web scaling frameworks

A novel class of frameworks for scalable web services in cloud environments

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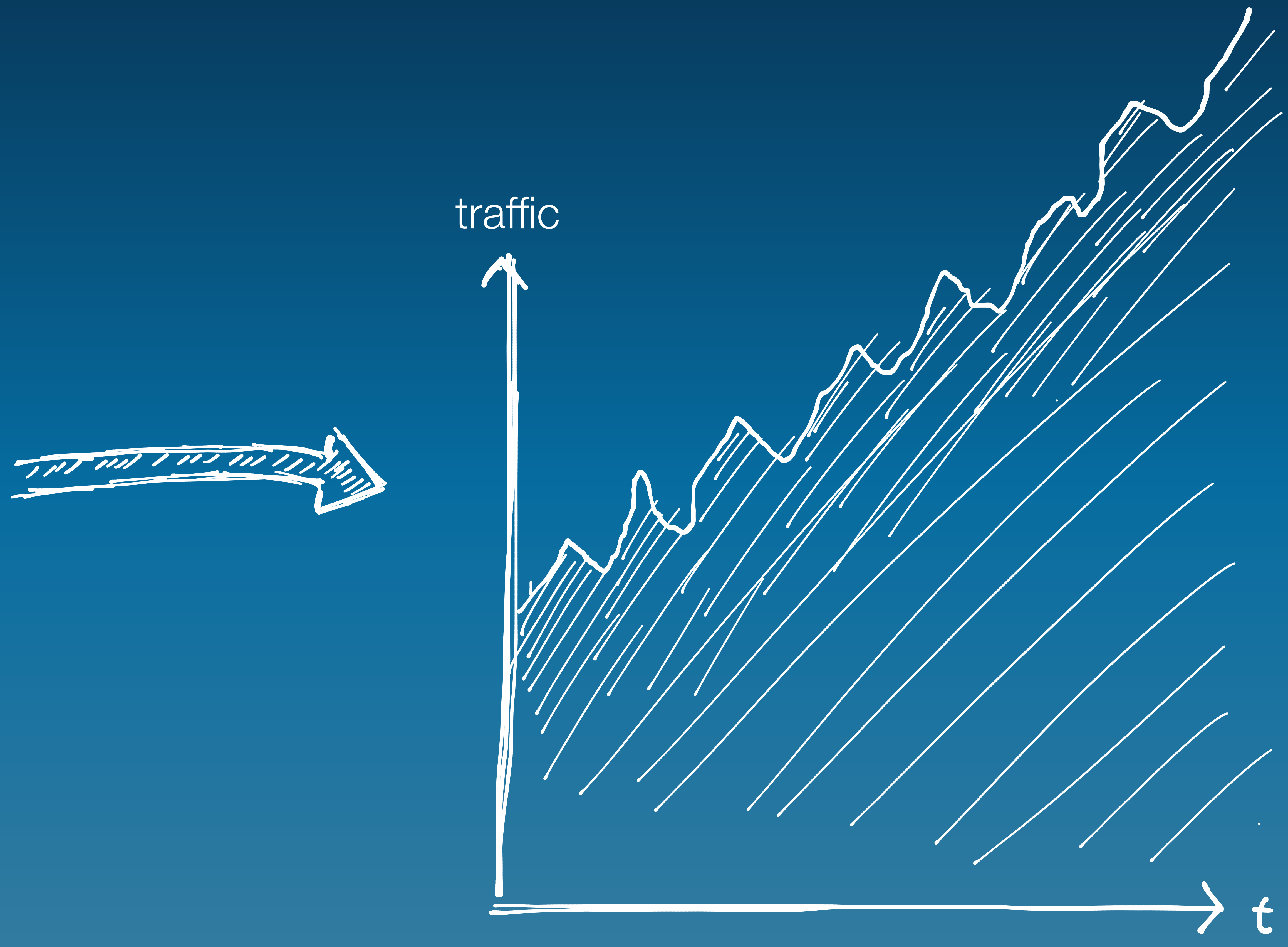
background

