A High Performance Wireless Trackside Meshed Network for Buenos Aires Commuter Trains

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SOFSE – The Train Company

- Operadora Ferroviaria Sociedad del Estado - Operates regional passenger services in Argentina
- State-owned company created in 2008, since March 2015 also runs the Buenos Aires urban commuter rail services previously operated by private companies
- Manages 9 lines (1000 km) including:
  - Sarmiento
  - San Martin
  - Mitre (3 Lines)
  - Roca
  - Belgrano (2 lines)
  - Urquiza

The Once Tragedy

22 February 2012

- A crowded train - about 1,200 passengers
- Approached station at speed– working brakes were never applied
- Hit buffers at 26 kph- 51 killed, more than 700 injured
- Second fatal accident on the Sarmiento line within six months, third deadliest train accident in Argentine history
- Cause never officially determined

SOFSE Objectives

Goals:

- Make Sarmiento a model of safety
- Avoid recurrences
- Address operator errors

Early Steps:

- CCTV to capture cockpit video for later review
- Saw need for real-time viewing in main control center

SOFSE's Required Solution

- Live streaming of video from Cab to main control center
- Aggregate network capacity for up to 26 simultaneous Hi-Def live video streams.
- A real-time Command and Control and station linked to the Public Address alert system at the main control center and at each station
- Command and Control system must include sufficient backbone network capacity to link each of the 16 stations with the main control center and with each other whenever needed

Public Tender

Specifications:

- 32 km of track, 16 stations 26 Trains (2 radios per train)
- No available 3G, 4G, or Fiber
- Stream 26 Hi-Def videos simultaneously
- Unlicensed spectrum (5.8 Ghz at 1 watt per radio)
- All stations and trains on a single network (>70 nodes)
- Command and Control with Station Alerting

Response: NO OTHER QUALIFIED BIDDERS!

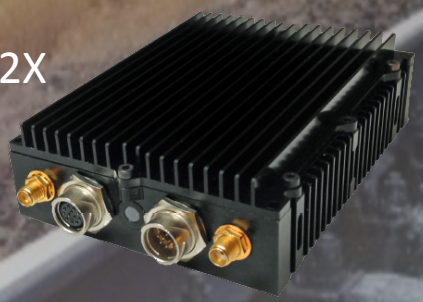
The Proposed Solution

- K Mesh, based on MN MIMO wave form, not restrained by 802.11 specifications
- Mutualink™ Emergency Collaboration Network

K (Carrier) Mesh Technology

- 2X and 4X MIMO COFDM - far exceeds the capabilities of WiMesh 802.11
- Superior proprietary meshing algorithm – development funded by DARPA
  - No tower to tower failover - assured delivery at the packet level
  - **Extremely robust in Urban Canyons and Subterranean Passages**
  - Very high DATA throughput (>100 Mbs)
  - Extremely reliable at long ranges (30 Mbs at 25 miles, 2 Mbs at 60 miles or more)

Model 42X



Model 44X

Model 42X
Hand Held

K Mesh Advantages

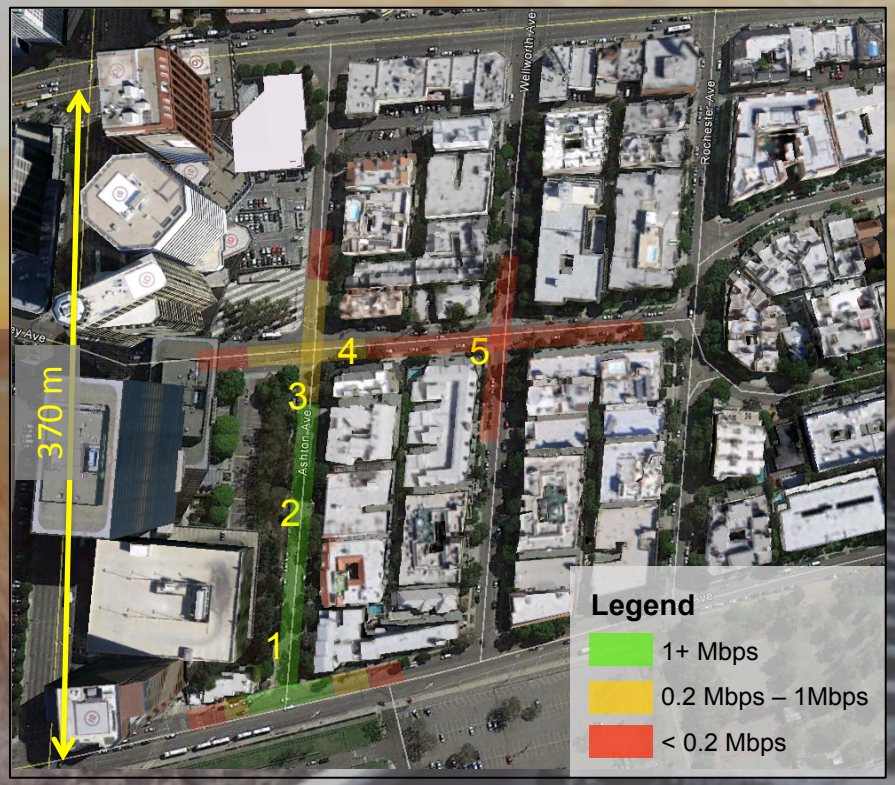
Due to the extraordinary level of real-time, packet-level control and the advantages of MN MIMO, K Mesh advantages include:

- Instantaneously routes each packet by the current optimal path
- Automatically selects the optimal modulation scheme for each packet according to current conditions
- Space-Time coding distributes redundant copies of data across multiple antennas to improve robustness
- Spatial multiplexing permits multiple data streams to be sent simultaneously , increasing the capacity of the link
- Rx Beamforming allows radios efficiently to sum energy received by all receiving stations
- Tx Beamforming allows radios to steer transmit beams toward the receiver on a real time basis

