

MONOLITHS TO MICROSERVICES

Sam Newman

Day Two

Overview

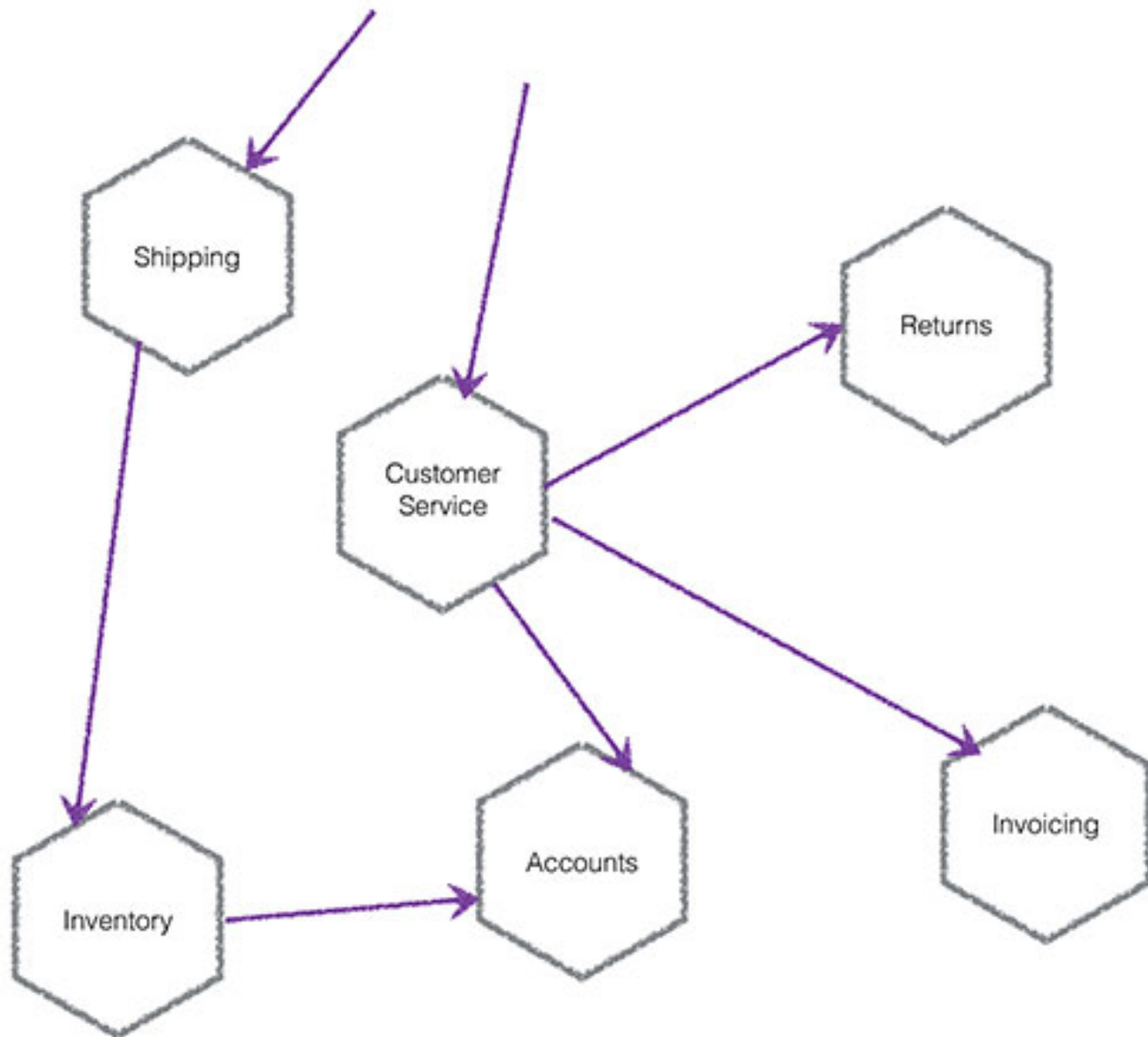
- Questions from day 1 & exercises
- Service collaboration options
- Build & Deployment
- Monitoring

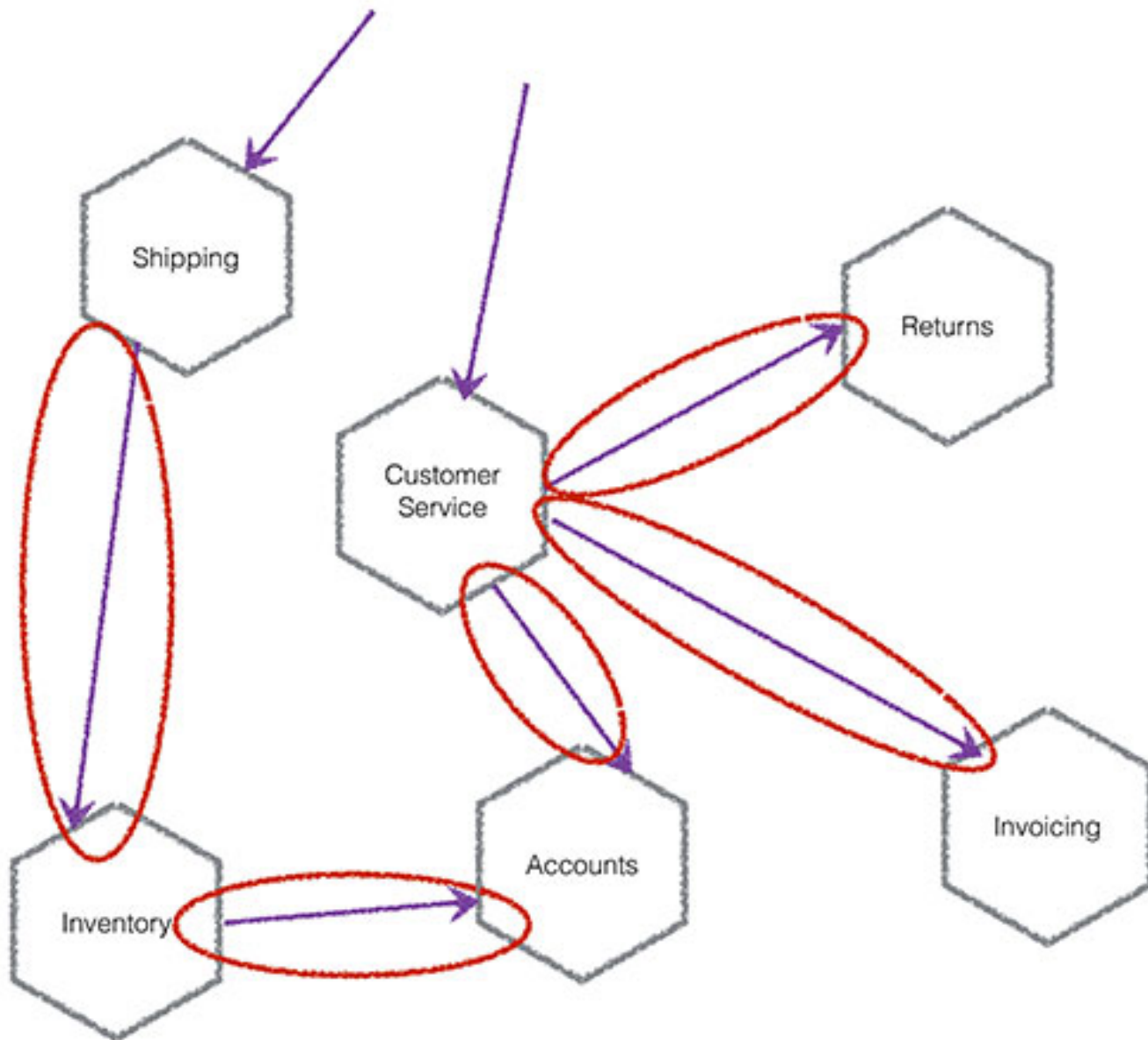
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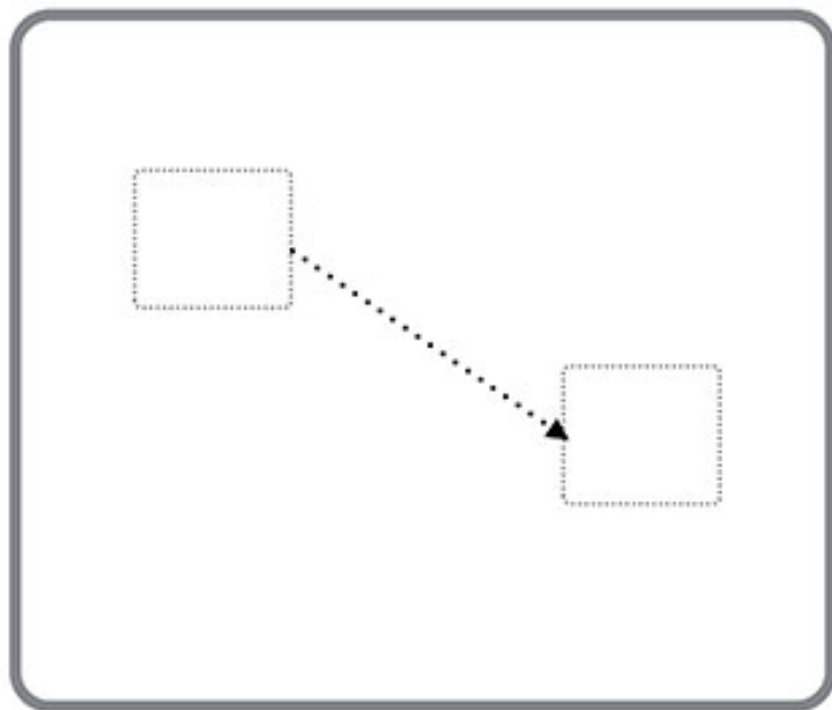
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Service Interactions



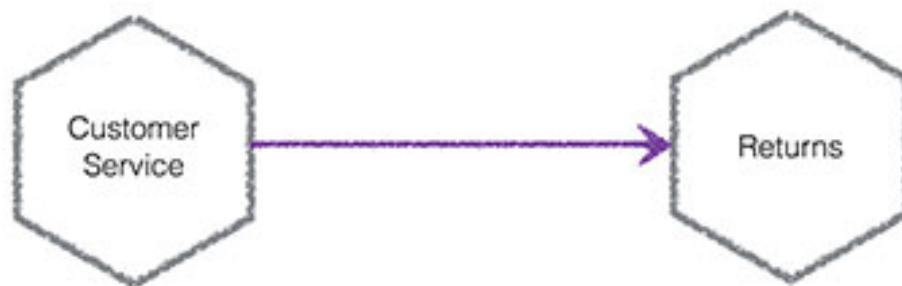






Cost of change
is low

Easy to reason
about



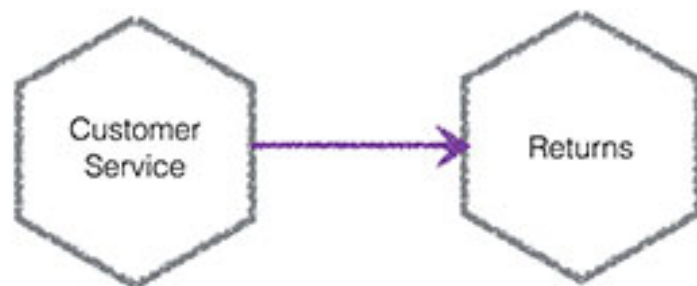
Changing a call ?

potential API breakage

two deployments to rollout a change

Are calls between services like
calls inside a process boundary?

