



LINUX 30 YEARS JUBILEE SEMINAR LINUX IN RESEARCH: A VIEW FROM HELSINKI

HEAD OF DEPARTMENT SASU TARKOMA



LINUS TORVALDS
Developer of Linux
operating system,
Millennium Prize
2012

Linus Torvalds was a student and employee at the department in 1988-1997

Linux OS was started in 1991 and version 1.0 was released in 1994

From 10 000 to 3.3 M lines of code

Today over half of the world's device shipments are based on Linux
Linux powers 100% of top-500 supercomputers

**"LINUX WAS INVENTED HERE" —
PROFESSOR MARTTI TIENARI**

Department of Computer Science at the University of Helsinki

Among top CS Departments in the Nordics

The number of professors has grown from 16 in 2017 to 32 in 2021.

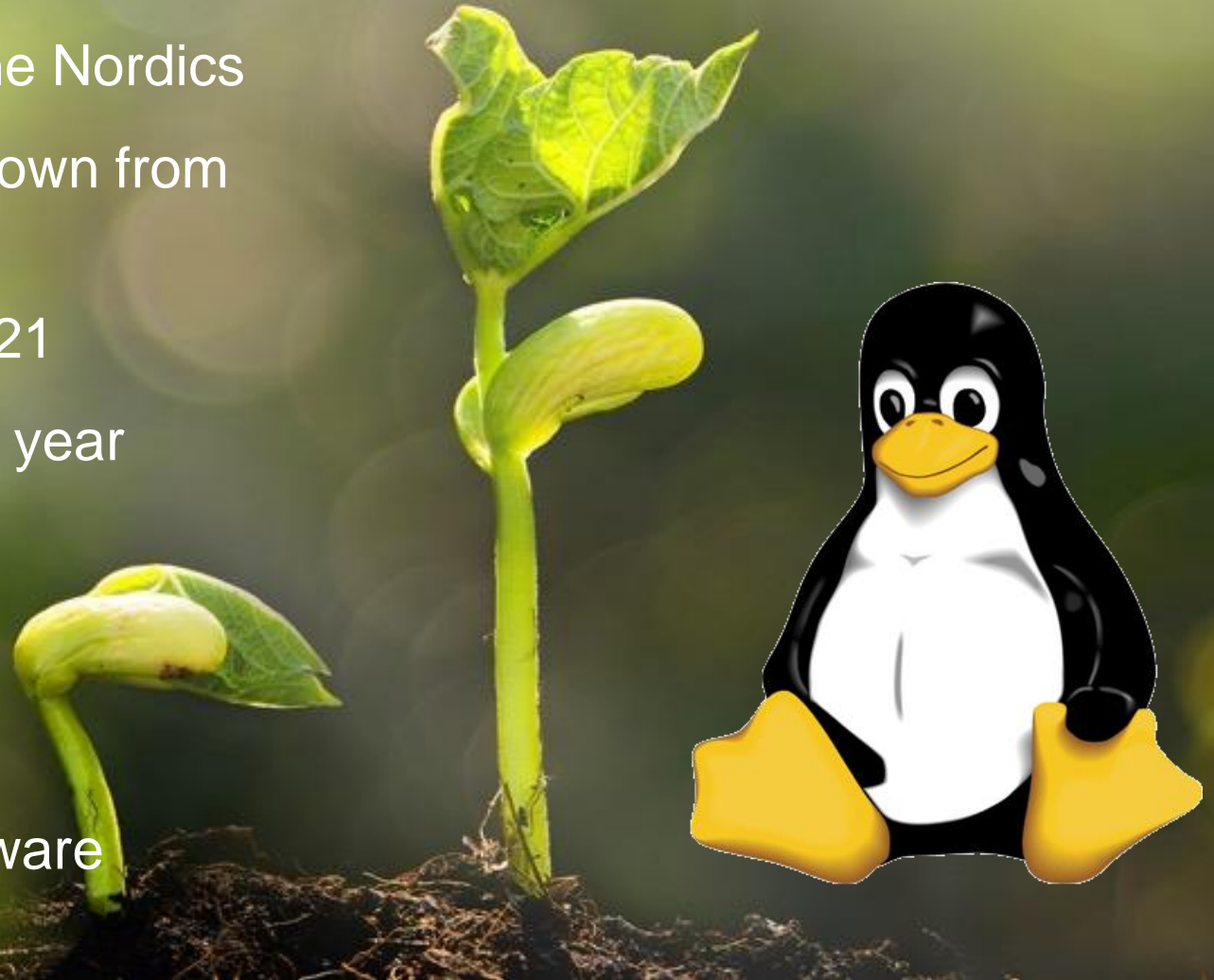
Approx. 260 staff members in 2021

