



# The New Technologies: Can CRISs Benefit?



Keith G Jeffery  
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# STRUCTURE

- Background
- The Proposition
- The New Technologies: GRIDs
- The New Technologies: Ambient Computing
- What does this mean for CRISs?
- Conclusion

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# CCLRC-RAL Site



- ISIS TS2 site
- ISIS
- Instrumentation Engineering
- Lasers
- Space Science
- Particle Physics
- Microstructures
- IT
- Spin-outs
- Administration
- Diamond site

# CCLRC-DL Site

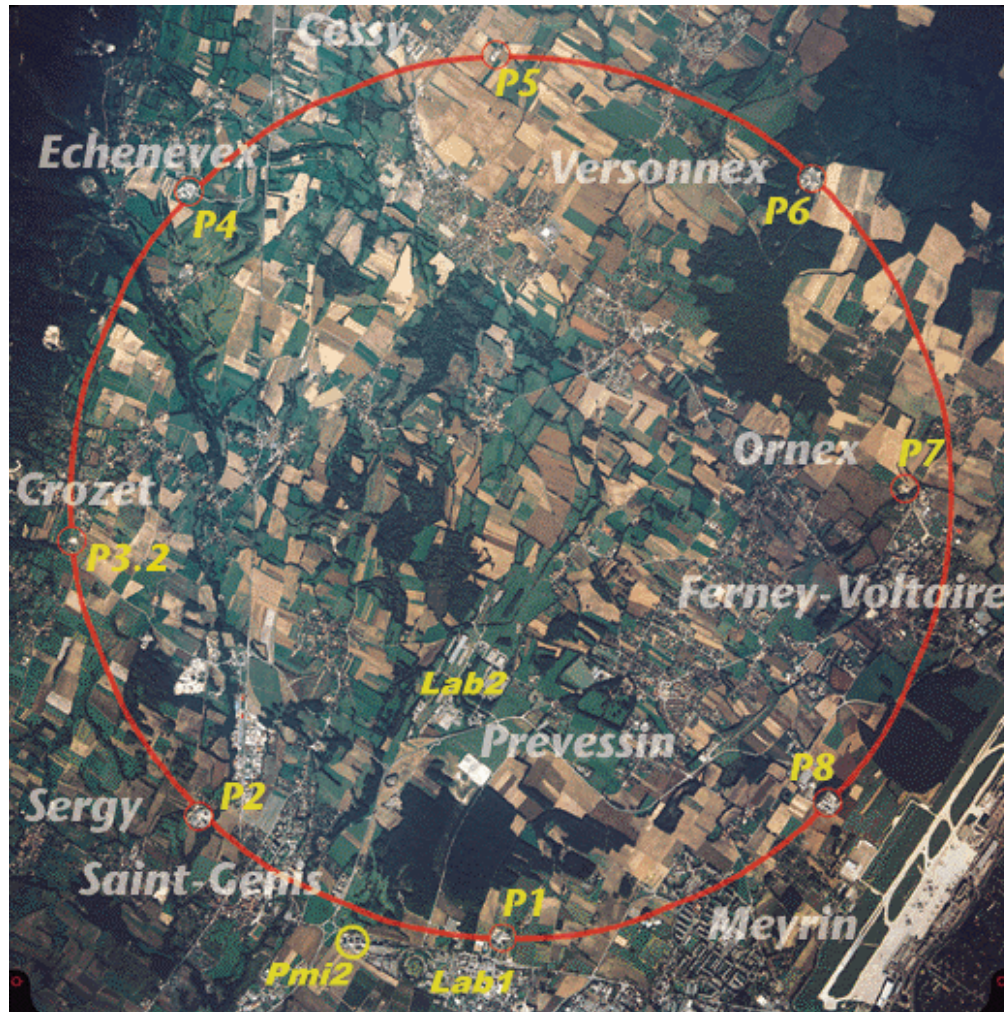


