

Unofficial Notes

Pacific Telecommunications Council

Annual Conference – PTC'23

January 15-18, 2023

Honolulu, HI



Financial, Valuation, and Industry Consulting

NOTICE: These notes were taken live at the PTC'23 in Honolulu, HI, January 15th to 18th 2023. They are a good-faith representation of our impressions of the events and what was said by participants. However, we cannot guarantee the accuracy of any specific comment. These notes are not endorsed by the Pacific Telecommunication Counsel in any way. This document is not a recommendation to buy or sell any security. Please consult with appropriate professional advisors before making significant business decisions. Comments and corrections are welcome.

EXECUTIVE SUMMARY

One veteran consultant declared, “The PTC conference is the Davos of the telecom sector! Attendees have lots of honest unplanned conversations about a range of topics.” While that may be a slightly generous take, the PTC conference always features an exceptional give and take between segments of the communications sector that often operate in silos.

Like news reports from Davos, most executive at PTC cautious about the global economic outlook, expecting a recession or at least lull in the market. Companies have had challenges with inflation, rising interest rates, and lingering supply chain challenges. Executive emphasized, where possible, their companies’ strong cash positions and other factors allowing them to ride out the economic cycle.

Regulation, consolidation, ESG and latency were central intertwined themes. Its clear senior executives have taken environmental responsibilities seriously. Several executives indicated that for data centers, having a zero-carbon plan was “table stakes” – needed to even be considered by major customers. Zero carbon policies, especially if considering the supply chain, require deep reviews of internal operations, those of suppliers and investment in new technologies, often forcing consolidation. Data centers expect significant growth and pressure to build closes to the edge to reduce latency. However, planned data centers are face increasing permitting challenges and pressure to minimize their impact on local communities (noise, electric use, water use, etc.). Undersea cable projects are proceeding, including a major replacement cycle for fiber laid ~20 year ago in the turn of the century TMT bubble. However, many of these projects are being delayed by increasingly difficult international permitting processes, often based on conservation principles. Undersea cable permitting is expected to become more difficult, particularly in Latin America with the rise of several left-wing governments.

Mobile operators are rapidly deploying 5G internationally, with over 170 systems operational globally - the fastest rollout of any of the wireless technologies to date. Expanding business models to serve fixed locations, managing expanding data demand, and digital inclusion were sub themes. Notably, the major wireless operators were not in attendance.

The role of satellite is evolving. New Very High Throughput Satellites (“VHTS”), e.g., ViaSat-3 and Non-Geostationary Satellite (“NGSO”) systems such as Starlink, portend to expand satellite’s role as an increasingly cost-effective alternative in hard to provision areas. NGSO systems will also reduce the traditional satellite latency issue. However, here again the issue of regulation arises with many governments in areas which might benefit the most from satellite, adding increasingly onerous requirements for market access.

Note: Multiple sessions were running simultaneously, so I was not able to summarize all of them.



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DAY ONE: SUNDAY JANUARY 15, 2023

A. SUBMARINE CABLE GATHERING & POSTER SESSION

08:30 – 09:00

- *Maximizing the Value of Legacy Subsea Cables*; Dr. Steve Grubb & Dr. Marc Stephens
- *DIB Working Group*; Tabata Materan
- *SubOptic Foundation*; Erick Contag
- *International Maritime Organization's Measures for Environmental Sustainability: A Potential Model for the Future of Subsea Cable Industry*; Anjali Sugadev & Hunter Vaughan
- *Automation for Submarine Cable Planning and Management*, Rob Roy
- *Sustainable Subsea Networks*; George Ramirez, Nicole Starosielski, Anjali Sugadev & Hunter Vaughan
- *A Carbon Footprint Model for a Subsea Cable System*; Nicole Starosielski, Kristian Nielsen, Anne Pasek & Meg Congram
- *Using GIS Technology to Visualize the Submarine Cable Market*, Kieran Clark
- *Open Cable Management Working Group*; Darwin Evans

[AM Comment: No presentations in this session. It was essentially a coffee break session with a series of submarine cable posers in the room. Submarine cable seems to make good fodder for interesting posters]

B. SUBMARINE CABLE WORKSHOP 1: AROUND THE WORLD UPDATE: HERE, THERE & EVERYWHERE

09:00–10:30

Tony Mosley, Director of Business Development, Ocean Specialists, Inc., USA
(MODERATOR)

Kent Bressie, Partner & Head of International Practice, HWG LLP, USA (PRESENTER)

Erick Contag, President & Trustee, SubOptic Association, USA (PANELIST)

Paul Gabla, Chief Sales & Marketing Officer, Alcatel Submarine Networks, France
(PANELIST)

Eric Handa, Co-Founder & CEO, APTelecom, USA (PANELIST)

Wayne Nielsen, Managing Director, WFN Strategies, LLC, USA (PANELIST)

Takahisa Ohta, Senior Director, NEC Corporation, Japan (PANELIST)

[AM Comment: Presentations captured overview of trends as opposed to a cable-by-cable construction update]

- Eric Handa, APTelecom – Indian Ocean Region
 - Indian ocean region is large – 2.7 billion people (including India)
 - Access is being denied to West Coast [of IOR], need to rebalance, and send traffic to Europe
 - Long mean time to repair in the region
 - Lots of national hazards – there is a need for more diversity
 - Permitting can be a lengthy process [AM Comment: Regulatory delays were a recurring theme]
 - DAS – distributed acoustic sensing technology is coming to the region
 - We are definitely in a boom – bullish on interregional connectivity
 - Eleven cable totaling 110,000 km are entering service
- Takashisa Ohta, NEC – Pacific and Oceania Projects
 - Strong demand from NE Asia, Japan, Australia, & U.S.)
 - Connectivity Demand (island countries)
 - Several projects are underway
- Paul Gabla, Alactel (Europe and Africa)
 - Several routes connecting US and Europe
 - Significant activity in the Middle East as it is between Europe and Asia
 - Activity to bring Africa into high-capacity realm – this is new and will help Africa join the digital economy
 - Permitting is becoming an increasingly difficult and lengthy process
- Wayne Neilson, WFN Strategies (Atlantic and Arctic Market)
 - 19 Atlantic systems, and 53% are over 13 years old
 - 2008-2015 – no new systems, but 1/year since (8 totaled added)
 - 2023-2026 – 4 systems planned
 - Some new systems are moving away from London-NY route
 - Will improve diversity
 - Atlantic is most competitive route
 - 2016-2020 – lit capacity grew more than total capacity
 - Demand growth now seems to be outpacing new systems
 - Arctic
 - Two new arctic systems since 2017 and three planned through 2026
 - Arctic reduces latency with Europe and eliminates bottlenecks such as Suez
 - But Arctic routes are unproven as are maintenance scenarios
 - Geopolitics are an issue – what are the odds a Europe-Asia route will go through Russia?
- Erick Contag, SubOptic Association (Latin America and Antarctic)

- Latin America
 - Resurgence of the left will lead to higher tax burdens also risk of nationalism
 - But still growth
 - Seeing 35% to 40% annual growth is normal. Much of the growth is due to new wireless networks, esp. in Brazil
 - Several projects are on the drawing board
 - Asian gateway between Sydney and Valparaiso Chile – will need some government funding
 - Antarctica
 - Satellites are not enough (not sure he has considered new NGSO satellites)
 - Poss. project to connect cost of Antarctica with New Zealand
 - Also putting data center in New Zealand
 - A few other plans that are in various stages of planning
 - Some legacy systems need to be replaced
 - Will see a slowdown in permitting despite efforts to modernize
 - Smaller islands have historically been passings, but expect to see more activity there in the future
- Kent Bressie, Harris Wiltshire Grannis (Regulatory Overview)
 - Lots of economic disagreements
 - BBNJ (Biodiversity Beyond National Jurisdiction)
 - Existing regimes were creating a “tragedy of the commons” and ICPC trying to resolve this [AM Comment: This is somewhat analogous to space junk in the satellite sector]
 - Treaty will create areas of marine protection areas (MPAs), but it creates problems for repair and access in the future. Want submarine cable treated as a stakeholder
 - We don’t have a submarine cable inter-governmental organization, so they are often treated with more restrictive default rules
 - All creating a framework for areas outside of jurisdiction
 - Still protected areas with jurisdictions
 - In the US there are two types of MPAs
 - National Marine Sanctuaries Act
 - Sanctuaries managers have lots of discretion – do not want any cable landings in N. California, so there are none, despite presence of Silicon Valley
 - Antiquities Act
 - NOAA is bias against commercial activities
 - No agency to support undersea cable construction
 - [AM Comment: negative outlook, drumming-up need for lobbying – but highly effective]
 - Offshore wind

