Modern Software Engineering

Building Better Software Faster

Dave Farley

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https://bit.ly/CDonYT

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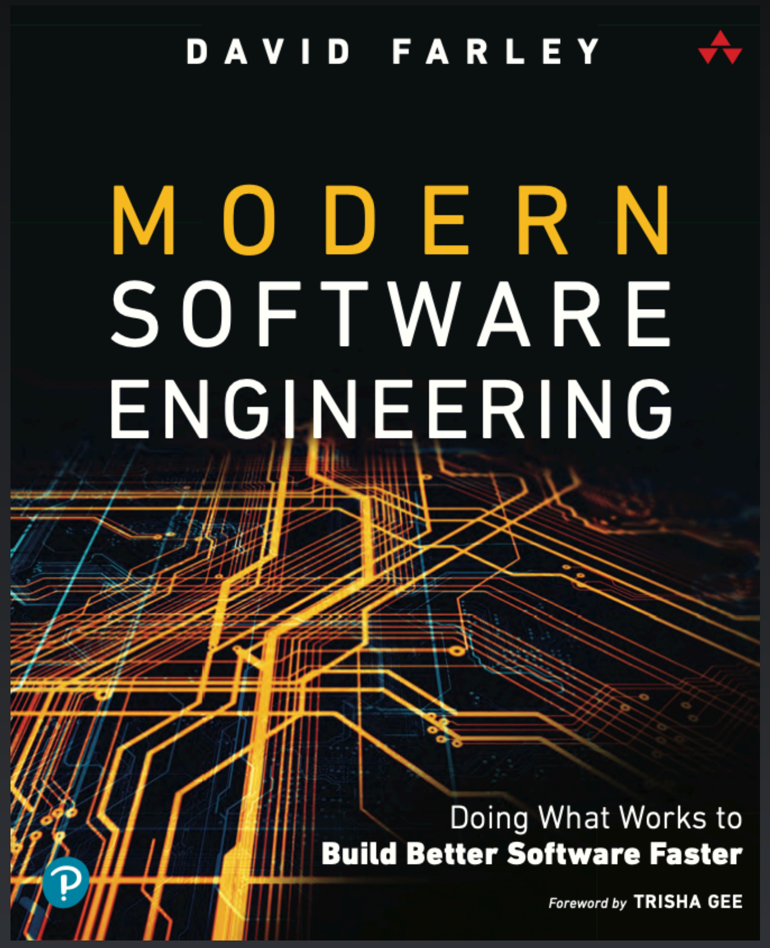
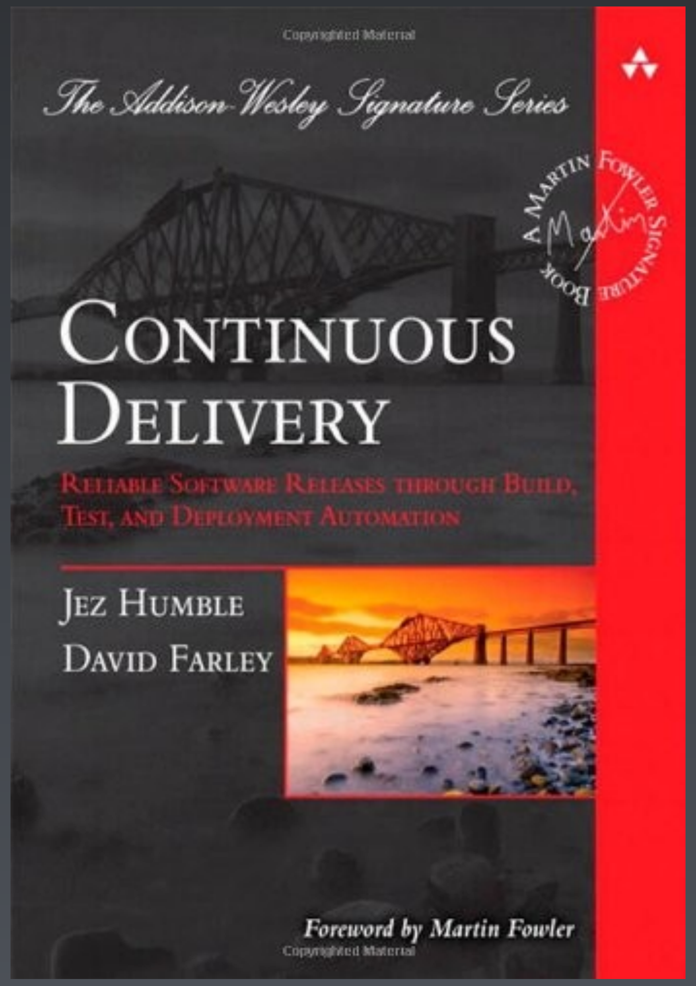
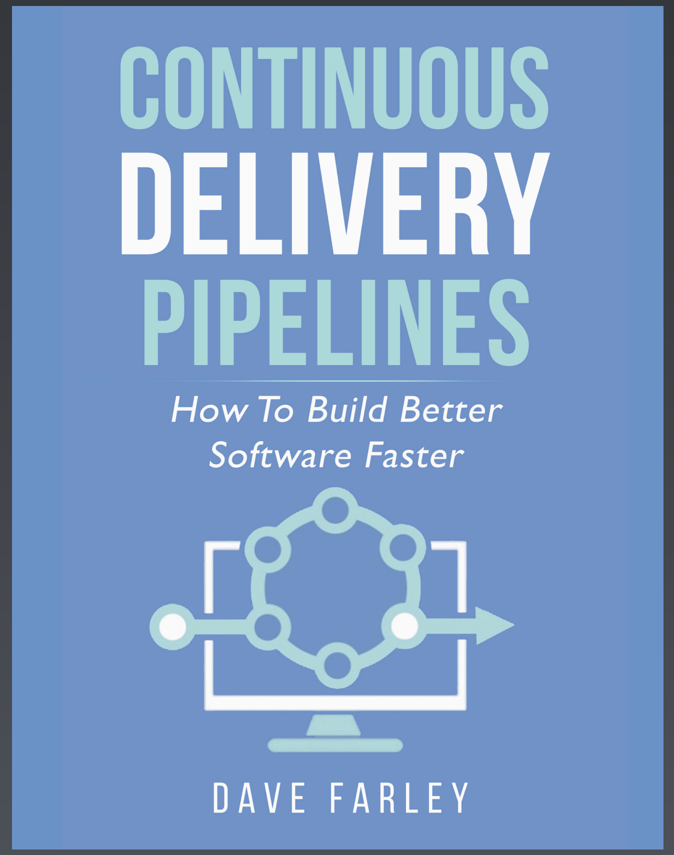
http://www.continuous-delivery.co.uk


DAVID FARLEY
MODERN SOFTWARE ENGINEERING
Doing What Works to Build Better Software Faster
Foreword by TRISHA GEE


The Addison-Wesley Signature Series
Continuous Delivery
Reliable Software Releases through Build, Test, and Deployment Automation
Jez Humble
David Farley
Foreword by Martin Fowler


CONTINUOUS DELIVERY PIPELINES
How To Build Better Software Faster
DAVE FARLEY

- ***What is Engineering***

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- ***What is Engineering***
- ***Common Foundational Principles***

- *What is Engineering*
- *Common Foundational Principles*
- *10 Guiding Principles for Software Engineering*

- What is Engineering
- Common Foundational Principles
- 10 Guiding Principles for Software Engineering
- Applying the Guidelines to Code

What is Engineering

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- ***Engineering in Other Disciplines is:***

  "The Stuff That Works"

- Engineering in Other Disciplines is:
  "The Stuff That Works"

- Software is Difficult!
  So What "Works" for Us?

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All Engineering is not the same!

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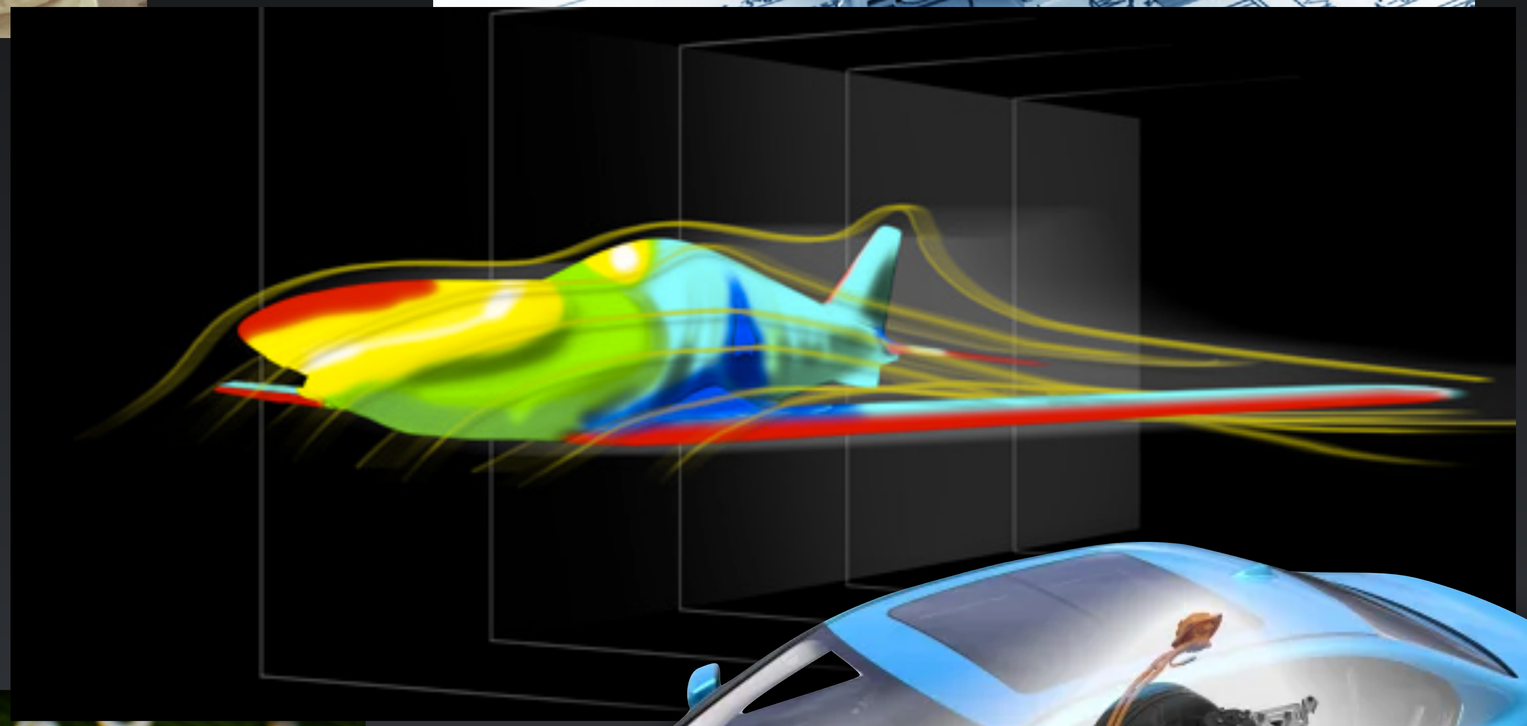
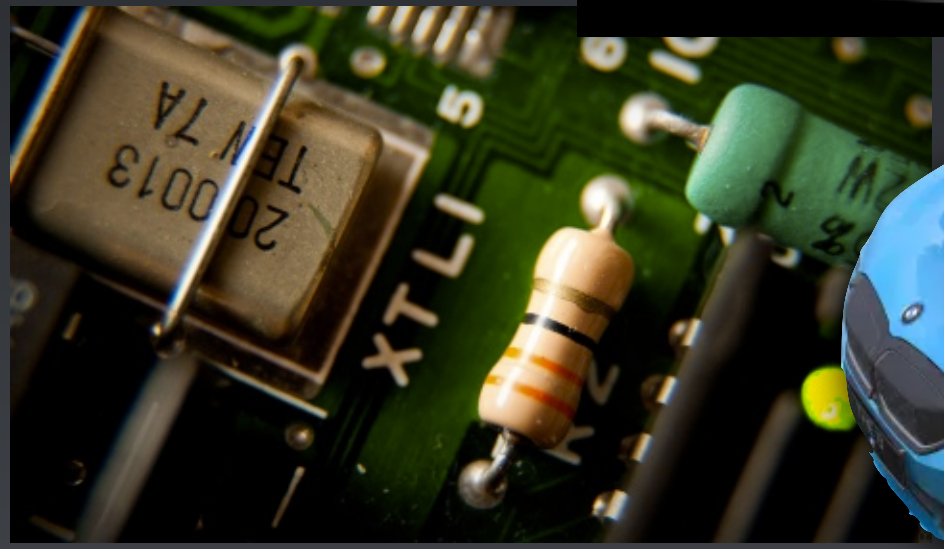
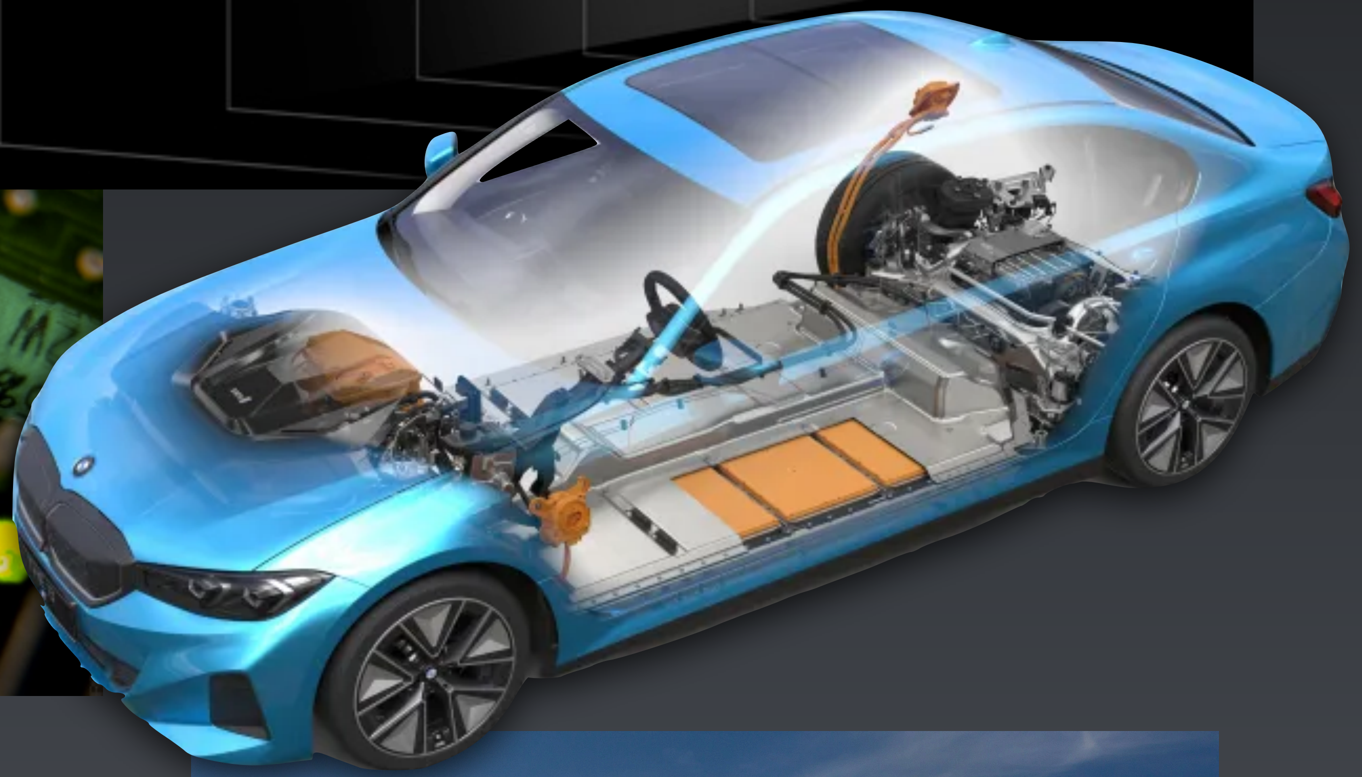
All Engineering is not the same!



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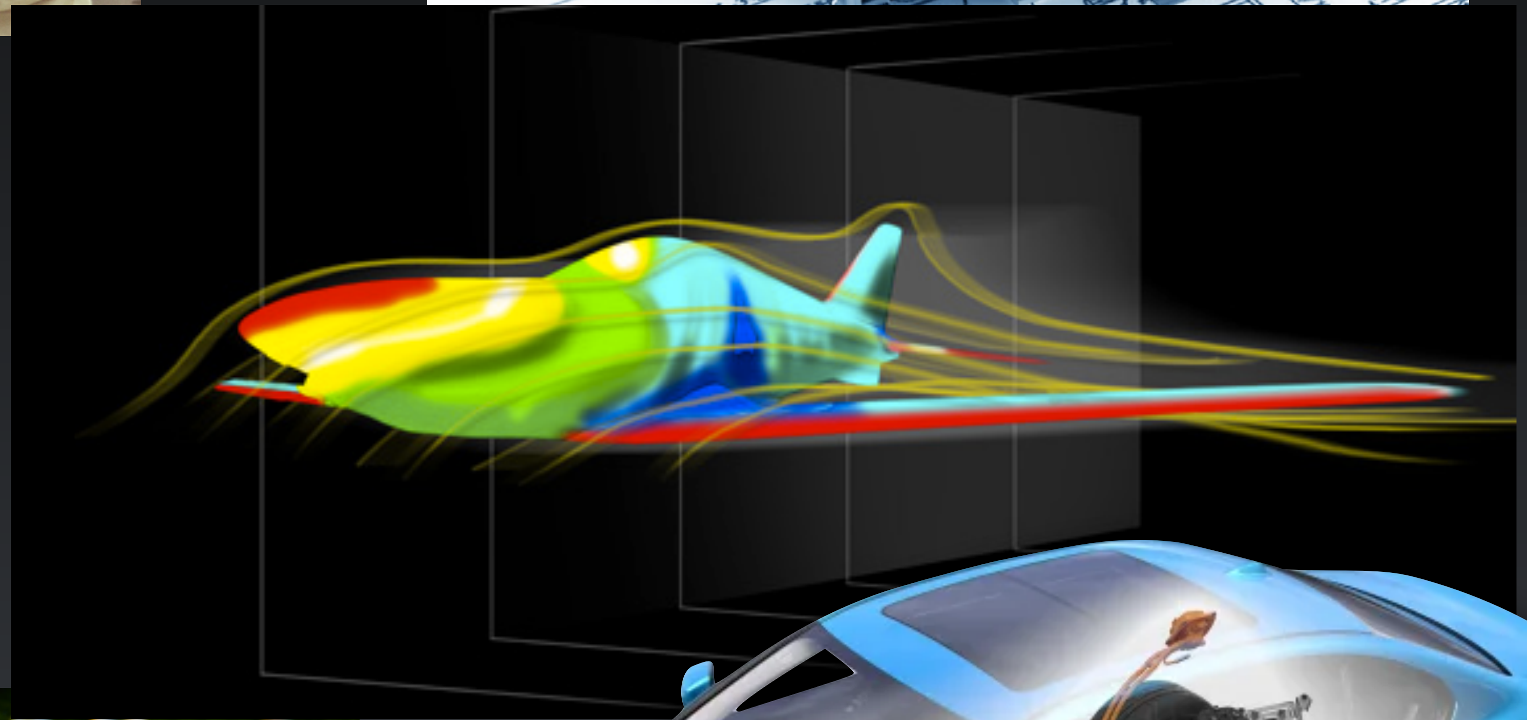
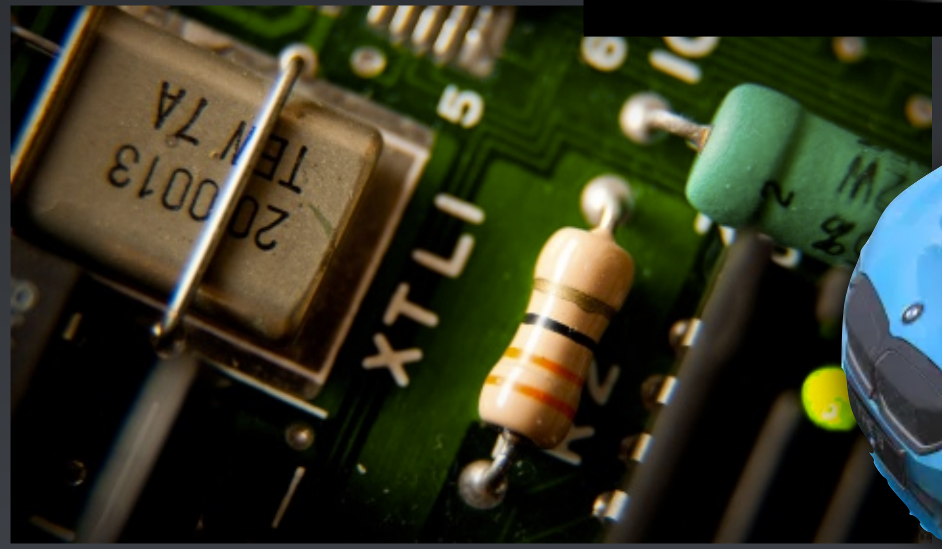
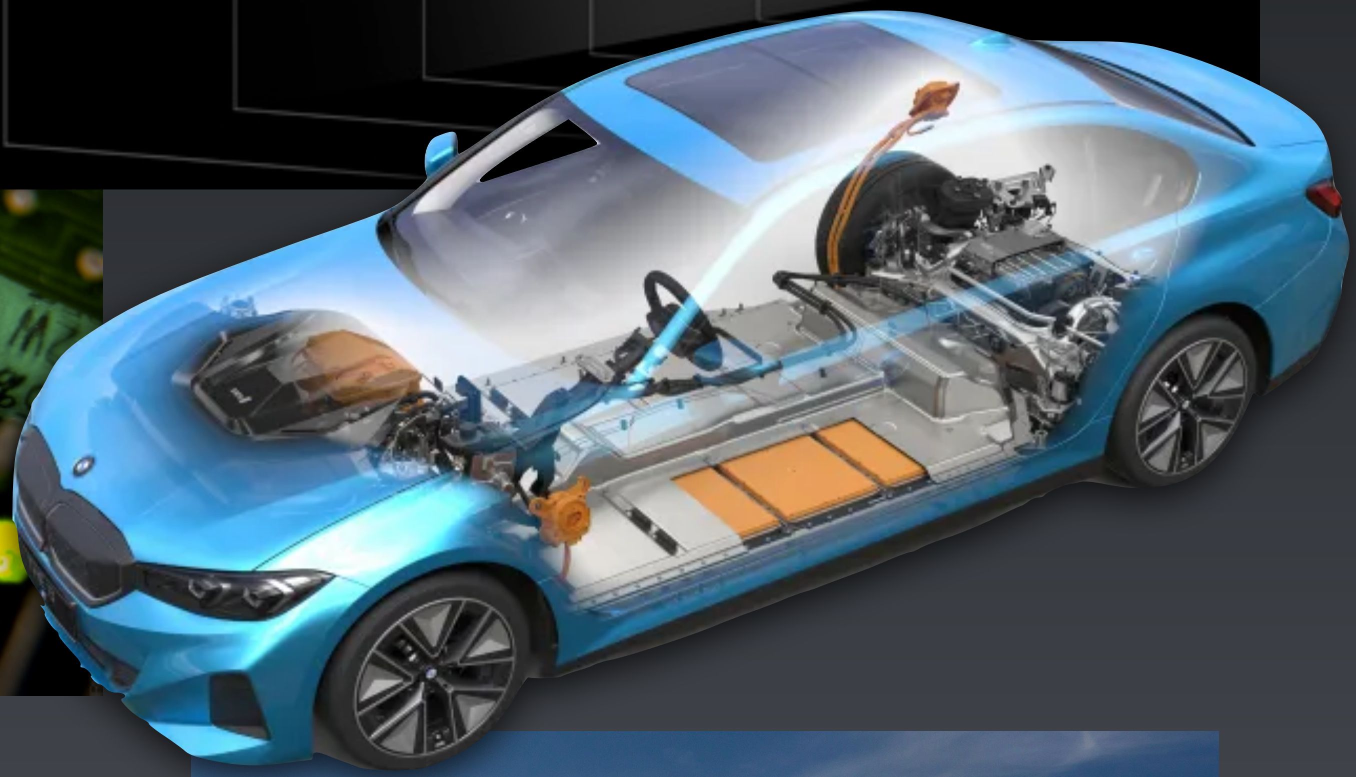
Learning From Other Engineering Disciplines



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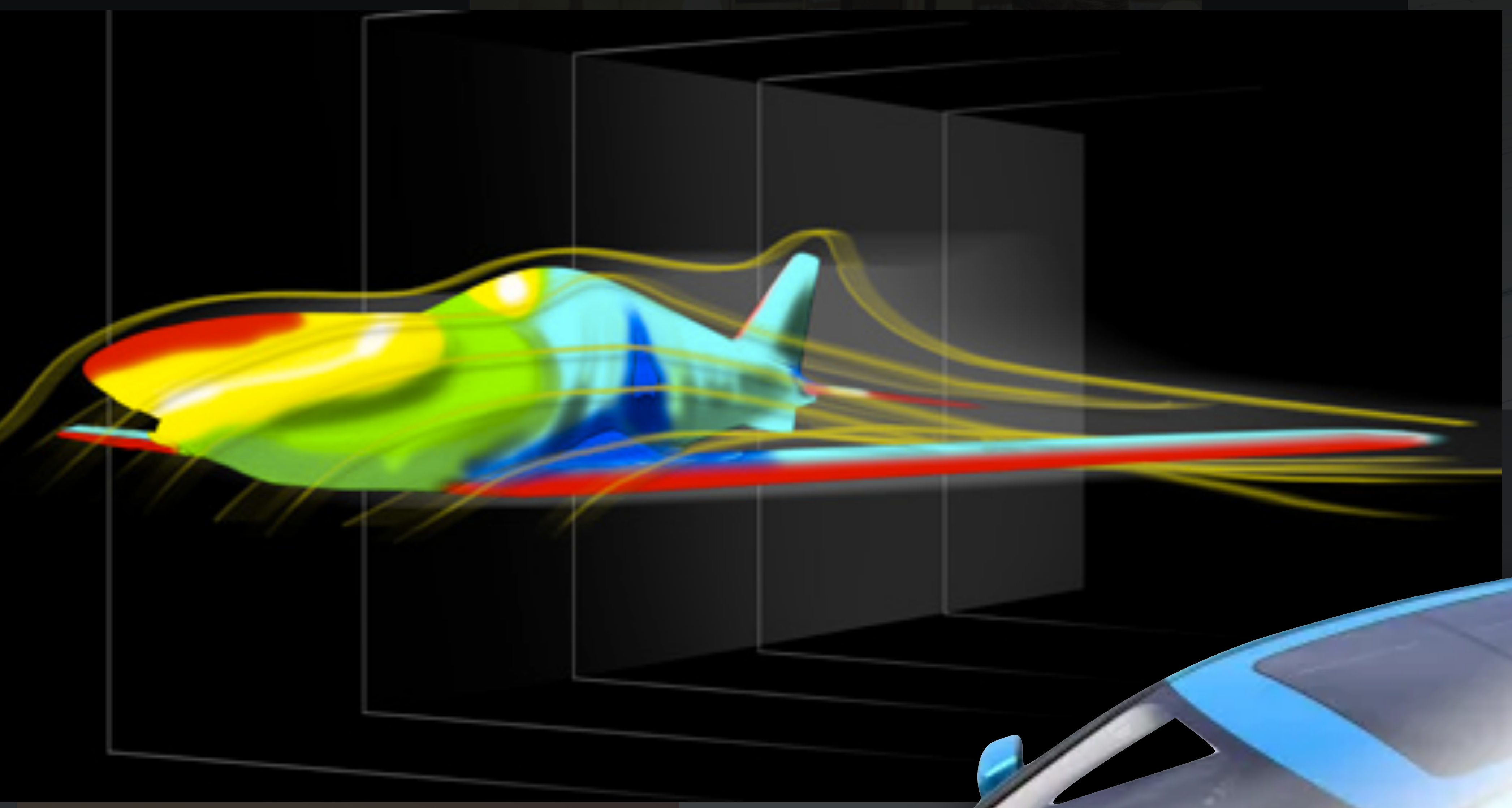
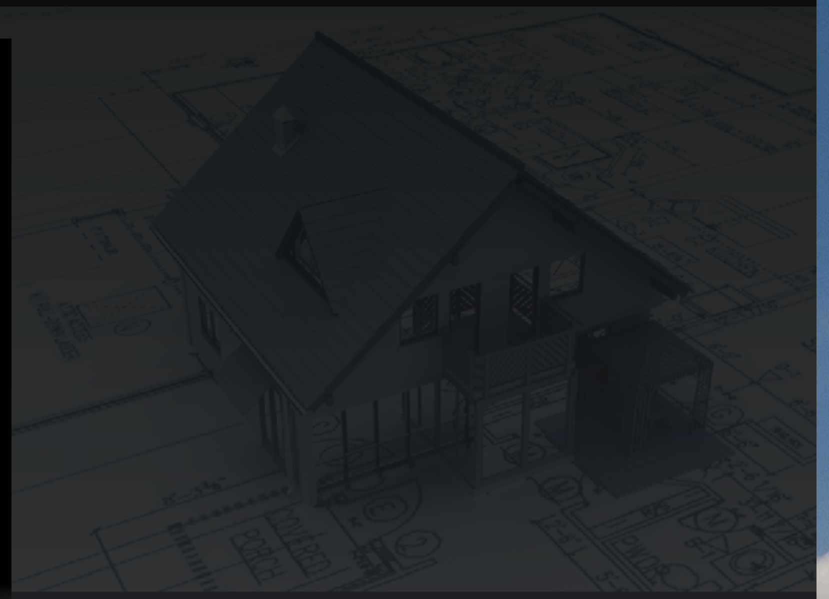
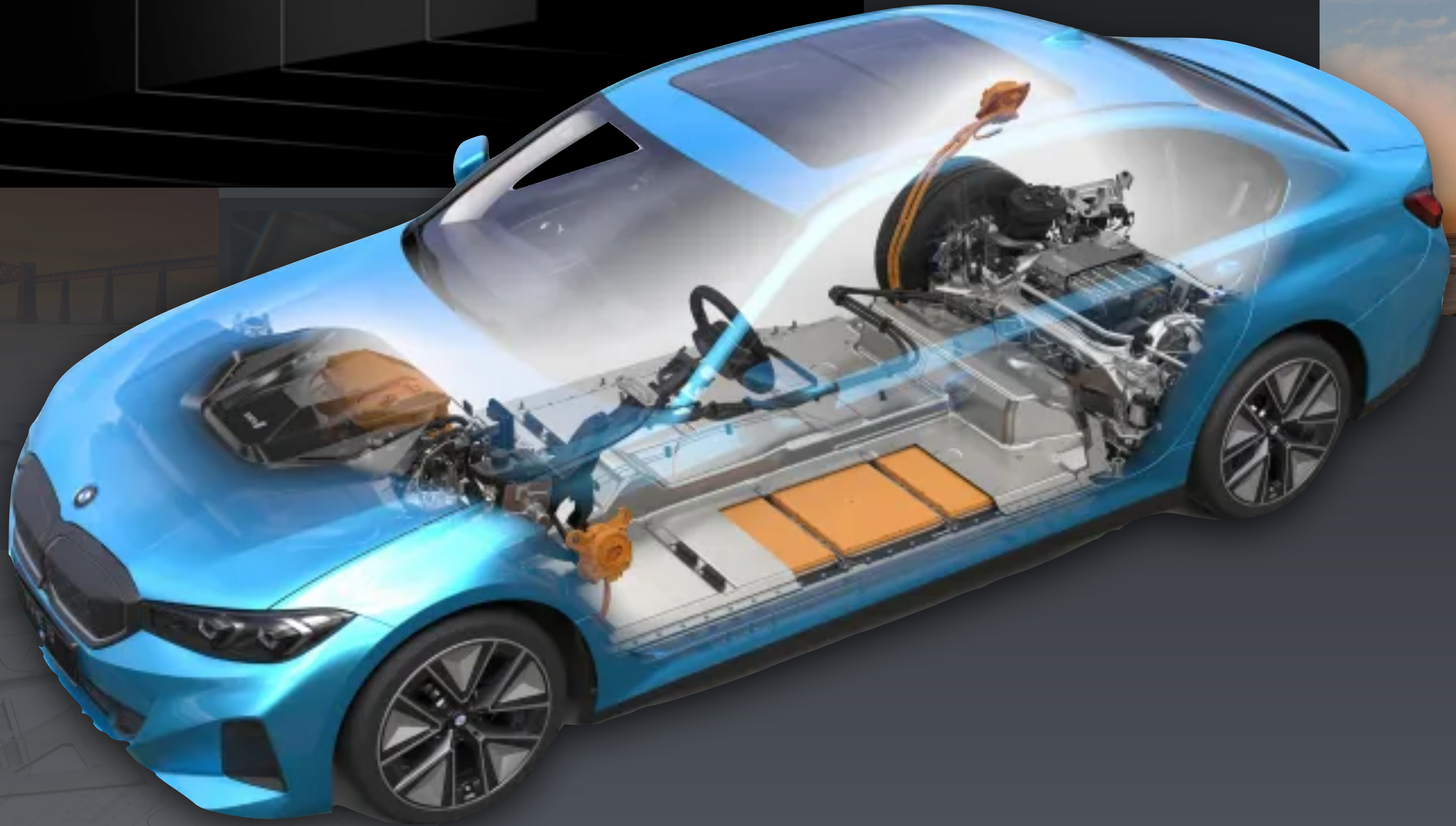
Learning From Other Engineering Disciplines



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Learning From Other Engineering Disciplines

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Learning From Other Engineering Disciplines

What Does This Mean for Us?

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What is ‘Engineering’?

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What is ‘Engineering’?

***Engineering** is the application of an empirical, scientific approach to finding efficient solutions to practical problems.*

(Dave Farley - Just Now!)

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To Put It More Simply…

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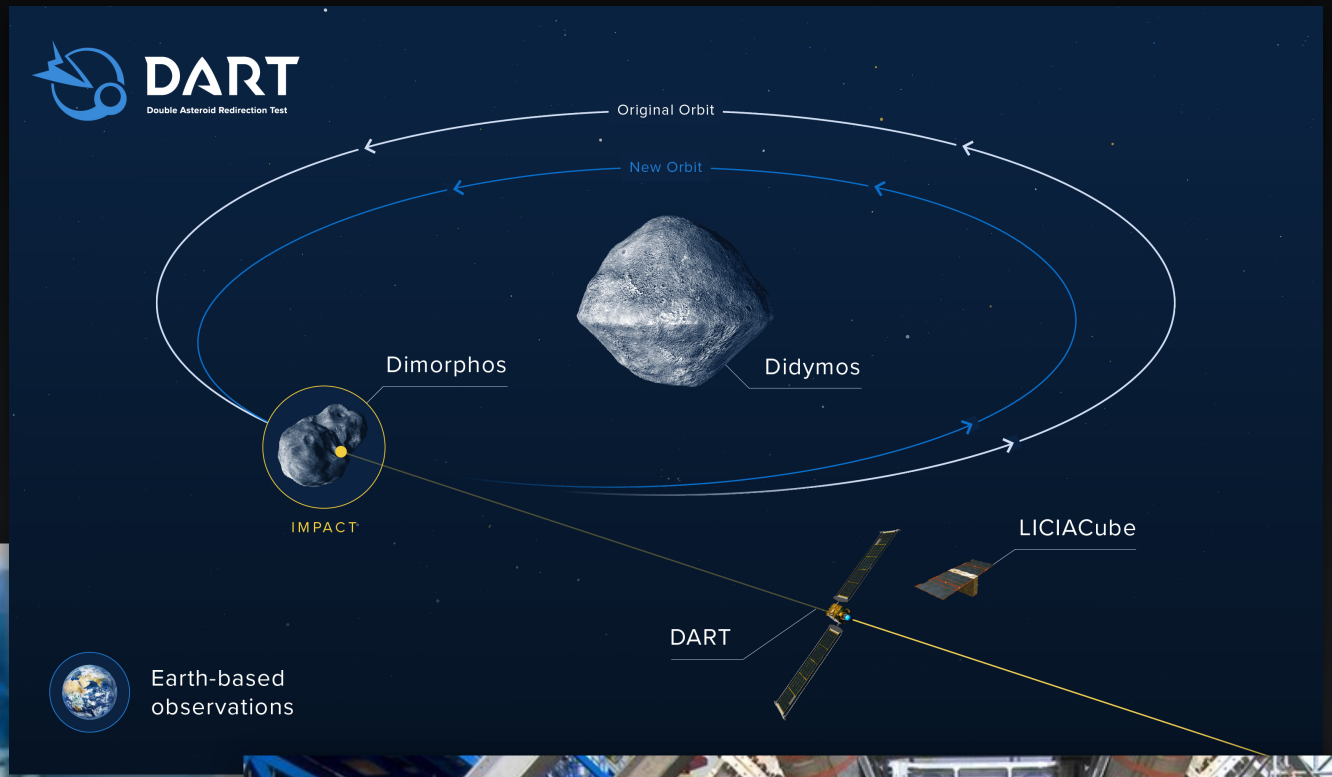
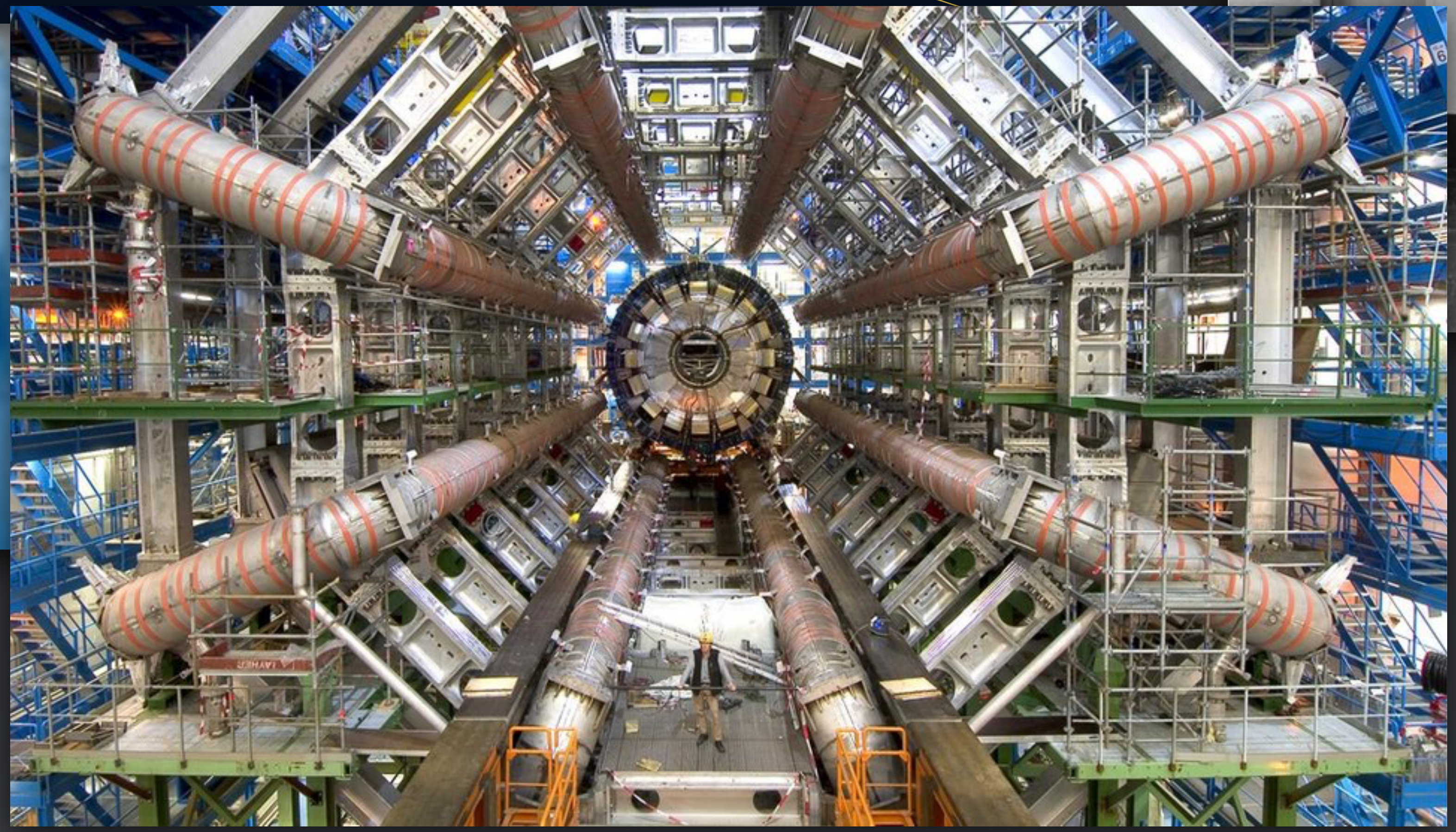
To Put It More Simply…





Engineering

is How We Solve the Hard Problems!

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To Put It More Simply…

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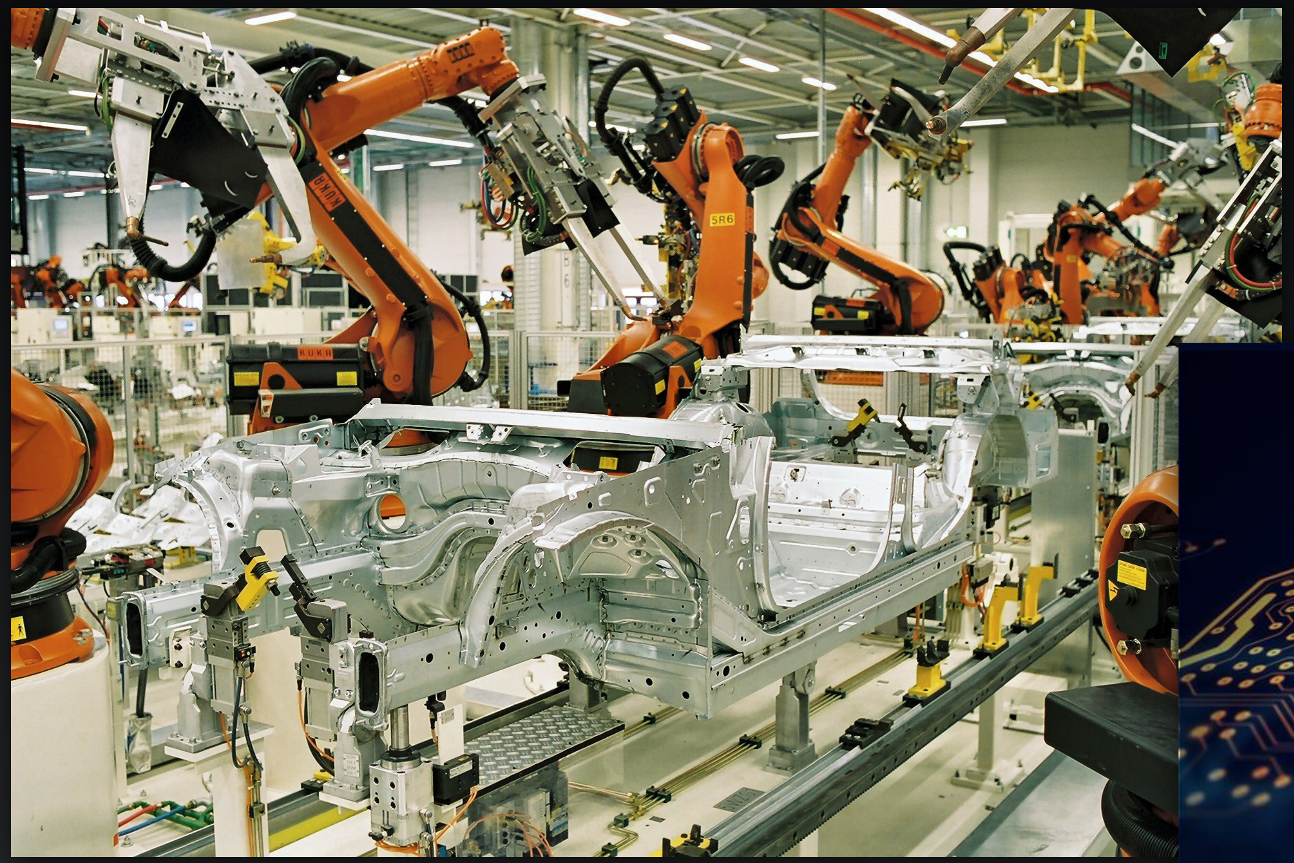
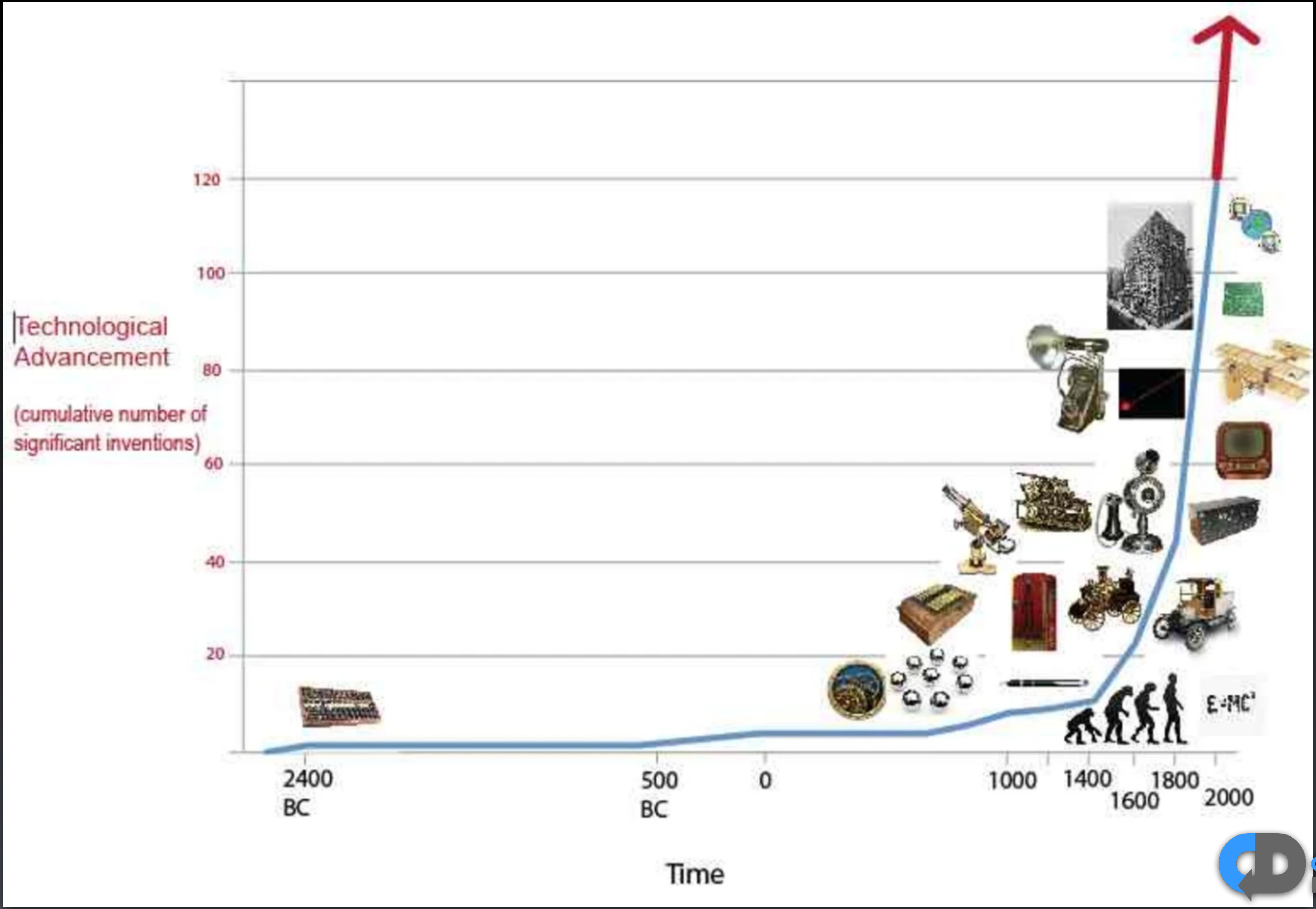
To Put It More Simply…



Engineering

The Foundation on Which Our High-Tech Culture is Built!