Robust Performance in Urban Canyons

GREEN STREETS = STRONG RECEPTION

802.11 Radio



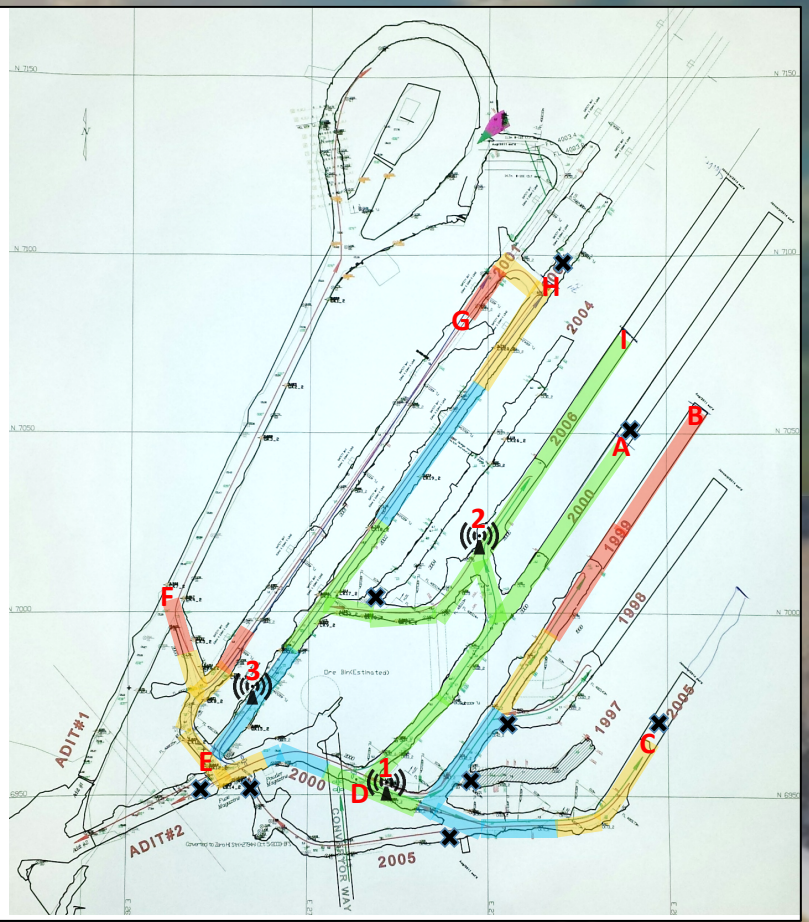
K Mesh

Exceptional Subterranean Performance

Exceptional Subterranean Performance

- **1, 2, 3** – Denote Locations of Fixed Radios
- 4th Radio Mobile and Followed Colored Path
- **A, B, C, …** - Denote Location of Measurements of Data Sent From 4th Radio to **Radio 2** (See table below)
- **Radio 1** – Rubber Duck Antenna, **Radio 2** – Helical Antenna, **Radio 3** – Helical Antenna, **Radio 4** – Laird Antenna
- ~50m x 50m Per Grid
- Vehicles Driving Between Signal Path Affected the Signal by Only 1~3dB
- ✖ - Denotes Inaccessible Area or Not Explored Area
- Radio Network Tested at 2.490GHz Center Frequency in a 20MHz BW

Location	MCS	SNR (dB)	File Transfer (Mbps)	TCP Iperf (Mbps)
A	12	37	37	31
B via R1	9, 3	18, 19	8.8	7.3
C via R1	12, 9	22, 22	14.4	10
D	11	29	35	25
E via R1	12, 2	31, 21	13.6	9.96
F via R3	2, 3	5, 12	8.8	7
G via R3	2, 3	3, 13	8	7.8
H via R3	14, 3	40, 12	12.8	12.4
I	14	25	64	37



ANTI-JAMMING MEASURES IN K MESH RADIOS

How does MN-MIMO overcome jamming?

Radio Interoperability and the ability to change frequencies on demand are InterLink's two most powerful tools for overcoming jamming.

Radio Interoperability:

For both voice and data, InterLink Radios communicate via IP over RF as well as over wired infrastructure. These radios can be comprised of multiple networks set to different frequencies, yet, when a single network spans multiple frequencies, the radios will interoperate seamlessly for both voice and data.

Ability to change frequencies on demand:

If, for instance, in a forward position, half the radios are on one frequency and half are on a different frequency, the two sets of radios can interoperate for voice and data. If one frequency is jammed, users on that frequency can switch to the other frequency and resume communications as if no jamming had occurred. If only a subset of the users of one are disabled by jamming, the surviving users need only connect to a radio of the other frequency, and a connection can be reestablished for the surviving radios in the jammed network. Can a radio move to a different frequency (automatically or manually) in the event that a frequency is jammed? Today, these changes are manual and are conducted from the Tactical Operation Center. In fact, an entire network of radios can be changed to a different frequency with one click using our broadcast update feature. In the future, this can be done automatically using the ST-DSA feature described in the next slide.

ANTI-JAMMING (continued)

Additional capabilities include:

Rx Beamforming: Allows radios efficiently to sum energy received by all receiving stations, thereby enabling connections with radios that would otherwise be lost under marginal jamming conditions.

Tx Beamforming: Allows radios to steer transmit beams toward the receiver on a real time basis, therefore enabling connections with radios that would otherwise be lost under marginal jamming conditions.

Tunable Frequency Range: Radios can be tuned to different frequencies within the capability range of a nominal band as defined by a radio chip set.

Dual Band Options: Radios can be equipped with two widely varying frequencies to circumvent jamming.

Superior Meshing: Our superior meshing algorithm allows our radios to circumvent “pockets” of jamming activity.

MN-MIMO: MN-MIMO allows radios to make good use of otherwise useless multipath signals even in the event of jamming.

ANTI-JAMMING (continued)

Our research program features a number of ongoing R&D efforts that aim to address jamming and other issues. Videos demonstrating our efforts can be found on at the following URLs:

Eigen Beamnulling:
https://dl.dropboxusercontent.com/u/6666734/www.interlinkcorp.com%20files/Multi%20Antenna%20Spatial%20Interference%20Mitigation%20Technology.mp4
The Eigen Beamnulling video demonstrates an interference suppression technique (minimize interference by around 20dB).

Single Transceiver Dynamic Spectrum Access:
https://dl.dropboxusercontent.com/u/6666734/www.interlinkcorp.com%20files/Single%20Transceiver%20Dynamic%20Spectrum%20Access%20Demo.mp4
The Single Transceiver Dynamic video demonstrates an interference avoidance technique, whereby the nodes move to a different frequency to avoid the interference.

Please note that these capabilities are currently under Research & Development and at a Technology Readiness Level (TRL) 4-6. Global InterLink welcomes the opportunity to partner with the Egyptian MOD to further advance this capability for their mission specific requirements.

