



ICNS PANEL :

**Content/Information-centric, User-centric, System-centric,...:
Different Dimensions or Different Directions?
Any Preference?**



ICNS PANEL

- **Moderator**

Eugen Borcoci, University "Politehnica" of Bucharest (UPB),
Romania

- **Panelists**

Yuichi Ohsita - Osaka University, Japan

Irina Fedotova - Siberian State University of
Telecommunication and Information Sciences, Russia

Rober M. Lee, hackINT, USA

Eugen Borcoci- UPB, BUcharest



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- **X-Centric/X-Oriented (Networking/Architecture) ??**
 - Information/content centric (ICN/CCN)
 - Content Aware Networking
 - User Centric Networking
 - Service Centric Networking
 - Internet of Things

 - Service Oriented Architecture
 - Network Centric Architecture?

- **Other visions/developments**
 - Software Defined Networking:
 - will it evolve in “Software Defined Internet Architecture” ?

 - Cloud computing (SaaS, PaaS, IaaS, NaaS, CaaS, ...X-aaS)



ICNS Panel

- **X-Centric/X-Oriented (Networking/Architecture) ??**
- **The Panel topics could be related to the recent large debates/discussions on :**
 - **Traditional “network neutrality” (at L3 level) w.r.t.**
 - **the trend to include more intelligence in the network + differentiated treatment of different types of flows**
 - **DiffServ**
 - **CAN**
 - **ICN/CCN**
 - **.....**



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SCIENCES



Hochschule Anhalt
Anhalt University of Applied Sciences

User-centric vs. System-centric - Towards the Self-configurable Internet of Things

Irina Fedotova

Siberian State University of Telecommunication and Information Sciences, Novosibirsk, Russia

March 24-29, 2013 - Lisbon, Portugal

Future Internet



- More nodes, more connections
- Any time, any place, any thing
- Millions of interconnected devices
- Internet of Things (IoT)
- Smart networks



By 2020, there will be 12.5 billion M2M devices globally, up from 1.3 billion devices today (Hatton 2012).

The 400 million mobile internet users of 2007 are predicted to grow to two billion users by 2015 (Richmond 2011)



Internet of Things



Vehicle, asset, person & pet monitoring & controlling



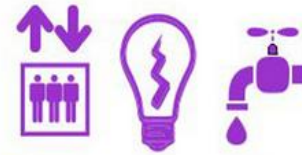
Agriculture automation



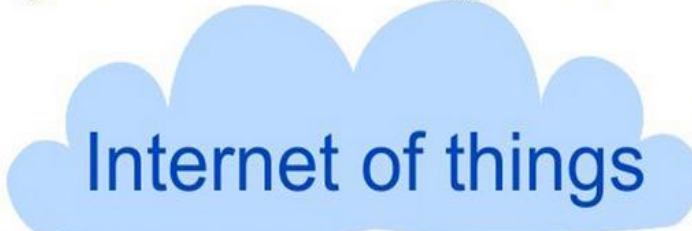
Energy consumption



Security & surveillance

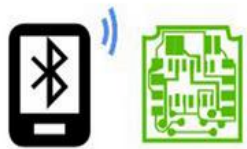


Building management



Internet of things

Everyday things get connected  for smarter tomorrow



Embedded Mobile



M2M & wireless sensor network



Everyday things



Smart homes & cities



Telemedicine & helthcare



Future Internet Challenges

- Auto-configuration of topology
 - Multi-hop routing

- Scalability
 - What brings IPv6 to the Internet?

Future Internet

- Energy saving
 - IoT is more wireless than wired

- Interfaces design
 - Future Internet appliances.
"Interface-free" or not?



**Thank you
for your attention**



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**Content/Information-centric, User-centric, System-centric,...:
Different Dimensions or Different Directions? Any Preference?**

**Eugen Borcoci
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■ **Traditional TCP/IP architectural stack**

- **Single architectural plane (Data, Control, Management)**
- **IP – best effort- simple very flexible, dynamic**
 - **Connectionless**
 - **No guarantees (Bandwidth, delay, order-preserving, etc.)**
 - **Agnostic w.r.t services and applications**
 - **High success (40 years)**
- **Transport layer**
 - **TCP (CO)**
 - **UDP(CL)**
- **Application layer**
 - **Supposed to solve all problems unsolved by L3, L4**
- **IP Addressing**
 - **Identity and location- included in IP address → problems**



■ **TCP/IP architectural stack**

■ **Long term evolution of TCP/IP stack (> 1970)**

- Many protocols added
 - At L3 level :Routing, Multicast, Mobility, Quality of Services
Security, Control, Management,
 - At higher layers: www, P2P, Overlay multicast, Session control,
Management, Security, ...

