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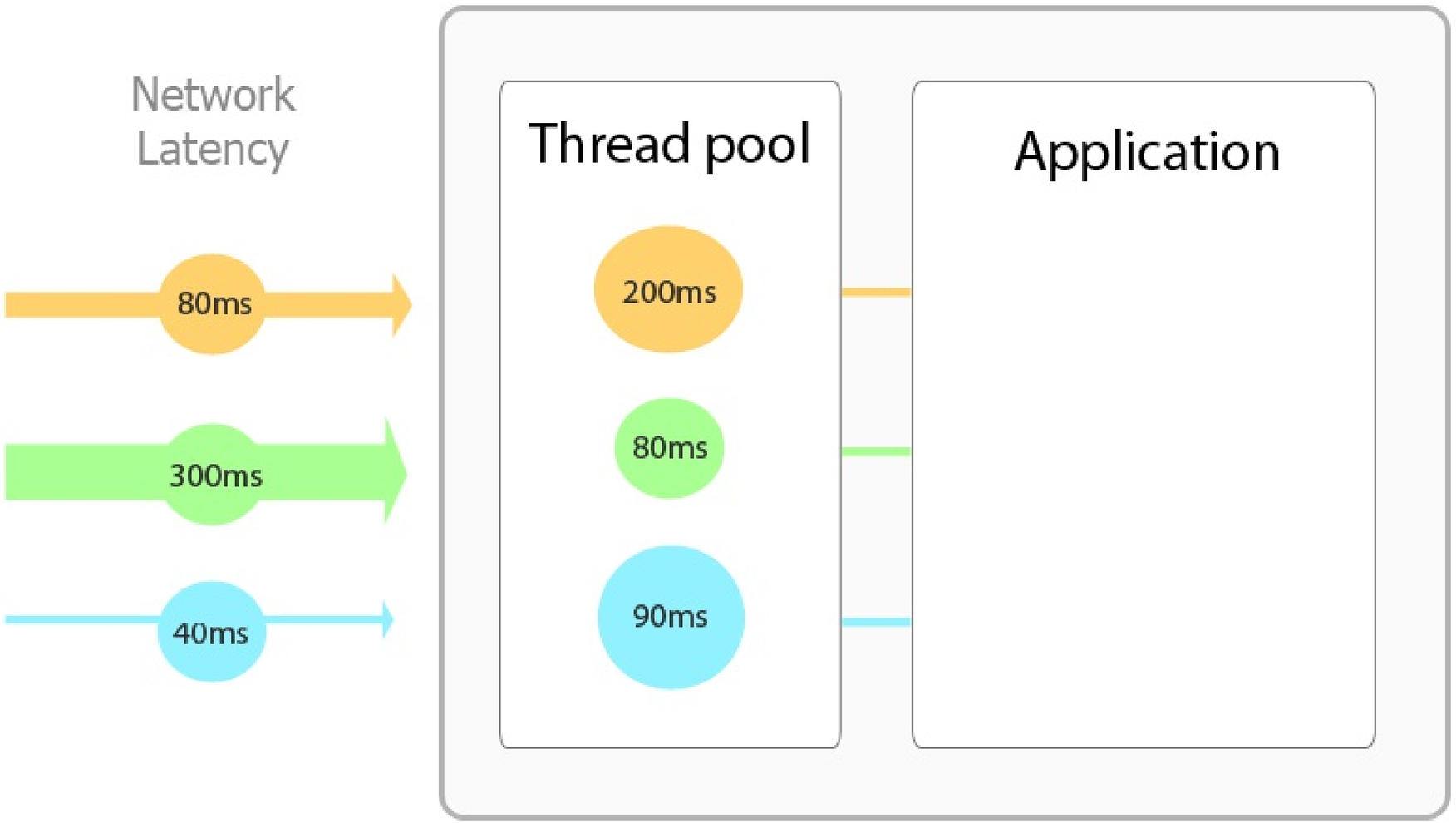
Agenda

- Motivation
- Ratpack - key concepts
  - Request handling
  - Dependency injection
  - Application configuration
  - Promises and Executions
  - Ratpack Modules
- Reactive Streams