background



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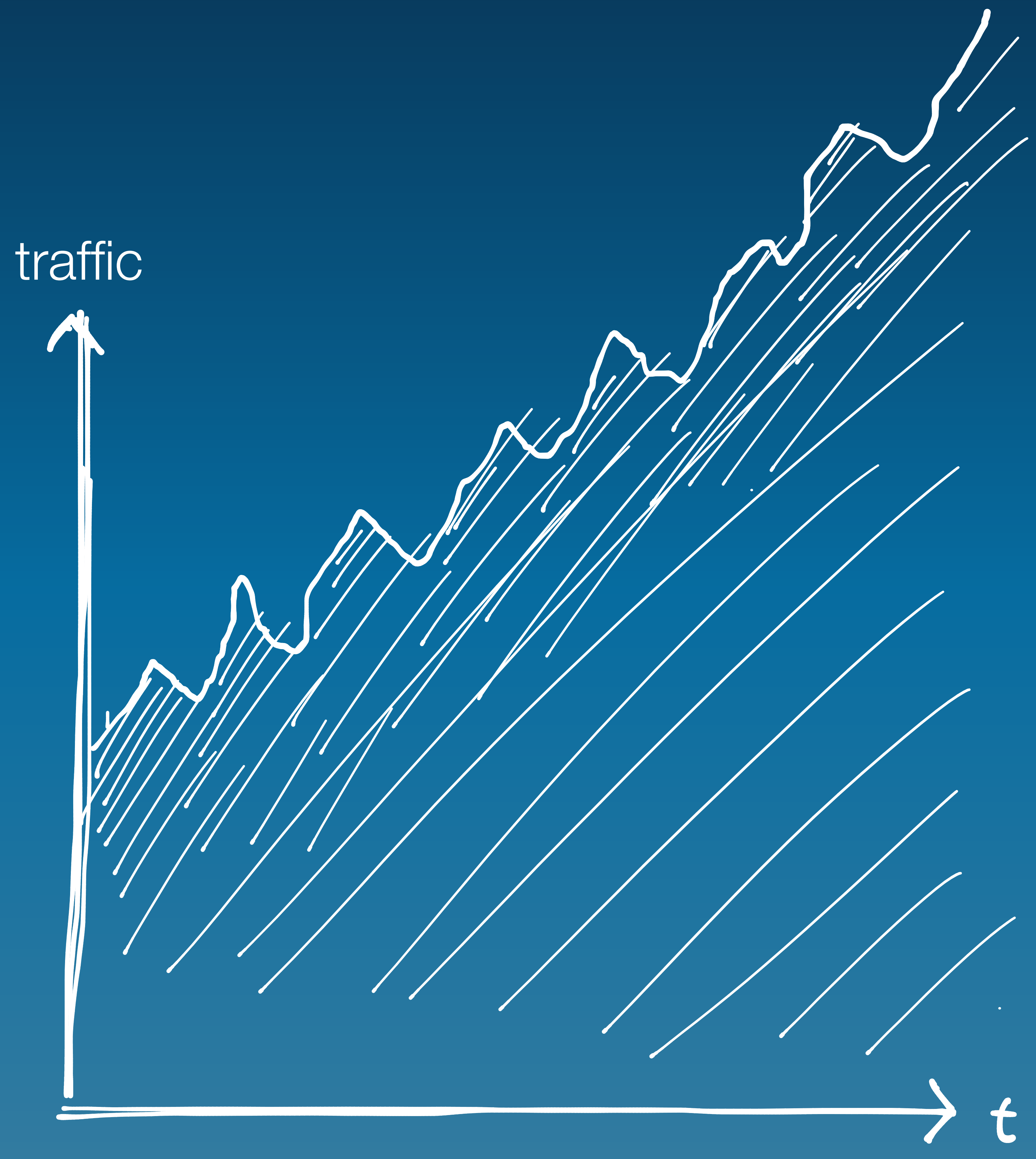
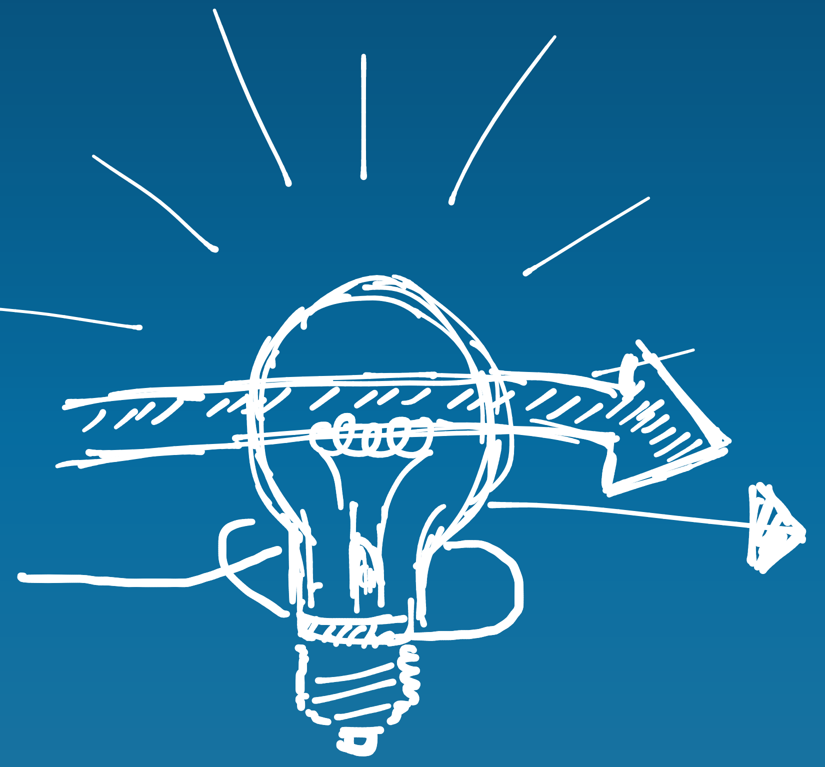




challenges

challenges

