

# Charles Translator:

## A Machine Translation System between Ukrainian and Czech

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# Introduction

# Story of Charles Translator in timeline

- Feb 24, 2022: start of Russia's full-scale invasion of Ukraine
- Mar 1: *Hi folks, shouldn't we build a Czech-Ukrainian translator?*

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- Mar 14: first cs ↔ uk translator published
- Apr 11: improved cs ↔ uk models
- May 24: Android app
- since Jun 2022:
  - support of audio inputs/outputs
  - improved frontends
  - WMT test sets

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- in the first days of invasion, more than half a million Ukrainian refugees granted temporary protection in Czechia
  - need for a fast and effective means of communication

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# March 2022: over 200 000 Ukrainian refugees in Czechia



Photo: René Volfík, irozhlas.cz

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  - no direct translation between uk and cs: pivoting through English
  - no specific focus on the needs of refugees and humanitarian organizations
  - no free API

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# Why direct translation?



Зараз заява ГОТОВА.  
(The declaration is now  
ready.)

Photo: René Volfík, irozhlas.cz

# Why direct translation?

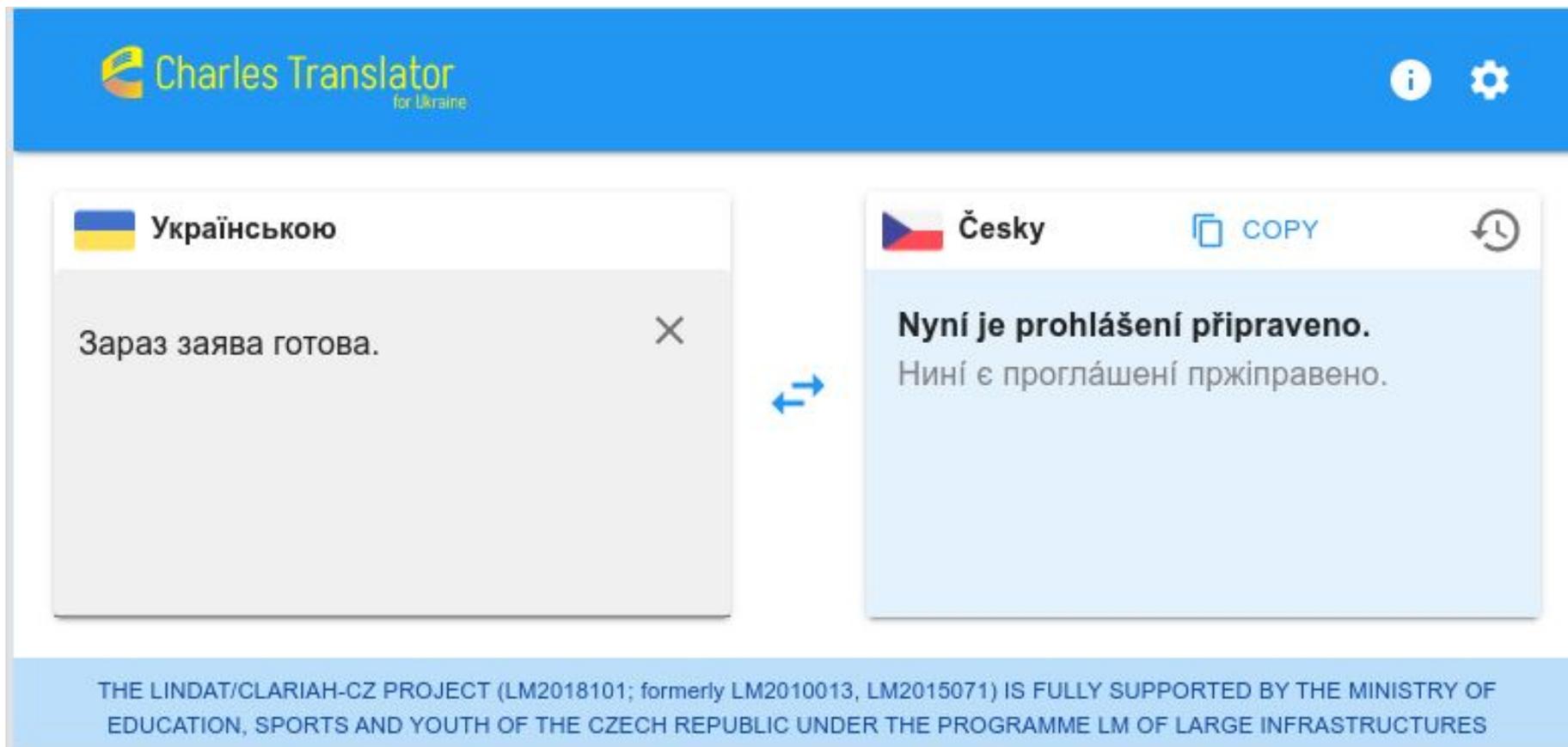


заява ⇒ application ⇒ aplikace  
*declaration* ⇒ *computer app*

The screenshot shows the Google Translate web interface. At the top, the text 'заява ⇒ application ⇒ aplikace' is shown with flags for Ukraine, the USA, and the Czech Republic. Below this, the word 'declaration' is translated to 'computer app'. The interface itself has a header with the Google Translate logo and a 'Přihlásit se' button. Below the header, the source language is set to 'UKRAJINŠTINA' and the target language is 'ČEŠTINA'. The input text is 'Зараз заява готова.' and the output is 'Nyní je aplikace připravena.' The interface also includes a microphone icon, a speaker icon, a character count '19 / 5 000', and a 'YH' dropdown menu. At the bottom right, there are icons for copy, share, and a feedback link.

