Università
della
Svizzera
italiana

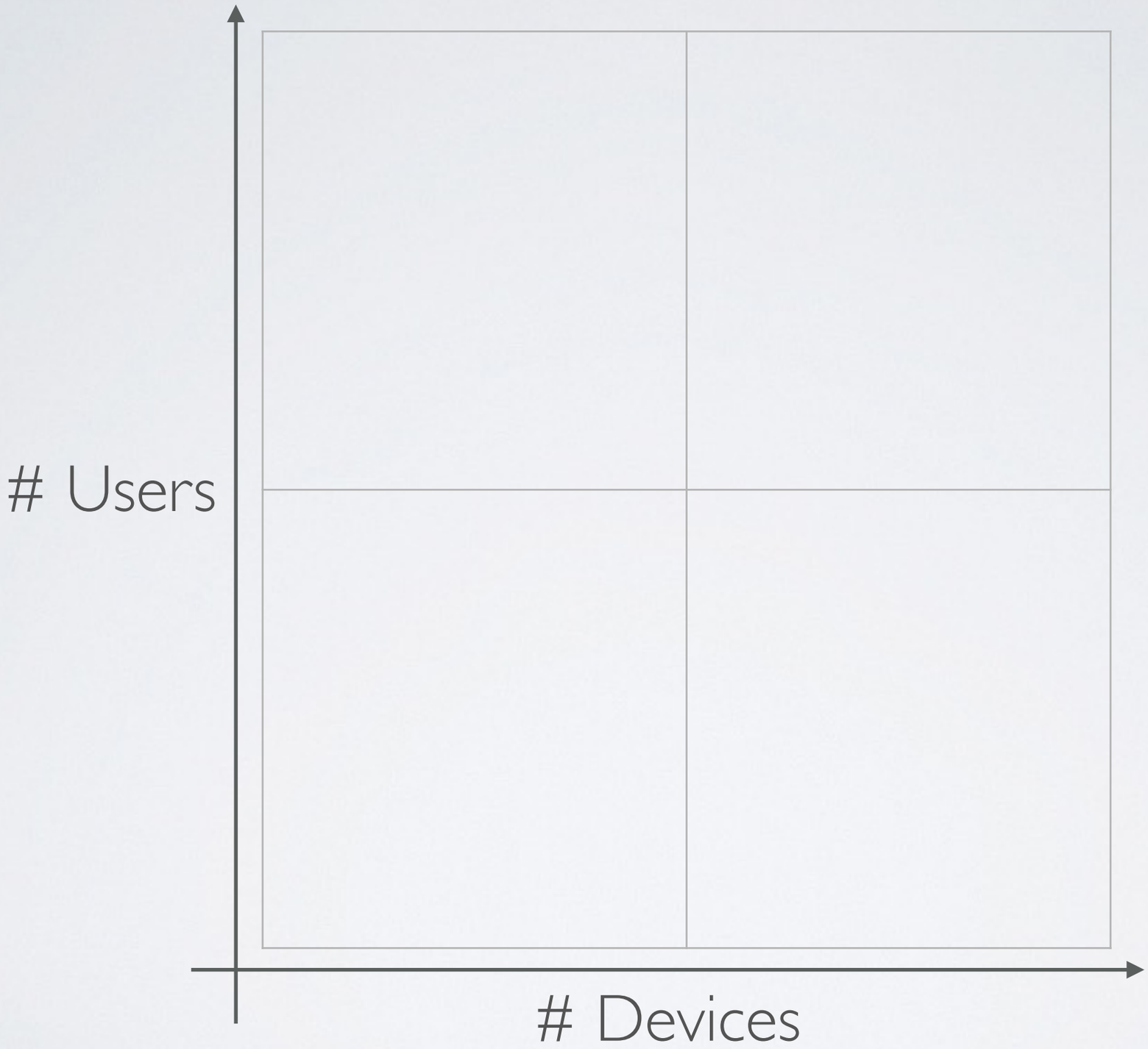
Faculty
of Informatics

Architecture, Design and Web Informations Systems Engineering Group

DEPLOYING STATEFUL WEB COMPONENTS ON MULTIPLE DEVICES WITH LIQUID.JS FOR POLYMER

Andrea Gallidabino
Cesare Pautasso

Deploying Stateful Web Components on Multiple Devices with Liquid.js for Polymer



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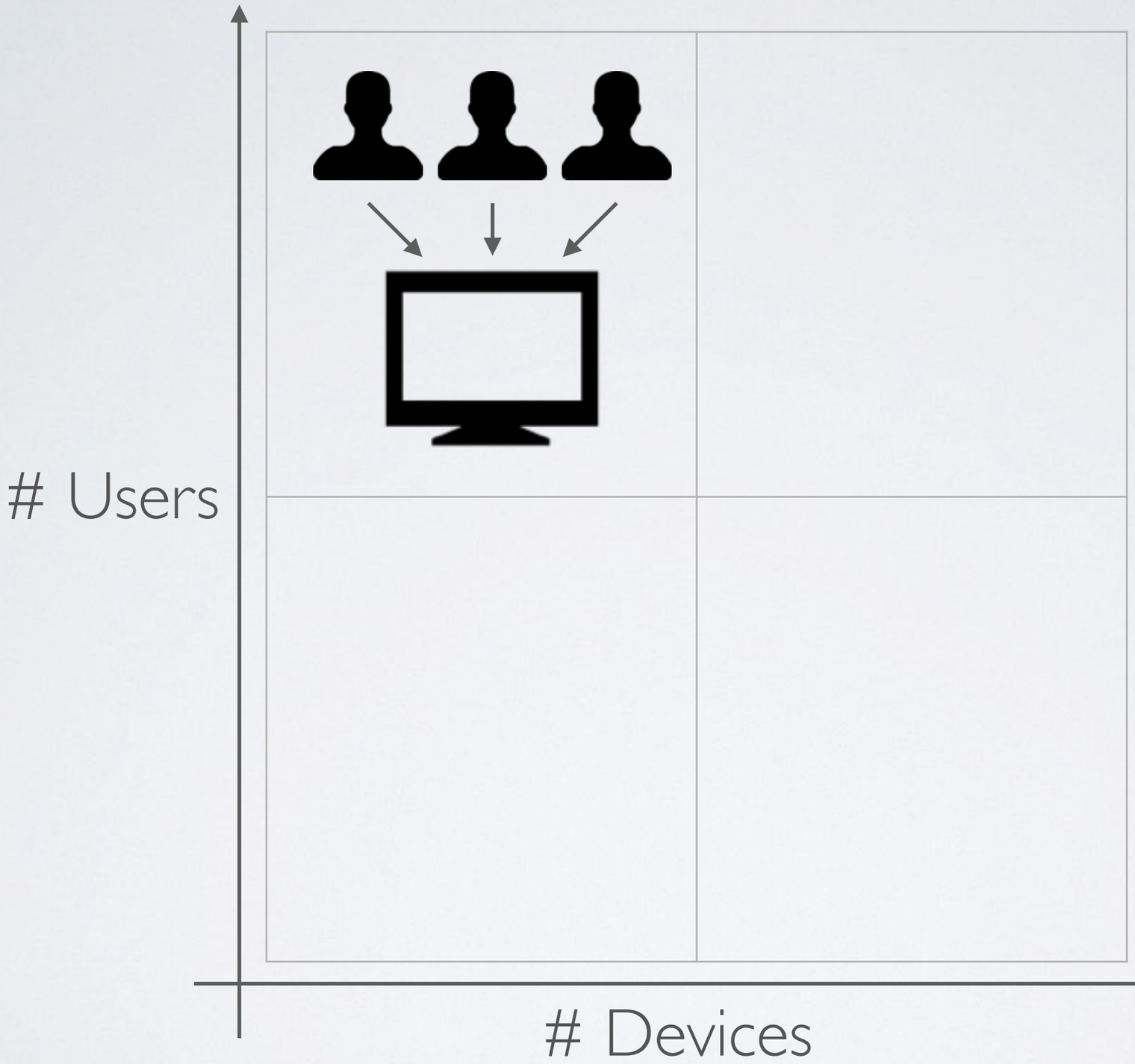

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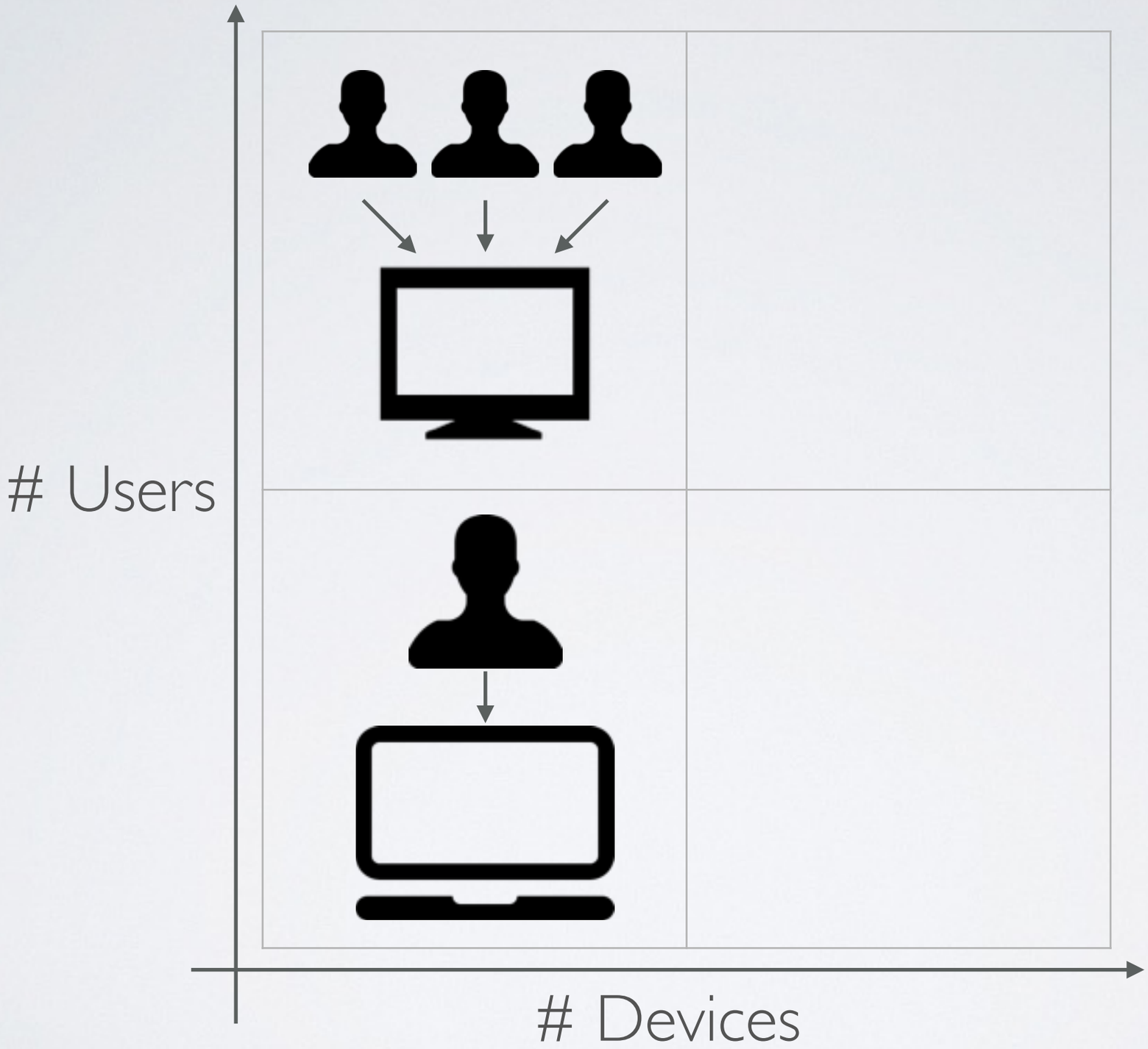

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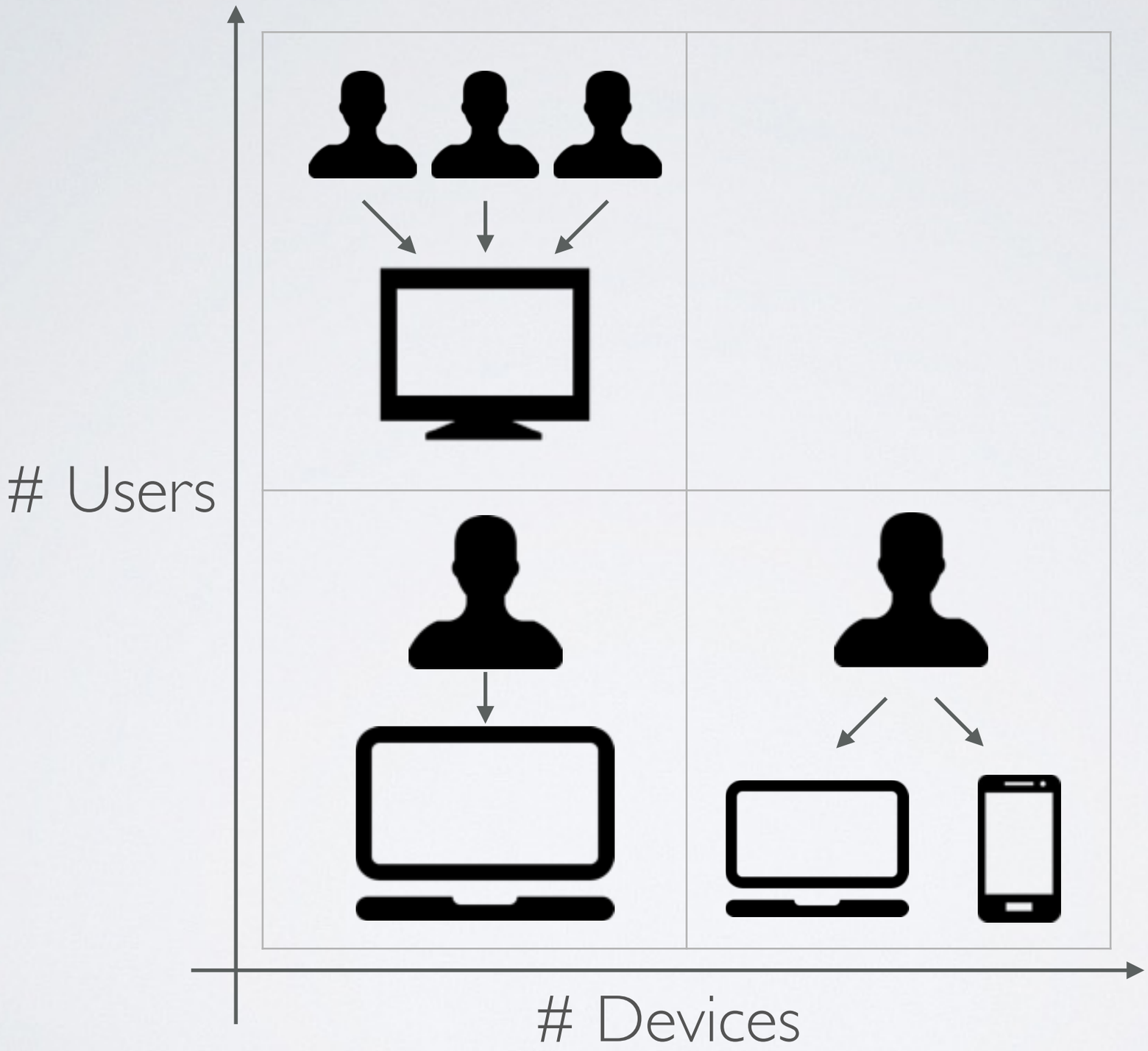

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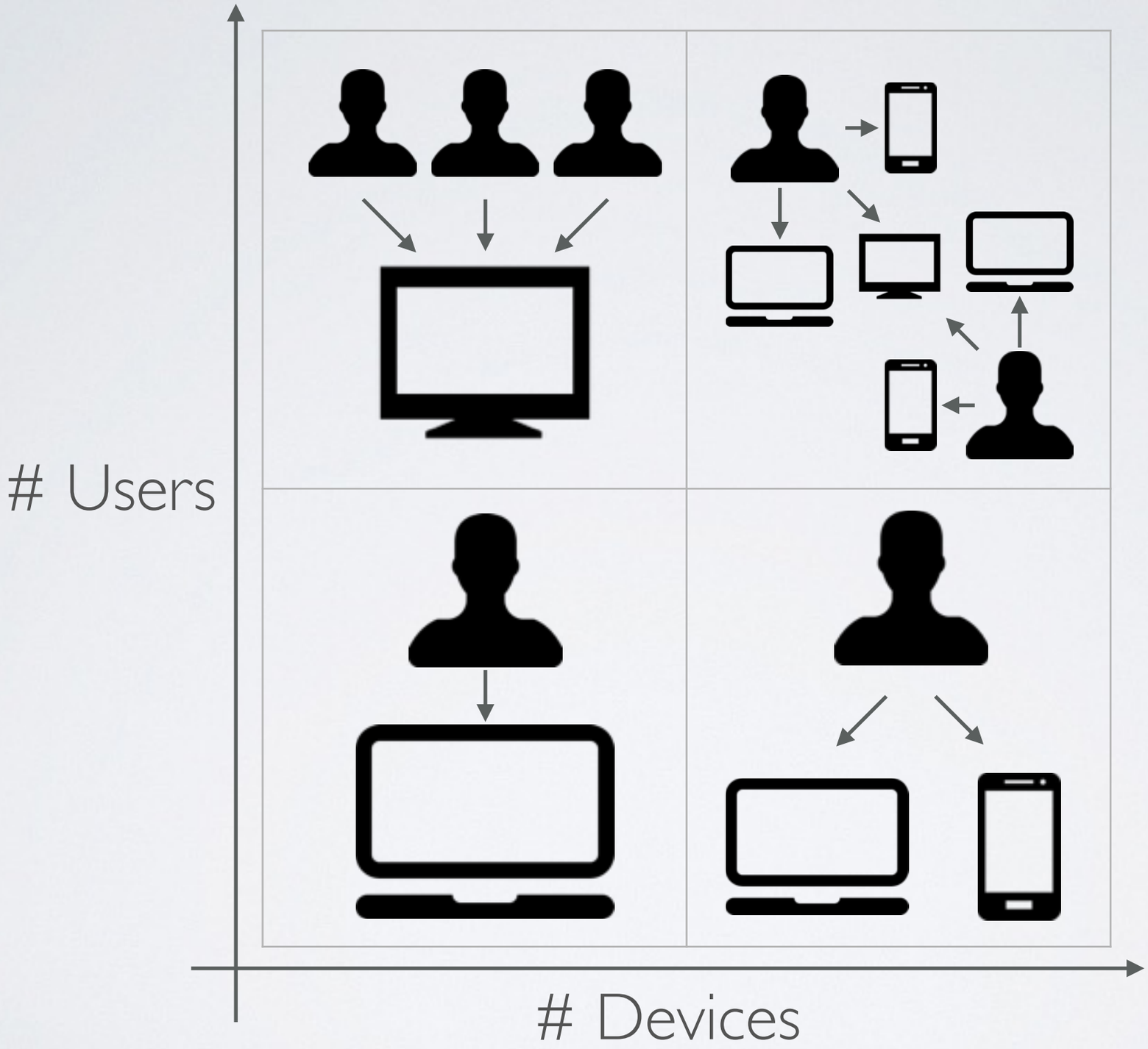
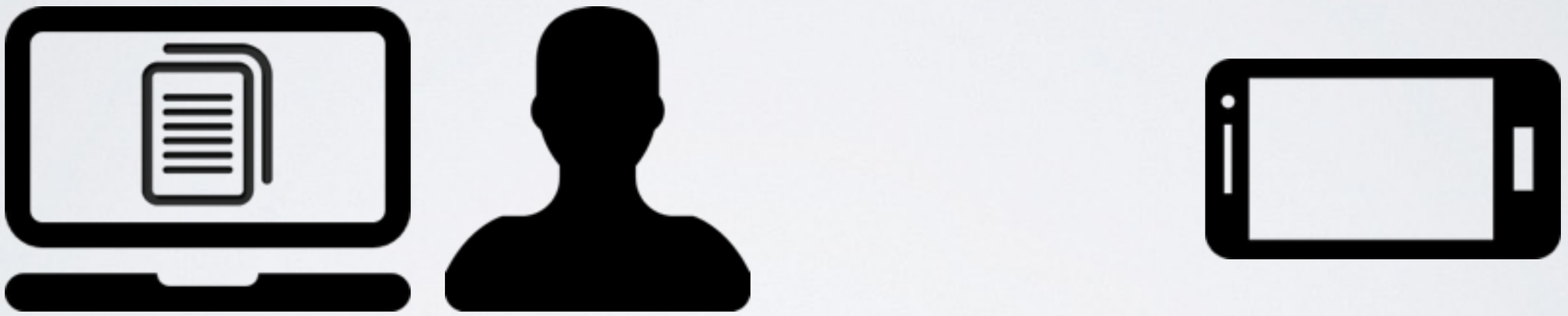


SEQUENTIAL SCREENING

SEQUENTIAL SCREENING



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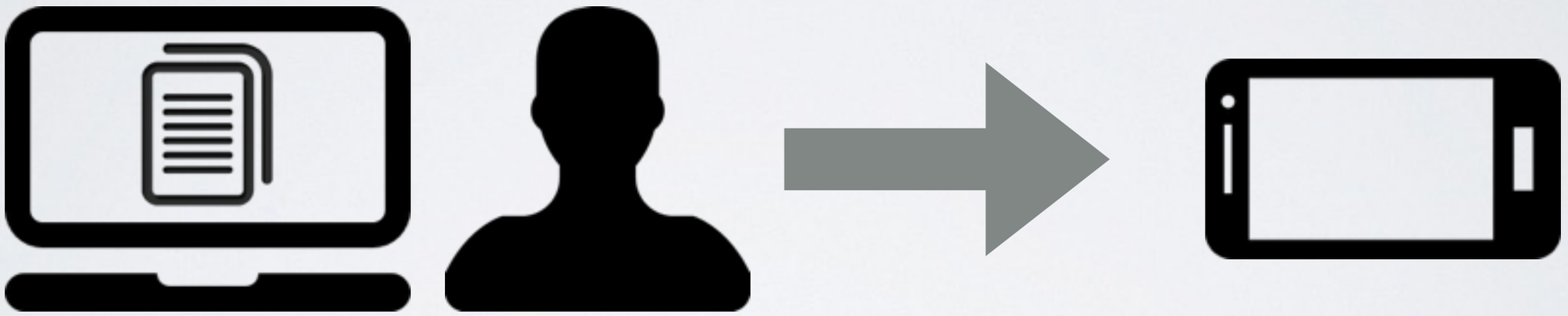

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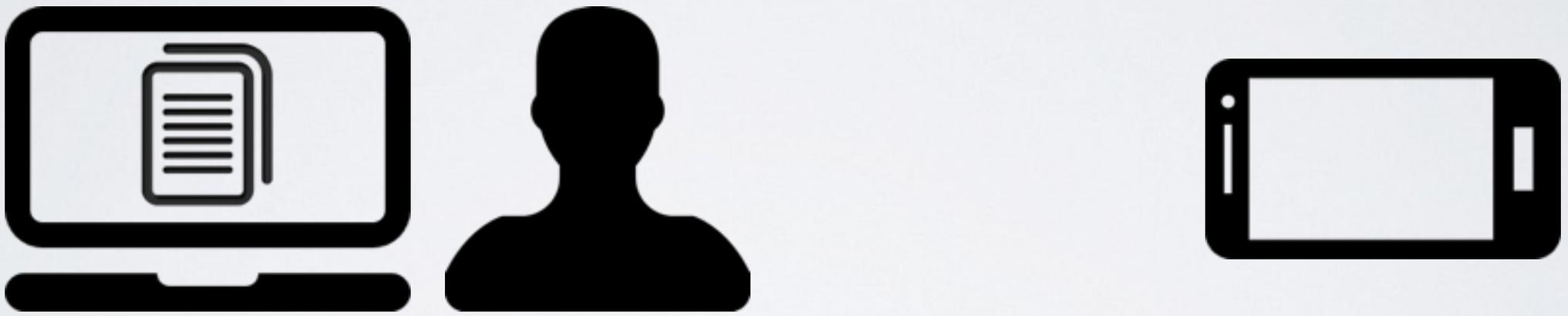

SEQUENTIAL SCREENING

SEQUENTIAL SCREENING

APPLE HAND-OFF

SIMULTANEOUS SCREENING

SIMULTANEOUS SCREENING

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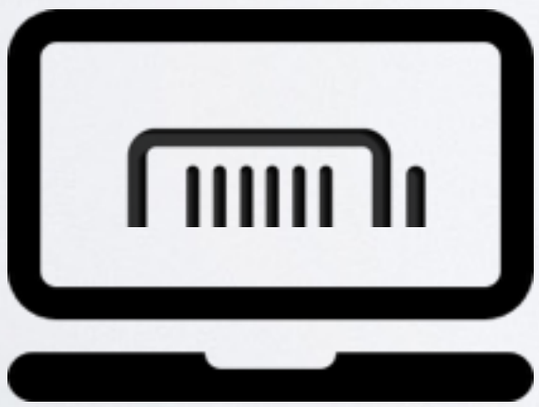
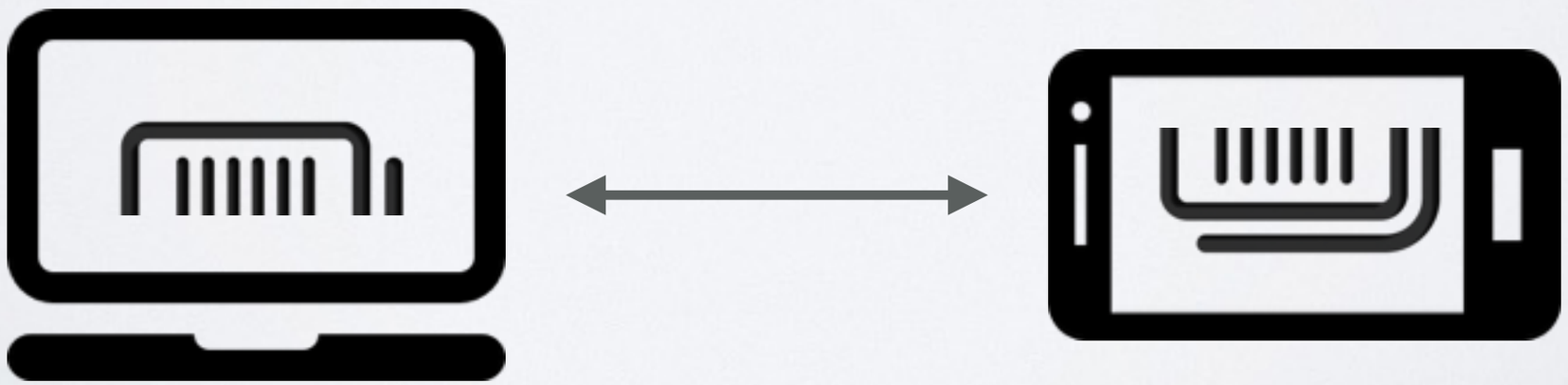


SIMULTANEOUS SCREENING



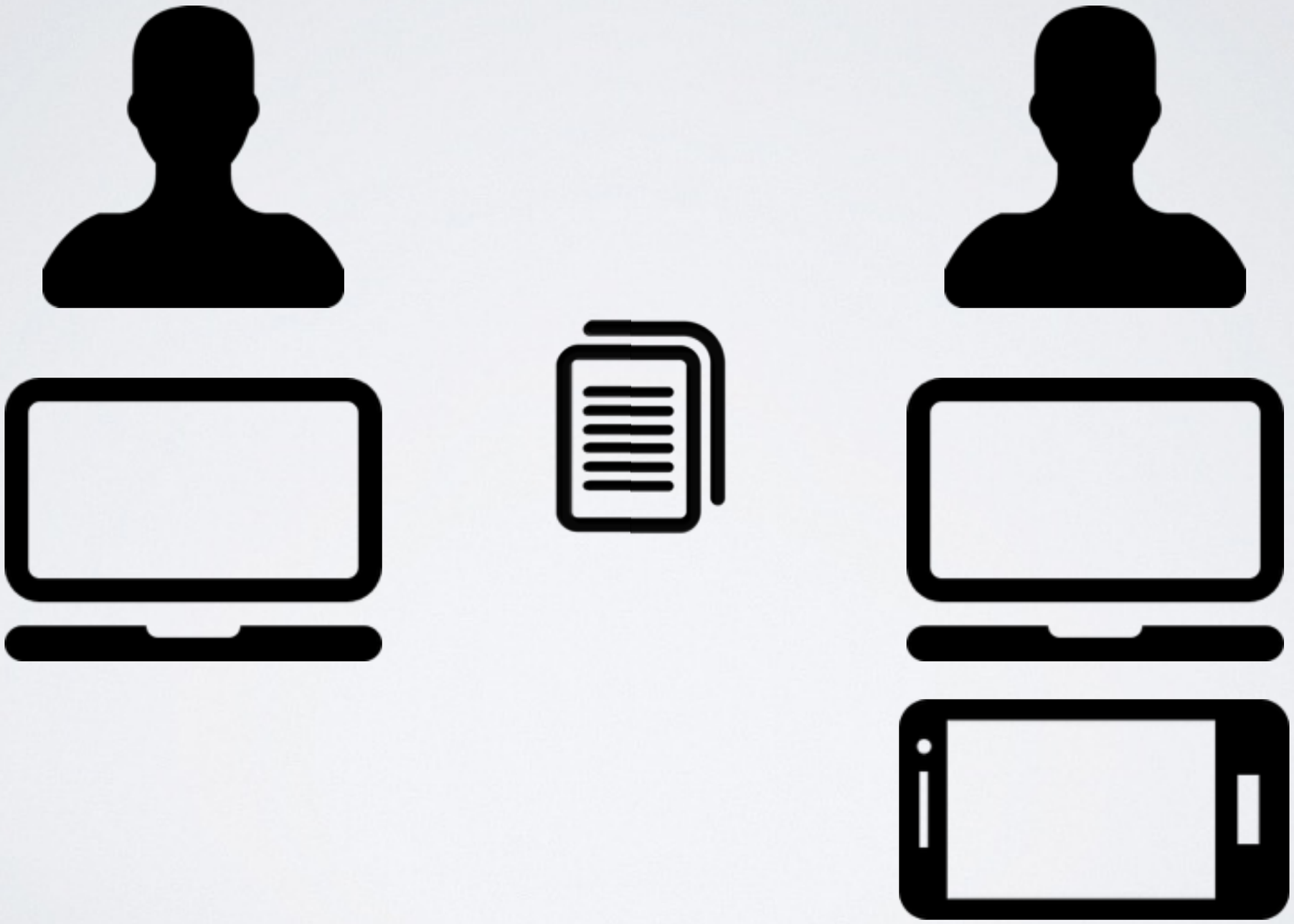
COLLABORATIVE SCENARIO

COLLABORATIVE SCENARIO





COLLABORATIVE SCENARIO



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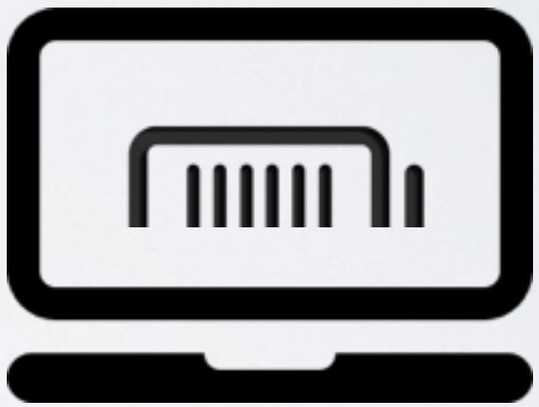

