Fast, reliable and affordable connectivity

Richard Chisala Jnr, MIEEE

CTO

C3 Limited

Kasungu Crescent

MPC Business Park

Chichiri, Blantyre, Malawi

e: richard.chisala@c3.mw

w: www.c3.mw

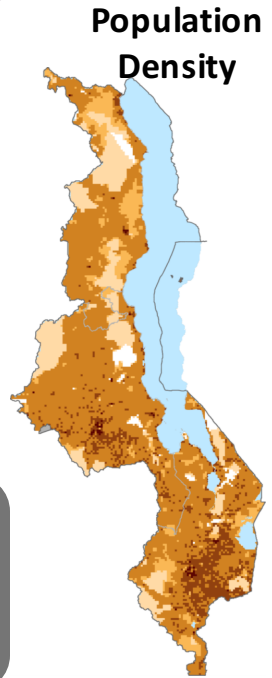
Broadband for the rest of us

"Connecting the Unconnected"

Let's check a few numbers…

Malawi's first nationwide broadband infrastructure

- $5 Million Investment
- 3 - 5 year Project
- 80 TVWS BTS 3,500 TVWS CPE's
- 10,000+ Wi-Fi Hotspots



C3's network covers both urban and rural areas, reaching out to 80% of the country's literate population which comprises 17.4 million people and grows at the second-fastest rate in the world (*Source: CIA World Factbook, 2014*).

Demystifying Enabling Factors

External

- Affordable and Cost Effective International Capacity
- Regulatory and Policy Frameworks
- Government Incentives
- Intelligent Internet Exchange Points
- Funding and Smart Financing
- Environmental Consideration
- Social and Economic Expectations

Internal

- Innovation and Creativity
- Agile Leadership and Management
- Partnership and Smart Collaboration
- Passion, Expertise and Skills
- Price Sensitivity for Sustainability
- Social Responsibility
- Do Not Cherry Pick (Inclusiveness)
- C3 Champions – Local Empowerment

Covering Customers Where They Are

- **TVWS CPEs**
  - C3 expects the number of TVWS CPE's (customer premise equipment) to grow to 3,500 in 3 years.
  - CPEs and their installation offered at cost in order to lower barriers to entry.
- **Public Wi-Fi Hotspots**
  - Each TVWS CPE location will at the same time host at least 1 public Wi-Fi hotspot, having a reach of 500m.
  - C3 expects to grow the number of public Wi-Fi hotspots to 10,000 over a period of 3 years.
- **Reaching further**
  - For customers beyond the reach of TVWS BTS (typically 10 to 20 km), C3 consider installing low-cost 5GHz radios with a range of 30 km.

What Makes C3 Unique

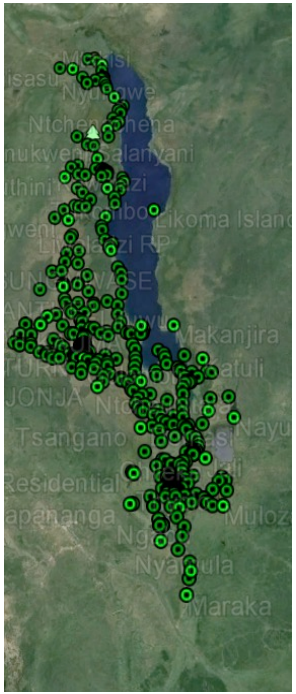
- **C3 is the first operator in Malawi to deploy its own network infrastructure more than 1Gbps backbone, towers and data centres to provide broadband 4G and fibre access complemented by novel cloud services which substantially reduce the need for Internet bandwidth**
- **C3 provides faster throughput, higher reliability and significantly lower cost, with the aim of making its services affordable to everyone who owns an Internet-capable device**
- **C3 has partnered with MPC, the country's incumbent postal operator with the aim of providing connectivity to its 183 post offices. Post offices are gradually converted to one-stop public service delivery centres servicing Revenue Authority, Road Traffic, Registration Bureau & Electoral Commission**
- **High Availability -** Mobile operators use grid and generators to fuel their base stations. **C3 uses solar-powered base stations with minimal maintenance.**

Current Status and Outlook – Near Term

- **A total of 80 TV White Spaces base stations to be deployed in four phases (20 per phase) over a period of two years and covering average surface area of almost 300 Square Kilometres.**
- **With these 80 base stations, approximately 75% of the inhabited areas and 60% of the country will be covered. This is 6.25 times less than the number of base stations needed for traditional cellular networks, thereby significantly impacting both CAPEX and OPEX and enabling to provide affordable service to areas and communities that were so far considered unviable.**
- **C3 expects to reach 80% of the literate population because its TVWS BTS cover all urban and peri-urban areas as well as many densely populated rural areas.** According to UNICEF, the total adult literacy rate in Malawi is 61.3%. *(www.unicef.org/infobycountry/malawi_statistics.html)*. **Literacy is 20% higher in urban areas than in rural areas despite the fact that primary school education is free.**
- **At least between 25 – 45 % Cheaper**

Social, Economic and Environmental Impact

- **C3 works with a number of stakeholders, all of which create significant socio-economic impacts. In these relationships, C3 acts as the online platform and connectivity partner availing the necessary infrastructure that has thus far been missing.** C3's partners provide compelling solutions in areas such as:
  - e-Health
  - e-Learning
  - e-Finance and e-Commerce
  - e-Government
  - e-Post



It would take too long to detail them on this slide, but we would be happy to share them with you.