Department will be 55 years next year

Architects of the Digital World

Core CS and Data Science

Algorithms, AI, Networking, Software



LINUX AND THE DEPARTMENT TODAY

Linux is a key OS for students, teachers and researchers

The Department maintains its own Linux distribution (Cubbli)

Linux is extensively used in networking, mobile and systems research

Our computing clusters and HPC are based on Linux

LINUX AND INTERNET PROTOCOL RESEARCH SINCE 1994



Early 90s: First Equipment Set of the Mowgli Project developing protocols for GSM data

LINUX AND INTERNET PROTOCOL RESEARCH AT THE DEPARTMENT

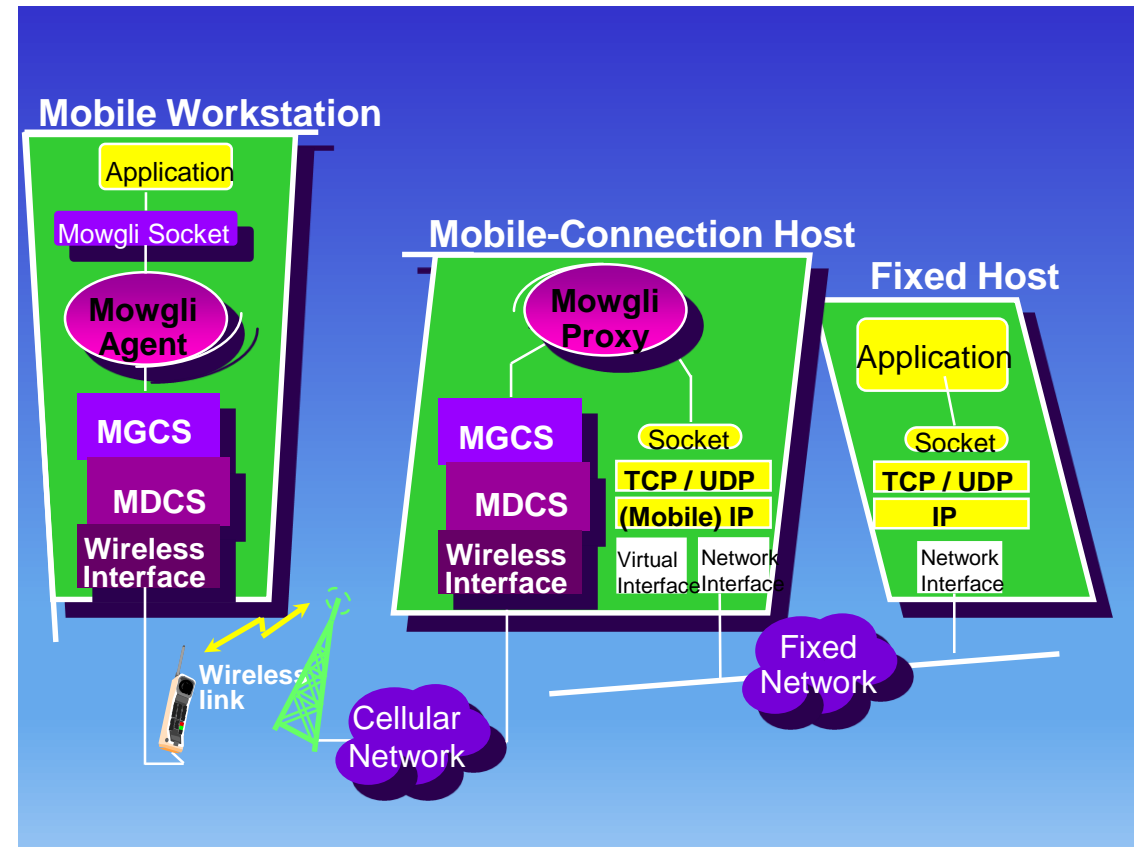
Linux TCP/IP protocol stack has served as the platform for experimental networking research since 1994

