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Data Visualization for IoT Measurements without Third Party Involvement

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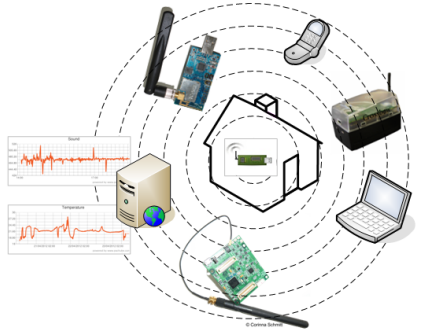
http://www.csg.uzh.ch/research/SecureWSN.html

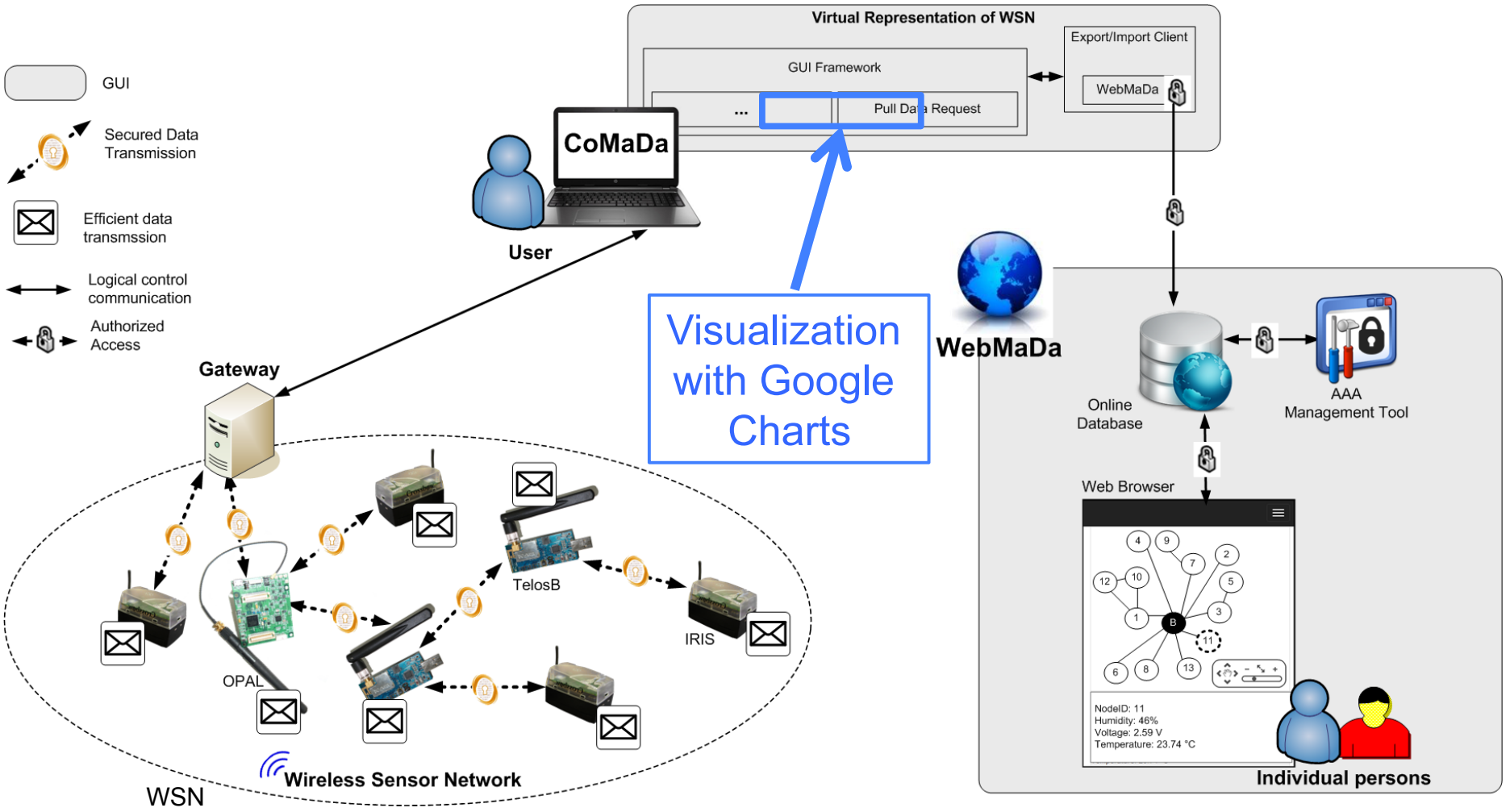


Motivation and Goal

- **Motivation:**
  - Number of IoT devices grow including Wireless Sensor Networks (WSN)
  - Automatic measurements (PUSH) in pre-defined intervals
  - Visualization in graphs preferred
  - Flexibility in time-range specification

