

# DECENTRALISED GREEN MICRO DC

ICT 2015 Bristol, Dr. Jens Struckmeier, Stefan Schlott,  
Cloud&Heat Technologies GmbH

**CLOUD&HEAT**  
THE CLOUD THAT HEATS HOMES WORLDWIDE

# DECENTRALIZED GREEN MICRO DATA CENTER



# COMPUTATIONAL POWER GENERATES HEAT

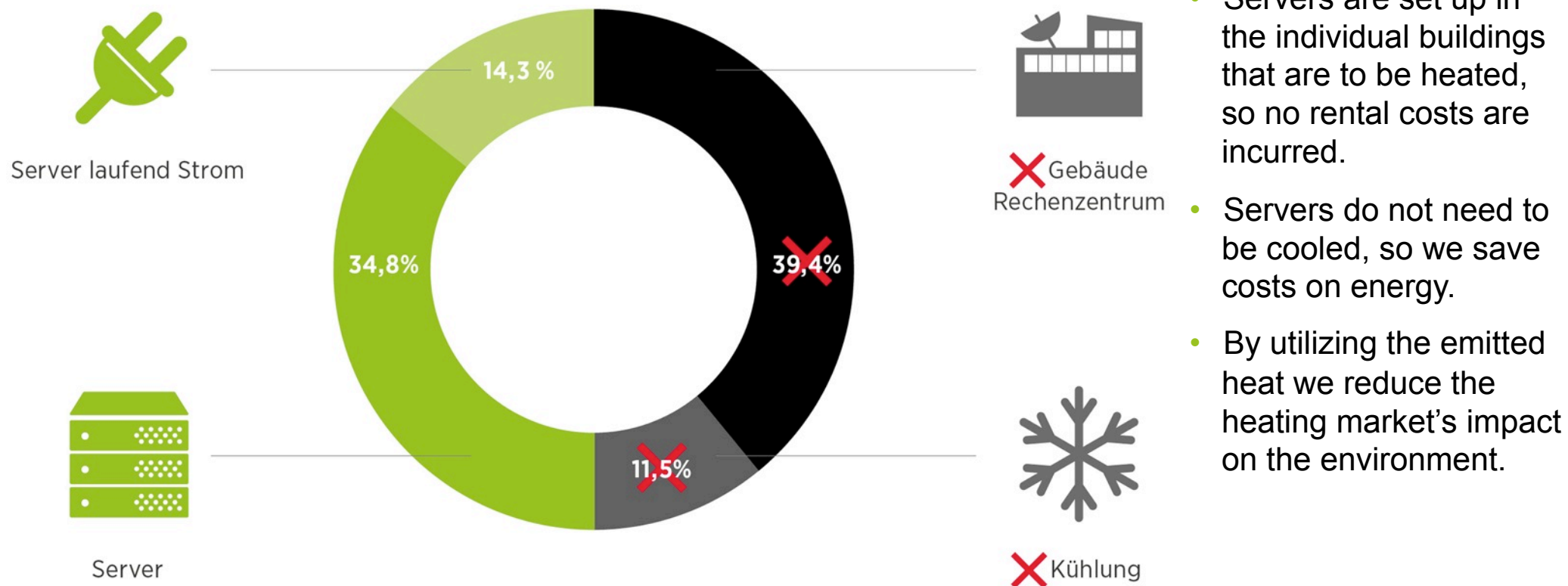
## Two markets

- Classic computer centers must expend additional energy to cool their servers.
- Instead of that, we harness the emitted heat to heat buildings and water.
- In doing this, we are uniting the classic heating market with the cloud computing market for the first time.
- We offer an efficient green tech alternative for both markets.



# ADVANTAGE OF DECENTRALIZED DC

## computing services and a sustainable heating system



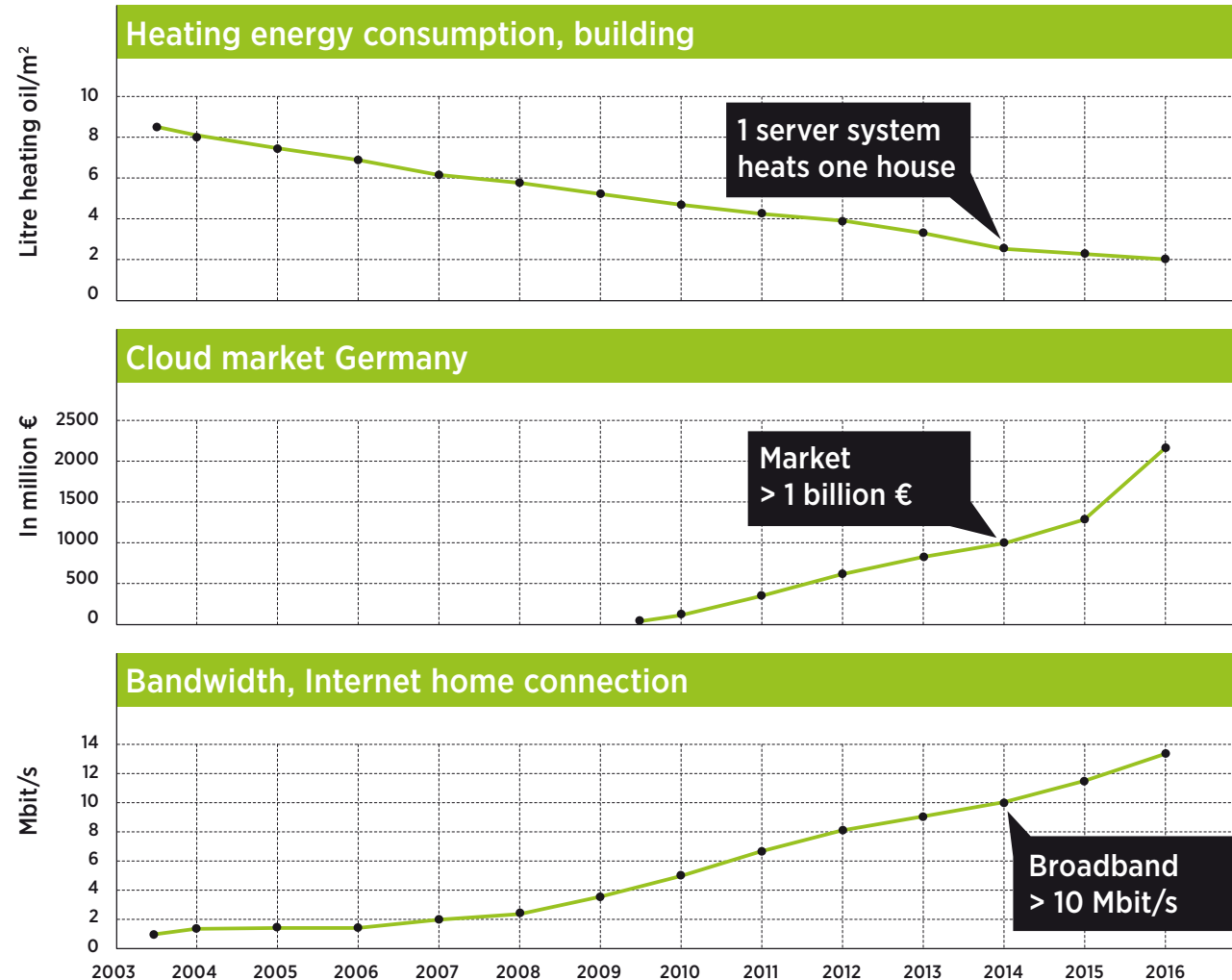
The Datacenter as a Computer: An Introduction to the Design of Warehouse-Scale Machines,  
Second Edition Luiz André Barroso, Jimmy Clidaras, Urs Hölzle



