Using Telex for disconnected cooperative engineering in a GIS

Ikram Chabbouh

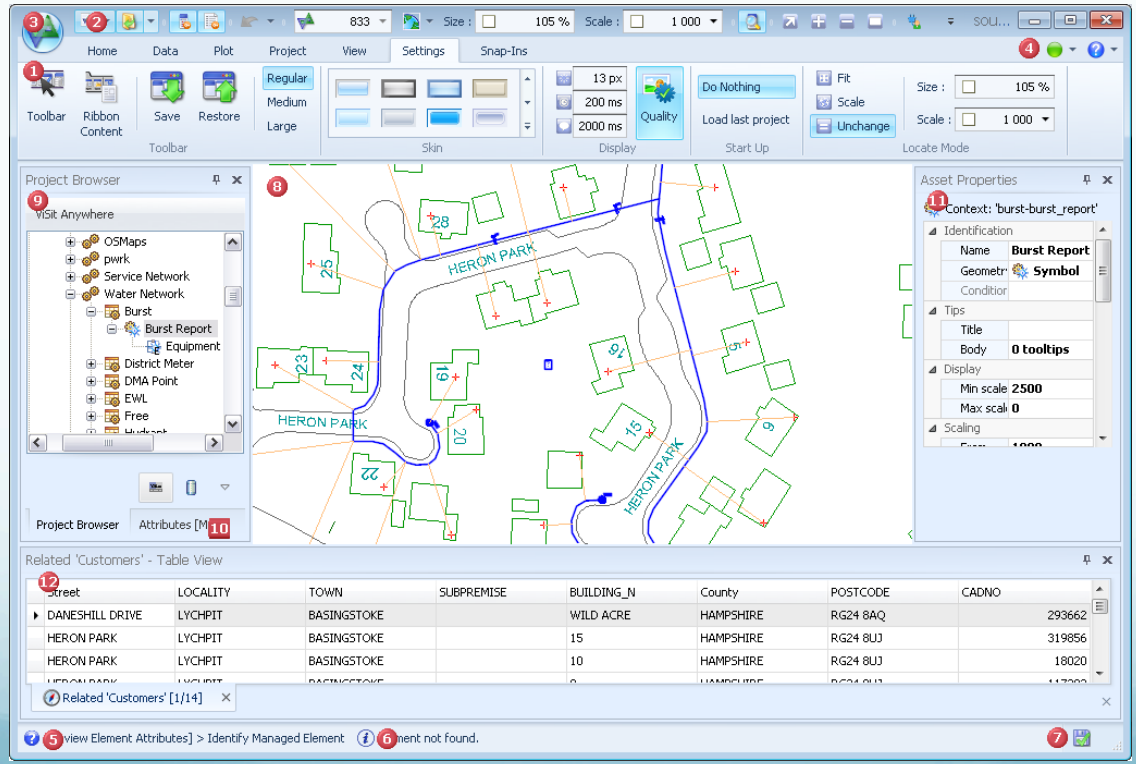
5/3/2012

Outline

- VA
  - General presentation
  - Update management
  - Current limitations
- Telex
- Telex and VA
  - What Telex can do
  - Proposed solution

