www.etp4hpc.eu

Presentations of New ETP4HPC Members

ETP4HPC GA, 15th March 2016, BCN

www.etp4hpc.eu

Luxembourg Institute of Science and Technology

ETP4HPC General Assembly – 15th March 2016 - BCN
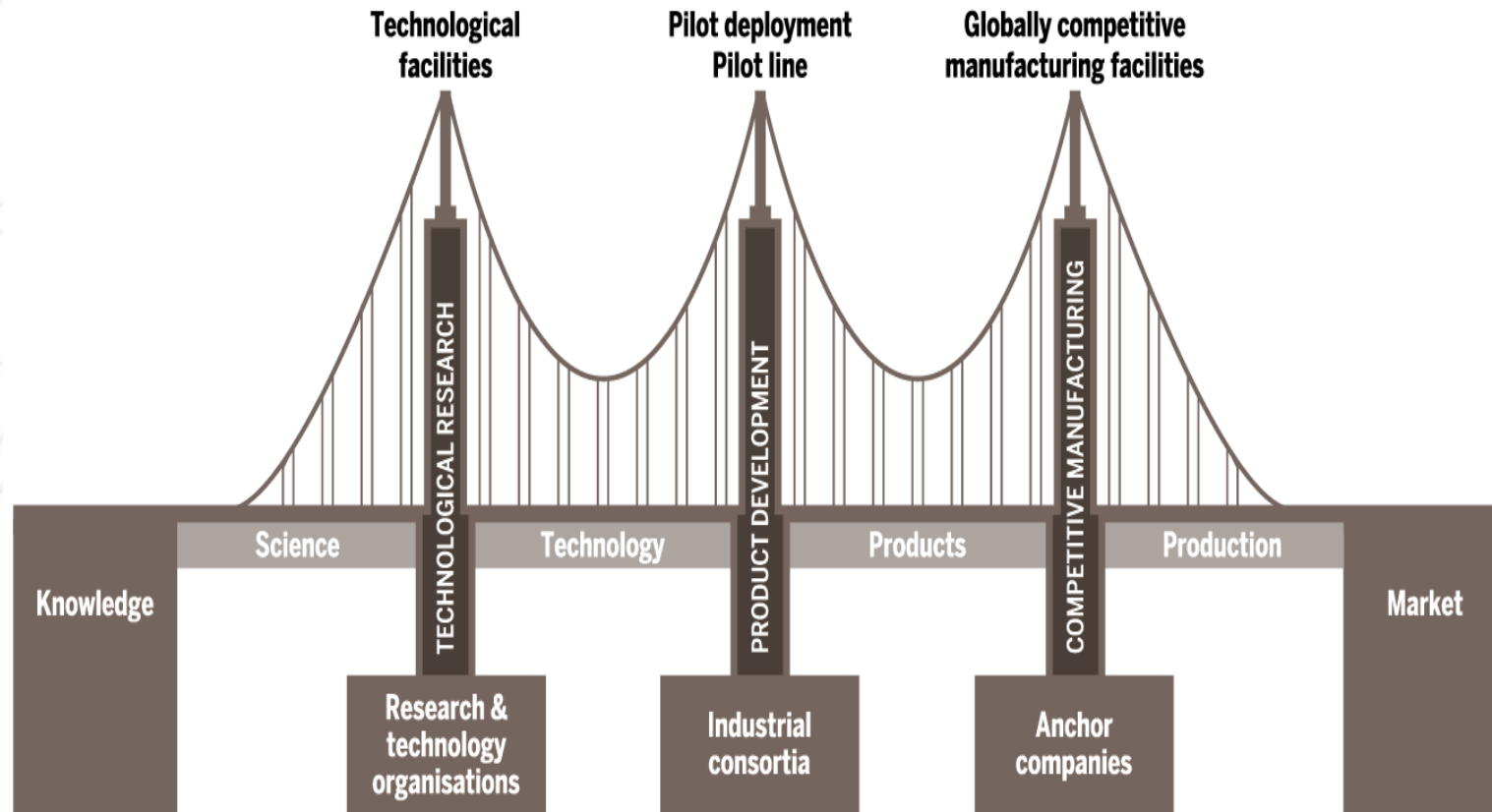
ACCELERATING YOUR INNOVATION

The **Luxembourg Institute of Science and Technology** (LIST) transforms scientific research in the fields of materials, environment and ITC into innovative technologies that respond to the needs of industry.

