Elm

Functional reactive programming for the browser

Agenda

- Elm Architecture by example
- Why Elm?
- Is it production ready?

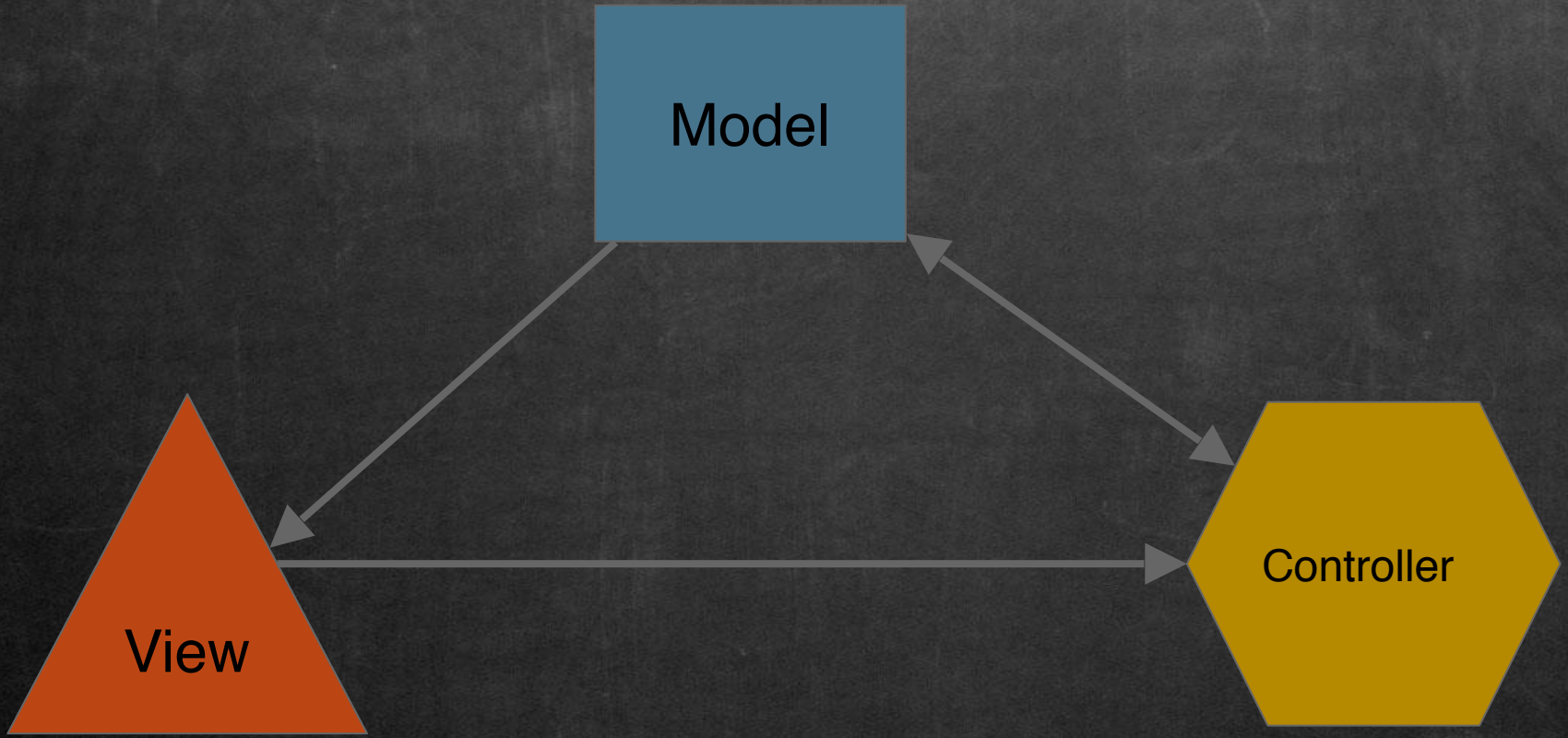
An Elm Program

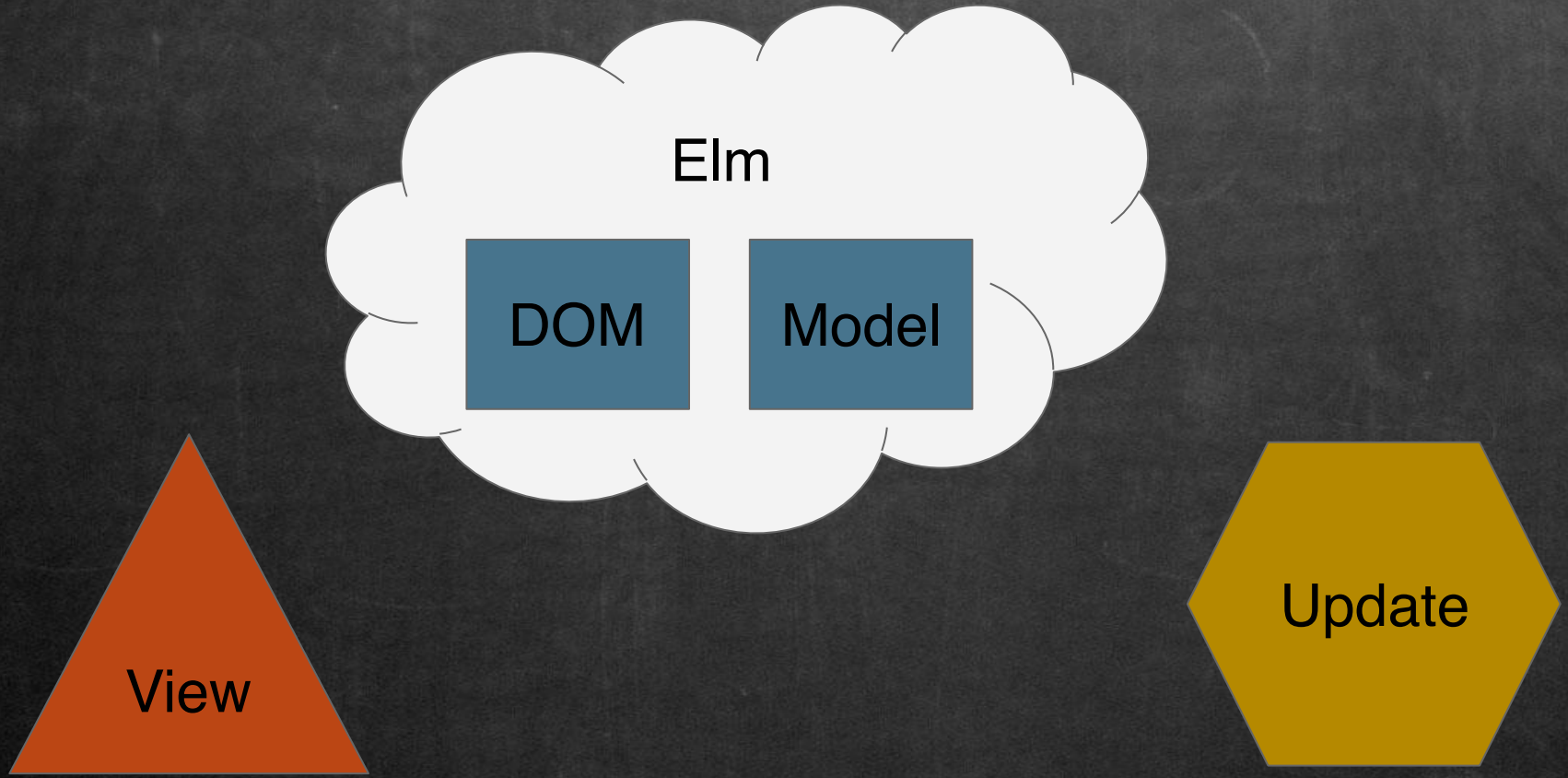
```elm
type Msg
  = Add
  | Sub


init = 0


update msg model =
  case msg of
    Add ->
      model + 1

    Sub ->
      model - 1
```

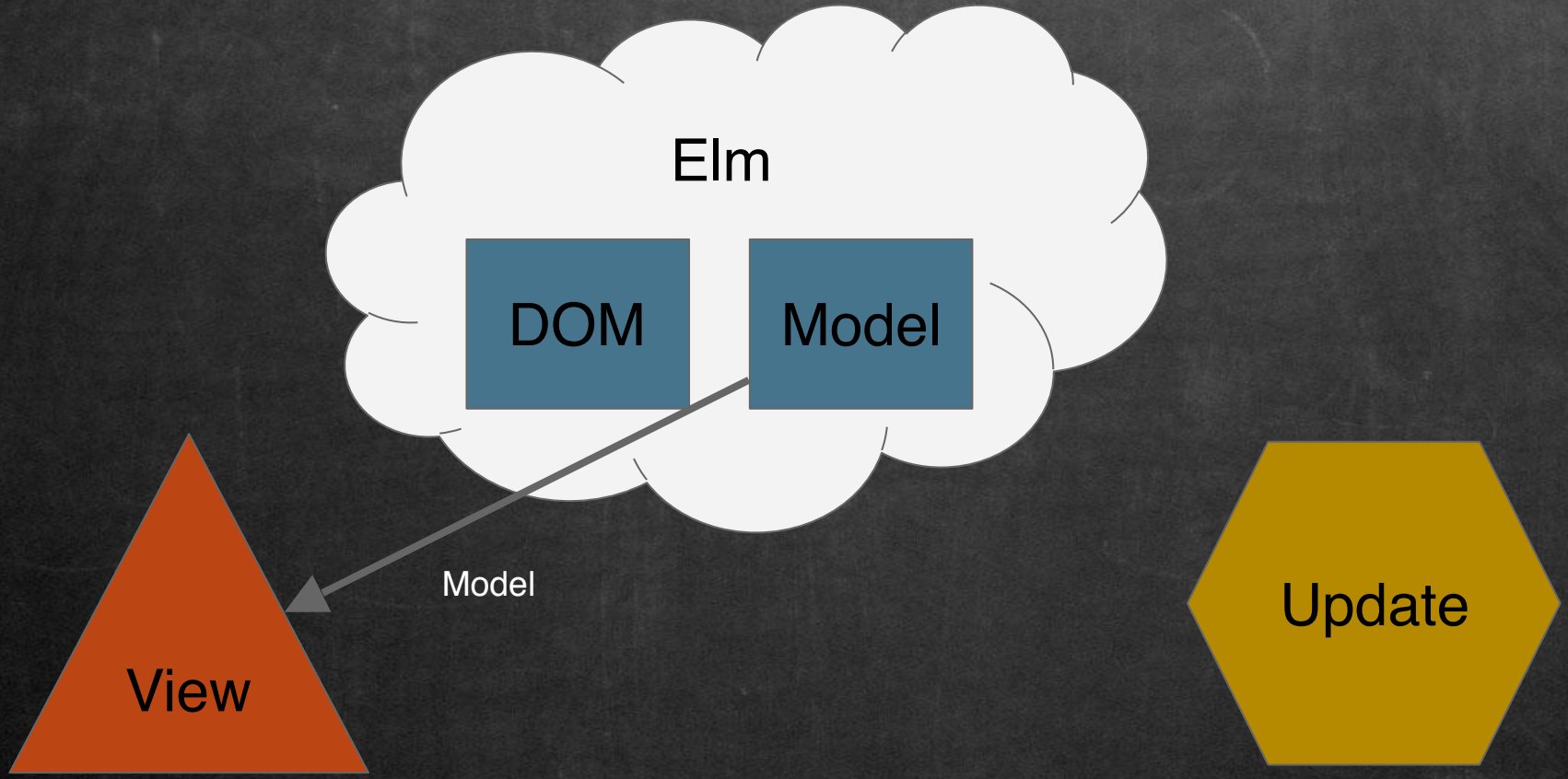
```elm
view model =
  div []
    [ span [] [text (toString model)]
    , button [ onClick Add ] [ text "+" ]
    , button [ onClick Sub ] [ text "-" ]
    ]
```

```elm
type alias Model = Int


type Msg
  = Add
  | Sub


init : Model
init = 0


update : Msg -> Model -> Model
update msg model =
  case msg of
    Add ->
      model + 1

    Sub ->
      model - 1
```

```elm
view : Model -> Html Msg
view model =
  div []
    [ span [] [text (toString model)]
    , button [ onClick Add ] [ text "+" ]
    , button [ onClick Sub ] [ text "-" ]
    ]
```


Model
View
Controller


Elm
DOM
Model
View
Update


Elm
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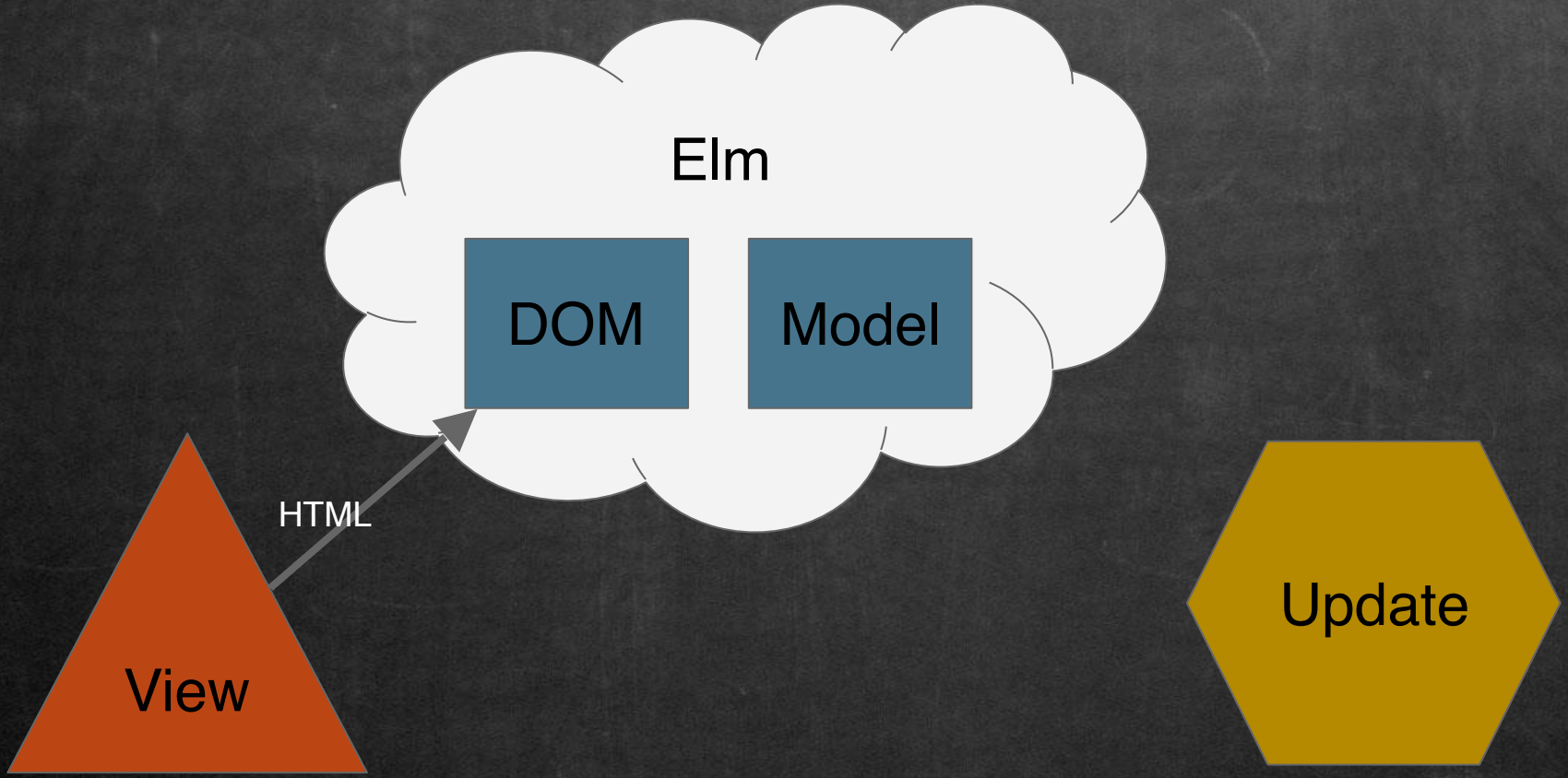
Update