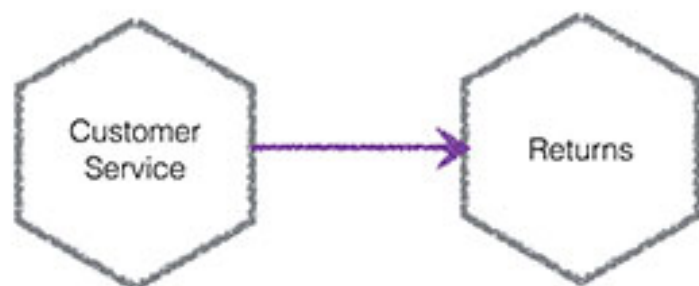
PERFORMANCE IMPLICATIONS



PERFORMANCE IMPLICATIONS



Per-call overhead is very low

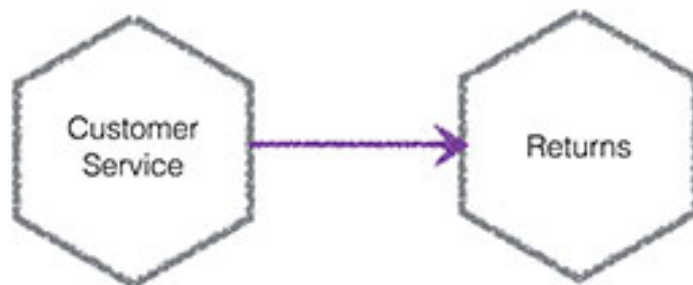


PERFORMANCE IMPLICATIONS



Per-call overhead is very low

Movement of data by reference

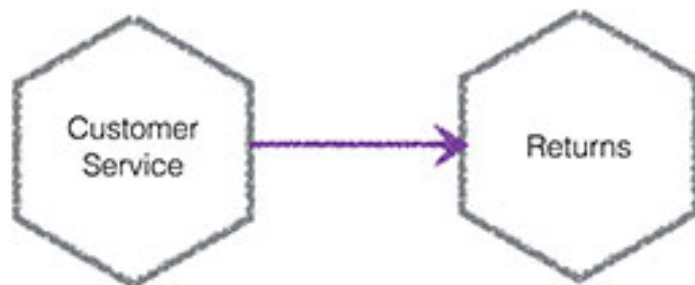


PERFORMANCE IMPLICATIONS



Per-call overhead is very low

Movement of data by reference



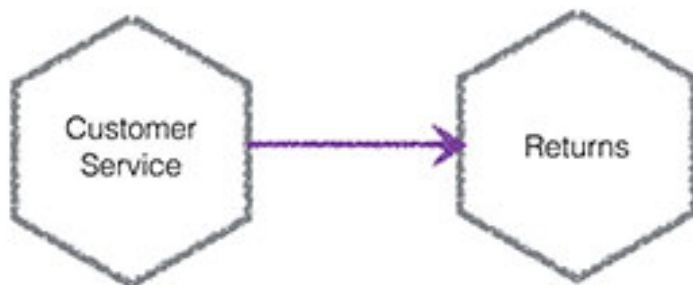
Call overhead can be very high

PERFORMANCE IMPLICATIONS



Per-call overhead is very low

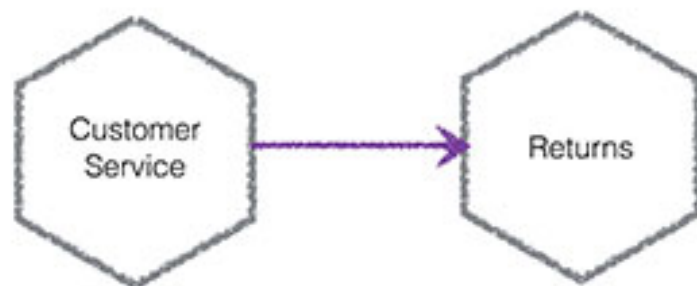
Movement of data by reference



Call overhead can be very high

Data moved by marshalling, or handing off to an external store

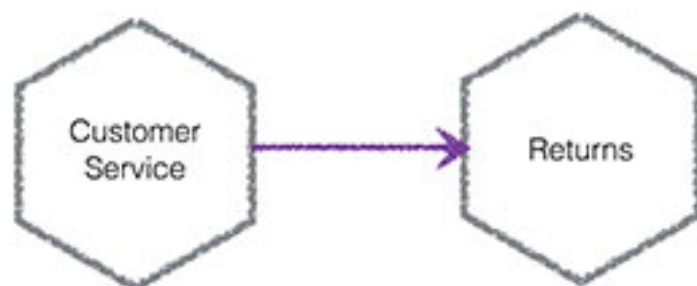
HANDLING ERRORS



HANDLING ERRORS



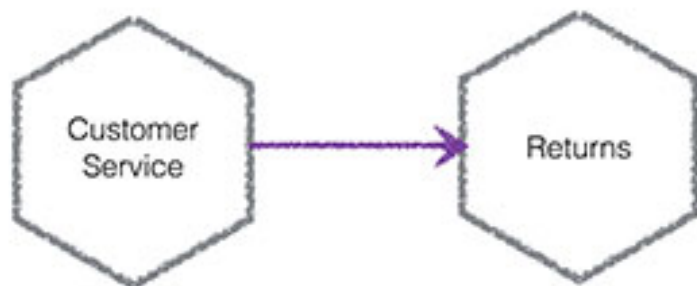
Errors straightforward



HANDLING ERRORS



Errors straightforward

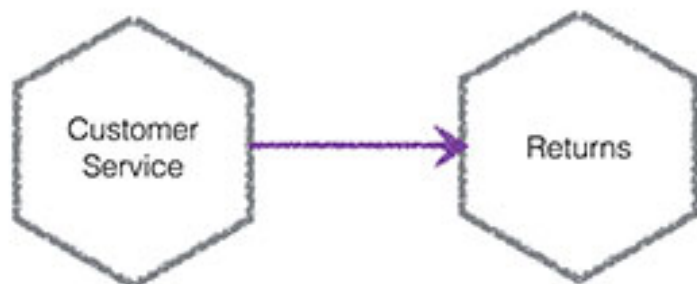


Timeouts

HANDLING ERRORS



Errors straightforward



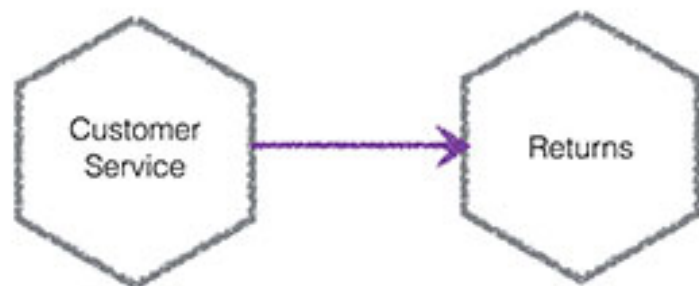
Timeouts

Downstream outage

HANDLING ERRORS



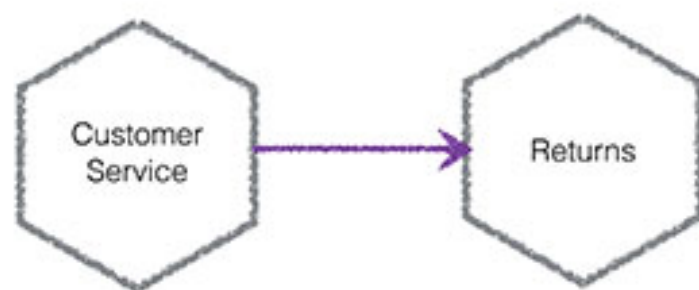
Errors straightforward



Timeouts

Downstream outage

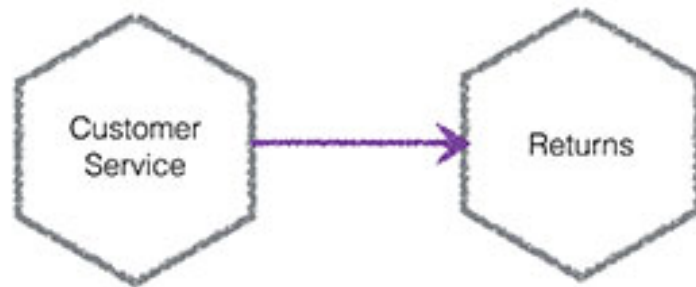
Difference between client and
server errors



4XX - you did something wrong!

5XX - there is something wrong at my end...

4XX vs 5XX status codes



4XX - you did something wrong!

5XX - there is something wrong at my end...

see [Client Error](#) ([code](#))

The client error status codes are categorized into those in which the client request is likely proper though often depending on its origin, and those in which the client request is **invalid**.

400 Bad Request

The server cannot or will not process the request due to a client request being malformed (e.g., malformed request syntax, size or length, invalid request message framing, or malformed URI).

401 Unauthorized (RFC 7231, 4)

Basic is not provided, but potentially for use after authentication is required and has failed or has not yet been provided. The response may include the [WWW-Authenticate](#) header.

Note: Some versions of HTTP (not page 4) [define](#) a second form for authenticating the client's identity, and the specific address is returned.

402 Payment Required

Reserved for future use. The original intention was for the code might be used to indicate that a [digital cash](#) or [micropayment](#) system, but that has failed.

403 Forbidden

The request was valid, but the server is refusing to respond to it. The user might be logged in but does not have the necessary permissions for the request.

404 Not Found

The requested resource could not be found but may be available in the future. Subsequent requests by the client are permitted.

405 Method Not Allowed

A request method is not supported by the requested resource. The resource is [GET](#) request or at least which requests are to be permitted and [POST](#), etc.

406 Not Acceptable

The requested resource is capable of generating responses for acceptable encoding, but none of the encoding is acceptable.

407 Proxy Authentication Required (RFC 7231, 4)

The client must first authenticate itself with the proxy.

408 Request Timeout

The server finished waiting for the request. According to HTTP specifications, the client should not produce a request unless the time for the server waits.

409 Conflict

Indicates that the requested resource could not be created because of conflict with the resource. It is not an [HTTP conflict](#) because it does not describe a conflict.

410 Gone

Indicates that the requested resource is no longer available and will never be available again. The server has not altered the resource but has been permanently changed the resource, and is [HTTP Not Found](#) may be used instead.

411 Length Required

The request did not specify the length of the content, which is required for the requested resource.

412 Precondition Failed (RFC 7231, 4)

The server does not meet one of the preconditions for the requested action or the request.

413 Request Entity Too Large (RFC 7231, 4)

The request is larger than the server is willing to accept. The server should not accept the request but may be able to respond to a smaller request.

414 Request-URI Too Long (RFC 7231, 4)

The [URI](#) provided was too long for the server to process. Often the result of too much data being provided in a single string, the [GET](#) request, or similar.

415 Unsupported Media Type

The request entity has a media type which the server does not support. For example, the client uploads an image as [image/jpeg](#) but the server does not handle that.

416 Range Not Satisfiable (RFC 7231, 4)

The client has asked for a portion of the file that the server does not have. For example, if the client asks for a part of the file that is larger than the file.

417 Expectation Failed

The server cannot meet the requirements of the [Expect](#) request header field.

418 I'm a teapot (RFC 8830)

This code was defined in 1998 as one of the features of [RFC 1936](#), [RFC 1937](#), [RFC 1938](#), [RFC 1939](#), [RFC 1940](#), [RFC 1941](#), [RFC 1942](#), [RFC 1943](#), [RFC 1944](#), [RFC 1945](#), [RFC 1946](#), [RFC 1947](#), [RFC 1948](#), [RFC 1949](#), [RFC 1950](#), [RFC 1951](#), [RFC 1952](#), [RFC 1953](#), [RFC 1954](#), [RFC 1955](#), [RFC 1956](#), [RFC 1957](#), [RFC 1958](#), [RFC 1959](#), [RFC 1960](#), [RFC 1961](#), [RFC 1962](#), [RFC 1963](#), [RFC 1964](#), [RFC 1965](#), [RFC 1966](#), [RFC 1967](#), [RFC 1968](#), [RFC 1969](#), [RFC 1970](#), [RFC 1971](#), [RFC 1972](#), [RFC 1973](#), [RFC 1974](#), [RFC 1975](#), [RFC 1976](#), [RFC 1977](#), [RFC 1978](#), [RFC 1979](#), [RFC 1980](#), [RFC 1981](#), [RFC 1982](#), [RFC 1983](#), [RFC 1984](#), [RFC 1985](#), [RFC 1986](#), [RFC 1987](#), [RFC 1988](#), [RFC 1989](#), [RFC 1990](#), [RFC 1991](#), [RFC 1992](#), [RFC 1993](#), [RFC 1994](#), [RFC 1995](#), [RFC 1996](#), [RFC 1997](#), [RFC 1998](#), 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[RFC 2797](#), [RFC 2](#)

see [Client Error](#) ([code](#))

The client made an attempt to make a request to the server to obtain the requested resource through either originating in a client application or the client itself.

400 Bad Request

The server cannot or will not process the request due to a client error (e.g., malformed request syntax, size limit exceeded, invalid request message).

401 Unauthorized ([RFC 7231](#))

Basic is not provided, but potentially for use after authentication is required and has either not been provided. The response may include the [WWW-Authenticate](#) header.

Note: Some versions of HTTP (not page 4) [define](#) a second form for authenticating the client's identity, and the specific address is substituted.

402 Payment Required

Reserved for future use. The original intention was for the code might be used to carry other form of [digital cash](#) or [monetary exchange](#), but that has never been used.

403 Forbidden

The request was valid, but the server is refusing to respond to it. The user might be logged in but does not have the necessary permissions for the request.

404 Not Found

The requested resource could not be found but may be available in the future. Subsequent requests by the client are permitted.

405 Method Not Allowed

A request method is not supported by the requested resource. The resource is only allowed to use one or more of the other request methods listed in the [Allow](#) header.

406 Not Acceptable

The requested resource is capable of generating responses for acceptable encoding, but none of the accepted encoding is supported by the client.

407 Proxy Authentication Required ([RFC 7231](#))

The client must first authenticate itself with the proxy.

408 Request Timeout

The server finished waiting for the request. According to HTTP specifications, the client should not produce a request unless the time for the server waits.

409 Conflict

Indicates that the requested resource could not be created or changed because it would conflict with the resource or with an [existing resource](#) or because the request is not valid.

410 Gone

Indicates that the requested resource is no longer available and will never be available again. The response has one status code that is permanent, and is "410 Gone" may be used instead.

411 Length Required

The request did not specify the length of the document, which is required by the requested resource.

412 Precondition Failed ([RFC 7231](#))

The server does not meet one of the preconditions for the requested action or the request.

413 Request Too Large ([RFC 7231](#))

The request is larger than the server is willing to accept. The response has one status code that is permanent, and is "413 Request Too Large" may be used instead.

414 Request-URI Too Long ([RFC 7231](#))

The [URI](#) provided was too long for the server to process. Often the result of too much data being provided in a particular request. The 413 request is similar.

415 Unsupported Media Type

The request entity has a media type which the server does not support. For example, the client uploads an image as [image/jpeg](#) but the server does not handle that image type.

The client has asked for a resource that the server does not support. For example, if the client asked for a particular file but the server does not have it.

416 Representation Not Supported

The server cannot find the representation of the requested resource.

417 Invalid Range ([RFC 7231](#))

The range was not valid. The range was outside of the document or the document is not a document.

418 I'm a Teapot ([RFC 9241](#))

The request was intended to produce a response for a teapot because a teapot cannot brew.

421 Misdirected Request ([RFC 7231](#))

The request was directed at a scheme that is not able to produce a response for example because a connection error.

422 Unprocessable Entity ([RFC 4918](#))

The request was well-formed but was unable to be followed due to semantic errors.

423 Locked ([RFC 4918](#))

The resource has a locking protocol that is in use.

424 Method Depends ([RFC 4918](#))

The request depends on a previous request, e.g., a [PROPFIND](#) request.

426 Upgrade Required

The client should switch to a different protocol such as [TSP](#) or [green](#) or the [upgrade](#) header field.

428 Precondition Required ([RFC 7231](#))

The origin server requires the request to be preceded by one or more [Precondition](#) headers, when a client GETs a resource's data, method).

429 Too Many Requests ([RFC 6585](#))

The user has sent too many requests in a given amount of time. Responded to with [retry-after](#) header.

431 Request Header Fields Too Large ([RFC 6585](#))

The server is unwilling to process the request because either an individual header field, or the header fields collectively, exceed size.

432 Unavailable For Legal Reasons

Response generated because of legal reasons (e.g., a document is protected by a patent or trademark) that renders the requested resource.

28 4XX Error Codes

500 Server Error ([code](#))

The server failed to fulfil an apparently valid request.

Response status codes beginning with the digit "5" indicate cases in which the server is aware that it has encountered a server error. These response codes are applicable in any server method.

500 Internal Server Error

Generic error message, given when an unspecified condition was encountered and no more specific message is available.

501 Not Implemented

The server either does not recognize the request method, or it lacks the ability to fulfil the request. Usually this implies the method is new.

502 Bad Gateway

The server was acting as a [gateway](#) or proxy and received an invalid response from the upstream server.

503 Service Unavailable

The server is currently unavailable (because it is overloaded or down for maintenance). Generally, this is a temporary condition.

504 Gateway Timeout

The server was acting as a gateway or proxy and did not receive a timely response from the upstream server.

505 HTTP Version Not Supported

The server does not support the HTTP version used in the request.

506 Variant Also Negotiates ([RFC 2295](#))

Transparent content negotiation for the request results in a circular reference.

507 Insufficient Storage ([RFC 4918](#))

The server is unable to store the representation needed to complete the request.

508 Loop Detected ([RFC 5842](#))

The server detected an infinite loop while processing the request (sent in lieu of 500 Already Reported).

510 Not Extended ([RFC 2774](#))

Further extensions to the request are required for the server to fulfil it.

511 Network Authentication Required ([RFC 6585](#))

The client needs to authenticate to gain network access, intended for use by interconnecting proxies used to control access.

https://en.wikipedia.org/wiki/List_of_HTTP_status_codes

James H. Thompson




<https://www.flickr.com/photos/goglundain/1397743125/>

A close-up photograph of a white ceramic teapot with a lid and a handle. The teapot is positioned in the foreground, and a text box is overlaid on its body. In the background, another teapot and some cups are visible, but they are out of focus. The lighting is soft, highlighting the smooth surface of the teapot.

418 - I'm A Teapot



A close-up portrait of Donald Trump, showing his face from the nose up. He has light-colored, wavy hair and is smiling slightly. A white rectangular text box is overlaid on the right side of his face, containing the text "410 - Gone".

410 - Gone

Keep it simple

Simple = Synchronous, Request
Response Communication

Synchronous

Synchronous

Asynchronous

Synchronous

Block and wait

Asynchronous

Synchronous

Block and wait

Asynchronous

Fire and (maybe) forget

Synchronous

Block and wait

Asynchronous

Fire and (maybe) forget

Simple to reason about

Synchronous

Block and wait

Asynchronous

Fire and (maybe) forget

Simple to reason about

Technology more
straight forward

Synchronous

Block and wait

Simple to reason about

Technology more
straight forward

Asynchronous

Fire and (maybe) forget

Great for long-
running jobs

Synchronous

Block and wait

Simple to reason about

Technology more
straight forward

Asynchronous

Fire and (maybe) forget

Great for long-
running jobs

And low latency too!

