

# Fusion symbolique de données

Enrichissement des données

ASWS

*Jean-Gabriel Ganascia*



# Fusion de données

The screenshot shows the top navigation bar of the University of Cambridge website. It includes the university logo, links for 'Study at Cambridge', 'About the University', and 'Research at Cambridge', a 'Quick links' dropdown menu, and a search bar. Below the navigation bar, there is a breadcrumb trail 'Home / FUSION 2018' and a 'Log in' button. The main content area features a banner for 'FUSION 2018' with the subtitle '21st International Conference on Information Fusion - 10 - 13 July 2018'. A secondary navigation bar contains links for 'Home', 'Call for papers', 'Programme', 'Special Sessions', 'Tutorials', 'Cambridge Information', 'Organising Team', 'Sponsorship', and 'Social Programme'. Below this, there is a 'Registration Information' link and a large image of a building with Gothic windows. To the right of the image is a 'Latest news' section with two entries: 'Keynote Presentations available here' dated July 30, 2018, and 'Thank you for a great Fusion Conference!!' dated July 15, 2018.

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21st International Conference on Information Fusion - 10 - 13 July 2018

Home Call for papers Programme Special Sessions Tutorials Cambridge Information Organising Team Sponsorship Social Programme

Registration Information

Latest news

[Keynote Presentations available here](#)  
Jul 30, 2018

[Thank you for a great Fusion Conference!!](#)  
Jul 15, 2018  
We would like to thank everyone involved in the conference this year.

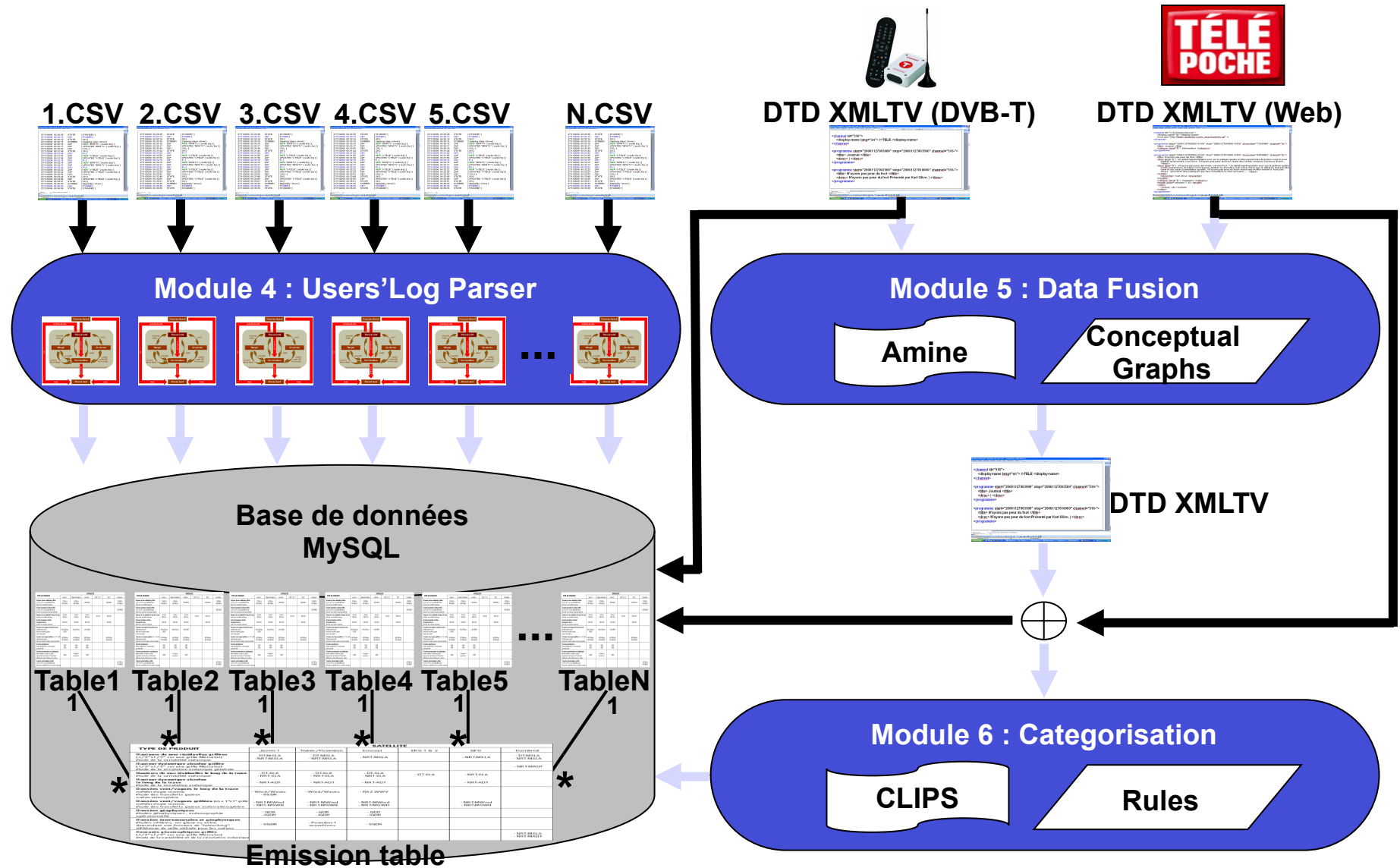


# Fusion d'information

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- Comment tirer parti de multiples sources d'information hétérogènes?
- Exemple:
  - Différents capteurs
  - Dégazage de navires en mer
  - Anticipation de crises politiques
  - Polysomnographie SAS
  - Méta-données
- Différents niveaux de fusion
  - Signaux
  - Connaissance → symboles...

# Data Fusion: télévision



# Télévision

Données TNT: peu de méta-données

Données des journaux ([www.telepoche.fr](http://www.telepoche.fr)): méta-données

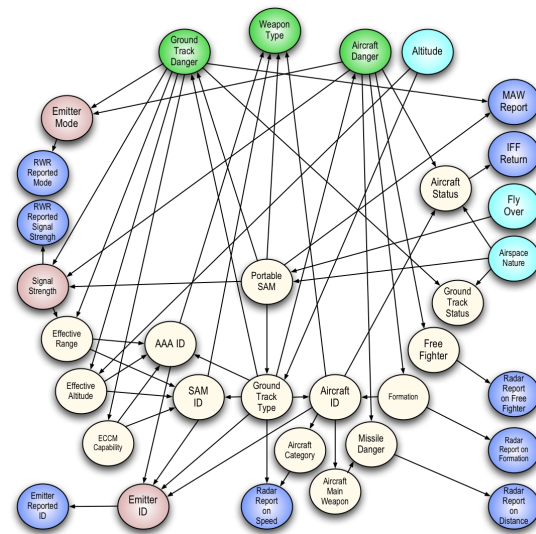
Données de l'INA – après la diffusion: description fidèle

Représentation des émissions à l'aide de graphes conceptuels

Utilisation de jointures maximales (*Claire Laudy, Jean-Gabriel Ganascia – Thalès – LIP6*)

# Journaux - Thalès

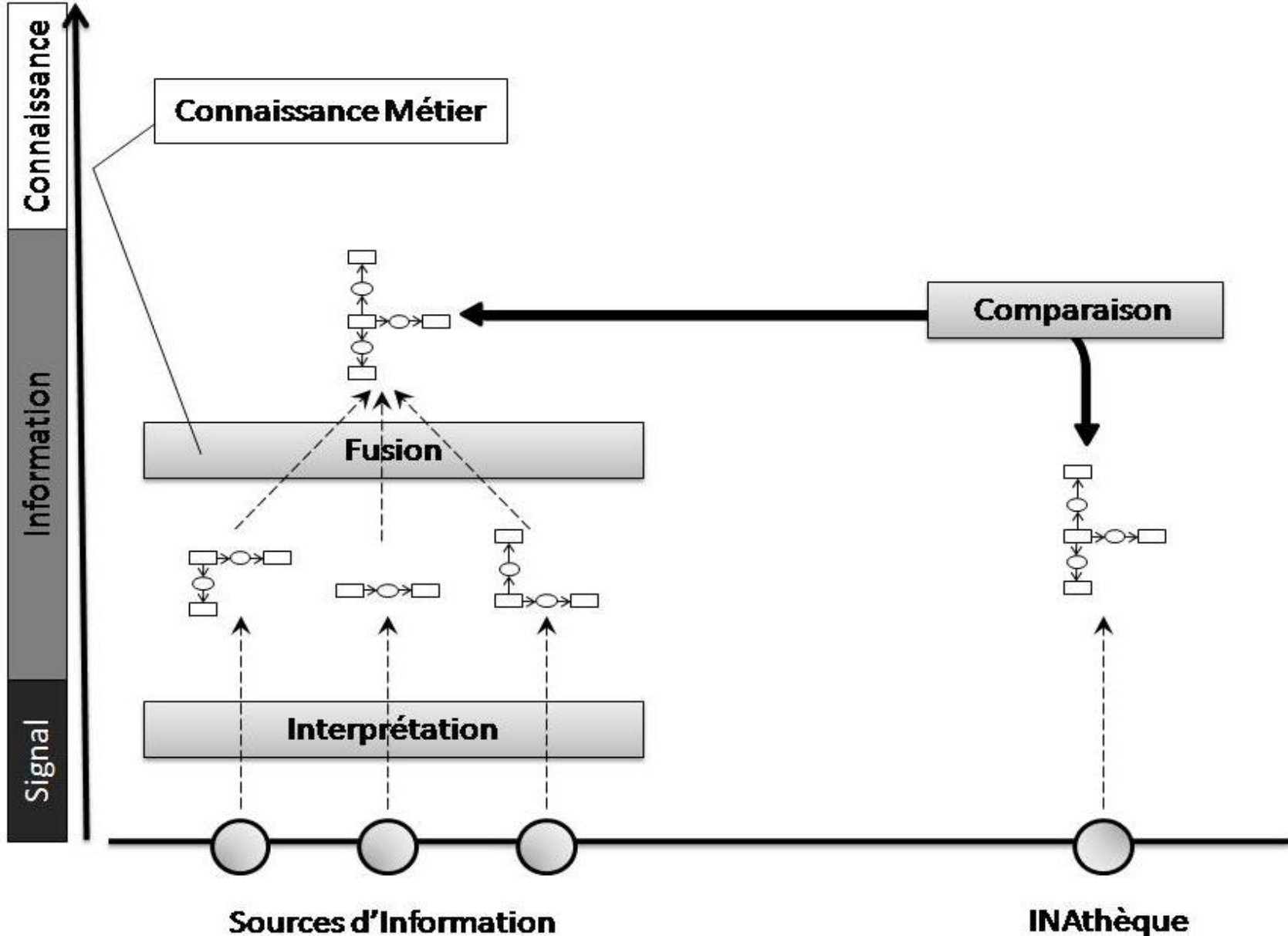
Anticipation des crises politique  
Crise en Côte d'Ivoire