■ **Recent proposals:**

- evolutionary, revolutionary, intermediate,...



■ **ICN/CON/CCN/CAN/NDN....**

- propose **some fundamental changes** for TCP/IP networking
 - claiming several advantages in the perspective of Future Internet
- **Terminology**
 - Not standardised, different (overlapping) semantics...
 - ICN/CCN - Information/Content Centric Networking
 - CON - Content Oriented Networking
 - DON - Data Oriented Networking
 - CAN - Content Aware Networking
 - NDN - Named Data Networking
 - **Related terminology:**
 - SON – Service Oriented Networking
 - NAA- Network Aware Applications
- **Examples of ICN/CON Projects**
 - EUROPE : PSIRP, 4WARD, PURSUIT, SAIL, ...
 - USA: CCN , DONA , NDN, ...

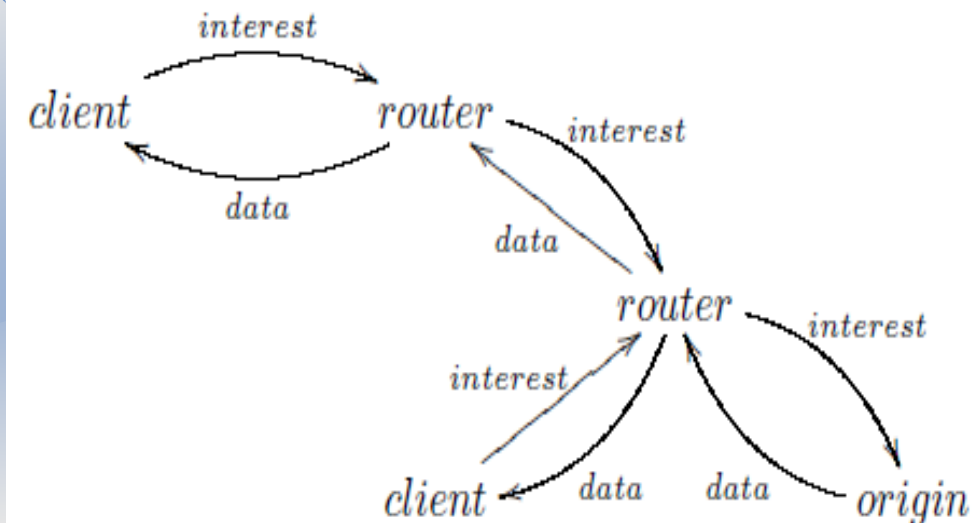


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- **Example : Content Centric Networking**
 - Relevant proposal in the area
 - Motivation: : Current networks **evolve mainly to info/content distribution and retrieval**
- **CCN Concepts**
 - Traditional networking : connections based on hosts locations CCN changes : **where** to **what** .
 - **Content treated as a primitive**
 - *decoupling location from identity, security and access*
 - *retrieving content by name*
 - **Routing named content**, (derived from IP), allows, (*claimed by authors*), to achieve *scalability security and performance*
 - Multicast native capabilities
 - Mobility capabilities

Source: Van Jacobson, Diana K. Smetters, James D. Thornton Michael F. Plass, Nicholas H. Briggs, Rebecca L. Braynard, **Networking Named Content**, Palo Alto Research Center, Palo Alto, CA, October 2009





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■ CCN Still open questions

■ First set

- What significant benefits does ICN designs offer?
- Are ICN designs the best solution to achieve those benefits?
- Is the current technology prepared to introduce soon these changes?
- Seamless development possible?
- **Scalability issues** (store information objects and not locations)
- **Huge processing tasks for routers** (In comparison with traditional ones)
- Different model for security w.r.t
- **Less support from the industry**

■ Additionally:

Can CCN be

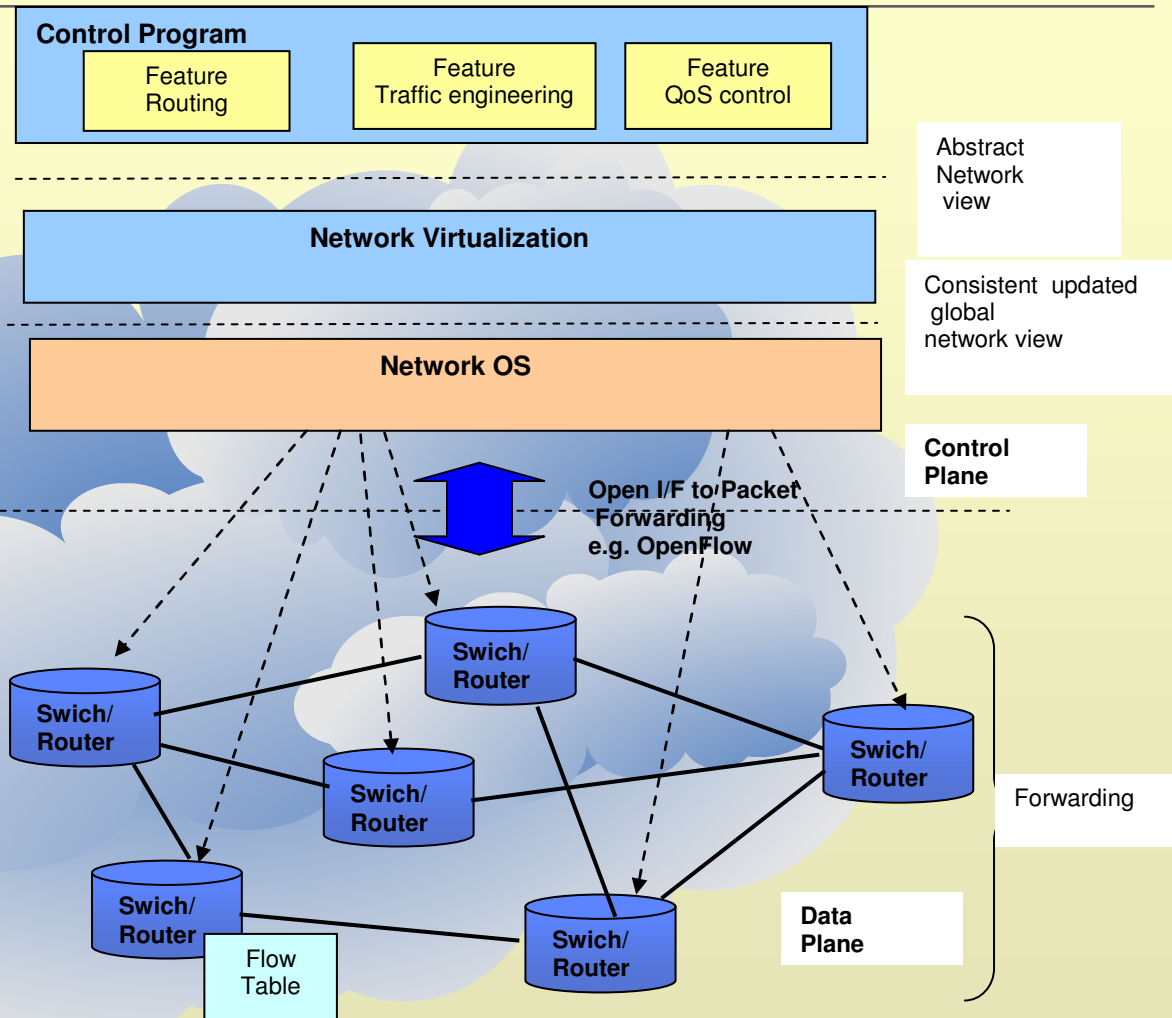
- considered/seen_as_support for “User Centric”? - apparently yes
- considered/seen_as_support for “Service-Oriented” ? -apparently yes
- supported by SDN? Estimate answer: yes.



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- **Software Defined Architecture (SDN)**
- **It is not originally defined as X-Centric**
- **Main ideas and advantages**
 - Decouple M&C intelligence from Forwarding part
 - Separation of Ctrl Plane /Data Plane
 - Have a more global view on the system
 - Simplify the Data Plane functions
 - More flexibility in develop the intelligent functions of the system
 - routing,
 - resource management,
 - traffic engineering,
 - QoS,
 - policies
 - adaptation to different types of high level services and applications
 - **High support of the industry**



