Peer-to-Peer Networks

01: Organization and Introduction

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People

- Christian Ortolf
  - PhD in computer science

- Christian Schindelhauer
  - Professor for Computer Networks and Telematics
  - Coauthor of the book „Peer-to-Peer-Netzwerke – Methoden und Grundlagen"
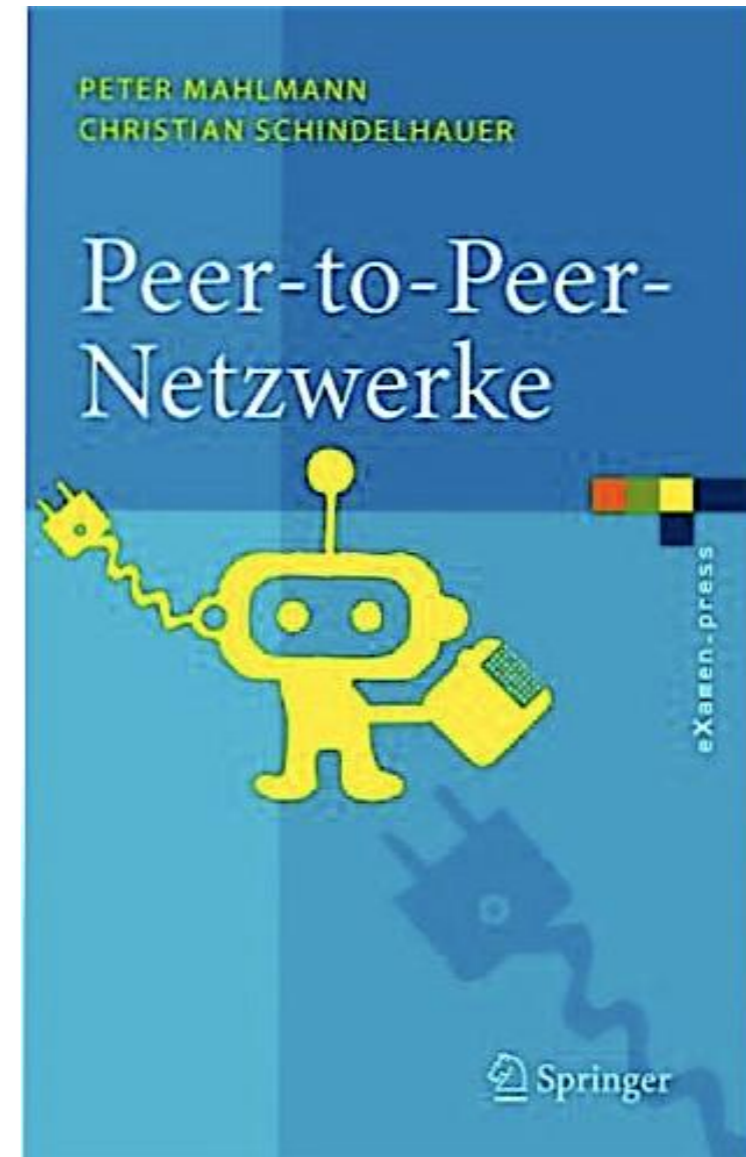
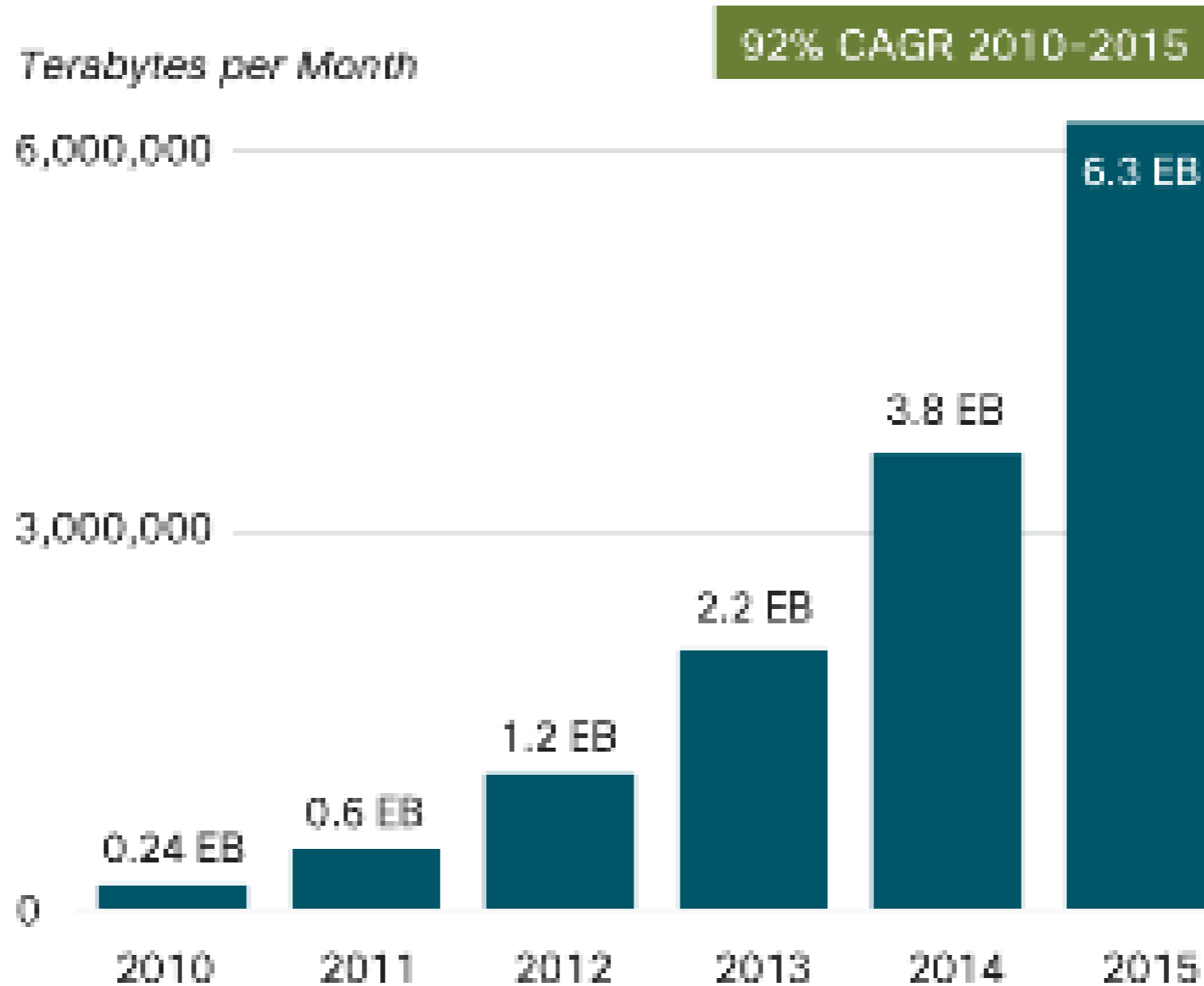- Aditya Oak
  - Tutor for the Lecture