# Fusion symbolique

Niveau d'abstraction



# Graphes conceptuels

## *John Sowa 1984*

Représentation sous forme de graphes

Visualisation

Traduction du langage naturel

Manipulables par une machine

Equivalence avec la logique

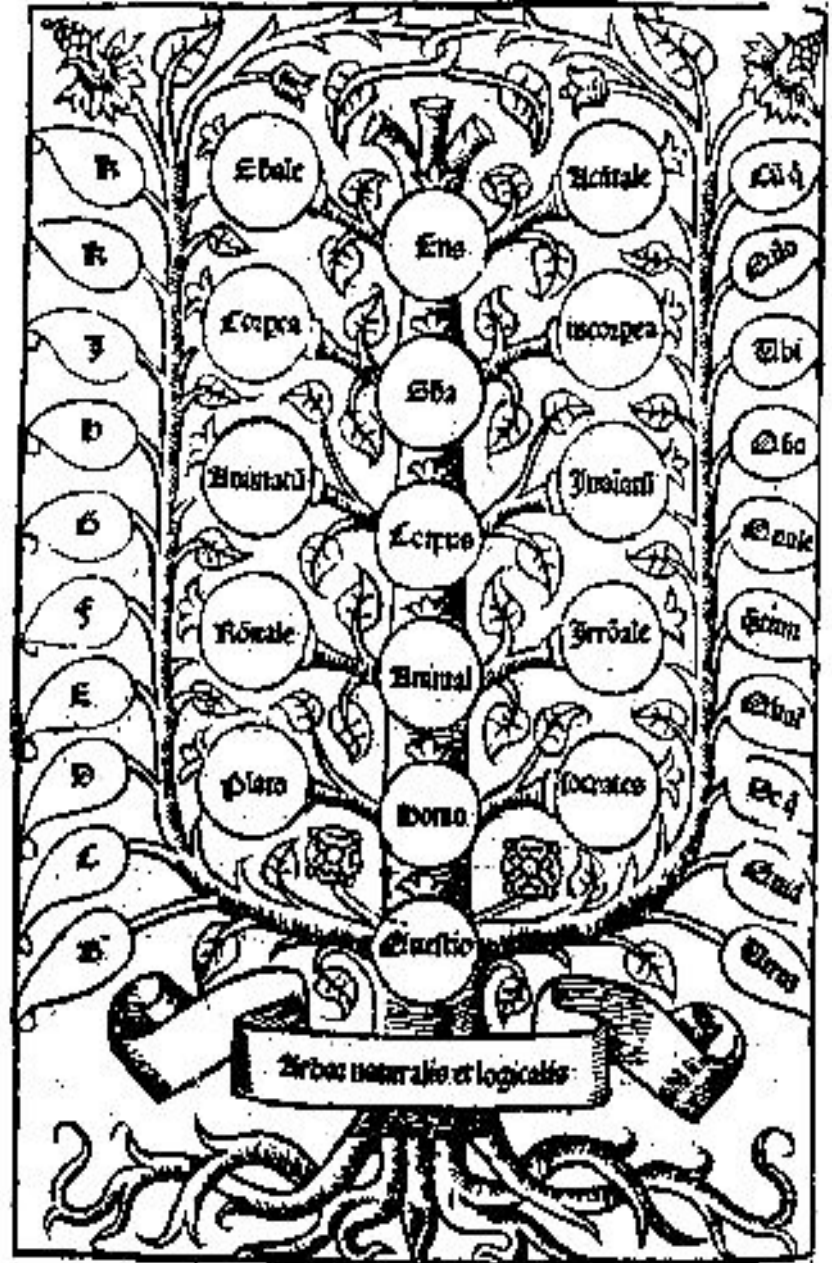
Origine:

Représentation des connaissances en IA

Réseaux sémantiques

« Frames »

Graphes « existentiels » de Charles Sanders Peirce (1839 - 1914)





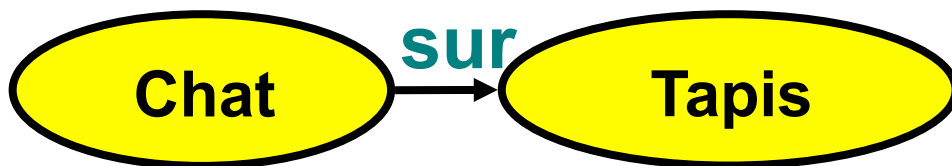
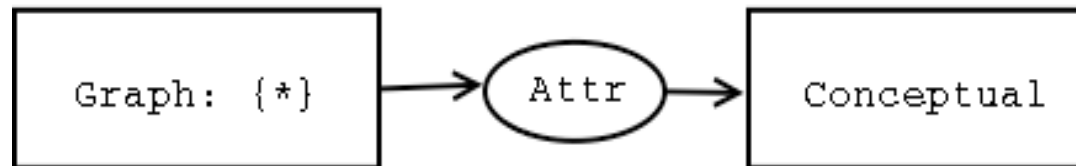
# Introduction aux graphes conceptuels

## « Un chat est sur un tapis »

Une graphe conceptuel comporte deux types de noeuds:

Des concepts, représentés avec des rectangles

Des relations, représentées à l'aide d'ovales



**Forme linéaire:** [Chat] -> (Sur) -> [Tapis]

**Traduction logique:**  $(\exists x:\text{Chat}) (\exists y:\text{Tapis}) \text{Sur}(x, y)$

# Opérations sur les graphes

**Jointure maximale:** construire le graphe qui contient toutes l'information de deux graphes, sans dupliquer d'information

**Généralisation:** prend deux graphes et construit un graphe qui contient les informations communes aux deux graphes

**Subsomption:** test si un graphe est plus général qu'un autre

**Sous-graphe:** détermine si un graphe est une branche d'un autre

# Jointure maximale et généralisation

```
g1 = [Drive] -  
      -obj->[Car],  
      -agnt->[Person],  
g2 = [Drive] -  
      -manr->[Fast],  
      -agnt->[Boy : John],
```

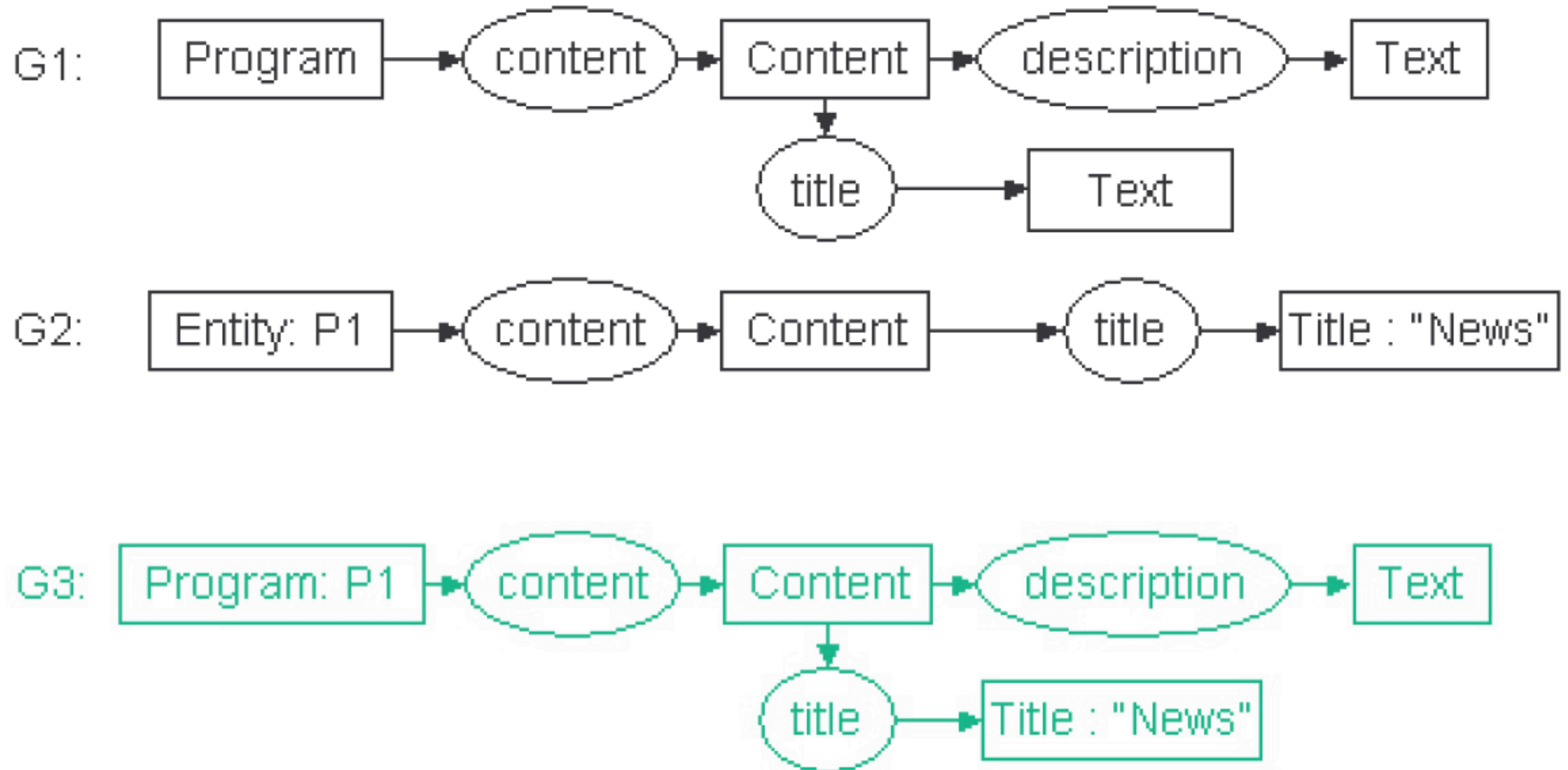
## Jointure maximale de g1 et g2

```
g3 = [Drive] -  
      -agnt->[Boy : John],  
      -obj->[Car],  
      -manr->[Fast]
```

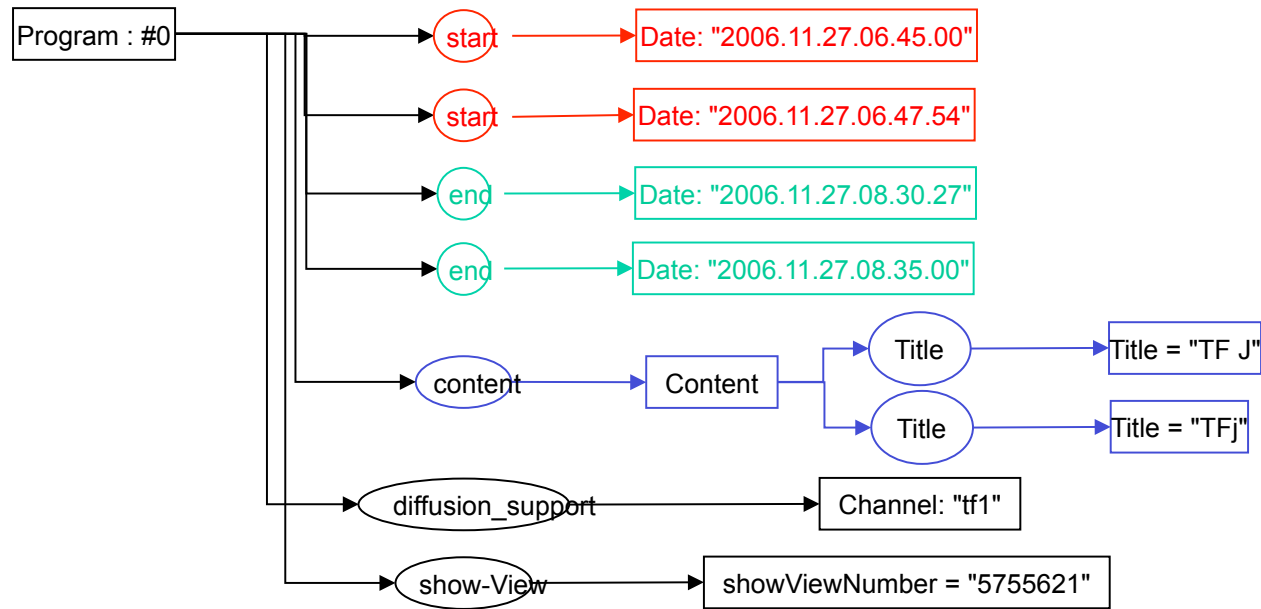
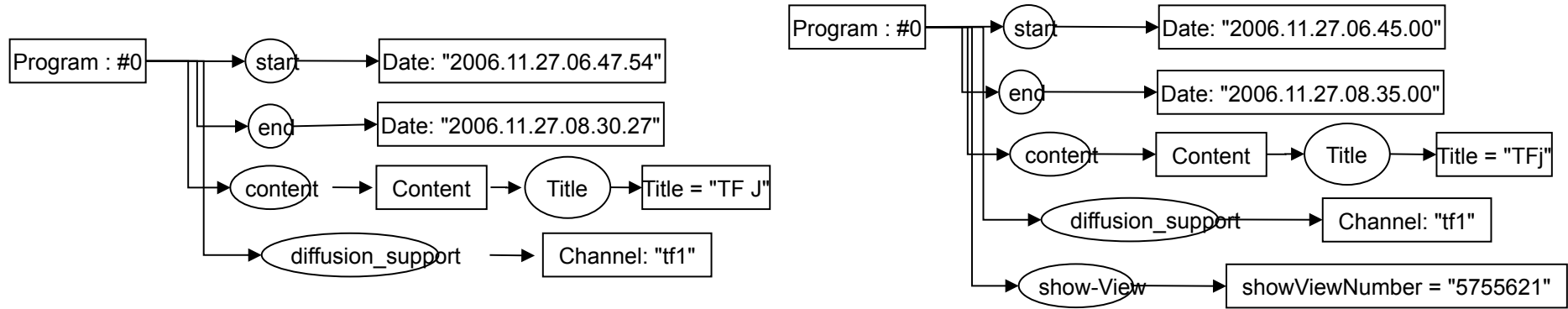
## Généralisation de g1 et g2

