Ocelotl: Time Aggregation Visualization for Trace Overview

Damien Dosimont [1] Guillaume Huard [2] Jean-Marc Vincent [2]

[1] INRIA

[2] Joseph Fourier University (UJF)
Grenoble

firstname.lastname@imag.fr

SoC-Trace Technical Meeting (July 2013)

Objectives

Schneiderman's analysis methodology

- **Overview** first
- **Zoom** and **filter**
- **Details** on demand

Overview

- Analysis tools lack **entry points**
- Need to provide **synthetic view**
- Show **phases**, **hot spots**
- Make the **link** with more precise representations

Objectives

Schneiderman's analysis methodology

- **Overview** first
- **Zoom** and **filter**
- **Details** on demand

Overview

- Analysis tools lack **entry points**
- Need to provide **synthetic view**
- Show **phases**, **hot spots**
- Make the **link** with more precise representations

Our proposition: Ocelotl

Principle

- Trace is divided in **time slices**
- **Variable parameter** enables to aggregate **consecutive slices**
- **Aggregates** are related to phases, disruptions

Theoretical aspects

- **Best-Cut partition** algorithm (Lamarche-Perrin)
- Trace time-slicing (Schnorr)

Implementation

- C++ library (best partition algorithm)
- FrameSoC module/Java (GUI, database queries, time-slicing)

Our proposition: Ocelotl

Principle

- Trace is divided in **time slices**
- **Variable parameter** enables to aggregate **consecutive slices**
- **Aggregates** are related to phases, disruptions

Theoretical aspects

- **Best-Cut partition** algorithm (Lamarche-Perrin)
- Trace time-slicing (Schnorr)

Implementation

- C++ library (best partition algorithm)
- FrameSoC module/Java (GUI, database queries, time-slicing)

Our proposition: Ocelotl

Principle

- Trace is divided in **time slices**
- **Variable parameter** enables to aggregate **consecutive slices**
- **Aggregates** are related to phases, disruptions

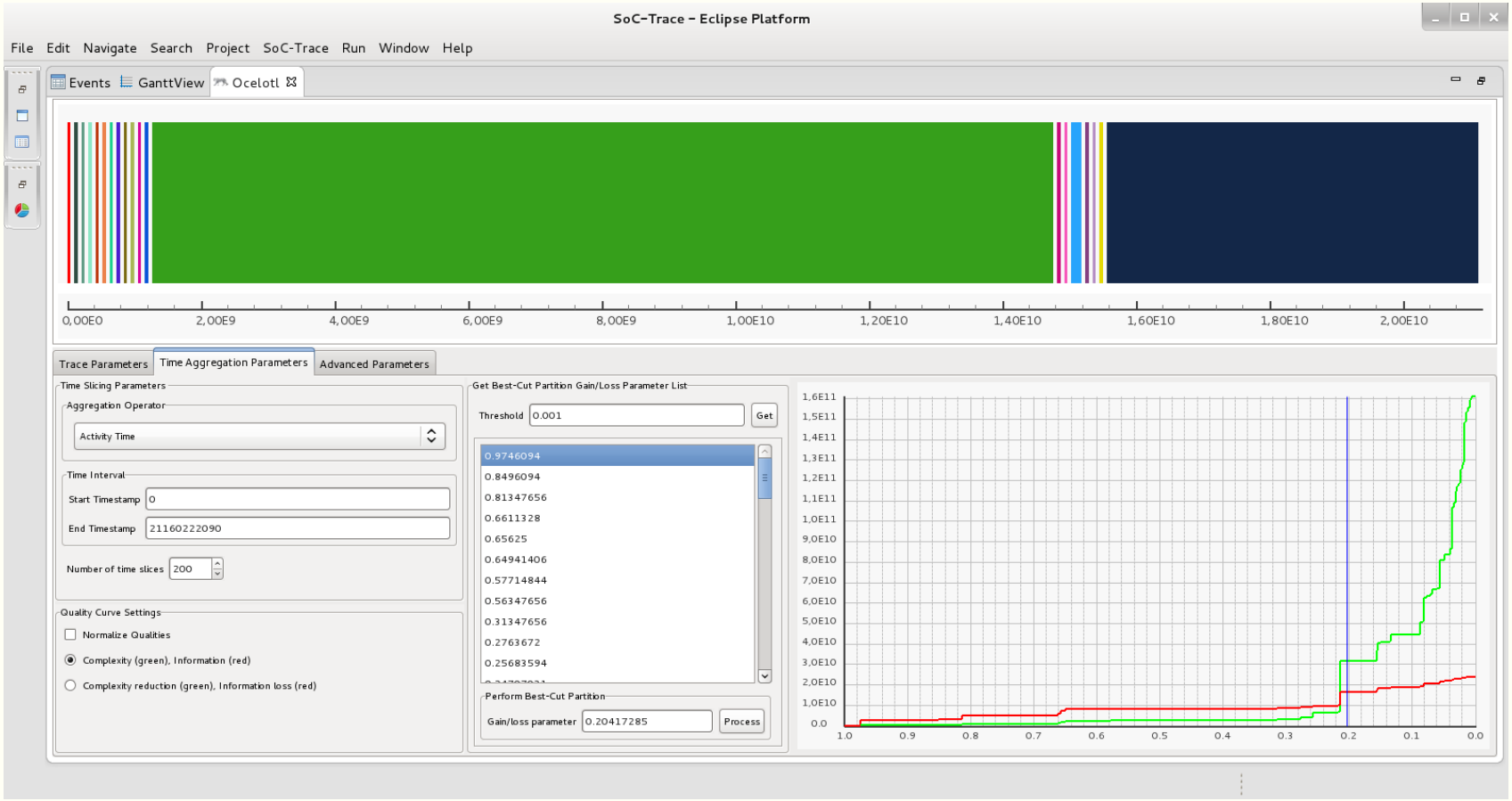
Theoretical aspects

- **Best-Cut partition** algorithm (Lamarche-Perrin)
- Trace time-slicing (Schnorr)

