

# THE IMPACT OF AI ON DATA CENTRE DESIGN

DATA CENTER FORUM DECEMBER 2023  
NIEK VAN DER PAS

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LEGRAND DATA CENTER SOLUTIONS  
WHITE SPACE CENTRE OF EXCELLENCE

 legrand®

# Who is presenting

## Lead Data Centre Expert

Minkels - A brand of Legrand

Nov 1990 - Present · 33 yrs

Veghel

- Coordinator Europe, Data Centre Standards, Legrand
- Convenor of ISO/IEC JTC1/SC 39 WG 1: Resource Efficient Data Centres
- Vice chair of the 2022 TiC council Drafting Group for the Development of a Temporary Assessment Framework For Data Centre Activities based on the EU Taxonomy Climate Delegated Act addressing "Data processing, hosting and related activities"
- Member of the working group on the European Code of Conduct on Data Centre Energy Efficiency
- Chair of the Dutch Standards committee "NEN Normcommissie 381039 'Computerruimtes en datacenters' "
- NEN representative in CENELEC TC 215 "Electrotechnical Aspects of Telecommunication Equipment" WG 3 "Facilities and Infrastructures"
- NEN representative in ISO/IEC JTC1/SC 39 WG 3: Sustainable facilities and infrastructures
- NEN representative in IEC TC 48D: Mechanical structures for electronic equipment




A profile card for Niek van der Pas. The top half features a circular portrait of a man in a blue shirt against a background of server racks. To the right of the portrait is a blue pencil icon. Below the portrait, the name "Niek van der Pas" is displayed in a large, bold font. Underneath the name, the text "Data Centre Design ★ Data Centre Standards" and "★Legrand ★ White Papers" is shown in a smaller font. A blue pencil icon is also present in the bottom right corner of the card's content area.

**Niek van der Pas**  
Data Centre Design ★ Data Centre Standards  
★Legrand ★ White Papers

# LEGRAND'S CSR APPROACH

The CSR strategy is driven by a CSR roadmap 2022-2024 and is based on four main areas of action to improve lives. These main areas guide and structure its commitments.

			
			
Promote diversity and inclusion	Reduce our carbon footprint	Develop a circular economy	Be a responsible business

## 2030 TARGETS



activities by **50%** and reduce carbon emissions in our value chain by **15%**



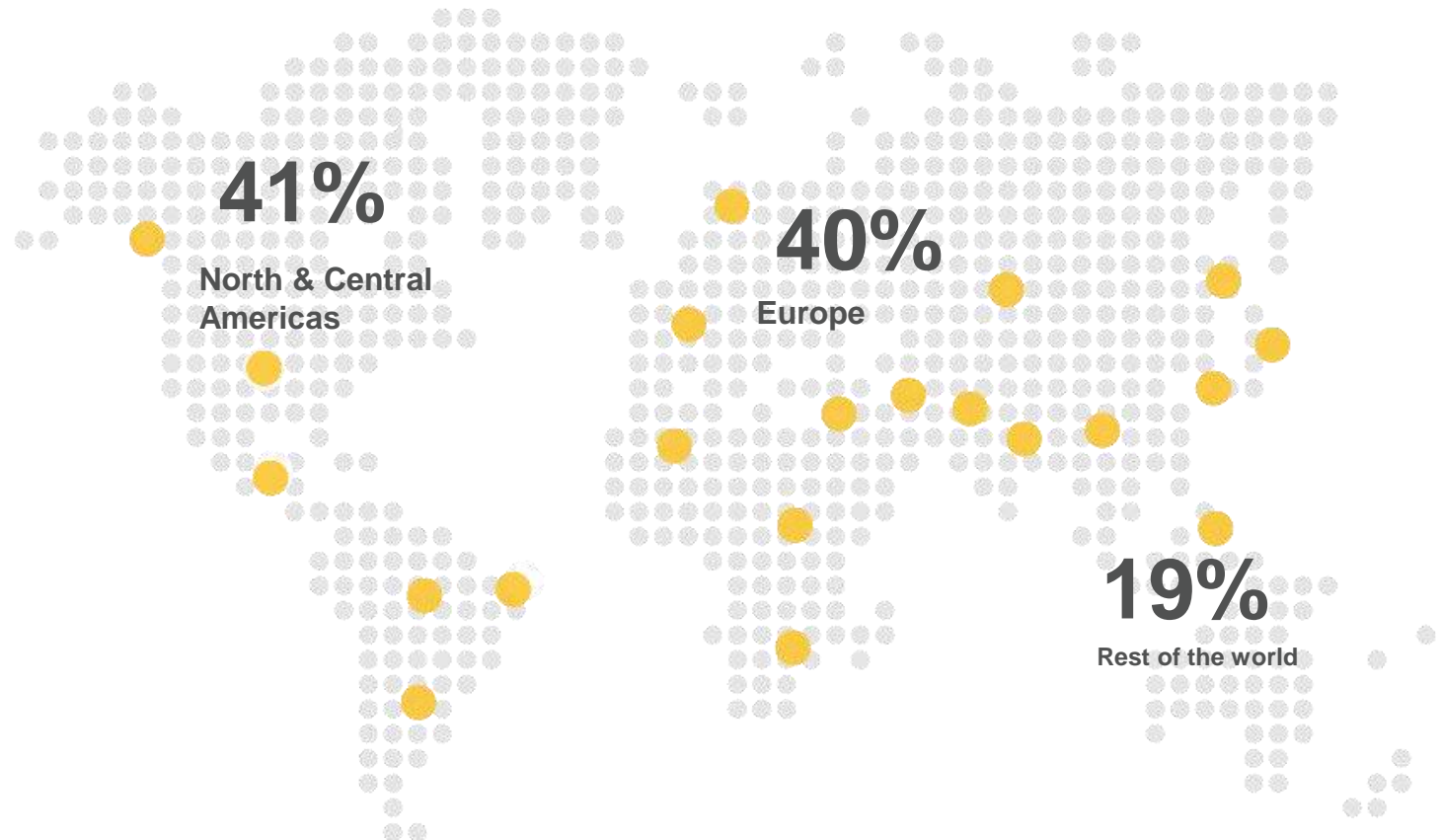
Achieve **80%** of our sales with eco-responsible solutions



**50/50** Achieve gender parity across the Legrand group's workforce  
Women in **1/3** of key positions



TURNOVER BY GEOGRAPHIC AREA



# THE GROUP IN FIGURES

In 2022

Close to  
**8.3B€** turnover

Present on  
**5** continents

More than  
**38 000** employees

Located  
**90** countries

CSR Achievement rate  
**123%**

Distributed in  
**170** countries



### legrand®

Complete global solutions for digital and electrical infrastructure.

### BORRI

Specialist in UPS for industrial applications and datacenters.

### CABLOFIL

Using its global strength and market leading position, Cablofil has developed a complete range of cable management solutions.

### COMPOSE

Specialist in passive data communication solutions, cabling of data centers, buildings and fiber optic infrastructures.

### Raritan.

Proven leader of intelligent PDUs, transfer switches, environmental sensors, serial consoles and KVM-over-IP Remote Access switches.

### Server Technology.

Leading specialist in customer-driven power, access and control solutions for monitoring and managing critical IT assets.

### Starline.

Starline has grown to become a global leader in busbar power distribution equipment

### USystems

USystems provide cooling products that enhance data center cooling, providing these to global businesses, making their data centers more environmentally friendly.

### GEIGER.

Data center fiber optic infrastructures, data center design and DCIM (monitoring & management) service and implementation.

### MINKELS

Turn-key hot/cold aisle containment and enclosures for data center infrastructures.

### modulan

Provider of fully customizable containment solutions. Maximum flexibility to cover customer needs.

### PowerControl

A leading provider of uninterruptible power supply (UPS) solutions, trusted by businesses worldwide to protect their critical power loads and avoid unplanned business downtime.

### VOLTADIS

Voltadis offers support in electrical power supply systems for data centers' grey rooms including design, commissioning, equipment supply, and installation.

### ZUGCHINI

Zucchini has become a leading brand of cast resin transformers, offering one of the most comprehensive ranges on the market.

