LESSONS LEARNED RUNNING

DATA PIPELINE ON AWS

RED | VENTURES

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aws CERTIFIED - SAA

RED | VENTURES

TECH & DATA-DRIVEN

CUSTOMER ACQUISITION

SALES & MARKETING

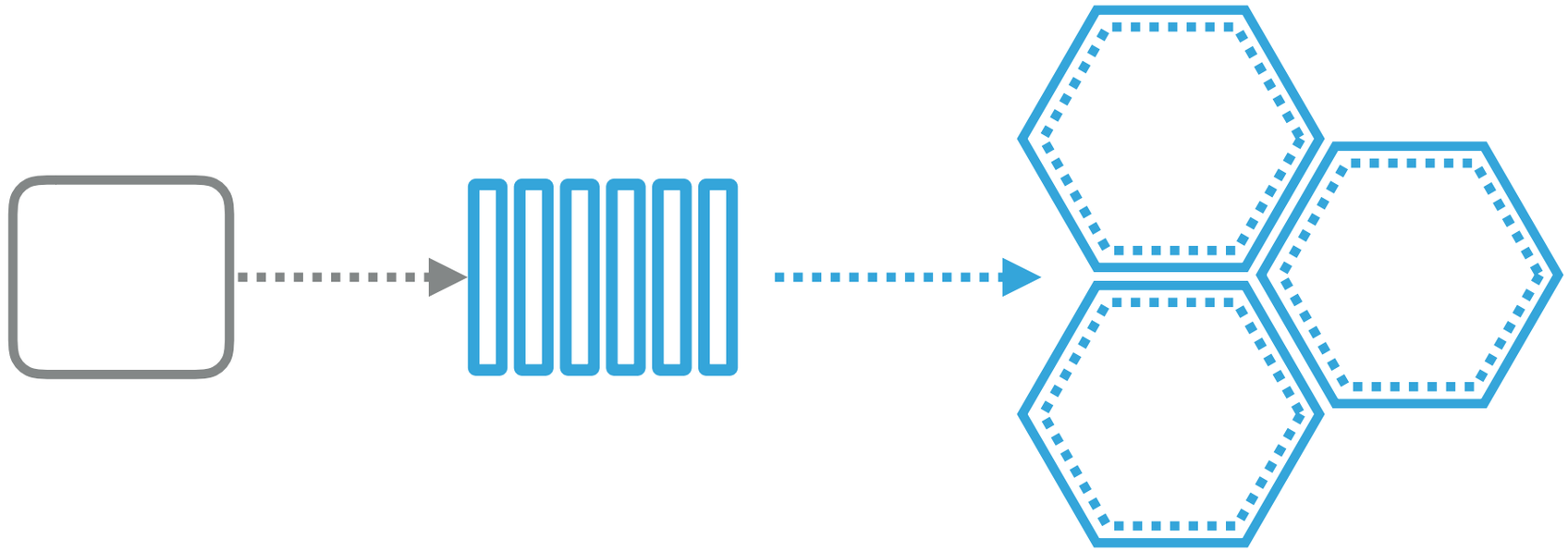
DATA


PRODUCT RECOMMENDATION
MACHINE LEARNING
DATA SCIENCE
USER EXPERIENCE
REALTIME ANALYSIS
DATA WAREHOUSE

DATA PIPELINE

RESPONSIBILITIES

- Collect
- Process
- Protect
- Access



DATA PIPELINE

DESIRED PROPERTIES

AVAILABLE

DURABLE

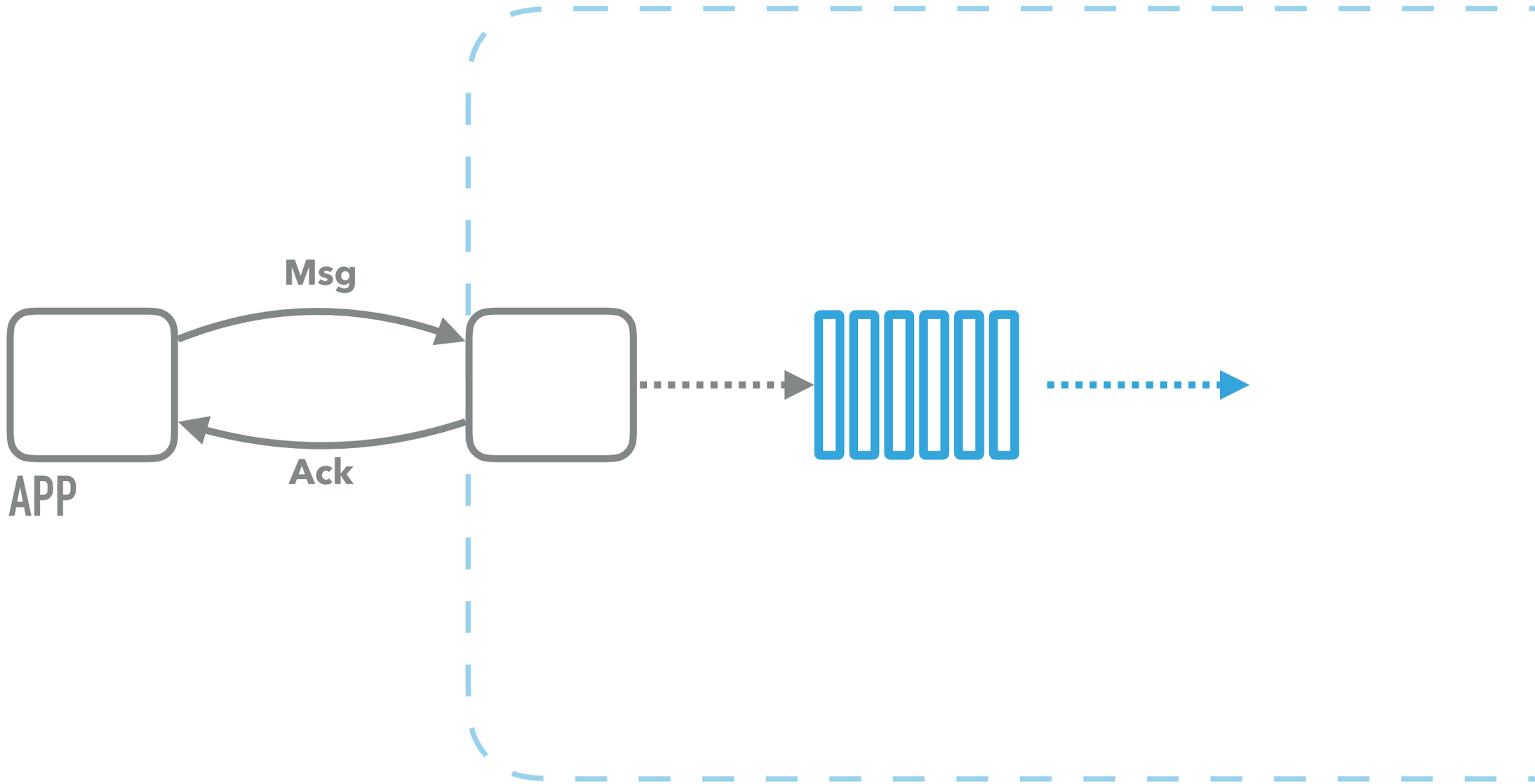
AVAILABILITY

Every request gets a response

Availability	Down time / Year
99%	3.65 days
99.9%	8.77 hours
99.99%	52.60 minutes
99.999%	5.26 minutes

DURABILITY

Guaranteed delivery when acknowledged



DATA

DESIRED PROPERTIES

IMMUTABLE

SCHEMA

IMMUTABLE DATA

- No UPDATE (Immutable data)
- Changes are stored as *sequence* of events
- Current State = Applying the history of changes

IMMUTABLE DATA

UserId	Date	City
10001	2015-07-01	Montréal
10001	2012-09-12	Toronto
10001	2009-07-26	New York
10001	2007-01-01	San Francisco

EVENT-SOURCING

- Event-Sourcing
  - User / Application events ↔ Data events
    - Reliable audit logs
    - Data consistency in multiple destinations
    - Complex queries
- One way of designing data pipeline

SCHEMA

- Enforced schema
- Data is structured
- Avoids data corruption

SERIALIZATION FRAMEWORKS

- Apache Thrift
- Protocol Buffers
- Avro
- ...

PROTOCOL BUFFERS + GRPC

- Serialization framework
- Schema
- gRPC is a binary RPC protocol

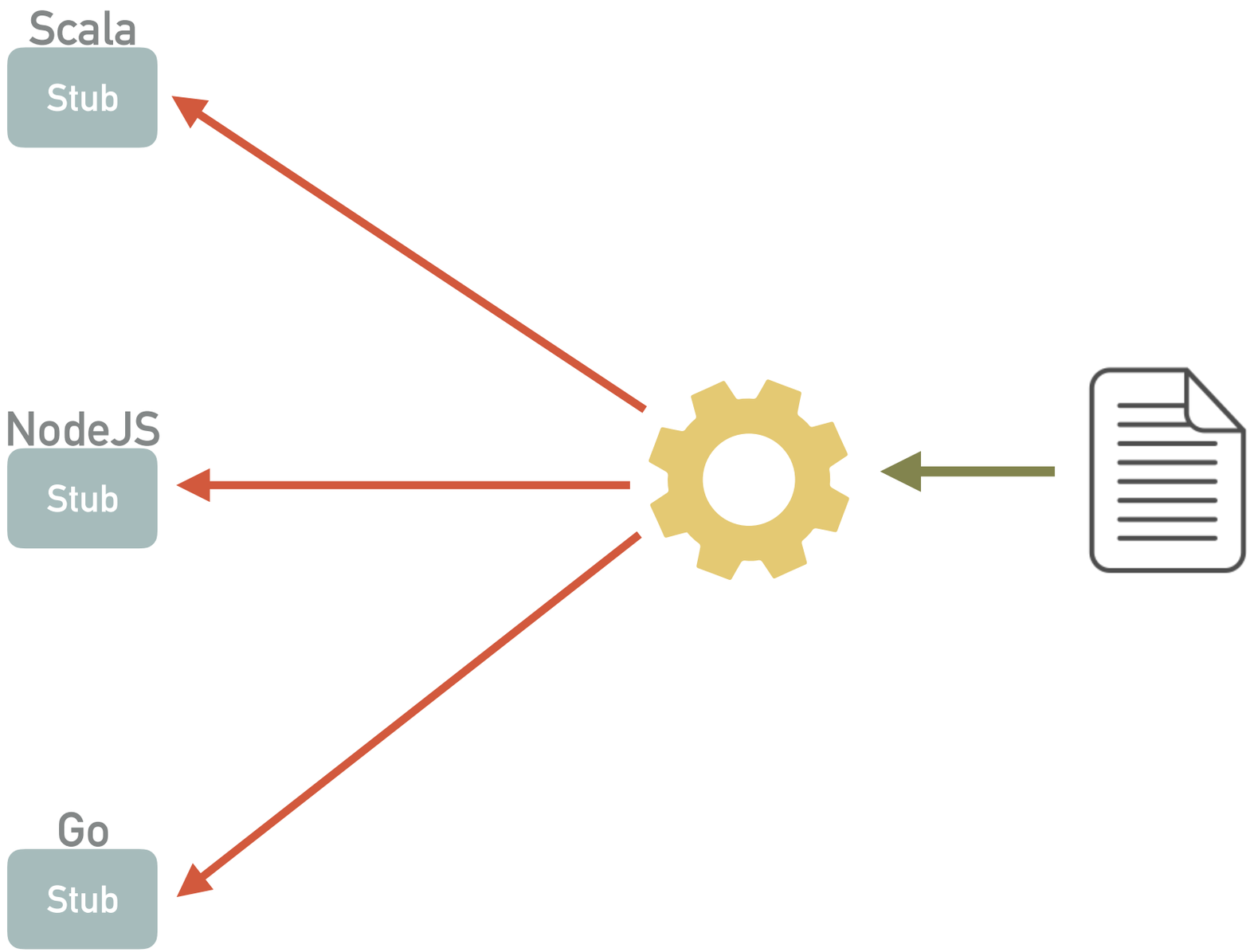
grpc.io

PROTOCOL BUFFERS

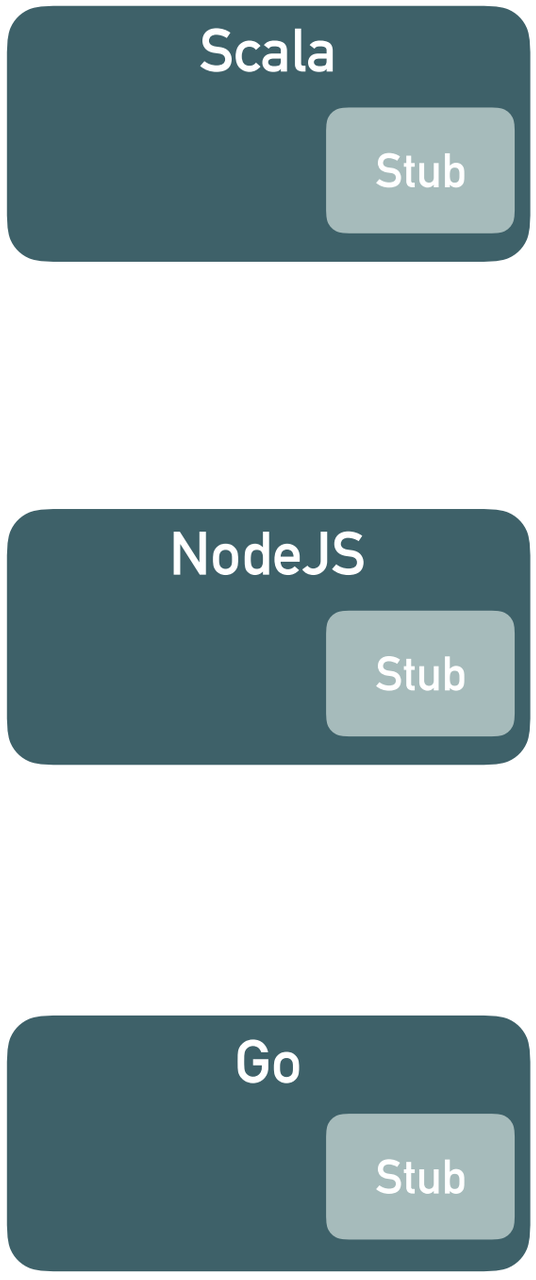
```
// Defining a Message

message Person {
  required string name = 1;
  required int32 id = 2;
  optional string email = 3;
}

// Defining a service

service SearchService {
  rpc Search (SearchRequest) returns (SearchResponse);
}
```

