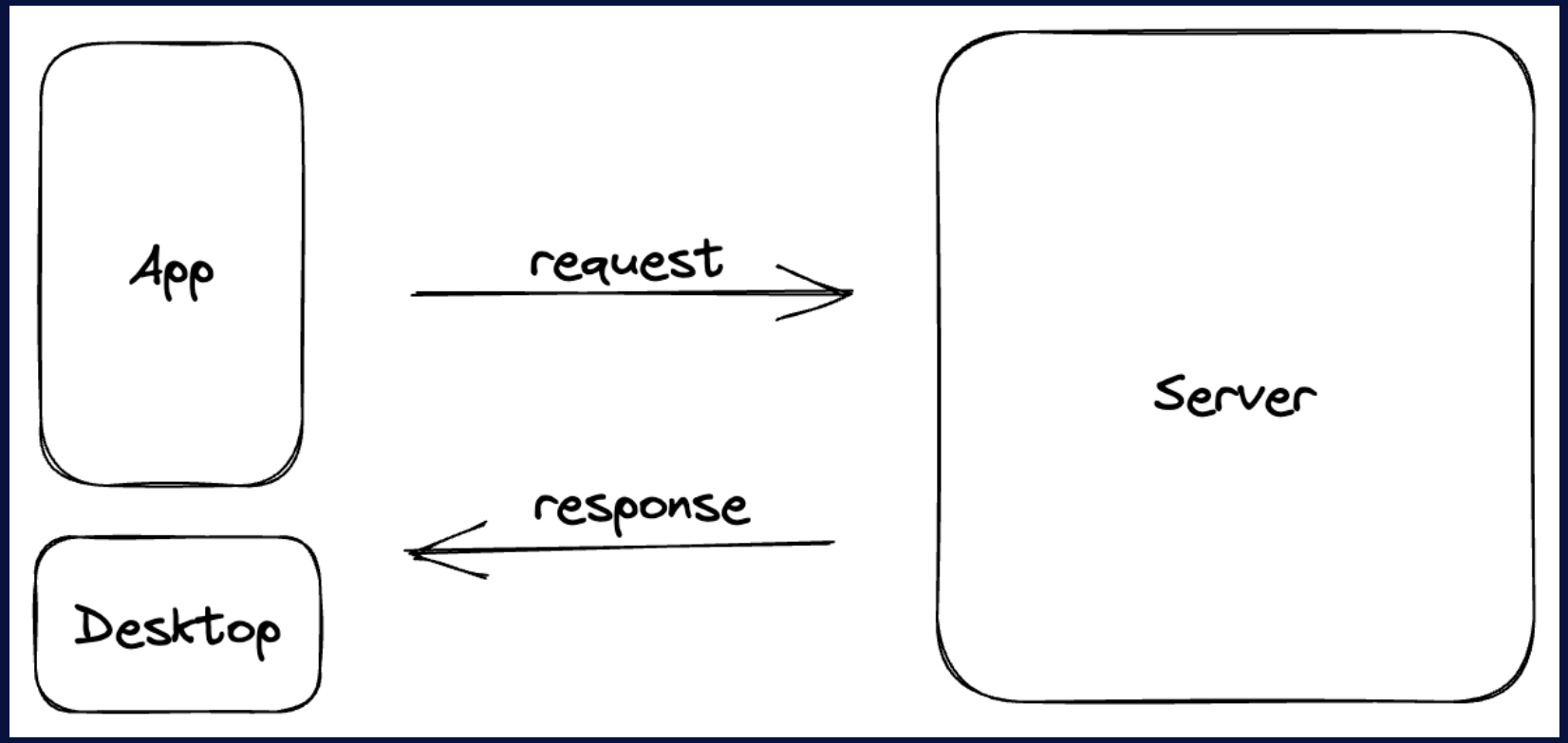
A FRIENDLY INTRODUCTION TO KTOR SERVER

What is Ktor?

