



Enabling Grids for E-science

Towards grid-enabled telemedicine in Africa

Yannick Legré on behalf of Vincent Breton

CNRS-IN2P3, LPC Clermont-Ferrand

EUMedGrid Workshop @ EGEE 2007 conference

www.eu-egee.org



Information Society
and Media



- **The World Wide Web provides seamless access to information that is stored in many millions of different geographical locations**
- **In contrast, the Grid is a new computing infrastructure which provides seamless access to computing power, data and other resources distributed over the globe**
- **The name Grid is chosen by analogy with the electric power grid: plug-in to computing power without worrying where it comes from, like a toaster**



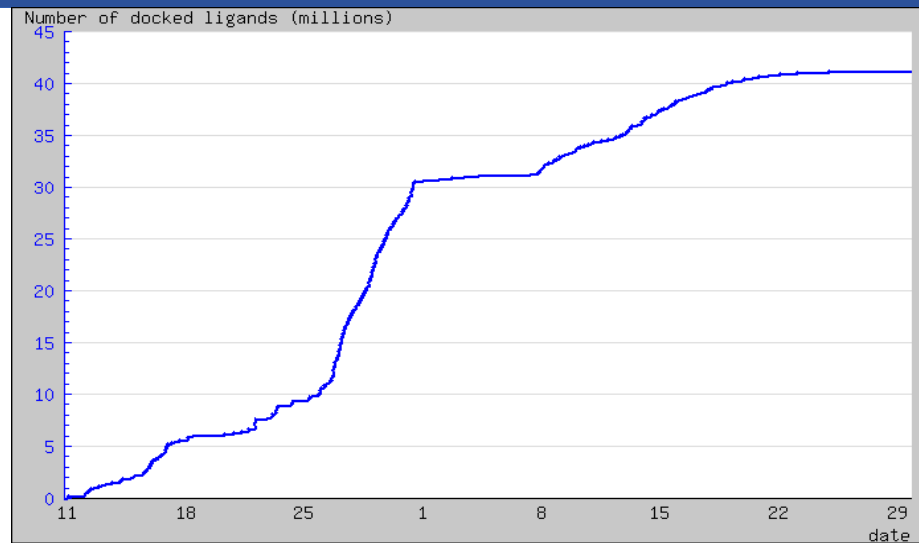
- **Contribute to the development and deployment of new drugs and vaccines**
 - Improve collection of epidemiological data for research (modeling, molecular biology)
 - Improve the deployment of clinical trials on plagued areas
 - Speed-up drug discovery process (in silico virtual screening)
- **Improve disease monitoring**
 - Monitor the impact of policies and programs
 - Monitor drug delivery and vector control
 - Improve epidemics warning and monitoring system
- **Improve the ability of African countries to undertake health innovation**
 - Strengthen the integration of African life science research laboratories in the world community
 - Provide access to resources
 - Provide access to bioinformatics services

- **Grids offer unprecedented opportunities for resource sharing and collaboration**
- **Grids open exciting perspectives to handle the information flows needed to fight neglected diseases**
 - Deployment of services for healthcare and research centers in endemic regions
 - Deployment of infrastructures (federation of databases) to collect biomedical data and improve disease monitoring
 - Cross-organizational collaboration space to share data and resources
- **Challenges**
 - Infrastructure capacity building in Africa
 - Grid technology must provide the services for data and knowledge management
 - IT expertise and willingness to share information is needed from the participating healthcare centers