+ modularized and distributed web applications

  who manages the distribution components?

+ application logic vs. hosting logic

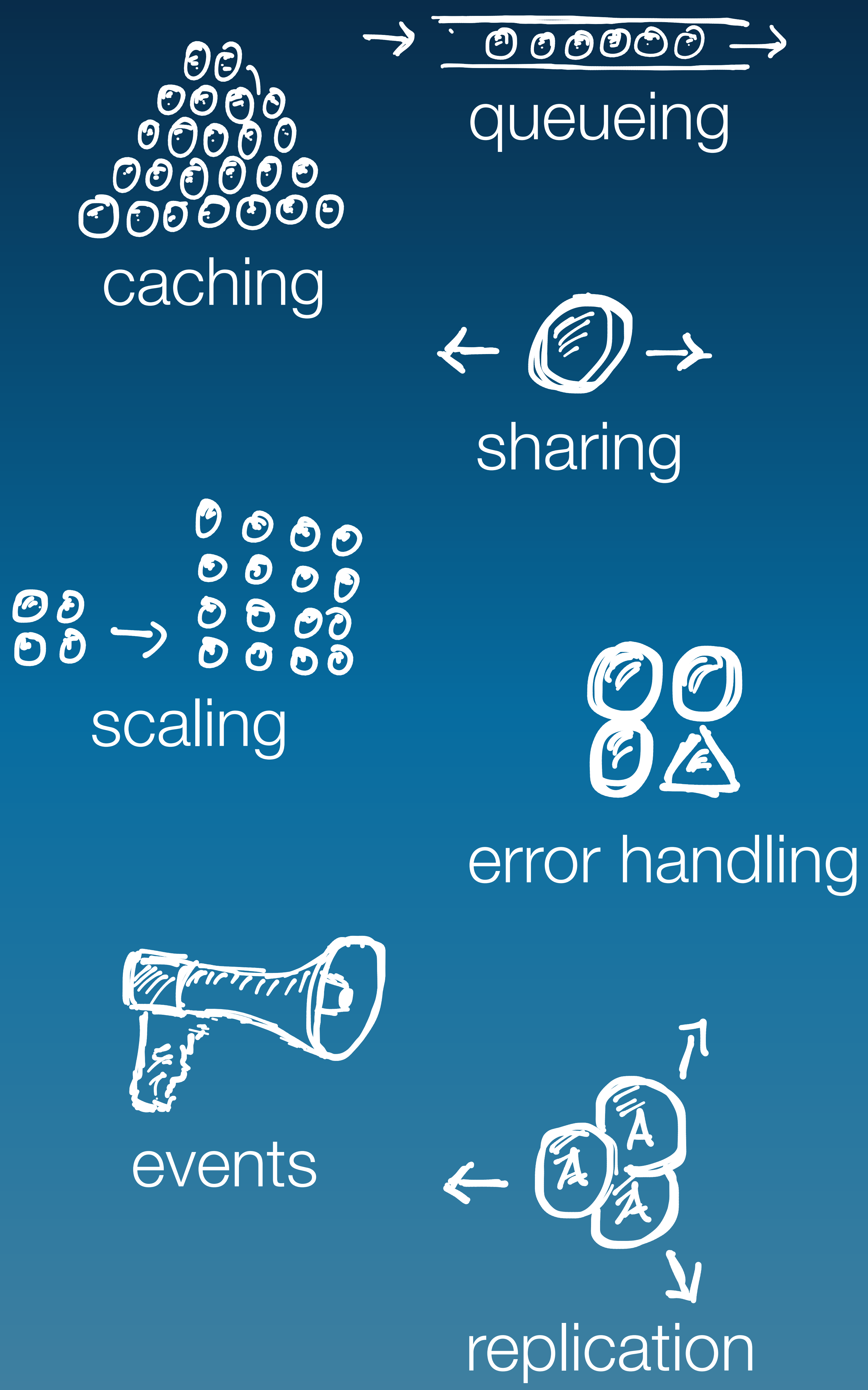
  how much does the app need to know?

