High Performance XML Data Retrieval

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Agenda

- Why XPath for Data Retrieval?
- Current XML Data Retrieval Strategies and Issues
- High Performance XPath Requirements
- Design of Extractor for XPath
- Extractor Use Cases

Why XPath for Data Retrieval?

- W3C Standard for XML Document Navigation since 2001
- Support for XML Schema Data Types in 2.0
- Support for Functions and Operators in 2.0
- Underlies XSLT, XQuery, DOM, XForms, XPointer

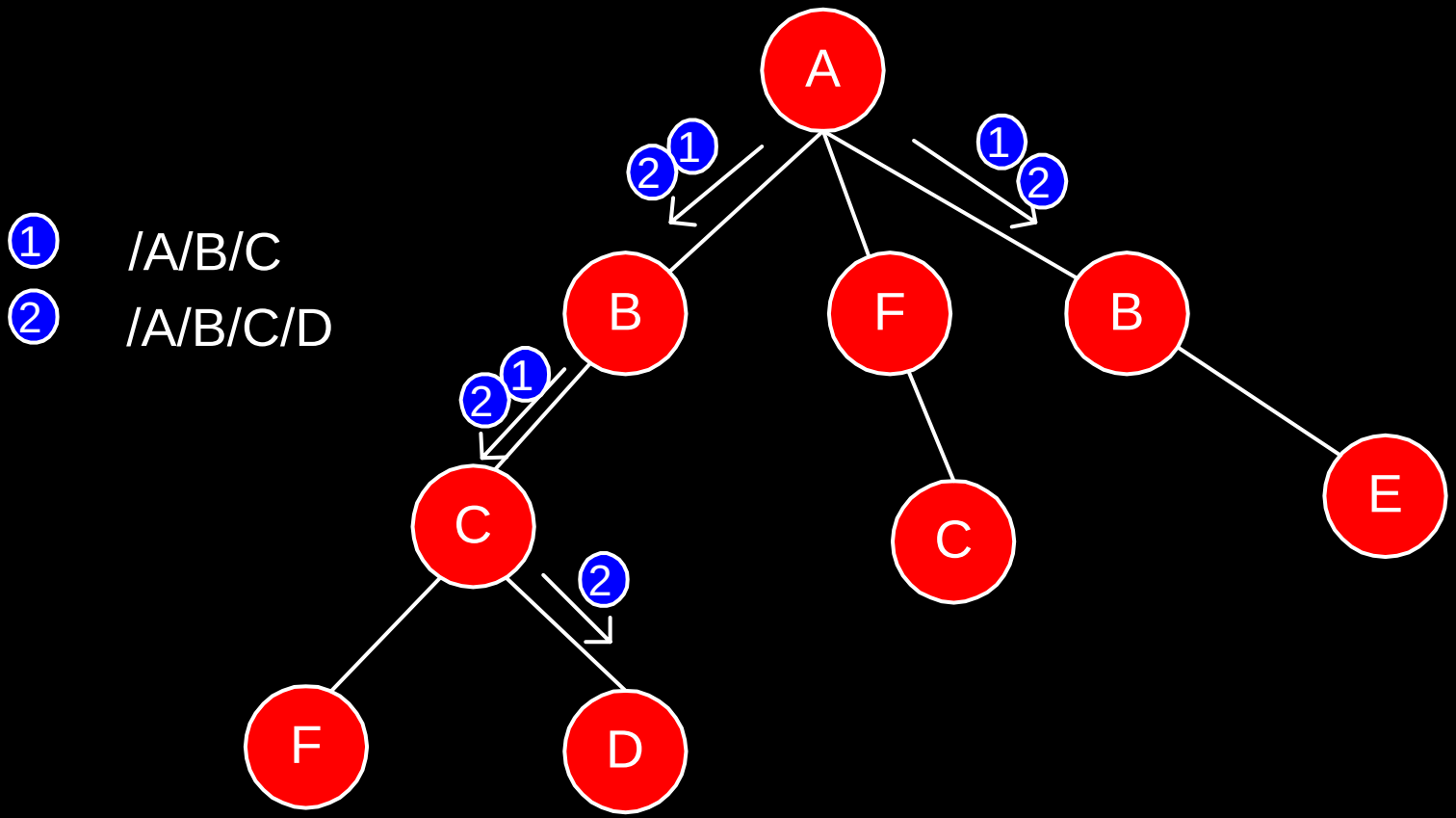
Current Standards-based Data Retrieval Strategies

- Document Object Model (DOM) Parsing
- Simple API for XML Parsing (SAX)
- Java API for XML Parsing (JAXP)
- Streaming API for XML Parsing (StAX)

Data Retrieval Using DOM Parsing

- Advantages
  - Dynamic random access to entire document
  - Supports XPath 1.0
- Disadvantages
  - DOM In-memory footprint up to 10x doc size
  - No planned support for XPath 2.0
  - Redundant node traversals for multiple XPaths