LUXEMBOURG
INSTITUTE
OF SCIENCE
AND TECHNOLOGY | LIST

Transferring scientific knowledge to the market

LIST'S MISSION

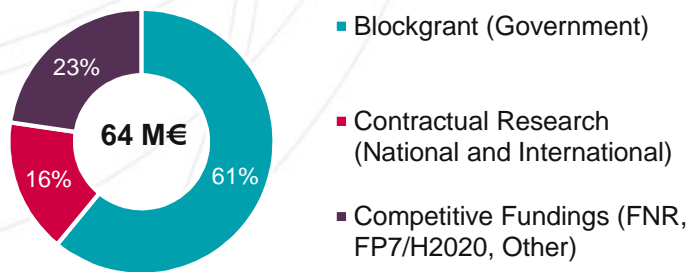## Supporting industry innovation
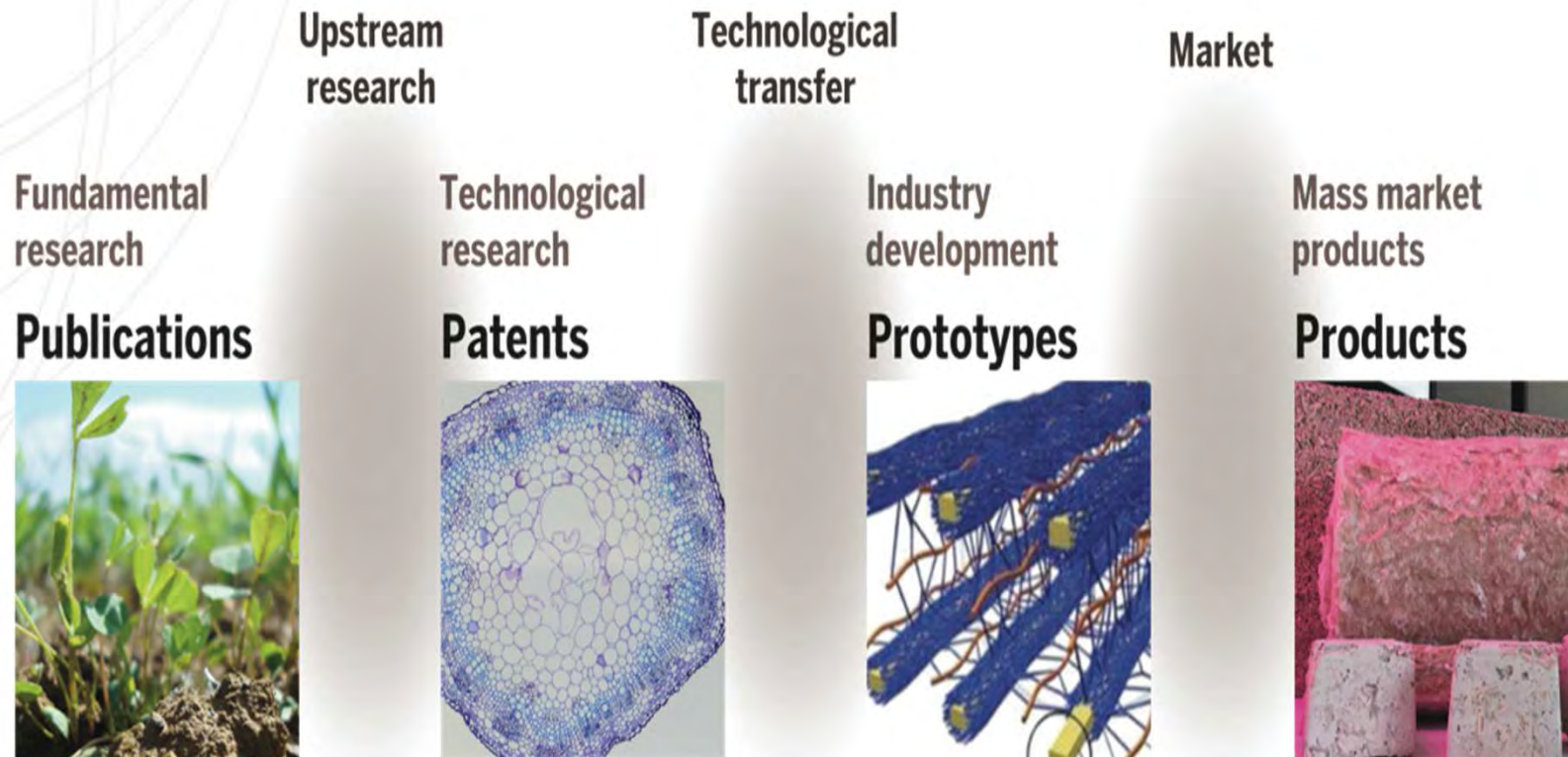
OVERVIEW

Key figures (2014)

Financial

2015 objectives of the Performance Contract signed with the Luxembourg State for 2015-2017

- 23%
- 64 M€
- 16%
- 61%

- Blockgrant (Government)
- Contractual Research (National and International)
- Competitive Fundings (FNR, FP7/H2020, Other)

Scientific Excellence

Referenced publications **350**

PhD & Post-Doc **70**

Business Collaboration

National partners **62**

Top European partners & clients **20**

Collaborative R&D projects **157**
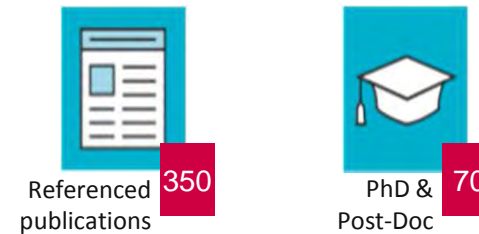
Technology Transfer

Patent families **50**

Licenses **76**

Spin-offs **2**
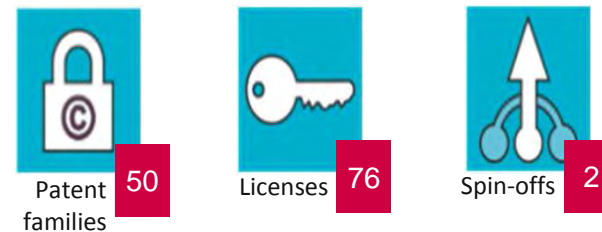
INTERDISCIPLINARY RESEARCH