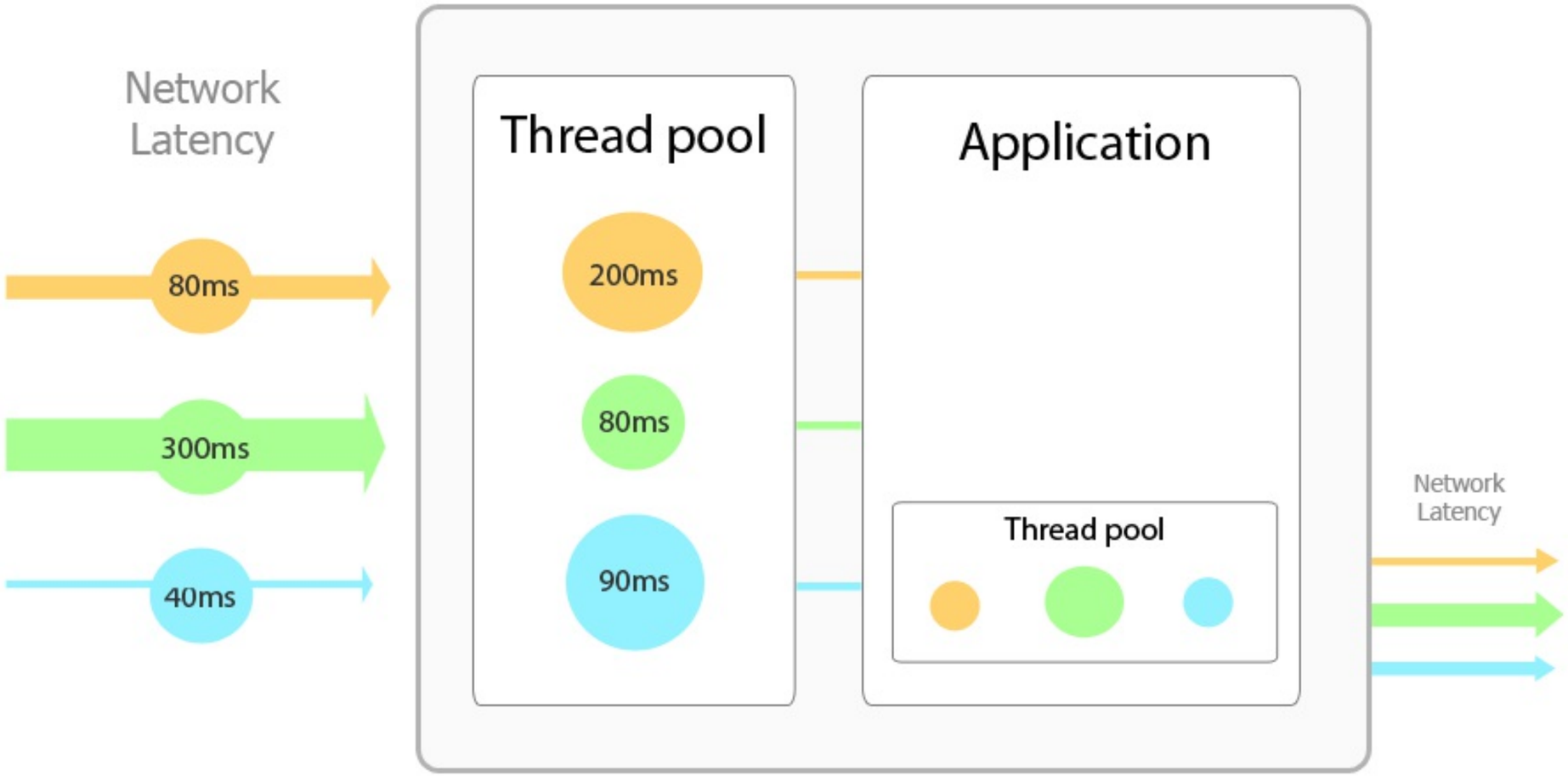
Java Servlets

- Born 20 years ago and still alive!
- Simple & effective processing model
- Request isolation
- But …

