OTTO VON GUERICKE
UNIVERSITÄT
MAGDEBURG

INF

FACULTY OF
COMPUTER SCIENCE

Networked Systems Lab / Seminar / Theses Introduction
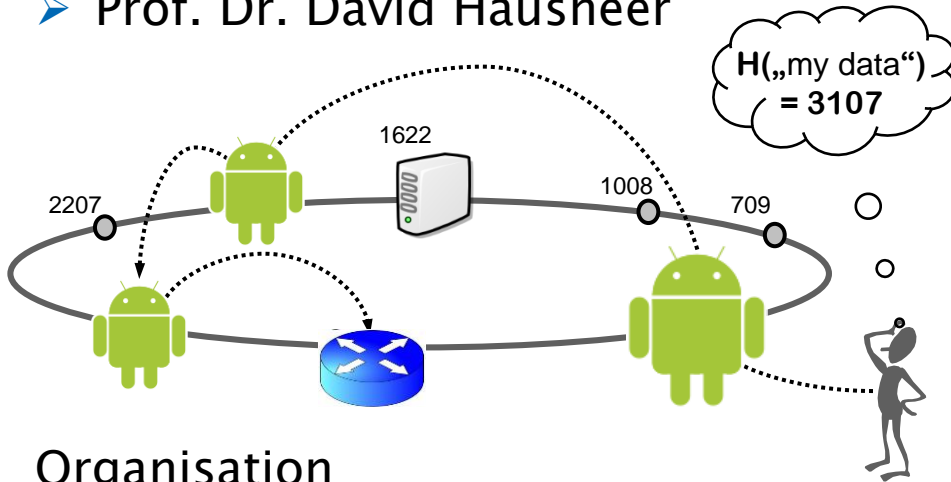
Prof. Dr. David Hausheer

Networks and Distributed
Systems Lab (NetSys)

Networks and Distributed Systems Lab
Prof. Dr. David Hausheer

Networks and Distributed
Systems Lab (NetSys)

Kickoff on 10.04.2024 15:15h Room G28-027

Praktikum Vernetzte Systeme

Dozent:
➢ Prof. Dr. David Hausheer

H(„my data") = 3107

1622
2207
1008
709

Organisation
➢ Individual- oder Team-Projekt
➢ 6 Kreditpunkte = 180h

Voraussetzungen
➢ BSc/MSc CV/INF/IngINF/WIF/DigiEng
➢ Solide Programmiererfahrungen
➢ Komm. und Netze wird empfohlen

Interesse? Weitere Infos unter:
http://www.netsys.ovgu.de/

Inhalte, u.a.:
➢ Software-defined Networking
➢ Network Functions Virtualization
➢ Netzwerk Sicherheit
➢ P2P und Overlay Netze
➢ Mobile Netze, Video Streaming
➢ Energy-effiziente Netze
➢ Netzwerk Simulation
➢ Oekonomische Aspekte

Lernergebnisse
➢ Design & Entwicklung von Anwendungen in Kommunikationsnetzen
➢ Anwendung von objektorientierten Programmiertechniken

Networks and Distributed Systems Lab
Prof. Dr. David Hausheer

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Kickoff on 10.04.2024
15:15h Room G28-027

Seminar Vernetzte Systeme

Dozent:
➢ Prof. Dr. David Hausheer

H("my data") = 3107

1622

2207   1008   709
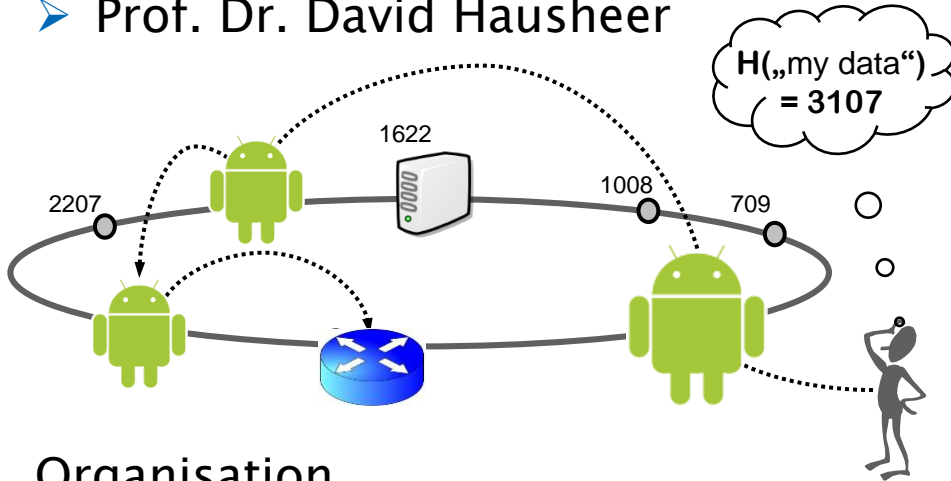
Organisation
➢ Wissenschaftliches Seminar
➢ 3 Kreditpunkte

