



# OpenAdap.net : an evolvable information processing environment

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- Knowledge sharing: social obstacles



OBSTACLES TO KNOWLEDGE DISSEMINATION



The richness circulating in the Cyberspace is poorly exploited because of **difficulties to share the know-how. Delays** appear until newly developed methods of information processing become available even within a specific field or discipline.

CONTRIBUTOR



"INVENTION"

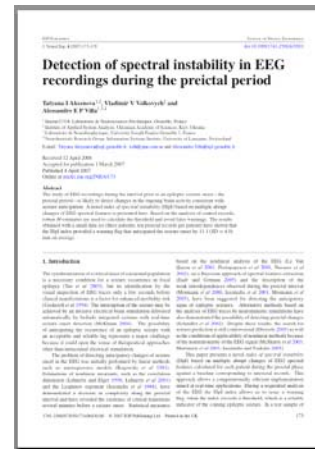
$$N_c^{(c)} = Q(a, c, \Omega) \cdot \tilde{N}_c^{(c)}$$

$$\tilde{N}_c^{(c)} = K \sum_{S_c \in \mathcal{S}_c} e^{-m(S_c)/K} \cdot \frac{1}{r!} \left[ \frac{m(S_c)}{K} \right]^r$$

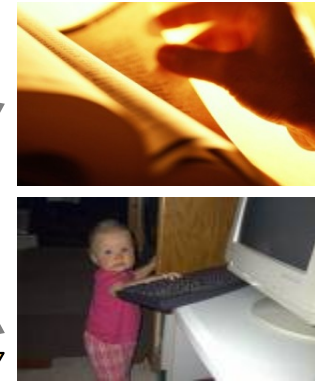
$$Q(a, c, \Omega) = F(c - a, a) \cdot \frac{\Omega!}{(\Omega - a)! a!}$$

$$K = \frac{(w/\Delta)^{c-1}}{(c-1)!} \equiv \frac{w^{c-1}}{f_\Delta(c-1)!}$$

DISSEMINATION



ACCESS



- Transdisciplinarity: technical obstacles**

The software is generally based on **tailored needs** and platforms **too narrowly designed**. Due to lack of a transdisciplinary vision **knowledge remains undiscovered** to users specialized in fields of competence other than that of the original author

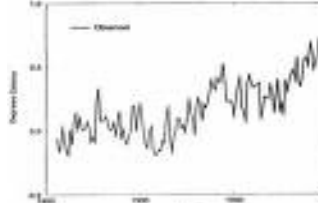
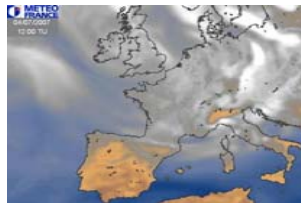
**LIFE AND CLINICAL SCIENCES**



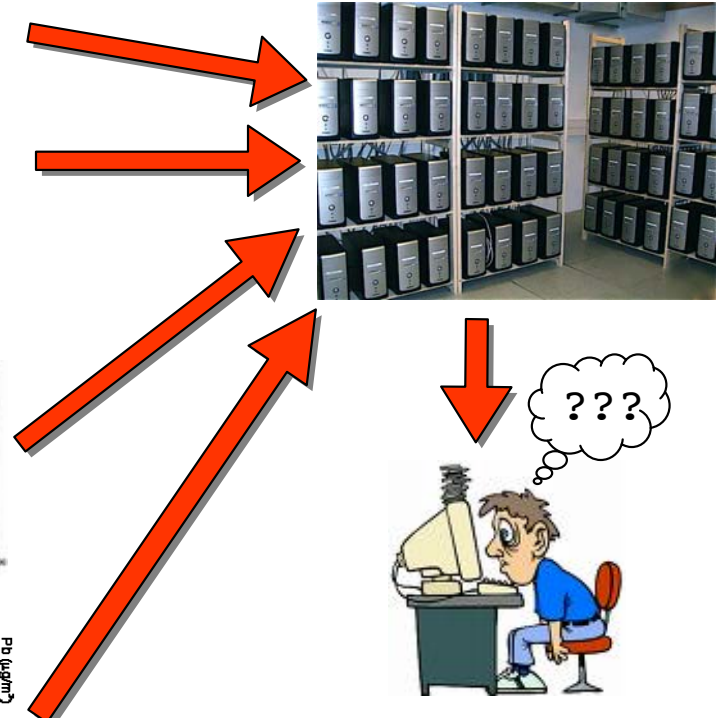
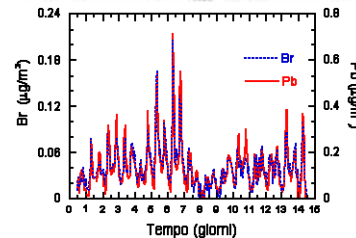
**ECONOMY AND FINANCE**



**CLIMATE AND METEOROLOGICAL SCIENCES**



**TRAFFIC JAM AND POLLUTION FORECAST**

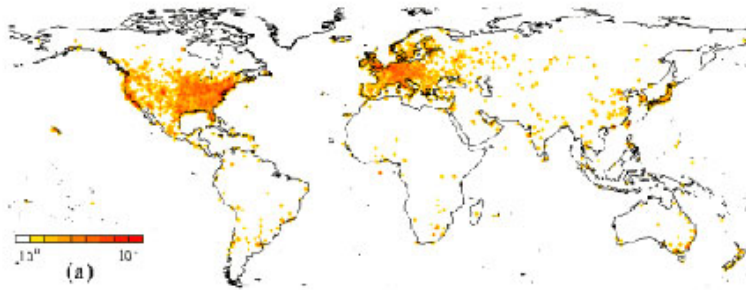


- Digital divide**

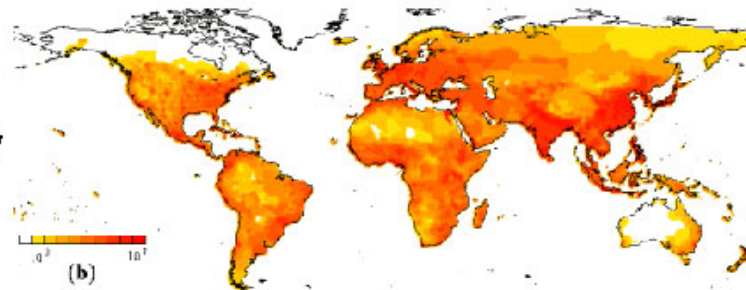


The existence of **barriers** in the flow of information processing **increase the overall cost** of knowledge production and distribution and **restrict its availability** to developing countries as well among **social classes** of developed countries.

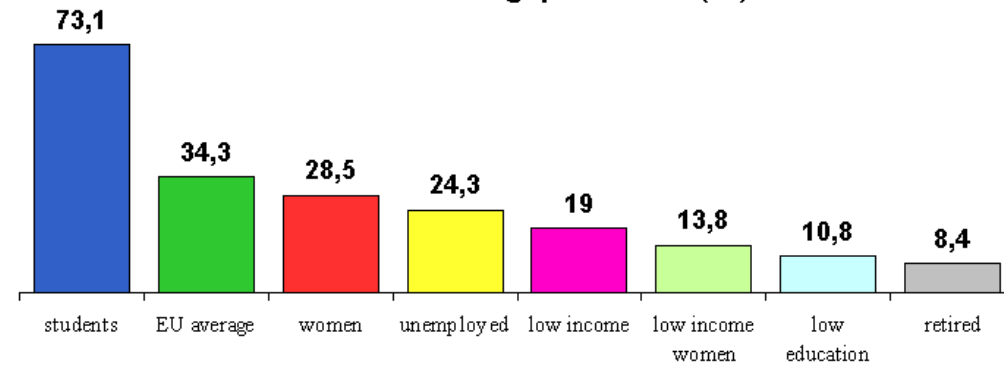
Router density



Population density



internet access gap in the EU (%)



# Research Objectives (1)

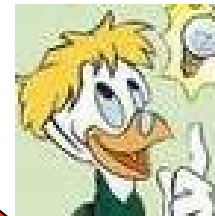
- To **avoid the "re-invention"** and **"re-discovery"** of existing knowledge so to **save time and expenses** by the whole society and prevent incorrect applications.
- To promote the development of **Communities with semantically related interests**. Community members who provide new knowledge become able to **share** their contribution and members who have information to be processed can **access** these services.



WHAT ?  
WHERE ?  
WHEN ?



KNOWLEDGE



KNOWLEDGE



KNOWLEDGE



OpenAdap.net

OpenAdap.net



# Research Objectives (2)

- To provide Communities the possibility to **transparently compose meta-resources**, based on the available resources, by means of a **network-centric operating system** driven by the activity of **intelligent adaptable brokers** with the advantages and features of Grid computing, Web Services and Peer-to-Peer applications.

Grid: a user has to process an information with one application distributed across

WS: many users exploit the same services provided by a centralized authority

P2P: many users dynamically exchange pieces of information in an unsupervised way

	Data treatment distribution	Hardware resource allocation	Hidden execution hosts	Applications sharing	Published application interfaced	Data sharing	Highly dynamic system	Transparent connections users ↔ resources
Grid	X	X	X					
Web Services			X	X	X	X		
P2P						X	X	X
openAdap.Net	X	X	X	X	X	X	X	X



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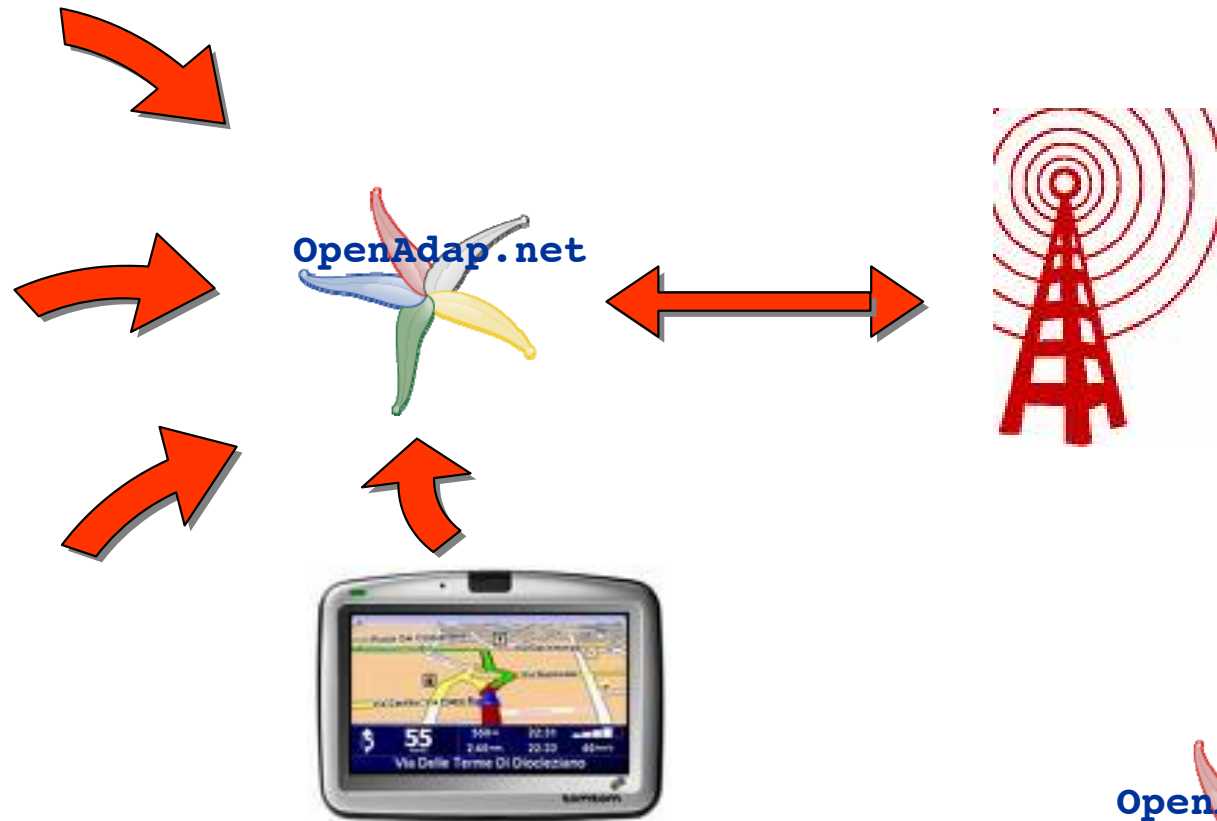
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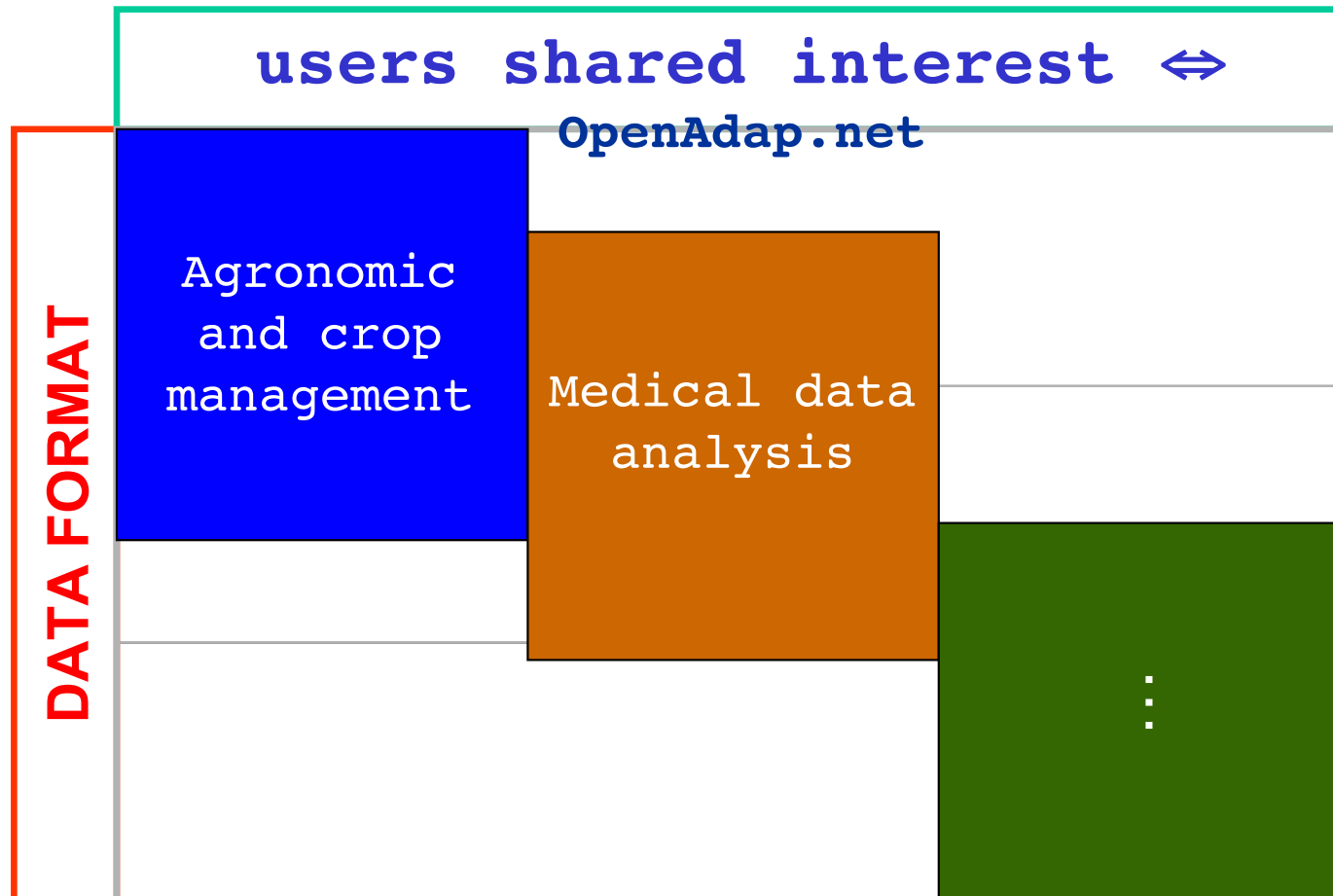
# Research Objectives (3)

- To develop a new **OpenAdap.net** protocol (**oan://**) for field instrumentation and wireless communication over Internet aimed at **easy ubiquitous knowledge sharing and access**.



# Research Objectives (4)

- To develop new business opportunities for Third Parties from all over the world, **SMEs** in particular, aimed at **added value services** (*educational, commercial, governmental, ...*).



# Target Audience

## COMMUNITIES



People who share a **knowledge representation** (**common data format**) driven by **common interests**.

**CONTRIBUTOR** : people who would like to **share their knowledge** with the Community. They maintain the authorship and keep **control and responsibility** over their contribution.



**USER** : people interested to **process their own information** or **access knowledge stored elsewhere** (e.g., in a public database) and **extract the results of their processing**. They exploit Contributors' applications in a trusted way.

[OpenAdap.net](http://OpenAdap.net)

## CONTRIBUTORS

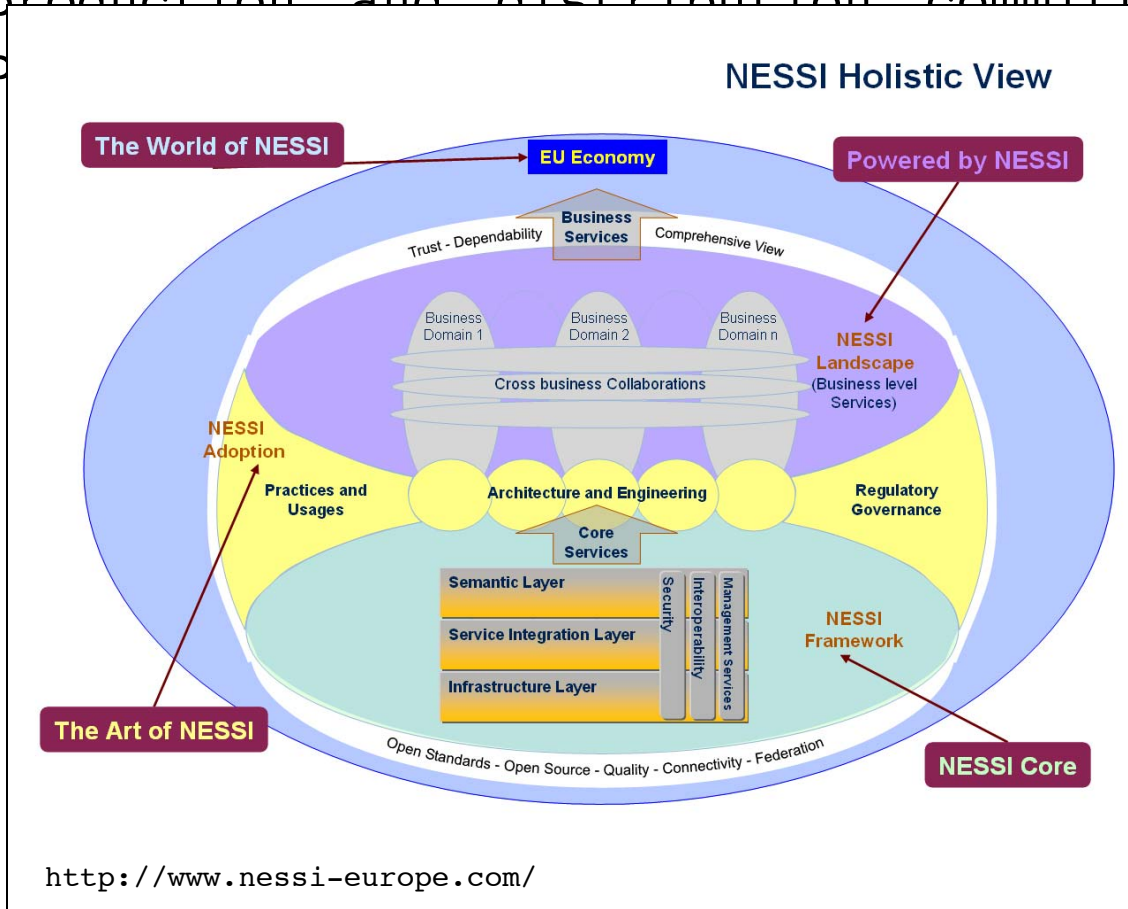


## USERS



# Research approach, Methodology (1)

The key is the development of a new original project called **OpenAdap.net**, that is **independent of a specific data type**. The project is aimed to enable a middleware that is an **Open Source software platform** providing flexible tools for knowledge production and distribution committed to the holistic view

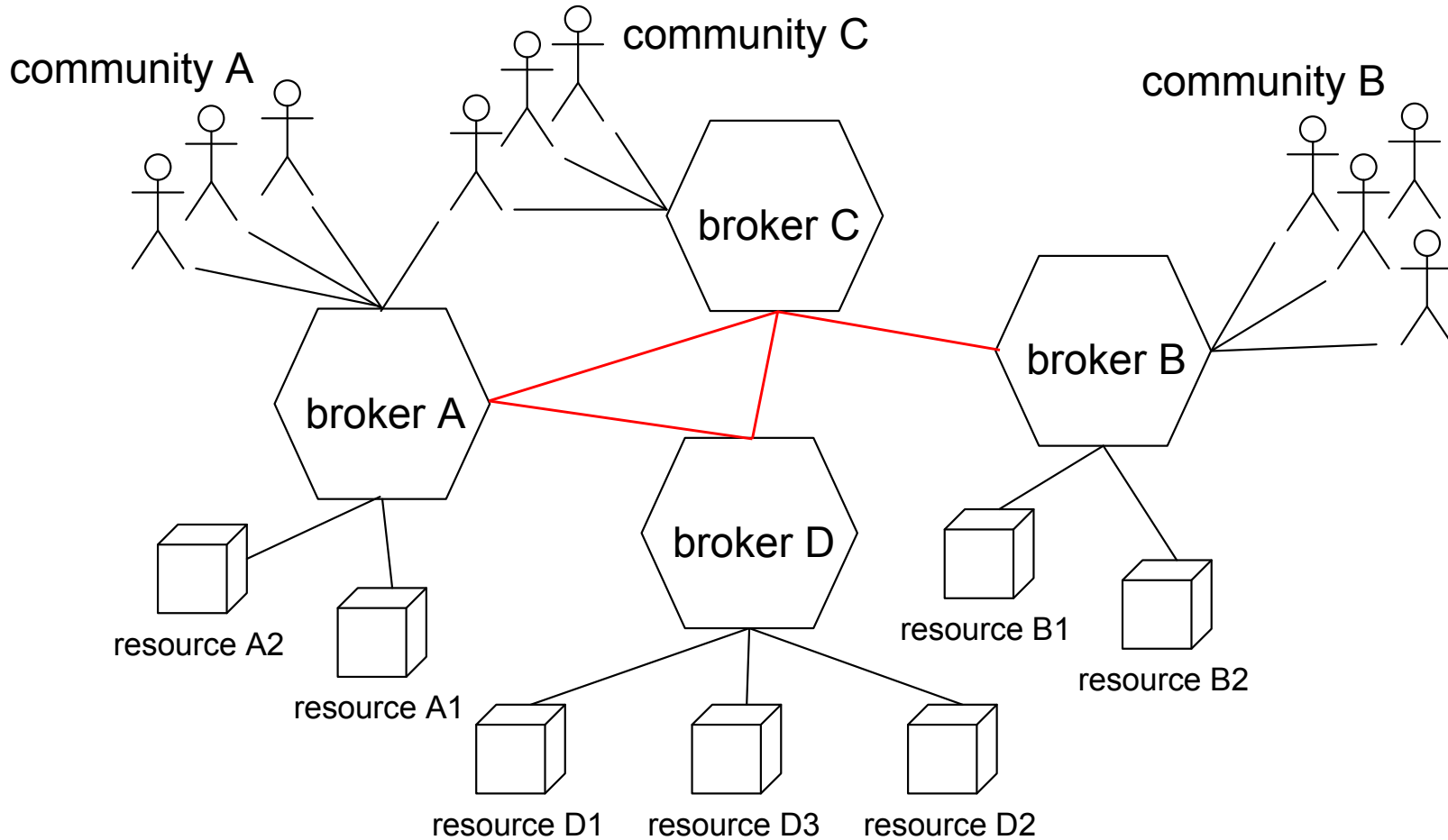


Evolving from vision to delivery, the **Networked European Software and Services Initiative (NESSI)** has defined a model, architecture and proposed implementations of **NEXOF**, the **NESSI Open Framework**, the embodiment of its Strategic Research Area.