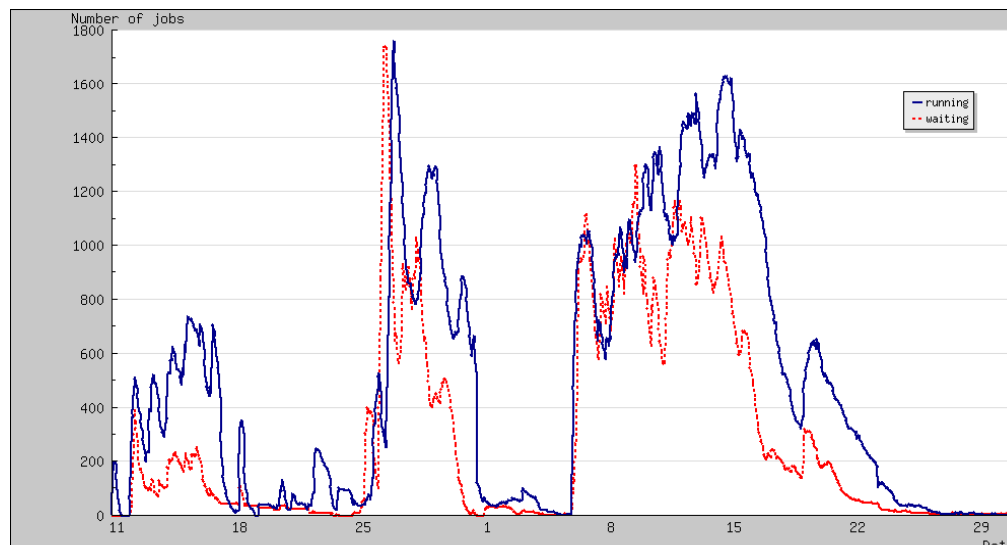
- **Drug discovery**
 - WISDOM for grid enabled *in silico* drug discovery against malaria and bird flu
- **Deployment of services for healthcare centers**
 - Prevention and follow-up of HIV/AIDS patients with the Action Biomali project
 - Development of grid-enabled telemedicine in Ouagadougou

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- **Significant biological parameters**
 - two different molecular docking applications (Autodock and FlexX)
 - about one million virtual ligands selected
 - target proteins from the parasite responsible for malaria
- **Significant numbers**
 - Total of about 46 million ligands docked in 6 weeks
 - 1TB of data produced
 - Up 1000 computers in 15 countries used simultaneously corresponding to about 80 CPU years
 - Average crunching factor ~600

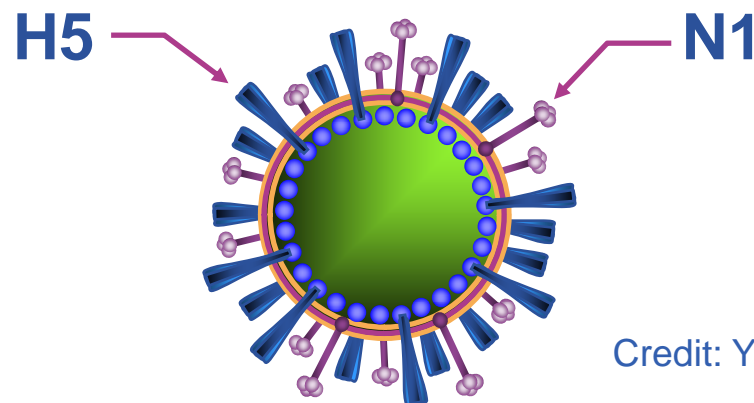


Number of docked ligands vs time



Number of running and waiting jobs vs time

- The goal is to study in silico the impact of selected point mutations on the efficiency of existing drugs and to find new potential drugs
- A collaboration of 5 grid projects: Auvergrid, BioinfoGrid, EGEE-II, Embrace, TWGrid
- Significant parameters:
 - One docking software: autodock
 - 8 conformations of the target (N1 neuraminidase)
 - 300000 selected compounds
 - 100 year CPU to dock all configurations on all compounds
- Timescale:
 - First contacts: March 1st 2006
 - kick-off: April 1st 2006
 - Targeted duration: 4 weeks



