High Level Total Cost of Ownership Comparison:

Stand Alone Public Safety Network vs. Public Private Partnership

Bell Labs

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Alcatel·Lucent

Objective

- Compare the total cost of ownership for nationwide LTE deployment for first responders by
  - Public Safety agency (Stand-alone network)

    vs.

  - Public Private partnership (shared network, Public safety agency and Wireless Service Providers (WSP))
- Determine the key variables that impact both the scenarios
- Show impact/sensitivity of key variable to Total Cost of Ownership (TCO) savings

High level view of scenarios

SCENARIO A
Go-alone

Key Assumptions:

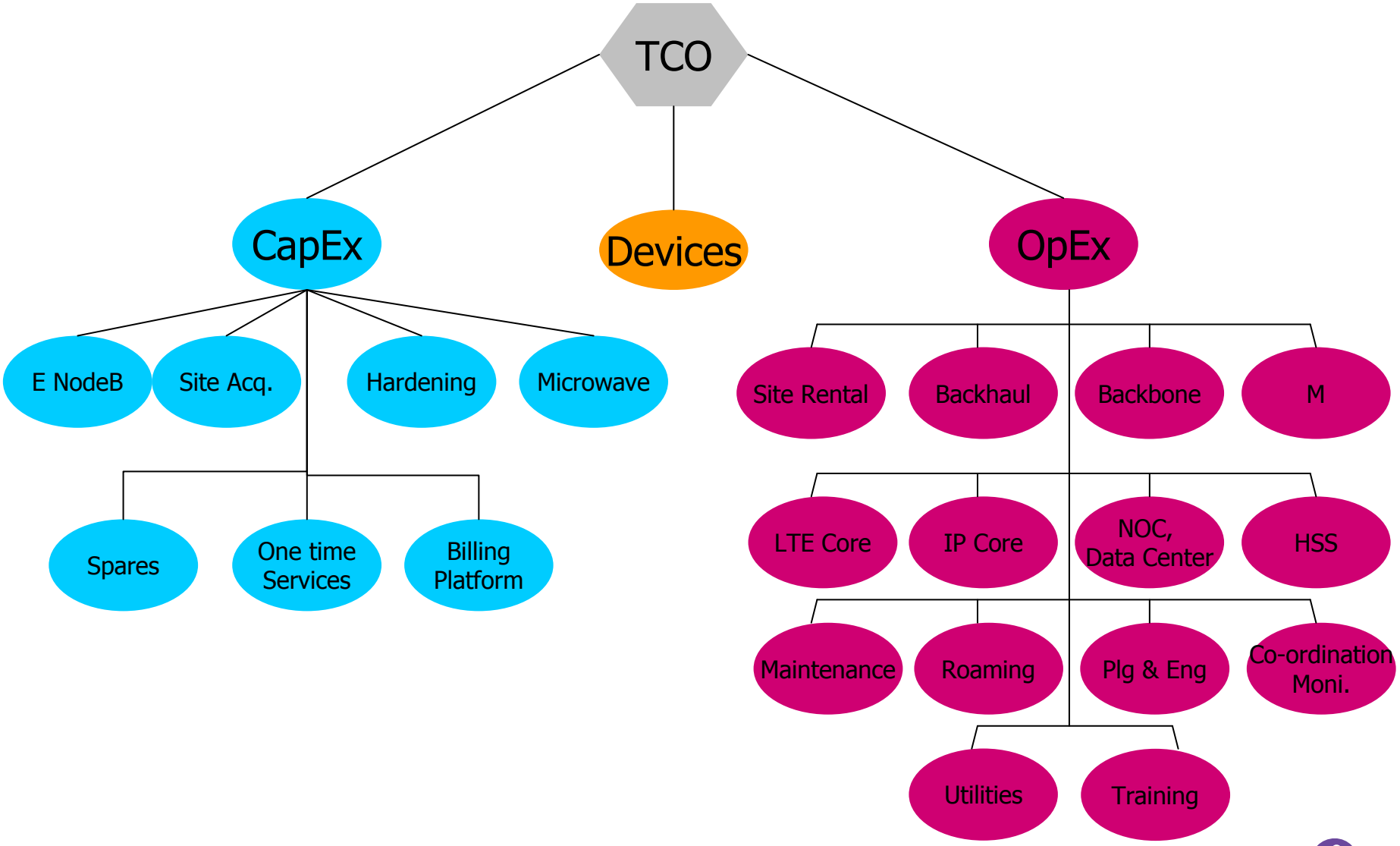
- Greenfield scenario
- Includes RAN (macro) and Core (EPC IP core, HSS, NOC, Billing platform and Data Centers) – all owned by public safety agency
- Backhaul Capex + Use existing MW backhaul
- Lease backbone network (including roaming traffic)
- Public Safety agency operates and manages the network – cheaper salary rates and less headcount assumed
- Considered cost of training
- Device and device management charges included
- SLAs and performance penalties not necessary