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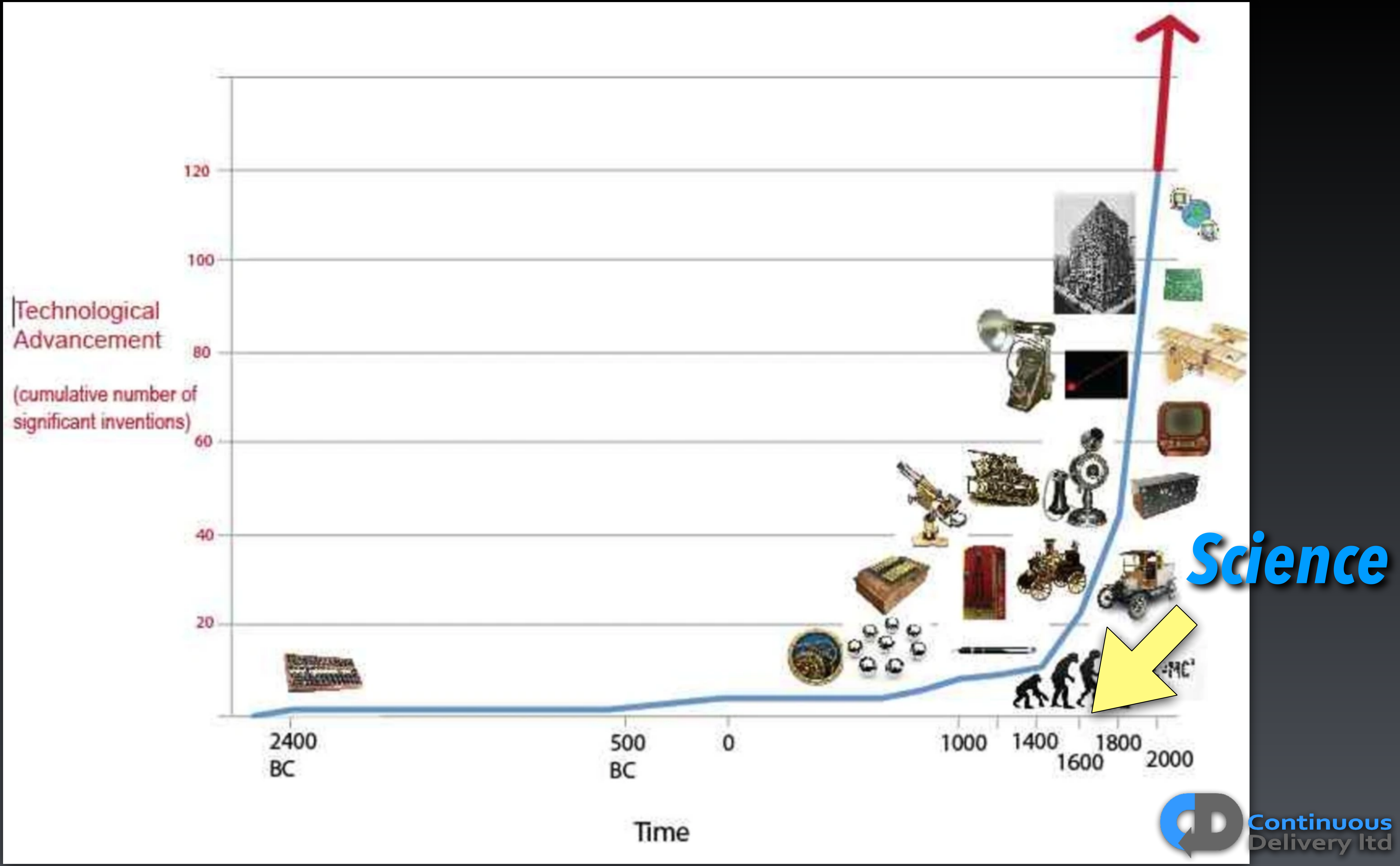

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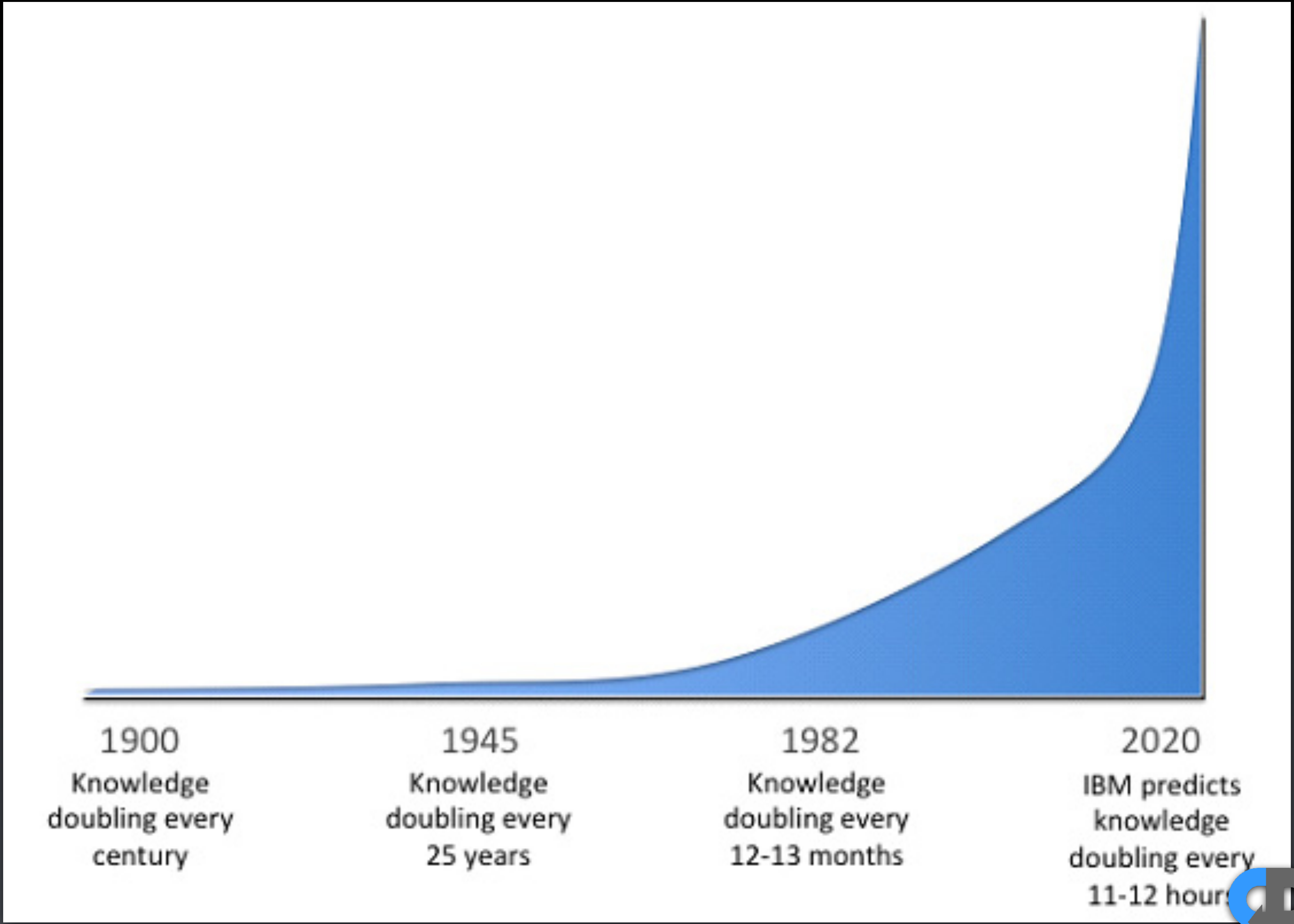

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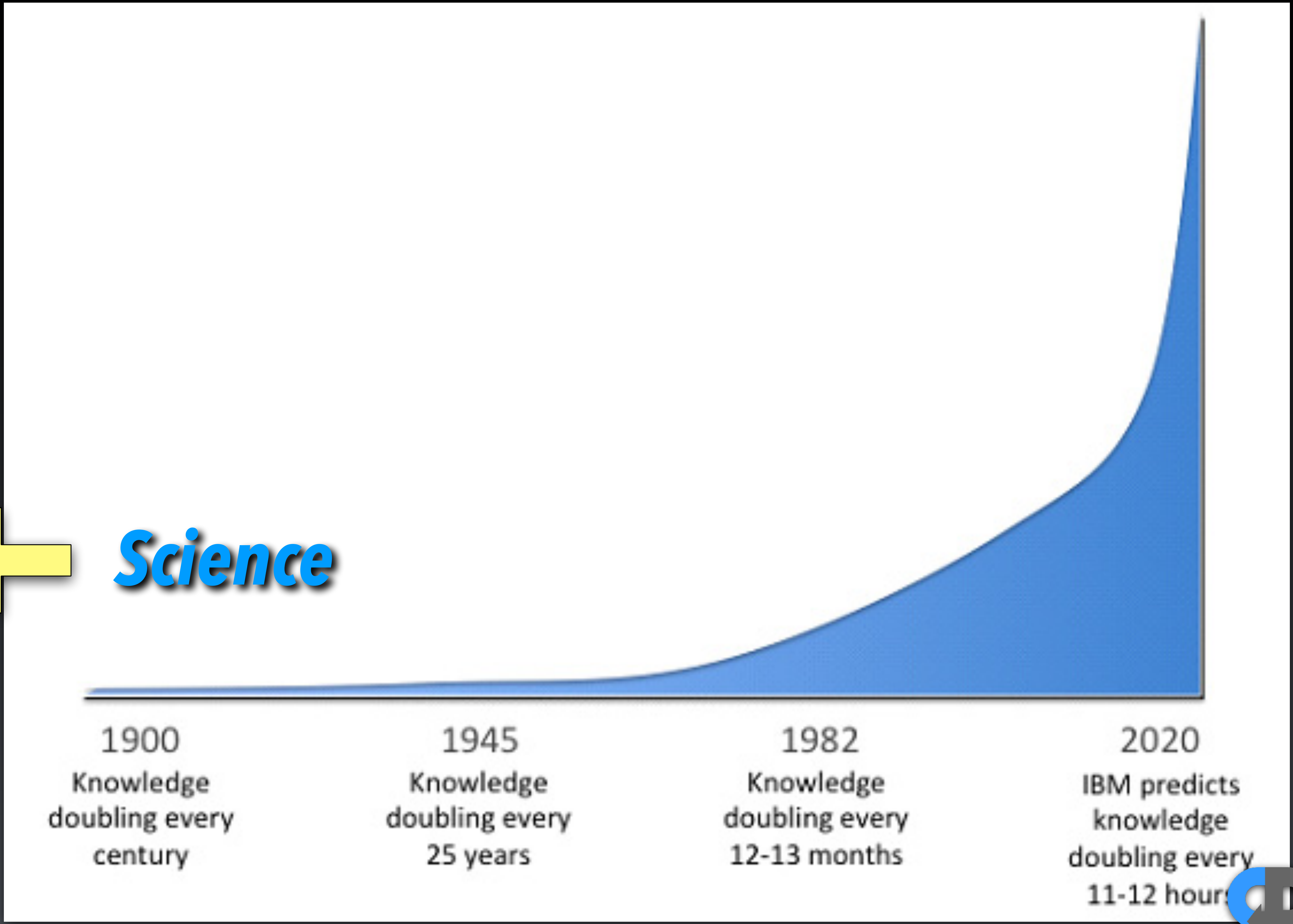

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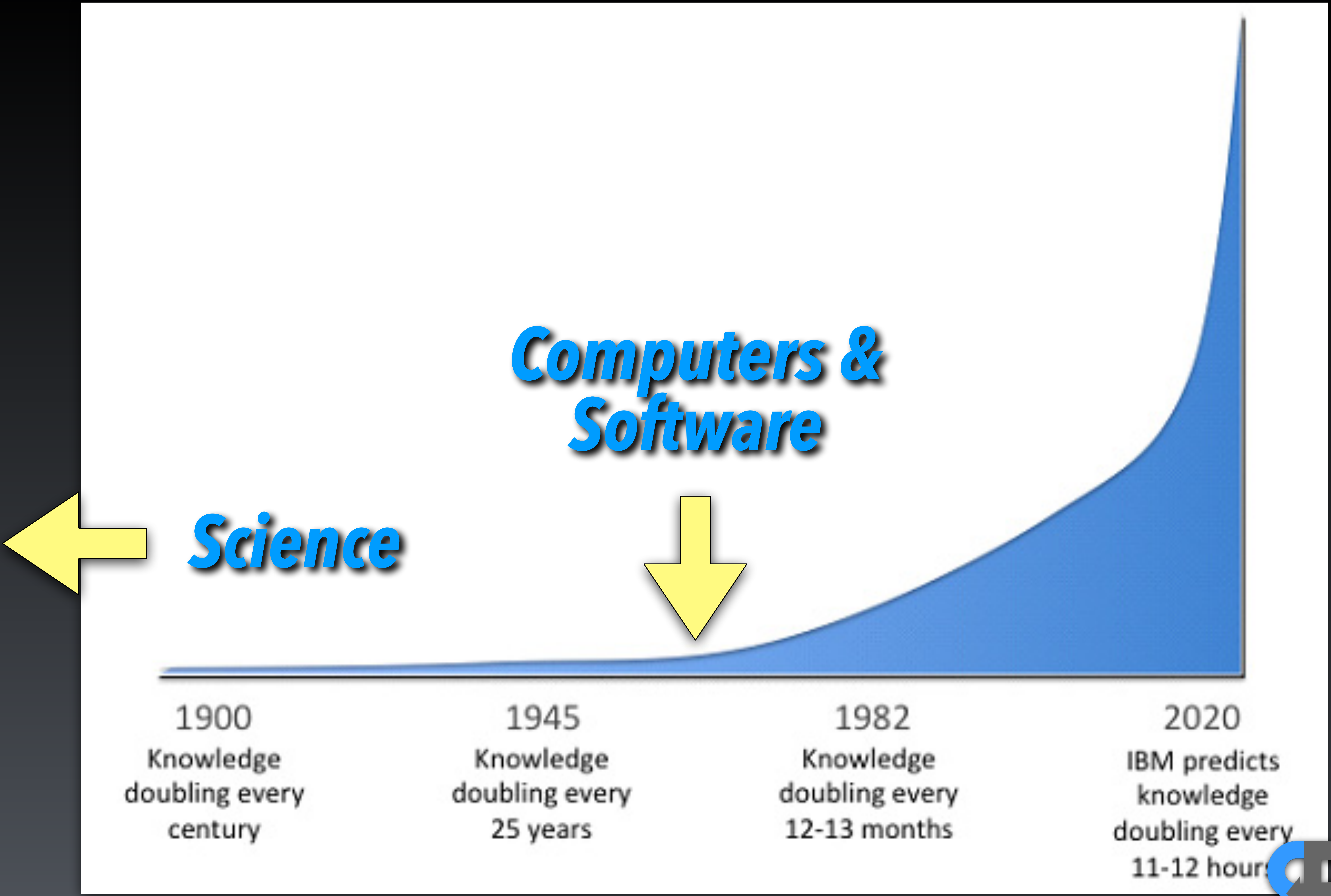

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What is Engineering Really For?

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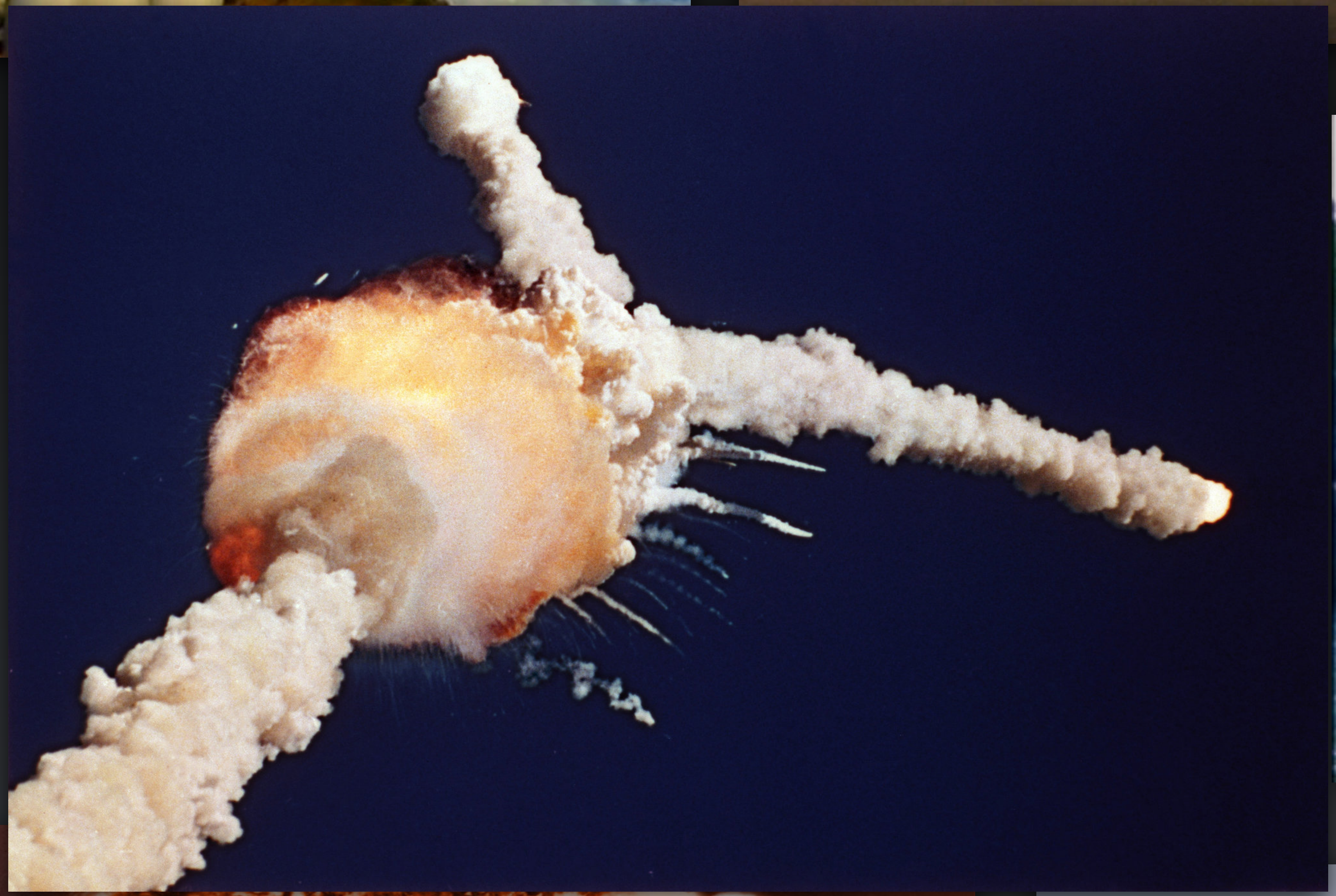

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It's Not to Define Solutions!

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It Rules Out Bad Ideas!

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“The Things We Can’t Afford to Get Wrong”

“The Things We Can’t Afford to Get Wrong”

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~~“The Things We Can’t Afford to Get Wrong”~~

This is NOT Our Problem!

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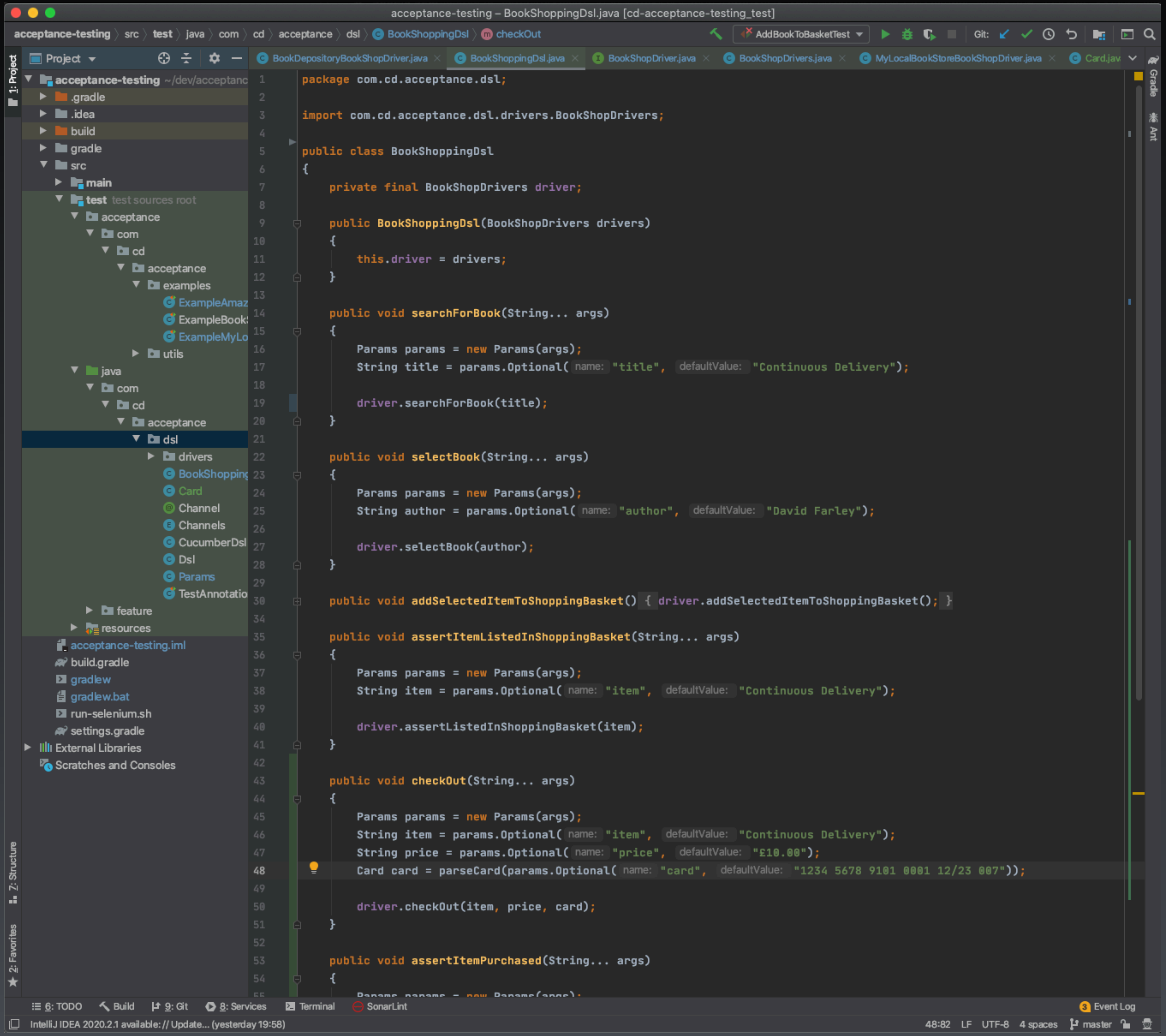

```java
package com.cd.acceptance.dsl;

import com.cd.acceptance.dsl.drivers.BookShopDrivers;

public class BookShoppingDsl
{
    private final BookShopDrivers driver;

    public BookShoppingDsl(BookShopDrivers drivers)
    {
        this.driver = drivers;
    }

    public void searchForBook(String... args)
    {
        Params params = new Params(args);
        String title = params.Optional( name: "title",  defaultValue: "Continuous Delivery");

        driver.searchForBook(title);
    }

    public void selectBook(String... args)
    {
        Params params = new Params(args);
        String author = params.Optional( name: "author",  defaultValue: "David Farley");

        driver.selectBook(author);
    }

    public void addSelectedItemToShoppingBasket() { driver.addSelectedItemToShoppingBasket(); }

    public void assertItemListedInShoppingBasket(String... args)
    {
        Params params = new Params(args);
        String item = params.Optional( name: "item",  defaultValue: "Continuous Delivery");

        driver.assertListedInShoppingBasket(item);
    }

    public void checkOut(String... args)
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        Params params = new Params(args);
        String item = params.Optional( name: "item",  defaultValue: "Continuous Delivery");
        String price = params.Optional( name: "price",  defaultValue: "£10.00");
        Card card = parseCard(params.Optional( name: "card",  defaultValue: "1234 5678 9101 0001 12/23 007"));

        driver.checkOut(item, price, card);
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    public void assertItemPurchased(String... args)
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```

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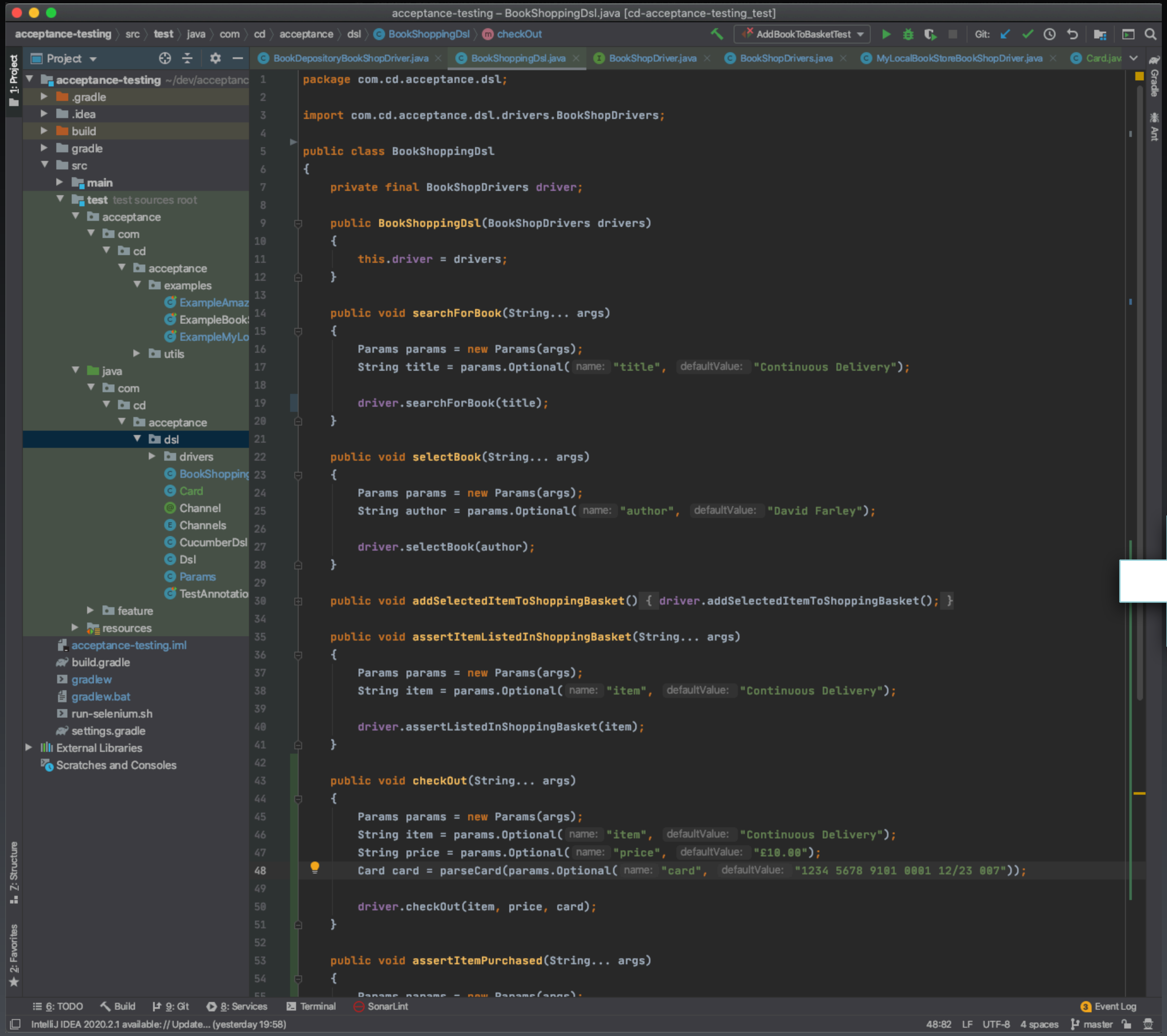
acceptance-testing – BookShoppingDsl.java [cd-acceptance-testing_test]
BookDepositoryBookShopDriver.java
BookShoppingDsl.java
BookShopDriver.java
BookShopDrivers.java
MyLocalBookStoreBookShopDriver.java
AddBookToBasketTest

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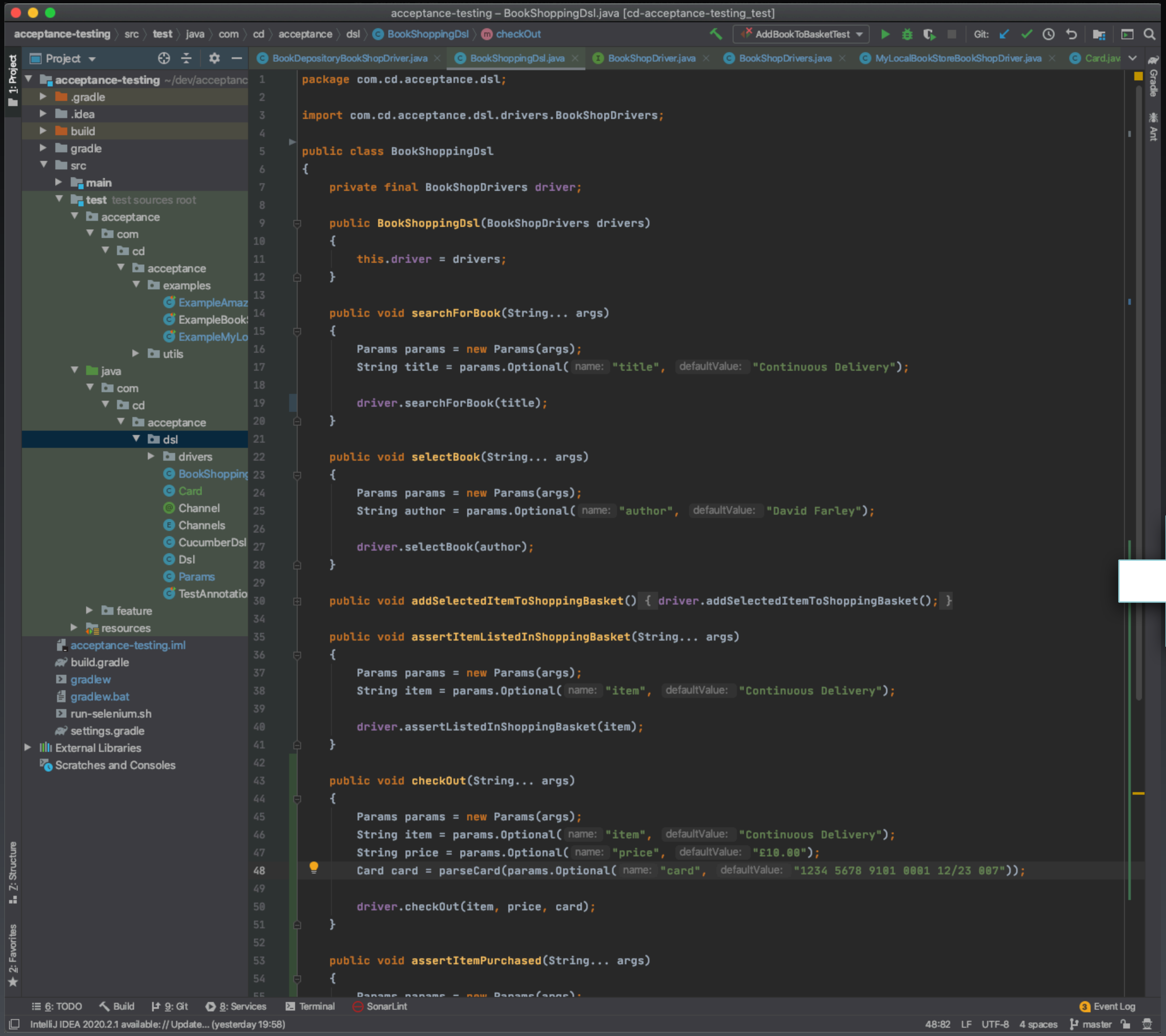

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    {
```

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DEPLOY

We Can Recreate Entire Systems for Free!

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Engineering *IS* About Exploration & Discovery

Software Development *IS* About Exploration & Discovery

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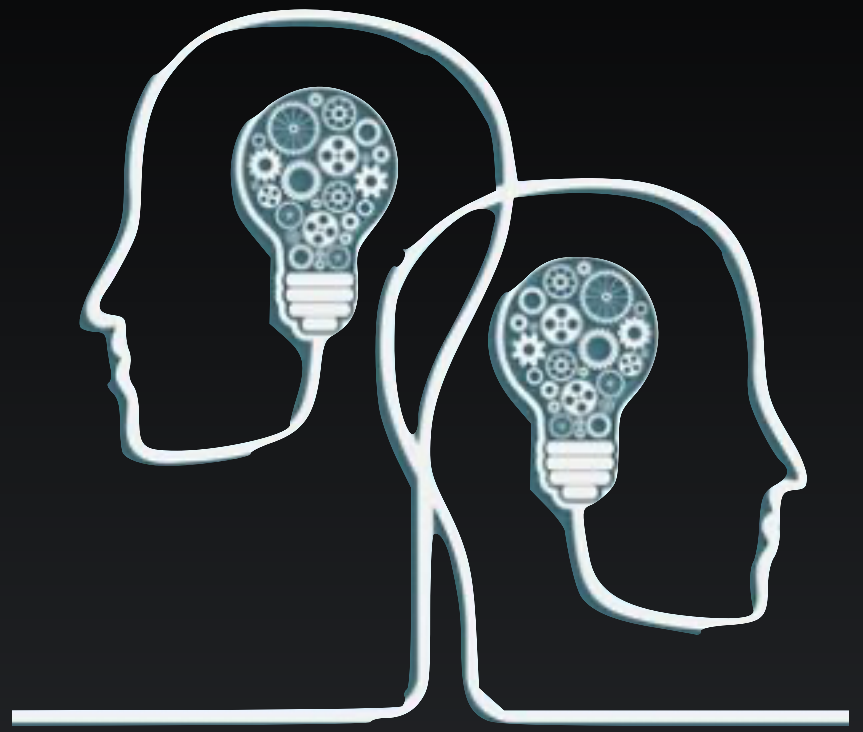
The Stuff That Works

The Stuff That Works



Optimise for Learning

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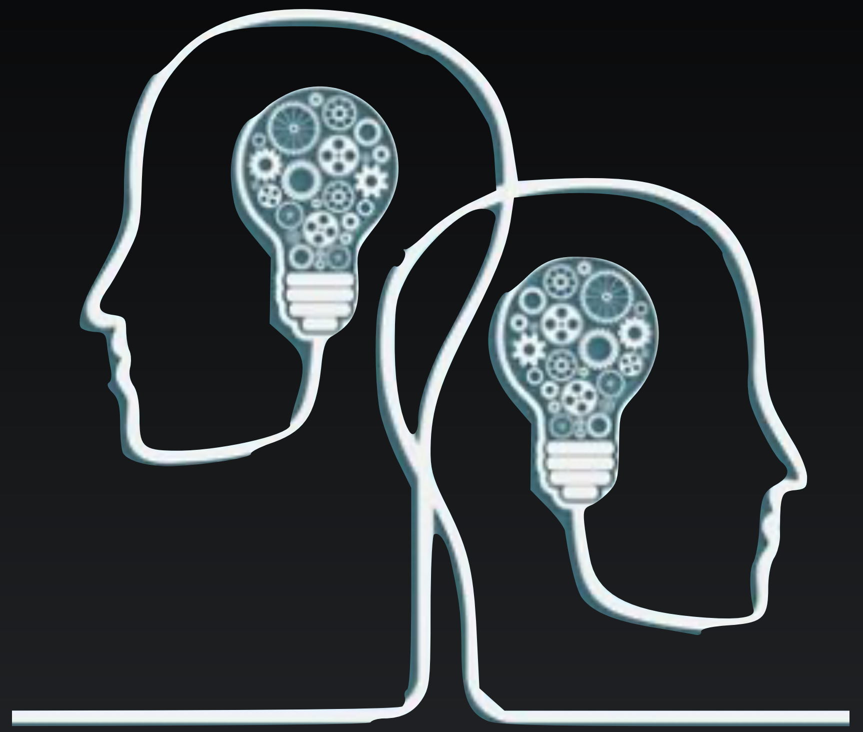
The Stuff That Works



Optimise for Learning

Optimise for Managing Complexity

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Optimise for Learning

Iterative Experimental

Feedback Driven

Incremental Empirical

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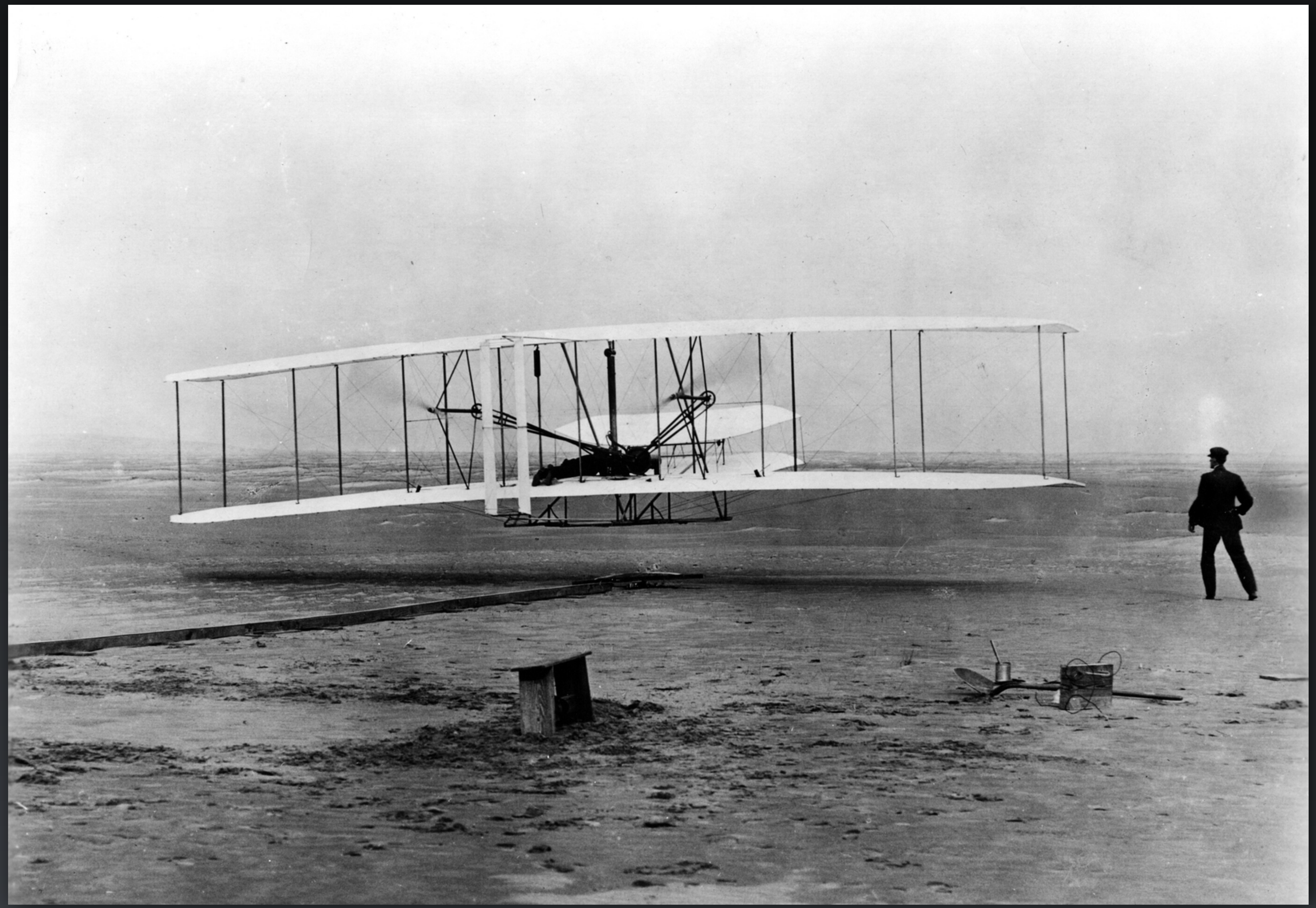
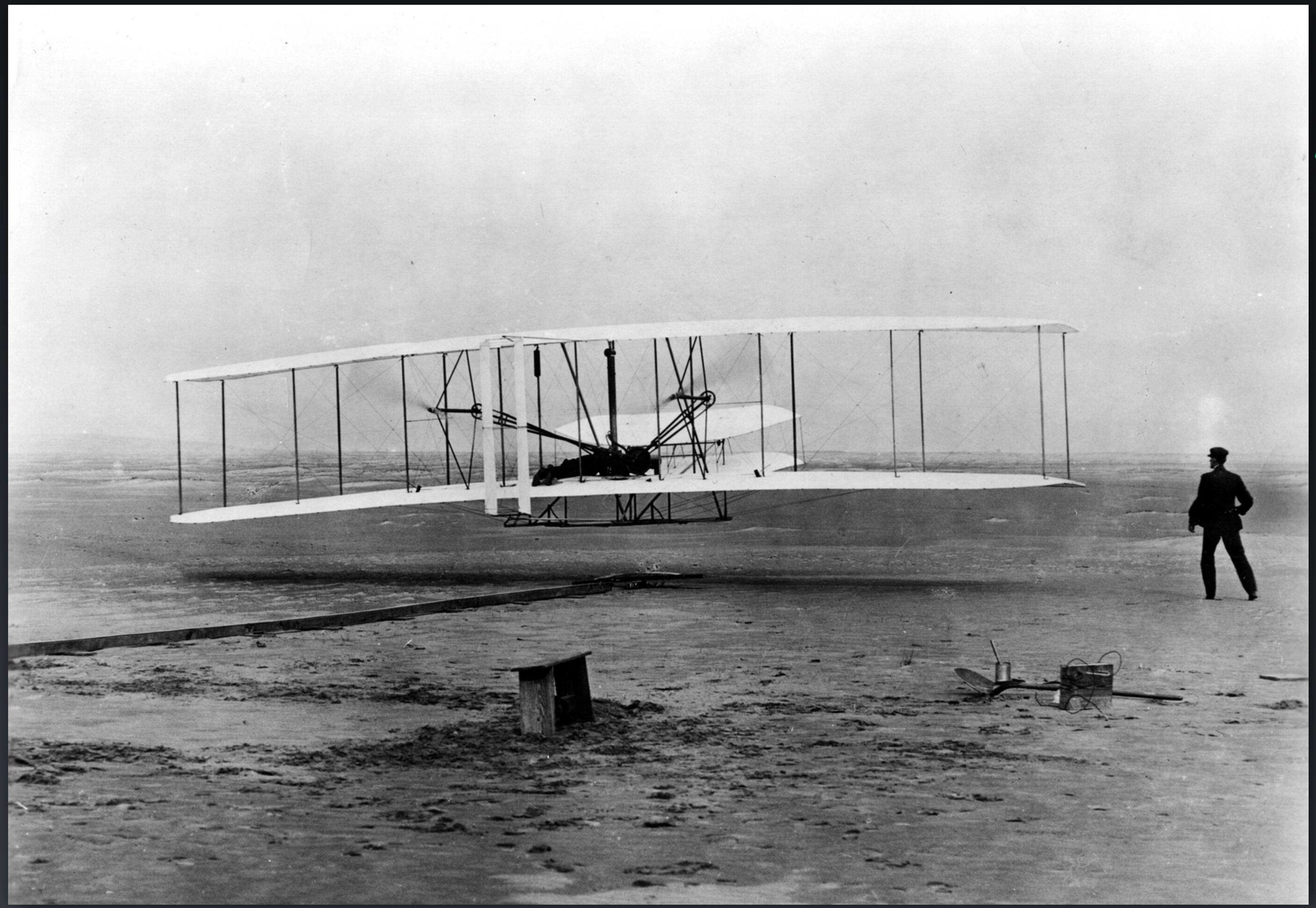
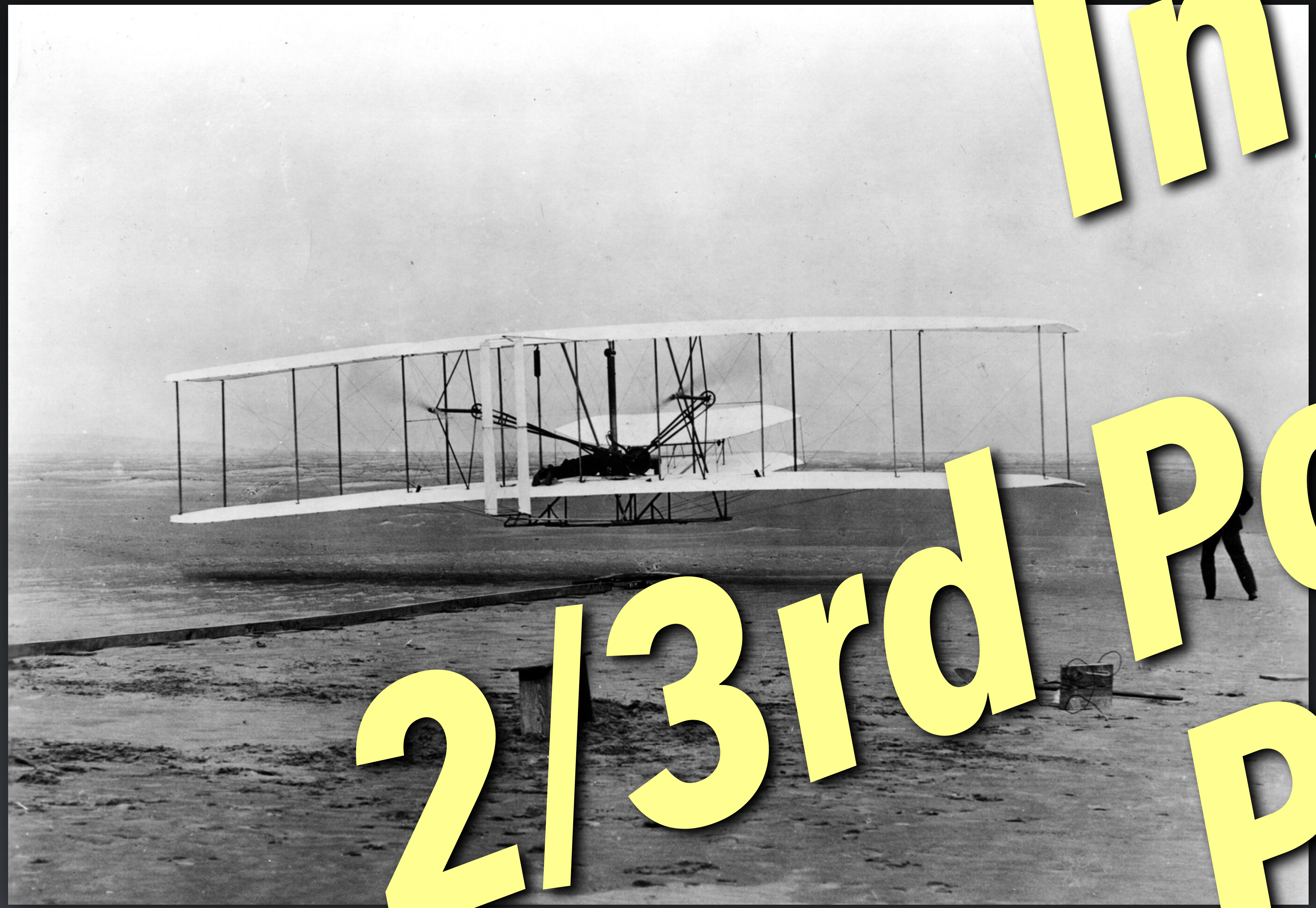
Iteration



Iteration



Iteration



In 2017
2/3rd Population of the
Planet Flew
With no Fatalities!

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Iteration

Iteration

The Goal

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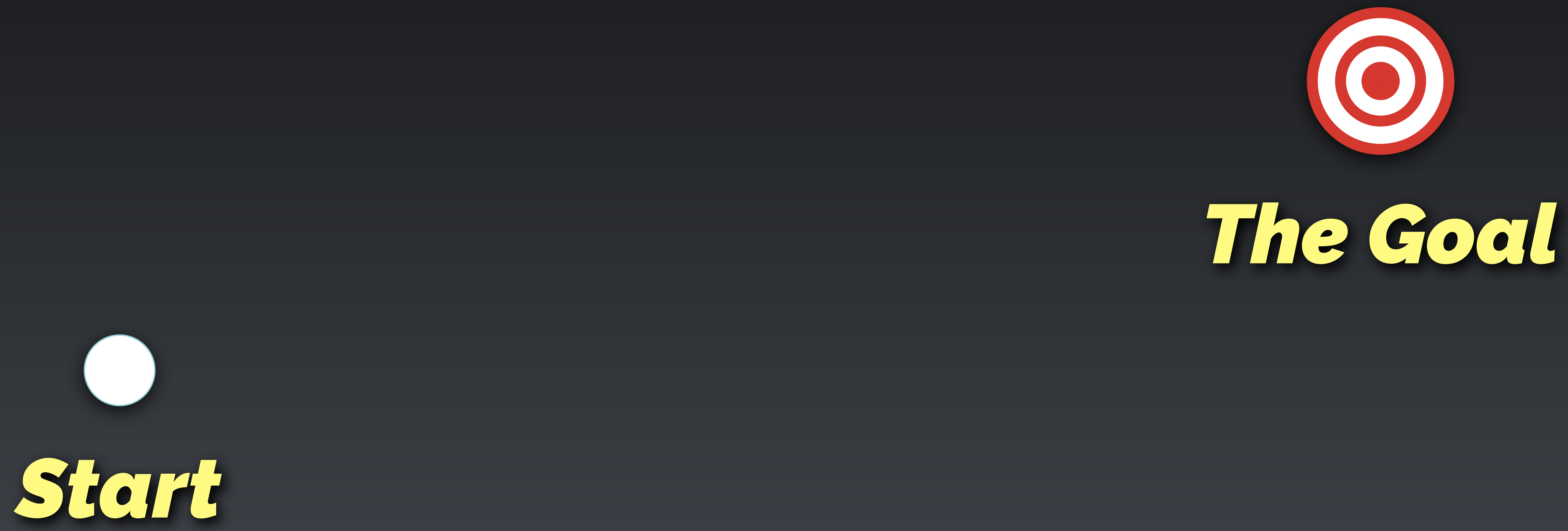
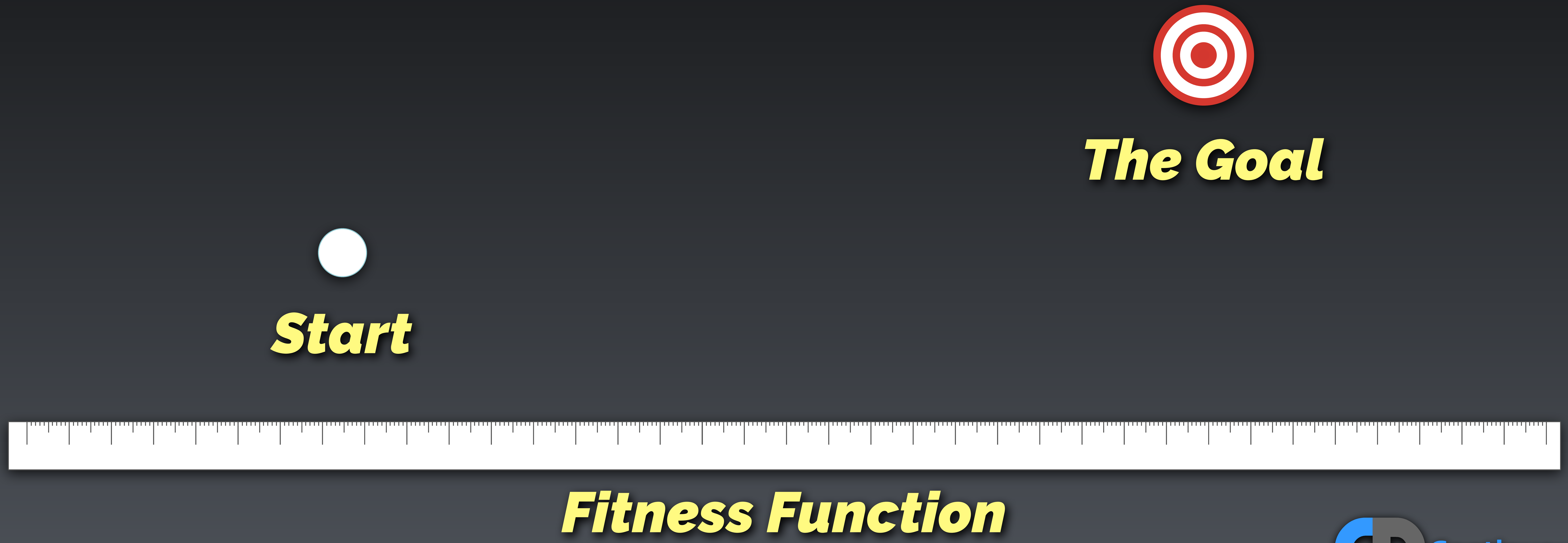
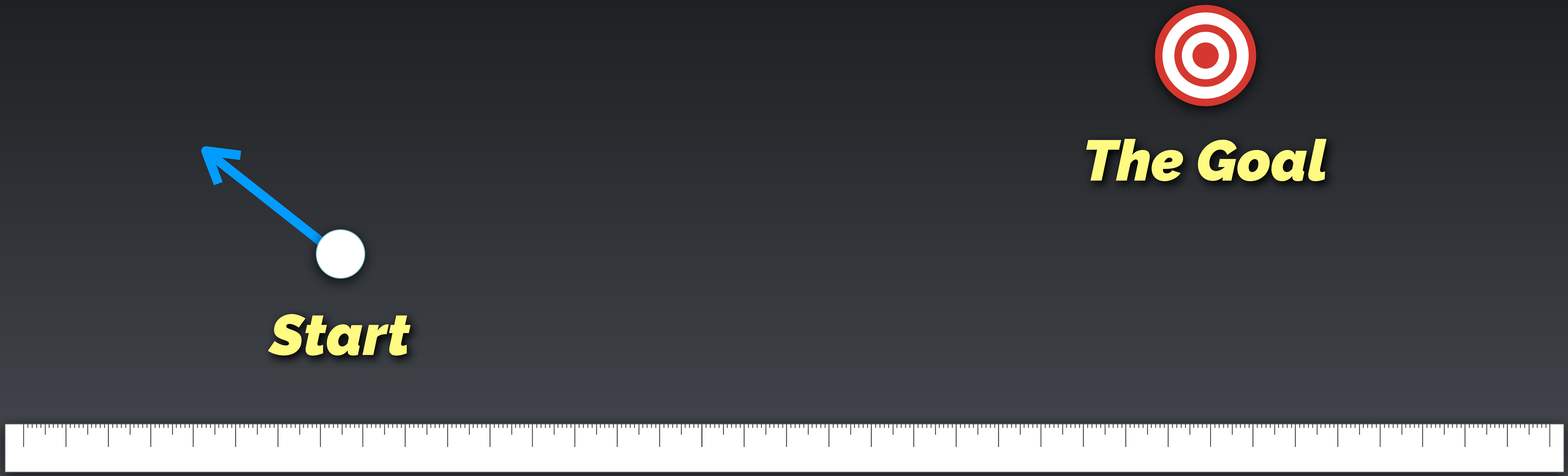
Iteration



Iteration



Iteration



Fitness Function

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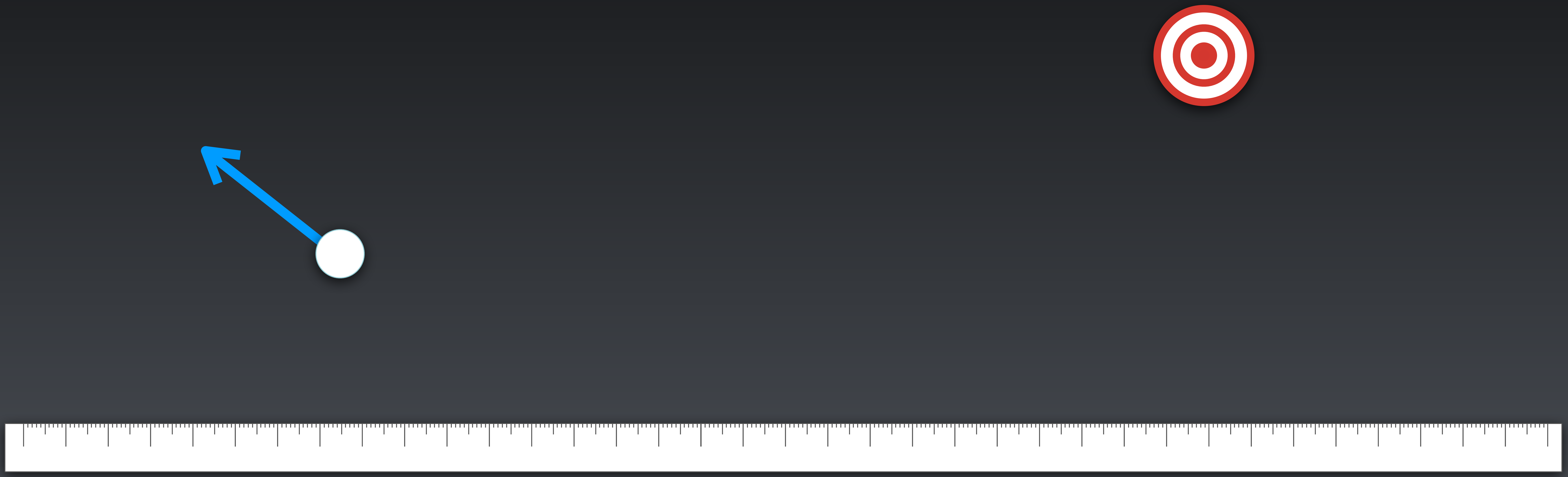
Iteration



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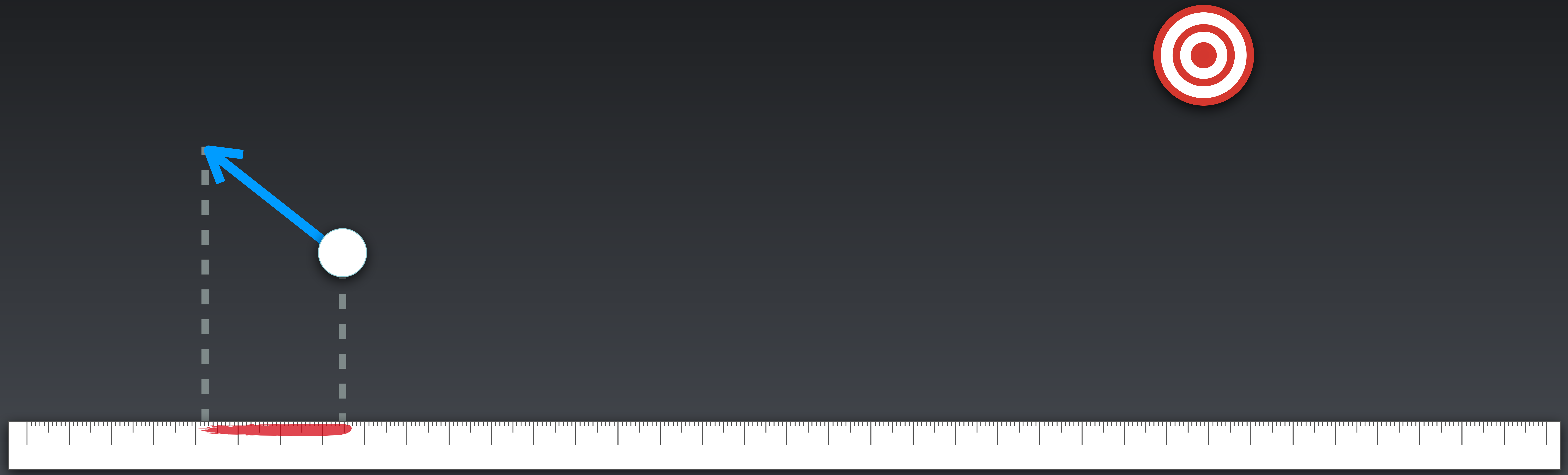
Iteration