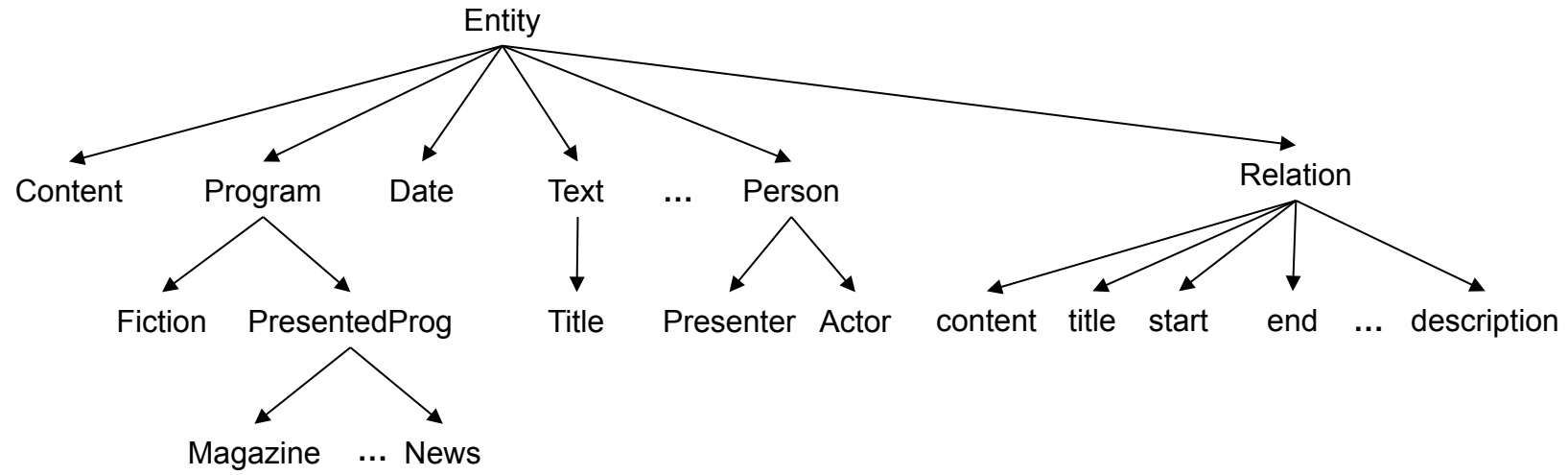
```
g4 = [Drive]-agnt->[Person]
```

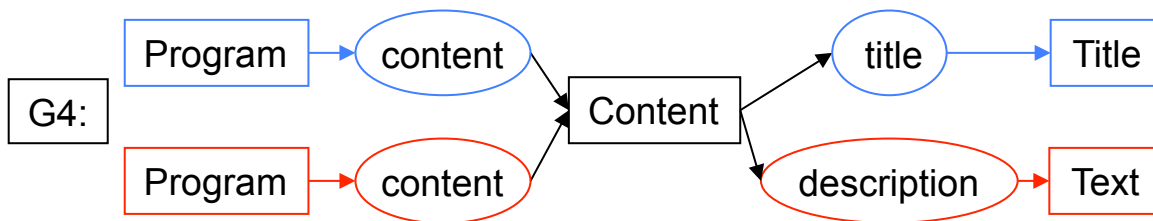
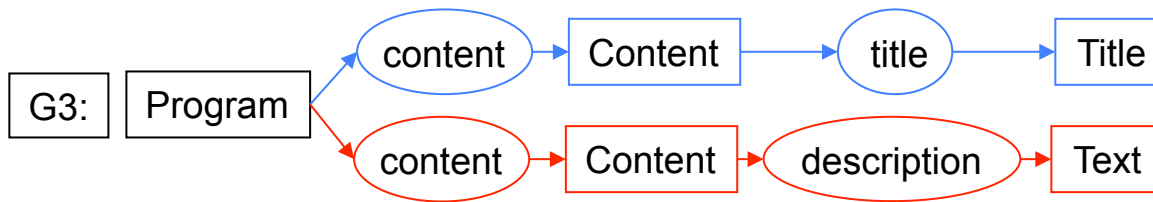
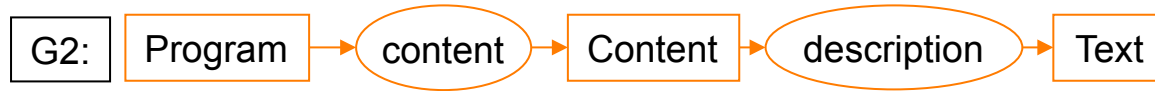
# Exemple de jointure maximale



# Limitations







```
<?xml version="1.0" encoding="ISO-8859-1" ?>
```

```
<tv generator-info-name="TSReader">
```

```
[...]
```

```
<channel id="1537-TF1">
```

```
<display-name lang="en">TF1</display-name>
```

```
<transport-stream-ID>6</transport-stream-ID>
```

```
<signal-info>-0.0 MHz</signal-info>
```

```
</channel>
```

```
<programme start="20061127063959" stop="20061127064753" channel="1537-TF1">
```

```
<title>Jt matin</title>
```

```
<desc>|-0.0 MHz</desc>
```

```
</programme>
```

```
<programme start="20061127064754" stop="20061127083027" channel="1537-TF1">
```

```
<title>TF1 JEUNESSE</title>
```

```
<desc>Au sommaire «Franklin». «Tabaluga». «Dora». «Bob l'éponge».|-0.0 MHz</desc>
```

```
</programme>
```

```
[...]
```

```
</tv>
```



```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE tv SYSTEM "xmltv.dtd">
<tv source-info-url="http://telepoche.guidetele.com/" generator-info-name="XMLTV" >
```

```
  <channel id="C1.telepoche.com">
    <display-name>tf1</display-name>
    <icon src="http://static.guidetele.com/c_img/chaine/tf1.gif" />
  </channel>
```

**[...]**

```
  <programme start="20061127064500 +0100" stop="20061127083500 +0100"
showview="5755621" channel="tf1">
    <title>TF1 Jeunesse</title>
    <desc lang="fr">Franklin. Tabaluga. Dora l'exploratrice(sous-titrage télétexte).</desc>
    <category lang="fr">emission jeunesse</category>
  </programme>
```

**[...]**

```
</tv>
```

# Fusion de deux sources

```
// Informations extraites de la source 1 (telepoche.fr) :
```

```
graphe ("source1gr1", [Mag_TV]-nom->[Nom_Source : "telepoche.fr"]).
graphe ("source1gr2", [Programme]-support_diffusion->[Chaine_TV]-nom->[Nom_Chaine :
France4]).
graphe ("source1gr3", [Programme]-contenu->[Contenu]-titre->[Titre : Rhinocéros]).
graphe ("source1gr4", [Programme]-contenu->[Contenu]-descr_LN->[Texte : "Après avoir connu
un grand succès parisien"]).
graphe ("source1gr5", [Programme] -
    -showView->[Numero_ShowView : "51403862"],
    -start->[Date : "20060626131500"],
    -stop->[Date : "20060626151500"],
    -langue_diffusion->[Langue : Français],
    -duree->[Duree : "90 minutes"]).

graphe ("source1gr6", [Spectacle]).
graphe ("source1gr7", [Programme]-presentateur->[Personne : "Charlotte Lipinska"]).
```

```
// Informations extraites de la source 2 (DVB) :
```

```
graphe ("source2gr1", [Source]-nom->[Nom_Source : "DVB"]).
graphe ("source2gr2", [Chaine_TV]-
    -nom->[Nom_Chaine : France4"],
    -provider->[Provider : "GR1"],
    -transport-stream->[TransportStream : "1(0x0001) -0.0Mhz"]).
graphe ("source2gr3", [Programme] -
    -start->[Date : "20060626131500"],
    -duree->[Durée : "90 minutes"],
    -langue_diffusion->[Langue : Français],
    -classement_parental->[Classement : "Unknown"],
    -caractéristique_Audio->[Carc_Audio : stereo]).

graphe ("source2gr4", [Spectacle]).
graphe ("source2gr5", [Programme]-contenu->[Contenu]-titre->[Titre : Rhinocéros]).
graphe ("source2gr6", [Programme]-contenu->[Contenu]-descr_LN->[Texte : "Théâtre"]).
```

# Graphe canonique

[Program] -

- > (start) -> [Date]
- > (stop) -> [Date]
- > (original\_language) -> [Language]
- > (diffusion\_language) -> [Language]
- > (duration) -> [Duration]
- > (content) -> [Content]-
  - > (description) -> [Text]
  - > (title) -> [Title]
  - > (theme) -> [Theme]
- > (diffusion\_support) -> [Channel]
- > (show-view) -> [ShowViewNumber]

# Difficultés de la fusion

## Incohérence

[Program #0] -

- (diffusion\_support) -> [Channel = "tf1"],
- (start)->[Date = "2006.11.27.06.45.00"],
- (end)->[Date = "2006.11.27.08.35.00"],
- (show-View)->[showViewNumber = "5755621"],
- (content) ->[Content] - (title) -> [Title = "TF! Jeunesse"]

[Program #0] -

- (diffusion\_support) -> [Channel = "tf1"],
- (start) -> [Date = "2006.11.27.06.47.54"],
- (end) -> [Date = "2006.11.27.08.30.27"],
- (content) ->[Content] - (title) -> [Title = "TF ! JEUNESSE"]

[Program #0] -

- (show-View) -> [showViewNumber = "5755621"],
- **(start) ->[Date = "2006.11.27.06.45.00"],**
- **(end) -> [Date = "2006.11.27.08.30.27"],**
- (content) -> [Content] – (title) -> [Title = "TF! Jeunesse"],
- (diffusion\_support) -> [Channel = "tf1"],

[Program #0] -

- (show-View) -> [showViewNumber = "5755621"],
- **(start) ->[Date = "2006.11.27.06.45.00"],**
- **(start) ->[Date = "2006.11.27.06.47.54"],**
- **(end) -> [Date = "2006.11.27.08.35.00"],**
- **(end) -> [Date = "2006.11.27.08.30.27"],**
- (content) -> [Content] – (title) -> [Title = "TF! Jeunesse"],
- (diffusion\_support) -> [Channel = "tf1"],

```
<?xml version="1.0" encoding="ISO-8859-1"?>
```

```
<!DOCTYPE tv SYSTEM "xmltv.dtd">
```

```
<tv source-info-url="http://telepoche.guidetele.com/" generator-info-name="XMLTV" >
```

```
  <channel id="C1.telepoche.com">
```

```
    <display-name>tf1</display-name>
```

```
    <icon src="http://static.guidetele.com/c_img/chaine/tf1.gif" />
```

```
  </channel>
```

```
  [...]
```

```
    <programme start="20061127064500 +0100" stop="20061127083500 +0100"  
    showview="5755621" channel="tf1">
```

```
      <title>TF! Jeunesse</title>
```

```
      <desc lang="fr">Franklin. Tabaluga. Dora l'exploratrice(sous-titrage télétexte).</desc>
```

```
      <category lang="fr">emission jeunesse</category>
```

```
    </programme>
```

```
  [...]
```

```
</tv>
```

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
```

```
<tv generator-info-name="TSReader">
```

```
[...]
```

```
<channel id="1537-TF1">
```

```
<display-name lang="en">TF1</display-name>
```

```
<transport-stream-ID>6</transport-stream-ID>
```

```
<signal-info>-0.0 MHz</signal-info>
```

```
</channel>
```

```
<programme start="20061127063959" stop="20061127064753" channel="1537-TF1">
```

```
<title>Jt matin</title>
```

```
<desc>|-0.0 MHz</desc>
```

```
</programme>
```

```
<programme start="20061127064754" stop="20061127083027" channel="1537-TF1">
```

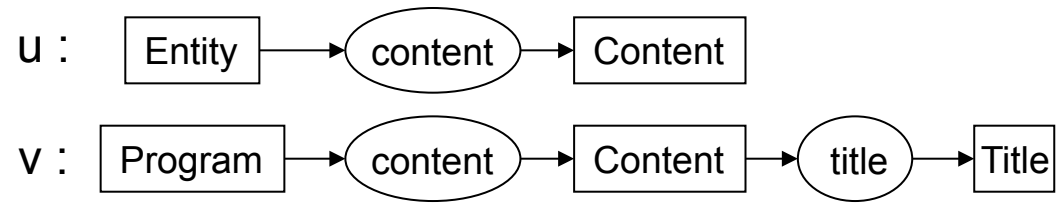
```
<title>TF ! JEUNESSE</title>
```

