



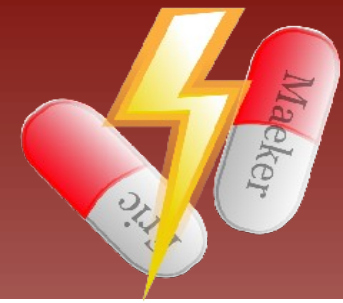
[www.freemedforms.com](http://www.freemedforms.com)



**FreeMedForms: an open EMR with management of drug-drug interactions and patient-drug interactions. An open source model.**



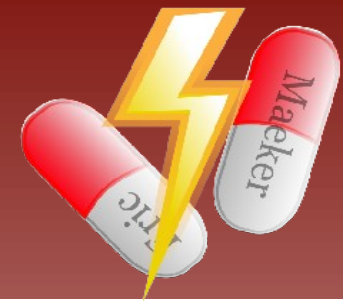
**Eric Maeker, MD (FR)**  
The FreeMedForms team



# FreeMedForms



- The FreeMedForms project is a **suite of medical applications** (EMR, prescriber, drugs interaction checker, some other coding assistants...)
- Driven by a **benevol community** of medical doctors and computer workers/scientists over the pulse of a french team.
- Composed of about 50 members (10 actives members)
- Supported by **OpenSuse Medical, Debian Med, Fedora Medical**, Arch Linux...
- Collaboration with other medical teams: GNUmed, FreeMed, Care2X, SynapseEMR



# FreeMedForms



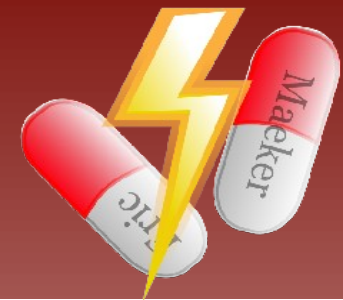
- Linux, MacOSX, Win32, Win64, (FreeBSD)
- C++ using Nokia's Qt libs
- Documented using Doxygen
- Massive usage of MVC architecture
- Builded using dynamic libraries with plugins architecture
- Using SQLite and/or MySQL for database