Ex NSF now  
new facilities

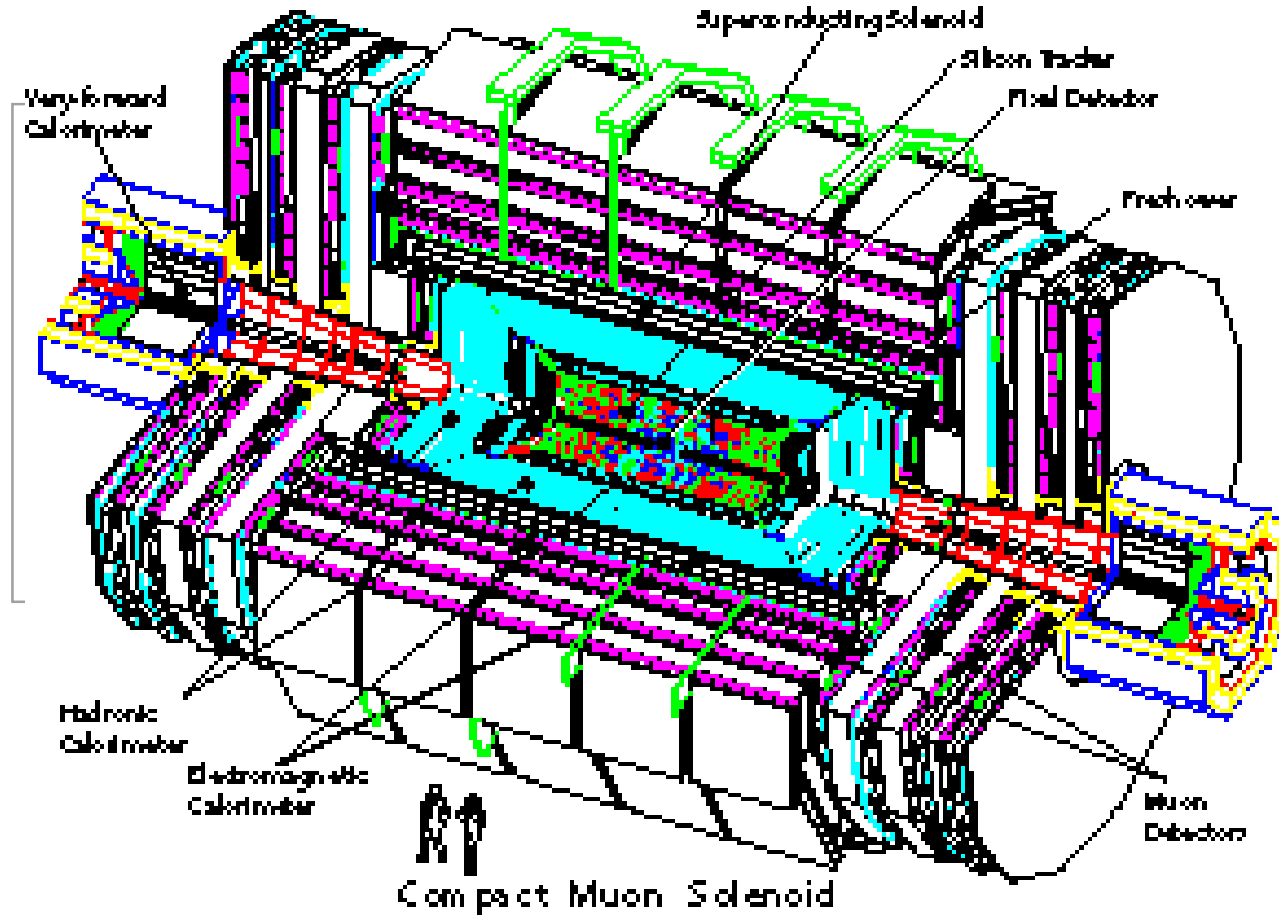
Synchrotron  
Radiation

IT

# PPD: CERN: LHC



# PPD : CMS



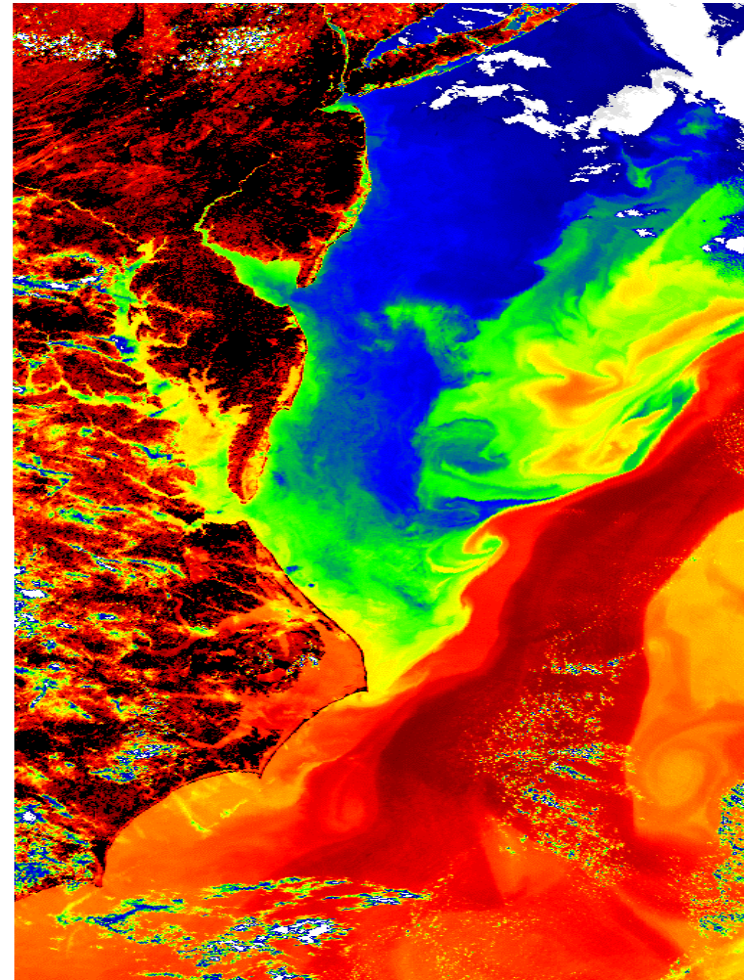
# ISIS: Neutrons



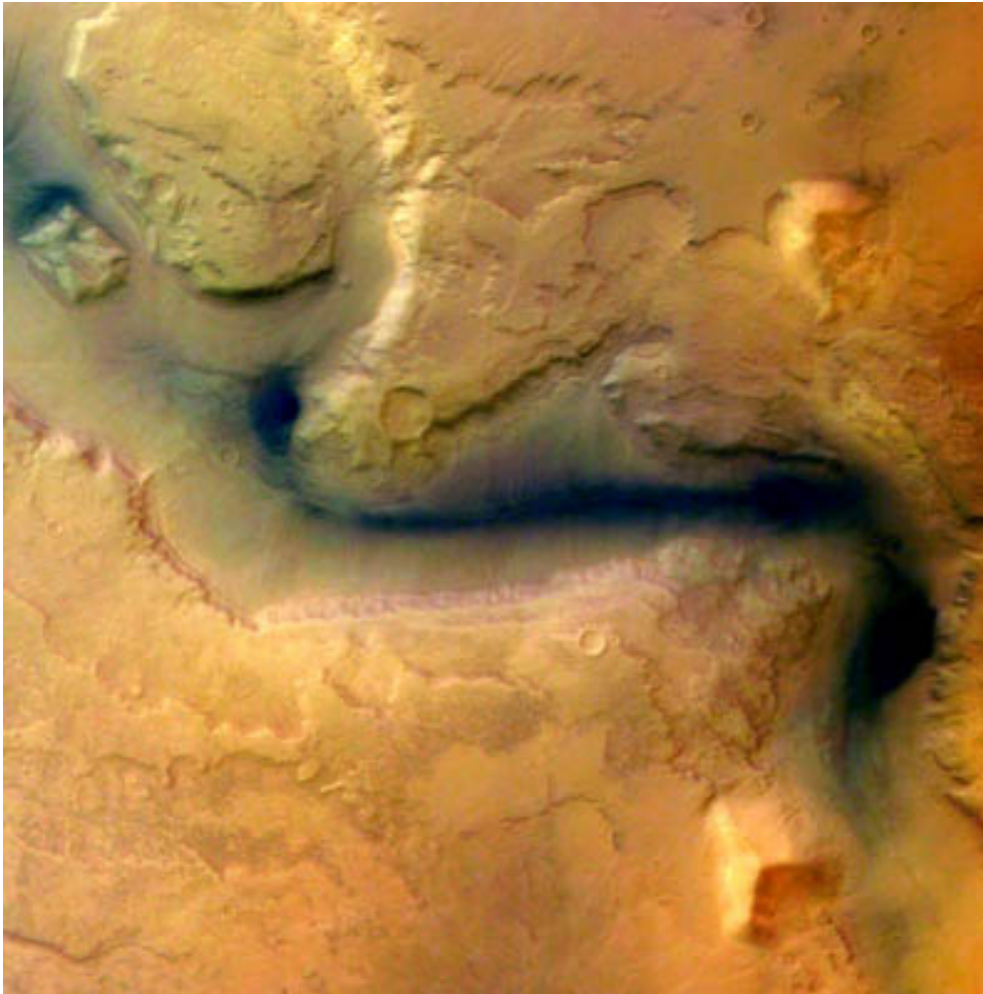


# SSTD: Earth

- Gulf Stream
- Carolina to New York



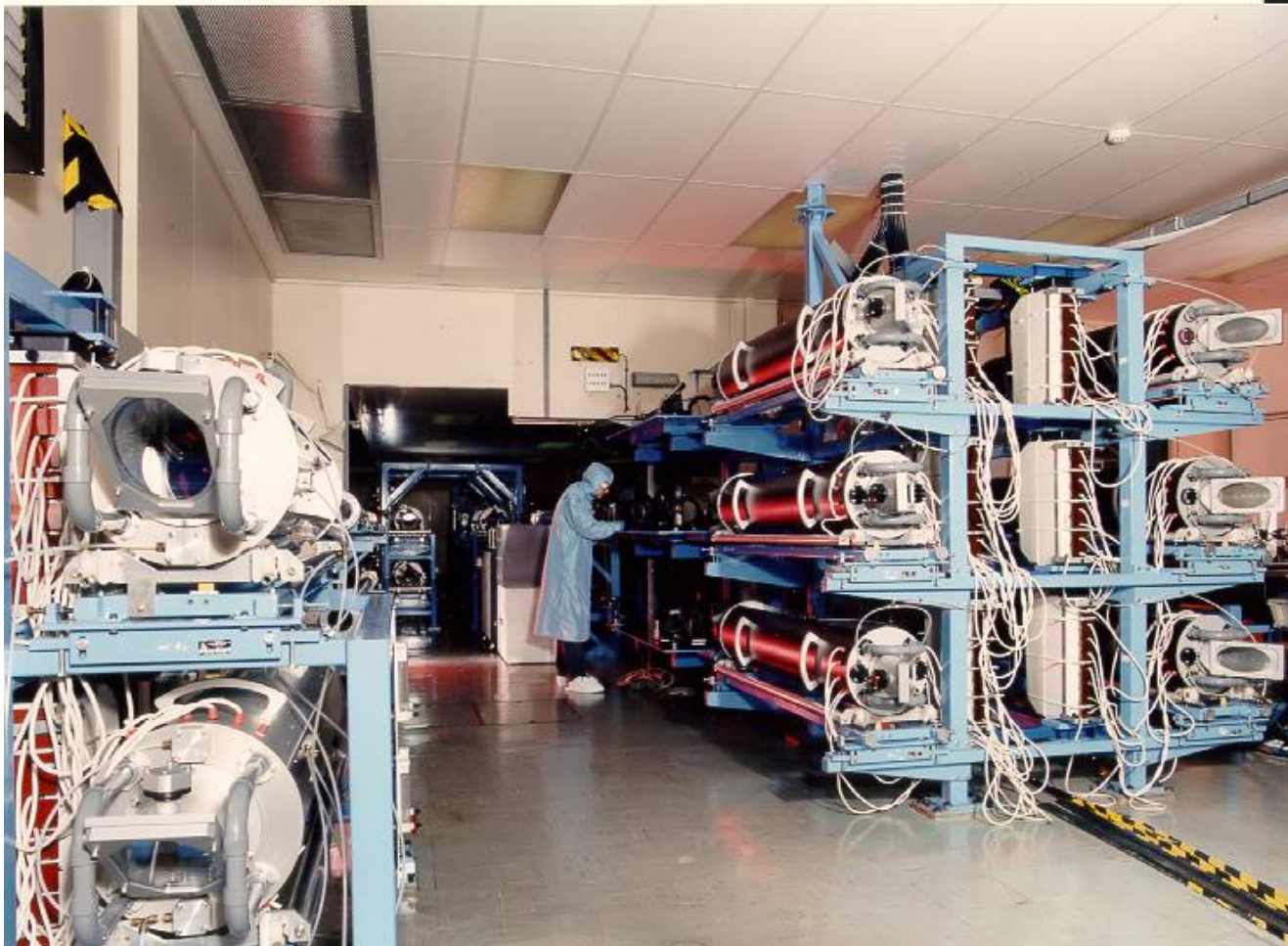
# SSTD: Mars



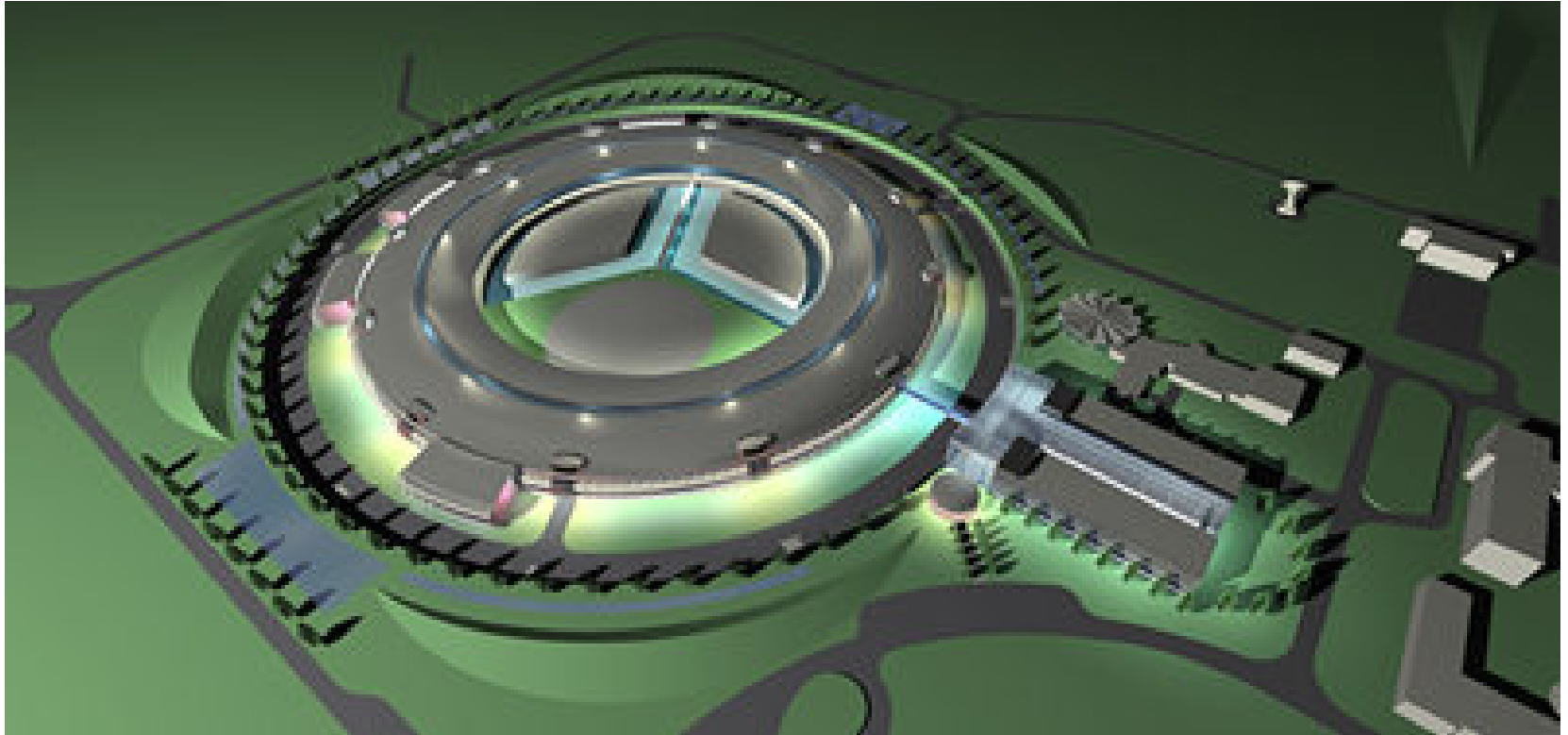
23 January 2004

This picture was taken by the High Resolution Stereo Camera (HRSC) onboard ESA's Mars Express orbiter, in colour and 3D, in orbit 18 on 15 January 2004 from a height of 273 km. The