cloudera®

# Capturing Data with Apache Flume

## Chapter 9

201509

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# Capturing Data with Apache Flume

**In this chapter you will learn**

- **What are the main architectural components of Flume**
- **How these components are configured**
- **How to launch a Flume agent**
- **How to configure a standard Java application to log data using Flume**

# Chapter Topics

**Capturing Data with Apache Flume** | **Introduction to Flume**

- **What is Apache Flume?**
- Basic Flume Architecture
- Flume Sources
- Flume Sinks
- Flume Channels
- Flume Configuration
- Conclusion
- Homework: Collect Web Server Logs with Flume

# What Is Apache Flume?

- **Apache Flume is a high-performance system for data collection**
  - Name derives from original use case of near-real time log data ingestion
  - Now widely used for collection of any streaming event data
  - Supports aggregating data from many sources into HDFS
- **Originally developed by Cloudera**
  - Donated to Apache Software Foundation in 2011
  - Became a top-level Apache project in 2012
  - Flume OG gave way to Flume NG (Next Generation)
- **Benefits of Flume**
  - Horizontally-scalable
  - Extensible
  - Reliable

# Flume's Design Goals: Reliability

- **Channels provide Flume's reliability**
- **Memory Channel**
  - Data will be lost if power is lost
- **Disk-based Channel**
  - Disk-based queue guarantees durability of data in face of a power loss
- **Data transfer between Agents and Channels is transactional**
  - A failed data transfer to a downstream agent rolls back and retries
- **Can configure multiple Agents with the same task**
  - For example, 2 Agents doing the job of 1 'collector' – if one agent fails then upstream agents would fail over