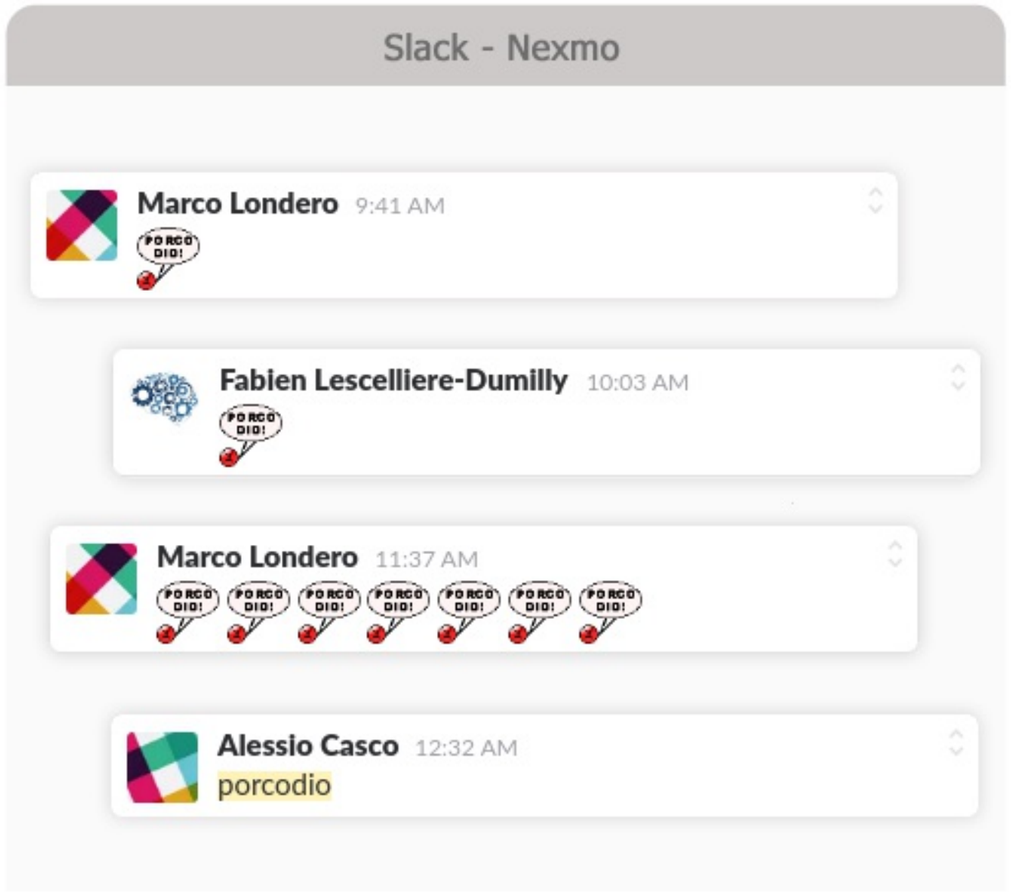
Servlet container



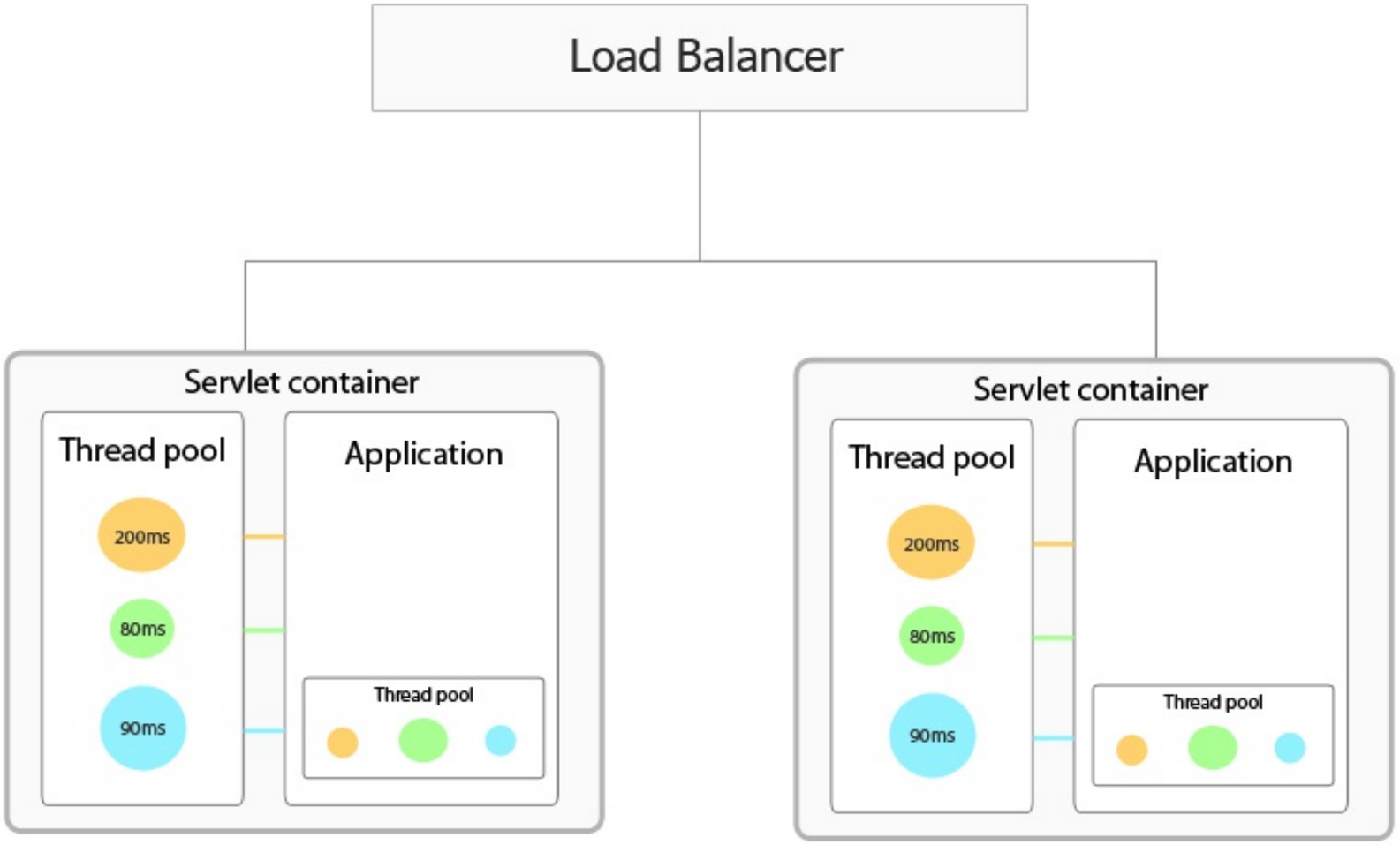