```
<desc>Au sommaire «Franklin». «Tabaluga». «Dora». «Bob l'éponge».|-0.0 MHz</desc>
```

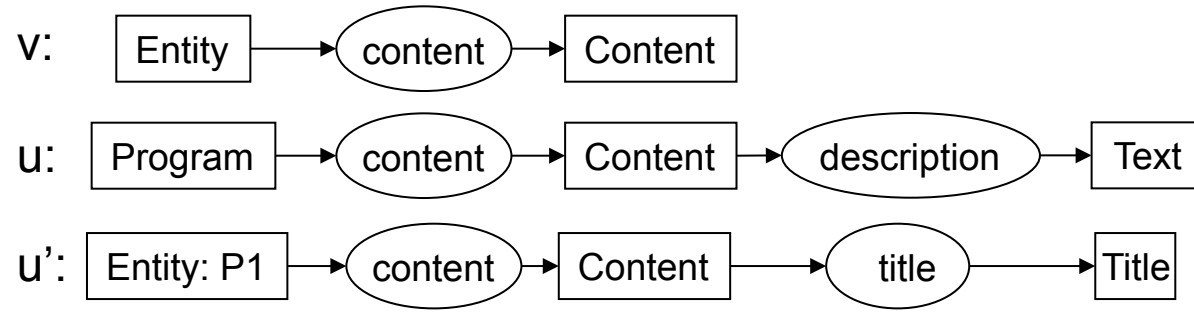
```
</programme>
```

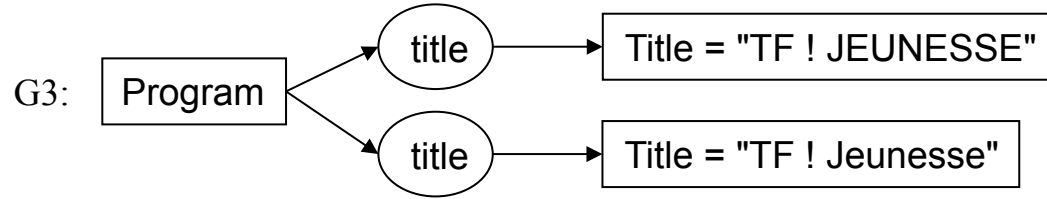
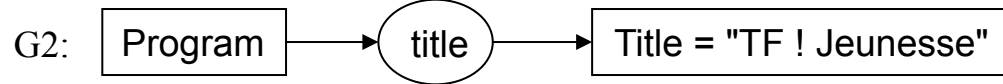
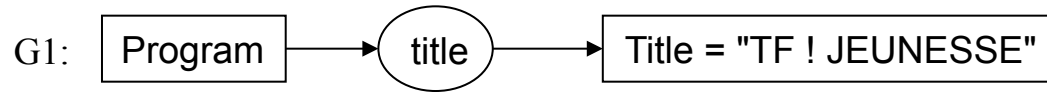
```
[...]
```

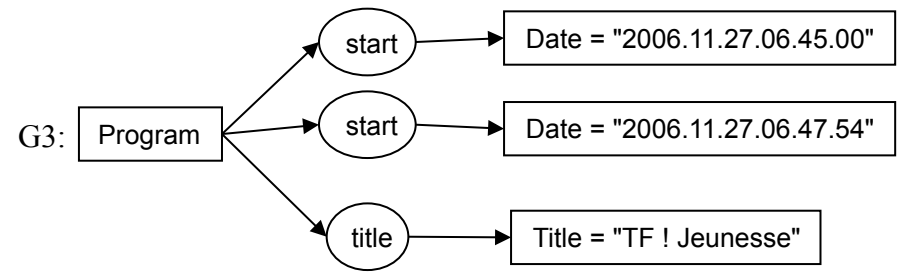
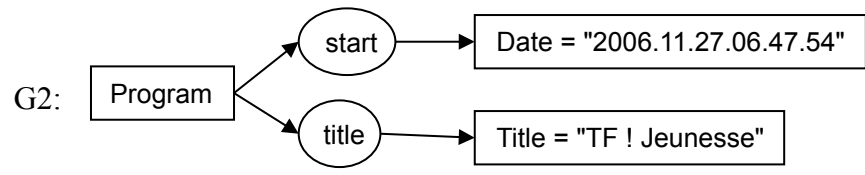
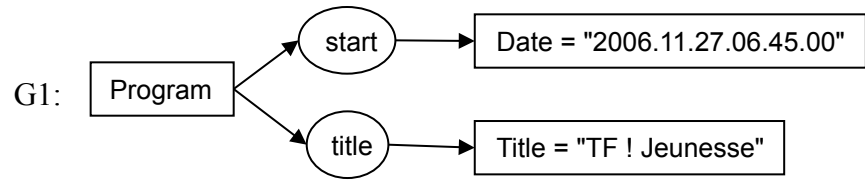
```
</tv>
```

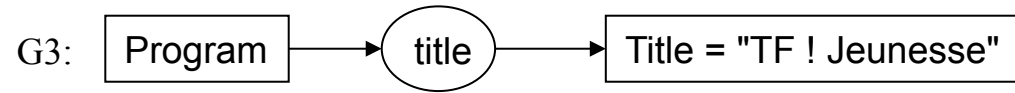
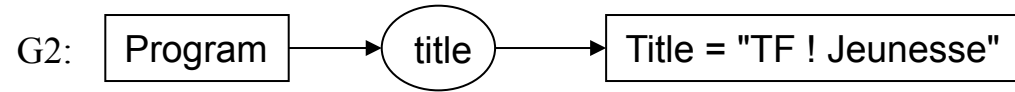
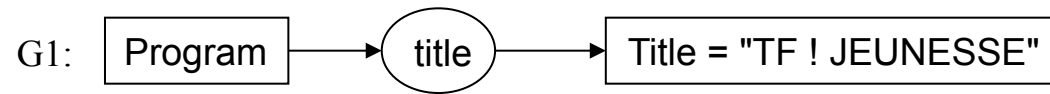


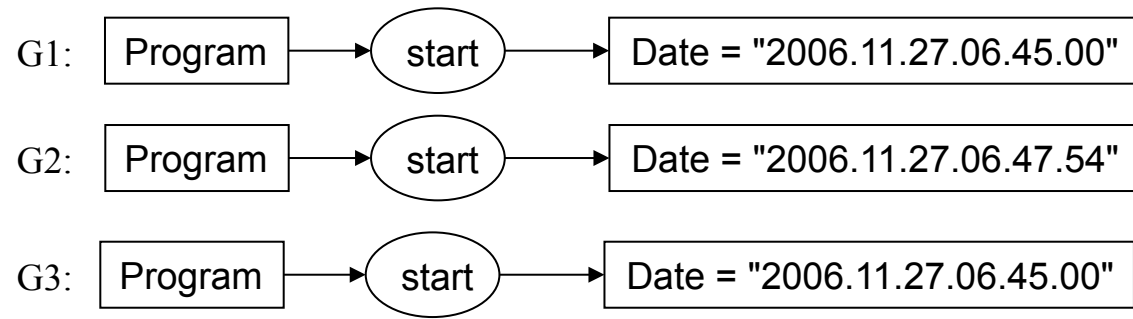