General

- Web page
  - http://cone.informatik.uni-freiburg.de/lehre/aktuell/p2p-WS16/

- Lecture
  - starts 17.10.2016
  - Monday, 4pm-6pm, 101-01-018
  - Wednesday, 10am-11am, 101-01-018

- Exercise classes
  - Wednesday, 11am-12am, building 101-01-018

- Oral exam
  - no prerequisites
  - register on-line (in time)

Exercises

- **Exercise class**
  - Wednesday, 11am-12pm, building 101, 101-01-018
  - starts 26.10.2016
- **Exercises**
  - appear every Wednesday on the web-page
  - voluntary, but are the basis for the oral exam
  - solutions of the exercises are discussed in the following week

Exam

- Oral exam

  - based on the lecture and the exercises

  - register online for the exam

  - Mandatory registration
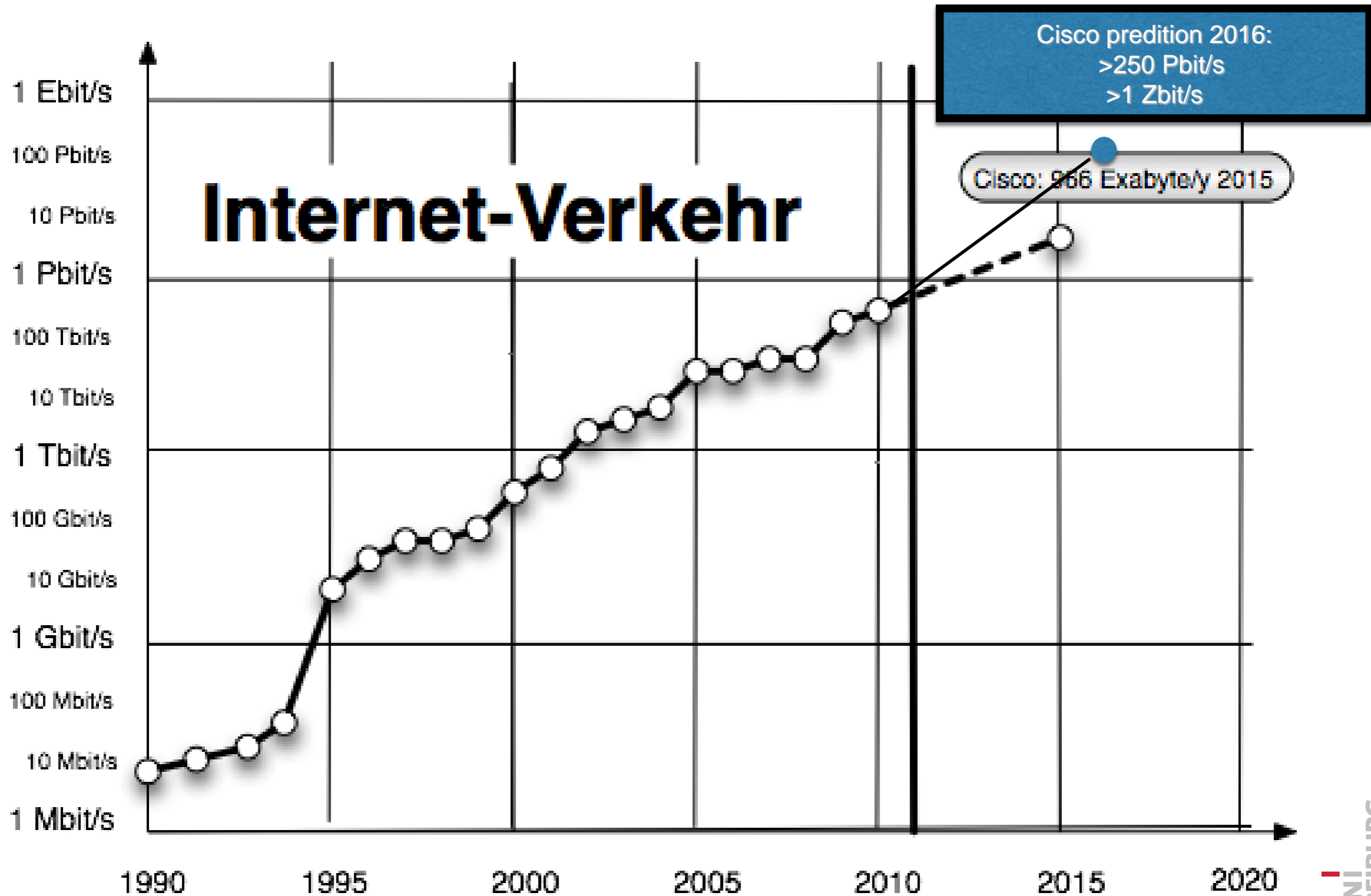
Materials

- ■ Slides
  - appear before the lecture on the web-page

- ■ Book
  - ~60% of the lecture can be found in *Mahlmann, Schindelhauer, Peer-to-Peer-Netzwerke — Methoden und Algorithmen, Springer 2007*

