Google
Developers

Found in Translation

Going Global with the Translate API

Josh Estelle
Staff Software Engineer

Rohit Khare
Product Manager

Google I/O

Why Machine Translation is Important

How Google Translate Works

How You Can Use the Translate API

Translation is hard

Google™

IBM 701

http://www.flickr.com/photos/94366076@N00/3432301223

pdxdiver

(cc) BY-SA

1954 Georgetown-IBM Experiment

250 vocabulary words

6 rules of grammar

60 Russian sentences to English

Computational Power

Computational Power

Data

Computational Power

Data

Statistical Machine Translation

Google's mission is to organize the world's information and make it *universally accessible* and useful

Google Translate: The Beginning

2001

5 languages

French
Italian
Spanish
Portuguese
German

Google Translate: The Beginning

2001

2003

8 languages

French
Italian
Spanish
Portuguese
German
Chinese
Japanese
Korean

Taking a Google Approach to Translation

2003

Google begins building our own statistical machine translation system

Learning from tons of data

Using huge computational power

It Worked

2005 NIST Machine Translation evaluation

40 hours

1000 sentences

Significantly better quality than other systems

Launch

2006

Chinese
Arabic

Russian

Arabic
Chinese
English
Russian

2006 4

Arabic
Chinese
Dutch
English
French
German
Greek
Italian
Japanese
Korean
Portuguese
Russian
Spanish

2007 13

Replaced 3rd-party system

Arabic
Bulgarian
Catalan
Chinese
Croatian
Czech
Danish
Dutch
English
Filipino
Finnish
French
German
Greek
Hebrew
Hindi
Indonesian
Italian
Japanese
Korean
Latvian
Lithuanian
Norwegian
Polish
Portuguese
Romanian
Russian
Serbian
Slovak
Slovenian
Spanish
Swedish
Ukrainian
Vietnamese

2008 34

Any language to every other

Afrikaans
Albanian
Arabic
Belarusian
Bulgarian
Catalan
Chinese
Croatian
Czech
Danish
Dutch
English
Estonian
Filipino
Finnish
French
Galician
German
Greek
Hebrew
Hindi
Hungarian
Icelandic
Indonesian
Irish
Italian
Japanese
Korean
Latvian
Lithuanian
Macedonian
Malay
Maltese
Norwegian
Persian
Polish
Portuguese
Romanian
Russian
Serbian
Slovak
Slovenian
Spanish
Swahili
Swedish
Thai
Turkish
Ukrainian
Vietnamese
Welsh
Yiddish

2009 51

API

2011

Afrikaans
Albanian
Arabic
Armenian
Azerbaijani
Basque
Belarusian
Bengali
Bulgarian
Catalan
Chinese
Croatian
Czech
Danish
Dutch
English
Esperanto
Estonian
Filipino
Finnish
French
Galician
Georgian
German
Greek
Gujarati
Haitian Creole
Hebrew
Hindi
Hungarian
Icelandic
Indonesian
Irish
Italian
Kannada
Khmer
Korean
Lao
Latin
Latvian
Lithuanian
Macedonian
Malay
Maltese
Norwegian
Persian
Polish
Portuguese
Romanian
Russian
Serbian
Slovak
Slovenian
Spanish
Swahili
Swedish
Tamil
Telugu
Thai
Turkish
Ukrainian
Urdu
Vietnamese
Welsh
Yiddish

May 2013

New Languages

Bosnian
Cebuano
Hmong
Javanese
Marathi

71 languages

How does it work?

CLASSIC SOUPS

清燉雞湯	57.	House Chicken Soup (Chicken, Celery, Potato, Onion, Carrot) ..... 1.
雞飯湯	58.	Chicken Rice Soup ..... 1.
雞麵湯	59.	Chicken Noodle Soup ..... 1.
廣東雲吞	60.	Cantonese Wonton Soup ..... 1.
蕃茄蛋湯	61.	Tomato Clear Egg Drop Soup ..... 1.
雲吞湯	62.	Regular Wonton Soup ..... 1.
酸辣湯	63.	Hot & Sour Soup ..... 1.
蛋花湯	64.	Egg Drop Soup ..... 1.
雲蛋湯	65.	Egg Drop Wonton Mix ..... 1.
豆腐菜湯	66.	Tofu Vegetable Soup .....
雞玉米湯	67.	Chicken Corn Cream Soup .....
蟹肉玉米湯	68.	Crab Meat Corn Cream Soup .....
海鮮湯	69.	Seafood Soup .....

CLASSIC SOUPS

清燉雞湯	57.	House Chicken Soup (Chicken, Celery, Potato, Onion, Carrot) ..... 1.
雞飯湯	58.	Chicken Rice Soup ..... 1.
雞麵湯	59.	Chicken Noodle Soup ..... 1.
廣東雲吞	60.	Cantonese Wonton Soup ..... 1.
蕃茄雷湯	61.	Tomato Clear Egg Drop Soup ..... 1.
雲吞湯	62.	Regular Wonton Soup ..... 1.
酸辣湯	63.	Hot & Sour Soup ..... 1.
雷花湯	64.	Egg Drop Soup ..... 1.
雲雷湯	65.	Egg Drop Wonton Mix ..... 1.
豆腐菜湯	66.	Tofu Vegetable Soup .....
雞玉米湯	67.	Chicken Corn Cream Soup .....
蟹肉玉米湯	68.	Crab Meat Corn Cream Soup .....
海鮮湯	69.	Seafood Soup .....

CLASSIC SOUPS

清燉雞湯	57.	House Chicken Soup (Chicken, Celery, Potato, Onion, Carrot) ..... 1.
雞飯湯	58.	Chicken Rice Soup ..... 1.
雞麵湯	59.	Chicken Noodle Soup ..... 1.
廣東雲吞	60.	Cantonese Wonton Soup ..... 1.
番茄蛋湯	61.	Tomato Clear Egg Drop Soup ..... 1.
雲吞湯	62.	Regular Wonton Soup ..... 1.
酸辣湯	63.	Hot & Sour Soup ..... 1.
蛋花湯	64.	Egg Drop Soup ..... 1.
雲蛋湯	65.	Egg Drop Wonton Mix ..... 1.
豆腐菜湯	66.	Tofu Vegetable Soup .....
雞玉米湯	67.	Chicken Corn Cream Soup .....
蟹肉玉米湯	68.	Crab Meat Corn Cream Soup .....
海鮮湯	69.	Seafood Soup .....

