CHALMERS

UNIVERSITY OF TECHNOLOGY

MASTERS' PROGRAMME IN
HIGH-PERFORMANCE COMPUTER SYSTEMS

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Computer Science and Engineering Department

Why HPC Systems?

Perfect **tool** for:

Science Simulations

Advice & Prediction

Big Data Analysis

Business Simulations
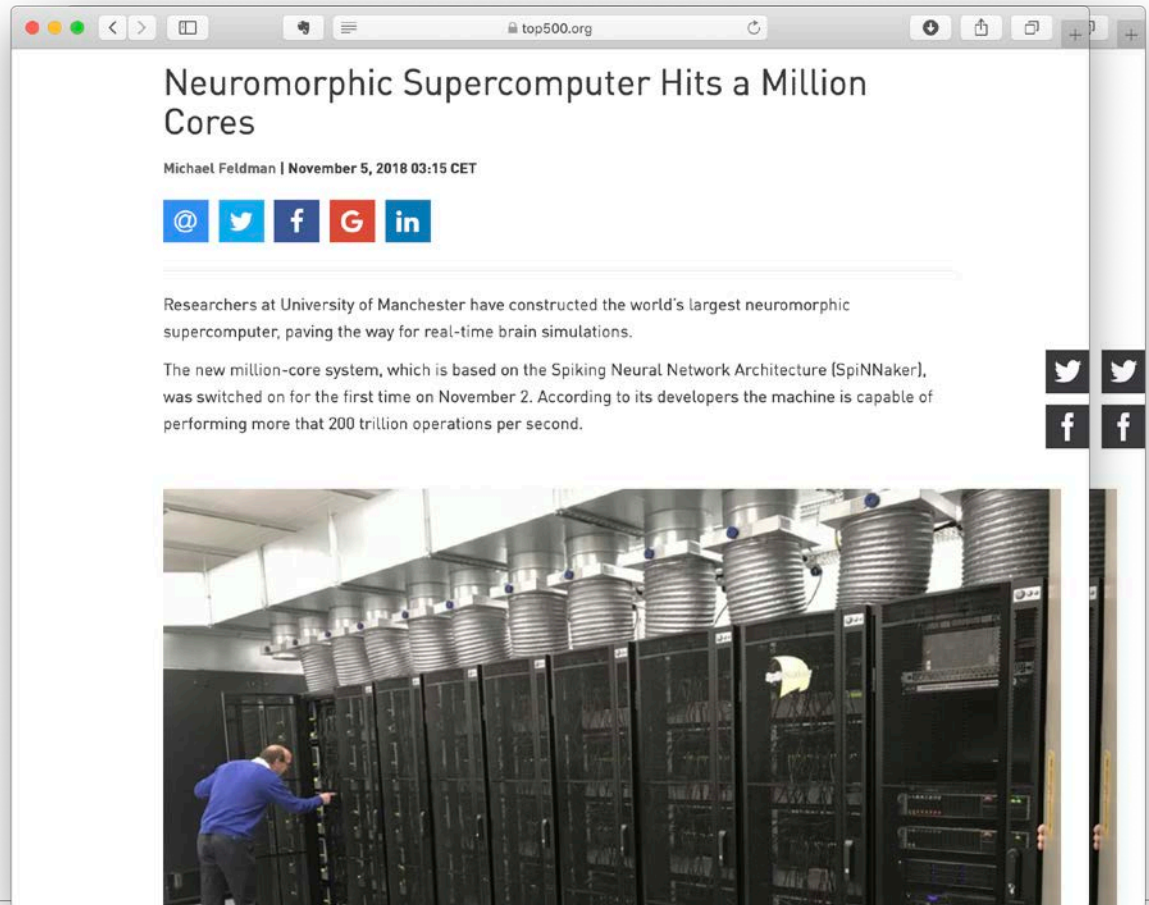
Autonomous Vehicles

Product Development

Personal Medicine

What are HPC Systems?

