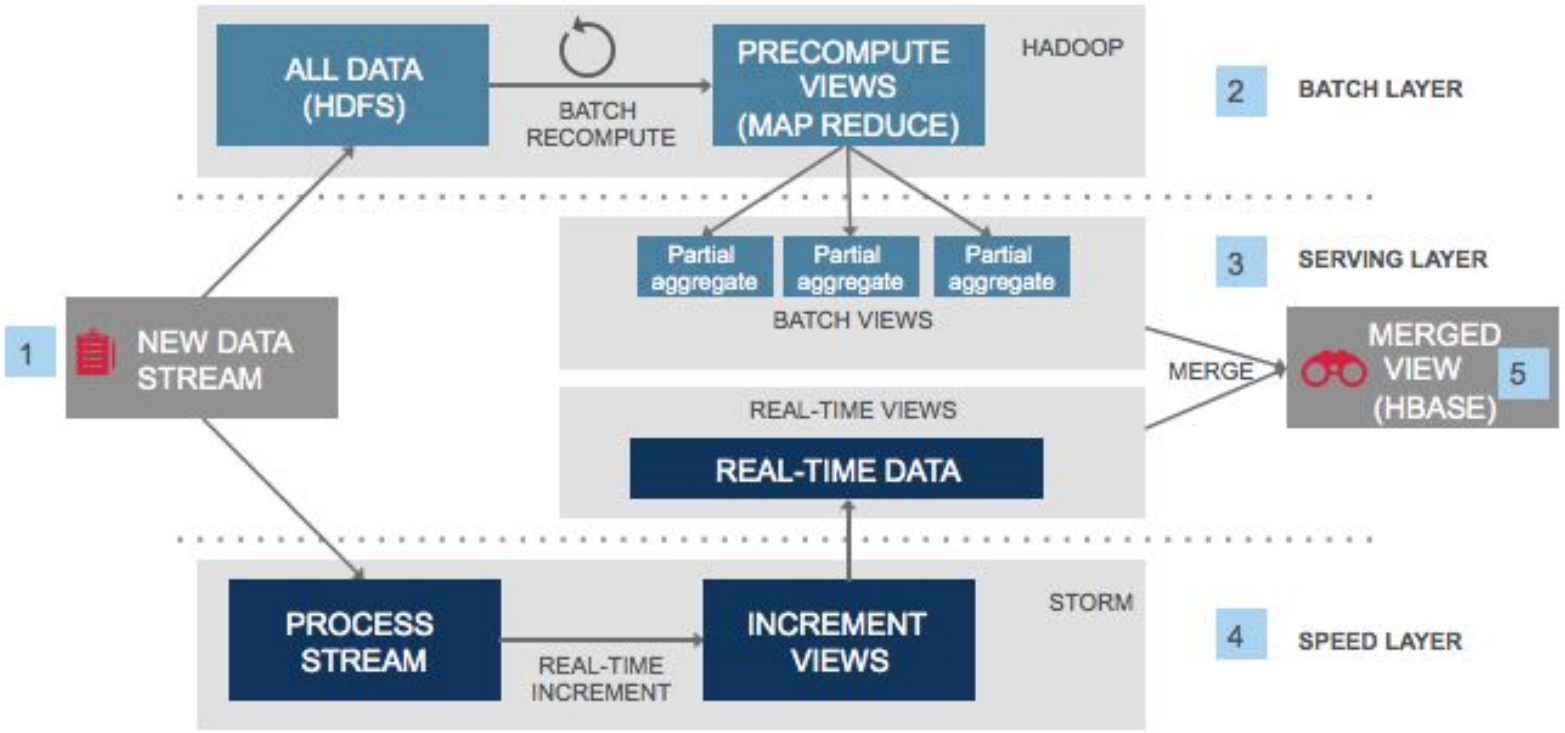
Reference Architectures

- **Ex.3: Lambda**
  - 30K-foot view



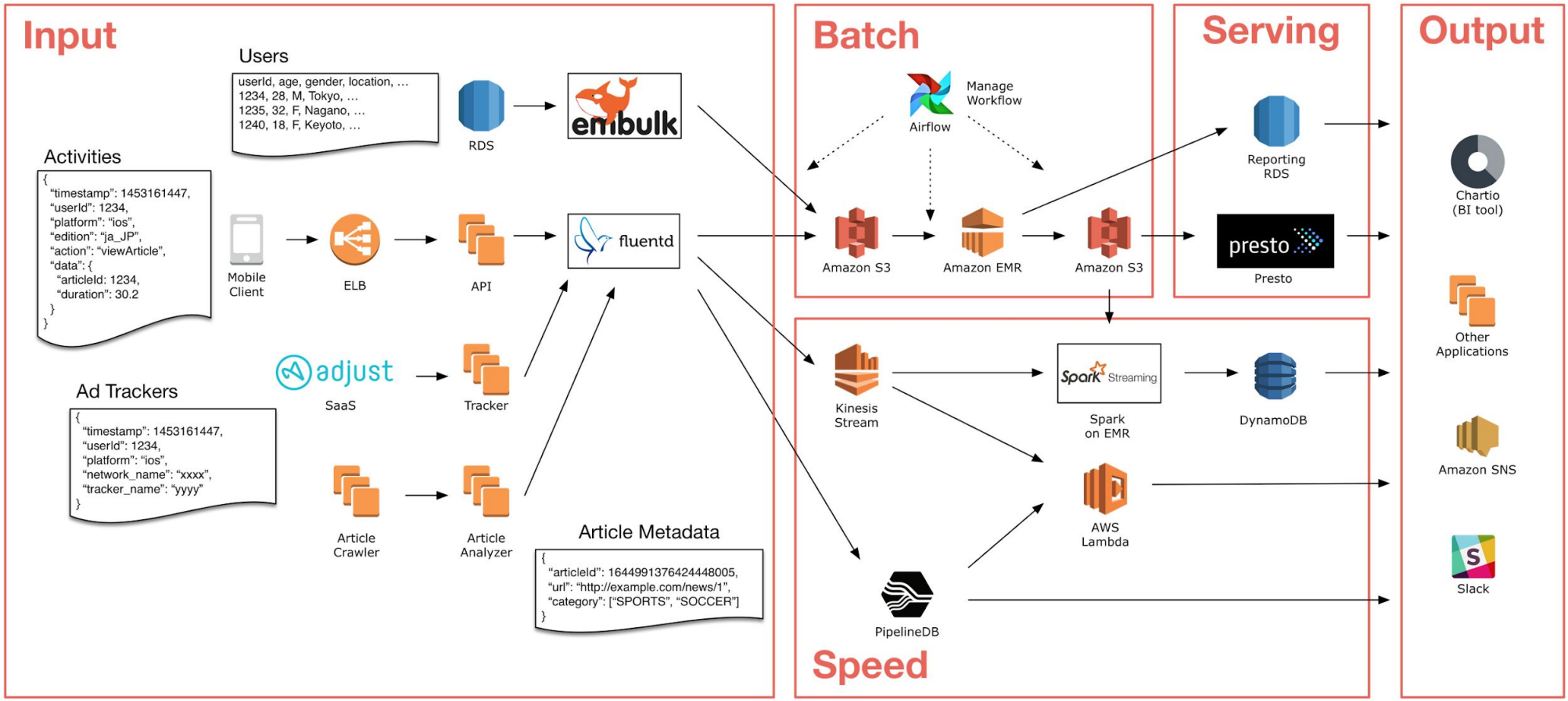
Reference Architectures

- **Ex.3: Lambda**
  - Real life



Reference Architectures

- Ex.3: Lambda

