PiCasso: Information-centric Edge Computing Platform for Wireless Mesh Networks

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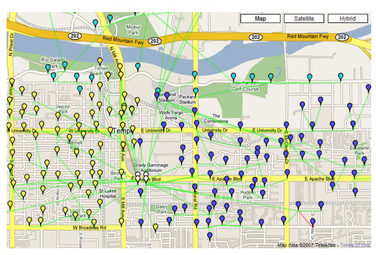
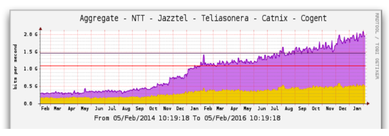
Municipal Wireless Networks

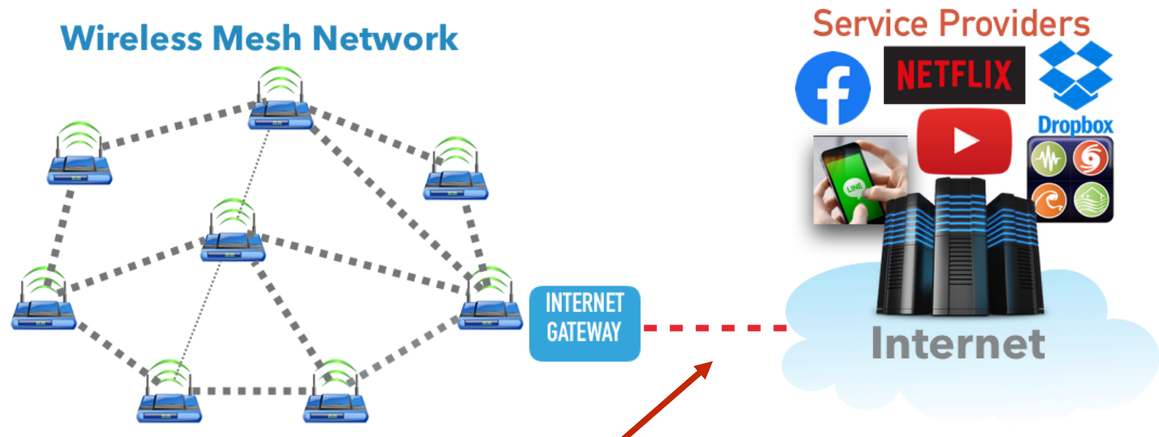




- large scale, self-organized, decentralized IP networks
- built and operated by WISPs or citizens (community)
- very dynamic and diverse in terms of hardware, software, network topology, routing protocols etc.

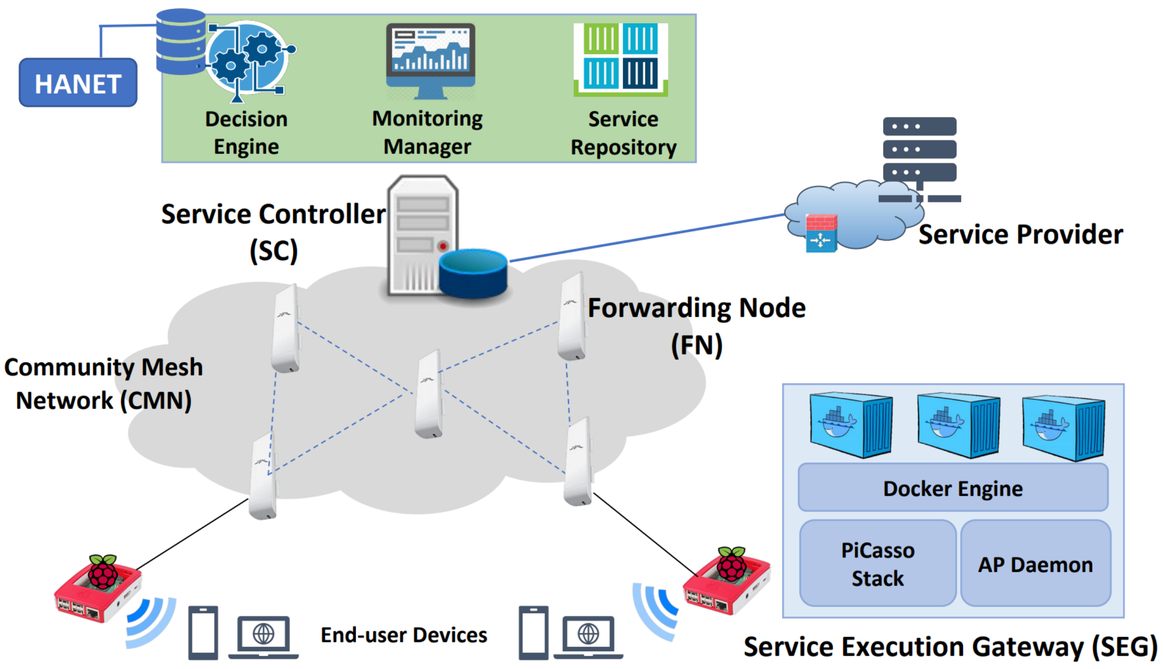
Challenges



- Constrained Backhaul
  - Intermittent connection (link)
  - High latency
  - Poor QoS and QoE
  - Services not available

Revenue Lost for SMEs !