Protobuf v2 | developers.google.com

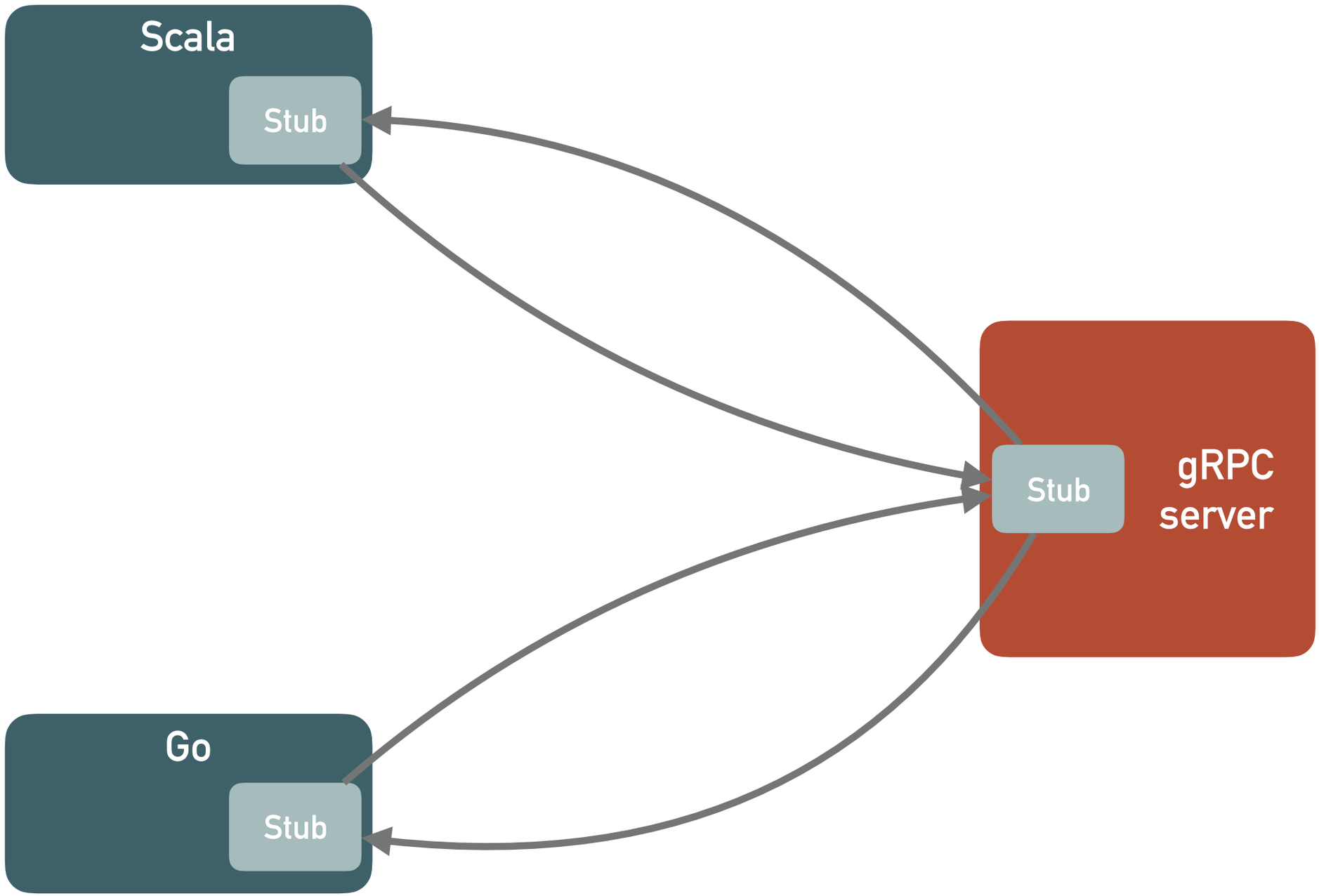
PROTOCOL BUFFERS COMPILER



PROTOCOL BUFFERS COMPILER

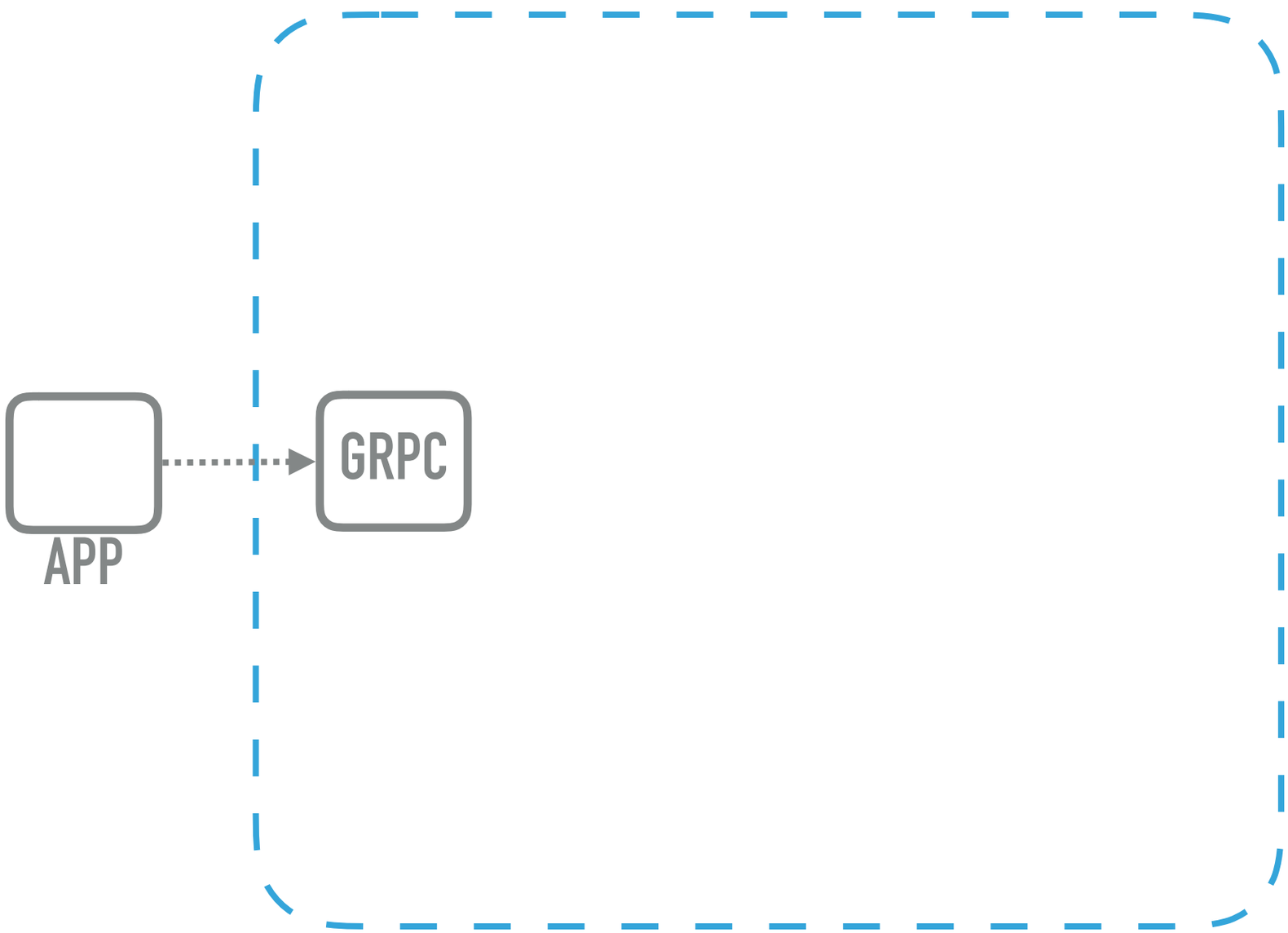


PROTOCOL BUFFERS + GRPC

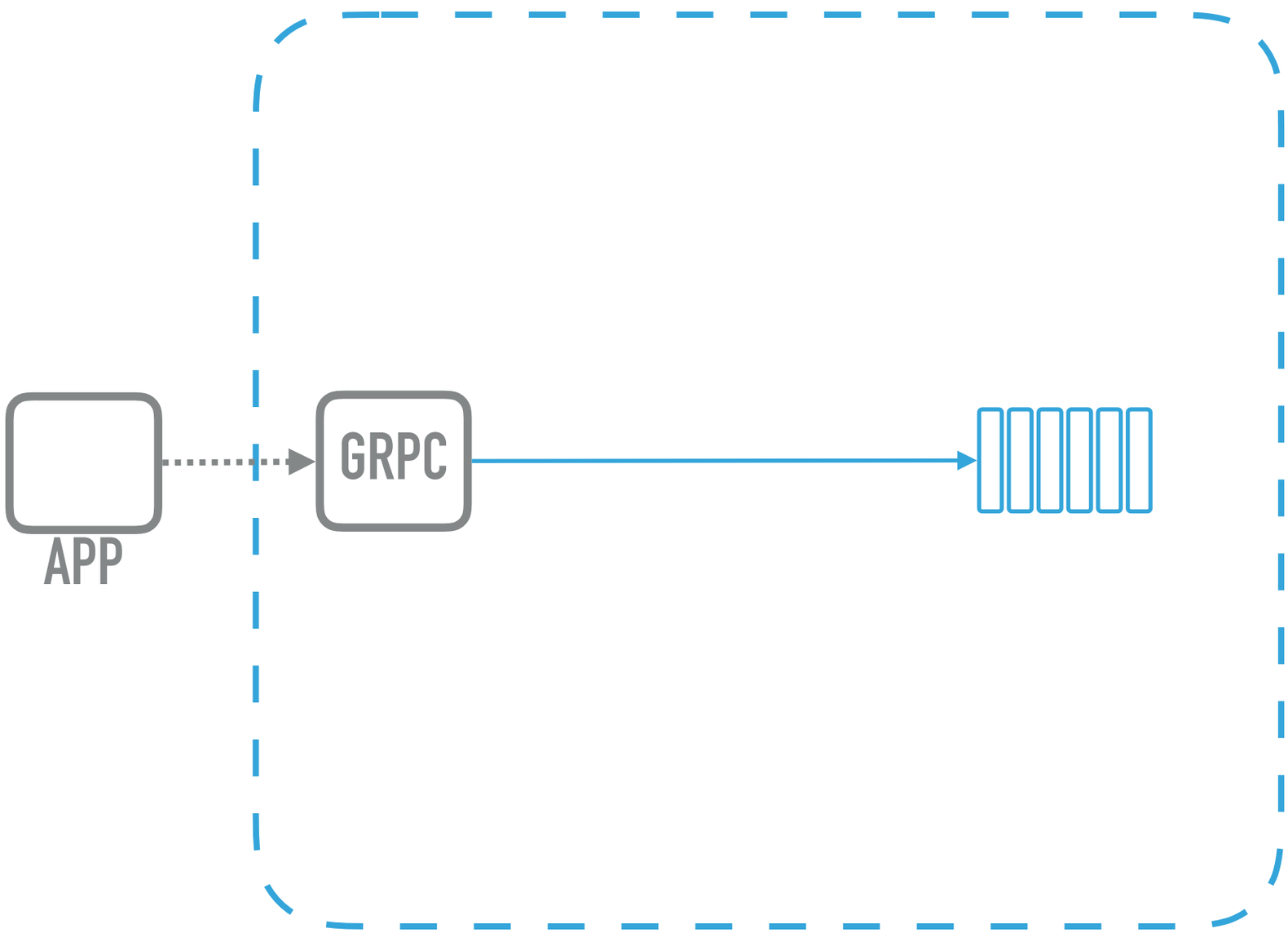


Handling gRPC traffic

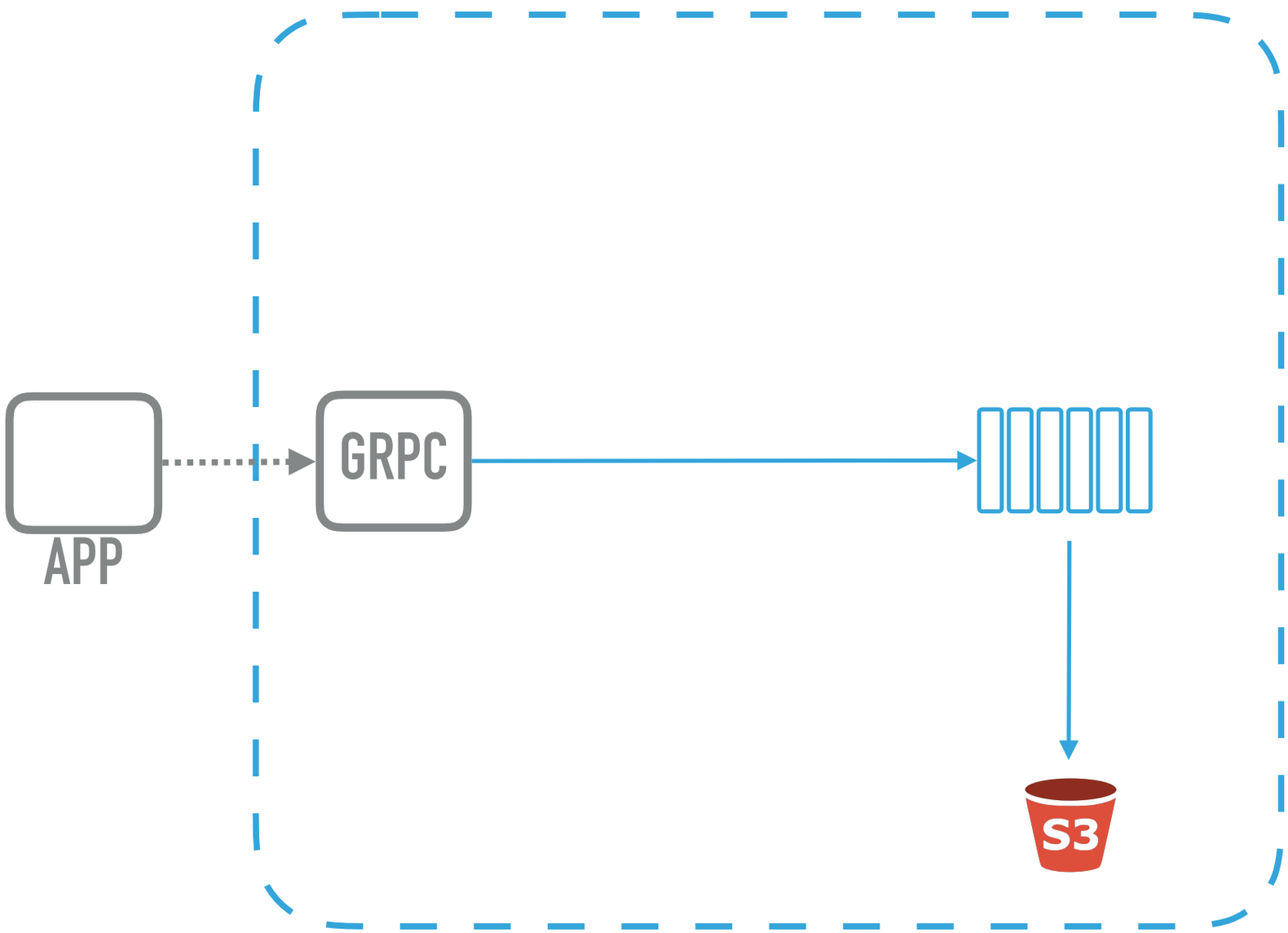
Handling gRPC traffic



Persisting gRPC traffic



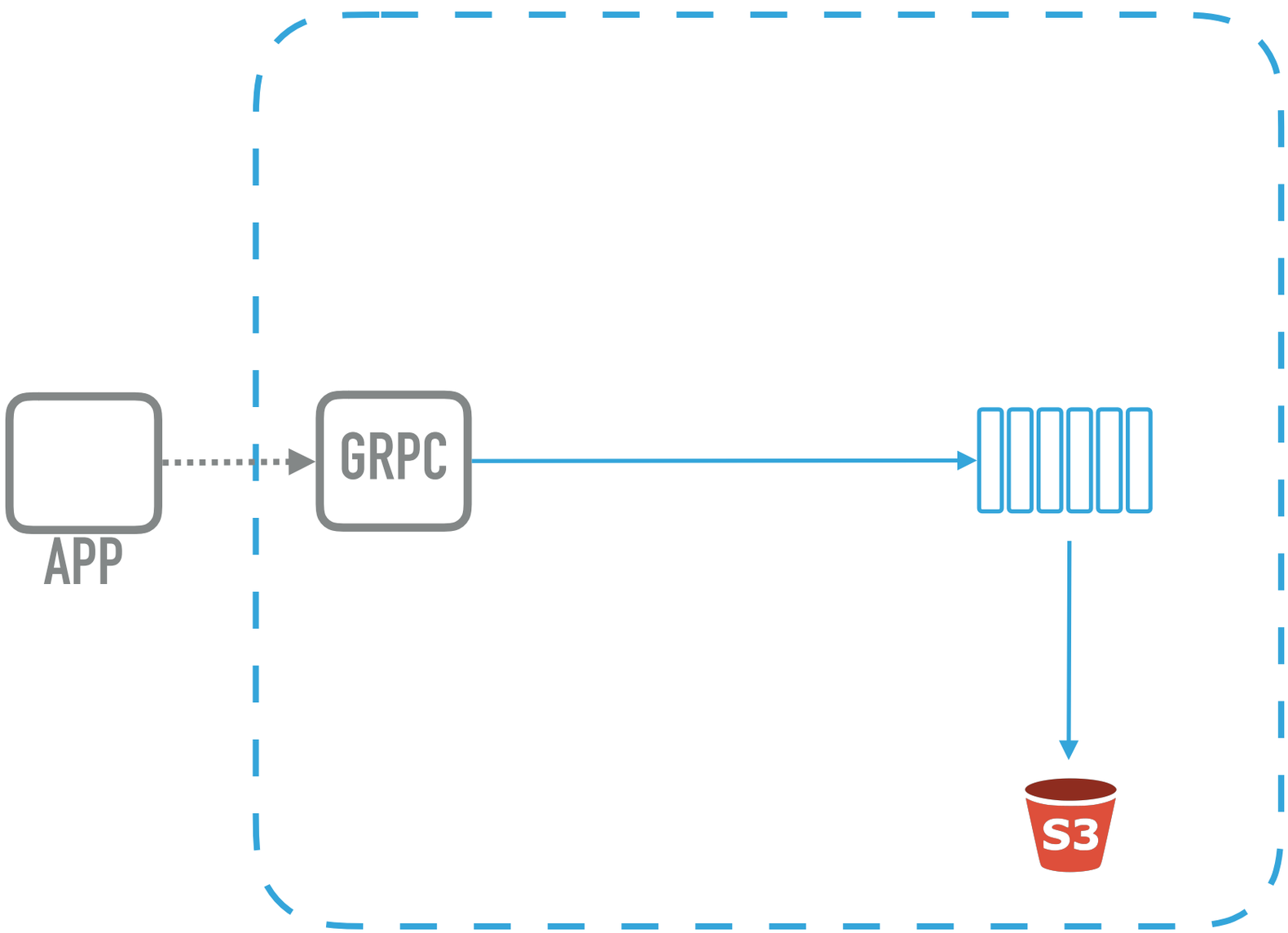
Persisting gRPC traffic