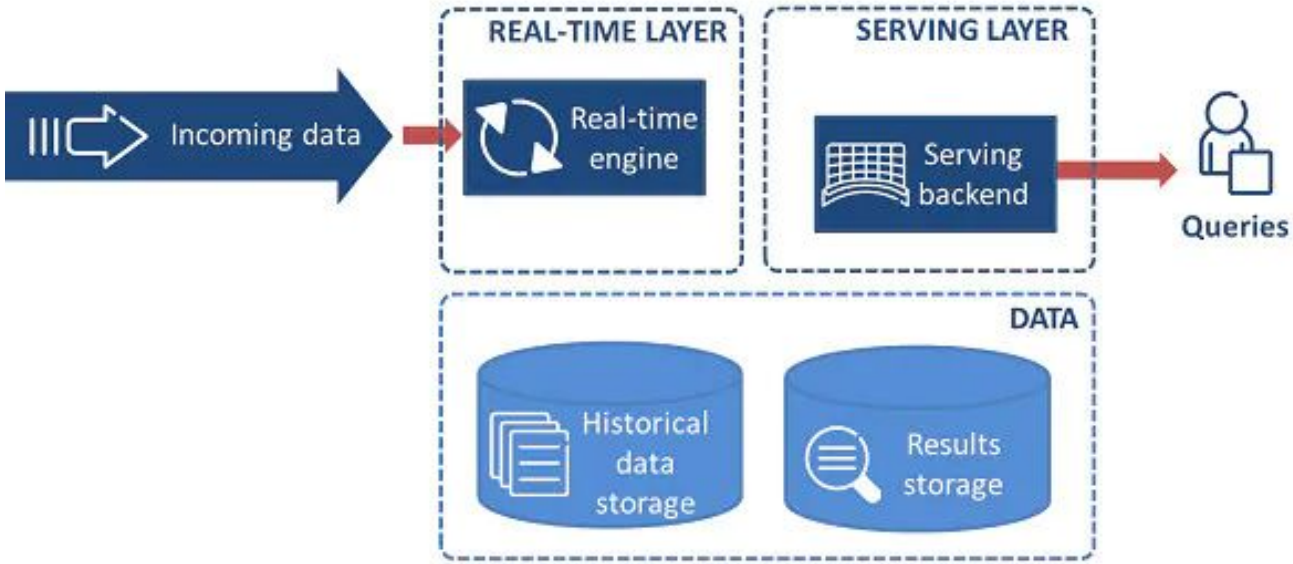


Reference Architectures

- **Ex.3: Lambda**
  - Pros
    - Optimizes subsystems based on operational requirements
    - Good at unbounded data (previous two are not)
  - Cons
    - Complexity (operational)
    - Write “almost” all the code twice