SCENARIO B
Public Private Partnership

Key Assumptions:

- Full eNodeB capex
- Share sites (tower, shelters, power, etc)
- Shared backhaul + incremental expenses for additional capacity
- Site rental expenses assumed
- LTE Core, IP Core, NOC, Data centers shared
  - Cost for SGW & rest of core
- WSP operates and manages the shared core – additional headcount and higher salary rate assumed
- Higher planning and engineering and co-ordination and monitoring expenses assumed
- Higher % of spares assumed
- Device and device management charges cheaper
- SLAs and performance penalties to be negotiated

Total Cost of Ownership – major components



Assumptions
Site Count, Devices

Site count and subscribers are assumed to be the same for both scenarios:

COMMON to both scenarios	1	2	3	4	5	6	7	8	9	10
First Responder Subs	200,000	500,000	1,300,000	2,200,000	3,145,913	3,193,102	3,240,998	3,289,613	3,338,957	3,389,042
# of e Node Bs	7,000	20,000	30,000	35,845	36,600	37,355	38,110	38,981	39,853	40,724
Backhaul Throughput/site	30 Mbps									

Devices:

$/Device for stand-alone: $1200 (Vehicular modem)/gross add

$/Device for public-private partnership: $900/gross add

Price Erosion (p.a.): 15%

Device management:

Stand-alone network: $30/gross add

Public private partnership: $5/gross add

Scenario A: ROM price typically offered by modem vendors today
Scenario B: assumes operator is able to leverage existing relationships and device ecosystem to obtain discounted price

Based on ALU's experience with its device management system. Operators have device management systems in place and therefore incur an incremental expense; Scenario B to include full cost of device management
Data for Scenario B based on ALU platform - representative of costs for US-based service providers (ALU experience)

Scenario A: Stand-Alone Public safety Network Scenario B: Shared Network/Public private Partnership

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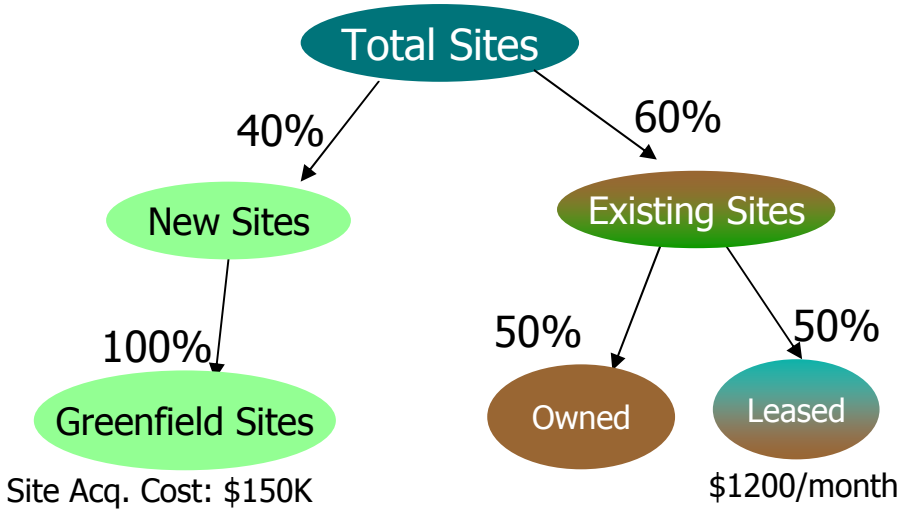
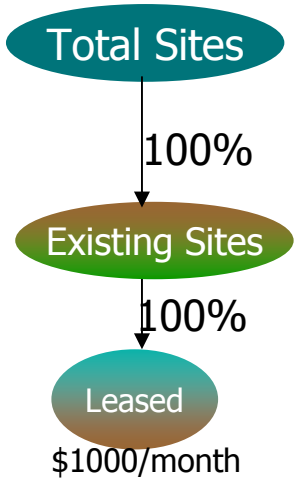
Assumptions
eNode B

