LoonyBin: Making Empirical MT Reproduciple, Efficient, and Less Annoying

Jonathan Clark
Alon Lavie

CMU Machine Translation Lunch

Tuesday, January 19, 2009

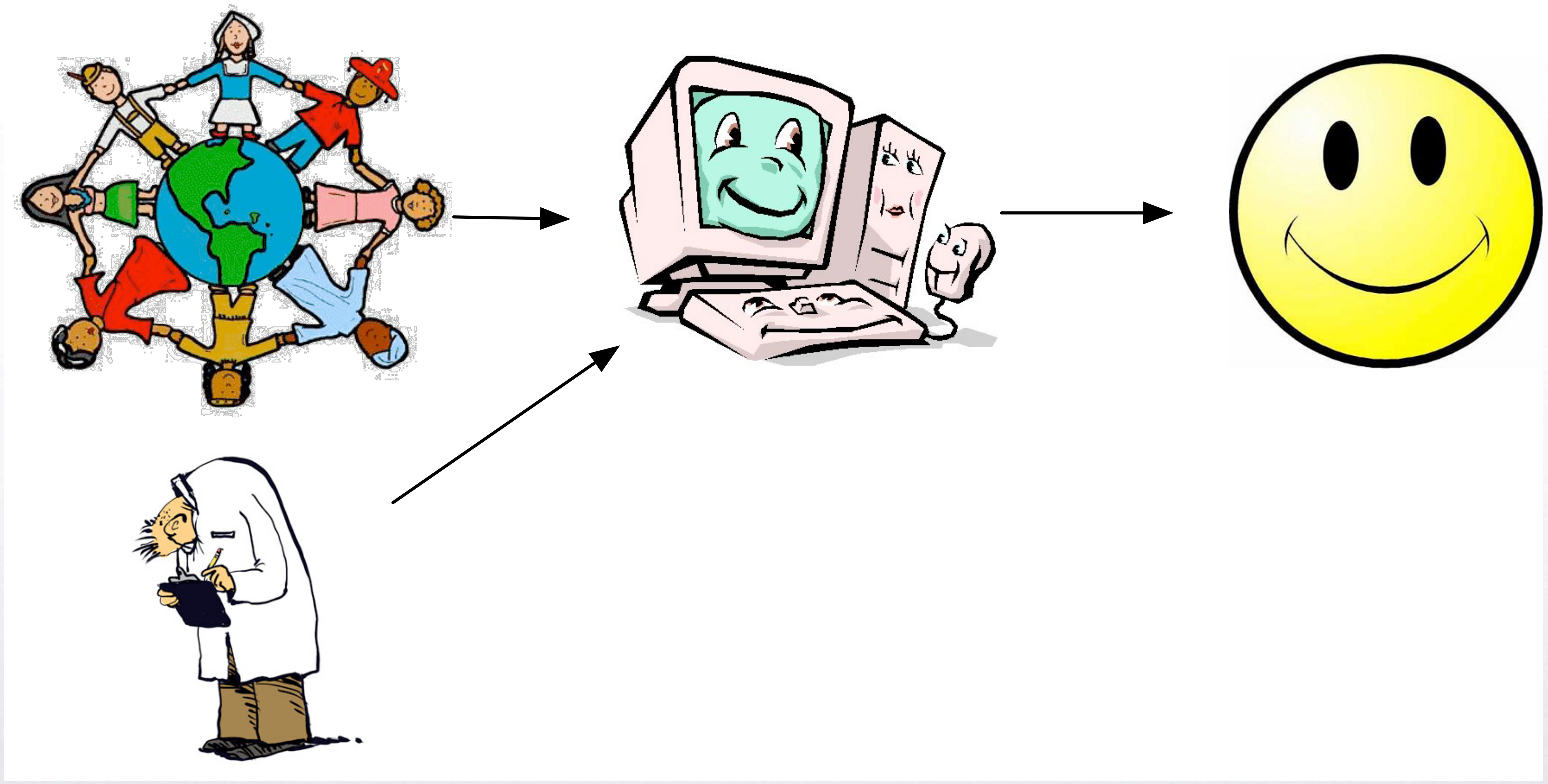
Outline

- A (Brief) Guilt Trip
- What goes into a LoonyBin workflow
- What goes on in a LoonyBin workflow
- What comes out of a LoonyBin workflow
- The MT Toolpack for LoonyBin