Fields of expertise

Staff: 160

Staff: 150

Staff: 130

ENVIRONMENTAL RESEARCH AND INNOVATION (ERIN)

- Water security and safety
- Plants for biomass, biopolymers and bioenergy
- Life cycle sustainability and risk assessment
- e-Science for environmental and biological applications

MATERIALS RESEARCH AND TECHNOLOGY (MRT)

- Nanomaterials and nanotechnologies
- Composite materials

IT FOR INNOVATIVE SERVICES (ITIS)

- Decisional knowledge dynamics
- Trusted service systems
- Service engineering with impact

LIST.lu

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY

Scapos

ETP4HPC General Assembly – 15th March 2016 - BCN

scapos AG   (Guy Lonsdale, CEO)
www.scapos.com

SME, established in 2009 (Fraunhofer spin-off)

- **Marketing & sales support for scientific & technical computing software**

- **Expertise in R&D Project Management (HPC: particular focal point)**

> Partners: Fraunhofer Institutes SCAI, ITWM, IML, IAIS; SIDACT GmbH; Maritime University Szczecin

> Product areas incl: CAE Tools & numerical libraries; Optimisation & Logistics

ETP 4 HPC

Steering Board representation for Fraunhofer (G. Lonsdale)

FORTISSIMO **FORTISSIMO 2**

Operational Project Management; Open Call Management

ExaNoDe

Operational Project Management

exdci European Extreme Data & Computing Initiative

SRA; KPI & Monitoring

Johannes Gutenberg University Mainz

# HPC@
Johannes Gutenberg University Mainz

André Brinkmann

Zentrum für Datenverarbeitung

Johannes Gutenberg University Mainz

Johannes Gutenberg University Mainz

- Founded in 1477 and reopened after a 150-year break in 1946 by the French forces

- 35,000 students from about 130 nations

- 4,150 academics, including 540 professors, teach and conduct research in JGU's more than 150 departments, institutes, and clinics

- Extraordinary research achievements in the fields of particle and hadron physics, materials sciences, and translational medicine

High Performance Computing
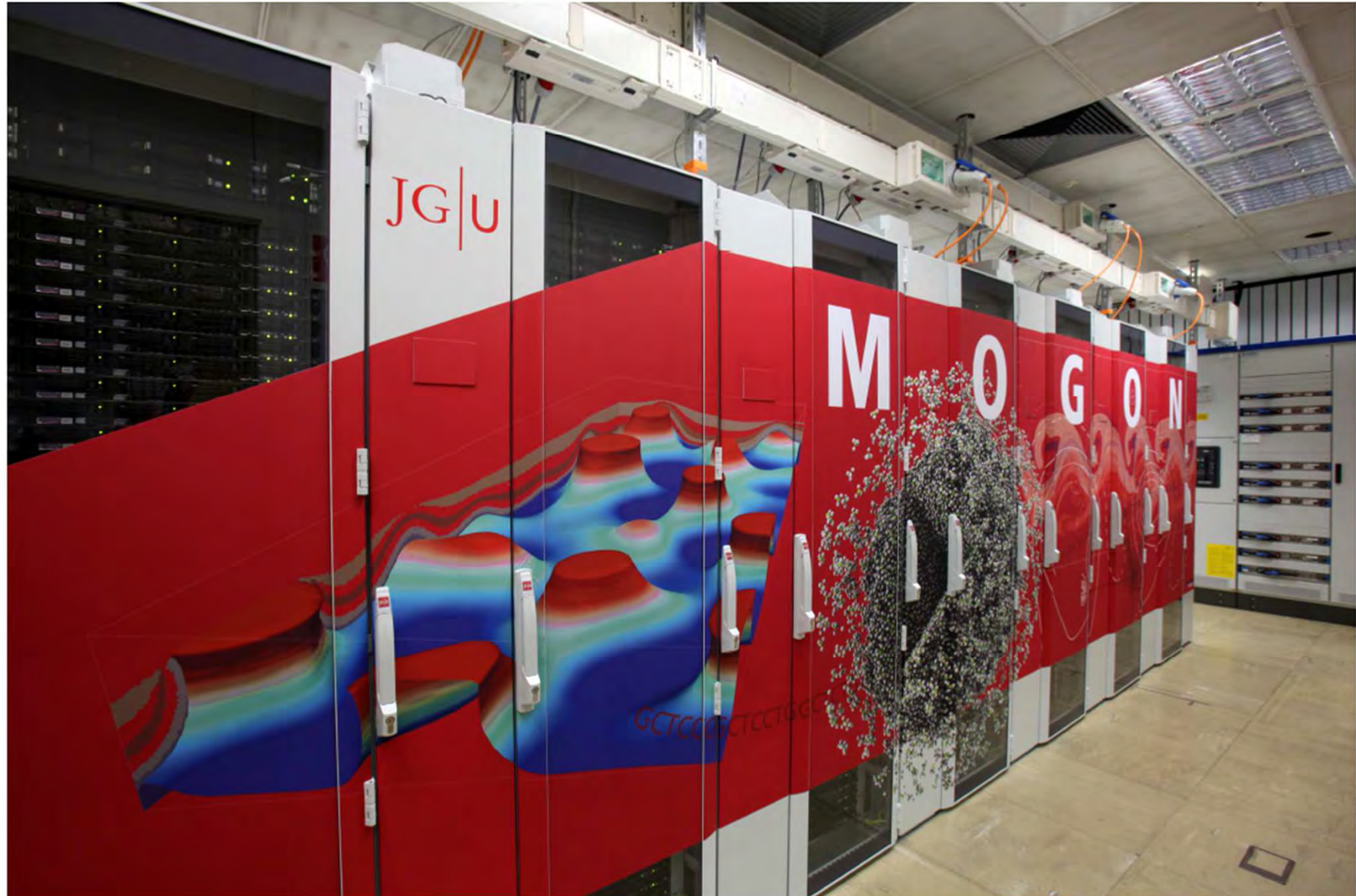
High Performance Computing