ENERGY EFFICIENT  
HOUSES ARE THE BASIS  
FOR CLOUD&HEAT

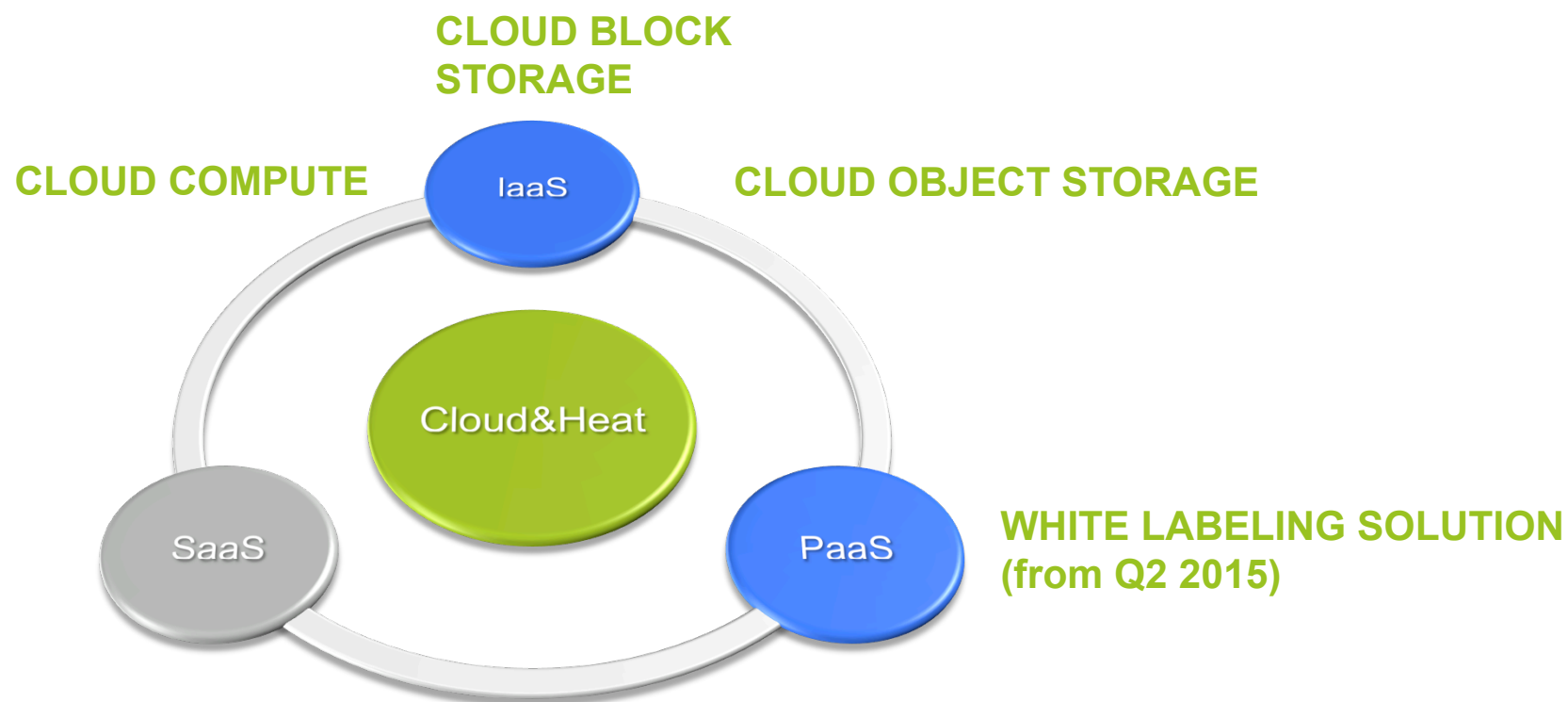
WIDESPREAD  
ACCEPTANCE OF  
CLOUD SOLUTIONS

BLANKET AVAILABILITY  
OF HIGH BANDWIDTH  
ENABLES DECENTRA-  
LISED DISTRIBUTION



# OPEN STACK BASED CLOUD

## High Performance and Scalable\*



\* IaaS Produkts are based on open source OpenStack, compatible to Amazon Web Services (AWS)

