# BL40A2010 Introduction to IoT-Based Systems

## Assignment 2, 23.01.2023


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**(1) Give one example of each of the following type of data.**

Answer:

(a) Analog: virtually or physically
(b) Digital: live stream

(c) Primary: notations or formula

(d) Secondary (i.e., lack of data that is informative):

(e) Metadata: size and path of the photo or video

(f) Environmental: Gas consumption

**(2) Write one example when the same structured data can be classified as (a) information, (b) redundancy and (c) not interpretable.**

Answer: A data element that contains several smaller details of their clients like , name, phone number and many more.

**(3) Photo-voltaic generation converts the sun's radiation into usable electricity. In this task, you will get the *direct solar radiation* with 1 minute time interval from the *Radiation observations* at FMI. Plot radiation profile of three different days so that one must be in March, other in July and the last in December (regardless of the year). What measuring station was used? Compare the solar radiation in those 3 days and provide *information* about the potential of solar generation in those days. You can also select the measuring station (but write it in the answer).**

*Hint:* Code like in the tutorial notebook.

In [16]:
```
import pandas as pd #https://pandas.pydata.org/
import matplotlib.pyplot as plt #https://matplotlib.org/
import matplotlib.dates as mdates #https://matplotlib.org/
```

In [23]:
```
radiation_march = pd.read_csv("march.csv",dayfirst=True,sep=",",
                              header=0,decimal=b".",index_col=0,
                              parse_dates= [[0, 1, 2, 3]],usecols=[0,1,2,3,5])

radiation_march.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1441 entries, 2022-03-18 00:00:00 to 2022-03-19 00:00:00
Data columns (total 1 columns):
 #   Column                          Non-Null Count  Dtype  
---  ------                          --------------  -----  
 0   Direct solar radiation (W/m2)  1441 non-null   float64
dtypes: float64(1)
memory usage: 22.5 KB
```

In [27]:
```
radiation_july = pd.read_csv("July.csv",dayfirst=True,sep=",",
                              header=0,decimal=b".",index_col=0,
                              parse_dates= [[0, 1, 2, 3]],usecols=[0,1,2,3,5])

radiation_july.info()
```

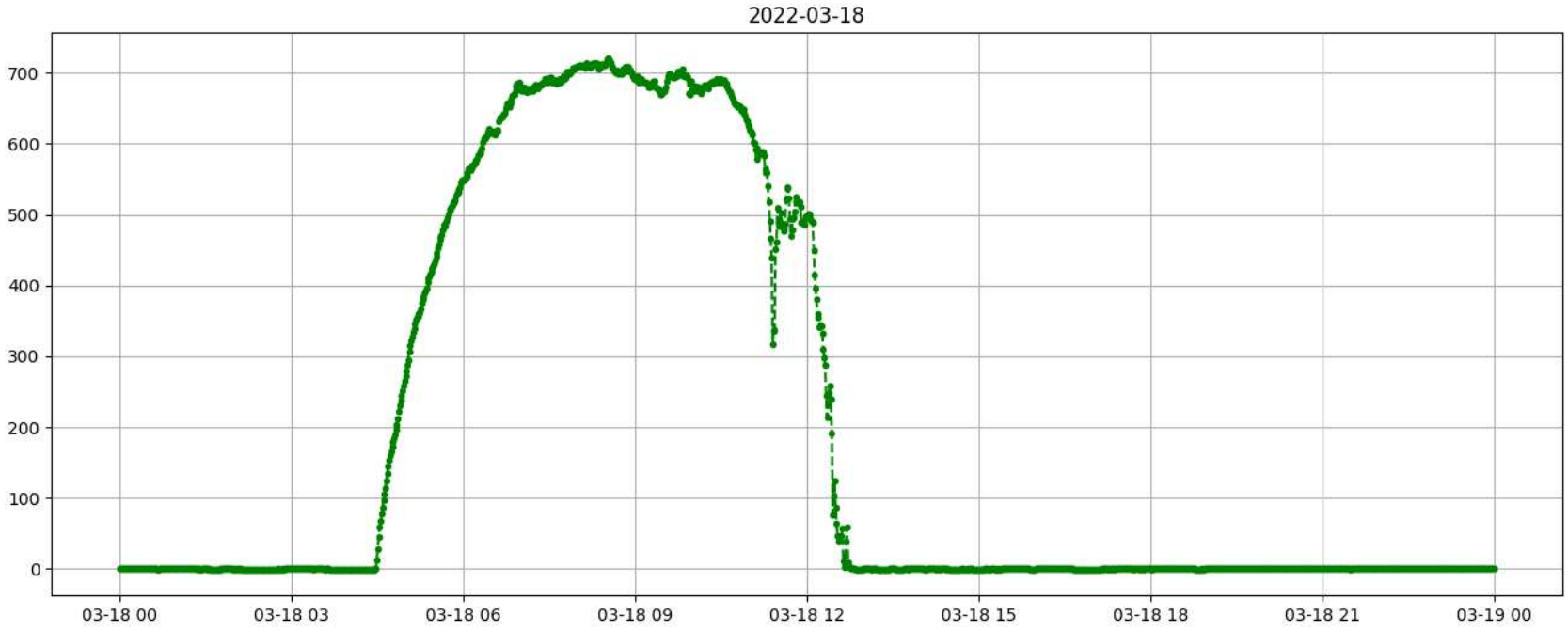
```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1441 entries, 2022-07-14 00:00:00 to 2022-07-15 00:00:00
Data columns (total 1 columns):
 #   Column                          Non-Null Count  Dtype  
---  ------                          --------------  -----  
 0   Direct solar radiation (W/m2)  1441 non-null   float64
dtypes: float64(1)
memory usage: 22.5 KB
```