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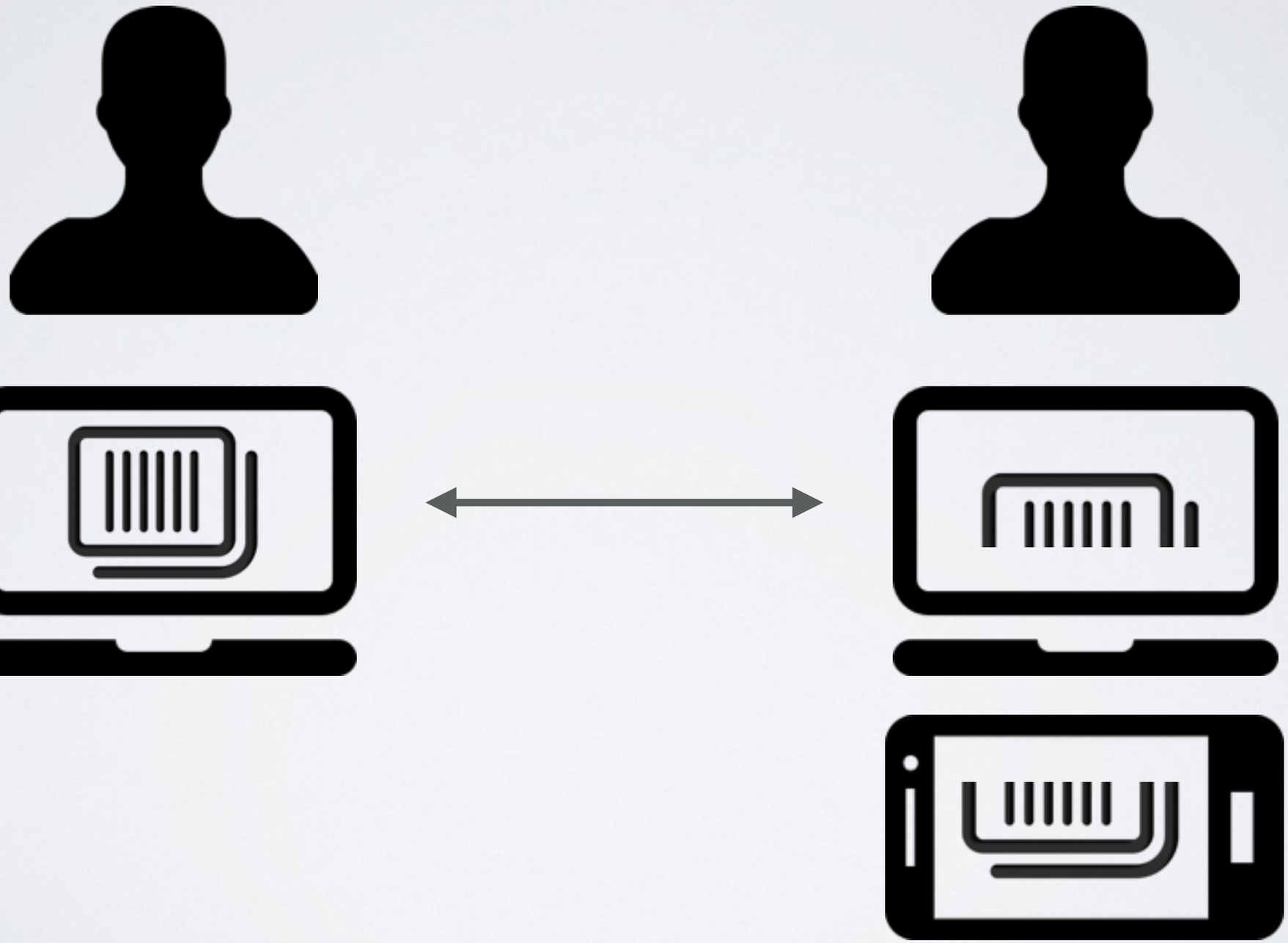

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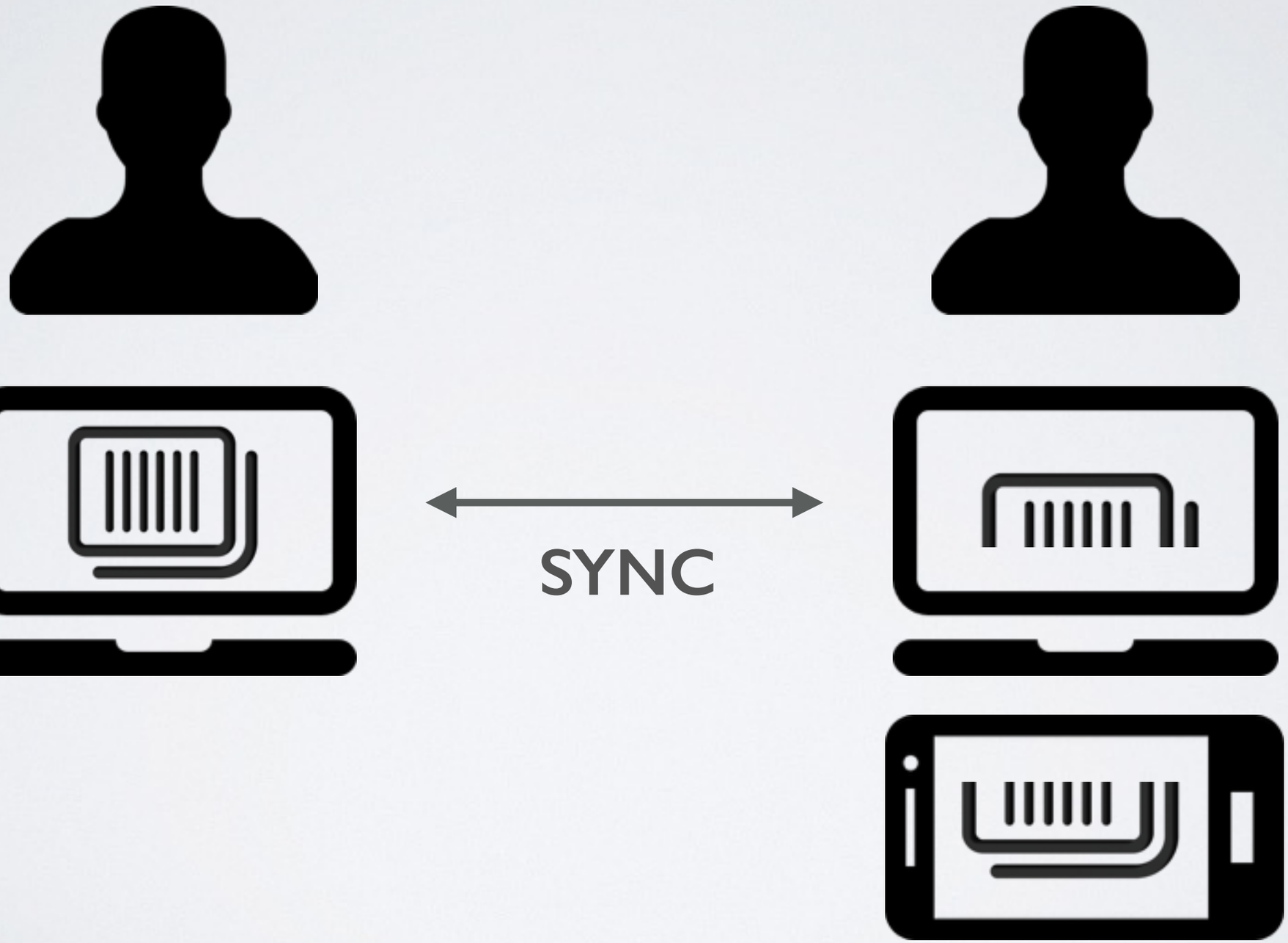


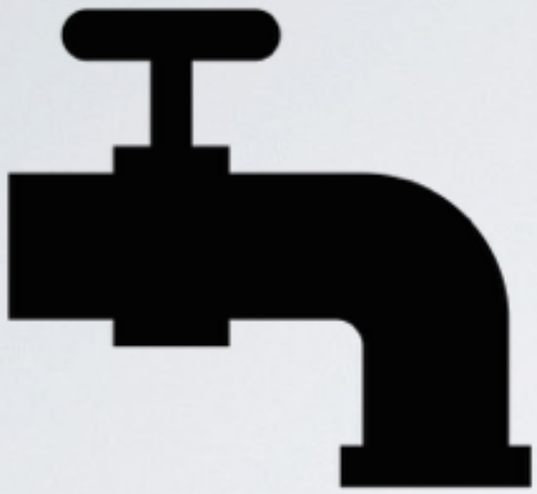
MULTI-DEVICE SOFTWARE

Adapts to **a set of** heterogeneous devices

Dynamic Migration (sequential scenarios)

State Synchronisation (collaborative scenarios)

METAPHOR



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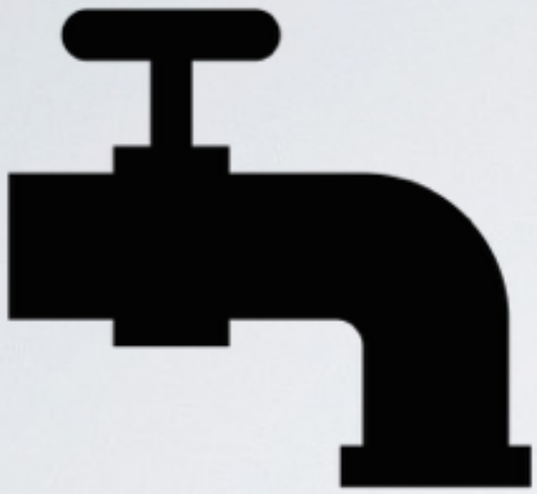

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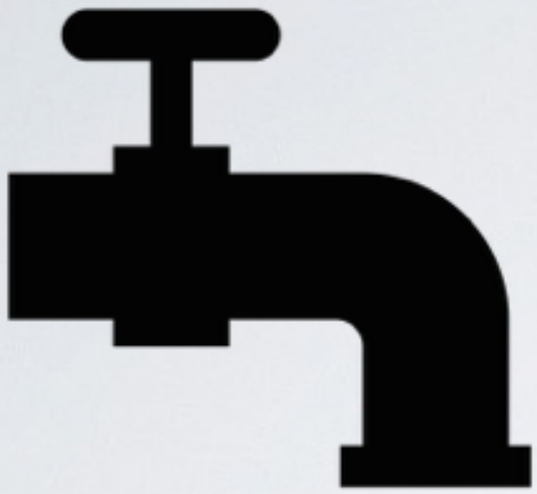

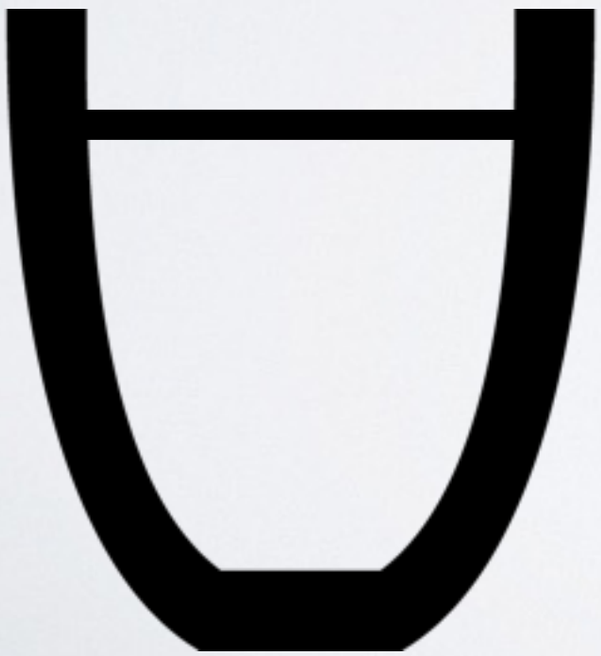

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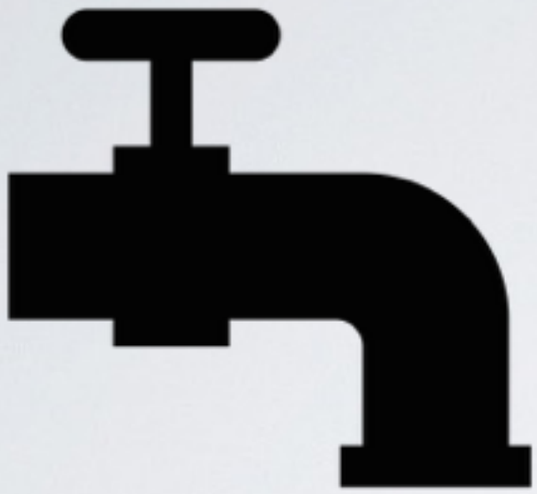

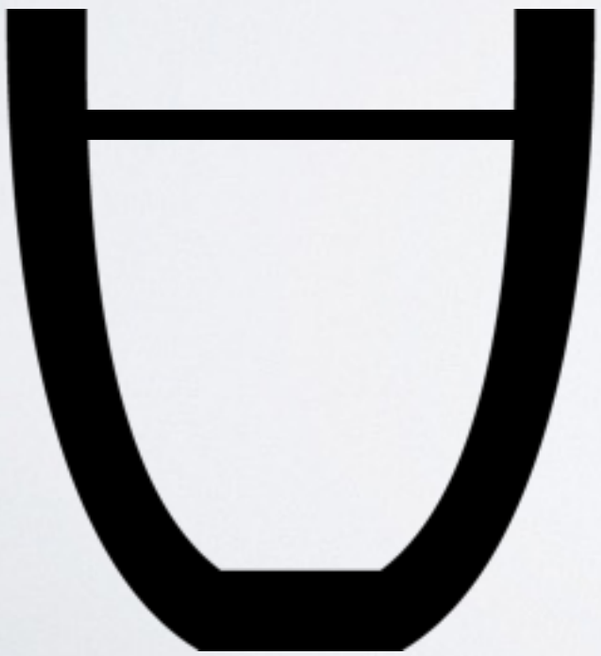

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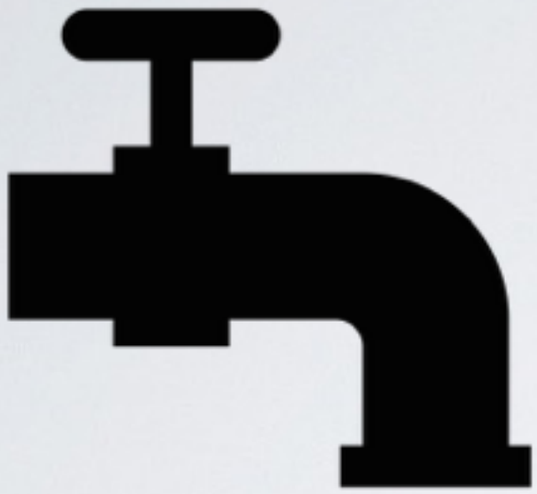

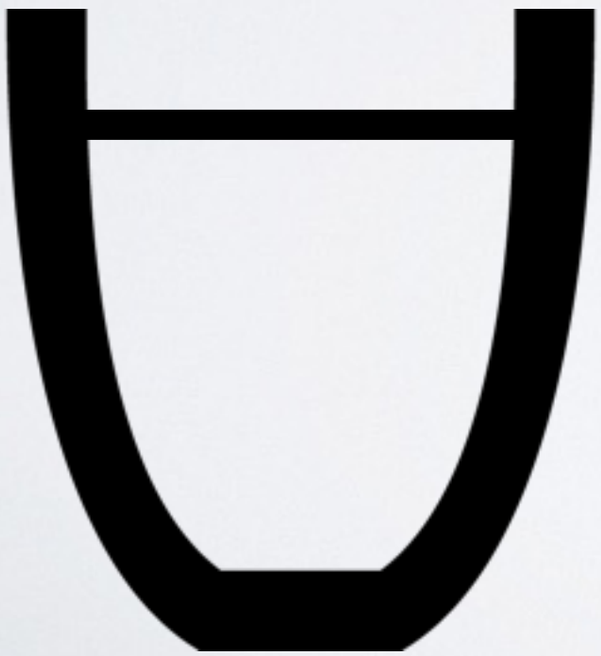

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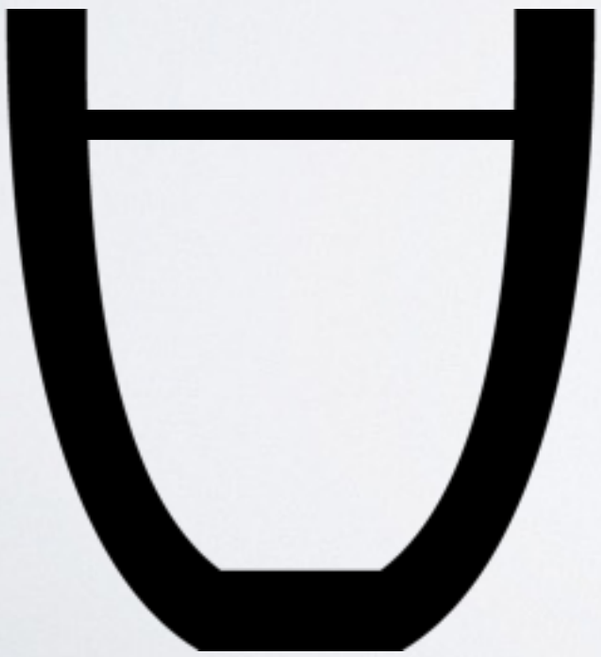

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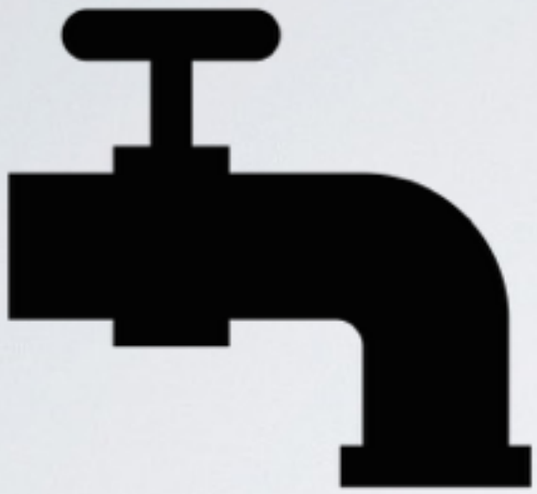
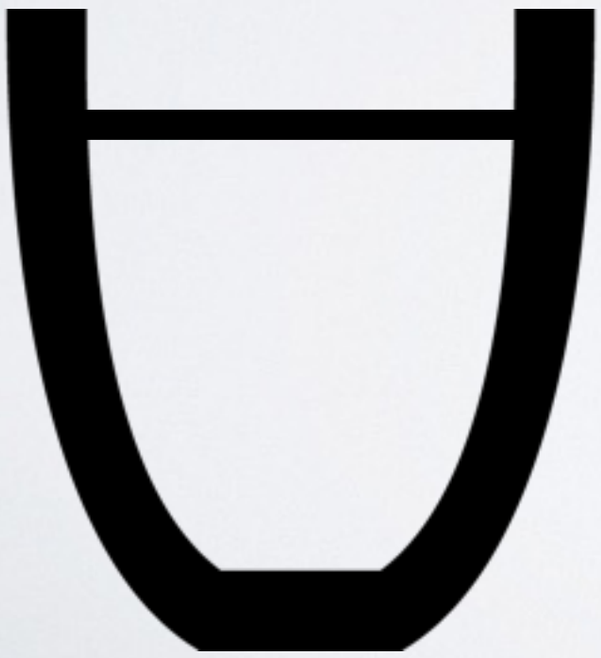
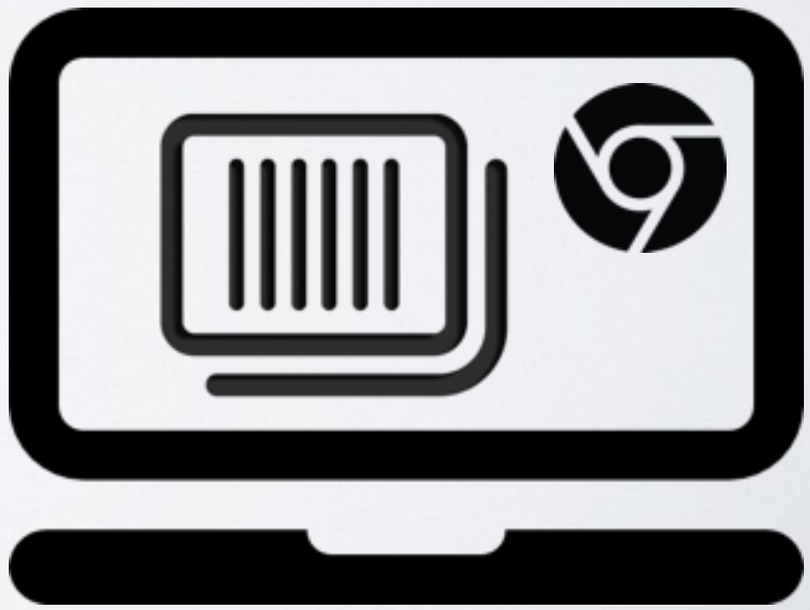






LIQUID APPLICATIONS

LIQUID APPLICATIONS

Roaming from a device to another one

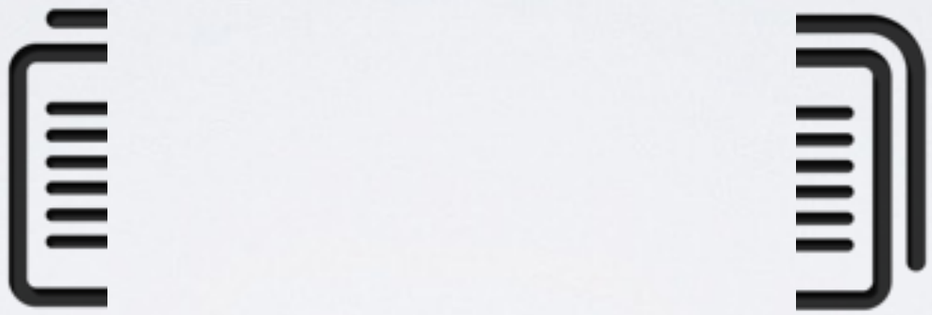
LIQUID APPLICATIONS

Roaming from a device to another one following user attention

LIQUID.JS FOR POLYMER

COMPONENT-BASED

COMPONENT-BASED



COMPONENT-BASED

COMPONENT-BASED

WebComponents Standard

COMPONENT-BASED

WebComponents Standard

Polymer Framework

COMPONENT-BASED

WebComponents Standard

Polymer Framework

Fine-grained decomposition

COMPONENT API

Device 1

Device 2

COMPONENT API

Device 1

Create(component_Type, device)

Device 2

COMPONENT API

Device 1

Create(component_Type, device)

Device 2

COMPONENT API

Device 1

Create(component_Type, device)

Delete(component)

Device 2

COMPONENT API

Device 1

Create(component_Type, device)

Delete(component)

Device 2

COMPONENT API

Device 1

Device 2

Create(component_Type, device)

Delete(component)

Move(component, device)

COMPONENT API

Device 1

Device 2

Create(component_Type, device)

Delete(component)

Move(component, device)

COMPONENT API

Device 1

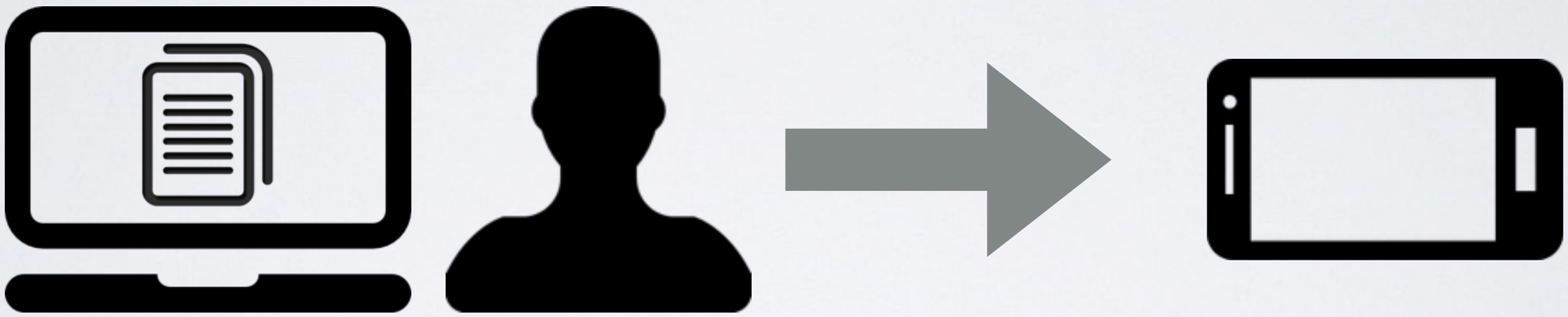
Device 2

Create(component_Type, device)

Delete(component)

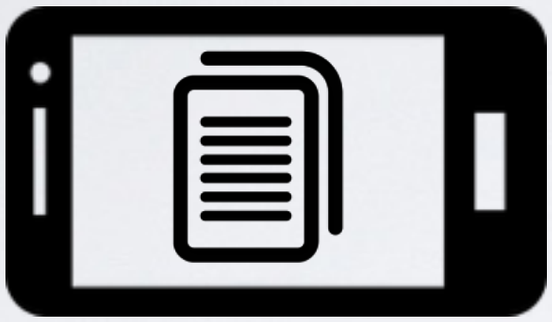
Move(component, device)

SEQUENTIAL SCREENING



COMPONENT API

Device 1



Device 2

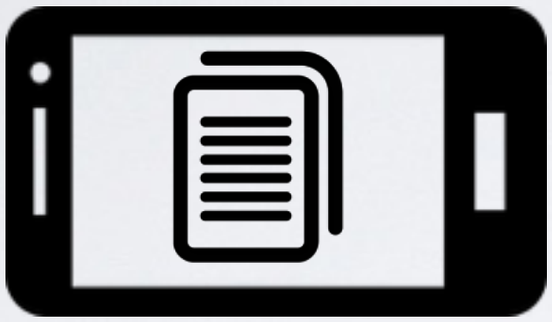
Create(component_Type, device)

Delete(component)

Move(component, device)

COMPONENT API

Device 1



Device 2

Create(component_Type, device)

Delete(component)

Move(component, device)

Fork(component, device)

COMPONENT API

Device 1

Create(component_Type, device)

Delete(component)

Move(component, device)

Fork(component, device)

Device 2

COMPONENT API

Device 1

Device 2

Create(component_Type, device)

Delete(component)

Move(component, device)

Fork(component, device)

Pair(component_1, component_2)

COMPONENT API

Device 1

SYNC

Device 2

Create(component_Type, device)

Delete(component)

Move(component, device)

Fork(component, device)

Pair(component_1, component_2)

COMPONENT API

Device 1

SYNC

Device 2

Create(component_Type, device)

Delete(component)

Move(component, device)

Fork(component, device)

Pair(component_1, component_2)

Clone(component, device)

COMPONENT API

Device 1

SYNC

Device 2

Create(component_Type, device)

Delete(component)

Move(component, device)

Fork(component, device)

Pair(component_1, component_2)

Clone(component, device)

Unpair(component_1, component_2)

COMPONENT API

Device 1

Device 2

Create(component_Type, device)

Delete(component)

Move(component, device)

Fork(component, device)

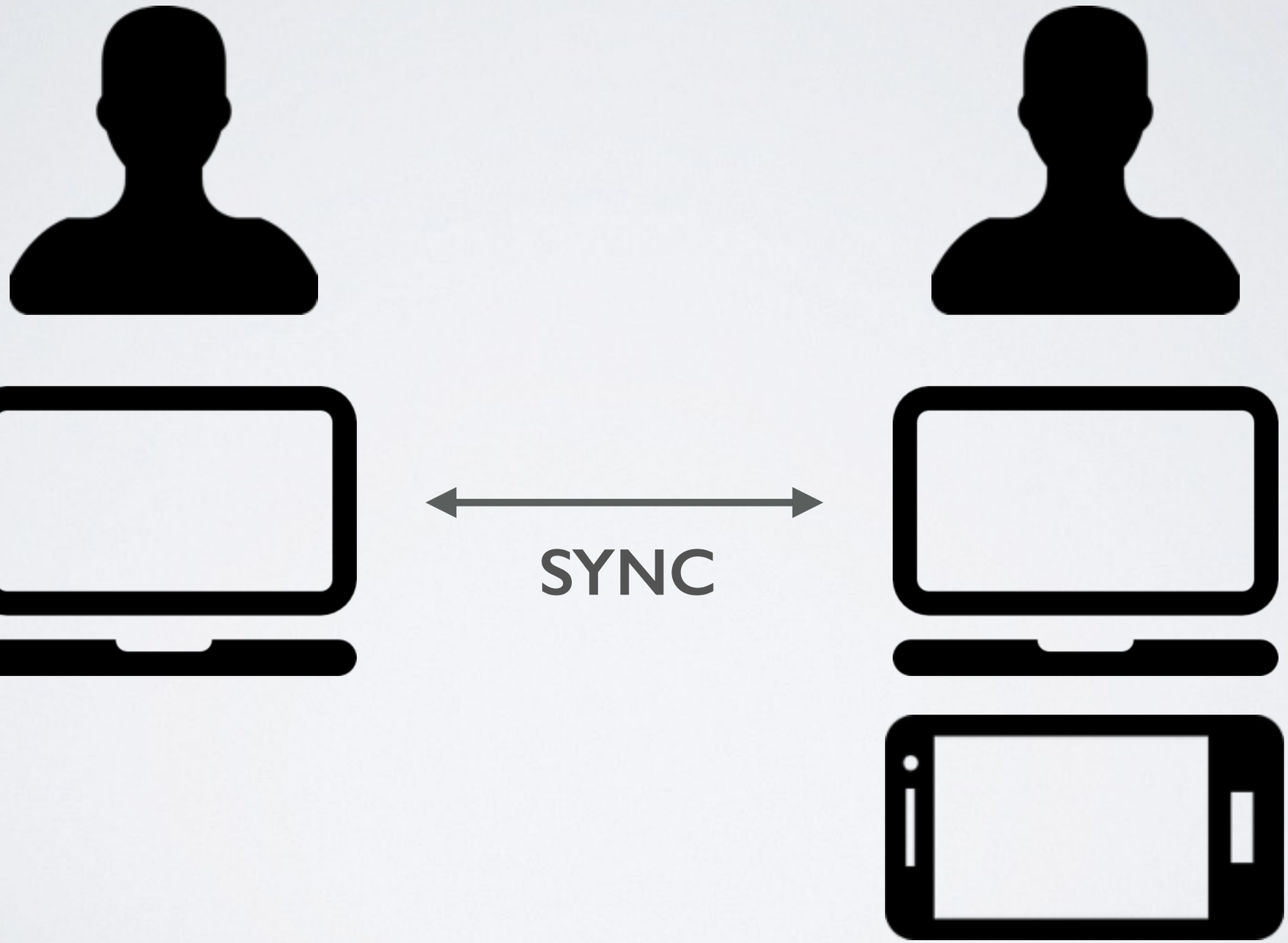
Pair(component_1, component_2)

Clone(component, device)

Unpair(component_1, component_2)

