Technische Universität München
Lehrstuhl für Kommunikationsnetze
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ITG Fachgruppentreffen 5.2.1 und 5.2.4

(Mobile) Content Delivery Networks (CDNs)
and
Information Centric Networks (ICNs)
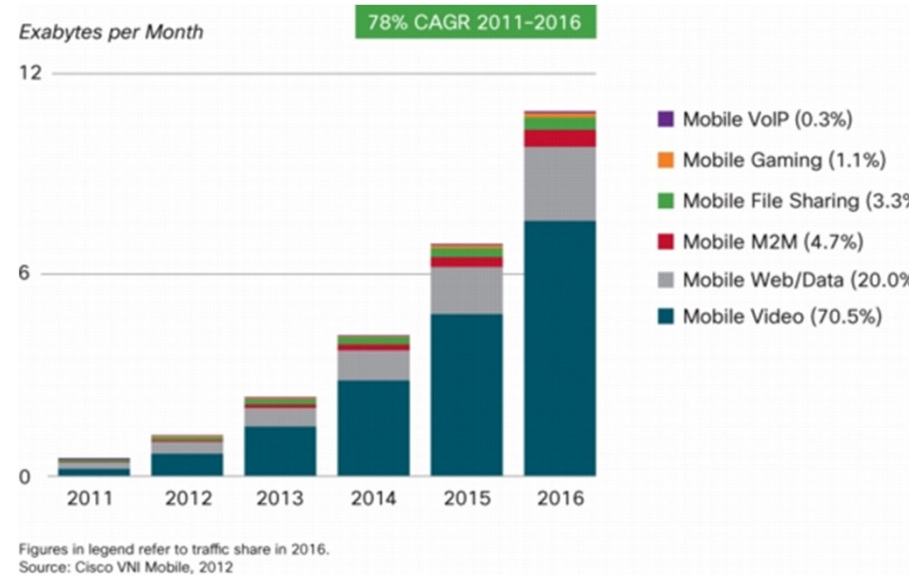
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(Mobile) Content Delivery Networks (CDNs) and Information Centric Networks (ICNs)

- (Mobile) multimedia data traffic is increasing dramatically

Exabytes per Month

78% CAGR 2011-2016

Legend:
- Mobile VoIP (0.3%)
- Mobile Gaming (1.1%)
- Mobile File Sharing (3.3%)
- Mobile M2M (4.7%)
- Mobile Web/Data (20.0%)
- Mobile Video (70.5%)

Figures in legend refer to traffic share in 2016.
Source: Cisco VNI Mobile, 2012

- **Content Delivery Networks (CDN)** are one solution to handle multimedia Internet traffic. So far CDNs are realized as over the top overlays to existing networks. The growing traffic demand, in particular for mobile networks, demands for new, *more network-centric solutions* such as **CDN integration to (mobile) network components** or new **Information-Centric Networking (ICN) paradigms**.

Mobile Content Delivery Networks

- Store or cache the content close to the user: **_edge-based CDN_**

RRDM: Request Router and Decision Manager
X-GW: Serving or Packet Data Network Gateway

