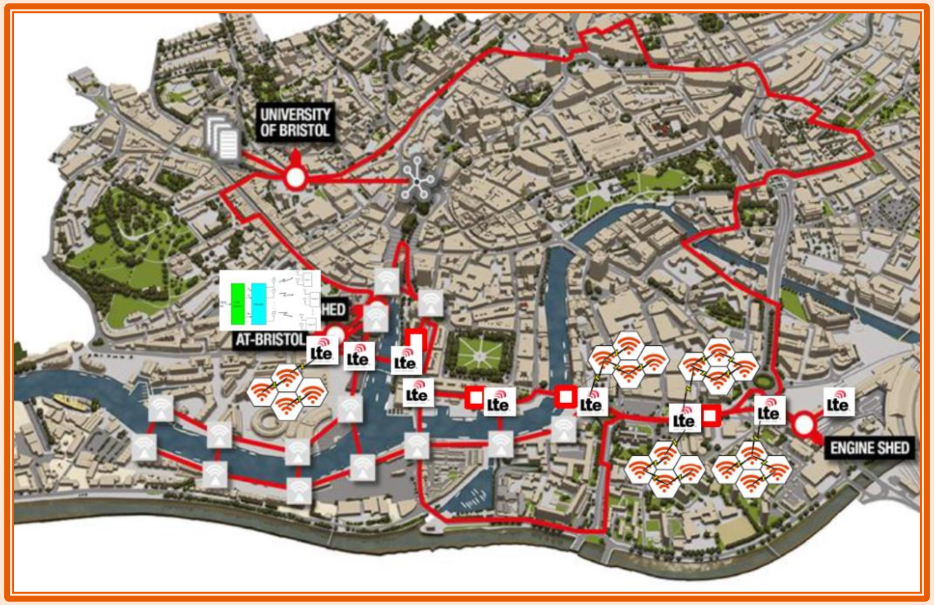
5G-XHAUL: FLEXIBLE FUNCTIONAL SPLITS AND NETWORK VIRTUALIZATION FOR 5G TRANSPORT

DANIEL CAMPS (I2CAT)