In [25]:
```
radiation_december = pd.read_csv("december.csv",dayfirst=True,sep=",",
                              header=0,decimal=b".",index_col=0,
                              parse_dates= [[0, 1, 2, 3]],usecols=[0,1,2,3,5])

radiation_december.info()
```

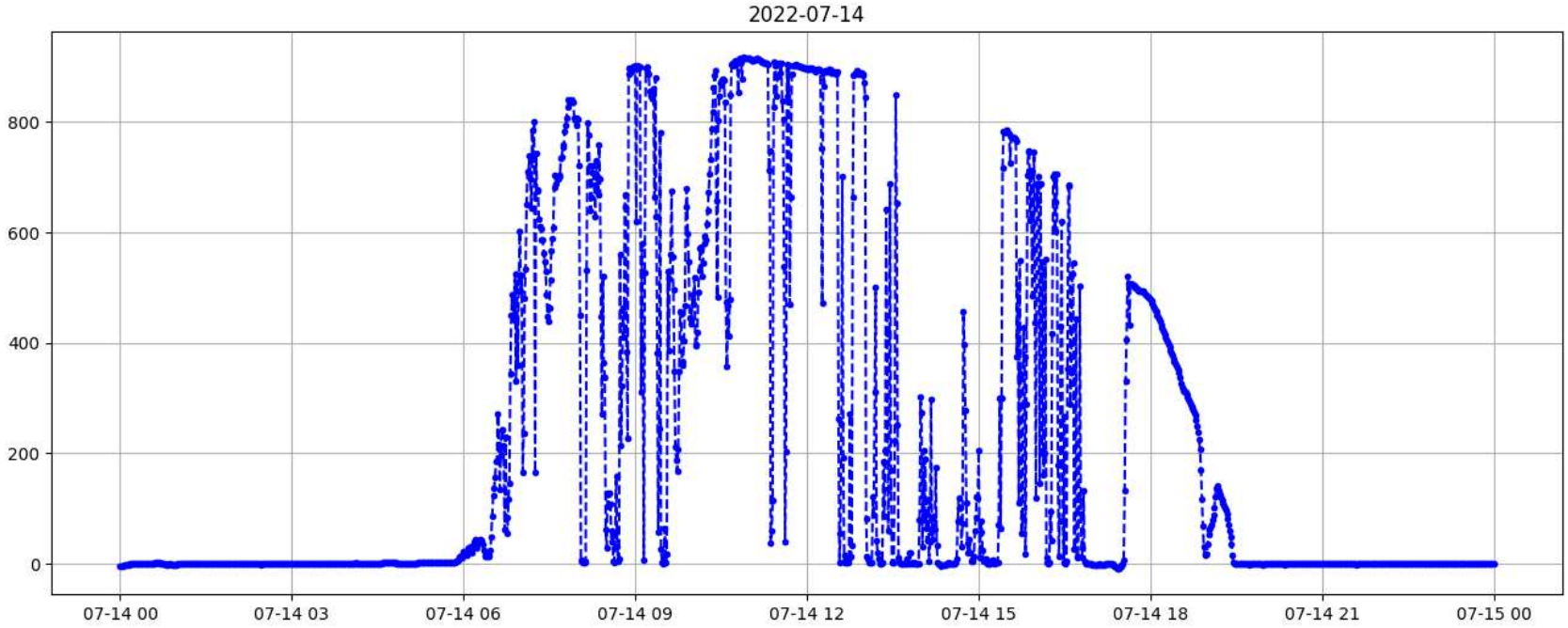
```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1441 entries, 2022-12-22 00:00:00 to 2022-12-23 00:00:00
Data columns (total 1 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   Direct solar radiation (W/m2)  1441 non-null   float64
dtypes: float64(1)
memory usage: 22.5 KB
```

