



# From BIOPATTERN to Bioprofiling over Grid for eHealthcare

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# Outline of talk

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- Introduction
  - The BIOPATTERN project
  - Grand vision
- Biopattern and bioprofile
- Why over grid?
- BIOPATTERN Grid
  - Prototype and services
  - An illustrative example
- Concluding remarks and future work



# The BIOPATTERN Project

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- EU FP6, 4-year, Network of Excellence (NoE), project within the ICT for Health
- Involves 30 partners from healthcare, academia and industry.
- Brings together researchers in medical informatics, bioinformatics, biosignal analysis and e-delivery technology
- Partners are from 11 countries
- More information at <http://www.biopattern.org>



# BIOPATTERN – Grand Vision

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- “To integrate co-operative research aimed at a pan-European approach to coherent and intelligent analysis of a citizen's *bioprofile*; to make the analysis of this *bioprofile* remotely accessible to patients and clinicians; and to exploit the *bioprofile* information to combat major disease classes”.
- Vision is long term, but it inspires short-term objectives.

# Biopattern and Bioprofile – what are they?



- *Biopattern* – basic information which provides clues about underlying clinical evidence for diagnosis and treatment.
  - A snapshot which includes features derived from data (e.g. genomics, EEG, ECG, imaging etc );
  - Often used for diagnosis and short-term patient monitoring.
- *Bioprofile* – personal “fingerprint” that combines a person’s bio-history and future prognosis.
  - Combines data, biopatterns, analysis and predictions of future or likely susceptibility to diseases;
  - Should drive personalised and better healthcare.