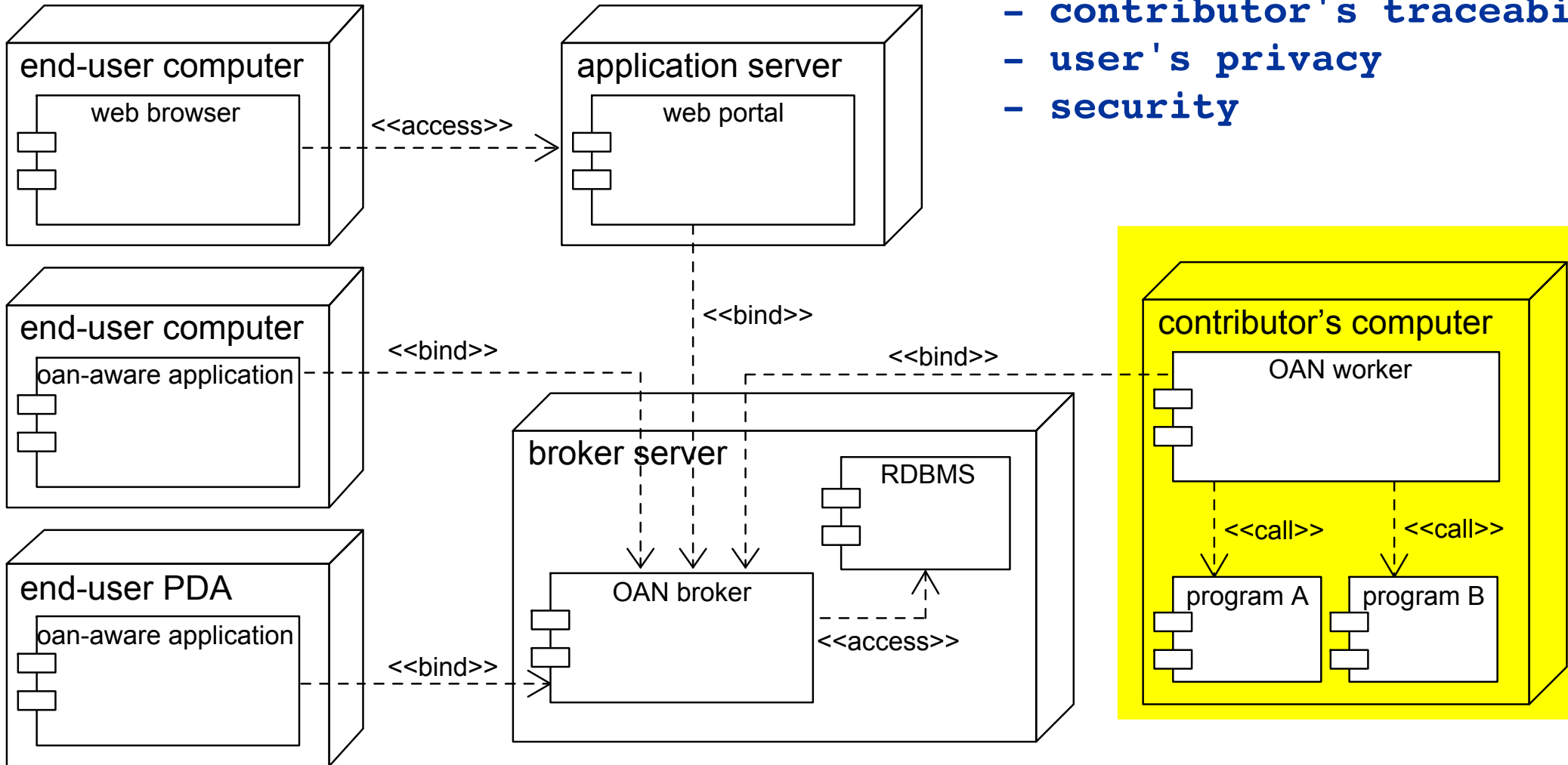
# Research approach, Methodology (2)

Resources are semantically organized and appear as a single entity able to orchestrate **unlimited, heterogeneous and dynamic resources distributed across multiple platforms.**



# Research approach, Methodology (3)

- contributor's traceability
- user's privacy
- security



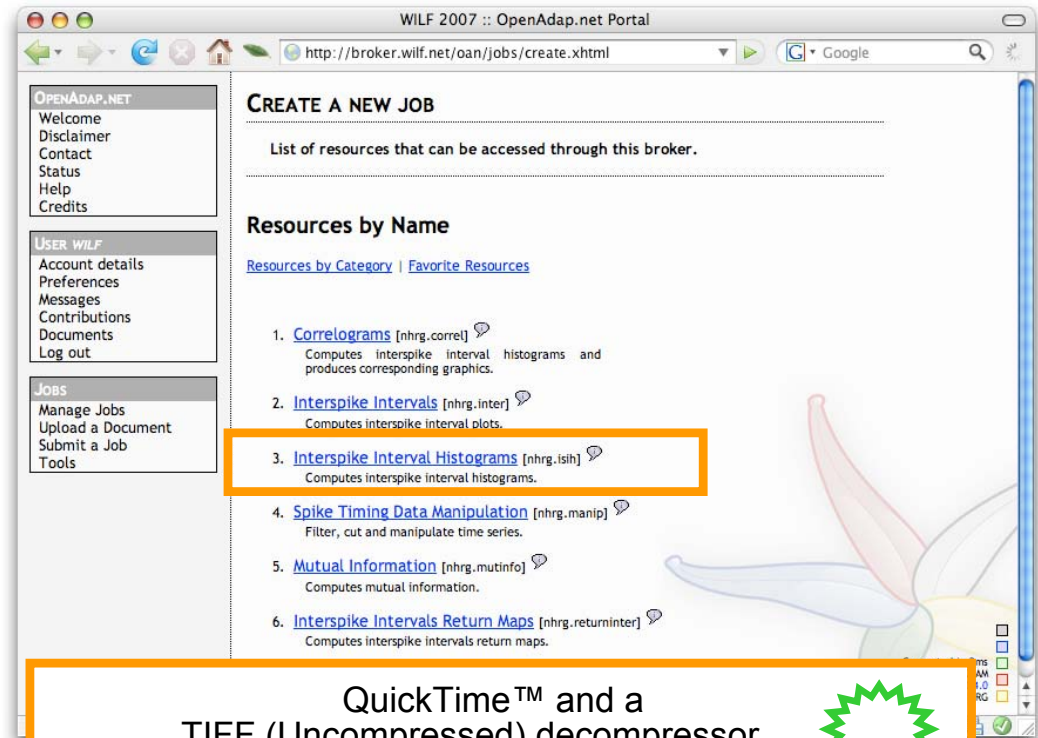
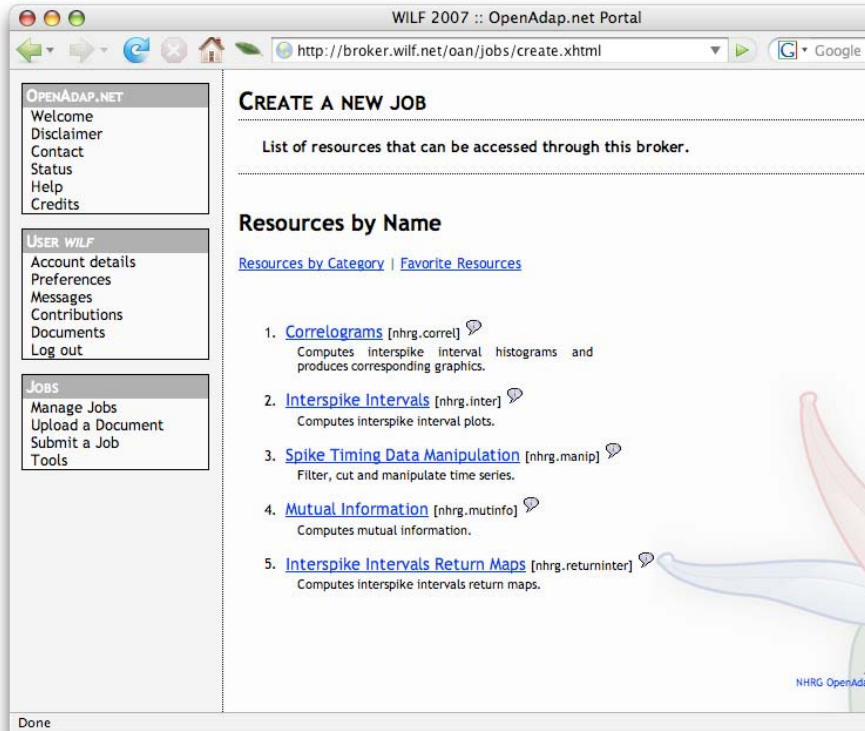
UML DEPLOYMENT SCHEME





# contributor: disseminating the knowledge

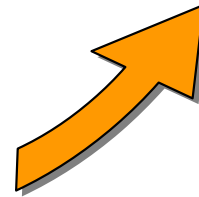
## COMMUNITY WEB PORTAL



QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

- responsibility
- acknowledgement
- control

### JOINING THE COMMUNITY



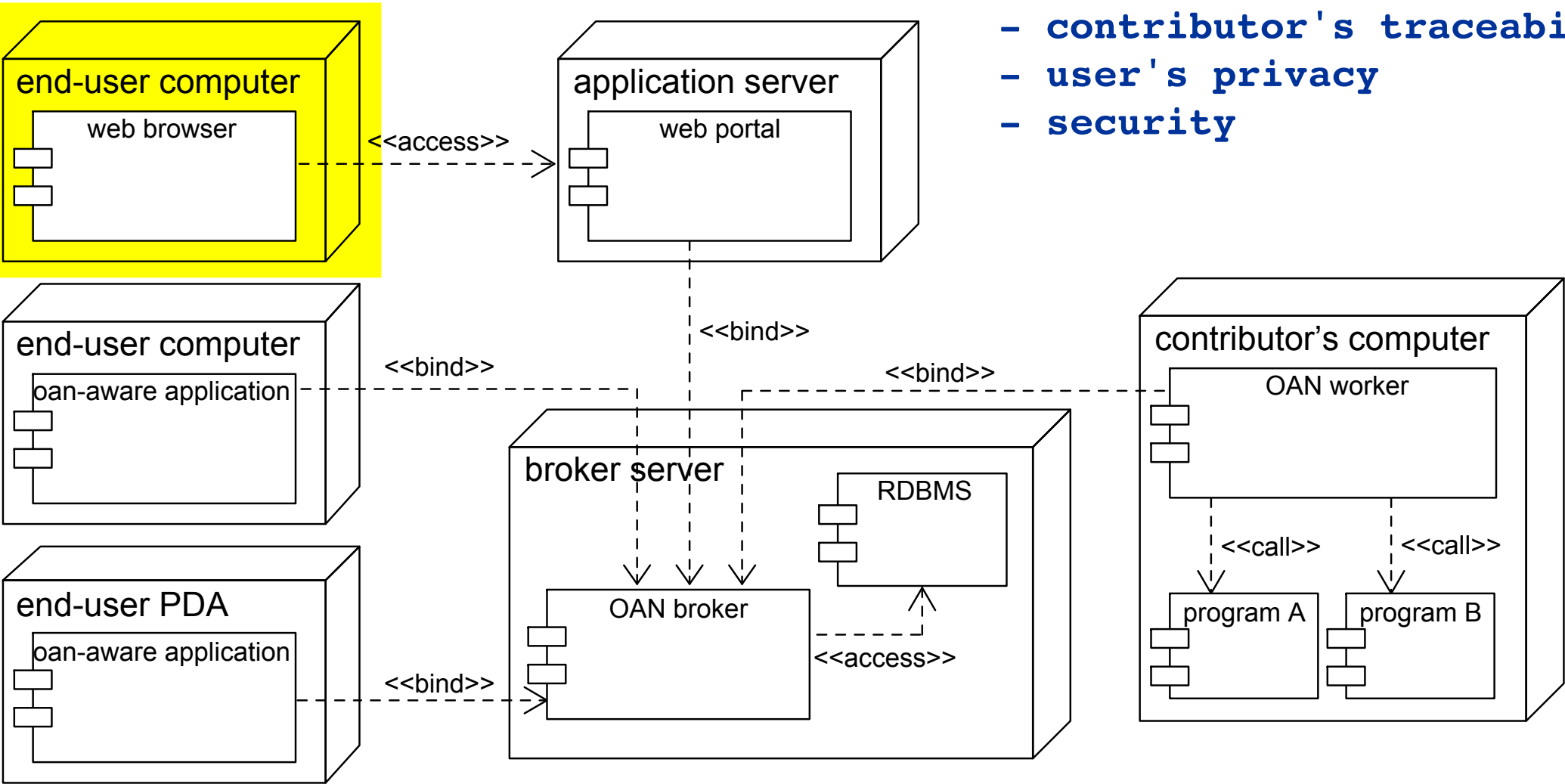
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# Research approach, Methodology (4)

- contributor's traceability
- user's privacy
- security



UML DEPLOYMENT SCHEME





# Research approach, Methodology (5)

**User's data**  
*(on-the-fly analyses)*

Privacy

OpenAdap.net



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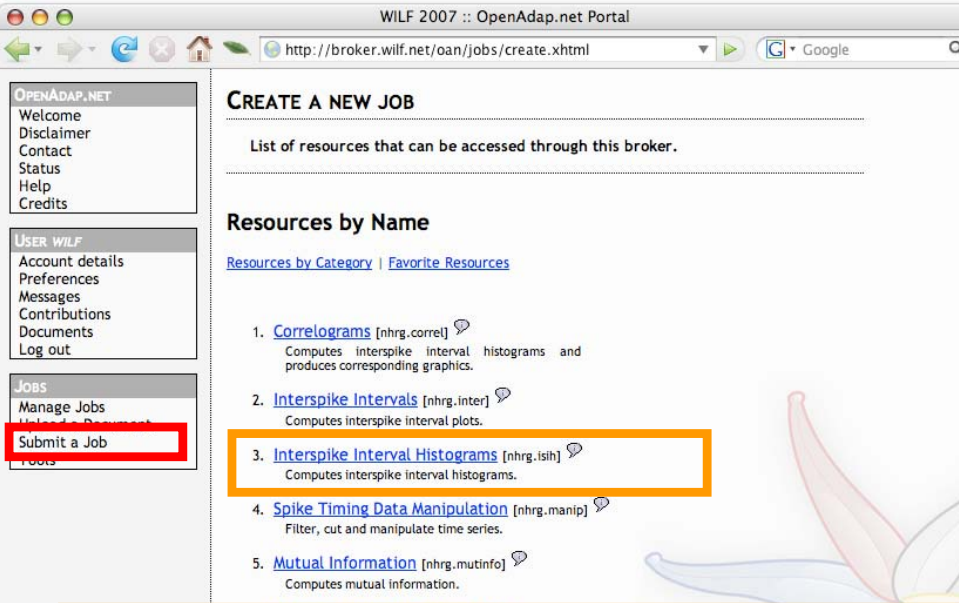
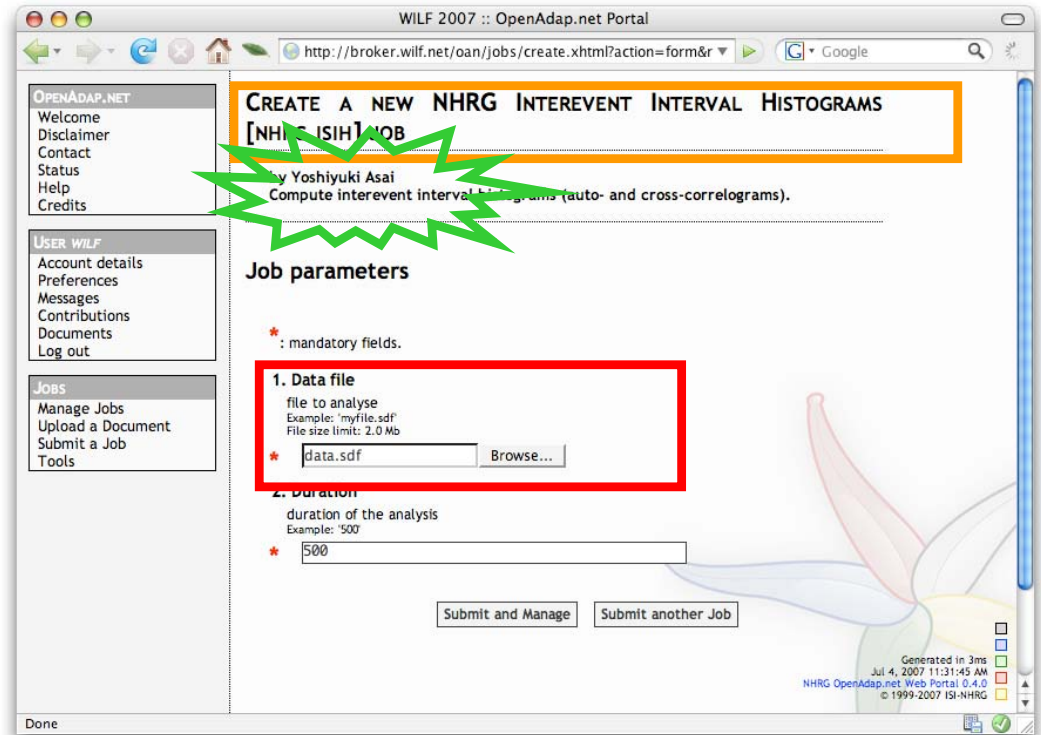
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# end-user computer: Web Portal (1)



QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.



**PROCESSING OWN INFORMATION  
IN A TRUSTED ARCHITECTURE**



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# end-user computer: Web Portal (2)

## MONITORING AND MANAGING THE JOB PROCESS

The screenshot shows a web browser window titled "WILF 2007 :: OpenAdap.net Portal" with the URL "http://broker.wilf.net/oan/jobs/list.xhtml". The page content includes a sidebar menu, a main heading "JOBS FOR WILF @ ISI02.LOCAL", a descriptive paragraph, and a table of jobs. The "Manage Jobs" link in the sidebar is highlighted with a red box. The "Status" column of the table has a green checkmark icon circled in orange, and the "Actions" column has a trash icon circled in blue. A callout box points to the "Status" column with the text "EXPLORE THE PROCESS OUTPUT".





**OPENADAP.NET**  
Welcome  
Disclaimer  
Contact  
Status  
Help  
Credits


**USER WILF**  
Account details  
Preferences  
Messages  
Contributions  
Documents  
Log out

**Jobs**  
Manage Jobs  
Upload a Document  
Submit a Job  
Tools

### JOBS FOR WILF @ ISI02.LOCAL

The task manager is used to control the status of the different tasks that have been launched by the user in the current session. Using the first column checkboxes, you can select the lines on which you would like to apply the actions triggered when pushing the buttons laying on the right of the table.

ID	Resource	Submission date	Status	Actions
job-00007	nhrq.isih	2007-07-04T11:33:14+0200	<input checked="" type="checkbox"/>	   

[Check All](#) [Uncheck All](#) With Selection: 

Refresh

Generated in 8ms  
Jul 4, 2007 11:34:15 AM  
NHRG OpenAdap.net Web Portal 0.4.0  
© 1999-2007 ISI-NHRG

EXPLORE THE  
PROCESS OUTPUT

WILF 2007 :: OpenAdap.net Portal

http://broker.wilf.net/oan/jobs/explore.xhtml?jobid=job-01

**OPENADAP.NET**  
 Welcome  
 Disclaimer  
 Contact  
 Status  
 Help  
 Credits

**USER WILF**  
 Account details  
 Preferences  
 Messages  
 Contributions  
 Documents  
 Log out

**JOBS**  
 Manage Jobs  
 Upload a Document  
 Submit a Job  
 Tools

## CONTENTS OF JOB JOB-00007

With this page, you can explore the contents of the job, manipulate, view, investigate, save, ... the data it contains, and eventually initiate new jobs starting from one or more of the documents.