## CRITICAL POWER



CAST RESIN TRANSFORMERS

HIGH POWER BUSBAR

UPS & STS SOLUTIONS

DMX3 ACB & DPX3 MCCB

BUSWAYS

## CABLE MANAGEMENT



OVERHEAD CABLE MANAGEMENT

EZ-PATH FIRE RESISTANT CABLE DUCT

## IT INFRASTRUCTURE



CONTAINMENT AND COOLING

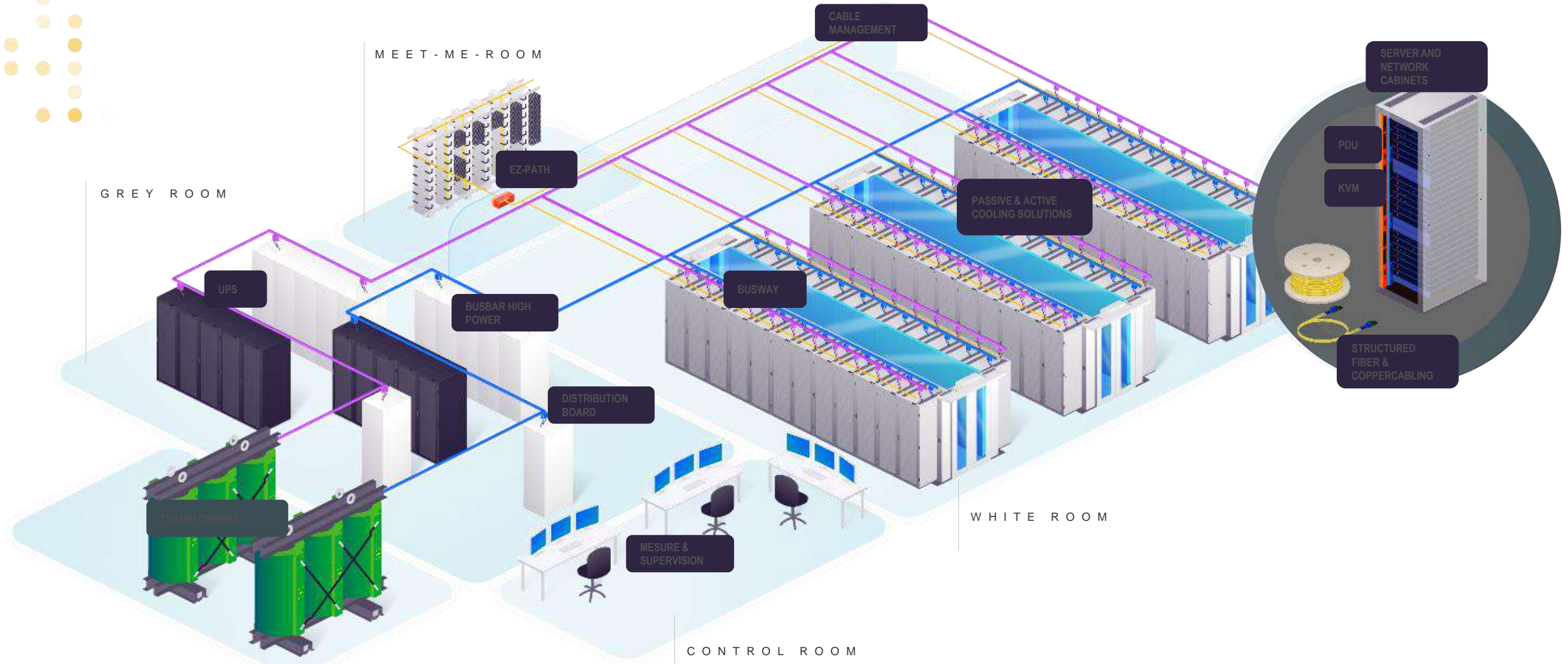
SERVER AND NETWORK CABINETS

INTELLIGENT PDU'S AND SENSORS

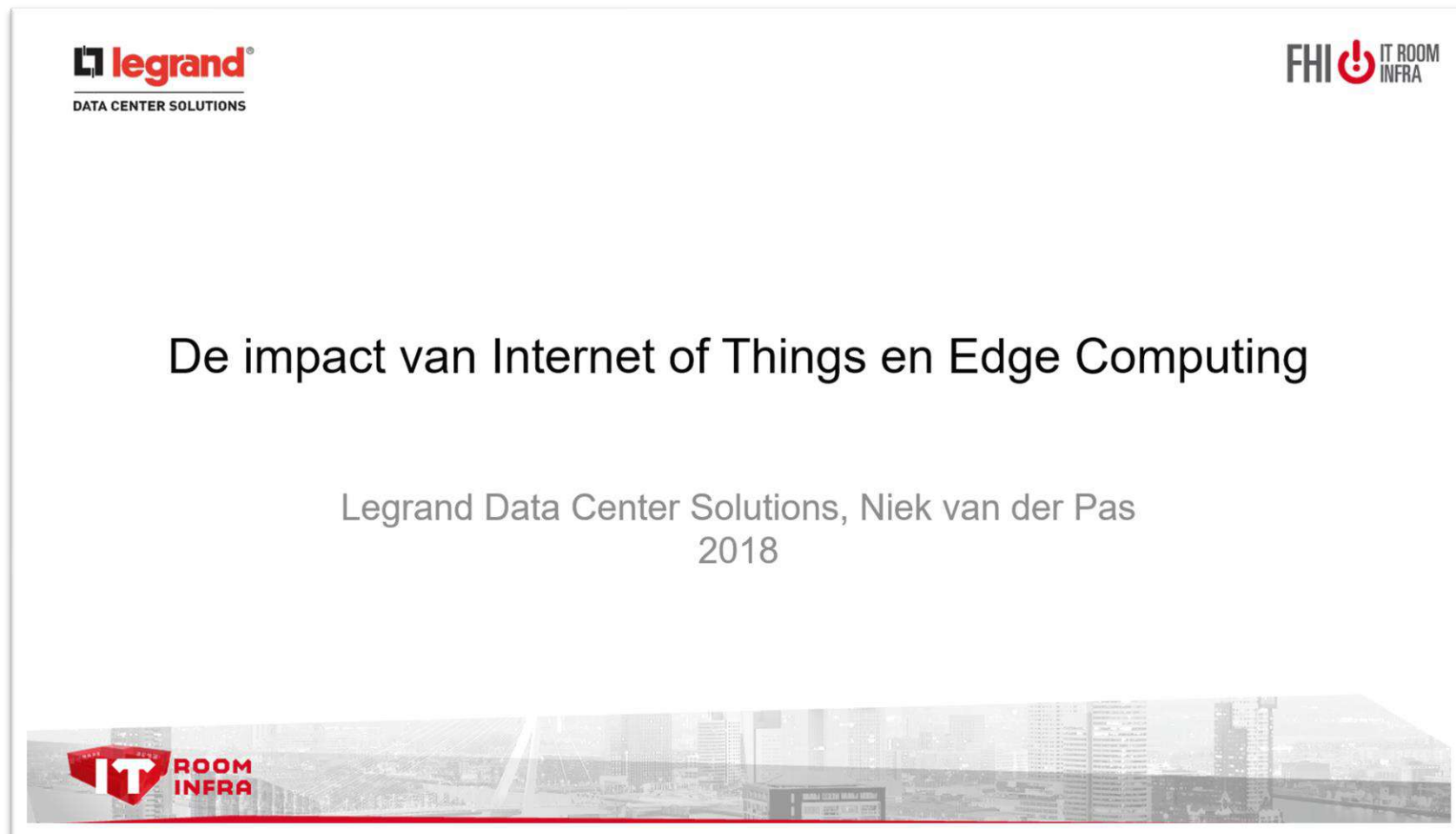
KVM & SERIAL CONSOLE

STRUCTURED FIBER AND COPPER CABLING


DCIM SOFTWARE INTEGRATION




# Looking back 5 Years




The slide features the Legrand logo and 'DATA CENTER SOLUTIONS' in the top left, and the 'FHI IT ROOM INFRA' logo in the top right. The main title is 'De impact van Internet of Things en Edge Computing'. Below it, the author is listed as 'Legrand Data Center Solutions, Niek van der Pas' with the year '2018'. At the bottom, there is a wide banner image of a city skyline at night with a red 'IT ROOM INFRA' logo overlaid on the left side.

 **legrand**<sup>®</sup>  
DATA CENTER SOLUTIONS



## De impact van Internet of Things en Edge Computing

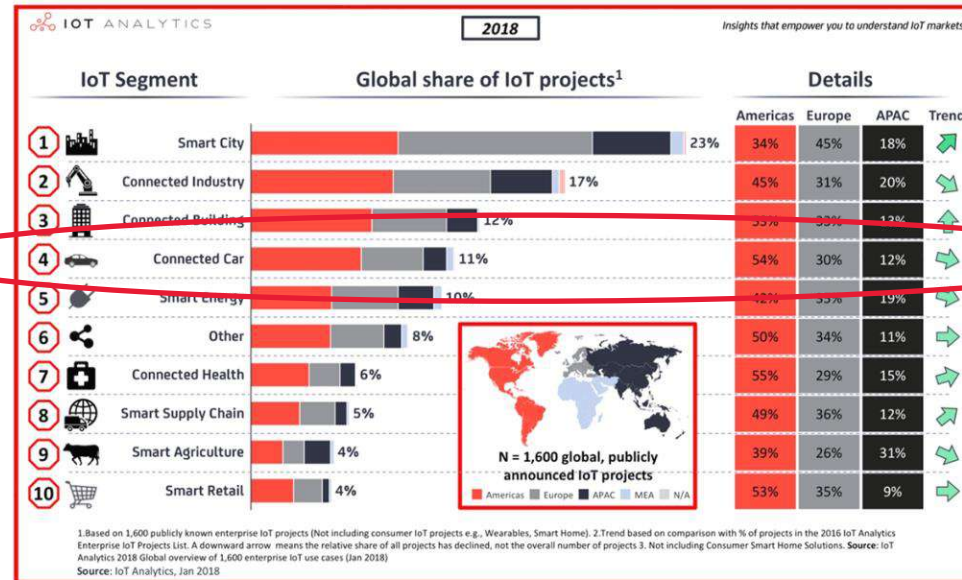
Legrand Data Center Solutions, Niek van der Pas  
2018






# Looking back 5 Years What is the Edge

## Wat stuurt de Edge




Source: IOT Analytics

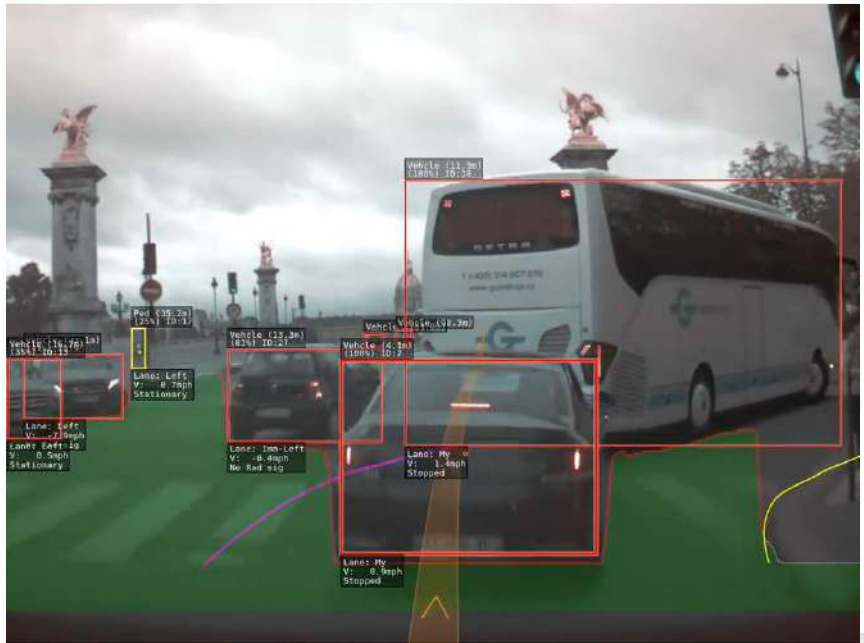
# Looking back 5 Years What is the Edge



DATA CENTER SOLUTIONS

## Zelfrijdende auto's
























Source: [Youtube](#)

### The 5 levels of driving automation

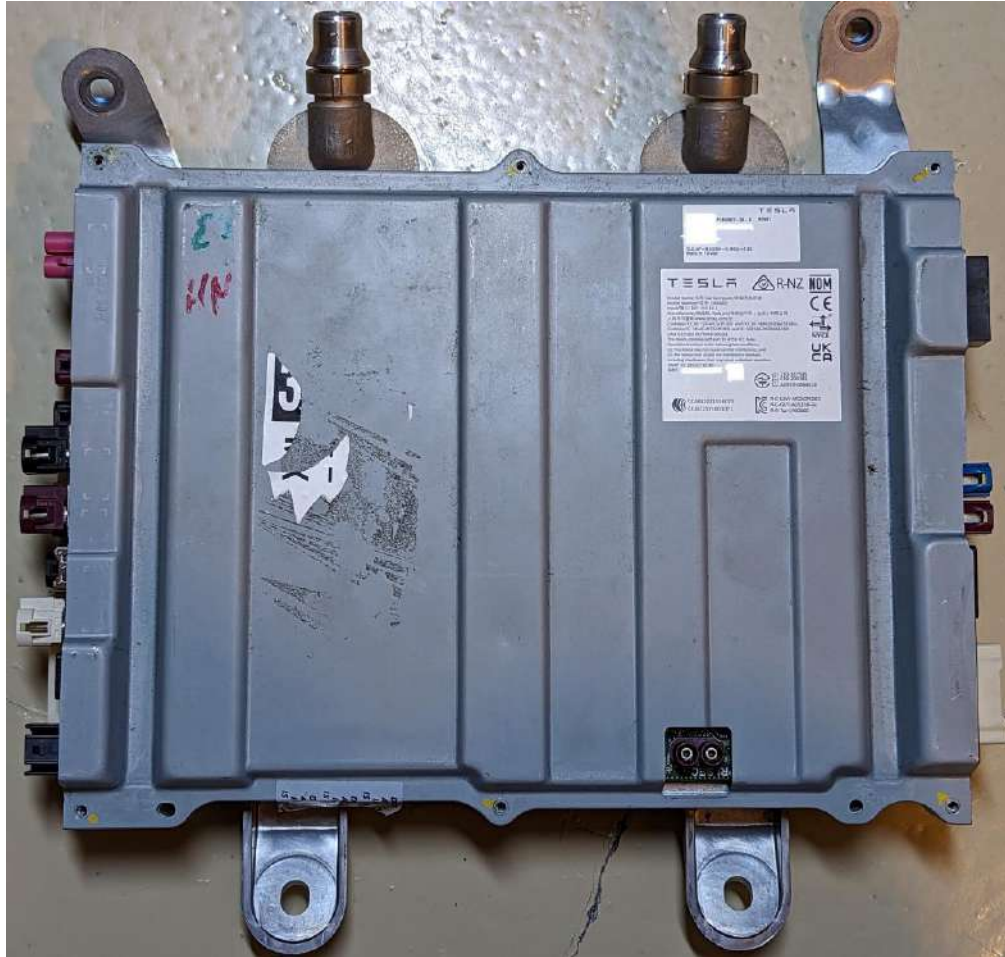
For on-road vehicles

		Human driver	Automated system		
		Steering and acceleration/ deceleration	Monitoring of driving environment	Fallback when automation fails	Automated system is in control
Human driver monitors the road	<b>0</b> NO AUTOMATION				N/A
	<b>1</b> DRIVER ASSISTANCE				SOME DRIVING MODES
	<b>2</b> PARTIAL AUTOMATION				SOME DRIVING MODES
Automated driving system monitors the road	<b>3</b> CONDITIONAL AUTOMATION				SOME DRIVING MODES
	<b>4</b> HIGH AUTOMATION				SOME DRIVING MODES
	<b>5</b> FULL AUTOMATION				

