Telematics
Chapter 1: Motivation

Univ.-Prof. Dr.-Ing. Jochen H. Schiller
Computer Systems and Telematics (CST)
Institute of Computer Science
Freie Universität Berlin
http://cst.mi.fu-berlin.de
Contents

- History of telecommunications
- Evolution of communication
- Economic aspects of telecommunications
- Computer networks
- The Internet
- Why we teach this course?
- Example for the course
History of telecommunications
A very short history ...
History of telecommunications

1799: Alessandro Volta invents the battery
1837: Samuel Morse develops the telegraph
1844: Morse sets up a telegraph line between Washington DC and Baltimore
History of telecommunications

1858: Installation of the first transatlantic cable for telegraphy (breakdown after 4 weeks)

1866: Installation of the second cable (worked ~100 years)

1876: Alexander Graham Bell patents the telephone (tele=distant; phone=voice)
History of telecommunications

1897: Strowger invents the electromechanical telephone exchange

1906: Lee De Forest invents the first amplifier for transcontinental telephony (from 1915)

1924: First demonstration of bidirectional, mobile, wireless phone (Bell Labs)
# History of telecommunications

- **1953**: First transatlantic telephone line! (TAT-1 with 36 Channels)

## Table of Transatlantic Telephone Lines

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Number of Channels</th>
<th>Origin</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAT-1</td>
<td>1956 – 1978</td>
<td>36</td>
<td>Newfoundland</td>
<td>Scotland</td>
</tr>
<tr>
<td>TAT-2</td>
<td>1959 – 1982</td>
<td>48</td>
<td>Newfoundland</td>
<td>France</td>
</tr>
<tr>
<td>TAT-3</td>
<td>1963 – 1986</td>
<td>138</td>
<td>New Jersey</td>
<td>England</td>
</tr>
<tr>
<td>TAT-4</td>
<td>1965 – 1987</td>
<td>138</td>
<td>New Jersey</td>
<td>France</td>
</tr>
<tr>
<td>TAT-5</td>
<td>1970 – 1993</td>
<td>845</td>
<td>Rhode Island</td>
<td>Spain</td>
</tr>
<tr>
<td>TAT-6</td>
<td>1976 – 1994</td>
<td>4000</td>
<td>Rhode Island</td>
<td>France</td>
</tr>
<tr>
<td>TAT-7</td>
<td>1978 – 1994</td>
<td>4000</td>
<td>New Jersey</td>
<td>England</td>
</tr>
<tr>
<td>TAT-8</td>
<td>1988</td>
<td>First fiber line 40000</td>
<td>USA</td>
<td>France</td>
</tr>
<tr>
<td>TAT-14</td>
<td>2000</td>
<td>Fiber 16 x 10 Gbps</td>
<td>USA</td>
<td>England</td>
</tr>
</tbody>
</table>
History of telecommunications

- Since 60ies diverse developments in telecommunication incl. the Internet

1962: Telstar, first communications satellite

1973: First mobile (Motorola “Dyna-Tac”)

1977: First digital, Optical network (Chicago)
# History of telecommunications: Milestones

<table>
<thead>
<tr>
<th>Year</th>
<th>Invention</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1840</td>
<td>Morse-Telegraph</td>
<td>Exchange of messages over long distances</td>
</tr>
<tr>
<td>1861/76</td>
<td>Telephone</td>
<td>Voice communication over long distances</td>
</tr>
<tr>
<td>1887</td>
<td>Electromagnetic Waves</td>
<td>Radio technology</td>
</tr>
<tr>
<td>1897</td>
<td>Strowger switch</td>
<td>Automatic switching</td>
</tr>
<tr>
<td>1923</td>
<td>Broadcast</td>
<td>Mass communication</td>
</tr>
<tr>
<td>1929</td>
<td>Coax cable</td>
<td>High data rates</td>
</tr>
<tr>
<td>1964</td>
<td>Satellites</td>
<td>Basis of global communications</td>
</tr>
<tr>
<td>1966</td>
<td>Fiber</td>
<td>Even higher data rates</td>
</tr>
<tr>
<td>1984</td>
<td>AT&amp;T divestiture</td>
<td>Break-up of AT&amp;T monopoly into Baby Bells</td>
</tr>
<tr>
<td>1997</td>
<td>Wavelength Division Multiplex</td>
<td>Even higher data rates up to 1Tbps (Tera = 10^{12})</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
Evolution of communication
From many networks to one network
Evolution of communication