CDN Management
and Control Principles

- **Content placement**
  - What content should be placed in which CDN node(s)? Depends on Content popularity (request rate) and System configuration (location of available CDN nodes)
- **Service placement**
  - Where to optimally place CDN nodes?
  - Future virtual networks will be more flexible → dynamically maintain an optimal config.
- **Content routing / request routing (RR)**
  - Select content locations and redirect user requests to optimal candidate
  - Objectives: save NW resources, inter-domain traffic, reduce delivery delay, increase reliability, availability, and performance, provide load balancing
  - Decision making (DM) based on content availability, CDN load node and health, topology information, operator policies
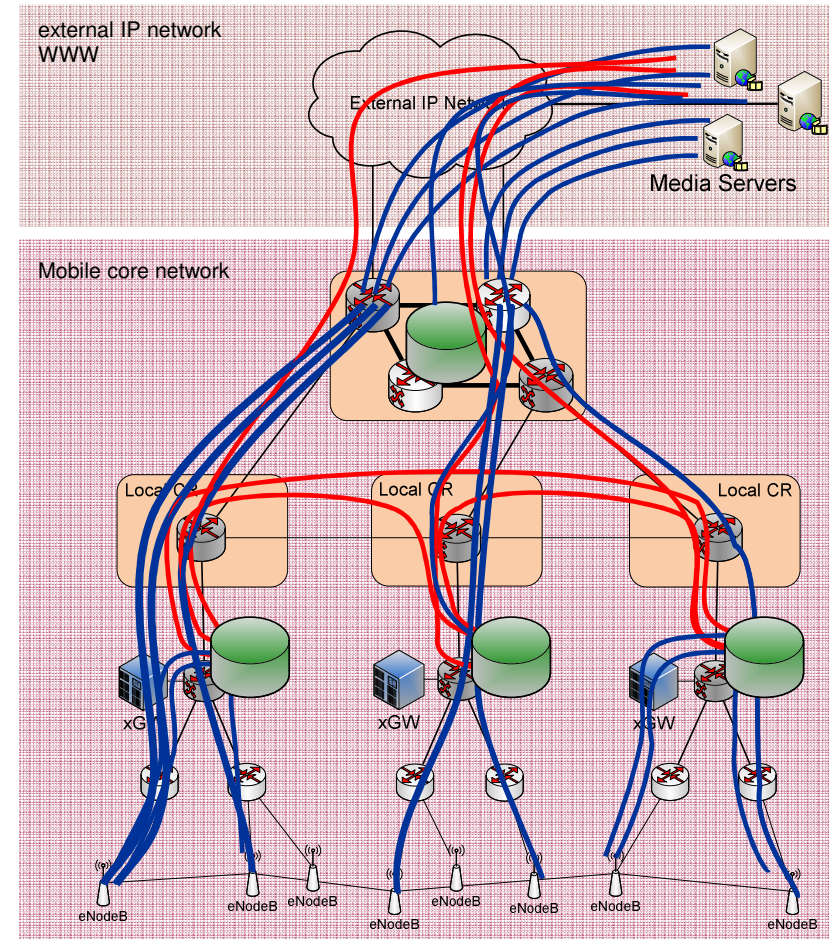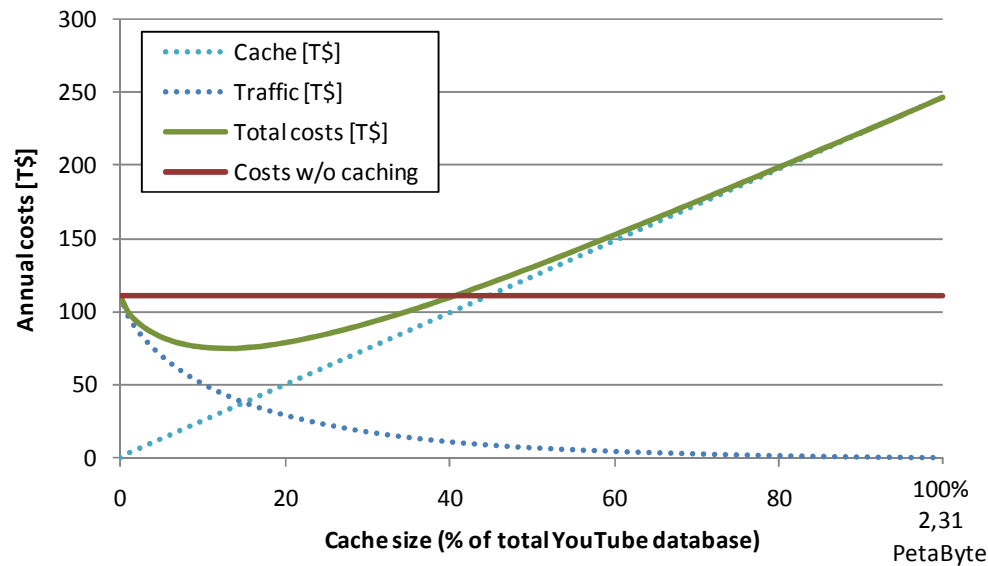
From EU project MEDIEVAL, http://www.ict-medieval.eu
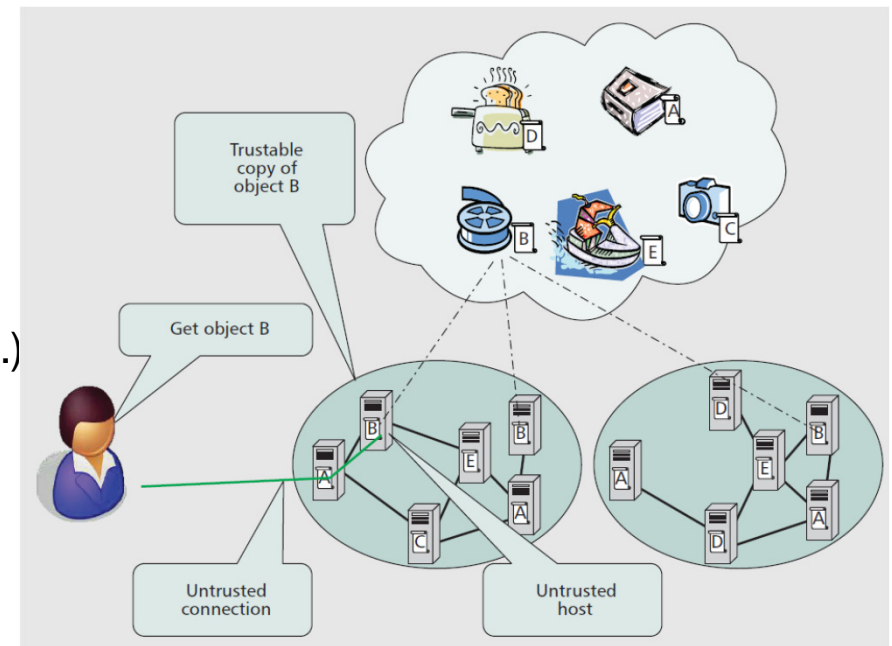
CDN management – evaluation*

