Internet 4All through Internet Lite: Connect the Future: The Killer App for 5G and Beyond

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IEEE FNI CTU WG Chair & INGR Board Member

WIRELESS WORLD
RESEARCH FORUM

Distinguished Lecture 11-13 December 2024

"Our mission is
to improve the life of **every human**
through **access to basic information** on the Internet…."

motivated by (Prof. Josef Noll):
- Professor at Uni Oslo - "Societal Security"
- Group leader at Telenor - "3G: Always online, always connected"
- European Space Agency - "Earth Observation & Climate Change"
- SIEMENS - "Chip design"

Dr. Sudhir Dixit
- IEEE Connecting the Unconnected Working Group
- Years of networking experience at Nokia, HP, BlackBerry, Verizon

Outline

- Digital Divide Overview
- Challenges for Connecting The Unconnected
- IEEE INGR CTU Working Group
- Use Cases and Architecture

Let's face it:

5G IS FOR THE BENEFIT OF TELECOMM OPERATORS, NOT US AS CONSUMERS

By josef | 24 June 2020 | Digital cooperation, Digital divide, Digital inclusion, Mobile Networks

this article is a translation from https://titan.uio.no/teknologi/2020/5g-nettet-er-til-fordel-teleoperatorene-ikke-forbrukerne, created by Bjarne Røsjø, 29Apr2020 in Norwegian

Professor Josef Noll, who helped develop the 3G network, is very critical with respect to 5G: «Designed to increase telecom operators' revenues», he says.

Titan.uio.no
Forskningsnyheter om realfag og teknologi

Digitaliseringsminister Nikolai Astrup (H) og direktør Jenny K. Lindqvist i Ericsson under en pressekonferanse om 5G-teknologi i Telias lokaler i Nydalen i Oslo i oktober 2019. Foto: Håkon Mosvold Larsen / NTB scanpix

–5G-nettet er til fordel for teleoperatørene, ikke forbrukerne

Missing 5G for All

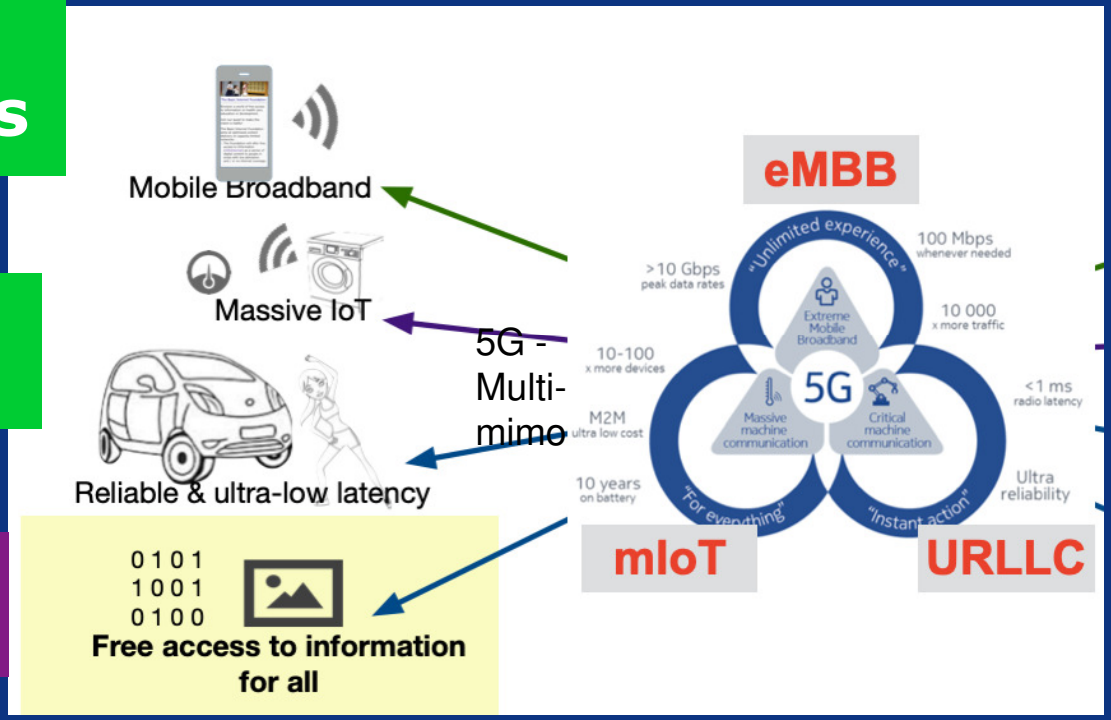
Revisit Access

Road model: pedestrians & cyclists

Digital pedestrians, digital cyclists vs digital cars (broadband)

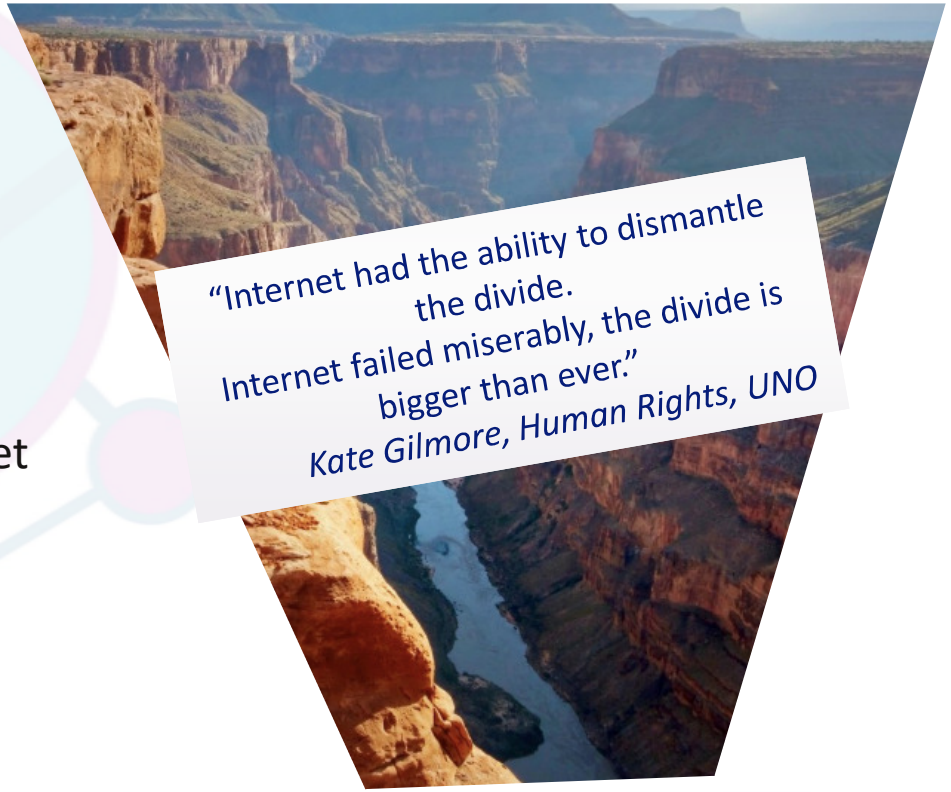
Internet Lite as a Digital Public Good (DPG)?

& 5G large cells

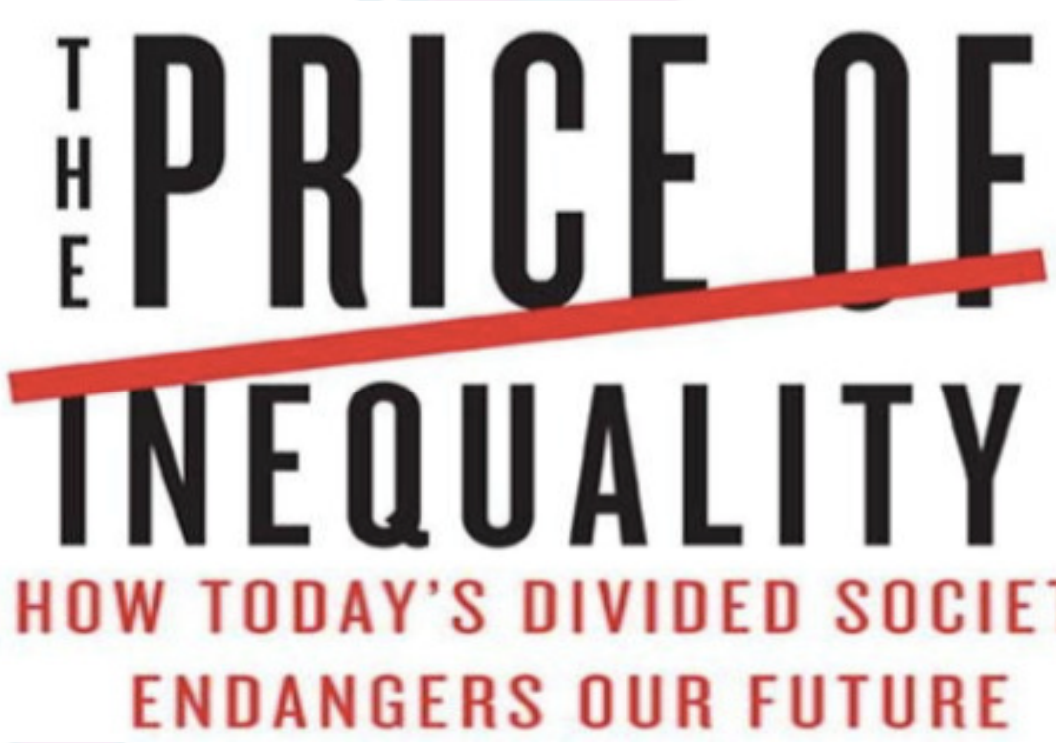


What Digital Divide Really Means

- The digital divide threatens our society
  - ~3.0 Billion are unconnected
- Huge costs for the society
  - not sufficient digital skills
  - not contributing to labor market
- Hampering innovation
  - no purchasing power
  - no ability to adopt innovations



if you'd rather like to listen to



Credit: Josef Noll, University of Oslo

Digital Divide:

~~Health Information~~

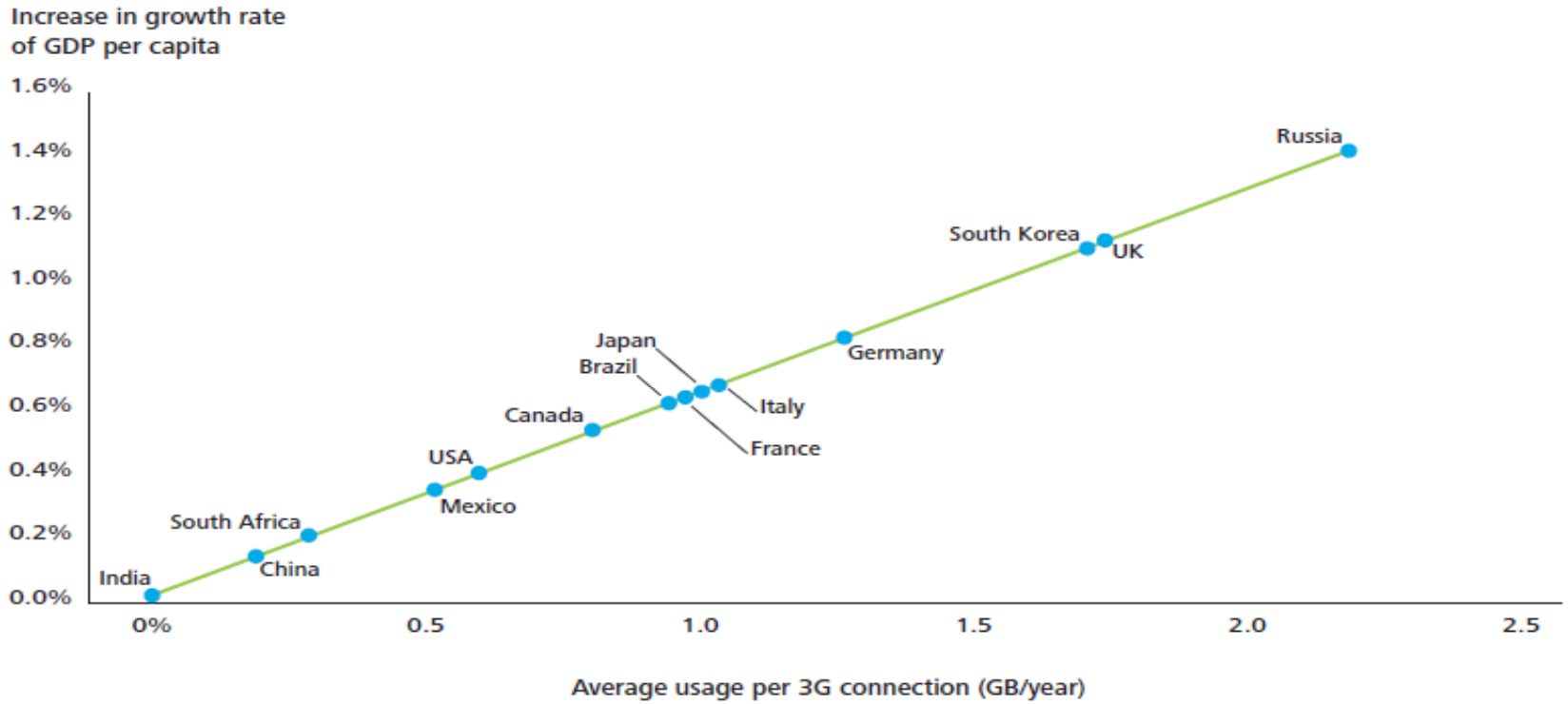
~~Education~~

~~Decent work~~

~~Equality~~

~~...a future....~~

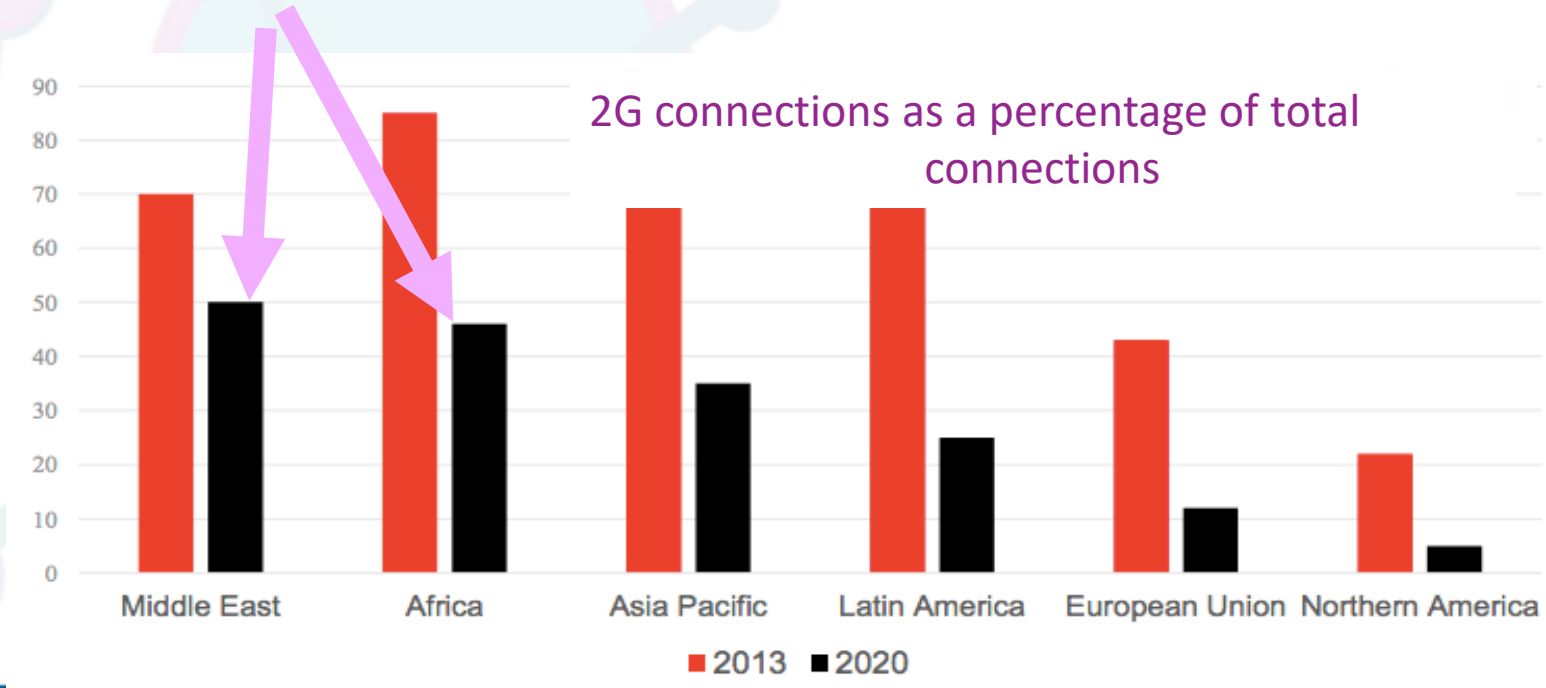
Increase in Growth Rate of GDP per Capita



Source: Deloitte analysis

The reality is…

~50% 2G in 2020



Internet (Wireless) Solutions are Critical to Sustainable Development

Sustainability targets set by UN for 2030

[redacted]

And what about IoT?

SUSTAINABLE DEVELOPMENT GOALS

FREEDOM OF EXPRESSION

We can't reach the U.N. goals for sustainable development without the internet

22 JUNE 2017 | 11:40 AM

Tweet Share

It's become common wisdom that the United Nations' ambitious "Global Goals for Sustainable Development" aren't just for the U.N., or even governments, to implement. Launched in September 2015, the 17 goals and 169 targets are "a series of ambitious targets to end extreme poverty and tackle climate change for everyone by 2030" (hence the alternative moniker, the "2030 Agenda for Sustainable Development").

Replacing the more arcane "Millennium Development Goals," these Sustainable Development Goals (SDGs) are everyone's goals, crowd-sourced to completion and promoted by companies and civil society alike. (Cue the hip, auto-playing video on the website.)

Smartly, the goals, especially Goal 17, emphasize that **access to technology underpins every one of these commitments** to the eradication of extreme poverty.

However, not all connectivity is the same, nor yields the same benefits to societies in terms of economic, social, or cultural development. As we told the International Telecommunication Union (ITU), only **stable, secure, and open access** to broadband internet will ensure success for the U.N. SDGs. That's something civil society and our partners will continue to make clear, and we'll need to work in legislatures to get the point across, not simply at aid and development banks.

To reach the SDGs, we need civil and political advocacy

Traditionally, information and communications technology (ICTs) have not been a major recipient of aid funding. That's one reason this crucial technology is "under-represented" in the SDGs and appears in only four of the 169 targets. It's assumed that telecommunications will take care of itself, having been largely deregulated and privatized in the 1980s and 1990s. Yet **more than half the world's population is not using the internet**, a statistic showing the failure of local, national, and global governance, with economic, political, and moral implications

PETER MICEK
@lawyerpants

FREEDOM OF EXPRESSION | GLOBAL | #ITU4SDG | #KEEPITON | CONNECTIVITY | ITU | SDG | SUSTAINABLE DEVELOPMENT GOALS | UNITED NATIONS

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https://www.accessnow.org/cant-reach-u-n-goals-sustainable-development-without-internet/

Basic

[redacted]

United Nations: High-Level Panel on Digital Cooperation

Basic Internet Foundation

Basic Internet Foundation
@Basic4All

Following

The panel highlights some references to be taken into consideration, including the @Basic4All 's DigI project in Tanzania #SDGs #digitalinclusion #DigitalCooperation @UNSGdigicoop

ıere has also been considerable private sector activity in this arena. Loon, project of Google's parent company Alphabet, uses internet-enabled alloons – in the aftermath of Hurricane Maria, they provided connectivity o 200,000 in Puerto Rico.[55] Amazon, OneWeb, Telesat, Space Norway and SpaceX are among companies considering connectivity solutions using low-earth orbit satellites.[56]

Some countries, such as Indonesia, have set targets that treat internet connectivity as a national priority.[57] While finance alone will not achieve universal internet access, it can help if invested wisely: some countries are generating financing from fees on existing communication network providers to help expand systems to those who are currently uncovered, for example through Universal Service Funds.[58]

Advance market commitments deserve further consideration as a possible way to incentivise investment, as they have in other areas such as vaccine developments. They involve a commitment to pay for a future product or service once it exists; the commitment in this case could come from consortia of governments, international organisations or others interested in enabling specific uses in areas such as health or education.[59]

Many local groups are also working on small-scale community solutions: for example, a rural community of 6,000 people in Mankosi, South Africa, built a solar-powered "mesh network" in collaboration with a university.[60] Such community projects are often not just about getting online but building skills and empowering locals to use technology for development and entrepreneurship.[61]

organisations.[62] Initiatives to improve access for marginalised populations should start with consultation involving these groups in the design, deployment and evaluation of such efforts.

Efforts to improve digital inclusion would be greatly helped if there were a clear and agreed set of metrics to monitor it. Initial work – notably by the Organisation for Economic Co-operation and Development (OECD), the Group of Twenty (G20), ITU, and the Economist Intelligence Unit – needs to be broadened to reflect the wide variety of global contexts and, importantly, needs greater buy-in and participation from developing countries.[63] The Panel urges international organisations, civil society and governments to develop action plans around reliable and consistent measures of digital inclusion with sex disaggregated data. Discussion about measurements and definitions would also focus attention on the issues underlying inclusion.

2.2 RETHINKING HOW WE WORK AND LEARN

Many previous waves of technological change have shifted what skills are demanded in the labour market, making some jobs obsolete while creating new ones. But the current wave of change may be the most rapid and unpredictable in history. How to prepare people to earn a livelihood in the digital age – and how to protect those struggling to do so – is a critical question for digital cooperation for governments and other stakeholders who aim to reduce inequality and achieve the SDGs.

United Nations High Level Panel on Digital Cooperation

- Jun 2019 report: Recommendations
  - Inclusiveness
  - Digital Public Goods (DPGs)

1A: We recommend that by 2030, **every adult** should have **affordable access** to digital networks, as well as **digitally-enabled** financial and **health services**, as a means to make a substantial contribution to achieving the **SDGs**…

1B: We recommend that a broad, multi-stakeholder alliance, involving the UN, create a **platform** for **sharing digital public goods**, ….

EAC:
- Akaliza (RW)
- Nanjira (KY)
- Bogolo (BW)

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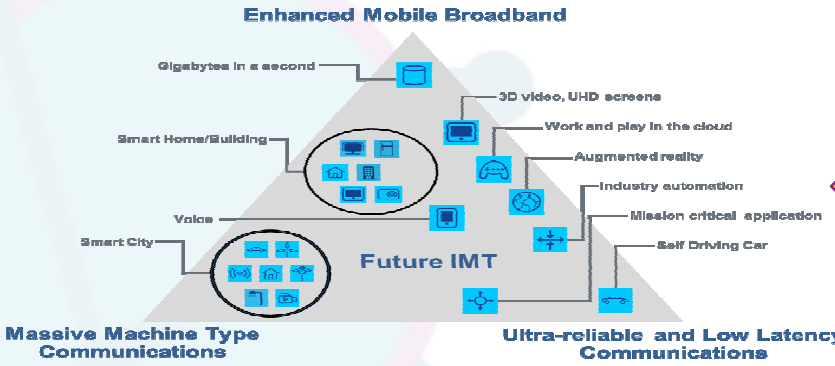
Why ~3B People Still Not on the (Mobile) Internet

1) Value proposition, such as for Digital Health, Education, Entrepreneurship
   - No help in the daily life, focus on entertainment content
   - Voice meets most daily needs
   - Literacy, HCI, Complexity

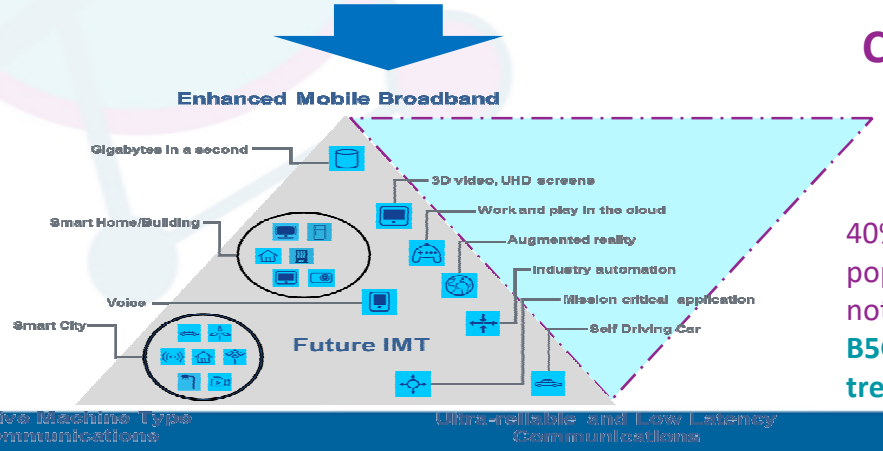
2) Technology and Capacity to absorb digital technologies
   - Off-grid, Coverage, Throughput, Content in local languages and relevant services, Scalability, Fear of technology
   - Costs for access

3) Affordability (Business/Economic)
   - Expensive smart phones, Expensive and confusing data plans
   - Understanding the power of digital (Governments)
   - Ancient business model – Freemium access

Reality about 5G



Forgotten needs of the developing world & digitally disadvantaged!



Connectivity for All

(Low mobility, off-grid, low cost, Local content, usable HCI and usable authentication/security)

40% (~ 3.2B people) of world population (7.9B) today (April 2021) do not have internet connectivity.

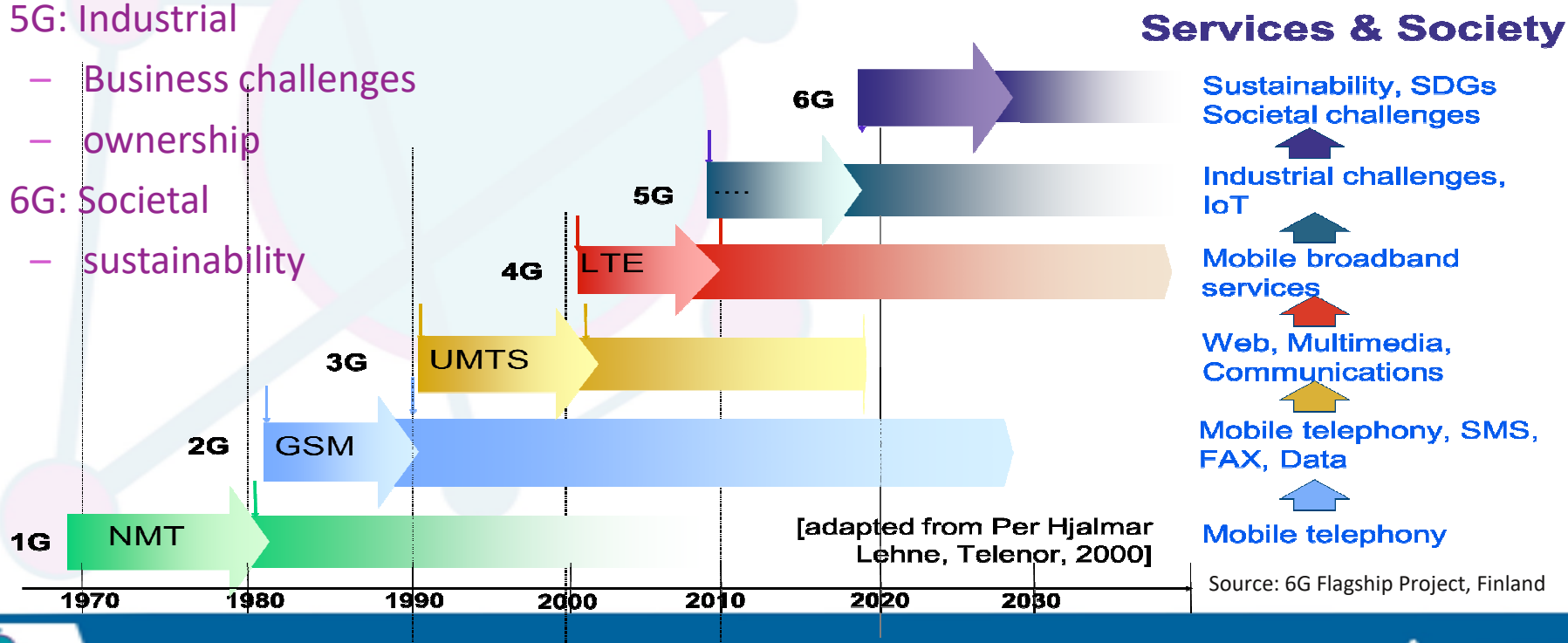
B5G and 6G are presented with a tremendous opportunity!!