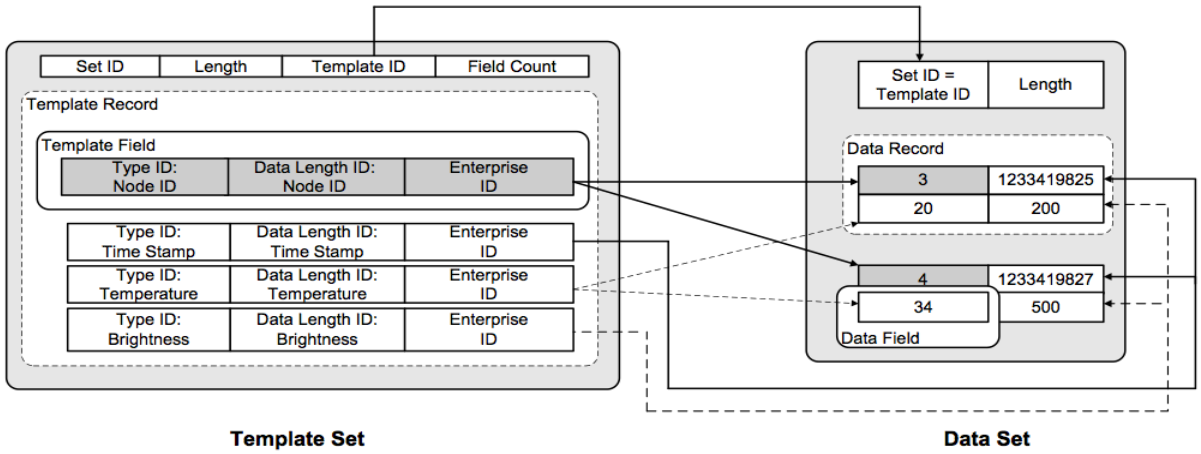
- **Goal:** Visualization without third party involvement
  - Extend SecureWSN
  - Exchange currently used third party Xively
  - Support same functionality as Xively

SecureWSN Architecture



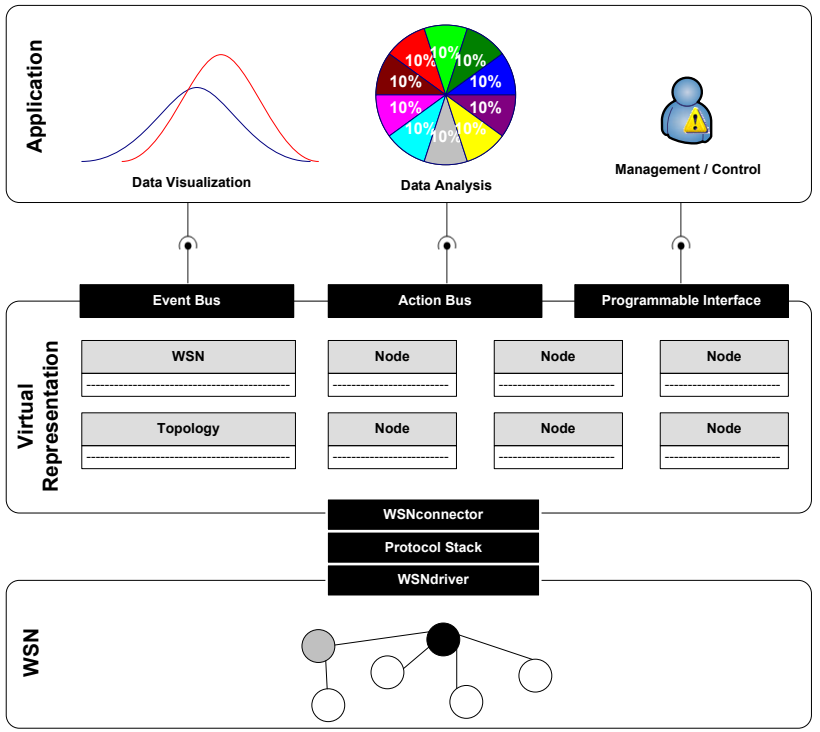
TinyIPFIX Data Format in WSN

- Inspired by IP Flow Information Export (IPFIX) protocol (RFC 5101)
  - Push based
  - Template-based design → Separation of meta information and data
- Header compression to match constrained device‘s message size
- Aggregation support