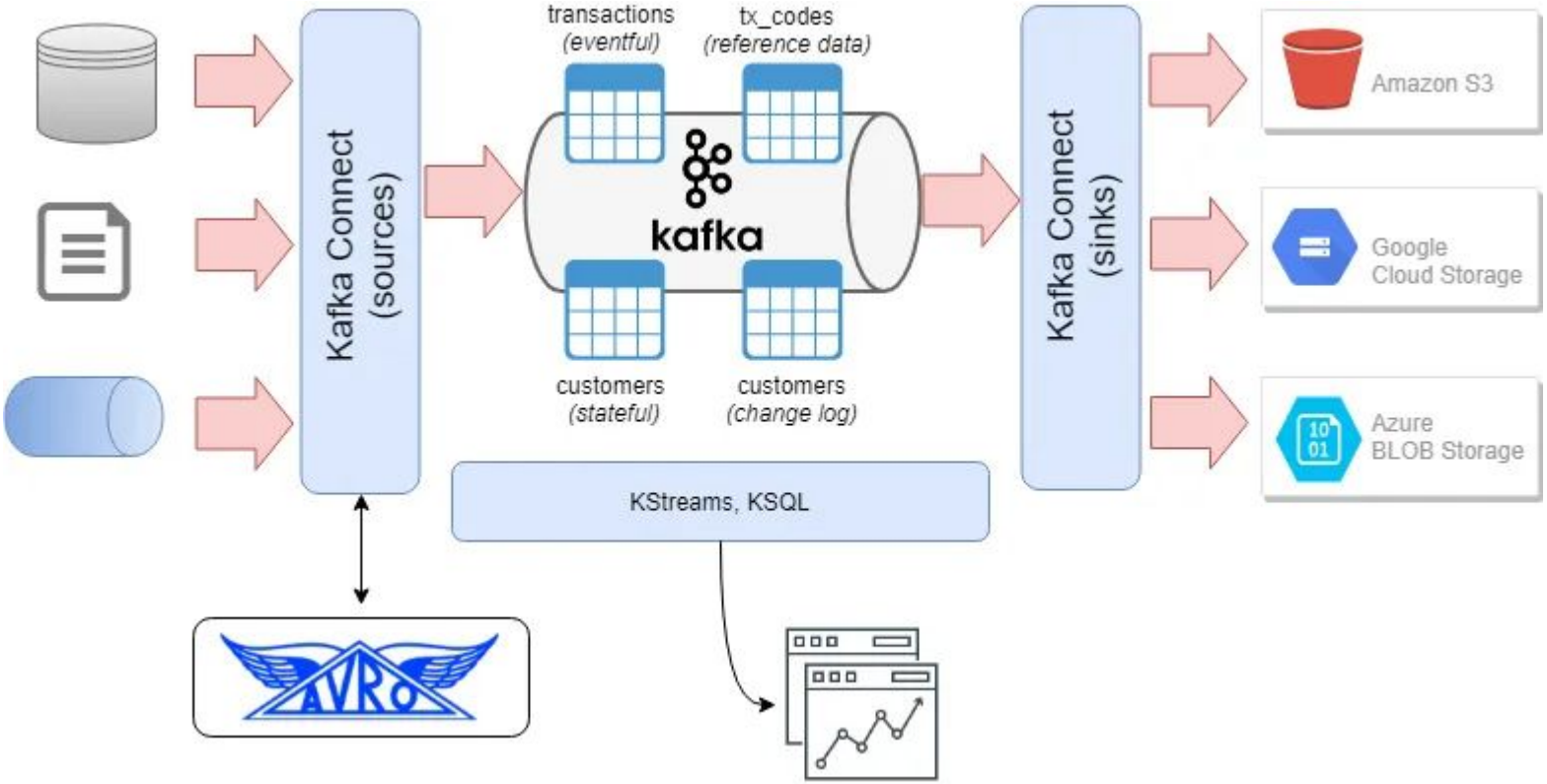
Reference Architectures

- **Ex.4: Kappa**
  - “Stream” as a first class citizen
  - Life is dynamic but DBs are static
    - (tables = streams)



Reference Architectures

- **Ex.4: Kappa**
  - Ex: Modern Kafka (not just a MQ)



Reference Architectures

- **Ex.4: Kappa**
  - Pros
    - Less moving parts (easier to manage)
      - Single processing FW
    - If batch and streaming analysis are identical, then using Kappa is likely the best solution.
  - Cons
    - Harder to implement (Less moving parts → Complexity is pushed to here)
    - Many real-time use cases requires optimize them (batch/stream) separately.

Reference Architectures

- **Recap**
  - Modern cloud applications are complex by nature
  - Architectural patterns helps to handle complexity
  - Understanding reference architectures is an important aspect to make a decision
    - There is no silver bullet
    - Build/buy decisions (CAPEX/OPEX balance)

Q/A