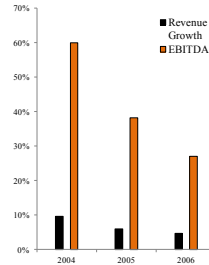


Techno-economic analysis of SDN



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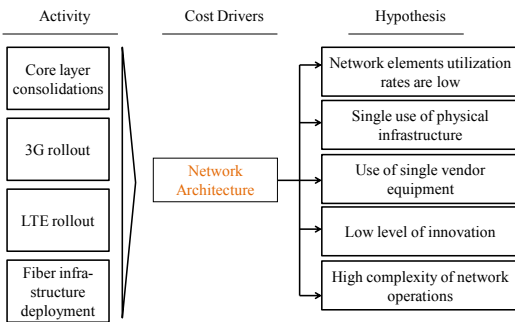
Mobile carriers experience margin pressure.



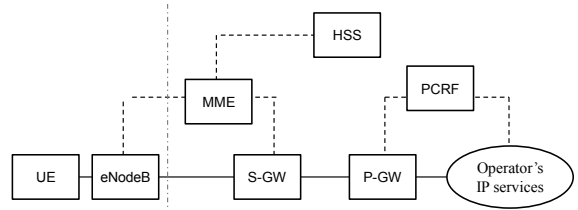
Data for mobile operators in Western Europe: revenue is nearly flat and margins are rapidly decreasing.
 Source: A.T. Kearny analysis, 2007

“European mobile operators’ revenues per minute for voice and data are decreasing far faster than their costs.”
 Source: A.T. Kearny analysis, 2009

Hypothesis for high costs of carriers

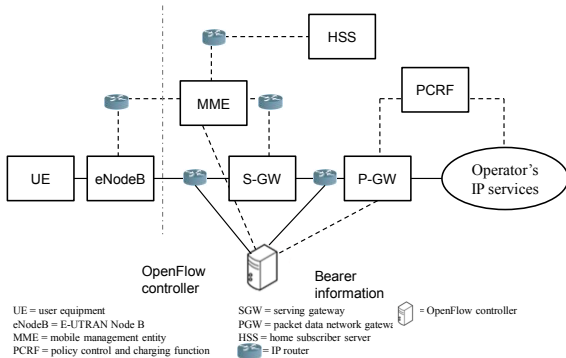


The LTE architecture: EPS network elements



UE = user equipment
 eNodeB = E-UTRAN Node B
 MME = mobile management entity
 PCRF = policy control and charging function
 SGW = serving gateway
 PGW = packet data network gateway
 HSS = home subscriber server
 = IP router

The LTE architecture: EPS network elements

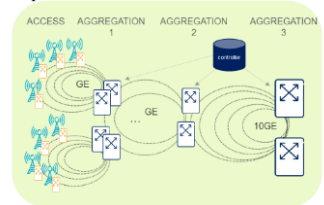


UE = user equipment
 eNodeB = E-UTRAN Node B
 MME = mobile management entity
 PCRF = policy control and charging function
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 HSS = home subscriber server
 = IP router
 = OpenFlow controller

Previous study

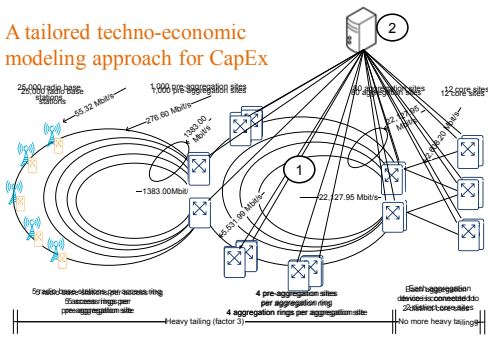
Results:

1. 79% lower total cost of ownership
2. 80% lower capital expenditures
3. 79% lower operational expenditures



Source: ACG Research, 2011

A tailored techno-economic modeling approach for CapEx



Network Model and Traffic Forecast for 2017 ⁹

Simpler network devices

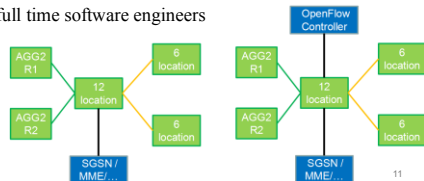
	2017	
Small size router (compact design with integrated route switch processor)	€ 44,186	1
Power Supply	€ -	1
Cable Management Tray	€ -	1
Power Cord 25Vac Europe	€ -	1
Fan Tray	€ -	1
Router OS	€ 13,178	1
IEEE 1588 Support	€ 10,078	1
VPN license (system)	€ 17,054	1
Line Card 20x1GbE	€ 8,527	1
1000BASE-SX SFP (550nm)	€ 488	2
1000BASE-EX SFP (40km)	€ 1,783	11
Total	€ 113,612.40	
Total	2009 € 227,224.806	

location	#	reduction
pre-aggregation site	2000	17.74%
aggregation site	160	9.49%
core site	12	7.32%
inner core site	12	7.66%