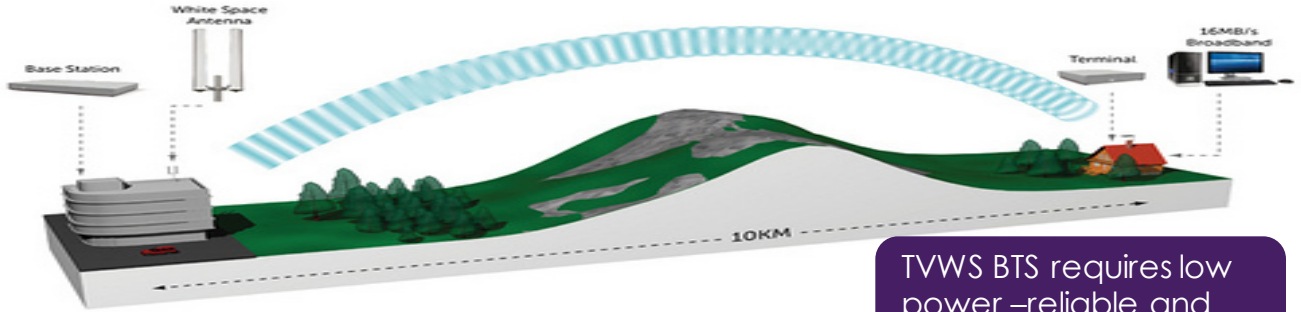
Television White Spaces (TVWS)

BUSINESS CHALLENGES

- Rural Connectivity costly for communities and extremely low ARPU clients
- Fibre based solutions and other 4G Wireless (LTE) not competitive and expensive to build in hostile terrain leverage on fixed broadband wireless solutions
- High capacity and better throughput required to underpin future broadband product

PROJECT AIMS

- Define and implement a service assurance layer that allows BAU expansion of TVWS build
- Leverage TVWS Signal Propagation Characteristics and License Exempt (Dynamic Access)



TVWS BTS requires low power –reliable and cheaper to maintain

Strategy and Tactics

- **Gain first mover advantage**
- **Achieve profitable operations**
- **Offer higher than standard SLA due to**
  - Robust TVWS signal propagation
  - "Built for Africa" equipment and applications
  - Design for off-grid power
- **Technology Trial ($50K)**
- **Commercial Trial ($660K)**

- **TVWS allows for non-interfering accessible spectrum (802.22 Compliant aka Wi-FAR)**
- **Off-grid inclusive methodology (solar/wind + battery) 24 – 48V DC with Max 200W/PoP this is significant power saving**
- **1::40 ratio Base station::CPE supports standard broadband speeds (4Mbps total)**
- **Capital Expense ~$50-$70M vs. LTE 4G ~$450-$650M (Considering 500 sites)**

Planning is Key

Channel Re-use Planning

Fail to plan - plan to fail

Document everything

- Sites
  - Physical, GPS, Contact information
- Equipment
  - IP, NM, Serial Numbers, Firmware, MAC Address
- Network
  - Configuration, topology, etc

Solar Power Calculations

Calculate the daily power consumption

Calculate number of batteries required

Calculate the number of panels required

Scenario:

- 2 x Base Station
- 1 x 6 Port Ethernet Switch

- Daily Power Consumption (W)
- Number and Rating of Batteries required (AH)
- Number and Rating of Solar Panel and Charge Controllers (W)

- A UHF channel is re-used to prevent adjacent channel interference

Basic Needs for Human Survival

Fast, reliable and affordable ACCESS for VIABLE cloud services

Water

Food

Fire

Shelter

Connectivity

Communication – the demarcation of membership into the 21st century

"Connecting the Unconnected"

C3's Management Team

Chris Schäke, CEO
Serial Entrepreneur, expert in connecting the unconnected

Richard Chisala, MIEEE CTO
Social Entrepreneur, advocate of affordable access and cloud services

Henry Chisala, CFO
Passionate, competent and keen to change Malawi's ICT landscape

Fast, reliable and affordable connectivity for cloud services
Questions?

THANK YOU!

Broadband for the rest of us