



Revolution Air Internet

# ITU Workshop on Network Performance, QoS and QoE

Kigali, Rwanda, 4-5 March 2019



Revolution Air Internet

# Who we are

- Revolution'Air is a new ISP in the Rwanda ecosystem;
- With a wireless-based Last mile technology;
- DOCSIS 3.0 - 5G Fixed Wireless Access (FWA) technologies;
- Primarily an “Eye-ball” network type;
- Use of High Frequency spectrum;



# QoS, QoE and network performance considerations for 5G and IoT

- **Introduction & Context:**
  - 5G - High bandwidths (Targets: 20Gbps-D and 10Gbps-U);
  - Low latency (~1ms);
  - 5G system includes:
    - eMBB (enhanced Mobile Broadband)
    - URLLC (Ultra Reliable Low Latency Communications)
    - mMTC (massive Machine Type Communications)
  - Different Network architecture;
  - Energy efficiency;
  - QoS - Protocol Data Unit-PDU Sessions;
  - Expected Best multimedia experience;

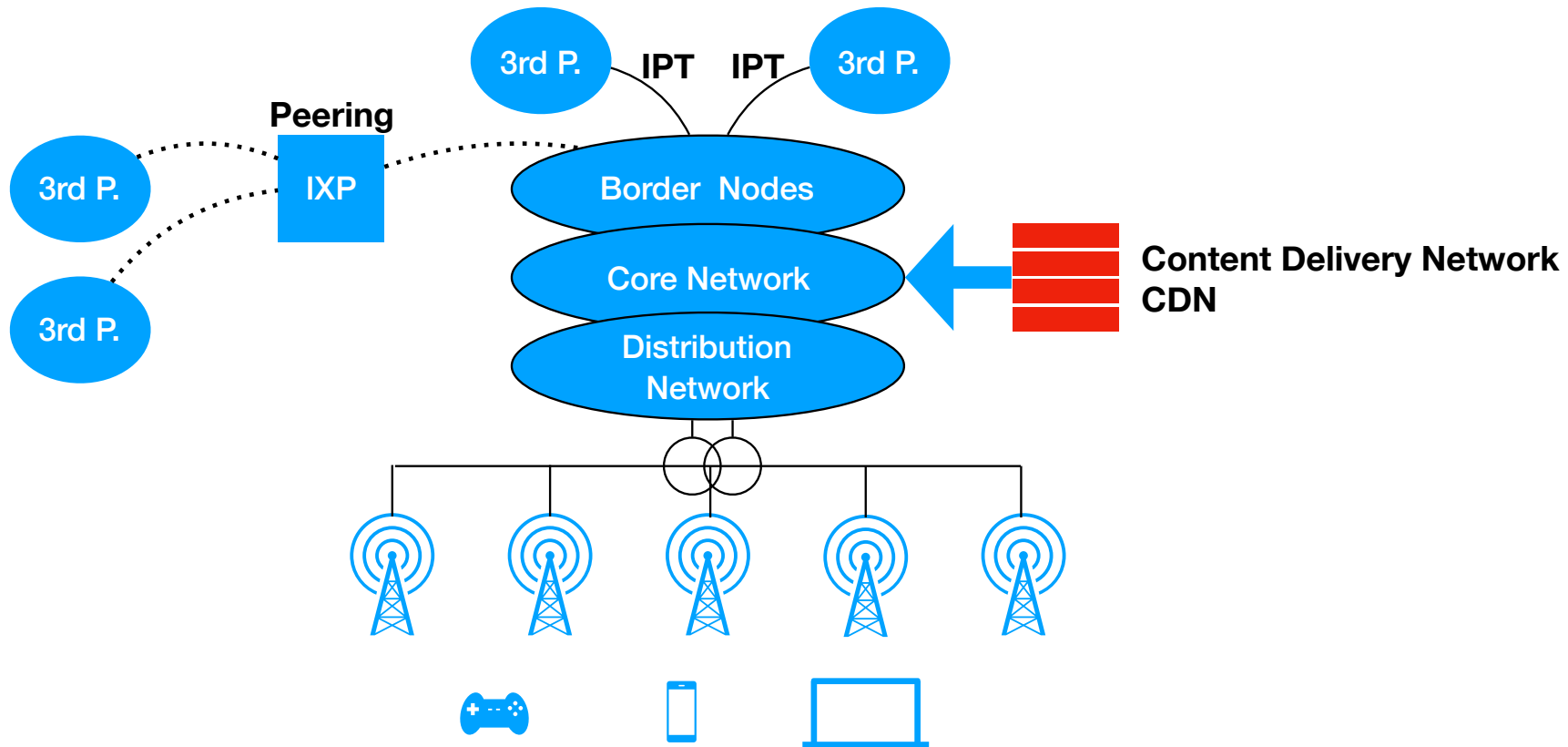


# QoS, QoE and network performance considerations for 5G and IoT

- **Current 4G Network architecture:**
  - Macro cells;
  - Bandwidth capacity limitation;
- **5G Network architecture:**
  - Small cells (Many of them) - Denser Network;
  - Covering small distances/areas BUT more devices;
  - High frequencies - High bandwidth;
  - 3 Main challenges: Weather/Rain, Environment obstacles (Trees) or/and Buildings (in urban areas);
  - Future picture: Overlapped 3G, 4G and 5G networks;