MOGON SPECS

64 «« 2100MHz Opteron 6272

Nodes »» **555**

35520 «« Cores

Total RAM »» **89TB**

1110TB «« Local Storage

QDR Infiniband »» **Fat tree**

Peak Performance

298 Teraflops

HPC Services & Research

- Competence Center for high performance computing (HPC) funded by the Carl Zeiss Foundation

- European Training Network (ETN) "BigStorage: Storage-based Convergence between HPC and Cloud to address Big Data Challenges"

- Intel® Parallel Computing Center for Lustre on "Lustre QoS: Network Request Scheduler and Monitoring Revisited"

- Member of the German Collaborative Research Centre "Multiscale Simulation Methods for Soft Matter Systems"

- BMBF HPC-SW project "Find a Suitable Topology for Exascale Applications" (FaST)

- Number of smaller joint projects with HPC storage companies, national and international HPC labs …

Asetek

Hot Water Data Center Liquid Cooling

March 2016

Jochen Polster, Sales Director EMEA

jpo@asetek.com

Who is Asetek?

- **The world's leading supplier of liquid-cooling systems for workstations, high performance PCs and servers**
  - Public company: In the market since 1999
  - Global operations: US, Denmark, China, Taiwan
  - More than 2.8 million units deployed in both consumer and enterprise
  - Patent protected Intellectual Property
  - Products offered by major OEMs:

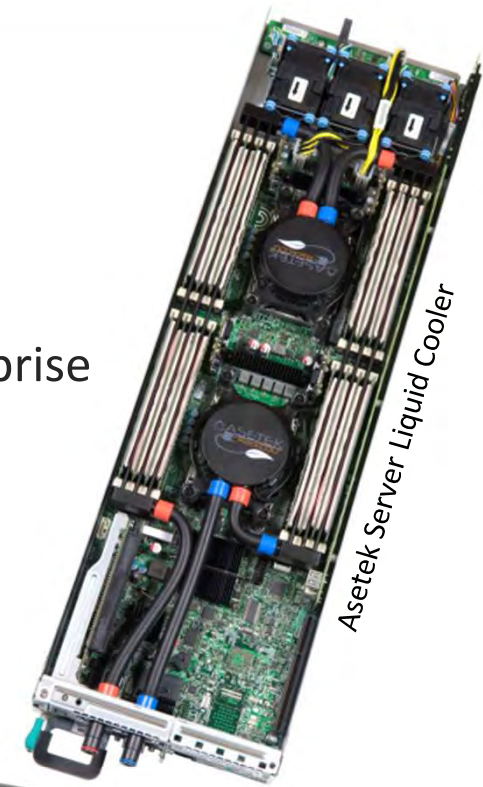 AMD   ASUS   CRAY   DELL   FUJITSU

  hp   intel   lenovo   PENGUIN COMPUTING

- **Asetek Liquid Cooling Systems are:**
  - Factory Sealed, Pre-assembled, Drop-in Solutions
  - Low-Pressure Operation/Low-Permeability Design
  - Robust, highly reliable, (FIT < 15)
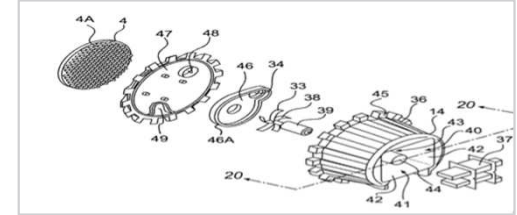 - Low cost – dramatic change from the past

Asetek Server Liquid Cooler

Asetek Desktop Liquid Cooler

Asetek <u>created the category for</u> robust, factory-sealed, low-cost liquid cooling

What makes Asetek unique?