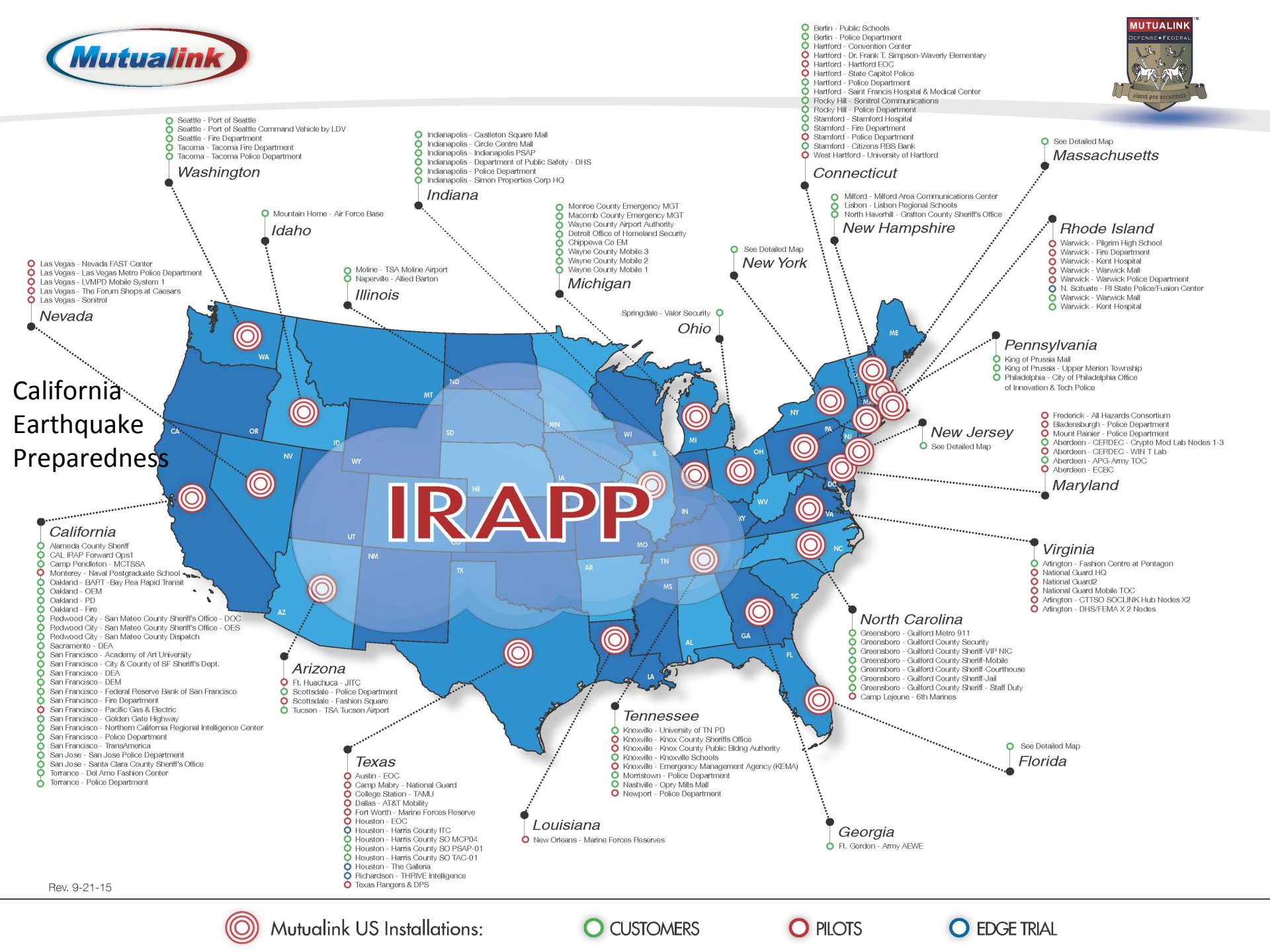
Command and Control System

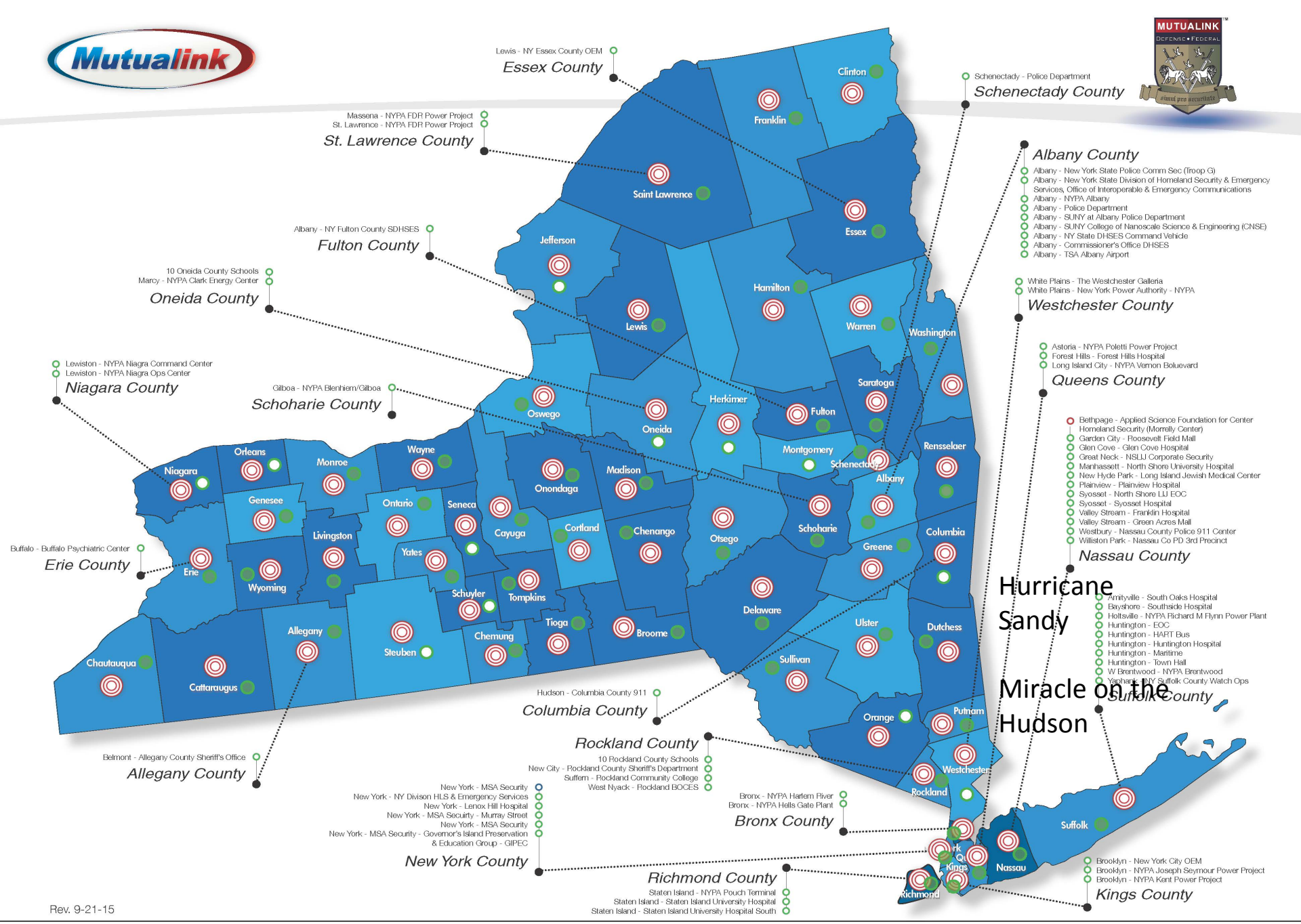
Mutualink™ Real-Time Emergency Collaboration