location is east of the Hellas basin at 41° South and 101° East. The area is 100 km across, with a resolution of 12 m per pixel, and shows a channel (Reull Vallis) once formed by flowing water. The landscape is seen in a vertical view, North is at the top.

# Lasers: Vulcan



# Diamond: Synchrotron Radiation



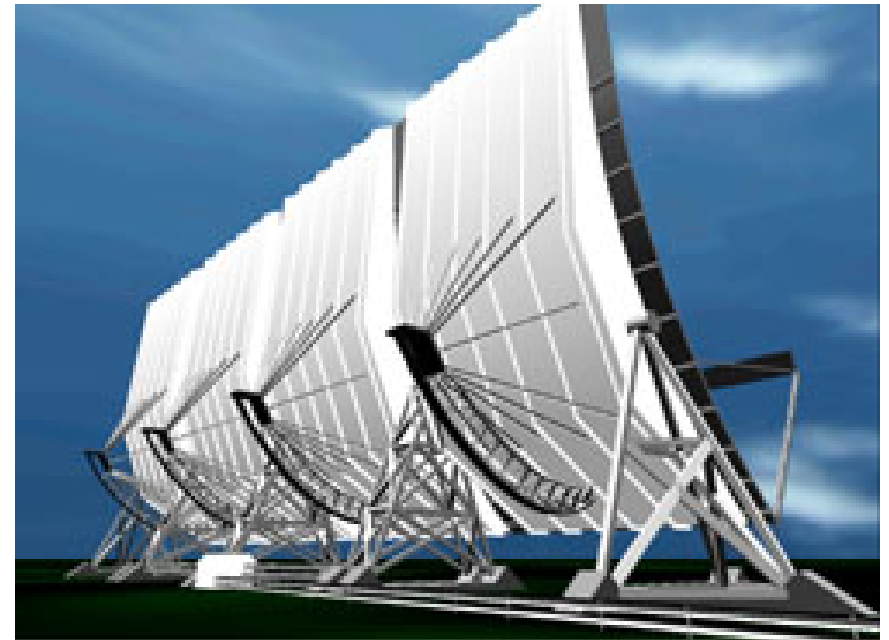
*Bird's eye view of the synchrotron building (Courtesy of JacobsGIBB Ltd / Crispin Wride Architectural Design Studio)*

# Computing



- CCLRC runs HPC(X)
- 5<sup>th</sup> fastest computer
- IBM Power series
- Used by UK R&D Community

