# Ovid
## A Software-Defined Distributed Systems Framework

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# Ovid

Build distributed systems that are

- easy to evolve
- easy to reason about
- easy to compose

# Approach

Create a theoretical model using abstractions

Deploy the distributed system using this model

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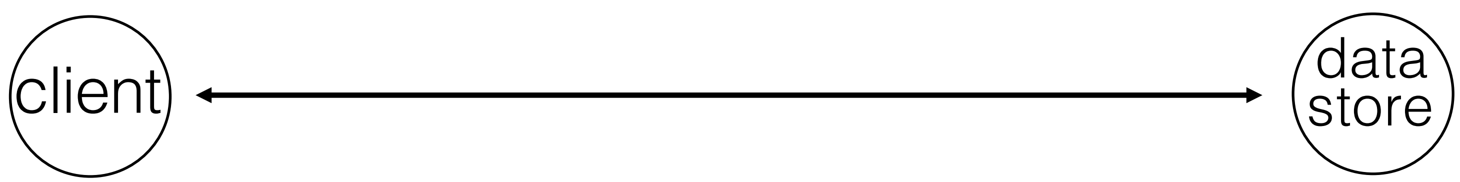
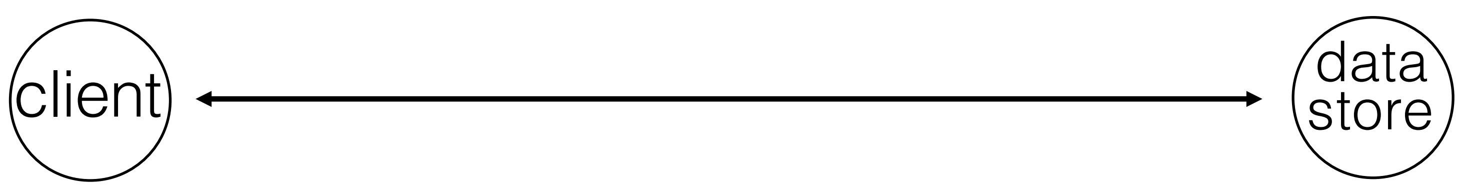
Deploy the distributed system using this model

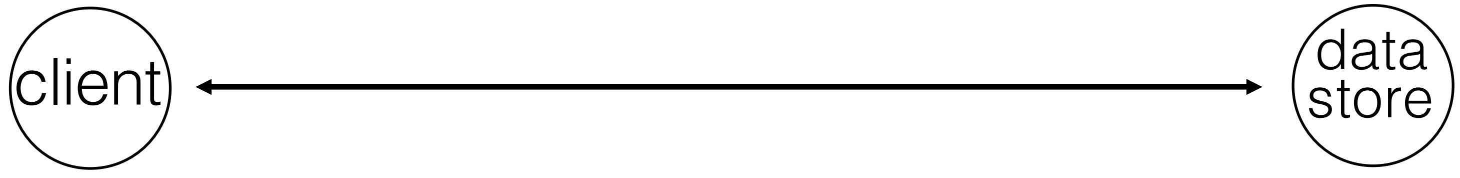

client
data
store


client
agent
data
store
agent

# not fault tolerant

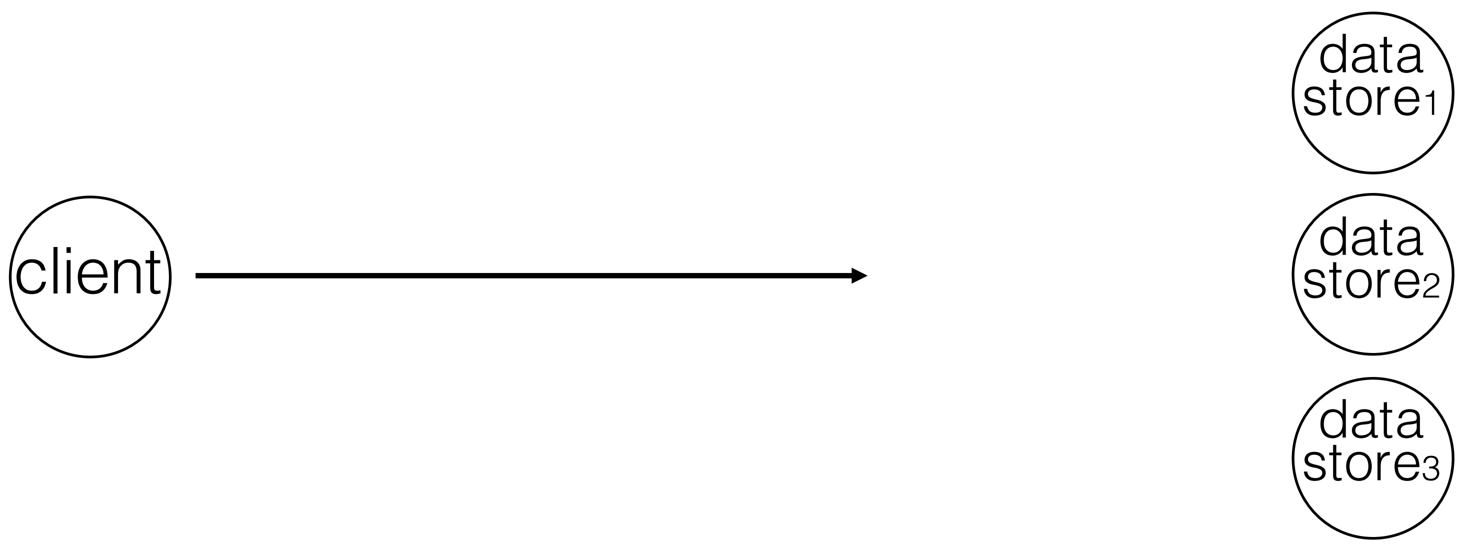


# transform data store agent to be fault tolerant




replicate(datastore,3) =

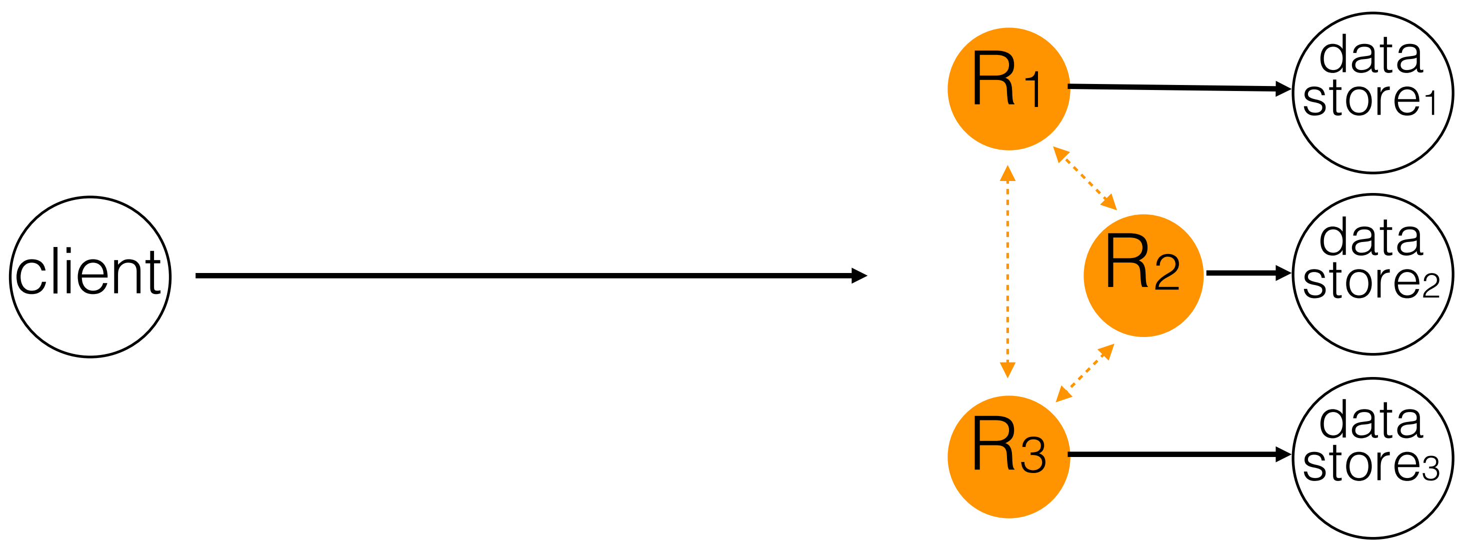
# transform data store agent to be fault tolerant




replicate(datastore,3) = datastore*3

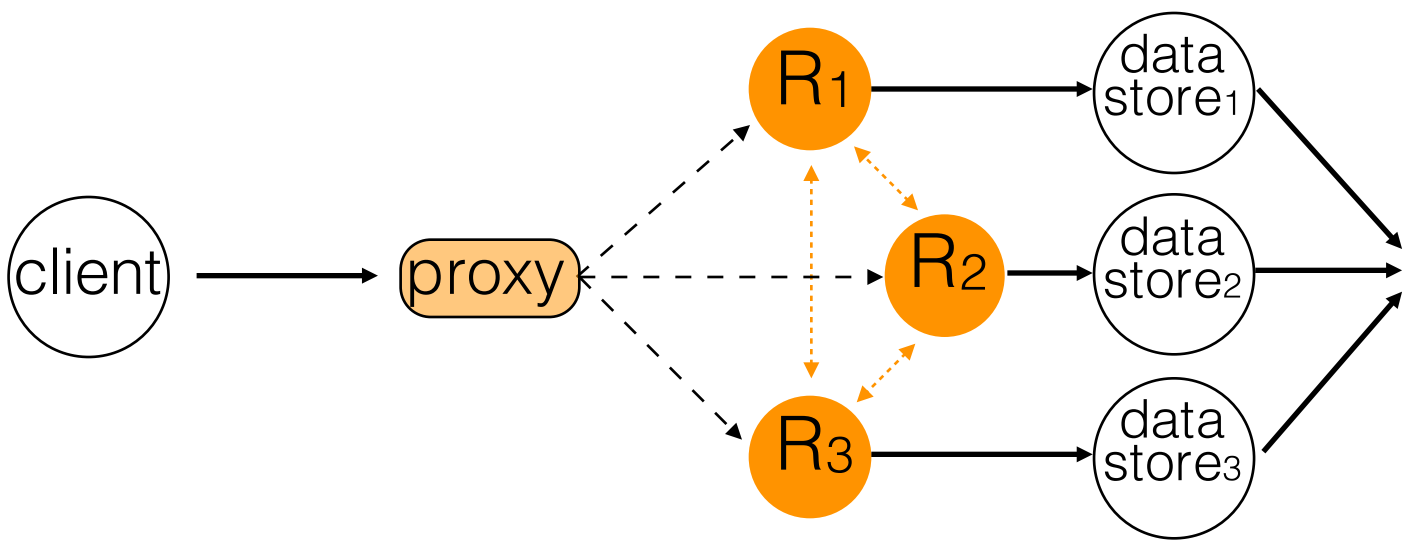
minority of replicas can fail
crash fault tolerant
asynchronous environment
linearizable