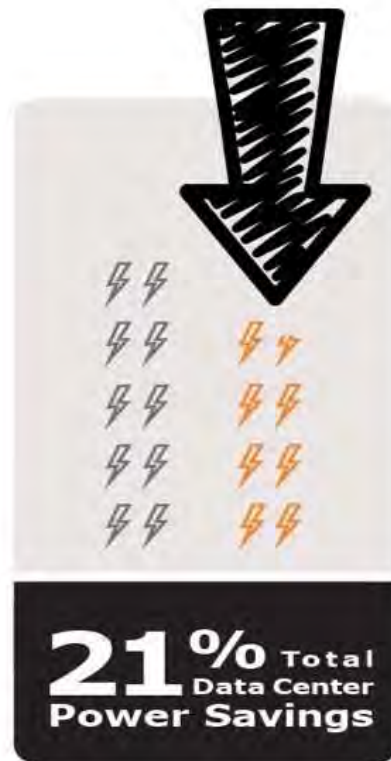|			
MARKET	**TECHNOLOGY**	**MANUFACTURING**	**INTELLECTUAL PROPERTY**
▪ Superior market leader by revenue, volume and customers ▪ Access to market through active customer relationships with almost all large industry players ▪ 16 years of experience with thermal management and liquid cooling	▪ **Highly efficient direct-to-chip liquid cooling** ▪ **Plug and play technology** ▪ **No end-user maintenance** ▪ **Common core technology behind all products** ▪ **Possible to re-use waste heat** ▪ **Low cost by design**	▪ Highly scalable manufacturing model using "copy exact" principle ▪ Full control over production at contract manufacturer in China ▪ High-tech CNC manufacturing plant in Denmark ▪ High volume production cost advantage. ▪ 60k to 90k coolers per month, typical.	▪ Several years ahead of competition ▪ All products and technologies are patent protected ▪ Asetek considers IP to be more than just technology and defends its IP vigorously

REDUCE OPEX

OPTIMIZE CAPEX

EXPANDING
Data Center Demands

UNLEASH POTENTIAL

GOING GREEN

Reduce OpEX

LIQUID COOLING
Done right!

50 % Lower Cooling Costs

21 % Total Data Center Power Savings

"The facilities cost for a hybrid liquid/air-cooled system was 50% of the cost of a completely air-cooled system"

John Noe,
Manager of Scientific Computing

REDUCE OPEX

OPTIMIZE CAPEX

UNLEASH POTENTIAL

GOING GREEN
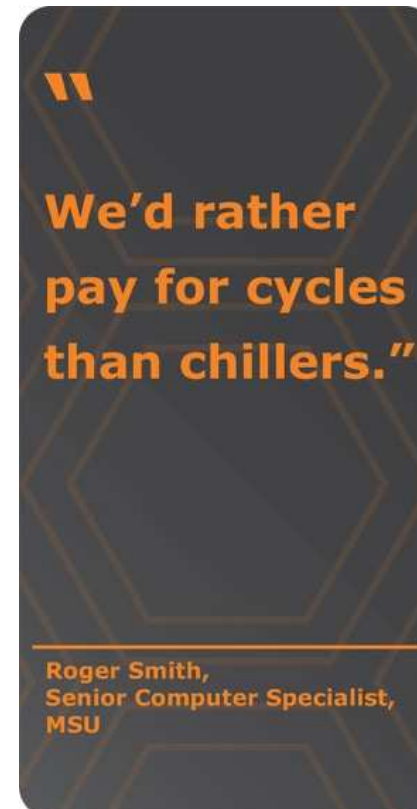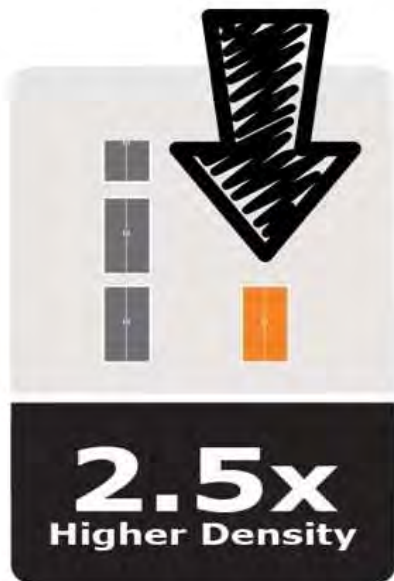
More Power Efficient Cooling
Eliminate chillers & cooling towers
Or utilize existing chillers
Reduce Server Power by Eliminating Fans

ASETEK

Optimize CapEX

SAVES MONEY ($)

SAVES POWER ⚡

SAVES SPACE

PAYS FOR ITSELF in 0-3 Years

2.5x Higher Density

"We'd rather pay for cycles than chillers."

Roger Smith, Senior Computer Specialist, MSU

REDUCE OPEX

OPTIMIZE CAPEX

UNLEASH POTENTIAL

GOING GREEN

Shift CapEX to Compute Cycles

Power Efficiency: Grow DC server count within current power envelope.

Optimize Physical Space: Increase server count within existing racks.

Cooling Efficiency: Purchase dry coolers rather than more chillers.

Liquid Cooling Landscape

Air Immersive

In-Row Coolers

Sealed Racks

Rear Door Coolers

Liquid Immersive

Immersion Racks

Immersion Servers

Conductive

Asetek RackCDU™ & Internal Loop™

ASETEK

Heat Pipes

Direct Touch

3 Data Center Solutions

RackCDU D2C™

Direct-to-Chip Hot Water Liquid Cooling
Captures 60%-80% of server heat.
Reduced data center OpEx.
Immediate to 1 year payback typical.

RackCDU ISAC™

Captures nearly 100% of server heat.
No air exchanged between servers & data
center. Mitigates air quality concerns.

Internal Loop™

Liquid Enhanced Air Cooling
Enables maximum wattage CPUs & GPUs.
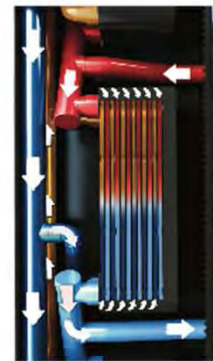No changes required to infrastructure.