INPUT VARIABLE	UNIT/SOURC	Scenario A	Scenario B	Notes:
eNode B	$/eNodeB	$57,000	$50,000	Scenario A: 3-s indoor eNB, 100 SAU, antennas, coax, 8h battery backup and E&I. Scenario B: Tier 1 NA eNode B, ~ 500 SAUs, E&I and other deployment services
% new sites	%	40%		Assumption
% existing sites	%	60%	100%	Scenario B assumes that all existing sites are utilized as operators have 3g/LTE footprint in all markets
% of existing sites that are leased	%	50%	100%	Operators have 3G/LTE sites, some may be owned and therefore considered sunk cost. To avoid $0 costs, assumed all sites to be leased
Site Acq cost (new sites only)	$	$150,000		
Hardening cost - existing site	$	$50,000	$50,000	
Hardening cost - new site	$	$65,000	$65,000	Battery Backup, structural enhancements, diesel generator, etc

Stand Alone



Public Pvt Partnership



Scenario A: Stand-Alone Public safety Network Scenario B: Shared Network/Public private Partnership

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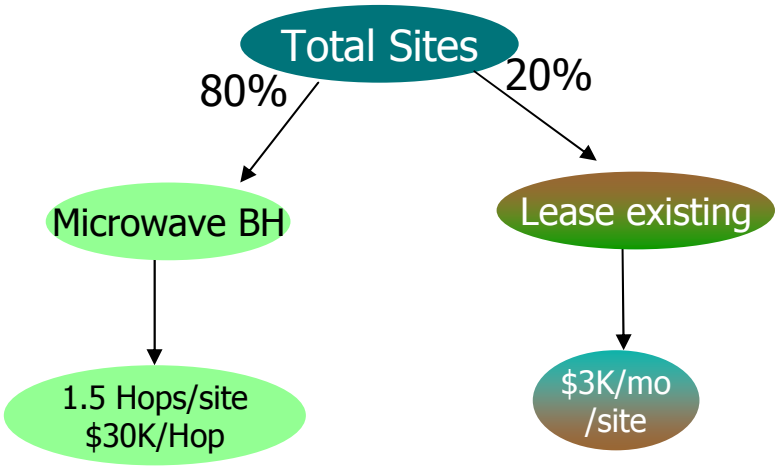
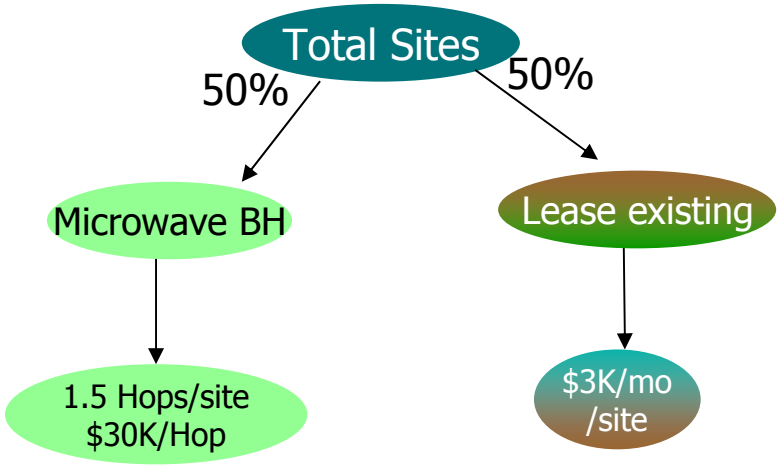
Assumptions
Backhaul, Backbone

Backhaul (Scenario A)



Backhaul (Scenario B)