PiCasso: ICN-based Edge Platform

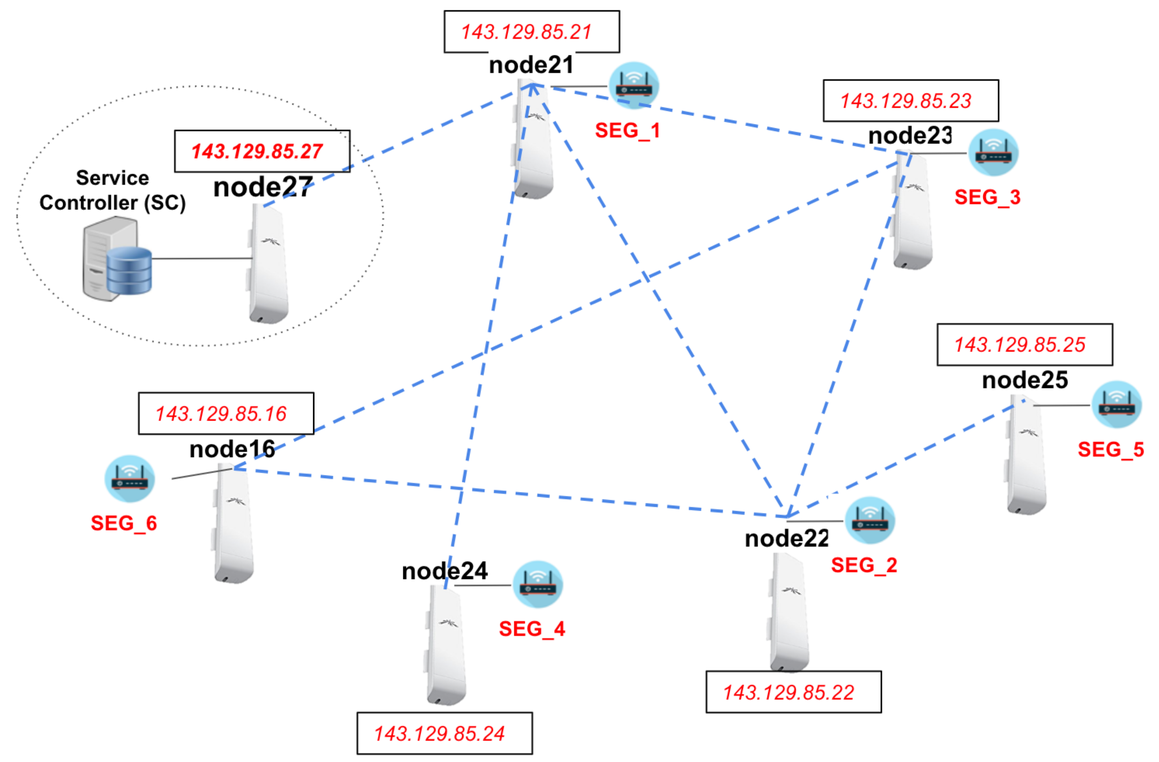


Smart Forwarding
- Named Data Networking (NDN)
  - Name based routing
  - Dynamic in-network caching
- Delay Tolerant Networking (DTN)
  - To support emergency situation

Monitoring System
- Node usage (CPU, memory)
- Network condition (bandwidth)

Service Placement Algorithms
- BASP (Bandwidth + Availability)

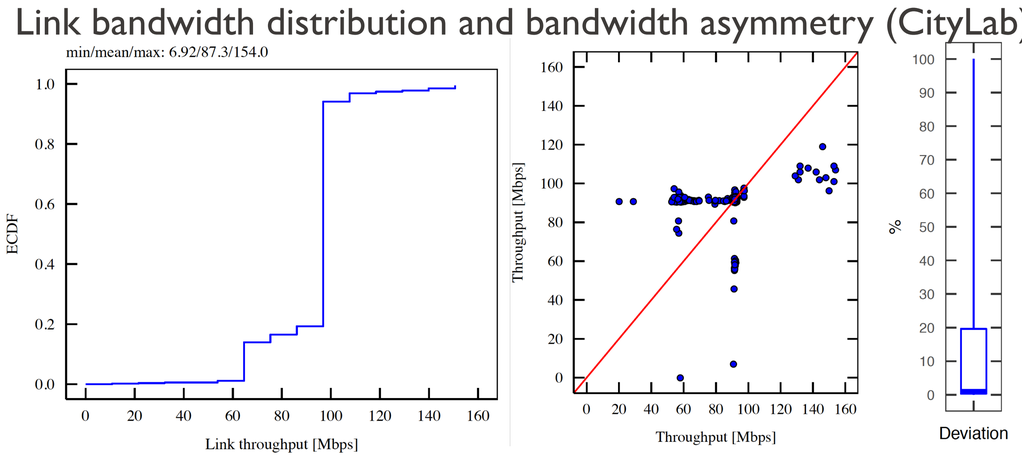
Demo Setup (CityLab)