- Framework for micro services, web applications, and HTTP services
- Open Source, by JetBrains
- Based on Kotlin Coroutines (asynchronous)


App
request
Server
response
Desktop

Self Contained Package

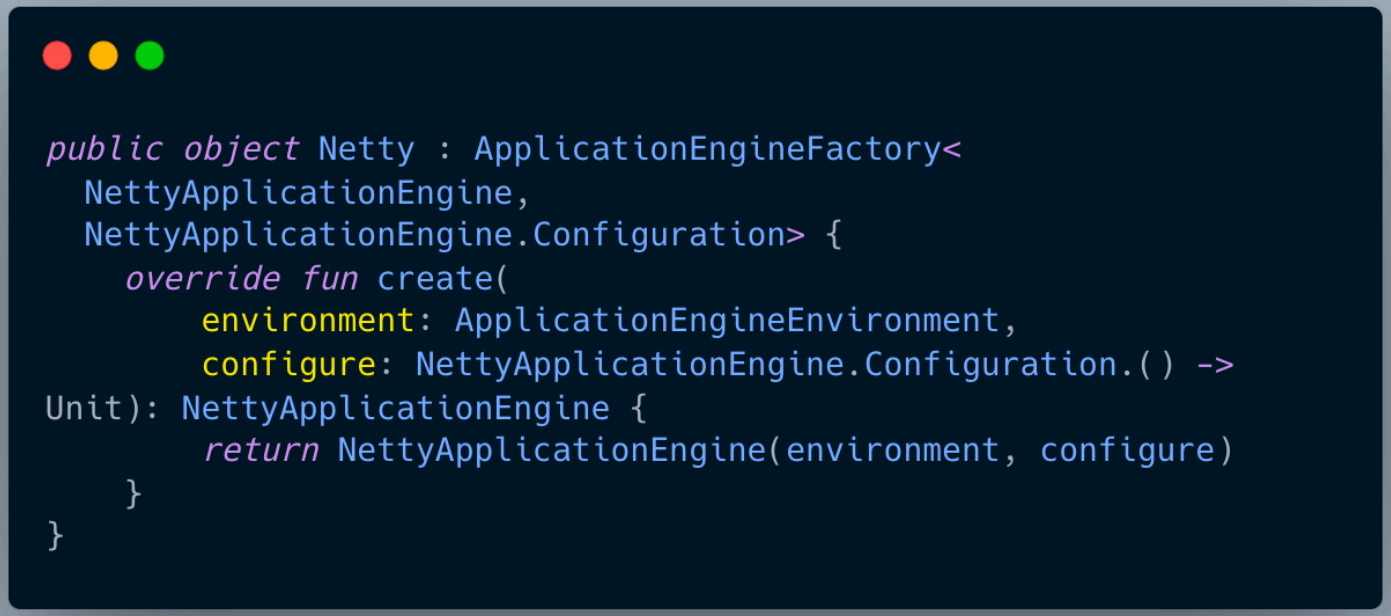
- Application controls the engine settings, connection, and SSL options

Servlet

- Servlet container controls the application lifecycle and connection settings

Your First Server

```
fun main() {
  embeddedServer(
    factory = Netty,
    port = 8080,
    host = "0.0.0.0",
    module = Application::module
  )
  .start(wait = true)
}
```


public object Netty : ApplicationEngineFactory<
NettyApplicationEngine,
NettyApplicationEngine.Configuration> {
override fun create(
environment: ApplicationEngineEnvironment,
configure: NettyApplicationEngine.Configuration.() ->
Unit): NettyApplicationEngine {
return NettyApplicationEngine(environment, configure)
}
}

Application Engine Environment

- Connectors that describe where and how server should listen.
- The running application
- start/stop functions

Application Engine Configuration

- Current parallelism level (e.g. the number of available processors)
- Threads used for new connections, processing connections, parsing messages