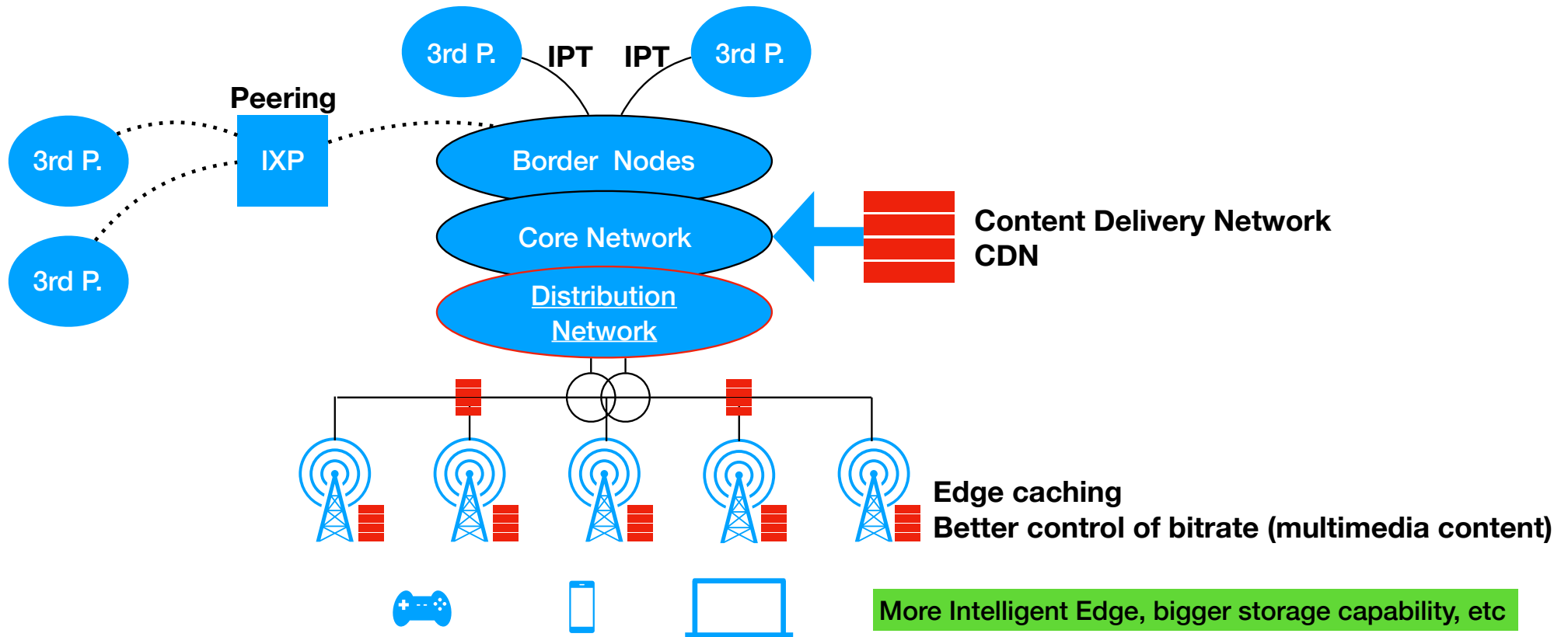
# QoS, QoE and network performance considerations for 5G and IoT

Current way to improve QoS and QoE (eMBB)... through Peering and CDNs



# QoS, QoE and network performance considerations for 5G and IoT

New possible ways to improve QoS and QoE... through Peering, CDNs, Edge caching





# QoS, QoE and network performance considerations for 5G and IoT

- **Caching aspects (Network operators)**
  - 60%+ of Internet content is video (multimedia);
  - HTTP/s caching techniques;
  - Edge caching NEAR End-user => Better usage of Network spectrum;
  - Local caching implies storage, processing power, etc. => \$\$);
- **Event-driven vs. Continuous stream of data**
  - M2M, D2D, V2x, etc.
  - Continuous streams of data;
  - Real-time and critical services/nodes/devices;



# QoS, QoE and **network performance** considerations for 5G and IoT

- **Network performance aspects;**
  - End-user **role** (speed-test, reporting, monitoring);
  - Use of **intelligent network probes** (for testing: latency, other metrics) - Could this be a License obligation?
  - Need of a **High performance backhaul technology & Architecture design** (Handling Multi path selection);
  - Need for Packet **servicing** and **buffering** capabilities @ each network elements/nodes;





# QoS, QoE and network performance considerations for 5G and IoT

- **In Conclusion:**
  - With 5G comes tremendous benefits, along with challenges;
  - New Architecture... (Denser networks);
  - Need to improve on current Caching techniques (other Best practices such as Peering to source content at the nearest source) to impact QoE;
  - Edge caching NEAR the end End-user;
  - New type of Network - More real-time, continuous streams of data;



Revolution Air Internet

# End - Questions?

[ghislain.nkeramugaba@revair.rw](mailto:ghislain.nkeramugaba@revair.rw)

+250 788 380 200