# CHALLENGES



- **MONITORING & SERVICE:**  
Centralized monitoring required (based on check\_MK)  
Redundancy for low frequency of service



- **HEAT & LOAD MANAGEMENT:**  
Managing heat demand with computational demand



- **SECURITY:**  
Increased security requirements to the rack enclosure

# ADVANTAGES

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## SECURE

Server locations in Germany only



## LOW COST

You pay only for what you use



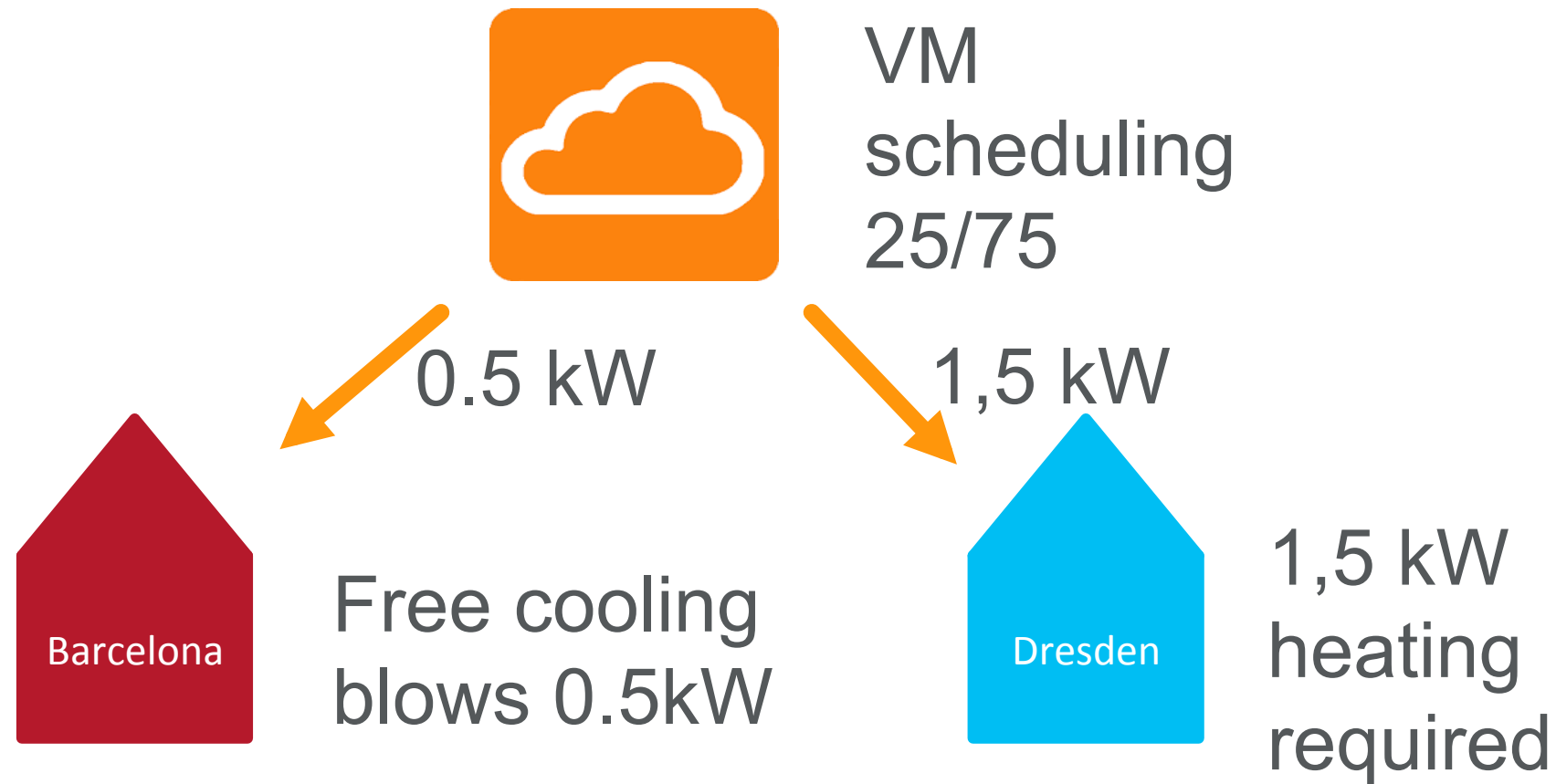
## HIGH AVAILABILITY

Failsafe applications with 99,9% availability



## FLEXIBLE & FAST

Full performance, individually configured



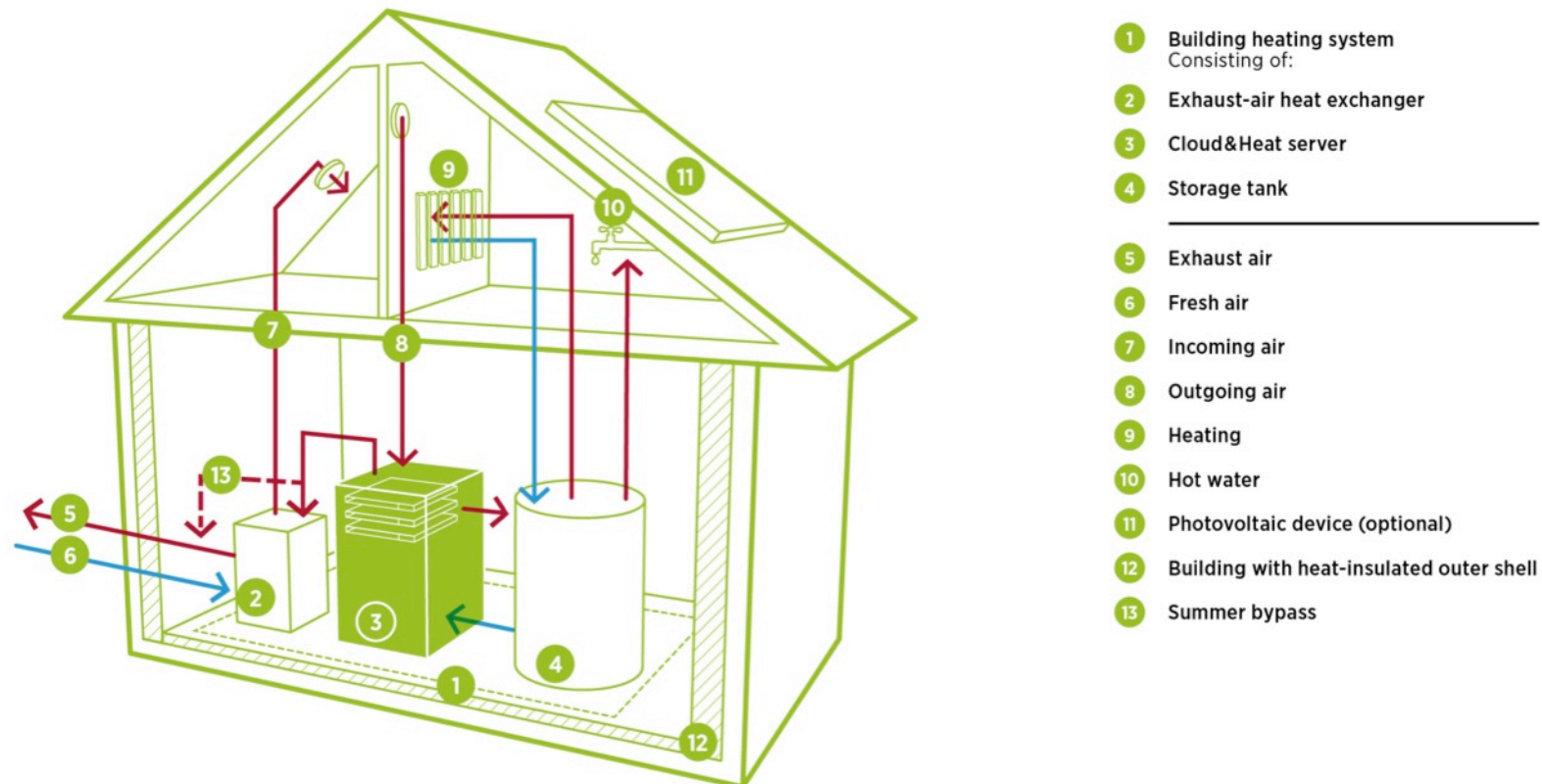
# DATASAFE

- **SECURE FIRE PROOF SERVER CABINET:** secure enclosure for data center security on single rack level
- **DIRECTLY AIR & WATER COOLED:** low energy passive cooling components enabling low PUE (typically 1.04)