Modules

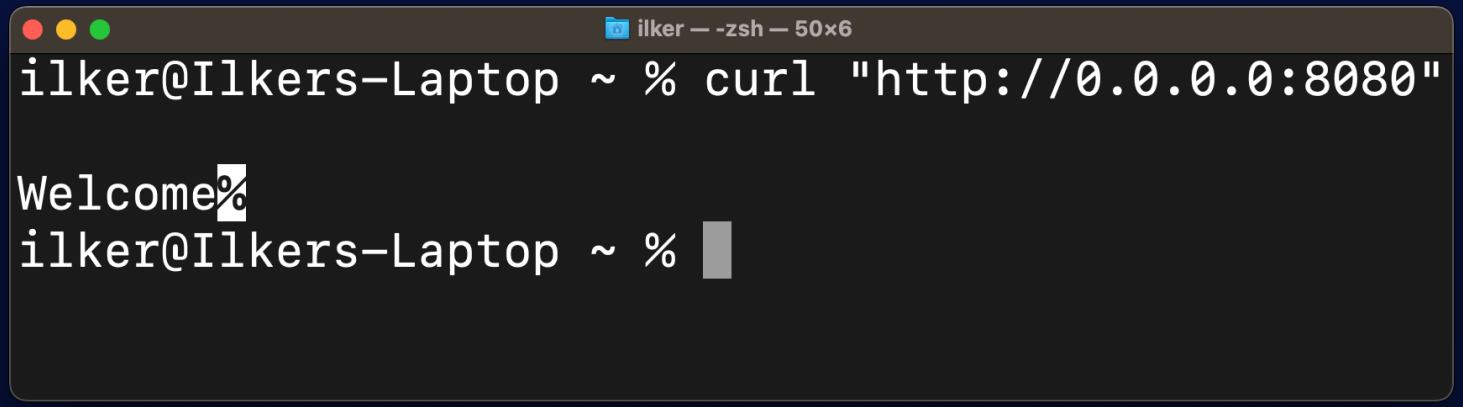
```
public actual val modules:
MutableList<Application.() -> Unit> =
mutableListOf()
```

Extension functions of an Application to structure the plugins

```
fun Application.module() {
    install(Resources)
    install(StatusPages)
    install(RequestValidation)
    configureRouting()
    configureSerialization()
}
```

```
fun Application.configureRouting() {
    routing {
        indexRoute()
        beerRoutes()
    }
}
```

```
fun Route.indexRoute() {
    route("/") {
        get {
            call.respondText(
                text = "Welcome",
                status =
HttpStatusCode.OK
            )
        }
    }
}
```


ilker — -zsh — 50×6
ilker@Ilkers-Laptop ~ % curl "http://0.0.0.0:8080"
Welcome%
ilker@Ilkers-Laptop ~ %

Routing

```
fun Route.beerRoutes() {
    route("/beer") {
        get {...}
        get("{name?}") {...}
        get("{id?}") {...}
        post {...}
        put("{id?}") {...}
        delete("{id?}") {...}
    }
}
```

Type Safe Routing

```
fun Route.beerRoutes() {
    get<resources.Beer> {...}
    get<resources.Beer.Id> {...}
    post<resources.Beer> {...}
    put<resources.Beer.Id> {...}
    delete<resources.Beer.Id> {...}
}
```

Resources

```
@Resource("/beer")
class Beer(
    val name: String? = null
) {
    @Resource("{id}")
    class Id(val parent: Beer =
Beer(), val id: Long)
}
```

Resources

- To define a route handler for a typed resource, pass a resource class to a verb function (get, post, put...).
- Serializable by default

Build Links from Resources

```
val link = href(Beer.Id(id = 1))
```

Get Beers

```
curl --header "Content-Type:
application/json" \
"http://0.0.0.0:8080/beer"
```


{
"data":null,
"errors":[
{"text":"No beers found!"}
]
}


get<resources.Beer> { resource ->
resource.name?.let {
beerStorage
.filter { it.name == resource.name }
.takeIf { it.isNotEmpty() }
?.let {
call.response.status(HttpStatusCode.OK)
call.respond(Response(data = it))
}
}
}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call.response.status(HttpStatusCode.OK)
call.respond(Response(data = it))
}
}
}


get<resources.Beer> { resource ->
resource.name?.let {...}
?: kotlin.run {
call.response.status(
HttpStatusCode.NotFound
)
call.respond(
Response<Beer>(
errors = listOf(
Error(text = "No beers found!")
)
)
)
}
}


get<resources.Beer> { resource ->
resource.name?.let {...}
?: kotlin.run {
call.response.status(
HttpStatusCode.NotFound
)
call.respond(
Response<Beer>(
errors = listOf(
Error(text = "No beers found!")
)
)
)
}
}


