

# Informasjons Infrastructures

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## Informasjon Infrastructures An introduction

### Issues :

- Why infrastructures - some different perspectives
- A brief overview of the course
- What is an infrastructure - 1
- The economics of infrastructures
- Infrastructures in Norwegian public sector # public infrastructures

### Background literature:

- » Hanseth, Ole:  
[http://www.ifi.uio.no/~oleha/Publications/lb\\_ISR\\_3rd\\_resubm2.html](http://www.ifi.uio.no/~oleha/Publications/lb_ISR_3rd_resubm2.html)
- Monteiro, E. <http://www.idi.ntnu.no/~ericm/IP.final.dobbel.htm>
- » Ciborra et al: From Control to drift, kap. 2, 4 and 5

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## Some questions

- What do you understand by infrastructure
  - » Give examples of (information ) infrastructure
  - » Similarities between physical and electronic infrastructure
- What is the difference between an infrastructure and an information system
- Why do you think infrastructures are important ?
- Hvilke spesielle utfordringer er knyttet til å utvikle og vedlikeholde en infrastruktur
- What specific challenges is tied to developing and maintaining an infrastructure?

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## Why talk about II

- Define /describe a set of entities having the same characteristics
  - » Open, enabling, generic, standard,
- Help us understand their specific characteristics
- Help us develop and maintain them
- Can explain the history/trajectory of previous dev.
  - » Internet, OSI, SAP,...
- Can (possible) predict about future II building:
  - » EPR, UMTS, PKI,...

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## Infrastructure - a misleading concept?

- Legacy from the industrial society:
  - » Emphasizes the physical and material underlying basis
  - » Stable, heavy, difficult to modify/slow changes
  - » Closed, limited in space (and time?)
- The new information society
  - » Global
  - » Flexible, dynamic
  - » Everything is changing, increasing speed
  - » Open, unclear boundaries,
    - Ecologies of infrastructures
  - » Changes implies learning - learning implies changes

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## Information systems or infrastructures

### Information systems - the traditional approach:

- » Management is control
- » Business strategy → Top-down strategic alignment
- » Claims that IT and infrastructure are flexible
- » Installed base are neglected
- » Standards are either neglected or taken as granted
- » Assumes centralised control
- » More complex IT-processes and standards
- » Implementations → Surprises, side effects unexpected outcomes of technology and organisation
- » Compromises ↔ installed base

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## What characterises an infrastructure

### The US Government when building an Nat II: (based on McGarty among others)

- Shared (sharable)
- Enabling
- Standardized
- Open and common
- Socio-technical
- Heterogeneous
- Installed Base
- Enduring

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### What characterises an infrastructure-2

Star Ruhleder (Steps to an ecology of knowledge)

- Embeddedness
- Transparency
- Reach of scope
- Learned as part of membership
- Links with conventions of practice
- Embodiments of standards
- Built on an installed base
- Becomes visible upon breakdown

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### Installed base

- Infrastructures are never designed from scratch(?)
- Something always exist
  - » We cannot bypass the history
  - Can only be modified and extended
- The installed base includes:
  - » Nodes in the network: equipment and software, vendors,...
  - » Protocols, standard and standard bodies, documentations, routines,
  - » Operations and support, documentations,
  - » Knowledge and experience, textbooks
- The installed base as a heterogeneous actor-network

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### Installed base as an actor

- Re-enforcing mechanisms
  - » In order to work, it must be aligned with the existing

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### Universalism and installed Base

Is universal design possible and desirable

- Examples: OSI-protocols (X.25, X.400), EDIFACT, SAP, electronic patient-journal
  - » Top-down development,
  - » Uniform and standardized network on all levels
  - » The goal is the perfect solution including most facilities
  - » 'Closed world
  - » Centralized control
  - » Monolithic organization

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### An alternative strategy: The Internet model

- The TCP/IP approach:
  - » Need to connect different networks
    - Connectivity at meta-level
    - Best efforts approach
  - » Balancing standards and flexibility
    - Openness,
    - Duplication, gateways
  - » Minimal standards
    - Incompleteness, gradually improvement
  - » What aspects are relevant
    - Technical
    - Humans
  - » Internet has gained momentum and become an actor that influences society at all levels
    - Serves many different user communities,...

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### The case of Internet- some basic characteristics

- The idea of packet switching and datagrams (Kleinrock)
  - » Distributed, digital and redundancy (Baran)
  - » IMPs: how to avoid  $n*(n-1)/2$  (Kahn)
  - » Symmetric protocols (NCP, SMTP, FTP...)
- Open Architecture Networking
  - » TCP/IP and black boxes: routers/gateways (Cerf, Kahn)
  - » Open network of independent network and No global control
  - » Best offer service - transmit and retransmit
  - » End-to-End responsibilities for error check, flow control
  - » Domain Name System
- Incorporation of TCP/IP in Unix BSD
- WWW: URL, HTTP and HTML

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# Informasjons Infrastructures

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## Basic ideas -2

- Its roots in academic tradition and basic research philosophy
- The openness: free flow of ideas and innovations
  - » Open access to all documents
  - » RFC (Request for proposals)
- The public funding of the development (and diffusion)
  - » Academic and research network infrastructures like NSFnet, HEPnet, JANET, NordUNet...
- The formation of open communities
- Peer institutions as IAB, IETF, W3C
- Open source movement
- The gift economy

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## Strategies

- Flexibility
  - » Flexible standards and technical solutions
- Modularisation and encapsulation
  - » E.g. The Internet IMPS and layered structure
- Minimal solutions
  - » E. g Internet versus OSI-protocols
- Gateways
  - » From  $N*(n-1)$  to  $M$  (= different protocols or subnets)
- Transitions strategies

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