CLASSIC SOUPS

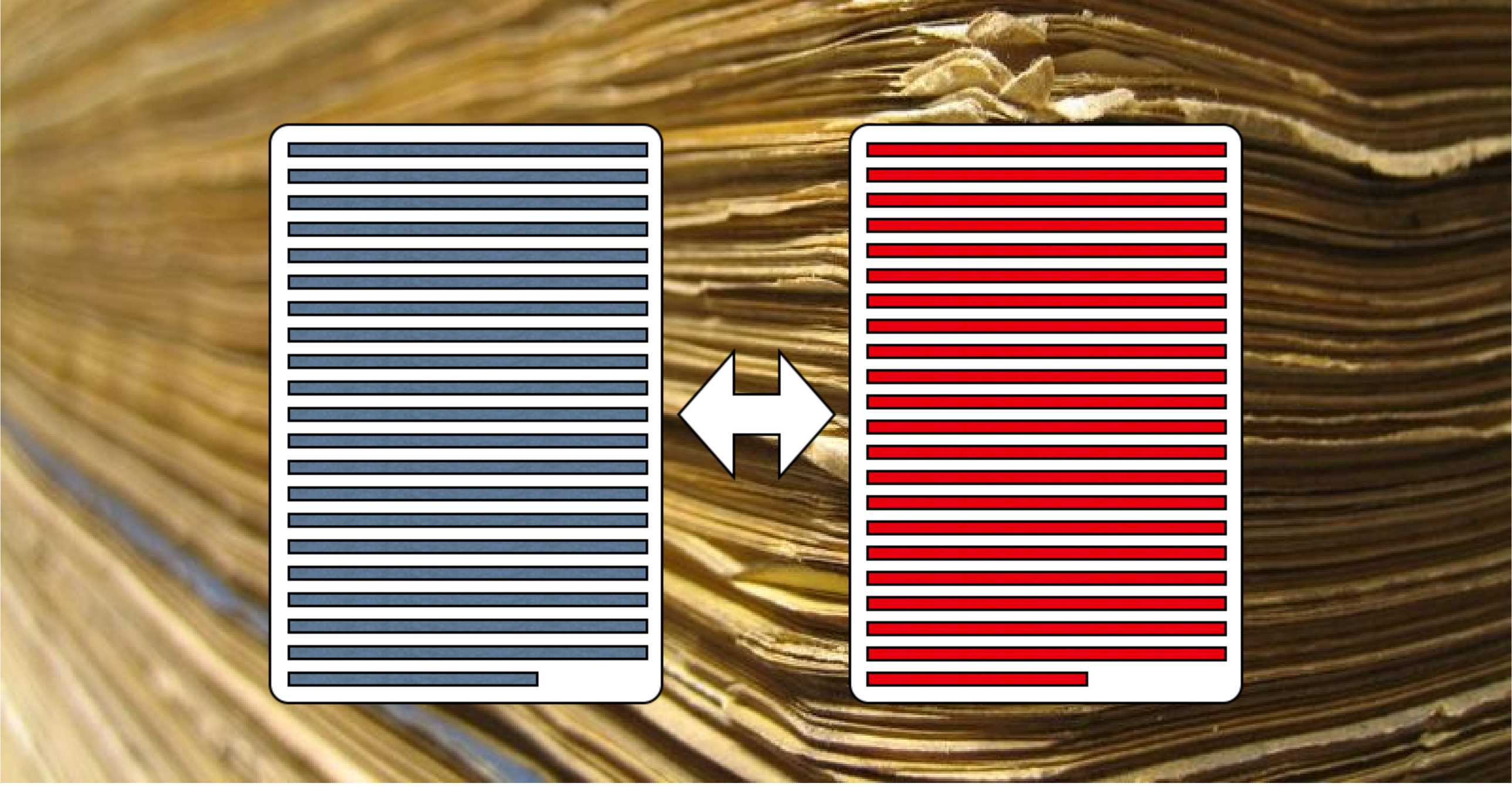
清燉雞湯	57.	House Chicken Soup (Chicken, Celery, Potato, Onion, Carrot) ..... 1.
雞飯湯	58.	Chicken Rice Soup ..... 1.
雞麵湯	59.	Chicken Noodle Soup ..... 1.
廣東雲吞	60.	Cantonese Wonton Soup ..... 1.
番茄雲湯	61.	Tomato Clear Egg Drop Soup ..... 1.
雲吞湯	62.	Regular Wonton Soup ..... 1.
酸辣湯	63.	Hot & Sour Soup ..... 1.
雲花湯	64.	Egg Drop Soup ..... 1.
雲雲湯	65.	Egg Drop Wonton Mix ..... 1.
豆腐菜湯	66.	Tofu Vegetable Soup .....
雞玉米湯	67.	Chicken Corn Cream Soup .....
蟹肉玉米湯	68.	Crab Meat Corn Cream Soup .....
海鮮湯	69.	Seafood Soup .....

CLASSIC SOUPS

清燉雞湯	57.	House Chicken Soup (Chicken, Celery, Potato, Onion, Carrot) ..... 1.
雞飯湯	58.	Chicken Rice Soup ..... 1.
雞麵湯	59.	Chicken Noodle Soup ..... 1.
廣東雲吞	60.	Cantonese Wonton Soup ..... 1.
番茄雲湯	61.	Tomato Clear Egg Drop Soup ..... 1.
雲吞湯	62.	Regular Wonton Soup ..... 1.
酸辣湯	63.	Hot & Sour Soup ..... 1.
雲花湯	64.	Egg Drop Soup ..... 1.
雲雲湯	65.	Egg Drop Wonton Mix ..... 1.
豆腐菜湯	66.	Tofu Vegetable Soup ..... N
雞玉米湯	67.	Chicken Corn Cream Soup ..... N
蟹肉玉米湯	68.	Crab Meat Corn Cream Soup ..... N
海鮮湯	69.	Seafood Soup ..... N