} Paxos consensus protocol



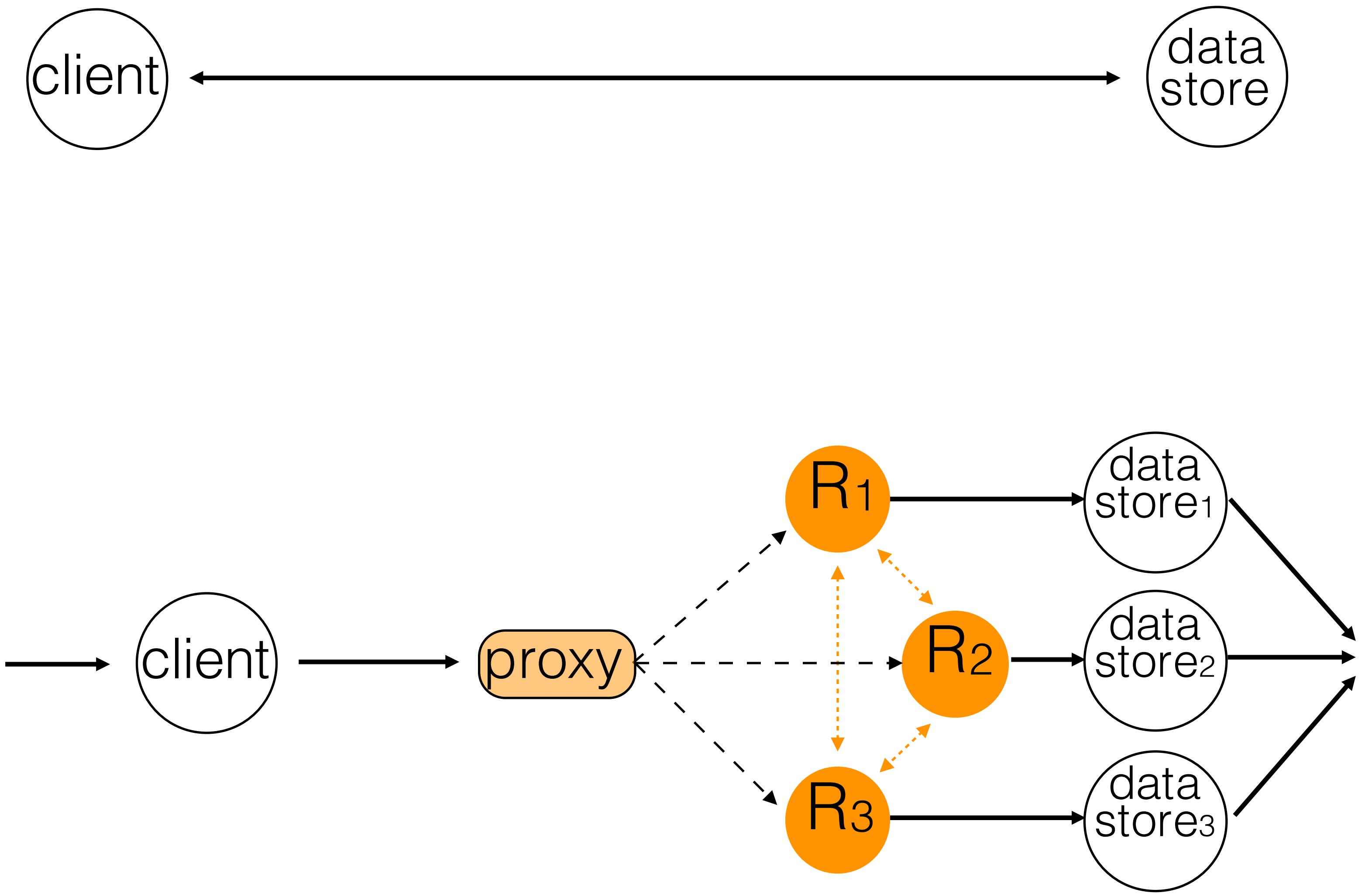

replicate(datastore,3) = R*3 + datastore*3

minority of replicas can fail
crash fault tolerant
asynchronous environment
linearizable




replicate(datastore,3) = proxy + R*3 + datastore*3

# How do we know that a transformation did not break an agent?



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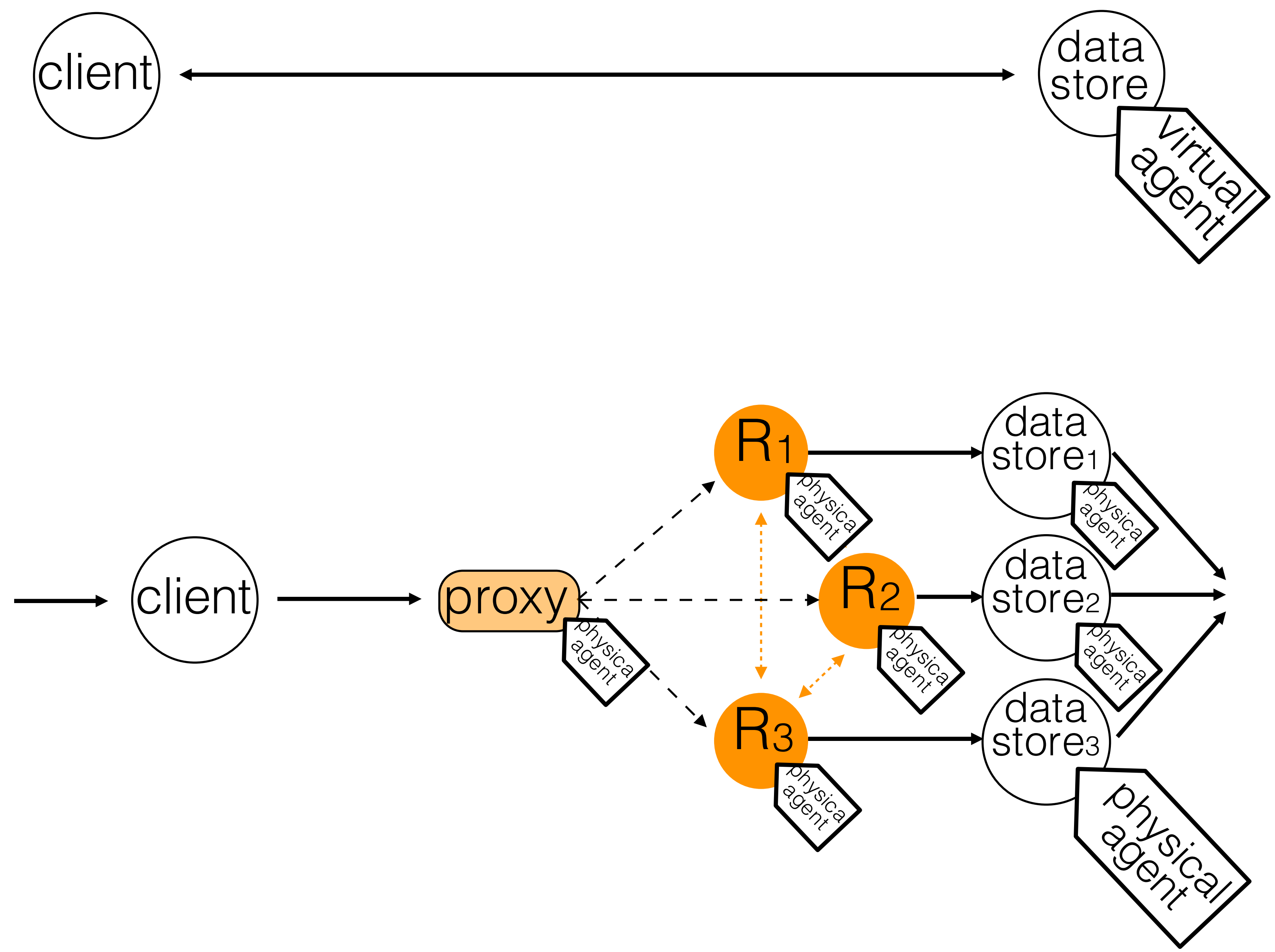
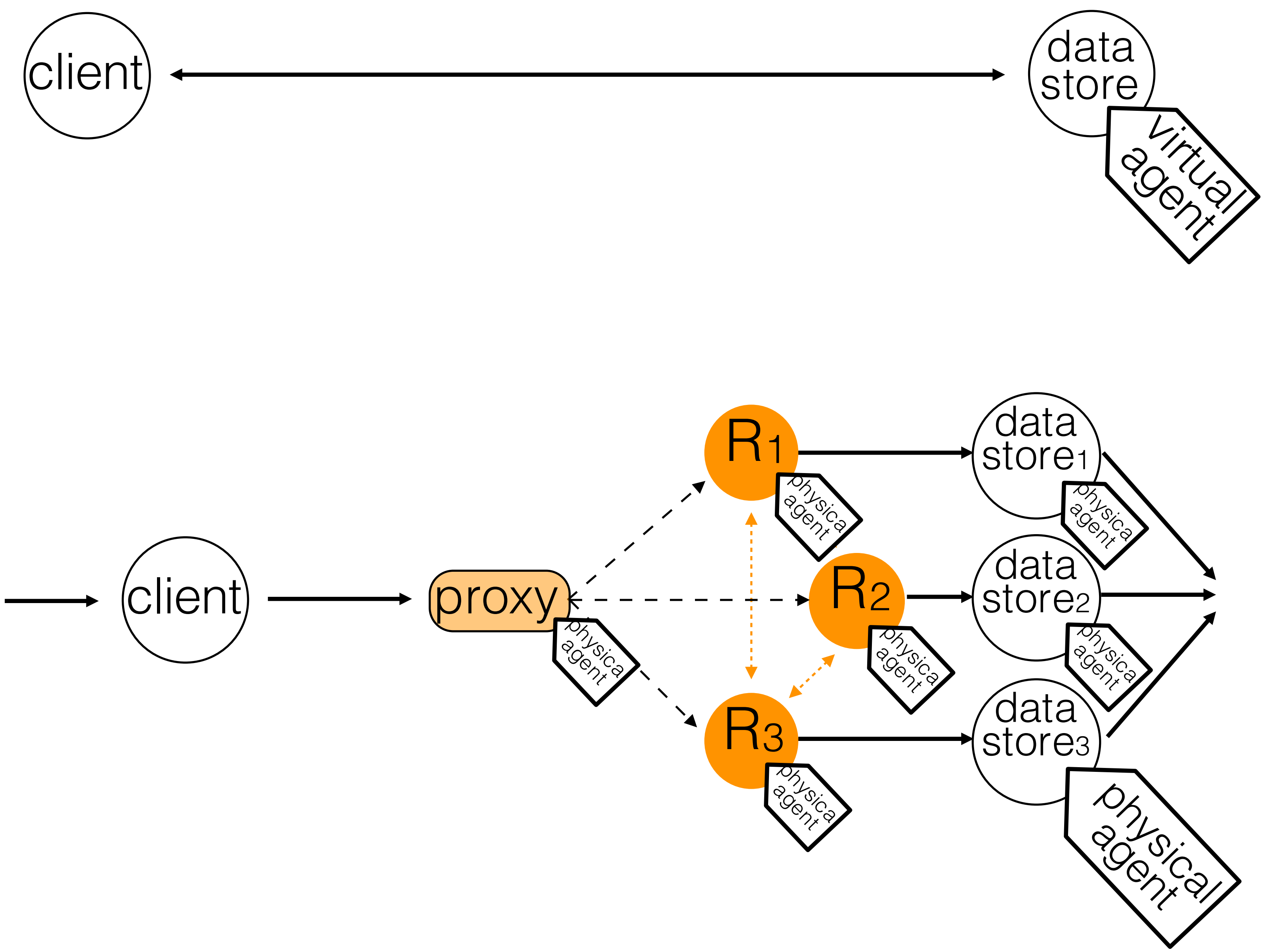
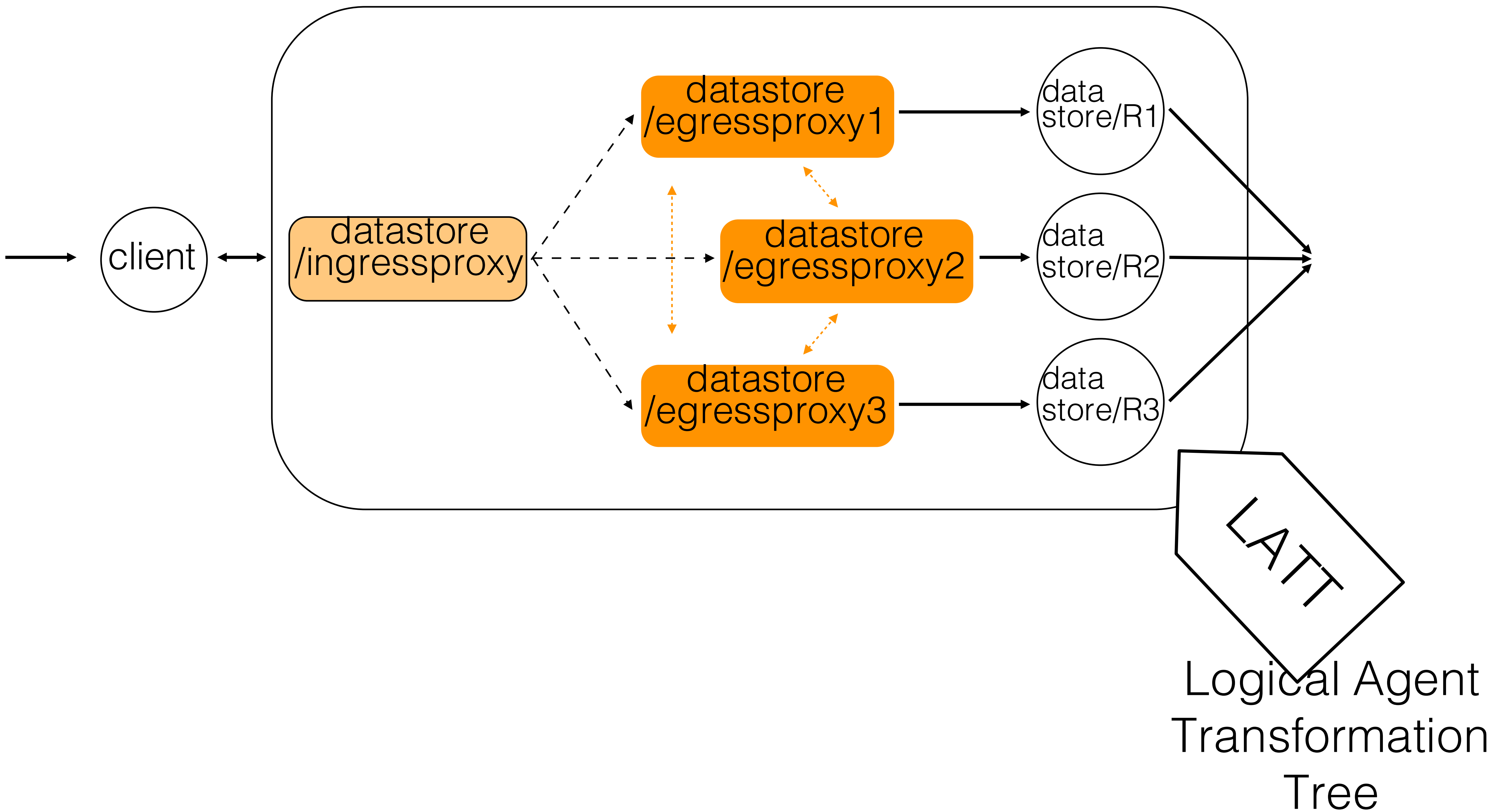