DOM-based XPath Data Retrieval



Data Retrieval using SAX/StAX Parsing

- Advantages
  - Stream-based processing for managed memory
  - Broadcast events for multicasting (SAX)
  - Pull parsing model for ease of programming and control (StAX)
- Disadvantages
  - No maintenance of hierarchical structure
  - No XPath Support either 1.0 or 2.0

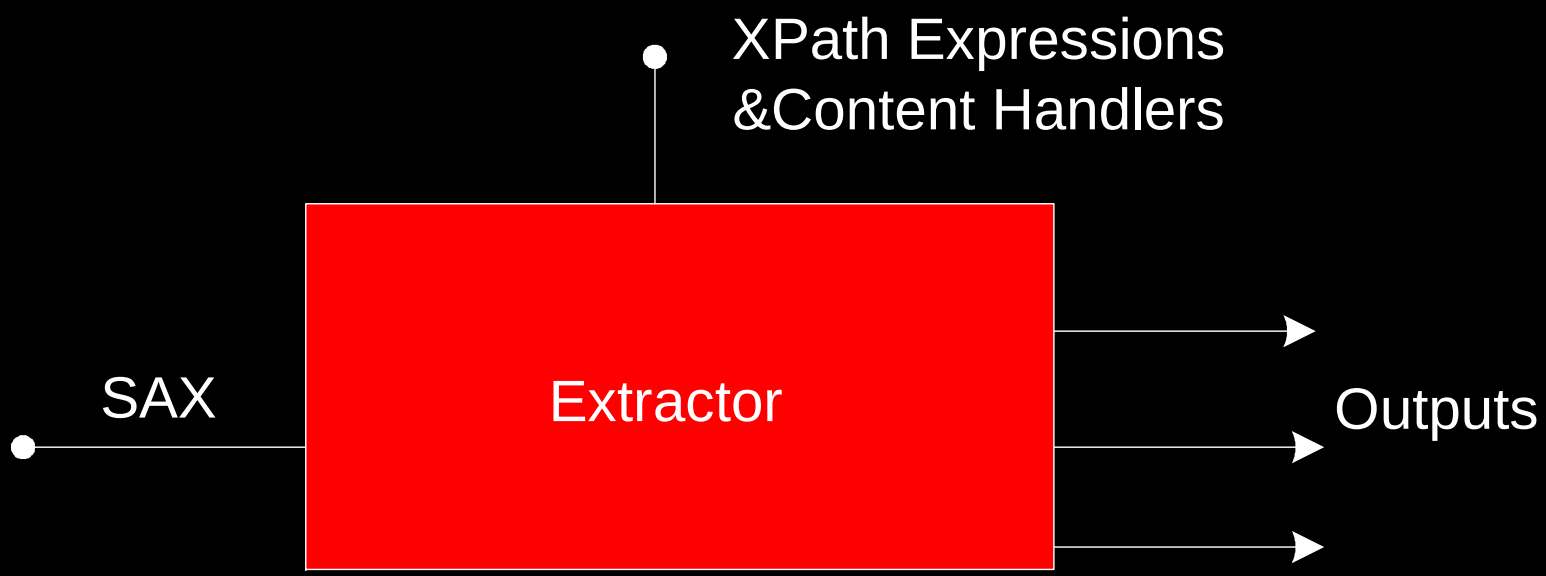
High Performance Requirements

- Retrieve XML data with managed memory resources
- Support for documents of all sizes
- Handle multiple XPaths with minimum node traversals
- Support DTD and Schema-based XML documents

Extractor for XPath

- Stream-based processing utilizing SAX
- Support for DTDs and XML Schemas
- Implements Publish/Subscribe model for scalability
- Handles multiple XPaths simultaneously
- Supports XPath 1.0; extended to 2.0