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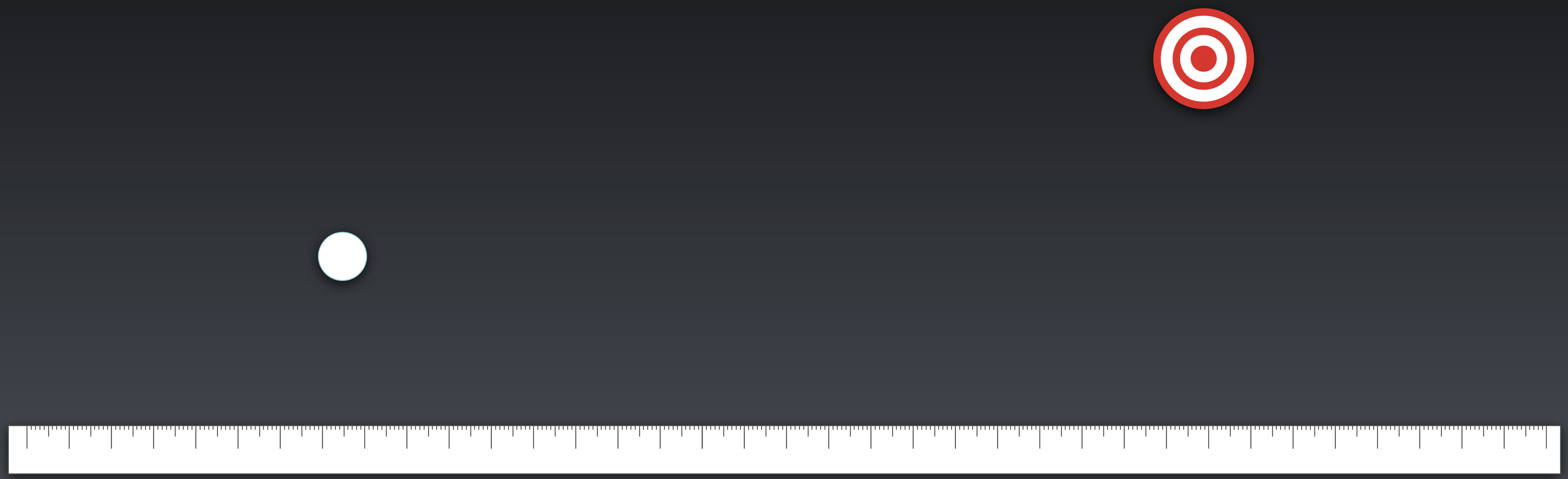
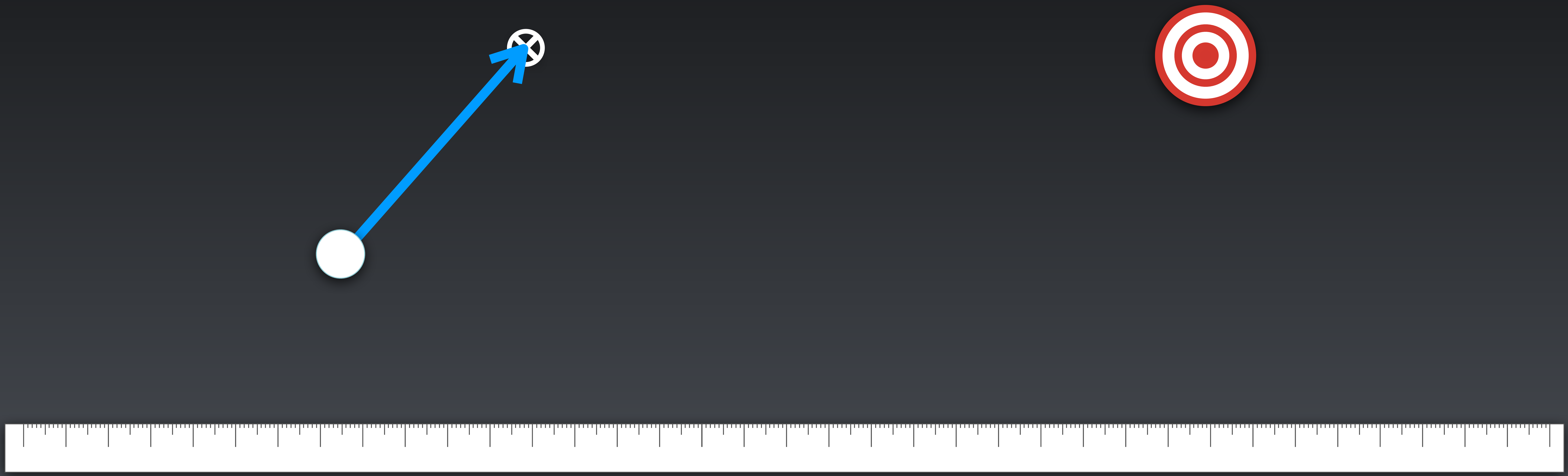
Iteration



Iteration



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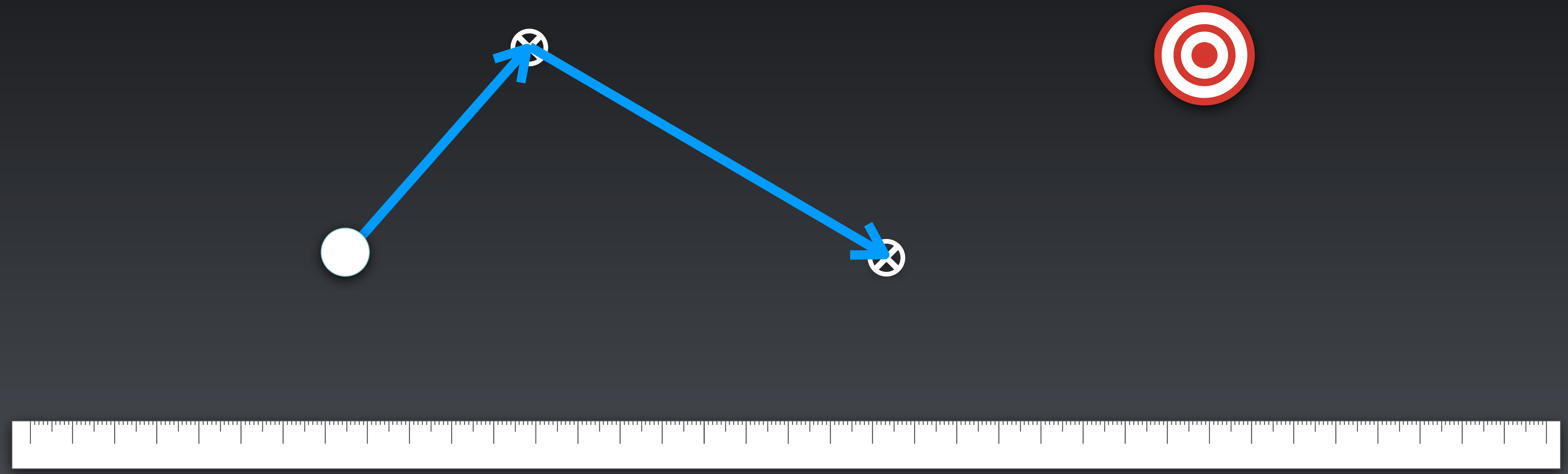
Iteration



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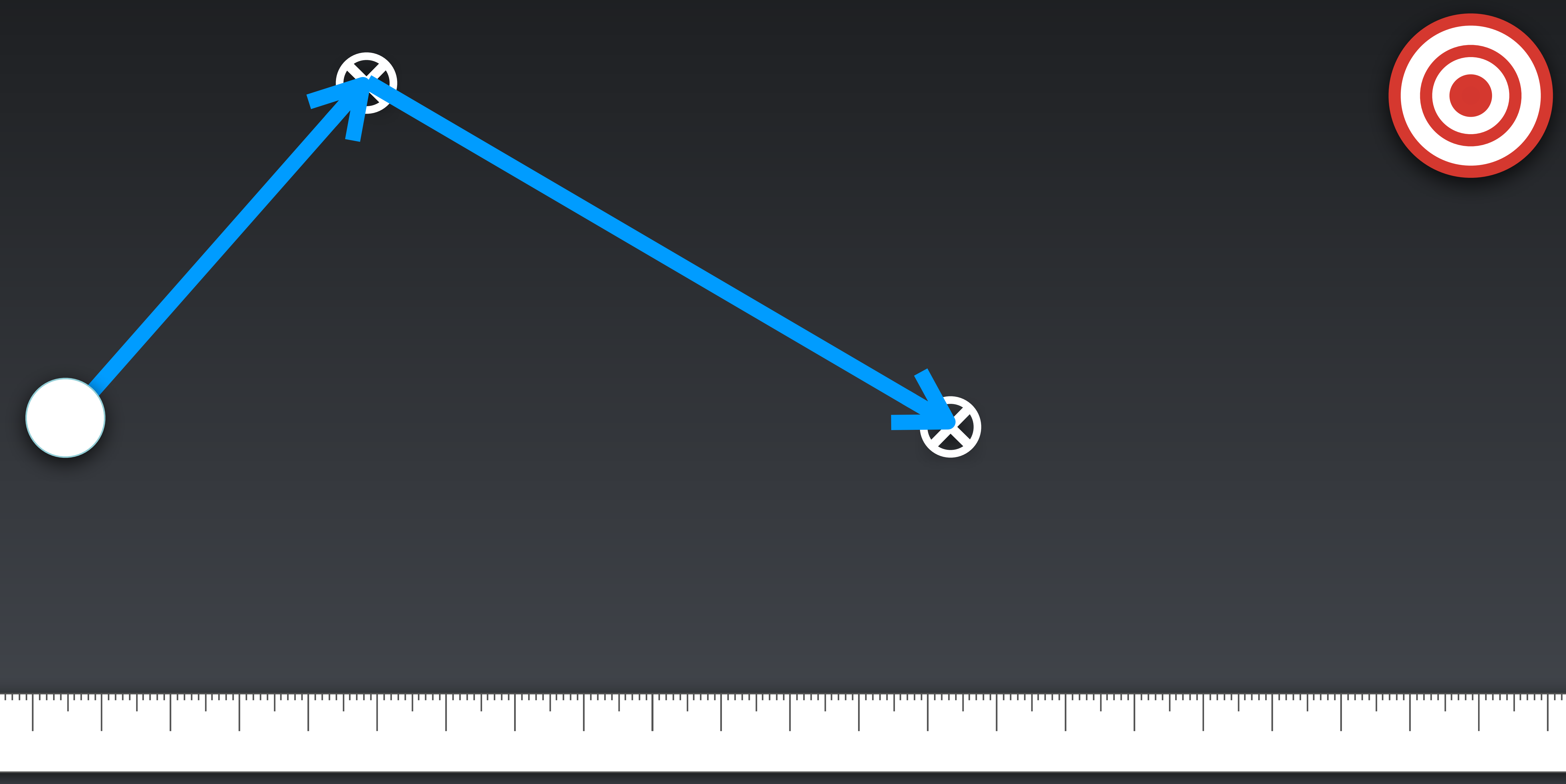
Iteration



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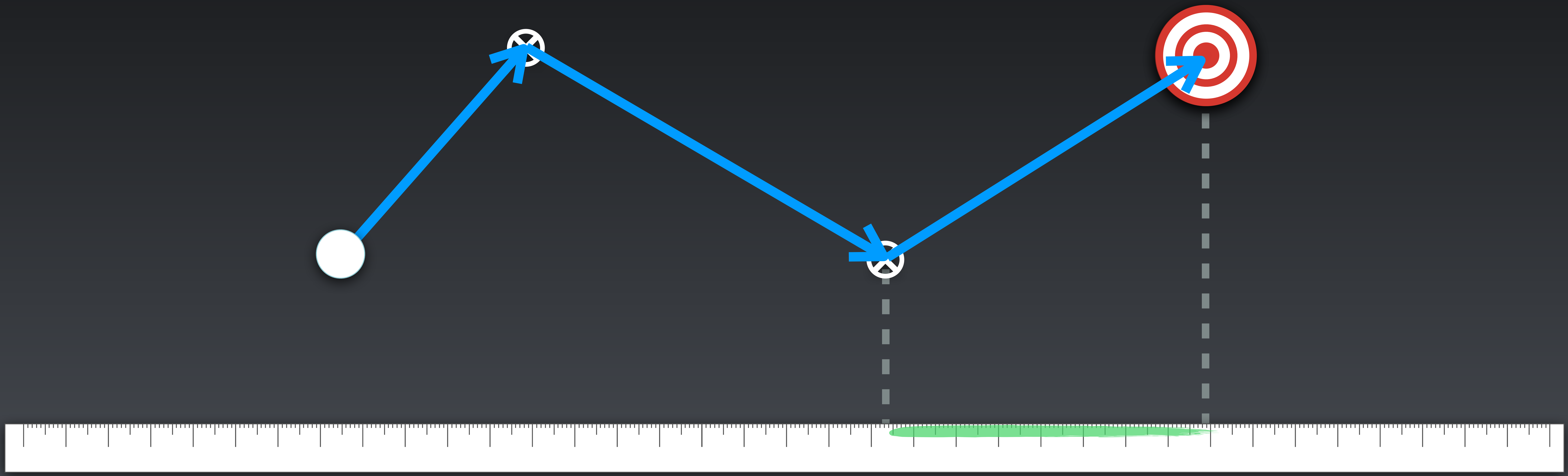
Iteration



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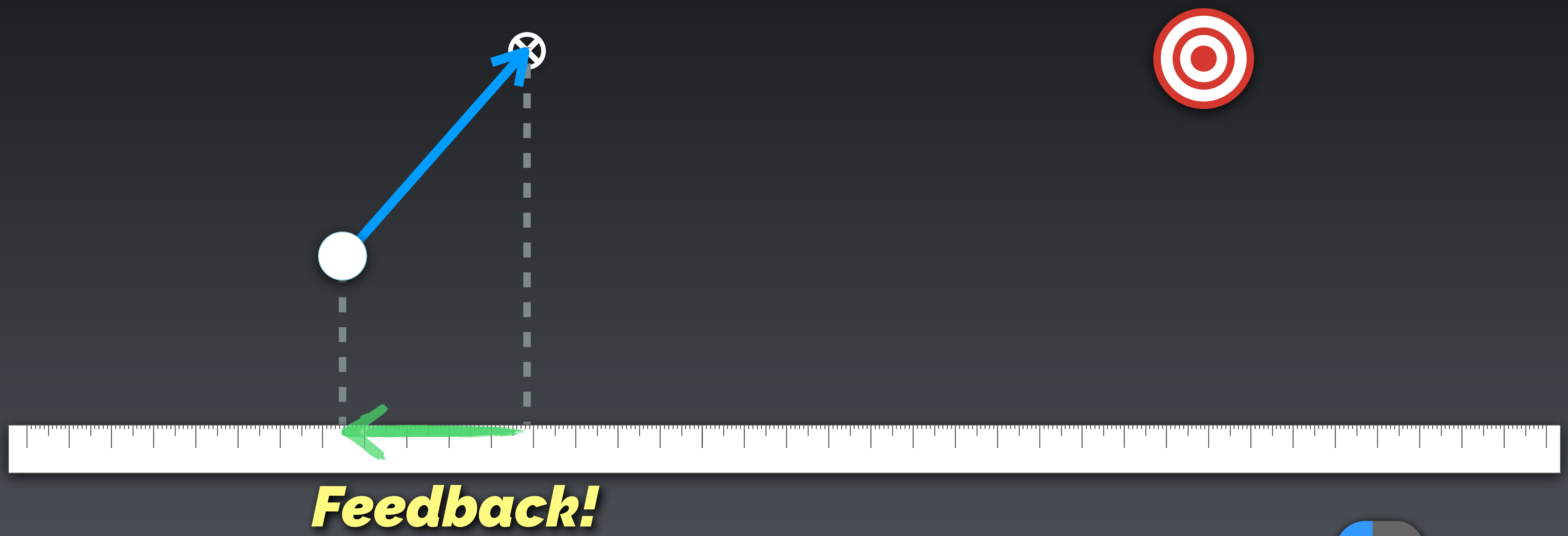
Feedback



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Feedback

Feedback

How Do You Balance a Broom?

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Feedback

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Feedback

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Feedback

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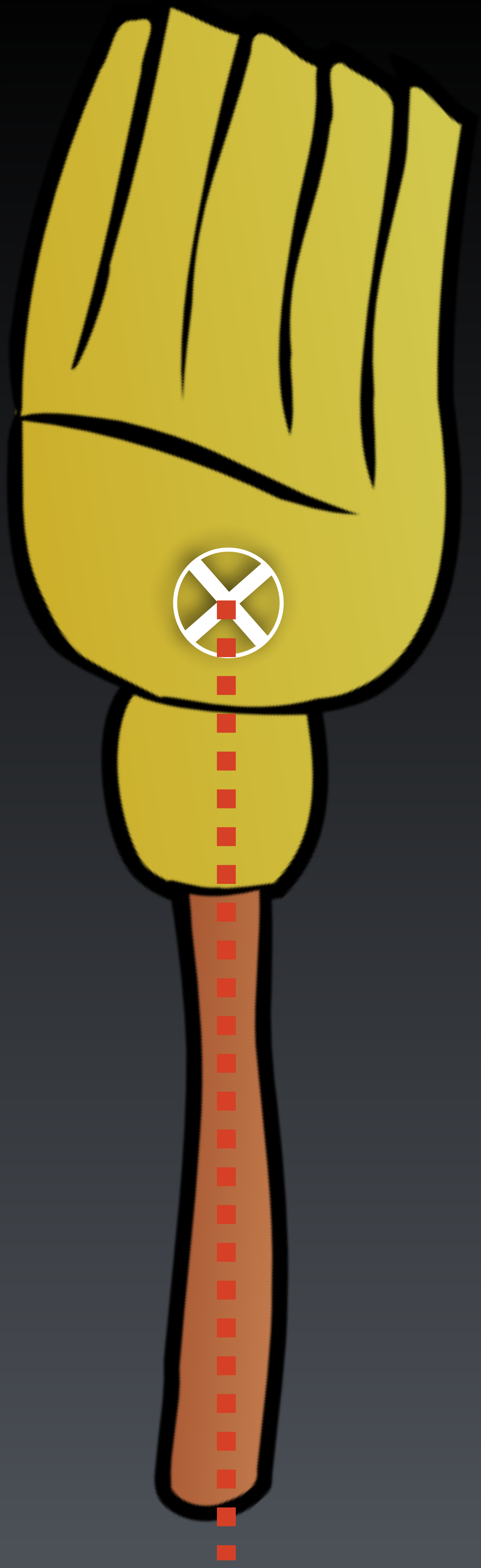
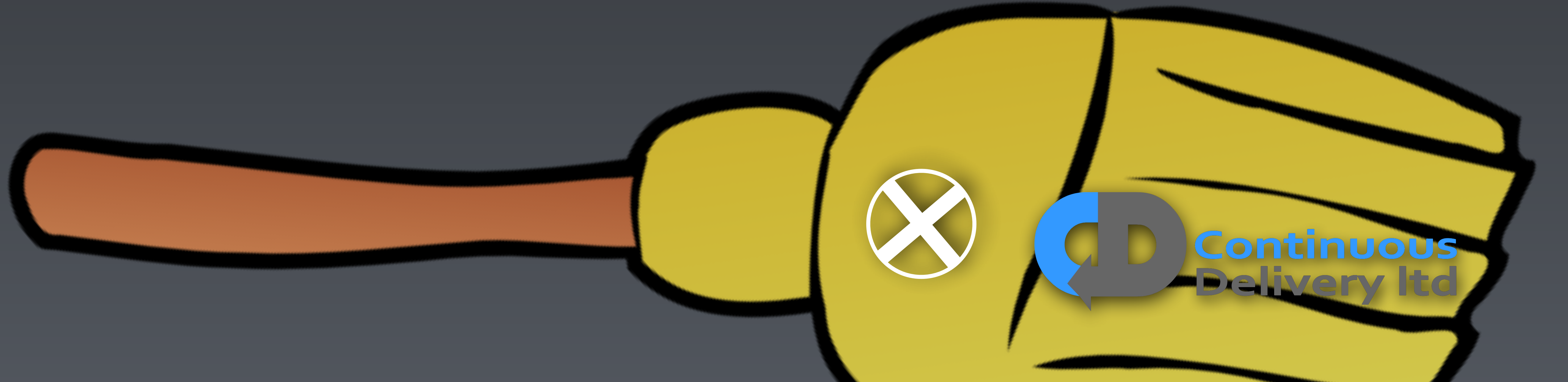
Feedback

Feedback



Feedback

There's Only One Solution to This!



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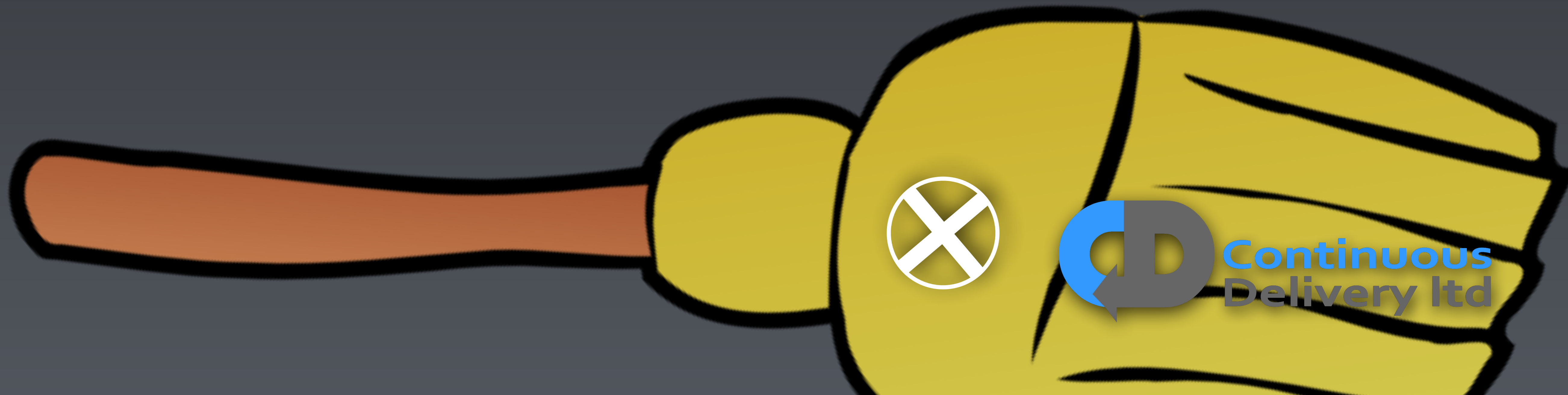
Feedback



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Feedback

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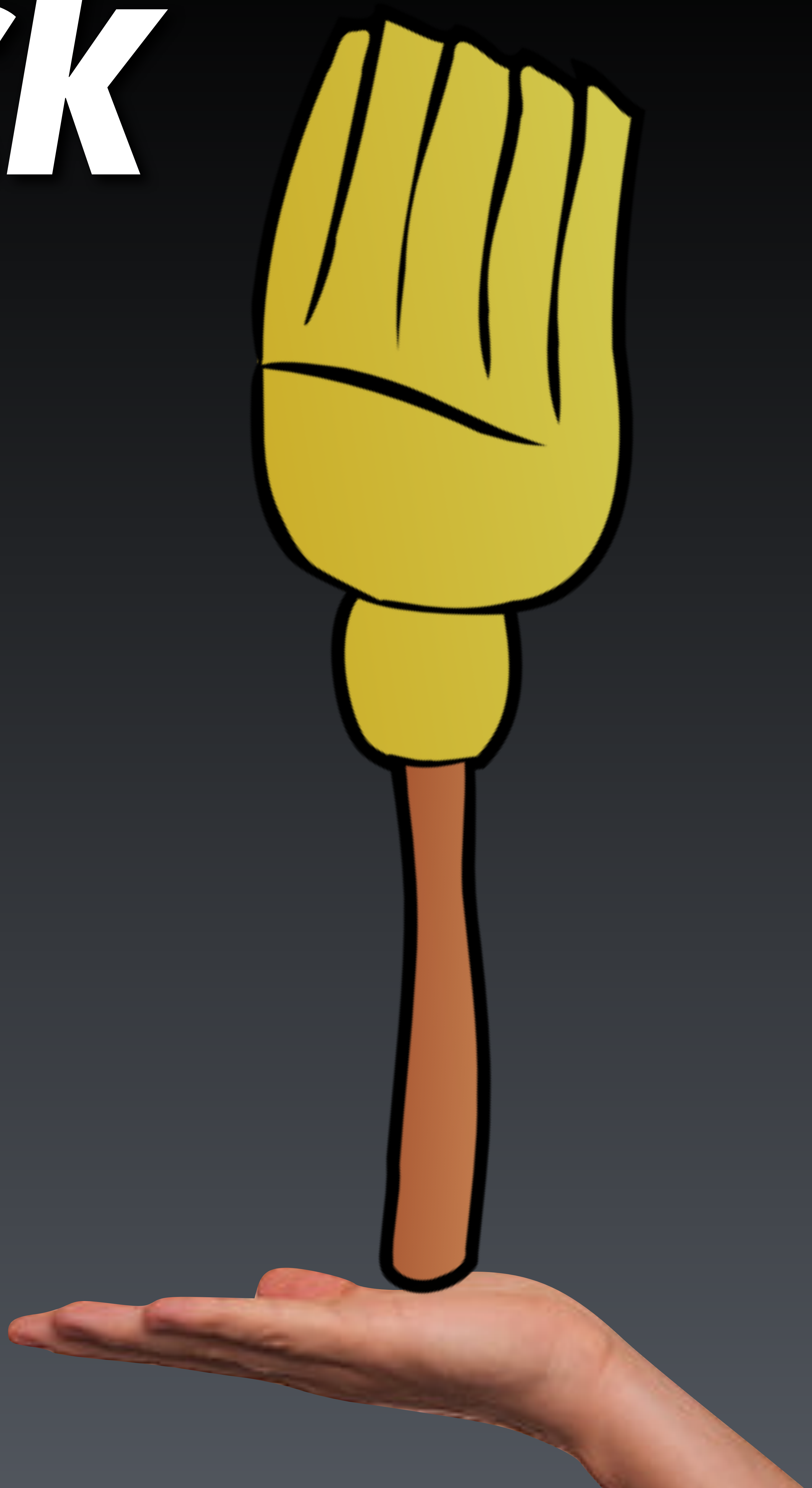

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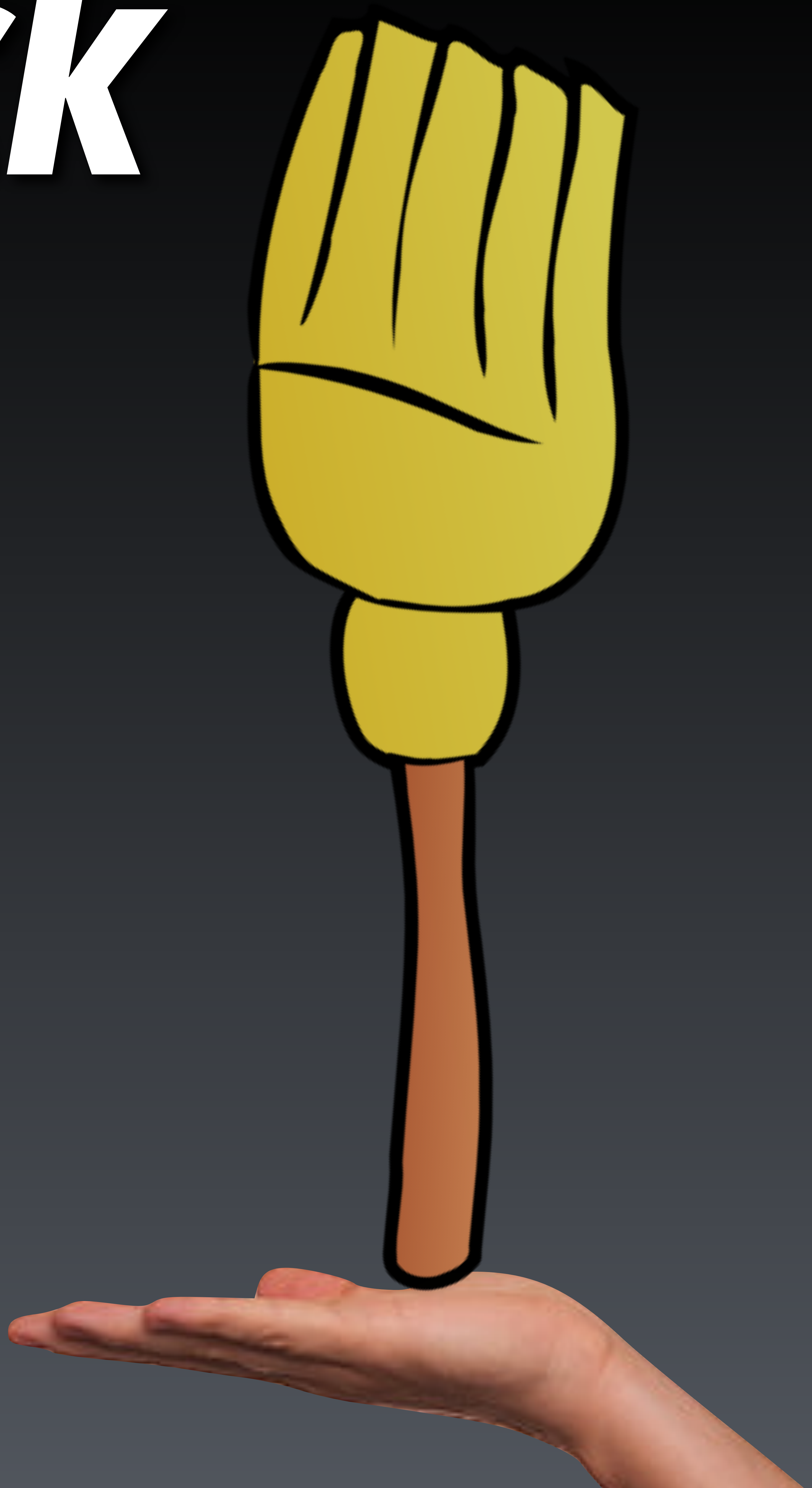

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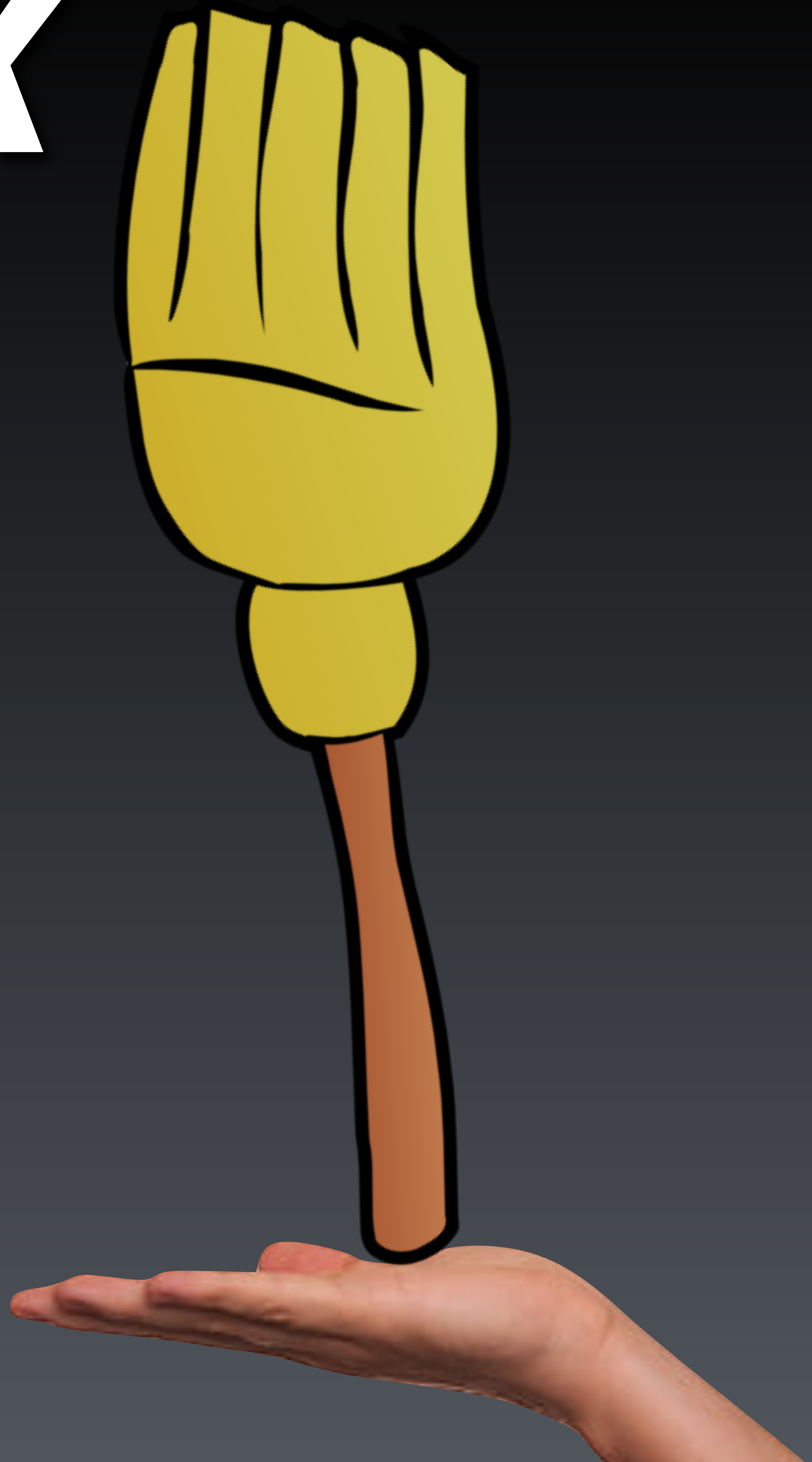

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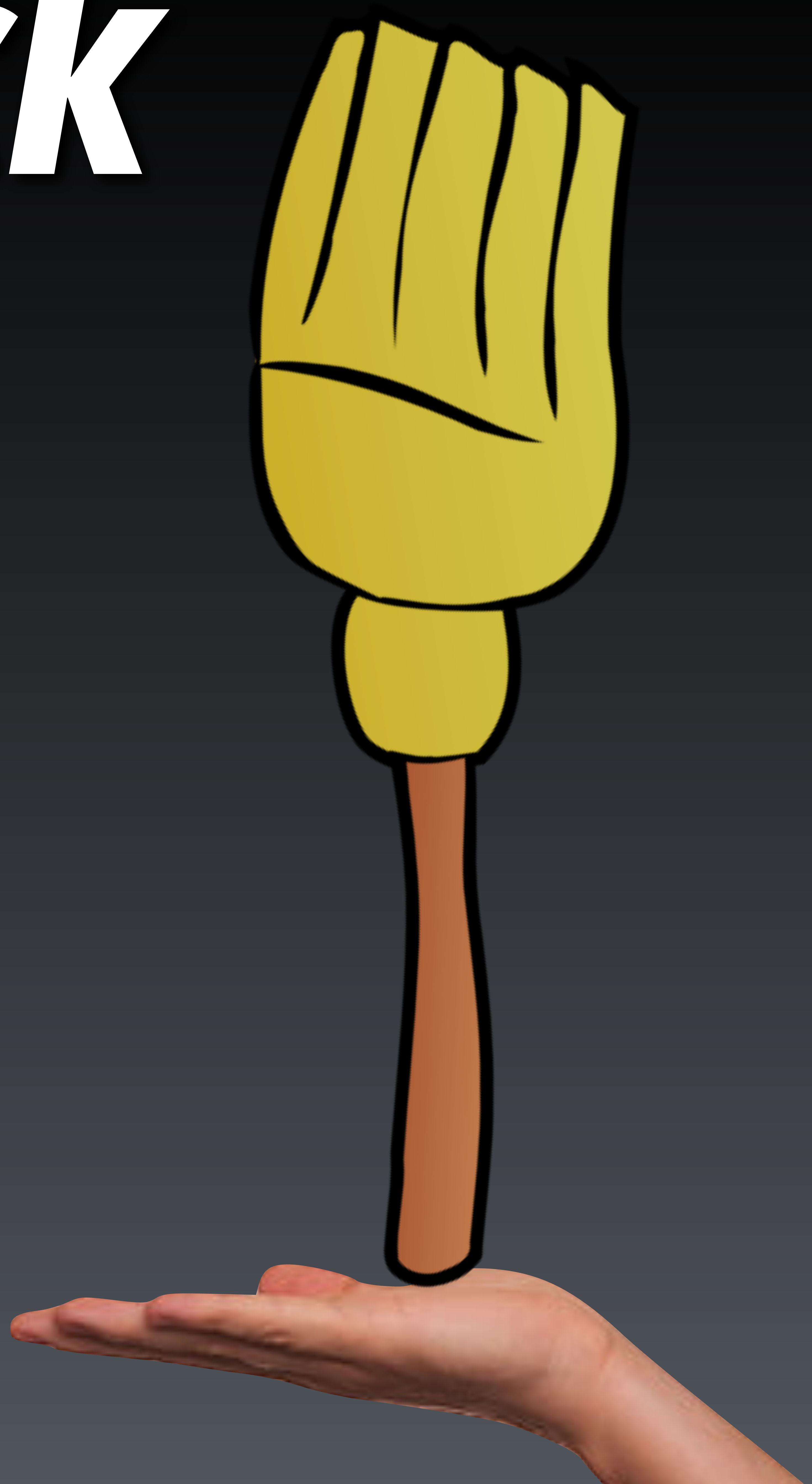

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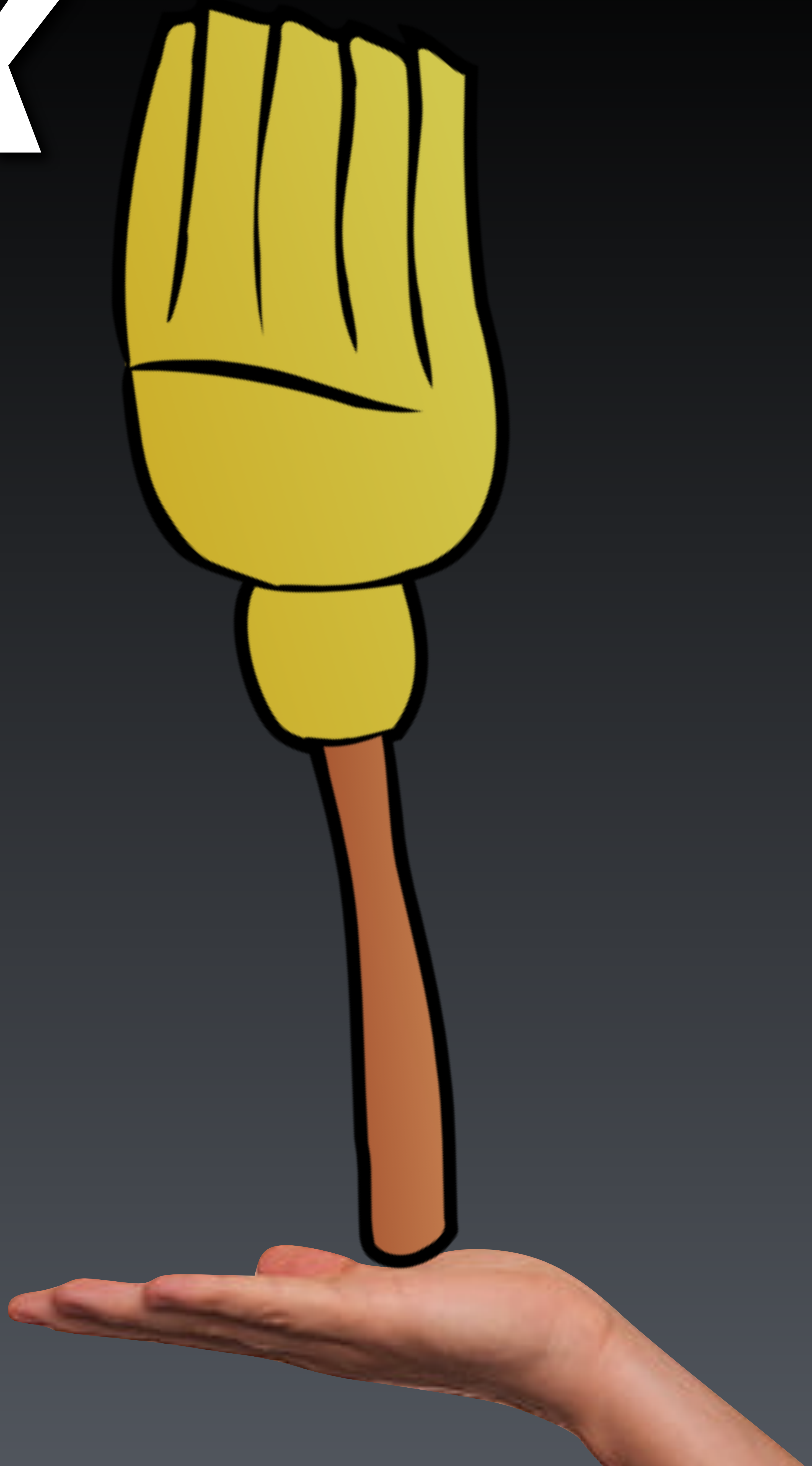
Feedback



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Feedback

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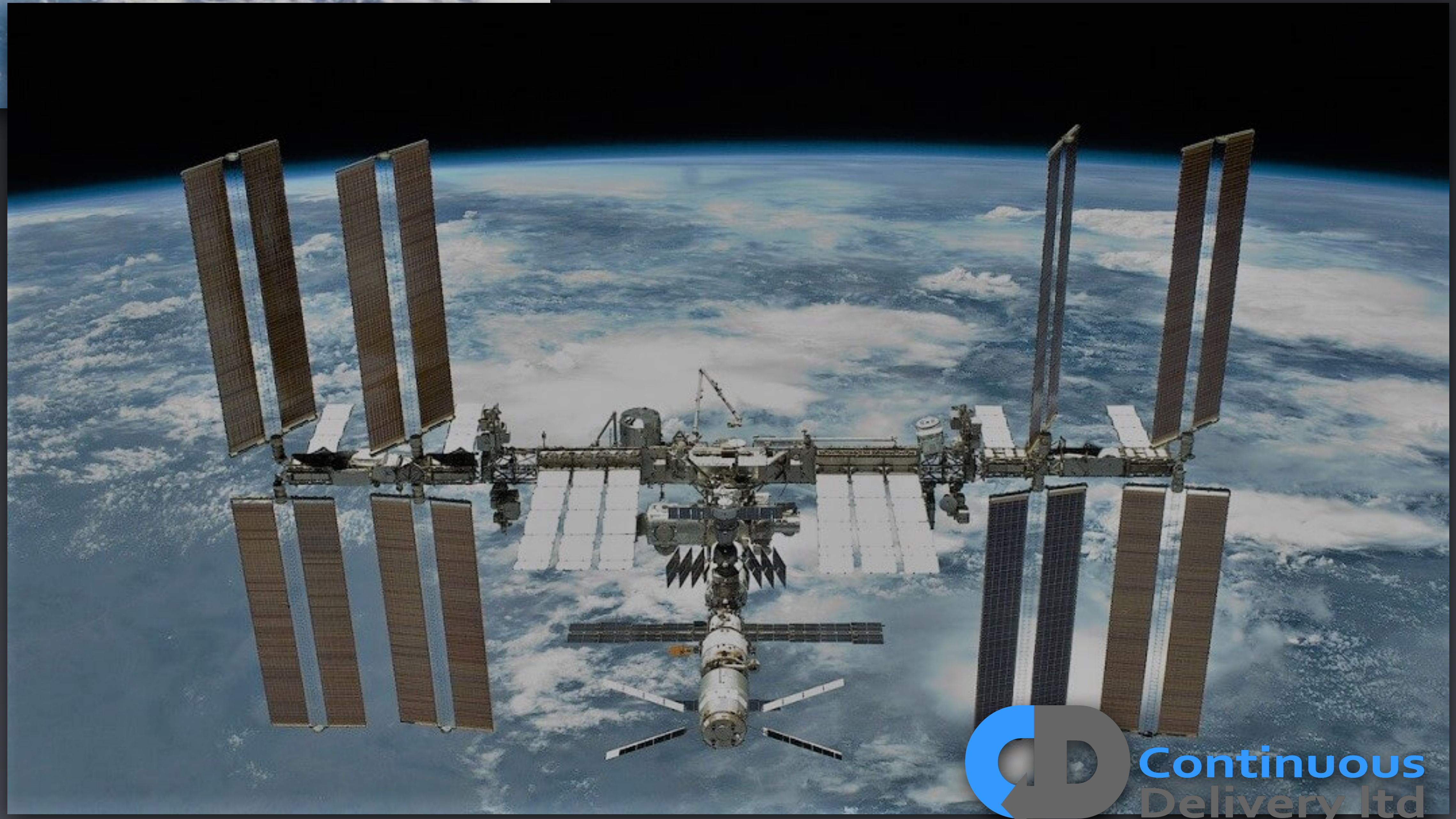
Incremental

Incremental

Incremental



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Experimental

Scary!

Experimental

How Else Can We Make Progress?

Experimental

Experimental

Experimental

Controlling the Variables!

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Experimental

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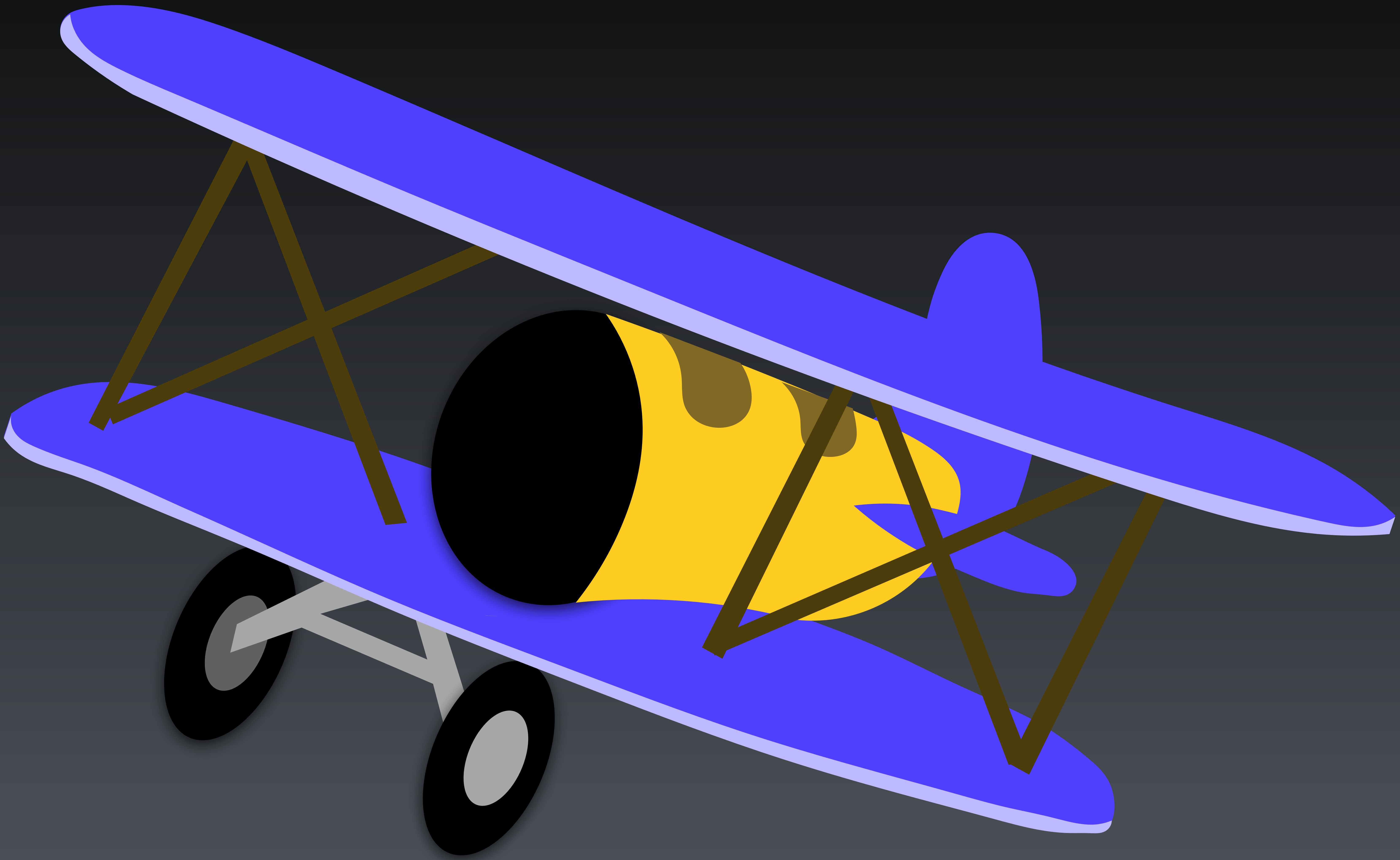
Experimental



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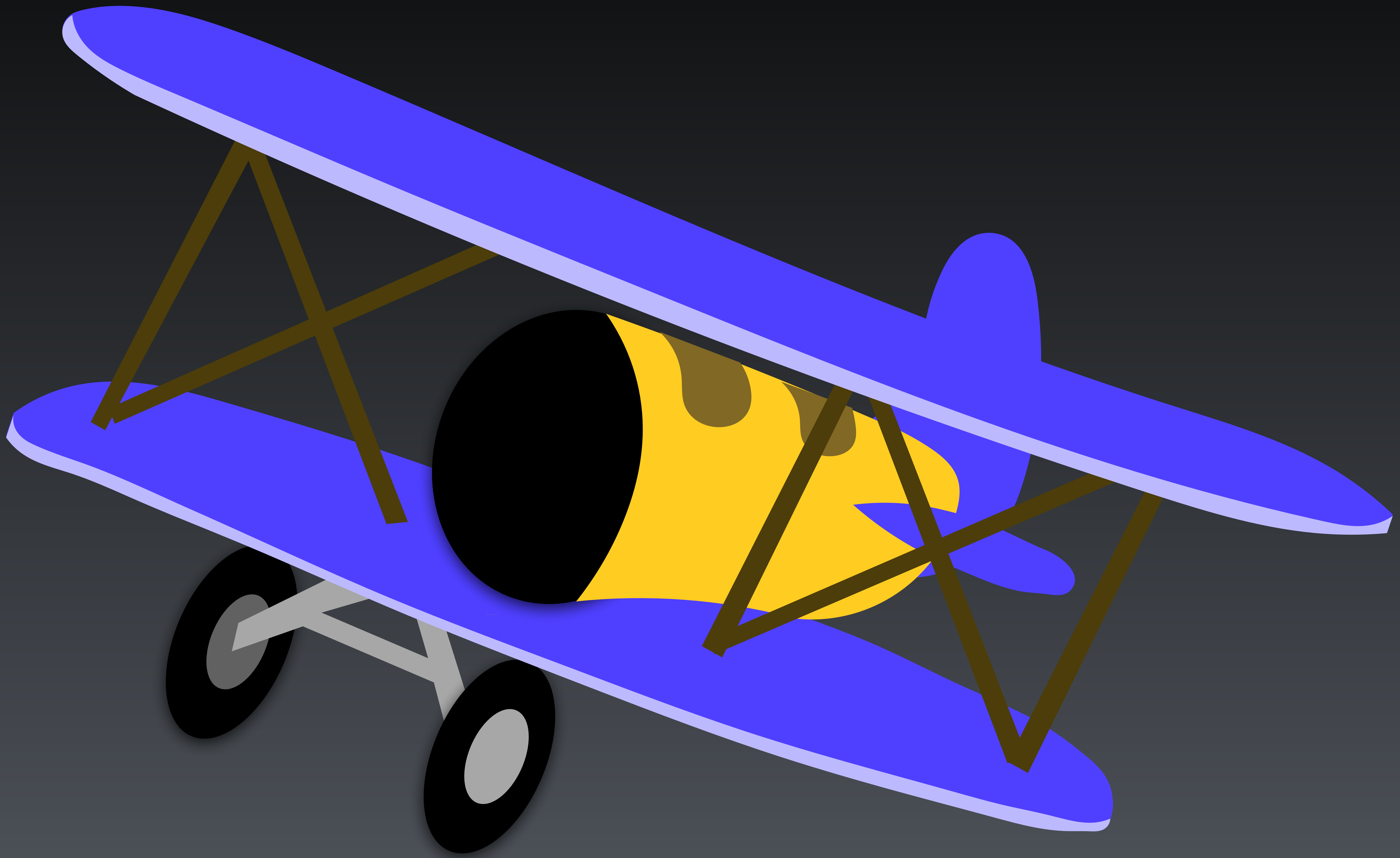
Experimental



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Experimental

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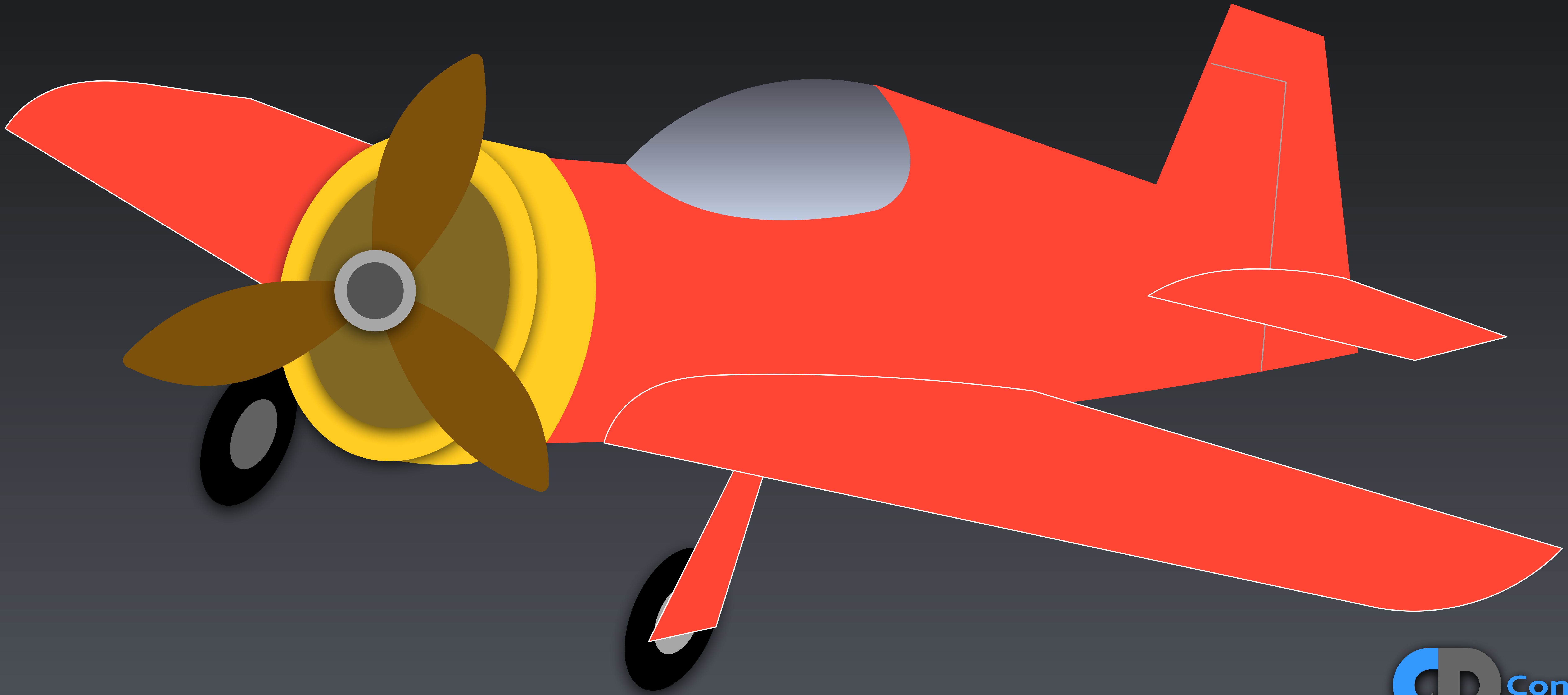
Experimental