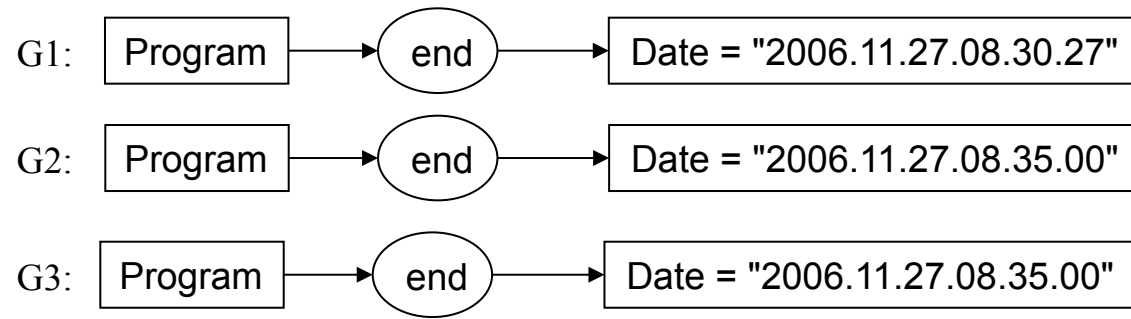












# Fusion de descriptions de programmes TV

**Objectif** : Automatiser l'enregistrement de programmes TV en fonction des habitudes d'un utilisateur.

## Besoins :

- Phases d'apprentissage et de recommandation : description complète de chaque programme
- Phase d'enregistrement : planning de programmation précis et sûr

## Fusion de 2 sources d'informations :

- flux de méta données de la TNT : **DVB**
- magazine TV en ligne : **telepoche.fr**

**Données de référence** : les enregistrements de l'INA

## Implantation d'une plateforme de fusion

### Utilisation de la plateforme AMINE :

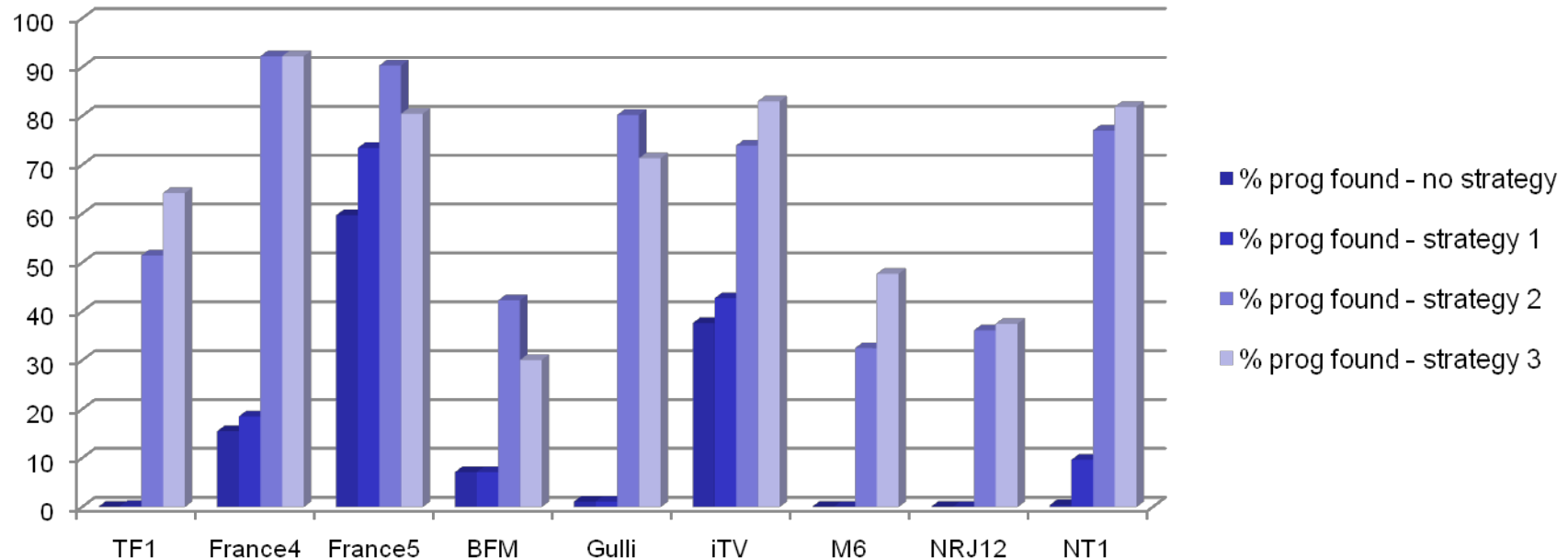