+ scaling considerations

  when to implement scaling?

+ performance prediction

  how much of what components are / would be needed?



queueing

caching

sharing

scaling

error handling

events

replication

There is a lot of relevant research for each component

+ but, we propose to combine those complementary components to a predictable, composed system

+ general concept
  web scaling frameworks

+ prototype
  mathematical model and empirical data

web scaling frameworks

web scaling frameworks

caching

queueing

sharing

events

error handling

replication

scaling

validation

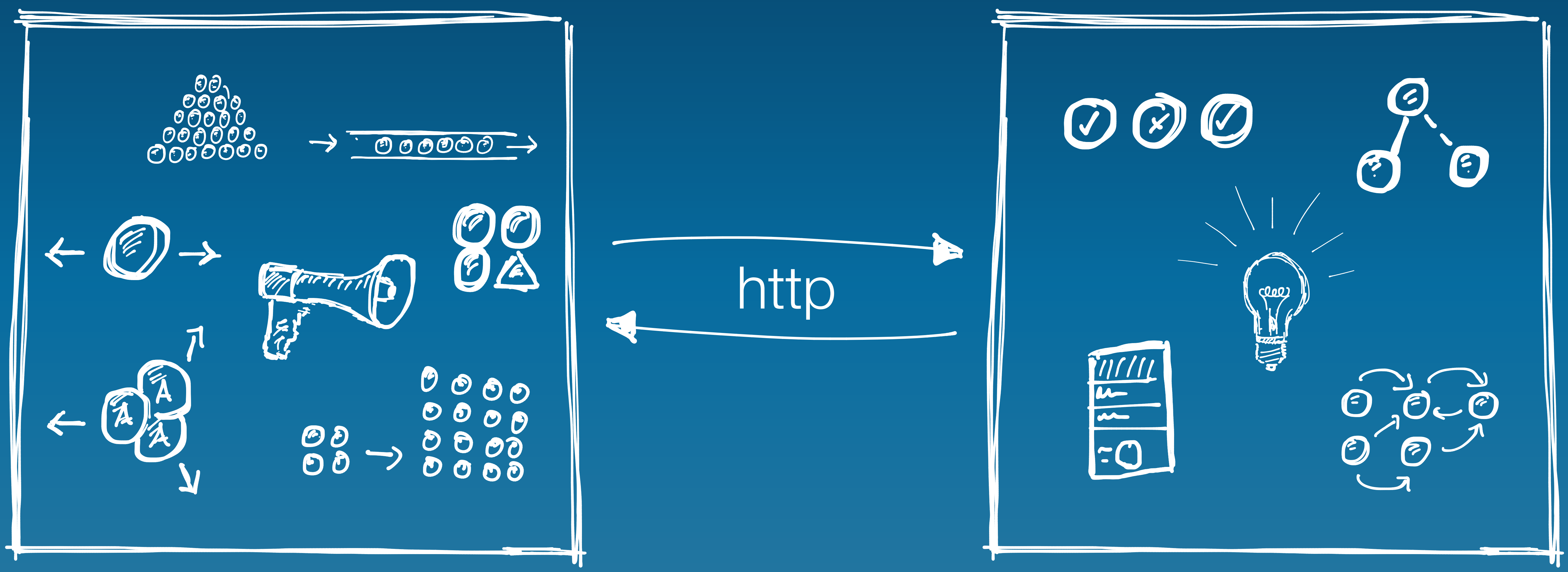
data model

logic

user interface

navigation

web scaling frameworks



http

web scaling framework

web application framework

web scaling frameworks

+ take over scaling

separate application logic from hosting logic

+ predict and manage performance

monitor and control

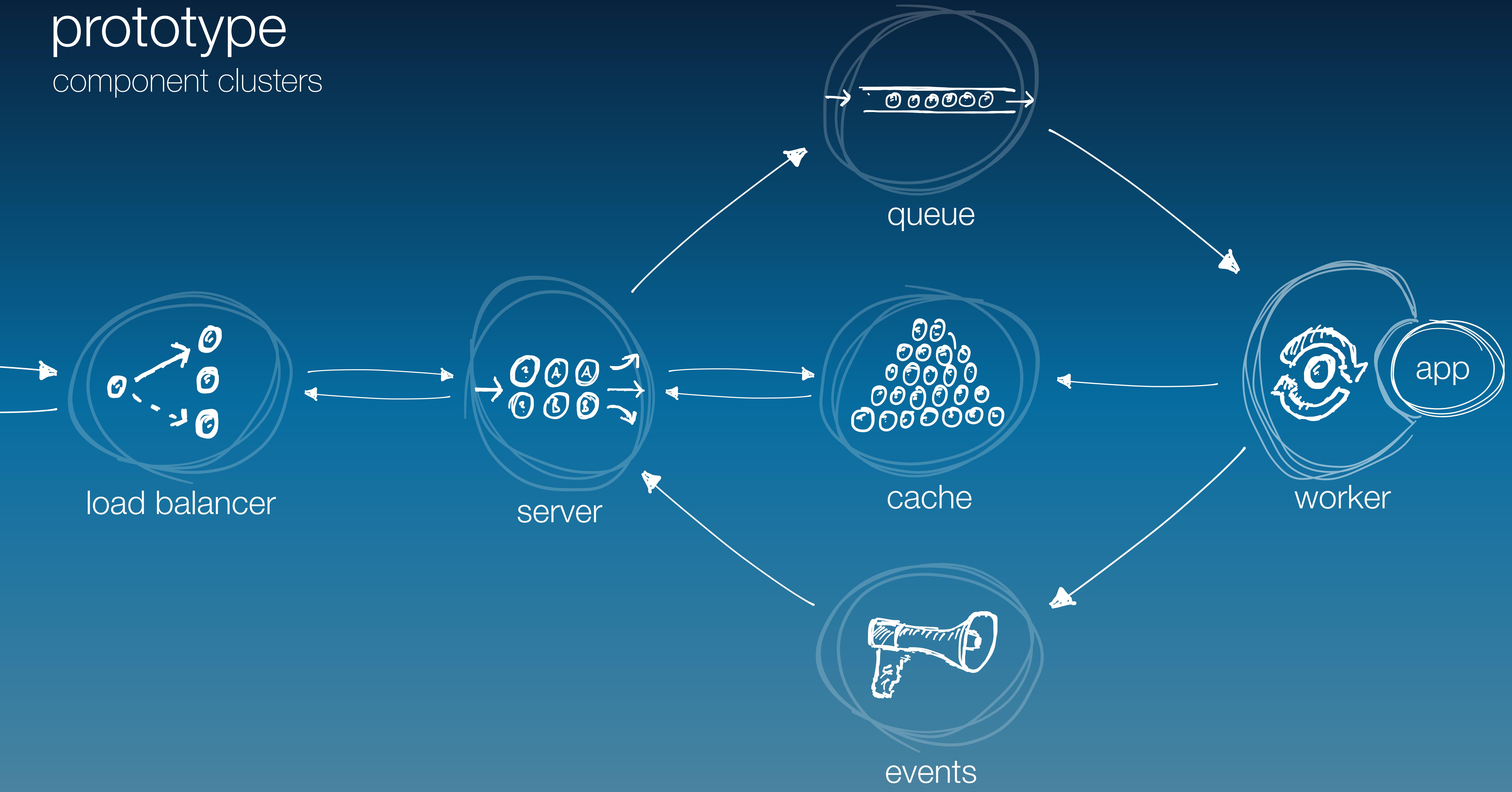
+ connect to existing web application frameworks