SIMULTANEOUS SCREENING

COLLABORATIVE SCENARIO



STATEFUL COMPONENTS

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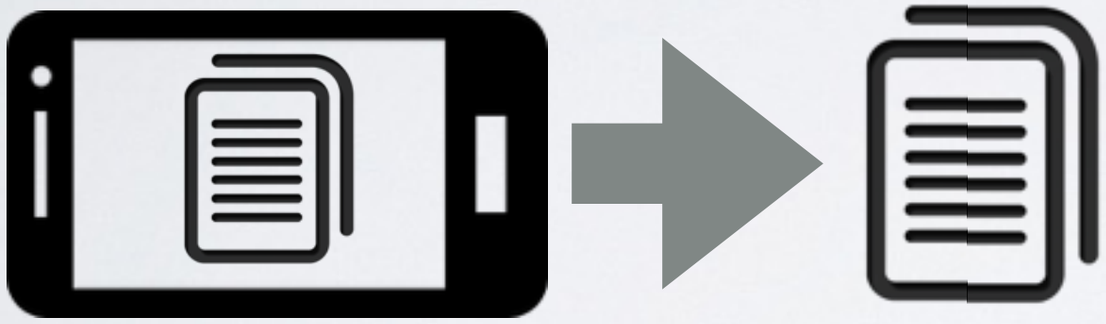
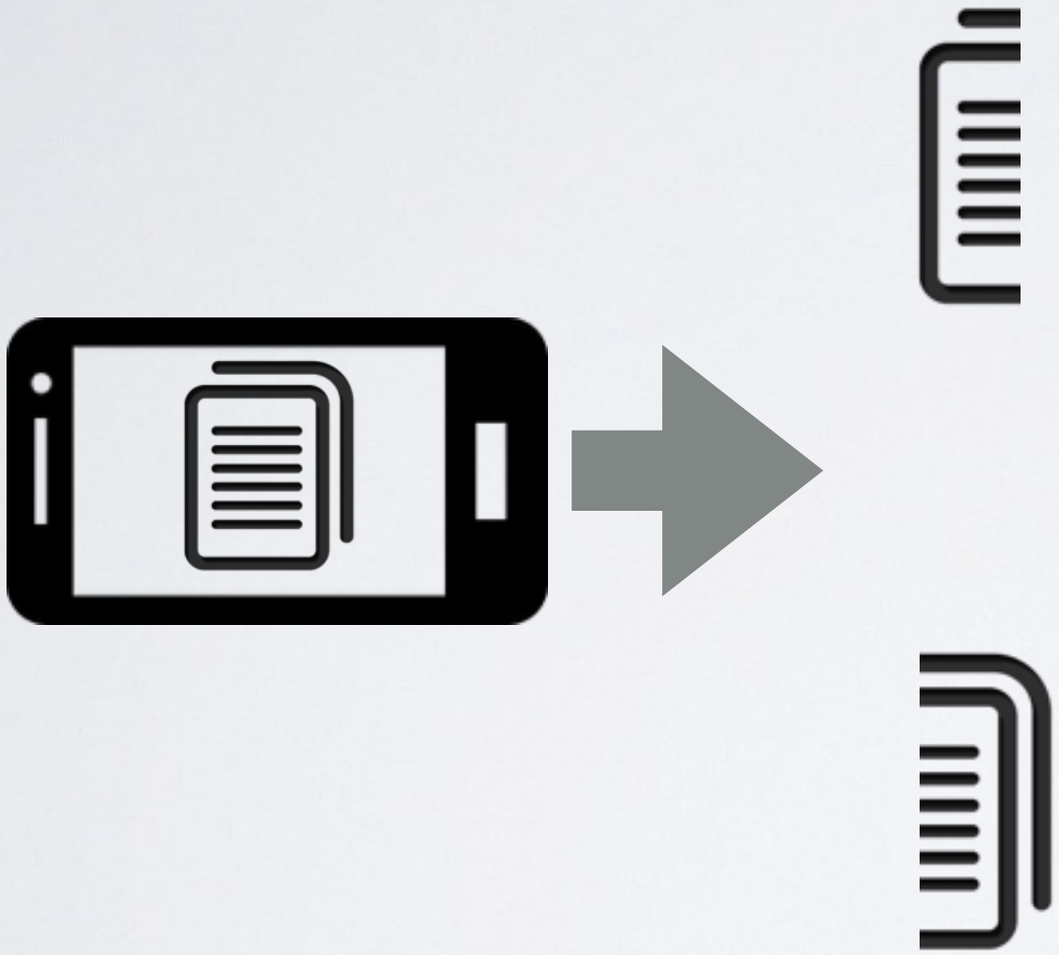
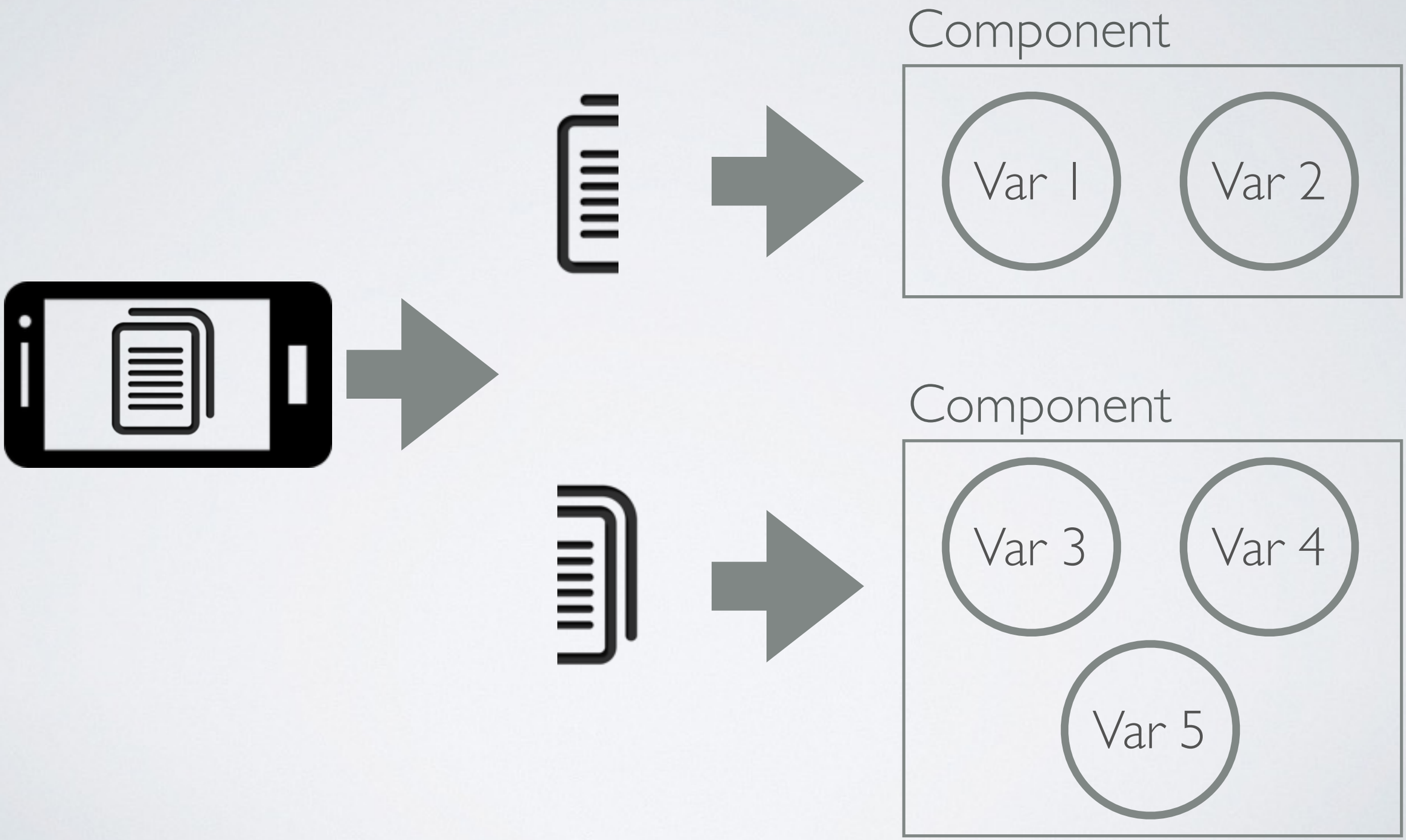


STATEFUL COMPONENTS



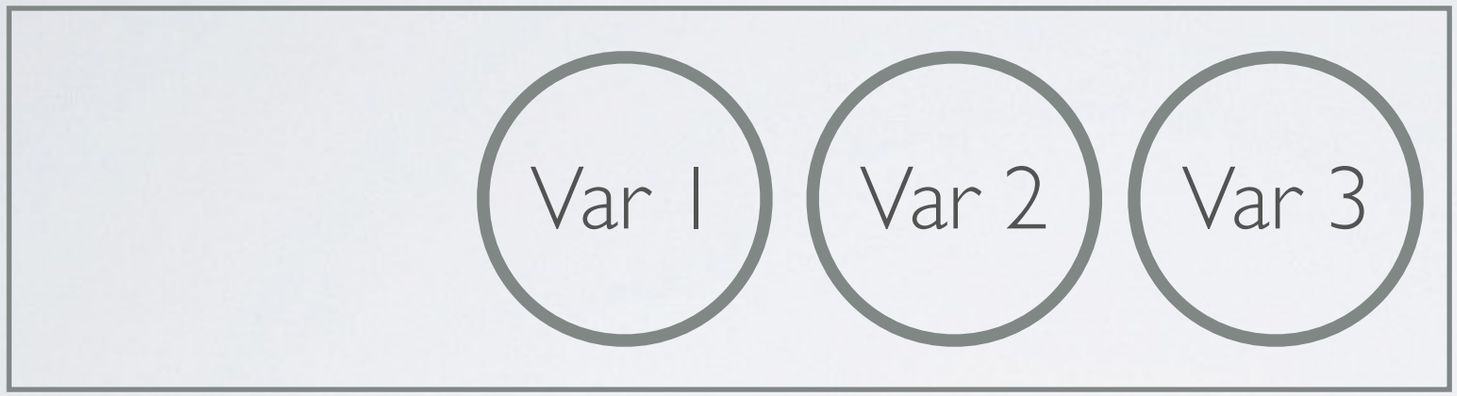
STATEFUL COMPONENTS



VARIABLE API

VARIABLE API

Component



VARIABLE API

VARIABLE API

Liquid Component

VARIABLE API

Liquid Component

Register (variable)

VARIABLE API

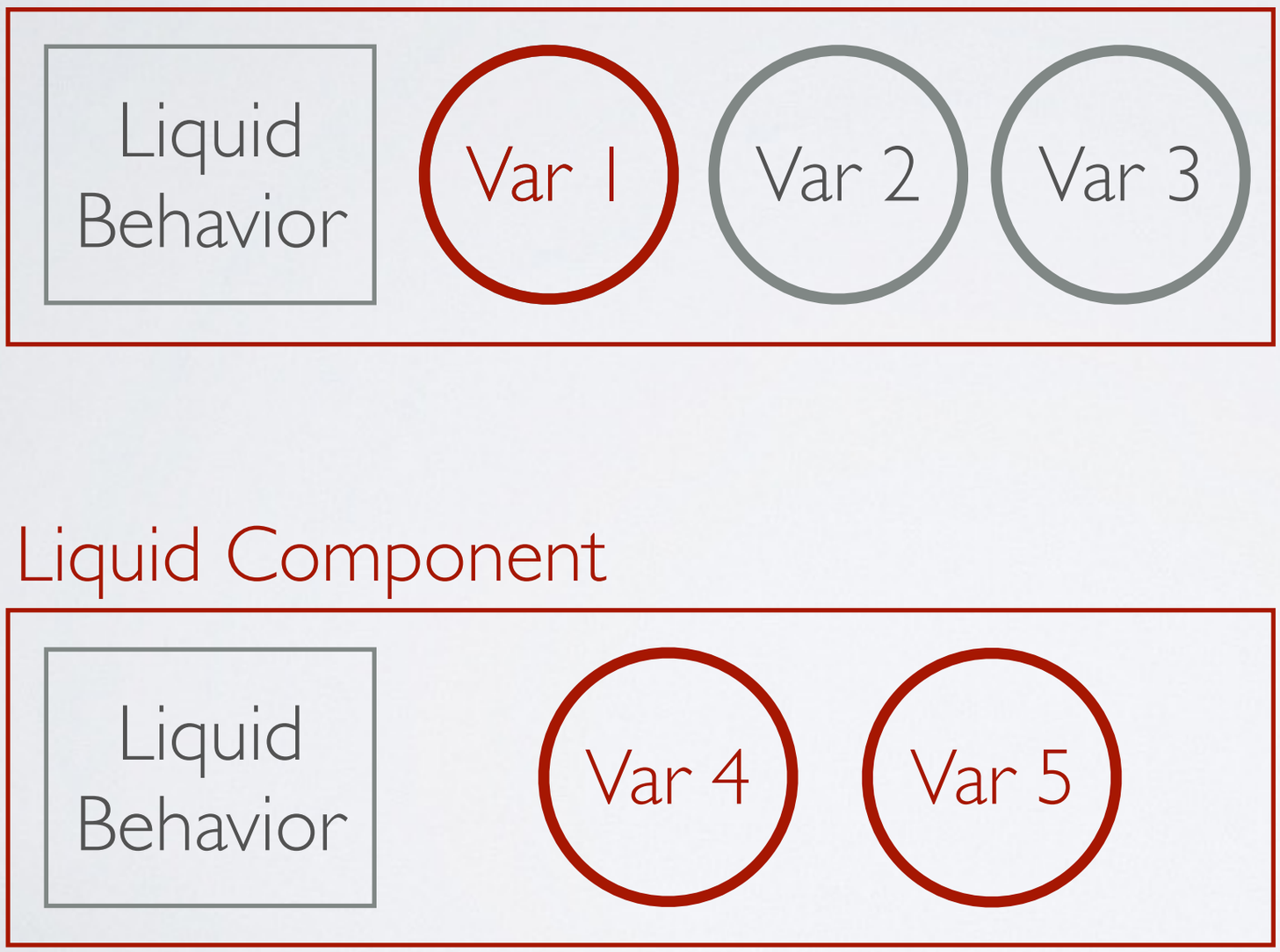
Register (variable)

VARIABLE API

Register (variable)

Pair (var_1, var_2)

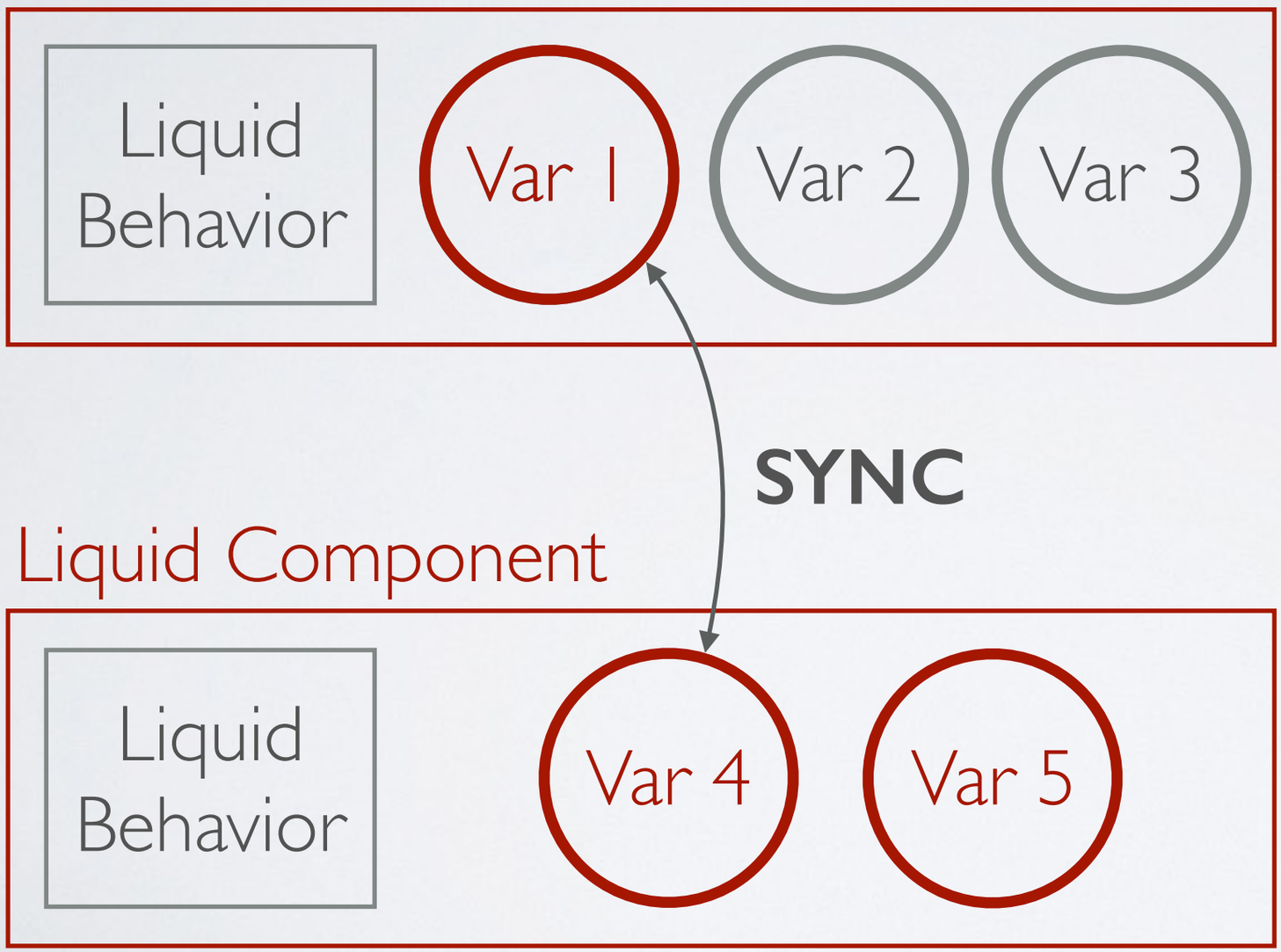
VARIABLE API



Register (variable)

Pair (var_1, var_2)

VARIABLE API



Register (variable)

Pair (var_1, var_2)

VARIABLE POLICIES

VARIABLE POLICIES

Sharing

VARIABLE POLICIES

Sharing

Component Scope

VARIABLE POLICIES

Sharing

Component Scope

Device Deployment

VARIABLE POLICIES

Sharing

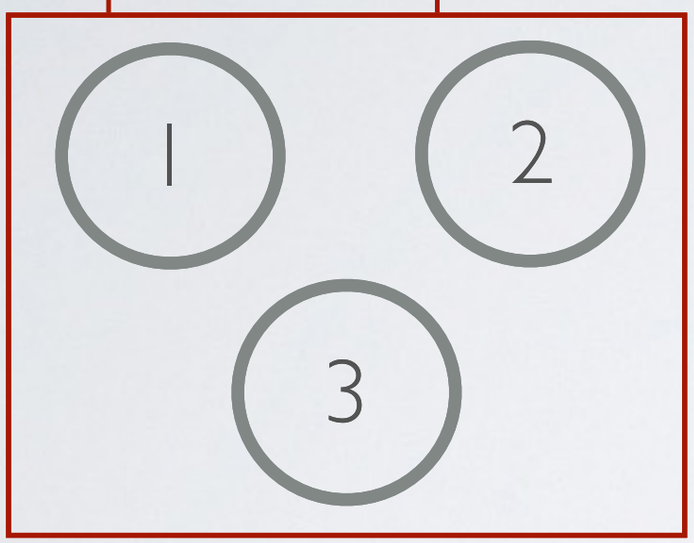
Component Scope

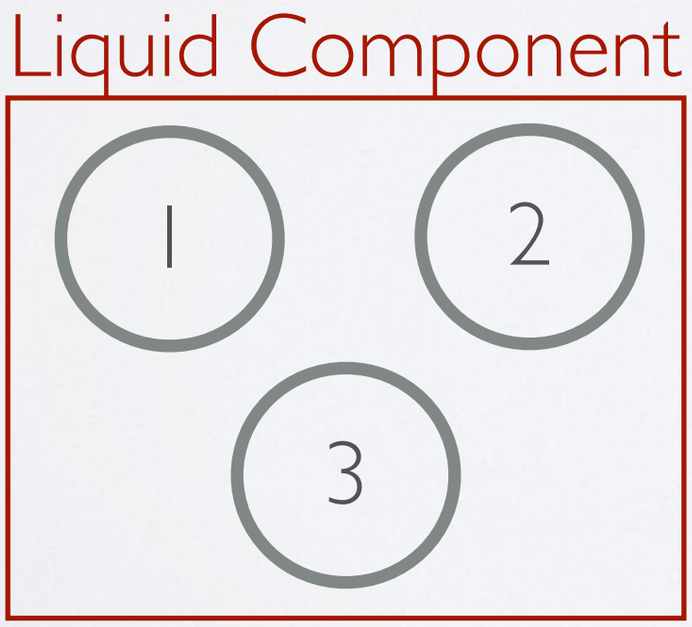
Device Deployment

Persistence

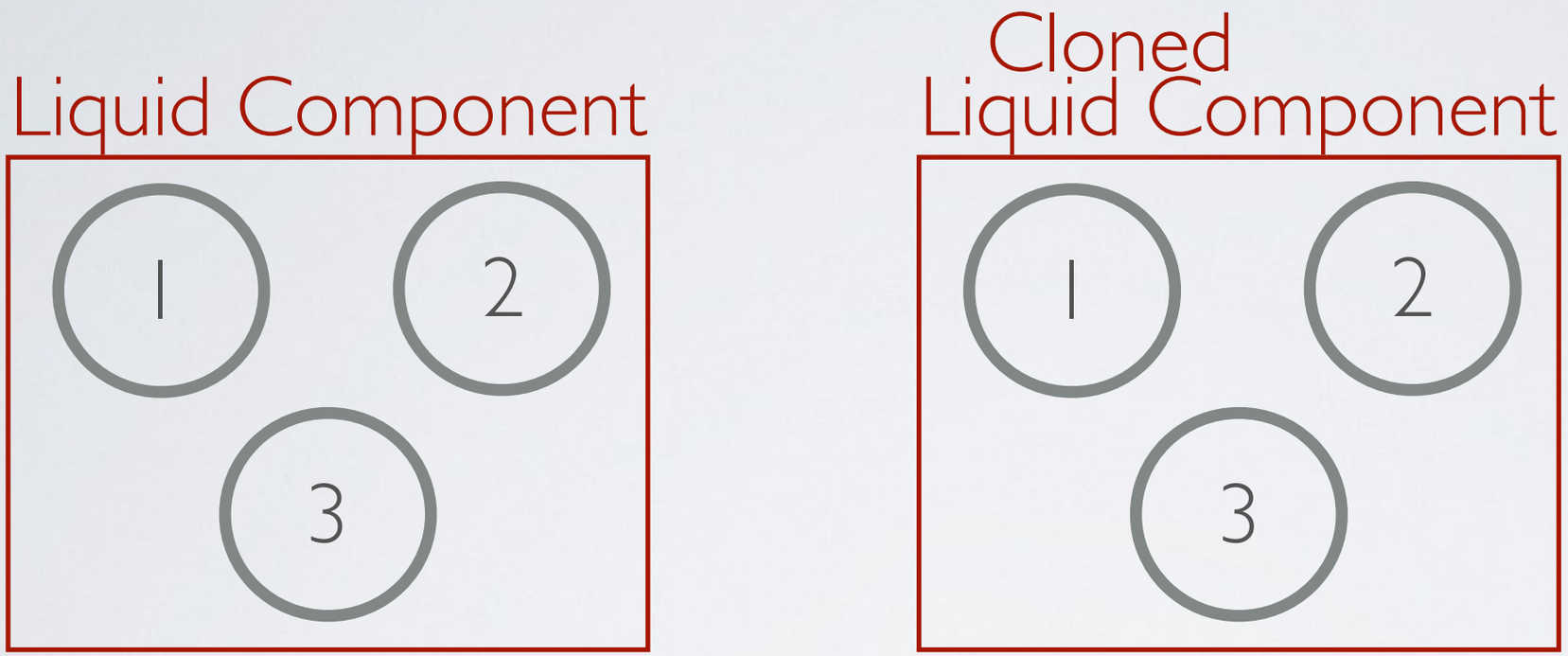
SHARING POLICY

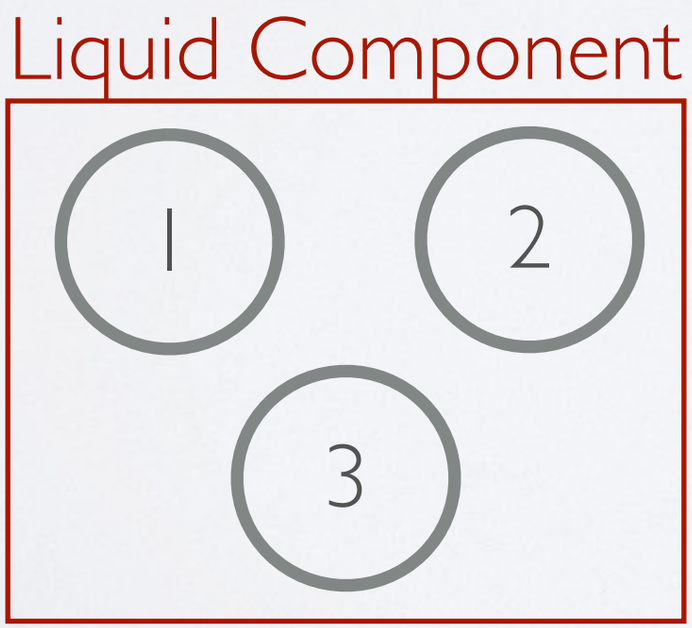
SHARING POLICY





SHARING POLICY





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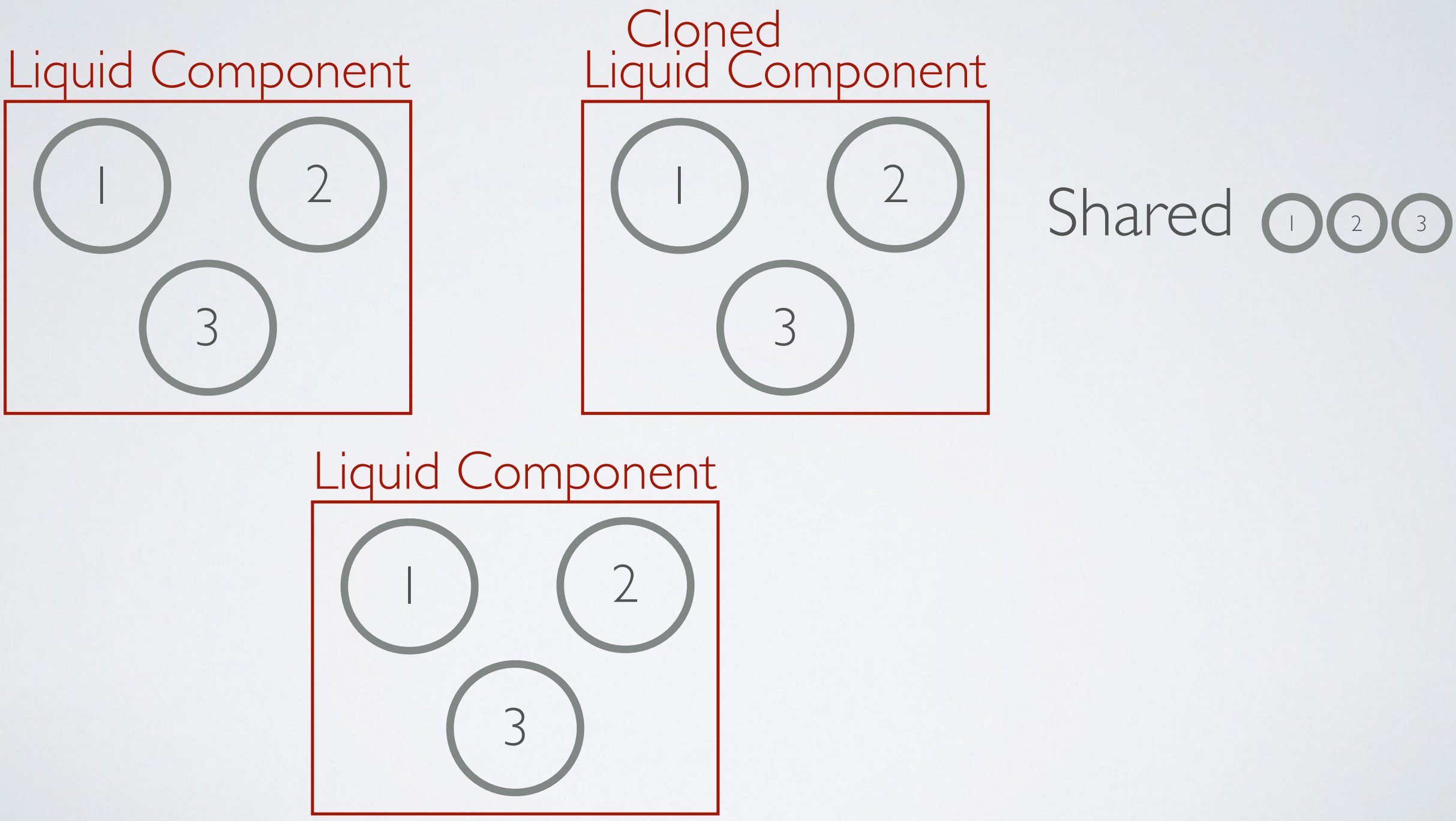

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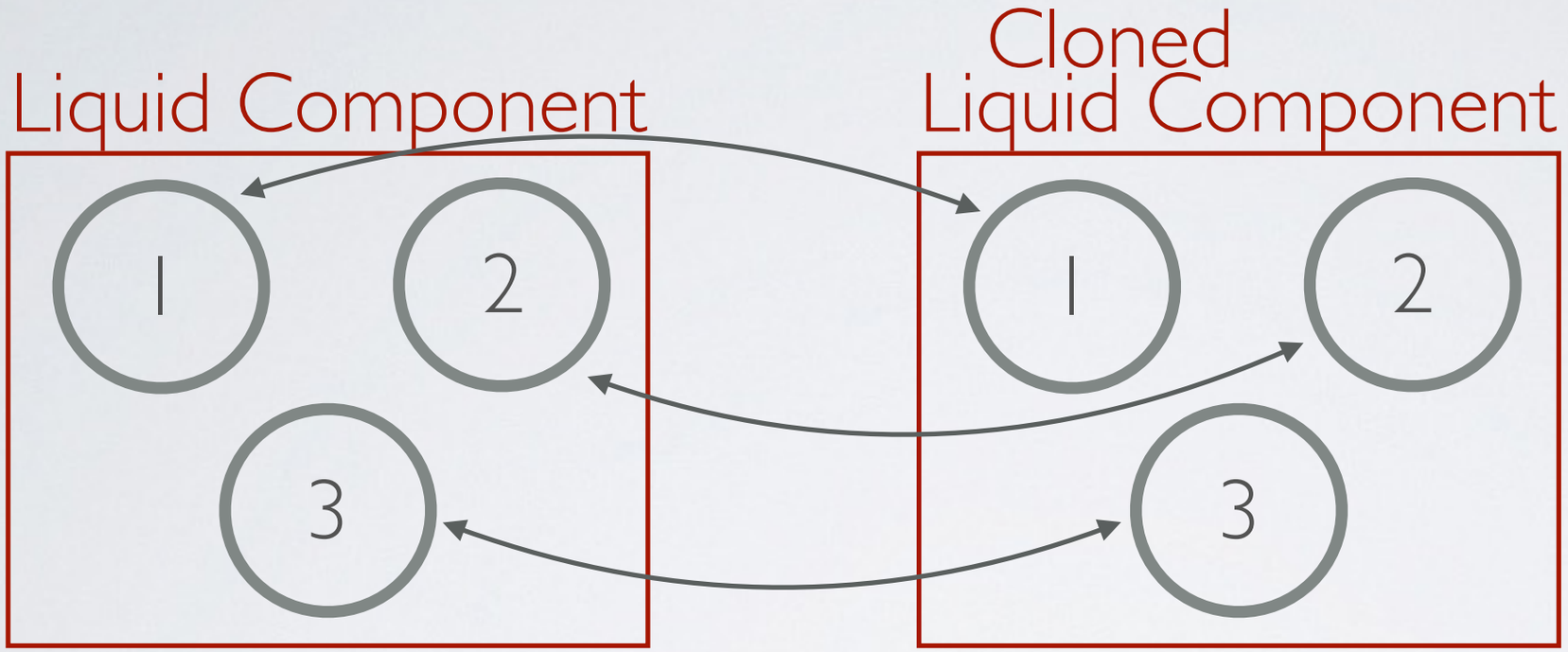

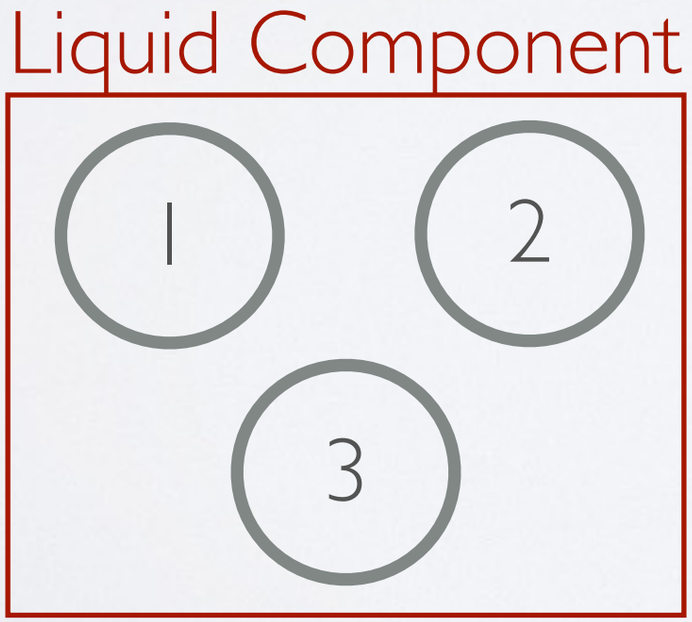

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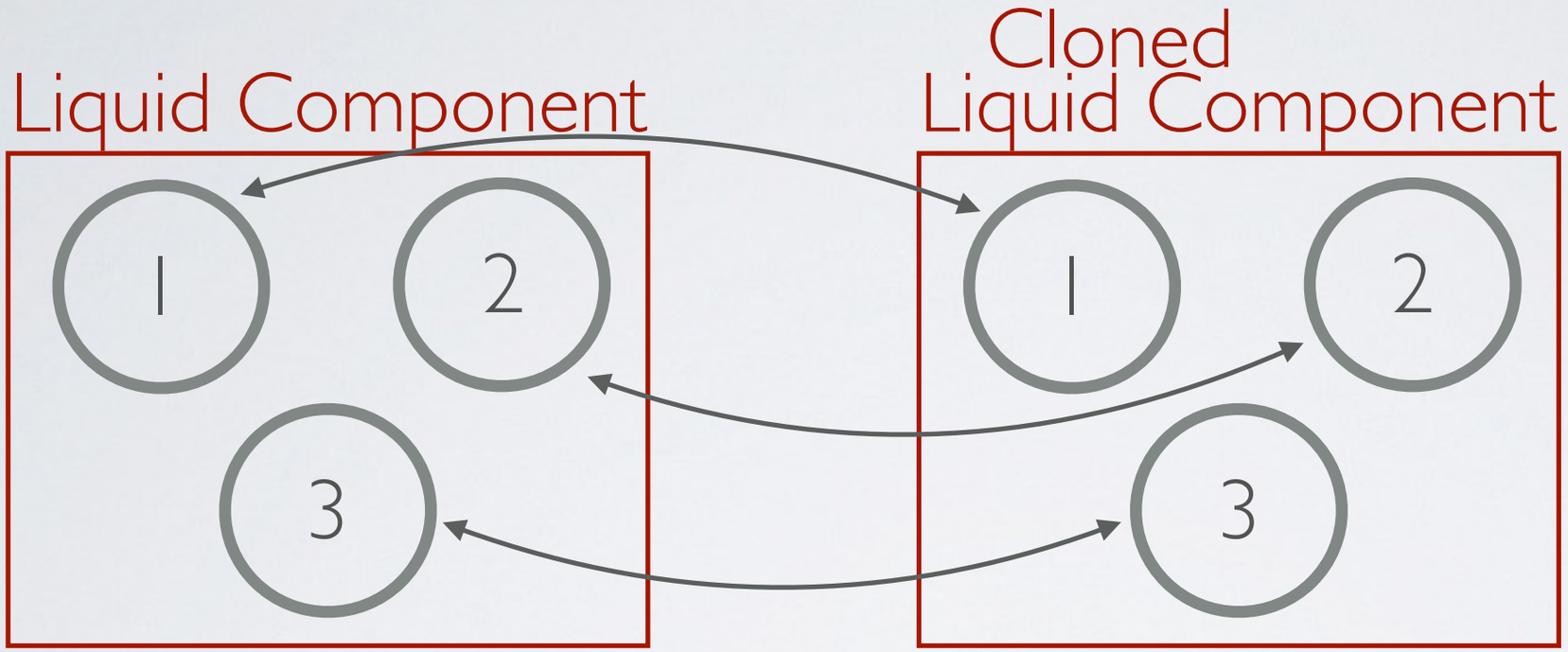