# DDI / PIM / FDI ???



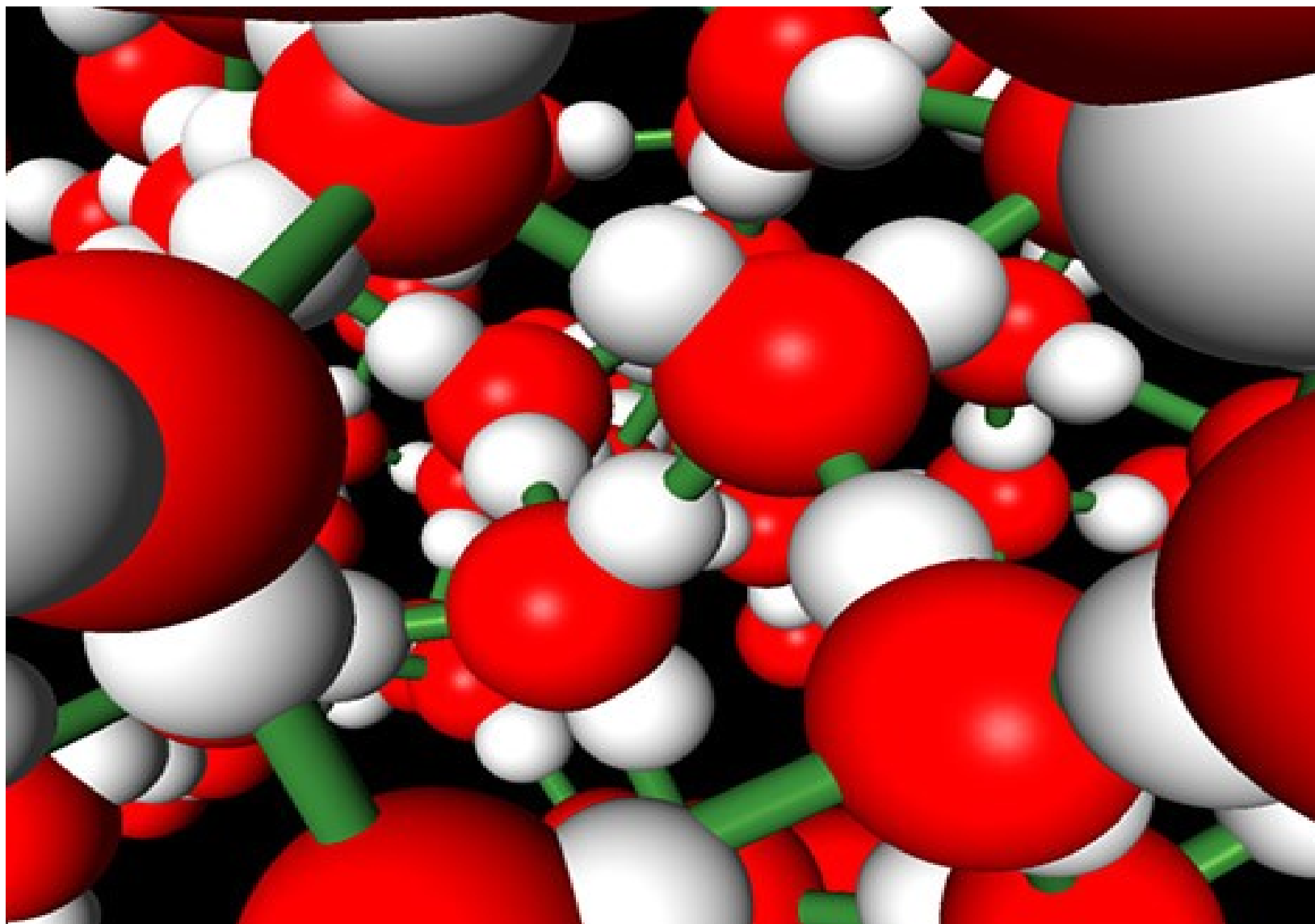
- Some short definitions, a drug can interact with:
  - Another drug == **drug-drug interaction** (DDI)
  - Patient's conditions and diseases (allergies, diseases, renal filtration, age...)
  - For old people == **potentially inappropriate medications** (PIM)
  - Food == **food-drug interactions** (FDI)
  - Some other items that are not listed here...
- Some « must to have » classifications:
  - ICD10, ATC (INN == **international non-proprietary name**)
- Each risk (DDI/PIM/FDI) as its own **Drug Engine** inside FreeMedForms



# FreeMedForms



## Drug Interaction Engines Presentation





# Drug Engine: DDI



- Started in 2008 with a very special attention for the DDI management
- DDI source data were identified [2-4]
- Free governmental drugs databases (FreeToolBox)
- Are actually available (with DDI management):
  - France, USA, Canada, Belgium, South Africa (partial), in preparation: Portugal, Denmark, Brazil
- Creation the **FreeDiams** application

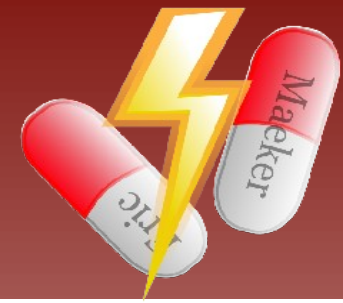
[2]: Thésaurus des interactions médicamenteuses. AFSSAPS, France

[3]: Drug Interactions: Cytochrome P450 Drug Interaction Table. Flockhart DA. Indiana University School of Medicine

[4]: P-glycoprotein Table - the Effect of Drugs and Foods. Oesterheld Jessica.

<http://www.freemedforms.com/>

RMLL 2011



# Drug Engine: PIM



- Quickly, the FreeMedForms EMR became usable (2010-11) we started the implementation of PIMs
- Main sources identified with PubMed, multiple countries (US, CA, FR, DE at least) [5-8]
- « By hand » XML encoding in connexion with
  - The ICD10 classification and plugin to process patient's diseases
  - The drug's ATC classification to process drugs
- 11 July 2011 → only 1 source is encoded (US)

[5]: Beers criteria updated. Arch Intern Med 163p2716-24(2003 Dec 8-22)

[6]: Priscus deutsch list. Dtsch Arztebl Int 107p543-51(2010 Aug)

[7]: French list. Rev Med Interne 30p592-601(2009 Jul)

[8]: MacLeod Canadian list. CMAJ 156p385-91(1997 Feb 1)





# What is a PIM ???



- PIMs are strong recommendation made by a panel of medical experts of the elderly (geriatricians)
- PIMs can be related
  - Only to drug (some drug should be avoid)
    - Eg: long acting benzodiazepines
  - And/or to the conditions and diseases of the patient
    - Eg: nsaid with chronic heart failure; fluoxetine with malnutrition
- This second part needs the ICD10 coding of the patient physiology and diseases
  - That is one the **\*\*major\*\*** problem of PIM calculation (time, knowledge...)





