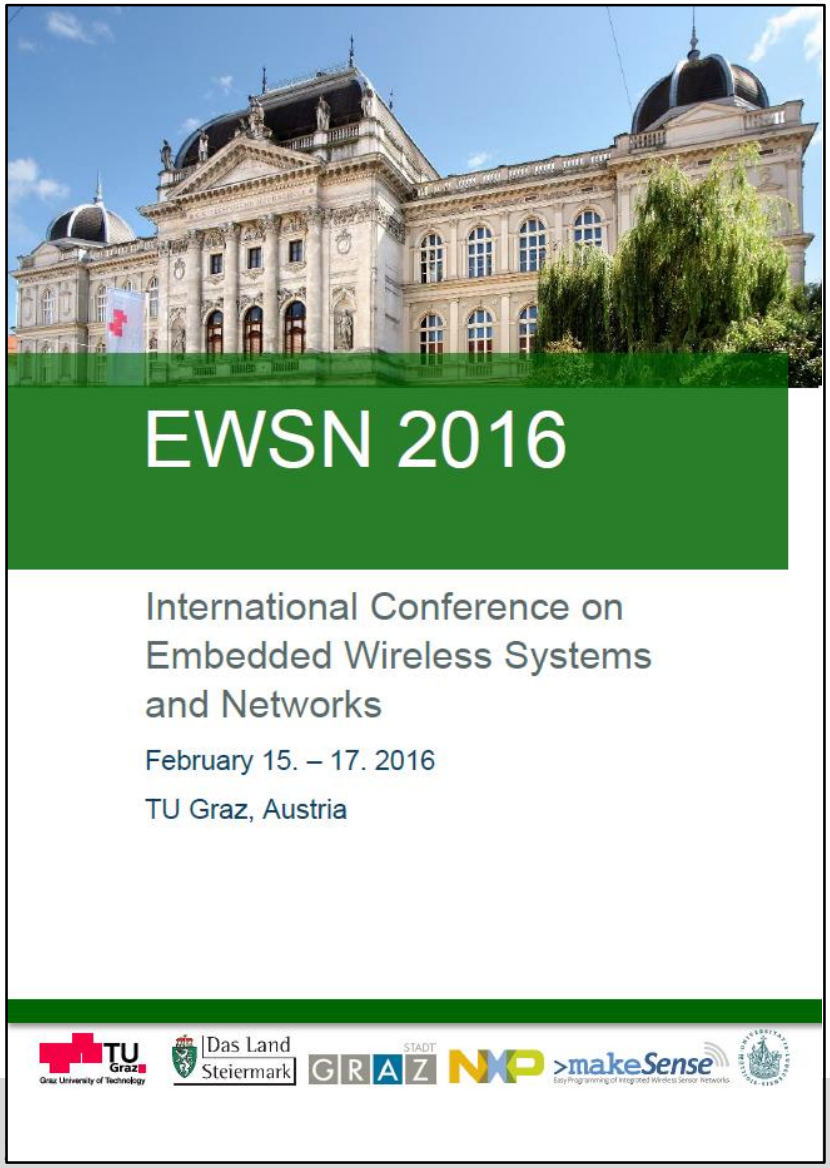
Welcome at EWSN 2016 in Graz!



EWSN 2016 Dependability Competition

Rules & Evaluation Procedure

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Organizers

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Background

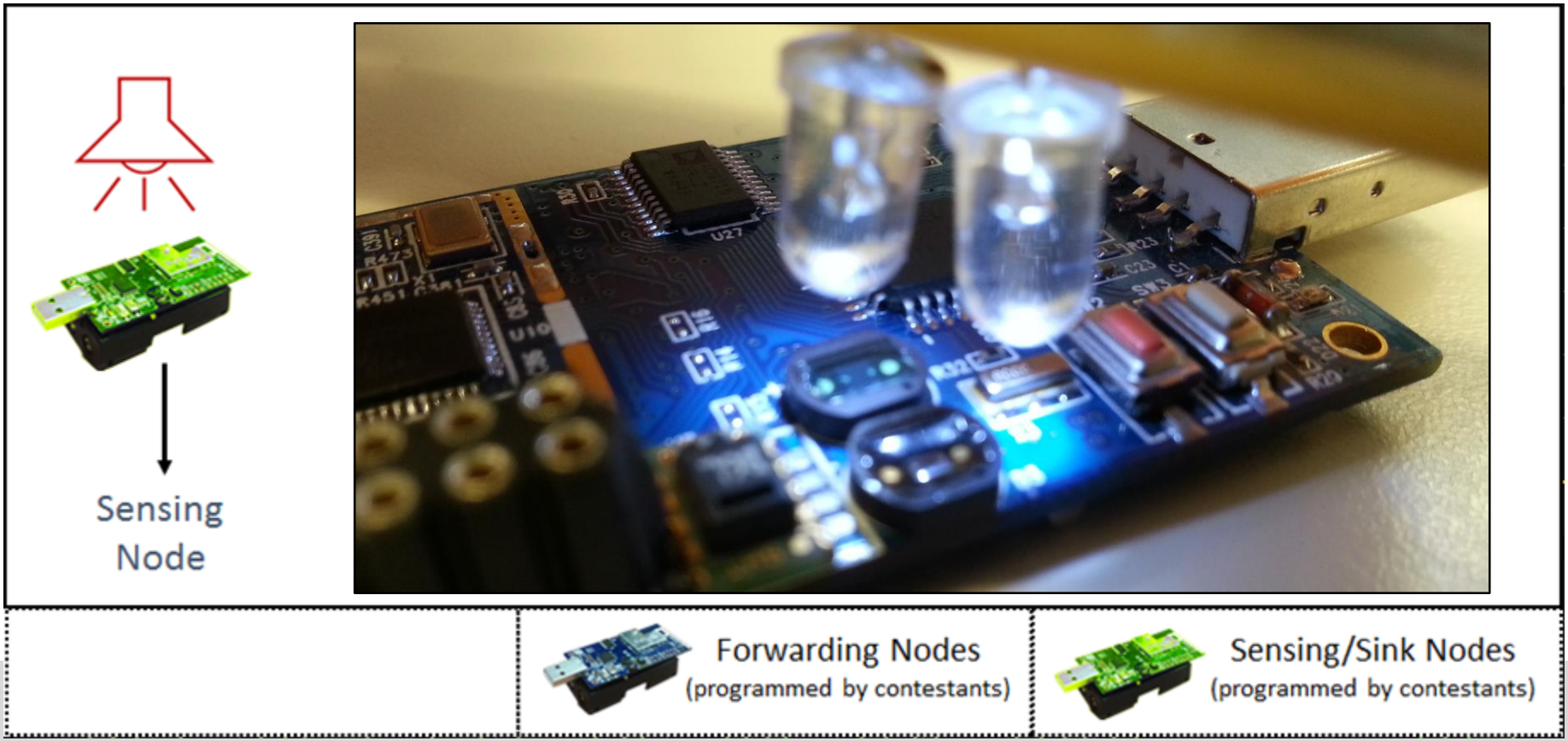
- An exciting première for EWSN
- Increasing need for dependable communication protocols for wirelessly networked embedded systems
  → That can meet the stringent dependability requirements imposed by new application domains such as smart production, smart cities, or connected cars
- A large number of network protocols and solutions proposed by academia & industry in the last decade
  → Performance rarely been benchmarked under the same settings
  → The EWSN dependability competition brings together researchers and practitioners from academia and industry to compare the performance of their solutions under the same settings