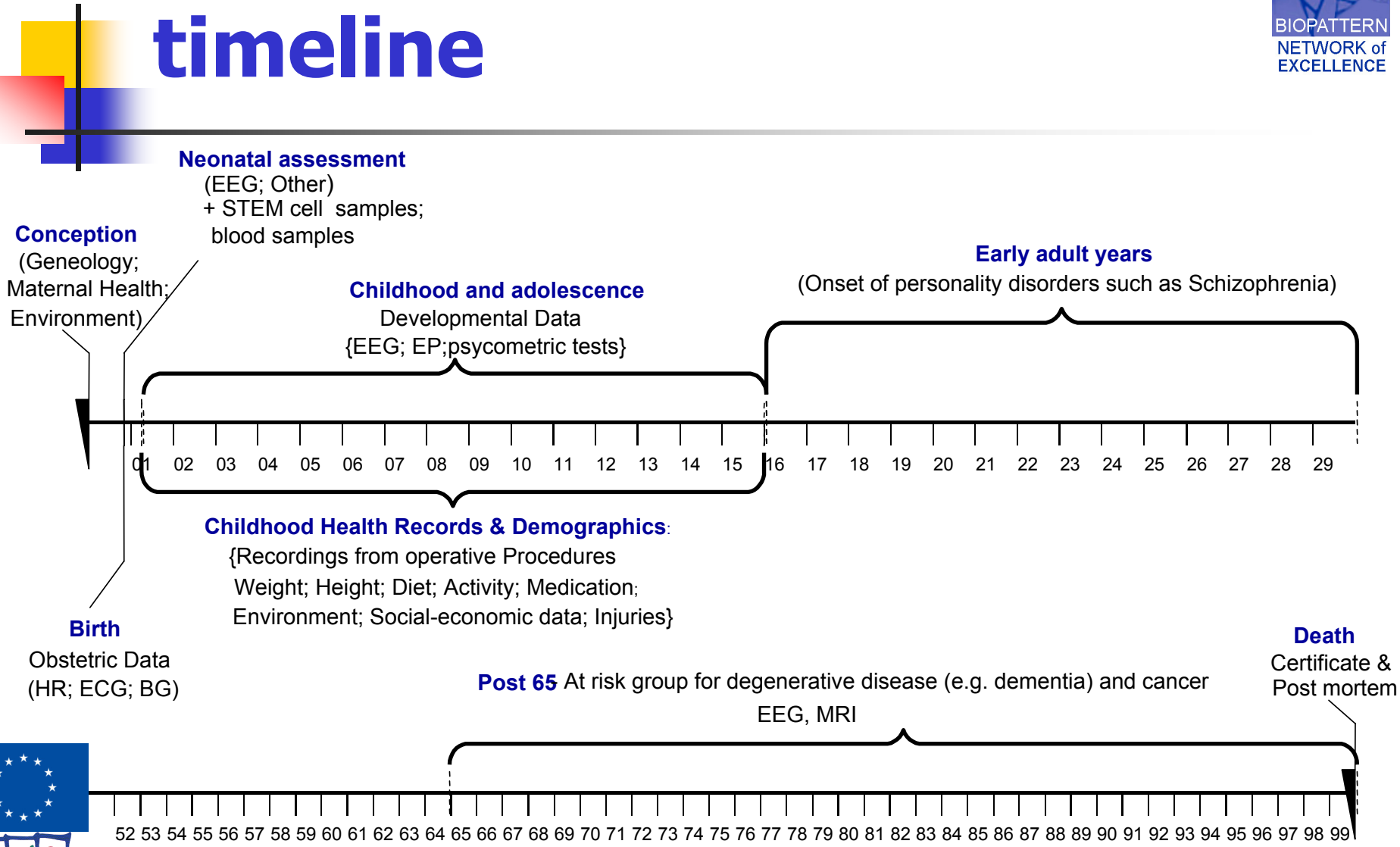


# Some of the key areas in BIOPATTERN

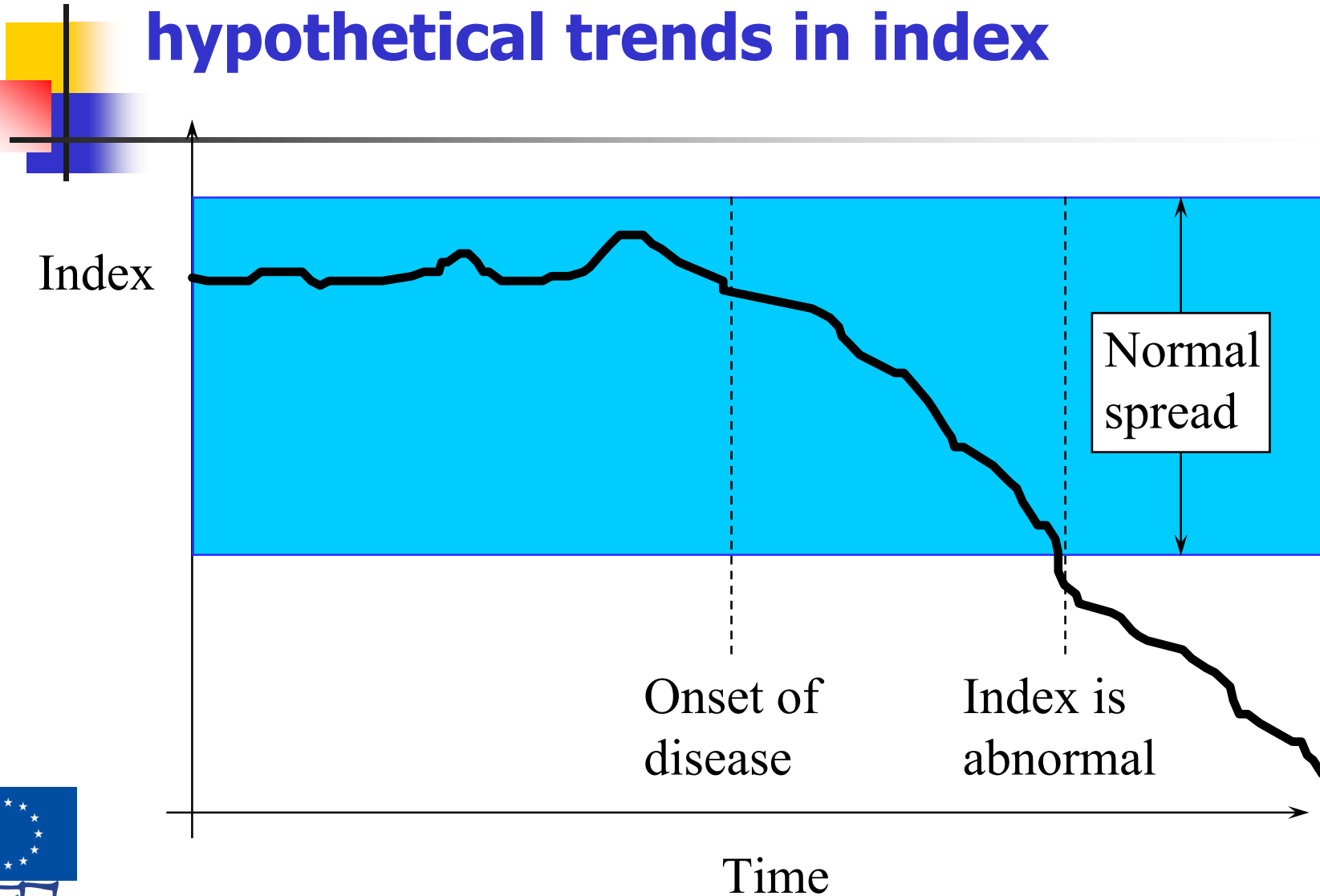
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- Bioprofiling for early detection and care for Alzheimer's disease.
- Early Life – fetal and neonatal bioprofiling assessing adverse events and their impact.
- Personalised care for breast cancer
- Personalised care for Leukaemia (in collaboration with GEMIMA Project)
- Personalised care for brain tumour (in collaboration with eTumour project).

