Enough Description of Data and its Utilization

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S Project: 1984-1994

Organization of our talk

- Needs of Data and Description
  - NetCDF and DDI
- DandD rule, DandD Instance
- InterDatabase
- DandD Client Server System
  - DandDServer
  - DandDBrowser
  - DandDR
- Data View and Visualization

Needs of Description

- Collaboration between data collector and analyzer.
  - Many people are concerned with a data.
  - on the way from data collection to analysis
- Data Storage
  - Nobody can understand the meaning of the data without enough description, for example, after a year .

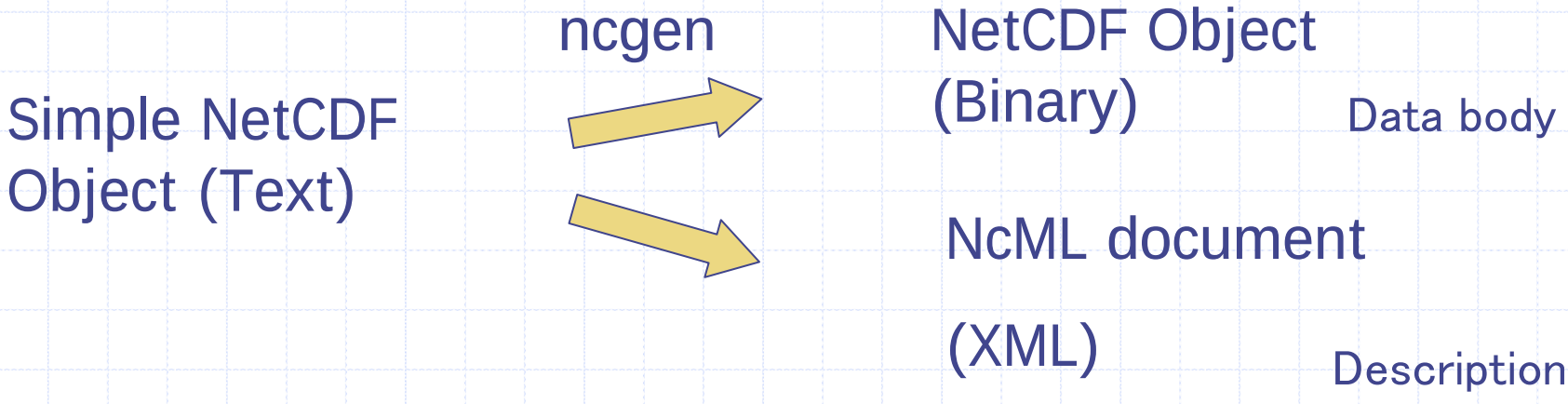
Specific or Unspecific

- Specific Field
  - NetCDF (Unidata Program)
    - For scientific array data
  - DDI (Data Documentation Initiative)
    - For social and behavioral science data
- Unspecific Field
  - DandD (DandD Project)
    - For any data
    - Open ended

NetCDF [Russ Rew et al. (1997) NetCDF User's Guide]

- Network Common Data Form
- CDL (Common Data Language)
  - Notation to describe a data

    → Simple NetCDF Object
- Recent Advances



Problems of NetCDF

- Insufficient data attributes
  - String ? Categorical ? Or Date?
    - Only string
  - Precision ?
    - Only integer, float or double
  - Missing or Invalid ?
    - Only a missing type
- No generarity

DDI [the Data Documentation Initiative(2003), DDI Front Page]

- For social and behavioral science
  - Census data
  - Questionnaire survey data
- Implementation
  - XML

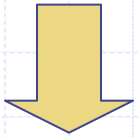
Problems of DDI

- Sampling Design
  - free description
    - No intelligent use of the design
- Data Organization
  - Variable Definition
    - No distinction between Axis and Value

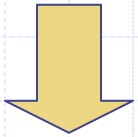
DDI is limited to describing the result of survey.

DandD (Data and Description)

- Philosophy of Data Science
  - Data without description is meaningless.