- **ECOLOGICALLY SUSTAINABLE:** The heating system from Cloud&Heat transforms the heat emitted by servers into heating energy. The electricity supply for operating the servers is provided exclusively by renewable energy sources.
- **ECONOMIC BENEFITS:** The supply of energy and the maintenance and servicing for a guaranteed minimum running time are free of charge for the user. The acquisition costs are comparable to alternative heating systems.



# HEATING WITH CLOUD&HEAT

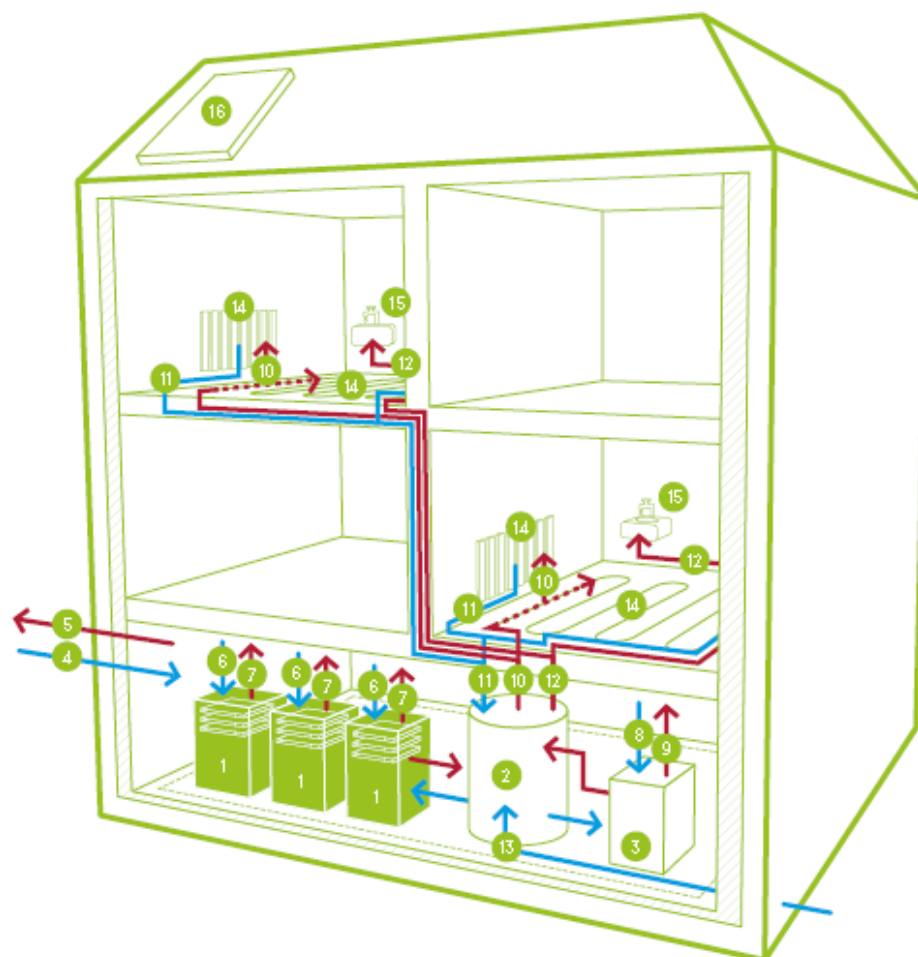
## How it works in a single-family home



Main functionality: A secure, fireproof cabinet is equipped with servers and set up in the building to be heated. The heat generated during computer operation is fed to a buffer storage, which supplies the water heating circulation system and heats the drinking water.