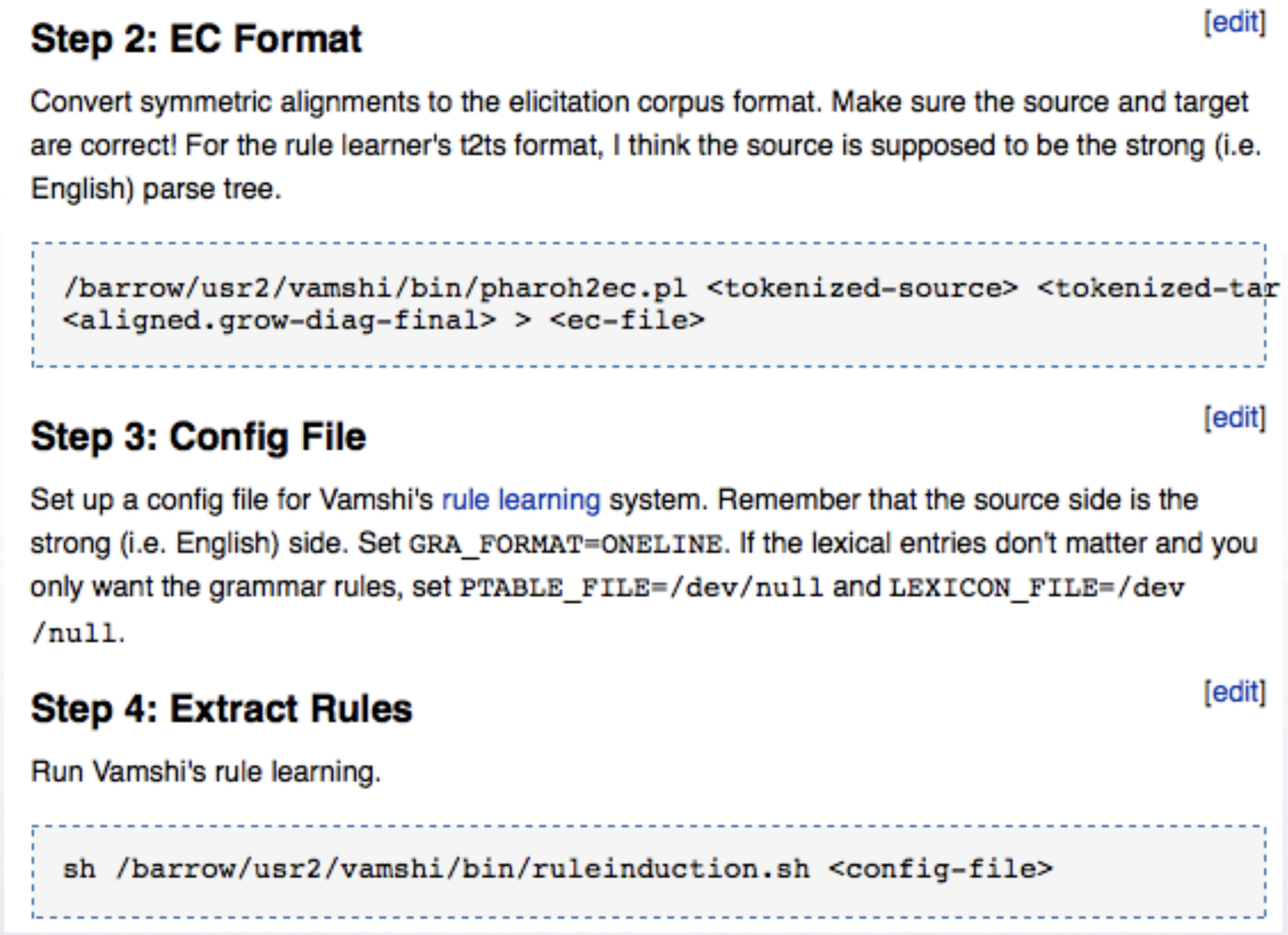
The Guilt Trip

- What does a scientifically responsible experiment look like?
  - Small Δ's, Reproducible, Detailed Analysis/Logs...
- What do most MT experiments look like?

What MT Research Pipelines Look like in Papers



Actual MT Workflows



Step 2: EC Format

[edit]

Convert symmetric alignments to the elicitation corpus format. Make sure the source and target are correct! For the rule learner's t2ts format, I think the source is supposed to be the strong (i.e. English) parse tree.

```
/barrow/usr2/vamshi/bin/pharoh2ec.pl <tokenized-source> <tokenized-tar
<aligned.grow-diag-final> > <ec-file>
```

Step 3: Config File

[edit]

Set up a config file for Vamshi's rule learning system. Remember that the source side is the strong (i.e. English) side. Set `GRA_FORMAT=ONELINE`. If the lexical entries don't matter and you only want the grammar rules, set `PTABLE_FILE=/dev/null` and `LEXICON_FILE=/dev /null`.

Step 4: Extract Rules

[edit]

Run Vamshi's rule learning.

```
sh /barrow/usr2/vamshi/bin/ruleinduction.sh <config-file>
```