Source: SAE International

Vox

# Looking back 5 Years **What is the Edge**



Tesla  
model Y  
Computer






Tesla  
model Y  
4G  
Antenna

# What is now: **What** are the edge trends

 IOT ANALYTICS

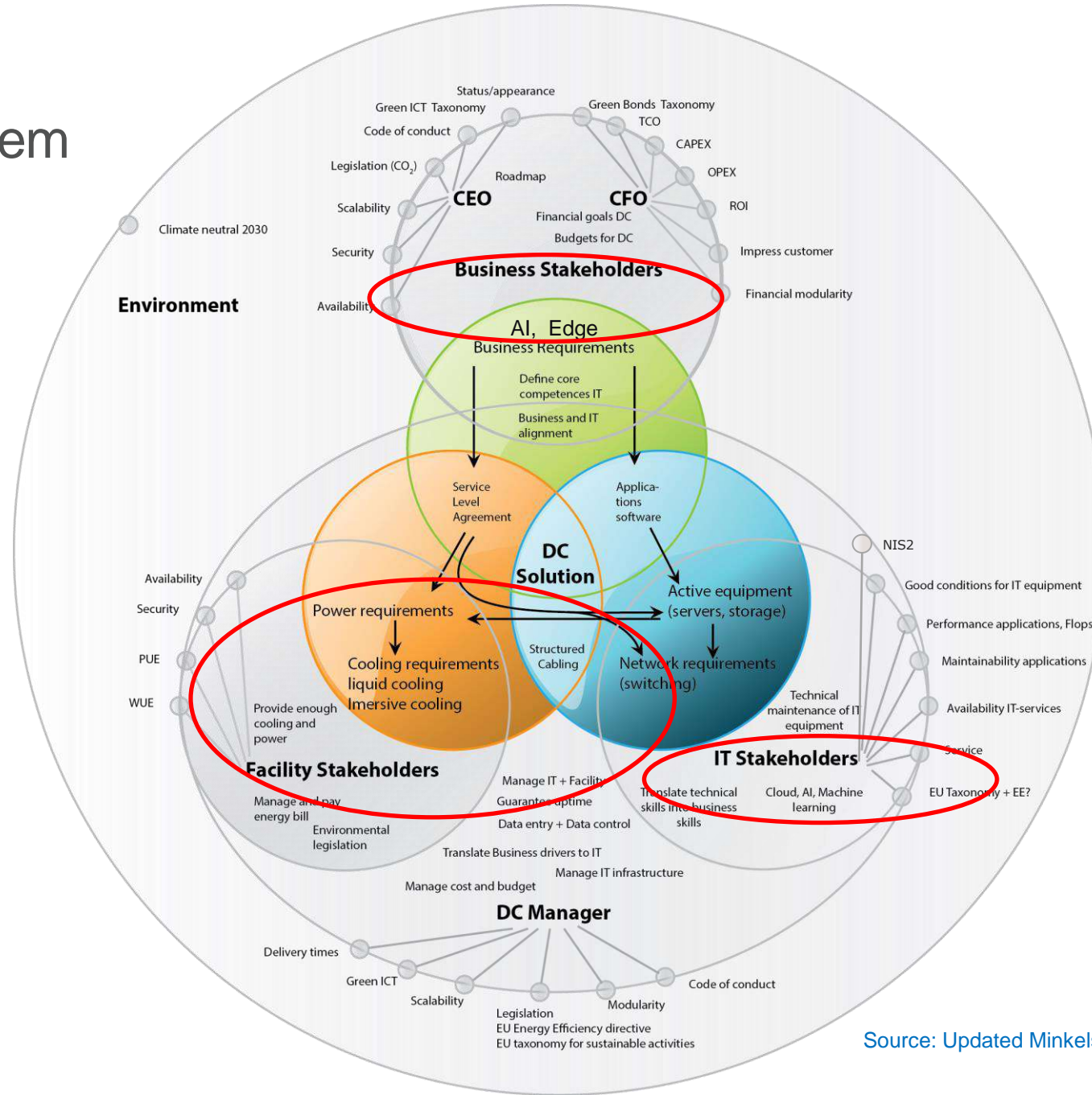
Your Global IoT Market Research Partner  
April 2023

## Top 10 IoT chipset & edge trends—as showcased at **embeddedworld 23**

-  1 Computation at the edge becoming more performant
-  2 New AI design cycle for embedded devices emerging
-  3 Energy-harvesting becoming commercially viable
-  4 OT connectivity becoming increasingly wireless
-  5 Advancements in RTOS technology
-  6 Chipset players adopting new Matter standard
-  7 Moving to data-centric architectures
-  8 Making software-defined vehicles (SDVs) a reality
-  9 “Security by design” becoming ever more important
-  10 Partnerships remain key due to rising complexity

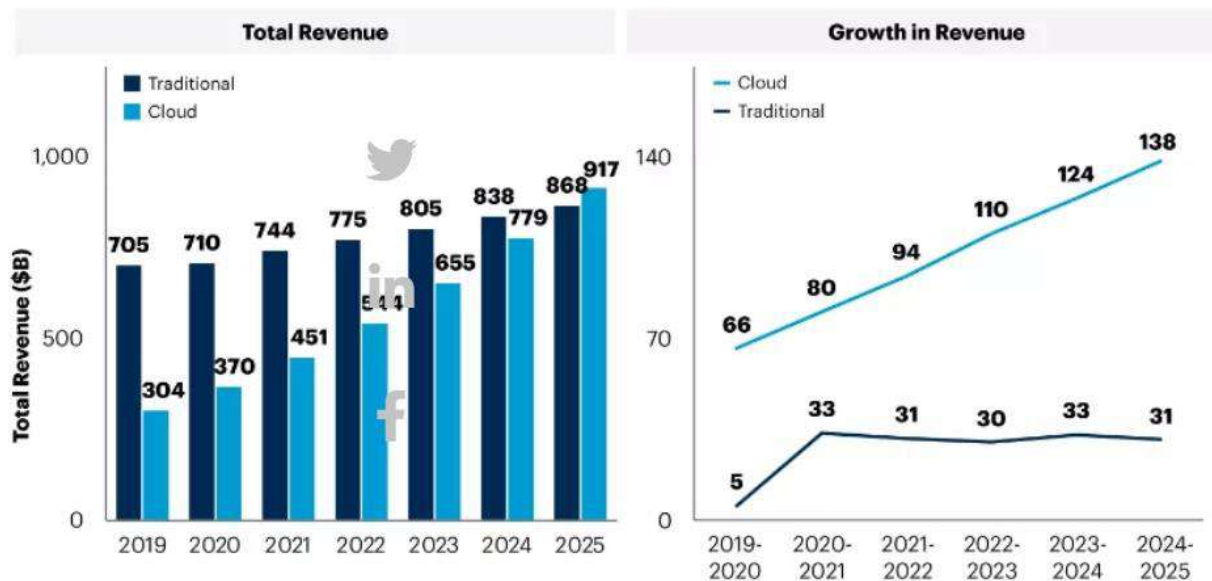
Source: IoT Analytics Research 2023. We welcome republishing of images but ask for source citation with a link to the original post and company website.

# Data Centre ECO system



Source: Updated Minkels white paper 2

# Moving to colocation and the cloud



Source: Gartner  
758067\_C

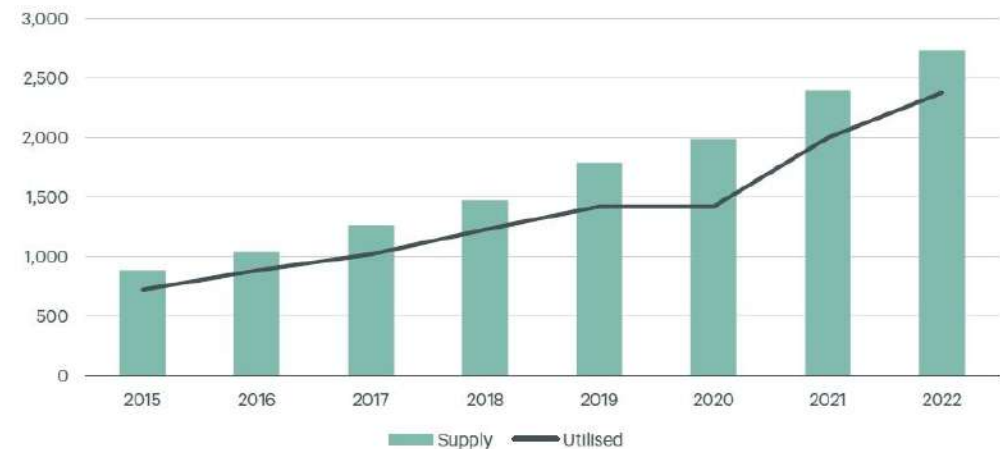
Gartner

Source: Gartner, February 2022

## Q4 and forecasted build activity

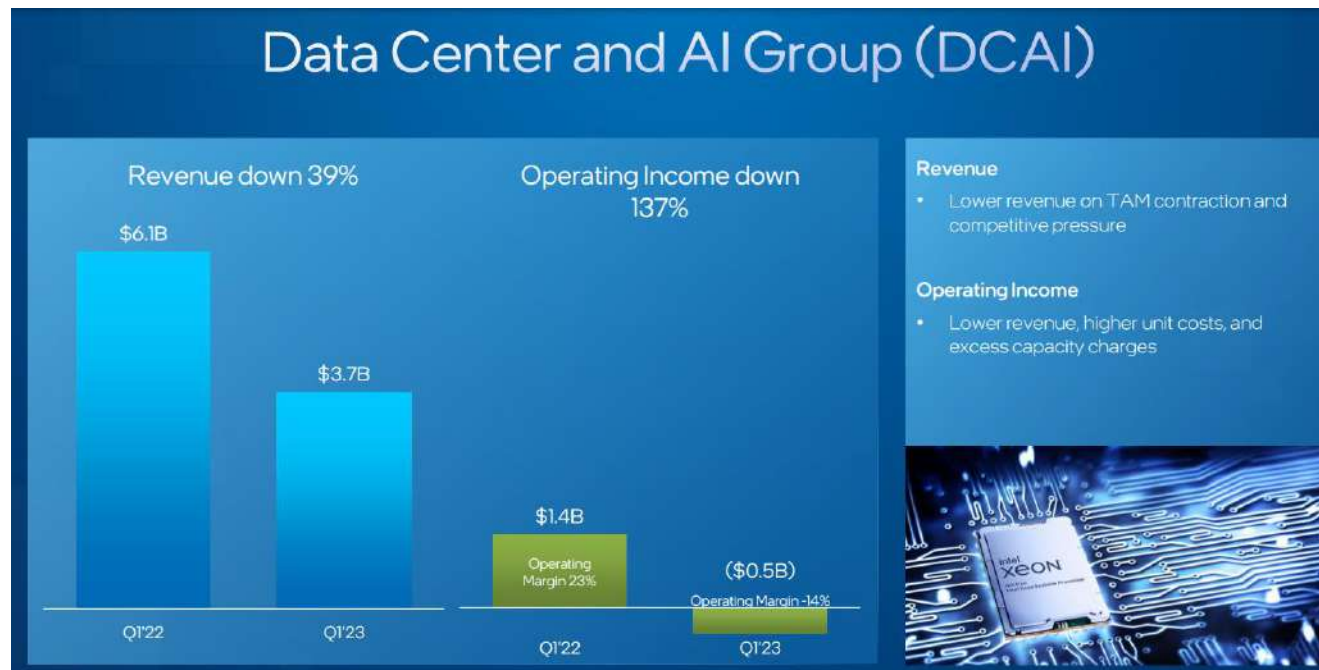
Frankfurt	There were 73MW of new supply delivered across four submarkets of Frankfurt in Q4. This year, we forecast 157MW of supply to be delivered in Germany's financial capital, the most capacity of any FLAPD market.
London	There are 132MW of new supply we forecast to be delivered in London this year, the third highest FLAPD market total.
Amsterdam	The market is forecasted to see 71MW of new supply, or about seven times the 2022 total. Two providers are expected to deliver the vast majority (66MW) of the total.
Paris	The French capital's supply base is projected to grow by 137MW, as several new large schemes are due to be delivered.
Dublin	All of the new leased data centre capacity (34-MW) in Dublin in 2022 was delivered during Q4. More than double that amount (73MW) is expected this year.