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Response<Beer>(
errors = listOf(
Error(text = "No beers found!")
)
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)
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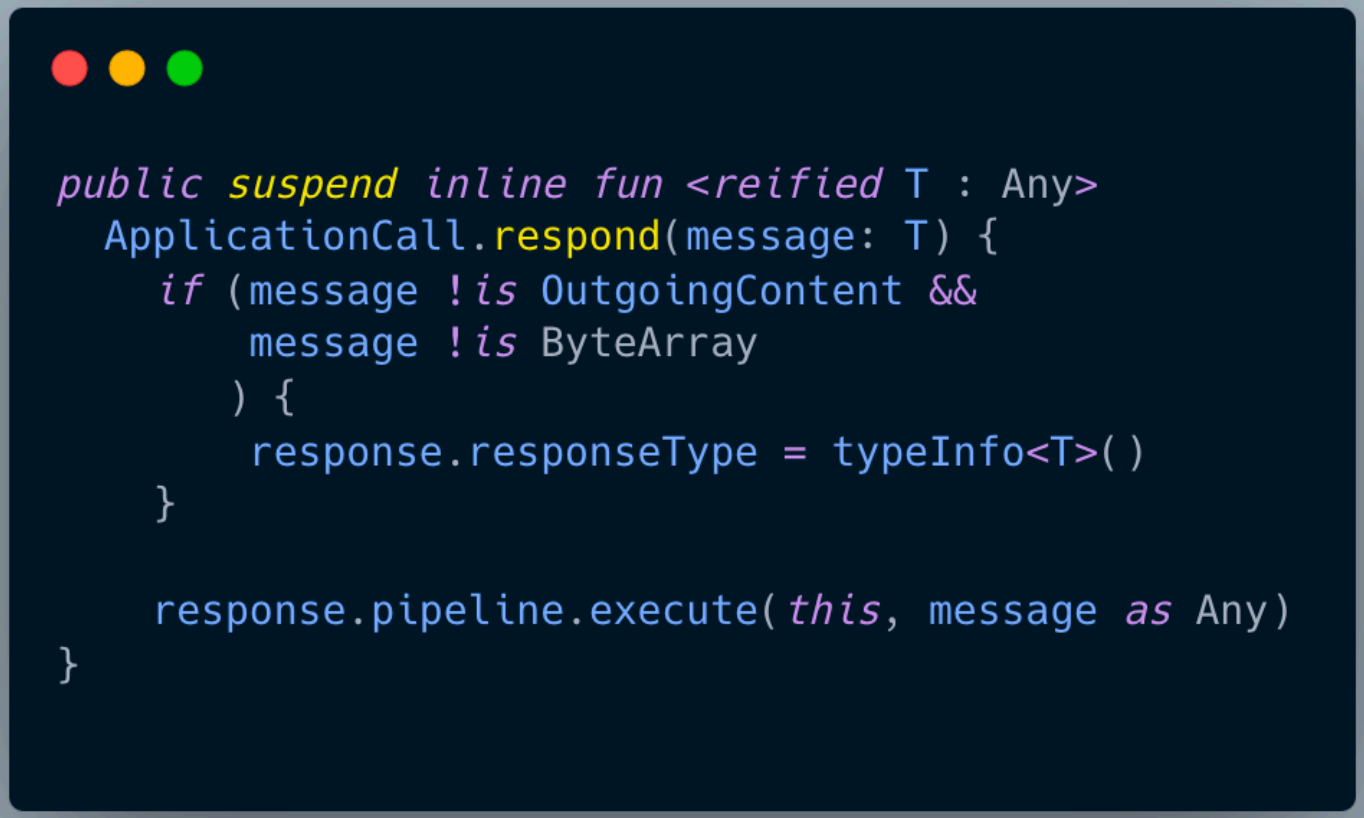
}



```
public suspend inline fun <reified T : Any>
  ApplicationCall.respond(message: T) {
    if (message !is OutgoingContent &&
        message !is ByteArray
       ) {
        response.responseType = typeInfo<T>()
    }

    response.pipeline.execute(this, message as Any)
}
```


public suspend inline fun <reified T : Any>
ApplicationCall.respond(message: T) {
if (message !is OutgoingContent &&
message !is ByteArray
) {
response.responseType = typeInfo<T>()
}
response.pipeline.execute(this, message as Any)
}

Response Model

```
@Serializable
data class Response<T>(
    val data: T? = null,
    val errors: List<Error>? = null
)
```