http as interface, not a replacement

prototype

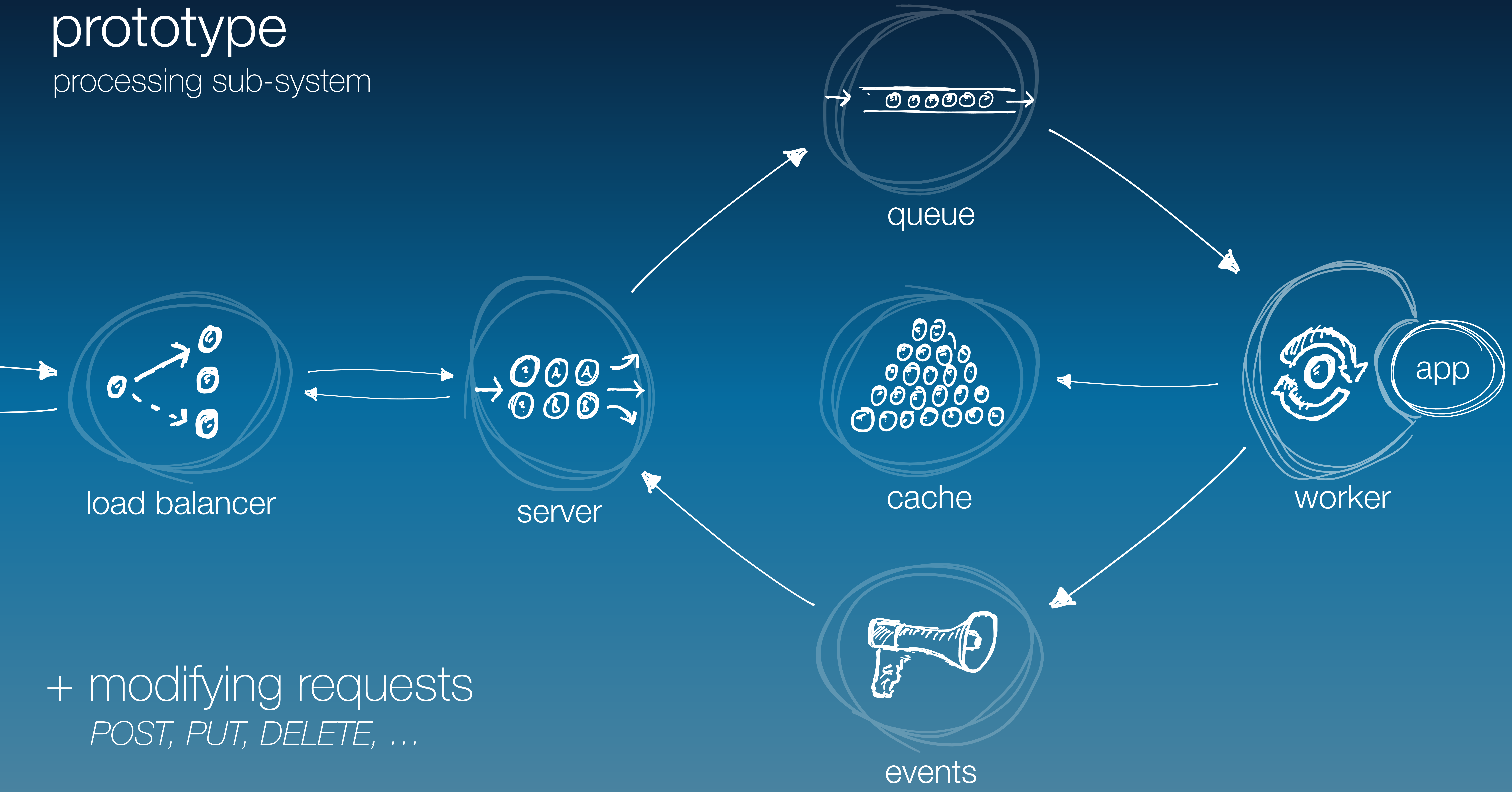
prototype

component clusters



prototype

processing sub-system

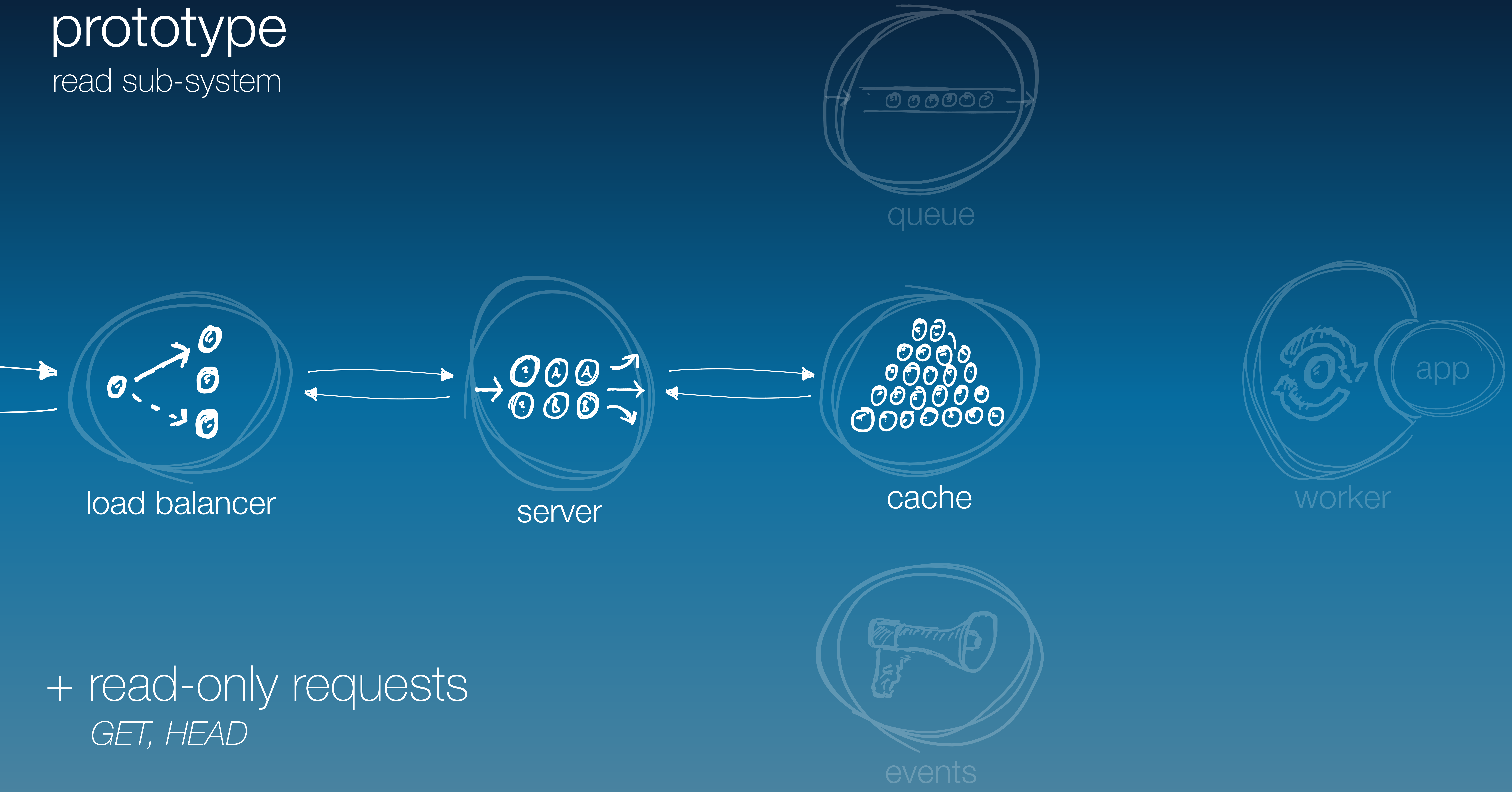


+ modifying requests

POST, PUT, DELETE, …

prototype

read sub-system



+ read-only requests

GET, HEAD

Caching everything is impossible

+ but, for most applications it isn’t…

+ application design matters

  design for cacheability

+ fast cloud storage is available

  storage is cheaper than compute units

+ post-processing

  mechanism that keeps resource dependencies updated

prototype

post-processing

+ worker and app are on the same host

  connect web scaling framework and web application framework

+ worker offers interface to app

  register dependency, push content, …

+ application declares resource dependencies

  synchronous and asynchronous dependencies

+ worker ensures updates of dependencies

  optimises and resolves update tree

prototype

post-processing example

+ app: create blog post dependencies

  synchronous: /index

  asynchronous: /sitemap

+ worker: POST /posts

  1. *sends request to app*
  2. *receives and stores sync. and async. dependencies*
  3. *pushes updates to the cache*
  4. *recursively resolves sync. dependencies*
  5. *forwards response to event system … client*
  6. *recursively resolves async. dependencies*