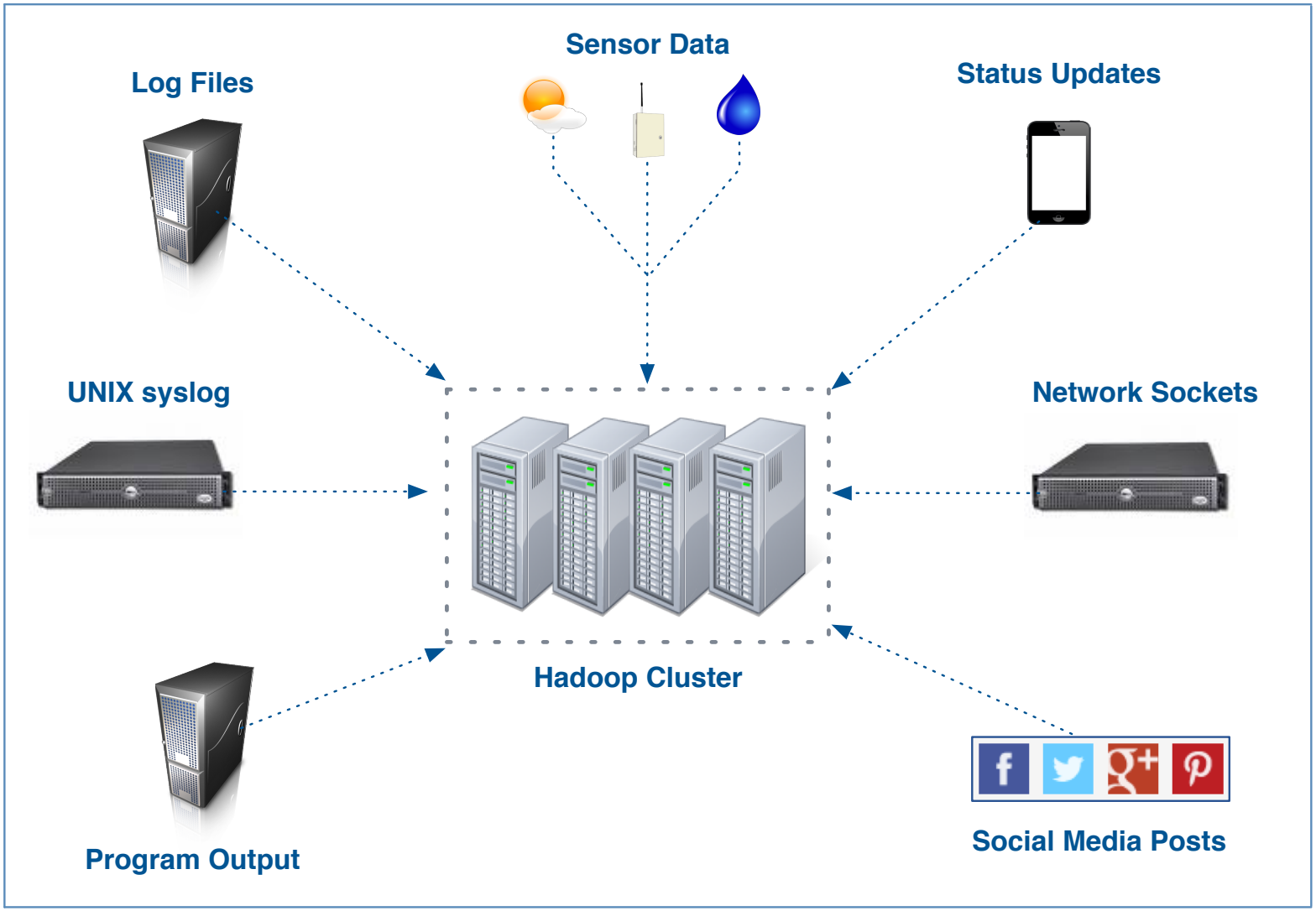
# Flume's Design Goals: Scalability

- **Scalability**
  - The ability to increase system performance linearly – or better – by adding more resources to the system
  - Flume scales horizontally
    - As load increases, more machines can be added to the configuration

# Flume's Design Goals: Extensibility

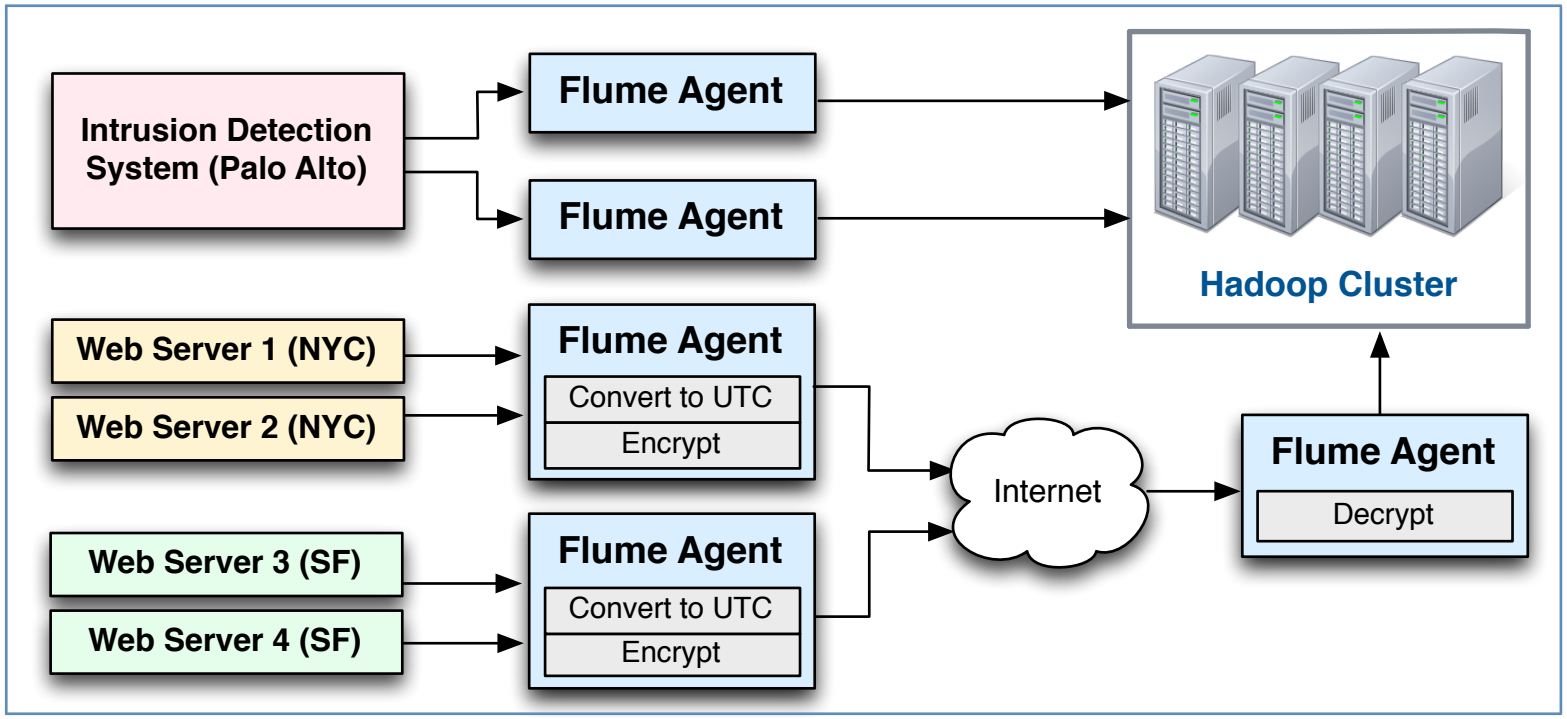
- **Extensibility**
  - The ability to add new functionality to a system
- **Flume can be extended by adding Sources and Sinks to existing storage layers or data platforms**
  - General Sources include data from files, syslog, and standard output from any Linux process
  - General Sinks include files on the local filesystem or HDFS
  - Developers can write their own Sources or Sinks