Odeslat zpětnou vazbu

# Why direct translation?



The screenshot shows the Charles Translator for Ukraine interface. The top bar is blue with the logo and name "Charles Translator for Ukraine" on the left, and an information icon and a settings gear icon on the right. Below the bar, there are two main panels. The left panel is titled "Українською" (Ukrainian) and contains the text "Зараз заява готова." (The statement is ready now.). The right panel is titled "Česky" (Czech) and contains the text "Nyní je prohlášení připraveno." (The statement is now ready.) and "Нині є проголошені пріп'явлено." (The statement is now ready.). A double-headed blue arrow between the panels indicates the translation direction. The bottom of the interface has a light blue footer with text about the project's funding.

Charles Translator  
for Ukraine

Українською

Зараз заява готова.

Česky

COPY

Nyní je prohlášení připraveno.  
Нині є проголошені пріп'явлено.

THE LINDAT/CLARIAH-CZ PROJECT (LM2018101; formerly LM2010013, LM2015071) IS FULLY SUPPORTED BY THE MINISTRY OF EDUCATION, SPORTS AND YOUTH OF THE CZECH REPUBLIC UNDER THE PROGRAMME LM OF LARGE INFRASTRUCTURES

# Why direct translation?

The screenshot shows the Google Translate interface. The source language is set to Czech (ČEŠTINA) and the target language is set to Ukrainian (UKRAJINŠTINA). The input text is "Jsem nemocná. A vy? Jsem nemocný. A ty? Jaké léky to jsou?". The direct translation output is "Я хворий. І ти? Я хворію. І ти? Які це наркотики?". A red box highlights the English translation of the input text: "I am ill [fem]. And you [formal]? I am ill [masc]. And you [informal]? What kind of medicine is that?".

Google Překladač

ROZPOZNAT JAZYK ČEŠTINA ANGLIČTINA ↕ UKRAJINŠTINA ČEŠTINA ANGLIČTINA

Jsem nemocná. A vy? X  
Jsem nemocný. A ty?  
Jaké léky to jsou?

I am ill [fem]. And you [formal]?  
I am ill [masc]. And you [informal]?  
What kind of medicine is that?

Я хворий. І ти? ☆  
Я хворію. І ти?  
Які це наркотики?

YA khvoryy. I ty?  
YA khvoriyu. I ty?  
Yaki tse narkotyky?

58 / 5 000

Odeslat zpětnou vazbu

# Why direct translation?



DeepL Překladač

DeepL Pro

Proč zrovna DeepL?

API

Přihlásit se



Čeština (detekováno) ▾



Ukrajínština ▾

Glosář

Jsem nemocná. A vy? ×

Jsem nemocný. A ty?

Jaké léky to jsou?

Я хворий. А ти?

Я хворий. А ти?

Що це за ліки?



# Why direct translation?



Digital Europe  
eTranslation

[About](#) | [Help](#) | [Liability](#)

Translate text

Translate documents

My translation requests

My settings

English

Jsem nemocná. A vy?  
Jsem nemocný. A ty?  
Jaké léky to jsou?

Я хворий. А як щодо тебе?  
Я хворий. А ти?  
Що це за ліки?

58 / 2500



From

Czech



To

Ukrain

# Why direct translation?



Prohledat web

Text

Překladatel

Konverzace

Aplikace

Pro firmy

Čeština

Jsem nemocná. A vy?  
Jsem nemocný. A ty?  
Jaké léky to jsou?



Ukrajnština

Я погано почуваюся. А ви?  
Я погано почуваюся. А ви?  
Що це за препарати?

yo pogano pochuvayusa. a vi?  
yo pogano pochuvayusa. a vi?  
shcho tse za preparati?

# Why direct translation?

 Charles Translator  
for Ukraine



 Česky

Jsem nemocná. A vy?  
Jsem nemocný. A ty?  
Jaké léky to jsou?