- ## Assumptions:
  - Content popularity is Pareto-distributed and differs in regions
  - Video characteristics based on YouTube data
  - Hierarchical mobile core network

- ## Cost model:
  - Traffic + storage costs
  - 4 scenarios: no caching, central, distributed, distr.-cooperative

*From EU project MEDIEVAL, http://www.ict-medieval.eu

Information Centric Networking

- CDNs usually work with standard Internet principles: connecting nodes by their IP address

- Today: content is in the focus, ie. users do not care where (exact IP address of server) the content resides

- Information Centric Networking =
  – Retrieve content by addressing content
  – Make content available, e.g., in social networks
- Main componentes
  – Named data objects (movie, web page...)
  – Naming scheme
  – API (lookup, delivery)
  – Routing and forwarding
  – Caching

From B. Ahlgren et al. A Survey of Information-Centric Networking. IEEE Communications Magazine, July 2012.

ICN Architectures Overview*

- Data-oriented Network Architecture (DONA)
- Content-Centric Networking (CCN) → www.named-data.org
- Publish-Subscribe Internet Routing Paradigm (PSIRP) → ICT PURSUIT
- Network of Information (NetInf) → ICT 4WARD, ICT SAIL

	DONA	CCN	PSIRP	NetInf
Namespace	Flat with structure	Hierarchical	Flat with structure	Flat with structure
Name-data integrity	Signature, PKI independent	Signature, external trust source	Signature, PKI independent	Signature or content hash, PKI indep.
Human-readable names	No	Possible	No	No
Information abstraction model	No	No	No	Yes
NDO granularity	Objects	Packets	Objects	Objects
Routing aggregation	Publisher/explicit	Publisher	Scope / explicit	Publisher
Routing of NDO request	Name-based (via RHs)	Name-based	NRS (rendezvous)	Hybrid NRS and name-based
Routing of NDO	Reverse request path or direct IP connection	Reverse request path using router state	Source routing using Bloom filter	Reverse request path or direct IP connection
API	Synchronous get	Synchronous get	Publish/subscribe	Synchronous get
Transport	IP	Many including IP	IP/PSIRP	Many including IP

Table 1. *Summary of characteristics of the ICN approaches.*
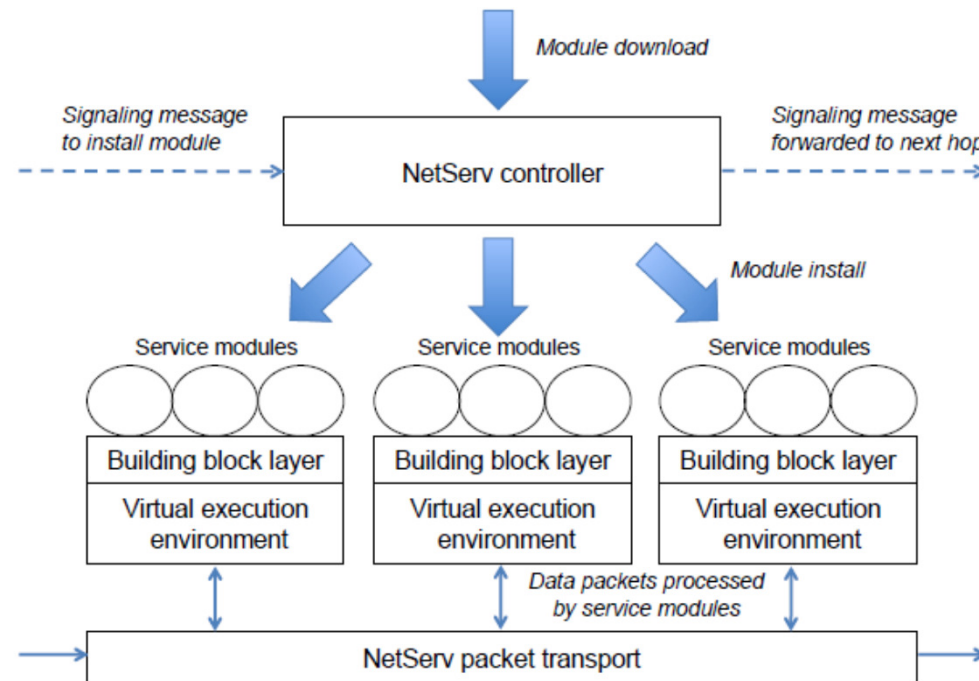
NRS: Name Resolution Service