DandD rule

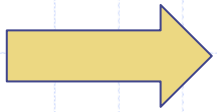


DandD Client
Server System

DandD rule (DDI)

- Element
  - Vector (a sequence of numbers) + Attributes
- Organization of elements
  - Array
  - Relational + Systems
- Background information (Multi-language)
  - Introduction
  - References
  - Relatives (Relation to other DandD Instances)
  - DataSampling

UTF16



DandD instance (an XML document)

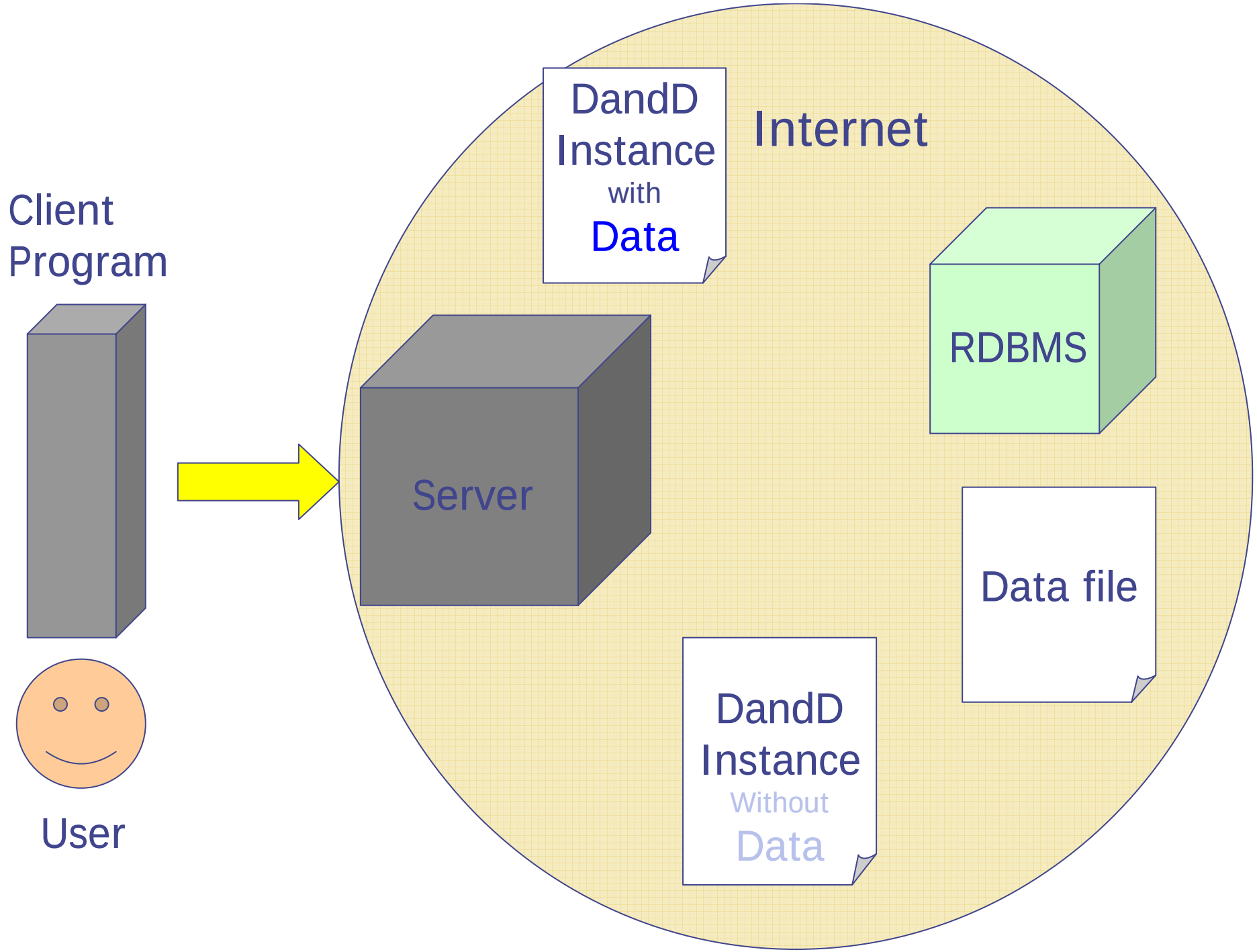
An example of DandD instance

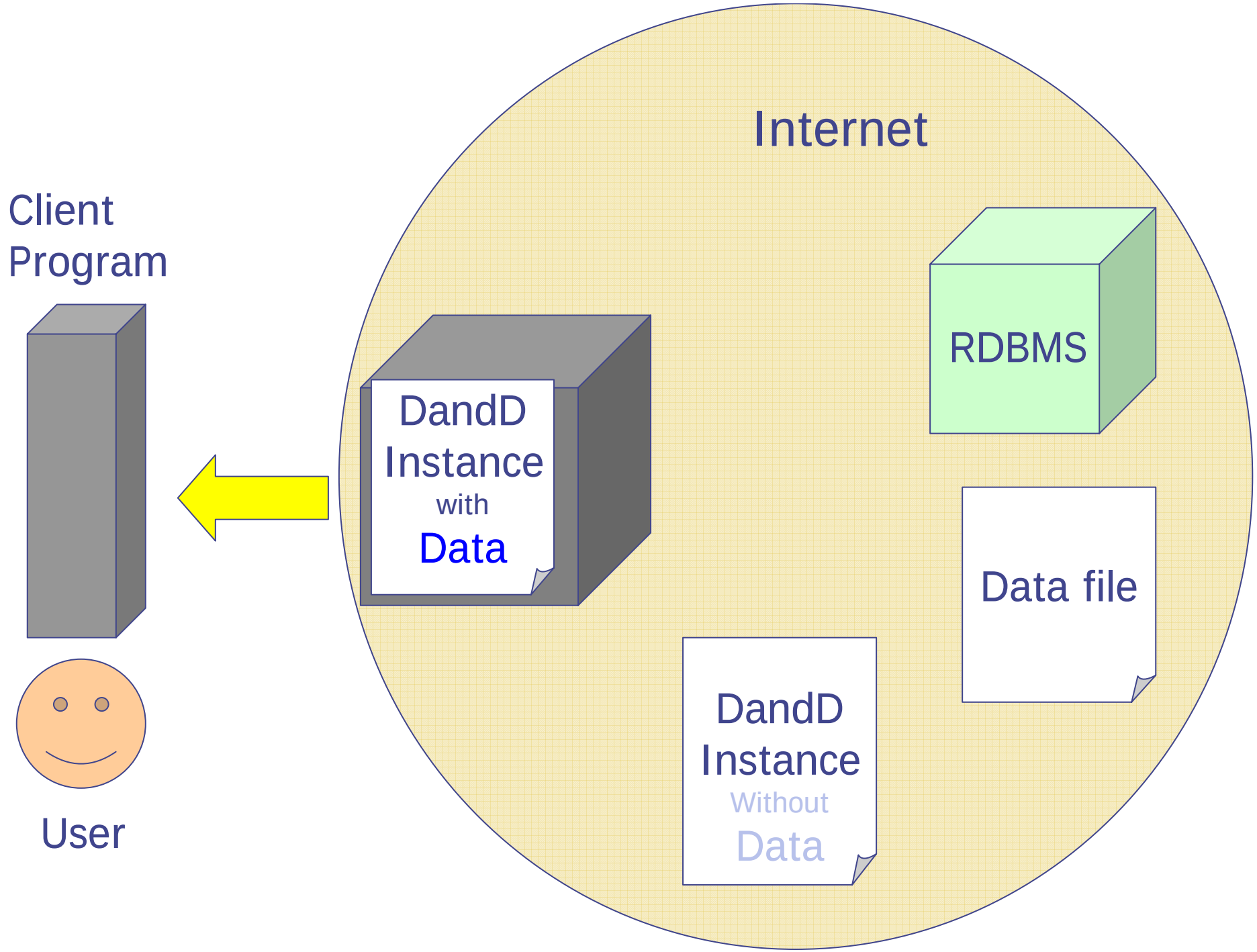
```
<Data>
<Relational Id="r1">
  <Value RefId="year" Systems="t1"/>
  <Value RefId="month" Systems="t1"/>
  <Value RefId ="day" Systems="t1"/>
    ...
 </Relational>
</Data>
<DataBody>
 <DataVector Id="year" >1975 2001 2003</DataVector>
 <DataVector Id="month" Code="c1 c2">1 2 3</DataVector>
 <DataVector Id="day" >9 3 10</DataVector>
  ...
</DataBody>
<Appendix>
   <Code Id="c1">"Oct." "Jan." "Sept."</Code>
   <Code Id="c2">"10月" "1 月" "9月" </Code>
</Appendix>
```

year	month	day	...
1975	10月	9	...
2001	1月	3	...
2003	9月	10	...