 Українською

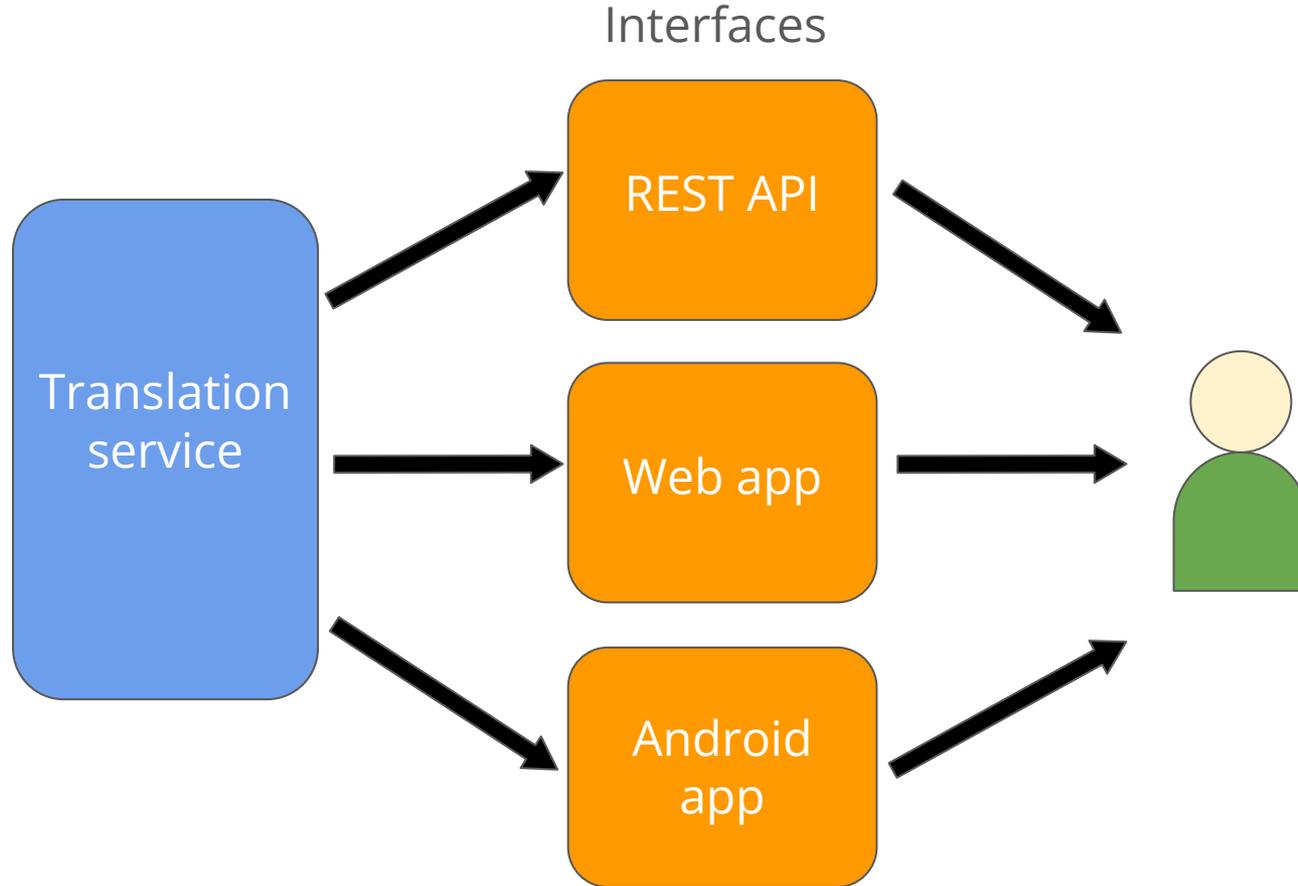
 COPY



**Я хвора. А ви?**  
**Я хворий. А ти?**  
**Які це ліки?**  
Ja chvora. A vy?  
Ja chvoryj. A ty?  
Jaki ce liky?

# Components of Charles Translator

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# Translation service

- method
  - Transformer architecture with iterated block backtranslation

# Translation service

- method
  - Transformer architecture with **iterated block backtranslation**

## nature communications

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nature > nature communications > articles > article

Article | [Open Access](#) | [Published: 01 September 2020](#)

### **Transforming machine translation: a deep learning system reaches news translation quality comparable to human professionals**

Martin Popel [✉](#), Marketa Tomkova, Jakub Tomek, Łukasz Kaiser, Jakob Uszkoreit, Ondřej Bojar & Zdeněk Žabokrtský

*Nature Communications* **11**, Article number: 4381 (2020) | [Cite this article](#)

**6273** Accesses | **76** Altmetric | [Metrics](#)

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  - Transformer architecture with iterated block backtranslation
- training data
  - collected in a short period of time with the help of volunteer subjects
  - parallel data:
    - translators, translation agencies
    - the InterCorp project of Czech National Corpus
    - the OPUS repository
  - monolingual data:
    - cs: CzEng 2.0
    - uk: WMT News Crawl, Leipzig Corpora, etc.

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- test data
  - pseudonymized and manually translated system logs from ChT + news crawls
  - annotated with user type and topic
  - published as WMT22 UK→CS and WMT23 CS→UK test sets

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- engine
  - LINDAT/CLARIN infrastructure

# Interfaces

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  - for non-commercial use available upon request

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- REST API
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- web app
  - transliteration/transcription
  - extended to other language pairs
  - React/Node.js
  - <https://translator.cuni.cz/>

