# Welcome to …

TDTS11 (Computer Networks and Internet Protocols)

… IT program students

TDDE35 (Large-scale Systems Distributed Systems and Networks)

… U program students

Andrei Gurtov, Professor
https://www.ida.liu.se/~andgu38/

Niklas Carlsson, Senior Associate Professor
https://www.ida.liu.se/~nikca89/

# Welcome to …

TDTS11 (Computer Networks and Internet Protocols)

… IT program students

TDDE35 (Large-scale Systems Distributed Systems and Networks)

… U program students

Andrei Gurtov, Professor
https://www.ida.liu.se/~andgu38/

Niklas Carlsson, Senior Associate Professor
https://www.ida.liu.se/~nikca89/

# Welcome to …

TDTS11 (Computer Networks and Internet Protocols)

… IT program students

TDDE35 (Large-scale Systems Distributed Systems and Networks)

… U program students

Andrei Gurtov, Professor
https://www.ida.liu.se/~andgu38/

Niklas Carlsson, Senior Associate Professor
https://www.ida.liu.se/~nikca89/

# Welcome to …

TDTS11 (Computer Networks and Internet Protocols)

… IT program students

TDDE35 (Large-scale Systems Distributed Systems and Networks)

… U program students

Andrei Gurtov, Professor
https://www.ida.liu.se/~andgu38/

Niklas Carlsson, Senior Associate Professor
https://www.ida.liu.se/~nikca89/

# Kick starting science ...

# What do you have in the future?

# How do we build services that are …

Efficient

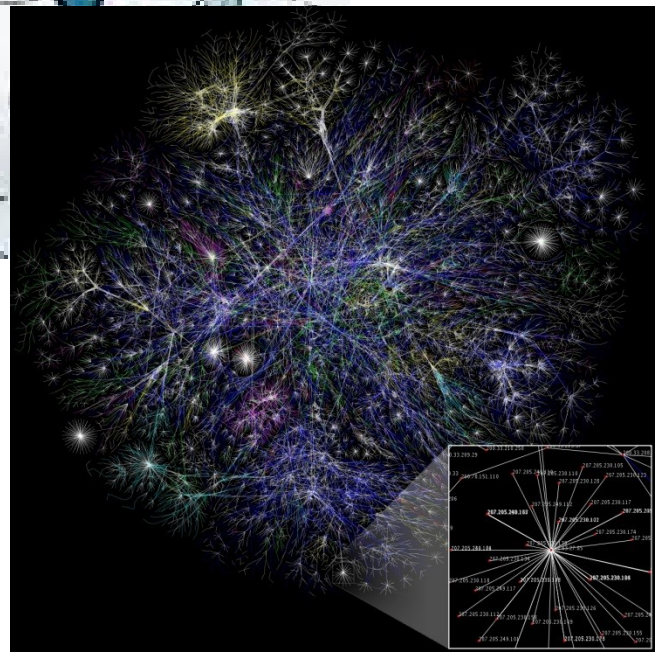
Secure

Reliable

# Basic example problems include …

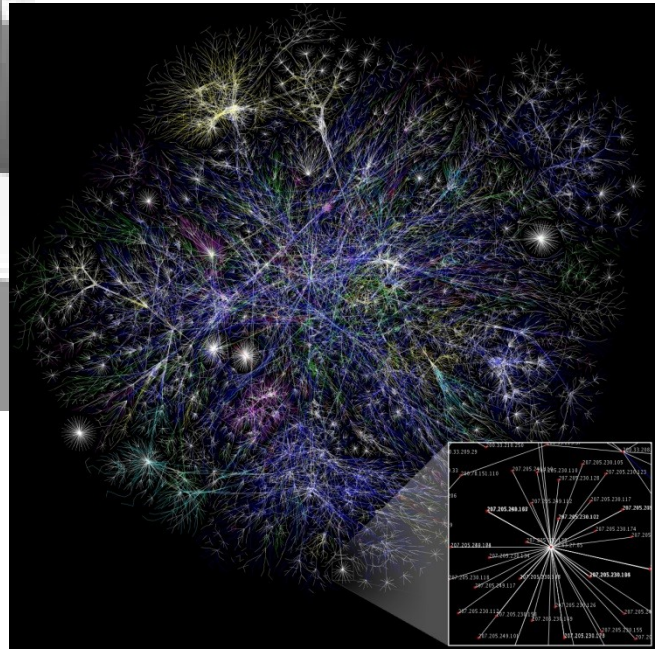
# How do we communicate with a machine across the world?

# How do we find out who to talk to?



# How can we trust that we talk to the right machine/organization?

# How do we find a path?



# How do we **avoid sending too much** for the receiver and network to handle?

# What happens at our machine? Inside the network? Along the path?

# What to expect? (What will be covered?)

- Design principles for computer networks
  - Conceptual view of Internet architecture
- Design, resource, and performance tradeoffs
  - General working knowledge of protocols/applications
  - Detailed knowledge of selected protocols/applications
  - Some practical hands-on experience
- Glimpse into the future of the Internet
  - Emerging trends and technologies

# People During vt1

Andrei

Niklas

Nikolaos

- Examiner TDTS11 + lecturer
  - Andrei Gurtov, Professor
  - Research area: Networking, network security, cloud computing, future Internet architectures, 6G, ...
- Examiner TDDE35 + lecturer
  - Niklas Carlsson, Senior Associate Professor
  - Research area: Security, privacy, multimedia systems, networking, internet measurements, performance evaluation of distributed systems and networks, sports analytics, ...
- Lecturer
  - Nikolaos Pappas, Associate Professor (Docent)
  - Research area: Semantic wireless communications, age of information, stochastic modelling and performance analysis of communication networks, wireless energy harvesting networks, ...
- Lab assistant TDTS11
  - Gurjot Singh (gurjot.singh@liu.se), PostDoc
- Lab assistant TDDE35
  - No labs/assignments during vt1
  - During vt2: Minxing + Sheyda (PhD students)
- Director of studies
  - Patrick Lambrix

# A few words about the lecturers

# Air and Ground Information Security Group

Andrei Gurtov, professor

# Air and Ground Information Security

**AEGIS Group led by Prof. Andrei Gurtov**

3 PhDs, 1 postdoc, master students
World top 1% scientist by research.com
Chair, IEEE Sweden Section


**Cybersecurity of transport and Industrial Internet**

Secure Remote Drone ID standard
AI-based intrusion detection for data link
Lightweight security for legacy and future aircraft
Training Air Traffic Controllers with a simulator