INPUT VARIABLE	UNIT/SOURC	Scenario A	Scenario B	Notes:
% sites requiring backhaul build	%	80%	50%	Through previous business cases, it is known that operators undergoing/completed backhaul transformation in most markets. Therefore assumed 50% new build and a Public safety incumbent would incur a higher % new build.
MW Capex/Hop	$/hop	$30,000	$30,000	Comparable pricing for higher capacity microwave including EF&I
# of hops/site requiring backhaul build	hops/site	1.50	1.50	Assumption
% sites with leased backhaul	%	20%	50%	Commercial operators lease backhaul from ILECs, CLECs or fiber providers
leased backhaul/month	$/month/site	$3,000	$3,000	Average for a ~40 Mbps Ethernet
# OC-3s		2	2	rough assumption on equivalent-capacity assuming a small fraction of roamers and local-breakout
Backbone network/OC-3	$/month	$4,000	$4,000	Monthly lease rate per OC-3

Assumptions
Core & other items

INPUT VARIABLE	UNIT/SOURC	Scenario A	Scenario B
LTE Core per sub	$/sub	$15	$10
IP Core per sub	$/sub	$15	$10
NOC, Data Centers per sub	$/sub	$15	$10
HSS Cost per sub	$/sub	$6	$6
Billing Platform	$	$1,500,000	
Spares	% of capex	16%	20%
EF&I	% of capex	0%	0%
Other one time services	% of capex	20%	10%

INPUT VARIABLE	UNIT/SOURC	Scenario A	Scenario B
Roaming Expenses			
% subs outbound roaming	% of subs	5%	5%
outbound roaming rate	$/MB	$0.03	$0.01
Usage (MB/month/sub)	MB/month	200	200
% roaming traffic	%	5%	5%

Core costs assumed to be cheaper due to many core network elements, expertise present in an operator's network, Source: representative of costs for US-based service providers (ALU experience)

Spares assumed to be higher for the partnership scenario due to overlap between different operators

Engineering, Installation included in e Node B price

Assumption is a lower roaming rate would be provided as an incentive by operators for engaging in the partnership program

Scenario A: Stand-Alone Public safety Network Scenario B: Shared Network/Public private Partnership

Assumptions
Maintenance

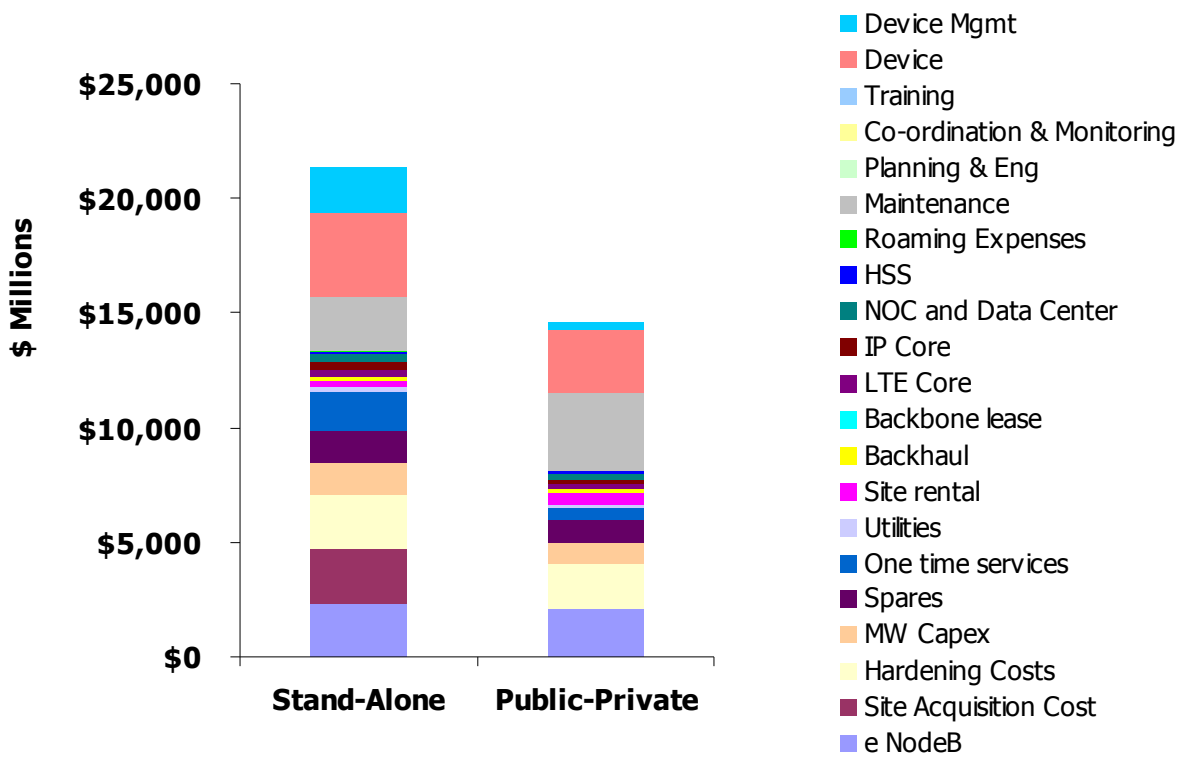
INPUT VARIABLE	UNIT/SOURC	Scenario A	Scenario B
Maintenance			
Ratio of Technicians per 1 Core Network		2	2.5
Ratio of Technicians per 25 Cellsites		1	1.5
Ratio of Engineers to 5 Core Network		1	1.5
Ratio of Engineers to 50 Cellsite		1	1.5
Salary of an Engineer	$	$120,000	$120,000
Salary of a Technician	$	$90,000	$90,000
Salary Inflation/Deflation	%	3%	3%
Planning & Eng costs	% of Eng Salary	3%	5%
Co-ordination & Monitoring	% of Eng Salary	3%	5%
Training costs	per technician	$0	

