Siklu's E-band Technology as a Cost Effective Alternative to Fiber

December 4, 2012

info@siklu.com

Siklu

Meet the Speaker

Daniel Ephraty

Director of
Sales Engineering

daniel.e@siklu.com

Daniel Ephraty is leading Siklu's sales engineering. Daniel has 20 years experience in wireless point-to-point systems, ranging from system design, through implementation, product management, to presale. In the last 3 years, he specialized in E-band technology, formerly with Bridgewave Communications, and currently with Siklu. Daniel holds an M.Sc. in Electrical Engineering from the Tel Aviv University in Israel.

Siklu Communications

High-Throughput Meets Low Cost:
The Etherhaul E-Band Radio

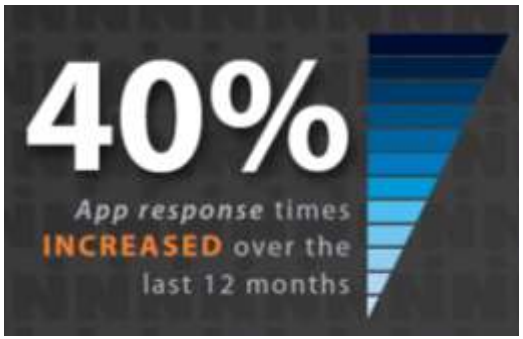
Siklu redefines wireless Ethernet connectivity by optimizing every aspect of millimeter-wave system design to deliver capacity and performance, while dramatically reducing equipment and operational costs.

In 2012 Siklu is the market leader in number of E-band links shipped globally.

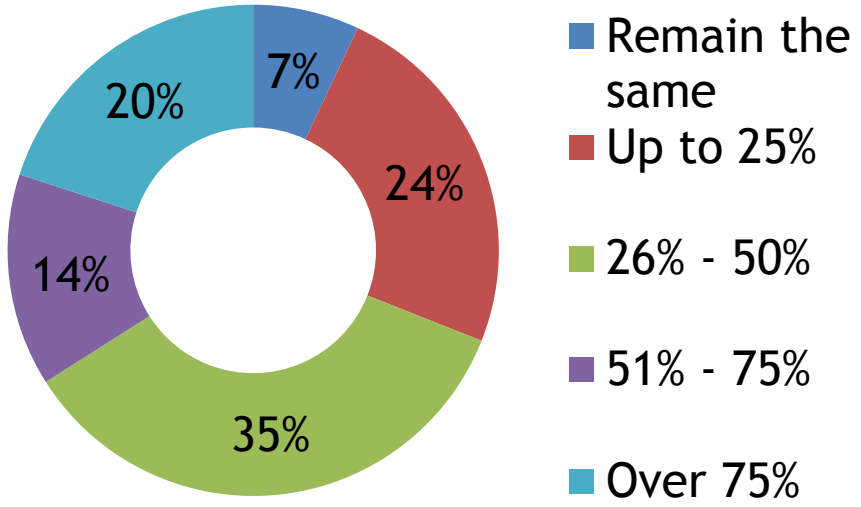
.

Broadband Trends for Businesses

- Cloud Services



Bandwidth Growth in the next 2 years



Source: Fifth Annual Global State of the network study by Network Instruments March 2012

- Smart Devices
- More businesses require high-speed connectivity as capacity demands are growing

Source: Cisco VMI Oct. 2012

Ethernet Everywhere

- Campuses:
  - Health
  - Education
  - Corporates, businesses
- Security:
  - CCTV
- Computing:
  - Distributed servers / storage
  - Cloud computing
  - LAN Extension
- Service providers, ISPs
  - Backhaul
  - Last mile

Fiber

- Often business' first choice:
  - "Infinite" bandwidth
  - Reliable
  - Secure
- But fiber also has a dark side…
  - Doesn't reach everywhere
  - Deploying new fiber
    - Prohibitively expensive ($100/m)
    - Complex and messy
  - Existing fiber is expensive to lease
    - $2,000/month for 100Mbps
    - $4,000/month for 1Gbps

Criteria for Fiber Alternatives

- Low equipment cost
- Minimal installation lead time and cost
- Low running costs
- Mature and faultless technology
- Capacity scalable to gigabit rates
- Copper: twisted pair (xDSL), and/or cable (DOCSIS)
  - Widely available
  - Relatively inexpensive
  - Limited in capacity
    - xDSL: up to ~100Mbps above 0.5 mile
    - Cable: up to ~300Mbps per cable, but is normally shared