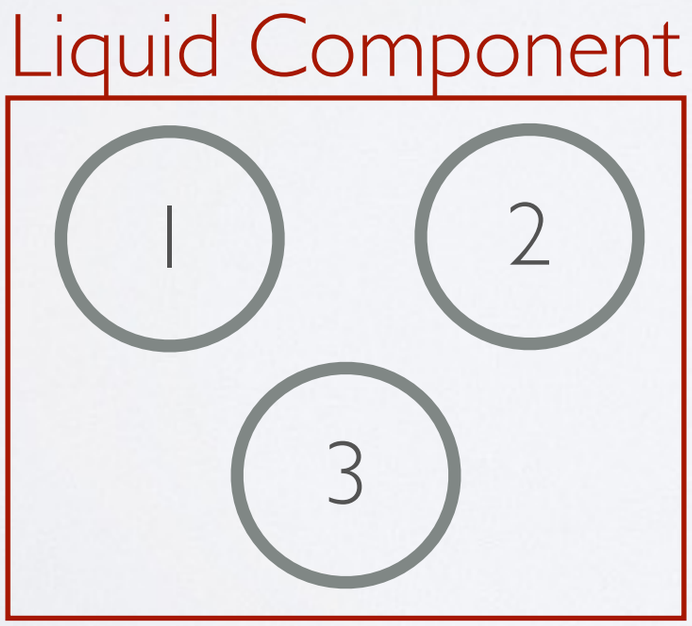

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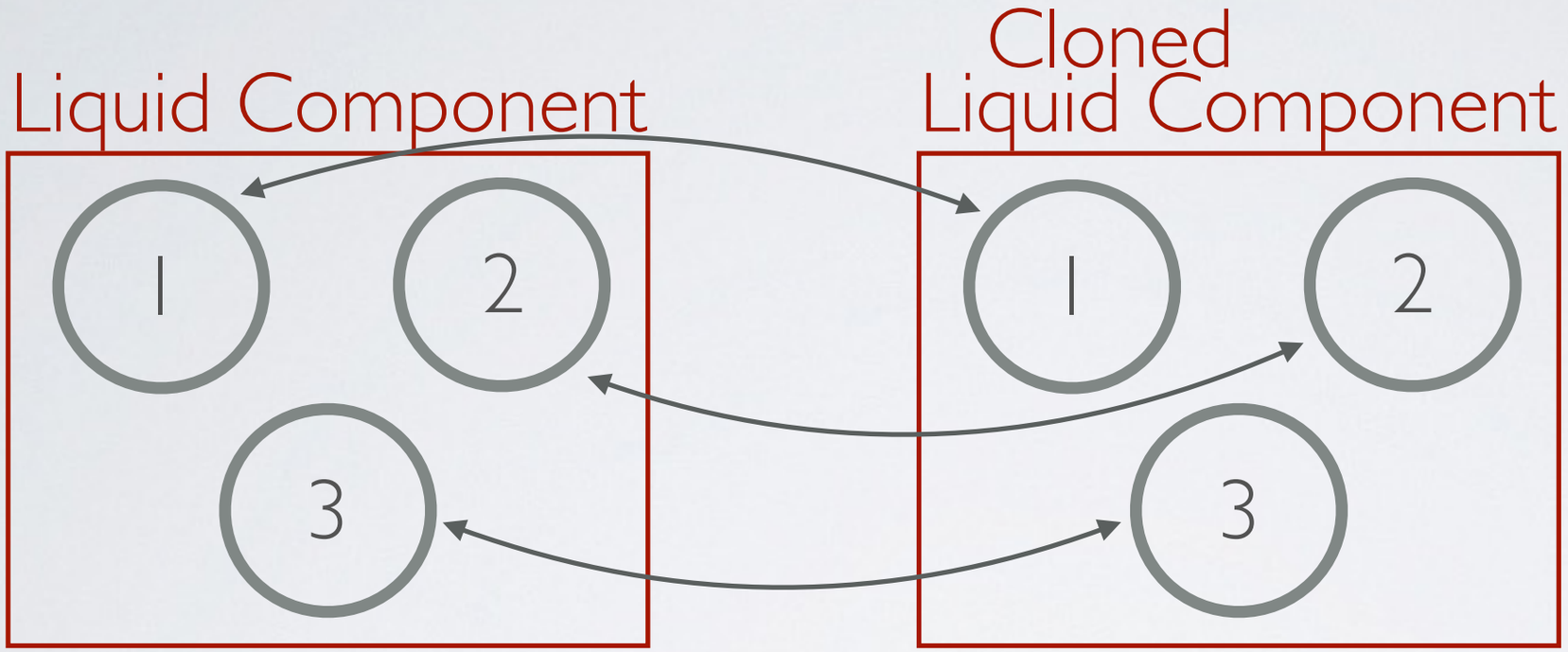

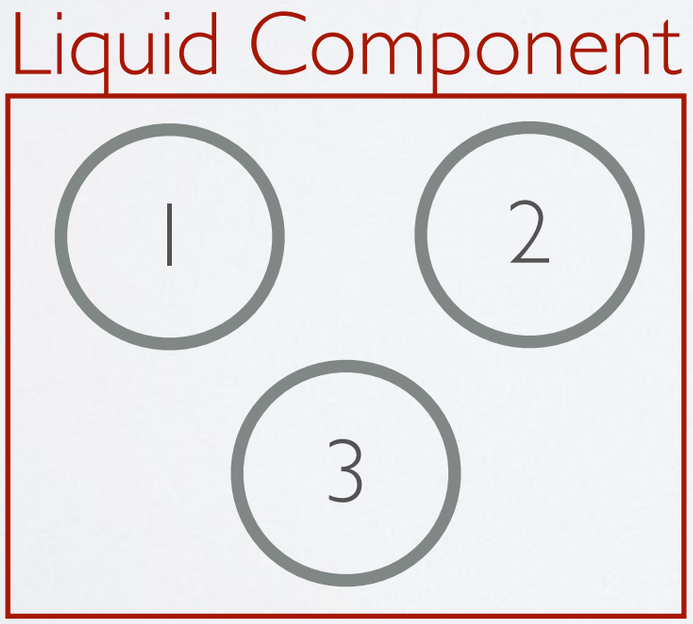

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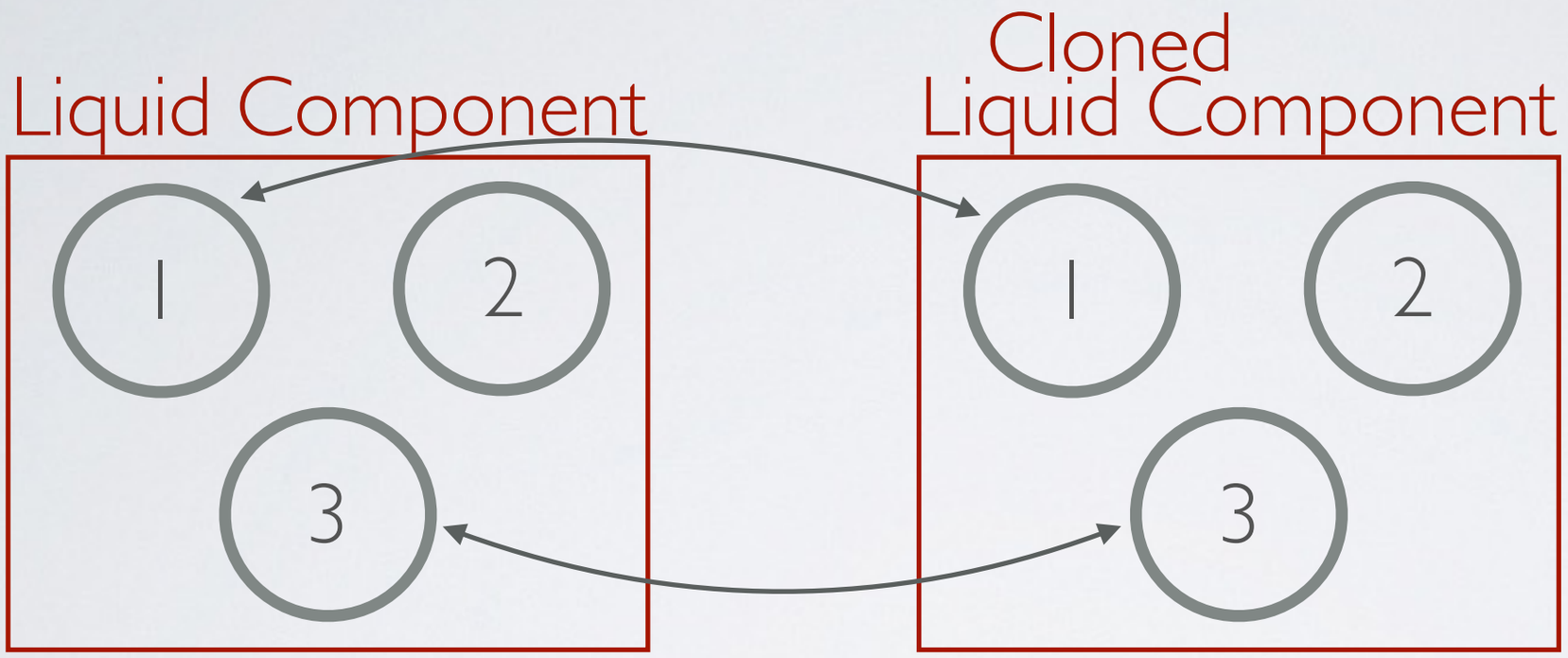
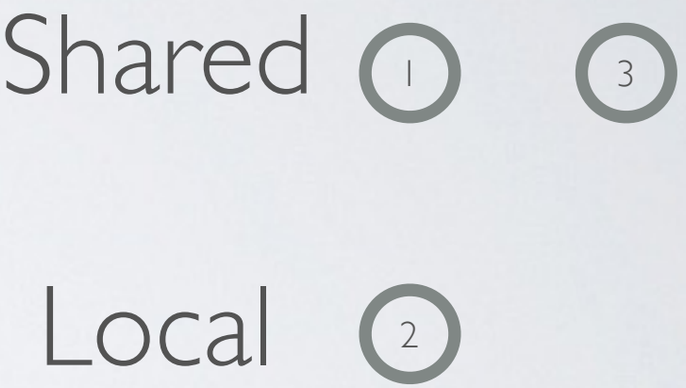
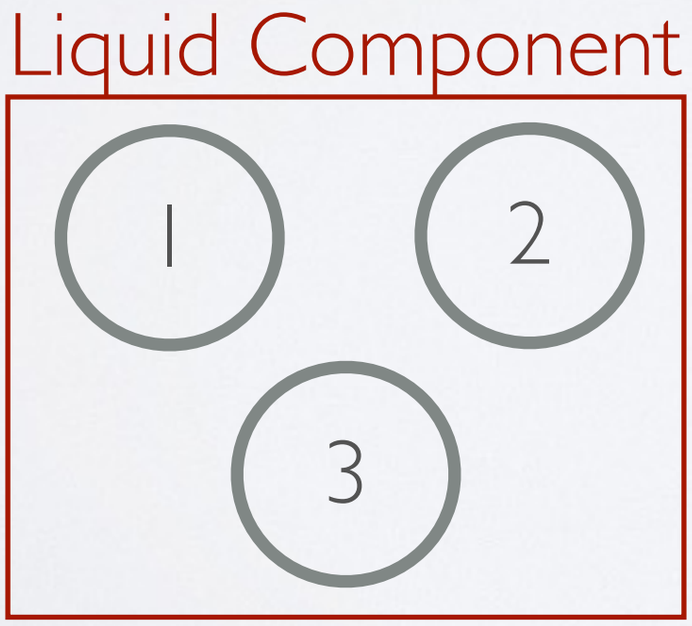
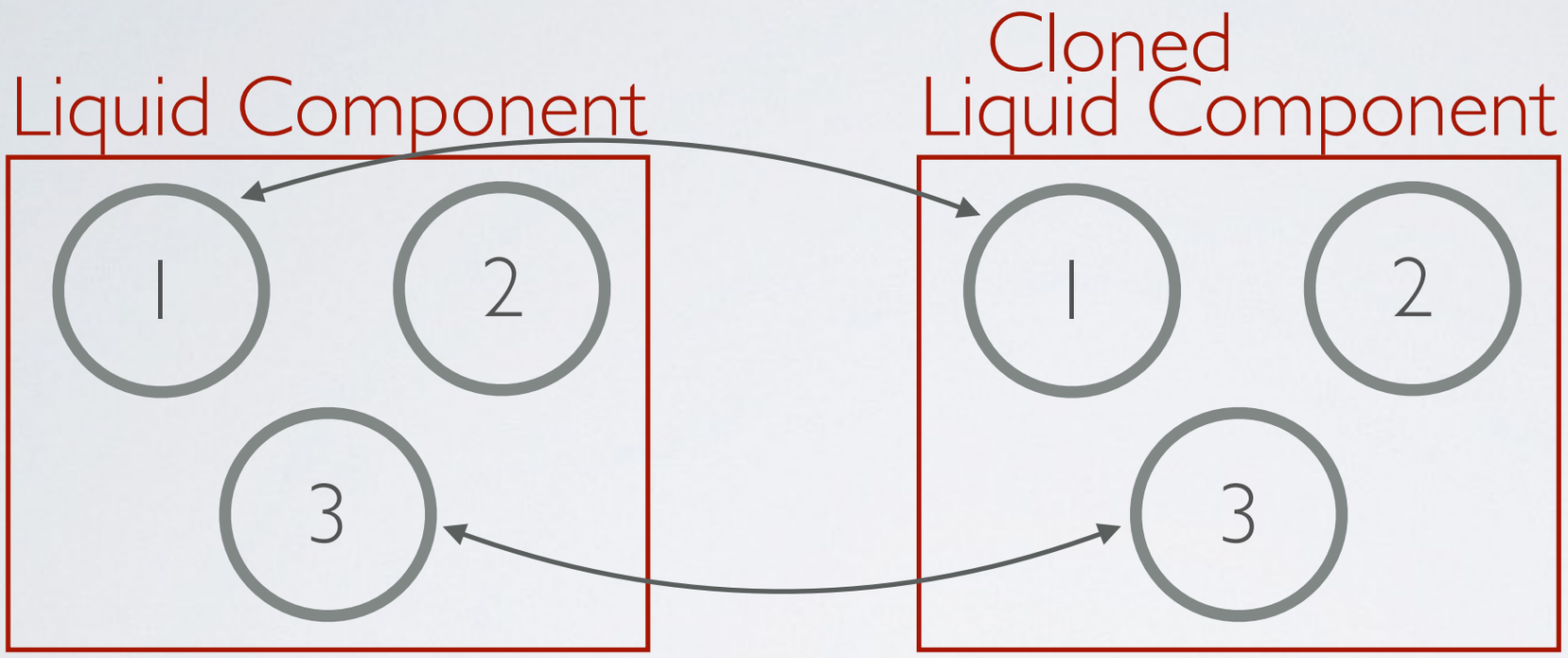
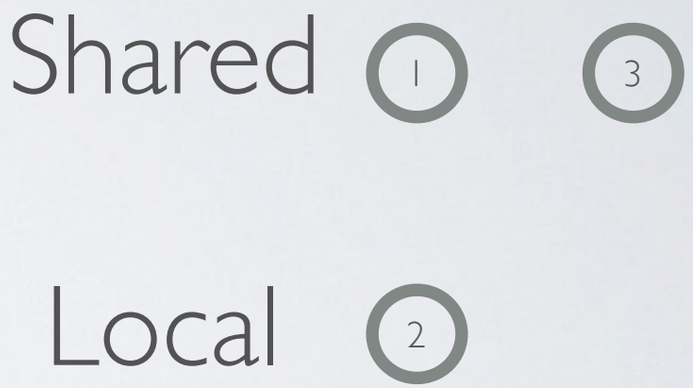


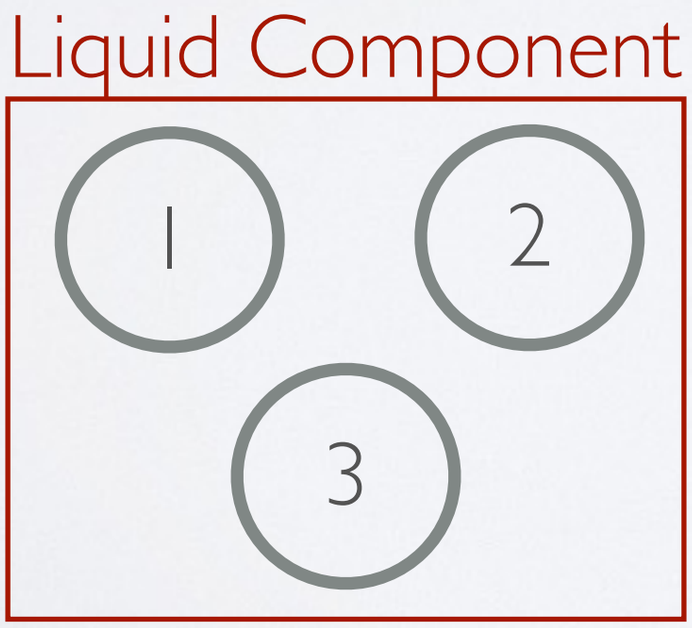




SHARING POLICY

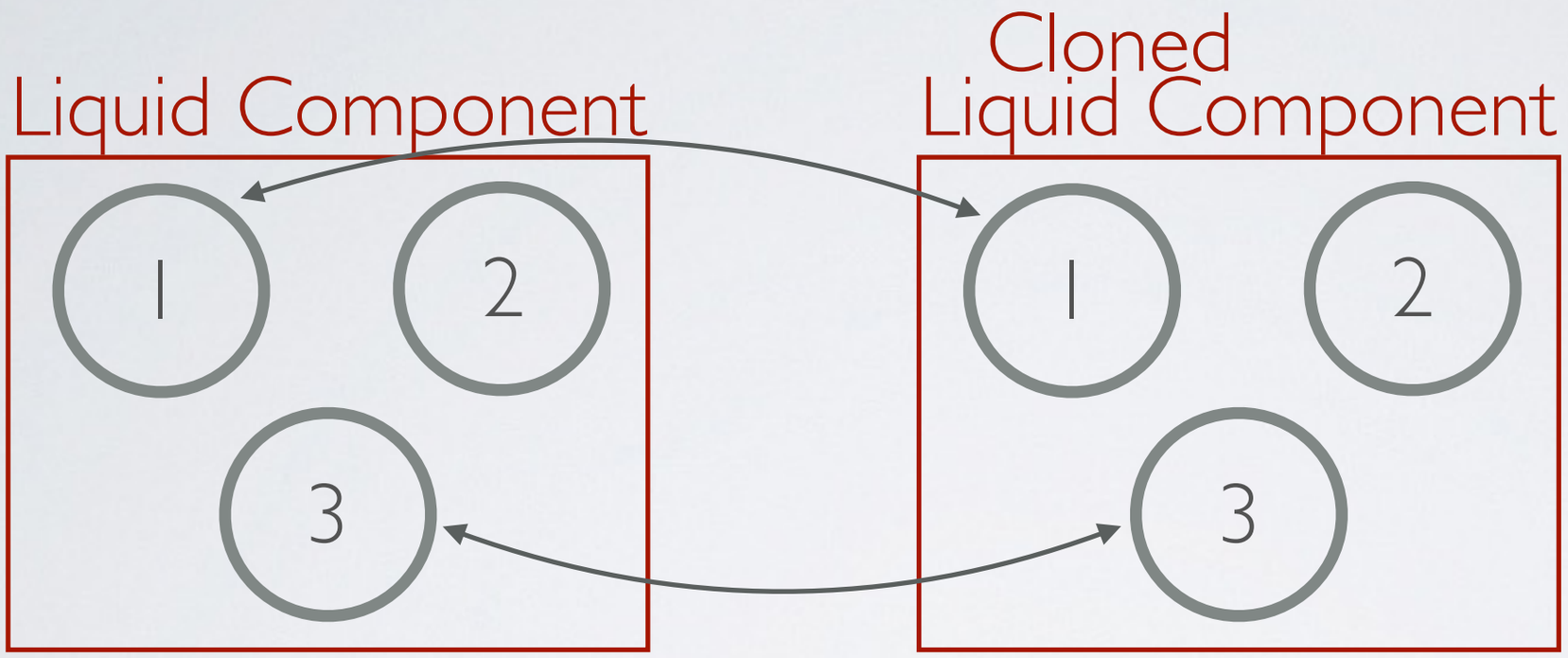


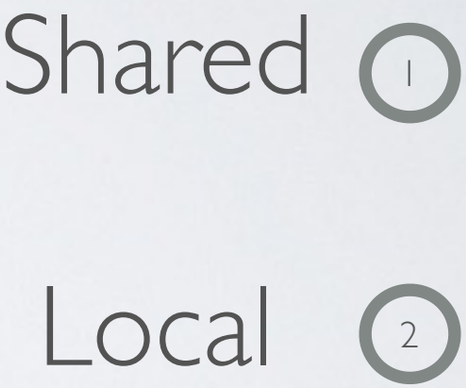


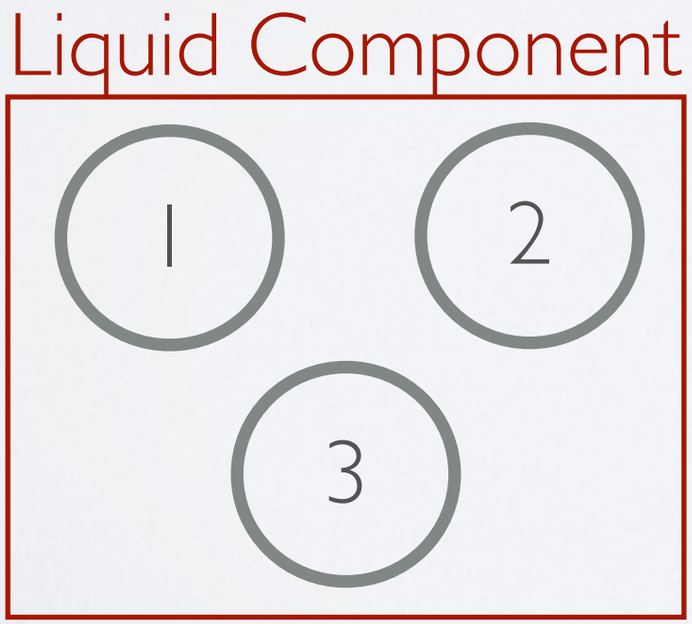


Global

SHARING POLICY







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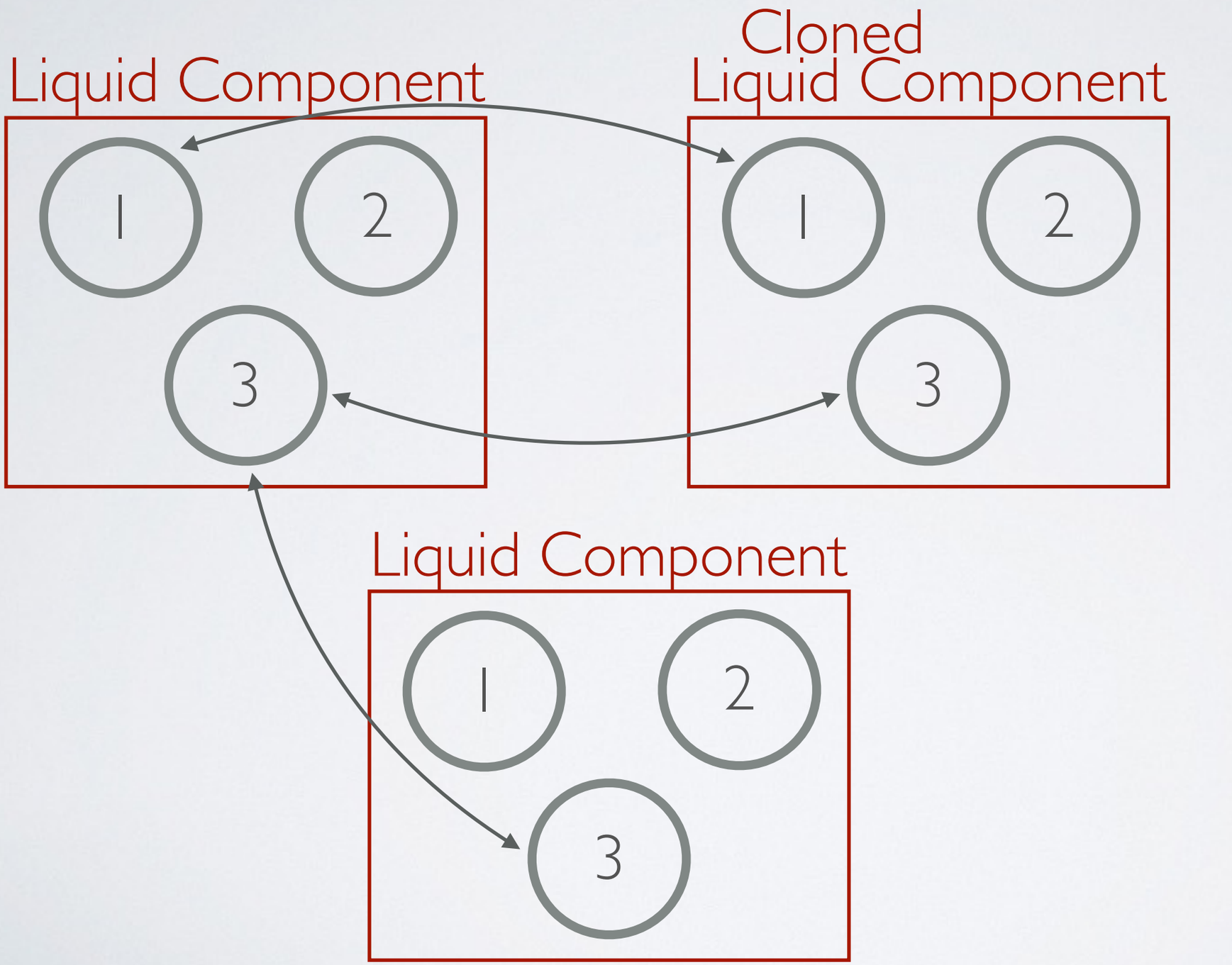
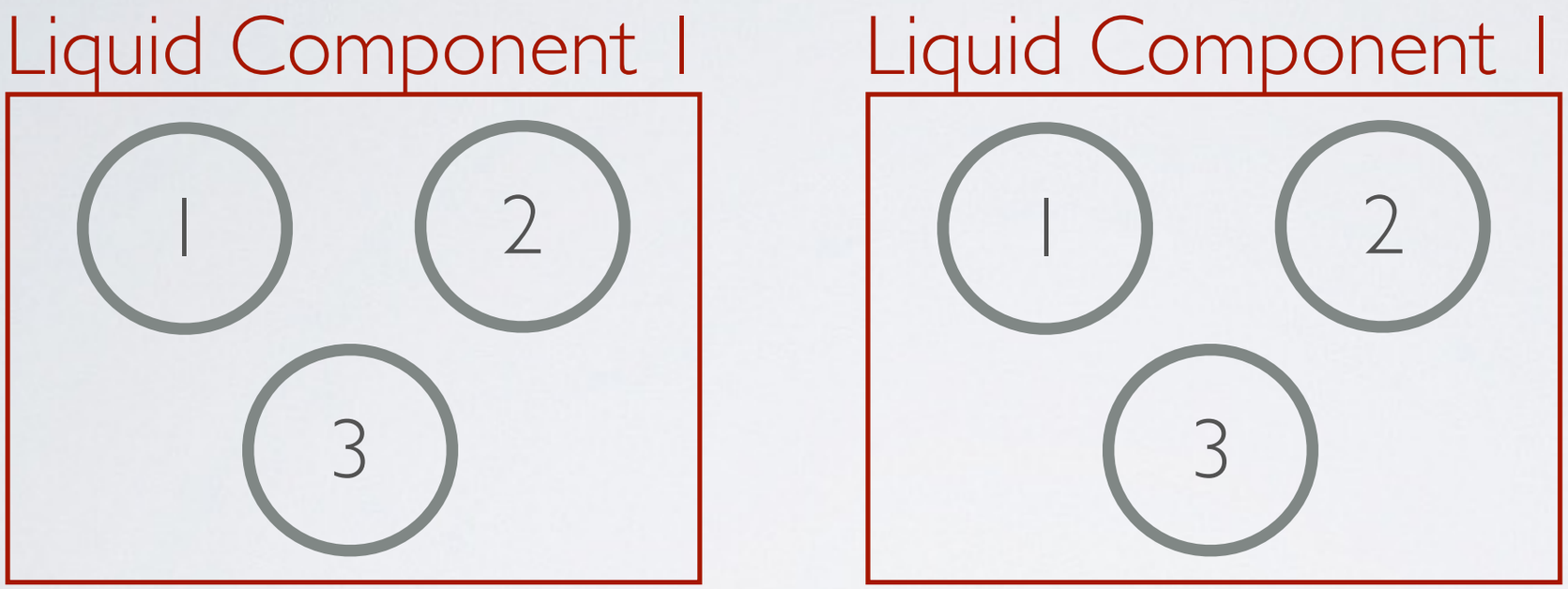
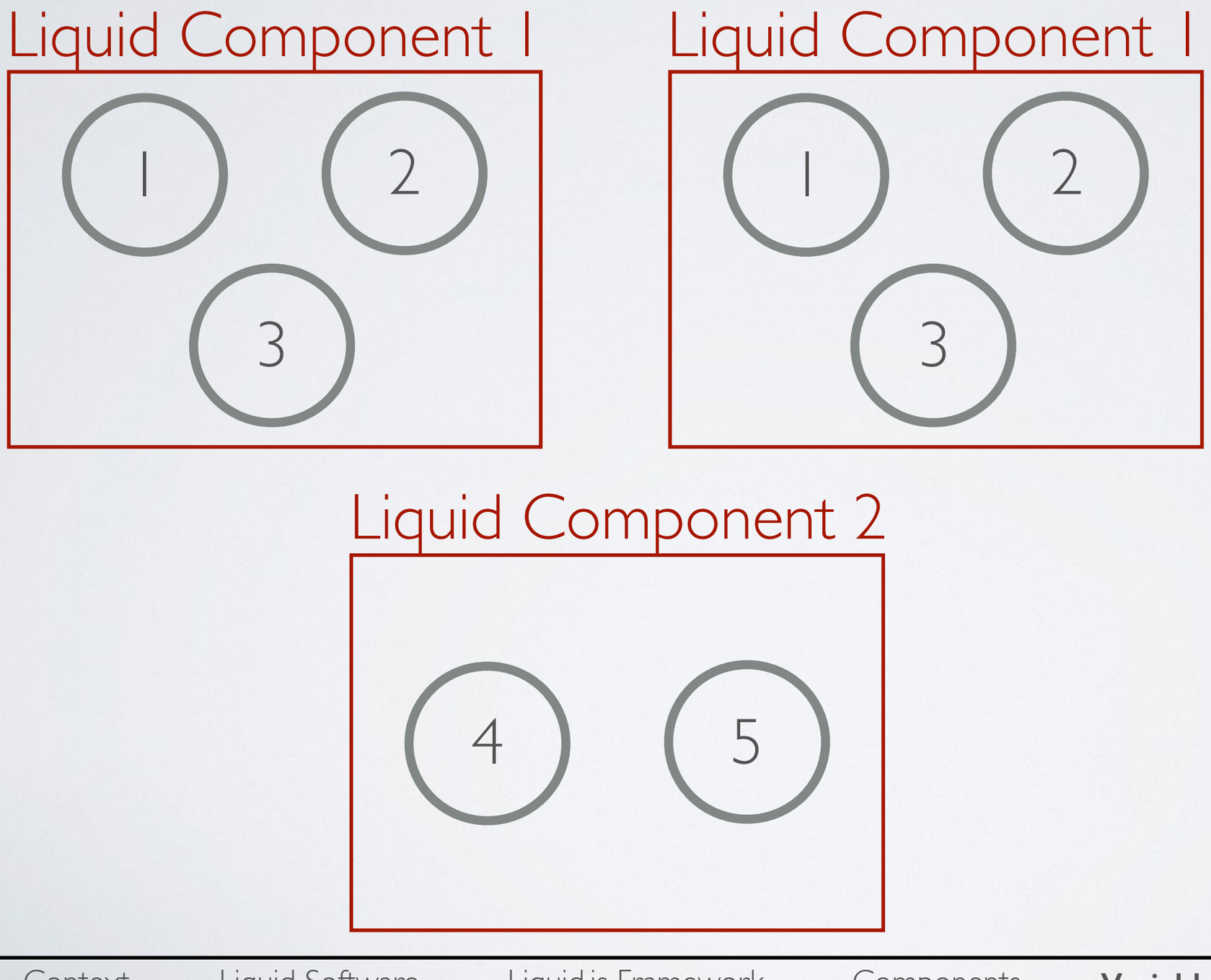


