Welcome to the 48th issue of Submarine Telecoms Forum magazine, our Regional Outlook edition.

My 82 year old father is a “Skypeaholic.”

Not that that is necessarily a bad thing; but he likes looking at you when he calls, and Arizona can be a pretty long way off – especially when you are traveling on another continent.

I may be dating myself, but I grew up reading Dick Tracy in the Sunday Tribune comics, and I recall how Dick could always talk to his colleagues from his wrist watch, all the time watching them on a small video face. This was science fiction then; this was something we could only imagine because we hadn’t even been to the moon yet.

Sadly, we’re not quite to the wrist video phone today, but we have come a very long way since my youth. Whether “skyping” with my team on some lonely short station in West Africa or talking with my daughter in Vienna, we can now look at each other in the eye much more easily. We can communicate much more effectively, but we have to be careful how we look – it’s so much harder to fake working when you look like you just rolled out of bed!

Regional cable systems make that all possible.

So, I’ll do my best not to look like I just came off Waikiki beach this week. I’ll try not to look like I am having too much fun either; and as always, save me a seat at the Mai Tai Bar.
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Engineering of submarine and terrestrial optical cable, microwave/WiMAX, mobile, satellite and RF systems for telecom, oil & gas and government clients
January 15th, 2010
- WFN Strategies Joins ICPC
- PIPE Applies to FCC to Transfer PPC-1 Licence

January 14th, 2010
- Rwandatel’s Submarine Cable to Land in Kigali By April
- Alcatel-Lucent to Host Live Web Press Conference to Announce Breakthrough Innovations in Optical Technology
- Bharti Airtel Announces Strategic Organisation Changes For Future Growth
- Ocean Specialists completes rapid submarine fiber installation in Gulf of Mexico
- OFS and Sterlite Settle Lawsuit
- Lightwave Logic Appoints Phillips W. Smith as Board Chairman

January 13th, 2010
- New Sub Sea Cable to connect Singapore to Sydney via Perth
- Tyco Telecommunications upgrades its cable lay vessels to the latest release of the advanced monitoring and control cable installation software, MakaiLay
- NASDAQ OMX Europe certifies Interoute Fast Trade service for algorithmic trading

January 12th, 2010
- Bangladesh Releases Submarine Cable Draft Regulation

January 11th, 2010
- WFN Strategies Launches Data Services Center
- SubOptic 2010 – Preliminary Program Now Available
- EXFO and Optnext Achieve Full Interoperability, Successfully Testing IEEE-Compliant 100 Gigabit Ethernet Optics
- Suriname-Guyana Submarine Cable System (SGSCS) lands in Guyana
- Gulf Bridge International, Iraqi Telecommunications sign agreement for cable landing in Iraq
- APOLLO Upgrades North Atlantic Capacity
- SubTel Forum Names European Sales Rep

January 8th, 2010
- Huawei complete 1000km 100G commercial trial in Spain
- WFN Strategies Assists Stratos

January 6th, 2010
- Hibernia Atlantic Receives Investment from Constellation Growth Capital

January 5th, 2010
- Alcatel-Lucent further advances 100G transmission by integrating advanced developments in next-generation coherent detection on its optical platforms

January 4th, 2010
- Bharti Airtel’s Middle East Connect Network to serve global carriers in the region
- New Cable Route Links Japan to Trans-Pacific Express

December 22nd, 2009
- Huawei Marine Won Turnkey Contract for LPTIC T-E System
Pacnet Delivers Pioneering Intelligent Private Line Service with Flexible Transport Protection
December 17th, 2009

Marshall Islands National Telecommunications Authority And Tyco Telecommunications Welcome Cable Ship Tyco Durable; Mark Significant Step Toward Regional And International Connectivity

Southern Cross Giganet Private Line Service Now Available

Apollo Opens New Point Of Presence In Equinix London Data Centre
December 15th, 2009

Orange inaugurates LION submarine cable in Reunion

Telstra to double Endeavour cable capacity

Hibernia Atlantic Acquires International Broadcast And Media Production Service Provider Mediaset

New subsea cable brings digital independence to Tunisia

UN to curtail 400-year-old ‘freedom of the seas’?

Making a Grab For Broadband Stimulus Cash

Huawei Marine Networks Co., Ltd.: Huawei Marine Successfully Delivers Hannibal Submarine Cable System for Tunisie Telecom

KDDI and Google Join Forces in Laying Japan-Singapore Cable

December 10th, 2009

JDSU Wins Frost & Sullivan Growth Award for Worldwide Gigabit Ethernet Test Equipment

PIPE International Chooses Equinix Sydney Data Center as Global Interconnect Providerfor New Undersea Cable

Launch of New Network Systems Bring New Era of Communication for Indonesia

December 9th, 2009

European enterprises assured of data security with Interoute

Broadband to Upstage Voice in Africa

December 8th, 2009

CeltixConnect Announces Sub-Sea Cable System to Meet Customer High Capacity Demands

Pacnet to Land New Cable System into India to Support Growing Demand for International Bandwidth

December 6th, 2009

AAG Goes Online

JDSU Selected by Southern Cross Cables Limited for Fiber Inspection Solutions

AT&T’S Undersea Cable Capacity Grows With Asia America Gateway Submarine Cable NETWORK

December 4th, 2009

ACE (Africa Coast to Europe) submarine cable welcomes new members

Huawei Marine Wins Turnkey Contract for PT Telkom’s MKCS Submarine Cable System

December 3rd, 2009

SubOptic 2010 – Exhibition Hall Sells Out

Bella Vista Trading Services S.A. and Energia Integral Andina S.A. select Alcatel-Lucent/IT Telecom consortium for the first submarine cable network linking the Colombian mainland with San Andres island

December 2nd, 2009

EASSy To Launch Operations In June; Price War Brewing

Tyco Telecommunications Deploys New Shore-End Plow

December 1st, 2009

Alcatel-Lucent Has Begun Laying Honotua

VNPT allowed to invest in APG undersea cable system

November 30th, 2009

New Artel Lands with SEACOM

LS Cable Completes First Submarine Cable Factory in Korea in Donghae City

Qtel Signs Major Cable Agreement with Tata Communications

November 25th, 2009

ISPs Put On Notice in Kenya

November 24th, 2009

Hibernia Atlantic to Partner with Eircom

Tata Communications and Middle Eastern Operators Launch Strategic Gulf Cable Project
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MEET OUR STAFF:

Wayne Nielsen has over 25 years of telecoms experience and developed and managed international projects in the Americas, Far East/Pac Rim, Europe and Middle East. He possesses a postgraduate Masters degree in International Relations, and Bachelor’s Degrees in Economics and Political Science. In 2001, he founded WFN Strategies, which provides project development and engineering of remote communications for telecoms, defense and oil & gas clients. He is also founder and publisher of SubTelForum magazine.

Kevin G. Summers is the Editor of Submarine Telecoms Forum, our resident graphic designer, a creative writing teacher and a professional author of both fiction and non-fiction. He has written stories set in the Star Trek universe, including the critically acclaimed “Isolation Ward 4,” featured in Star Trek: Strange New Worlds IV. He has also published original fiction in Lords of Justice, Tales of Moreauvia, and the forthcoming Shadows of the Emerald City. Learn about his writing at his website: www.kevingsummers.com.

Kristian Nielsen has been working for Submarine Telecoms Forum since 2008 as Business Manager, and has recently been promoted to Sales Coordinator. He has supported various international telecoms projects with his accounting expertise, and is the originator of many of SubTel Forum’s products. He has previously lived abroad, is an active leader in his Venturing Crew, an outdoors based, co-ed arm of Boy Scouts, and enjoys computer gaming, scuba diving, skiing, backpacking, and other outdoor activities.

Wilhelm Sicking has been in the publishing business for about 40 years as marketing manager, new-business manager and publisher of trade and technical magazines - and in the oil and gas industry for more than 20 years. He is now the media representative of PennWell Corporation in Continental Europe, Eastern Europe, and Russia. He has also joined SubTel Forum as European Representative. Wilhelm is a graduate of the Marketing Academy in Hamburg.

Ben Skidmore founded the independent media sales firm Partners Publishers’ Representatives in 2005, and has represented multiple industry publications. He has been involved in the media industry for over 7 years, and has a wide range of experience in online and print media marketing. He has worked with multiple Fortune 1000 companies, helping them market their products and services.

Michael Yee has been in the oil and gas industry for more than 20 years, first as regional editor of Asian Oil & Gas and Asia Pacific Correspondent of Offshore. He is now the Asia Pacific media representative of PennWell Corporation, specializing in media and event sales. He has now also joined SubTel Forum as Asia Pacific Representative. Michael has a Bachelor’s degree in civil engineering and a Master’s degree in English studies.
TRAVELS WITH CHARLIE
A TRAVELOGUE OF ONE ENGINEER’S TIME ON ASSIGNMENT IN ANGOLA

GUY ARNOS
November 21, 2009, Saturday afternoon. Our team is in the Angola Telecom Cacuaco cable station, talking over the orderwire while another team is in Porto Amboim, 305 cable kilometers away to the south, as we commission the first segment of the ADONES cable system.

We first started this process sixteen months ago in this same station, when I connected the OTDR to the two segments landing here and discovered the first two of what would become fourteen cable faults to plague this system commissioning program. Two and a half months and three repairs later, we were back here in Cacuaco, trying again, only to be shut down a second time. Then came the long, painful wait for an available cableship. But today, all the repairs south of Cacuaco are complete, the cableship Chamarel is clearing back into Angola after a port call, getting ready to make repairs to the northern segments, and we are commissioning the longest of eight unrepeated spans comprising the ADONES system. Things could be worse.

We have a plan: to commission four segments and return to Luanda in eight days. It’s an ambitious plan, and we hope it is as good and as flexible as it is ambitious, for we are dealing with Africa, where nothing works as you expect, and logistics for contingencies are difficult at best. The other team set out this morning at 7:00 AM for Porto Amboim, a three hour drive once you escape the clutches of Luanda traffic. They were planning to leave at 5:30 AM. Unfortunately for them, another car had parked blocking their vehicles in and the driver could not be found until 7:00 AM. Not an auspicious start to our carefully crafted plan. Now, instead of 30 minutes to leave Luanda, it takes two hours and we start our day behind schedule. Normally we wouldn’t care too much, but there is no place to stay overnight in Porto Amboim, and the nearest hotels are in Sumbe, an hour drive further south. For safety, we do not want the teams to be out driving the highways after darkness falls, given the quality and isolation of the roads in Angola. They need to be done by 6:00 PM today. It may be summer here in the Southern Hemisphere, but we are near the equator and night comes early and falls quickly.

The ADONES system, supplied by Ericsson, is a festoon system of 1,800km following the Angolan coast from Cabinda province in the far north to Namibe in the far south. The eight landing points of ADONES in Cabinda, Soyo, N’zeto, Cacuco (Luanda), Porto Amboim, Benguela, Lucira and Namibe reach nearly 80% of Angola’s population. Two cable spans cross the mouth of the Congo River between Cabinda and Soyo for security during periods of high flow. ADONES is currently equipped with three of eight possible 10Gb/s wavelengths in the Marconi MHL3000 terminal equipment, bringing massive capacity to three of Angola’s five largest cities, capacity which currently outstrips Angola’s international capacity on SAT-3. The new WACS system will expand the international bottleneck with
economically priced bandwidth and, with 24 fibers in the ADONES cable, domestic capacity growth can also be provided inexpensively. That has been the promise of ADONES for the last two years, but before that promise can be delivered, we have to commission this damn system!

Local tests on the racks here in Cacuaco and down in Porto Amboim are complete, and the fibers have all been tested. It's time to put up a 12 hour performance test, but a muxponder card in Port Amboim has a bad tributary slot. We have no spares for that card readily at hand because they are tied up in Angolan customs, and have been for the last three weeks. I call Arne Asplund, the Ericsson project manager, and the first contingency plan is developed on the fly. The same cards are in use on the Cabinda – Soyo span, and Ericsson has staff in Soyo who can bring some of those cards back to Luanda by Thursday or Friday. Then a car can bring the cards to Porto Amboim early next Saturday while the teams return from Lobito that morning, passing through Porto Amboim on their return to Luanda. We will rob Pedro to pay Paolo, and pray that we can get the spares out of customs before we go to commission Cabinda to Soyo. It just might work. The Porto Amboim team leaves for Sumbe and we pack up, find our driver and head back to Luanda. On Saturday evening at 6:30 PM the 15km drive will only take 40 minutes or so, not like the two hours or more it can take at the wrong time on a weekday morning or afternoon.

