ICN Baseline Scenarios
draft-pentikousis-icn-scenarios-02

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IETF 86
Orlando, Florida, USA
Draft Goals

• Establish a common understanding about potential experimental setups (testbed and simulation)
• Provide equal ground for comparison, an agreed framework
• Scenarios should be general enough and “technology agnostic”
  – Scenario detail may vary
• Aim to get feedback from implementers, both on the scenario definition and level of detail
• All approaches need not implement all scenarios
  – but all scenarios should end up illustrated in a real demo
Draft Overview and Update

• Address real-world use cases
  – Social Networking++
  – Real-time A/V Communications
  – Mobile Networking++
  – Infrastructure Sharing
  – Content Dissemination (updated in -02)
  – Network Interaction (NEW in -02)
  – Energy Efficiency (*needs more input*)
  – Delay and Disruption Tolerance (updated in -02)
  – Internet of Things (NEW in -01)
  – Smart City (NEW in -01)

• Things that you can do with the host-centric approach today and things you cannot do (well)
  – ICN should *make easy things easy and difficult things possible*
Community Document

Please contribute
Social Networking

• “Natural fit” for showcasing the superiority of ICN over traditional client-server TCP/IP-based systems
  – Pull-based server-less content-retrieval [CCR]
  – Push-based Twitter-like service [ICN-SN]
  – Photo-sharing [CBIS]
  – Could relate to IETF PPSP WG demos and see how they would work over ICN

• Consider: network efficiency, multicast support, caching performance, reliance on centralized mechanisms
Topology: Social Networking

Figure 1. Dumbbell with linear daisy chains
Real-time A/V Communications

• Area is well studied in packet- and circuit-switched networks
  – Many tools and evaluation frameworks/models
• ICN work has barely scratched the surface
• VoIP, anyone?
  – [VoCCN] illustrated feasibility over a particular ICN “flavor”
  – Need to go much further than that
• Scalable video is coming. How does it perform over ICN?
• Consider: complexity, scalability, reliability, mobility, well-established QoS/QoE methodology
(Multiaccess) Mobile Networking

• Mobile network scenarios have not been presented *in detail* in the literature
• But there are a lot of ideas
  – Capitalize on the wireless broadcast nature
  – Take advantage of (implicitly available) in-network storage and caching
  – Get out of the tunnel (mentality)
    • Do *we* *really* need anchors?
      – No need to maintain e2e connectivity [PSIMob, EEMN]
    • How does *is* it relate with IETF DMM efforts?
Topology: Wireless/Multiaccess

Figure 2. Overlapping wireless multiaccess
Infrastructure Sharing

• Beyond ICN as an overlay
• What is “infrastructure” in an information-centric network?
• How do we use optimally all resources that end-hosts bring into the network?
• How does an ICN operator plan and dimension its network?
  – Storage-bandwidth tradeoffs [SHARE, CL4M]
  – What about “multi- tenancy”, virtualization?
• Consider operational and economical aspects
Content Distribution

• Content dissemination has attracted more attention than other aspects of ICN
  – This is sometimes due to a “misunderstanding”
• Decentralized content dissemination supported by all approaches
  – Plenty of scenarios, often overlapping with those previously presented
• Expect active RG contributions, this category can expand and break-up into sub-categories
• Consider: stored and streaming A/V distribution, file distribution, mirroring and bulk transfers, SVN/Git-type of services, as well as traffic aggregation
Network Interaction

• New types of network interaction
  • “an edge-driven, bottom-up incentive structure”

• ...plus evolution of existing interactions
  – Location independence, multiaccess, data mule, in-network storage
  – Small-cell networks, HetNets, virtualization and overlays

• Evaluate ICN across multiple network types
  – Combination of technical and economic aspects
  – New actors, transformation of existing actors
  – Pure “ICN world” vs. “islands” vs. “migration path”
EE and DTN

• Build energy efficiency into ICN from the beginning
  – No need for separate scenarios at this stage

• ICN delay and disruption tolerance should be evaluated as well
  – Examine to which extent different ICN technologies can support “classic” DTN scenarios
Internet of Things

• IoT: intersection of Internet services with the physical world
  – Create everyday experiences using interconnected things [IoTEx]
  – Capitalize on inherent ICN capabilities for data discovery, caching, and trusted communication

• For dense sensor network deployments, disassociating sensor naming from network topology, using named content at the lowest level of communication in combination with in-network processing of sensor data can be more efficient than a host-centric design [nWSN]
  – Recent work raises doubts that this is the case [NCOA]

• Consider resource-constrained, extremely large numbers of nodes
  – ICN node design requirements, scalability, efficient naming, transport, and caching of time-restricted data
Smart City

• ICT is the technological backbone of a Smart City
  – Intelligent transportation systems, healthcare, A/V communications, peer-to-peer and collaborative platforms for citizens, social inclusion, active participation in public life, e-government, safety and security, sensor networks, and IoT.

• Recent smart city-related ICN-based work
  – home energy management [iHEMS]
  – geo-localized services [ACC]
  – smart city services [IB]
  – traffic information dissemination in vehicular scenarios [WAK]

• Smart city scenarios provide ample space for exercising ICN approaches
  – analyze the capacity of using ICN for managing extremely large data sets
  – study ICN performance in terms of scalability in distributed services
  – verify the feasibility of ICN in a very complex application like vehicular communication systems
  – examine the possible drawbacks related to privacy and security issues in complex networked environments
Interim Group Work Discussion (1/2)

• Topologies: what kind of networks do we have in mind?
  - Can we fix this parameter at least for some (benchmark) evaluations?
  - Fig. 1, 2, other? Scenarios draft as a discussion starter

• Traffic patterns: what types of traffic do we consider?
  - Can we (reuse) workloads from p2p and cdn?
  - What about web and voip?
  - Should we capture workloads using ccnx/openneinf/blackadder and use them for evaluations? What are the drawbacks?
  - Traffic engineering?
Interim Group Work Discussion (2/2)

• Evaluation tools
  – ndnSIM scenarios tend to look a bit like good old ns2 TCP scenarios
  – Evaluation metric (e.g. those used for TCP: goodput, "fairness", loss recovery)
  – Multimedia evaluation tools (e.g. evalvid, MOS/R model, etc.)

• Common simulation scenarios: eventually most of the evaluation work will be done with simulation (well, at least from the academic side)
  – Can we come up with some first group of reusable simulation scenarios?
  – Perhaps even setup a DB of some sort?
Section 3

• Evaluation Methodology
  – Theoretical analysis vs. Simulation vs. Testbed
  – How to select the topology
    • Graph
    • Topology/Graph annotations (Bandwidth/delay/storage/computation)
    • Dynamicity (mobility, packet loss, link and node failure)
  – Load (e.g. user requests)
  – Traffic metrics
    • Application pov (goodput, delay, QoS/QoE, R scores, MOS, ...)
    • Network pov (“resource efficiency”, control plane overhead)
  – System metrics
    • Reliability, scalability, delay and disconnection tolerance
  – Resource equivalence and tradeoffs
  – Technology evolution assumptions
Thank You