- Creates risk of damage if wind farms aren't coordinated with undersea cable companies
- Want to have early-stage coordination
- International Seabed Authority (“ISA”) and deep seabed mining
 - Need to protect cables
 - Nauru wants to exploit seabed, will have some additional contentious sessions
- Cabotage and protectionism
 - Now less opening of trade and more protectionism in the sea
 - More moves to treat cable repair and local and require domestically flagged ship. In India and US are pushing this way
- Nordsea Pipeline has created concerns
 - Governments are too focused on rare malicious threats than all threats (most are from fishing and anchors)
 - Should take a more holistic approach and share data
- USA: Team Telecom
 - Excessively focused on foreign ownership rather than actual threat [AM Comment: foreign ownership is a trigger for FCC review, although almost all cables are reviewed, but security mitigation provisions go well beyond foreign ownership matters]
 - Routine cases are now faster, but process remains unpredictable
 - Compliance is burdensome
- USA: FCC
 - FCC has not done much despite taking first steps
 - Proposal to replace international bureau with Space Bureau and no discussion of submarine cable – no efforts to support the submarine cable industry as they have with the satellite industry.
- ICPC is doing a lot to try to help [AM Comment: Mr. Bressie is ICPC's international legal advisor]
 - Among other things, charting needs to be improved
 - Trying to help members with cable damage claims processes

C. SUBMARINE CABLE WORKSHOP 2: KEYNOTE PANEL PART 1 - LEADING BY EXAMPLE

Nicole Starosielski, Associate Professor of Media, Culture, and Communication, New York University, USA (MODERATOR)

Emmanuel Danjou, Head of Business Development, Alcatel Submarine Networks, France (PANELIST)

Didier Dillard, Chief Executive Officer Orange Marine, Orange, France (PANELIST)

Takahiro Kashima, Professional, NEC Corporation, Japan (PANELIST)



Peder Nærbø, Founder and Chairman, Bulk Infrastructure Group, Norway (PANELIST)

Andrew Robinson, Director System Engineering, Xtera, Inc., Canada (PANELIST)

- Takahiro Kashima, NEC
 - Heads marking of undersea cable
 - Want to be Net zero carbon emission by 2040 from own and entire supply chain
 - Reduce own electric consumption
 - Added solar power
 - Can transmit excess power to other factories
 - Add Wind farm
 - Supply Chain
 - Need to survey supplies electric use and carbon emission
 - Wide range as some suppliers don't even know their electric use or carbon emission
 - Set targets for CO2 emission from customers

- Didier Dillard, Orange Marine
 - One of oldest cable ship companies in the world starting in the 19th century
 - Seven ships in operation
 - Manufacture ROVs for repairing cables
 - Four categories
 - Try to go beyond regulatory requirements (waste treatment, etc.) – first ship owner to get green marine award
 - Update internal operations
 - Use shore power, when possible, as opposed to using generators on board
 - Added solar panels in parts of southern France – produce more power than needed and added back to the French national network
 - Partner with NGOs such as Euro Argo to help with testing water, counting sea mammals, and things like this – adds minimal time to each project
 - Reduce carbon emission on vessels – cannot have a large impact without new vessels. Moving from two diesel engine with a battery back-up. Will have more flexibility to adjust engine power. Improved hull design to reduce drag. Still only improves 20-25%

- Andrew Robinson, Xtera
 - Wet plant technology
 - Smaller repeaters – uses less materials, etc.
 - Intelligent powering
 - Can reuse many cables for certain applications

- Emanuel Danjou (Alcatel)
 - What have we done?



- 2021 developed a Green Charter
 - Doing ISO26000, and CSR certification
- 100% of waste recycled
- Use renewable energy, LED lighting, solar panels in cable landing stations, etc.
- Reduce power per bit by 70% with special division multiplexing (SDM) technology
- What we will do
 - DAS sensing creates mapping of the sea
 - Partnership with environmental organization for improving sea biodiversity
- Peder Naerboe, Bulk Infrastructure Group
 - Electricity maps to put infrastructure in areas where they do less damage and have lots of power (i.e., Norway)
 - In Southern Norway, can get a gigawatt of power
 - Added data centers and interconnected with fiber
 - Move data to the power – places like Nordics and Canada
 - Happy Valley Goose Bay has massive power requirements
 - Europe needs to report CO2 on annual reports every year

[AM Comment: Massive emphasis on environmental goals. The industry appears to be taking it quite seriously across various countries]

D. TELEGEOGRAPHY WORKSHOP

14:00–15:15:

Brianna Boudreau, Senior Research Manager, TeleGeography, USA (PRESENTER)

Jonathan Hjembo, Senior Manager, TeleGeography, USA (PRESENTER)

Alan Mauldin, Research Director, TeleGeography, USA (PRESENTER)

- Brianna Bourdreau
 - Big new investment in submarine cable, especially in Asia
 - Price erosion continues, but has slowed
- Alan Mauldin, Telegeography
 - 20 years ago, 42% if all internet traffic went through the US
 - The highest connected networks all went through the US
 - Content providers networks were heavily US centric
 - Now US as % of connected capacity from 42% to 27%
 - Share of interregional connectivity is now 80% down from ~90%
 - Asia and Europe now connect less to the US as they have more intra-regional connectivity

- US is not important for Middle East and Africa – they connect locally
- Almost all international traffic from Latin America is going through the US
- More US-centricity for cloud, content providers
- Changes due to more local interconnections, CDN and Caches have move content locally, so they do not need to go to the US
 - Cloud regions are being made local
- More new investment is in cables to do not link to the US (2021-2025, 70% is not linked to the US)
- US price advantage has narrowed significantly, and US is not always best located
- 82% of Brazil's international connections are to the US
- 29% of operators have at least one link to the US
- Europe Asia investment will not replace US-Asia routes
- US Centricity is not declining
- Slides are available – go to website (<https://www2.telegeography.com/ptc-2023>)

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E. WTA WORKSHOP: MANAGING MULTI-LAYER CONNECTIVITY

15:30–16:45

Randall Barney, Director of the Certification and Membership, World Teleport Association (WTA), USA (MODERATOR)

John Brader, VP/GM Satellite Services, SageNet, USA (PANELIST)

Chris Faletra, Senior Director Infrastructure Services, COMSAT, USA (PANELIST)

Steve Richeson, VP Sales & Marketing, Mission Microwave, USA (PANELIST)

Richard Swardh, Sr VP, Comtech, USA (PANELIST)

- Chris Faletra, Comsat
 - Ground terminals and modems are limiting factors
 - Handheld device is long-term at this point
 - Eutelsat's Orchestra will be multi-layer, but everyone is going about things differently
 - Teleport operators will need to look at business different and have lots of infrastructure in place to connect the different layers
 - Need to be ready for multiple hub architecture
 - Looking at "Teleport as a service" – manage cloud, etc.
 - Teleport operator needs to get out of manager services attitude, but that teleport operator is facilitating their customers to do things and supporting them
 - OneWeb covers most of the Arctic region with 7-10 Gbps, Telesat's Lightspeed will put lots of capacity in the Arctic

- John Brayer, SageNet
 - Multi-layer networks have been going a long time with satellite
 - Today's [multi-layer] satellites are really multi-orbit services.
 - Software defined satellite have been discussed for a long time. Really only two up so far (Eutelsat) and some more coming from Inmarsat
 - Different layers will have different needs
 - SES is the only one that can do a multi-layer solution on their own
 - We can do it for customers as needed
 - Will need more uniformity to get generic hardware that will work anywhere
 - Looking to outsource one of our teleports due to the amount of space needed to host platforms and it needs to keep-up with new satellite systems
 - There has been some decline in GEO investment
 - GEOs are perfect vehicles for controlling data to other orbits – may not be used with direct connection to customers
 - New battery technology is improving live of GEO satellites

- Richard Swardth, Comtech
 - Software is disrupting the telco sector and it is not happening in the satellite sector
 - Satellite seems to lag telco trends by a few years
 - All satellite operators have bespoke solutions that don't work together.
 - Need a good systems integrator to stitch them together at the IP layer
 - Teleport operators have it difficult due to packaged solutions
 - Lots of software virtualization which provides lots of flexibility
 - Helps to solve the issue of standards as the software can manage the different standards – like Open RAN
 - Satellite provides lots of applications, the new phone service will provide low bandwidth SMS-type emergency services
 - Satellite will not compete with fiber, but can increasingly offer a good service

- Steven Richeson, Mission Microwave
 - Customers are looking for the “Swiss Army” terminals that will do everything, but lots of things in the way including certifications. Military certifications are very rigorous
 - If you get a terminal certified you cannot change it, but new constellations will need some flexibility. This creates “gotch-yas” for multi-layer antennas
 - How do you get value out of multi-layer capability? Its not clear
 - More layers of complexity make it harder for teleports – need to show the benefit of simplifying that to customers
 - We are in early days of virtualization of RF
 - Satellite is a good back-up solution
 - Less investment in GEO, but pricing is declining for building and time frames are accelerating



[AM Comment: Satellite still has a serious standards problem that is slowing the drive to less expensive ground equipment. Everyone knows it, but no one can seem to find a solution]

F. GREAT LAWN OPENING RECEPTION

- Annual evening reception
 - Entertainment was excellent with traditional Hawaiian dancers – hula and fire dances with some audience participation
 - Well attended but
 - Food was not as varied as in past years
 - No mixed drinks as in past years
 - Lawn was worn to dirt in many places



