

Wireless Infrastructure Deployment and Economics (Course IK2514)

Jan Markendahl COS/ICT

Associate Professor

Wireless Infrastructure Deployment and Economics

The course consists of three parts

- Telecom Markets and Regulation
- Mobile Operator Business
- Wireless Broadband Network Deployment and Economics

The course is about "How to":

- Organize telecom markets
- Run a operator business and make money
- Dimension, design & analyze mobile broadband networks

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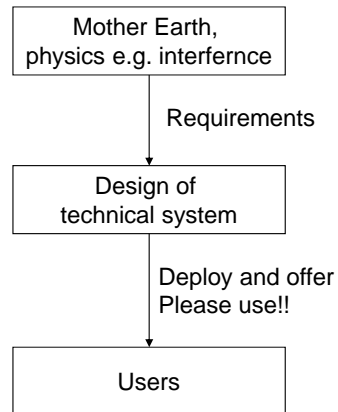
Agenda today

- Why this course? Your expectations?
- Course overview, course objectives
- KTH Social and the schedule
- About part 1 of the course and homework 1
- About part 2 and 3 of the course
- Lecture: Actors & roles at the telecom market
 - A small exercise

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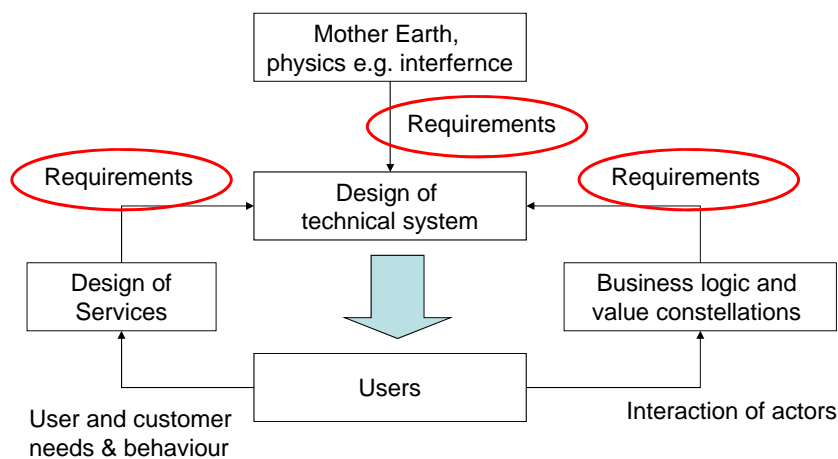
Design of mobile systems - traditional approach



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Design of mobile systems - assumption on future approach



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Overall objectives and learning approach

The overall objective

- To enable students to design, model and analyze technical systems in an overall business context

Learning approach

- A strong focus is put on “learning by doing” with home works, reviews, seminars and a operator game
- Guest lecturers to give different perspectives
 - Regulator
 - Financial market
 - Manufacturers
 - Mobile operators
 - Internet companies
 - User and pricing

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Homework and operator game

- Three homework assignments
 1. To analyze the telecom market in a country
 2. To compare business strategies of two mobile operators in a country
 3. To dimension and make an overall networks design and make cost and capacity trade-offs
- To do reviewing
- Mobile operator game
 - A business game where operators compete year 0 - 6(8)
 - A full day exercise where 3-4 students is the mgmt team