RackCDU D2C Overview

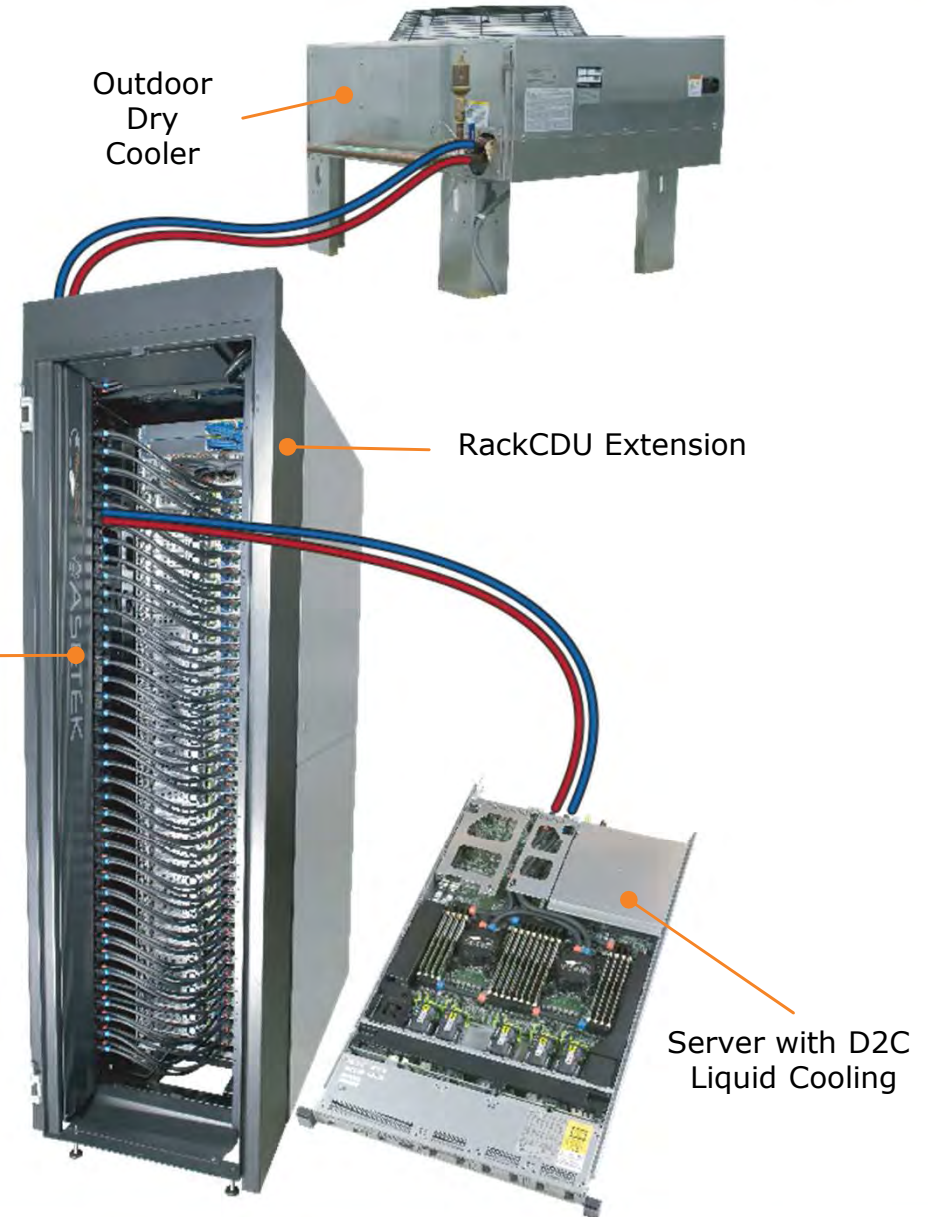RackCDU D2C™

"Free cooling" solution that captures between **60%** and **80%** of server heat, reducing data center cooling cost by over **50%** and allowing **2.5x-5x** increases in data center server density.

Outdoor Dry Cooler

RackCDU Extension

Liquid-to-Liquid Heat Exchanger

Server with D2C Liquid Cooling

ASETEK

Backup

January 2016

Sandia National Laboratories

Sky Bridge Supercomputer
600 teraflop - 1848 nodes

Save CapEx and OpEx While Growing Your HPC

Challenge

Data center cooling capacity constrained.

Solution

Cray CS300-LC with RackCDU D2C cut air heat-load by more than 70%, making mechanical upgrade unnecessary.

Installation Highlights

CapEx Savings on mechanical upgrades paid for liquid-cooling plus additional compute.

Sandia National Laboratories

CRAY
THE SUPERCOMPUTER COMPANY

"The facilities cost for a hybrid liquid/air cooled system was 50 percent of the cost of a completely air-cooled system"

- John Noe, Manager of Scientific Computing

OPTIMIZE CAPEX   UNLEASH POTENTIAL

ASETEK

University of Tromsø

Recycling Waste Heat in Norway

Stallo Supercomputer
6,560 liquid cooled cores

Challenge

Data center energy reuse for year-round campus heating.

Solution

RackCDU D2C retrofit enabled recouping 70% of supercomputing power for campus heating.

Installation Highlights

Initial install running production workloads since January 2014.
Success led to build out of full system, completed June 2015.