Systems that: have lots of compute elements

have large memory

are very fast

do many computations per second

fit in small spaces

do not consume much energy

In the news…

Neuromorphic Supercomputer Hits a Million Cores

Michael Feldman | November 5, 2018 03:15 CET

Researchers at University of Manchester have constructed the world's largest neuromorphic supercomputer, paving the way for real-time brain simulations.

The new million-core system, which is based on the Spiking Neural Network Architecture (SpiNNaker), was switched on for the first time on November 2. According to its developers the machine is capable of performing more that 200 trillion operations per second.

Past

- **HPC systems = supercomputers**

Today and Future

- HPC systems = supercomputers
- Ubiquitous in autonomous vehicles - **machine learning**
- centers & IoT infrastructures - **analyze big data**

Why choose MPHPC?

industry is using them

they are hard to design

they are hard to build
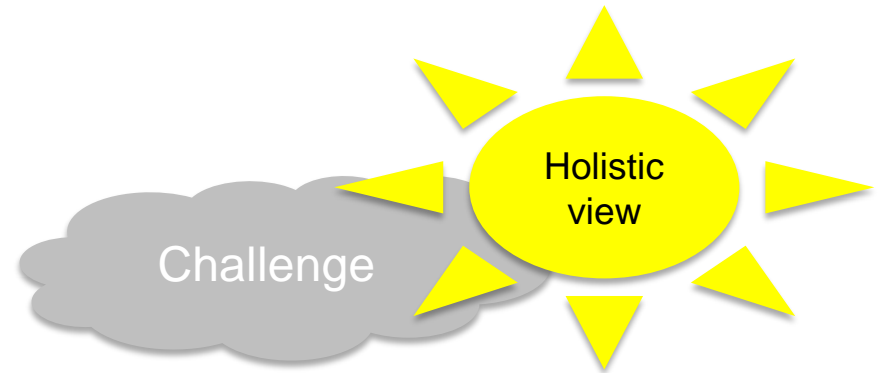
they are hard to program

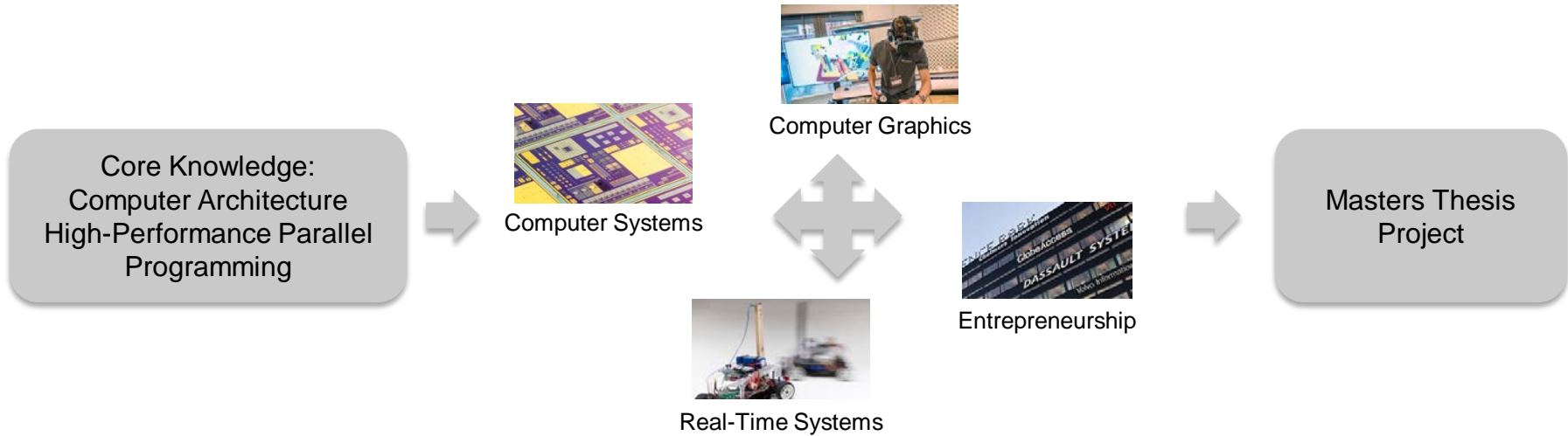*you like computer architecture and engineering!*

you like tough challenges

you want to design, build, and sell one!