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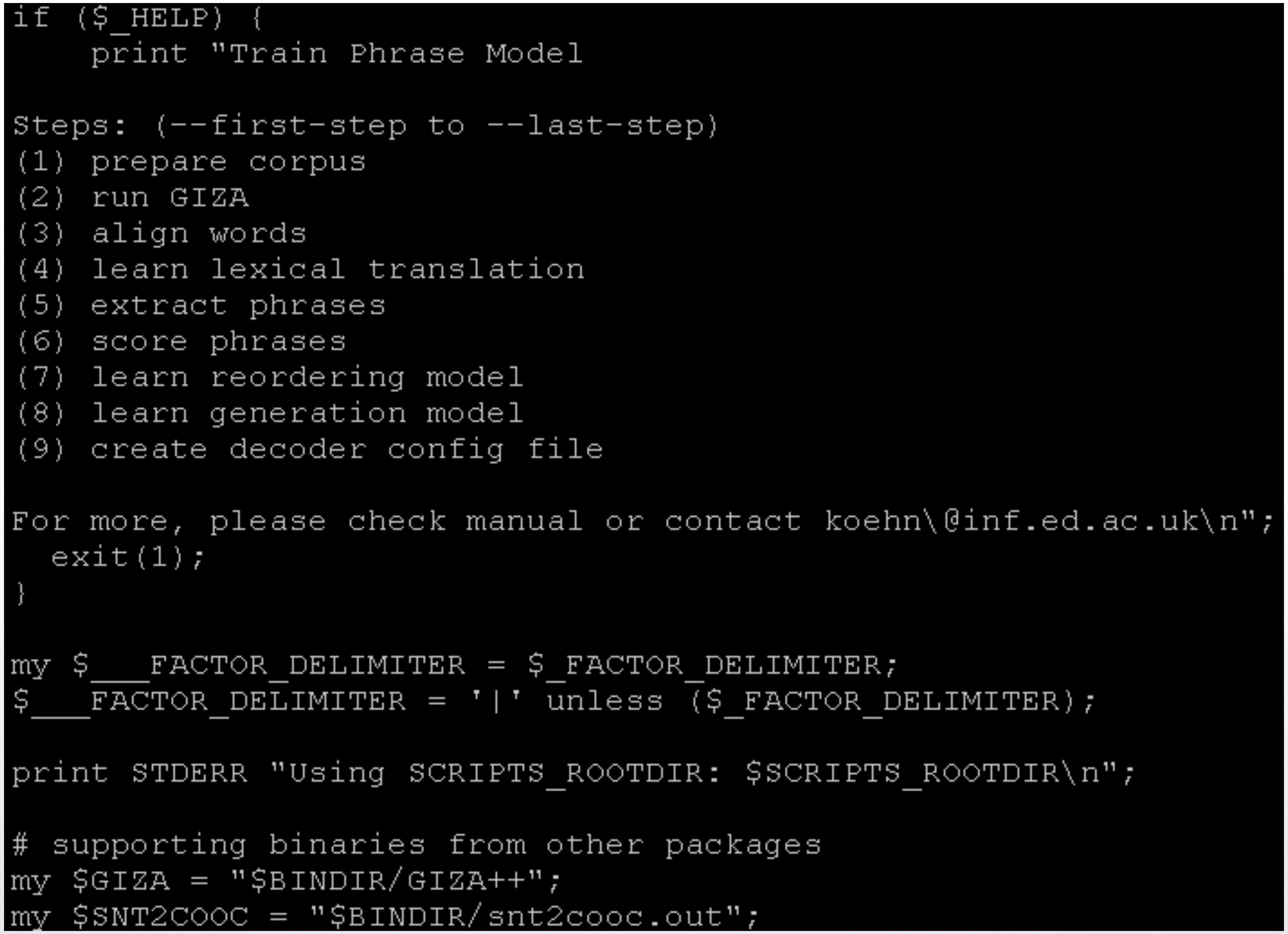


```
if ($_HELP) {
    print "Train Phrase Model

Steps: (--first-step to --last-step)
(1) prepare corpus
(2) run GIZA
(3) align words
(4) learn lexical translation
(5) extract phrases
(6) score phrases
(7) learn reordering model
(8) learn generation model
(9) create decoder config file

For more, please check manual or contact koehn\@inf.ed.ac.uk\n";
  exit(1);
}

my $___FACTOR_DELIMITER = $_FACTOR_DELIMITER;
$___FACTOR_DELIMITER = '|' unless ($_FACTOR_DELIMITER);

print STDERR "Using SCRIPTS_ROOTDIR: $SCRIPTS_ROOTDIR\n";

# supporting binaries from other packages
my $GIZA = "$BINDIR/GIZA++";
my $SNT2COOC = "$BINDIR/snt2cooc.out";
```