Voraussetzungen
➢ BSc/MSc CV/INF/IngINF/WIF/DigiEng
➢ Kommunikation und Netze wird empfohlen

Interesse? Weitere Infos unter:
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Inhalte, u.a.:
➢ Software-defined Networking
➢ Network Functions Virtualization
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Lernergebnisse
➢ Literatursuche, Klassifizierung, Evaluation, Vergleich
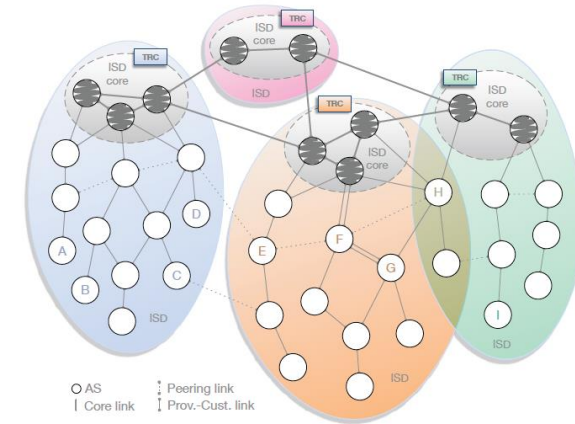➢ Bericht (6-10 Seiten) und Präsentation (20-30min) einer Literaturstudie

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Network Security

❖ **SCION: Scalability, Control, and Isolation on Next-Generation Networks**
  ➢ A Software-defined WAN approach

❖ **SCION Design Goals**
  ➢ Availability in the presence of adversaries (e.g. DDoS)
  ➢ Transparency and control over forwarding paths
  ➢ Multipath forwarding
 ➢ Efficiency, Scalability, and Extensibility
  ➢ Deployability

❖ **SCION provides incentives for deployment to overcome the resistance for upgrading today's core Internet infrastructure**
  ➢ ISPs are able to define new business models and sell new services.
  ➢ Migration requires minimal added complexity (and cost) to the existing infrastructure.

❖ **In cooperation with Adrian Perrig (ETH Zurich)**

SCiON

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SCIONLab

❖ Fast setup, low entry bar for users

❖ Little required technical expertise: Setup of a SCION should be simple, intuitive and automated

❖ SCION AS can be instantiated as a VM in few clicks
  ➢ http://www.scionlab.org/
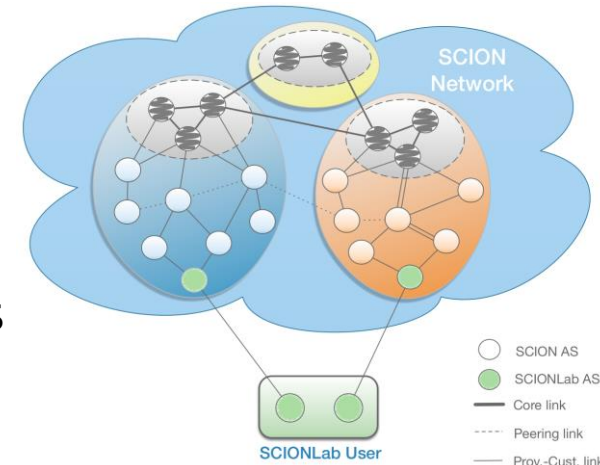
❖ Ongoing Projects (a.o.):
  ➢ Deployment of SCION on Internet Exchange Point Infrastructure
  ➢ Traffic Optimization via Performance-based Path Selection
  ➢ Improving SCION BitTorrent with Efficient Multipath Usage
  ➢ Design and Implementation of User-based Attachment Point
  ➢ A Secure IoT Network based on SCION
  ➢ Deployment of SCION over the EU GEANT/Fed4FIRE+ Topology

❖ Joint work with Lars-Christian Schulz, Thorben Krüger, Marten Gartner, Tony John, Robin Wehner, et al.