- ■ Further Literature
  - Research papers will be presented during the lecture on the slides and on the web-page
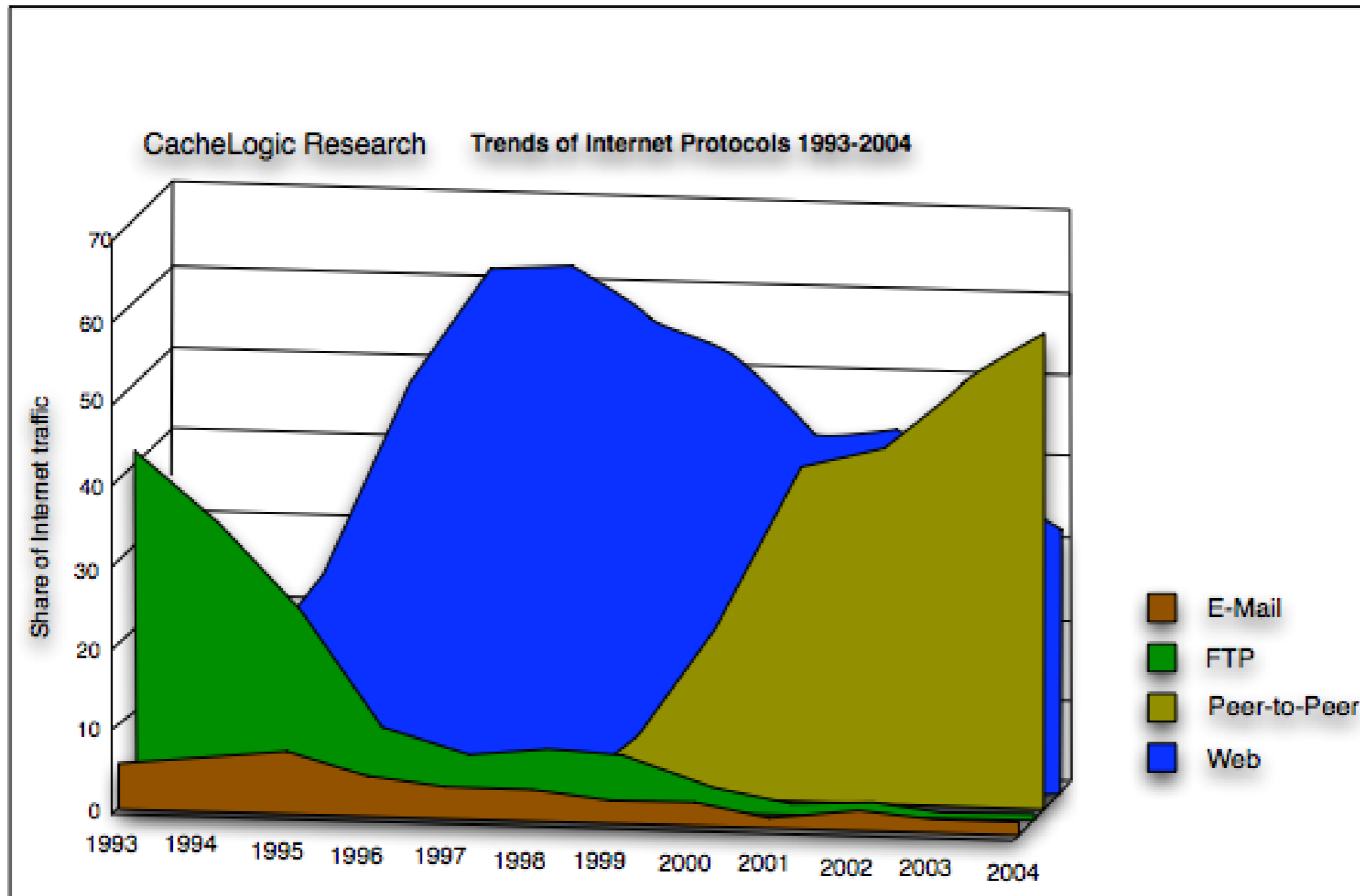
PETER MAHLMANN
CHRISTIAN SCHINDELHAUER