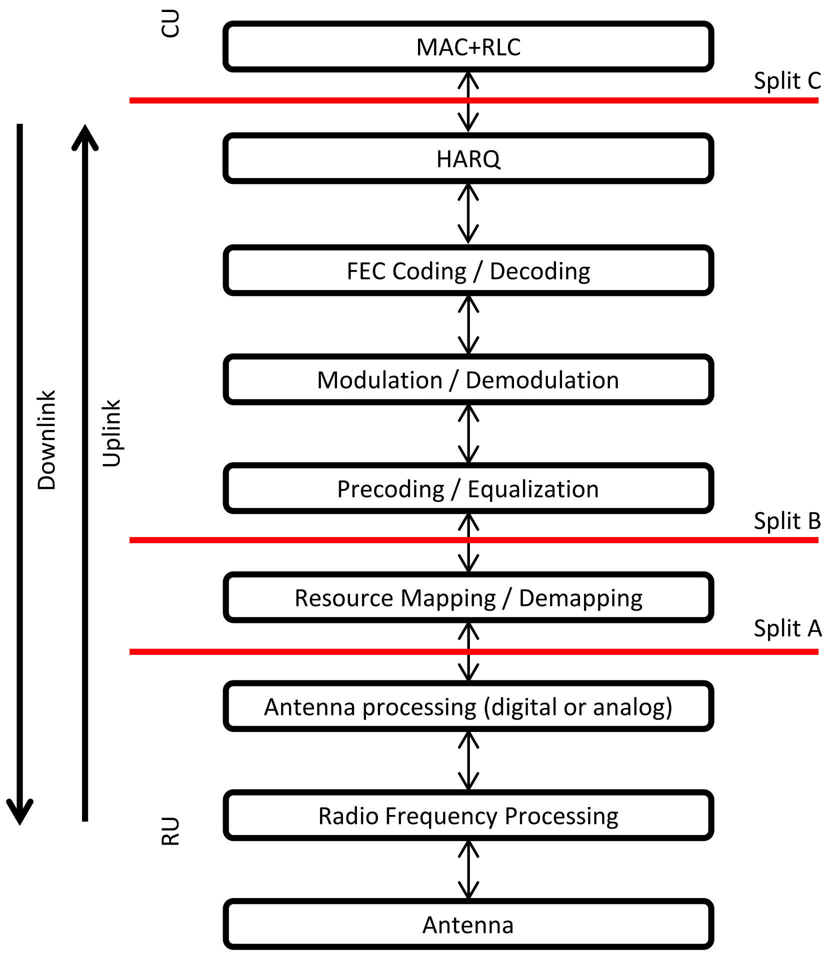


Bristol 5G city testbed with 5G-XHaul extensions

Horizon 2020
European Union funding
for Research & Innovation

1- Convergence of FH and BH / Functional Splits

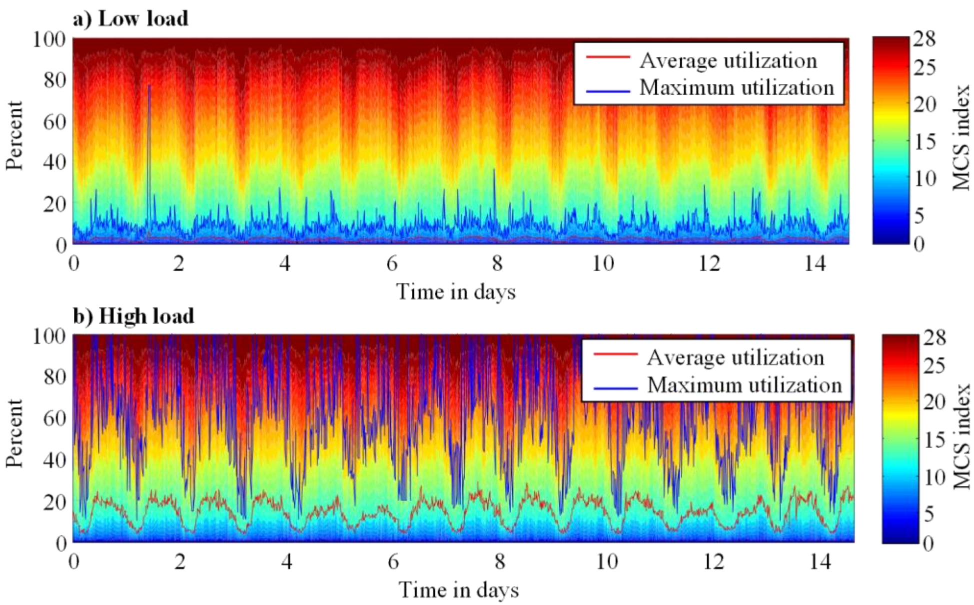
5G-XHaul



No.	Advantages/Disadvantages
C	• "Centralized MAC" • Data rate depends on actual user data rate • No HARQ delay requirement • Potentially no hardware accelerators at CU • No centralized CoMP, MU-MIMO • Requirements similar to classical backhaul
B	• "NGFI" • Only utilized RB forwarded (enables stat. mux.) • No guard carriers, cyclic prefix on FH • Frequency domain (lower A/D res.) • Additional hardware at RU required (FFT)
A	• "Reasonable CPRI" • Additional antenna processing at RU for beamforming • No limitation in centralized processing • Very little digital hardware at RU • Very high, static data rate • Low latency required

5G-Xhaul view is that the future 5G network will possibly consist of a mix of functional splits