COMPONENT SCOPE

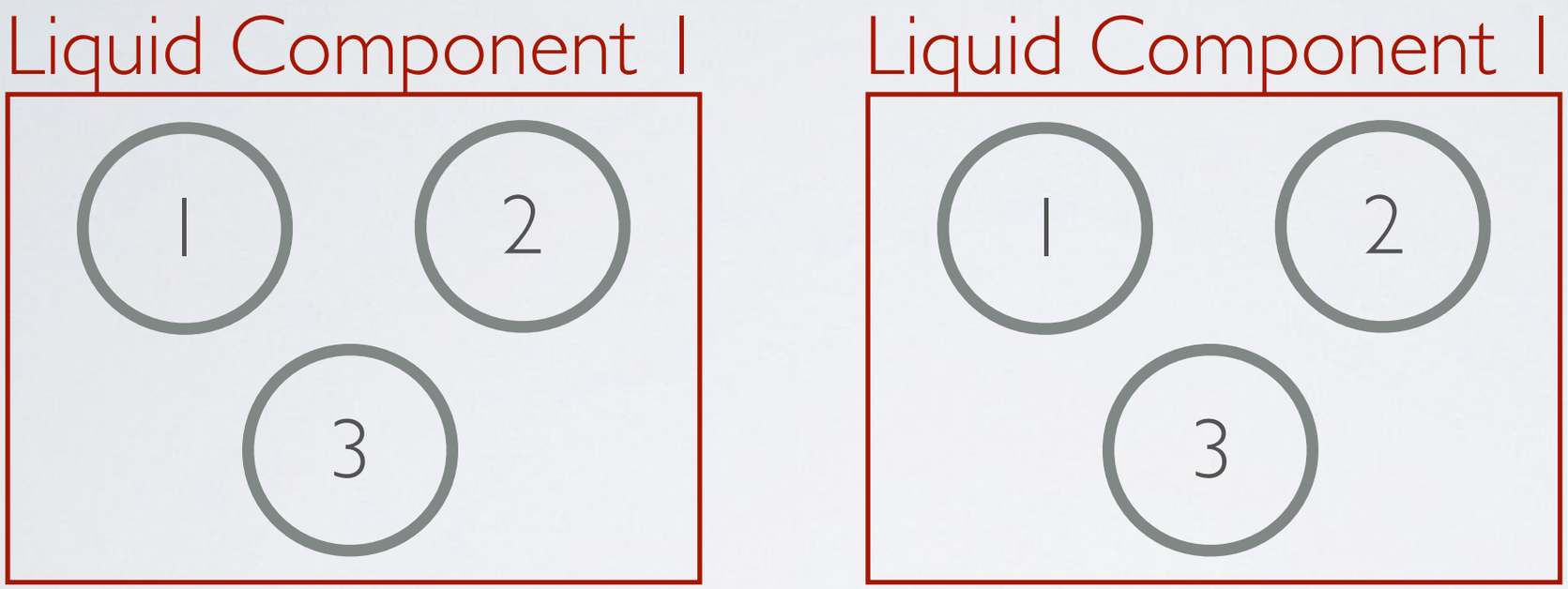
COMPONENT SCOPE



COMPONENT SCOPE

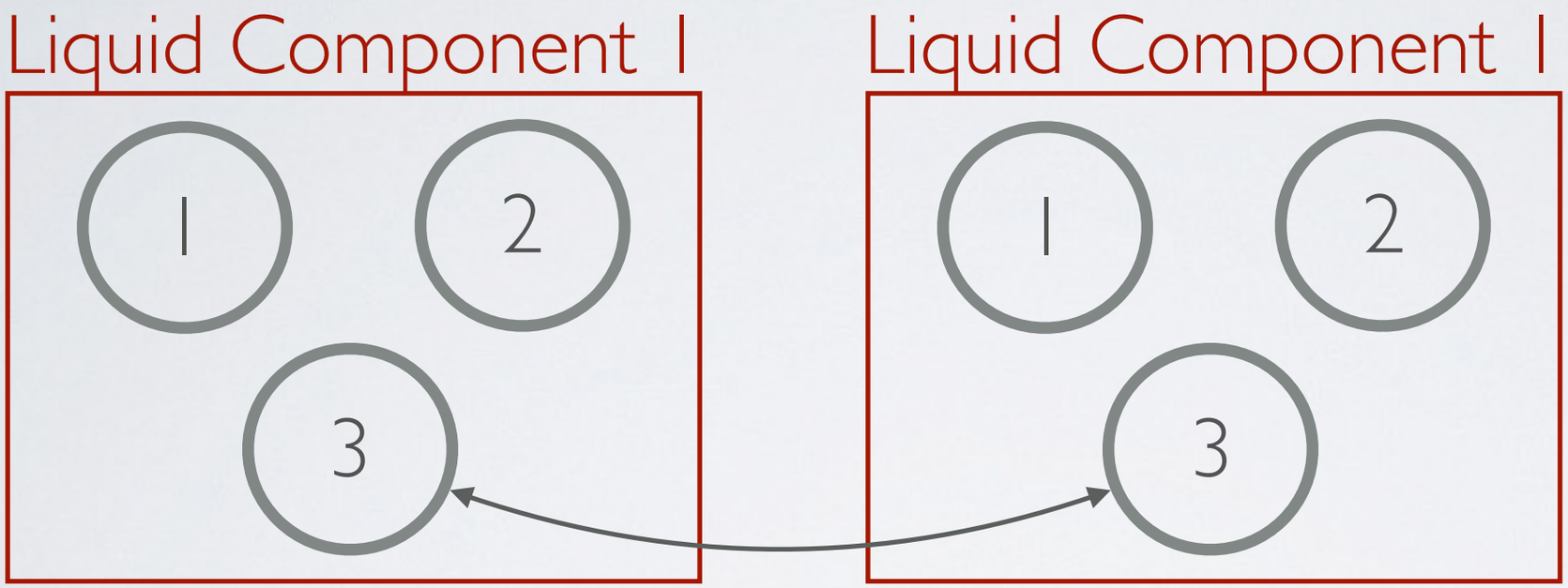


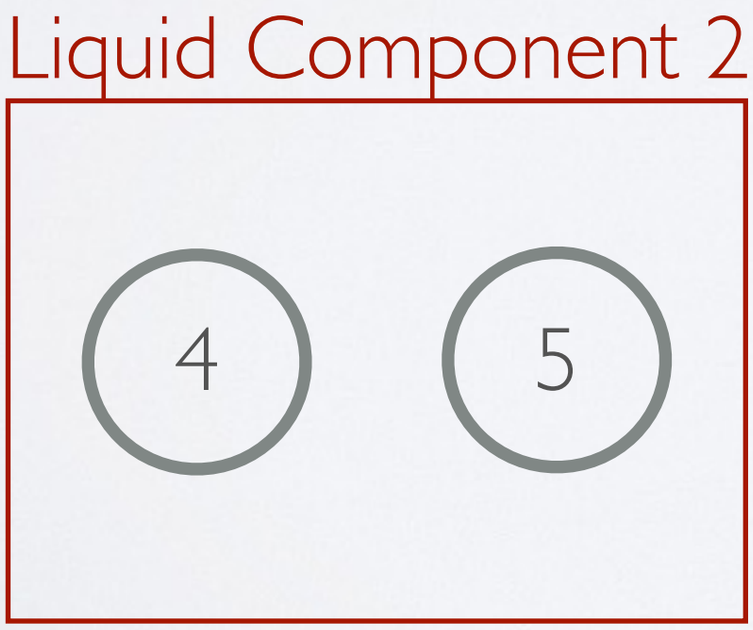
COMPONENT SCOPE



Intra-component

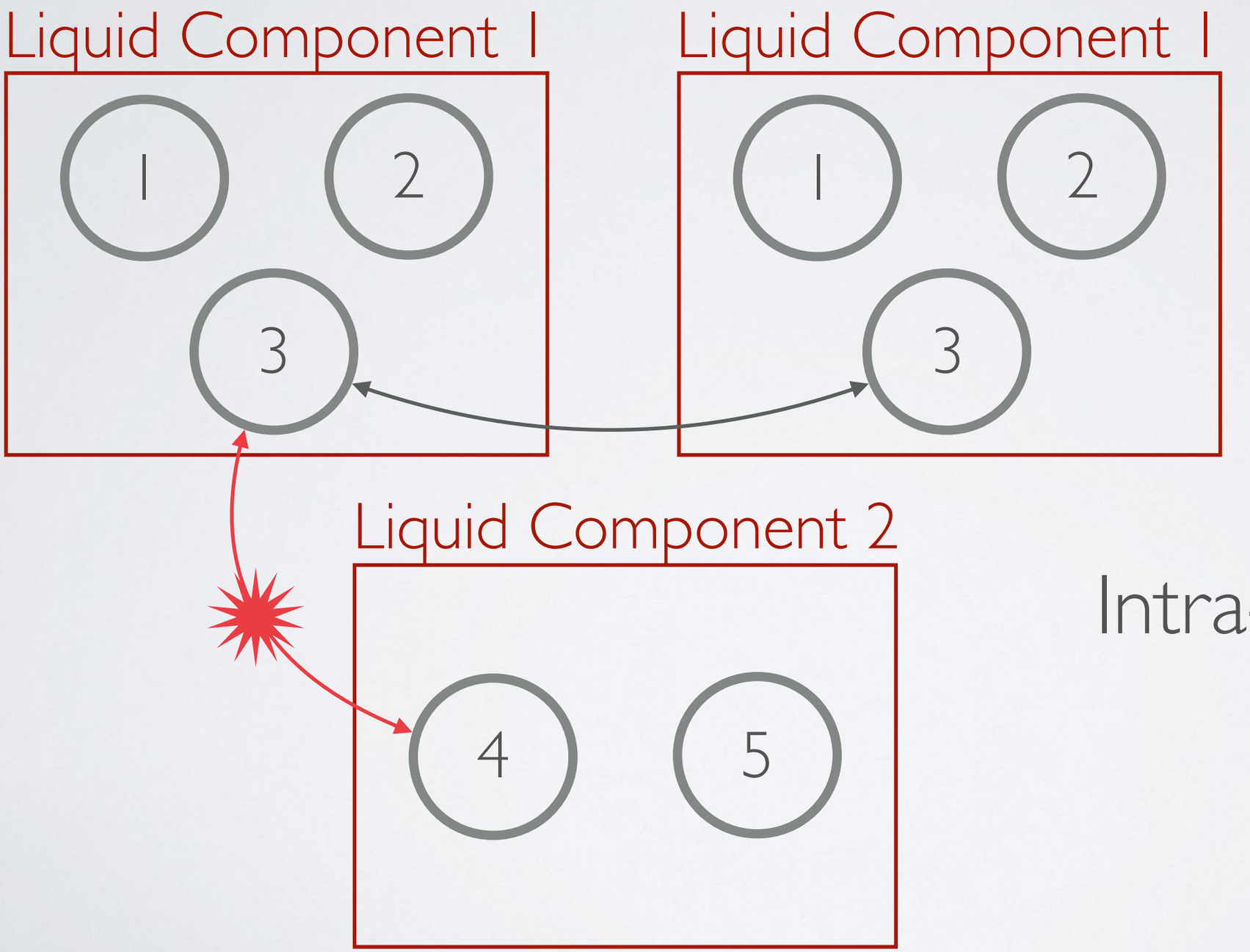
COMPONENT SCOPE





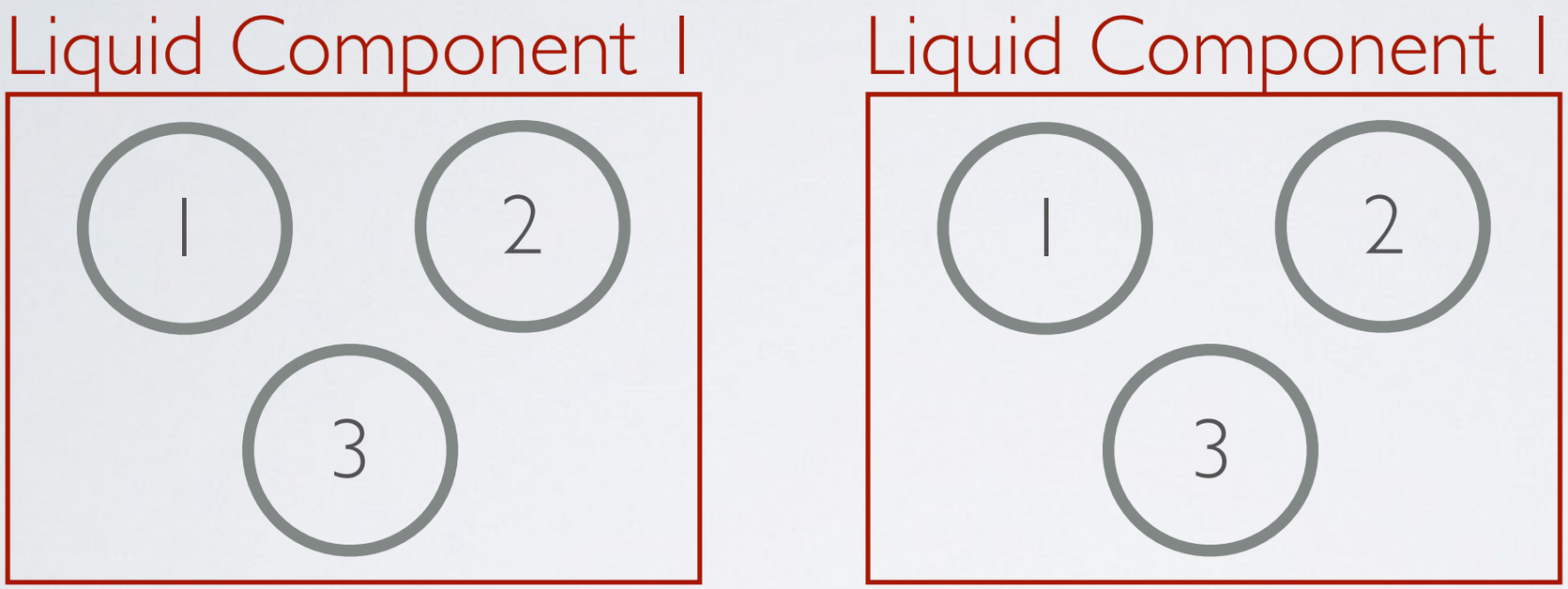
Intra-component

COMPONENT SCOPE



Intra-component

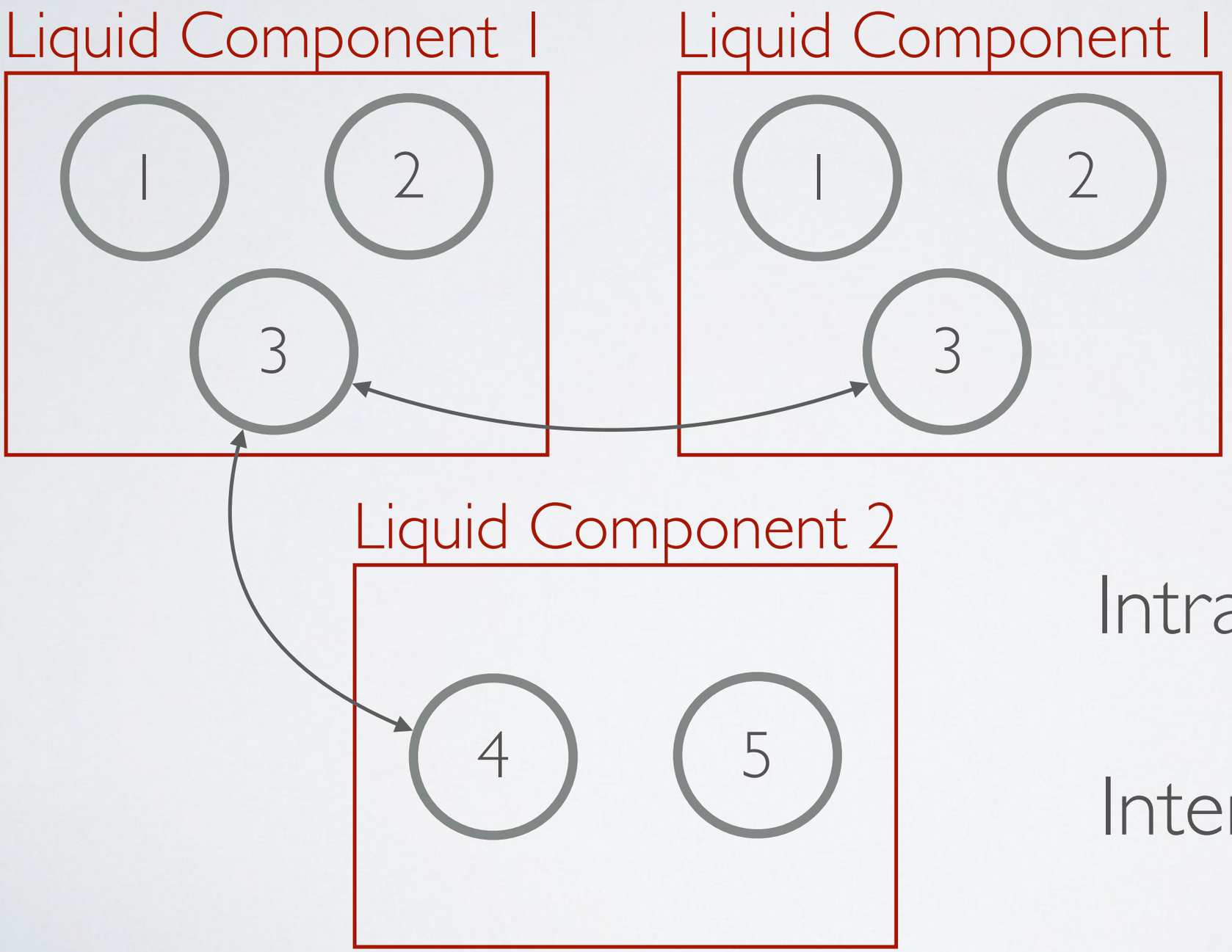
COMPONENT SCOPE



Intra-component

Inter-component

COMPONENT SCOPE

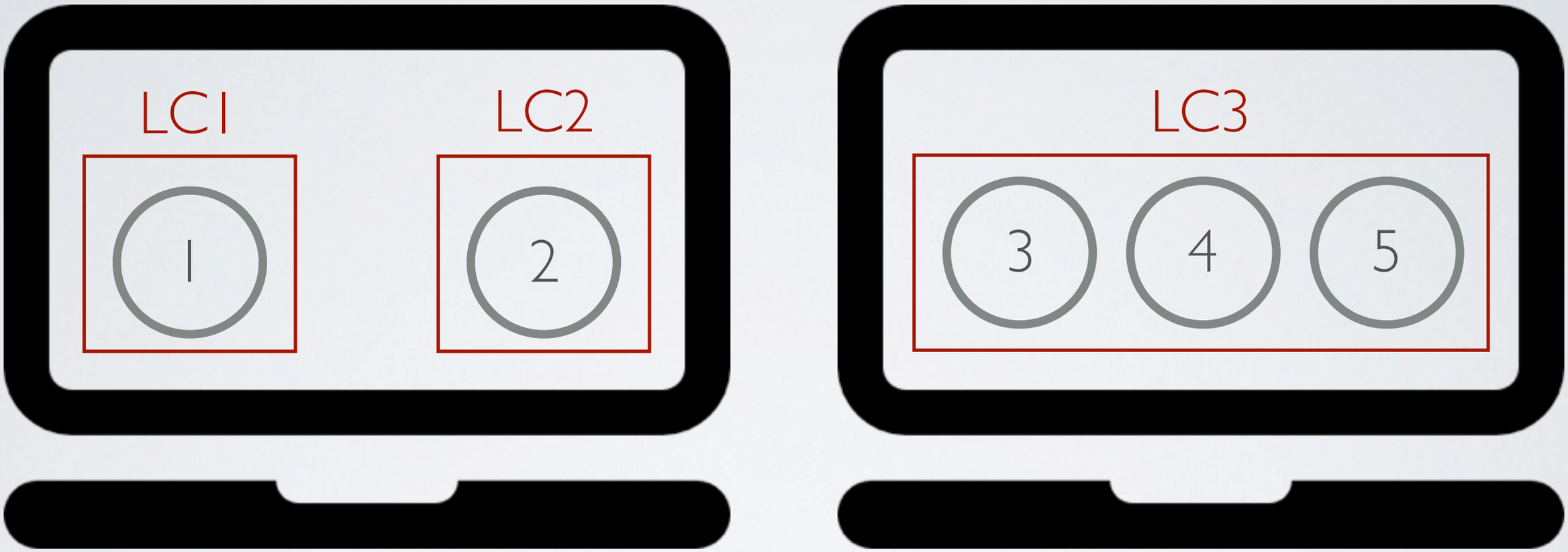


Intra-component

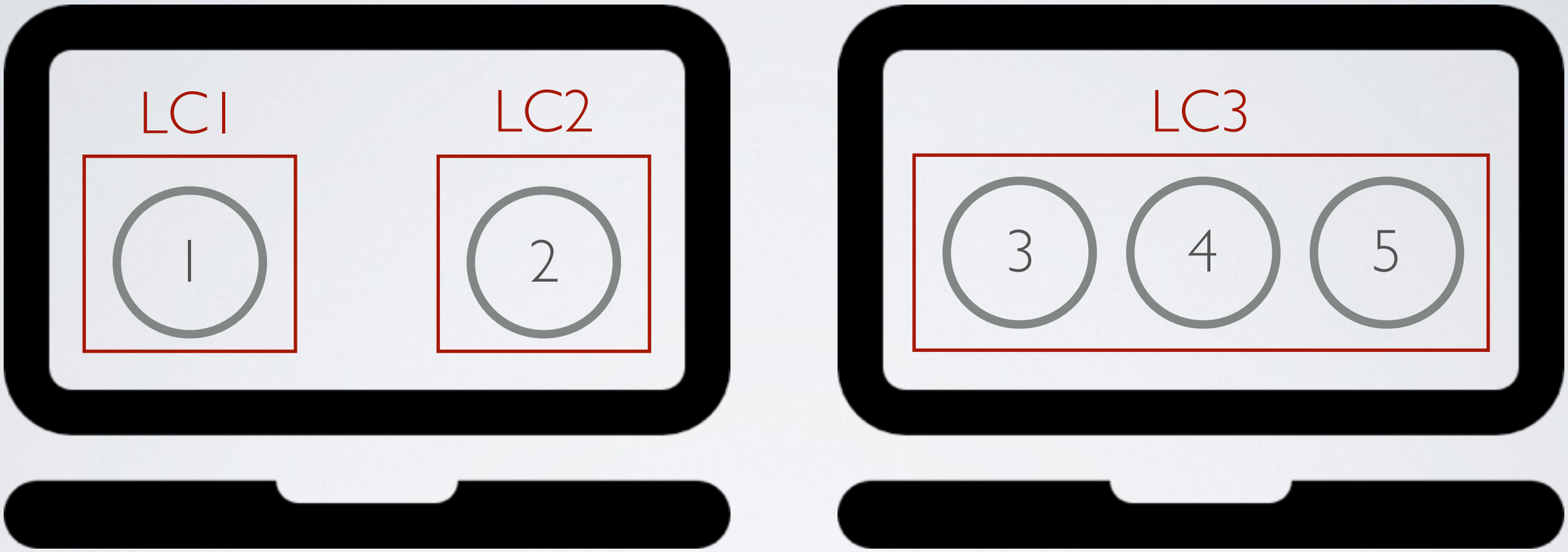
Inter-component

DEVICE DEPLOYMENT

DEVICE DEPLOYMENT

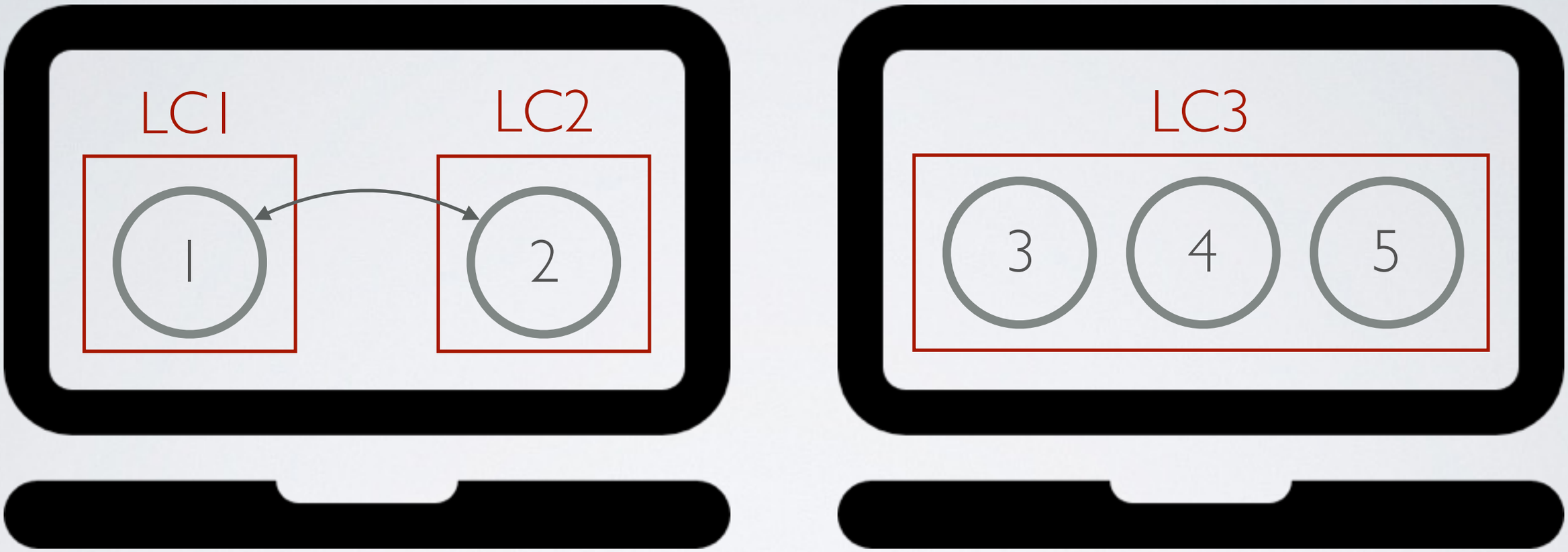


DEVICE DEPLOYMENT



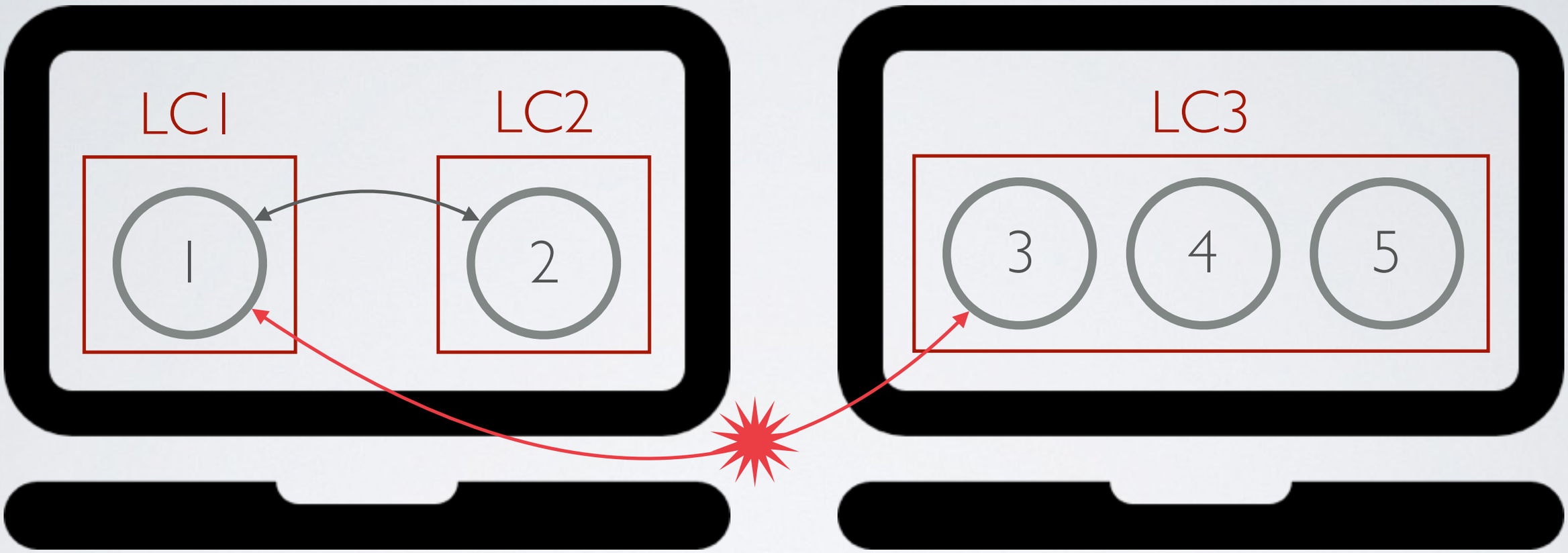
One device

