

Introduction to the Internet of Things

Session 01

Ulrich Norbistrath

“Vernetzte Dinge”?

A case for English

pro

- You will need this at work
- You will need this in a lot of courses
- Literature and material is English anyway
- It would be Denglish
- I have more experience teaching in English
- There will be international followers of the class (and you might meet them later in class)
- It's more hip
- You can still talk to me in German

con

- You don't feel comfortable.
- You want me to be formal and say “Sie” to you

whoami

- <http://ulno.net>, Ulrich Norbistrath
email: replace http:// with ulno@
- **Adjunct Professor**
 - FH Upper Austria
 - (George Mason University)
- **Inventor/Maker/Artist**
- **Independent IoT Consultant**
- **PhD** from RWTH Aachen University:
“Configuring eHome Systems”
- **Research:** Internet of Things, Story Driven Modeling,
search support
- **Teaching:** H&B Automation, SE, Systems
- **International teaching and research experience:**
USA, Germany, Austria, Estonia, Kazakhstan,
Singapore, Indonesia, Brazil



Who are U?

- Write down (needs to be submitted later):
 - What type of programming experience?
 - What have you done with micro controllers, which ones have you used? (Like Arduino, ESP8266, Particle/Photon)
 - Which single board computers do you know/have you used (Raspberry Pi, Orange Pi, Beaglebone, Labrador)?
 - Who is a maker or part of a maker community? What do you like, would you like about it? How could it relate to this class?
 - What do you already know about IoT?
 - What are your expectations from this class?

Outline Today

- Introduction
- Syllabus + Course Logistics
- What is the Internet of Things
- Quick lab outline
- Toys presentation

Summary, Syllabus (<http://bit.ly/2yBGY8I>)

- Definition: Internet of Things
- Sensors
- Actors
- Connected systems
- Frameworks
- Designing and Building IoT Systems
- Data collection and Visualization
- Industrial Opportunities
- Scenarios, Stories, and Pitches

Learning Objectives

- Define and critically reflect on the term “Internet of Things” as well as align and position Internet Of Things technology in comparison to cloud and mobile computing
- Equip most physical objects with networked sensors
- Equip and interact with most physical objects with actors
- Write code to set-up systems to collect, visualize, analyze, and act on data from the physical world
- Design and implement various IoT systems made up of sensors, wireless network connection, and actuators
- Build and test a complete working IoT system as well as design and implement respective simulator components to speed up testing
- Present and defend the design and implementation of several Internet Of Things Systems in a portfolio and public presentations

Grading

- 30% Projects
- 10% Research reports
- 50% Portfolio
- 10% Extra activities (must be documented in portfolio and provable for me → need to be part of that chat/forum)
 - Helping others
 - Chat activity
 - Documentation effort
 - Extraordinary solutions
 - Support and fixes for related open source projects
 - Filing issues