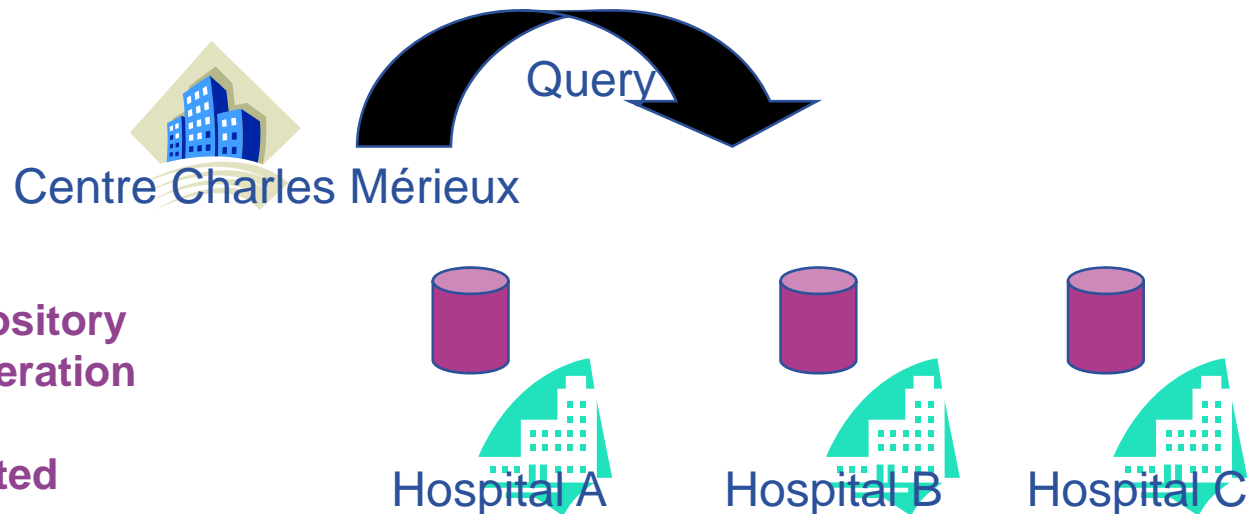
Credit: Y-T Wu

- **Access to treatment has considerably improved in subsaharian Africa**
 - More than 500.000 persons treated with ARVs today
 - It represents about 10% of the persons infected with HIV in need of a treatment
- **HIV/AIDS treatments are complex and life long**
 - Drugs used for tri-therapy must be kept in a cool environment
 - Treatment evolves with patient condition from first line to second line protocols
- **Systems to increase prevention and monitor ARV supply, storage and distribution are urgently needed**
 - Exemple: the Biomali european project (EuropeAid)

- **Goal: increase prevention and biological follow-up of patients with HIV/AIDS, tuberculosis and malaria in Mali**
- **Methods:**
 - build a network of laboratories to strengthen existing healthcare centres
 - set-up a system for the collection of reliable data relevant to biological diagnosis
- **Partners: Fondation Mérieux, Fondation Mérieux Mali, Mali Health Ministry**
- **Funding: European Commission (EuropeAid), Fondation Mérieux**

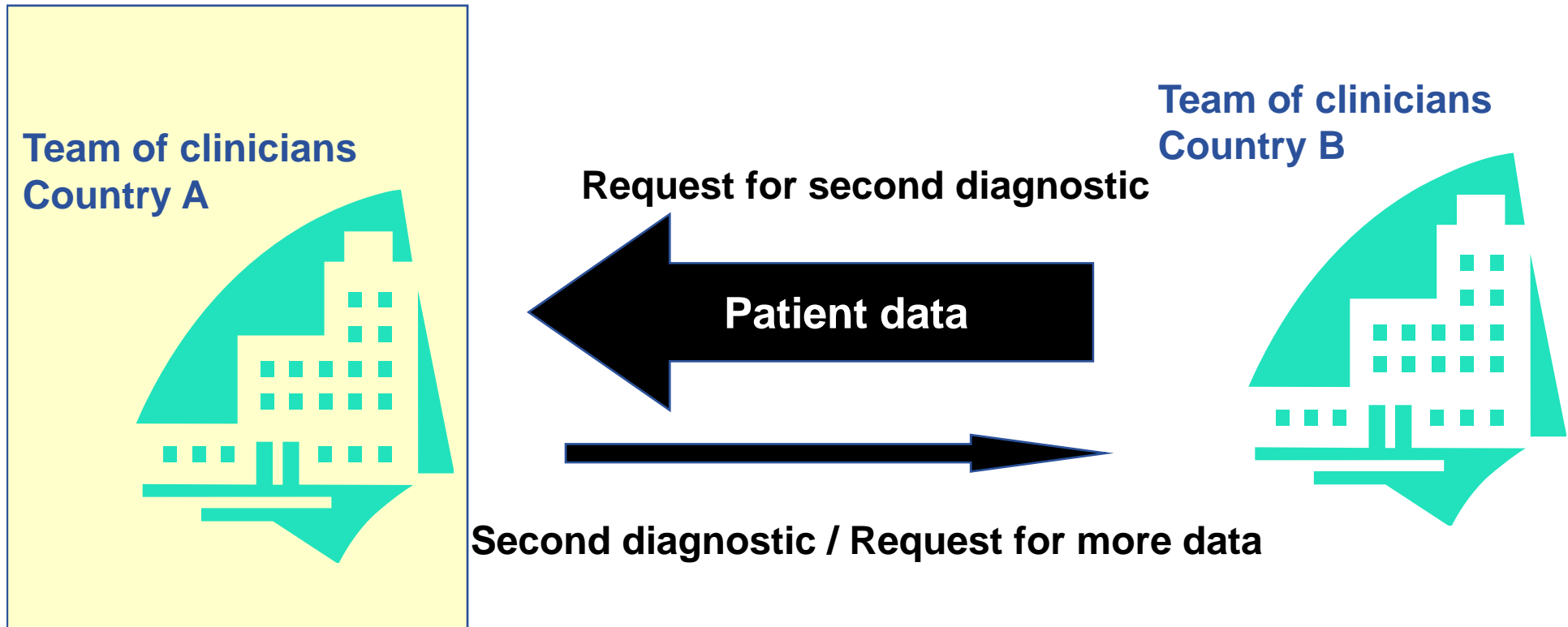
- **Goals**
 - design an IT architecture to handle the information flow in the network of laboratories
 - set-up an information system for data collection