Implementation

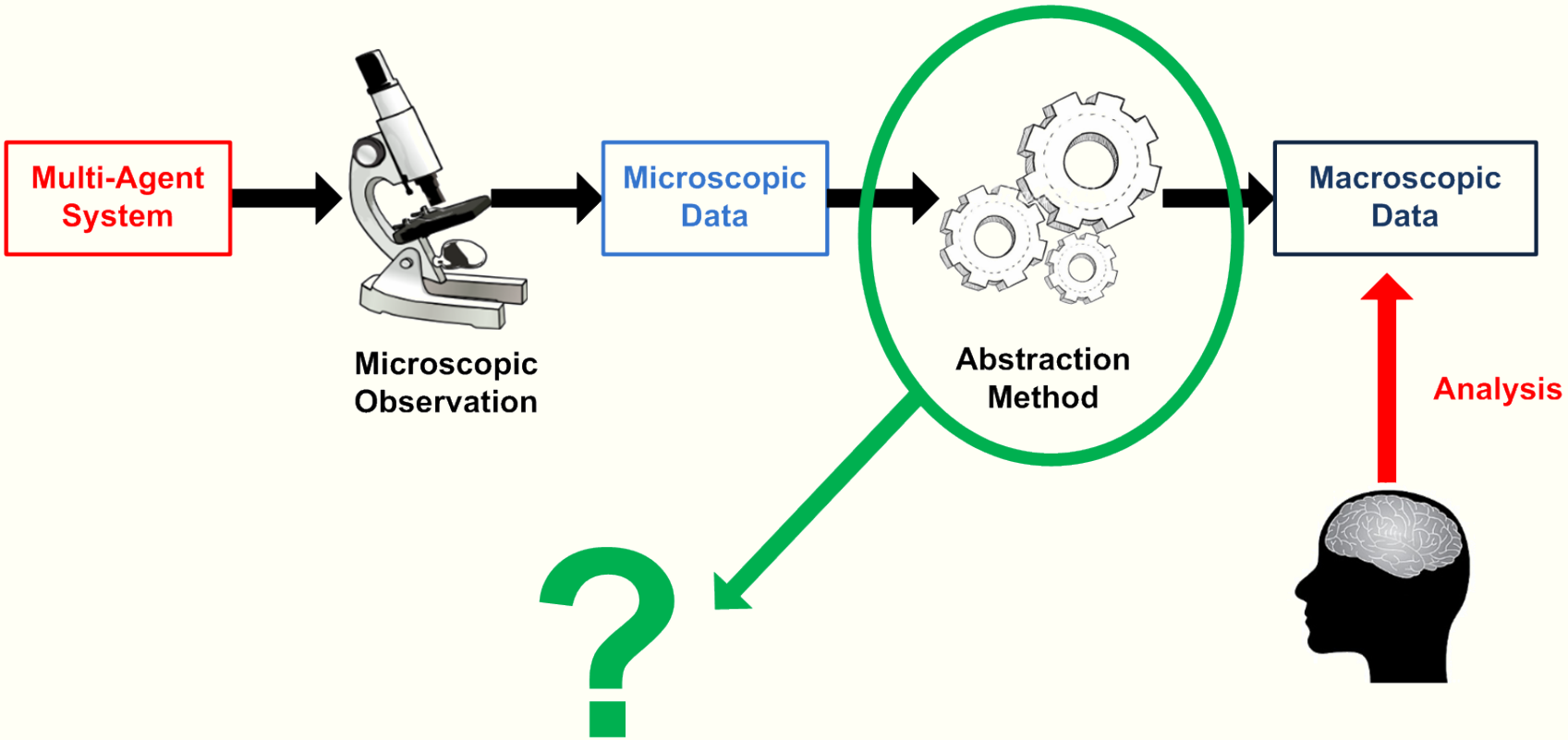
- C++ library (best partition algorithm)
- FrameSoC module/Java (GUI, database queries, time-slicing)

Our proposition: Ocelotl

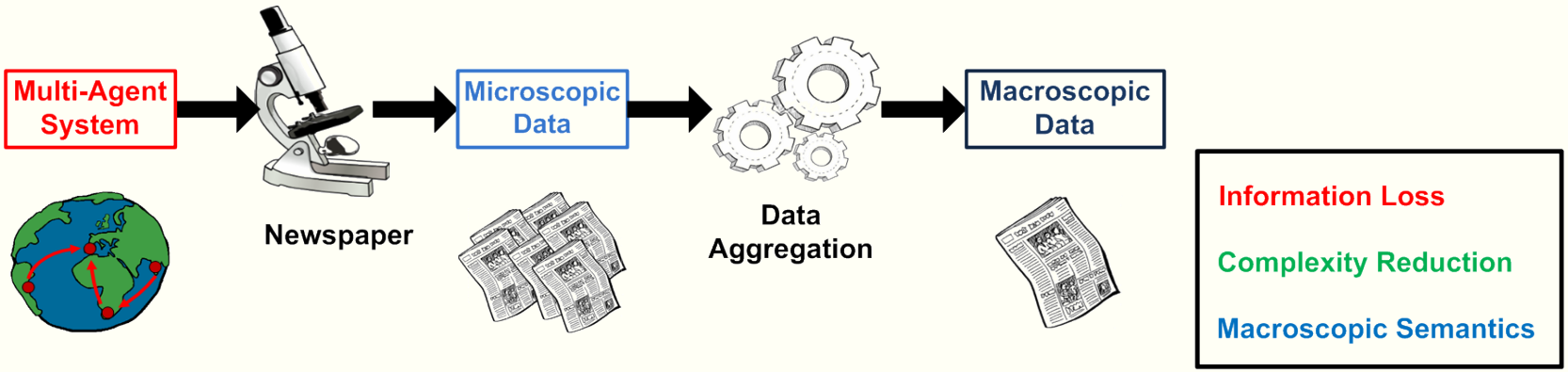


Lamarche-Perrin Works: Multi-Agent Systems

How to Build a Meaningful Macroscopic Description?