Hawaiian Dancing at Opening Reception

DAY TWO: MONDAY, DECEMBER 16, 2023

G.WHY INTERNET CONNECTIVITY MATTERS MORE THAN EVER FOR THE PACIFIC RIM

David Schaeffer, CEO and Founder, Cogent

- 23% per year deflation
 - Cogent made bet that Internet is dominant network
- Internet is amalgamation of networks
 - Telcos wanted to be toll keepers
 - Open architecture with no specific purposes
- Delivery
 - Wireless 5G
 - Twisted pair - limits
 - Coax cable – dominated connectivity to end users
 - Fiber - more for last mile
 - Cost per but is much lower
 - Should be everywhere to end user
- 7.5 billion in world with 5.3 billion with Internet access
 - Internet allows development of new business models and innovation
 - 1% annual GDP growth is due to the internet. It flattens the world
 - Internet adapted well during pandemic
 - Would not have been possible 10-15 years ago
- Moore's law is running up against physical limits of materials
 - Heat dissipation, etc.
- Need for centralizing computing processing and content
 - Hyperscale's have centralized in ~40 global location – warehouses of computing and data – this trend will continue
 - 4% of global power is going to data centers and this will continue to increase
 - Faster increase in Pacific Rim

[AM Comment: Throughout the conference there were extensive discussions about green/energy conservation efforts in the industry]

- Marking is moving to mobile even though the deliver is not as efficient
 - Market is trying to figure out which application should go wireless, and which should be wireline
 - Unicasting uses far more capacity and transforms society – everyone is a publisher
- Legacy access networks are under significant financial pressure
 - This is natural and good
- For the next 20-30 years, Internet will dominate

- Need to build next generation networks while keeping pricing low and not too much regulation
- Censorship when access providers trying to charge tolls to reach end users
 - This is not positive, less now than in the last five years
 - Service providers need to get away from the idea they own customers' eyeballs
- Most Internet models have been free "ad based," but less than 1% of GDP is advertising. Subscription opens-up other subscription-based models
- Decoupling the applications from the networks allows more innovation
 - Service providers need to provide adequate returns to investors
 - Make sure service providers are transparent to application – must be enablers as opposed to gatekeepers
 - This is hard exp. If there is an existing business (e.g., telco)
 - Should welcome apps that use lots of bandwidth
 - Telecom used to >4% of GDP, now just over 1% of GDP, but falling fast as industry gets more efficient
- "Smart People buy Dumb Pipes"

H. CHALLENGES AND OPPORTUNITIES IN THE DIGITAL INFRASTRUCTURE SECTOR

Marc Ganzi, CEO DigitalBridge

- \$60 million in digital assets, on 27 digital portfolio companies with 100+ infrastructure professionals
- Headed into a storm
 - Netomnia has a strong platform, transform, and scale and then get customers
 - Customers need help –
- Had a strong 3Q
 - Data center businesses grew 33% y/y and continues into 4q
 - Customers continue to spend money
 - Fiber is growing slower
 - Small Cell/Edge is where the opportunities lie
 - Delevered in downturn due to long-term contracts and securitized contacts and extended debt term to navigate the cycle
- Compared 2023 with 2009 and 2002!
- Own your own dirt
- Most customers emphasize owning their network
- Renewable power is a requirement – table stakes
- Pricing is no moving back in our favor
- Pricing power returned to data center operators in 2022 and will continue into 2023
- Demand is growing, but supply is constrained

- Switch as lots of room to growth – more than major competitors combined
- Being private, team can think long-term
 - Paid high price for Switch, but it was justified
 - [AM Comment: This was more of a sales talk about his company's financial performance]

I. FROM BOOTSTRAPPED TO BILLIONS: A GO-TO-MARKET SUCCESS STORY

Henry Schuck, Founder and CEO, Zoom Info

- Started with book report and then;
 - Added contact information
 - Then added selling signals. New people, website visits etc. so these can be incorporated in company
- Only 2% of people on website ever fill out a form
 - 70% of firms don't respond to leads on website
 - Most just send an e-mail. Only 12% respond within 30 minutes
 - No follow-up in other areas
 - Less than 3% even tried more than on follow-up
- Very important to follow-up quickly
 - Delay lowers closing rate quickly
 - Almost no one called leads in person
- Method
 - Identify the firms you sell to
 - Identify the people you sell to
 - Identify what makes the best fit for prospect
 - How to automate motion to appeal to target companies
 - Based on info suggesting they are in market for your services (intent spikes)
- In 10 years, companies that don't follow-up on form fills won't be in business
 - Starts with CRM
- Need to make "go to market a strategic advantage"

J. INFRASTRUCTURE INVESTMENT

10:45–11:20

Jonathan Atkin, Managing Director, Global Head - Communications Infrastructure, RBC Capital Markets, USA (MODERATOR)

Ariana Batori, Senior Investment Officer / Global Lead Broadband Investments, IFC - International Finance Corporation, USA (PANELIST)

Peter Hopper, Managing Director, DigitalBridge, USA (PANELIST)

Kristin O'Connor Leung, Managing Director, GIC Real Estate, USA (PANELIST)

- Ariana Batori, IFC
 - 5G deployment is in early stages
 - Not all 5G capex will be done by carriers or tower companies
 - Different types of contracts put capex spend on different parties
 - Operators in Africa have had to deal with power and have become logistics companies. In other areas, tower companies will need to learn some of these skills as well.
 - Question if tower companies should become digital infrastructure companies as opposed to staying with core business
 - Looking at satellites and options. Hope for direct to mobile satellite.
 - Have done equity and debt deals with subsea cables, but it is hard because the investments are not liquid
 - Hyperscalers continue to expand regions and opportunity zones
 - New data centers drive fiber connections, etc.
 - Most companies came out of pandemic more digitally enabled than before they went in
 - IFC focuses exclusively on private sector companies – can't invest in a telco that is majority government owned
 - Also graduated so less investment to companies as their country's income grows

- Kristin O'Connor Leung, GIC
 - Office tower market is tough
 - Industrial assets are simpler. Data centers have cost of capital about 100 bps higher
 - Concern about slowing in demand for datacenters due to cloud providers slowing, but have not seen that for those with power availability and go to market advantages
 - Hyperscalers often take lots of capacity and then need to take time to digest
 - Have appetite to put money into digital assets, but not at yesterday's prices. Deal processes are getting elongated due to disconnect between buyer and seller expectations. It's getting harder to find others to co-invest with us

- Peter Hopper, DigitalBridge
 - Global tower operators – see lots of growth from 5G
 - US story tends to play out over the rest of the world over time
 - Hyperscalers will need to go to South America and infrastructure will need to deploy make that possible

- Don't have any satellite investments, but don't have enough expertise to want to jump into it. Concerned about long-term pricing due to increased supply. Need to know where we are in the maturation of market
- May have subsea investments in time, but also have concerns because largest customers are building ng their own cables. But may make sense to partner with them – not now
- Cloud growth may be slowing, but still growing ~25% - lots of growth and not impacting demand for our portfolio companies

Fund raising is harder due to higher interest rates, cap rates have risen a bit, but it is situational. As volatility drops, cap rates will come back in

K. DAY TWO LIGHTNING TALKS

12:15-13:15

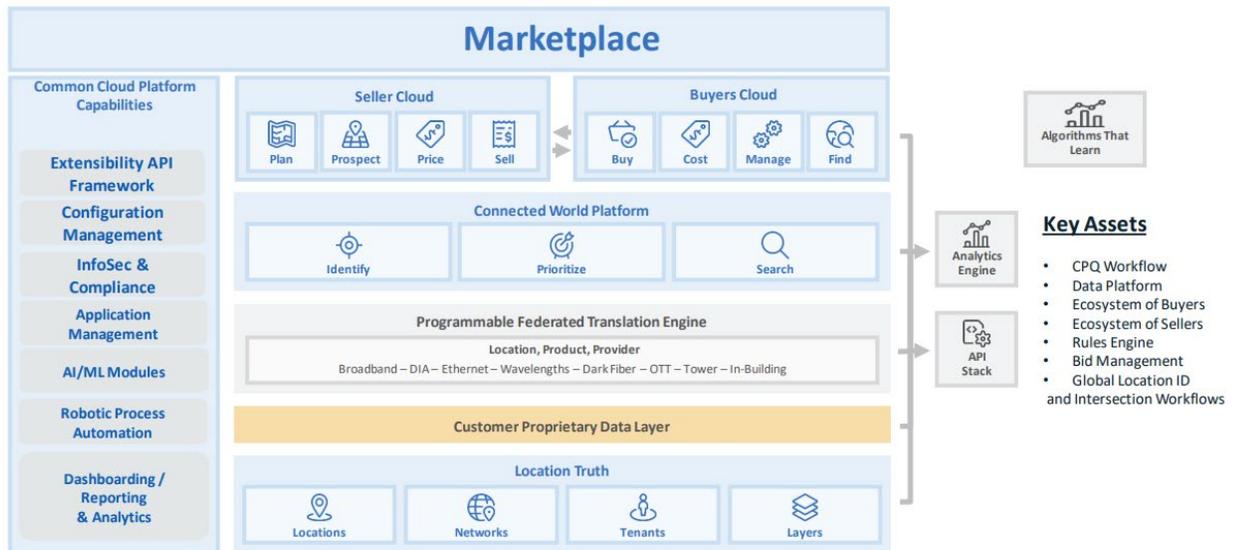
Dean Bubley, Director, Disruptive Analysis, United Kingdom (MODERATOR)