A truly international team has been assembled to commission ADONES. Arne Asplund, Swedish, has been working this “eight month project” for the last two and a half years. For Ericsson, Arne has recruited Sibu Norolela from South Africa, Carlos N’dala and Moacir Martins from Angola, and Zoran Belobrajic, Boris Bastijancic, and Davor Karasic (Vanna, I’d like to buy a vowel!) from Croatia. For WFN Strategies, representing Angola Telecom are Charlie Foreman and myself; Steve Lentz will join us on December 1st.

Charlie and I arrived Thursday morning on the Houston Express; bustling quickly through immigration and customs to wait two and a half hours to find our driver who had come to the wrong place at the airport and left his cell phone in the car. Welcome to Angola. After checking in to our hotel, changing some money, and loading up our local pre-paid cell phones and cellular data modems with plenty of credits, we head up the hill to Ericsson’s offices inside the Swedish embassy complex in the Miramar district, just down the street from the US Embassy fortress. There we meet the Croatians for the first time. Zoran, Boris and Davor arrived Monday, and have been getting their feet under them, studying the system layout and readying spares and test gear. Introductions are made, acquaintances are renewed, excellent coffee is drunk; we grab Sibu and Carlos and sit down to discuss the idiosyncrasies of working in Angola, and our cunning plan. We work the bugs out of the plan, divide ourselves into teams and finish for the day. Friday we will go through test plans and procedures as well as the spares and test equipment, but Thursday night Charlie and I regroup for some much needed showers, a couple of cold beers, dinner, and a good night’s sleep not in an airline seat.
Sunday, November 22, 2009, 5:30 AM. Boris, Sibu and I gather in the predawn dark at the Ericsson office. Arne lets us in and we load our luggage, test gear and spares into the silver Land Cruiser that will be our home for the next seven days. Bebiano, our driver, is cheerful despite the hour—a demeanor he will maintain for the whole week. Bebiano speaks only a few words of English, and I am the only one of the three of us who speaks any Portuguese. It’s not a lot, so it should be an interesting trip. Fortunately, last year I found a wonderful Portuguese/English dictionary app for my iPod Touch which is quicker and easier to use than a phrase book; it’s a life saver, but it won’t help you speak like a native. We leave by 6:00 AM and escape Luanda traffic with only one brief delay. Once out of Luanda, the three of us doze off and on as Bebiano makes good time down the two-lane highway through intermittent, light, misty rain. We arrive in Porto Amboim just around 9:00 AM. To our surprise, we find the other team still in Sumbe, just packing to leave for Benguela, about two and a half hours farther south. It was too early for breakfast at any of our hotels in Luanda this morning, so we set off to forage for coffee and food, which we finally find at the third restaurant we try. Sated, with our caffeine levels rising, the guard lets us into the otherwise deserted terminal building and we begin to clean connectors, take OTDR traces and prepare for testing with the other team when they arrive in Benguela. The rest of the day proves uneventful; the team in Beguela puts up the 12 hour overnight test and we head off to Sumbe, arriving at our hotel just after dark.

Meanwhile, Chamarel has cleared into Angola in Luanda, and has headed back out to work on the segment between Cacuaco and N’zeto to the north. By Sunday evening the cable fault has been recovered, one end has been jointed, and they are preparing to make the final splice. Repairs have been going remarkably smoothly on board and I get regular e-mails from Richard Hoffman, our shipboard representative. We are awaiting a shore ending crew coming up from South Africa to replace the N’zeto shore end of the N’zeto to Soyo segment. After the repair in the Cacuaco to N’zeto segment is complete, Chamarel will proceed to work on the two segments between Cabinda and Soyo before coming back to make a deep water repair in the N’zeto to Soyo segment. Unfortunately, none of the eight cable segments has escaped some form of cable damage. Fortunately, a recently begun cable awareness campaign seems to be working, and there have been no new faults in the last few months. Richard’s e-mails make running commentary of all the fishing activity he sees, and it’s quite a lot. We fear some of the larger vessels are illegally operating in Angolan waters, which will make it harder to reach them with the cable awareness message. We hope that word of mouth concerning damaged and tangled gear from the previous faults will reach them.

At the inception of the project, ADONES was believed by some to be redundant to Angola Telecom’s needs. Now, with the planned terrestrial network replacement and expansion more than a year behind schedule, ADONES has become the prodigal son instead of the adopted stepchild. Oil companies and wireless carriers are clamoring for bandwidth between Cabinda, Benguela and Luanda, anticipating the imminent completion of ADONES.
November 23, 2009, Monday morning. After loading the Land Cruiser, we check in with the team in Benguela before leaving the hotel. We are in no hurry this morning, for the other team has a hard eight to nine hour drive ahead of them to get to Namibe through Lubango. Then, Tuesday morning they will drive up the road to Lucira and back while we wait in Benguela. Lucira is perhaps the most remote site in the ADONES system. Neither of Angola’s cell phone carriers covers this small fishing village, and we are not certain if there is any regular phone service either, unless it is served by satellite. The coastal road south from Benguela directly to Lucira is dirt and nearly impassible, so we must drive all the way to Namibe, the southernmost point of the system, and then back north 200km to Lucira. With no hotels or guest houses in Lucira, any team working there must make the five hour round trip drive each day.

The news from Benguela this morning is not good. About six hours into the 12 hour test, commercial power to Angola Telecom’s Benguela facility was lost and the site generators did not come on line. Two hours later, the battery in our test set gave out, knocking down the test at a little over eight hours. We only have one SDH analyzer between the two teams because of scheduling and shipping difficulties getting another rental unit from South Africa – don’t ask. The second contingency plan of the week is born. The Benguela team will leave the test set there and head off for Namibe. We will restart the Porto Amboim to Benguela segment test today when we arrive, tomorrow perform the Benguela to Lucira segment test from Benguela, and then bring the test set to Namibe where the teams will meet to test the final Lucira to Namibe segment. Our plan adapted, the Benguela team heads off to Namibe and we depart Sumbe for Benguela.

Bebiano is once again cheerful this morning; he smiles and laughs at my fractured Portuguese and launches rapid-fire responses of which I catch only a few words at a time. But at least he knows what we want to do. After stopping at the local supermarket for water and snacks, we start a companionable drive south to Benguela. The weather is good and the ride is pleasant. I worked with Sibu last year; he is quiet, competent and conscientious, and smiles easily. Boris is affable with a sense of humor nearly as sick as my own; he, too, is competent and conscientious. None of us feels compelled to fill a comfortable silence with unnecessary words.

Bebiano likes to drive fast and the road here is good, but a nasty vibration somewhere in the car that starts somewhere above 120km/hr makes me caution him to slow down from time to time, and he complies good-naturedly. About halfway to Benguela the left rear tire suddenly goes flat. Bebiano eases us safely to the side of the road in the best spot we can find. It’s not a very good one. We are on the main North/South coastal highway, but it is only two lanes with no paved...
shoulders. We are in a depression between two rises in the road, and only about halfway out of the traffic lane with an uneven dirt shoulder. We unload the vehicle sufficiently to gain access to the jack, and alternately assist Bebiano and watch for the fast-moving traffic rocketing over the hills. Forty-five drama filled minutes later we are back on the road with the nearly bald spare now on the left rear. Bebiano starts to push it and, in bad Portuguese, I suggest he slow down, as we no longer have any spare; he cheerfully complies. At least the vibration is gone.

A little over an hour later, we unload at the Benguela central office and Bebiano goes off in search of a new tire. Sibu and Boris restart the 12 hour test and connect the test set to an uninterruptible power supply feeding a router in a neighboring rack that we hope we won’t really need. We carry out a few other tests, Boris and I walk the outside plant down to the beach manhole and I check in with the other team who has made it to Namibe in eight hours. Before we know it, Bebiano has returned with a new tire and it’s time to head back to Benguela. We arrive just before dusk and have a quiet night in, fixing ourselves simple suppers in the small but well equipped kitchen attached to our suite of nicely appointed individual rooms.

On the way back from Benguela this evening we passed one of four new stadiums that have been built for the African Cup of Nations soccer tournament to be held in Angola this coming January. This is the first time that the African Cup of Nations has ever been hosted in Angola, and the whole country is proud and excited. Just before we reached the stadium site we passed a collection of rusty steam powered machinery on display alongside the road across from the main rail station and yard near the Catumbela River on the outskirts of Benguela. Angola is constantly revealing its dichotomy of the old and the new.

Tuesday, November 24, 7:00 AM. I open the door of my room to the sounds and smells of breakfast cooking across the hall. Entering the kitchen, I am greeted by Boris and a tiny, smiling Angolan woman who chirps a cheerful “bom dia” as she works at the stove frying ham, eggs and bacon for us. Our cook brings over a pot of hot water and we make instant coffee, tucking in to our breakfast accompanied by individual crusty, warm loaves of wonderful fresh baked bread. Sibu enters the kitchen a few minutes later and, lucky for him, we remembered to save him some food. We thank our pixie-like cook and, still smiling, we exchange “bom dias” as we leave to haul our gear back down to the car. Once again we are off to Benguela with Bebiano at the helm.

The 20km stretch of four-lane, divided highway between Lobito and Benguela is one of the nicest roads in all of Angola. It is not a fast road; Lobito is Angola’s second largest port after Luanda and the Lobito/Benguela area is a center of heavy manufacturing in Angola. There is traffic aplenty, with a commensurate share of trucks hauling shipping containers but, fortunately, it is nothing like Luanda's traffic quagmire. In 20 minutes we are at the Benguela station and find that our test has run undisturbed and error free overnight. Boris and Sibu take down the test and we putter on various tasks waiting for 10:00 AM when we are scheduled to call Lucira on the orderwire.

10:00 AM comes and goes and no one answers in Lucira. We try again on the half hour, and once more at 11:00 AM when someone does answer. It seems one of the other team’s cars had a flat tire on the way to Lucira. One of the reasons the other team has two cars is that they were going to Lucira first. Because that road is so isolated with no way to call for help, it was only prudent to send two cars together. The rest of the day is uneventful. The Lucira team completes local tests on both sets of equipment and loops one set to us and the other set back to Namibe so we can carry out the 12 hour test on that segment when we arrive in Namibe with the test set, and before anyone has to go back to Lucira. Sibu and Boris set up the 12 hour test to Lucira and we return to Lobito while the other team drives back to Namibe. Today was easy, tomorrow will be tougher.
At sea, Chamarel has completed repairs on the N’zeto to Cacuaco segment and has begun repair operations on the near shore Soyo to Cabinda segment.

November 25, 2009, Wednesday morning. We are up early in Lobito. The boys in Namibe have an easy day today as they wait for us to arrive. The same delightful lady cooks breakfast for us, then we say our goodbyes and pack the Land Cruiser. We return to the Benguela station to find our test has run perfectly overnight. We break down the test setup and patch the tributaries from one segment straight through to the other, the configuration we will need for the long term stability test. We don’t know if we will have to come back to Benguela station and need to leave it prepared if we don’t return. We toss the last pieces of gear in the back of the car and head off on the long drive to Namibe.

The road between Benguela and Namibe is approximately 520km, 350km to Lubango, and 170km from Lubango to Namibe. Lubango is nearly 150km inland and sits some 2,000 meters above sea level. The road between Benguela and Lubango was heavily damaged during the 27 years of Angolan civil war, and has been under reconstruction for several years. Last year Sibu drove on that road and it took nearly eight hours just from Benguela to Lubango. Recent reports are that it is much better. We will see for ourselves today.

The countryside gets drier and the vegetation turns to scrub as we leave the outlying commercial neighborhoods of southern Benguela. The land is dry and dun colored, without ground cover between the low, dusty bushes. The road is excellent: well paved with wide shoulders and the occasional passing lane in the hills. Bebiano’s foot gets heavy, and it is hard to discourage him unless we get into curvy sections as the road begins to rise into the foothills. We make good time for an hour or so and, suddenly, we are into dirt road. It’s not a bad dirt road, it is relatively smooth, but we slow to 60-70km/hr as the dust rises around us in huge clouds from the traffic ahead of us, and from our own vehicle. Visibility limits our speed as much as road surface. Then, almost as quickly as it started, the dirt ends. We have spent about 20 minutes in the dirt. Little do we know that this is just a taste of what will come. We enjoy pavement for another 30 minutes or so, and then the real dirt road starts in earnest.