Elm
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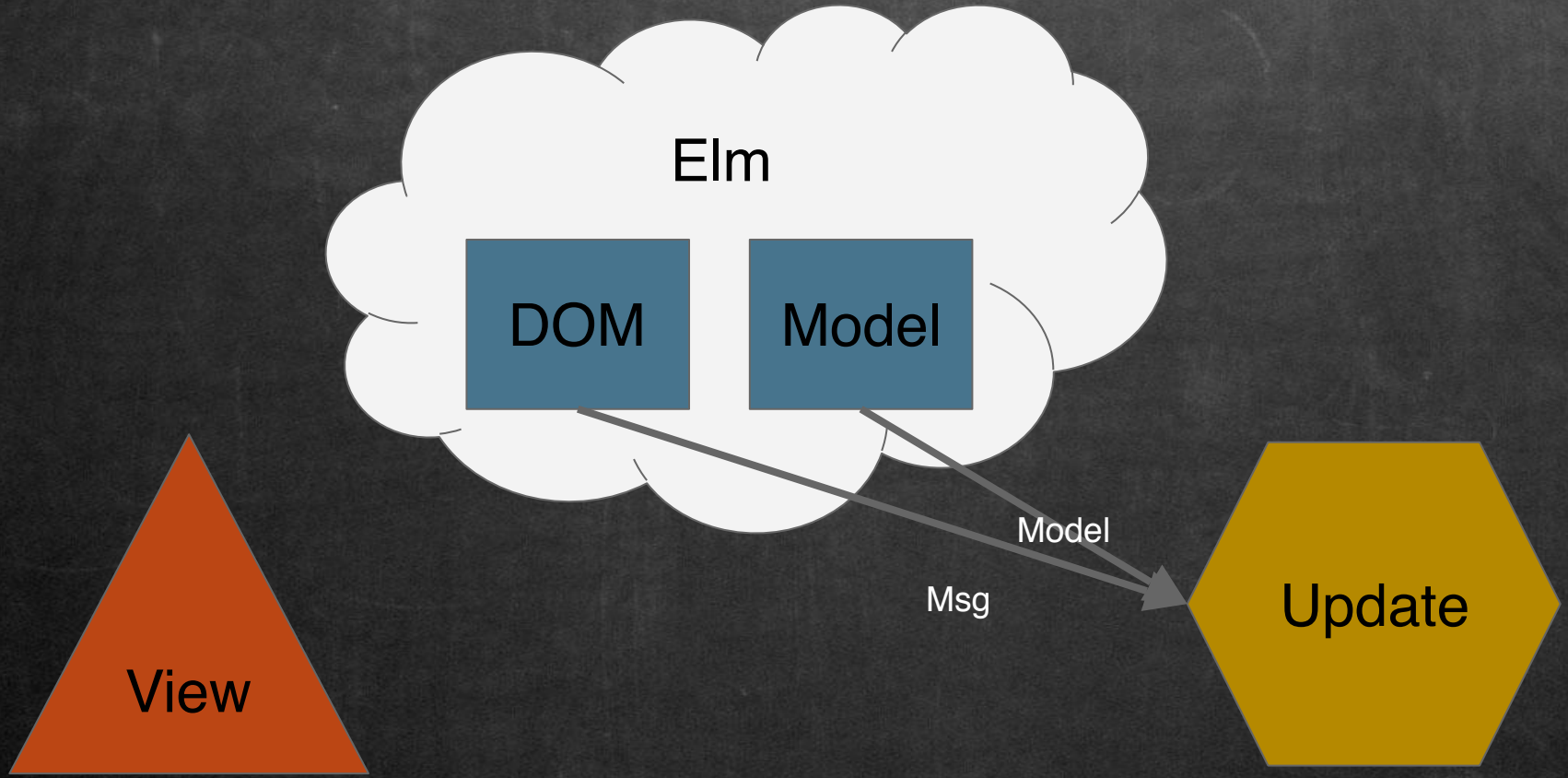
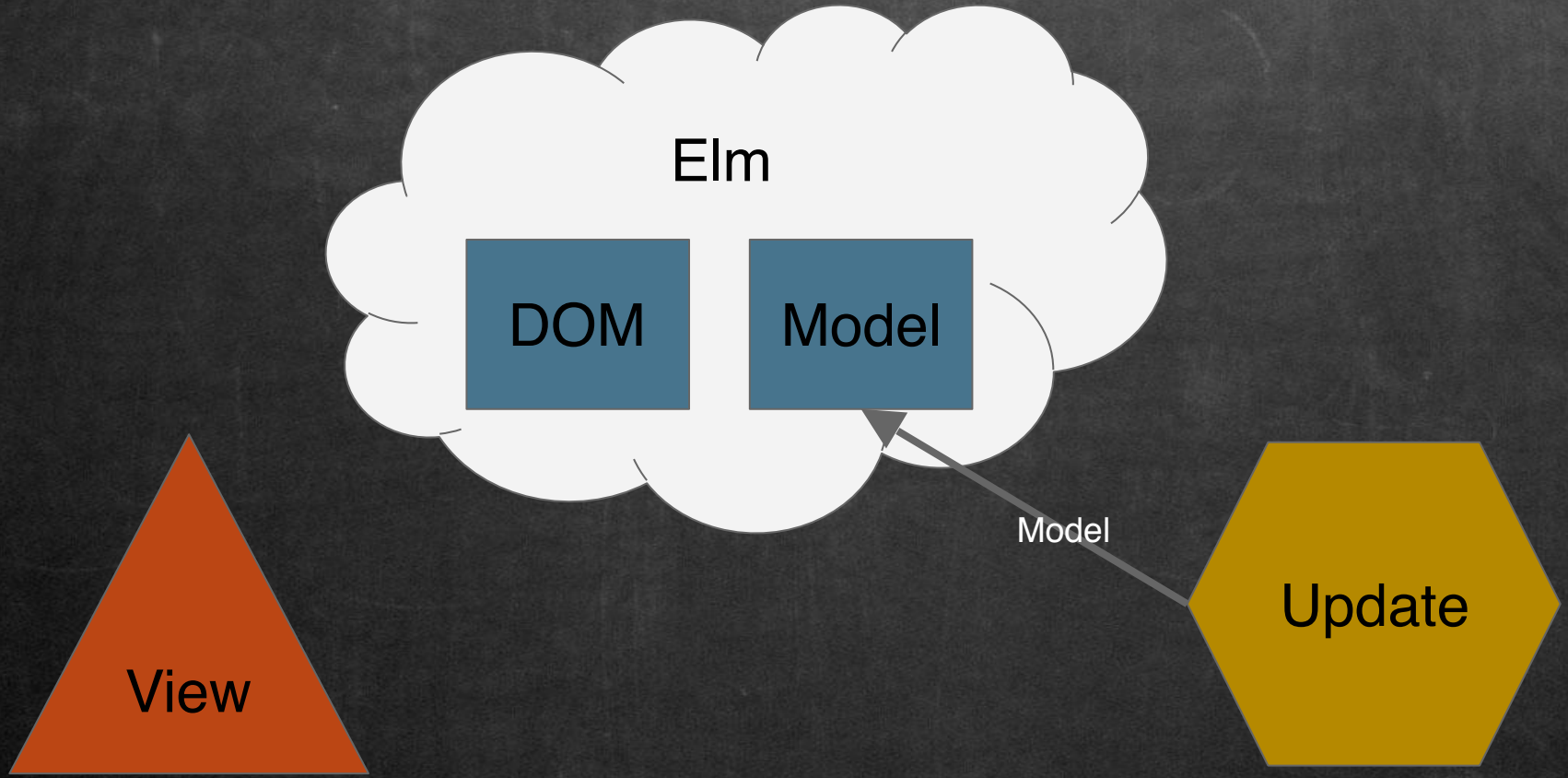
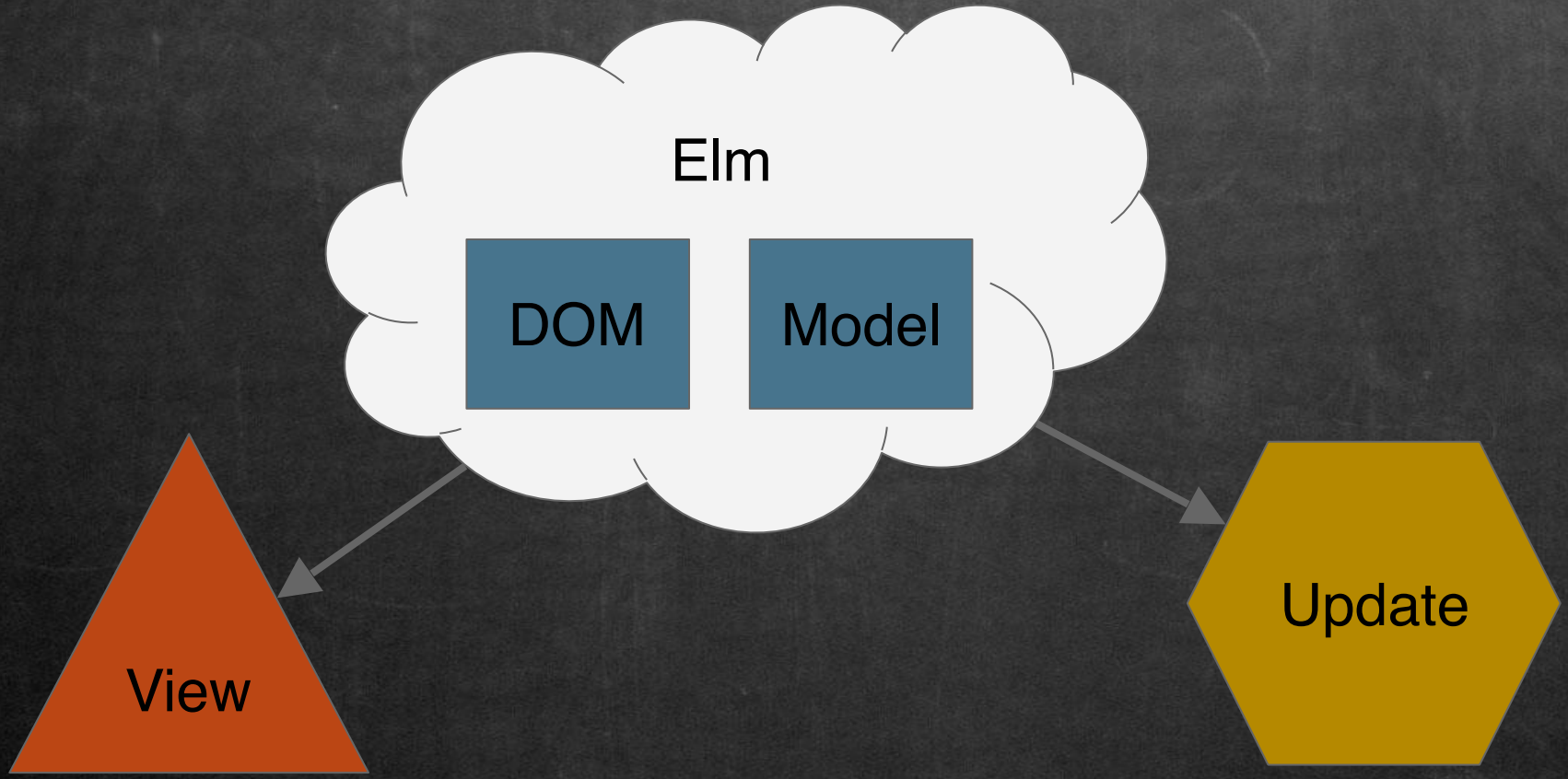

Elm
DOM
Model
Model
Msg
View
Update


Elm
DOM
Model
Model
View
Update


Elm
DOM
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```elm
type alias Model = Int


type Msg
  = Add
  | Sub


init : Model
init = 0


update : Msg -> Model -> Model
update msg model =
  case msg of
    Add ->
      model + 1