http://www.flickr.com/photos/sukisuki/218039088/

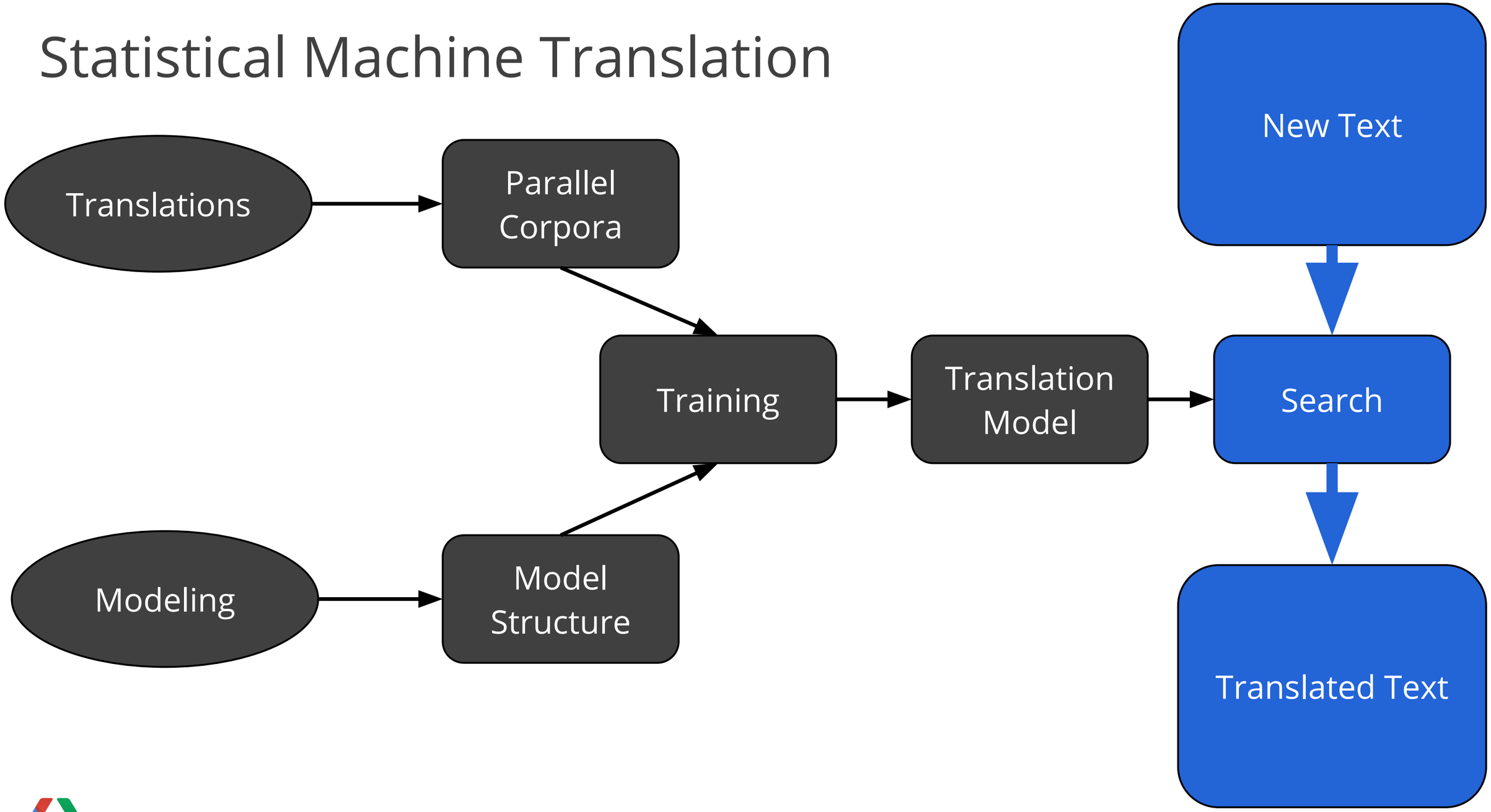
(cc) BY-SA



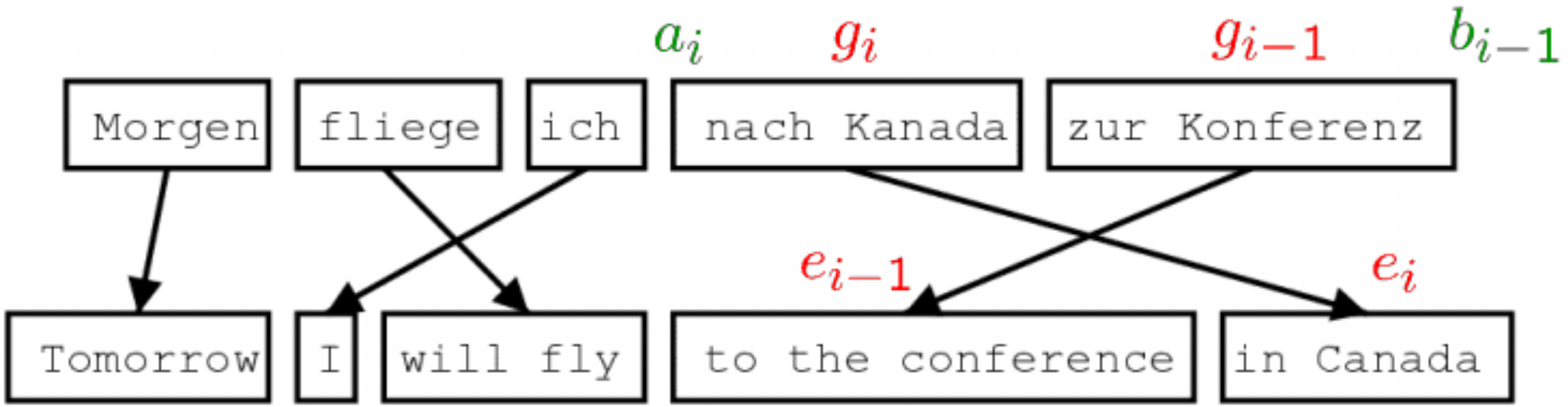
http://www.flickr.com/photos/sukisuki/218039088/