Experimental



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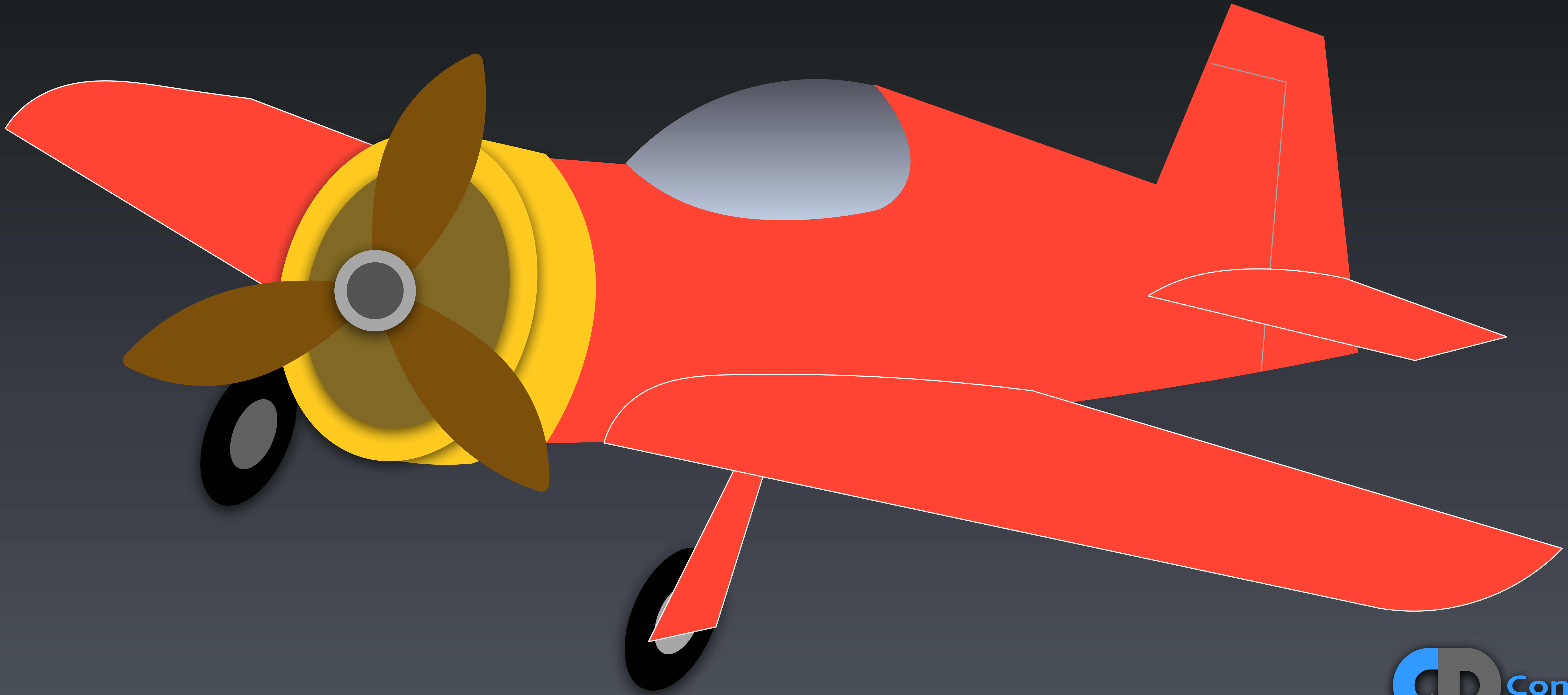
Experimental



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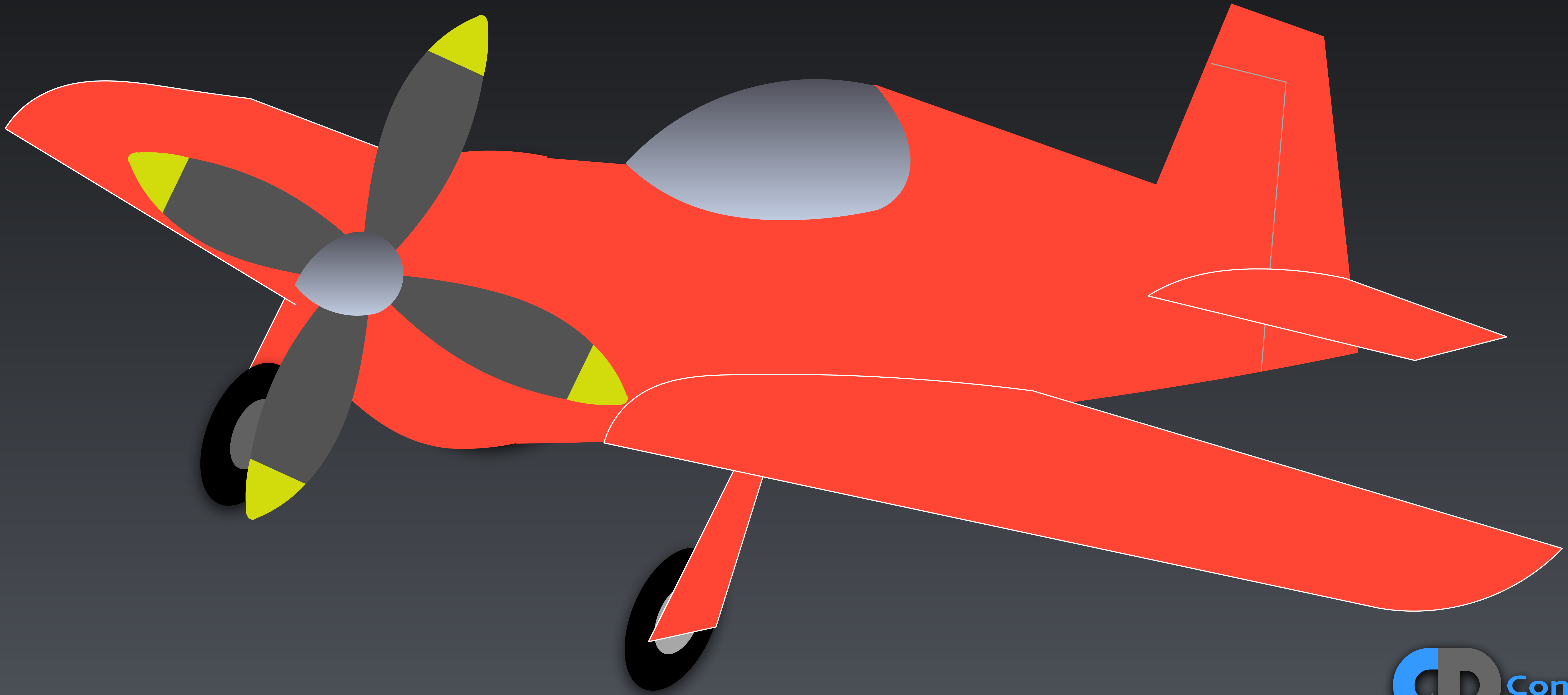
Experimental



Empirical

Continuous Delivery ltd

Empirical

Continuous Delivery ltd

Empirical

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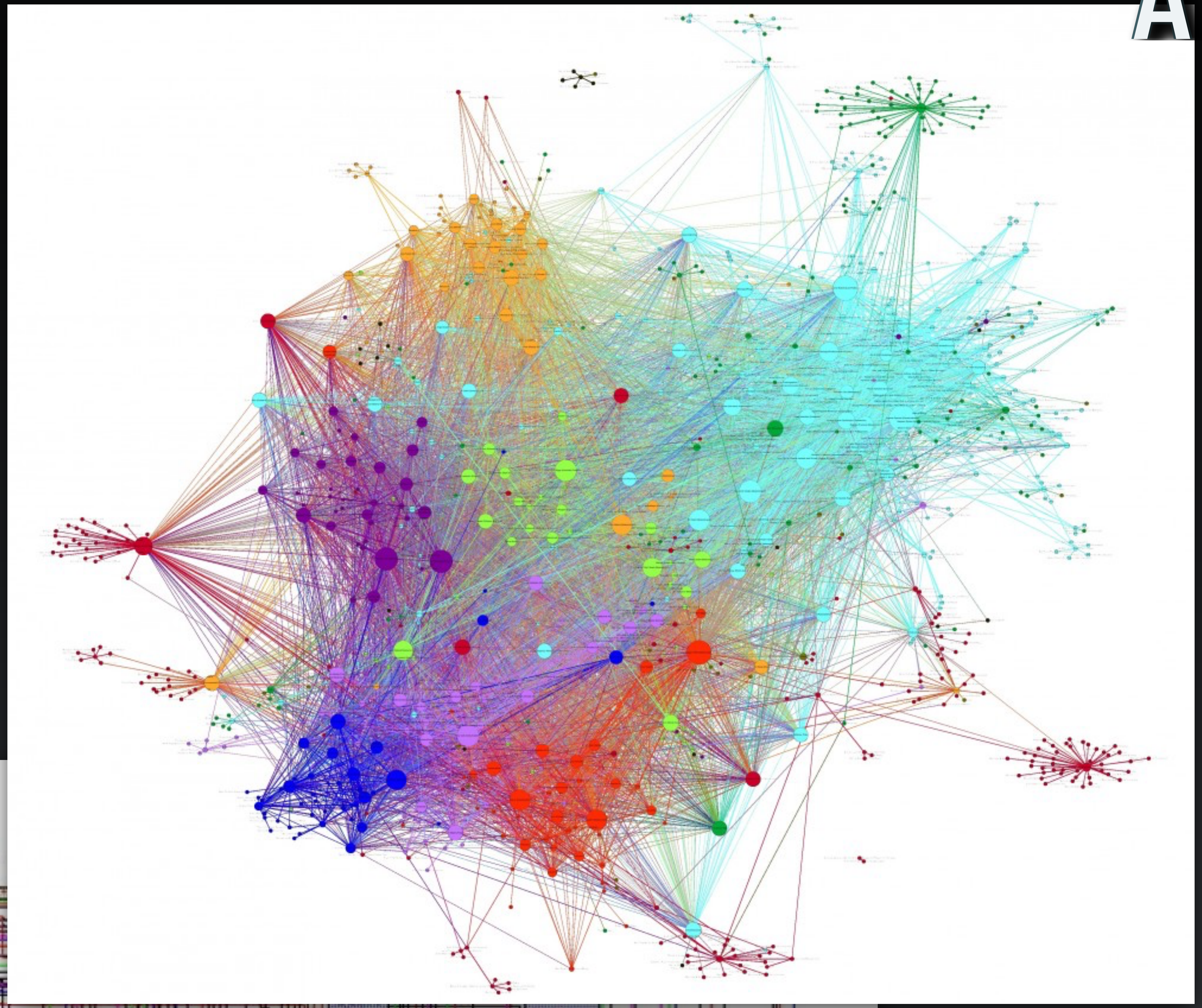

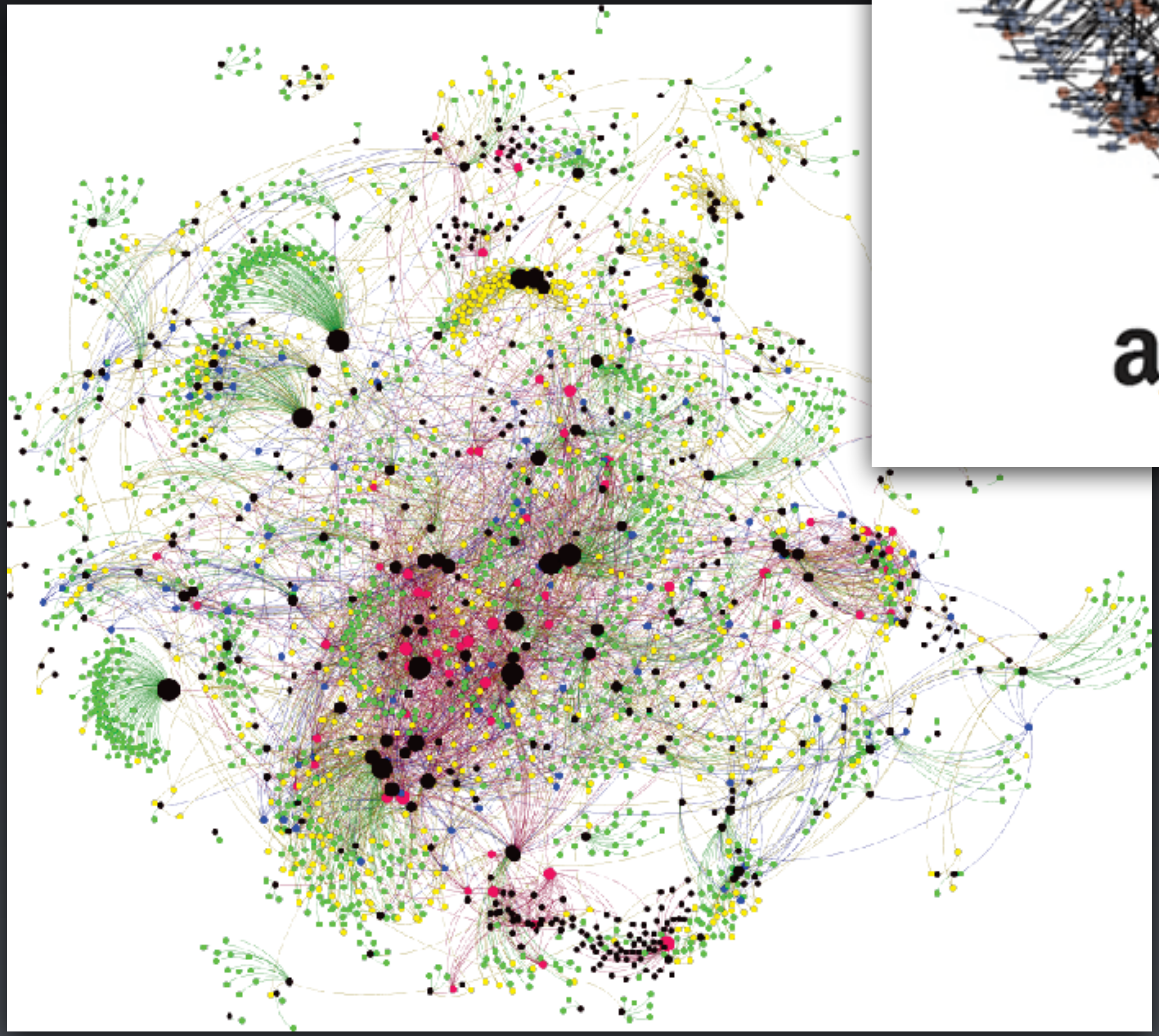

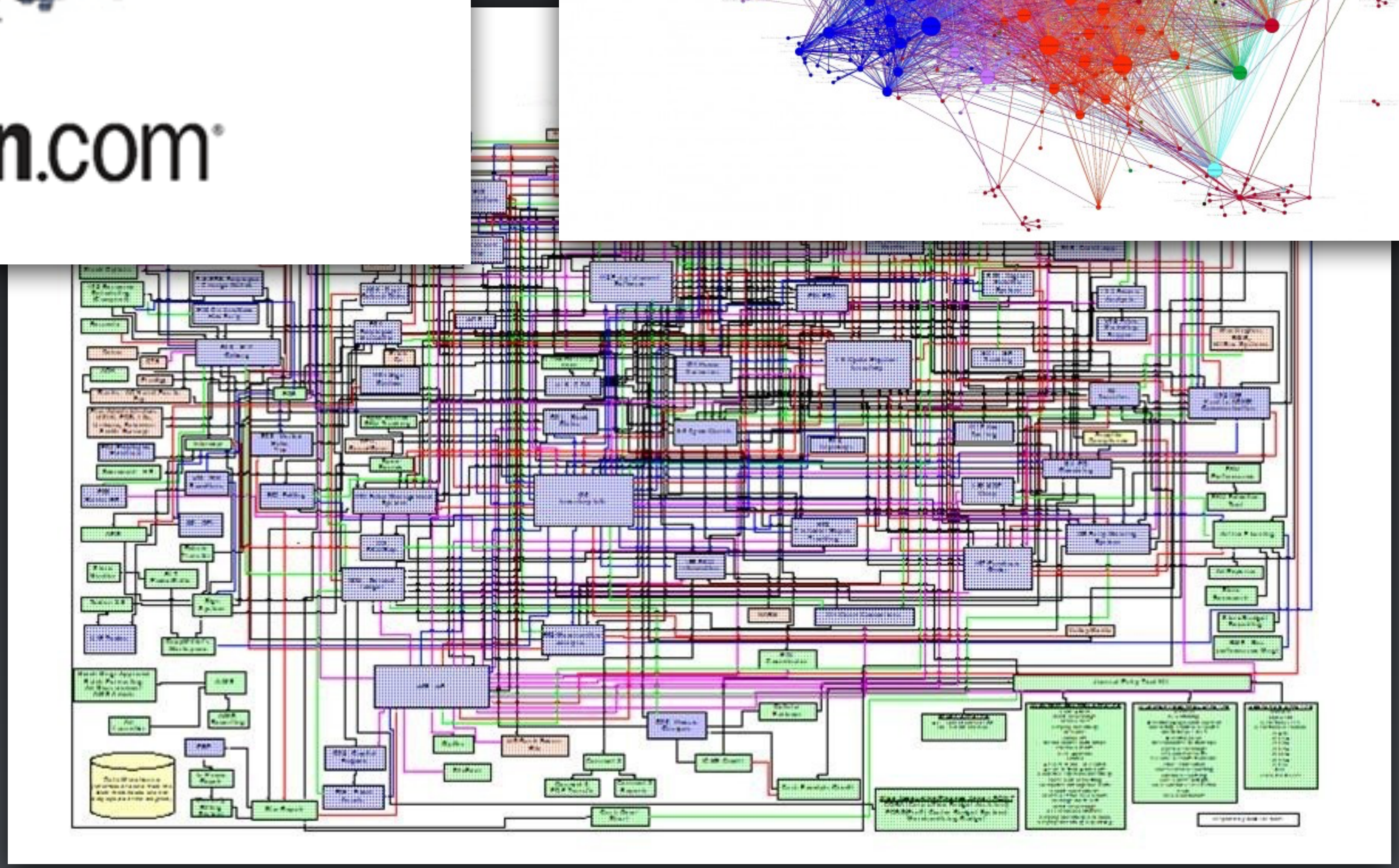

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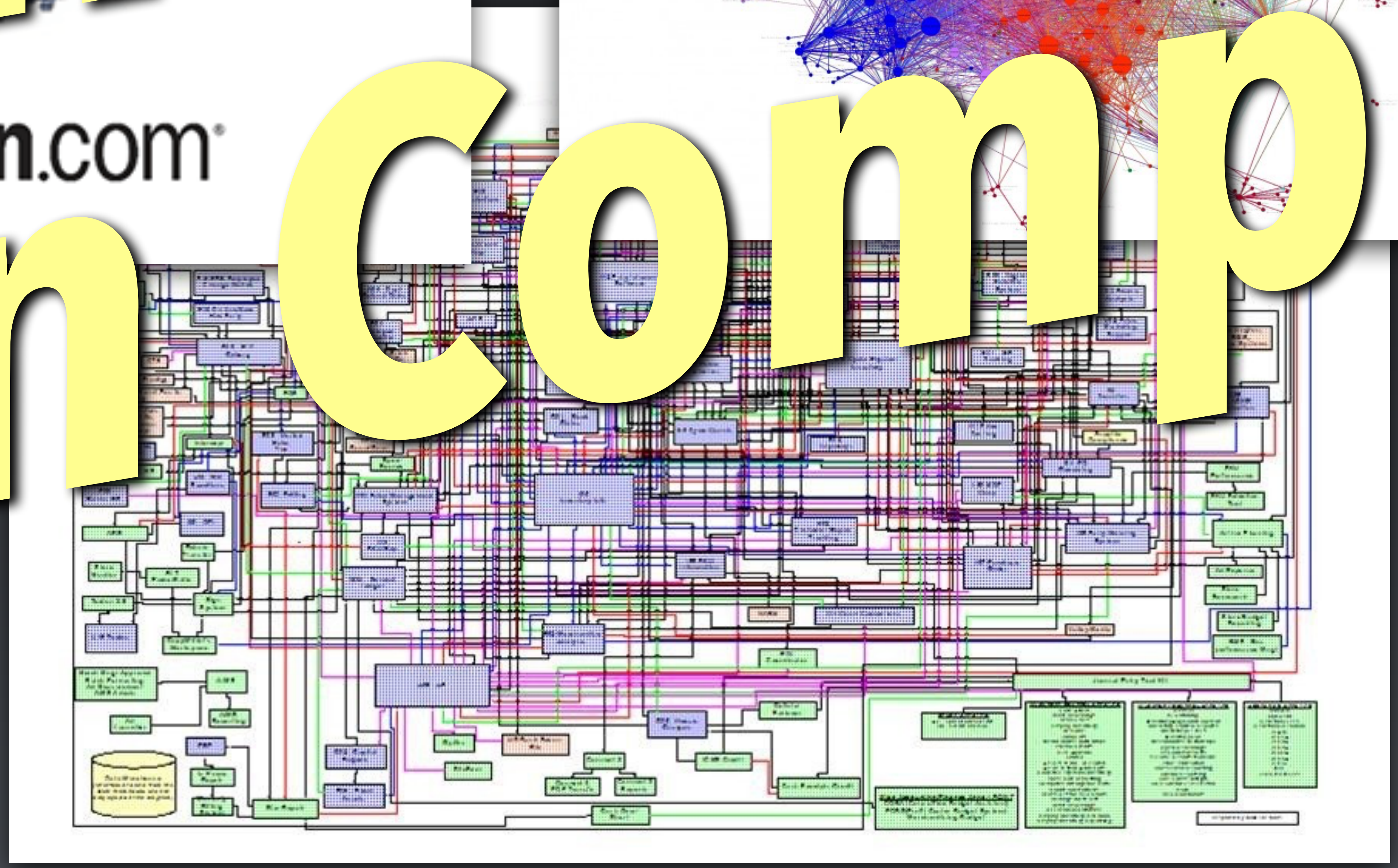
Modern Software is Often Complex!



Software Development is about Learning & Managing Complexity

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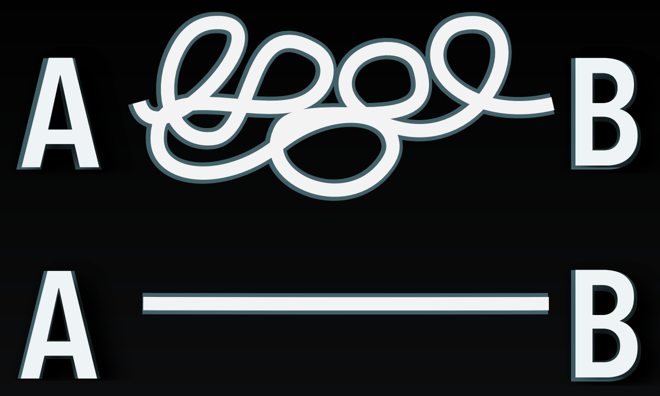
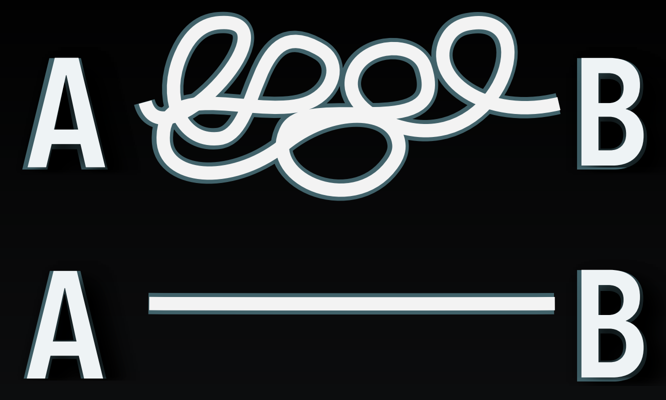


Managing Complexity



Managing Complexity

Modularity

Cohesion

Separation of Concerns

Abstraction

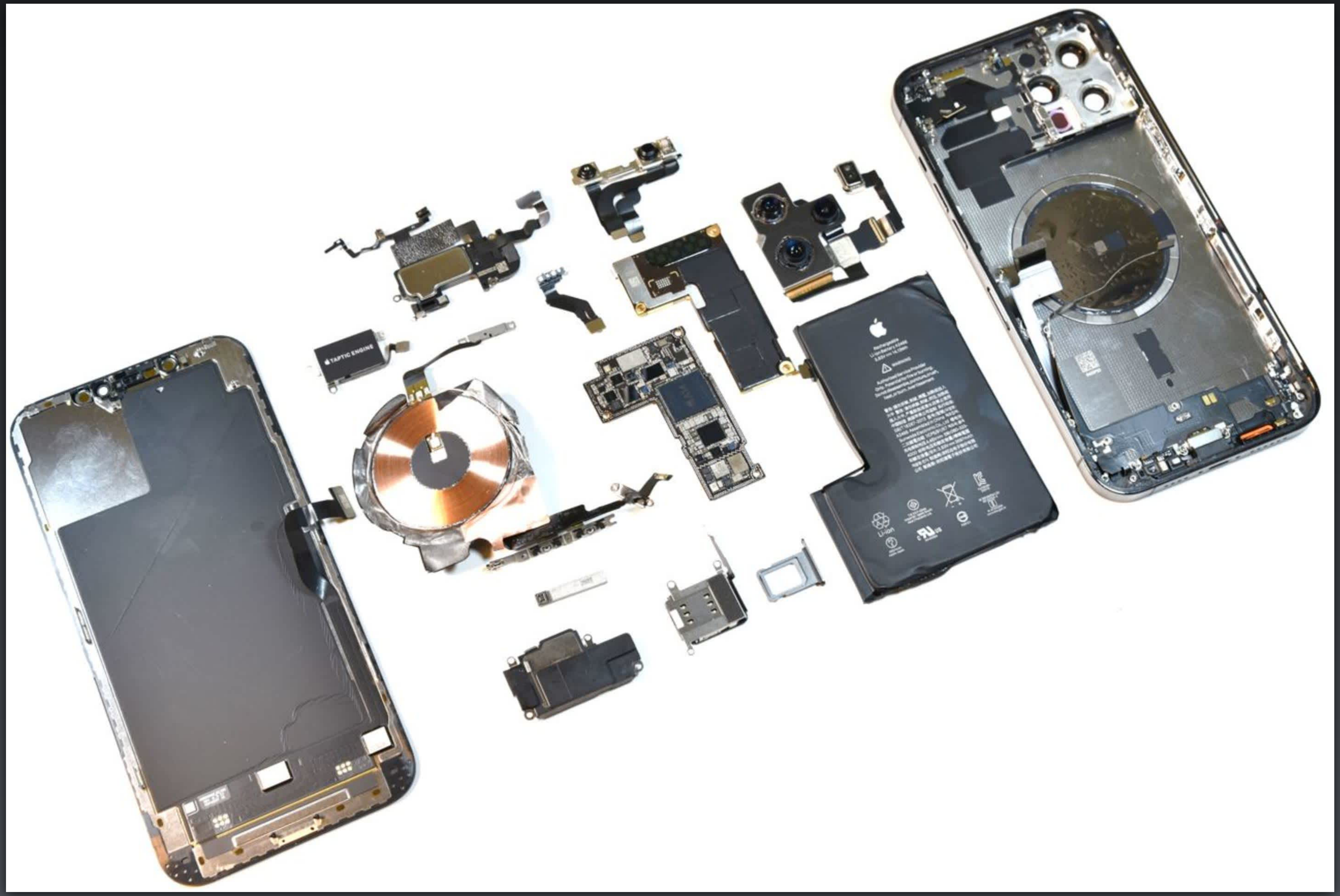
Coupling

Continuous Delivery ltd

Modularity

Modularity

Modularity



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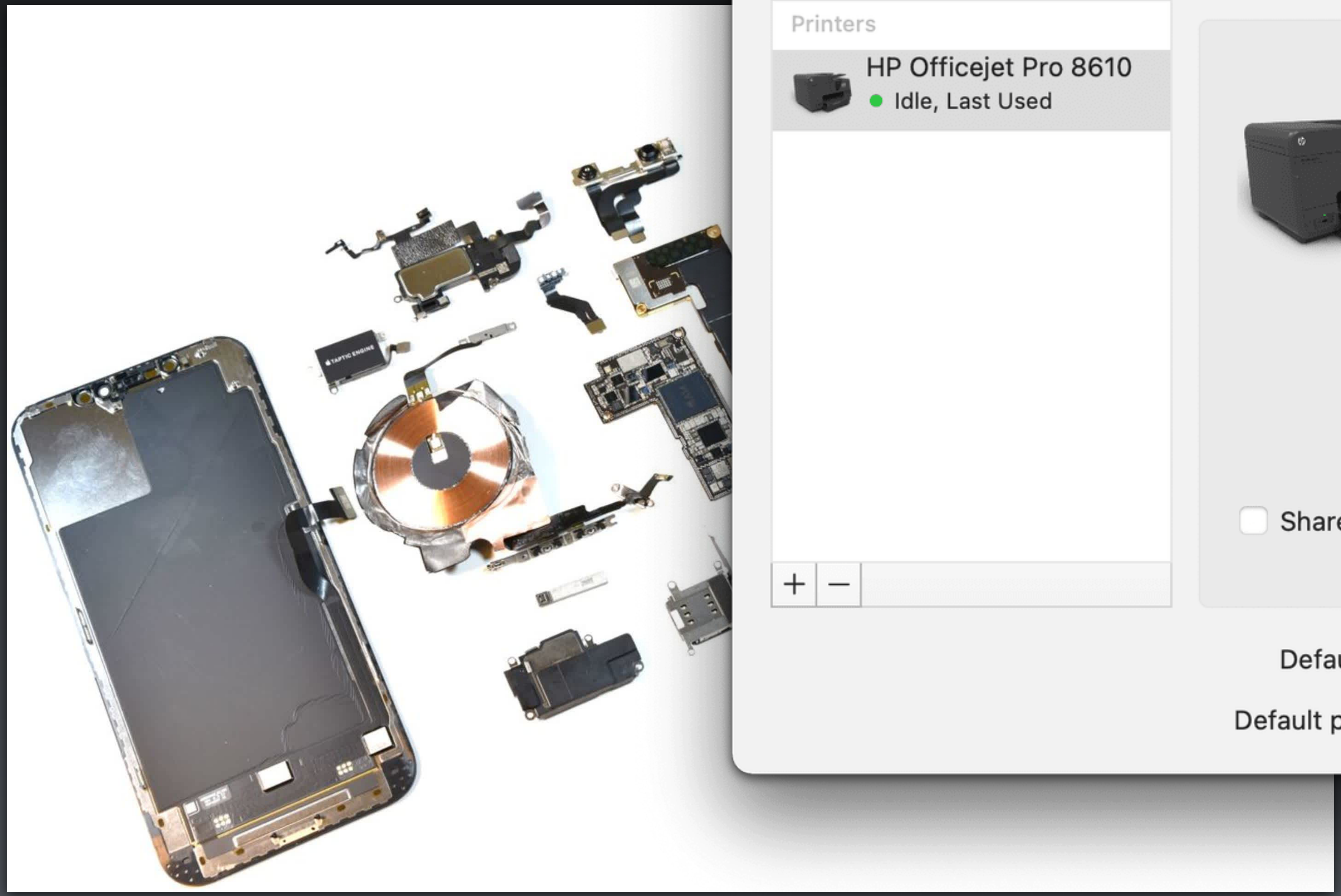
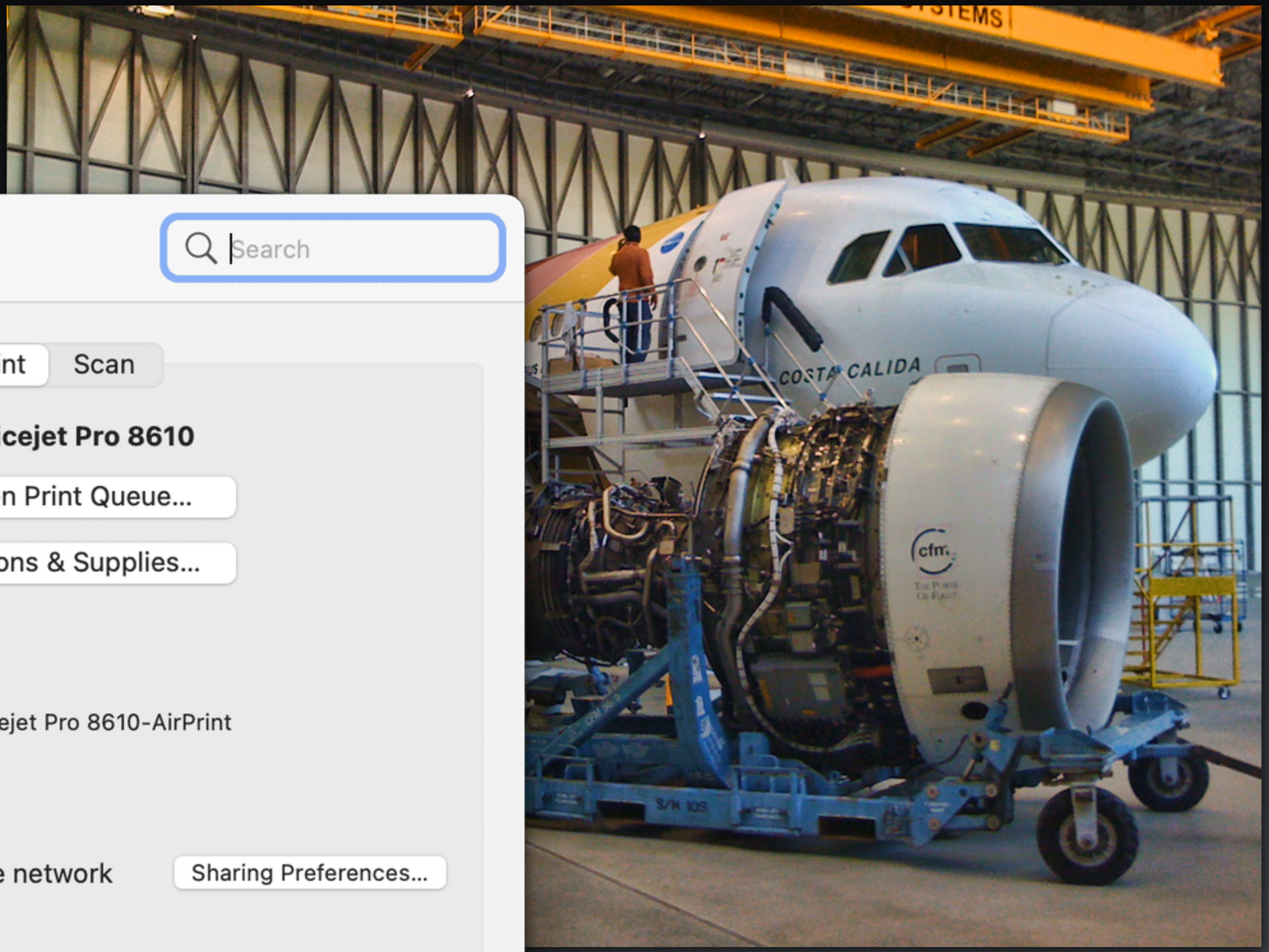
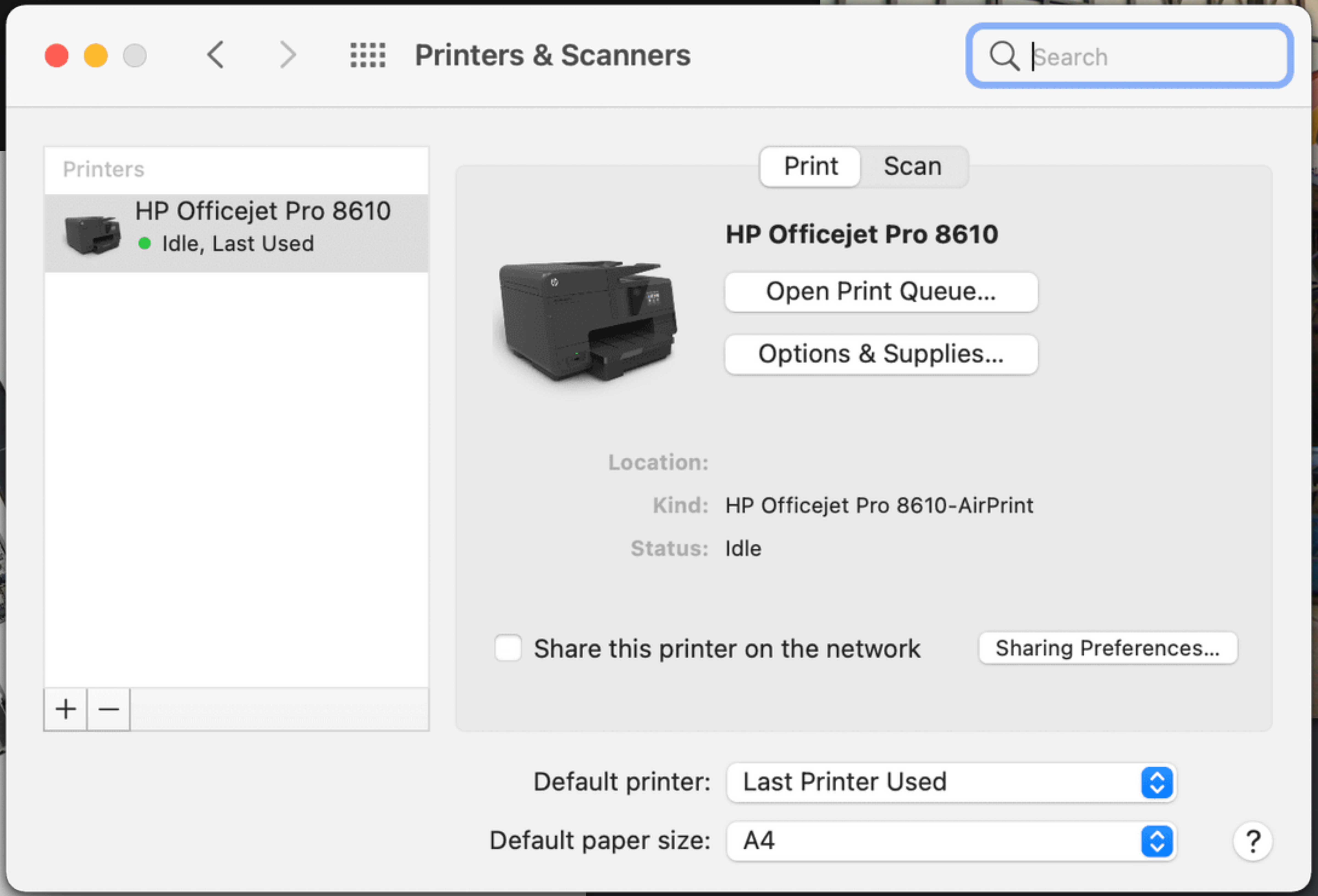
Modularity



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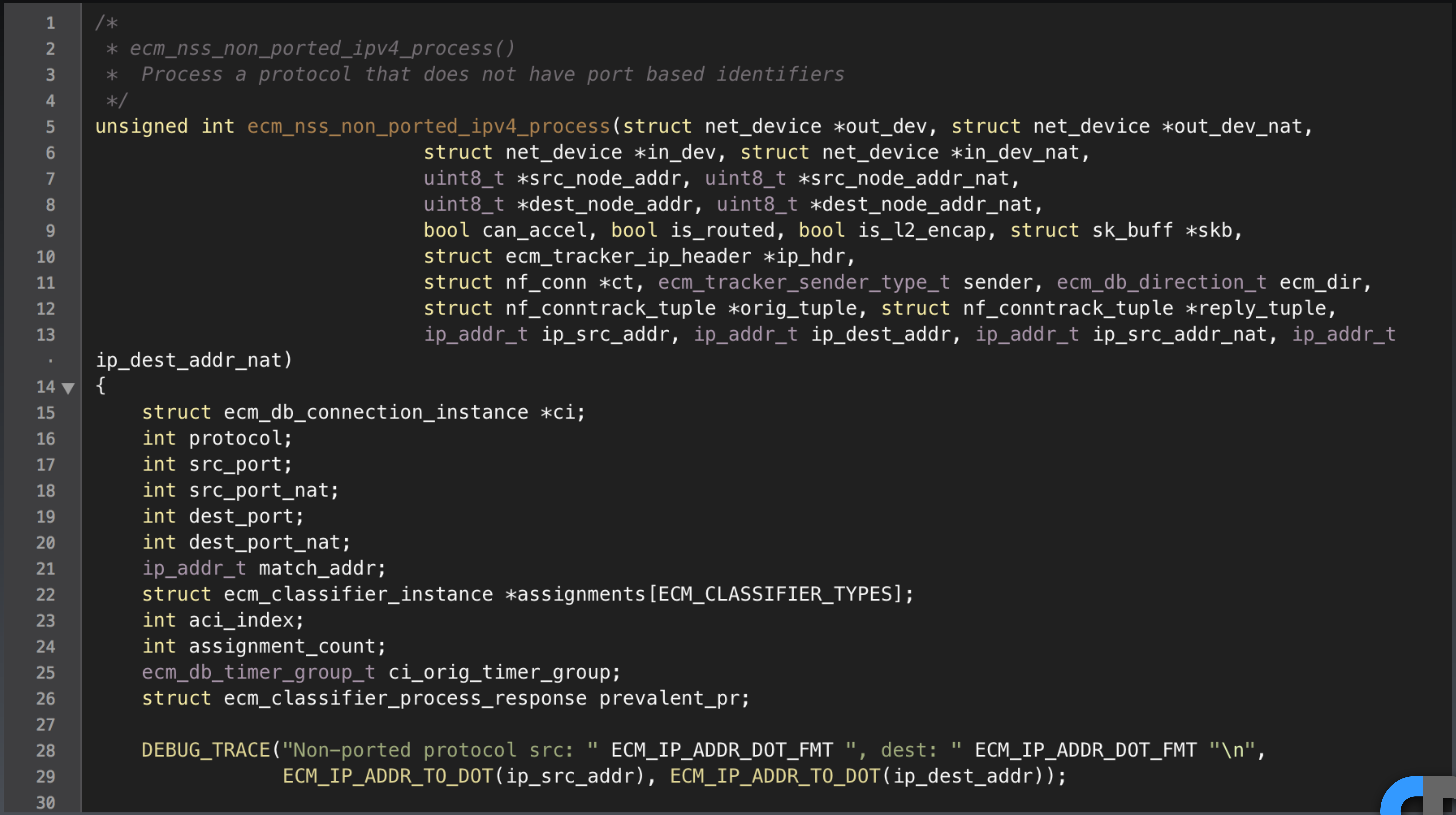
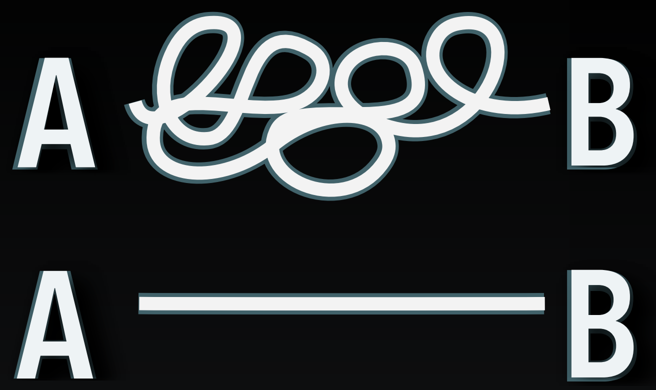


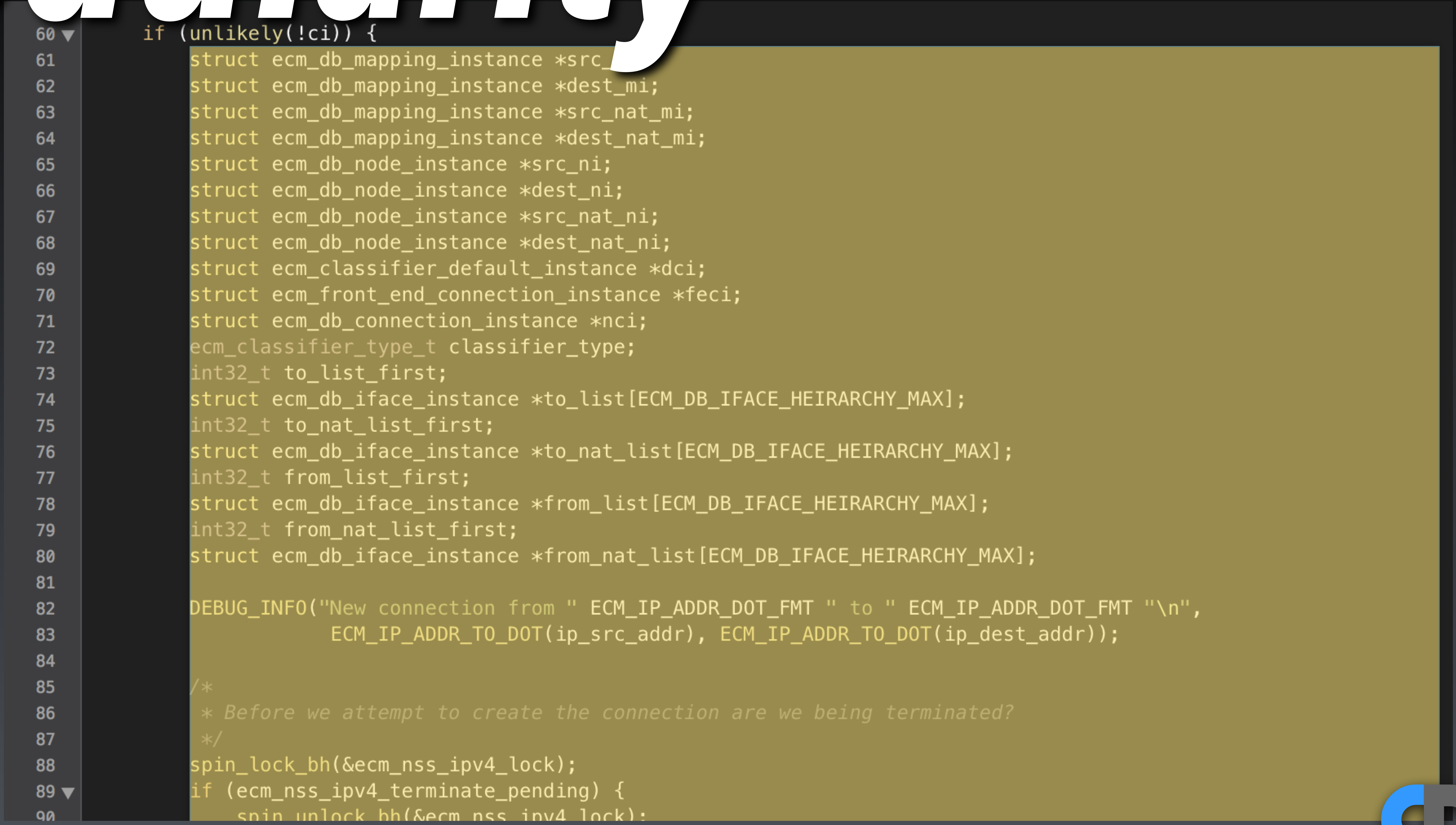
```c
/*
 * ecm_nss_non_ported_ipv4_process()
 *  Process a protocol that does not have port based identifiers
 */
unsigned int ecm_nss_non_ported_ipv4_process(struct net_device *out_dev, struct net_device *out_dev_nat,
                            struct net_device *in_dev, struct net_device *in_dev_nat,
                            uint8_t *src_node_addr, uint8_t *src_node_addr_nat,
                            uint8_t *dest_node_addr, uint8_t *dest_node_addr_nat,
                            bool can_accel, bool is_routed, bool is_l2_encap, struct sk_buff *skb,
                            struct ecm_tracker_ip_header *ip_hdr,
                            struct nf_conn *ct, ecm_tracker_sender_type_t sender, ecm_db_direction_t ecm_dir,
                            struct nf_conntrack_tuple *orig_tuple, struct nf_conntrack_tuple *reply_tuple,
                            ip_addr_t ip_src_addr, ip_addr_t ip_dest_addr, ip_addr_t ip_src_addr_nat, ip_addr_t ip_dest_addr_nat)
{
    struct ecm_db_connection_instance *ci;
    int protocol;
    int src_port;
    int src_port_nat;
    int dest_port;
    int dest_port_nat;
    ip_addr_t match_addr;
    struct ecm_classifier_instance *assignments[ECM_CLASSIFIER_TYPES];
    int aci_index;
    int assignment_count;
    ecm_db_timer_group_t ci_orig_timer_group;
    struct ecm_classifier_process_response prevalent_pr;

    DEBUG_TRACE("Non-ported protocol src: " ECM_IP_ADDR_DOT_FMT ", dest: " ECM_IP_ADDR_DOT_FMT "\n",
            ECM_IP_ADDR_TO_DOT(ip_src_addr), ECM_IP_ADDR_TO_DOT(ip_dest_addr));

```

Modularity



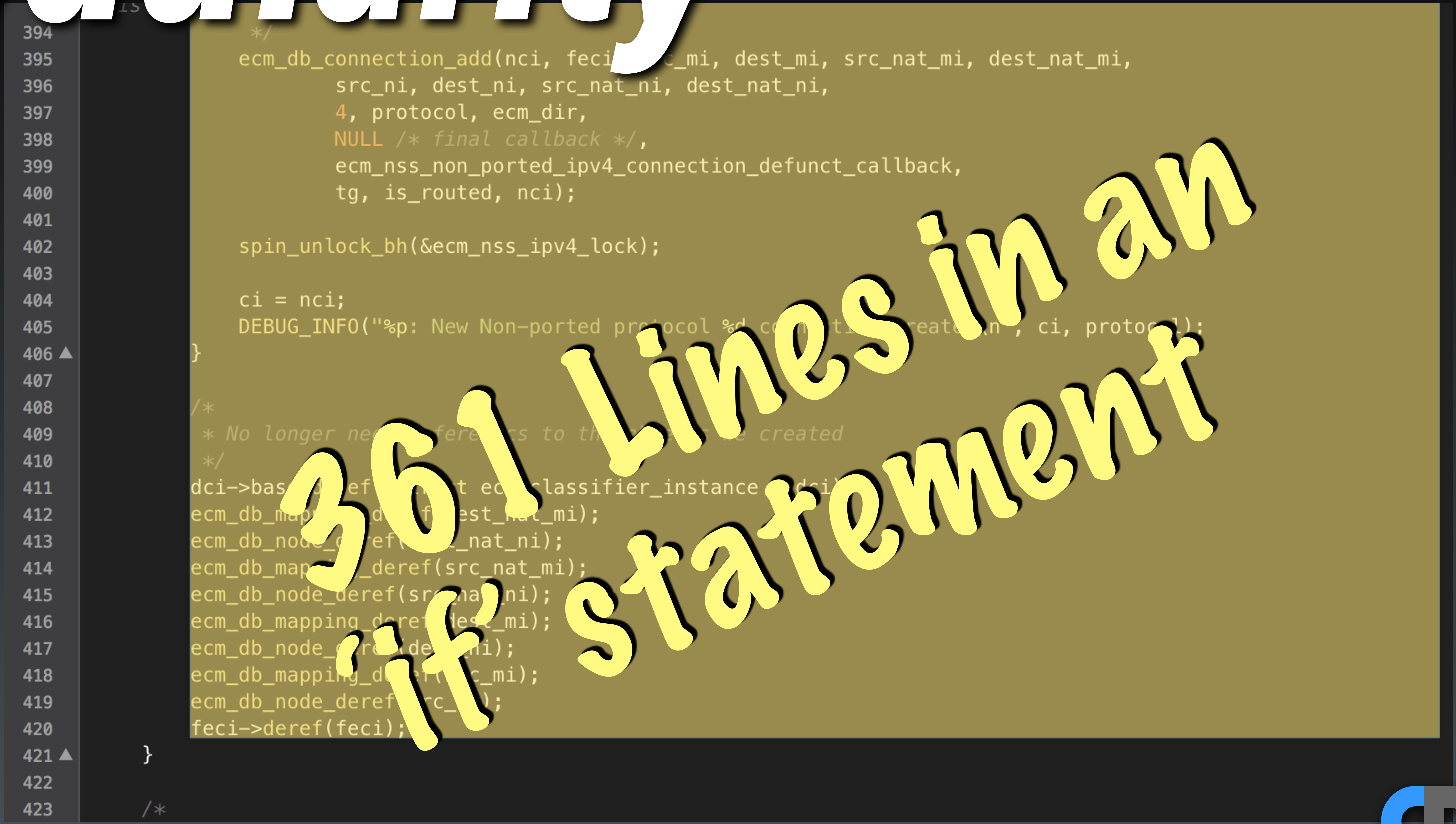

```
    if (unlikely(!ci)) {
        struct ecm_db_mapping_instance *src_
        struct ecm_db_mapping_instance *dest_mi;
        struct ecm_db_mapping_instance *src_nat_mi;
        struct ecm_db_mapping_instance *dest_nat_mi;
        struct ecm_db_node_instance *src_ni;
        struct ecm_db_node_instance *dest_ni;
        struct ecm_db_node_instance *src_nat_ni;
        struct ecm_db_node_instance *dest_nat_ni;
        struct ecm_classifier_default_instance *dci;
        struct ecm_front_end_connection_instance *feci;
        struct ecm_db_connection_instance *nci;
        ecm_classifier_type_t classifier_type;
        int32_t to_list_first;
        struct ecm_db_iface_instance *to_list[ECM_DB_IFACE_HEIRARCHY_MAX];
        int32_t to_nat_list_first;
        struct ecm_db_iface_instance *to_nat_list[ECM_DB_IFACE_HEIRARCHY_MAX];
        int32_t from_list_first;
        struct ecm_db_iface_instance *from_list[ECM_DB_IFACE_HEIRARCHY_MAX];
        int32_t from_nat_list_first;
        struct ecm_db_iface_instance *from_nat_list[ECM_DB_IFACE_HEIRARCHY_MAX];

        DEBUG_INFO("New connection from " ECM_IP_ADDR_DOT_FMT " to " ECM_IP_ADDR_DOT_FMT "\n",
                    ECM_IP_ADDR_TO_DOT(ip_src_addr), ECM_IP_ADDR_TO_DOT(ip_dest_addr));

        /*
         * Before we attempt to create the connection are we being terminated?
         */
        spin_lock_bh(&ecm_nss_ipv4_lock);
        if (ecm_nss_ipv4_terminate_pending) {
            spin_unlock_bh(&ecm_nss_ipv4_lock);
```

