CellStore - the Vision of Pure Object Database

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Outline

- **CellStore project**
- **Low-level storage model**
  - **Cell model**
  - **Mapping scheme**
- **CellStore/OODB**
  - **Object Virtual Machine**
- **Current prototype**

CellStore Project

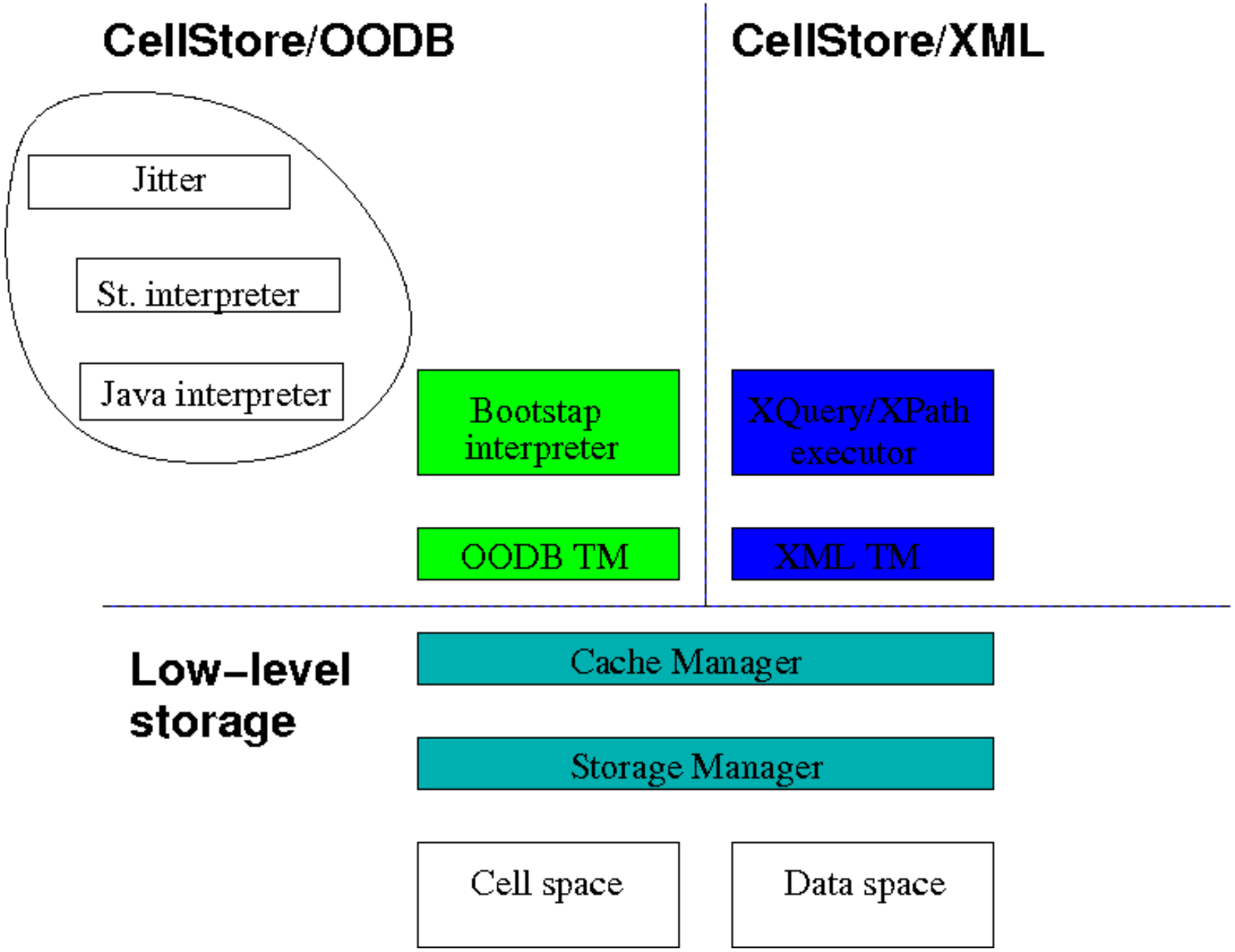
Main goal of CellStore project is to implement an experimental, hybrid (non-relational) database engine

The project consists of three main parts:

- ***Low-level storage***
- ***CellStore/XML***
- ***CellStore/OODB***

CellStore is developed within SWING reseach group at Department of Computer Science, FEE, CTU

CellStore - architecture



CellStore - architecture (Continued)

Low-level storage I.

- **based on LISP idea of fixed-length *cells*, each cell consists of several *fields***
- **divides the structure form raw data (strings, byte sequences)**
- **data are stored in two separate spaces:**
  - **Cell space which contain only structural information**
  - **Data space which contain raw data as strings, texts, images and so on**

Low-level storage II.

Using this model, it is possible to store:

- **XML data**
- **any object structure based on class-instance object model (Smalltalk, Java)**
- **any object structure based on prototype object model (Self, ECMAscript)**
- **any relational data**

All mentioned types of data can be stored together in one database instance.

Low-level storage III.

For each data model a different *mapping schema* must be used. Mapping schema just gives a concrete meanings to the cell fields.

Example of mapping schema for XML tree

- **each DOM node is mapped to one cell**
- **first field contains pointer to parent cell (i.e. parent node)**
- **second field contains pointer first child cell (i.e. first child node)**
- **third field contains pointer to sibling cell (i.e. sIbling node)**
- **subsequent field meannings differ with type of cell.**

CellStore/OODB

One can thing about OODB as about

- **a kind of database engine**
  - **transactions**
  - **persistency**
  - **access control**
- **a kind of multi-user virtual machine with persistent object memory**

Problems of todays virtual machines

Todays virtual machines are unmodifiable, it is difficult to debug them, to experiment with them, to port them to another platform.