Our speed drops to about 40km/hr, and the ride is horrible. Where traffic permits, Bebiano moves from side to side on the road seeking the smoothest path. The dust is nearly impenetrable where we follow along with buses and large tractor-trailer trucks also picking their way through the potholes and bumps. The incentive to pass these large vehicles is not only to make time, it is also to escape the choking dust. When trying to pass, it is almost like driving through fog.
As we have progressed towards Lubango the road has risen and the dry scrub landscape has given way to Baobab and other deciduous trees, but the ground beneath the trees is still dry and without cover. This lack of ground cover combined with the excavation of the road yields the heavy dust. Beside us, between the trees, we can see the roadbed under construction; some of it is nearly ready to be paved; other sections are definitely works in progress. I learn some new words in Portuguese, none of them polite, as I try to express to Bebiano how bad we think this road is. My dictionary has some excellent and unexpected translations. The “f” word in English is also an “f” word in Portuguese. Boris provides translation into Croatian and the alliteration is lost. We all laugh.

The ride is draining as we are continuously tensed and braced for the next impact. After about an hour, we pull off on a section of the reconstructed roadbed for a 10 minute break. Another half an hour and we have finished the 60km of hell as we find the pavement again. To our left, as we get ready to pull back onto the asphalt, we see red and white striped tape with red and white skulls and cross bones, and the words “perigo minas.” The words are Portuguese for “danger mines,” and we have seen our first minefield. It is just one more sobering remnant of a prolonged and devastating civil war.

The rest of the road to Lubango is excellent and we make good time, arriving at the new Sonangol gas station and mini-mart just outside of the northwest side of the city in about five hours, not too bad. We work our way through Lubango, another of Angola’s five largest cities, and climb through a beautiful wooded park on our way out of town. We continue on a high plateau that is greener than what we are used to seeing in the Angolan countryside where we have been. There are more trees and even grass and ground cover. Houses and outbuildings appear to be in better repair and built of better materials than the hand made concrete and adobe blocks which are ubiquitous in this country. Things seem a little less desperately poor.

About 20km out of Lubango, and seemingly in the middle of nowhere, we come to a steel frame gate across our lane, and a shack made from a small shipping container. It is a tollbooth! For what we cannot imagine, as the last tollbooth we came across was for the bridge over the Cuanza River, south of Luanda. Bebiano pays the toll of 200 kwanza (a little over US$2.00), the gate is raised, and we are on our way. In a few kilometers we come to the pass at Serra da Leba. A small river on the high plain has cut a deep gorge in the face of the cliffs which mark the abrupt end of the plateau.

The two-lane road twists through at least six hairpin switchbacks which remind me of my own experiences in the Rocky Mountains in the US. The views are stunning, and the pass continues for 14km along the face of the cliffs as it drops nearly 1,000 meters in altitude. If not for all those kilometers of bad road we would never have witnessed these breathtaking views.

At the foot of the pass we encounter one of the many informal, yet semi-permanent, open air markets often seen along the Angolan highways. Continuing on, the terrain turns to barren, rocky desert for many kilometers until we suddenly drop a few hundred meters into a verdant river valley. The green lasts only a few kilometers, and we are back into the parched desert for the last push into Namibe. Along the highway, on either side at regular intervals, we see long abandoned wrecks of cars and trucks with the look of skeletons picked clean by scavengers and insects.

We arrive in Namibe seven and a half hours after departing Benguela, parking in front of the Hotel Moçâmedes, named after the original Portuguese appellation for this city. Once solely a fishing port, Namibe has grown to be Angola’s third largest port catering particularly to bulk mining cargos such as iron and copper ores at Sacco Mar. We find our colleagues, relaxed, at the hotel. After a morning
at the Namibe station and a couple cold ones at lunch, they have been hanging out waiting for our arrival. Mildly jealous, but glad to be out of the car and not sitting, we check into the hotel and take our bags to our rooms. We catch up with our friends for a few minutes then, reluctantly, get back in the car and head to the Namibe station. Charlie and I walk the outside plant to the beach while Sibu, Boris, Zoran and Davor set up the 12 hour test. Returning to the station, I am introduced to the local Angola Telecom staff. While waiting for the test to run undisturbed for an hour before leaving it, I overhear Zoran complain about our plan changing every 15 minutes. Actually it’s only been every other day. I chuckle to myself. That’s just the nature of working in Africa: adapt or fail. We leave the station just as dusk sets in, return briefly to the hotel, and then head for dinner at a waterfront restaurant the other team has discovered. There, accompanied by cold N’gola beer (only available in Lubango and south) and the rest of the team, I enjoy two beautiful lobsters, plucked fresh from the tank beside the table, and shake off the very long day.

Thursday, November 26, 7:30 AM. We go to breakfast at the buffet downstairs, head to the Namibe station to find out our test has run without errors, and then take off to Lucira. Bebiano will stay here in Namibe; a respite after yesterday’s long drive. Charlie decides to join us, and the four of us split up into the two cars. Charlie and I haven’t had a chance to catch up in nearly a week, so we get into the sable brown Lexus Land Cruiser equivalent that has been Charlie’s home, while Sibu and Boris get in the other silver Land Cruiser driven by Andre. Afonso is our driver, and he has the most English of the three; it’s still not a lot, though probably better than my Portuguese. The first 120km are excellent pavement. We start driving back out of town about 15km inland and then turn north. The road rises into low hills and mesas, and the land is rocky, parched and covered in scrub vegetation. After a while, we travel a high plateau and the road turns to well-tended gravel at the 100km post. The road makes a sharp left turn, crests a hill and we begin to descend. Ahead, through a cloud of the ever-present dust, we see the Atlantic Ocean breaking on the beach as we approach Bentiba, another small coastal village named for the desert that surrounds it. Bentiba is home to a prison camp started by the Portuguese and now maintained by the Angolan government. We have been told that security around the prison is minimal because the location itself, in the middle of the desert, makes escape nearly impossible, if not deadly.

About 30km beyond Bentiba the road has risen again and deteriorates into bad dirt and broken pavement. Portions of the old roadbed are everywhere, paralleling the current track. Apparently, the old road was washed out by years of the annual rainy season deluges, aided by neglect during the many years of Angola’s inner strife. Work in progress is evident now in multiple locations along the path, as are remnants of an old above ground water pipeline leading from a large concrete cistern. Afonso picks his way along the broken surface and we come to the turn off for the village of Lucira. The last 9km into Lucira follows a gorge cut by a dry streambed; at least it is dry at this time of year. We drop nearly 300 meters and pass what appear to be wild donkeys, following the clear remains of another old,
broken road complete with speed limit signs and signs indicating the direction of upcoming turns; the only thing missing is the road. We make a final left turn around an outcropping of rock and the pretty fishing village of Lucira is revealed in front of us. It is around 11:00 AM as we make our way through town to the Angola Telecom site, and Charlie and I remember that at home it is Thanksgiving Day.

We arrive at the site to find that neither of the generators powering our shelter is working. Another shelter on the site holds some type of radio equipment, and is powered by a large array of solar cells, but not our equipment. Along with no cell service, Lucira also has no commercial power. Angola Telecom has made an arrangement with the local fishermen, who also require diesel fuel, to combine their fuel deliveries so their 5,000 liter fuel tank can be filled once a month as the delivery trucks require a minimum load of 10,000 liters to make the long trip to Lucira. Right now we are not burning any fuel at all.

Before arriving we knew that one generator had failed, and Ericsson has been waiting for their subcontractor to repair it. The second genset stopped last night (according to the local site guard) and the equipment is running on batteries. The voltmeter reads just over 53 volts, down from the battery float voltage of 54 volts. The low voltage disconnect will drop the equipment near 42 volts, we need to move quickly to get our work done and try to get the generator running. Other than an Iridium satellite phone, the only connectivity we have with the team in Namibe is the orderwire on the transmission equipment. If the site goes down, we lose that communication.

We start testing fibers with the door to the shelter open and temperatures rising. We forgot to charge one of our battery powered fiber scopes last night, so we get Afonso to bring over one of the cars so we can charge it using a 12 volt inverter that plugs into the cigarette lighter. Sibu goes off, and about 10 minutes later he gets the remaining generator started. We’re not sure what Sibu did, but we talk to Namibe and ask them to get some fuel delivered here, along with someone to check the fuel filters. Collectively, we breathe a sigh of relief as the lights and air conditioning come on in the shelter, and we finish up our work. Once again, Charlie and I walk the outside plant to the beach manhole, revealing some of Lucira.

We reach the water and find a pristine beach in a beautiful bay, surrounded by prominent headlands. Above the high water mark, someone has planted small deciduous trees of unknown species, surrounded at the bases with white painted rocks. To the south we see a long, rickety pier extending from a low wood frame building which may be a processing facility. Near the building on the beach, nets are laid out to dry in the sun. To the north, a couple of more substantial piers jut into the bay, the fishing fleet lies at anchor and people are playing on the beach. This morning the fleet consists of two large trawlers (20m or more), a few motor vessels and about 20 native wooden skiffs, mostly powered by outboards. Behind us, the municipal buildings of Lucira are well maintained with their fresh paint sparkling in the bright sun against the azure sky and the backdrop of the rocky hills rising swiftly behind the village.

Work completed, we pile back into the cars and depart for Namibe. On the way back, Charlie and I discuss how we might describe all that we have seen this week and bring some understanding of it to our teenage daughters. It is a daunting task.

As we get close to Namibe, I fire up my wireless modem and check e-mail to find that Chamarel has encountered heavy currents off the mouth of the Congo River and has broken off repair work after making only one splice in the near shore segment of Soyo to Cabinda. The ship will move out to the offshore segment and south towards Soyo to continue work there.

We return to the Namibe station to join our colleagues and finish up the last few tasks before we depart Namibe for good. Apart from the failed card we must replace in Porto Amboim, we are finished with the southern half of the ADONES system and we will start the two day drive back to Luanda tomorrow morning. Charlie and I have decided to
celebrate Thanksgiving by taking the whole crew out to dinner tonight at the same restaurant as last night. We explain the Thanksgiving holiday to our international group, Carlos offers to buy shrimp appetizers for the table, and the party starts. We all have much to celebrate. My Thanksgiving dinner is wild boar accompanied with cold dark N’gola beer instead of traditional roast turkey and red wine, but we have the fellowship of a successful team effort that takes some of the sting out of missing family and friends. Somehow, the seven of us have succeeded in running this restaurant, and the neighboring one, out of dark N’gola beer, but we manage almost as well with the lighter version until it is time to head back to the hotel. Upon returning, I call my wife and daughters at my sister-in-law’s house in Maryland and enjoy some family time for a few minutes. The day comes to a quiet end.

The next morning, all three vehicles leave in convoy for Lobito. Uneventfully we follow the same road with the same magnificent views and appalling dirt sections and, together, celebrate our success again in the Restinga section of Lobito Friday night. Saturday morning we rise, breakfast and convoy to Porto Amboim. Andre experiences a bad tire north of Sumbe before arriving in Porto Amboim where we find our earlier contingency plan has come to fruition. The driver has arrived with our spare card and, within an hour, the swap has been made, the fibers re-patched, and we are back on the road to Luanda, arriving before dark and on schedule.

In eight days we have driven more than 2,500km over bad roads, and commissioned and tested four transmission segments with trying logistics, basically on schedule. Instead of the full day off for the teams originally planned for Sunday, some will have to go to Cacuaco to start the 12 hour test to Porto Amboim. I think we can safely put this in the “win” column. We don’t yet know what our next two weeks will bring, but without doubt the surprises and challenges will continue. After all, it’s not a job, it’s an adventure.

Guy Arnos has over 25 years experience in submarine and terrestrial networks, and has been responsible for the planning, engineering and implementation of transoceanic, transcontinental and metropolitan telecom systems. He joined WFN Strategies in 2001 as Director of Projects, and has been responsible for accomplishment of telecoms engineering projects in Angola (ADONES), Australia (NW Shelf), Antarctica, Trans-Pacific cables (MPC, Unity North), UAE (Multi-use Submarine Cable System), Colorado/ Oklahoma/Wyoming (Broadband Wireless), and Gulf of Mexico.
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GULF BRIDGE INTERNATIONAL
THE HIGH TECH BRIDGE CONNECTING THE GULF WITH THE REST OF THE WORLD

STAN KRAMER
Introducing Gulf Bridge International (GBI) and the GBI Network™

Gulf Bridge International (GBI) is the Gulf region’s first privately owned submarine cable operator. Based in Qatar, the company’s mission is to connect the Gulf nations to each other – and to the world beyond – using world-class fiber-optic technology. GBI is a new company owned and operated by investors in the GCC. The GBI Network™ will be used to provide wholesale international bandwidth to fixed and mobile telecommunication operators, internet service providers and other capacity users throughout the Gulf region.

