REMEDI: Robust and Efficient Machine Translation in a Distributed Infrastructure

Bi-Annual Report: Month 24

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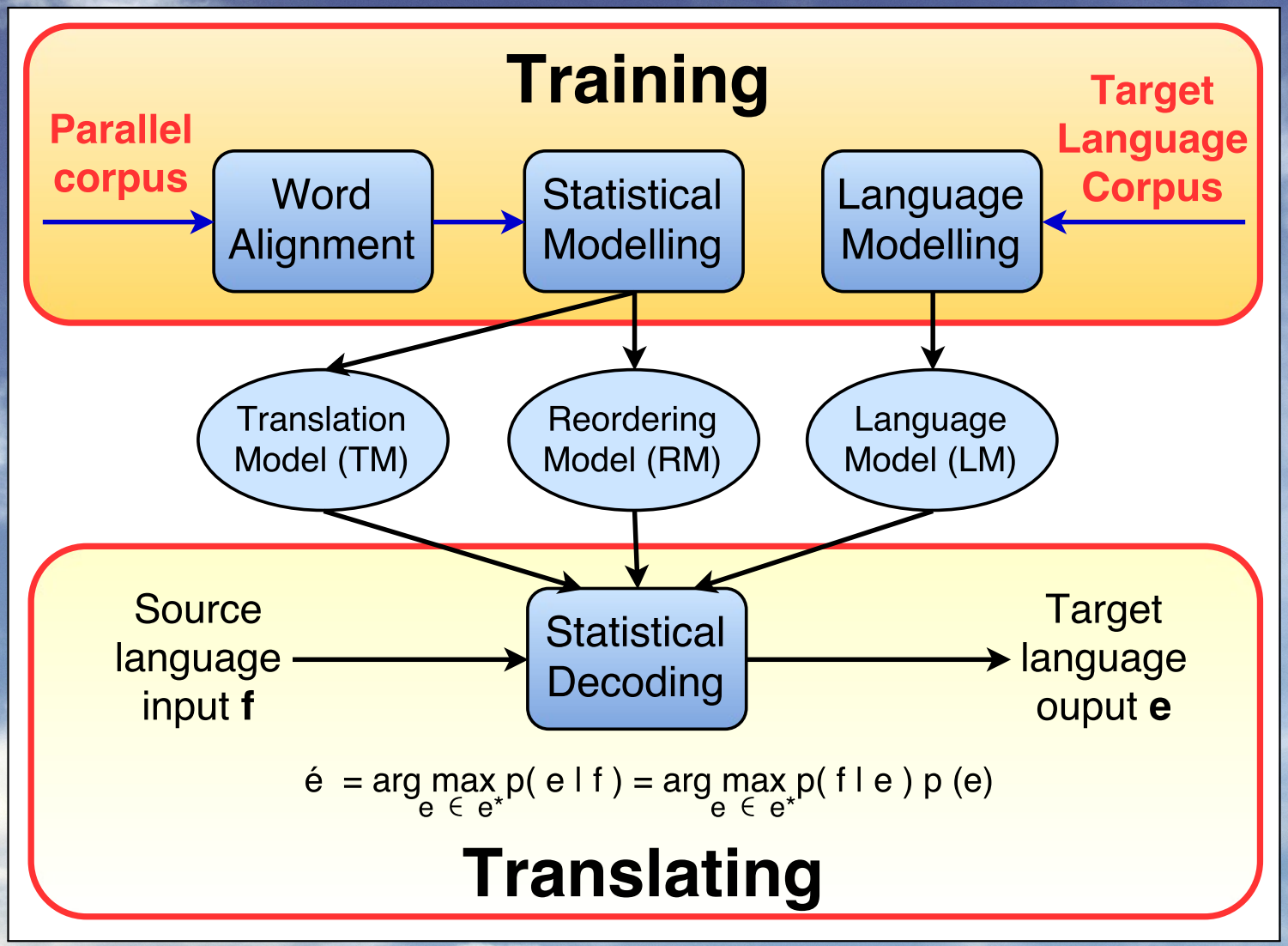
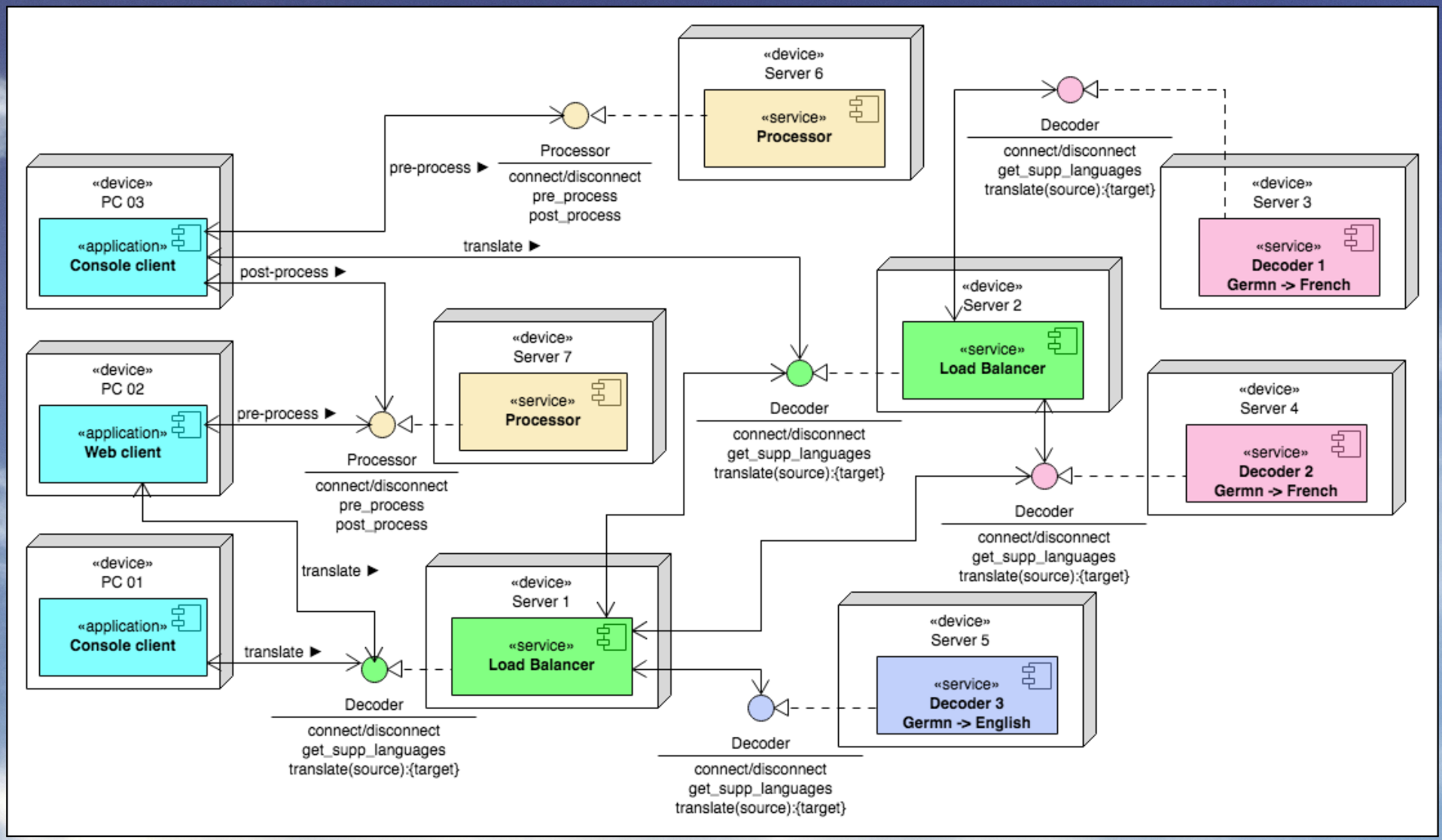
Retrospective

Statistical Machine Translation

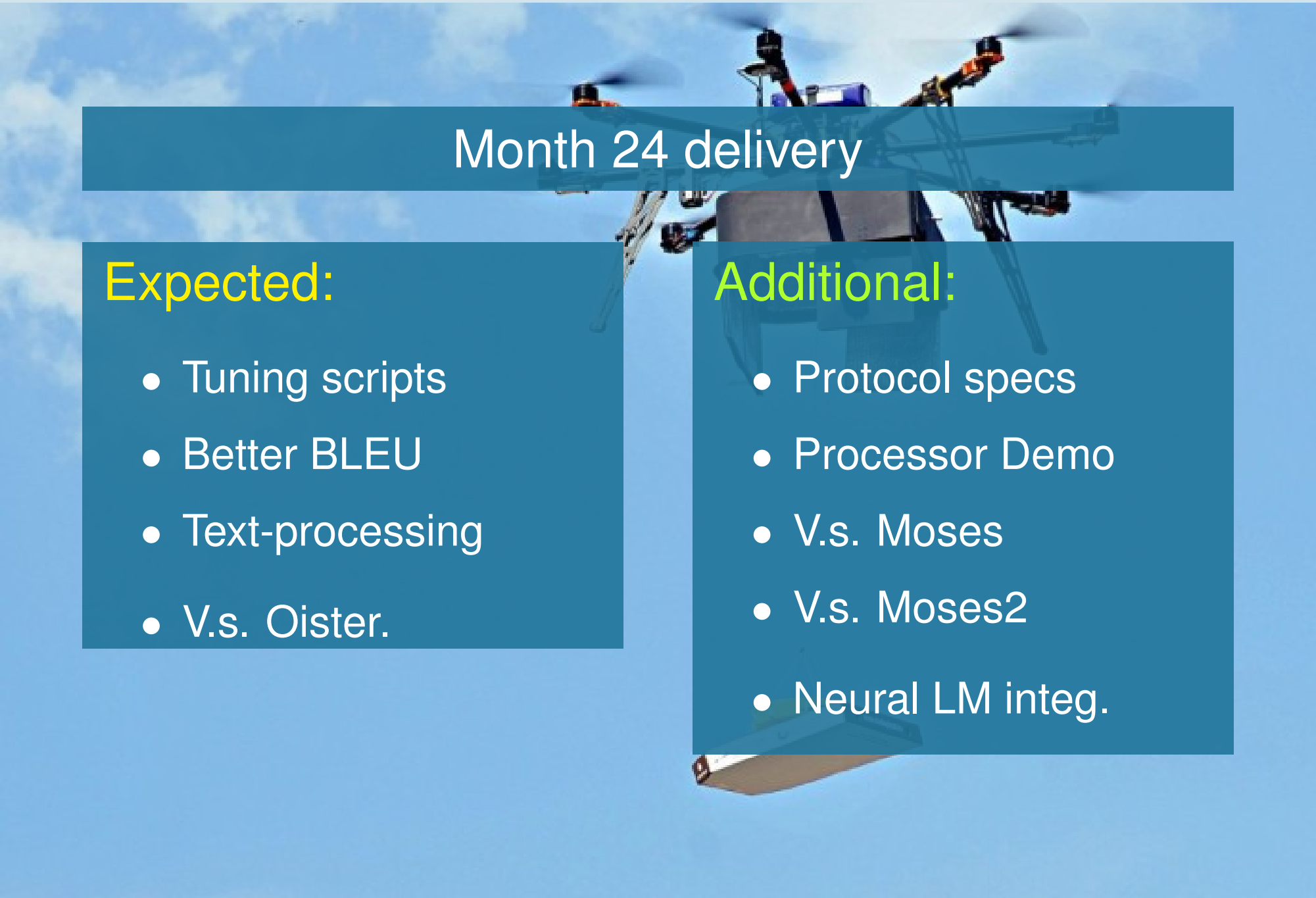


Retrospective: Previous 3 deliveries



Functionality, Performance, Profiling, Documentation

Present days



Month 24 delivery

Expected:

- Tuning scripts
- Better BLEU
- Text-processing
- V.s. Oister.