- Gestion de l'ontologie
- Manipulations simples de Graphes Conceptuels

### Stratégies :

- Classes JAVA indépendantes



## Resultats – Pertinence de l'extensions



Pas de stratégie - équivalent à la Jointure Maximale.

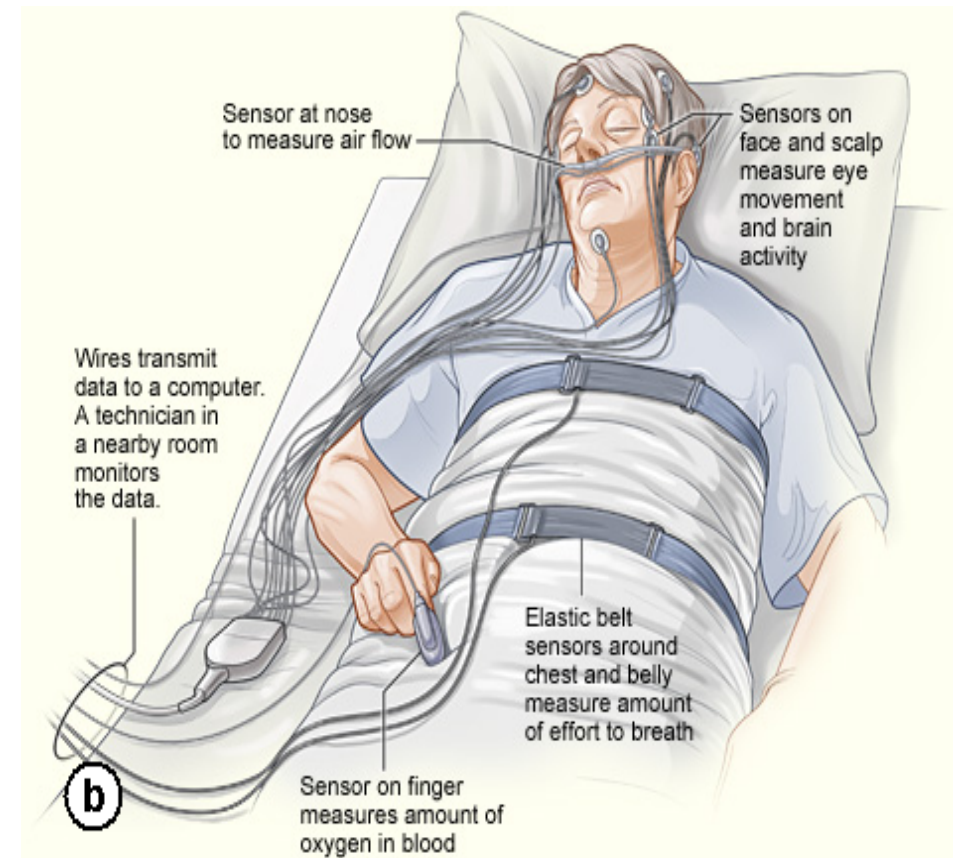
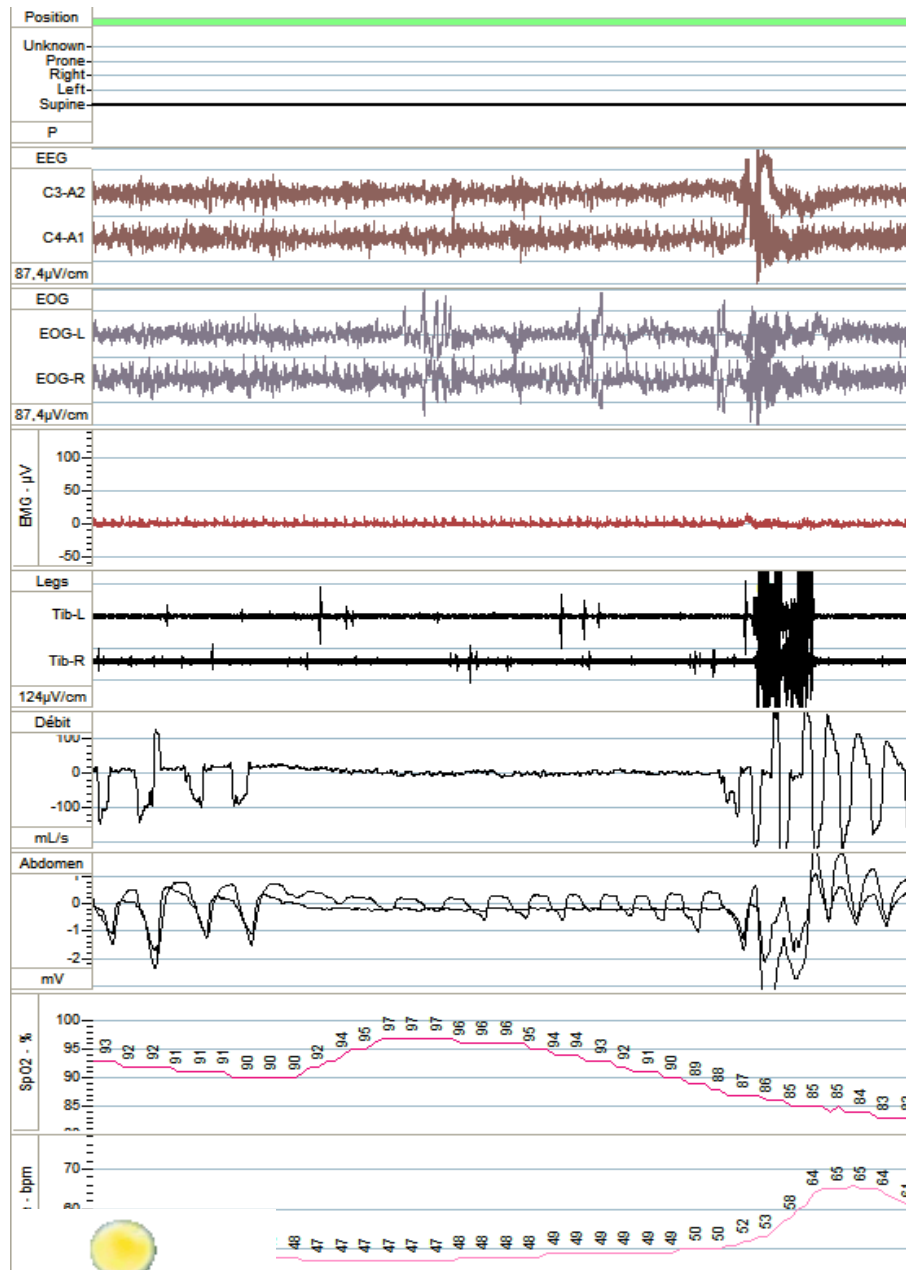
Stratégie 1: Étend la notion de **compatibilité entre les dates**.

Stratégie 2: Étend la notion de **compatibilité entre les dates et les titres**. Deux titres sont compatibles si l'un est contenu dans l'autre.

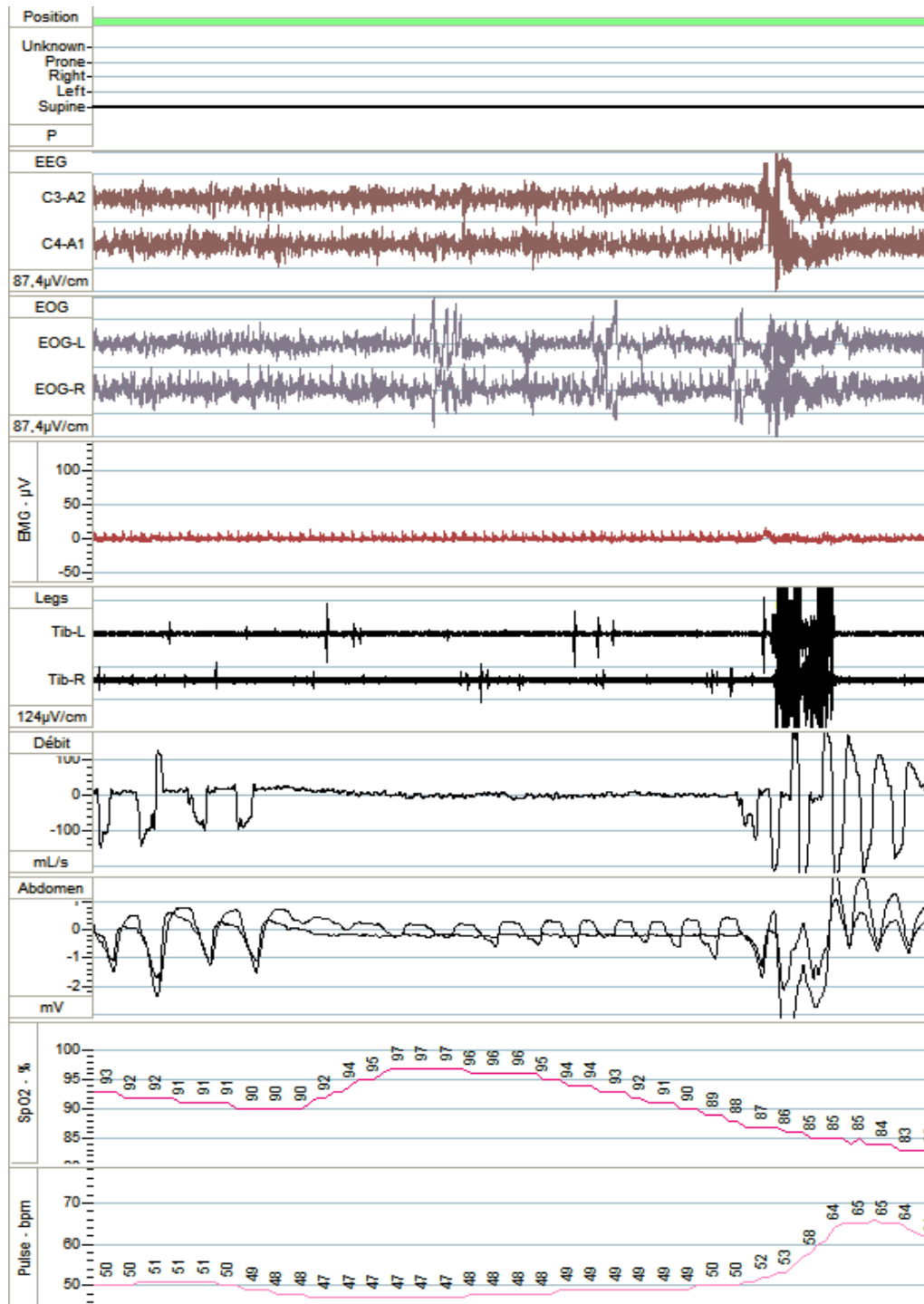