# FreeMedForms



**Workflow ?**





# Data (drugs)



## Raw drug database

### Requierements (mandatory):

- Brand drug names
- Know molecular composition
  - Molecule name
  - ATC of molecule (optionnal)
  - Dosage and reference to dosage
- Route of administration

### Optionnally:

- National unique identifier
- Drug ATC code
- Drug packaging
- Drug package prices

## FreeToolBox



C++  
SQLite  
+/- bash  
Still alpha

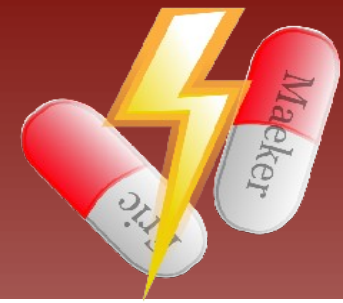
## Formalized FreeMedForms Drugs database

### Available:

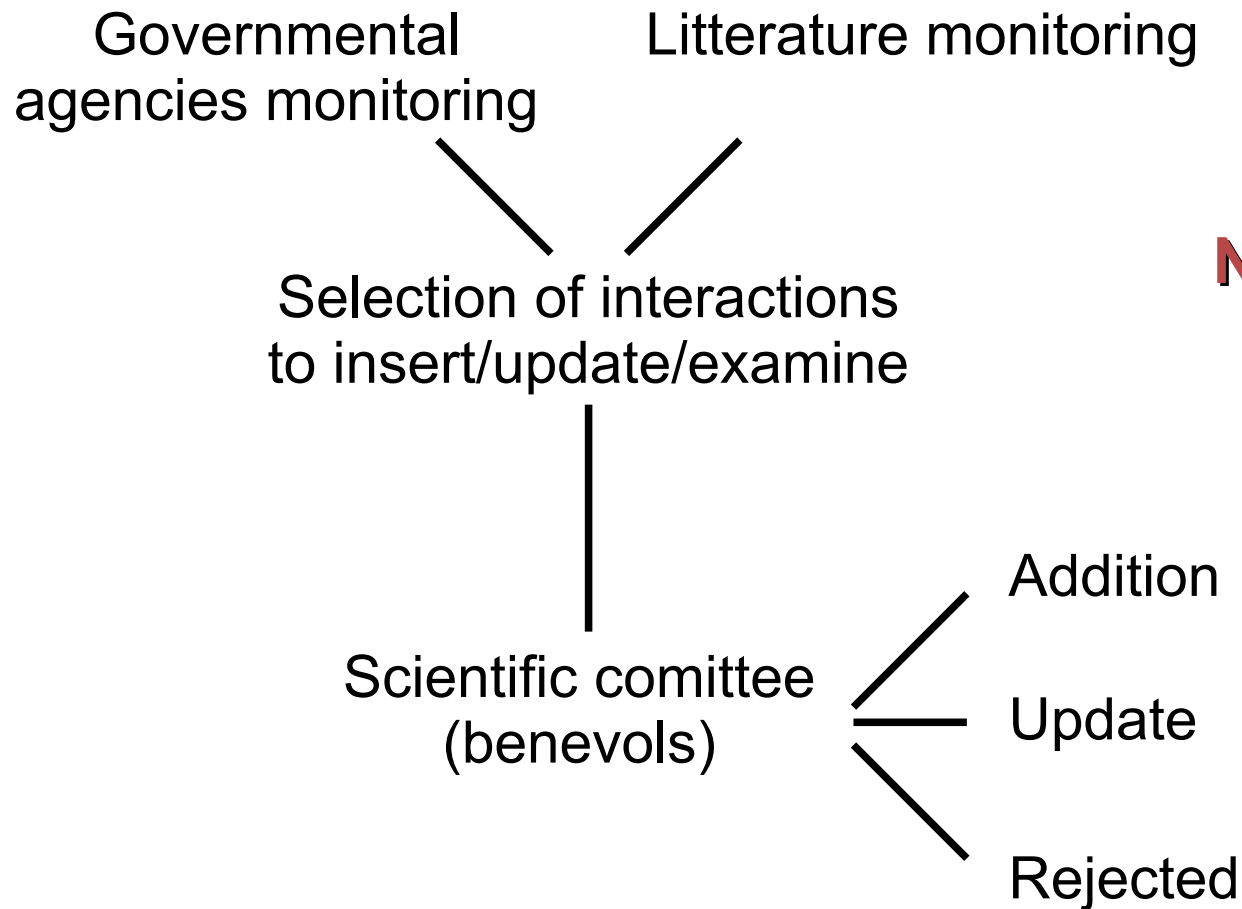
- Drug brand name
- Country
- INN composition with ATC links from the molecular composition of the drug
- Normalized route of administration
- Normalized dosage