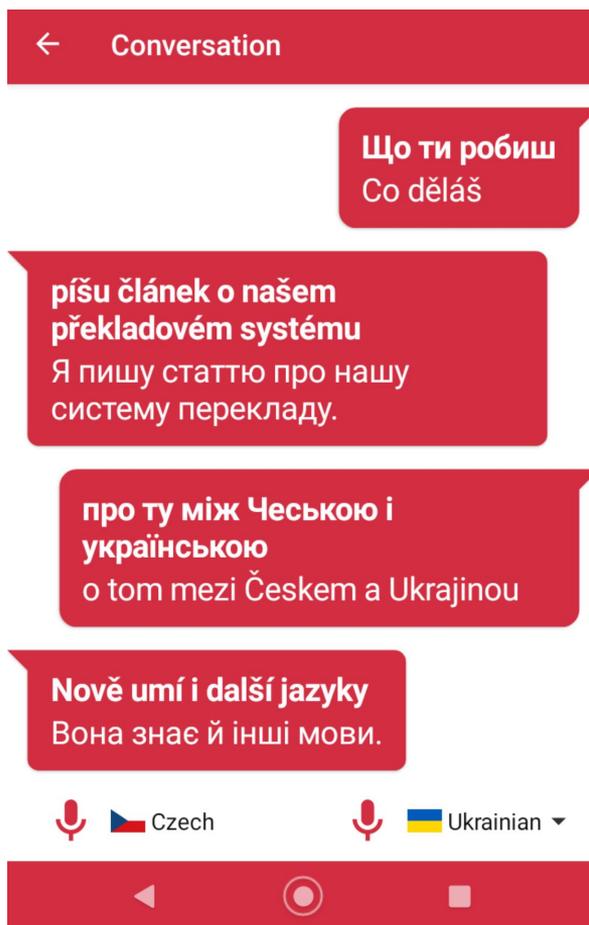
The screenshot displays the Charles Translator web application interface. At the top, a blue header contains the logo "Charles Translator for Ukraine" on the left and information and settings icons on the right. Below the header, two text boxes are shown side-by-side, connected by a double-headed blue arrow. The left box is titled "Česky" (Czech) and contains the text "Píšeme článek o našem překladovém systému." (We are writing an article about our translation system.). The right box is titled "Українською" (Ukrainian) and contains the translated text: "Ми пишемо статтю про нашу систему перекладу. My rušemo statťju pro našu systemu perekladu." (We are writing an article about our translation system. My rušemo statťju pro našu systemu perekladu.). The right box also features a "COPY" button and a refresh icon.

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# Interfaces

- REST API
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- web app
  - transliteration/transcription
  - extended to other language pairs
  - React/Node.js
  - <https://translator.cuni.cz/>
- Android app
  - web app features
  - audio input/output
  - conversation mode
  - Kotlin using Jetpack Compose
  - installed by around 2000 people
  - 

# Android app



# Quality of translations

# WMT 2022 General MT shared task evaluation

## WMT22 Ukrainian→Czech

SQM	chrF	System
0.393	—	HUMAN-A
0.221	59.6	HuaweiTSC
0.181	60.7	AMU
0.137	60.4	Lan-Bridge
0.102	59.0	<b>Charles</b>
0.095	60.3	Online-B
...		
-0.036	57.5	Online-A
-0.157	56.3	Online-G
-0.276	55.3	Online-Y
—	53.7	eTranslation
-0.626	50.7	ALMAnaCH

## WMT22 Czech→Ukrainian

SQM	chrF	System
0.295	—	HUMAN-A
0.225	64.0	Online-B
0.151	61.5	AMU
0.125	64.0	Lan-Bridge
0.065	62.6	HuaweiTSC
0.062	61.5	<b>Charles</b>
...		
-0.008	60.8	Online-G
-0.075	62.2	Online-A
-0.257	59.6	Online-Y
—	57.5	eTranslation
-0.669	54.5	ALMAnaCH

# WMT 2022 General MT shared task evaluation

## Czech→Ukrainian

Range	Ave.	Ave. z	System
1	85.6	0.295	HUMAN-A
2-5	84.6	0.225	Online-B
2-3	84.1	0.151	AMU
3-6	82.5	0.125	Lan-Bridge
3-6	81.1	0.065	HuaweiTSC
4-8	81.9	0.062	CharlesTranslator
6-8	80.2	0.026	CUNI-JL-JH
6-8	80.2	-0.002	CUNI-Transf.
9-10	79.8	-0.008	Online-G
9-10	79.2	-0.075	Online-A
11	76.0	-0.257	Online-Y
12	68.4	-0.669	ALMAnaCH-Inria

## Ukrainian→Czech

Range	Ave.	Ave. z	System
1	89.6	0.417	HUMAN-A
2-3	85.6	0.182	AMU
2-4	83.5	0.148	HuaweiTSC
4-8	83.5	0.127	Lan-Bridge
3-8	82.0	0.110	CUNI-Transf.
4-8	82.5	0.082	CharlesTranslator
4-8	81.4	0.052	CUNI-JL-JH
4-8	81.9	0.042	Online-B
9-10	80.0	-0.101	Online-A
9-10	77.5	-0.138	Online-G
11	73.9	-0.351	Online-Y
12	69.2	-0.617	ALMAnaCH-Inria

# WMT 2023 General MT shared task evaluation

Czech→Ukrainian		
Rank	Ave.	System
1-3	83.7	ONLINE-B
1-3	83.6	GPT4-5shot
1-3	83.2	Human-refA
4-8	82.8	ONLINE-W
4-8	82.4	CUNI-GA
4-8	81.8	Charles Translator
4-8	81.3	GTCOM_DLUT
4-8	80.6	ONLINE-A
9-11	79.5	ONLINE-G
9-13	78.7	ONLINE-Y
9-13	78.7	MUNI-NLP
10-13	77.4	Lan-BridgeMT
10-13	76.9	NLLB_MBR_BLEU
14	76.7	NLLB_Greedy