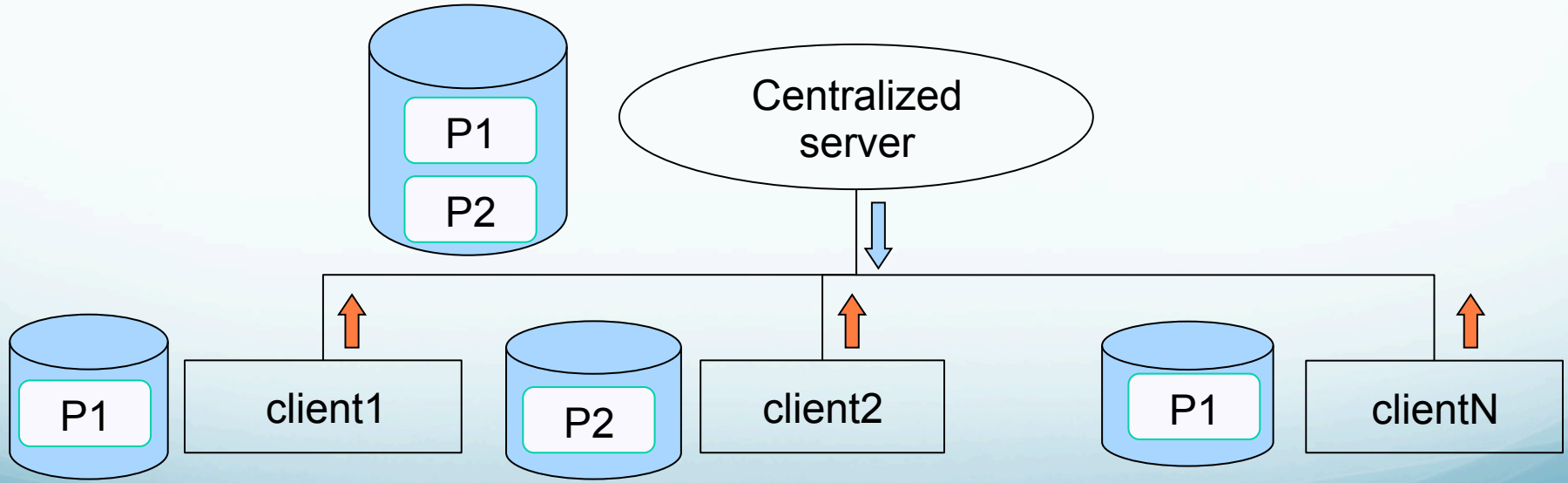
General presentation

SME 20 years old company
Geographical Information System Software
VA software collaborative tool for editing spatial data



VA current state

Client/server architecture
Storage of spatial data ➔ large data sets
Data organized into projects



Application objects

Physical objects:

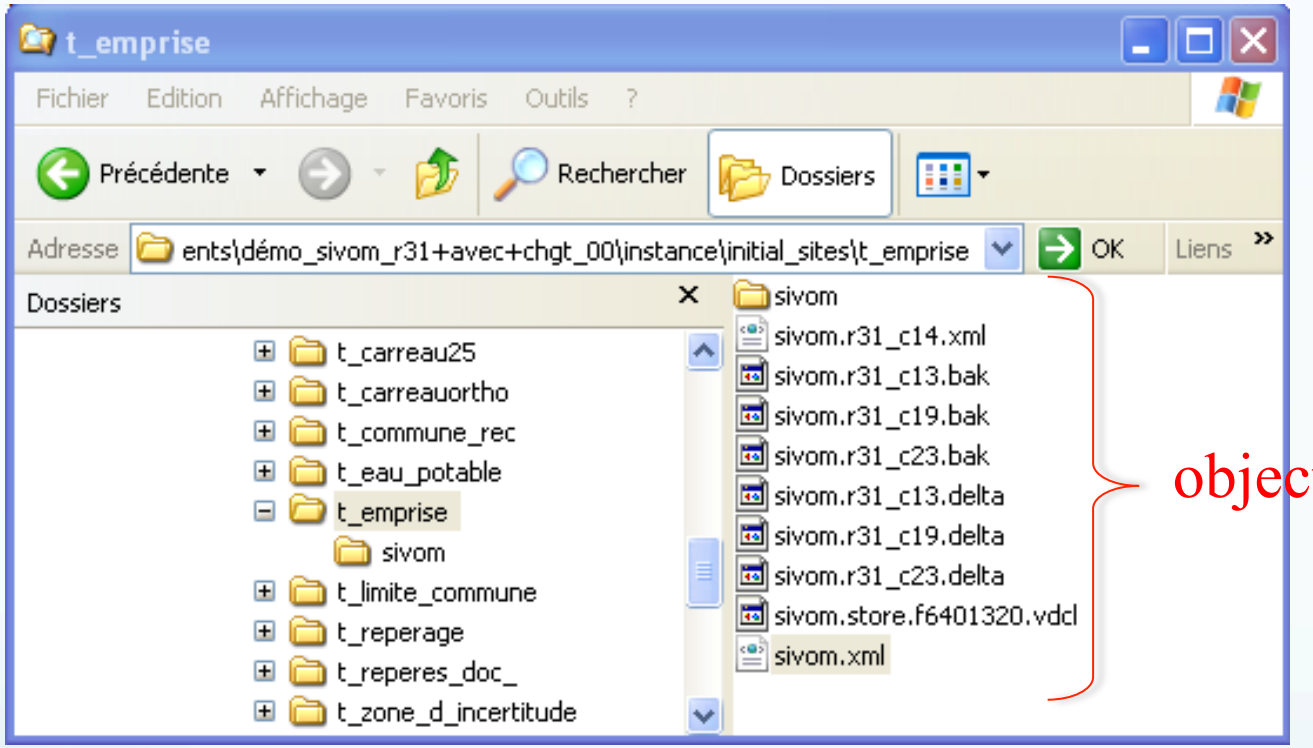
- types, schema objects, table instances, graphical objects, attributes data

Logical objects :

- Storable objects: a change controller per object
- Controlled elements: a change controller per group of objects

Objects serialize themselves in XML format and create themselves from serialized versions