Create a Beer

```
curl --header "Content-Type:
application/json" \
--data "{"name": "Bock"}" \
"http://0.0.0.0:8080/beer"
```


{
"data":{
"id":5324519225709165061,
"name":"Bock"
},
"errors":null
}


post<resources.Beer> {
val beer = call.receive<BeerToCreate>()
val id = Random.nextLong()
beerStorage.add(
Beer(id = id, name = beer.name)
)
beerStorage.find { it.id == id }?.let {
call.response.status(HttpStatusCode.Created)
call.respond(Response(data = it))
}
}


post<resources.Beer> {
val beer = call.receive<BeerToCreate>()
val id = Random.nextLong()
beerStorage.add(
Beer(id = id, name = beer.name)
)
beerStorage.find { it.id == id }?.let {
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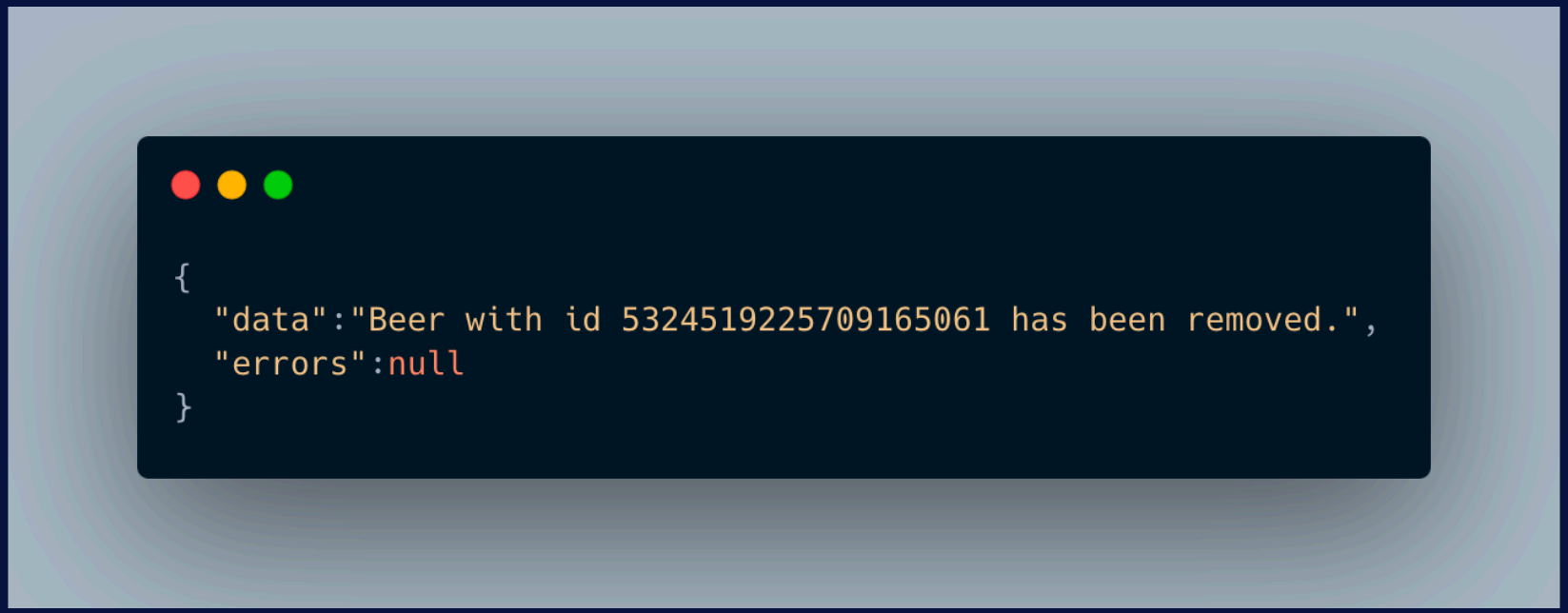
Beer(id = id, name = beer.name)
)
beerStorage.find { it.id == id }?.let {
call.response.status(HttpStatusCode.Created)
call.respond(Response(data = it))
}
}


public suspend inline fun <reified T : Any>
ApplicationCall.receive(): T =
receiveNullable(typeInfo<T>())
?: throw
CannotTransformContentToTypeException(
typeInfo<T>().kotlinType!!
)