DEVICE DEPLOYMENT



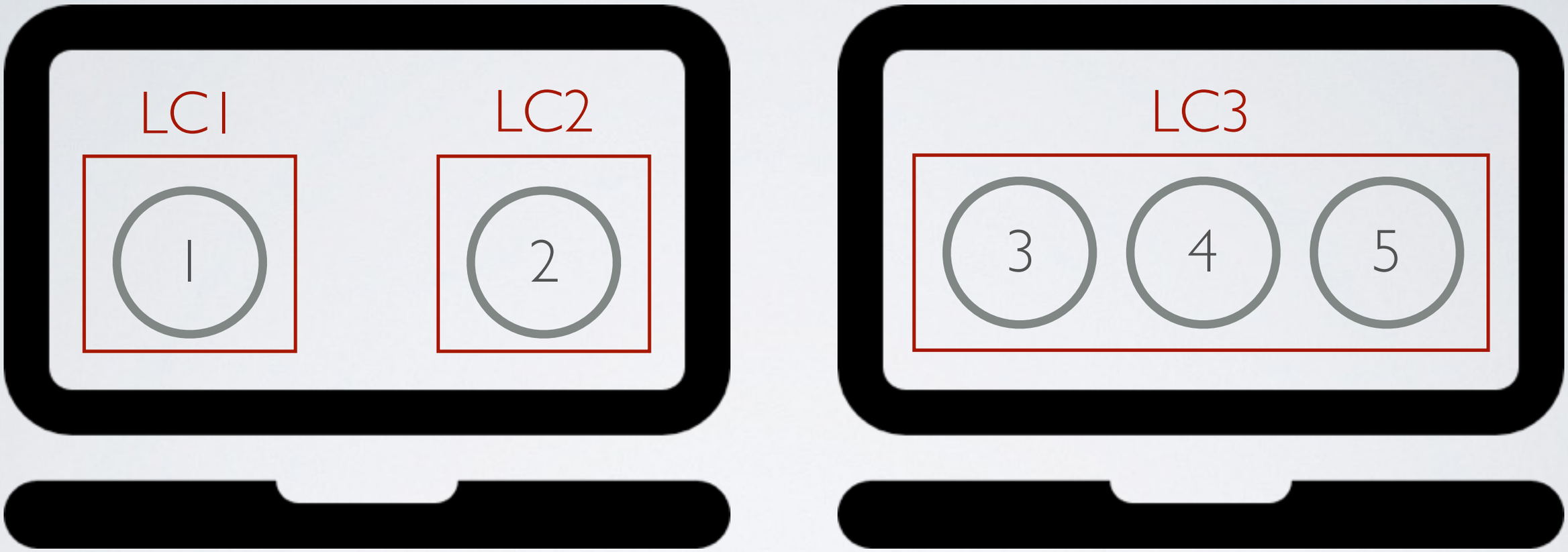
One device

DEVICE DEPLOYMENT



One device

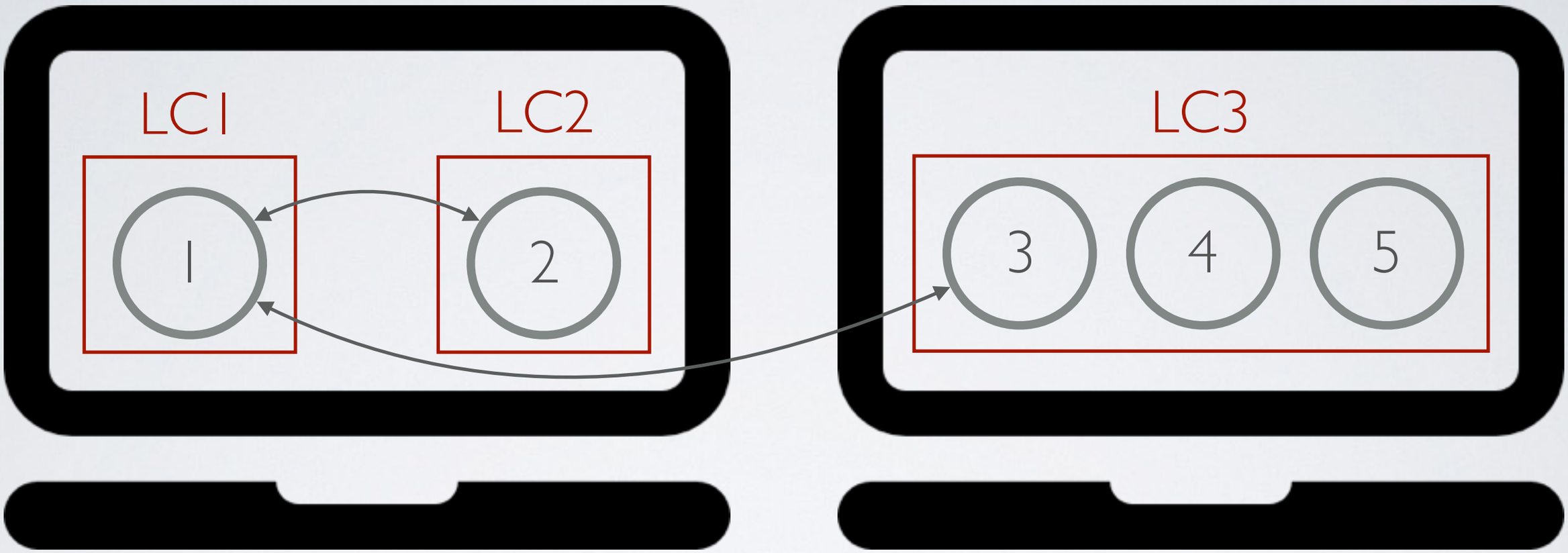
DEVICE DEPLOYMENT



One device

Many devices

DEVICE DEPLOYMENT

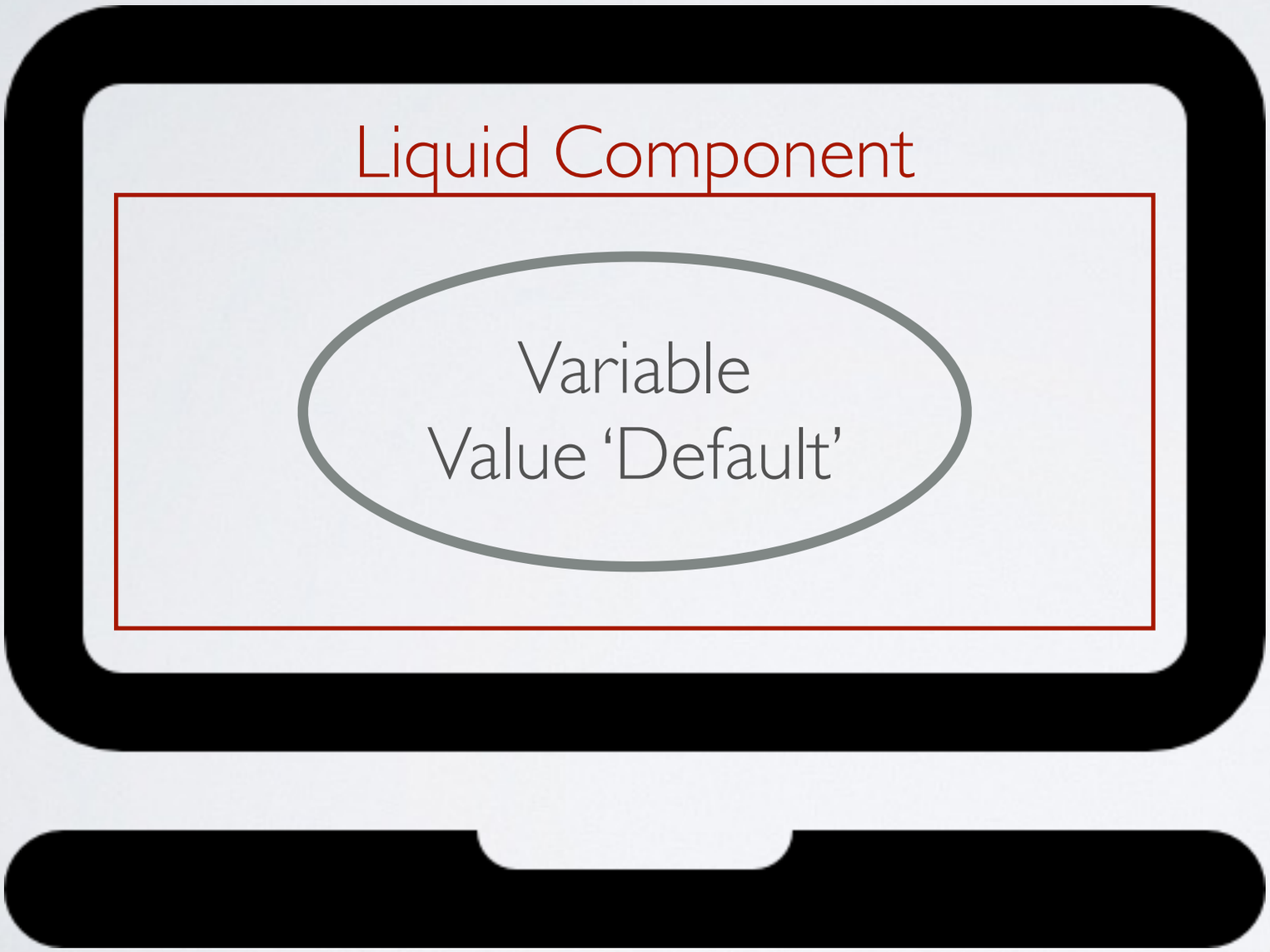


One device

Many devices

PERSISTENCE POLICY

PERSISTENCE POLICY



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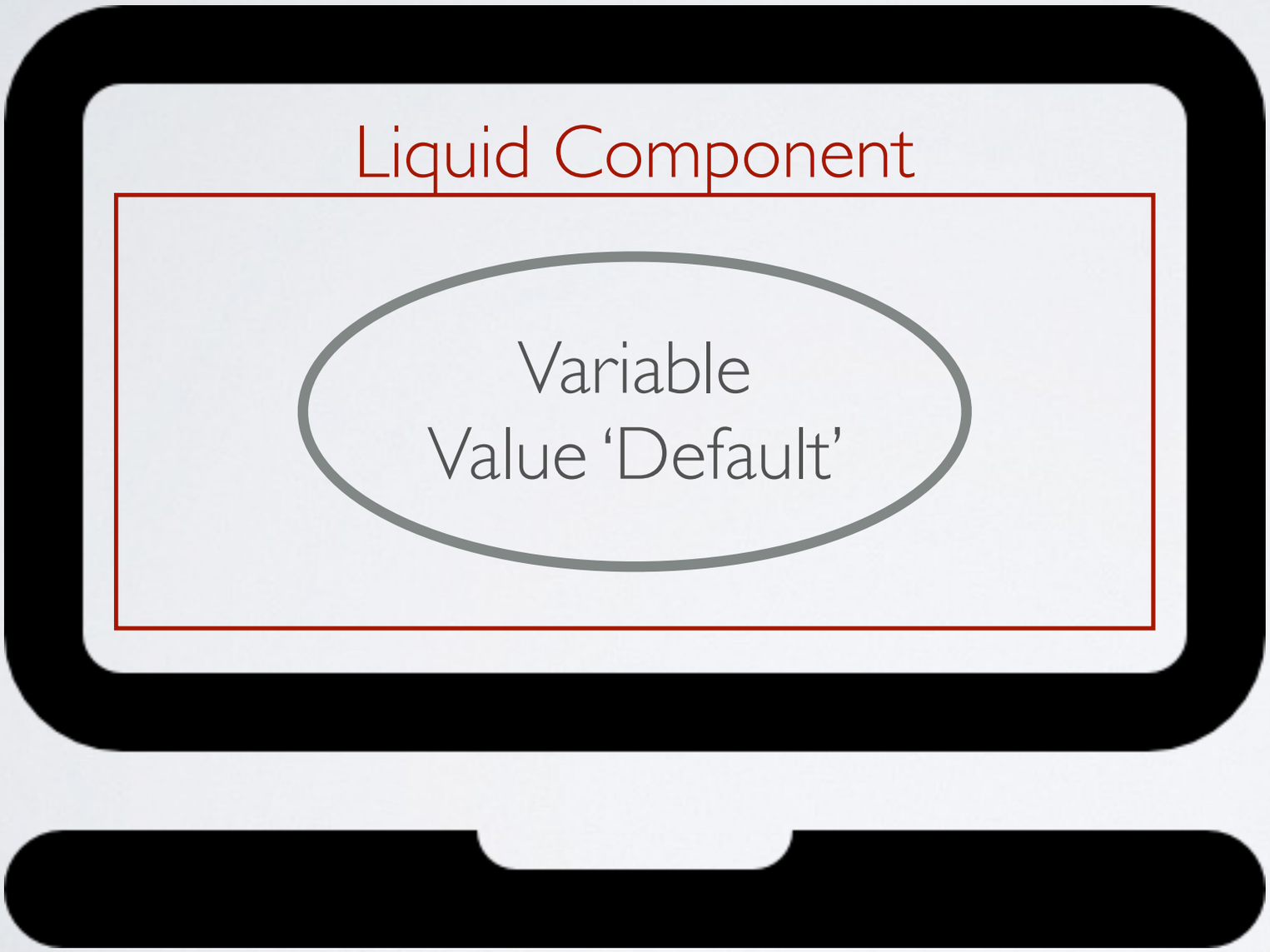
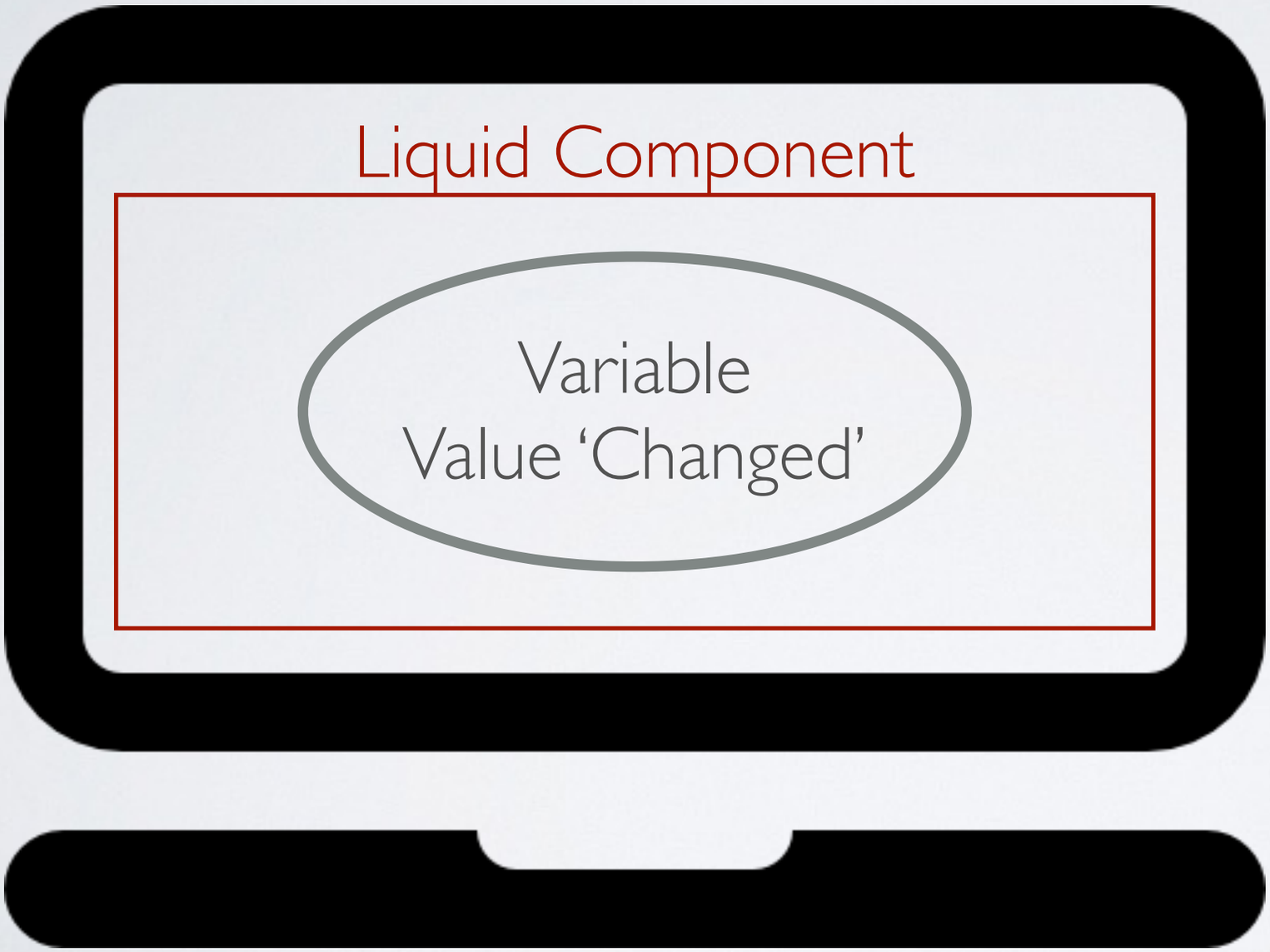


Volatile

PERSISTENCE POLICY

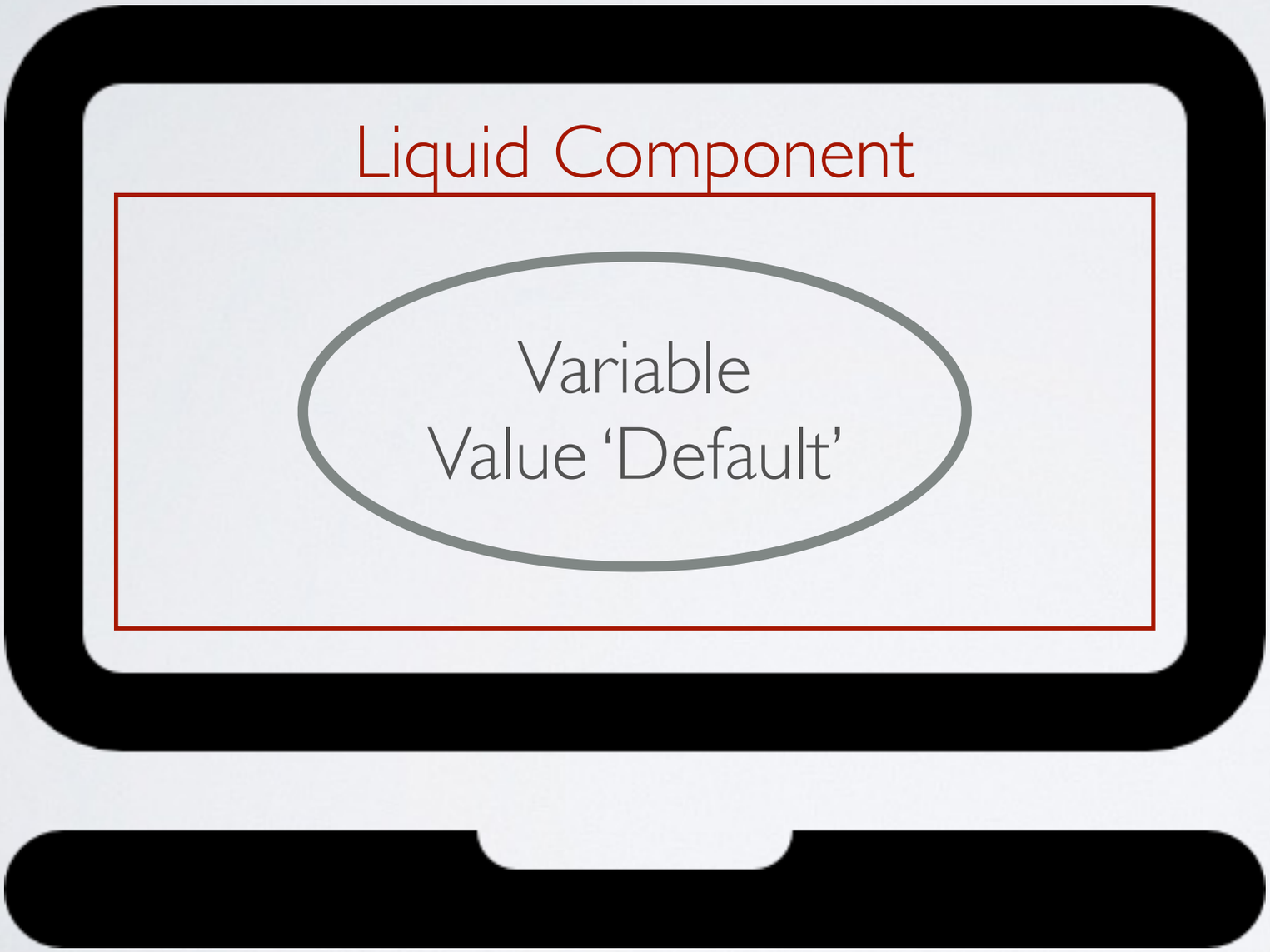


Volatile

PERSISTENCE POLICY

Volatile

PERSISTENCE POLICY



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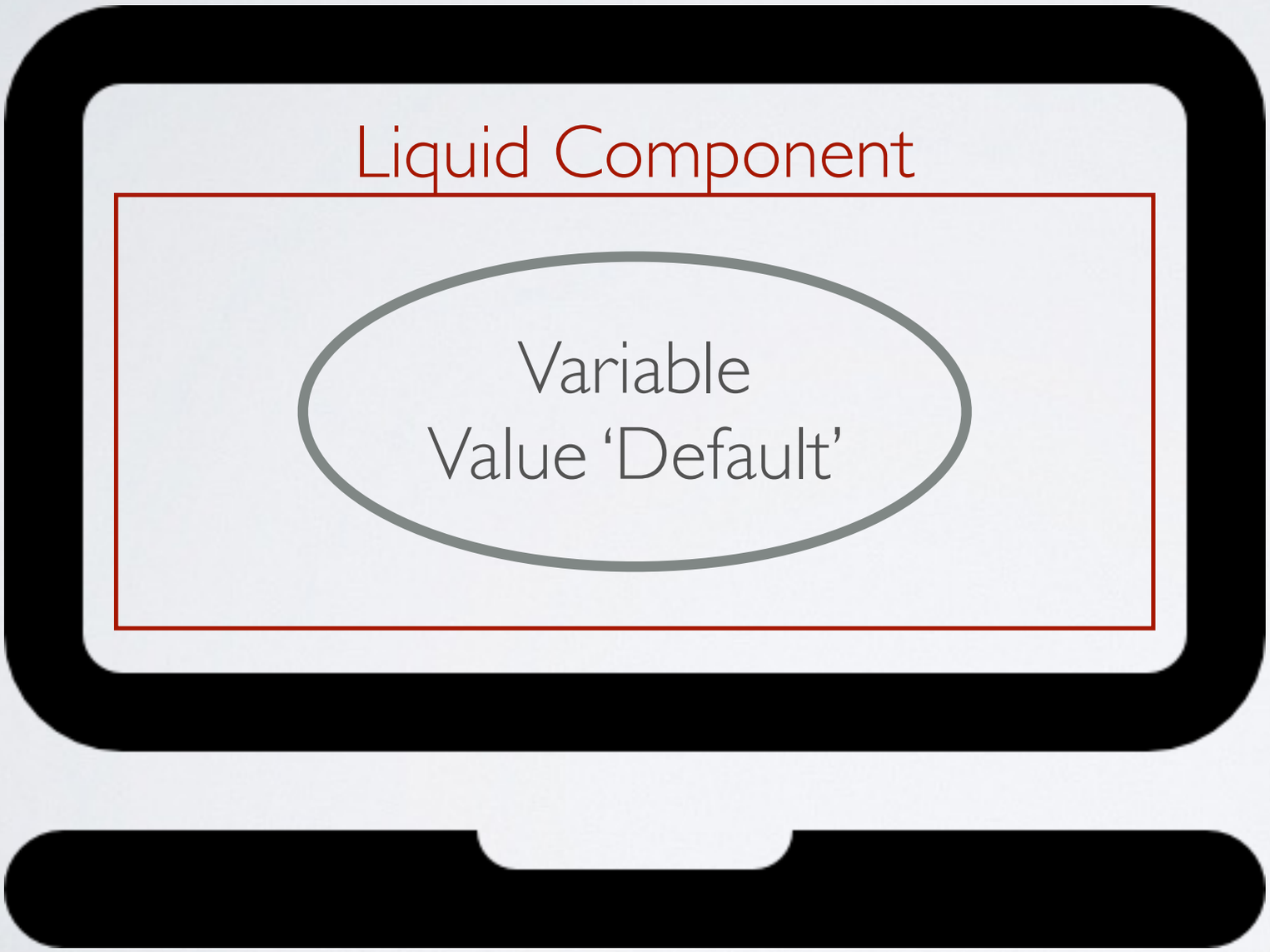
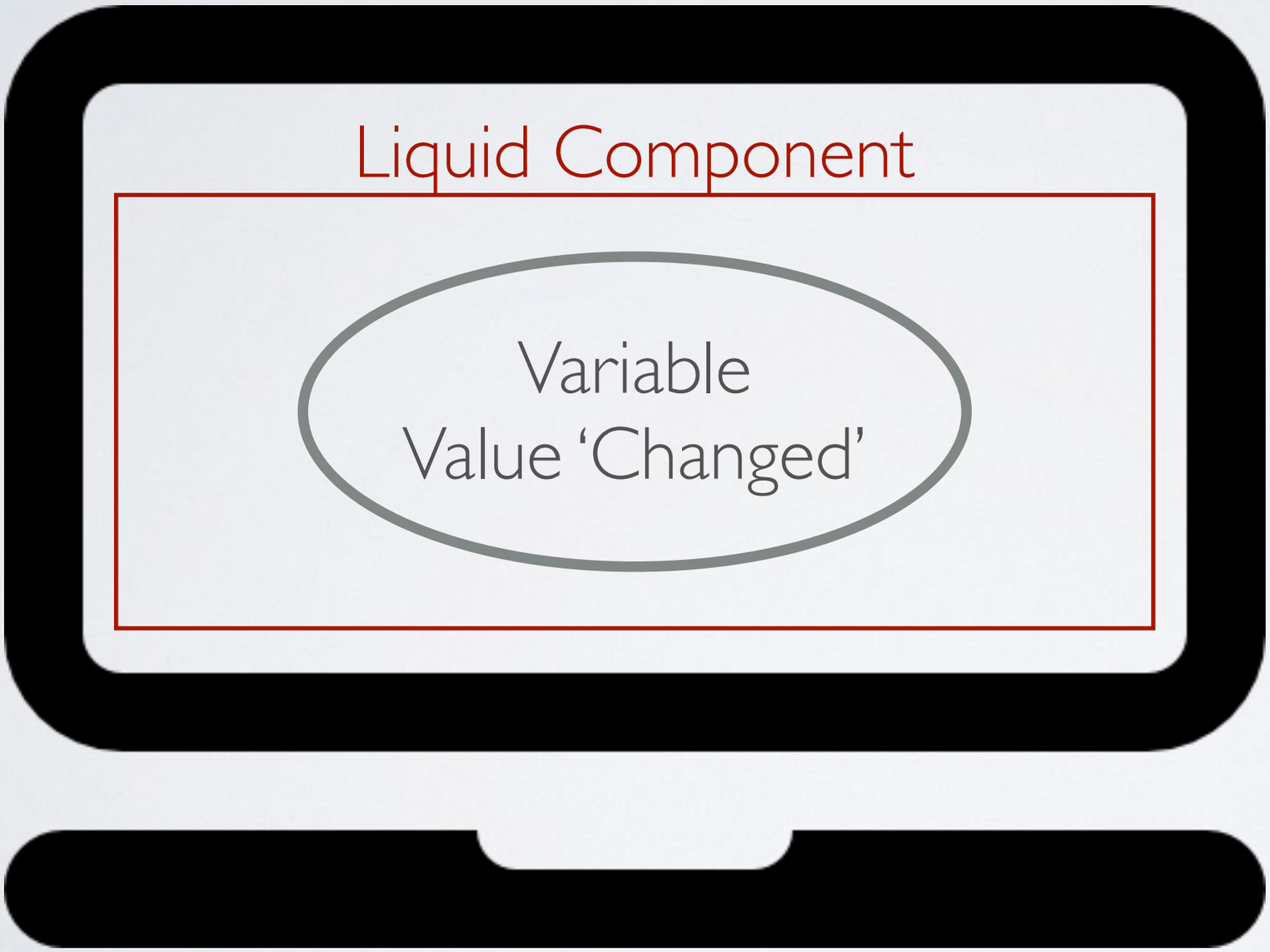
PERSISTENCE POLICY