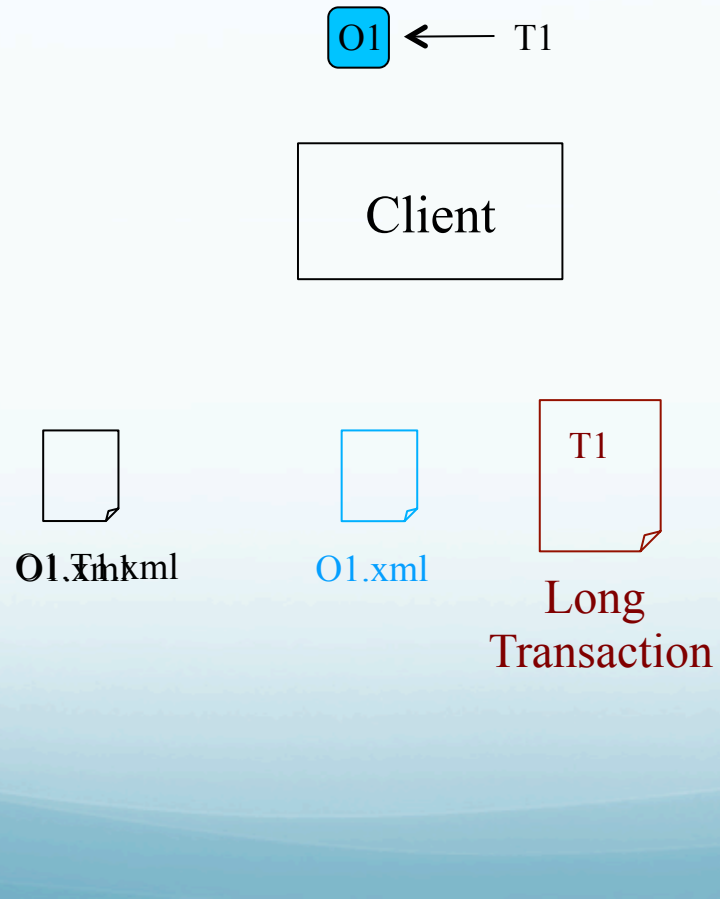
Update management



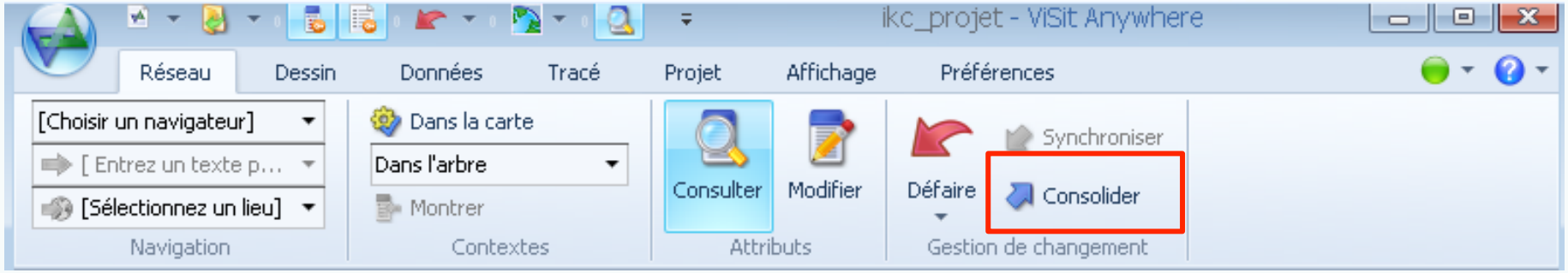
object ≈ XML file (current state)
+ [backup states]

State-based update management
Update an object = in memory + on disk
On disk : replace the old object state with the new state