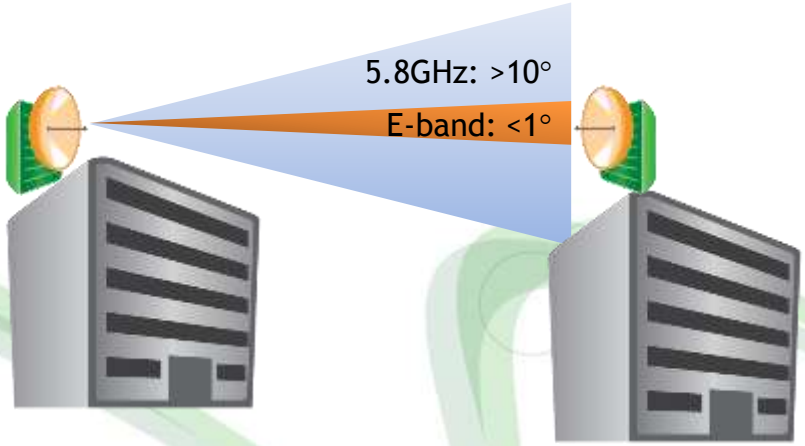
Wireless Fiber Alternatives

- Inexpensive
- Relatively quick to deploy
- Mature technology

	Frequency	Capacity	Disadvantages
Non LOS	Sub-6GHz	<200Mbps	• Congested spectrum • Unlicensed
Microwave	6-38GHz	200Mbps (standard channel) 400Mbps (wide channel) X2 (dual polarization)	• Congested spectrum • Expensive license
60GHz	57-64GHz	1GbE and beyond	• Distance < ½ mile • Unlicensed
E-band	71-86GHz	1GbE and beyond	• Distance < 4 miles

What is E-band?

- 10GHz spectrum: 71-76GHz and 81-86GHz
- Advantages of E-band over traditional microwave bands:
  - Uncongested
  - Very wide channels ⇒ Gigabit throughputs
  - Lightly licensed
    - Protection against interference
    - Simple: register in FCC database
  - Inexpensive: $75 for a 10-year license
  - Pencil-beams (beam-width < 1˚):
    - Minimum interference
    - Secure (hard to detect and intercept)
  - Small footprint



E-band and Criteria for Fiber Alternative

- Low equipment cost
  - From $5,200 per link, including antennas
- Minimal installation lead time and cost
  - Can be installed in half a day
  - <$1000 labor and incidentals

- Low running cost
  - Energy, roof space, maintenance, support and warranty services <$2,500/year
- Mature and faultless technology
  - Deployed by global Tier-1 mobile service providers
  - Thousands of links in operation globally
- Capacity scalable to gigabit rates

ROI Illustration

- Example, Fast Ethernet (100Mbps), Cost of 1 year:

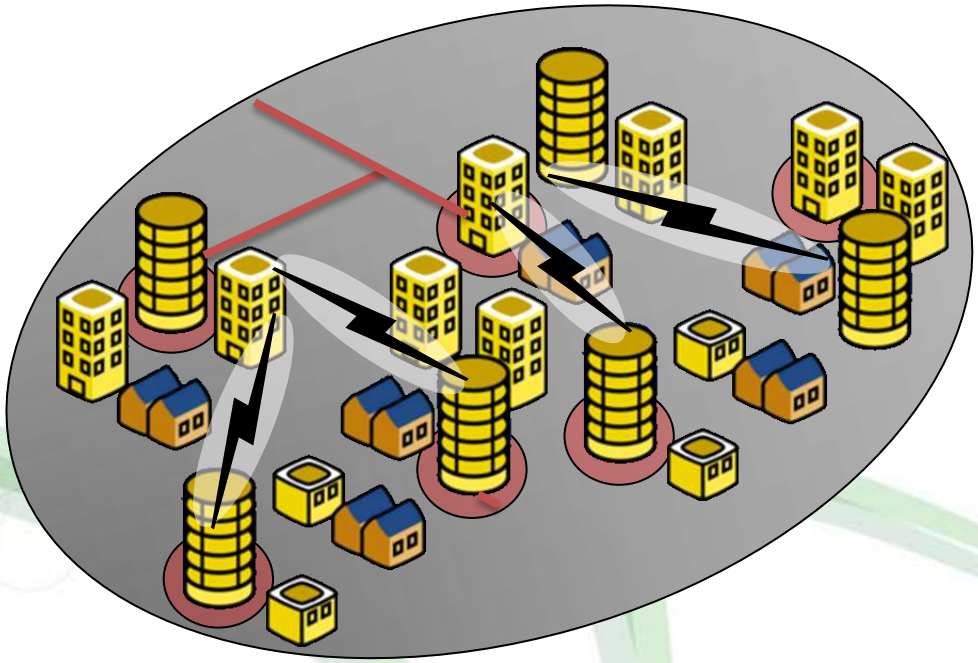
	Leased Fiber	Siklu's E-band Radio
Equipment Cost	-	$5,200
License	-	$75
Installation	-	$1,000
OPEX	*$24,000	$2,500
	$24,000	$8,775