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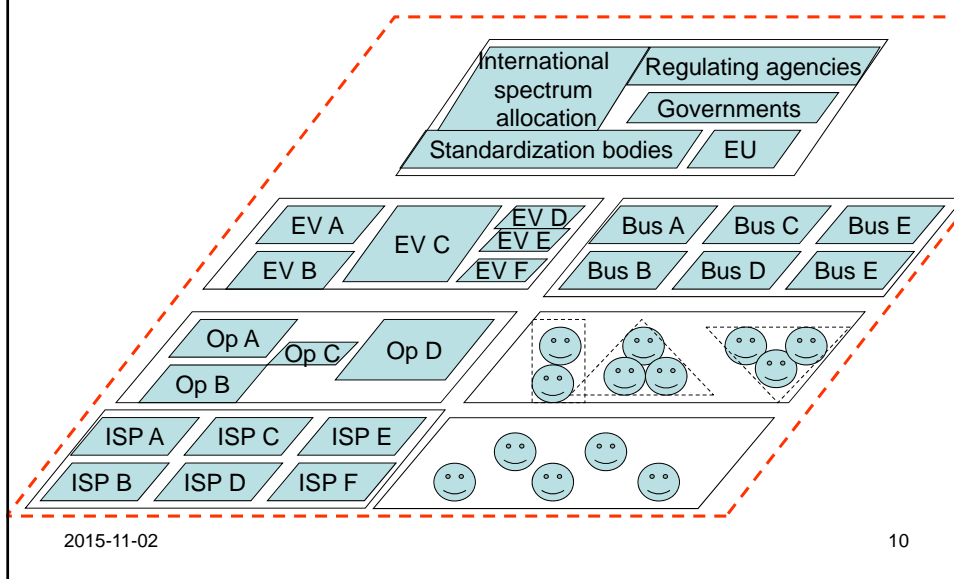
Course overview

- Course content
- Course objectives
- Learning approach
- Agenda, lectures and lecturers
- Home work assignments
- The mobile operator game
- Examination and credits

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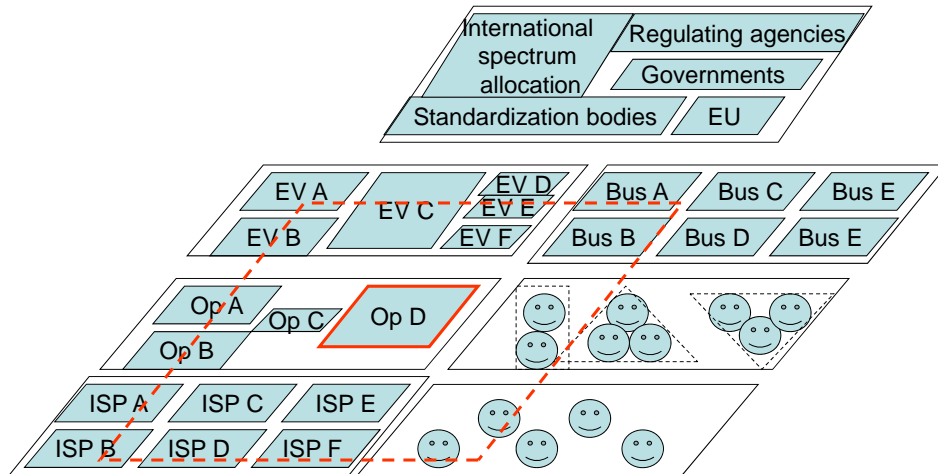
Part1: Telecom Markets and regulation



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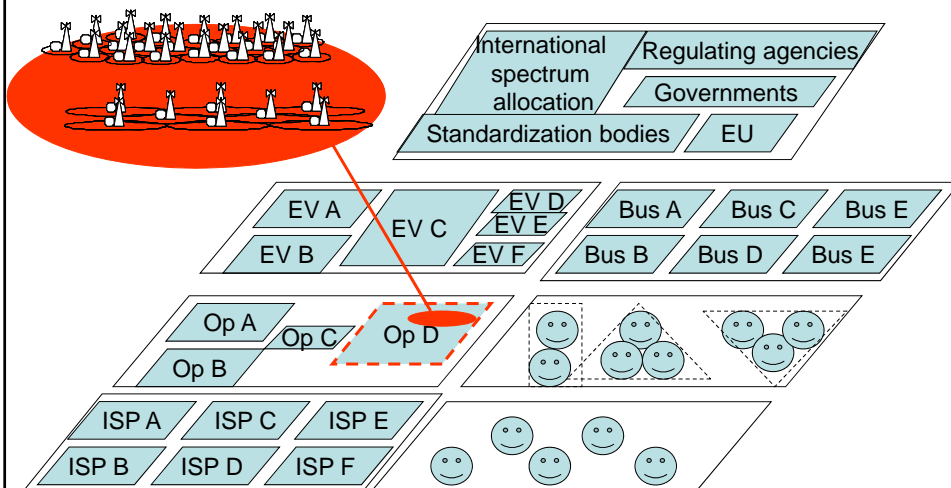
Part 2: Mobile operator business