Peer-to-Peer-
Netzwerke

eXamen-press

Springer

Internet Traffic

Cisco predition 2016:
>250 Pbit/s
>1 Zbit/s

Cisco: 966 Exabyte/y 2015

Internet-Verkehr
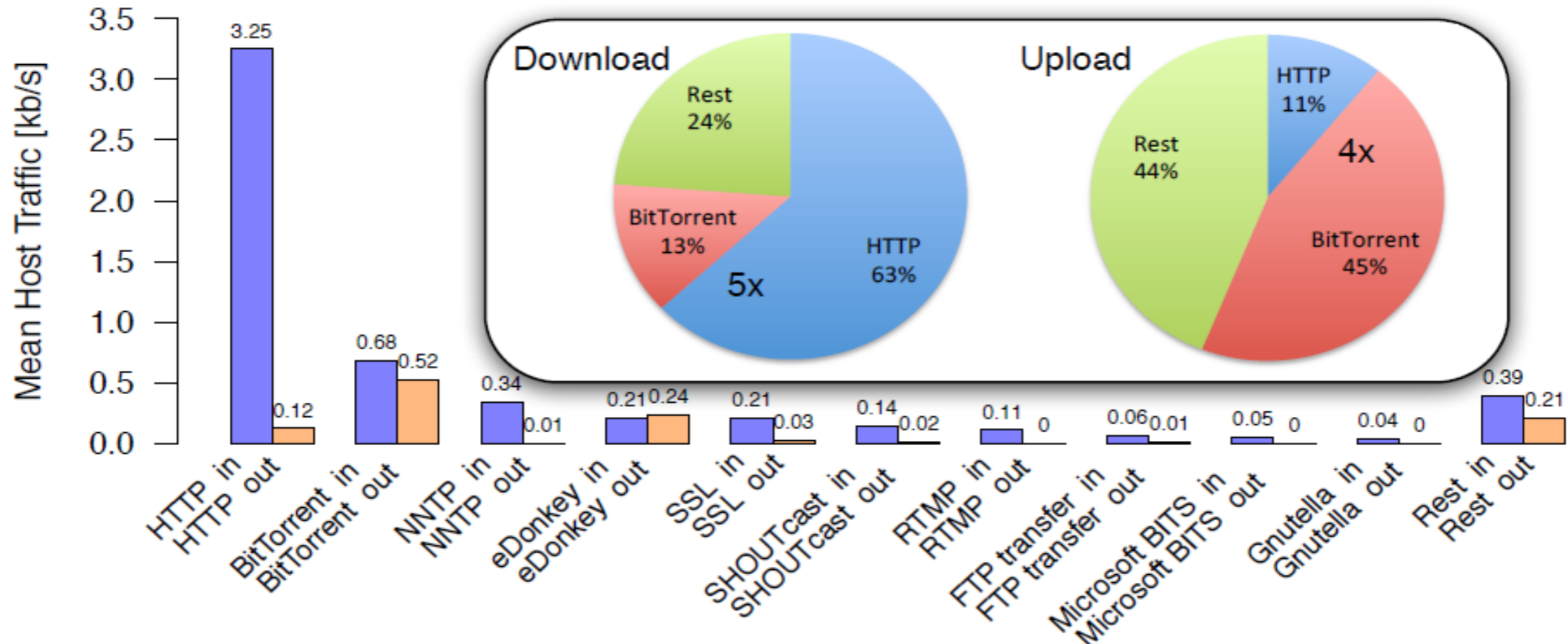
CacheLogic Research   Trends of Internet Protocols 1993-2004
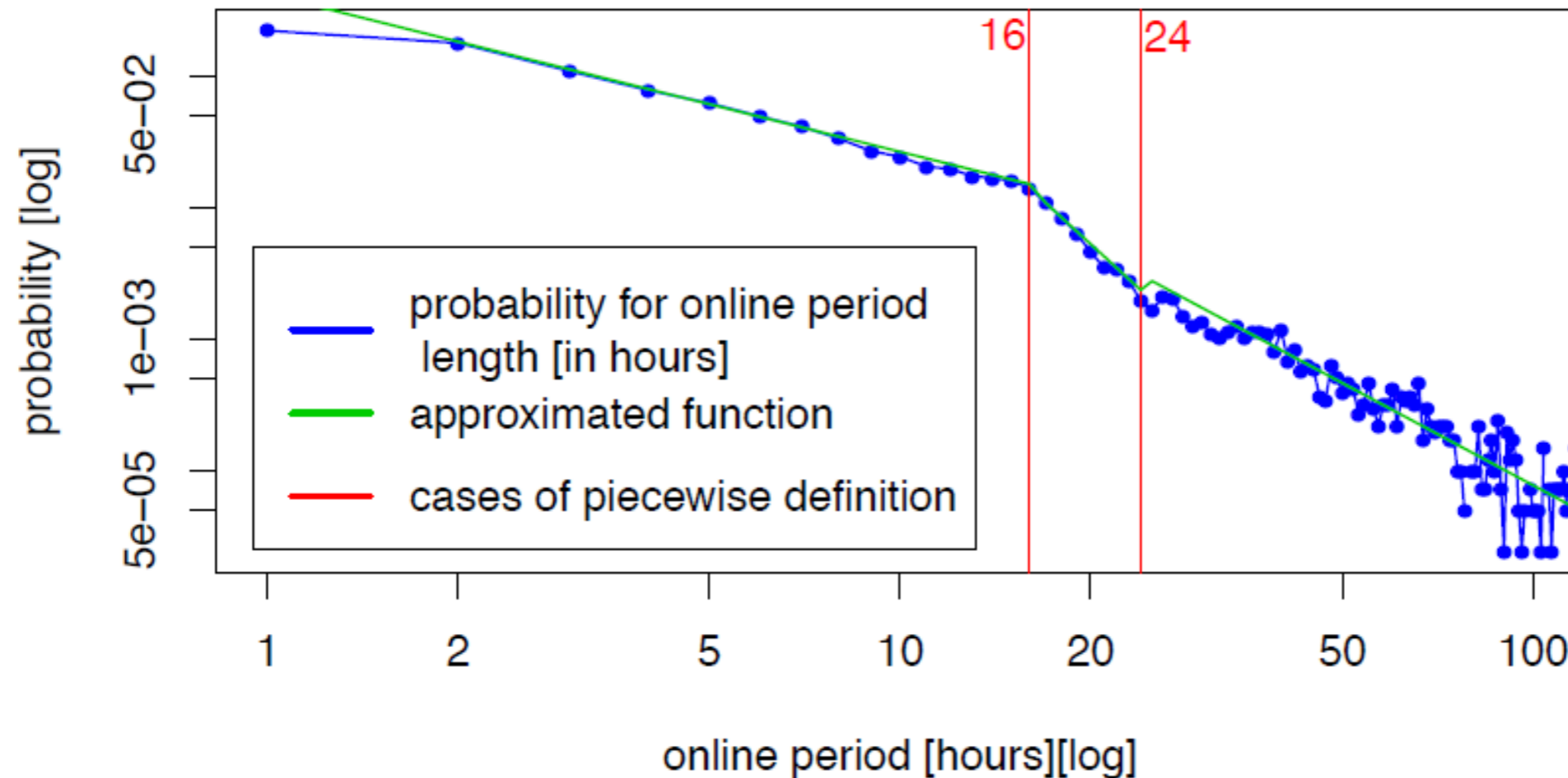
Internet Traffic of a German ISP August 2009