* $2,000/month

- ROI in less than 5 months
- For GbE, leased fiber averages at $4,000/month – ROI in less than 3 months

Fiber Alternative with the Fastest ROI

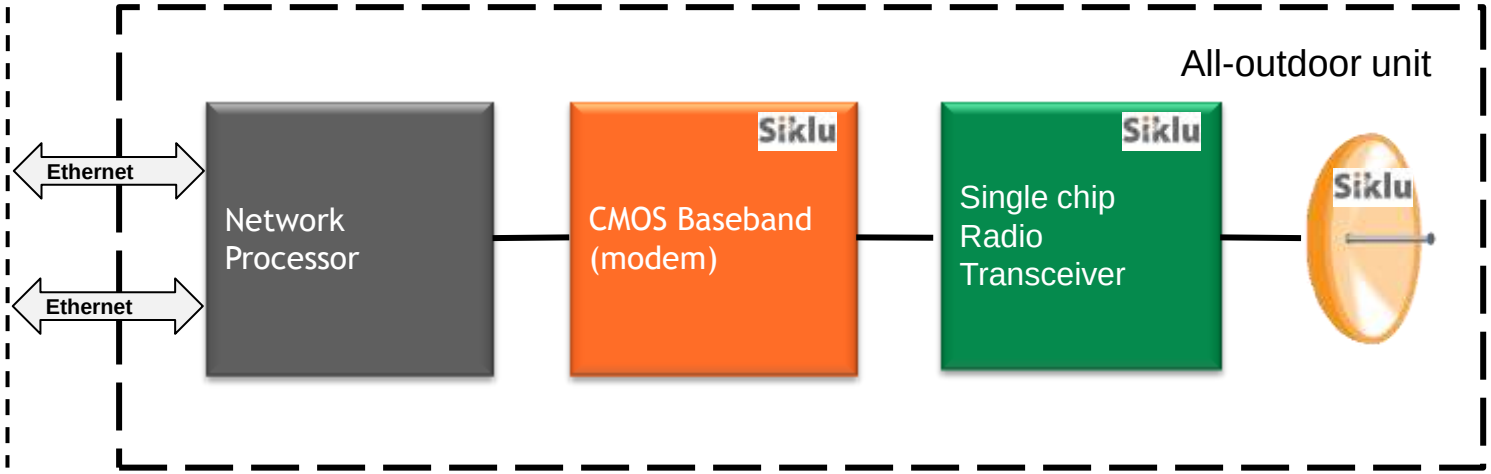
- ROI in a few months
- Gigabit capacity
- 71-76 / 81-86 GHz E-band provides abundant, uncongested lightly licensed spectrum:
  - Fast and simple licensing at a minimum fee
  - Interference protection
- All-outdoor solution:
  - Small footprint
  - easy and quick installation
- Technology validated by global Tier-1 mobile service providers



Siklu at a Glance

- Siklu redefines wireless backhaul by optimizing every aspect of millimeter-wave system design to enable service providers to boost network capacity and performance, while dramatically reducing equipment and operational costs
- Siklu's EtherHaul™ Highlights:
  - Operates in the licensed, uncongested and inexpensive 71-76/81-86 GHz E-band spectrum
  - Provide Gigabit-per-second capacity to meet the growing needs of new data services
  - Revolutionary all-silicon-based design results in the industry's lowest TCO
  - Green design – extremely low power consumption, small form factor, easy installation

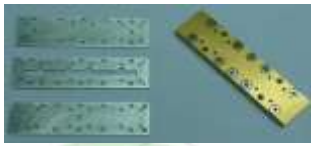
‘Siklu inside’ - Modular VLSI-based Platform



Siklu’s CMOS base band (modem) chip

Siklu’s antenna feed

Siklu’s SiGe RFIC for E-band



Siklu’s diplexer

Conclusions

- The need for broadband connectivity is on the rise and reliable cost-effective solutions are necessary for a growing number of oranizations
- Fiber is expensive to lease, and even more so to deploy
- E-band provides the best alternatives for gigabit rates, up to a distance of about 4 miles
- ROI of a few months
- Siklu's E-band solutions offer the best price-performance products available on the market

- **Contact Siklu to learn more how you can expand your service foot-print quickly and affordably**


Siklu
THANK YOU
daniel.e@siklu.com
www.siklu.com

Max Link Distance: Las Vegas, NV*

*$R_{0.01\%}$=15.4mm/h

		Link Availability			
		Target: 100Mbps @99.99%		Target: 1Gbps @99.99%	
	Throughput	Percentage	Minutes / Year	Percentage	Minutes / Year
1' Antenna		Link: 3,750m		Link: 2,100m	
	1000Mbps	99.911%	Whole year - 466	99.990%	Whole year - 54
	700Mbps	99.964%	278	99.995%	26
	350Mbps	99.983%	100	99.997%	14
	80Mbps	99.990%	34	99.998%	6
	20Mbps	99.993%	18	>99.999%	3
	Link Down		**36**		**5**
2' Antenna		Link: 5,000m		Link: 3,000m	
	1000Mbps	99.954%	Whole year - 242	99.990%	Whole year - 50
	700Mbps	99.974%	106	99.994%	19
	350Mbps	99.985%	57	99.996%	12
	80Mbps	99.990%	24	99.998%	6
	20Mbps	99.992%	15	99.998%	4
	Link Down		**40**		**9**

