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Ask Bigger Questions

Real Time Data Ingest into Hadoop using Flume

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What is Flume

- Collection, Aggregation of streaming Event Data
  - Typically used for log data
- Significant advantages over ad-hoc solutions
  - Reliable, Scalable, Manageable, Customizable and High Performance
  - Declarative, Dynamic Configuration
  - Contextual Routing
  - Feature rich
  - Fully extensible

Core Concepts: Event

An Event is the fundamental unit of data transported by Flume from its point of origination to its final destination. Event is a byte array payload accompanied by optional headers.

- Payload is opaque to Flume
- Headers are specified as an unordered collection of string key-value pairs, with keys being unique across the collection
- Headers can be used for contextual routing

Core Concepts: Client

An entity that generates events and sends them to one or more Agents.

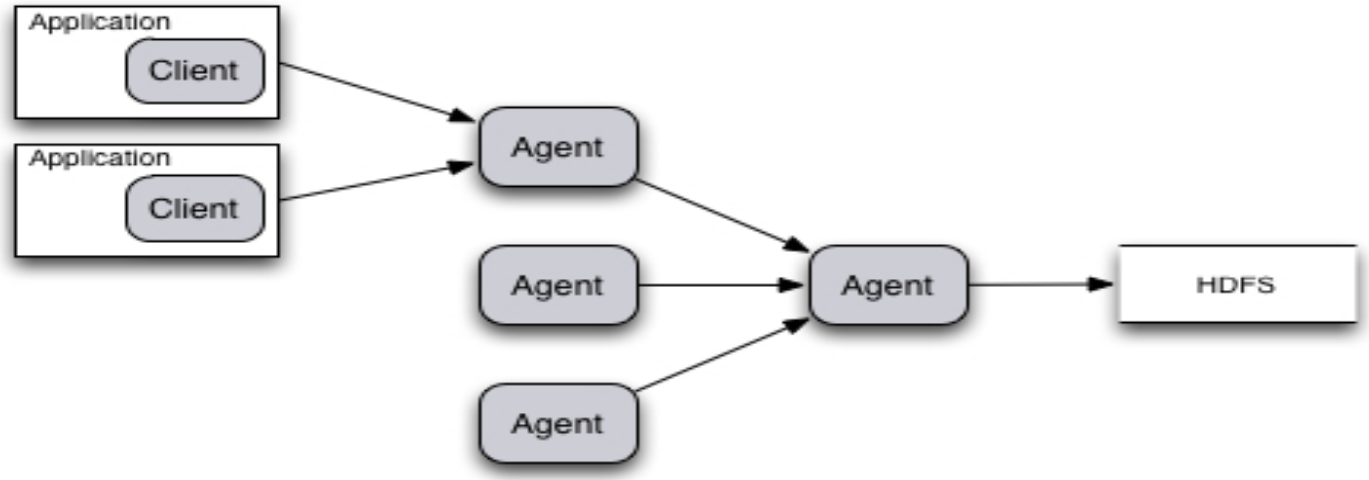
- Example
  - Flume log4j Appender
  - Custom Client using Client SDK (`org.apache.flume.api`)
  - Embedded Agent – An agent embedded within your application
- Decouples Flume from the system where event data is consumed from
- Not needed in all cases

Core Concepts: Agent

A container for hosting Sources, Channels, Sinks and other components that enable the transportation of events from one place to another.

- Fundamental part of a Flume *flow*
- Provides Configuration, Life-Cycle Management, and Monitoring Support for hosted components

Typical Aggregation Flow



$[Client]^{+} \rightarrow Agent\ [\rightarrow Agent]^{*} \rightarrow Destination$

Core Concepts: Source

An active component that receives events from a specialized location or mechanism and places it on one or Channels.

- Different Source types:
  - Specialized sources for integrating with well-known systems. Example: Syslog, Netcat
  - Auto-Generating Sources: Exec, SEQ
  - IPC sources for Agent-to-Agent communication: Avro
- Require at least one channel to function

Sources

- Different Source types:
  - Specialized sources for integrating with well-known systems. Example: Spooling Files, Syslog, Netcat, JMS
  - Auto-Generating Sources: Exec, SEQ
  - IPC sources for Agent-to-Agent communication: Avro, Thrift
- Require at least one channel to function

Core Concepts: Channel

A passive component that buffers the incoming events until they are drained by Sinks.