6G: Digitization of the Society

- 1G-3G: Speed, flexibility
- 3G-4G: Service view
- 5G: Industrial
  - Business challenges
  - ownership
- 6G: Societal
  - sustainability

Sustainability: Killer app for 6G

Ultra-long battery life,
Charging, Indoor/Outdoor



Source: 6G Flagship Project, Finland

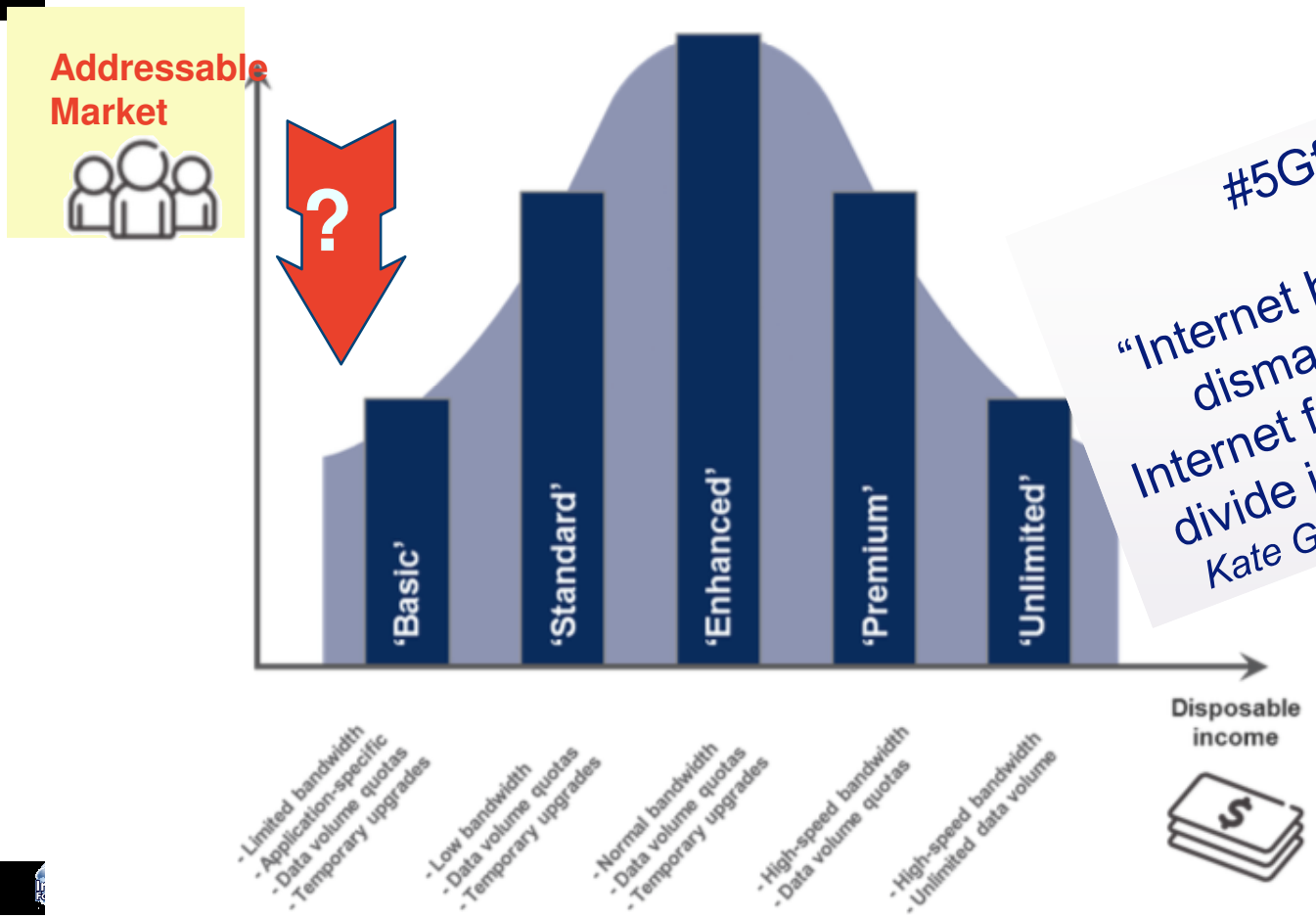
Challenges

- 3B+ people either still unconnected or under-connected
- Low population density
- Sparse and clustered settlements
- Comparatively lower income levels
- Remote and difficult to access regions
- Lack of education and exposure to absorb digital technologies
- Local cultural and political nuances inhibiting empowerment
- Inadequate grid-based power supply
- Price-benefit comparison with urban/suburban areas

Step 1: Let's address **every single human**

- Internet Lite
- One Information Spot per village
- Free Access to Health,Education, Etc.

Telecom view on digital inclusion

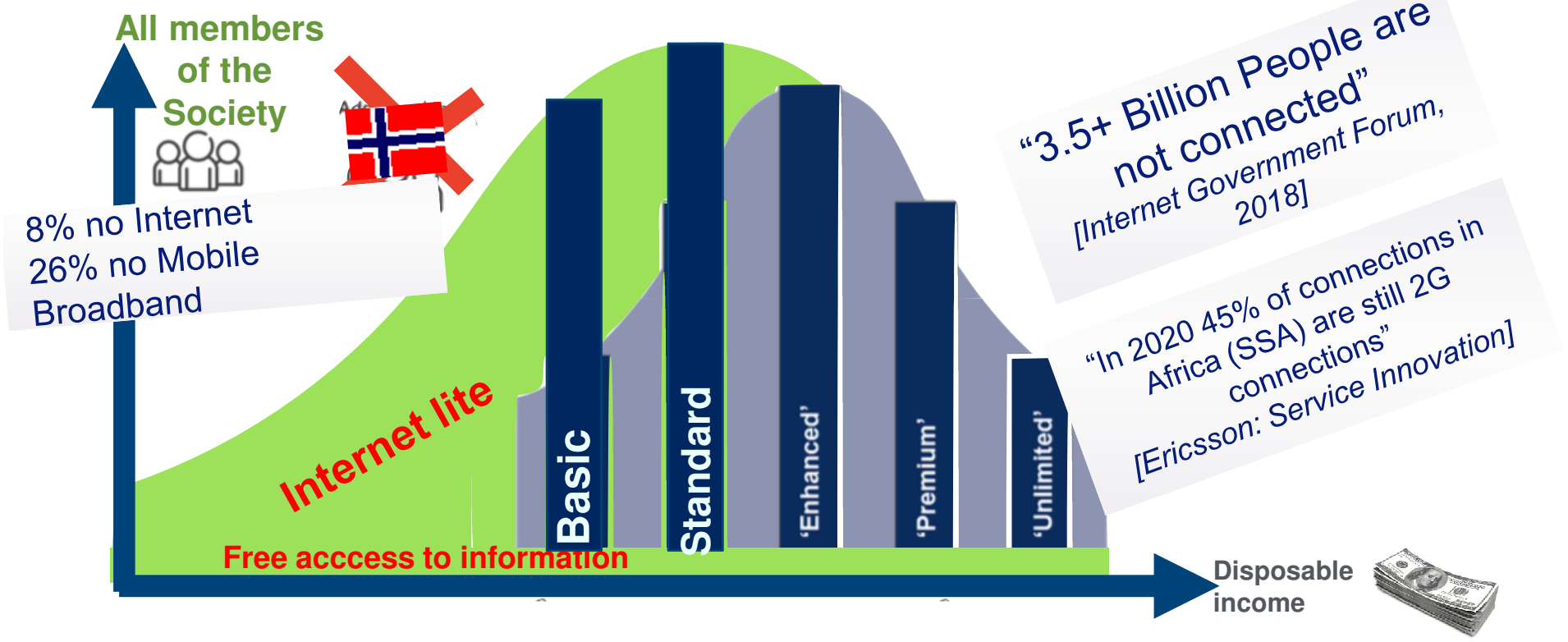


#5Gfor All?

"Internet had the ability to dismantle the divide. Internet failed miserably, the divide is bigger than ever."
Kate Gilmore, Human Rights, UNO

Source: Service Innovation through Smart Networks, Ericsson, https://www.ericsson.com/assets/local/networks/documents/service-innovation-through-smart-networks.pdf

6G (#5GforAll) for digital inclusion



[Adapted from: Service Innovation through Smart Networks, Ericsson, 2018]

Step 2: Let's solve the **problem of access**

- Internet Lite
- One Information Spot per village
- Free Access to Health & Education

No magic, exist today….
Lightweight Protocols, e.g. AMP

BasicInternet.org/Mission

BasicInternet.org/Mission/?amp

Our Mission

We make digital inclusion happen to improve the life of every single human, by providing free access to the internet and its information

The Challenge

Access to information is crucial for participation, education, and health care.

Worldwide, more than 800 million people don‘t have access to basic information.

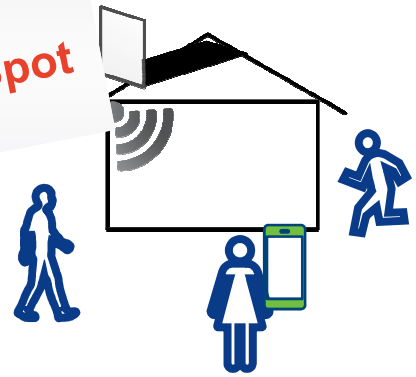
Internet Lite - AMP experience

Our solution

- We build Information Spots in Villages
  - ➡ Wifi Spots with Free Access to Information
  - ➡ Focus on Digital Health
- We introduce the Freemium model for access
  - ➡ Free access to information
  - ➡ Premium access to broadband content
- We build the basis for Sustainable Development
  - ➡ Catalyst for the Sustainable Development Goals (SDGs)
  - ➡ for Health, Education, Agriculture, Decent Work, …

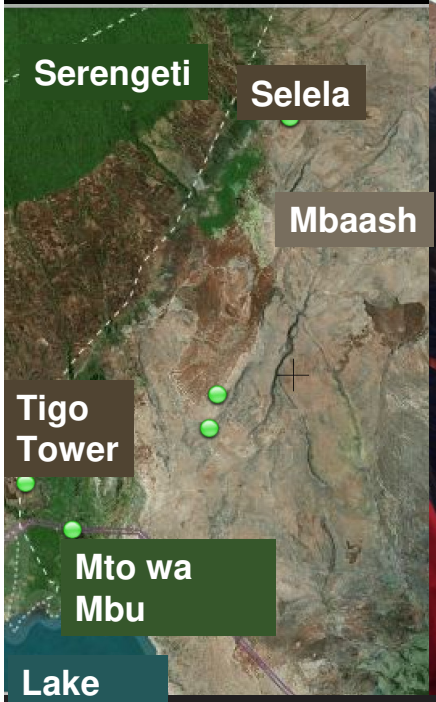
"Providing Internet to the basic of the pyramid isn't a question of affordability, but rather a question of sustainability"
Internet Governance Forum, Panel

Starting with one Information Spot per village



BasicInternet.org
@Basic4all

“Connect the Unconnected”
Selela Market Place

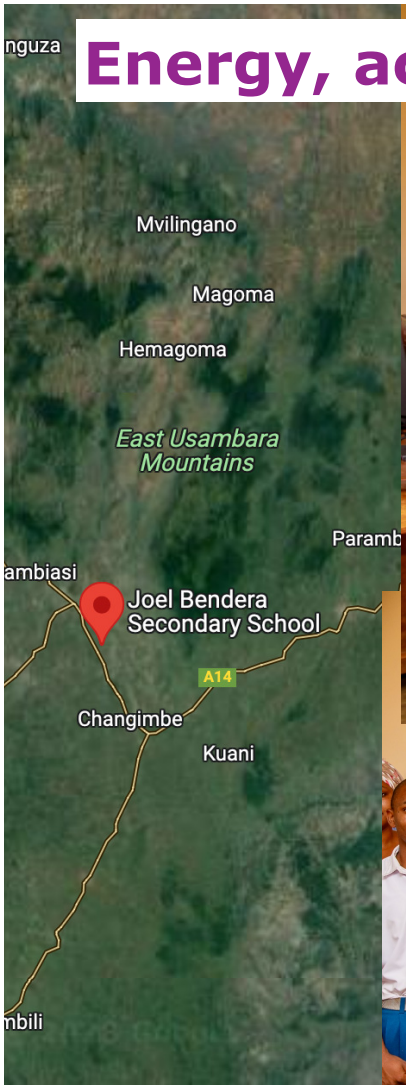


- Antenna in 6 m height
- Reaches Tigo tower > 20 km away

@Basic


“Connect the Unconnected”
Izazi
Basic Internet Foundation
Antenna
Village office
Installation time: 1,5 h; catching the signal from the Vodacom tower in Migoli (~10km away)

Energy, access and information



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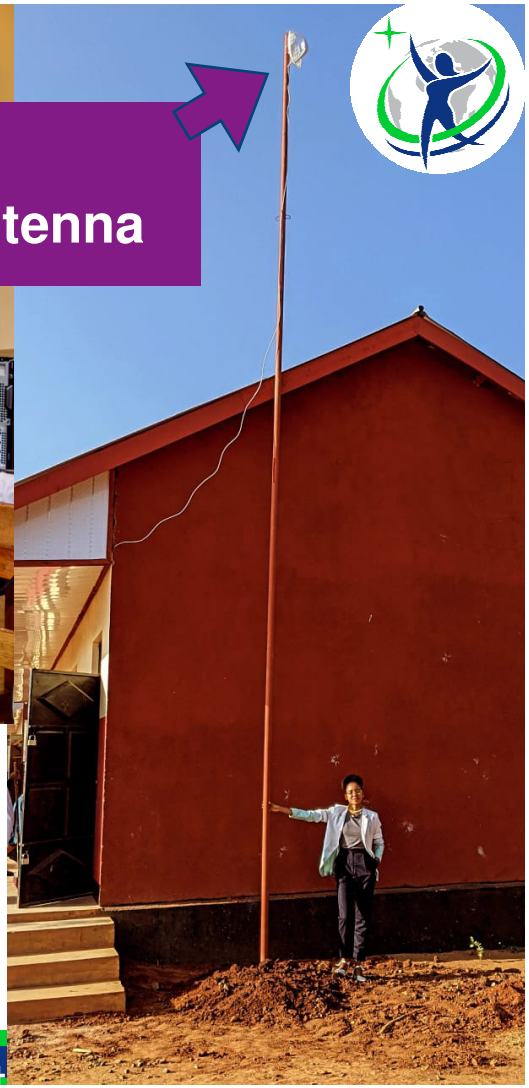