Max Link Distance: Los Angeles, CA*

*$R_{0.01\%}$=25.0mm/h

		Link Availability			
		Target: 100Mbps @99.99%		Target: 1Gbps @99.99%	
	Throughput	Percentage	Minutes / Year	Percentage	Minutes / Year
1' Antenna		Link: 2,900m		Link: 1,650m	
	1000Mbps	99.929%	Whole year - 373	99.991%	Whole year - 50
	700Mbps	99.967%	202	99.995%	25
	350Mbps	99.984%	85	99.998%	14
	80Mbps	99.990%	32	99.999%	5
	20Mbps	99.993%	19	>99.999%	3
	Link Down		**36**		**3**
2' Antenna		Link: 3,800m		Link: 2,400m	
	1000Mbps	99.958%	Whole year - 219	99.990%	Whole year - 53
	700Mbps	99.975%	88	99.994%	21
	350Mbps	99.985%	52	99.996%	14
	80Mbps	99.990%	24	99.998%	7
	20Mbps	99.993%	16	99.999%	4
	Link Down		**39**		**7**

Max Link Distance: Phoenix, AZ*

*$R_{0.01\%}$=33.1mm/h

		Link Availability			
		Target: 100Mbps @99.99%		Target: 1Gbps @99.99%	
	Throughput	Percentage	Minutes / Year	Percentage	Minutes / Year
1' Antenna		Link: 2,500m		Link: 1,450m	
	1000Mbps	99.947%	Whole year - 277	99.990%	Whole year - 50
	700Mbps	99.971%	125	99.995%	25
	350Mbps	99.984%	67	99.998%	14
	80Mbps	99.990%	30	>99.999%	6
	20Mbps	99.993%	19	>99.999%	3
	Link Down		**36**		**2**
2' Antenna		Link: 3,200m		Link: 2,050m	
	1000Mbps	99.966%	Whole year - 179	99.990%	Whole year - 51
	700Mbps	99.978%	61	99.994%	20
	350Mbps	99.986%	42	99.997%	14
	80Mbps	99.990%	22	99.998%	7
	20Mbps	99.993%	15	99.999%	4
	Link Down		**38**		**6**

Max Link Distance: New York, NY*

*$R_{0.01\%}$=43.1mm/h

		Link Availability			
		Target: 100Mbps @99.99%		Target: 1Gbps @99.99%	
	Throughput	Percentage	Minutes / Year	Percentage	Minutes / Year
1' Antenna		Link: 2,150m		Link: 1,300m	
	1000Mbps	99.932%	Whole year - 359	99.990%	Whole year - 53
	700Mbps	99.965%	178	99.996%	30
	350Mbps	99.983%	90	99.998%	15
	80Mbps	99.990%	38	>99.999%	5
	20Mbps	99.994%	22	>99.999%	2
	Link Down		**32**		**1**
2' Antenna		Link: 2,750m		Link: 1,800m	
	1000Mbps	99.957%	Whole year - 226	99.990%	Whole year - 52
	700Mbps	99.974%	88	99.995%	24
	350Mbps	99.985%	57	99.997%	15
	80Mbps	99.990%	28	99.999%	6
	20Mbps	99.993%	18	>99.999%	3
	Link Down		**35**		**4**

Max Link Distance: Atlanta, GA*

*$R_{0.01\%}$=60.8mm/h

		Link Availability			
		Target: 100Mbps @99.99%		Target: 1Gbps @99.99%	
	Throughput	Percentage	Minutes / Year	Percentage	Minutes / Year
1' Antenna		Link: 1,800m		Link: 1,100m	
	1000Mbps	99.930%	Whole year - 367	99.990%	Whole year - 52
	700Mbps	99.962%	168	99.996%	32
	350Mbps	99.981%	101	99.999%	14
	80Mbps	99.990%	44	>99.999%	4
	20Mbps	99.994%	25	>99.999%	1
	Link Down		**29**		**1**
2' Antenna		Link: 2,300m		Link: 1,500m	
	1000Mbps	99.952%	Whole year - 252	99.991%	Whole year - 50
	700Mbps	99.970%	96	99.995%	26
	350Mbps	99.983%	68	99.998%	14
	80Mbps	99.990%	34	>99.999%	5
	20Mbps	99.994%	21	>99.999%	2
	Link Down		**33**		**2**