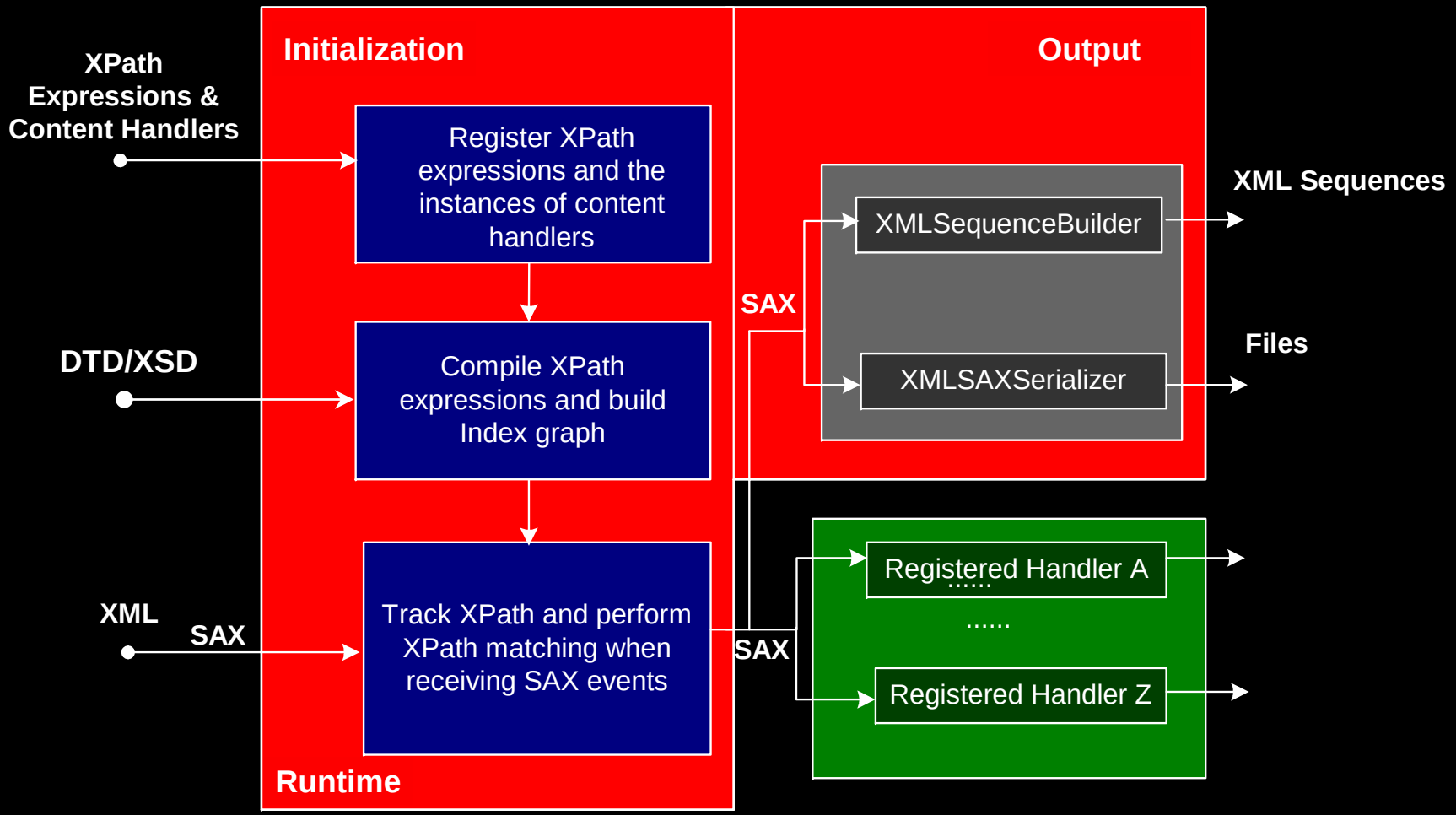
Extractor's Publish/Subscribe Processing Model



Extractor's Function Blocks

- **Initialization**: registration of XPaths/Handlers
- **XPath Compilation**: compiles and builds index graphs
- **XPath Tracking**: maintains XPath state and matches doc XPaths with the indexed XPaths
- **Output**: sends matching XPath start/stop events along with the XML data