1. HOW TO VALUE SPECTRUM

- **J. Armand Musey, President, Summit Ridge Group, LLC (PRESENTER)**
 - Spectrum is an intangible asset with many attributes of land
 - But spectrum licenses don't have specific property rights
 - Spectrum value can be measured by license holder (commercial value), improvement to economic growth, and social value (improved access to health, education, etc.)
 - Commercial value typically valued on the basis of comparable transactions \$/MHz-PoP
 - Comparables must be carefully evaluated
 - Valuations are highly volatile due to low numbers of bidders and other factors

2. HIDING IN PLAIN SITE: CONNECTIVITY AS THE BEST POINT OF DIFFERENTIATION AND DRIVER OF CUSTOMER EXPERIENCE FOR SERVICE PROVIDERS

- **Ben Edmond, CEO/Founder, Connectbase, USA (PRESENTER)**
 - Connectbase platform has a variety of tools, including continuously update network location data
 - Allows for purchase and sale of real time connectivity
 - The clip form Connectbase's presentation below probably describes it best:



3. POLITICAL, SOCIAL, AND ETHICAL ISSUES IN WEB3 AND THE METAVERSE

- **Nir Kshetri, Professor, Bryan School of Business and Economics, University of North Carolina-Greensboro, USA (PRESENTER)**

- Summary of academic paper that analyzes national, political, global geopolitical, ethical, social, and environmental issues associated with Web3 and the metaverse
- DAOs are transformative applications of Web3. They are self-managed organizations that are run by blockchain-based smart contracts and with their own bylaws and rules of procedure
- There have also been concerns that enemy states may engage in a new kind of cyberwarfare using the metaverse to attack each other
- A key policy concern for nations is that Web3 can also create challenges for modern states in a variety of tasks they perform, such as enforcing laws and collecting tax from sales
- Western technology companies' use of what some perceive as unfair and deceptive practices to collect data needed to build Web3 and metaverse applications have also been controversial

4. THE IMPORTANCE OF STRUCTURED CABLING

- **Cade Lever, Technical Director, Codecom, Australia (PRESENTER)**

- Overview of Codecom's custom fit cable solutions and their benefits in terms of space saving, ease of installation, durability, and other factors

5. SOME CURRENT RADIOFREQUENCY SPECTRUM REGULATORY ISSUES

- **Chip Yorkgitis, Partner, Kelley Drye & Warren LLP, USA (PRESENTER)**



- Detailed overview of the challenges facing regulators in dealing with receivers sensitive to signals outside of their specified frequencies
- FCC has historically not regulated receivers, but receivers are at the center of controversial proceedings
 - GPS and Ligado
 - C-band and airplane and helicopter altimeters
- FCC is slowly moving towards putting increased responsibility on receiver manufacturers

L. INDUSTRY UPDATE: CRITICAL TRENDS IN TELECOM

13:45–14:10

Joe Weinman, Founder & Principal, XFORMA LLC, USA (MODERATOR)

Dave McCrory, Global Head of Insights and Analytics, Digital Realty, USA (PANELIST)

Jim Poole, Vice President, Global Business Development, Equinix, USA (PANELIST)

Darren Yong, Asia Pacific Head of Telecom, Media, and Technology, KPMG Asia Pacific, Singapore (PANELIST)

- Darren Yong, KPMG
 - We collected lots of data
 - Tech companies are moving across industries into other things like banking
 - Distributed compute is becoming bigger – moving away from hub and spoke to containerized application
- Dave McCrory, Digital Realty
 - Data Gravity
 - Data growth and then attracts applications and services to use it, but that also creates more data
 - The closer you are to the data, the more you will consume it and contribute to it
 - The number of projects in data center is growing exponentially
 - It is becoming hard to manage
- Jim Poole, Equinix
 - Most enterprises are adopting hybrid multi-cloud architectures
 - A 40% CAGR is impressive given the size of the base
 - Number of locations and cabinets being deployed is increasing
 - Distinction between “core” and “edge”
 - Core is growing one and a half times, but enterprises are expanding even faster
 - Enterprises are moving close to populations to provide better experience



- Most network as a service offerings are still coming
- Joe Weinman, Xforma
 - World is tilting more towards edge, leading to greater need for interconnection

M.POLICY AND PERSPECTIVE FOR THE NEW DIGITAL INFRASTRUCTURE ERA

14:15–14:45

Tara Giunta, Partner; Co-Chair, ESG Risk, Strategy, and Compliance Group, Paul Hastings LLP, USA (MODERATOR)

John Giusti, Chief Regulatory Officer, GSMA, United Kingdom (PANELIST)

Shigeo Naito, Deputy Director-General, ICT R&D and Cybersecurity Policy, Ministry of Internal Affairs and Communications (MIC), Japan (PANELIST)

Robert Strayer, Executive Vice President of Policy, Information Technology Industry Council (ITI), USA (PANELIST)

- Shigeo Naito, MIC
 - Want to promote 5G in Japan by supporting R&D
 - Infrastructure is important
 - In September 2021, formulated cybersecurity strategy for ITC
 - Address cybersecurity across borders by helping with capacity building programs internationally
 - Try to realize carbon neutral – needs be discussed beyond the G7, but also over the Internet
- Robert Strayer, ITI
 - Pandemic added gasoline to supply chain issues
 - Countries are working on ways to avoid foreign dependencies on critical areas and to maintain skills in critical areas
 - Countries are also limiting exporting key technologies and limiting investments
 - Also increased privacy laws are limiting the export of sensitive or personal data
 - Additional spectrum is important
 - Countries know they need to work together on cybersecurity issues and work on supply chain
 - Working on standards for data technologies
 - Need to create smart policies for supply channel rules – don't want to stop international trade
- John Giusti, GSMA
 - 5G has been the fastest rollout of telecom technologies – in 179 markets
 - Asia Pacific is leading in 5G

- Need harmonized affordable spectrum
 - So much of digital future is being able to use it – need low-priced spectrum
- [AM Comment: Real focus on low spectrum prices]
- Global ROIC is under 10%, revenues are flat
- Pandemic made clear the importance of connectivity and the challenges facing those without it. Trying to unite industry to see if we can make progress with public/private partnerships to connect the remaining 3.2 billion unconnected
 - Trying go country by country to look like specific barriers
 - Publish annual updates on progress
- 50% of the mobile industry has committed to Net0 carbon emissions by 2030
[AM Comment: It's unclear how all of the environment promises made in the industry will be measured/audited]
- 5G is 10x to 15x more efficient than 3G
 - Mobile makes it easier for other industries to enable other industries to reduce carbon emissions

N. ON THE WAY TO THE METAVERSE

14:50–15:00

Gaya Nagarajan, VP of Network Infrastructure, Meta, USA (PRESENTER)

Robert Pepper, Head of Global Connectivity Policy and Planning, Meta, USA (INTRODUCER)

- Gaya Nagarajan, Meta
 - Over the past decade the infrastructure has supported Facebook. Video has been on the of the biggest drivers
 - Have on of largest backbone networks, partnered with ISPs, to develop efficient caching networks to support video
 - AI is on the dominant traffic sources for networks
 - Where are we heading?
 - Today we have static content
 - Moving to more real time experiences (like with gaming)
 - Need to improve networks to support this
 - GPUs are moving from the data centers to the edge
 - Need a network to enable these
 - Need quick feedback loop to end users – latency needs to get lower
 - Latency and jitter will not be acceptable in the future
 - Need to build closer to the end user – good latency in tier-1 markets
 - Need to replicate in tier-2 and tier-3 market
 - Will require peering infrastructure upgrades
 - Need to understand the network from end-to-end to optimize the user experiences – approach may change based on user's specific application

O. SATELLITE: NEW SOLUTIONS, NEW APPLICATIONS

15:15–16:15

Christopher Baugh, CEO and Founder, Northern Sky Research (NSR)/Analysys Mason, USA (MODERATOR)

Christopher Stott, Chairman and C.E.O, Lonestar Data Holdings Inc., USA (PANELIST)

Paul Mattear, Head, Global SatCom AWS, Amazon Web Services, USA (PANELIST)

Jeremy Rose, Partner, COMSYS LLP, United Kingdom (PANELIST)

Alexander Schumann, Director of Marketing, Pacific Dataport Inc., USA (PANELIST)

- Chris Baugh, NSR/Analysys Mason
 - Starlink has one million subscribers
 - Direct to device is going crazy and all telcos are interested