# Use cases

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  - shared our REST API with them

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- Pomáhej Ukrajině web platform



# Pomáhej Ukrajině uses Charles Translator

The screenshot shows the Pomáhej Ukrajině website interface. At the top left is the logo, a heart with the Ukrainian flag colors, followed by the text "Pomáhej Ukrajině" and "Центральне місце для надання допомоги". On the top right, there is a language selector showing "ua" and a menu icon. Below the header, the main heading is "Пропозиції допомоги" (Offers of assistance), with a button "Показати неопублічні пропозиції" (Show unpublished offers). The main content area consists of a grid of buttons, each with an icon and a category name:

- Transport (Транспорт)
- Material assistance (Матеріальна допомога)
- Psychological assistance and therapy (Психологічна допомога та терапія)
- Tutoring (Репетиторство)
- Language courses (Курси чеської мови)
- Textbooks and learning materials (Підручники та навчальні матеріали)
- Veterinary assistance (Ветеринарна допомога)
- Translation (Переклад)
- Vacant non-residential premises (Вакантне нежитлове приміщення)
- Volunteer assistance (Волонтерська допомога)
- Free time (У вільний час)
- Adaptation groups (Адаптаційні групи)
- Health and social assistance (Охорона здоров'я та соціальна допомога)

- connects public offers of assistance with the needs of refugees and aiding organizations
- translating segments of the offers

# Use cases

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# Use cases

- actively asking organizations that assisted Ukrainian refugees about their translation needs
  - shared our REST API with them
- Pomáhej Ukrajině web platform
- Police of the Czech Republic



# Czech Police uses Charles Translator



The screenshot shows a web browser window with the URL `oznameni.policie.cz`. The page features the Czech Police logo in the top left corner and a yellow button labeled "EN ↓" in the top right. The main content is a dark image of a destroyed building with the following text overlaid in white:

**If you have any information on war crimes in connection with war in Ukraine, your information and testimony may be crucial for identification and prosecution of the perpetrators.**

At the bottom of the image, there are two yellow buttons: "TO MAKE A TESTIMONY" (with a pencil icon) and "MORE INFORMATION" (with an information icon).

# Czech Police uses Charles Translator

**Preferred Language**

Čeština

English

Український

Русский

**3/4 Incident questions Circumstances**

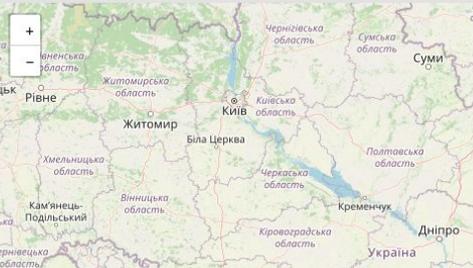
**Did you witness an attack of armed forces of any side of the conflict against civilians, infrastructure and civil objects in Ukrainian territory? \***

Yes

No

**Place \***

Please write most accurate address: county, city, street, number



The map displays several Ukrainian regions including Івано-Франківська область, Житомирська область, Чернігівська область, Сумська область, Київська область, Черкаська область, Хмельницька область, Кам'янець-Подільський, Вінницька область, Кіровоградська область, and Дніпро. Major cities like Рівне, Житомир, Біла Церква, Київ, Кременчук, and Дніпро are also labeled.

**Event Type \***

Damage to life and health of civilians

Attacks against unarmed civilians and residential areas

Attacks against civil infrastructure (educational, cultural or medical facilities)

Attacks against industrial infrastructure (factories, power plants, food storages, agriculture)

Looting, pillaging, theft

Kidnappings, hostage taking

Sexual violence, torture and abuse

Executions

Occurrence of mass graves

Conducting of combat operations and usage of prohibited means of combat in residential areas (area bombing, mine planting)

Prohibited usage of special ammunition (e.g. cluster bombs, vacuum bombs, phosphorus munition, chemical and biological weapons)

Other

**Information on the Offender \***

Russian armed forces and allied armed groups under united command

- prosecution of **war crimes in Ukraine**
- translating testimonies of witnesses
- Ukrainian ⇔ Czech, Russian ⇔ Czech
- on-premise installation (sensitive data)

**Another information that may be useful**

Another information on the incident, offender, witnesses etc.