Extractor's Function Blocks



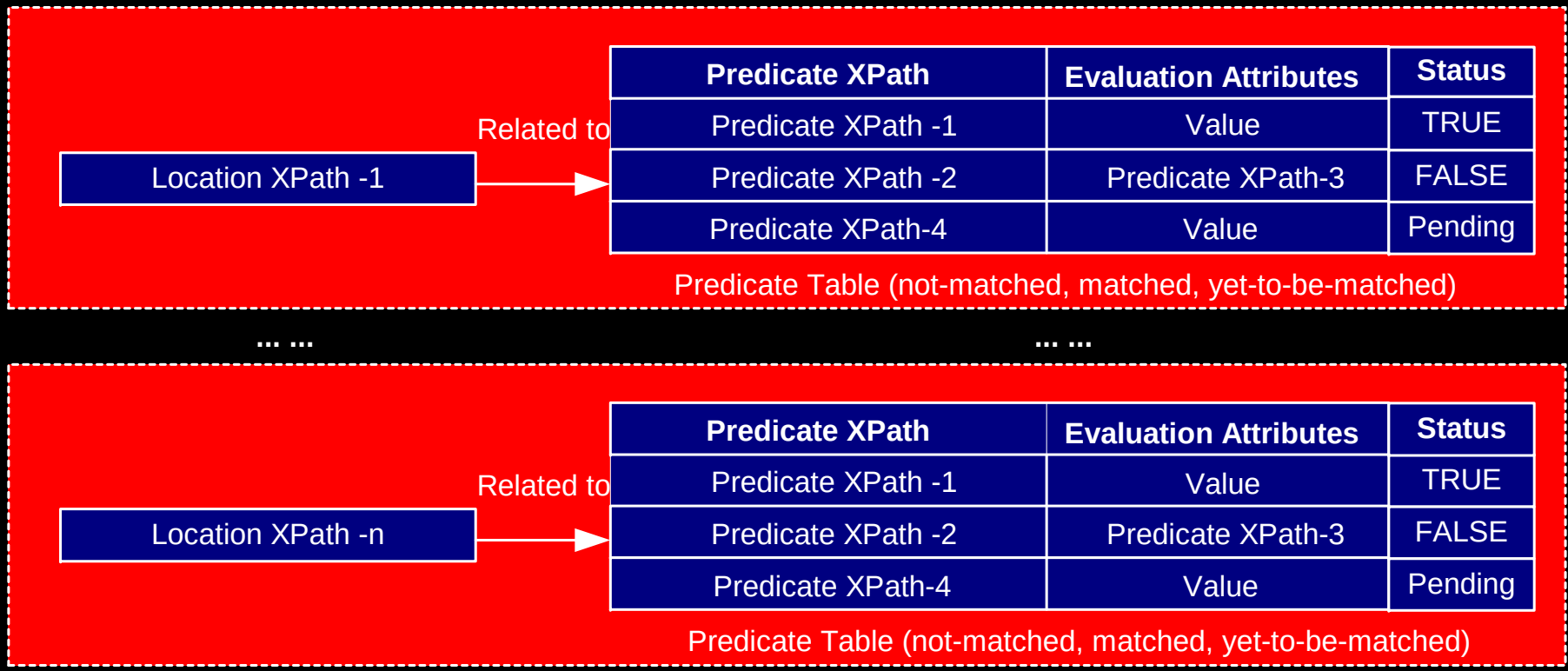
Initialization

- Registration of absolute XPaths
- Support for XML Namespaces for differentiation
- Registration of execution handlers using XContentHandler()
- Built-in Handlers for ease of use
  - XMLSequenceBuilder()
  - XMLSAXSerializer()

XPath Compilation

- XPath streamability evaluation
- Streamable isAll=true/false option
  - True: Process only streamable XPaths
  - False: Buffer data as needed
- Build XPath Predicate Table
- Build Index Tree
  - XPath Dependency Tree (w/o DTD/XSD)
  - Data Model Tree (w/ DTD/XSD) using existing Validation engine

Compilation of Each XPath Predicate

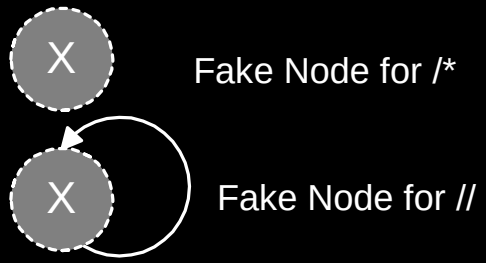


Also Used for isAll = True condition

Runtime XPath Matching

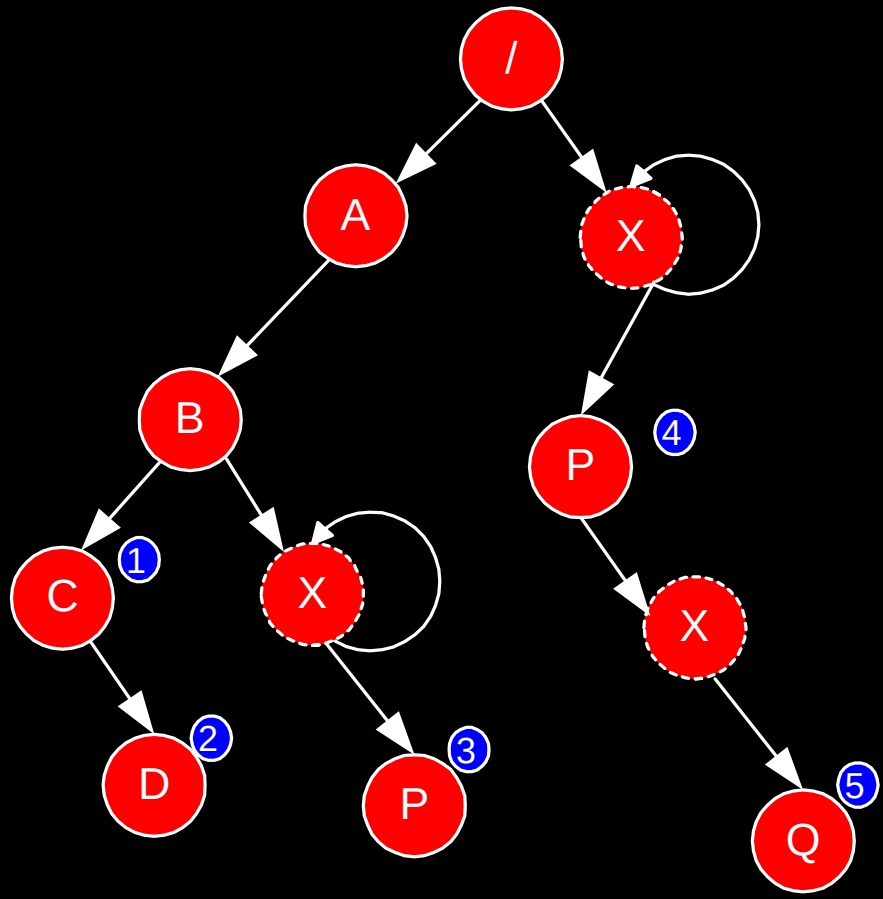
- State Machine tokenizes and tracks
  - In-scope Namespaces
  - Current Element Name
  - Current Element Attributes
  - Node Position Relative to Siblings
  - Number of Child Elements
- Implemented as a Stack