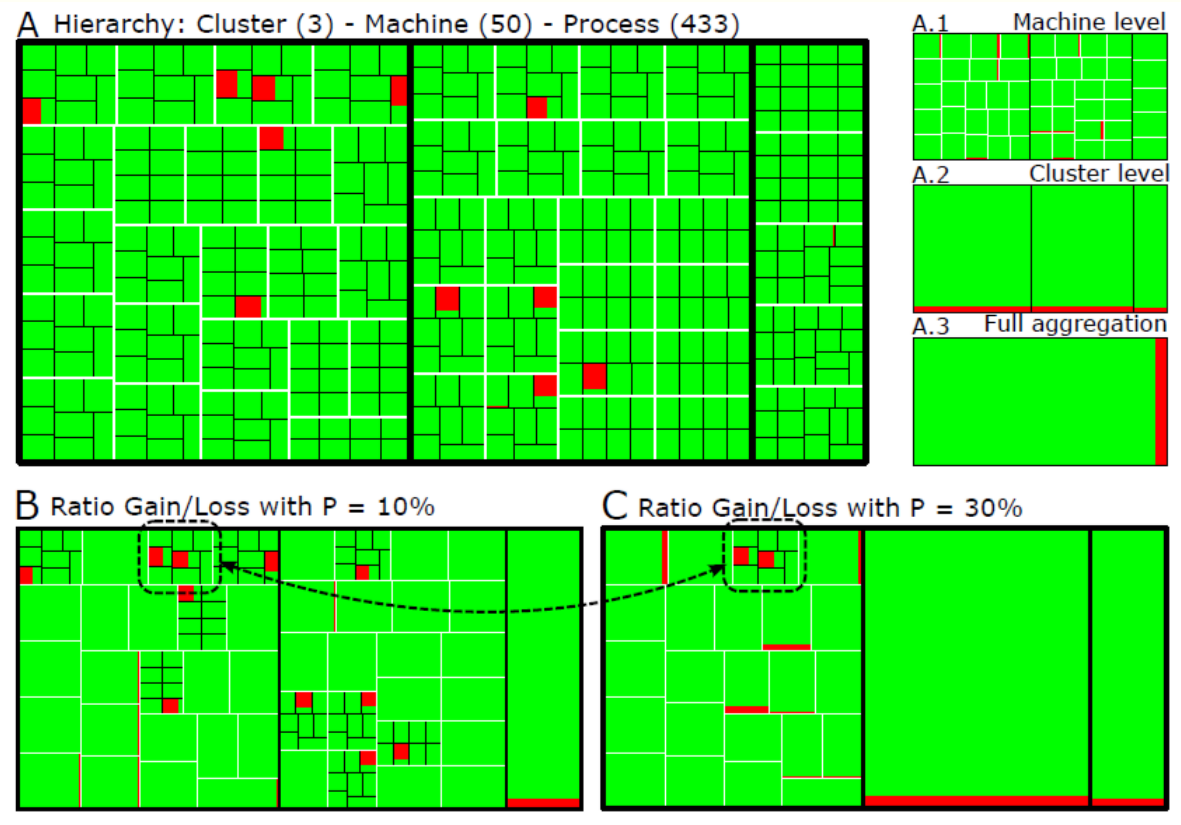
Example: Geomedia Project



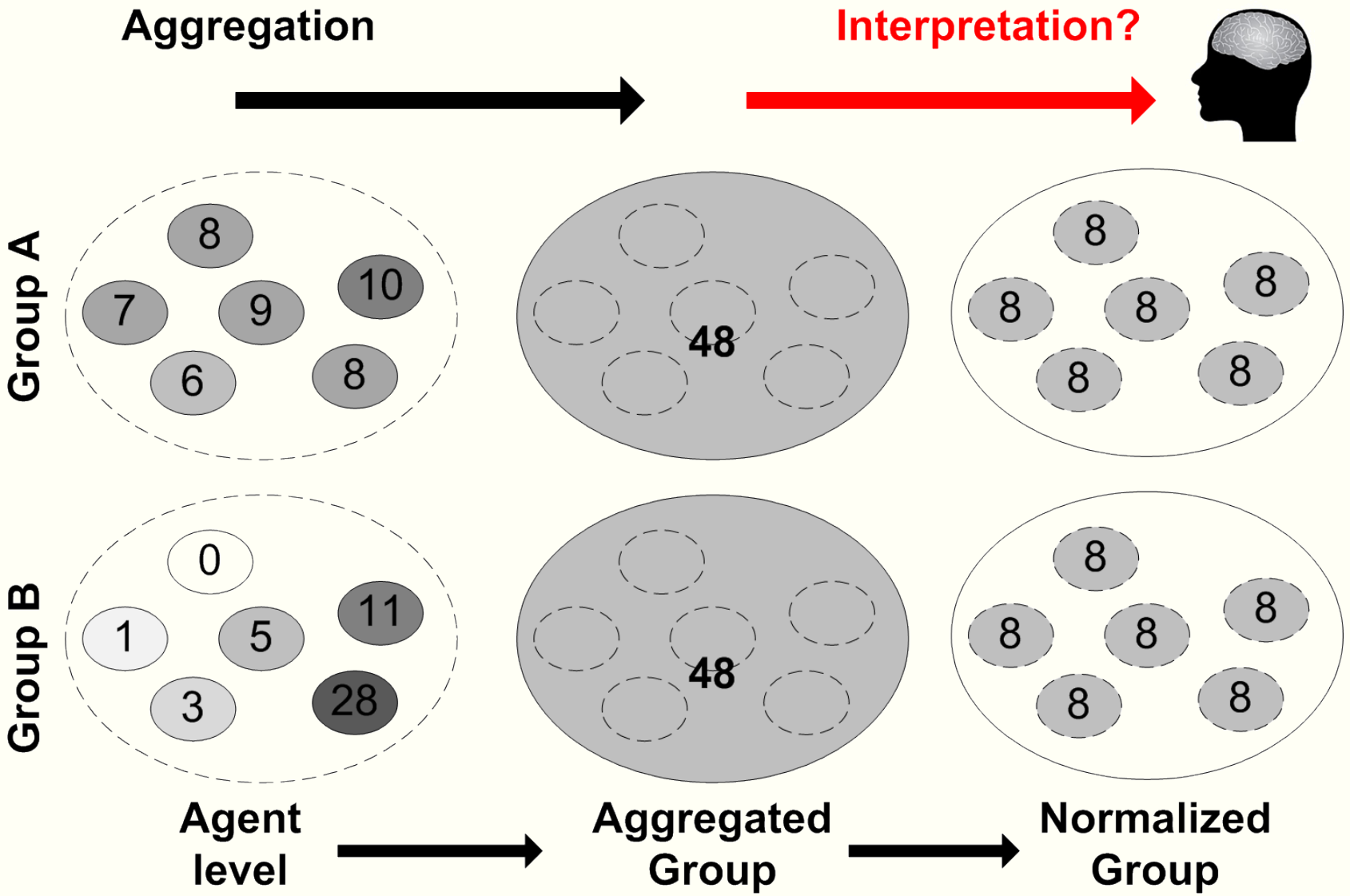
Resolution: Max | Resolution: Intermediary | Resolution: Min

Example: Viva

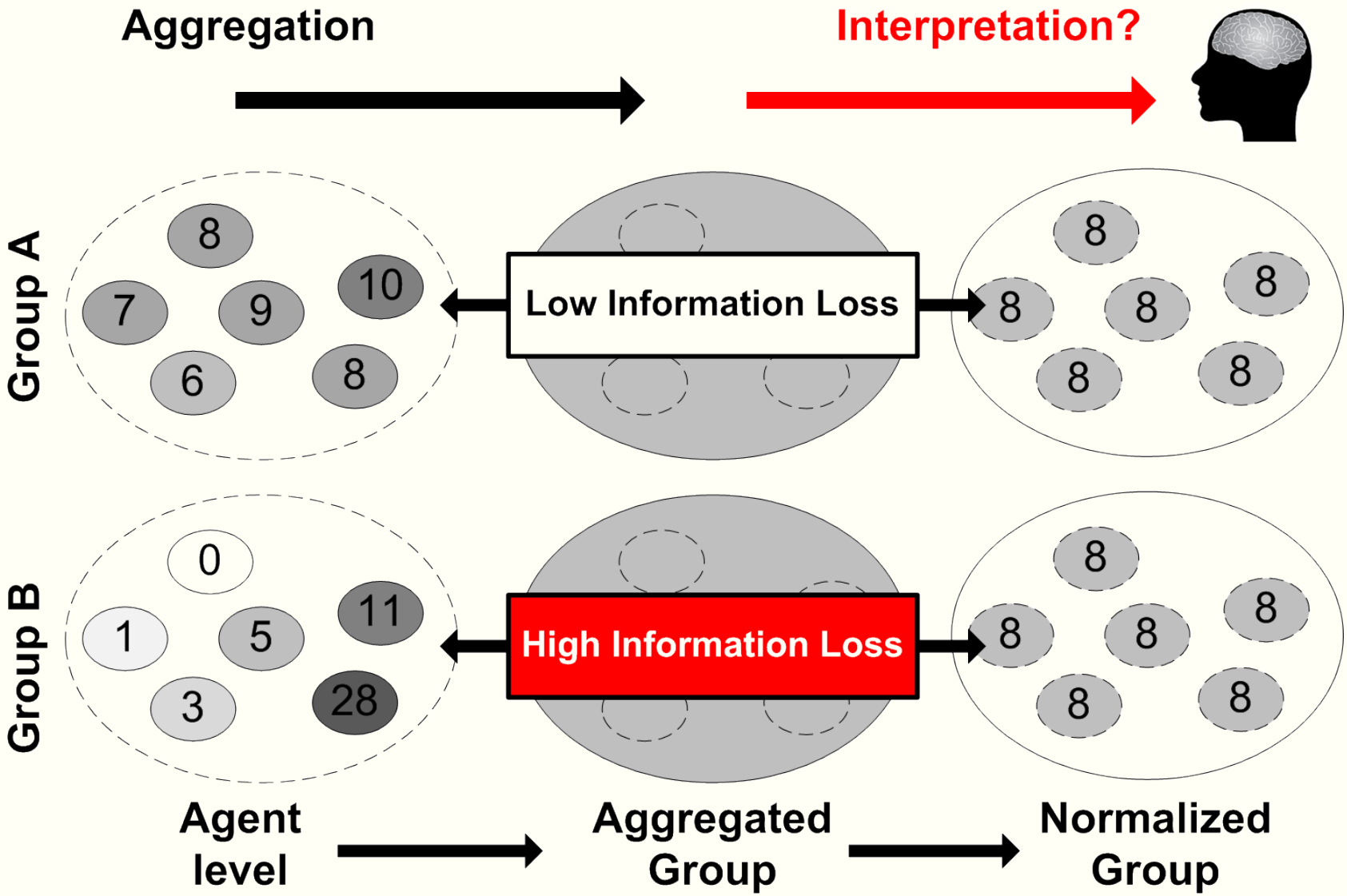
Represent Hierarchical Structure according to Value Heterogeneity