Servlet container



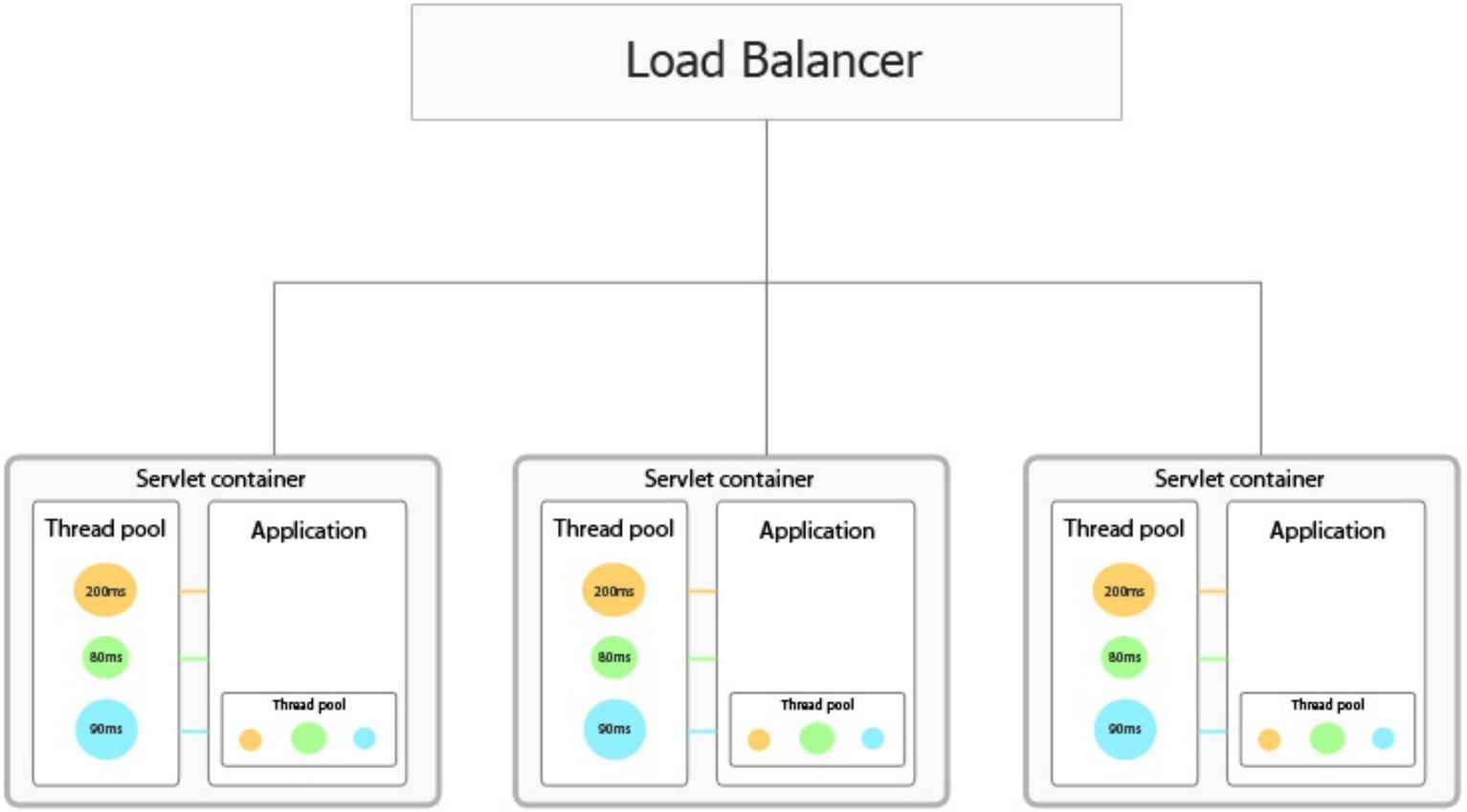
PORCODIO!