XPath Index Tree (w/o DTD/XSD)



1. /A/B/C
2. /A/B/C/D
3. /A/B//P
4. //P
5. //P/*/Q

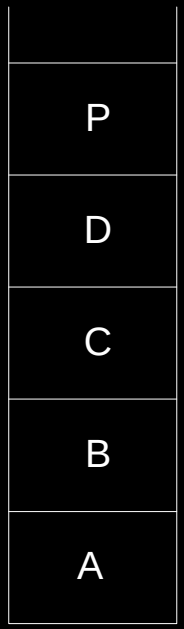
XPath Expressions



XPath Dependency Tree

Dependency Tree Traversal

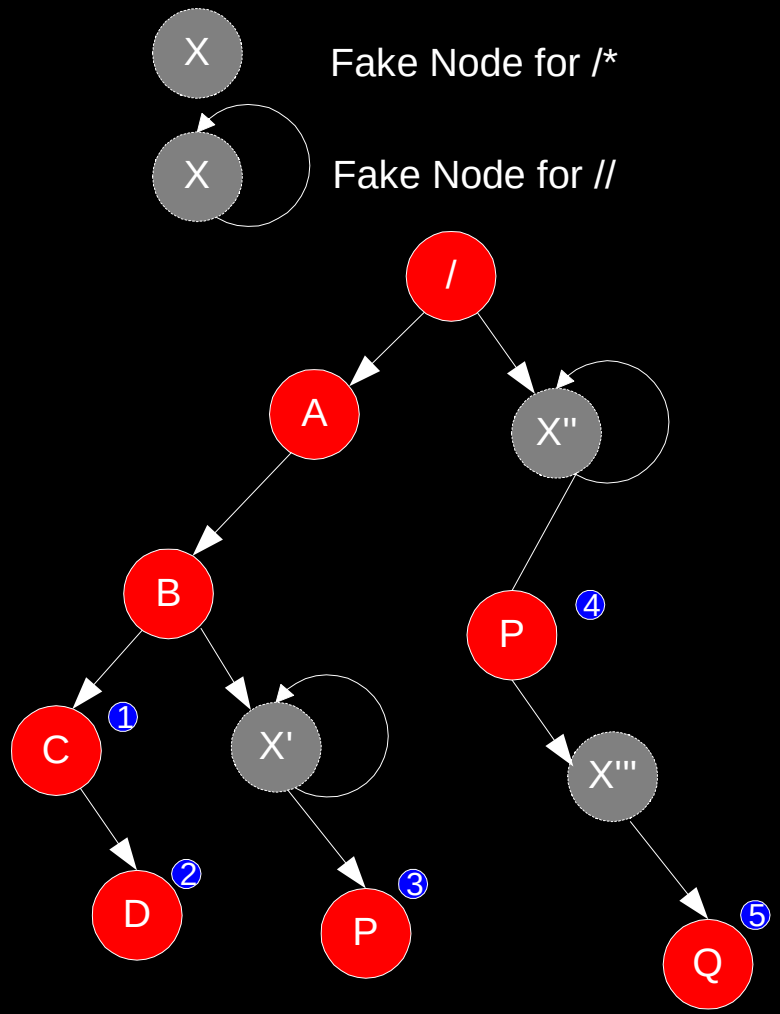
1. /A/B/C
2. /A/B/C/D
3. /A/B//P
4. //P
5. //P/*/Q