- Mobile & Wireless Networking (Cellular, WiFi, Satellite, ...)
- Protocol Performance Experimentation
- Transport Protocol Enhancements
- Energy Efficiency
- Protocols for Internet of Things

Linux stack allows smooth experimentation of new network protocol developments

Many of the protocol developments have been contributed back to Linux kernel stack

Communication Architecture for Mobile Devices



LINUX AND SMARTPHONE RESEARCH SINCE 2000

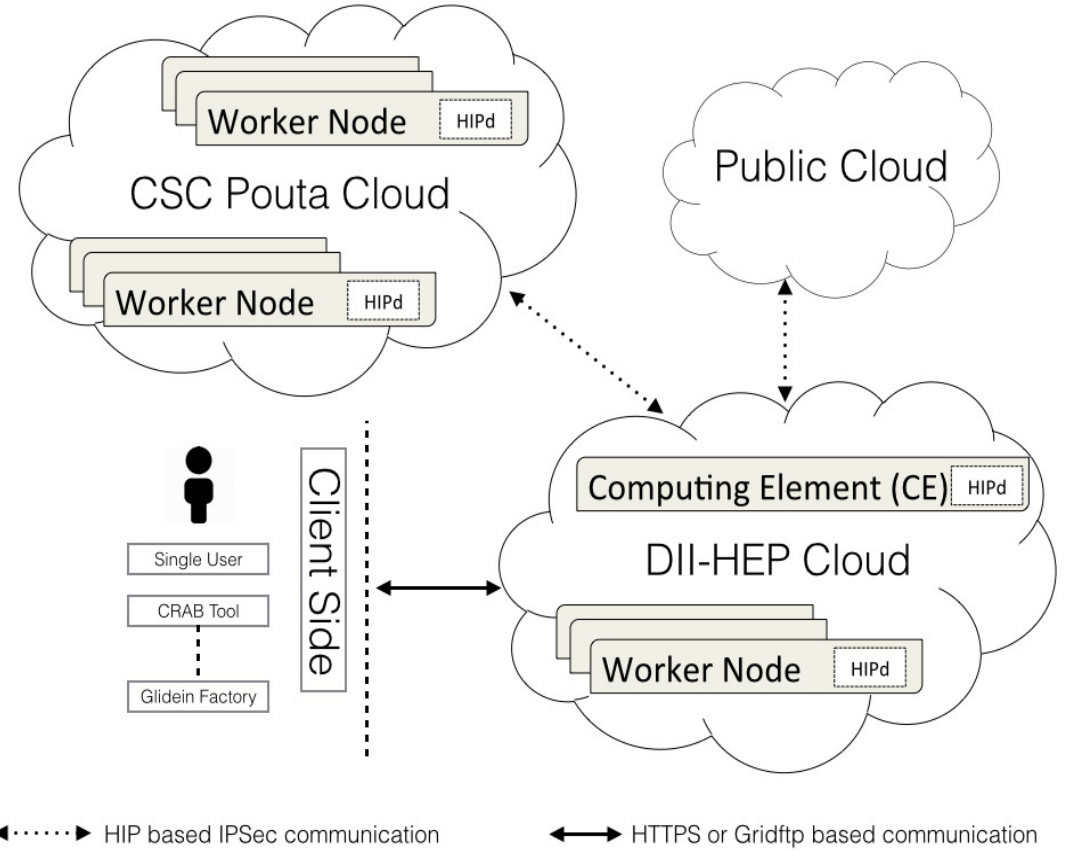


2002: PDA with Linux 2.4.3 extended with GSM
Data and GPS running Java applications and
software agents