- HTTP most traffic

- BitTorrent most upload

Top ten services of the average user

CoNe
Freiburg

Online period length probability

Source: Alsbih, Janson, S. Analysis of
Peer-to-Peer Traffic and User Behaviour
ITA 2011
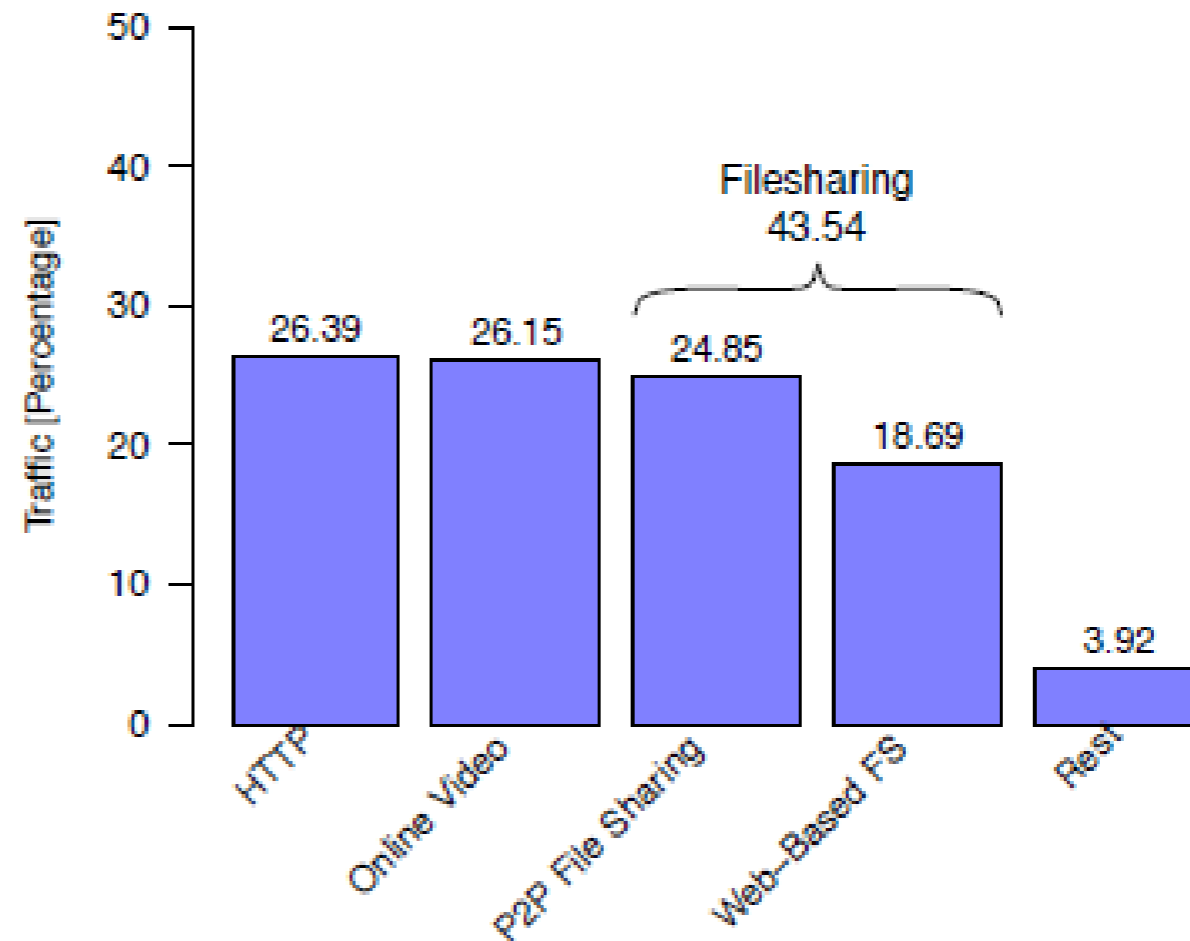
- Fourier analysis shows 12h and 24h peak

- 24h periodicity roughly resembles sin curve

Fourier analysis of traffic & periodicty

Source: Alsbih, Janson, S. Analysis of Peer-to-Peer Traffic and User Behaviour ITA 2011

Internet Traffic 2010
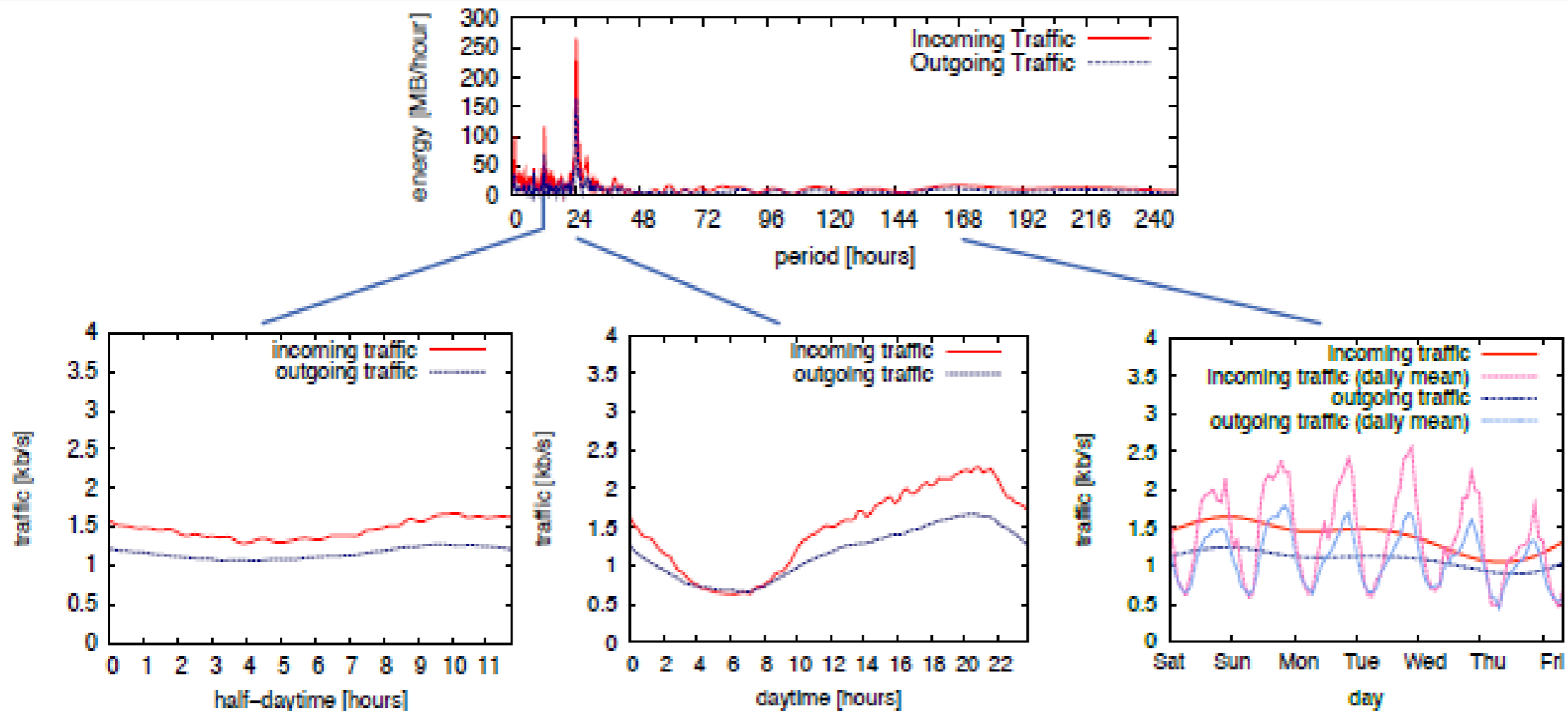
- Cisco Visual Networking Index Usage