# Use refinement mappings to prove equivalence




client
data
store

# Use path names to represent transformations



# Supported transformations

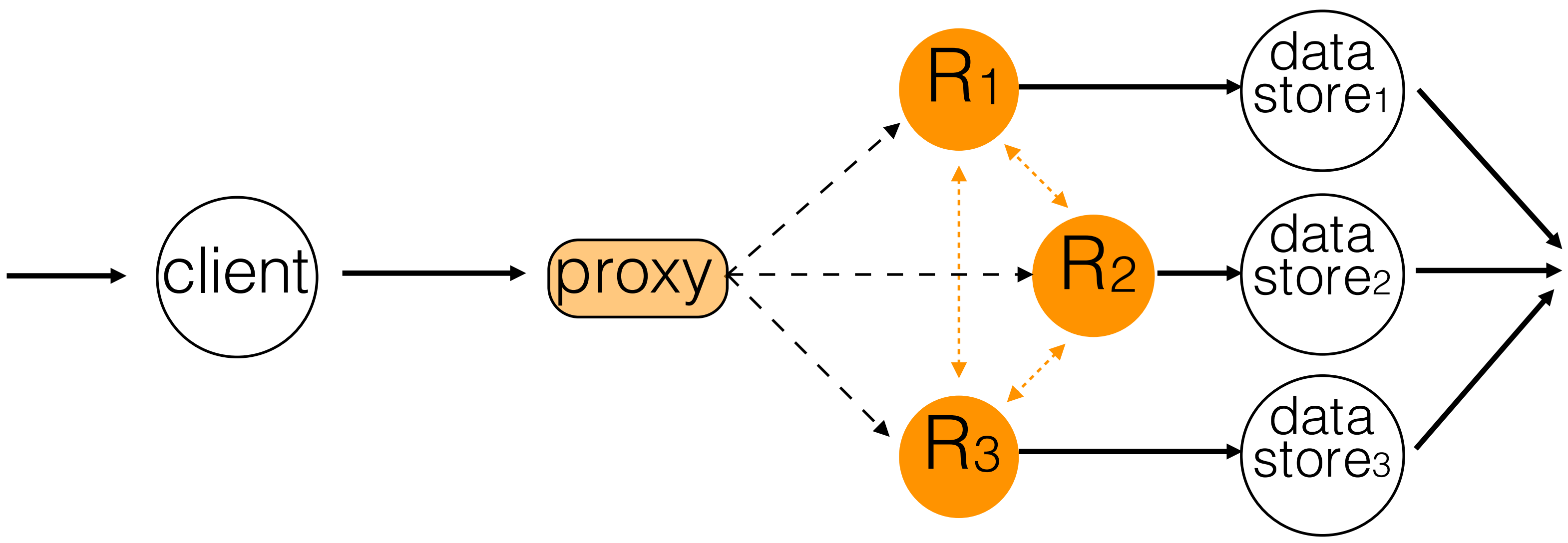
- replication
- byzantine resistance
- batching
- sharding
- encryption/decryption
- compression
- load-balancing
- deduplication

# Approach

Create a theoretical model using abstractions

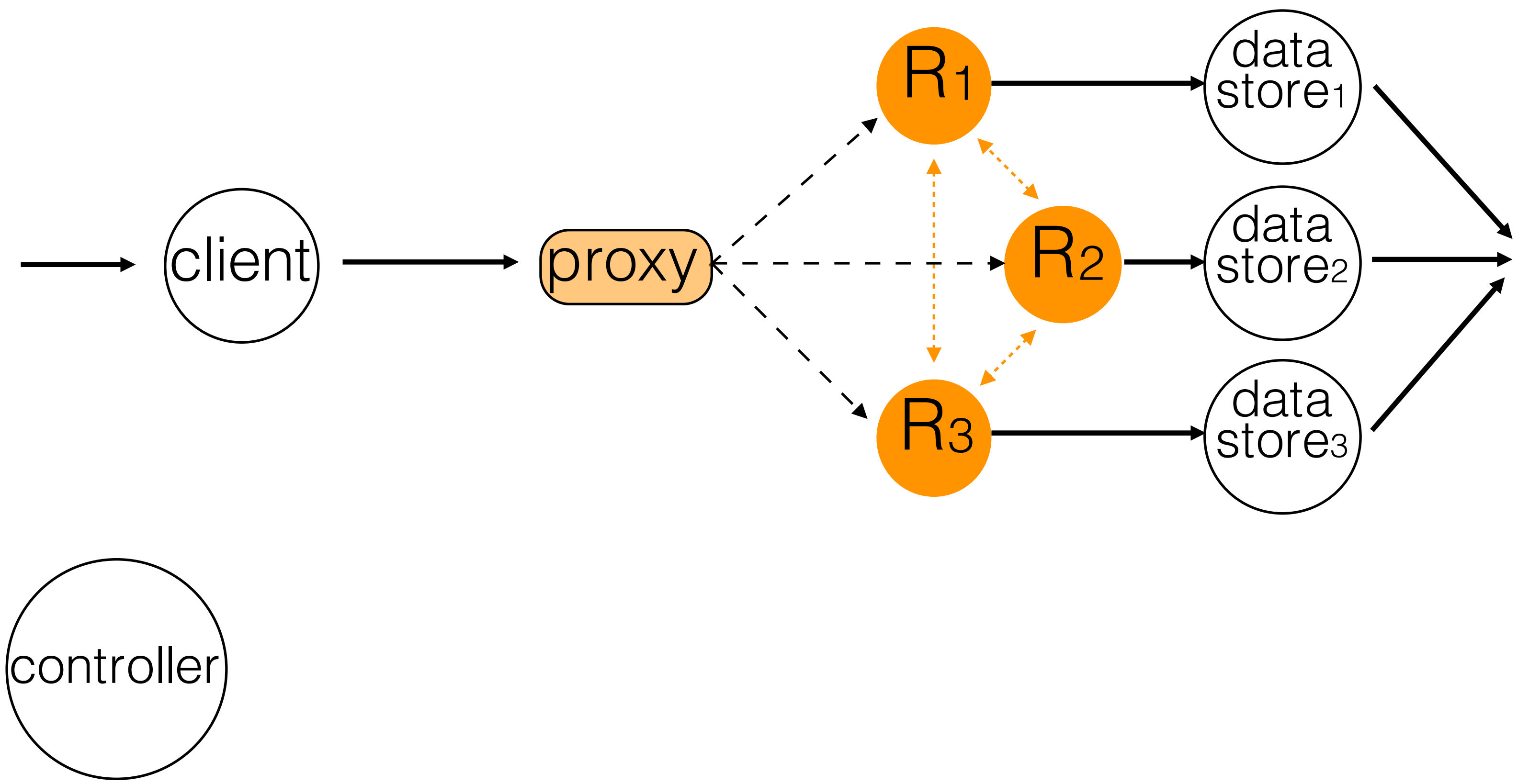
Deploy the distributed system using this model

# Deployment




- Create a configuration from the model
- Deploy processes on boxes depending on the configuration