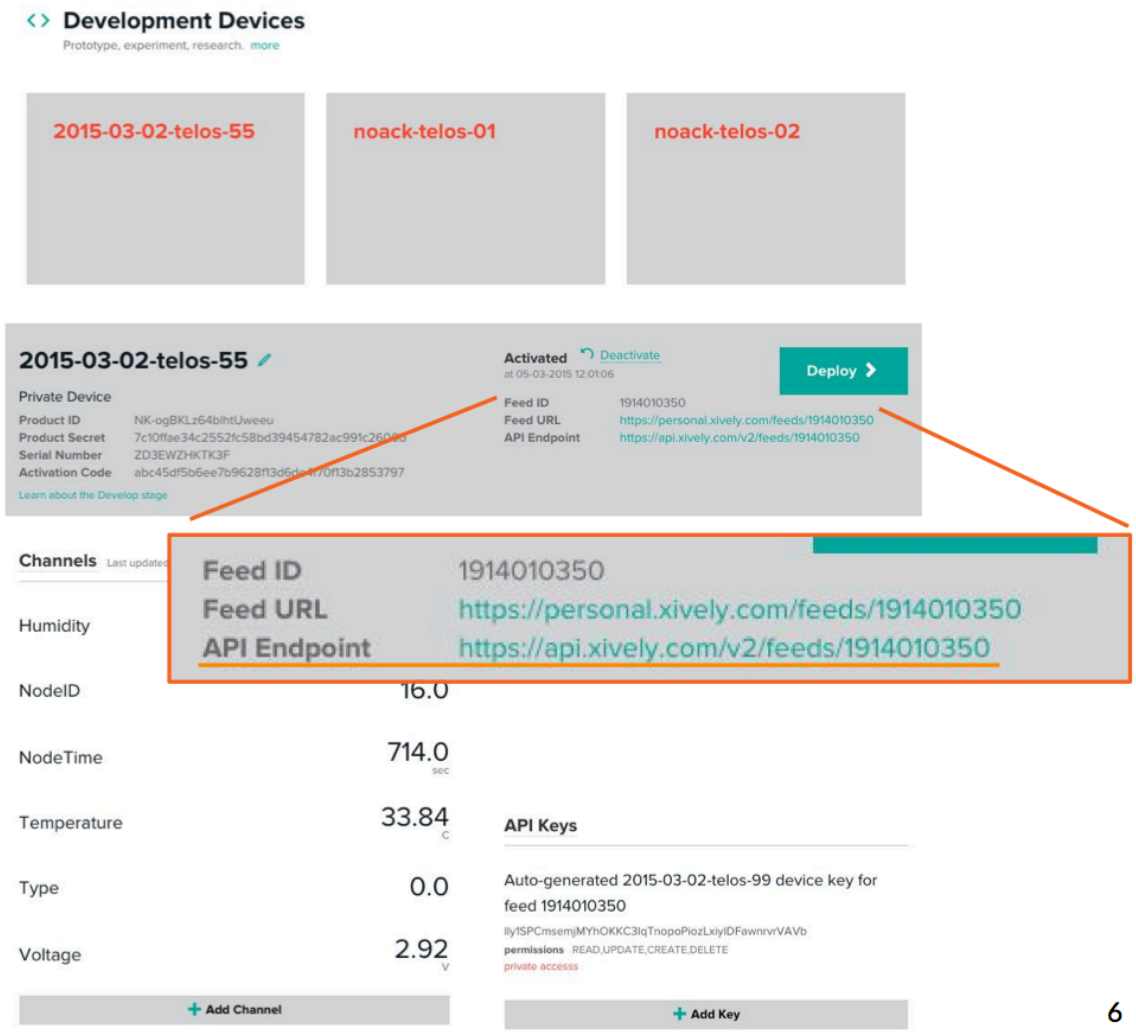
CoMaDa (Version 1.1)

- **Co**nfiguration, **Ma**nagement, and **Da**ta Handling
  - Virtual representation → Separation of program logic from drivers
  - Each WSN is linked to one CoMaDa component
  - Configuration of WSN components
  - Managing deployed network receiving network information
  - Stores and visualize data with third Party