- The classical telecommunication is focused on voice communication
  - Humans are the communication peers
- Voice communication network

![Diagram of telephone communication system]

- Requirements
  - Acceptable voice quality
  - Availability
  - Scalability
  - Cost
Evolution of communication

Chapter 1: Motivation
Evolution of communication

Chapter 1: Motivation
Evolution of communication

- Besides voice communication also data communication networks were created
  - No voice communication

➤ Every single **service** demands for its own network
Evolution of communication

Voice network

Data network

Convergence of networks

One network for all services
Evolution of communication

One Network
(Everything over IP)
Evolution of communication
From humans and machines
Evolution of communication

- Four evolution steps

- Step 1:
  - Person to person
    - Direct communication, telephony, ...

- Step 2:
  - Person to machine
    - Fax, Email, PC usage, ...
Evolution of communication

● Step 3:
  ● Machine to machine
    ● Computer to computer, e.g. Grid Computing, sensor networks, Web 2.0

● Network of computers:
  - which exchange information in an autonomous way
  - which use these information by taking the environment into account
  - the obtained information are not necessarily traditional information, i.e., not only digits or text or images
  - together with other components which make the global system useful or necessary for the user
Evolution of communication

● Step 4:
  ● Things to things (The Internet of Things)
    ● Computers become more numerous, cheaper, and smaller. They are implicitly everywhere; they are less computers but rather “things” or “objects”.

● Possible and/or already existing applications of such systems:
  ● in medicine (body area networks, supervision of health condition, ...)
  ● in entertainment (the new ICE age, ICE = Information, Communication, Entertainment)
  ● in enterprises (fleet management, self maintenance, ...)
  ● at home (assisted mobility, supervision of property, regulation of consumption, e.g. of fuel or of gas or of electricity, ...)
  ● in traffic (traffic regulation, maintenance, car to car communication, ...)
  ● in emergency situations (crisis management)
Evolution of communication: Examples from CST lab

Industry control system → LAN, WLAN, GPRS → local server + cache → Internet → e.g. Amazon.com

Univ.-Prof. Dr.-Ing. Jochen H. Schiller • cst.mi.fu-berlin.de • Telematics • Chapter 1: Motivation
Example Application: Habitat Monitoring/Skomer Island UK

Manx Shearwater
Combination of RFID and ScatterWeb

- Main challenge: robustness, reliability, easy-to-use
- Joint project with Oxford University and MSRC

More information: research.microsoft.com/habitats/
AvianGPS

Core: MSP430F1610 + CC1101
Sensors: GPS, Pressure Sensor, Light Sensor

Weight: 7 g (without battery)
Size: 24 mm x 45 mm

Partners: Freie Universität Berlin, University of Oxford, Microsoft Research Ltd.
Challenging application: safety for rescue forces
Localization on the disaster site
Project FeuerWhere – the extreme challenge

Data transmission & localization

TETRA

Mobile, self-organizing WSN
TETRA trunked radio network

Berliner Feuerwehr
4450 fire fighters
300000 incidents/year (8000 fires)
Evolution of communication
From wired to wireless
Evolution of communication

1970

VoIP/Video

2011

Smartphone, Mobile

Email

Blogs

IM
Evolution of communication

- Everybody, at anytime, from anywhere.

- Trendsetter: Mobile telecommunication
  - more than 4 billion users
  - more than fixed network users
  - world-wide service by using satellites

- Goal:
  - Transmission of Voice, Data, Audio, Video, ...