Background

- October 2015
  - 49 authors from 13 different countries have answered to the call for competitors
- February 2016
  - 11 international teams striving to provide the most dependable networking solution for wirelessly networked embedded systems operating in environments rich with radio interference
- 11 systems being evaluated
  - 40 people from 11 different countries
  - 23% from outside Europe
  - 18% from the industry

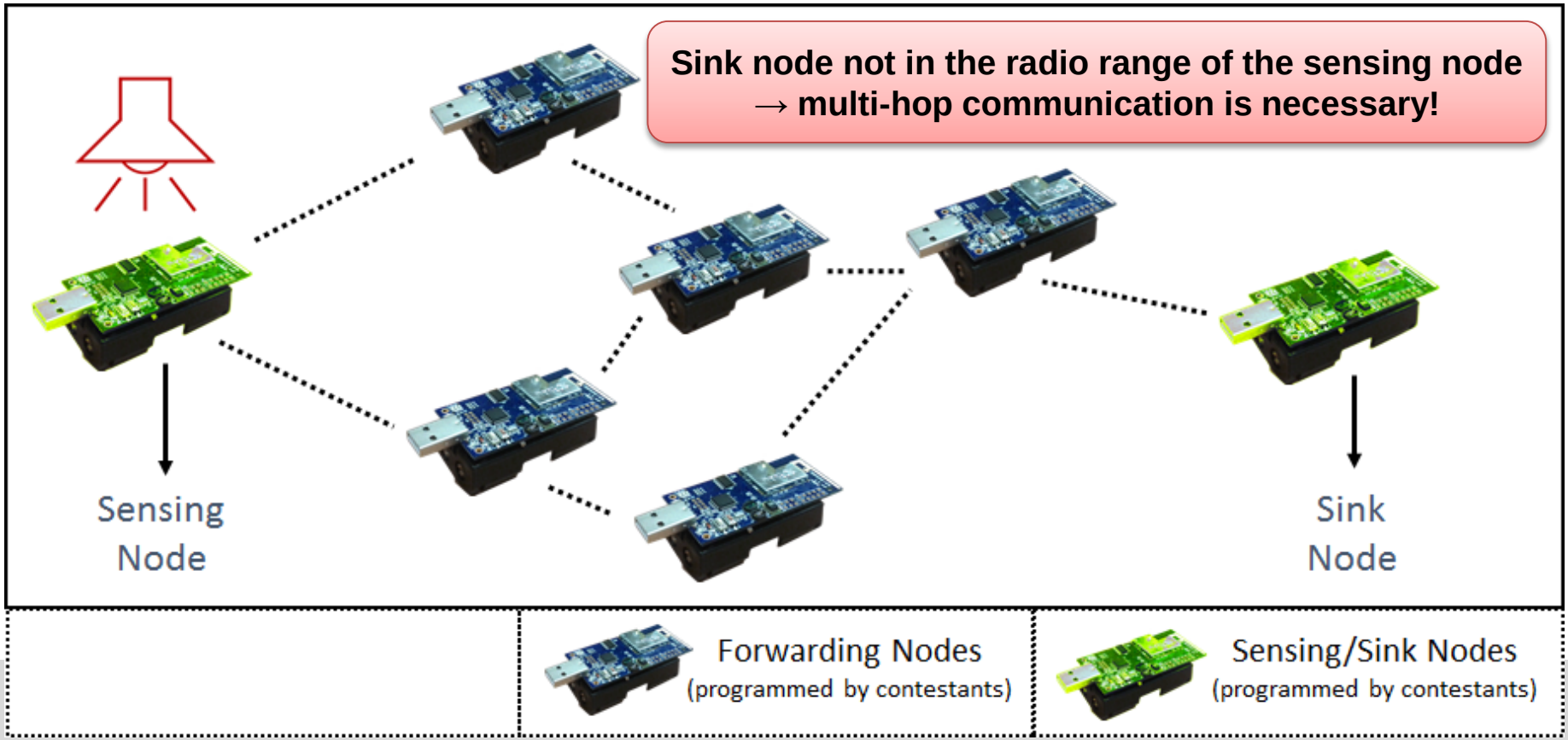
Evaluation Scenario

- Sensing node in proximity of a light source (blinking LED)
  - Continuously monitoring its brightness using light sensors



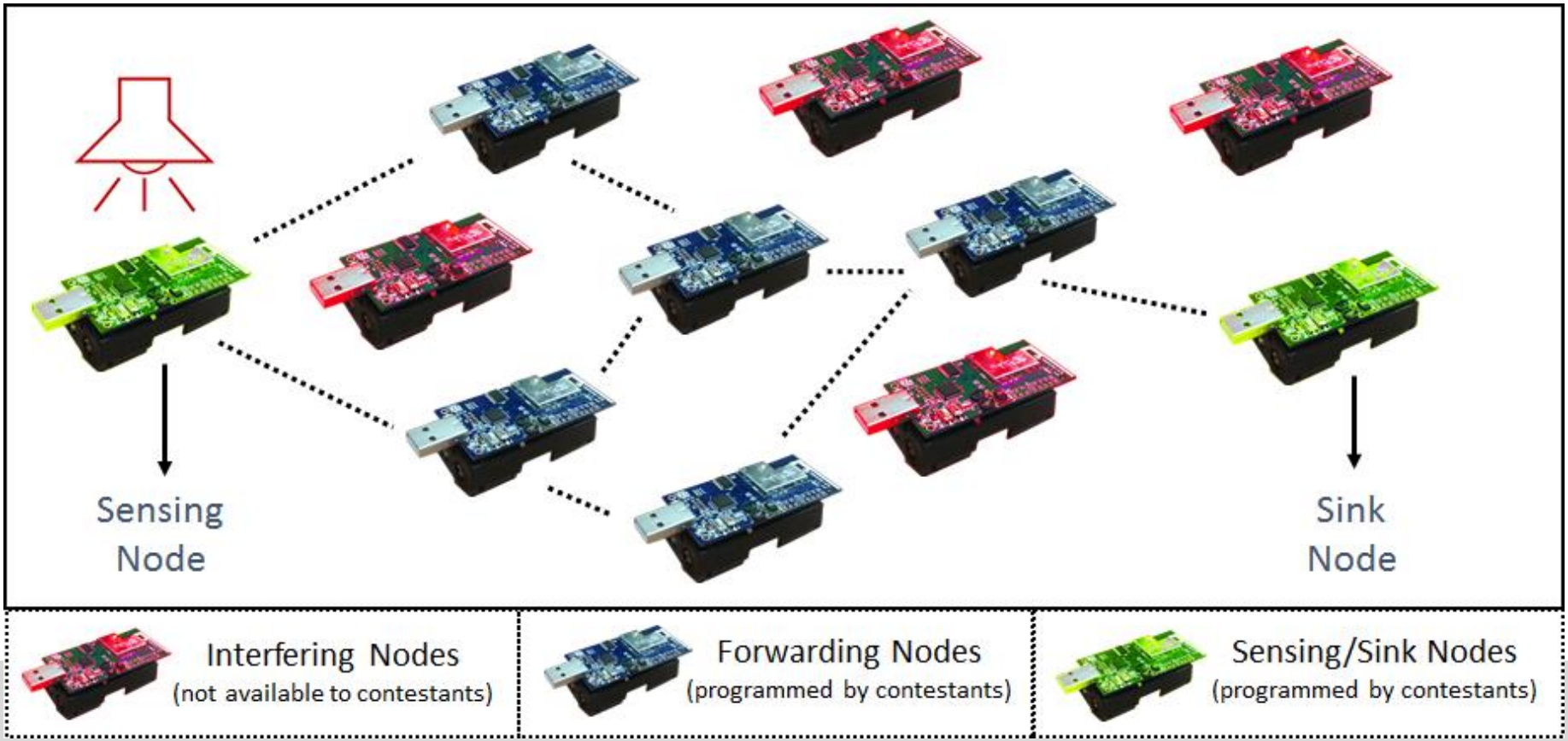
Evaluation Scenario

- Sensing node in proximity of a light source (blinking LED)
  - Continuously monitoring its brightness using light sensors
  - Changes in LED status (on/off) need to be forwarded to a sink



