

# PI System for Improved Education: A Case Study from the Czestochowa University of Technology

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of Technology**

**WYDZIAŁ ELEKTRYCZNY**



Politechnika Czestochowska



OSIsoft.

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# Presentation Agenda:

- About Czestochowa University of Technology, Faculty of Electrical Engineering
- OSIssoft and CUT – how did it start?
- PI System in Computer Science courses
- Students Club – what have we done?
- Educational process
  - Engineering thesis
  - Work with real proces data
- CUT for business – students' benefits
- Next steps

# Czestochowa University of Technology

## Faculty of Electrical Engineering

- „A” category government ranking of research units
- BSc studies in:
  - Electrical Engineering
  - Electronics and Telecommunications
  - Computer Science
  - Automation and Robotics
- Master studies in:
  - Electrical Engineering
  - Computer Science

- FEANI accreditation

- The graduate students can apply for the European Engineer title (EUR ING)



- ERASMUS +

- Slovakia, Germany, Italy, Great Britain, Romania



Erasmus+

# Faculty key research directions

- Research and implementation of measurement and diagnostic devices used in electrical and power engineering
- Optimization, modeling, intelligent management and forecasting methods in the power industry
- Modern measurement methods, thermal imaging diagnostics and materials engineering
- Modeling and analysis of electromechanical systems, diagnostics systems of renewable energy sources
- Numerical and analytical methods in computer science and electrical engineering

# CUT - cooperation with business and industry

Licensed software used in teaching and research (among others)



Cooperating agreements (teaching, research and development)



*Polaniec  
power plant*



Energia Odnawialna S.A.



# Using the PI System by Faculty of Electrical Engineering


- Monitoring & management of Faculty assets
  - smart meters, photovoltaic panels, wind turbines, weather station
- Research and development
  - Automation and optimization of industrial processes
  - Predictive Maintenance
  - Forecasting of power generation
  - Data validation
- **Education/Teaching**
  - **Student workshops**
  - **OSIsoft PI science club**
  - **Part of the curriculum (gradually implemented as elements of selected curriculum)**
  - **PI System as a stand-alone course as part of standard curriculum (in the future)**

# OSIsoft and Częstochowa Tech – How did it start?

- December 2014 – Educational & Research Software License Agreement
- February 2015 – first PI Workshop in Częstochowa Tech for students and teachers Faculty of Electrical Engineering
  - Three days' workshop including basis of PI PocesBook, PI DataLink PI Coresight and AF Server (lecturer Tadeas Marciniak OSIsoft)
- March 2015 – PI in the Students' Science Club
  - After workshop a part of students decide to continue learning PI System



# OSIsoft for Faculty of Electrical Engineering

- April 2015 – now
  - Cooperation with  (PI System integrator)
- October 2015 – now
  - OSIsoft Academic Program (Nicolas Peels)
- January 2016
  - open lecture for Faculty's students, workshop for students of Computer Science (lecturer Tadeas Marciniak – OSIsoft, about 65 students attended)
- June 2016
  - Set up of the PI-to-PI Interface with ENGIE (Polaniec Power Plant)