(cc) BY-SA

Statistical Machine Translation



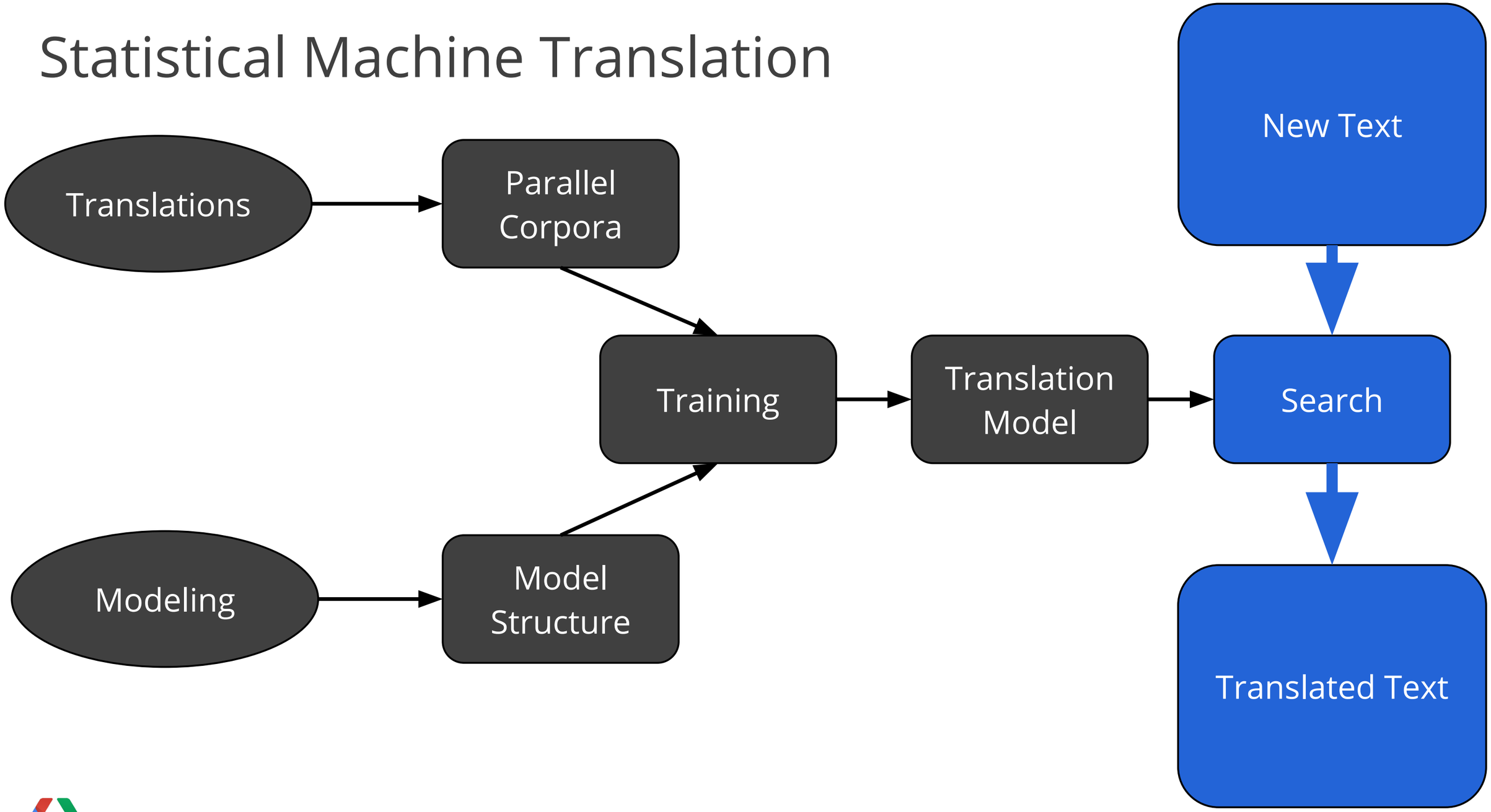
Phrase-based Translation Model



$$P(e|g) = P(\{\bar{g}_i\}|g) \prod_i P(\bar{e}_i|\bar{g}_i) P(a_i - b_{i-1})$$

Segmentation Translation Distortion

Statistical Machine Translation



Today

Today

Google Translate

translate.google.com

Google Translate for Android

Google Translate for iOS

Chrome

Today

200+ million users

92% of which, come from outside the USA

1 billion translations a day

Translating more text each day than you'd find in 1 million books

Translating more text each day than *all* professional translators translate in an entire year