# Concepts of bioprofiling – timeline



# Subject-specific bioprofile analysis – hypothetical trends in index



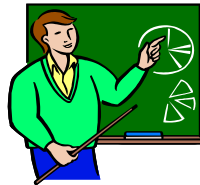
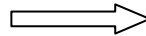


# Why over Grid?

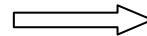
- Conceptually, our interest is in “bioprofiling from birth to death”
- Bioprofiling databases are geographically distributed.
  - Mobility of a citizen (e.g. Mike’s life journey)
  - Databases may be located at different countries/centres.
  - Collaboration and cooperation with partners across the EU, need sharing of resources (e.g. expertise, data and software/ algorithms).



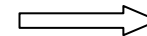
France  
(0-20 yrs)



U.K.  
(20-40 yrs)



Italy  
(40-60 yrs)



Germany  
(60- yrs )

## Mike's life journey



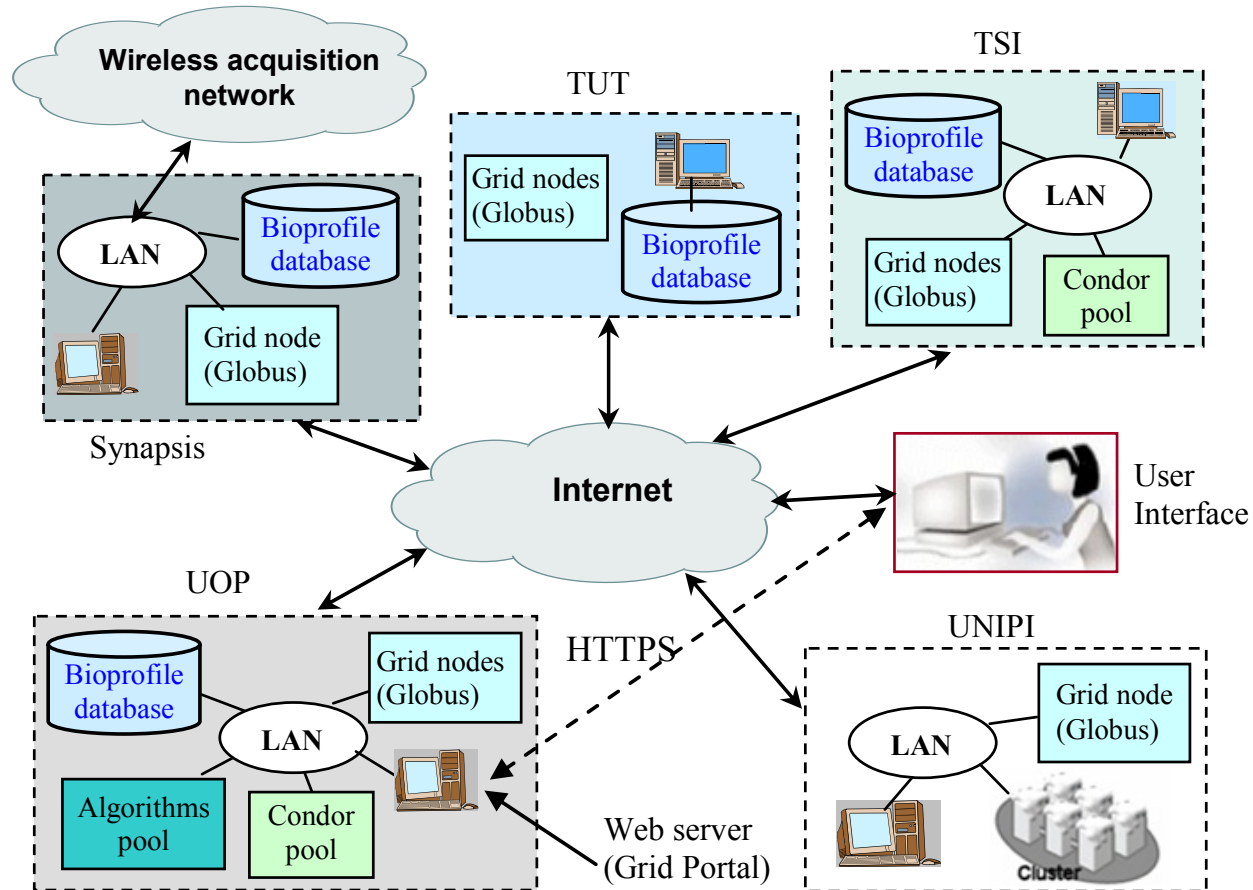


## Why over Grid? (cont.)

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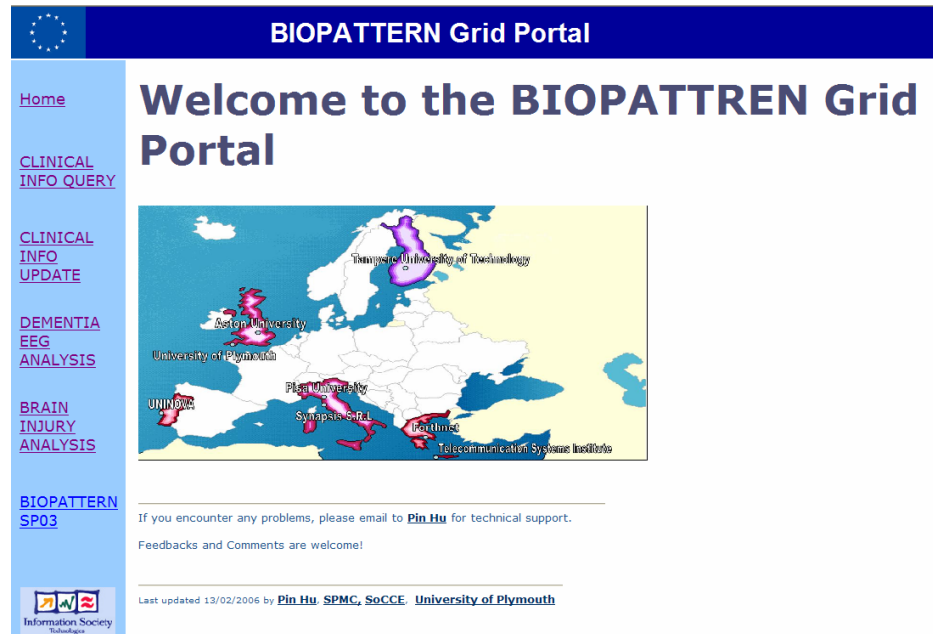
- Bioprofiling databases are huge and dynamic.
  - E.g. serial MRI, EEG, genomics, etc.
  - Regular update of data
- Online access to computational intelligent methods are needed to process and analyse data at anytime and from anywhere
- Intelligent analysis is computational intensive
  - Processing, analysis and interpretation of multi-model biomedical data
  - Visualisation of large biomedical data sets
  - Integration and fusion of data

# BIOPATTERN Grid prototype



# BIOPATTERN Grid services

- High level (Web level) services
  - For end users to use grid-enabled services via the BIOPATTERN grid portal