LINUX AND CLOUD RESEARCH SINCE 2010

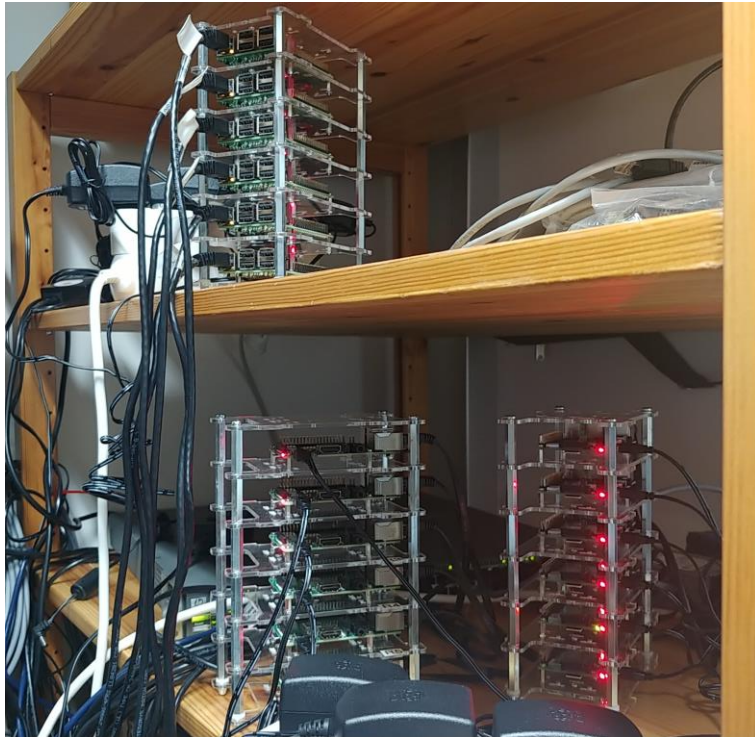


Running OpenStack at large scale

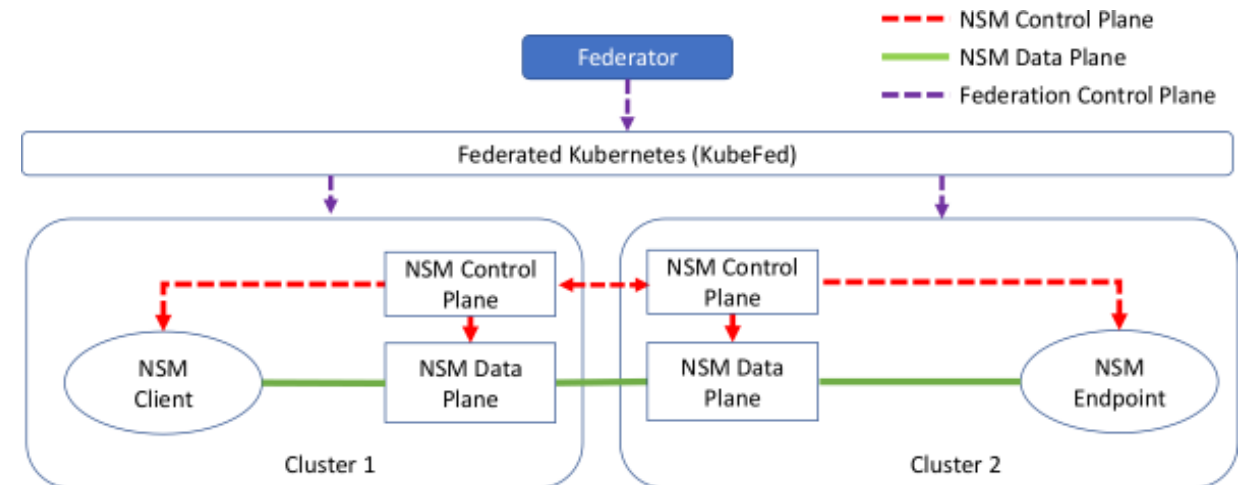


Integration of grid and cloud computing.
Collaboration with CSC and CERN.
Security and indirection with the Host Identity Protocol.

LINUX AND MOBILE NETWORK RESEARCH



2016: Wireless Software-Defined Networking (SDN) equipment



2021: Federated Kubernetes with Network Service Mesh (NSM)

Powering small clusters of Raspberry Pis.