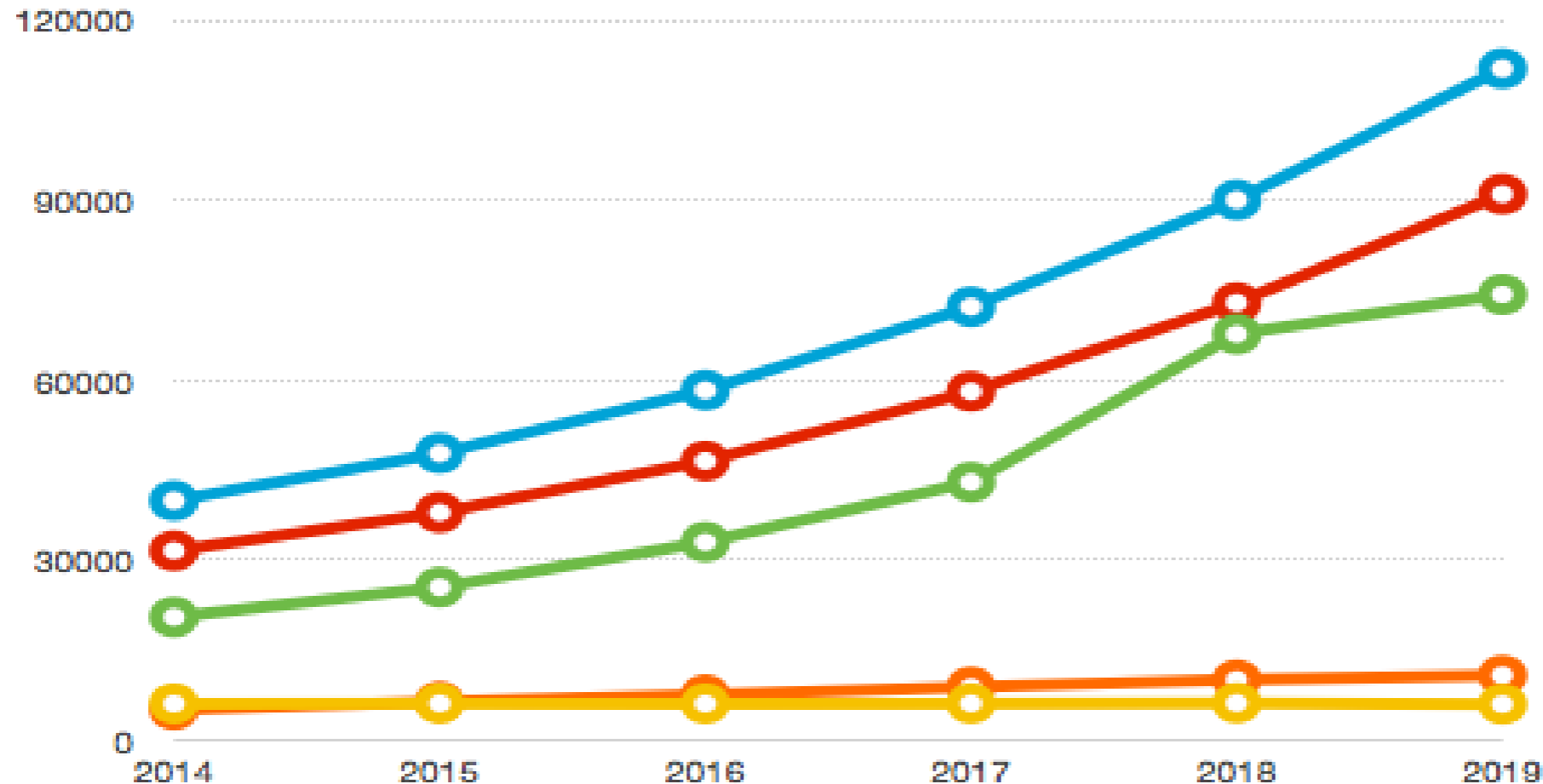- contains data of 20 anonymous service providers