Continuous Delivery ltd

Modularity



```
         */
        ecm_db_connection_add(nci, feci, src_mi, dest_mi, src_nat_mi, dest_nat_mi,
                src_ni, dest_ni, src_nat_ni, dest_nat_ni,
                4, protocol, ecm_dir,
                NULL /* final callback */,
                ecm_nss_non_ported_ipv4_connection_defunct_callback,
                tg, is_routed, nci);

        spin_unlock_bh(&ecm_nss_ipv4_lock);

        ci = nci;
        DEBUG_INFO("%p: New Non-ported protocol %d connection created\n", ci, protocol);
    }

    /*
     * No longer need references to the objects we created
     */
    dci->base.deref((struct ecm_classifier_instance *)dci);
    ecm_db_mapping_deref(dest_nat_mi);
    ecm_db_node_deref(dest_nat_ni);
    ecm_db_mapping_deref(src_nat_mi);
    ecm_db_node_deref(src_nat_ni);
    ecm_db_mapping_deref(dest_mi);
    ecm_db_node_deref(dest_ni);
    ecm_db_mapping_deref(src_mi);
    ecm_db_node_deref(src_ni);
    feci->deref(feci);
}

/*
```

361 Lines in an 'if' statement

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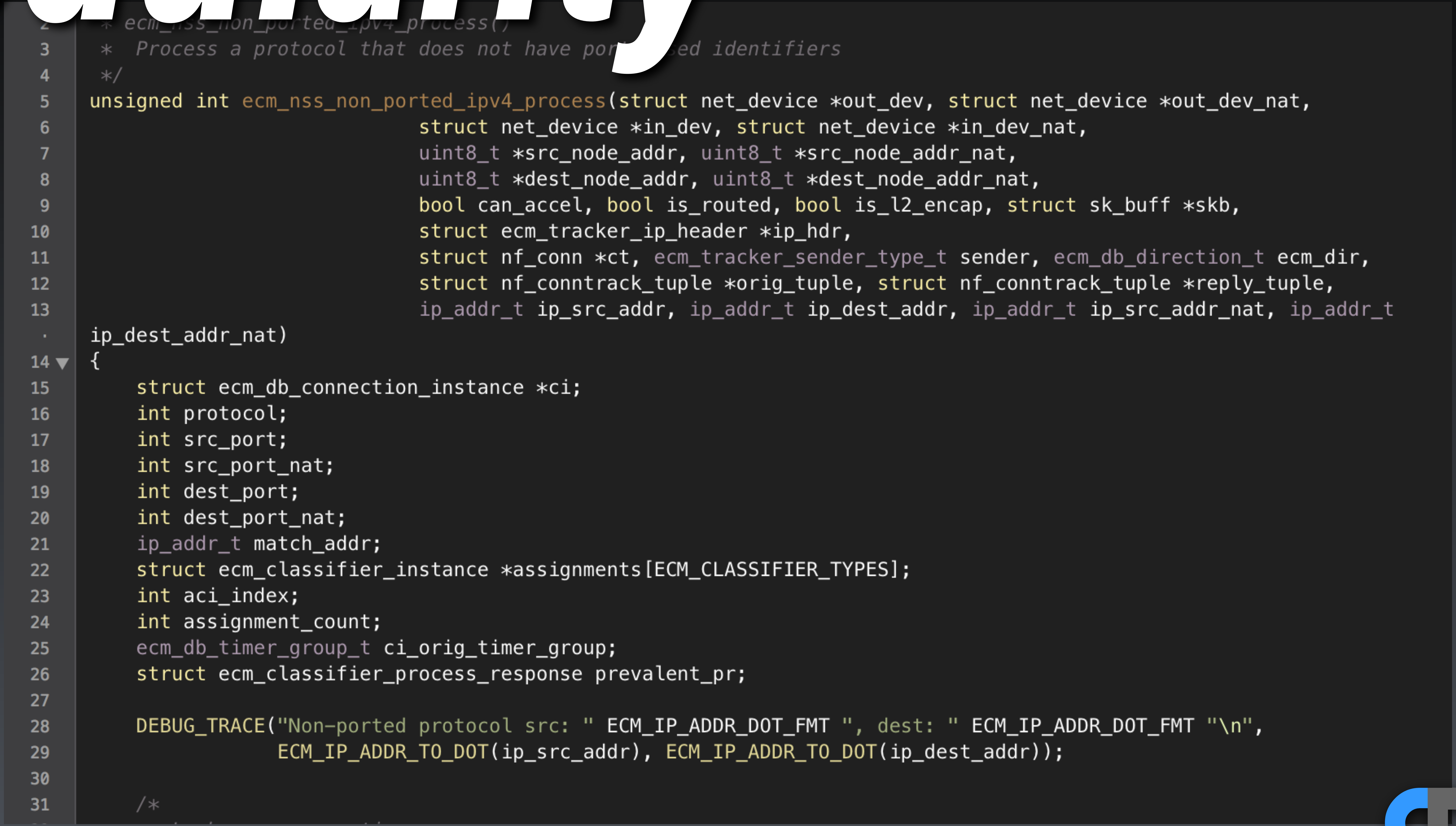
Modularity


```
 * ecm_nss_non_ported_ipv4_process()
 *  Process a protocol that does not have por[illegible]ed identifiers
 */
unsigned int ecm_nss_non_ported_ipv4_process(struct net_device *out_dev, struct net_device *out_dev_nat,
                            struct net_device *in_dev, struct net_device *in_dev_nat,
                            uint8_t *src_node_addr, uint8_t *src_node_addr_nat,
                            uint8_t *dest_node_addr, uint8_t *dest_node_addr_nat,
                            bool can_accel, bool is_routed, bool is_l2_encap, struct sk_buff *skb,
                            struct ecm_tracker_ip_header *ip_hdr,
                            struct nf_conn *ct, ecm_tracker_sender_type_t sender, ecm_db_direction_t ecm_dir,
                            struct nf_conntrack_tuple *orig_tuple, struct nf_conntrack_tuple *reply_tuple,
                            ip_addr_t ip_src_addr, ip_addr_t ip_dest_addr, ip_addr_t ip_src_addr_nat, ip_addr_t ip_dest_addr_nat)
{
    struct ecm_db_connection_instance *ci;
    int protocol;
    int src_port;
    int src_port_nat;
    int dest_port;
    int dest_port_nat;
    ip_addr_t match_addr;
    struct ecm_classifier_instance *assignments[ECM_CLASSIFIER_TYPES];
    int aci_index;
    int assignment_count;
    ecm_db_timer_group_t ci_orig_timer_group;
    struct ecm_classifier_process_response prevalent_pr;

    DEBUG_TRACE("Non-ported protocol src: " ECM_IP_ADDR_DOT_FMT ", dest: " ECM_IP_ADDR_DOT_FMT "\n",
                ECM_IP_ADDR_TO_DOT(ip_src_addr), ECM_IP_ADDR_TO_DOT(ip_dest_addr));

    /*
```

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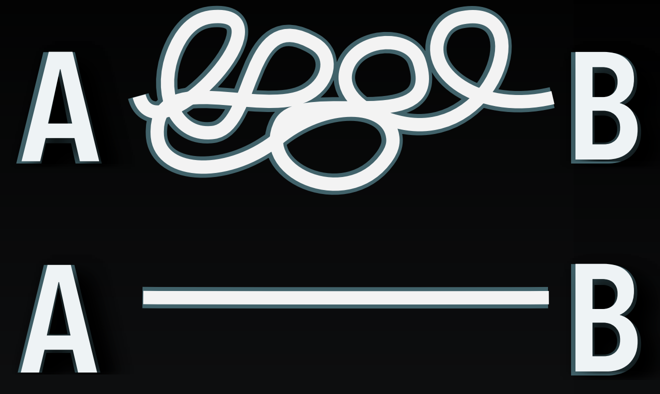
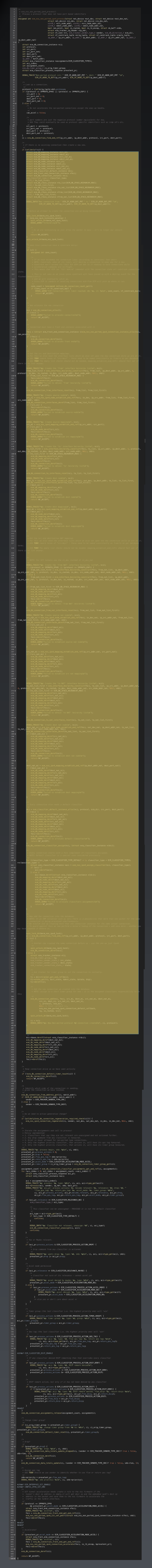
Modularity





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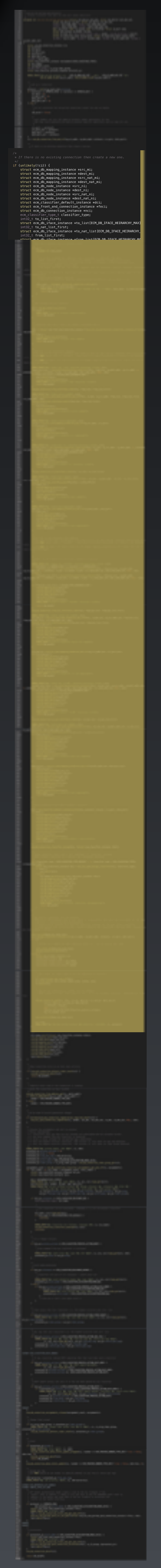
Modularity



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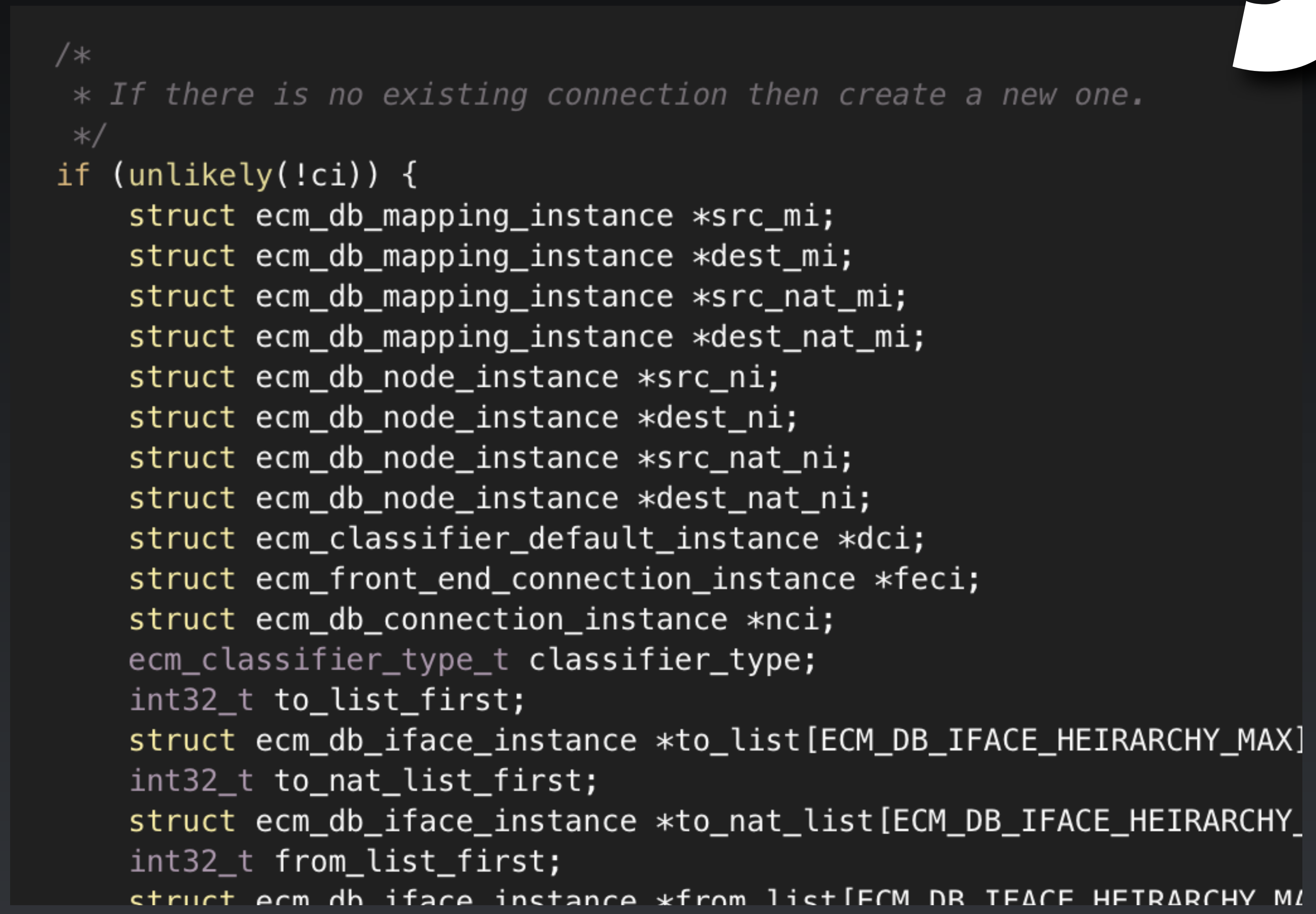
Modularity



```
/*
 * If there is no existing connection then create a new one.
 */
if (unlikely(!ci)) {
	struct ecm_db_mapping_instance *src_mi;
	struct ecm_db_mapping_instance *dest_mi;
	struct ecm_db_mapping_instance *src_nat_mi;
	struct ecm_db_mapping_instance *dest_nat_mi;
	struct ecm_db_node_instance *src_ni;
	struct ecm_db_node_instance *dest_ni;
	struct ecm_db_node_instance *src_nat_ni;
	struct ecm_db_node_instance *dest_nat_ni;
	struct ecm_classifier_default_instance *dci;
	struct ecm_front_end_connection_instance *feci;
	struct ecm_db_connection_instance *nci;
	ecm_classifier_type_t classifier_type;
	int32_t to_list_first;
	struct ecm_db_iface_instance *to_list[ECM_DB_IFACE_HEIRARCHY_MAX]
	int32_t to_nat_list_first;
	struct ecm_db_iface_instance *to_nat_list[ECM_DB_IFACE_HEIRARCHY_
	int32_t from_list_first;
	struct ecm_db_iface_instance *from_list[ECM_DB_IFACE_HEIRARCHY_MA
```

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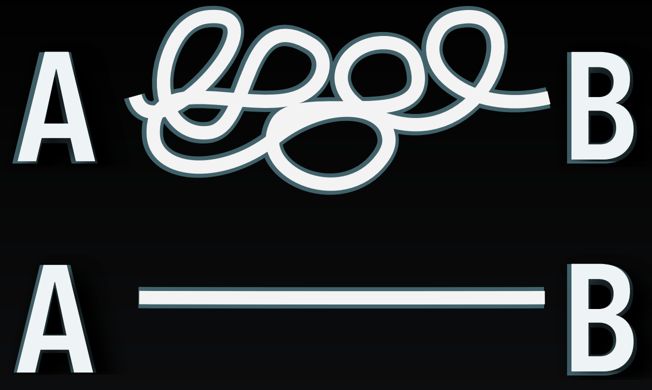
Modularity



```
if (noConnection(ci)) {
    createConnection();
}
```

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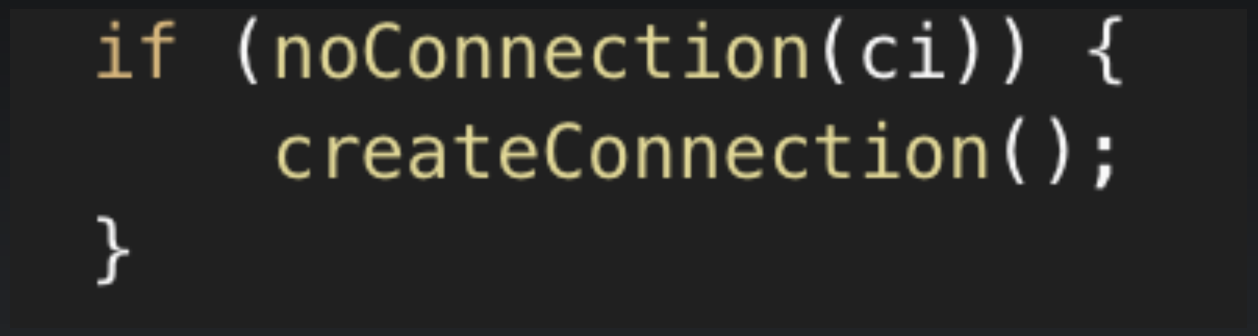
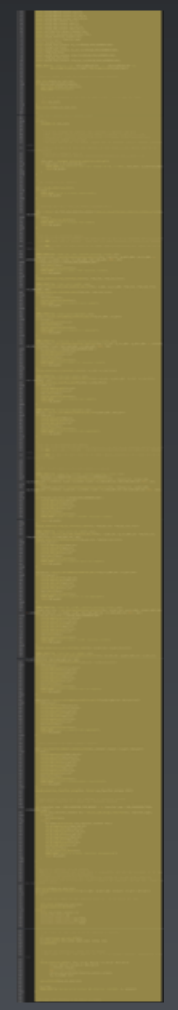
Modularity



```
if (noConnection(ci)) {
    createConnection();
}
```



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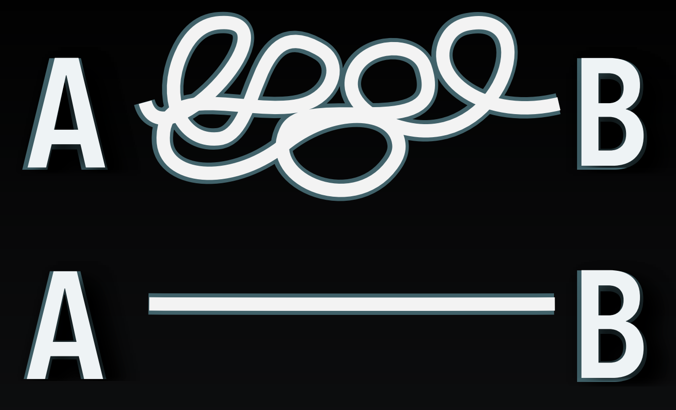

"Good Design is about moving the things that are related closer together, and the things that aren't related further apart" - ***Kent Beck***

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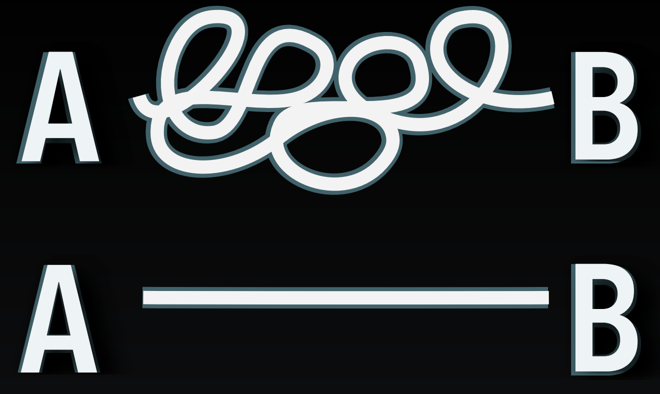
"Good Design is about moving the things that are related closer together, and the things that aren't related further apart." - *Kent Beck*



Modularity

things that aren't related further apart

Cohesion

things that are related closer together

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Separation of Concerns

Separation of Concerns

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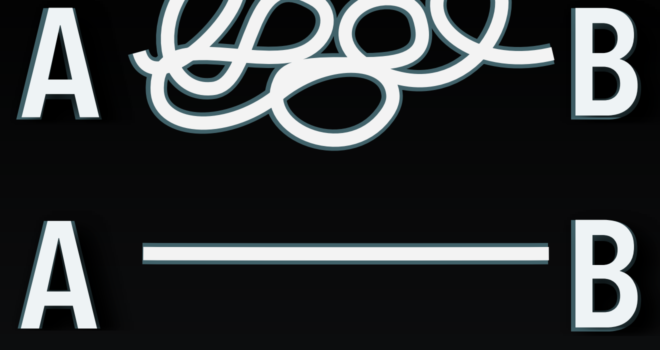
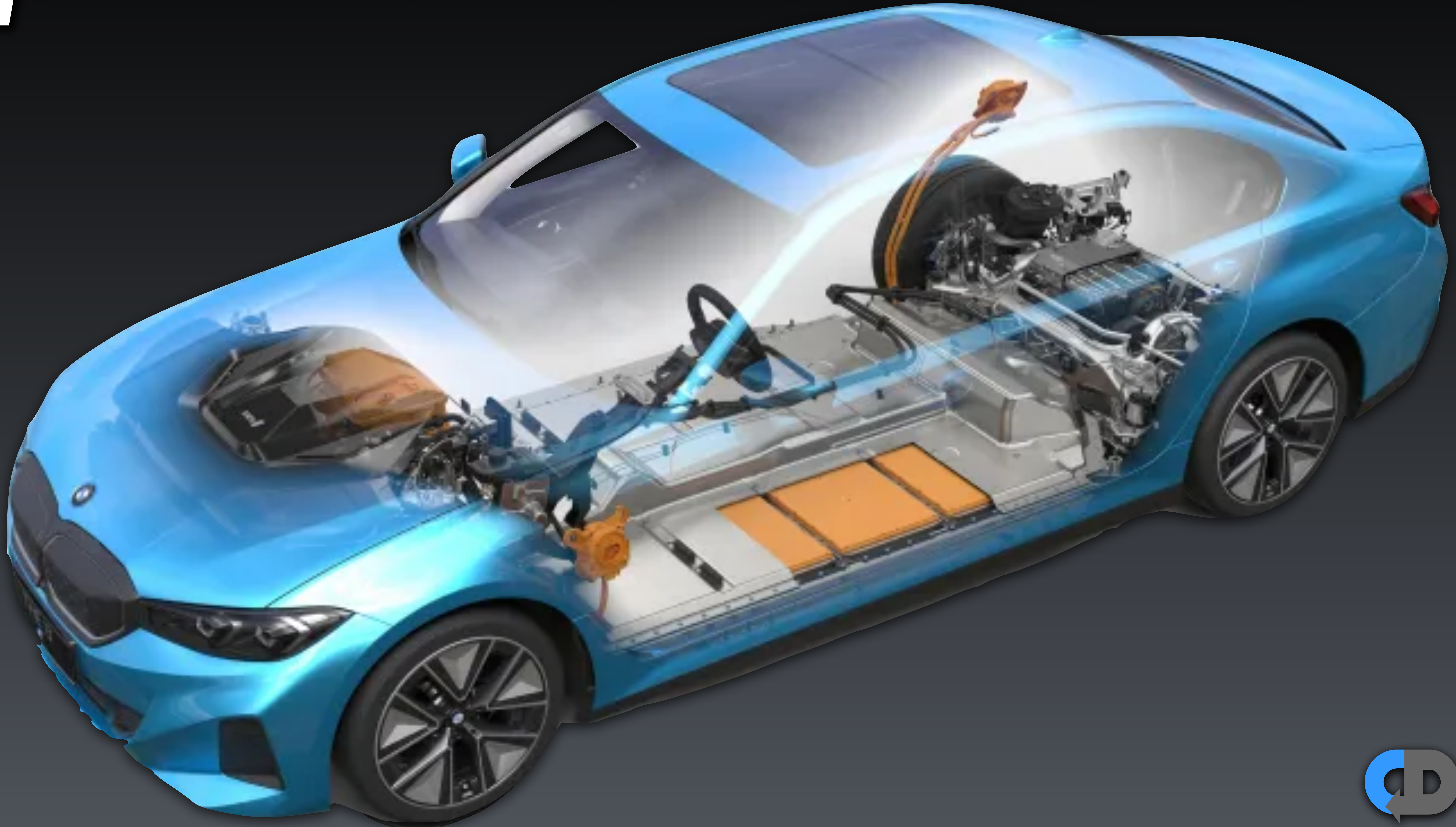
Separation of Concerns





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Separation of Concerns

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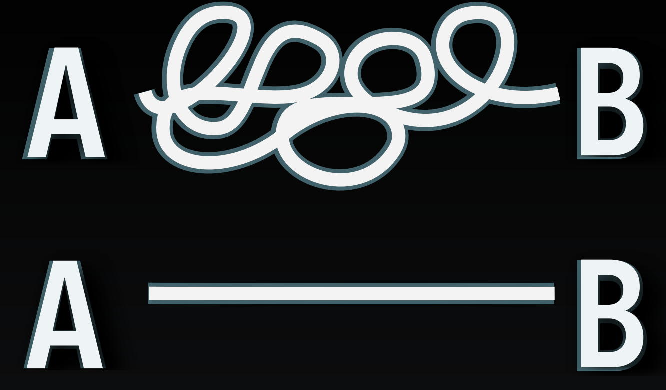
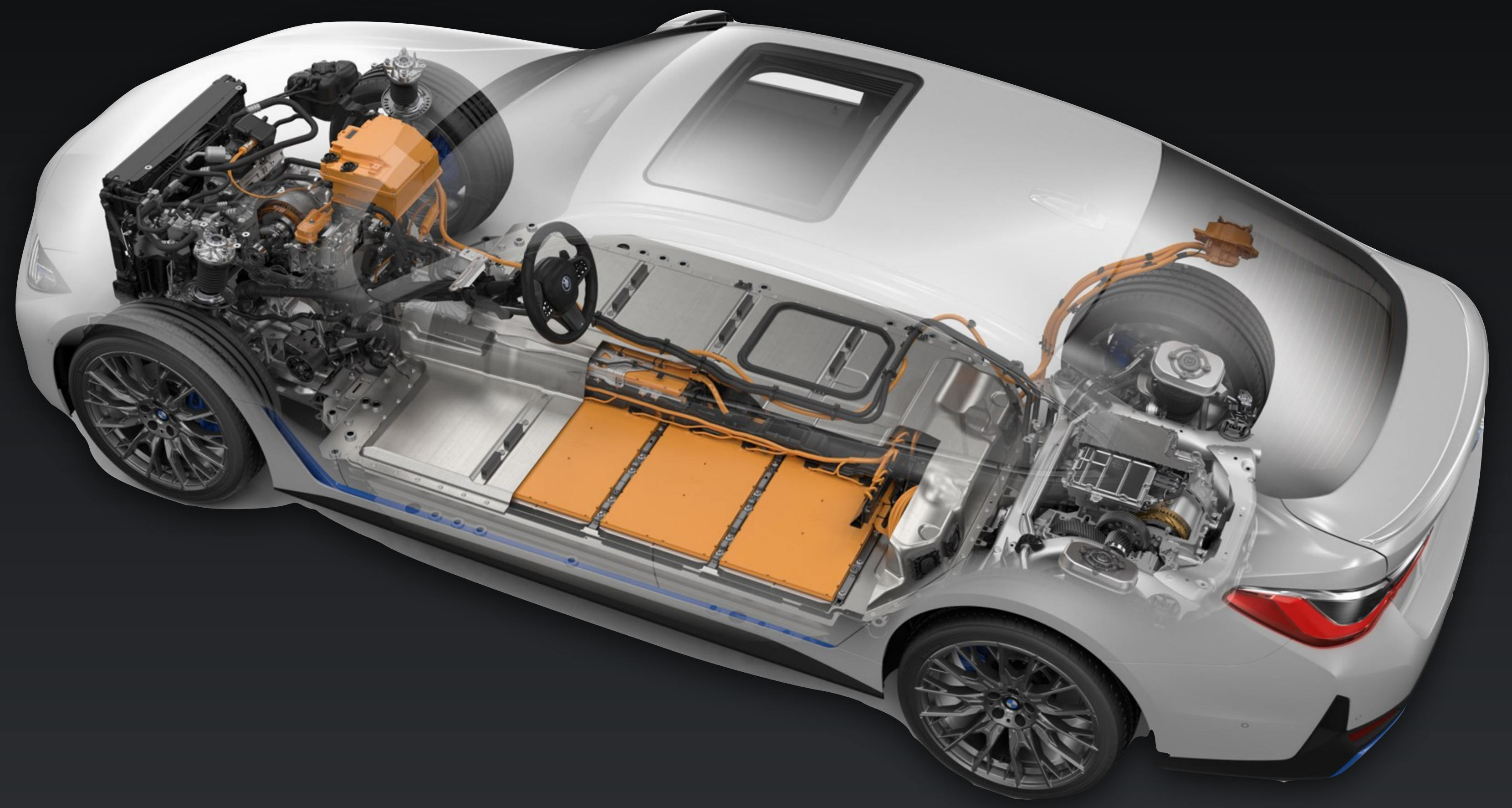
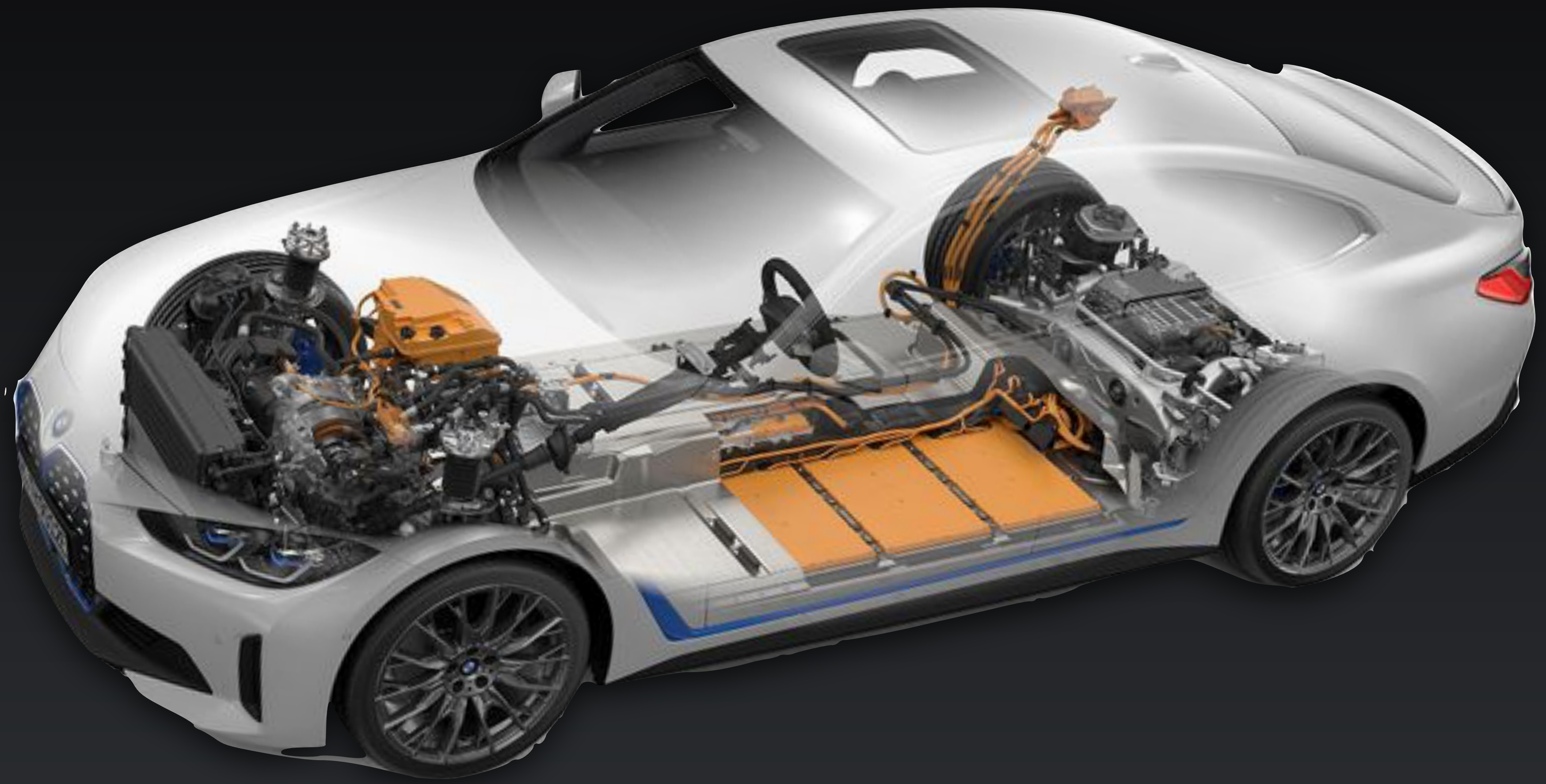
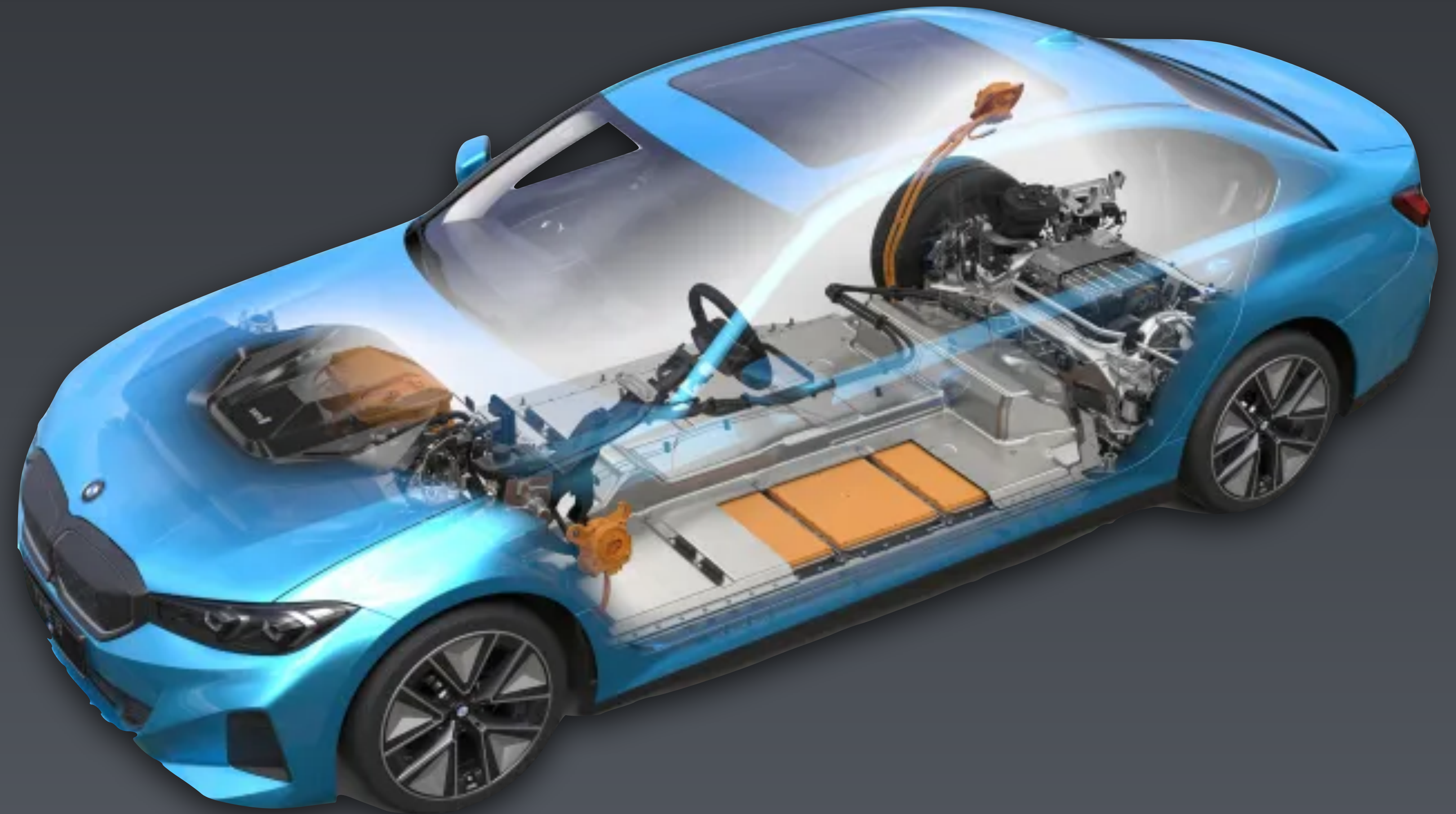
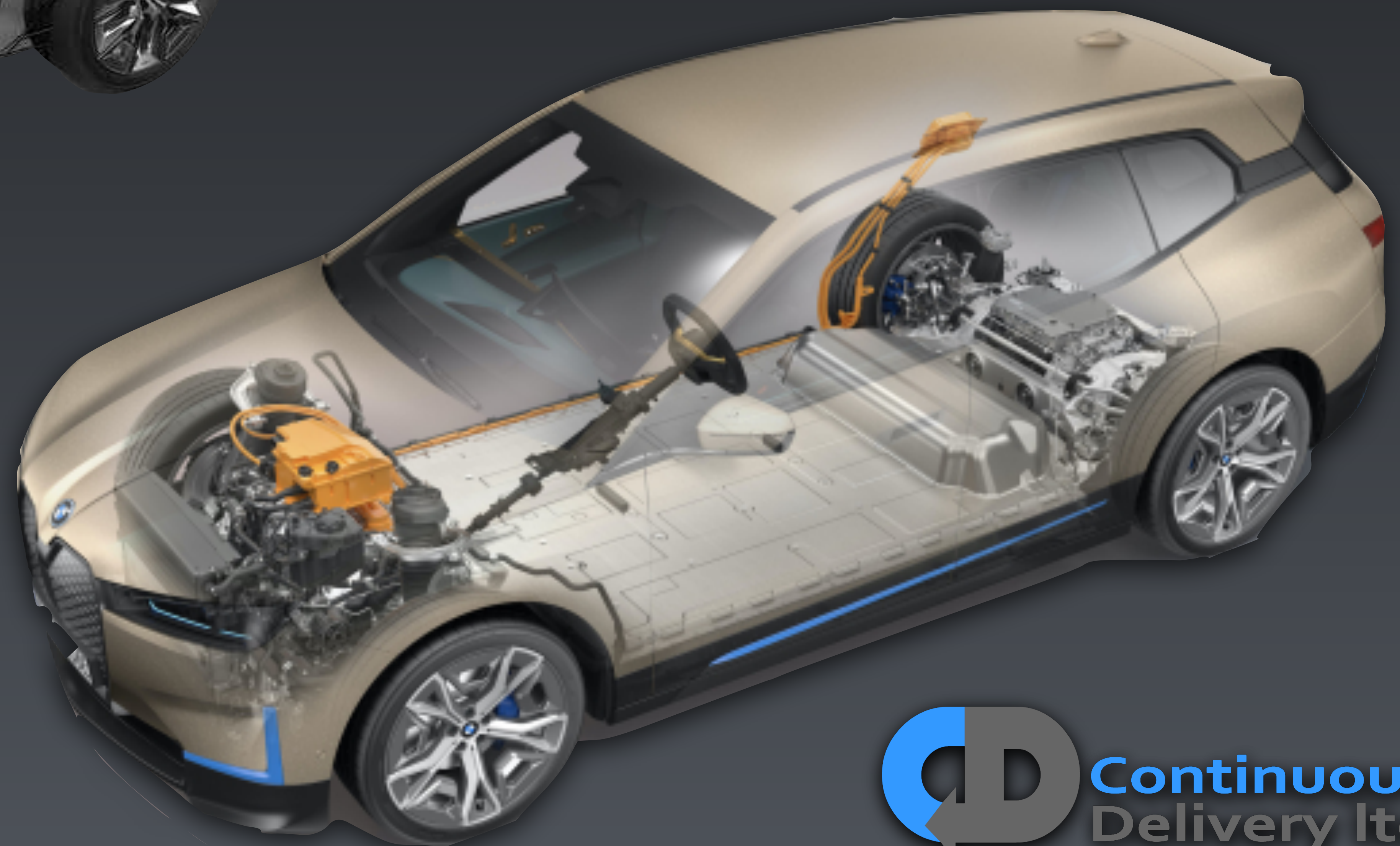
Separation of Concerns











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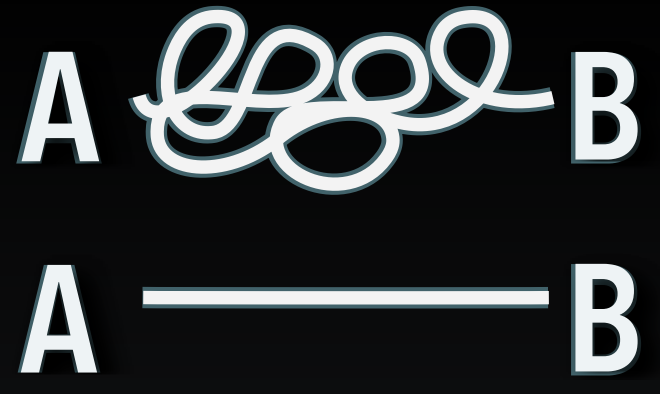
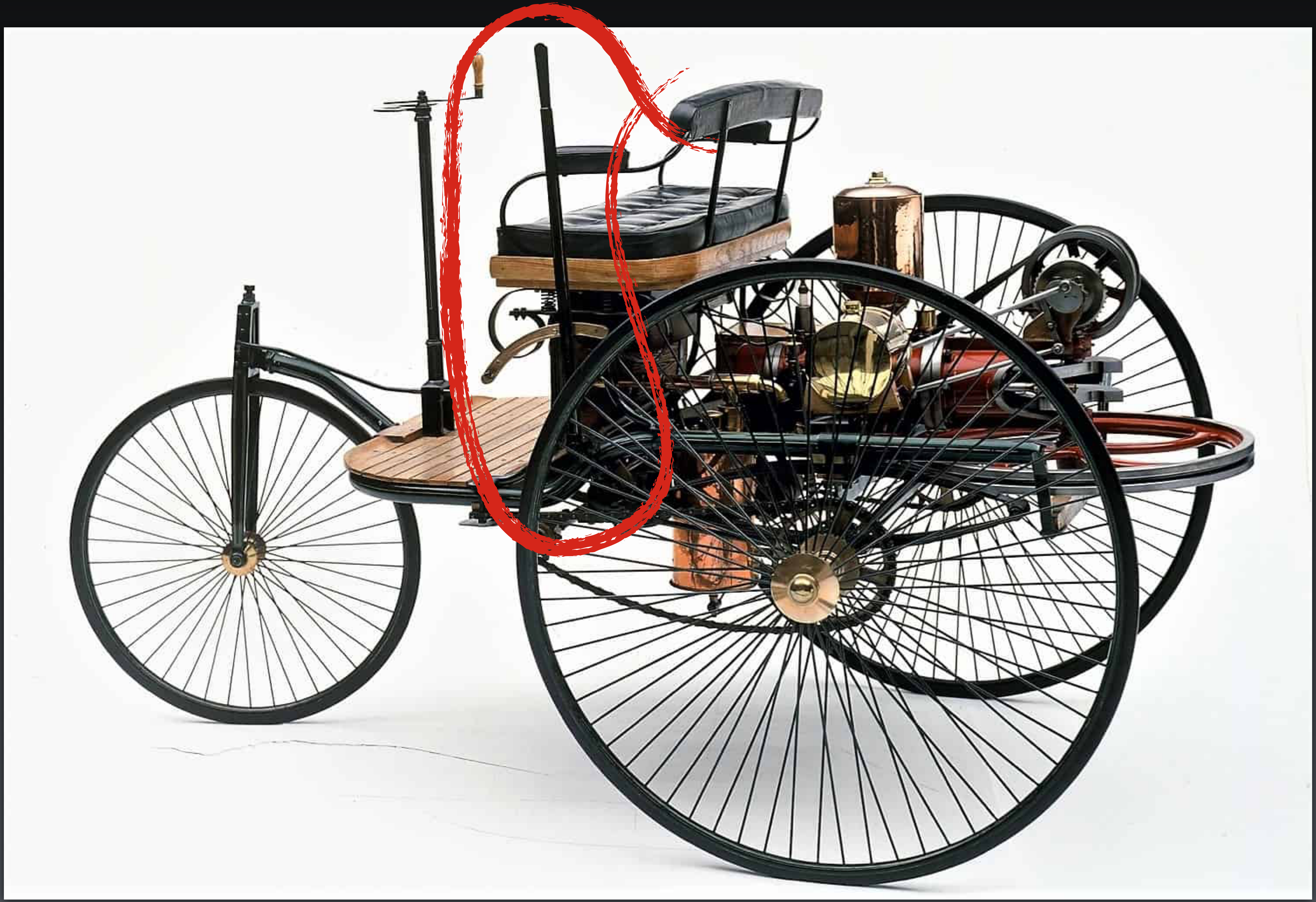
Abstraction

Continuous Delivery ltd

Abstraction





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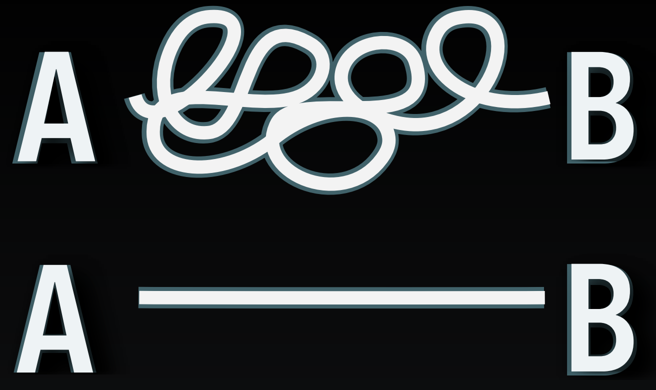
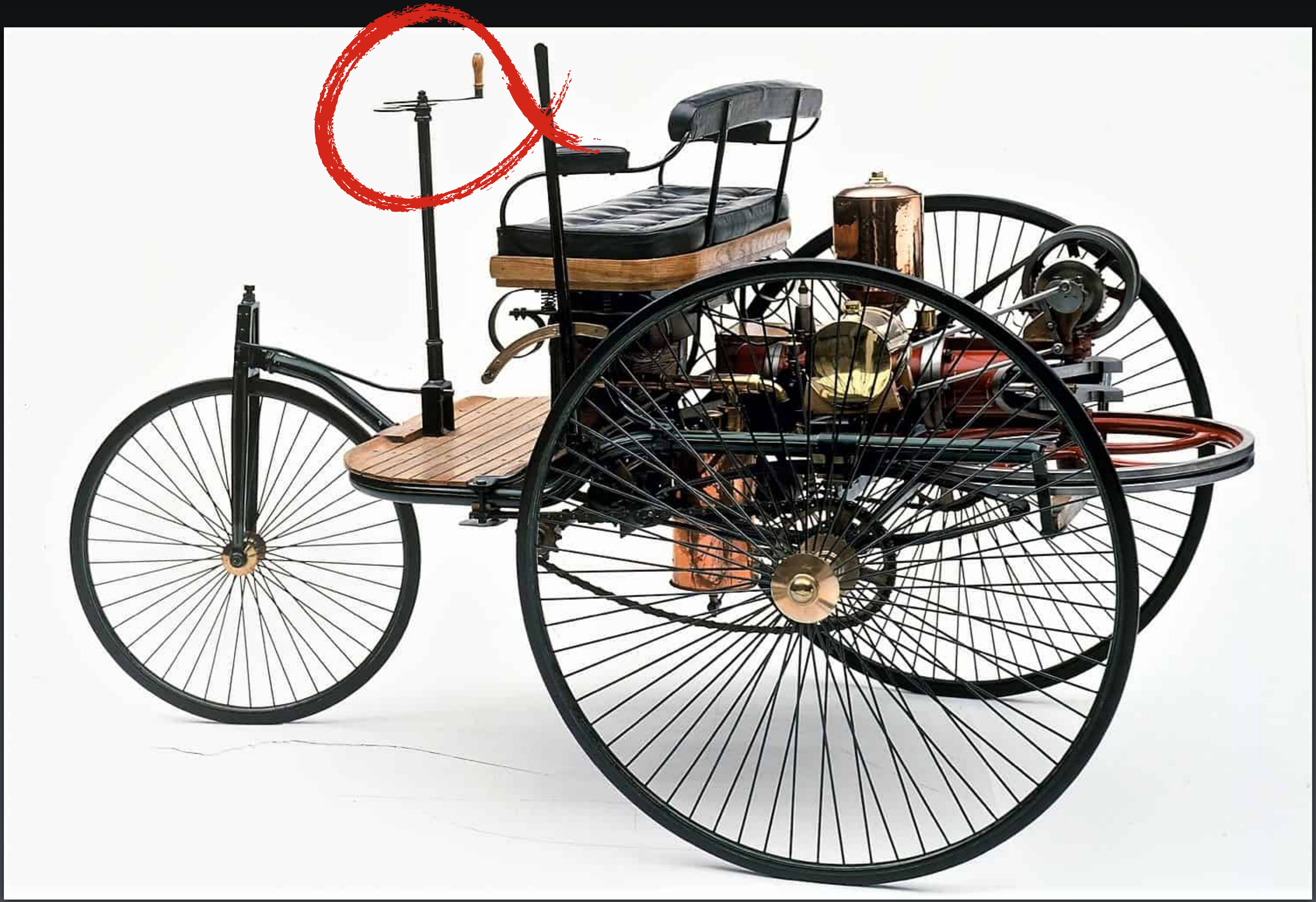
Abstraction





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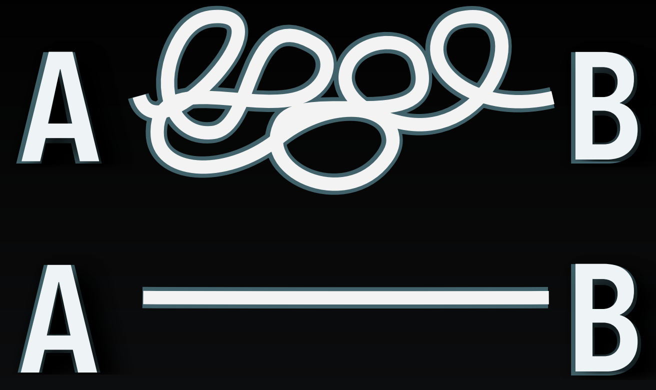
Abstraction



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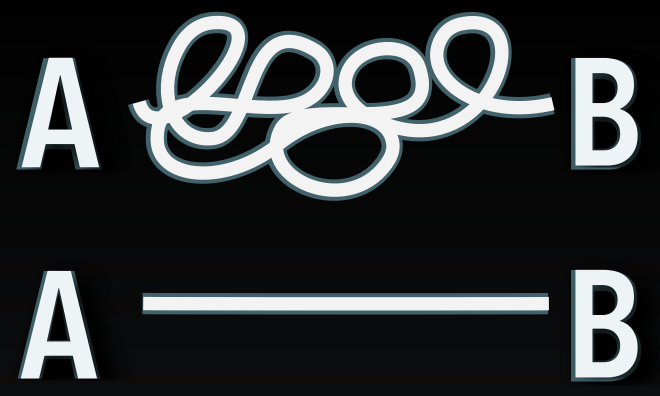

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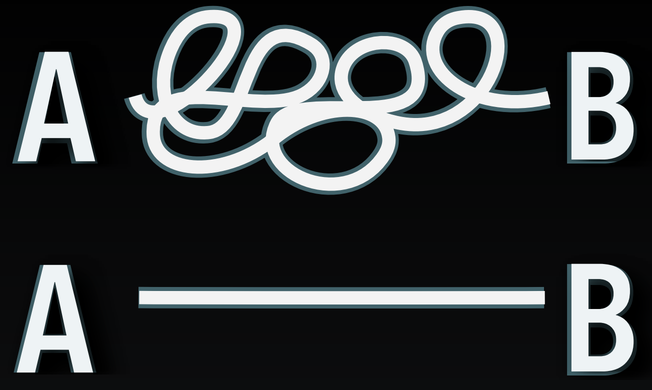

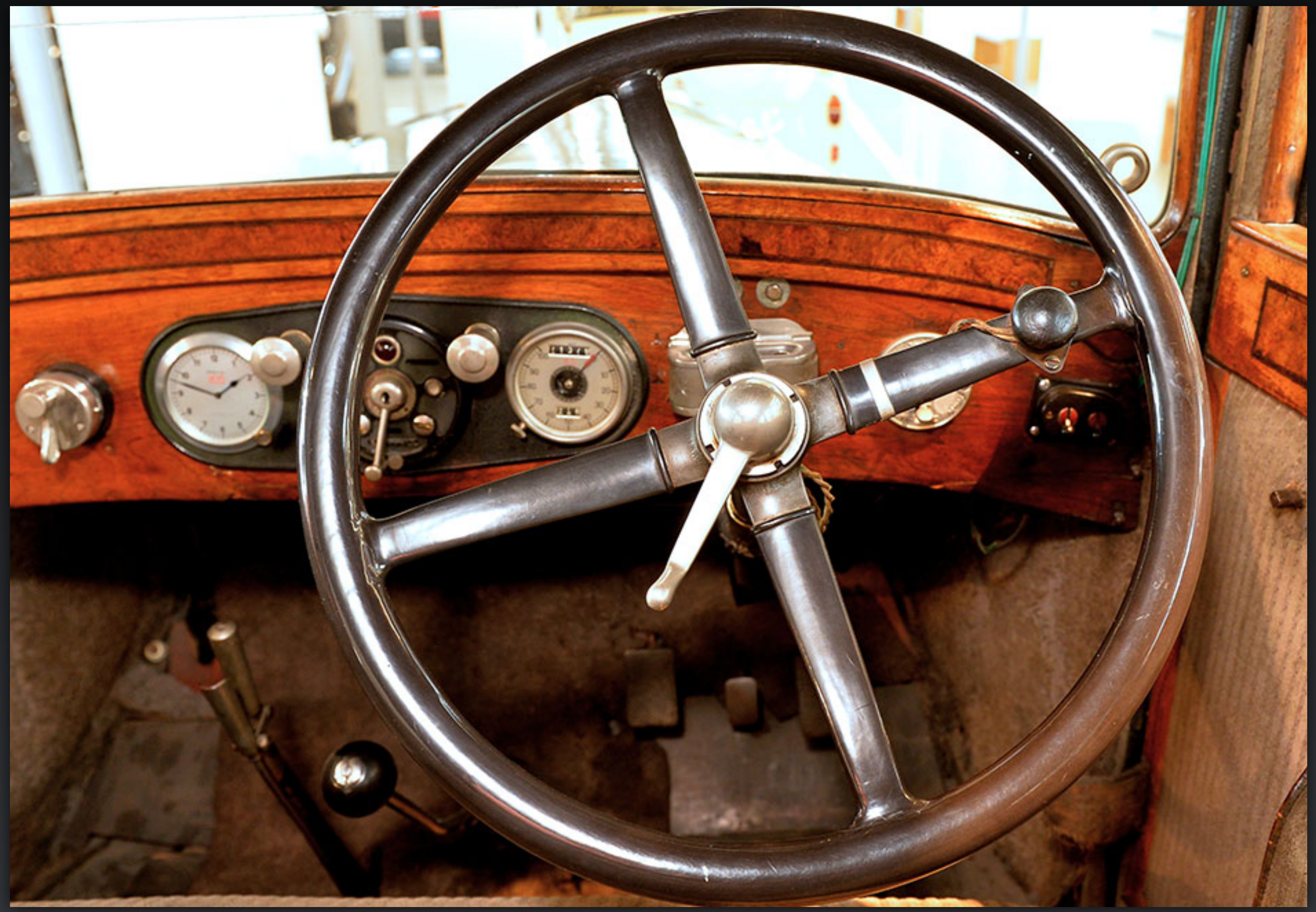

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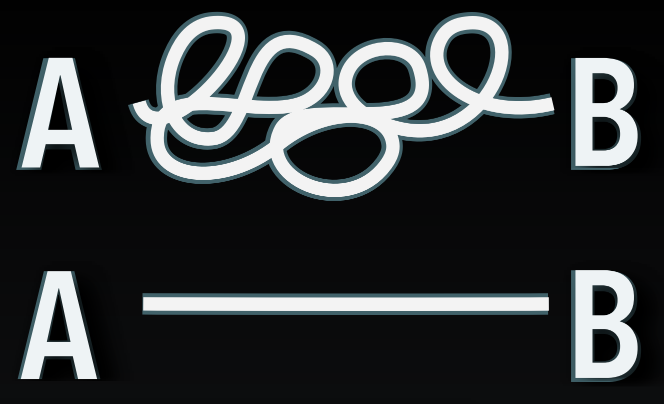

