

Inside Erex Functionality and real world scenarios

Paris, May 31, 2017

About me

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Goal of this presentation

Showcase how Erex can be used

The Erex Eco-system

Two main web applications



Erex Exchange



Users who interact with the graphical user interface:

- Infrastructure managers who have the responsibility of validating and distributing metered data
- Traction unit administrators can retrieve data for their traction units, and delegate data access to applicable train operators.
- Eress administration

Control of input files

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Storage

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Validation

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Correction

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Allocation

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Distribution

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Control of input files

Storage

Validation

Correction

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t Time stamp	Log	Type	Text	File name
10/05/2017	REJECTED	UTILITS	Rejected. All 4 time series are ignored.	TRP_9410600402550_01e875_1705102125.edi
10/05/2017	REJECTED	UTILTS Validation	Rejected. All 4 time series are ignored.	TRP_9410600402550_01e85c_1705102100.edi
10/05/2017	REJECTED	UTILTS Validation	Rejected. All 4 time series are ignored.	TRP_9410600402550_01e820_1705102000.edi
10/05/2017	REJECTED	UTILTS Validation	EDI validation failed when trying to open the edi file	TRP_9110300003820_036226_1705102000 edi
10/05/2017	REJECTED	UTILTS Validation	EDI validation failed when trying to open the edi file	TRP_9110300003820_03b226_1705102000.edi
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10/05/2017 20:12	REJECTED	U/TILTS Validation	EDI validation failed when trying to open the edi file	TRP_9110300003820_036226_1705102000.edi
10/05/2017 19:21	REJECTED	UTILTS Validation	Rejected. All 12 time series are ignored.	9185442519551_201705101900.edi
10/05/2017	REJECTED	UTILTS Validation	Rejected. All 4 tme series are ignored.	9185442519481_201705101000.edi
10/05/2017	REJECTED	UTILTS Validation	Rejected. All 4 time series are ignored.	9185442519361_201705101900.edi
10/05/2017 19:21	REJECTED	UTILTS Validation	Rejected. All 4 time series are ignored.	9185442519221_201705101900.edi
10/05/2017	REJECTED	UTILTS Validation	Rejected, All 4 time series are ignored.	TRP_9410600402550_01e7e4_1705101900.edi
10/05/2017	REJECTED	VTILES Validation	Repected. All 4 time series are ignored.	9184118600941_201705101835.edi
10/05/2017 19:11	REJECTED	UTILTS Validation	From time can not be greater than or equal to end time (DTM+324)	UTILTS- E30_20170510160232737_1165002003_708000320 8537 edi
Message Log	Details			
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10/05/2017	REJECTED	UTILTS Validation	From time can not be greater than or equal to end time (DTM+324)	E30_20170510180232412_1185002002_708000320

Oslo

Distribution

Allocation

Control of input files





Internal benefit:

User has the possibility to correct data and re-import, such that the metered data can be used.

External Benefit:

User can inform upstream systems of data quality issues

Validation and Correction



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Operator view Message Log Proc	ess Log Event Monitor Import co	trol	
From: To: 09/05/2017 22:00 10/05/2017	22.00 Update		
Process Statistics 🥮			
Procedure Name	Tatal	Notsuccessful	
allocation	1672	0)	
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validation	(1691)	19)	
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Validation and Correction



Checks for violations in:

- Physical laws
- Configured limits
- Missing data

Event Monitor (12017)	
ConsumptionPoint	12017
Speed exceeded, successfully interpolated	2017
Generation without movement	(3052)
Consumption without movement	3699
Speed exceeded, but no interpolation possible within set timerange	245
Missing location and quantity value	(164)
Movement without consumption	(120)
Speed exceeded, single record corrected	6
Hole detected	1194
Missing quantity value	(340)
Power has exceeded maximum limit	(1180)

- Exchange will attempt to correct data, and notify the operator.
- Operator is given the chance to correct data that Exchange is unable to correct and re-send corrections.
- Location values that are unable to be corrected, and that are outside of any configured settlement area will not be forwarded anywhere.