Volatile

Session

PERSISTENCE POLICY



Volatile

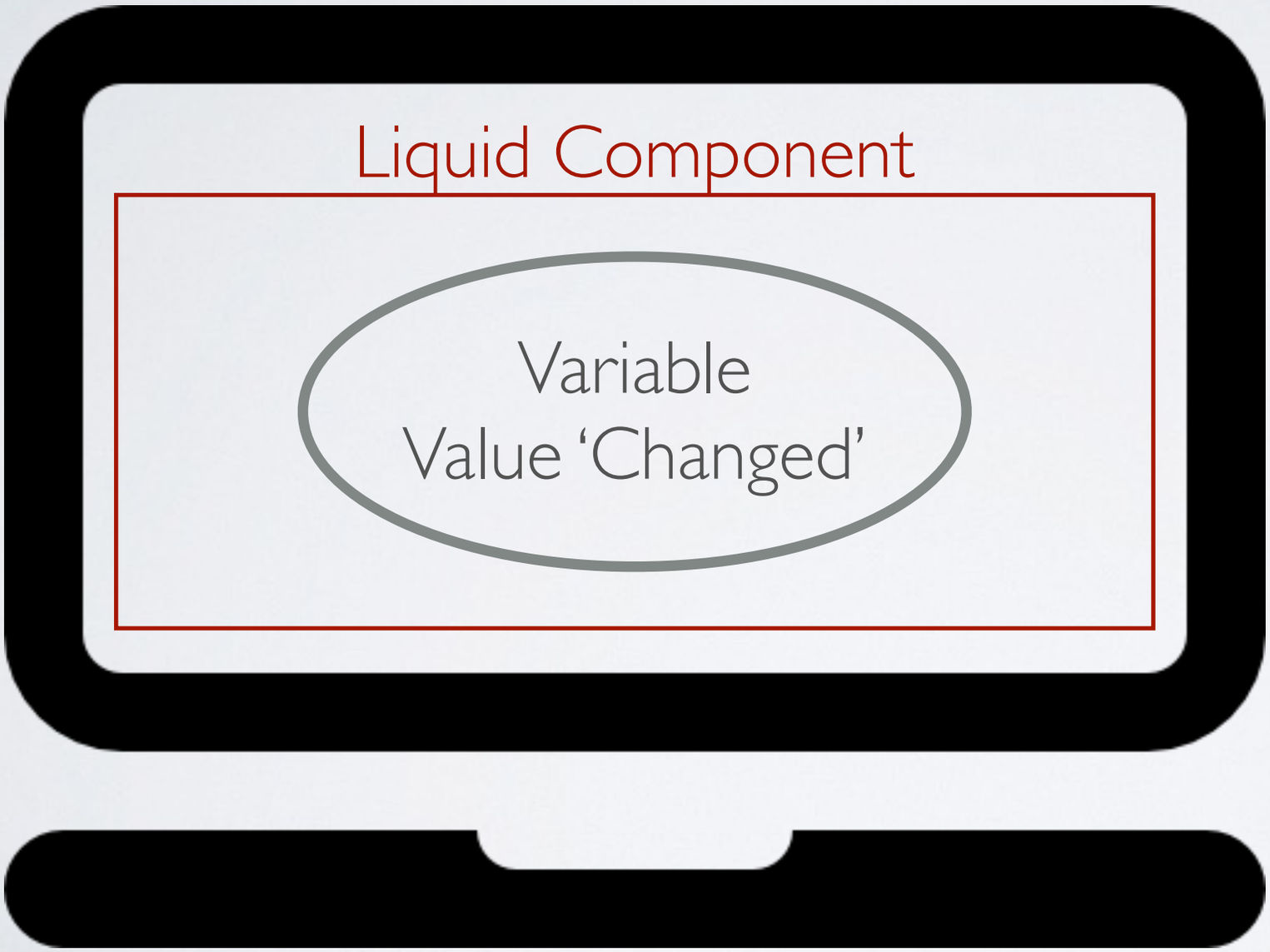
Session

PERSISTENCE POLICY

Volatile

Session

PERSISTENCE POLICY



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Session

PERSISTENCE POLICY

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Session

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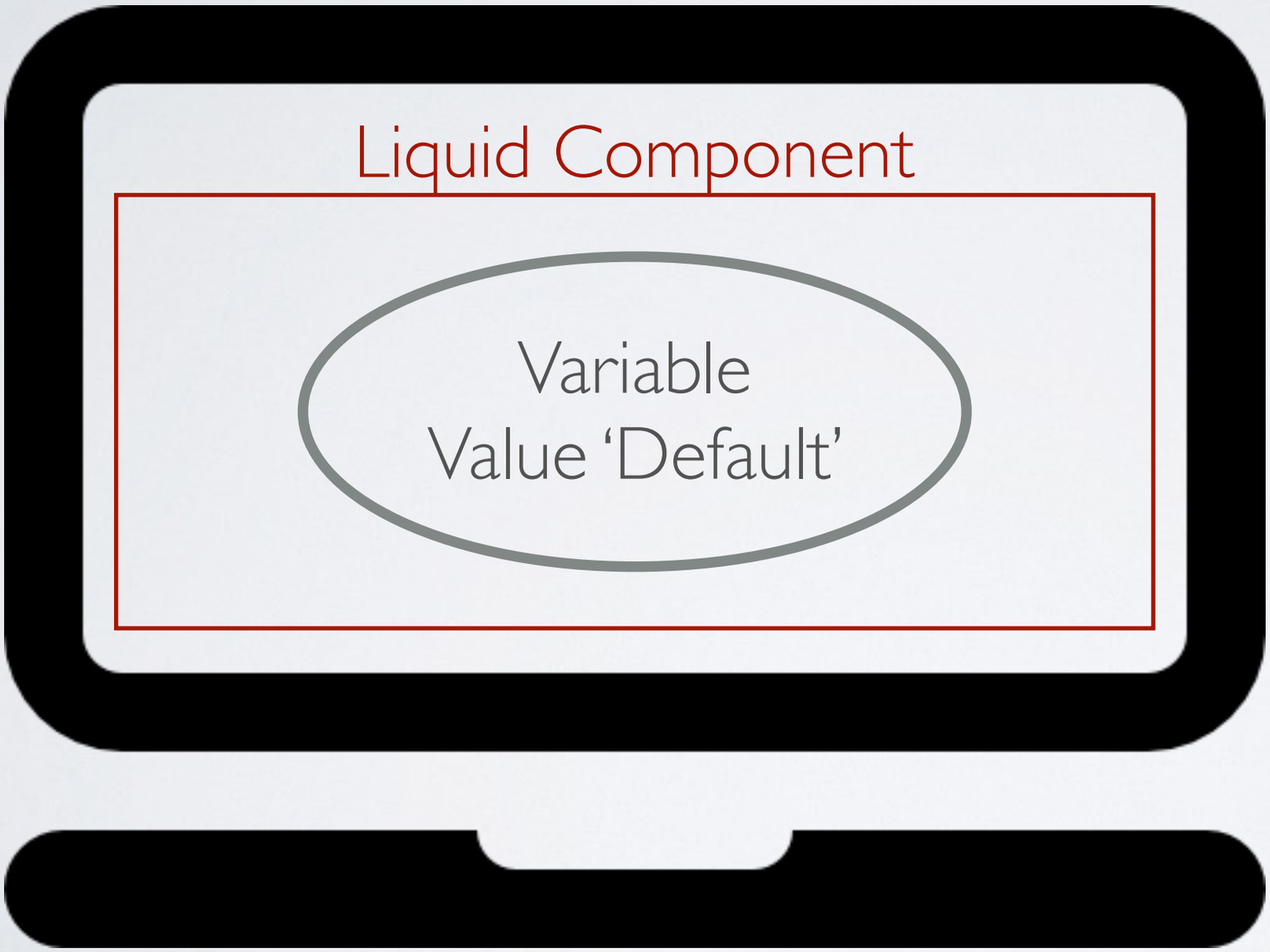
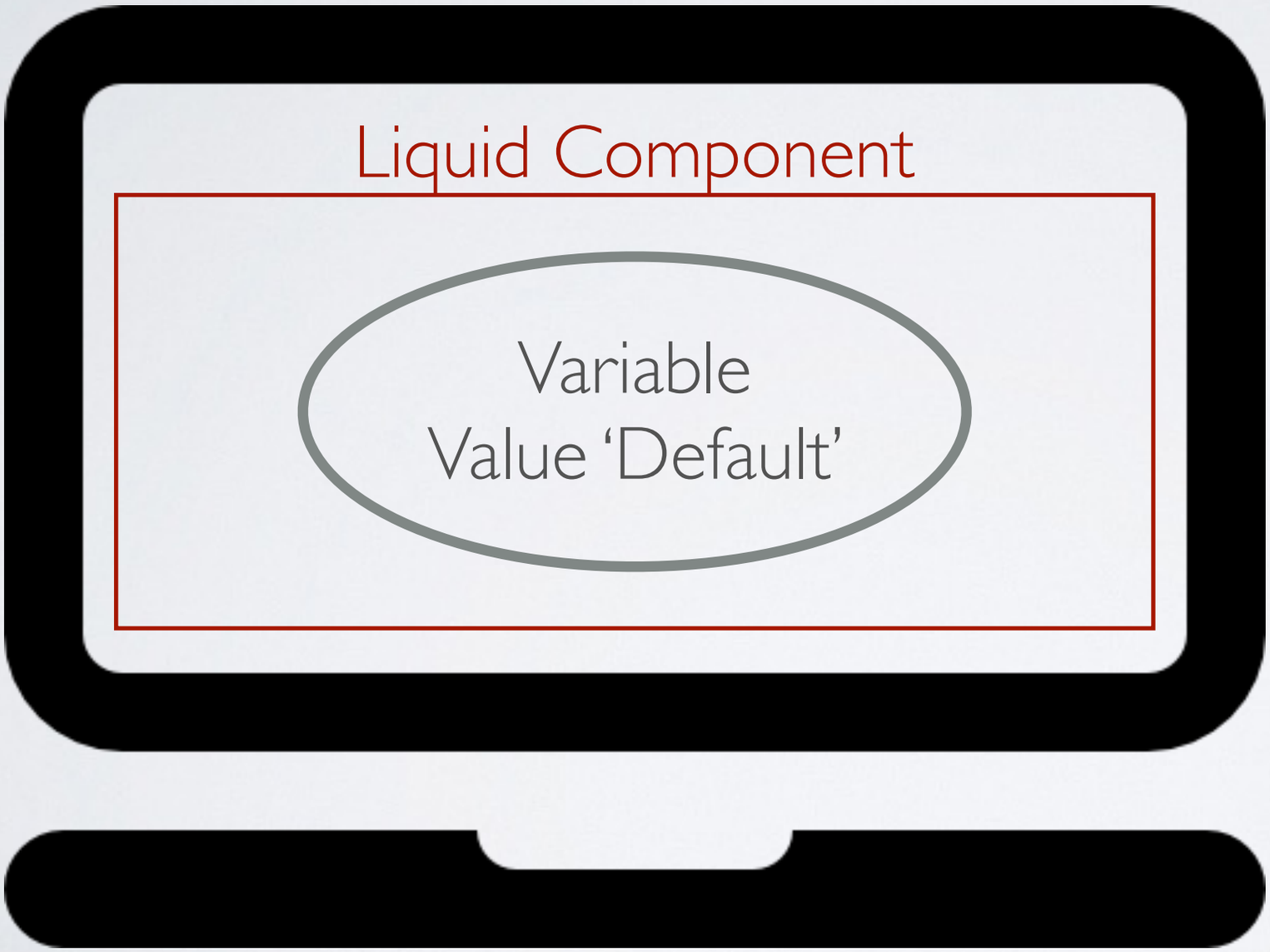


Volatile

Session

PERSISTENCE POLICY

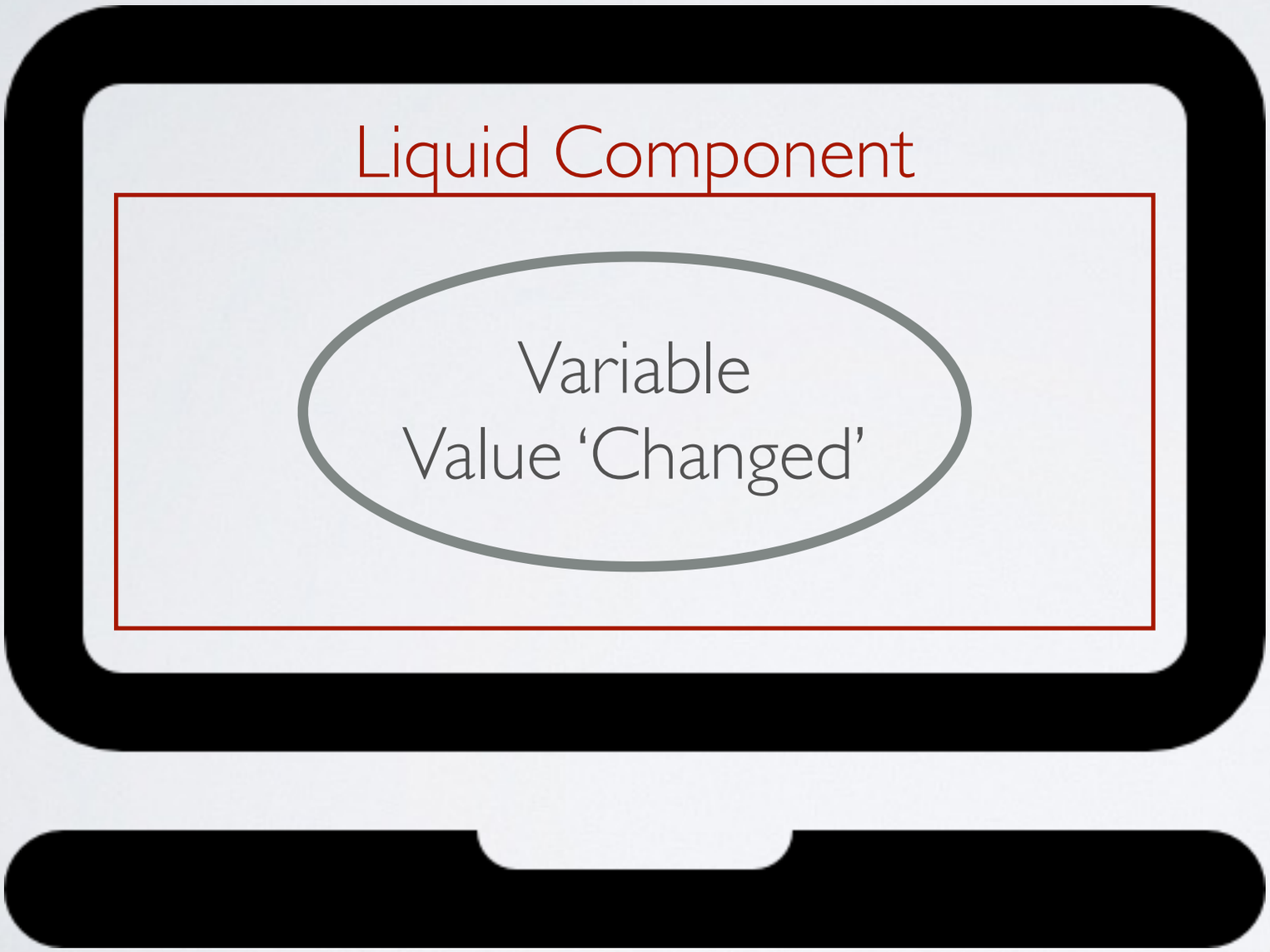


Volatile

Session

Persistent

PERSISTENCE POLICY



Volatile

Session

Persistent

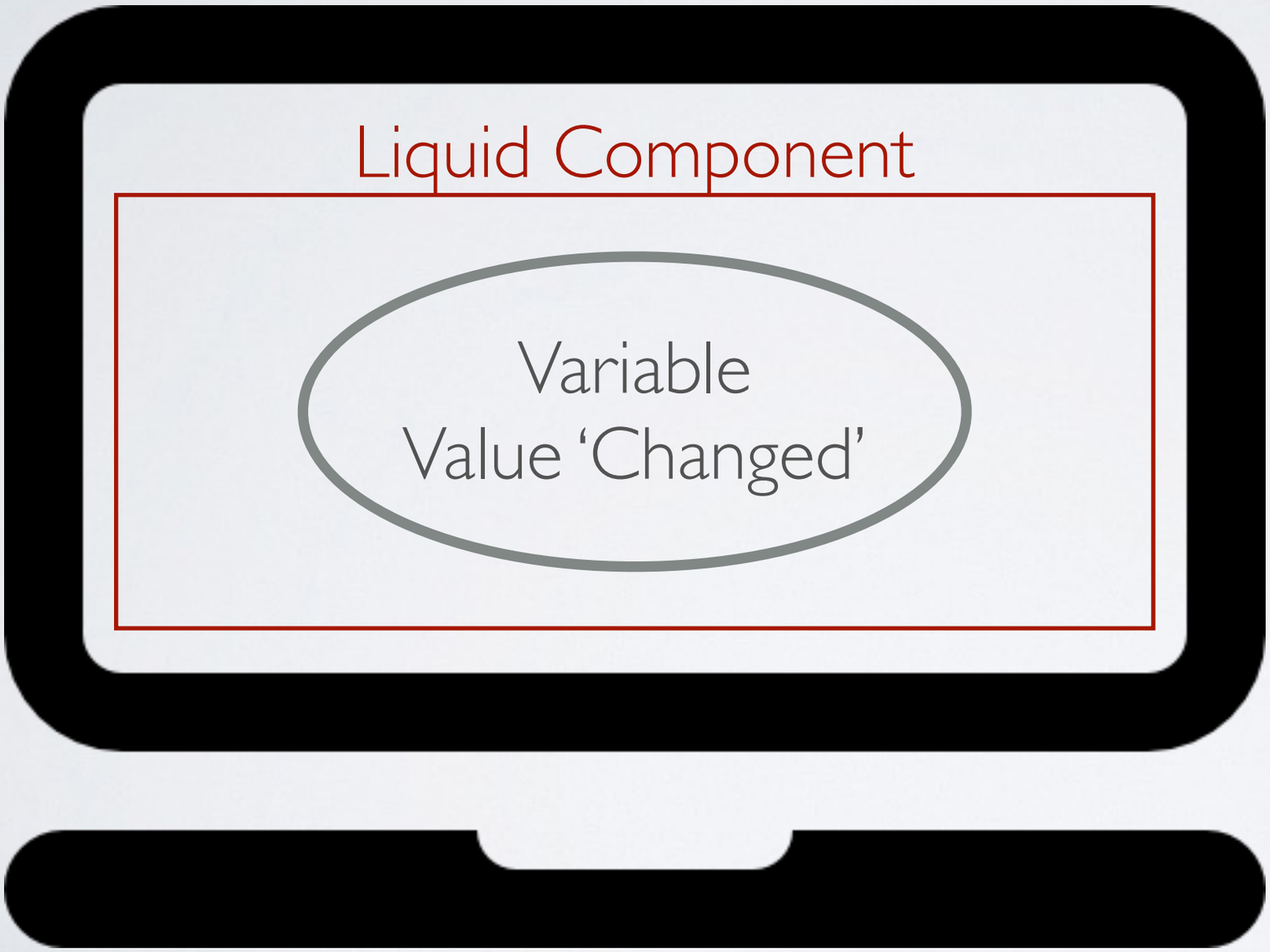
PERSISTENCE POLICY

Volatile

Session

Persistent

PERSISTENCE POLICY

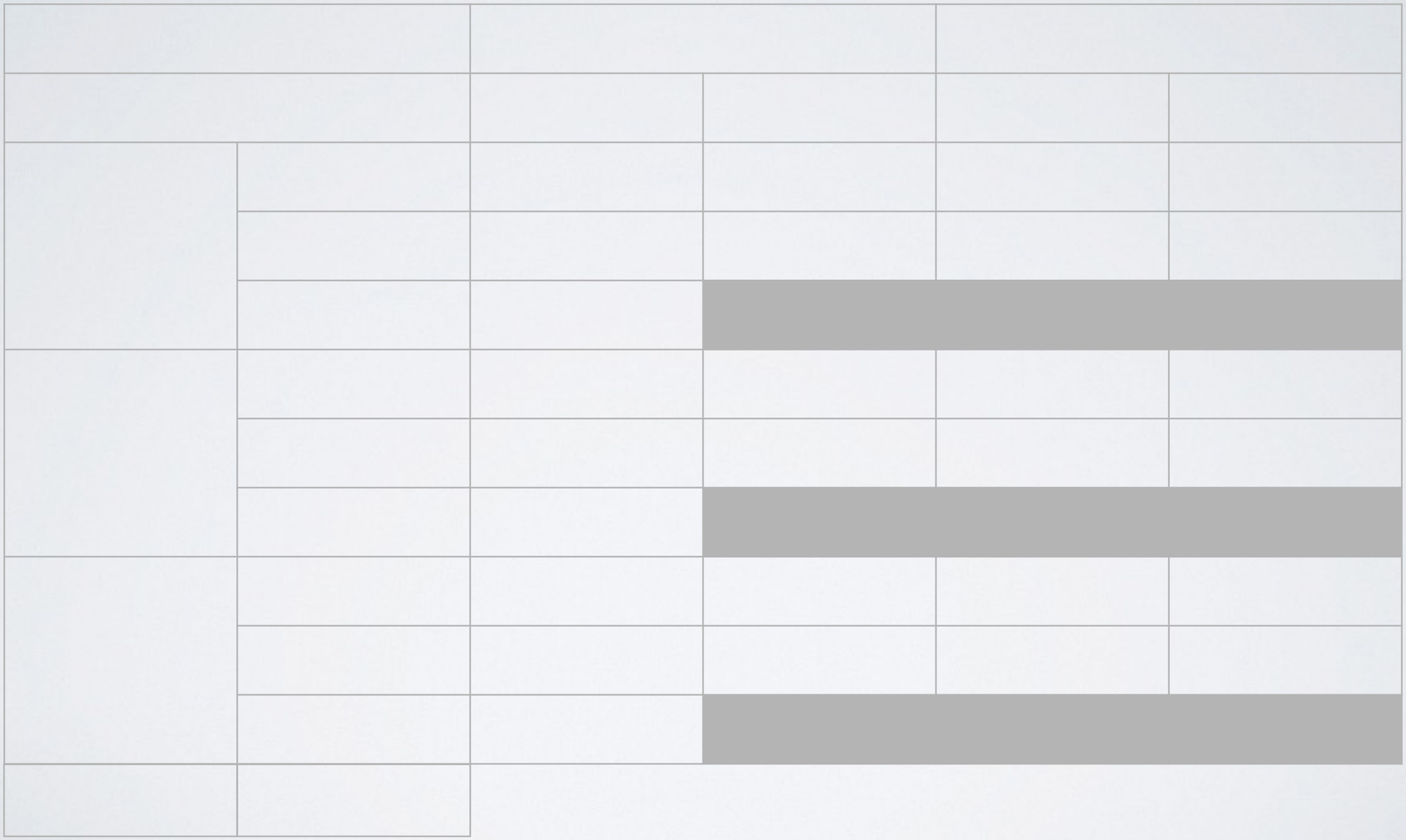


Volatile

Session

Persistent

DECISION



DECISION

Scope					
Deployment					
Persistence	**Sharing**				

DECISION

Scope		Intra-Component		Inter-Component	
Deployment		1 Device	Many	1 Device	Many
Persistent	Global				
	Shared				
	Local				
Session	Global				
	Shared				
	Local				
Volatile	Global				
	Shared				
	Local				
Persistence	Sharing				

DECISION

Scope		Intra-Component		Inter-Component	
Deployment		1 Device	Many	1 Device	Many
Persistent	Global				
	Shared				
	Local				
Session	Global				
	Shared				
	Local				
Volatile	Global	Browser Memory	Browser Memory	Browser Memory	Browser Memory
	Shared	Browser Memory	Browser Memory	Browser Memory	Browser Memory
	Local	Browser Memory			
Persistence	Sharing				

DECISION

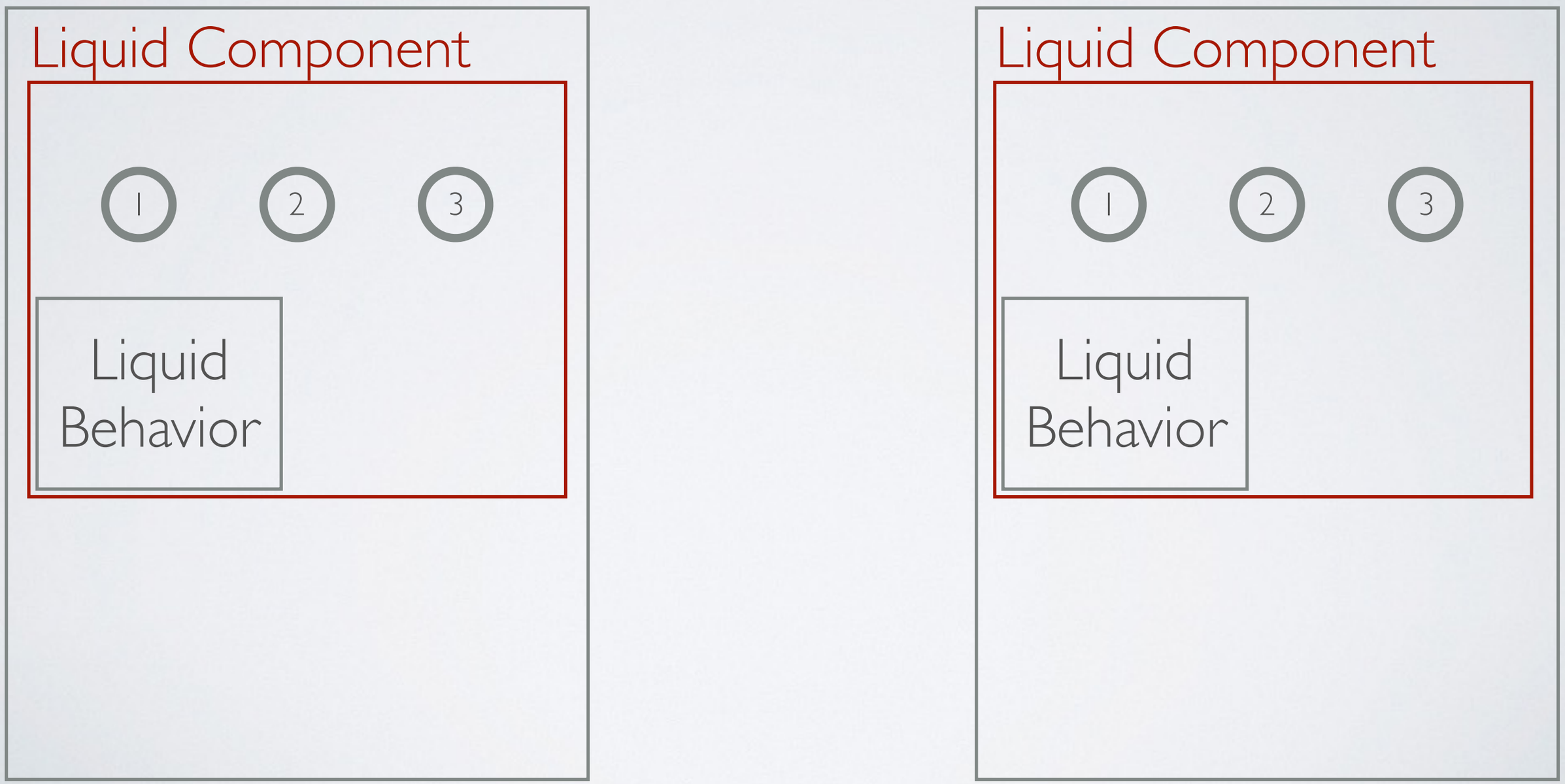
Scope		Intra-Component		Inter-Component	
Deployment		1 Device	Many	1 Device	Many
Persistent	Global				
	Shared				
	Local				
Session	Global	Session Storage	Server	Session Storage	Server
	Shared	Session Storage	Server	Session Storage	Server
	Local	Session Storage			
Volatile	Global	Browser Memory	Browser Memory	Browser Memory	Browser Memory
	Shared	Browser Memory	Browser Memory	Browser Memory	Browser Memory
	Local	Browser Memory			
Persistence	Sharing				

DECISION

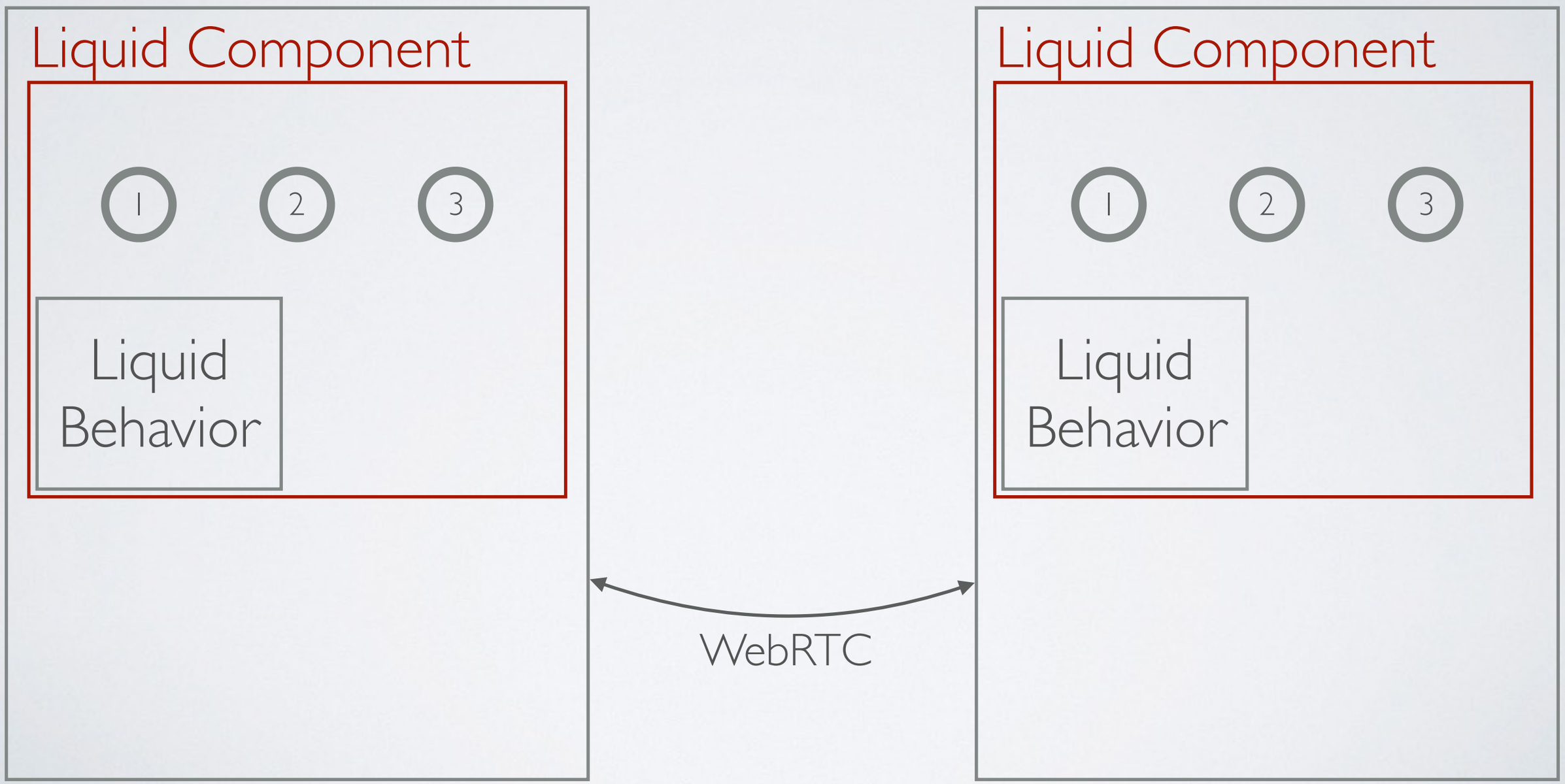
Scope		Intra-Component		Inter-Component	
Deployment		1 Device	Many	1 Device	Many
Persistent	Global	Local Storage	Server	Local Storage	Server
	Shared	Local Storage	Server	Local Storage	Server
	Local	Local Storage			
Session	Global	Session Storage	Server	Session Storage	Server
	Shared	Session Storage	Server	Session Storage	Server
	Local	Session Storage			
Volatile	Global	Browser Memory	Browser Memory	Browser Memory	Browser Memory
	Shared	Browser Memory	Browser Memory	Browser Memory	Browser Memory
	Local	Browser Memory			
Persistence	Sharing				

WHERE DO WE STORE THE STATE

WHERE DO WE STORE THE STATE



WHERE DO WE STORE THE STATE



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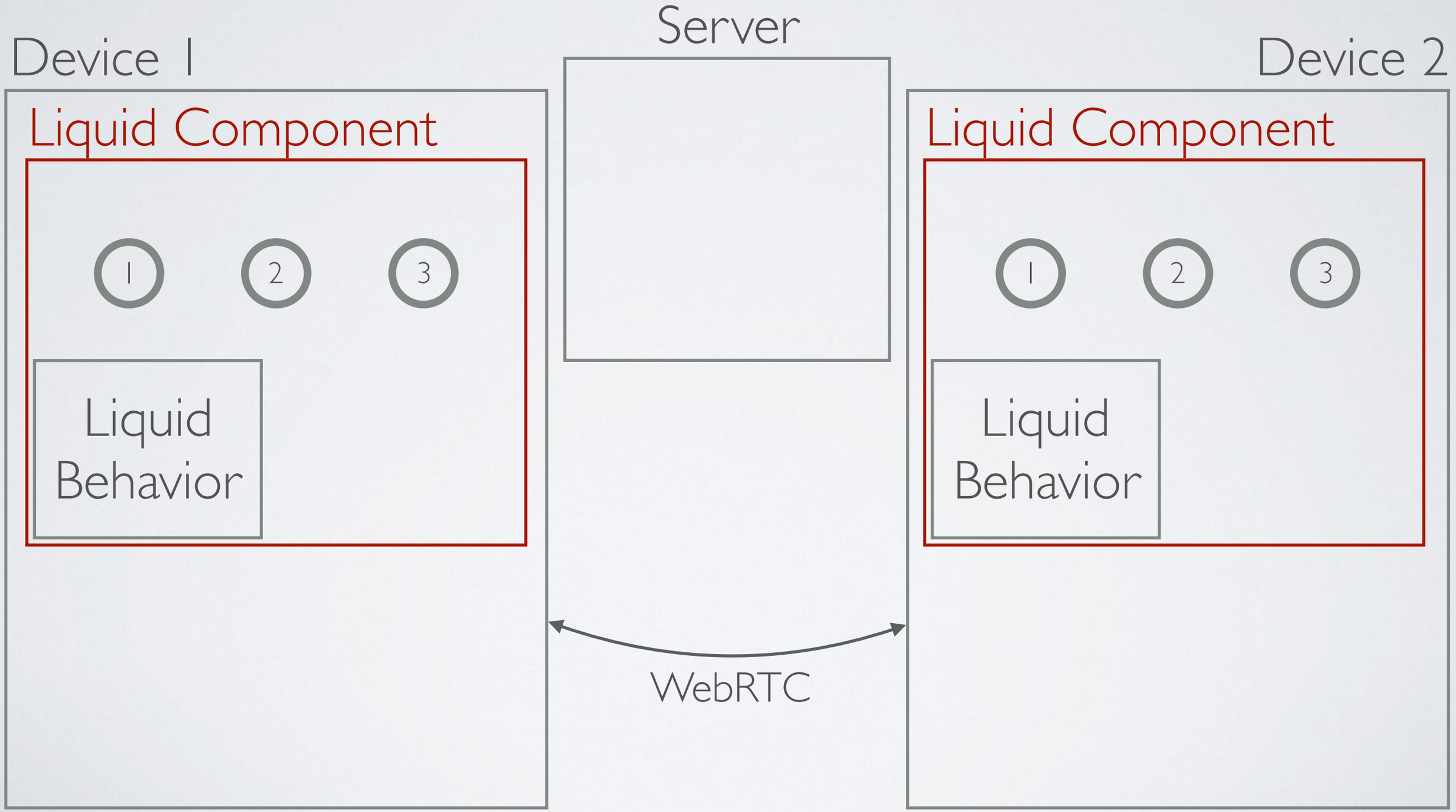

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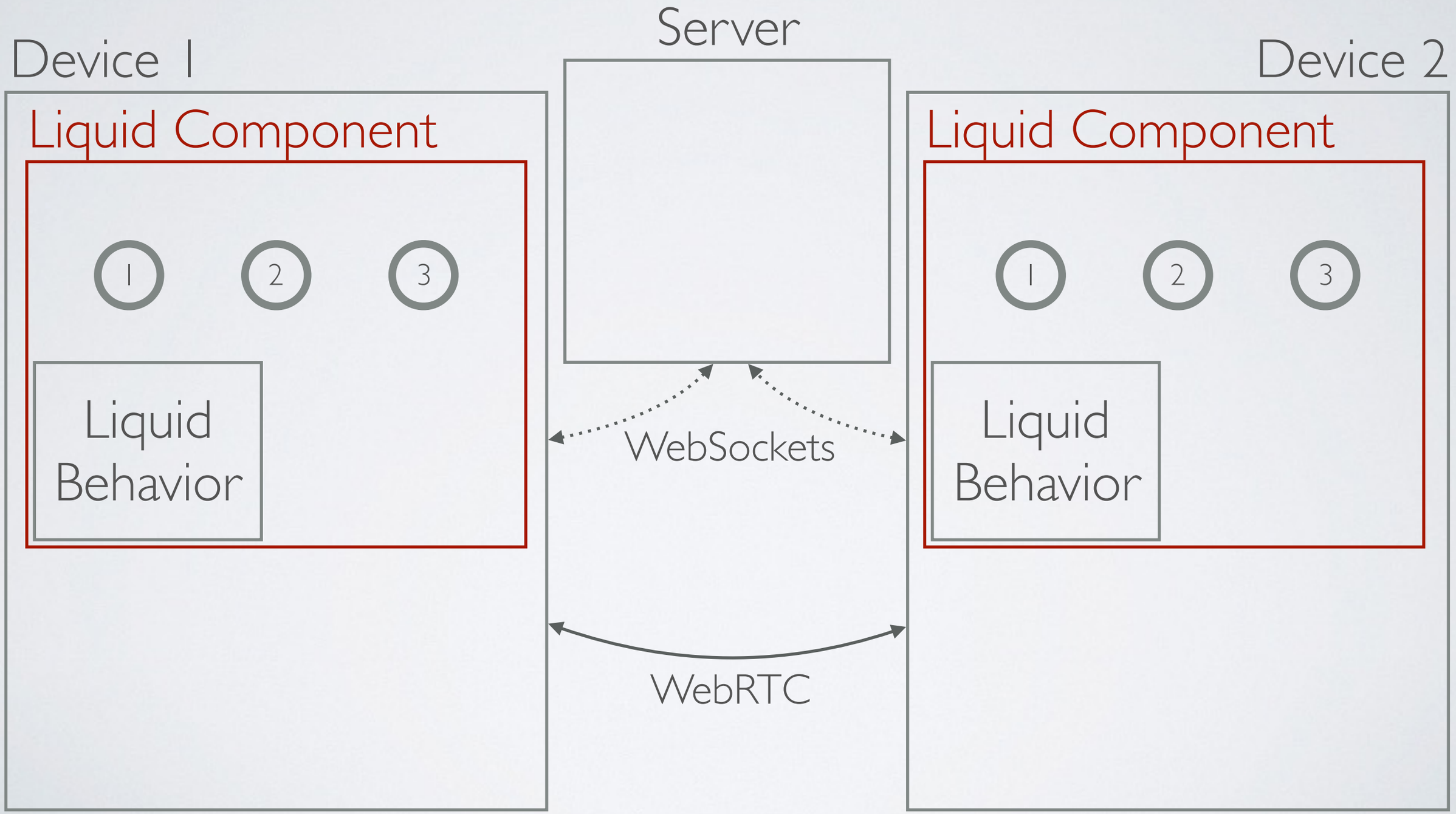

