

# Rust in TiKV

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# About me

- Tang Liu
- Chief Architect of PingCAP
- Worked at Kingsoft and Tencent
- Open sources: LedisDB, go-mysql, etc.

# Agenda

- Why do we use Rust in TiKV
- TiKV architecture introduction
- Key technology
- Future plan

# What's TiKV?

A distributed Key-Value database with:

- Geo-Replication
- Horizontal scalability
- Consistent distributed transaction
- Coprocessor for distributed computing
- Working with TiDB like Spanner with F1

# We need a language with:

- Fast speed
- Memory safety
- Thread safety
- Binding C efficiency

# Why not C++?

- Memory leak, dangling pointer, etc...
- Data race
- No official package manager
- Development cycle will be long...

# Why not Go?

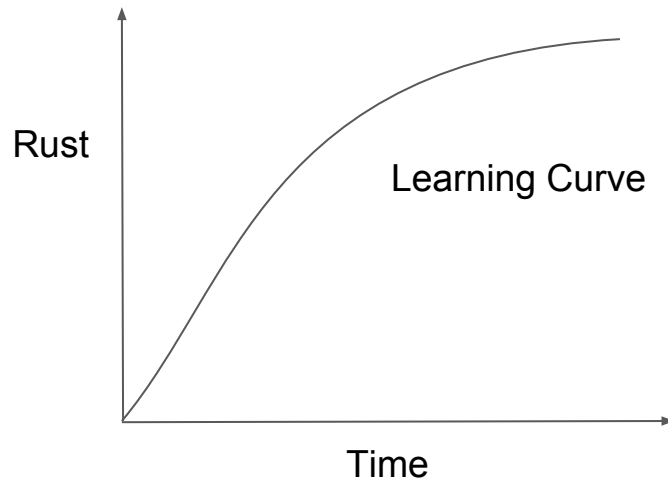
- GC
- Data race
- Goroutine runtime expenses
- CGO expenses

So we turned to Rust...



# But Rust...

- Steep learning curve
- Long compiling time
- Lack of libraries and tools
- Few programmers know it in China

