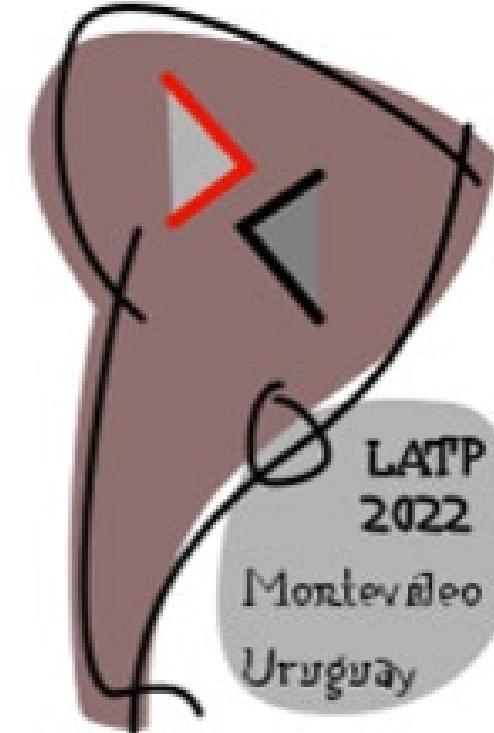


Behavior con B de Bonsai

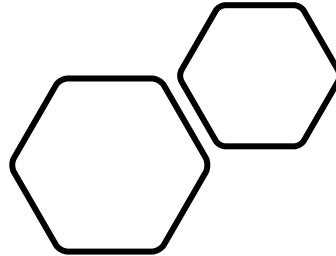
Nacho Sanguinetti

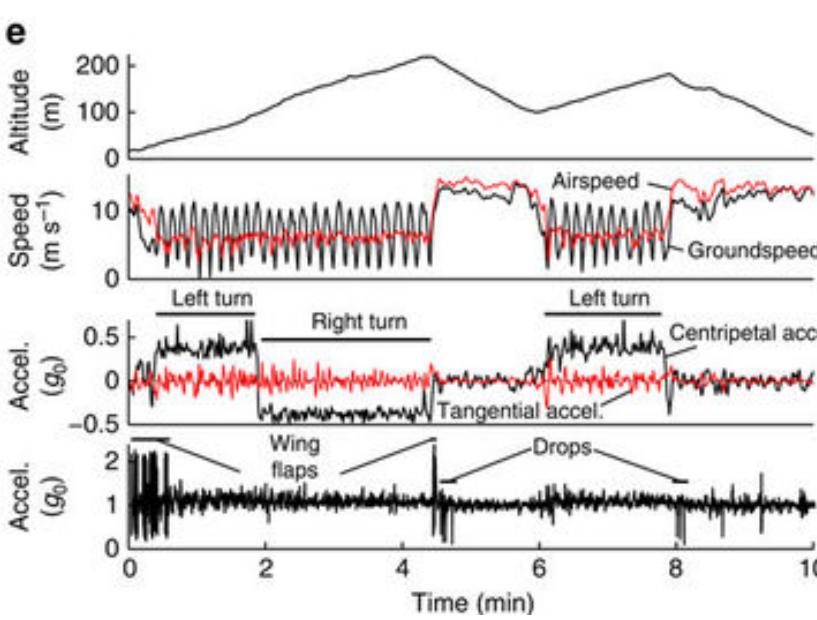
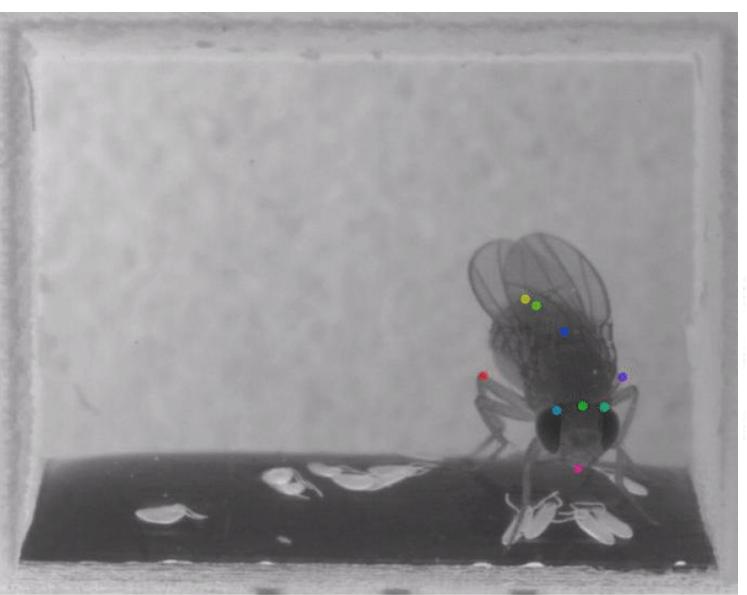
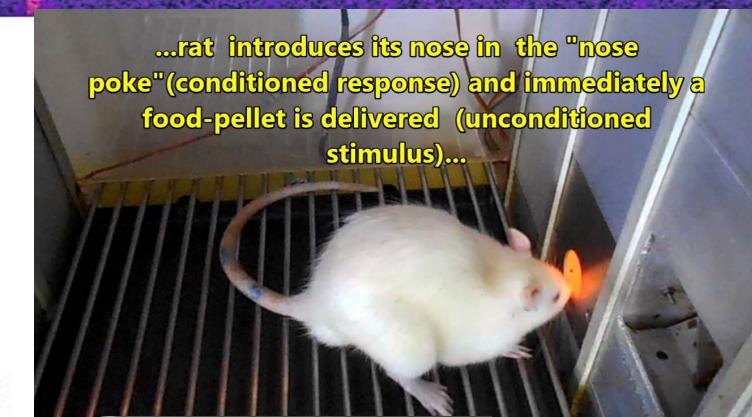
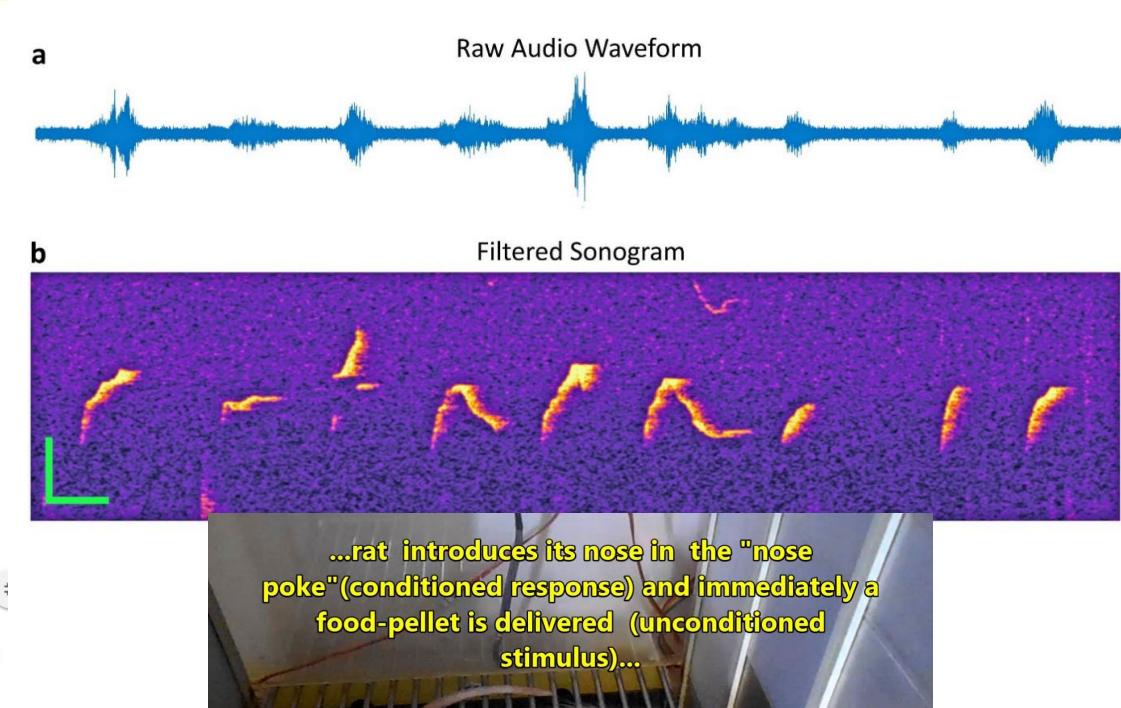
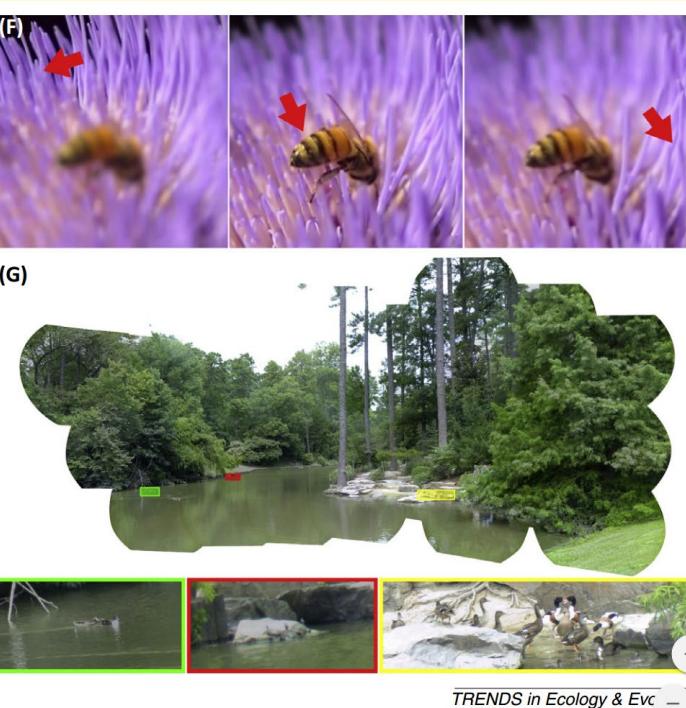
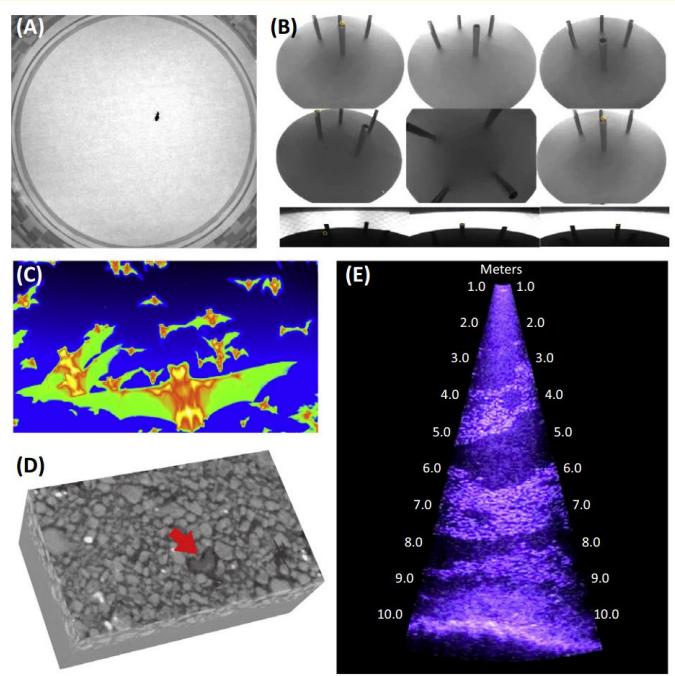
Harvard University



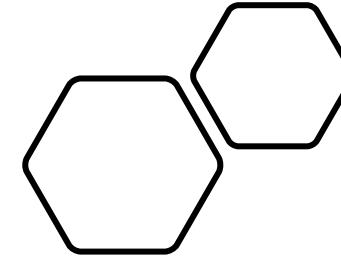
HARVARD
Faculty of Arts and Sciences

Cómo se registra
el
comportamiento?

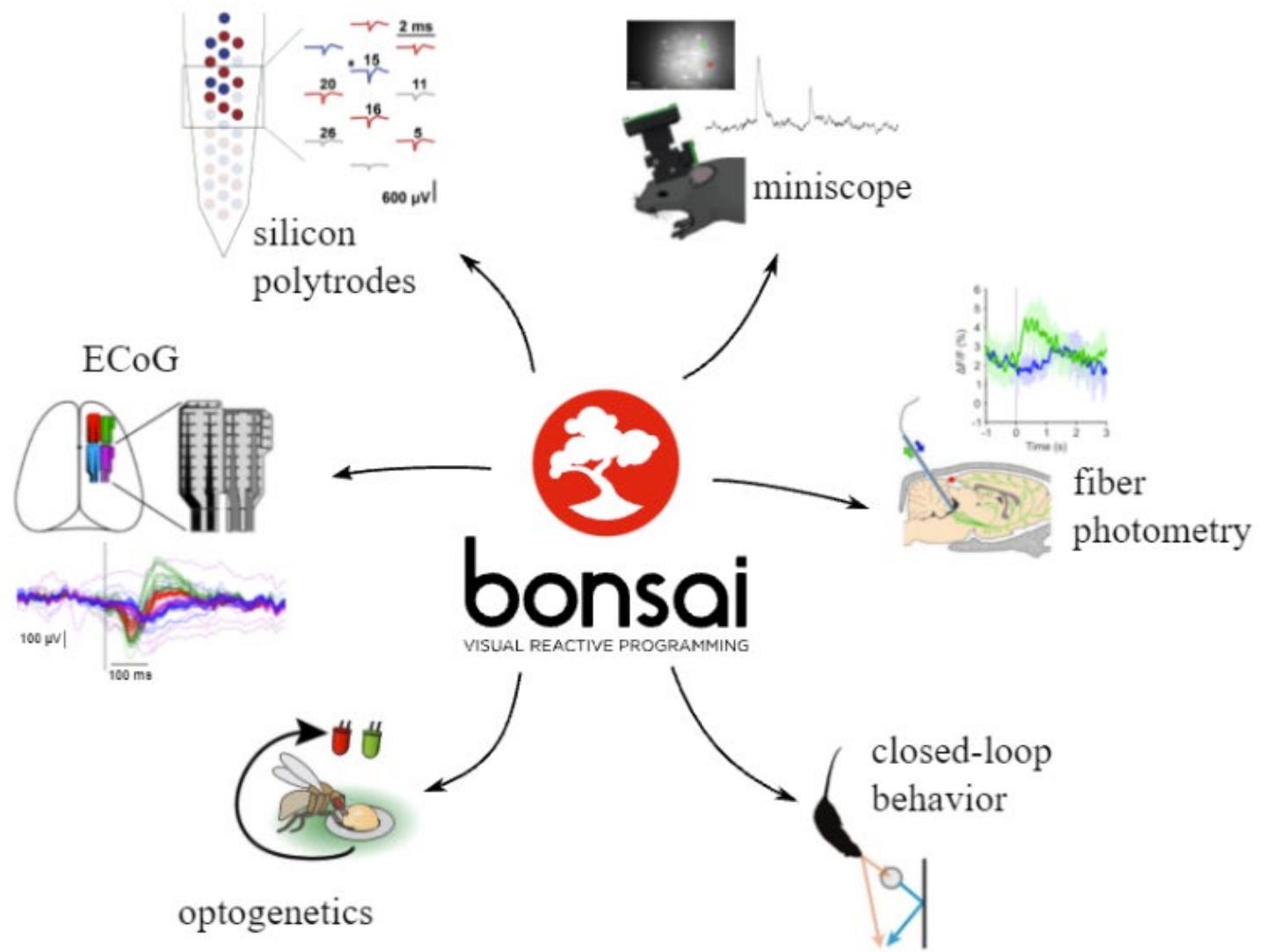




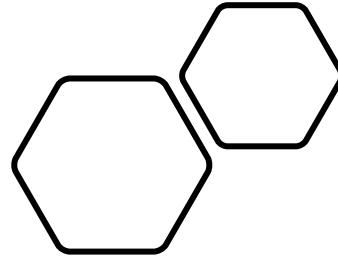
Qué tipo de
equipamiento
queremos
controlar?







Cómo
hacemos
entonces?



El antes...

Noldus

[APPLICATIONS](#)[PRODUCTS](#)[CUSTOMER STORIES](#)[ABOUT NOLDUS](#)[MYNOLDUS](#)[CONTACT](#)[BLOG](#)

VIDEO TRACKING SOFTWARE

EthoVision XT

EthoVision XT is the most widely applied video tracking software that tracks and analyzes the behavior, movement, and activity of any animal.

[WEBSHOP](#)[WHAT'S NEW](#)

- ✓ A cost-effective solution for all standard behavioral tests such as the Morris water maze and open field testing
- ✓ High-throughput and high-content testing
- ✓ Suitable for sophisticated test-protocols



▪ **EthoVision XT**

[What's new](#)

[Benefits](#)

[Set up your system](#)

[Gathering data](#)

[Data analysis](#)

[Modules](#)

[Resources](#)

[Free trial](#)

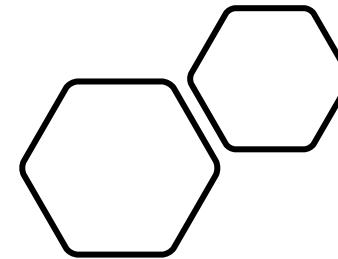
Starting at (USD)

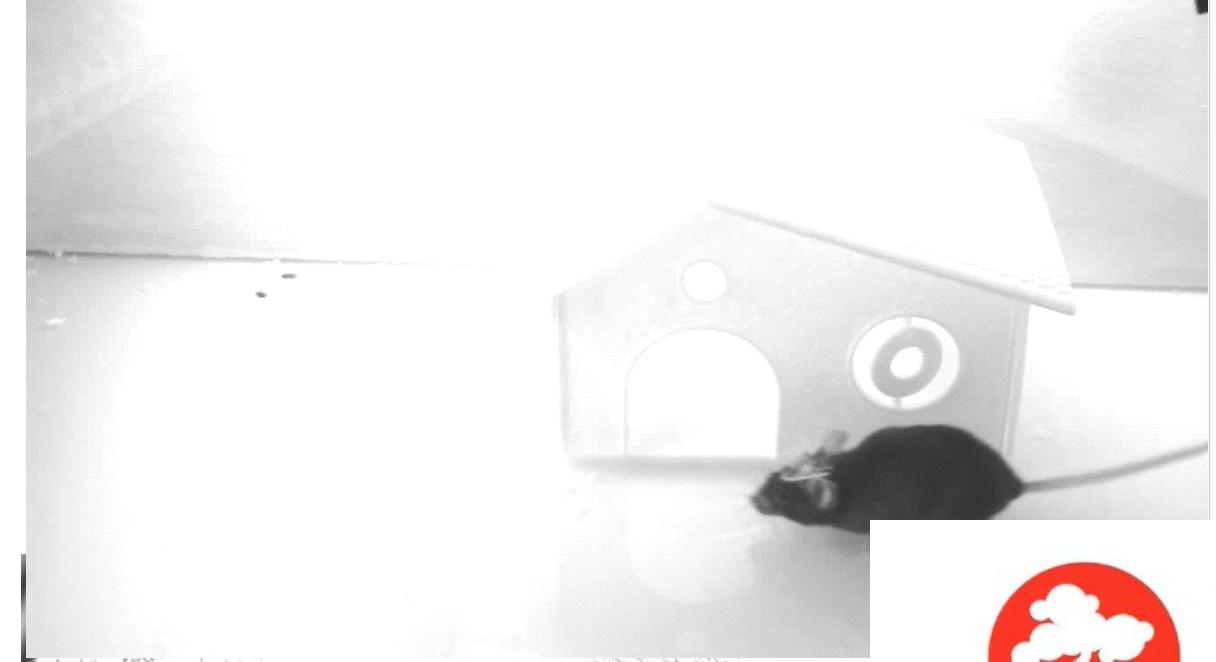
\$ 5,925



Seguro costaba mucha plata

El después...