Issues

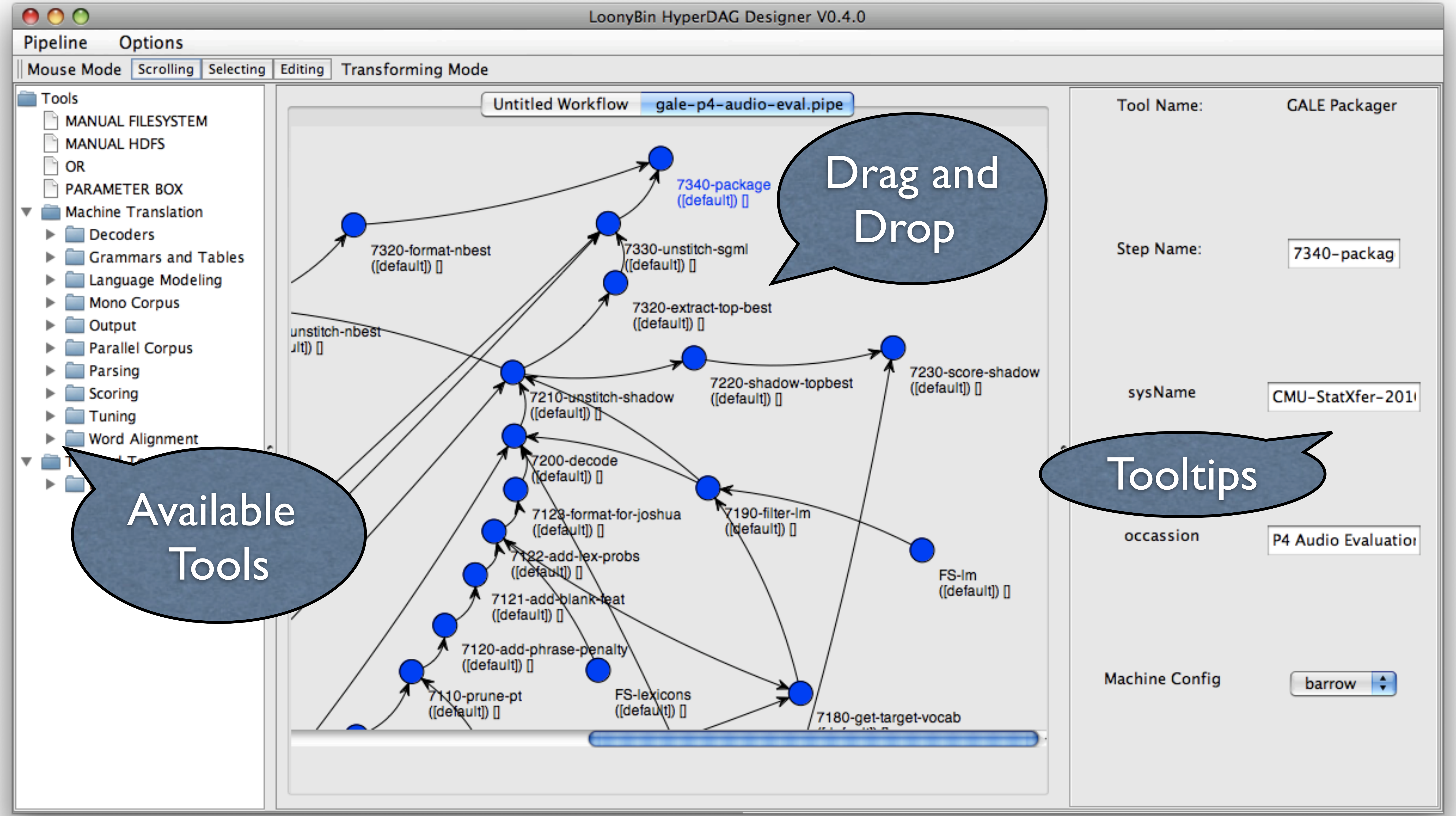
- Automation
- Reproducibility
- Variability
- Scripting Bugs
- Multiple machines, clusters, and schedulers
- Hard to see Big Picture
- “But that’s not research”

What goes into LoonyBin

Going in

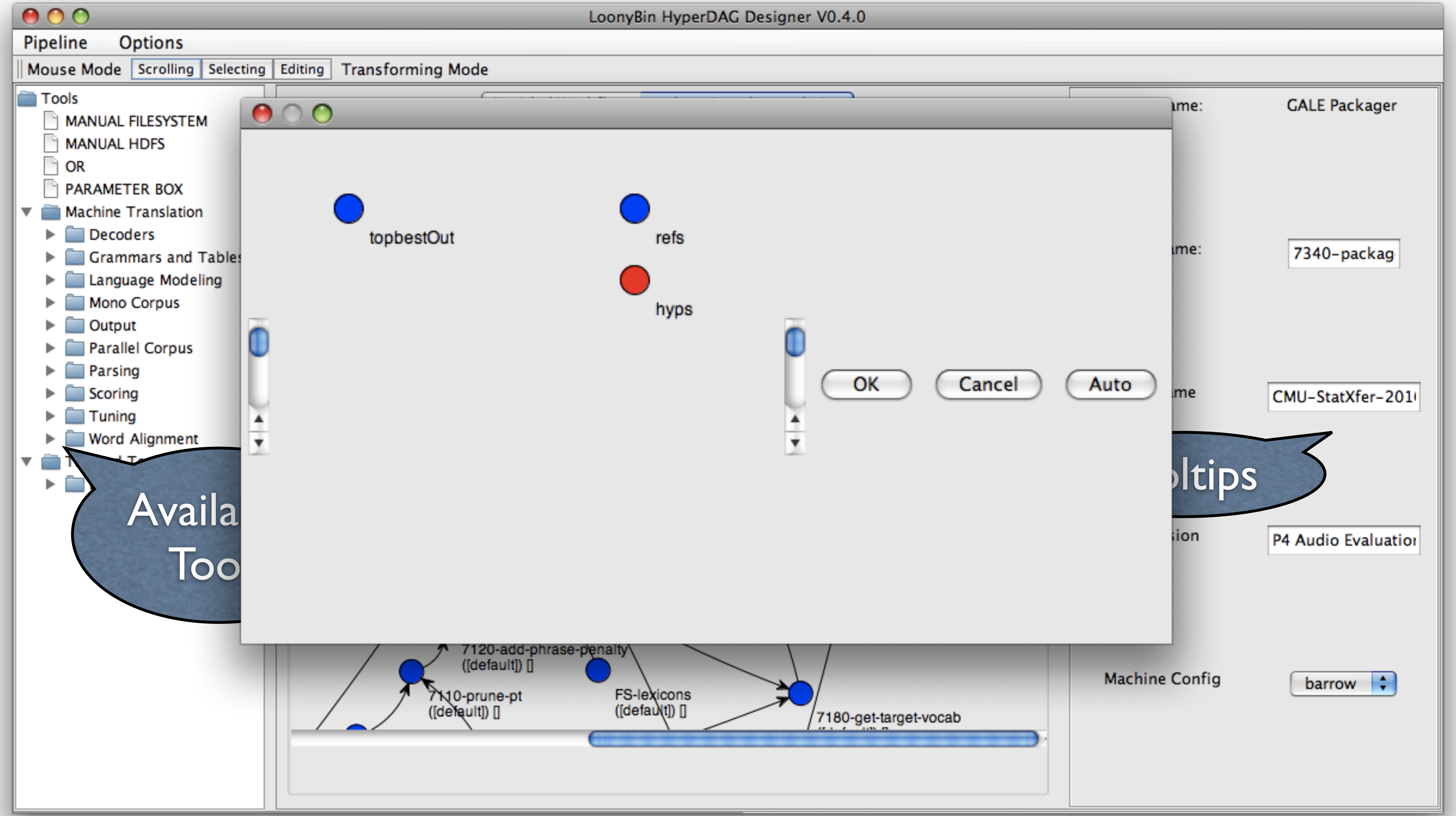
- Knowledge from self 6 months ago
- Knowledge from predecessors about removing the 300-character underscore out of the corpus after 8 years
- Visual representation of input/output files and parameters as a DAG + integrated documentation for each tool
    - ALL parameters, etc. are specified in LoonyBin
- Mapping from vertices (tool instances) to machine instances

