


# CONNET 2015

## Content Oriented Networks and Systems- Challenges

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# Content Oriented Networks and Systems- Challenges

## IARIA CONNET 2015 @ ICNS 2015

- **The International Symposium on Advances in Content-oriented Networks and Systems**
- **Facts:**
  - **Internet and Telecom convergence** → Integrated networks: Future Internet
  - **Content:** became a main entity to be exchanged between different actors in the current and Future Internet
    - In few years content (live, pre-recorded, etc.- especially video and media content) will be ~ 90% of the total global traffic
  - **High increasing rate of mobility communications** (10 **3 in 5-6 years) and strong orientation towards content related services and applications
  - **New emergent (rather general) technologies** aiming to change networks and services architectures : *Cloud Computing, Software Defined Networks (SDN), Network Function Virtualization (NFV)*
  - *Over the Top solutions (OTT), combinations*
  - **Content Oriented solutions** – in networking and services: CON/ICN/CCN/CDN/CAN, …

# Content Oriented Networks and Systems- Challenges

- **IARIA CONNET 2015 @ ICNS 2015**
- **The International Symposium on Advances in Content-oriented Networks and Systems**

- **The symposium work will ( hopefully) contribute to some of the research issues to solve challenges of CON/CCN/…..**

# Content Oriented Networks and Systems- Challenges

- **Content Related Actors**
  - Content Provider ( CP)
  - Advertiser (A)
  - (High Level) Service Provider – (HL)SP
  - Content Delivery Network Provider ( CDNP)
  - Network Provider/Operator ( NP/NO/ISP)
  - Device/Client
  - Consumer (machine/human)
    - **Note : New terminology - *Prosumer* = producer and consumer of content**
  - **In practice the above roles can be combined**

# Content Oriented Networks and Systems- Challenges

- **Content processing aspects**
  - ***Managed and/or unmanaged* – point of view**
    - Content itself
    - Transport (through the network)
    - End devices/clients
  - **Different solutions → different complexity/cost/quality**
    - E.g. IPTV: managed transport and delivery, guaranteed QoS/QoE, Linear+ VoD, Payment
    - Internet TV (OTT) : Best Effort, no QoS guarantees, mostly on demand, pay or free services

# Content Oriented Networks and Systems- Challenges

- **ICN/CON/CCN/CAN/NDN….**
  - recent significant attention of the research community and also of industry and operators
  - propose some fundamental changes for TCP/IP networking - claiming several advantages in the perspective of Future Internet
  - **Some of still open questions (1):**
    - what significant benefits do ICN designs offer?
    - are ICN designs the best solutions to achieve those benefits?
    - is the current technology prepared to introduce soon these changes?
    - seamless development possible?
    - scalability issues?
    - …..?

# Content Oriented Networks and Systems- Challenges

- **ICN/CON/CCN/CAN/NDN….**
  - **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- last decade**
      - EUROPE : PSIRP, 4WARD, PURSUIT, SAIL, …
      - USA: CCN , DONA , NDN, …

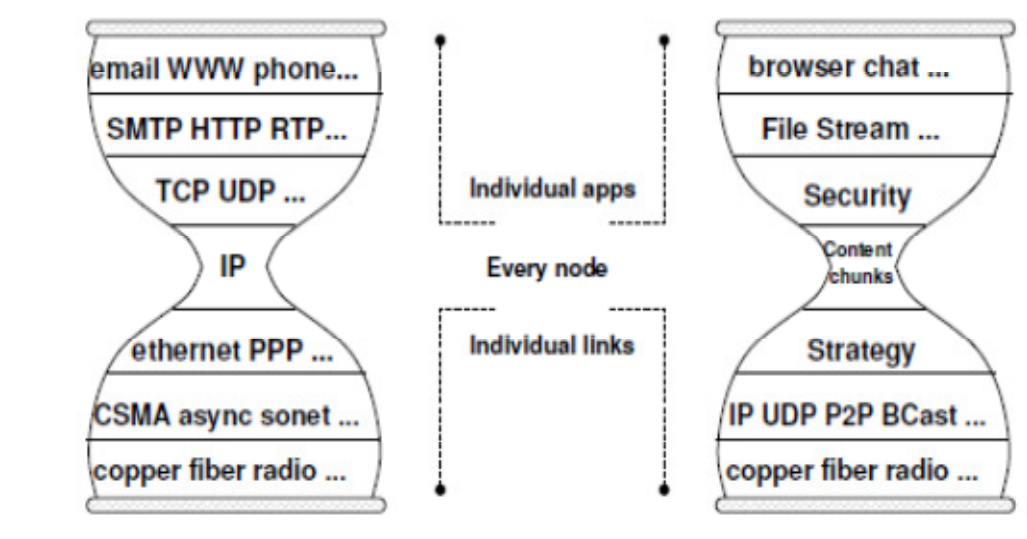
# Content Oriented Networks and Systems- Challenges

- **Relevant CON Example:**
- Example 1: Content Centric Networking
- *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*

- **CCN Concepts**
  - Traditional networking : connections based on hosts locations (need mapping *what* -> *where).*
  - **CCN:** 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

# Content Oriented Networks and Systems- Challenges

- **Relevant CON Example:**
- Content Centric Networking (cont'd)
- **CCN concepts (cont'd)**
- CCN proposes new "thin waist" of the Internet: IP → to chunks of named content




Traditional TCP/IP stack

**Original picture CCN**

| | |
|---|---|
| **Application** | Applications: browser chat, file stream: |
| | **Security** |
| | **Content chunks** |
| | **Strategy** |
| | P2P, .. |
| TCP, UDP, … | UDP |
| **IP** | Intra-domain routing: OSPF, .. Inter-domain routing: BGP, ... (placed here to show their role) |
| **Data link** | Any Layer 2 |
| **Physical Layer (wireline, wireless)** | Any PHY |

Alternative view of CCN stack (if it run on top of IP)

# Content Oriented Networks and Systems- Challenges

- **Open research issues in CON**
  - **CON and CDN concepts and architectures** – are they complementary- how they can cooperate?
  - **Content naming** ( flat, hierarchical, ..)
  - **Content-based (adaptive) routing and forwarding** – how they cooperate with current routing and forwarding?
  - **CON In-network caching policies** versus CDN and P2P caching policies and solutions ( where to make caching in CONs?)
  - **Multicast and mobility** ( native claimed CON/CCN properties)- are these true and convenient in practice?
  - **The most relevant Use cases?**
    - e.g. how to solve communications primarily based on location?

# Content Oriented Networks and Systems- Challenges

- **Open research issues in CON (cont'd)**
- **Scalability** issues of CON (very important)
- **CON concepts versus SDN concepts-** (apparently they go in different directions!)
- **CON and cloud computing technologies-** how they can cooperate?
- **CON versus Virtualization-** how they work synergically ?
- **Security** – (secure the content objects or the transportation network/ environment)?
- QoS/QoE in CONs
  - Managed and unmanaged solutions ( OTT-like or managed)
- **Deployment issues** – seamless/not-seamless, CAPEX, OPEX?

# Content Delivery Systems- Challenges

- Thank you !