Information Loss



Information Loss



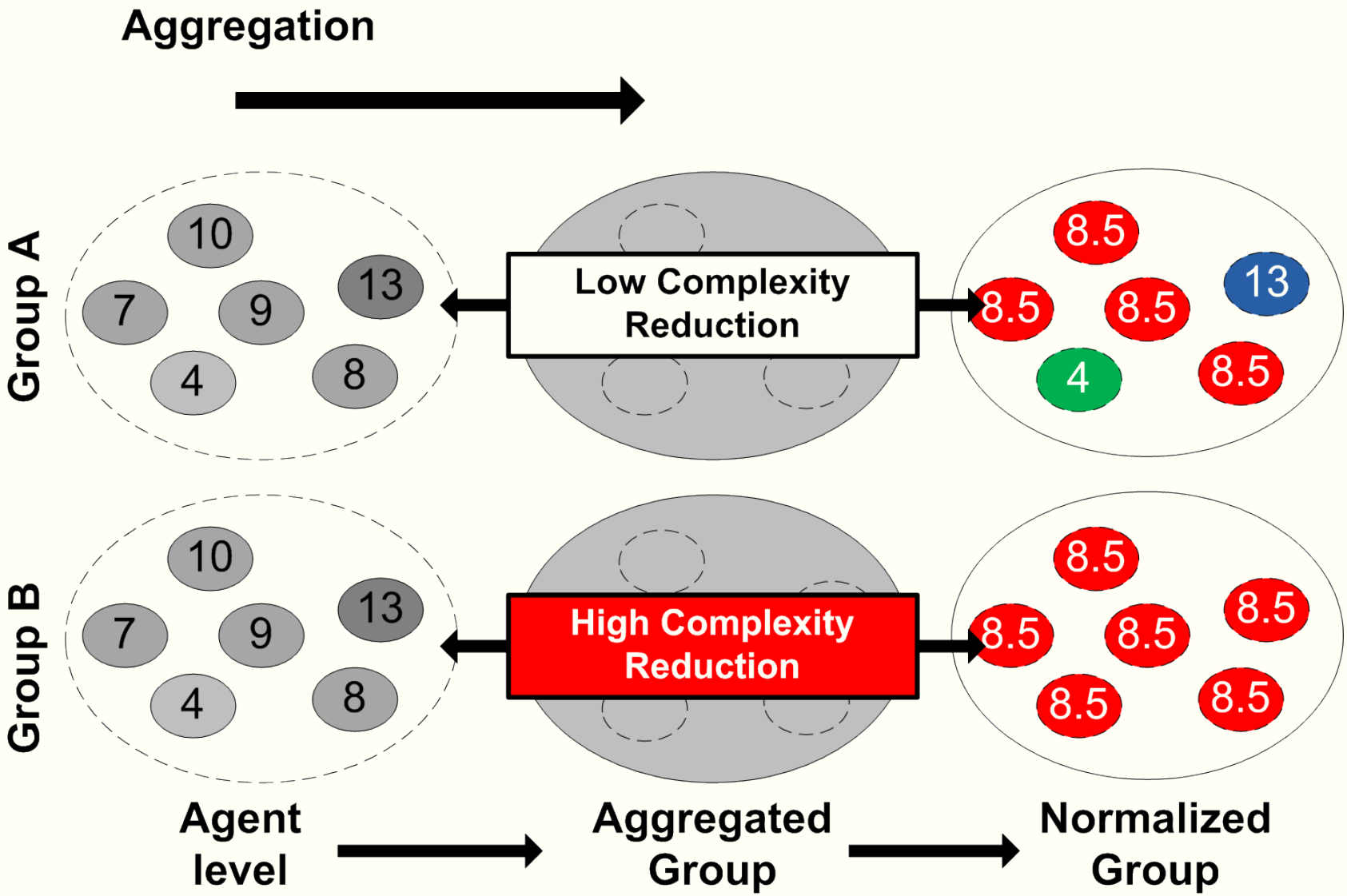
Information Loss Measure

Kullback-Leibler Divergence

$$\text{loss}(A||e) = \sum_{e \in A} v(e) \times \log_2 \left(\frac{v(e)}{v(A)} \right) \text{ in bits/x}$$

- Quantity of information than one **loses** by using an **aggregated description** instead of the **microscopic description**