Our Approach and Impact

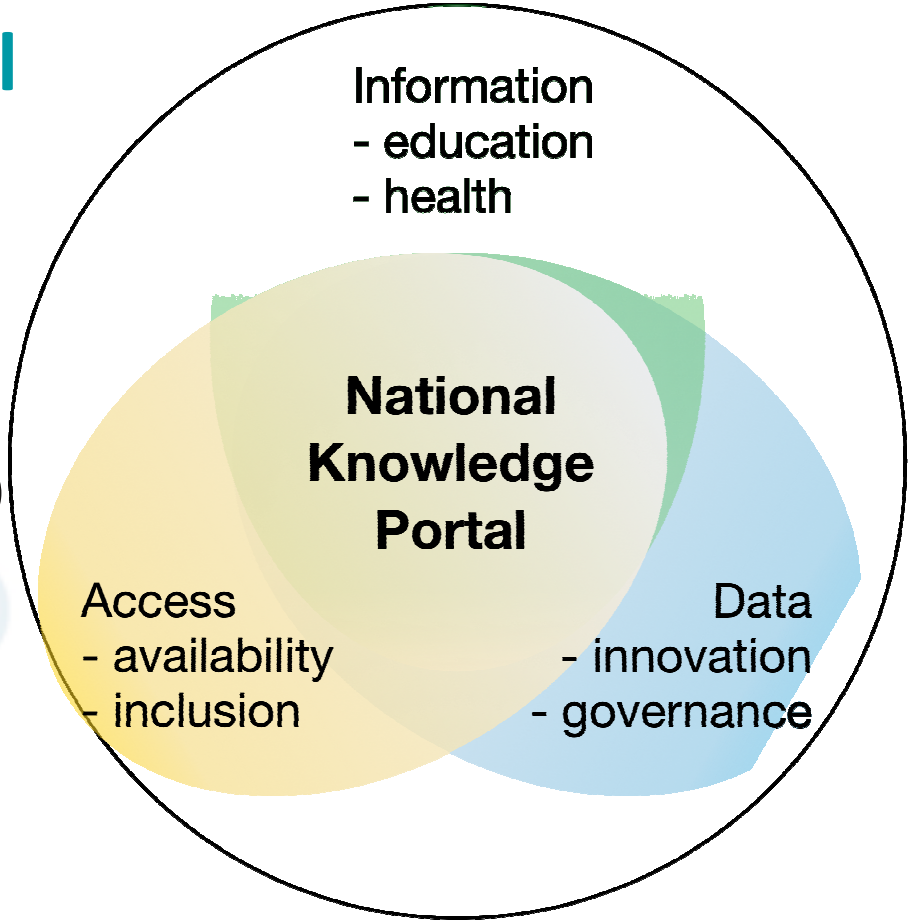
- Show and prove through deployment
- Focus on school education and healthcare
- Integrate renewable energy solution for locations without a grid or unreliable power supply
- Community engagement to reduce Capex and Opex
- Adopt Freemium business model for commercial sustainability
- Partnerships with telecom operators, ISPs, local schools, health centres and local authorities
- Solution rolled out in over 250 schools and health centres in Tanzania, Kenya, Rwanda, Ethiopia and expanding
- Solution successfully deployed in Norway and Germany
- Internet Lite being developed as a global standard by IEEE SA

Step 3: **Integrated Approach** for Digital Inclusion

- National Knowledge Portal
- “Access, Skills, Regulation & Inclusion”

National Knowledge Portal

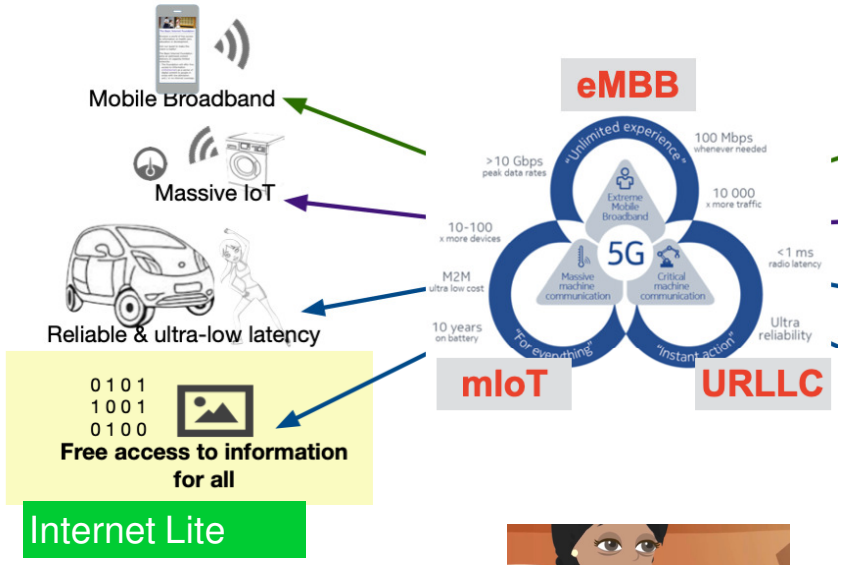
- Repository of data for selected verticals
- Trustworthy Information
  - Authenticated sources
  - Education, Digital Public Goods (DPGs)
- Regulatory Framework
  - Free access to Knowledge Portal



Connect The Future

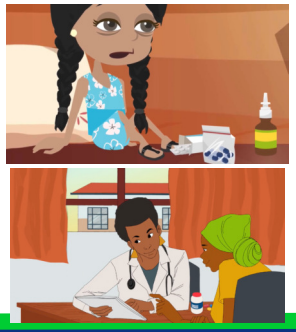
World Summit of the Information Society - W

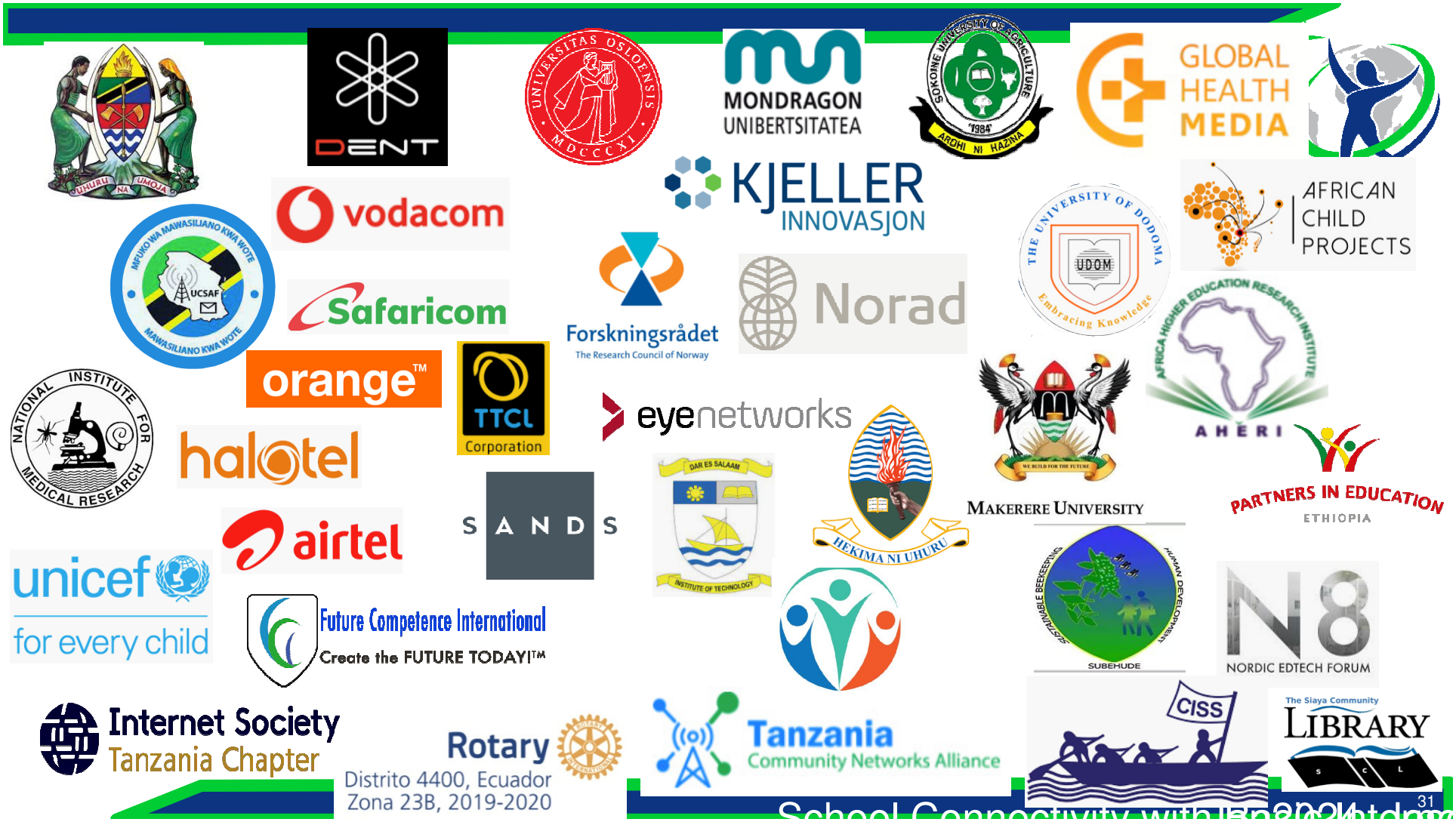
Doreen Bogdan
Secretary General ITU



Internet Lite

Community Learning & Living Labs (CL3)

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Tanzania
Community Networks Alliance
CISS
The Siaya Community
LIBRARY

Thank you, without you we would not see the light!





#WomenInTech
#EmpowerWomen

Connecting Tumaini Open School

#ConnectTheFuture

Concluding remarks (1/2)

- Digital Inclusion is the key for sustainable development to meeting all the SDG goals
- Net neutrality
  - access to information, compressed text and pictures through the InfoInternet open to all content providers.
  - InfoInternet is net neutral as long there is no reselling of content
- Current focus on content and services that provide measurable value, e.g., digital health, education, employment, gender equality and e-governance
- Catalyst for SDG 2030
- Alliances in Africa and India and other parts of the world

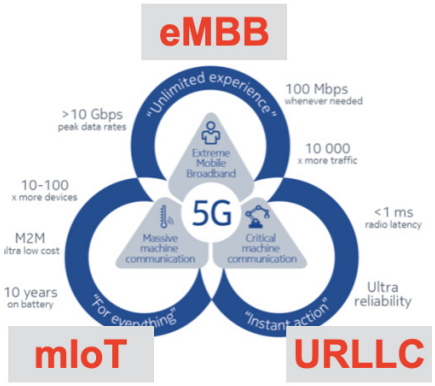
for a world:
"Where everyone can open his browser and get free access to Internet"

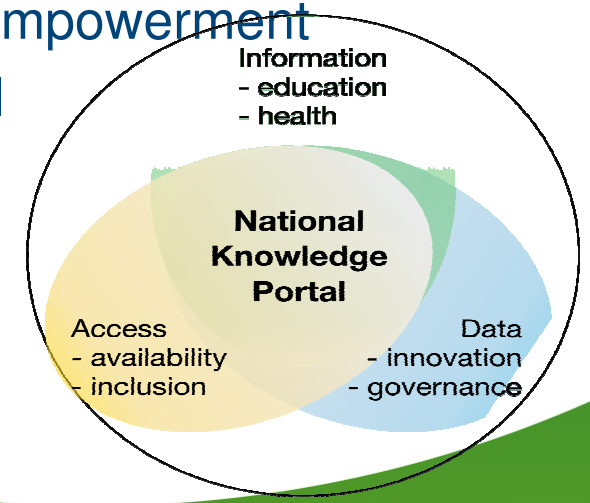
No one should have to choose between access to the Internet and food or medicine.

SESA

Concluding remarks (2/2)

- **Sustainability in Mobile Development**
  - 5G is not answering the Digital Divide (yet)
  - 5G is not contributing to the SDGs (yet)
  - Drive 6G where CTU is an overarching requirement
- **Address the Grand Challenges**
  - Digital Inclusion and Societal Empowerment
  - The National Knowledge Portal
    - Access
    - Skills
    - Regulations
    - Inclusion





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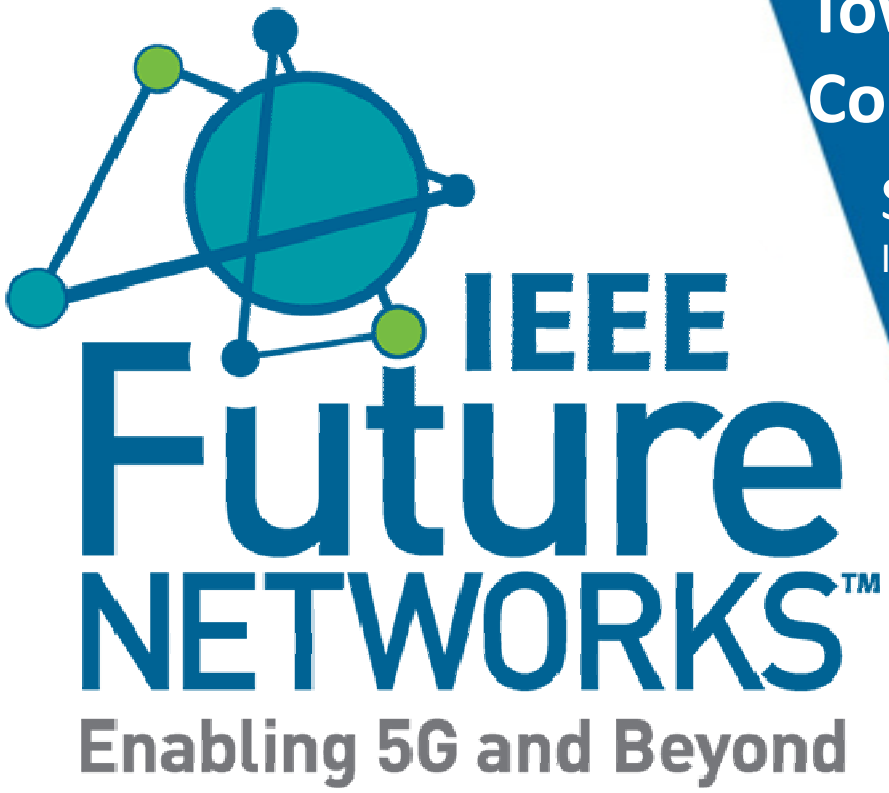


IEEE Future Networks Roadmap Towards 6G & Enabling Connecting the Unconnected (CTU)

Sudhir DIXIT, PhD, MBA, Life Fellow IEEE
IEEE FNTC CTU WG Chair & INGR Board Member

IEEE ComSoc Distinguished Lecture

13 December 2024

IEEE

International Network Generations Roadmap (INGR)

Future network technologies (5G, 6G, etc.) are expected to enable fundamentally new applications that will transform the way humanity lives, works, and engages with its environment. Be a part of this transformation today!

