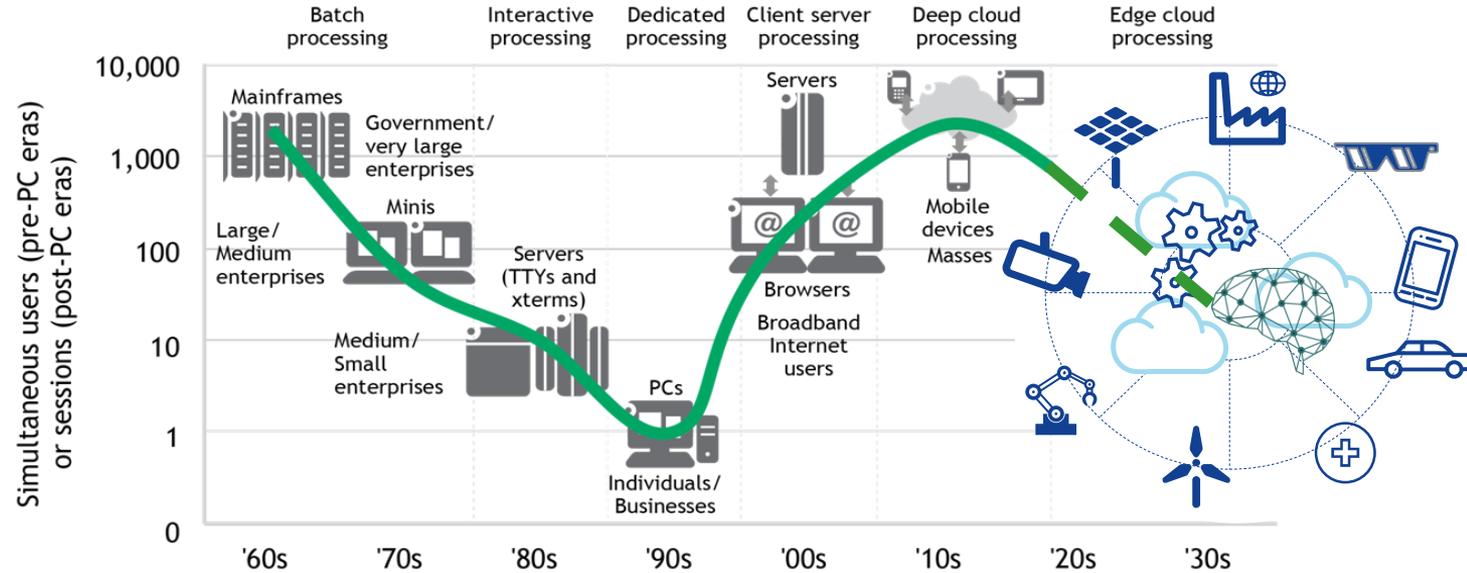


Cloud Research

Priorities for time horizon: 2019 – 2021

- Josef Urban, Head of Technology Vision
- 07-11-2016

Move to the edge cloud – a historical perspective



Today's research items – not a complete list

- **E2e management** of cloud infrastructures across distributed data centers (MEC)
- **Automated and optimized placement** of functions and services in distributed clouds – optimized with regard to throughput, security, real-time support, or depending on function and service specific requirements – automated based on an e2e orchestration across the entire distributed cloud environment
- **Security, privacy, and trust** issues in those distributed cloud infrastructures; e.g. how to enable secure boot of functions in virtualized environments and thus ensure the integrity of those functions.
- **Support for data intensive and data driven** services running in distributed clouds
- **Faster innovation cycles** by supporting the application and adoption of DevOps approaches allowing the close interaction between service developers and the operation of those services in the cloud
- The implications of **componentization** on networking, security, as well as on the architecture of functions and services running in the cloud.
- Improved support for **virtualized networking** in the cloud (e.g. Network PaaS, etc.)

Cloud Research areas

Distributed multi-access edge clouds as part of secure connected systems

E2E cloud management

A new dimension of user experience

New approach to manage growing complexity

Research items

Distributed multi-access edge clouds as part of secure connected systems

- Permanent need for security research
- High number of IoT devices will create larger attack surface
- Security should not slow down low latency services
- New approaches for identification, authentication, access control, as well as the integrity protection for networks, data, and the devices connected to cloud based systems.
- Digital Trust for accessing resources in multiple administrative domains
- Research has to develop, analyze, and prove new concepts and the extension of existing solutions.

E2E cloud management

- Unified orchestration of virtualized and non-virtualized resources
- E2e unified resource management including access to accelerators and work-load optimized processors
- Automated and intelligent function placement in distributed cloud environments based on machine learning and data analytics
 - Functions running in the edge and functions running in the centralized cloud form a service
 - Massively scalable security analytics at the edge
- Interworking with adaptive service lifecycle management

Research items

A new dimension of user experience

- Quality of Experience is based on the entirety of the service experience including the usability, functionality and operability of a service.
- A service has to adapt over time to meet users' changing needs and to improve over time by learning from failure.
- Build on DevOps and applying service design thinking
- “Ubiquitous computing enabled by cloud”
- Security, privacy, trust
 - Transparency and trust in cloud-based automation

New approach to manage growing complexity

- Complexity of the cloud is growing:
 - Virtual machines and containers
 - Centralized – distributed (local)
 - Closer interaction with applications (application orchestration in the cloud)
 - Autonomously working data-driven components distributed across the cloud infrastructure
- Can for example complex system theory help?

Research needs towards a highly distributed cloud infrastructure

Distributed multi-access edge clouds as part of secure connected systems	E2E cloud management
A new dimension of user experience	New approach to manage growing complexity



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