# PI System in Computer Science courses

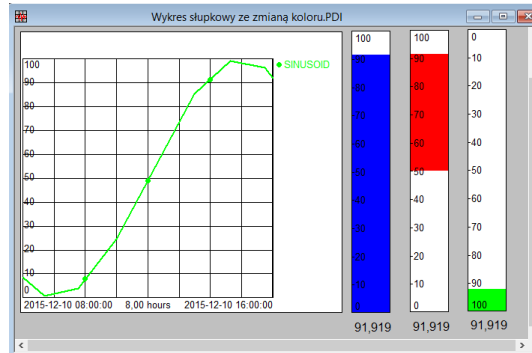
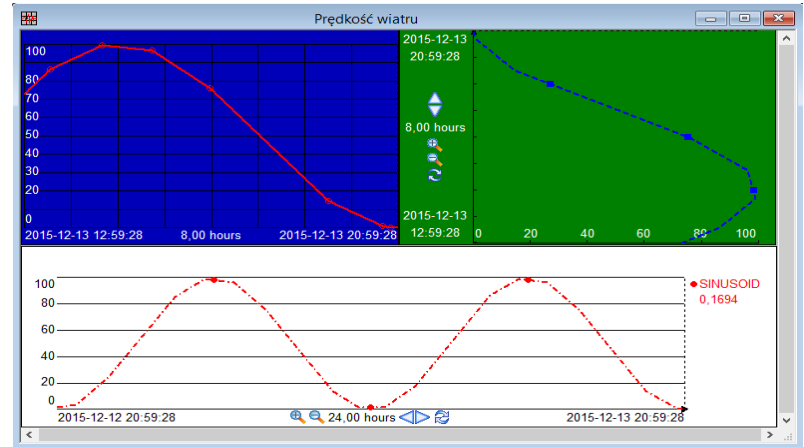
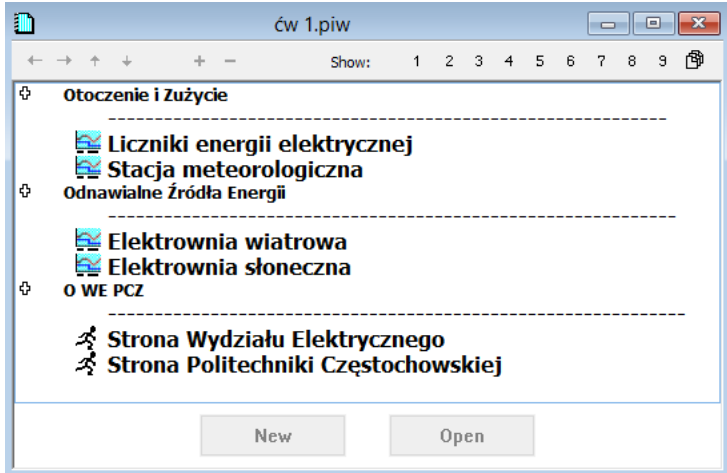
The course syllabus remains the same but the tool was replaced with the PI System!

Source materials to prepare exercises – [Osisoft Learning](#)

- October 2015 – February 2016
  - first elements of PI System in courses:
    - Network systems course
    - Management and information processing course
- January 2016 – at the end of semester one day workshop (lecturer Tadeas Marciniak – OSIssoft, about 15 students attended)

# PI System in Computer Science courses (exercises)

## PI ProcessBook



# PI System in Computer Science courses (exercises)

## PI DataLink

The screenshot displays the PI DataLink software interface. The menu bar includes: D LINK, NARZEDZIA GŁÓWNE, WSTAWIANIE, UKŁAD STRONY, FORMUŁY, DANE, RECENZJA, WIDOK, and PI DATALINK. The 'PI DATALINK' menu is expanded, showing options: Settings, About, and Help. Below the menu, there are several toolbars with icons for 'Current Value', 'Archive Value', 'Compressed Data', 'Sampled Data', 'Timed Data', 'Calculated Data', 'Time Filtered', 'Explore', 'Compare', 'Search', 'Asset Filter', 'Properties', 'Update', and 'Resources'. A blue box highlights the 'Current Value', 'Archive Value', 'Compressed Data', 'Sampled Data', and 'Timed Data' icons.