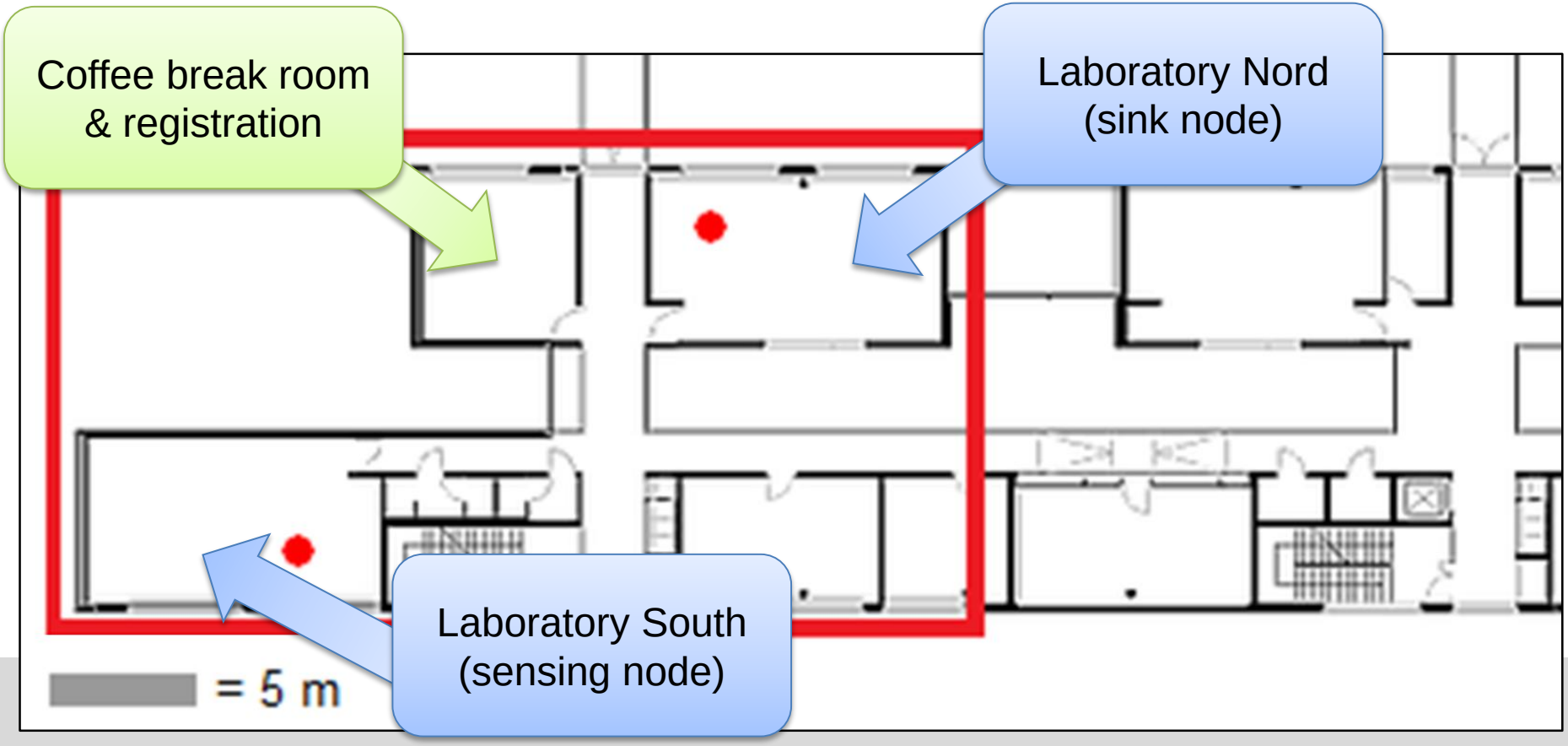
Evaluation Scenario

- RF interference will be generated in the evaluation area
  - Sensor nodes will run JamLab to ensure repeatability across experiments



Evaluation Area

- An area of about 150 m^2 on the 1st floor of Inffeldgasse 16
  - Office building (TU Graz, Institute of Technical Informatics)
  - Two large laboratories and open space (corridors)

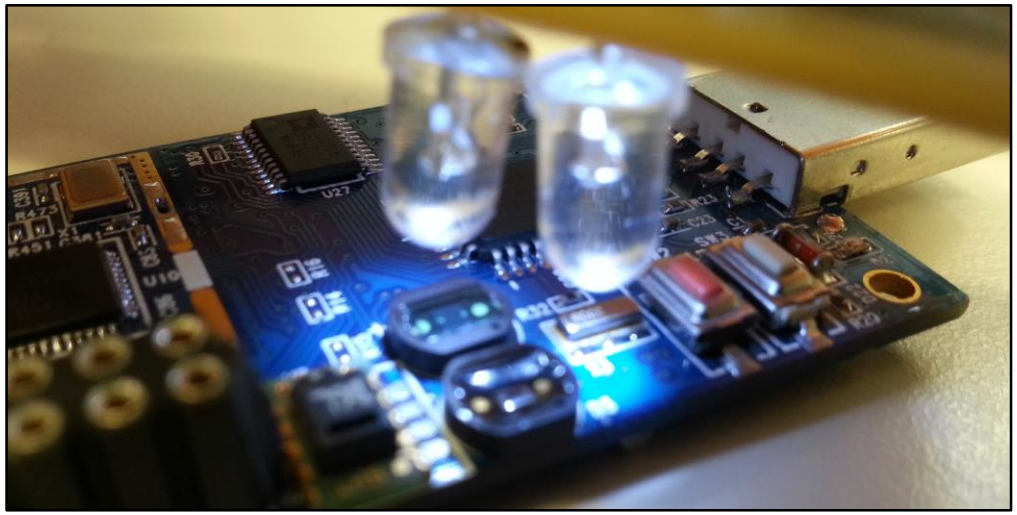


Hardware

- Wireless sensor nodes
  - Maxfor and Advanticsys replicas of TelosB / Tmote Sky nodes
  - All powered via USB and connected to a testbed infrastructure
- More than 45 nodes around
  - Mounted on ceiling, attached on walls...
  - Only a few nodes (at most 15) can be programmed by contestants
  - The other nodes will be devoted to interference generation
  - Nodes may be shuffled between preparation and evaluation days (!)