Stratégie 3: Étend la notion de **compatibilité entre les dates et les titres**. Deux titres sont compatibles si la longueur totale des sous chaînes communes entre les deux titres excède un seuil.



# Médecine maladies du sommeil

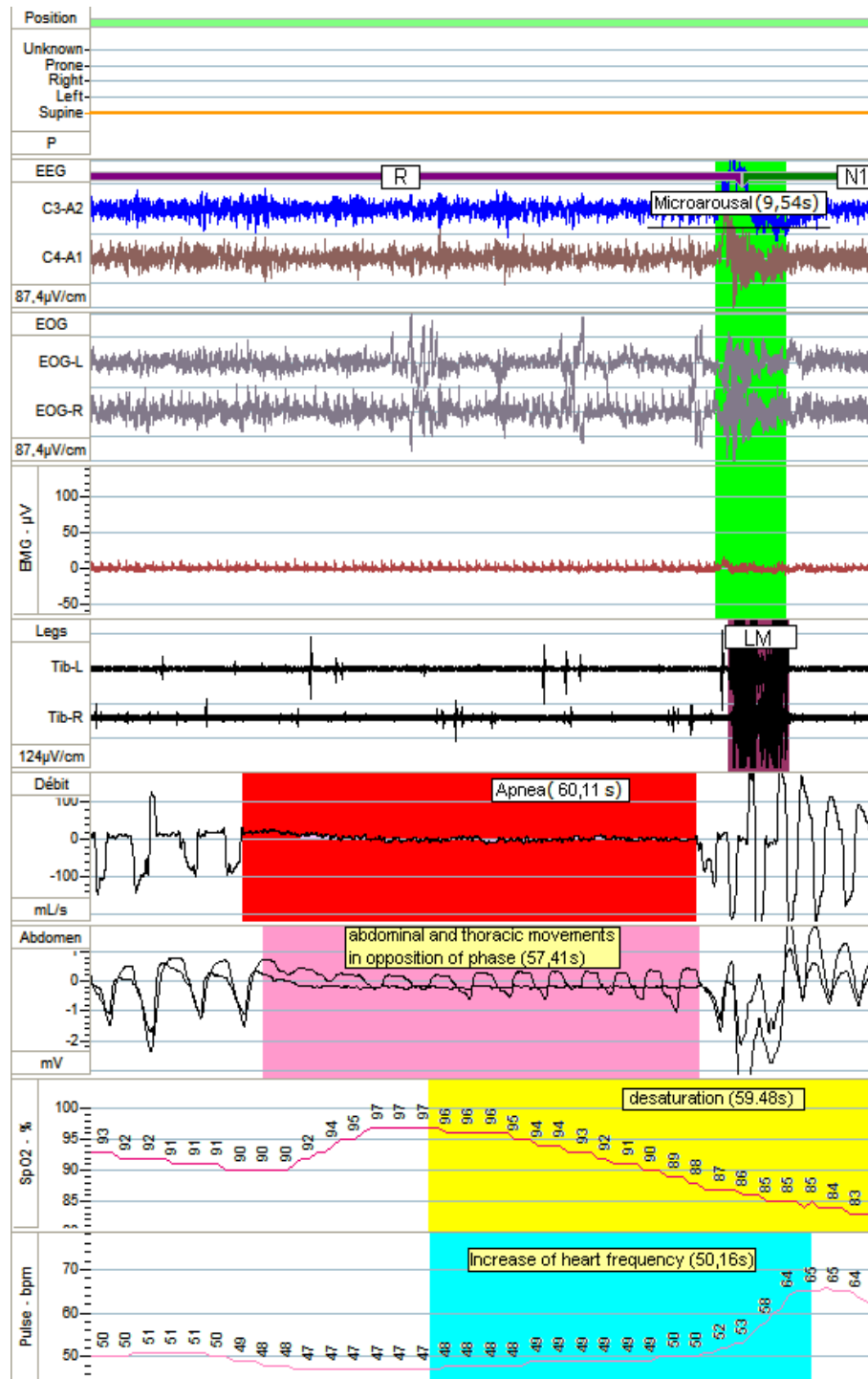


# Médecine sommeil SAS

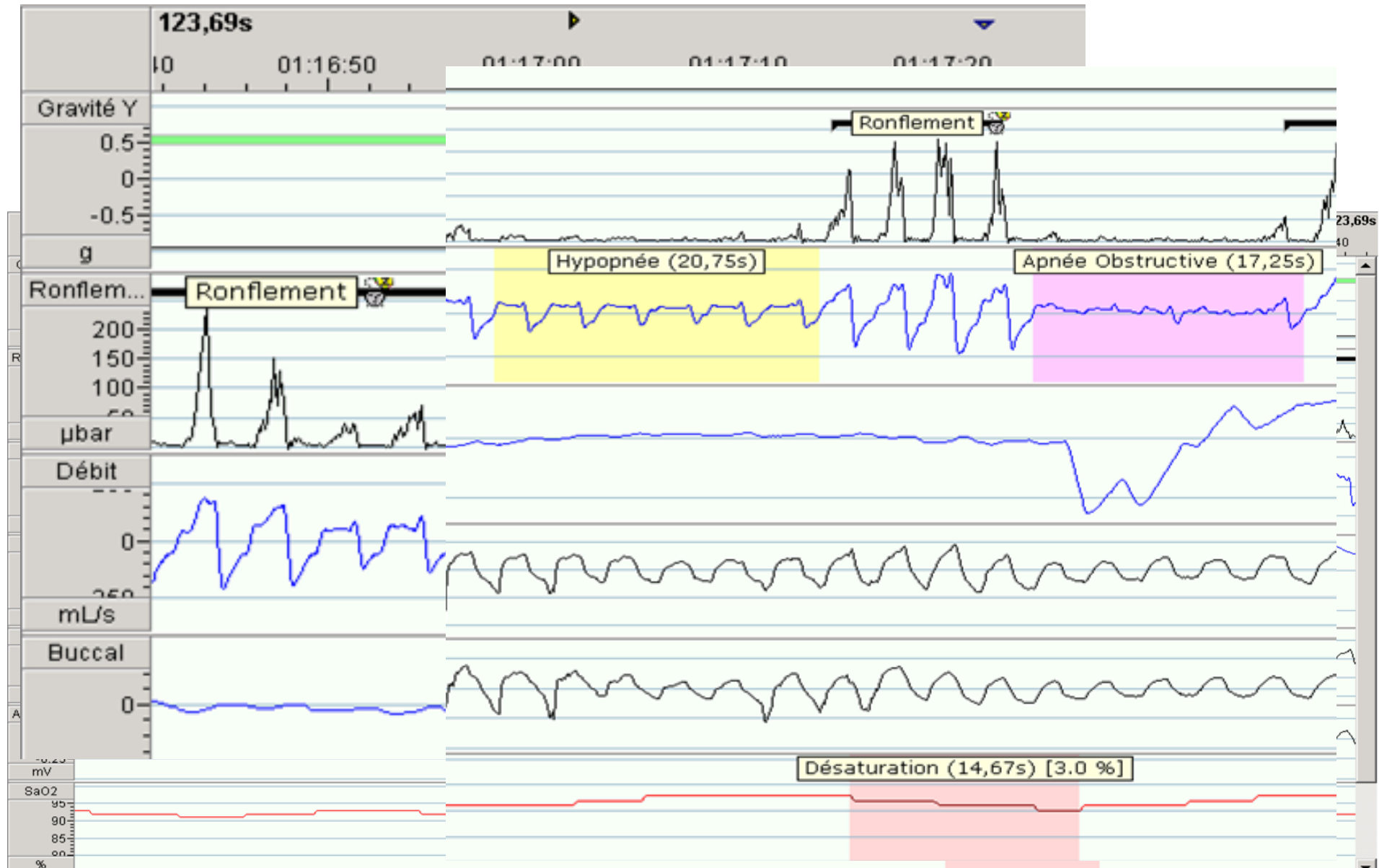


# Médecine sommeil SAS

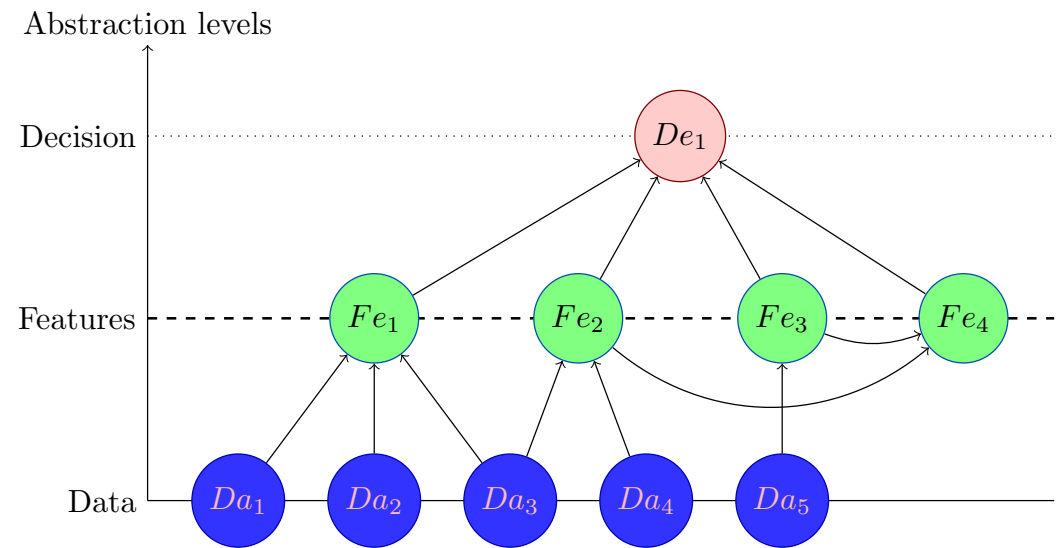
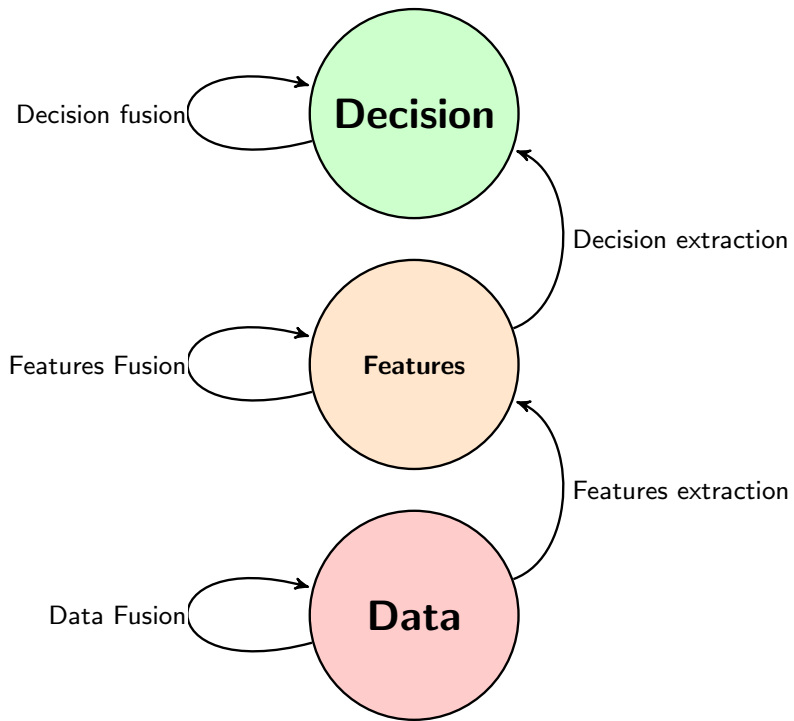
« Zonage »

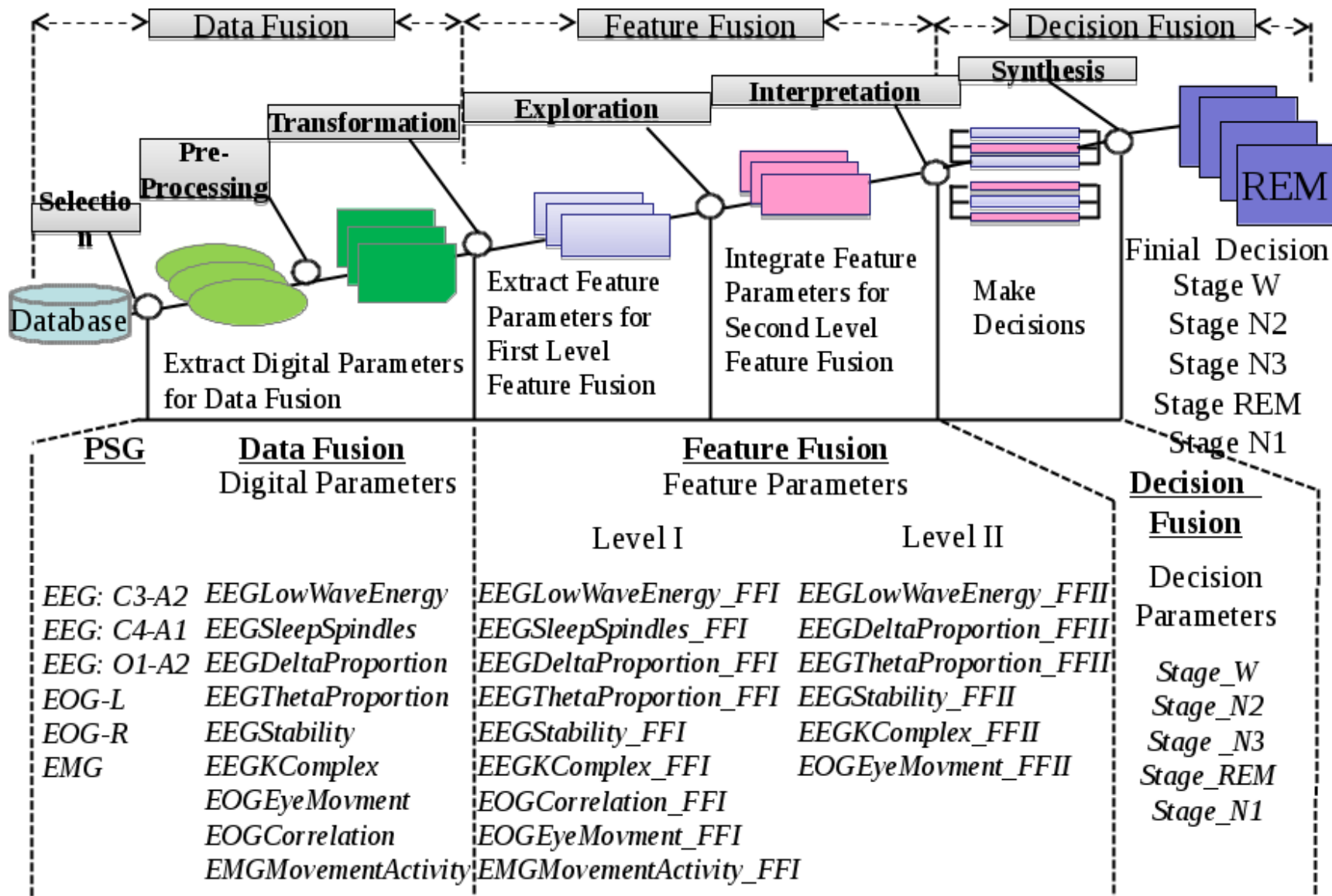


# Zonage du sommeil

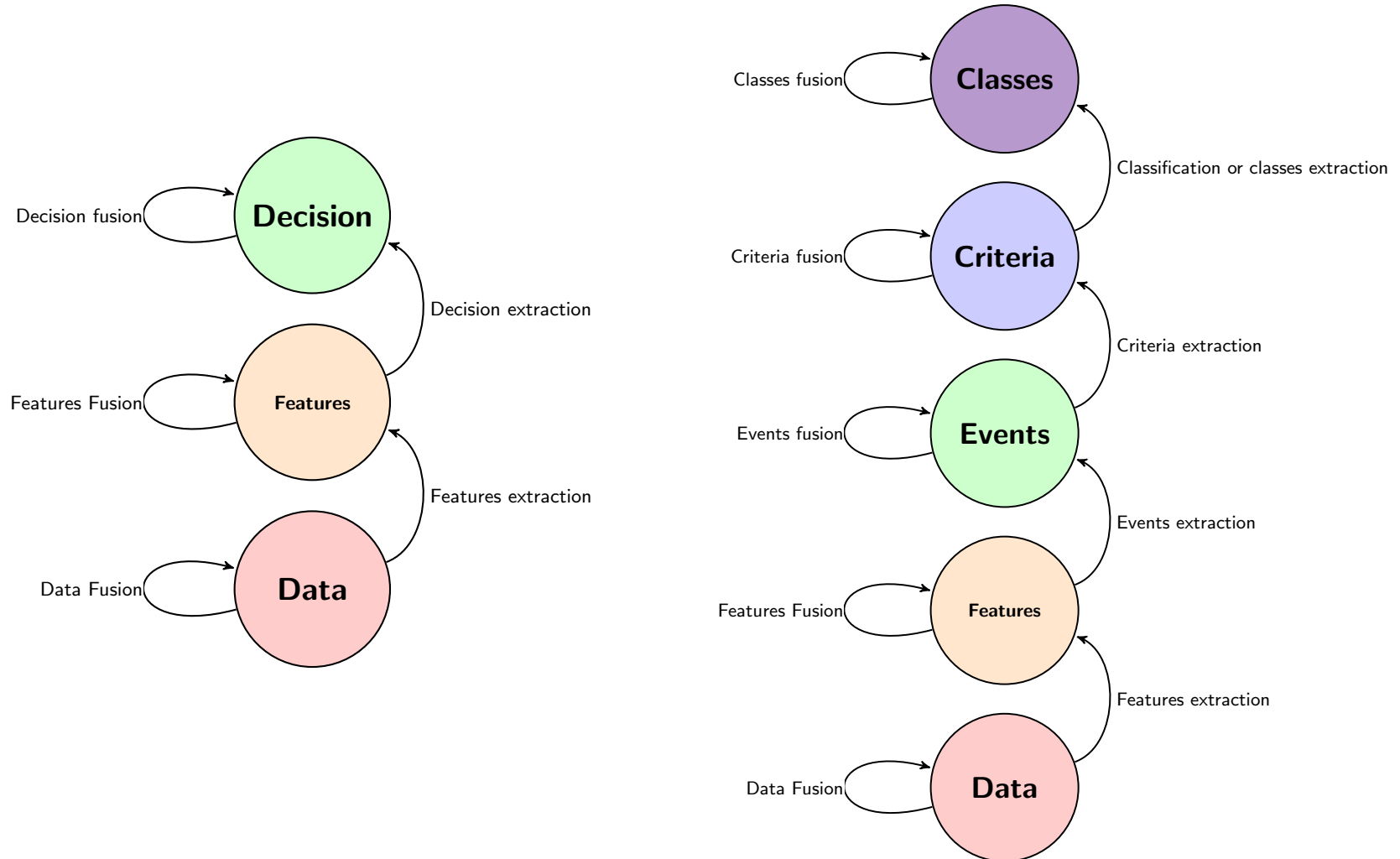