# Deployment

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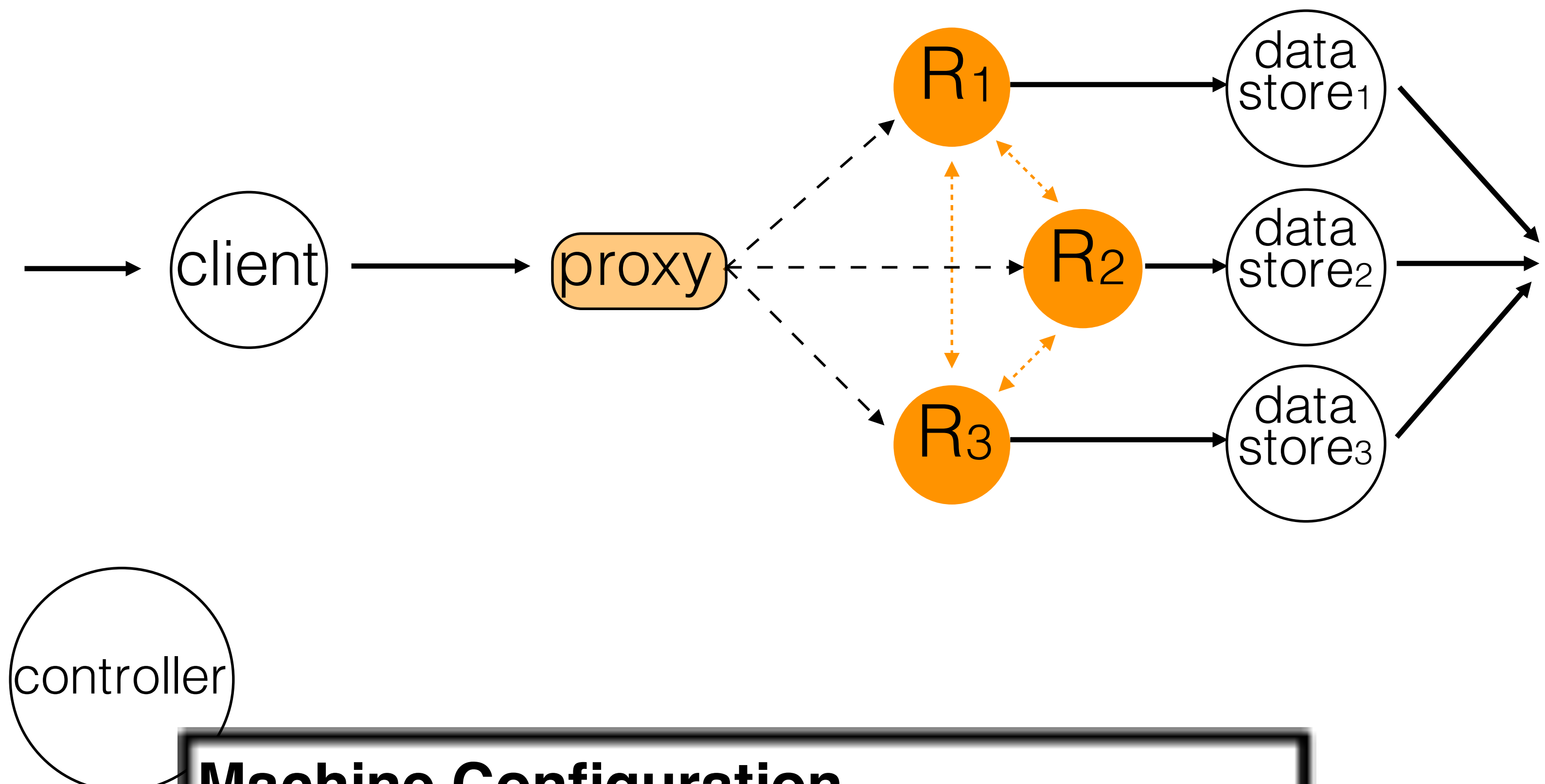
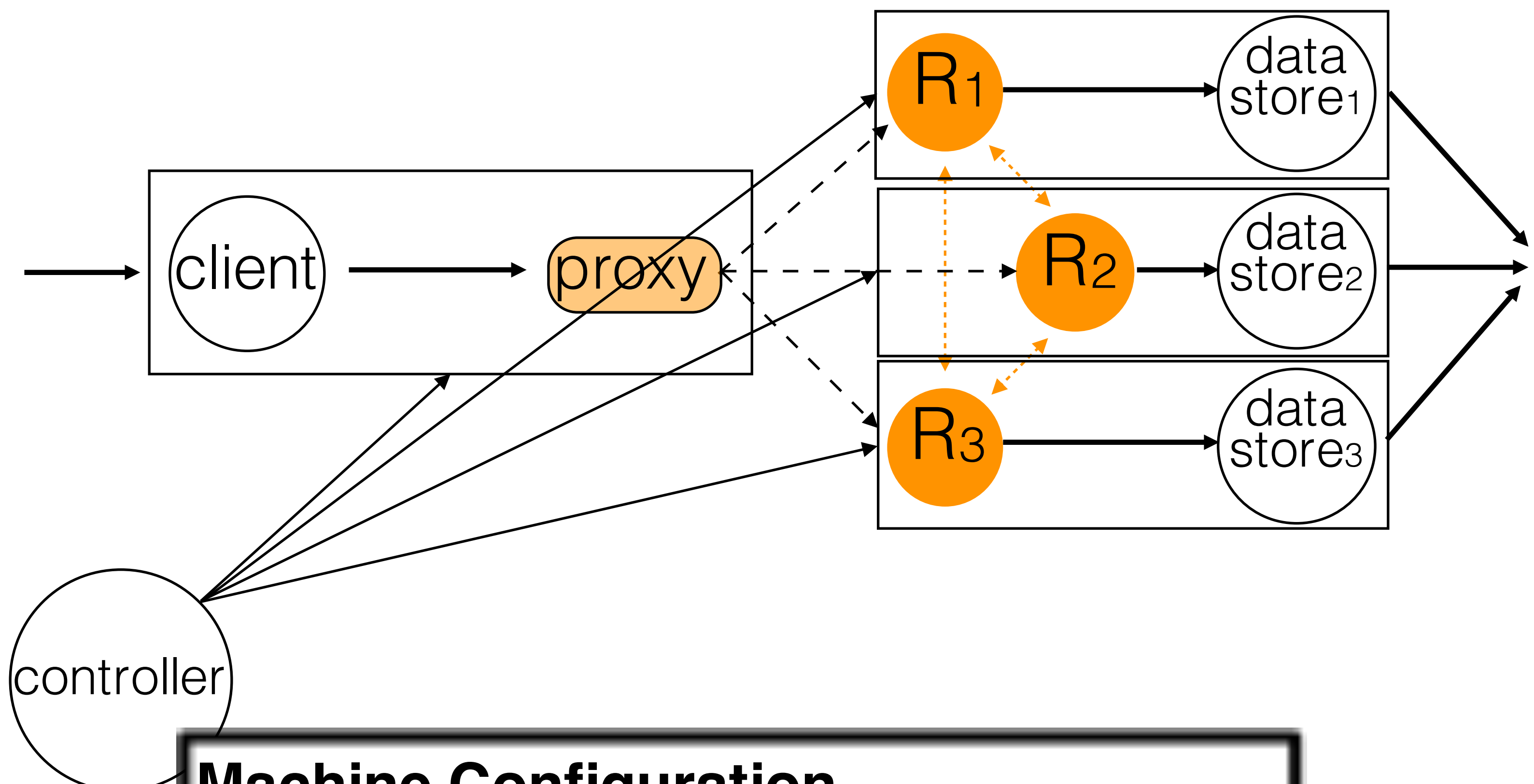



**Machine Configuration**

**client** 192.168.7.56 client.cpp
**proxy** 192.168.7.56 proxy.cpp
**R1** 192.168.7.80 replica.cpp
**R2** 192.168.7.81 replica.cpp
**R3** 192.168.7.82 replica.cpp
**data store1** 192.168.7.80 datastore.cpp
**data store2** 192.168.7.81 datastore.cpp
**data store3** 192.168.7.82 datastore.cpp

# Deployment

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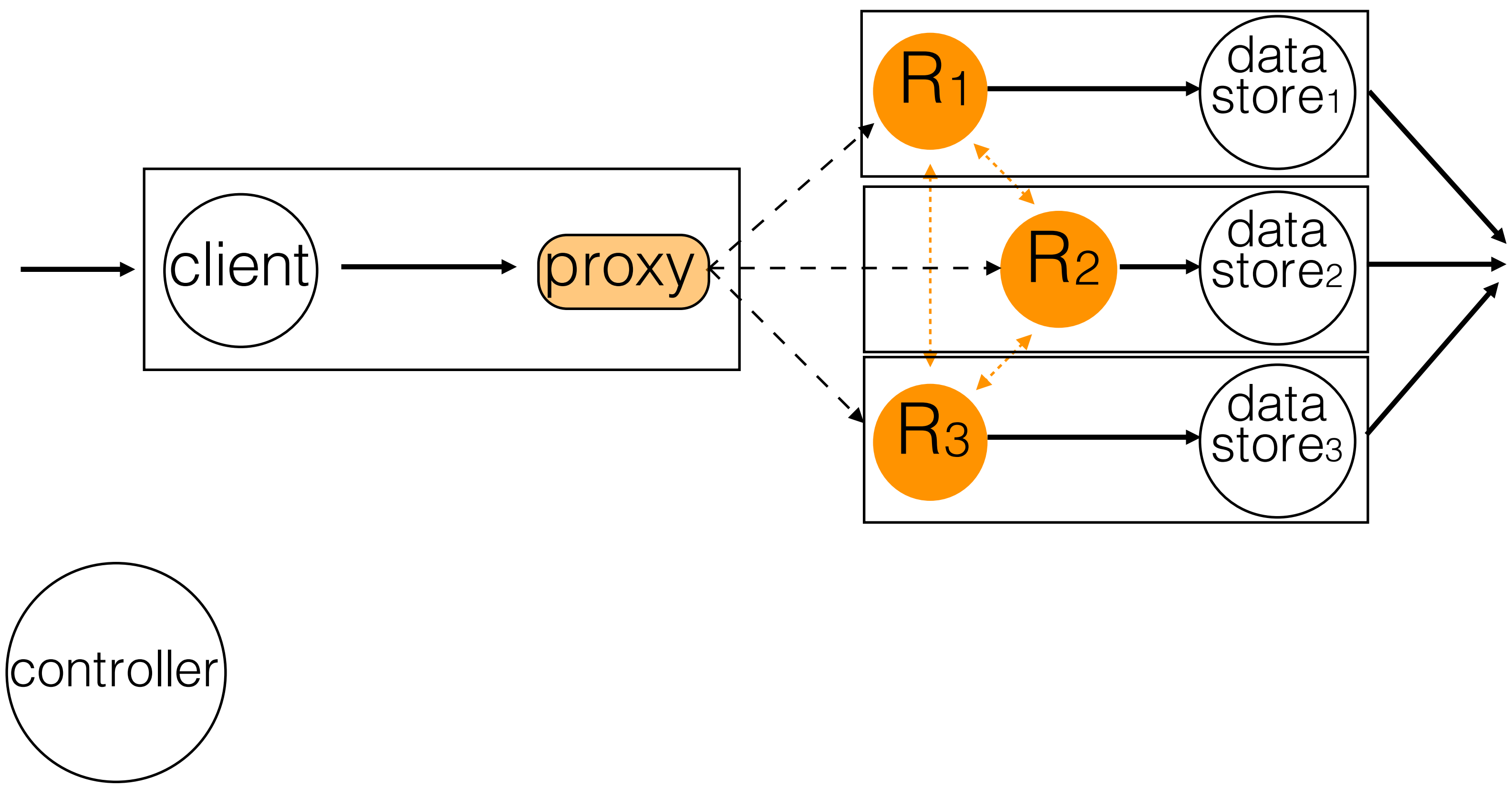
# Dynamic Routing




- Create routing tables
- Route messages to destination depending on the model

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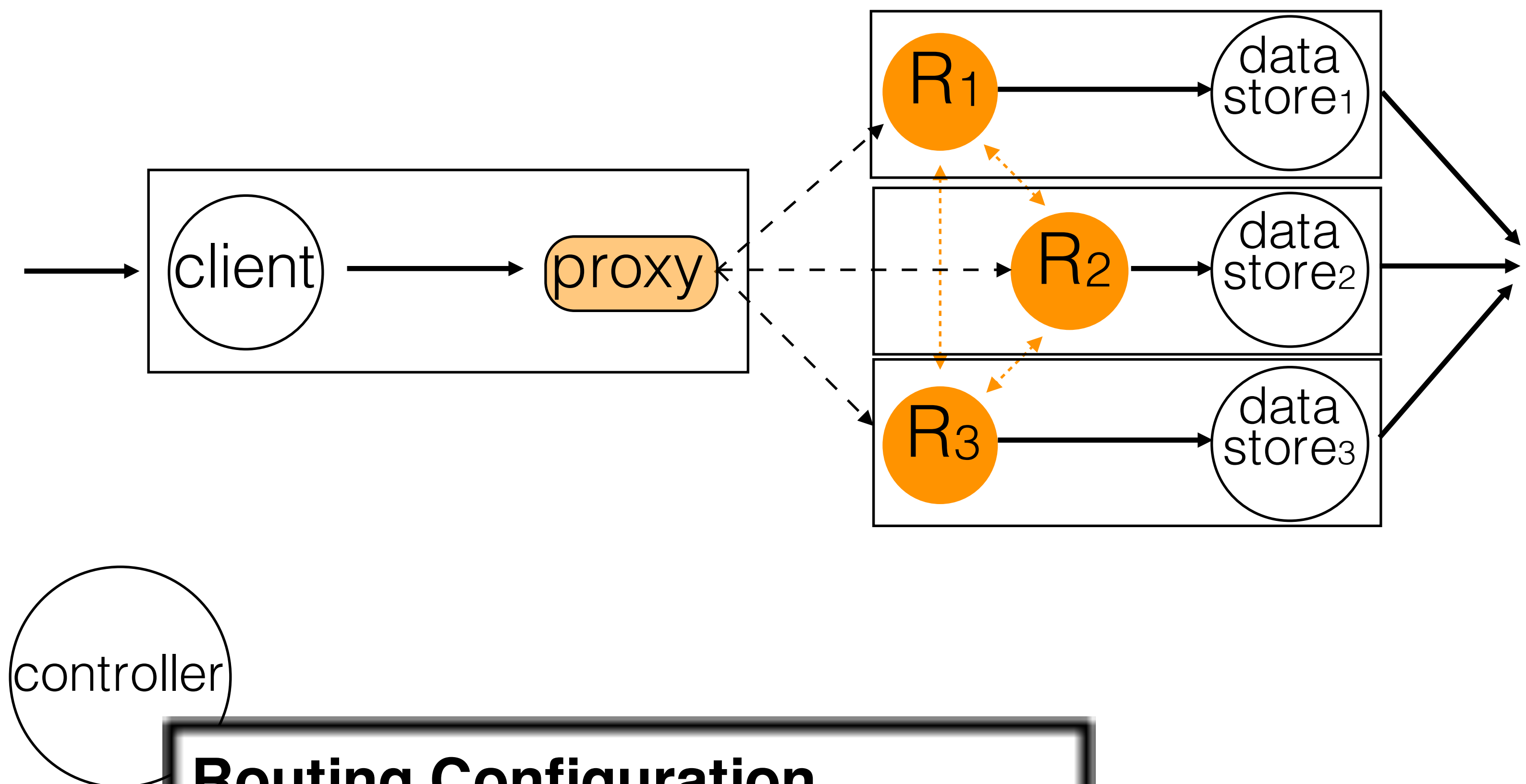
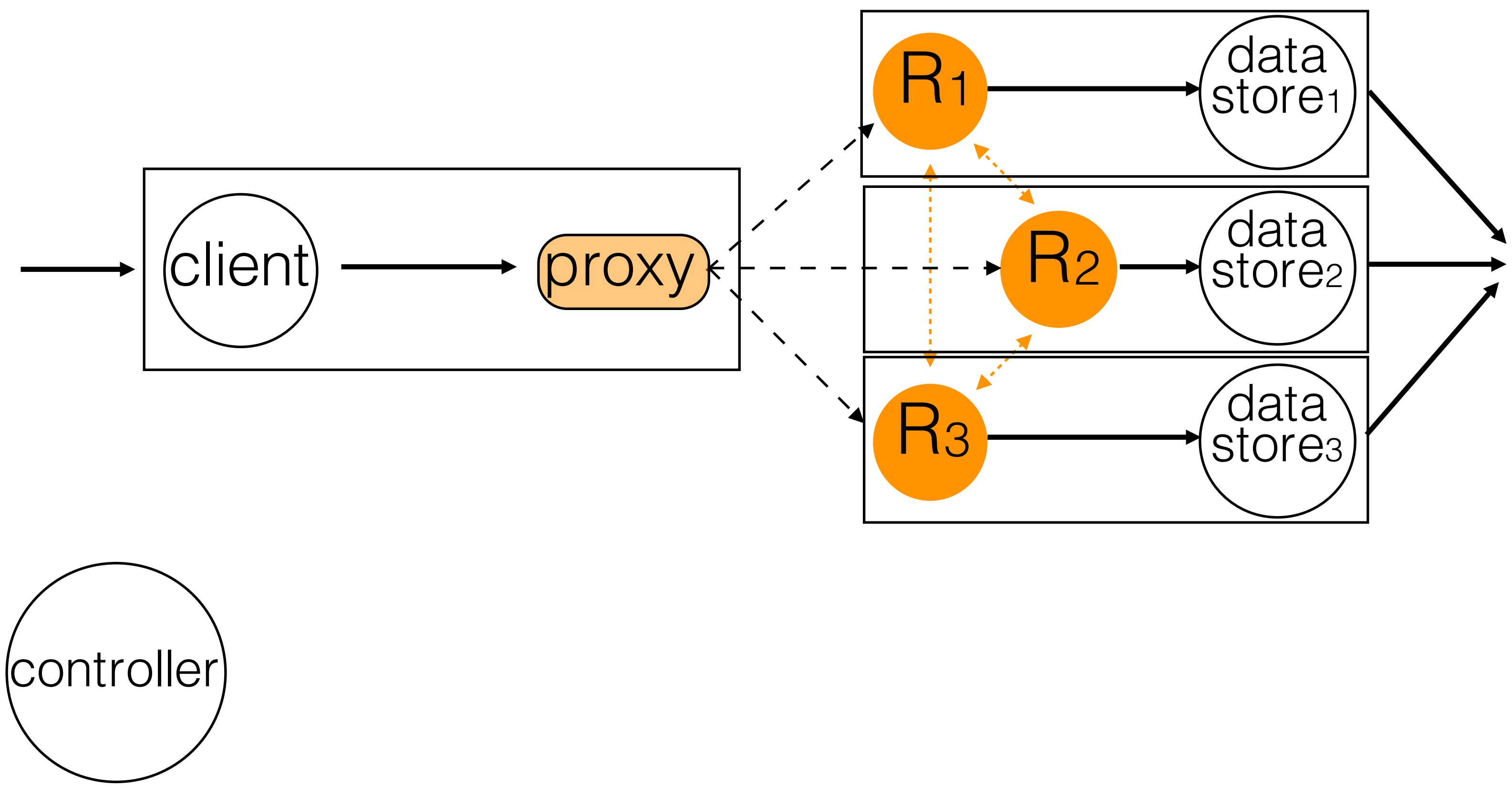