* From B. Ahlgren et al. A Survey of Information-Centric Networking. IEEE Communications Magazine, July 2012.
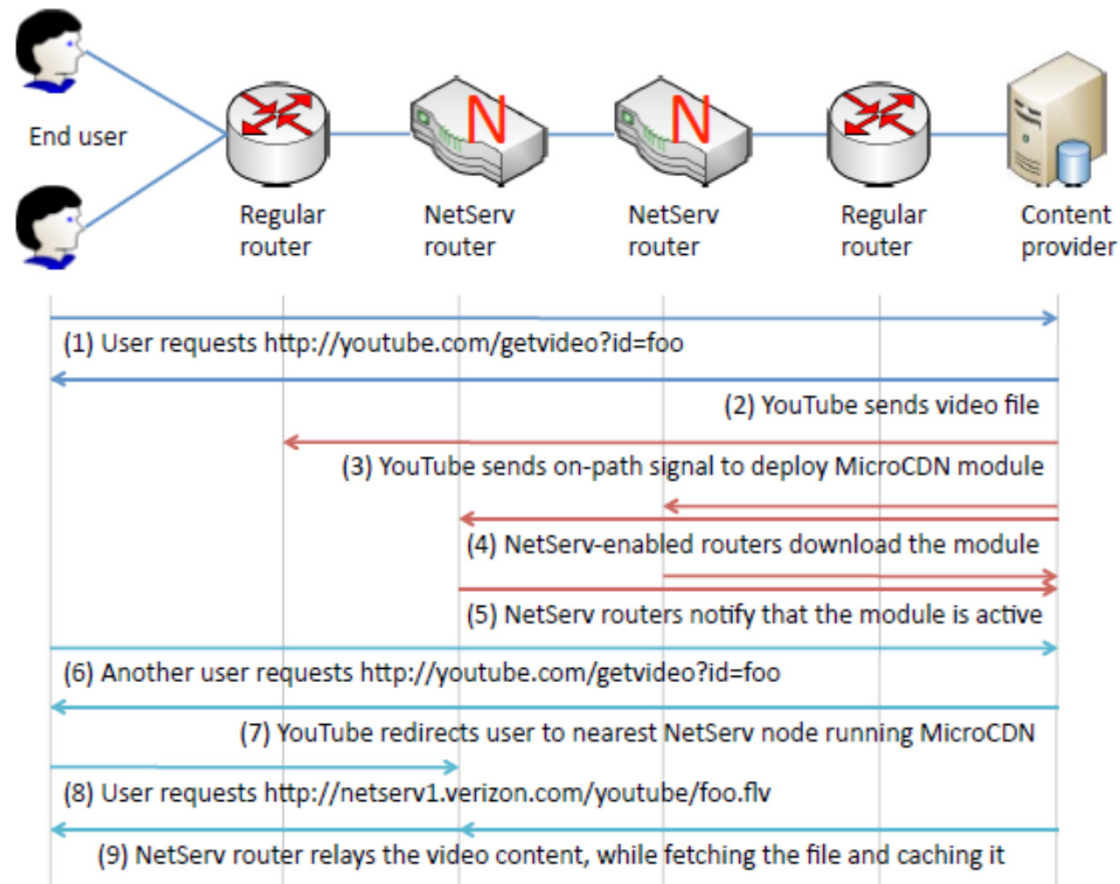
Service-centric Networking

- **NetServ**: node architecture for deploying in-network services
- Use case: MicroCDN – dynamic CDN adapting to content providers needs

J. W. Lee, R. Francescangeli, J. Janak, S. Srinivasan, S. Baset, H. Schulzrinne, Z. Despotovic, W. Kellerer
NetServ: Active Networks 2.0. IEEE ICC, FutureNet IV workshop, Kyoto, Japan, June 2011.

MicroCDN use case

J. W. Lee, R. Francescangeli, J. Janak, S. Srinivasan, S. Baset, H. Schulzrinne, Z. Despotovic, W. Kellerer
NetServ: Active Networks 2.0. IEEE ICC, FutureNet IV workshop, Kyoto, Japan, June 2011.

Agenda

- 13:00 Einführung ins Thema **"(Mobile) Content Delivery Networks and Information Centric Networks"** (Kellerer, TUM)

- 13:15-13:45 Gerhard Haßlinger (T-Systems) und Jochen Eisl:
"Efficiency of caching for fixed and mobile broadband access"

- 13:45-14:15 Chris Drechsler (TU Chemnitz):
"Improving the Efficiency of HTTP Caching by Client-Cooperation"

- 14:30-15:00 Florian Metzger, Kurt Tutschku (Univ. Wien):
"Analyzing Signaling Load in a 3G Core Network"

- 15:00-15:30 Sandford Bessler, Eva Kühn, Thomas Paulin (FTW Wien):
"Disruption tolerance in vehicle to infrastructure communication: Making a Case for Intelligent Roadside Infrastructure"

- 15:30 Zusammenfassung

- 15:45 Ende der Fachgruppensitzung

- 28.9. Zukunft der Netze Tagung:
Information Centric Networking (Netinf aus SAIL) *Dirk Kutscher (NEC)*