    Sub ->
      model - 1
```

```elm
view : Model -> Html Msg
view model =
  div []
    [ span [] [text (toString model)]
    , button [ onClick Add ] [ text "+" ]
    , button [ onClick Sub ] [ text "-" ]
    ]
```

Characteristics

An Elm program has / is

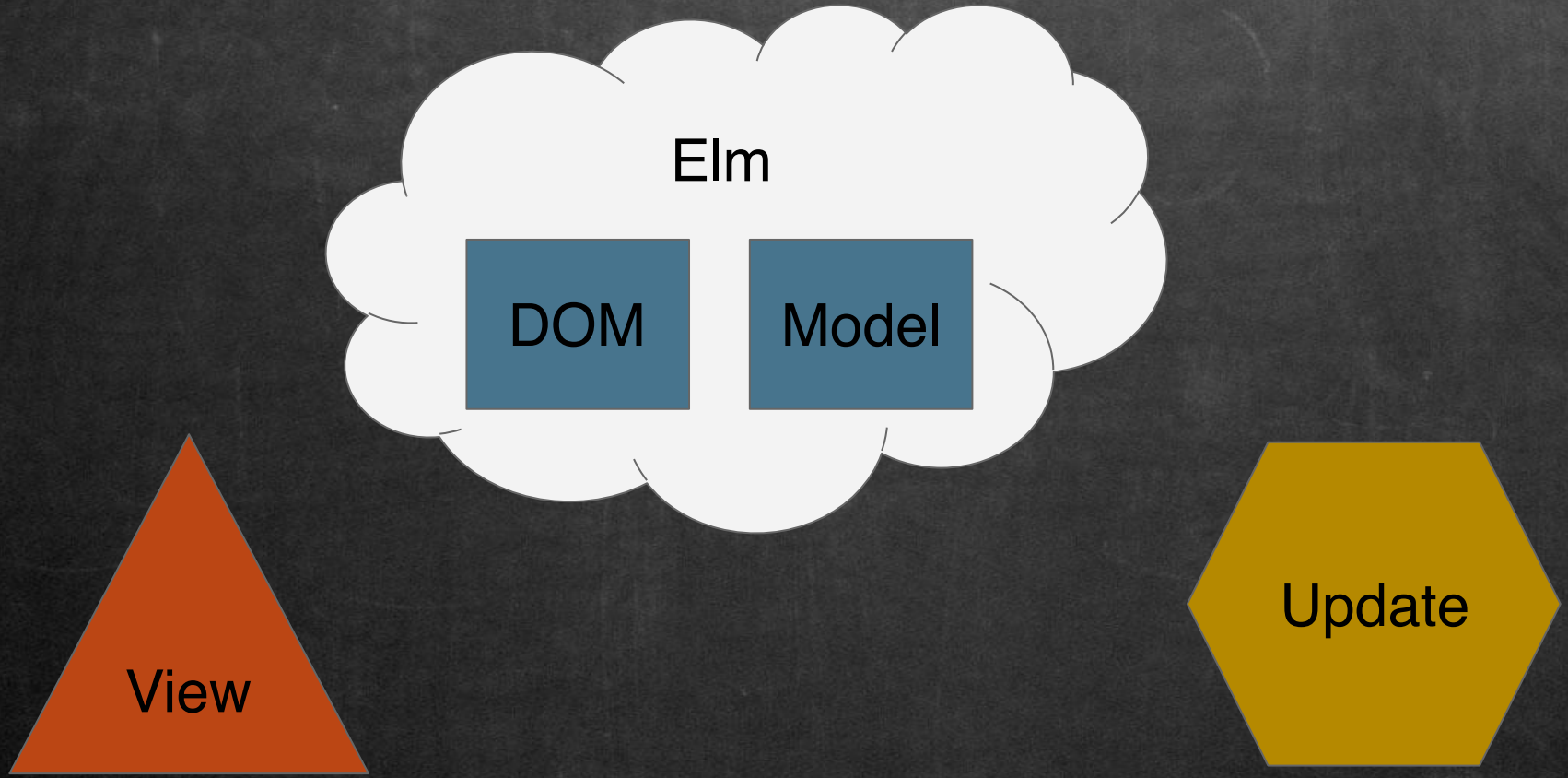
- only true (pure) functions (no side effects)
- immutable data
- no state (DOM / Model)
- reactive by design

Benefits

- testing of stateless / pure functions is easy
- testing without global state is easy
- better maintainability
- no concurrency problems

- Time Travel Debugger (build-in)(debug.elm-lang.org)

Reactive


Elm
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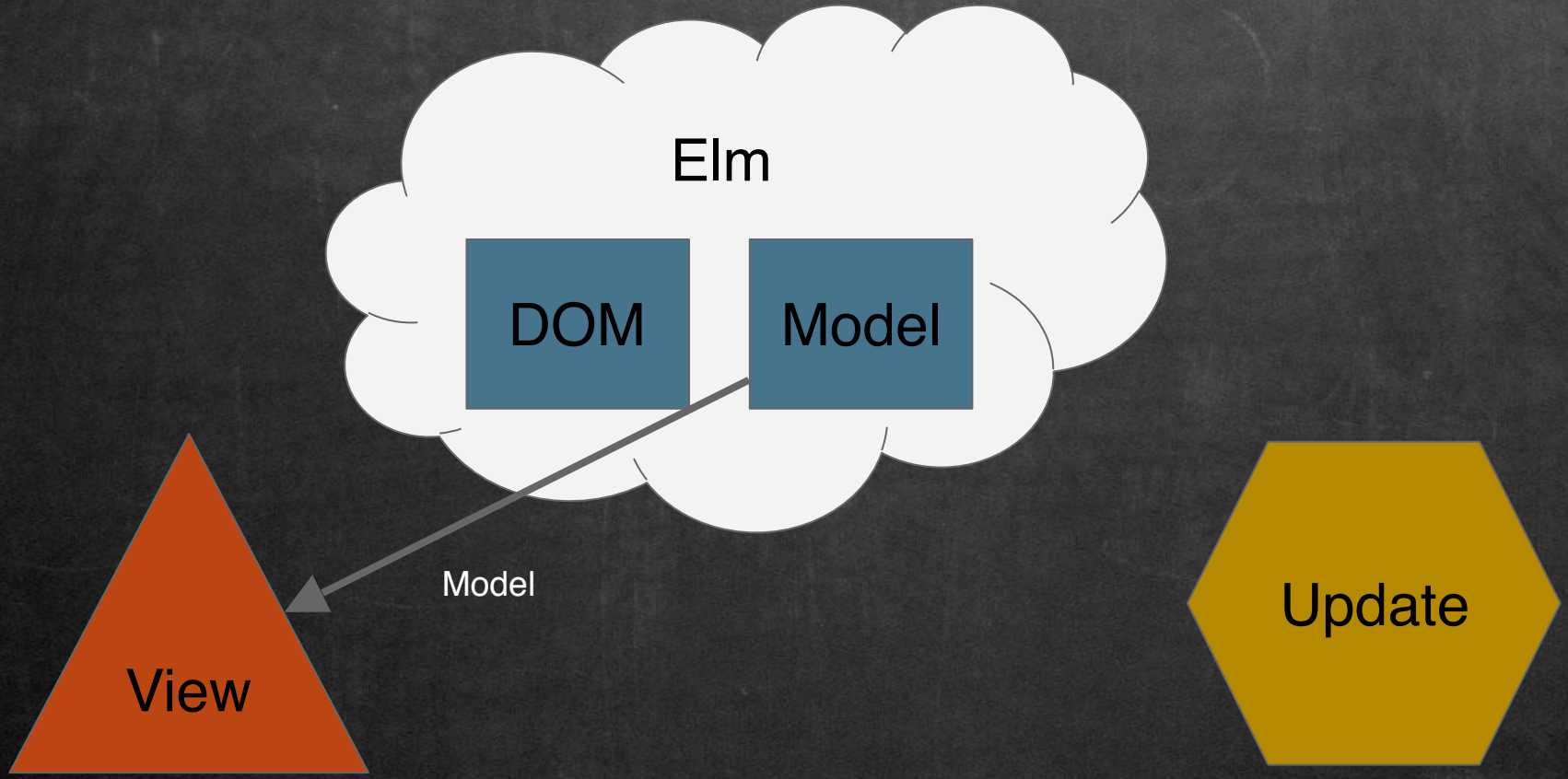