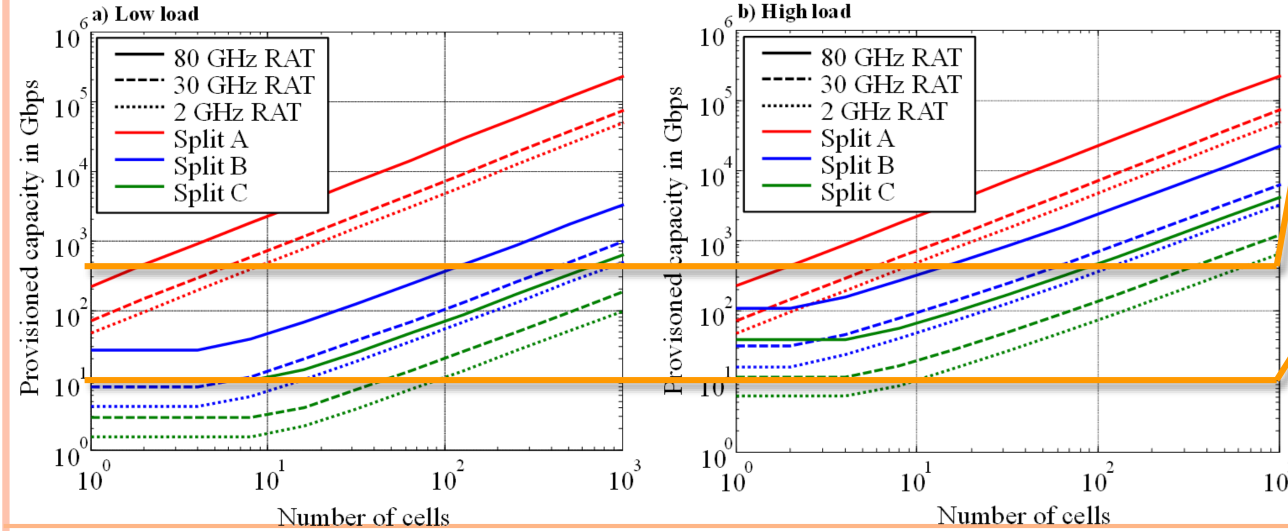
1- Data Rate Requirements



Measured traffic from 33 LTE cells in dense urban scenario

Scaled to reflect higher utilization

CPRI traffic is static but FH traffic should follow traffic variation to enable statistical multiplexing →splits B, C



400G Ethernet (IEEE P802.3bs)