The development of the project grew from the vision of the Qatar Foundation, who saw the project as a means of achieving their mission to prepare the people of Qatar and the region to meet the challenges of an ever-changing world, and to make Qatar a leader in innovative education and research. The company has completed the majority of the investor subscription process and is fully financed to construct the both phases of the GBI Network™. Phase I involves the construction of the Gulf ring and connectivity to Europe, while Phase II completes the link to India.

The Gulf Bridge Mission

The achievement of a knowledge-based society in the Gulf depends upon the availability of high-capacity fiber-optic connectivity, both within the Gulf and around the globe. Consumers in the Gulf are demonstrating a strong demand for information products and services. Global business and technology leaders likewise desire to enhance their communications services. To provide those services, telecom operators and internet service providers of the Gulf region require competitively priced, highly resilient connectivity. All of these needs will be met by GBI, the new bridge to the Gulf.

The Gulf Opportunity

The Gulf countries have experienced very strong broadband subscriber growth in recent years, which is considered the most important driver of demand for international bandwidth services. Between 2007 and 2008, when Asia and Europe were experiencing 16-18% growth, broadband subscribership in the Gulf increased by 55%. This growth is expected to continue as broadband penetration of 14% lags well behind other regions (for example, 78% in Europe). The exciting opportunity implied by these statistics allowed GBI to overcome the difficult environment of the worst financial crisis in 80 years to secure all the funding necessary to construct the entire GBI Network™; assemble a senior team of executives and subject matter experts; close and bring into force the supply contract for the construction in the Gulf and to India; and close and bring into force the agreements needed to extend the fiber pair connectivity to Europe.

The GBI Network™

The GBI Network™ will use advanced technology including Optical Add – Drop Multiplex (OADM) branching units to create direct connections among numerous countries. Integration with another submarine system will be used to extend direct connectivity from inside the Gulf all the way to Europe and to India. Mesh switching will enable optimal use of all this connectivity to efficiently provide both service and protection.

Tyco Telecommunications was awarded the supply contract for the new construction. Established telecom operators in each country are taking part as landing parties. These operators are providing the necessary cable stations and connections from the beach to those cable stations, as well as interconnection, back-haul services and co-location space for other operators and, in some cases, alternate back-haul service providers.

The GBI Network™ has been designed as a regional submarine cable system in the Arabian Gulf with onward connectivity from Qatar and UAE to Europe and India as shown in Figure 1.

GBI Network™ employs advanced undersea technology from its turn-key system supplier, Tyco Tele-
communications, who are providing the undersea cable, repeaters and branching units, DWDM terminal equipment, Element Management Systems (EMS) in terminal stations, and Network Management Systems (NMS) in GBI’s Network Operations Center (NOC).

Within the Gulf, the GBI Network™ is designed as a fully redundant, self-healing ring architecture; onward connectivity to Europe and India is designed for resiliency against equipment faults. The wet plant design capacity within the Arabian Gulf is 128 x 10 Gbps channels on each of two fiber-pairs. The wet plant design of the fiber pairs which provide the onward connectivity Qatar to Oman and Qatar to India can also each support 128 x 10 Gbps channels whereas the fiber pair from Qatar to Egypt can support a minimum of 96 x 10 Gbps channels.

Future GBI connectivity to other cable landings on the Arabian Peninsula via fiber acquired on another undersea cable can be enabled through preinstalled stubbed Branching Units positioned between the Egypt landing and the India BU. The network topology is shown in Figure 2.

The complete GBI network is realized through a physical integration of undersea cable systems and a negotiated commercial agreement. The commercial benefits of this arrangement are in the reduction of implementation costs through sharing of infrastructure and the avoidance of unnecessary interconnection and transit fees.

**GBI Network Connectivity**

Although GBI Network™ employs a small number of fiber pairs in the undersea cable, extensive point-to-point connectivity is established through use of Optical Add Drop Multiplexing (OADM) functionality within the undersea plant. The OADMs permit the selective add/drop of wavelengths between the trunk cables and the branch cable stations. The OADM wavelength selection is performed as part of the system design and has been tailored to the unique capacity requirements of each landing station based on comprehensive country pair traffic studies. Figure 3 illustrates the extensive connectivity facilitated through the GBI Network™.

**Project Implementation**

A venture of this type requires the complete and timely cooperation of those having key roles to play in the project development. The integration of the GBI network with that of another system outside the Gulf presents a unique interface challenge. To meet this challenge, detailed technical, commercial and operational agreements were put in place among three parties - GBI; the other system operator; and Tyco Telecommunications - to manage the risks inherent in such an interconnection. In order to manage the interface issues and to provide project management of the implementation, Gulf Bridge has contracted The David
Ross Group Inc (DRG) to serve as overall Program Manager for the effort. DRG is a global leader in the development of undersea fiber networks. They have put in place for GBI the key project management disciplines and infrastructure to manage all aspects of this endeavor during the initial phases of the project. This allows the GBI team to gradually build its infrastructure as the project progresses, and avoids the need for the GBI start up entity to have a full cadre of experienced staff in place at the start of implementation.

DRG, in concert with the GBI core team, manages the implementation of the shore-end facilities from the various landing parties; all aspects of the supply contract, including hard-goods manufacture, permits, survey and marine operations from Tyco Telecommunications; and delivery of the requisite undersea fiber pair and terrestrial capacity from other network operators. A key element of the DRG Program Management approach is the implementation of a formalized Risk Management process. Applying the considerable experience of DRG and Tyco Telecommunications, potential program risks are identified early in the project and formal mitigation plans and monitoring processes are established that will reduce program delays or cost increases. Risk mitigation is managed in a team approach among GBI, DRG and Tyco Telecommunications.

Key to the success of the project is the partnership being developed between GBI and the various Landing Parties - the domestic carriers who will provide the shore facilities and management of the landing stations. Landing Party agreements are being developed that provide those carriers with affordable, resilient intra-Gulf connectivity and access to key locations outside the Gulf. Connectivity with GBI will provide much-needed redundancy for the Landing Parties’ international networks. To date, transport routes outside the Gulf have been limited, leading to the potential for extended downtime should a cable cut occur – a situation that resulted significant loss of connectivity in 2009 due to a cable cut.

Conclusion

GBI, with a clear vision and mission and strong financial backing, has developed a compelling response to the needs of the Gulf community for enhanced information infrastructure.

The GBI Network™, through the creative use of technology and leverage of already planned or existing infrastructure will support the transformation of the Gulf region into an information-based society with access to affordable, reliable broadband capacity, creating the bridge to sustainable growth.

Stan Kramer is the Vice President, Program Management for David Ross Group. Mr. Kramer has over 25 years experience in the telecommunications & electronics industry, specializing in marketing & sales, procurement and manufacturing. He is currently serving as Program Manager for GBI. Prior to joining The David Ross Group, Mr. Kramer was on Tyco Electronics corporate staff responsible for improving overall cost structures across the manufacturing supply chain. Prior to this, Stan had executive level responsibility for sales, marketing, business development and product management for the design, manufacture, installation and maintenance of undersea cable systems at Tyco Telecommunications. He also formed the sales operations function for capacity sales and developed on-ward connectivity solutions for the Tyco Global Network.

Thanks to John Mariano, Partner & Executive VP - DRG and Jim Baroni, VP, Network Design - DRG for their significant contributions to this article.
MIDDLE EAST BANDWIDTH PRICING REVIEW
EUROPE-MIDDLE EAST-INDIA: IS A NEW GLUT UPON US?
In 2010, five new submarine cable systems connecting the Middle East are scheduled for activation, with additional systems planned for service soon after. Europe India Gateway (EIG) cable, India-Middle East-Western Europe (IMEWE), Middle East North Africa (MENA) Cable System, TE North, and FLAG Hawk will cumulatively increase potential capacity between Europe and Egypt by more than 14 times. While the cable cuts to SeaMeWe-3, SeaMeWe-4, and FLAG Europe-Asia (FEA) in Q4 2008 and subsequent service disruptions demonstrated a need for greater physical diversity and restoration in the region, and the region holds promise as an emerging market with high growth for bandwidth demand, the large infusion of new capacity prompts questions about a bandwidth glut and price declines. This month’s Bandwidth Pricing Report reviews the new cables and their potential impact on pricing.

**New Supply**

Over the last two years, upgrades to existing systems have made a dramatic difference in available supply on the Europe to Asia route. On the segments between Europe and the Middle East, FEA was upgraded from 25 Gbps to 85 Gbps, and SeaMeWe-4 was upgraded from 480 Gbps to 1.35 Tbps, tripling lit capacity on the route. With a total aggregate unprotected design capacity of nearly 2 Tbps on existing cables, operators have little remaining potential capacity to activate. New system capacity will dwarf existing capacity with the five new systems offering a potential capacity of 26.24 Tbps between Europe and Egypt. The initial lit capacity on these new cables could reach 2 Tbps, thereby more than doubling the amount of lit capacity in service (see Figure: Planned Submarine Cables (Middle East and North Africa)).

**New Hubs Emerging**

London, New York, Hong Kong, and Tokyo have long served as intersections of global submarine capacity. With the deployment of new cable systems between Europe and Asia, new locations are emerging as capacity hubs. While landings points for the new systems vary, many of the new systems overlap in Egypt, Jeddah, Fujairah and Mumbai. (See Figure: Middle Eastern Submarine Cable Connectivity Matrix). New cable construction will further extend capacity to underserved markets in the Gulf region, as well as countries like Lebanon and Tunisia. Integration with SEACOM, TEAMS, and the EASSy cables will pick up demand from emerging East African markets.
Pricing Trends

Even before the introduction of new cable systems, upgrades on existing systems have prompted dramatic price declines. An upgrade to SeaMeWe-4 in 2008 nearly tripled available capacity between Europe and Fujairah, giving consortium members additional capacity at a very low incremental cost, and spurning price reductions of more than 50 percent over the past year. Median STM-1 monthly lease prices between Marseille and Fujairah from nearly $30,000 per month in Q3 2008 to $12,000 per month in Q3 2009. (see Figure: Wholesale Median STM-1 Monthly Lease Prices, Marseille to Fujairah, Q4 2008 to Q3 2009.)

Although undersea cable system prices connecting the Middle East have dropped, establishing connectivity beyond landing stations poses a taller price hurdle. For many Middle Eastern destinations, foreign operators are obligated to use preset “one stop shop” arrangements, with the local carrier providing the half-circuit on the consortium system and the necessary backhaul service.

For instance, in mid-year 2009 unprotected prices between a point of presence within the United Kingdom and a customer premise in the UAE for E-1s was between $15,000 and $18,000 per month, for DS-3s $155,000 and $180,000 per month, and for STM-1s between $275,000 and $290,000 per month. Prices between a point-of-

Notes: Cables shown are those introduced since 1997. Landing points for cables outside of Europe, Egypt, the Middle East and India are omitted. Highlighted rows indicate the countries where cable landings overlap.
presence in Mumbai and a customer premise in the UAE are about two-thirds the U.K. rates, with STM-1s approximately $155,000 per month.

Comparatively, monthly recurring charges for STM-1s on SeaMeWe-4 between these countries and Western Europe contribute only a fraction of these costs. Marseille to Fujairah STM-1 median lease prices at $12,000 per month contribute only 4 percent of the POP-to-end service noted above. London to Mumbai, inclusive of backhaul to the city centers, is only $40,000 per month, about 75 percent cheaper than a UAE to Mumbai service. (See Figure: Wholesale Median STM-1 Monthly Lease Prices by Route, Q3 2009.) While these prices are 5 to 10 percent less than they were a year ago, the year-on-year price erosion is nothing near proportionate to the price changes seen on SeaMeWe-4.

Although backhaul and local access for foreign carriers in the Middle East remains a hurdle, the SeaMeWe-4 cable system has otherwise made high capacity international services available and significantly more affordable. Where sales on FLAG Europe-Asia and SeaMeWe-3 were often STM-1 increments and below, sales on SeaMeWe-4 are often STM-4s and STM-16s, frequently deployed to access Internet exchanges and relatively inexpensive IP transit in major Western European and Asian cities.