**ADD ANOTHER INCIDENT**

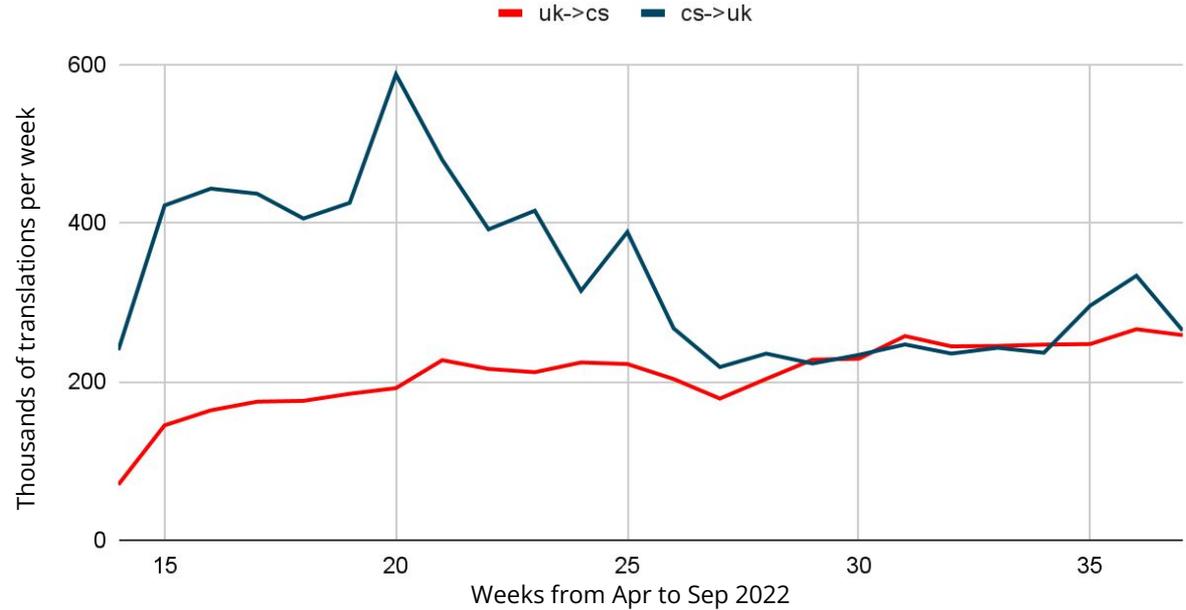
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- Police of the Czech Republic



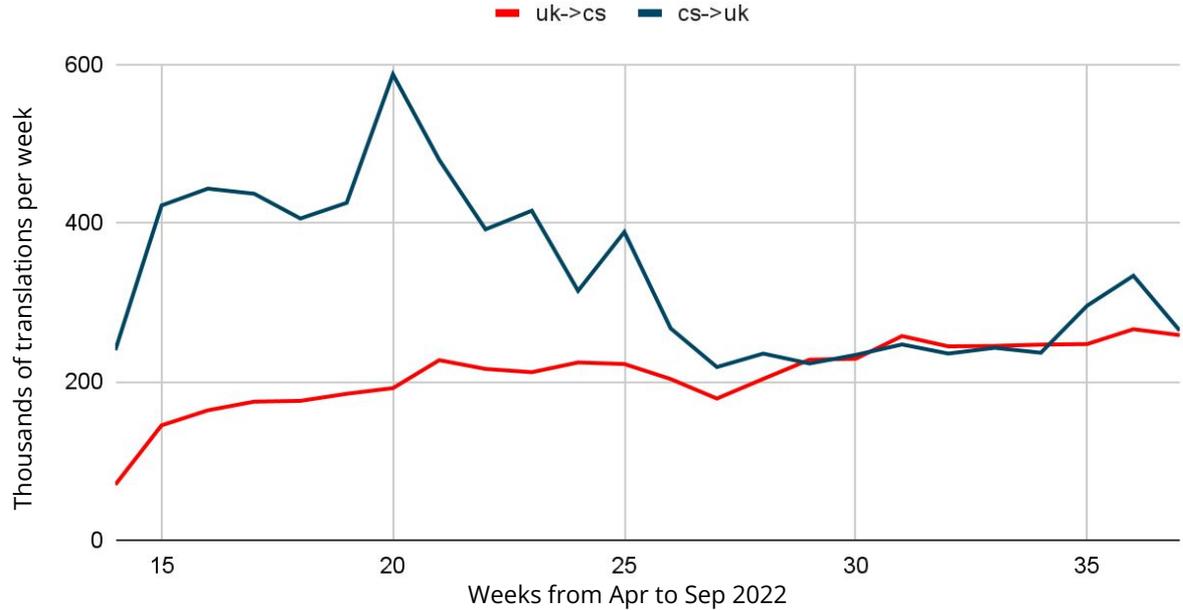
# Service usage

- Apr-Sep 2022



# Service usage

- Apr-Sep 2022



- Sep 2023
  - UK→CS: 30k translation requests per day
  - CS→UK: 12k translation requests per day

Слава Україні!

Try it: <https://translator.cuni.cz>



# Thank you for your attention!

## Acknowledgements

This work was supported by the project TQ01000458 (EdUKate) financed by the Technology Agency of the Czech Republic ([www.tacr.cz](http://www.tacr.cz)) within the Sigma 3 Programme. It was further supported by the Ministry of Education, Youth and Sports of the Czech Republic, Project No. LM2023062 LINDAT/CLARIAH-CZ and Cooperatio AMES of the Faculty of Arts, Charles University.

The authors also express their gratitude to the Institute of the Czech National Corpus ([korpus.cz](http://korpus.cz)), to České překlady ([ceskepreklady.cz](http://ceskepreklady.cz)) and to the following individuals for their contributions: Zdeněk Kasner, Jiří Mayer, Rudolf Rosa, Ondřej Košarko, Martin Majliš, Oxana Čmelíková, Peter Polák, Tomáš Musil, David Nápravník and Denys Bojko.