**Routing Configuration**

**client** datastore proxy
**proxy** datastore R1,R2,R3
**R1** datastore datastore1
**R2** datastore datastore2
**R3** datastore datastore3
**datastore1** client client
**datastore2** client client
**datastore3** client client

# Dynamic Routing

msg: dest | payload



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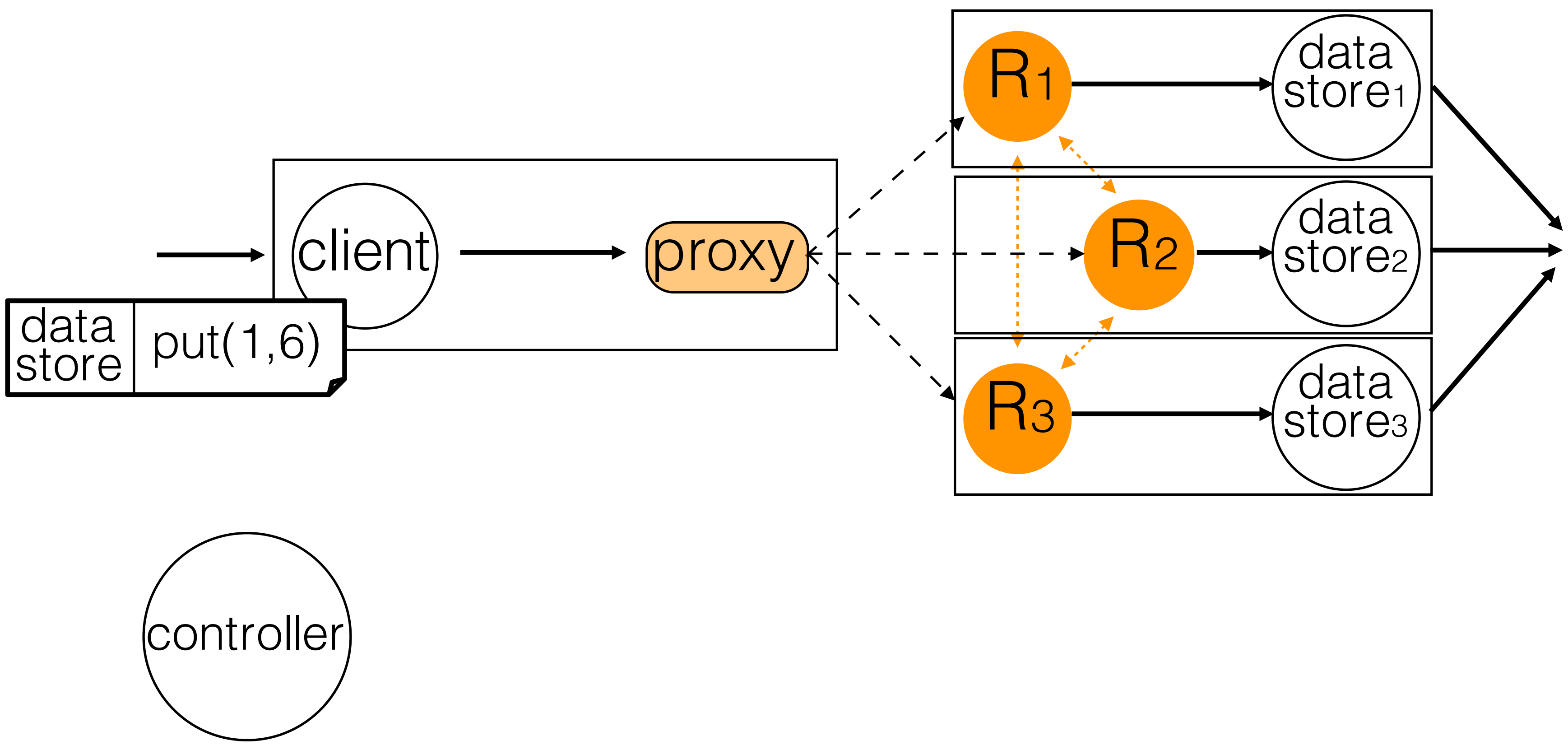

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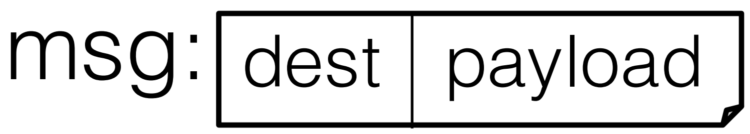


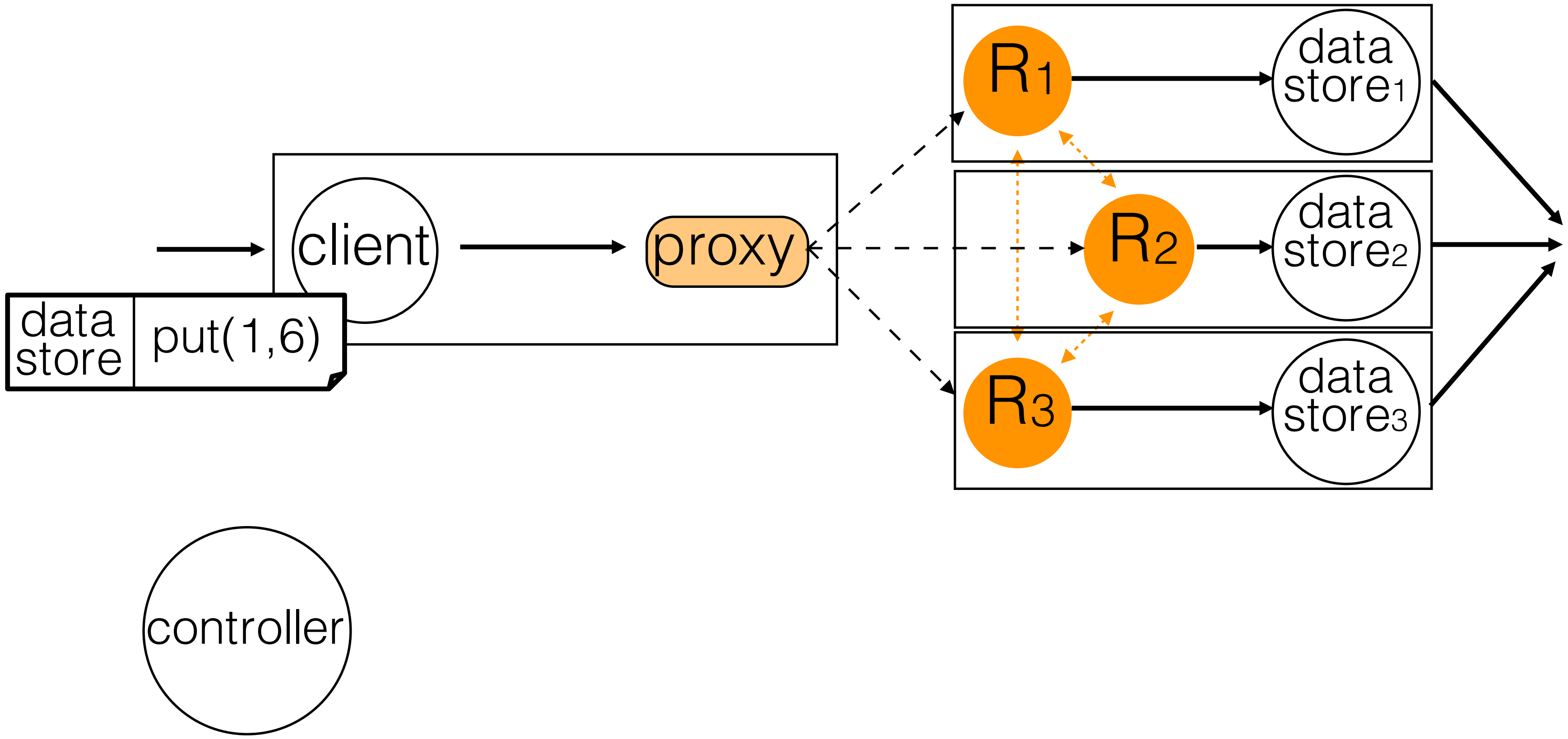


- send msg(dest,payload)