- Christopher Stott, Lonestar Lunar
 - In an inflection point in the industry 2.5 quintillion bytes of data per day. Going to 5.0. Already talking about exabytes.
 - Satellites are the transport layer and go anywhere instantly
 - Never going to be a time where satellites are not needed
 - Demand is greater than capacity
 - Starlink is really infrastructure - a distributed data center
 - Each satellite has 40 lynx servers. Tesla's cars use lots of data
 - OpenAI, if it scales will use a lot of capacity
 - Putting data centers on the moon, AWS is doing a data center in space for NASA

- Paul Mattear, AWS
 - Things going well at AWS for 2023
 - Data demand is increasing
 - Need to get out of commodity situation and provide value for end customers
 - DOD has a request for a multi-orbit solution
 - LEO will have different business units (b2b, B2C, DoD, etc.)
 - Does all that data need to come back to the earth?
 - Keiper is not part of AWS
 - Product expected in 2026
 - Money will be made in population centers not rural areas
 - Intelsat did not make much money in Africa
 - Starlink made their own hubs and antennas – LEO fold see themselves as code writers and not as capacity suppliers
 - Deliver platform for a solution to be developed

- Satellite operators don't work well together – consider standards that prevent equipment from working on each other's networks
- Interoperability will be built into DoD contracts eventually and this will force it into the satellite industry
- Satellite has been helpful for short-term business continuity, but hard to build a business around it
- Jeremy Rose (Comsys)
 - PTC is the Davos of the satellite industry – people talk about a lot of things
 - 2023 will be difficult. Are we at another Iridium stage with all the new constellations? Some of the NGSOs will become operational
 - Lots of issues to get the constellations working – landing rights, market entry strategy – lots of hard issues to deal with that will need to be addressed
 - Perhaps, lots of bodies on the ground in a few years
 - in five years. It will morph as it grows (e.g., Gen2)
 - Satellite will remain a niche and standards are not likely, but has place
 - Software defined satellites will be helpful to addressing fiber breaks
- Alexander Schumann, Pacific Dataport
 - 2023 is the year
 - OneWeb and Starlink offer ubiquitous solutions in Alaska
 - People are finally adopting and using
 - New satellites being built and implemented in 2023 that will change the broadband landscape
 - Definite race for satellite companies to offer coverage in the arctic
 - Hundreds of megabits from a satellite to handset is not likely due to physics
 - Satellite is more competitive with fixed broadband to the home

P. DRFORTRESS RECEPTION AT THE HALEKULANI HOTEL

- Attempting to crash the SES reception, I somehow found myself at the DRFortress reception at the super swanky Halekulani Hotel. DRFortress is Honolulu-based provider of data center solutions (see: <https://www.drfortress.com/>) [AM Comment: This hotel is sometimes referred to as the “highly colonic” because if you stay there, it cleans you out (financially)]
 - Food was much better and far more varied than at the PTC Opening reception
 - Beer and wine were free, but mixed drinks were \$17
 - The grass was greener
 - Entertainment was recorded music – pleasant enough, but not as dramatic as the hula and fire dancing at the Opening Reception on the Great Lawn the day prior
 - All, in all, it was a classy event



DRFortress Reception at the Halekulani Hotel

DAY THREE: TUESDAY JANUARY 17, 2023

Q. SECURITY

08:30–09:45

Richard Taylor; Palmer Chair & Professor, Telecommunications Studies Emeritus, The Pennsylvania State University, USA (MODERATOR)

Richard Canevez; Postdoctoral Scholar, School of Communication and Information, University of Hawaii at Manoa

Trisha T. C. Lin; Professor, National Chengchi University, Chinese Taipei Image

Monica Nila Sari; PhD Candidate, Keio University, Japan Image

Jenifer Winter; Professor, School of Communication and Information, University of Hawaii, USA Image

- Richard Canevez, U. Hawaii
 - How to counter digital information disorder
 - Striated (highways) vs smooth (flows from user to user)
 - Combined efforts such as education
 - Need to think beyond the state
 - Institution of war is no longer the domain of the state's military institutions
 - War has multiple battlefronts with information warfare
 - Information war is everywhere
 - US is not prepared to information warfare
 - Idea applies to international malicious conduct as opposed to internal dialectic processes in a country [AM Comment: I am not sure I understand where the line between the two falls]
- Trisha T. C. Lin, National Chengchi University
 - Social media networks have echo chambers
 - Taiwan has bot-base disinformation campaigns
 - Influences people's perception
 - Echo chamber is measured by the extent people get information that is not consistent with their beliefs
 - Many people don't know they are interacting with bots – hard to detect
 - Promoting digital literacy
- Monica Nila Sari, PhD Student, U. Tokyo
 - ASEAN consists of 10 countries in SE Asia
 - Fastest growing internet markets
 - But lots of information leaks and hacks in the region
 - ASEAN is setting-up cyber security network to deal with cybersecurity
 - Large gaps in cyber maturity between ASEAN countries
 - Due to priorities, economic development, and other factors

- Measured legal, technical, and organizational measures
 - No legal mechanism to force compliance
 - Focus on technical measures
- Capacity development
 - ASEAN – Japan Cybersecurity capacity building centre
 - ASEAN - Singapore cybersecurity centre
 - ASEAN Cybersecurity center
- Other standards being considered
 - Budapest Convention
 - NATA Cyber Defense Framework
 - Asia Pacific Computer Emergency Response
- Recommendations
 - Mutual legal assistance on criminal matters
 - Apply voting formula for some members to move ahead
 - Improve capacity building
 - More mature countries could provide best practices
- Jenifer Winter, University of Hawaii
 - Health data
 - Who is controlling data, for whose benefit?
 - Clinical data and demographic data about health information
 - Most interested in granular individual data
 - Take an expansive view of health data
 - Patient generated health data (from Smartwatches, etc.)
 - Not governed by HIPPA, but by tech companies' internal policies
 - Health data linkage
 - IT firms can link data with other information they can get elsewhere
 - Need for new perspective on governance of health data
 - Data Accuracy, Integrity, Provenance
 - Data linkage lower cost of gathering, but then there are accuracy and provenance concerns
 - HIPPA requires remove 18 health attributes to anonymize, but people are finding linkages to be able to re-attribute to people
 - Challenge – governance
 - Data was formerly under the control of a specific agency, but now moving across agencies and standards are getting muddled and at the same time, the data is often more revealing
 - Managing the linkages of data may require that it is not owned by one party, but considered a public good
 - Seeing emergence of “data trusts” that people can contribute data to

R. SPECIAL OLYMPICS: A DIGITAL TRANSFORMATION JOURNEY

9:45 – 10:10



Prianka Nandy, Chief Information Officer, Special Olympics

- Harder to reach athletes in less developed countries
- All outdoor and in person activities stopped during COVID
 - Increased depression and loneliness
- 52% of athletes in SE Asia did not have connectivity
 - Hard to do online events to try to create some human connections
 - Many lost housing
- Focused on data collection to identify donors and athletes to support
 - Build a data warehouse using Azure and combined with information on athlete health – often the first time the athlete has seen a doctor
 - Share dashboards to share with local partners to allow them to make referrals, etc.
 - Over 200 Special Olympics groups around the world
 - Worked on data about what sports events to do and where
 - Constituent services are first on the list of priorities, CRM, HR, CRM, etc.
- Berlin Event
 - Will have over 30 events and 7,000 athletes and need timing systems, etc. and electronic health records for athletes, also have a mobile app for constituents
- Five-year plans
 - Focused on collecting high-value data
 - How do we get athletes back after covid
 - Provide DEI training for corporations related to neuro-diverse athletes
- Partners such as Microsoft are helping with digitalization. Looking for tech companies to help with efforts

[AM Comment: It was an interesting perspective on how smaller organizations and companies can leverage technology to accomplish things that previously would have been only possible by larger companies]

S. INFRASTRUCTURE - GLOBAL CEO PERSPECTIVES

0:15–10:45

Madonna Park, Managing Director, Global Head of Communications Infrastructure, RBC Capital Markets, USA (MODERATOR)

Randy Brouckman, Chief Executive Officer, EdgeConneX, USA (PANELIST)

Bruno Lopez, President & Group Chief Executive Officer, ST Telemedia Global Data Centres, Singapore (PANELIST)

Andrew Power, President & CEO, Digital Realty, USA (PANELIST)

Rangu Salgame, Chairman & CEO, Princeton Digital Group, Singapore (PANELIST)

- Rangu Salgame, Princeton Digital
 - Getting harder to set-up data centers due to land and other issues
 - Seen as the enemies of sustainability – gone some ways to fix this narrative, but it is not complete
 - Need to get new people in the industry
 - Challenges in Asia are quite diverse
 - Don't do minority investments – must be controlled by us to maintain consistency. This takes more time to get local teams, etc.
 - Expanding in India and Japan
 - Having strong balance sheet positions, us well in the uncertain future
 - Being private gives us more flexibility
 - We can stay above noise and focus on execution
 - Long-term investors are good
 - We manage at the group level. But some local partners finance locally at better rates
 - We are not in a rush to go public, so we have a lot of optionality