FIGURE 3: FLAPD market supply and utilisation, 2015 – 2022 (MW)



Source: CBRE Research, Q4 2022

# Moving to colocation and the cloud but



### Q1 2023 SEGMENT RESULTS

(\$ in millions)	Q1'23	Q1'22	Y/Y
<b>Data Center</b>			
Net Revenue	\$1,295	\$1,293	Flat
Operating Income	\$148	\$427	Down 65%

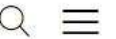
“We are in the very early stages of the AI computing era, and the rate of adoption and growth is faster than any other technology in recent history,” Su said. “And as the recent interest in generative AI highlights, bringing the benefits of large-language models and other AI capabilities to cloud, edge and endpoints requires significant increases in computer performance. AMD is very well-positioned to capitalize on this increased demand for compute[.]”

# Artificial Intelligence will become a dominant IT driver



## *Google Calls In Help From Larry Page and Sergey Brin for A.I. Fight*

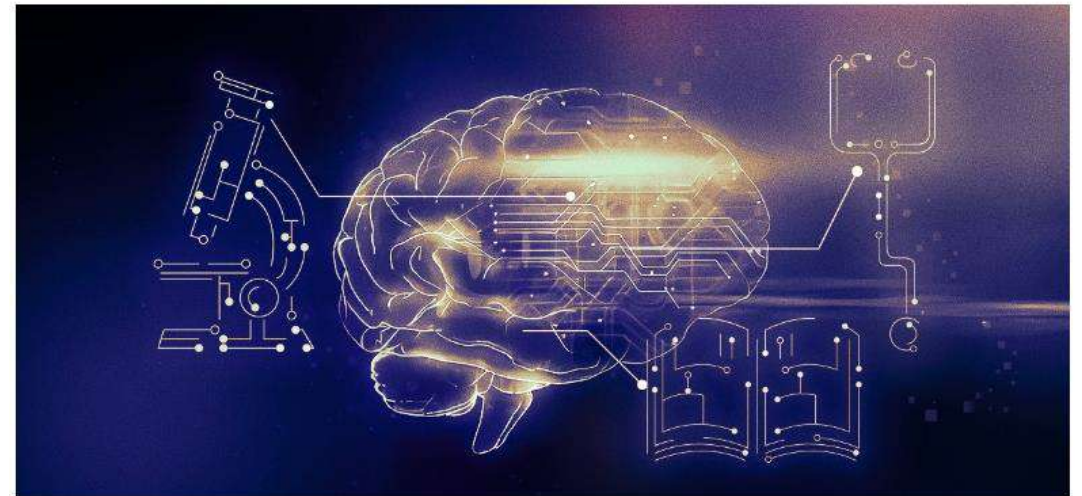
A rival chatbot has shaken Google out of its routine, with the founders who left three years ago re-engaging and more than 20 A.I. projects in the works.



## The Age of AI has begun

Artificial intelligence is as revolutionary as mobile phones and the Internet.

By **Bill Gates** | March 21, 2023 • 14 minute read





# Artificial Intelligence will become a dominant IT driver

marketsandmarkets.com/Market-Reports/artificial-intelligence-market-74851580.html



MARKETSANDMARKETS

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## Instant Answers with GPT - Ask Now!

Ask real questions. Get complete answers !

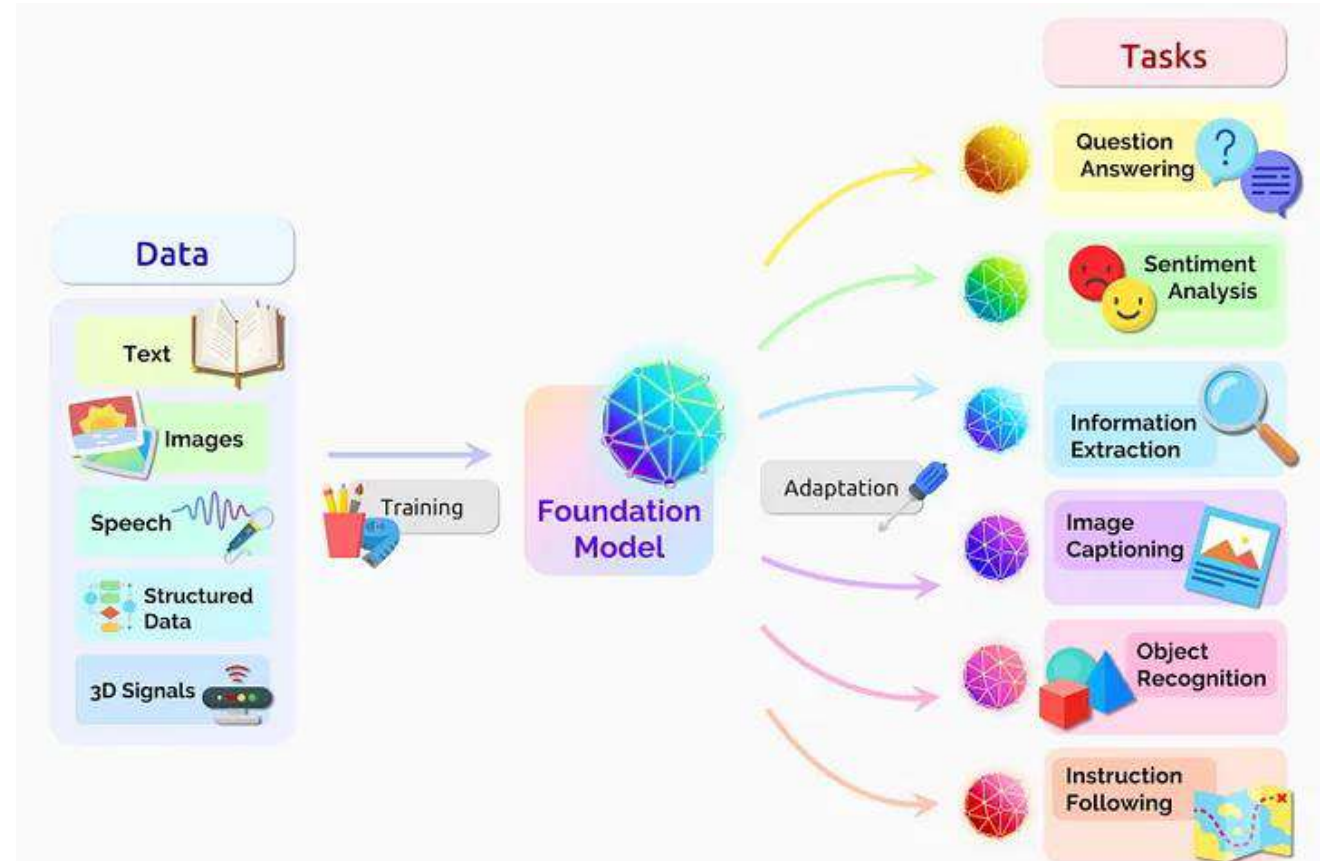
### Can you give an insight in the AI market expectations

The AI market is expected to experience significant growth in the coming years. According to MarketsandMarkets, the AI market is projected to reach USD 407.0 billion by 2027, at a CAGR of 36.2% during the forecast period. The growth of the market is driven by the increasing adoption of cloud-based applications and services, big data, and the growing demand for intelligent virtual assistants. However, the limited number of AI technology experts and data privacy and unreliability of AI algorithms are some of the key restraints to the market. The underlying opportunities in the AI market include improving operational efficiency in the manufacturing industry and the adoption of AI to improve customer service. According to MarketsandMarkets, the global Artificial Intelligence (AI) market is expected to grow significantly in the coming years. The market is driven by factors such as increasing demand for AI-based solutions in various industries, growing investments in AI, and increasing adoption of cloud-based AI solutions. Additionally, the increasing demand for AI-based solutions in the healthcare industry is expected to further drive the growth of the AI market. Furthermore, the increasing demand for AI-based solutions in the automotive industry is expected to create lucrative opportunities for the AI market.

Load More...

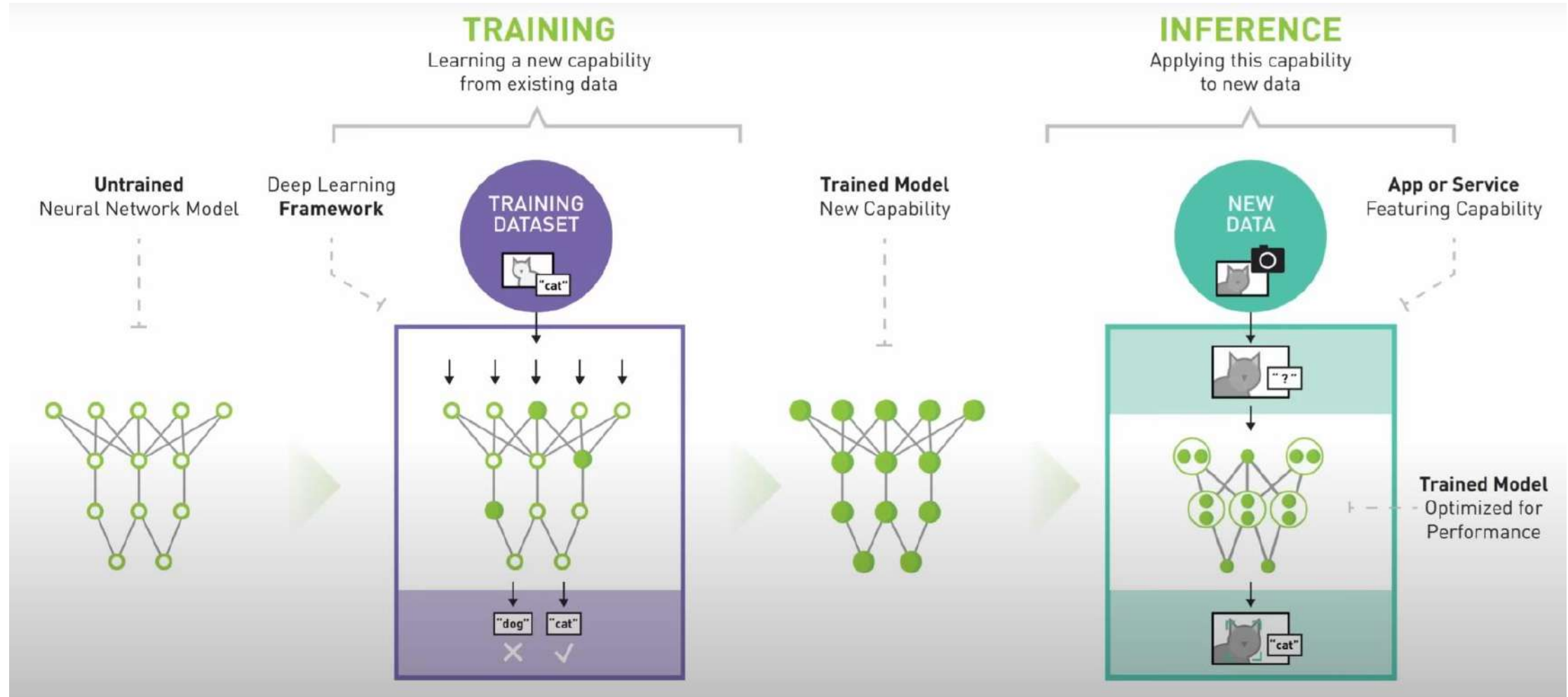
Type Your Question

# Artificial Intelligence will become a dominant IT driver



Source: [knowledgezone.co.in](http://knowledgezone.co.in)