Obligatory Screenshot


LoonyBin HyperDAG Designer V0.4.0
Pipeline
Options
Mouse Mode
Scrolling
Selecting
Editing
Transforming Mode
Tools
MANUAL FILESYSTEM
MANUAL HDFS
OR
PARAMETER BOX
Machine Translation
Decoders
Grammars and Tables
Language Modeling
Mono Corpus
Output
Parallel Corpus
Parsing
Scoring
Tuning
Word Alignment
Untitled Workflow
gale-p4-audio-eval.pipe
7340-package ([default]) []
7320-format-nbest ([default]) []
7330-unstitch-sgml ([default]) []
7320-extract-top-best ([default]) []
unstitch-nbest
7220-shadow-topbest ([default]) []
7230-score-shadow ([default]) []
7210-unstitch-shadow ([default]) []
7200-decode ([default]) []
7123-format-for-joshua ([default]) []
7190-filter-lm ([default]) []
7122-add-lex-probs ([default]) []
FS-lm ([default]) []
7121-add-blank-feat ([default]) []
7120-add-phrase-penalty ([default]) []
7110-prune-pt ([default]) []
FS-lexicons ([default]) []
7180-get-target-vocab
Drag and Drop
Available Tools
Tooltips

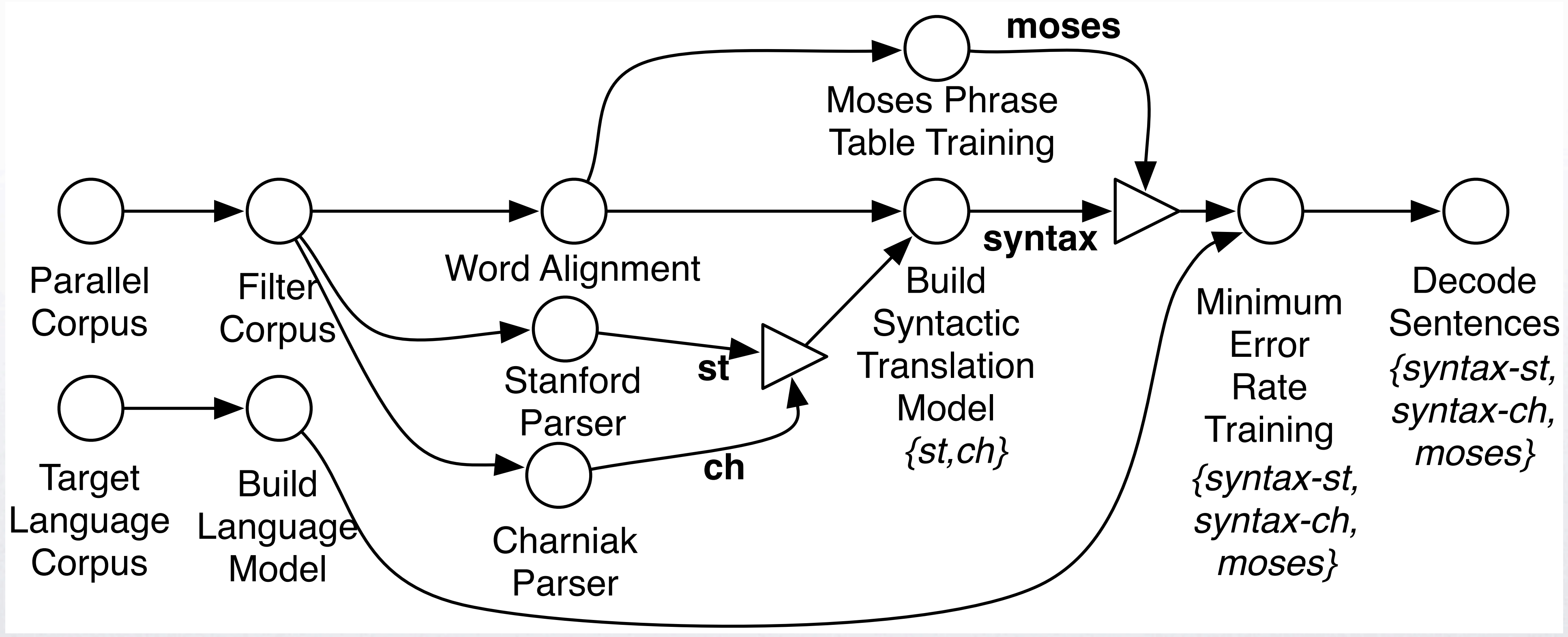
Tool Name:	GALE Packager
Step Name:	7340-packag
sysName	CMU-StatXfer-201
occassion	P4 Audio Evaluatior
Machine Config	barrow