- Andrew Power, Digital Realty
 - 2022 hit the industry hard – inflation, interest rates, supply chain, etc.
 - Customers were doing things themselves, but that it is changing, and pendulum is swing back in our direction as we have lots of long-term planning etc. in place
 - Sector has had huge consolidation. In a volatile world now with valuation that makes consolation difficult. More consolidation once it settles down
 - Integration of deals is a lot of work
 - Global consistency but need to have local expertise – partnerships are the way to get there
 - Only on the job for a month
 - Expect momentum at firm will accelerate. Want to be trusted partners

- Randy Brouckman, EdgeConneX
 - Power is an issue. People underestimated the scale that will be necessary
 - Regulatory and zoning challenges exit
 - Global hyperscalers and web scalers are asking for more. This creates opportunities for those who can execute
 - Sustainability is a major issue and industry is on the same side of the table and is coming together
 - Largest companies are looking on a global scale. Looking at automation on global scale. Companies in one or a few markets will be absorbed by larger platforms
 - Buyers will be more selective on the quality of what they buy
 - About have a dozen global platforms will result
 - Progress is inversely proportional to size of announcement
 - Use more partners, but immerse them in our ways of working
 - We needed the right partners, but customers keep us on the hook for results



- Expect growth will be overweighted in Asia
- Interesting ways to deal with debt at local level and have access to capital from utility partners
- Not ready to go public – today is not the time for us

Bruno Lopez, ST Telemedia

- Building scale is hard, especially across markets
- New entrants, but customers want people who can have a track record of execution – the strong will get stronger
- We believe work we have done with partnerships is good “think global, act local” – it is harder with partnerships as you need to build a unified vision, but this is what customers want [AM Comment: or is this what local regulators require?]
- Bloomberg article suggesting we are going public is ahead of itself
 - But we don’t rule anything out. We are in a good position and have good shareholders
 - We are focused on things ahead of us. Less talk and more delivery

T. SUSTAINABLE DIGITAL INFRASTRUCTURE

10:50–11:20

Jennifer Weitzel, President, Global Data Center Business, GLP, USA (MODERATOR)

Joseph Kava, Vice President Global Data Centers, Google LLC - Mountain View, CA, USA (PANELIST)

Jennifer Ruch, Sustainability Director, Oracle Cloud Infrastructure, Oracle, USA (PANELIST)

Jonathan Atkin, Managing Director, Global Head - Communications Infrastructure, RBC Capital Markets, USA (PANELIST)

Joley Michaelson, CEO & Founder, The Sun Company, USA (PANELIST)

- Jennifer Weitzel, Global Data Center Business - Moderator
 - Data centers driver 3% of electricity use and 1% of carbon emissions
 - Sustainability and security go hand in hand
- Joseph Cava, Google
 - In 2008, Google was already carbon neutral. In 2017, got 100% match electricity usage with sustainable use. Want to get to 100% zero carbon by 2030. Also working on water usage and replenishing any usage by 120%
 - Not have 68% sustainable energy hour by hour worldwide. The last 1/3 will be much harder
 - Shareholders and customers are demanding transparency

- Customers need Google data so they can make sure their value chain is meeting sustainability requirements
 - Lots of new technologies from heating, cooling, to building materials
 - Steel and concrete/cement are 16% of greenhouse gas emission.
 - Mass timber as replacement for steel, but in the early stages
 - Security and sustainability are not opposed. Sustainability will require grid upgrades that will likely be more secure
 - Will likely surpass 1.5 degree Celsius globally but need to work to keep it under 2.0 degrees. Pandemic made people aware of the value of digital infrastructure
 - Highest impact on change is allowing people to make more informed decisions – such as Google maps to find more environmentally sustainable routes. Already have 2/3 carbon neutral energy 24 hours in a very short time
- Jennifer Ruck, Oracle
 - Work with sustainable vendors and holding them accountable
 - Admittedly behind Google on dashboards, but it is a top priority from customers
 - [AM Comment: Does not seem to have set the same targets as Google yet]
 - Not a lot of standards and data availability to make some of the carbon emission reductions. Need standards to everyone is on the same page with respect to claims
 - Industry's message about value of data centers needs to get organized
 - Sustainability needs to be an open dialog
- Jonathan Atkin, RBC Capital
 - Investors increasingly place emphasis on sustainability [AM Comment: Based on anecdotal evidence, this is very likely true. However, it would be nice to have a way to quantify it]
 - Data center grid usage in some export countries is far above 3%
 - \$1.3 trillion are in ESG funds, not including financial sponsors who are also facing pressure from limited partners to pursue environmentally responsible investments
 - Green bonds are also out there that provide lower cost funding
 - Liquid cooling is big as it is operating at higher temperatures can save energy in multi-tenant environments
 - Data center power usage concerns is partially a matter of perception (see Dutch moratorium, etc.)
 - Need a common score card for companies and disclose progress
- Joley Michaelson, Sun Company
 - Want to help companies to provide a turnkey ESG offering (water, to energy, to circular economy)
 - Vet and rate partners, etc.
 - Main attribute it that the technology needs to be ready and secondly that there is financing for it



- Capital enablement is an important factor
 - Sustainability requires grids being upgraded and this is good for security
 - Data centers does make society progress
 - Standardization is most important. Excited about some larger projects my firm is working on
- An audience member, Joe Weinman, ask why we should be concerned that datacenters use 2% of the world's electric use given that datacenters make video conferencing and online shopping possible, which saves lots of energy, and likely makes it energy neutral. The panel did not seem to have good answers.

U. DEMOCRATIZING WIRELESS CONNECTIVITY

11:25–12:00

Toni Paracuelles, Chief Strategy Officer, Mobi, Inc., USA (MODERATOR)

Justen Burdette, Chief Executive Officer, Mobi, Inc., USA (PRESENTER)

Brad Coates, VP, Product + Engineering, Mobi, Inc., USA (PRESENTER)

Meredith Mawhar, VP, Finance + Administration, Mobi, Inc., USA (PRESENTER)

Chi Nguyen, Chief Operating Officer, Mobi, Inc., USA (PRESENTER)

Erlend Prestgard, Chief Executive Officer, WG2, Norway (PRESENTER)

Cassandra Sabado-Evans, VP, Stores, Mobi, Inc., USA (PRESENTER)

- Justen Burdette, Mobi
 - Launched in 2005, lots of changes in telecom, particularly wireless
 - As regional wireless provider we focus on communities
 - Like many regional wireless providers, we struggled to get the most current handsets
 - Went from one of hundreds of regional wireless carriers to one of dozens
 - Has been a challenge to make affordability really work, but we think we have the right formula now
 - Most affordable single plan is most critical as it allows us to bring wireless connectivity to more people
 - \$9.99/month for life – unlimited talk, text, and data, but data slows down after 1 GB
 - Extra data upfront or at the end of the month
 - Voluntarily adopting FCC's data labeling plan
 - First 25,000 customers get a \$4 discount, to \$4.99
- Chi Nguyen, Mobi, Inc.
 - Stay true to our values to helping our customers and keep the connected
 - We have invested in training our customer care team – they are true customer advocates – even if it does not help bottom line. Want them to center fairness and equity for the long-term relationship

- We take being a corporate citizen very seriously
- Brian Coates, Mobi, Inc.
 - Want to stay as close to the customer as possible – operate as an agile start-up
 - Built OSS from ground-up
- Justin Brudette, Mobi, Inc.
 - Any call, text or data session is control and authorized by the core. It is the heart and brain of the network
 - Most networks are using old cores that are not upgraded which makes it hard to deploy new functionalities
 - Now live on new Mobi1 core!
 - Kicked off project before 2022 Thanksgiving and cloud core went live last week! – incredibly fast
 - Another partner, Federated Wireless pioneered concept of share spectrum so they can use the amount of spectrum we need
 - Lots of new people decided to start small wireless businesses
 - First time this has happened in a long time that people can get small amount of spectrum as needed
 - Also using femtocells to expand capacity and fill in coverage gaps
 - A way to decentralize wireless networks and change connectivity in new ways
 - Will be launching a Mobi femto cell for under \$99 and will get a discount on their wireless bill
 - 5G Sidelink will be added to 5G standard
 - If customer is at the edge of coverage, that customer's cell phone can be a hop to another customer just outside of the coverage area for emergency calls – will supplement satellite SOS
 - The above would not be possible for a small carrier without partnerships we have developed
- Erlend Prestgard, WG2
 - Developed new core for Mobi
 - More efficient platform that allows easier development of future features at a fraction of the costs
 - Core is also international and Mobi can be a global consistent core operator
- Meredith Mawhar, Mobi, Inc.
 - 62% of Americans spend over \$100/month for wireless service
 - The average American is paying over \$65/month
 - Mobi customers will be able to add wearables for \$0.99/month each as opposed to \$19/month with AT&T
 - Now able to offer service on mainland with one bill no matter where they roam
 - Will be announcing some new partners that expand the network shortly
 - Moving from physical SIMS to ESIMS