Challenge

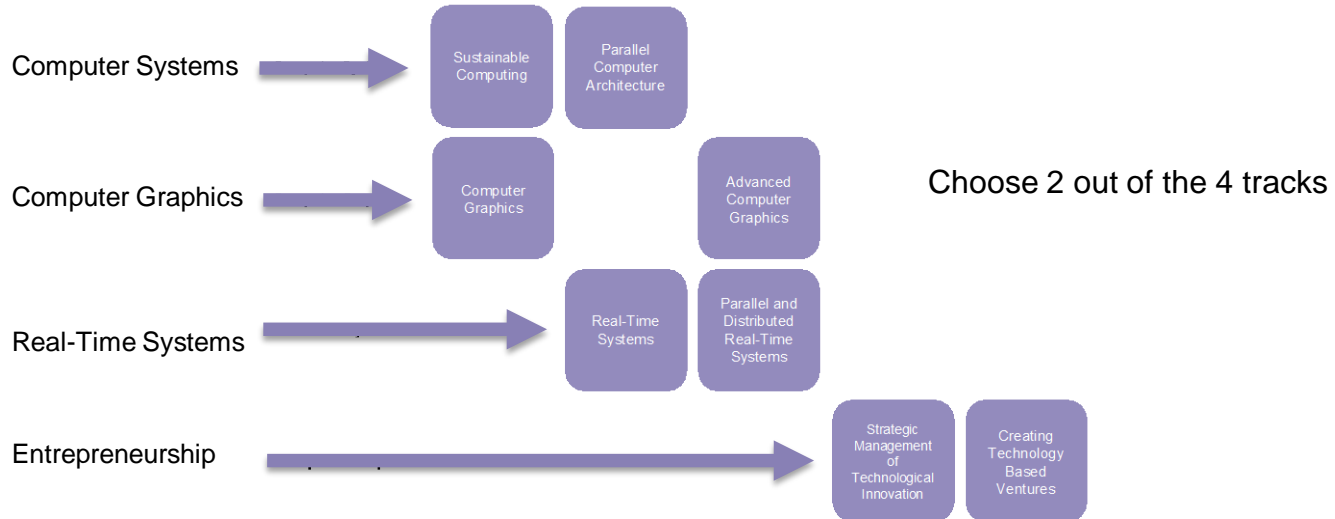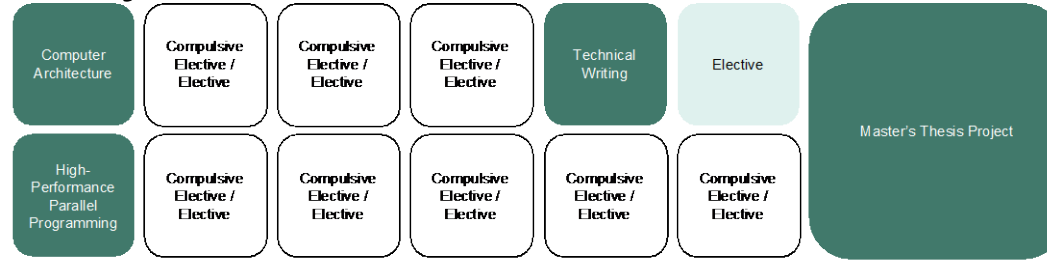- Design **software** and **hardware** for demanding **power and energy constraints**
- Being able to **develop** and **exploit** HPC systems and
- Bring solutions to the **market**
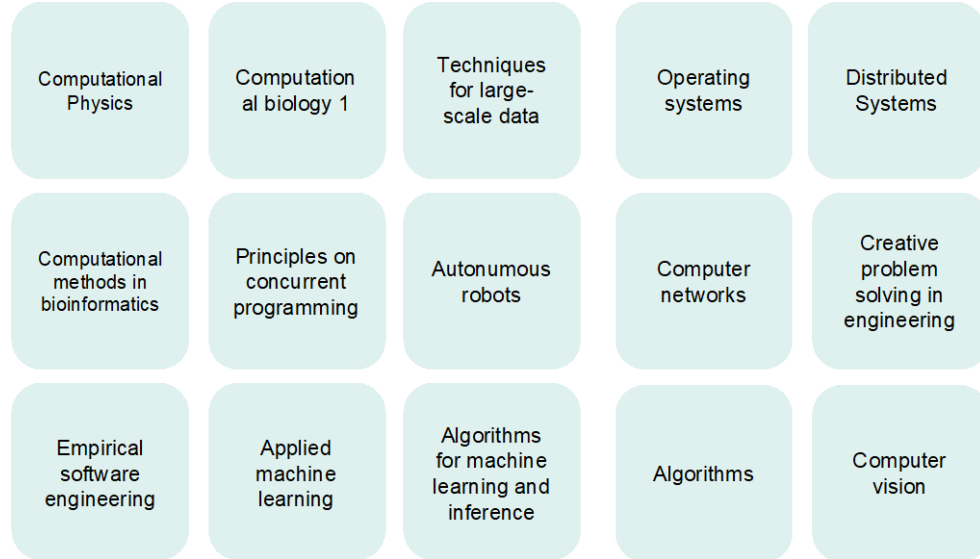
Holistic view