- Running Kubernetes
- Piloting cloud edge architectures

Linux for Edge Computing, 5G and Beyond

Drones and other autonomous sensors



Internet of Things



End-user Applications: AR and maps

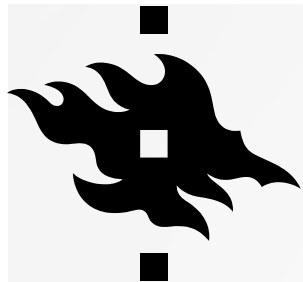


Linux and containers are the basis for the future of telecom

Edge computing is a form of **cloud computing** and part of the **5G architecture**

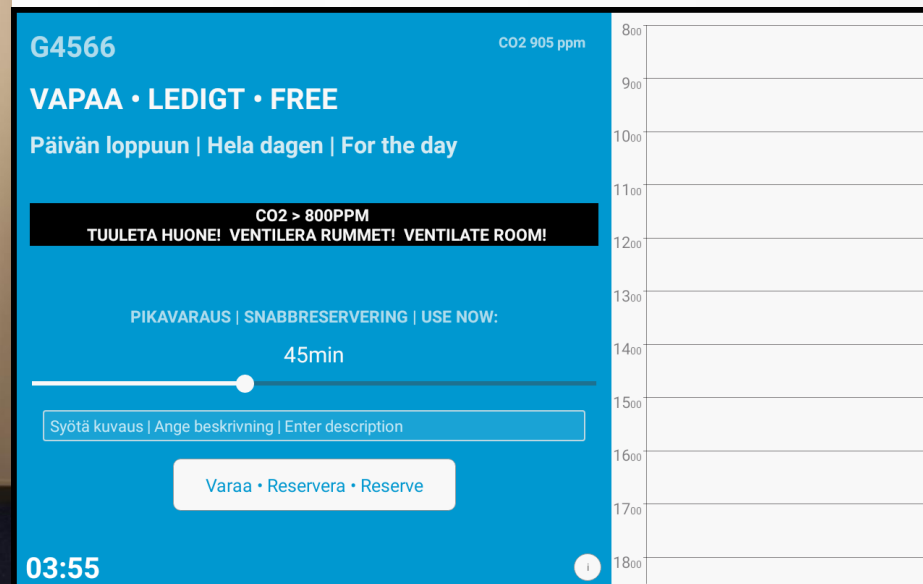
Edge computing facilitates application and service logic running on **edge servers near end-devices**

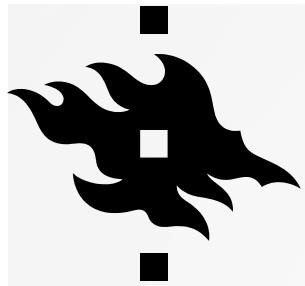
Network slices support **programmability** of the network and enable flexible placement and configuration of virtualized network functions



LINUX FOR SMART CAMPUS

Campus powered by Linux
Smart TVs, Android tablets, IoT
devices, and VMs for
management software





LINUX AND ROBOTS

- Linux provides a home for most cyber-physical systems.
- We have experimented with a Linux robot platform with localization and mapping
- Robot designed to provide autonomous cleaning operation on a construction site
- Linux is a perfect platform for teaching how to build real-life software and digital solutions



Industrial scale vacuum cleaner robot

LINUX IN EDUCATION

Linux powers our CS education
Among first to adopt Docker in university
education. Docker has been a platform for
software engineering projects since 2019.

Highly popular Full Stack MOOC course:

<https://fullstackopen.com/en/part12>

One of the first Kubernetes MOOC courses:

[DevOps with Kubernetes](#)

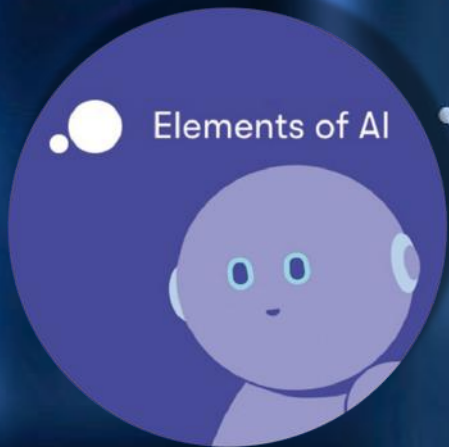
DevOps with Docker MOOC

<https://devopswithdocker.com/>

Linux mindset: Open Source MOOC kernel



GROWING PORTFOLIO





LINUX EVERYWHERE

**FROM THE VERY SMALL TO
THE VERY LARGE**

**FROM UNDERWATER TO
SPACE**



ENJOY THE JUBILEE SEMINAR