- The INGR is a semi-annual technical document highlighting network technology evolutions over 3-, 5- and 10-year horizons.
- Created by a group of 100+ international IEEE experts from industry, academia and prominent research labs, organized across 15 distinct working groups.
- Every 12-18 months, INGR will release a new multi-chapter document highlighting development needs, the challenges/roadblocks to achieving those needs, and potential solutions to those challenges.
- At least twice a year, INGR leadership will do outreach to industry and hold presentations highlighting the most crucial future technical roadblocks, to engage industry to solve or avoid those risks and roadblocks.
- **FREE with Future Networks membership – Join today!**

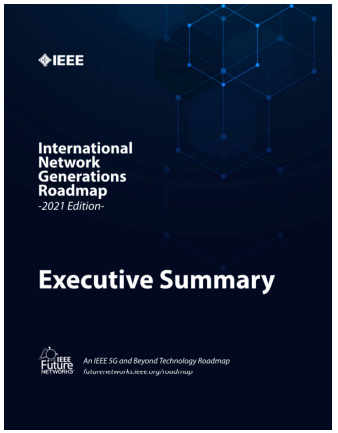
Contact us to get involved!
Craig.polk@comsoc.org

IEEE INGR Structure and Working Groups

CATEGORY	DESCRIPTION	INGR WORKING GROUP CHAPTERS
Access	Describes how the users are able to reach the network	• **Massive MIMO** • mmWave and Signal Processing • Hardware • Energy Efficiency
Networks	Describes how the networks are interconnected	• Edge Automation Platform • Satellites • Optics
System and Standards	Describes system standards and testability	• Standardization Building Blocks • Testbed • Systems Optimization
Enablers and Users	Represents all the elements that enable deployment, assure functionality and security and address impact on society and environment	• Deployment • Applications and Services • Security and Privacy • Artificial Intelligence and Machine Learning (AI/ML) • **Connecting the Unconnected (CTU)**

Accessing INGR 2023 Chapters

1. Visit FutureNetworks.ieee.org/roadmap
2. Sign in as an FNI member (IEEE account)
3. Download all chapters



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  - For others, only USD $5 - $15 annually
  - URL to join: **bit.ly/fni-join**

CTU WG Overview

- Make future generations of networking affordable, relevant and useable so that every human being is digitally connected and reaps the benefits of access to enormous knowledge on the web, services and social networks
- Focus on digitally unconnected and under-connected sections of the society who are under-served or digitally disadvantaged both in urban and rural areas both in the developed and developing countries
- Areas of focus are: Affordable technologies; solutions and architectures; coverage; innovative yet sustainable business models; simplified human-device interfaces; use cases; simplified authentication and security; crowd sourcing and curation of local content and services; application of cloud, AI/ML, virtualization and IoT
- Offer a single platform for discussions, R&D, best practices and standards for the many initiatives and projects presently ongoing in the world
- Information dissemination and digital competence building of digitally disadvantaged section of the society
- In alignment with the IEEE mission of “Technology for Humanity.”

Scope of the CTU WG

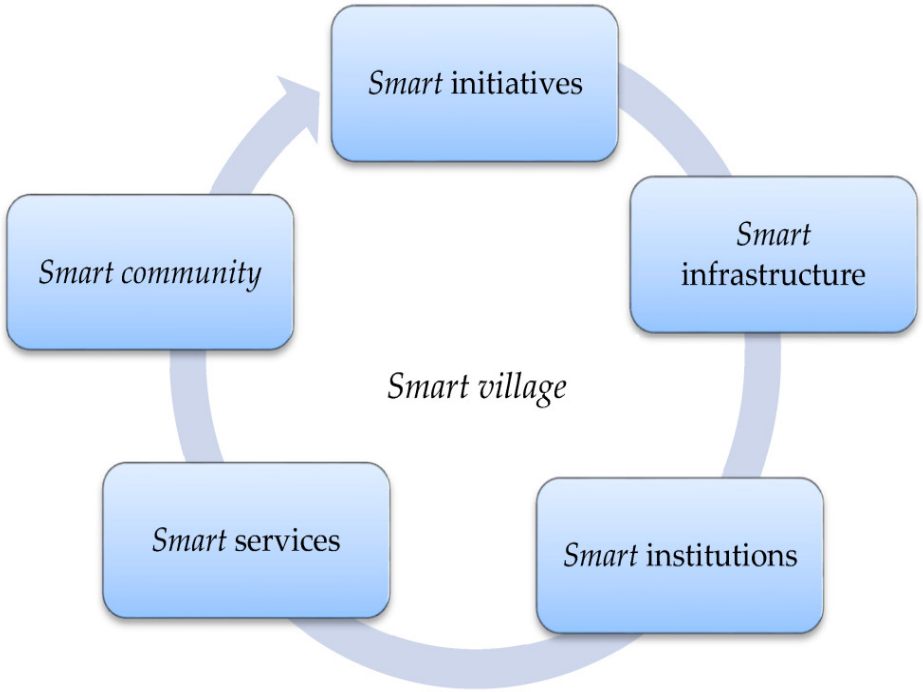
- Articulate the necessity along with the use cases to connect the unconnected
- Provide state of the art of CTU
- Determine requirements, including the need to be affordable and simple to use
- Propose micro-service architectures based on traditional and novel KPIs
- Community and shared networks
- Identify policy and regulatory issues
- CTU fits within the overall vision of IEEE of Technology for Humanity and FNI
- 1st edition covered all the above topics
- 2nd edition includes the role of cloud, block chain, IoT, AI, and the need of guidelines and testing to validate the various projects ongoing around the world
- The gap would probably be closed between the time period of 2025 and 2030

Today's Landscape (1/2)

- Numerous ongoing projects but lacking coordination and unified strategy => critical mass to drive standards, requirements and operator interest
- Technologies available today but RoI and affordability remain major hurdles
- Virtual, cloud, AI and edge technologies not seriously considered
- mmWave not suitable, but Wi-Fi, white space, microwave, cellular (4G, 5G, B5G), and low orbiting satellite present viable options
- Advance antenna technologies not yet considered seriously due to CAPEX
- Inappropriate business models limiting uptake in rural and remote areas
- Growing interest in community networks and local entrepreneurship
- Legacy regulations and government policies are inhibiting rapid progress.

Today's Landscape (2/2): Selected Technology Overview

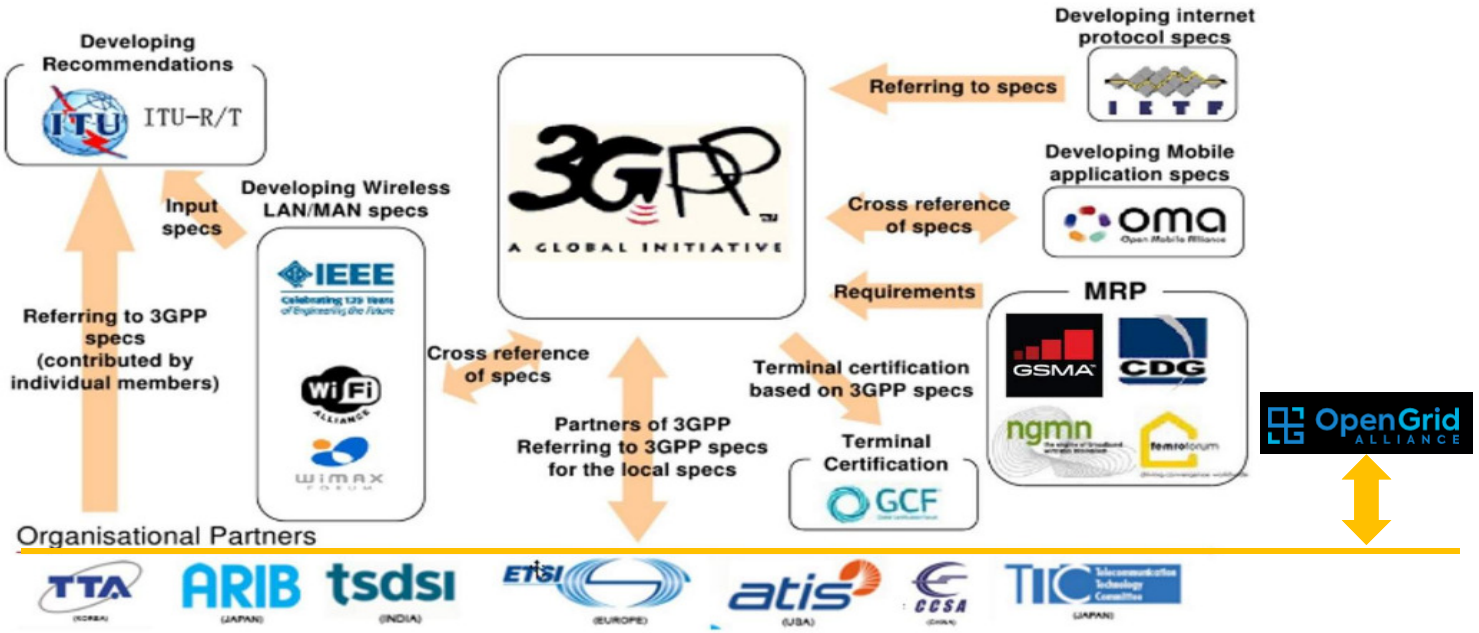
- NLOS
- Spectrum
- TV white space
- Community networks and resource sharing
- Distributed content servers & Knowledge Platform
- Long range WiFi
- IEEE 802.22 Wi-FAR ® standard for WRAN
- Clustered deployment



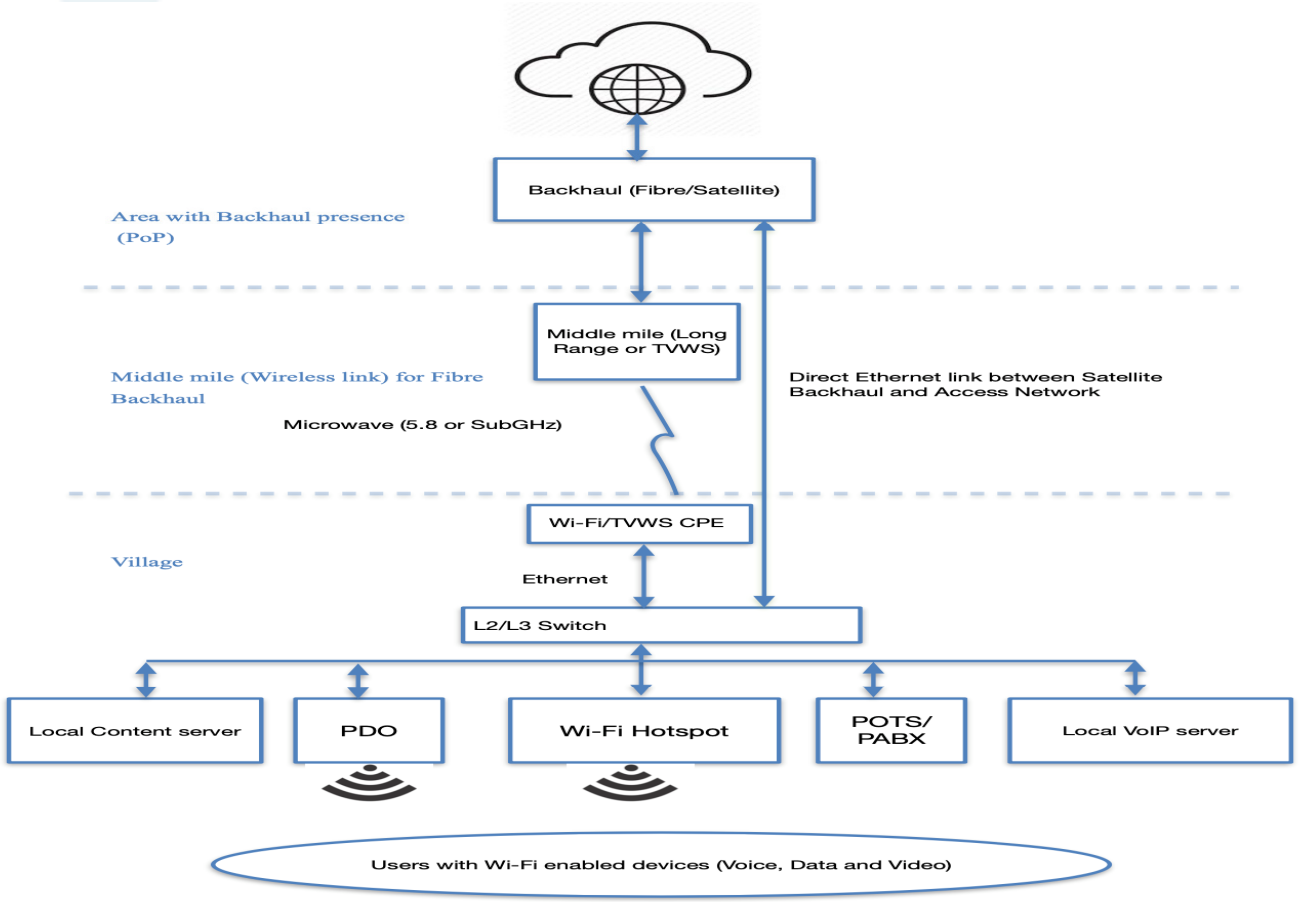
Top Requirements to Meet 10-year Vision

- Pandemic has given impetus to affordable broadband access throughout the world
- Speedy policy reforms
- Creating own local content is a dream waiting to come true, requiring digital capacity building
- Concept of free access to Digital Public Goods (DPGs) championed by the United Nations is due for implementation in National Knowledge Platforms => motivating innovative architectures
- Concept of DPG Lite for free and DPG Heavy from the Internet core
- Cost effective backhaul and middle mile solutions
- Availability of grid or renewable energy sources
- Frugal 5G network (IEEE P2061)
- Network slicing
- Sustainable business models, e.g, Village Level Entrepreneur (VLE), Freemium, Revenue sharing, Bartering, Incentives, engagement of industry verticals
- Need passive NLOS repeaters, TV white space (lower radio spectrum) allocation for rural connectivity

