

Institute of Computer Science University of Würzburg Prof. Phuoc Tran-Gia

#### Anwendungsprogrammierung und Netzwerkdesign im zukünftigen Internet

Prof. Phuoc Tran-Gia Institute of Computer Science University of Würzburg Germany

#### Signaling Storm in Mobile Networks, January 2012





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#### **Smartphone Gaming** ...





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#### **Application Diversity in Mobile Networks**



- Increasing heterogeneity on application layer
- Increasingly diversity in mobile applications with specific network access patterns
- →3G network congestion due to high amount of application-generated signaling traffic



#### **Inferring Network Signaling Load**



#### **News Reader: Inline Ad Placement**



# Network-aware application design



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## Network- aware vs. network-unaware application design



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#### **Network-unaware application design**





#### A never-ending tussle: Applications & Networks

- Research: network-oriented or application-oriented
- Can we design advanced applications without knowing the underlying network?
- Can we design future networks without caring about possible applications?

#### Application-aware Network Design

- Network design should be adaptive towards application
- Inter-application control and network design necessary
- Composing a network for a QoE-aware application

#### Network-aware Application Design

- Application design has to take network features into account
- Performance problems with network-agnostic applications



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### Network & Application: a never-ending tussle



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#### **Network-aware application design**



#### **Application and Network**



#### **Example: Improving YouTube Download Quality**

Utilizing application information





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#### **Example: Improving YouTube Download Quality**



#### **Application-aware Traffic Management**



#### **Application-aware Traffic Management**

- Application aware: Observing YouTube playtime buffer
  - YouTube is prioritized in case of low YouTube buffer
    - e.g. buffered playtime  $\beta < 10$  s
  - YouTube is playing fine
  - while download performance only marginally influer







## ... emerging protocol architecture ...



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#### **Emerging protocol architecture**





#### **Applications & Networks**



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#### **Applications & Networks**



## Danke!



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