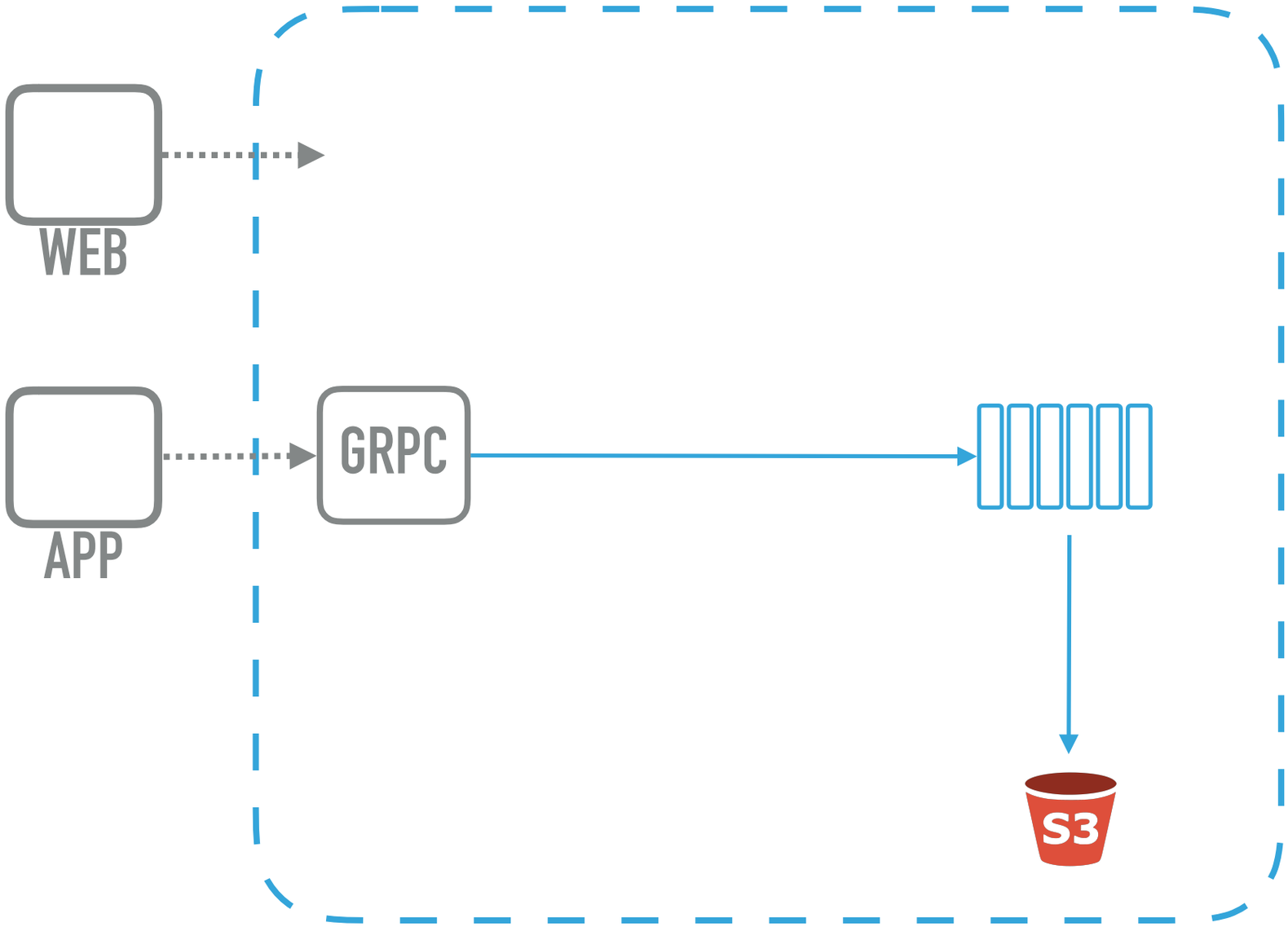
GRPC ENDPOINT – TECHNOLOGIES

- Go application
- AWS Elastic Container Service (ECS)
- Network Load Balancer (NLB)
- AWS PrivateLink
- Kinesis stream
- Kinesis Firehose to S3 (disaster recovery)

Persisting gRPC traffic



Handling web/http traffic



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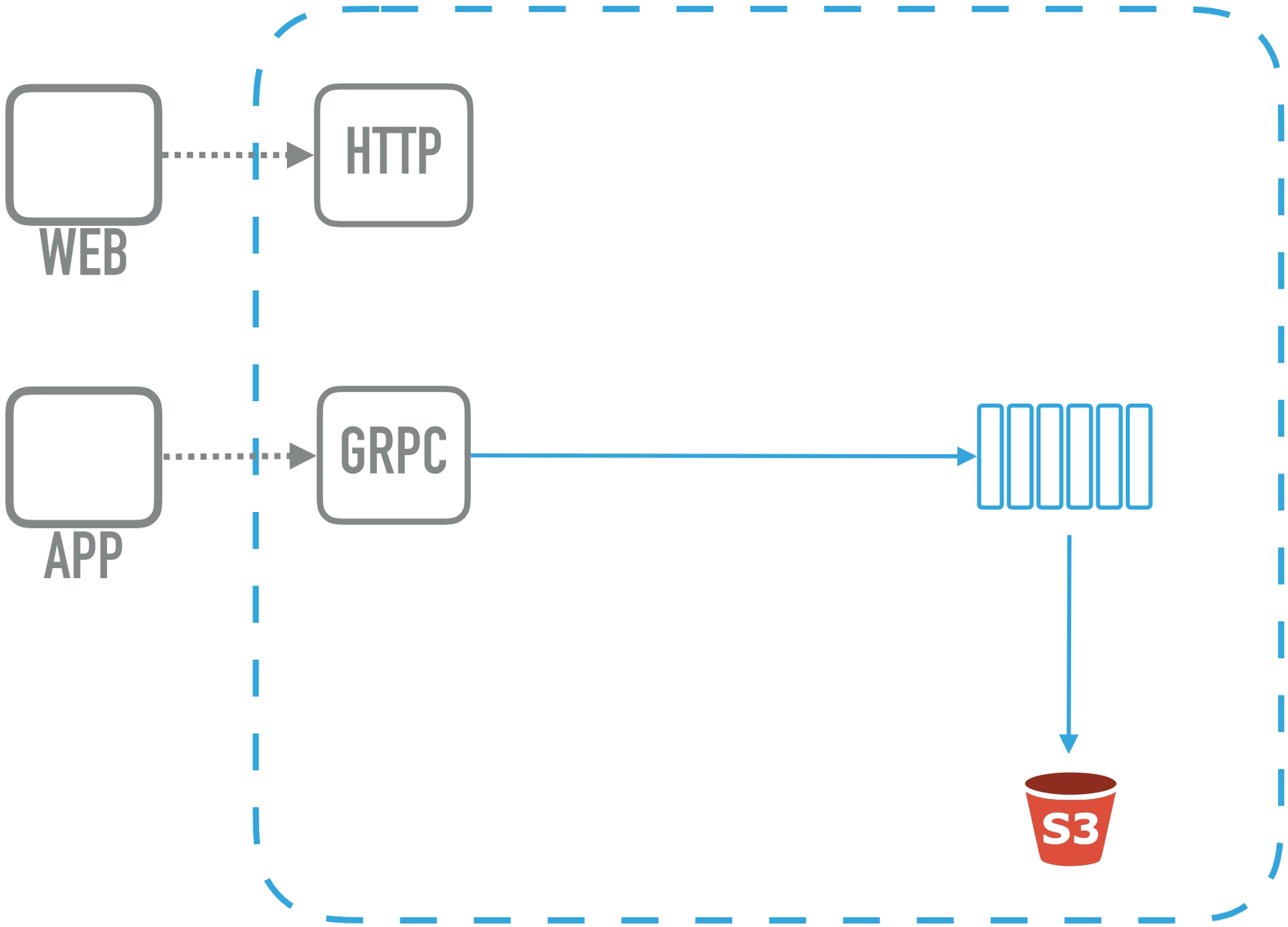
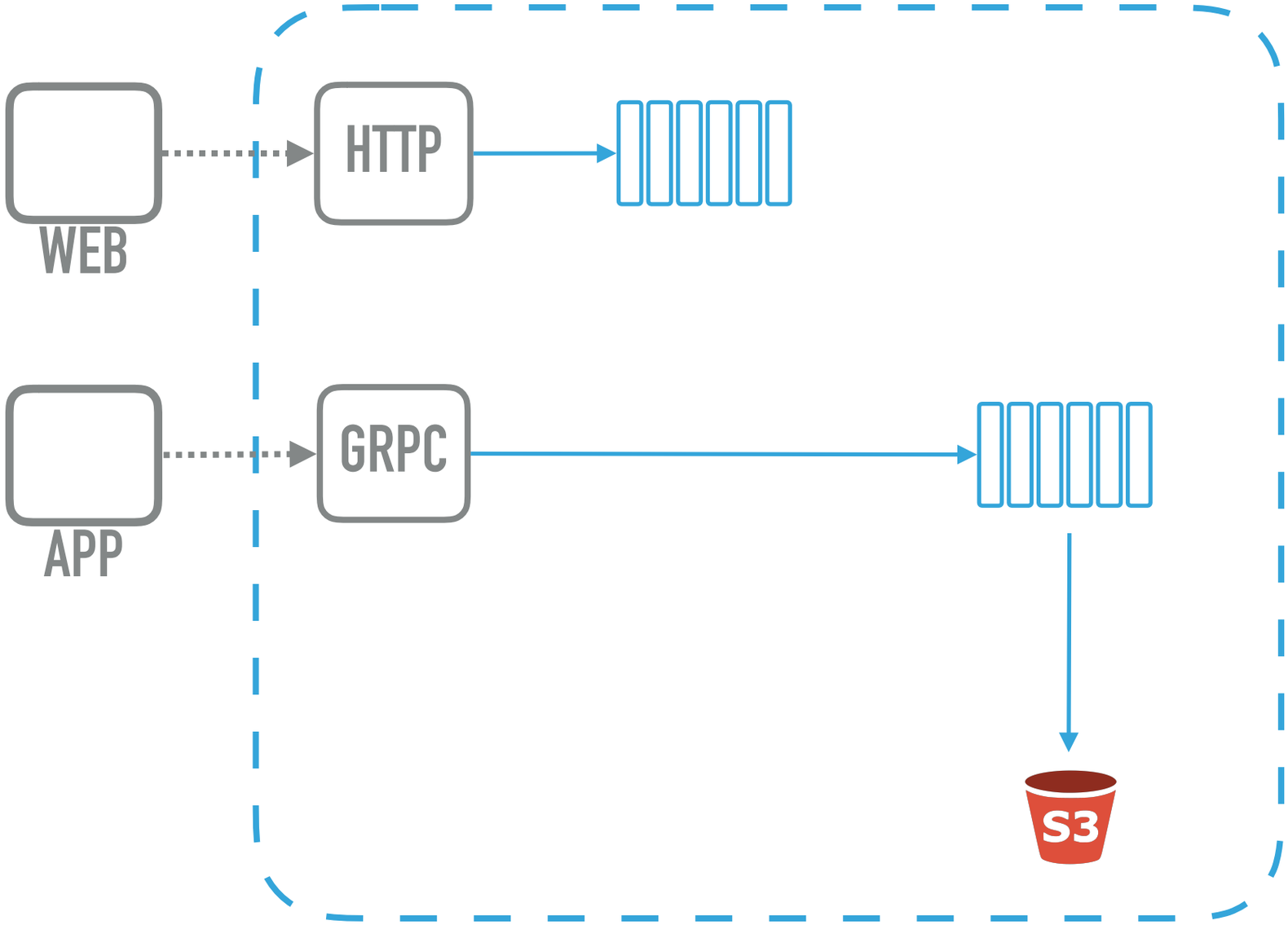