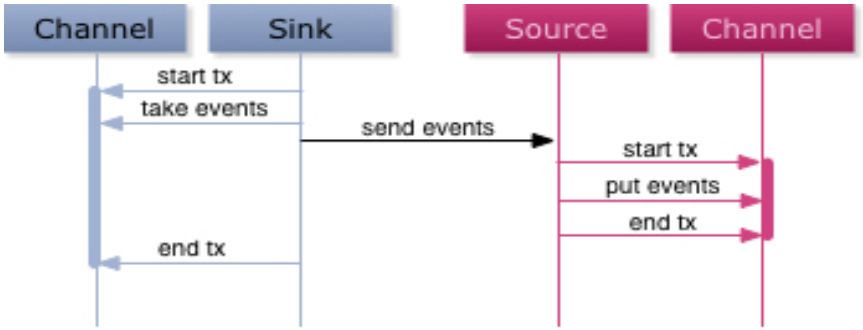
- Different Channels offer different levels of persistence:
  - Memory Channel: volatile
    - Data lost if JVM or machine restarts
  - File Channel: backed by WAL implementation
    - Data not lost unless the disk dies.
    - Eventually, when the agent comes back data can be accessed.
- Channels are fully transactional
- Provide weak ordering guarantees
- Can work with any number of Sources and Sinks.

Core Concepts: Sink

An active component that removes events from a Channel and transmits them to their next hop destination.

- Different types of Sinks:
  - Terminal sinks that deposit events to their final destination. For example: HDFS, HBase, Morphline-Solr, Elastic Search
  - Sinks support serialization to user's preferred formats.
  - HDFS sink supports time-based and arbitrary bucketing of data while writing to HDFS.
  - IPC sink for Agent-to-Agent communication: Avro, Thrift
- Require exactly one channel to function

Flow Reliability



Reliability based on:

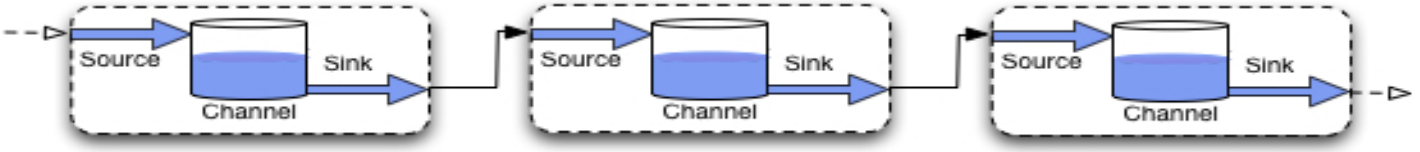
- Transactional Exchange between Agents
- Persistence Characteristics of Channels in the Flow

Also Available:

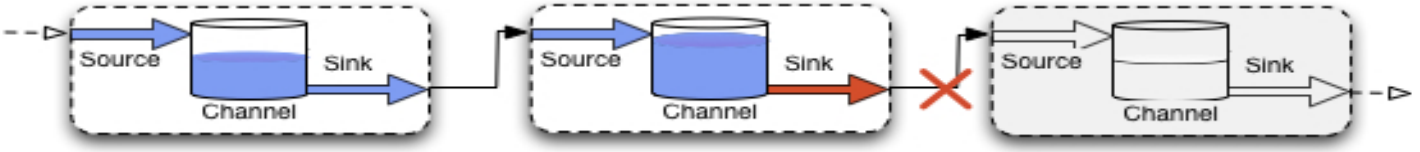
- Built-in Load balancing Support
- Built-in Failover Support