Additional:

- Protocol specs
- Processor Demo
- V.s. Moses
- V.s. Moses2
- Neural LM integ.

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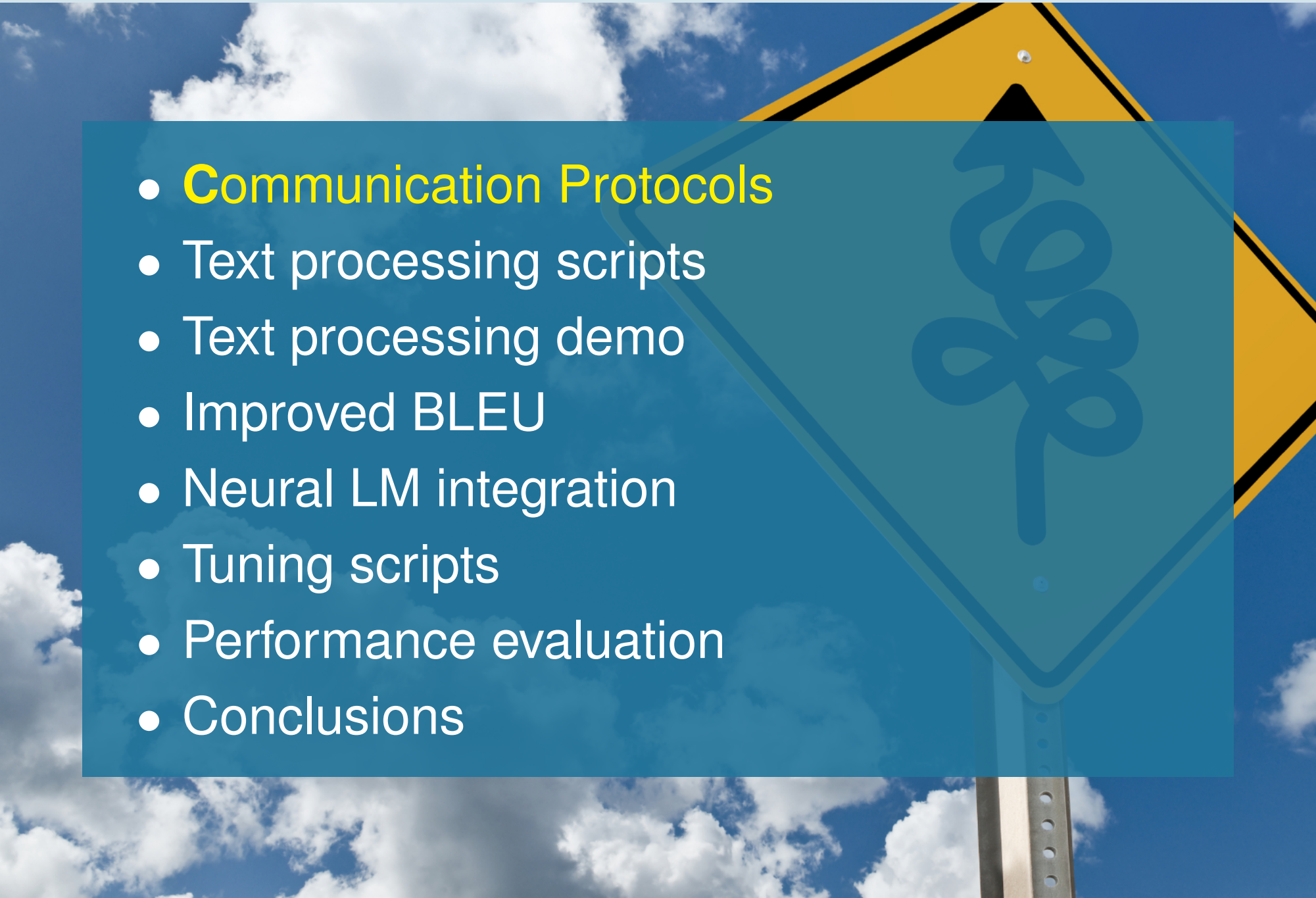
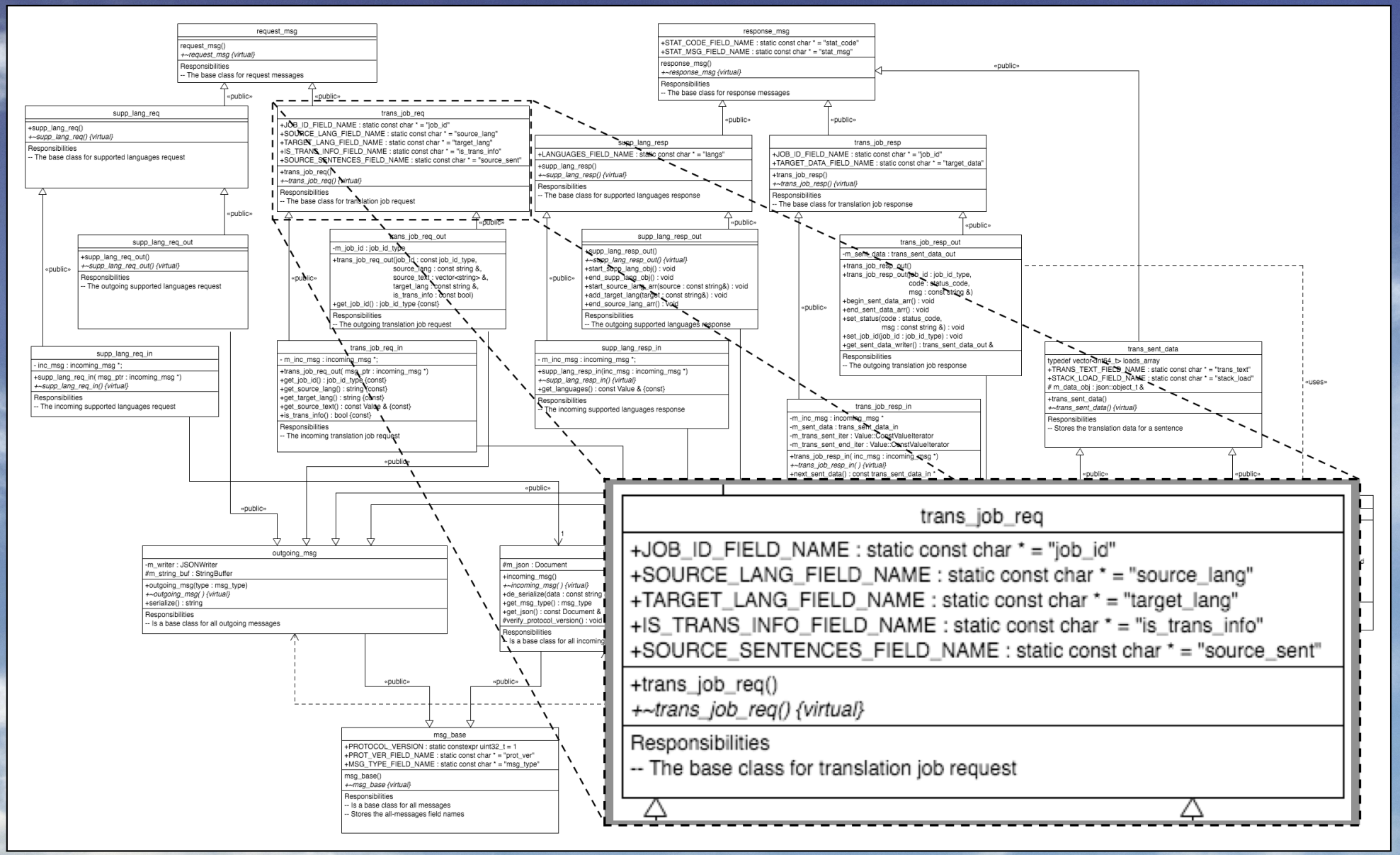


Protocols: Supported communications

- **(T)** - Translation
- **(S)** - Supported languages
- **(P)** - Pre-/Post-processing

Req/Resp	Server	Balancer	Processor
Client	(S), (T)	(S), (T)	(P)
Balancer	(S), (T)	(S), (T)	

Protocols: Class diagram



Protocols: JavaScript Object Notation

```
{
  "prot_ver" : 0,
  "msg_type" : 3,
  "job_id" : 101,
  "priority" : 10,
  "source_lang" : "german",
  "target_lang" : "english",
  "is_trans_info" : true,
  "source_sent" : [
    "how are you ?",
    "i was glad to see you .",
    "let us meet again !"
  ]
}
```

Translation Request, JSON

Protocols: JavaScript Object Notation

```
{
  "prot_ver" : 0,
  "msg_type" : 4,
  "job_id" : 101,
  "stat_code" : 3,
  "stat_msg" : "Some translation tasks were canceled",
  "target_data" : [
     {
       "stat_code" : 2,
       "stat_msg" : "OK",
       "trans_text" : "Wie geht es dir ?",
       "stack_load" : [ 3, 67, 90, 78, 40, 1 ]
     },
     {
       "stat_code" : 4,
       "stat_msg" : "The service is going down",
       "trans_text" : "i was glad to see you ."
     },
     {
       "stat_code" : 2,
       "stat_msg" : "OK",
       "trans_text" :  "Lass uns uns wiedersehen!",
       "stack_load" : [ 7, 76, 98, 90, 56, 47, 3 ]
     }
   ]
}
```