Demos

Tomorrow

More Languages

Better Quality

Ubiquitous

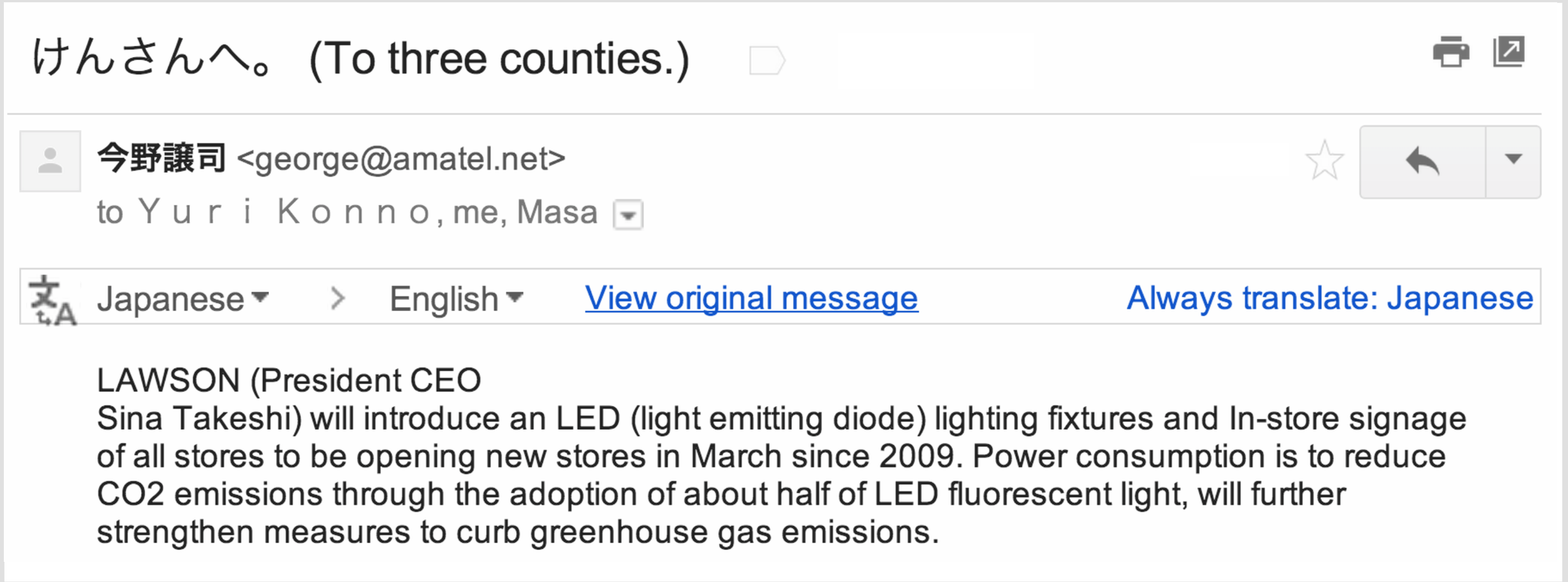
Real time communication

Going Global with Google Translate

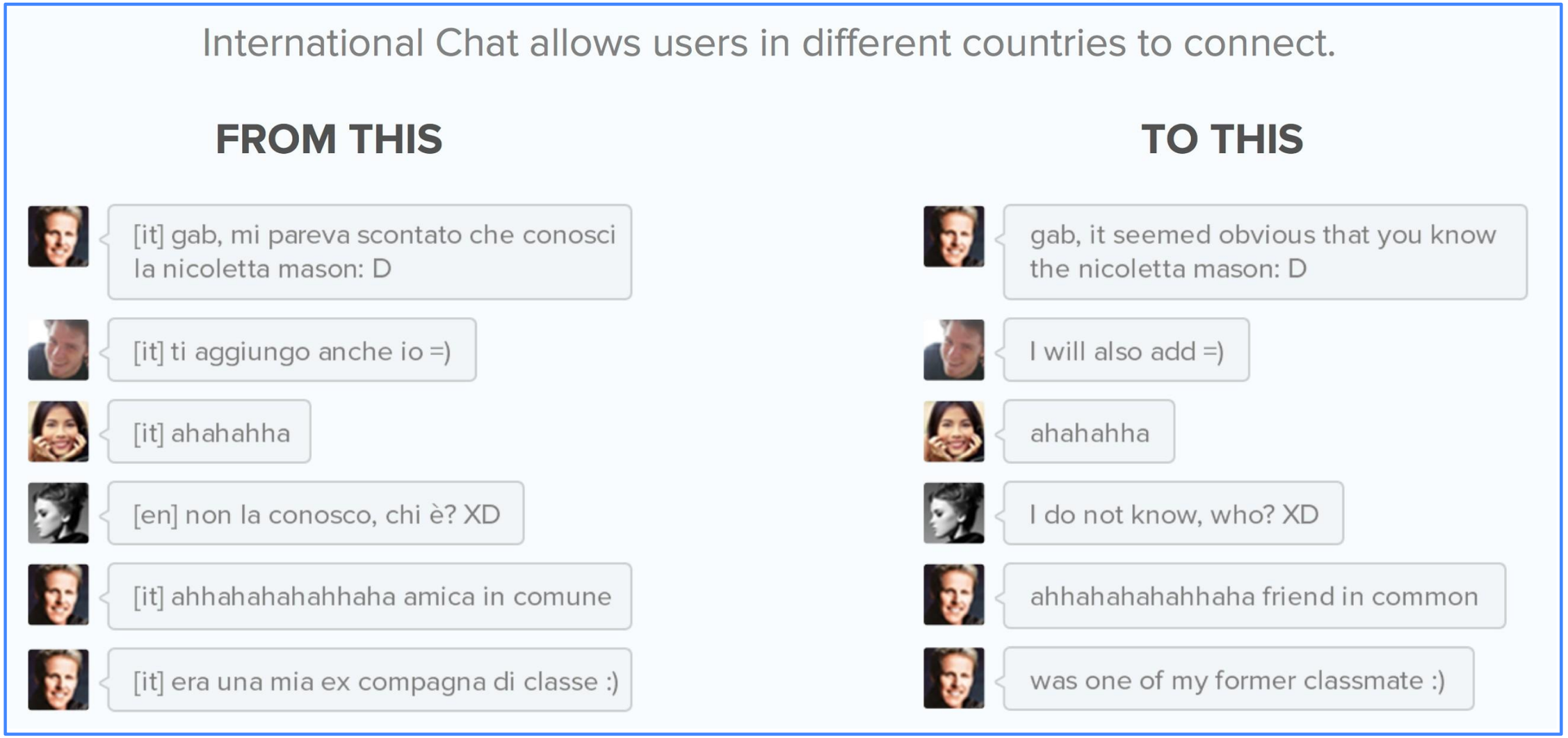
What can Machine Translation do for Google?

Gmail, Apps, Search, ...

GMAIL



What can Machine Translation do for you?



source: theBackplane.com

Translate API is Open for Business

Google™ Cloud Platform

Google Services

Compute

- Compute Engine (IaaS)
- App Engine (PaaS)

Storage

- Cloud Storage (Blob)
- Cloud SQL (Relational)
- Cloud DataStore (NoSQL)
- Persistent Disk (Block)

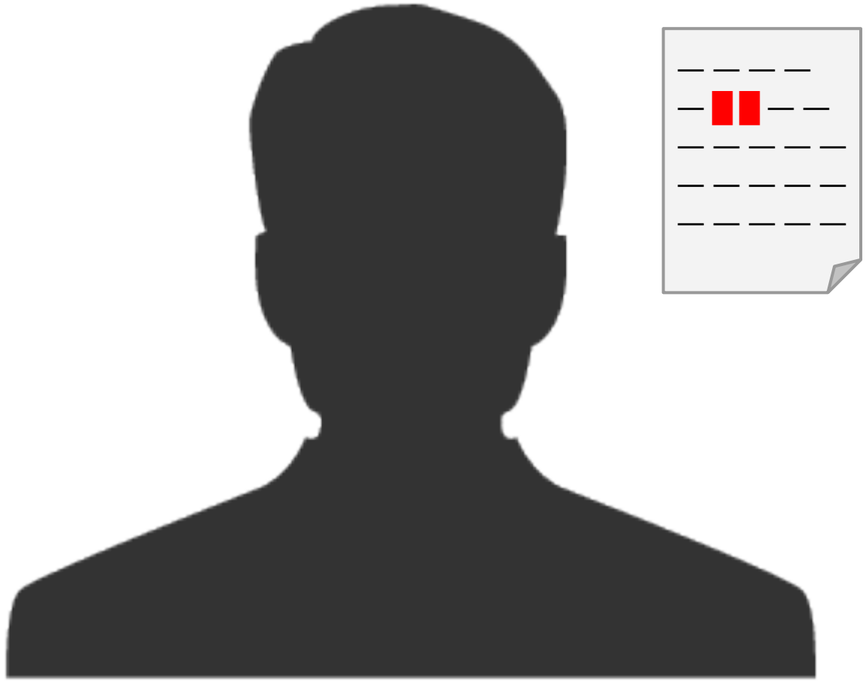
App Services

- BigQuery
- Cloud EndPoints
- Translation
- Queues
- and more...

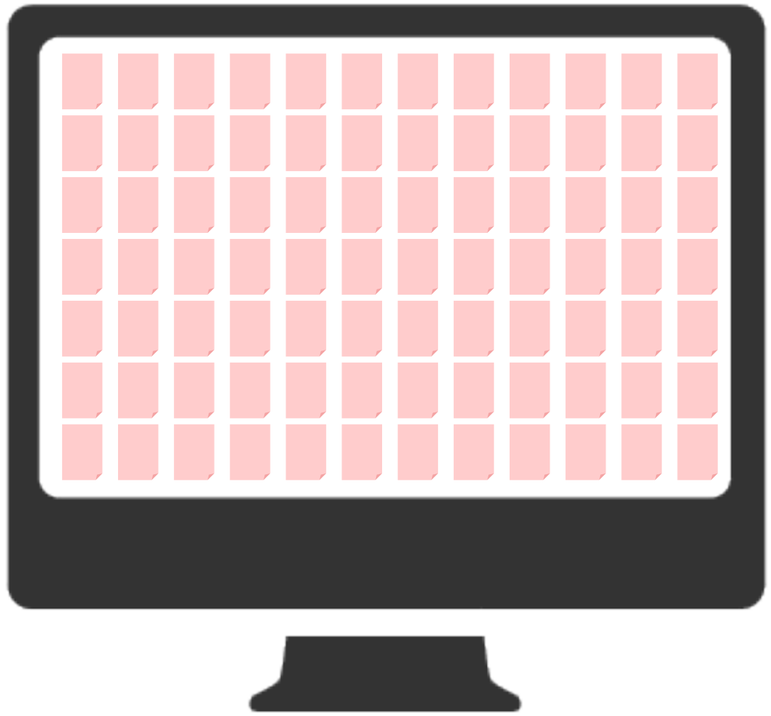
Google Infrastructure

- ✔ Global Data Centers
- ✔ 99.95% Uptime SLA
- ✔ Performance
- ✔ Redundancy
- ✔ Disaster Recovery
- ✔ Audits & Certifications
- ✔ Security
- ✔ Energy Efficient

How much translation can you buy for $1?