Light Source

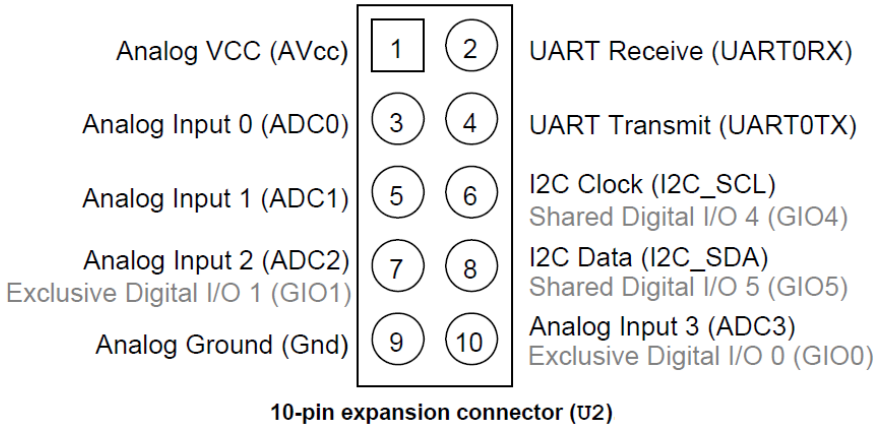
- The light source will be a blinking LED controlled by a TelosB node connected to the testbed infrastructure
  - Initial state of the LED: off
  - At least 2 seconds in between each change in LED status
  - At least 15 seconds in the beginning of an experiment before a status change

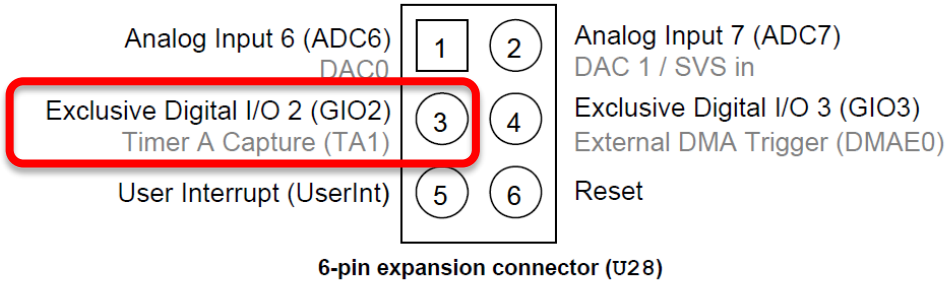


Sink Node

- A sink node will receive the information about the LED status (on/off) and trigger the GIO2 pin accordingly
  - Light on: GIO2 pin high
  - Light off: GIO2 pin low

Latency will be measured from the instant in which the LED status has changed to the one in which the GIO2 pin of the sink has changed!



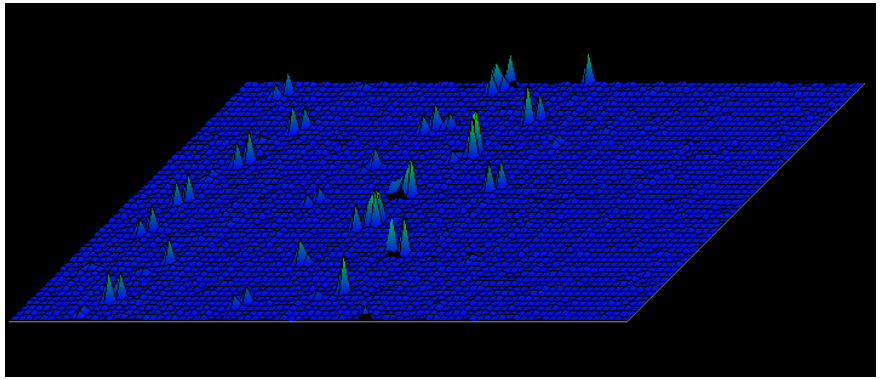


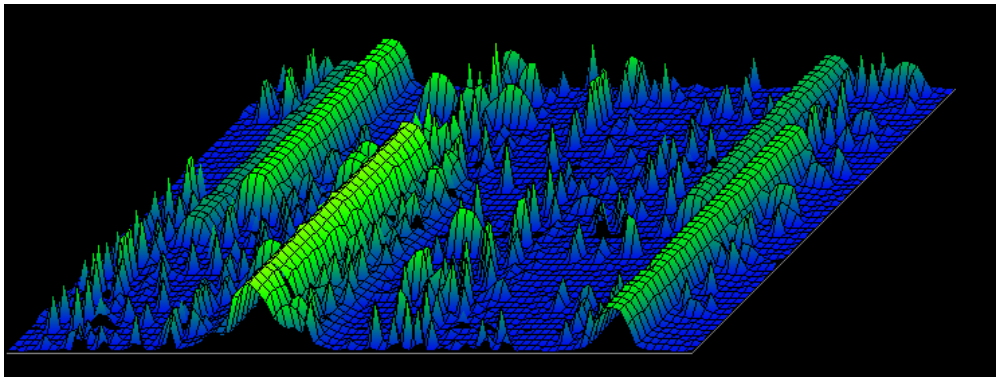
Node ID and Roles

- Two options to read the node ID
  - On-board 1 MB external flash
    - → The ID is an unsigned short (16 bits) number
    - → Example program in Contiki on how to read it from flash is available here
  - 48-bit unique ID chip (DS2411)
- Identity of sensing and sink nodes:
  - Sink node: 219 (00:12:74:00:13:b7:76:fb)
  - Sensing node: 116 (00:12:74:00:16:bf:86:a0)