# Artificial Intelligence will become a dominant IT driver



# Where does Artificial Intelligence live



CUSTOM CDU DELIVERED      1<sup>ST</sup> DOJO CABINET INSTALL

2021      2022

2.2 MW LOAD TESTING

CUSTOM COOLING DISTRIBUTION UNIT (CDU)      FIRST INTEGRATED DOJO CABINET      2.2 MW LOAD BANK TESTING

TESLA LIVE

legrand DATA CENTER SOLUTIONS      FHI IT ROOM INFRA

### Zelfrijdende auto's

Source: YouTube

ROOM INERA

#### The 5 levels of driving automation

For on-road vehicles

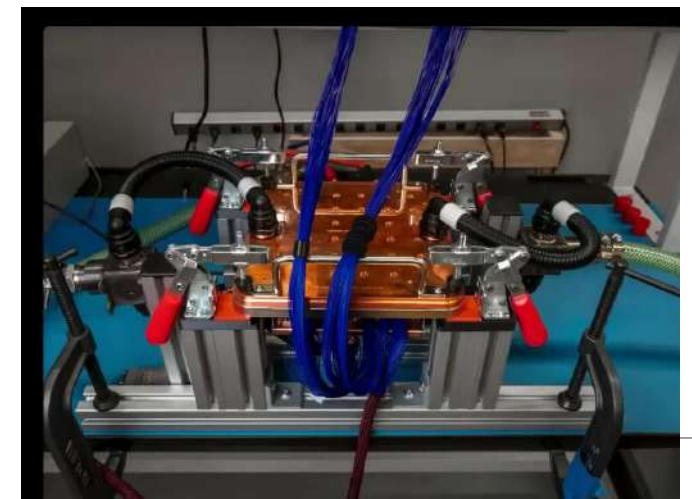
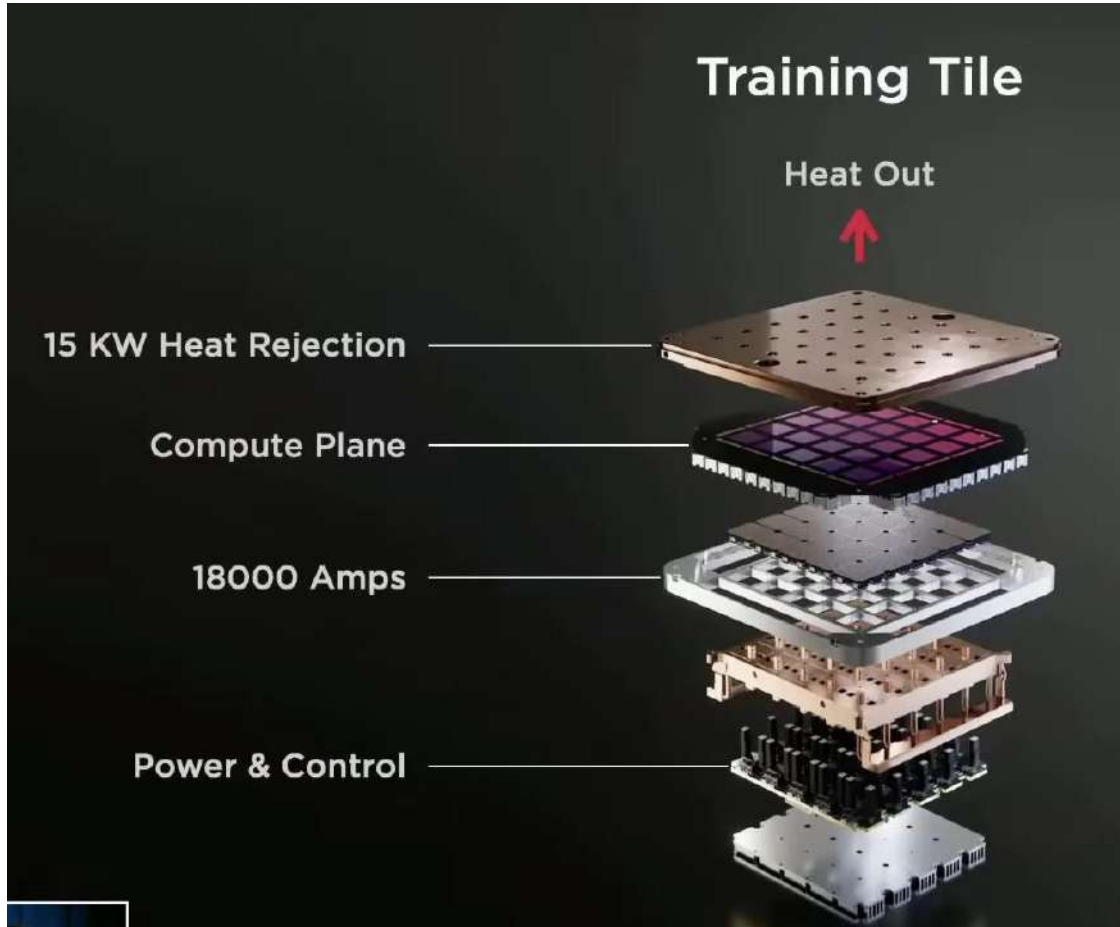
Automation Level	Human driver	Automated system
0 NO AUTOMATION	Steering and acceleration of driving	None
1 DRIVER ASSISTANCE	Monitoring of driving environment	STEERING ASSISTANCE
2 PARTIAL AUTOMATION	Monitoring of driving environment	STEERING ASSISTANCE, ADAPTIVE CRUISE CONTROL
3 CONDITIONAL AUTOMATION	Monitoring of driving environment	STEERING ASSISTANCE, ADAPTIVE CRUISE CONTROL, LANE CHANGING ASSISTANCE
4 HIGH AUTOMATION	Monitoring of driving environment	STEERING ASSISTANCE, ADAPTIVE CRUISE CONTROL, LANE CHANGING ASSISTANCE, TRAFFIC JAM ASSISTANCE
5 FULL AUTOMATION	None	STEERING ASSISTANCE, ADAPTIVE CRUISE CONTROL, LANE CHANGING ASSISTANCE, TRAFFIC JAM ASSISTANCE, ROADWORK ASSISTANCE

Source: SAE International

Vox



# Tesla and AI

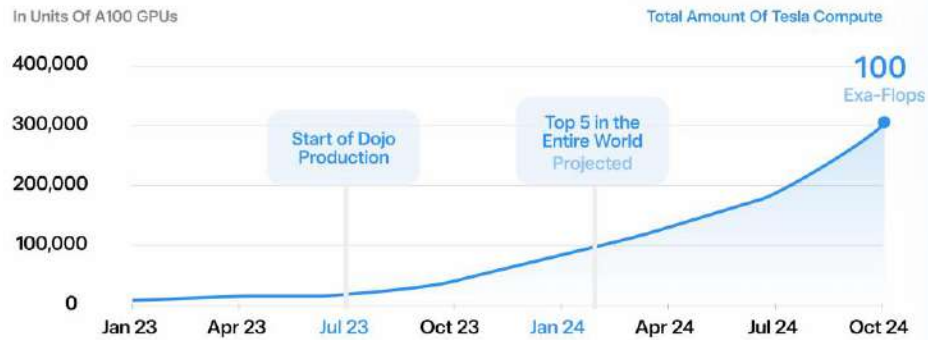


# Tesla and AI



**Tesla Owners Silicon Valley** @teslaownersSV · Jun 21  
Exponential improvement coming to FSD Beta once Dojo is up and running.

## Trained On Extremely Large Compute



**Elon Musk** @elonmusk · Jun 21

Subscribed

Replying to @teslaownersSV

I should clarify that Dojo V1 is highly optimized for vast amounts of video training vs general purpose AI. Dojo V2 will address these limitations.



**Tesla AI** @Tesla\_AI · Jun 21

Replying to @Tesla\_AI

These models will learn from a huge set of extremely diverse data from the Tesla fleet



0:16 32 190 2,053 149.9K

# Tesla and AI



**Tweet**

**Penny2x** @imPenny2x · Jun 22  
No big deal, Tesla is just going live with an Nvidia competitor soon.

**Elon Musk** @elonmusk  
Not exactly a competitor to Nvidia, as we aren't selling Dojo computers (although it could be sold as service).  
We just need a crazy amount of training compute to get full self-driving 10X safer than human, but can't get enough GPUs, plus prices are extremely high!

12:31 AM · Jun 22, 2023 · 2M Views

757 Retweets 104 Quotes 11.3K Likes 184 Bookmarks

*Note: In the original image, the phrase "but can't get enough GPUs, plus prices are extremely high!" is circled in red.*



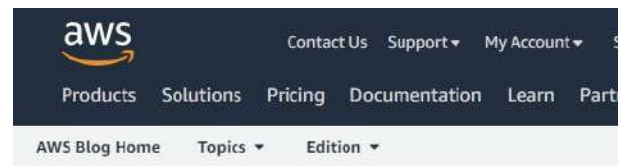
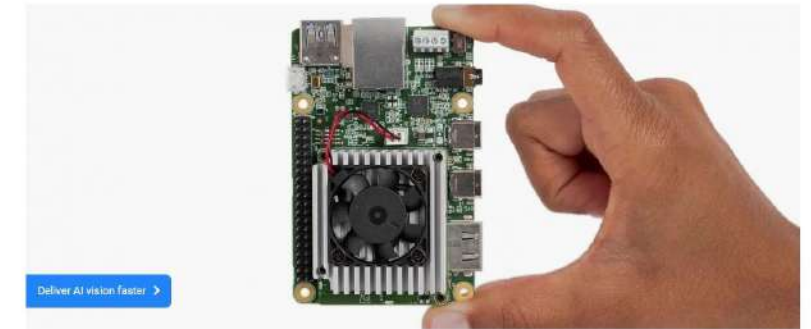
# Artificial Intelligence will become a dominant IT driver

## Enterprise AI Hardware Portfolio

IC922 is a significant market addition enabling an end-to-end solution for AI and cloud



## AI Hardware: Overview of Edge Machine Learning Inference in 2022



AWS Machine Learning Blog

Deploy pre-trained models on AWS Wavelength with 5G edge using Amazon SageMaker JumpStart