Class logistics

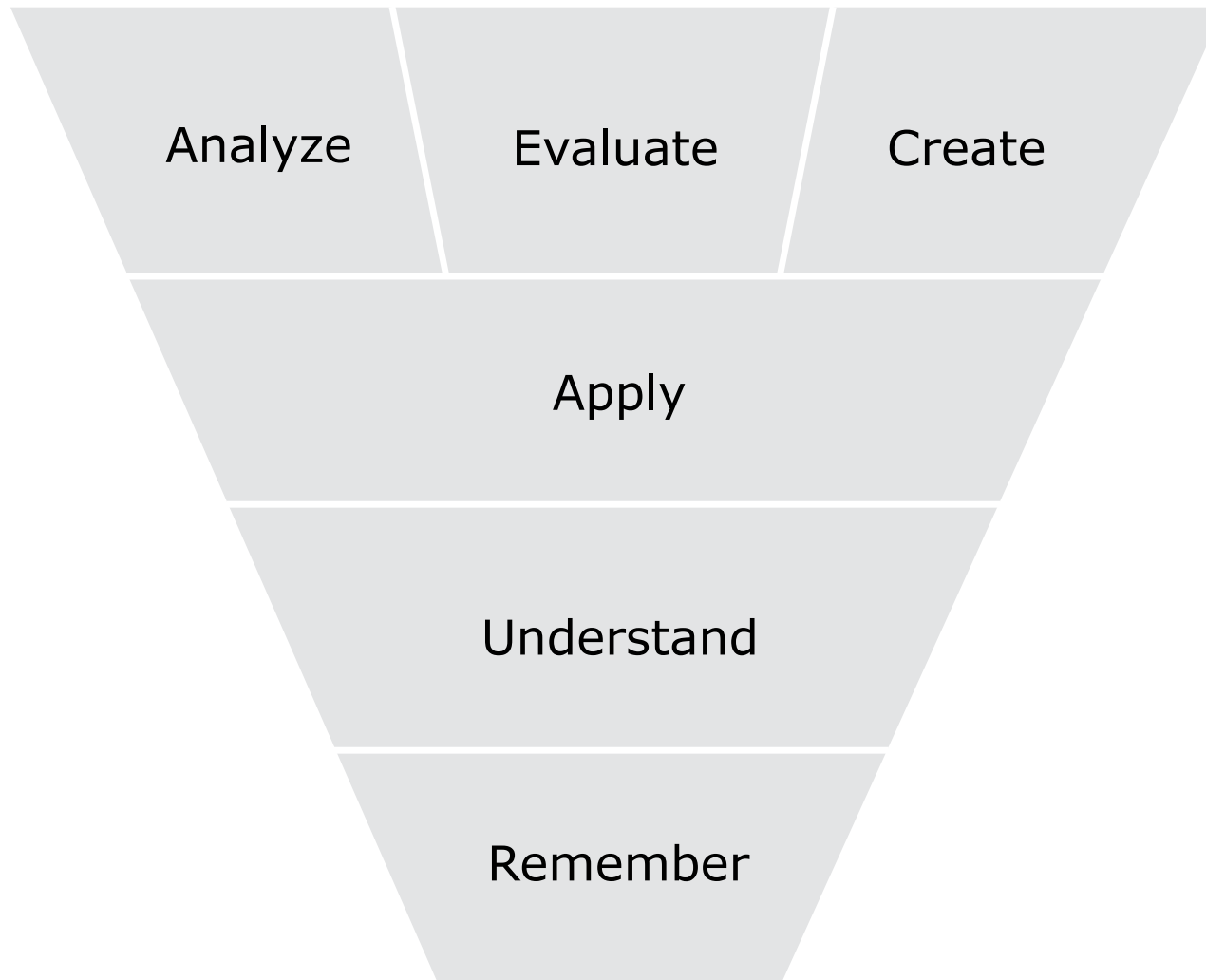
- Login to matrix chat room IoTempower (use for example Riot Web or mobile Riot client) - subscribe to #iotempower:matrix.org or respective Facebook group
- Use Any chat system for private class-related discussions and invite me (riot, whatsapp, facebook. discord, gitter, ... NOT slack)
- Create git repository (one for a team – 2 persons), give me read-access
 - Everything goes in there (eventually shared repo for team later or mutual remotes, so plan your subfolders accordingly)
 - In lab, add everything from class.
 - Text and documentation only as Restructured Text or Markdown.
 - On Moodle, post links to git repo
 - This whole git-repo will be your portfolio.
 - No binaries (maybe some pictures you took or drew) in the git folder!

I don't lecture!

But this is a lecture...

- ... and you are lecturing right now!
- OK, sometimes, but ...
- How do you learn best?
- You know Bloom's Taxonomy of Learning?

Blooms Taxonomy of Learning

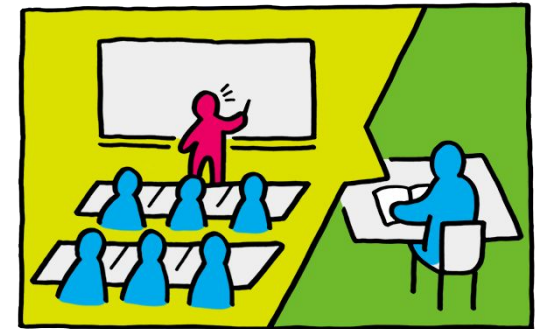


What does this mean?

- Lecture → flipped class room
- Self study, video material, online classes
- Teacher: more guide and coach than subject matter expert
- Interdisciplinary focus
- Team and social skills