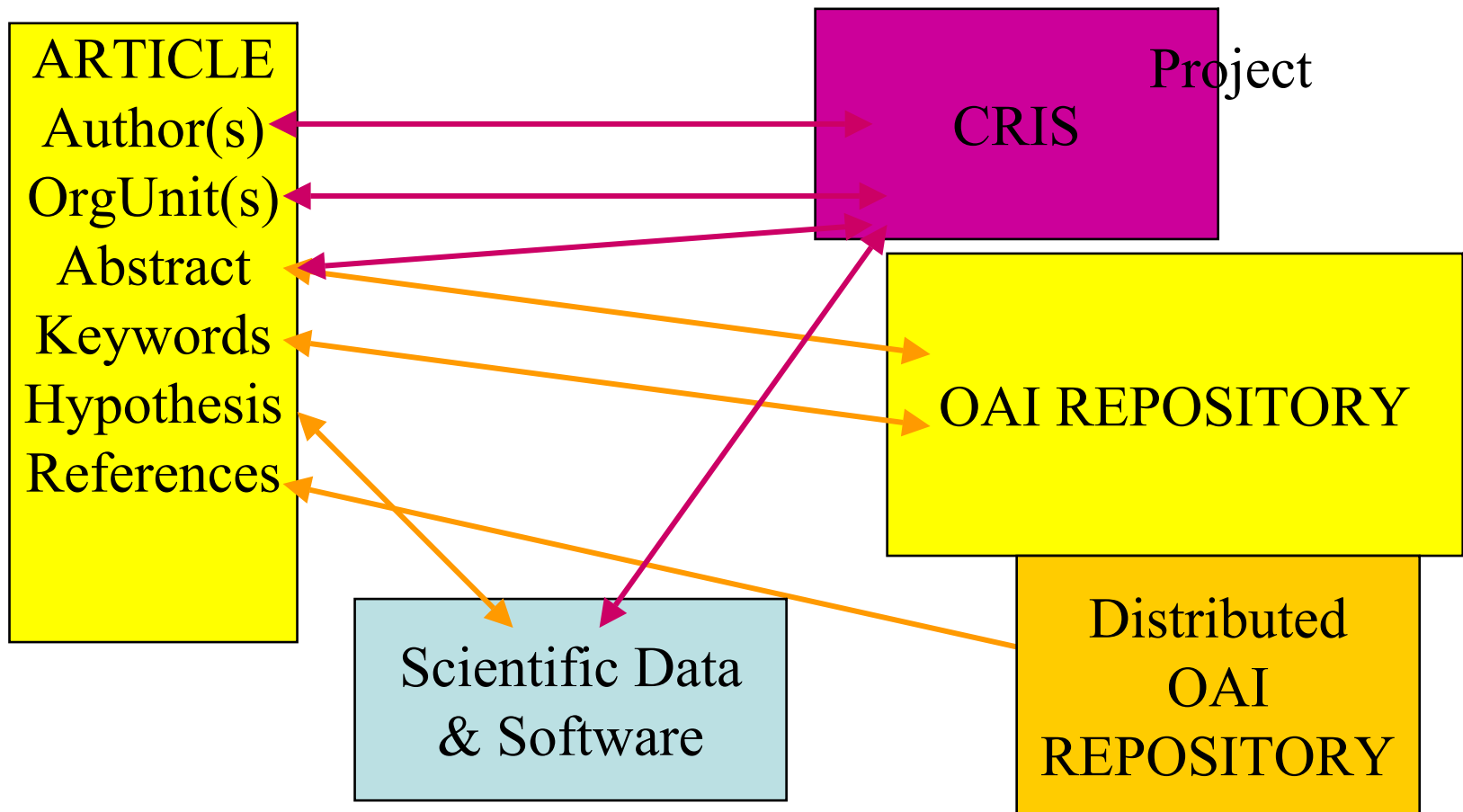
# VR: EISCAT Control



# Background : Conclusion

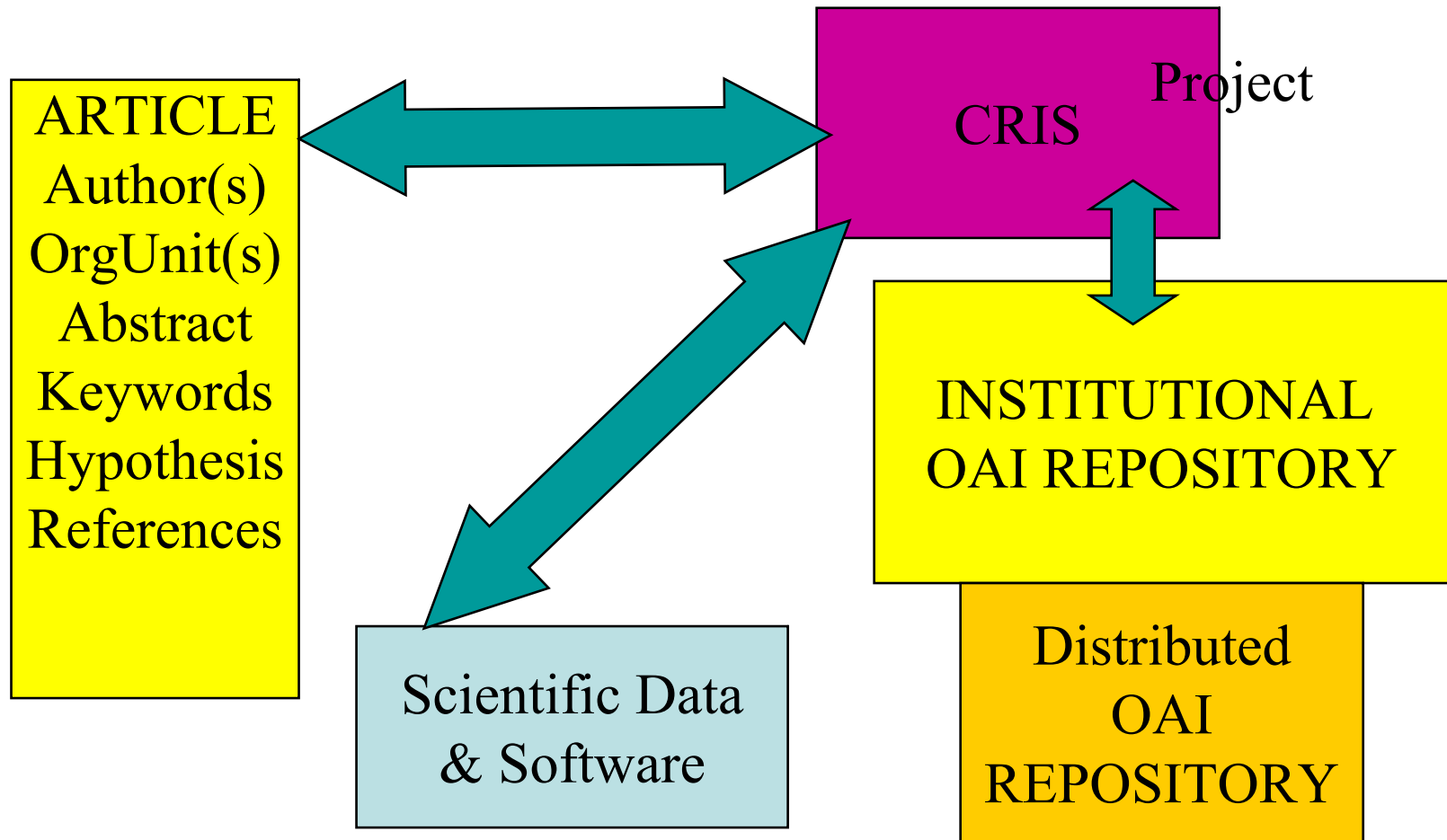
- Large Scientific Facility Laboratory
  - Hundreds of thousands of users
- Need for integrated environment (at the lab and worldwide available) for:
  - Strategic planning
  - Management of science, engineering and technology
  - Scientific data collection
  - Scientific data analysis
  - Generation of products, patents, publications
    - Technology transfer and innovation
    - Increasing human knowledge
- ➔ need a sophisticated CRIS

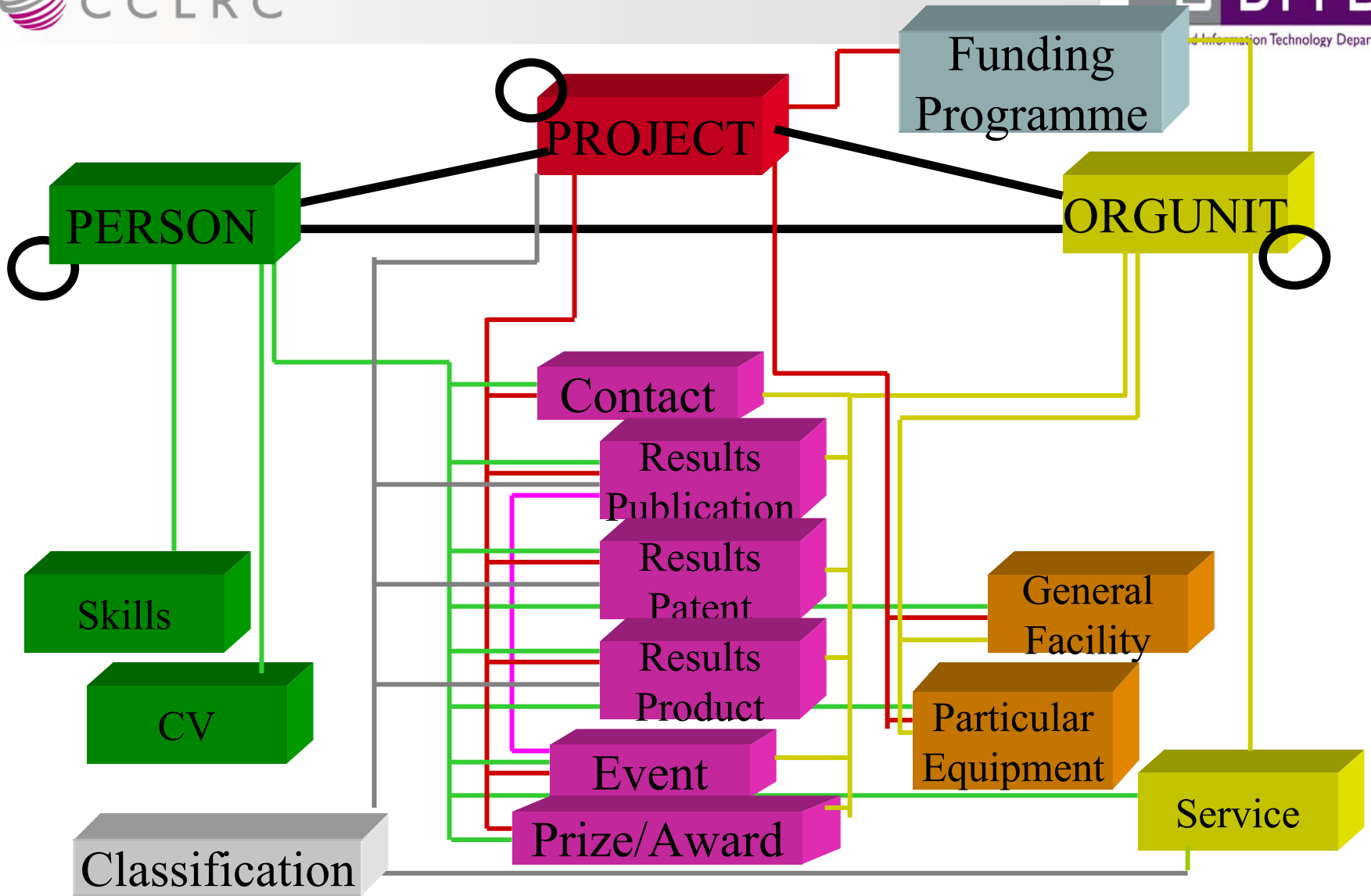
# The 'nightmare'





# The 'dream'





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# The Proposition

- Historically we have followed the process:
  - Requirements, Design, Development and Implementation then Maintenance
- There are new technologies
  - New business opportunities e.g. Amazon.com
- Perhaps CRISs should develop as new businesses using the new technologies

# The New Technologies

- The relevant new technologies are:
- GRIDs
  - Autonomic computing
    - User requests : system responds
    - Data, information, knowledge, computing, detectors for more data...
  - Metadata, agents, brokers
- Ambient computing
  - Pervasive, continuous, personalised connectivity

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## In the beginning.....