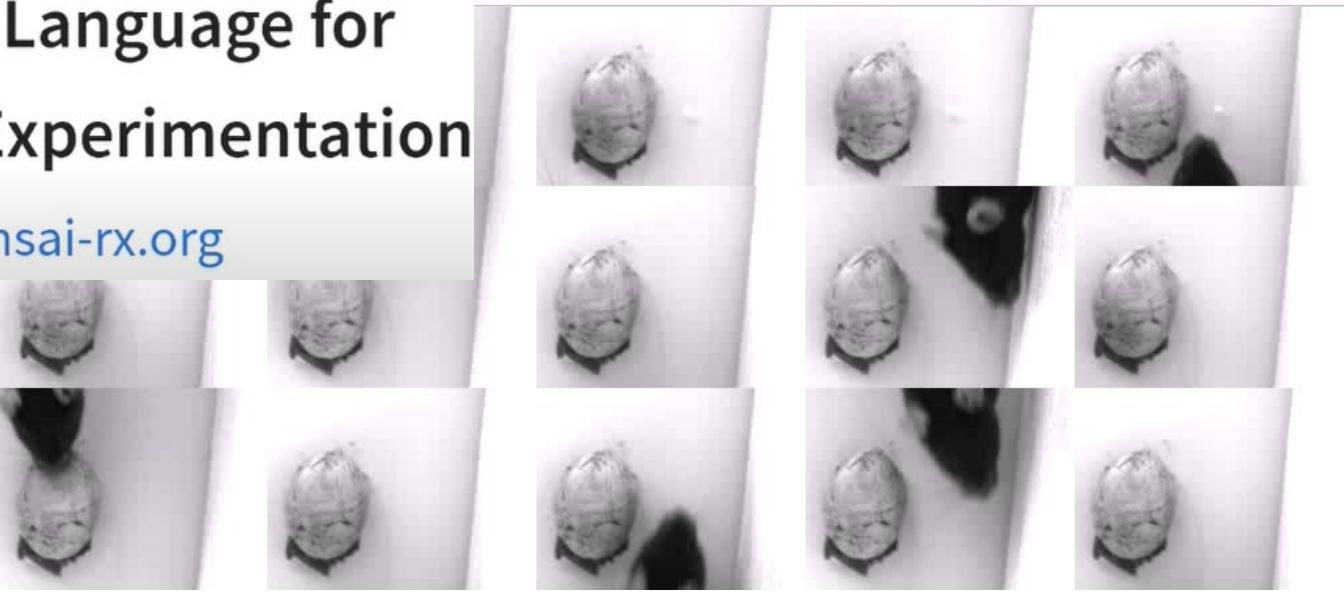




bonsai
VISUAL REACTIVE PROGRAMMING

A Visual Language for
Scientific Experimentation

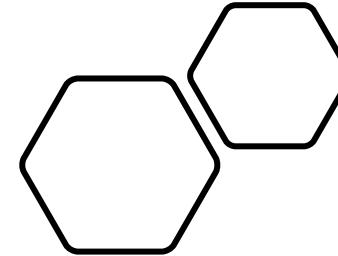
bonsai-rx.org



Por qué?

- Software abierto
- Visual programming Language (VPL)
- Reactive programming (Rx) – Good for Asynchronous streams.
- Extendible con paquetes customizados(NuGET) or nodos con Python.
- Machine Vision en tiempo real y control de todo tipo de equipos
- Posibilidad de hacer experimentos de bucle cerrado
- Fácilmente modificable para prototipos y experimentos piloto

Algunos
Ejemplitos...

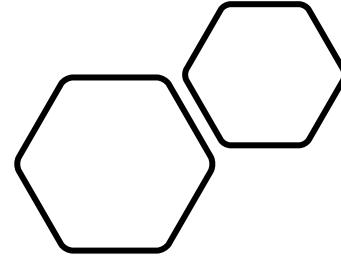




Tenss Lab, ThreeinthemorningVR



Bonsai Para los datos asincrónicos



Qué son los datos asincrónicos?



30 Hz (fps)

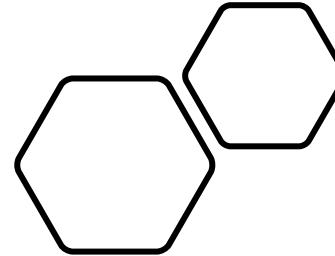


30,000 Hz (30kHz)

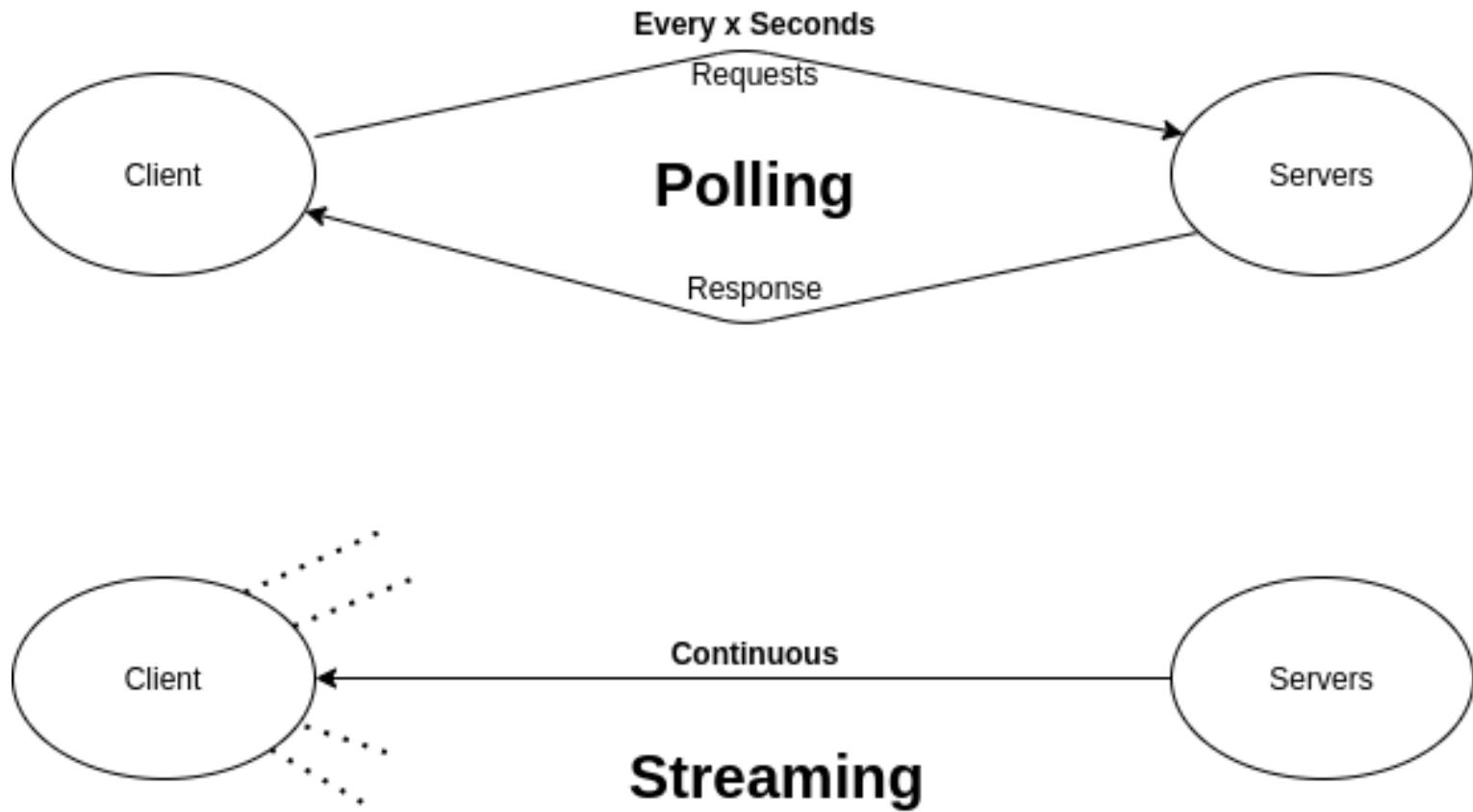


?????

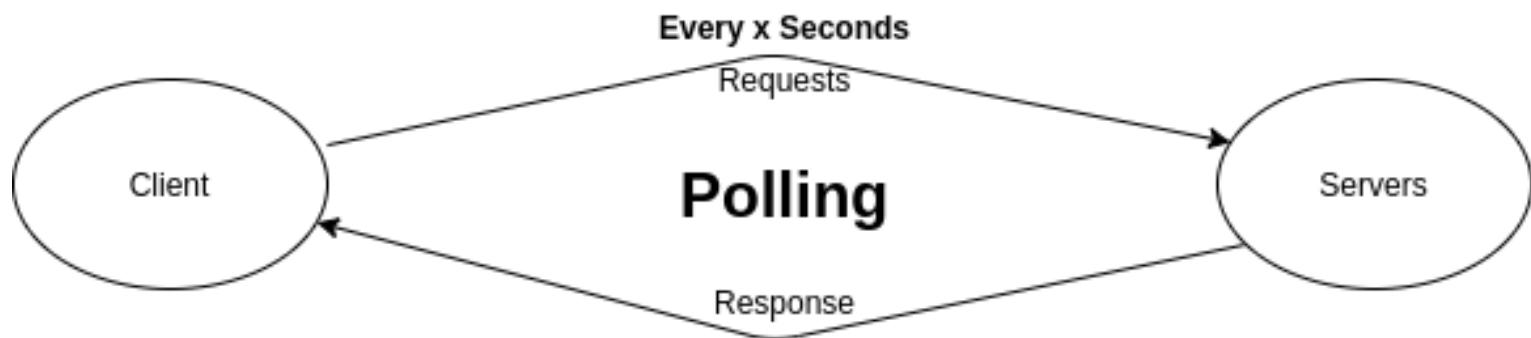
Bonsai como Reactive X



Cómo se relacionan las computadoras con los dispositivos?

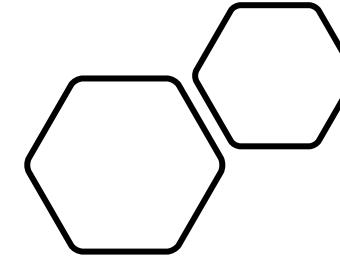


Polling vs Reactive (or streaming)



A Visual Language for
Scientific Experimentation
bonsai-rx.org

Una metáfora
para Polling vs
Reactive



Jakob Voigts

[About](#)[Publications](#)[Lab website >>](#)[Science](#)[Doing science](#)[Data analysis](#)[Open Ephys](#)[Technical things](#)[Electrophysiology](#)[Calcium imaging](#)[Matlab](#)

Basic techniques for making mechanical structures for systems neuroscience

Posted on December 8, 2020 by jvoigts

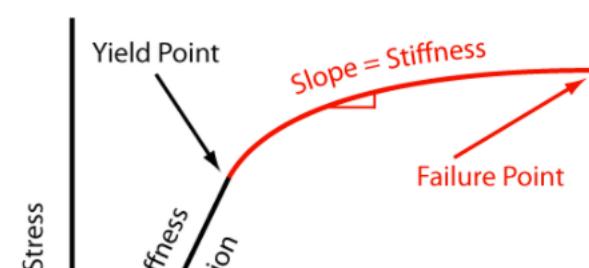
In systems neuroscience, a lot of times we need to build or modify mechanical support structures to keep devices in place. This could be cameras, electrode manipulators, slides, lenses, headposts, etc. Almost universally, these structures need to keep relatively light devices or preparations at precise positions, this means they should not drift, vibrate, or deflect.

This is an extremely large topic and I am only going to cover some basic but concrete points here with the goal of clearing up some common misconceptions and providing some basis for making better design or purchasing decisions. **Keep in mind that in a lot of cases it may be advisable to pay an expert to help design your rig or to look for existing solutions. Your time is expensive, and spending it to build something that you could buy is often a bad trade-off.**

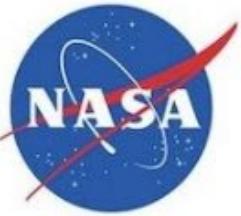
A lot of the more fundamental points in this post are made better by Dan Gelbart in his excellent [video series 'Building Prototypes'](#). If you have the time, watch these.

Stiffness vs. yield strength

People often spend their efforts in the wrong place when building instruments because they think that in order to reduce drift or vibration, the things they build need to just be 'as strong as possible', which means that the best structure would be the one that can hold the most weight. This is usually a misconception because **what matters when building instruments is stiffness at low stress/strain, not strength**.



Metáfora para secuencias de observables

 **NASA** 
@NASA

Explore the universe and discover our home planet
with @NASA. We usually post in EDT (UTC-4).
· <http://www.nasa.gov>

+ Follow

FOLLOWERS 10,007,852 FOLLOWING 231



 **NASA** @NASA
Magnetar near supermassive black hole at our galaxy's center
delivers surprises: go.nasa.gov/1G9MO1N @chandraxray
pic.twitter.com/qwOhGyellj

53m ago   

 **NASA** @NASA
Calling all students! Help design a 3-D space container for
astronauts. More: go.nasa.gov/1HfitjM @K12FutureE
amp.twimgimg.com/v/e751b9a8-cb1...

2h ago   

Metáfora para secuencias de observables



WebCam
@CameraCapture

Follow

Capture full-resolution images at 30 frames per second
with @CameraCapture. We usually post in color (RGB).

FOLLOWERS 1



FOLLOWING 0



WebCam @CameraCapture



53m ago



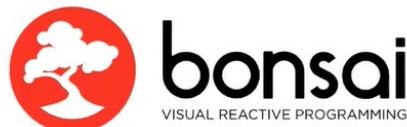
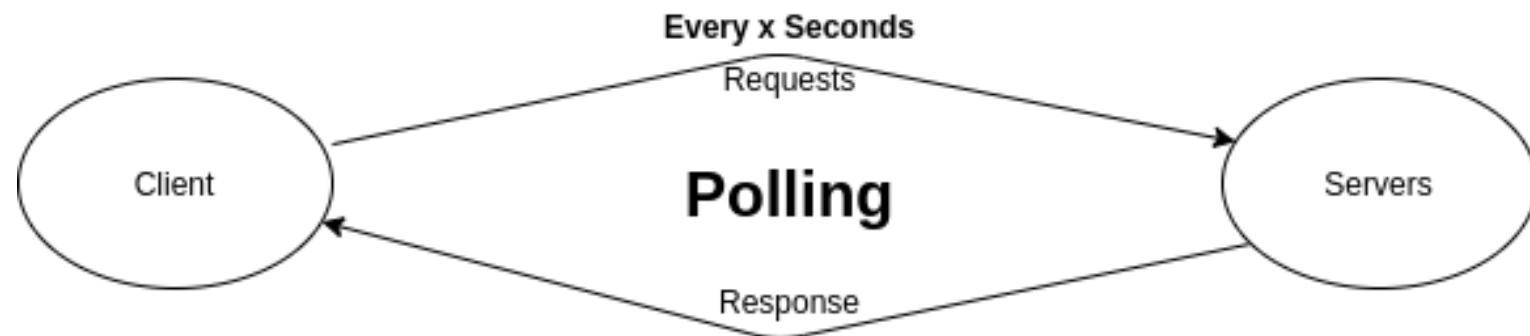
WebCam @CameraCapture



53m ago



Polling vs Streaming



A Visual Language for
Scientific Experimentation

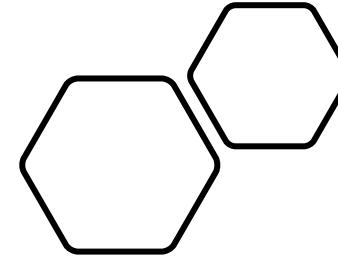
bonsai-rx.org

Continuous

Streaming



Bonsai como
un Visual
Programming
Language



editor.bonsai (Running) - Bonsai

File Edit Workflow Tools Help

C:\Users\Public\Documents

Workflow

```
graph LR; CameraCapture[Camera Capture] --> ConvertColor[ConvertColor]; ConvertColor --> HsvThreshold[HsvThreshold]; HsvThreshold --> FindContours[FindContours]; FindContours --> BinaryRegionAnalysis[BinaryRegion Analysis]; BinaryRegionAnalysis --> LargestBinaryRegion[LargestBinary Region]; LargestBinaryRegion --> CsvWriter[CsvWriter]; CsvWriter --> CentroidX[Centroid.X]; CsvWriter --> CentroidY[Centroid.Y]
```

Properties

HsvThreshold
Segments the input image using an HSV color range.

Misc

Lower	75,106,55
H	75
S	106
V	55
Upper	115,255,155
H	115
S	255
V	155

Centroid.X

Centroid.Y

Upper

The upper bound of the HSV color range.

Toolbox

Search Modules (Ctrl+E)

- Source
- + Editor.Scripting
- + Expressions
- + Reactive
- + Video
- + Scripting
- + Harp
- + RealSense
- + Ephys
- + Dsp
- + Shaders
- + Shaders.Input
- Vision
 - AffineTransform
 - CameraCapture
 - CreateExtrinsics
 - CreateIntrinsics
 - CreatePoint
 - CreatePoint2d
 - CreatePoint2f
 - CreatePoint3d
 - FileCapture
 - LoadImage
 - LoadIntrinsics
 - SolidColor
 - + Vision.Drawing
 - + Osc
 - + Arduino
 - + IO
 - + uEye
 - + Audio
 - + PointGrey
 - + Windows.Input
 - + Bitalino
- CameraCapture
Produces a video sequence of images acquired from the specified camera index.