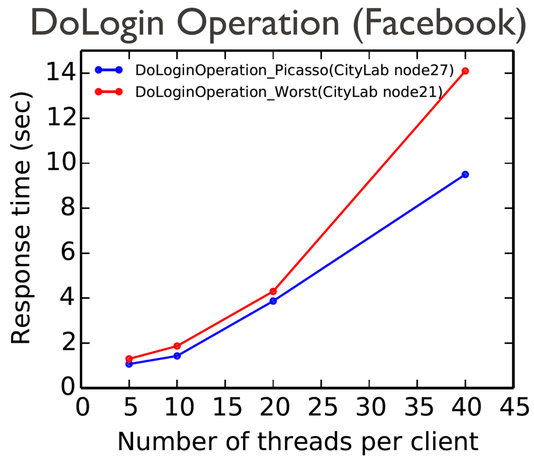
- 7 Wireless nodes in CityLab FIRE testbed (fully mesh)
- Rodestraat 14 and Grote Kauwenberg 2, Antwerp
- WiFi 802.11ac on 2.4GHz and 5GHz (Ubuntu 16.04)
- Location of Service Controller selected by BASP

Results and Lessons Learned

Link bandwidth distribution and bandwidth asymmetry (CityLab)

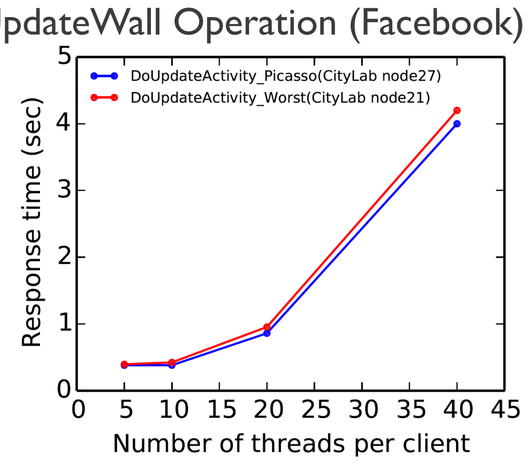


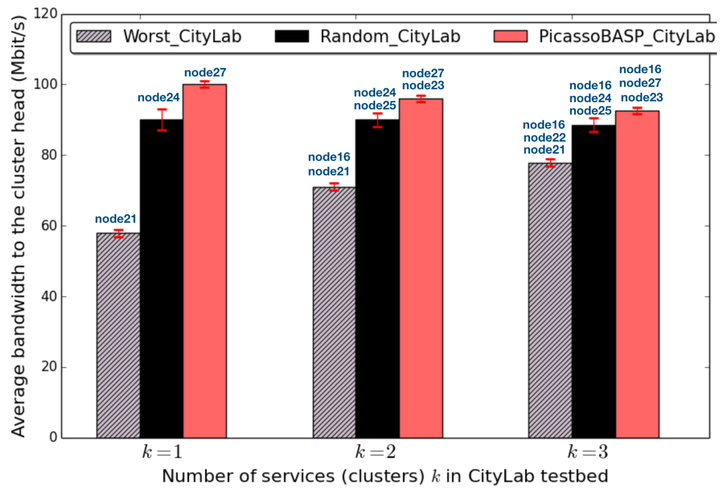
DoLogin Operation (Facebook)



37% gain in terms of response time

UpdateWall Operation (Facebook)





$$\arg\max_S \sum_{i=1}^{k} \sum_{j \in Si} f_{ij}$$

f_{ij} – bandwidth of the path, from node i to j

partition k of clusters: $S = S_1, S_2, S_3, \ldots S_k$

- Non-uniform resource distribution in the CityLab testbed
  - Service Placement heuristic a must for ICN components
  - 37% gain obtained with real services (Open source Facebook)
- Deployment benefits: Easy to deploy (plug and play feature of PiCasso)
- ICN-ready testbed in CityLab ! (NDN, NFD deployed) !
- Traffic reduction benefits (Operator gain): ongoing work (Stage 2)
  - NDN caching