XPath Stack

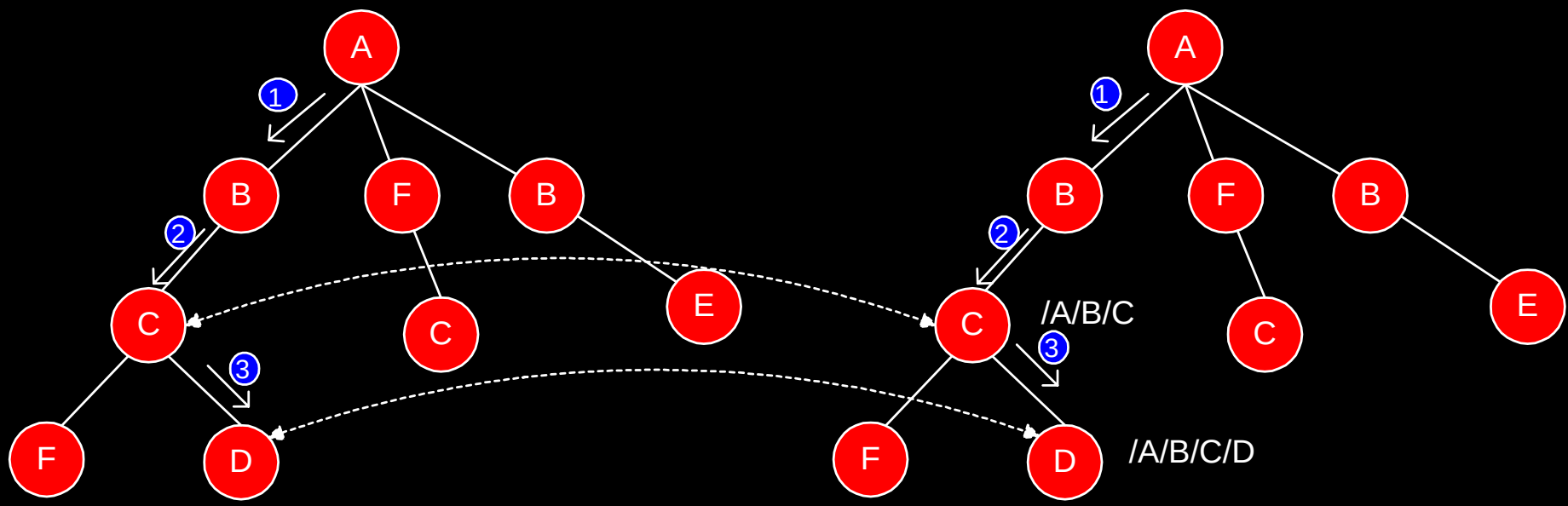
3 4	P	X''	X'
2	D	X''	X'
1	C	X''	X'
	B	X''	
	A	X''	