The **Traditional** Model

Knowledge **Acquisition**

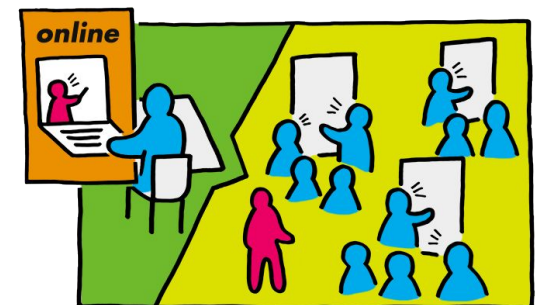


Knowledge **Construction**

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The **Flipped** Model

Knowledge **Acquisition**



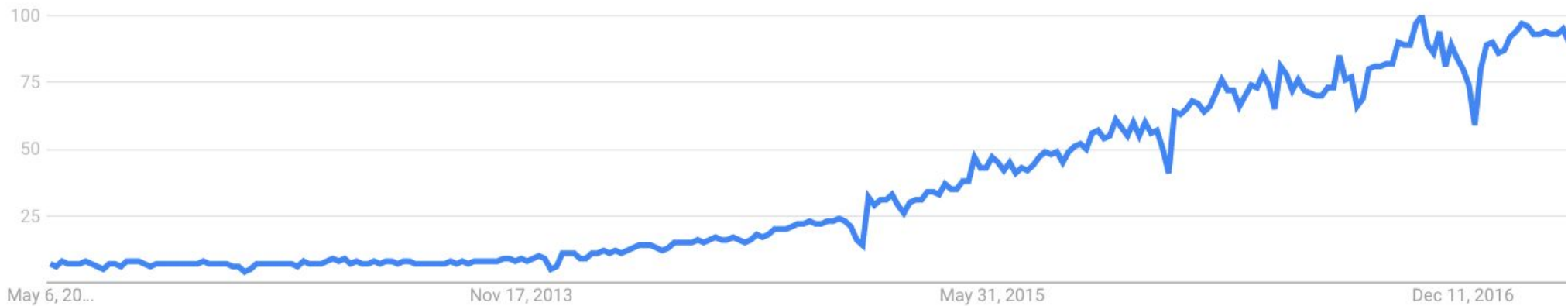
Knowledge **Construction**

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IoT Trendy?

IoT - Google Webtrends

Interest over time ?



Personal statistic: >20 talks: IoT and Making since 2015,
5 classes, several small workshops since 2014

IoT

- What does the Internet of Things entail?
- Use laptop to google about IoT, find and note down including small description (add to research record):
 - 3 domains (included areas)
 - 2 commonly used (data) protocols
 - 2 typical devices (appliance or controller)
- 10 minutes time
- 5 minutes: compare notes with neighbor/ combine results

TIA IoT Introduction

<https://www.youtube.com/watch?v=jJaWMWz6RpE>

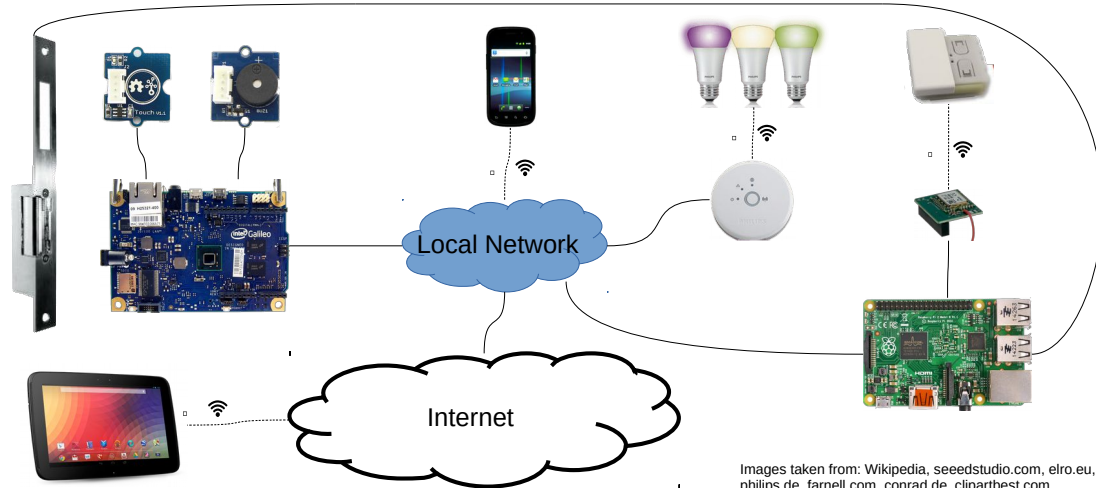
- Extend your domain and appliance/devices list, by 2 you didn't have yet
- What are the benefits of IoT? (record at least 4)
- What are the challenges? (record at least 4)
- Groups of 3-4: re-combine results and add explanations
- Add to your personal participation record, specify with whom you worked
- Extend further at home and transfer to portfolio

Internet of Things (IoT)

