Producer Acknowledgments (`acks`)

1. Concept: Acks Kya Hai?

Jab Producer data bhejta hai, toh usko kaise pata chalega ki data safely Broker (Server) tak pahunch gaya?

- **Acknowledgment (Ack)** ek tarah ka "Confirmation" ya "Receipt" hai jo Kafka Broker wapas Producer ko bhejta hai.
- Aap choose kar sakte hain ki aapko kitni safety chahiye.

Iske 3 main settings hote hain:

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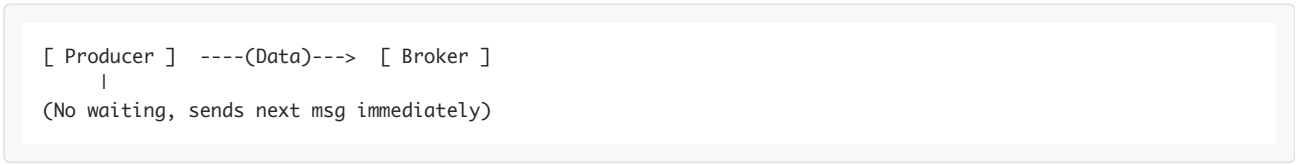
2. Setting 1: `acks = 0` (No Wait / Fire & Forget)

- **Behavior:** Producer data bhejta hai aur turant agla message bhejne lagta hai. Wo Broker ke response ka wait **nahi** karta.
- **Risk:** High Data Loss. Agar network fail hua ya broker down hua, toh Producer ko pata bhi nahi chalega aur data kho jayega.
- **Speed:** Very High (kyunki wait time zero hai).

Text Diagram:



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3. Setting 2: `acks = 1` (Leader Acknowledgement)

- **Behavior:** Producer tab tak wait karta hai jab tak **Leader Broker** ye confirm na kar de ki "Haan, maine data write kar liya hai".
- **Risk:** Limited Data Loss.
  - *Scenario:* Leader ne data likha -> Producer ko "OK" bheja -> Lekin abhi Replicas copy nahi kar paye the -> Leader CRASH ho gaya. -> **Data Loss.**
- **Speed:** Medium (Default setting in many older versions).

Text Diagram:

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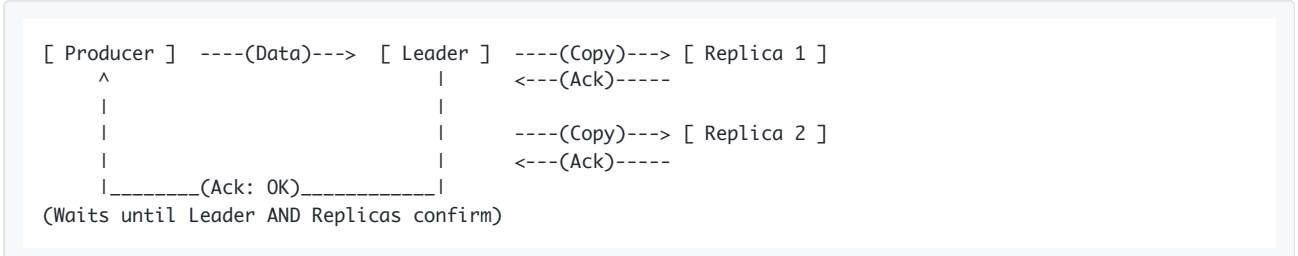
4. Setting 3: `acks = all` (Leader + Replicas)

- **Behavior:** Producer tab tak wait karta hai jab tak **Leader** aur saare **In-Sync Replicas (ISR)** data write na kar lein.
- **Risk:** No Data Loss (Safest). Jab tak sab copy nahi kar lete, Producer aage nahi badhta.
- **Speed:** Low (Latency high hoti hai kyunki sabka wait karna padta hai).

Text Diagram:



Topic Durability (Server Failures)

1. Durability Rule

Kafka ki power ye hai ki servers (brokers) fail hone ke baad bhi data bacha rehta hai. Iska ek simple mathematical rule hai:

> ***Rule:*** *Agar aapka Replication Factor **N** hai, toh aap **N - 1** Brokers permanently loose kar sakte hain bina data khoye.*

2. Examples (Calculation)

Replication Factor (N)	Calculation (N - 1)	Kitne Brokers Fail ho sakte hain?	Safety Level
3 (Standard)	3 - 1 = 2	**2 Brokers** fail ho sakte hain, data safe rahega.	High (Production Grade)
2	2 - 1 = 1	**1 Broker** fail ho sakta hai.	Medium
1	1 - 1 = 0	**0 Brokers** (Agar broker gaya, data gaya).	Low (Dev/Test only)

Example Scenario: Agar aapke paas **3 Brokers** hain aur **Replication Factor 3** hai:

1. Broker 101 Down -> Data still accessible (Broker 102 & 103 have copies).
2. Broker 102 Down -> Data still accessible (Broker 103 has copy).
3. Broker 103 Down -> Ab Data Unavailable hoga.

Summary Table

Setting	Wait Time	Data Safety	Use Case
`acks=0`	Zero	Dangerous	Logs, Tracking (jahan data loss chalta hai)
`acks=1`	Low	Medium	Regular Apps (Balanced)
`acks=all`	High	Max Safe	Financial Transactions, Banking

Next Step: Would you like to start the **Zookeeper** section now? (Note: Zookeeper purana concept hai but Kafka samajhne ke liye zaruri hai).