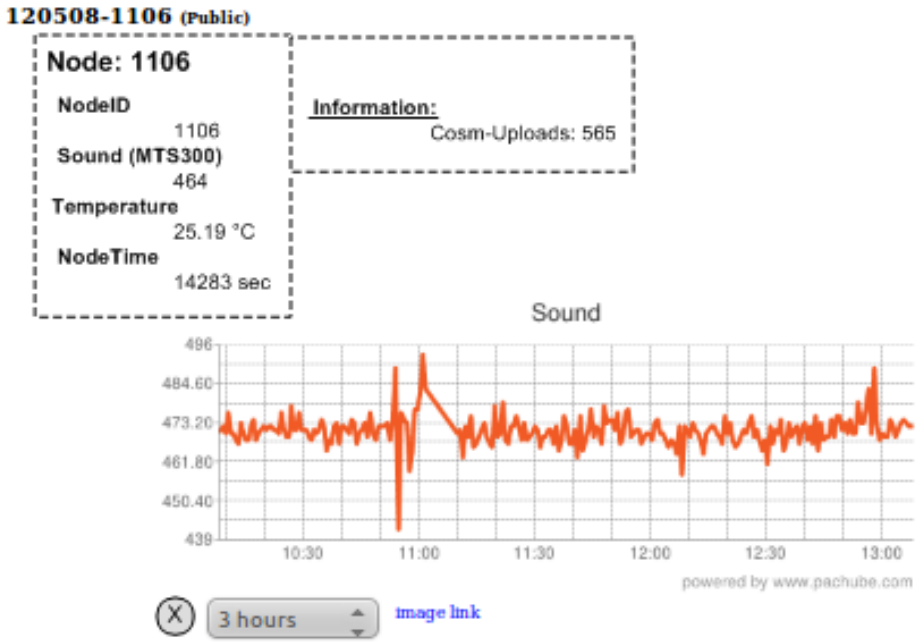


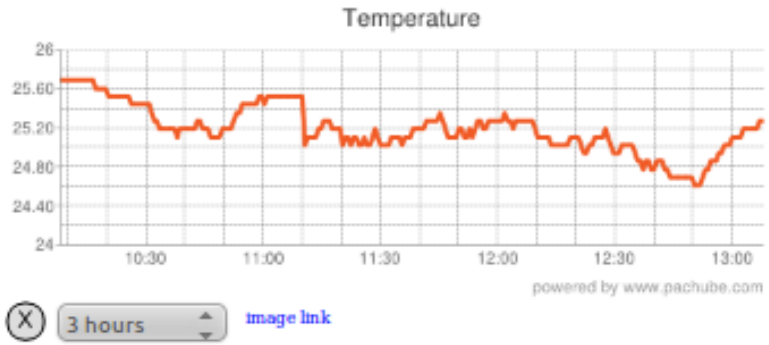
Visualization with Third Party Xively (1)

- Cloud Service
- IoT PaaS (Platform as a Service)
- 1 Device = 1 Feed
- API Endpoint for Feed



Visualization with Third Party Xively (2)





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<img src="https://api.cosm.com/v2/feeds/1556278986/datastreams/Temperature.png?width=500&height=200&colour=%23f15a24&duration=180minutes&title=Temperature&show_axis_labels=true&detailed_grid=true&scale=auto&timezone=+1">

Visualization with Third Party Xively (3)

- Features
  - Visualize data of an (old) feed with a line chart
  - Add/Remove nodes
  - Add/Remove fields/channels
    - Humidity
    - Temperature
  - Filter
    - Show last 5 minutes
    - Show 30 minutes
    - Sow 1 hour
    - Etc.
  - Download charts

- Drawbacks
  - Fast-changing API
  - Need for internet connection/ Network overhead
  - Privacy issues (Third party)
  - Authentication/ Storing Credentials
  - Only Static PNGs

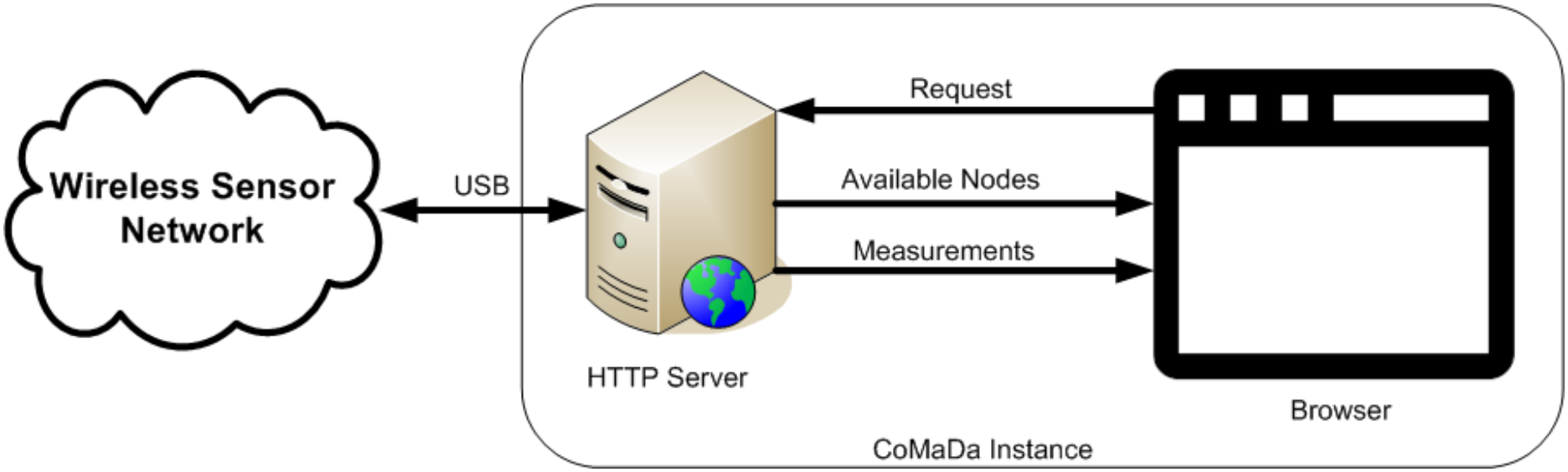
Visualization without third party involvement!