Flow Reliability

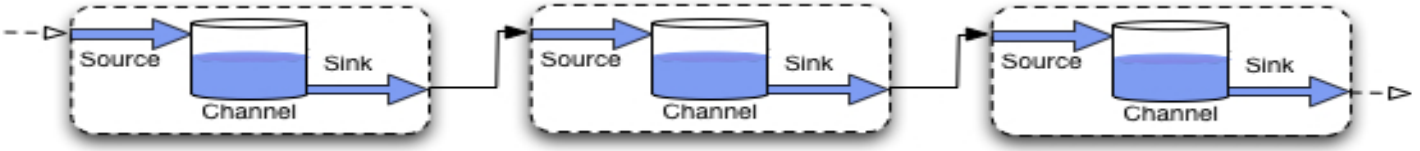
Normal Flow



Communication Failure between Agents



Communication Restored, Flow back to Normal



Flow Handling

Channels decouple impedance of upstream and downstream

- Upstream burstiness is damped by channels
- Downstream failures are transparently absorbed by channels

→ Sizing of channel capacity is key in realizing these benefits

Configuration

- Java Properties File Format

```
# Comment line
key1 = value
key2 = multi-line \
               value
```

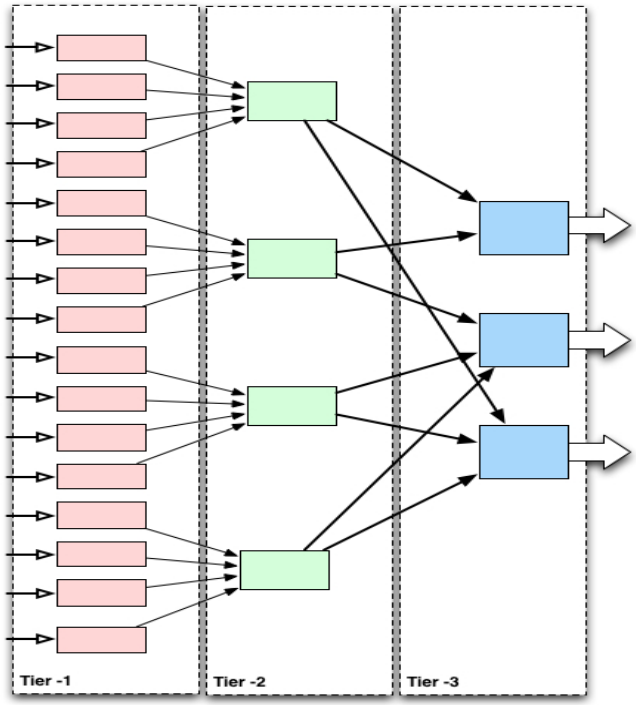
- Hierarchical, Name Based Configuration

```
agent1.channels.myChannel.type = FILE
agent1.channels.myChannel.capacity = 1000
```

- Uses soft references for establishing associations

agent1.sources.mySource.type = HTTP
agent1.sources.mySource.channels = ***myChannel***

Configuration

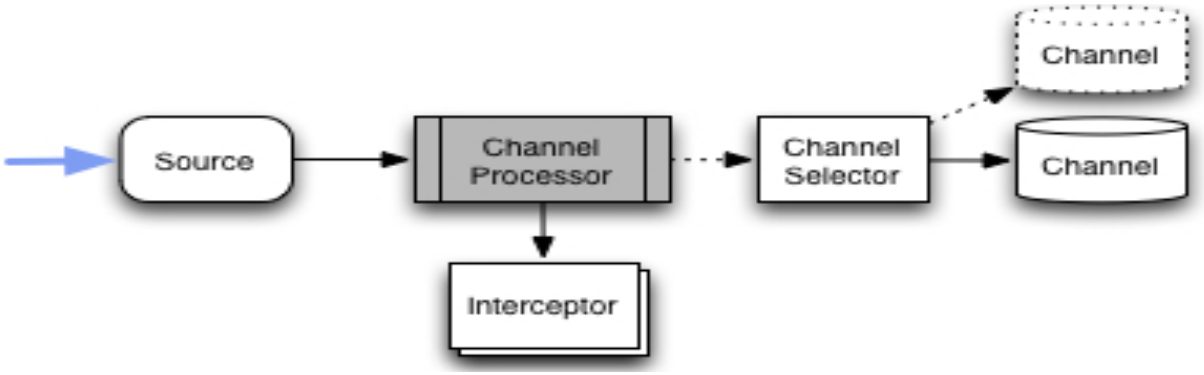


Typical Deployment

- All agents in a specific tier could be given the same name
- One configuration file with entries for three agents can be used throughout

Contextual Routing

Achieved using Interceptors and Channel Selectors



Interceptors

Interceptor

An Interceptor is a component applied to a source in pre-specified order to enable decorating and filtering of events where necessary.