Slack - Nexmo
Marco Londero 9:41 AM
Fabien Lescelliere-Dumilly 10:03 AM
Marco Londero 11:37 AM
Alessio Casco 12:32 AM
porcodio

Scaling up


Load Balancer
Servlet container
Thread pool
200ms
80ms
90ms
Application
Thread pool
Servlet container
Thread pool
200ms
80ms
90ms
Application
Thread pool

Scaling up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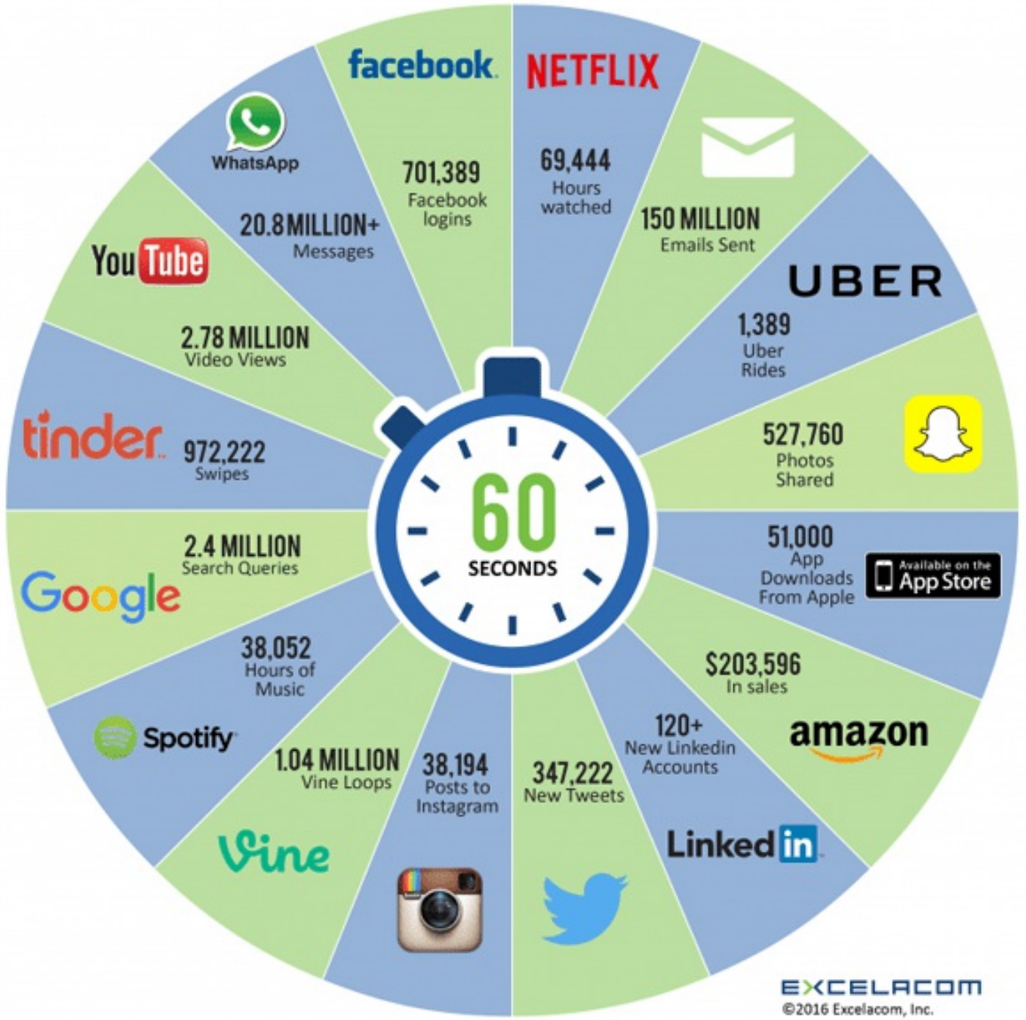
Application
Thread pool