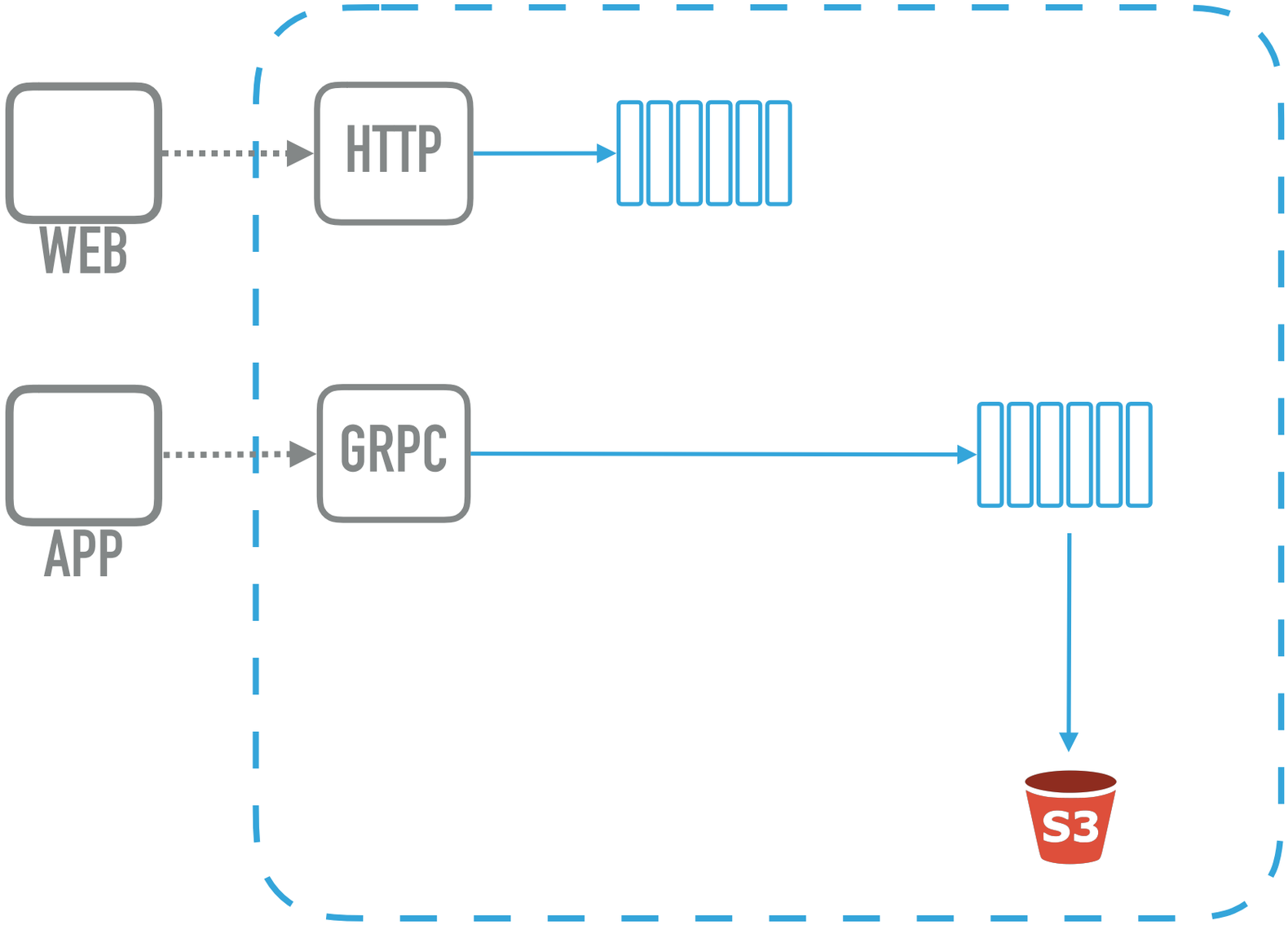
Persisting web/http traffic



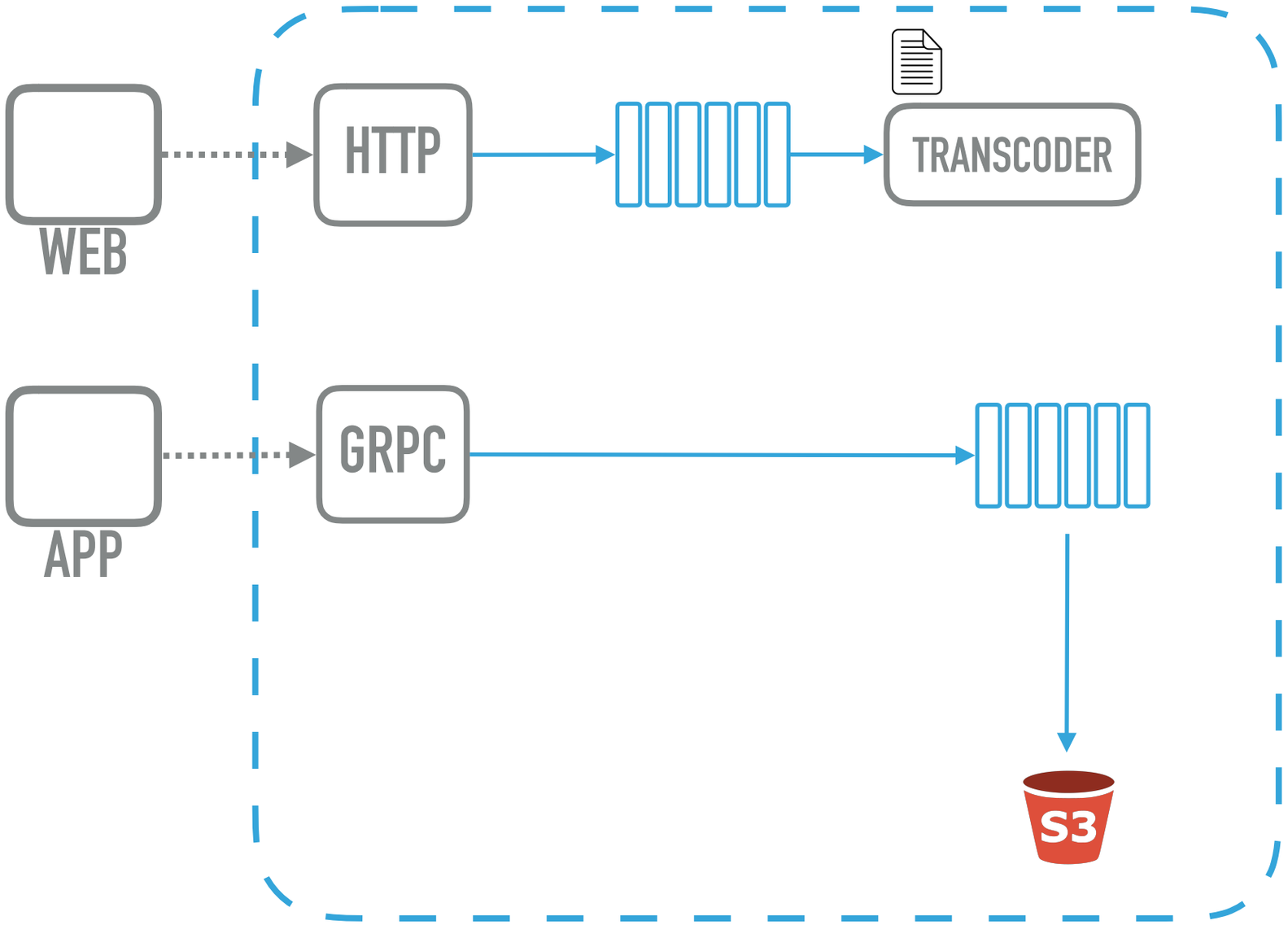
HTTP ENDPOINT – TECHNOLOGIES

- Go application
- AWS Elastic Container Service (ECS)
- Application Load Balancer (ALB)
- Kinesis stream