Additional half headcount (technicians and engineers) assumed for public private partnership due to overlap of functions

Planning, Co-ordination, etc assumed more for partnership program due to multiple entities

Scenario A: Stand-Alone Public safety Network Scenario B: Shared Network/Public private Partnership

10 Yr TCO Comparison



- Site Acquisition cost is the biggest contributor to the stand-alone network TCO
- The other major contributors are hardening costs, maintenance costs, e NodeB, device management and one time services are major contributors
- Maintenance is the biggest contributor to the public private partnership TCO
- Other major contributors include e NodeB, hardening costs, devices, etc

	Stand-Alone	Public-Private
TCO →	$21,371M	$14,653M
Capex →	55%	45%

10 Yr TCO Savings → 46%= $6,718M

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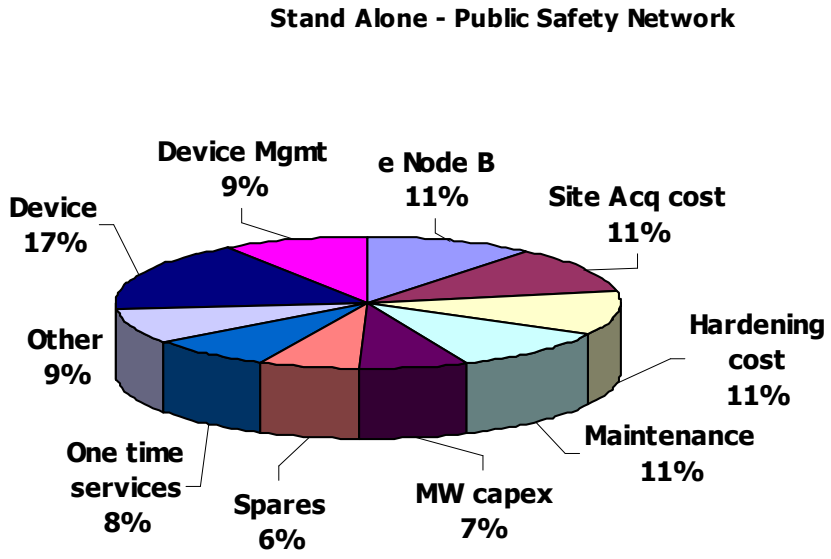
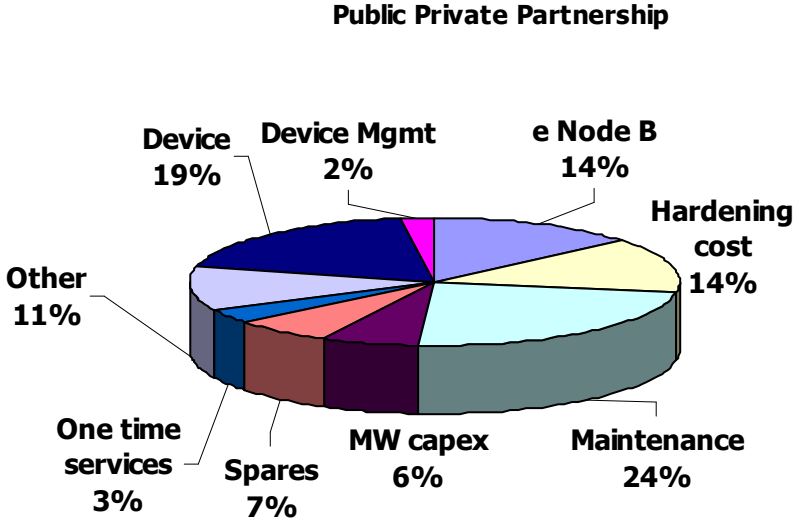
TCO distribution across scenarios