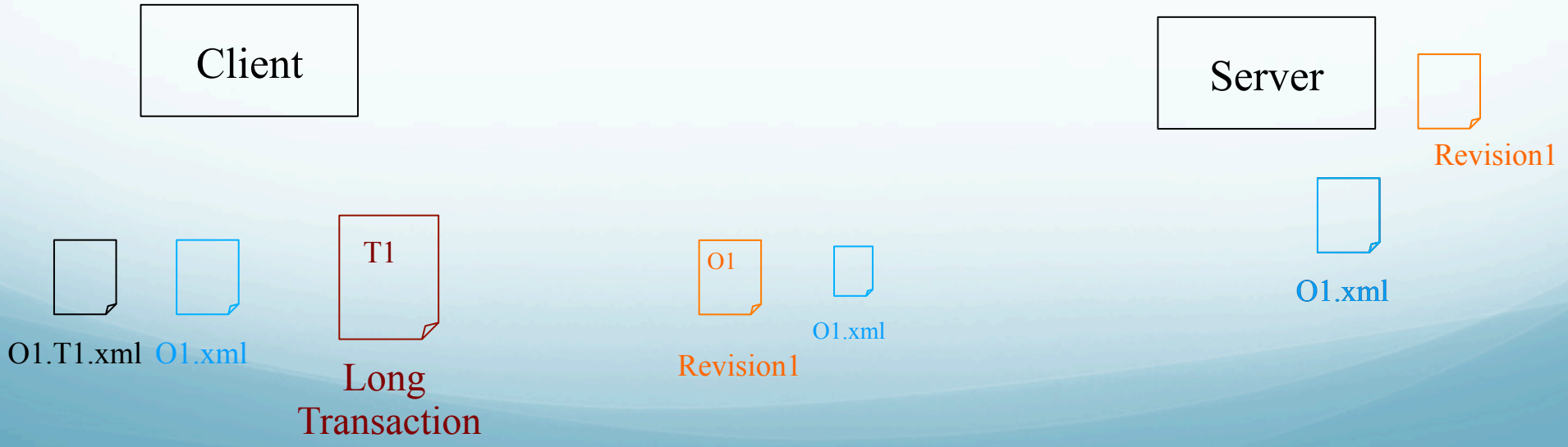
Local update



Update consolidation

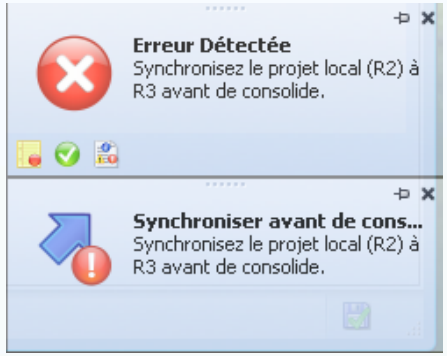


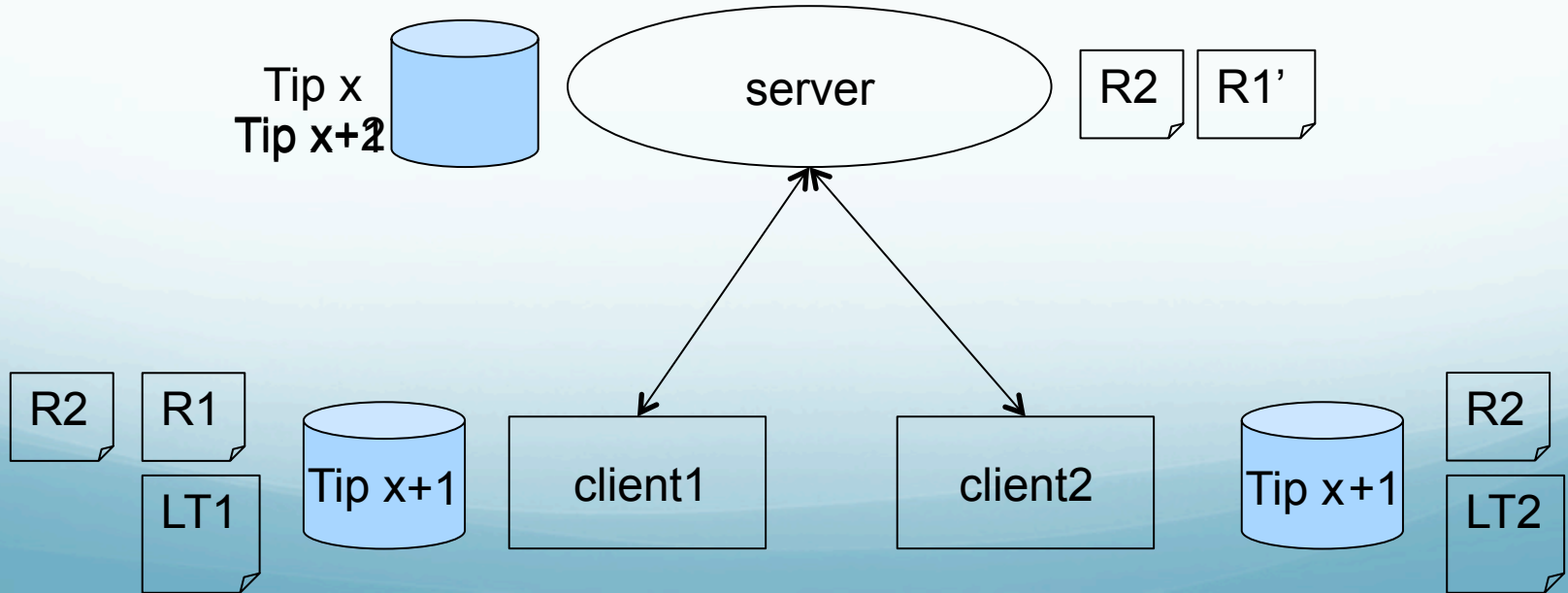
Same version number



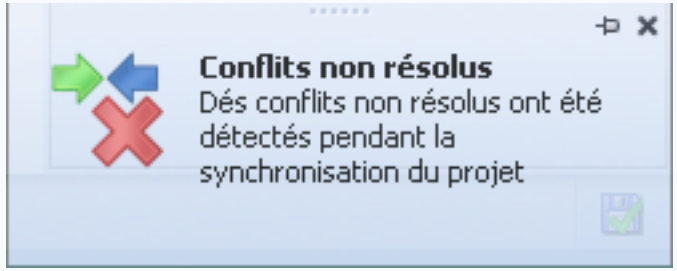
Update consolidation

Different version numbers





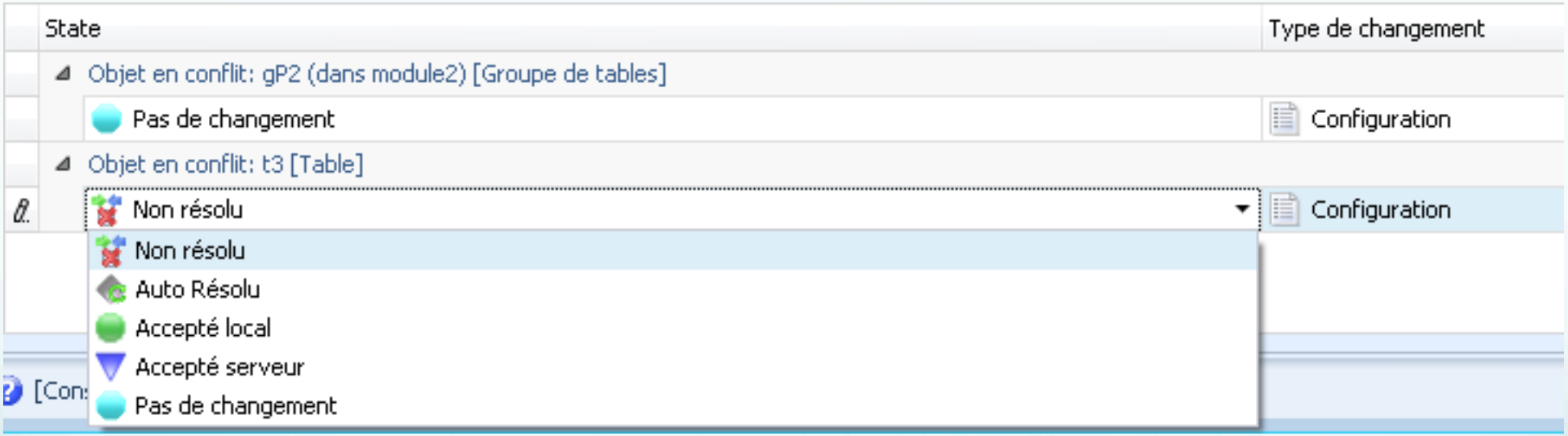
Conflict detection



Revisions used to detect conflicts on client side
Coarse grained conflict detection: conflicts detected at the object level
Watches to declare implicit conflicts (not very used)

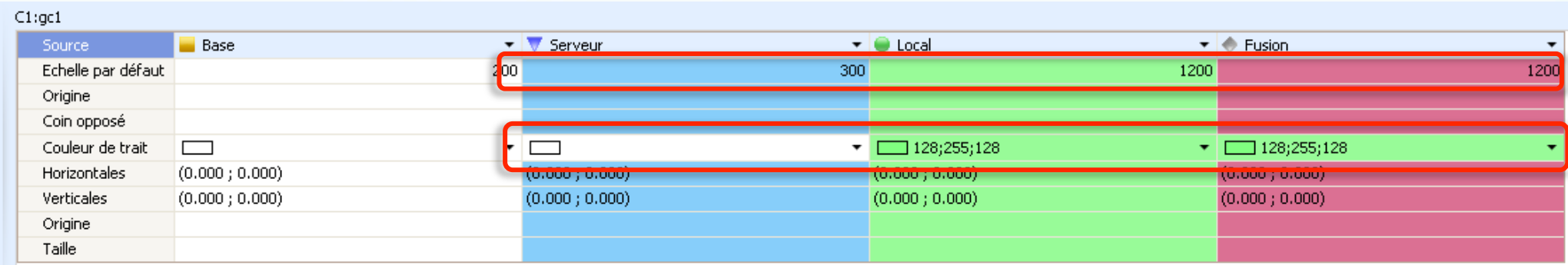
Conflict resolution

Manual resolution of conflicts



Conflict resolution

Manual merge of updates



Outline

- VA
  - General presentation
  - Update management
  - Current limitations
- Telex
- Telex and VA
  - What Telex can do
  - Proposed solution