Outlook

Bandwidth oversupply begets price declines, but the link between cable development and price is complex. Cable systems introduce large amounts of capacity into the markets at once, but with long lead times, so they come as no surprise. Ownership also affects market prices for new capacity. New consortium systems, such as IMEWE and EIG, initiate service with capacity allocated to the immediate foreseeable needs of consortium members, so even though turning the cable on introduces a large amount of capacity in the region, it does not necessarily flood the open bandwidth market with excess capacity. Future consortium system upgrades, as demonstrated with SeaMeWe-4 and APCN-2 in the Pacific region, appear more likely to trigger price competition.

Investor-owned systems will be more immediately exposed to market prices for wet capacity and price hurdles for backhaul and local access. Dependent on other carriers as customers, they will compete on novel attributes such as independent ownership, path diversity and unique landing stations. MENA, for instance, will compete with the combined FLAG Falcon/FLAG Hawk systems. Over the medium term, little price differentiation will exist between systems on parallel routes.

Beyond aggregate supply and the distinctions between cable systems, international bandwidth pricing for the Middle East will depend on demand. Future system upgrades, and the unit cost reductions they deliver, won’t be made unless demand warrants. The Middle East has demonstrated the highest regional compounded annual growth rate in international Internet traffic tracked by TeleGeography’s Global Internet Geography —near 115 percent between 2005 and 2009. The compounding effect of growth of that magnitude quickly results in high absolute bandwidth needs. Dynamics in the cable system market will produce further price erosion in the short-term, which may be triggered again by individual system upgrades over time. In the longer term however, a sustainable balance between supply, demand, and modest price competition seems likely.

FIGURE 4

Wholesale Median STM-1 Monthly Lease Prices by Route, Q3 2009

Notes: Each bar represents the median monthly lease price for a STM-1 (155 Mbps) circuit on the listed route. Prices are in USD and exclude local access and installation fees. Routes originating in Marseille do not include backhaul at the terminating end. The London to Mumbai price includes backhaul to city centers.
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WHAT IMPACT HAS THE NEW INTERNATIONAL FIBRE REALLY HAD IN AFRICA?

PETER LANGE
It is one of the big stories in global telecoms in 2009/2010: Many African countries are gaining access to fibre optic international submarine cables for the first time. Some directly, others (e.g. landlocked countries) via terrestrial fibre links with neighbouring countries. And some countries are gaining access to a second international cable in addition to an existing one which, in most cases, has been monopolised by a national telco.

Announcements have been made that the cost of international bandwidth will now come down by as much as 90% off the satellite-based or monopolistic fibre pricing levels of the past. This will make broadband Internet access affordable to a much broader part of the population. The Internet brings access to education, unbiased information, and improved competitiveness in the global marketplace – all things that will empower and literally revolutionise the economies and societies in these countries.

But what impact has the new international fibre really had, several months or in some cases years after its arrival?

The answer differs from country to country, ranging from “dramatic” to “none”. The demand is certainly there in all countries, but for the full benefit of new international fibre to unfold, all the other elements along the supply chain to the end user need to be developed. These include:

- national fibre backbone networks (preferably more than one) to take the new cheap bandwidth to population centres around the country;
- a regulatory regime for fair and open access to the international fibre and the national backbone;
- wireless and 3G mobile broadband infrastructure (and competition) on the access level.

www.budde.com.au, the largest global telecommunications research site on the web, has recently updated a number of African country reports that can serve as case studies of what is possible in markets with a favourable environment, and what the roadblocks are in others:

The SEACOM, TEAMS and LION submarine cables have brought international fibre bandwidth to Kenya, Tanzania, Mozambique and Madagascar for the first time in mid 2009. Landlocked countries that benefit include Uganda and Rwanda, with Malawi and Zimbabwe preparing to do the same. Sudan and landlocked Ethiopia have been connected since 2003 and 2006, respectively. Like Ethiopia, landlocked Botswana is diversifying its terrestrial fibre links via neighbouring countries to gain a competitive advantage. Zambia, also landlocked, gained access to the SAT-3/WASC/SAFE cable in 2009 via Namibia and South Africa. Namibia is not landlocked but also still depends on other countries for transit links until new submarine cables arrive on the African west coast in 2010 and 2011.

All of these countries are at varying stages of development with their national fibre backbones and wireless/3G mobile broadband networks, and they have different regulatory regimes. In some of them, the new international fibre has already led to lower broadband prices on the consumer retail level, in others not yet.

Ethiopia can be called Africa’s dinosaur in terms of telecom deregulation and serve as an example for how international and national fibre may not change anything if it is monopolised. The national telco, ETC still has a total monopoly on everything - fixed, mobile, and it is even the country’s only ISP. It connected to international fibre from Saudi Arabia via Sudan in 2006 and has rolled out quite a bit of national fibre, but the new international link has only limited capacity and is unreliable. It is not sufficient to support a large broadband market, so ETC continued its low-volume high-price strategy, resulting in some of the world’s lowest penetration rates in all market segments. Internet connectivity has even been cut to eight regional towns, including a state capital, due to “over-subscription” which had exhausted the available bandwidth of 16Mb/s to each town.
Kenya was expected to lead the way with lowering broadband prices when it gained access to not one but two international cables for the first time in mid 2009, Seacom and TEAMS. But while prices have come down to some extent, the government gave ISPs a four-months ultimatum in December to do more or face price caps.

Madagascar is a positive example: The LiON cable went live there in December 2009, and the operator of the cable (Orange) immediately cut its retail broadband prices in half, while tariffs of other broadband providers remained unchanged. Orange has bemoaned the fact that the regulatory framework is not clear on how it can exploit the cable, in particular wholesaling capacity to other operators. The national telco, Telma (still 32% government-owned) is a partner in the EASSY cable project, and it looks like the government is waiting for its arrival later in 2010 before (possibly) moving on regulation. Telma is also rolling out a national fibre backbone - so far the only one in the country.

South Africa is different from many other countries in the region in that it has already had international fibre access for some time (the SAT-3/WASC/SAFE cable, monopolised by Telkom SA with resulting high prices). The second national operator, Neotel, landed the Seacom cable in the country. In addition, the government created a new entity, Broadband InfraCo to provide open access to government-owned national infrastructure, which compromised Neotel’s business plans to some extent. InfraCo, together with all other major fixed and mobile operators in the country (Telkom, Neotel, Vodacom, MTN) is rolling out the West Africa Cable System (WACS). So there is now a sufficient degree of infrastructure-based competition, and prices have come down.

WACS is only one of several fibre initiatives along the African west coast, to compete with the SAT-3/WASC cable. However, most markets along the west coast have not moved on deregulation as much as their eastern counterparts and have left the incumbent telco with monopoly rights, so that the new cables may not have the maximum possible effect immediately.

Nigeria is one exception, where second national (and mobile) operator Globacom is spearheading the Glo-1 international cable and has built an extensive national fibre backbone. The incumbent national telco, Nitel, is no real threat, but other mobile operators such as MTN and Zain are rolling out national fibre as well, and on the access level the market is very competitive with many fixed-wireless operators.

The Glo-1 cable also landed in Senegal and Ghana, but it is unclear how many of the other planned landing points along the African west coast will actually be implemented, so SAT-3/WASC looks set to remain the only cable serving that region until the MainOne, ACE and WACS cables arrive later in 2010 and 2011.

International fibre bandwidth hubbing, a lucrative business

The small West African country of Benin has been working quietly over the past few years to become a regional hub for international fibre bandwidth. The national telco, Benin Telecoms (BT) has been building terrestrial fibre routes to landlocked neighbouring countries such as Burkina Faso and Niger, allowing them to connect to its landing station for the SAT-3/WASC cable, the only one serving the region. But also other coastal countries in the region are using Benin as a hub – Togo because it doesn’t have its own SAT-3/WASC landing station, and Nigeria because its national telco Nitel is in disarray and not managing its own landing station properly.
The Togo link was extended to Ghana earlier this year, giving Benin a backup route to another SAT-3/WASC landing station, which is important since ships’ anchors have in the past damaged various branches of the cable, causing major outages.

Benin may get its own Glo-1 landing station in the future, and the France Telecom-sponsored ACE cable is scheduled to reach it in 2011. Meanwhile, other companies are already pushing into this lucrative business: Nigerian alternative telco, Phase3 Telecom has teamed up with electricity utilities in Benin and Togo to roll out and operate fibre along power lines, with expansion plans for Ghana, Burkina Faso, Niger and Cote d’Ivoire (Ivory Coast) from 2010.

However, lower broadband prices will only trickle down to consumers in the region if and when BT and the other national telcos pass the cost savings on. For the time being it looks like most of them are trying to maintain the comfortable low-volume/high price business model of the past, keeping consumer broadband prices high. But this will change as competition intensifies and regulatory pressure on the incumbents to open their markets.

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CROSSING THE MED
AND THE NEED FOR DIVERSITY

IOANNIS KONSTANTINIDIS
Connecting Middle East, North Africa & South Asia to the rest of the world

The Arabic name for a Middle Eastern marketplace is “souq” (or alternately “sooq” or “suq”). In Persian Middle East, they are called “Bazaar”. Either named souq or bazaar the M.East & S.Asia markets have a common label in the telecom business: Booming.

Natively produced traffic in M. East and N. Africa as well as transit traffic from S.Asia is presenting immense growth. The latest Internet studies show that the Broadband penetration is still low in the area, showing, however, huge yearly increases in international bandwidth needs.

Current Internet bandwidth estimates are in the range of more than 950 Gbps for M.East, Africa and S.Asia, while nearly doubling on an Y2Y basis (2009 est., source: Telegeography Research).

From an international wholesale telecommunications carrier perspective these regions and their increasing broadband needs present a worthy challenge and a unique business opportunity.

And how is this traffic served?

Today the Mediterranean is an important link between the Major International Exchanges in Europe and the Middle East, N. Africa and S.Asia regions.

The Mediterranean Basin is, in terms of geography, the area of choice for the connection of the M.East countries, Pakistan, a big portion of India’s traffic, as well as of N.E.Africa, to the European International Telecom Traffic Exchange Centers.

All the existing (SMW-3, SMW-4, Flag FEA, etc), as well as under development cabling systems (IMEWE, MENA, TEN, EIG, FLAG HAWK, TGN etc) that connect the above mentioned areas to Europe are passing through the Mediterranean Basin.

MEDITERRANEAN STATS

4 intercontinental Asia-Europe cable systems in service and 4 more under construction*:

- EIG (Europe-India Gateway)*
- FLAG Europe-Asia
- IMEWE*
- MENA*
- SEA-ME-WE-3
- SEACOM
- SEA-ME-WE-4
- TGN Eurasia*

10 major international intra-regional cable systems:

- ALPAL-2
- Atlas Offshore (Morocco-France)
- GO-1
- GWEN
- Hannibal (Tunisia-Italy)
- HAWK/FLAG NGN System 3
- KELTRA-2 (Italy-Tunisia)
- Med Nautilus
- TE North
- Sicily – Malta - 2

Other cable systems:

- 32 other international point-to-point systems,
- 61 domestic cables.

Existing & under development cable systems connecting M.East, N. Africa & S.Asia to W.Europe through the Mediterranean Basin, are landing:

- either at Med coast (Sicily Italy & France Marseilles), as well as at Atlantic coasts (UK, France, Benelux & Germany (SMW-3, EIG, FEA),
- or at Med coast only (Sicily Italy & France Marseilles) – (SMW-4, IMEWE, MENA, TEN, Eassy).

Alexandria in Egypt (11 cables), Marseille in France (11 cables) and Sicily in Italy (21 cables landing at 3 separate locations) are the most congested locations and the landing points of choice for the majority of the international traffic from M.East, N.Africa & S.Asia to Europe. In order to reach Sicily and Marseille, new and existing submarine cables have to cross the Sicilian strait that is a very narrow corridor between Tunisia and Sicily.

As a consequence, and although there is a lot of activity in the area with many new projects under construction, they mainly address and serve capacity demands, not resilience and diversity plans.
The Med corridor, a rather unique fault history

The Mediterranean is an active boundary between tectonic plates, making it prone to earthquakes. The tectonic plate boundary runs west to east along the coast of Algeria and then turns northwards between Sicily and Sardinia. There have been a dozen or so recorded earthquakes along that line. Almost all of the cables connecting M.East & S.Asia have to cross right over the fault line, west of Sicily, south of Sardinia, within a very narrow corridor to land at Sicily or Marseilles.