evaluation

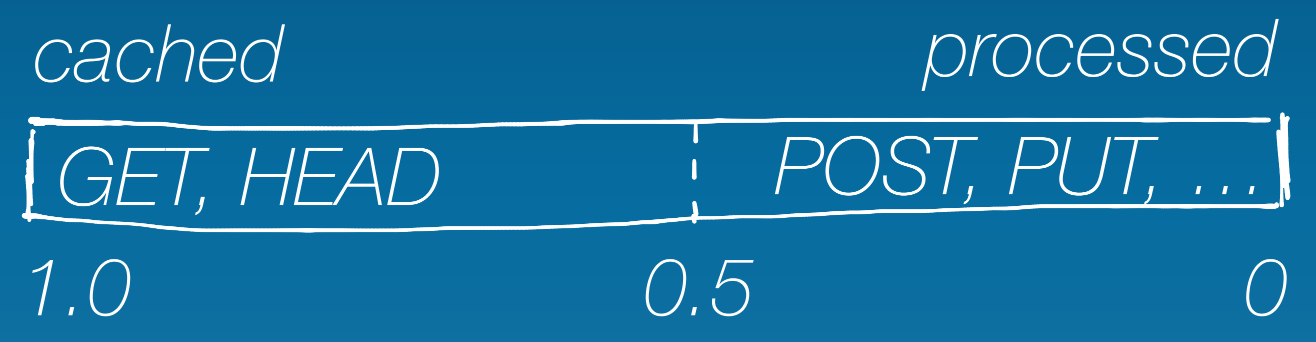
evaluation

+ mathematical model

  component delays and sub-systems

+ cache / processing ratio (CPR)

  traffic distribution ratio between 1 and 0



+ scaled version vs. normal version

  web scaling framework + web application framework vs. web application framework

+ empirical data collection

  single machine scope and multi-machine scope

evaluation

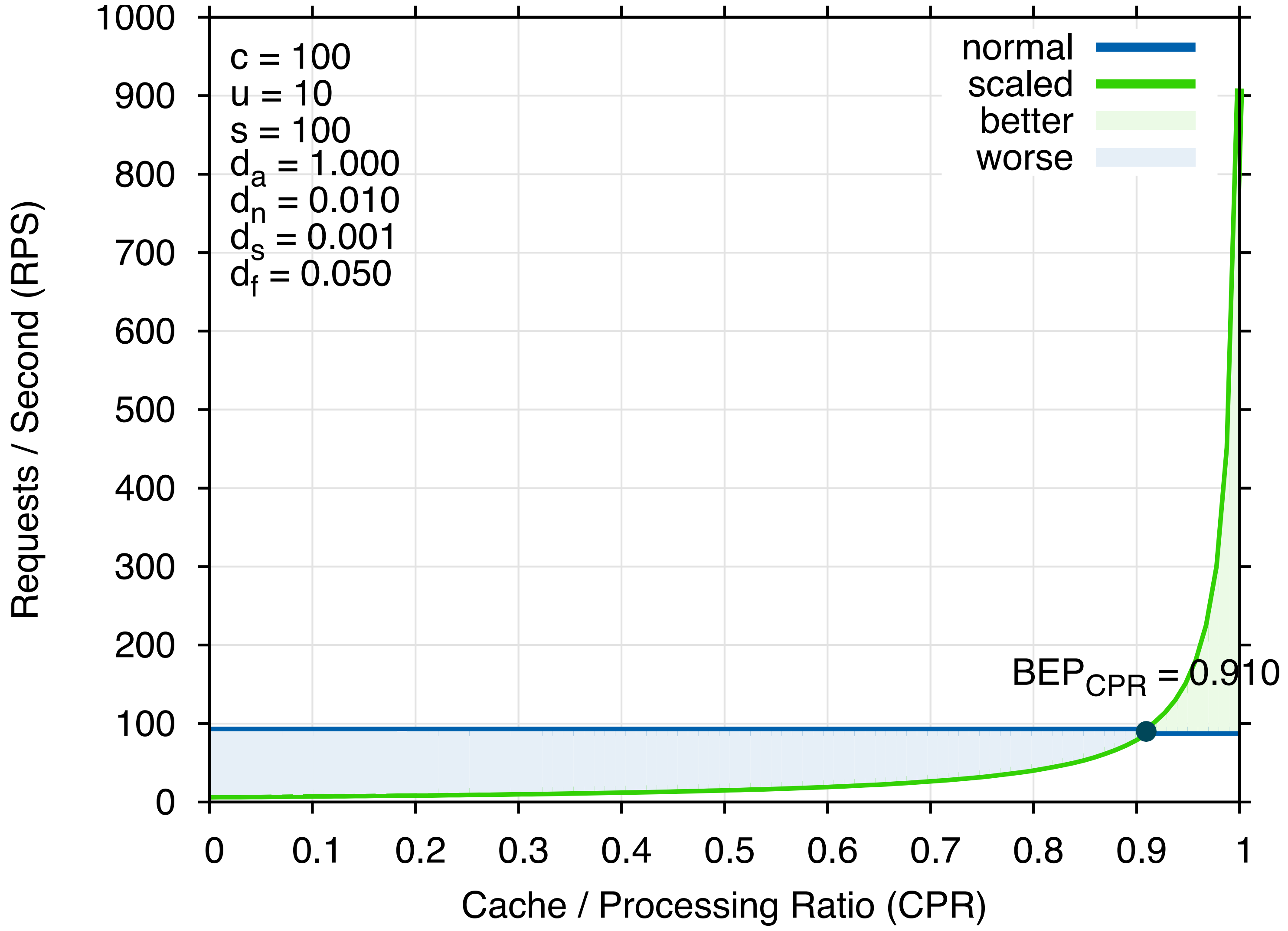
+ mathematical model: analytical prediction