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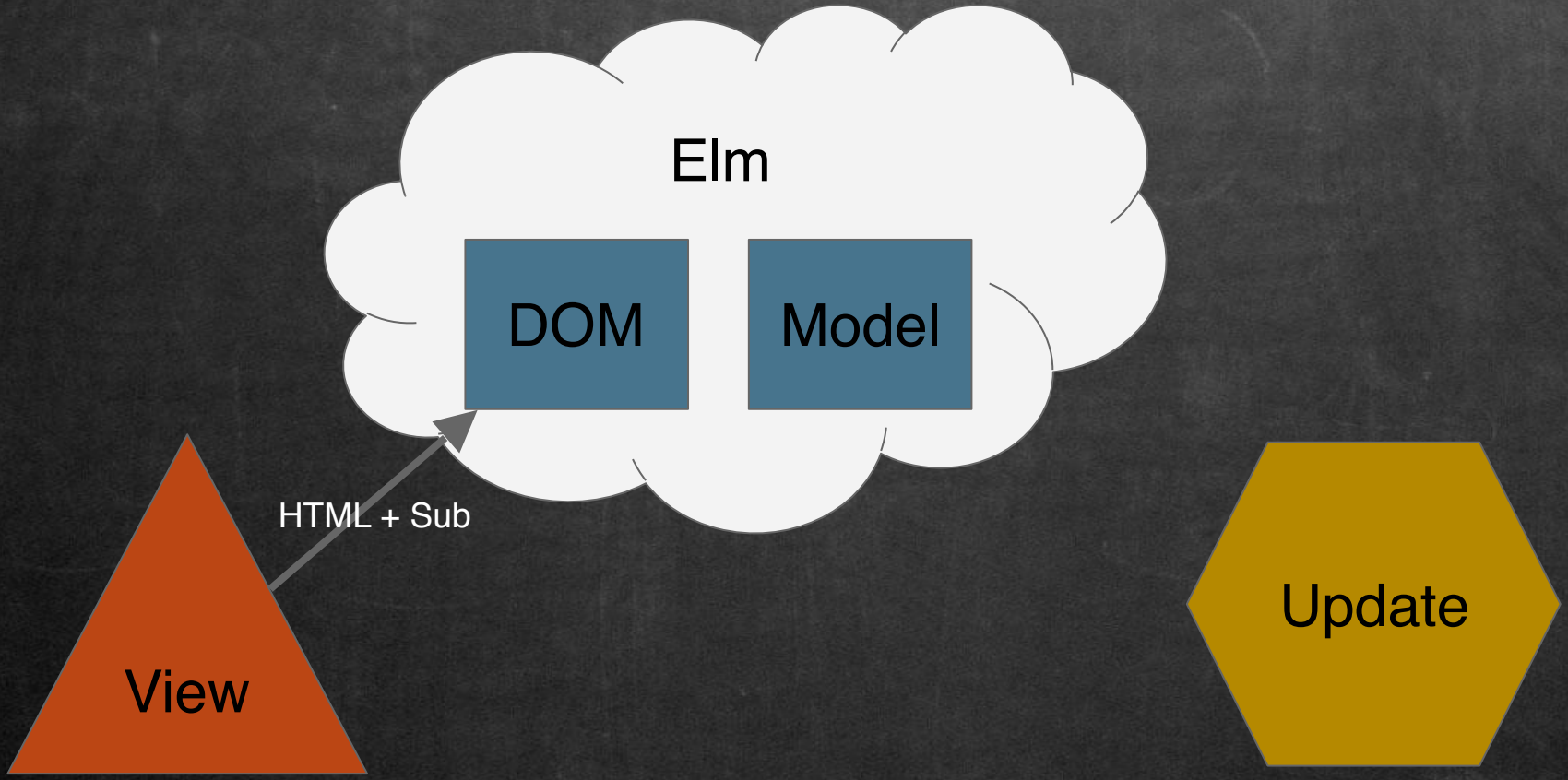
Elm
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HTML + Sub
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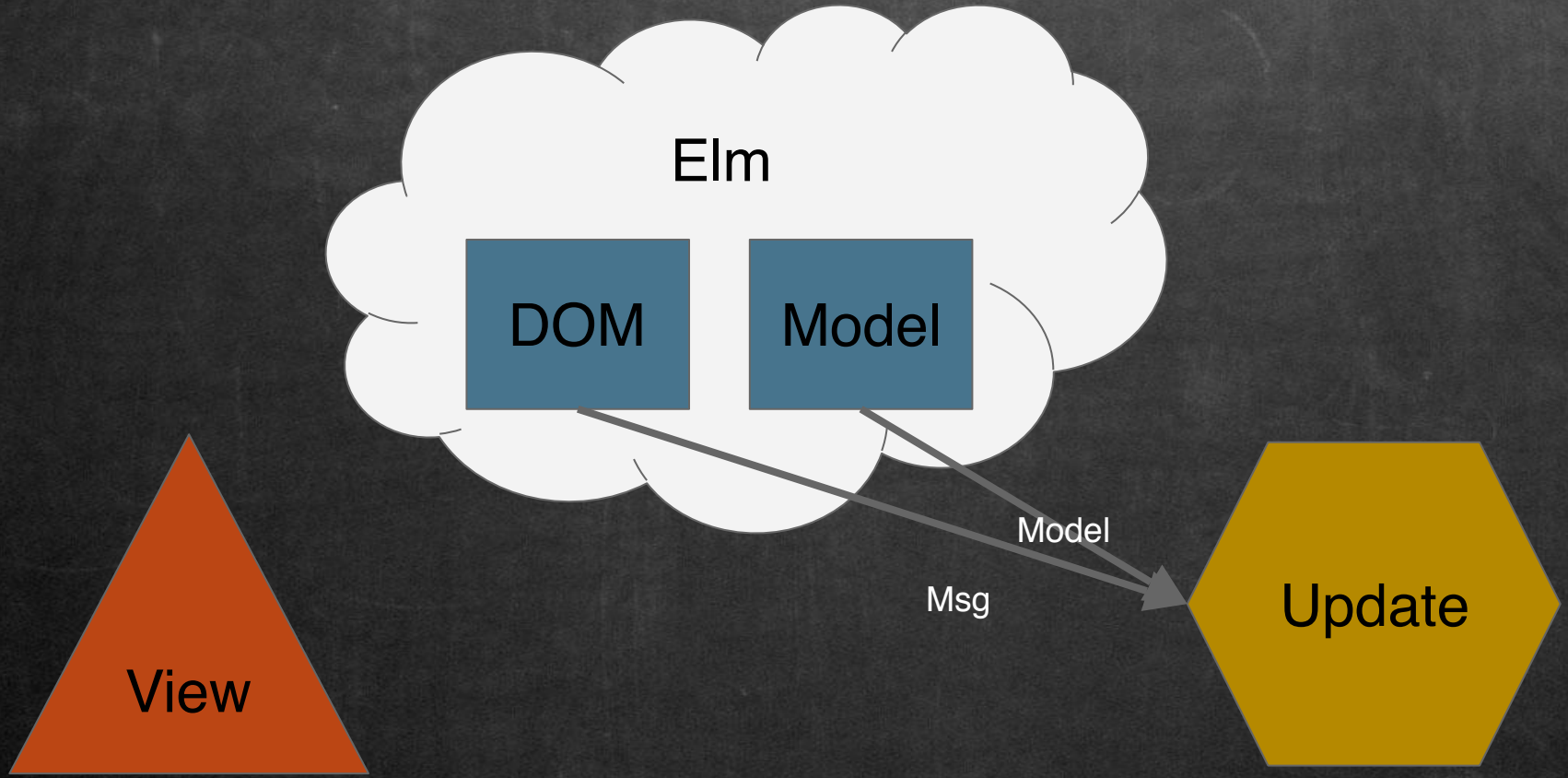
Elm
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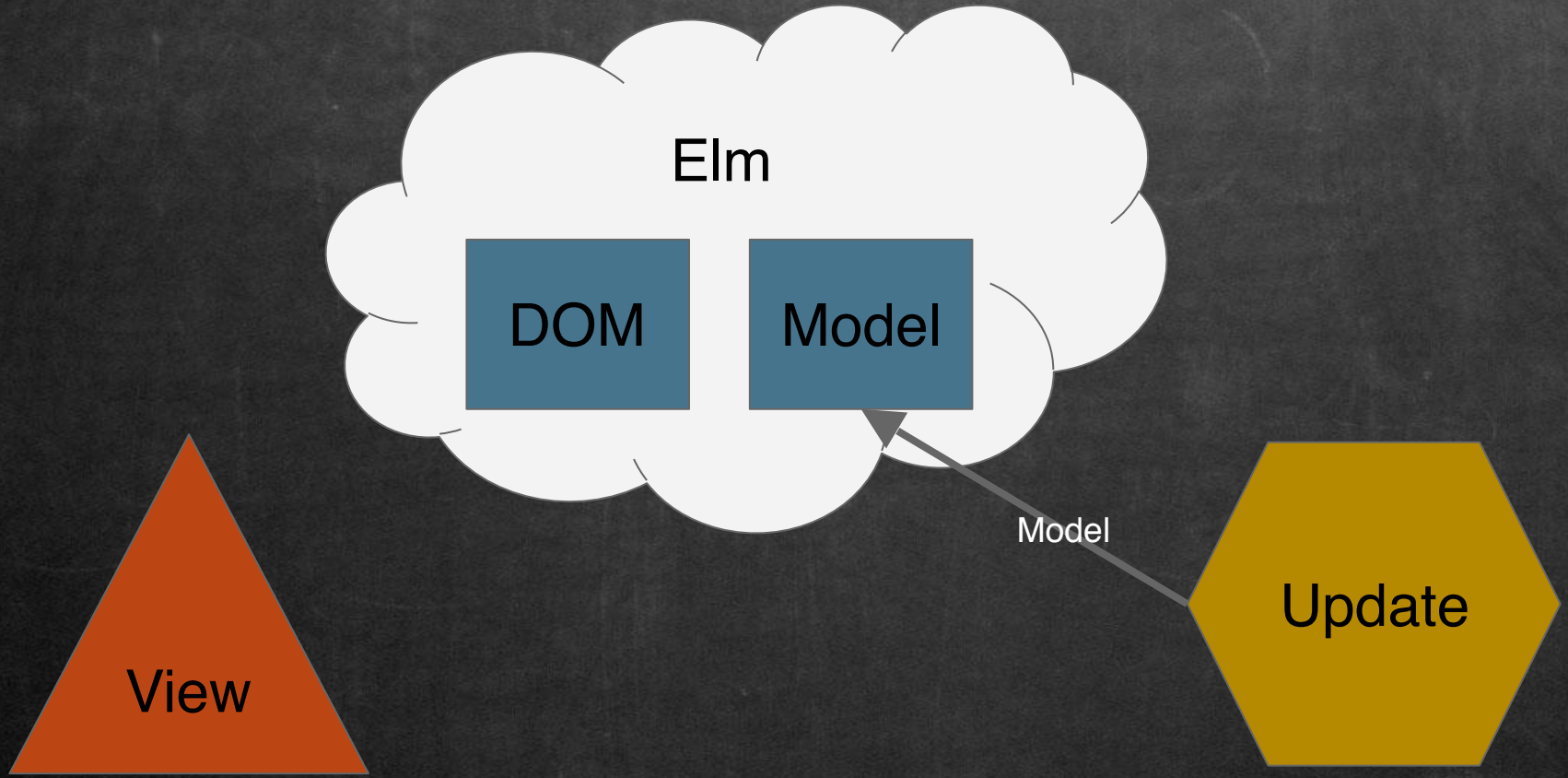
Elm
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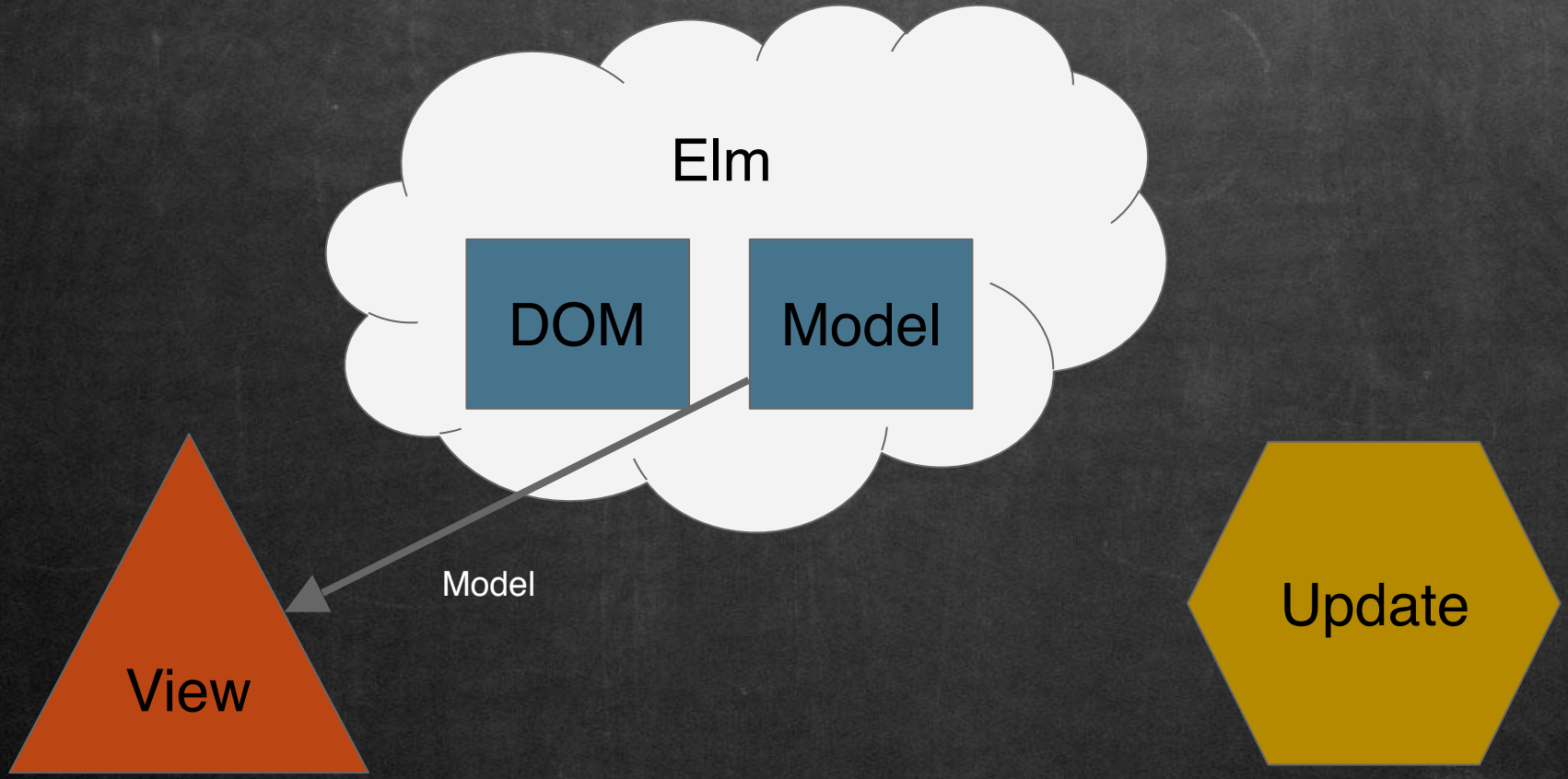
Elm
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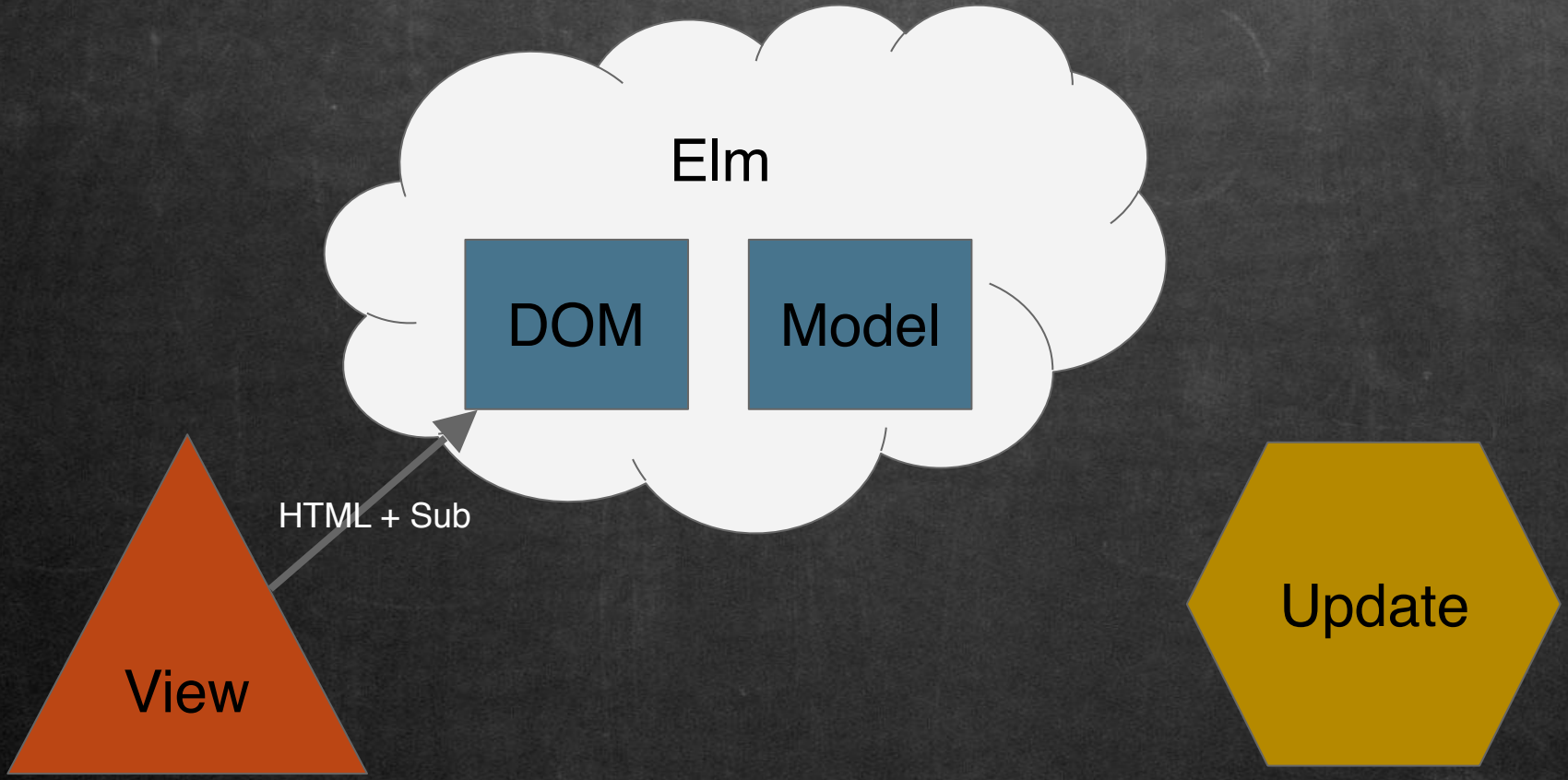
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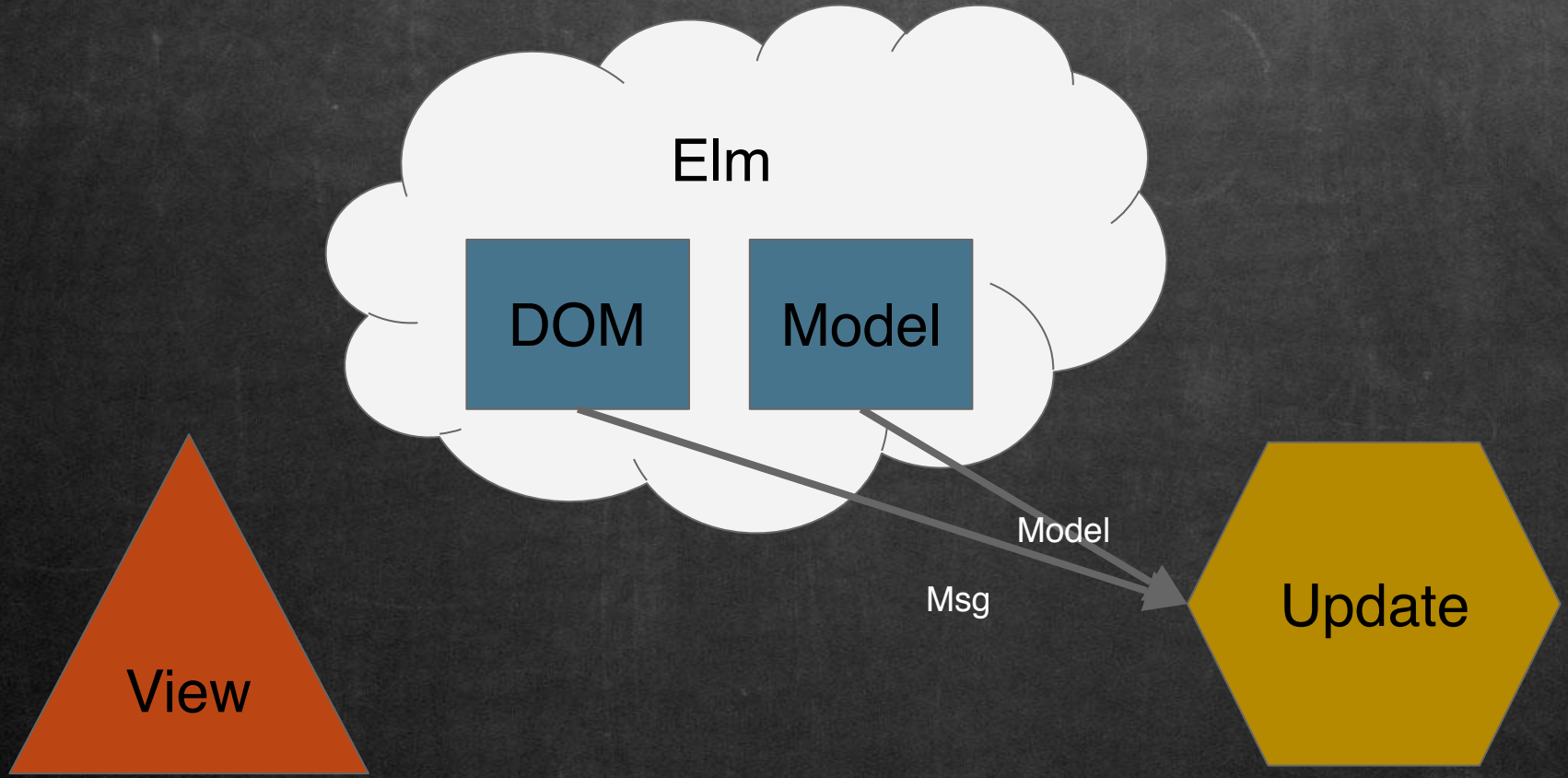