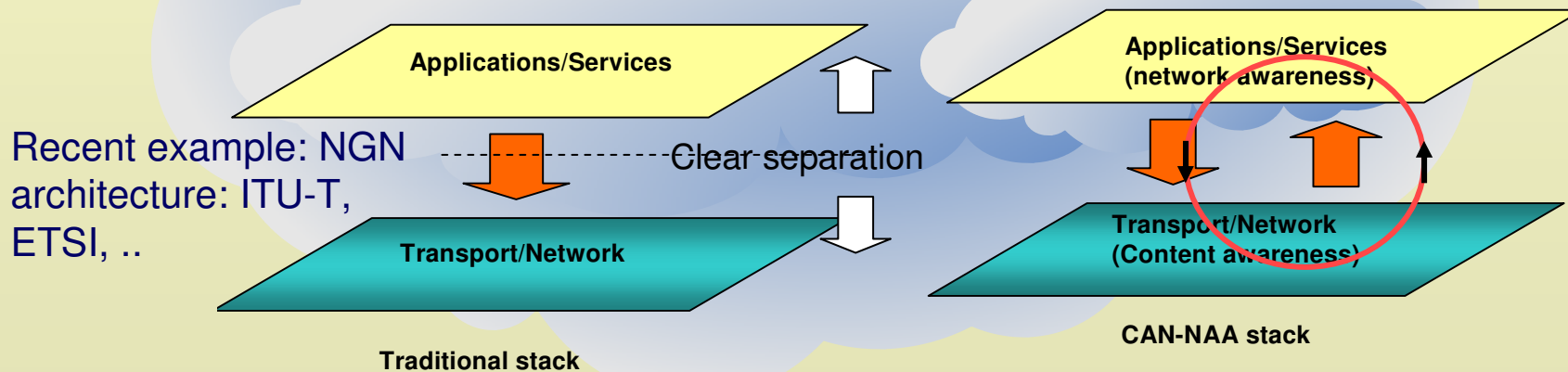


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Content-Aware Network (CAN) and Network Aware Application (NAA) - Concepts

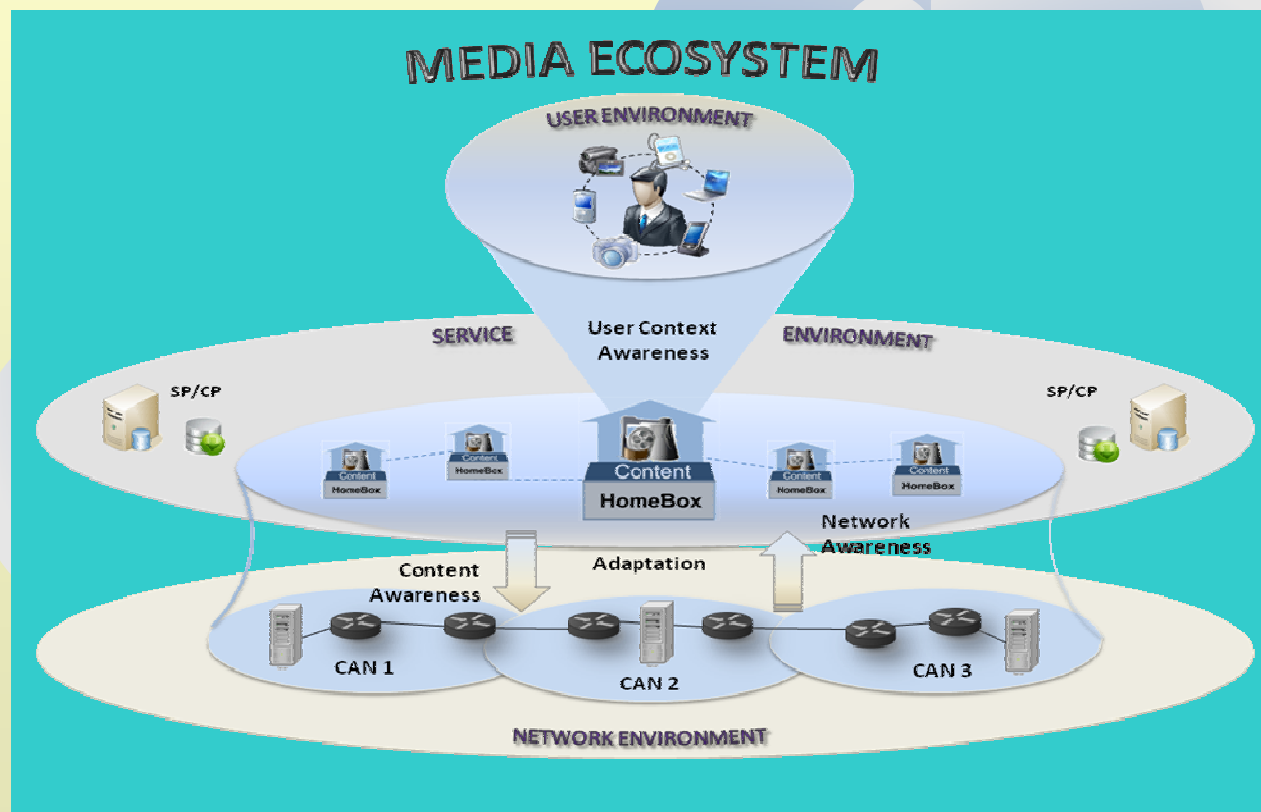
- Target: better interactions (content-network) but still preserving the architecture modularity
- CAN : adjusting network resource allocation based on limited understanding of the nature of the content
- NAA: network-aware content processing : adjusting the way contents are processed and distributed based on limited understanding of the network condition