- **Grid added value: deployment of a federation of databases in the main healthcare centres**
 - Data are stored in the hospitals and queried for monitoring and analysis



Added value:

- no central repository
- queries on federation of databases
- privacy protected



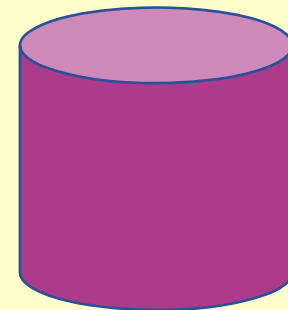
Patient data transferred with second diagnostic request (email):

- patient data circulated on internet
- limited information representation
- limited medical data administration

Team of clinicians
Country A



Web portal:
authenticated access
structured information
multilingualism



Team of clinicians
Country B



Request for second diagnostic



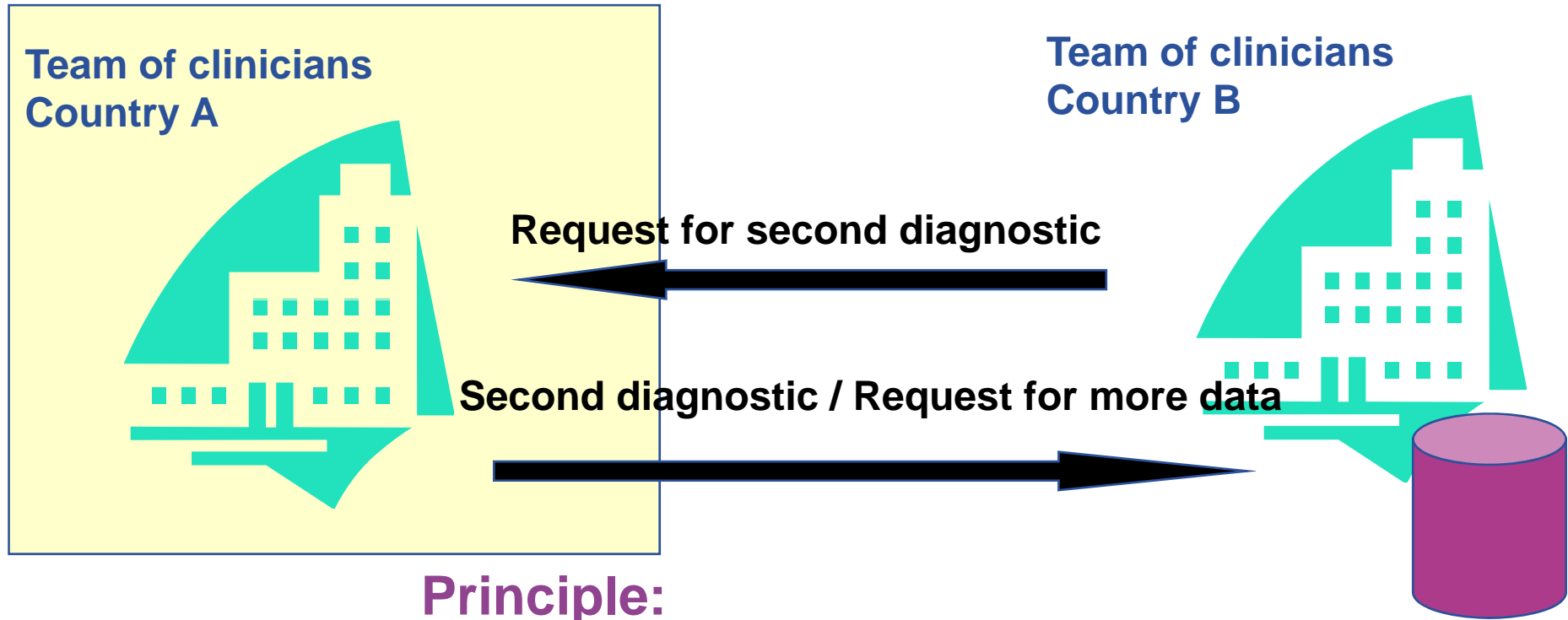
Second diagnostic / Request for more data