Challenge

CHALMERS
UNIVERSITY OF TECHNOLOGY

Core Knowledge:
Computer Architecture
High-Performance Parallel
Programming

Computer Systems

Computer Graphics

Real-Time Systems

Entrepreneurship

Masters Thesis
Project

MPHPC Study Plan

Computer Architecture	Compulsive Elective / Elective	Compulsive Elective / Elective	Compulsive Elective / Elective	Technical Writing	Elective	Master's Thesis Project
High-Performance Parallel Programming	Compulsive Elective / Elective	Compulsive Elective / Elective	Compulsive Elective / Elective	Compulsive Elective / Elective	Compulsive Elective / Elective	

Computer Systems → Sustainable Computing | Parallel Computer Architecture

Computer Graphics → Computer Graphics | Advanced Computer Graphics

Real-Time Systems → Real-Time Systems | Parallel and Distributed Real-Time Systems

Entrepreneurship → Strategic Management of Technological Innovation | Creating Technology Based Ventures

Choose 2 out of the 4 tracks

MPHPC Study Plan

Computational Physics	Computational biology 1	Techniques for large-scale data	Operating systems	Distributed Systems
Computational methods in bioinformatics	Principles on concurrent programming	Autonumous robots	Computer networks	Creative problem solving in engineering
Empirical software engineering	Applied machine learning	Algorithms for machine learning and inference	Algorithms	Computer vision

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Requirements & Admissions (EN)

- *Bachelor's degree (or the equivalent) with a major in:* Computer Engineering, Computer Science, Automation and Mechatronics, Electrical Engineering, Engineering Physics, Software Engineering or related subjects
- *Prerequisites:* Mathematics (including Calculus (at least 7,5 cr.) and Linear algebra (at least 7,5 cr.)), Programming in a general-purpose language (e.g. C/C++/Java/Haskell or similar (at least 7,5 cr.)), Introduction to computer engineering (at least 7,5 cr.), and one of the following courses: Discrete mathematics and/or Mathematical statistics and/or Probability theory and/or Algorithms and/or Data structures (at least 7,5 cr.)
- *Preferable course experience:* Basic computer organization, Machine-oriented programming, Principles of concurrent programming, Mathematical modelling and problem solving

MPHPC

Requirements & Admissions (SE)