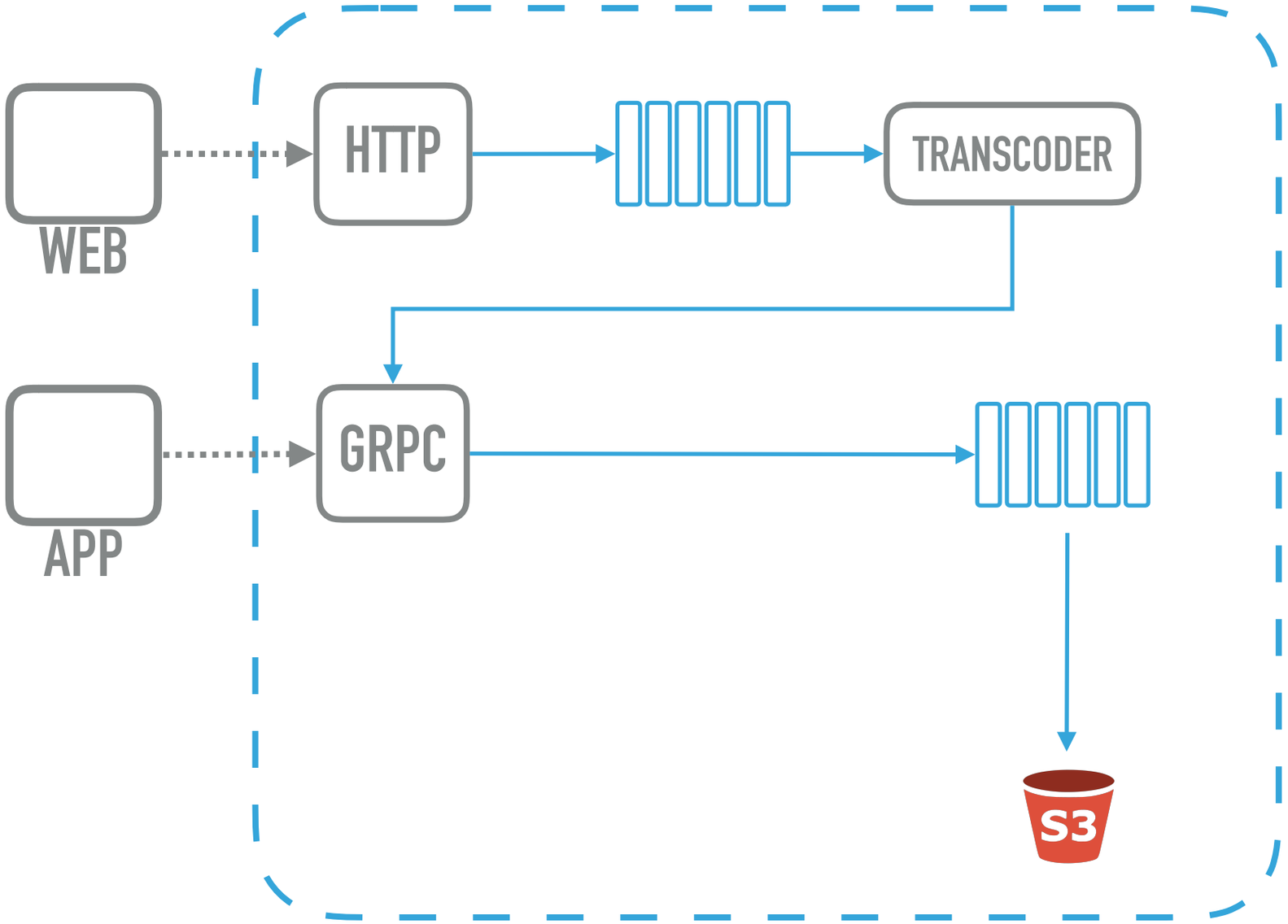
Persisting web/http traffic



Converting JSON to Protobuf



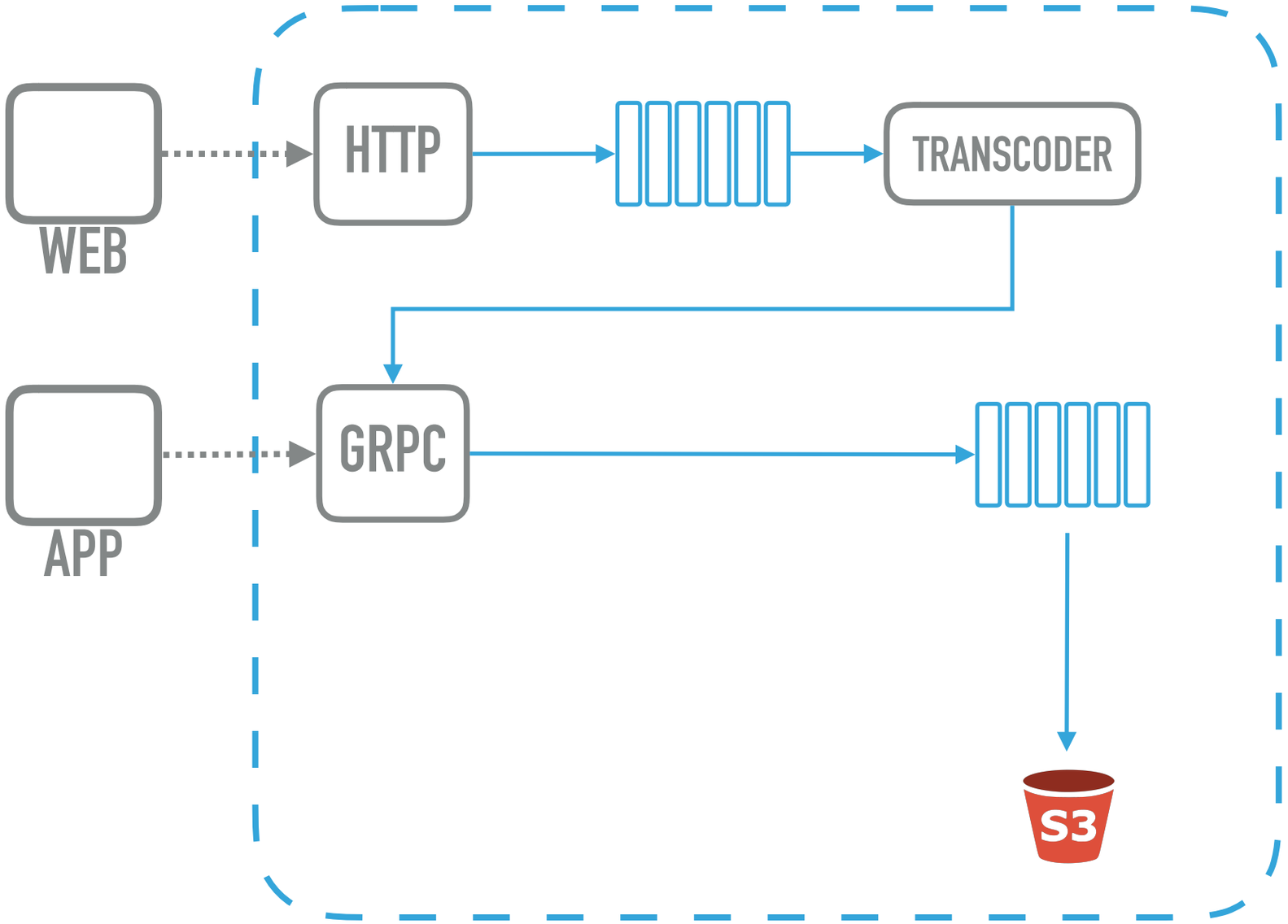
Pushing converted data to gRPC



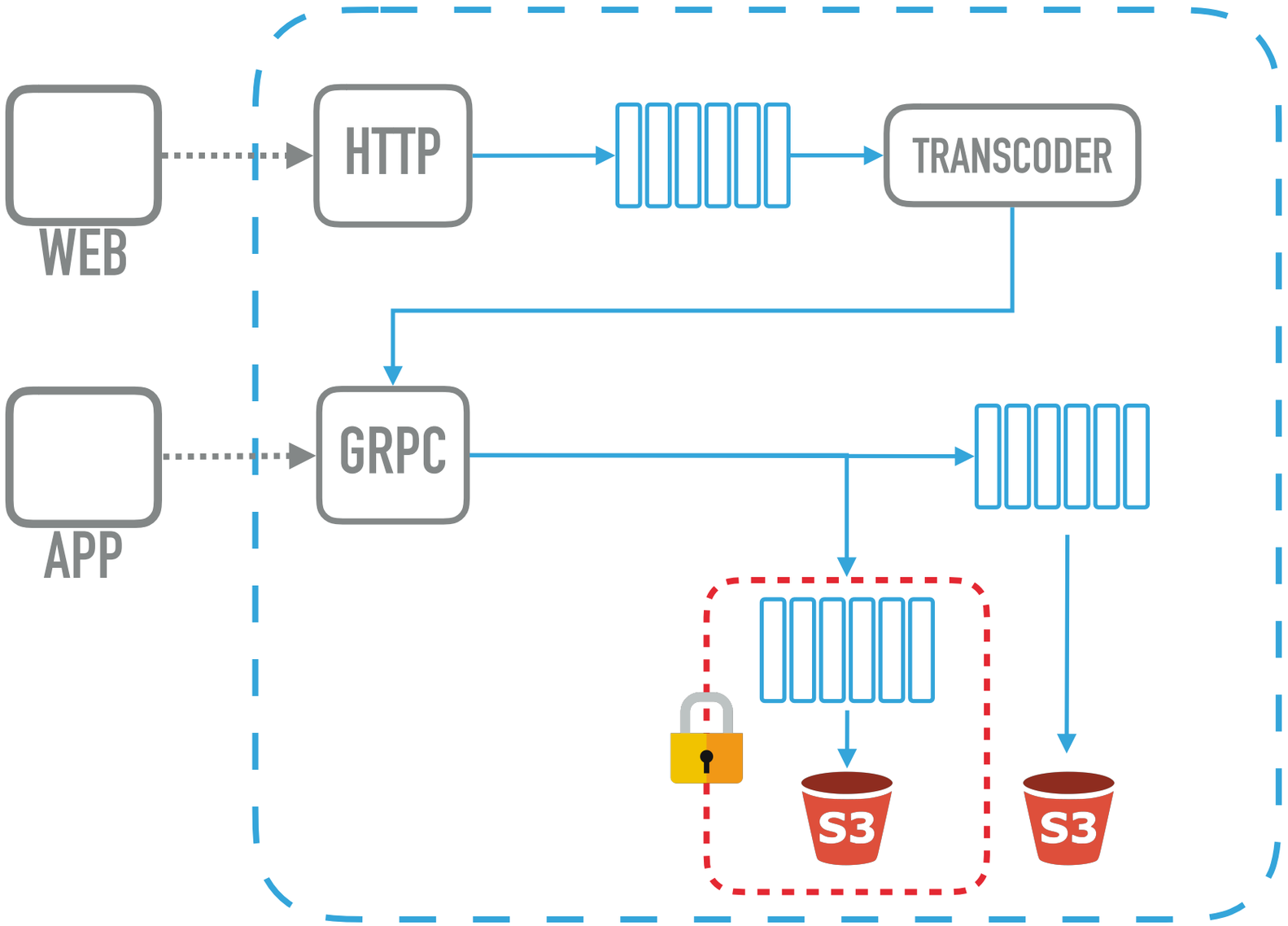
TRANSCODER – TECHNOLOGIES

- Scala application
- AWS Elastic Container Service (ECS)
- Kinesis Enhanced Fanout