**Exit**

```
Exit code: 0
Everything worked fine.
```

## Outputs

Name	Size	Content Type	Actions
graphics.xyvz	98 kb	application/x-nhrig-xyviewer-document	
input.sdf	0 b	application/x-nhrig-timeseries-sdf	
stderr.txt	0 b	text/plain	
stdout.txt	124 b	text/plain	

Generated in 35ms  
 Jul 4, 2007 11:35:23 AM  
 NHRG OpenAdap.net Web Portal 0.4.0  
 © 1999-2007 ISI-NHRG

Done

**ACTIONS ARE ASSOCIATED TO THE OUTPUT CONTENT**



WILF 2007 :: OpenAdap.net Portal

http://broker.wilf.net/oan/jobs/explore.xhtml?jobid=job-01

**OPENADAP.NET**  
Welcome  
Disclaimer  
Contact  
Status  
Help  
Credits

**USER WILF**  
Account details  
Preferences  
Messages  
Contributions  
Documents  
Log out

**Jobs**  
Manage Jobs  
Upload a Document  
Submit a Job  
**Tools**

**CONTENTS OF JOB JOB-00007**

With this page you can explore the contents of the job, manipulate view

**AN ACTION APPLIES A TOOL TO A CONTENT-RELATED OUTPUT FILE**

**NHRG XY-Viewer 0.7.0**  
File View Browse OAN Help

ARD (reg) [1,1] corr-demo.data  
T=101.5, R=0.98, F=0.96, C=1.00

ARD (reg) [1,2] corr-demo.data  
T=101.5, R=2.00, F=1.99, C=1.34

ARD (reg) [1,3] corr-demo.data  
T=101.5, R=2.60, F=1.36, C=1.34

ARD (reg) [1,4] corr-demo.data  
T=101.5, R=2.20, F=1.18, C=1.17

ARD (reg) [1,5] corr-demo.data  
T=101.5, R=3.25, F=1.65, C=1.21

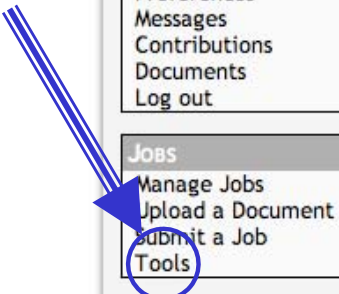
ARD (reg) [1,6] corr-demo.data  
T=101.5, R=1.30, F=1.34, C=1.30

ARD (reg) [1,7] corr-demo.data  
T=101.5, R=1.11, F=1.11, C=1.26

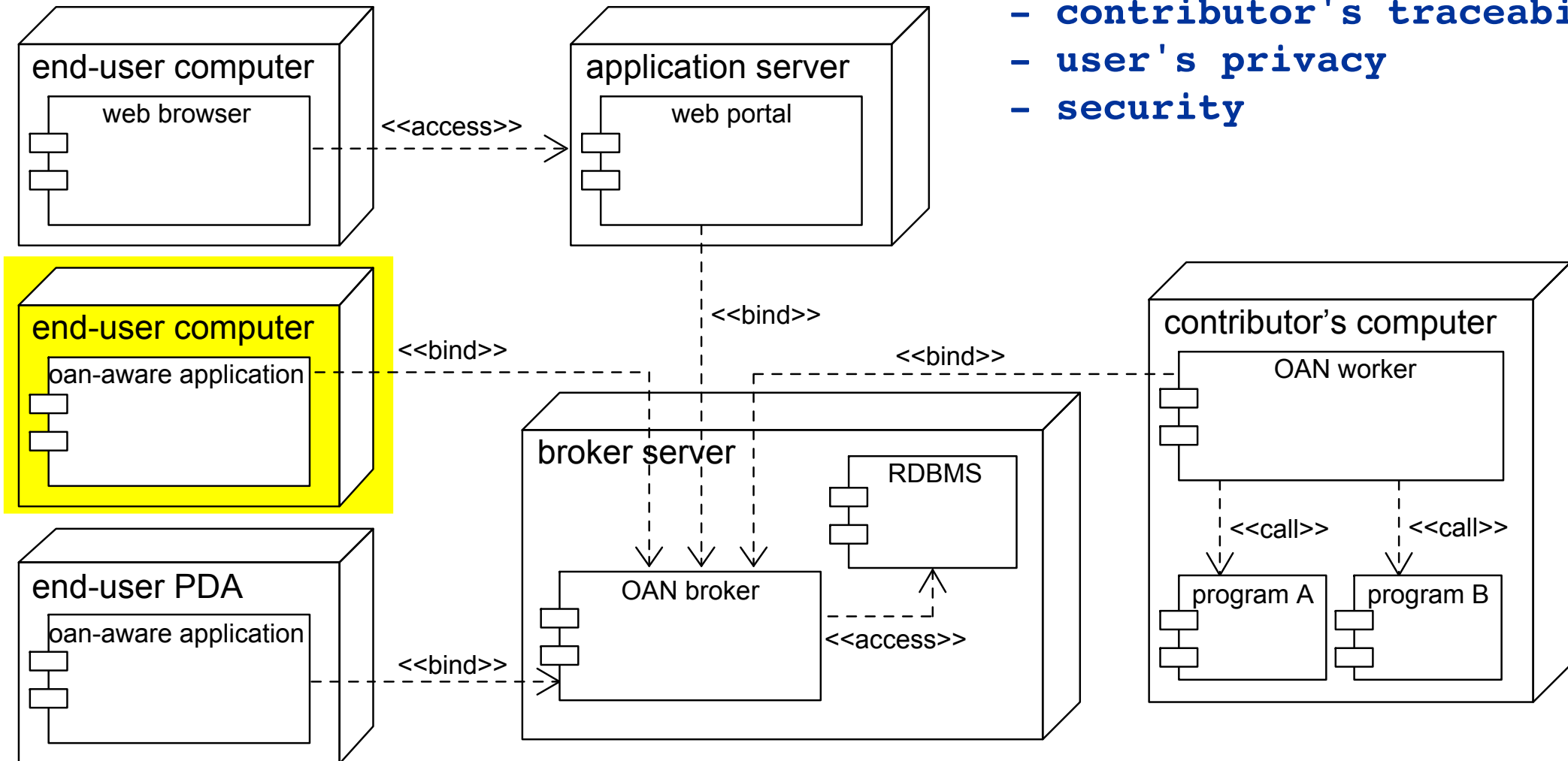
ARD (reg) [1,8] corr-demo.data  
T=101.5, R=2.41, F=1.20, C=1.05

ARD (reg) [1,9] corr-demo.data  
T=101.5, R=1.51, F=2.73, C=1.30

Ready Stop page 1/6

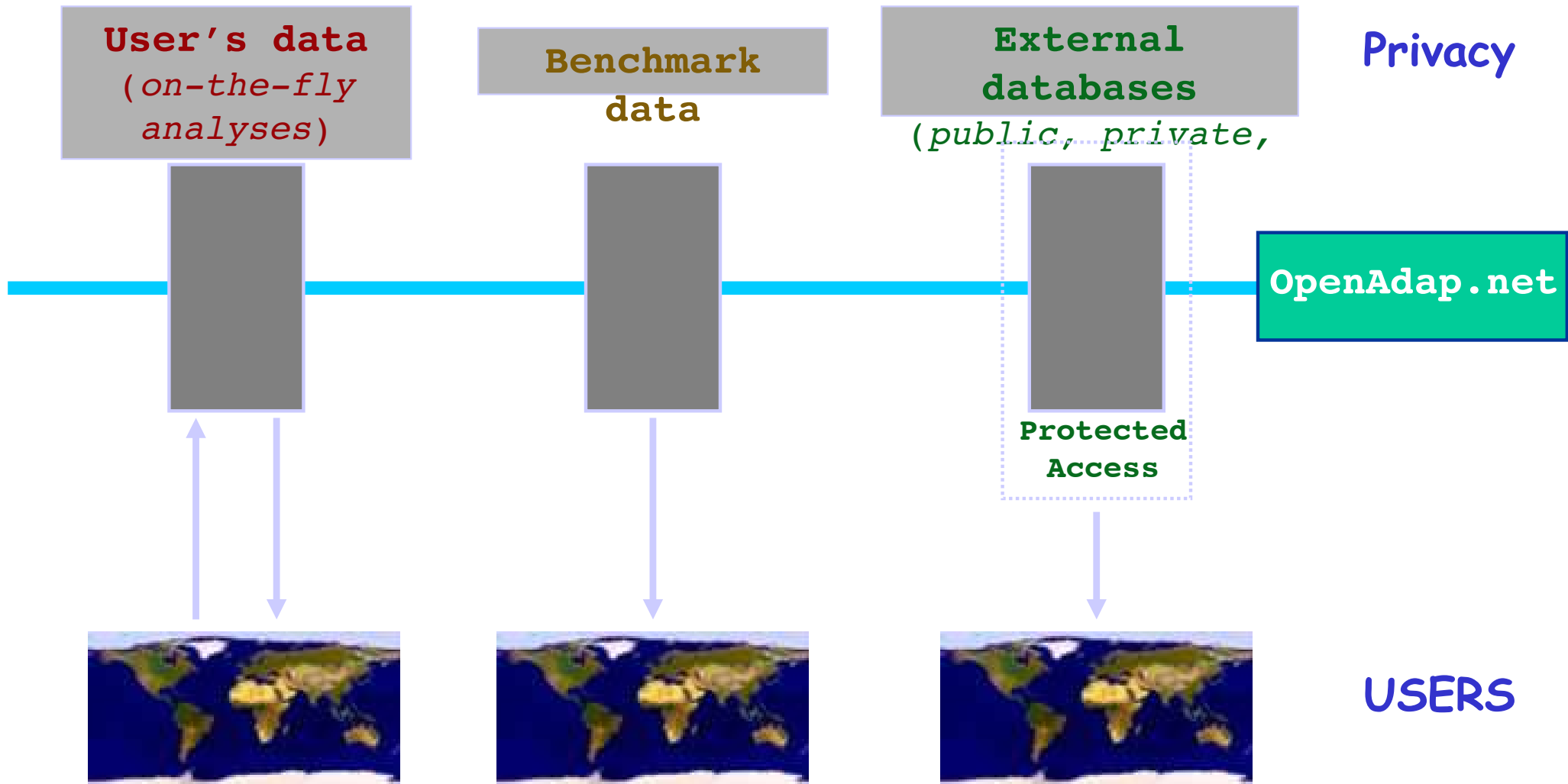


- contributor's traceability
- user's privacy
- security



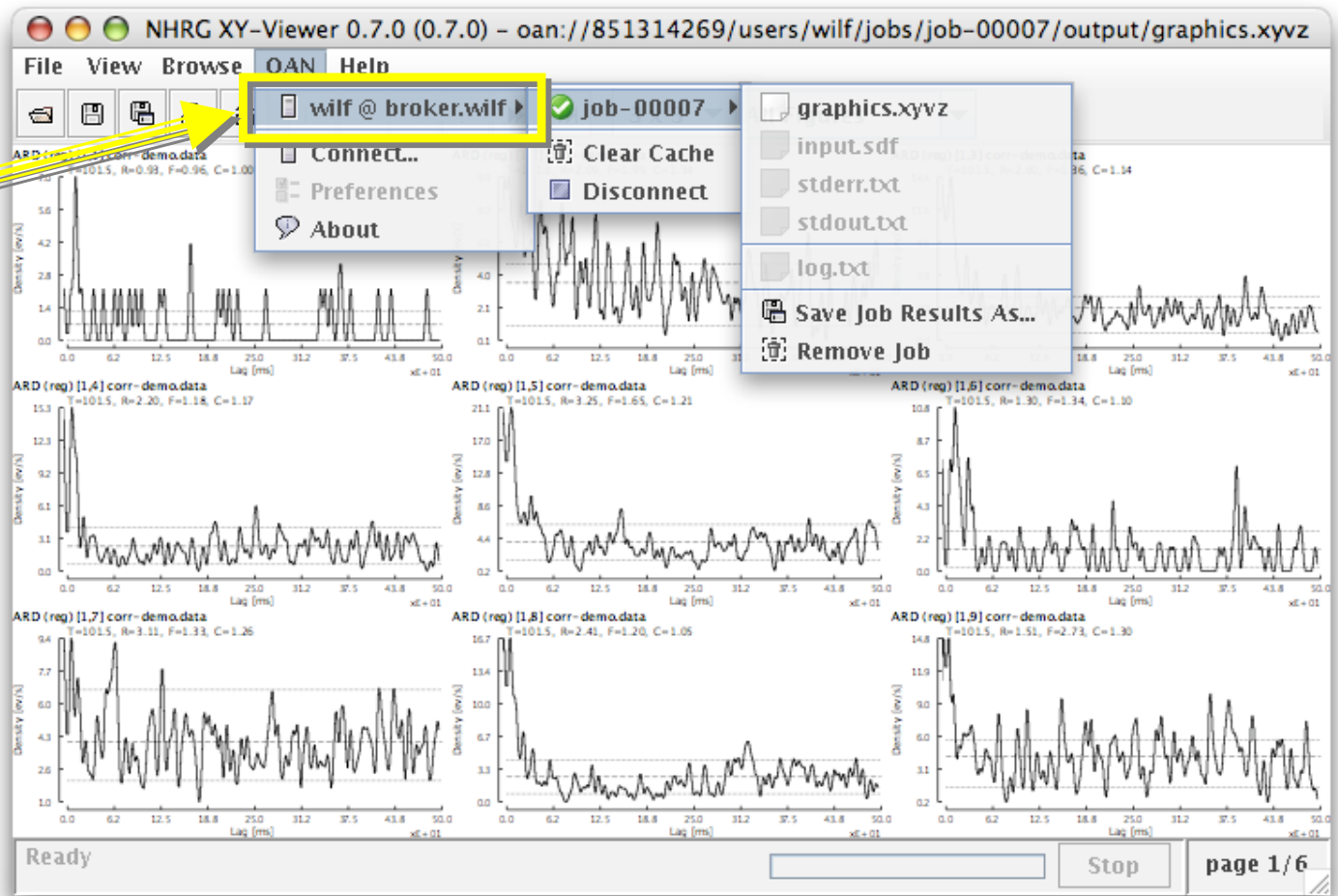
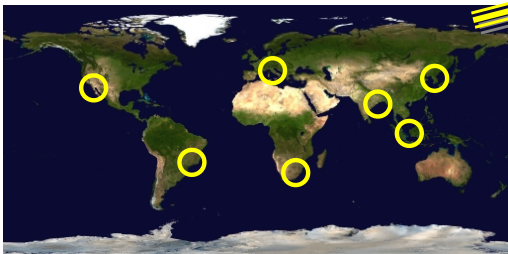
UML DEPLOYMENT SCHEME

# Research approach, Methodology (7)

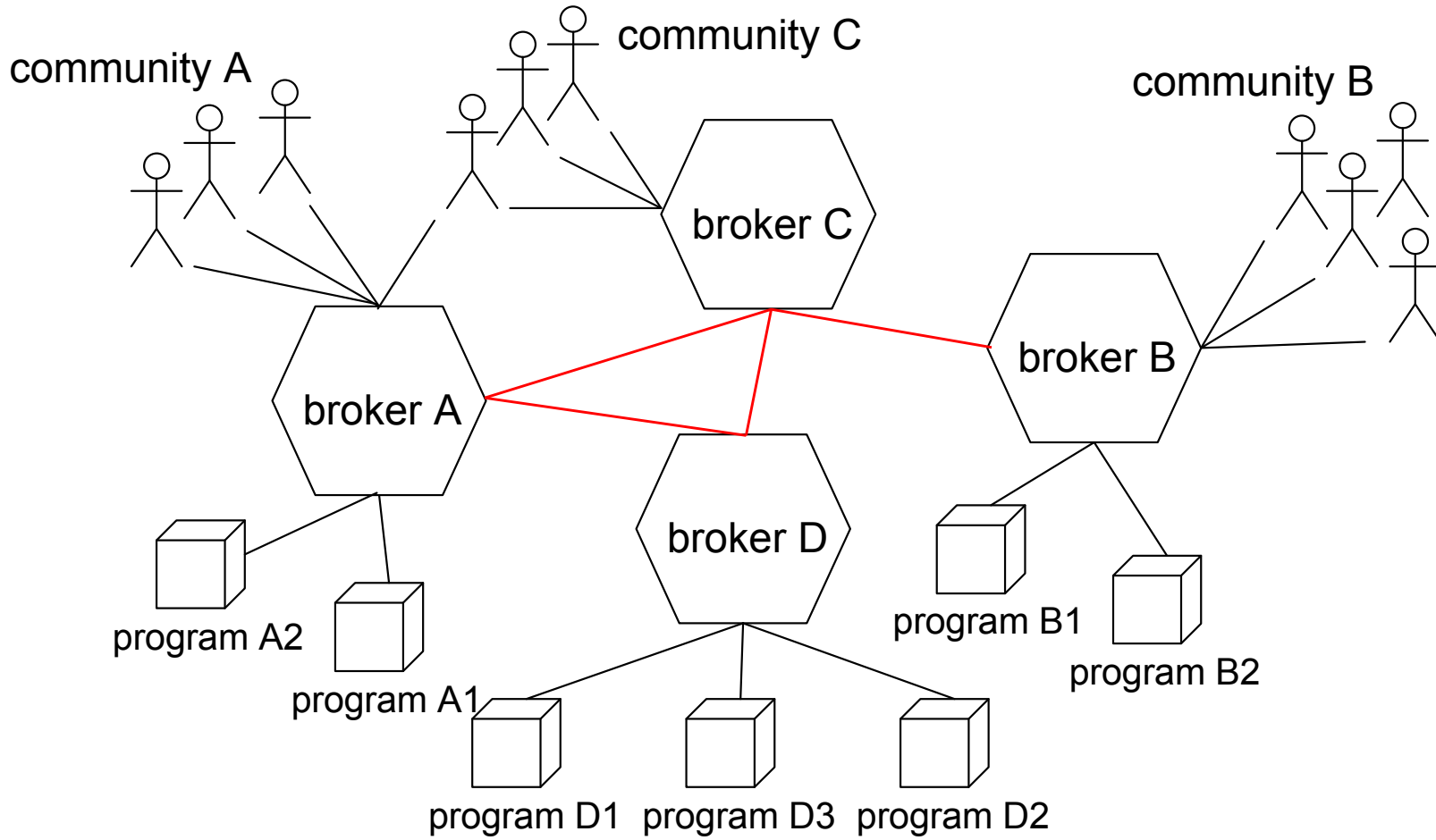


# end-user computer: oan-aware XY-Viewer

ENABLING COLLABORATIVE WORKING ENVIRONMENT

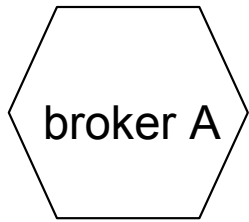


# Brain inspired evolvable connectivity



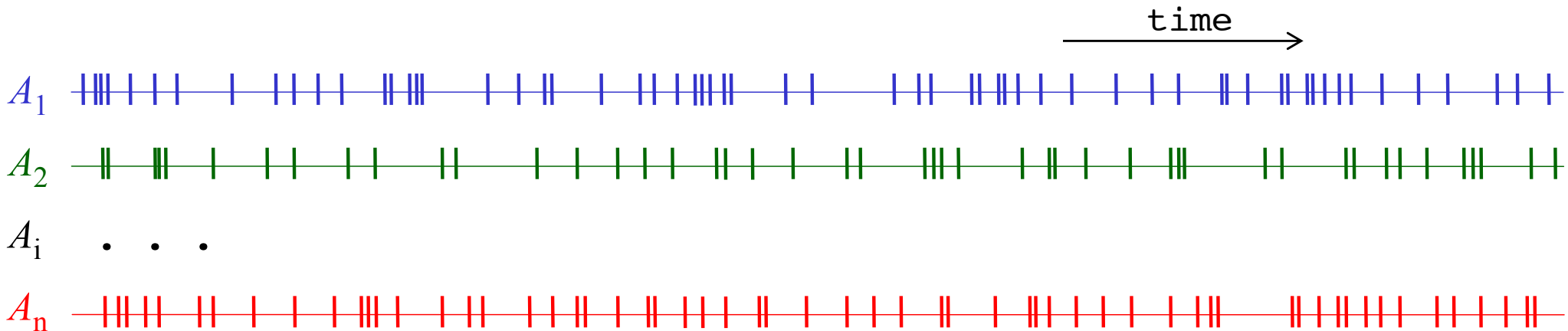


# Brain inspired evolvable connectivity



Each broker is characterized by multidimensional parameters  $\{X_i\}$  like the computing load generated by specific tasks, the availability of the resources, the number of accesses or the semantic proximity with the other brokers.

The dynamics of each parameter is expressed by a sequence of discrete values corresponding to multidimensional point processes.