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Part 3: Network dimensioning, deployment and cost structure analysis



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Course objectives

After the course the students should be able to:

- Analyze telecom markets in terms of actors, market segments, services, regulation + identify differences
- Describe the key characteristics of a Mobile Network Operator and identify strengths and weaknesses
- Dimension and design of a wireless network given demand, spectrum and radio access technologies
- Model and analyze the cost structure of a mobile operator network and compare different solutions

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Learning Approach

- A strong focus is put on “learning by doing” with home works, seminars and a operator game
- Motivation
 - The course covers a multitude of architectures, concepts, methods and tools within both wireless technology as well as areas of economics and business.
 - Each concept, solution etc may not be so complex or difficult to understand, but the combination of all aspects leads to a very high degree of complexity.

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Part 1: Telecom Markets and regulation

- Market structure, type of actors and business relations at telecom markets
- Telecom regulation, regulated markets and services, Spectrum allocation and licensing;
- Operator competition and cooperation, Mobile operator strategic planning
- **Home work 1:** Country study -description and analysis of the telecom market in country X

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Part 2: Mobile operator business

- Overview of operator business; marketing, customer management, charging & billing
- Cost structure, financing, investments and risk, revenue streams, pricing and subscriptions
- Operator challenges for mobile broadband, the revenue gap, capacity & coverage, data rate
- **Home work 2:** Analysis of operator strategy
- **Mobile Operator Business game** session (1 day) and preparation and summary report

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Part 3: Network dimensioning, deployment and cost structure analysis

- Economics of wireless infrastructure, cost-capacity trade-offs, scalability, spectrum allocation
- Network dimensioning, deployment and configuration strategies, impact of user demand
- Cost structure modeling & analysis of network, to calculate CAPEX, OPEX, Net present value
- **Home work 3:** Dimensioning and high level design of a wireless network incl. cost structure analysis

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The homework assignments tasks

- Homework 1 task:
 - Describe the telecom market in country X in terms of characteristics of key actors
 - Identify problems and challenges for the identified key actors
- Homework 2 task:
 - Compare business strategies of two mobile operators in "your" country
 - Find data on business performance and operator strategy in order to do a comparison
- Homework 3 task:
 - Dimensioning of a radio access network and analysis of the cost structure for different deployment options and types of used Radio Access Technologies (RATs).

**For HW1 and HW2:
Report no more than 4 pages in total
2 slides for a 5 min presentation**

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To pass home work assignments 1 and 2

- To do a draft report and send for review
 - Max 4 pages in total
- Review the reports of student in the group
- Present review comments in group session
- Make a oral presentation of results
 - Max 5 minutes and 2 slides
- Attend the presentation seminar
- Revise report according to the review comments and submit a final version

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Examination and grading

- In total the home works and the problems can give 30 points ($3 \cdot 5$ points + $5 \cdot 3$ points).
 - Each home work will be graded with 0 to 5 points and these points are included in the points at the exam.
 - At the exam there will be five problems to solve; each problem can give maximum 3 points.
- To pass the course
 - All home work assignments are satisfactory (3-5 points)
 - In total 12 points are required (grade E)
- Credits
 - 7,5hp = 5 weeks of full time work distributed over 9 weeks

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Course outline and timing

- Part 1: start 2/11
Telecom Markets and Telecom regulation
- Part 2: start 17/11 (game session 10/12)
Mobile operator business, including Business game
- Part 3: start 25/11
Network dimensioning, deployment and configuration
and cost structure analysis
- Written exam: 11/1, 2016

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 KTH Social

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Lectures & seminars – part 1, week 1