Validation and Correction



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Speed exceeded, but no interpolation possible within set timerange

Process:	validation
Event registered:	10/05/2017 03:02
Data start:	09/05/2017 22:10
Data end:	09/05/2017 22:15
Time series type:	Corrected train 5min
Interval:	5 min
ID:	
Data description:	active consumption (MWh), E30

Time	Value	Latitude	Longitude	Latitude	Longitude
09/06/2017 21:46	O	55.63040	12.62649	55.62971	12.64892
09/05/2017 21:50	D	55.62971	12.64892	55,60347	12.74294
09/05/2017 21:55	D	55.60347	12.74294	55.56583	12.91272
09/05/2017 22:00	D	55.56583	12.91272	55 56261	12.97585
09/05/2017 22:05	0.007	55.56261	12.97585	55,56261	12,97585
09/05/2017 22:10	0.024	55.83157	14.25695	55.83157	14.25695
09/05/2017 22:15	0.03	55.83157	14,25695	55,83157	14.25695
09/05/2017 22:20	0.016	55.83157	14.25695	55.83157	14,25695
09/05/2017 22:25	0.004	55.83157	14.25695	55.83157	14.25695
09/05/2017 22:30	0.047	65.83167	14.25695	55.83157	14.25695
DOUDE FROM T DOUDE	0.007	55 67905	13 14505	55.67906	13 14506

Start time	Value	Lat	Lon	Lat	Lon
09/05/2017 22:10	0.024	55.83157	14.25695	55.83157	14.25695

Save and rerun procedure





Railway Energy Data Flow



Erex Settlement



Erex Settlement

Input- Train run data control

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Unsolved Failures ✔			
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Process Statistics	Tional (12231) (12551)	Notinucomistul D D	_

04453) (79) (818) 8548

Non-metered traction units Parked rolling stock Other consumption Losses Train run data EREX SETTLEMENT Electricity grid Energy supplier(s) Tariffs Corset invoice Statistics Reports Losse Correct invoice Statistics Reports Losse Losse Losse Correct invoice Statistics Reports Losse Losse Losse Losse Losse Correct invoice Statistics Reports Losse Los

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ACCEPTED	
UTILTS Webston	ŧ

	634
Incomplete metered timeseries removed	341
Payload and meleved locations did not match	(170
Payload and metered energy did not match	3
Non measured location data ignored	(197
Partial metered not used	(20
TransferringPoint	189978



11.33 05.30 24/05/2017 Reported REJECTED because departure location = arrival location in a section. OCP 24/05/2017 2036 42 id: 429985 10:17 16:47 distance 24/05/2017 24/05/2017 REJECTED because departure location = arrival location in a section. OCP 42 Reported weight 2036 10:17 16:47 id: 429985 24/05/2017 24/05/2017 Reported

25/02/2017 14:31	25/02/2017 15:45	Reported distance
25/02/2017 14:31	25/02/2017 15:45	Reported weight

Input- Train run data control

 1943
 REJECTED because train run railway undertaking is unknown: 3173
 4

1943 REJECTED because train run railway undertaking is unknown: 3173 4

04/01/2017 03:22	04/01/2017 06:49	Reported distance	2301	REJECTED because traction unit is not registered in Erex	16
04/01/2017 03:22	04/01/2017 06:49	Reported weight	2301	REJECTED because traction unit is not registered in Erex	16
0.110.110.0.17	0.110.110.0.17				

Processing of input

Status Proce Operator view

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Process Statisti	ics 🗸				
Procedure Name			Tixtue	Not successful	
preprocessing			12551		
calculate-unmeter	red-energy		(11982)	(0)	
combine			205	(0)	
Message Log (/	(üšsi7) 😑	70337	Event Mon	itor (200716) 🗢	
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ACCEPTED		(6646)			
UTILTS Weldston		(\$1420)		Payload and metered locations did not match	
Bull Iner Fur Loneine				Payload and metered energy did not match	
Page 15	100 7 2017			Partial metered not used	
ruge 15 JU	IIIE /, 2017			Non measured location data ignored	
		Oslo		TrainMeteringPoint	



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Status Processes Queries Auwysis Administration Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Image for ElSpot price Selected Time Series Type Selected Time Series Type Selected Time Series Type Time range for ElSpot price Selected Time Series Type Selected Time Series Type Selected Time Series Type Time range for ElSpot price Selected Time Series Type Selected Time Series Type Selected Time Series Type Time range for ElSpot price Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type Selected Time Series Type <td< th=""><th>Inpu</th><th>ut- Ener</th><th>gy pric</th><th>es</th><th></th><th>Non-metered traction units Parked rolling stock Other consumption Losses</th></td<>	Inpu	ut- Ener	gy pric	es		Non-metered traction units Parked rolling stock Other consumption Losses
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01/01/2017 09:00 01/01/2017 10:00 25.74 11/01/2017 18:31 system	01/01/2017 08:00	01/01/2017 09:00	26.18	11/01/2017 16:31	system	
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Output- Analysis