Translation Response, JSON

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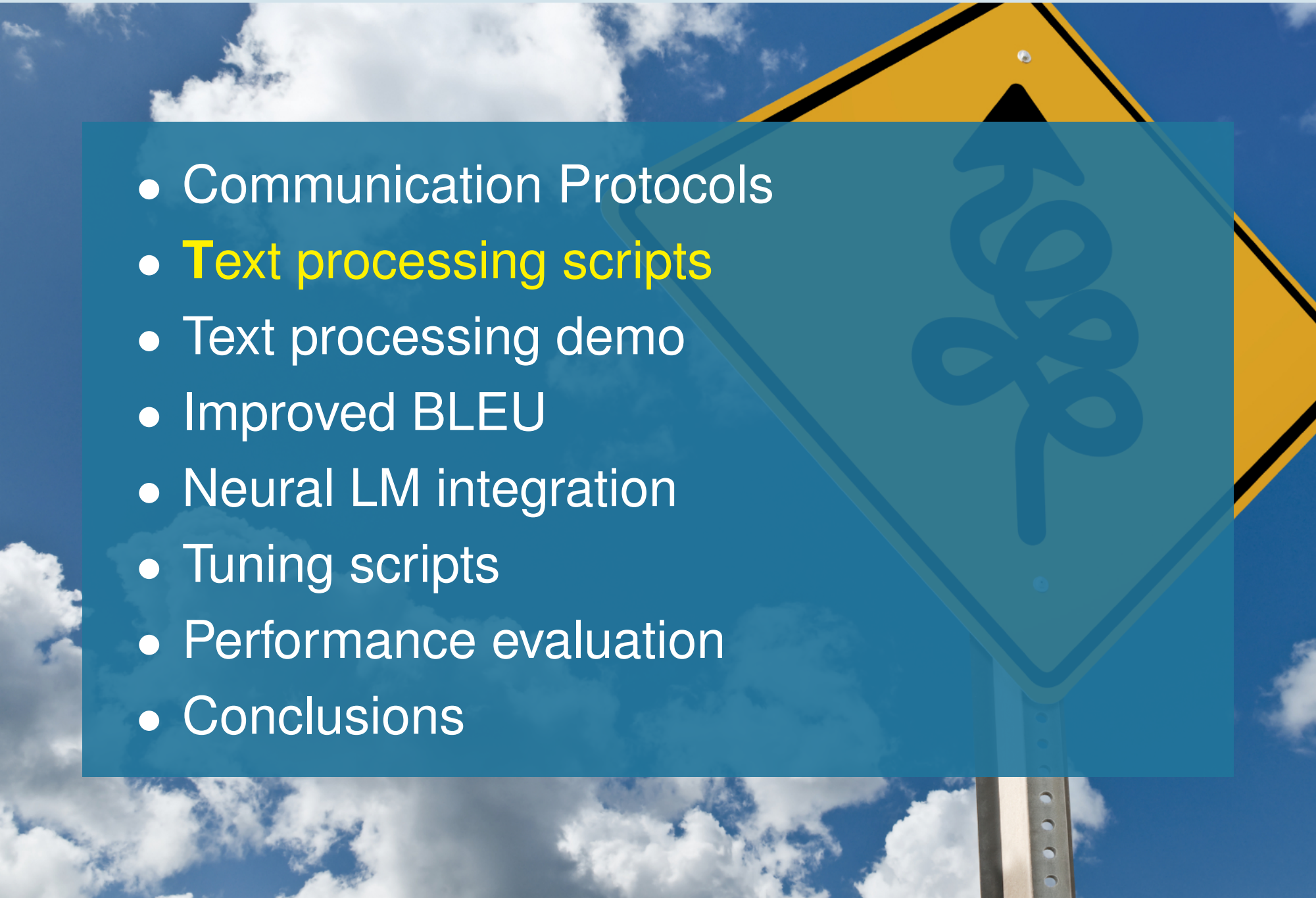

Text processing scripts

Integrated third-party tools and services

- **`pre_process_nltk.sh`:**
  - Language detection via NLTK stop words [LB02, COJA15]
  - Template generation for text structure restoration
  - Sentence splitting using NLTK and Stanford Core NLP
  - Tokenization and lowercasing via NLTK [MSB+14]
- **`post_process_nltk.sh`:**
  - Sentence capitalization as a separate option
  - Text de-tokenization via MTMonkey [AORP13]
  - True-casing via Moses [KHB+07] or Truecaser [LIRK03].
  - Text structure restoration from a pre-generated template.

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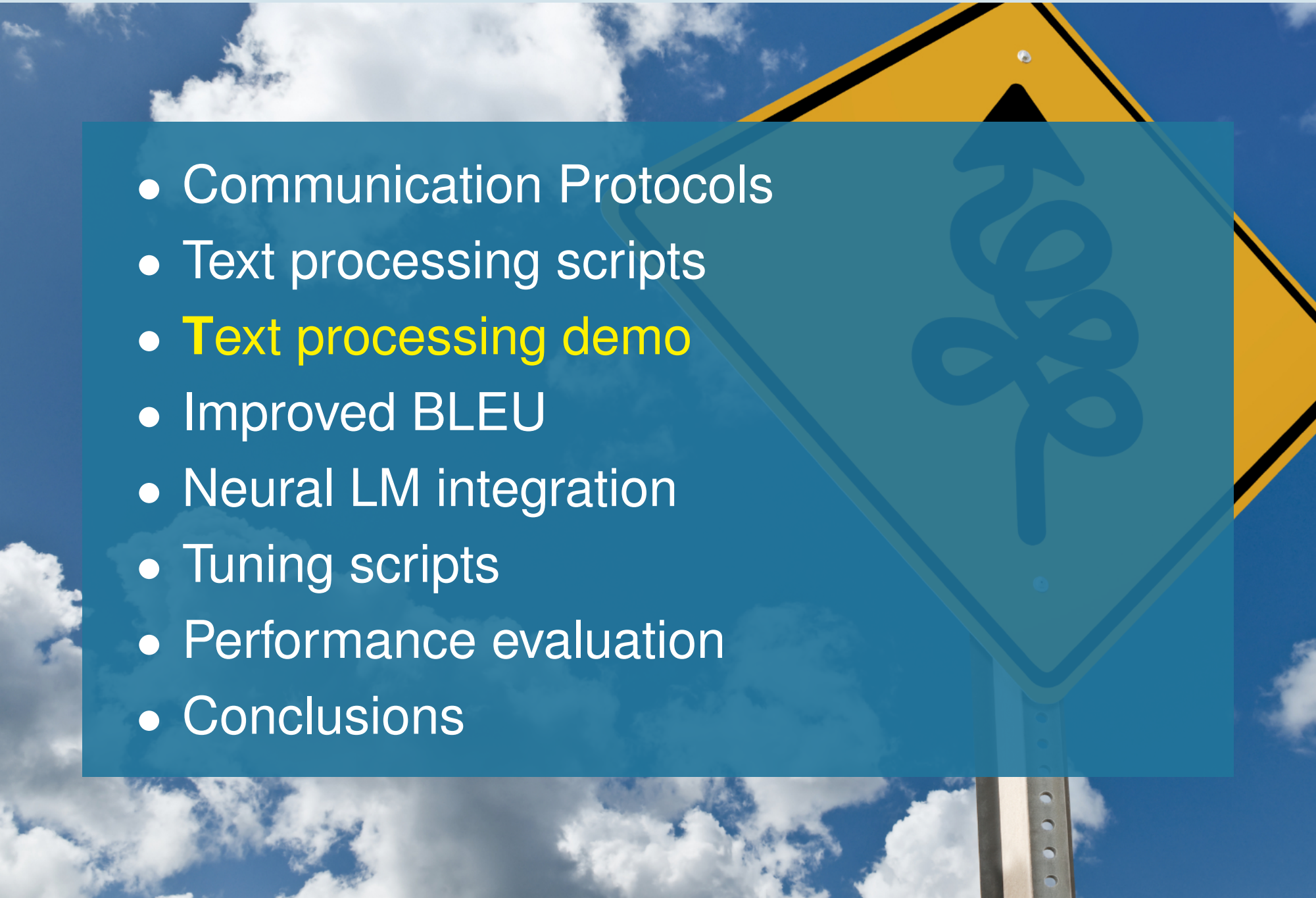
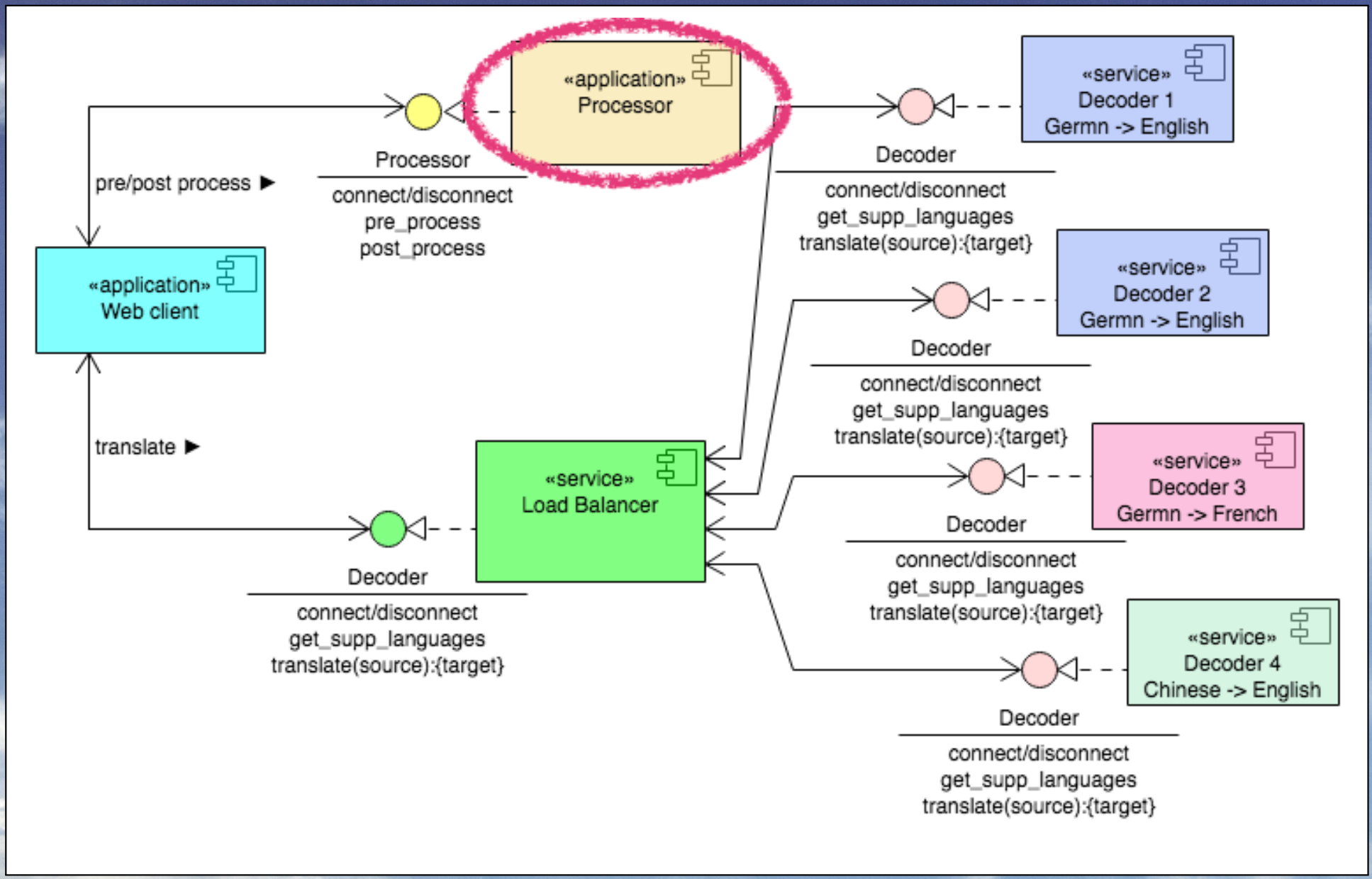