- **How easy is to modify the garbage collector?**
- **How easy is to modify the jitter?**
- **How easy is to change the code sematics (interpeter) ?**

One possible solution is to implement as much as possible on the top of light-weight virtual machine.

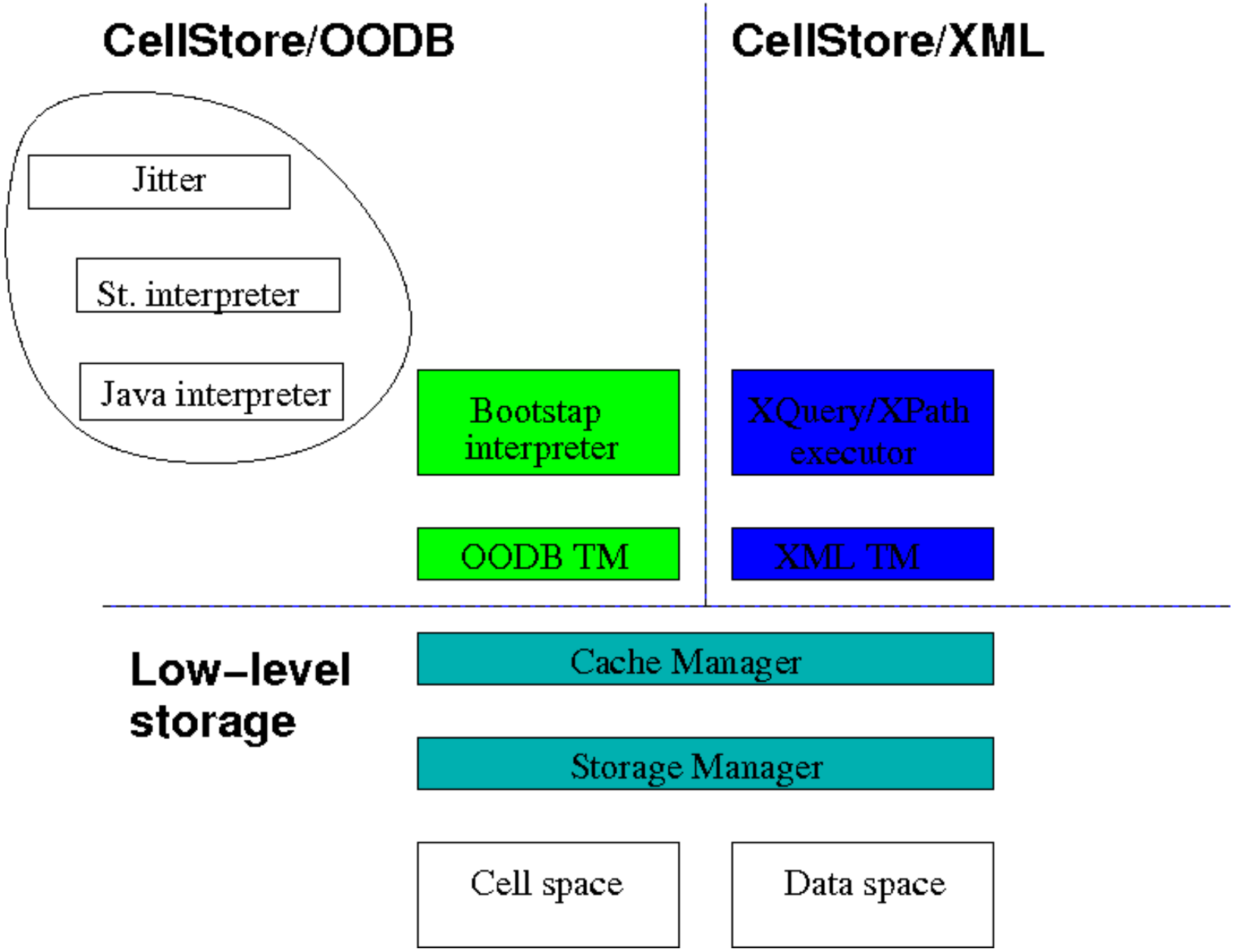
Light-weight virtual machine

Requirements for the VM:

- **simple object model capable to store any arbitrary object model**
- **object memory with simple and clean interface**
- **support for n-code cache (jitter output) and n-code execution**
- ***bootstrap interpreter* (naive one will be sufficient)**

Everything else (full-featured interpreter, GC, jitter etc.) could be implemented on the top of VM

CellStore - architecture



CellStore - architecture (Continued)

Current prototype

We have prototype implementation (in Smallalk/X):

- ***Low level storage***
  - **configurable cell space manager**
  - **naive data space manager**
  - **prototype implementation of cache and recovery manager**
- ***CellStore/XML***
  - **XML:DB API Core level 0 (modified for Smalltalk language)**
  - **naive XPath query service (no indexes, no types, no functions)**
  - **prototype implementation of transaction manager**

Current prototype (Continued)

- ***Cellstore/OODB*** **- nothing done**

Problems

- **access control on object (graph-like) structure**
- **what about long-term transaction and nested transactions**
- **database distribution, distributed GC**

Ongoing development

- **refactoring of low-level storage manager**
- **access control lists**
- **mapping models**
- **garbage collector interface**
- **intepreter interface**
- **XQuery module**

Thank you for your attention