Interference Generation

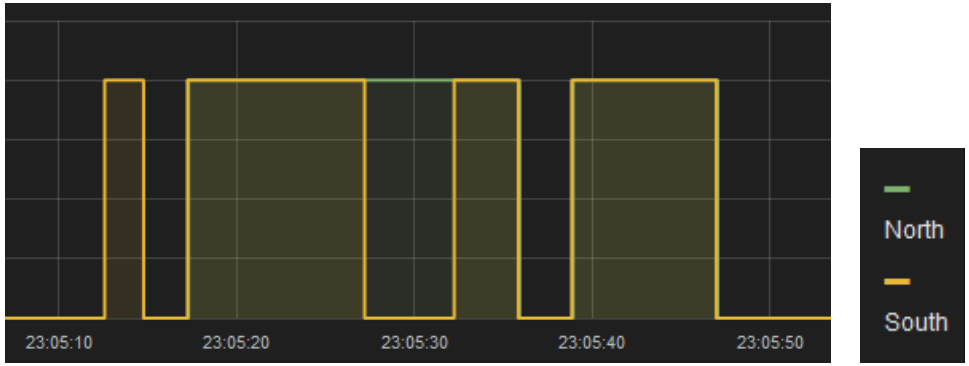
- Radio interference generated using JamLab
  - http://soda.swedish-ict.se/4110/1/boano11JamLab.pdf
  - Repeatable interference patterns similar to the one produced by common appliances (e.g., Wi-Fi devices & microwave ovens)
  - In principle, all IEEE 802.15.4 channels will be interfered
  - An example of a Contiki application running JamLab emulating a Wi-Fi video streaming can be found here

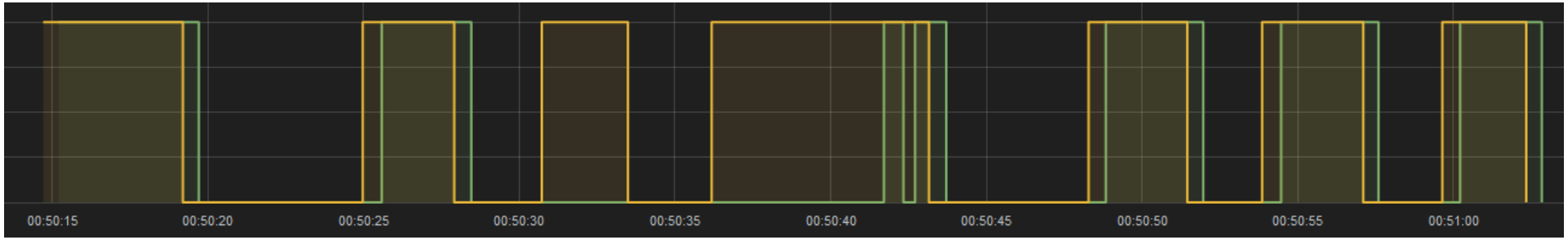




Evaluation

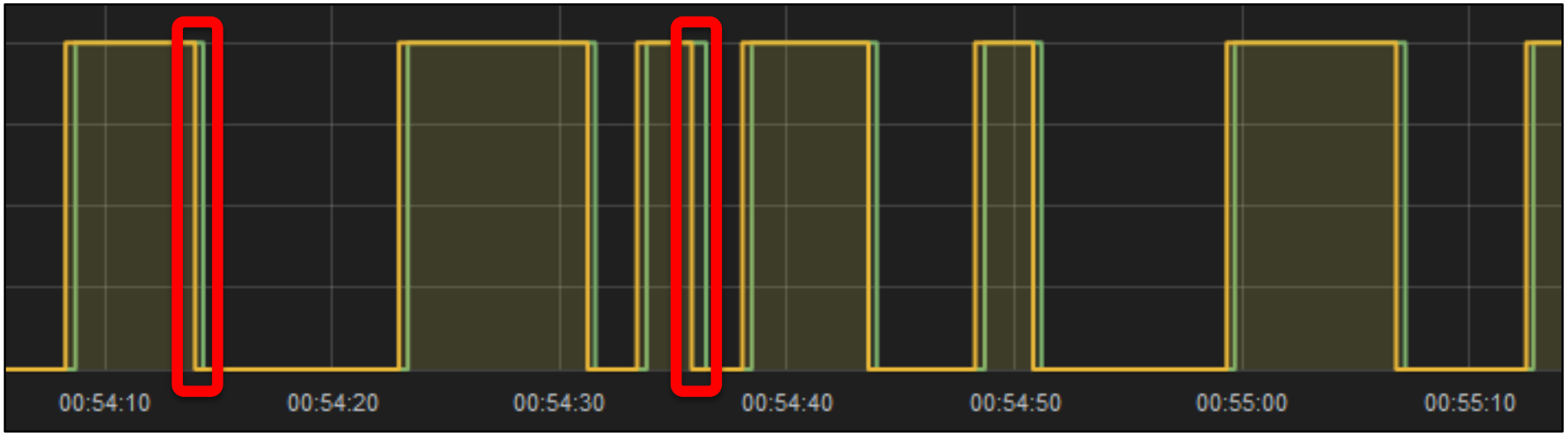
- Solutions will be evaluated according to three criteria:
  - Reliability of transmissions
    - → Number of changes in the LED status that were missed (i.e., that were not correctly reported to the sink)