1-2 words



100 pages

source: at $20 per 1 million characters, assuming English averaging 5 chars/word.

How to Call the Translate API

Translate API Code Sample 1:
Automatic Source Language Detection

REST

```
https://www.googleapis.com/language/translate/v2?key={INSERT-YOUR-KEY}&q=hello%20world&target=de
```

JSON

```
{
    "data": {
        "translations": [
            {
                "translatedText": "Hallo Welt",
                "detectedSourceLanguage": "en"
            }
        ]
    }
}
```

Translate API Code Sample 2:

Automatic HTML Parsing & Alignment

REST

```
https://www.googleapis.com/language/translate/v2?key={INSERT-YOUR-KEY}&q=Morgen%20werde%20
ich%20zu%20der%20Konferenz%20in%20Kanada%20%3Cb%3Efliegen%3C/b%3E&source=en&target=de&format=html
```

JSON

```
{
    "data": {
        "translations": [
            {
                "translatedText": "Tomorrow I will \u003cb\u003efly\u003c/b\u003e to the conference in Canada."
            }
        ]
    }
}
```

Translate API in Google Apps Script

Lightweight option for Google Apps automation

.GS

```
function TranslateInAppsScript() {
   var spanish = LanguageApp.translate('This is a test', 'en', 'es');
   Logger.log(spanish);
}
```

LOG

```
1  function TranslateInAppsScript() {
2     // The code below will write "Esta es una prueba" to the log.
3     var spanish = LanguageApp.translate('This is a test', 'en', 'es');
4     Logger.log(spanish);
5  }
6
```

Logging output

[13-05-09 13:41:14:414 PDT] Esto es una prueba

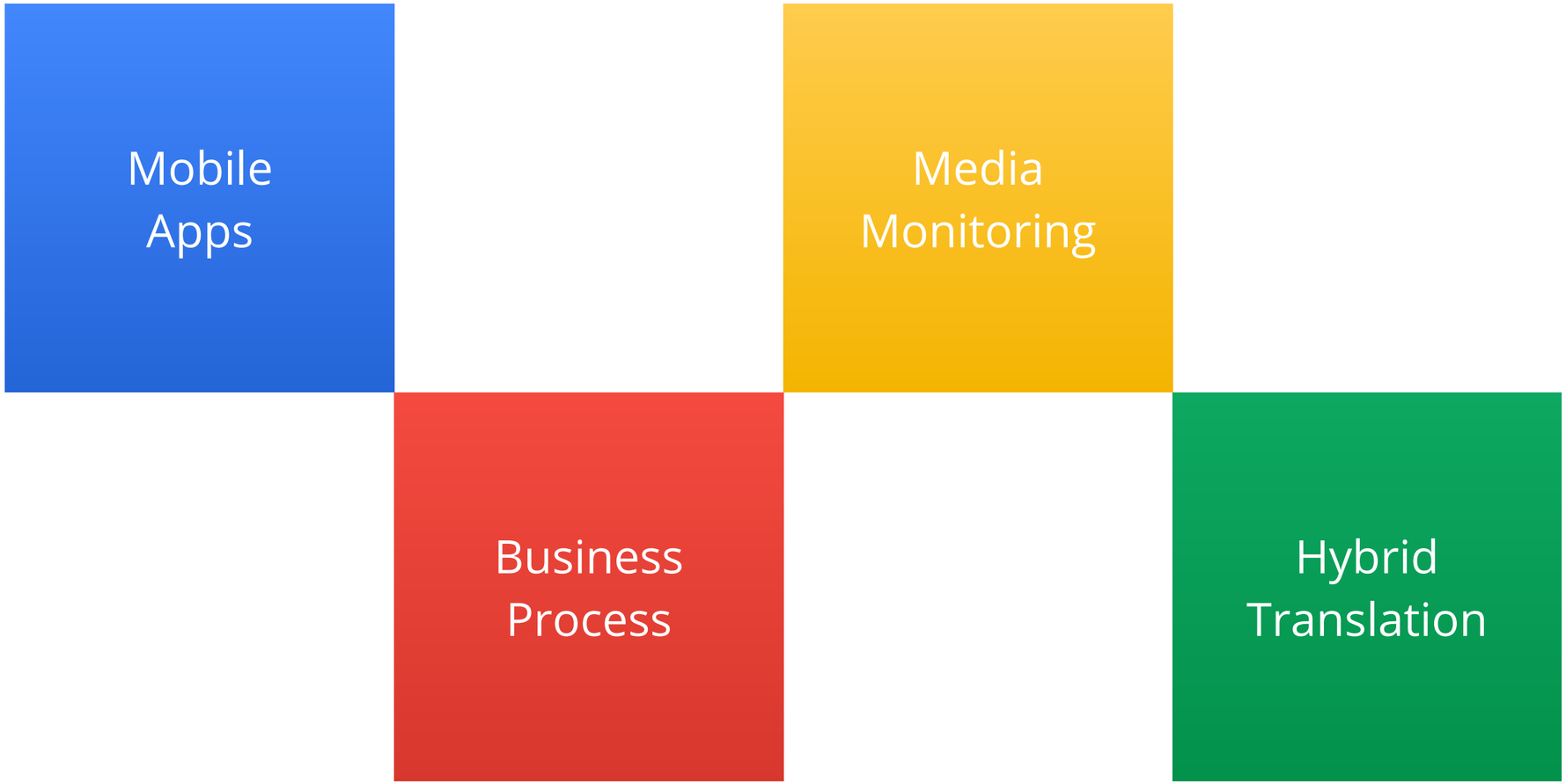
Translate API Services (and Terms of Service)

- Translate API v2 offers our core Statistical Machine Translation (SMT) as a service:
  - Language detection
  - Translation between any of our supported languages