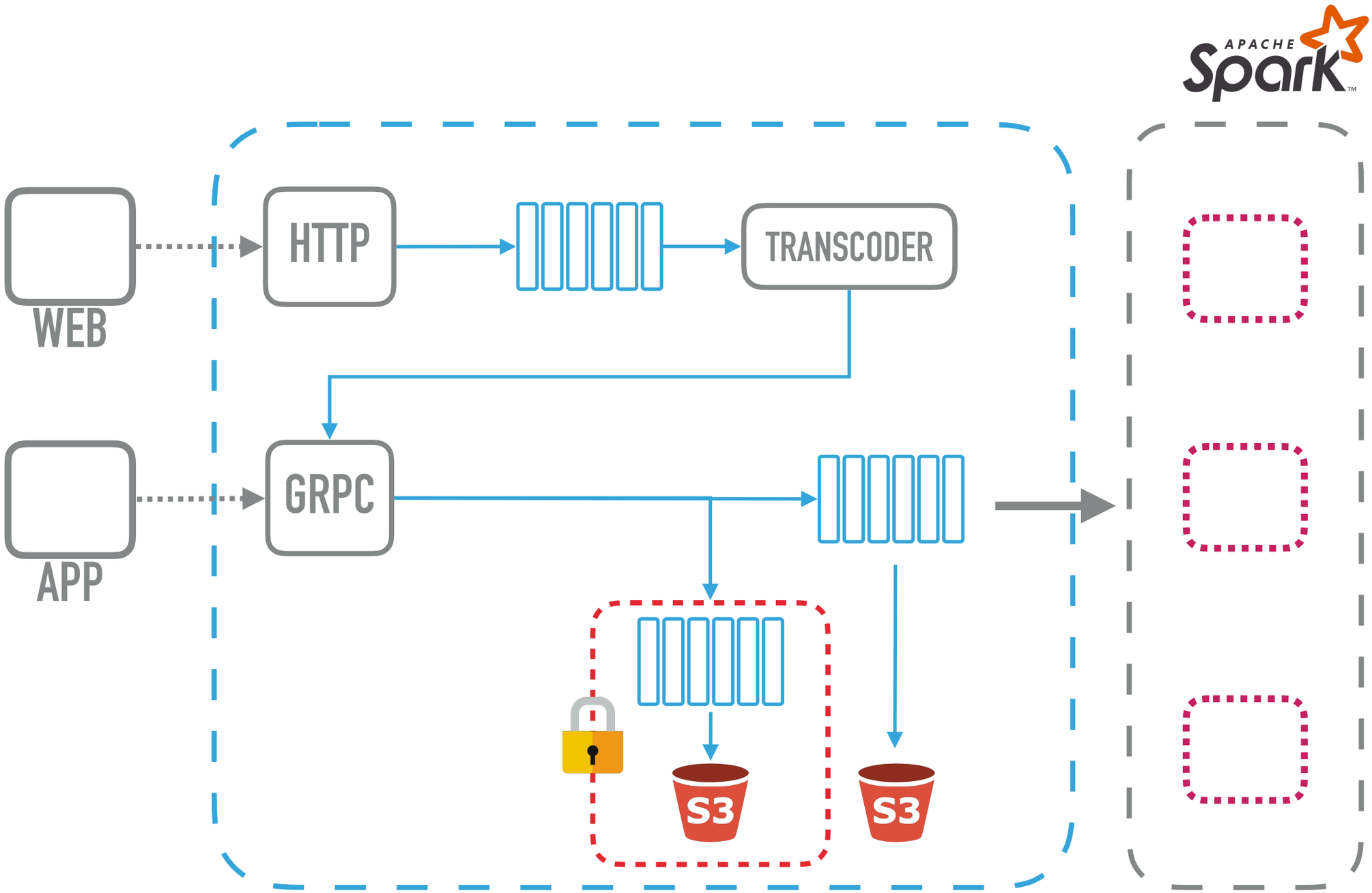
Pushing converted data to gRPC



Handling Sensitive data - Redaction

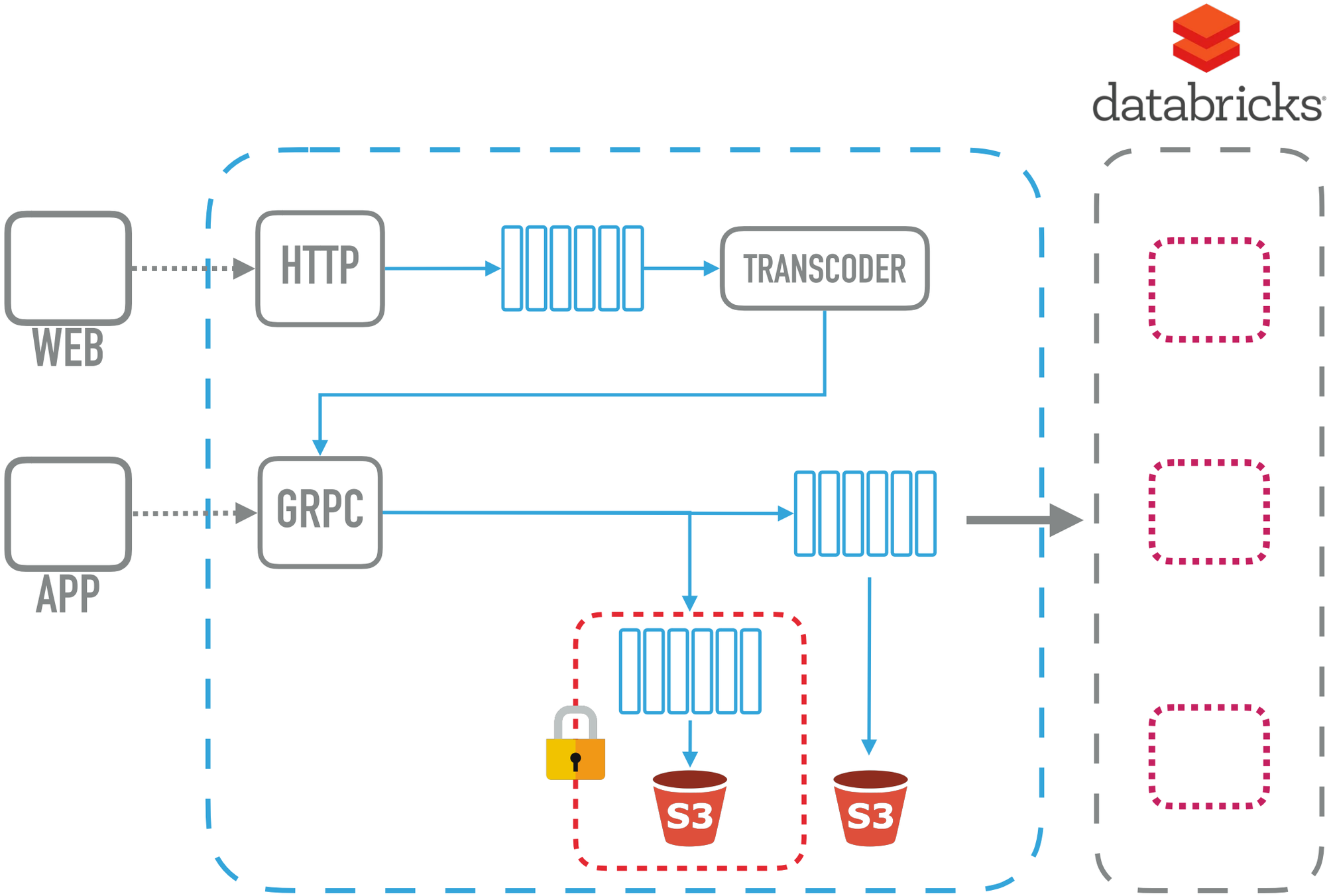


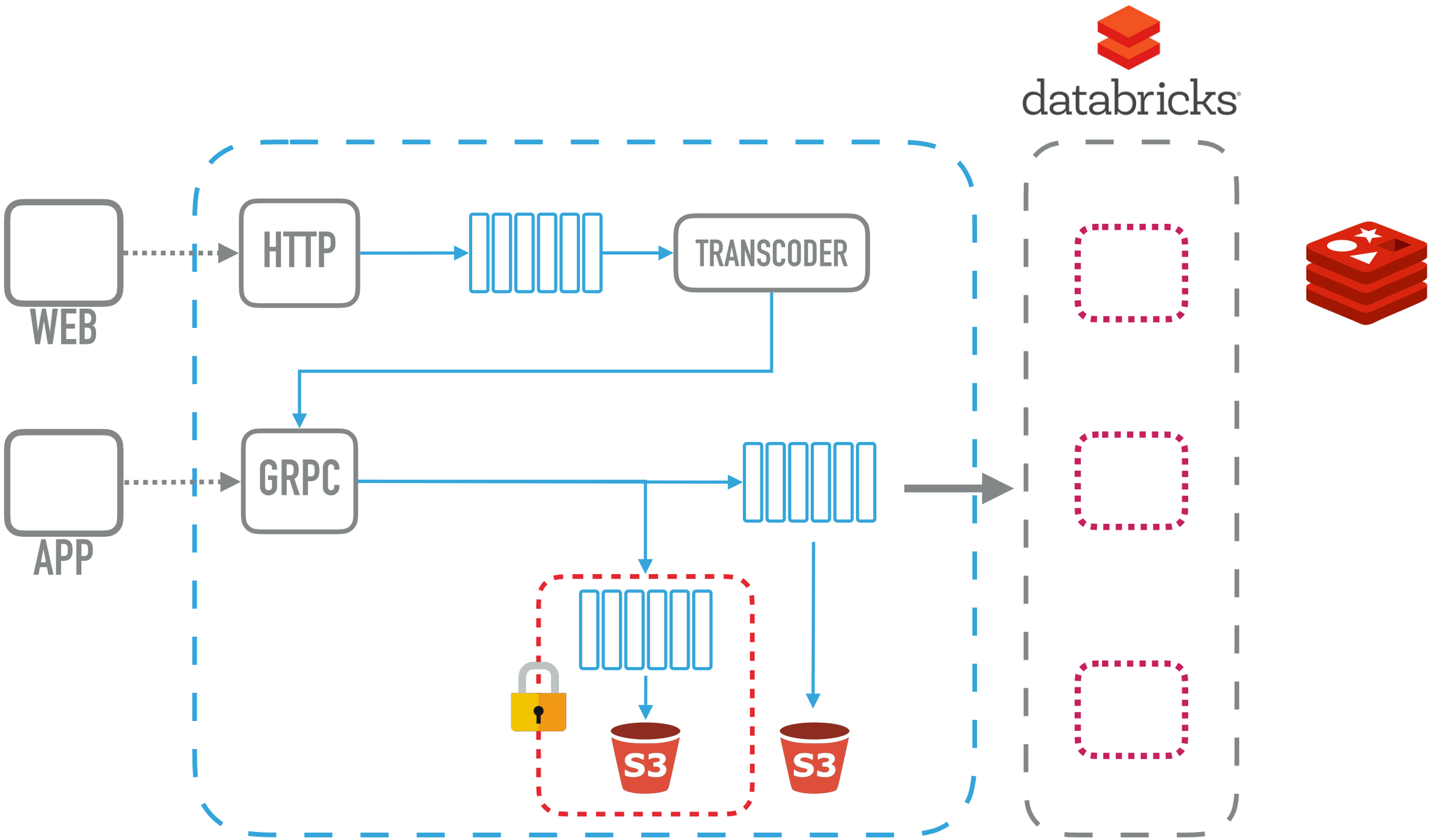
Consuming data, ETL - Apache Spark



APACHE SPARK

- Apache Spark through **DataBricks**
  - Extensive tools
  - Runs on your AWS infrastructure (VPC)
  - Ability to extend with custom tools
  - Easy to use


databricks
WEB
APP
HTTP
GRPC
TRANSCODER
S3
S3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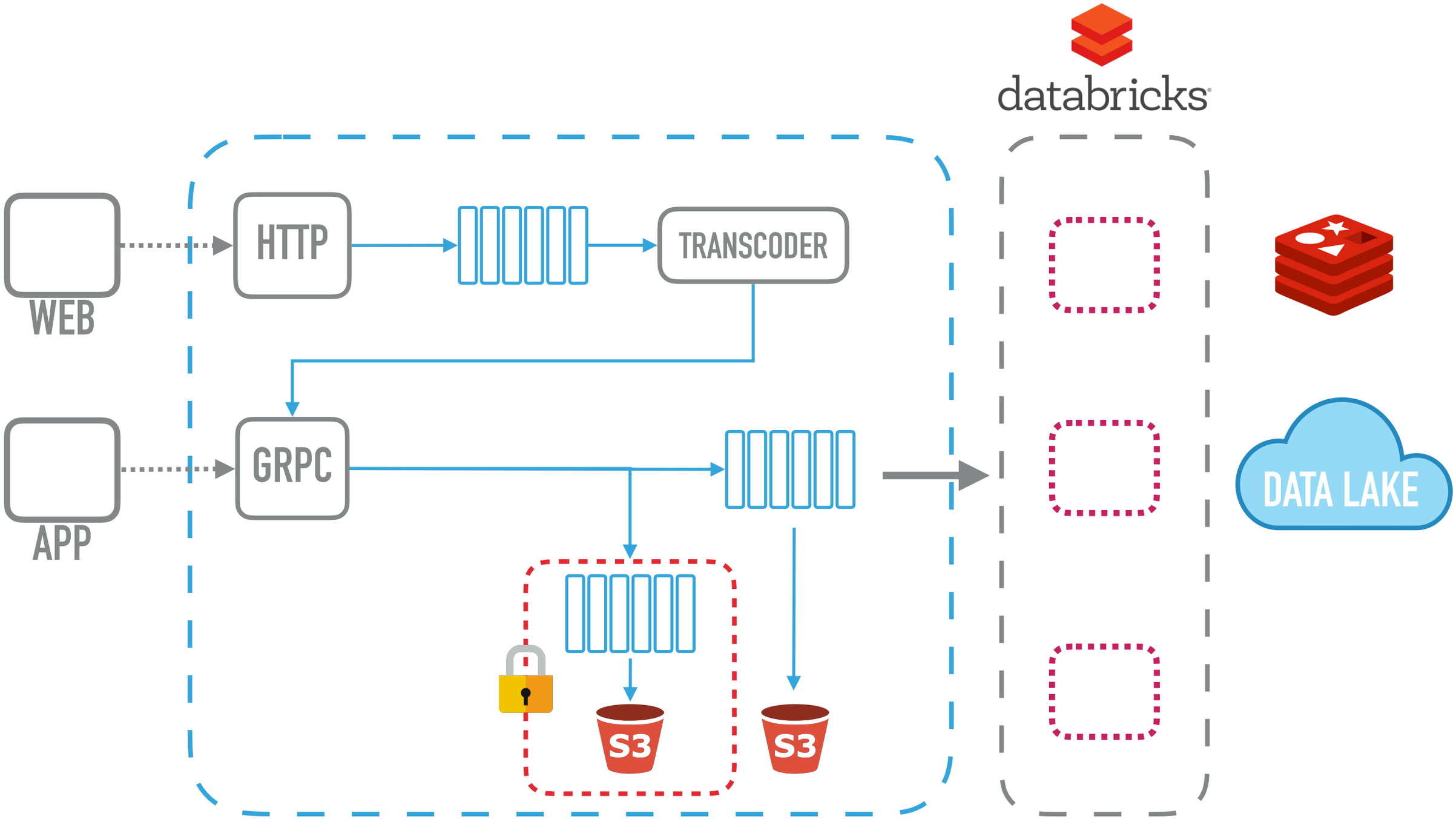
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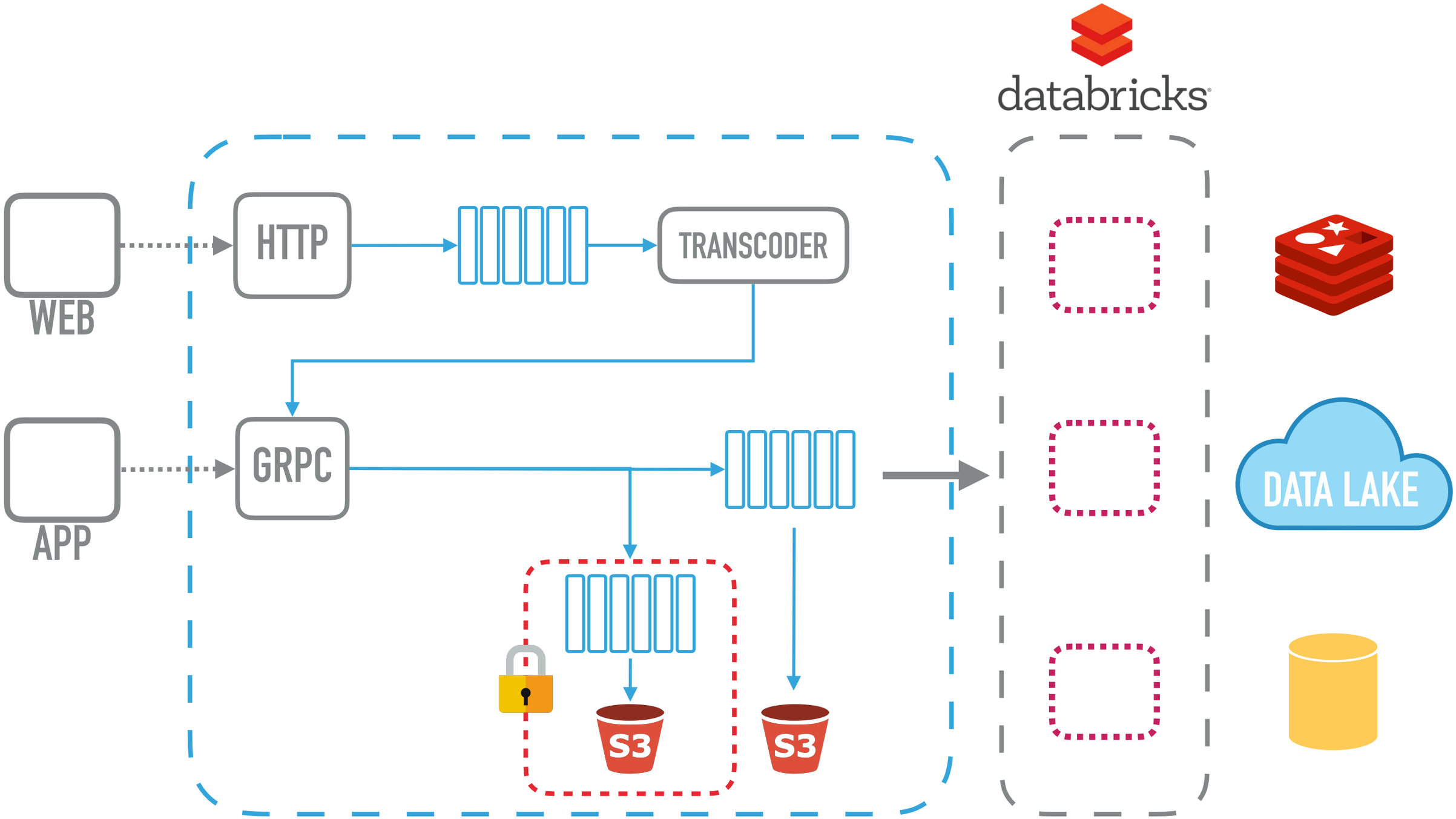
DATA LAKE