- November 2; 10-12 (Jan Markendahl, KTH)
 - Course overview, Intro to telecom actors and roles
- November 3; 13-15 (Bengt Mölleryd, PTS)
 - Development of telecom markets
 - Regulation and liberalization
- November 4; 13-15 (Bengt Mölleryd, PTS)
 - Telecom and spectrum regulation
 - Role of regulator and examples of regulated markets
- November 5; 10-12 (Jan Markendahl, KTH)
 - More on actors and roles, ecosystems,
 - Telecom markets from the end-user perspective
- November 06; 12.00
 - > Submit draft HW1 report

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Lectures & seminars – part 1, week 2+3

- November 09; 10-12 (Jan Markendahl, KTH)
 - Q&A session for Home work 1
 - Country studies, examples of regulation, competition, etc
 - November 10; 13-15 (Student groups, no teacher)
 - Review seminar, discussions in student groups
 - November 12; 10-12 (Ashraf Widaa, Jan Markendahl, KTH)
 - More on operators and spectrum
 - Non European country cases
 - November 13; 10-12 (Johan Rydberg, PTS + Jan Markendahl)
 - Net Neutrality
 - Cases on mobile media, mobile payments, IoT services
 - November 16, 10-12 (Students)
 - Oral presentations of Homework 1
- November 18; 11.59
-> Submit final HW1 report

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Home work 1 deadlines 2015

Activity	Home work 1
Home work is assigned to each student	15-11-03 ; 12.00
Draft report sent to teacher & reviewers filename: "country"_HW1_1.doc	15-11-06; 13.00
Review comments sent to teacher and authors filename: "country"_HW1review_by"name"	15-11-09; 08:59
Review session and discussions in review groups (room 210 available, no teacher present)	15-11-10; 13:00-15:00
Send slides for oral presentation to teacher filename: "country"_HW1.ppt	15-11-16; 07:59
Oral presentation of HW1, Each review group will present together (compile into one file with PPT)	15-11-16 ; 10:00-12:00 Max 5 min per country
Send final report version to teacher filename: "country"_HW1_2.doc	15-11-18; 11:59
Feedback and HW1 grading send to student	15-11-25; 12.00 latest

About review of the homework reports

- Below is a short check list with key aspects to consider when reviewing the HW reports
 - Are the key aspects of the analysis covered?
 - Is there a relevant methodology section?
 - Are the results and analysis clearly described?
 - Are the results and analysis supported by a convincing argumentation?
 - Is the report OK when it comes to layout, presentation style and language
 - Are there sections with “cut and paste” material from webpages, reports, etc?
 - Are relevant references used?
 - Is there any self-assessment and is it relevant?

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For you to do today

- Sign list of presence, contact data
- If not done - Select course in Daisy
- If not done - Send e-mail to me, janmar@kth.se
 - Your expectations on the course
 - Your home country, other countries you have lived in
 - language you control besides english
 - Experiences that may be useful for the course

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An exercise on actors and roles

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About actors at the telecom market

- Users
 - Consumers, business users, enterprises
- Equipment vendors
 - Networks, subsystems, handsets, laptops
- Operators
 - Fixed and Mobile, Broadband, MVNO's
- Providers of different kinds of services
- Regulators, standardization bodies

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Exercise on actors that you can identify

Task 1: A user of a smartphone using LTE

Task 2: A user with a WLAN enabled laptop
using hot spot where you need to pay

- Find as many actors as possible
- Write name of each actor at a "post it" note
 - Real names: Ericsson, Telia, Nokia, Dell,
 - Think "here and now" in Stockholm area
- Work in groups for another 10 minutes
- Then put notes on the board

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About actors at the telecom market

- There are many types of actors at the market and many actors within each type of actors
- We will run a small exercise on actors that you can identify
- Two scenarios
 1. A user of a smartphone using LTE
 2. A user with a WLAN enabled laptop

Examples and some hints









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Stockholm ~~Central Station~~ at the train to Uppsala


Choose a wireless network

Click an item in the list below to connect to a wireless network in range or to get more information.

