Twin City Perl Workshop 2008

Processing XML documents with

XML::LibXML

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About me

- Dept. of Computational Linguistics, Charles University, Prague
- maintainer of XML::LibXML + LibXSLT
  - written by Matt Sergeant, Christian Glahn
- xsh (shell language for XML processing)
  - combines XPath, Perl, Shell
  - lots of usefull features
  - visit http://xsh.sourceforge.net

  or search CPAN for **XML::XSH2**

Introduction

- about 200 XML-* distributions on CPAN
  - XML::DOM, XML::Simple, XML::RSS, ... XML::LibXML
  - APIs, parsers, generators, filters
  - generic or vocabulary-specific
  - different processing strategies

- what to consider before you choose?

Processing strategy decision

- Data size:
  - small (kb) / Large (10s of MB) / Huge (100s of MB)
- Processing:
  - Read-only / Read->process->write / Stream
- Vocabulary:
  - custom (application specific) / defined by user, standard, customer, etc.
- Context requirement
- Required data model
  - nested structures / DOM tree / custom objects
- Data traversal (systematic / random cherry picking)

XML::LibXML
a swiss knife for all that

- interface to libxml2 library by Daniel Veillard

  see http://xmlsoft.org

- Standard compliant parser
- Validation: DTD, RelaxNG, XML Schema 1.0
- SAX, DOM, and Reader APIs
- XInclude, C14N, XPath, and XSLT 1.0 (with libxslt and XML::LibXSLT)

XML Parser

- libxml2 parser is very fast
- supports many character encodings
- parsing from files, strings, file handles (PerlIO), URLs (FTP and HTTP and possibly other via input callbacks)
- Parses gzipped XML documents
- Optional on-the fly validation and XInclude processing

DOM Parser

- building in-memory DOM Tree

```
my $parser = XML::LibXML->new;
my $dom = $parser->parse_file($filename_or_URL);
```

- easy navigation
  - using DOM Level 2 API
  - XPath support
- C data structures inside
  - less memory usage than e.g. nested Hash/Arrays
  - accessors via object methods (XS)
    - slower than Perl hash/array accessors
    - if many, Perl->XS->Perl transitions get expensive

SAX Parsing

- Event-driven API for stream parsing
  - clean interface
  - requires little memory
  - user's class defines handler methods

    start_element, end_element, characters, ...
- SAX layers can be chained:

  parser -> filter -> filter -> .... -> handler/writer
- Slow for large documents
  - at least one (but usually much more) Perl method calls for each input node (multiply by millions)
- XML->SAX, DOM->SAX, and SAX->DOM interfaces

XML::LibXML::Reader

- Cursor-based API for stream XML parsing (pull-parsing)

```
while ($reader->read) {
    my $type = $reader->nodeType;
    # start_element, end_element, text, comment,...
    my $el_name = $reader->name;
    my $depth = $reader->depth;
    my $val = $reader->getAttribute('foo');
    ....
}
```