Demo: Deployment



Demo: Text processing demo

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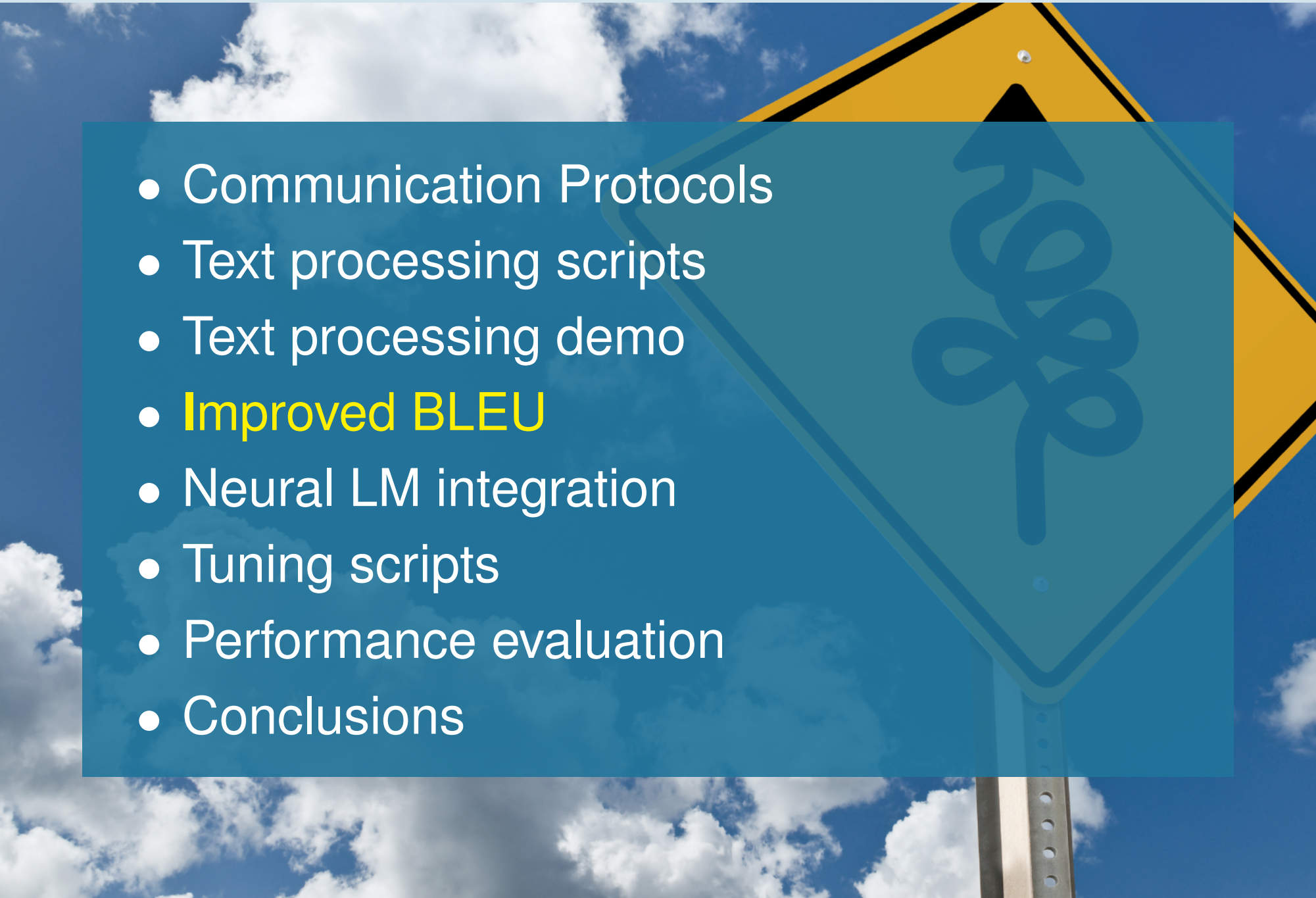

Improved BLEU

- Chinese to English:
  - **MT-**04 [Gro10]
  - CTB segmented [MSB+14]
  - 1788 sentences
  - 49582 tokens
- **Oister**: 36.8 BLEU
- REMEDI m-18: $\approx$ 23 BLEU
- REMEDI m-24: 36.72 BLEU

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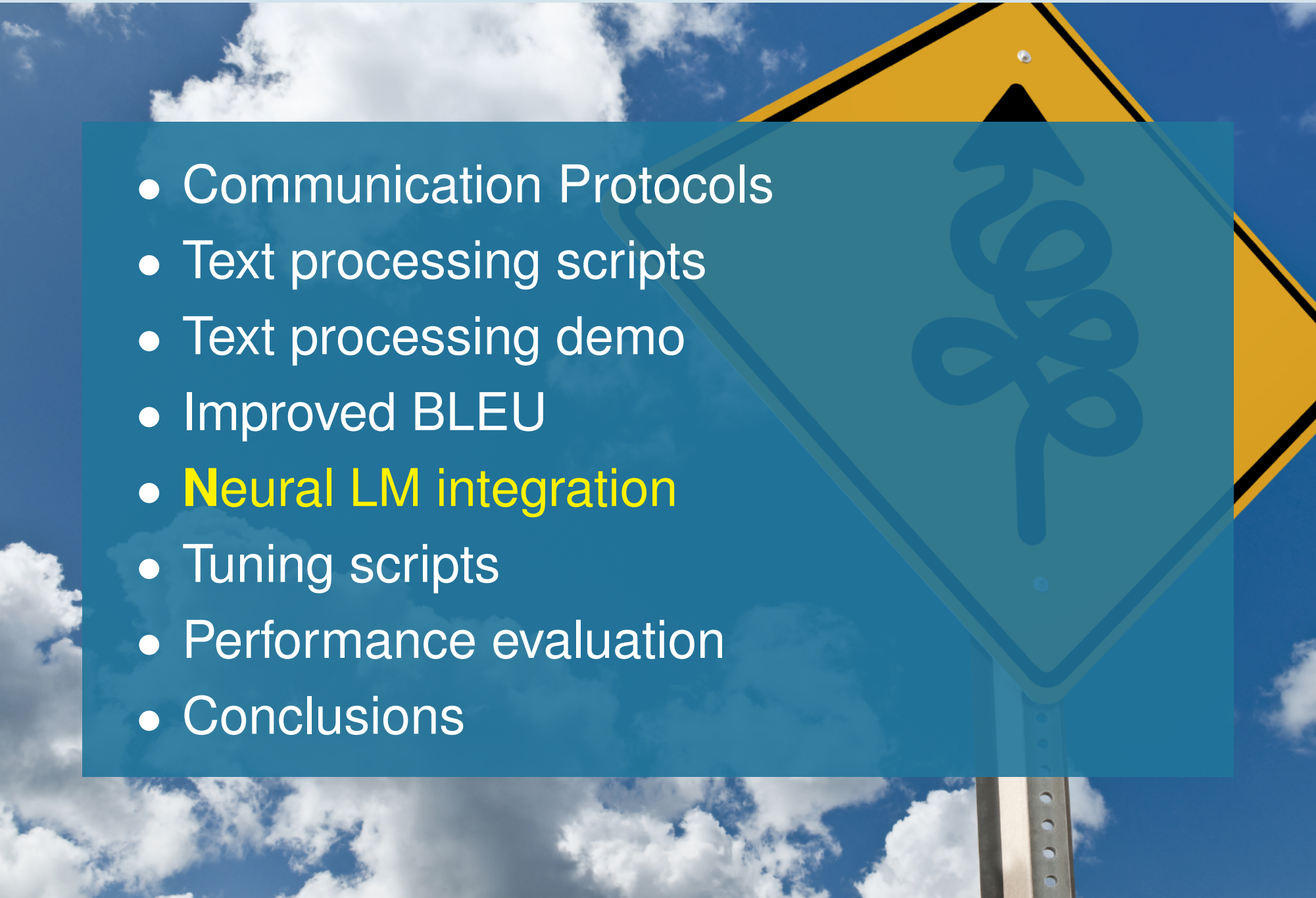
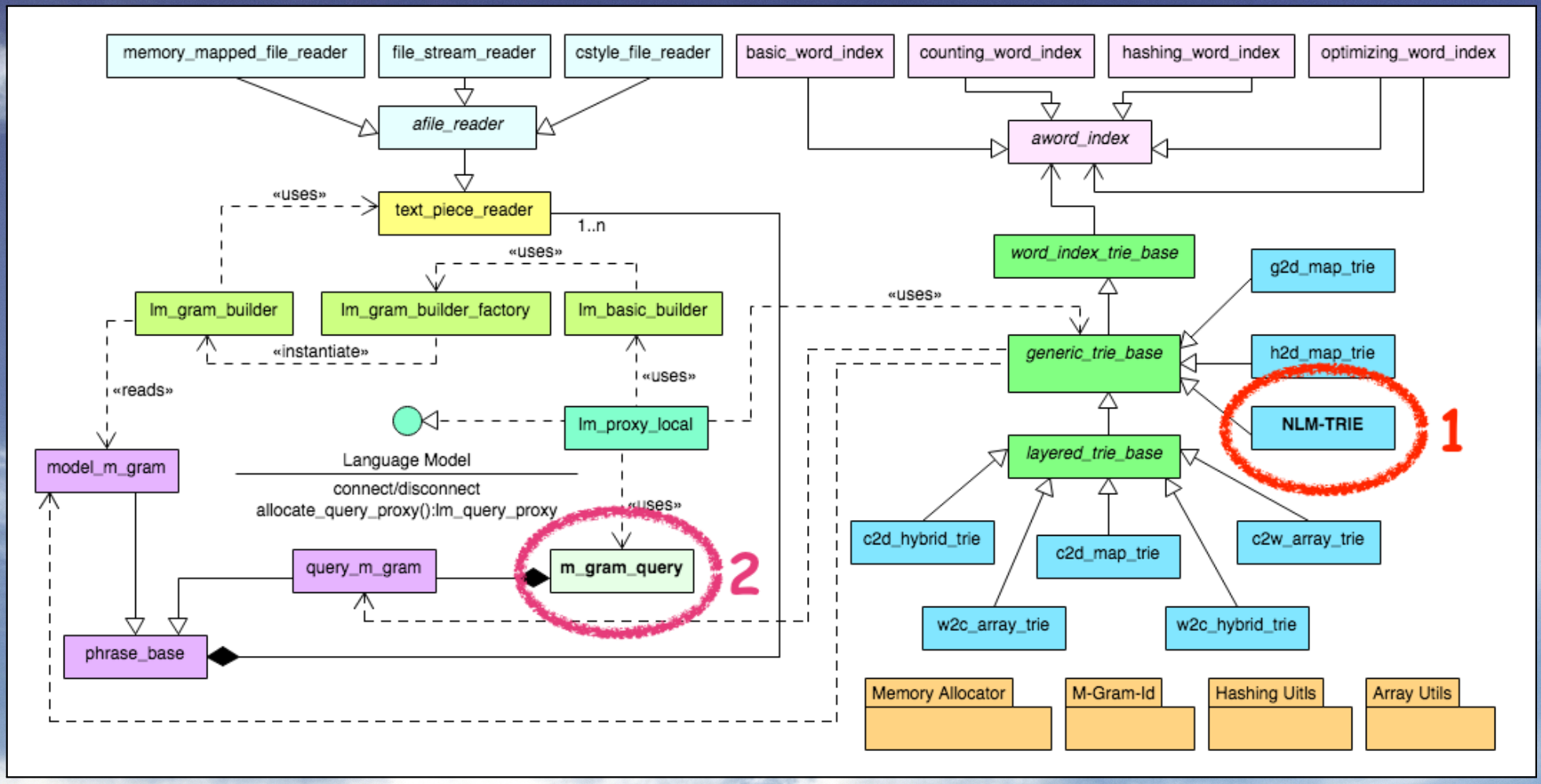