During the last five years, severe earthquakes and subsequent landslides in North Algeria (2003) as well as between Sicily and Tunisia (2008), have caused a number of service failures in intercontinental Asia-Europe cables and damaged several others, causing widespread Internet outages and service delays in M.East, India and elsewhere.

The participation of an operator to different submarine cable systems, strategy of all large wholesale carriers, cannot protect them in the majority of cable cuts, since all cables are passing from specific points where cuts are often. The submarine cable cuts of the last 5 years clearly dictate the imperative need for the use of alternative routes and more terrestrial – protected segments.

The issue is expected to become more critical in the near future with new capacities to be activated in new submarine cable systems, raising the stakes in case of disaster. Past experience has shown that the nightmare of losing a large number of intercontinental cables for several days is not to be underestimated.

Need for diversity and more capacity brings new cable systems, but are we on the right path?

In order to reply, closer attention has to be paid to the requirements of business users and ISPs. The most important issue here is to offer network availability with reasonable costs over low latency routes. In other words, due to the increasing importance of Internet related applications in everyday life, the failure to provide an acceptable internet service at a reasonable price is causing serious distress in financial and social aspects. In order to ensure the best possible network availability and performance, a carrier has to offer not only physical, but geographical network diversity as well, in a cost effective manner.

The need for diversity is becoming more critical not only from performance issues so far, but also due to new demand being driven from the African region. There is high potential in Africa, where countries like Libya, Morocco, Egypt are expanding their consumer and corporate needs and create new demand for reliable communications with guaranteed quality of service.

Since the complexity of routing traffic across the Mediterranean basin will only increase in the following years, due to the rising in broadband traffic coming from all regions, telecom carriers are looking for new alternative ways to reach them.

Following the trend to invest in terrestrial networks, some carriers are planning to build new networks crossing in M.Eastern countries and Turkey to reach Europe. These solutions appear quite tempting and new ambitious plans have been announced in the recent years, but at least for the time being, specific unfavorable conditions such us limited deregulation, difficult terrain, complex geopolitical relations, combined with significant investments and high risks are generating a less than ideal environment in the viability of these projects.

On the other hand there are numerous new cable systems currently in construction like G01, Eassy, AWCC, System 2, etc. but the inherent weaknesses of their design, such as linearity and absence of ring formations with sufficient capacity, undermine future development plans presenting a major bottleneck to support high quality services.
Alternative European Hubs to offer the much needed diversity solutions

It is widely acknowledged that the cable cuts in the Med Basin during the last years have affected Sicily, Marseille and the other N. Atlantic landing points.

A wider spread of new and existing submarine cables to more landing points in the Mediterranean basin, especially in the eastern part of this region, is gaining a significant momentum among the major wholesale players as an alternative solution to availability and resilience issues.

At the moment, there is a number of landing sites that can take on the role of important future traffic hubs like Greece, Turkey as an alternative terrestrial route, and potentially Cyprus. The eastern, the better!

From the above candidates, Chania landing station located in the island of Crete, the most southern part of Greece and Europe (surrounded by the Aegean and the Libyan seas), has a significant geographical advantage being in close proximity to Egypt, Libya and the M.Eastern countries. In the mean time, residing outside the narrow corridor between Sicily and Tunisia, Chania station has never experienced a severe outage. The station is operated and maintained by the Greek incumbent operator OTE.

OTELEGLOBE, the international wholesale carrier of OTE, has made significant investments during the last years building out two fully diverse and protected terrestrial backbone networks that connect South East Europe and the Balkans with the major European hubs. During the last cable cut (Dec-2008) in Mediterranean, that affected a lot of submarine cable systems at the same time, OTELEGLOBE helped a number of carriers/incumbents to re-route their voice & data traffic through Chania landing station, by using the non-affected SMW-3 segments of “Chania-Alexandria” & “Chania-Cyprus” and its high capacity state-of-the-art and fully protected backbone networks.

At the moment, only the recently upgraded SeaMeWe3 club cable lands in Chania, serving medium size traffic, but there are future plans to attract more cables creating high capacity connectivity south and east from Crete.

As the broadband penetration (mobile and fixed) in the aforementioned regions is booming, from a commercial point of view it is definitely on the right track to increase the capacity offered in order to satisfy the increasing needs. Meanwhile, the economic crisis has put pressure to all of the players in the region making the return on the investments undertaken even more difficult. In that sense it is more critical than ever in our business to differentiate based on the quality of the services offered as everyone is already working on cutting down the costs.

The differentiation in the Med which upon completion of the all the new cable systems will be considered quite cluttered, will only come from the increased reliability offered to our customers. The alternative hubs are presenting an ideal solution to combine high availability and resilience figures due to the diverse routing, with satisfactory latency levels for destinations in Europe.

Mr. Ioannis Konstantinidis holds the position of OTEGlobe’s Executive Commercial Director, and previously held the position of Executive Technology Director. He contributed significantly to the development and establishment of company’s business. Major highlight of his career within OTEGlobe consists the design, implementation & operation of OTE’s high capacity International MPLS/Data/IP Network (Multi-Service Platform - MSP), which features one of the company’s core business. Mr. Ioannis Konstantinidis is 41 years old, married with 2 children.”
Japanese Submarine Cables: The First 100 Years

Submarine telegraph cables were first brought to the land of the rising sun by the Dane, Carl Fredrick Tietgen who, in 1870, set up the Great Northern China and Japan Extension Company and fought off strong English competition to lay and operate new telegraph cables connecting Russia, China, and Japan. As part of this contract, two cables were landed in Japan in June and November 1871: these were Nagasaki to Vladivostok 1,430km and Nagasaki to Shanghai 912km. Both cables went into commercial service on 1st January 1872. The cables were made in England by Hoopers Telegraph Works Company and armoured by Siemens Brothers, both manufacturing companies were located on the River Thames in London. The cables were laid by the Danish naval vessel Tordenskold. In order to maintain these cables, Tietgen had built, in 1872, what is acknowledged to be the first ever purpose built cable repair ship, the H.C. Oersted.

In 1872, the first submarine telegraph cable owned by the Japanese government was installed by the steam ship Densimu Maru across Kanmon Straits, linking two cities in Honshu and Kyushu. Its purpose was to connect Tokyo to the cables built by Great Northern via the domestic land line from Tokyo to Nagasaki.

Over the next few years many new cables were installed by Great Northern and other companies, but all were manufactured in England. In 1889, the Ministry of Communications became the monopoly operator of all telecommunications in Japan, it was responsible for all infrastructure, manufacturing and operation. The submarine cable network continued to expand and by the end of the century over 4,000km of cable had been laid connecting many of the 3,900 islands that made up the Japanese Empire at that time. It wasn’t until 1896 that the Japanese Government purchased its first submarine cable ship, the Okinawa Maru; this ship was built in England by Lobintzi & Co. The first Japanese built cable ship was the Ogasawara Maru, which was launched in 1906.

At the beginning of twentieth century, in the course of preparation for Russo-Japanese War, General Gentaro Kodama; know as “the greatest resourceful general of the century”, became concerned over the international telecommunications situation at a time when nobody else in the Japanese authorities seemed to pay much attention to the problem. Under his leadership, a team of Japanese engineers built a long distance submarine cable from Kyushu to Taiwan, including the construction of the cable stations, conducting route/site surveys, laying the cables with the Okinawa Maru, and manufacturing the terminal equipment. All this was accomplished, apart from the cable supply, without any advice or support from non-Japanese experts.

The first submarine cable to be manufactured in Japan, had rubber insulation and was made in 1915. The first Gutta Percha insulated cable was made by the Furukawa Electric Co in 1922 at its Yokohama factory for a contract with the Chinese Government. In 1932, the Sumitomo Electric Cable & Wire Works built a new plant in Osaka to meet the increased demand for submarine cable from the Ministry of Communications. In 1935, the Nippon Submarine Cable Co Ltd. (NSCC) was established as a joint venture between Fujikura Ltd, Furukawa and Sumitomo. This combined the Osaka plant in Taisho-Ku with the existing Yokohama factory. In 1941, as demand continued to grow, a new factory was built on a different site in Yokohama and the old factory was closed.

After WWII, the operating model for the submarine cable industry in Japan was developed with significant American influence. A state owned telecommunications infrastructure was established, supported by an oligopoly of private companies manufacturing equipment. Two government owned corporations were set up, Nippon Denshin Denwa Koshin, also known as Nippon Telegraph and Telephone Public Corporation (NTT) in 1952, responsible for domestic telecommunications and Kokusai Denshin Denwa (KDD) in 1953, responsible for international telecommunications.

KDD’s first international submarine telephone cable was laid in 1964 between the mainland of the USA - Hawaii - Guam - Japan and was jointly owned with AT&T. This system contained some cable manufactured by the Ocean Cable Company Ltd (OCC) but the repeaters were all made in the USA. OCC had previously been established to undertake the development of trans-Pacific cables, and in 1964 it was merged with NSCC to make a single submarine cable manufacturer.

The first submerged repeaters to be manufacture in Japan were made by Fujitsu Limited and the NEC Corporation in 1969. Both companies’ designs were used on the, Hokkaido Uchiura Bay system. By 1970, the Japanese submarine cable supplier industry had become powerful in its own region and was beginning to compete with the major global submarine system suppliers (Alcatel Submarcom, AT&T and STC Submarine Systems) on the world stage.

Okinawa-maru
MANAGING THE ECONOMIC LIFECYCLE OF A SUBMARINE CABLE SYSTEM

PAUL F. SZAJOWSKI, GERALD SOLOWAY, SAMMY J. THOMAS
A growing number of private investor groups, using a different model than the traditional network consortium approach to new cable investment, have been deploying new cables in both underserved and developed markets. Advances in transmission technology continue to pressure downward the cost of transmission and competition among network operators and cable providers quickly translate the lower cost to lower prices for transmission and connectivity.

The interaction of growing worldwide connectivity demand with technology-driven cost reduction gives rise to a predictable model of the economic lifecycle (as opposed to the physical lifecycle) of submarine cable infrastructure. Accelerating demand for capacity has lead to an increasing number of privately led cable projects, unaffiliated with traditional network operators. Steadily eroding prices for capacity into the foreseeable future potentially limit the economic lifecycle, and investment value, of existing and new systems. An analysis and model of submarine cable cash flow suggests that, with proper risk management strategies, the potential for profitable worldwide investment in new projects is larger than has been generally expected, even in relatively mature markets. Nonetheless, successful projects will require well crafted business plans and active implementation to realize success. Financial success in this new environment of declining prices and evolving technology require use of new management strategies in every phase of a cable system’s lifecycle, from design, to construction, to operation, to capacity upgrades.

1. Demand Environment

1.1 Demand Growth
Demand for bandwidth on submarine cable systems is soaring. Driven by this demand, submarine cable capacity has been keeping pace, some via capacity upgrades and some by new systems. After a period of low growth early this decade, since 2005 we have seen very high compounded growth rates. For example, on the very heavy trans-Atlantic route, lit capacity has gone from about 4.5Tbps in 2004 to about 9.5Tbps in 2008. Of this, internet traffic constitutes 72% of the traffic (about 2.2Tbps), private networking 27%, (810Gbps), and switched voice is 1%, (30Gbps). Since 2005, international IP traffic has increased at a CAGR of 55-65% in developed nations and 85-105% in developing countries. This trend shows no sign of abating.

Global IP traffic is expected to increase fivefold from 2008 to 2013, approaching 56 exabytes per month in 2013, up from approximately 9 exabytes per month in 2008. All forms of video (TV, VoD, P2P, etc) will exceed 90% of all global consumer IP traffic. Video calls and messaging will grow 10x between 2008 and 2013. Mobile data traffic will roughly double each year from 2008 to 2013, increasing 66 times between 2008 and 2013. Mobile video will be the fastest growing application and will constitute about two-thirds of mobile data. This demand will drive increased capacity needs on submarine cable systems. Forecasts show that in 2014, just 5 years from now, 47Tbps of lit capacity will be needed trans-Atlantic, up from 9.5Tbps. Some of this capacity does not exist today and will need to be built. Similarly, lit capacity on the trans-Pacific route is expected to grow from about 6.5Tbps in 2008 to 23Tbps in 2014. Here, sufficient capacity does exist on existing or planned cable systems.

Demand growth is universal around the world. Figure 1 shows IP traffic growth per month by region.