In [33]:
```
day1 = '2022-03-18'
plt.figure(figsize=(16,6))
plt.plot(radiation_march,color='green', marker='.',linestyle='--')
plt.title(day1)
plt.ylabel("W/m2")
plt.grid(True)
plt.show()
```

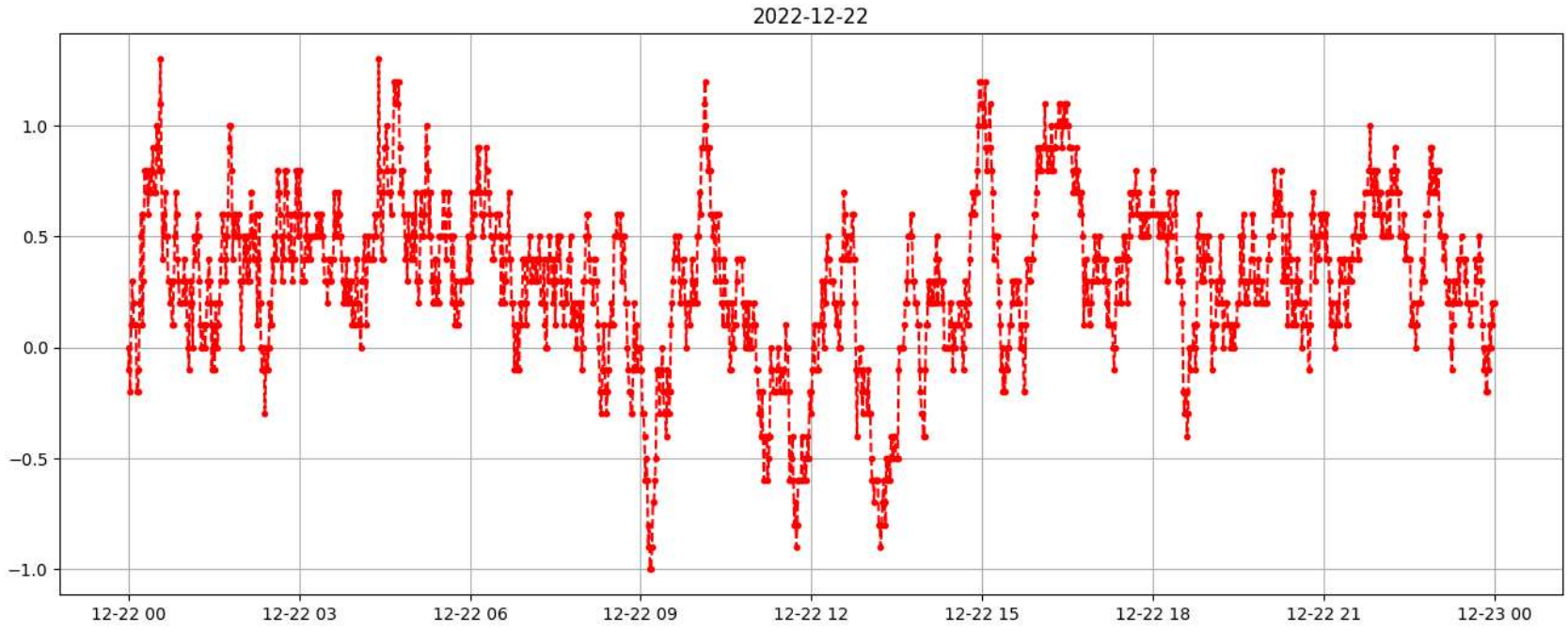



In [32]:
```
day1 = '2022-07-14'
plt.figure(figsize=(16,6))
plt.plot(radiation_july,color='blue', marker='.',linestyle='--')
plt.title(day1)
```

```
plt.ylabel("W/m2")
plt.grid(True)
plt.show()
```