Google Charts

Google Charts

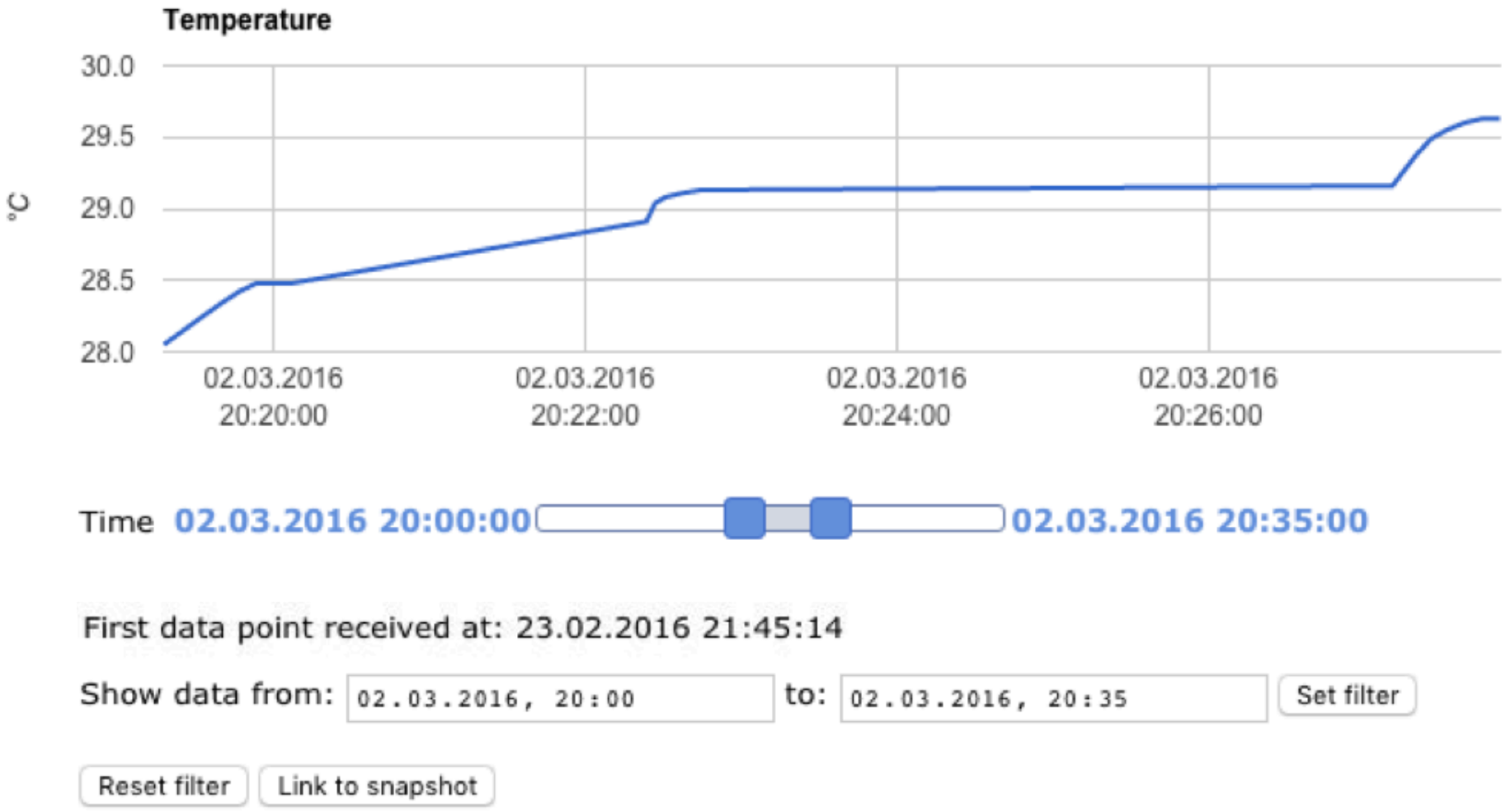
- It's Free!
- No REST-API
- JavaScript library
- SVG, HTML5 or VML (Vector Markup Language)
- Interactive charts
- Real-time data visualization
- Highly modifiable charts
- Based on data tables
- Generate static PNGs
- Simple Filters
- Extensive Documentation
- Popular