Running

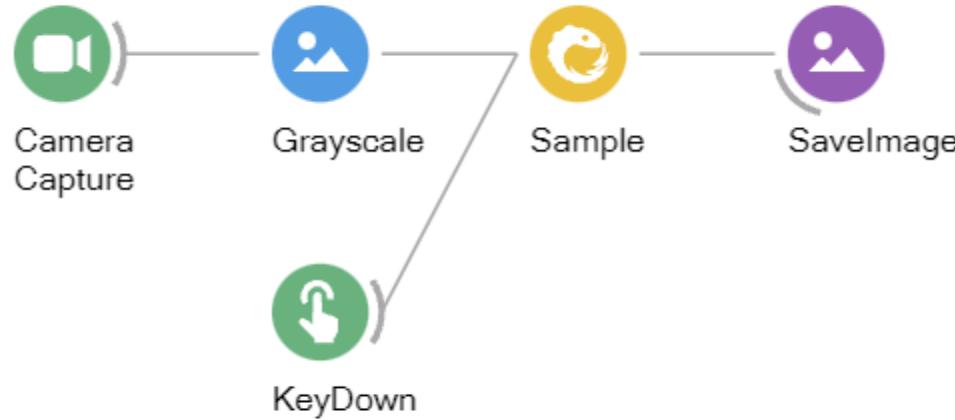
Tipos de Nodos en Bonsai

Category	Description
 Source	generate event streams from devices or files
 Transform	convert or process individual data items
 Combinator	manage control flow or synchronize parallel inputs
 Sink	save data or trigger external outputs
 Nested	group operators to organize complex processing
 Property	organize workflow properties or change their values dynamically

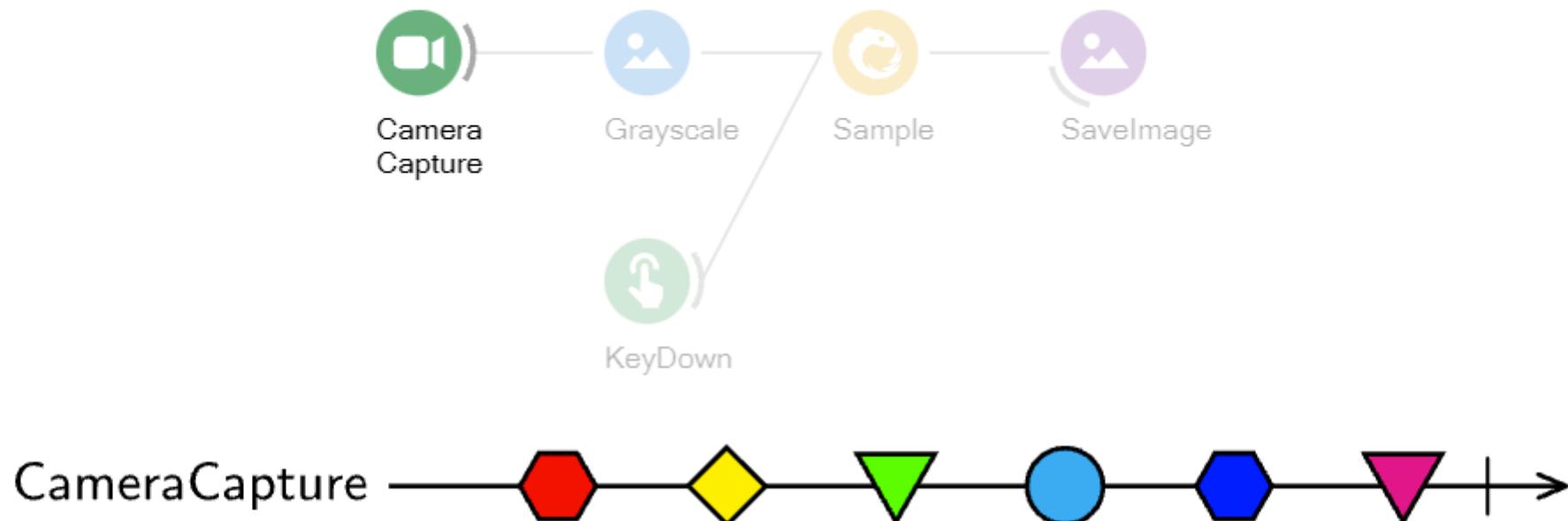
Los Nodos se conectan con líneas de izq-der

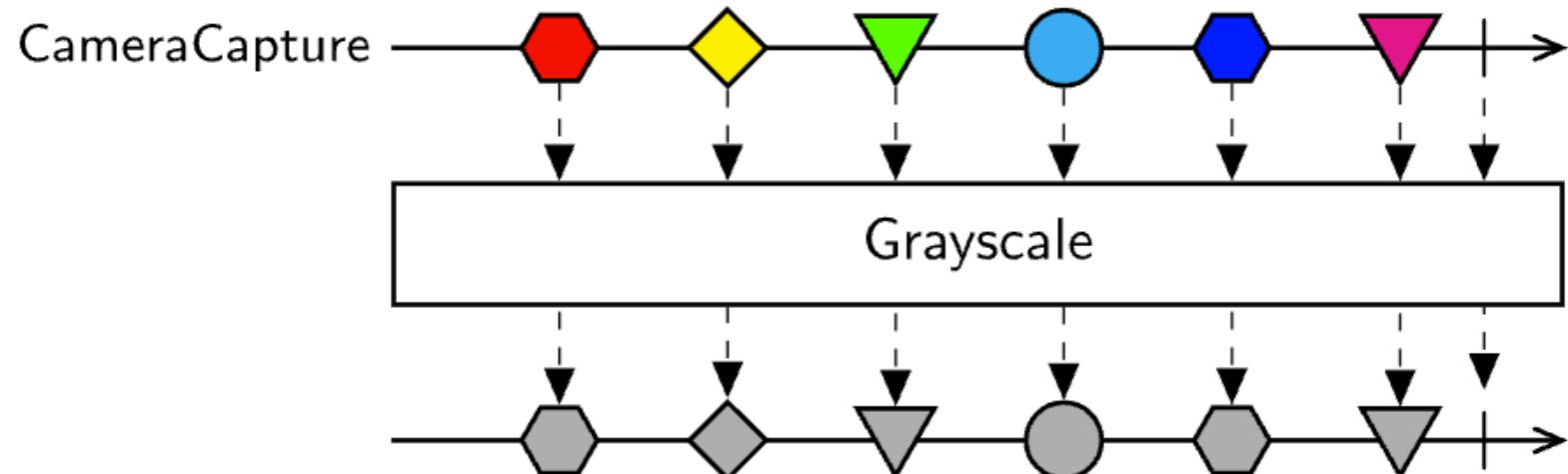
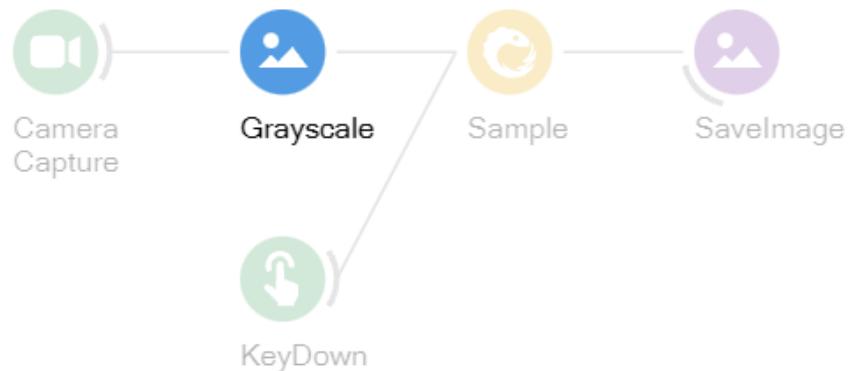


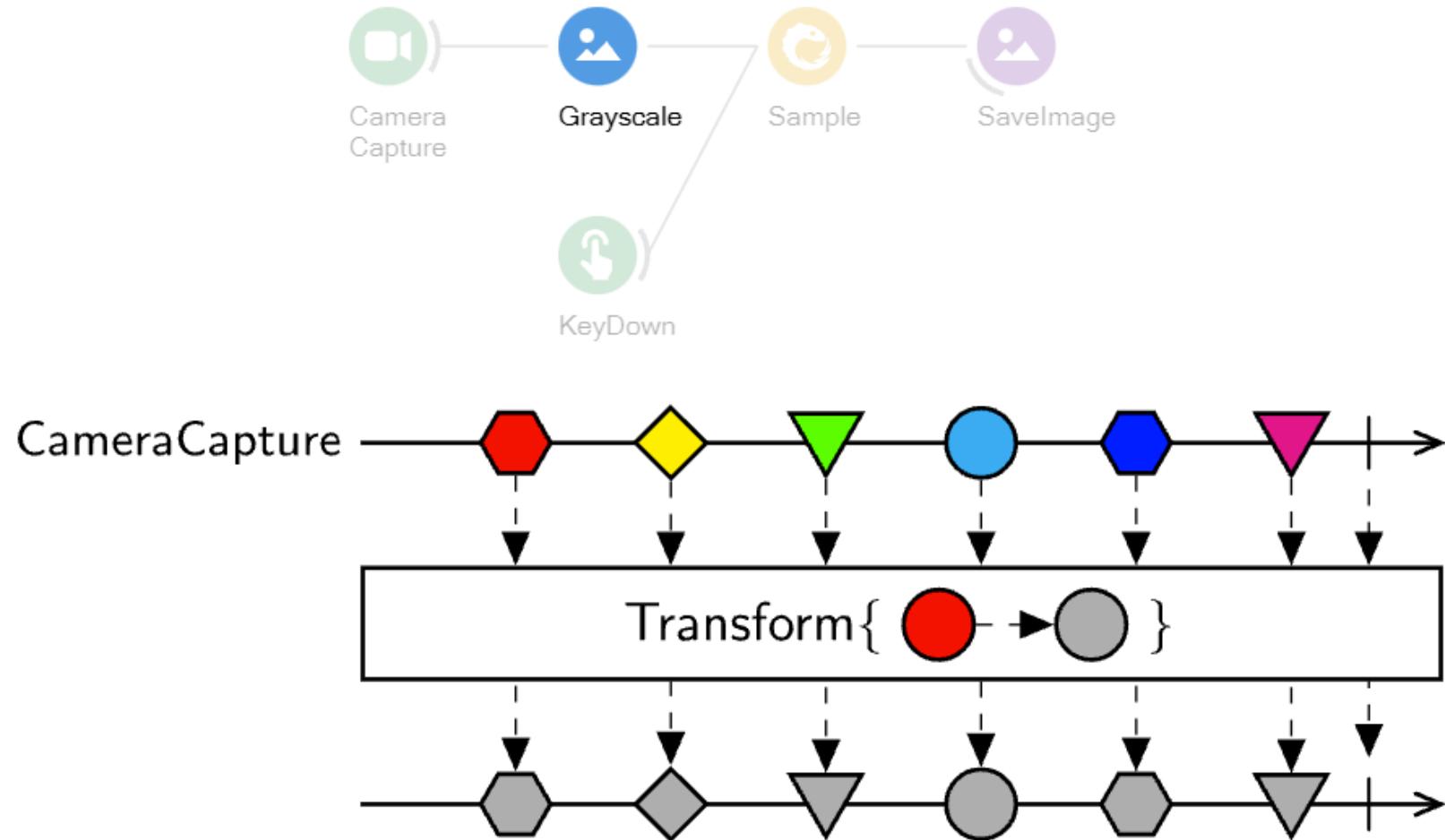
La serie de nodos conectados se denomina workflow

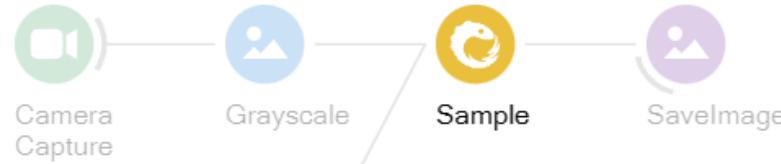


Veamos este primer ejemplo..

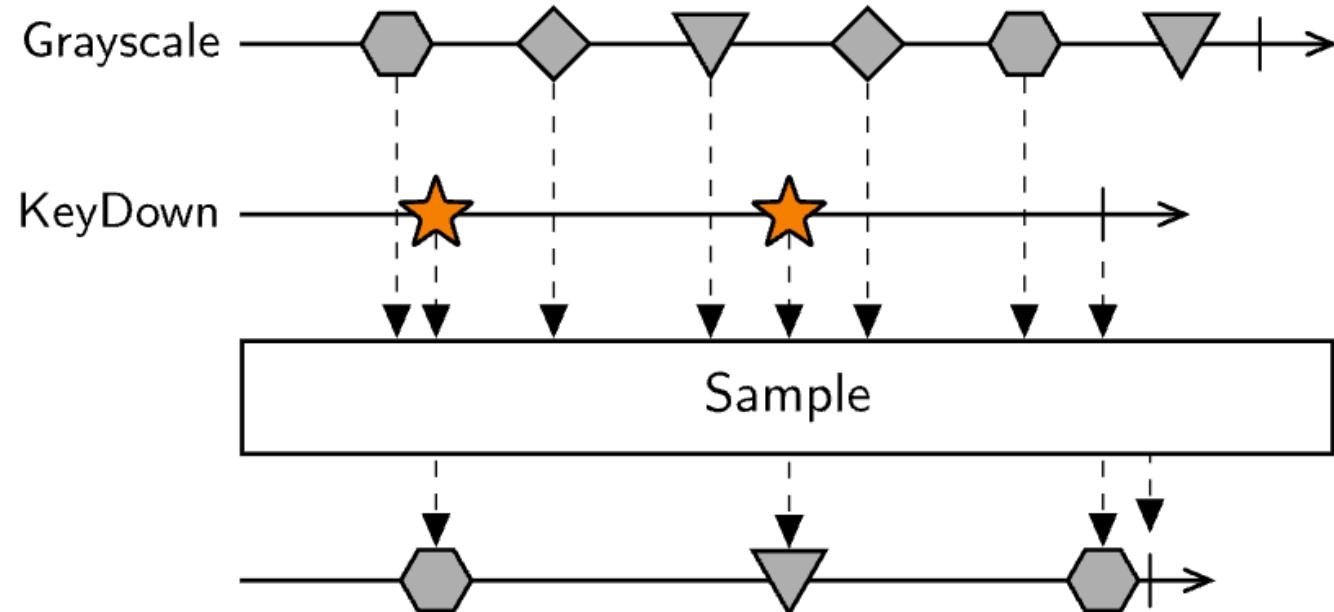


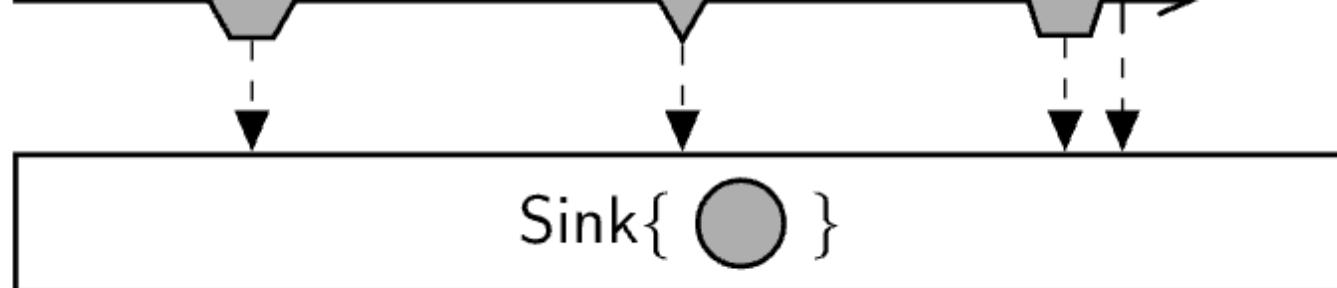
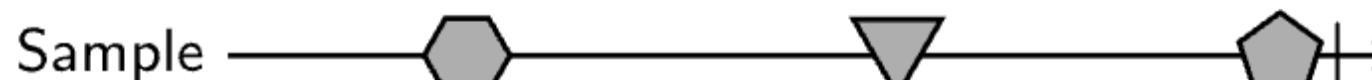
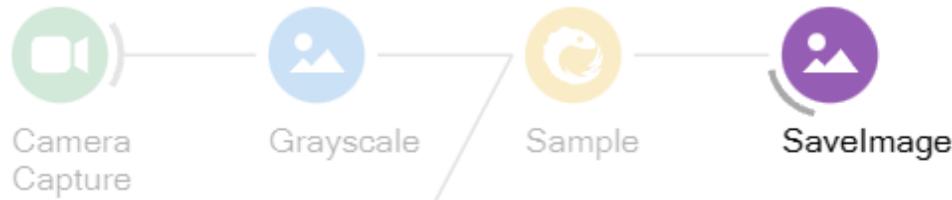


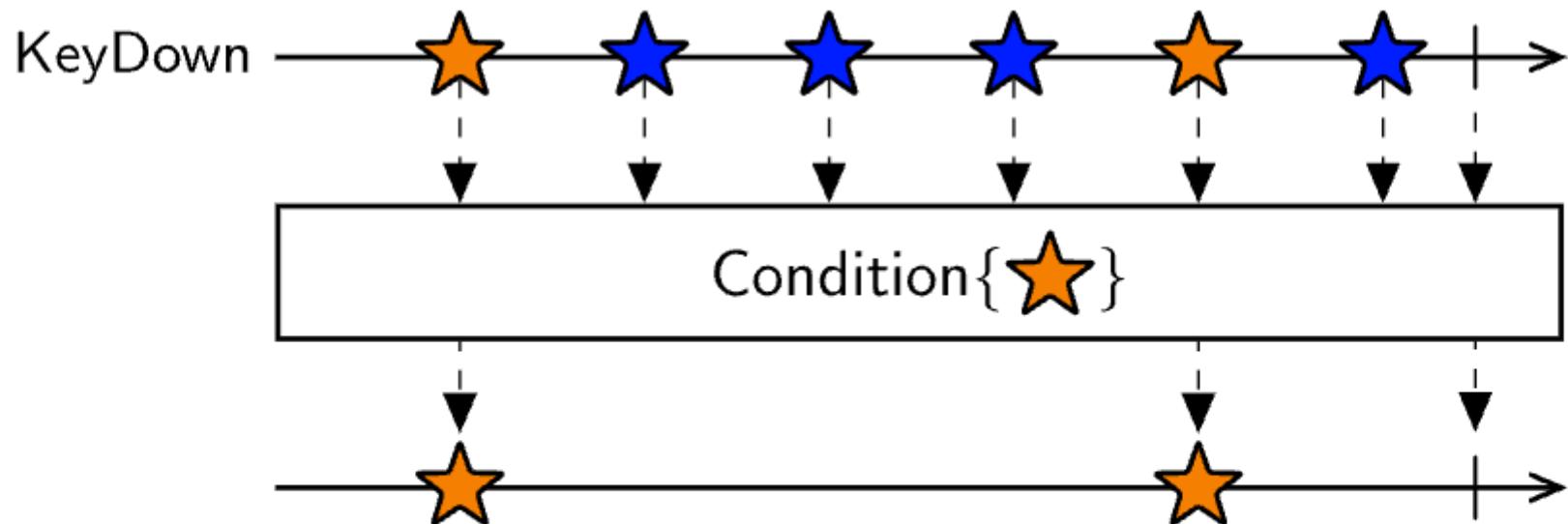
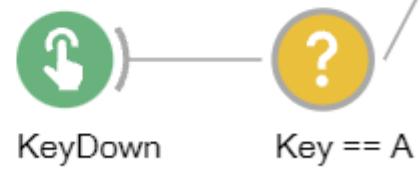