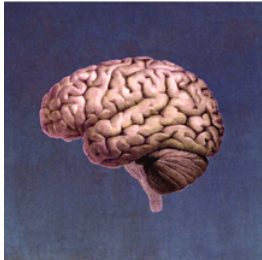


The screenshot shows the BIOPATTERN Grid Portal website. At the top, there is a blue header with the European Union flag and the text "BIOPATTERN Grid Portal". Below the header, the main content area features a large heading "Welcome to the BIOPATTREN Grid Portal" and a map of Europe with several locations highlighted in red and purple, including: Tampere University of Technology, Aston University, University of Plymouth, UNINOVA, Pisa University, Synapsis srl, and Partimed. On the left side, there is a vertical navigation menu with links: Home, CLINICAL INFO QUERY, CLINICAL INFO UPDATE, DEMENTIA EEG ANALYSIS, BRAIN INJURY ANALYSIS, and BIOPATTERN SP03. Below the map, there is a text box that reads: "If you encounter any problems, please email to [Pin Hu](#) for technical support. Feedbacks and Comments are welcome!". At the bottom, it says "Last updated 13/02/2006 by [Pin Hu](#) SPMC, SoCCE, University of Plymouth". The footer of the page includes the Information Society Technologies logo.

# BIOPATTERN Grid services (Cont.)

- Low level (Grid level) services
  - For users to directly access grid resources
  - Services accessed via Globus containers
  - Data services
    - (e.g. Remote data acquisition, which offers automated data acquisition, management and exchange )
  - Computational services
    - (e.g. Crawling service, which provides a generic search engine to collect relevant specific documents, data etc.)
  - Management services
    - (e.g. Workflow substitution and management services)

# An illustrative example - bioprofiling over Grid for dementia



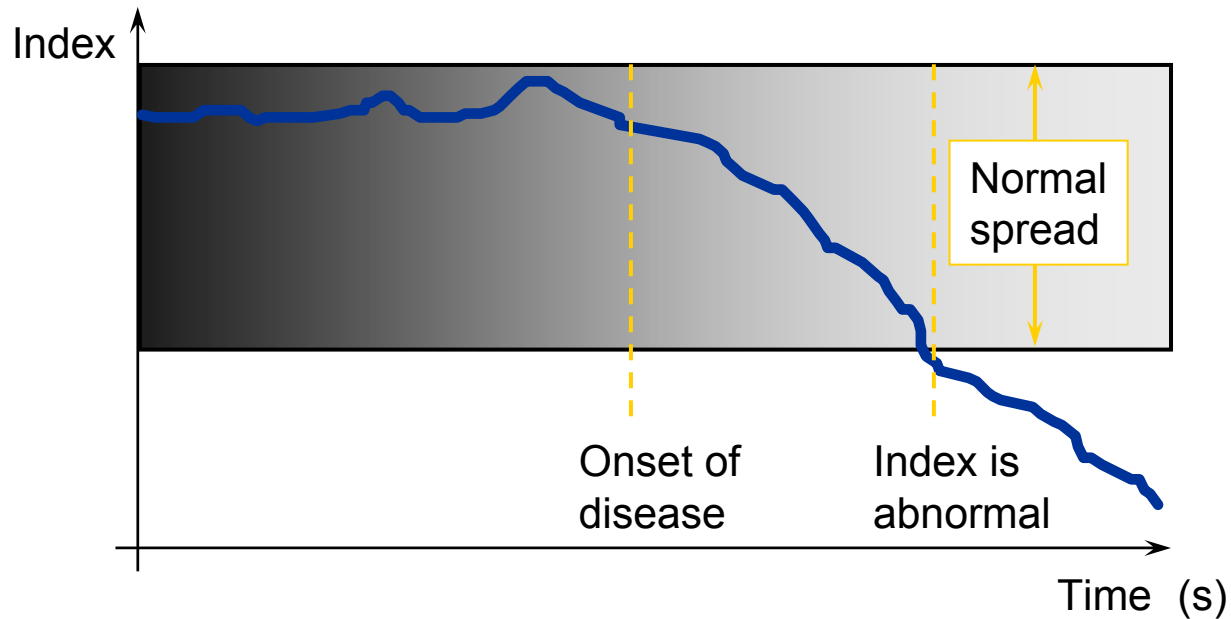
Dementia is a progressive, age-related neurodegenerative disorder associated with cognitive decline and aging.

It is common in the elderly.  
10% of persons over age 65  
and up to 50% over age 85  
have dementia.