patient data

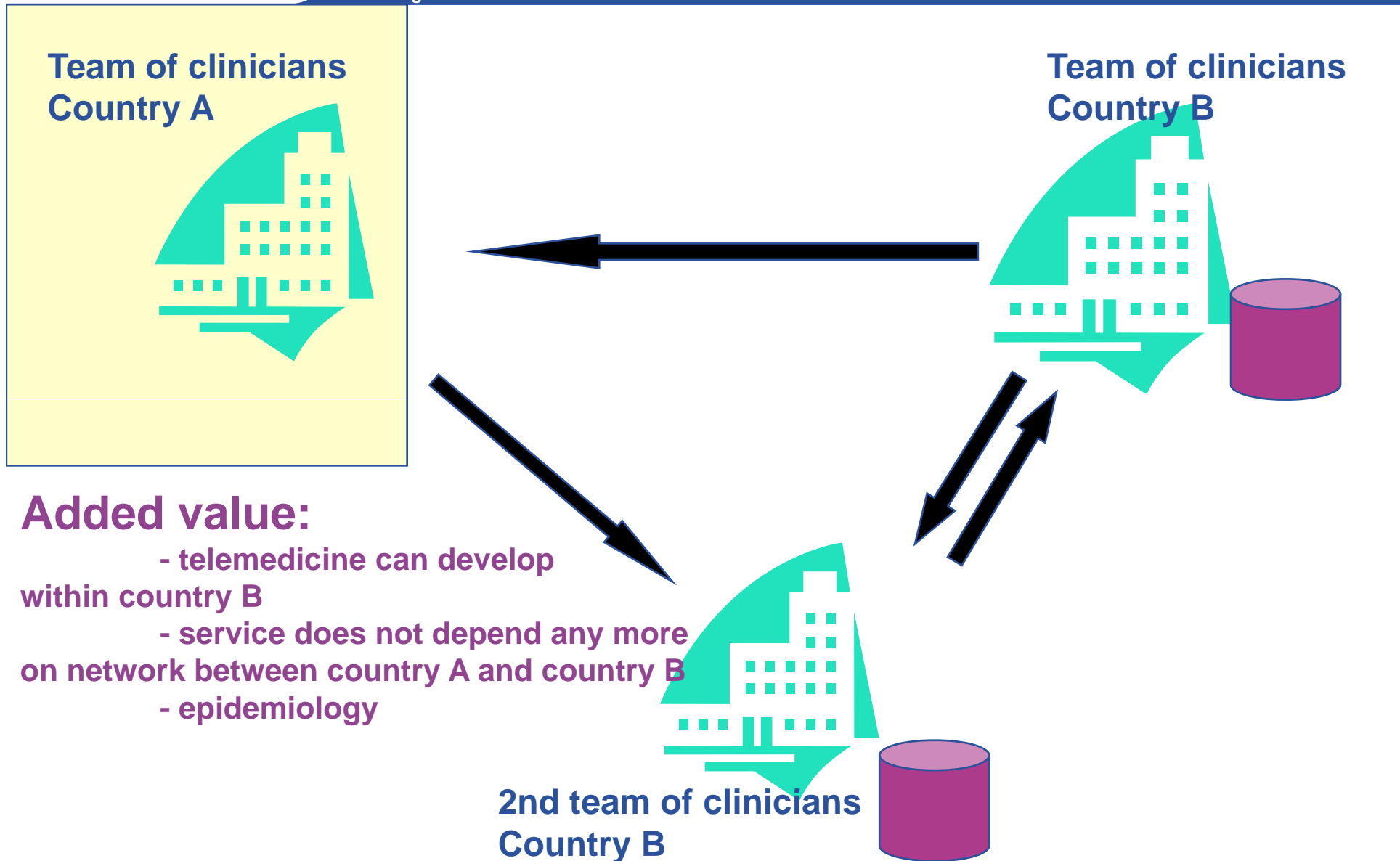


Patent data sent to central repository:
- patent medical data outside
hospital (legal issues)
- service depends on network
between country A and country B



Principle:

- No central data repository
- Patient data kept in databases inside hospital where patient is treated (security, legal issues)
- Structured information, common data format
- Authenticated access for second diagnostic



- **Main challenges**

- Access to internet and sufficient bandwidth are mandatory
- Data management services on grids are still under development
- Grid middlewares are not available on the operating systems deployed in African healthcare centres
 - Many different versions of DOS/Windows
 - Very little linux
- Mind-set changing and Training people

- **What is needed**

- 1MB/s connection is sufficient
- robust, open source and secure grid data management services
- Porting of grid middlewares on the operating systems available in Africa on which other services are provided
 - Recent versions of DOS/Windows
 - Ubuntu linux

- **Goals:**

- Develop information systems in Ouagadougou healthcare centres
- Foster collaboration between clinicians in the field of
 - Ophthalmology
 - Radiology

- **Strategy:**

- 1. Using existing internet connection, develop first telemedicine applications
- 2. Deploy them in Ouagadougou and Clermont-Ferrand
- 3. Deploy intranet in Ouagadougou healthcare centres
- 4. Develop grid-enabled telemedicine services
- 5. Deploy them in Ouagadougou and Clermont-Ferrand

- **Medical partners**
 - Schiphra Dispensary, Ouagadougou, Burkina-Faso
 - Centre Hospitalier Universitaire, Ouagadougou, Burkina-Faso
 - Centre Hospitalier Universitaire Gabriel Montpied, Clermont-Ferrand, France
 - Michel Renaud, Ophthalmologist
- **Technical partners**
 - HealthGrid association
 - CNRS-IN2P3
- **Sponsors**