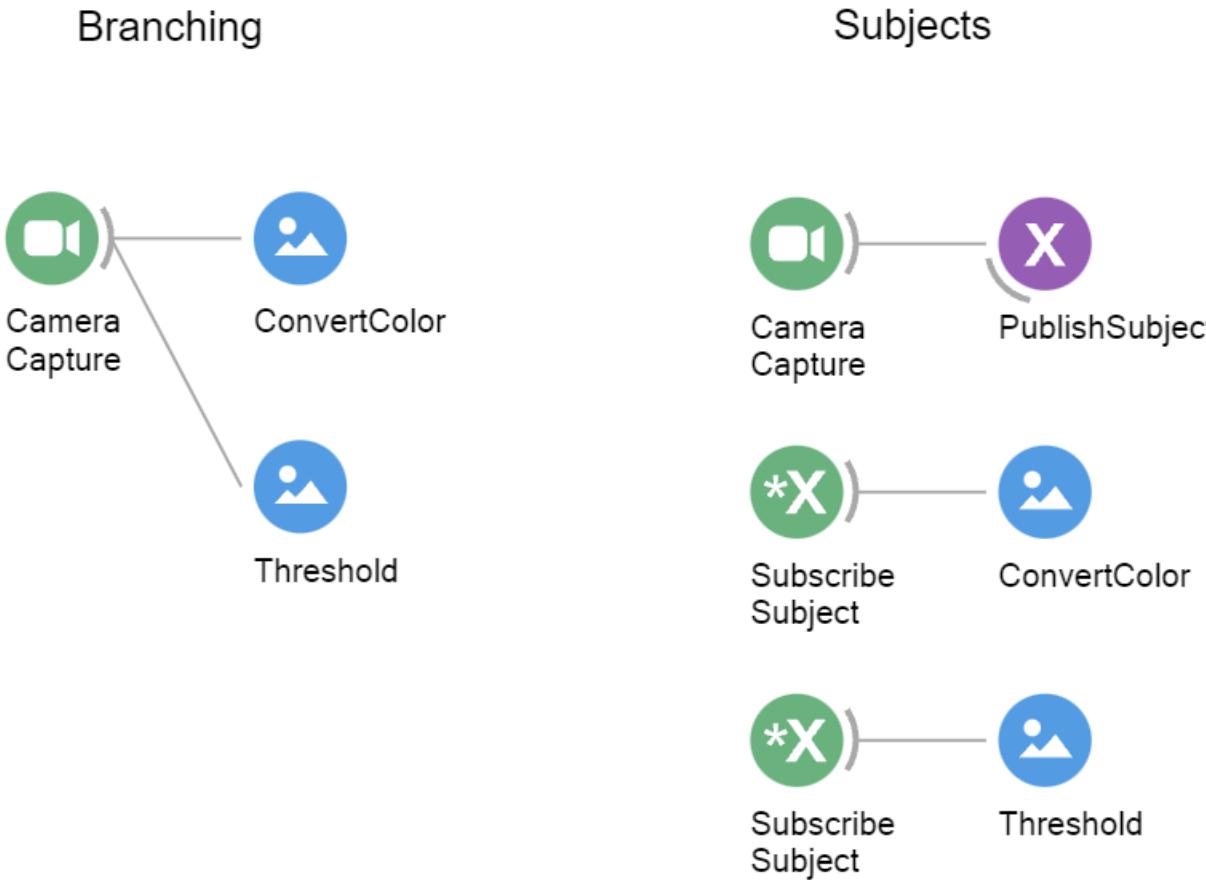
KeyDown



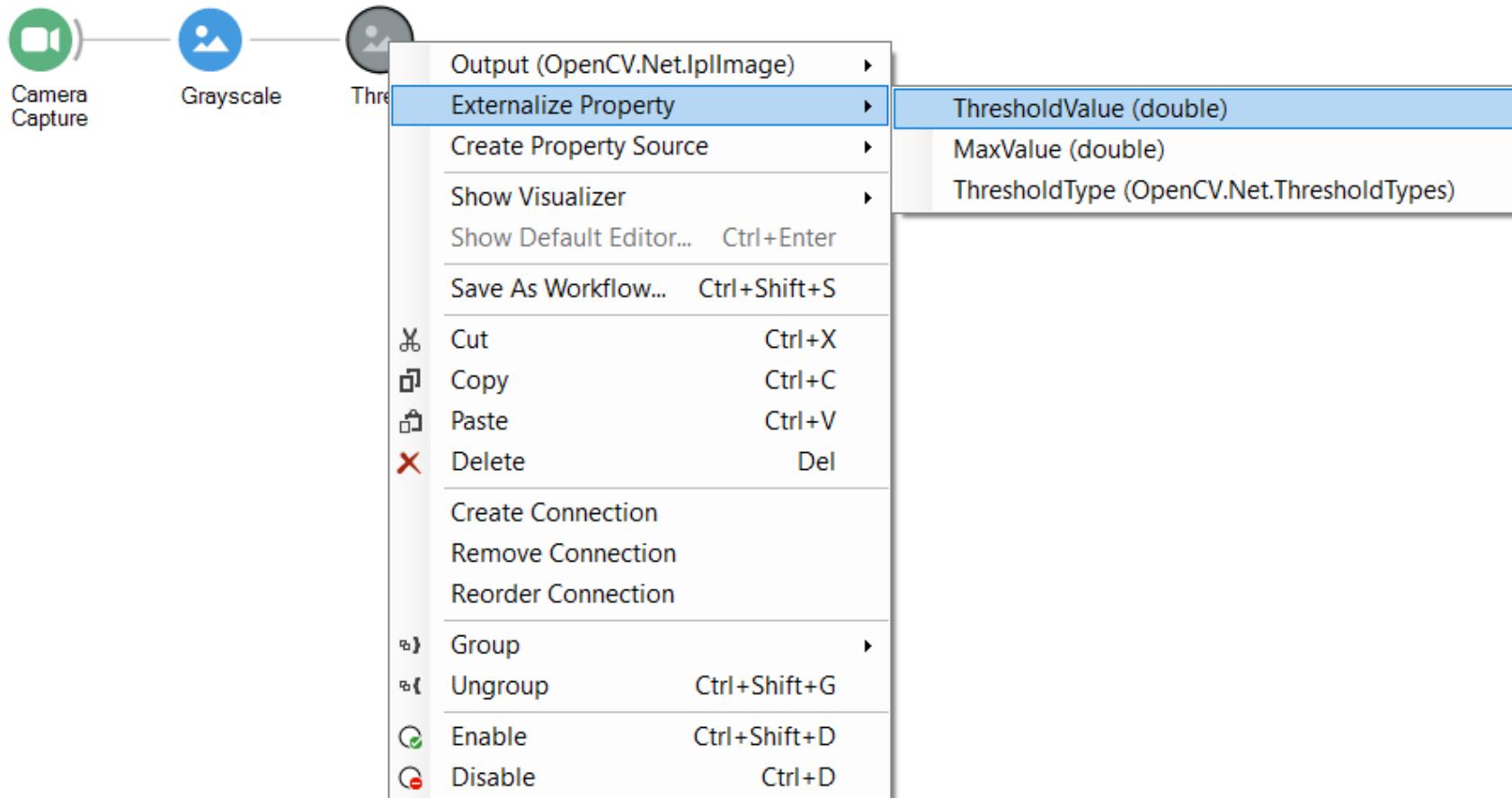




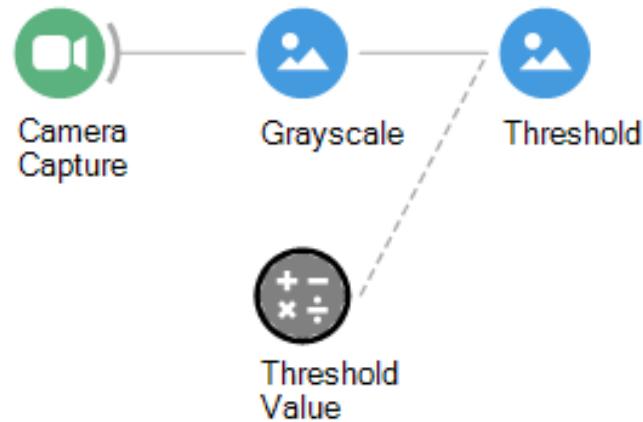
Utilizando el mismo nodo en varios workflows



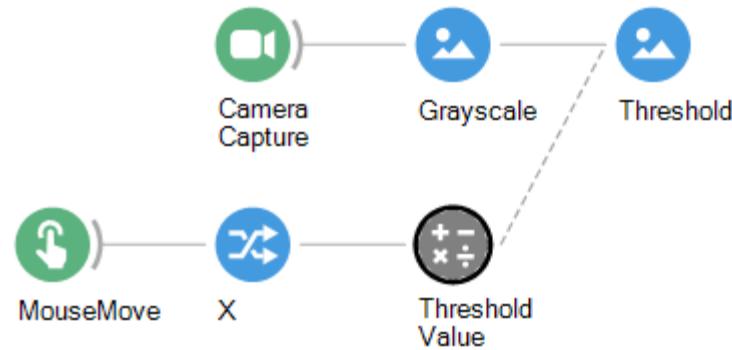
Bonsai permite externalizar propiedades



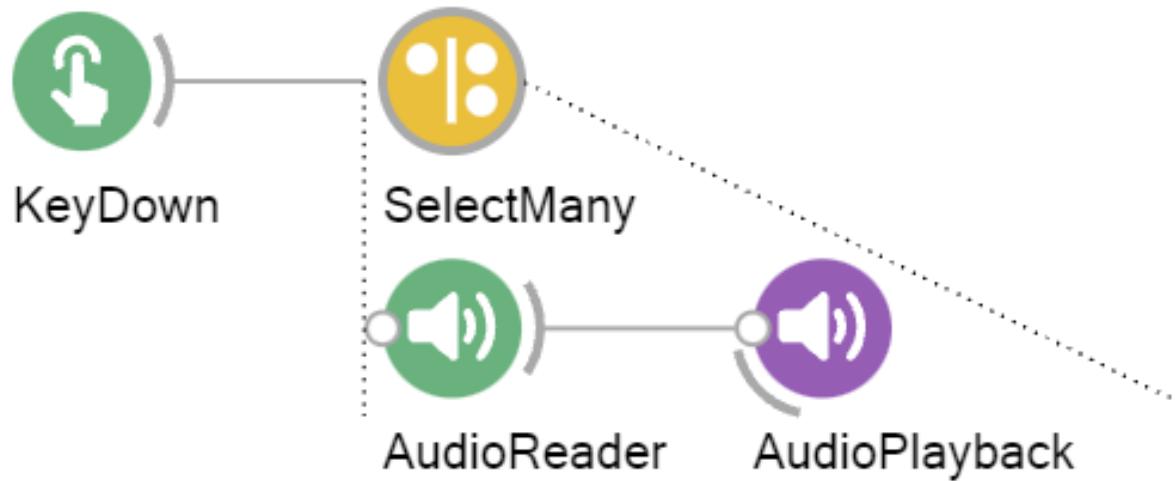
Bonsai permite externalizar propiedades



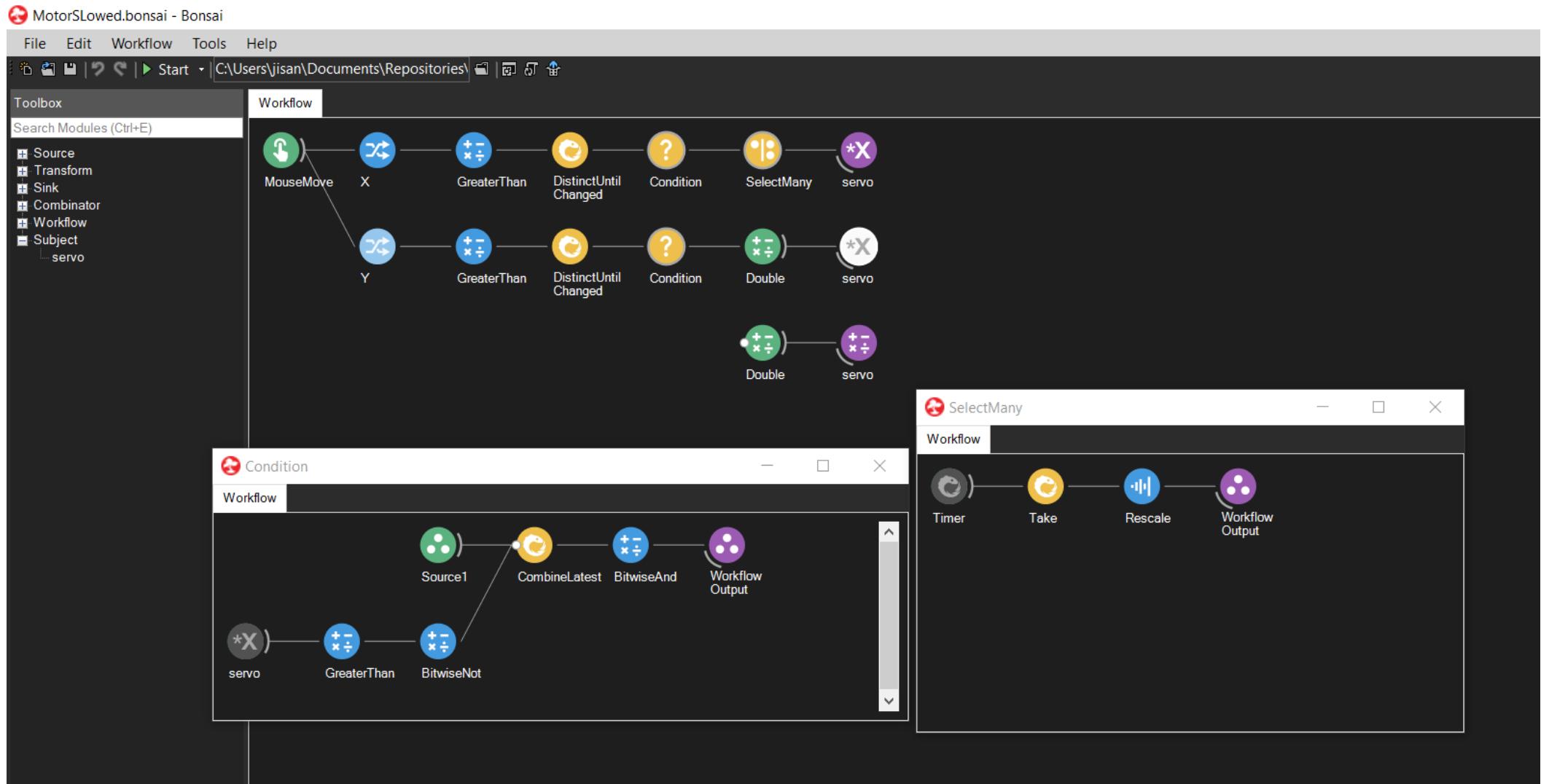
Podemos controlar una propiedad con otra parte del workflow



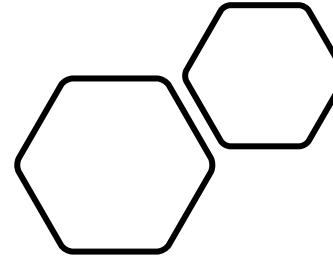
En Bonsai existen los Nodos anidados
(nested)



Un programa de Bonsai puede ser muy Complicado



ReactiveX : El algebra de Bonsai





ReactiveX

Introduction

Docs ▾

Languages ▾

Resources ▾

Community ▾



ReactiveX

An API for asynchronous programming
with observable streams

Choose your platform

Groups



Conversations

Search conversations within bonsai-users@g...



New conversation

★ Bonsai Users 695 members

1–30 of 1025



My groups

Recent groups

Comedy Café Berlin

Public groups

Starred conversations

Bonsai Users

Conversations 99+

Members

About

My membership settings



Xiao Han

Runtime Error – Hi, I've been using Bonsai for recording awhile and everything works out fine. Yet recently my

5:34 PM



cpw....@gmail.com

Frequency generator for 2 LEDs at 2 different frequencies (analog output) – Hi, I am intending to modulate 2 sep...

11:10 AM



uest...@gmail.com 2

Recommend a Machine Vision Camera – Does anyone use the OptiHub 2 + Flex3 (<https://optitrack.com/cameras/>)

4:38 AM



lia...@gmail.com

Matrix Writer – Hi, I am using AnalogInput and saving the data using MatrixWriter. I just wanted to be sure about t...

Nov 2



lia...@gmail.com

Using NiDaq DigitalOutput correctly – Hi, I am adding a workflow I am trying to build. All the extra bits are less im...

Nov 2



utopie5...@gmail.com, brunocruz 2

stimulation time information into csv – Hey Hayato, You can timestamp Bonsai events using the Timestamp nod...

Nov 2



canh...@gmail.com

Method to remove motion blur – Hello I was looking for a method to remove motion blur. Anything in Bonsai? Kin...

Oct 29



bfri...@gmai..., yarabii...@gma... 2

Basic ROI in a video Setup – Hello! A while ago I did what you mentioned. What I did was use the "ExpressionTransf...

Oct 27



bramn...@gmail.com, brunocruz 3

Animating an ellipse – Hi Bruno, This worked perfectly, thank you so much! On Tuesday, October 19, 2021 at 2:19:...

Oct 27



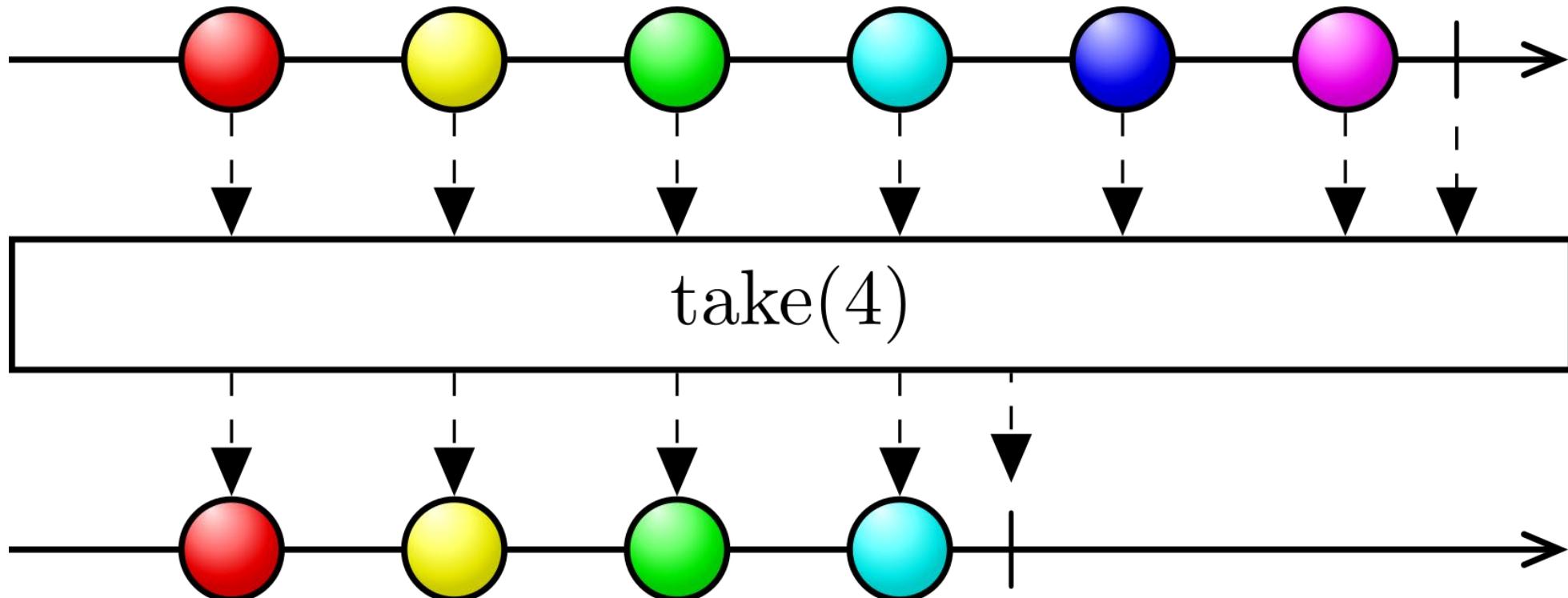
zhehao, jonathan...@gmail.com 3

Community Packages cannot be found by search box – Hi Jonathan, Thanks for your solution! I tried but unfortu...