« Heavy weight » commit for users

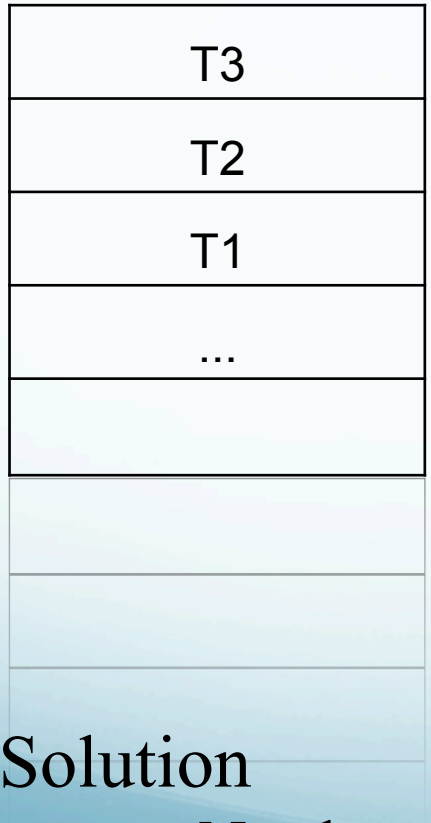
Users have to apply all the committed updates
Users resolve conflicts manually

Solutions

- partial replication of data
- filter the irrelevant updates
- finer-grained conflict detection
- automatic resolution of conflicts

Reverse chronological undo of operations

Stack of transactions



Updates do not commute (based on the previous state)
Undo in the reverse chronological order of execution

Solution

Need to detect dependencies between operations

System integrity

Change type of a column → must update corresponding stored data
Add a column → must set a default value to existing records
Geographical constraints → move a valve when a pipe is moved

Solutions

Allow/disallow operations, execute appropriate processing, etc.