System definition

```
<Time Id="t1">
  <Year RefId="year"/>
  <Month  RefId="month"/>
   <Day RefId="day">
</Time>
```


Client
Program
User
Server
DandD
Instance
with
Data
Internet
RDBMS
Data file
DandD
Instance
Without
Data


Internet
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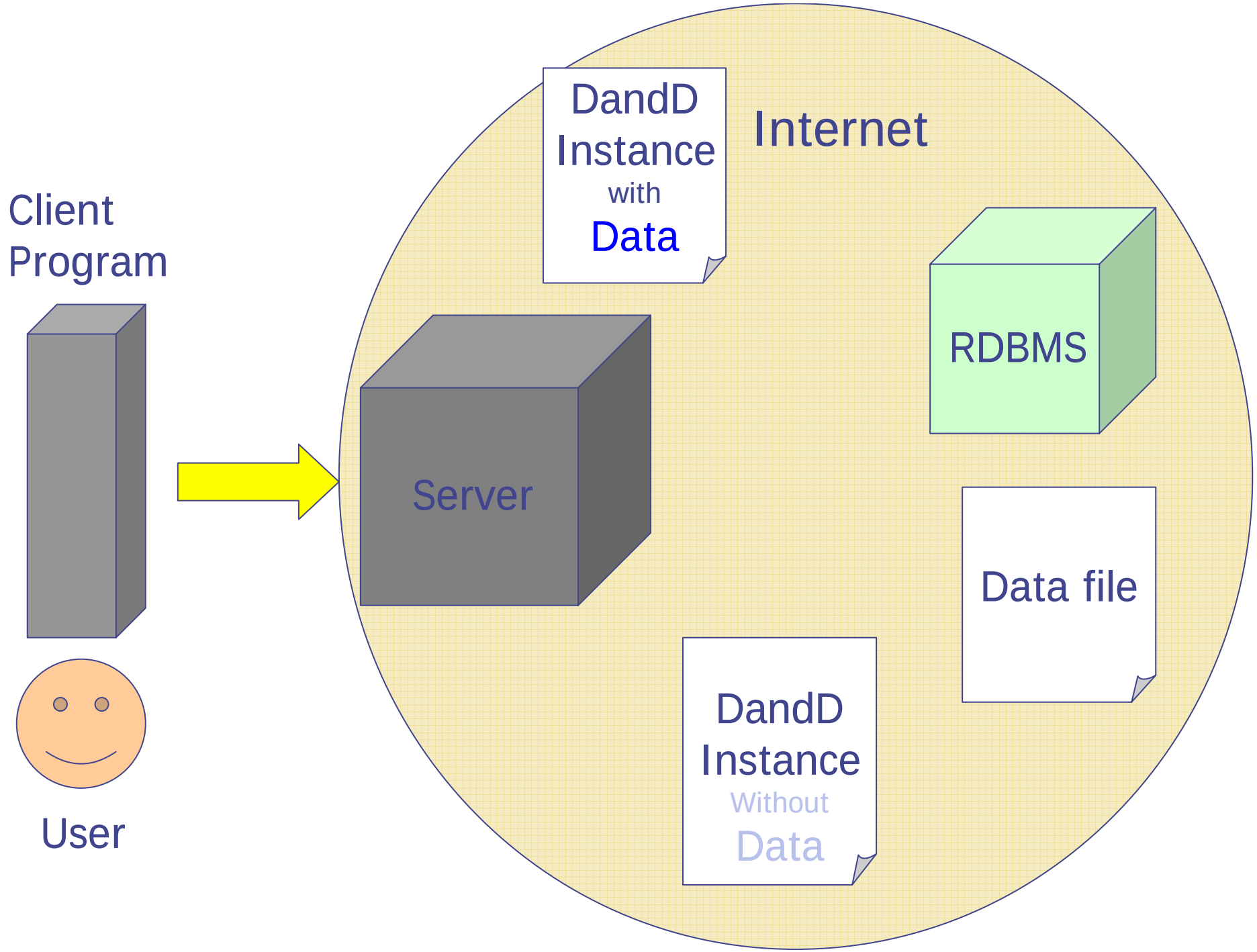
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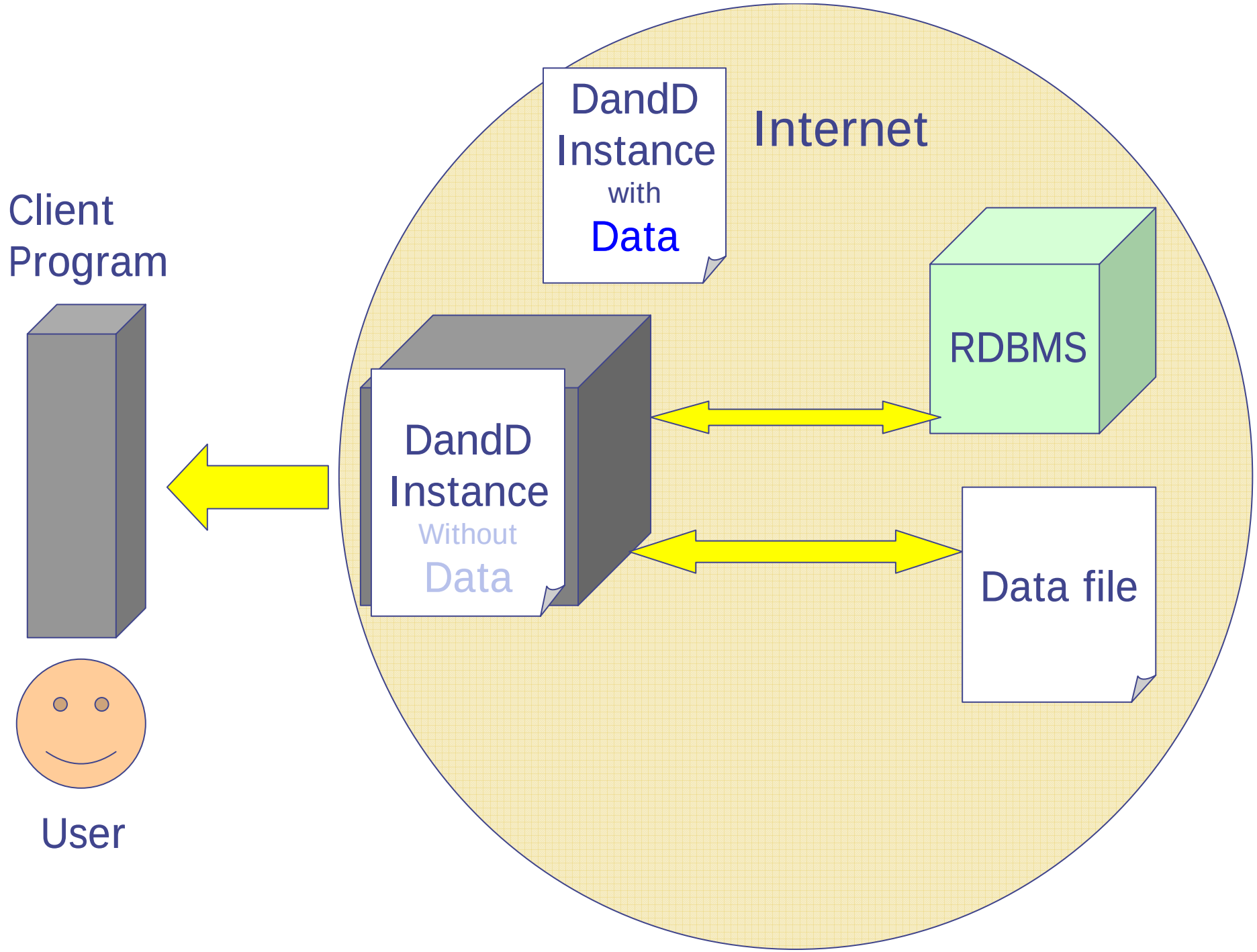