# An illustrative example - bioprofiling over Grid for dementia (cont.)

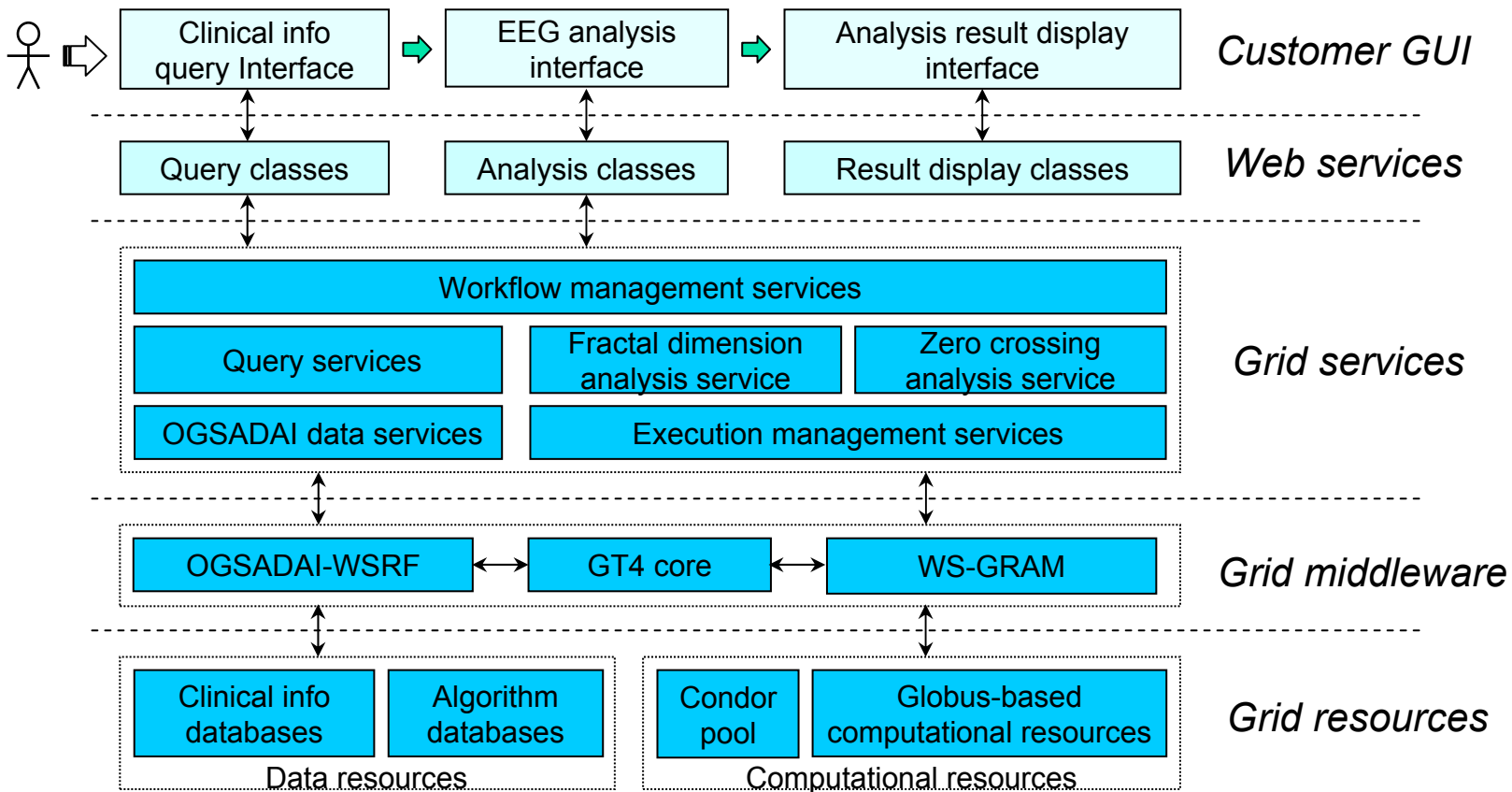
Detection of dementia by use of a biomarker derived from analysis of EEG