- **Example of CAN oriented solution**
- **ALICANTE, 2010-2013, Integrated Project (IP): MediA Ecosystem Deployment Through Ubiquitous Content-Aware Network Environments,**
 - **19 European Partners**
- Based on new challenging concepts (Future Internet – oriented) of
 - **Content Aware Networking**
 - **Network Aware Application**
- Proposal of a novel virtual Content-Aware Network (CAN) layer
- Actors: providers, operators and end-users,
 - users may access the offered multimedia services in various contexts and also to become private content providers.

- **ALICANTE project:**
 - Architectural high level view





■ **Conclusions/opinions**

- Content/Information-centric
- User-centric
- Content aware Networking
- Software Defined Networking
-
- are complementary solutions
- they can be seen as different “dimensions”/aspects
- they can cooperate
- However the current support of the industry is different :
 - e.g :
 - more for SDN
 - less for ICN/CCN/CAN
- Still open research issues for
 - ICN/CCN/CAN-scalability, support of interactive synchronous communications, ..
 - SDN- scalability, reliability in large networks



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Thank you!

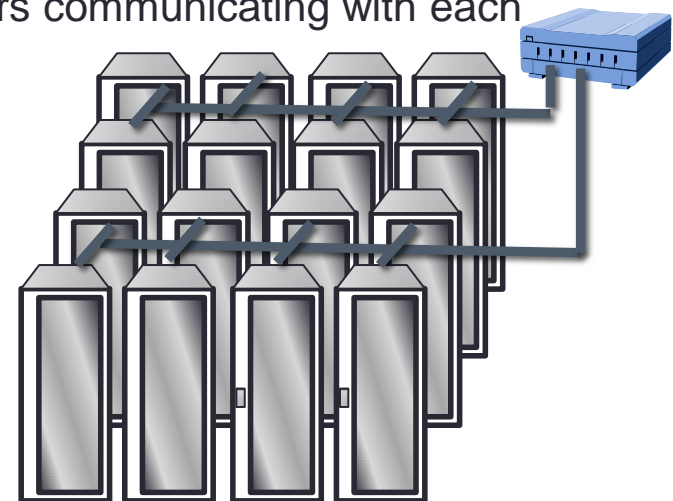
RELATION BETWEEN DATA CENTER NETWORK AND FUTURE NETWORKS

Yuichi Ohsita, Ph.D.

Assistant Professor, Osaka University

What is the data center network

- Network within a data center
- Data Center
 - One data center is constructed of a lot of server racks.
 - One server rack includes a lot of servers.
 - Applications of data centers
 - One data center is used as one computer.
 - A large amount of data is handled by the servers communicating with each other
 - A large amount of data is stored in the servers by using distributed file systems.
 - A memory with large size is constructed from RAMs of many servers.



Problem in a data center network

- Problems
 - Scalability
 - Data center network should accommodate more than hundreds of thousands of servers to construct a large data center.
 - Performance
 - Data center network should provide sufficiently low latency and large bandwidth between servers for the application in the data center
 - Robustness to the failures
 - Failures are common in a large data center, because a large data is constructed of a large amount of devices.
 - Data center should provide the service even when failures occur.
 - Low power consumption
 - Network consume a non-negligible fraction of total energy consumption of a data center.
 - Technologies to reduce the energy consumption of servers have been proposed.
 - The energy consumption of the network should also be reduced.
 - Low costs
- Research Themes
 - Network Topology
 - Efficient Resource Allocation
 - Routing
 - Transportation Control
 - Micro Traffic Engineering

Relation of data center network with future network

- Difference from ISP networks
 - Without geographical constraints
 - Any network structures can be used without considering the geographical constraints.
 - Can implement any new protocol at once
 - data center may be used as a testbed for new protocol
 - Frequent and significant traffic change (< few seconds)
- Common with ISP Networks
 - Large network
 - The size of network managed by a single manager is large.

Can common technologies be used in any networks?

My Answer

- Current
 - Everything over IP
 - IP over everything
- Future
 - Some base network technique (e.g., Virtualization).
 - Specific network technology (e.g., routing for data centers)
- Relation between the data center and future network
 - Data center network can be a good field for evaluating new network technology.
 - Caution: some problems/methods are limited to data center network, while the others are common for all networks.