- Can even download the app to change to Mobi
- Working on international roaming and 5G home internet in the future

V. DAY THREE LIGHTNING TALKS

12:15 - 13:15

Joe Weinman, Founder & Principal, XFORMA, LLC (Moderator)

1. DATA CENTRES ARE OVERCOMING THE ABILITY TO PROCURE CAPACITY FOR LONG-TERM GROWTH

- **Eric Jacobs, Chief Revenue Office at Aligned Data Centers**

[AM Comment: I missed this “Lightning Talk” because the prior presentation from Mobi went overtime]

2. THE WIRELESS WORLD 2030

- **Dean Bublely – The Wireless World in 2030**

[AM Comment: I missed this “Lightning Talk” because the prior presentation from Mobi went overtime – the summary below is from Dean’s slide presentation]

- 5G will transform the telecom sector opening-up opportunities for:
 - Rural or indoor neutral host networks
 - Private/Industrial MNOs
 - Fixed wireless MNOs – among others
- New indoor use cases (B2B and B2C)
- Industry on 10-year cadence for new evolutions (e.g., 6G next)
 - Faster speed and lower latency
 - Greater density and indoor coverage
 - Improved locational accuracy
- Policy makers should evaluate using “Good stats” not “Easy stats”
 - Requires more work to get good metrics to measure network quality
- Over-hyped: 5G slicing, “Always best connected”, and 6G “teleportization” & THz
- Underhyped: Neutral host mobile networks, open-access fibre, open roaming for fiber, and indoor wireless solutions

3. MEET CIRION – LEADING DIGITAL INFRASTRUCTURE AND TECHNOLOGICAL PARTNER OF CHOICE WITH THE EXPERIENCE, FLEXIBILITY, AND INNOVATION REQUIRED FOR SUCCESS IN LATIN AMERICA

- **Gabriel Holgado, EVP of Sales at Cirion**

- Previously the Latin American Operations of Lumen – backed by Stonepeak
- Connect Latin America
- 18 data centers
- 80% of customers are 25 years or longer
- Integrated technological proposition
 - Voice, data services, security, etc.



- Leading digital infrastructure and technology partner in the region
- From expansion perspective making plans
 - Working in Mexico
 - Subsea network is evolving
 - Data center piece is evolving
- 4. **DATA CENTER PLATFORM ORCHESTRATION – MOVING BEYOND REAL ESTATE**
- **Robert Davidson, CEO of Qarbon Technologies**
 - Qarbon has a platform for datacenters and customers to coordinate electronically. The platform aims to eliminate much of the manual work of coordination to save on labor and offer better customer service
 - Too much hassle coordinating with multiple datacenter operators
 - Need to be able to work across multiple vendors in data centers
 - Provide a centralized portal
 - Lots of individual API's need to be updated
 - We onboard and update APIs for the benefit of their subscribers
 - Qarbon LATTICE creates 1st orchestration platform for data center infrastructure
 - Can standardize things like doing ESG calculations between providers
 - Customers can't handle all of this themselves
 - Benefits for both the customer and data center
 - Tier-2 or Tier-3 data center can effectively punch above their weight and offer API strategies like Equinix
 - Beta sign-ups start this summer [2023]

W. SMART CITIES, SMART WILDERNESS, AND EDGE

13:45–14:15

Joe Weinman, Founder & Principal, XFORMA LLC, USA (MODERATOR)

Giuliano Di Vitantonio, Chief Executive Officer, AtlasEdge Data Centres, United Kingdom (PANELIST)

Tom Frazier, Chief Executive Officer, Redivider Blockchain, USA (PANELIST)

Raul Martynek, Chief Executive Officer, Databank Ltd, USA (PANELIST)

- Joe Weinman, Xforma (Moderator)
 - Everyone is watching the Edge. Today's world is complex from an architecture perspective
 - Data sovereignty, especially in Europe, may require data to stay local
 - In rural areas it is hard to
- Giuliano Vitantonio, AtlasEdge Data Centres
 - JV with DigitalBrige and Liberty Global
 - Distinction between edge and edge computing and edge data centers

- Need to identify applications that require computing will need an edge data center – autonomous vehicles won't need this as the computing is done in the car
 - Volume of data movement is important for the calculation
 - Sustainability will be an advantage in the future. Distributing data centers more broadly will minimize local distribution
 - Cloud is driving application today
 - Will have hundreds of locations in the US and Europe by the end of the decade
 - No more 250 megawatt data centers – need much larger ones
 - Each smart city application is different and is tied to geographies
 - For edge to succeed, edge need to interconnect, and interconnections need to be more distributed locally
- Raul Martynek, Databank, Ltd.
 - Largest geographic footprint of US data center
 - Networks need to catch-up to available bandwidth
 - Gaming industry with multiple players require almost zero latency so compute needs to be very close to the user (200-400 miles)
 - Cloud has similar architecture, but edge will vary
 - Data centers have lots of overhead for security, compliance, etc. Modular data centers need to have compelling reason as they don't scale with the overhead needed
 - For now, metro environment suffices for most applications today. May need to more far edge as super low latency applications emerge
 - We are open to smart cities, but we are application agnostic
 - Think smart cities will take time – not seeing a lot
 - Tom Frazier, Redivider
 - Designed around minimal impact – all data centers prefabricated and disposable
 - Need tens of thousands of data centers across the country, so will be small and be for special applications
 - Need to get common definition of “edge”
 - Data backhaul
 - Cloud edge is the big driver
 - As enterprises put more into cloud data centers will need to grow
 - Time to power is a big hold-up for data center rollout. This will be easier for small data centers
 - Can buy-in with cities using smaller datacenters with lower noise, power, etc.
 - Covid showed how technology enables communications – a wake-up for governments
 - Governments are more open to trying to make something appropriate work

X. THE ARCHITECTURE FOR DIGITAL INFRASTRUCTURE: BEYOND TELECOM

14:20–14:50

Patricia Paoletta, Partner, HWG LLP, USA (MODERATOR)

Robert Pepper, Head of Global Connectivity Policy and Planning, Meta, USA (PANELIST)

Motohiro Tsuchiya, Professor, Graduate School of Media and Governance, Keio University, Japan (PANELIST)

- Robert Pepper, Meta
 - Discussions at PTC have moved over the year from telecom to end-to-end connections
 - Minutes of voice, to text, photos, to internet, to video, to AR [augmented reality]
 - AR is in the future, but we need infrastructure to provide this quality of experience
 - Edge is more than a buss word – it is very important
 - Meta does NOT have datacenters around the world
 - Need partners to make edge investment
 - Move from CPU to GPU
 - Seeing carrier neutral data centers
 - Have been funding and paying for caching in over 200 countries and over 1,000 metros
 - Over 100 points of presence around the world, most in Europe
 - Meta assumes we are in a “zero trust” world
 - Have an open cable – each consortium members have their own fiber pairs (no frequency sharing, etc.). Each member has its own equipment at the landing station. The same is with fiber sharing in the US
 - Without security, you don’t have a network or business
 - Also have diversity of routing and diversity of cable landing stations
 - Most cable failures are not malicious, but we still plan zero trust
 - Can’t let fear of cybersecurity stop investment in new cables
 - Want open cable landing so there is interconnection competition
- Motohiro Tsuchiya, Keio Univ
 - International relations professor with deep interest in undersea cables
 - Japan is an island country – 99% international traffic is undersea cables and 1% is satellite
 - Different companies do different things with undersea cables
 - Huawei is building cables in middle east and Africa
 - Concerned about systems in cable landing stations and potential for supply chain attacked

- Concern about small chips in cable landing stations that can send data back to foreign government
 - Can identify combinations between people but not the message itself – need to have more secure communication systems in the future
 - How to secure cables and systems – a big factor in the future
- Want to open cable landing station which are not controlled by carriers
 - Can't let foreigners into cable landing facilities without controls
 - Physical security of cables is important as the locations are easy to find – can even find manhole covers to get into them
 - Need good solutions to protect cable landing stations, but don't have a good solution as they are privately owned
- Japan seeing to put more cable landing stations in rural areas
 - Helps rural economy and even more if they need to add security
- Lots of cables are cut during war – WWI, WWII, Crimea cable cut
 - China may cut cables to Taiwan other than one to China

Y. THE ZERO TOUCH, HIGH TRANSACTION TELCO, AND BEYOND

14:55–15:15

Marc Halbfinger, Chief Executive Officer, Console Connect by PCCW Global, Hong Kong SAR China (INTERVIEWEE)

Gary Kim, Principal, IP Carrier, USA (INTERVIEWER)