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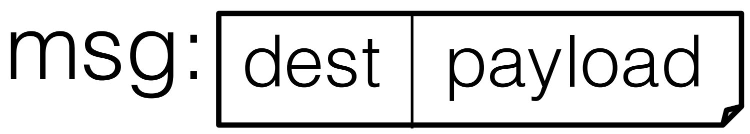
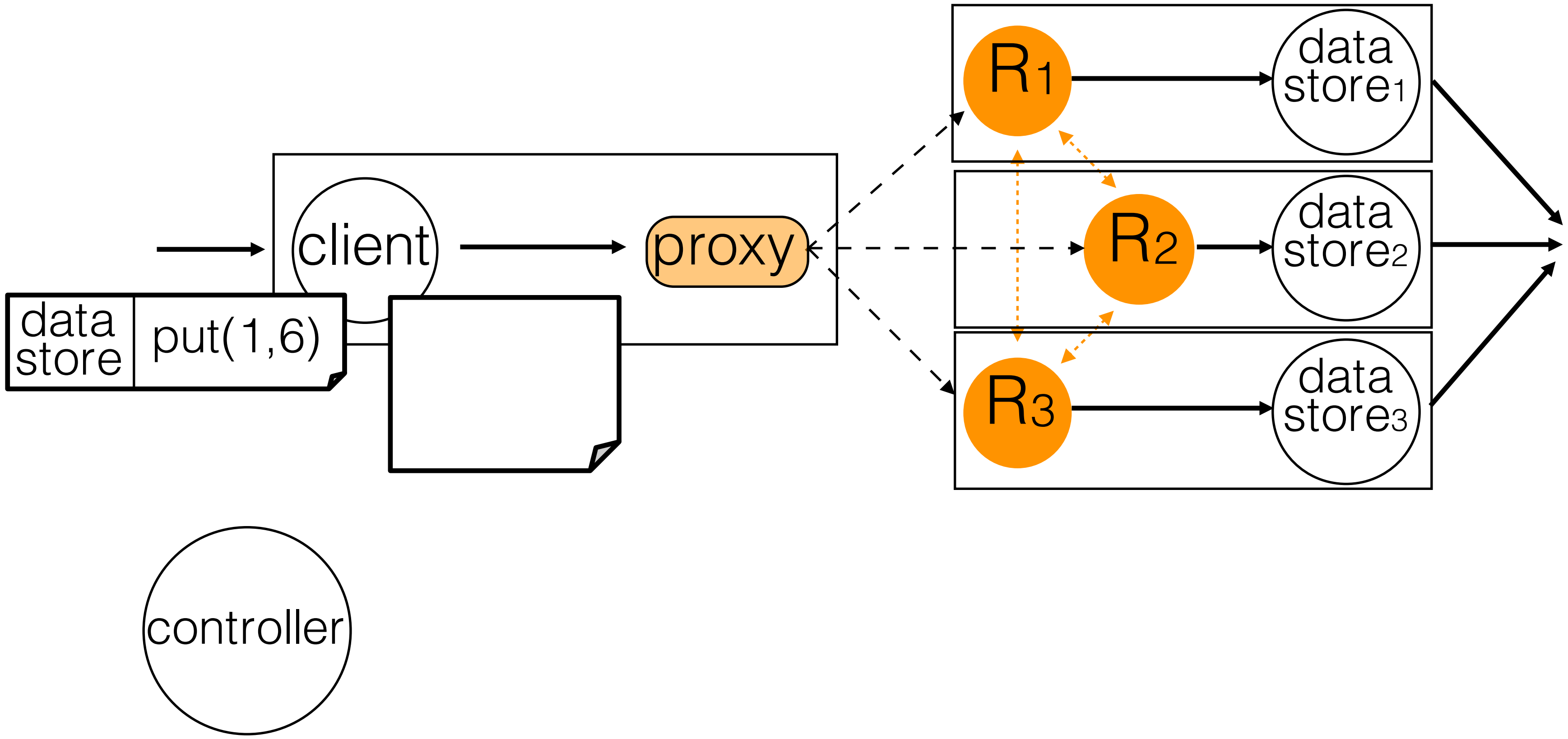
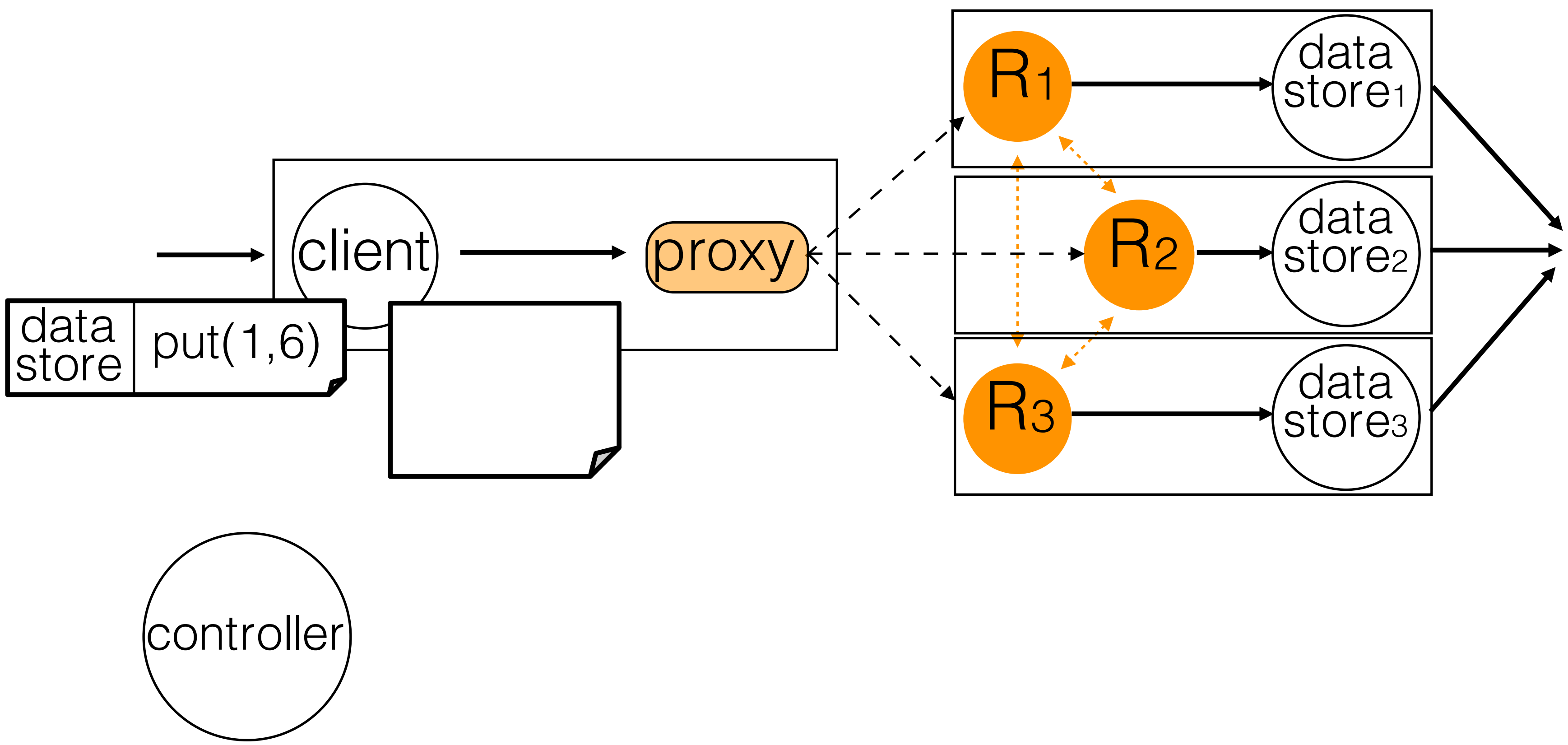



- send msg(dest,payload)
- look for dest in routing table

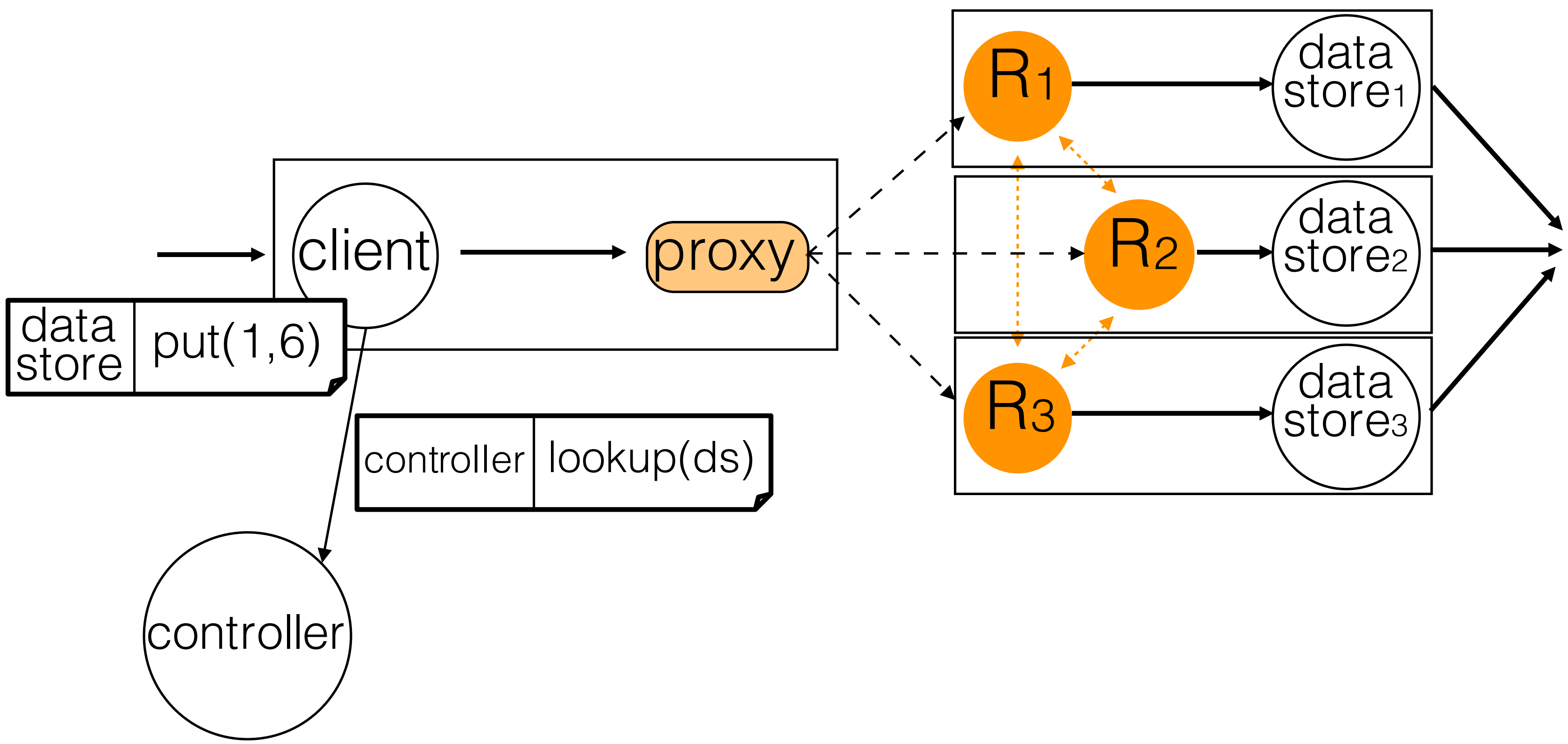
# Dynamic Routing

msg: | dest | payload |




- send msg(dest,payload)
- look for dest in routing table
- dest not present

# Dynamic Routing


- send msg(dest,payload)
- look for dest in routing table
- dest not present
- send lookup message to controller