Synchronous

Block and wait

Simple to reason about

Technology more
straight forward

Asynchronous

Fire and (maybe) forget

Great for long-
running jobs

And low latency too!

More complex

Collaboration Styles

Collaboration Styles

Request/Response

Collaboration Styles

Request/Response

Event-based

Collaboration Styles

Request/Response

Initiate a request, expect
a response

Event-based

Collaboration Styles

Request/Response

Initiate a request, expect
a response

Event-based

Things happen,
things react

Request/Response

Request/Response

Event-based

Request/Response

Event-based

Synchronous

Request/Response

Event-based

Synchronous

Asynchronous

Request/Response

Event-based

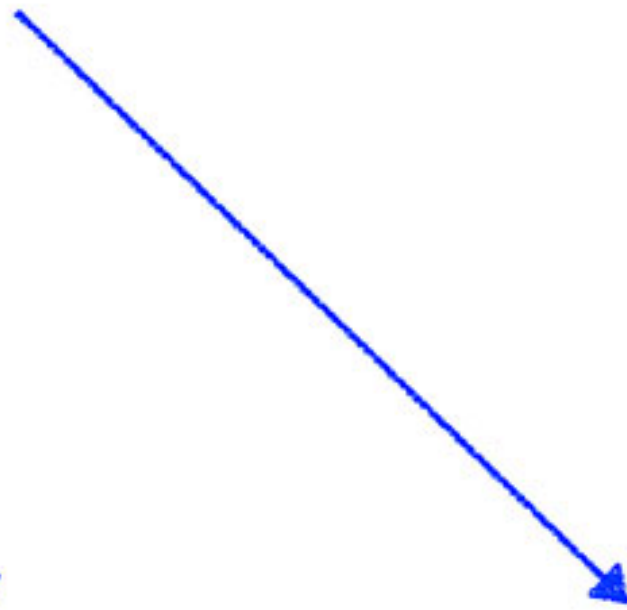


Synchronous

Asynchronous

Request/Response

Event-based

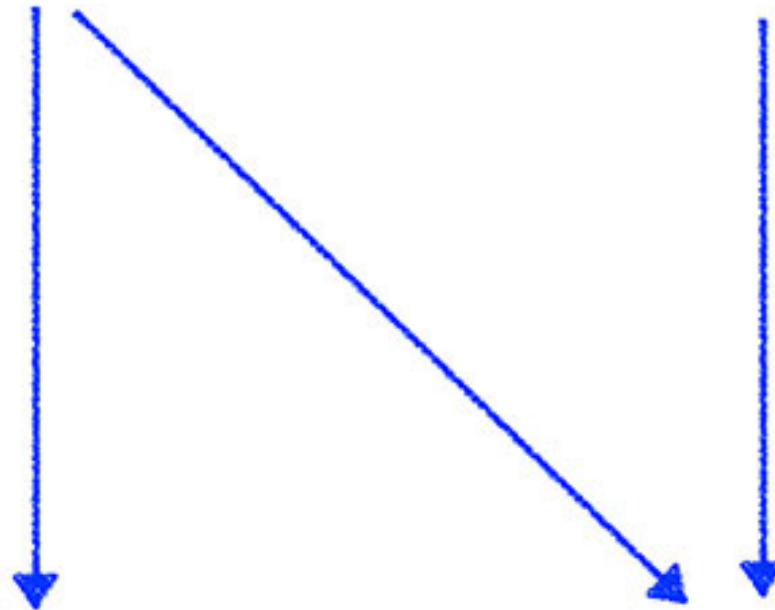


Synchronous

Asynchronous

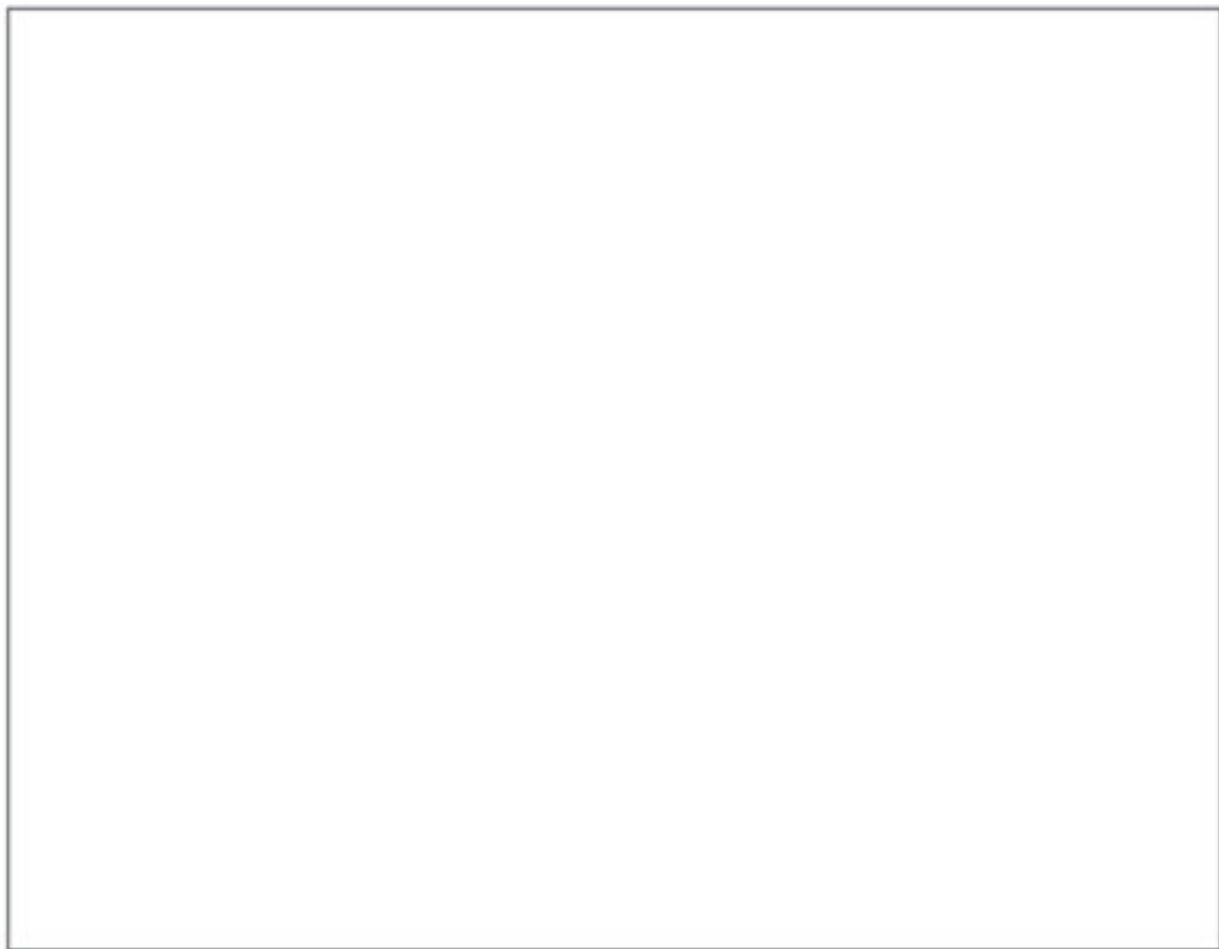
Request/Response

Event-based

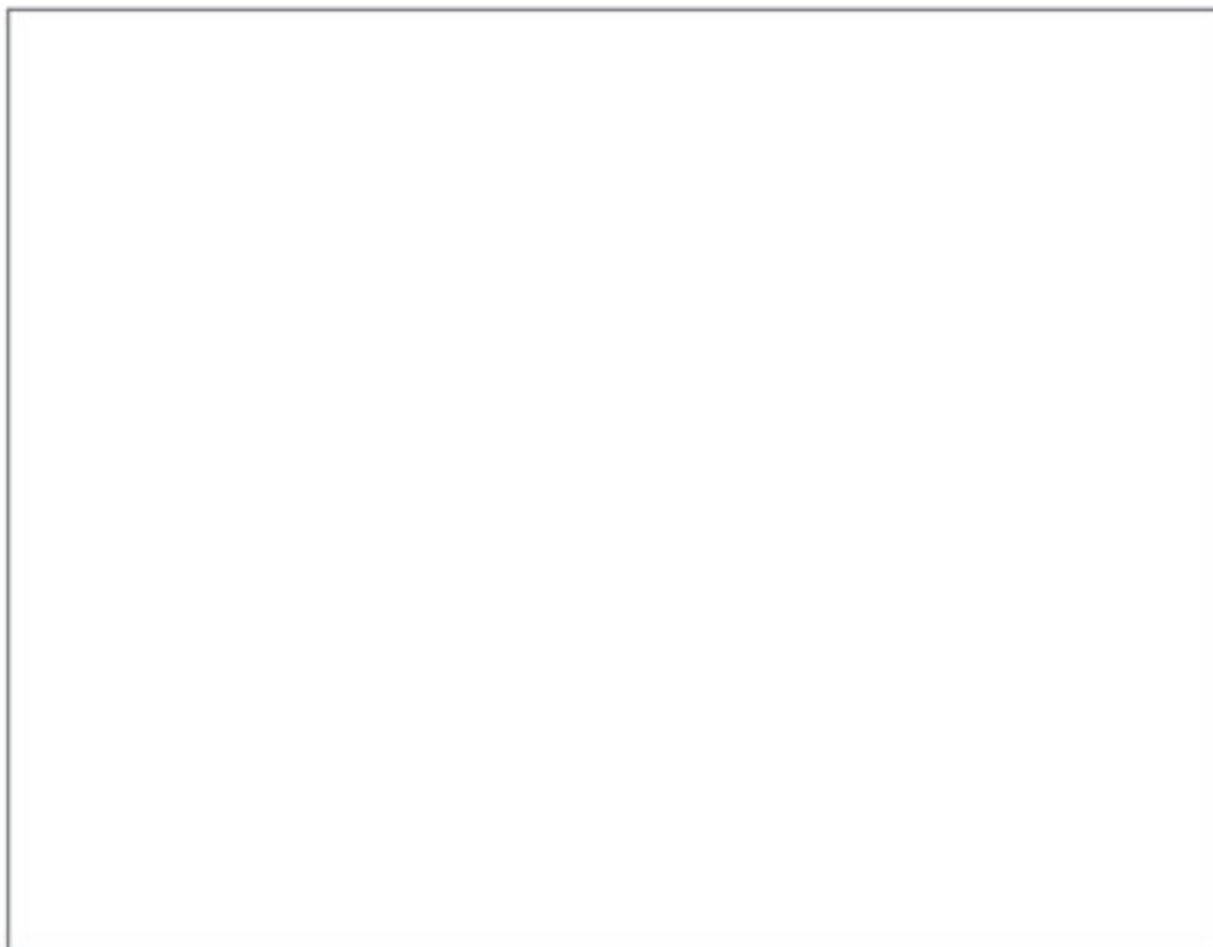


Synchronous

Asynchronous

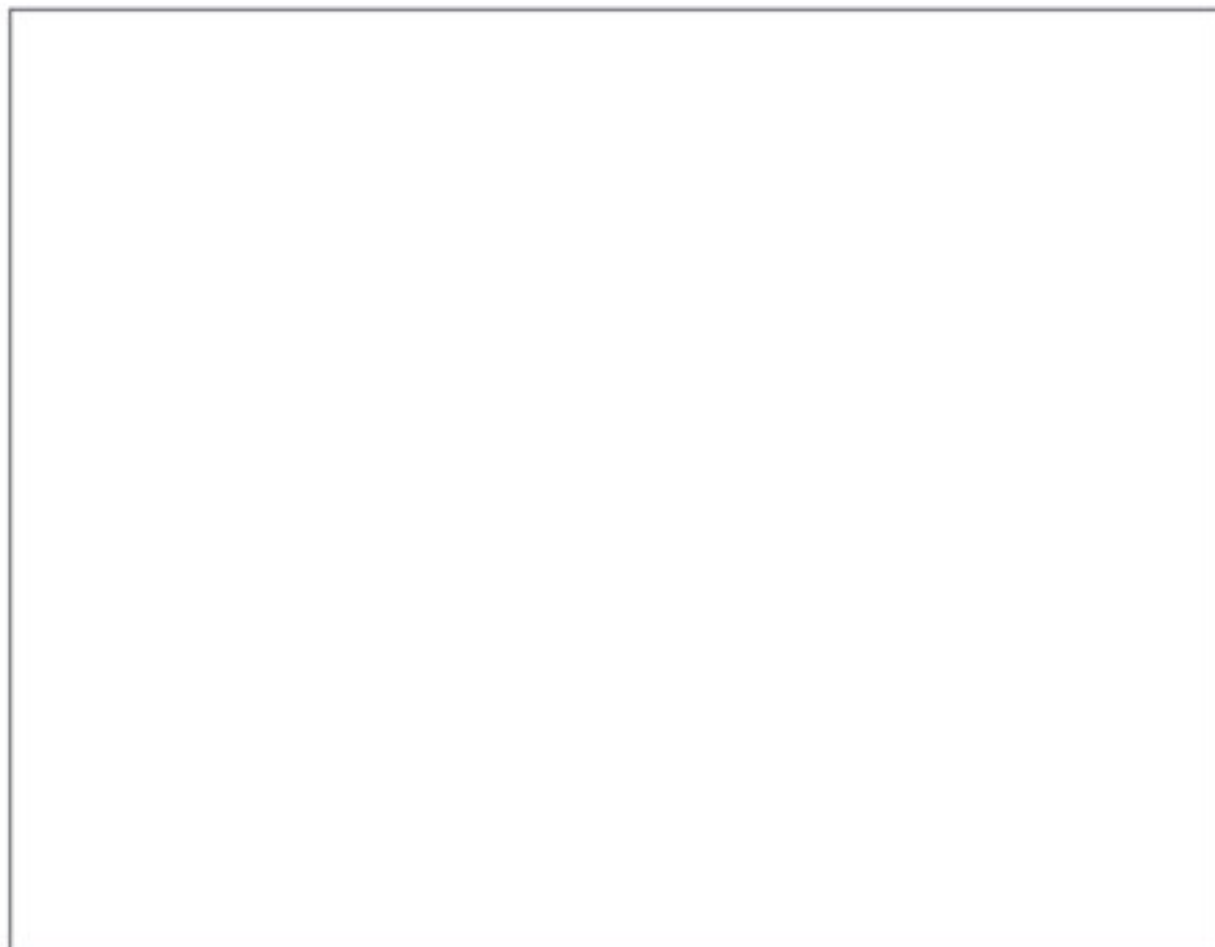