→supports all splits/RATs

→for split A/full centralization only a few cells can be aggregated in one link

→for splits B up to 100 cells

10G Ethernet~CPRI rate 8

→can support only low load, no support of split A/full centralization

1- Transport Classes

5G-XHaul

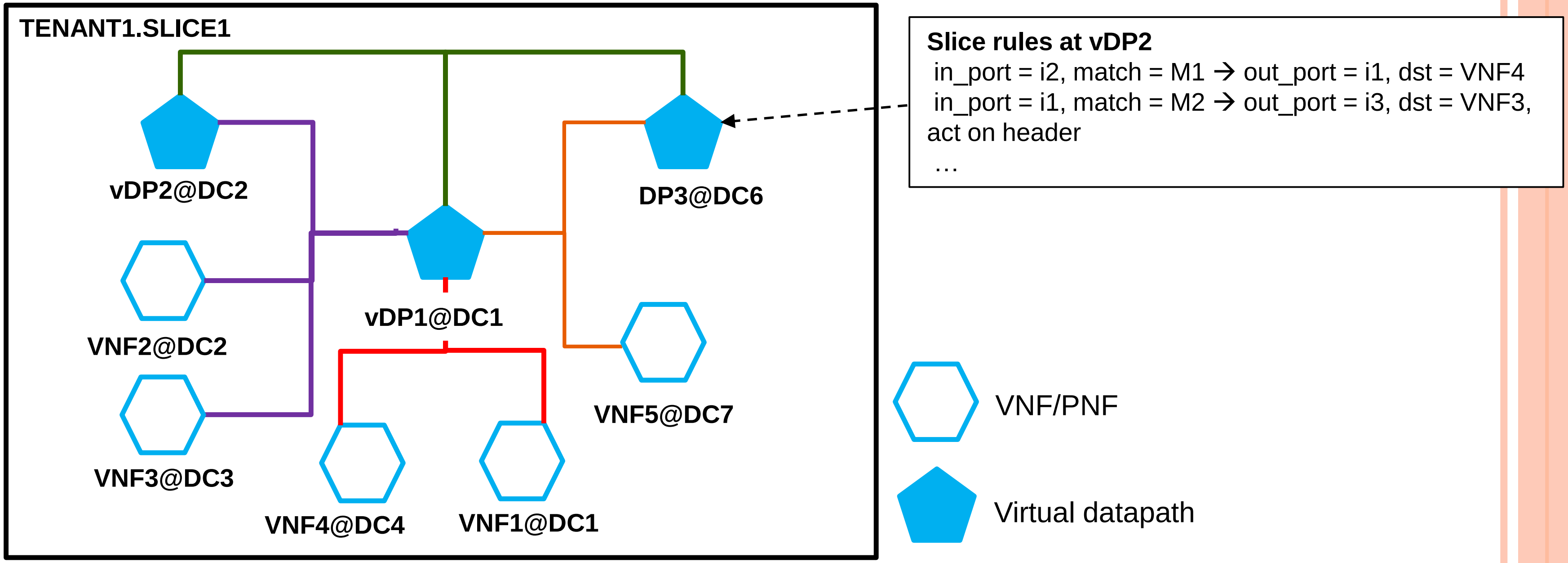
- Transport network should be **packet-based**
- Transport network should **support different splits/interfaces**
- Transport network should support different **services with different requirements** (high data rate / low latency / high reliability)
- Transport network should support **statistical multiplexing**

→different requirements can be managed via **SDN**, but **low overhead**/ complexity required

→**Transport classes:**

	Use case	Transport latency (round trip)	Synchronization	Typical data rate per access point
TC 0	• Synchronization	Very low variance	Enabler	10 Mbps
TC 1	• Split A traffic • Split B traffic without relaxed HARQ • Tactile user traffic • Failover signaling • SDN in-band control signaling	≤ 200 μs	Synchronous, time aligned	100 Gbps
TC 2	• Split B traffic with relaxed HARQ • Split C traffic with coordinated beamforming • Relaxed tactile user traffic	≤ 2 ms	Synchronous, time aligned	50 Gbps
TC 3	• Split C traffic without coordinated beamforming • Conventional BH/ fixed access traffic • Control signaling	≤ 20 ms	Asynchronous, not time aligned	10 Gbps