---

More than 4 billion mobile phone users worldwide

<table>
<thead>
<tr>
<th>Year</th>
<th>Subscriptions</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>2.7 Billions</td>
<td>+21%</td>
</tr>
<tr>
<td>2007</td>
<td>3.3 Billions</td>
<td>+22%</td>
</tr>
<tr>
<td>2008</td>
<td>3.9 Billions</td>
<td>+18%</td>
</tr>
<tr>
<td>2009</td>
<td>4.4 Billions</td>
<td>+12%</td>
</tr>
<tr>
<td>2010</td>
<td>4.8 Billions</td>
<td>+9%</td>
</tr>
</tbody>
</table>

*Mobile subscriptions including pre-paid, 2009/2010 forecast

Source: EITO, IDATE
Evolution of communication

1. UMTS, GSM 384 kbit/s, WLAN 780 kbit/s
2. UMTS, GSM 115 kbit/s
3. LAN 100 Mbit/s, WLAN 54 Mbit/s
4. UMTS, DECT 2 Mbit/s
5. GSM 57 kbit/s, Bluetooth 500 kbit/s
6. GSM 115 kbit/s, WLAN 11 Mbit/s
7. LAN, WLAN 780 kbit/s

GSM 384 kbit/s, WLAN 780 kbit/s
UMTS, GSM 115 kbit/s
LAN 100 Mbit/s, WLAN 54 Mbit/s
UMTS, DECT 2 Mbit/s
GSM 57 kbit/s, Bluetooth 500 kbit/s
GSM 115 kbit/s, WLAN 11 Mbit/s
LAN, WLAN 780 kbit/s
Evolution of communication
Ubiquitous communication
Evolution of communication

Mainframe Computing 1960s

Mini Computing 1970s

Personal Computing 1980s

Desktop Internet Computing 1990s

Mobile Internet Computing 2000s
Evolution of communication

Note: PC installed base reached 100MM in 1993, cellphone / Internet users reached 1B in 2002 / 2005 respectively; Source: ITU, Mark Lipacis, Morgan Stanley Research.
Evolution of communication

User Interface

Input Device

Device Usage

Text

Graphical

Touch

Keyboard

Mouse

Fingers

Content Creation

Communication

Content Consumption

Source: Morgan Stanley Research
Evolution of communication

● Radio Frequency Identification (RFID) is a technology to identify all types of objects without contact by using radio frequency

● Unlike bar-coding, RFID technology enables the reading, writing, and recording of data on the applied tag irrespective of location, type of environment, contact, or visibility

● Thus RFID opens up new opportunities in the areas of identification logistics, material management, production, and service.
Evolution of communication

- Pervasive computing
  - Tiny computer embedded in everyday devices, e.g., appliances

- Assisted life
  - Travel
  - Healthcare
  - Shopping

- Disadvantage
  - Privacy
Evolution of communication

WE WANT TO IMPLANT THIS RFID TAG IN YOU.

THAT VIOLATES MY RIGHTS!

WE WANT TO IMPLANT THIS RFID TAG IN YOU AND IT'S ALSO A CELLPHONE, DIGITAL CAMERA, AND MP3 PLAYER.

WRONG

RIGHT →

Copyright © 2006 David Farley, d-farley@ibiblio.org
http://ibiblio.org/Dave/drfun.html
Evolution of communication: On the road

Personal Travel Assistant, DAB, PDA, Laptop, GSM, UMTS, WLAN, Bluetooth, ...

UMTS, WLAN, DAB, GSM, TETRA, LTE...

ad hoc

Chapter 1: Motivation
Economic aspects of telecommunications
Economic aspects: Business sectors

- **Supplier**
  - Produces hard-/software-technologies, e.g., Siemens, Cisco, Nokia, Alcatel, ...

- **Common Carrier**
  - Offers transportation services, e.g., Deutsche Telekom, Vodafone, KPN, etc.

- **Service Provider**
  - Offers value-added services on the basis of the Common Carrier, e.g., Internet Service Provider, Intelligent Networks, 0800-, 0190- services

- **Content Provider**
  - Offers contents, e.g., news, magazines, publisher, stores, etc.