Request/Response



Request/Response

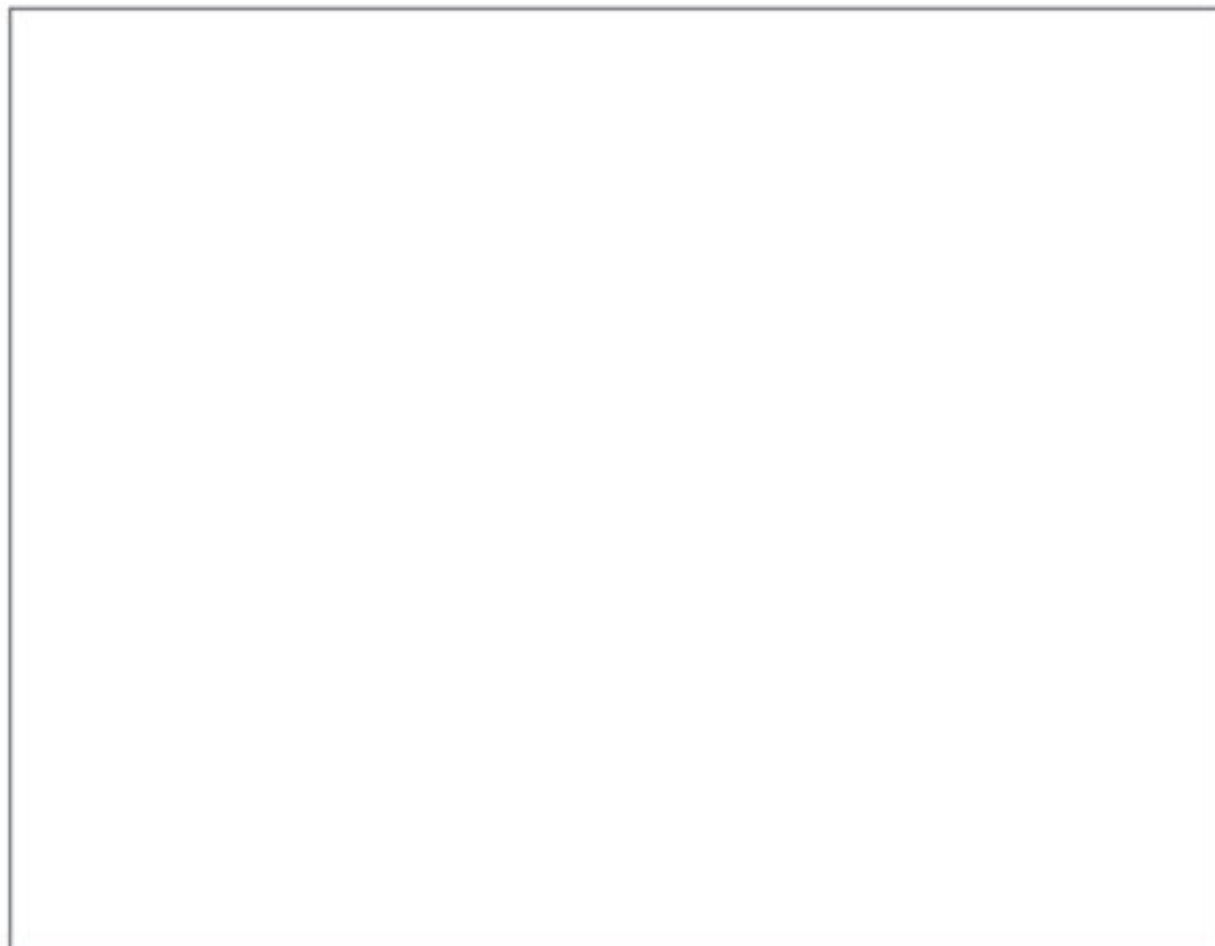
Event-based



Request/Response

Event-based

Synchronous



Request/Response

Event-based

Synchronous

Asynchronous



Request/Response

Event-based

Synchronous

RPC

HTTP

Asynchronous

Request/Response

Event-based

Synchronous

RPC

HTTP

Asynchronous

RPC

HTTP

	Request/Response	Event-based
Synchronous	RPC HTTP	
Asynchronous	RPC HTTP	HTTP

Request/Response

Event-based

Synchronous

RPC

HTTP

Asynchronous

RPC

HTTP

Akka

HTTP

	Request/Response	Event-based
Synchronous	RPC HTTP	
Asynchronous	RPC HTTP Akka Message Brokers	HTTP Message Brokers

Simple = Synchronous, Request
Response Communication

HTTP

Very well supported

Good error handling semantics

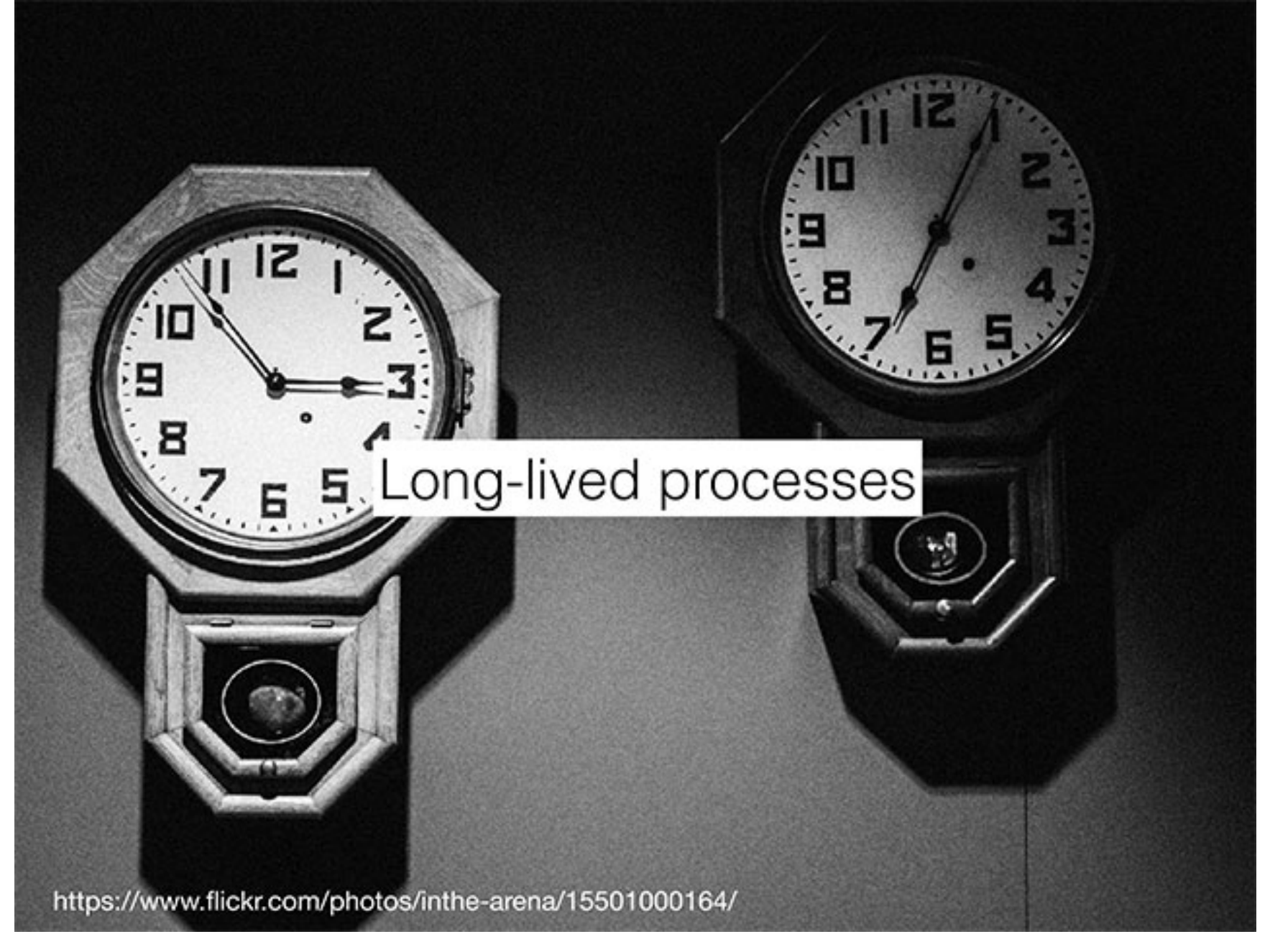
Cache controls

Easy to scale - good, reliable
(boring?) technology

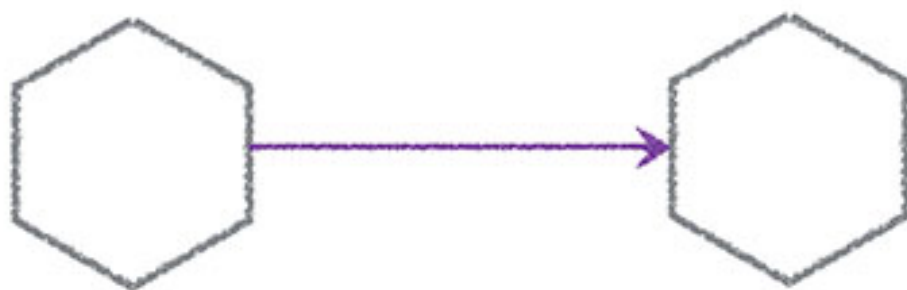
Where does this break down?

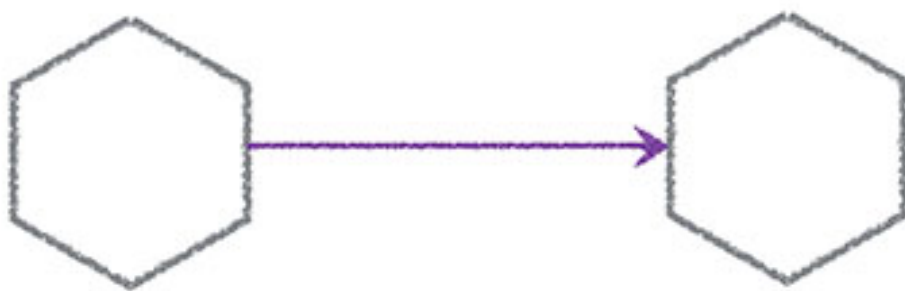


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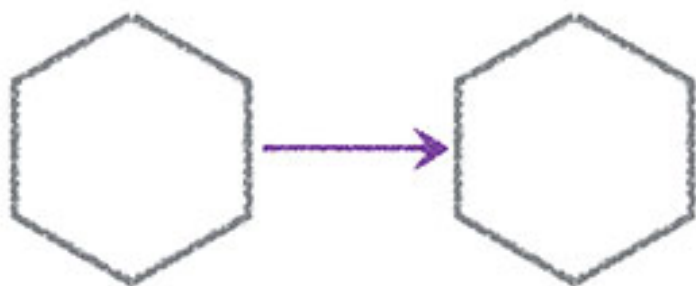