	WLAN Zone - The Cloud	Connected 
	Unsecured wireless network	
	SJ	Manual 
	Unsecured wireless network	

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Internet ombord

TILL STARTSIDAN | KÖP KOD | OM INTERNET OMBORD | SNABBLÄNK TILL SJ.SE

Välkommen till Internet ombord
Här hittar du information om hur du kan koppla upp dig på tåget

Aktuell position




Updated 22:06 [Ladda om kartan](#)

Logga in på internet

Surfa på internet
Att surfa utanför SJ internet ombord är en betaltjänst, logga in här.

Jag accepterar användarvillkoren.

Välj typ av kod: ▼


Diin kod: 

▼ Annonser

Du får poäng när du köper Internet ombord, på dina resor, och allt i bistro.

[Bli medlem nu!](#)

InterRail
tågluffa i Europa




Snabbblankar till SJ.se

Här har du tillgång till information på sj.se utan att du behöver koppla upp dig externt.

- > Köp resa
- > Tidtabeller
- > Resttips
- > Resa med SJ
- > Trafikföringar
- > Kontakta SJ

Svar på vanliga frågor om inloggning



Logga in med koden du hittar på biljetten. 12 tecken: AAA1234A1234
Om du behöver hjälp kan du kontakta vår tekniska support på tel 031-799 21 50.

[Läs mer](#)
[Support in English](#)

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Betala med kontokort 

- | | | |
|---|-------|---------|
| <input checked="" type="radio"/> Internet ombord 30 minuter | Pris: | 49 SEK |
| <input type="radio"/> Internet ombord 60 minuter | Pris: | 69 SEK |
| <input type="radio"/> Internet ombord 120 minuter | Pris: | 89 SEK |
| <input type="radio"/> Internet ombord hela resan | Pris: | 109 SEK |

SJ Prio:





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Stockholm Central Station at the train to Uppsala

the cloud

Arlanda Express - Stockholm C

Anslut mig

Användarnamn:

Lösenord:

Kom ihåg mig

Genom att ansluta till tjänsten bekräftar du att du har tagit del av och godkänner användarvillkoren

Köp access tid nu

Välj ditt accesspaket till Internet här

Tjänsteleverantörer

Konto hos en av våra tjänsteleverantörer?

- Telenor
- iPass
- Skype
- Sprint PCS
- Trustive
- Echovox SMS (Nordics)
- AT&T
- KeyConnect

Englisch | Svenska | Deutsch | Dansk | Finnish | Norsk

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Stockholm Central Station at the train to Uppsala

the cloud

Arlanda Express - Stockholm C

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Englisch | Svenska | Deutsch

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Welcome to The Cloud Networks

<<Back You are securely connected to this site.

Cloud pay-as-you-go

Quick and easy bite sized access

Vouchers are valid from first login for the time purchased. Vouchers expire irrespective of use after time period expires.

- 30 minut access (30 Minutes) - SEK 40.00
- 60 minut access (60 Minutes) - SEK 60.00
- 180 minut access (180 Minutes) - SEK 90.00
- 1 dag access (24 Hours) - SEK 120.00
- 7 dagar access (7 Days) - SEK 240.00
- 30 dagar access (30 Days) - SEK 295.00

Enter your personal and payment details

Getting started

1. Select a Wi-Fi access package
2. Enter your personal and credit/debit card details (please note we do not accept Maestro)
3. Accept the terms and conditions
4. Submit

We'll then create a username and password and you'll be able to get online straightaway.

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Two observations

- 1. There are totally different types of business logic within the telecom sector
 - A network business
 - A user equipment business
 - A service provisioning business
- 2. Wireless Internet access can be provided
 - By mobile operators
 - That control all (most) resources
 - By other cooperating actors
 - That contribute with different resources