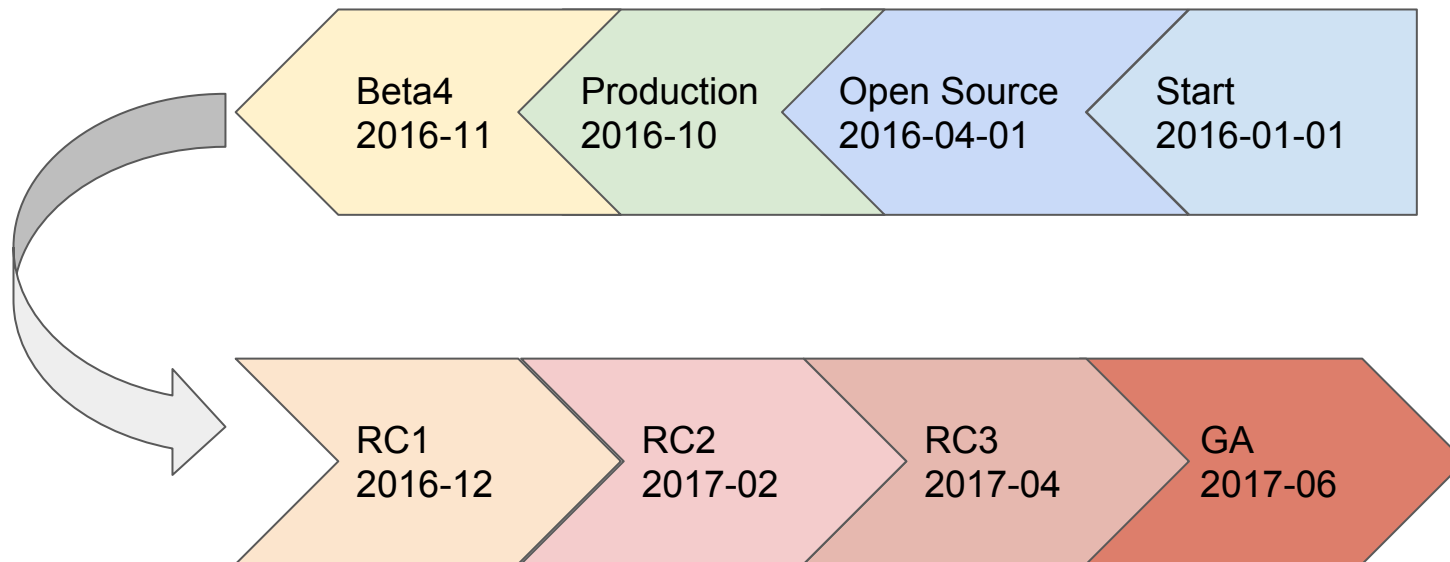


# Why Rust?

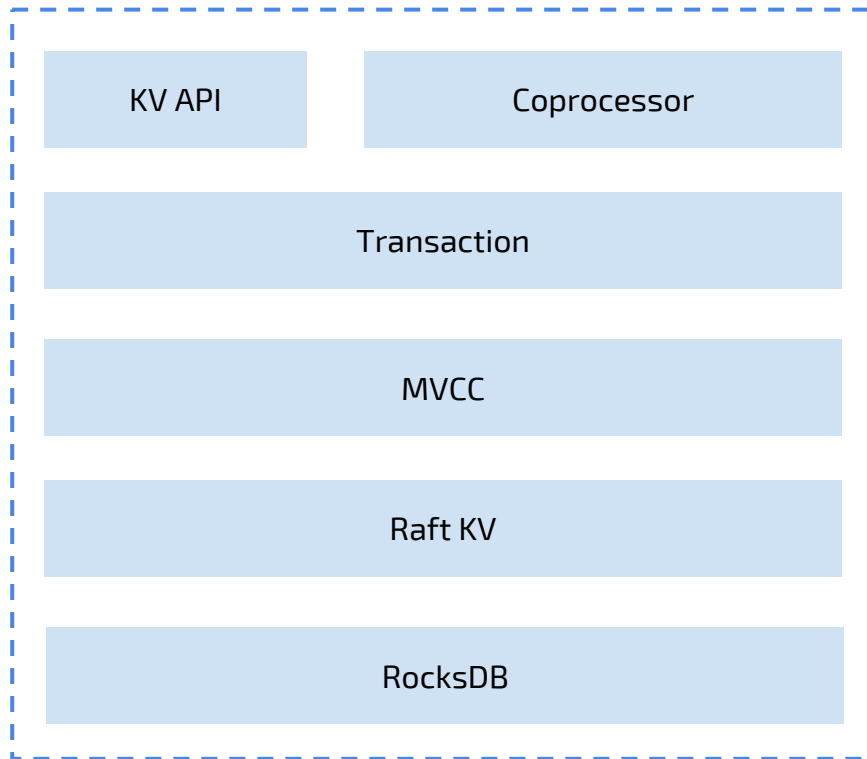
- Memory safety
- Thread safety
- No GC
- Calling C is fast
- Official package manager

We made a hard but great decision:  
Use Rust!