# BIOPATTERN Grid services for dementia



## EEG analysis for early detection of dementia





# BIOPATTERN Grid services (cont.)

**BIOPATTERN Grid Portal**

Home

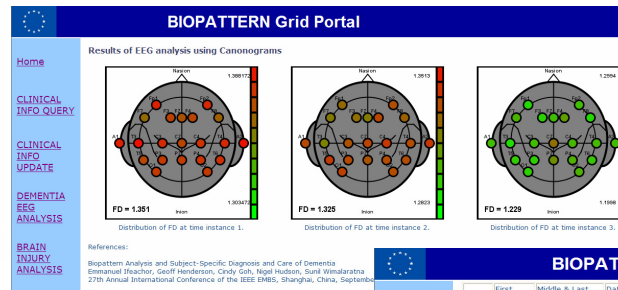
Create a new patient record

Lee First Name  
 Douglas Last Name  
 1933 Year of Birth  
 05 Months of Birth  
 02 Day of Birth  
 70 Weight (kg)  
 180 Height (cm)  
 European Ethnic Origin  
 Amsterdam City of Origin  
 Nederland Country of Origin  
 Plymouth City of Residence  
 England Country of Residence  
 English Nationality

Gender  
 Male  Female  
 AD  
 not specified  yes  no  suspicions

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Update patients' records



See the progress of dementia development



**BIOPATTERN Grid Portal**

Home

ID	First Name	Middle & Last Name	Date of Birth	Gender	Weight	Height	EthnicOrigin	CityOrigin	CountryOrigin	City of Resident	Country of Resident	Nationality
1	Faiza	Al Fajral	1932-03-29	F	60	161	Arab	Dubai	UAE	Spain	Madrid	Emirates
2	Ikedi	Agalaba	1921-10-15	M	67	165	African	Wan	Nigeria	India	Calcutta	Nigerian
3	Munna	Al Jadeed	1939-05-21	F	45	155	Arab	Sharjah	UAE	Spain	Seville	Emirates
4	Achabe	Oshodi	1932-07-13	M	84	184	African	Kano	Nigeria	Spain	Seville	Nigerian
5	Alisha	Argawal	1934-11-07	F	59	153	Indian	Jajpur	India	Germany	Hamburg	Indian
6	Marco	Sanchez	1920-09-12	M	80	163	Latin	Barcelona	Spain	India	Delhi	Spanish
7	Yinje	Wang	1919-02-24	M	85	172	Chinese	Nanjing	China	Nigeria	Abuja	Chinese
8	Ikedi	Anyanike	1936-11-28	M	65	174	African	Kano	Nigeria	Spain	Barcelona	Nigerian
9	Ikedi	Onwunali	1939-06-29	M	82	176	African	Wari	Nigeria	Germany	Hamburg	Nigerian
10	Uwakwe	Oshodi	1934-04-04	M	69	176	African	Kano	Nigeria	China	Beijing	Nigerian
11	Jun	Li	1914-11-04	M	81	170	Chinese	Chongqing	China	Spain	Madrid	Chinese
12	Yao	Hu	1919-07-18	M	86	171	Chinese	Wunan	China	France	Nice	Chinese
13	Enrique	Acha	1918-03-08	M	84	173	Latin	Madrid	Spain	Germany	Hamburg	Spanish
14	Faiza	Hamadicharef	1922-10-02	F	44	158	Arab	Sharjah	UAE	USA	Texas	Emirates
15	Shuxian	Feng	1926-11-22	F	58	151	Chinese	Chongqing	China	USA	Texas	Chinese
16	Mark	Hopkins	1920-05-23	M	82	183	European	Plymouth	England	India	Calcutta	English
17	Carmen	Madrigal	1941-09-24	F	40	169	Latin	Barcelona	Spain	France	Paris	Spanish
18	Yusuf	Al Sahid	1915-04-21	M	74	178	Arab	Abu Dhabi	UAE	Nigeria	Kaduna	Emirates
19	Achabe	Anyanike	1943-11-23	M	87	170	African	Kano	Nigeria	Nigeria	Kaduna	Nigerian
20	Enrique	Estefan	1943-03-07	M	77	161	Latin	Barcelona	Spain	USA	Texas	Spanish

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View patient information





# Data integration issues in BIOPATTERN

- Different types of data and databases
- Data models - to describe and handle different data structures
- Knowledge models and infrastructure - to support data analysis, interpretation and integration of information from multimodal data and knowledge.

# Concluding remarks and future work

- Ongoing project
  - An integrated data, computation and knowledge grid environment
  - More and enhanced grid applications and services to support Bioprofiling (brain diseases and cancers)
  - Enhanced portal
- Move from research prototype to clinical prototype
  - Ethical and regulatory issues
  - Privacy, security and QoS issues
  - Scalability issues
  - Develop links with large Grid projects (e.g. EGEE)