Delete a Beer

```
curl --header \
"Content-Type: application/json" \
--request DELETE \
"http://0.0.0.0:8080/beer/532..."
```


{
"data":"Beer with id 5324519225709165061 has been removed.",
"errors":null
}


delete<resources.Beer.Id> { resource ->
val id = resource.id
if (beerStorage.removeIf { it.id == id }) {
call.response.status(HttpStatusCode.Accepted)
call.respond(
Response(
data = "Beer with id $id has been removed."
)
)
} else {
// Error
}
}


delete<resources.Beer.Id> { resource ->
val id = resource.id
if (beerStorage.removeIf { it.id == id }) {
call.response.status(HttpStatusCode.Accepted)
call.respond(
Response(
data = "Beer with id $id has been removed."
)
)
} else {
// Error
}
}


delete<resources.Beer.Id> { resource ->
val id = resource.id
if (beerStorage.removeIf { it.id == id }) {
call.response.status(HttpStatusCode.Accepted)
call.respond(
Response(
data = "Beer with id $id has been removed."
)
)
} else {
// Error
}
}

SSL and Certificates

- Ktor uses Java KeyStore (JKS) as a storage facility for certificates.
- Self-signed certificates for testing purposes by calling `buildKeyStore()`.


fun main() {
val keyStoreFile = File("build/keystore.jks")
val keyStore = buildKeyStore {
certificate("alias") {
password = "password"
domains = listOf(
"127.0.0.1",
"0.0.0.0",
"localhost"
)
}
}
keyStore.saveToFile(keyStoreFile, "password")
}


fun main() {
val keyStoreFile = File("build/keystore.jks")
val keyStore = buildKeyStore {
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domains = listOf(
"127.0.0.1",
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domains = listOf(
"127.0.0.1",
"0.0.0.0",
"localhost"
)
}
}
keyStore.saveToFile(keyStoreFile, "password")
}


fun main() {
...
val environment = applicationEngineEnvironment {
sslConnector(
keyStore = keyStore,
keyAlias = "alias",
keyStorePassword = { "password".toCharArray() },
privateKeyPassword = { "password".toCharArray() }
) {
port = 8443
keyStorePath = keyStoreFile
}
module(Application::module)
}
}


fun main() {
...
val environment = applicationEngineEnvironment {
sslConnector(
keyStore = keyStore,
keyAlias = "alias",
keyStorePassword = { "password".toCharArray() },
privateKeyPassword = { "password".toCharArray() }
) {
port = 8443
keyStorePath = keyStoreFile
}
module(Application::module)
}
}

```
fun main() {
    ...

    embeddedServer(
        factory = Netty,
        environment = environment
    ).start(wait = true)
}
```

Send HTML in Response


fun Application.module() {
routing {
get("/beer") {
val beers = listOf("Bock", "Glitch")
call.respondHtml(HttpStatusCode.OK) {
head {
title { +"Beers" }
}
body {
h1 { +${beers.joinToString(",")} }
}
}
}
}
}


fun Application.module() {
routing {
get("/beer") {
val beers = listOf("Bock", "Glitch")
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head {
title { +"Beers" }
}
body {
h1 { +${beers.joinToString(",")} }
}
}
}
}
}

Respond with HTML Form


get("/beer") {
call.respondHtml {
body {
form(
action = "/beer",
encType = FormEncType.applicationXWwwFormUrlEncoded,
method = FormMethod.post
) {
p {
+"Beer Name:"
textInput(name = "beer name")
}
p {
submitInput() { value = "Create Beer" }
}
}
}
}

Templates

- To respond, call the `respondHtmlTemplate()`.
- To create a template, implement the `Template` interface.
- Inside templates, use `Placeholder` or `TemplatePlaceholder`.

Conclusions


ALWAYS HAS BEEN
KOTLIN IS CAPABLE
OF EVERYTHING
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USE KOTLIN
ONLY FOR BACKEND
USE KOTLIN
BOTH FOR
FRONTEND AND BACKEND
USE KOTLIN
FOR ANDROID,
IOS, FRONTEND,
BACKEND, DESKTOP
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The Repository

Where To Stalk Me

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