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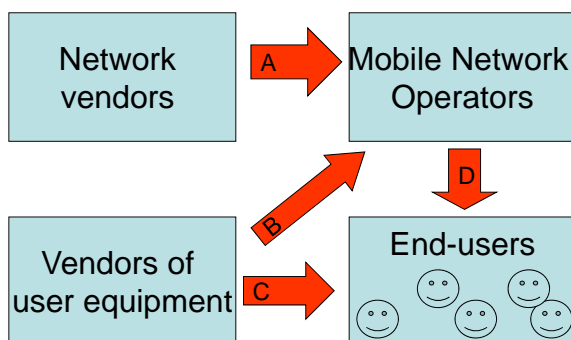
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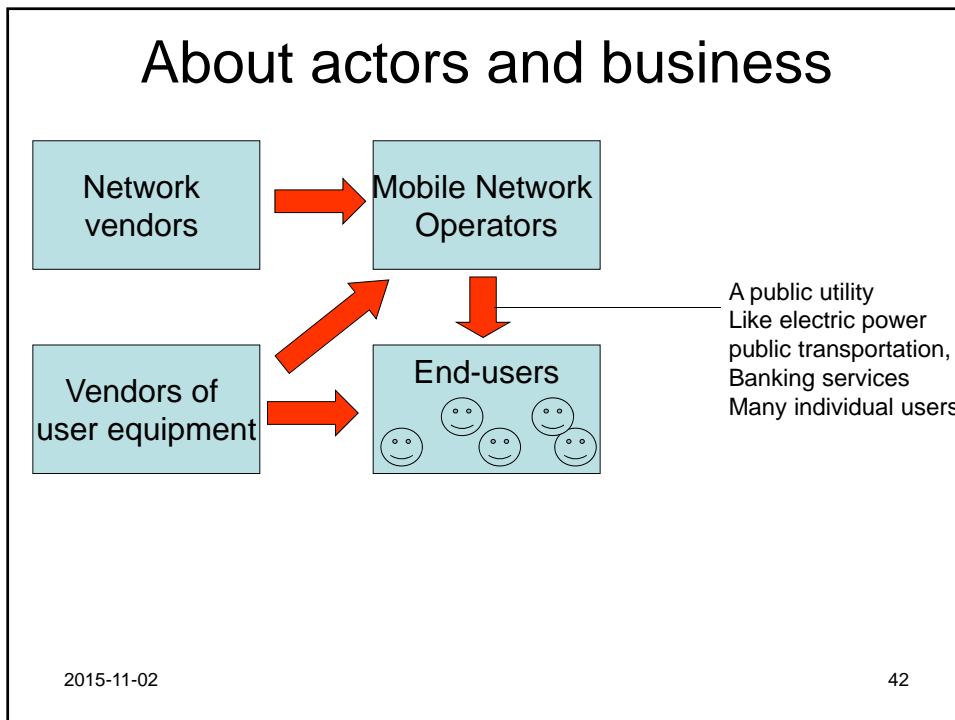