### Not yet available:

- Packaging of drugs and price

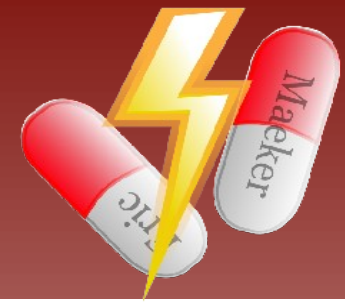


# Data (interactions)



**No automated data mining**

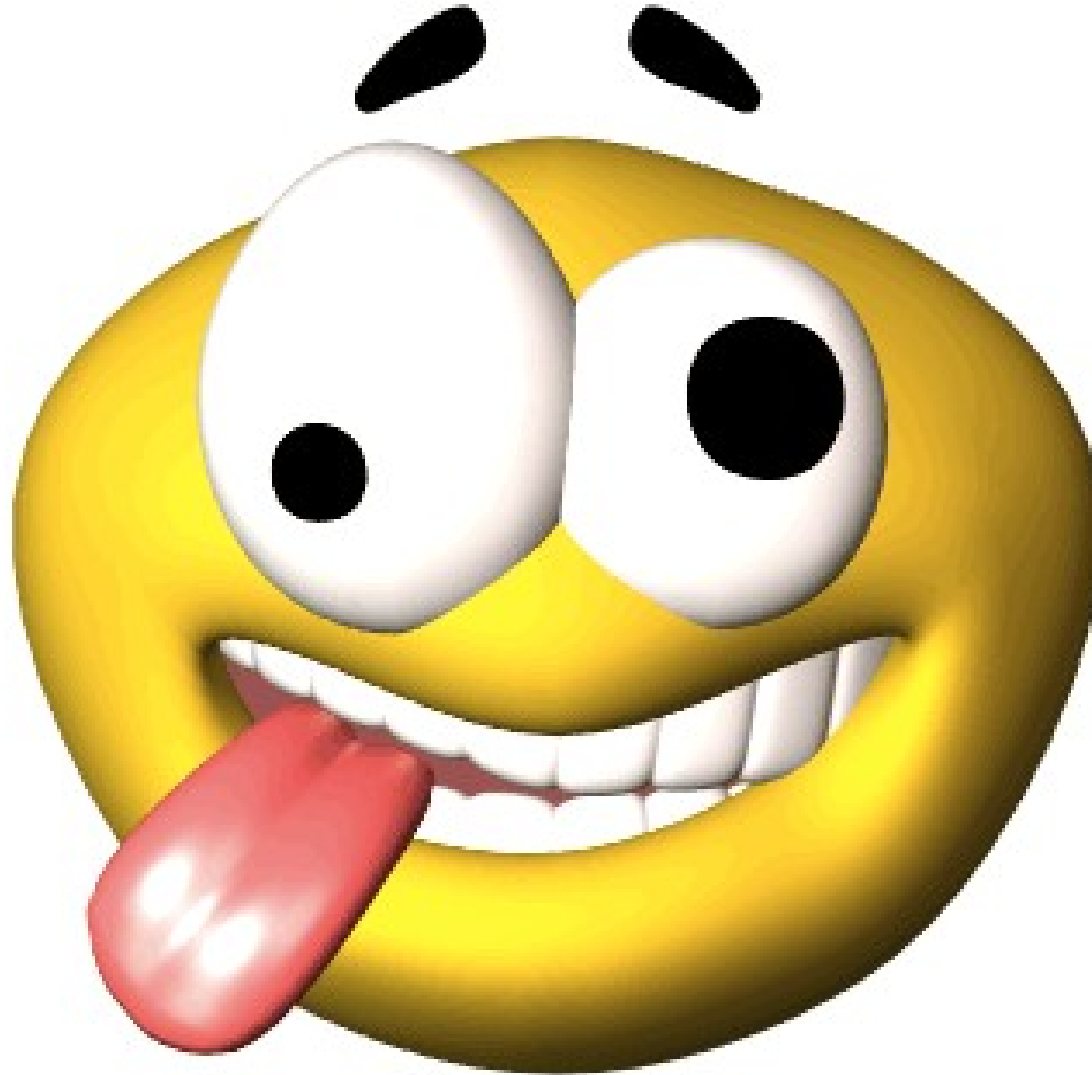
Translation and risks categorization / normalization