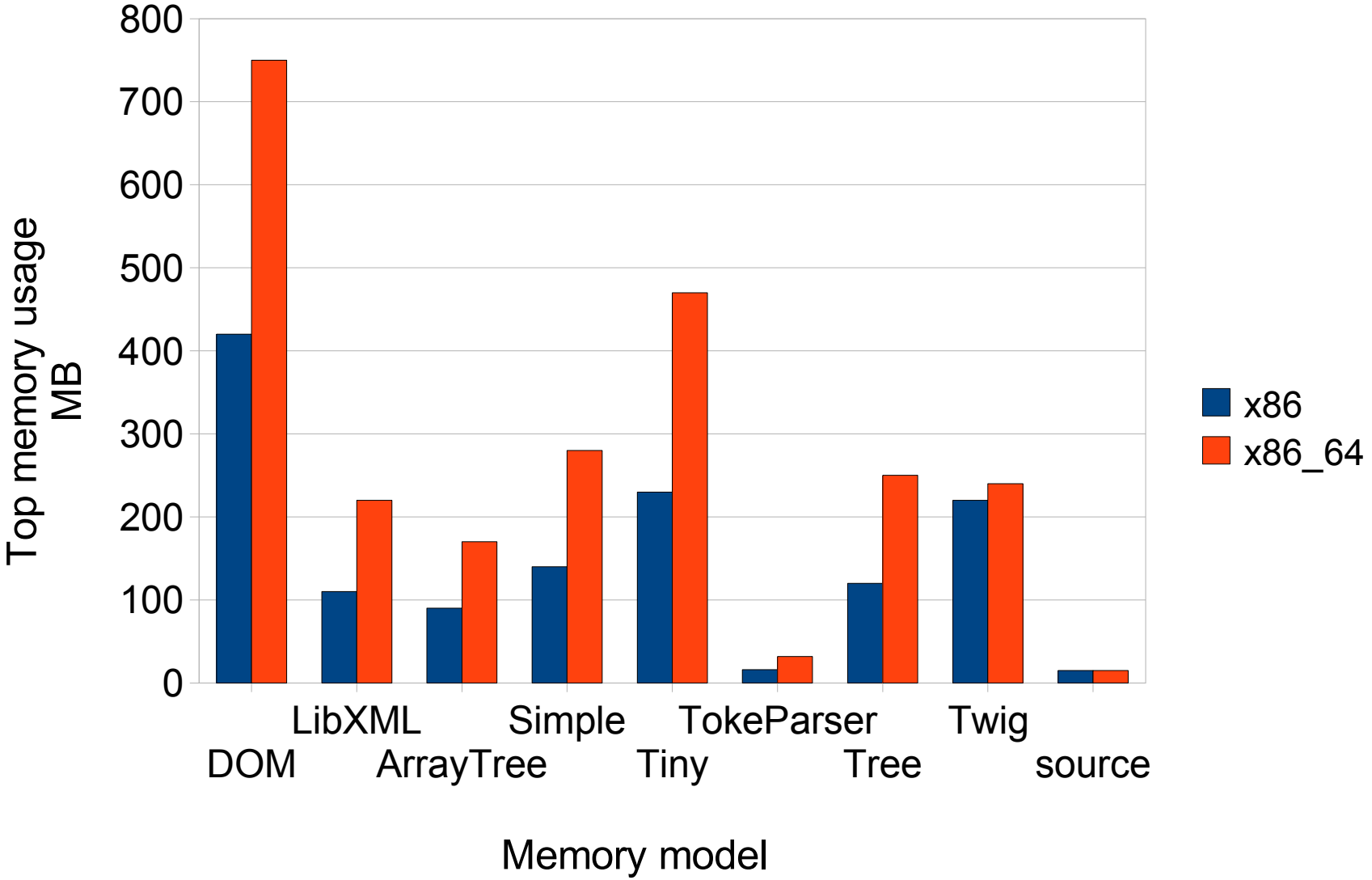
- Supports fast-forward skipping of uninteresting nodes
  - nextSibling
  - nextSiblingElement(name,nsURI)
  - nextElement(name,nsURI)
  - nextPatternMatch(XPathPattern)

Building DOM fragments

- $reader->copyCurrentNode($deep)
  - extract a DOM node or subtree
- Creating sub-documents
  - $reader->preserveNode()
    - keep the current node in the in-memory tree
  - $reader->preservePattern(XPathPattern)
    - preserve matching elements along with all ancestors and descendants
  - $reader->document()
    - collect the DOM consisting of preserved nodes