Abstraction

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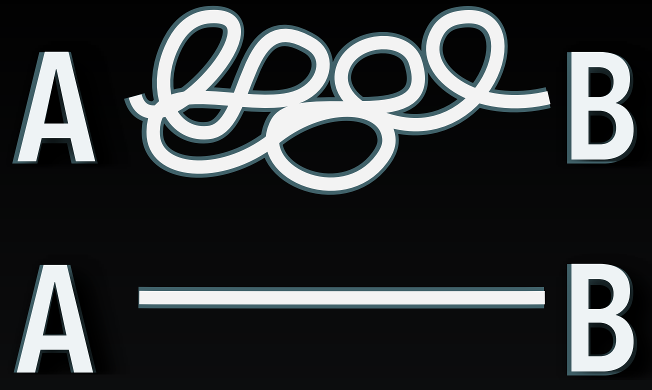

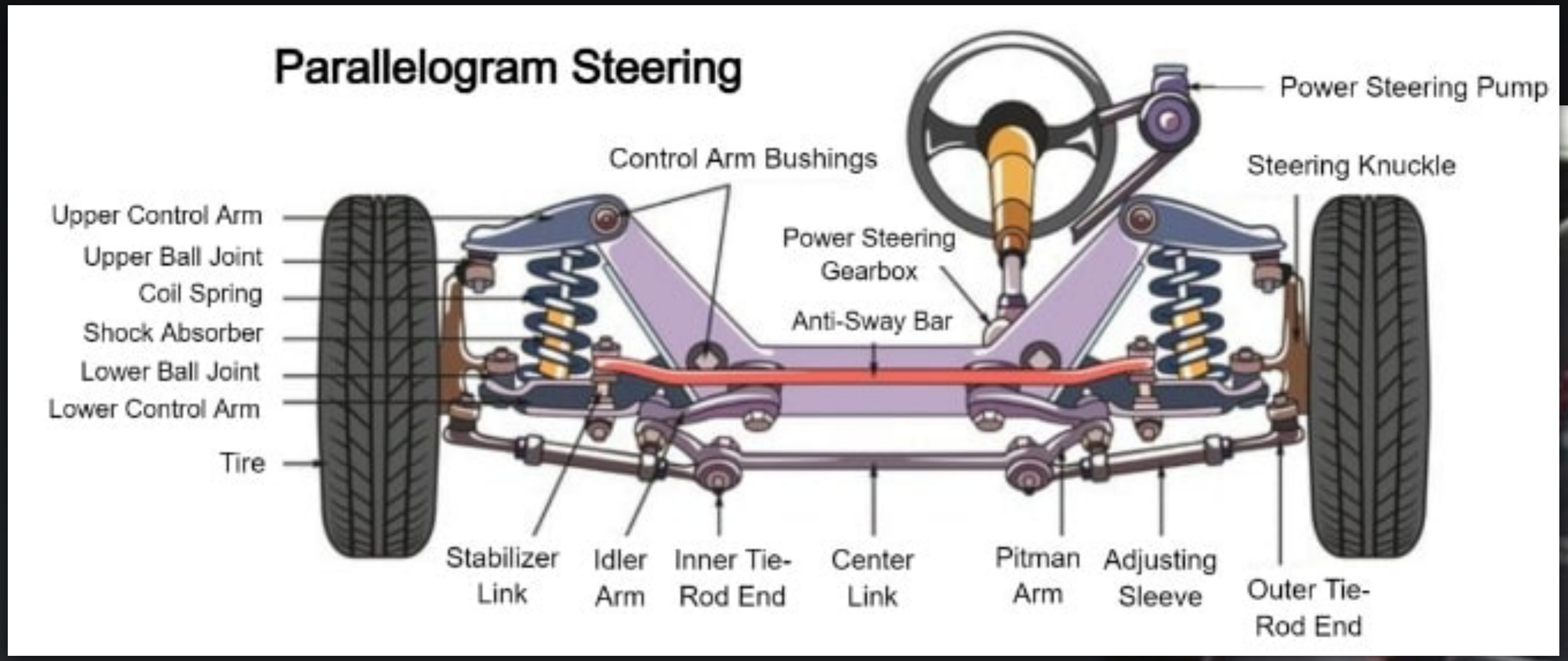

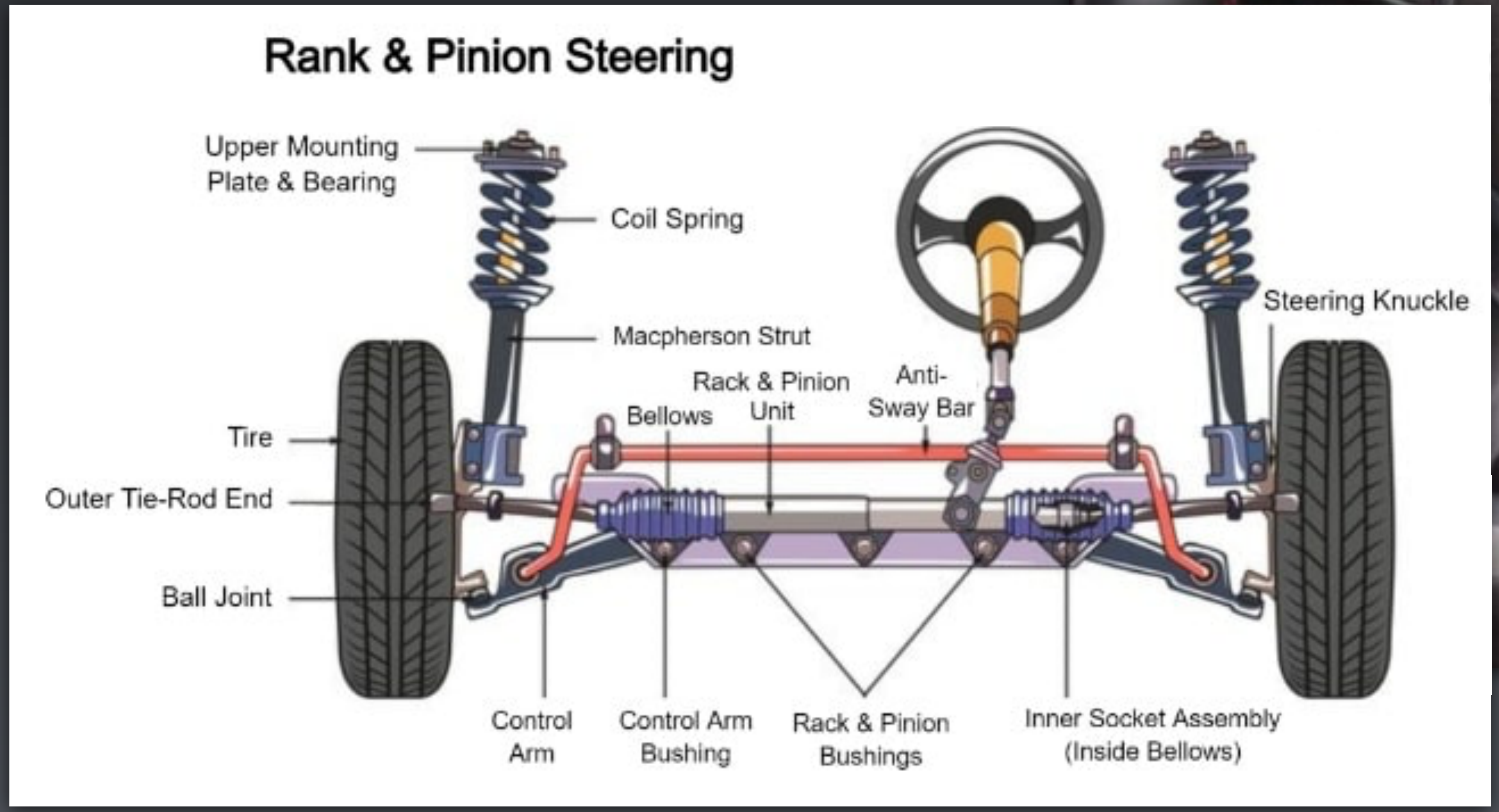

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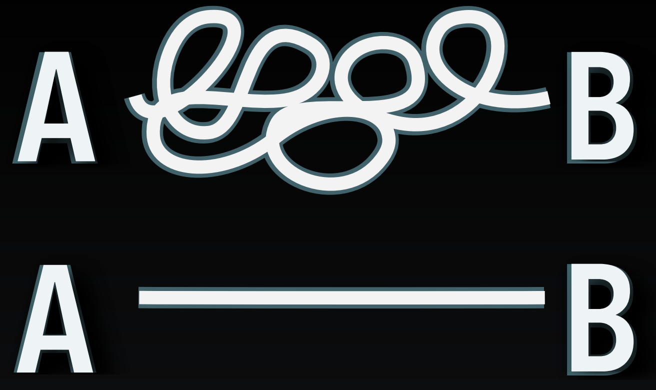
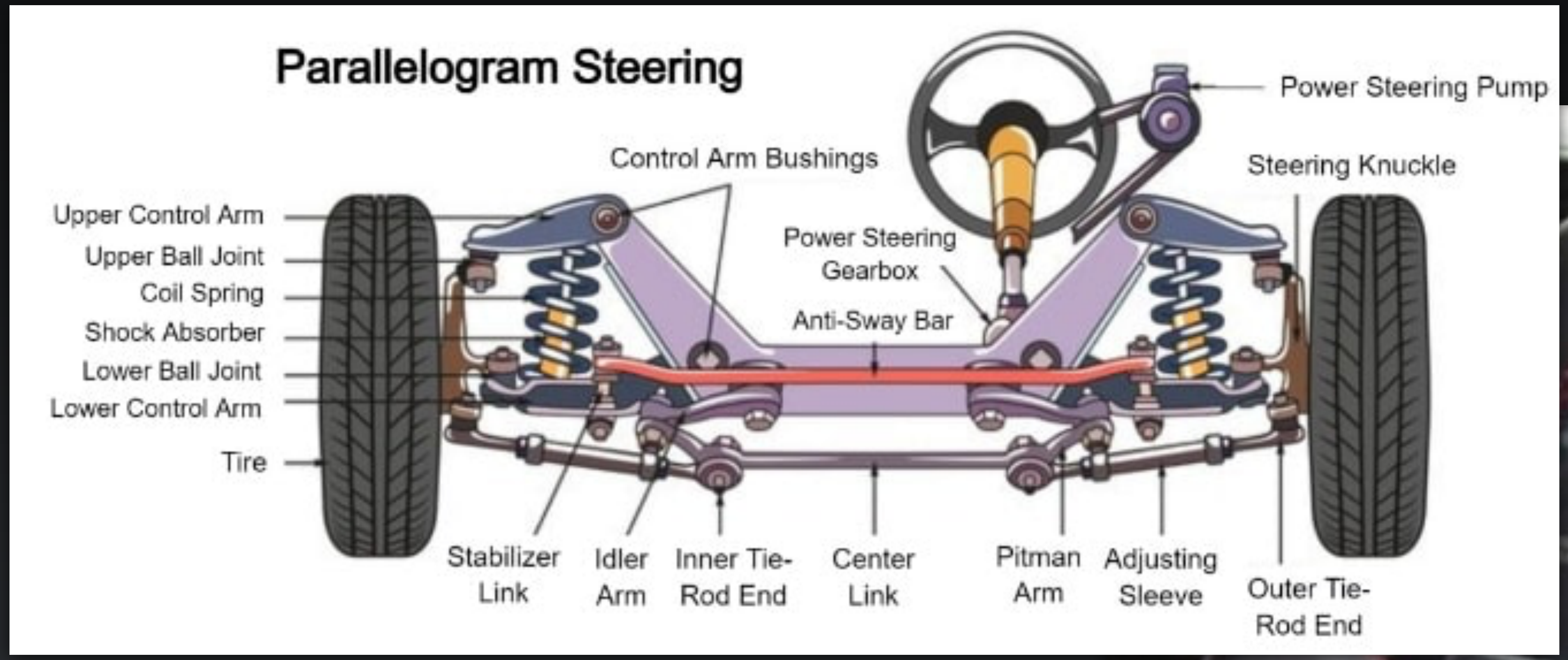
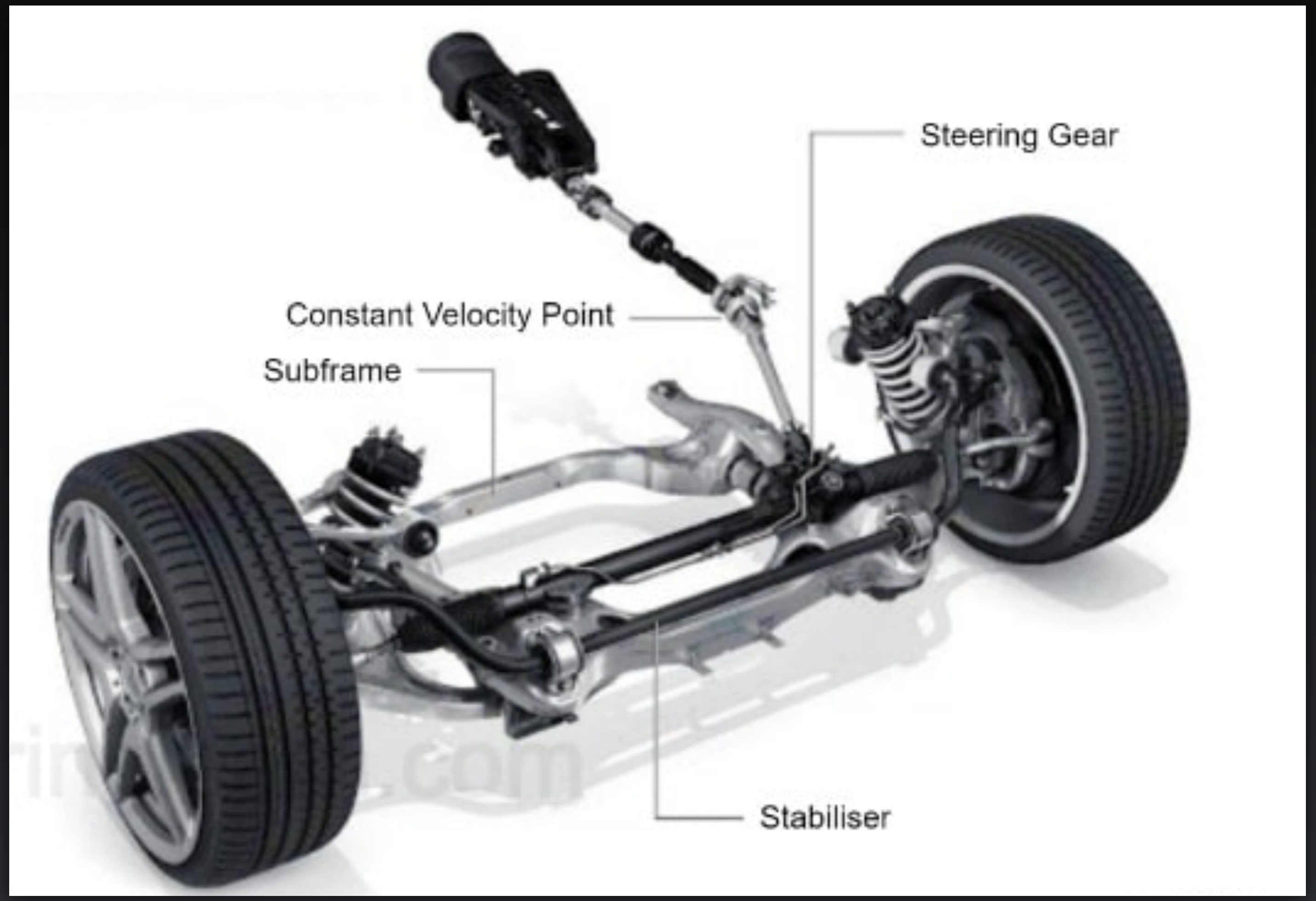
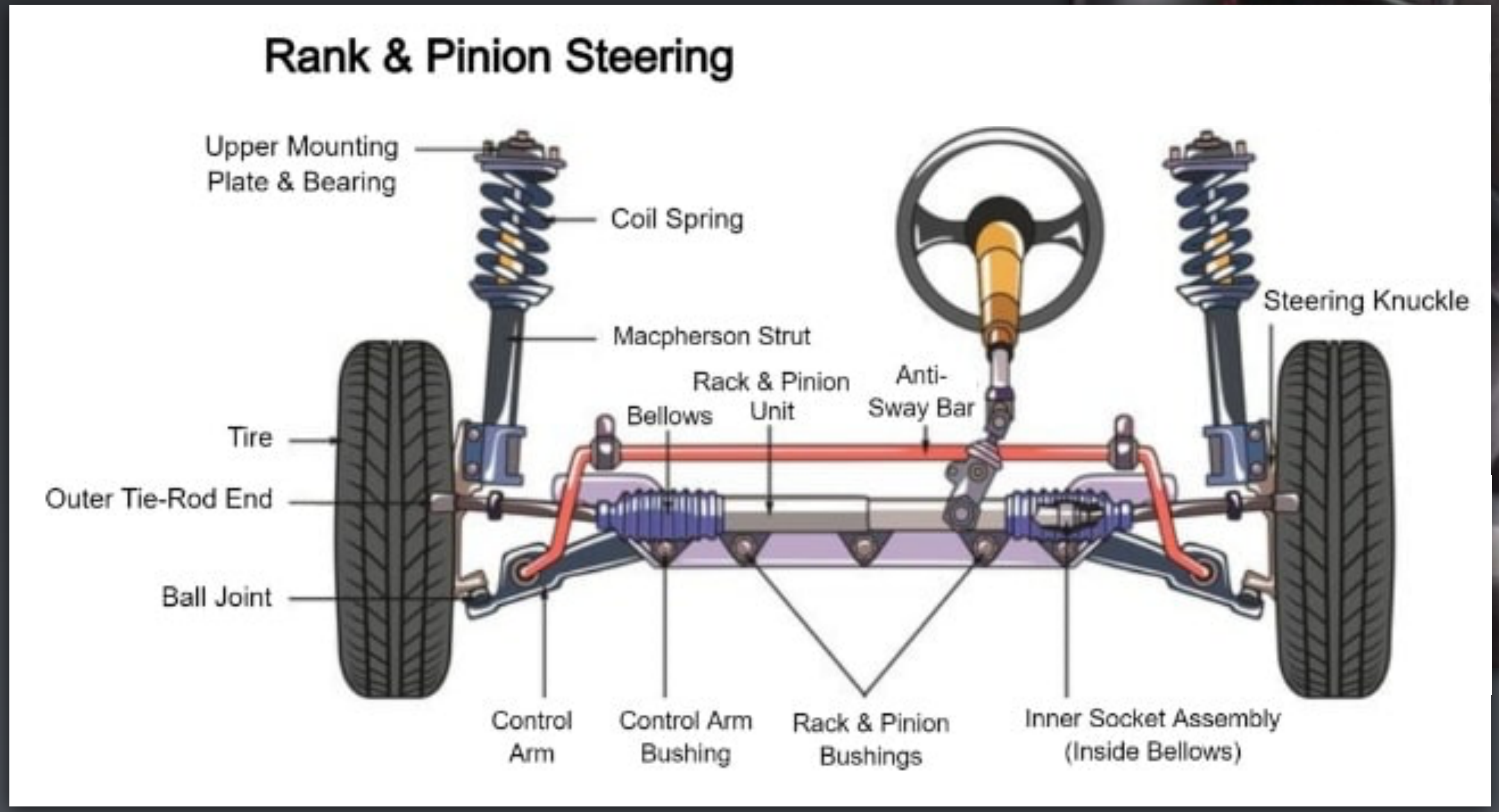
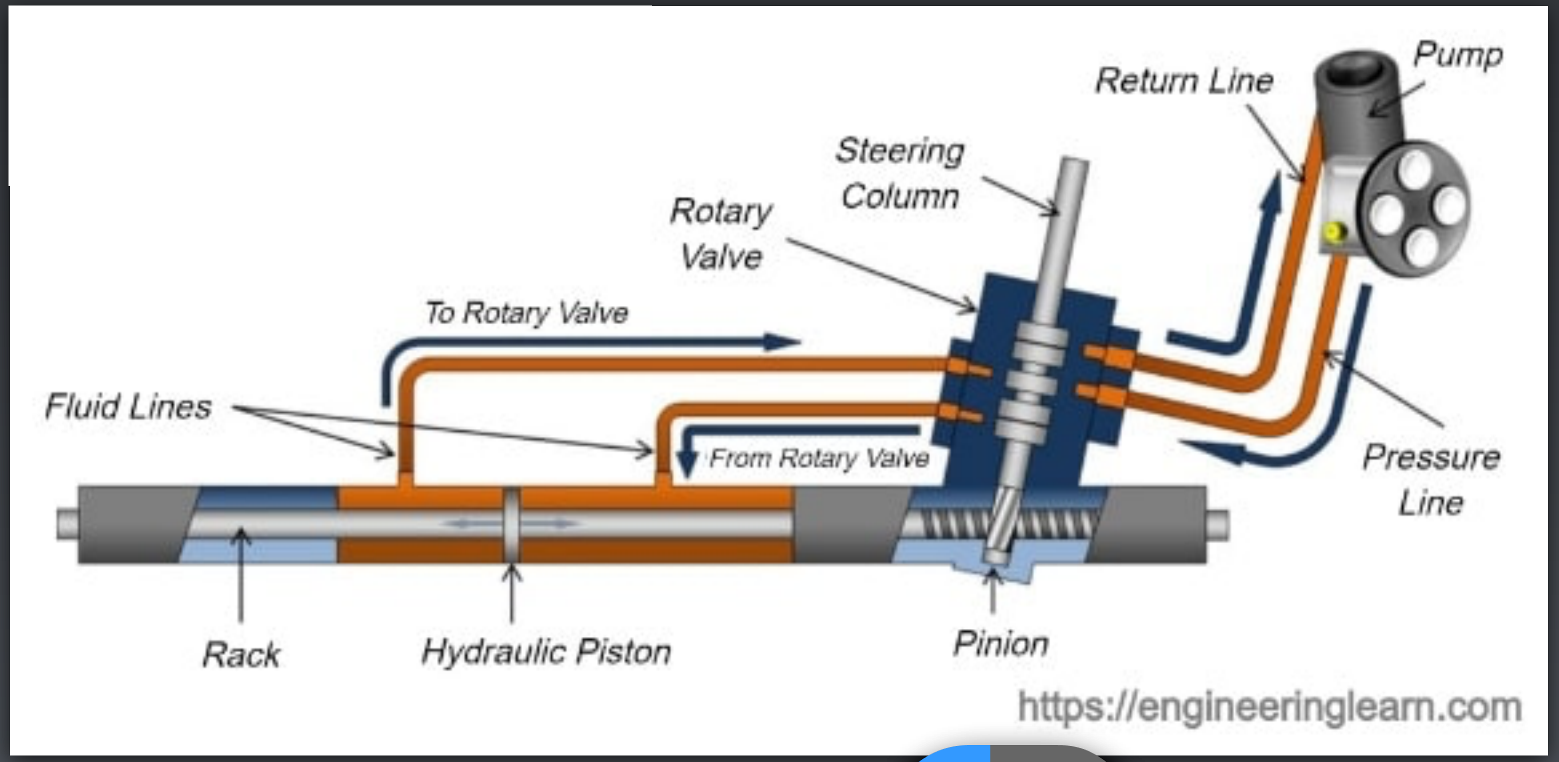
Abstraction











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Source: engineeringlearn.com

Abstraction

A B

A B

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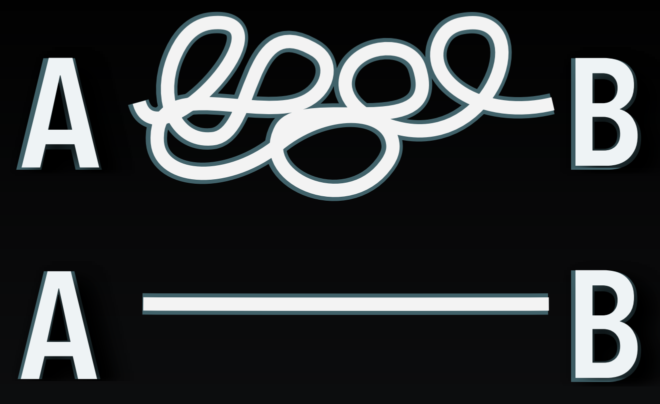
Abstraction



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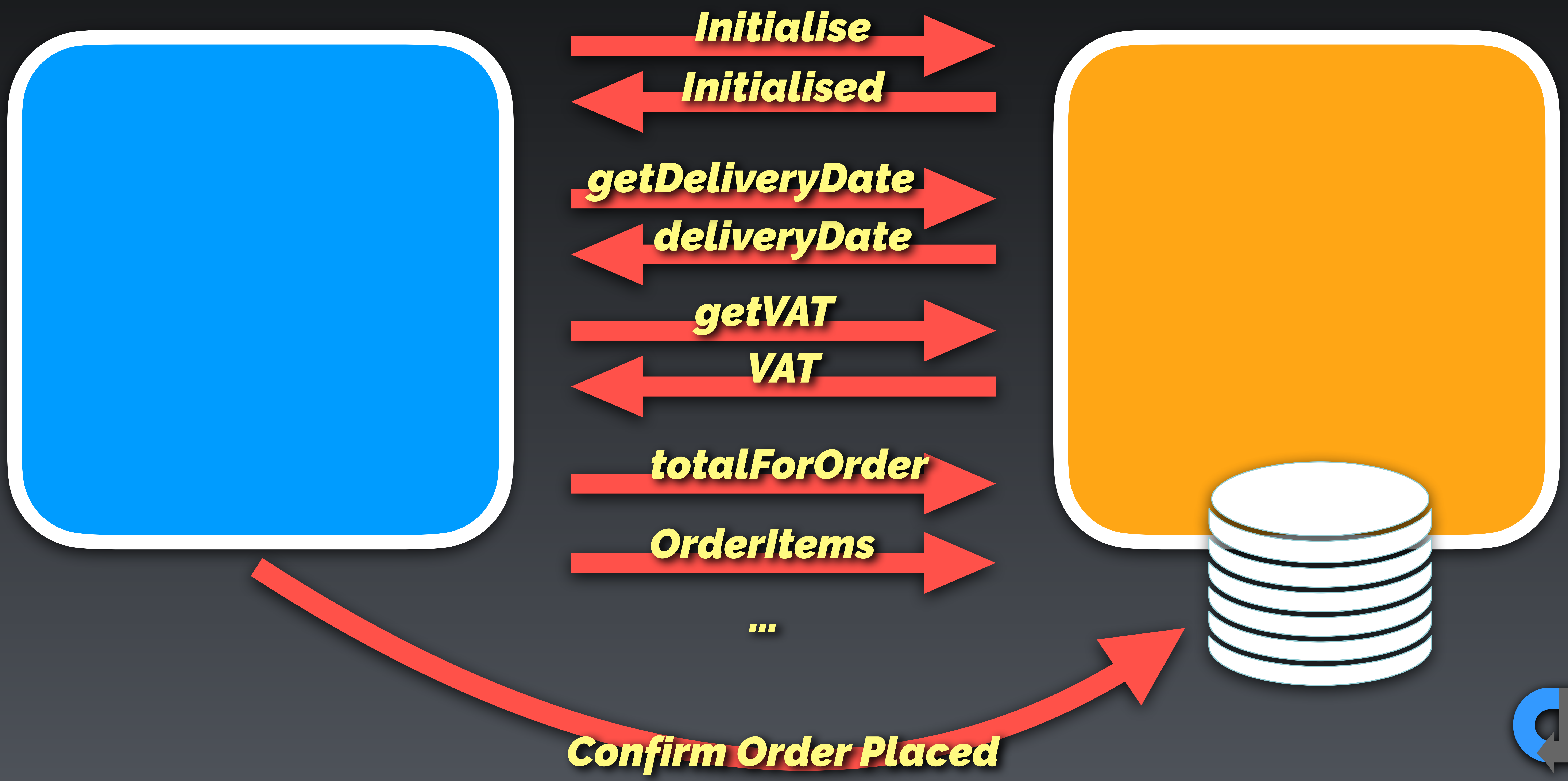
Abstraction

Continuous Delivery ltd

Abstraction



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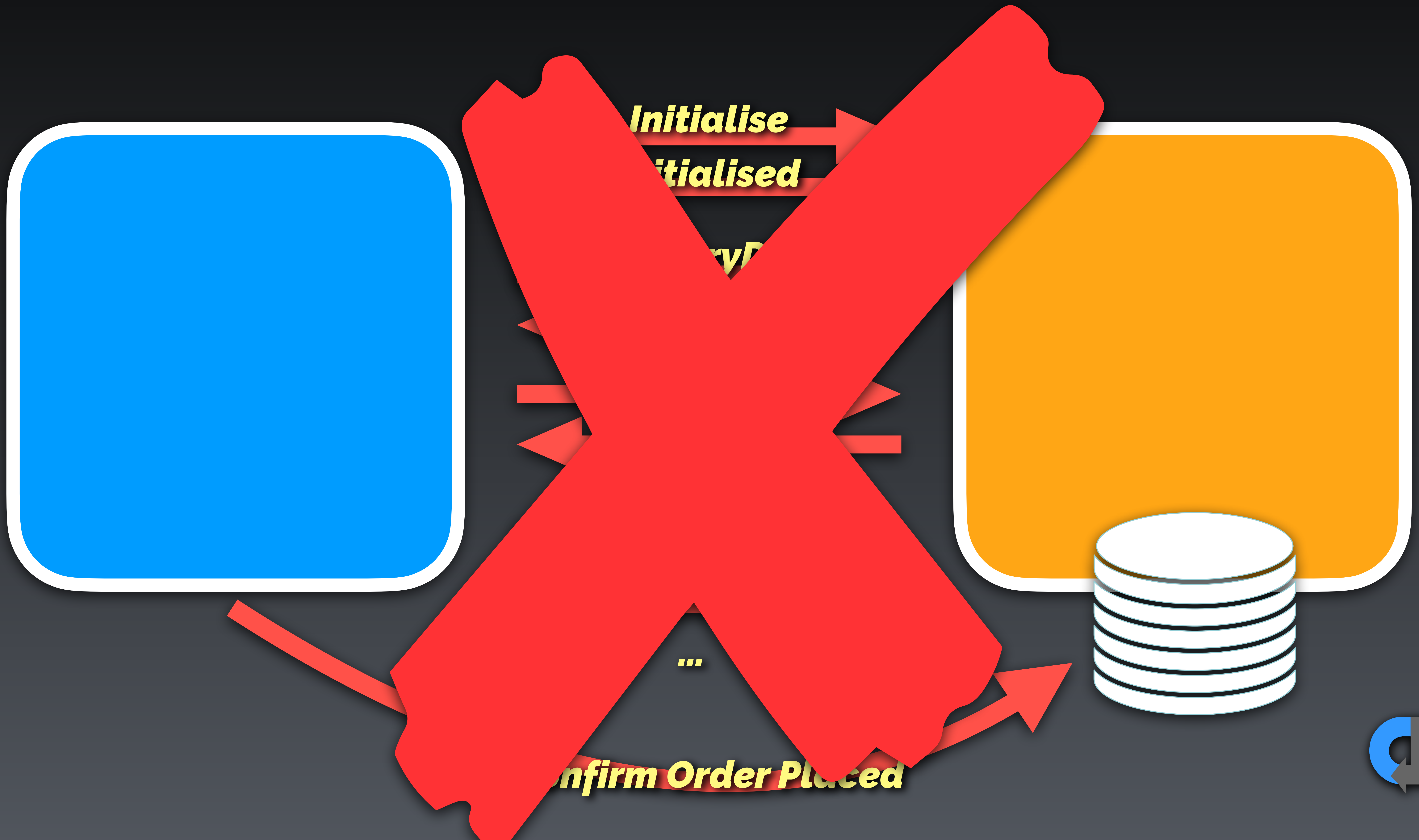

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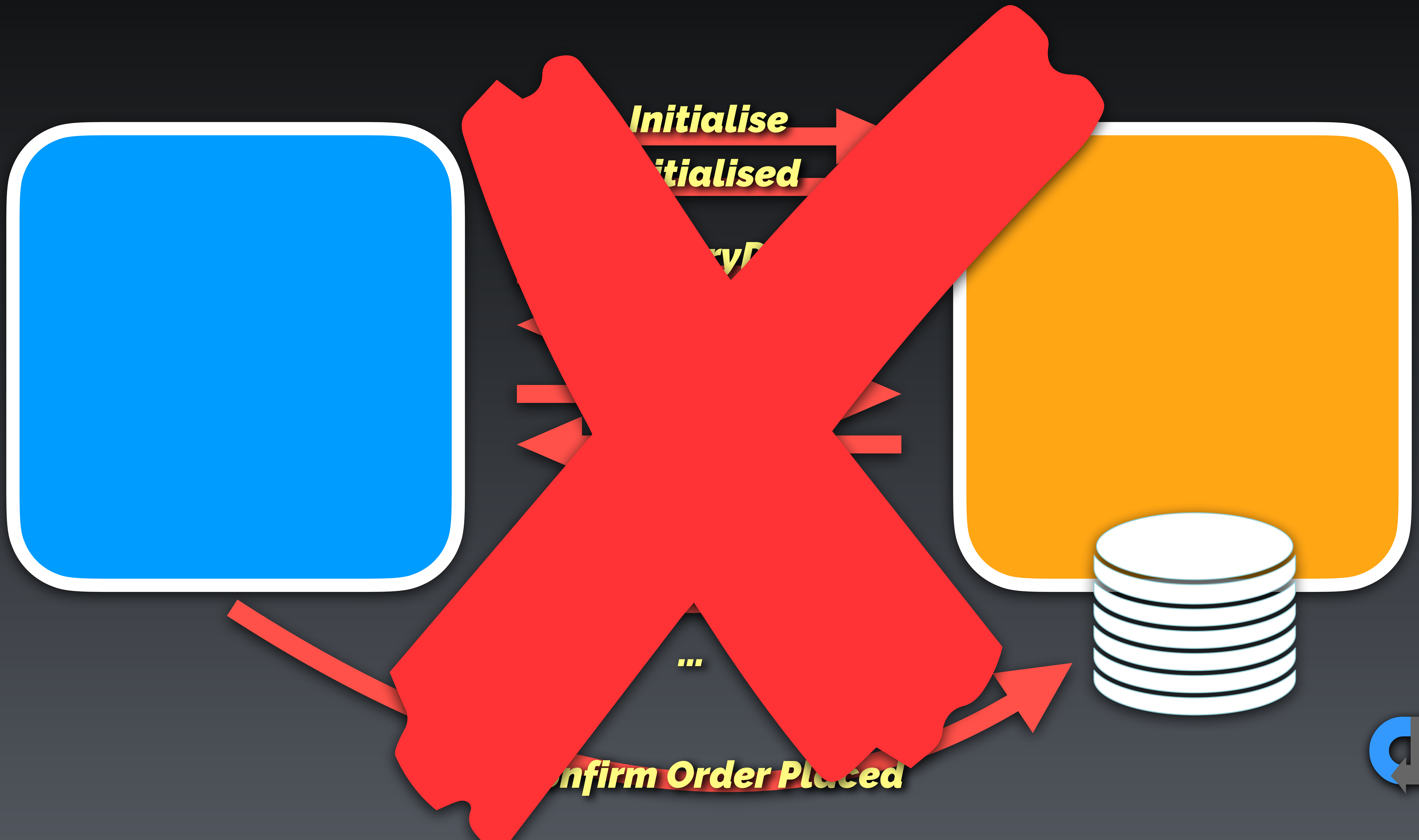

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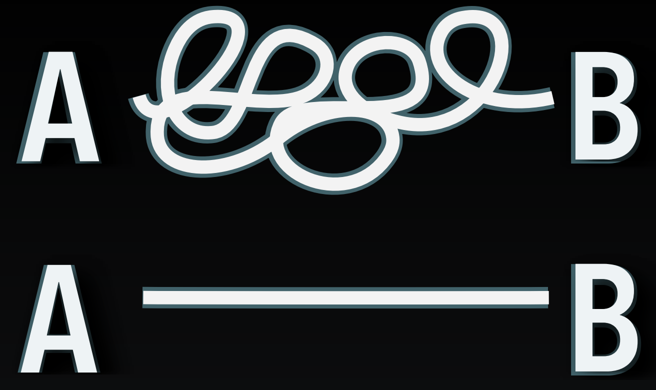
Abstraction



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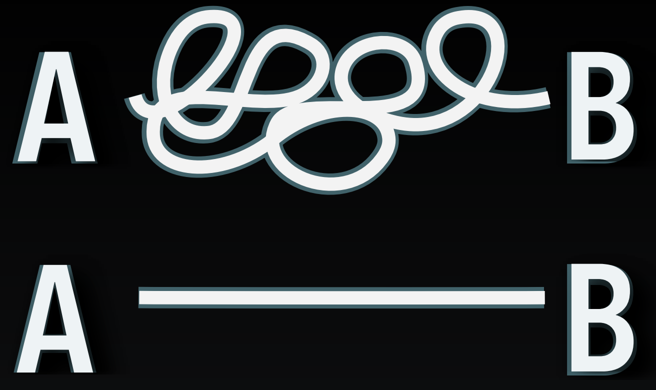
Abstraction

Continuous Delivery ltd

Abstraction



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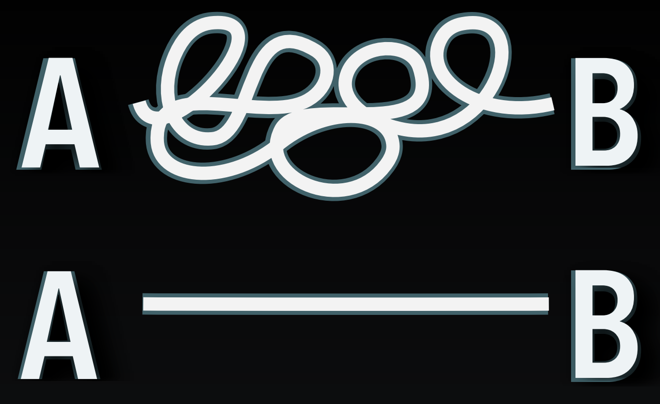

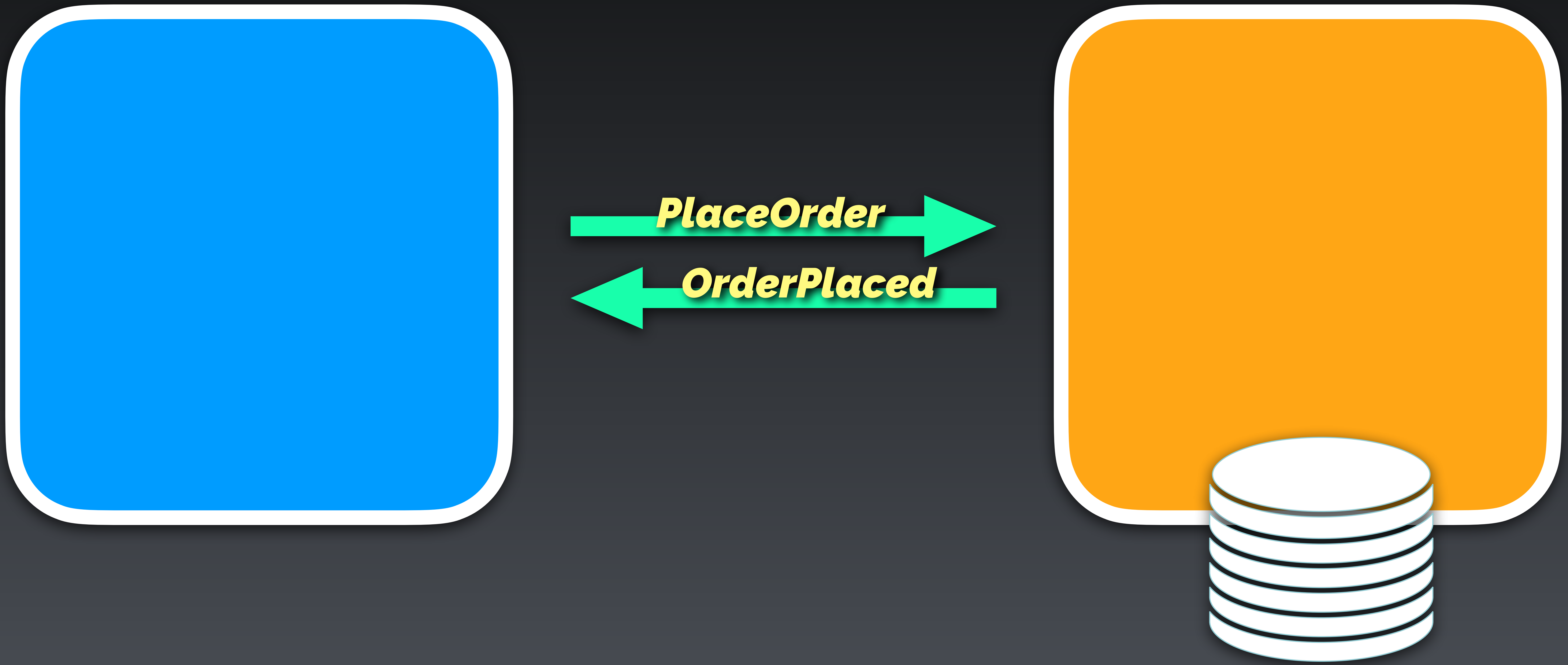

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Abstraction

Keep Secrets!

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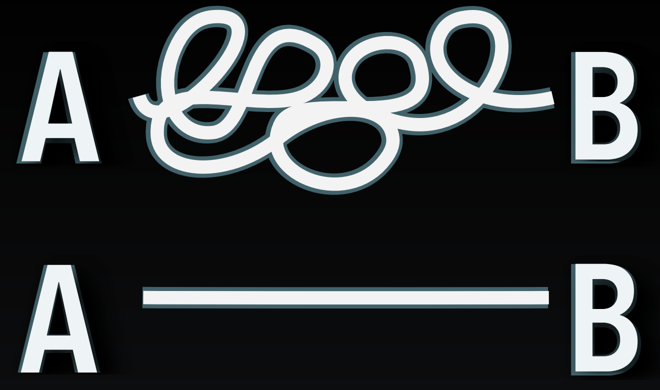
Coupling



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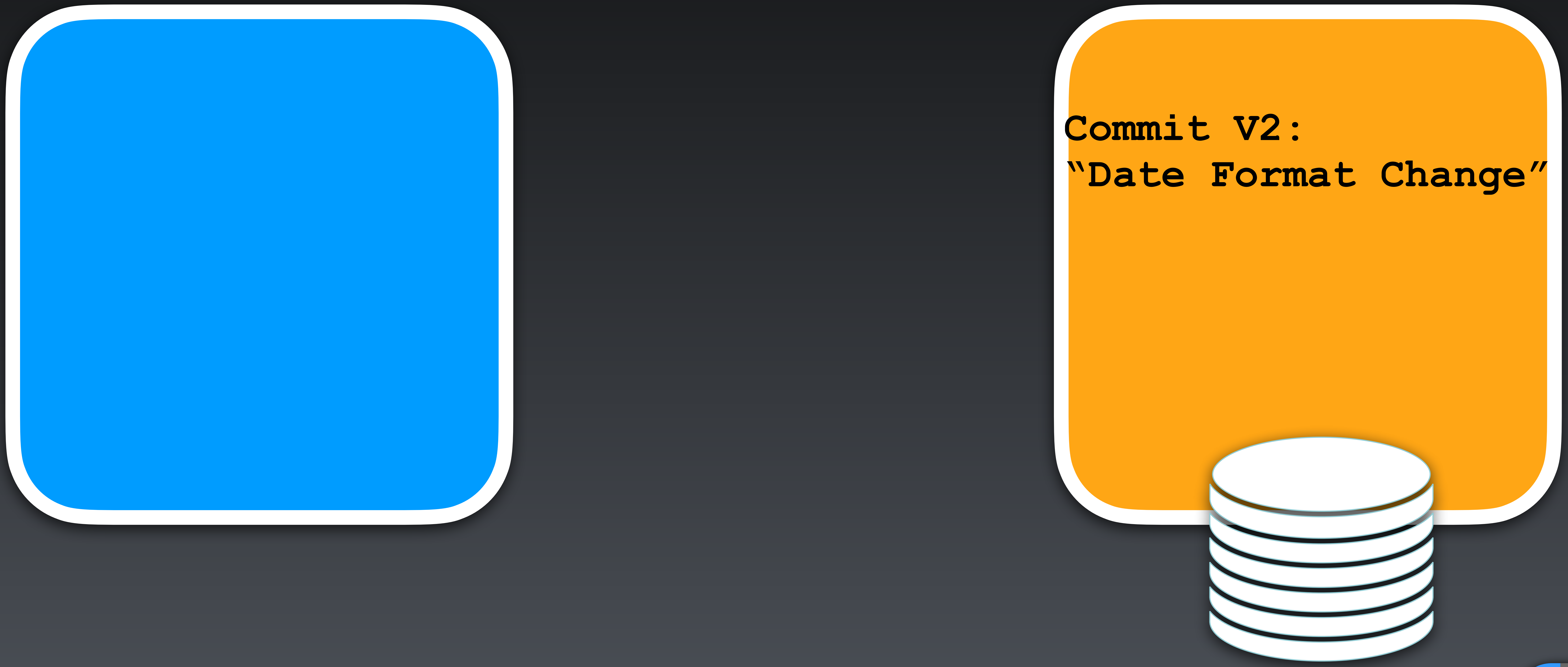
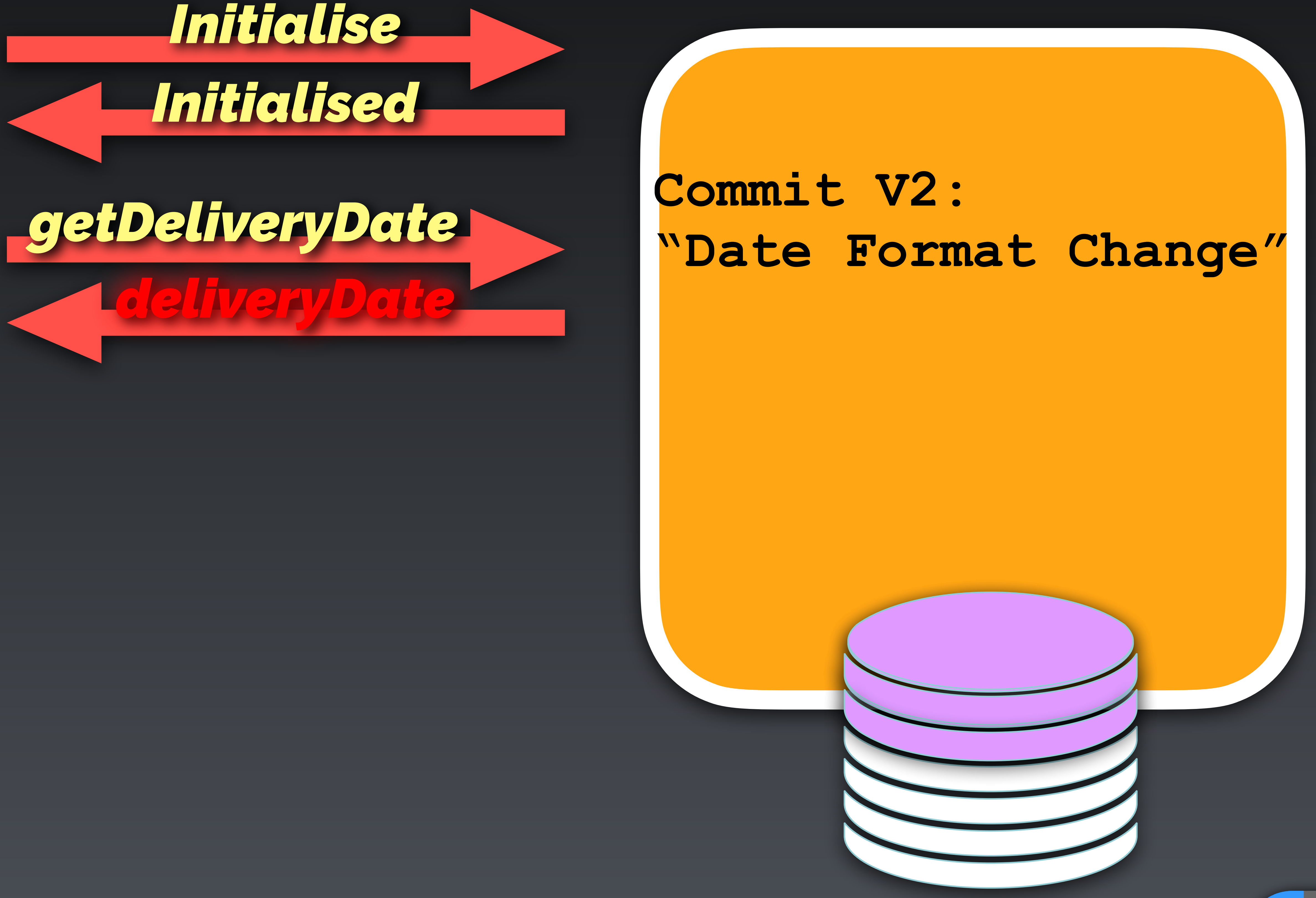
Coupling



Coupling



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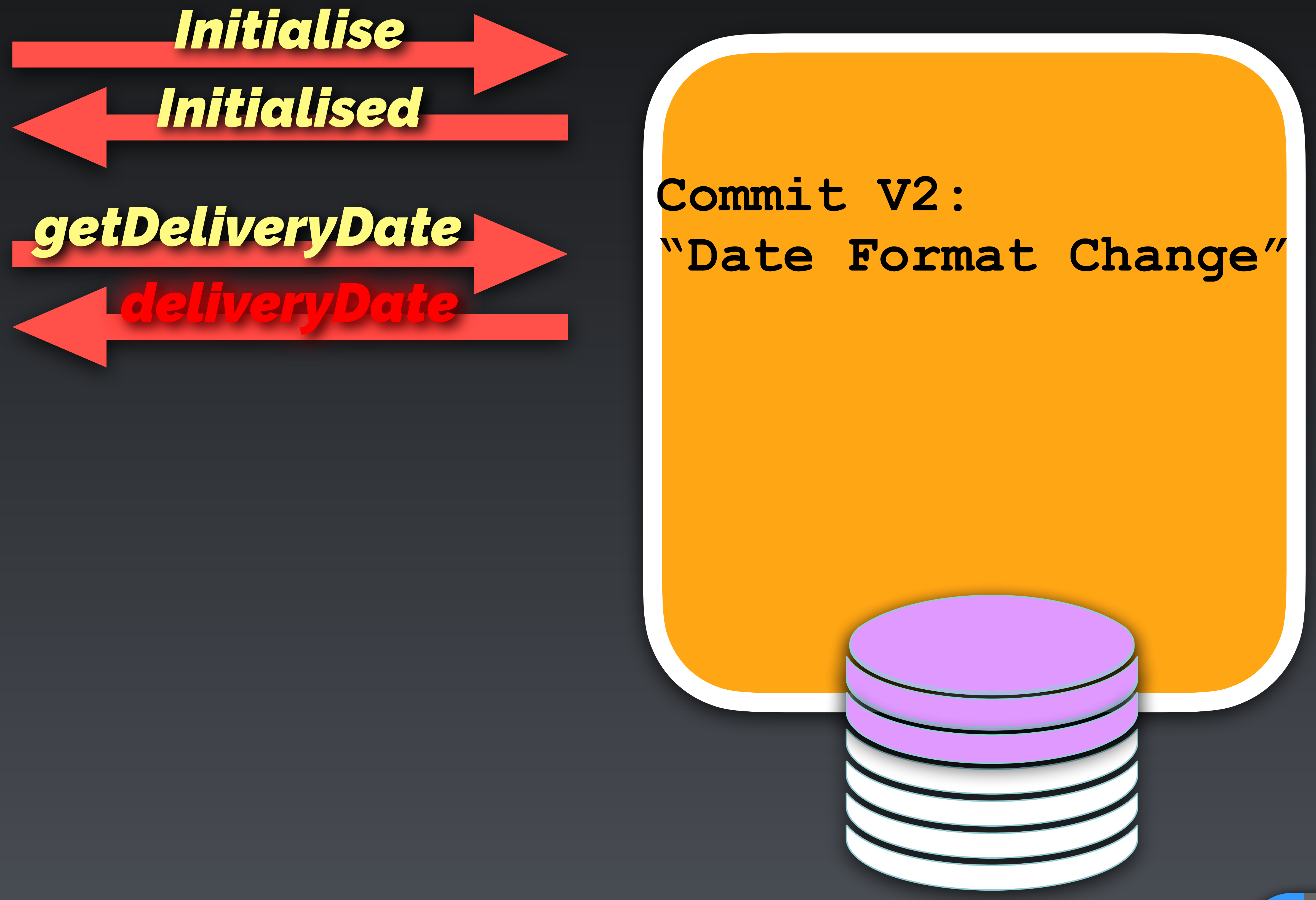
Coupling

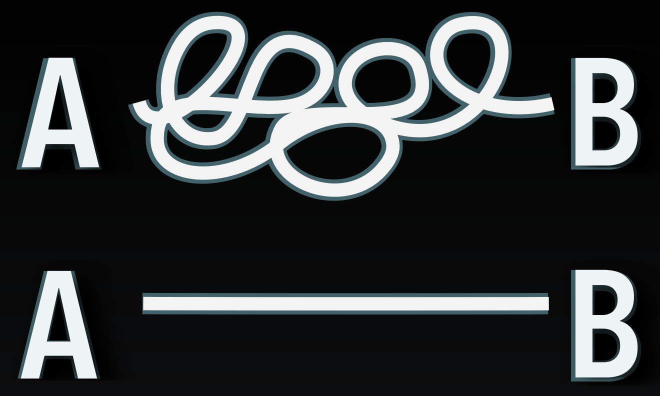
A
B
A
B


Initialise
Initialised
getDeliveryDate
deliveryDate
Commit V2:
"Date Format Change"

Coupling

Continuous Delivery ltd

Coupling

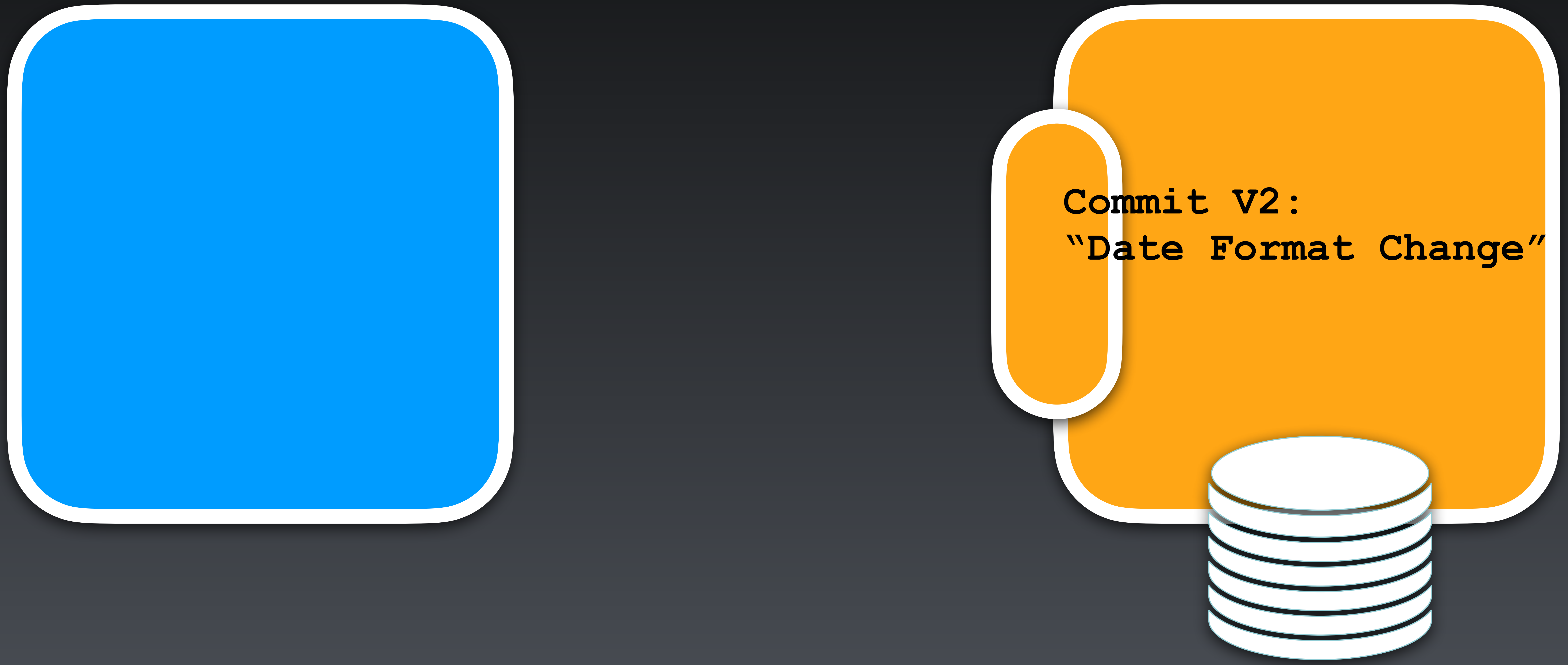


Continuous Delivery ltd

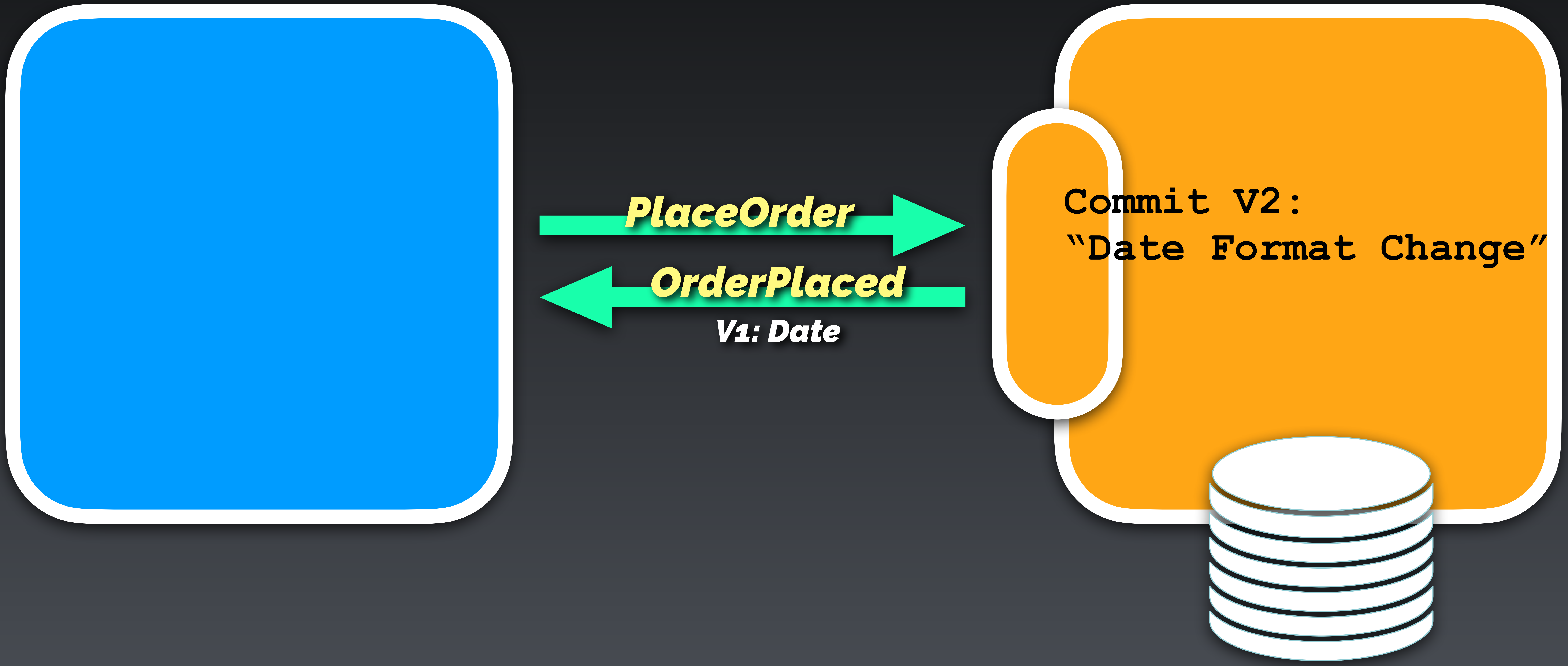
Coupling

Continuous Delivery ltd

Coupling



Coupling



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Applying the Guidelines

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Managing Complexity

Continuous Delivery ltd

Managing Complexity

Modularity

Cohesion

Separation of Concerns

Abstraction

Coupling

Managing Complexity

Modularity

Cohesion

Separation of Concerns

Abstraction

Coupling

Just Motherhood & Apple Pie?