# HEATING WITH CLOUD&HEAT

How it works in a multi-family dwelling



\*\*according to directions „DVGW-Worksheet W 551“

- 1 Cloud&Heat server
- 2 Buffer storage for radiators + water heating
- 3 Air/water heat pump
- 4 Incoming air system\*
- 5 Exhaust air system\*
- 6 Incoming air, Cloud&Heat server
- 7 Outgoing air, Cloud&Heat server
- 8 Incoming air, heat pump
- 9 Outgoing air, heat pump
- 10 Radiator feed
- 11 Radiator return flow
- 12 Hot water\*\*
- 13 Incoming fresh water
- 14 Heating system
- 15 Hot water tap locations
- 16 Photovoltaic device (optional)

\*Note: Also possible to construct with controlled ventilation of living space with heat generation or e.g. underground car park ventilation



**Object Wallotstraße Dresden:** Heating power 165kW, providing basic load for warm water and heating for 56 housing units



# QUO VADIS? IN THE NEXT DECADE



Cooling Towers at Google's Data Center in The Dalles, Oregon





A central cooling plant in Google's Douglas County, Georgia data center. *Photo: Google/Connie Zhou*

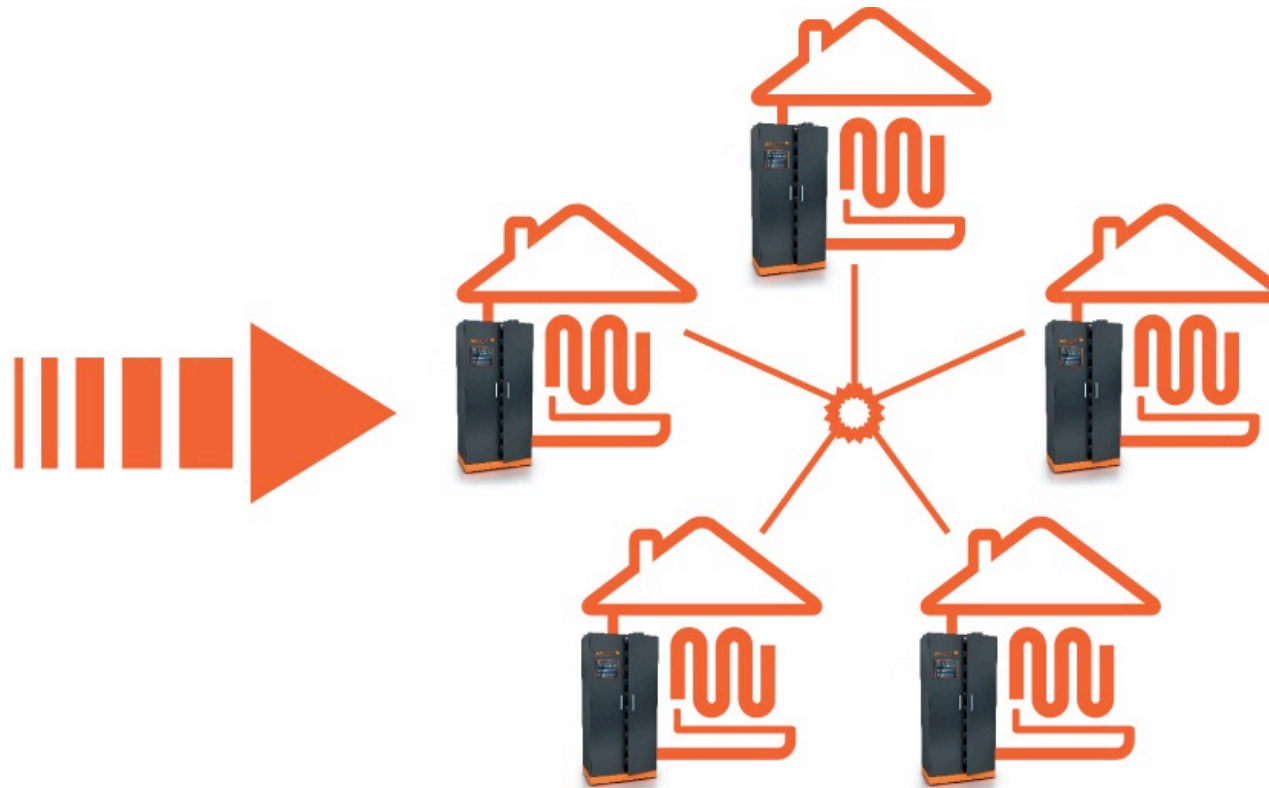


„...data centres ...consume more than 3% of US electricity, and approximately 1.5% to 2% of global electricity, growing at a rate of approximately 12% annually.“\*



\*Greenpeace International 4/2011: How Dirty is your Data?

\*\*Borderstep I., Hintemann, R. & Fichter, K. (2013). Server und Rechenzentren in D. im Jahr 2012



**PUE << 1.06 !**

# QUO VADIS?

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## Via Della Conciliazione

2005/4/4



Source: <http://www.spiegel.de/panorama/bild-389031-473266.html>

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# Gaming: They were the first to recognize