Below the interface, a data table is shown with columns A, B, and C. The table contains the following data:

	A	B	C
1			
2	\\osi.connectpoint.local\BA:ACTIVE.1	20-gru-15 14:18:37	Active
3	\\osi.connectpoint.local\BA:CONC.1	20-gru-15 14:20:37	0,902393997
4	\\osi.connectpoint.local\BA:LEVEL.1	20-gru-15 14:20:37	4,697245598
5	\\osi.connectpoint.local\BA:PHASE.1	20-gru-15 14:18:37	Phase1
6	\\osi.connectpoint.local\BA:TEMP.1	20-gru-15 14:20:37	3,613884449

• Using basic functions

# PI System in Computer Science courses (exercises)

## PI Coresight

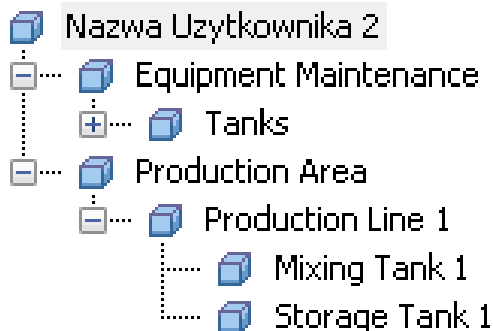
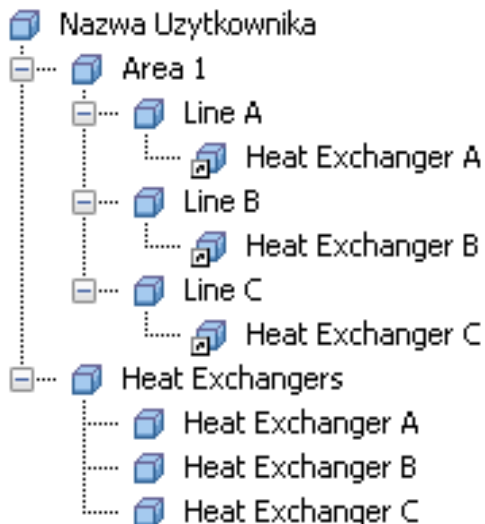


Zestawienie tabelaryczne ▼

Path	Name	Description	Value	Trend	Average ▲	Minimum	Maximum	Range
piserver	BA:TEMP.1	Temperature Reactor 1	43,079		19,278	0	56,567	56,567
piserver	BA:LEVEL.1	Level Reactor 1	34,418		21,357	0	41,483	41,483
piserver	BA:CONC.1	Concentration Reactor 1	40,922		22,287	0	47,358	47,358
piserver	CDEP158	Light Naphtha End Point	85		57,763	19,104	85	65,896
piserver	SINUSOID	12 Hour Sine Wave	0,00060897		59,512	0,00060897	99,168	99,167
piserver	CDT158	Atmospheric Tower OH Vapor	47,665		64,44	47	87,869	40,869
piserver	SINUSOIDU	UTC 12 Hour Sine Wave	5,7373		67,025	6,7938	99,999	93,206
piserver	CDM158	Light Naphtha End Point Control	Cascade		n/a	n/a	n/a	n/a
piserver	BA:PHASE.1	Phase Reactor 1	Phase5		n/a	n/a	n/a	n/a
piserver	BA:ACTIVE.1	Batch Active Reactor 1	Active		n/a	n/a	n/a	n/a