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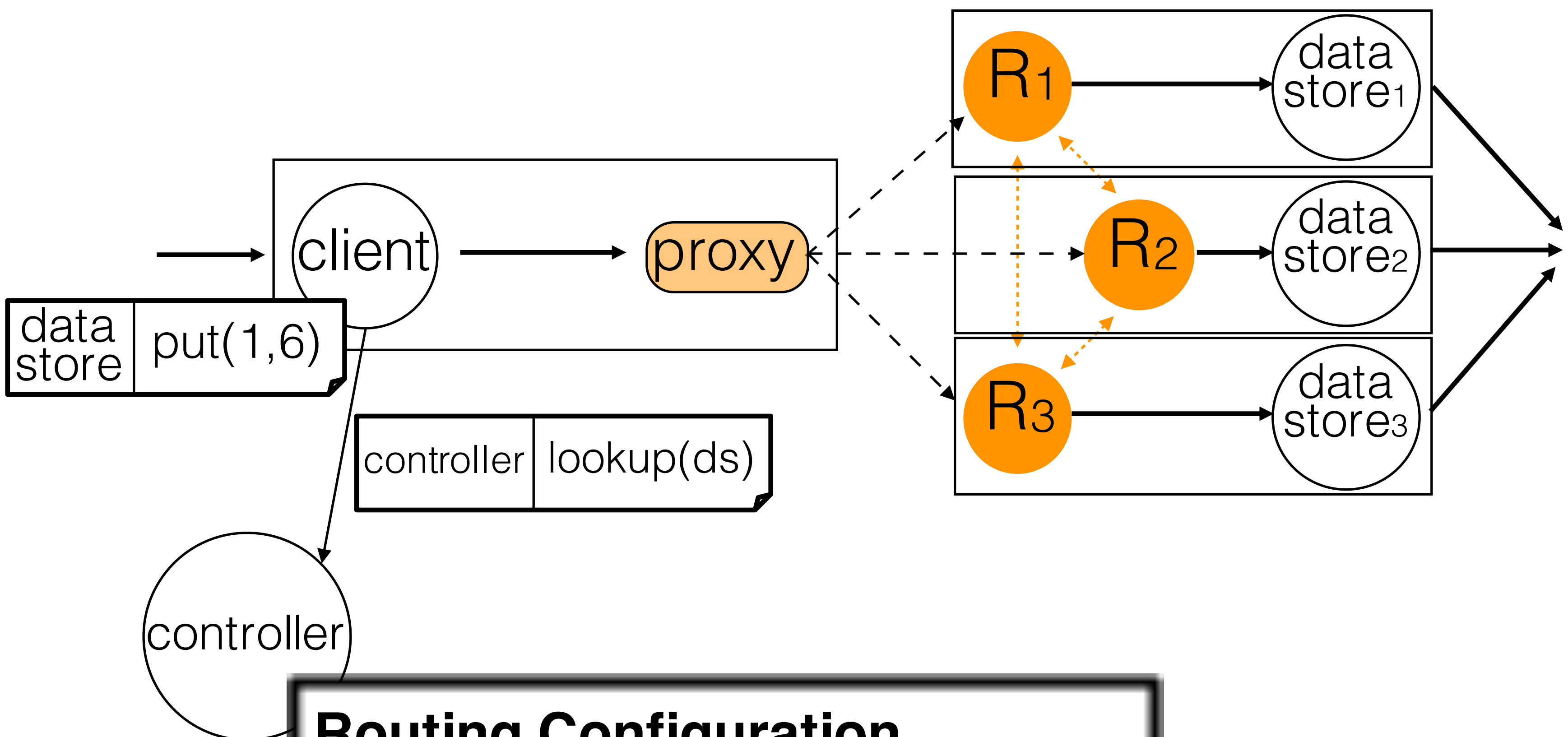


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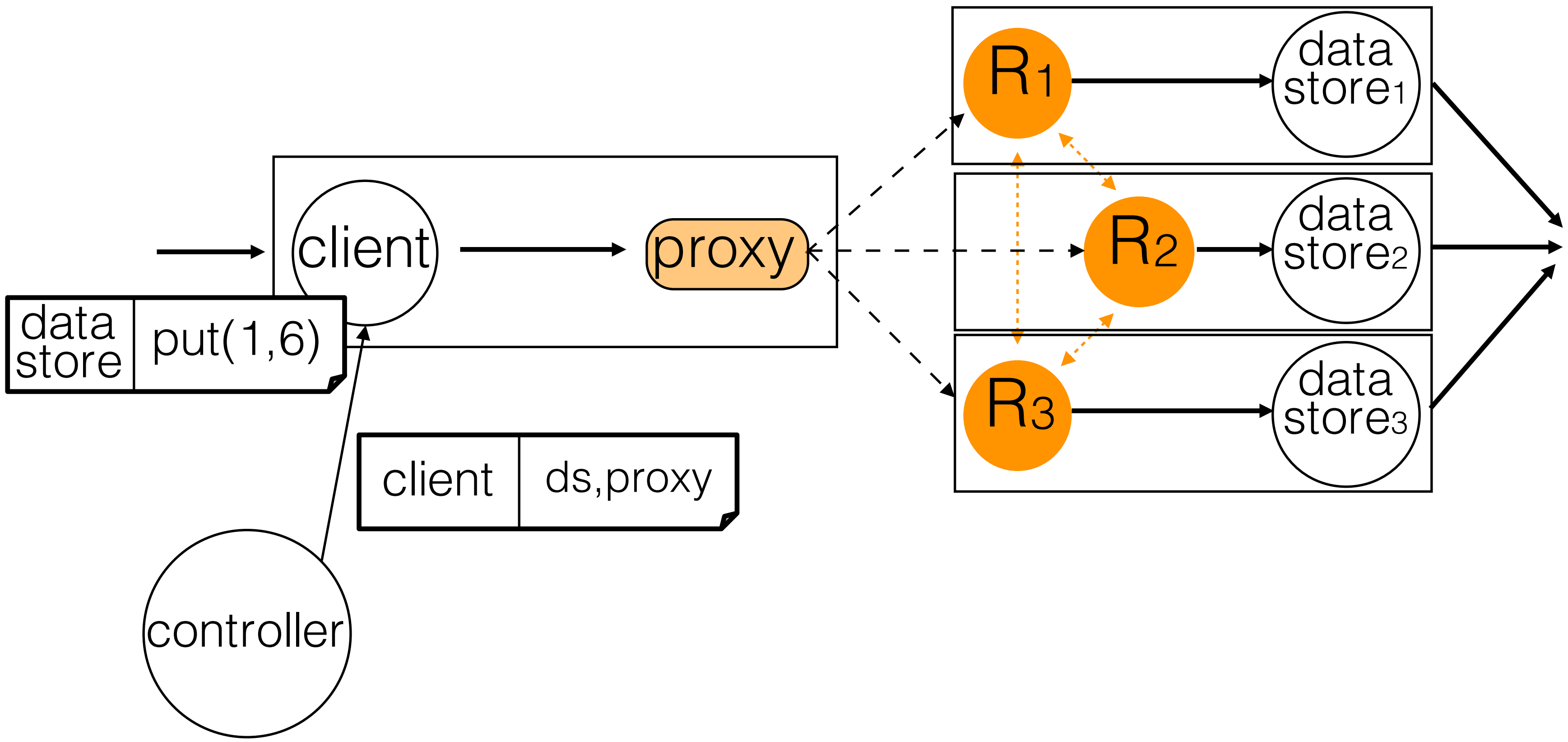


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- get route mapping

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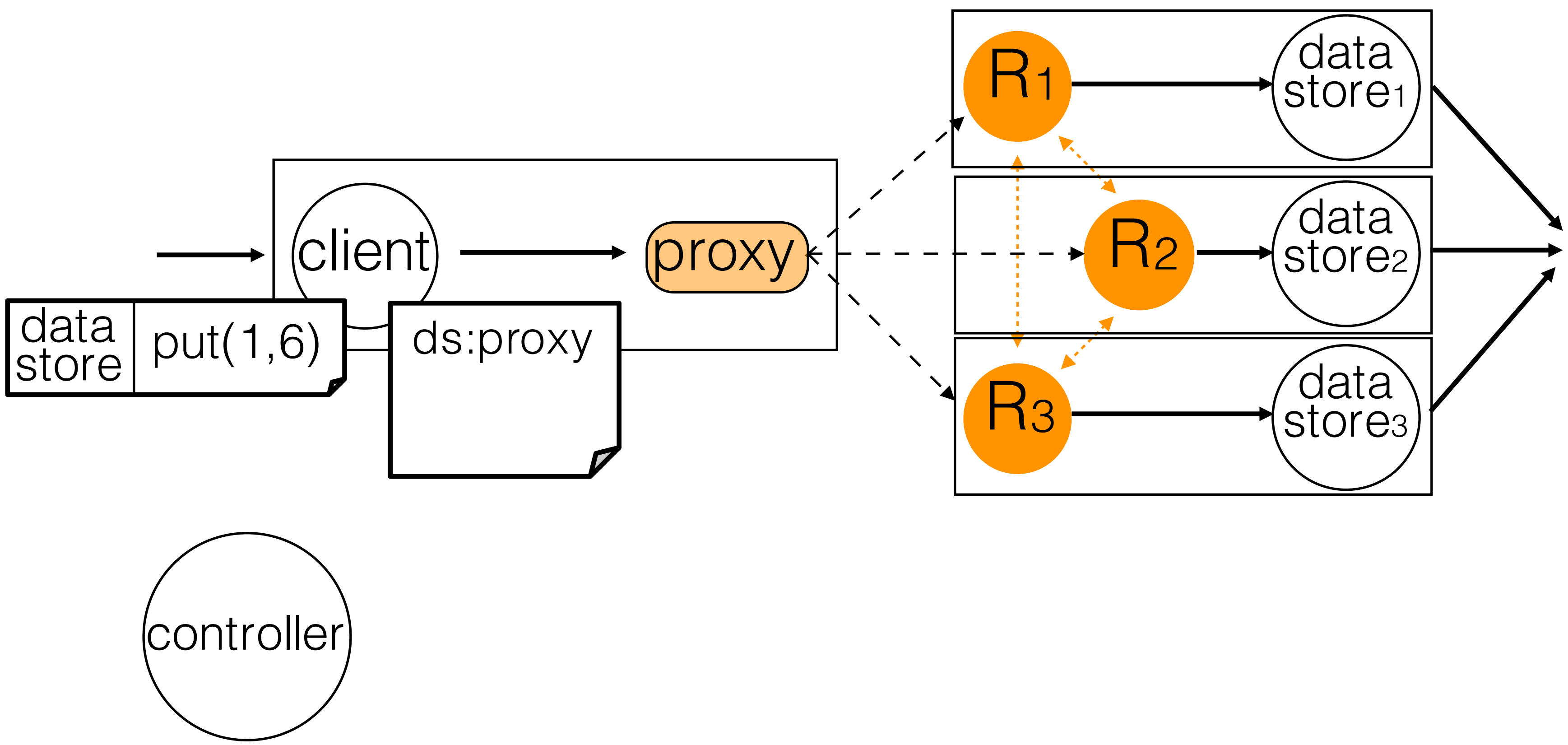


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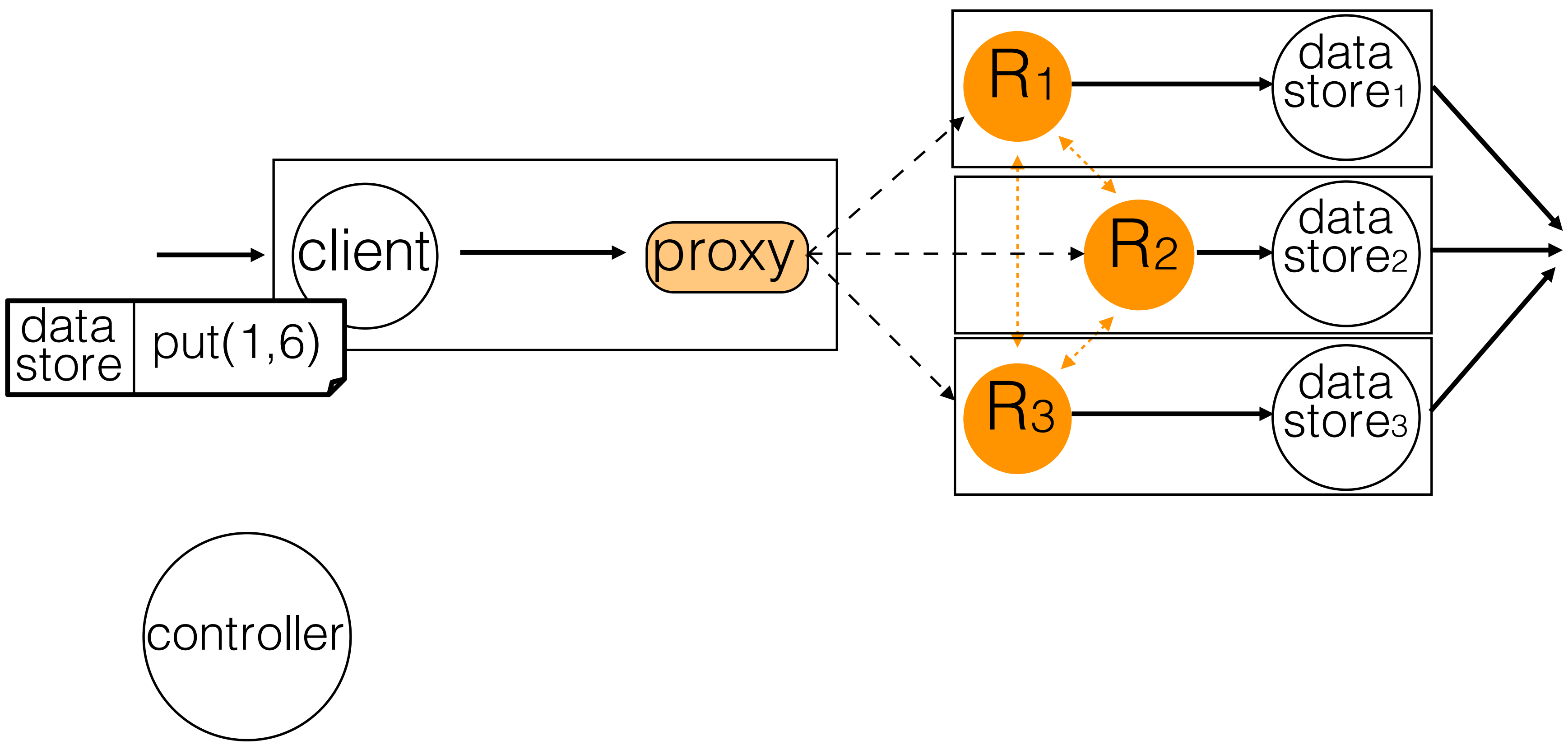