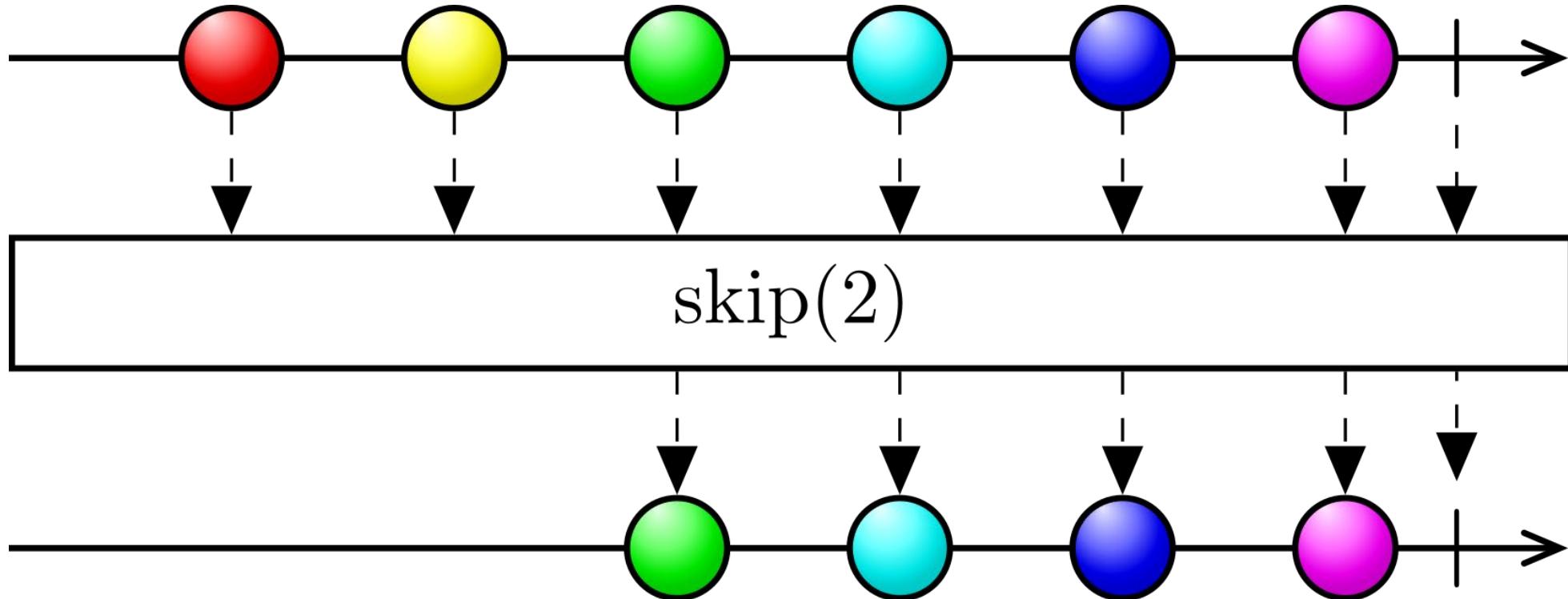
Oct 27



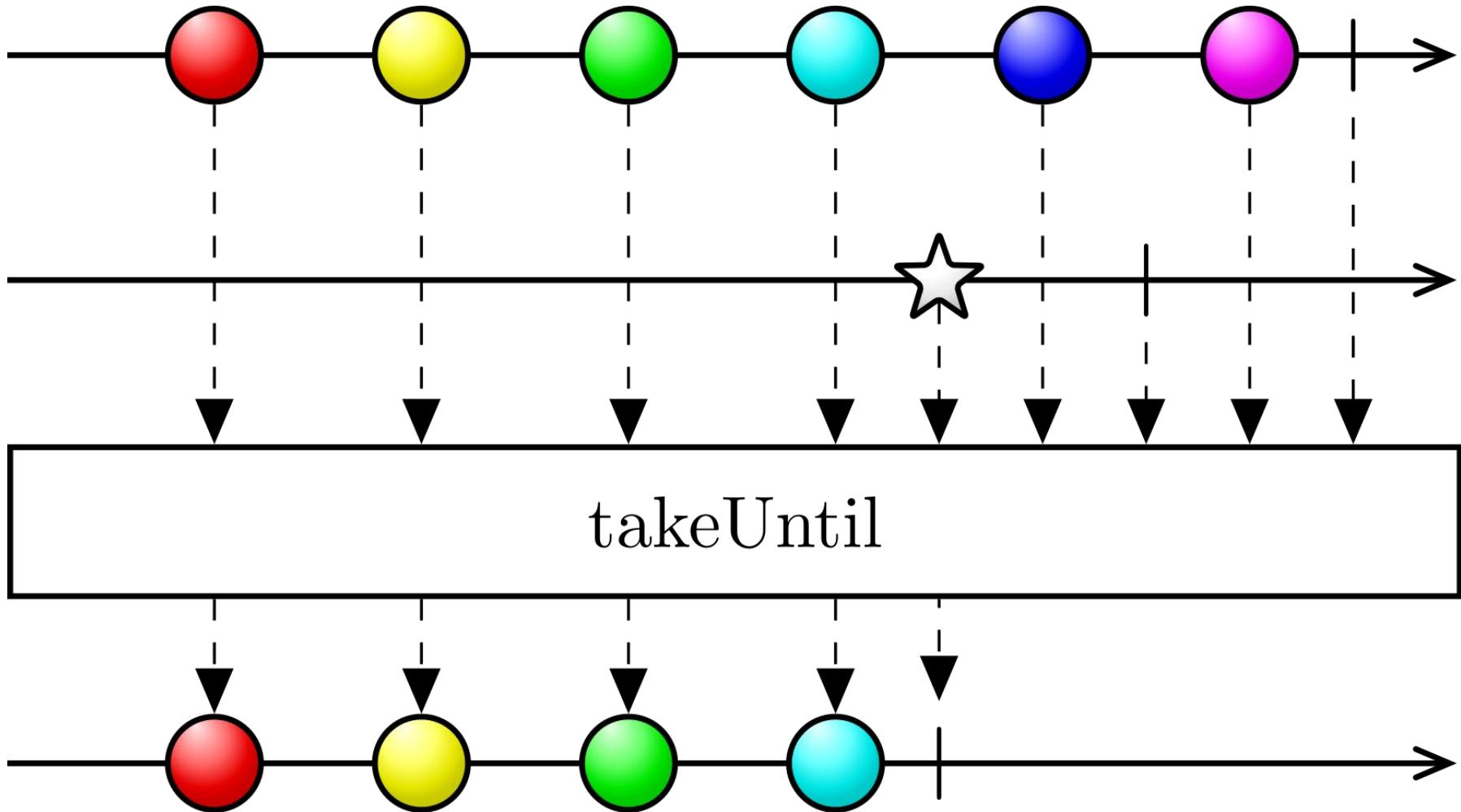
Take



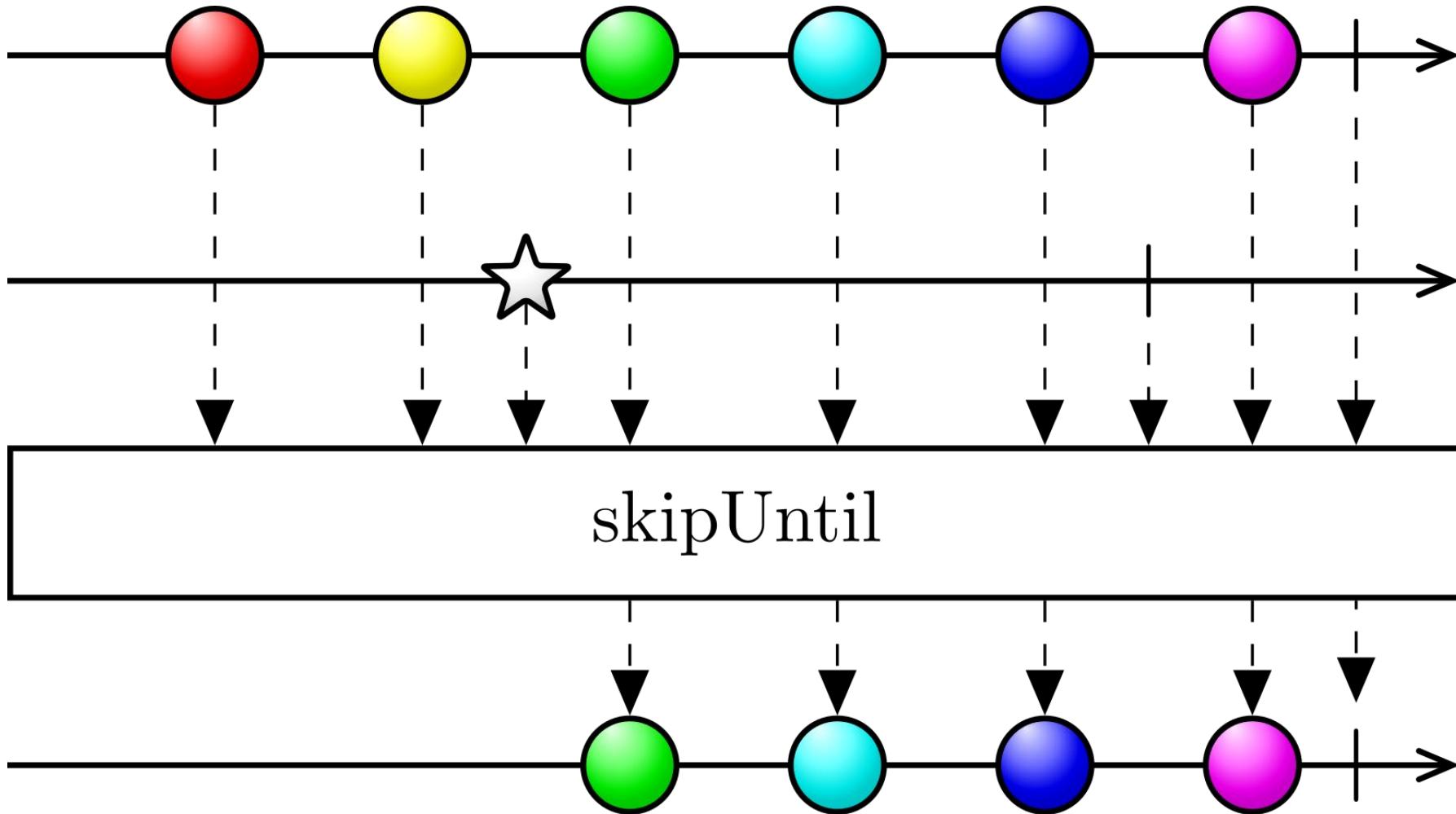
Skip



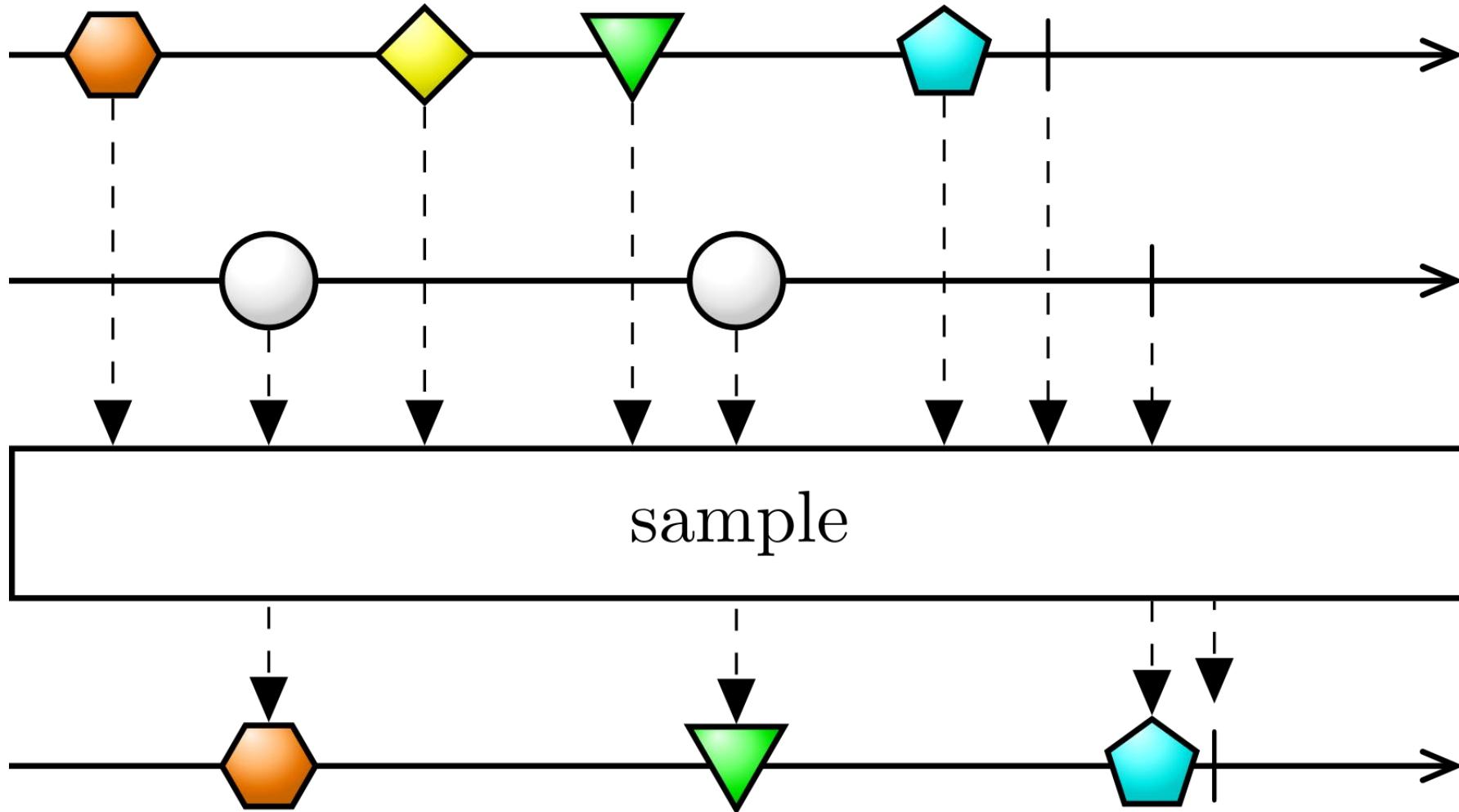
TakeUntil



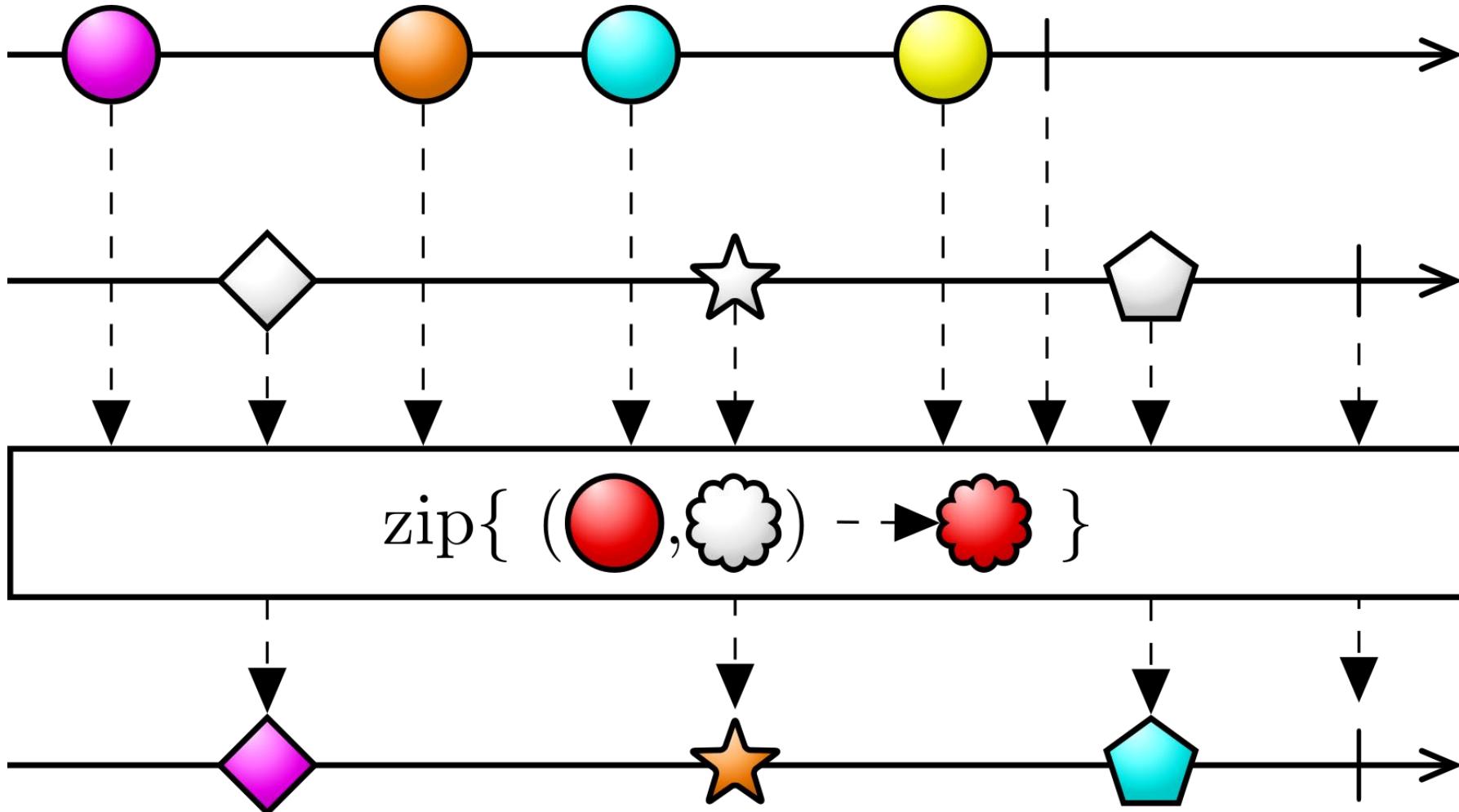
SkipUntil



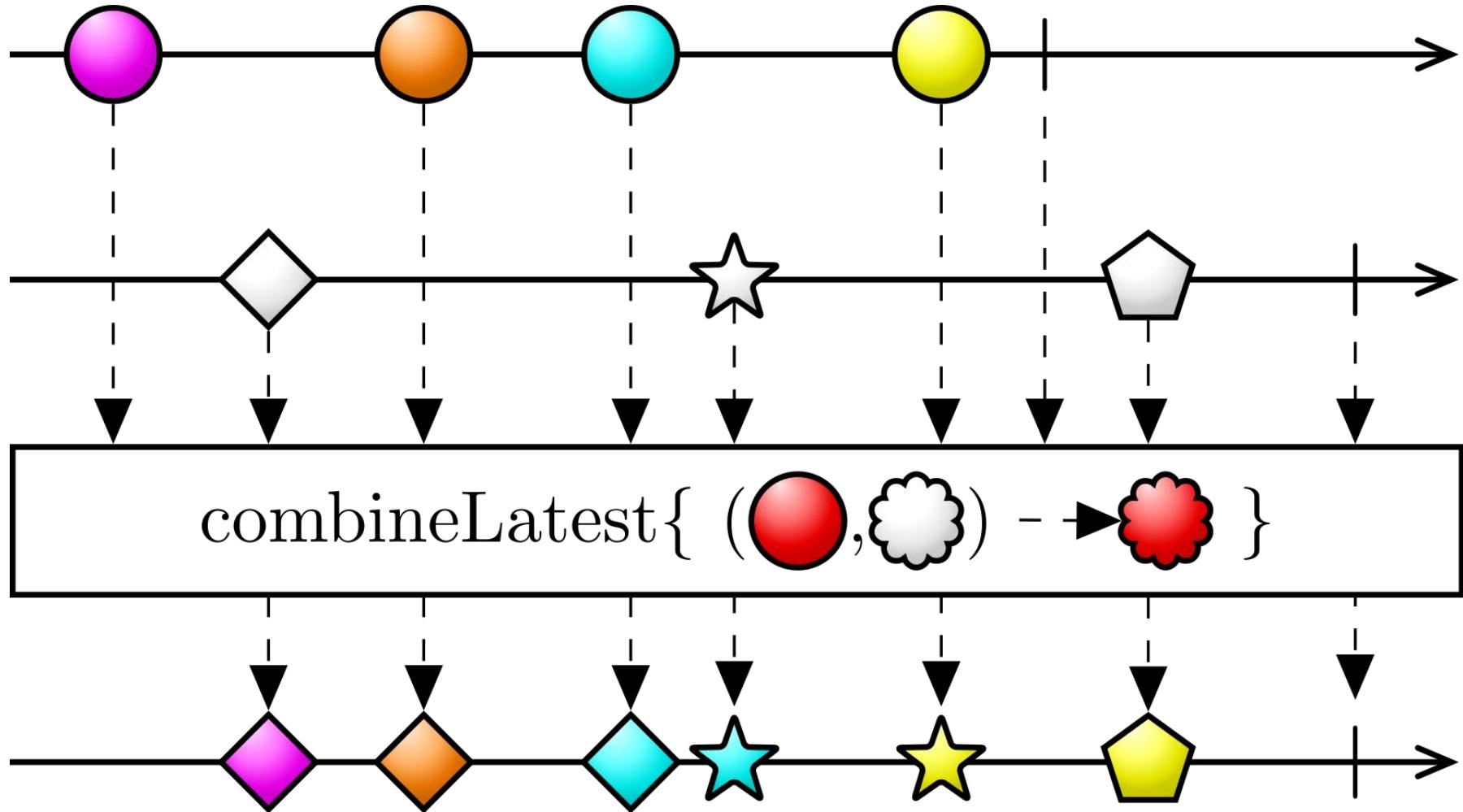
Sample



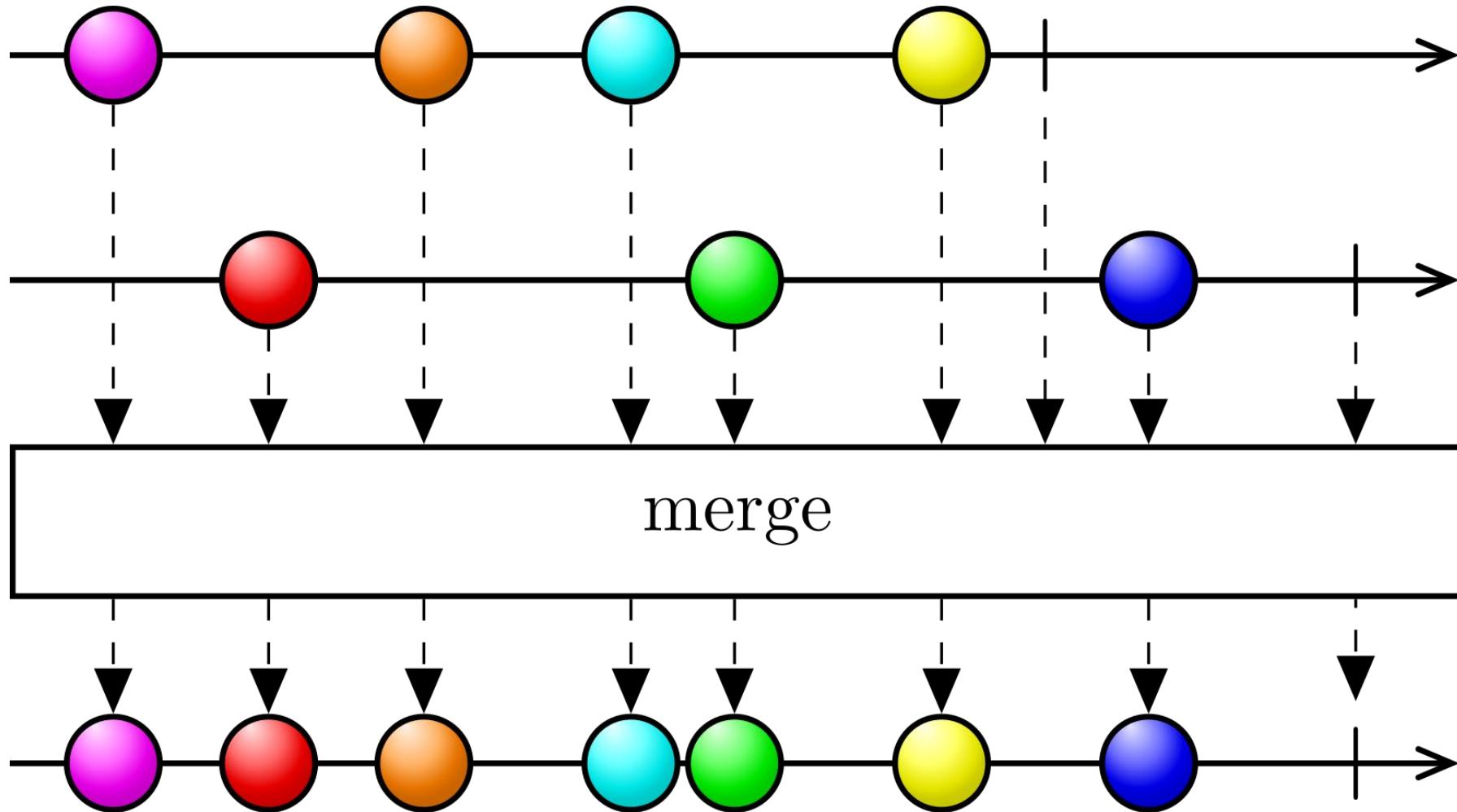
Zip



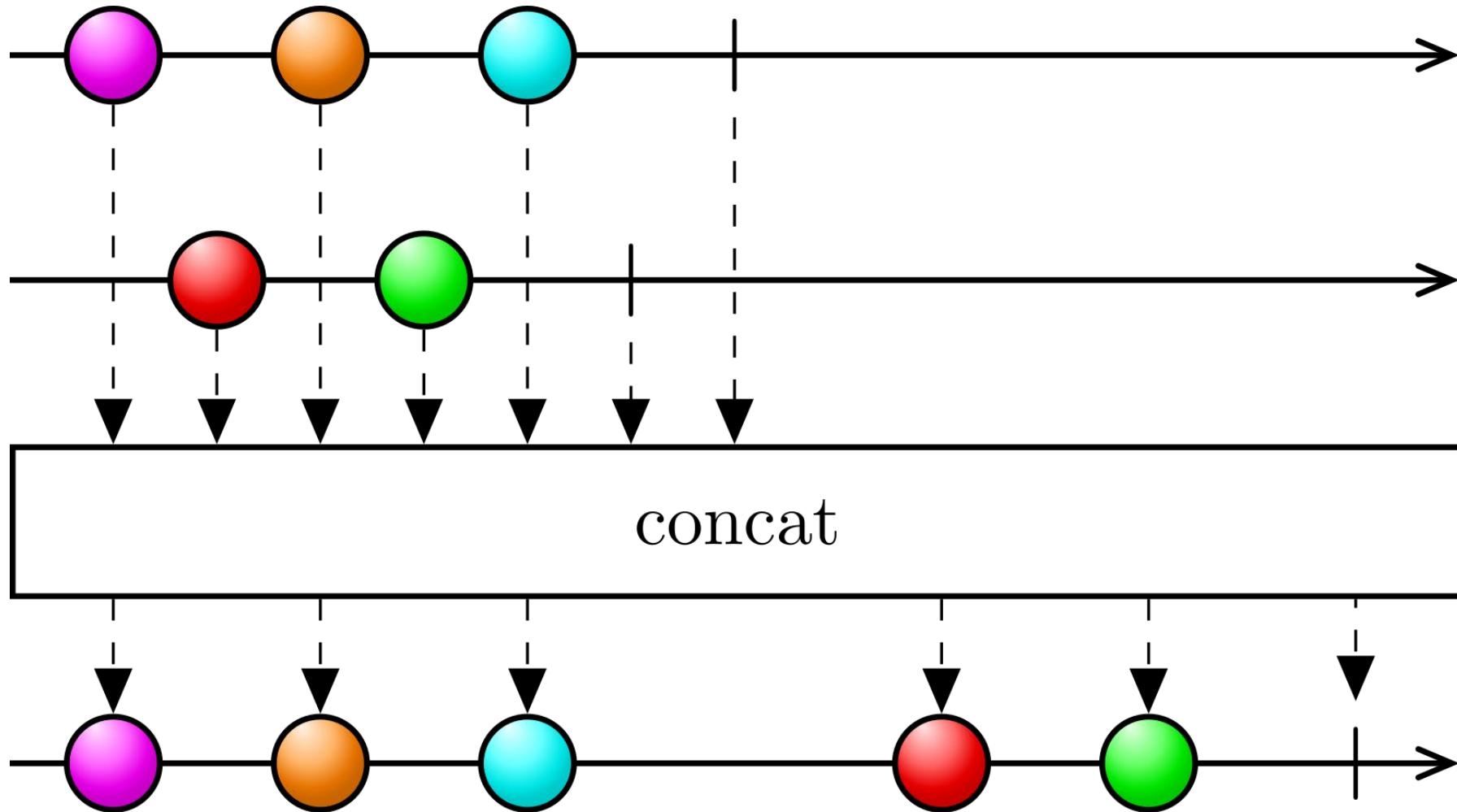
CombineLatest



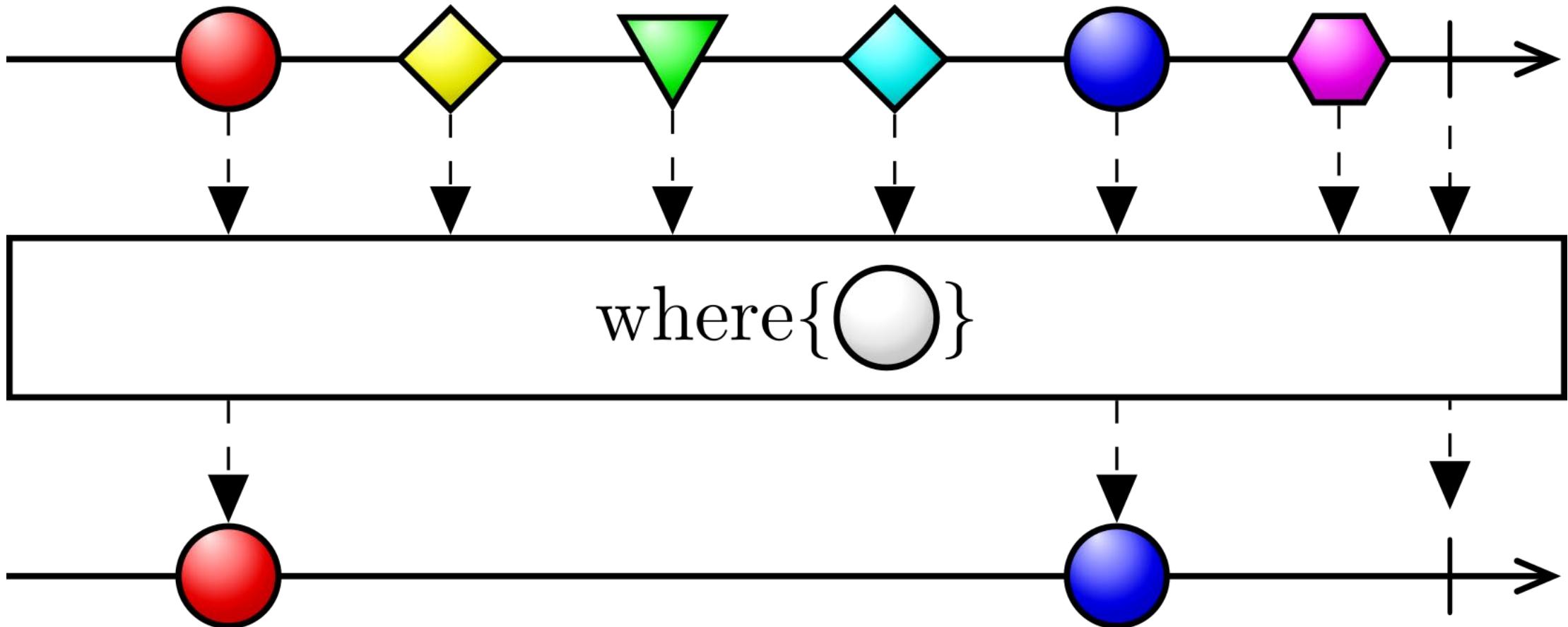
Merge



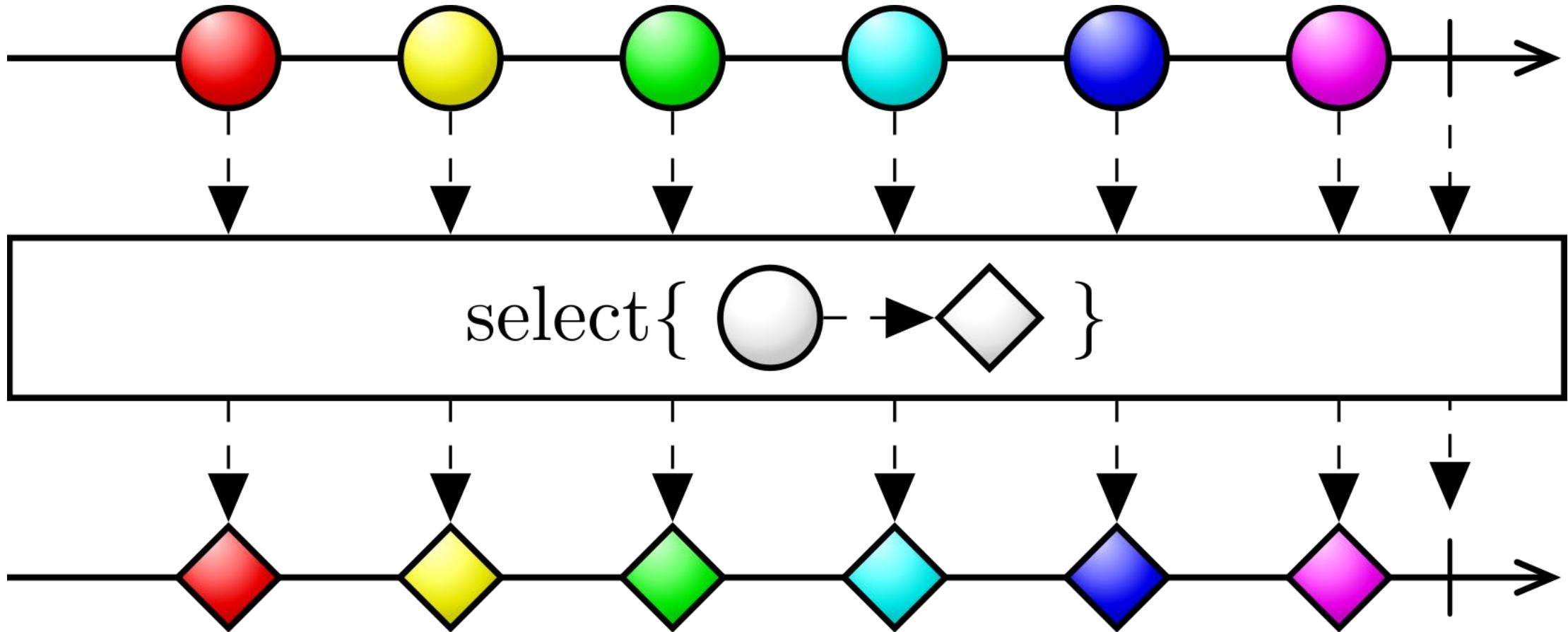
Concat



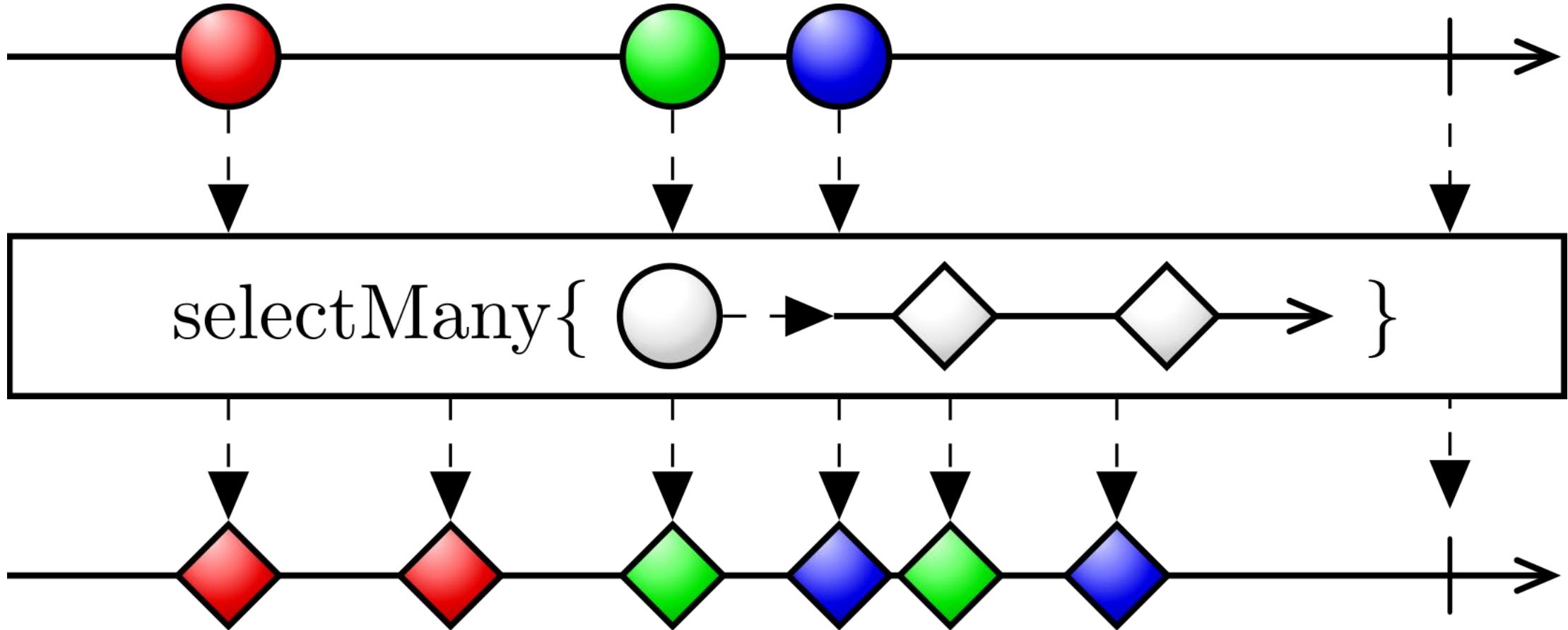