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•	Combine re	suits Viscalizatio	on of train runs								(H)
С	ombine	e result searc	h								Train rur data
TH	e Sei Range C	2017 March	Te: 500 01/04/2017 00.00	a							
Tri	in .										Electrici gi
G	atomer 😤 g	sinci el	Train Type Covert of		Train Metering Po	et R _{Sene}	- A	Traction unit(s) selected			
			*		-				-		
s	earch										
rair		where mete	red data was rej	ected (3	09)						
	Train no.	(reported value)	Start time - End time		Process time	User	Event				
▶ □	40274	. (30/03/2017 10:24 - 30/0	3/2017 12:10	04/04/2017 19:40) system	Payload ar	nd metered energy did not m	atch 🛶 🛲	•	
	Train	runs with no	metered data r	eceived	(65)						
⊾ 🗏		Train no. (repor	rted value)	Start time -	End time			Process time	User		
	D	42878		10/03/2017	08:59 - 10/03/2017	7 10:29		07/04/2017 09:46	olei		
		Train runs	with estimated r	esult (10	3581)						
		Train no. (r	eported value)	Start	time - End time			Process time		User	
		54201 15001 81 Train	runs with metere	ed data u	used (1247)	3/2017 20	:36	06/04/2017 0	8:38	system	
		5	Train no. (reported valu	le)	Start time -	End time		Pro	cess time		User
		₽	47527	,	31/03/2017	05:31 - 31	1/03/2017 08	B:11 06/	04/2017 08:37		system
		Þ	47544		31/03/2017	19:06 - 31	1/03/2017 22	2:34 06/	04/2017 08:37		system
		₽	48558		31/03/2017	21:10 - 31	1/03/2017 23	3:51 06/	04/2017 08:37		system

Erex Settlement



eress

Output- Reports / Settlement





Output- Reports / Settlement / Invoice specification

Settled amount total (Euro) Settled amount details (Eur	For energileveranse i april 2017
Off Peak Commodity	Kostnader krafthandel Pris Volum Kostrader
Grid cost Total Total (all time periods)	Kostnader innkjøpt elektrisk energi 38,6500 MV/h Elektrisk energi tilskelevert fra forbrukspunkt 38,6500 MV/h Elektrisk energi tilskelevert fra forbrukspunkt 6,5450 MV/h Netto elektrisk mergi levert forbrukspunkt 267,80 NOK/MV/h
Settlement detai	Andre kostnader relatert til kr Advensitrasjonkostrader krathan Opprevelsespranser - <order></order>
	Totale kostnader krafthandel
Off Peak Payload (Million TonneKm) Consumption (GWh)	Kostnader nett
Corrected consumption (G Energy per TonneKm (Wh Cost (Thousand Euro) Energy unit price (Euro/M TonneKm unit price (Euro/M	Orrforminge- og overforningstop Andre kostnader relatert til ne Advenistrasjonskostnader nett
Total (all time periods)	Totale kostnader sett
Consumption (GWh) Corrected consumption (G	Oppsummering
Energy per TonneKm (Wh Cost (Thousand Euro) Energy unit price (Euro/M	Totale energicostnader ekoklusiv m
TonneKm unit price (Euro	A betale (+) / Til gode (-) eluki
	Manuardarugh (0.00 %)
	A betale (+) / Til gode (-)

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Infrastructure manager

Statistics Reports

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Erex Settlement

Erex- Interesting findings

- By using data supplied from energy-meters, one train operator was able to uncover a production error in a series of traction units. This error was causing the units to consume a lot more energy than what was anticipated.
- Increased awareness of the energy consumption caused train operators in Norway to use doors that close automatically during stabling. These doors used to be left open until the next departure.
- A considerable amount of errors is uncovered by Erex in Train run data every month.
- Metered data relayed by the system is used by external systems for energy efficiency purposes.



Thank you for your attention

Inside Erex Functionality and real world scenarios

Paris, May 31, 2017