Neural LM integration



Hamidreza Ghader, Neural LM model, just 2 modifications

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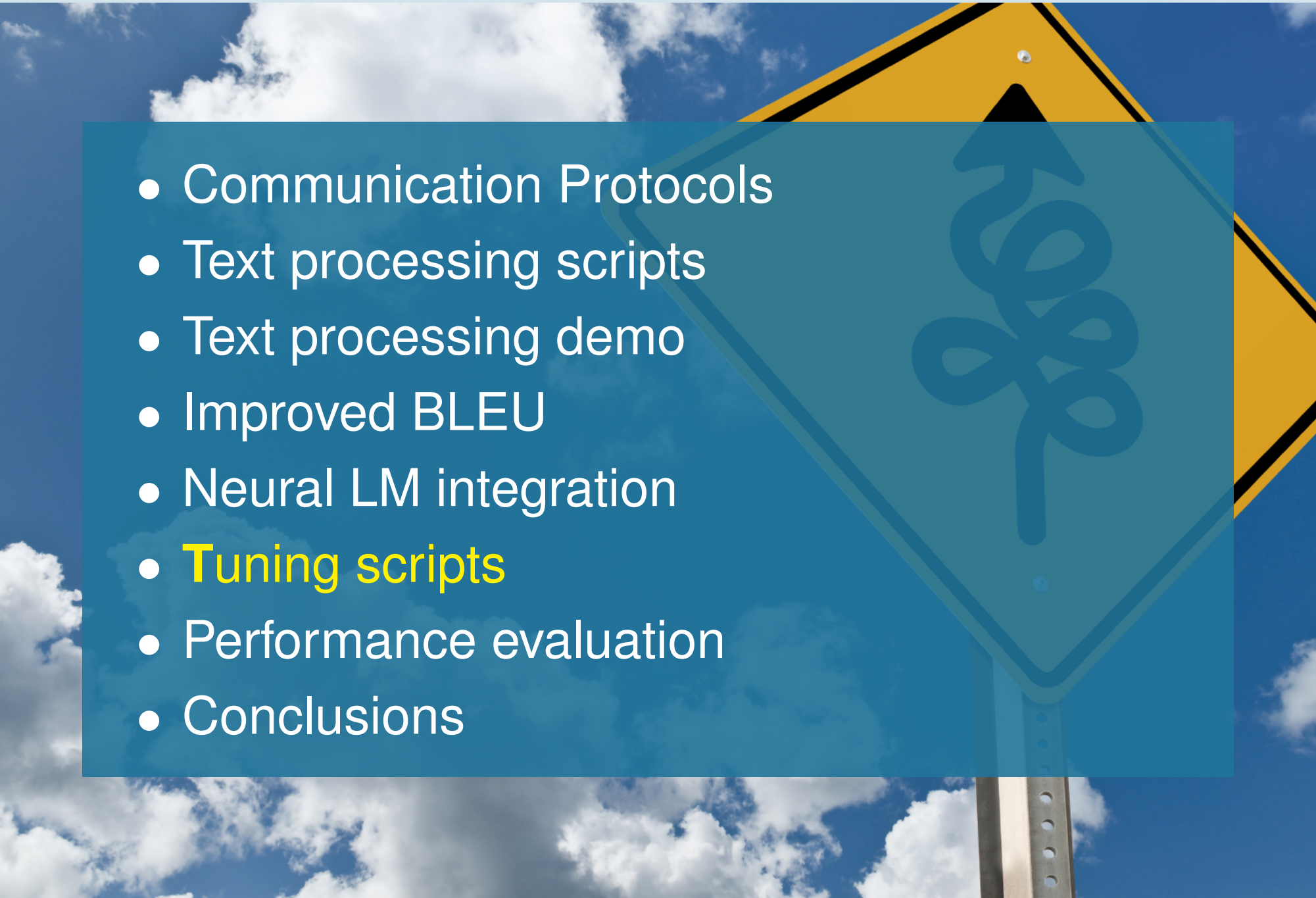

Available Tuning scripts

Tuning: Employ Discriminative Training to optimize translation performance

- `run_tuning.sh`
  - Run tuning infrastructure
- `tuning_progress.pl`
  - Monitor BLEU scores
  - Extract configuration files
- `kill_tuning.pl`
  - Kill tuning processes

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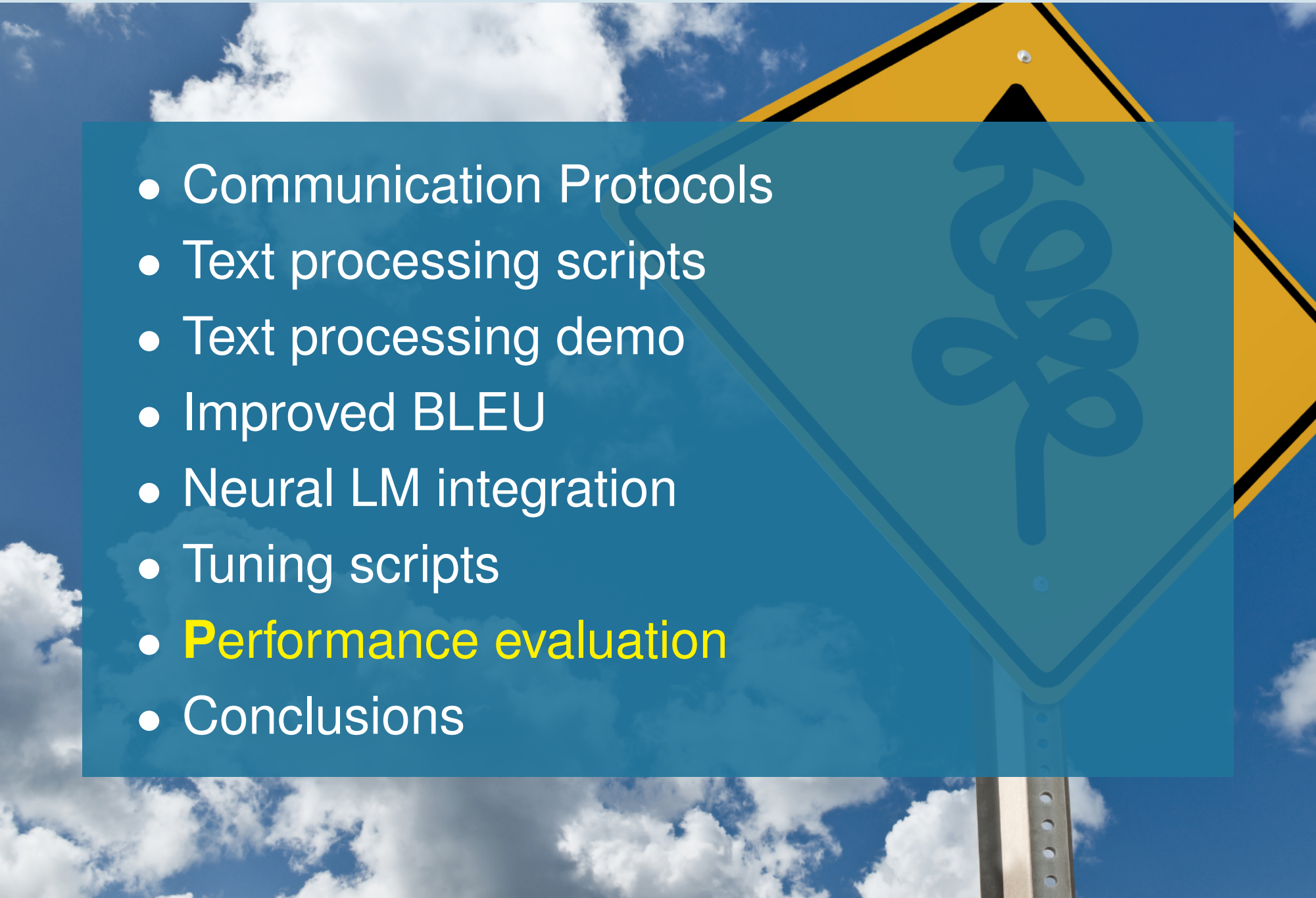


