Virtual Public Networks (VPuN)

Arjuna Sathiaseelan
Computer Laboratory
UK statistics show almost half of the UK’s adult population who do not use the Internet live in social housing and are in lower socio-economic groups (Source: Digital by Default, 2012)
Define new architectures that efficiently reduce wastage (for e.g. network operator capacity)

Enable more localised access

Utilise unused capacity to create low cost access opportunities

Enabling Less than Best Effort (LBE) access including time-shifted access provisioning

Enable new opportunities for new stakeholders to emerge (for e.g. local government, charities, grass root user communities)
Public Access WiFi Service (PAWS)

- Citizen’s device
- PAWS Gateway
- Sharer’s Access Point
- Upstream ISP
- Internet
- Management/VPN Server
- MLab Server

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**Deployments in Nottingham**
- broadband performance measurements, sharing experiments and understanding PAWS usage characteristics
- Enabling Less than Best Effort (LBE) access
- WiFi access points: lack of QoS (both upstream and wireless)
- DSLAM/MSAN: Need L2 QoS differentiation
- PAWS: We throttle at 2Mbps downstream/512Kbps upstream
Need to extend the stakeholder value chain for incentivizing donated access (e.g. local government)

UK’s digital by default programme could achieve savings of £2.2 bn!

Provide new low-cost economic opportunities

Network operators can sell connectivity at lower cost
NGOs/local councils can become Virtual Network Operators (VNOs)

Network operators can provide LBE as basic free service with opportunities to top-up (adaptive QoS, reverse pricing (ATT))
IoT data transmission without spending on infrastructure

WiFi offloading opportunities for mobile operators etc

FON has >5 million hotspots around the globe!
Digital Divide: Nottingham

Area 1: Bulwell, Bulwell Forest
Area 2: Basford, Bestwood
Area 3: Aspley, Bilborough, Leen Valley
Area 4: Arboretum, Radford & Park, Dunkirk & Lenton
Area 5: Sherwood, Berridge
Area 6: Mapperley, St Ann’s, Dales
Area 7: Wollaton West, Wollaton East & Lenton Abbey
Area 8: Bridge, Clifton North, Clifton South
Wardrive around Aspley
Challenges

#1 How do we enable the VNO? 
VPN doesn’t work!

#2 Home sharer sharing patterns
Bandwidth isolation
PAWS clients should not be allowed to hog the bandwidth

Confidentiality
Traffic eavesdropping by collocated devices should be prevented

Accountability
Sharers should not be accountable for the actions of PAWS clients

Minimal configuration overhead for users and ISPs
PAWS configuration and management should be outsourced to third parties
Virtual Public Networks

Home network user

I can share 2 Mbps from 22:00 to 6:00

Will user

Access link

VPuN Operator

SDN Control Plane

Home Network

OpenFlow

ISP

OpenFlow

Internet

Guest user

Best Effort

Less than Best Effort
Community Wireless Mesh Networks

Wireless mesh network for Internet access sharing
Extending coverage
Traffic offloading

Community wireless networks
Guifi.net (>30000 nodes)
AWMN (>1000 nodes)
Funkfeur (~1000 nodes)

Outsourcing management is important
Use case: Mapping social relationships to network resource provisioning

(1) User authenticates using FB (Flow 1)

(2) Packet of Flow 1

(3) Controller

(4) OAuth

(5) /me/friends/OwnerID

(6) Map(Relationship, QoS)

(7) ovs-ofctl add-flow

(8) Flow 1 placed in queue
VPuN enables flexible control of edge networks, resource management and traffic engineering.

How about future networks that data mine OSN to do automatic traffic engineering?
- Disasters/Emergency

How about future networks that can predict resource allocation requirements?
- Predicting what you are going to watch and allocating resources
- Predicting there is going to be a flash crowd and allocating resources

Opportunities are endless!