- Linking the main control center and all 16 rail stations:
- Instantaneous sharing of video with integrated interoperable radio, voice, video, telephone
- Allows coordination among all SOFSE lines in later phases of deployment
- Ability to become a multi-agency collaboration system if and when SOFSE opts for that functionality

Command and Control System

Mutualink™ Emergency Collaboration Network


Mutualink
MUTUALINK
DEFENSE • FEDERAL
Seattle - Port of Seattle
Seattle - Port of Seattle Command Vehicle by LDV
Seattle - Fire Department
Tacoma - Tacoma Fire Department
Tacoma - Tacoma Police Department
Washington
Mountain Home - Air Force Base
Idaho
Las Vegas - Nevada FAST Center
Las Vegas - Las Vegas Metro Police Department
Las Vegas - LVMPD Mobile System 1
Las Vegas - The Forum Shops at Caesars
Las Vegas - Sonitrol
Nevada
Moline - TSA Moline Airport
Naperville - Allied Barton
Illinois
Indianapolis - Castleton Square Mall
Indianapolis - Circle Centre Mall
Indianapolis - Indianapolis PSAP
Indianapolis - Department of Public Safety - DHS
Indianapolis - Police Department
Indianapolis - Simon Properties Corp HQ
Indiana
Monroe County Emergency MGT
Macomb County Emergency MGT
Wayne County Airport Authority
Detroit Office of Homeland Security
Chippewa Co EM
Wayne County Mobile 3
Wayne County Mobile 2
Wayne County Mobile 1
Michigan
Springdale - Valor Security
Ohio
See Detailed Map
New York
Berlin - Public Schools
Berlin - Police Department
Hartford - Convention Center
Hartford - Dr. Frank T. Simpson-Waverly Elementary
Hartford - Hartford EOC
Hartford - State Capitol Police
Hartford - Police Department
Hartford - Saint Francis Hospital & Medical Center
Rocky Hill - Sonitrol Communications
Rocky Hill - Police Department
Stamford - Stamford Hospital
Stamford - Fire Department
Stamford - Police Department
Stamford - Citizens RBS Bank
West Hartford - University of Hartford
Connecticut
Milford - Milford Area Communications Center
Lisbon - Lisbon Regional Schools
North Haverhill - Grafton County Sheriff's Office
New Hampshire
See Detailed Map
Massachusetts
Rhode Island
Warwick - Pilgrim High School
Warwick - Fire Department
Warwick - Kent Hospital
Warwick - Warwick Mall
Warwick - Warwick Police Department
N. Scituate - RI State Police/Fusion Center
Warwick - Warwick Mall
Warwick - Kent Hospital
Pennsylvania
King of Prussia Mall
King of Prussia - Upper Merion Township
Philadelphia - City of Philadelphia Office
of Innovation & Tech Police
New Jersey
See Detailed Map
Frederick - All Hazards Consortium
Bladensburgh - Police Department
Mount Rainier - Police Department
Aberdeen - CERDEC - Crypto Mod Lab Nodes 1-3
Aberdeen - CERDEC - WIN T Lab
Aberdeen - APG-Army TOC
Aberdeen - ECBC
Maryland
California
Earthquake
Preparedness
IRAPP
California
Alameda County Sheriff
CAL IRAP Forward Ops1
Camp Pendleton - MCTSSA
Monterey - Naval Postgraduate School
Oakland - BAFT -Bay Rea Rapid Transit
Oakland - OEM
Oakland - PD
Oakland - Fire
Redwood City - San Mateo County Sheriff's Office - DOC
Redwood City - San Mateo County Sheriff's Office - OES
Redwood City - San Mateo County Dispatch
Sacramento - DEA
San Francisco - Academy of Art University
San Francisco - City & County of SF Sheriff's Dept.
San Francisco - DEA
San Francisco - DEM
San Francisco - Federal Reserve Bank of San Francisco
San Francisco - Fire Department
San Francisco - Pacific Gas & Electric
San Francisco - Golden Gate Highway
San Francisco - Northern California Regional Intelligence Center
San Francisco - Police Department
San Francisco - TransAmerica
San Jose - San Jose Police Department
San Jose - Santa Clara County Sheriff's Office
Torrance - Del Amo Fashion Center
Torrance - Police Department
Arizona
Ft. Huachuca - JITC
Scottsdale - Police Department
Scottsdale - Fashion Square
Tucson - TSA Tucson Airport
Texas
Austin - EOC
Camp Mabry - National Guard
College Station - TAMU
Dallas - AT&T Mobility
Fort Worth - Marine Forces Reserve
Houston - EOC
Houston - Harris County ITC
Houston - Harris County SO MCP04
Houston - Harris County SO PSAP-01
Houston - Harris County SO TAC-01
Houston - The Galleria
Richardson - THRIVE Intelligence
Texas Rangers & DPS
Louisiana
New Orleans - Marine Forces Reserves
Tennessee
Knoxville - University of TN PD
Knoxville - Knox County Sheriffs Office
Knoxville - Knox County Public Bldng Authority
Knoxville - Knoxville Schools
Knoxville - Emergency Management Agency (KEMA)
Morristown - Police Department
Nashville - Opry Mills Mall
Newport - Police Department
Georgia
Ft. Gordon - Army AEWE
North Carolina
Greensboro - Guilford Metro 911
Greensboro - Guilford County Security
Greensboro - Guilford County Sheriff-VIP NIC
Greensboro - Guilford County Sheriff-Mobile
Greensboro - Guilford County Sheriff-Courthouse
Greensboro - Guilford County Sheriff-Jail
Greensboro - Guilford County Sheriff - Staff Duty
Camp Lejeune - 6th Marines
Virginia
Arlington - Fashion Centre at Pentagon
National Guard HQ
National Guard2
National Guard Mobile TOC
Arlington - CTTSO SOCLINK Hub Nodes X2
Arlington - DHS/FEMA X 2 Nodes
See Detailed Map
Florida
Rev. 9-21-15
Mutualink US Installations:
CUSTOMERS
PILOTS
EDGE TRIAL