Landing hack/Die Hard 2

Detecting vulnerable Industrial devices
Scalable and secure LAN-as-a-service
Open-source development of Host Identity Protocol
6G and SatCom

ETHER

Co-funded by the European Union

# Communications for Networked Intelligent Systems Group

Nikolaos Pappas

Associate professor, docent

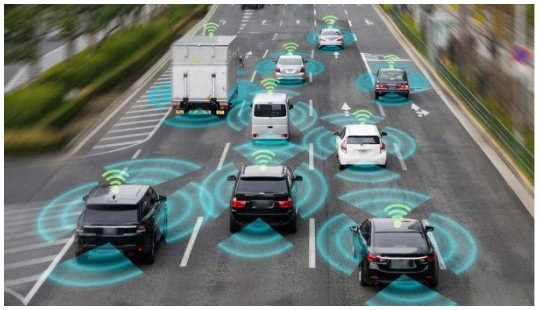
Swedish Research Council

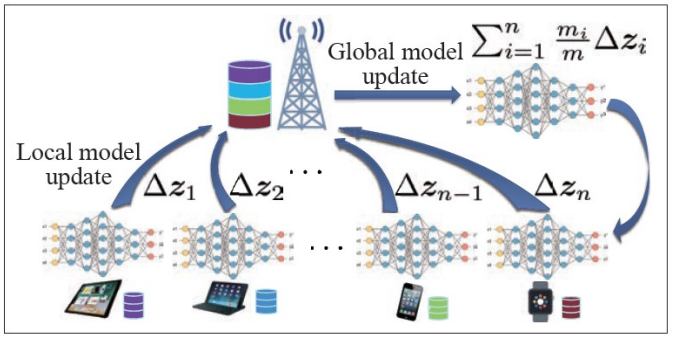
ELLIIT

Excellence Center at Linköping – Lund in Information Technology

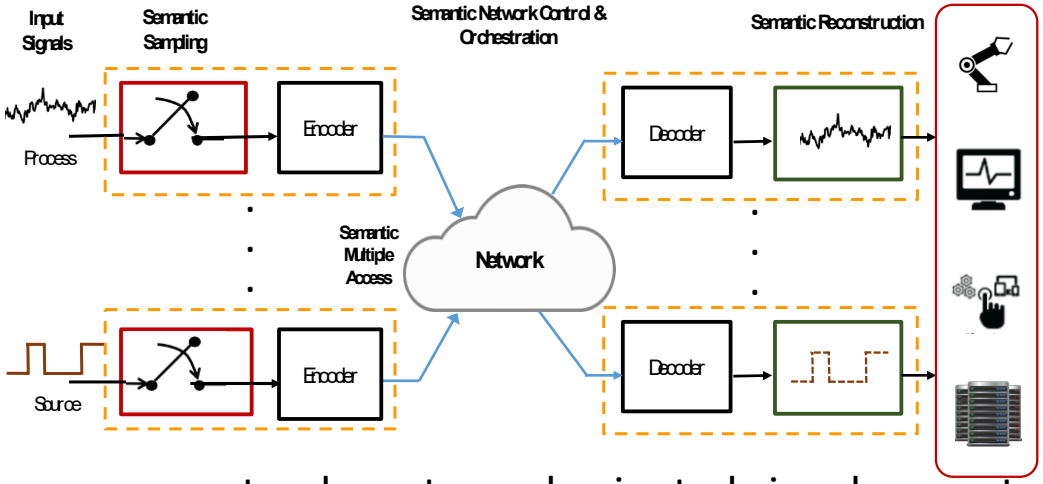
CENIIT

# Emerging wireless ecosystem in 5G and beyond



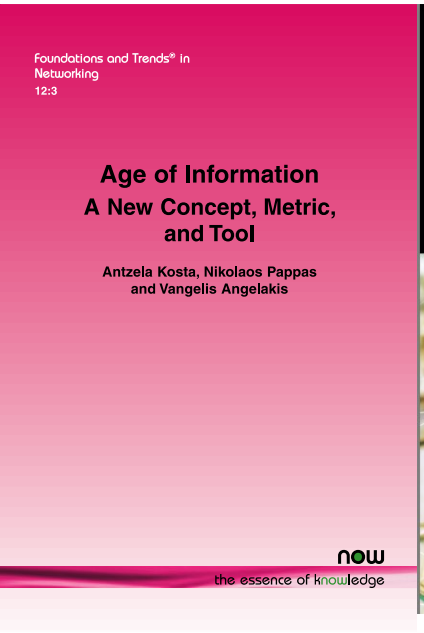


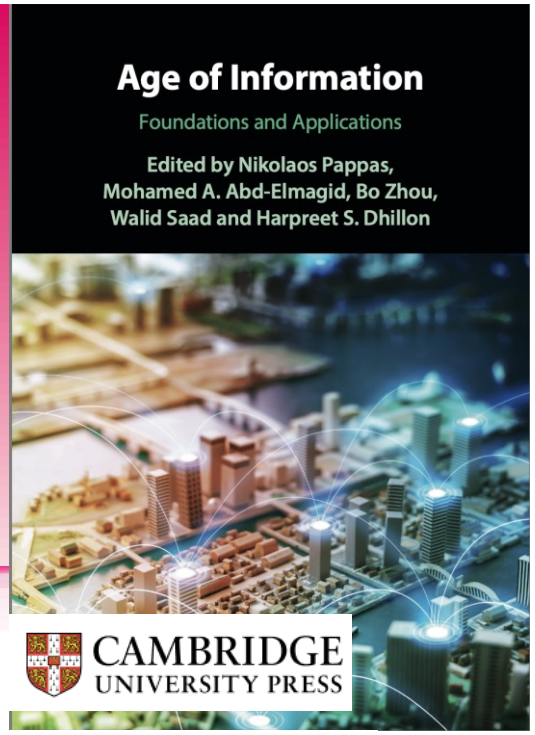

## Towards Goal-oriented Semantic Communication

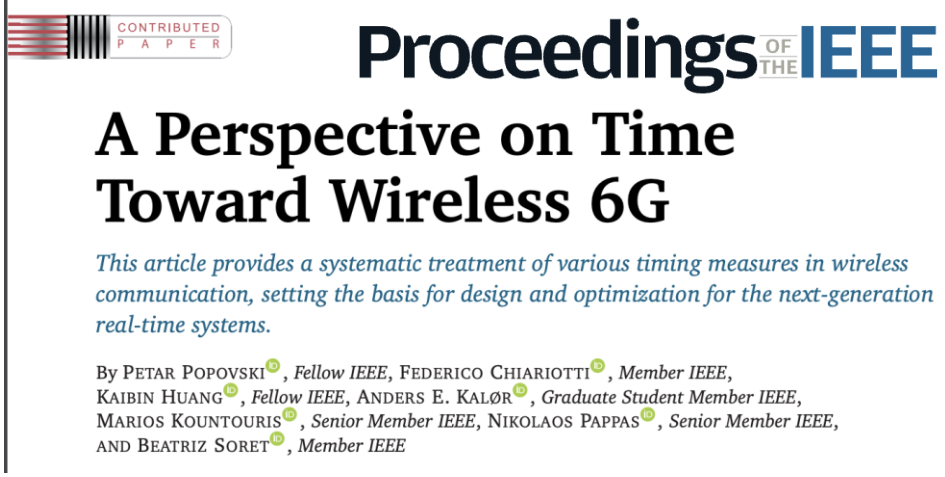


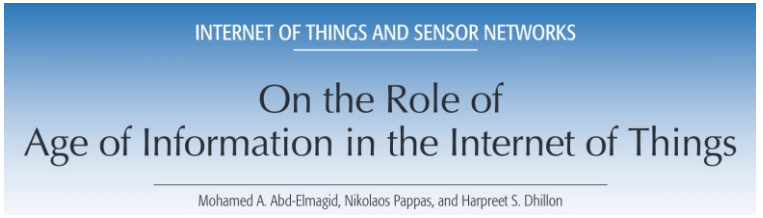