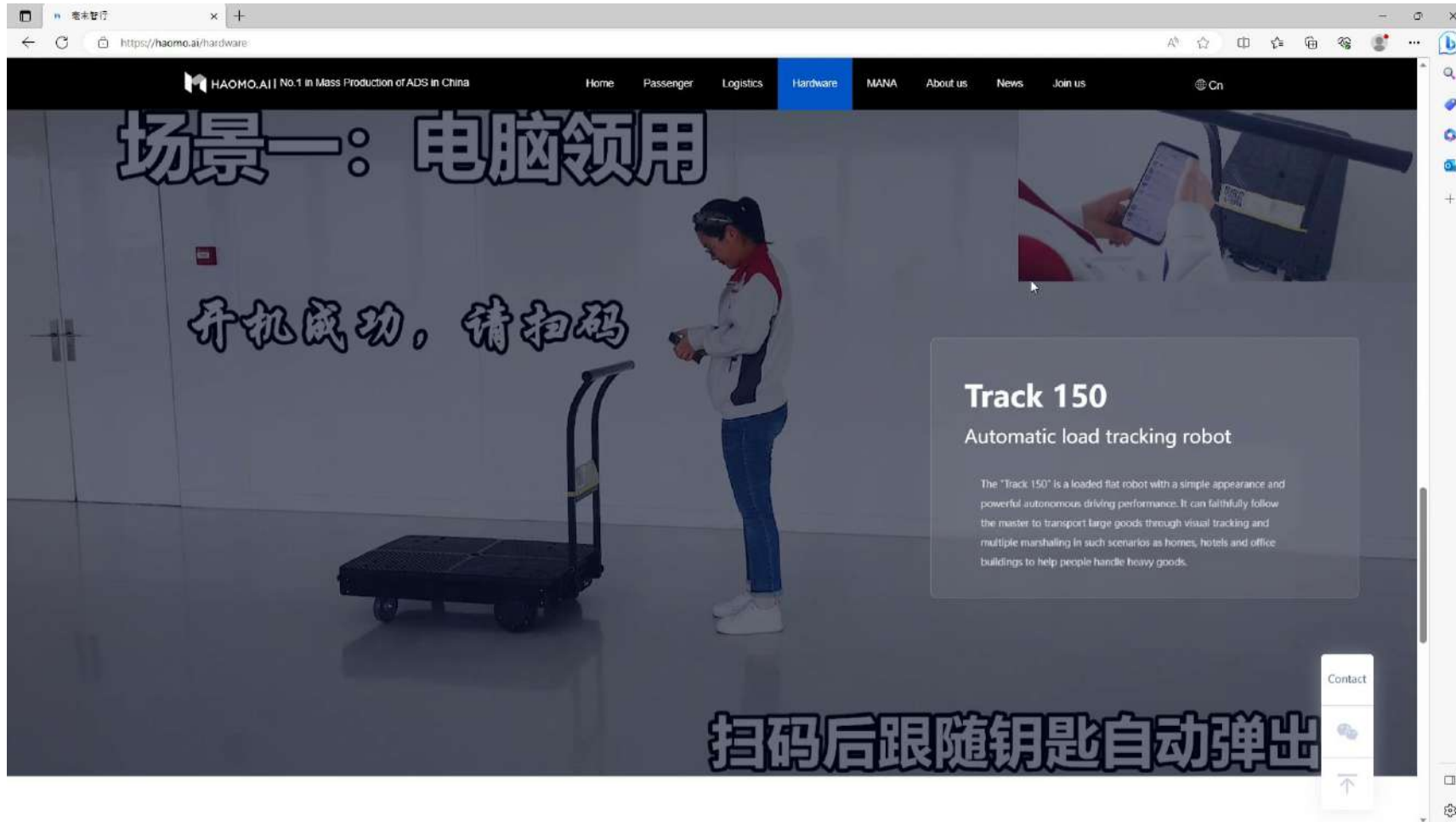
## Products

Helping you bring local AI to applications from prototype to production

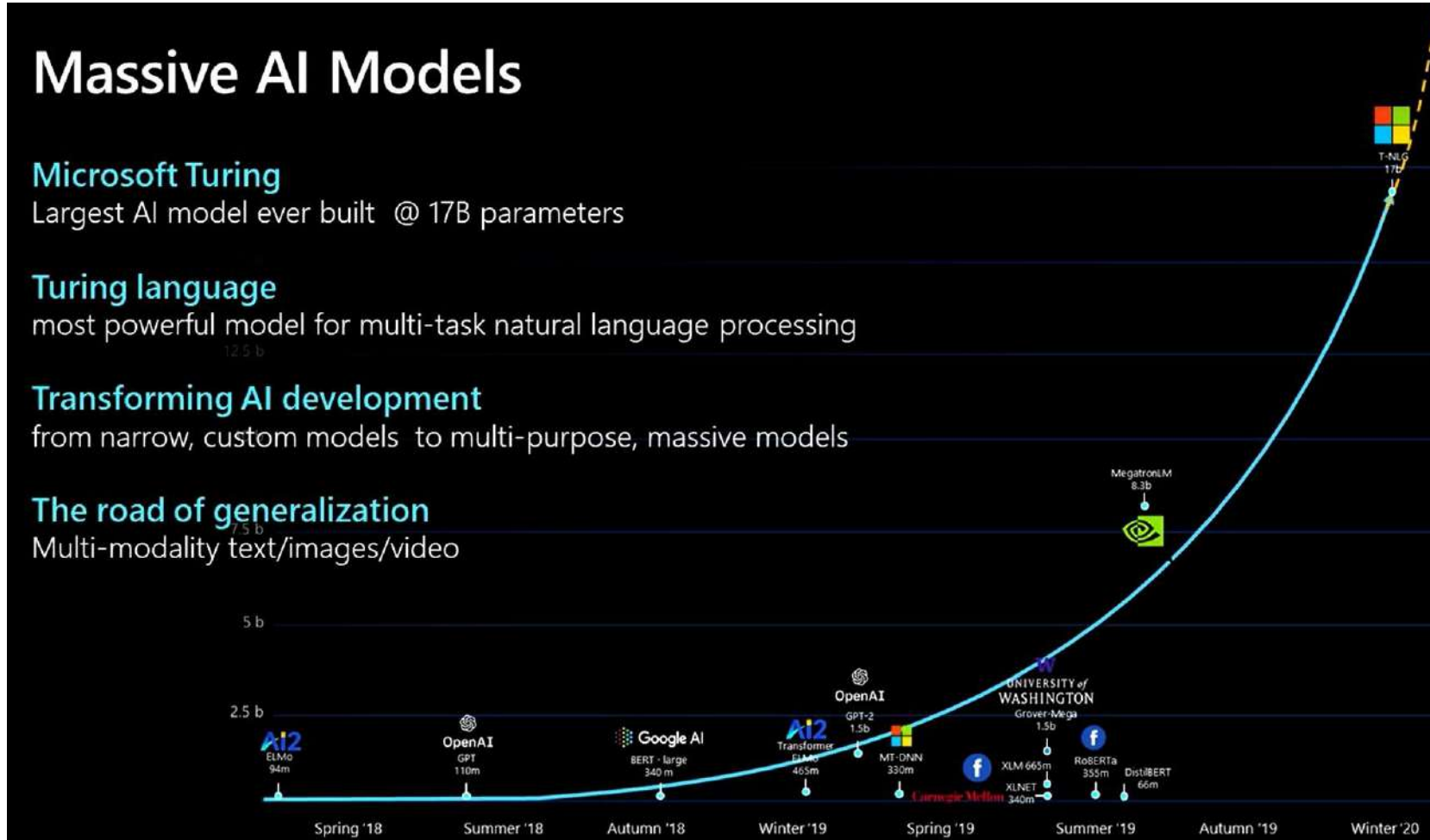




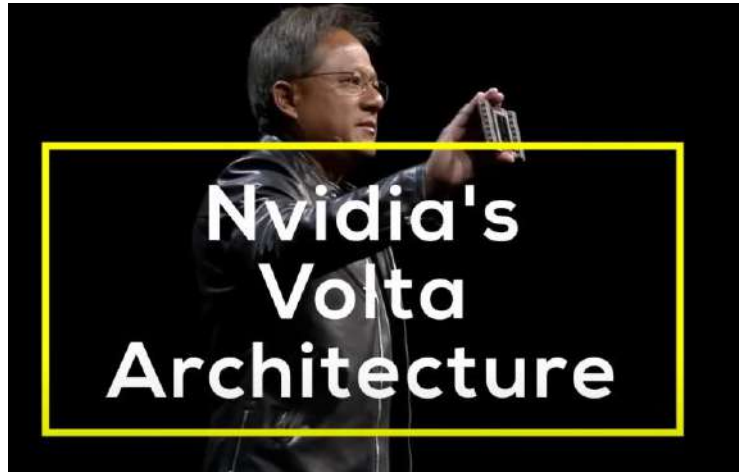
# Where does Artificial Intelligence live



# Artificial Intelligence will become a dominant IT driver



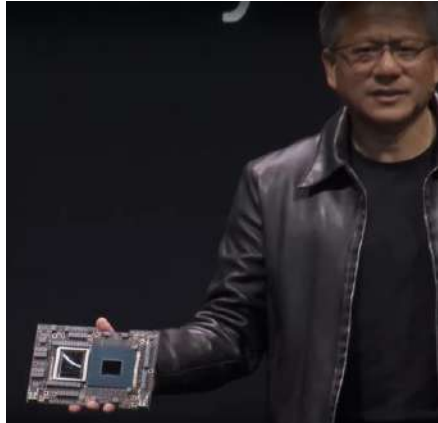
# Artificial Intelligence will become a dominant IT driver



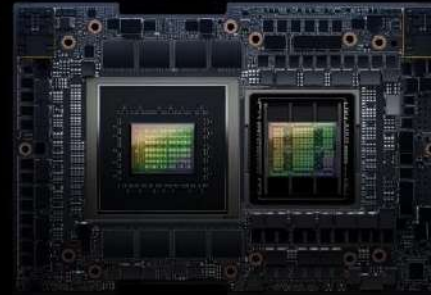
GP100	GV100
15.3bn transistors	21.1bn transistors
610mm <sup>2</sup> @ TSMC 16nm	815mm <sup>2</sup> @ TSMC 12nm
3,584 CUDA-cores	5,120 CUDA-cores
10.6 TFLOPS FP32	15 TFLOPS FP32
	640 Tensor-cores
	125 TFLOPS FP16



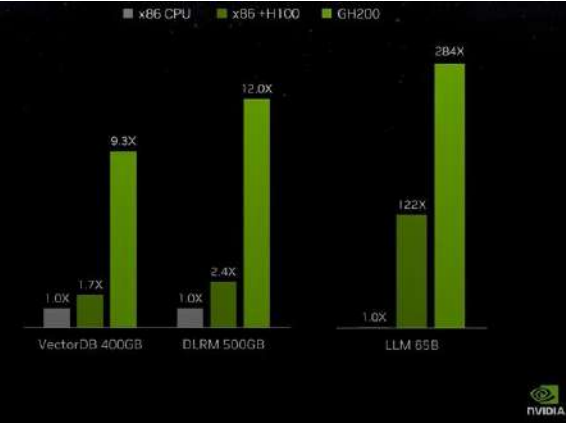
# Where does Artificial Intelligence live in the future



NVIDIA GH200 GRACE HOPPER SUPERCHIP  
NOW IN PRODUCTION  
The Engine for the Generative AI Era