• IoT Domains

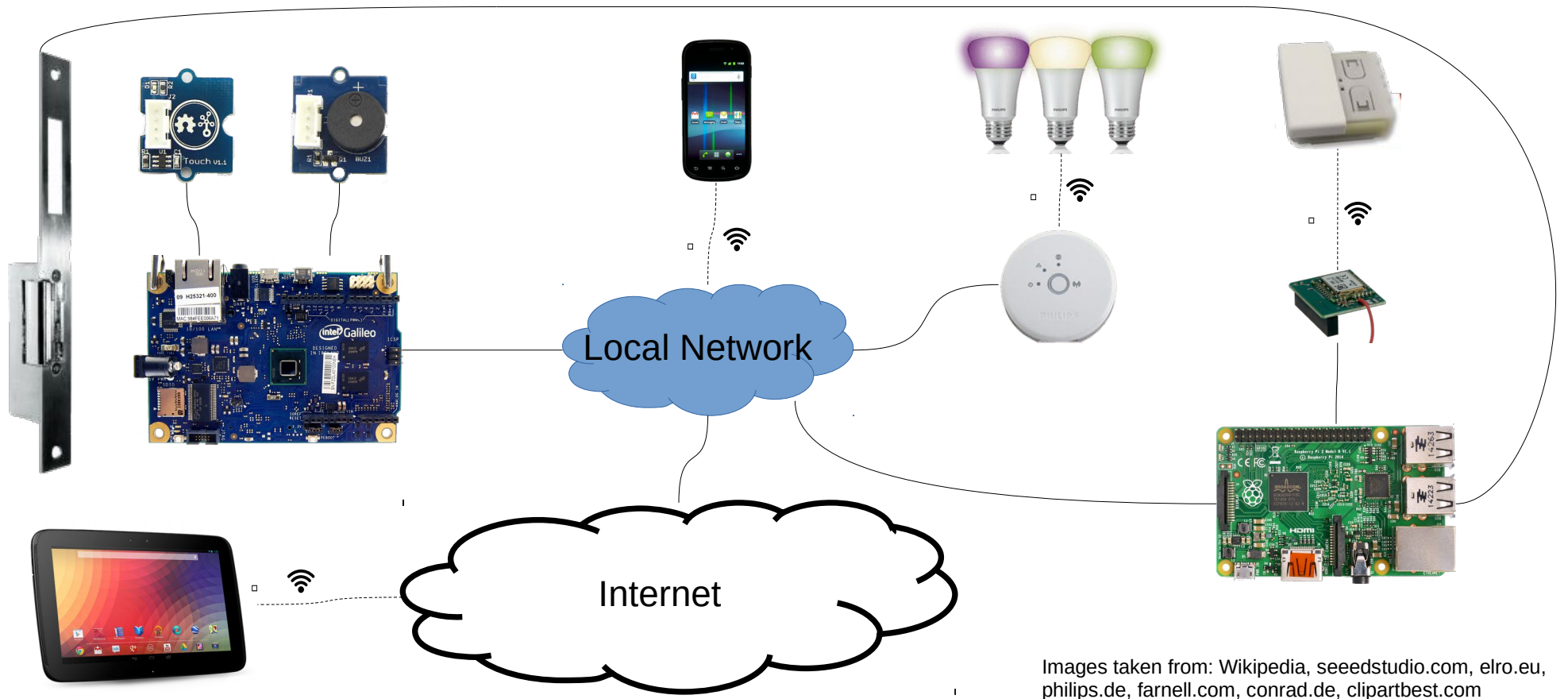
- Ubiquitous Computing (Pervasive Computing)
- Home automation
- Urban Computing/Smart Cities
- Embedded Computing
- Actor/Sensor Networks
- M2M Communication
- Mobile Computing, Wearable Computing
- (Hacking/Making)
- Big/Actionable Data
- **Systems, Connectivity, Data**

• Devices and controllers



Example IoT System

Smart Door Bell



Images taken from: Wikipedia, seedstudio.com, elro.eu, philips.de, farnell.com, conrad.de, clipartbest.com

Lab Outline

- Setup Raspberry Pi iot gateway based on IoTempower image
- [Setup key and ssh into it or use web access]
- Learn to blink an (if exists the onboard) LED on ESP8266 with Arduino IDE
- Login to WiFi of iot gateway from ESP8266
- Switch on/off blinking remotely.
- Program second esp8266, connect to same network, connect button, use button to switch on/off the blinking on other ESP8266
- Work in pairs.
- Document everything also (especially) failures → in portfolio git folder, “just” link to shared work, after lecture, re-visit at home and reflect on lecture and lab (train your memory AND critical thinking skill)

Toys

- (some of the) hardware we use in class
 - Raspberry Pi 3
 - Sunfounder raspberry pi sensor kit
- (task → research report) Pick and list 3 devices/nodes that immediately spark interest (and why)