Introduction and Courses Overview | 24

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Topics: P4, Linux Kernel Extensions, SCION Application Development (Lars-Christian Schulz)

❖ Extensions to the P4 Reference Compiler and Behavioral Model

❖ SCION Processing in P4TC (P4 in the Linux Kernel)

❖ Multipath TCP over SCION-IP Translation

❖ Applications of Graph Neural Networks in SCION Routing

❖ Applicability of BGP routing policies to SCION (Seminar)

❖ SCION support in "Peering Manager" (Web development in Python/Django) (Seminar, Lab)

❖ Development of a SCION Plugin for OPNsense (Lab)

Type: T(hesis), L(ab), S(eminar)

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Topics: Multipath Networking (Tony John)

❖ Designing a Dynamic FEC Adjustment Mechanism for Multipath Transport Protocols: Investigate adaptive strategies for Forward Error Correction (FEC) to improve real-time data transmission over unreliable networks, considering variable loss rates and latency (Thesis)

❖ Security Implications of Multipath Transport Protocols: Analyze the security vulnerabilities and defense mechanisms specific to multipath transport protocols (Thesis)

❖ Predictive Path Quality Assessment in Multipath Networks: Design a model that predicts path quality metrics such as latency, bandwidth, and loss rate in real-time, facilitating better path selection decisions in multipath networks (Thesis)

❖ Developing a GUI for visualizing multipath network performance that visualizes the performance and decision-making process of multipath transport protocols in real-time (Lab)

❖ Evaluating the effectiveness of Forward Error Correction in multipath networks (Lab/Seminar)

❖ Evaluating acknowledgement schemes for real-time communication protocols (Lab/Seminar)

Type: T(hesis), L(ab), S(eminar)

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Topics: Multipath Bulk File Transfer (Marten Gartner)

❖ Extend BitTorrent's fairness mechanisms in path-aware networks with active peer communication (T)

❖ Adapt BitTorrent client for multi transport protocol support (e.g. use PANAPI) (TCP, SCION/QUIC) (L)

❖ Implement a building mechanism to bundle the minimal SCION endhost stack into a single application (L)

❖ Analyse key properties of the current Internet (AS path length, number of available paths between destinations, routing decisions, overlay/underlay topology, etc) (T/S)

❖ Development on the SEED Internet Emulator (incorporate existing changes and add new features) (L)

❖ Add live features to the visualization of the SEED Internet Emulator (L)

Type: T(hesis), L(ab), S(eminar)

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Topics: SCION Border Router (Robin Wehner)

❖ Extend the SCION P4 Tofino border router implementation with control plane support for SCMP (Python) (L)

❖ Implement support for external routers (as the one we have for Tofino) in the SEED network emulator (Python) (L,S)

❖ Extend SEED with better support for the SCION AS-ISD numbering – Implement a default strategy for SCION ASNs and adapt the displayed ASNs to the SCION naming convention (L)

❖ Implement a replay suppression mechanism as required by SCION EPIC for the Go reference SCION border router (L,T)

Type: T(hesis), L(ab), S(eminar)

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Organization

❖ This week: Write me an e-mail to hausheer@ovgu.de with:
- ➢ Topics you are interested (may be multiple, in order of preference)
- ➢ Type (Lab, Seminar, Thesis)
- ➢ Individual- or Teamproject
- ➢ Name(s) of involved person(s)

❖ Next week: Make an appointment with me to discuss the topic and initiate the work and register with the exam office (in case of lab work)

❖ Deadlines:
- ➢ Presentations will take place after the end of the semester
- ➢ Reports (+ Code) have to be handed in a week prior to the presentation (<tbd>)
- ➢ A preliminary version needs to be handed in for feedback (<tbd>)

❖ Templates:
- ➢ Presentation template will be provided later
- ➢ Report template: IEEE Template for Transactions
  http://www.ieee.org/publications_standards/publications/authors/author_templates.html#sect1

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Requirements

❖ Report
  ➢ Team projecs: 5 pages for 1 person, 5,5 pages for 2 persons, 6 pages for 3 persons
  ➢ Seminar work: 6-10 pages

❖ Presentation
  ➢ Team projecs: 20min (+5-10min demo)
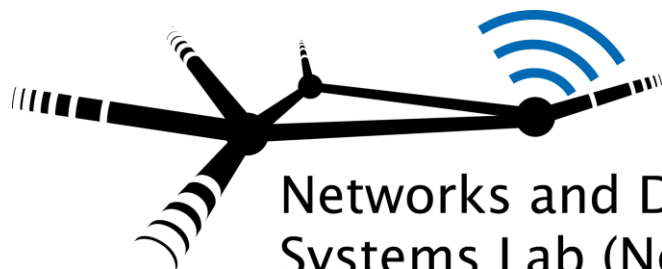 ➢ Seminar work: 20-30min (+15min discussion)

❖ Exam registration
  ➢ To be done with the corresponding exam registration form
  ➢ To bring with you for my signature, once the presentation date is fixed

❖ Plagiarism
  ➢ Please take care to correctly reference other work and dont copy/paste content from other documents
  ➢ Reports will be checked for plagiarism and plagiarism will be reported

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➢ Like our Facebook page at https://www.facebook.com/netsyslab/

➢ Our website is available at http://www.netsys.ovgu.de/