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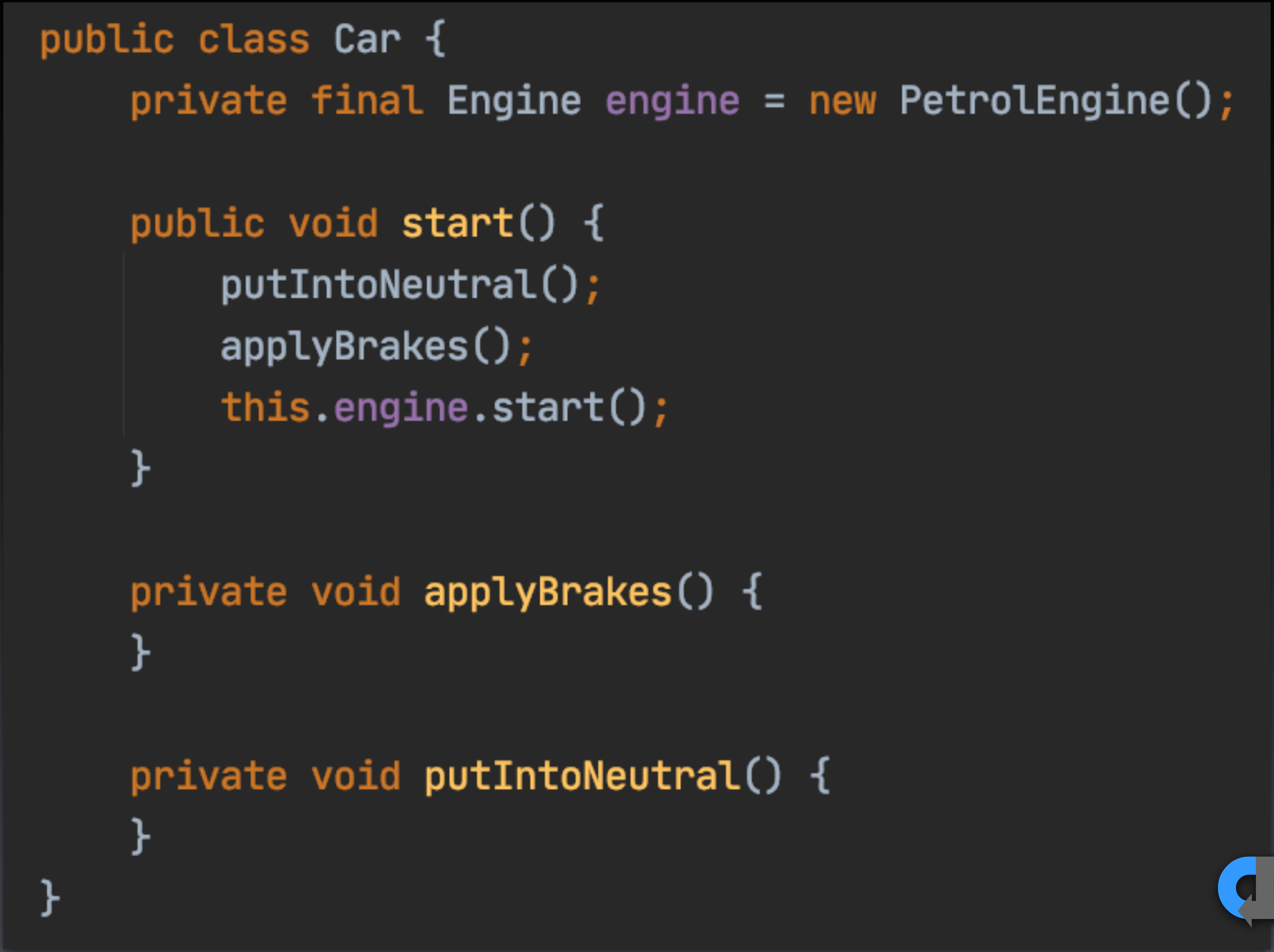
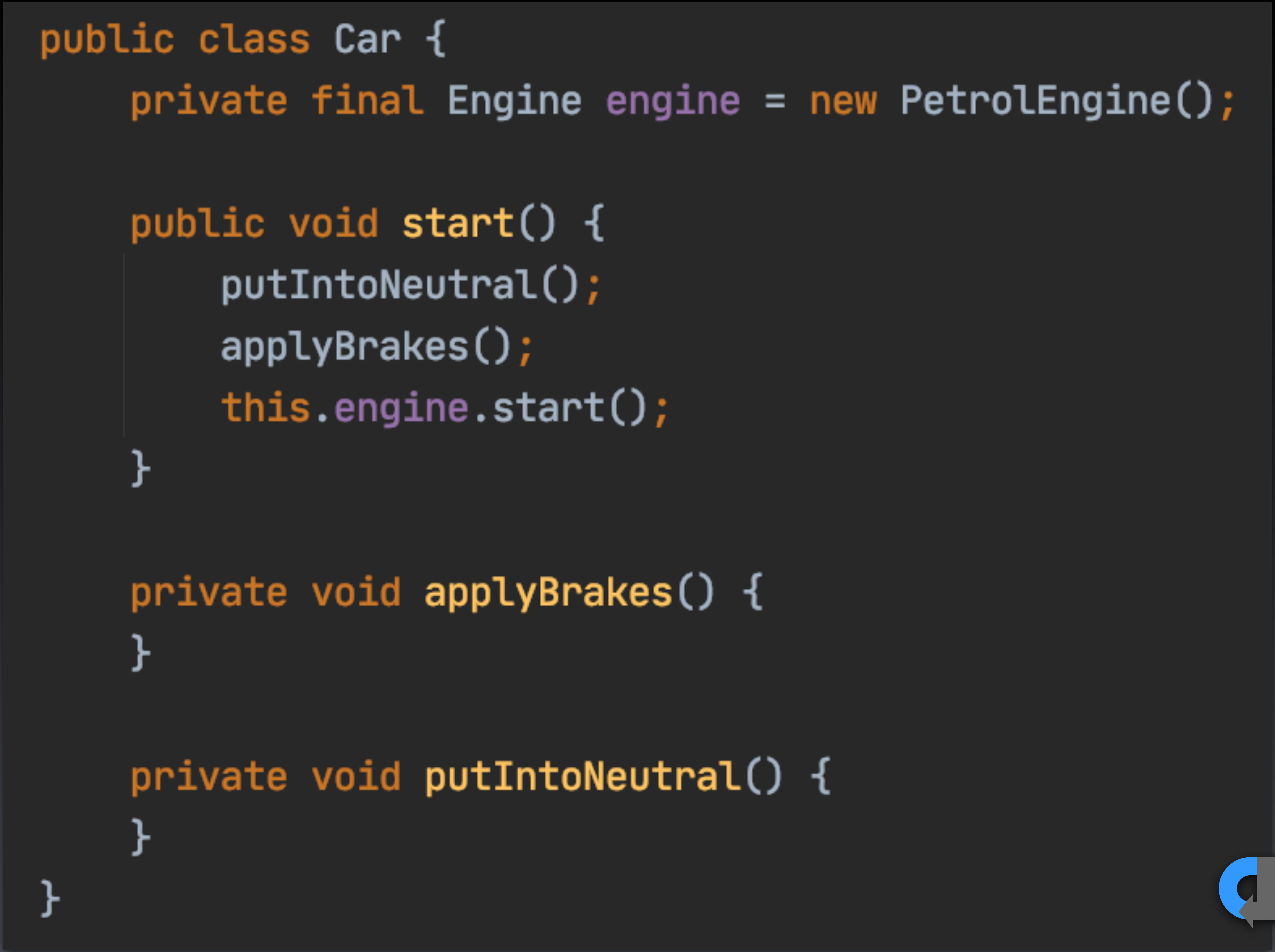


```java
public class Car {
    private final Engine engine = new PetrolEngine();

    public void start() {
        putIntoNeutral();
        applyBrakes();
        this.engine.start();
    }

    private void applyBrakes() {
    }

    private void putIntoNeutral() {
    }
}
```



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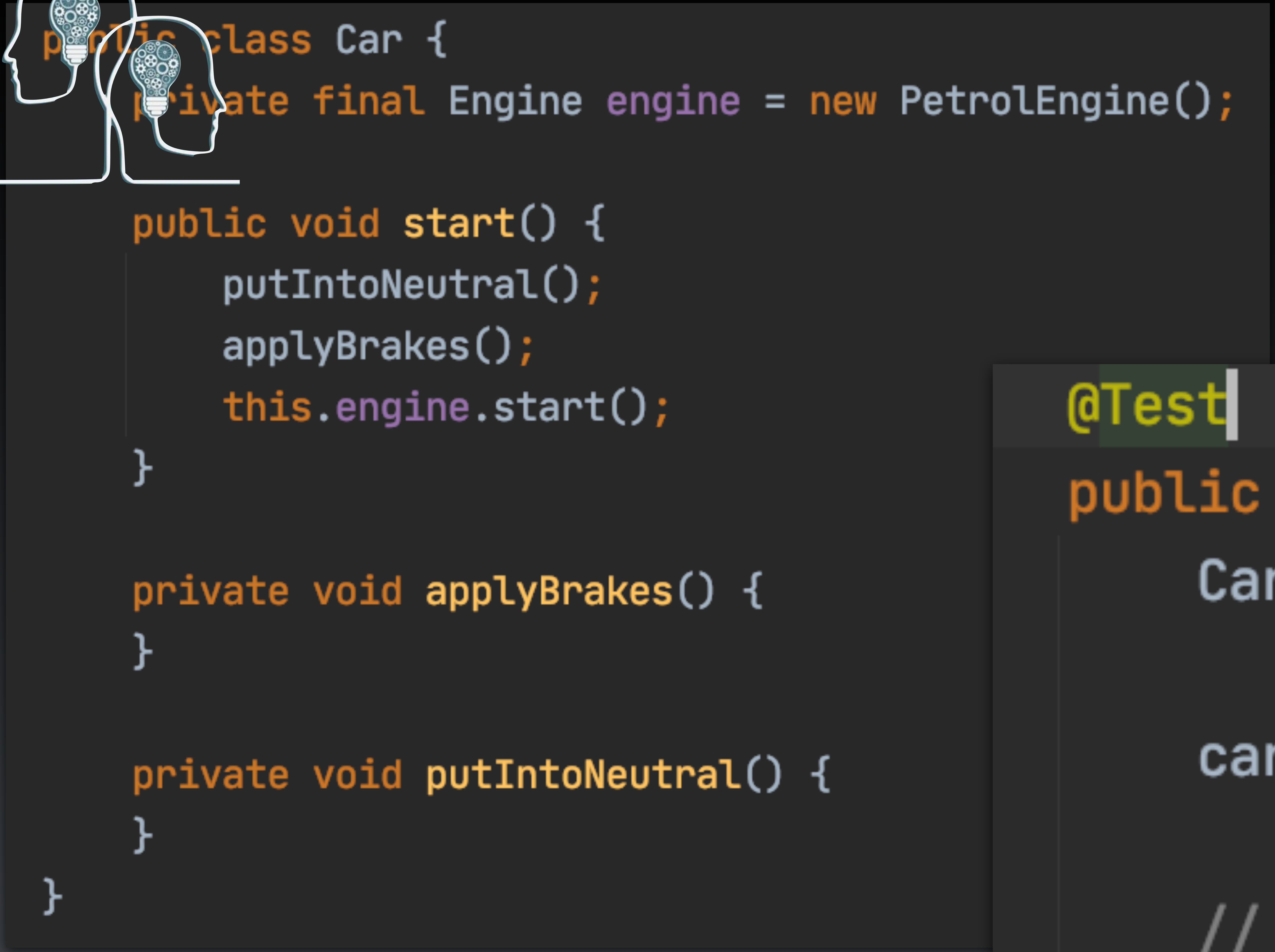
Continuous Delivery ltd



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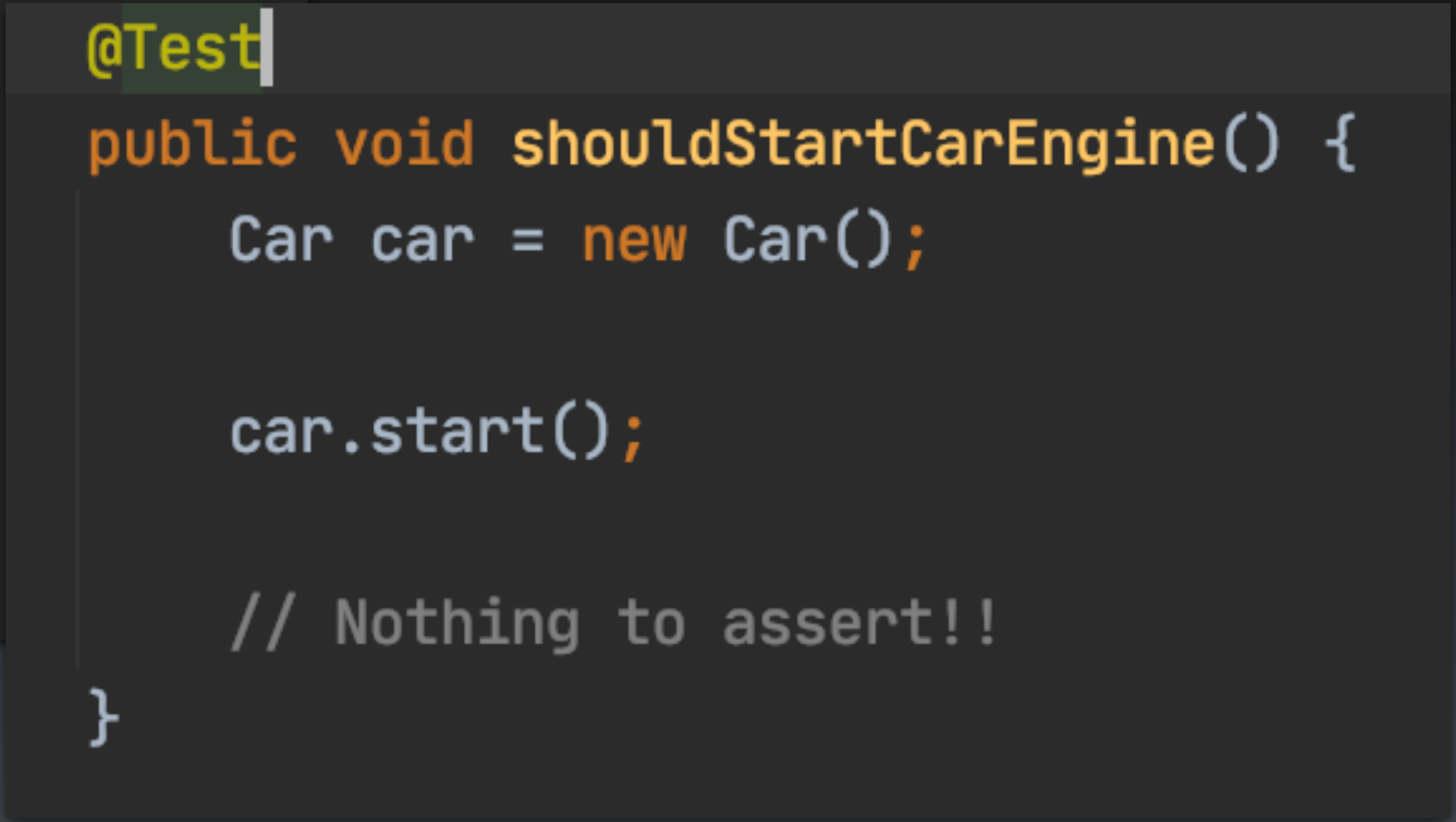
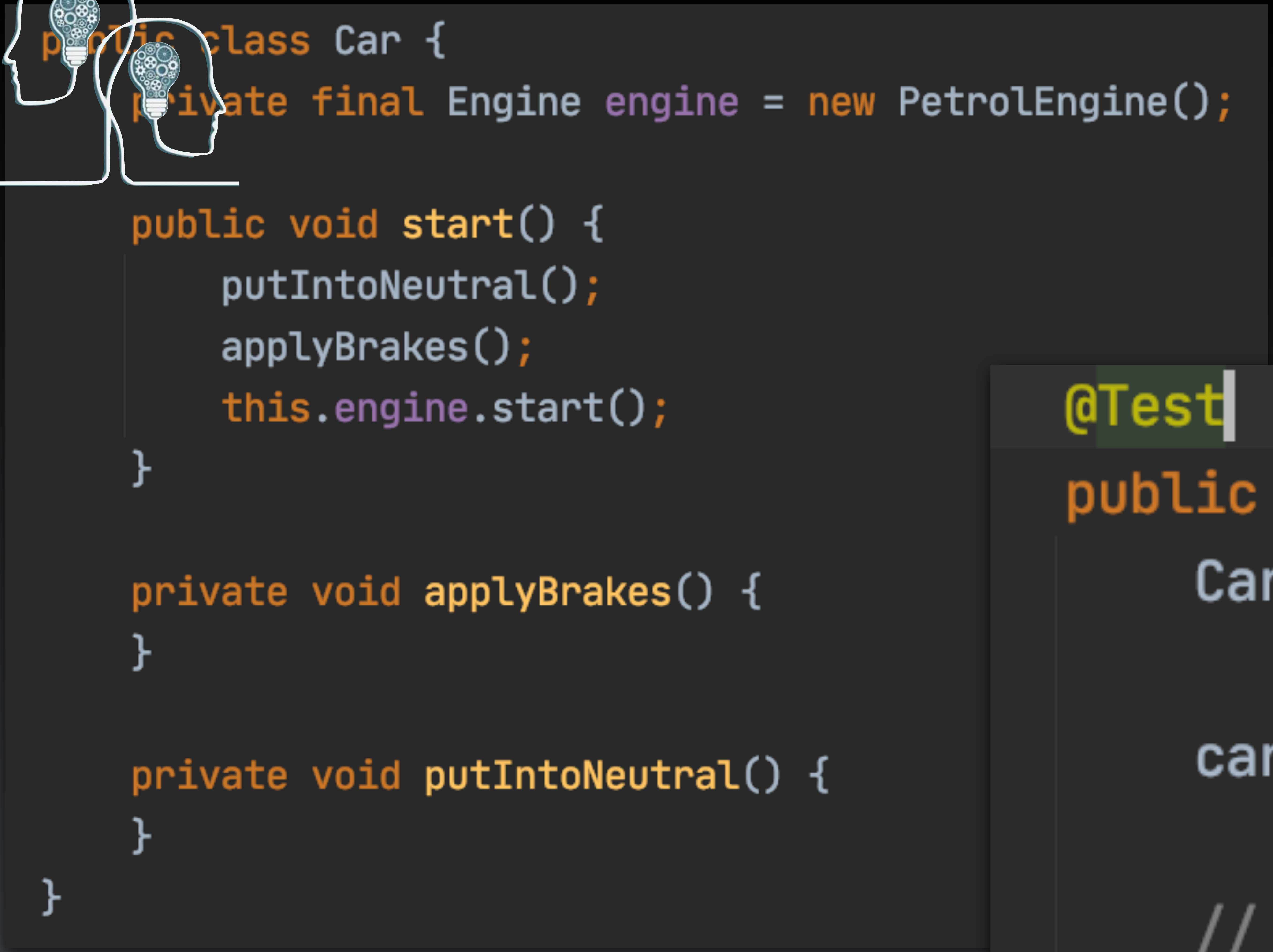


```
@Test
public void shouldStartCarEngine() {
    Car car = new Car();

    car.start();

    // Nothing to assert!!
}
```



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    public void start() {
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        this.engine.start();
    }

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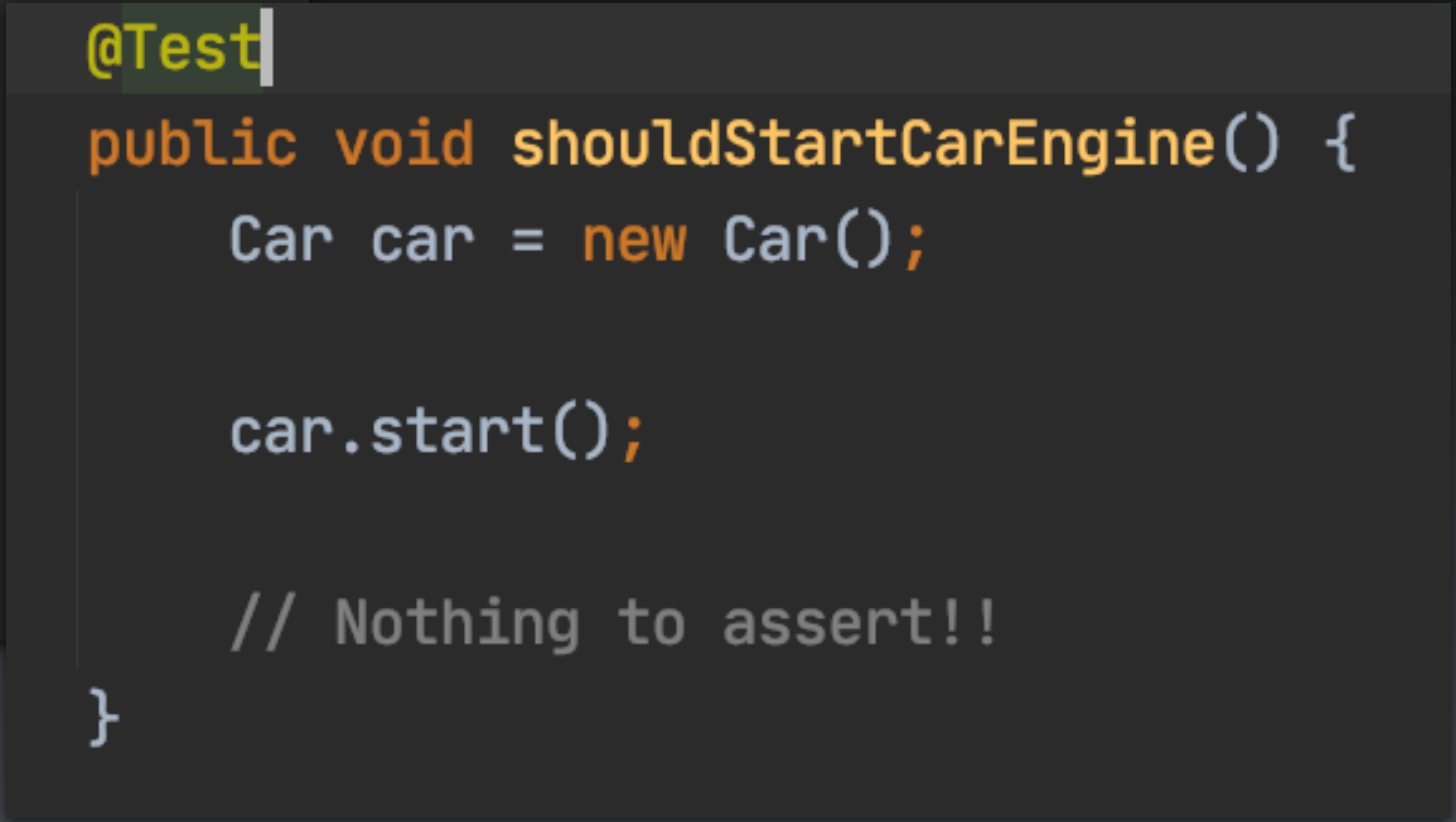
```



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@Test
public void shouldStartCarEngine() {
    Car car = new Car();

    car.start();

    // Nothing to assert!!
}
```
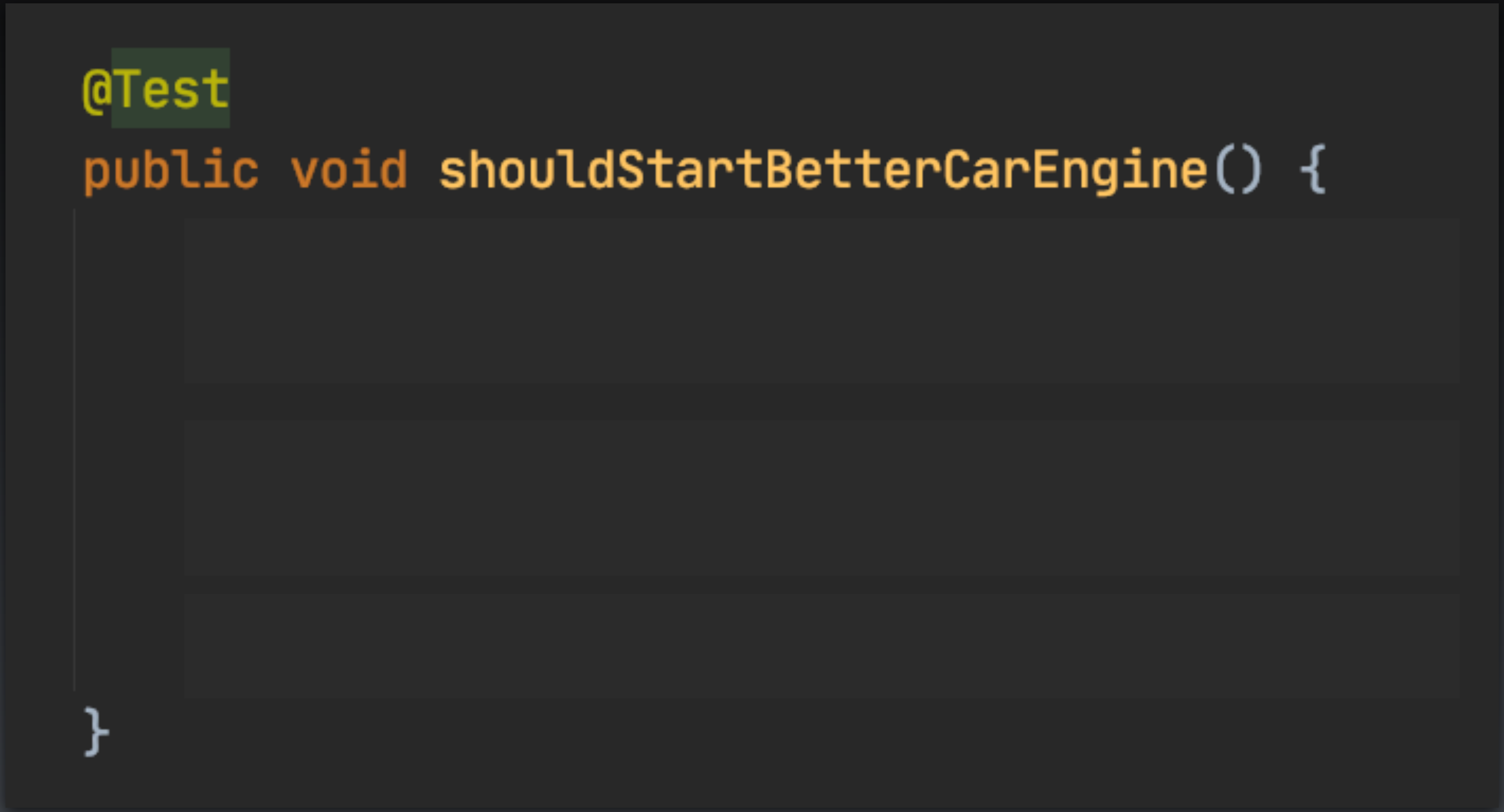
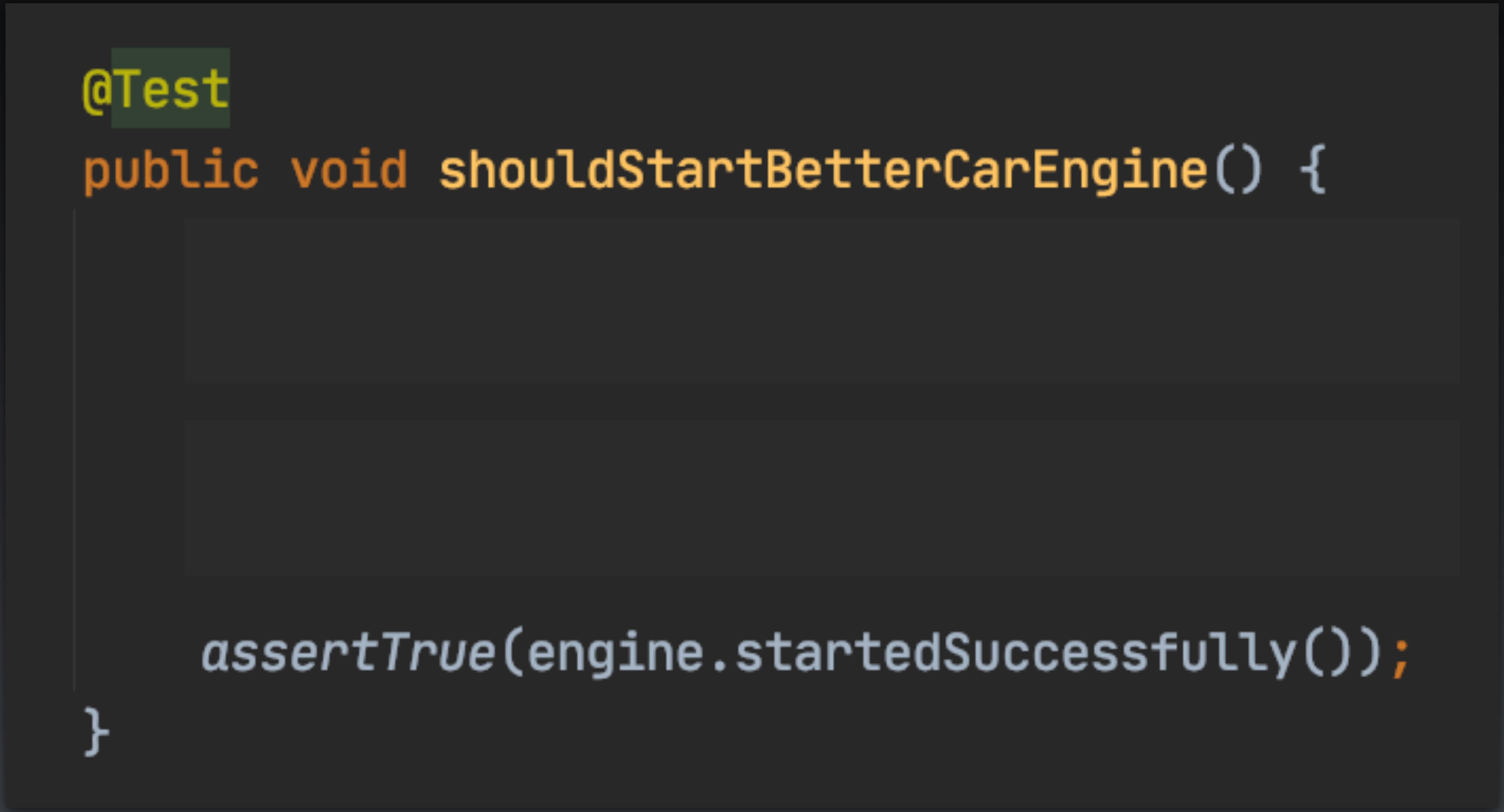
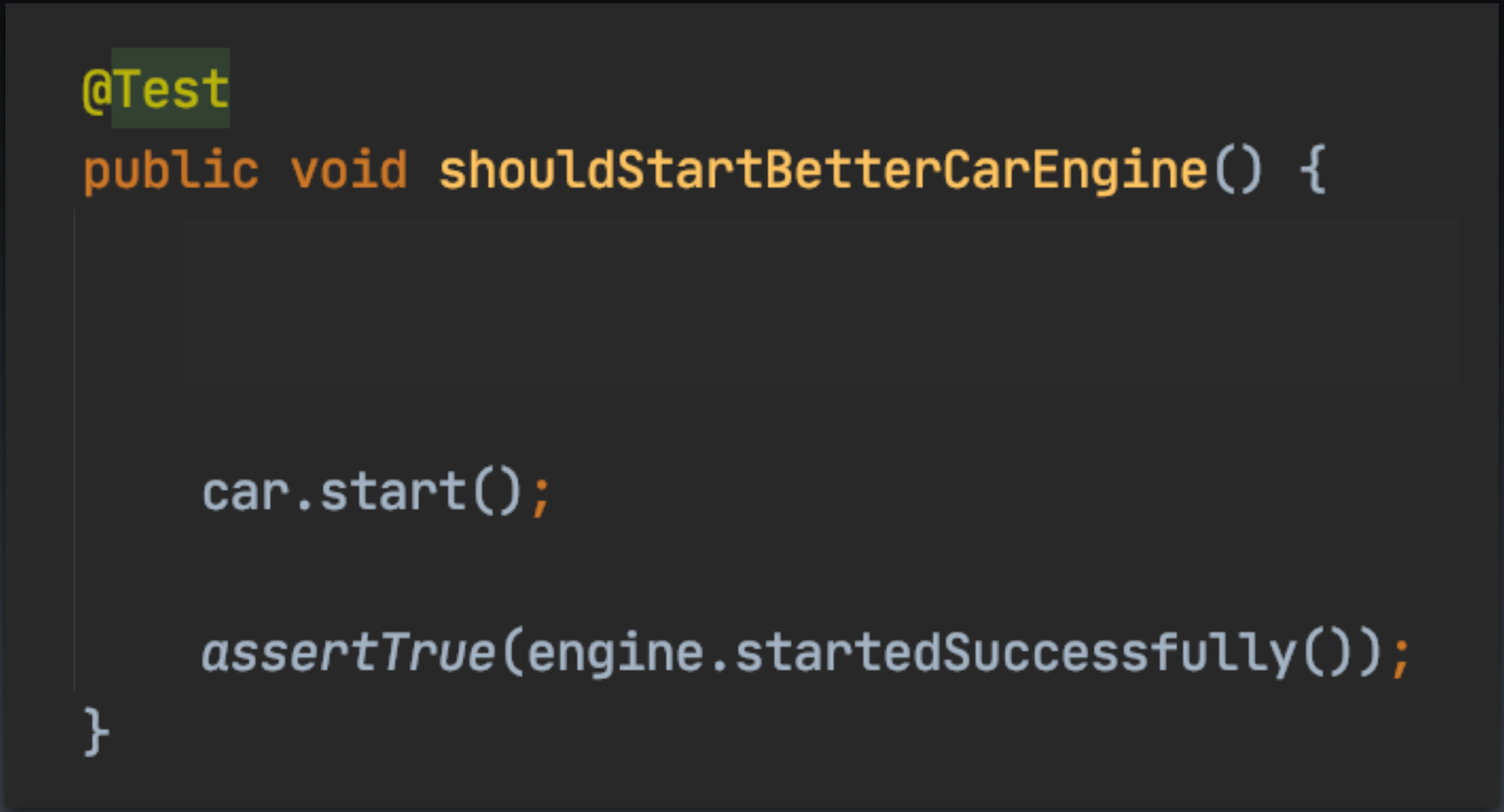

Continuous Delivery ltd



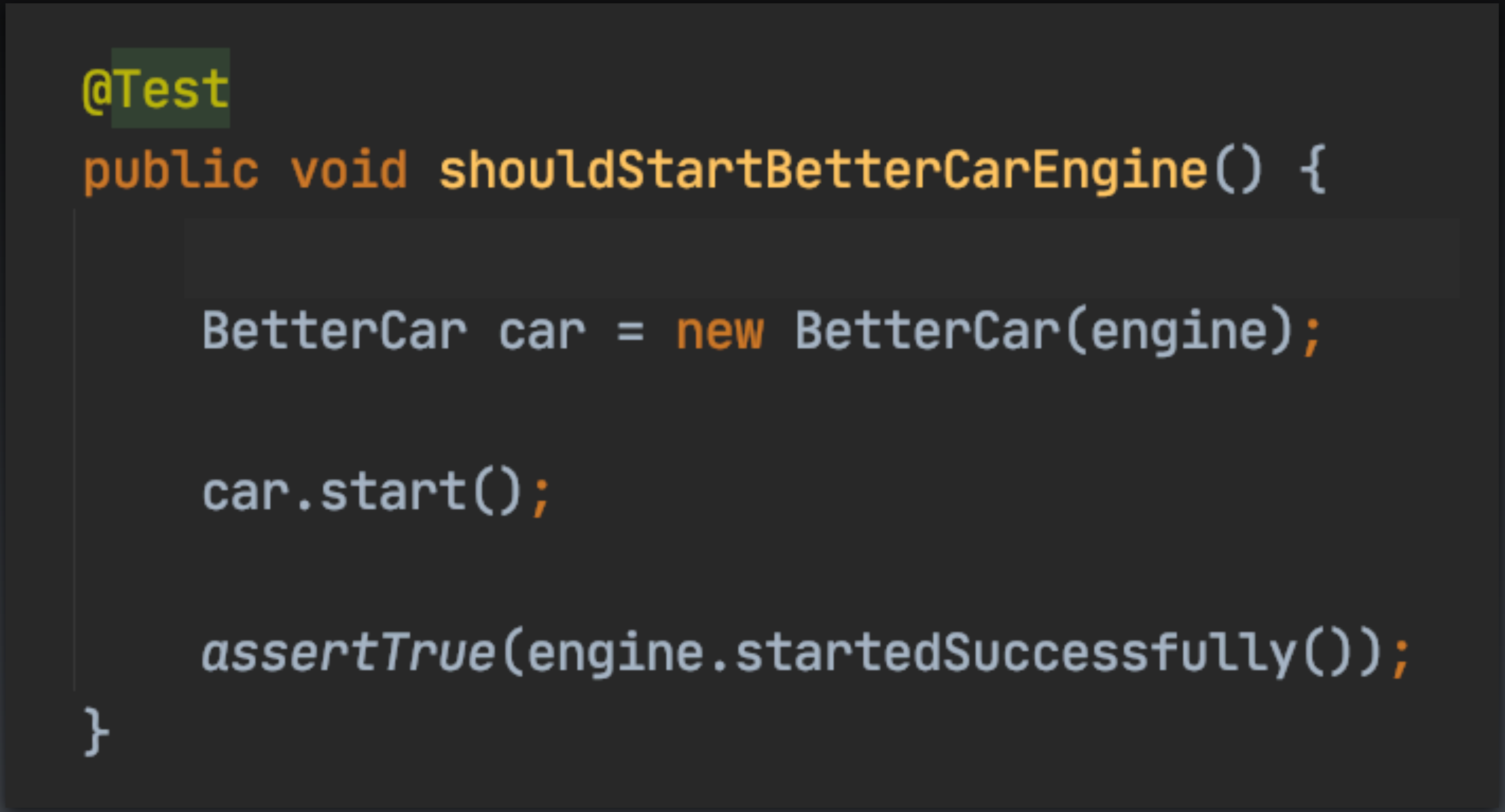
```
@Test
public void shouldStartBetterCarEngine() {



}
```



```
@Test
public void shouldStartBetterCarEngine() {



    assertTrue(engine.startedSuccessfully());
}
```

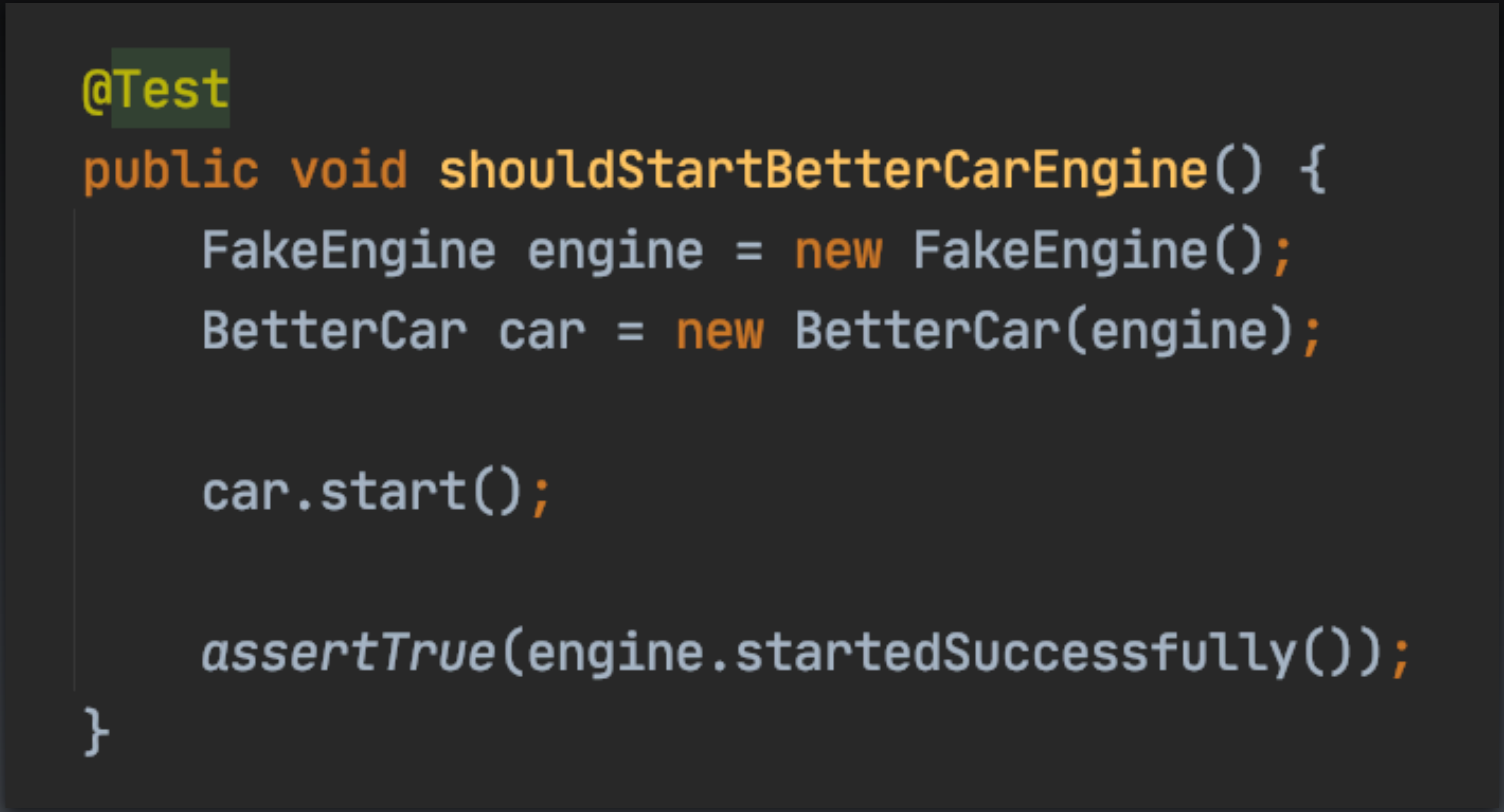


```
@Test
public void shouldStartBetterCarEngine() {



    car.start();

    assertTrue(engine.startedSuccessfully());
}
```



```java
@Test
public void shouldStartBetterCarEngine() {

    BetterCar car = new BetterCar(engine);

    car.start();

    assertTrue(engine.startedSuccessfully());
}
```

Continuous Delivery ltd



```java
@Test
public void shouldStartBetterCarEngine() {
    FakeEngine engine = new FakeEngine();
    BetterCar car = new BetterCar(engine);

    car.start();

    assertTrue(engine.startedSuccessfully());
}
```

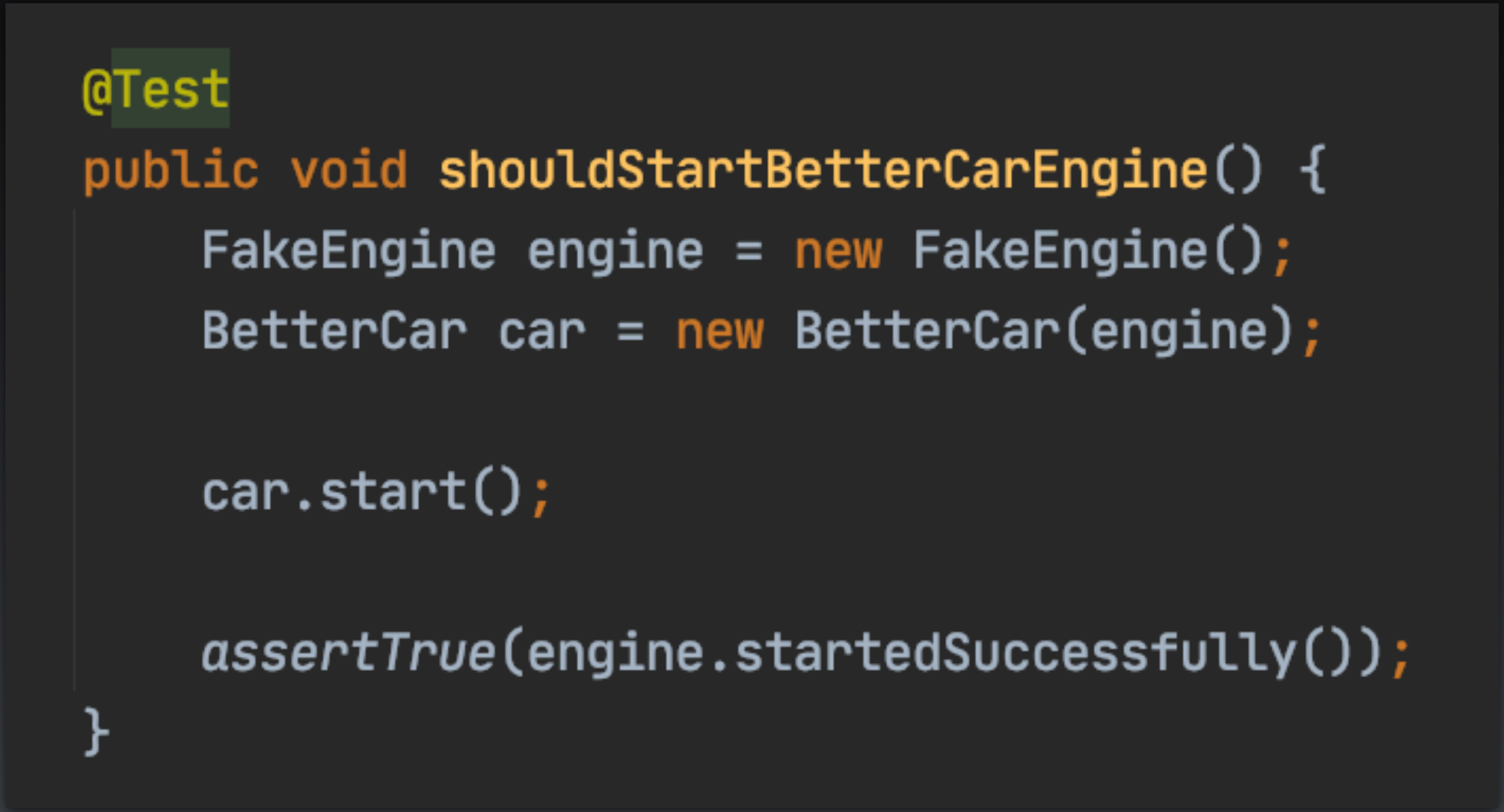
A ~ B

A — B

```java
public class FakeEngine implements Engine {
    private boolean started = false;

    @Override
    public void start() {
        started = true;
    }

    public boolean startedSuccessfully() {
        return started;
    }
}
```

```
{
;
);

y());
```