Do we need change?

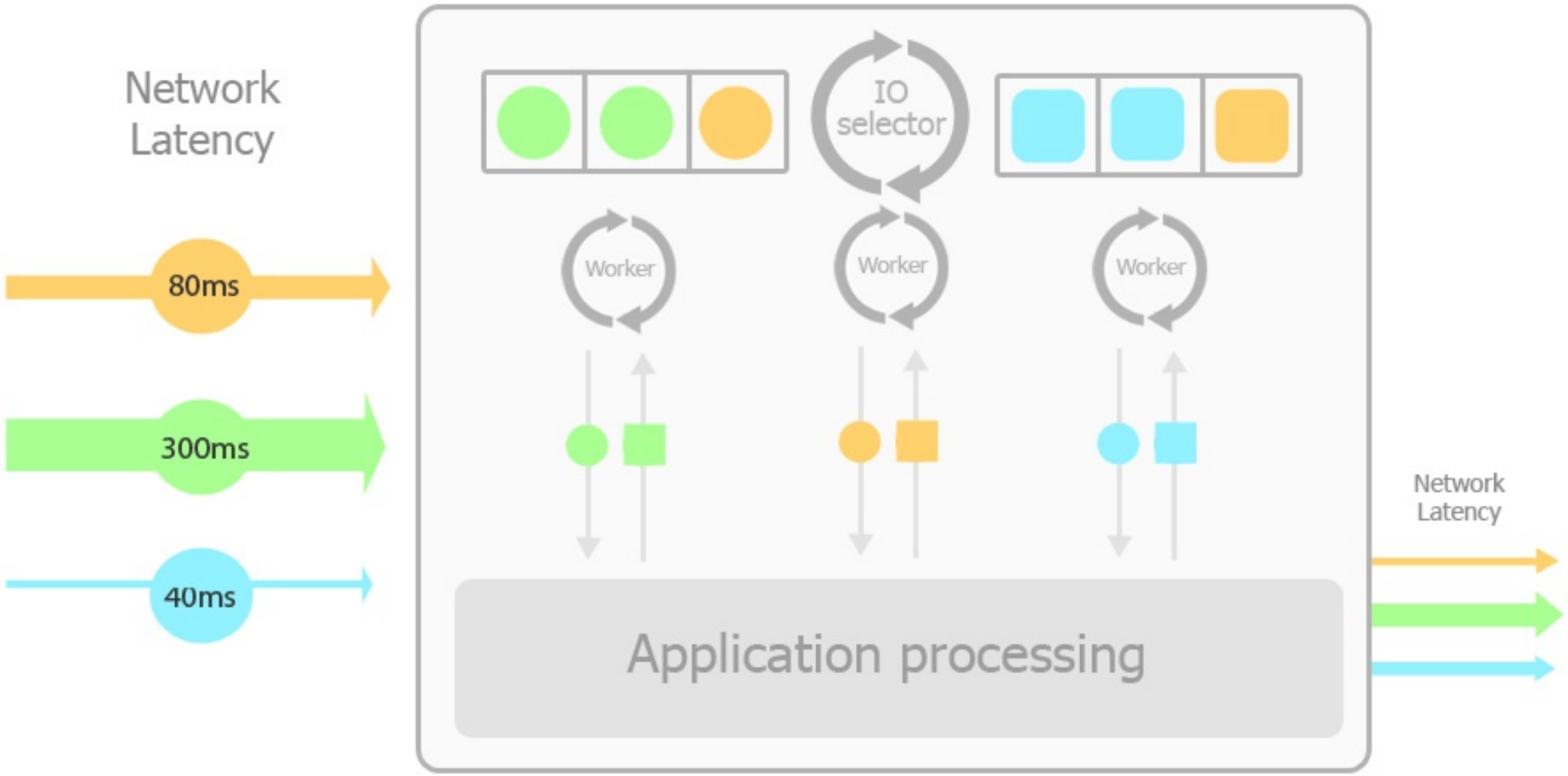
2016 What happens in an INTERNET MINUTE?



