

# Toward Green Mobility : Visualizing Solar Power Simulations with Zabbix

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SRA OSS K.K.

# Who are we?

#### ΤΟΥΟΤΑ

#### Mitsuhiro ONO

 20 years of experience as a system engineer





#### Toshihiro AKAMATSU

 10 years of experience as a system & technical support engineer for OSS including Zabbix



Zabbix certified professional

#### TOYOTA MOTOR CORPORATION SRA OSS K.K.

- E2E Computing group, InfoTech-IS;
   From Vehicle to Cloud Center
- Recent projects
  - Advanced development of connected infrastructure for green mobility
  - Advanced development of system monitoring with anomaly detection

OSS related services



- Technical support
- Consulting
- Product Development
- Training
- **Zabbix premium partner in Japan**

### Challenges toward a sustainable mobility society

- Carbon Neutrality and Expanding the Value of Mobility
- In-Car : Multi Pathway
  - Providing diverse options (BEV,PHEV,HEV,FCEV,H2,CN fuels)
- Out-Car: Connected Service
  - Collecting and analyzing car condition and situations from the cars connected the internet.
  - Ex) Energy saving route guidance



FORDABLE AND



Carbon Neutrality

FCE\

#### Green energy is key as connected cars demand rises TOYOTA



Changes in the total Number of connected cars





Connected car total data transfer volume

If the amount of transfer and processing increases use a lot of electricity

The use of green energy is essential, as is the conservation of energy.

## **Issues in utilizing green energy**

ΤΟΥΟΤΑ

- Solar power is the most widely adopted
  - Power generation potential for anywhere
  - Cost reductions lead to cheaper electricity
- Solar power generation fluctuates seasonally
  - Weather affects electricity generation.
    Surplus occurs if production exceeds demand.
  - Balancing power supply is hard for power companies.
- To reduce waste, we are working on control power usage dynamically when surplus is expected.





https://www.enecho.meti.go.jp/category/saving\_and\_new/saiene/grid/08\_syuturyokuseigyo.html

### **Developing a solar power simulator for surplus use TOYOTA**

- Simulation-based visualization of power generation potential
  - : when, where, and how much
    - □ When : several hours before
    - □ Where : best place on our sites
    - How much : potential varies with weather
  - OSS; quick and small start
    - Essential dashboard widget
    - Extensive monitoring functions and examples
    - Active support and community
    - ⇒Zabbix is well-suited

#### Experiment to manage resources using solar predictions **TOYOTA**

 Utilizing computer resources during periods and at locations with surplus energy



#### ΤΟΥΟΤΑ Integration of Zabbix with solar power simulator Solar power simulator **Electric generation** Global solar capacity radiation API (EGC) (GSR) SNMP Open Zabbix Weather CO<sub>2</sub> reduction Weather GSR EGC Weather Current and hourly forecast values up to 72 hours later

# Zabbix dashboard for solar power simulator **TOYOTA**

#### Visualization of data from simulators

- History of solar power generation
- Current values of
  - Solar radiation
  - Solar power generation
  - CO2 reduction
- Forecast values of Solar power generation
  - Hourly for the next 24h
  - Total for the next 24h
  - Total for the next 72h
- Weather forecast
- Location map



# **Display of power generation potential**

 Ranking of future power generation potential using top hosts widget

Top electirc generating capacity potential next 24h									
Edge	Potential		Î						
Riga		14.05 KW							
Dubai		13.92 KW							
Naha		10.65 KW	1						
Beijing		10.25 KW							
Top electric generating capacity potential next 7	2h								
Top electric generating capacity potential next 7	2h Potential		^						
Top electric generating capacity potential next 7 Edge	2h Potential	40.57 KW	Î						
Top electric generating capacity potential next 7         Edge         Riga         Dubai	2h Potential	40.57 KW 36.18 KW	•						
Top electric generating capacity potential next 7         Edge         Riga         Dubai         Naha	2h Potential	40.57 KW 36.18 KW 28.89 KW							

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# Weather forecast

ΤΟΥΟΤΑ

#### Hourly weather forecast for each site using top hosts widget

Weather														
Site	Now	1h later	2h later	3h later	4h later	5h later	6h later	7h later	8h later	9h later	10h later	11h later	12h later	Longitude (for sort)
Riga	Clouds)	Clouds)	Clouds)	Clouds)	Clouds)	Clouds)	Clouds)	🔅 (Clear)	🔅 (Clear)	🔅 (Clear)	🔅 (Clear)	🔅 (Clear)	(Clear)	24.22
Naha	Clouds)	<b>膋</b> (Rain)	Clouds)	🔅 (Clear)	<b>(</b> Clear)	🔅 (Clear)	🔅 (Clear)	127.69						

Iconic display using value mapping



Adding column for longitude and sorting geographically

# **Site-to-Site Comparison**

Display current values using gauge widget
 Display history and forecast values using graph widget



# **Graph display of forecast values**



Graphs usually display values at the time the values are taken

> Some ingenuity is required to display the forecast values on the graph

- Display only the latest values per forecast hour using aggregation
- Display values at forecast time using time shift





# Zabbix and Kafka integration



# Zabbix to Kafka Aggregating multiple Zabbixes data in Kafka with kafka-connector Kafka to Zabbix Integrating data in Kafka

Integrating data in Kafka from other Zabbixes via Zabbix API history.push





- To achieve a sustainable mobility society, we are working on utilizing green energy.
  - Zabbix is suited for real time, flexible visualization of solar power generation status linked to the latest weather forecasts.
- We will verify the architecture that utilizes green energy including solar and wind.

# SRA OSS booth is here!!

ZABBIX FLOOR PLAN M 1:100 SUMMIT CONFERENCE HALL CONFERENCE HALL CONFERENCE HALL 2024 ENTRANCE "OMEGA 1" ENTRANCE "OMEGA 2" ENTRANCE "OMEGA 3" SRA OSS 入り 人 PRESS WALL WOMEN's wc COFFEI STORAGE ------initMAX 41111111 ,,,,,,,,,,,, S ZABBIX MERCH SHOP ШИ business ZABBIX ZABBIX allenta SOLD ¥<sub>IZI−IT</sub> 909.00 645.00 672.00 MEN's PLATINUM PLATINUM wc REGISTRATION LOUNGE AREA MAIN ENTRANCE **Check Out Our Zabbix Dashboard!**