Continuous Delivery ltd



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    assertTrue(engine.startedSuccessfully());
}
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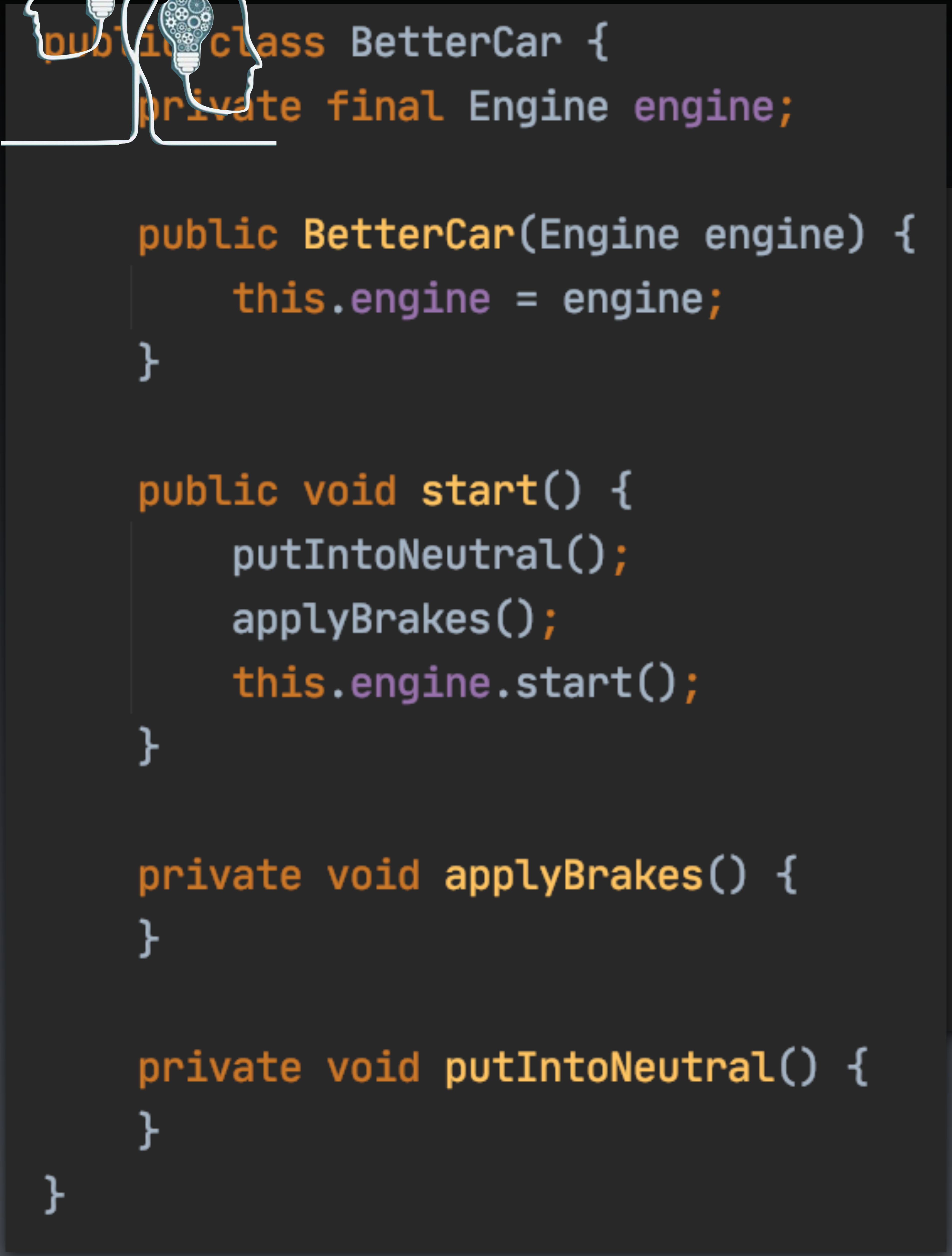


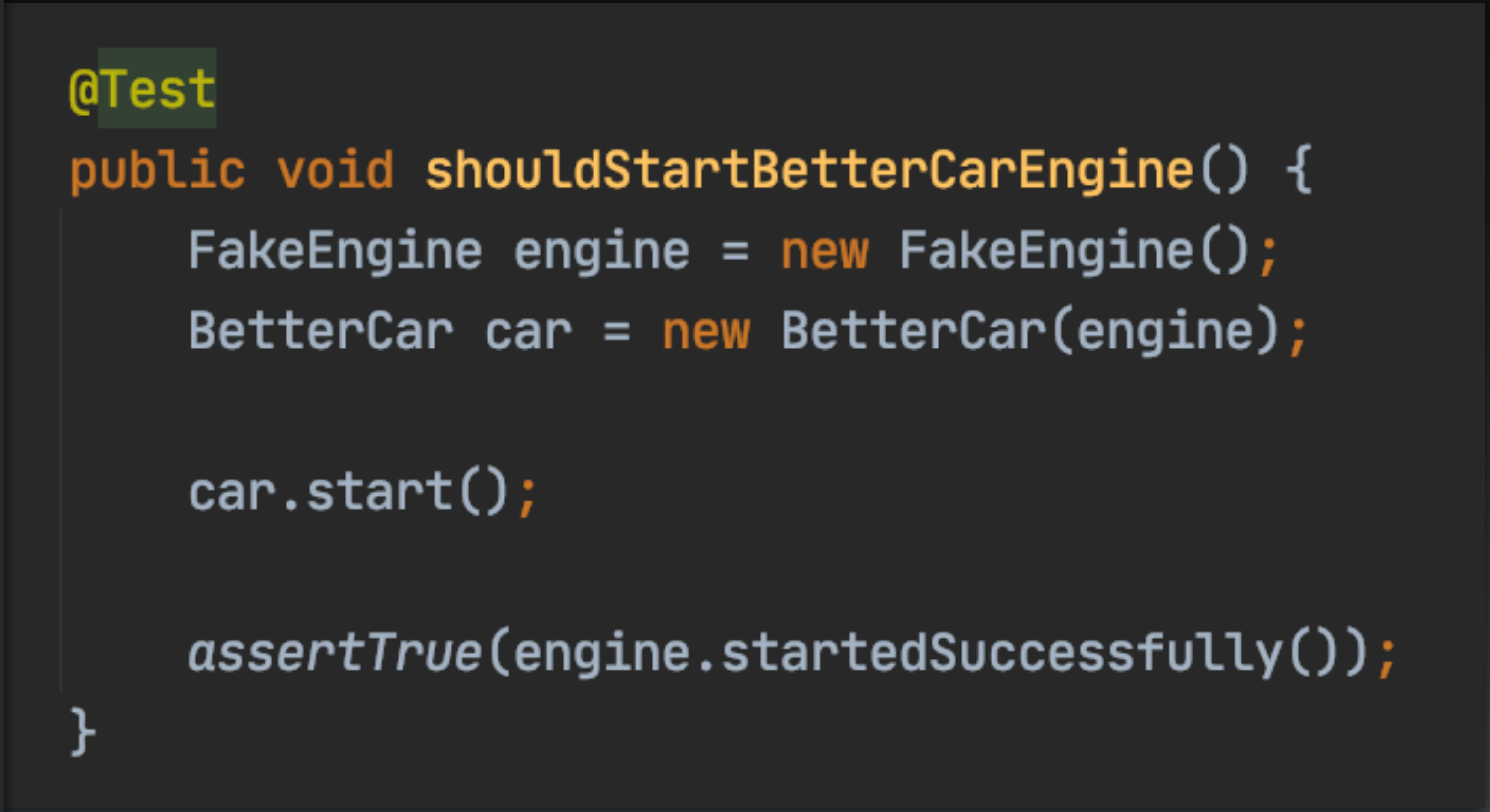
```java
public class BetterCar {
    private final Engine engine;

    public BetterCar(Engine engine) {
        this.engine = engine;
    }

    public void start() {
        putIntoNeutral();
        applyBrakes();
        this.engine.start();
    }

    private void applyBrakes() {
    }

    private void putIntoNeutral() {
    }
}
```



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    car.start();

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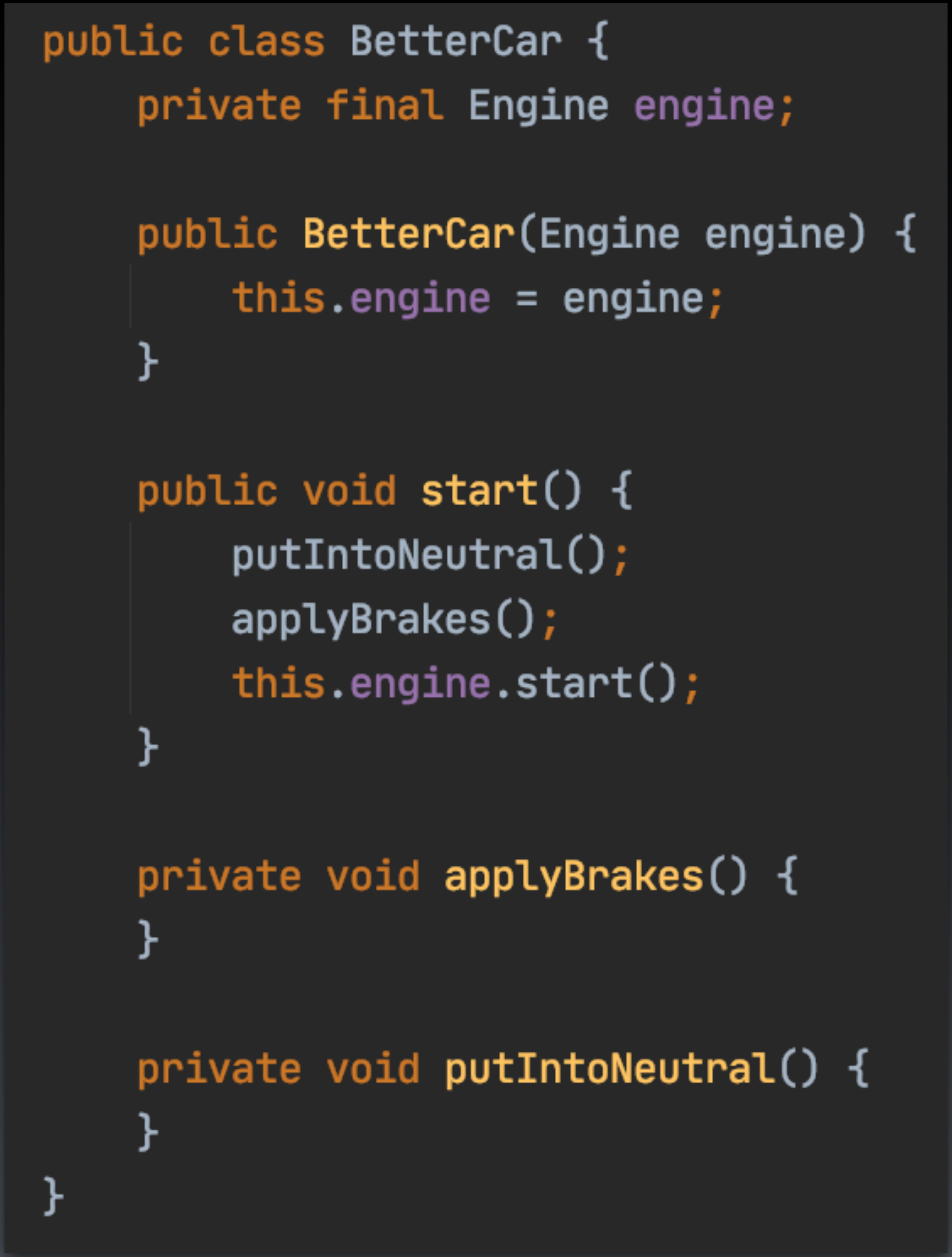

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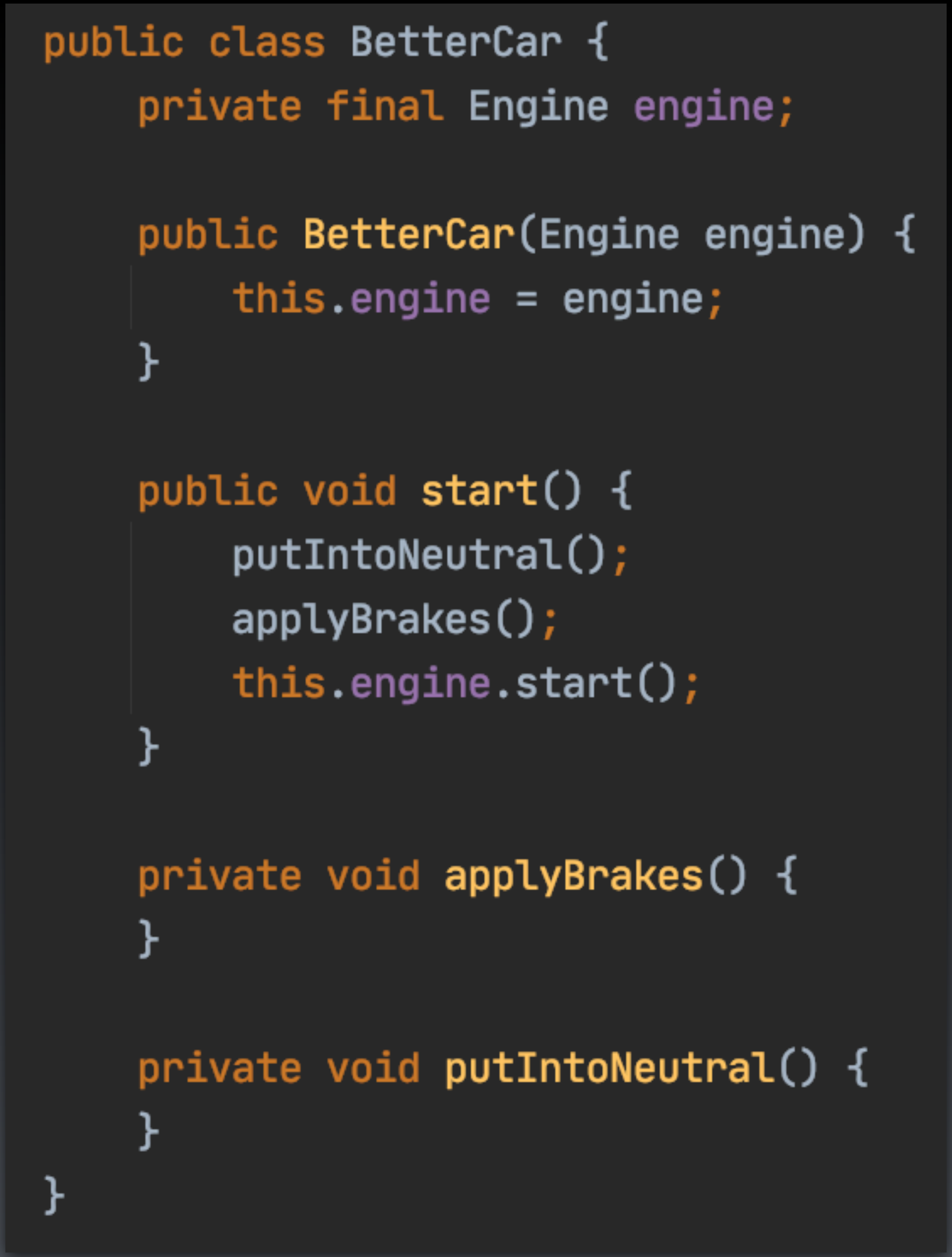

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```

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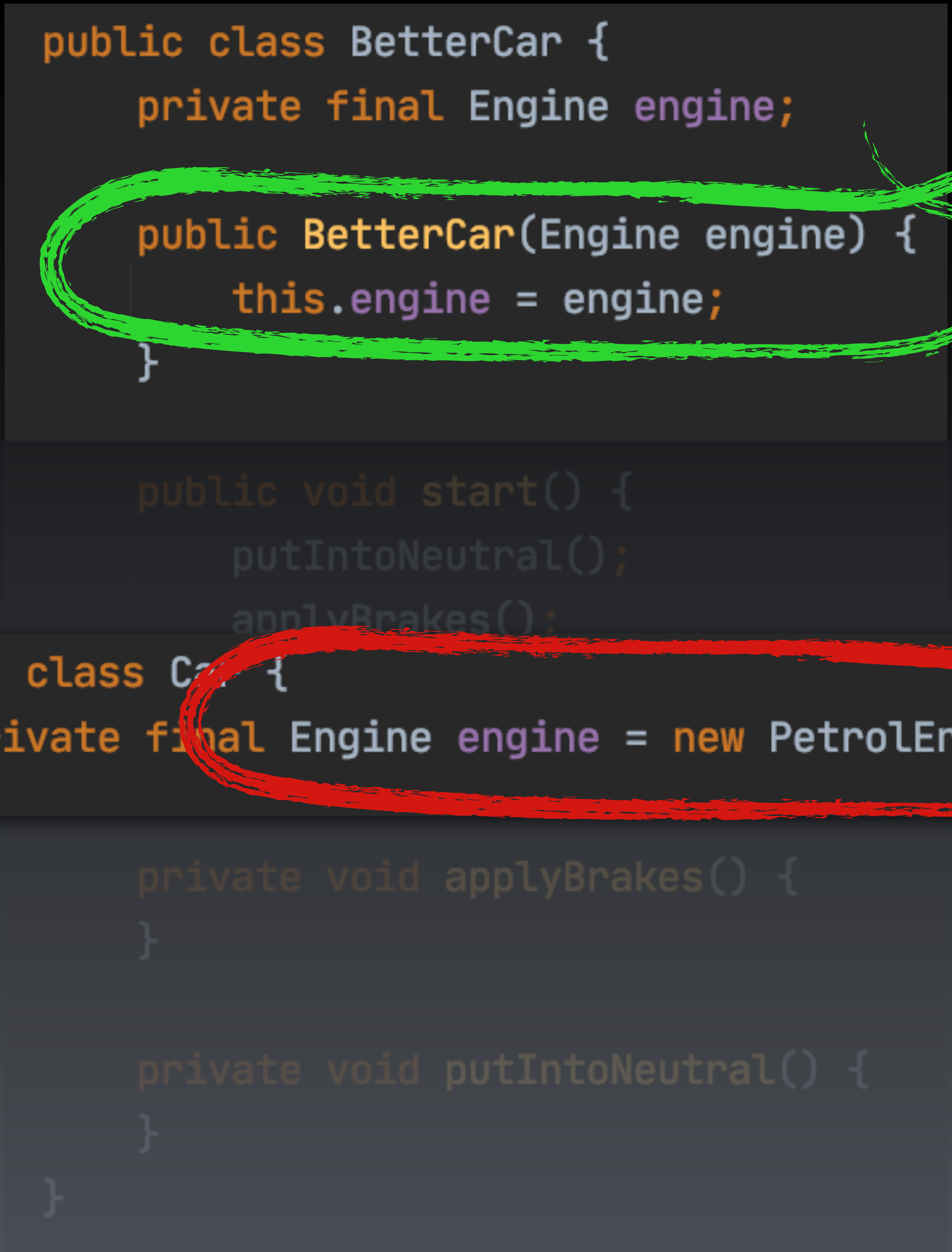

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    private final Engine engine;

    public BetterCar(Engine engine) {
        this.engine = engine;
    }

    public void start() {
        putIntoNeutral();
        applyBrakes();

    private void applyBrakes() {
    }

    private void putIntoNeutral() {
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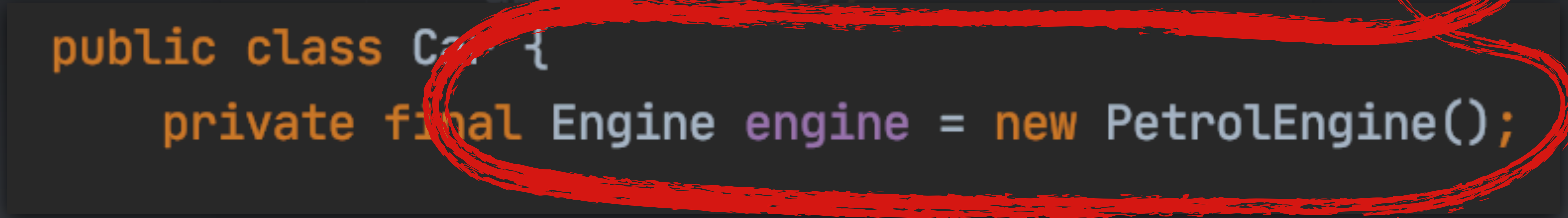
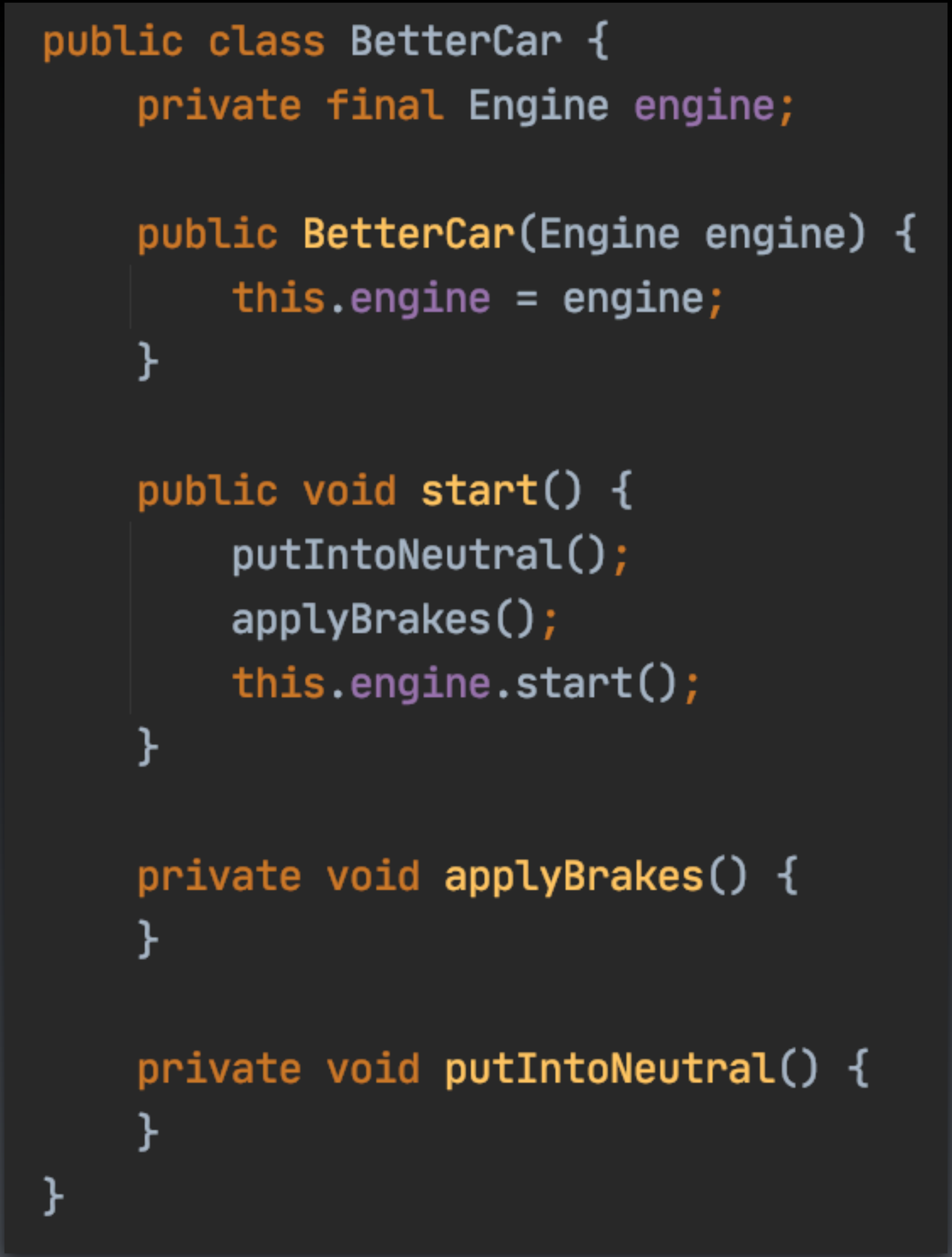


```
public class Car {
    private final Engine engine = new PetrolEngine();
```



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```

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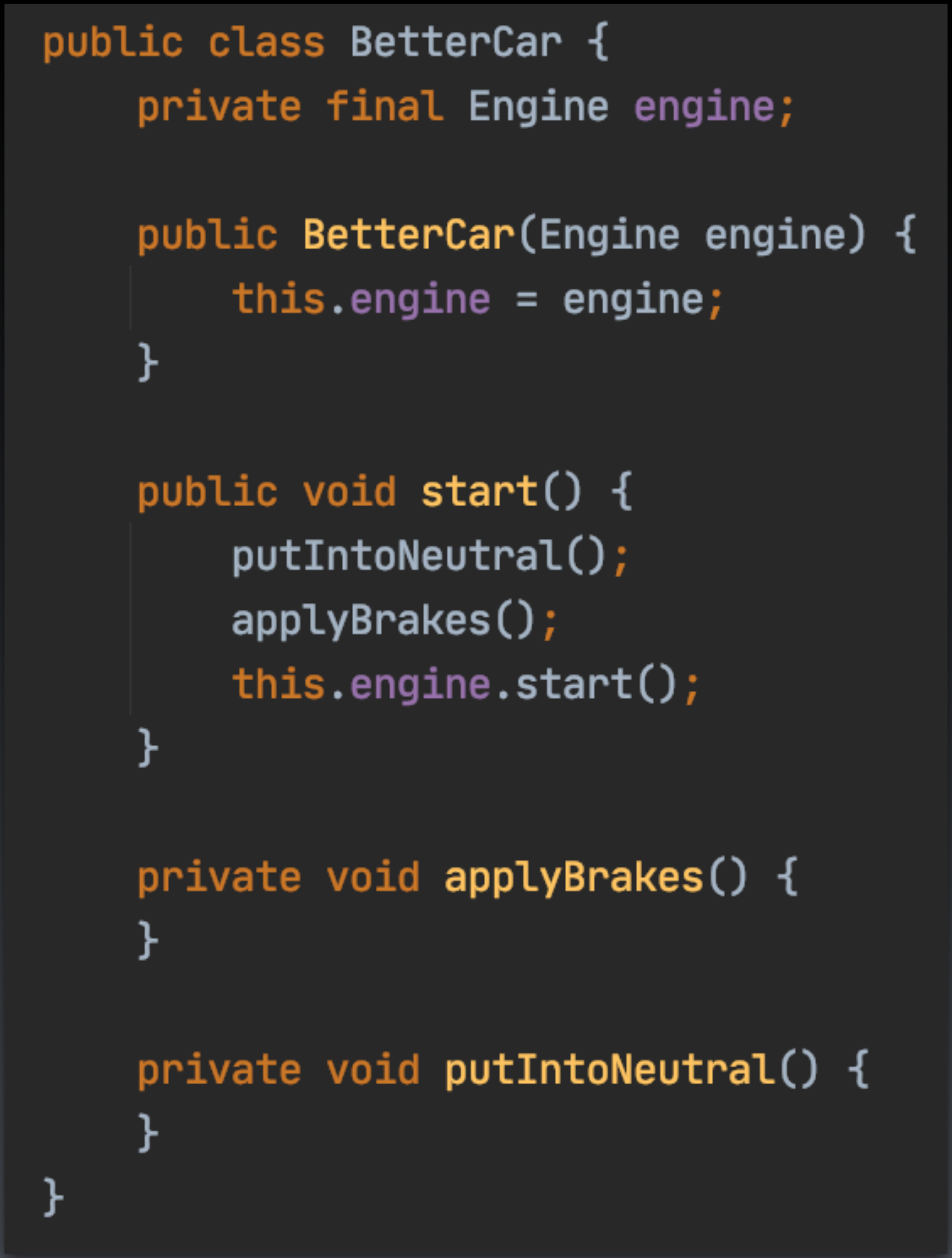

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    private final Engine engine;

    public BetterCar(Engine engine) {
        this.engine = engine;
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    public void start() {
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        applyBrakes();
        this.engine.start();
    }

    private void applyBrakes() {
    }

    private void putIntoNeutral() {
    }
}
```

A B

A B

Continuous Delivery ltd

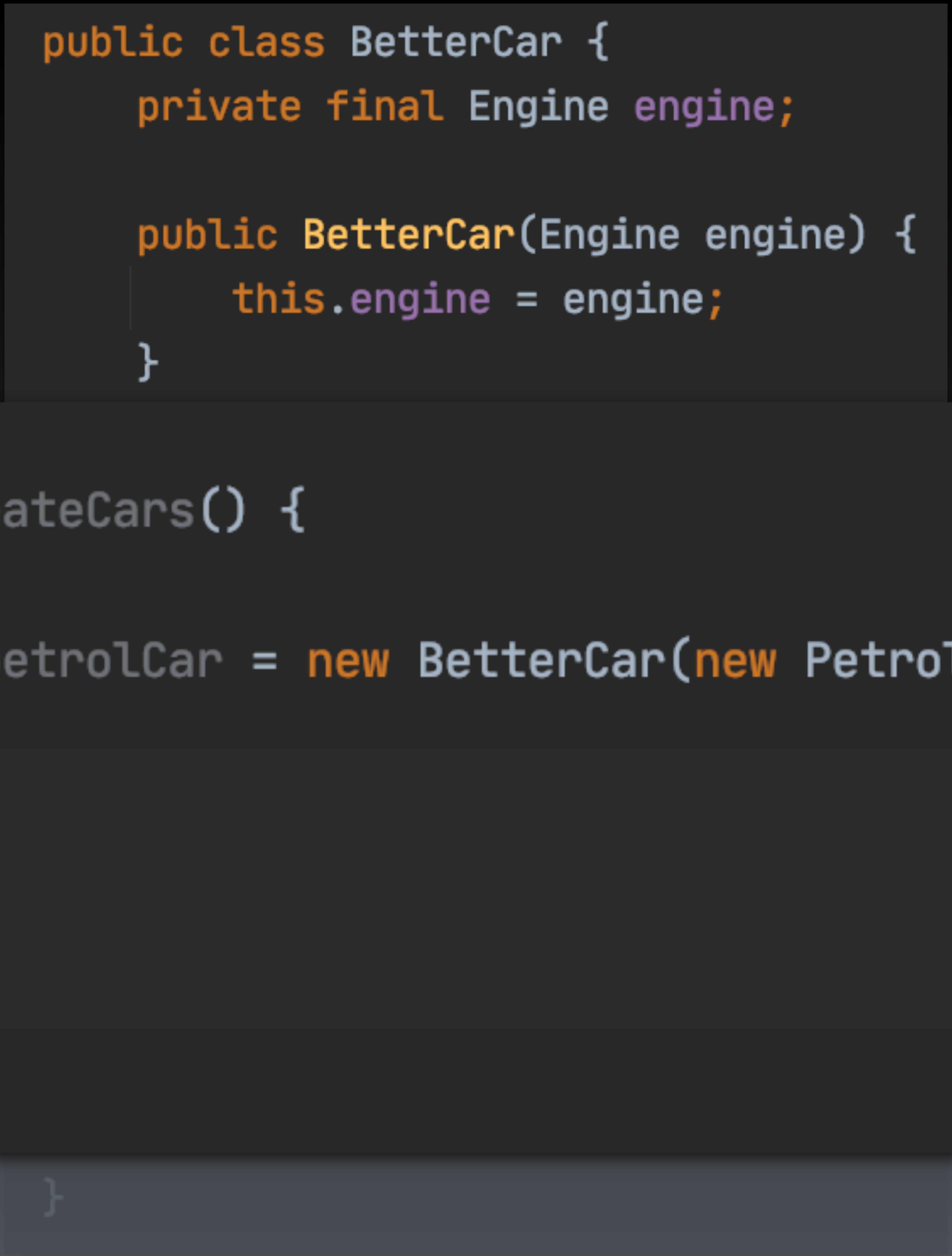
```java
public class BetterCar {
    private final Engine engine;

    public BetterCar(Engine engine) {
        this.engine = engine;
    }
}
```

```java
public void createCars() {

}
```

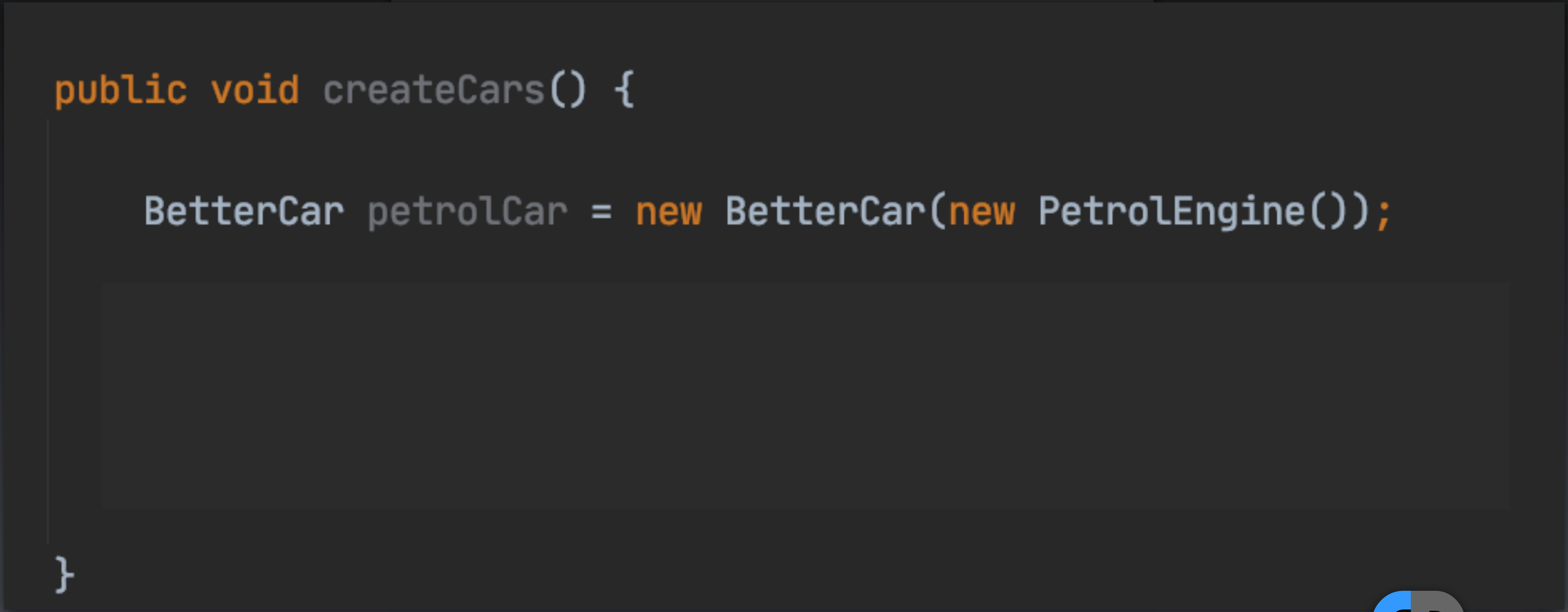
Continuous Delivery ltd



```java
public class BetterCar {
    private final Engine engine;

    public BetterCar(Engine engine) {
        this.engine = engine;
    }
```

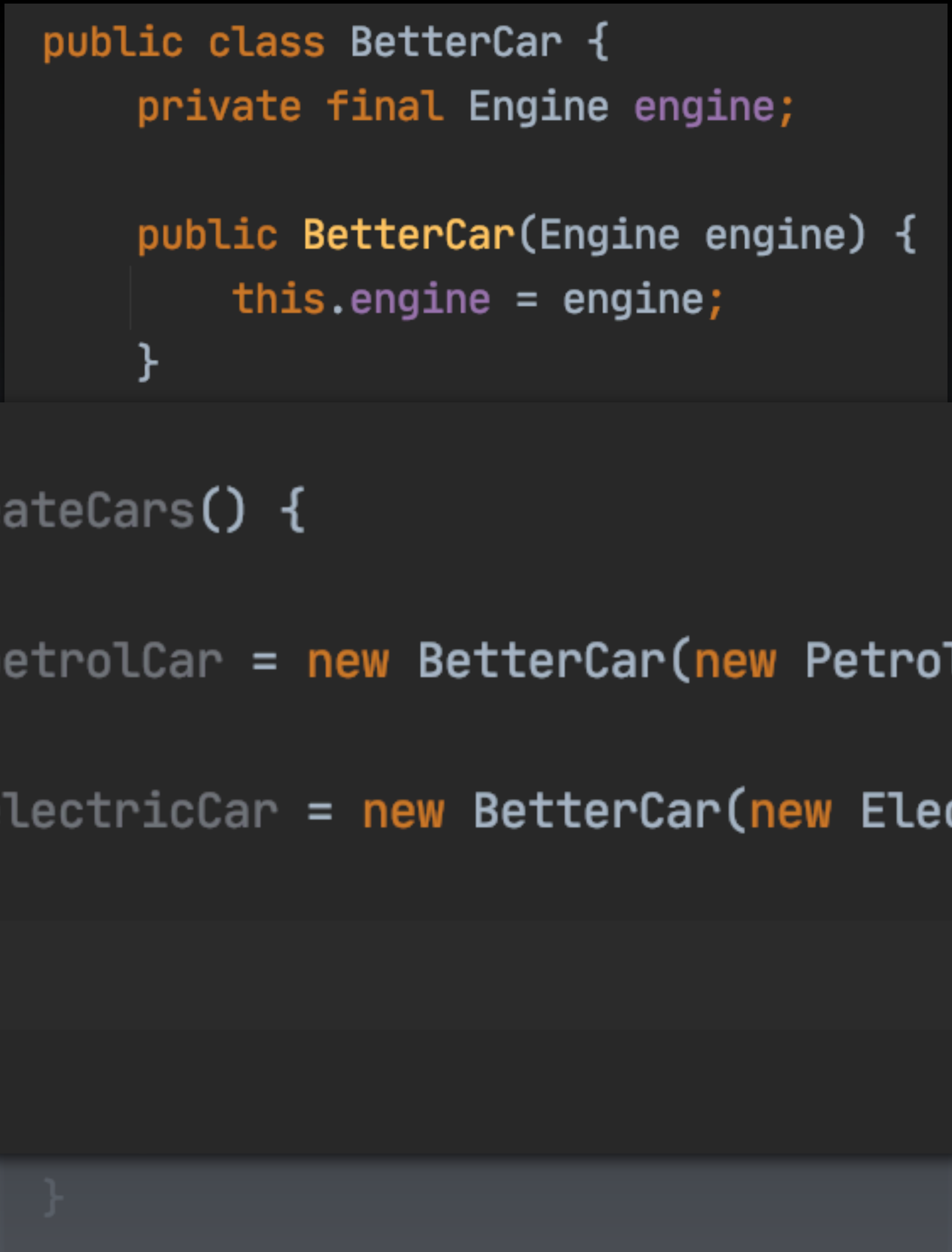
```java
}
```



```java
public void createCars() {

    BetterCar petrolCar = new BetterCar(new PetrolEngine());

}
```



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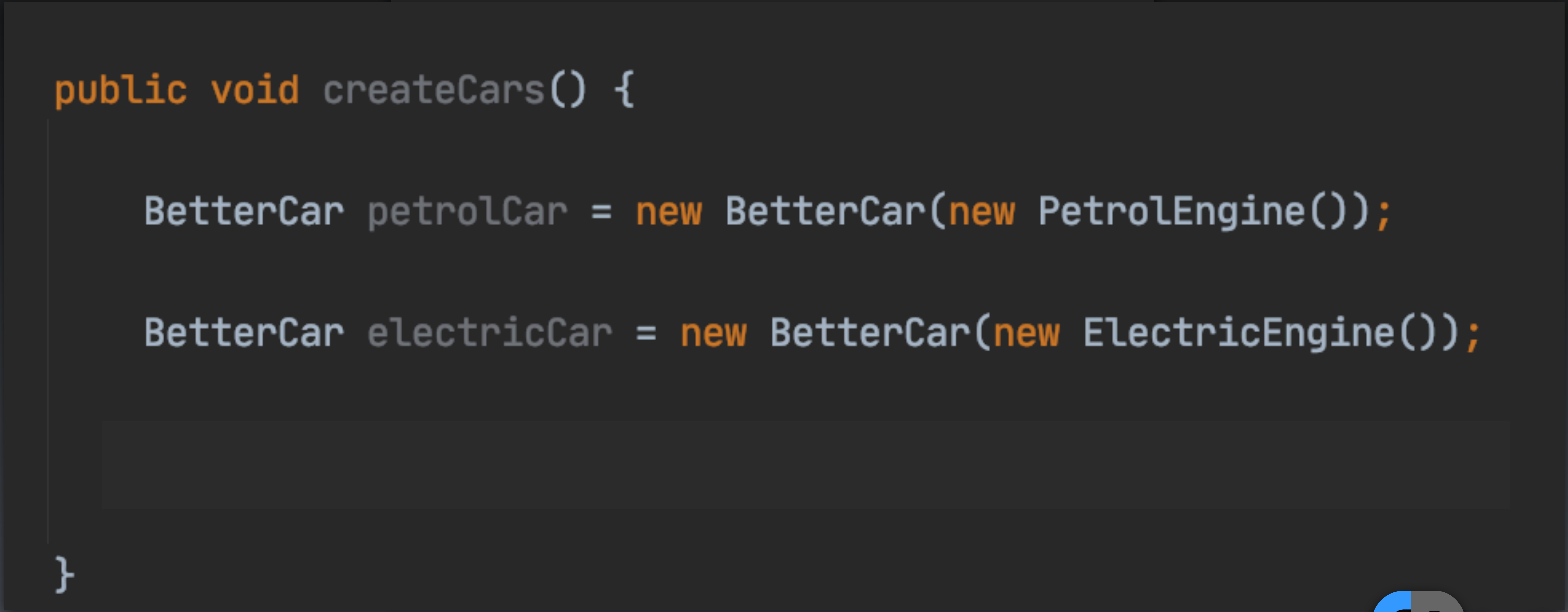
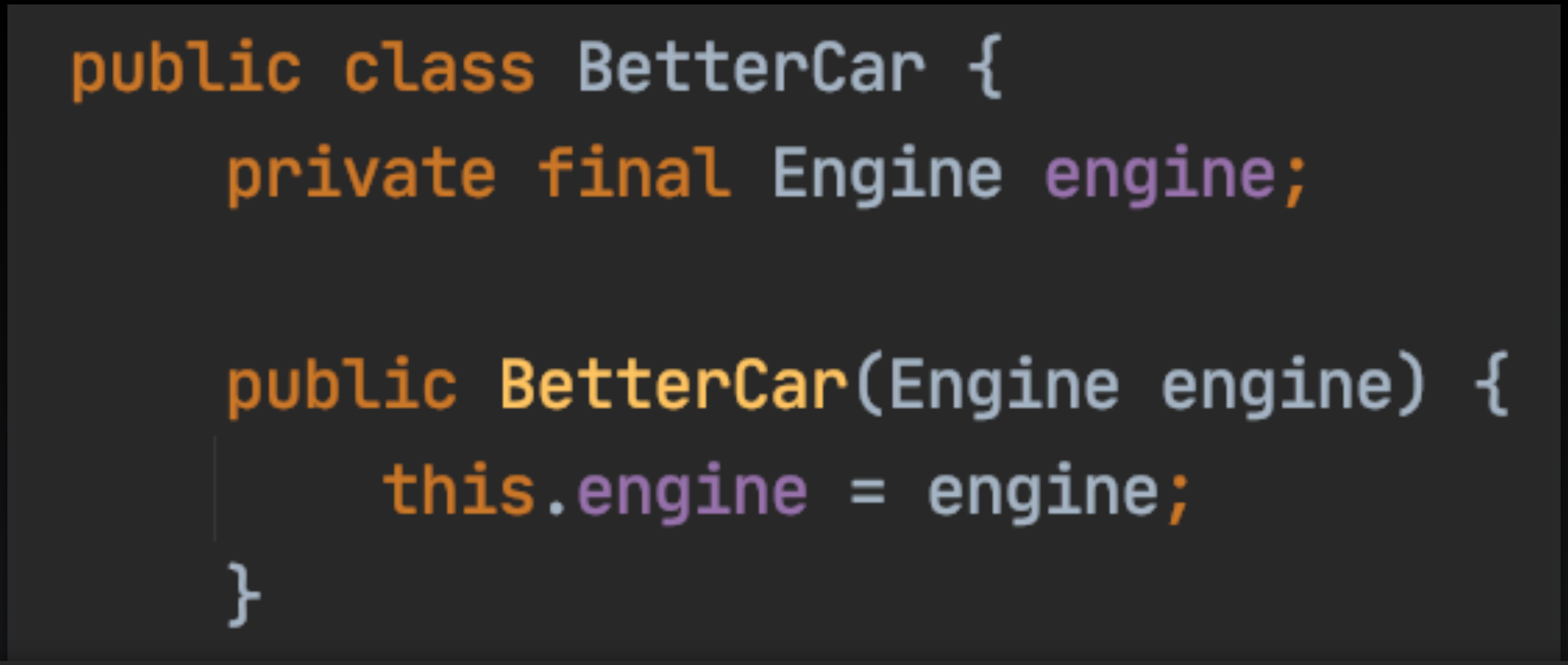
public class BetterCar {
    private final Engine engine;

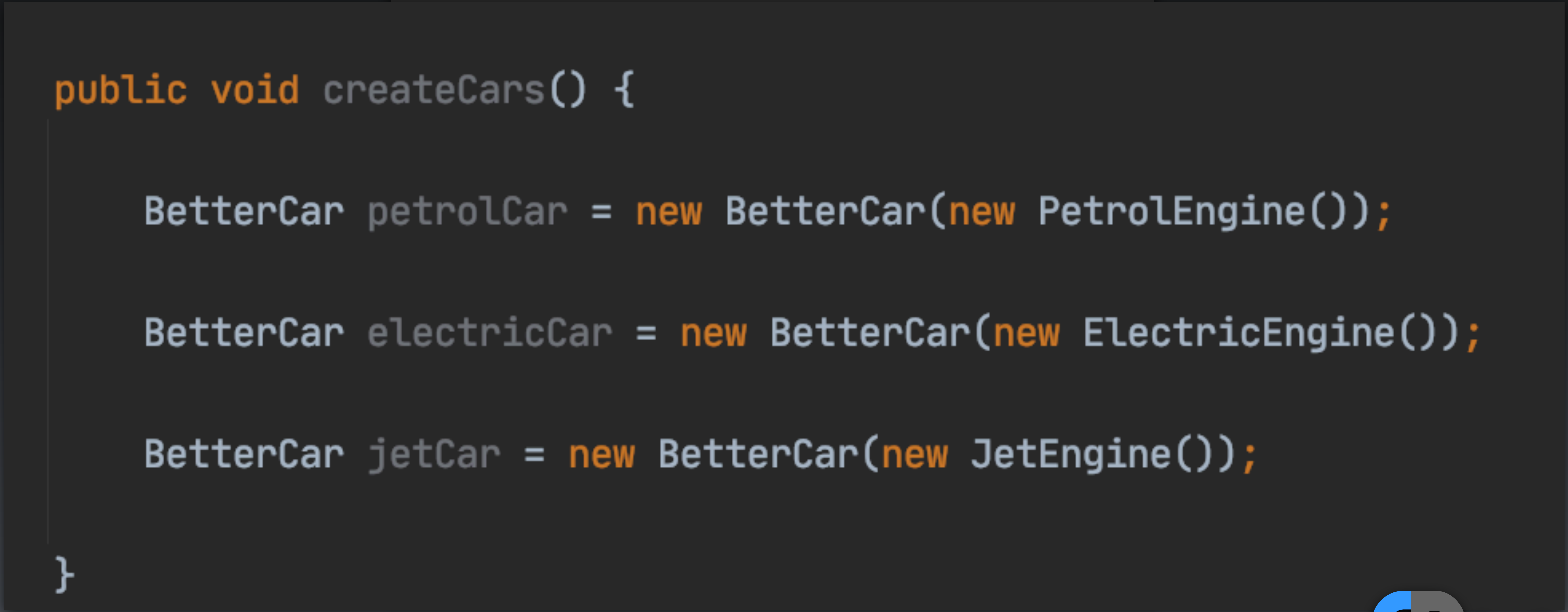
    public BetterCar(Engine engine) {
        this.engine = engine;
    }
}
```



```java
public void createCars() {

    BetterCar petrolCar = new BetterCar(new PetrolEngine());

    BetterCar electricCar = new BetterCar(new ElectricEngine());


}
```



```
public class BetterCar {
    private final Engine engine;

    public BetterCar(Engine engine) {
        this.engine = engine;
    }
```



```
public void createCars() {

    BetterCar petrolCar = new BetterCar(new PetrolEngine());

    BetterCar electricCar = new BetterCar(new ElectricEngine());

    BetterCar jetCar = new BetterCar(new JetEngine());

}
```

The Tools of Our Trade!

Optimise for Learning	Optimise to Manage Complexity
Iteration	Modularity
Feedback	Cohesion
Incremental	Separation of Concerns
Experimental	Abstraction
Empirical	Coupling

Continuous Delivery ltd

- ***These Things Matter for 1 Reason***

- *These Things Matter for 1 Reason*
- *They Allow us to Change Our Software*

Embrace Change!

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Delivery ltd

Embrace Change!

JS Frameworks Change All the Time!

Requirements Change

Technologies Change

Businesses Change

People Change

Plans Change

Markets Change

Our Designs Change

Customers Change

Our Understanding Changes

The Quality of a System
is Defined by
Our Ability to Change it!

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Delivery ltd

Q&A

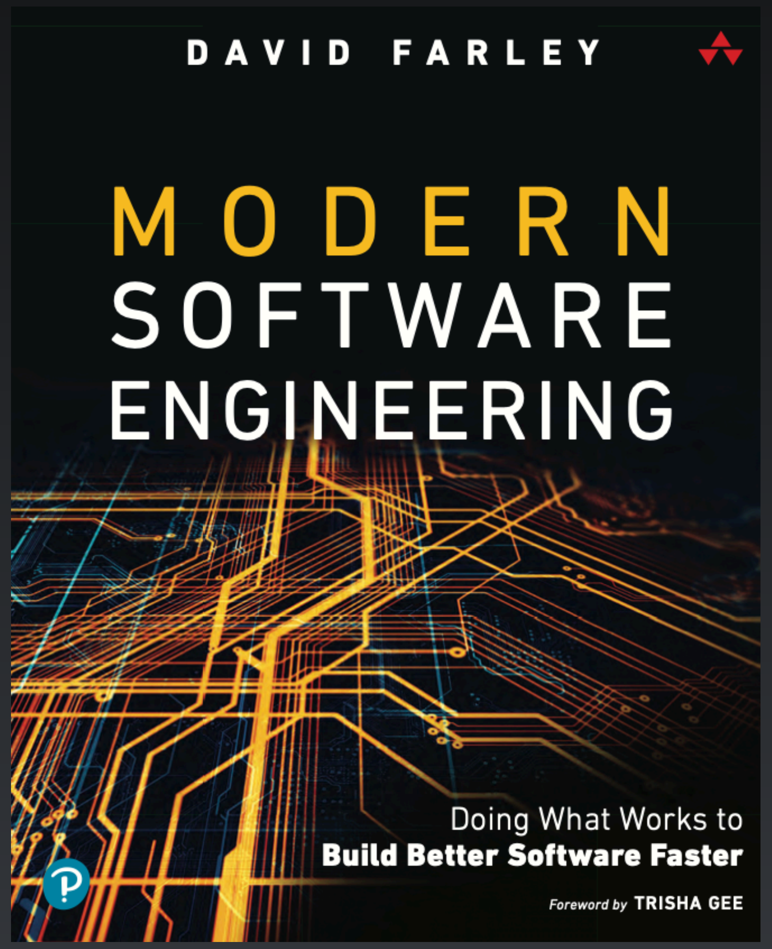
http://www.continuous-delivery.co.uk

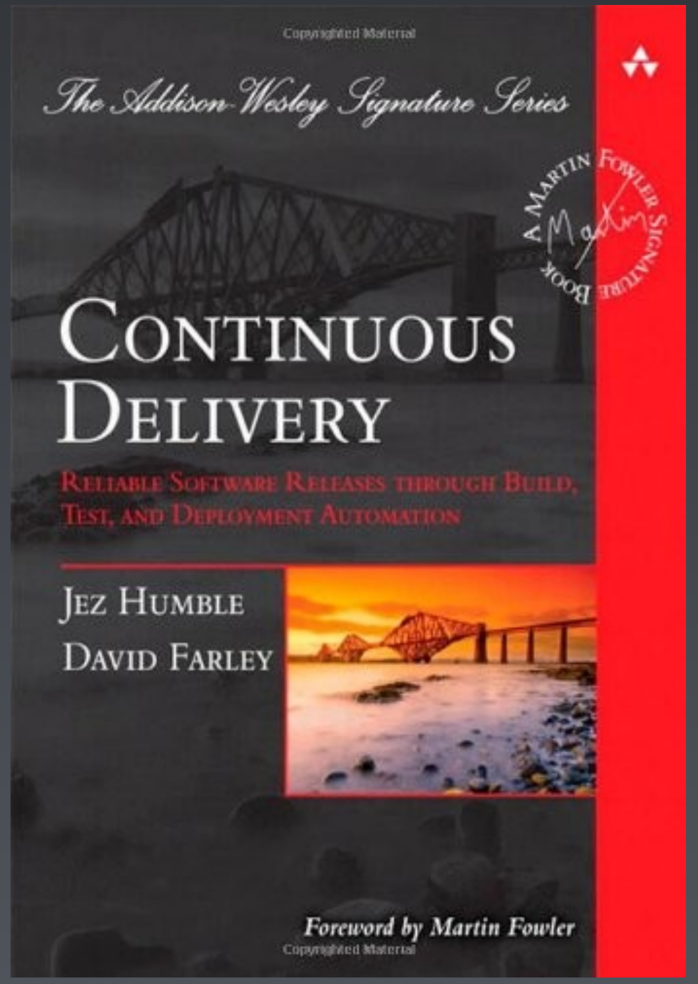
Dave Farley

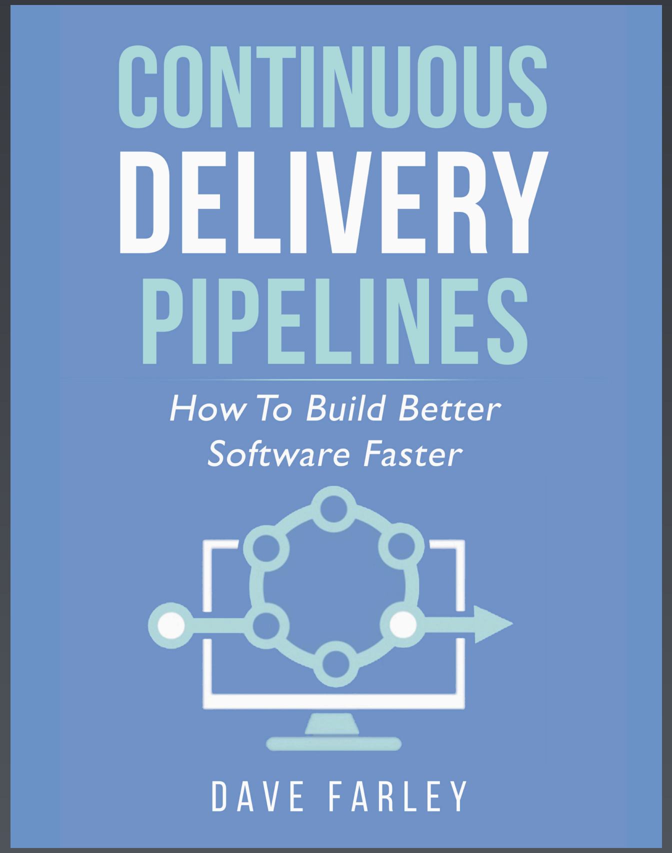
https://www.davefarley.net

@davefarley77

https://bit.ly/CDonYT


DAVID FARLEY
MODERN SOFTWARE ENGINEERING
Doing What Works to Build Better Software Faster
Foreword by TRISHA GEE


The Addison-Wesley Signature Series
CONTINUOUS DELIVERY
Reliable Software Releases through Build, Test, and Deployment Automation
Jez Humble
David Farley
Foreword by Martin Fowler


CONTINUOUS DELIVERY PIPELINES
How To Build Better Software Faster
DAVE FARLEY