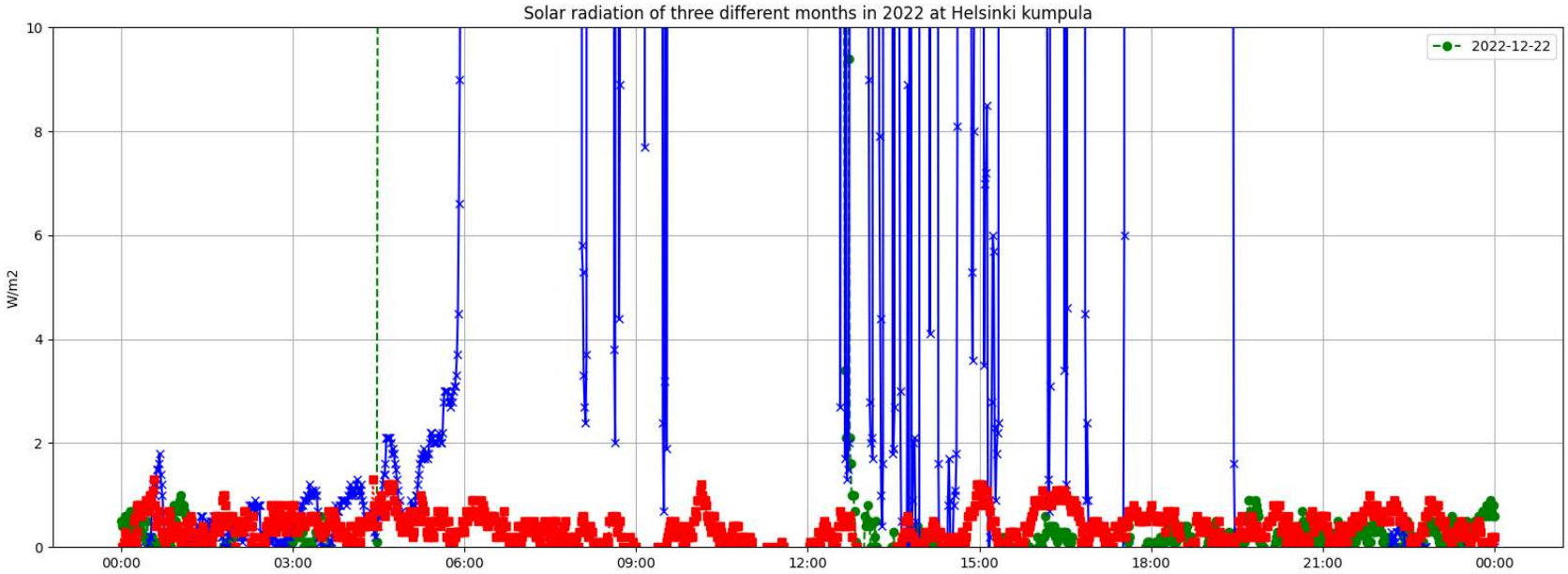



In [34]:
```
day1 = '2022-12-22'
plt.figure(figsize=(16,6))
plt.plot(radiation_december,color='red', marker='.',linestyle='--')
plt.title(day1)
plt.ylabel("W/m2")
plt.grid(True)
plt.show()
```




In [35]:
```
delta1 = radiation_march.index[0].date() - radiation_july.index[0].date()
delta2 = radiation_march.index[0].date() - radiation_december.index[0].date()
```

In [40]:
```
fig, ax = plt.subplots(1,figsize=(16,6))
plt.plot(radiation_march.index, radiation_march.values, label=day1, color='green',
         marker='o',linestyle='--')
plt.plot(radiation_july.index + pd.offsets.Day(delta1.days),
         radiation_july.values, color='blue', marker='x',linestyle='-')
plt.plot(radiation_december.index + pd.offsets.Day(delta2.days),
         radiation_december.values, color='red', marker='s',linestyle=':')
plt.legend()
plt.ylim([0, 10])
plt.title("Solar radiation of three different months in 2022 at Helsinki kumpula")
plt.ylabel("W/m2")
plt.grid(True)
plt.tight_layout()
xfmt = mdates.DateFormatter('%H:%M')
ax.xaxis.set_major_formatter(xfmt)
plt.show()
```




**(4) Read the text What Does the Metaverse Mean for the Future of Energy Consumption?. Write a brief analysis of the text based on the relation between data, energy and level of processes. From the energy perspective, is it possible to maintain this kind of technologies? Note: This is clearly not a right/wrong question, but a space to critically think about current issues related to the course.**

Answer: For the energy perspective, it will not affect the energy consumption because they made a sustain wind farm that means with growing technologies of the virtual world, the chances are very high to decrease the amount of energy. To conclude this topic, i would say that this technology will partially maintain the metaverse because it may harm at long extent according to the data.