# Common Flume Data Sources



# Large-Scale Deployment Example

- **Flume collects data using configurable "agents"**
  - Agents can receive data from many sources, including other agents
  - Large-scale deployments use multiple tiers for scalability and reliability
  - Flume supports inspection and modification of in-flight data



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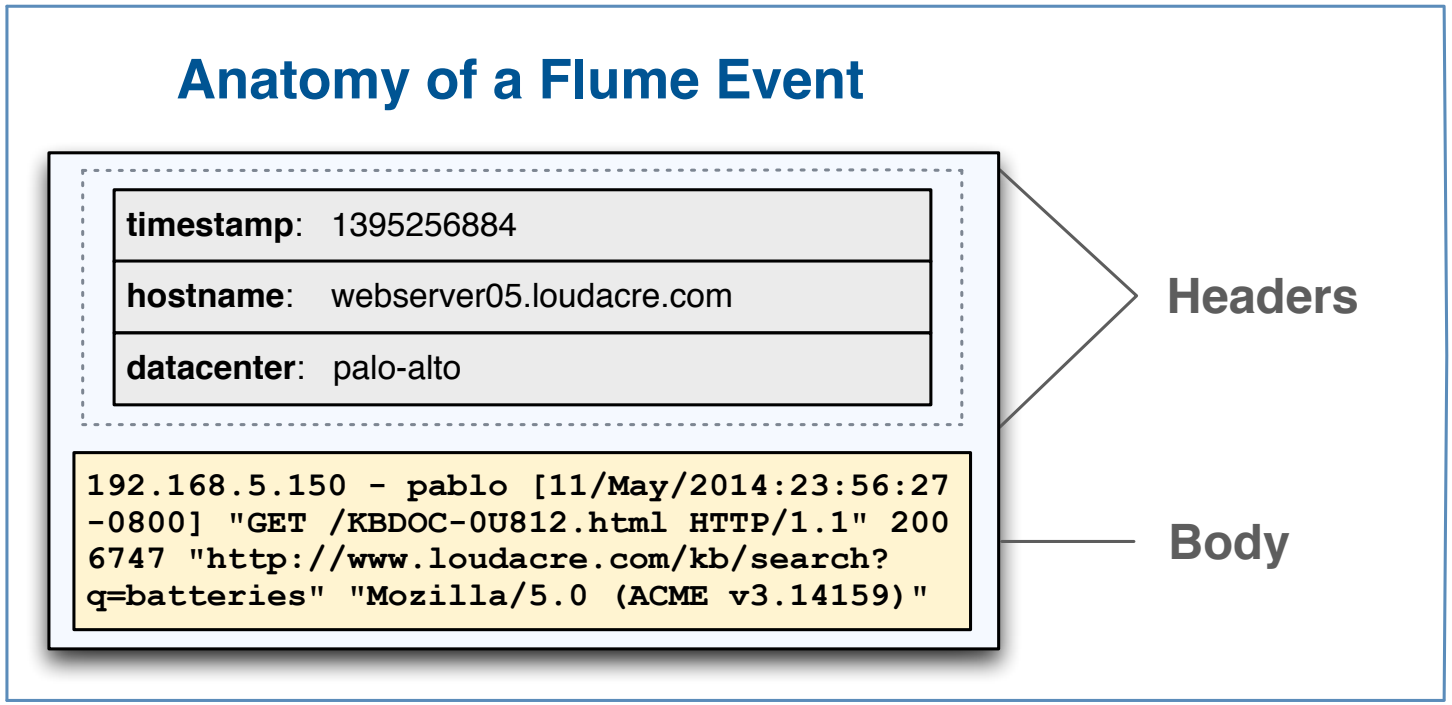
# Flume Events