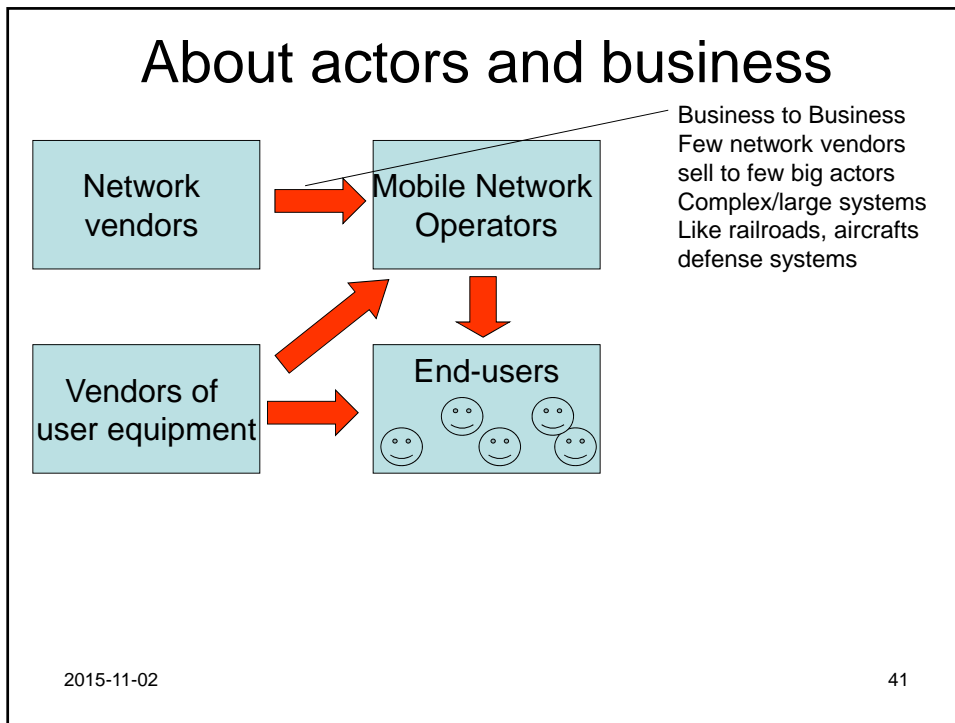
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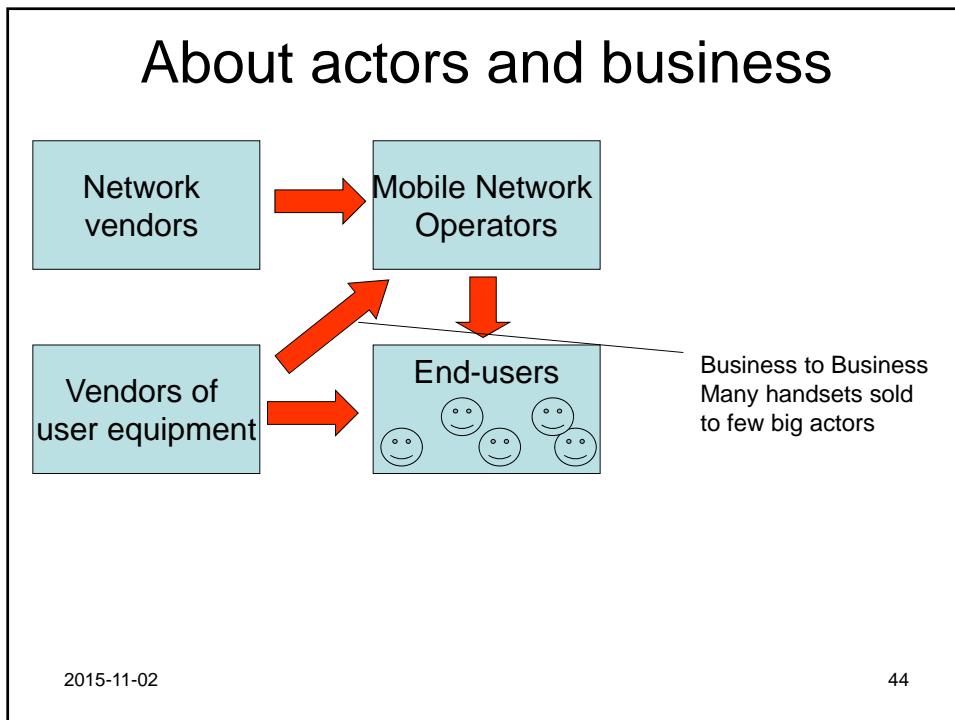
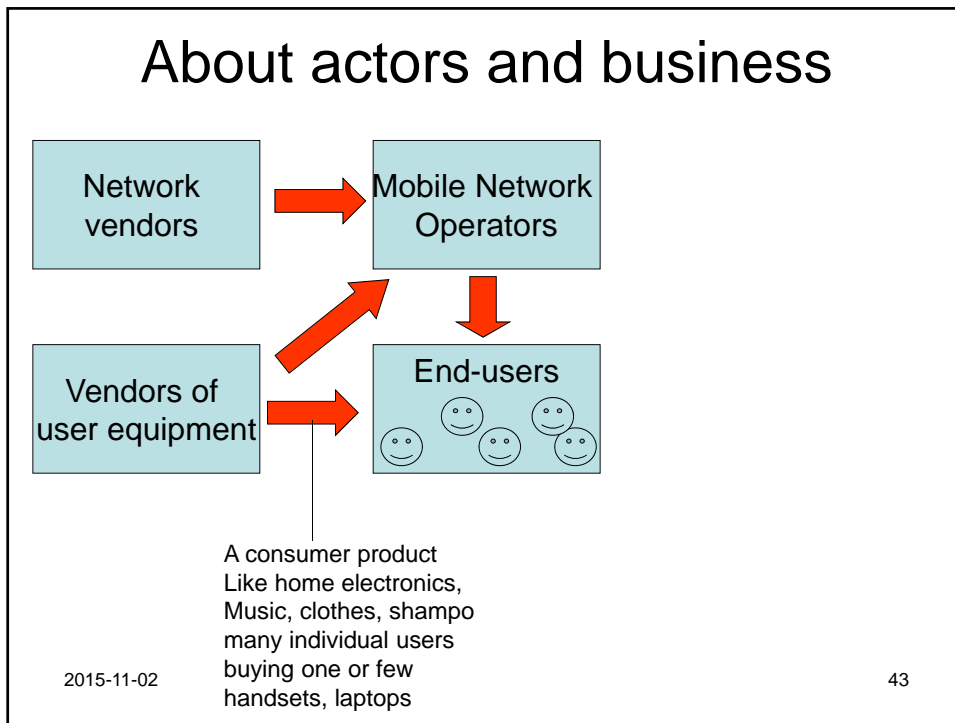
About actors and business