- Communication process extends up to goal-oriented signal reconstruction and information exploitation
- A monitored signal: a physical phenomenon/event distributed in space and evolving in time
- Key semantic operations - Prioritize information and the goal-driven representation of it

# High Impact Publications



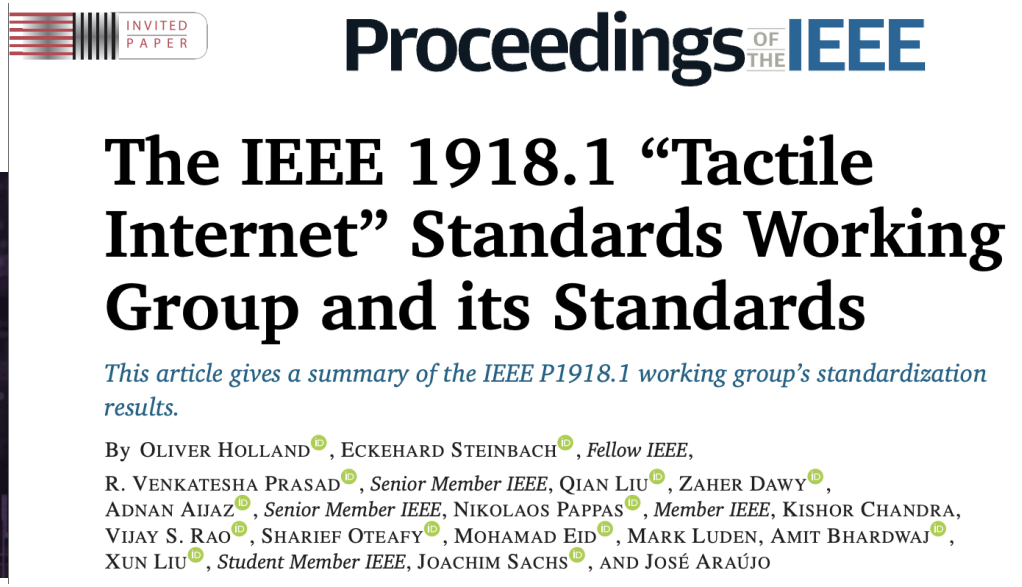




IEEE Communications Magazine • December 2019





# National and international collaboration








香港中文大學
The Chinese University of Hong Kong



Aalto University

UNIVERSITY
OF OULU

UPPSALA
UNIVERSITET


LUND UNIVERSITY


SINGAPORE UNIVERSITY OF
TECHNOLOGY AND DESIGN


UNIVERSITÉ DU
LUXEMBOURG

# Security and Networks Group

Niklas Carlsson, senior associate professor

# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

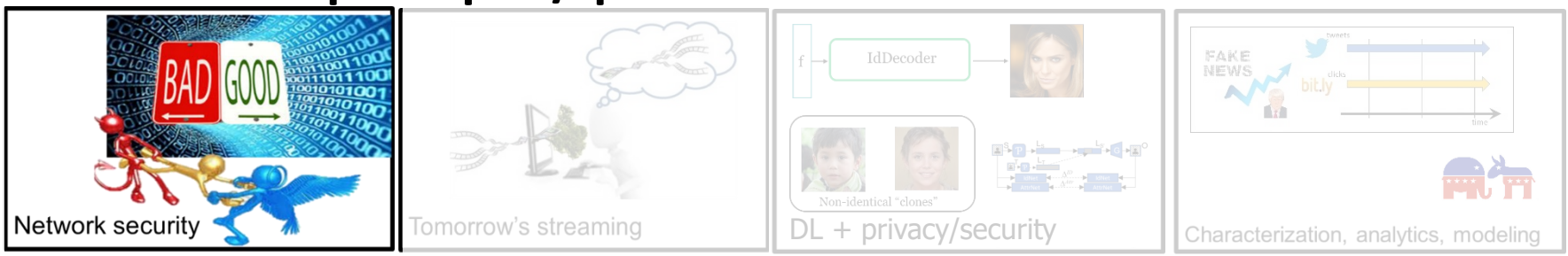
**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions



# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions

# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

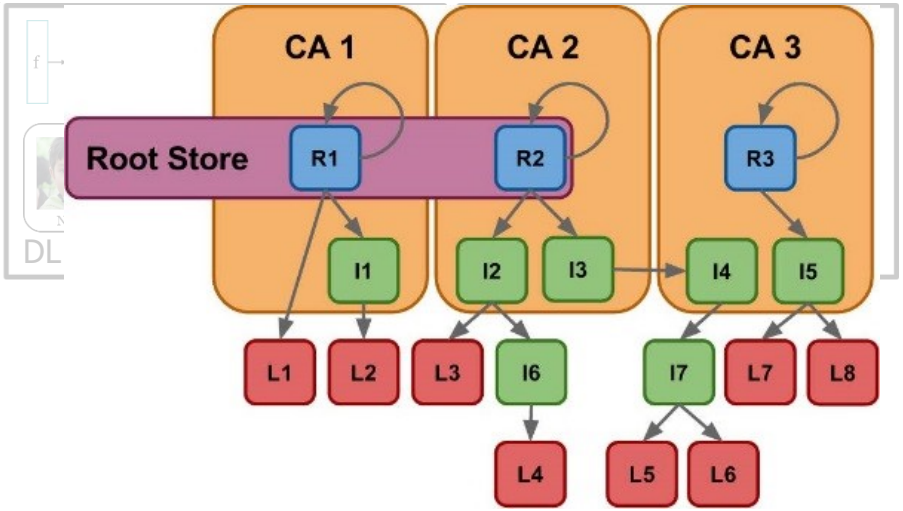
**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions

# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

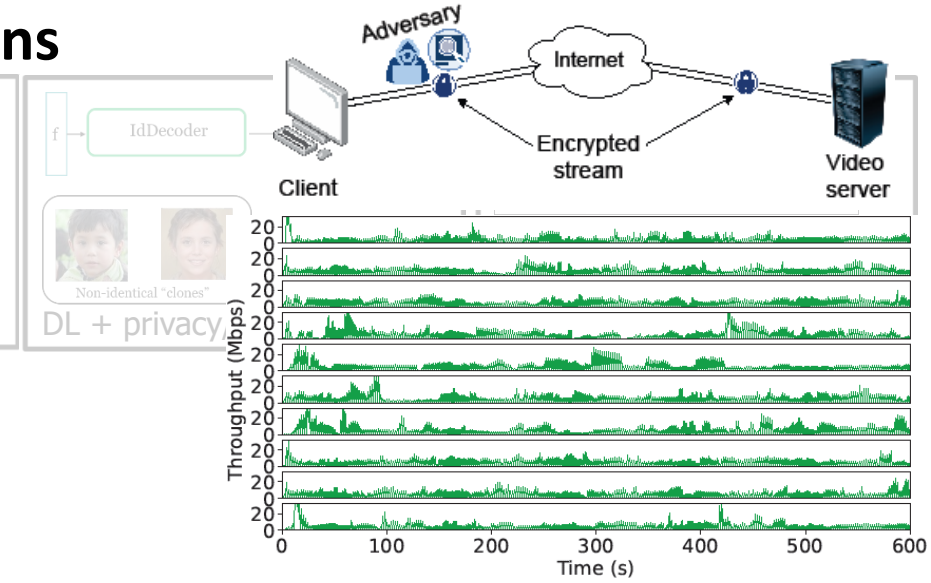
**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

## Current team

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions

# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions

# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

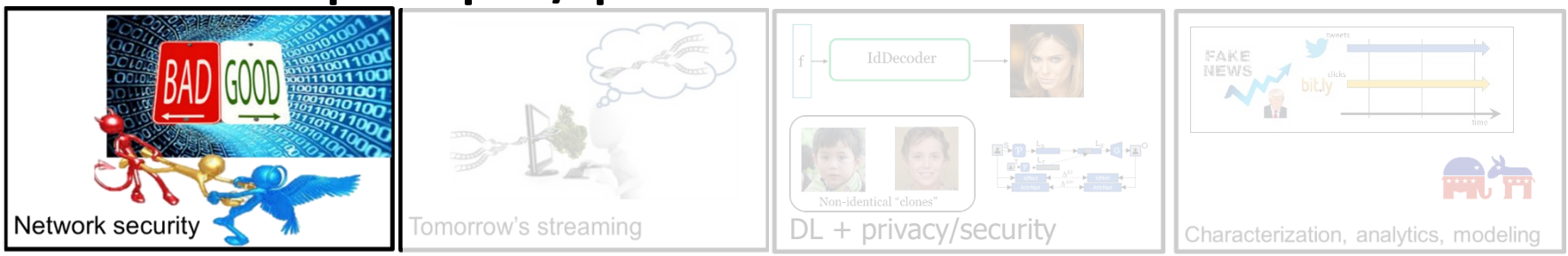
**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions



# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

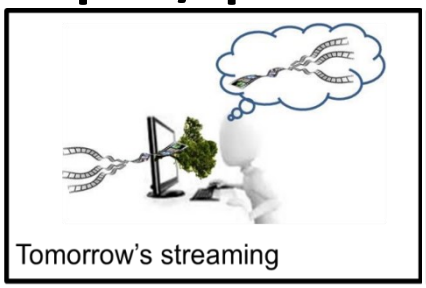
**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions



# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

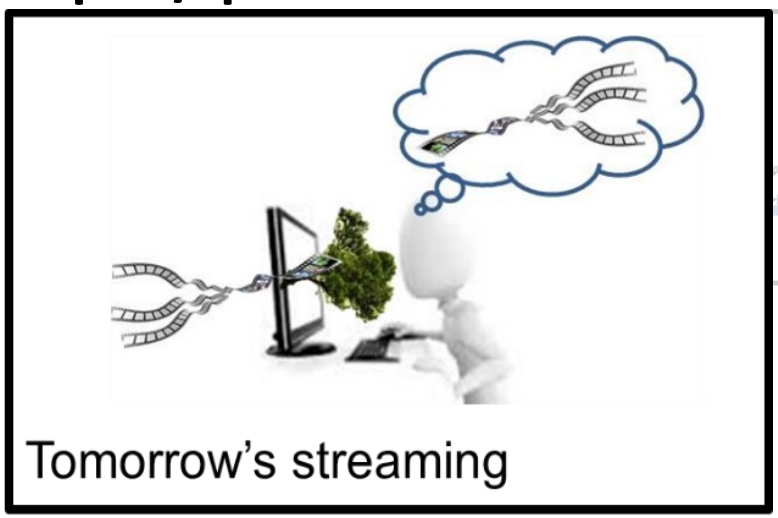
**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions



# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

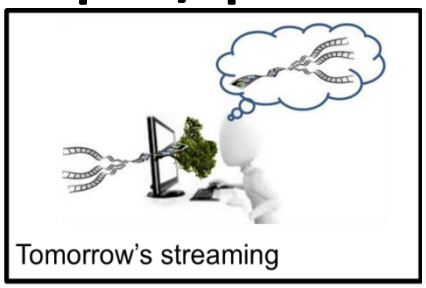
**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions



# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

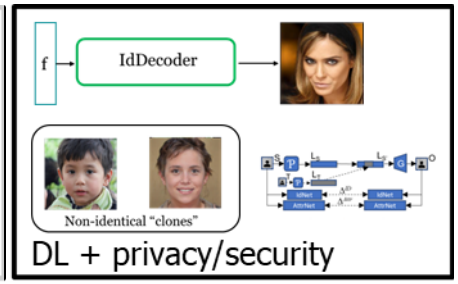
**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions









# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

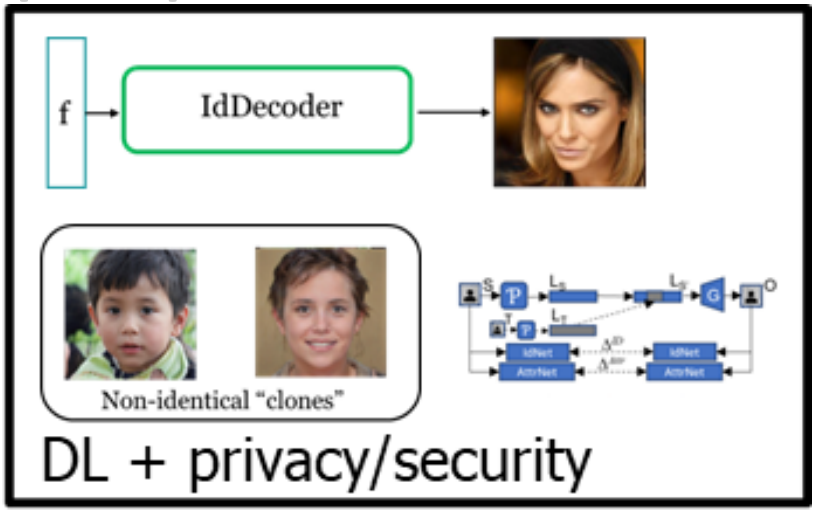
**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions



# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

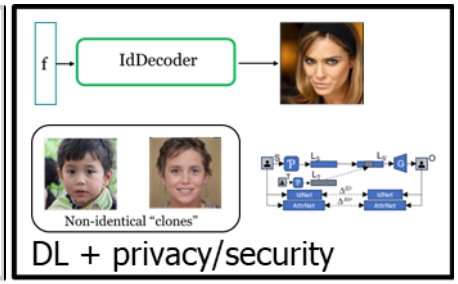
**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

## Current example topics/questions









# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

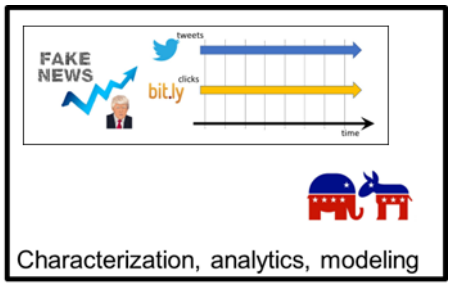
## Current example topics/questions









# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

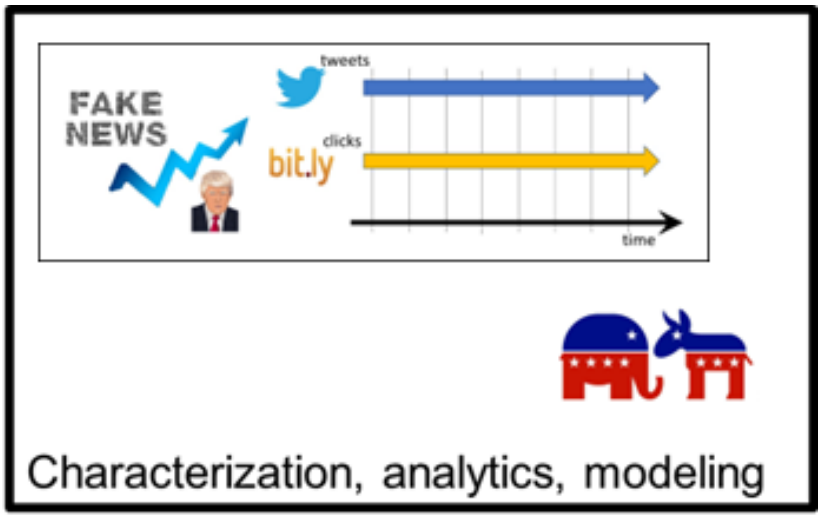
## Current example topics/questions









# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

**Current team**

Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

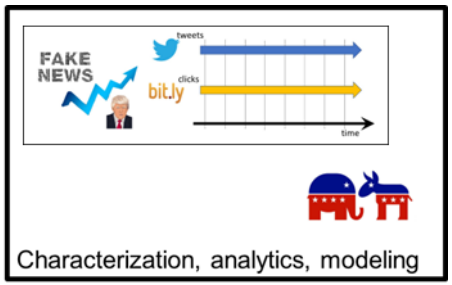
## Current example topics/questions









# Research group overview

**Group leader:** Niklas Carlsson (Senior Associate Professor)

**Interest/aims:** Provide system insights and solutions that help deliver tomorrow's services both effectively and securely

**Methodologies:** E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

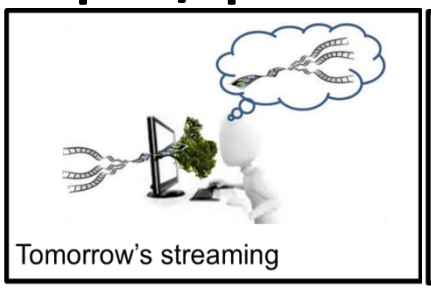
## Current team

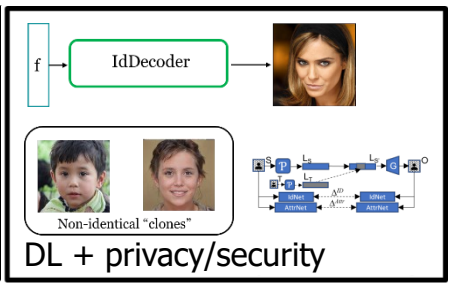
Niklas Alireza David Karol Carl Magnus Sheyda Minxing Ethan Somiya