- **An *event* is the fundamental unit of data in Flume**
  - Consists of a body (payload) and a collection of headers (metadata)
- **Headers consist of name-value pairs**
  - Headers are mainly used for directing output

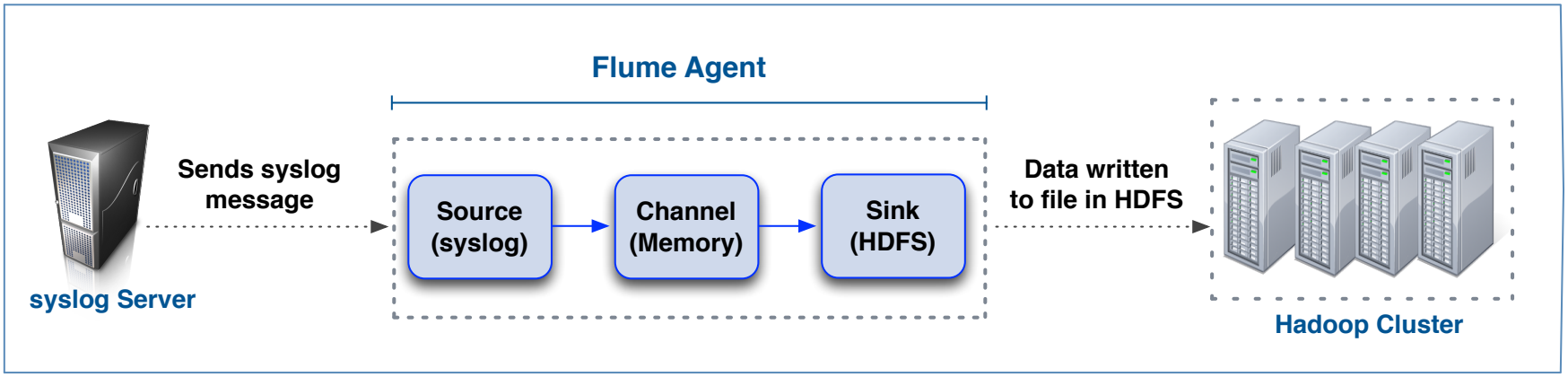


# Components in Flume's Architecture

- **Source**
  - Receives events from the external actor that generates them
- **Sink**
  - Sends an event to its destination
- **Channel**
  - Buffers events from the source until they are drained by the sink
- **Agent**
  - Java process that configures and hosts the source, channel, and sink