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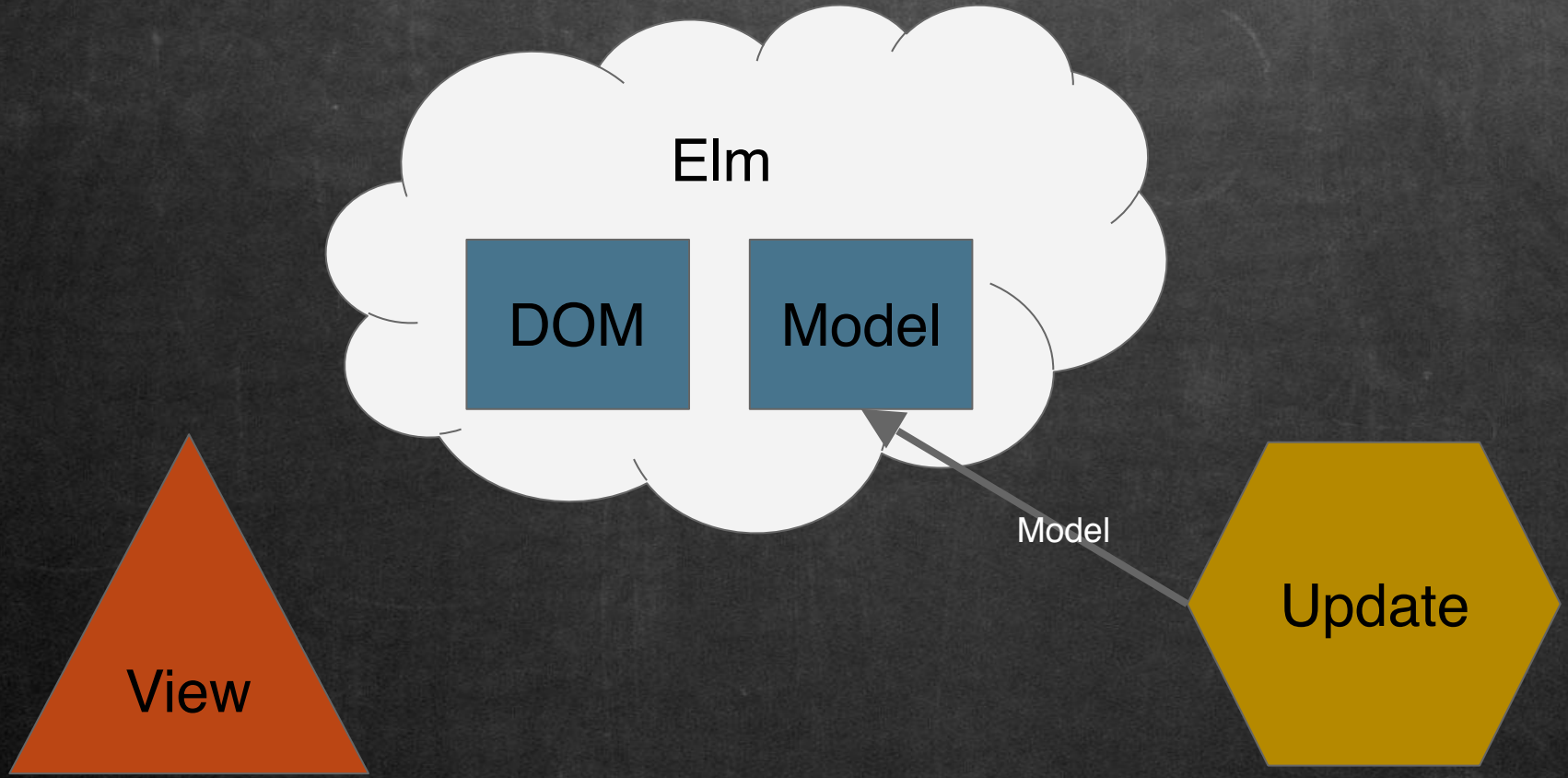
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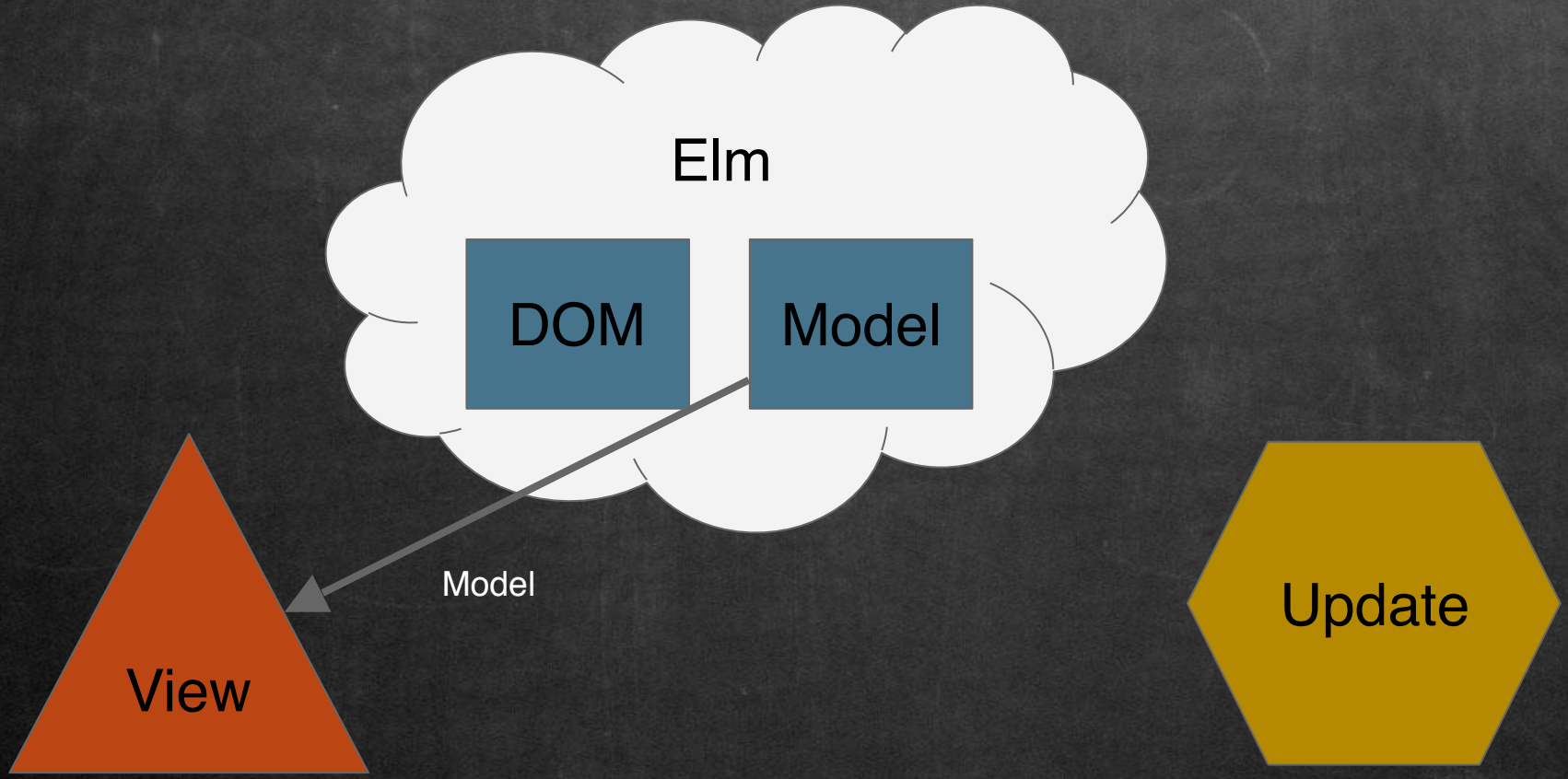
Elm
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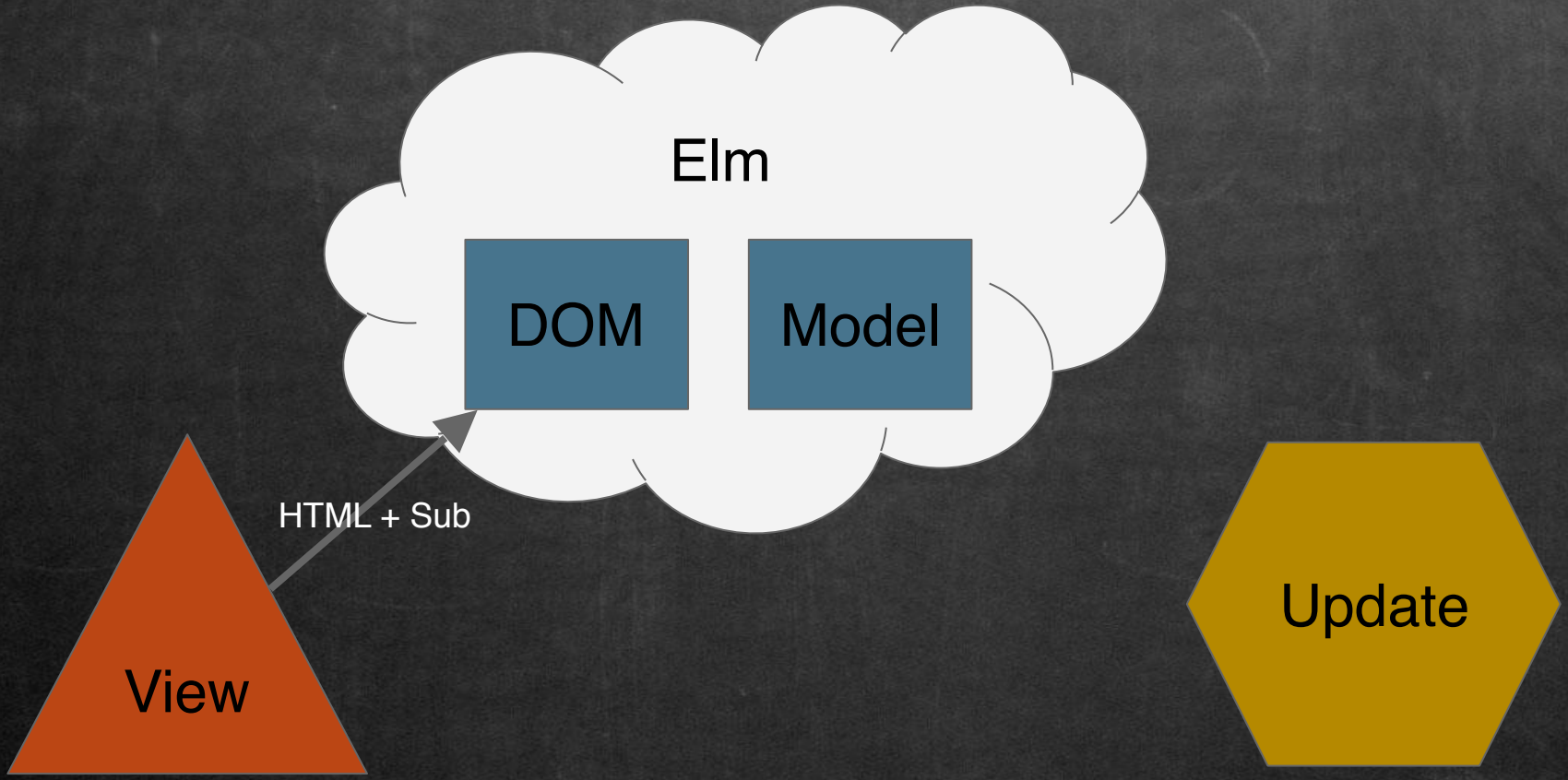

Elm
DOM
Model
HTML + Sub
View
Update

- driven by events (messages)
- view function delivers not only HTML but ‘subscriptions’ to DOM events

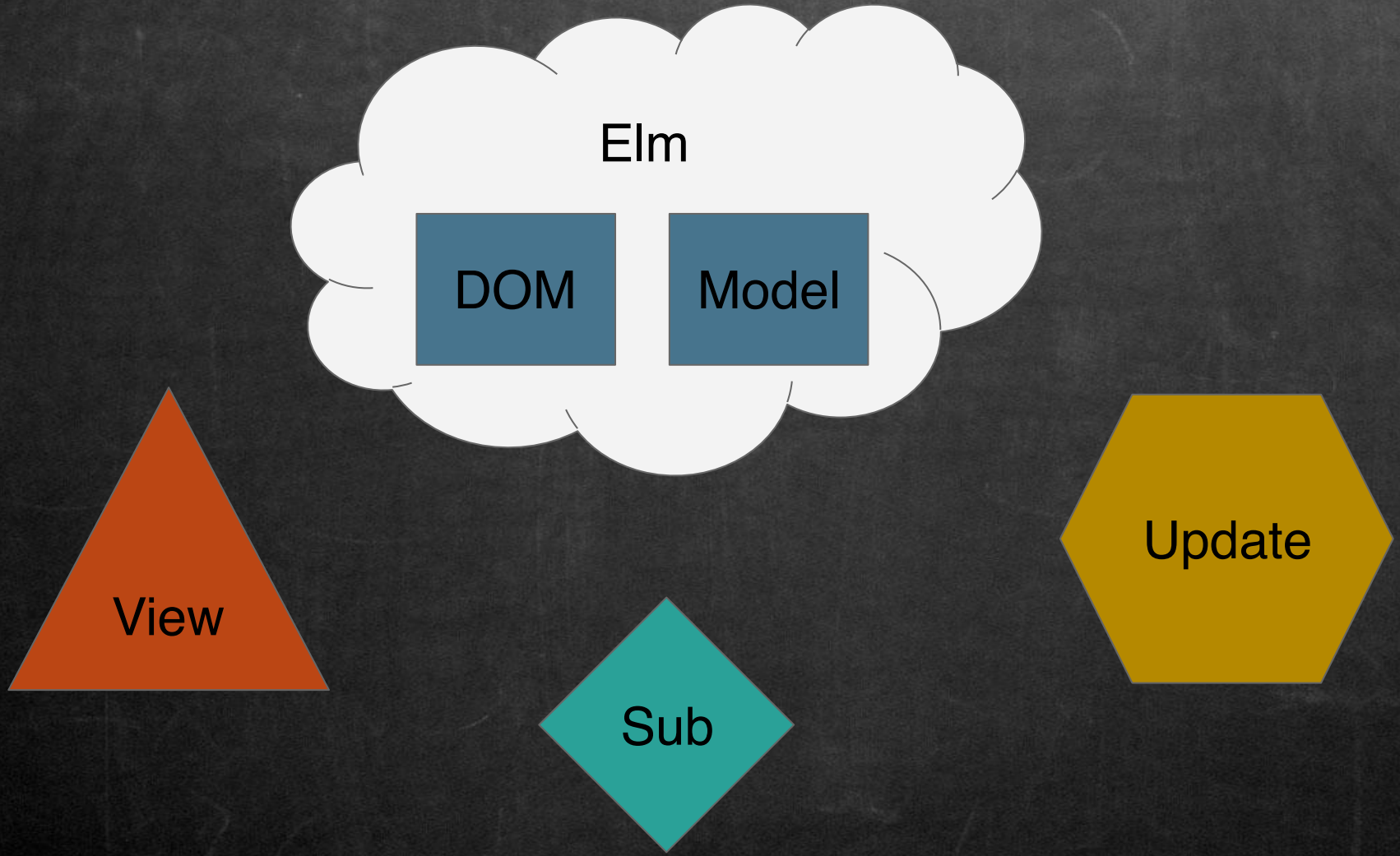
```
view : Model -> Html Msg
view model =
  div []
      [ span [] [text (toString model)]
      , button [ onClick Add ] [ text "+" ]
      , button [ onClick Sub ] [ text "-" ]
      ]
```

How to subscribe to other events?

(WebSockets, URL changes, ...)