Client
Program
User
DandD
Instance
with
Data
Internet
DandD
Instance
Without
Data
RDBMS
Data file

InterDatabase (2001)

- Databases on the Internet
  - Scattered data on the network
  - Accessible via network
- Interface to databases (DandD instance)
  - Different database management systems
  - Different storage types
- Principle
  - Unit : DataVector
  - Integration : Relational

External DataVector

- Body
  - Null
- Attributes
  - Access
  - Protocol
  - PostProcessing

```
<DataVector Id="i1"
            Access="a1"
            Protocol="p1"
            PostProccesing="scan" />
```

Example of external DataVector

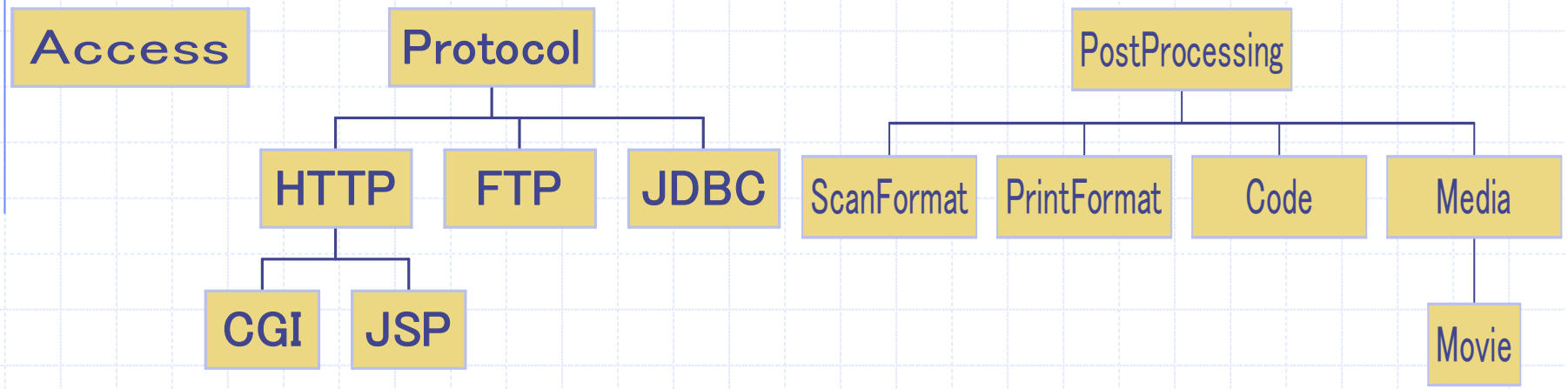
```
<DataVector Id="i1" Access="a1"
Protocol="p1"  PostProccesing="scan" />
<Appendix>
<Access  Id="a1" IP="131.113.65.1"
UserId="anonymous" />
<Protocol Id="p1" Physical="tcp">
  <FTP Suffix="/test.csv" Offset="3" Lines="28" />
</Protocol>
<ScanFormat Id="scan">
" %*s,%s,%*s"
</ScanFormat>
</Appendix>
```

ftp://131.113.65.1/test.csv

2003,12,11

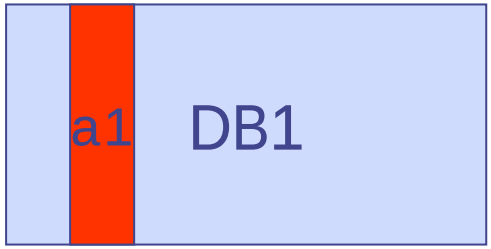
2003,12,12

Inheritance tree of Access, Protocol, and PostProcessing



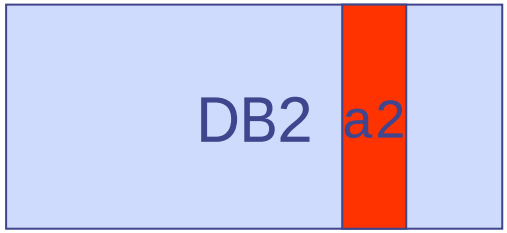
Integration of external DataVectors

```
<Relational Id="r1">
        <Value RefId="a1">
        <Value Refid="a2">
</Relational>
```

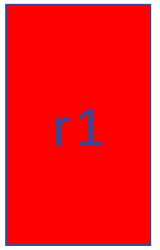


<DataVector id="a1" /> (exists in DB1)

<DataVector id="a2" /> (exists in DB2)



Scattered into two Databases



Virtual cbind in R

Integration of external DataVectors(2)

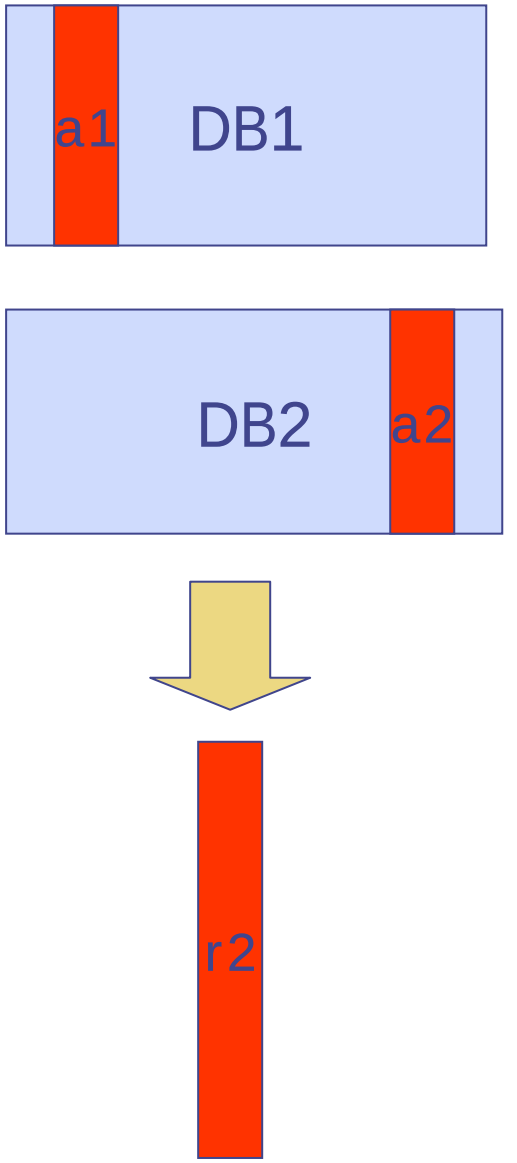
```
<Relational Id="r2">
        <Value RefId="a1 a2">
        .....
</Relational>
```