Mutualink
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DEFENSE • FEDERAL
Lewis - NY Essex County OEM
Essex County
Massena - NYPA FDR Power Project
St. Lawrence - NYPA FDR Power Project
St. Lawrence County
Albany - NY Fulton County SDHSES
Fulton County
10 Oneida County Schools
Marcy - NYPA Clark Energy Center
Oneida County
Lewiston - NYPA Niagara Command Center
Lewiston - NYPA Niagra Ops Center
Niagara County
Gilboa - NYPA Blenheim/Gilboa
Schoharie County
Buffalo - Buffalo Psychiatric Center
Erie County
Belmont - Allegany County Sheriff's Office
Allegany County
Hudson - Columbia County 911
Columbia County
Rockland County
10 Rockland County Schools
New City - Rockland County Sheriff's Department
Suffern - Rockland Community College
West Nyack - Rockland BOCES
New York - MSA Security
New York - NY Divison HLS & Emergency Services
New York - Lenox Hill Hospital
New York - MSA Security - Murray Street
New York - MSA Security
New York - MSA Security - Governor's Island Preservation & Education Group - GIPEC
New York County
Bronx - NYPA Harlem River
Bronx - NYPA Hells Gate Plant
Bronx County
Richmond County
Staten Island - NYPA Pouch Terminal
Staten Island - Staten Island University Hospital
Staten Island - Staten Island University Hospital South
Schenectady - Police Department
Schenectady County
Albany County
Albany - New York State Police Comm Sec (Troop G)
Albany - New York State Division of Homeland Security & Emergency Services, Office of Interoperable & Emergency Communications
Albany - NYPA Albany
Albany - Police Department
Albany - SUNY at Albany Police Department
Albany - SUNY College of Nanoscale Science & Engineering (CNSE)
Albany - NY State DHSES Command Vehicle
Albany - Commissioner's Office DHSES
Albany - TSA Albany Airport
White Plains - The Westchester Galleria
White Plains - New York Power Authority - NYPA
Westchester County
Astoria - NYPA Poletti Power Project
Forest Hills - Forest Hills Hospital
Long Island City - NYPA Vernon Boluevard
Queens County