```elm
type alias Model = Time


type Msg
  = Tick Time


init : (Model, Cmd Msg)
init =
  (0, Cmd.none)


update : Msg -> Model -> (Model, Cmd Msg)
update msg model =
  case msg of
    Tick time ->
      (time, Cmd.none)
```

```elm
view : Model -> Html Msg
view model =
  div []
    [ span [] [text (model |> toString)]
    ]

subscriptions model =
    Time.every Time.second Tick
```


Elm
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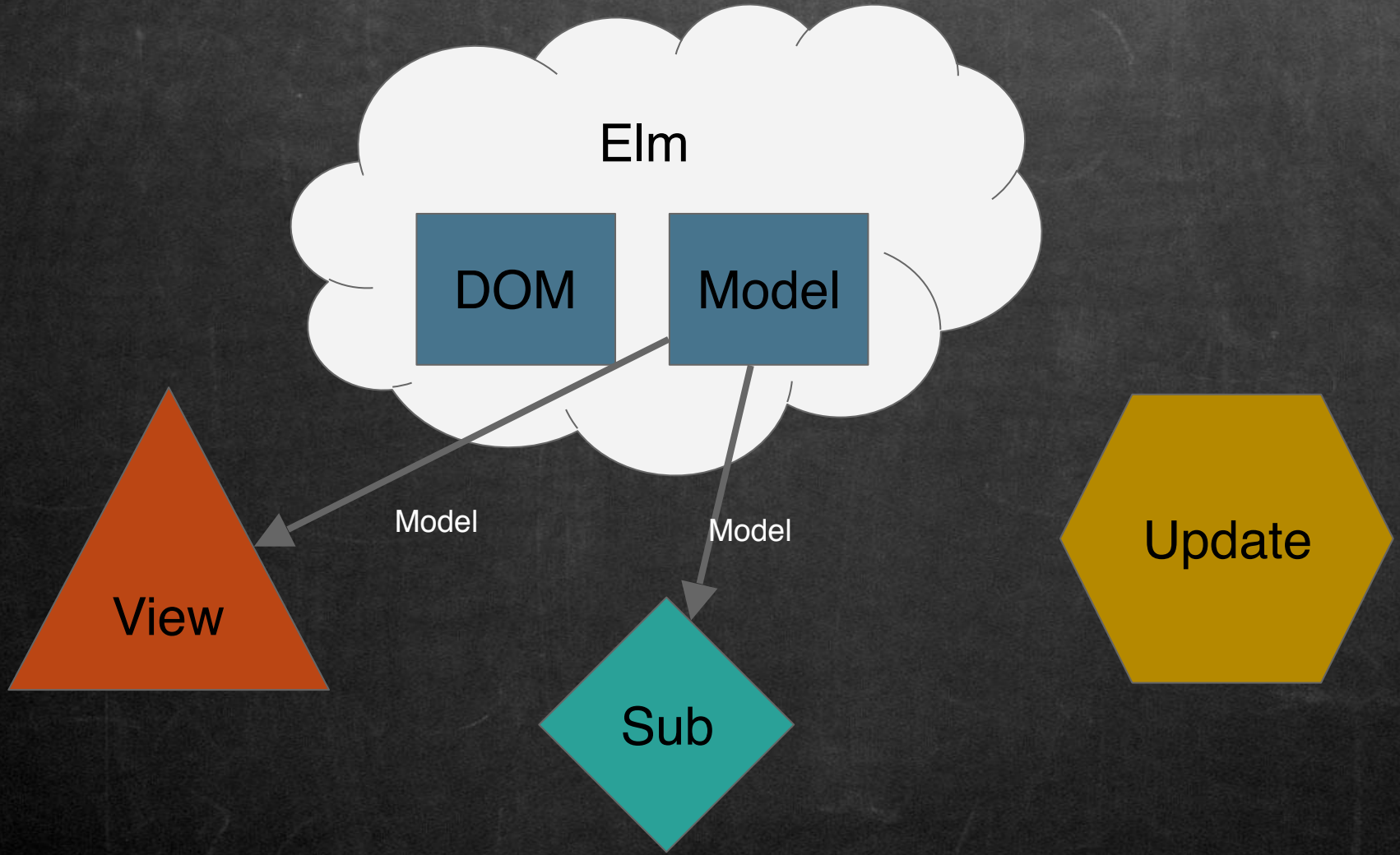
Elm
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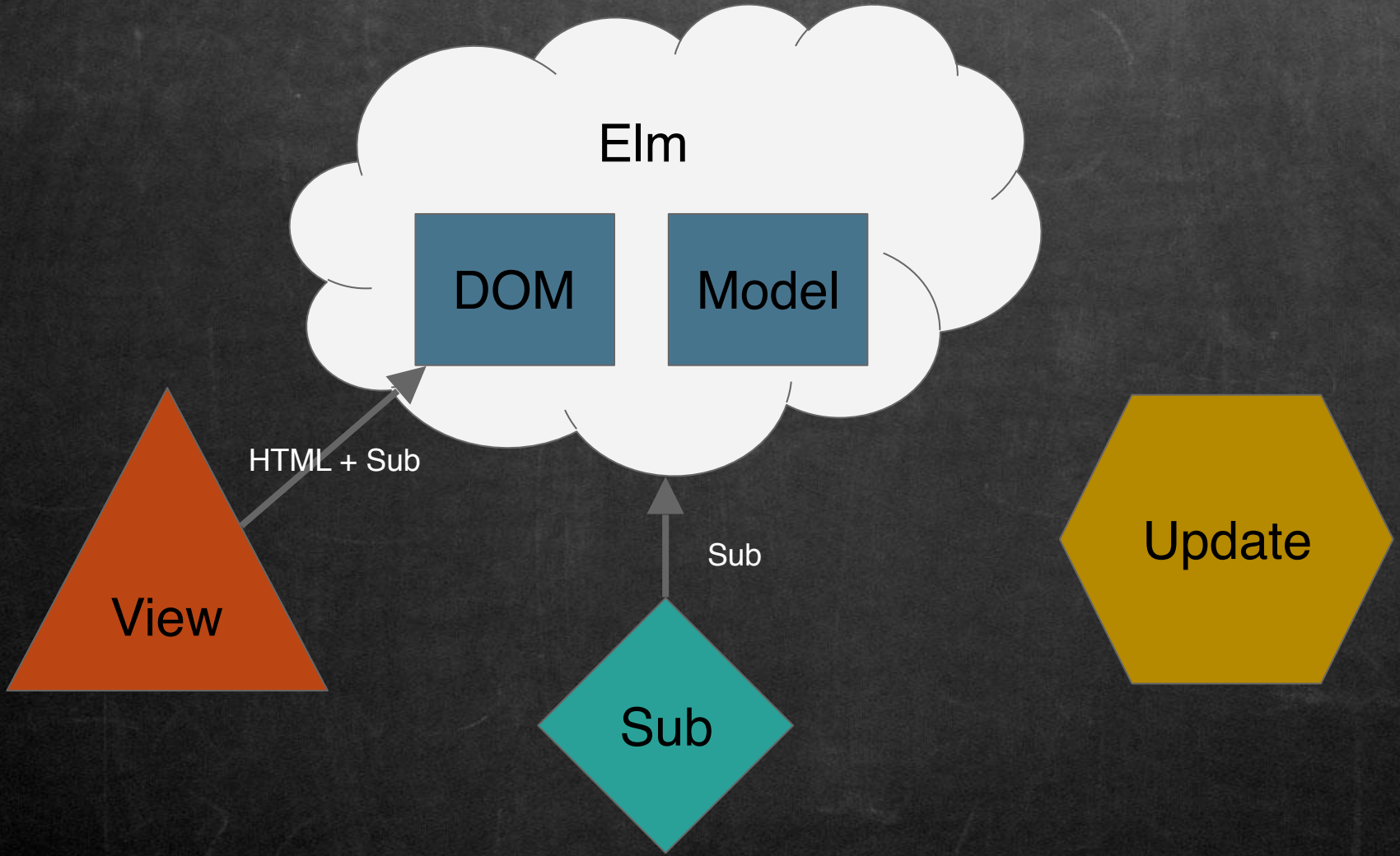
Elm
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HTML + Sub
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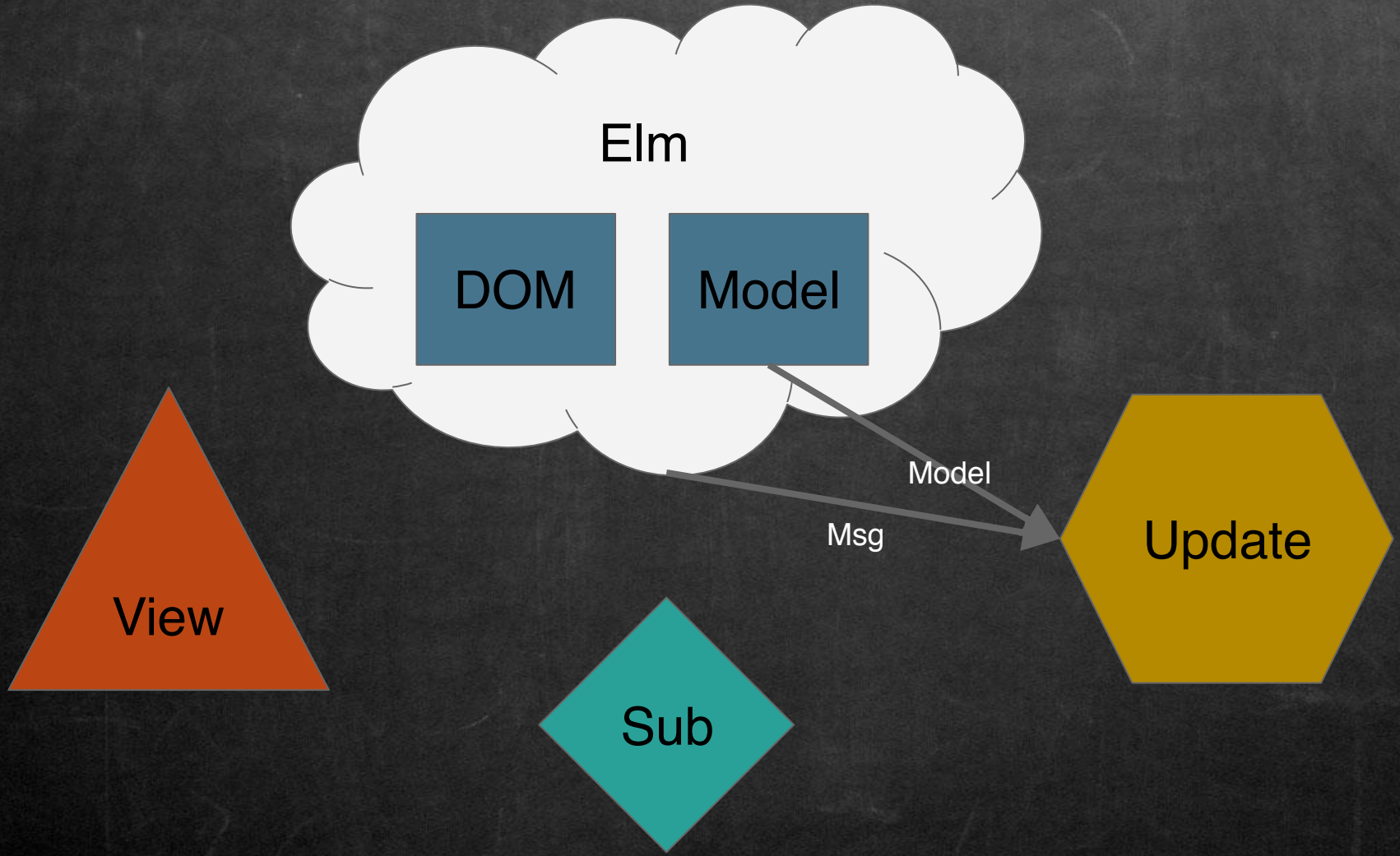
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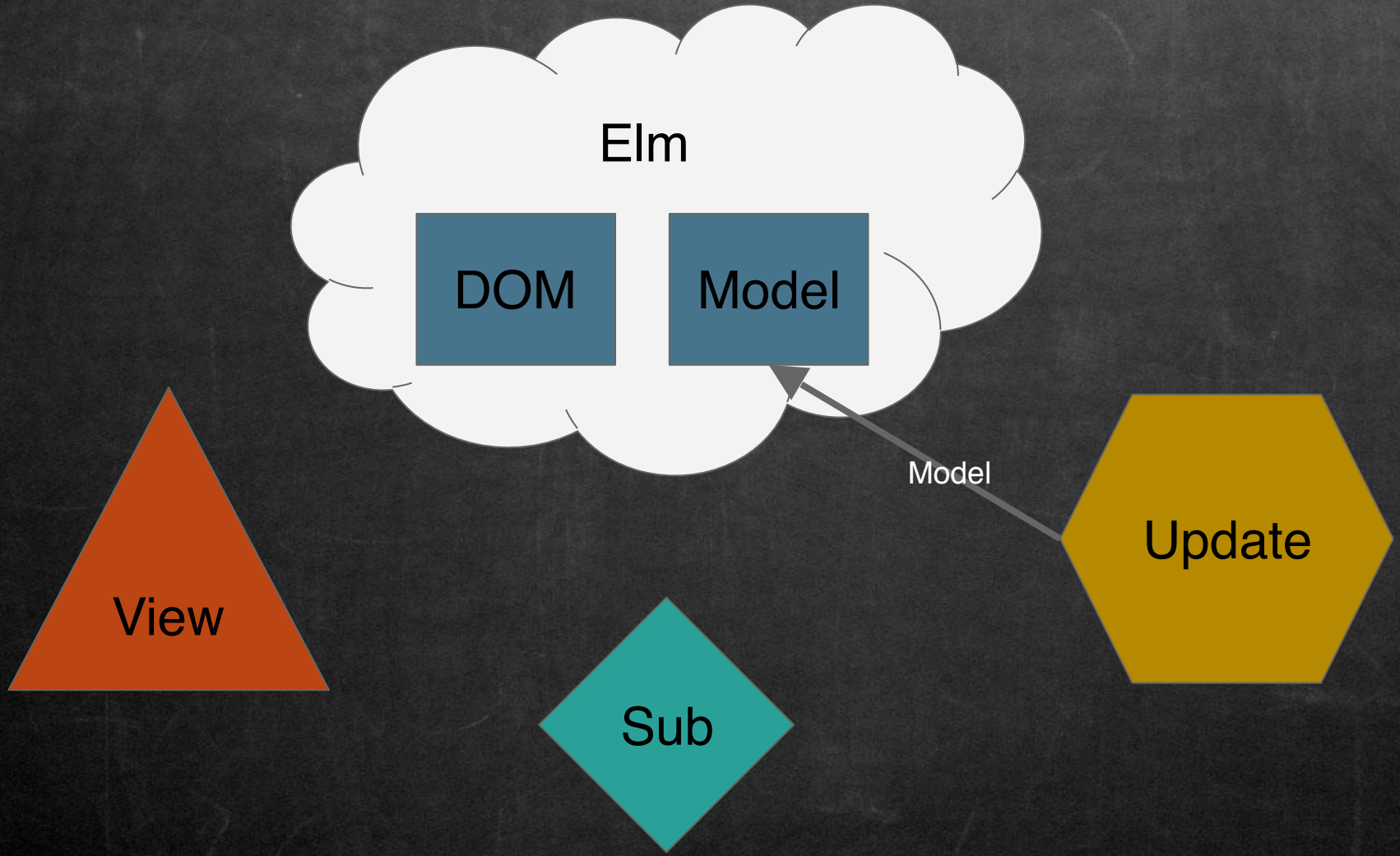
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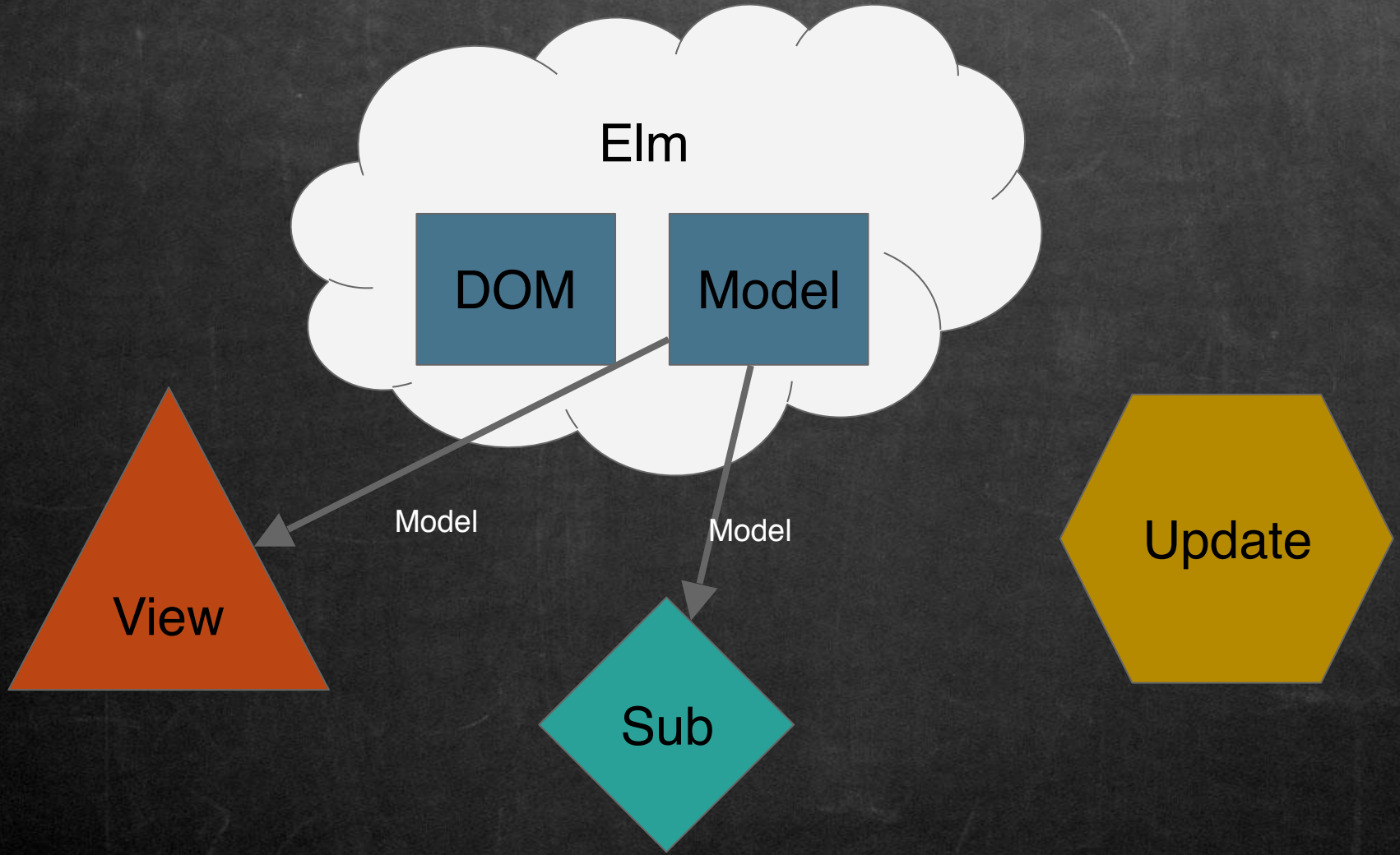
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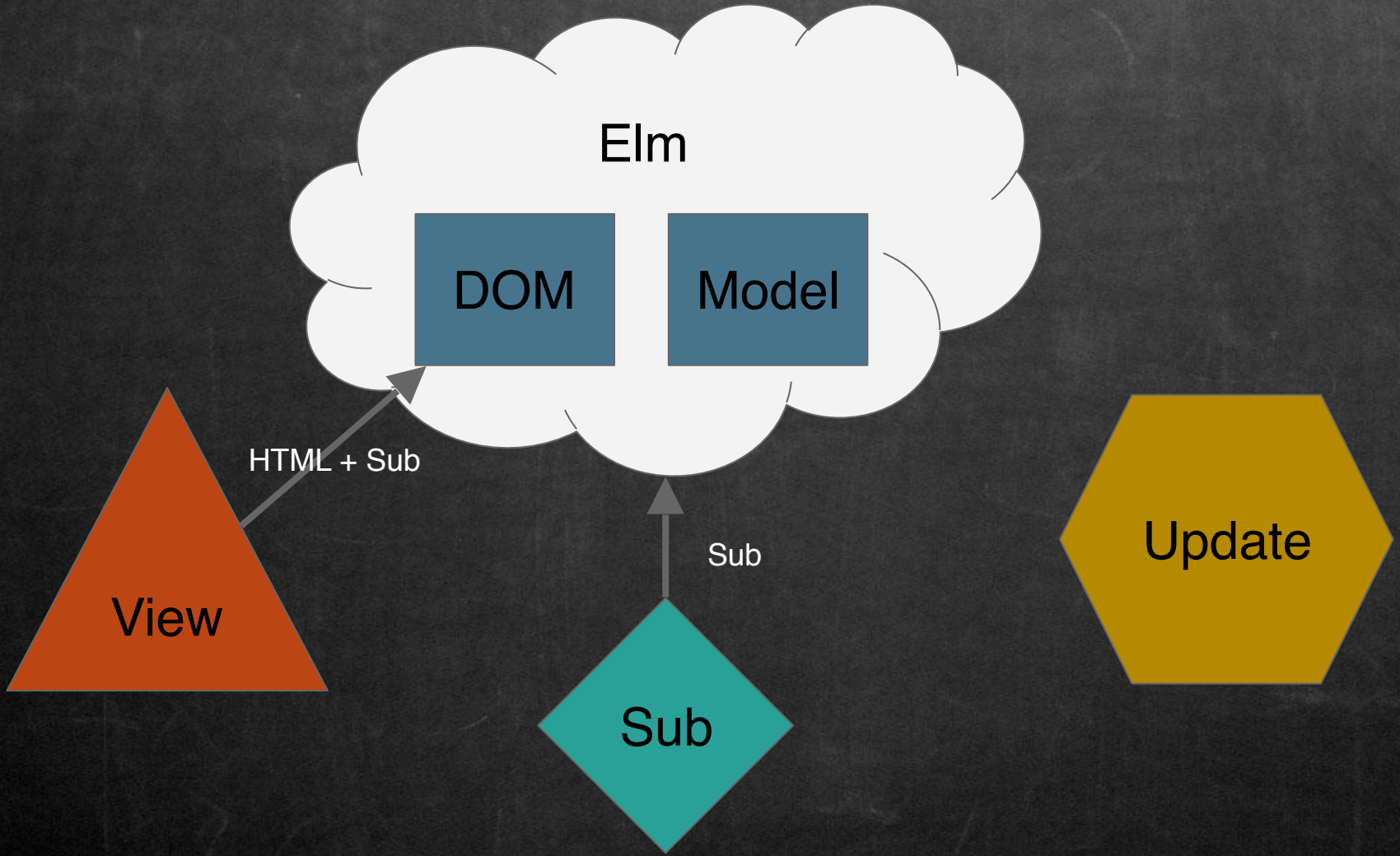
Elm
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Side effects

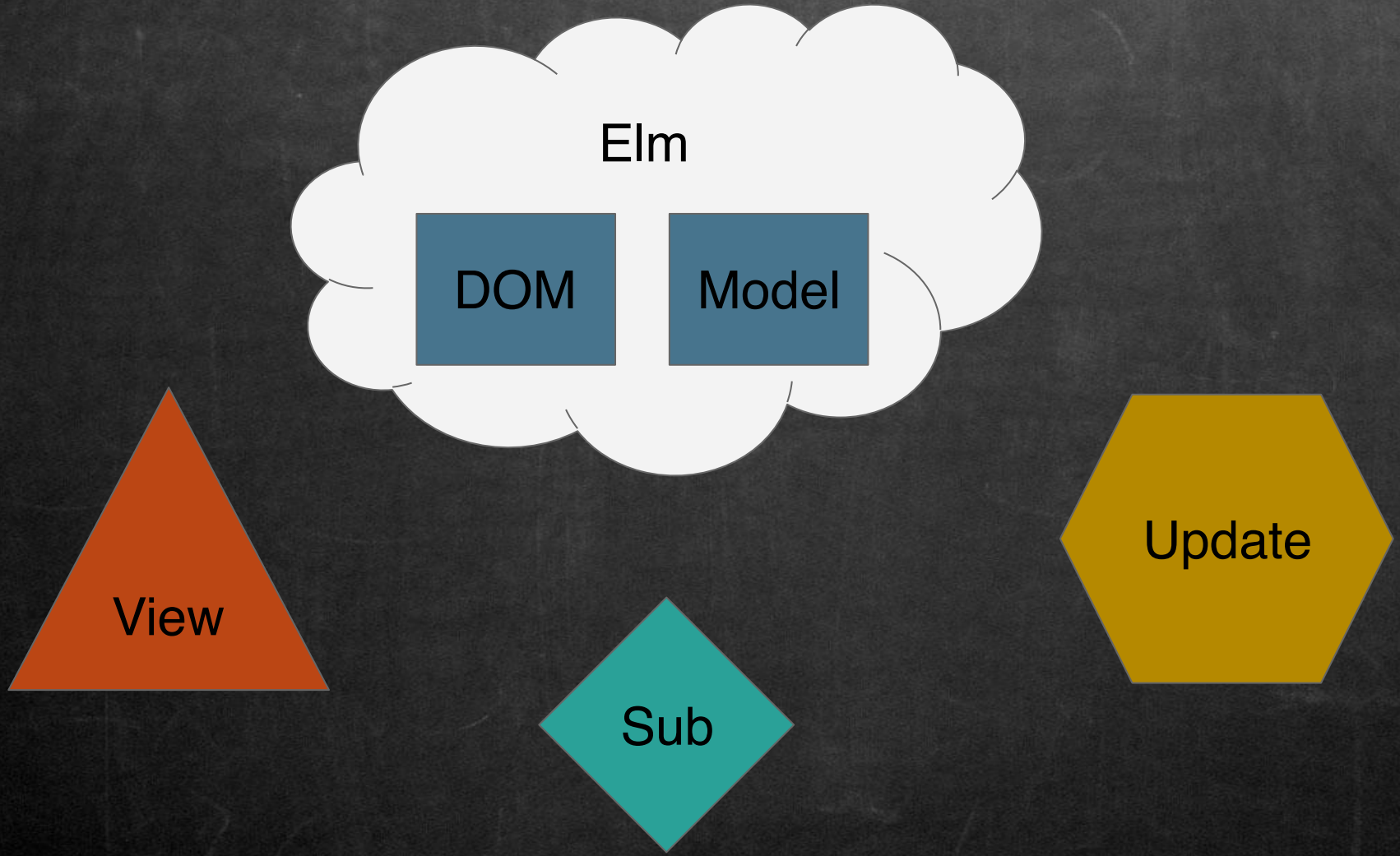
How to work with side effects?

(REST call, Websocket send, ...)