- **User**
  - Shall pay everything

- A company may belong to several groups!
Economic aspects: Converging industries

Content
Entertainment, Information services, Publisher

Interactive Multimedia

Computer
Hardware, Software

Communication
Telephone, TV, Satellite
Economic aspects: The telecommunications market

<table>
<thead>
<tr>
<th>ITK-Markt</th>
<th>Marktvolumen (in Mrd. Euro)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2004</td>
</tr>
<tr>
<td>Deutschland</td>
<td></td>
</tr>
<tr>
<td>Summe ITK + digitale CE</td>
<td>137,8</td>
</tr>
<tr>
<td>Digitale CE</td>
<td>6,8</td>
</tr>
<tr>
<td>Summe ITK</td>
<td>131,1</td>
</tr>
<tr>
<td>Informationstechnik(^1)</td>
<td>66,3</td>
</tr>
<tr>
<td>Telekommunikation(^2)</td>
<td>64,8</td>
</tr>
<tr>
<td>Summe ITK Hardware u. Systeme(^3)</td>
<td>34,0</td>
</tr>
<tr>
<td>Computer Hardware</td>
<td>17,4</td>
</tr>
<tr>
<td>TK-Endgeräte</td>
<td>5,2</td>
</tr>
<tr>
<td>Bürotechnik</td>
<td>2,7</td>
</tr>
<tr>
<td>Datenkommunikations- u. Netzinfrastruktur</td>
<td>8,7</td>
</tr>
<tr>
<td>Software</td>
<td></td>
</tr>
<tr>
<td>IT-Services</td>
<td>15,4</td>
</tr>
<tr>
<td>Telekommunikationsdienste(^4)</td>
<td>55,0</td>
</tr>
</tbody>
</table>

\(^1\) Computer Hardware, Bürotechnik, Datenkommunikations- hardware, Software, IT-Services
\(^2\) TK-Endgeräte, Netzinfrastruktur, Telekommunikationsdienste
\(^3\) Computer Hardware, TK-Endgeräte, Bürotechnik, Datenkommunikations- u. Netzinfrastruktur
\(^4\) ohne Carrier-to-Carrier Geschäft

Quelle: BITKOM (September 2007)
Computer networks
Computer networks

● Digital Telecommunication
  ● Digitalization of **all communication forms**
    ● Audio, Music, Text, Graphics, Pictures, Video, Technical Data, etc.
  ● Focusing on multimedia
    ● Integration of several communication forms

● Basics: Computer-Computer-Communication
  ● Digital telecommunication is exclusively based on computers
  ● Modern telecommunication networks are **Computer Networks**
Computer networks

LAN 2

Home appliance

Transmission System

Mobile user

Wireless LAN

Robot

Backbone

LAN 1

Multifunctional/Multimedia Device

Univ.-Prof. Dr.-Ing. Jochen H. Schiller • cst.mi.fu-berlin.de • Telematics • Chapter 1: Motivation
Computer networks: Software

- Complexity of software for networks
  - Example: EWSD-System of Siemens
    Elektronisches Wählsystem Digital / Electronic Digital Switching System


60 MOI
50 MOI
40 MOI
30 MOI
20 MOI
10 MOI

Mercury | Gemini | Apollo | Lunar Mission Control | Space Shuttle | B-ISDN (S9) | EWSD-APS USA (Docu: 750,000 DIN-A4) | EWSD-APS WM | EWSD-APS DBP-14

MOI = Million Object-Code-Instructions
The Internet
The Internet

- The Internet consists of
  - a set of computers, which
    - use the TCP/IP protocols
    - are somehow (directly or indirectly) connected
    - offer or use particular services
  - a set of users, which have access to these services
  - a set of other networks, which (somehow) are accessible
The Internet: Design Principles

- Design Principles of the Internet
  - Minimalism and autonomy
    - The network operates by itself
    - It does not require internal changes when new networks are added
  - Best-effort service model
    - The network tries to transmit data as good as possible, but does not guarantee a reliable service
  - Soft-state (stateless)
    - The routers **do not** need to **maintain** end-to-end communication information
  - Decentralization
    - No single entity administers the Internet
The Internet: Structure

● Goal
  ● World-wide communication of heterogeneous computers

● Structure:
  ● Interconnection of computers and local networks over and partially interconnected router networks

Definition of a uniform protocol family: TCP/IP
The Internet: The “real” Structure