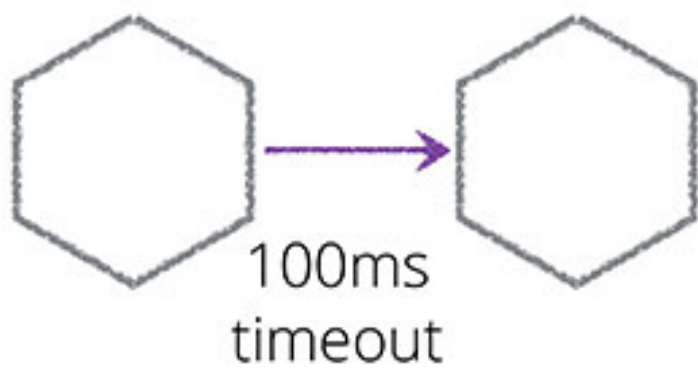
Long-lived processes

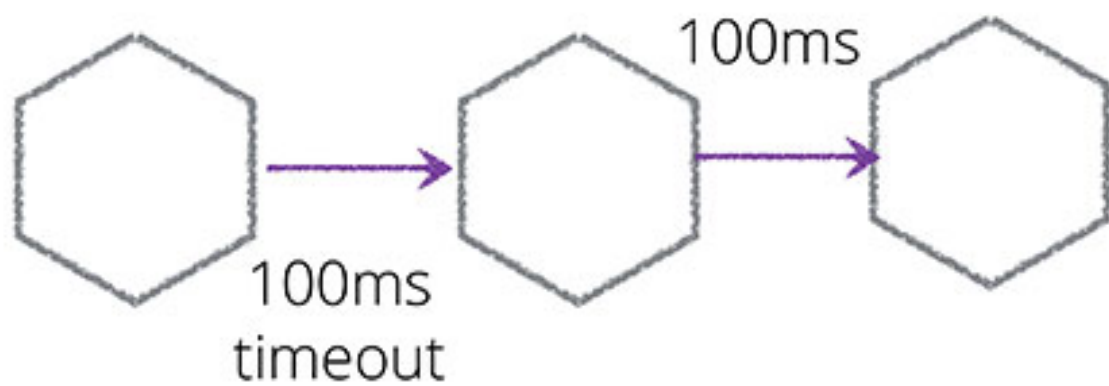


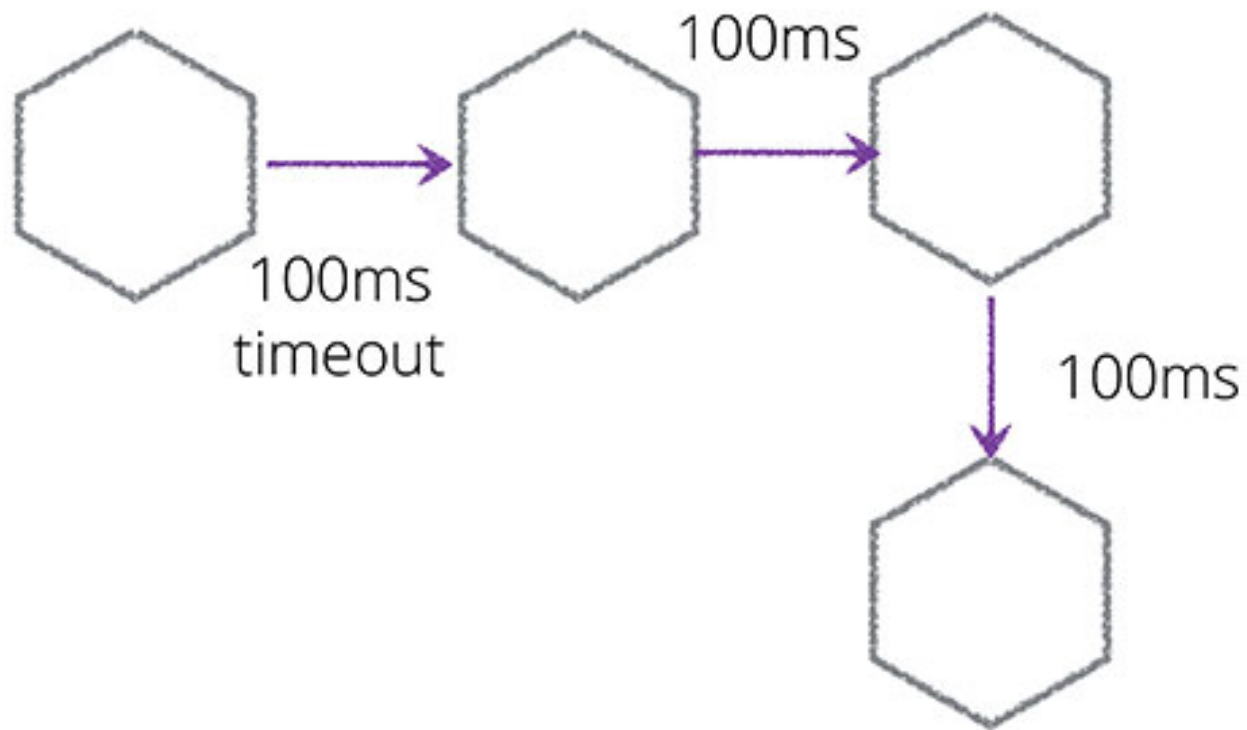


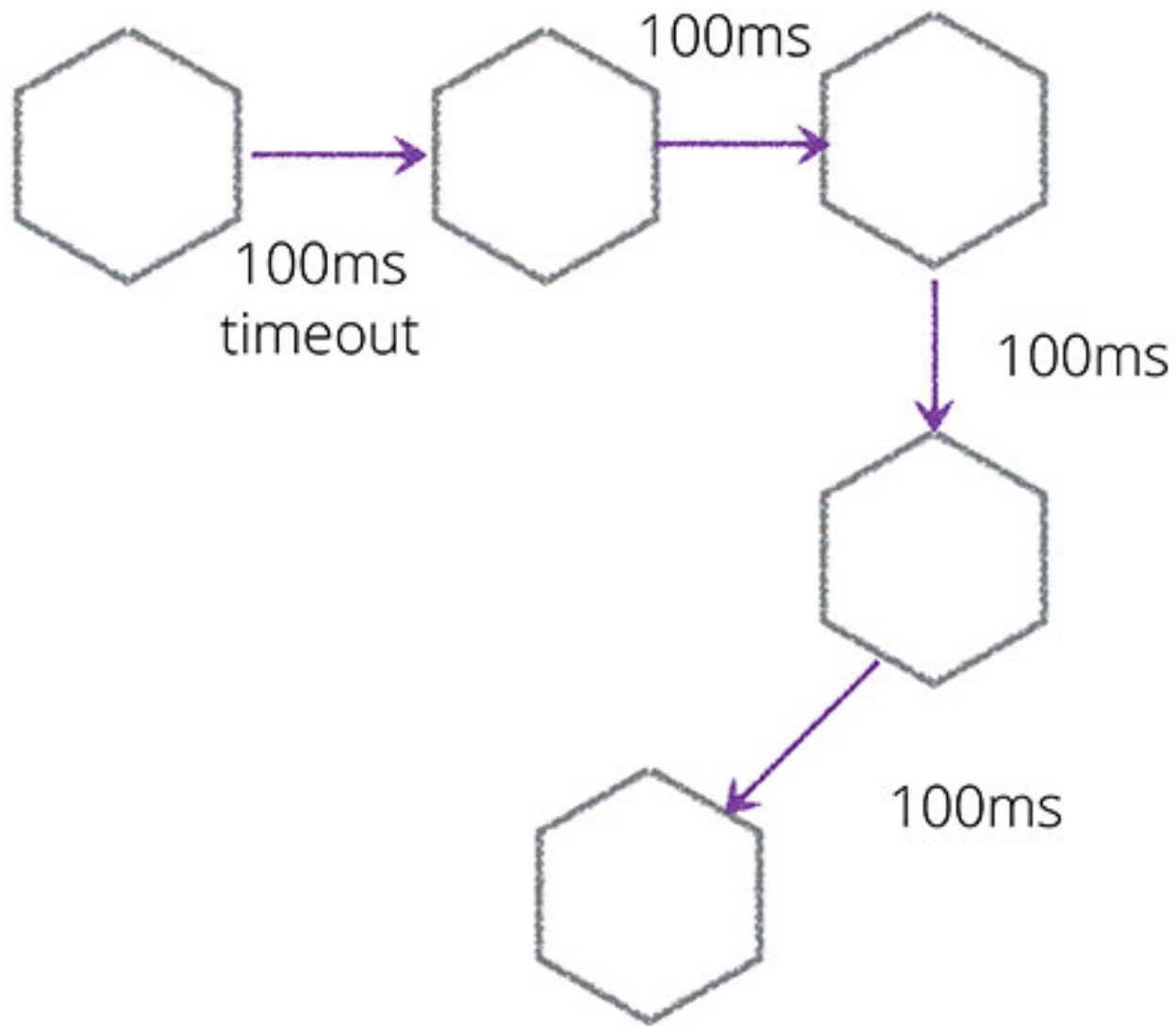
Call overhead

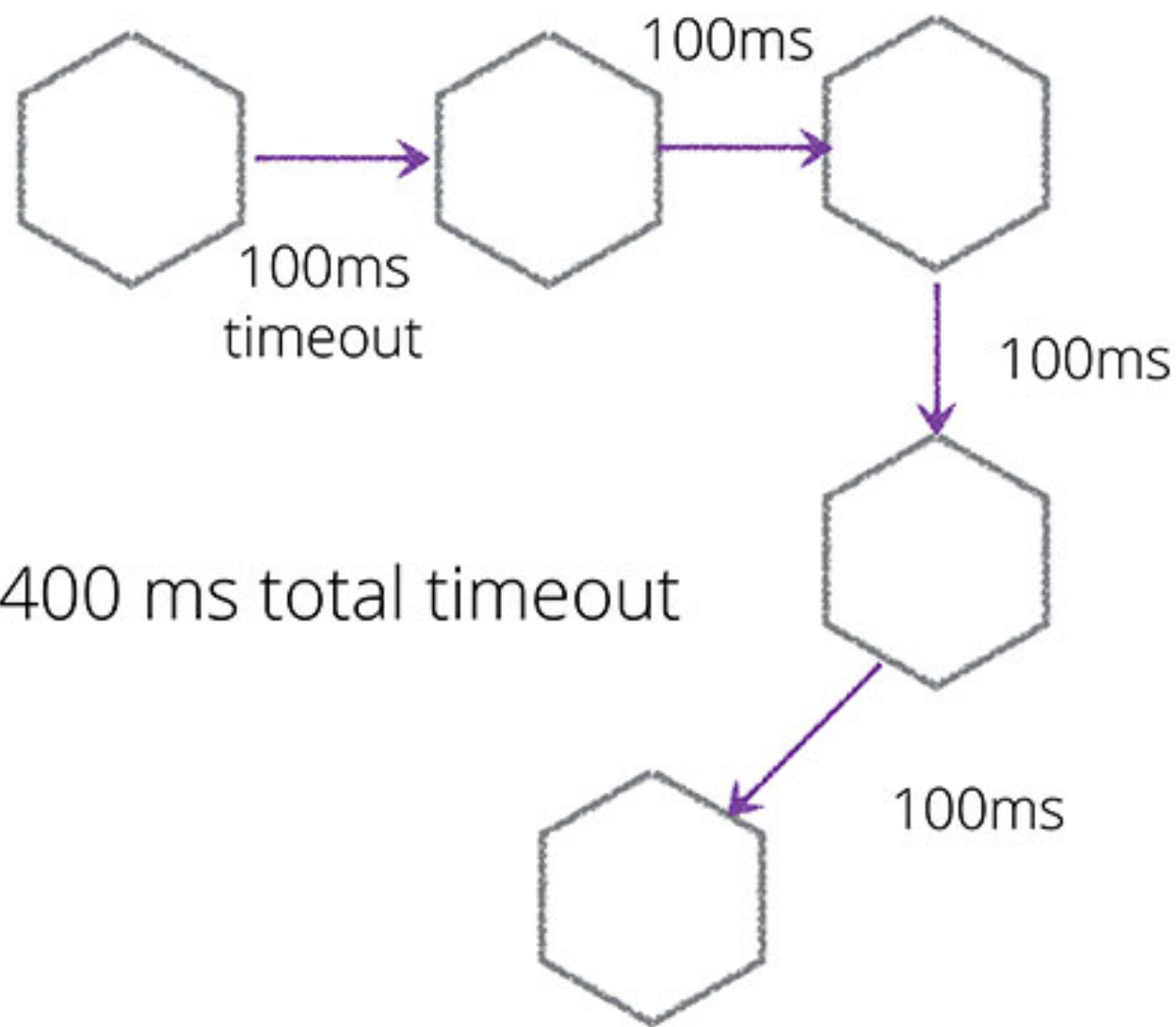










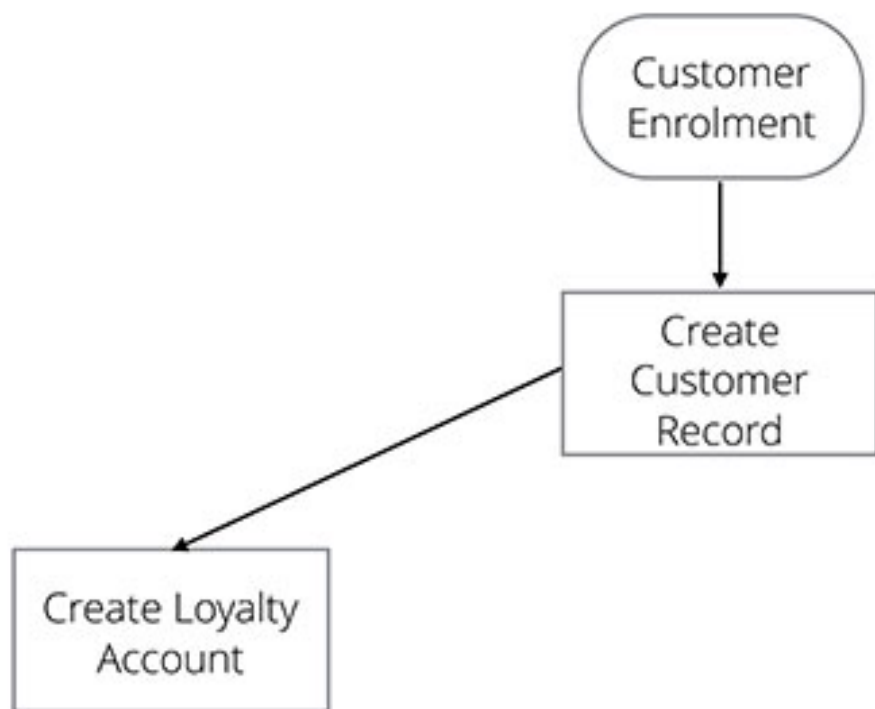


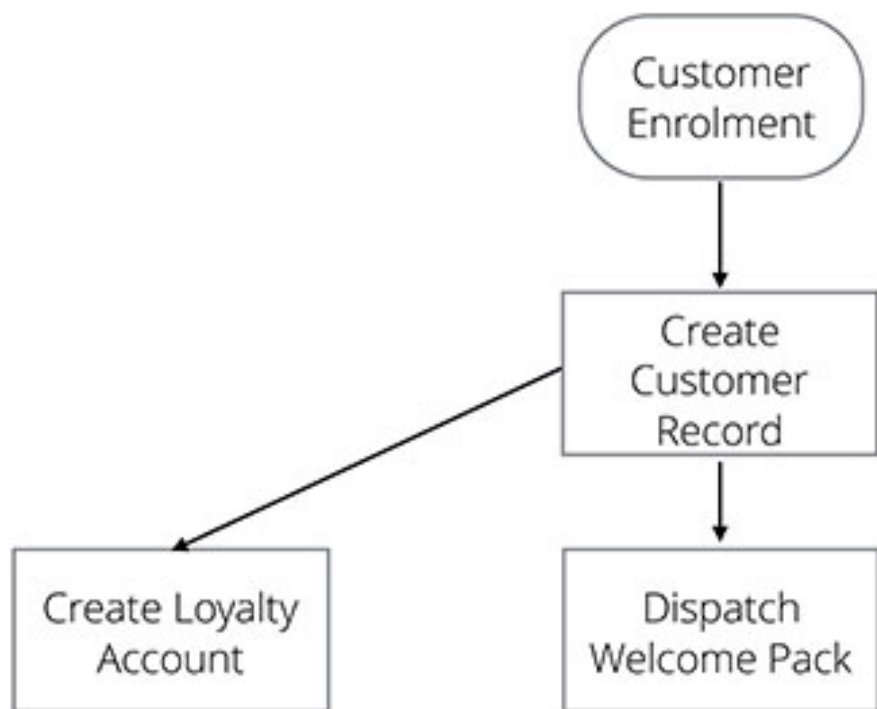
Choreography vs Orchestration

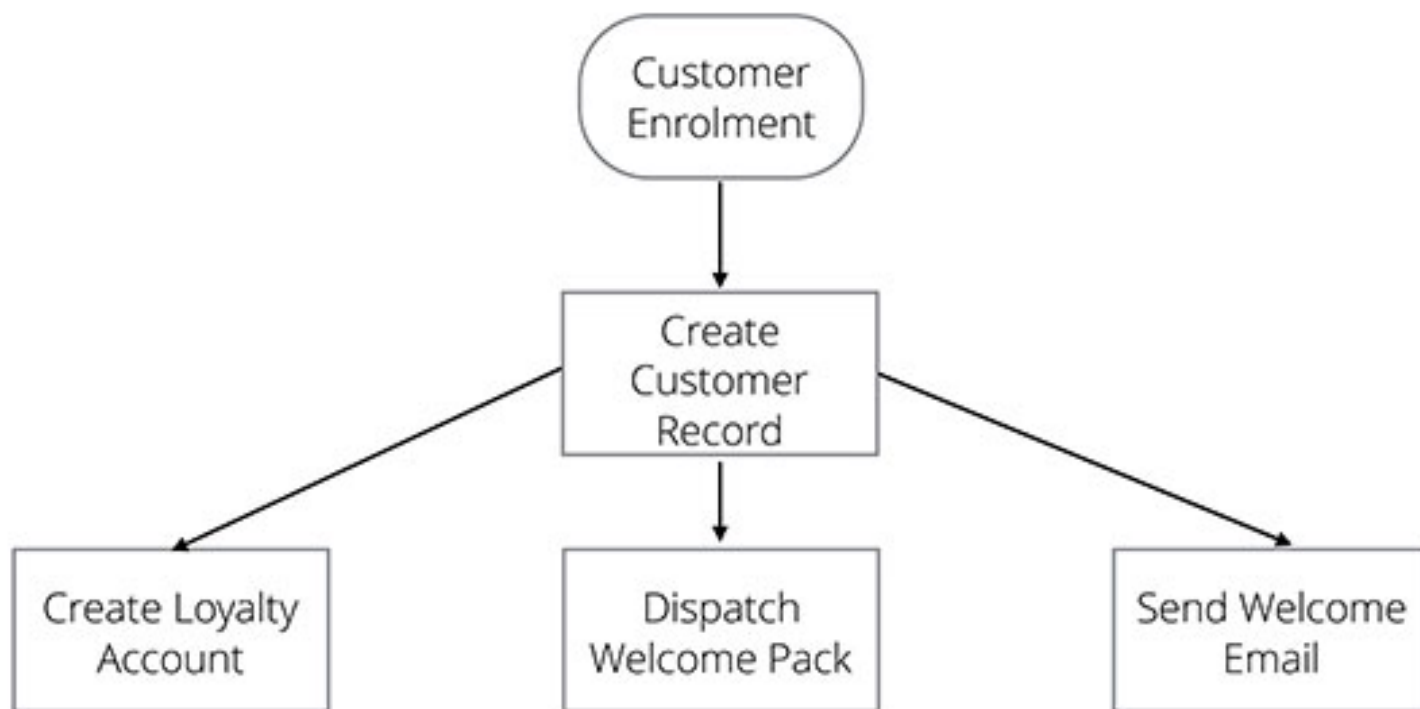
Customer
Enrolment

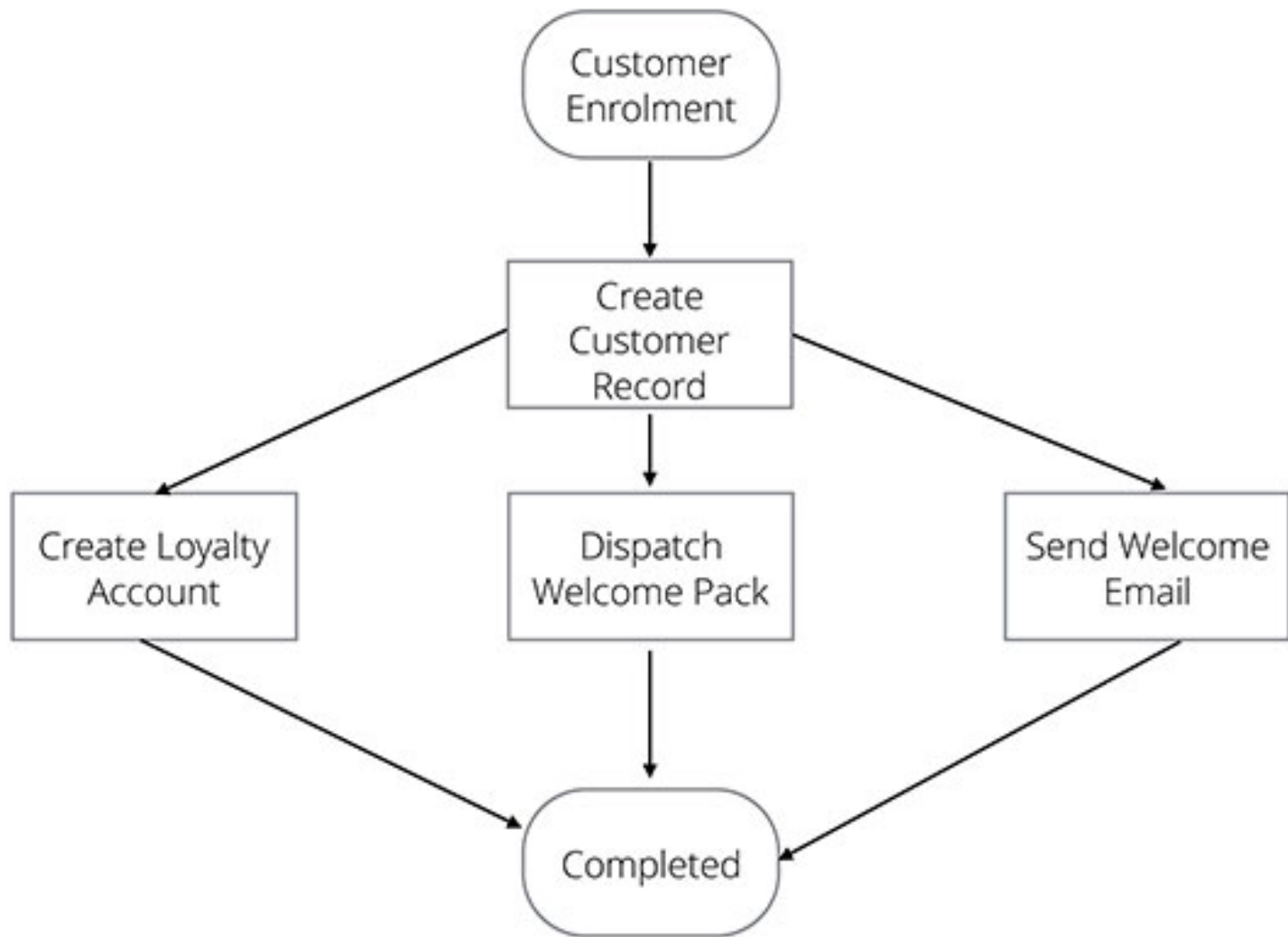








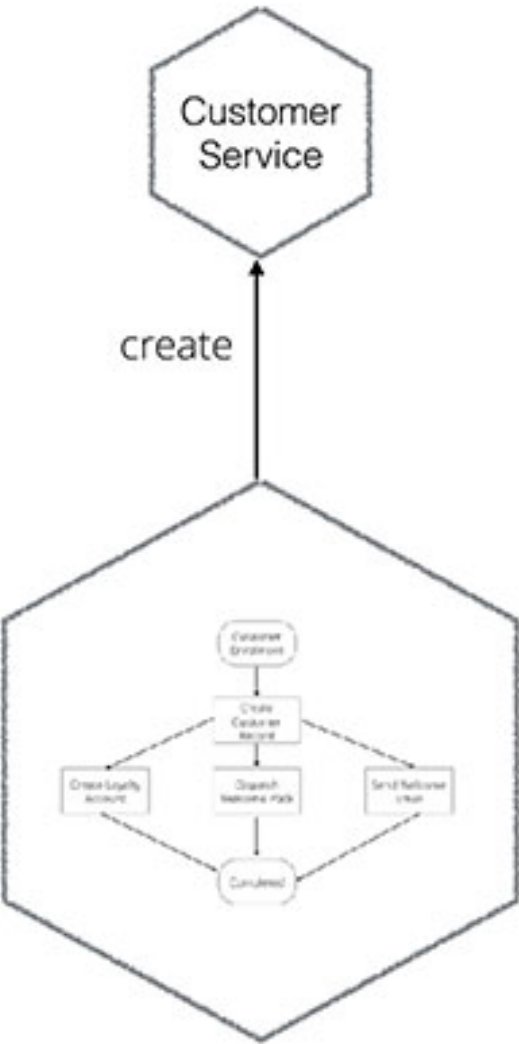




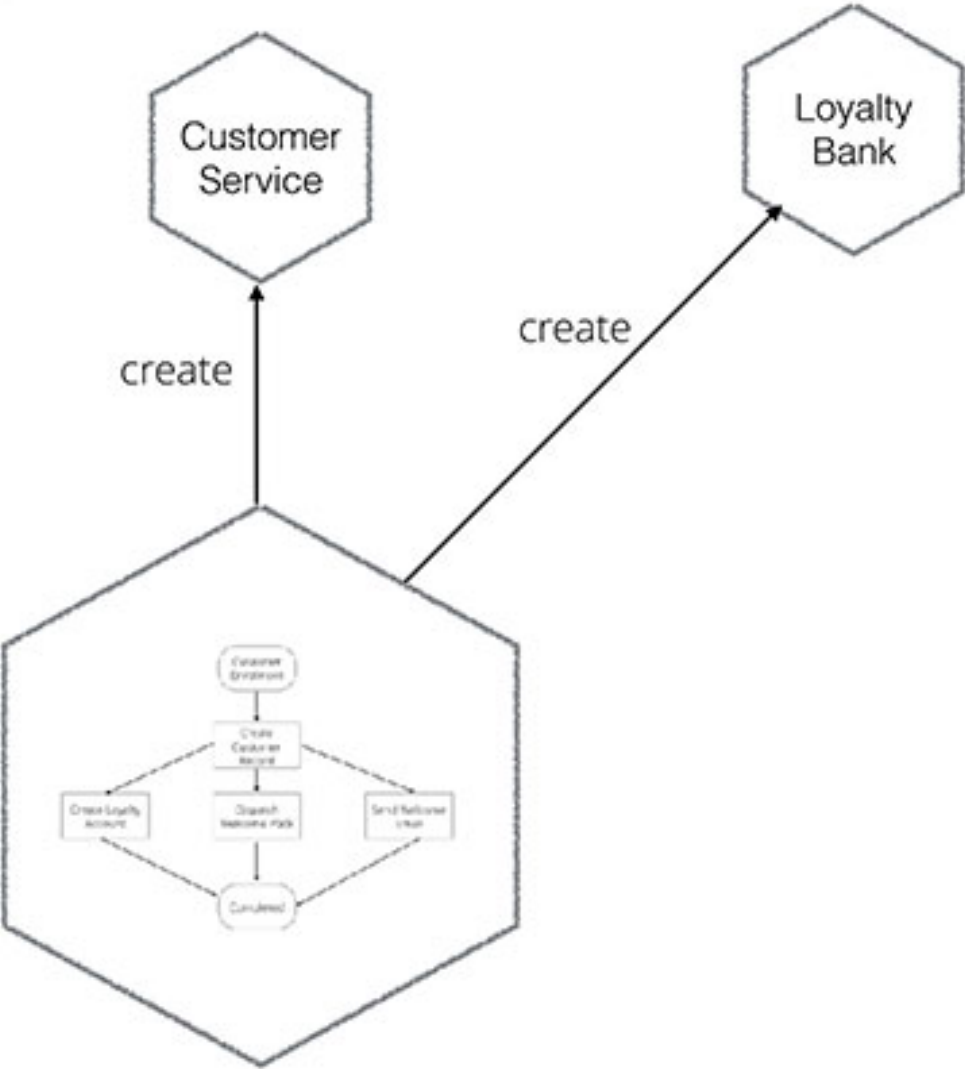
ORCHESTRATION



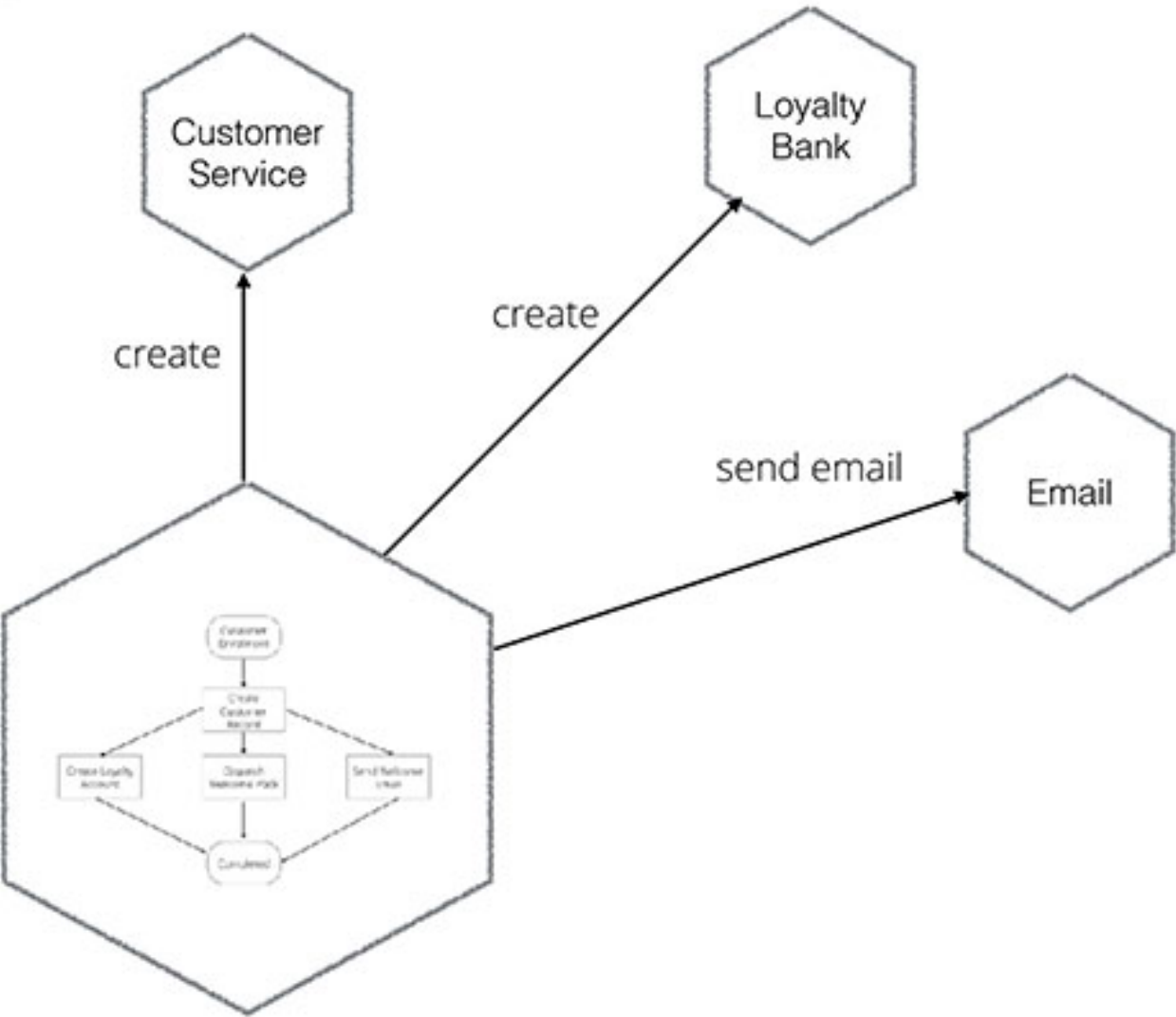
ORCHESTRATION



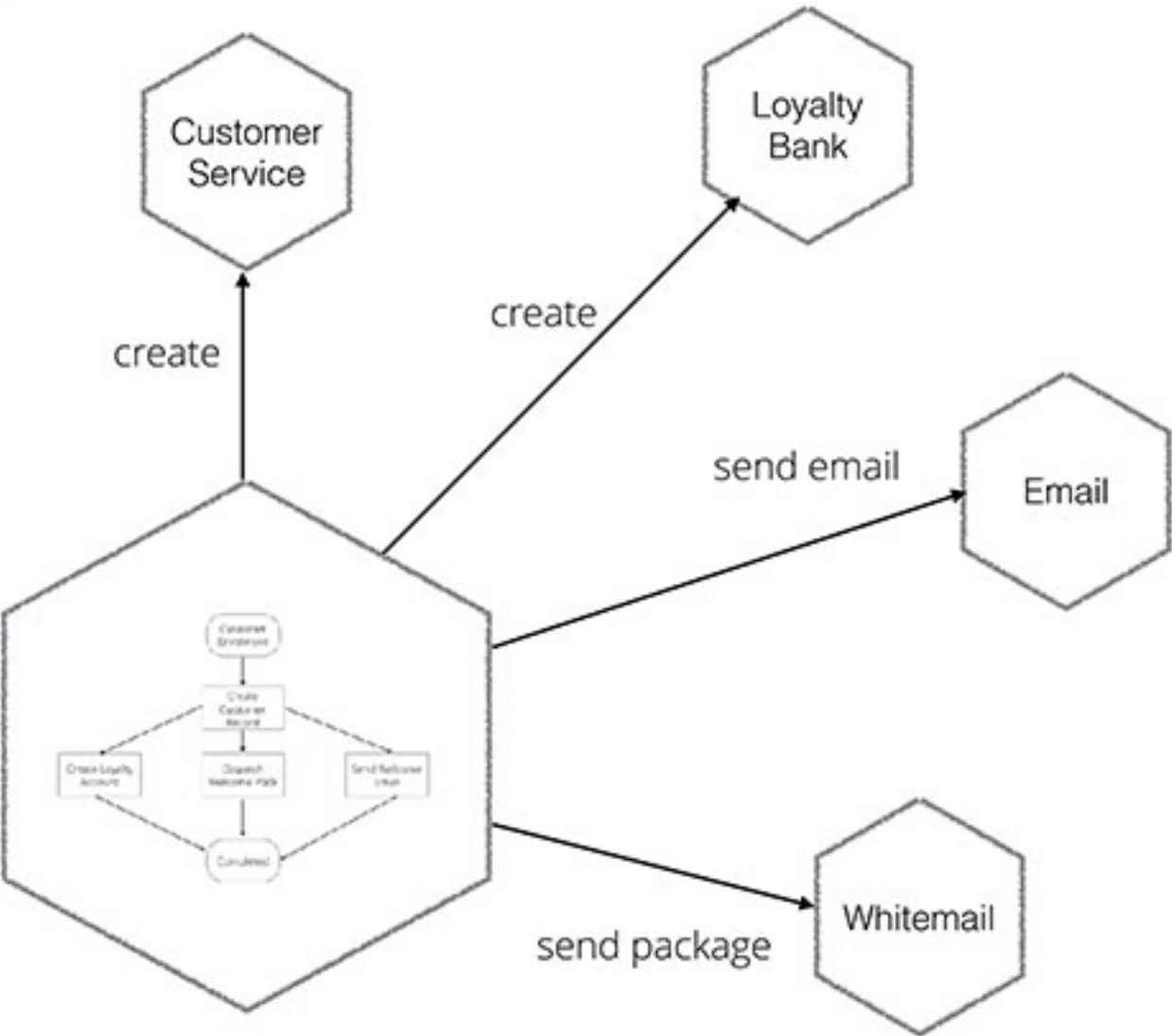