© Prof. Fettweis

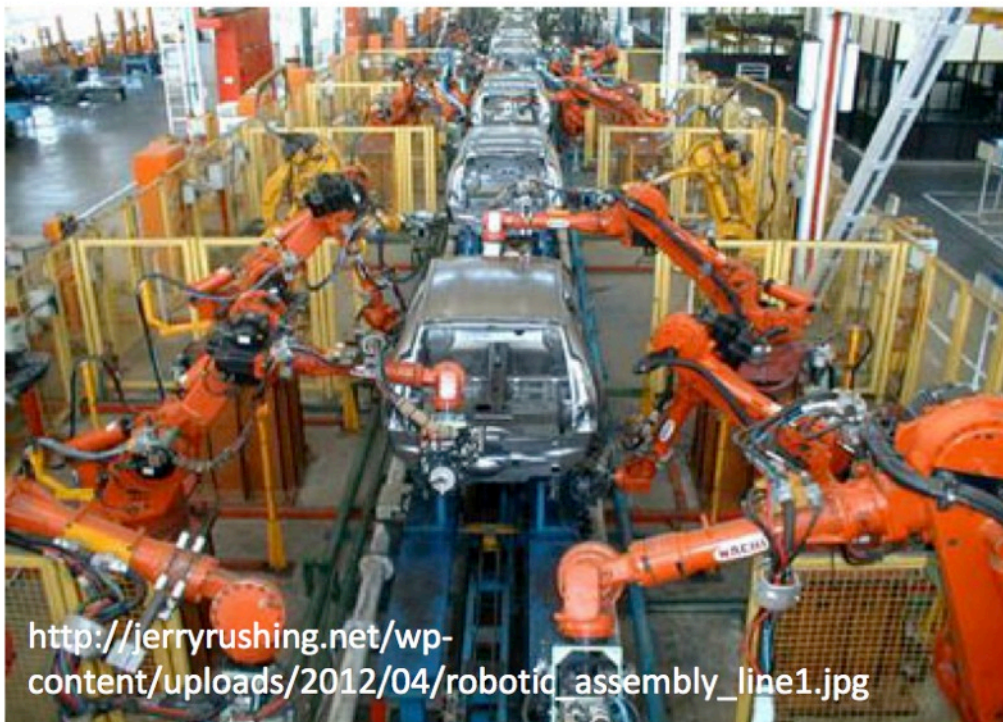
THE CLOUD THAT HEATS HOMES WORLDWIDE

Decentralized Multiple Green Micro Datacenter// Cebit 2015



# The Tactile Internet

## The Manufacturing Revolution Ahead



© Prof. Fettweis

# Platooning



1-2 ms examples of today's cars: ESC, ABS



Tomorrow: platooned ESC & ABS





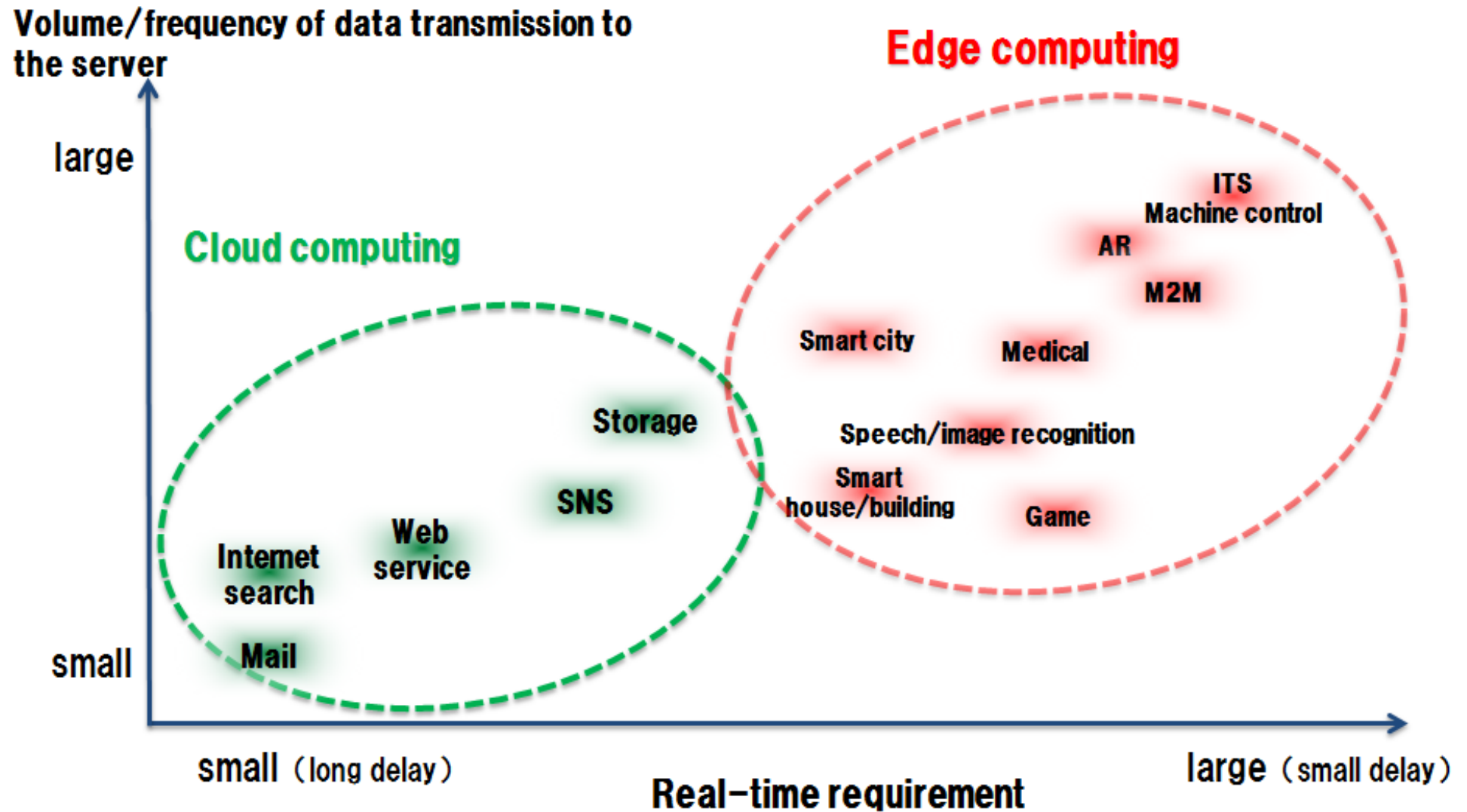
## Tactile Internet Killer App: Free Viewpoint Video



© Prof. Fettweis

# OUTLOOK EDGE COMPUTING

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© NTT, Japan



REAL TIME for these apps = **1ms** response time!