Other Benefits (at 25°C ambient)

73% reduction in cooling energy.
9% reduction in IT energy.

"We have moved from counting how many flops from the supercomputer to how many watts we recycle." - Svenn Hanssen, UiT

OPTIMIZE CAPEX   GOING GREEN

ASETEK

Mississippi State University

Invest in Supercomputers, Not Chillers

CRAY
THE SUPERCOMPUTER COMPANY

MISSISSIPPI STATE UNIVERSITY

Shadow Supercomputer
33,600 liquid cooled cores

Challenge

Data center cooling capacity constrained.

Solution

Cray CS300-LC with RackCDU D2C enabled MSU to buy more computer rather than additional chillers.

Installation Highlights

Initial install of 5-rack cluster February, 2014

Success led to install of second 4-rack cluster in Dec. 2014

Other Benefits

Performance increases with liquid cooling:

System Type	LINPACK	Xeon Phi Avg. Temp
Air Cooled (18°C)	1.82 TFLOPS	72.75ºC
Liquid Cooled (25°C)	2.01 TFLOPS	62.5ºC

"We'd rather pay for cycles than chillers."

- Roger Smith, Senior Computer Specialist, MSU

OPTIMIZE CAPEX   **UNLEASH POTENTIAL**

ASETEK

LIQUID COOLING
Done right!

Running Asetek RackCDU Since June 2013

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Skynet Cluster

Challenge

Build the world's most energy efficient data center with PUE of 1.06 and ERE of 0.9.

Solution

RackCDU D2C retrofit enabled 64% heat capture and doubled compute density.

Installation Highlights

Operating reliably since June 2013.

New RackCDU D2C cooled equipment for installation in 2H 2015.

"Asetek liquid cooling is easy to deploy and just plain works."

- Steve Hammond, Director, Computational Science Center

ASETEK

GOING GREEN

Some Resources

- **Video: How RackCDU D2C works**
  https://youtu.be/lBEP35H32NE

- **Blogs and Articles**
  http://www.asetek.com/press-room/blog/

- **General purpose benefits calculator**
  http://www.asetek.com/data-center/calculate-your-savings/

- **Publically Announced Customer Summaries**
  http://www.asetek.com/data-center/data-center-installations/

- **RackCDU D2C™ Liquid Cooling site**
  http://www.asetek.com/data-center/data-center-coolers/rackcdu-d2c/

Cybeletech

ETP4HPC General Assembly – 15th March 2016 - BCN

CybeleTech
Technologies numériques pour le monde végétal
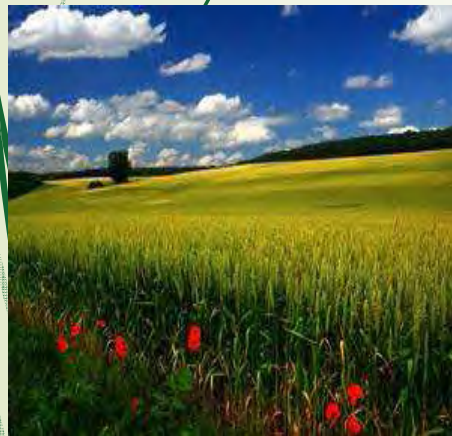
Software

Case study

Services

for all the stakeholders in agriculture

View

Challenges

Increase agricultural production

+ 50% by 2050

Preserve natural resources

Agriculture uses 70% of resources in water/year

Preserve environment

100 millions tons of nitrogen spread each year

Decrease GHG emission by agriculture (17 to 32%)

ICT

Modeling and simulation tools

Monitoring and data assimilation

Decision aids tools

Access to high performance computing

Rise of digital agriculture

CybeleTech

Technologies numériques pour le monde végétal

Based on most recent numerical technologies

- Plant growth modeling technologies
- IoT , data analytics and data assimilation
- Stochastic optimization and optimal control
- Parallel computing , cloud computing
- IT architectures and platforms of services
- Visualization tools
- Hardware-software interaction environments …

…with a team of high qualified engineers

CybeleTech

Technologies numériques pour le monde végétal

Strong added value services

➡ ## Numerical softwares development

Model and simulation, Machine Learning, Decision Aided Tools…

➡ ## Design and development of adapted Information Systems

Database architectures, human-computer interfaces and visualization tools, plateforms of services, parallel architectures…

➡ ## Studies for varietal selection process, crops management, increased competitiveness in production phases, yield predictions…