EXCELACOM

Is there another way?

Non-blocking Runtimes



Ratpack

- High-performance, reactive web framework
- Build on Java 8 and Netty
- Using asynchronous non-blocking model
- Rapid develompent
- Aims to make async programiring on JVM easier

Ratpack - Hello Nexmo!

```
@Grab('io.ratpack:ratpack-groovy:1.4.2') 1

import static ratpack.groovy.Groovy.ratpack; 2

ratpack {
  handlers {
    get { 3
      render "Hello Nexmo!"
    }
  }
}
```

1. Groovy's dependency managment system "grab" the necessary dependencies and make it avaiable to our runtime classpath
2. Static import of the Groovy.ratpack method provides our script with the Domain-Specific Languages (DSL)
3. GET handler - binding a processing block for incoming HTTP GET requests

Handler Chain

- Handler is a "core" object in Ratpack
- Acts on a Context - can handle, delegate or add some new handlers
- Processed top-down (Order matters)

```
public class Server {

  public static void main(String[] args) throws Exception {
    RatpackServer.start( serverSpec -> serverSpec
        .handlers( chain -> chain
          .get( ctx -> {
            ctx.render("Hello Nexmo!");
          })
      )
    );
  }

}
```

Handler Chain (Continued)

- Can be defined to match on HTTP verb, URL or Content-Type
- Just a simple @FunctionalInterface
- Supports decoupling the rendering logic by implementing Renderer<T>

```
public class HelloNexmoHandler implements Handler{

  @Override
  public void handle(Context ctx) throws Exception {
    ctx.render("Hello Nexmo!");
  }

}
```

Handler method binding

- byMethod - for HTTP method
- byContent - for MIME types
- Easy & descriptive way how to build up REST api

```
handlers {
    prefix("api") {
        all { ... }
        delete { ... }
        post { ... }
        put { ... }
        patch { ... }
        get (":id") {
          byContent {
            html { ... }
            json { ... }
            xml { ... }
            noMatch { ... }
          }
        }
    }
}
```

Registries

- Chain is backed by registry
- "Map like type" where Key is a type and Value an instance
- Can be layered or "Joined"
- Something like ApplicationContext in Spring

```
handlers( chain -> chain
  .all( ctx -> {
    String userAgent = ctx.getRequest().getHeaders().get("User-Agent");
    ClientVersion clientVersion = ClientVersion.ofUserAgent(userAgent);
    ctx.next(Registry.single(clientVersion));
  })
  .get( ctx -> {
    ClientVersion clientVersion = ctx.get(ClientVersion.class);
    // ...
  })
)
```

Dependency injection

- Ratpack itself provides "sort of" DI
- Supports Google Guice
- Supports Spring

```
public class Server {
  public static void main(String[] args) throws Exception {
      RatpackServer.start( serverSpec -> serverSpec
        .registryOf( registrySpec -> registrySpec
          .add( UserService.class, new AsyncUserSerivce() )
        )
        .handlers( chain -> chain
          .get("user/:id", ctx -> {
            Long id = ctx.getPathTokens().asLong("id");
            ctx.get(UserService.class)
               .getById( id )
               .then( user -> ctx.render( json( user ) ) );
          })
        )
      );
    }
}
```

Dependency injection - Groovy

- Out-of-the-box support for Guice
- Slightly different approach

```
ratpack {
  bindings {
    bindInstance(UserService, new AsyncUserService())
  }
  handlers {
    get("user/:id") { UserService userService ->
      userService.getById( pathTokens.id ).then { user ->
        render( toJson( user )  )
      }
    }
  }
}
```

Async programming

- No language-level support for continuations
- Non-deterministic data flow

```
public interface AsyncDatabaseService {
  void findByUsername(String username, Consumer<User> callback);
}

RatpackServer.start(spec -> spec
  .registry(...)
  .handlers(chain -> chain
    .get(":username", ctx -> {
      AsyncDatabaseService db = ctx.get(AsyncDatabaseService.class);
      String username = ctx.getPathTokens("username");
      db.findByUsername(username, user -> {
        ctx.render( user );
      });
    })
  )
);
```