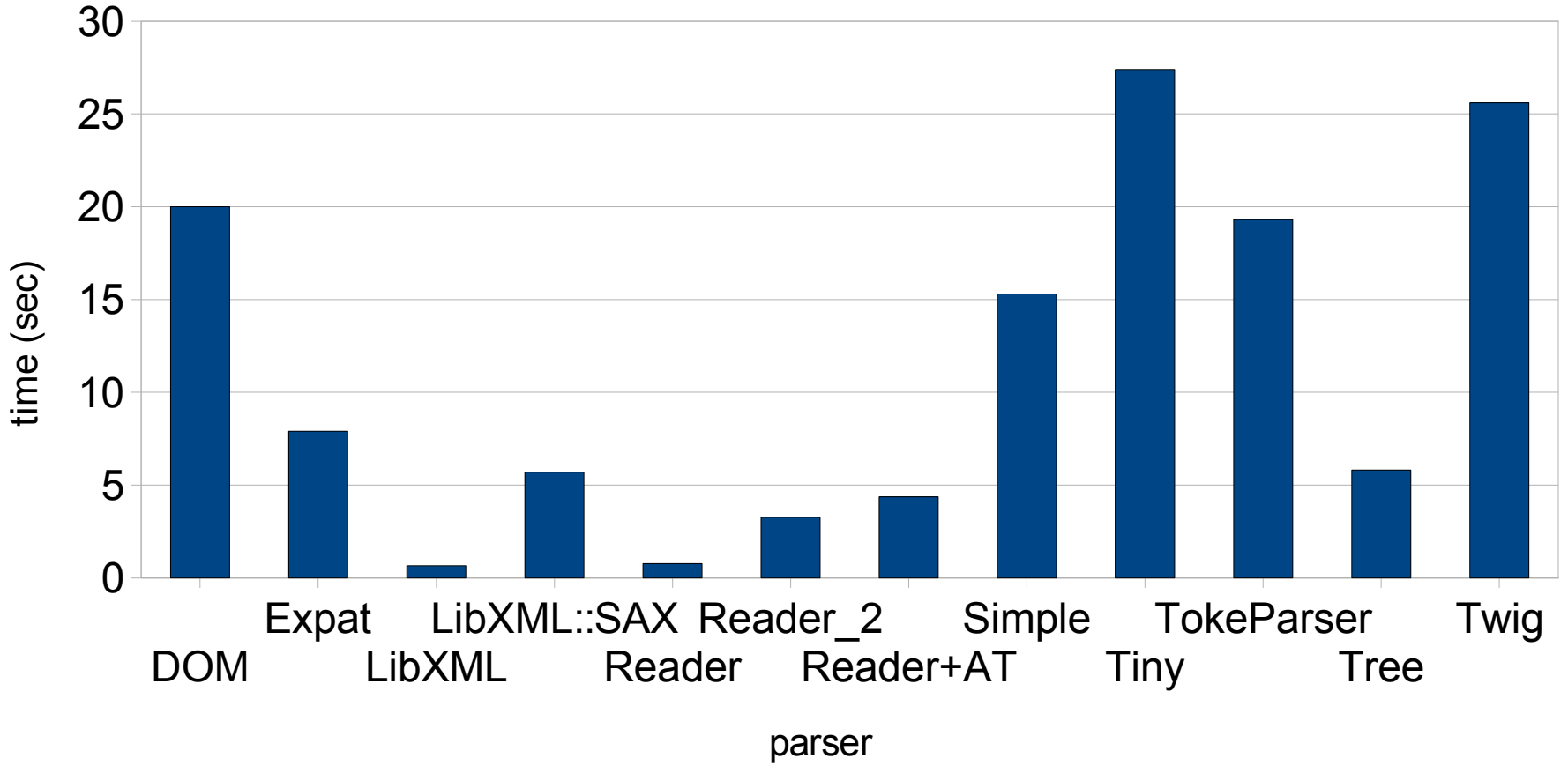
Memory usage

Input: 15 MB of XML (dictionary)



Parser performance

- XML::* - Parsing + building data structures
  - Reader_2 = XML::LibXML::Reader+retrieve all names and values
  - Reader+AT = XML::LibXML::Reader + build nested Array tree



Accessor performance

- XML::LibXML : $el->name 250K/s
- XML::DOM : $el->getTagName 500K/s
- Native hash : $el->{name} 2200K/s

XPath querying

- Basic

```
$doc->findnodes(q{ /x/y[@foo=”bar”] });
$node->findvalue(q{ count(preceding::y[not(@foo)]) });
```

- Advanced

```
my $xc = XML::LibXML::XPathContext->new();
$xc->registerNs('x', 'http://www.w3.org/1999/xhtml');
my @nodes = $xc->findnodes('//x:div',$doc);
```

- Pre-compiled (NEW)

```
my $exp = XML::LibXML::XPathExpression
    ->new($complex_xpath);
$node->findnodes($exp); # many times
```

XPath pattern matching

- Subset of XPath - path(s) of name tests

```
$pat = XML::LibXML::Pattern
   ->new('.//foo|//p:bar/p:*/*', { p=>'http://foobar/ns' });
```

- DOM node matching

```
if ($pat->matchesNode($node)) { ... }
```

- Reader pointer matching

```
$reader = XML::LibXML::Reader->new(location=>$url);
...
if ($reader->matchesPattern($pat)) {...}
...
while ($reader->nextPatternMatch($pat)) { ... }
```