Traffic Study

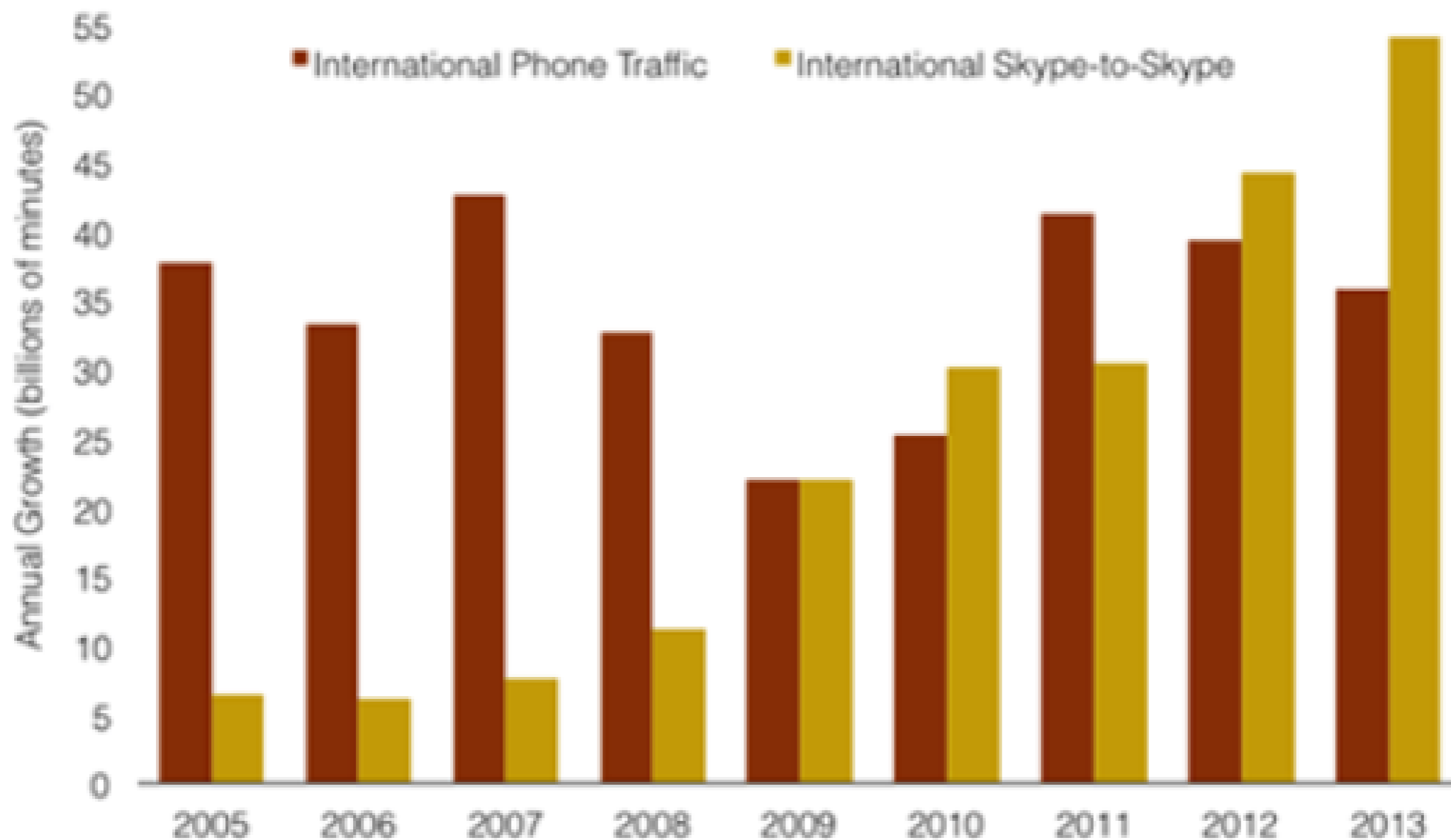["Cisco Visual Networking Index: Usage", White Paper, 2010]

Internet Traffic 2014-2017

Cisco Prediction 2014 (PB/mo)	2014	2015	2016	2017	2018	2019
Internet Traffic	39912	47811	58321	72261	90090	112000
Internet Video	20485	25452	33000	43000	67700	74300
Filesharing	6044	6081	6046	6080	6147	5961
Web, Email, Data	5018	6382	7500	8820	10019	10763
Consumer IP Traffic	31548	37916	46527	58125	72938	91043