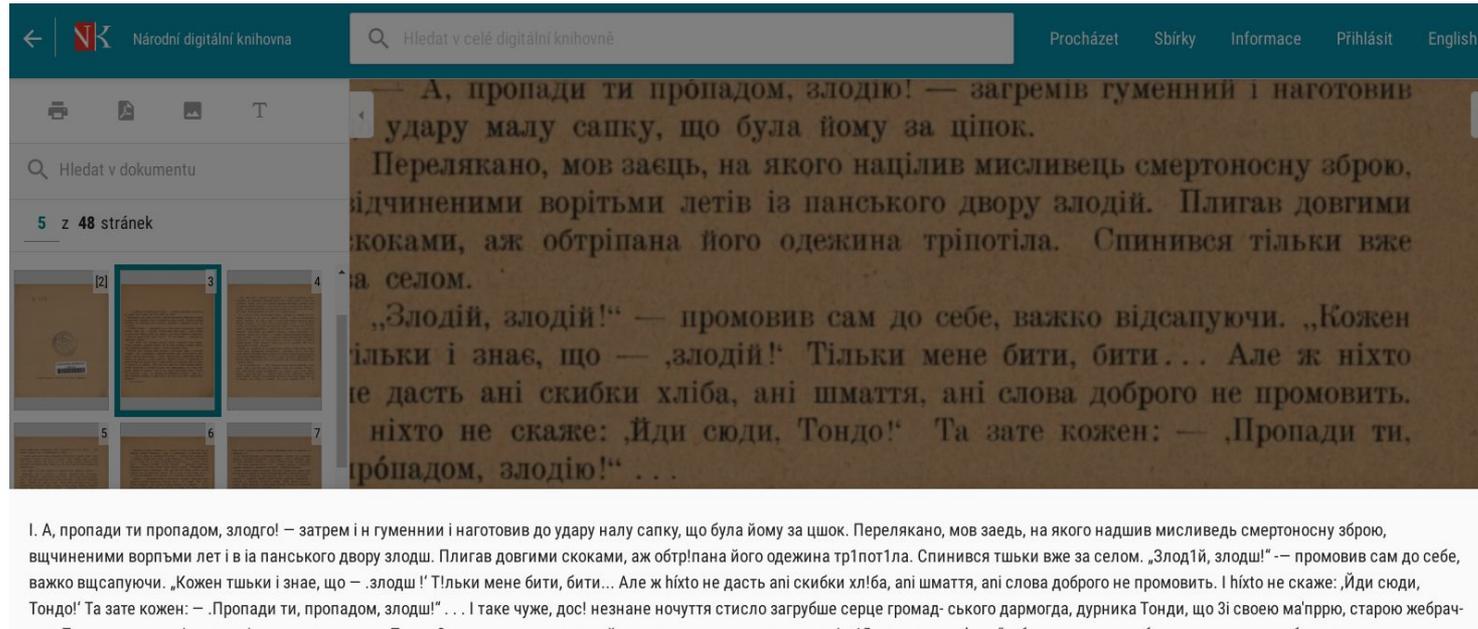


Charles University  
Faculty of Mathematics and Physics  
Institute of Formal and Applied Linguistics



unless otherwise stated

# Main work: collect and clean training data



ndk.cz has thousands of Ukrainian books, but no mapping to Czech translations and Russian OCR software:

УКРАЇНА ⇒ УКРАЇНА or УКРАША or УКРА1НА or УКРА!НА

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- March 1: *Hi folks, Shouldn't we build a Czech-Ukrainian translator and put it on Lindat?*
- March 12: hackathon to develop a new frontend
- March 14: first cs ↔ uk translator published
- April 11: improved cs ↔ uk models
- May 24: Android app
- since September: evaluating 11 systems in WMT22 shared task

The screenshot shows the 'Appraise' interface for the WMT22 shared task. It features a dark header with 'Appraise' and 'Dashboard' on the left, and the user ID 'ukrces1901' on the right. Below the header, there are two evaluation cards. Each card contains a source sentence in Ukrainian, a target sentence in Czech, and a horizontal slider for quality appraisal. The slider ranges from 0 to 6, with labels: 0: Nonsense/ No meaning preserved, 2: Some meaning preserved, 4: Most meaning preserved and few grammar mistakes, 6: Perfect meaning and grammar. Each card also has a 'Reset' button on the left and a 'Submit' button on the right.

**Example 1:**  
Source:  У Бородянці під Києвом у ході розбирання завалів двох багатоповерхових житлових будинків виявлено тіла 7 цивільних.  
Target:  v civilním oblečení, ale nepodařilo byla při demontáži sutin dvou vícepodlažních obytných budov nalezena těla 7 civilistů.

**Example 2:**  
Source:  Захисники Маріуполя заявили про розпилення над містом невідомої отруйної речовини з російського безпілотної.  
Target:  Obránci Mariupolu oznámili postřik neznámé vaše země, sakra, ne dronu nad městem.