```elm
update : Msg -> Model -> ( Model, Cmd Msg )
update msg model =
  case msg of
    ReqRndVal ->
      ( model, Random.generate NewRndVal (Random.int 1 100) )

    NewRndVal value ->
      ( value, Cmd.none )


view : Model -> Html Msg
view model =
  div []
    [ span [] [ text (toString model) ]
    , button [ onClick ReqRndVal ]
             [ text "New random value" ]
    ]
```


Elm
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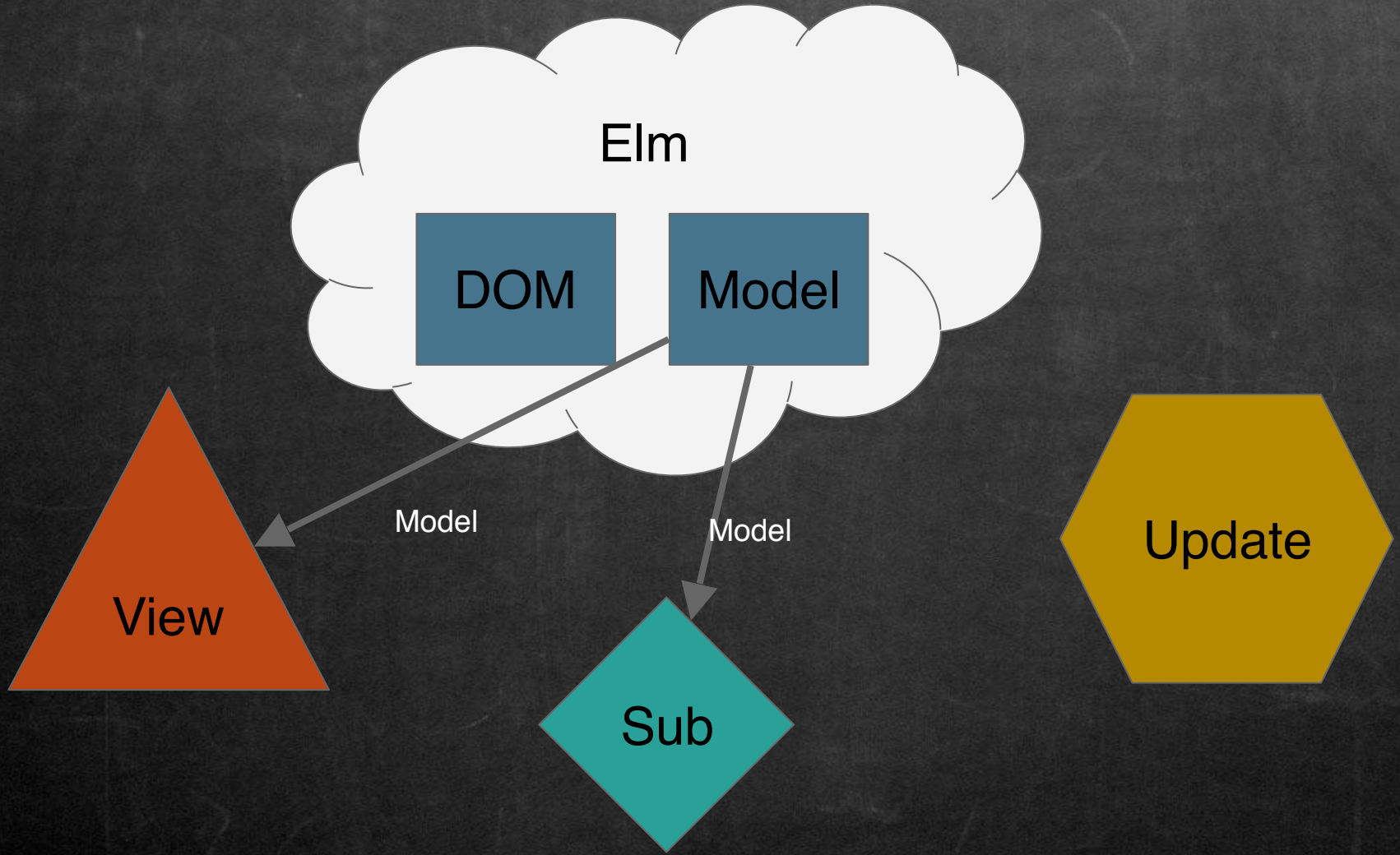
Elm
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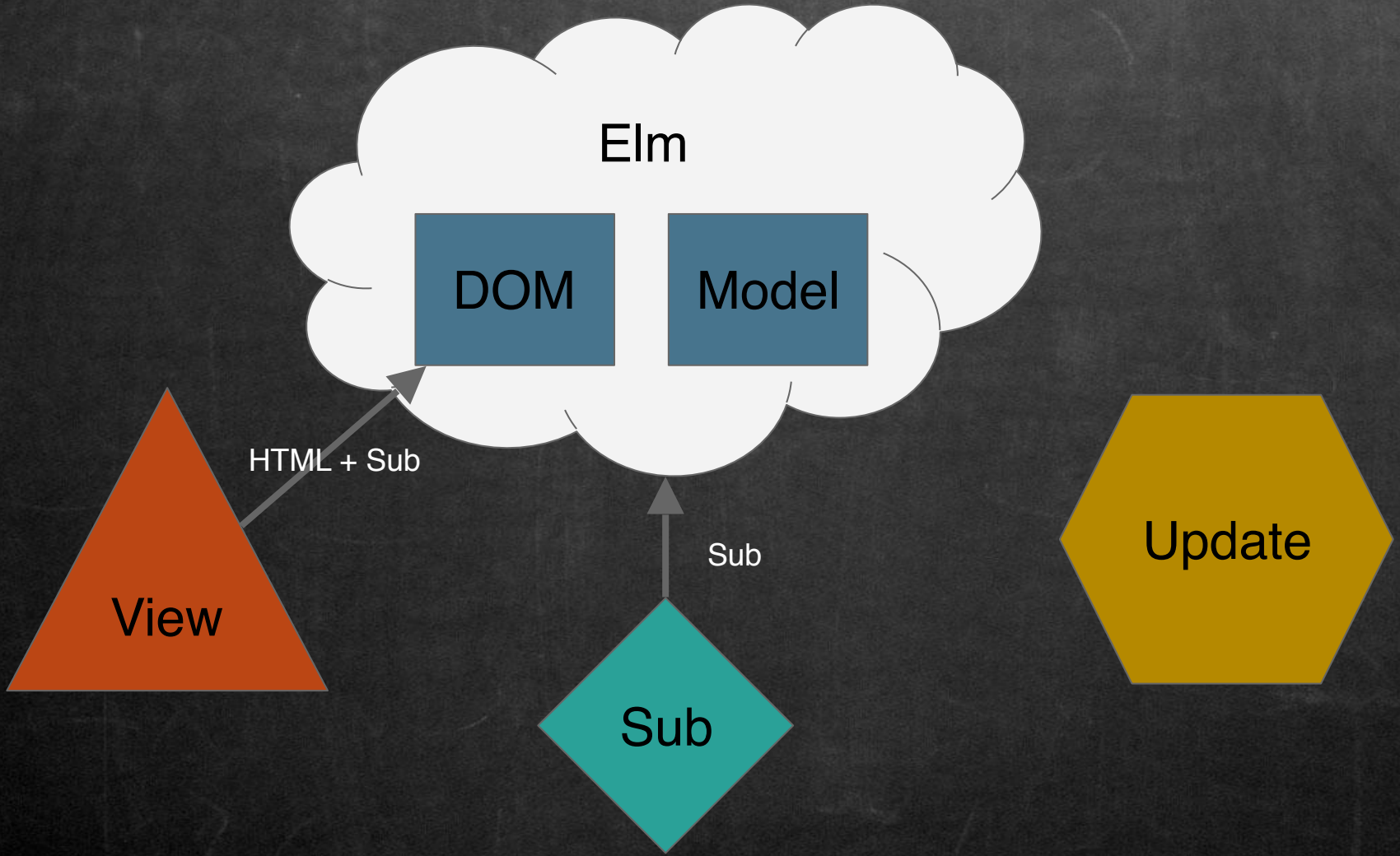
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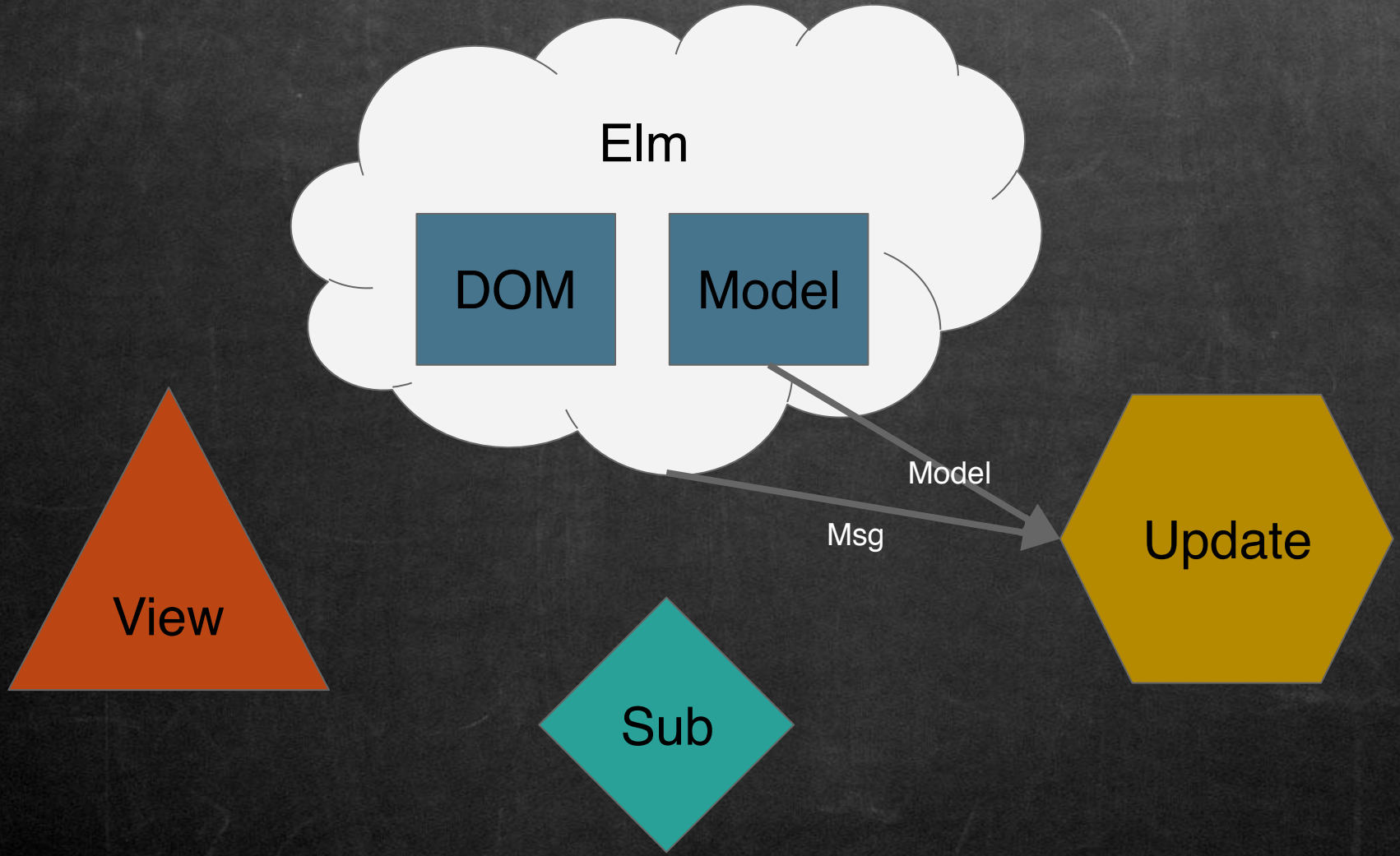
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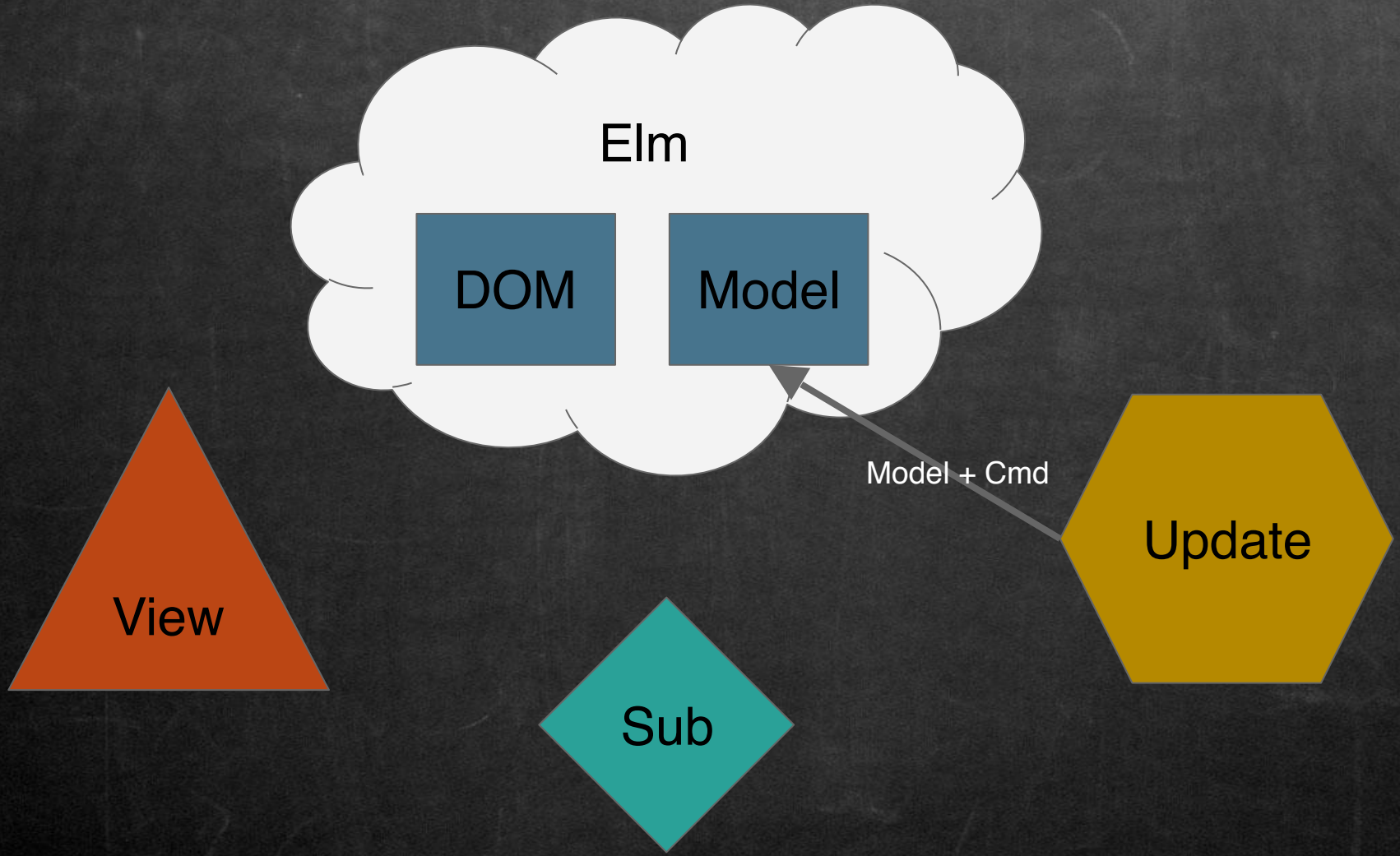
Elm
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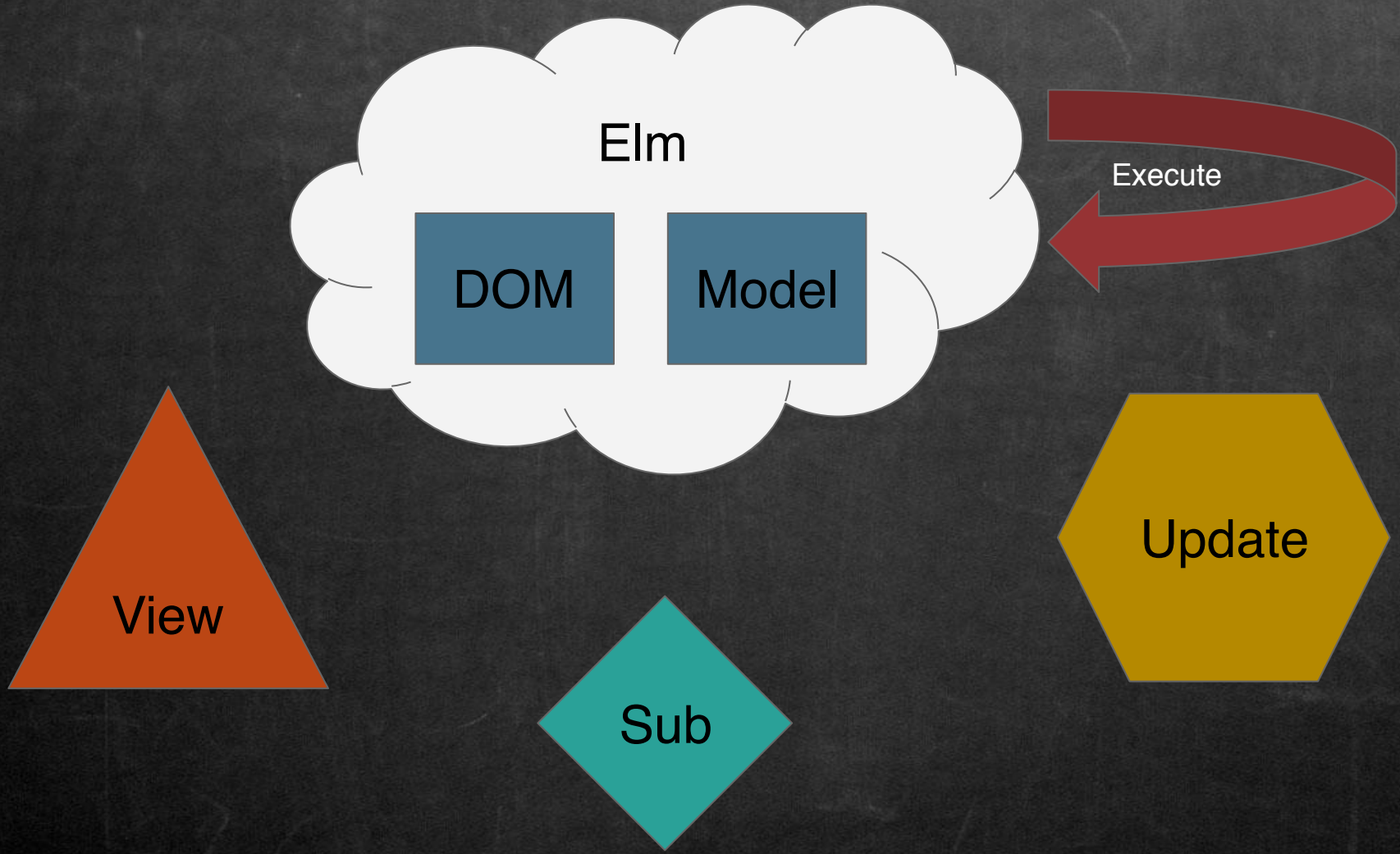
Model
Model + Cmd
Update
View
Sub


Elm
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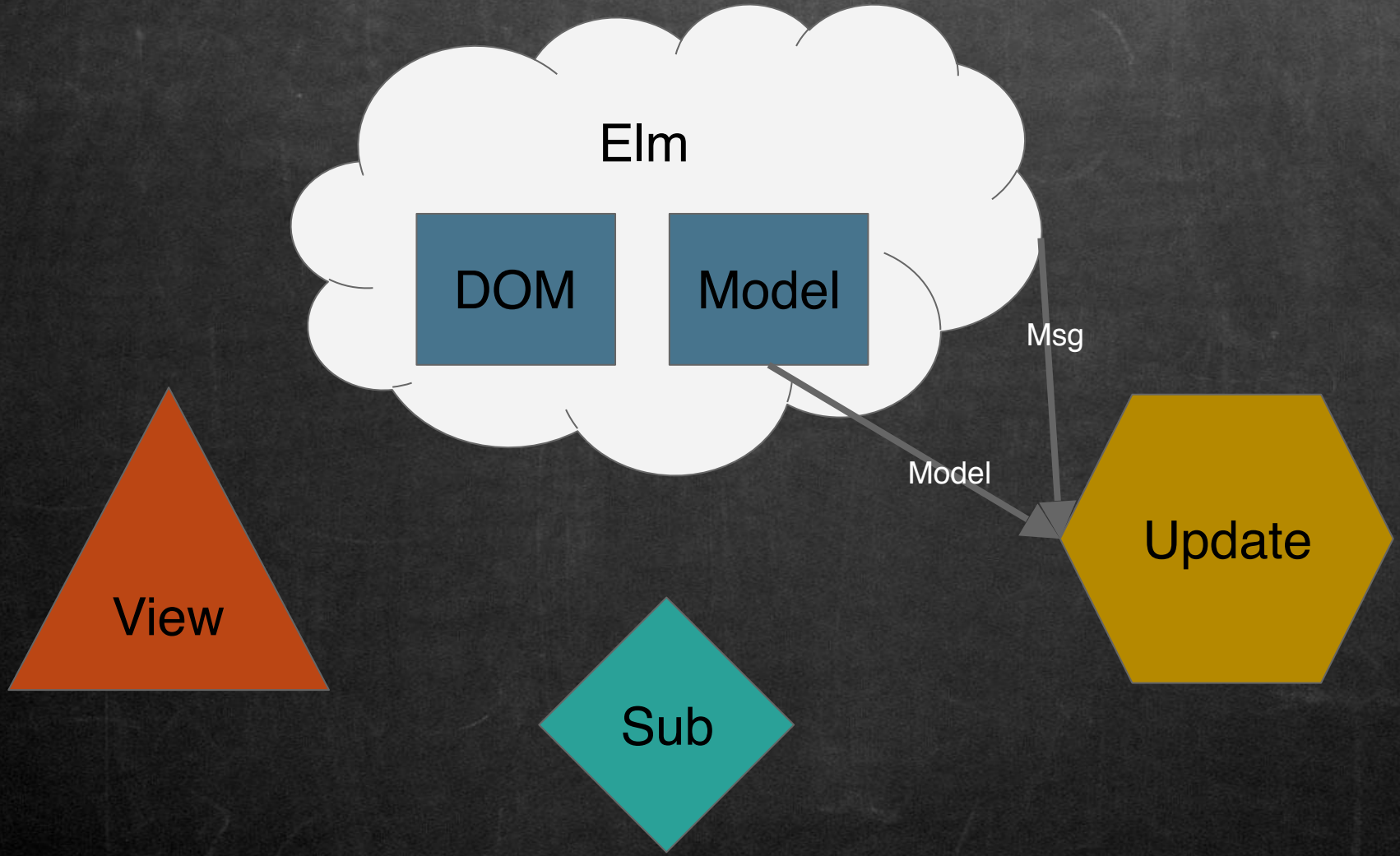
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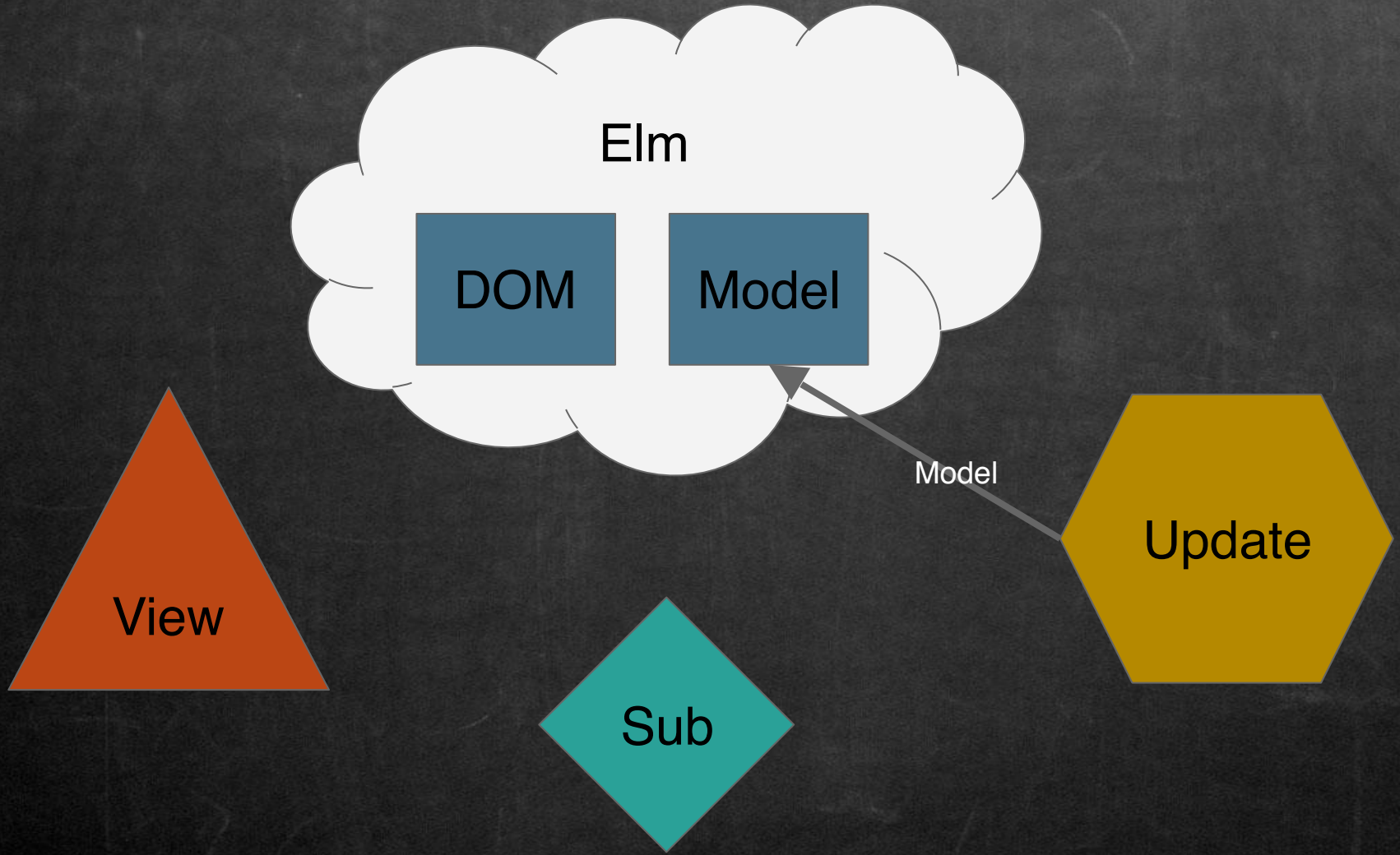
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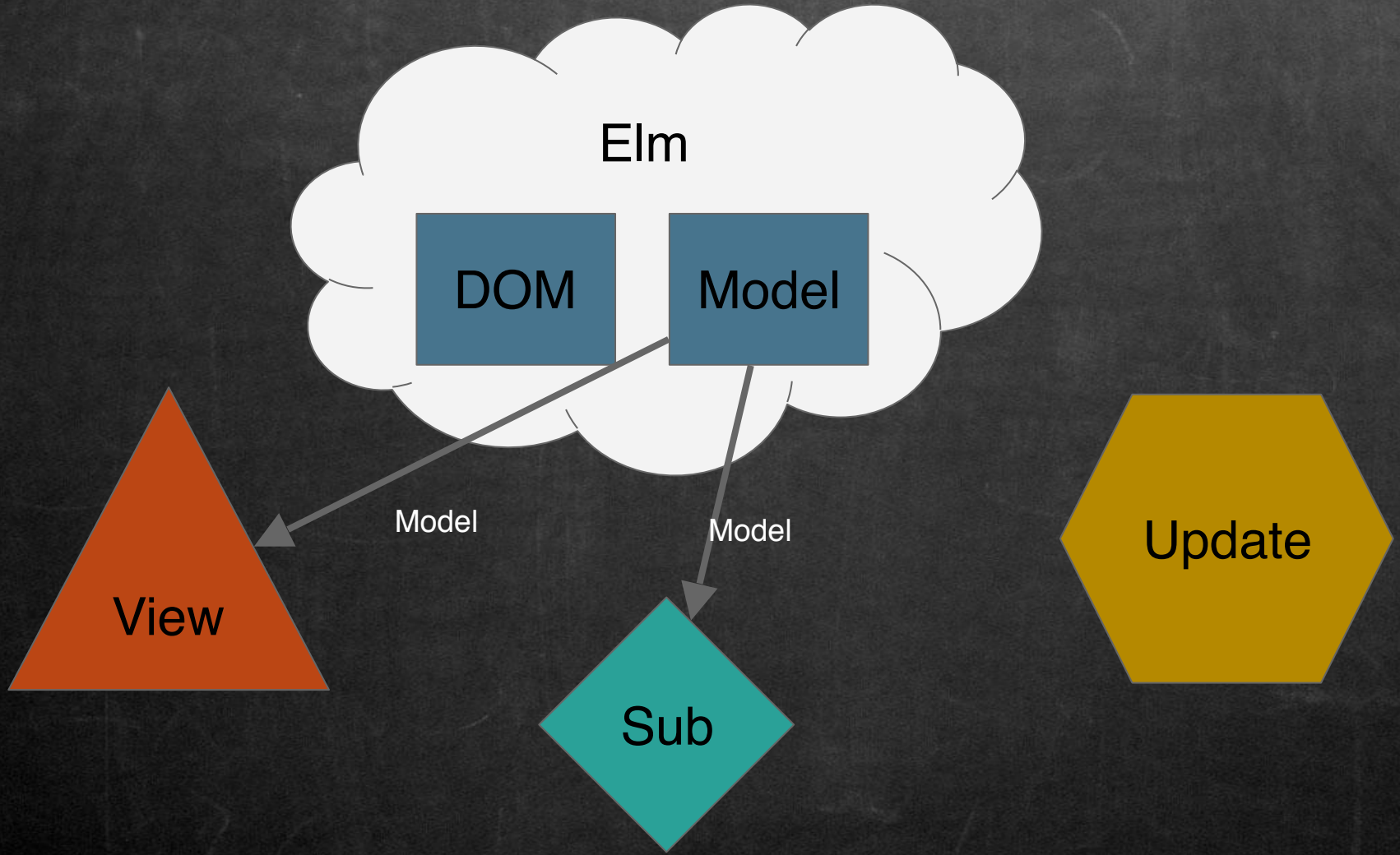
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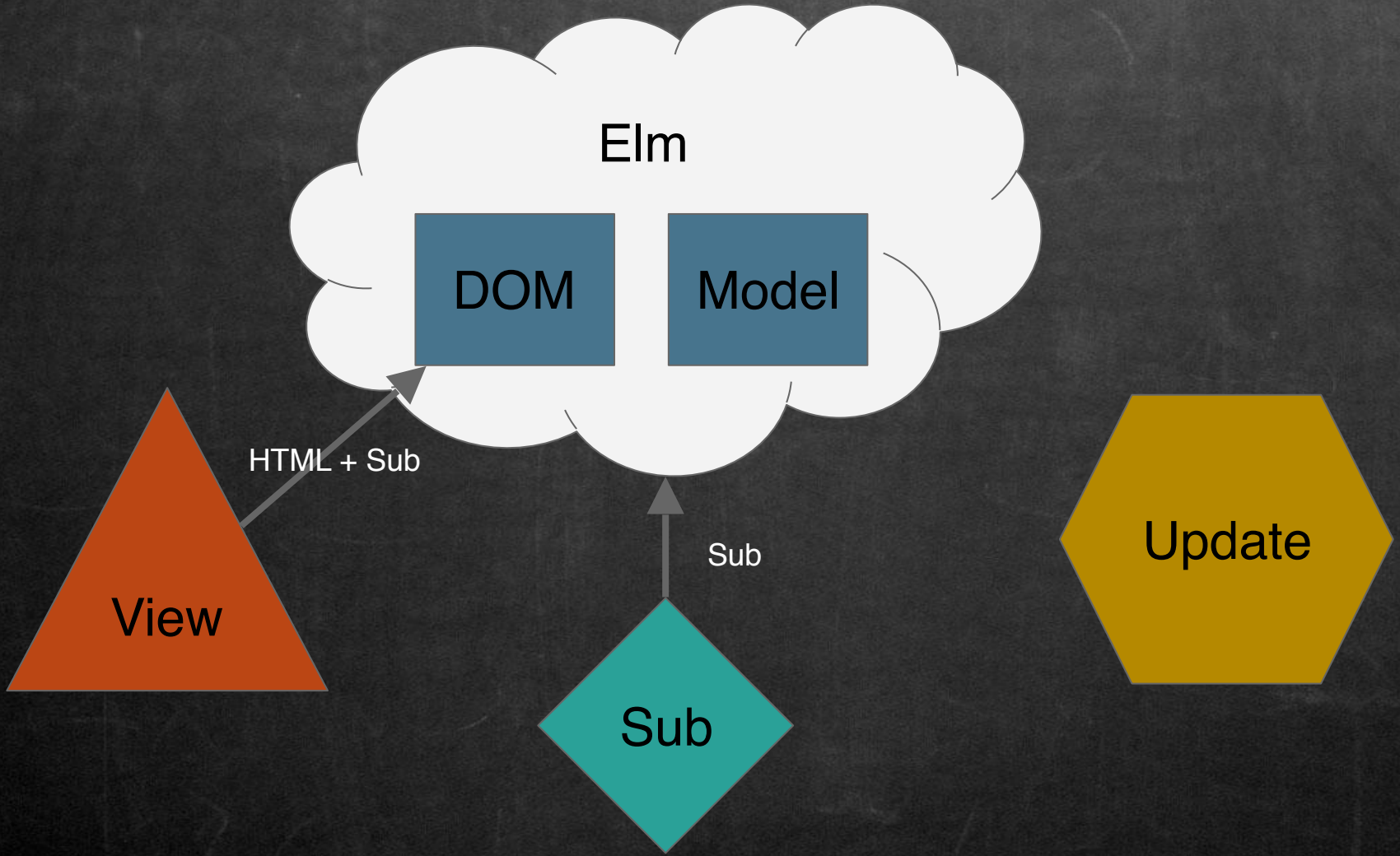
Elm