# Flume Data Flow

- **This diagram illustrates how syslog data might be captured to HDFS**
  1. Message is logged on a server running a syslog daemon
  2. Flume agent configured with syslog source receives event
  3. Source pushes event to the channel, where it is buffered in memory
  4. Sink pulls data from the channel and writes it to HDFS



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# Notable Built-in Flume Sources

- **Syslog**
  - Captures messages from UNIX syslog daemon over the network
- **Netcat**
  - Captures any data written to a socket on an arbitrary TCP port
- **Exec**
  - Executes a UNIX program and reads events from standard output *
- **Spooldir**
  - Extracts events from files appearing in a specified (local) directory
- **HTTP Source**
  - Receives events from HTTP requests

* Asynchronous sources do not guarantee that events will be delivered

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# Interesting Built-in Flume Sinks

- **Null**
  - Discards all events (Flume equivalent of `/dev/null`)
- **Logger**
  - Logs event to INFO level using SLF4J
- **IRC**
  - Sends event to a specified Internet Relay Chat channel
- **HDFS**
  - Writes event to a file in the specified directory in HDFS
- **HBaseSink**
  - Stores event in HBase

SLF4J: Simple Logging Façade for Java

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# Built-In Flume Channels

- **Memory**
  - Stores events in the machine's RAM
  - Extremely fast, but not reliable (memory is volatile)
- **File**
  - Stores events on the machine's local disk
  - Slower than RAM, but more reliable (data is written to disk)
- **JDBC**
  - Stores events in a database table using JDBC
  - Slower than file channel

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# Flume Agent Configuration File

- **Flume agent is configured through a Java properties file**
  - Multiple agents can be configured in a single file
- **The configuration file uses hierarchical references**
  - Each component is assigned a user-defined ID
  - That ID is used in the names of additional properties

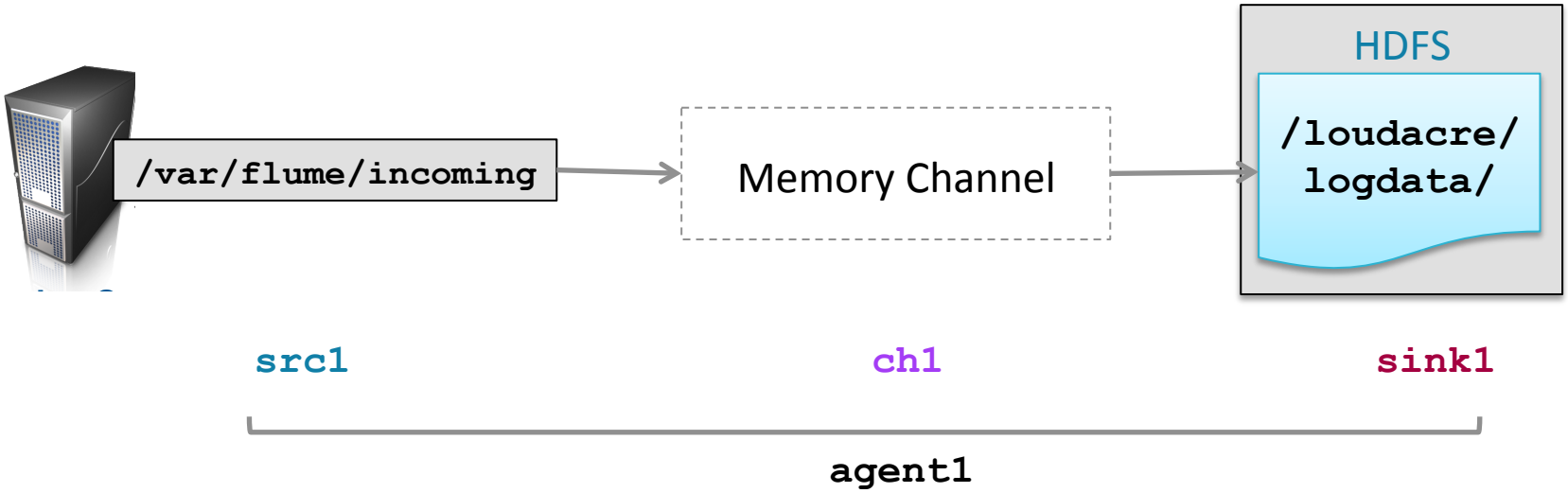
```
# Define sources, sinks, and channel for agent named 'agent1'
agent1.sources = mysource
agent1.sinks = mysink
agent1.channels = mychannel

# Sets a property 'foo' for the source associated with agent1
agent1.sources.mysource.foo = bar

# Sets a property 'baz' for the sink associated with agent1
agent1.sinks.mysink.baz = bat
```