Chapter 1: Motivation
The Internet: The “real” Structure

- World Connection Density, Courtesy of ChrisHarrison.net
The Internet: The “real” Structure

● World City-to-City Connections, Courtesy of ChrisHarrison.net
The Internet: The History


Univ.-Prof. Dr.-Ing. Jochen H. Schiller • cst.mi.fu-berlin.de • Telematics • Chapter 1: Motivation
# The Internet: The History

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1957</td>
<td>USSR launches Sputnik, first artificial earth satellite. In response, US forms the Advanced Research Projects Agency (ARPA) within the Department of Defense (DoD) to establish US lead in science and technology applicable to the military.</td>
</tr>
</tbody>
</table>
| 1960s | Design of packet-switching networks  
  - Paul Baran, RAND: "On Distributed Communications Networks"  
  - No single outage point. |
| 1967 | ACM Symposium on Operating Principles  
  - Plan presented for a packet-switching network |
| 1968 | Network presentation to the Advanced Research Projects Agency (ARPA) |
| 1969 | ARPANET commissioned by DOD for research into networking  
  - Uses Network Control Protocol (NCP) through Information Message Processors (IMP) developed by Bolt Beranek and Newman, Inc. (BBN)  
  - First node at UCLA, soon after at Stanford Research Institute (SRI), UCSB, and the University of Utah. First Request for Comment (RFC): "Host Software" by Steve Crocker |
| 1970s | Store and Forward Networks  
  - Electronic mail technology extended to conferencing. |
<p>| 1970 | ALOHAnet developed by Norman Abrahamson, Univ. of Hawaii |</p>
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>15 nodes (23 hosts): UCLA, SRI, UCSB, U of Utah, BBN, MIT, RAND, SDC, Harvard, Lincoln Lab, Stanford, UIU(C), CWRU, CMU, NASA/Ames</td>
</tr>
</tbody>
</table>
| 1972 | - International Conference on Computer Communications with demonstration of ARPANET between 40 machines organized by Bob Kahn.  
- InterNetworking Working Group (INWG) created to address need for establishing agreed upon protocols. Chairman: Vinton Cerf. |
| 1973 | First international connections to the ARPANET: England and Norway |
| 1982 | - INWG establishes the Transmission Control Protocol (TCP) and Internet Protocol (IP), as the protocol suite, commonly known as TCP/IP, for ARPANET.  
  - This leads to one of the first definition of an "internet" as a connected set of networks, specifically those using TCP/IP, and "Internet" as connected TCP/IP internets. |
| 1983 | - Name server developed at Univ. of Wisconsin, no longer requiring users to know the exact path to other systems.  
- ARPANET split into ARPANET and MILNET with the latter becoming integrated with the Defense Data Network created the previous year. |
| 1984 | Domain Name Server (DNS) introduced. |
| 1988 | Internet worm burrows through the Net. |
## The Internet: The History

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>IP-Link to the Internet from Germany over Eunet-IRB Dortmund and XLink (eXtended Lokales Informatik-Netz Karlsruhe)</td>
</tr>
<tr>
<td>1989</td>
<td>Number of hosts breaks 100,000.</td>
</tr>
<tr>
<td>1991</td>
<td>EBONE: European Backbone</td>
</tr>
<tr>
<td>1992</td>
<td>▪ Internet Society is chartered (<a href="http://www.isoc.org">www.isoc.org</a>).</td>
</tr>
<tr>
<td></td>
<td>▪ World-Wide Web released by CERN.</td>
</tr>
<tr>
<td></td>
<td>▪ Number of hosts breaks 1,000,000.</td>
</tr>
<tr>
<td>1995</td>
<td>Internet gets public through WWW</td>
</tr>
<tr>
<td>1996</td>
<td>University Corporation for Advanced Internet Development - Internet2</td>
</tr>
<tr>
<td>1999</td>
<td>Internet2-Backbone: Abilene</td>
</tr>
<tr>
<td>1998-2002</td>
<td>Rise and fall of the dotcoms</td>
</tr>
</tbody>
</table>
The Internet: Development

Number of US households with access (in Mill.)