- Built-in Interceptors allow adding headers such as timestamps, hostname, static markers etc.
- Custom interceptors can introspect event payload to create specific headers where necessary

Contextual Routing

Channel Selector

A Channel Selector allows a Source to select one or more Channels from all the Channels that the Source is configured with based on preset criteria.

- Built-in Channel Selectors:
  - Replicating: for duplicating the events
  - Multiplexing: for routing based on headers

Contextual Routing

- Terminal Sinks can directly use Headers to make destination selections
  - HDFS Sink can use headers values to create dynamic path for files that the event will be added to.
  - Some headers such as timestamps can be used in a more sophisticated manner
- Custom Channel Selector can be used for doing specialized routing where necessary

Load Balancing and Failover

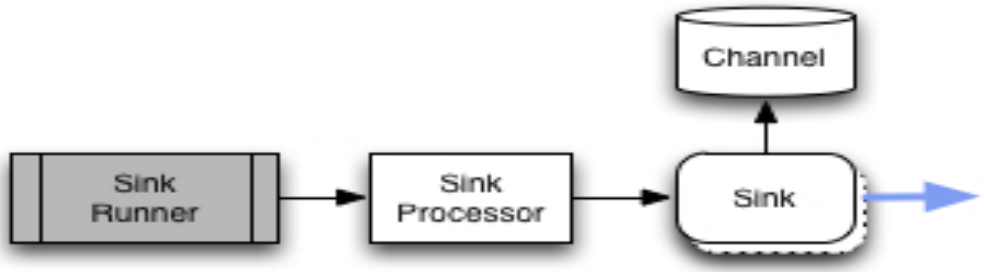
Sink Processor

A Sink Processor is responsible for invoking one sink from an assigned group of sinks.

- Built-in Sink Processors:
  - Load Balancing Sink Processor – using RANDOM, ROUND_ROBIN or Custom selection algorithm
  - Failover Sink Processor
  - Default Sink Processor

Sink Processor

- Invoked by Sink Runner
- Acts as a proxy for a Sink



Sink Processor Configuration

- A Sink can exist in at most one group
- A Sink that is not in any group is handled via Default Sink Processor

- Caution:

  Removing a Sink Group does not make the sinks inactive!

Client API

- Simple API that can be used to send data to Flume agents.
- Simplest form – send a batch of events to one agent.
- Can be used to send data to multiple agents in a round-robin, random or failover fashion (send data to one till it fails).
- Java only.
- `flume.thrift` can be used to generate code for other languages.
  - Use with Thrift source.

Embedded Agent

- Client API throws exceptions if data could not be sent.
- Applications may not be able to tolerate this.
- Embedded Agent – A (limited) Flume agent within your application
- Has a channel – so buffers data in-memory or on-disk till the data is sent or the channel is full.
- Throws exceptions only if the channel is full (or error writing to channel).
- Cushion for application if something causes data to be stuck within the application
- Supports sending data to other Flume agents only, no HDFS, HBase etc.

Summary

- Clients send Events to Agents
- Agents hosts number Flume components – Source, Interceptors, Channel Selectors, Channels, Sink Processors, and Sinks.
- Sources and Sinks are active components, where as Channels are passive
- Source accepts Events, passes them through Interceptor(s), and if not filtered, puts them on channel(s) selected by the configured Channel Selector
- Sink Processor identifies a sink to invoke, that can take Events from a Channel and send it to its next hop destination
- Channel operations are transactional to guarantee one-hop delivery semantics
- Channel persistence allows for ensuring end-to-end reliability

Questions?