- In 1999 the UK Research Councils (which fund university R&D) were undergoing their Strategic Review Exercise for funding beyond 2000
  - Grand challenge science projects
- The DGRC (John Taylor) unhappy that plans
  - had too little IT
  - the IT proposed was incoherent
- So he asked CCLRC CEO (Bert Westwood) to have someone generate an IT plan
- And Bert asked me

## The GRIDs Vision

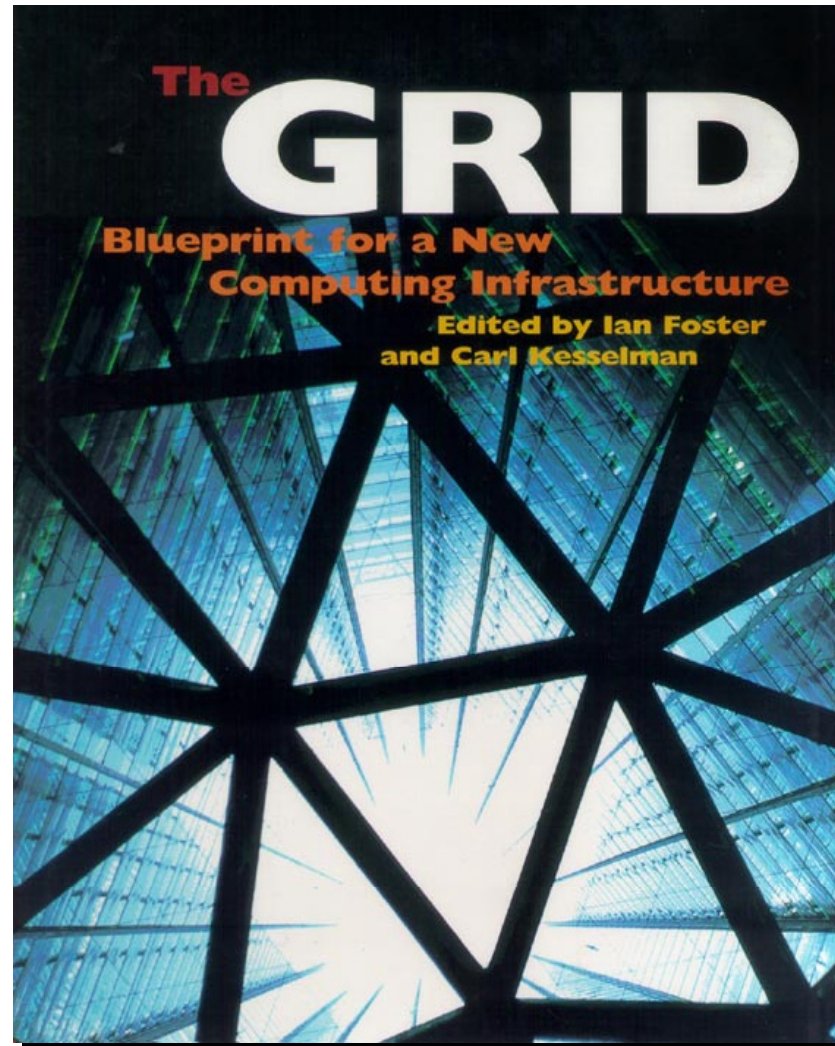
- The end-user interacts with the GRIDs environment to clarify the request
  - using a ‘device’ or ‘appliance’
- The GRIDs environment proposes a ‘deal’ to satisfy the request
  - which may or may not involve money
- The user accepts or rejects the ‘deal’



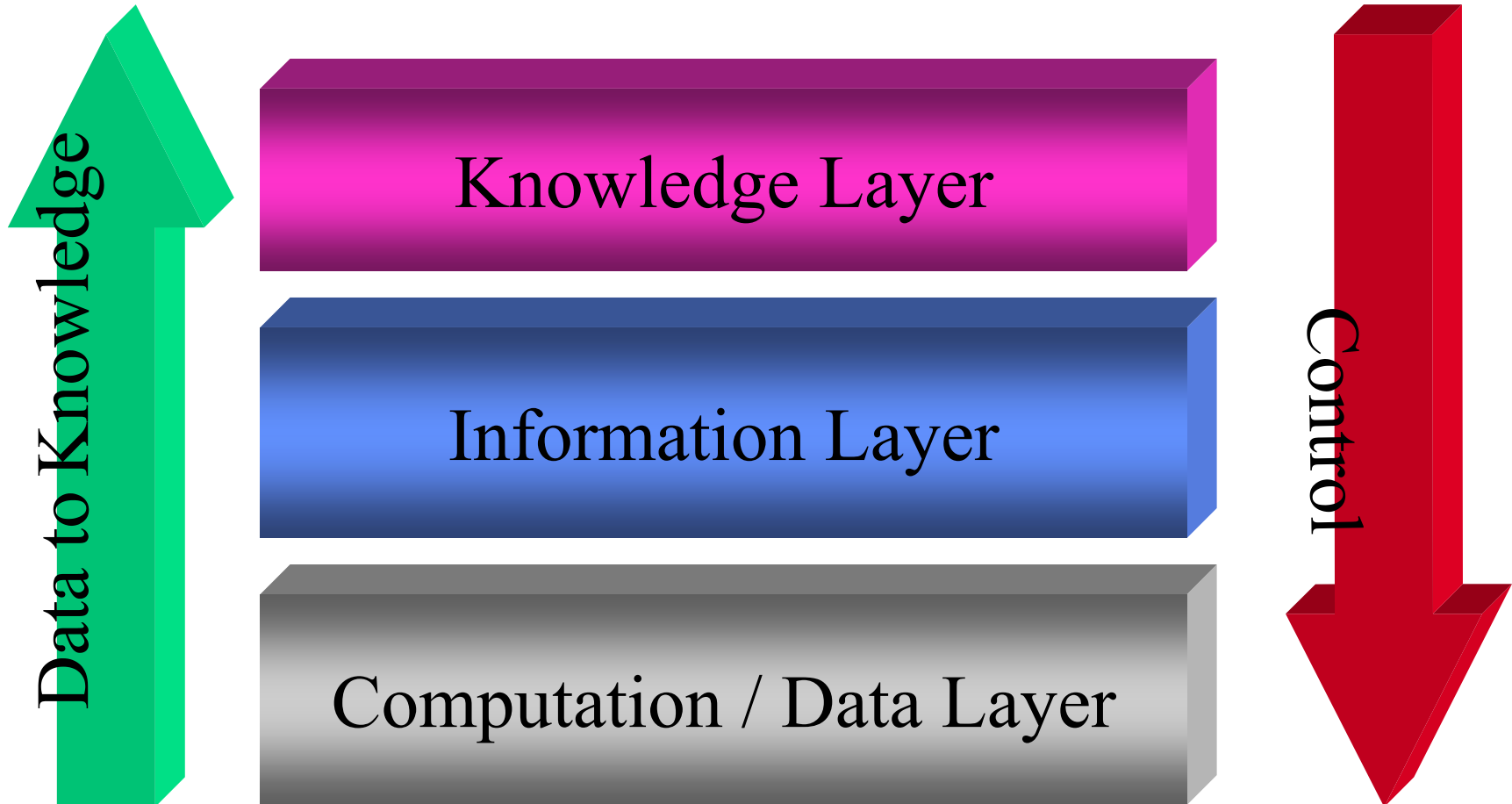
# The GRIDs Vision

- The GRIDs environment is such that
  - A user can interact with it intelligently
  - It provides transparent access to
    - data, information, knowledge
    - computation
    - instrumentation / detectors

# The GRID Bible



# The GRIDs Architecture



# The Computation/Data Grid

- a computation / data grid
  - raw computing power
  - associated data stores
  - network-connected
  - both floating point computation and data-handling with logic;

# The Information Grid

- an information grid superimposed
  - connecting together the major information sources
  - interfaces : homogeneous access to heterogeneous distributed information
  - sophisticated statistical analysis / reduction techniques for floating point numbers, textual information and multimedia information
  - special facilities for images
  - all with associated visualisation and VR (virtual reality) facilities.