4 PetaFLOPS TE | 72 Arm CPUs | 96GB HBM3 | 576GB GPU Memory



**INTRODUCING MGX**  
Open Modular Server Design for Accelerated Computing

Multi-Generation Standardized for TTM and Improved ROI

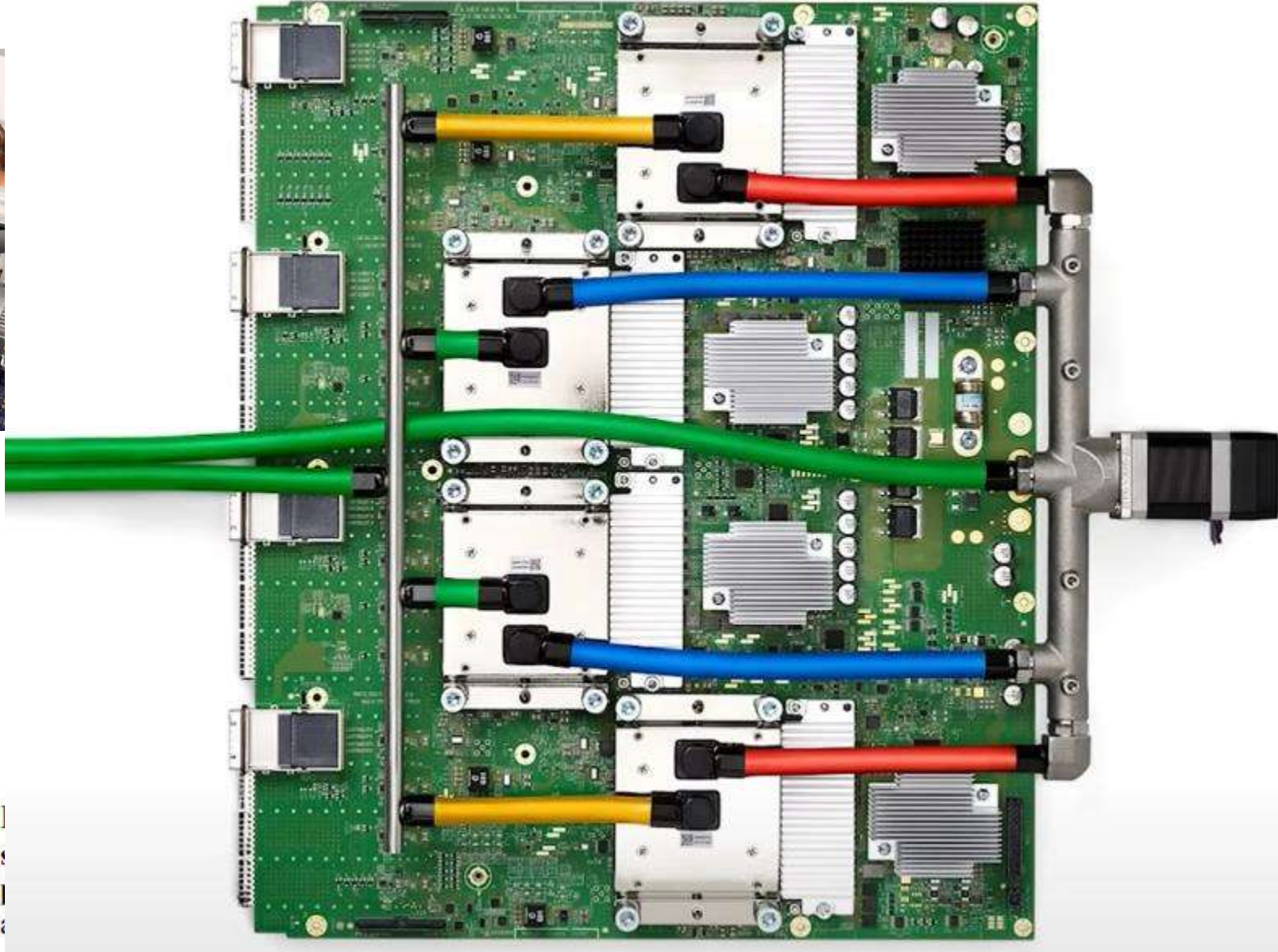
Configurable into 100s of Solutions

Integrates into Cloud and Enterprise Data Centers

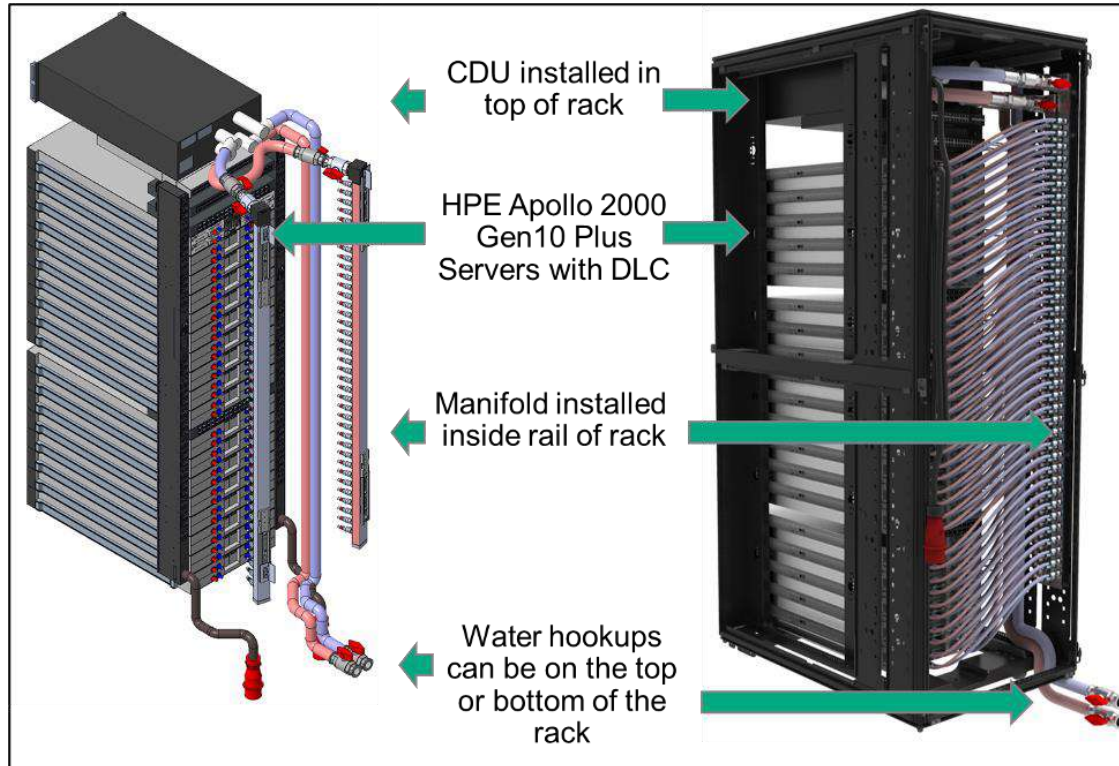
1 GPU

Grace Hopper Liquid-Cooled Server for HPC  
1U | 2 Grace Hopper | 2 BF-3 | 4 PCIE

# Artificial Intelligence will become a dominant IT driver



# Artificial Intelligence will become a dominant IT driver




147bn



>10,000 CDN3 GPU cores  
24 Zen 4 CPU cores  
lots of I/O (CLX 3.0)  
Infiniy Cache  
128GB HBM3

AMD MI300



World's First Integrated Data Center CPU + GPU  
**AMD INSTINCT™ MI300**  
Breakthrough architecture to power the exascale AI era

# Where does Artificial Intelligence live

## Executive Summary

This document is not a specification for OAI/OAM products. It is a set of guidelines on design, validation and implementation of liquid cooling solutions for AI Training Systems with 8x OAM products or others like



OCP OAI SYSTEM LIQUID COOLING

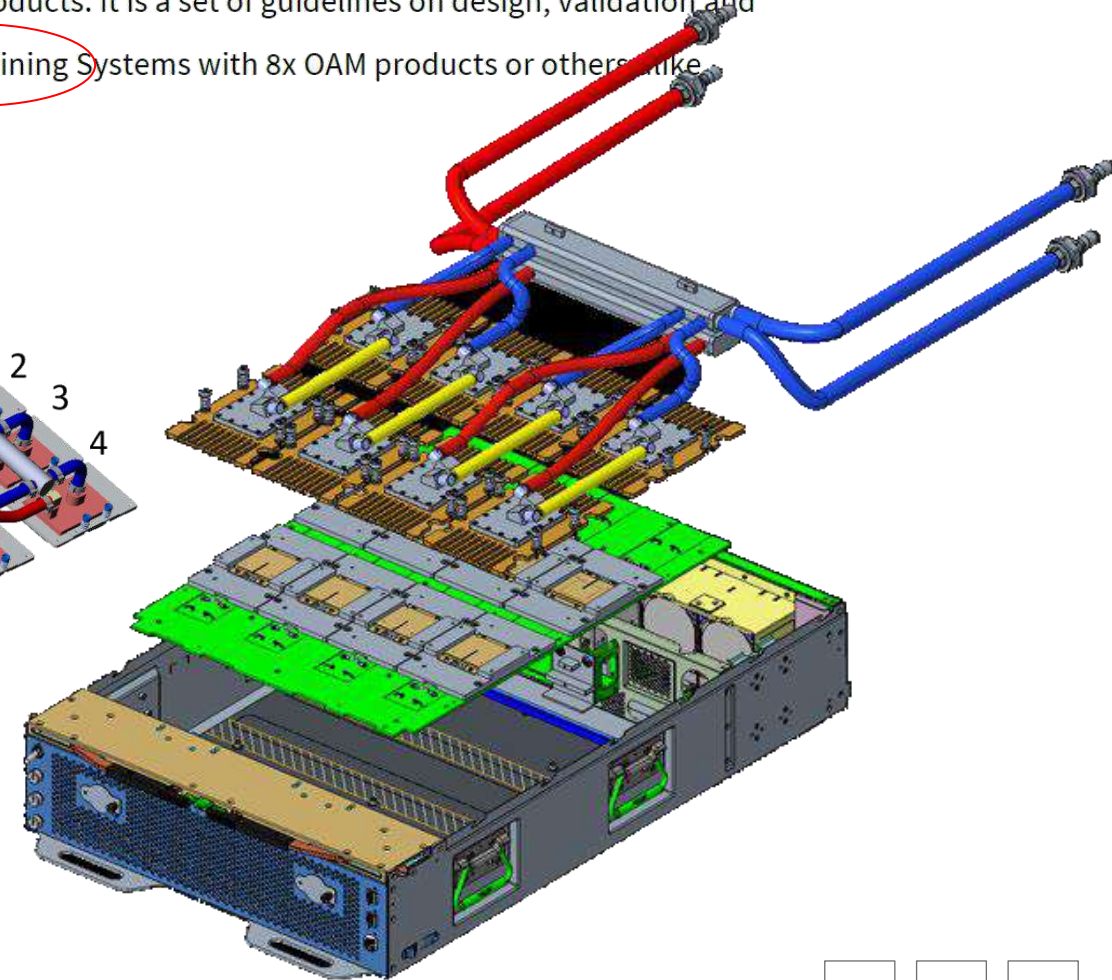
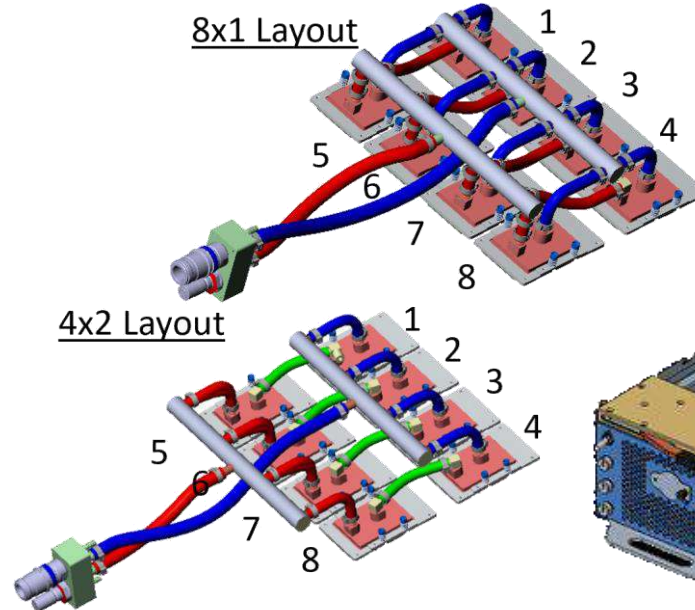
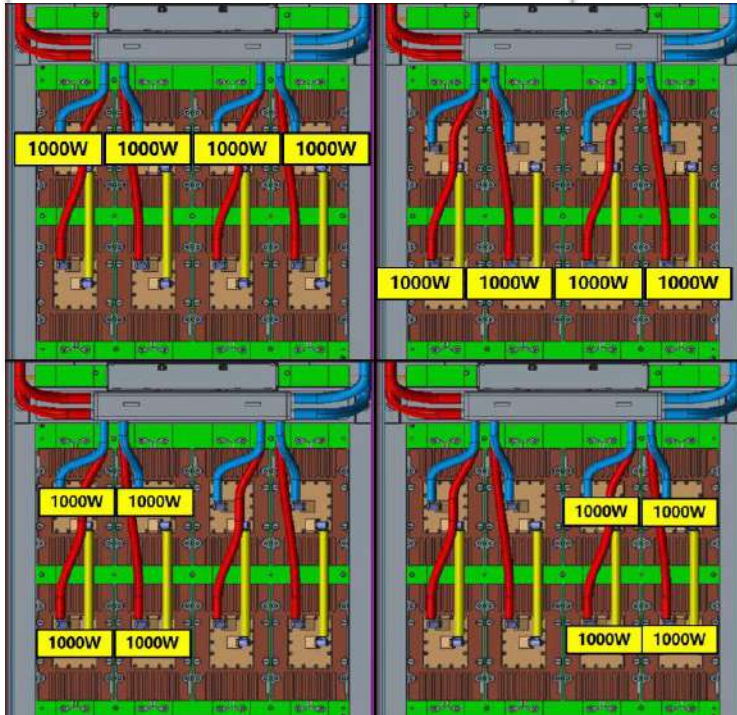