ORCHESTRATION



ORCHESTRATION



ORCHESTRATION



Pros

Pros

Explicit representation of business process

Pros

Explicit representation of business process

Know in-line if there has been a problem

Pros

Explicit representation of business process

Know in-line if there has been a problem

Cons

Pros

Explicit representation of business process

Know in-line if there has been a problem

Cons

Can be fairly coupled

Pros

Explicit representation of business process

Know in-line if there has been a problem

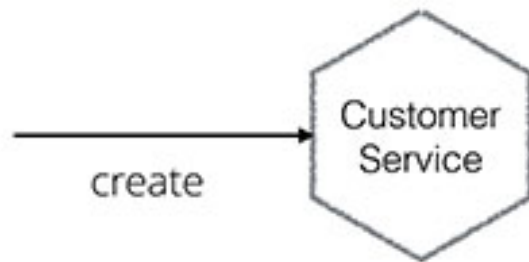
Cons

Can be fairly coupled

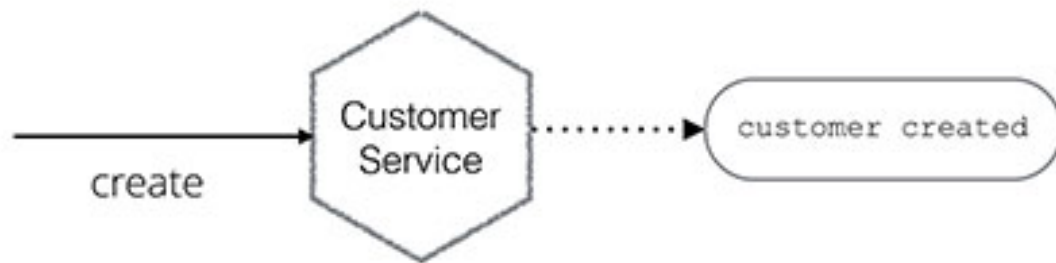
Can lead to overly smart (and dumb
services)