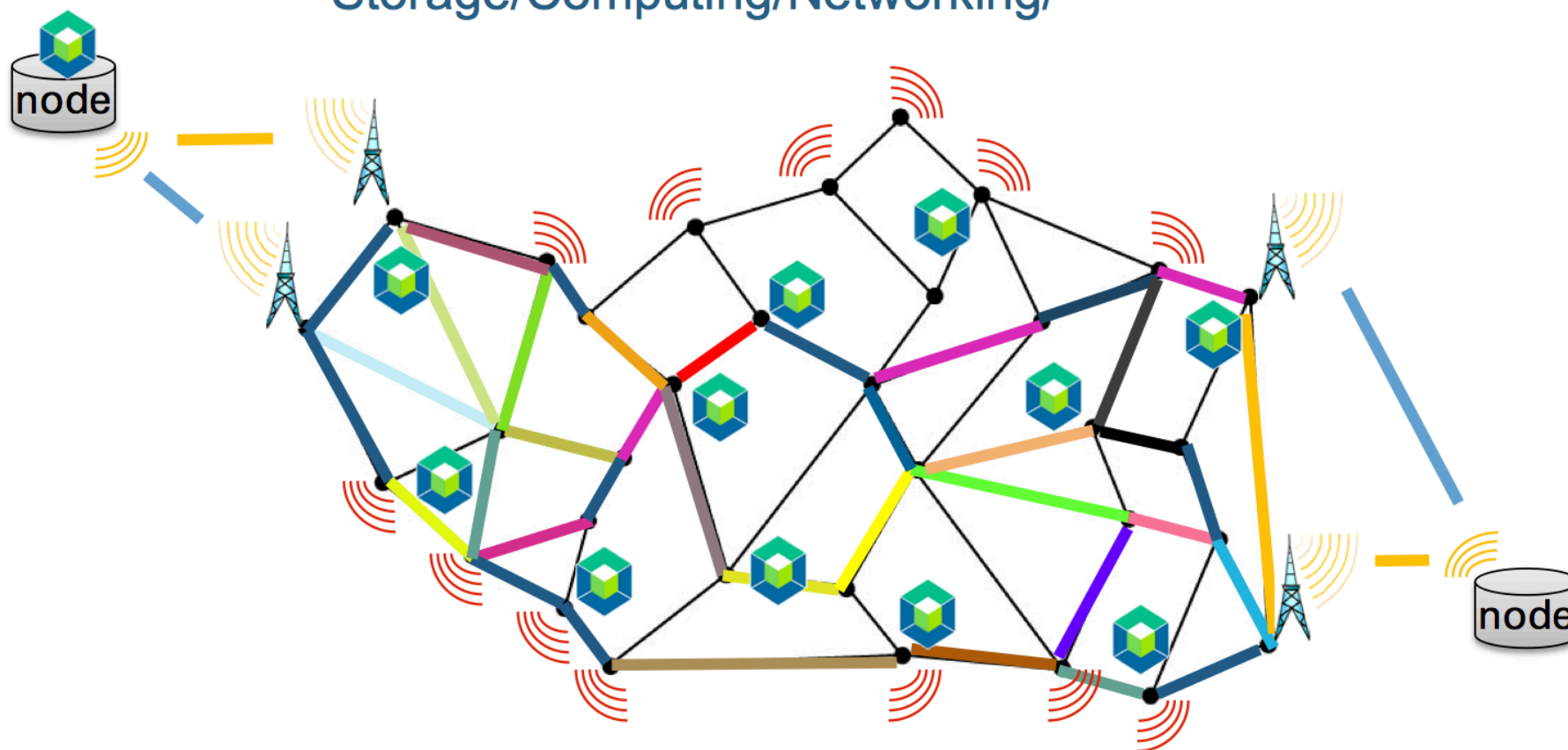
LIMITING FACTOR: **SPEED OF LIGHT**: 299.792km/s