databricks
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HTTP
GRPC
TRANSCODER
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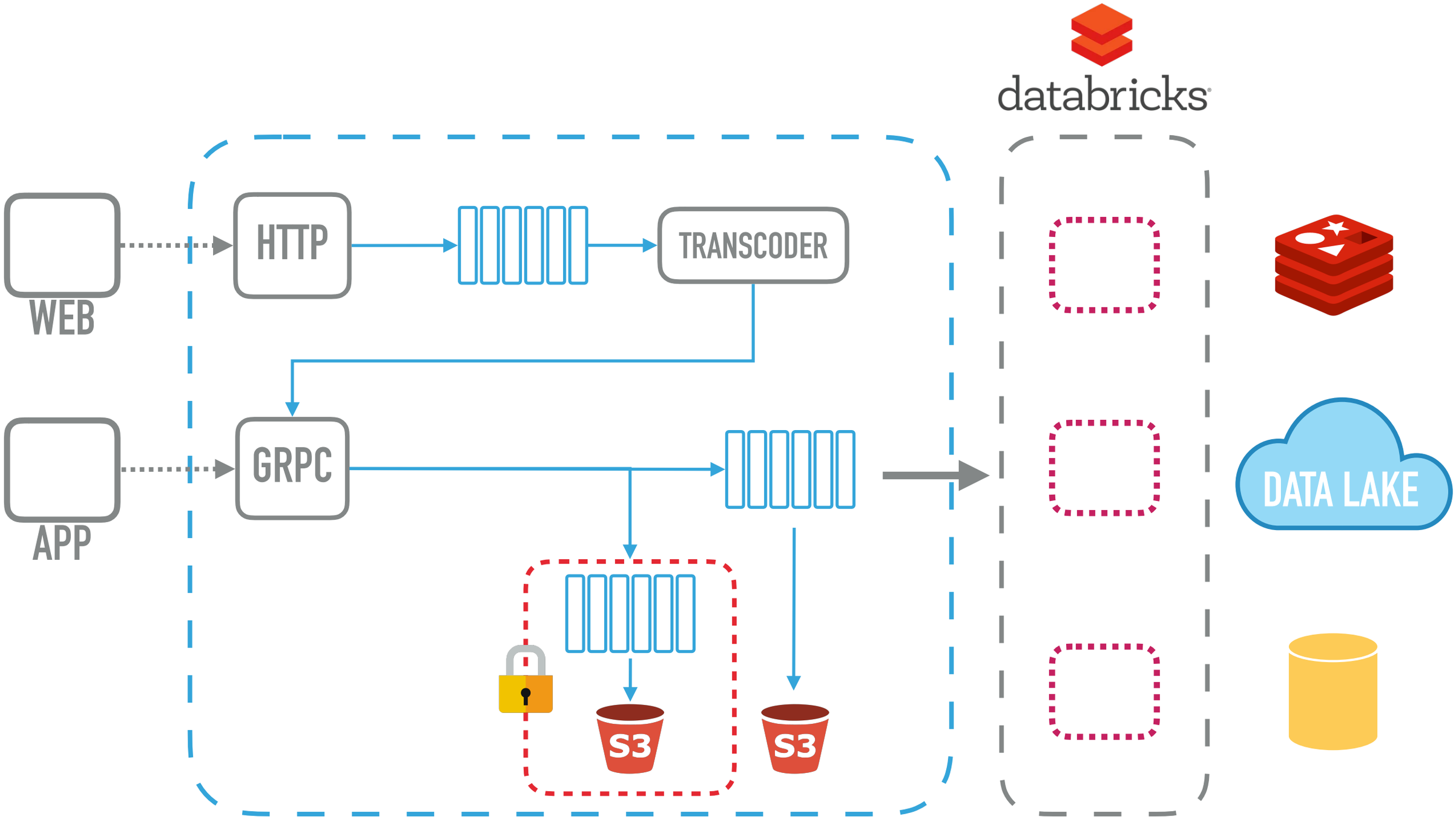
S3
DATA LAKE

TECHNOLOGIES

- Redis
- RedShift Spectrum
- Parquet
- S3 - multi-tenant storage
- AWS Relational Database Service (RDS)


databricks
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HTTP
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TRANSCODER
S3
S3
DATA LAKE

6 LESSONS

LEARNED

OBSERVABILITY

1/6

Honest Status Page
@honest_update

We replaced our monolith with micro services so that every outage could be more like a murder mystery.

7:10 PM - 7 Oct 2015

3,010 Retweets **2,627** Likes

@honest_update

MONITORING

- Golden metrics
  - Latency
  - Traffic
  - Errors
  - Saturation

MONITORING

- Analyzing long-term trends
  - Predict future capacity
  - Detect anomalies in trends
- Symptoms vs. Causes
  - What's broken & why

MONITORING

- Black box monitoring
  - Periodic test message
  - Measure end-to-end
- White box monitoring
  - Monitor individual components

DISTRIBUTED TRACING

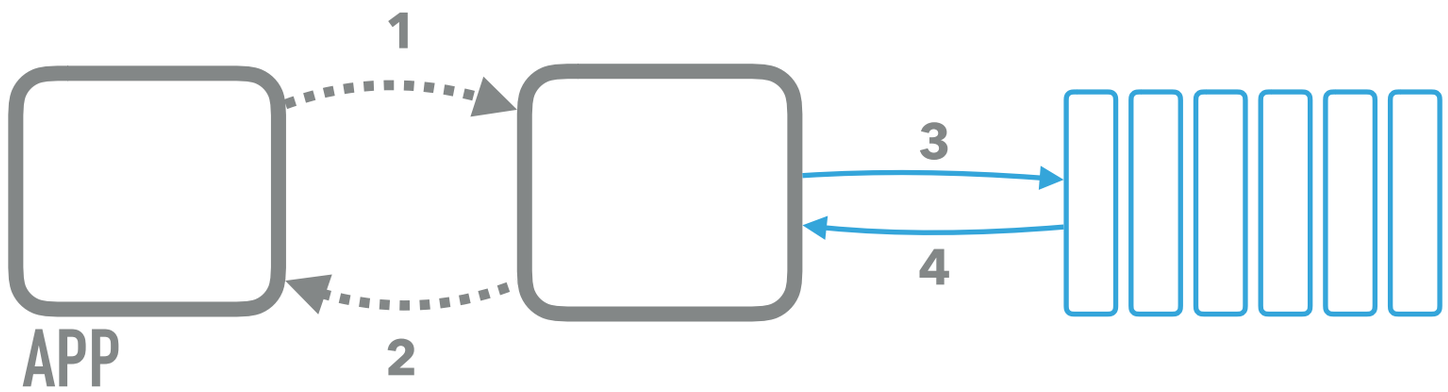
DISTRIBUTED TRACING

- Visibility to system over time
- Locally aggregated logs
- Centralized logs

ALERTING

- Define thresholds
- Define appropriate resolution
- Signal vs. Noise
- Define escalation paths

DURABILITY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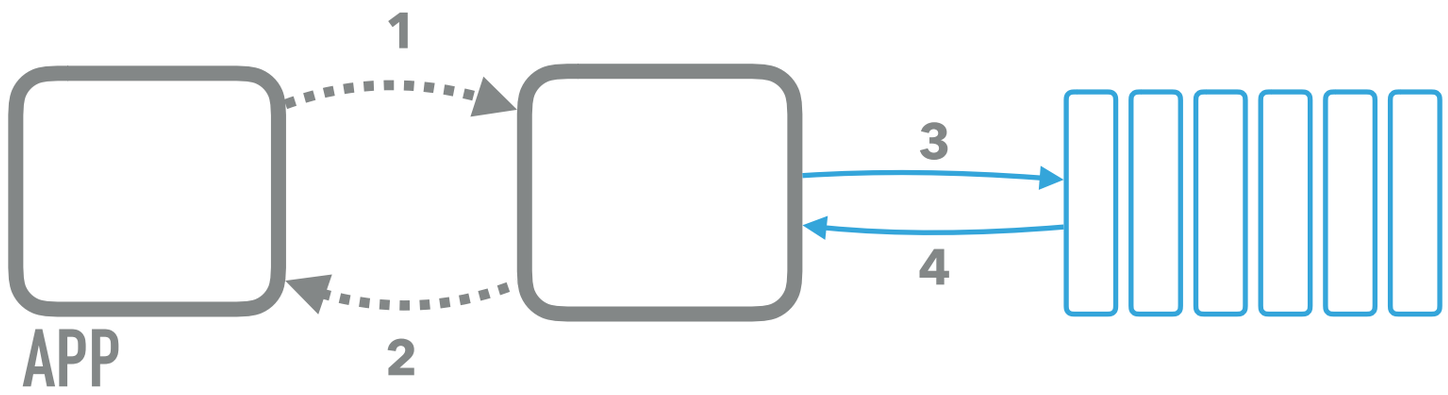
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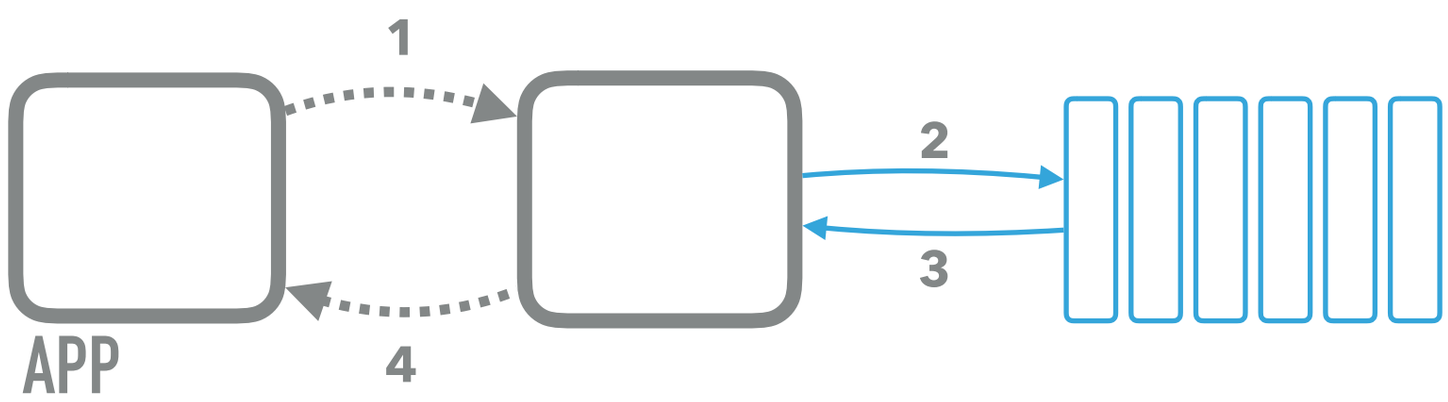
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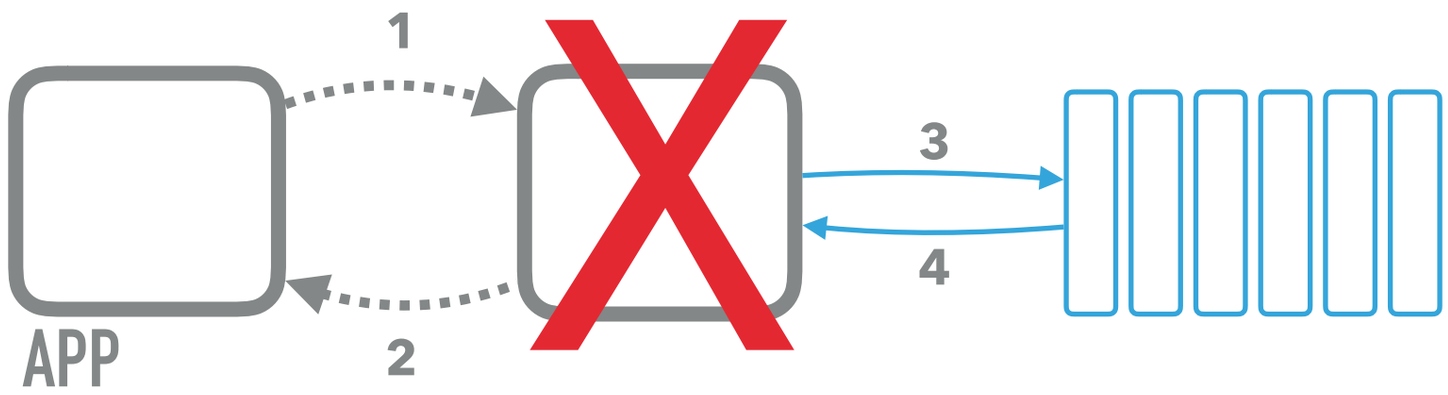
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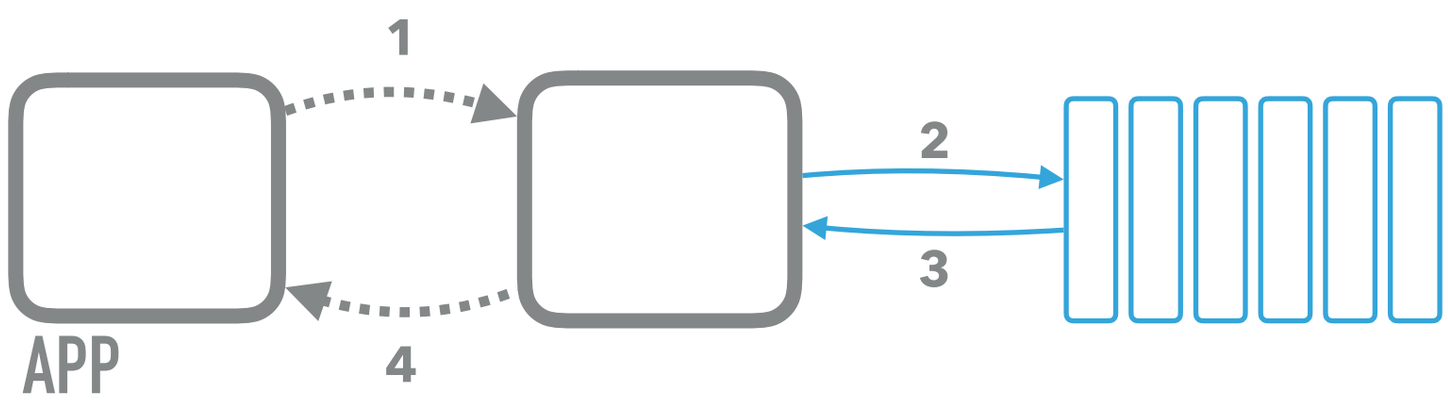
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APP
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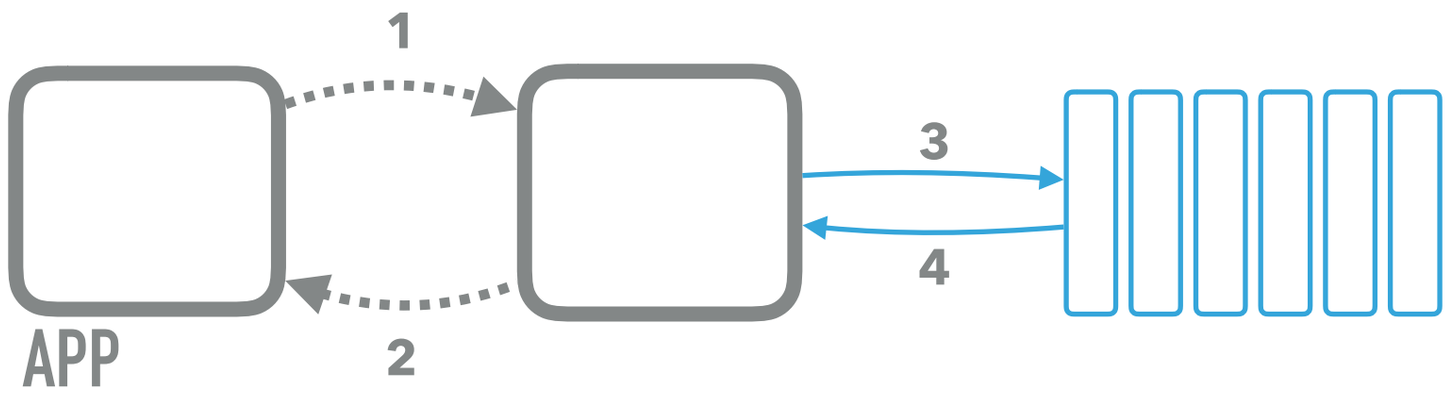
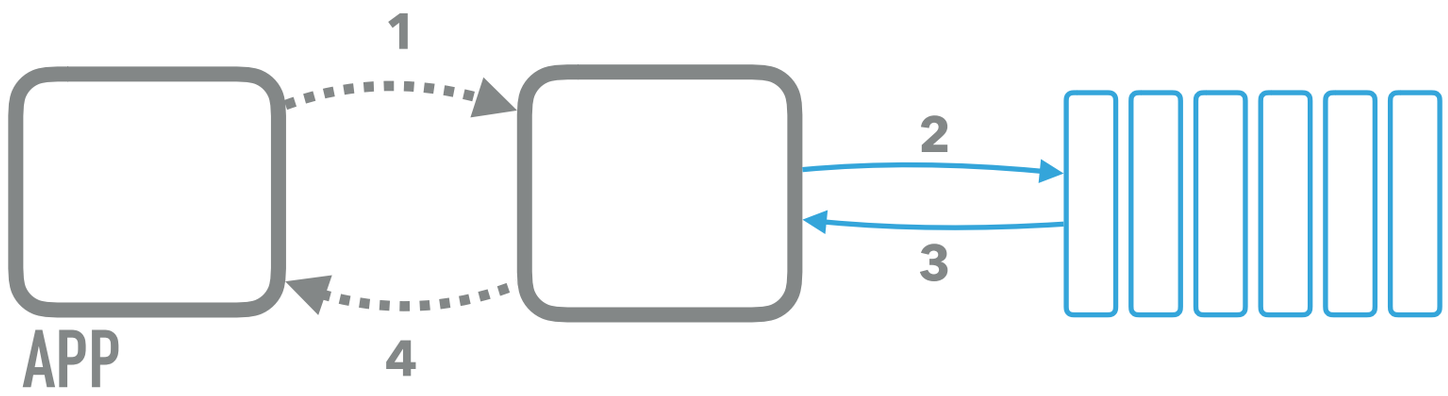
Fire & Forget