From imperative to async programming

```
public interface AsyncDatabaseService {
  void findByUsername(String username, Consumer<User> callback);
  void loadUserProfile(Long profileId, Consumer<UserProfile> callback);
}

RatpackServer.start(spec -> spec
  .registry(...)
  .handlers(chain -> chain
    .get(":username", ctx -> {
      AsyncDatabaseService db = ctx.get(AsyncDatabaseService.class);
      String username = ctx.getPathTokens("username");

      User;
      db.findByUsername(username, u1 -> user = u1);
      db.loadUserProfile(user.getProfileId(), userProfile -> { NPE :-(
        ctx.render( userProfile );
      });
    })
  )
);
```

A "solution" - Nested async call

- Nested code blocks - difficult to read and mantain. "Callback hell"

```
public interface AsyncDatabaseService {
  void findByUsername(String username, Consumer<User> callback);
  void loadUserProfile(Long profileId, Consumer<UserProfile> callback);
}

RatpackServer.start(spec -> spec
  .registry(...)
  .handlers(chain -> chain
    .get(":username", ctx -> {
      AsyncDatabaseService db = ctx.get(AsyncDatabaseService.class);
      String username = ctx.getPathTokens("username");

      db.findByUsername(username, u1 -> {
        db.loadUserProfile(user.getProfileId(), userProfile -> {
          ctx.render( userProfile );
        });
      });

    })
  )
);
```

Promises - A better approach

```
public interface AsyncDatabaseService {
  Promise<User> findByUsername(String username);
  Promise<UserProfile> loadUserProfile(Long profileId);
}

RatpackServer.start(spec -> spec
  .registry(...)
  .handlers(chain -> chain
    .get(":username", ctx -> {
      AsyncDatabaseService db = ctx.get(AsyncDatabaseService.class);
      String username = ctx.getPathTokens("username");

      db.findByUsername(username).flatMap( user -> {   1
        return db.loadUserProfile(user.getProfileId());   2
      }).then( profile -> {
        ctx.render( profile );
      });

    })
  )
);
```

1. Once the data is avaiable, it is streamed to the provided function
2. Transform the value of the stream by chaining the two promisses

Promises vs Callbacks

```
db.findByUsername(username, u1 -> {
  db.loadUserProfile(user.getProfileId(), profile -> {
    db.loadUserFriends(profile.getFriendsIds(), friends -> {
      db.loadPhotosFromFriends(friends.getPhotoIds(), photos -> {
        ctx.render( photos );
      });
    });
  });
});
```

```
db.findByUsername(username).flatMap( user -> {
  return db.loadUserProfile(user.getProfileId());
}).flatMap( profile -> {
  return db.loadUserFriends(profile.getFriendsIds());
}).flatMap( friends -> {
  return db.loadPhotosFromFriends(friends.getPhotoIds());
}).then( photos -> {
  ctx.render( photos );
});
```

Ratpack Promise

- Representation of a potential value
- Say things about the value without having it
- Represent a processing construct that is much more aligned with the concept of a continuation - denotes a frame of the continuation
- During the invocation of each frame, the continuation is suspended until its operation returns a value (fulfilling the promise)
- The serialization of the async calls gives - deterministic control flow

Ratpack Execution Model

- Is an implementation of a continuation and Promise<T> represents distinct frames of the continuation.
- Processing stream is created from the async call
- The processing calls that make up a stream are placed into a stack

```
RatpackServer.start( spec -> spec
 .handlers( chain -> chain
   .get( ctx -> {
     print("1");
     Blocking.get( () -> {
       print("2");
       return blockingUserService.loadUsers();
     }).then( userList -> {
       print("3");
       ctx.render( userList );
     });
     print("4");
   })
 );
 // prints 1423
```

Ratpack Execution Model (continued)

- Ratpack's execution model guarantees that the exception being thrown is the logical outcome. In fact, the background operation is never initiated.
- Requests are smartly handled based on data, not on response-writing timeouts
- Ratpack is said to provide Thread affinity

```
RatpackServer.start( spec -> spec
 .handlers( chain -> chain
  .all( ctx -> {
    ctx.next();
    throw new Exception(":-)");
  })
  .get( ctx -> {
    Blocking.get( () -> {
      return blockingUserService.loadUsers();
    }).then( userList -> {
      ctx.render( userList );
    });
  })
);
```