ICN Baseline Scenarios

draft-pentikousis-icn-scenarios-02

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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

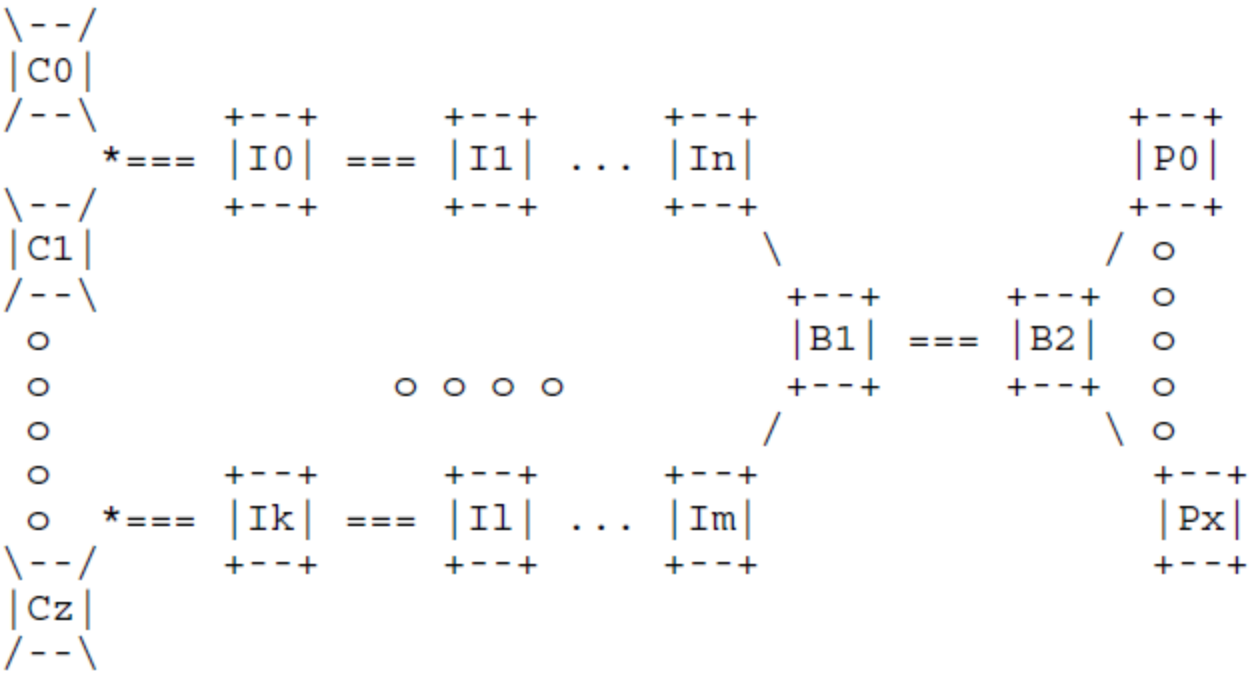

Figure 1. Dumbbell with linear daisy chains

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

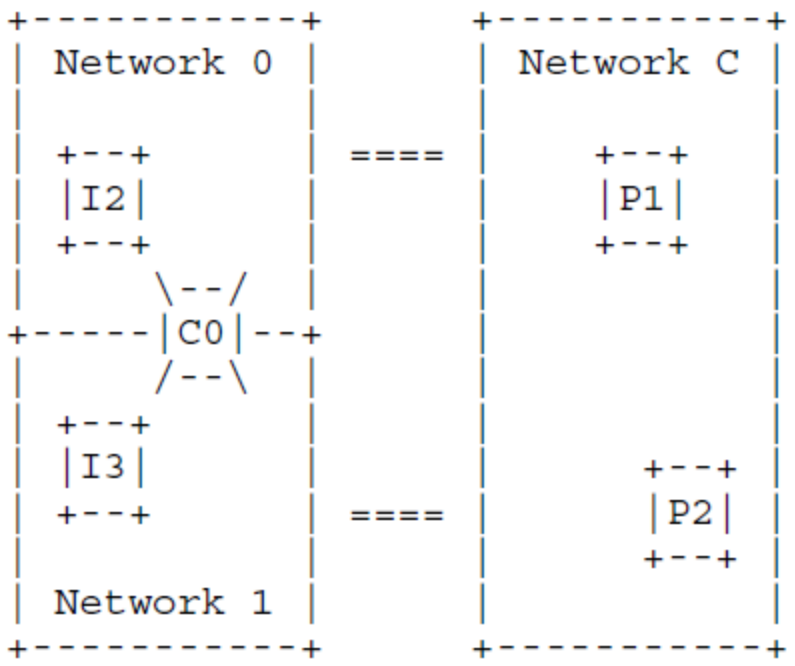

Figure 2. Overlapping wireless multiaccess

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 fro 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