<DataVector id="a1" /> (exists in RDB1)

<DataVector id="a2" /> (exists in RDB2)

Integration of the attributes is necessary in this case !!

→ **virtual rbind in R**

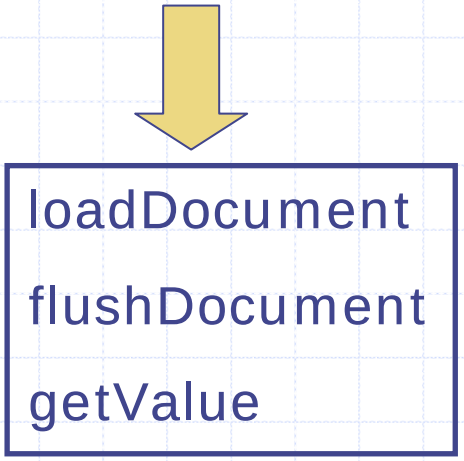


DandD Client Server System

- Advantage of client
  - Platform independent
    - Communication through socket
  - Easy programming
    - Query and Response
  - Mobility
    - cellular phone
    - PDA

DandDServer

- Recieve : DOM (Document Object Model) methods + Original methods
- Send : Flag+Size+String
- Implementation by Java
  - XML Parser
    - Xerces for Java2 (Apache)
  - Interpreter
    - Pnuts (Sun Micro Systems)

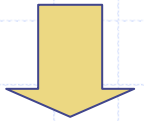


Client System

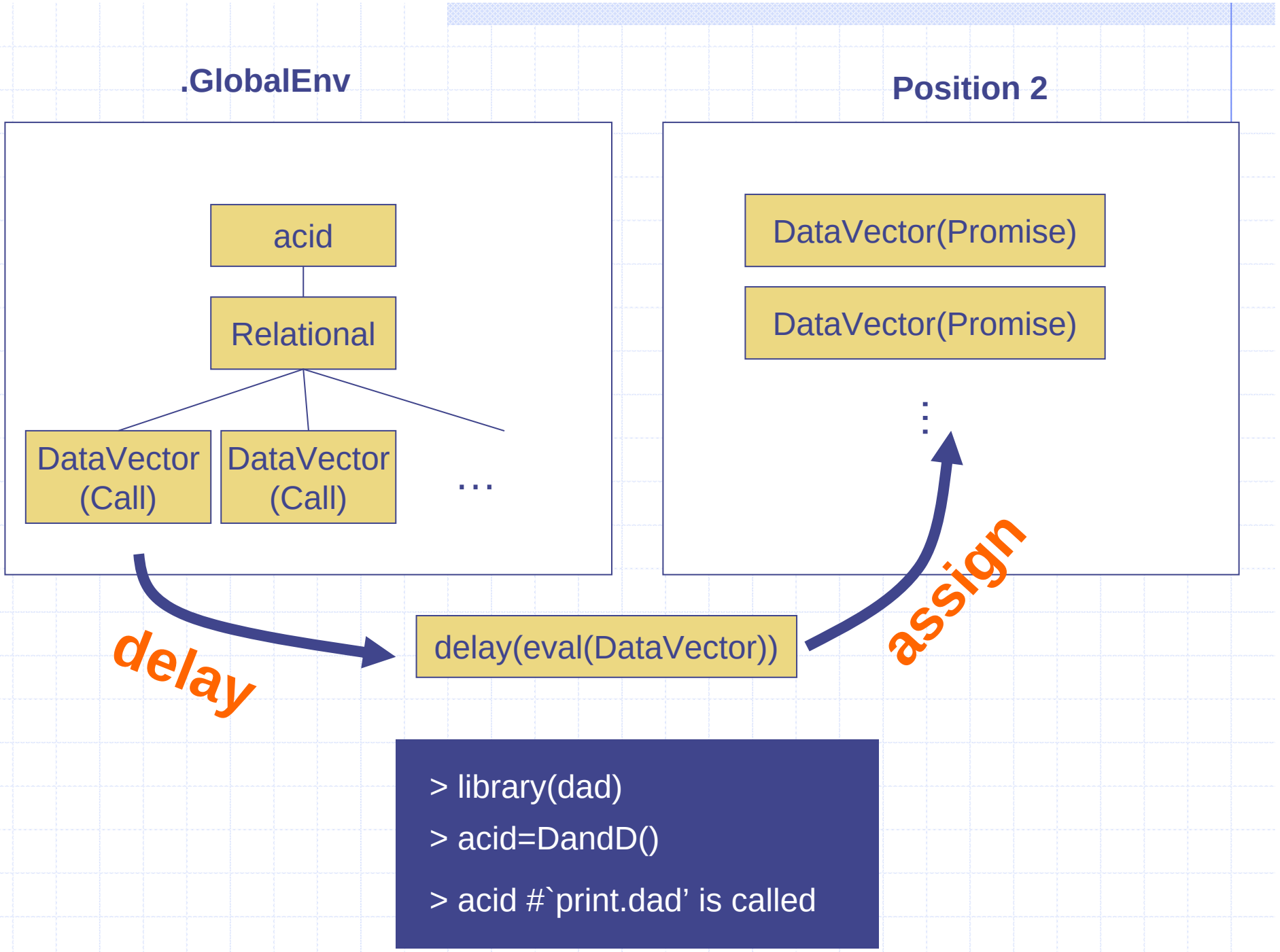
- Browsing
  - DandDBrowser
- Analysis and Modeling
  - DandDR
- Generation and Modification
  - DandD Instance Generation
  - Edit or update