Bethpage - Applied Science Foundation for Center Homeland Security (Morrelly Center)
Garden City - Roosevelt Field Mall
Glen Cove - Glen Cove Hospital
Great Neck - NSLIJ Corporate Security
Manhassett - North Shore University Hospital
New Hyde Park - Long Island Jewish Medical Center
Plainview - Plainview Hospital
Syosset - North Shore LIJ EOC
Syosset - Syosset Hospital
Valley Stream - Franklin Hospital
Valley Stream - Green Acres Mall
Westbury - Nassau County Police 911 Center
Williston Park - Nassau Co PD 3rd Precinct
Nassau County
Hurricane Sandy
Miracle on the Hudson
Amityville - South Oaks Hospital
Bayshore - Southside Hospital
Holtsville - NYPA Richard M Flynn Power Plant
Huntington - EOC
Huntington - HART Bus
Huntington - Huntington Hospital
Huntington - Maritime
Huntington - Town Hall
W Brentwood - NYPA Brentwood
Yaphank - NY Suffolk County Watch Ops
Suffolk County
Brooklyn - New York City OEM
Brooklyn - NYPA Joseph Seymour Power Project
Brooklyn - NYPA Kent Power Project
Kings County
Clinton
Franklin
Saint Lawrence
Essex
Jefferson
Lewis
Hamilton
Warren
Washington
Saratoga
Herkimer
Oswego
Oneida
Fulton
Montgomery
Schenectady
Rensselaer
Albany
Madison
Onondaga
Cayuga
Cortland
Chenango
Otsego
Schoharie
Columbia
Greene
Delaware
Ulster
Dutchess
Sullivan
Orange
Putnam
Westchester
Rockland
Suffolk
Nassau
Kings
Richmond
Queens
Niagara
Orleans
Monroe
Wayne
Genesee
Ontario
Seneca
Livingston
Yates
Wyoming
Erie
Schuyler
Tompkins
Tioga
Chemung
Broome
Steuben
Allegany
Cattaraugus
Chautauqua
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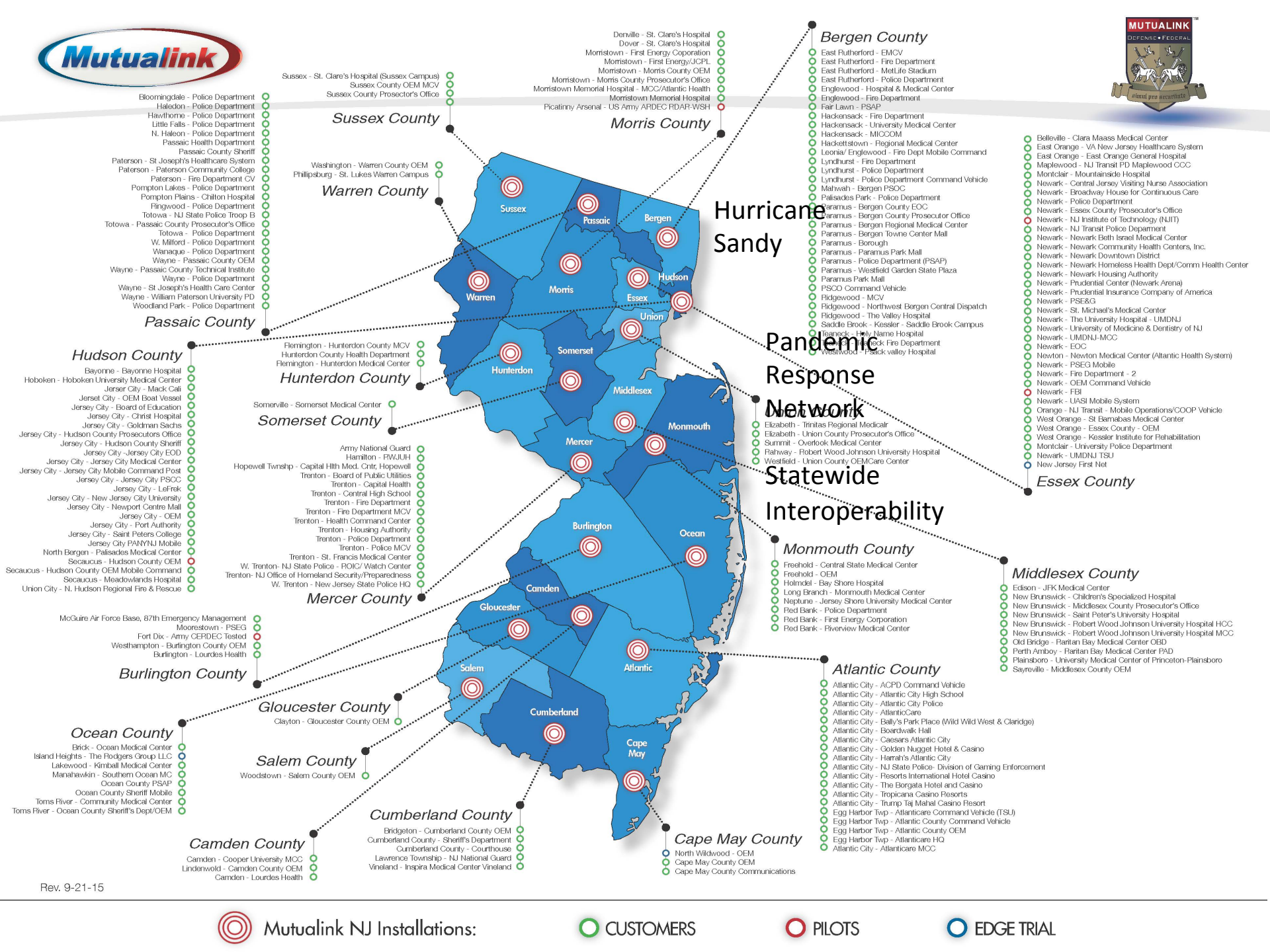
Mutualink
MUTUALINK
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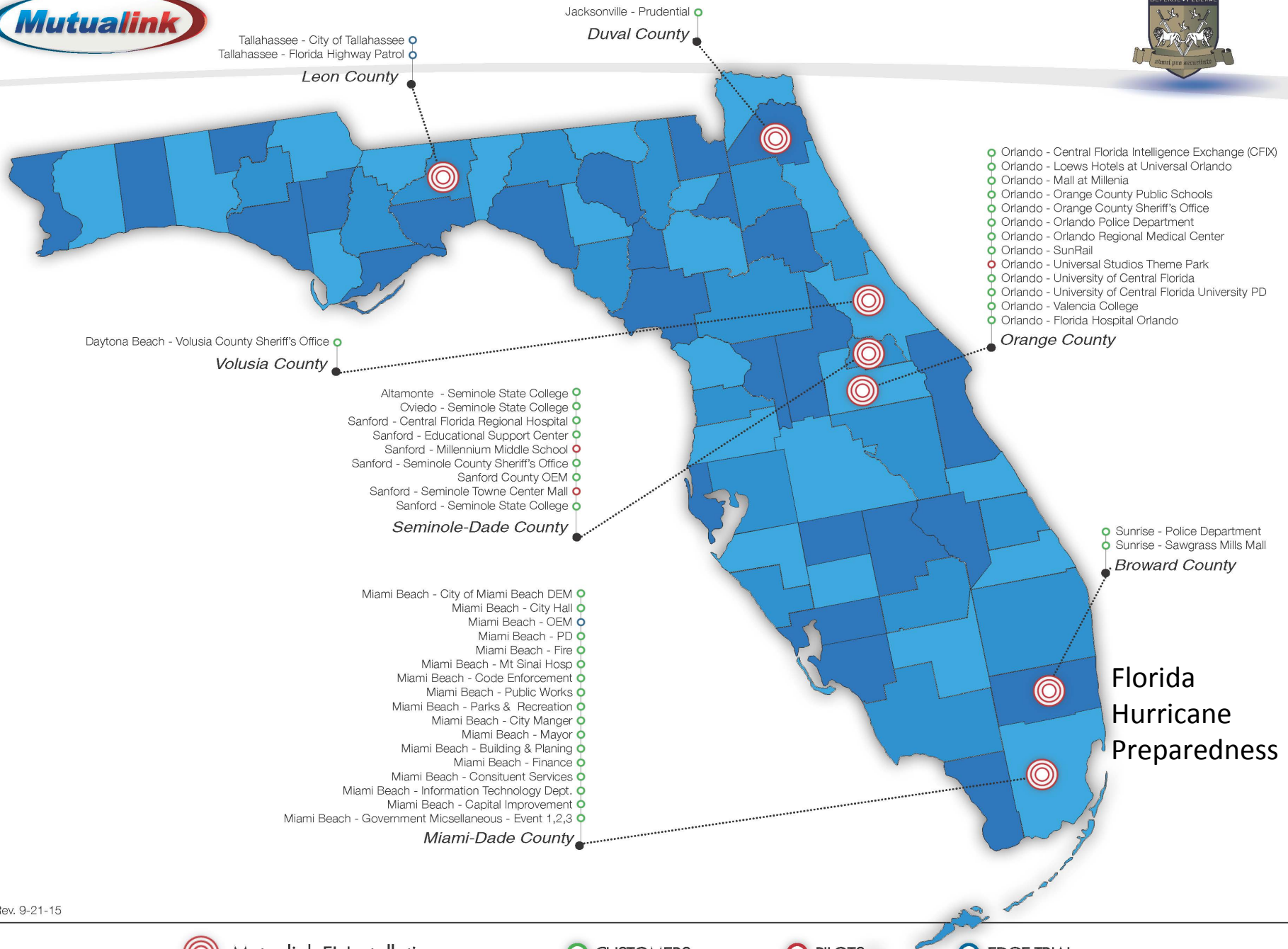
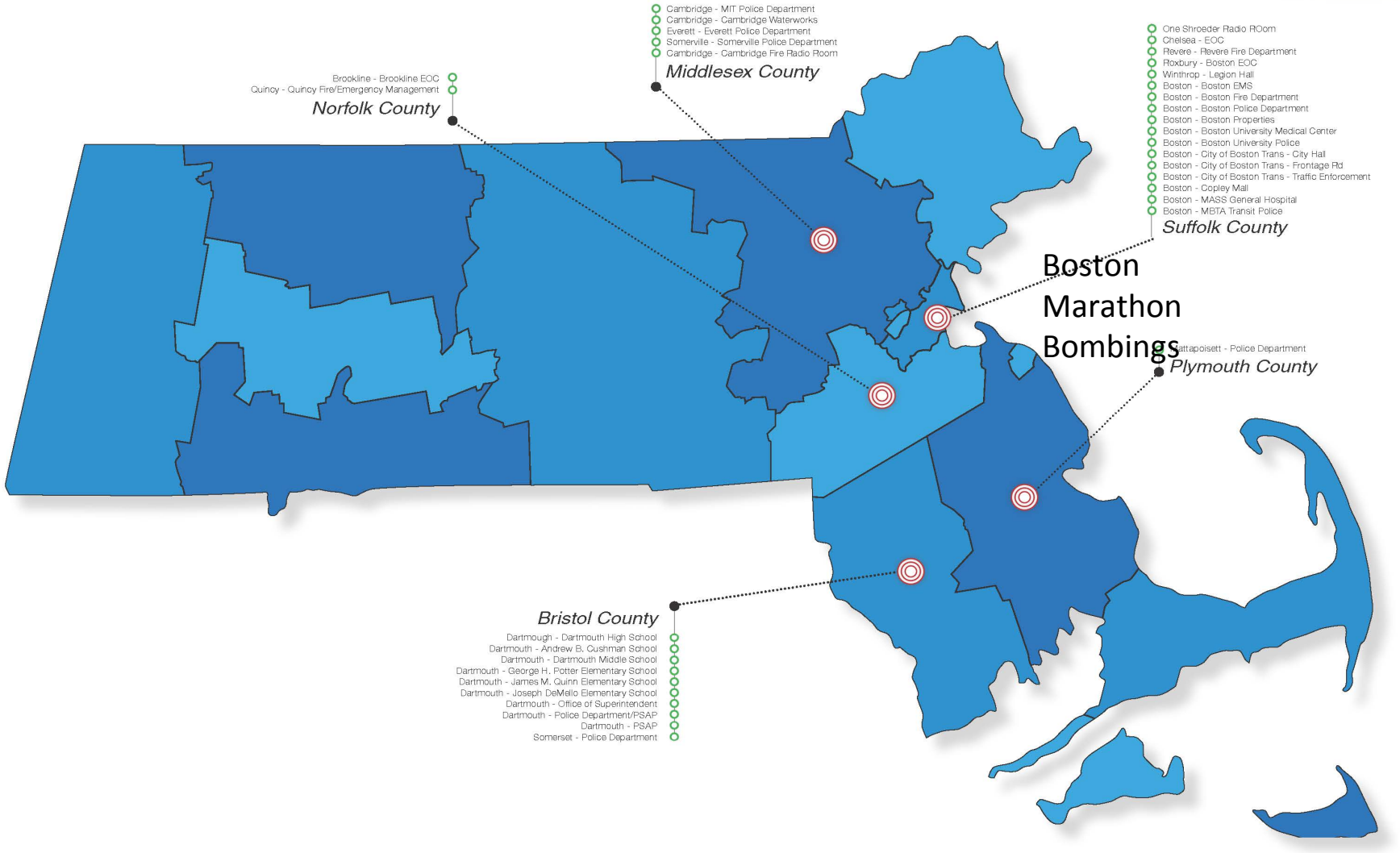
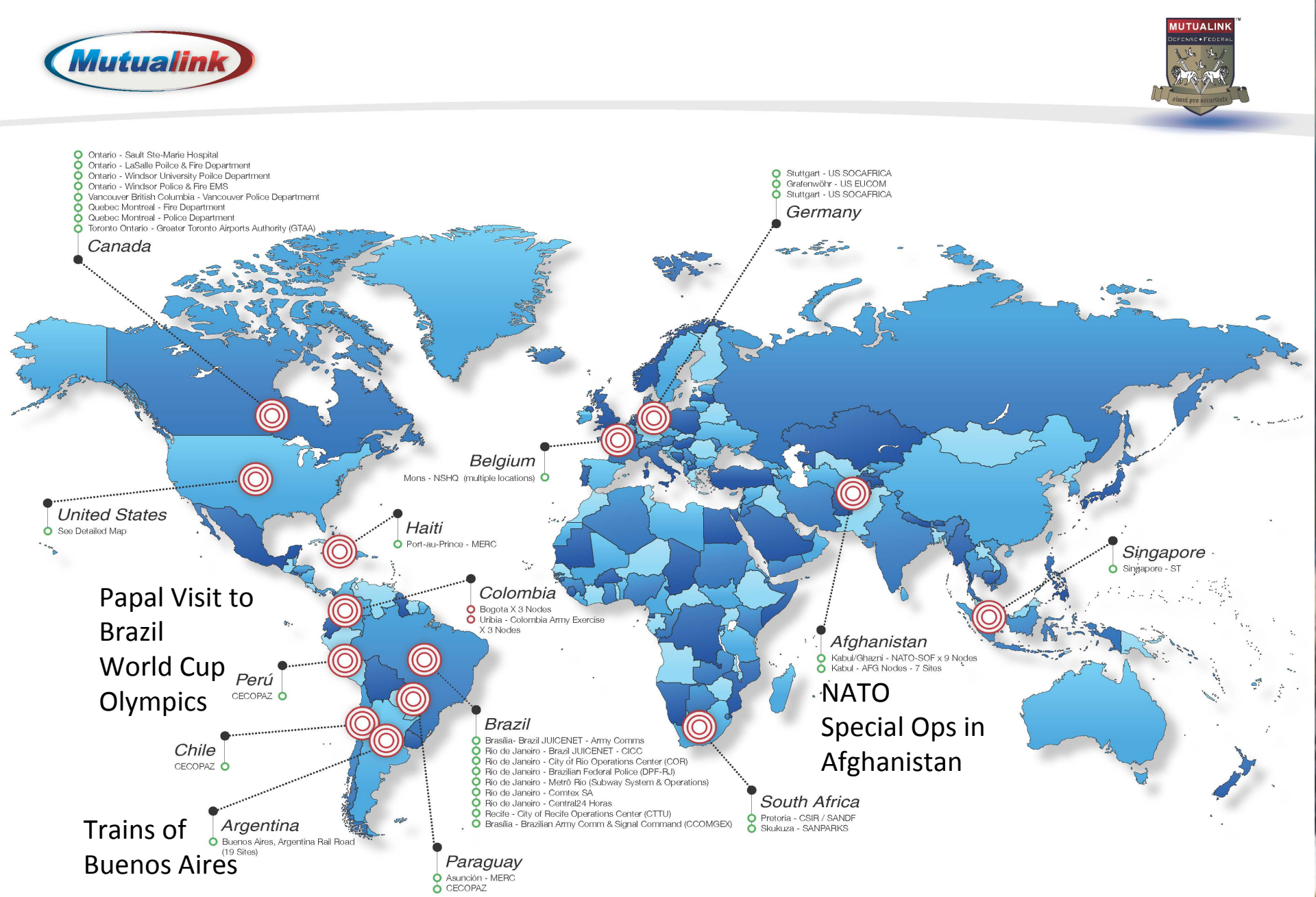
Hurricane Sandy
Pandemic Response Network
Statewide Interoperability
Sussex - St. Clare's Hospital (Sussex Campus)
Sussex County OEM MCV
Sussex County Prosector's Office
Sussex County
Bloomingdale - Police Department
Haledon - Police Department
Hawthorne - Police Department