Evaluation

- Solutions will be evaluated according to three criteria:
  - End-to-end latency
    - → Time necessary to communicate a change in the LED status to the sink node
    - → Measured with microseconds precision using GPS timestamps



Evaluation

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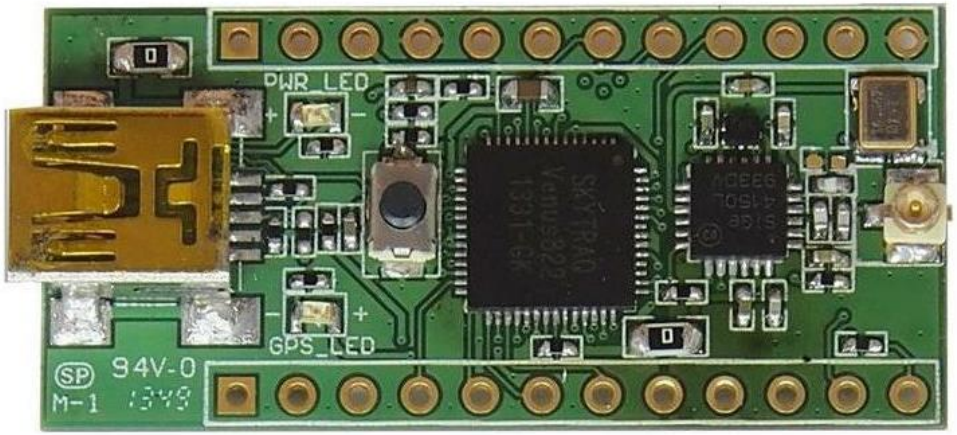
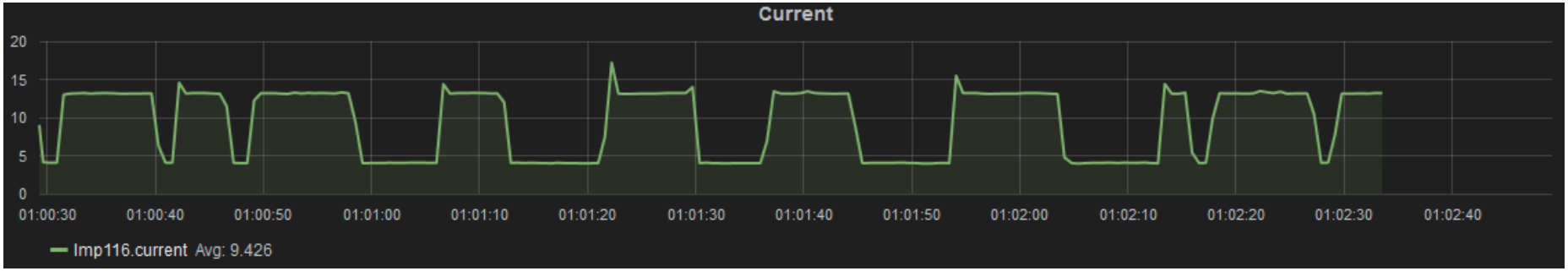
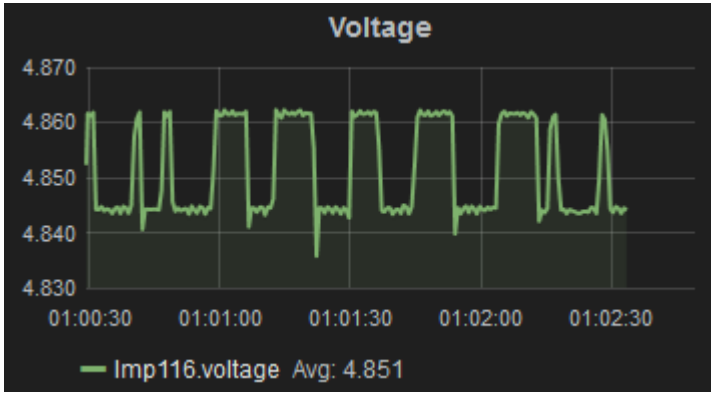
NavSpark-GL : Arduino Compatible Development Board with GPS/GLONASS
http://navspark.mybigcommerce.com/navspark-gl-arduino-compatible-development-board-with-gps-glonass/



Evaluation

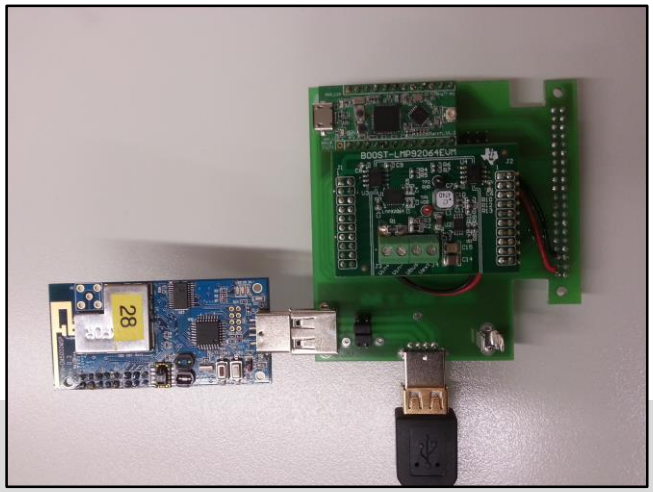
- Solutions will be evaluated according to three criteria:
  - Energy-efficiency
    - → Overall power consumed by the nodes in the network (measured in hardware)