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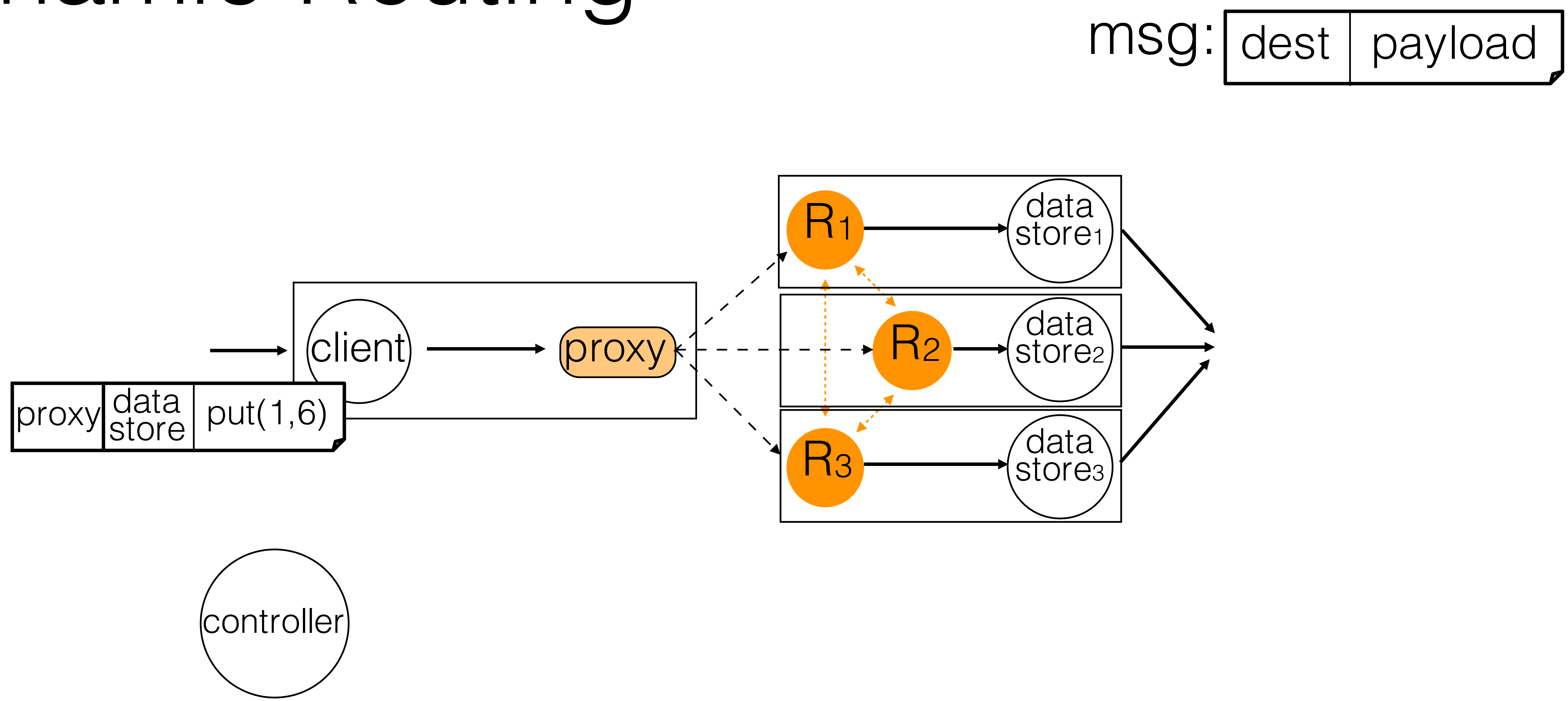


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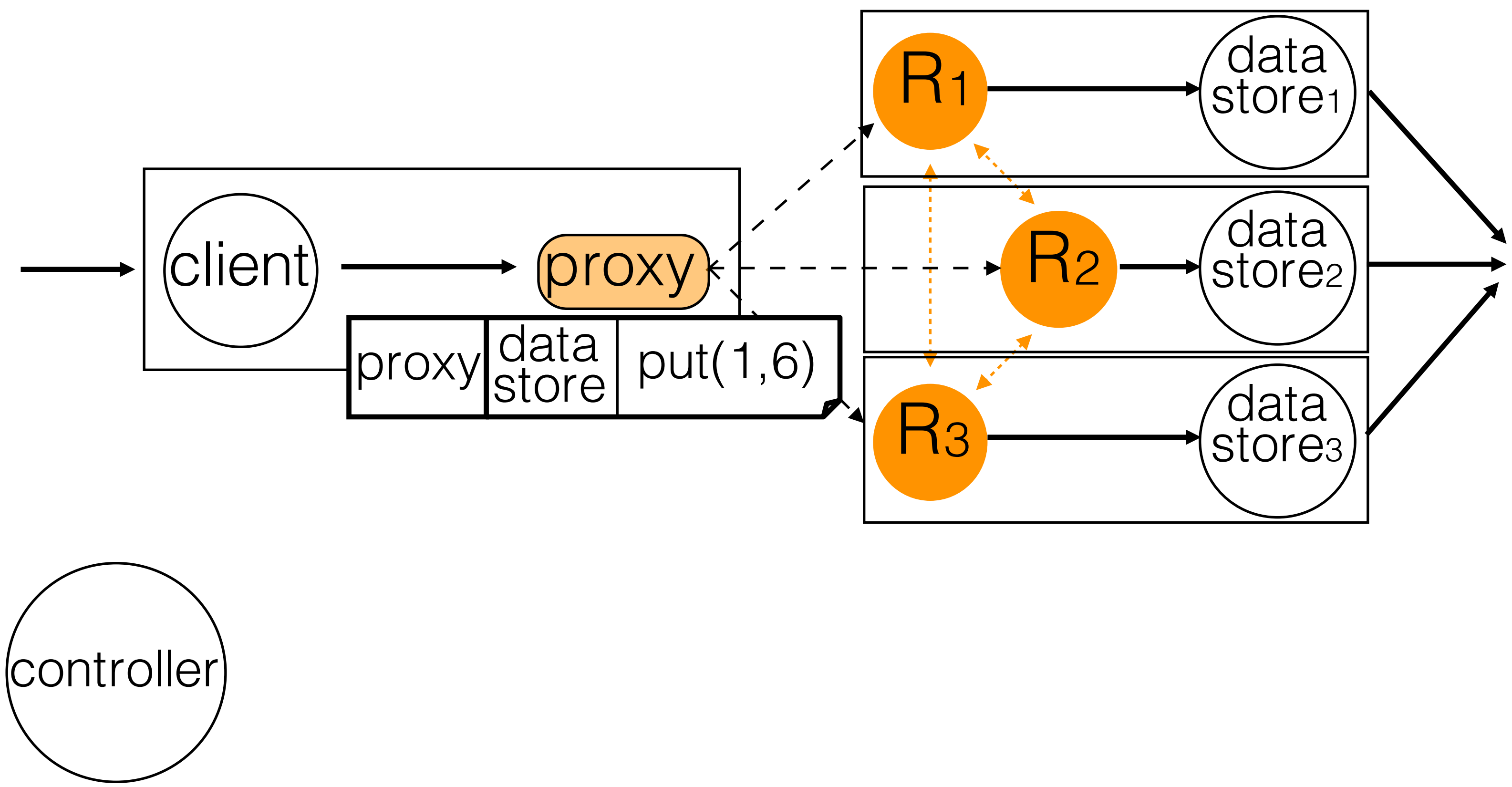


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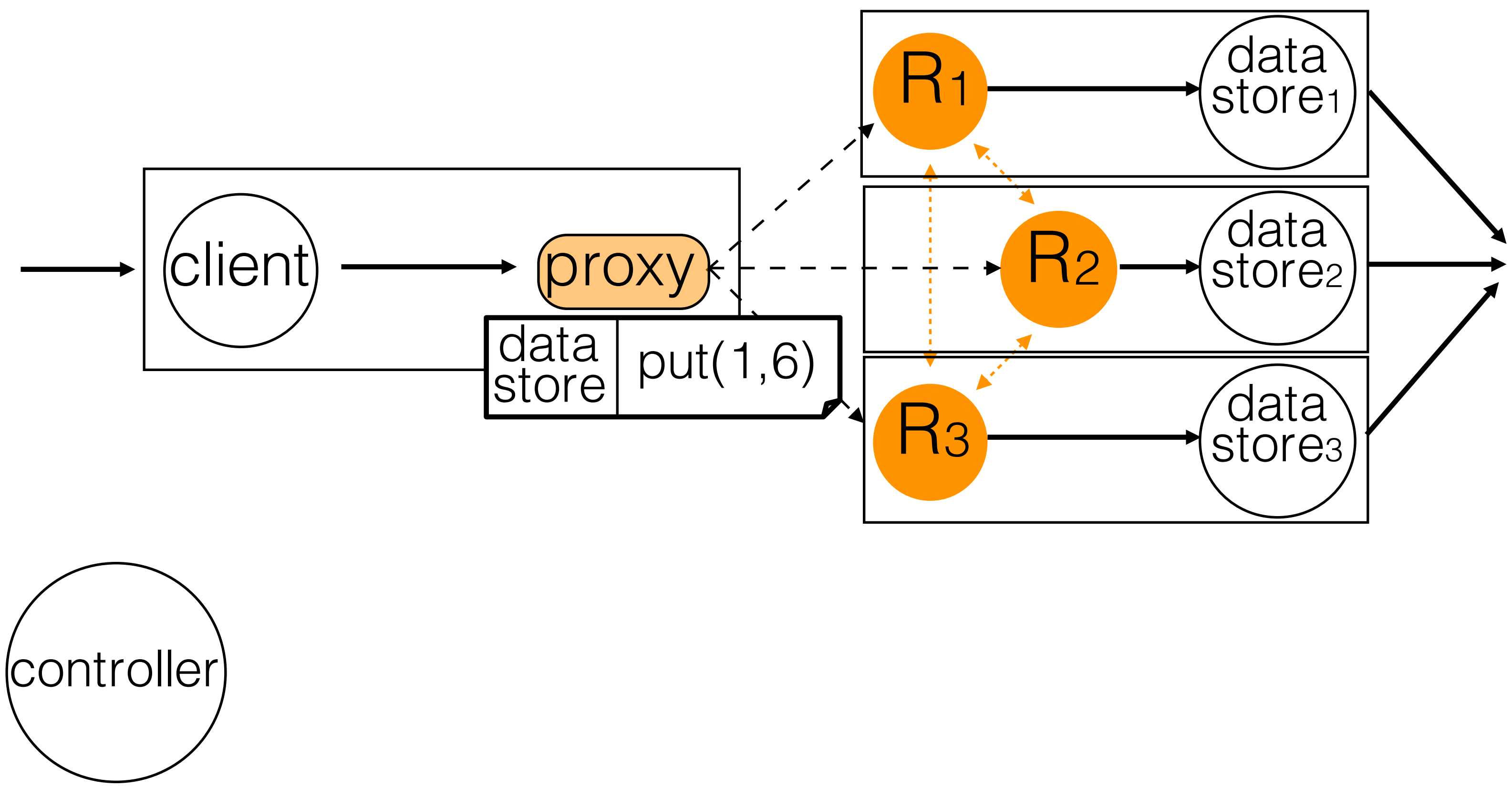


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# Conclusion

- Ovid introduces new abstractions and a new way of modeling distributed systems.
- Ovid can create distributed systems that can be reconfigured and deployed on the fly.
- Ovid makes building, running, maintaining and evolving distributed systems an easy task.