Integration into CoMaDa

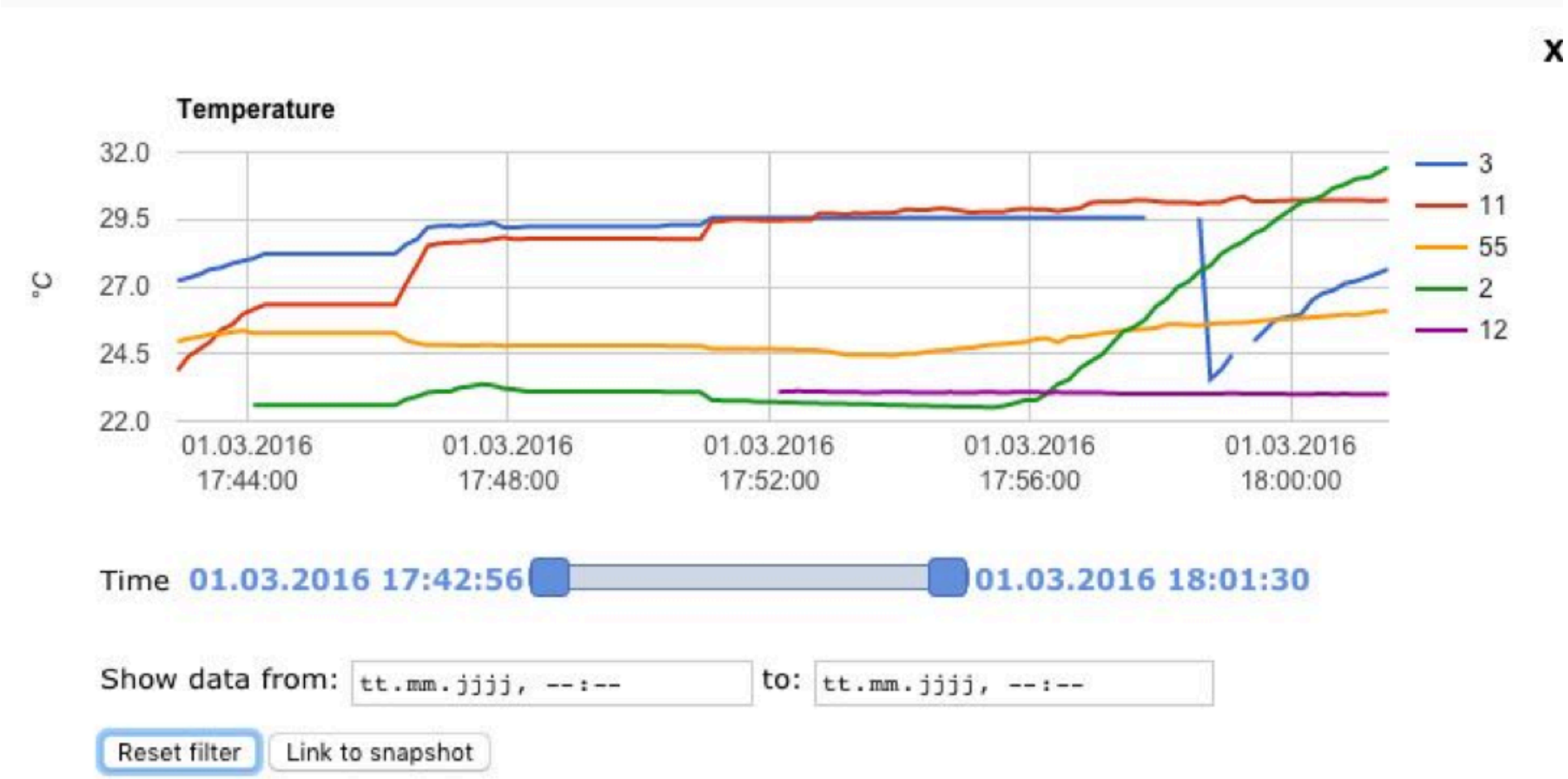


Visualization of Data (1)