# PI System in Computer Science courses (exercises)

## PI Server – Asset Framework



Mixing Tank 1

General Child Elements Attributes Ports Analyses Version

Filter

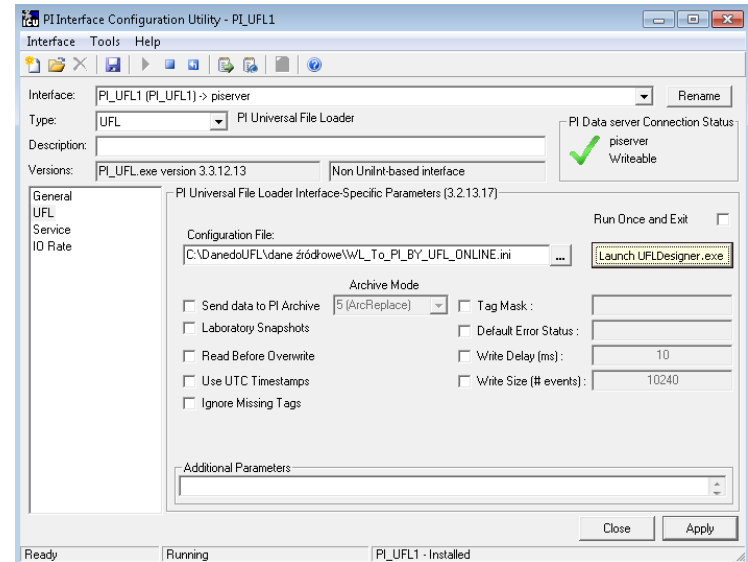
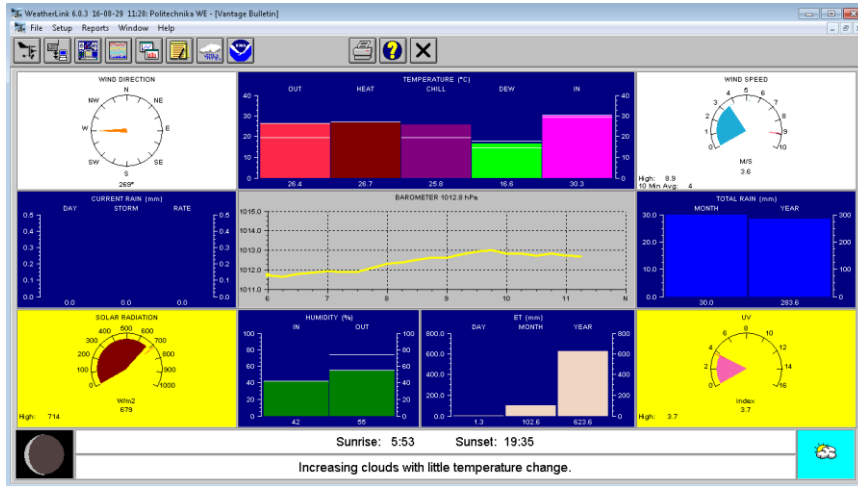
Name	Value
Attribute1	21,7623 °F
Level	90 ft
Lining	SSteel
Spec	
Manufac...	0
Cost C...	0
Location	0
Width	0

# What have we done?

## Monitoring of Faculty assets – Weather Station

Visualization and store data from meteo station (part of engineering thesis):

- Sending data to PI Server using PI UFL Interface and VPN connection



# What have we done?

## Monitoring of Faculty assets – Weather Station

- Store data in PI Server

Tag Name	Server	Timestamp	Value
WL_Dew_Pt_OnLine	piserver	8/29/2016 11:35:00 AM	16.6
WL_Pressure_OnLine	piserver	8/29/2016 11:35:00 AM	1,012.8
WL_Solar_Energy_OnLine	piserver	8/29/2016 11:35:00 AM	5
WL_Wind_Dir_OnLine	piserver	8/29/2016 11:35:00 AM	W
WL_Rain_OnLine	piserver	8/29/2016 11:35:00 AM	0
WL_Wind_Speed_OnLine	piserver	8/29/2016 11:35:00 AM	4.5
WL_Solar_Radiation_OnLine	piserver	8/29/2016 11:35:00 AM	697
WL_Temp_In_OnLine	piserver	8/29/2016 11:35:00 AM	30.3
WL_Temp_Out_OnLine	piserver	8/29/2016 11:35:00 AM	26.4
WL_Humidity_OnLine	piserver	8/29/2016 11:35:00 AM	55

The screenshot shows the Point Builder interface. On the left, a tree view shows the 'PISERVER' server selected. The main area displays a list of points with columns for Name, Stored Values, Point Source, Point Type, Point Class, and Descriptor. Below the list, the 'General' tab is active, showing details for the point 'WL\_Temp\_Out\_OnLine'.