normal version does not consider cpr

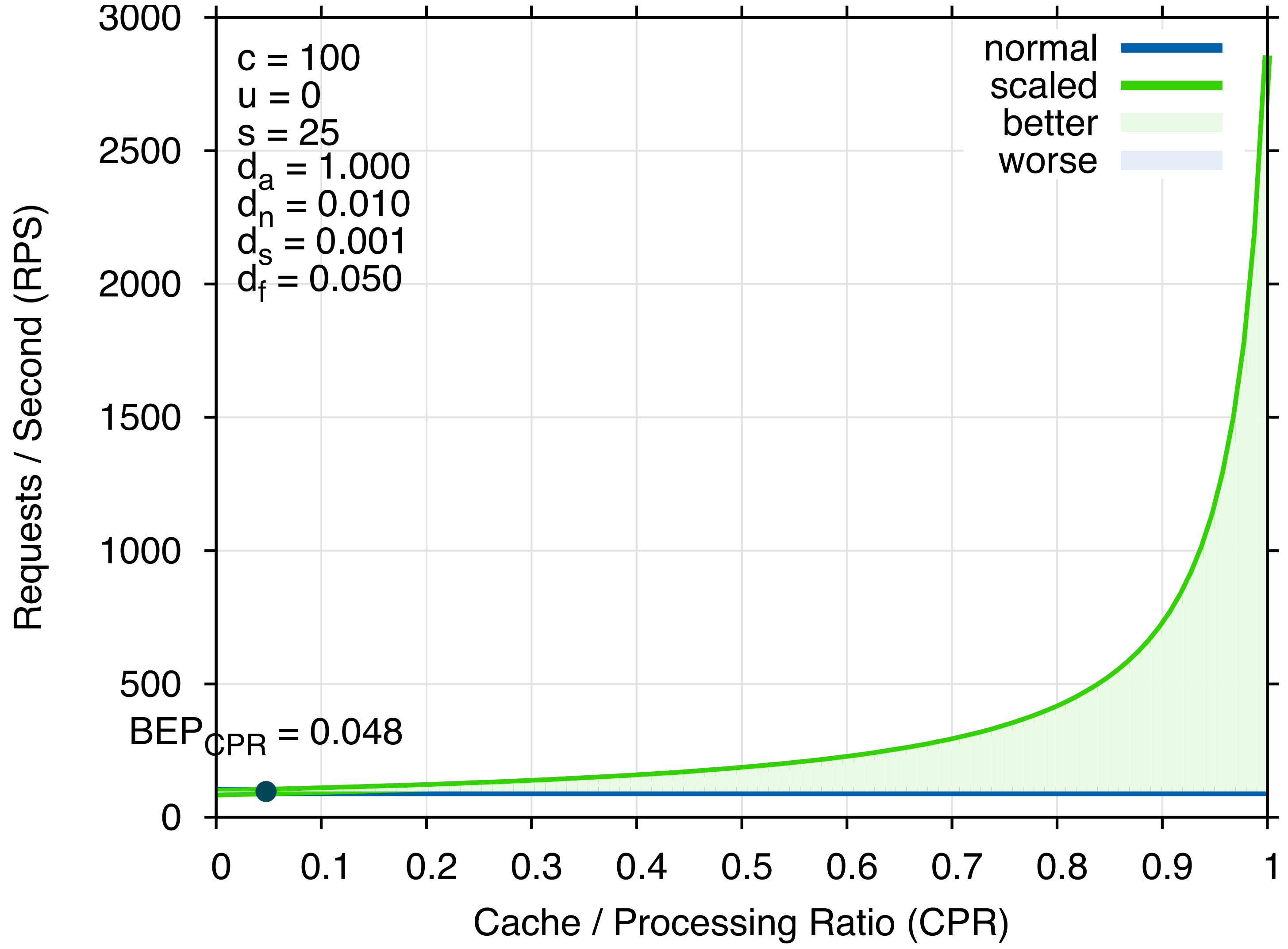
on a single machine

all components on same host

worst case

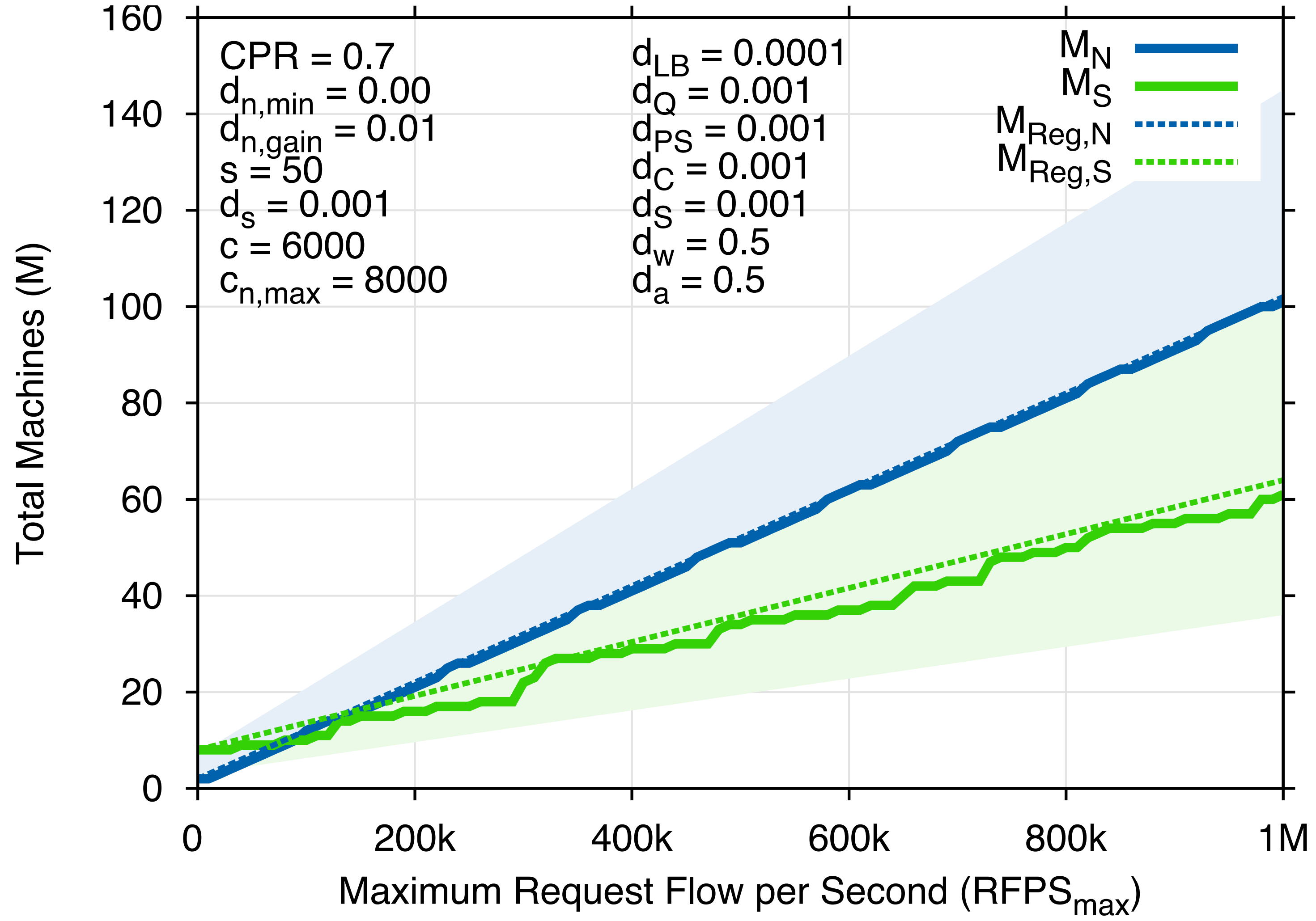


best case



on multiple machines

44% fewer machines



evaluation

+ empirical data collection

normal version vs. scaled version - single machine scope

V_n: normal version vs. V_S: scaled version

- + 81 parameter tuples

  cpr, da, s, u

CPR = (1.0, 0.5, 0.0)
da = (0.0, 0.5, 1.0)
s = (25,50,100)
u = (0,5,10)

- + expected the cpr to be highly influential