Complexity Reduction



Complexity Reduction Measure

Shannon Entropy

$H(v) = \sum (v(i) \times \log_2 v(i))$ in bits/x

Entropy Reduction

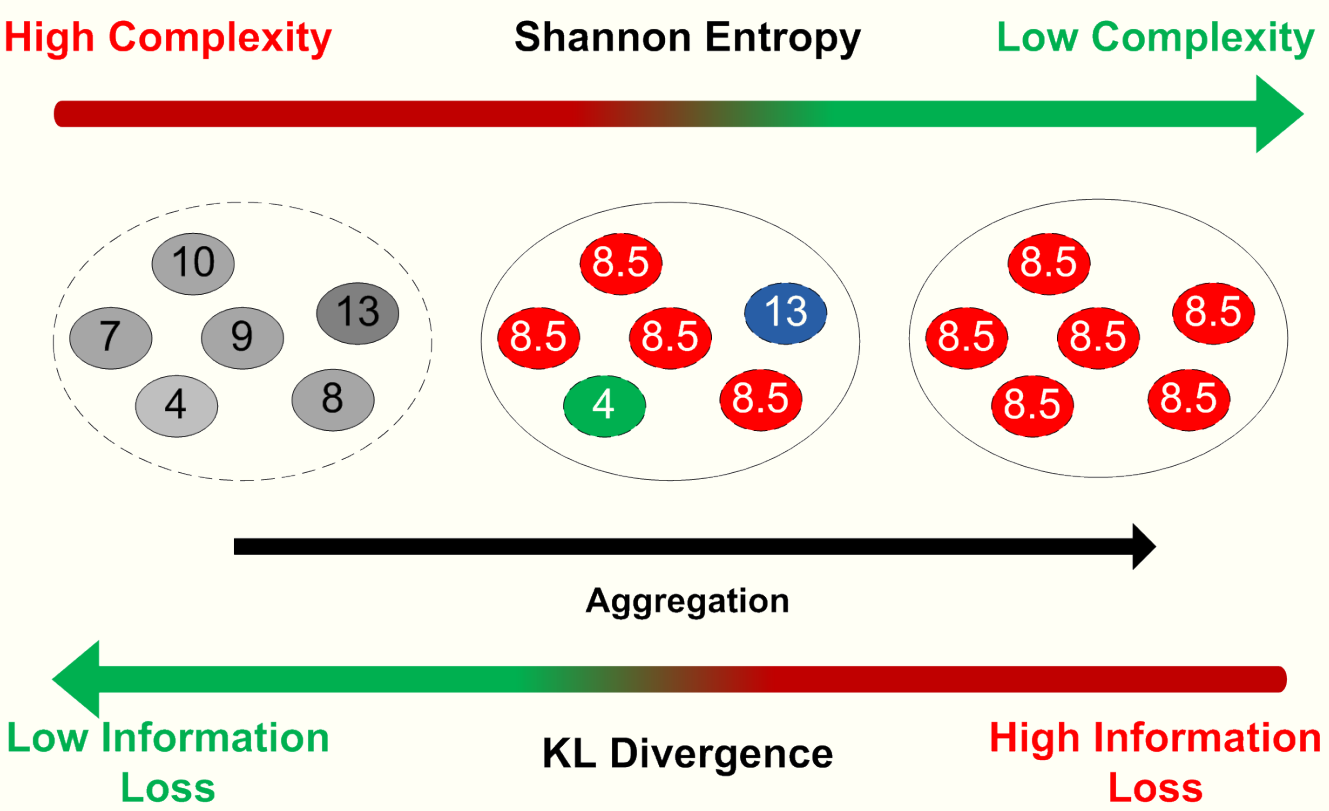
$gain(A||e) = H(A) - H(e)$ in bits/x

- Quantity of information than one **saves** by encoding the **aggregated description** instead of the **microscopic description**

Compromise Finding between Information Loss and Complexity Reduction

Parametrized Information Criterion

$$\text{pIC}(\mathcal{A}) = p \times \text{gain}(\mathcal{A}) - (1 - p) \times \text{loss}(\mathcal{A})$$

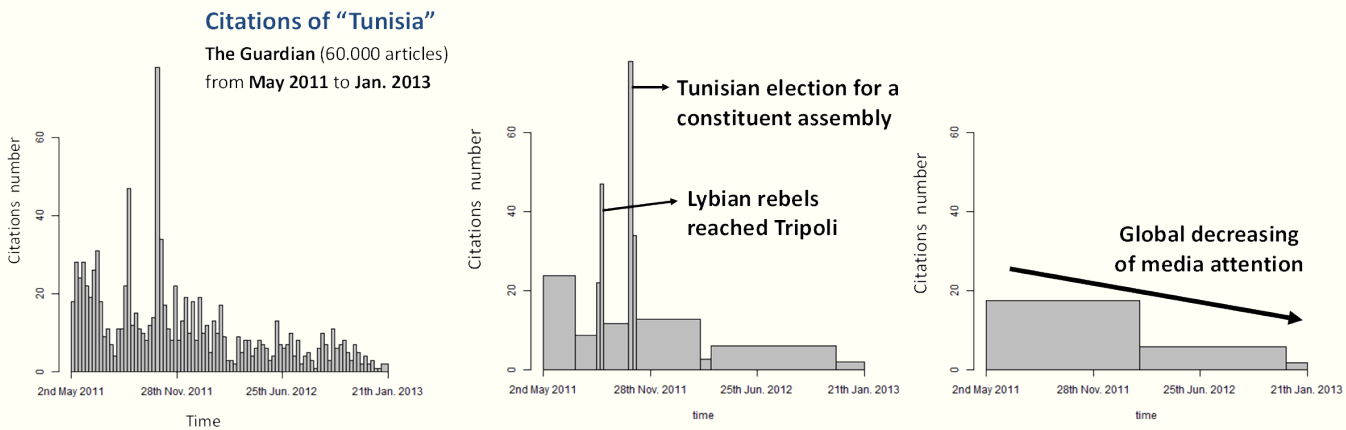


Temporal Aggregation

Temporal Aggregation principle

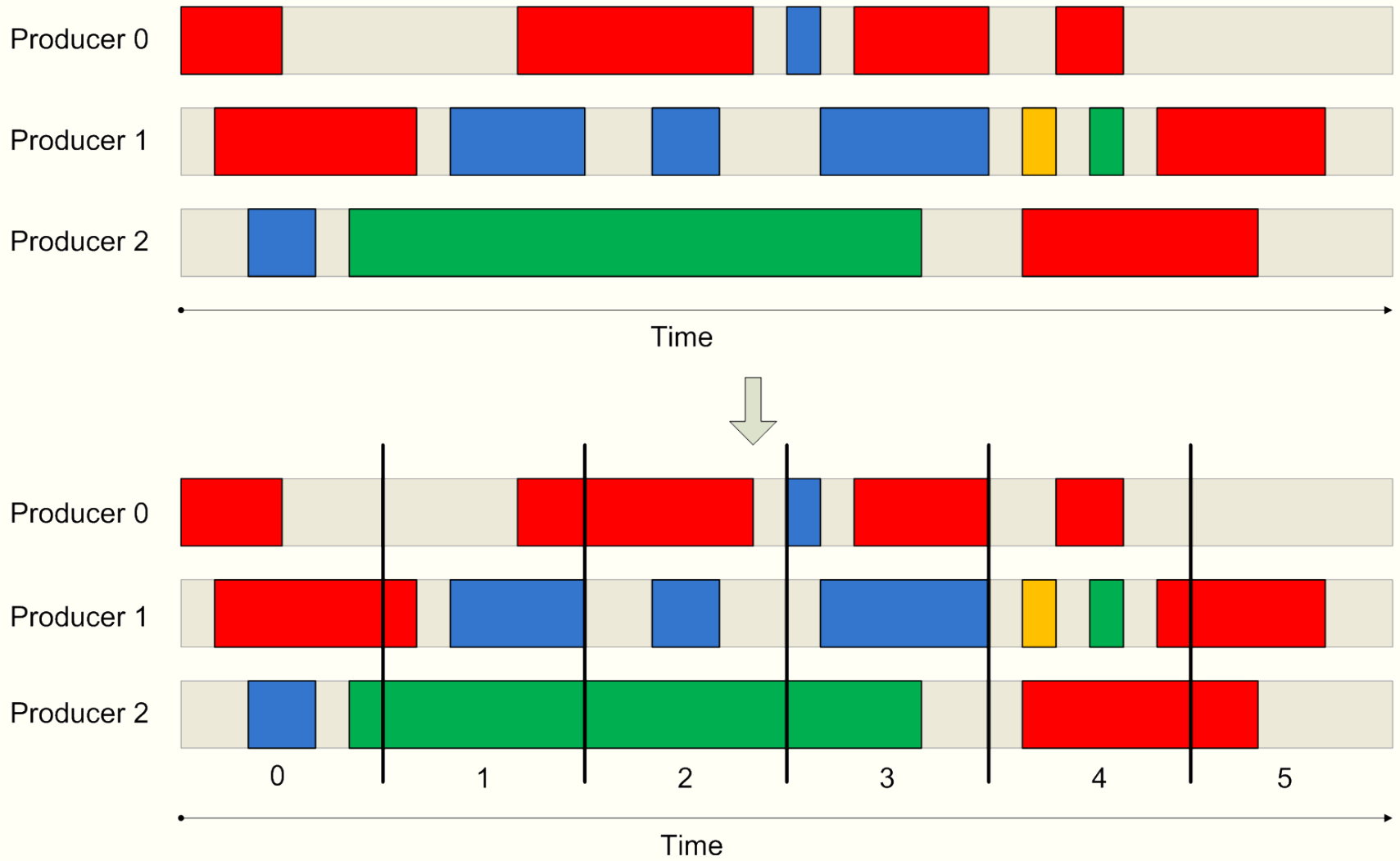
- Same principle but only consecutive data can be aggregated