 - IBM
 - Association Eaux Vives (NGO)

- **First telemedicine application developed for the follow-up of patients undergoing ophthalmic surgery**
 - Exchange of patient medical files through FTP transfer
 - Prototype developed and tested in Clermont-Ferrand in 2005
- **Installation at Schiphra dispensary in August 06**
- **Evaluation of requirements for intranet deployment in August 06**
- **Choice of grid data management technology is still an issue**

- **Example of the oncoming Grid school in Vietnam – October 29th – November 16th in collaboration with the EGEE Asia Federation**
- **3 weeks training:**
 - Week 1 – System Administrators
 - Week 2 – Application Developers
 - Week 3 – Application Users
- **4 sites will be installed and a full grid infrastructure should (will?) be available at the end of the period**
- **Could we reproduce such thing for African countries?**

- **Grids open new perspectives for medical development**
- **Deployment of grid-enabled medical services in Africa is faced with several challenges**
 - Access to internet and sufficient bandwidth are mandatory
 - Data management services on grids are still under development
 - Grid middlewares are not available on the operating systems deployed in African healthcare centres
- **Efforts are being made to address them on pilot projects**
 - Prevention and follow-up of HIV/AIDS patients with the Action Biomali project
 - Development of grid-enabled telemedecine in Ouagadougou

eGee USER FORUM

A blue silhouette map of Europe is centered on the slide. A white callout box with a black border is positioned over France, with a white arrow pointing to the Clermont-Ferrand region. A yellow line connects the top of this callout box to the yellow 'G' in the 'eGee' logo above.

Clermont-Ferrand (FR)
11-14 February 2008

contact: egee-uf3@healthgrid.org
website: www.eu-egee.org