Obligatory Screenshot



HyperWorkflows

- **HyperWorkflows:** Shared substructure in experiments
- Encode small variations in a HyperDAG


moses
Moses Phrase Table Training
Parallel Corpus
Filter Corpus
Word Alignment
syntax
Build Syntactic Translation Model {st,ch}
Stanford Parser
st
Charniak Parser
ch
Target Language Corpus
Build Language Model
Minimum Error Rate Training {syntax-st, syntax-ch, moses}
Decode Sentences {syntax-st, syntax-ch, moses}

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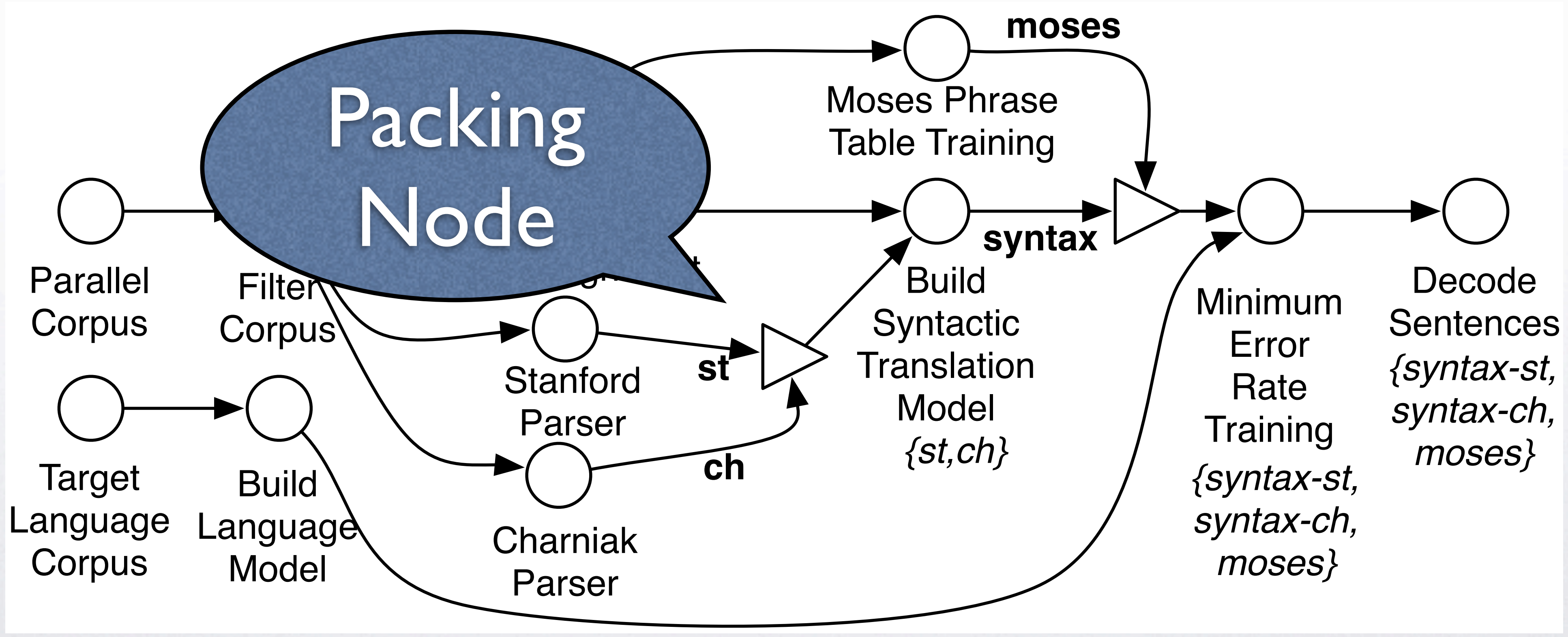