Ex: Tunisia citation

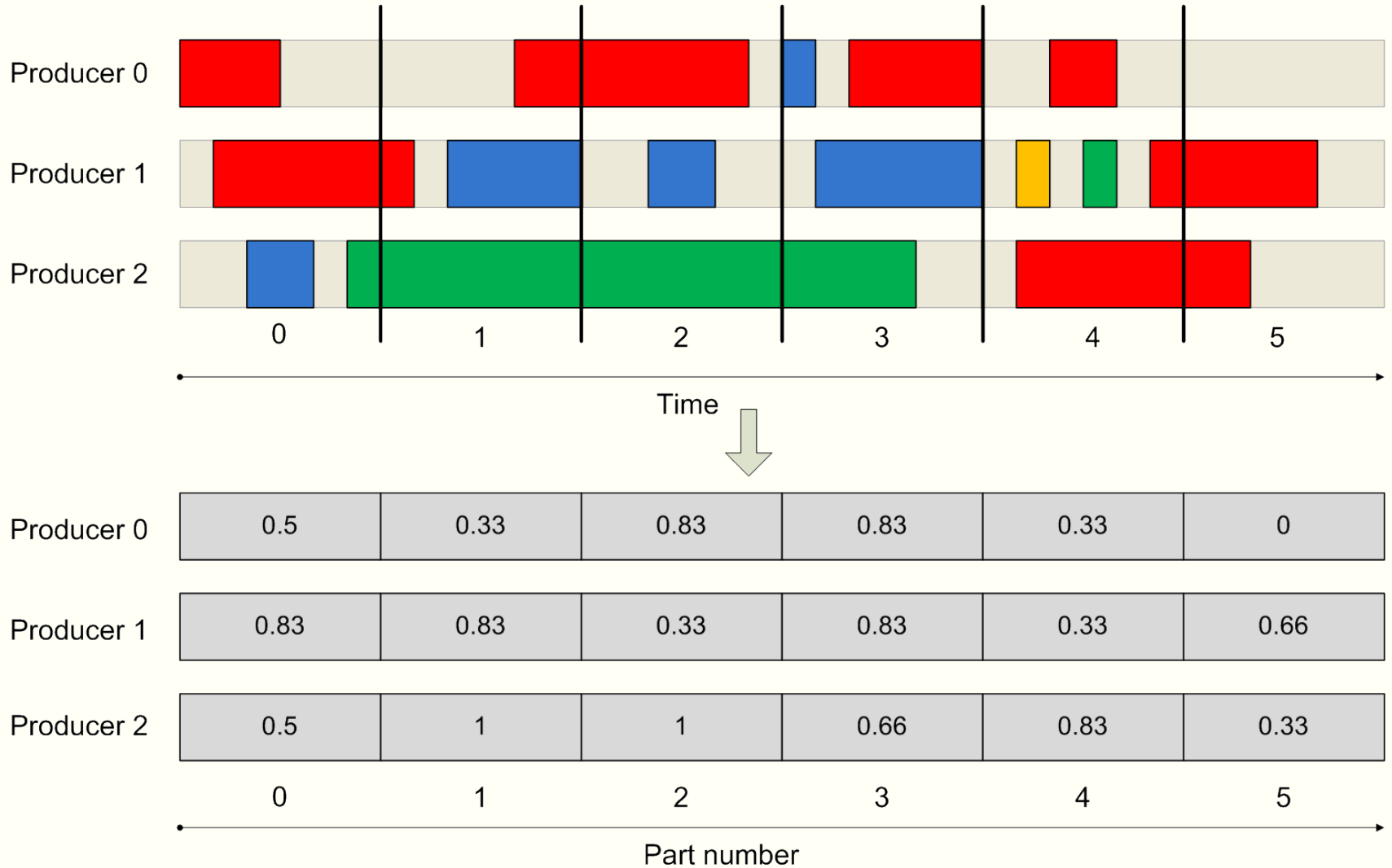


Need of a microscopic level description

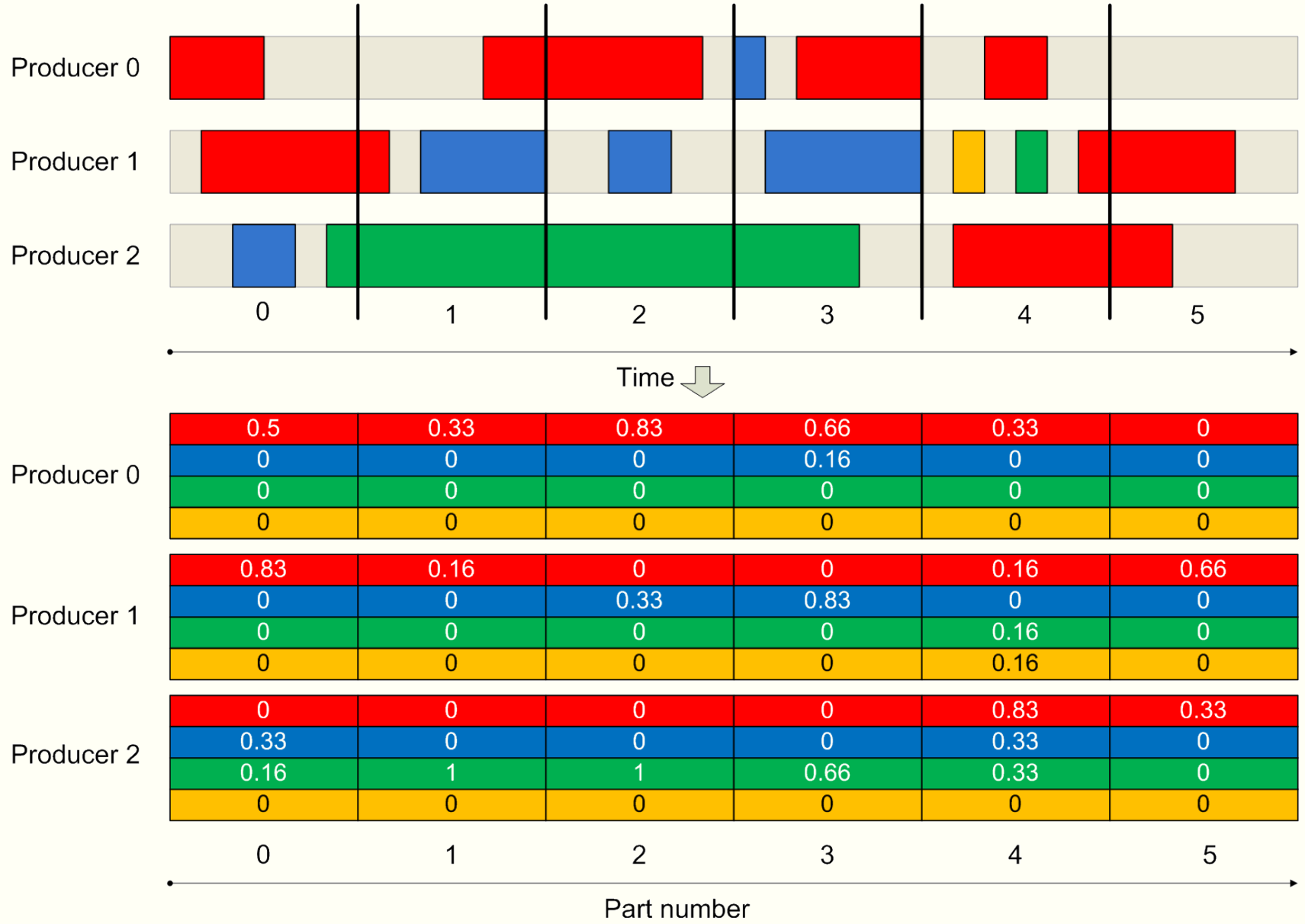
Microscopic Level: Time-Slicing



Microscopic Level: Producer Activity Time Matrix