# Example: Configuring Flume Components (1)

- **Example: Configure a Flume Agent to collect data from remote spool directories and save to HDFS**



# Example: Configuring Flume Components (2)

```
agent1.sources = src1
agent1.sinks = sink1
agent1.channels = ch1

agent1.channels.ch1.type = memory

agent1.sources.src1.type = spooldir
agent1.sources.src1.spoolDir = /var/flume/incoming
agent1.sources.src1.channels = ch1

agent1.sinks.sink1.type = hdfs
agent1.sinks.sink1.hdfs.path = /loudacre/logdata
agent1.sinks.sink1.channel = ch1
```

Connects **source** and channel

Connects **sink** and channel

- **Properties vary by component type (source, channel, and sink)**
  - Properties also vary by subtype (e.g., netcat source vs. syslog source)
  - See the Flume user guide for full details on configuration

# Aside: HDFS Sink Configuration

- **Path may contain patterns based on event headers, such as timestamp**
- **The HDFS sink writes uncompressed SequenceFiles by default**
  - Specifying a codec will enable compression

```
agent1.sinks.sink1.type = hdfs
agent1.sinks.sink1.hdfs.path = /loudacre/logdata/%y-%m-%d
agent1.sinks.sink1.hdfs.codeC = snappy
agent1.sinks.sink1.channel = ch1
```

- **Setting `fileType` parameter to `DataStream` writes *raw* data**
  - Can also specify a file extension, if desired

```
agent1.sinks.sink1.type = hdfs
agent1.sinks.sink1.hdfs.path = /loudacre/logdata/%y-%m-%d
agent1.sinks.sink1.hdfs.fileType = DataStream
agent1.sinks.sink1.hdfs.fileSuffix = .txt
agent1.sinks.sink1.channel = ch1
```

# Starting a Flume Agent

- **Typical command line invocation**
  - The **--name** argument must match the agent's name in the configuration file
  - Setting root logger as shown will display log messages in the terminal

```
$ flume-ng agent \
   --conf /etc/flume-ng/conf \
   --conf-file /path/to/flume.conf \
   --name agent1 \
   -Dflume.root.logger=INFO,console
```

* `ng` = Next Generation (prior version now referred to as og)

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# Essential Points

- **Apache Flume is a high-performance system for data collection**
  - Scalable, extensible, and reliable
- **A Flume agent manages the source, channels, and sink**
  - Source receives event data from its origin
  - Sink sends the event to its destination
  - Channel buffers events between the source and sink
- **The Flume agent is configured using a properties file**
  - Each component is given a user-defined ID
  - This ID is used to define properties of that component

# Bibliography

**The following offer more information on topics discussed in this chapter**

- **Flume User Guide**
  - `http://flume.apache.org/FlumeUserGuide.html`

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# Homework: Collect Web Server Logs with Flume

- **In this homework assignment you will**
  - Configure Flume to ingest web server log data to HDFS
- **Please refer to your Homework description**