Requirements

Light weight commit for users

- Detect conflicts between concurrent versions
- Solve conflicts automatically

Non chronological undo of operations

- Detect dependent actions
- Propose a schedule of operations to undo

Outline

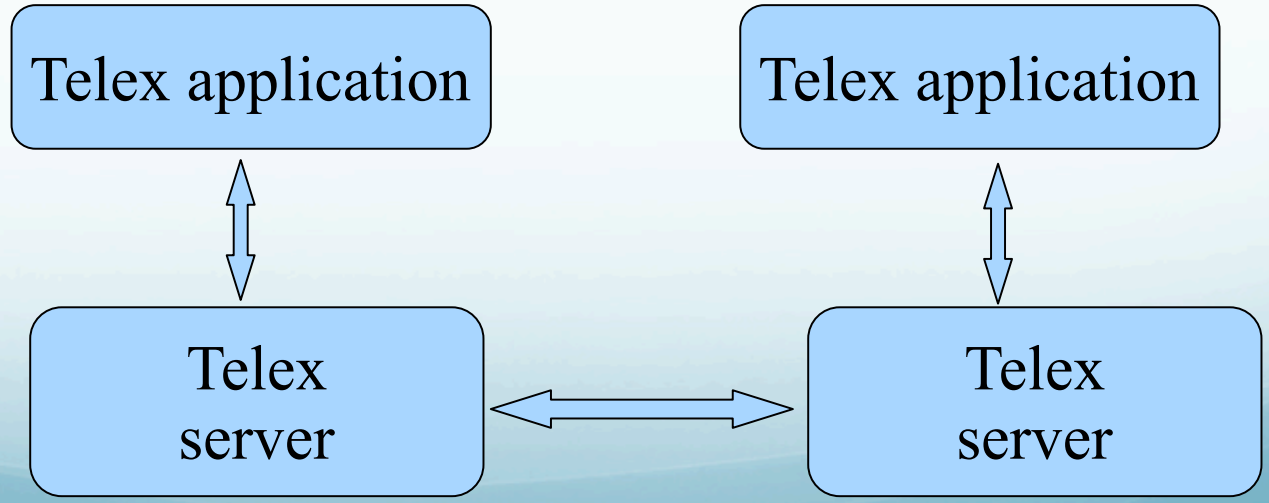
- VA
  - General presentation
  - Update management
  - Current limitations
- Telex
- Telex and VA
  - What Telex can do
  - Proposed solution

Telex

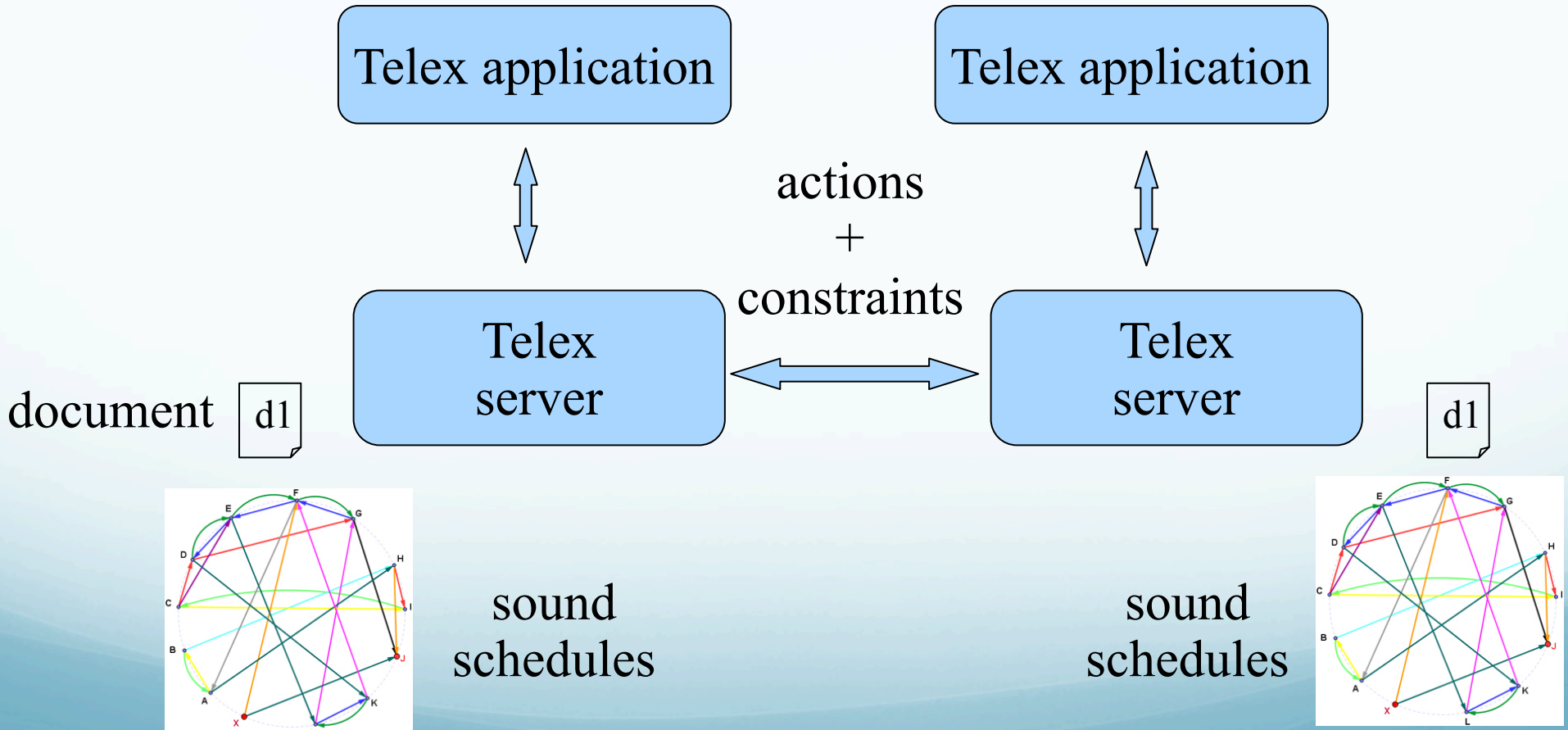
Middleware for developing collaborative applications
Takes care of :