DandDR

```
>library(dad)
>foo=DandD(“Acid.dad”) # return DandD Object
>foo
Acid Rain (Relational) attached to "AcidRain.dad:AcidRan"
[1] "SlftCcn"(Sulfate Cocentration)     "NtrtCnc"(Nitrate Concentration)
[3] "CntnsPr"(Continuous Precipitation)
>plot(foo) # visualization of DandD object
```



Promise Objects
by delay method

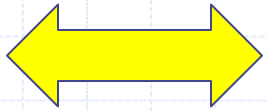

.GlobalEnv
Position 2
acid
Relational
DataVector (Call)
DataVector (Call)
...
DataVector(Promise)
DataVector(Promise)
delay
delay(eval(DataVector))
assign
> library(dad)
> acid=DandD()
> acid #`print.dad' is called

DandDR

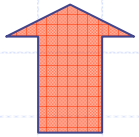
```
>library(dad)
>foo=DandD(“Acid.dad”) # return DandD Object
>foo
Acid Rain (Relational) attached to "AcidRain.dad:AcidRan"
[1] "SlftCcn"(Sulfate Cocentration)     "NtrtCnc"(Nitrate
Concentration)
[3] "CntnsPr"(Continuous Precipitation)
>plot(foo) # visualization of DandD object
```

Visualization

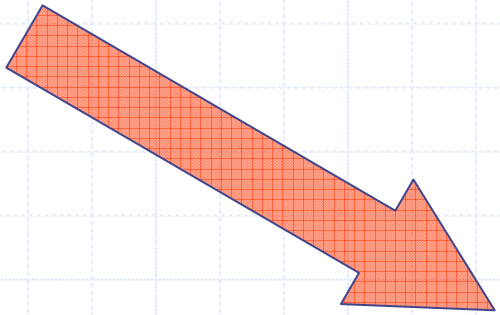
Data View



Visualization



DandDR



DandD Instance

Data organization

Various attributes

Background information

Visualization by DataType attribute of DataVector

- Conditional variable
  - Conditional
    - Unordered
    - Ordered
    - Equispaced
    - Binary
  - Auxiliary
    - Number
    - Sequence

→ **X axis**

- Nominal variable
  - Id

→ **Label**

- Resulting variable
  - Categorical
    - Category
    - OrderedCategory
    - Logical
  - Measurement
    - Score
    - Interval
    - NULL
  - Count
    - Count

→ **Y axis**

Homepage

- DandD Project Homepage
  - Examples of DandD instance
  - DTD
  - Software
- URL

http://www.stat.math.keio.ac.jp/DandDIII/