Collaborating Organizations Creating Critical Mass and Consensus Outcome



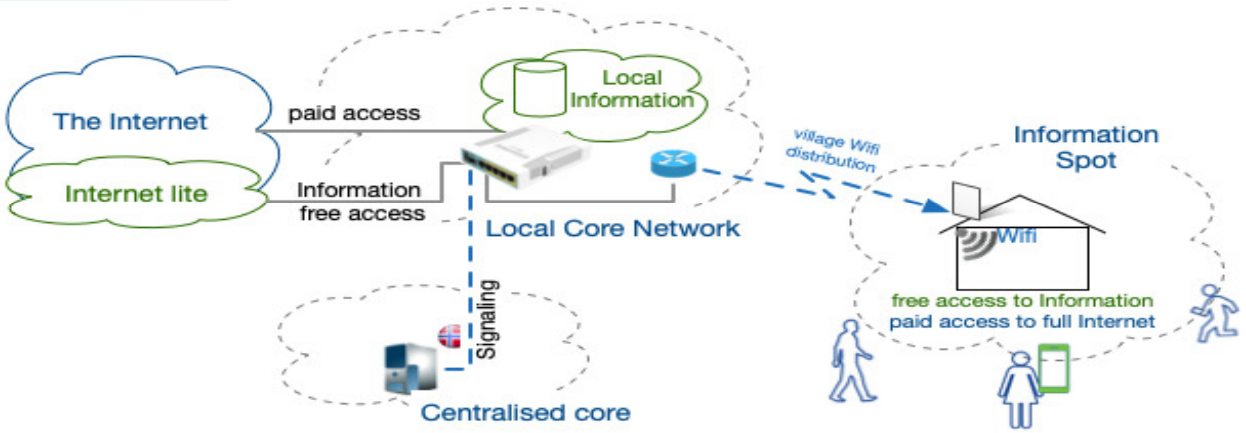
An Example Connectivity Architecture



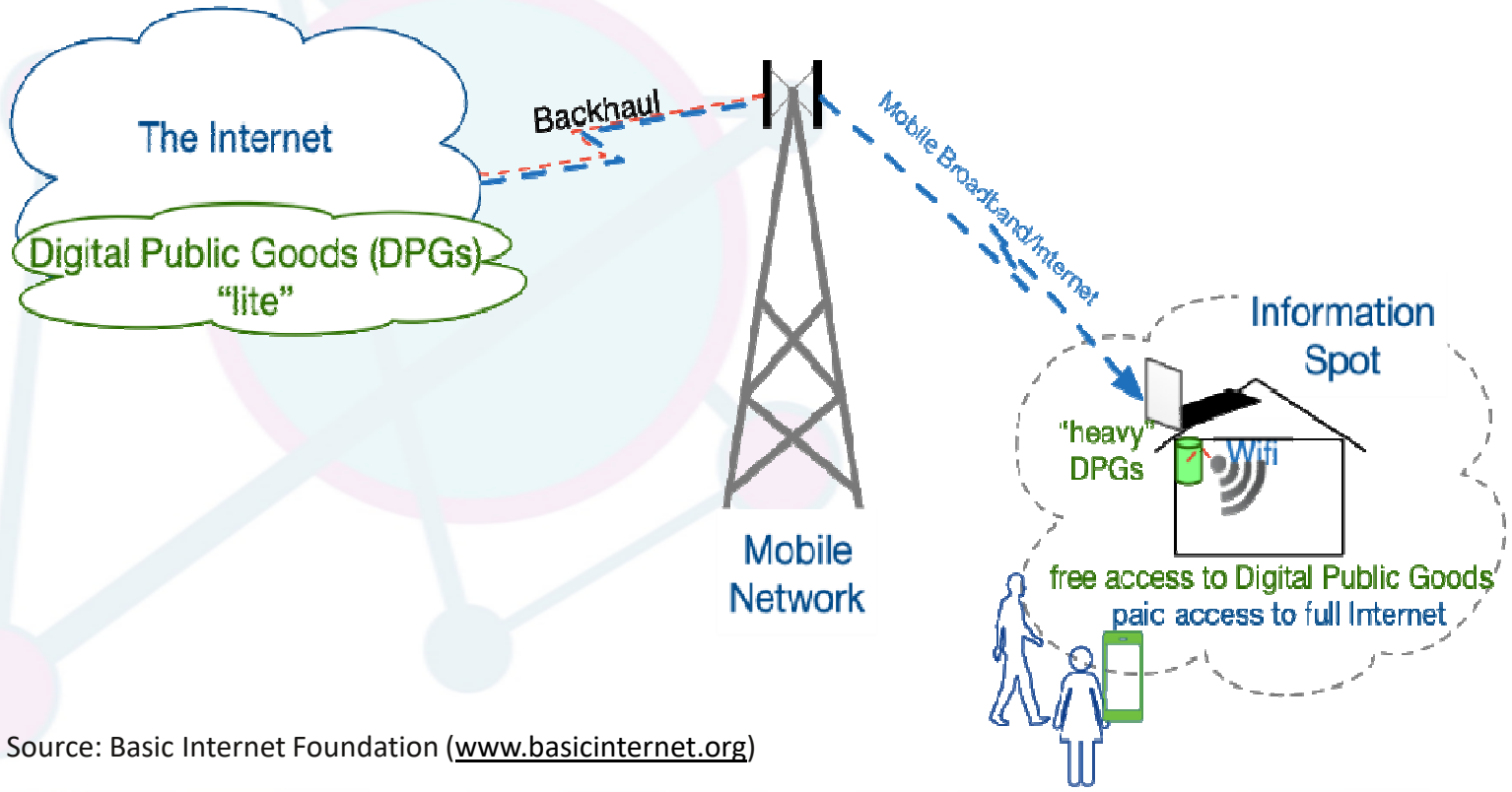
Source: C-DoT, India

Proposed Internet access (with free + paid access)

- Distributed architecture (layered: basic + full)
  - Centralised core
  - Local core network
  - Local information
  - Local access
- Free access to
  - Basic Information (InfoInternet)
  - Local Information
- Paid access (voucher)
  - For full Internet, including video streaming, games
- Connectivity to
  - Mobile Operator Network
  - Radio Link Network
  - Satellite back-bone

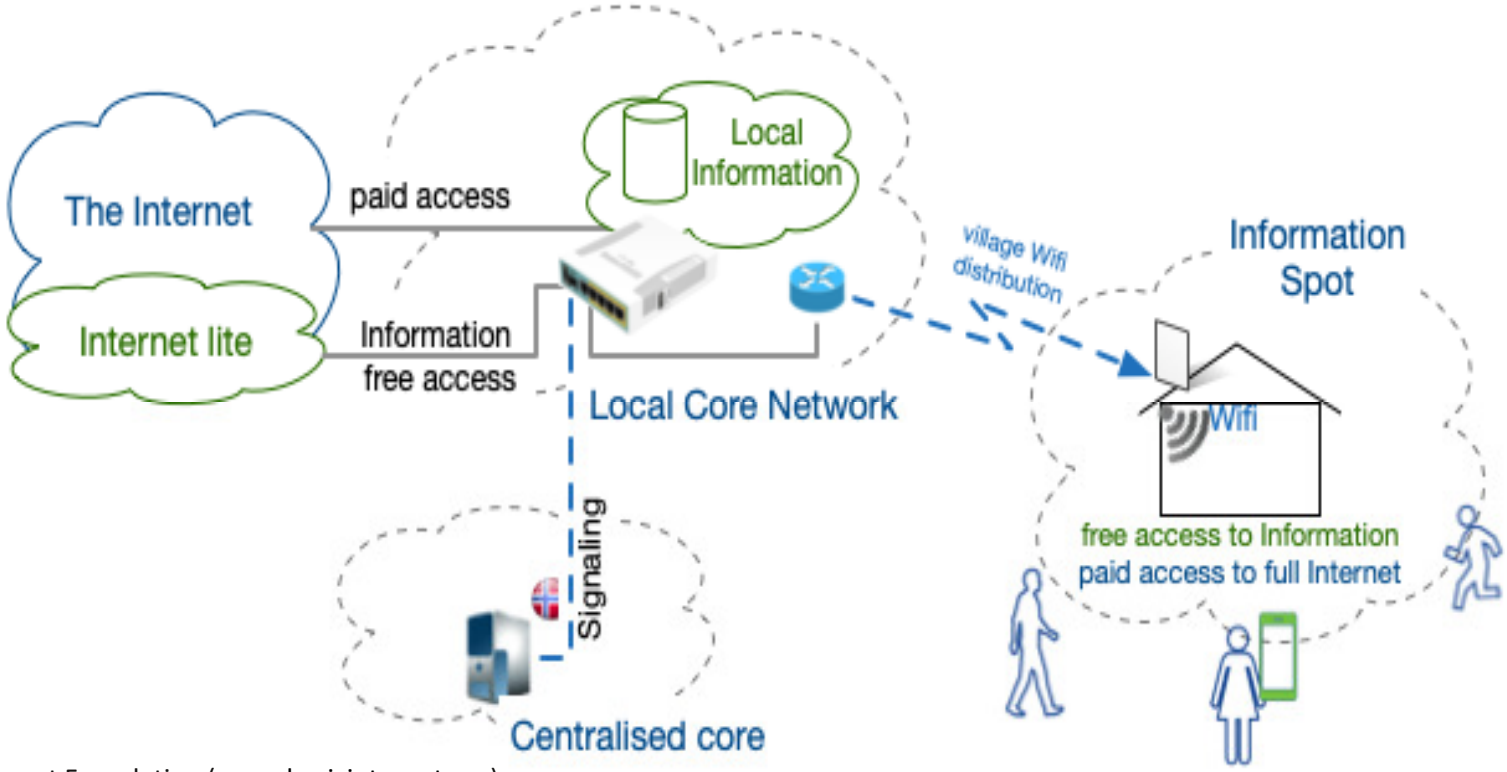


An Architectural Model for Free Access to DPGs



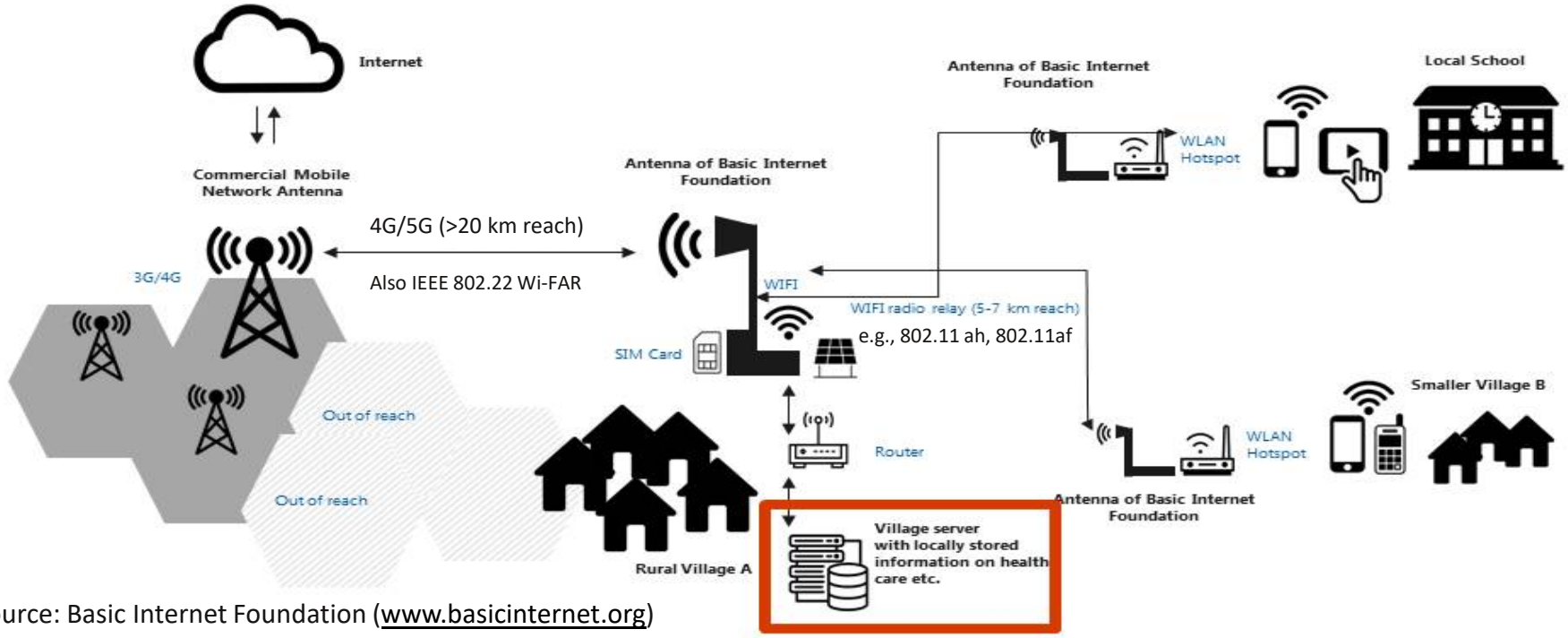
Source: Basic Internet Foundation (www.basicinternet.org)

A Potential Deployment Architecture (based on DPGs)