(Source: Bertelsmann)
The Internet: User statistics

Internet Users in the World by Geographic Regions

- Asia: 704.2 million
- Europe: 402.4 million
- North America: 251.7 million
- Latin America / Caribbean: 175.8 million
- Africa: 65.9 million
- Middle East: 48.0 million
- Oceania / Australia: 20.8 million

Source: Internet World Stats - www.internetworldstats.com/stats.htm
Estimated Internet users are 1,668,870,408 for June 30, 2009
Copyright © 2009, Miniwatts Marketing Group

www.internetworldstats.com
The Internet: User statistics

World Internet Penetration Rates by Geographic Regions

- North America: 73.9%
- Oceania / Australia: 60.1%
- Europe: 50.1%
- Latin America / Caribbean: 30.0%
- Middle East: 23.7%
- Asia: 18.5%
- Africa: 6.7%
- World, Avg.: 24.7%

Source: Internet World Stats - www.internetworldstats.com/stats.htm
Penetration Rates are based on a world population of 6,767,805,208 and 1,668,870,408 estimated Internet users for June 30, 2009.
Copyright © 2009, Miniwatts Marketing Group

www.internetworldstats.com
The Internet: Number of Hosts

Internet Domain Survey Host Count

Source: Internet Systems Consortium (www.isc.org)
Why do we teach this course?
Relationship between research and teaching
Research topics

- Network Architectures and Communication Protocols
  - Wired networks
    - Local Area Network (LAN)
    - Wide Area Network (WAN)
    - Internet
  - Wireless networks
    - Wireless Local Area Network (WLAN)
    - Mobile Ad-hoc Network (MANET), Wireless Mesh Network (WMN), Wireless Sensor Network (WSN)
    - GSM, 3GPP
  - Protocols
    - HTTP, TCP/UDP, IP
    - IEEE 802.11a,b,g
  - Internet of Things
    - Anytime, Anywhere, Anything
Research topics

DES-Mesh
The wireless mesh network DES-Mesh is made up of custom stationary mesh routers, each with at least 3 IEEE 802.11a/b/g radios per node. This setup allows a wide variety of studies of different layers of the network protocol stack.

DES-Testbed
The DES-Testbed is a hybrid wireless multi-hop network. Currently, it consists of a mesh network and a wireless sensor network, each with 100 nodes. The research focus is on real world studies and comparisons of the results to simulations.

DES-WSN
The wireless sensor network DES-WSN consists of 100 custom MSB-A2 sensor nodes. These sensor nodes are equipped with temperature, humidity, pressure, and motion sensors allowing a basic monitoring of environment parameters in the DES-Testbed.

Outdoor DES-Node
- 10 outdoor DES-Nodes
- Improve connectivity between buildings
- Each with 3 IEEE 802.11a/b/g radios

Indoor DES-Node
- 100 indoor DES-Nodes in 3 buildings
- Each with 3 IEEE 802.11a/b/g radios
- Connected to central server

MSB-A2 Sensor Node
- Based on ARM7 microprocessor
- Chipcon CC1100 868MHz transceiver
- Variety of sensors on board

www.des-testbed.net
Research topics

Sensor Network  Cellular System  Fixed Network  Internet
Chapter 1: Motivation

Research topics

Baltic Sea

Temperature Sensors

Sensor Network

GPRS wireless connection

Buoy with Sensors

Radio

Radio

Ground

Sweet Water

Weight/Anchor

Temperature Sensors
Research topics

- Sensor node with processor, RF, and sensor
Research topics

Processor

Temperature Sensor

Interface to Chain of Sensors
Research topics
Making WSNs seawater-proof

Protection of nodes in oil (incl. antenna)
Research topics

- Interoperation between sensor networks and other networks
Example for the course
Multimedia communication over the Internet
Example: Video Streaming over the Internet
Trends

- Computers do not stay alone anymore
- Communication metaphor evolves from human-to-human communication to everything-to-everything communication
  - Penetration of computer and networking into all aspects of life
  - Internet of the Things
- Existing networks are going to be integrated
  - Telephone networks, mobile networks, computer networks, etc.
- The computer and telecommunication market is young, but one of the fastest growing economic sectors
- The penetration of computer and communications are not everywhere the same in the world