10

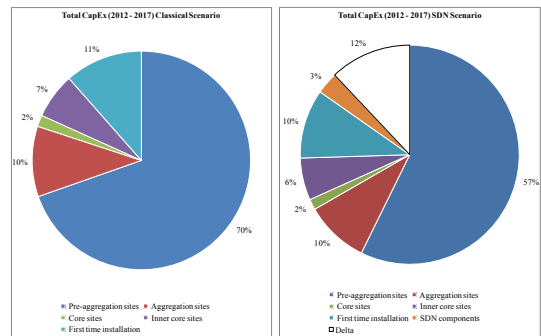
Control is shifted to the core

1. Simpler core devices
2. Extra SDN component: OpenFlow controller
 1. Cost: Average price of available controllers
 2. 100 OpenFlow switches to 1 controller + extra controller for redundancy
3. Tailored software – 10 full time software engineers



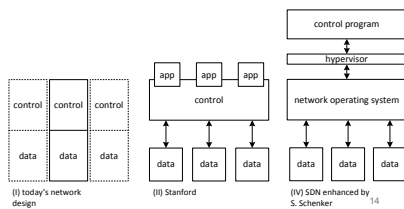
11

CapEx reduction of 12%



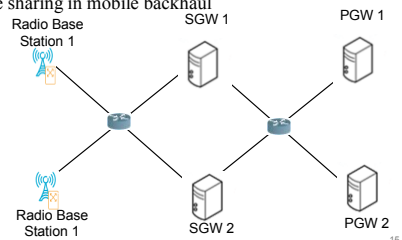
Virtualization of the infrastructure with SDN

1. Virtualization isolates administrative domains of different operators
2. Active sharing in mobile backhaul



Active sharing of mobile backhaul

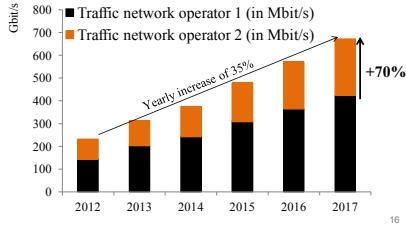
1. Virtualization isolates administrative domains of different operators
2. Active sharing in mobile backhaul



15

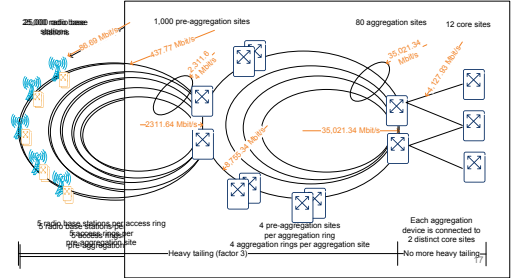
Modeled by total traffic increase of 70%

1. Virtualization isolates administrative domains of different operators
2. Active sharing in mobile backhaul



Virtualization of the infrastructure with SDN

1. Active sharing of network equipment
2. Second operator on the same network (70% of customers of first)

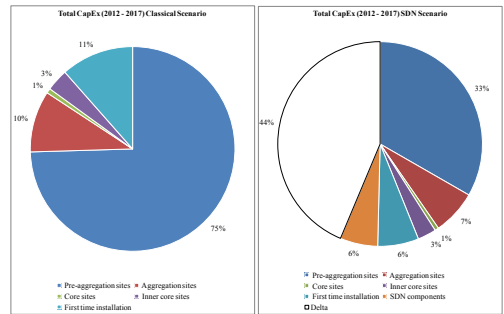


Simpler network devices

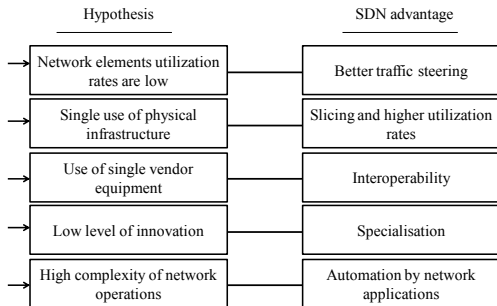
	First operator	Second operator
Small size router (compact design with integrated route switch)	€ 44,186	1
Power Supply	€ -	1
Cable Management Tray	€ -	1
Power Cord 23Vac Europe	€ -	1
Fan Tray	€ -	1
Router OS	€ 13,178	1
IEEE 1588 Support	€ 10,078	1
VPN license (system)	€ 17,654	1
Line Card 20x1GbE	€ 8,527	1
1000BASE-SX MMF (550nm)	€ 488	2
1000BASE-EX SFP (40km)	€ 1,283	2
Total	€ 113,612	€ 110,047
Total	2000 € 227,224,806	€ 220,093,023

Location	type single operator 1	type single operator 2	type shared
pre-aggregation site	small size router	small size router	small size router
aggregation site	small size router	small size router	medium size router
core site	medium size router	medium size router	large size router
inner core site	2 large size routers	2 large size routers	3 large size routers
Total reduction			

General CapEx reduction of 44%



Main SDN advantages for Carriers



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FUTURE INTERNET DEPT.

IBCN Internet Based Communication Networks and Services (IBCN)

SPARC

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