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View
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```elm
type Msg
  = RestPost User
  | RestPostResult (Result Http.Error UserId)


update : Msg -> Model -> ( Model, Cmd Msg )
update msg model =
  case msg of
    RestPost user ->
      ( model, RestClient.postUser RestPostResult user )

    RestPostResult (Ok userId) ->
      (model, Cmd.none)

    RestPostResult (Err error) ->
      (model, Cmd.none)
```

- side effects are delegated to Elm runtime
- Elm program is free of side effect → purely functional

Why Elm?

Why Elm ?

Why functional ?

- no mutable state
- no side effects

⇒ testable

⇒ predictable

Why Elm ?

Why not JavaScript ?

- ML class language
- concise

⇒ easy to understand

- strongly typed
- static
- side effect free

⇒ if it compiles it won’t crash

Why Elm ?

Why not PureScript ?

- only basic language features
- opinionated framework
- made for one purpose

⇒ easy to get into (Elm to PureScript is like C to C++)

⇒ similar architecture and design

Is Elm ready for production?

- Performance of JavaScript
- DOM Performance (Graph)
  http://elm-lang.org/blog/blazing-fast-html-round-two
- Stable ?
- Language not final
- Very helpful with migrations
- Mature tooling ? (versioning)
- Good documentation ?
- Active community