CybeleTech
Technologies numériques pour le monde végétal
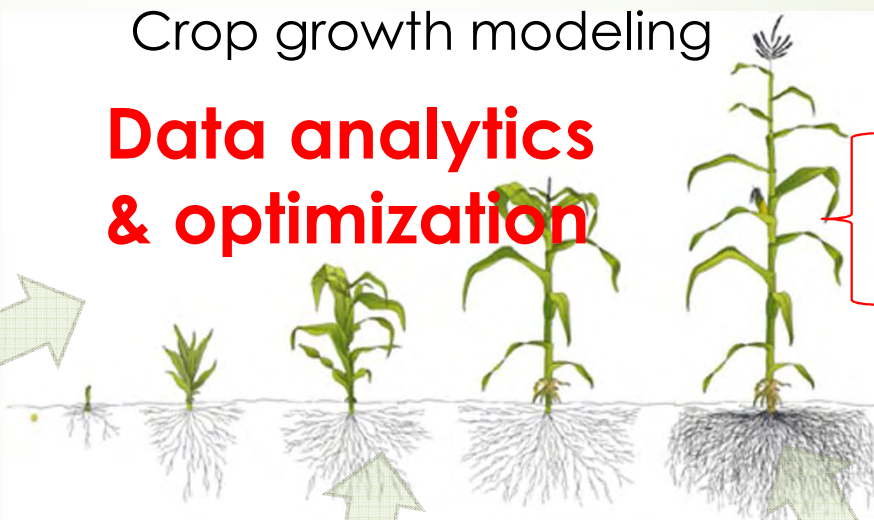
Satellite imaging
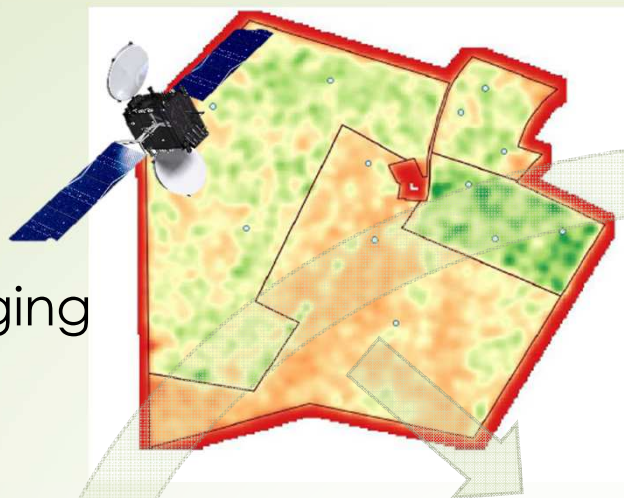
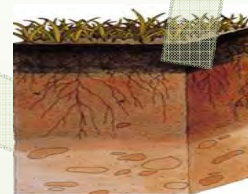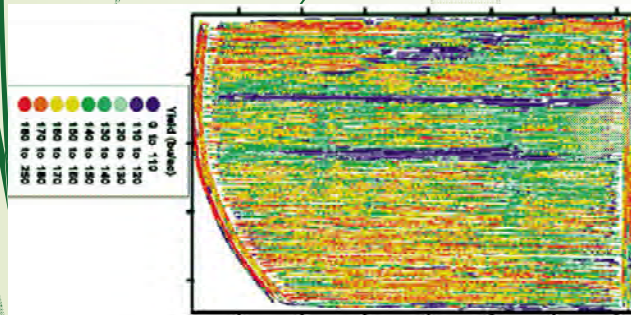Weather data

Crop growth modeling

Data analytics & optimization

**Sowing
Irrigation
Fertilizers
Pesticides**

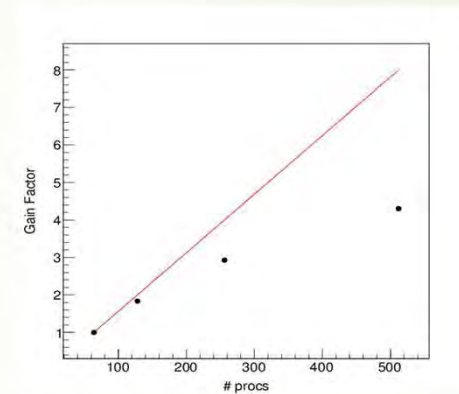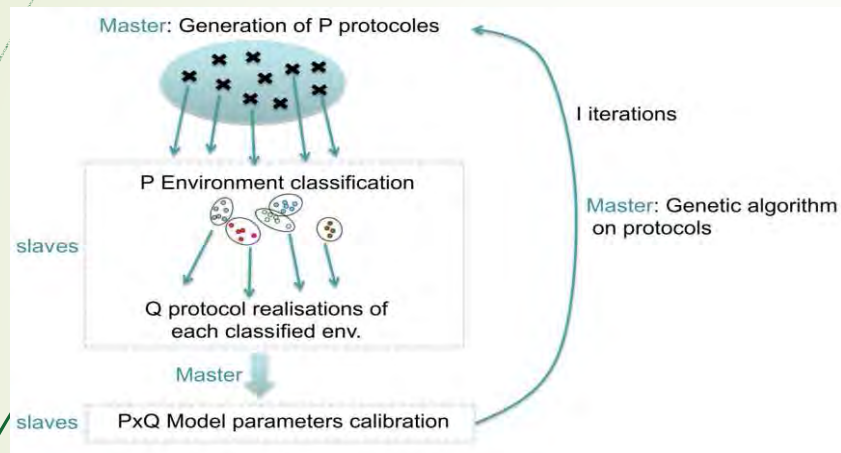Yield maps

Agronomic data

Soil database

CybeleTech

Technologies numériques pour le monde végétal

HPC roadmap

- To test new parallel architectures and to improve performance of codes

Example : Tests of optimization application on Mont-Blanc:

- To design new parallel algorithms

- To deploy production applications on distributed platform for multiple data sources handling

- To participate to HPC projects (PRACE, Mont Blanc…) to sustain R&D needs

CybeleTech

Technologies numériques pour le monde végétal

Our membership in ETP4HPC

- To adapt applications softwares and to validate new architectures

- To develop new skills

- To take part in collaborative projects with resources providers

CybeleTech

Technologies numériques pour le monde végétal