Devices, Capex (e Node B, Site Acq, Hardening, etc) are the key variables to consider for a stand-alone network

Additional headcount for maintenance make maintenance the critical factor for a shared public private network



Impact of Key Variable
Device

10 Yr TCO savings ($M		Device (Public Safety) = $1200							
	$ 6,718	$ 600	$ 700	$ 800	$ 900	$ 1,000	$ 1,100	$ 1,200	$ 1,300
Device (Public Private Partnership) = $800	$ 400	$ 6,413	$ 6,718	$ 7,023	$ 7,327	$ 7,632	$ 7,936	$ 8,241	$ 8,546
	$ 500	$ 6,109	$ 6,413	$ 6,718	$ 7,023	$ 7,327	$ 7,632	$ 7,936	$ 8,241
	$ 600	$ 5,804	$ 6,109	$ 6,413	$ 6,718	$ 7,023	$ 7,327	$ 7,632	$ 7,936
	$ 700	$ 5,500	$ 5,804	$ 6,109	$ 6,413	$ 6,718	$ 7,023	$ 7,327	$ 7,632
	$ 800	$ 5,195	$ 5,500	$ 5,804	$ 6,109	$ 6,413	$ 6,718	$ 7,023	$ 7,327
	$ 900	$ 4,891	$ 5,195	$ 5,500	$ 5,804	$ 6,109	$ 6,413	$ 6,718	$ 7,023
	$ 1,000	$ 4,586	$ 4,891	$ 5,195	$ 5,500	$ 5,804	$ 6,109	$ 6,413	$ 6,718
	$ 1,100	$ 4,281	$ 4,586	$ 4,891	$ 5,195	$ 5,500	$ 5,804	$ 6,109	$ 6,413
	$ 1,200	$ 3,977	$ 4,281	$ 4,586	$ 4,891	$ 5,195	$ 5,500	$ 5,804	$ 6,109
	$ 1,300	$ 3,672	$ 3,977	$ 4,281	$ 4,586	$ 4,891	$ 5,195	$ 5,500	$ 5,804
	$ 1,400	$ 3,368	$ 3,672	$ 3,977	$ 4,281	$ 4,586	$ 4,891	$ 5,195	$ 5,500

10 Yr TCO savings greater than current baseline of $6718M

10 Yr TCO savings less than current baseline of $6718M

10 Yr TCO savings assuming $1200/device for both scenarios

Table above shows how the 10 Yr TCO savings change when the device price for the two scenarios are changed

The baseline TCO savings holds true in all cases where the public safety device price is $300 more than that for the public private partnership case

Public Private partnership for Public Safety
General Thoughts

- Primary purpose of a partnership deal is to lower the TCO of all operators involved, reduce time to market or increase coverage
- Appropriate governance, structure and terms appear to be where may a deal succeed or fail – typically not technology issues
  - This would help in reducing the overhead associated with the increase in operational expenses to administer and manage the partnership deal
- It is highly important to align interests/objectives: strategy, roadmaps, geography
- There are technical and operational issues that may not allow to lower TCO in some partnership scenarios
  - Current outsourcing arrangements that WSPs today have will require additional considerations