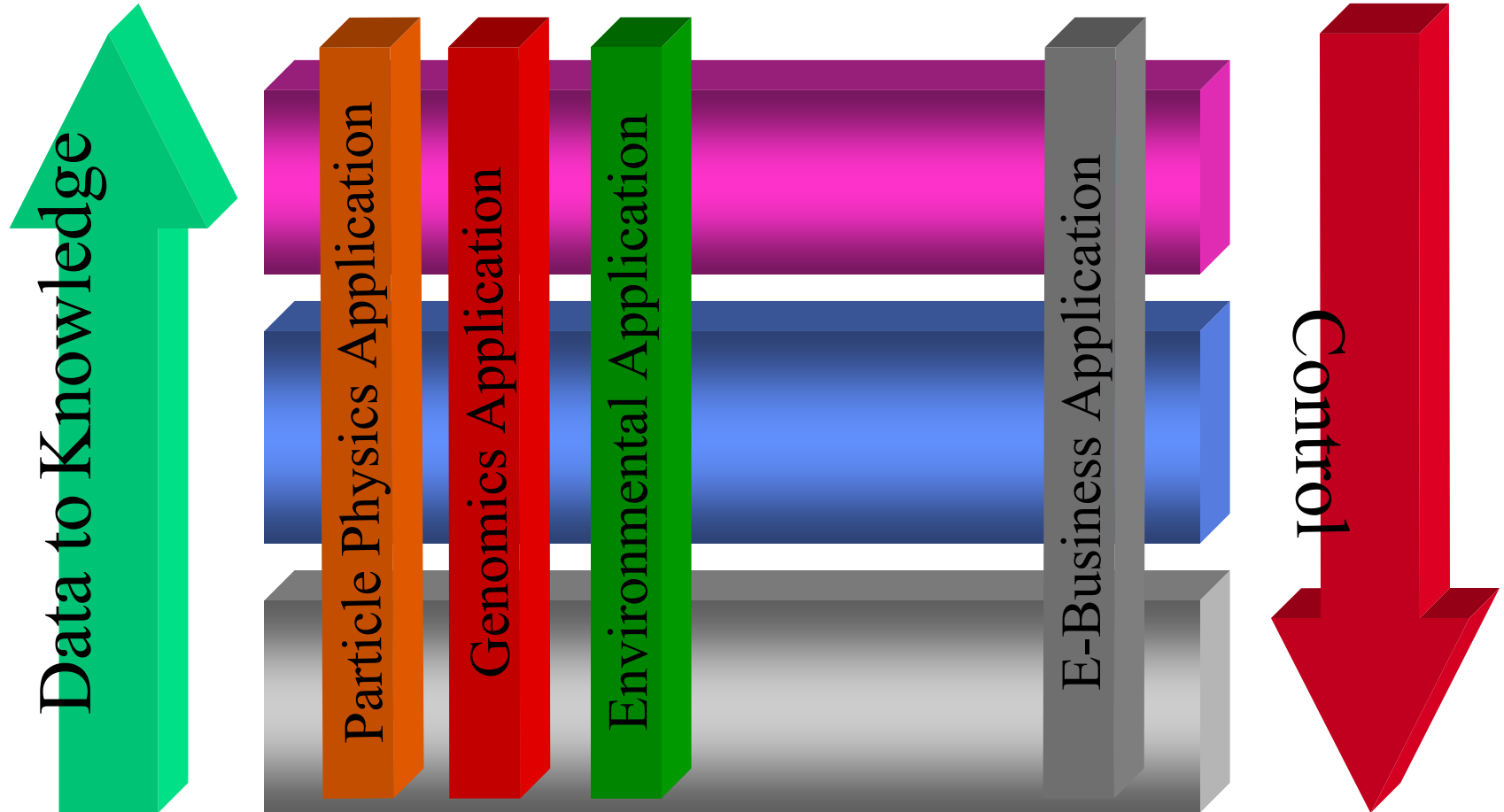
# The Knowledge Grid

- a knowledge grid superimposed
  - utilising KDD (knowledge discovery in database) technology of which a well-known component is ‘data mining’.
  - support intelligent assists to decision makers (from control room to strategic thinkers)
  - provide interpretational semantics on the information.

## In addition.....

- Each grid will have suitable security controls
  - information availability
  - prevention of unauthorised access
- appropriate to the source and the accessor.
- Similarly rights access (e.g. copyright, IPR) will be controlled.