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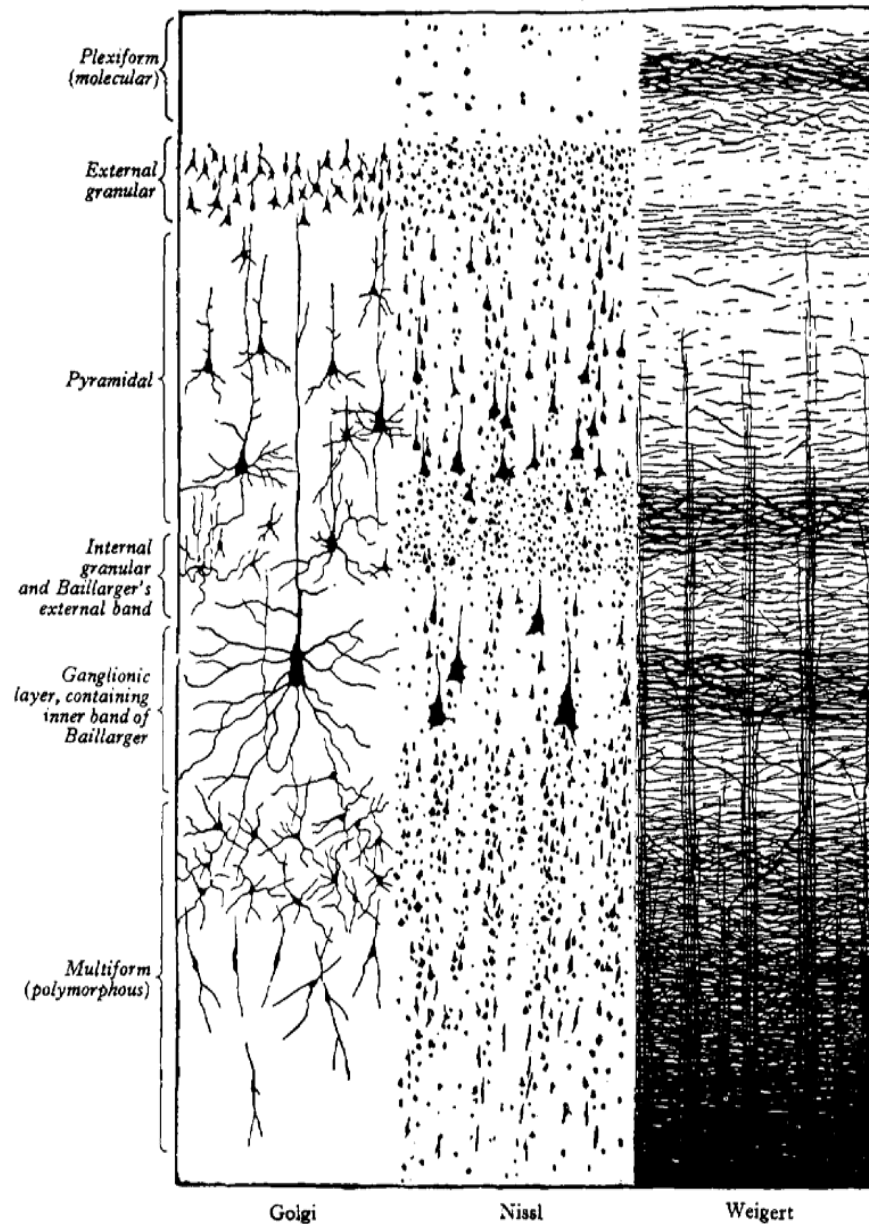
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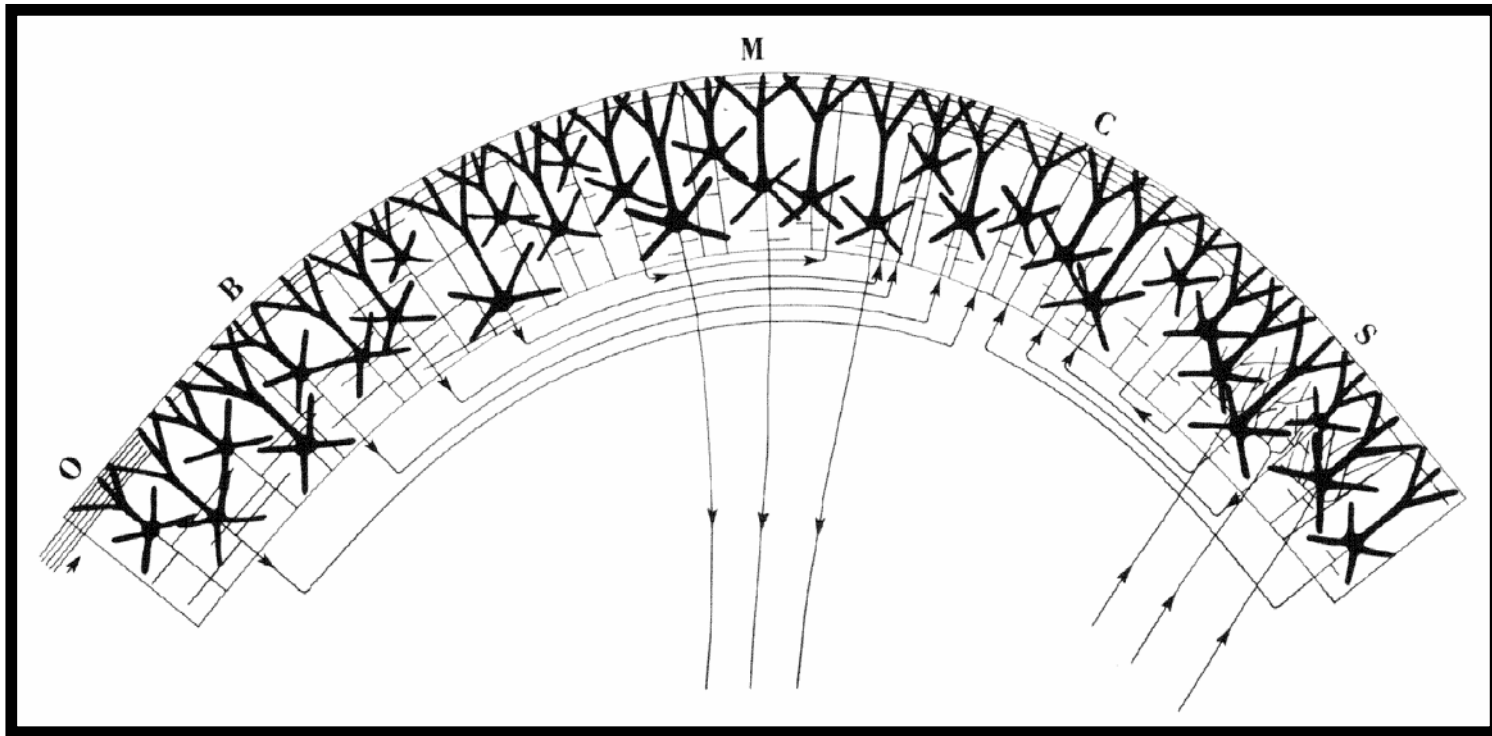




# Brain inspired evolvable connectivity



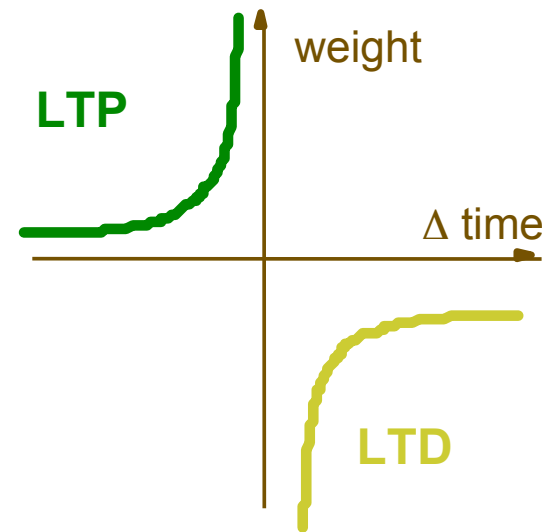
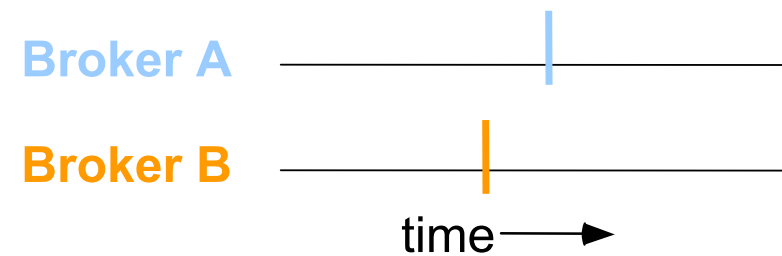
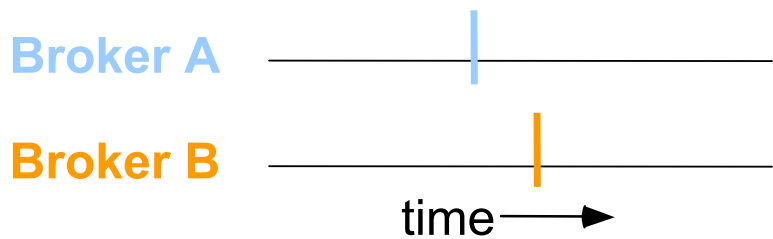
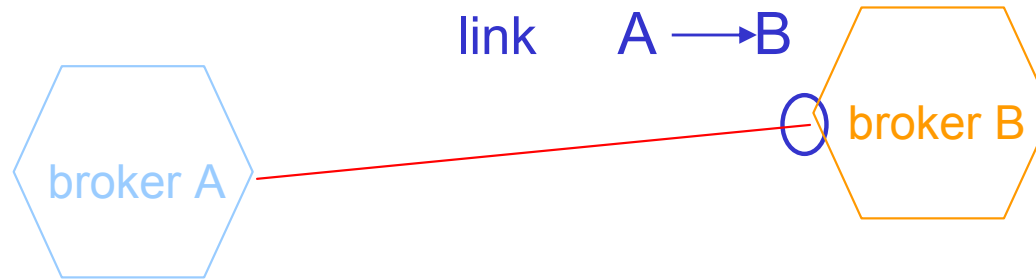
# Brain inspired evolvable connectivity



The skeleton cortex (fig. 8.3) from "On textures of Brain", by Valentino Braitenberg, Springer Verlag, 1977.

# Brain inspired evolvable connectivity

Modifiable links by Event Timing Dependent Plasticity

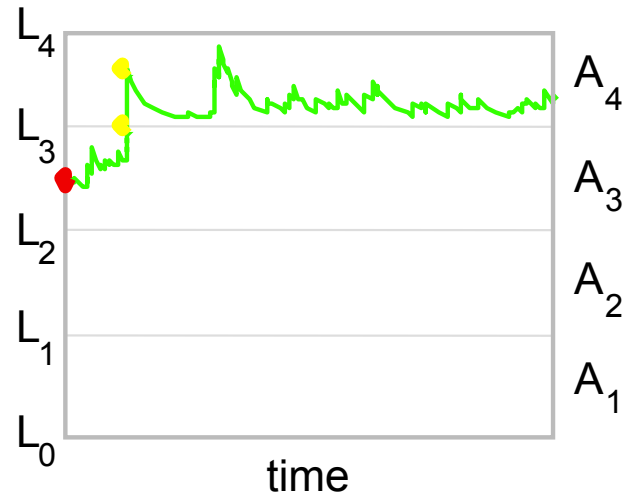




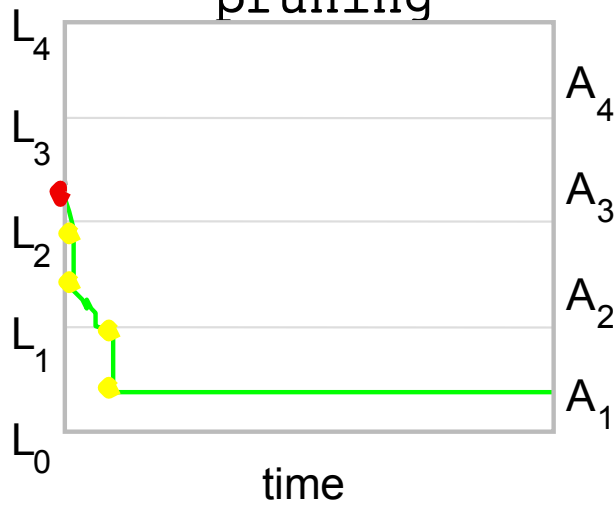
# Brain inspired evolvable connectivity

## Effect of Event Timing Dependent Plasticity

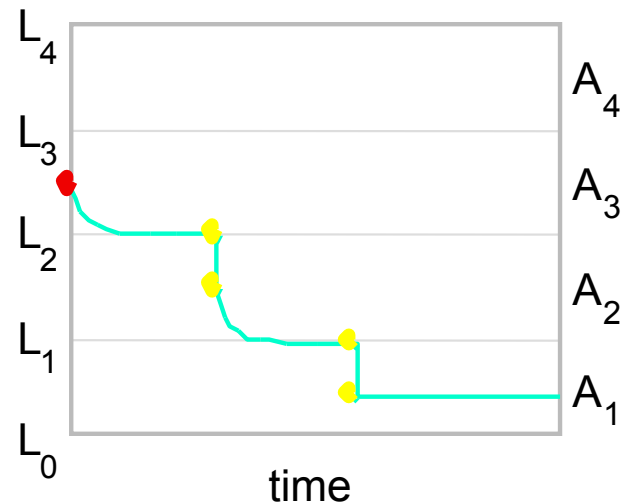
Potentiation & link strengthening



depression & link pruning



link pruning



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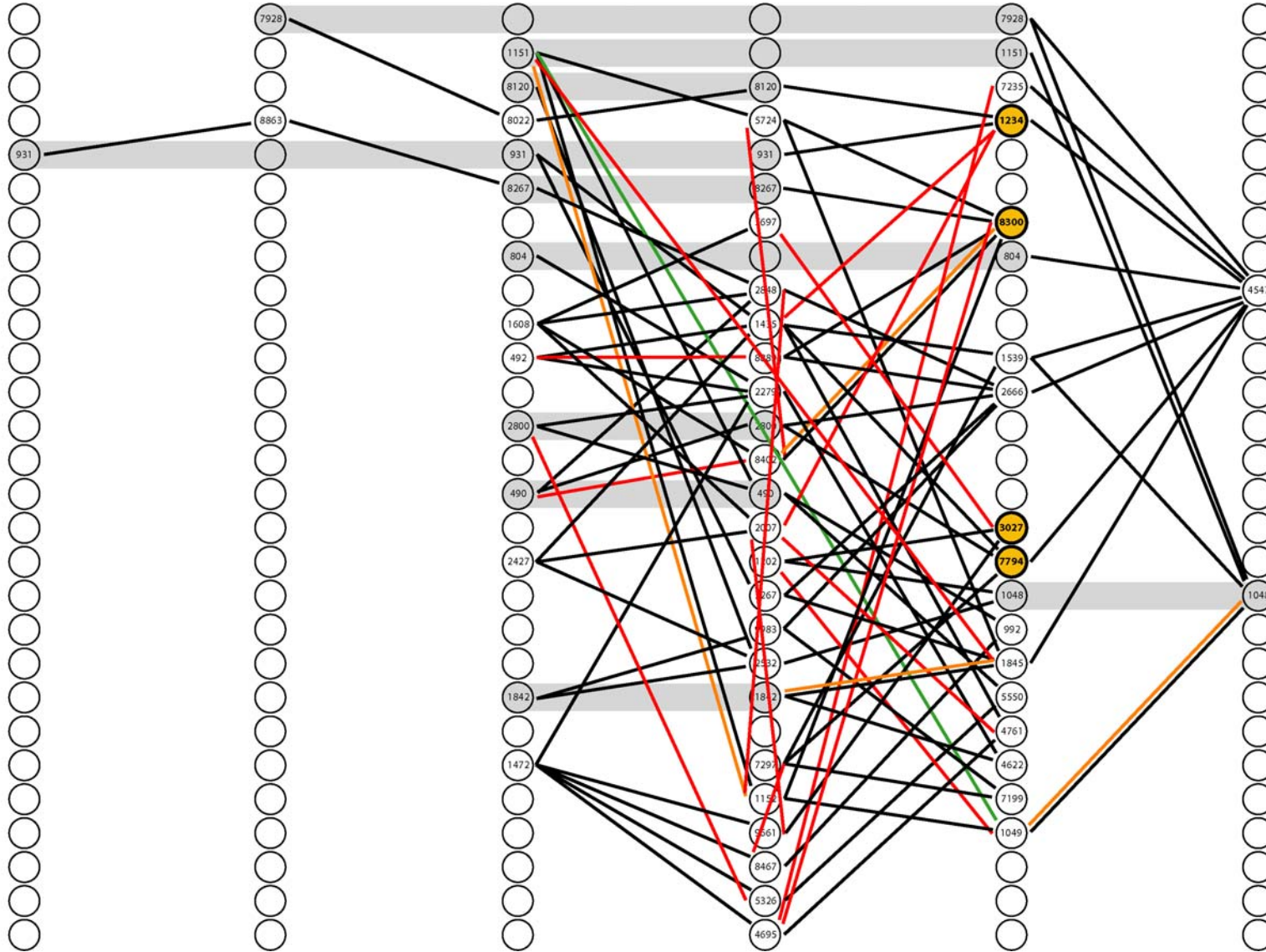
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | NO INPUT

t= 0

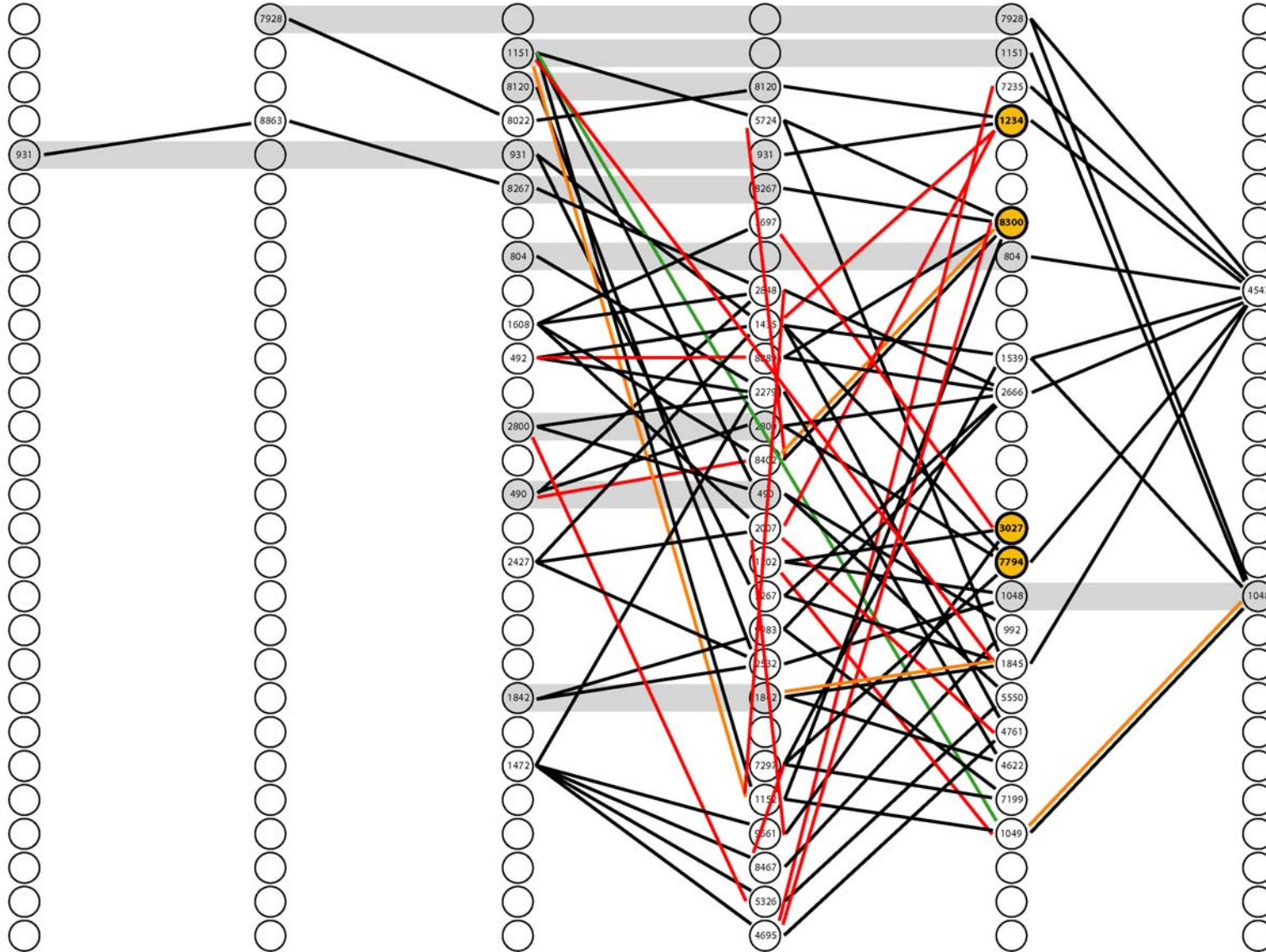




# Brain inspired evolvable connectivity

Background noise = 10 events/s | NO INPUT

t= 0



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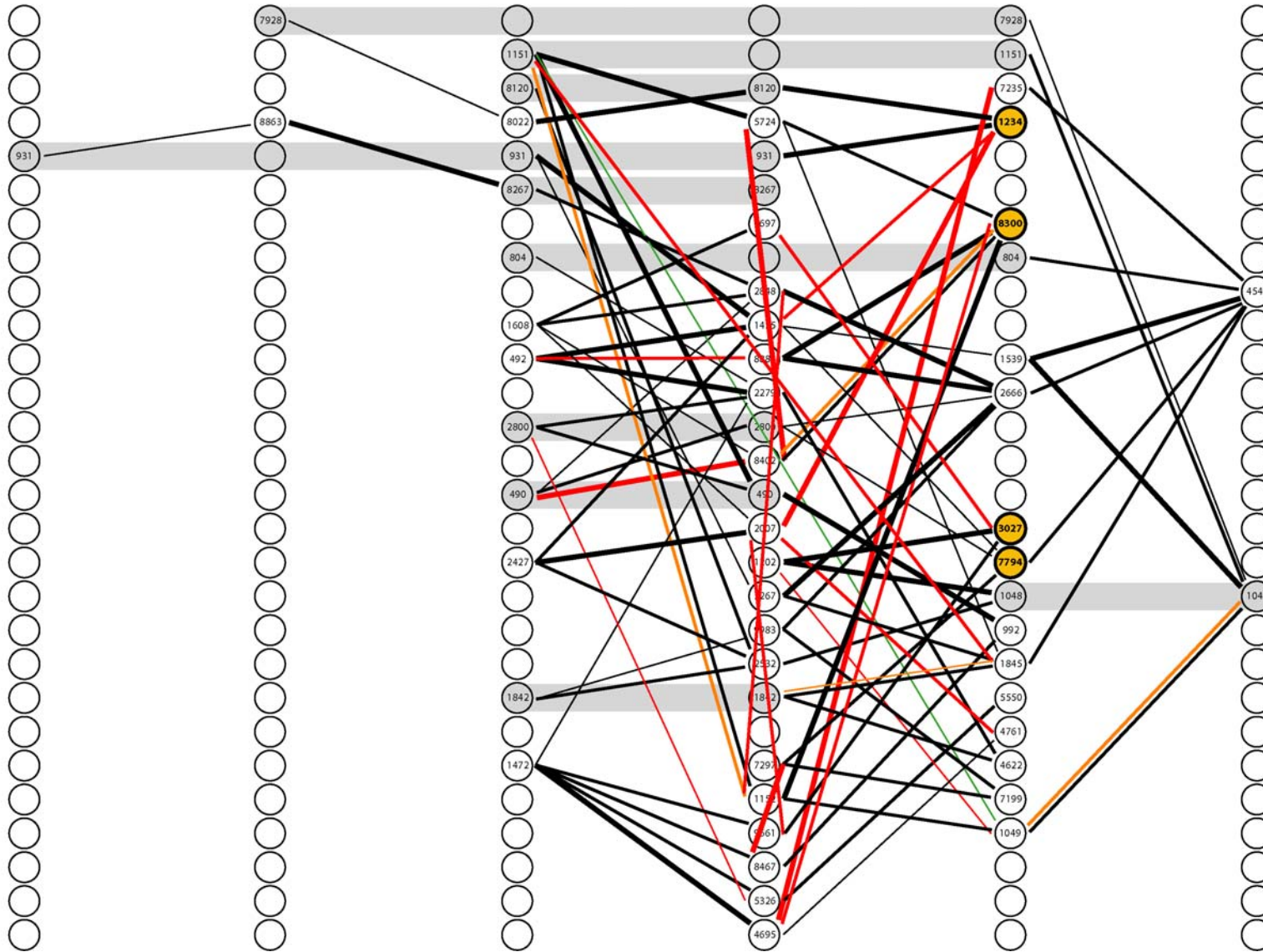
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | NO INPUT