CHOREOGRAPHED

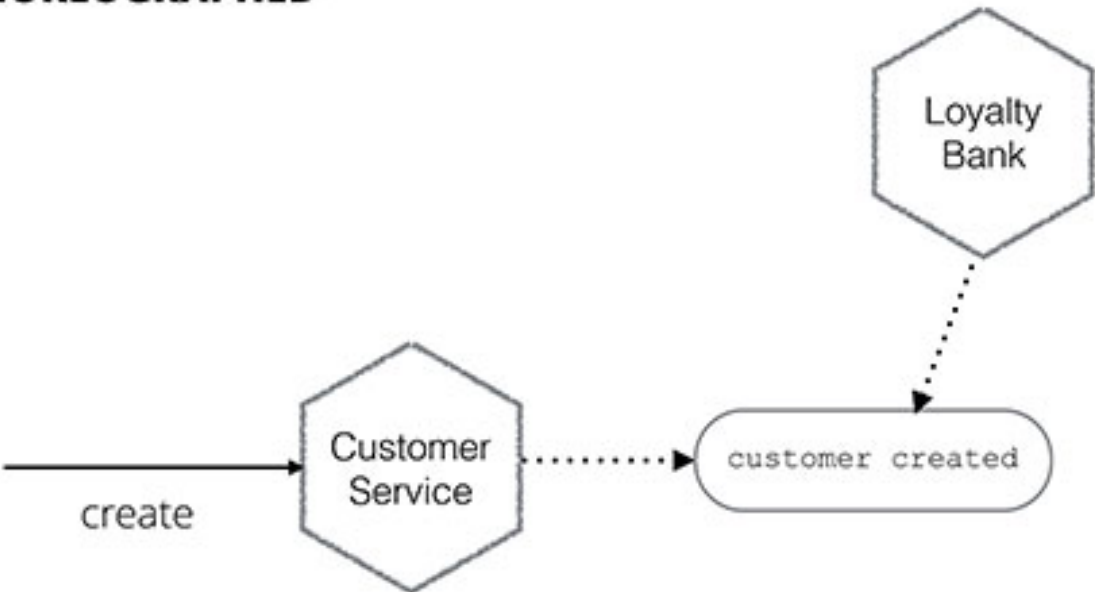
CHOREOGRAPHED



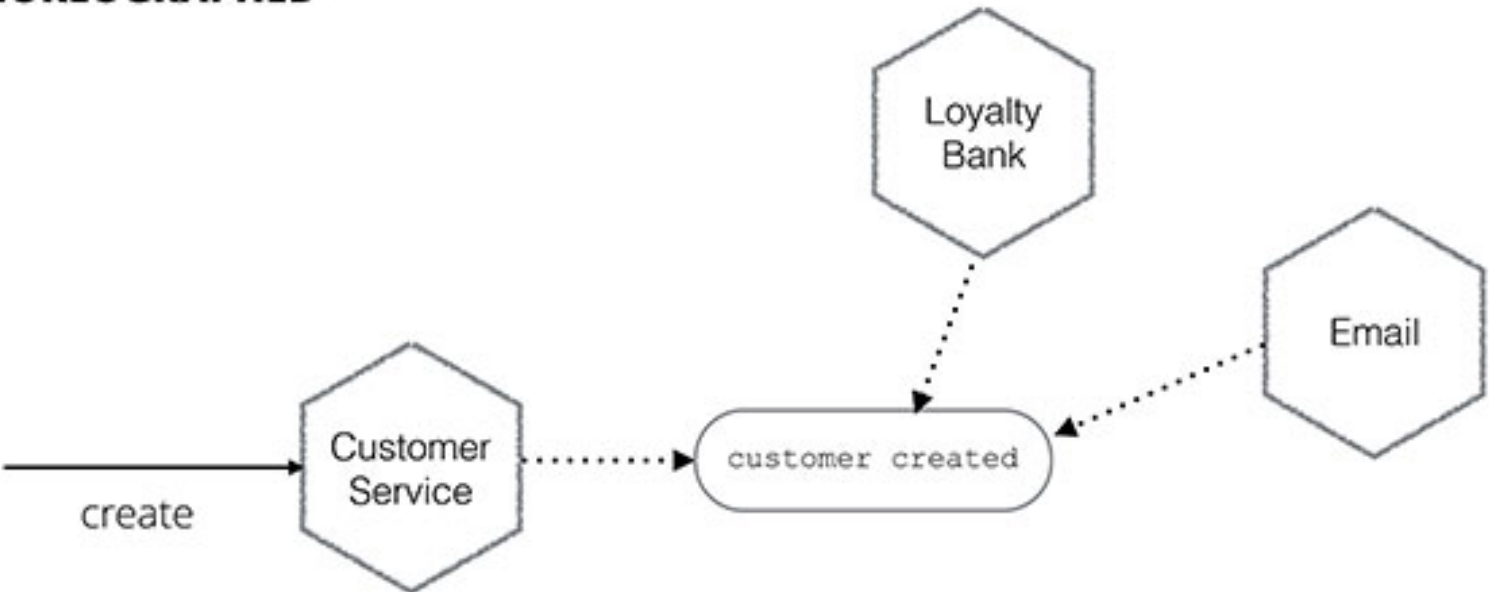
CHOREOGRAPHED



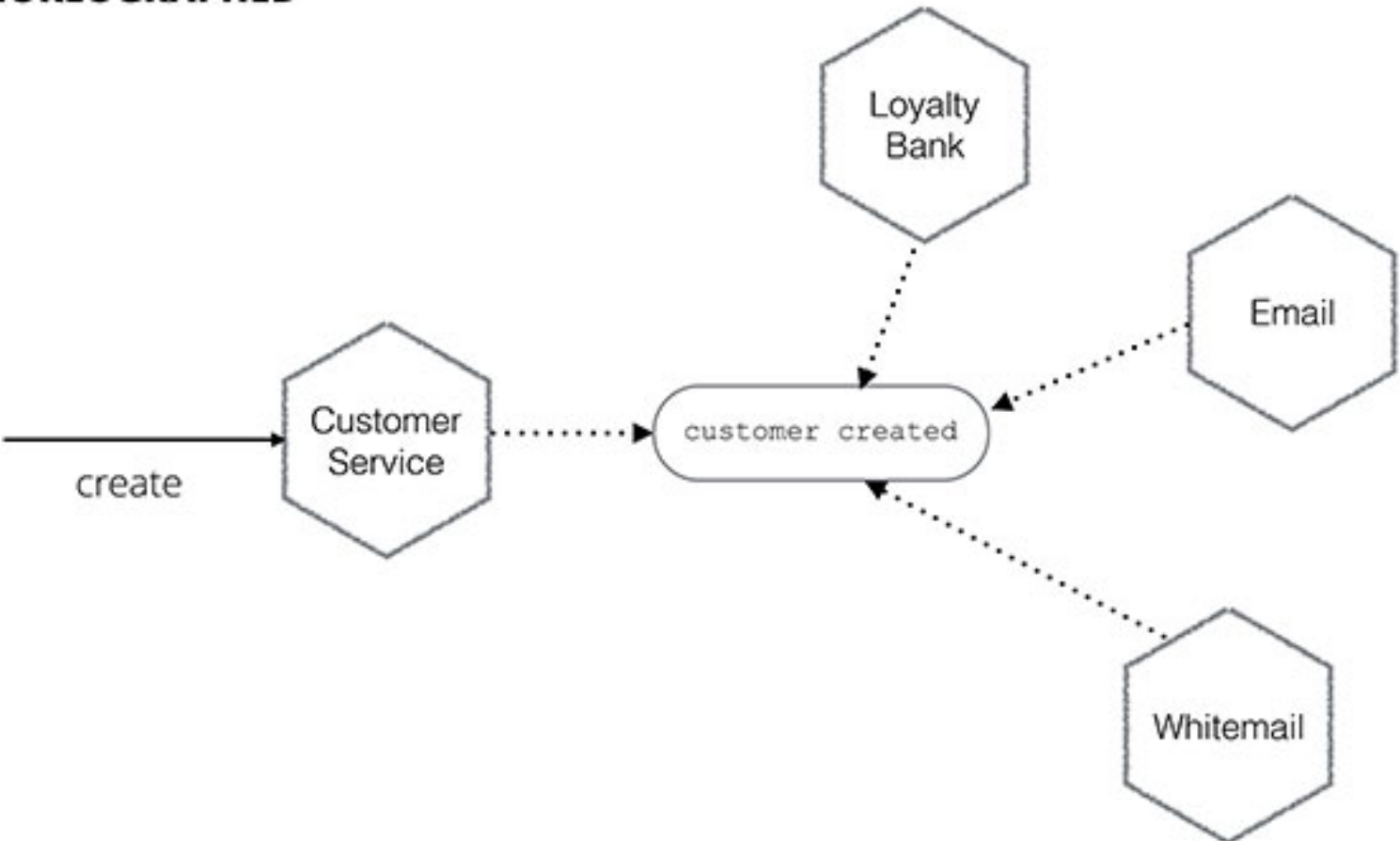
CHOREOGRAPHED



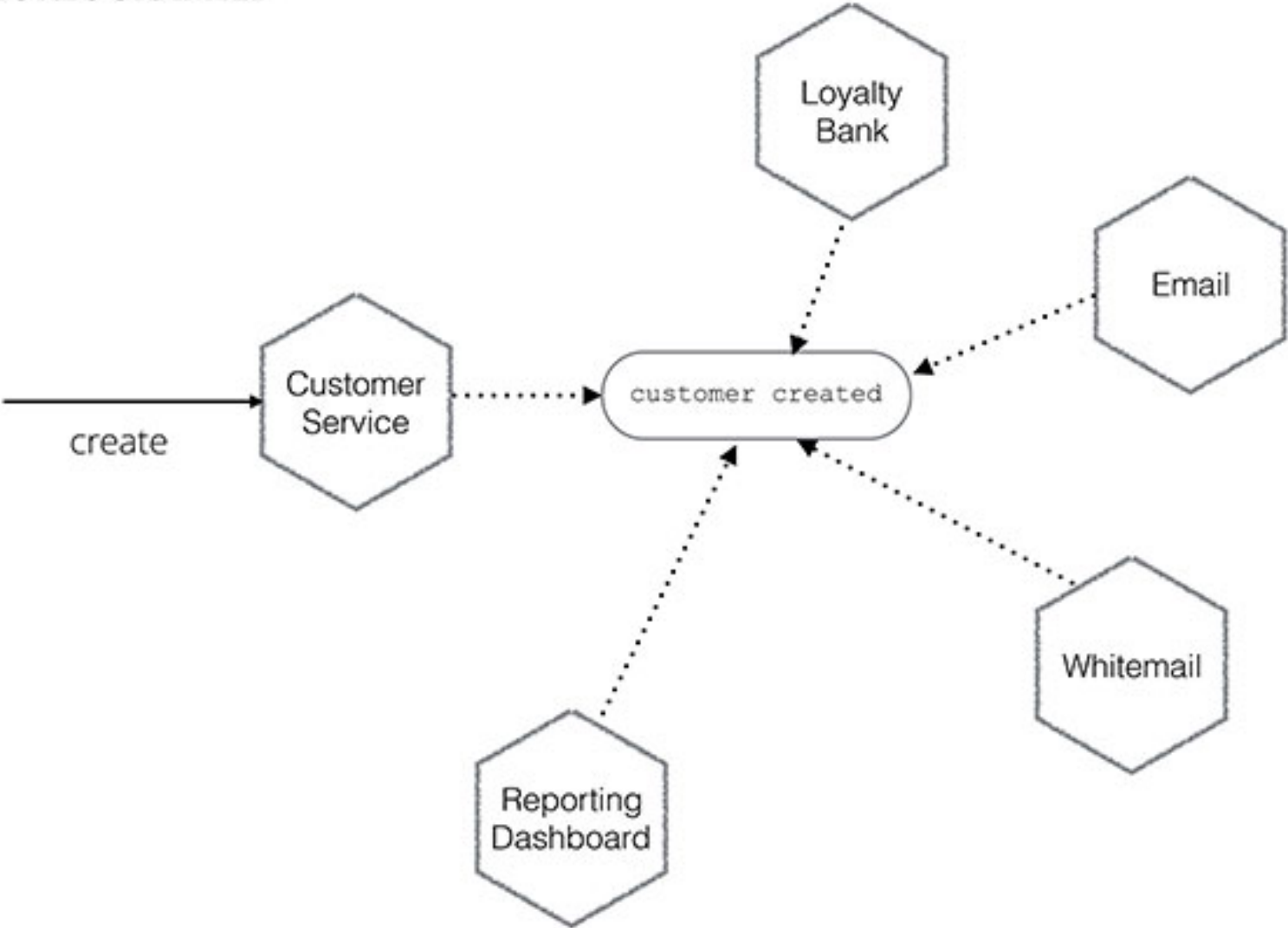
CHOREOGRAPHED



CHOREOGRAPHED



CHOREOGRAPHED



Pros

Pros

Highly decoupled

Pros

Highly decoupled

Evenly distributed smarts

Pros

Highly decoupled

Evenly distributed smarts

Cons

Pros

Highly decoupled

Evenly distributed smarts

Cons

Lost explicit business process mapping

Pros

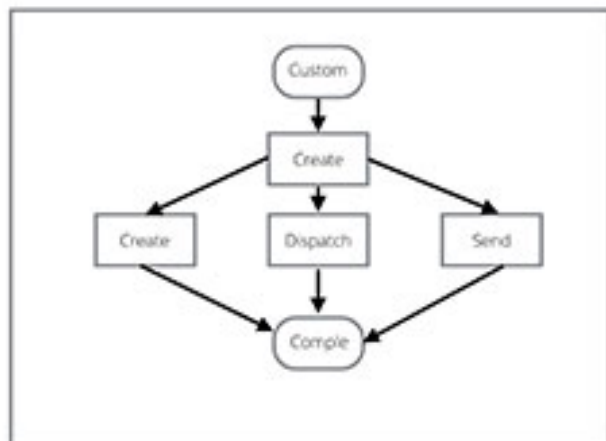
Highly decoupled

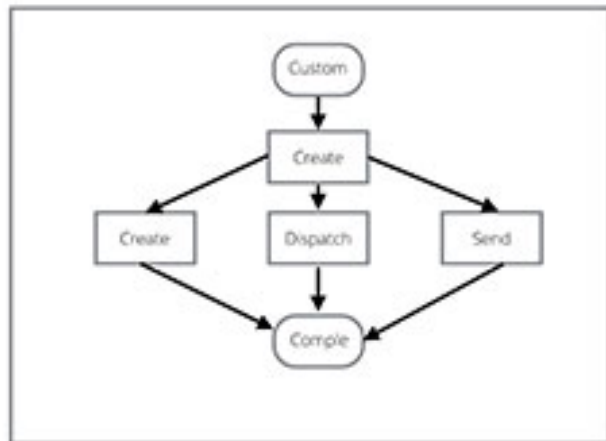
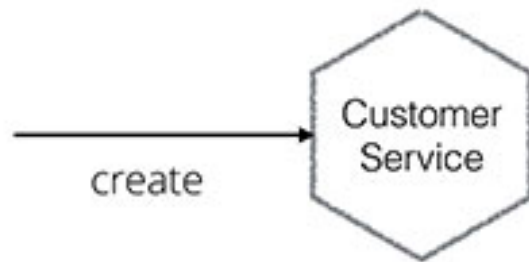
Evenly distributed smarts