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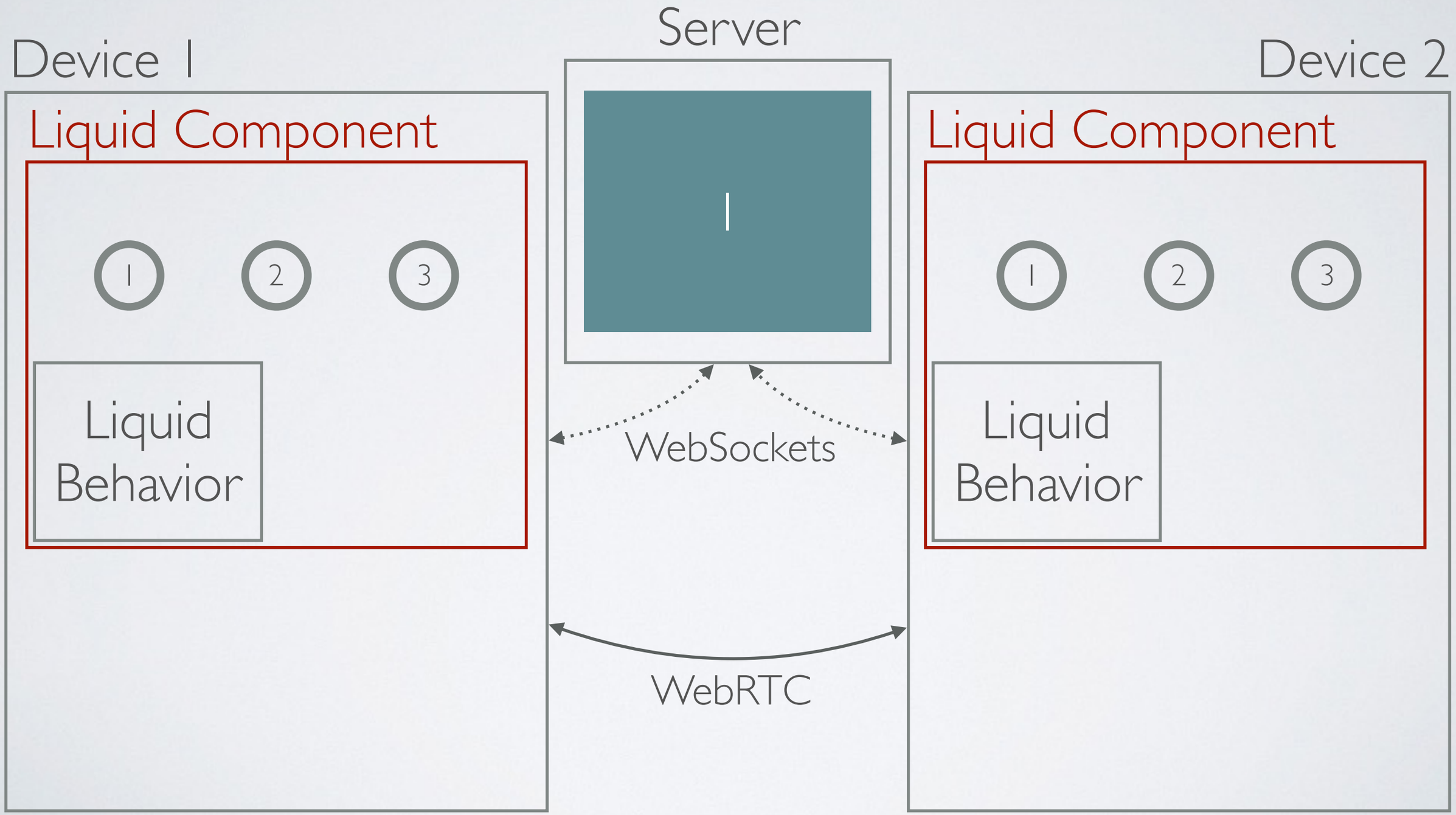

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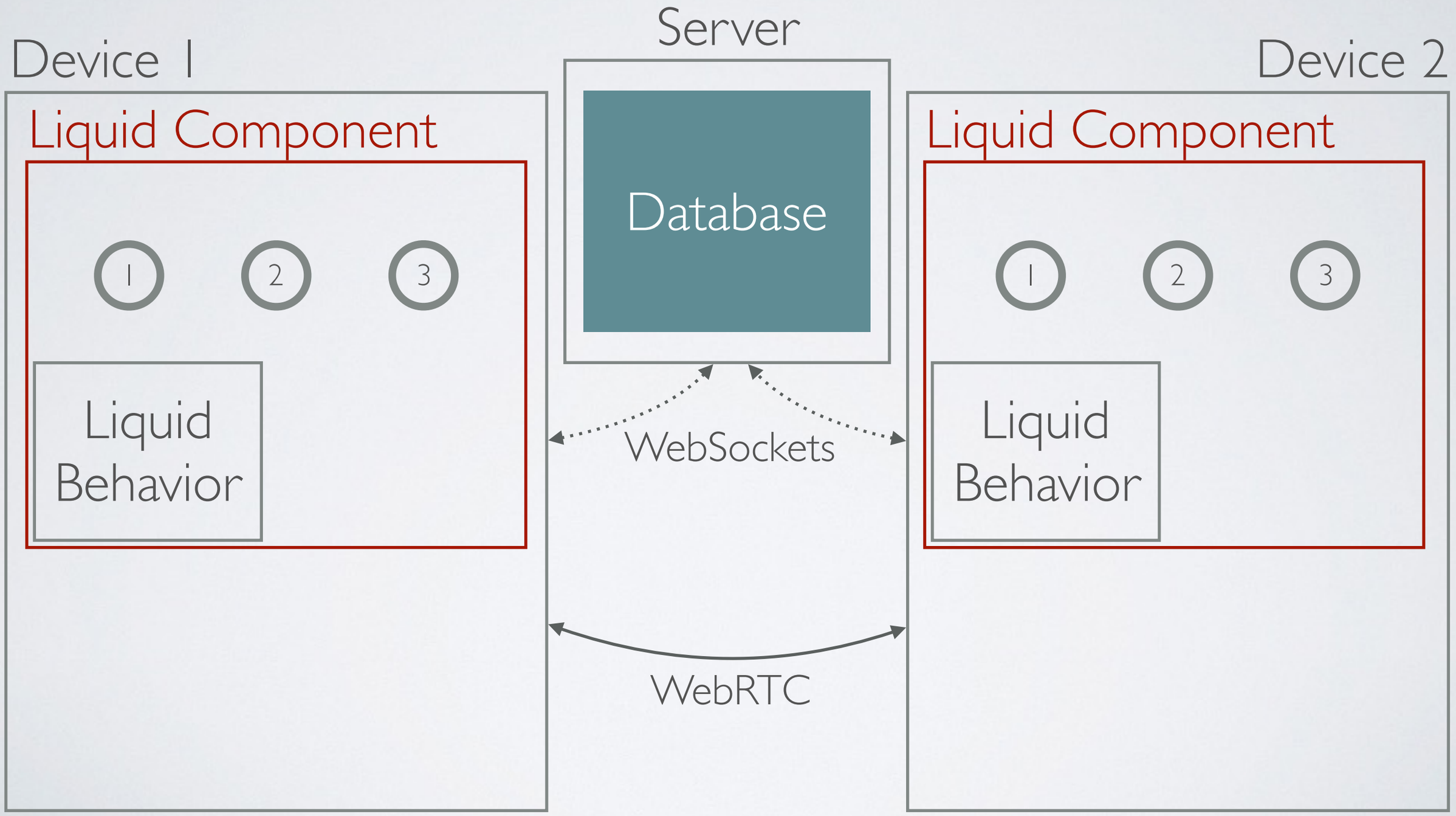
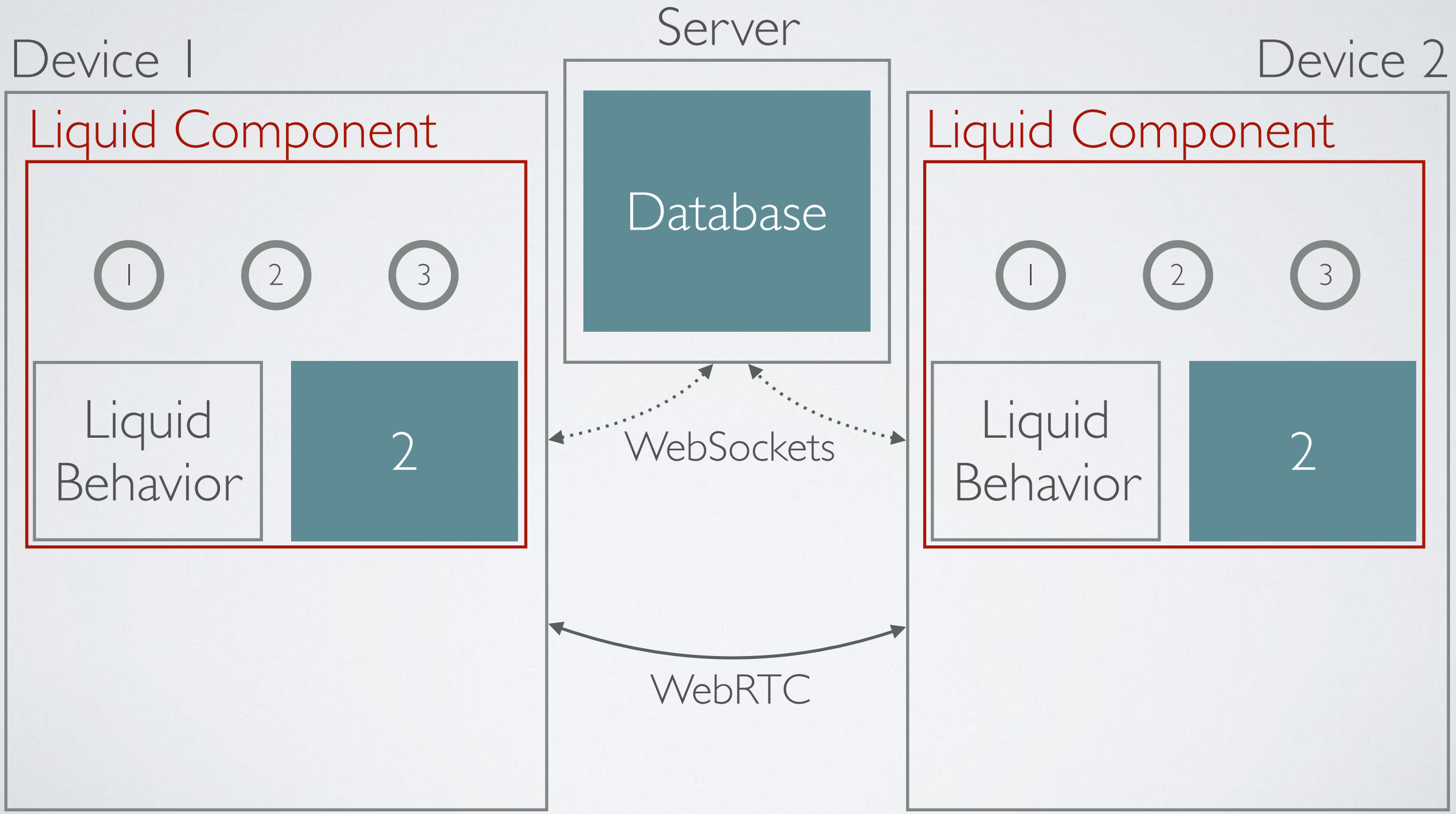
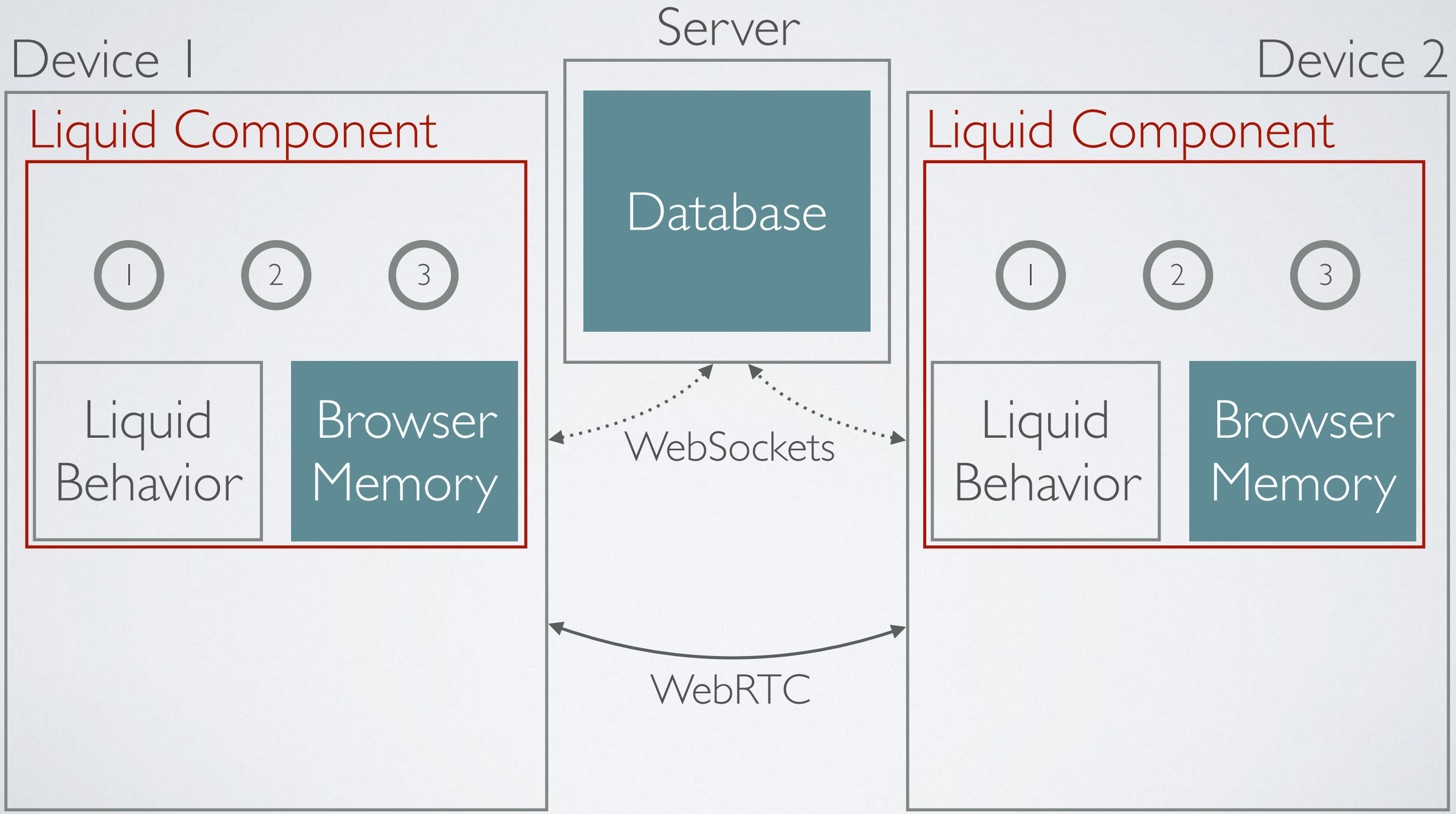


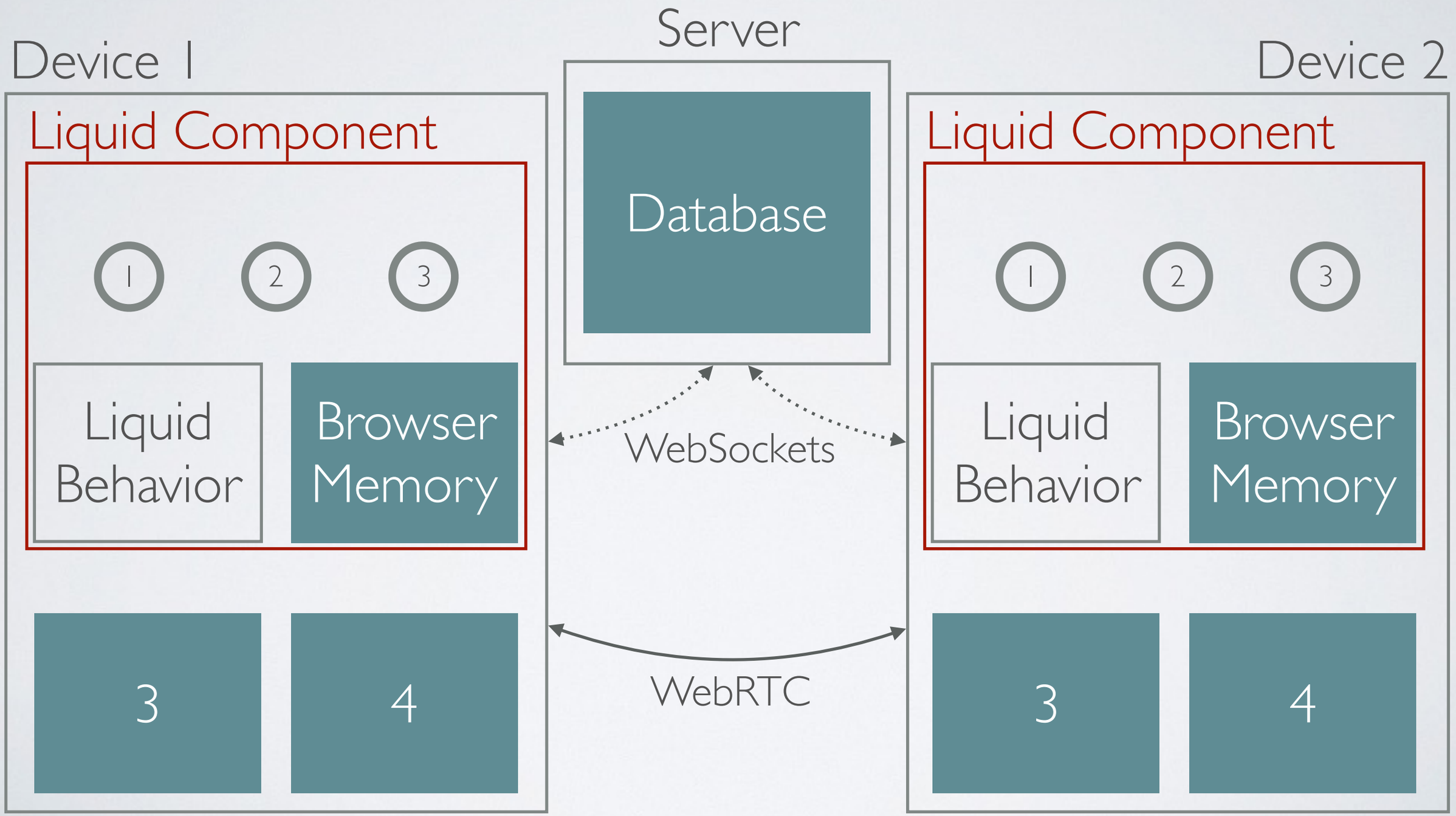
WHERE DO WE STORE THE STATE



WHERE DO WE STORE THE STATE



WHERE DO WE STORE THE STATE



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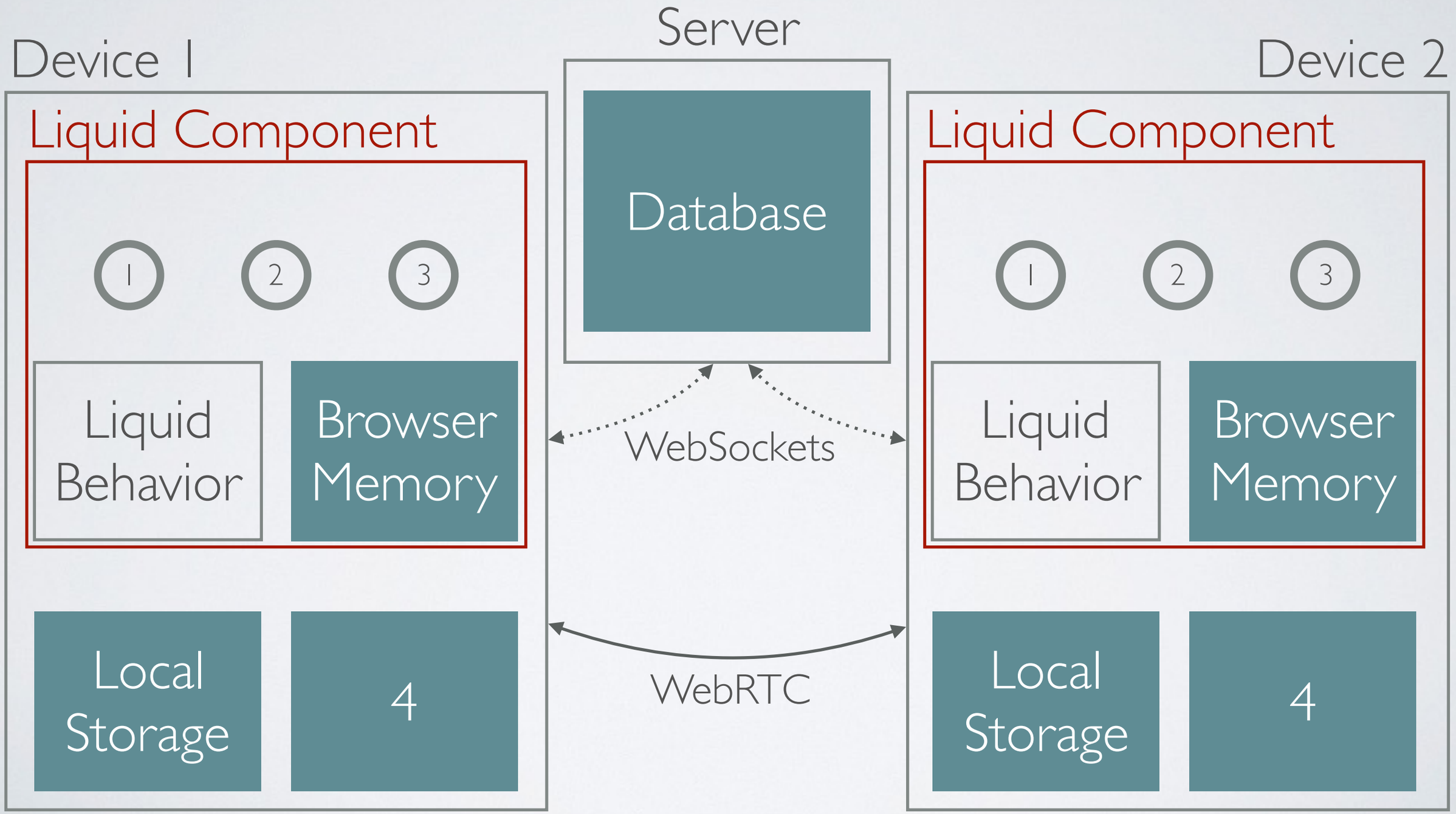

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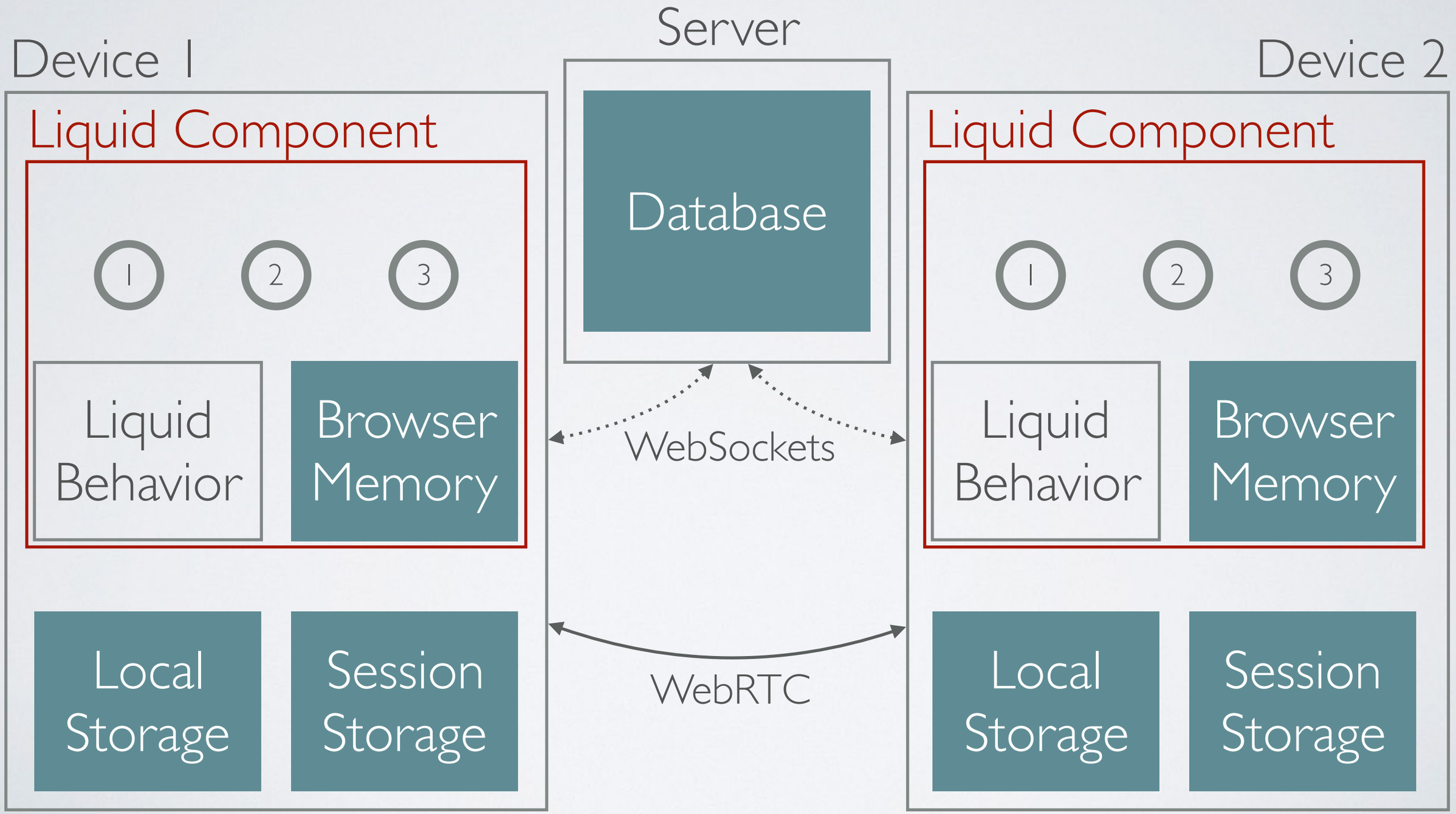

CONCLUSION

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Solution for the three use case scenarios:

CONCLUSION

Solution for the three use case scenarios:

sequential screening, simultaneous screening, collaborative

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Solution for the three use case scenarios:

sequential screening, simultaneous screening, collaborative

Transparently synchronise component state

CONCLUSION

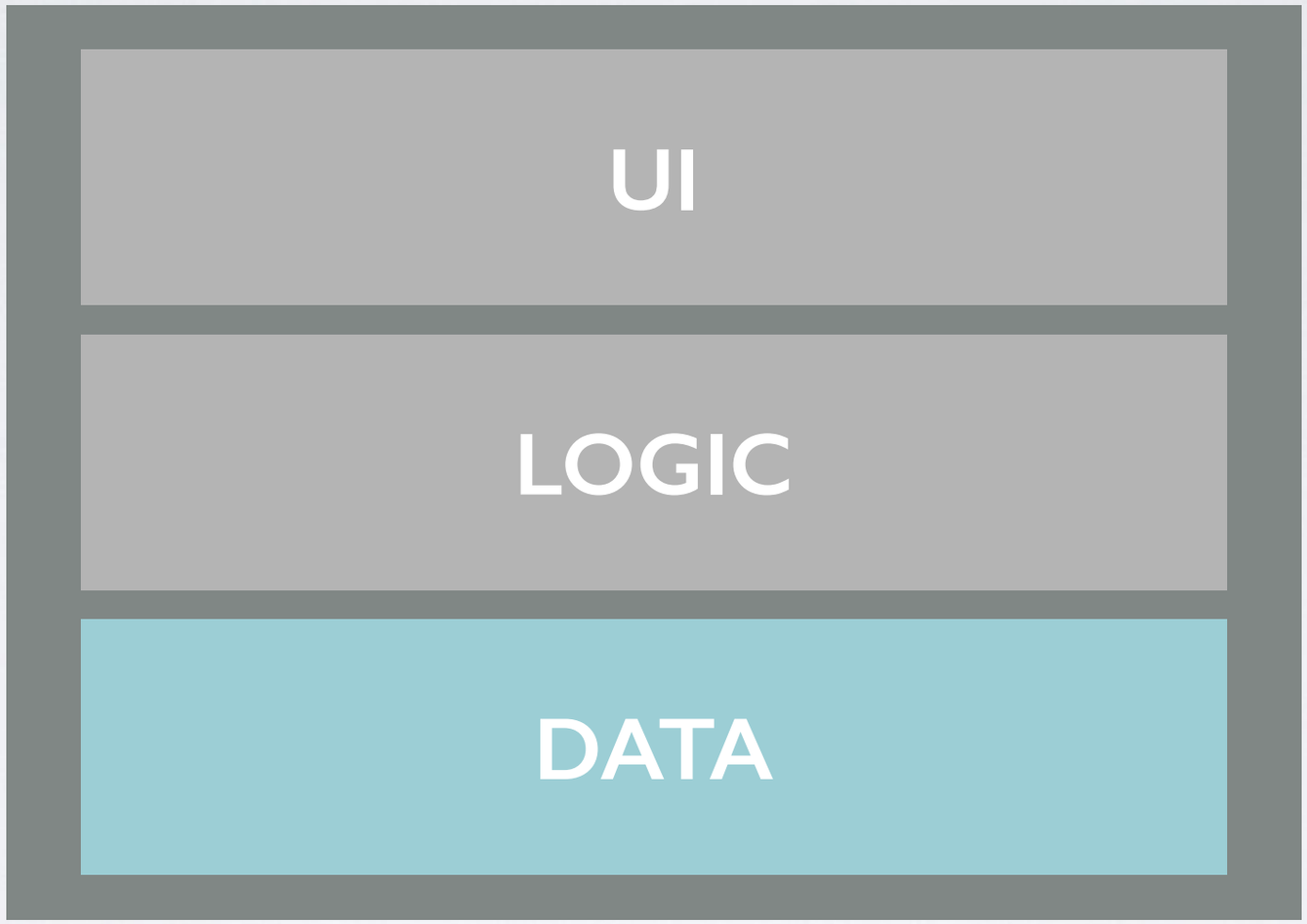
Solution for the three use case scenarios:

sequential screening, simultaneous screening, collaborative

Transparently synchronise component state

Decentralised environment

FUTURE WORK



COMPSAC'14

A. Taivalsaari, T. Mikkonen, and K. Systä

Liquid Software Manifesto: The Era of Multiple Device Ownership and Its Implications for Software Architecture

ICWE'15

T. Mikkonen, K. Systä, and C. Pautasso

Towards liquid web applications

WICSA'16

A.Gallidabino, C. Pautasso, T. Mikkonen, V. Ilvonen, K. Systä, J.-P. Voutilainen, and A. Taivalsaari.

On the architecture of liquid software: Technology alternatives and design space

WWW'16 (Demo paper)

A. Gallidabino, and C. Pautasso.

The Liquid.js framework for migrating and cloning stateful Web components across multiple devices

1st International Workshop on

Liquid Multi-Device Software for the Web

Lugano

ICWE2016

http://icwe2016.inf.usi.ch/liquid