- replication,
- data consistency,
- conflicts management,
- commitment across the distributed servers.

Optimistic replication



Telex


Telex application
Telex application
actions
+
constraints
Telex
server
Telex
server
document
d1
d1
sound
schedules
sound
schedules

Outline

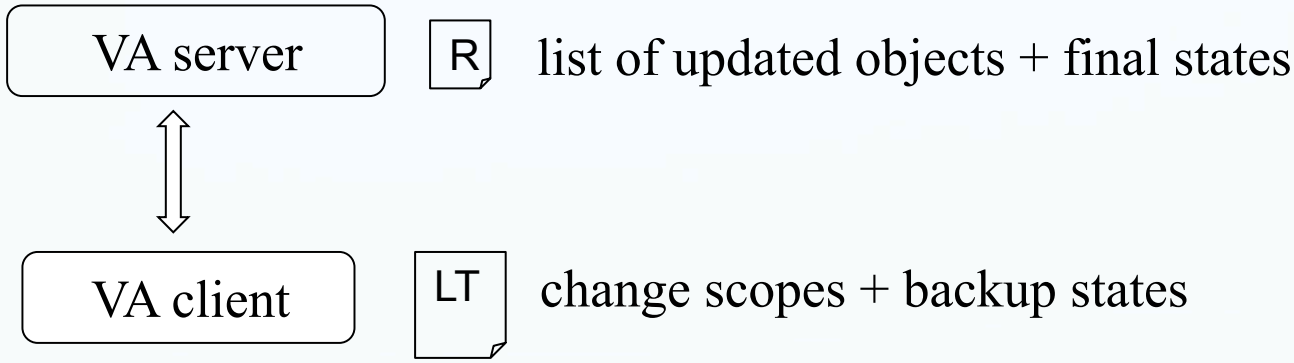
- VA
  - General presentation
  - Update management
  - Current limitations
- Telex
- Telex and VA
  - What Telex can do
  - Proposed solution

What Telex can do

Use Telex to detect conflicts/dependencies in VA
Express VA in terms of a Telex application
Desired properties of the solution:

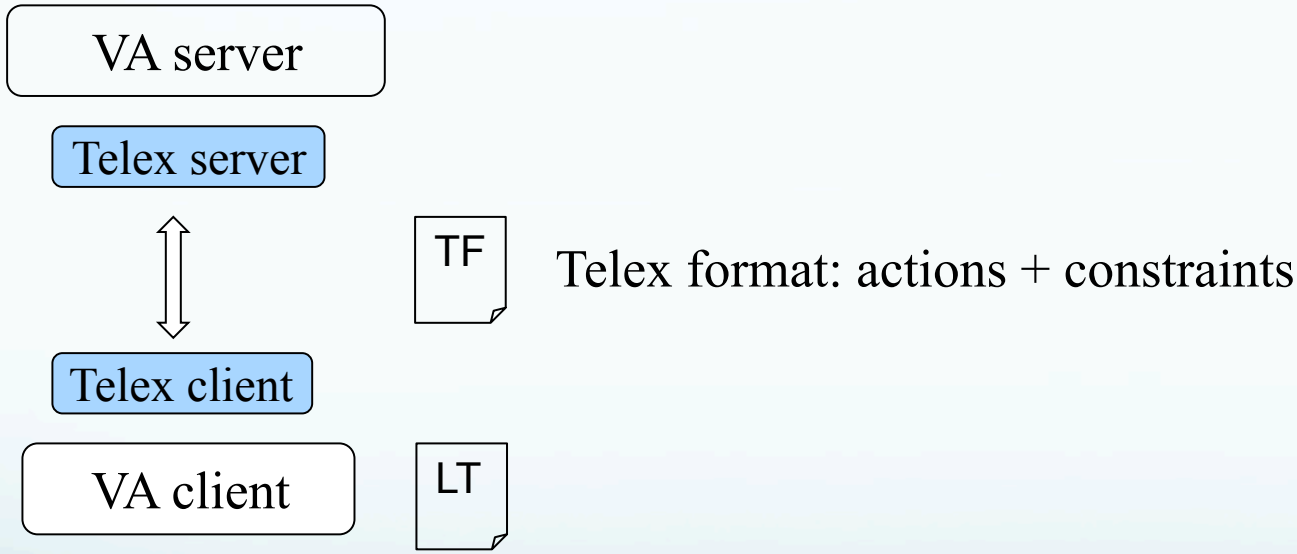
- Simple design
- As transparent as possible

Mapping concepts

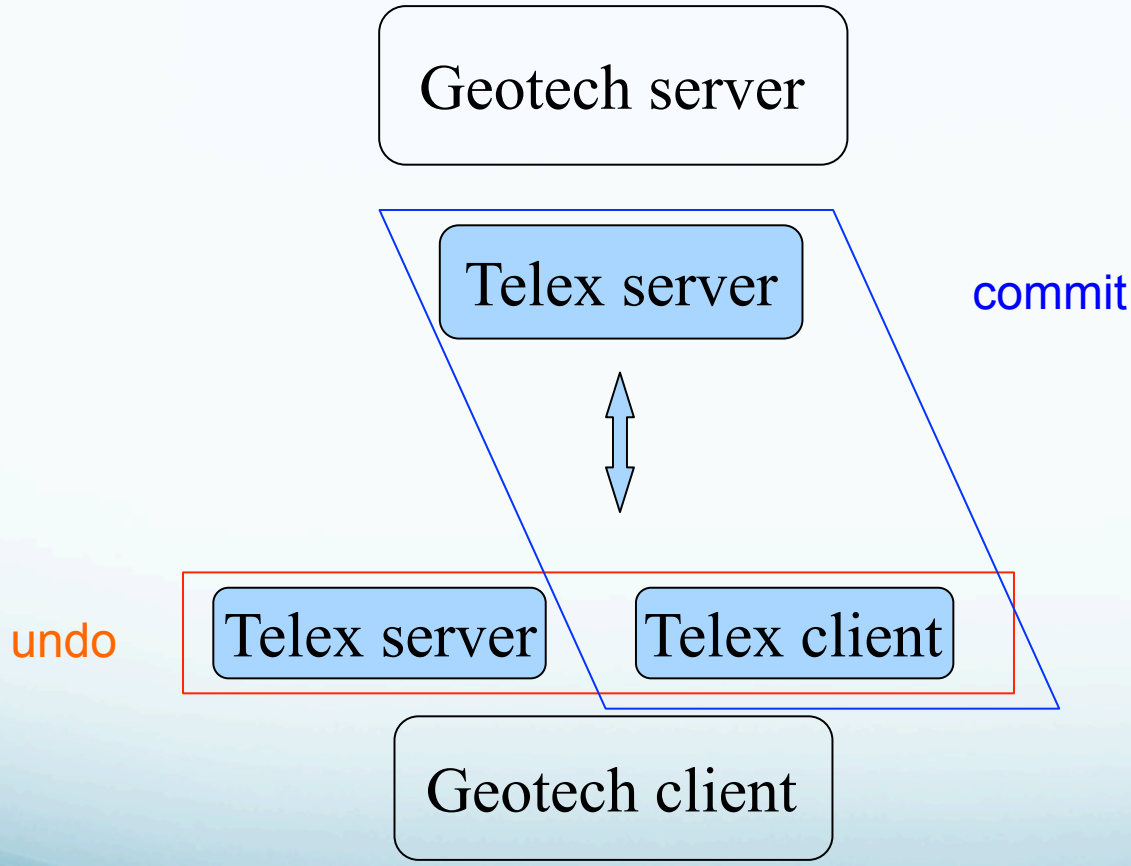


Action in Visit Anywhere = Change scope
Constraints = Causality between dependent change scopes
Dependence/conflict = Change scopes that reference the same object

Detect conflicts / dependencies



Proposed architecture



Conclusion

Preliminary work
Propose an architecture to use telex as a reconciliation engine
Proof of concept
Design choices (mapping Telex concepts to VA)
Developed a module that translates LT into actions/ctrs