Server	Name	Stored Values	Point Source	Point Type	Point Class	Descriptor
PISERVER	WL_Dew_Pt_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny ?????????? - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Heat_Index_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny ?????????? - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Humidity_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny wilgotnosc - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Pressure_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny cnienie powietrza - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Rain_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny opady deszczu lub sniegu - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Rain_Rate_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny ?????? - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Solar_Energy_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny energia sloneczna - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Solar_Index_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny ??????? - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Solar_Radiation_Max_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny maksymalna radiacja sloneczna - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Solar_Radiation_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny radiacja sloneczna - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Temp_In_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny temperatura wewnatrz w pomieszczeniu gdzie stoi loger - wartosc wprowadzana online z OzeToPI
PISERVER	WL_Temp_Out_Max_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny temperatura zewnetrzna maksymalna - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Temp_Out_Min_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny temperatura zewnetrzna minimalna - wartosc wprowadzana online z OzeToPI przez UFL i VPN
PISERVER	WL_Temp_Out_OnLine	Real-time data	UFL	Float32	classic	Stacja pogody Wydział Elektryczny temperatura zewnetrzna - wartosc wprowadzana online z OzeToPI przez UFL i VPN

**General** | Archive | Classic | Security | System

Name: WL\_Temp\_Out\_OnLine  Server: PISERVER

Descriptor: Stacja pogody Wydział Elektryczny temperatura zewnetrzna - wartosc wprowadzana online z OzeToPI przez UFL i VPN

Stored Values: Real-time data Point Source: UFL Point Class: classic

Point Type: Float32 Digital Set: Eng Units: Exdesc: Source Tag: Display Digits: -5

Session Record

# What have we done?

## Monitoring of Faculty assets – Weather Station

- Create structure in PI Asset Framework

The screenshot displays the PI System Explorer (Administrator) interface. The left pane shows a tree view of elements under 'Stacja pogodowa', including 'Solar power plant', 'Stacja pogodowa', 'Storage', and 'Wind power plant'. The main pane shows the 'Stacja pogodowa' asset with a table of data points. The right pane shows the configuration for the selected 'Wilgotność' (Humidity) data point.

Name	Value
Ciśnienie	1012.8 hPa
Energia promieniowania słonecznego	5 Ly
Kierunek wiatru	W
Opady	0 mm
Promieniowanie słoneczne	697 W/m2
Prędkość wiatru	4.5 m/s
Punkt Rosy	16.6 °C
Temperatura wewnętrzna	30.3 °C
Temperatura zewnętrzna	26.4 °C
Wilgotność	55 %

Configuration for 'Wilgotność':

- Name: Wilgotność
- Description:
- Properties: <None>
- Categories:
- Default UOM: percent
- Value Type: Single
- Value: 55 %
- Data Reference: PI Point