Packing Node
moses
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syntax
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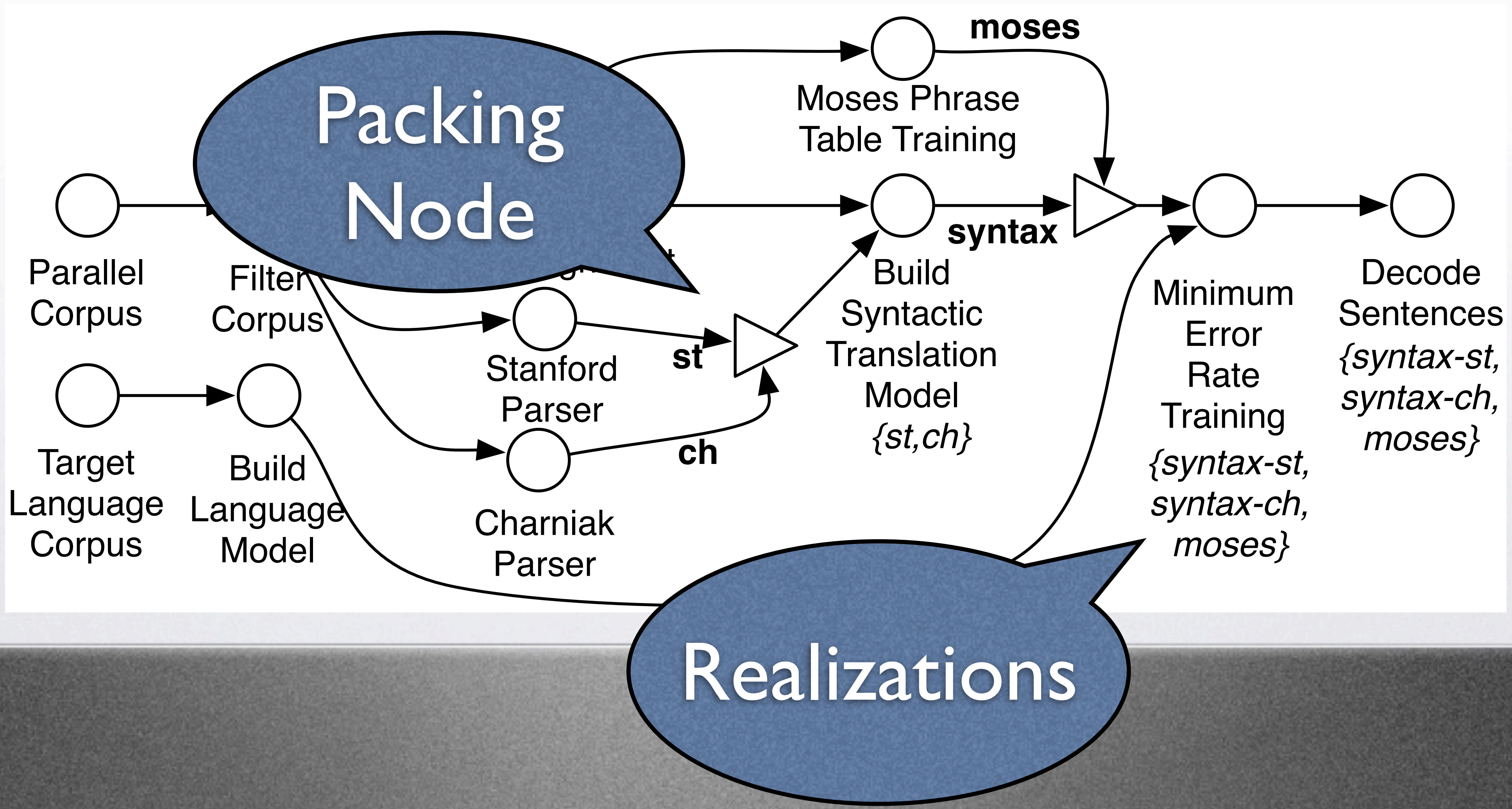
Packing Node
Realizations
moses
Moses Phrase Table Training
syntax
Parallel Corpus
Filter Corpus
Stanford Parser
st
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Build Syntactic Translation Model {st,ch}
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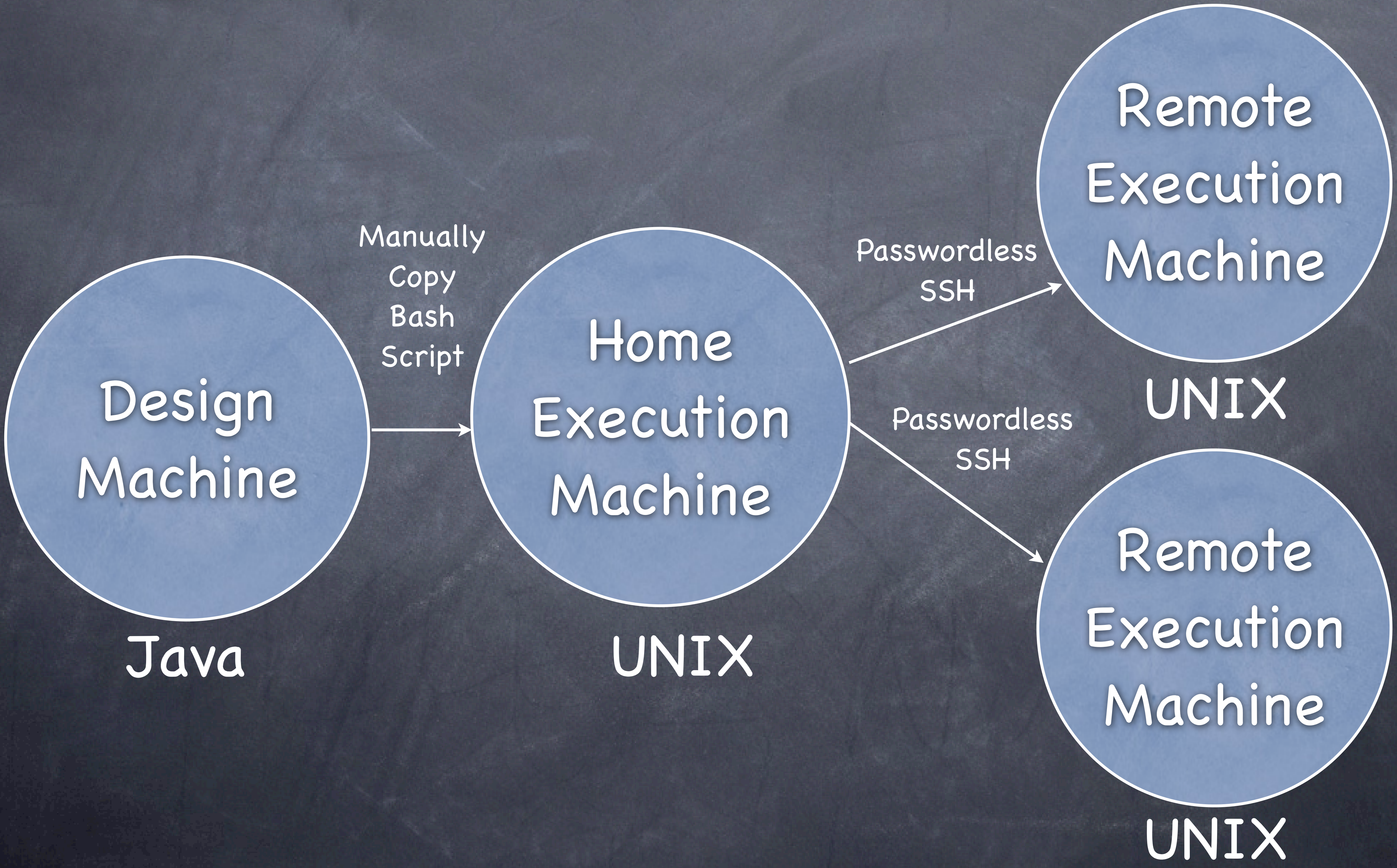
What goes on
and
What comes out