Evaluation: Task and Tools

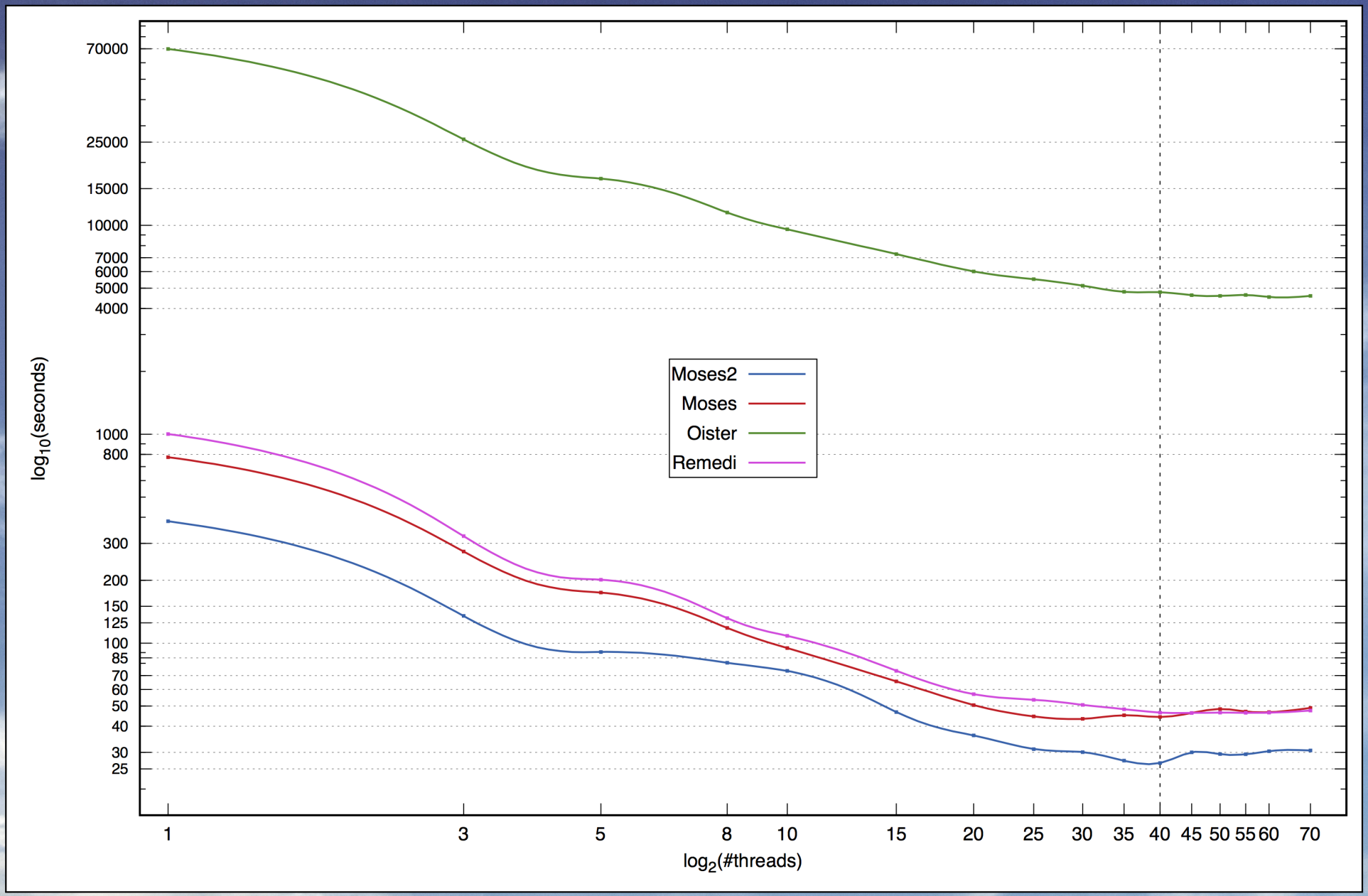
- Multi-threaded SMT systems
  - REMEDI - 2 years old, C++
  - Moses/Moses2 - 11 years old, C++
  - Oister - 6 years old, Perl
- Empirically compare
  - Pure decoding times
  - Scaling on multi-core

Evaluation: Experimental setup

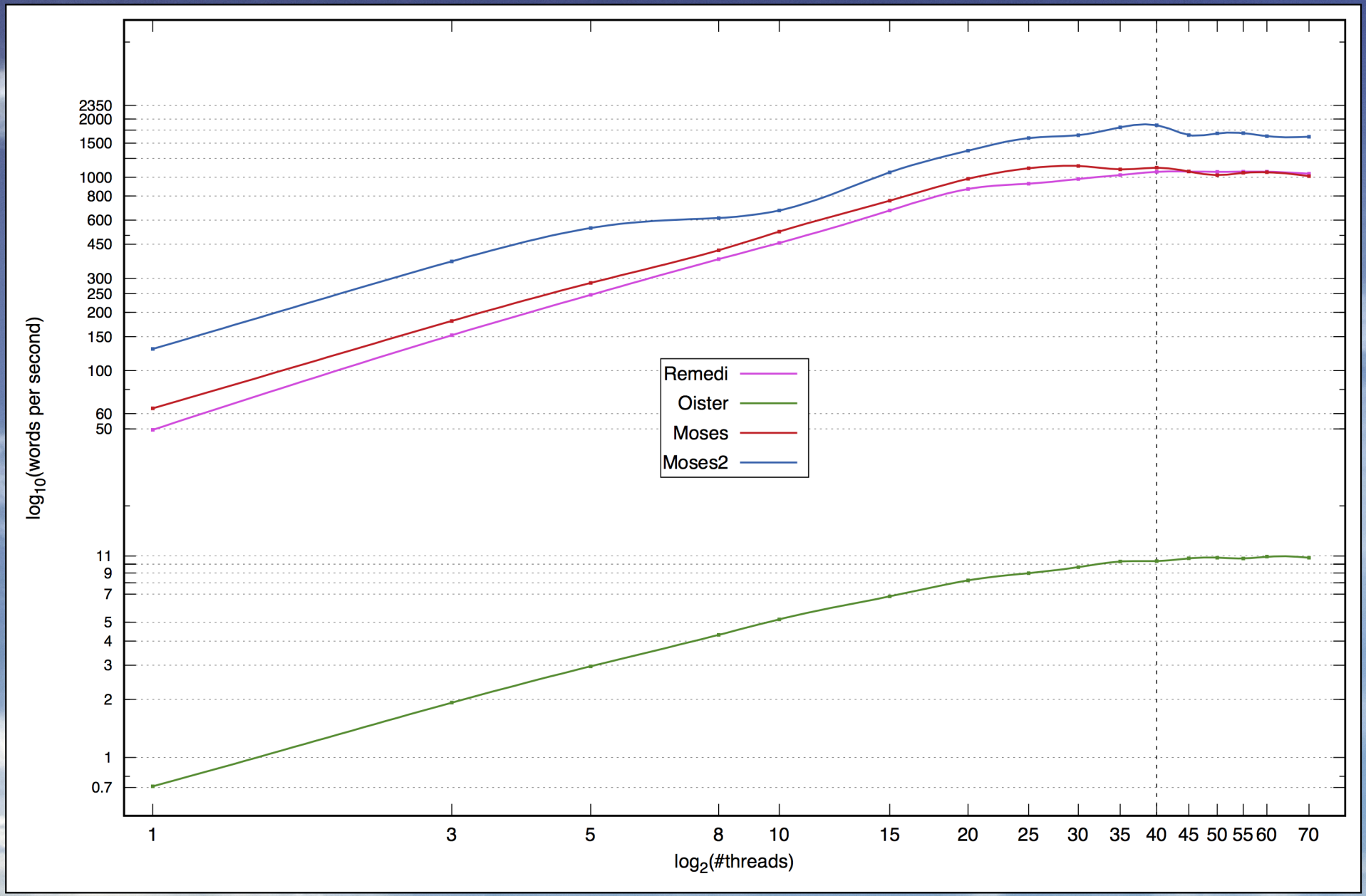
- Chinese to English:
  - MT-04 data set
  - CTB segmented
  - 1788 sent
- Independently tuned:
  - Oister: 36.8 BLEU
  - REMEDI: 36.72 BLEU
  - Moses/2: 35.53 BLEU
- Perform:
  - 10 runs per exp.
  - Oister 3 runs

- Large Models:
  - LM: 48.9 Gb, 5g
  - RM: 9.7 Gb, 8f
  - TM: 1.3 Gb, 5f
- Black-box experiments
- Measure runtime
- Obtain data:
  - Avg loading times
  - Avg total times
  - Std. Deviations