Matched Node



XPath Dependency Tree

Synchronous Data Model Traversal



XML Document Tree

XML Data Model

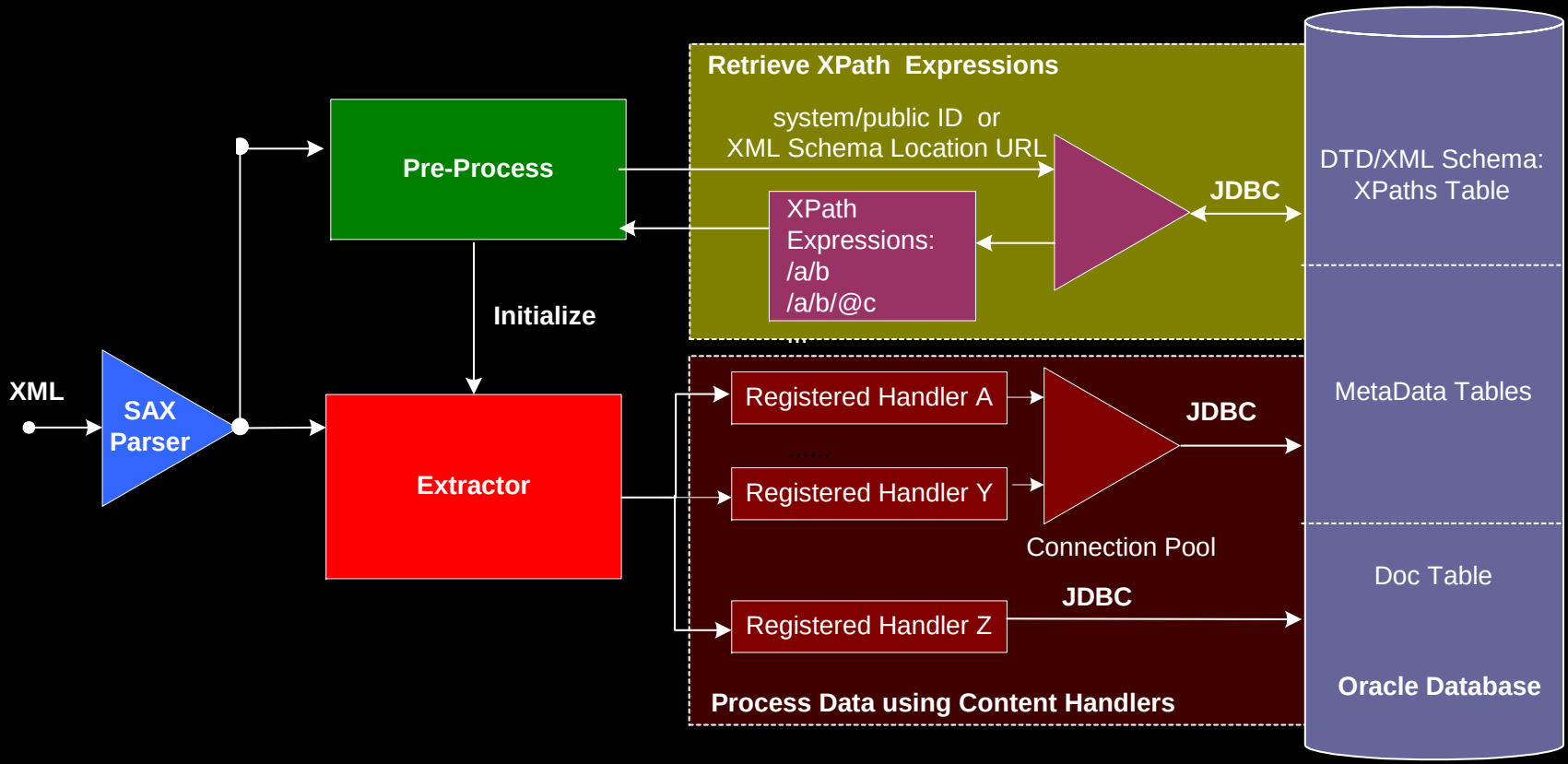
Extractor Output

- XContentHandler()
  - Execution of Registered Content Handlers
- XMLSequenceBuilder()
  - Built-in Handler
  - Presents Result Set as XMLSequence Object
  - Contains a Linked List of XMLItems
- XMLSAXSerializer
  - Built-in Handler
  - Serializes output to Printwriter or OutputStream