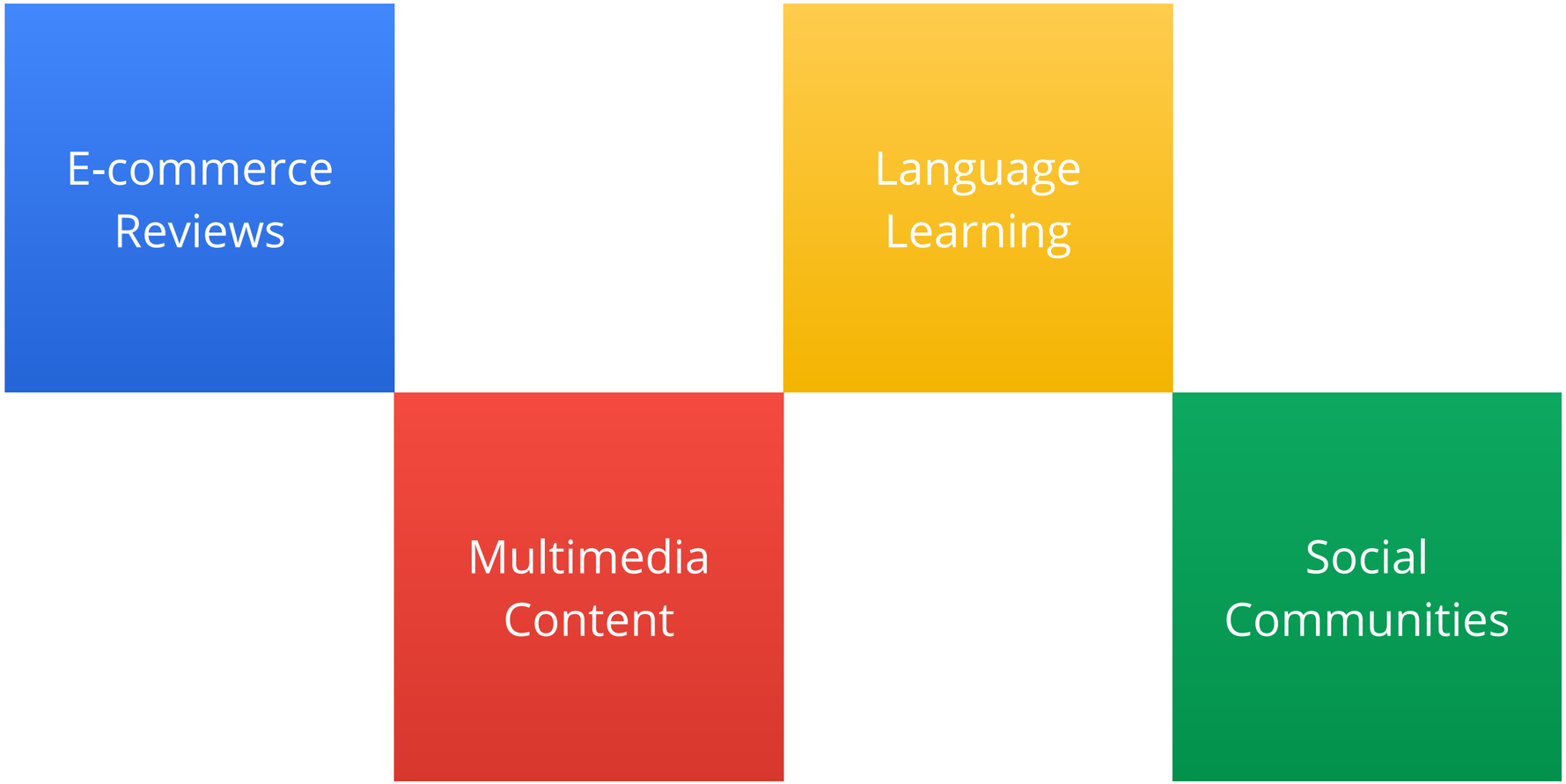
- Google remains committed to providing end-users a wide range of free services
- … but commercial use requires careful attention to Translate-specific Terms of Service:
  - Primarily related to *attribution:* users need to know these are algorithmic results
  - Also aimed at ensuring that nobody unwittingly trains an MT with our output

When to Use the Translate API

How are developers using Translate API today?