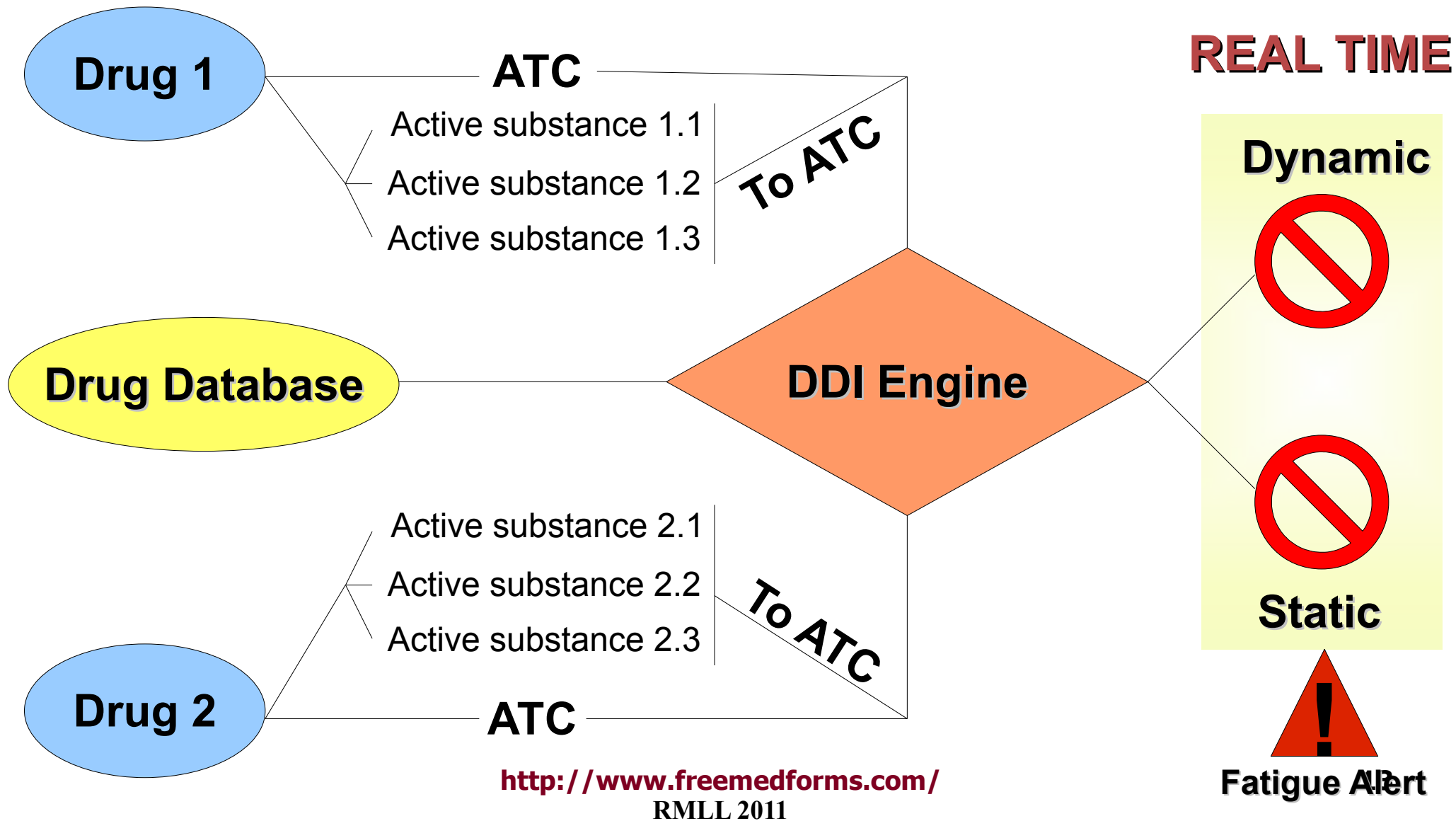
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Some philosophy ?