Little Falls - Police Department
N. Haleon - Police Department
Passaic Health Department
Passaic County Sheriff
Paterson - St Joseph's Healthcare System
Paterson - Paterson Community College
Paterson - Fire Department CV
Pompton Lakes - Police Department
Pompton Plains - Chilton Hospital
Ringwood - Police Department
Totowa - NJ State Police Troop B
Totowa - Passaic County Prosecutor's Office
Totowa - Police Department
W. Milford - Police Department
Wanaque - Police Department
Wayne - Passaic County OEM
Wayne - Passaic County Technical Institute
Wayne - Police Department
Wayne - St Joseph's Health Care Center
Wayne - William Paterson University PD
Woodland Park - Police Department
Passaic County
Washington - Warren County OEM
Phillipsburg - St. Lukes Warren Campus
Warren County
Denville - St. Clare's Hospital
Dover - St. Clare's Hospital
Morristown - First Energy Coporation
Morristown - First Energy/JCPL
Morristown - Morris County OEM
Morristown - Morris County Prosecutor's Office
Morristown Memorial Hospital - MCC/Atlantic Health
Morristown Memorial Hospital
Picatinny Arsenal - US Army ARDEC RDAR-WSH
Morris County
Bergen County
East Rutherford - EMCV
East Rutherford - Fire Department
East Rutherford - MetLife Stadium
East Rutherford - Police Department
Englewood - Hospital & Medical Center
Englewood - Fire Department
Fair Lawn - PSAP
Hackensack - Fire Department
Hackensack - University Medical Center
Hackensack - MICCOM
Hackettstown - Regional Medical Center
Leonia/ Englewood - Fire Dept Mobile Command
Lyndhurst - Fire Department
Lyndhurst - Police Department
Lyndhurst - Police Department Command Vehicle
Mahwah - Bergen PSOC
Palisades Park - Police Department
Paramus - Bergen County EOC
Paramus - Bergen County Prosecutor Office
Paramus - Bergen Regional Medical Center
Paramus - Bergen Towne Center Mall
Paramus - Borough
Paramus - Paramus Park Mall
Paramus - Police Department (PSAP)
Paramus - Westfield Garden State Plaza
Paramus Park Mall
PSCO Command Vehicle
Ridgewood - MCV
Ridgewood - Northwest Bergen Central Dispatch