Microscopic Level: State Activity Time Cubic Matrix



Quality Computation

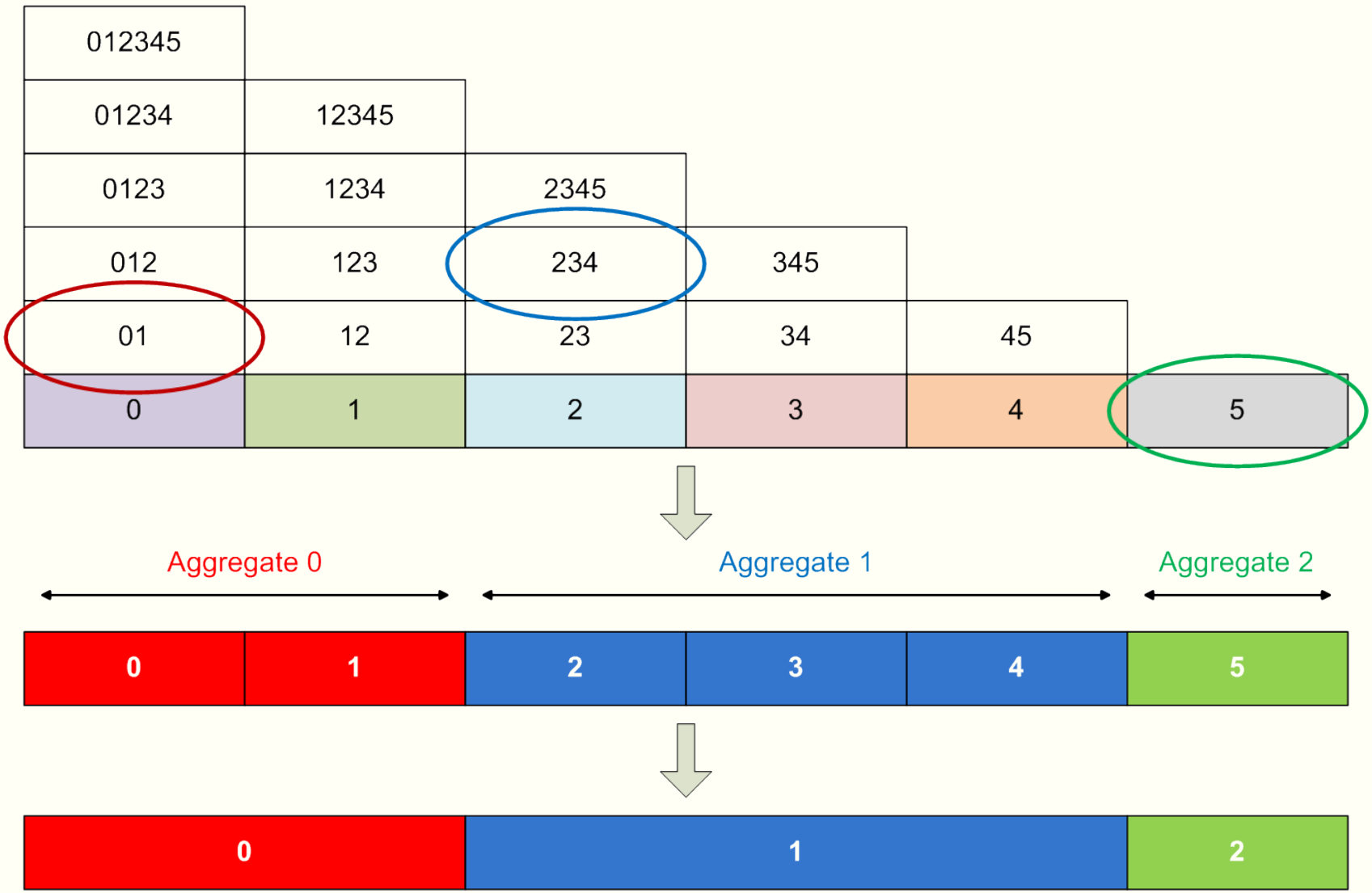
Gain and loss formulas: originally for scalars

012345					
01234	12345				
0123	1234	2345			
012	123	234	345		
01	12	23	34	45	
0	1	2	3	4	5