Visualization of Data (2)



Visualization of Data (3)



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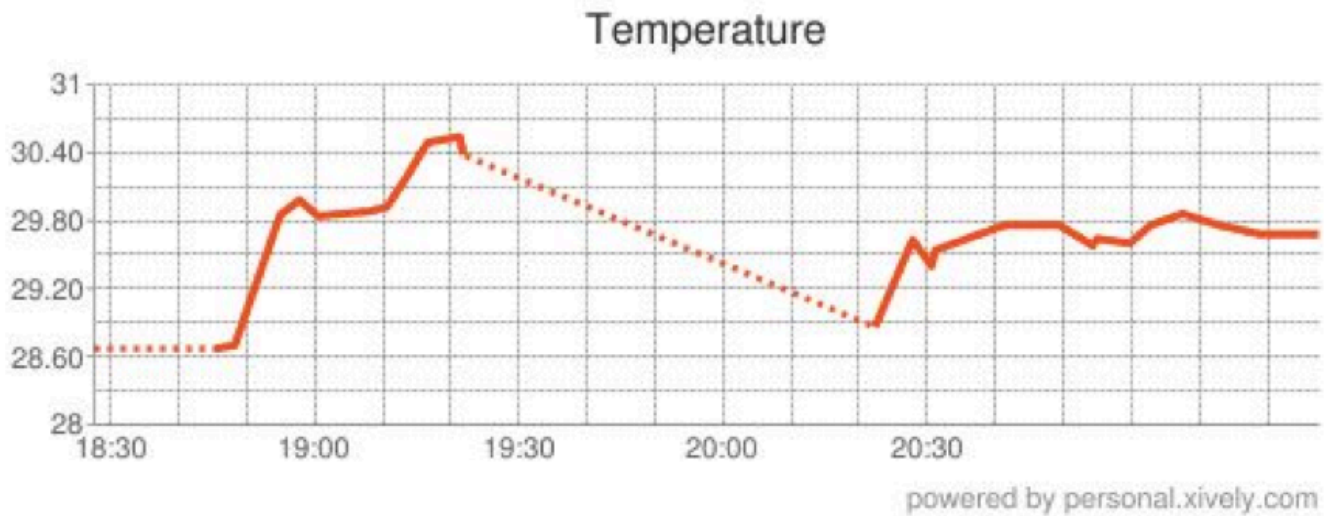
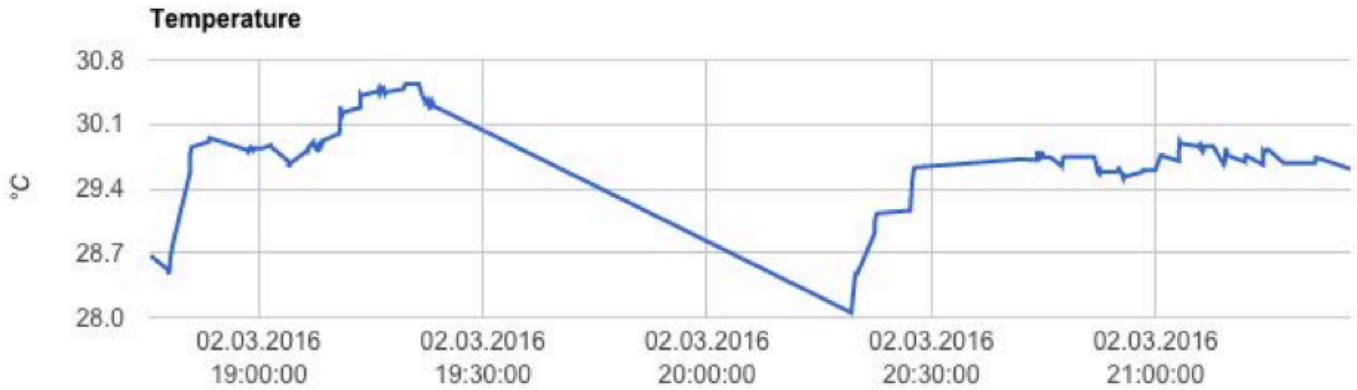
Google Charts vs Xively Visualization