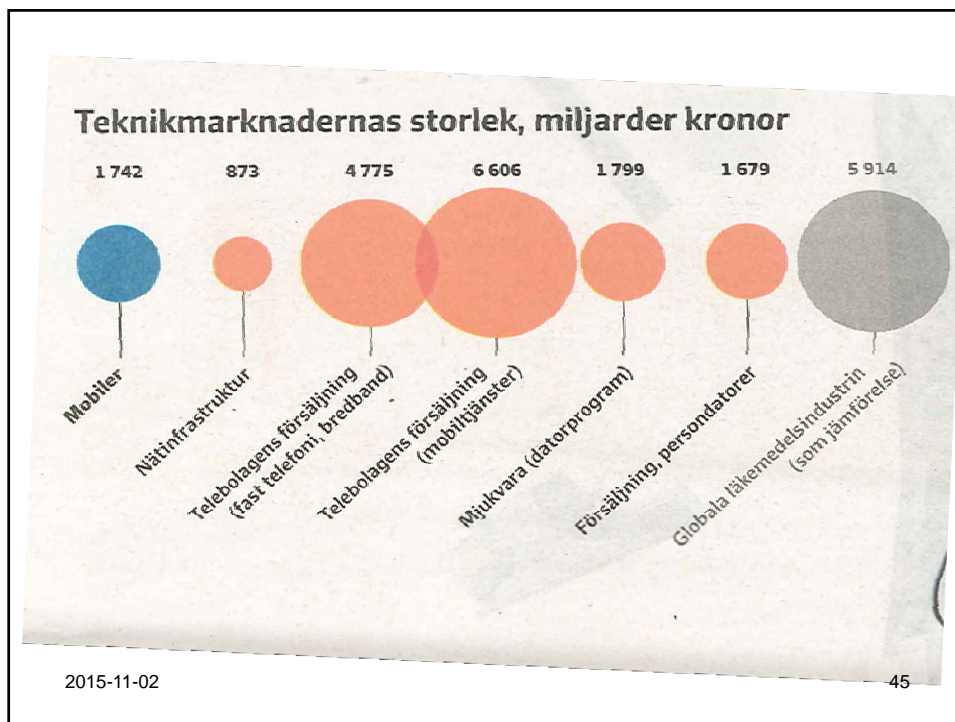


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Global sales – answer

- Network infrastructure : 100 units
- Mobile devices: 200
- Laptops, PC´s: 200
- SW for laptops, PC´s:200
- Fixed and broadband telecom services: 500
- Mobile telecom services: 800

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