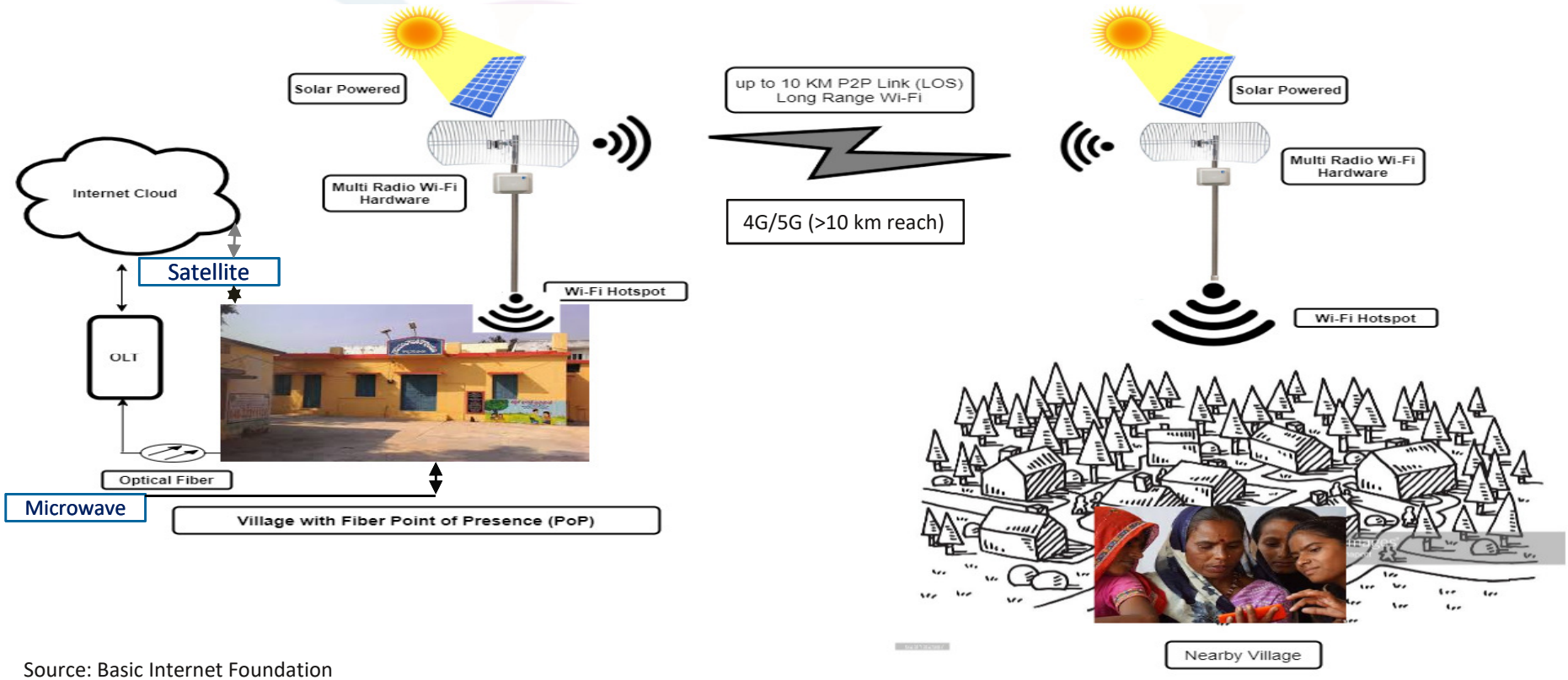
Source: Basic Internet Foundation (www.basicinternet.org)

An Architectural Model for Distributed Deployment of Internet Access



Source: Basic Internet Foundation (www.basicinternet.org)

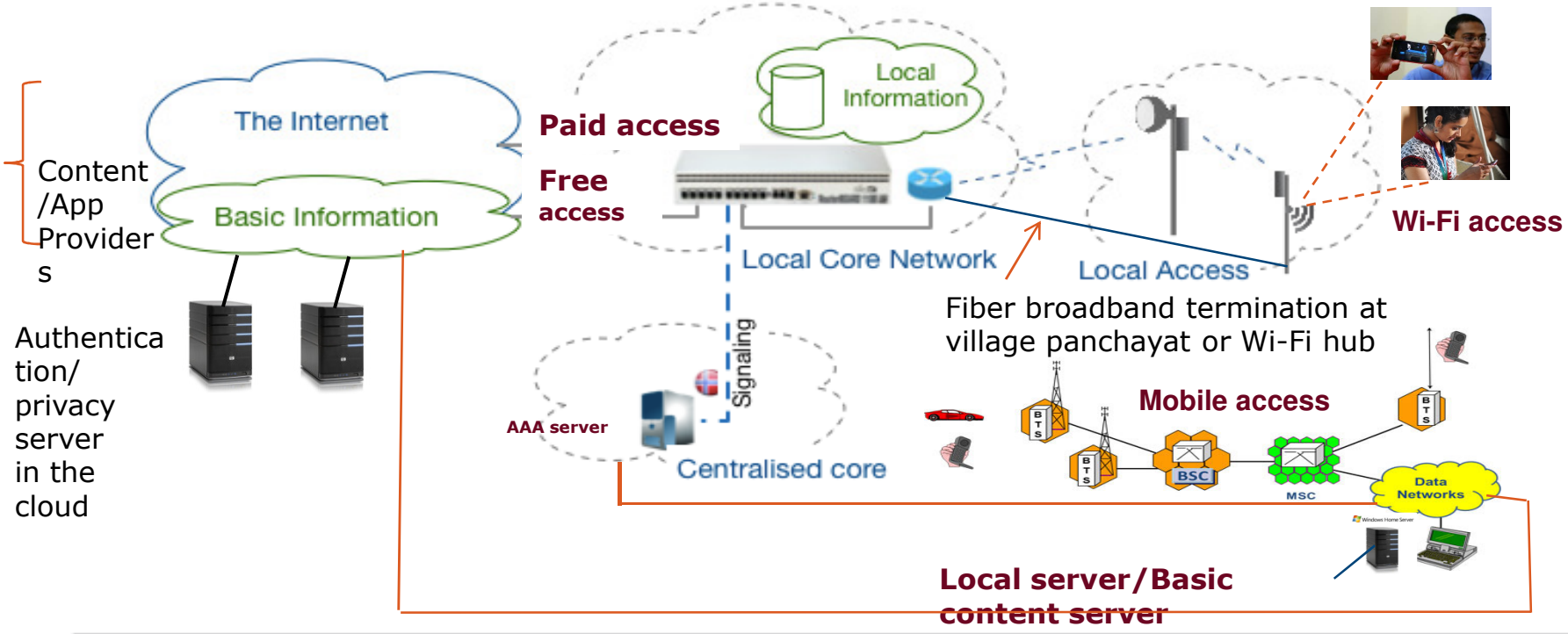
Extending Rural Broadband to Nearby Villages



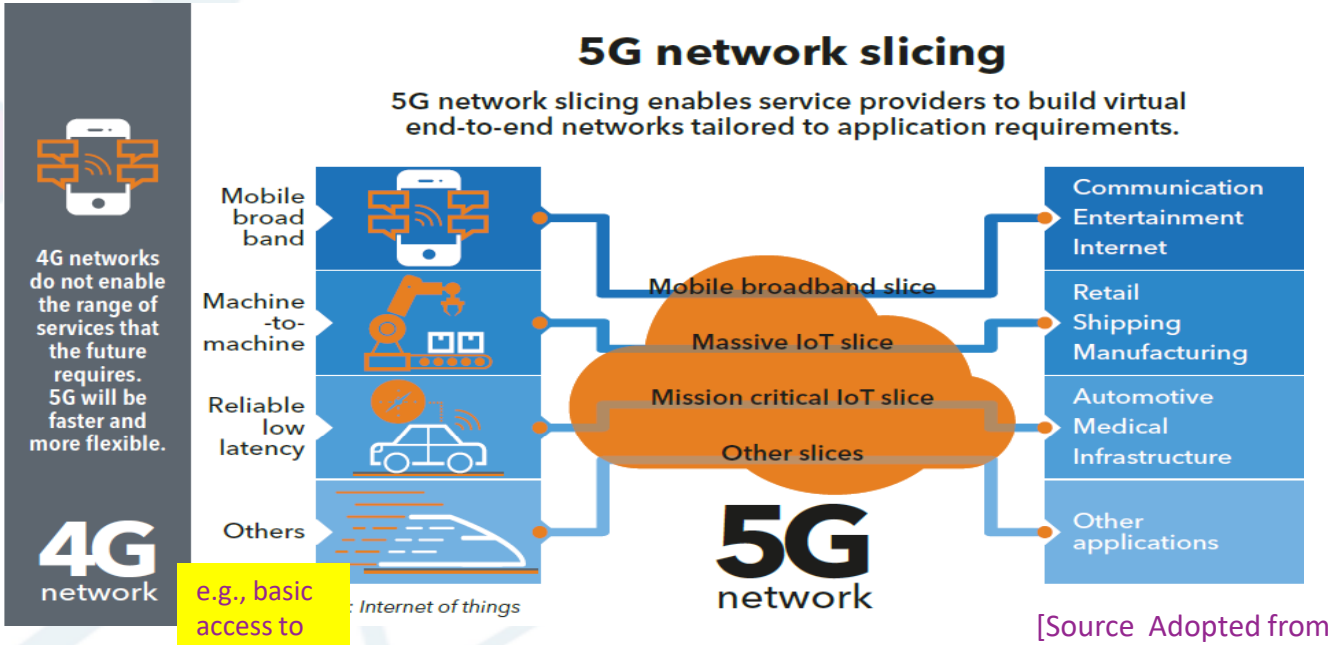
Source: Basic Internet Foundation (www.basicinternet.org)

Extending Rural Broadband to nearyby villages through Wi-Fi Access & Middle mile with Fibre Backhaul

A more detailed systems architecture



5G Network Slicing for Bridging the Digital Divide



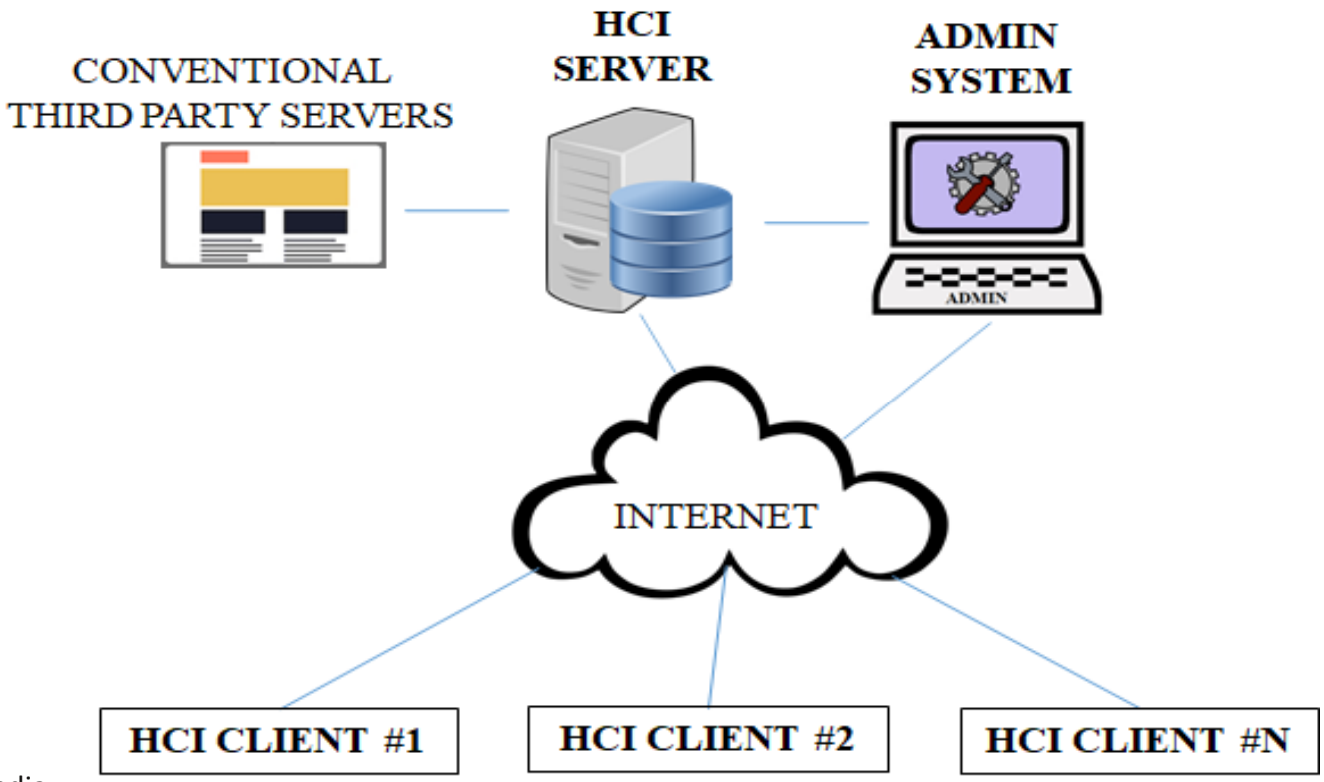
[Source Adopted from sdx Central]

e.g., basic access to Internet by everyone

(1) T. Do, J. Noll, S. Dixit, B. Dzogovic, V. Do, B. Feng, "Reducing Inequalities with 5G Internet Light Network Slice," IEEE 5G World Forum, Santa Clara, USA, 9-11 July, 2018.

(2) J. Noll, S Dixit, D. Radovanovic, M. Morshedi, C. Holst, A. Winkler, "5G Network Slicing for Digital Inclusion," Comsnets 2018, Bangalore, Jan 3 -7 2018.