Why it is fast, why is it slow

- Inside XS, most things are very fast
- Perl -> XS -> Perl transitions and Perl calls are expensive
  - affects SAX as well as DOM traversal or Reader that stops on every element
  - ref($node) eq 'XML::LibXML::Element' is 3x faster than
    $node->nodeType == XML_ELEMENT_NODE
  - DON'T : if ($node->name eq “foo”) {... } elsif ($node->name eq “bar”) ...
    (use variables)
- XPath over wide DOM or returning many nodes is slow
  - XPath requires nodes to be returned in document order
  - document-order sort is O(C(n) * n^1.2) (Shell's sort)
    where C(n) (complexity of comparing positon of A and B) is not constant!
  - for read-only documents use indexElements() to make C(n)=1

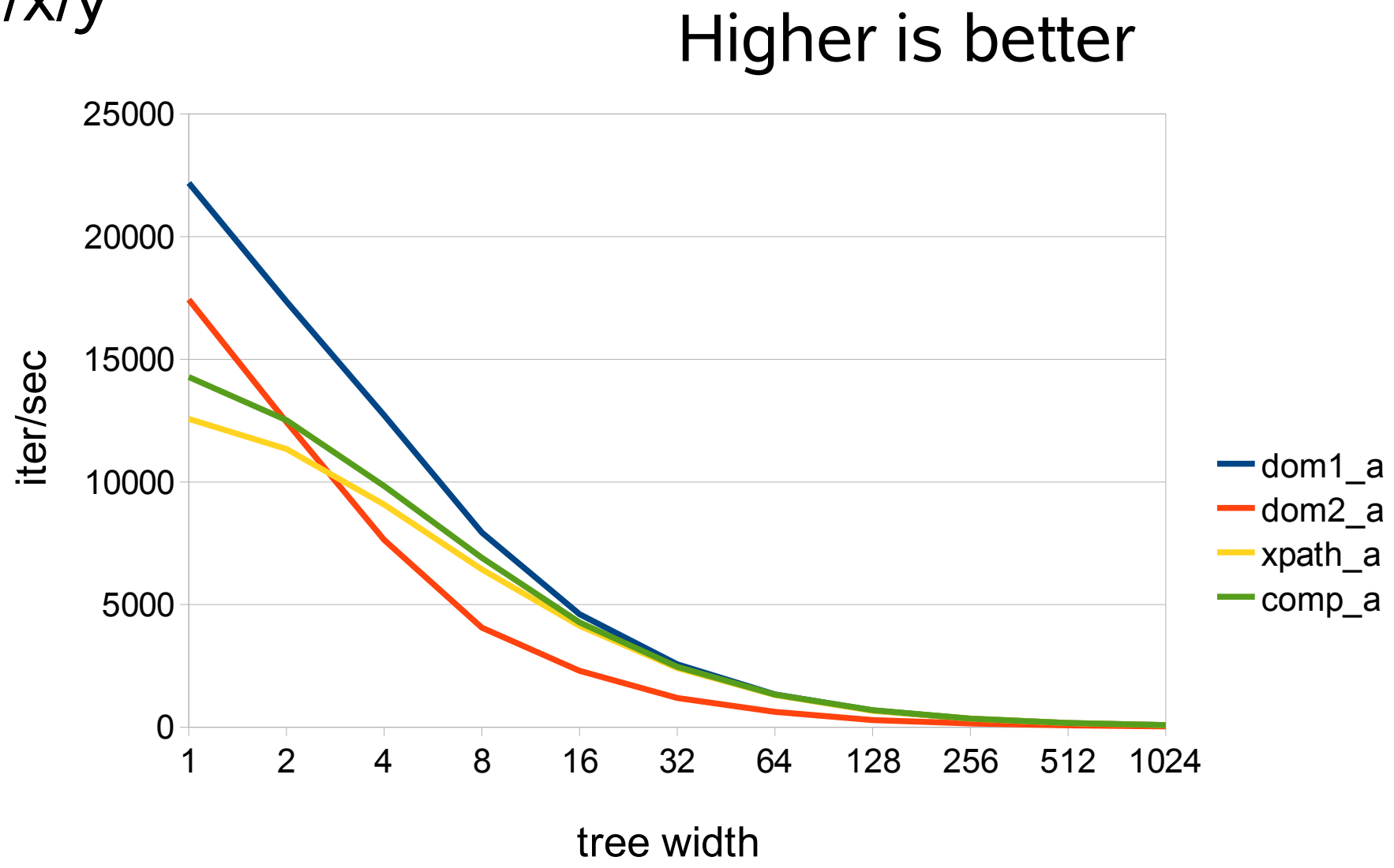
XPath versus DOM traversal

Approximating XPath 'child::y' or .'/y' in DOM

1. $node->getChildrenByTagNameNS(undef,'y')
2. grep $_->nodeName eq 'y', $node->childNodes