Xively

Google Charts

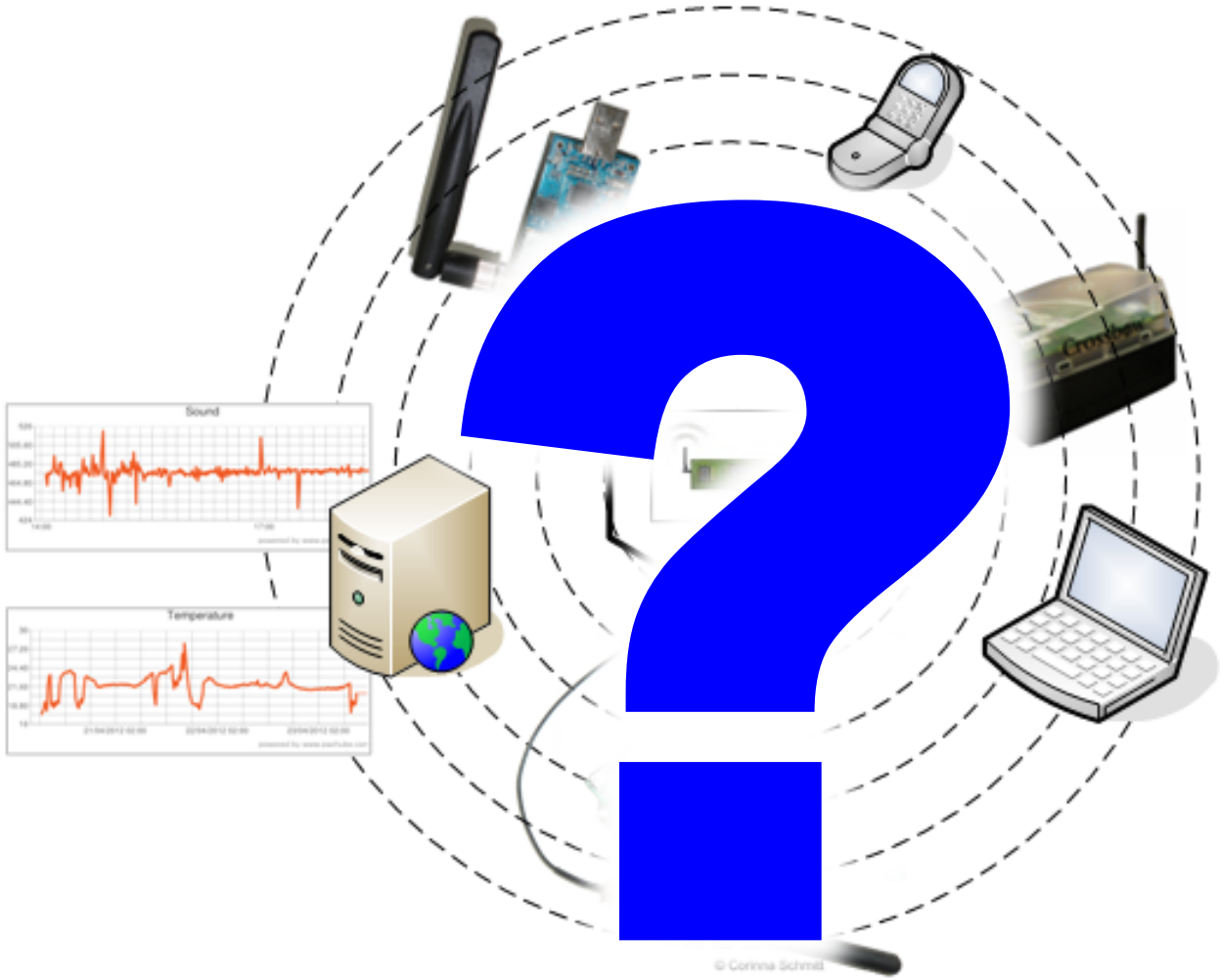


Conclusion

- Successful exchange of third party visualization!
- All Drawbacks eliminated
- All original features supported and extended
  - Layered Charts
  - Dynamic Snapshots possible
- Flexible adjustments of other sensor data
- No security issues due to database running on CoMaDa instance without connection to the outside

- Future work
  - Integration in WebMaDa supporting mobile access
  - Visualization of older data → database solution is needed
  - Support for upcoming measurement types

Thanks ...



References

- SecureWSN: http://www.csg.uzh.ch/research/SecureWSN.html
- Tim Strasser: Offline Method for Graphical Visualization of Sensor Data; Universität Zürich, Communication Systems Group, Department of Informatics, Zürich, Switzerland, March 2016, URL: https://files.ifi.uzh.ch/CSG/staff/schmitt/Extern/Theses/Tim-Strasser-VA.pdf
- C.Schmitt, A.Freitag, G.Carle: *CoMaDa: An Adaptive Framework with Graphical Support for Configuration, Management, and Data Handling Tasks for Wireless Sensor Networks*, 9th International Conference on Network and Service Management (CNSM), IFIP, Zurich (CH), ISBN: 978-3-901882-53-1, pp. 211-218, October 2013