Deployment Scenario of an HCI System



Source: C-DoT, India

Micro Operator (µO)

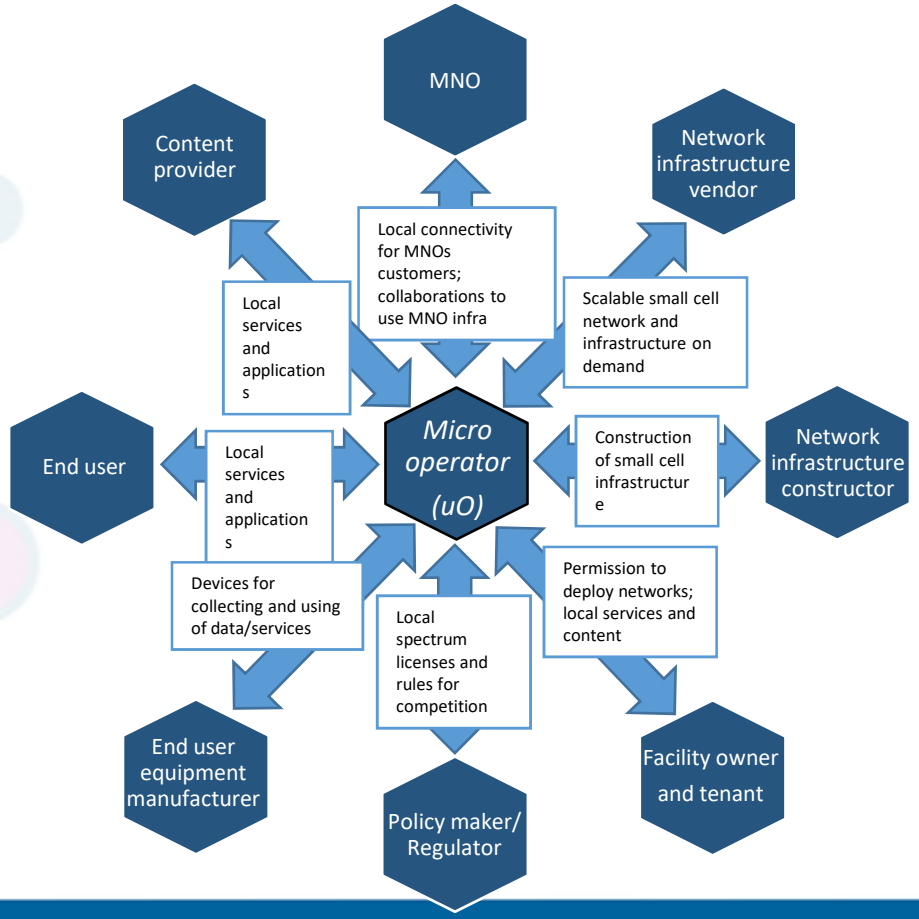
Virtual operator does not have own infrastructure but has own customer base

Micro operator (µO) has own infrastructure but not necessarily own customer base

Revenue models for µOs are not based on monthly fees of bytes
Part of property offering – inclusion to rent
Part of customer service model
Improving the efficiency of public service => savings for society

Possible only via changes in regulation.

Source: 6G Flagship Project, Finland, Oulu University



Significant Accomplishments

- *Released two editions of the CTU chapters, 3rd edition to be released in Nov 2023*
- *Identified areas of standardization*
- *Organized Global competition and summit*
- *WG Participation* – 5GRM-connecting@ieee.org

Highlights of CTU Topics for INGR 2023 Edition

- *Addressing the "digital divide"*
- *Services and applications to meet those needs through a competitive challenge.*

Added sections on D2D communication, spectrum sharing, PM-WANI, TVWS

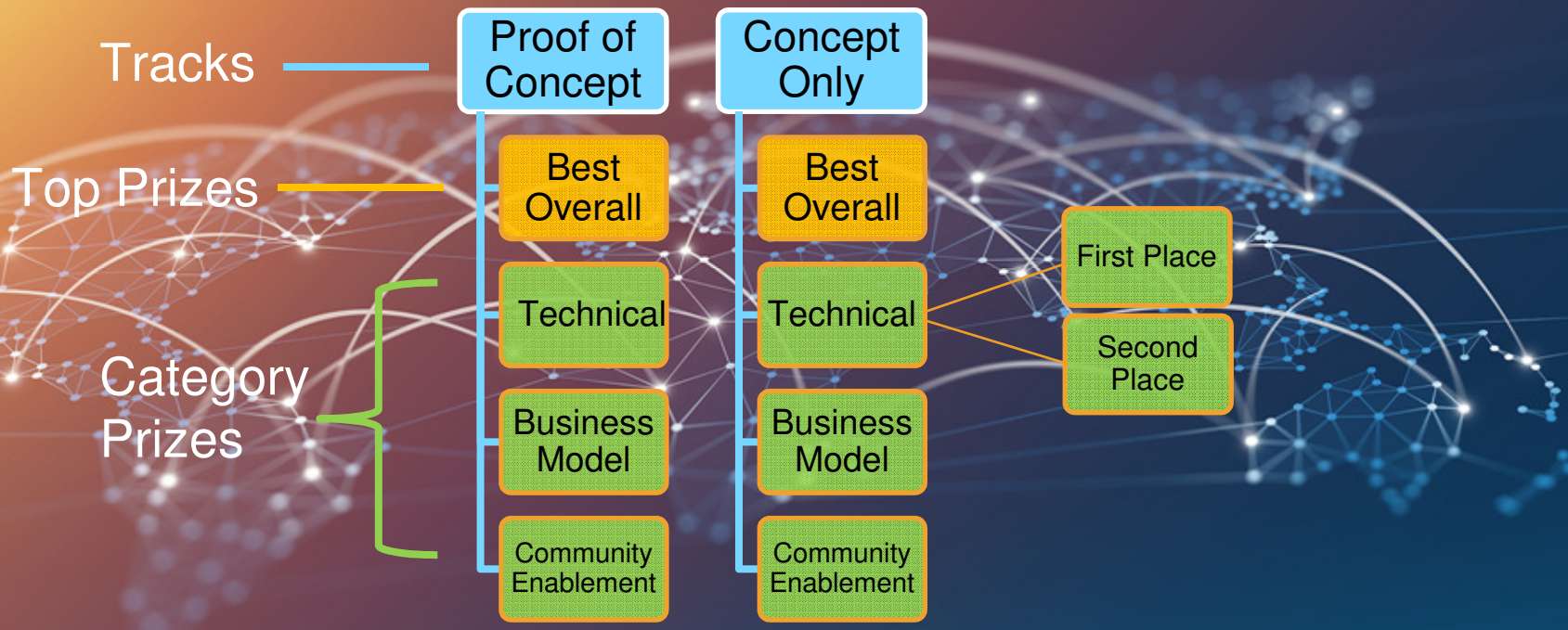
- *Additional work items on IoT, AI, ML and network slicing*
- *Novel business models for any CTU solutions to be commercially sustainable*

IEEE Connecting the UNCONNECTED CHALLENGE

IEEE Future Networks

- What it is
  - Annual competition that rewards early-stage achievements in connectivity
  - Global, open to all
  - Two tracks: Proof of concept, and Concept only
  - Three categories: Technical Applications, Business Models, Community Enablement
  - 3 Judging Phases
    - Phase 1 - Preliminary Abstract & 2 KPI's
    - Phase 2 - Full Format Submission with 9 KPI's
    - Phase 3 - 30 Min Presentations by winning teams

Search for Early-Stage Projects or *Ideas*



IEEE Connecting the UNCONNECTED CHALLENGE

IEEE Future Networks

- What makes it unique
  - Focus on *early-stage* projects and mere ideas
  - Early support both innovators and connectivity
  - IEEE's global membership/talent base
  - Open to IEEE members and non IEEE members
  - Advisory Committee of IEEE and non IEEE members
  - Connect winners with additional funding opportunities

IEEE Connecting the UNCONNECTED CHALLENGE

IEEE Future Networks

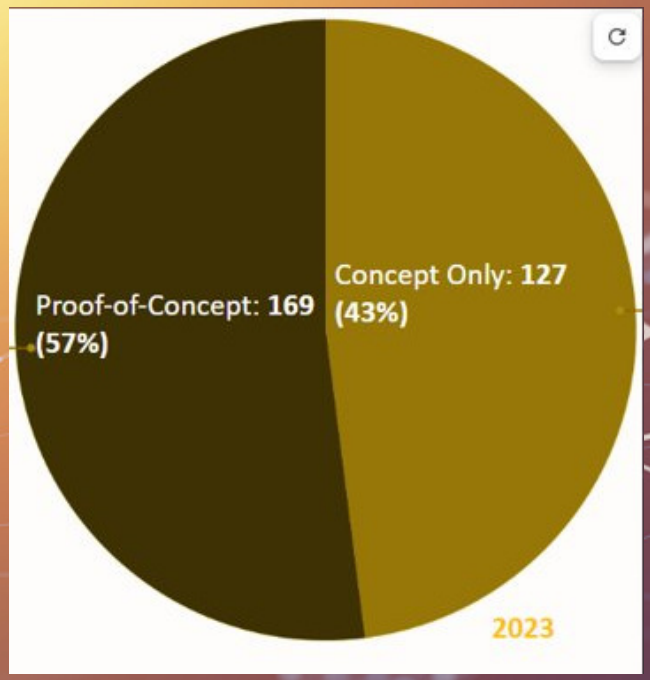
- 2021 – Inaugural Year
  - 257 submissions from 69 countries
  - 11 awardees and 1 honorable mention were recognized
  - $60,000 prize pool
  - Winning teams gave presentations at IEEE CTU Summit
- 2022
  - 226 submissions from 43 countries
  - 13 awardees and 3 honorable mention
  - $67,000 prize pool
  - Winning teams gave presentations at IEEE CTU Summit

IEEE Connecting the UNCONNECTED CHALLENGE

IEEE Future NETWORKS

- **2023 –**
  - 296 submissions received from 43 countries
  - 19% screened out due to relevancy issues
  - 240 submissions reviewed by 41 members of the Selection Committee
  - 137 moved on to Phase II
  - 28 moved on to Phase III
  - 14 technical prize winners
  - $133,000 prize pool
    - + 2 follow up prize/grant opportunities totaling $107,000

2023 CTU Challenge Metrics



Type of Participants	
Companies or commercial entities	26%
Non-profit organizations	32%
Students	12%
Academics/professors	17%
Individuals	9%
Others	4%

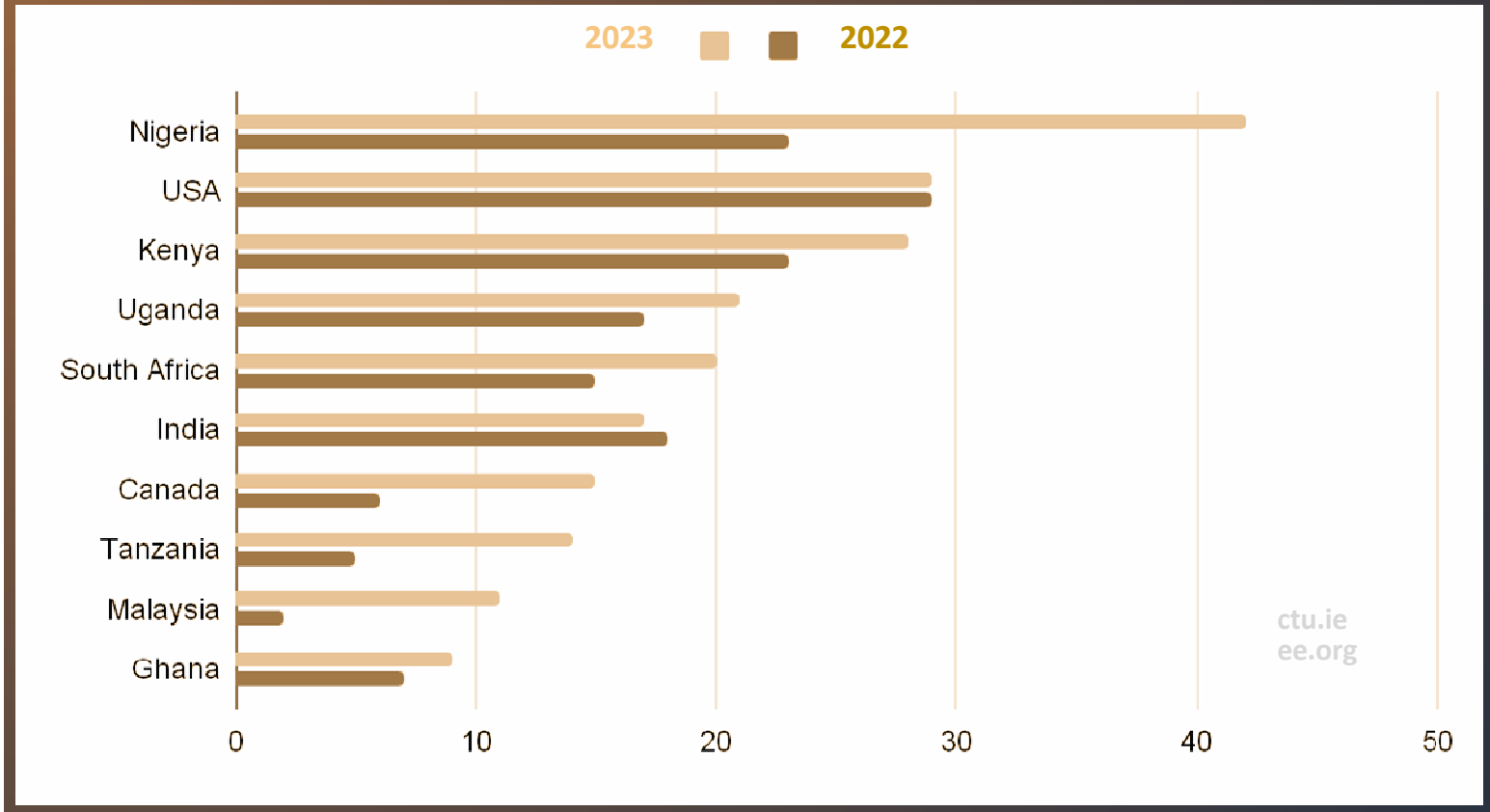
Concept Only: **127**

Proof-of-Concept: **169**

2023 Winner Metrics

- Winners - 19 total prizes/grants awarded
  - 14 technical prizes
  - 1 additional region prize (Best Overall from Canada)
  - 2 additional Gender Inclusion prizes
  - 1 additional Gender Inclusion Idea grant
  - 1 additional Focus on Canada grant (in selection process)
- Concept Only - 7 (50 % of technical prize winners)
  - 1st Place Co TA - Best Overall from Canada
- Proof Of Concept - 7 (50 % of technical prize winners)
- Honorable Mentions - 0

Country of Submission - 2023 v/s 2022



Country	2023	2022
Nigeria	42	23
USA	29	29
Kenya	28	23
Uganda	21	17
South Africa	20	15
India	17	18
Canada	15	6
Tanzania	14	5
Malaysia	11	2
Ghana	9	7

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If you would like to join the working group please send mail to:
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