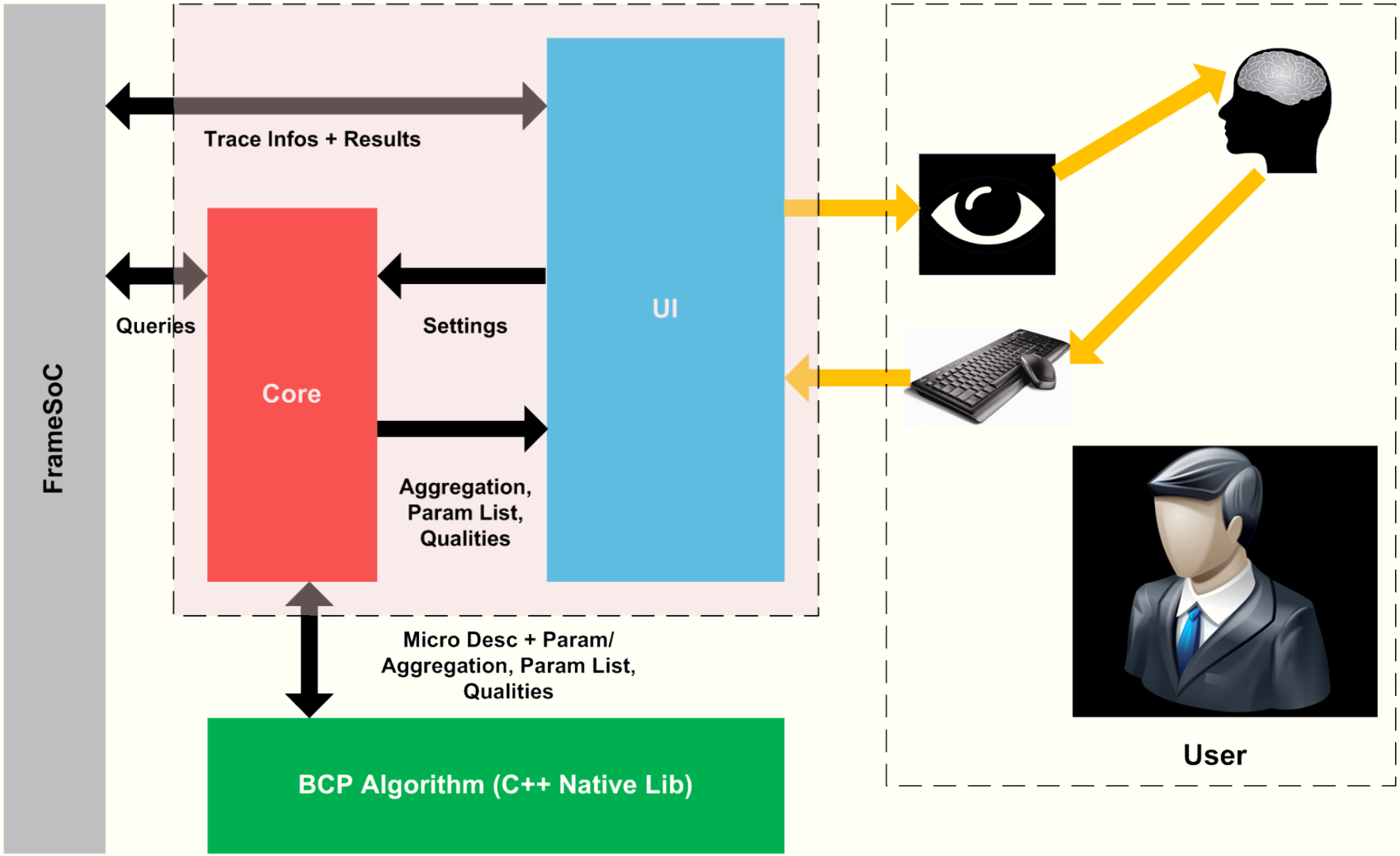
Adaptation for time-sliced description

- Vector (ex: activity time per process)
  $\text{quality}(A) = \sum_{i \in n} \text{quality}(A[i])$
- Matrix (ex: activity time per state type)
  $\text{quality}(A) = \sum_{i \in n} (\sum_{j \in m} \text{quality}(A[i][j]))$

Best-Cut Partition for a given *p*



Implementation



Other Interesting Tools

Pajé Trace Management

- **Importer**
- **Exporter**
- **Cleaner** (Pop/Push State -> Set State)

Filter

- **Filter** EP by timestamps and generate results

Gantt with Pajé Semantics

- soon...

Other Interesting Tools

Pajé Trace Management

- **Importer**
- **Exporter**
- **Cleaner** (Pop/Push State -> Set State)

Filter

- **Filter** EP by timestamps and generate results

Gantt with Pajé Semantics

- soon...

Other Interesting Tools

Pajé Trace Management

- **Importer**
- **Exporter**
- **Cleaner** (Pop/Push State -> Set State)

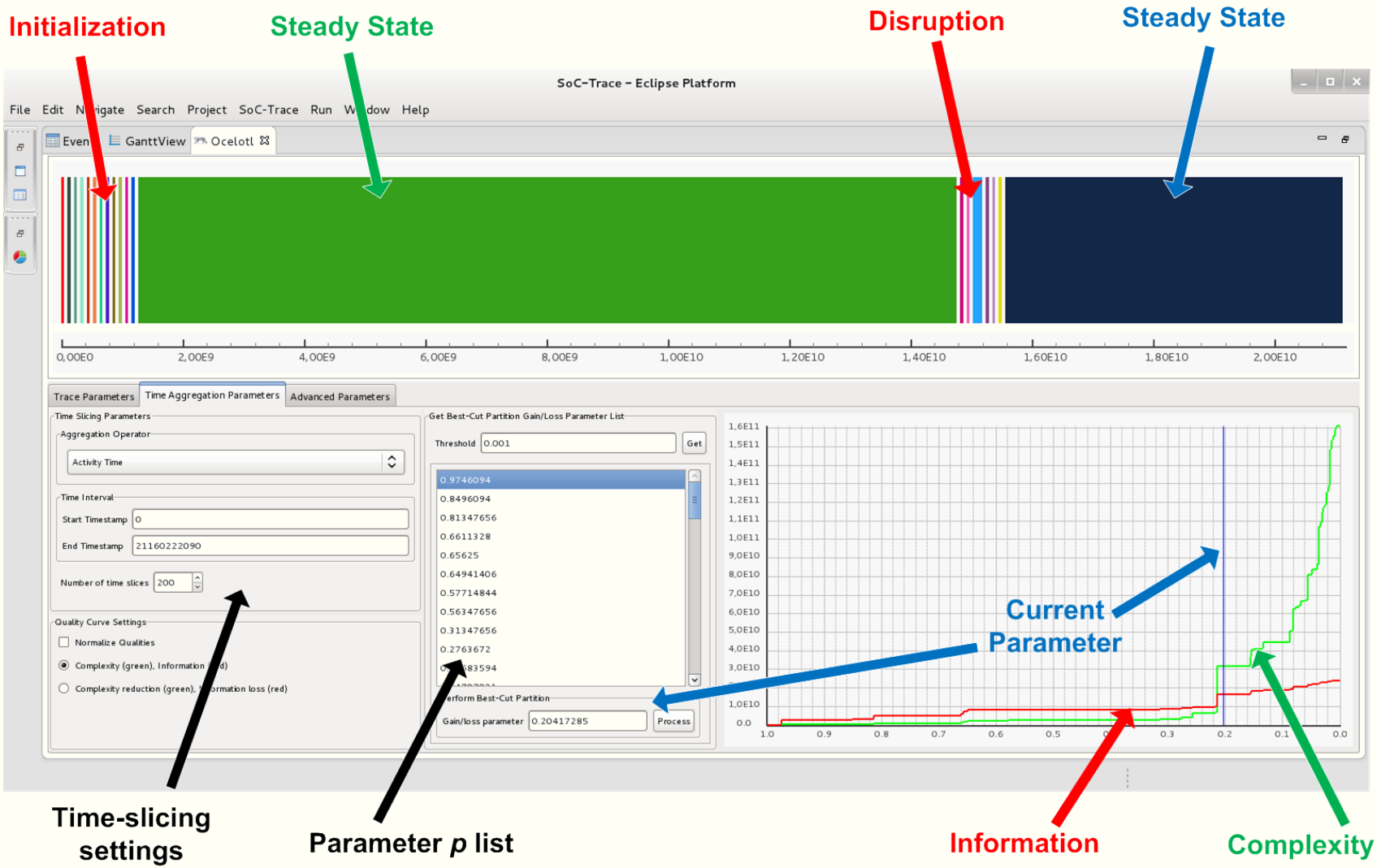
Filter

- **Filter** EP by timestamps and generate results

Gantt with Pajé Semantics

- soon...

Overview a Trace



Demonstration

Conclusion

Time Aggregation Visualization

- Able to represent application **behavior over time**
- Solves some **time scalability** issues
- First step of an analysis flow

But...

- Lack of **space dimension** representation
- Lack of **interaction** (details-on-demand)

Conclusion

Time Aggregation Visualization

- Able to represent application **behavior over time**
- Solves some **time scalability** issues
- First step of an analysis flow

But...

- Lack of **space dimension** representation
- Lack of **interaction** (details-on-demand)

Future Works

New features

- Discontinue parts **similarity**
- **Hierarchical** aggregation
- Aggregation **metrics**
- Visualization/parts representation improvement
- User **interaction**

Outside embedded system domain

- What about HPC/Distributed Systems?

Future Works

New features

- Discontinue parts **similarity**
- **Hierarchical** aggregation
- Aggregation **metrics**
- Visualization/parts representation improvement
- User **interaction**

Outside embedded system domain

- What about HPC/Distributed Systems?

Merci de votre attention!

http://moais.imag.fr/membres/damien.dosimont/