# OUTLOOK GREEN EDGE CLOUD / FOG CLOUD

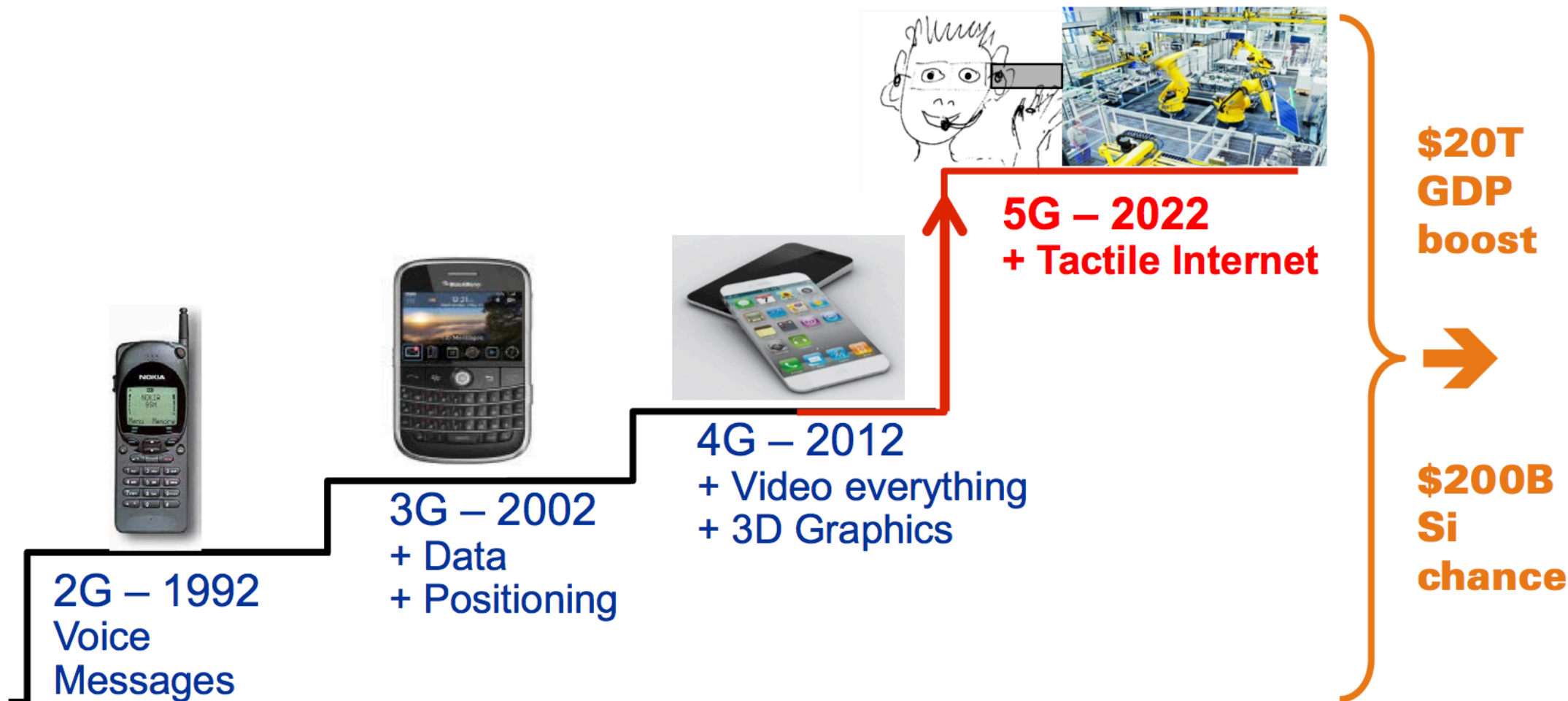


**Revolution → Distributed Everything**  
Storage/Computing/Networking/



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# Cellular Roadmap of USPs



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# RESEARCH PROJECTS

- **LEADS (Big Data Analysis):**

Industrial partner i.a.: RED HAT, ADIDAS



SPONSORED BY THE



Federal Ministry  
of Education  
and Research

- **PARADIME (Energy Efficient Computing):**

Partner i.a.: TU-Dresden,  
Barcelona Supercomputing Center, Université de Neuchatel



- **FAST REALTIME (Real-Time Cloud):**

Partner i.a.: Siemens, Funkwerk, Escrypt,  
Vodafone, ZMD



- **SeReCa (Secure Enclaves for Reactive Cloud):**

Partner i.a.: Imperial College London, Red Hat Ltd.



Europa fördert Sachsen.





# CUSTOMERS & PARTNERS...

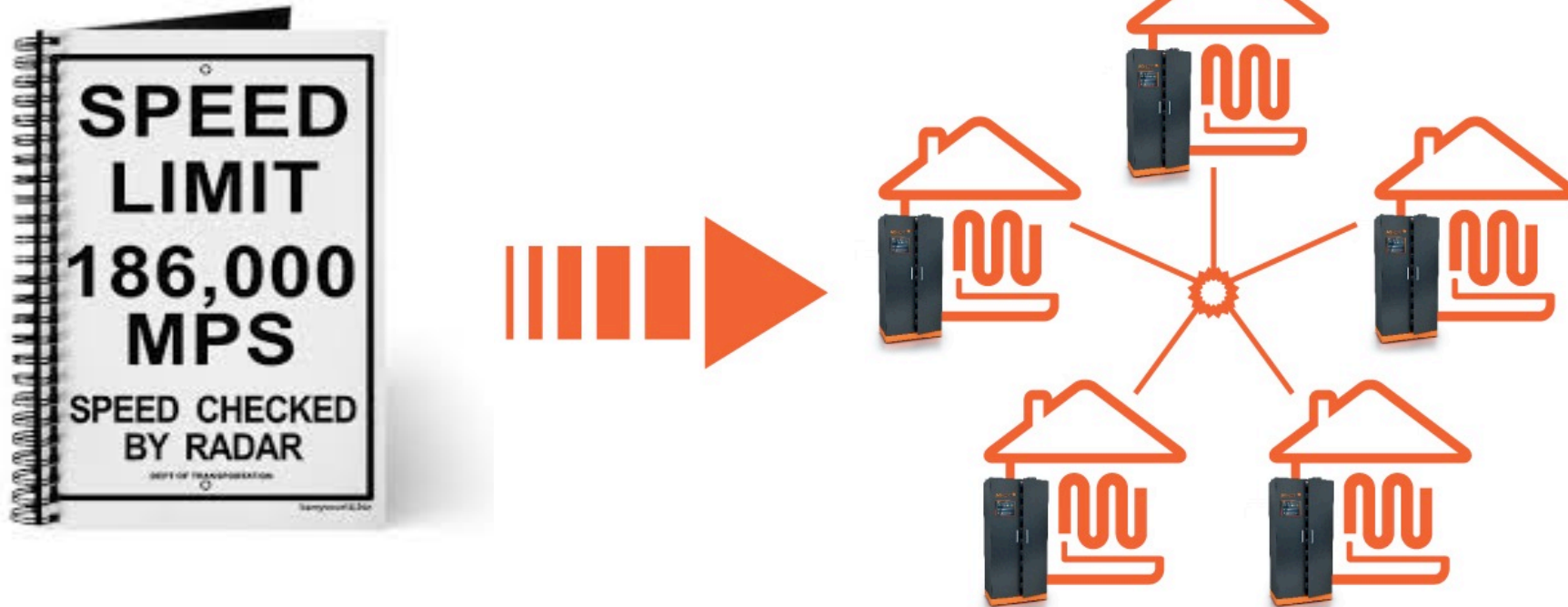
## .... YOU ARE WELCOME TO JOIN



INQUENCE



## HEATING HOMES: GREEN & LOW LATENCY COMPUTING



THANK YOU FOR YOUR ATTENTION:  
[www.cloudandheat.com](http://www.cloudandheat.com)



**CLOUD & HEAT**  
THE CLOUD THAT HEATS HOMES WORLDWIDE

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