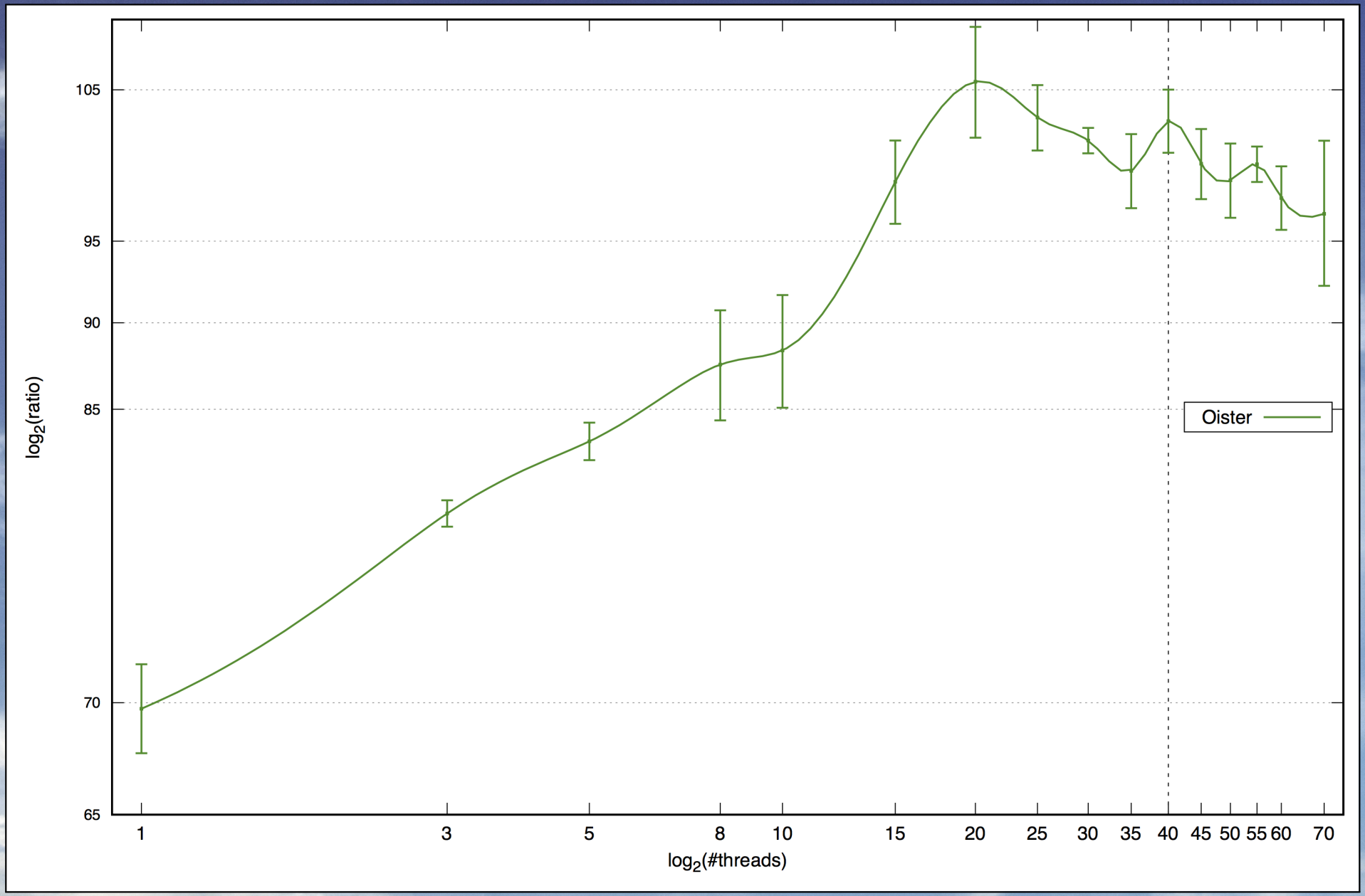
Evaluation: Decoding times



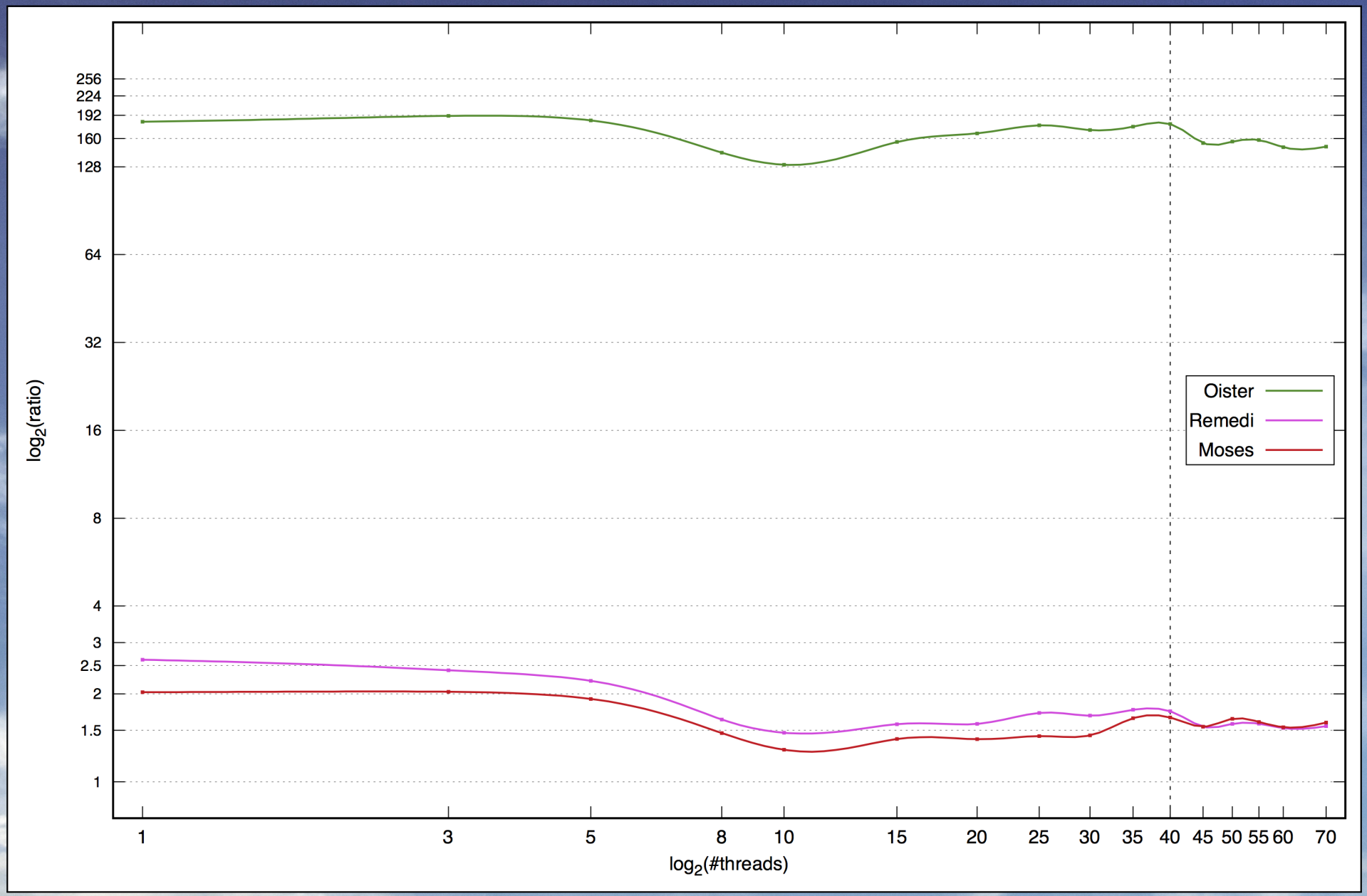
Evaluation: Words per second



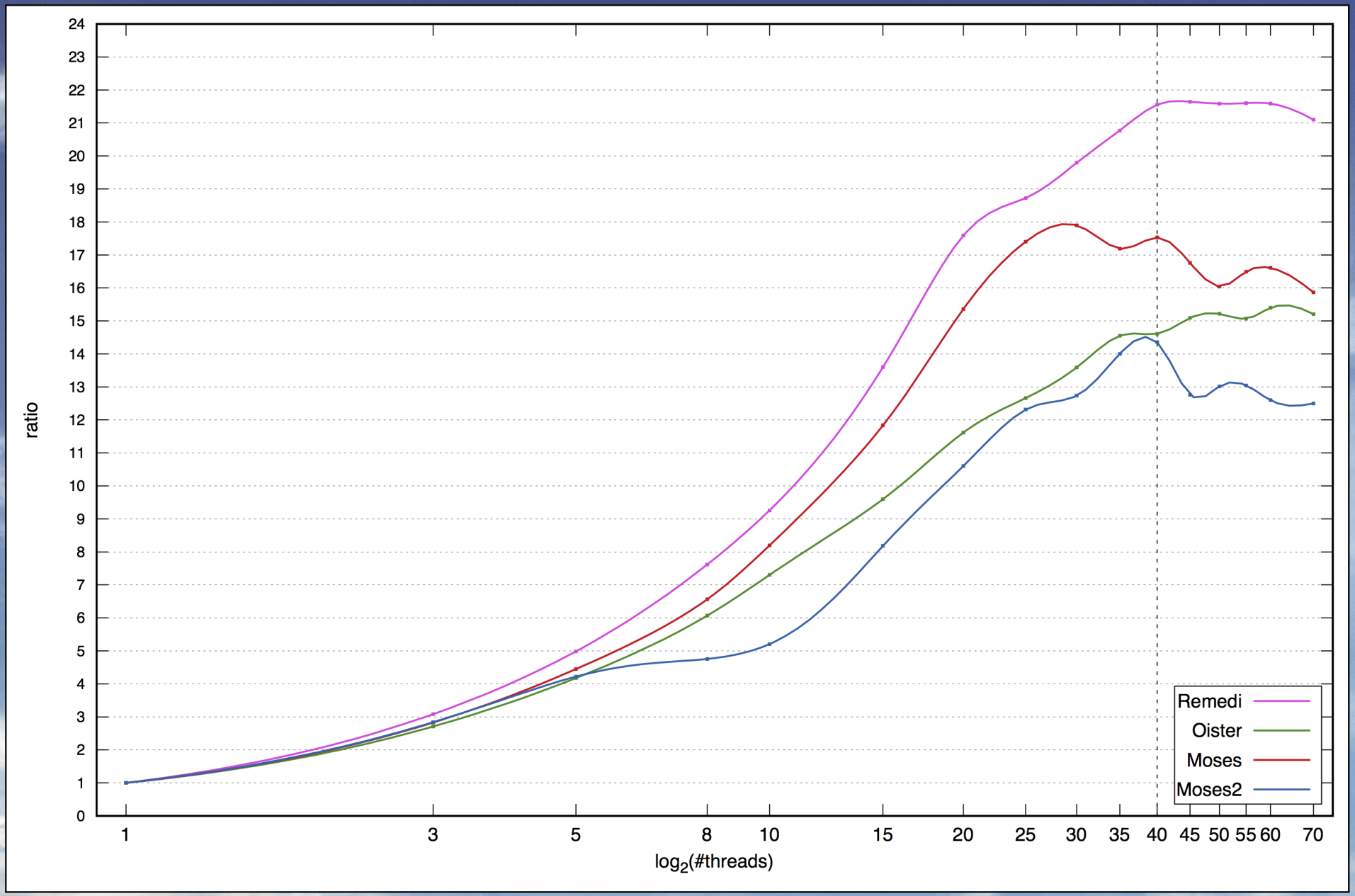
Evaluation: Oister vs. Remedi



Evaluation: All vs. Moses2



Evaluation: Multi-threading speedups



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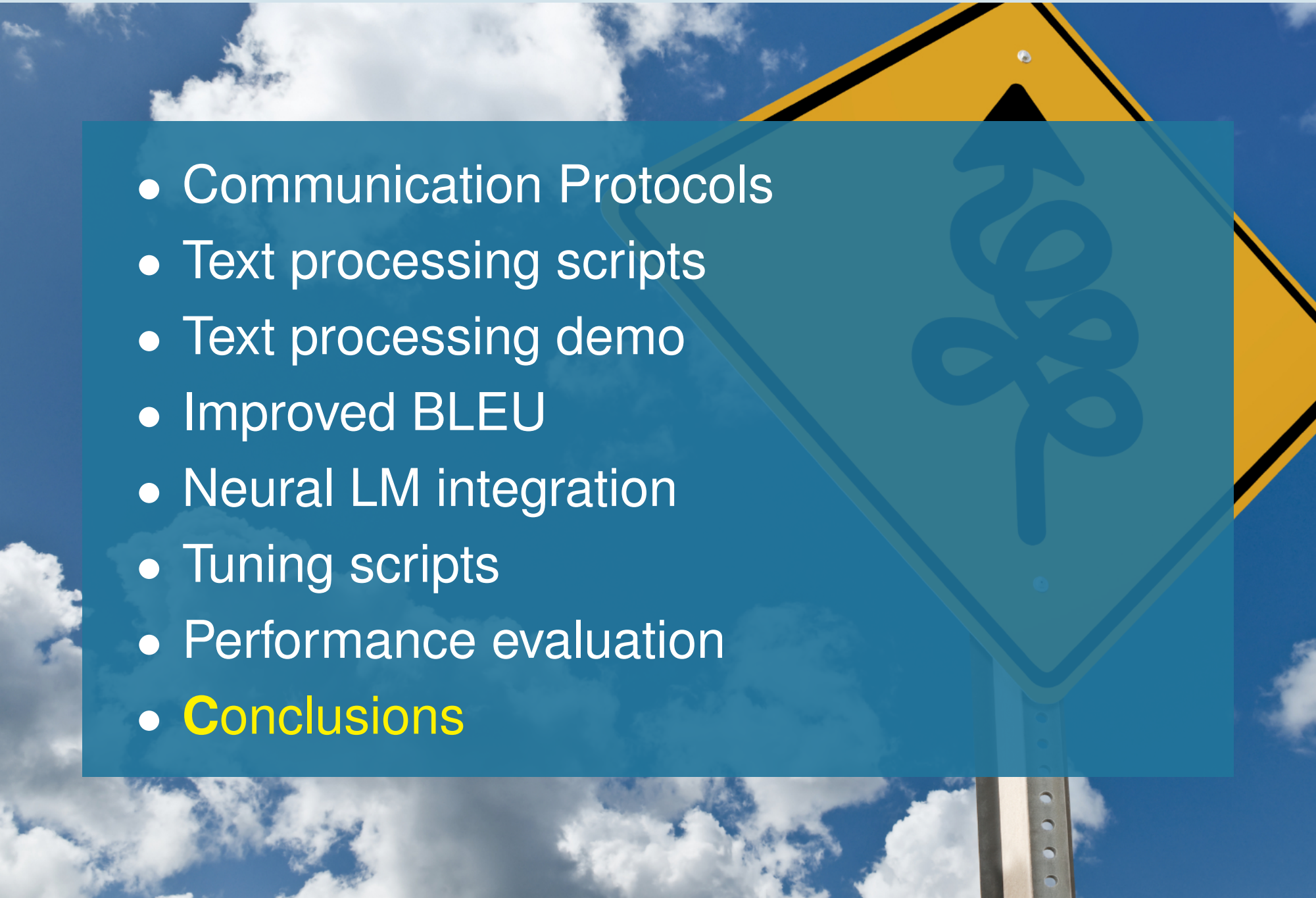
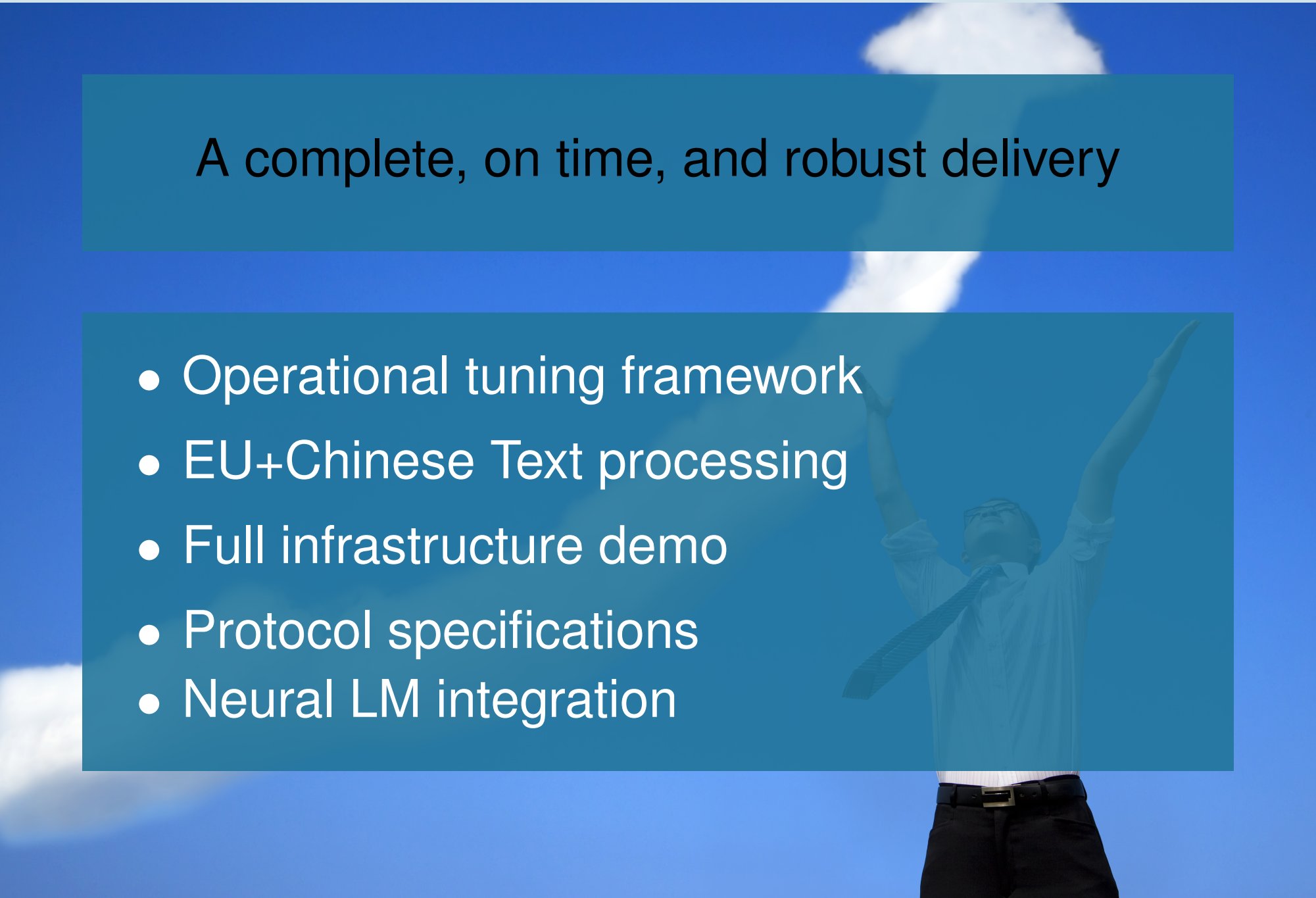


Conclusions - 1/2



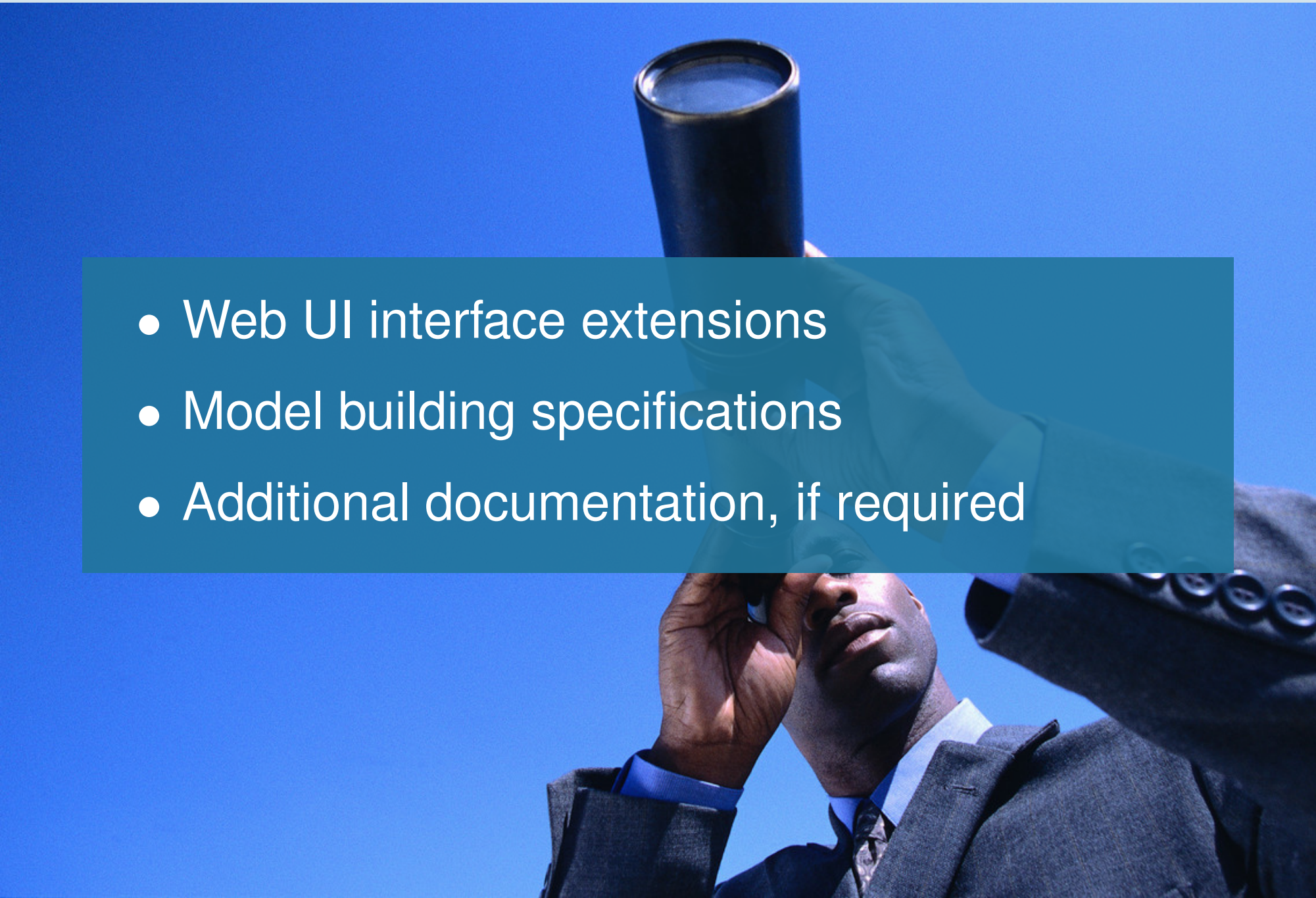
A complete, on time, and robust delivery

- Operational tuning framework
- EU+Chinese Text processing
- Full infrastructure demo
- Protocol specifications
- Neural LM integration

Conclusions - 2/2

- MT-04, Chinese $\rightarrow$ English
  - From $\approx$ 23 $\rightarrow$ 36.72 BLEU
  - Matching Oister in BLEU
- The best scaling in #threads
- Most stable in its decoding times
- 70 to 100 times faster than Oister
- Matches Moses if #threads == #cores
- Is just $\approx$ 2.5 to 1.5 times slower than Moses2
- Better BLEU than Moses/Moses2

Future plans



- Web UI interface extensions
- Model building specifications
- Additional documentation, if required

Discussion

Thank you all!

Literature I

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