Compounded annual growth rates vary from a low of 40% in Japan and 43% in North America, to a high of 61% for Latin America. Overall, at these rates, IP traffic almost doubles every two years. International IP traffic will grow at even higher rates. It is forecast to grow from a low of 45 – 55% per year in developed countries to 95 – 105% per year in areas like Latin America, the Middle East and South Asia.
1.2 Key Drivers of Demand

In a word, the key driver of demand is video. As previously mentioned, all forms of video will make up 90% of all consumer internet traffic. Every segment of the video market will experience extremely high growth rates, with the highest growth rates in mobile video. It is expected that mobile data, driven by video, will roughly double each year from 2008 to 2013, increasing 66 times between 2008 and 2013. Almost 64 percent of the world’s mobile data traffic will be video in 2013. This is being driven by the increase in the number of devices containing digital screens, and the increase in size and resolution of digital screens which encourages the use of higher bit rate traffic.

Commercial video, that is, video provided by sites like Hulu, NBC, CBS, ABS, Viacom, TNT, etc. took off in 2008 and used as much bandwidth in 2008 as YouTube, although it served far fewer streams and minutes. Commercial video is expected to quintuple between 2008 and 2012 and grow to 80% of consumer video delivered over the Internet by 2012. Figure 2 below depicts the expected growth of commercial video.

When looking at the absolute pricing by capacity, we see even more dramatic variations. For example, on a per unit of bandwidth basis, purchasing 10Gbps is about 20% of the price of a STM-1. Lower amounts of bandwidth are dramatically more expensive on this basis. When looked at by region, price reductions over the last 4 years for a STM-1 have varied from as little as 3% annually trans-Pacific to as much as 12% for South America to Miami. However, the South America to Miami prices remain very high, typically 50% more than trans-Pacific and more than double trans-Atlantic. There are also large price differences between carriers in the same region. It is not unusual to find 300% and higher differences between the lower and highest price carrier in a region. When carriers do lower prices, they tend to be in large increments of 20%, 30% or even 50%.

1.3 Price Trends

There are several overriding themes that characterize the pricing of usage on submarine cables. First and foremost is that pricing is going down over time. This is true independent of the pricing parameters, which include region, amount of bandwidth and type of service. However, there is no universal decrease per unit time that applies in all cases. For example, price declines for 10Gbps (one wavelength) over the past several years have averaged 31% for London-New York, whereas the price declines over the same period for a protected STM-1 have only averaged 6%.

When looked at on a per kilometer basis, one also finds very high variation depending upon route. For example, Hong Kong to Tokyo is about 5 times as expensive on a per kilometer basis as London to New York. Even in absolute terms, Hong Kong to Tokyo is about double the price of London to New York.

So what we have are two general trends, that prices are going down, and that the more bandwidth purchased, the lower the cost per unit of bandwidth. Beyond that it is hard to generalize. We can surmise that the trans-Atlantic route is the least expensive because there is so much capacity and...
so many competitors. However, there is a great deal of capacity on some other routes, and yet we do not see the same levels of pricing. Clearly, where there is little competition, pricing is high and that is attracting new entrants. There are also issues of government regulation and incumbent carriers that have kept pricing artificially high in some regions, and while that is improving, it is not likely to disappear very quickly.

There are also technology trends which will continue to drive down the costs to build new bandwidth or upgrade an existing submarine plant. For example, we are starting to see 40Gbps per wavelength being used in some shorter segments, and recent announcements by some vendors seem to indicate we will see this deployed on segments as long as 8km without any changes to the wet plant. Given this and recent announcements of new cable systems coming online in the next few years, the continued high growth in demand should be able to be met without any problem. These factors should ensure that pricing for submarine cable bandwidth will continue their inevitable decline.

2. Cable Transmission Technology

2.1 Historical Developments

Undersea optical cable systems are an integral part of the international telecommunications infrastructure for supporting rapidly growing marketplace bandwidth needs. In today’s world economy, undersea optical cable systems and networks have become a critical component to the constantly evolving Internet delivery fabric. The central issue related to undersea communications cable is one of scalability of capacity in meeting and anticipating future capacity demands of the network. The issue of network “non-scalability” leads to retirement decisions of networks due to poor economic network forecasts of anticipated revenue over time.

Economics of all telecommunication networks require network operators to meet anticipated network growth projections while lowering bandwidth capacity rates, in order to remain competitive. To meet the requirement of increased traffic demand and falling capacity pricing, network providers are required to introduce technological enhancements within the network to substantially increase available bandwidth capacity, to maintain a positive rate of revenue return for network investors. The requirement to maintain a positive cash flow for a particular network will determine the economic viability of the network.

Historically, each successive technological improvement within an undersea cable system has reduced the infrastructure costs, improved quality, and available capacity. System economics require carriers to balance the economics of maximizing system capacity while providing competitive prices to sell in volume to their clients. Economic advantages realized through incorporating emerging technologies improve the overall capacity within an undersea cable system. As a system becomes highly trafficked, the incremental cost of upgrading a system to a higher capacity is relatively low when compared with the initial system cost. The greatest influence on price then becomes the level of competition on each route.

A study of the TAT- systems, (Transatlantic Telecommunications), provides a useful example of network capacity evolution driven through customer needs. TAT-8 was the 8th TAT cable system, designed initially to carry 40,000 telephone circuits between the US, France and Great Britain, and was the first TAT cable system to utilize fiber optic technology. TAT-8, constructed in 1988 by a cable consortium led by AT&T, British Telecom and France Telecom, provided a breakthrough in data traffic transport between the United States and Europe by employing an underwater cable branching unit deployed off the coast of Great Britain to provide services to France and Great Britain. In 1988, the TAT-8 system was built at a cost of US$335M, and was retired from service in 2002. TAT-8 contained two working pairs of
optical fibers, and a spare, each fiber operating at 295.5Mb/s and fully regenerated every 40km of cable span, using an optical-to-electrical-to-optical conversion process (OEO). TAT-11 was the last fully regenerated OEO TAT system. It was AT&T’s 11th TAT cable system, started operation in 1993 and was decommissioned in 2004. TAT-11 provided two optical circuits, each operating at full capacity, providing 565Mb/s along each fiber, of service along through the path.

2.2 Emergence of WDM and the Optical Amplification Benefit

Wavelength Division Multiplexing (WDM) technology introduced into the market provided a means for system expansion through capacity upgrades. WDM allows the network operator to increase the overall capacity of a fiber system by transporting multiple data streams within the optical domain in a non-interfering manner through wavelength assignments. Wavelength assignment provided a specific wavelength allocation to specific outgoing data streams prior to multiplexing onto a fiber for transport. The enhancement of overall bandwidth realized through this process allows carriers to multiply the capacity of existing systems without having to replace the physical cable. Because the WDM signals never terminate in the optical layer, the WDM interface can be bitrate and format independent, allowing the network provider to easily integrate WDM solutions within existing equipment and expanding overall available capacity in the embedded fiber, resulting in a more flexible, scalable system design than legacy O-E-O technology described above.

The first TAT undersea cable systems to employ WDM technology were TAT-12/13 (two- to four-channel upgrade) and introduced to the undersea cable market erbium doped fiber amplifier (EDFA) technology. At this point in time EDFA technology contributed substantially to the tremendous ramp-up in available undersea system capacity, and implemented an amplification design approach operating in the 1530-1560nm wavelength range, where an optical bandwidth of approximately 3.77THz is available. This region of the optical spectrum, known as the C-band, is at the center of the lowest-loss region of the fiber transmission, and is by far the most widely deployed of all EDFA technologies in today’s networks. EDFA’s, operating within the 1530-1560nm spectral range provided the means to multiply the potential transmission capacity of a TAT-12/13 fiber, as well as to offset span and incurred optical splice losses between each optical amplifier repeater. TAT-12/13, deployed in 1996, was designed to transmit 5Gb/s through a single pair of fibers at one wavelength.

TAT-12/13 was followed by the TAT-14 system in 2001, designed to operate with a total design capacity of 3.2Tb/s over 15,428km between the east coast of the US and Europe. TAT-14 was sponsored by a consortium cable group which included; AT&T, BT, Cable & Wireless, Deutsche Telekom, France Telecom, MCI WorldCom, Pacific Gateway Exchange, Level-3 Communications, Swisscom and Telia as participants.

The TAT-14 system, was a cable system designed for 16 wavelengths, each at 9.95Gb/s, in a ring topology, built from multiple pairs of fibers, one fiber in each pair is used for data carried in one direction and the other in the opposite direction. Currently in operation, TAT-14 system is still economically viable and currently experiencing system upgrades to overall capacity bandwidth.

2.3 Emerging System Technology Implementations

2.3.1 Transmission Data Rate Improvement

By introducing technological improvements optical transmission rates have evolved substantially over that used in the first optical TAT-8 system. Recently, a system test conducted on TAT-14, and sponsored by Sprint Communications, demonstrated the ability of the system to successfully support and transport data rates at 40Gb/s per wavelength.
Through efficient system design, future optical transmission systems will provide the means of transporting system capacity transmission rates in excess of tens of TB/s, over currently deployed transoceanic distances, while maintaining a system profit margin to support upgrades and service enhancements. The evolution of technology and transmission rates is illustrated in Figure 4:

**2.3.2 Transmission Channel Spacing**

By leveraging optical amplification technologies like WDM, Dense-WDM (DWDM) as well as ultra dense WDM technologies, an overall capacity enhancement factor in excess of 1000 times (30dB) since the first deployed optical transmission system has been realized. DWDM technology introduced to the undersea system market led to a substantial increase in network bandwidth efficiency supported by a given number of fibers. DWDM technology allows for optical channel capacity beyond 200 channels; thereby dramatically increasing fiber capacity density and overall network transmission bandwidth efficiency.

**DWDM technology, providing routing at the wavelength level, unfolds the capacity of a fiber by allowing more and more users onto the network at lower costs, as opposed to legacy technologies for which costs saturate at some minimum level. By reducing channel spacing to 50GHz, DWDM technology can increase network throughput by a factor of two when compared to 100GHz spaced systems. Anticipated future migration to Ultra-DWDM channel spacing 25 & 12.5GHz spacing will enable even higher channel counts, significantly increasing effective system bandwidth capacity over a single fiber.**

**2.3.3 Extension of the EDFA Amplification Window**

As mentioned previously, the introduction of EDFA technology contributed substantially to the tremendous ramp-up in undersea system capacity, providing an optical bandwidth of approximately 3.77THz. Additional landmark advances in optical amplifier technology have extended the effective optical gain region of the EDFA device beyond the traditional 1560nm upper limit to a longer amplification edge located at 1610nm. The longer 1610nm operating limit of the EDFA device beyond the traditional 1560nm upper limit to a longer amplification edge located at 1610nm. The longer 1610nm operating limit of the EDFA device, designated as the L-band, allows for an additional 6THz of usable amplifier bandwidth for system use. However due to optical amplification inefficiencies within the L-band, these amplifiers are restricted to operate typically over the 1570nm to 1610nm range, while C-band amplifier devices operate over the 1530nm to 1560nm spectral range. Through proper network design an optical system can be designed to supporting a network design accommodating channels within both C-band and L-band regions, affording a significant enhancement in optical channel capacity.

**2.3.4 Migration to IP Packet Switching**

Recently Sprint demonstrated the feasibility of transporting IP-based capacity at 40Gb/s over the TAT-14 network end-to-end, over a 7,630km span. The November 2008 field trial conducted between Sea Girt, New Jersey and Denmark, successfully demonstrated the ability to transport IP content over-Dense-Wavelength-Division Multiplexing (IPoDWDM) systems, and demonstrated the emerging trend for upgrading network capacity with dry-plant IP hardware only. The Sprint field test illustrated that for emerging networks as well as established undersea systems to remain cost competitive, network operators may consider transitioning to less expensive packet based Ethernet terminations on the SLTE network endpoints. Having less expensive IP-based terminal equipment, at each shore end-point will allow for a smooth transition to packet switching at the carrier based terrestrial network side, thereby lowering capacity transport costs. IP based interfaces will also provide to the customer the opportunity to purchase less expensive unprotected transport circuits, where IP based technology will provide to the customer restoration insurance when needed. As a result IPoDWDM transport will provide increased capacity at a lower operating cost, at provisioned data rates of 40Gb/s, allowing the network to remain cost competitive.