Settings...  
\\PISERVER\WL\_Humidity\_OnLine



# What have we done?

## Monitoring of Faculty assets – Weather Station

Visualization

PI Coresight



PI ProceBook

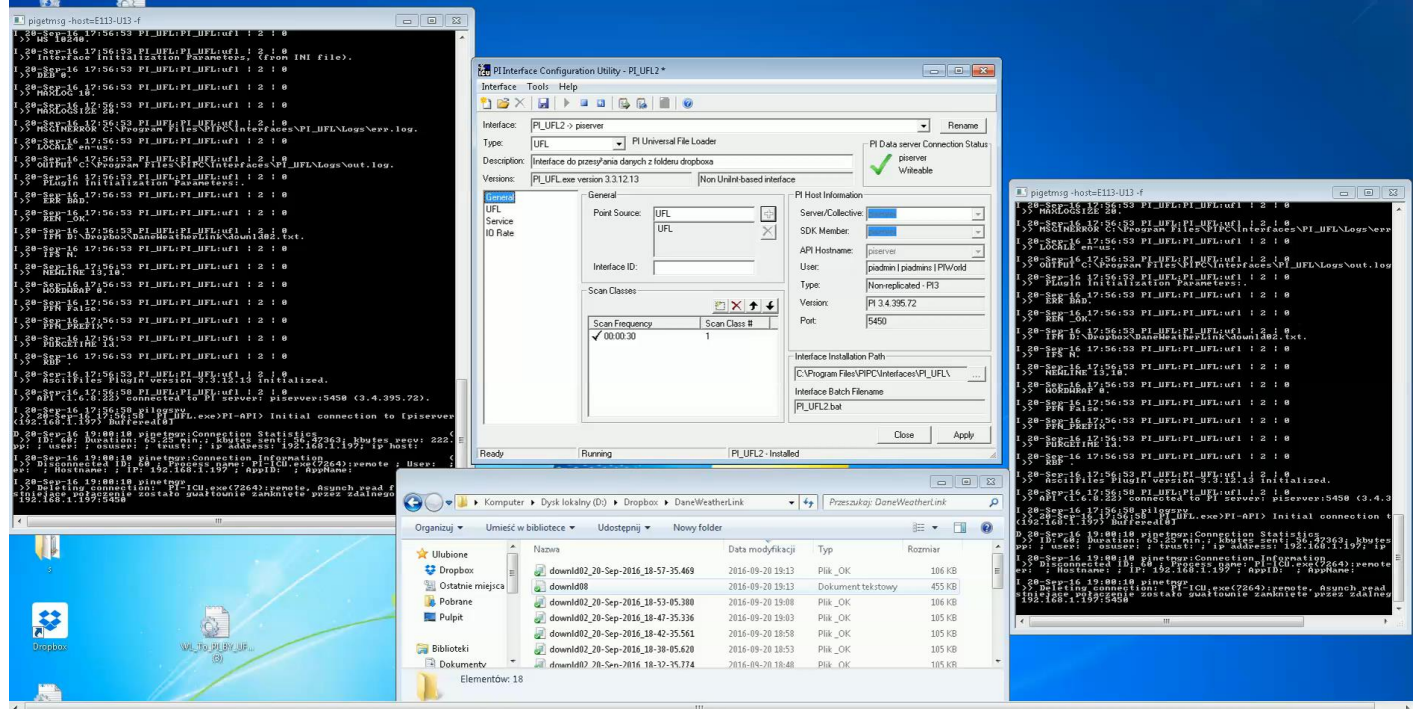
# What have we done?

## Monitoring of Faculty assets – Weather Station

Visualization  
on the map

Integration

with other systems – REMS (Real-time and asset data visualization platform)



# Education process - engineering thesis

- In autumn 2016
  - Acquisition and visualization data from meteorological station using the PI System
- In spring 2017
  - The use of PI System to monitor the assets Faculty of Electrical Engineering, Technical University of Czestochowa
  - Using Event Frames to find important process information
  - Creating AF Structure of ENGIE Polaniec Power Plant assets

## Work with real process data

### PI-to-PI Interface between Polaniec Power Plant and CUT

- Autumn 2016 - autumn 2017
  - Tags structure in PI AF,
  - Data validation methods,
  - Efficiency of energy production
  - Dashboards (PI DataLink, PI Coresight)

# Work with real process data

## Cooperation with ConnectPoint:

- Suggestions consider engineering and master thesis
- IT support of PI System
- Students internships
- Create Faculty structure in AF (smart metres, renewable energy sources)
- Business projects

# CUT for business – students' benefits

- Knowledge about real-time processes
- Access (limited) to real systems
- Working on polish language version
  - PI Coresight
  - PI DataLink
- **Participation in business project**
- **Better Chance of getting job**

## Next steps

- Prepare courses for student basis on PI System software
- Workshops for students and teachers
- Grants
  - internships program
  - additional courses
- Cooperation with companies using PI System

# Contact Information

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감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

Dziękuję