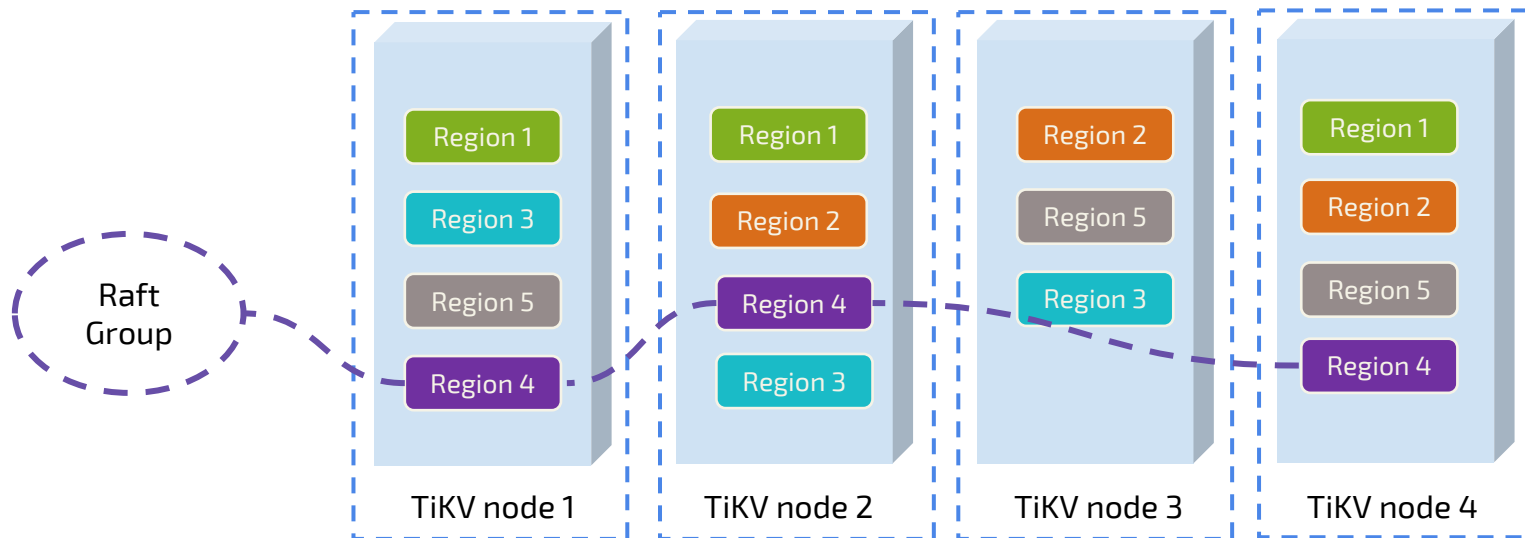
# TiKV Timeline



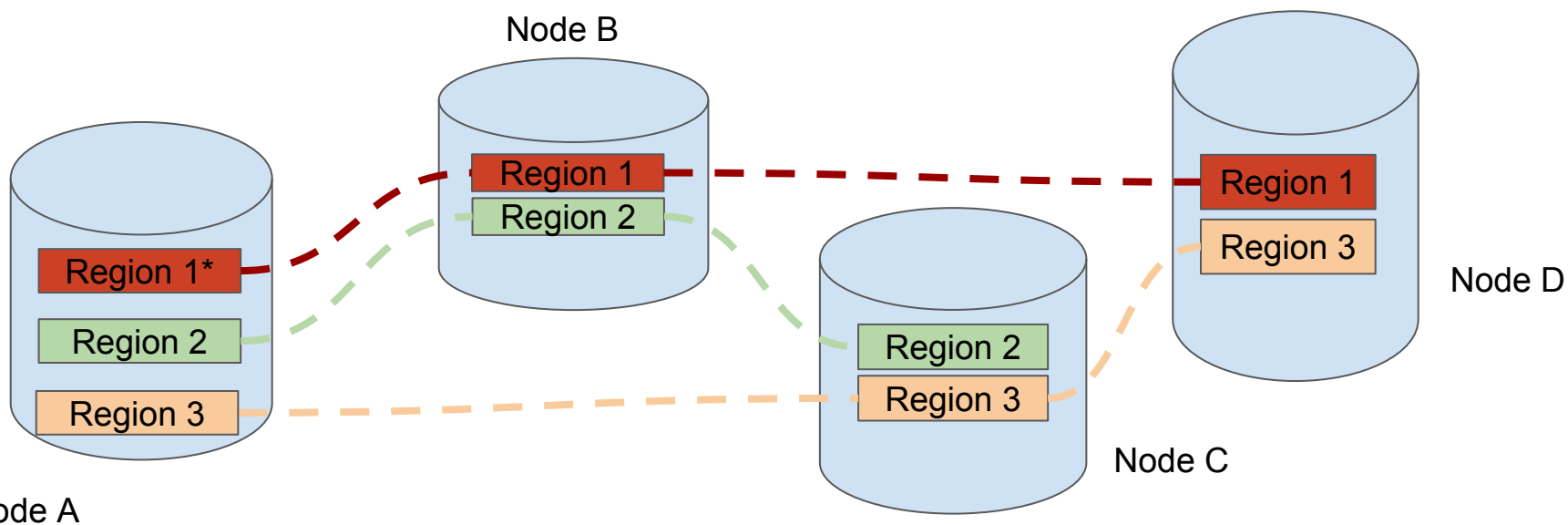
# TiKV Architecture



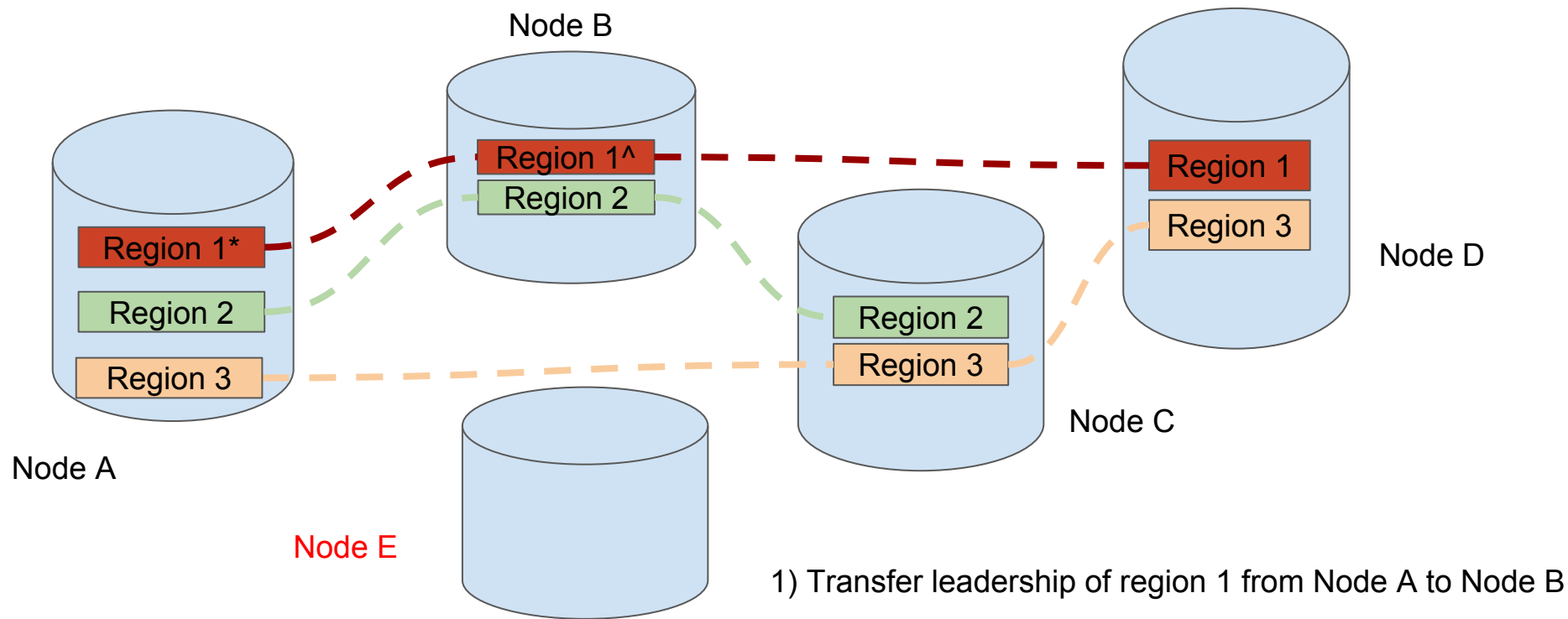
# Multi-Raft



# Scale-out (initial state)

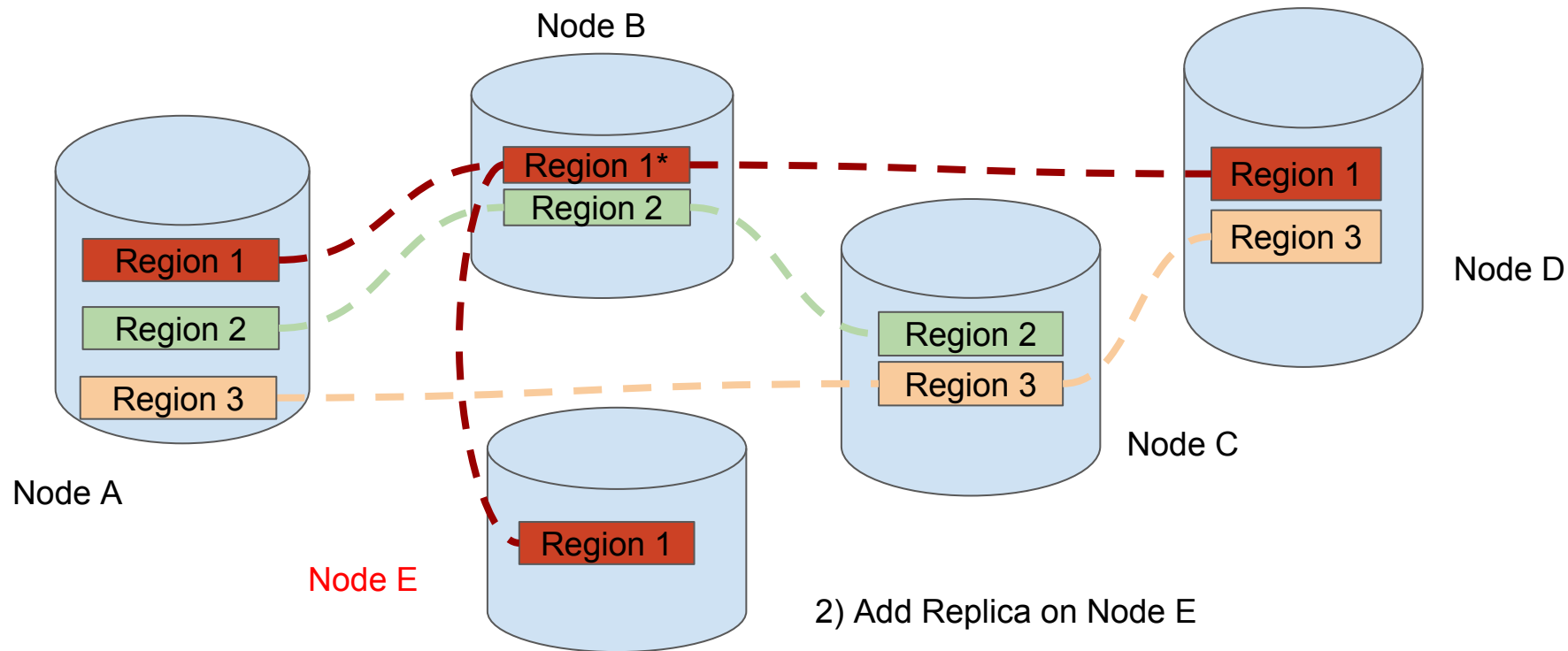