t= 2000



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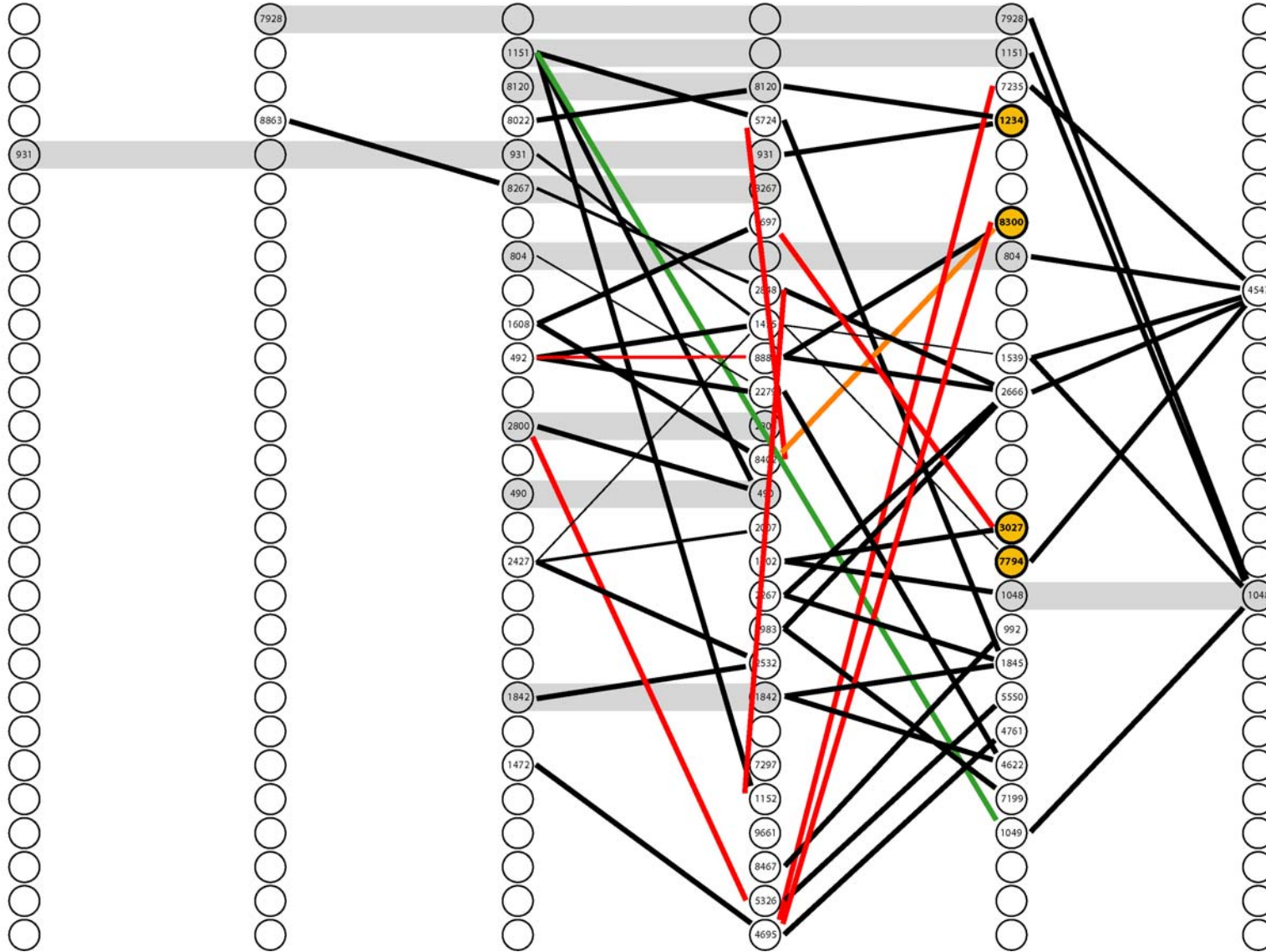
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | NO INPUT

t= 5000



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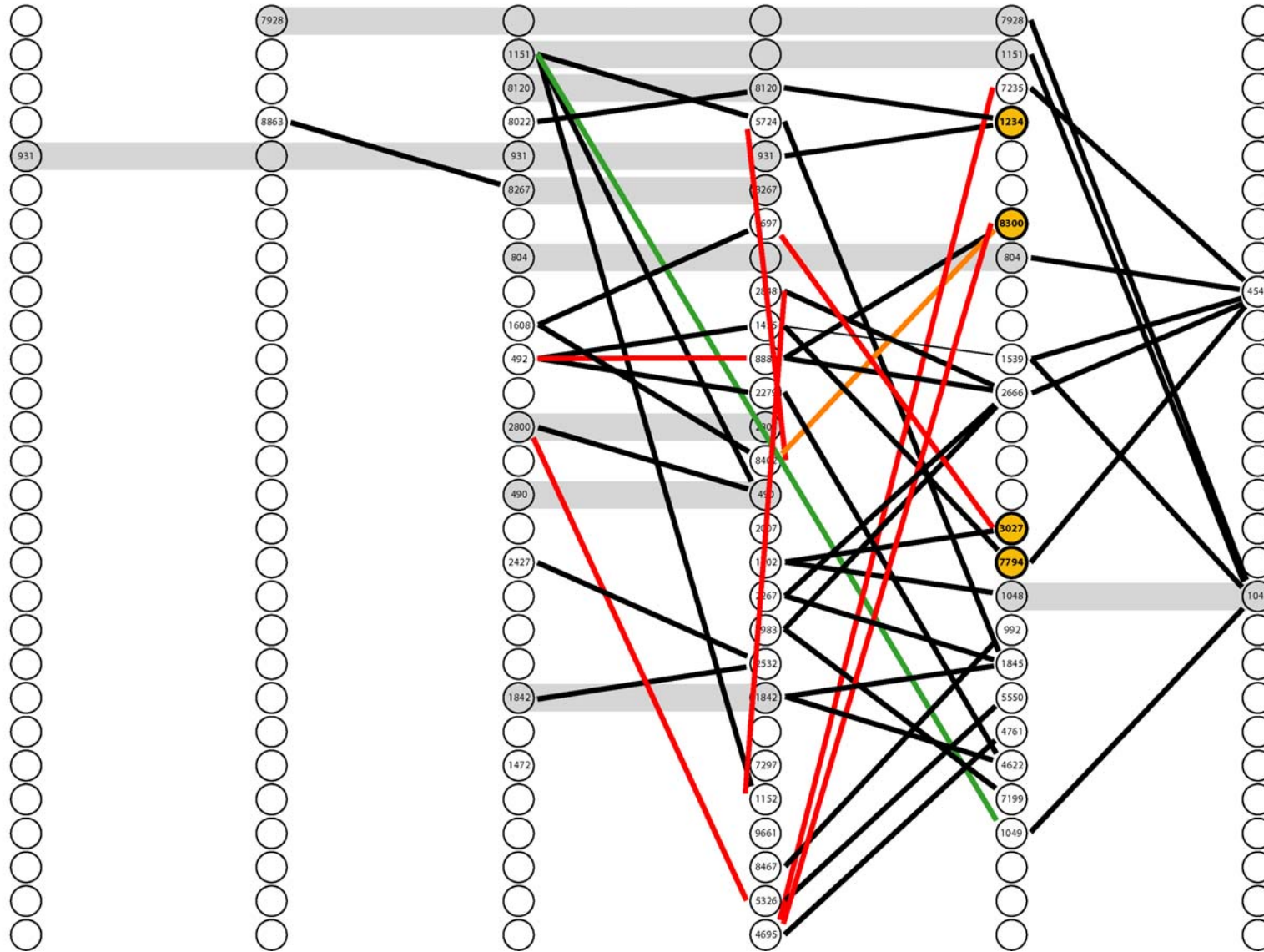
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | NO INPUT

t= 10000



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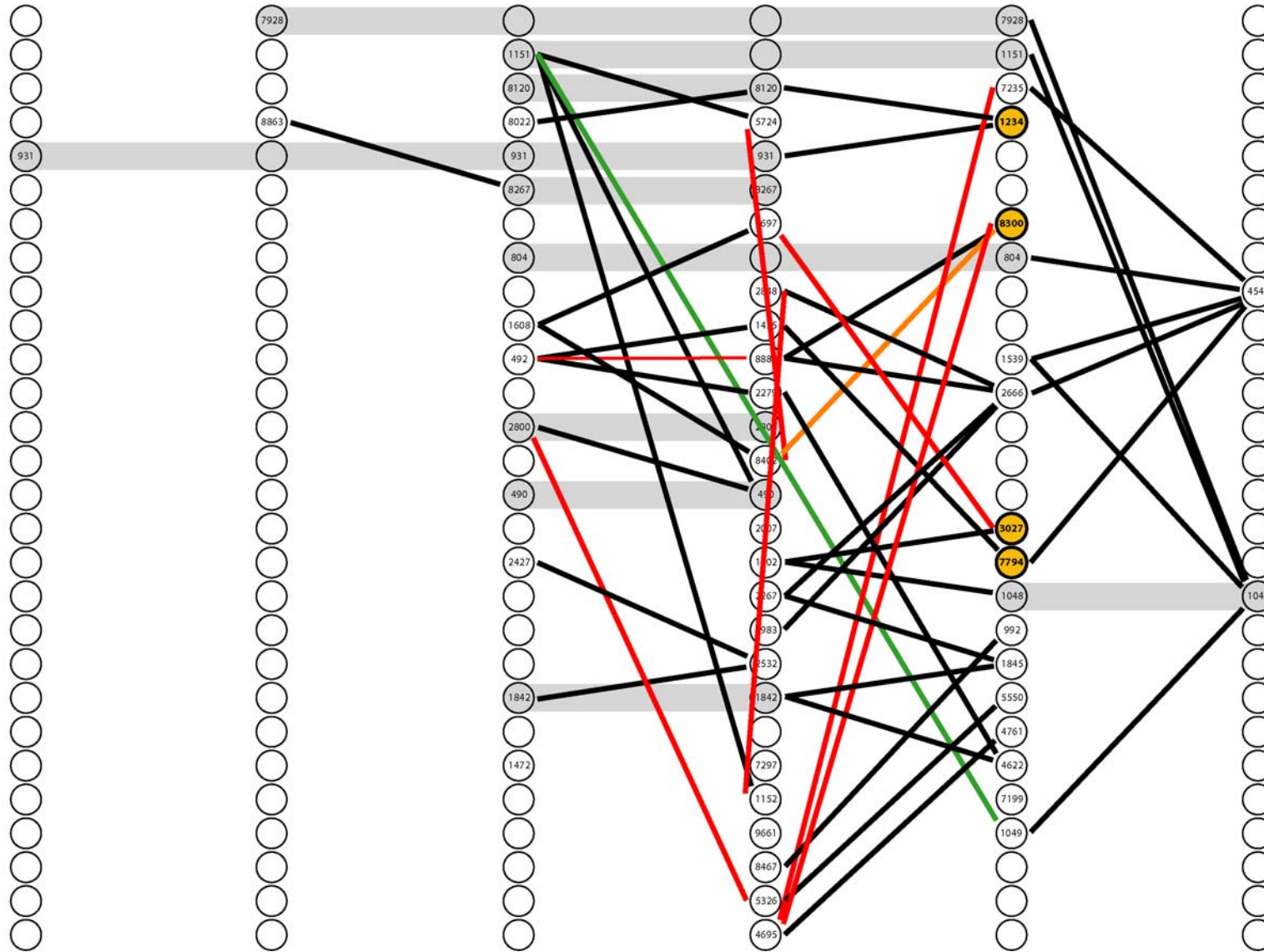
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | NO INPUT

t= 25000



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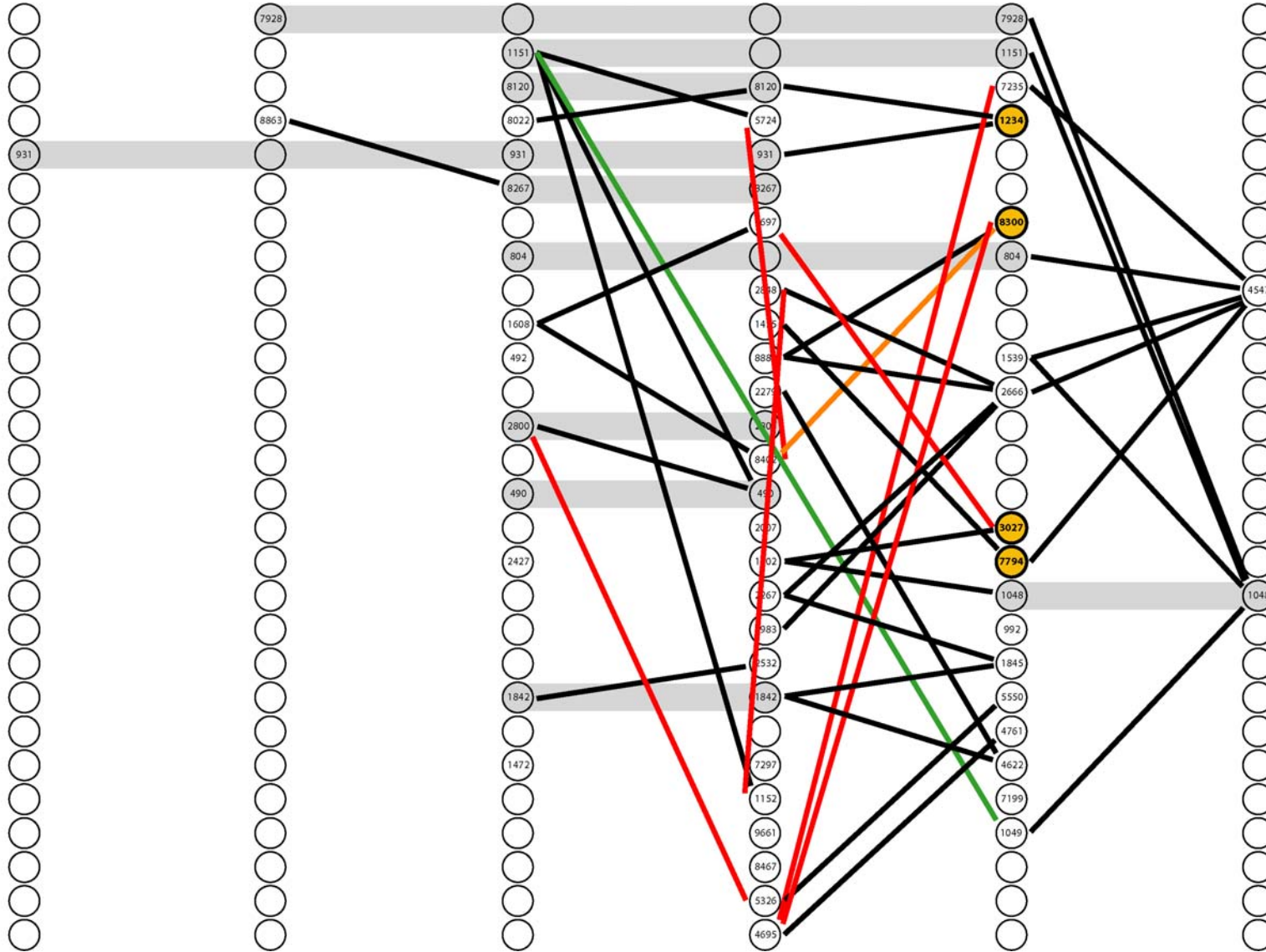
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | NO INPUT

t= 100000



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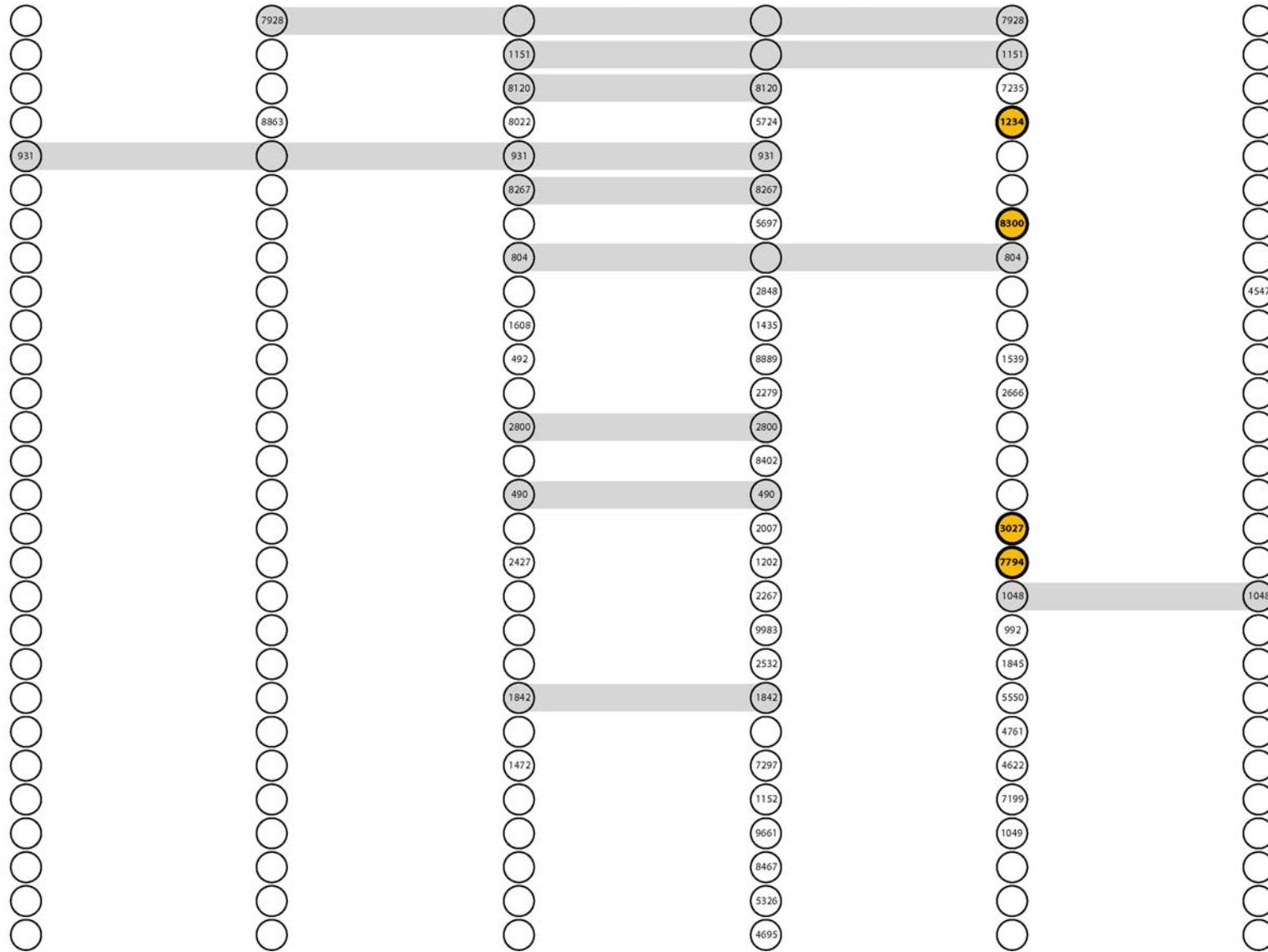
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | NO INPUT

t= 1000000



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# Brain inspired evolvable connectivity



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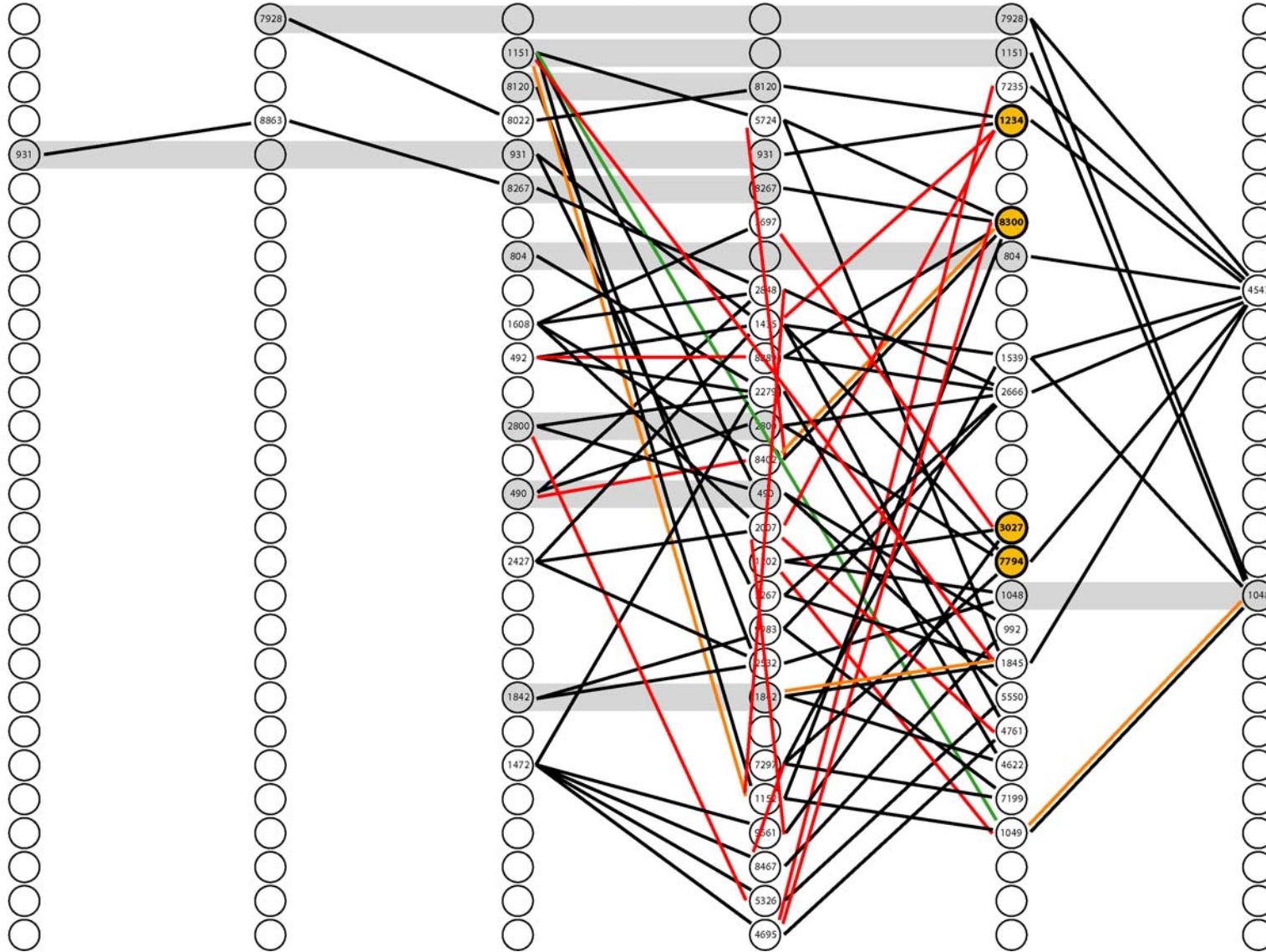




# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 0



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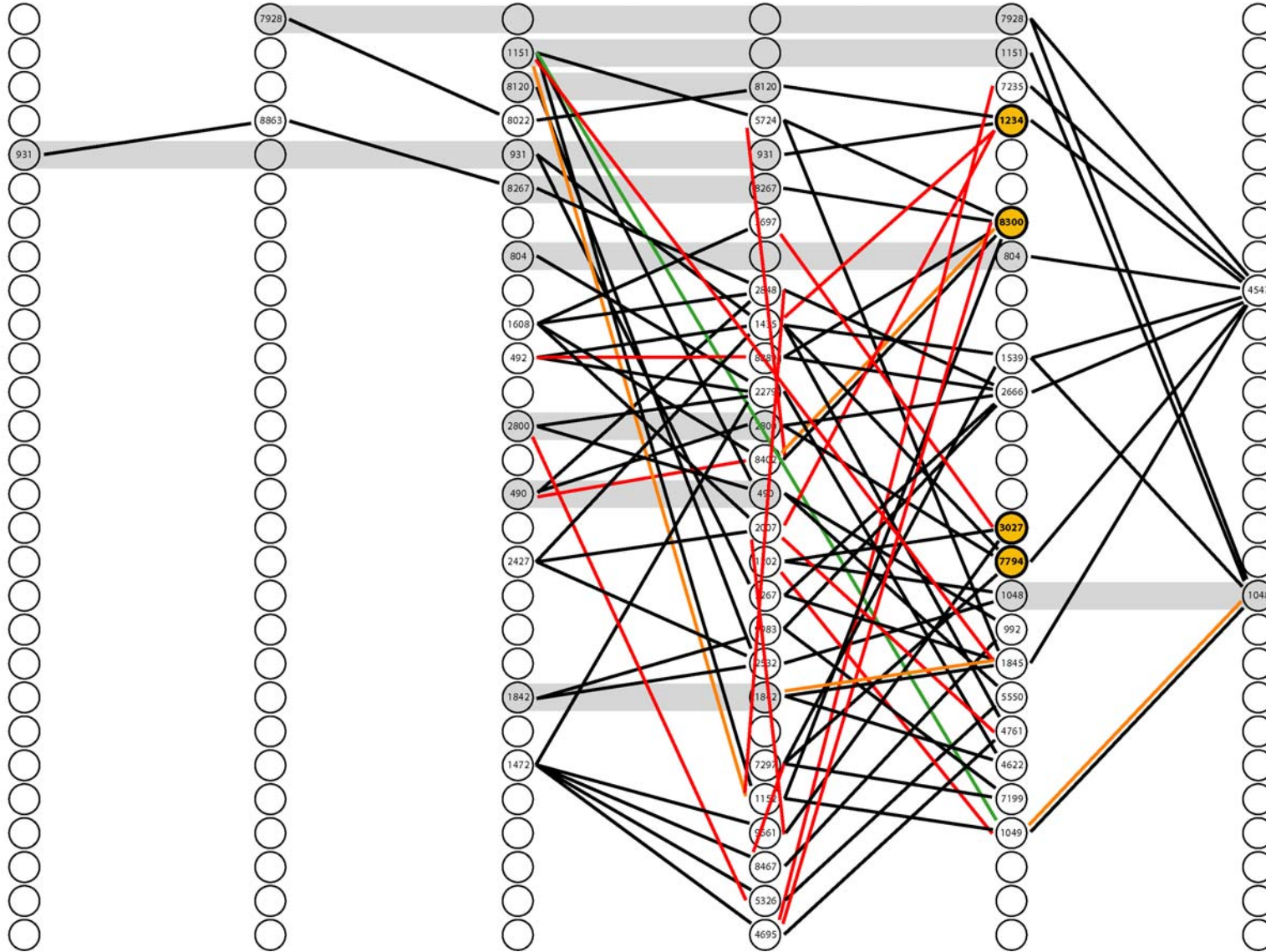
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 0



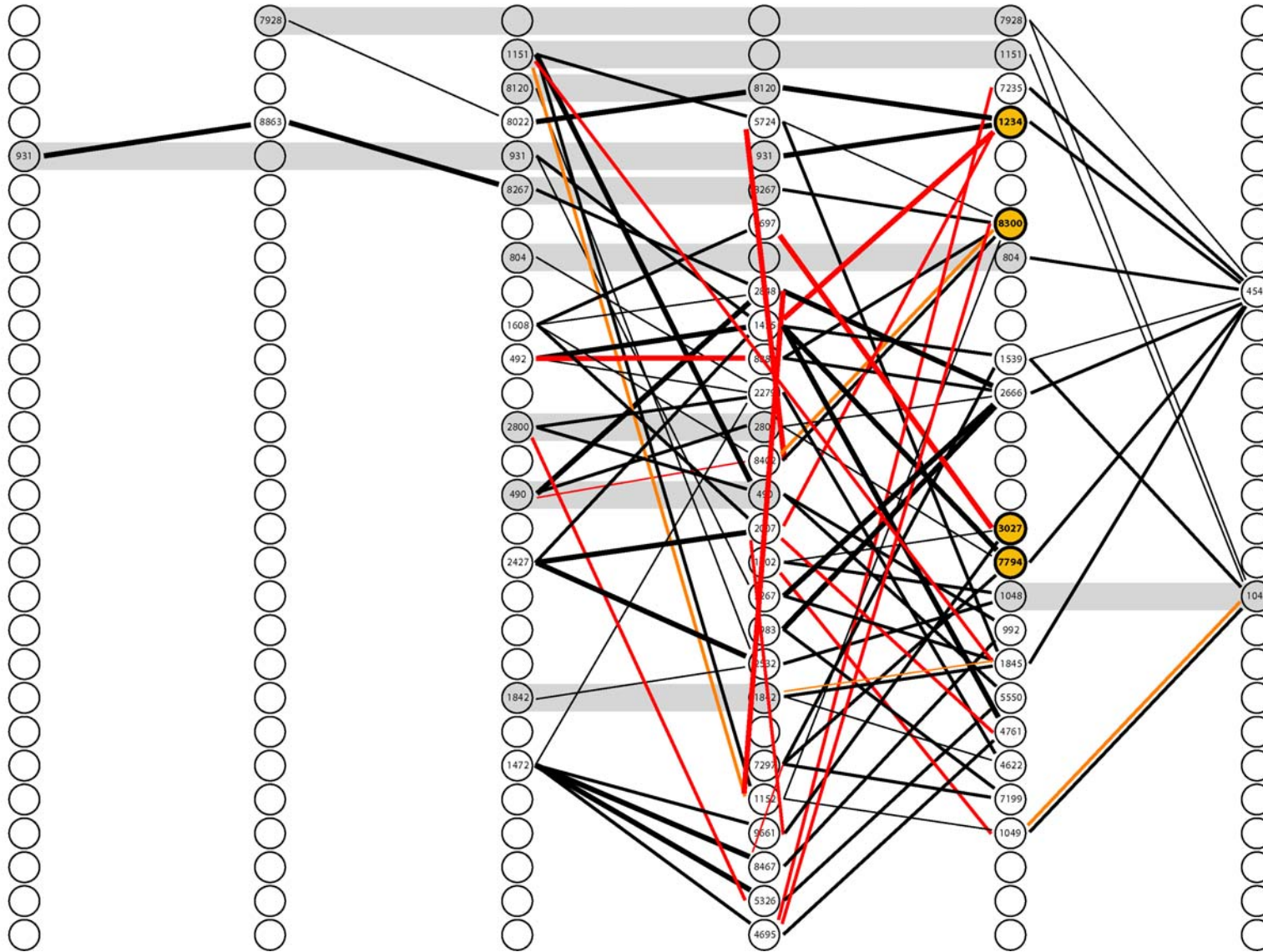
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 2000

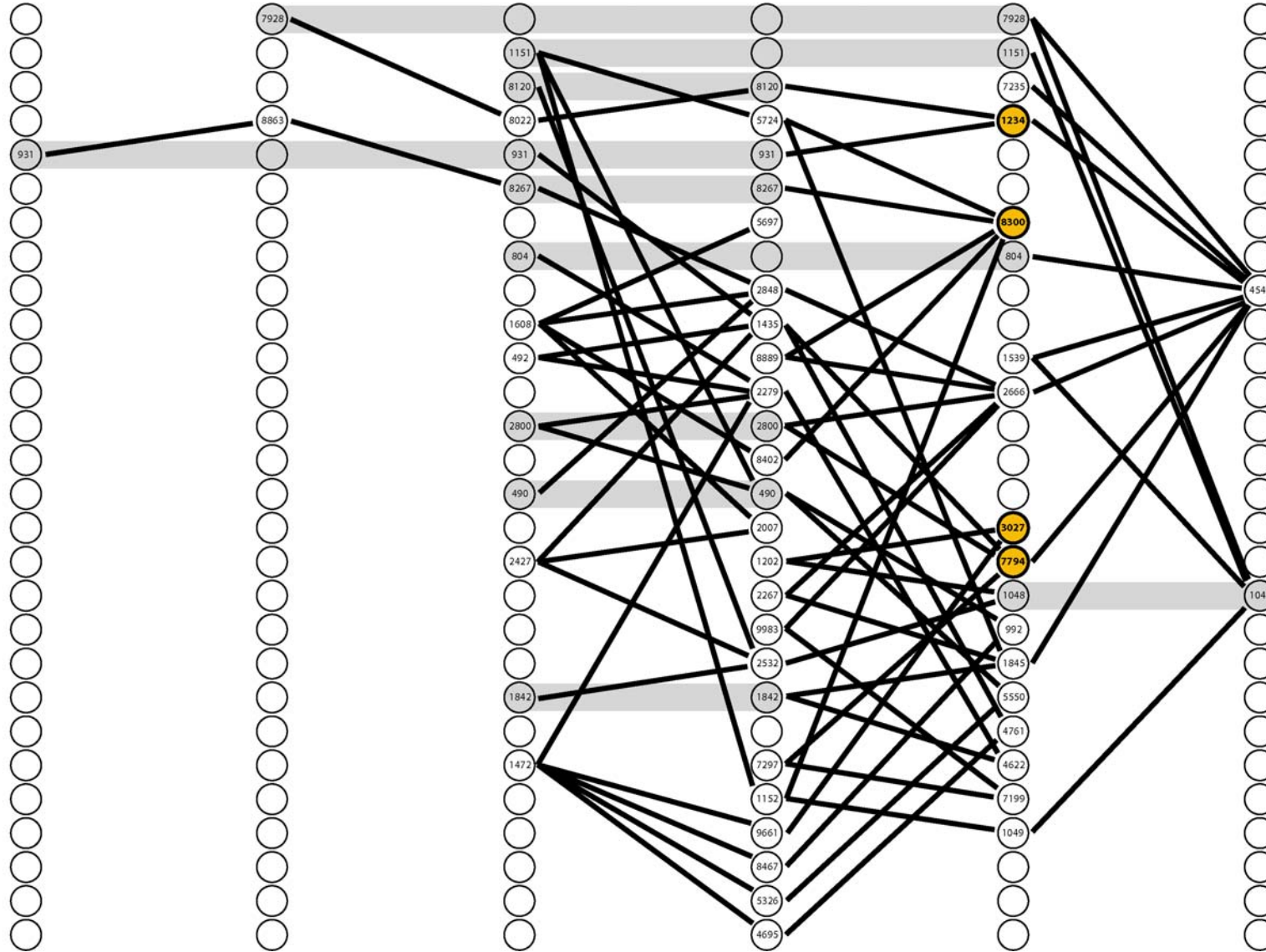




# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 5000



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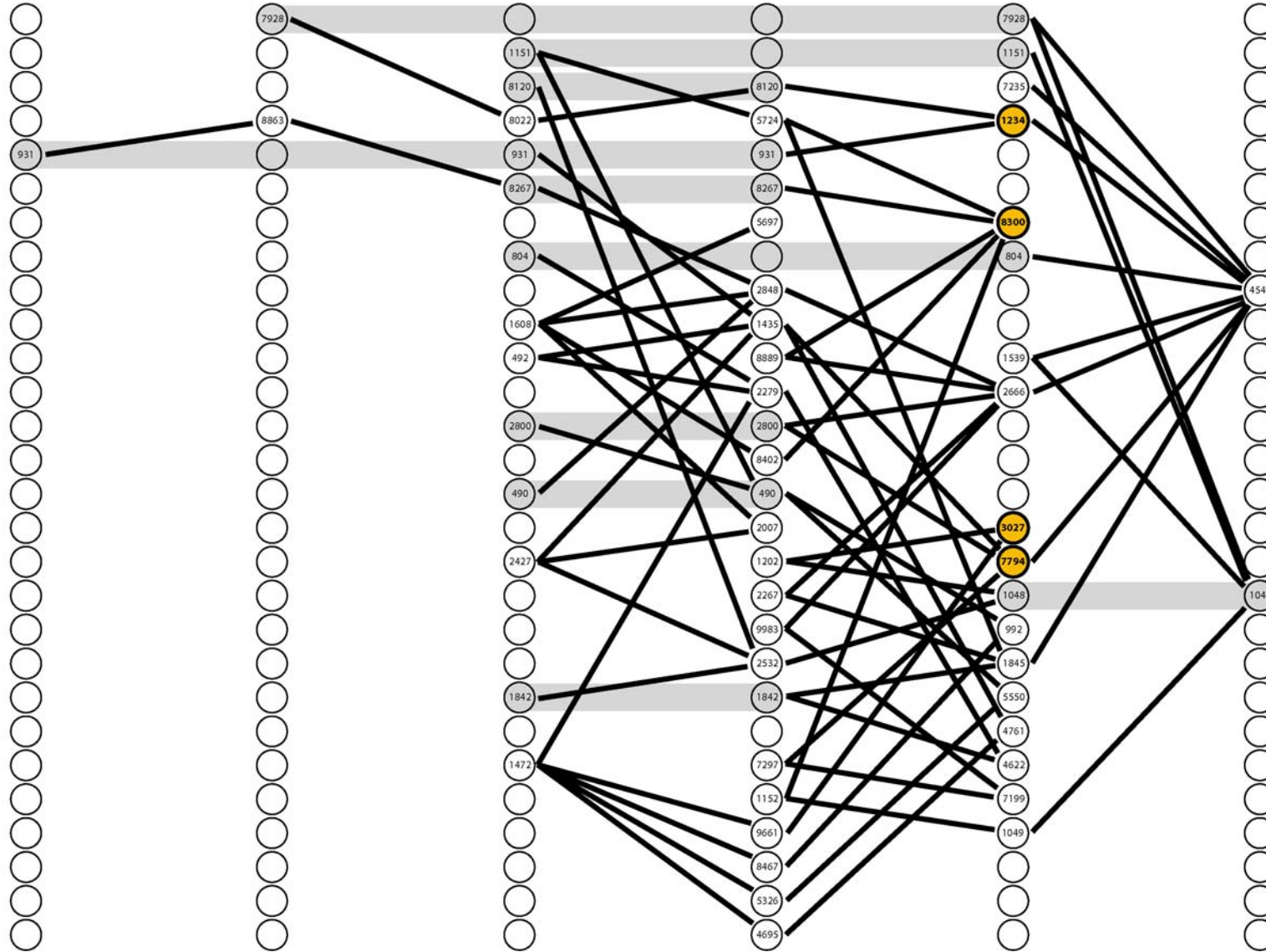
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 25000



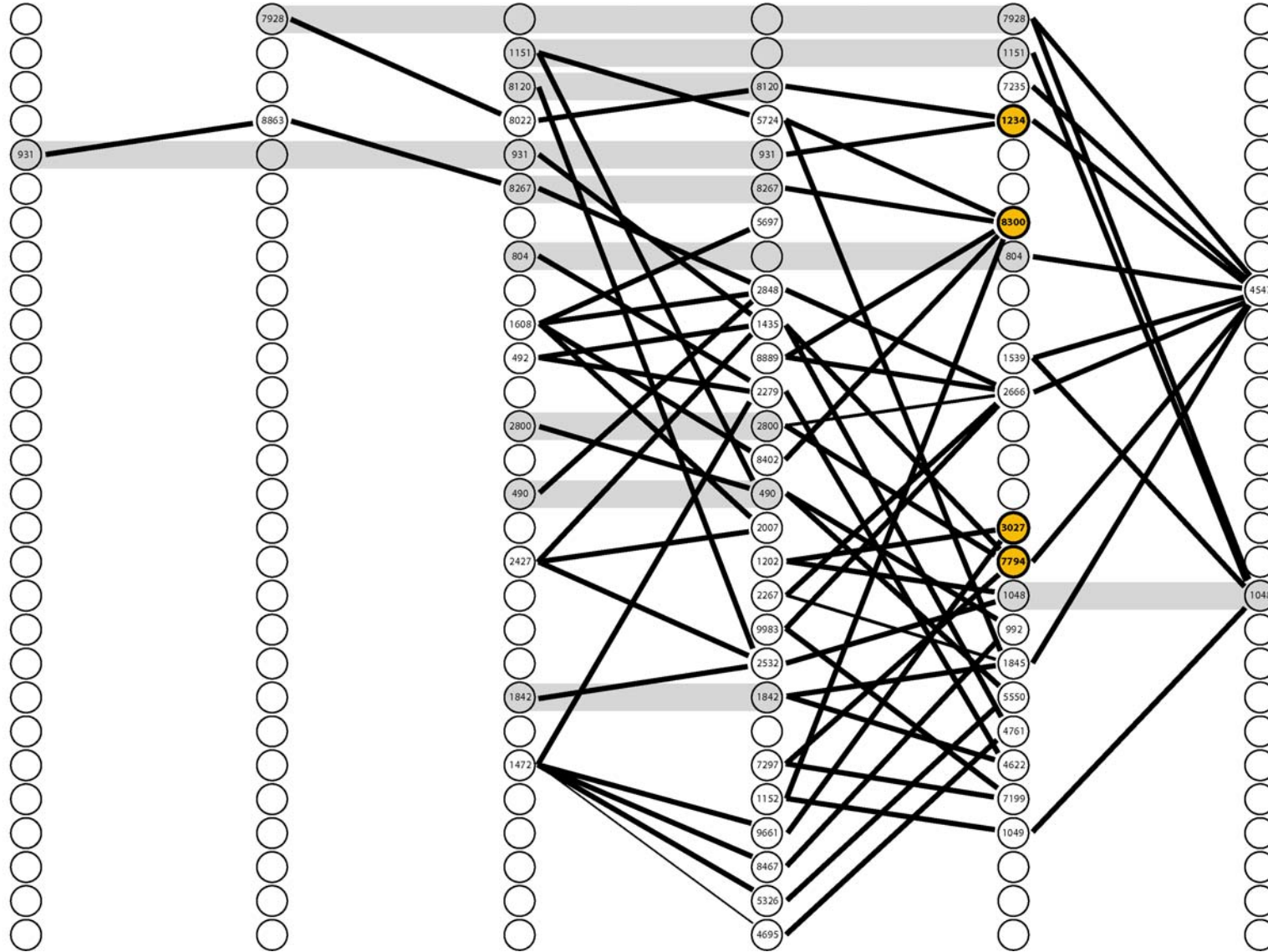
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 100000