**Recent Alumni:** Minh-ha (PhD 2024), Alireza (PhD 2024), August (RA + MSc 2024)

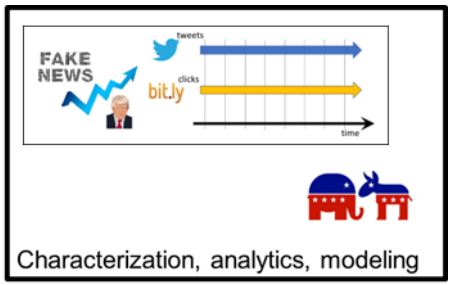
## Current example topics/questions

Network security


Tomorrow's streaming



DL + privacy/security



Characterization, analytics, modeling


# Sports Analytics Group

Patrick Lambrix, professor

Niklas Carlsson, senior associate professor

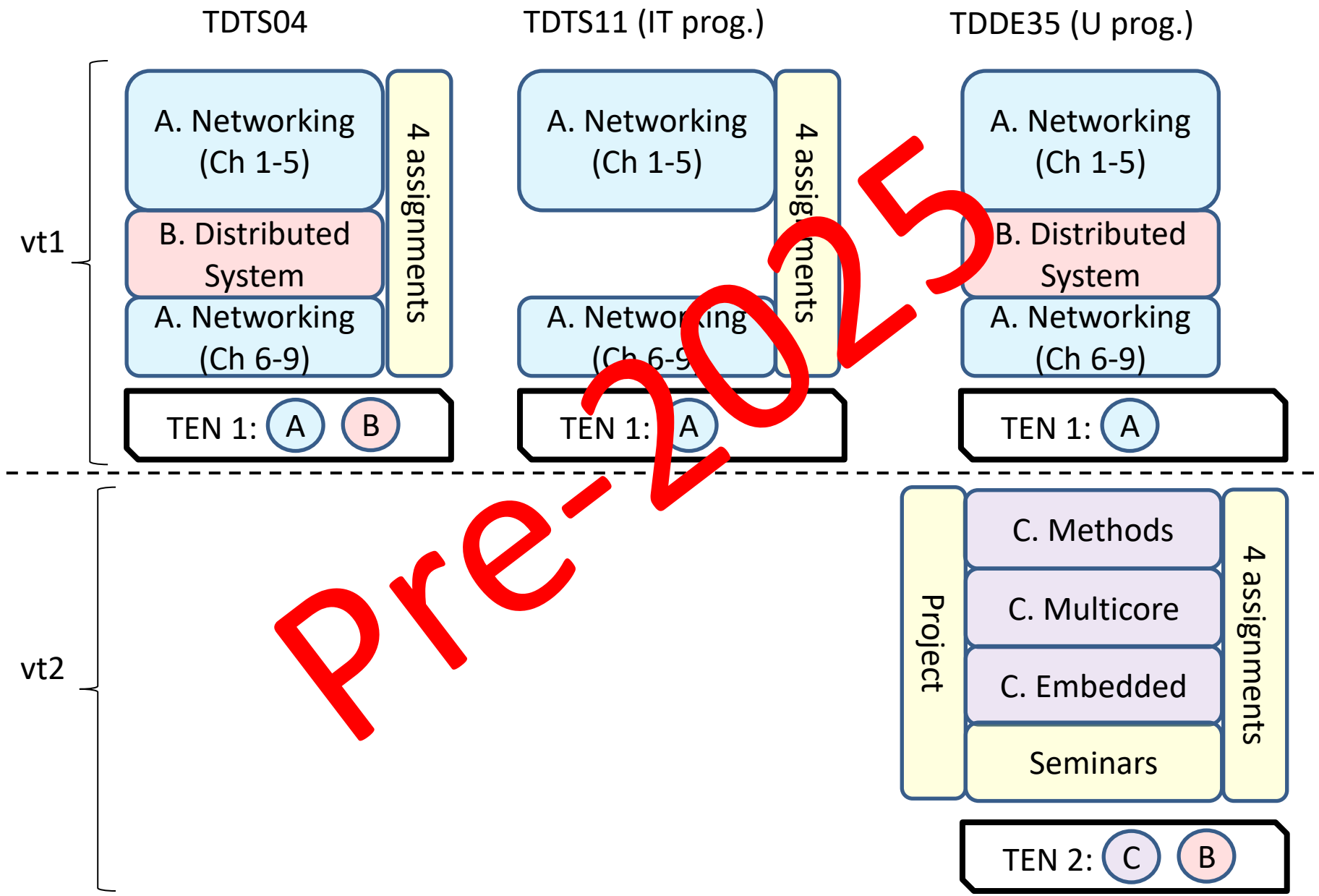
# Sports Analytics

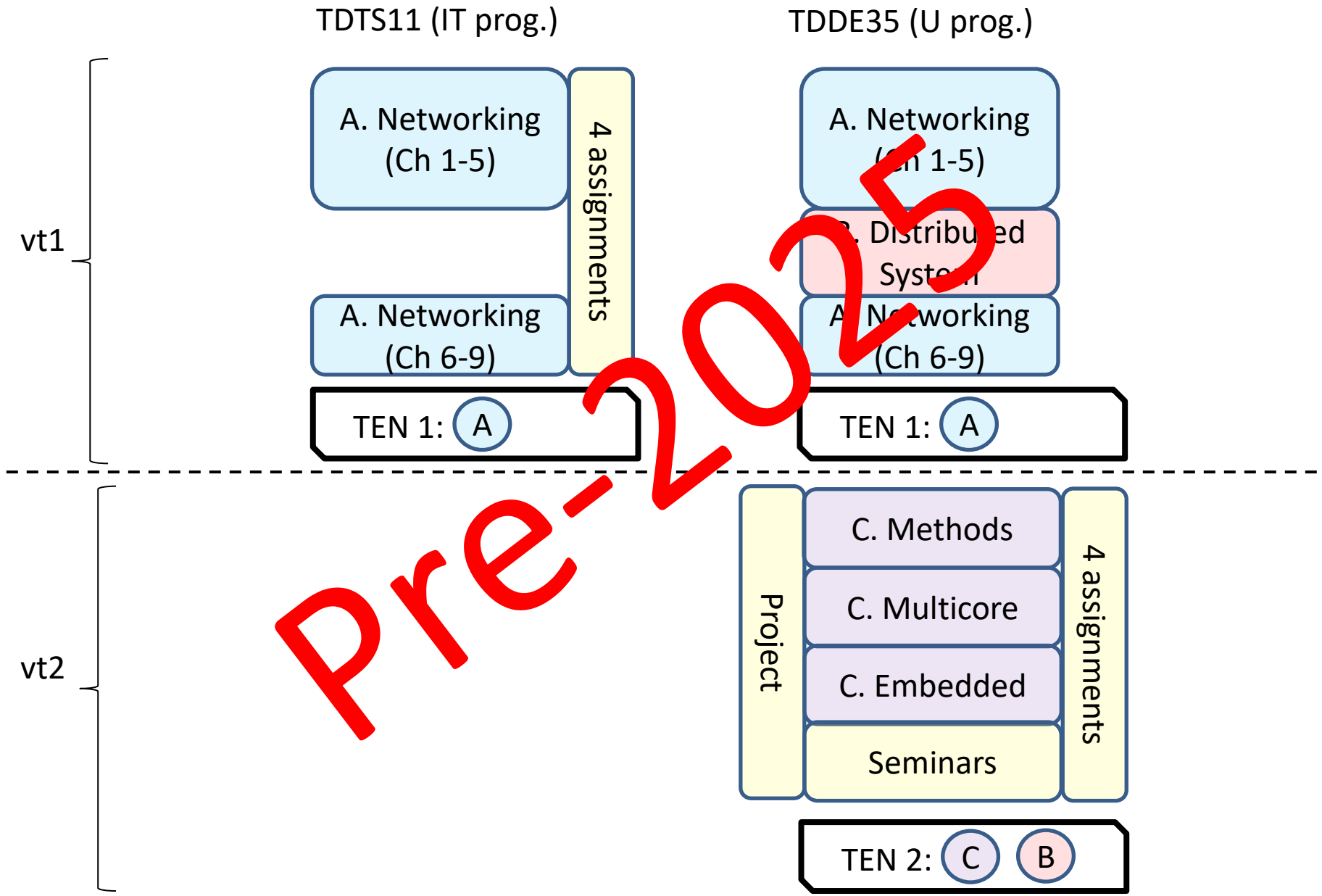

**Examples**

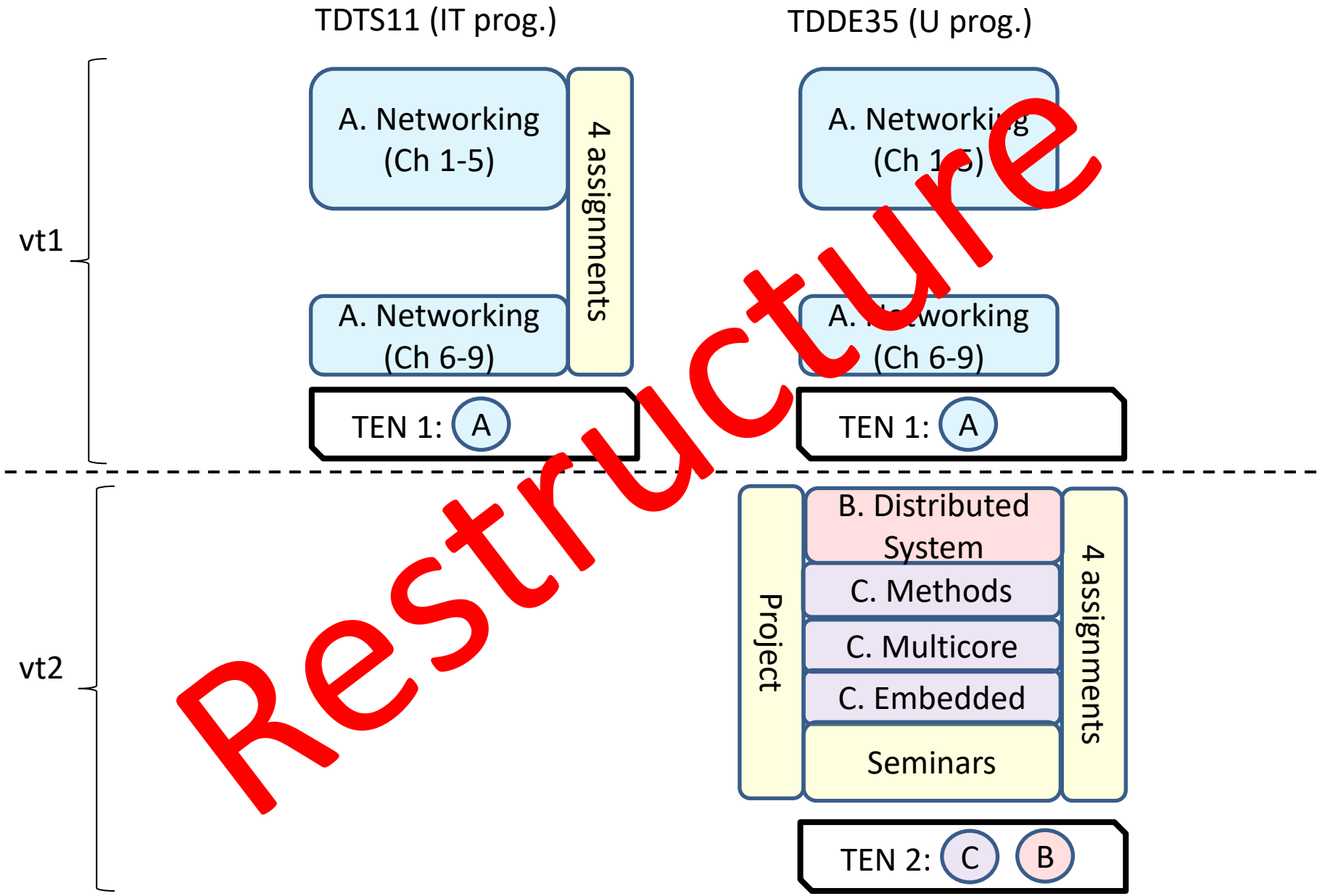
- Player performance (e.g., goal importance)
- Player roles, player combinations, and strategies
- Game and season outcome prediction