# Drug-Drug Interactions calculation





# Alert philosophy [9]

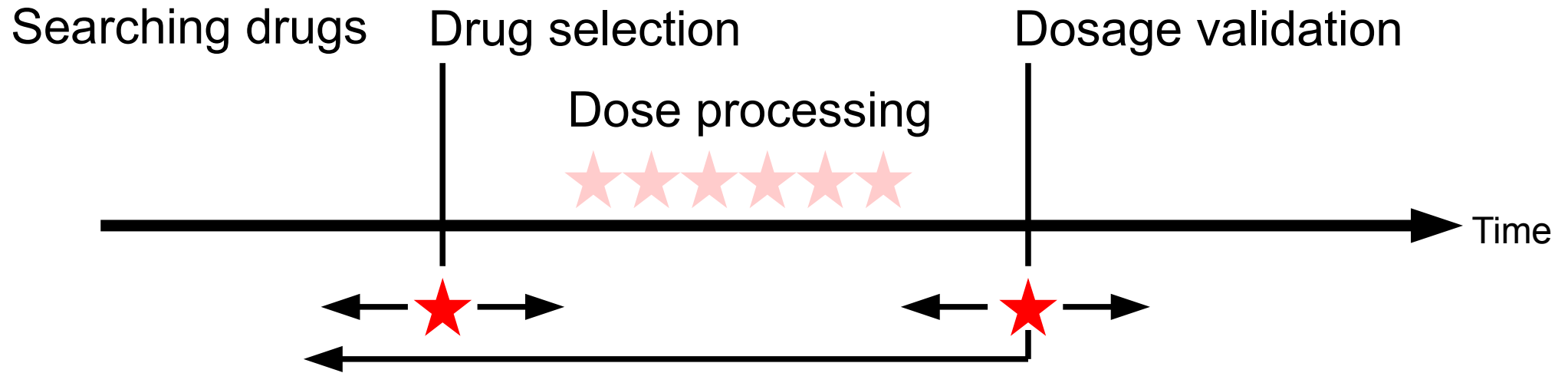


- Two kind of alerts: **static and dynamic alerts**
  - Static → icon and tooltip
  - Dynamic → blocking dialog
- Alert system provides **three level of risk**: low, medium, high;
- And an **infinite number of categories** (DDI, PIM, drug duplication, dose checking, allergies, intolerances...)
- Each drug engine (DDI / PIM) owns its alert computation
- **Threshold of alerts** can be adapted by the user for each type of alerts
- Question: cumulative score of drug interactions ?

[9]: J Am Med Inform Assoc. 2010 Sep-Oct;17(5):493-501.





# Timing of the alert system



Drugs allergies  
 Drugs intolerances  
 Processed  
 Noticed

\* DDI & PIM not dose-related:  
 processed  
 \* DDI & PIM dose-related:  
 noticed in some special cases or  
 if prescription is only a selection  
 of drugs (w/o dosing)  
 \* Management of route