# Scale-out (add new node)

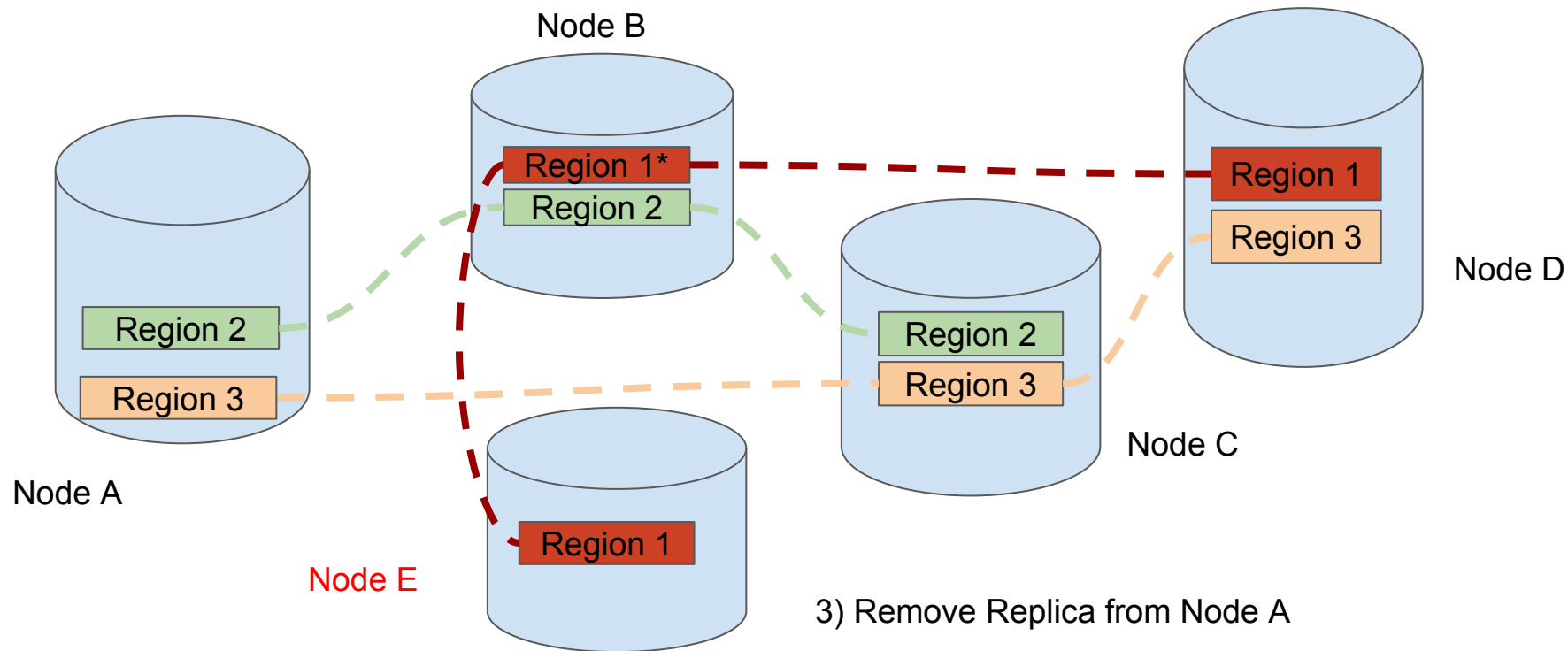




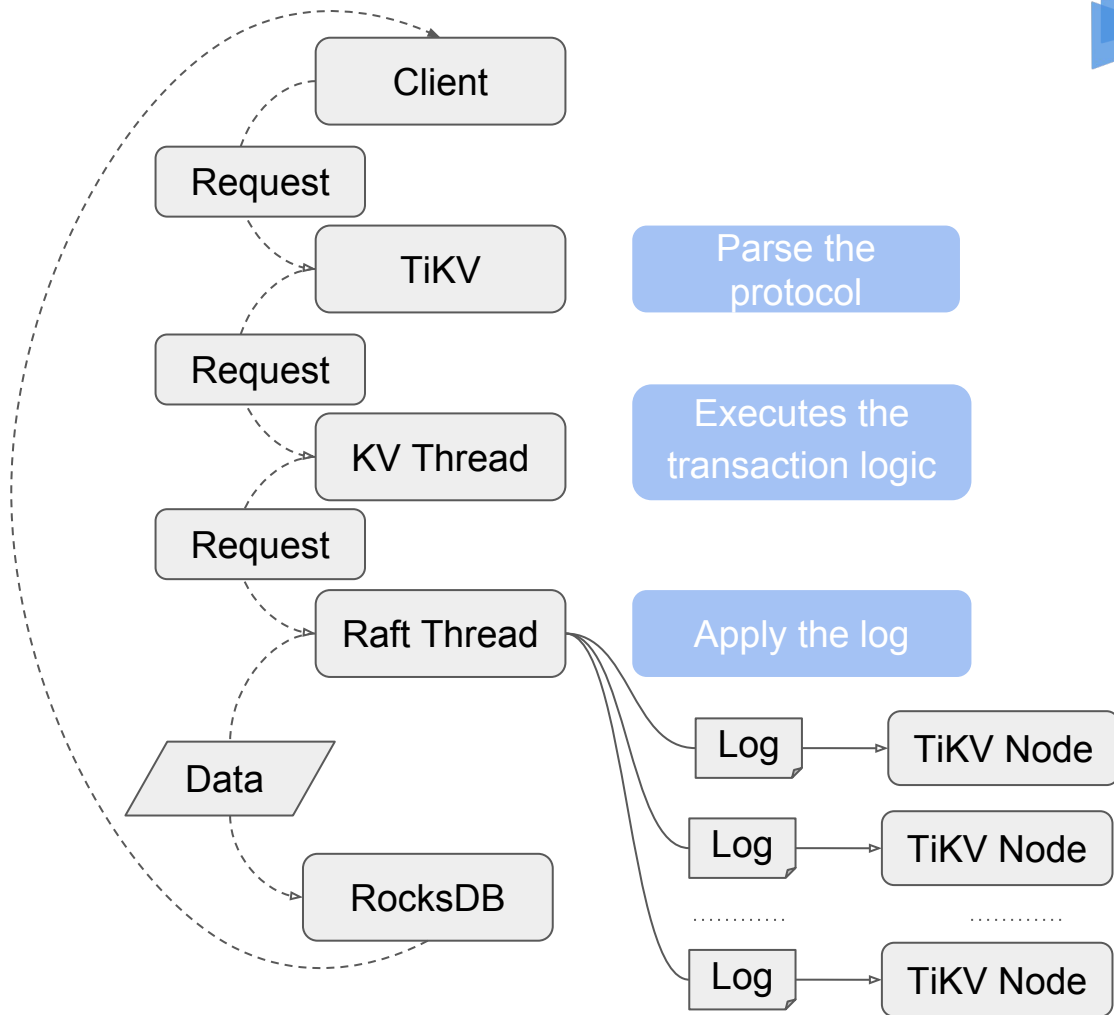
# Scale-out (balancing)



# Scale-out (balancing)



# A simple write flow



# Key technology

- Networking
  - Protocol Buffers (protobuf)
  - mio
  - gRPC
- Asynchronous framework
  - mio + callback
  - tokio-core + futures
  - thread pool + futures-cppool

# Key technology

- Storage
  - rust-rocksdb
- Monitoring tool
  - rust-prometheus
- Profile tool
  - jemallocator with prof feature
- Lint tool
  - clippy

# TODO...

- Make TiKV more fast, like removing Box
- Make TiKV more stable, like introducing Rust sanitizer.
- Contribute more Rust open source modules, like raft library, open-tracing, etc.
- Participate in other Rust projects more deeply, like rust-gRPC
- Write more articles about Rust on Chinese social media and organize more Rust meetups
- Be a strong advocate of Rust in China

Thank you!