- Marc Halbfinger, PCCW
 - Customers can provision themselves
 - Automatic provision ports now exceed manually provisioned ports
 - Have always been vertically integrated
 - involved in subsea, data centers, layer 1, 2, 3, etc.
 - Now over 850 data centers, going to over 1,000 in 2023
 - Close to 800,000 km of fiber
 - Try to engineer system from the user and back to the network
 - The moment the user goes in, there are a series of automated processes to make it easier for them
 - Have operations center to ensure they 1) can do a fast credit check; and 2) simultaneously start physical provisioning
 - Also have financial settlement teams when working with 3rd parties
 - Trying to get to automated bandwidth settlement – hope to get there soon
 - Infrastructure as a service is often offered without regulation in the jurisdiction
 - Regulators are likely to target infrastructure providers and may be able to work with regulated service providers to offer a consistent service



- Starting to see a network effect to communities of value to evolve and grow seems to increase week on week
- Consumers can sign a contract for a day, a week, a month
 - The shorter the timeframe, the higher the rate
 - If we can fill with short-term demand, revenue may be higher
 - Longer term contacts are more commodified
- Digital platforms economics
 - One user can connect with others
 - Service/applications adjacent UCASS or other can access the platform to reach customers

Z. A NEW ERA FOR SATELLITE CONNECTIVITY – FROM BROADBAND TO DIRECT TO DEVICE

15:30–16:30

Christopher Baugh, CEO and Founder, Northern Sky Research (NSR), USA (CO-MODERATOR)

Gregg Daffner, President of APSCC; CEO, GapSat, France (CO-MODERATOR)

Himanshu Agarwal, Senior Regional Sales Director, Hughes Network Systems, LLC, India (PANELIST)

James Alderdice, VP, Asia-Pacific, Lynk Global Inc, USA (PANELIST)

Brandon Seir, Chief Commercial Officer, Kacific Broadband Satellites Ltd., Singapore (PANELIST)

John Turnbull, Director, Networks Sales, Australia and Pacific, SES, Australia (PANELIST)

- James Alderdice, Lynk
 - Will soon launch direct to handset phone
 - Commercial service announced for April
 - No modifications to phone are needed
 - Use frequencies in 617 MHz to 960 MHz range
 - Mobile operators will set price to subscribers, but it is viable in every market – operators set the rate, but it will be extremely affordable
 - 7 billion active SIM cards, and many are in areas with coverage issues
 - Hundreds of millions of expected subscribers
 - Will be a roaming service that complies with 3GPP
 - Want hundred Mbps to the phone within three years
 - Can close link budget to any device
 - Wireless operators have latent spectrum across their whole territory
 - Link budget is a function of the amount of spectrum available, the satellites and other factors – but path to over 100 Mbps

- Initial launch will be SMS, not voice or high-speed data [AM Comment: It seems a long way from SMS to 100 Mbps – I don't believe T-Mobile can get close to 100 Mbps on the 600 MHz portion of their 5G terrestrial network]
 - Mobile operators have good coverage with respect to population coverage, but not geographic coverage – this is where we play
 - Use existing roaming ecosystem
 - Network is flexible, can put gateway where they are needed
 - Only need one gateway to start service (can use a store and forward – 90 minutes in worst case)
 - Some countries will need a gateway in country and others won't
 - A key route to market is that all existing phones in the world are compatible
 - Filed for 5,100 satellites, need 1,000 for real-time global coverage
 - Over 200 markets to open-up – first step is with mobile operators, and they work with the local regulators

[AM Comment: There were lots of questions, including some skepticism, from the satellite friendly audience]
- Brandon Seir, Kacific
 - Rates of Thuraya and Iridium have come down
 - Launched 1st satellite in 2019 (condosat with JSAT)
 - Covers almost all of Pacific and region with focus on PNG
 - Want to launch a fleet of satellites
 - Second satellite has a lot of coverage around Indonesia, but still in design phase
 - Backhaul demand is picking-up and see demand for clinics etc.
 - Some markets are hard East Timor – want \$40/month
 - Nepal is hard also 33% fee and 25% margin on import
 - Trying to get consultants, World Bank, etc. to help open the markets
 - Hinting that black market payments are needed to open doors
 - Indonesian model is good model, and market requires at least 1 tbps
 - Need to work down the value chain and deal with certain partners and need to have infrastructure in the country
 - Would like fees waived for a few years
 - India is a specific market
 - Need a good partner for market access and distribution
 - Starlink will be allowed to have an earth station in two years, suggesting they may be shifting their policy
 - Licenses in several countries, India beam is not being used
 - Have over 12,000 site and many have long-term contract
 - In India and Bangladesh and others, capacity needs to be sold 1st to the government and customers buy from the government
 - Requirements for mobile backhaul contracts for several years
- Himanshu Agarwal, Hughes
 - HughesNet serves millions of customers [AM Comment: ~2 million people]

- Indonesian government has appointed an effective group
 - Using a lease model to accelerate demand to rural areas
- Have capacity over India – some movement towards deregulation
 - In India, Hughes uses capacity on government satellites for their VSAT networks. Looking into eventually using their own satellites and providing landing rights for others
 - Also, own distribution rights for OneWeb in India
- Jupiter-3 launched in 2023 and covers America (north and south) with 500 gbps

- John Turnbull, SES
 - SES, based in Luxembourg uses GEO and MEO
 - [AM Comment: SES had a nice AR presentation in the exhibit hall]
 - Not enough capacity in Indonesia and government model is not too bad
 - O3B approach is to carriers for them to distribute. Mobile backhaul is only one part of what we are doing. Model is to work through partners
 - O3B is complementary to satellite to handset projects

- Greg Daffner, GapSat - Moderator
 - Indonesia is making big push for rural broadband
 - Satellite features on iPhone14s sold in China or Hong Kong or Macau, have been permanently disabled for satellite connectivity

DAY FOUR: WEDNESDAY JANUARY 17, 2023

AA. SPECTRUM MANAGEMENT

09:00–10:15

Rob Frieden, Emeritus Professor of Telecommunications and Law, The Pennsylvania State University, USA (PANELIST)

Moinul Zaber, Professor and Senior Academic Fellow, University of Dhaka and United Nations University, Portugal (PANELIST)

Nico Grove, Managing Director & Co-Founder, Kawikani, Kawikani GmbH & Co KG, Germany (MODERATOR)

- Rob Frieden, Penn State – “Rising Stress in Multilateral Space and Spectrum Resource Planning”
 - Space spectrum is getting more controversial due to new stresses with LEOs, space debris, etc.
 - Incumbents can be incentivized to make do with less spectrum via subsidization
 - Lots of new demands for spectrum
 - Bezos and Musk are arguing on social media
 - A small particle can jeopardize the International Space Station, also satellites, and launch vehicles can crash into earth
 - Research questions
 - How does the goals of nation states impact the ability of the ITU to deal with space conflicts?
 - With new issues such as security, trade, etc. impact the above
 - UN process is slow and painful – “consensus by exhaustion”
 - US space documents have not been updated since adopted in the 1960s
 - UN Outer Space Treaty 1967
 - Not clear who is responsible for collisions
 - ITU expertise should be added
 - ITU Constitutions – Articles 44 and 45
 - Registry of satellites part of the US
 - Frequencies are the province of the ITU
 - ITU Radio regulations development emphasizes on consensus
 - Allocations, power limits, coordinating, recording, and monitoring -- all needed
 - Different ITU regions – what do you do with new technologies that have greater compatibility with non-conforming uses
 - Assumption of mutually exclusive use is no longer accurate
 - Frustration with the above has pushed people to consider the relevance of the ITU
 - Proliferating and diverging interests

- Newly elected ITU Secretary General from the US may be more accommodating to new technologies
 - Many layers of issues
 - What will Chinese do given the decertification of Chinese equipment and service providers?
 - Will countries start acting unilaterally
 - Frieden's paper published in the Telecom Policy Journal [AM Comment: Paper is available on SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4180784]
 - NGSO coordination as additional systems added is not clear
 - Also, interference with NGSO customer earth stations and GEO
 - Artemis Accords streamlines and modernized space treaties (adopted by 21 countries), forwarded by the US, but many see to advantage advanced countries
 - Can allocate orbital slots to less developed countries to enable them to get slots, but it will increase costs for well-developed countries
- Moinul Zaber, Univ. of Dhaka "Covering the last 50% - the role of 5G spectrum policy intervention"
 - How find a way to connect the last 50% in Indonesia
 - Want to have an auction that gets reasonable winning bid while making sure operators fulfill user needs
 - Tradeoff between auction price and buildout requirements
 - Operators need spectrum to ensure QoS
 - Lots of factors impact spectrum pricing
 - Government has emphasized expanding the size of the network
 - Number of BTS has grown ~5x in last 10 years
 - Still 50% without access
 - One large giant Telkomsel with large market share
 - Looked at auction data from Analysis Mason
 - Too many islands (17,000) to cover at once, so need to prioritize
 - Government should focus on islands with highest concentration rates by conducting auctions on regional basis
 - Try to increase competition where market concentration is high
 - Lots of concentration in Papua
 - Government incentives by reducing spectrum fees to build in unconnected areas
 - Satellite is still expensive in country so, trying to advance wireless buildout
 - Need satellite but also need work to help