Where



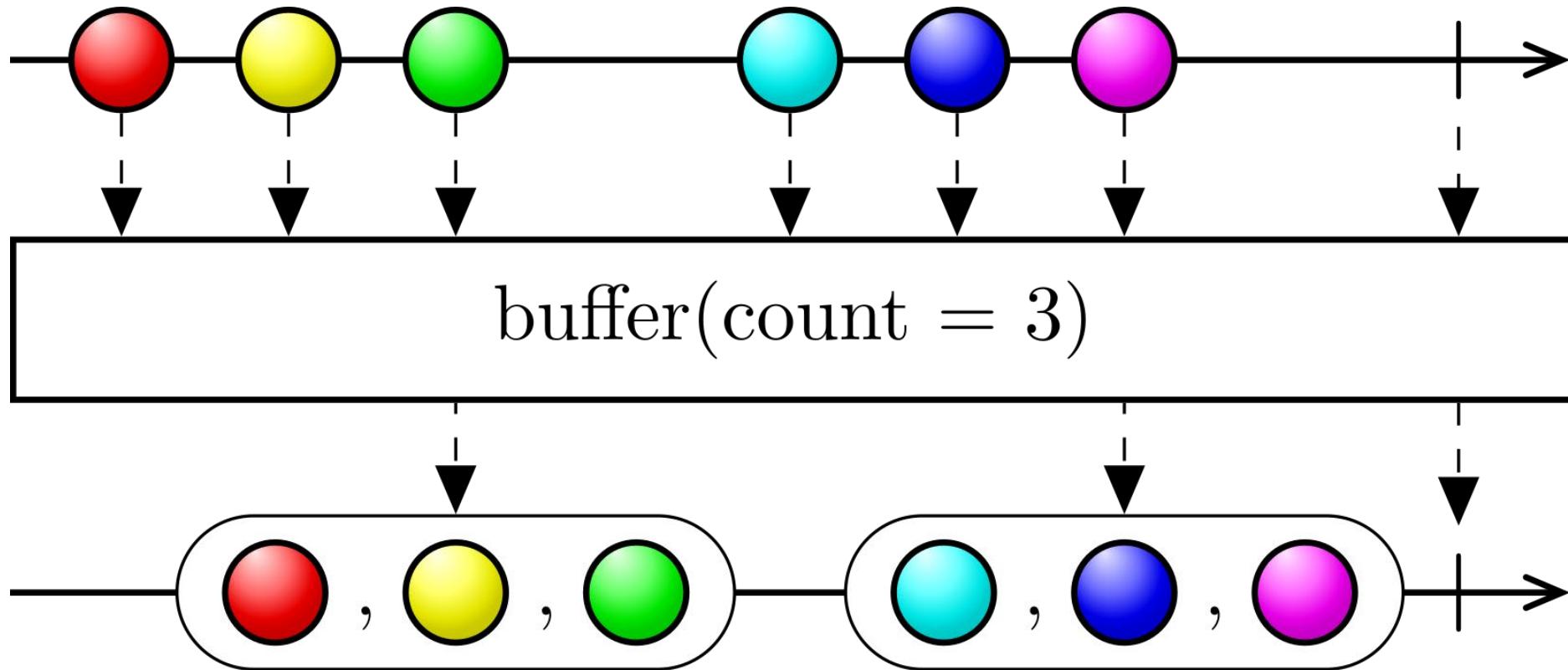
Select



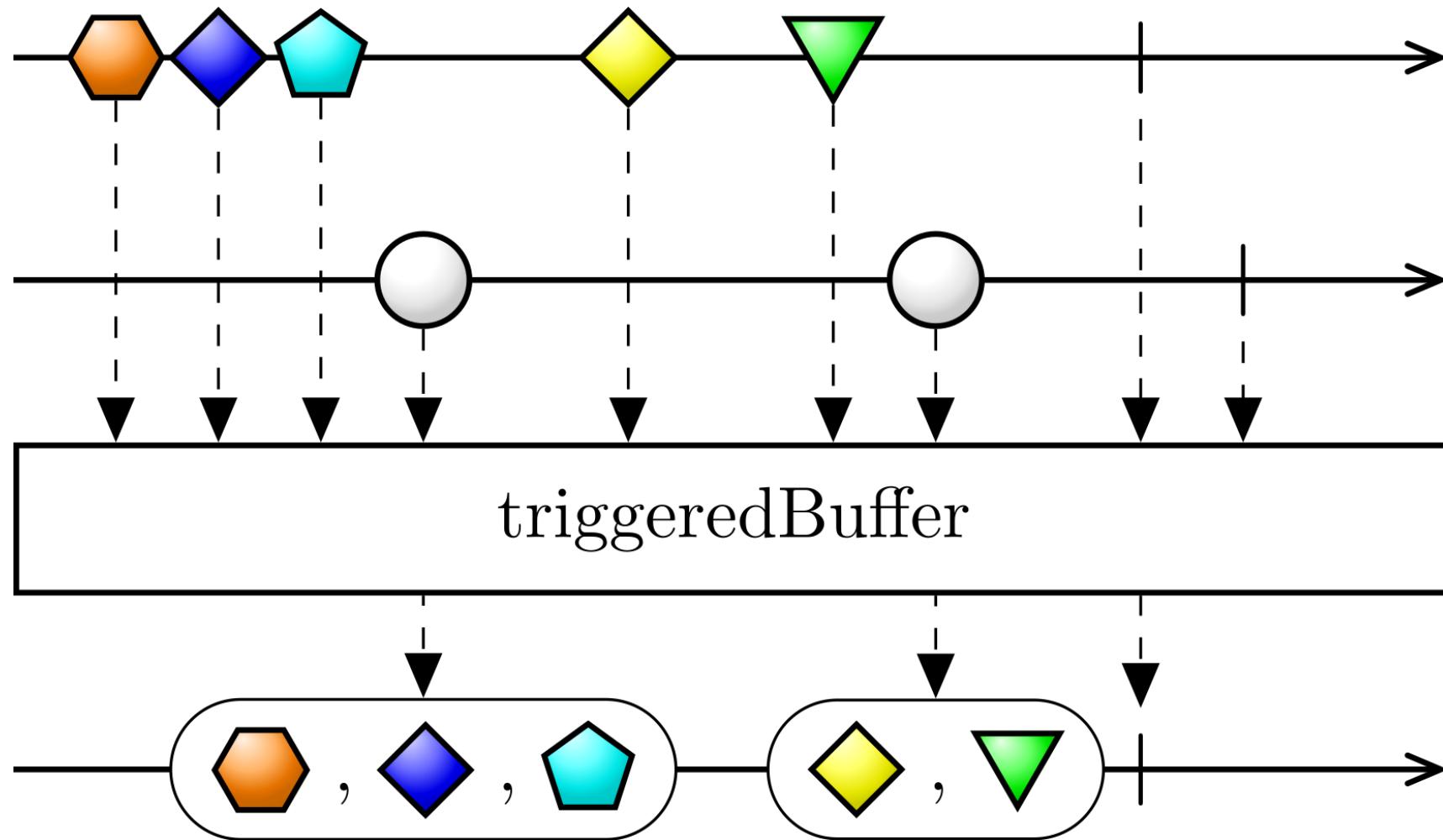
SelectMany



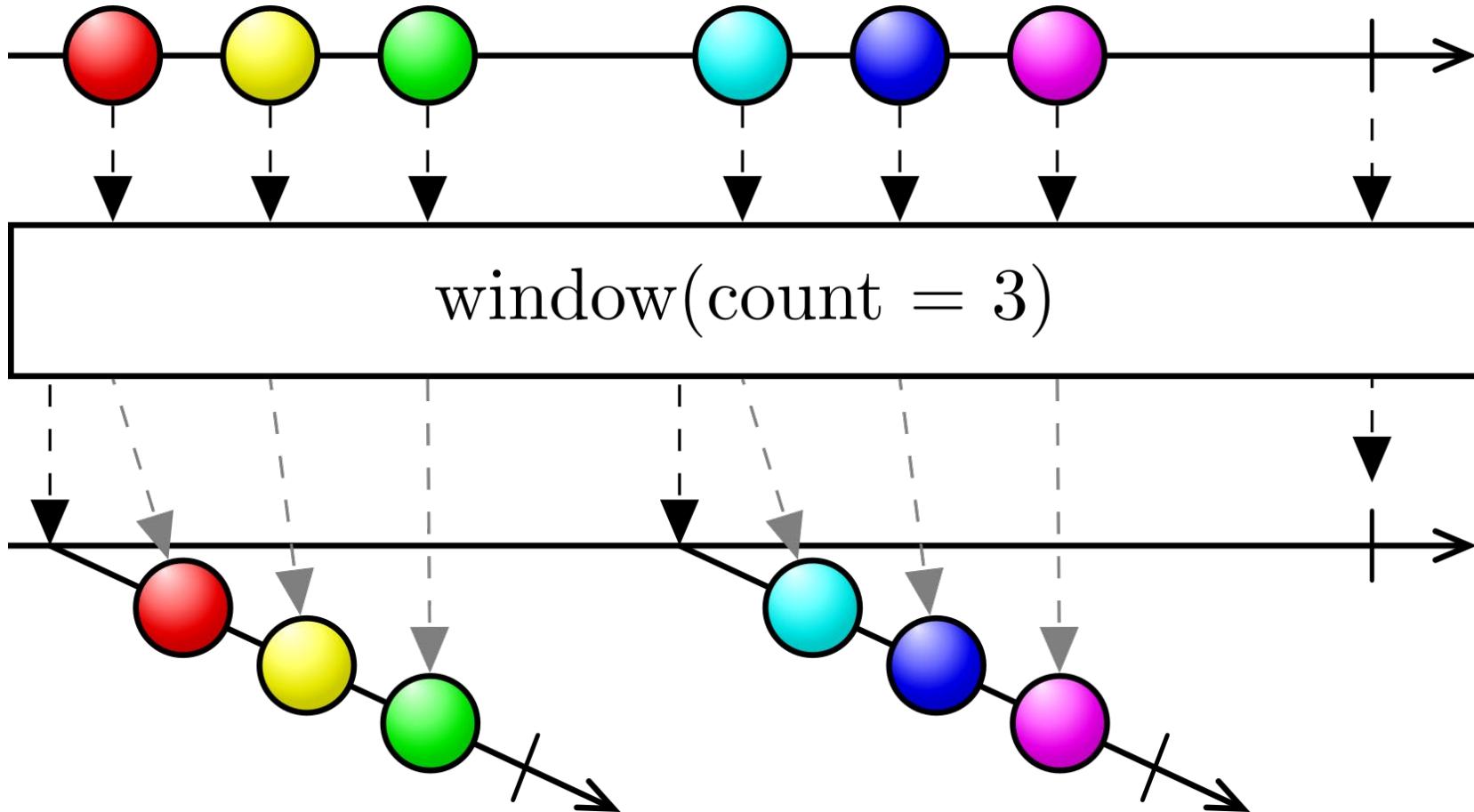
Buffer



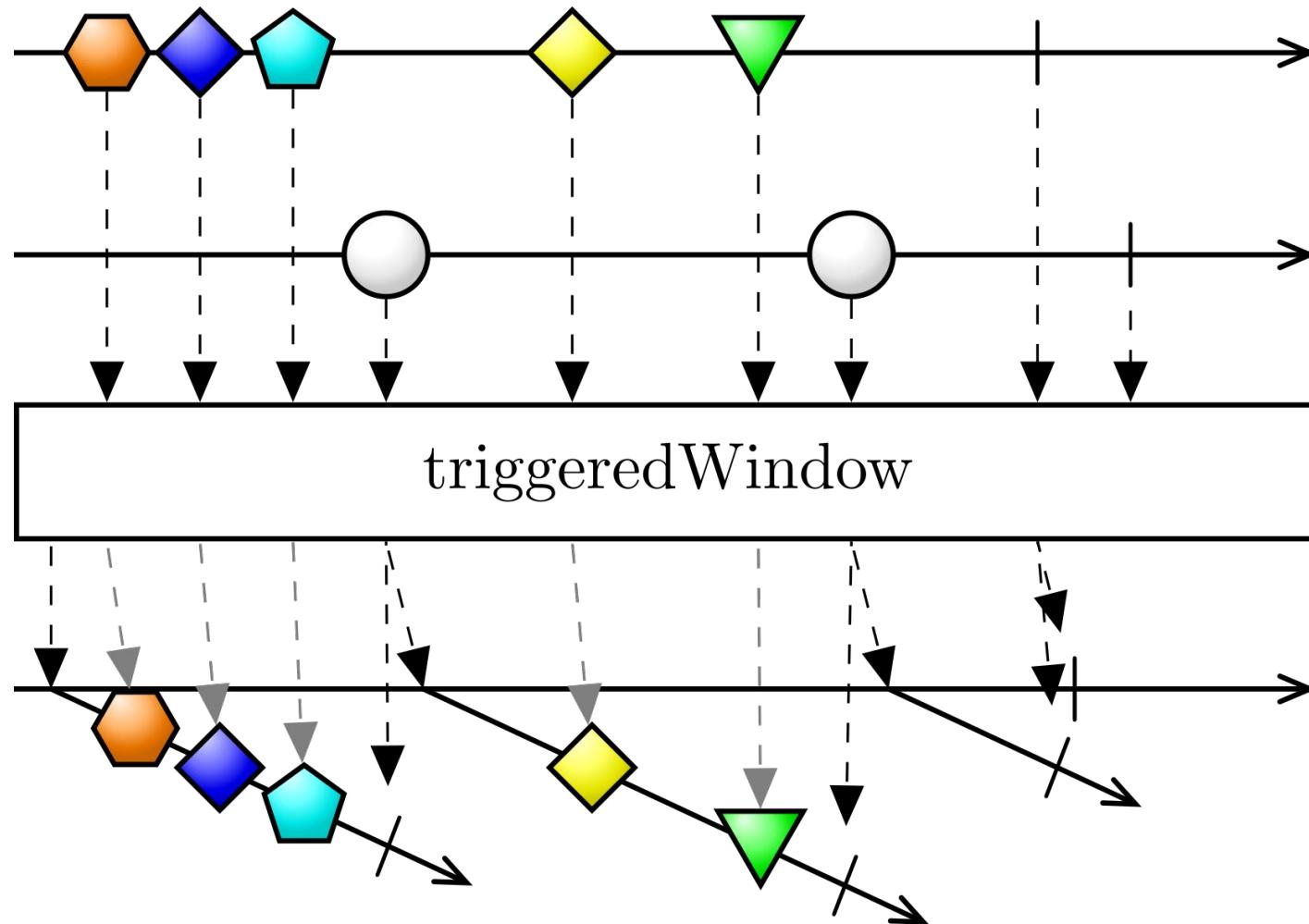
TriggeredBuffer



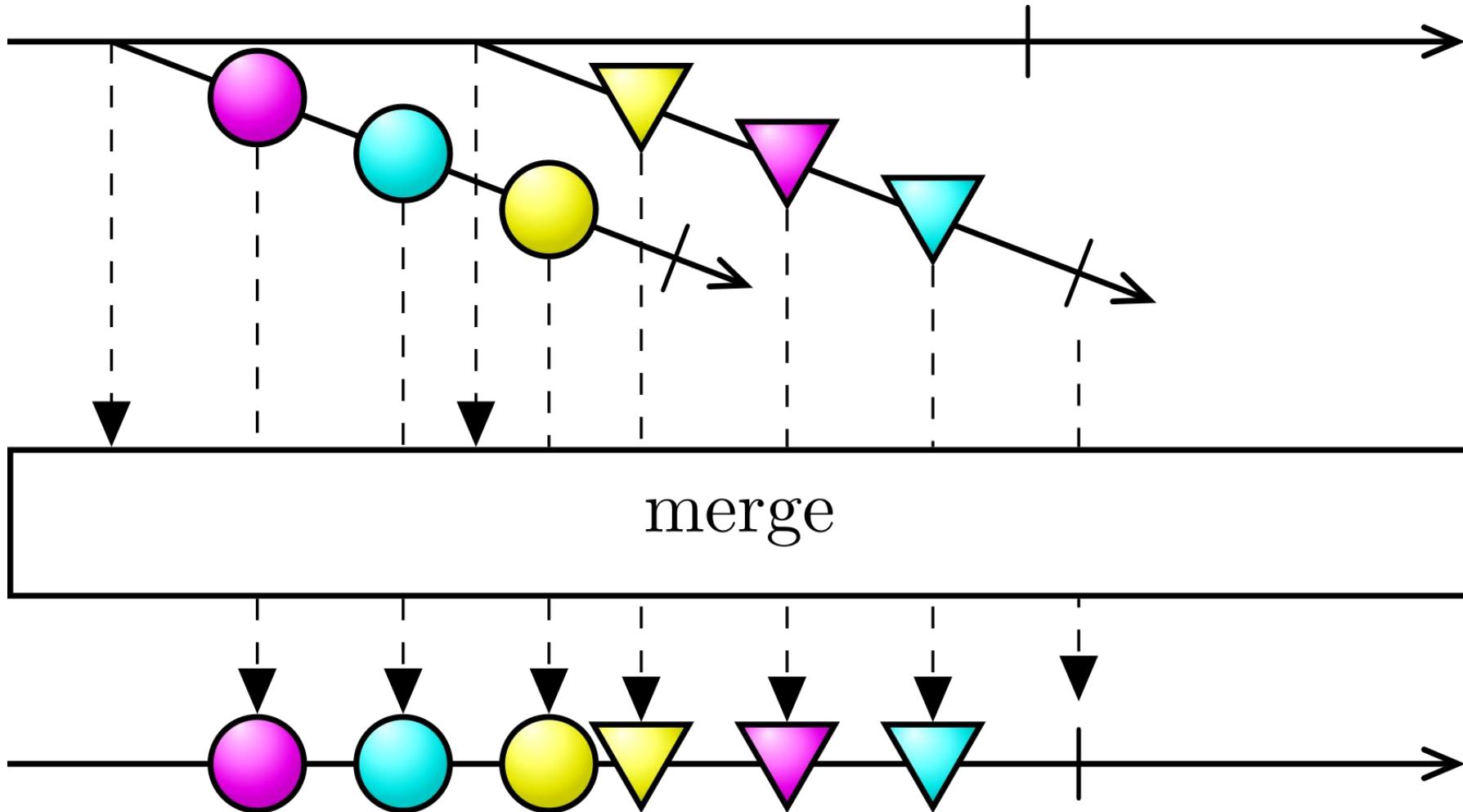
Window



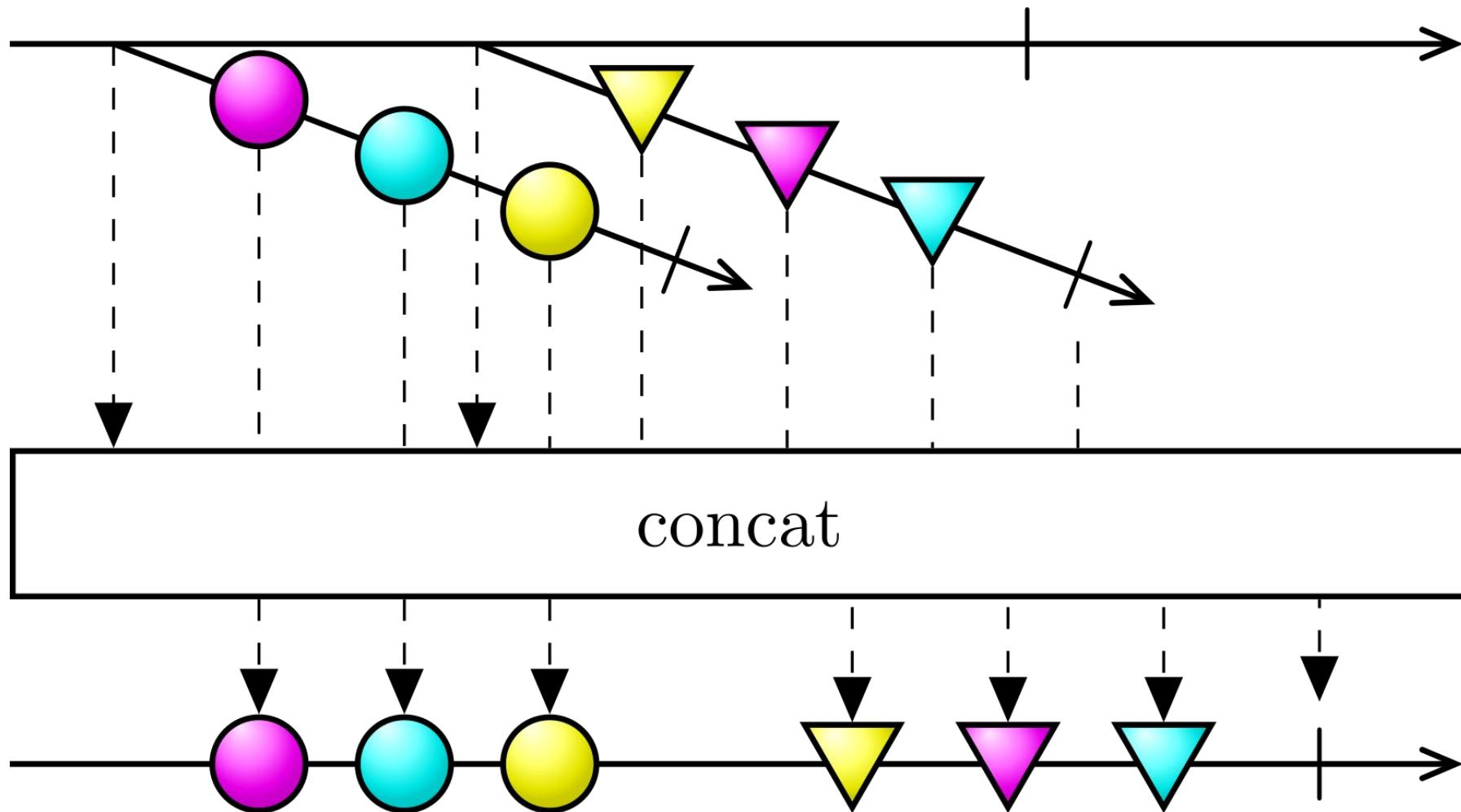
TriggeredWindow



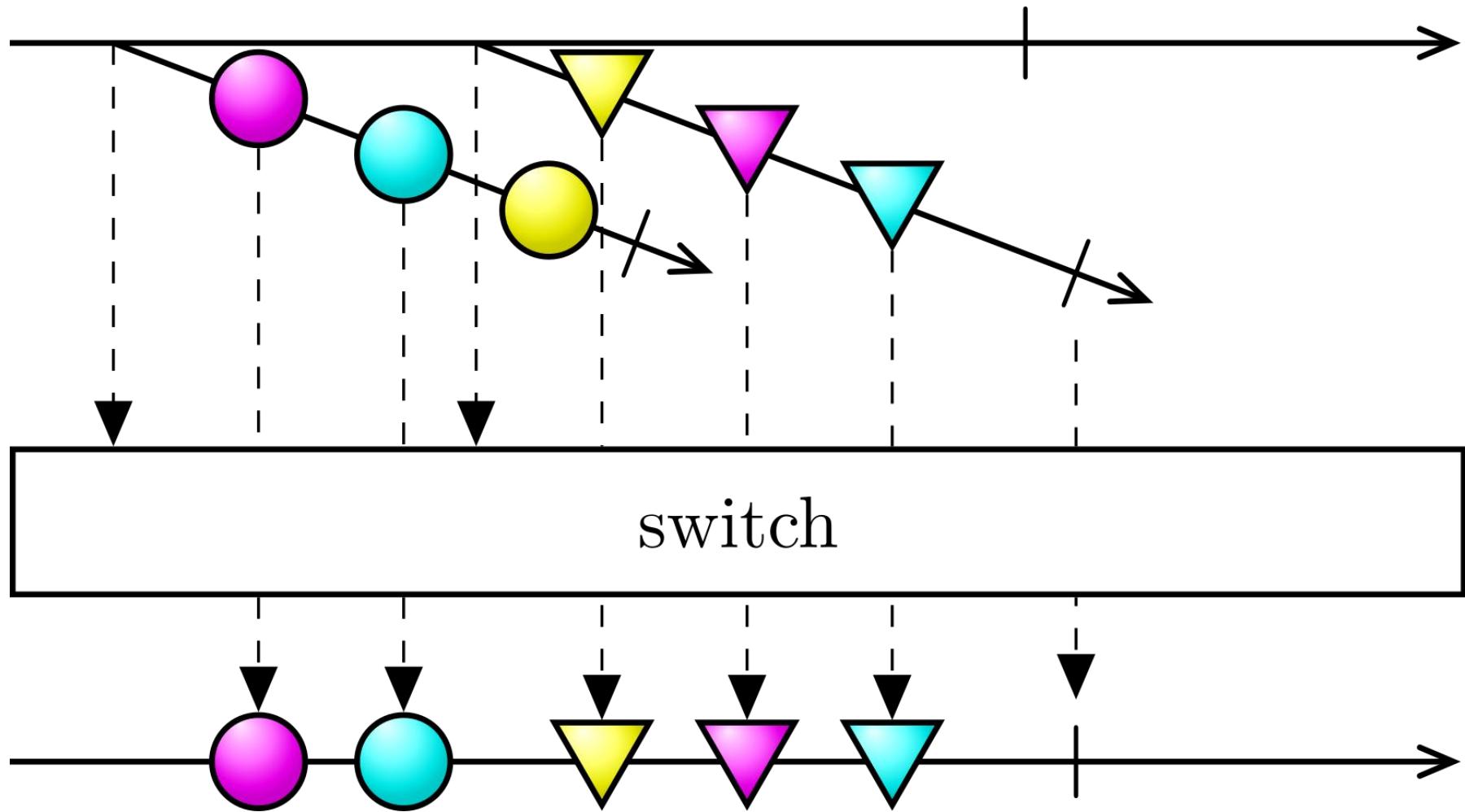
Merge (Window)



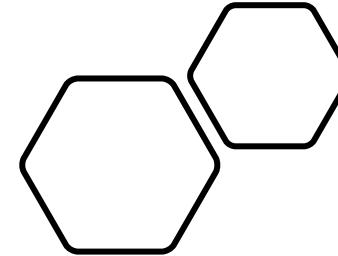
Concat (Window)



Switch



Machine Vision

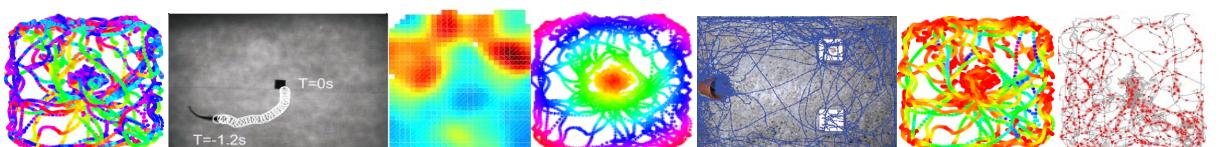
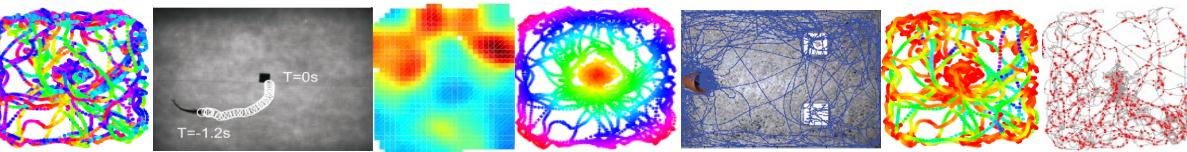