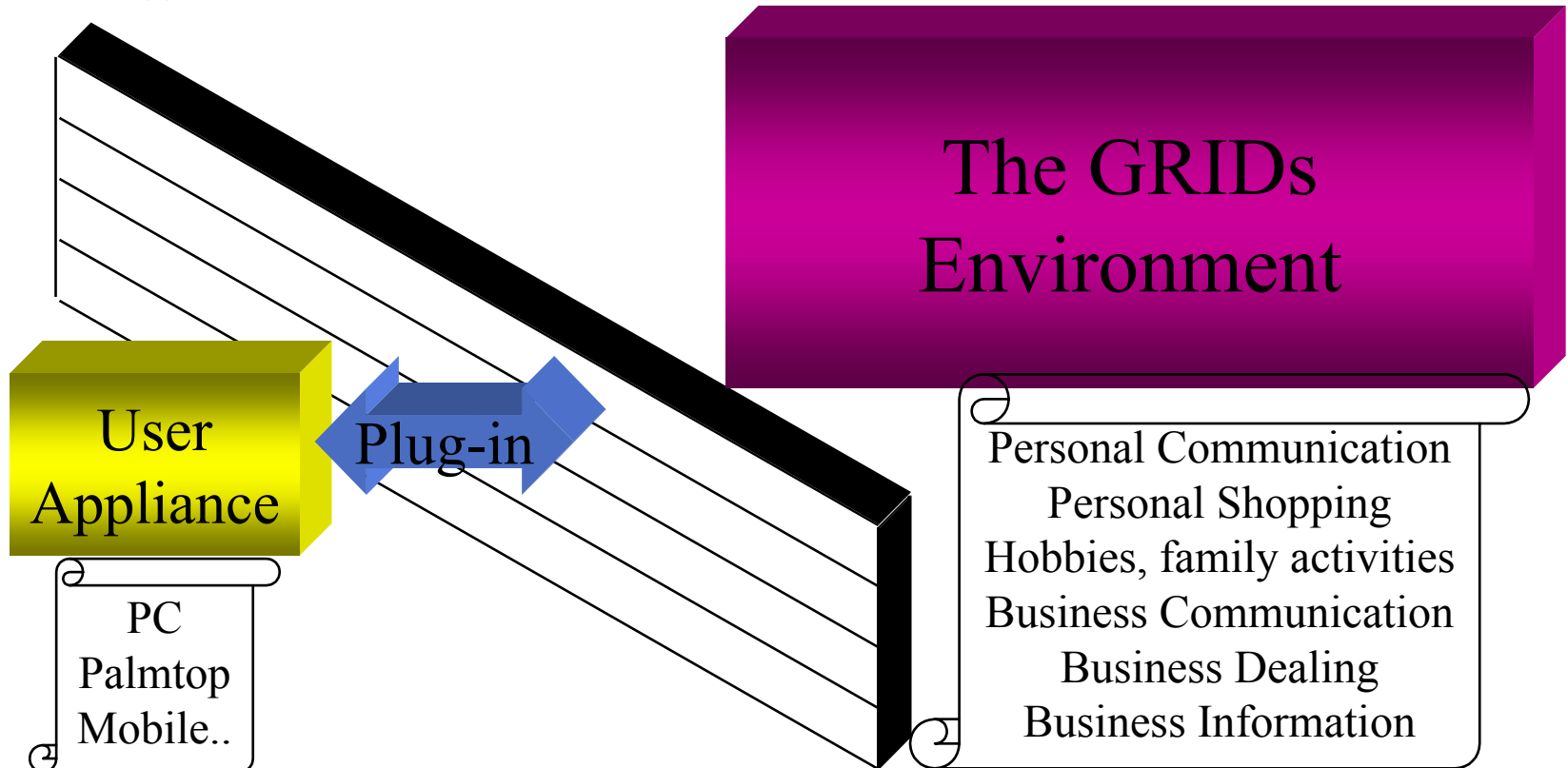
# The GRIDs Architecture



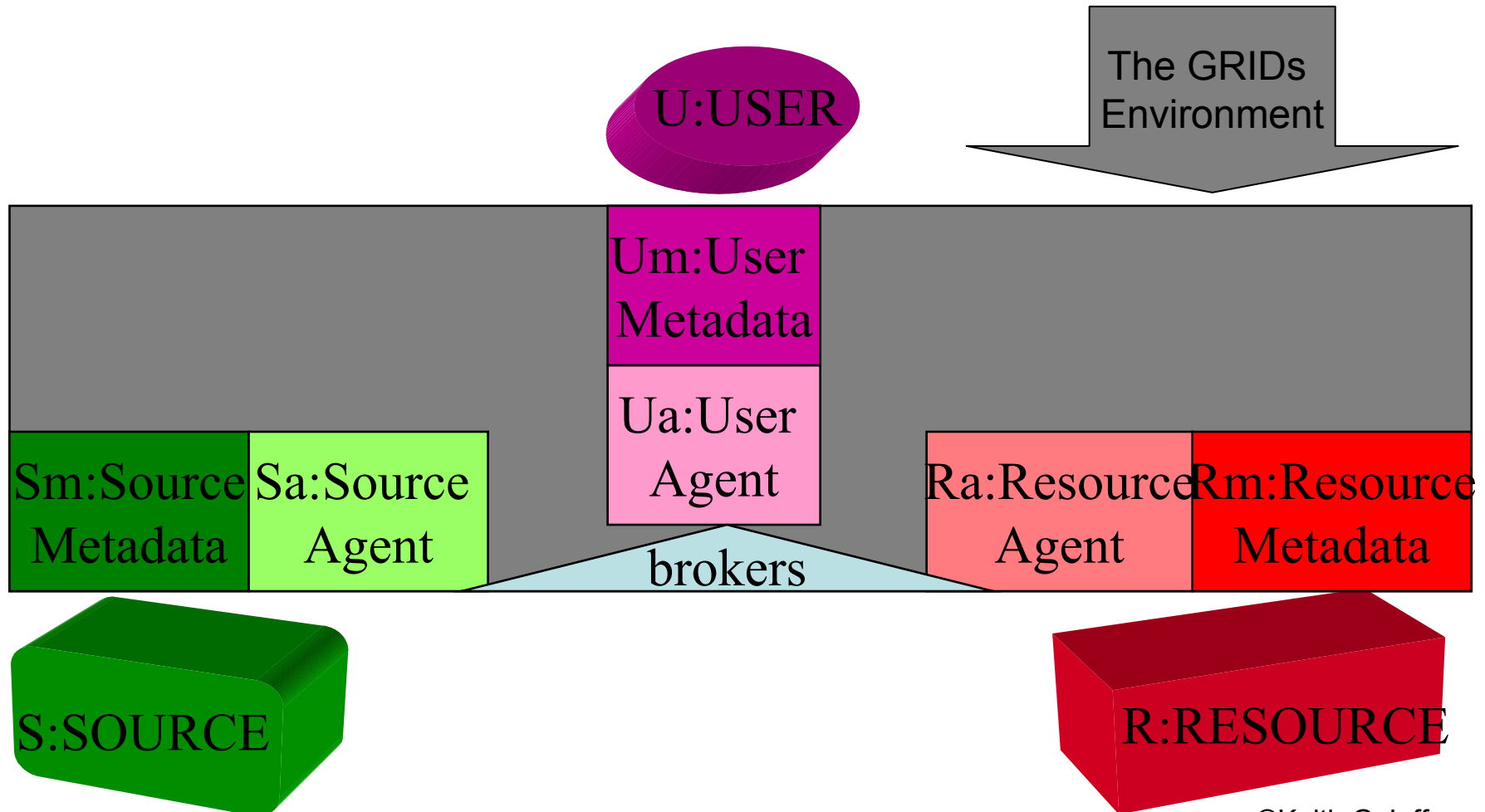


# The Big Idea: What it Provides

‘The Wall’



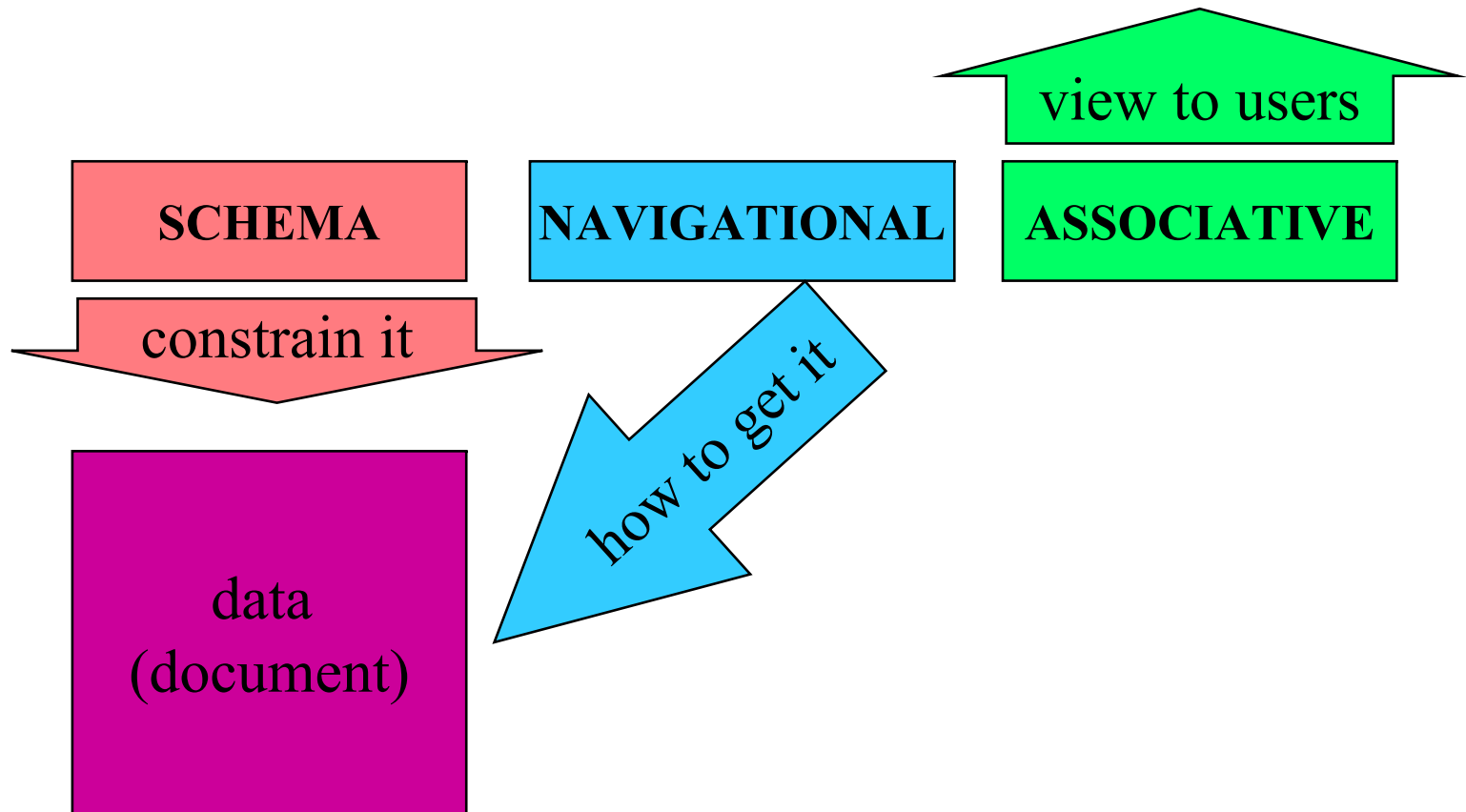
# A POSSIBLE ARCHITECTURE



## A POSSIBLE ARCHITECTURE: Components

- Metadata
- Representative Agents
- Brokers
- User
- Source
- Resource
- User
- Source
- Resource

# Classification of Metadata



# Representative Agents

- Represent the entities {U, S, R} **continuously** and **actively** within the GRIDs environment
- With metadata represent the entity to others represented by their agents
- Act on behalf of the entity

# Brokers

- (a) authentication,
- (b) clarification / precision of request,
- (c) resource discovery (information and if necessary compute power, visualisation facilities etc)
- (d) authorisation (rights),
- (e) offer and pricing,
- (f) closure of deal (U accepts (e))

## Brokers (continued)

- (g) fusion of responses,
- (h) application of any transformation / analysis / simulation / visualisation processes,
- (i) presentation formatting (for variously abled devices and people using various resources),
- (j) network routing, and (k) scheduling of physical resource access / usage

# Monitoring Brokers

- and others will monitor
  - quality of service,
  - utilisation of resource collections
  - specialist physical resources
  - etc etc.