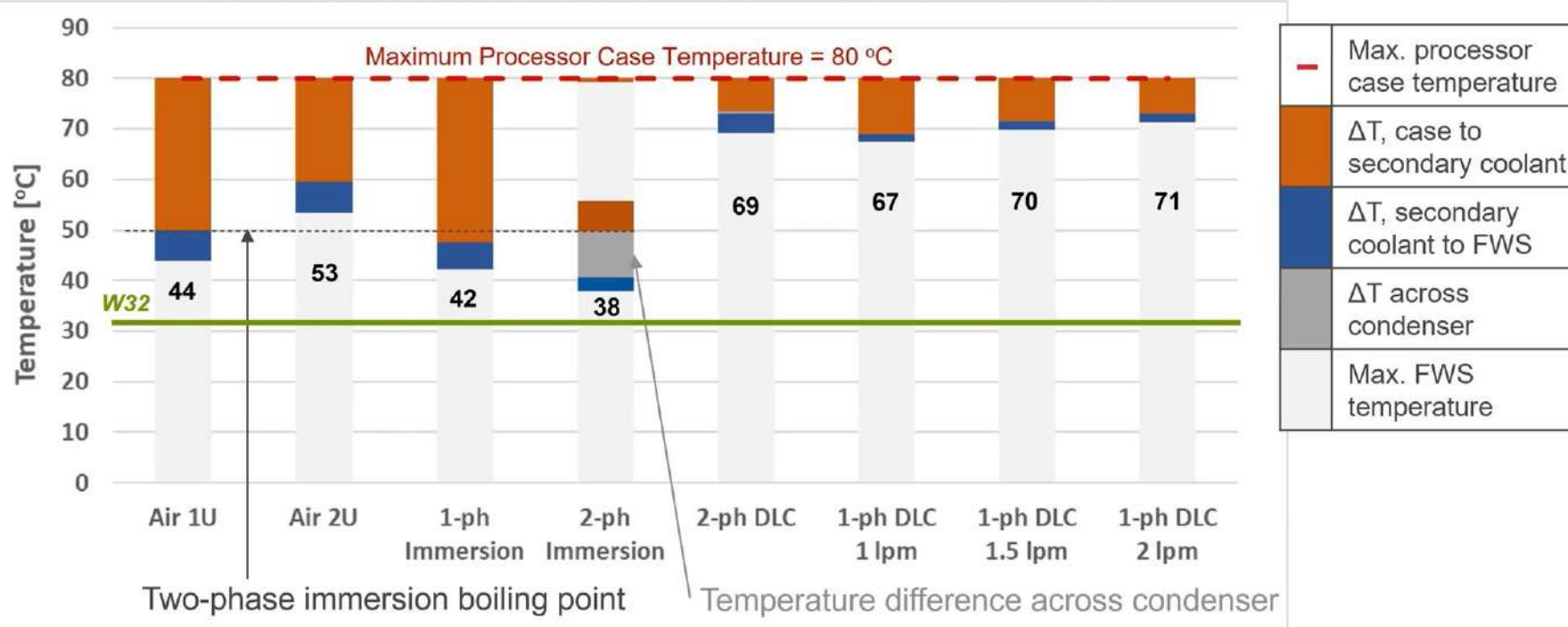
Figure 1. Prototype Chassis Design with TTV tray representing UBB1.0 and the 4x2 coldplate pairs of 5mm Manually-mate Quick Connects for coolant supply/return.

# IT cooling will move from Air to direct liquid Cooling

## Cooling water temperatures - 250 W processors



32 server rack of dual 250 W processors – 16 kW total rack load



DELL Technologies

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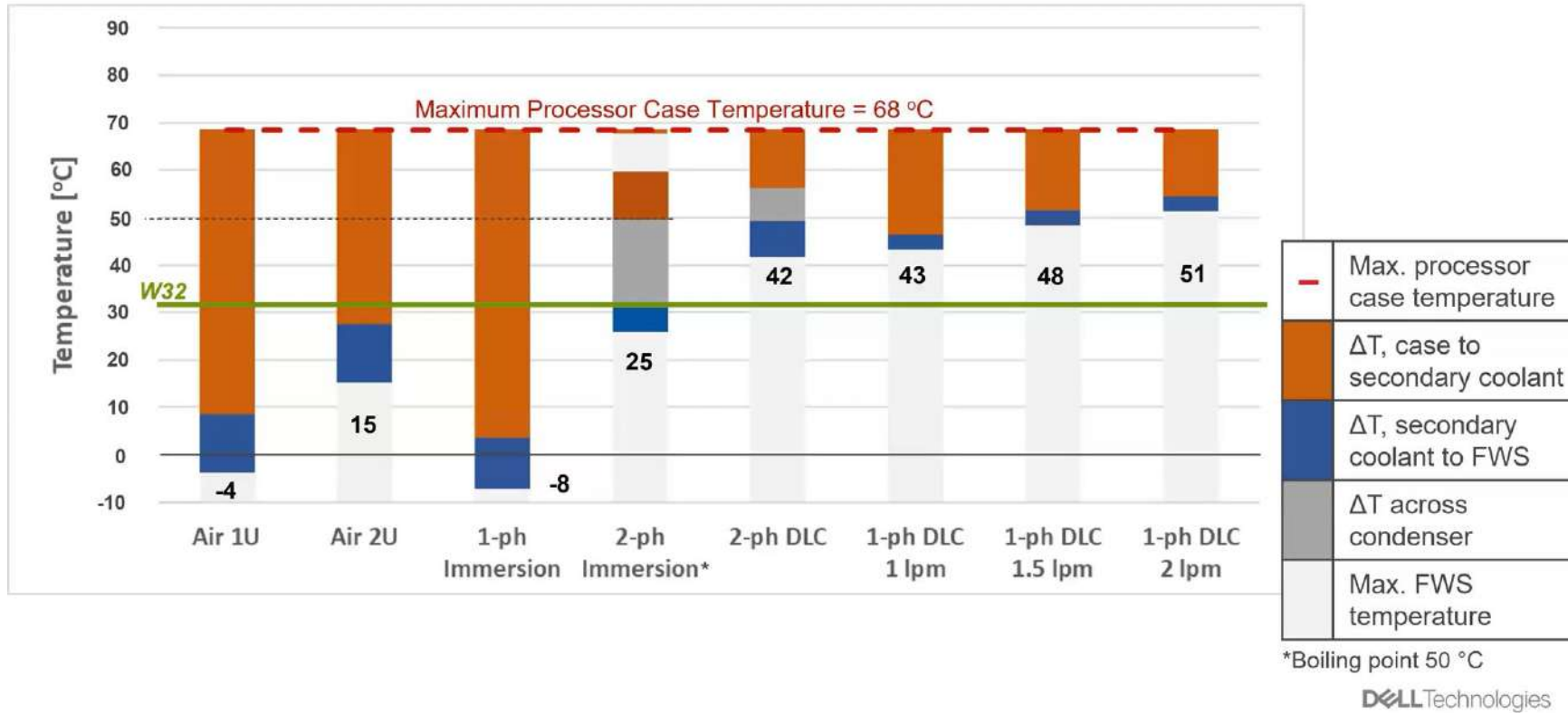


# IT cooling will move from Air to direct liquid Cooling

## Cooling water temperatures - 500 W processors



32 server rack of dual 500 W processors – 32 kW total rack load



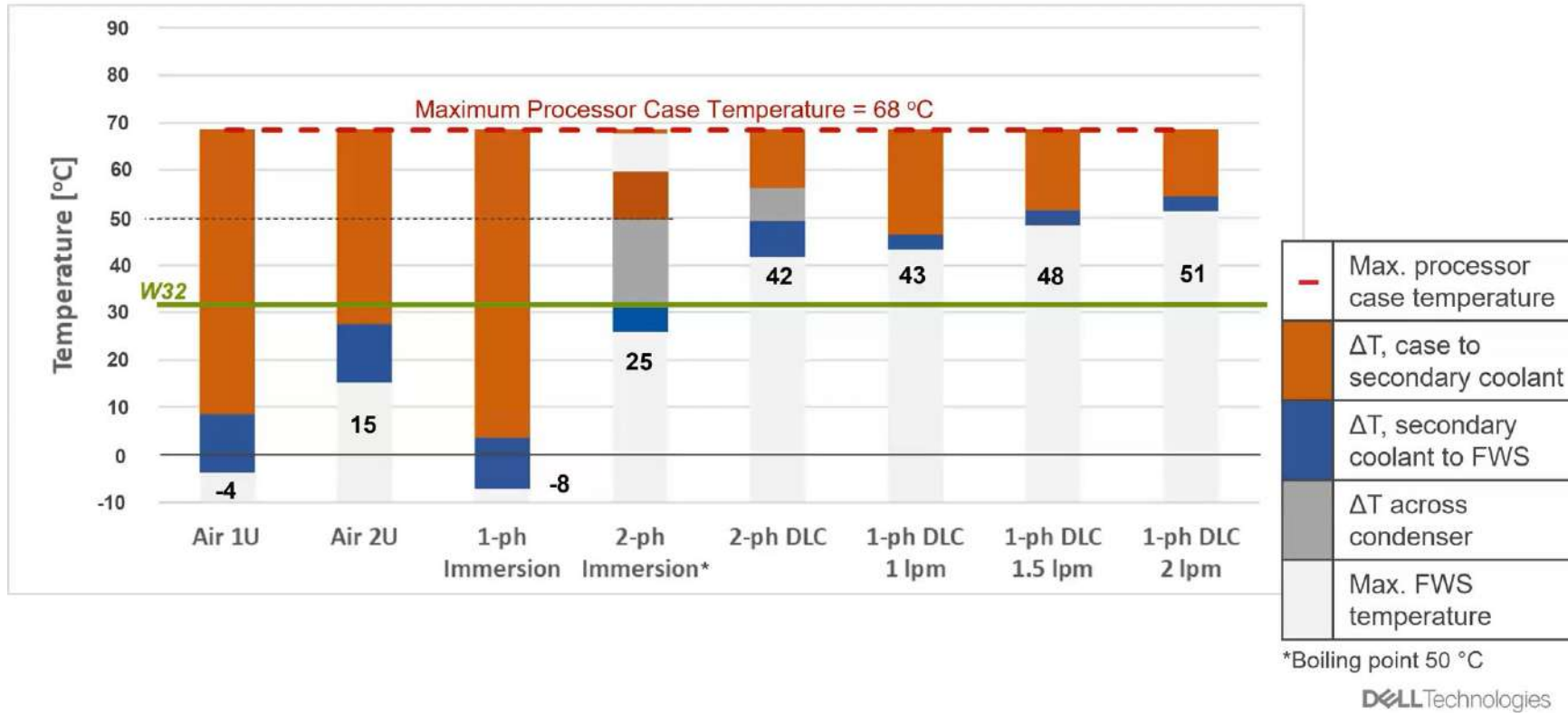
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# IT cooling will move from Air to direct liquid Cooling

## Cooling water temperatures - 500 W processors



32 server rack of dual 500 W processors – 32 kW total rack load



22 of 31 © Copyright 2023 Dell Inc.

# HIGH PERFORMANCE/AI COMPUTING LEGRAND DATA CENTER SOLUTIONS



Rear door cooling

+



Liquid chip cooling

## USYSTEMS REAR DOOR COOLER



Fans				
Type		Backward Curved Centrifugal		
Number of fans		5	6	
Air flow	m <sup>3</sup> /h (CFM)	30%	2135 (1257)	2553 (1502)
		70%	5262 (3097)	6293 (3703)
		100%	6871 (4044)	8217 (4836)
Current 50Hz 230v / 60Hz 208v	A	30%	0.65 / 0.72	0.79 / 0.87
		70%	3.71 / 4.09	4.46 / 4.92
		100%	7.54 / 8.33	9.04 / 9.98
Power Input 50Hz 230v	W	30%	51	61
		70%	398	478
		100%	845	1014
Total fan noise	dB	30%	69	67
		70%	85	83
		100%	90	89

- Fans N+1, up to N+4
- Hot-Swappable & universal fans
- Dual power supply. A & B (ATS)
- Automatic safety settings in case of failure
- At 100% (93 kW) → 1014W power consumption by 6 fans
- Automatic adjustment for minimum consumption

# Questions - Discussion