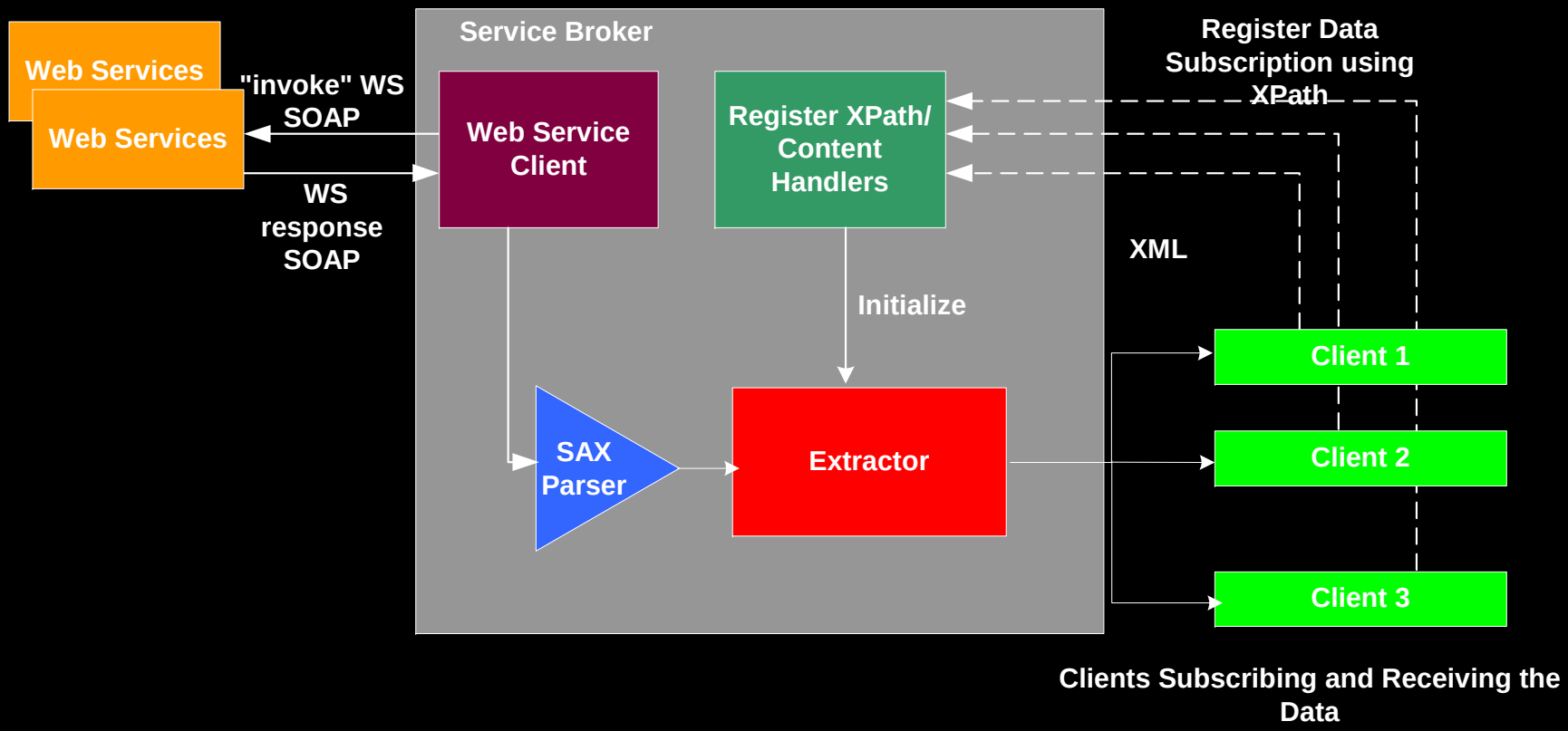
Extractor Use Cases

- Content Management
- Web-Services
- XSLT/XQuery Implementation

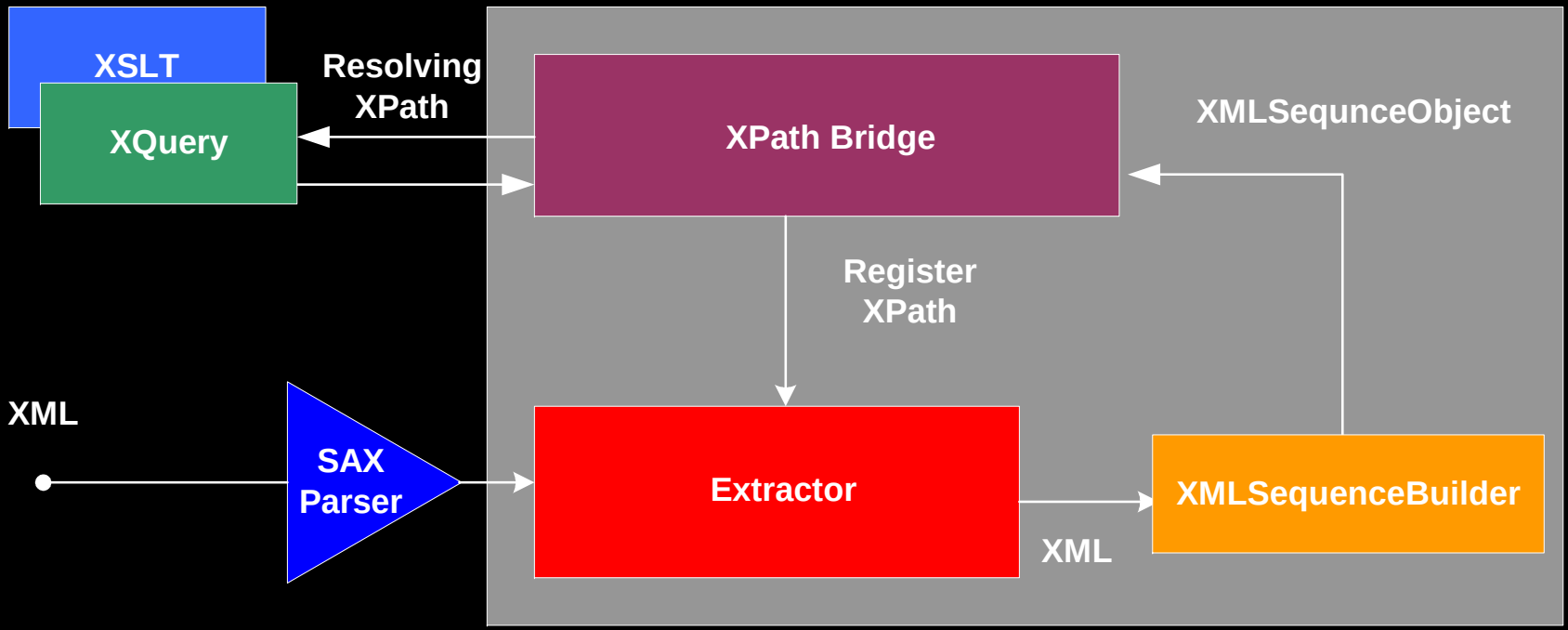
Extractor Content Management Use Case



Extractor Web Service Use Case



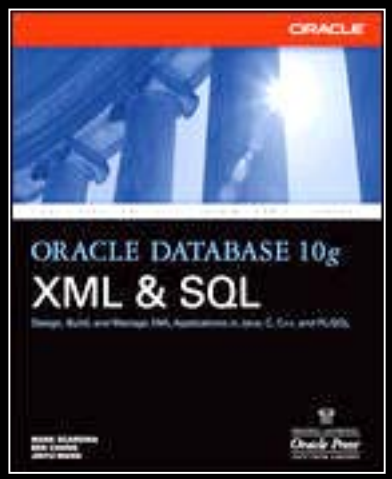
Extractor XSLT/XQuery Use Case



Oracle XML Resources

Oracle Technology Network

- http://otn.oracle.com
- Downloads, Demos, Samples, Papers
- XML Support Forum



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