# GRIDs: The Challenges

- Ease of Use
  - Metadata, agents, brokers
  - Expressive and representative languages
- Trust, security and privacy
- Performance
  - Mobile code
  - Ease of optimisation, management
  - Networking

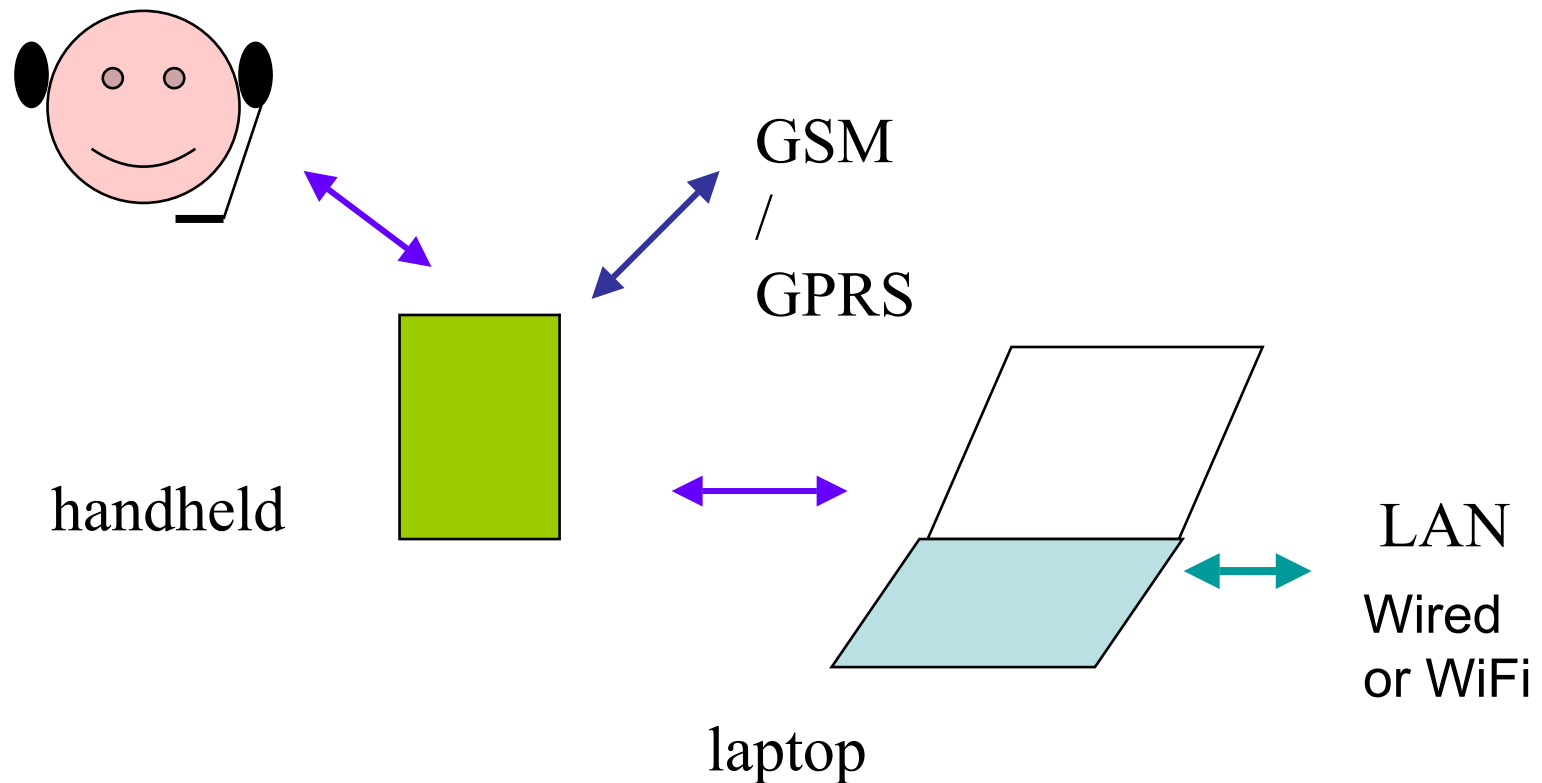
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## Ambient, pervasive, mobile

- The user appliance may well be mobile and requires pervasive connectivity
- It may have interesting capabilities such as attachment of detectors / instruments
  - Scientific research
  - paramedics, firefighters
  - Even ‘road warriors’

# Ambient Computing: The Solution: User



# Ambient Computing: The Solution

- Access via some network means to 'base system' and from there:
- Access to services / servers
  - Intranet
    - Office
    - Management information / decision support
  - Extranet (via proxy servers / firewall)
    - General information e.g. for travel, financial data, news, sport, entertainment

# Ambient Computing: The Challenges

- Communications
  - Volume (multimedia, sensors)
  - Security (and privacy – geolocation)
- Synchronisation
- Customisation of interface
  - Multi-mode, multimedia
  - Intelligent filtering
- Availability of required sources & resources to satisfy the request

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# What does it mean for CRISs

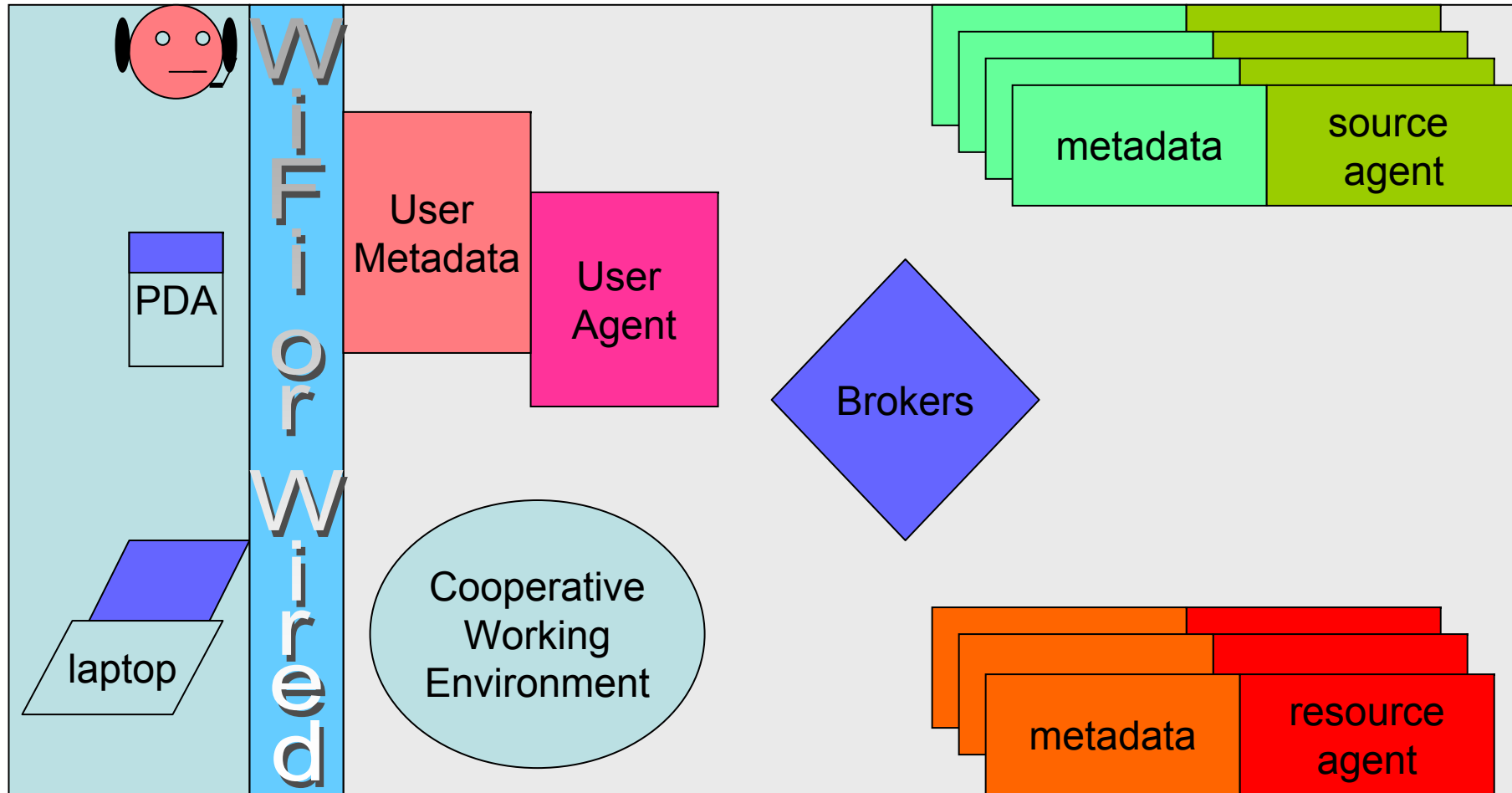
- Homogeneous access – heterogeneous information
- Access to computation as well as information
- Knowledge processing – decision-making
- Collection of new data - detectors
- Integration with scientific datasets, publications etc
- Push as well as pull
- Improved data input – knowledge-assisted



# The CRIS of the Future

Bluetooth

GRIDs Environment



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## Conclusion

- We should build CRISs appropriate for the ‘new world’
  - GRIDs
  - Ambient computing
- To take advantage of the new business opportunities
- To integrate with the rest of the environment of the user



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