2- FROM MEF SERVICES TO TRANSPORT SLICES

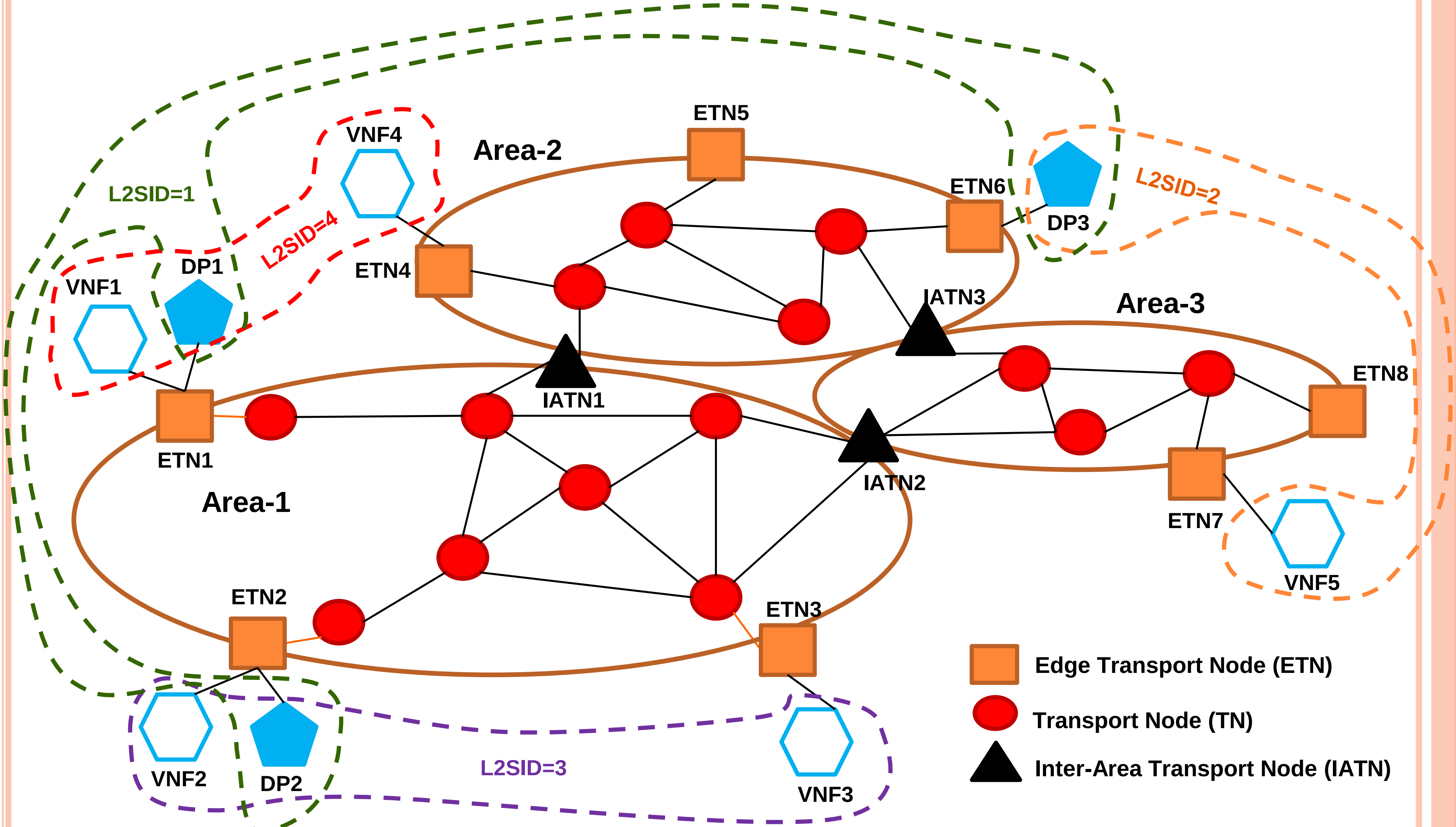


- The transport network connects distributed edge/regional/centralized DCs
- Tenants define VNFs/vDPs (dynamically)
- Tenants control their vDPs on real time (business logic)
- Similar KPIs than in MEF case need to be maintained

2- INITAL DESIGN (1/2)

- Control plane design guidelines:
  - Per tenant full address virtualization
  - Data plane scalability: edge tunneling + control plane areas
  - Control plane scalability + resiliency: combination of replica and hierarchical controllers
- Three main data plane entities:
  - **Transport Nodes (TNs)**: Maintain forwarding state for intra-area tunnels (tenant agnostic). Technology independent.
  - **Inter-Area TNs (IATNs)**: bind transport tunnels from different areas
  - **Edge TNs (ETNs)**: maintain per-tenant state:
    - Maintain binding: <L2SID + VNF_@> → ETN_@
    - A control plane keeps track of VNF location
    - Deployed in distributed edge/reginal/central compute&storage facilities

2- INITAL DESIGN (2/2)



Thanks for your attention!

Questions?