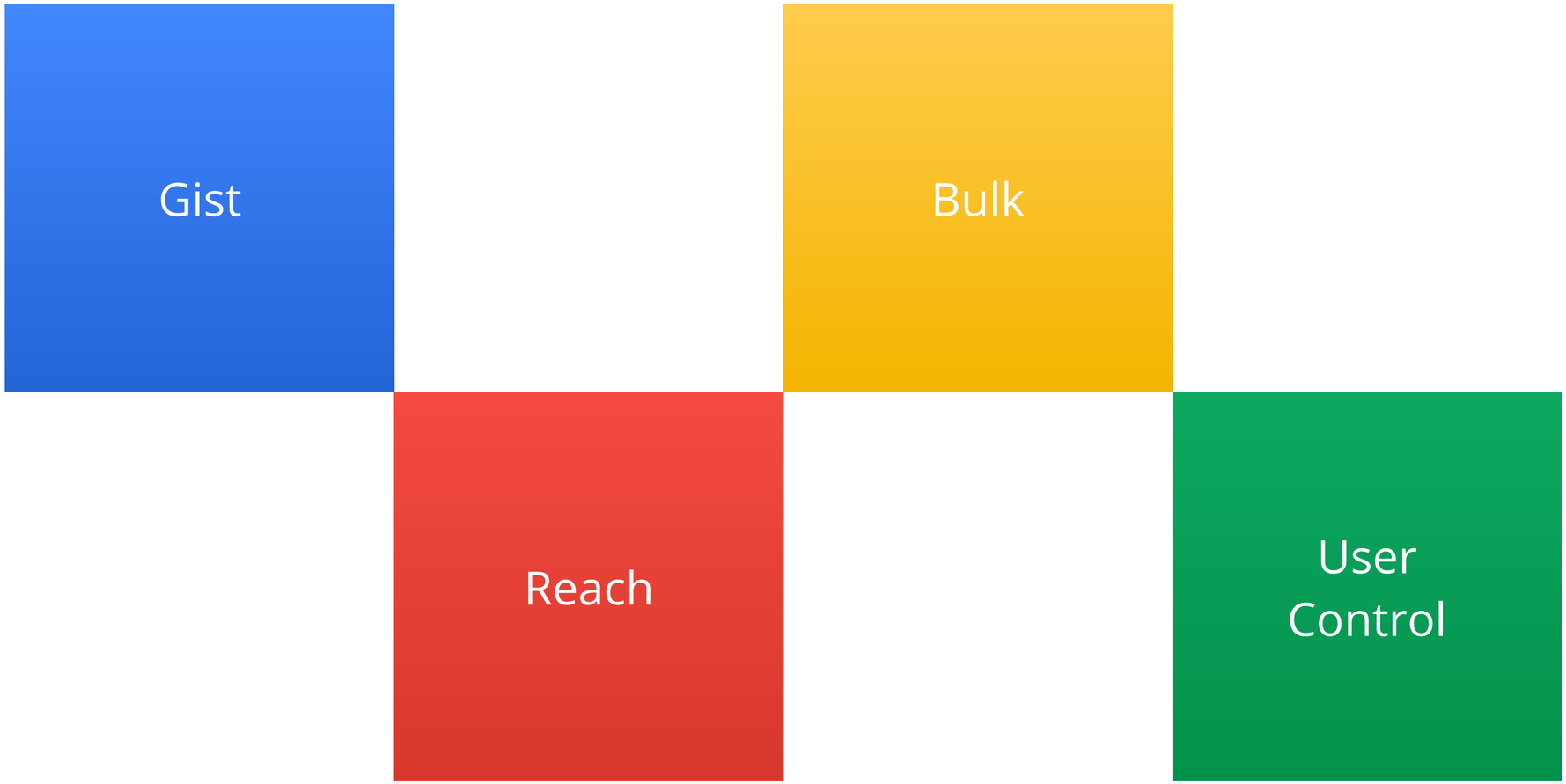


How are *Web* developers using Translate API today?

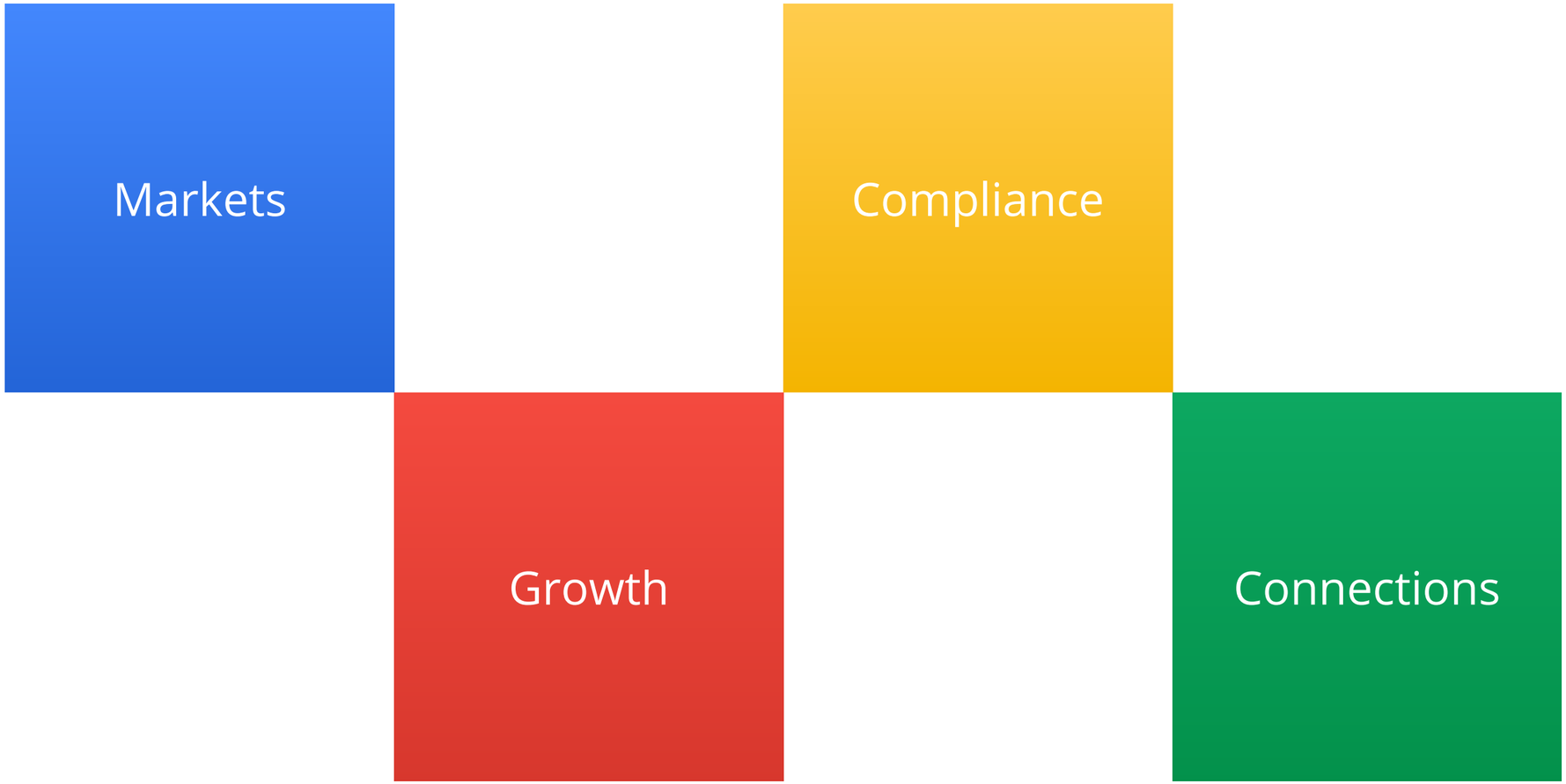


Best Practices for the Translate API

When is Machine Translation better?



Tap into new opportunities for “Going Global”…



Google's mission is to organize the world's information and make it *universally accessible* and useful

Thanks!

+Josh Estelle

+Rohit Khare

Online Resources

- translate.google.com
- developers.google.com/translate
- cloud.google.com/products/more-products

Related I/O Sessions

Session Title	Time Slot	Room
Building Android Apps for a Global Audience	5/17 @ 12:00PM	Room 12
Developing for a Global Audience: Tools ...	5/16 @ 11:15AM	Room 7
Use Apps Script to Create Dynamic Google Forms	5/15 @ 1:55PM	Room 7

Google
Developers

Extra Slides

The police refused the students a permit because they feared violence.

The police refused the students a permit because **they** feared violence.

The police refused the students a permit because **they** *advocated* violence.

Understanding the Translate API ToS

- There are universal Terms of Service (uToS) for Google's services for developers
- … as well as additional ToS for specific services, such as Translate API

  §1. Prohibitions — you cannot use our output as input for another MT

  §2. Content — we do not own your content (we only need a license to process it)

  §3. Advertising — we will not inserts Ads in our translations

  §4. Markup — if you publish our translations on the Web, you have to warn crawlers

  §5. Fees — we will bill you monthly, you will pay promptly, and give notice of changes

- Our Developer's Guide also outlines our Attribution Requirements:
  - Users deserve to know that they are reading the results of automated translation
  - Users deserve to know that they are reading the results of ***our*** automated translation
  - You can only use the Google brand (including our name our logo) in very specific ways

Note: this is not legal advice, nor a binding summary of our ToS. Please consult the agreements at https://developers.google.com/translate/v2/terms

Google
Developers