  V_S expected to be better for tuples where CPR = 1.0

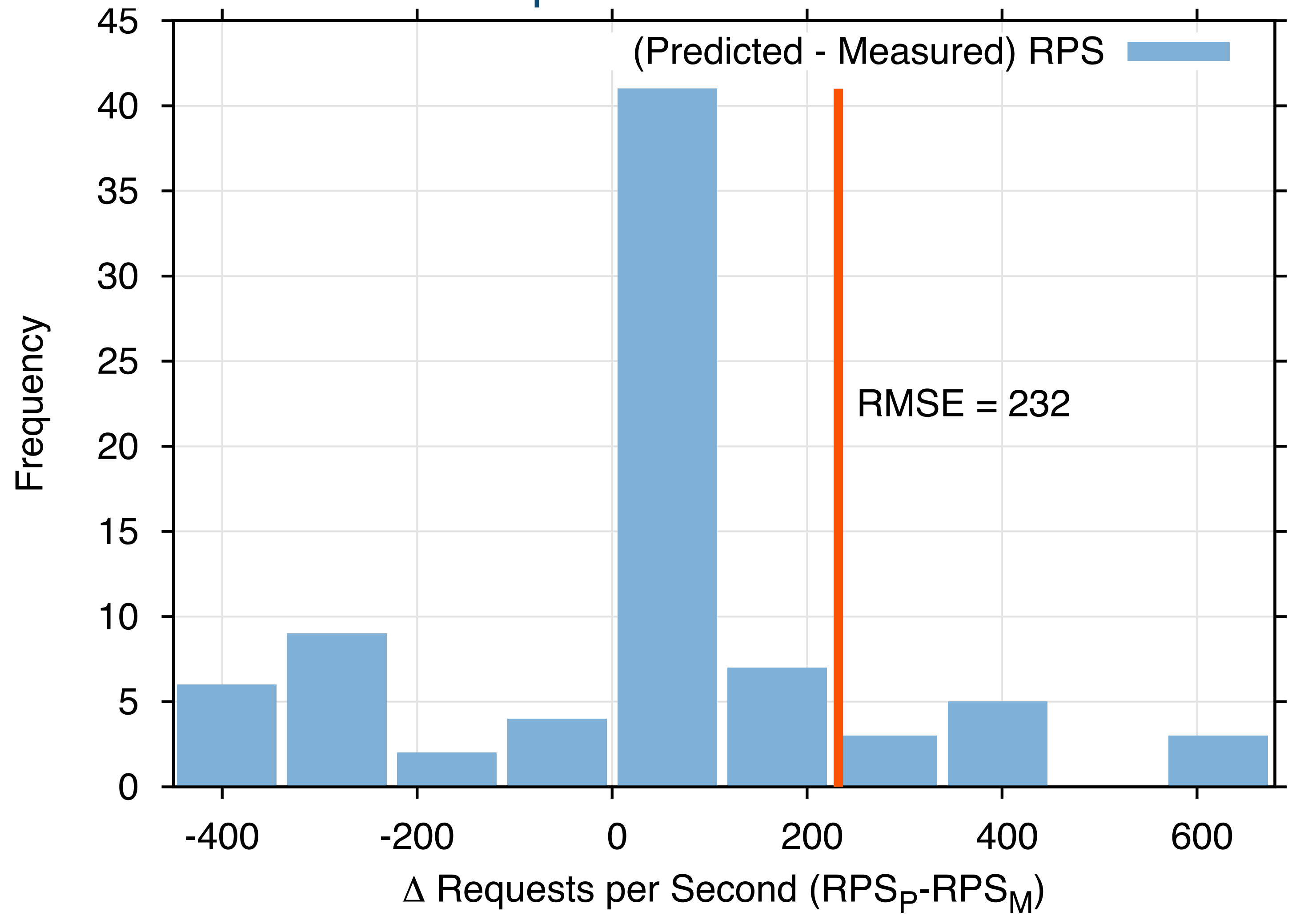
  V_n expected to be better for tuples where CPR = (0.5, 0.0)

- + hypothesis: In 33% V_S performs better than V_n

  accepted with a result of 37%

model vs. data

97.6% prediction fit



in progress

in progress

+ empirical data collection

  multi-machine cloud scope

  raspberry pi cluster of 42 machines

+ further implementations

  web scaling frameworks

thank you!

thank you!

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