- *Kandidatexamen (eller motsvarande) med huvudområde inom:* Datateknik, Datavetenskap, Automation och Mekatronik, Elektroteknik, Teknisk fysik, Mjukvaruteknik eller motsvarande
- *Förkunskapskrav:* Matematik (innehållande Matematisk analys (minst 7,5 hp), Linjär algebra (minst 7,5 hp)) och Programmering i ett generellt programmeringsspråk (t.ex. C/C++/Java/Haskell eller liknande (minst 7,5 hp)), Grundläggande datorteknik (minst 7,5 hp)), samt en av följande kurser: Diskret matematik och/eller Matematisk statistik och/eller Sannolikhetslära och/eller Algoritm och/eller Datastrukturer (minst 7,5 hp)
- *Rekommenderade kurser:* Datorsystemteknik, Maskinorienterad programmering, Principer för parallell programmering, Matematiskt modellering och problemlösning

MPHPC
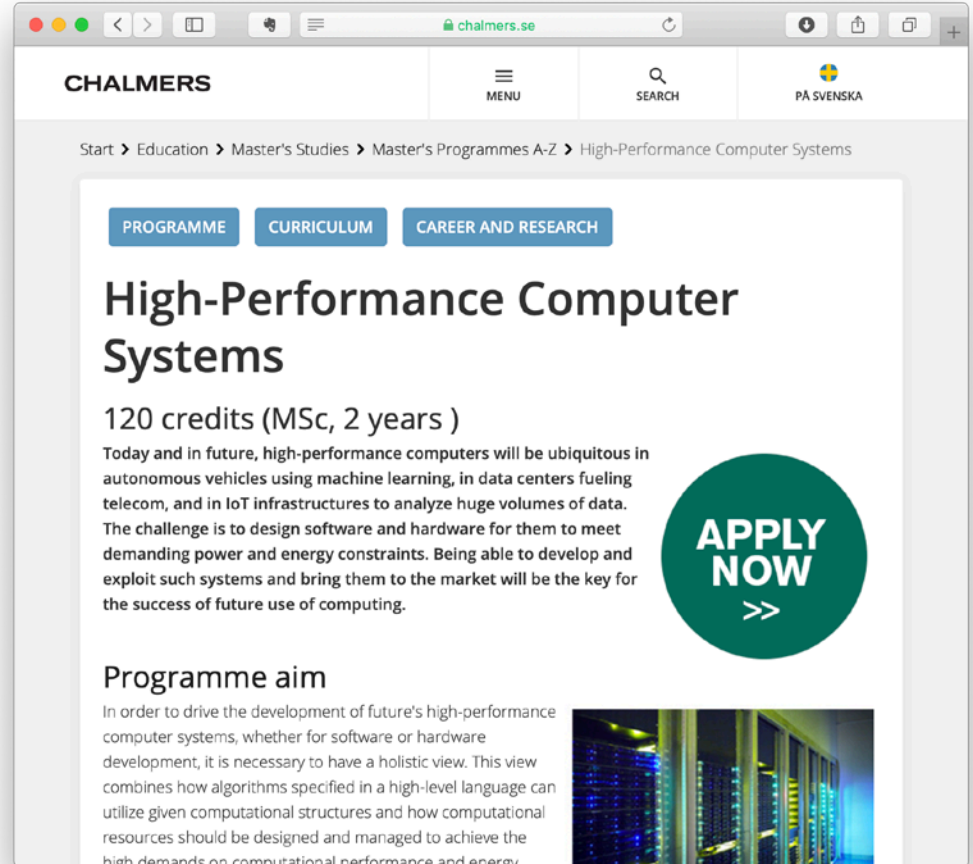
Requirements & Admissions (Chalmers)

Sökande från nedanstående program uppfyller alla särskilda förkunskapskrav utifrån de obligatoriska kurserna i respektive civilingenjörsprograms kandidatdel alt högskoleingenjörsprogram utan ytterligare kurskrav:

- Automation och mekatronik, civilingenjör (300hp)
- Datateknik, civilingenjör (300hp) – platsgaranti, ackrediterat
- Datateknik, högskoleingenjör (180hp) – platsgaranti
- Elektroteknik, civilingenjör (300hp) - ackrediterat
- Informationsteknik, civilingenjör (300hp) - ackrediterat

MPHPC

- **<mark>Starting Fall 2019</mark>**
- **<mark>Apply now!!!</mark>**
- Any further info: **ppedro@chalmers.se**