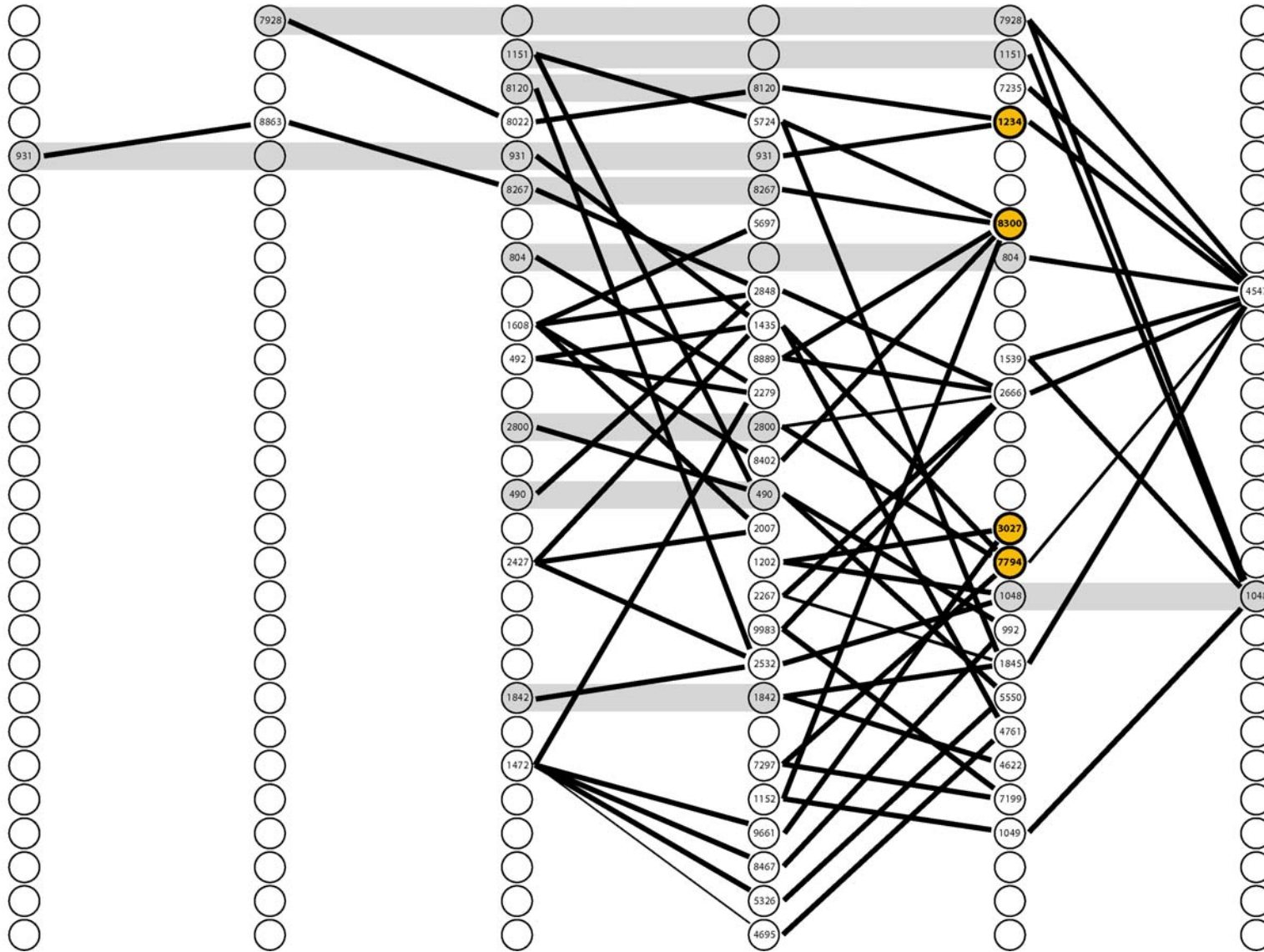




# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 200000



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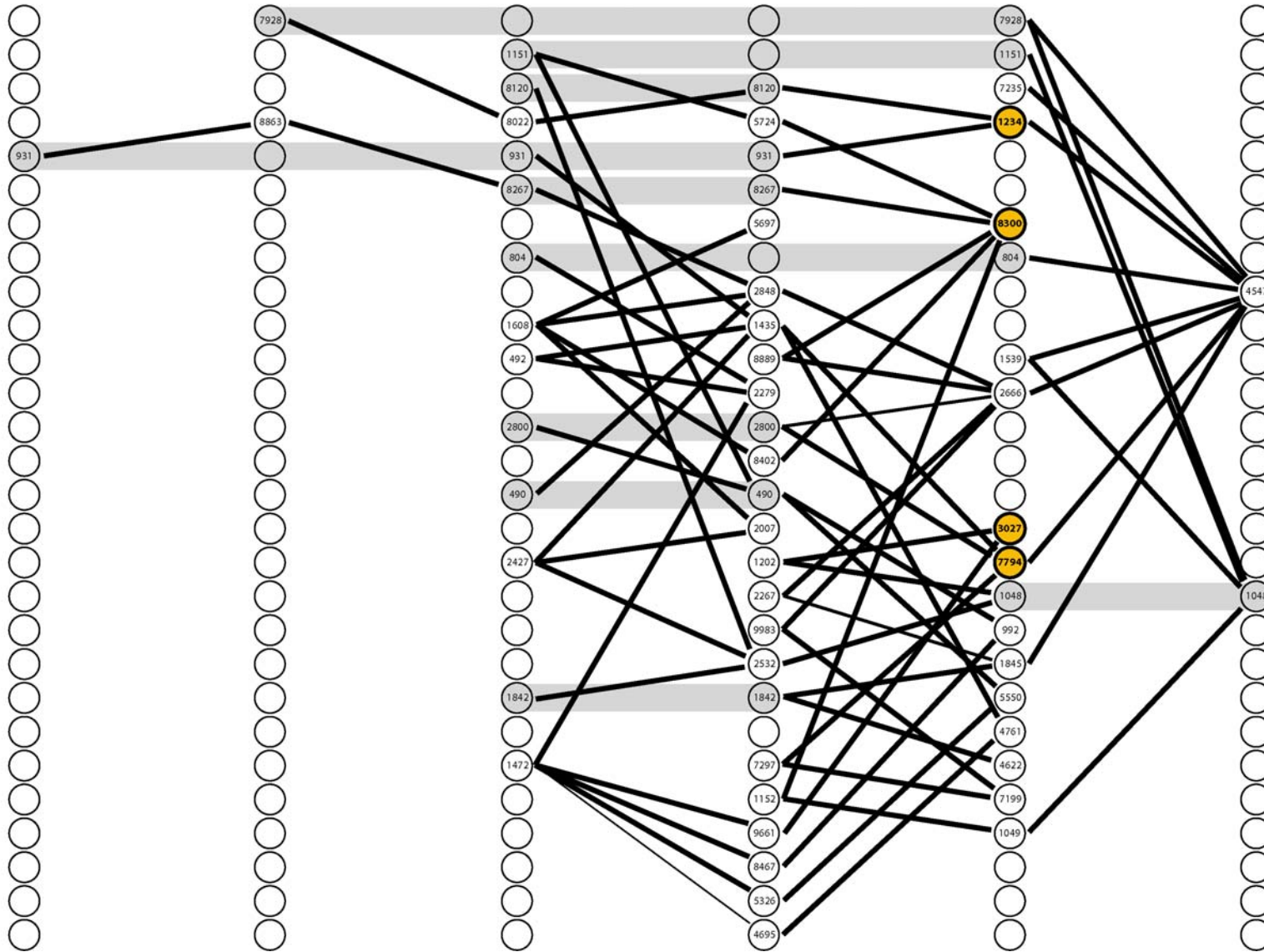
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 300000



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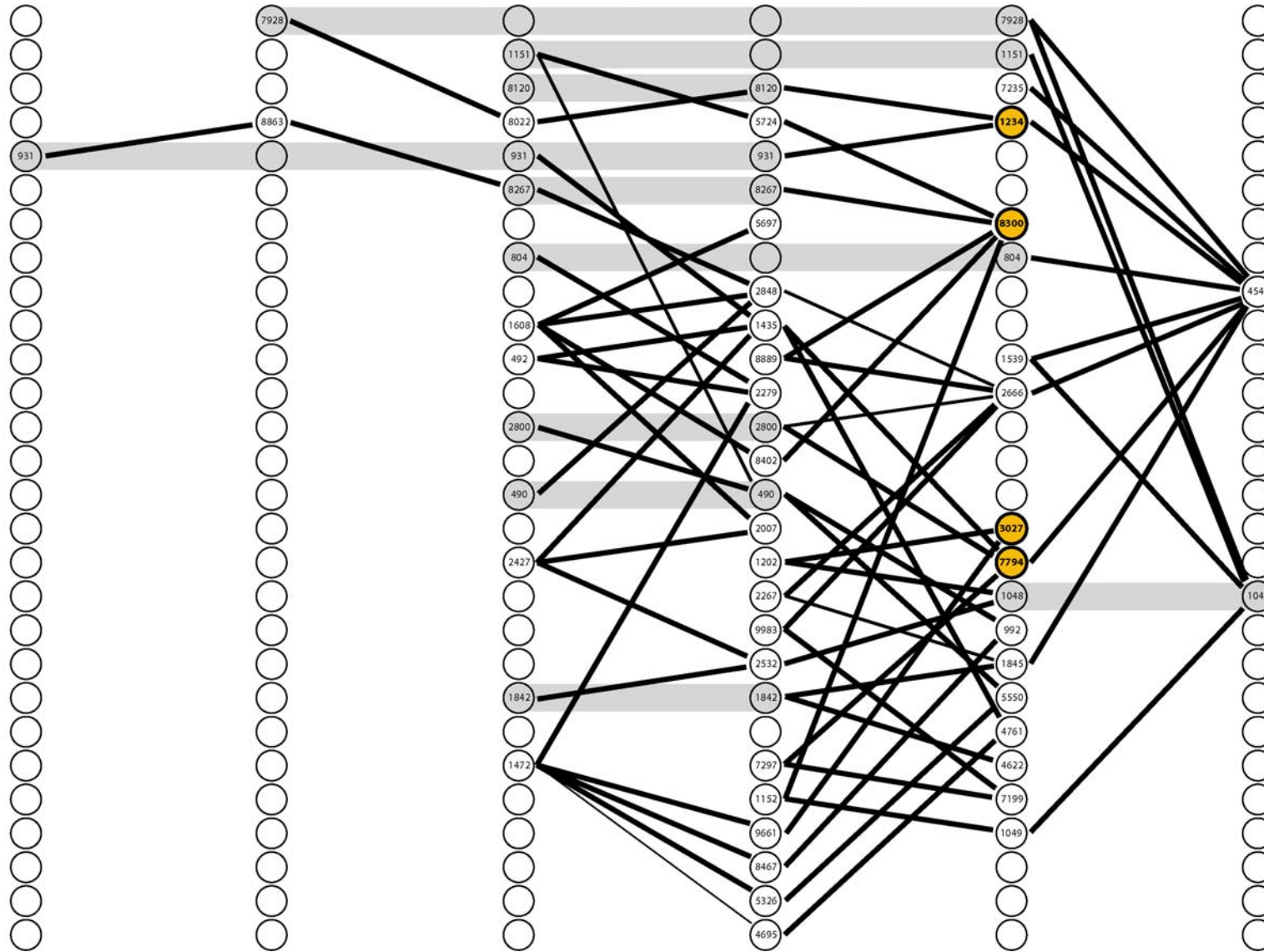
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 40000



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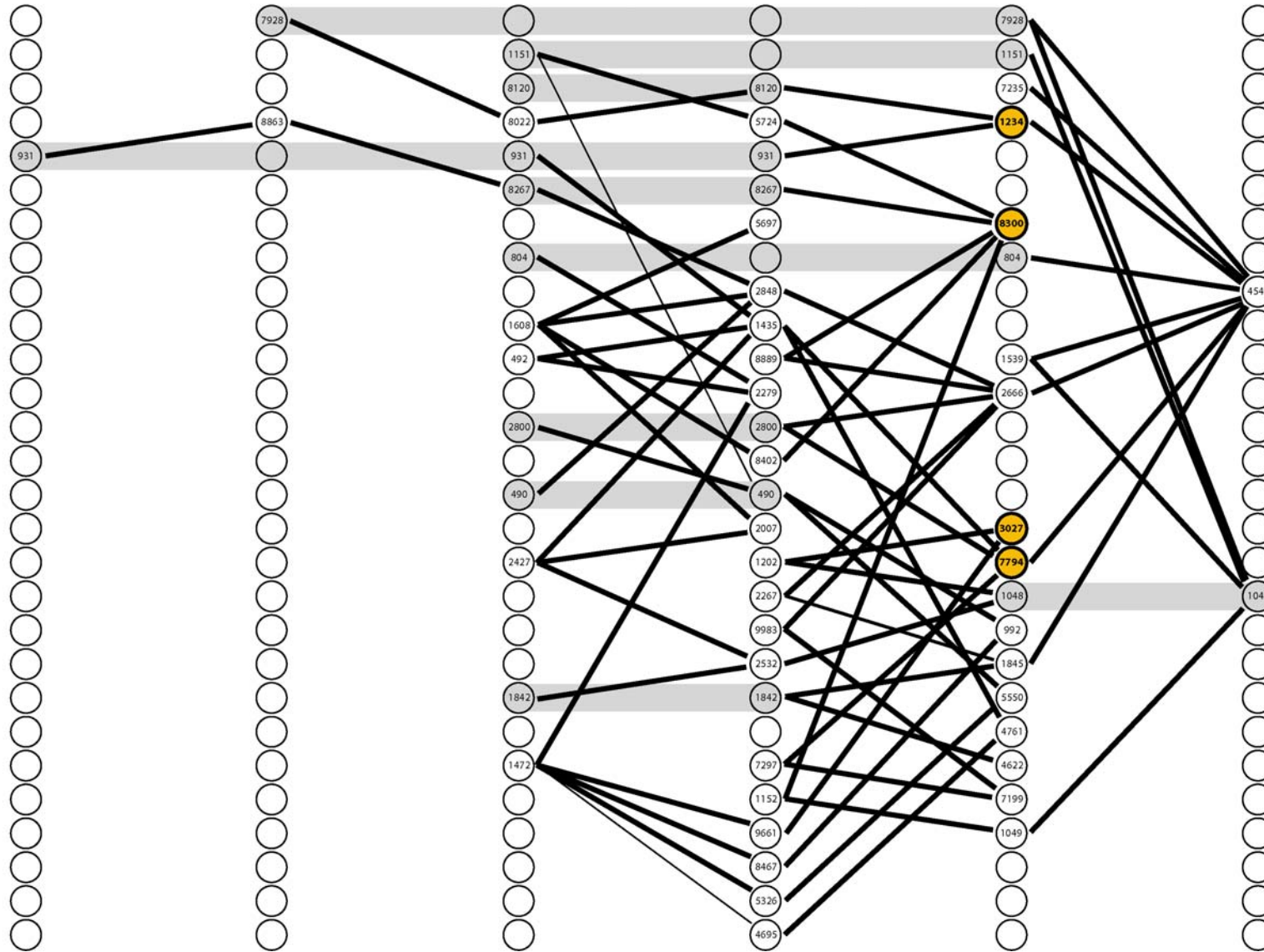
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 50000



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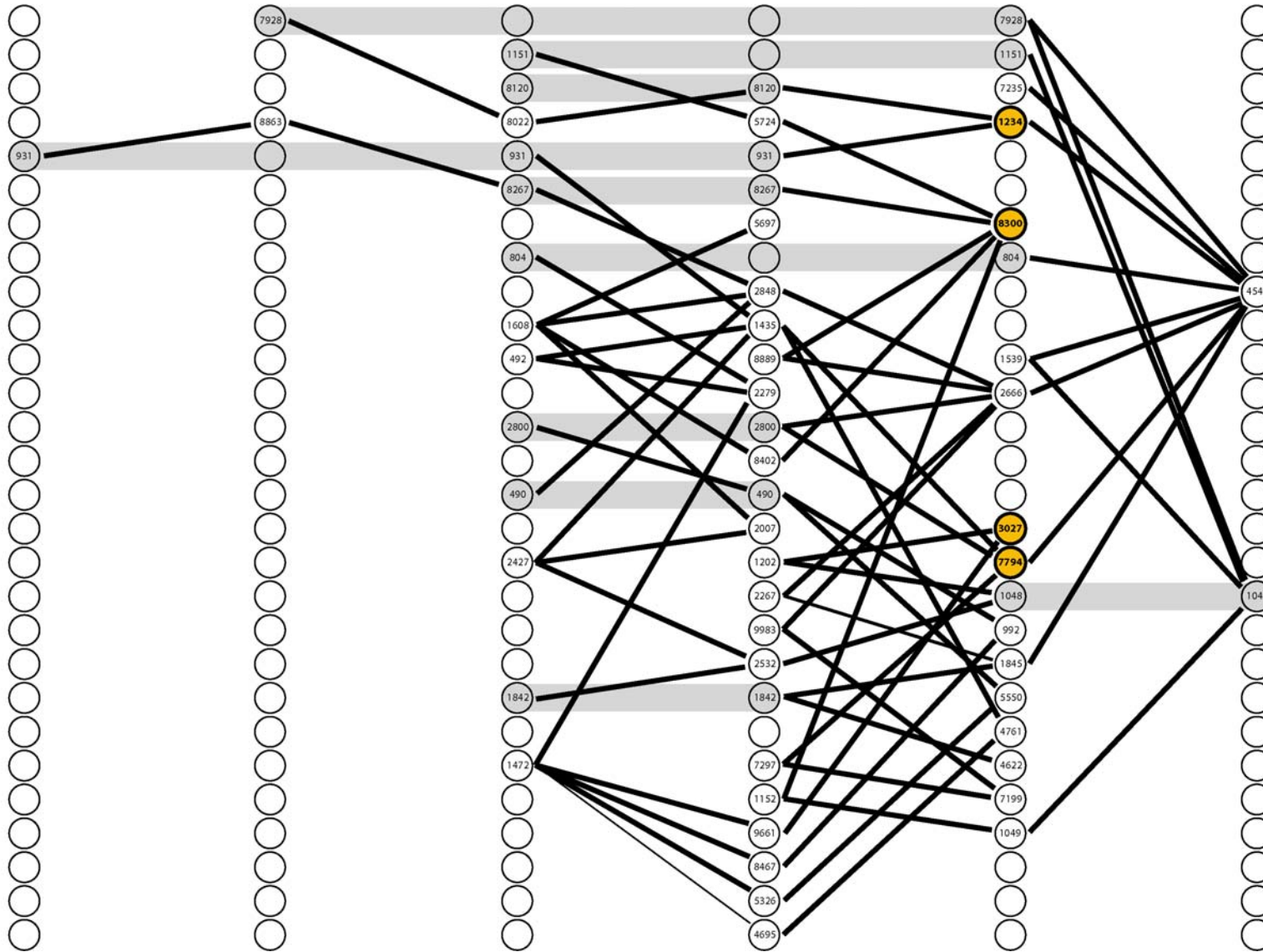
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 60000



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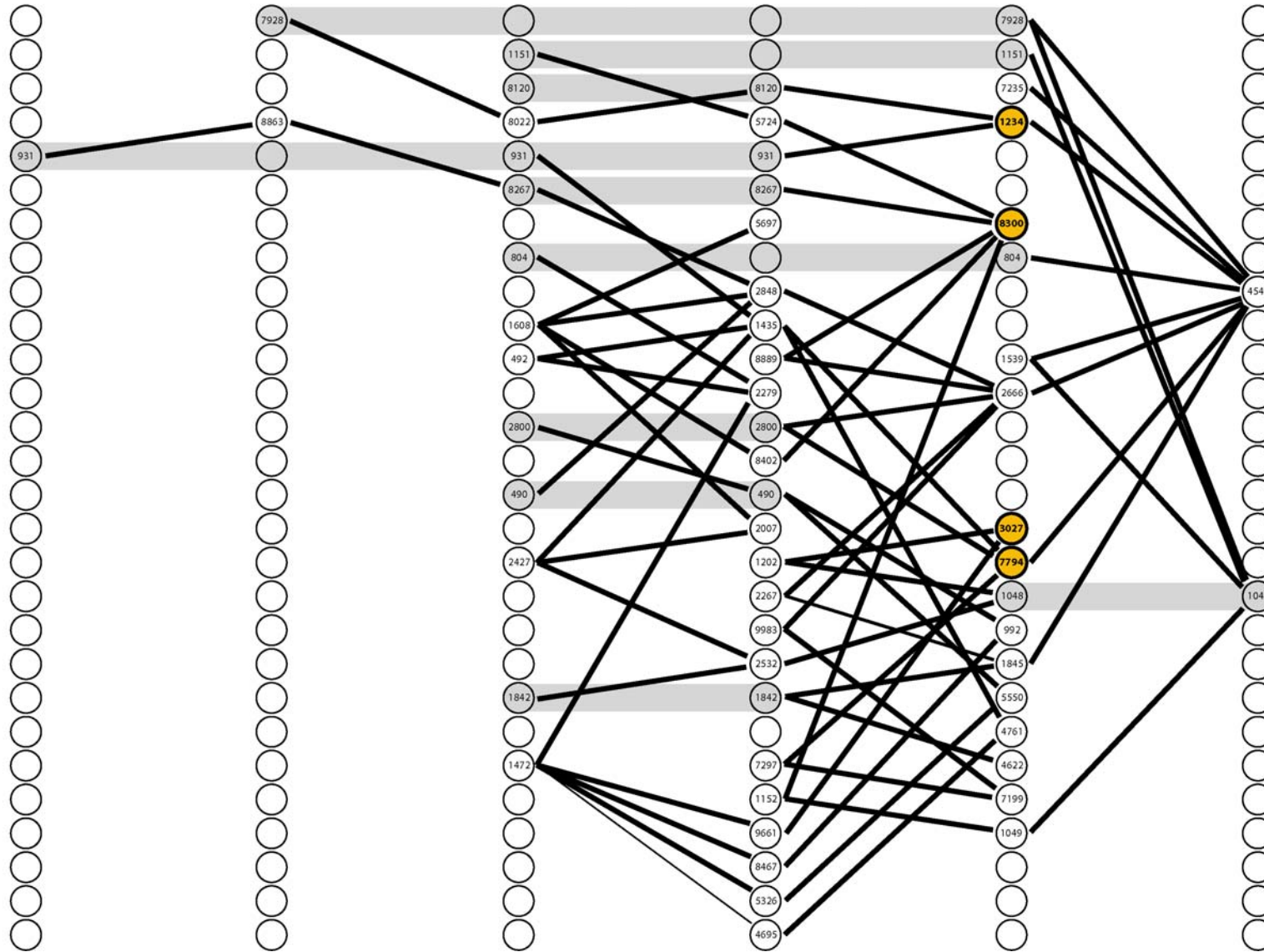
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 70000



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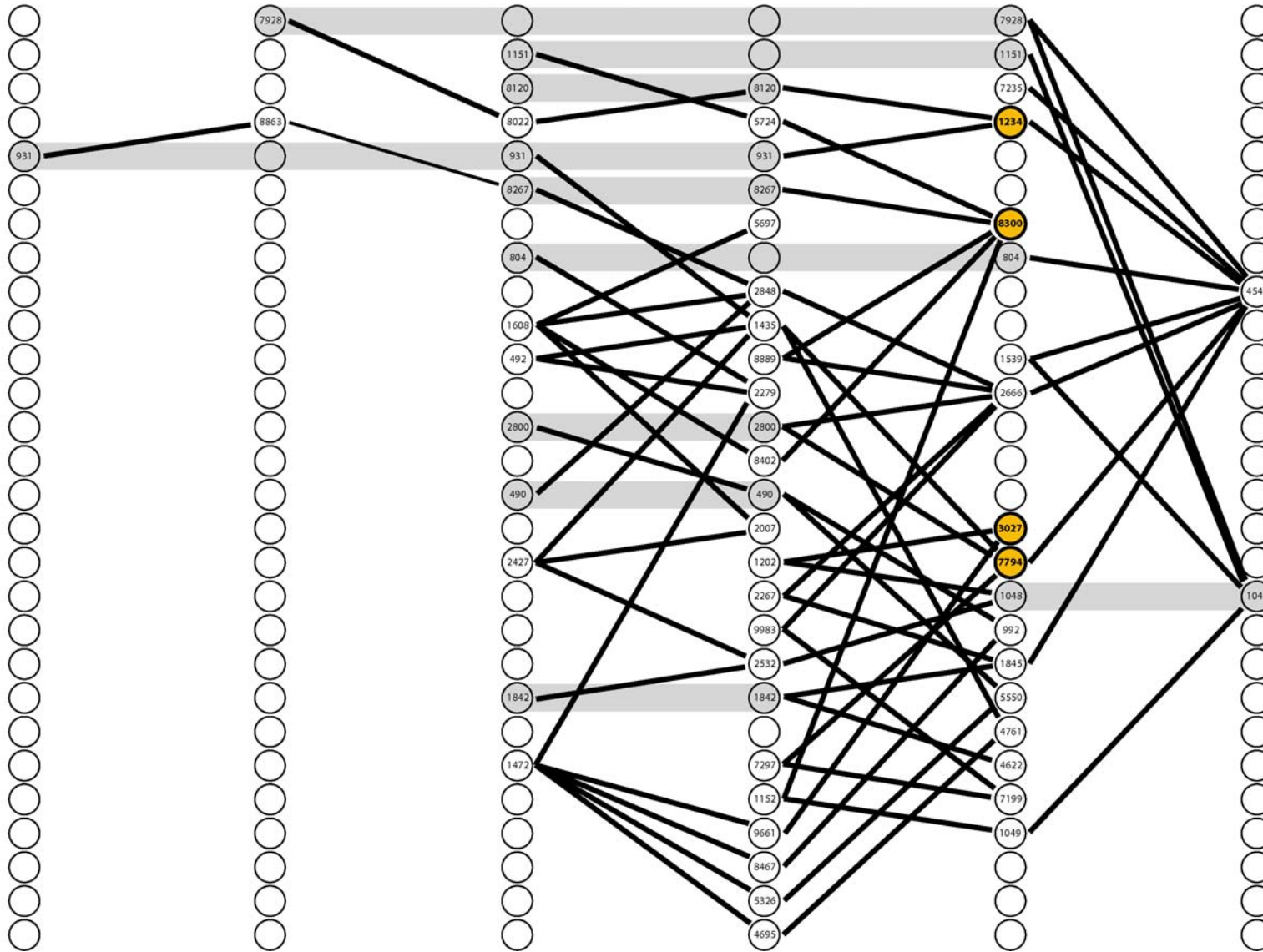
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 80000