Backup

10 Yr TCO Summary*

Capital expenses:	Stand-Alone	Public-Private
e NodeB	$2,321	$2,036
Site Acquisition Cost	$2,443	$0
Hardening Costs	$2,281	$2,036
MW Capex	$1,466	$916
Spares	$1,362	$998
EF&I	$0	$0
One time services	$1,702	$499
Utilities	$255	$150
Billing Platform	$2	
Opex		
Site rental	$176	$489
Backhaul	$195	$195
Backbone lease	$1	$1
LTE Core	$332	$221
IP Core	$332	$221
NOC and Data Center	$332	$221
HSS	$133	$133
Roaming Expenses	$80	$27
Maintenance	$2,290	$3,434
Planning & Eng	$0	$0
Co-ordination & Monitoring	$0	$0
Training	$0	$0
Device	$3,655	$2,741
Device Mgmt	$2,016	$336
Total Capex	$11,832	$6,635
Total Opex	$9,539	$8,018
10 Yr TCO	$21,371	$14,653

*$ Millions

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Inputs and Assumptions

INPUT VARIABLE	UNIT/SOURC	Scenario A	Scenario B	Notes:
eNode B	$/eNodeB	$57,000	$50,000	Scenario A: 3-s indoor eNB, 100 SAU, antennas, coax, 8h battery backup and E&I. Scenario B: Tier 1 NA eNode B, ~ 500 SAUs, E&I and other deployment services
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# of hops/site requiring backhaul build	hops/site	1.50	1.50	Assumption
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leased backhaul/month	$/month/site	$3,000	$3,000	Average for a ~40 Mbps Ethernet
# OC-3s		2	2	rough assumption on equivalent-capacity assuming a small fraction of roamers and local-breakout
Backbone network/OC-3	$/month	$4,000	$4,000	Monthly lease rate per OC-3
LTE Core per sub	$/sub	$15	$10	NaaS Model (2008) - representative of costs for US-based service providers (ALU experience)
IP Core per sub	$/sub	$15	$10	
NOC, Data Centers per sub	$/sub	$15	$10	
HSS Cost per sub	$/sub	$6	$6	
Billing Platform	$	$1,500,000		
Spares	% of capex	16%	20%	
EF&I	% of capex	0%	0%	
Other one time services	% of capex	20%	10%	

Scenario A: Stand-Alone Public safety Network
Scenario B: Shared Network/Public private Partnership

Inputs and Assumptions …contd

INPUT VARIABLE	UNIT/SOURC	Scenario A	Scenario B	Notes:
Roaming Expenses: Scenario A - add HLR or AAA, connectivity to roaming exchange, roaming rate. Scenario D - connectivity to roaming exchange,				
Roaming Expenses				
% subs outbound roaming	% of subs	5%	5%	Roaming is a small percentage for public safety
outbound roaming rate	$/MB	$0.03	$0.01	Current roaming rate for a rural market
Usage (MB/month/sub)	MB/month	200	200	Assumption of usage is for calculating roaming traffic
% roaming traffic	%	5%	5%	
site rental/month (existing sites)	$/site/month	$1,200	$1,000	standard north american lease rate
Maintenance				
Ratio of Technicians per 1 Core Network		2	2.5	based on previous business cases, needs to be refined based on actual market and other conditions
Ratio of Technicians per 25 Cellsites		1	1.5	
Ratio of Engineers to 5 Core Network		1	1.5	
Ratio of Engineers to 50 Cellsite		1	1.5	
Salary of an Engineer	$	$120,000	$120,000	Avg salary rate and inflation rate - previous buisness cases for North American operators
Salary of a Technician	$	$90,000	$90,000	
Salary Inflation/Deflation	%	3%	3%	
Planning & Eng costs	% of Eng Salary	3%	5%	Scenario A - representative of costs for US-based service providers (ALU experience) ; assumed a higher number for Scenario B due to overlap of functions
Co-ordination & Monitoring costs	% of Eng Salary	3%	5%	
Utilities (as % of CapEx)		3%	3%	
Device	$/device /gross add	$1,200	$900	Scenario A: ROM price typically offered by modem vendors today Scenario B: assumes operator is able to leverage existing relationships and device ecosystem to obtain discounted price
Price Erosion	YoY %	15%	15%	
Device Management	$/gross add/month	$30	$5	Operators have device management systems in place and therefore incur an incremental expense; Scenario B to include full cost of device management. Data for Scenario B based on ALU platform -representative of costs for US-based service providers (ALU experience)