What happens where?



Push-button MT for the Masses

- A bash script is generated and copied over
- Check if files and tools are present *first*
- Sanity checking at each step
- Copying of files (including to HDFS)
- Automatic login to remote machines (via passwordless SSH)
- Scheduler wrappers (e.g. Torque/Condor/SGE)

What comes out

- Artifacts of the workflow in an organized directory structure
- Log with detailed information about data (corpus, alignments, parses, etc.) after pipeline step
  - Simple text format
  - Complete history in each file
- Email/SMS notifications of completion/failure

Example Log Output

```
5000-tune.it1.AvgWeight.pt_wordcount    -1.76
5000-tune.it1.ExampleTopbestHyp.1 oslo 6-2 -lrb- afp -rrb- - terje roed…
5000-tune.it2.hypotheses.Total    712902
5000-tune.it2.hypotheses.PerSentence      396
5000-tune.it2.hypotheses.AddedTotal       272703
5000-tune.it2.hypotheses.AddedPerSentence 151
5000-tune.it2.Weight.lm   1.55
4250-prune-pt-default.MachineName    gritgw1005.yahooresearchcluster.com
4250-prune-pt-default.Datestamp Tue Oct 6 22:38:35 UTC 2009
4250-prune-pt-default.TimeElapsed       0:17:17
4250-prune-pt-default.COUNT.Phrase_Records_Read   14561086
4250-prune-pt-default.COUNT.Source_Sides_After_Pruning    176529
4250-prune-pt-default.FileSystemCounters.FILE_BYTES_READ  308358509
```

LoonyBin Best Practices

- **Lots** of steps. Why?
  - Continue on failures
  - Interchange components easily
  - Record effect of each component on data

MT Toolpack for LoonyBin

- Will be released MT Marathon next week
    - Joshua training pipeline including Berkeley aligner and recasing (Jonny and Byung @ JHU)
    - Moses training pipeline
    - MGIZA/Chaksi (Qin)
    - SAMT (Andreas)
    - Multi-Metrics -- BLEU/NIST/Meteor/TER (Kenneth)
    - LM training via SRILM
    - MEMT (Kenneth)

Adding your own tools

```
class Lowercase(Tool):

    def getName(self):
        return 'Machine Translation/Output/Unescape English'

    def getDescription(self):
        return "Unescapes -lrb- -rrb- '' `` and splits hyphens"

    def getRequiredPaths(self):
        return ['gale-p4-scripts']

    def getParamNames(self):
        return []

    def getInputNames(self, params):
        return [ ('eFileIn', 'file containing English data') ]

    def getOutputNames(self, params):
        return [ ('eFileOut', 'unescaped file with English data') ]

    def getCommands(self, params, inputs, outputs):

        return [ ('unescapeEnglish.py < %(eFileIn)s'%inputs +
                  ' > %(eFileOut)s'%outputs) ]

    def getPostAnalyzers(self, params, inputs, outputs):
        return [ ]
```

Conclusion

- Make your life easier
- Be a more responsible scientist

Questions?

Post-Mortem: Directory Structure

- (picture of directory structure)

Post-Mortem: Future Work

- Default parameters -- Next few months
- Asynchronous DAG execution (currently all steps are run in serial) -- Next year
- Workflow monitoring and modification during execution -- Next several years

Post-Mortem: Recommendations

- Store your workflow files in SVN
- Store your log files in SVN -- experimental data is useful long after we get annoyed with size of data files!
- Log the SVN revision of frequently changing tools in your Loon logs -- Build them from SVN every time to ensure you’re executing that version