XPath/DOM Performance

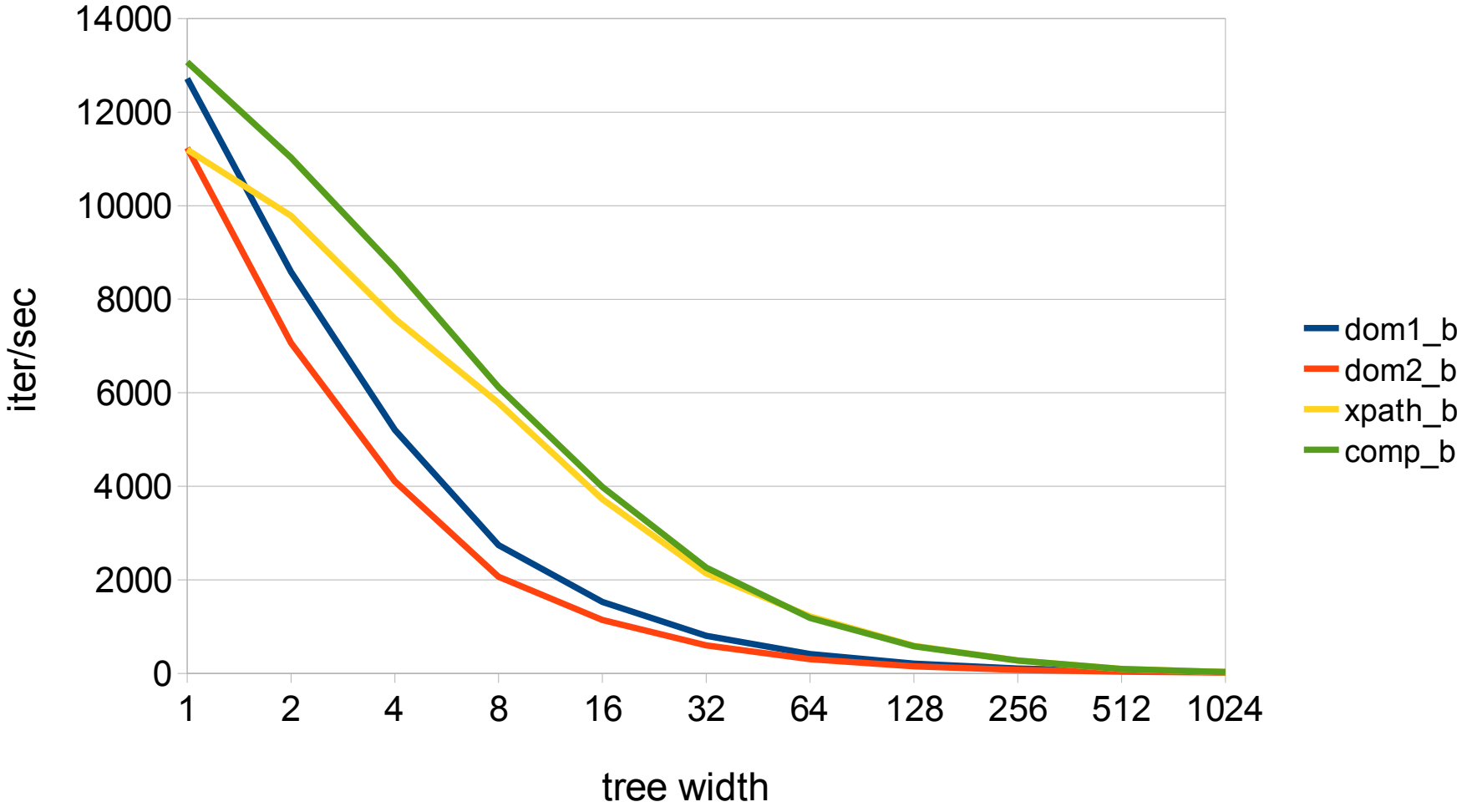
- a) /x/y



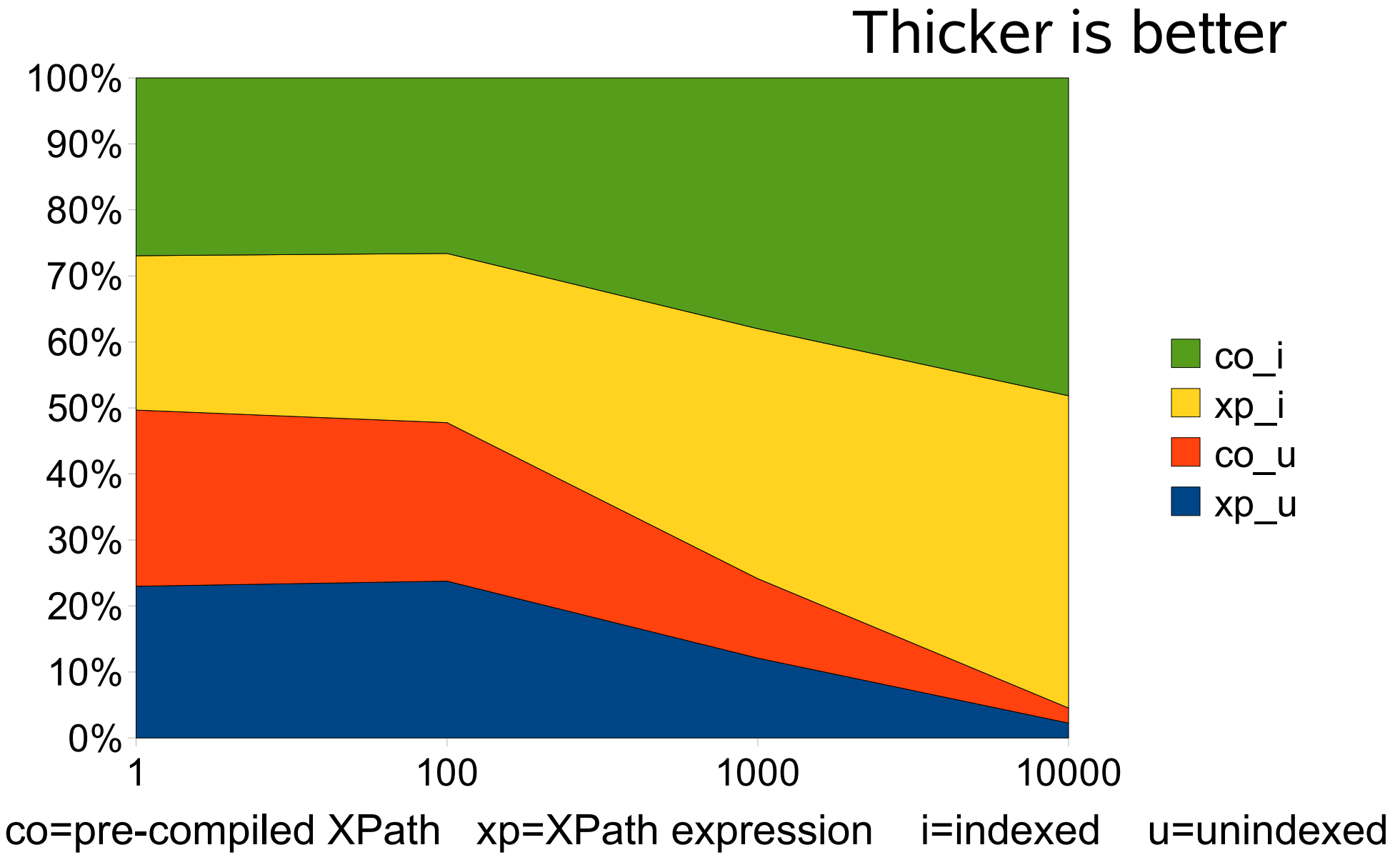
XPath/DOM Performance

- b) /x/y[@bar="baz4"]

Higher is better



Performance benefit of indexElements on XPath



That's all

Thank you!