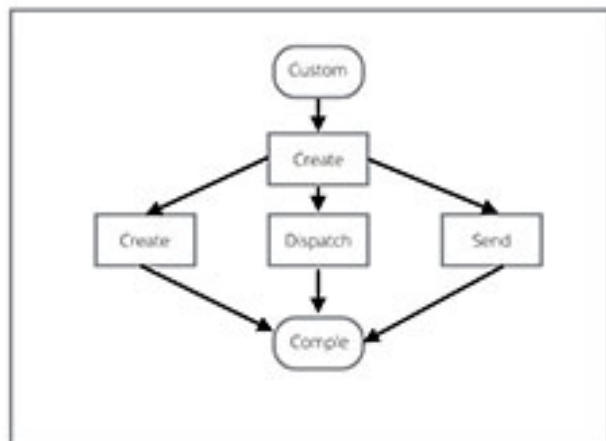
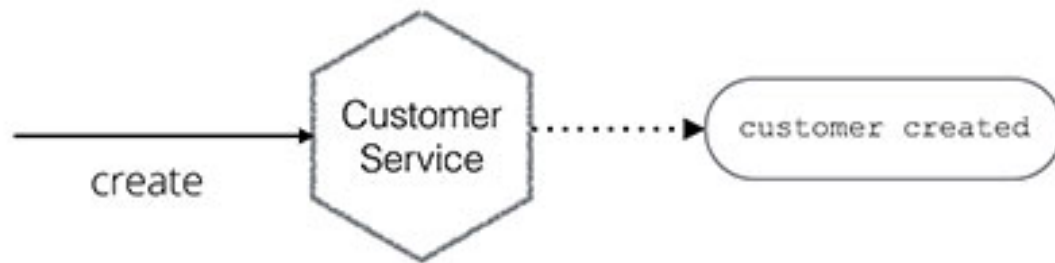
Cons

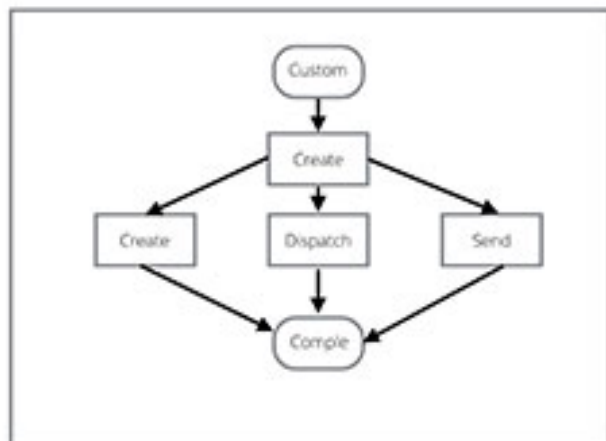
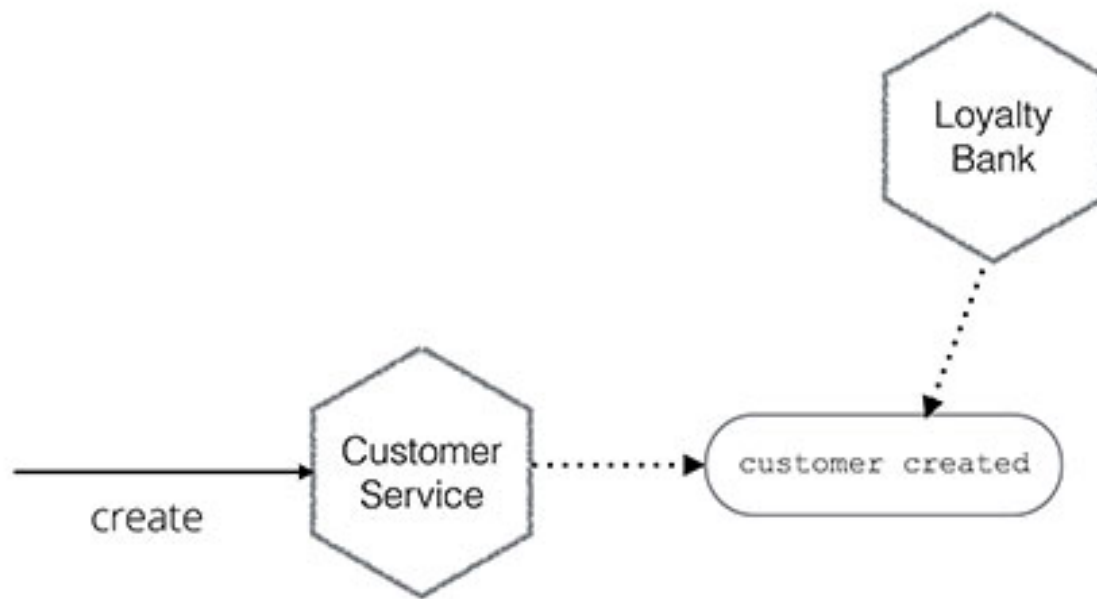
Lost explicit business process mapping

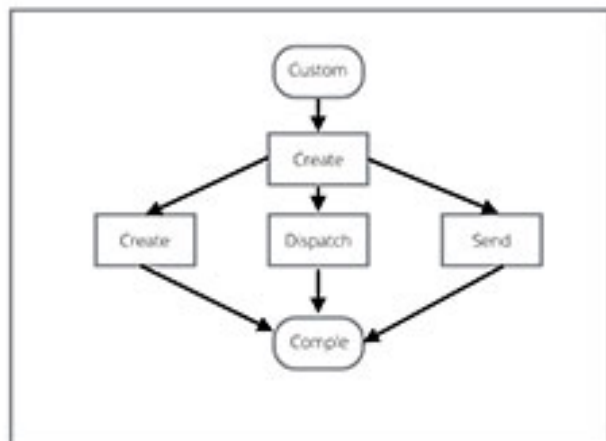
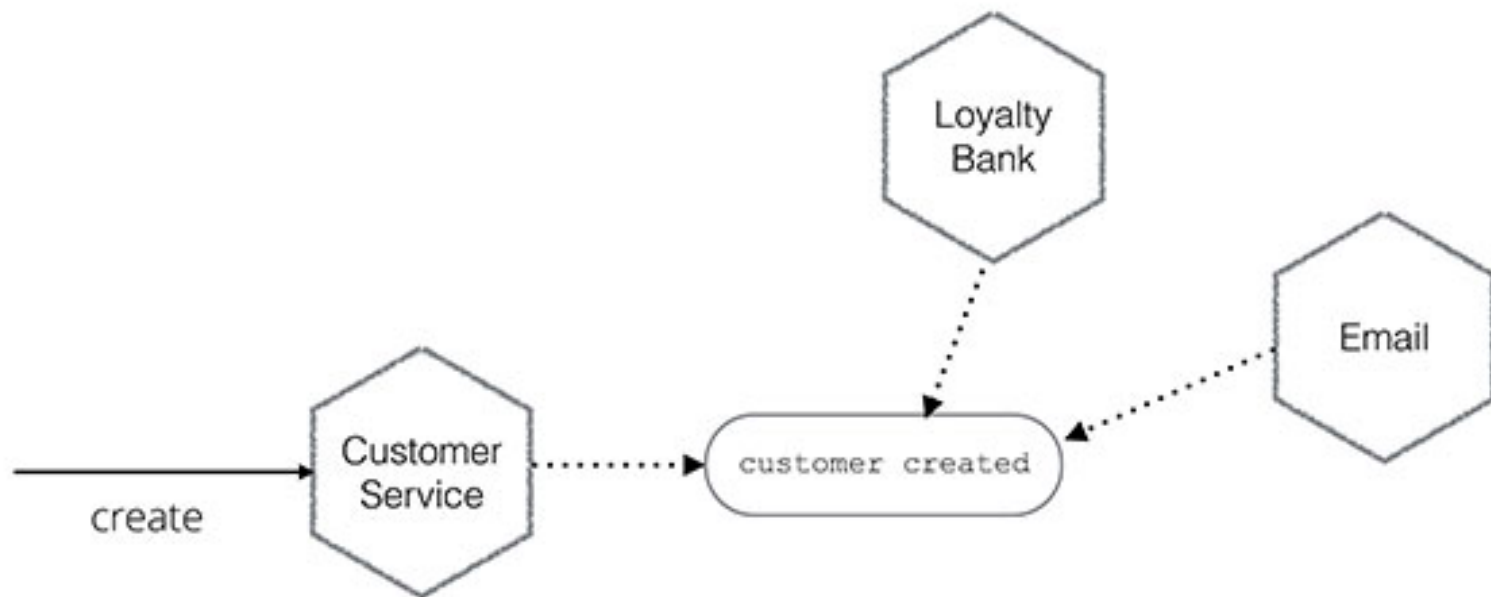
Understanding completion or error states
is complex

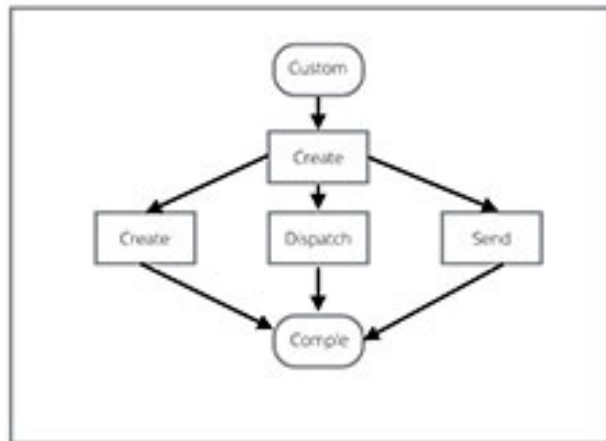
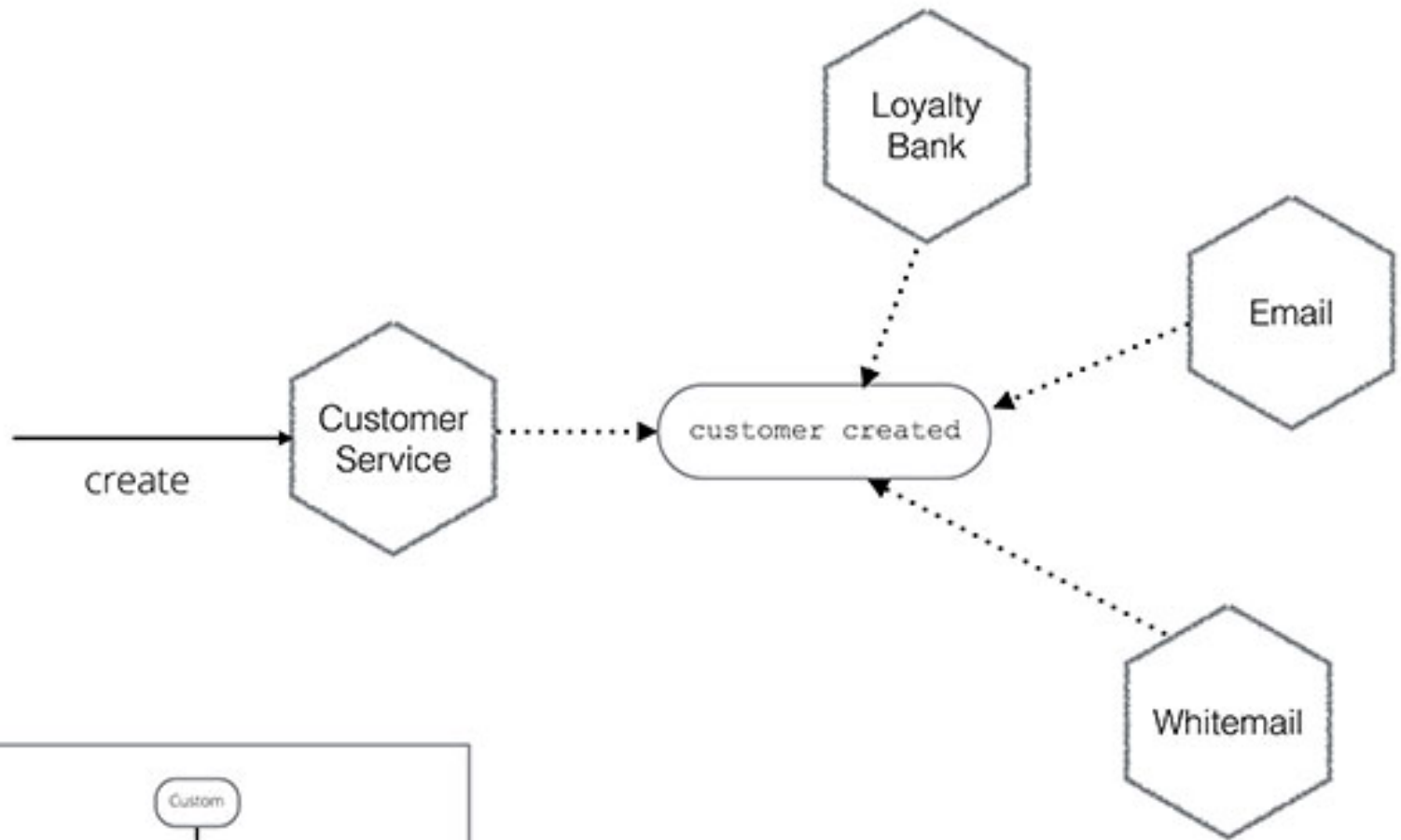














Summary

Keep it simple

Think about interaction style
first, tech second

Orchestration vs Choreography