**3. Cable Life Cycle And Operating Cash Flows**

**3.1 A Different Operating Environment**

Accelerating traffic volumes, driven by the evolution of demand from individual subscribers to addressable devices, is being met by rapid evolution of technology. Each successive generation of technology delivers more traffic with a marked decline in cost per unit. These two trends, accelerating growth and declining price per
unit of traffic, have changed the financial dynamics of submarine cable systems. The new business model has attracted growing attention from private investors, who have built a growing portion of new capacity in new and existing systems. This is an important observation, because it means that RFS delays and system outages will permanently reduce a systems asset value and ROI. To preserve a system’s value, it is imperative that design and construction activity be managed to meet (or beat) a projected RFS target. During a system’s operation, insurance plans must be deployed to cover cash flow losses due to outage restoral. Figure 5 demonstrates the reduction of operating Cash Flow, and economic life, due to RFS delays:

3.3 Ultimate System Capacity a Key Determinant of Economic Life
System capacity at full utilization is an important factor in the determination of a system’s life cycle and value. Expansion of useable capacity will typically proceed based on current system utilization rate and projected demand growth. The operating cash flow of the cable system will grow as total demand grows and system expansion proceeds. Once useable capacity reaches the ultimate design capacity of the system, operating cash flow growth reaches its limit. With a system operating at full design capacity, operating cash flow will begin to decline as short term transit leases are renewed at lower unit prices. The rate of decline of operating cash flow will be a function of the general rate of price decline and the proportion of capacity that is used for short term leases.

As a design consideration, the ultimate system capacity should be sized to support a minimum target for the economic life of the system. The continued evolution of transmission technology offers an opportunity to reevaluate upgrade plans over the life of a system. Technology upgrade

![Cash Flow Measured Relative to Year 1 Gross Revenue](image)

The high growth rate of traffic offers investors the opportunity to quickly recover invested capital in new or acquired systems. This attractive feature however is counterbalanced by an operating environment of ever decreasing unit prices, which forces investors to carefully plan and execute their business plans to achieve target return on investment (ROI) and system market value. Cash flows, the basis for measuring a system’s value, have a predictable pattern in this type of environment. There is also a definite limit to the economic life cycle of a cable system in a declining price environment. When operating cash flow turns negative, the economic life of the cable system is at its end. This limit can be extended by managing cash flow with careful and attentive operations strategies. Figure 5 illustrates annual operating cash flow of a submarine system, and highlights key factors which drive the dynamics of cash flow and the length of the economic life.

3.2 Cash Flow Delays or Interruptions Reduce System Value
In a high growth declining price environment, cash flow delays or interruptions can never be recovered.
strategies can extend the life of a system, providing an opportunity for current operators. Evaluation of potential acquisition of existing systems would be based in large part on the suitability of exploiting new technologies in the upgrade path, thereby extending system life and enhancing the potential return on investment. Figure 6 illustrates an example of switching technologies during upgrade, and how it enhances system value and extends the economic life.

3.4 Using Insurance To Protect Operating Cash Flow
The declining price environment that submarine cable systems will be operating in does not permit recovery of operating cash flow lost to system repair for outages or lost due to business interruption. Every outage induced cash flow loss will reduce both cable economic life and system value. The probabilistic distribution of losses from outages and other events in any time period show that the odds are stacked against the system operators. Losses can never be less than zero, but they can range to over 7x average annual repairs, representing catastrophic loss. Figure 7 is an example of the range of potential losses that could be experienced, and the benefit of an insurance strategy to protect operating cash flow from those losses:

- Potential cash flow loss from outages is significantly reduced, protecting the economic life
- Bargaining position with marine repair services is enhanced, especially with regard to the relationship between the fixed and variable cost components of a repair contract
- The value of the submarine system is enhanced since risk of outsized losses to cash flow is eliminated. Conversely, an uninsured system would see a reduction to its potential market value due to the threat of catastrophic loss.

4. Key Conclusions

4.1 Cash Flow Is Value
In a declining price environment, any delays or interruptions in cash flow generation can never be recovered, thus permanently reducing value and system economic life.

4.2 Cash Flow Protection Strategies Are Necessary In Every Phase Of A Submarine Cable System Project
Project management must be focused to meet or beat RFS date, since delays cannot be realistically recovered. Vendor management plans must include incentives, as well as penalties, to encourage all project participants to support successful and timely RFS.

Once a cable system is operational, an insurance strategy must be implemented to protect cash flow from losses due to outage repair and restoration, and other potential cash flow interruptions. Systems without adequate insurance plans will penalize current investors.

4.3 Upgrade Planning Should Constantly Reevaluate Available Technology
The continuous evolution of transmission technology enables system operators to extend a cable system’s economic life by expanding the effective capacity of that system beyond initial design. If an upgrade path was considered during a system design phase, new technologies provide an attractive economic option. Extended economic life of a system implies higher system value.
Paul Szajowski has over 30 years of experience in the Telecommunications industry. Currently he is an independent optical communications technical consultant supporting undersea and terrestrial system projects. In prior assignments Mr. Szajowski was responsible for design, development & integration of advanced telecommunication networks for specialized networking applications while employed by AT&T and Lucent Technologies/Bell Laboratories as a Distinguished Member of the Technical Staff. Mr. Szajowski directed technical R&D activities related to design and integration of free-space optical (FSO) transmission hardware with the ABC Broadcasting Network for delivery of SD & HD video content during NFL Monday Night Football and the 2000 Super Bowl. Mr. Szajowski is an established subject matter expert within the free-space optics technology sector and has consulted on Olympic Telecommunications projects for the Sydney, Salt Lake City, Athens and Beijing Games. Mr. Szajowski holds four US issued patents related to optical networking applications and is a prior chair of the SPIE Optical Communications Conference between the years of 1999-2001.

Jerry Soloway, Ph.D. has had a very successful 40-year career in the high tech industry, with a primary focus in telecommunications. Currently, he is an independent consultant. Until April 2006, he was Senior Vice President of Business Development at UTStarcom, a position he assumed in January 2005. Prior to this, Dr. Soloway was Senior Vice President, Engineering at UTStarcom from January 1999 through January 2005, during which time the company grew from less than $200M in revenues to $2.7B. It also completed a very successful IPO in March 2000. Prior to his tenure at UTStarcom, Dr. Soloway worked for Lucent Technologies (formerly Bell Labs) for 29 years. There he held executive positions in Consumer Products, Business Terminal Development, PBX Systems Engineering, Key System Development, and Access Systems. He holds a Ph.D. from Polytechnic Institute of New York, an MS from New York University, and a B.S. from Cooper Union, all in Electrical Engineering. Dr. Soloway also holds seven patents in communications and computer graphics technology.

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CALL FOR PAPERS

The ICPC is holding its next Plenary meeting in Mauritius during the period 1 - 3 June 2010 inclusive. The theme of this Plenary will be:

Protecting the global submarine cable network: New and evolving challenges for operators, governments and stakeholders in the expanding submarine cable community

Presentations that address the following topics are invited:

- Social and economic impacts of submarine cable failures
- Legal and regulatory challenges & solutions
- Recognising and reducing the risk from natural hazards
- Working with international organisations to improve cable protection
- Recognising and reducing the risk from man-made hazards
- Emerging technologies & concepts for cable protection

Abstracts must be submitted via email to plenary@iscpc.org no later than 28 February 2010. For more information about this Call for Papers and opportunities for exhibitors please visit the ICPC’s website at www.iscpc.org
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Letter to a friend
from Jean Devos

My friend,

What are you doing for the planet?
We are invited to answer that question every day. Please shut off the lights, keep your car in the garage, have a shower instead of a bath, go biking instead of driving, and eat locally grown food so as to save the planet.

Ok. Good. Why not? I can understand this kind of language.

But what I read in telecom press magazines and websites puzzles me. For instance, this title from an Alcatel-Lucent paper: “Transforming Communications For A Sustainable World.”

The paper describes “a comprehensive eco-sustainability program” where I picked up several new expressions such as “addressing environmental challenges,” “Sustainable communications network,” “ICT, the ingredient for green and growth,” “eco-efficiency,” “eco-sustainable optical networking terminals,” and “leaner and greener.” AT&T Inc. recently announced a new “Business Sustainability Advisory Council, a set of industry players that will advise AT&T on the links between its services and environmental initiatives. What does that all mean my friend?

I can somewhat understand the energy side of things. The energy that is used to keep data flowing and networks buzzing is growing quite large. Verizon Business has opened a $1 million lab designed to show government agencies how Verizon’s new fiber-to-the-desk Optical LAN can significantly cut power bills.

But the reality is that the Telco’s are painting themselves in green in the hope that “Green will sell.” It’s the same way that our politicians now understand that not showing a green tendency, a green attitude, is politically risky. President Obama is far from having the support of the American opinion, or that of the Congress, but he realized that not showing up at the Copenhagen conference would have been a disaster for his image in the world.

Having thrown away all the world in “isms” such as socialism and communism, the world has now found its new ideology. I notice that the most popular green guy in my country, highly visible in the media, is advocating that we need to stop this rush for continuous growth. This guy is sponsored by the biggest industrial companies involved in nuclear plants or chemical products. They let him say what he wants, but they feel such sponsorship is good for their images. They hide themselves behind a green face.

My friend, what can the submarine cable world do for the planet? I propose the following answer: Let’s stop throwing money away!

At this very moment we can identify Billions of € and even more in $ sitting useless in the bottom of our oceans. How many tons of copper? Polyethylene? Steel? How many sleeping lasers, amplifiers, receivers and miles of dark fiber? We all have in mind 4 pairs, 6 pairs and even 8 pairs cables, installed 10 years ago, of which only one pair has been lit, and that not even fully utilized. The North Atlantic is a good example of this waste of money. After 10 years without a new cable, there exists still plenty of unused capacity, and the next cable is not even at the planning stage. Billions of £ which could have found a better use.

A “green attitude” would mean to build cable according to genuine need. A “green attitude” would mean considering infrastructure as a common tool, open to everyone. Infrastructure is not a gun for a war. Why are we building 3 or 4 super highways (i.e. 12 to 16 high capacity pairs of fiber along the coast of West Africa) these days? Why not a co-build concept? That would not prevent all these operators embarked in the same cable to compete on services.

My friend, we do not need this new marketing language. But we definitely need this “green attitude,” aiming at building a well adjusted network, growing wisely according to the real traffic need, with nobody staying unconnected when others are overfed. This is the “climate change” that we desperately need. "Global warming," in our industry, should come from “more cooperation.” In that sense, I dream that SubOptic 2010 will be a “green” meeting, the sunrise of a “climate change!”

Jean Devos

Jean Devos is a senior consultant with Submarcom Consulting. He is also one of the founders and a board member of Axiom, a Paris based company specialized in Submarine systems projects study & management. He spent three years developing Tyco’s international capability, and was the head of ASN (Alcatel Submarine Networks). Jean was born in 1938 and is graduated from the Lille University. He is the founder of SubOptic and carries a vast international experience in our field.
## UPCOMING CONFERENCES AND EXHIBITIONS

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I moved my family out to the country last fall.

We left the hustle-bustle of the city for an 100 year old farmhouse on 6 rolling acres. We have lush fields begging for sheep, woods teeming with deer, and absolutely no traffic.

The one thing I miss from the city, however, is high-speed internet. Where I lived back in Leesburg, Virginia, I had a fiber-optic connection right into my house. I paid about $40/month for lightning fast internet. Out in the country, the best I could get was a satellite connection providing 1mb/second for a whopping $80/month.

“It’s better than dial-up,” I kept telling myself as I was trenching the connection between the dish and my house. “Better... but not much.”

It’s especially difficult to make the transition from fiber to satellite because of my job. I spend my days writing about submarine cables, about all the amazing changes in store for Africa because of the landings of cables like SEACOM and ADONES. But in the oldest state in the Union, the prospects for a fiber connection to my rural farmhouse are bleak.

If you’ve read Guy Arnos’ article about his time in Angola, then you’ve seen pictures of the rural conditions in that country. And we’ve all read the editorials coming out of Africa echoing the continental frustration that the much-anticipated submarine cable systems have not yet fulfilled their promise to increase capacity and reduce costs for everyone.

What happened?

A lack of infrastructure. In order for fiber to be effective, the infrastructure must be in place to deliver the connection, and in parts of Africa (and apparently parts of the United States) the infrastructure just isn’t there.

What’s the solution to this problem? Better planning? More businesses in rural areas to drive up the need? Or just patience? All I know is that it takes me 50x longer to download an issue of SubTel Forum from my house than it does at the office. I guess that’s the trade-off for living in the country.

Have to go now... it’s time to shear the sheep.