Por qué?

- El registro visual es muy informativo acerca del comportamiento de un animal
- El registro visual resuelve el problema de perder los datos crudos de nuestras observaciones comportamentales.
- Computer/Machine vision es hacer que la computadora “vea” o “entienda”
- Nos permite tomar desiciones sobre nuestros experimentos sin estar ahí!!!!

El proceso

- Adquisición
- Segmentación
- Extracción
- “Entendimiento”
- Usar la Información para hacer algo



Una Imagen... una series de 3 Matrices 2-D

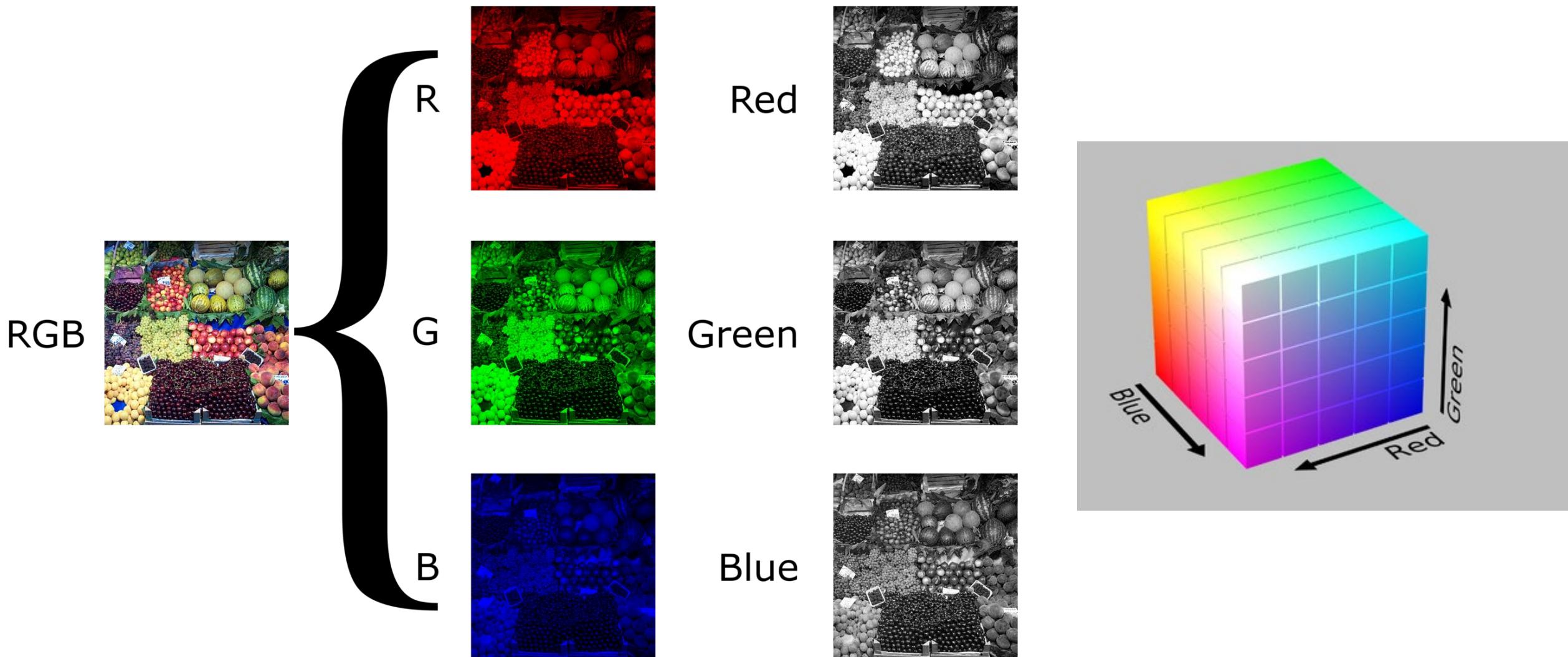