# Niveaux d'abstraction - fusion

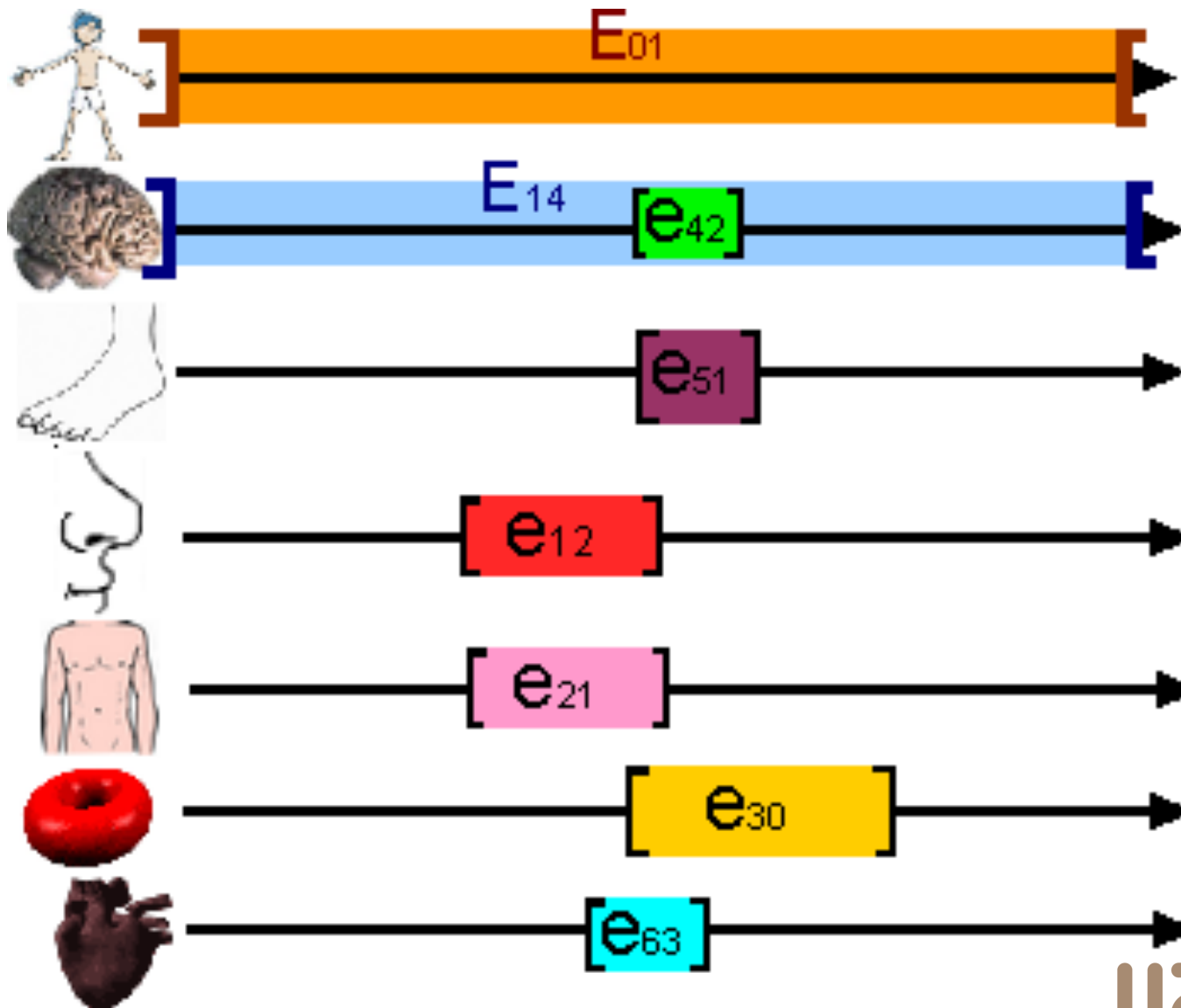




# Niveaux d'abstraction - fusion



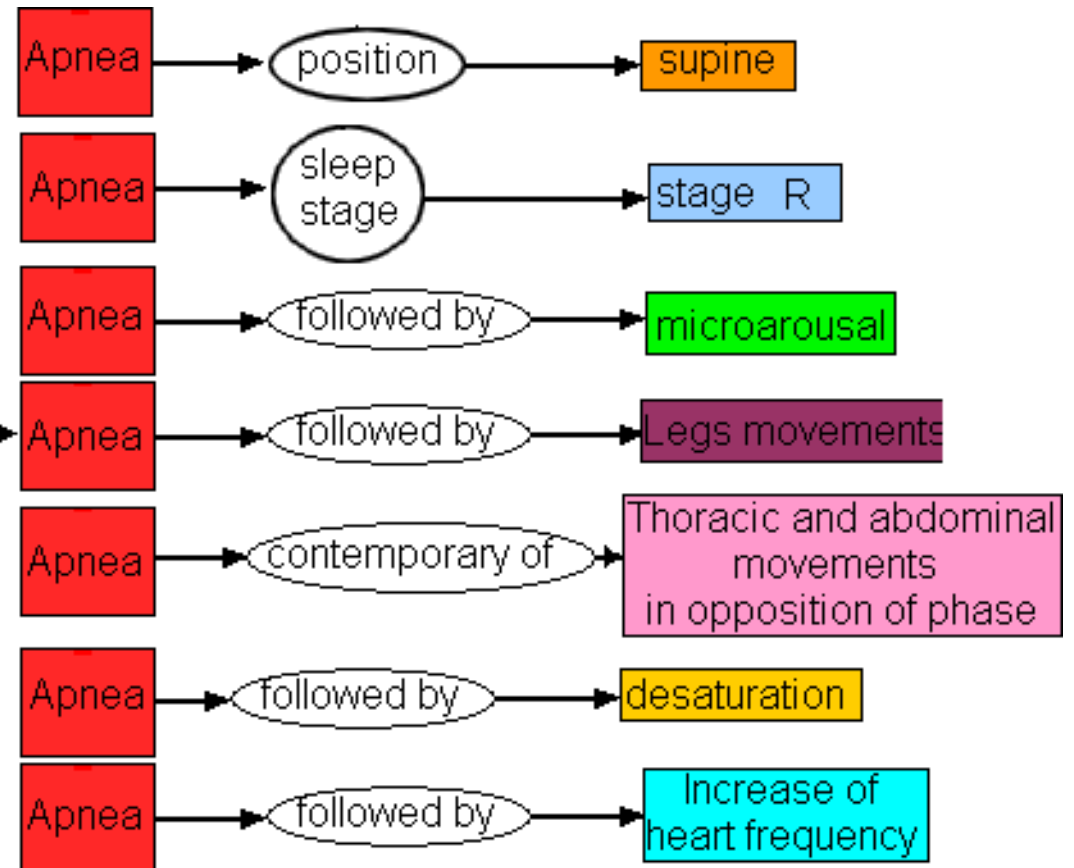
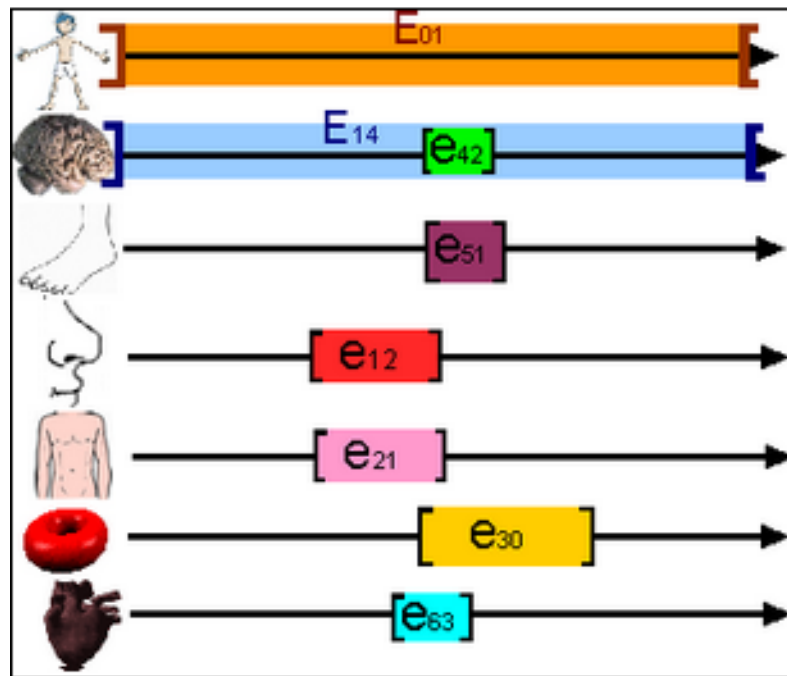
# Médecine – sommeil: événements





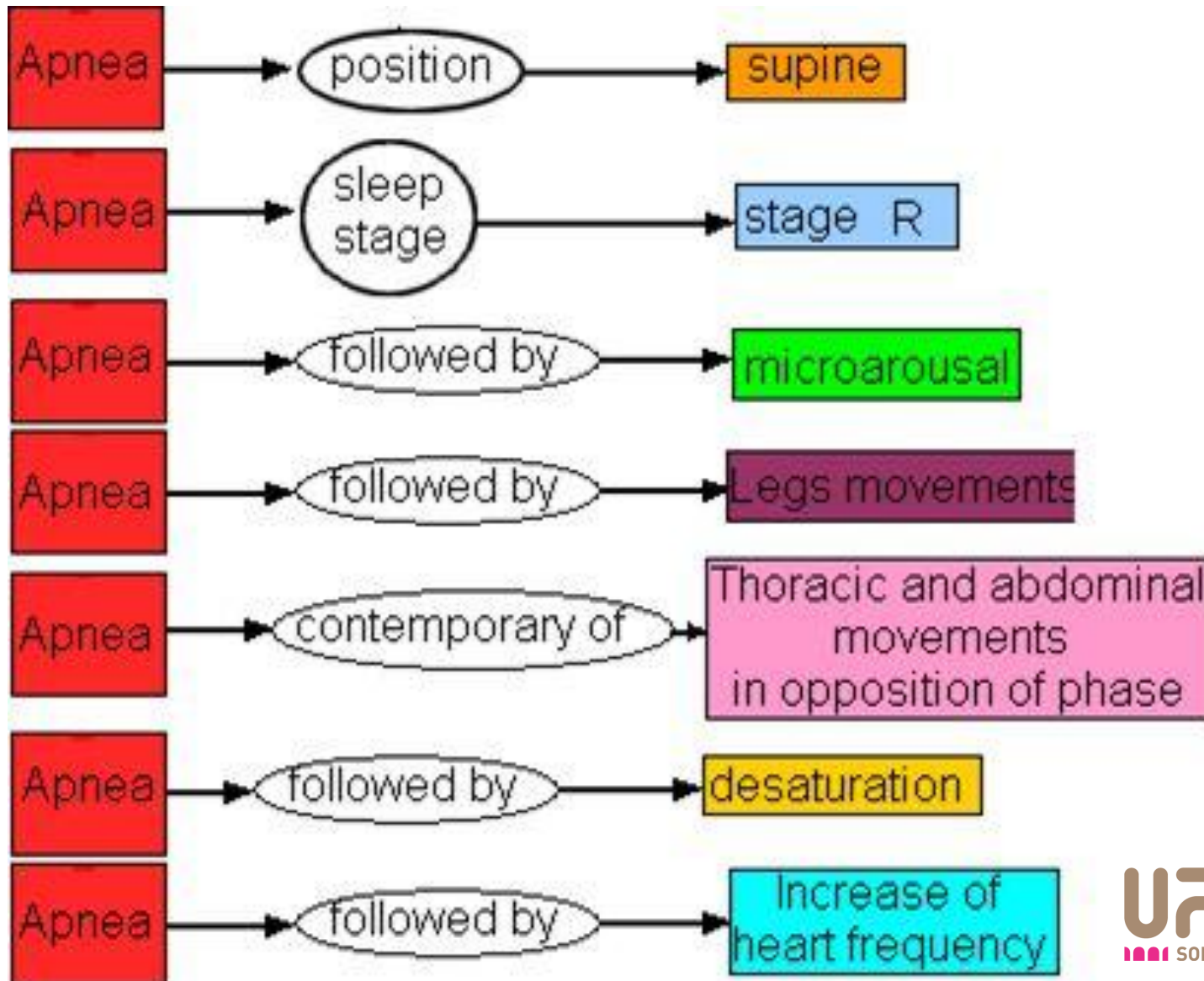
# Médecine – sommeil

## Représentation symbolique



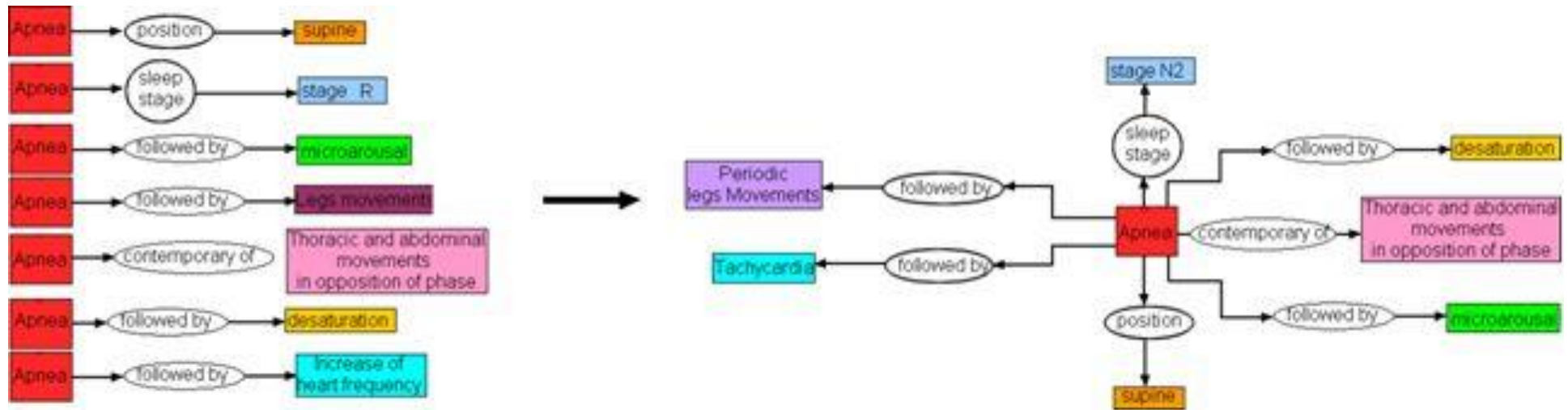


# Représentation GC

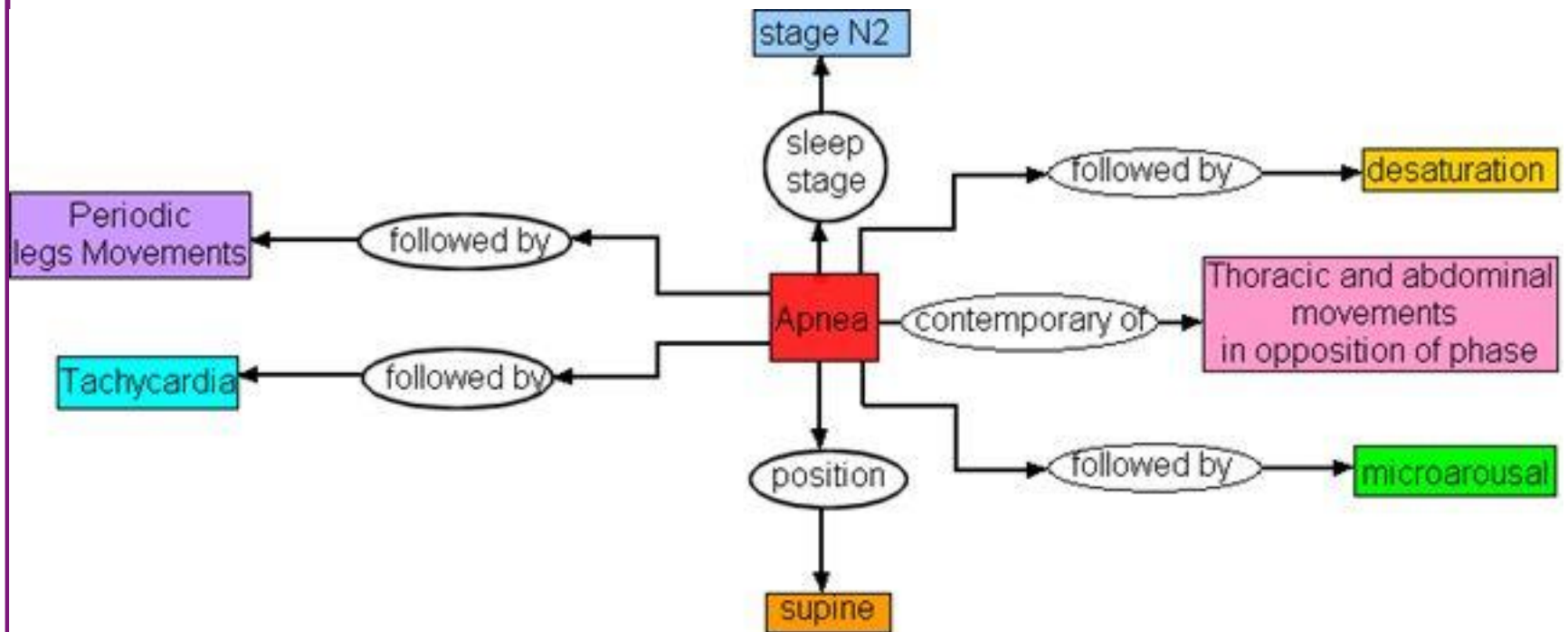




# Processus de fusion

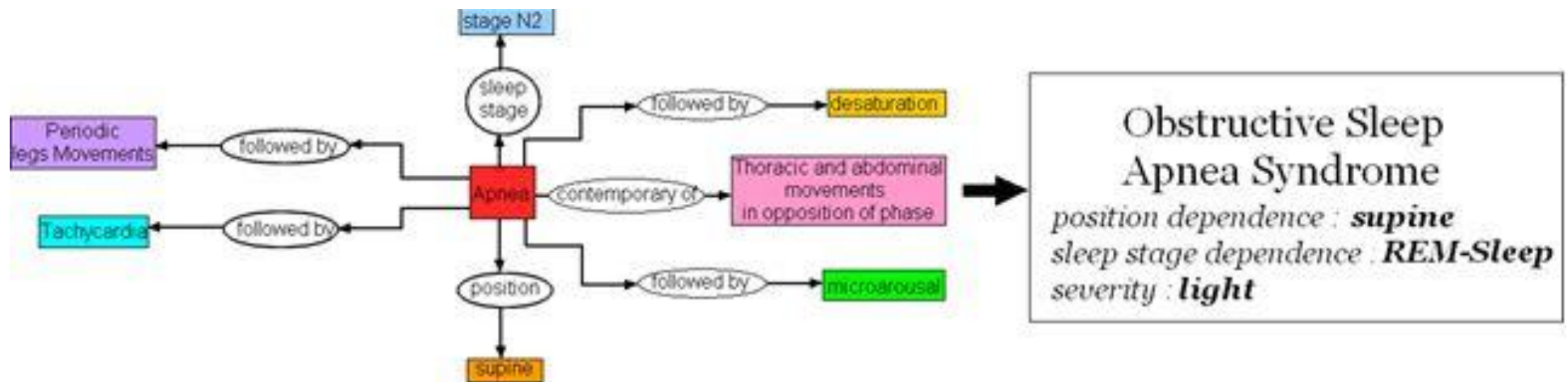


# Fusion symbolique: résultat





# Diagnostic



# Comparaison analyse automatique et humaine – *Ugon & al. 2012, 2019*