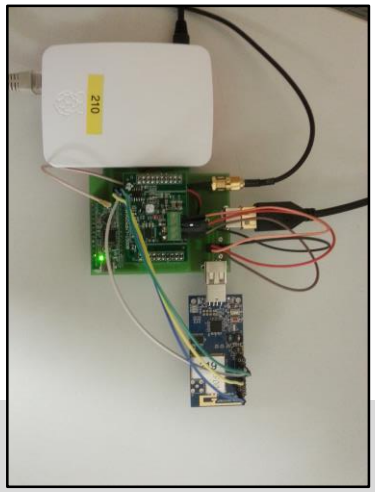


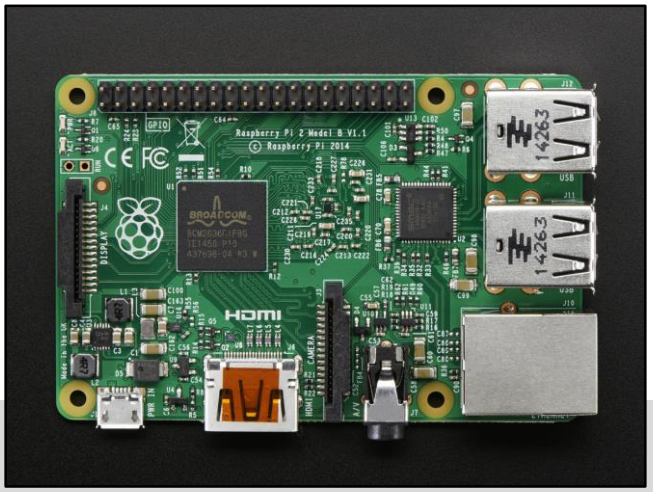


Evaluation

- Solutions will be evaluated according to three criteria:
  - Energy-efficiency
    - → Overall power consumed by the nodes in the network (measured in hardware)
- Custom boards measuring current & voltage
  - Based on a Raspberry Pi2
  - Energy measurements synchronized with the reset pin
  - Values sampled every 25 µs







Evaluation Metric

- For each criterion, a separate ranking of the solutions will be derived
  - The team with the best rankings across all three metrics wins!
- The organizers will consider the relative differences in each metric
  - In case of a tie, these will decide which solution is best
  - If there are no significant differences, the most energy-efficient solution will be preferred

Awards

- Top three teams will be awarded
  - First place: 750€
  - Second place: 500€
  - Third place: 250€
- Announcement of the results
  - During the main conference track
  - Tuesday, 16.02.2016 at 9:45
- The top 3 teams from each category will be given the opportunity to present the details of their work
  - Be ready to give a 10 min talk about your system if you end up in one of the top 3 places!

Preparation Days

- How to proceed
  - Teams have a budget of test runs on the testbed infrastructure (max 5 minutes for each run)
  - Teams receive the results (three evaluation metrics) as well as serial output from each node
  - No pre-determined schedule (testbed allocated on-demand, giving priority to teams that already had the least test runs)
- Saturday
  - No interference is generated
  - Basic test of your setup to make sure your sensing node can communicate to the sink
- Sunday
  - Full tests with different interference patterns

Preparation Days

- Online GUI
  - Contestants can check anytime the experiments online
  - All experiments are saved on a InfluxDB
  - http://fitipc190.tugraz.at:3000/

Preparation Days

- Firmware upload
  - All sensor nodes USB powered and connected to a testbed infrastructure for efficient reprogramming
  - Provide us with a single binary file to be uploaded to all nodes in the network using a common MSP430 Bootstrap Loader
  - Send this code by e-mail to cboano@tugraz.at
  - We will upload this software on the testbed
- FTDI / serial output enabled
- Sunday: teams will know each other's results
  - Results and current "classification" will be available to other contestants during the preparation

Final Evaluation

- 55 minutes timeslots for each team (see official schedule)
  - 10 minutes preparation and testbed reprogramming
  - 35 minutes evaluation run
  - 10 minutes to gather results
  - Teams should come to the evaluation area 10 minutes prior to the timeslot and return to the main venue (where the workshops take place) after their timeslot
- Firmware upload
  - Send the final code to be used for the evaluation by e-mail to cboano@tugraz.at by Sunday 14.02.2016, 23:59 CET
  - Provide us with a single binary file to be uploaded to all nodes in the network using a common MSP430 Bootstrap Loader
- FTDI / serial output will be disabled

Final Evaluation

- To ensure repeatable experiments, the surrounding Wi-Fi access points will be disabled
  - Wi-Fi will still work, but it will only use the 5 GHz band
  - Operations on the 2.4 GHz band will be disabled from 8:00 to 20:00 on Monday, 15.02.2016
  - During the preparation days, Wi-Fi will still be active in order to allow all contestants to surf the Internet
  - We will monitor the interference levels during the evaluation to make sure there is no suspicious activity

Misbehaviours will be Punished!

- Any contestant caught generating deliberate radio interference during the evaluation on Monday will be immediately disqualified!
- Any contestant caught attaching own equipment to or manipulating the testbed will also be disqualified!
- In case significantly more LED status change events then expected are generated, the team may be disqualified for cheating (i.e., randomly activating the sink's GPIO pin)

Questions?

Good luck to all contestants!

&

Happy coding!!!