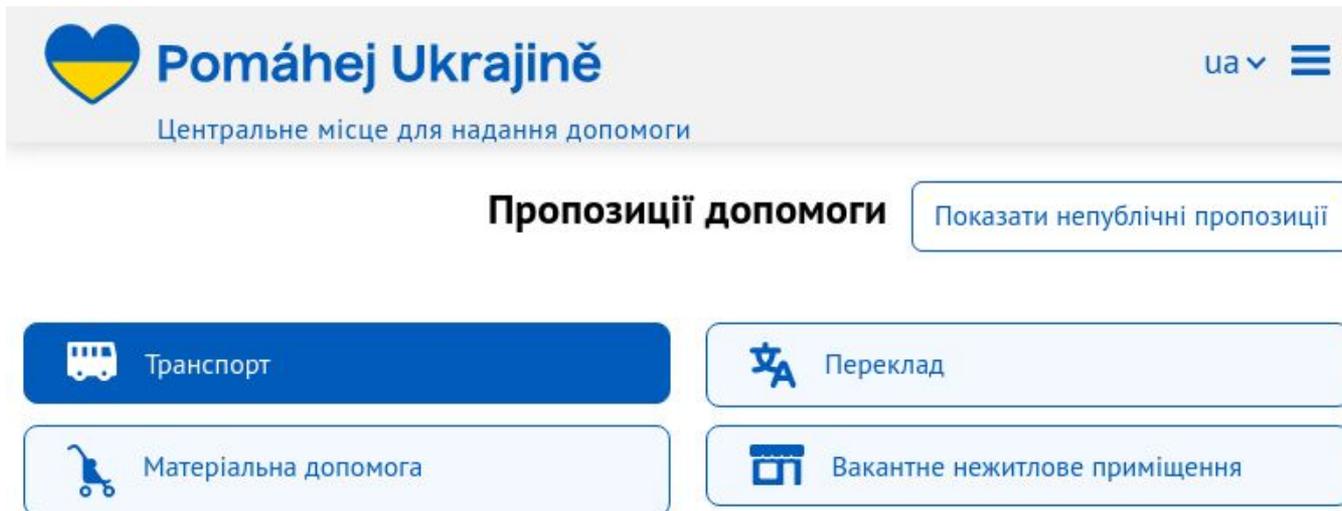
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# Why to develop our own MT?

- Quick solution until Big Tech companies improve their Ukrainian models
- Direct translation (not pivoted through English)
- Collect “in-domain” test set
- Focus on the needs of refugees and humanitarian organizations
- Offer free API (and on-premise for sensitive data)



The screenshot shows the website header for "Pomáhej Ukrajině" (Help Ukraine). The header includes a logo with a heart containing the Ukrainian flag, the text "Pomáhej Ukrajině", and a language selector set to "ua". Below the header is a section titled "Пропозиції допомоги" (Offers of help) with a button to "Показати неpubлічні пропозиції" (Show non-public offers). Below this are four category buttons: "Транспорт" (Transport), "Переклад" (Translation), "Матеріальна допомога" (Material assistance), and "Вакантне нежитлове приміщення" (Vacant non-residential premises).

**Pomáhej Ukrajině** ua ▾ ☰  
Центральне місце для надання допомоги

**Пропозиції допомоги** [Показати неpubлічні пропозиції](#)

 **Транспорт**

 **Переклад**

 **Матеріальна допомога**

 **Вакантне нежитлове приміщення**

# Charles Translator for Ukraine: Timeline

- March 1: *Hi folks, Shouldn't we build a Czech-Ukrainian translator and put it on Lindat?*
- March 12: hackathon to develop a new frontend
- March 14: first cs ↔ uk translator published at LINDAT/CLARIN

Charles Translator for Ukraine

Українською

Зараз заява готова.

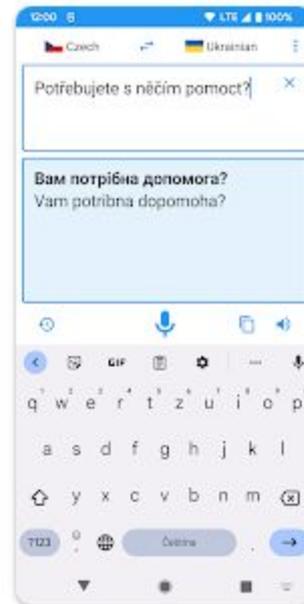
Česky COPY

Nyní je prohlášení připraveno.  
Нині є проголошені пржіправено.

THE LINDAT/CLARIAH-CZ PROJECT (LM2018101; formerly LM2010013, LM2015071) IS FULLY SUPPORTED BY THE MINISTRY OF EDUCATION, SPORTS AND YOUTH OF THE CZECH REPUBLIC UNDER THE PROGRAMME LM OF LARGE INFRASTRUCTURES

# Story of Charles Translator in timeline

- March 1: *Hi folks, shouldn't we build a Czech-Ukrainian translator?*
- March 12: hackathon to develop a new frontend
- March 14: first cs ↔ uk translator published
- April 11: improved cs ↔ uk models
- May 24: Android app



# Charles Translator for Ukraine: Start

- March 1, 2022: *Hi folks,  
Shouldn't we build a Czech-Ukrainian translator and put it on Lindat?*

*Many people use Google Translate that pivots through English and a direct translator would be better.*

*Best,  
Jindřich Libovický*



# Experience with high-quality English-Czech NMT

## Context-aware evaluation: 15 evaluators