DDI & PIM dose-related  
 processed and noticed

-  Dynamic alert  
And Alert processing
-  Informative alerts



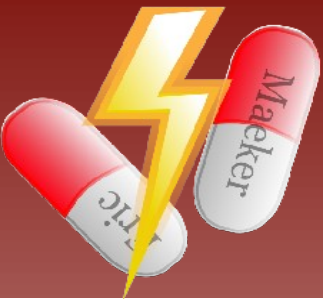


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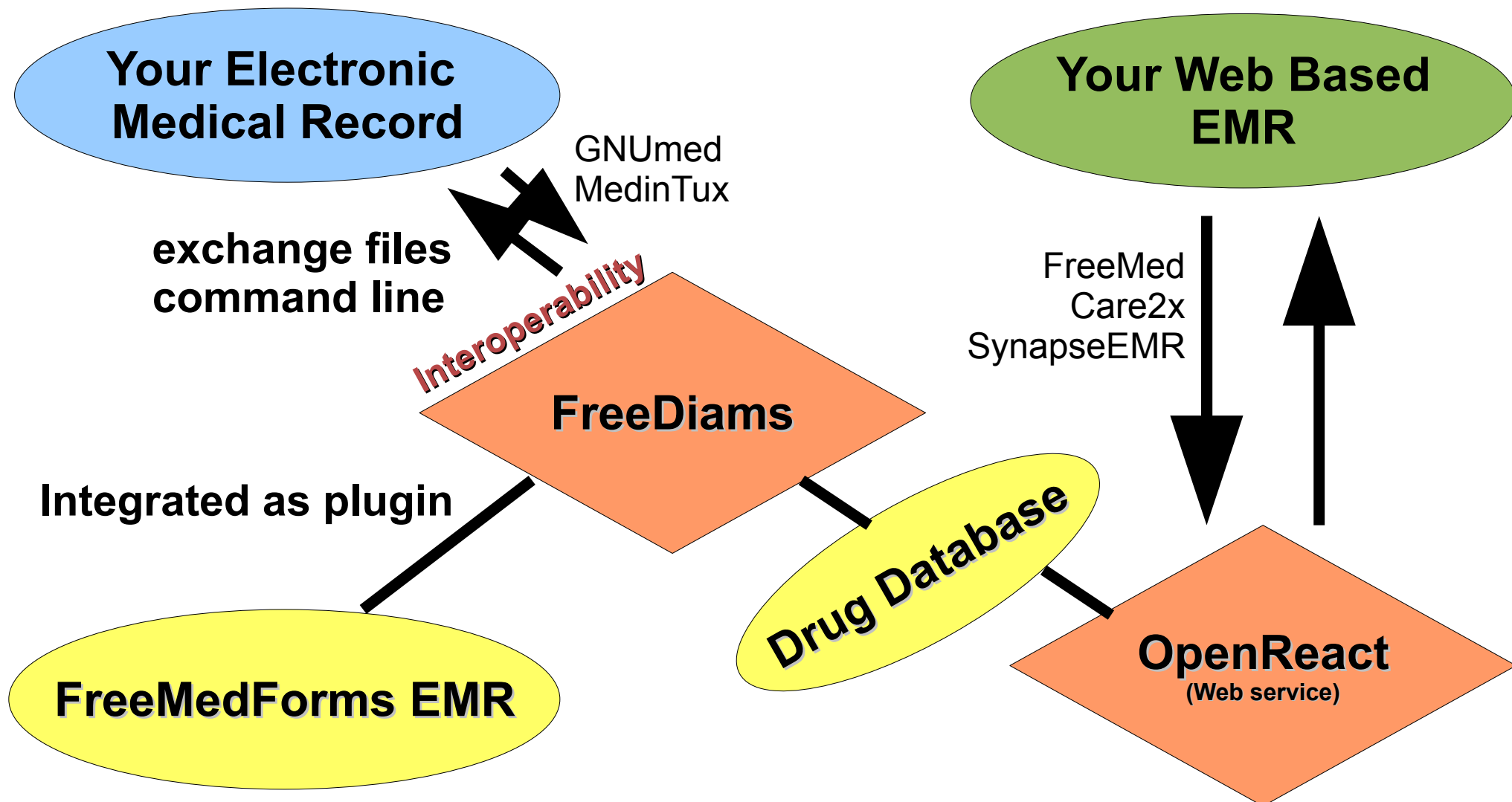


**Finger in...**





# Drug interactions: Interoperability





# FreeMedForms





# FreeMedForms Needs you !



- FreeMedForms is a great and big project
- Actually unfunded
- Need devs, testers, translators, MD, pharmacists... (and funds)
- Code is available @SVN:  
<http://code.google.com/p/freemedforms/source/checkout>
- Web site: <http://www.freemedforms.com/>
- Mailing: [freemedforms@googlegroups.com](mailto:freemedforms@googlegroups.com)
- Kisses to my wife and children (who support my devs...)
- Thanks, The FreeMedForms Team