Guaranteed Delivery



DURABILITY

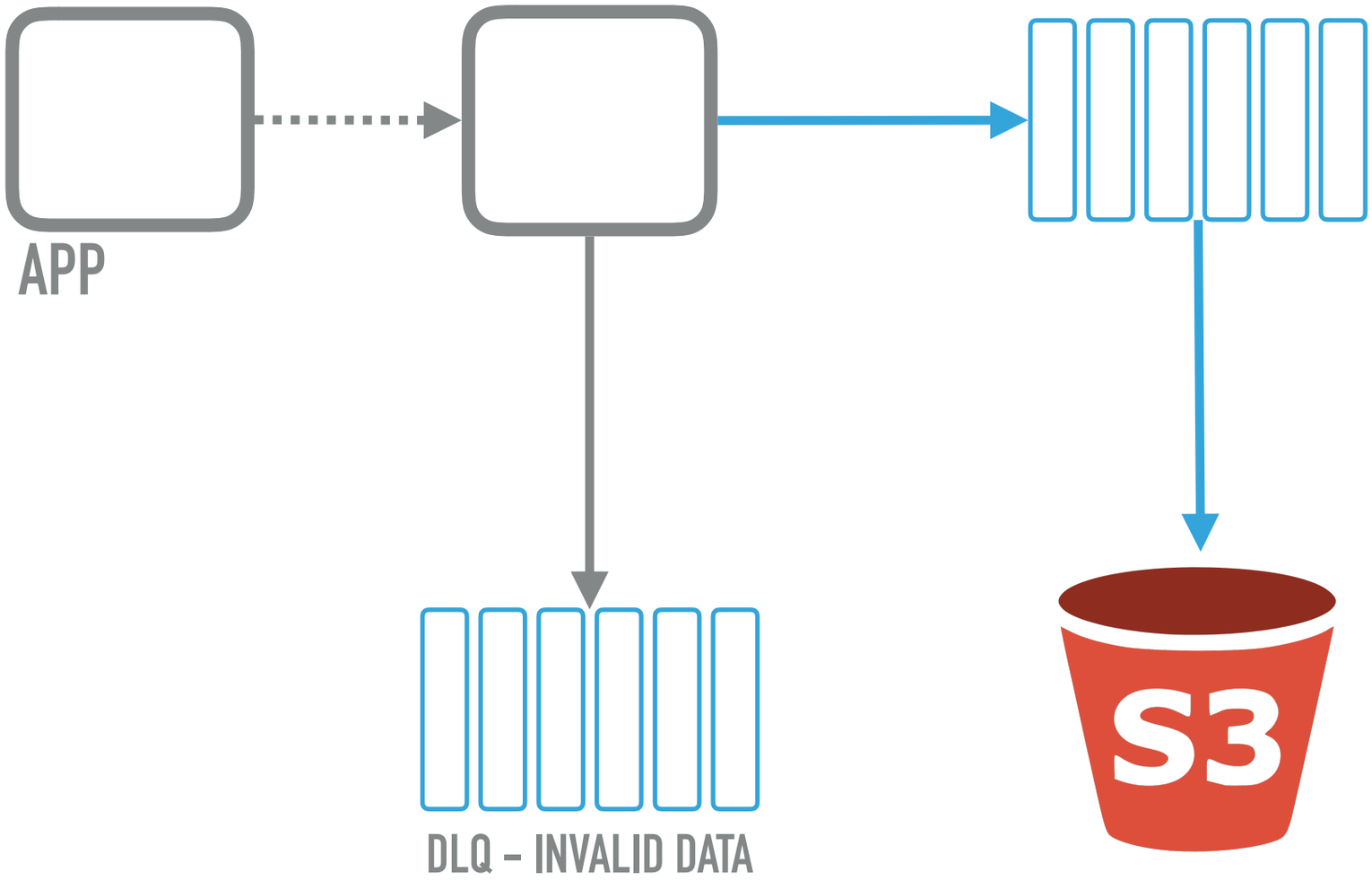
- Fire & Forget
  - Lower latency
  - Lower durability = Higher data loss
- Guaranteed delivery
  - Higher durability = Lower data loss
  - Higher latency

DURABILITY

- Delivery semantics
  - At least once
  - Exactly once
  - At most once

FAULT TOLERANCE

- Human error / Machine error
- Simple collectors
- Immutable data
- Disaster recovery / Replay of historical data
- Dead Letter Queue (DLQ) for invalid data


APP
DLQ - INVALID DATA
S3

ARCHITECTURE

& Technologies

3/6

ARCHITECTURE & TECHNOLOGIES

AS SIMPLE AS POSSIBLE,
BUT NOT SIMPLER

Albert Einstein

TECHNOLOGIES

- Understand the technologies
- Understand the trade-offs
- Build vs. Buy

TECHNOLOGIES

- Kinesis vs. Kafka
- gRPC vs. HTTP
- Apache Spark: AWS EMR vs. DataBricks
- …

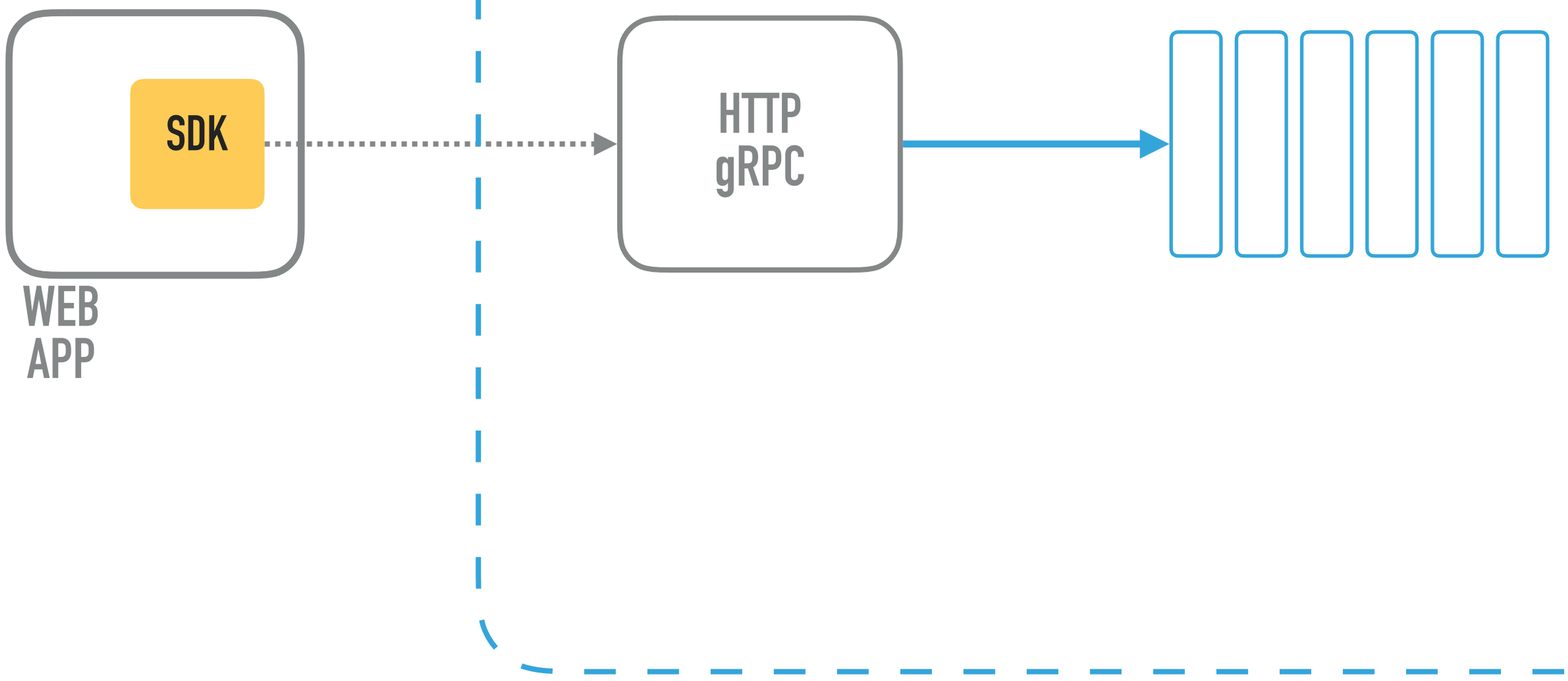
ARCHITECTURE & TECHNOLOGIES

- External facing techs
  - Consistent interface
  - Familiar techs
- Internal techs
  - Ability to experiment

SDK

Software Development Kit

4/6


SDK
WEB
APP
HTTP
gRPC

SDK

- Provide in early stages
- Easier adoption of service
- Take control
- Build resiliency
  - Retry mechanism
  - Circuit breaker

SECURITY

Everyone's Responsibility

5/6

SECURITY

- Do not collect the data you do not need

SECURITY

- Encryption: Rest vs. In-transit
- Anonymizing vs. Pseudonymizing
- Life cycle policies
- Enrichment

SECURITY

- Multiple copies of the data?
- Right to be forgotten (GDPR)

AUTOMATION

6/6

AUTOMATE

- Builds and Deployments (CI / CD)
- Automate infrastructure provisioning

INFRASTRUCTURE AS CODE

- Automatic provisioning
- Parameterized infrastructure code
- Reproducible environments
- Short-lived environments (tests)

TESTING

- Unit & integration tests
  - LocalStack (AWS services in container)
- End-to-End tests
  - Actual infrastructure (smaller capacity)

TRADE-OFFS

TRADE-OFFS

- Maintainability
- Operations
- Security
- Simplicity
- Adoption
- Performance
- …

INFORMED

DECISIONS

QUESTIONS?

RESOURCES

- Google | Site Reliability Engineering
- Designing Data Intensive Applications