Skype Traffic

Increase in International Phone and Skype Traffic

Download
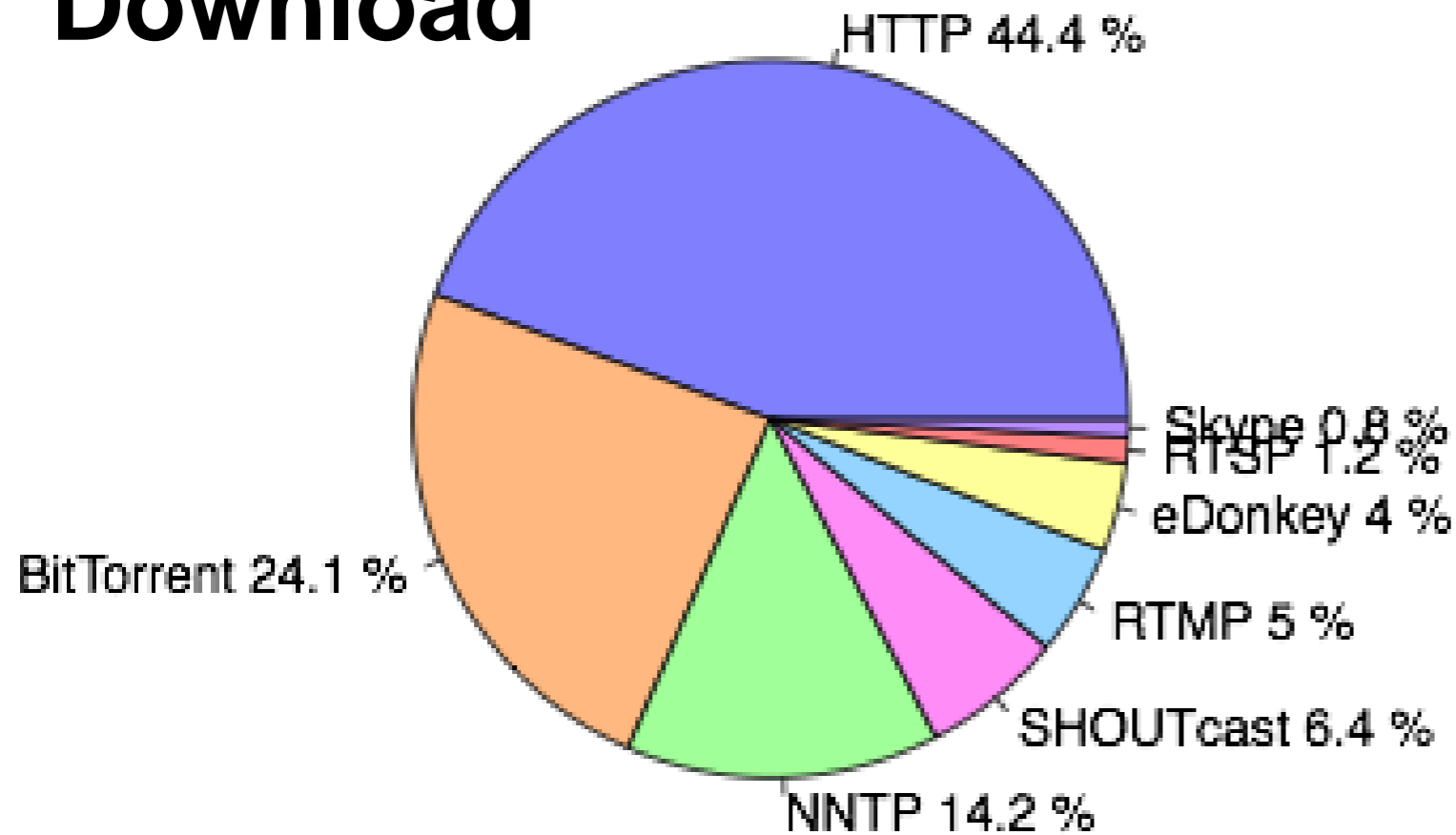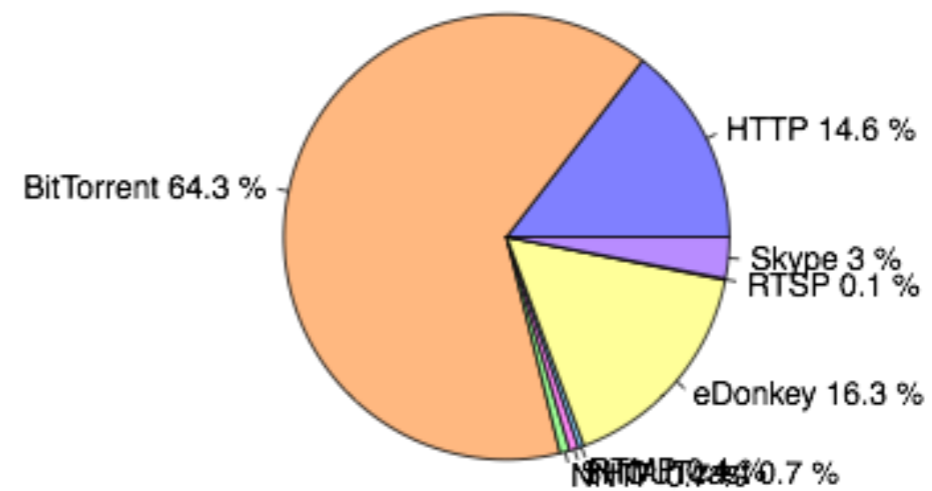
HTTP 44.4 %

Skype 0.8 %
RTSP 1.2 %
eDonkey 4 %

RTMP 5 %

SHOUTcast 6.4 %

BitTorrent 24.1 %

NNTP 14.2 %

Upload

HTTP 14.6 %

Skype 3 %
RTSP 0.1 %

BitTorrent 64.3 %

eDonkey 16.3 %

NNTP/RTMP/SHOUTcast 0.7 %

Source: Alsbih, Janson, S. Analysis of
Peer-to-Peer Traffic and User Behaviour
ITA 2011

Milestones P2P Systems

- Napster (1st version: 1999-2000)

- Gnutella (2000), Gnutella-2 (2002)

- Edonkey (2000)
  - later: Overnet usese Kademlia

- FreeNet (2000)
  - Anonymized download

- JXTA (2001)
  - Open source P2P network platform

- FastTrack (2001)
  - known from KaZaa, Morpheus, Grokster

- Bittorrent (2001)
  - only download, no search

- Skype (2003)
  - VoIP (voice over IP), Chat, Video

Milestones Theory

- **Distributed Hash-Tables (DHT) (1997)**
  - introduced for load balancing between web-servers
- **CAN (2001)**
  - efficient distributed DHT data structure for P2P networks
- **Chord (2001)**
  - efficient distributed P2P network with logarithmic search time
- **Pastry/Tapestry (2001)**
  - efficient distributed P2P network using Plaxton routing
- **Kademlia (2002)**
  - P2P-Lookup based on XOr-Metrik
- **Many more approaches**
  - Viceroy, Distance-Halving, Koorde, Skip-Net, P-Grid, ...
- **Further Developments**
  - Network Coding for P2P
  - Anonymity, Security
  - P2P Streaming

What is a P2P Network?

- **What is P2P NOT?**

  - a peer-to-peer network is not a client-server network

- **Etymology: peer**

  - from latin par = equal

  - one that is of equal standing with another

  - P2P, Peer-to-Peer: a relationship between equal partners

- **Definition**

  - a Peer-to-Peer Network is a communication network between computers in the Internet

    - without central control

    - and without reliable partners

- **Observation**

  - the Internet can be seen as a large P2P network

Contents

- Short history

- First Peer-to-Peer Networks

  - Napster

  - Gnutella

- CAN

- Chord

- Pastry und Tapestry

- Game theory

- P2P traffic

- Codes

- P2P in the real world

Peer-to-Peer Networks

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