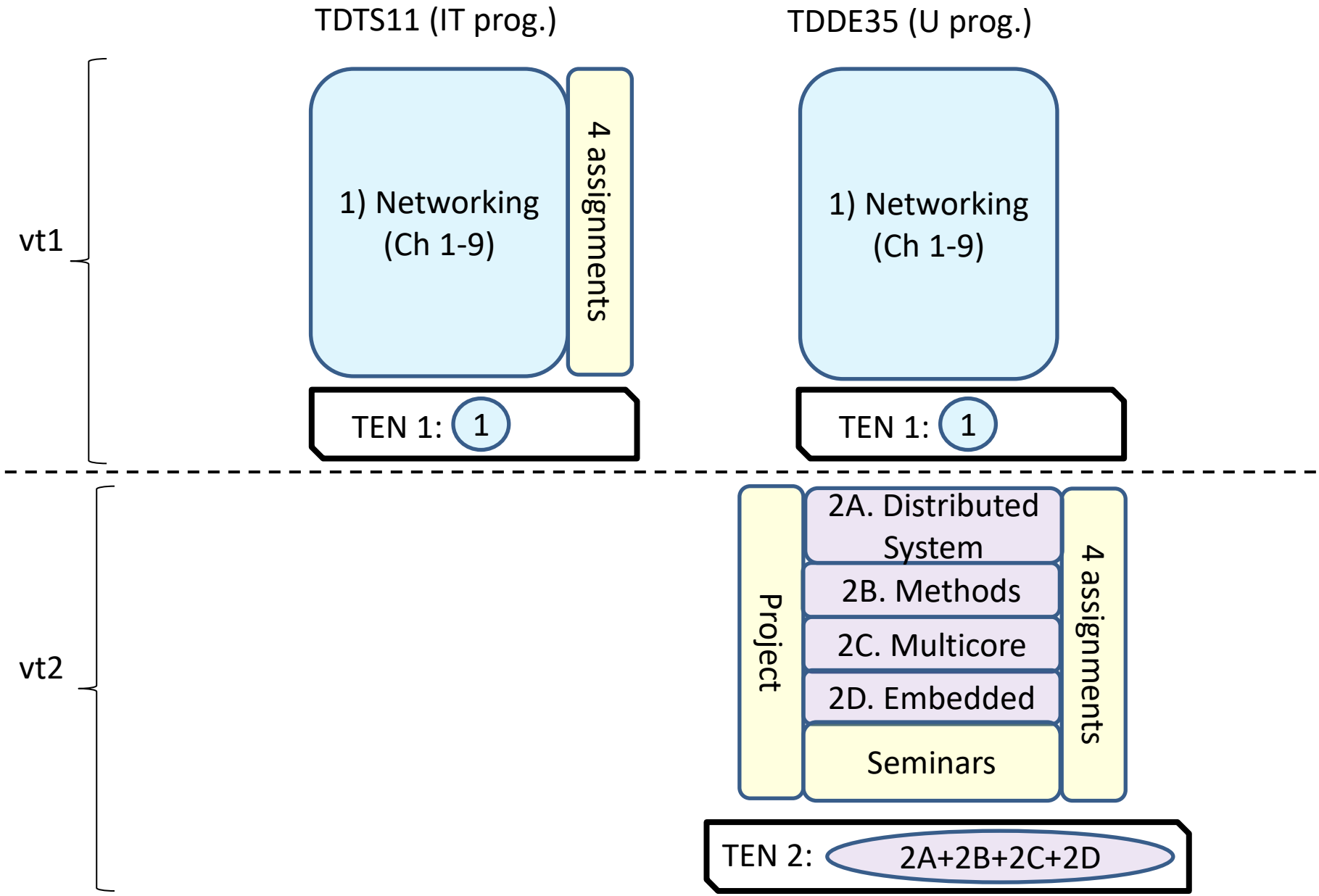

**LINHAC**: Linköping Hockey Analytics Conference

# Back to the course …


TDTS04
TDTS11 (IT prog.)
TDDE35 (U prog.)
vt1
A. Networking (Ch 1-5)
B. Distributed System
A. Networking (Ch 6-9)
4 assignments
TEN 1: A B
TEN 1: A
vt2
Project
C. Methods
C. Multicore
C. Embedded
Seminars
TEN 2: C B
Pre-2025


TDTS11 (IT prog.)
TDDE35 (U prog.)
vt1
A. Networking (Ch 1-5)
4 assignments
A. Networking (Ch 6-9)
TEN 1: A
A. Networking (Ch 1-5)
B. Distributed Systems
A. Networking (Ch 6-9)
TEN 1: A
vt2
Project
C. Methods
C. Multicore
C. Embedded
Seminars
4 assignments
TEN 2: C B
Pre-2025


TDTS11 (IT prog.)
TDDE35 (U prog.)
vt1
A. Networking (Ch 1-5)
4 assignments
A. Networking (Ch 6-9)
TEN 1: A
A. Networking (Ch 1-5)
A. Networking (Ch 6-9)
TEN 1: A
vt2
Project
B. Distributed System
C. Methods
C. Multicore
C. Embedded
Seminars
4 assignments
TEN 2: C B
Restructure


TDTS11 (IT prog.)
TDDE35 (U prog.)
vt1
1) Networking (Ch 1-9)
4 assignments
TEN 1: 1
1) Networking (Ch 1-9)
TEN 1: 1
vt2
Project
2A. Distributed System
2B. Methods
2C. Multicore
2D. Embedded
Seminars
4 assignments
TEN 2: 2A+2B+2C+2D

# Course Overview(s)

- Written exam
  - Grads: ‘fail’, 3, 4, 5.
- Four (4) mandatory lab assignments
  - Must pass all assignments
  - Ten (10) lab opportunities + 2 lessons
  - Register on webreg. (Deadline for TDTS11 on Wednesday!!)
  - TDTS11: One (1) optional assignment
    - Up to 4 bonus marks for exam
- Vt1: Thirteen (13) lectures
  - Twelve (12) network “focus” [all groups]
  - Last lecture with some exam preparation [based on examiner]
  - Likely guest lecture by Sectra
- See your respective websites for more information ...

# Lecture Videos and Slides

- Strongly suggest attending lectures, but complementing material available
- Andrei's recorded lectures from a similar course are available here
  - https://liuonline-my.sharepoint.com/:f:/g/personal/andgu38_liu_se/Eh1nFrZCvgZCqOO9p2hyWzsBSOQ--TXgPqxkb_lZsBmixg?e=nypWek
- Videos and other materials from book authors are available here
  - https://gaia.cs.umass.edu/kurose_ross/lectures.php
  - https://gaia.cs.umass.edu/kurose_ross/online_lectures.htm

# Lecturers' Wish List

- Buy/rent and read the textbook
  - Very good textbook, written by highly regarded researchers in the field
  - No time to cover everything during lectures
  - Read the corresponding chapter before the lecture!
- Work hard (and smart)
  - Attend lectures
  - Make sure you **understand** the material
  - Start assignments early (some will take time)
  - Ask questions during class + discuss with peers
- Follow deadlines

So let’s start the course …