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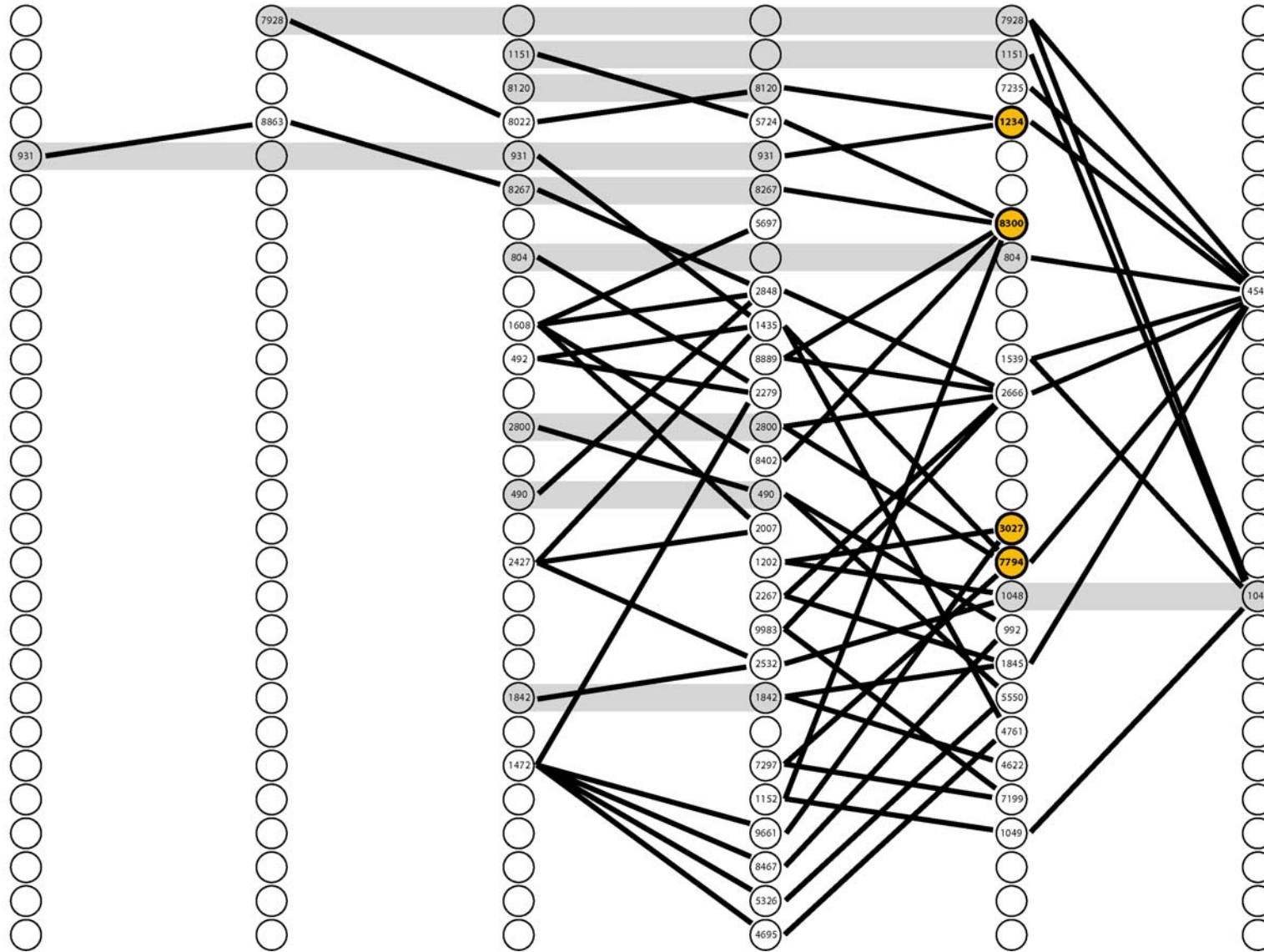
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 90000



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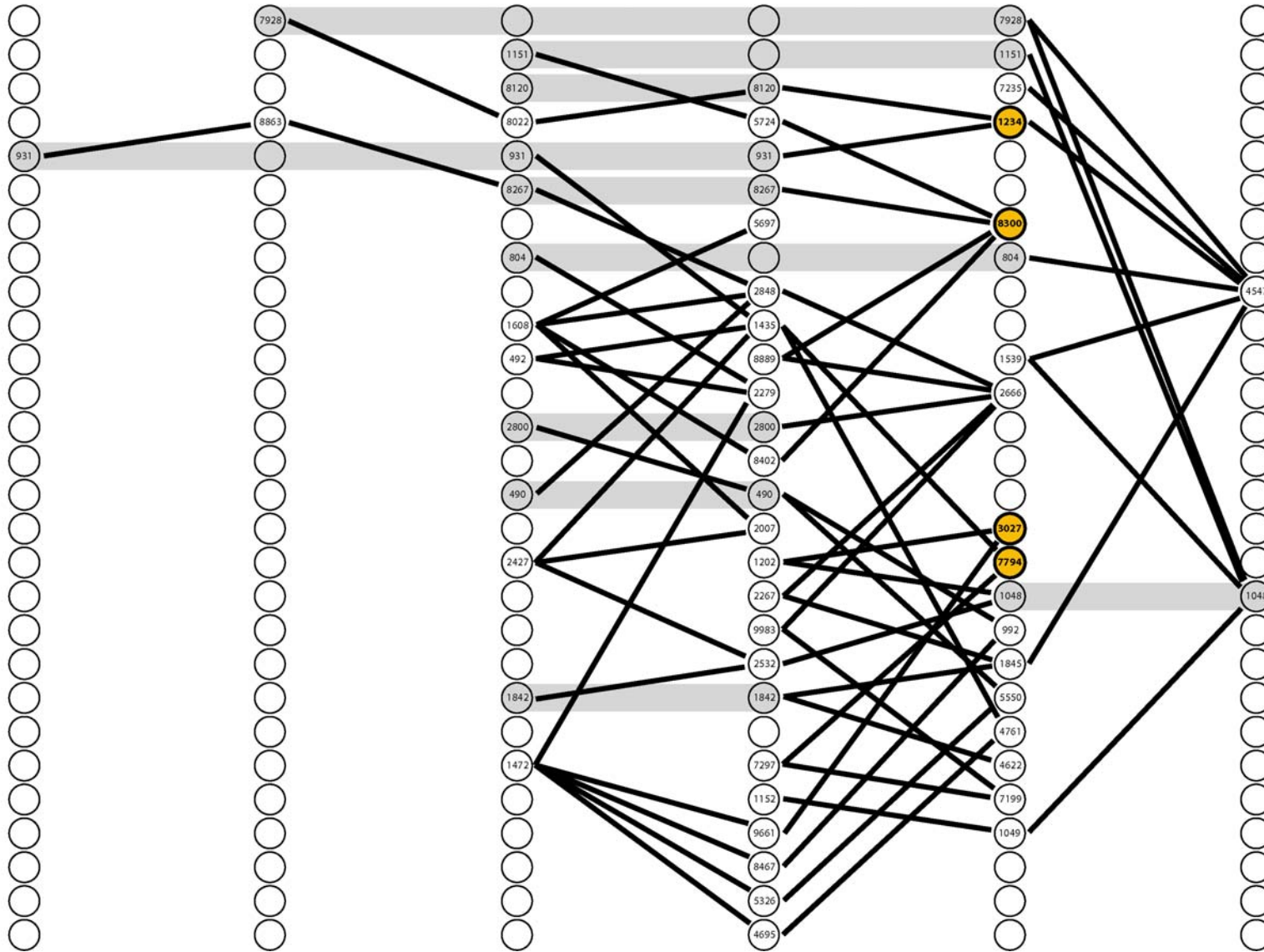
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# Brain inspired evolvable connectivity

Background noise = 10 events/s | Spatio-temporal input pattern of activity

t= 1000000



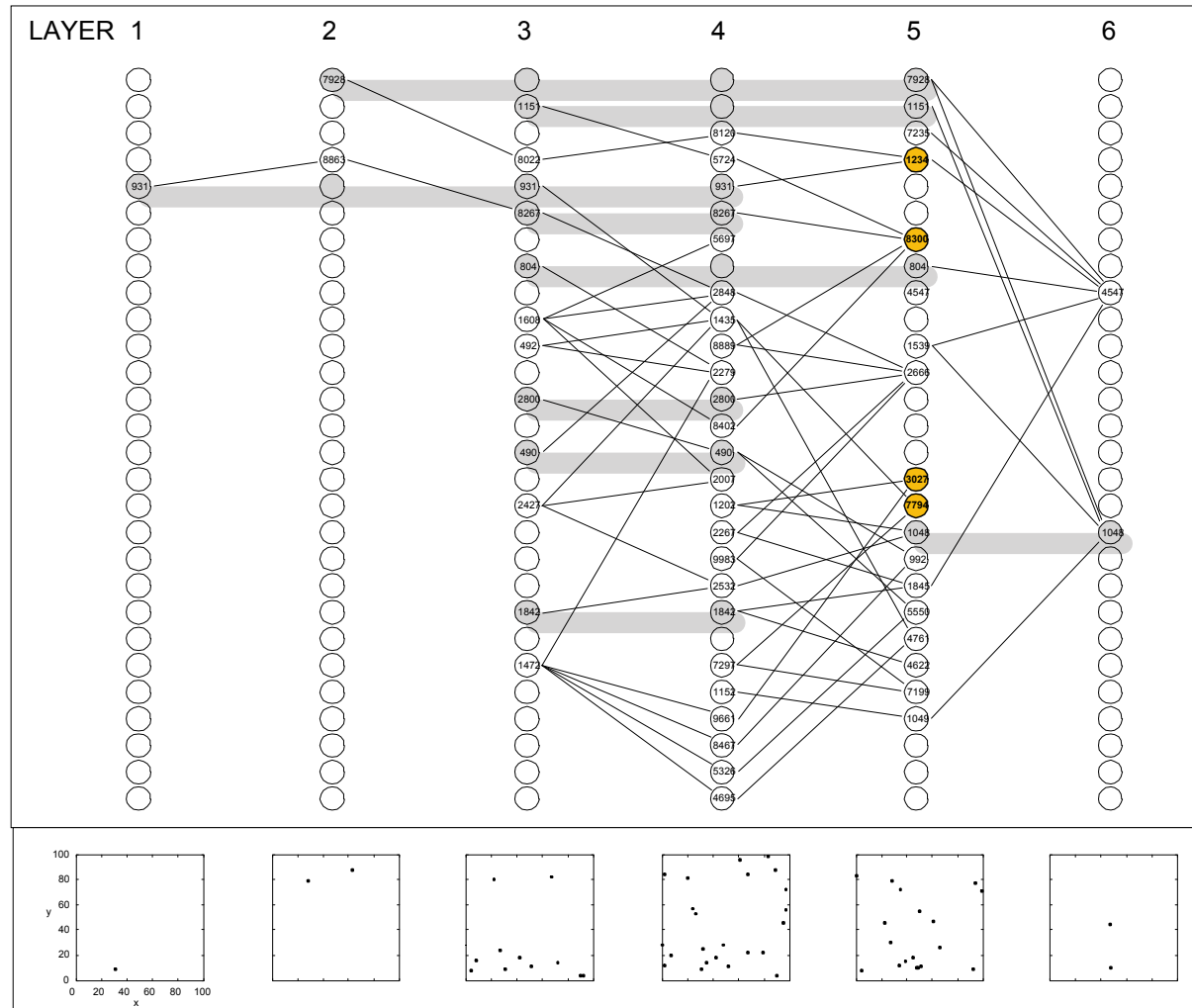
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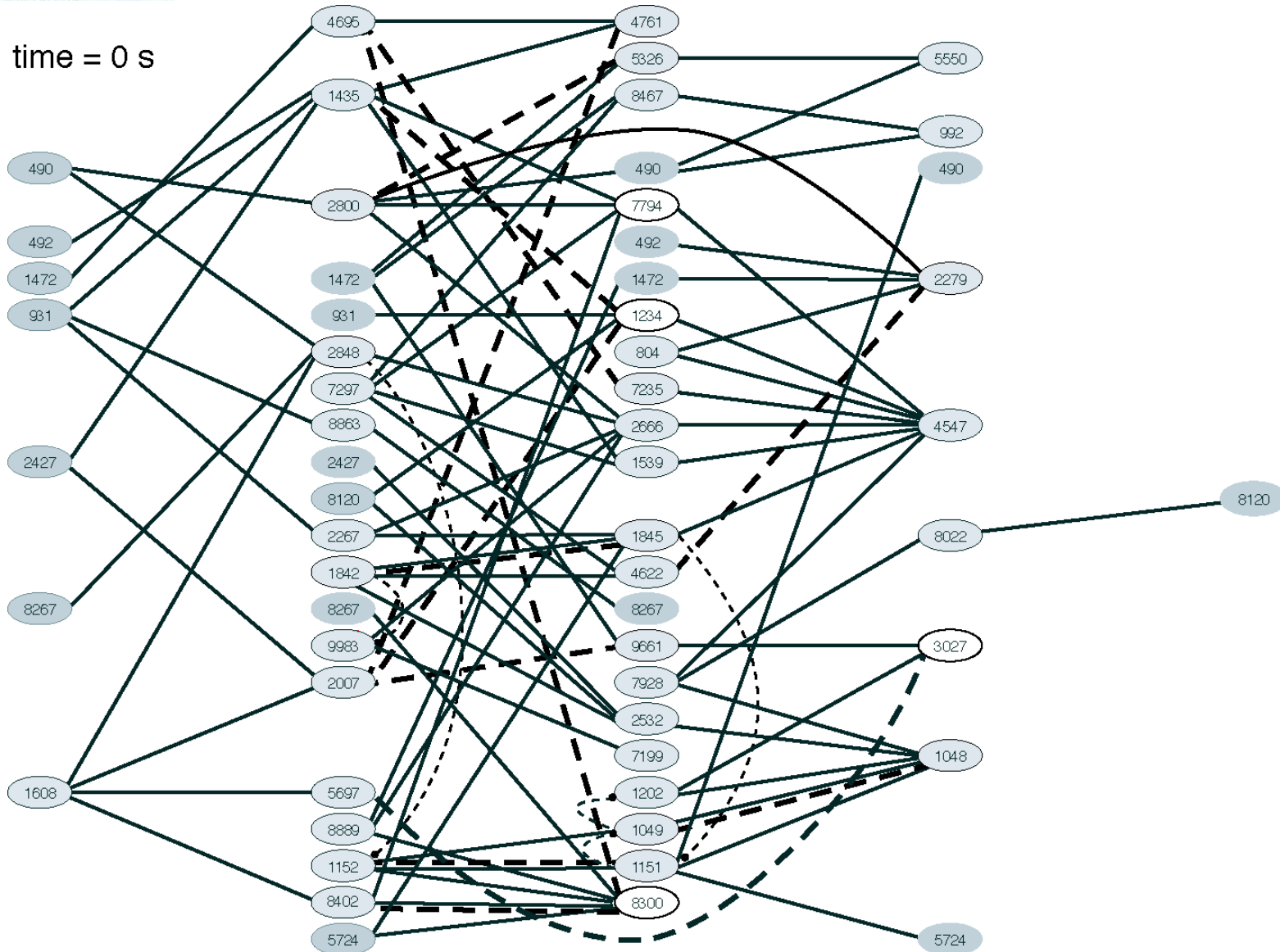
# Brain inspired evolvable connectivity

At time=1'000'000 | Emergence of diverging/converging networks





# Brain inspired evolvable connectivity



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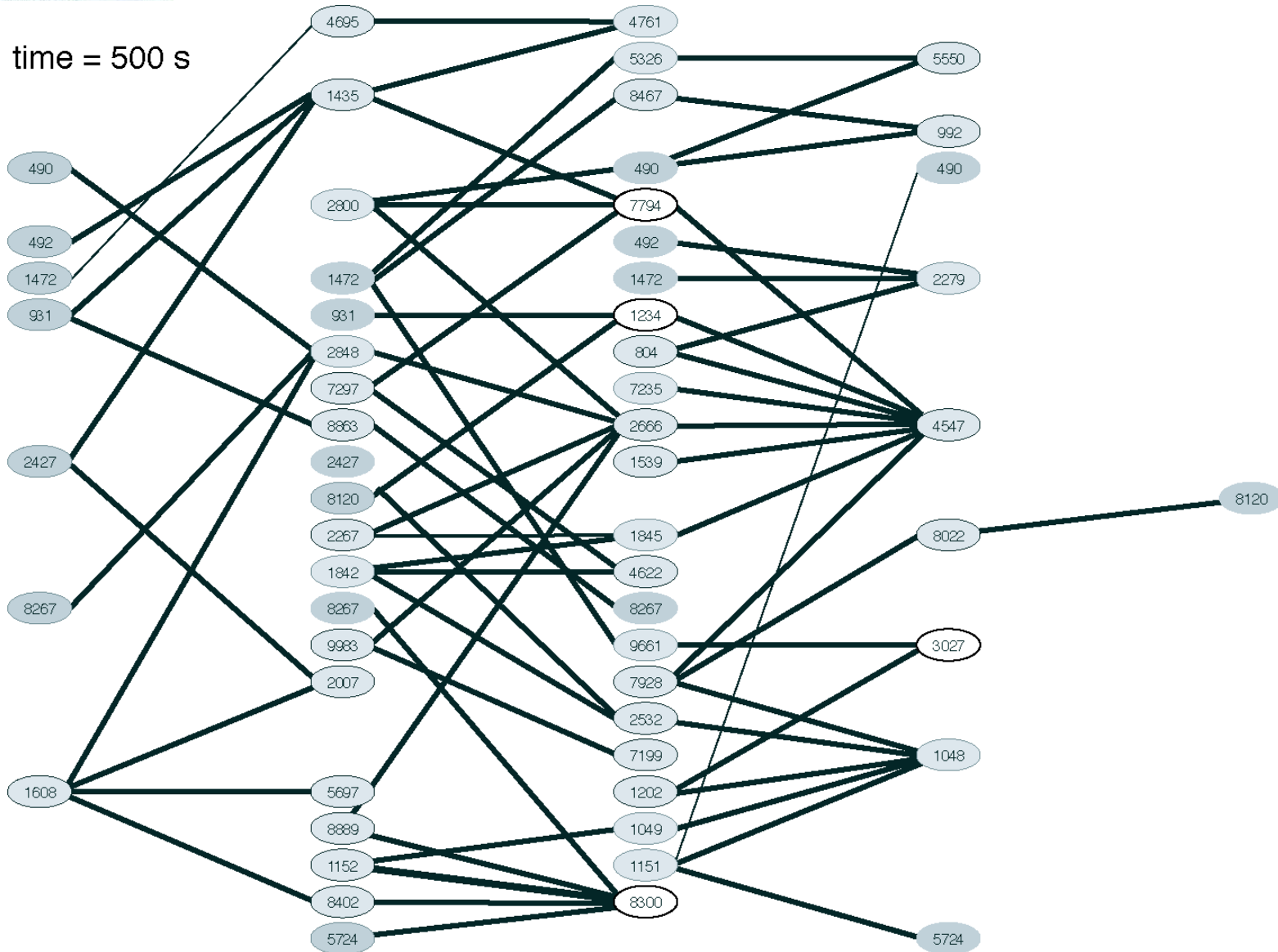
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## Major Outcomes/Results

- **Concept proof** and **feasability** have been validated.

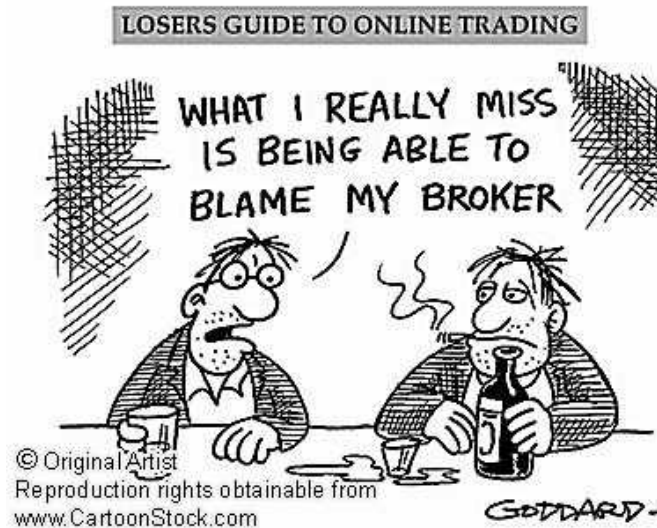


- An **OpenAdap.net** testbed is active and used on a daily basis by a Community interested in multivariate time series analyses sharing a suitable format originally developed in physics and successfully applied in financial forecasting and modeling of stock market, analysis of origin of glacial cycles, music, and biological data.
- A key element in the next stage of development consists in making the *brokers* **adaptive and dynamically interconnected** (like a neuronal network).
- The information will be processed and dispatched among all components following a set of "**learning**" rules, for **example** [benet](#) taking into account broker activity dependent parameters.



## Major Outcomes/Results

- The rules themselves will **evolve and optimize** in an unsupervised fashion, thus allowing the emergence of **dynamic links** among the adaptive brokers. Emergence of **nonlinear dynamics** will make **OpenAdap.net** closer to the complexity of a **living organism**.





# Conclusion and outlook

The service and software architecture deployed in **OpenAdap.net** are not bound to a specific Community. They constitute a global virtualisation tool offering new opportunities to European focused SMEs to improve their efficiency and strengthen their competitiveness independently from their domain.



A Consortium submitted a **FP7 proposal** [ICT-2007-1] (FP7-216525)



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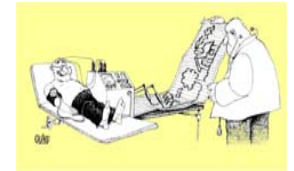




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