590



592

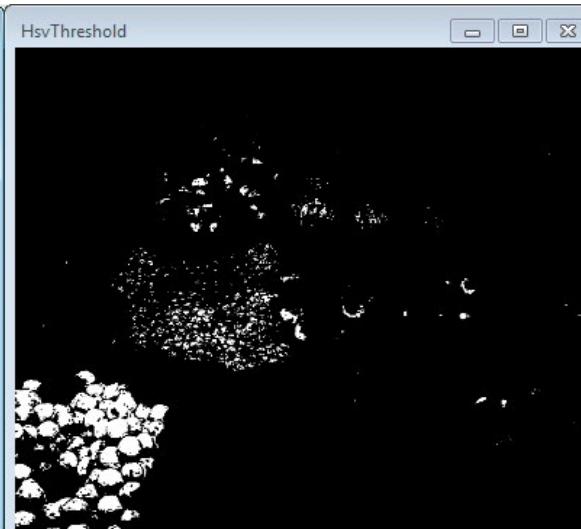
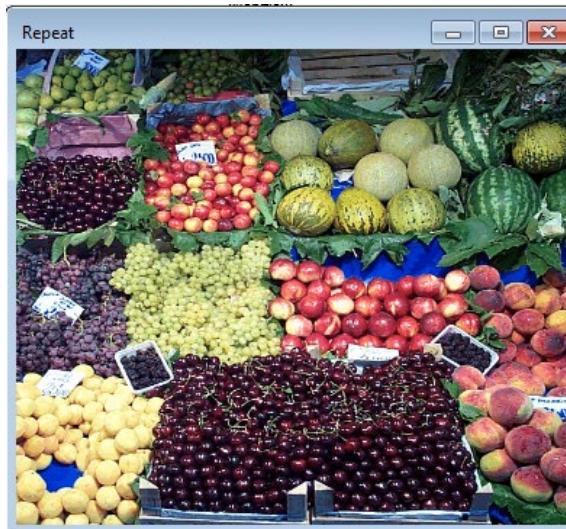
$592 \times 590 \times 3$

Como se compone?...



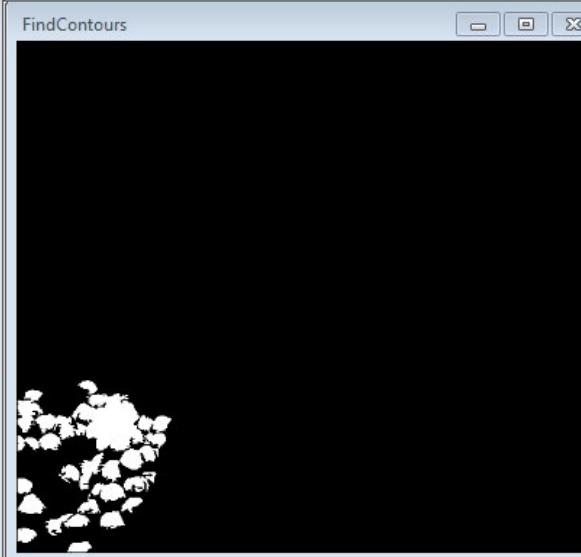
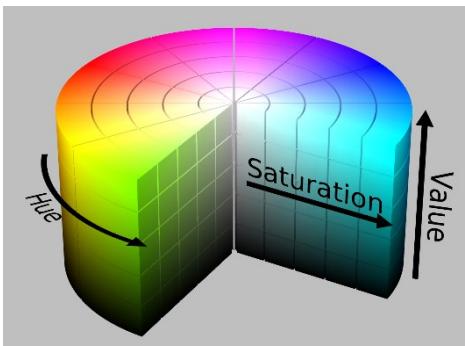
Segmentando la Imagen (Teo va a la frutería)

Original RGB image



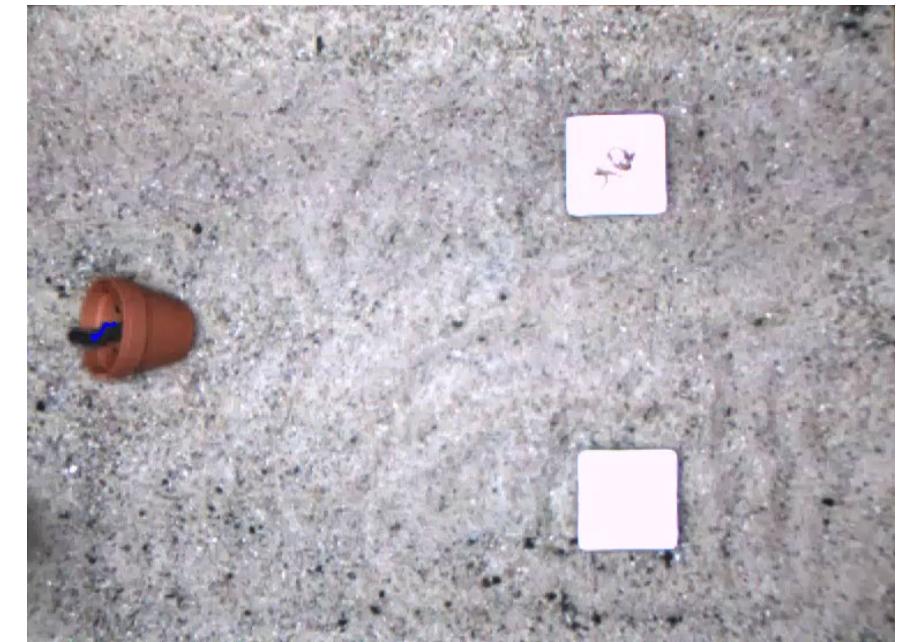
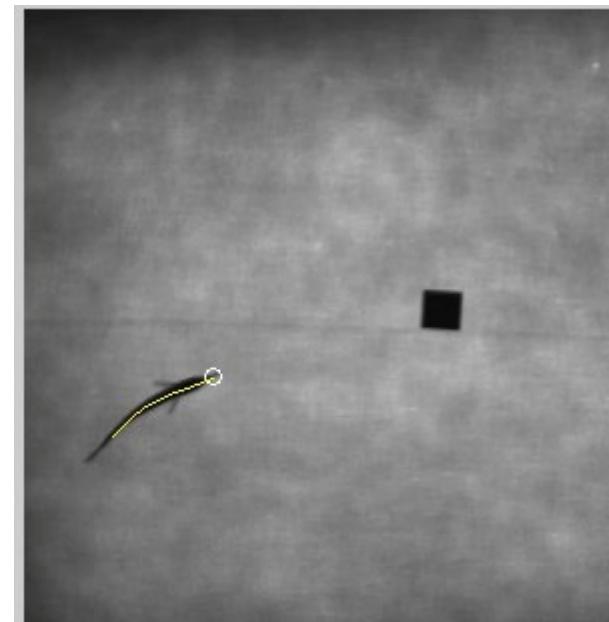
Threshold by HSV
(This is now a binary image)

Converted to HSV



Finding contours
(blobs of 1's)
We can set a minimum area

Ejemplos de Computer vision



A
programar!!!!