Ridgewood - The Valley Hospital
Saddle Brook - Kessler - Saddle Brook Campus
Teaneck - Holy Name Hospital
Teaneck Fire Department
Westwood - Pascack valley Hospital
Belleville - Clara Maass Medical Center
East Orange - VA New Jersey Healthcare System
East Orange - East Orange General Hospital
Maplewood - NJ Transit PD Maplewood CCC
Montclair - Mountainside Hospital
Newark - Central Jersey Visiting Nurse Association
Newark - Broadway House for Continuous Care
Newark - Police Department
Newark - Essex County Prosecutor's Office
Newark - NJ Institute of Technology (NJIT)
Newark - NJ Transit Police Deparment
Newark - Newark Beth Israel Medical Center
Newark - Newark Community Health Centers, Inc.
Newark - Newark Downtown District
Newark - Newark Homeless Health Dept/Comm Health Center
Newark - Newark Housing Authority
Newark - Prudential Center (Newark Arena)
Newark - Prudential Insurance Company of America
Newark - PSE&G
Newark - St. Michael's Medical Center
Newark - The University Hospital - UMDNJ
Newark - University of Medicine & Dentistry of NJ
Newark - UMDNJ-MCC
Newark - EOC
Newton - Newton Medical Center (Atlantic Health System)
Newark - PSEG Mobile
Newark - Fire Department - 2
Newark - OEM Command Vehicle
Newark - FBI
Newark - UASI Mobile System
Orange - NJ Transit - Mobile Operations/COOP Vehicle
West Orange - St Barnabas Medical Center
West Orange - Essex County - OEM
West Orange - Kessler Institute for Rehabilitation
Montclair - University Police Department
Newark - UMDNJ TSU
New Jersey First Net
Essex County
Union City - Union City OEM
Elizabeth - Trinitas Regional Medicalr
Elizabeth - Union County Prosecutor's Office
Summit - Overlook Medical Center
Rahway - Robert Wood Johnson University Hospital
Westfield - Union County OEMCare Center
Hudson County
Bayonne - Bayonne Hospital
Hoboken - Hoboken University Medical Center
Jerser City - Mack Cali
Jerset City - OEM Boat Vessel
Jersey City - Board of Education
Jersey City - Christ Hospital
Jersey City - Goldman Sachs
Jersey City - Hudson County Prosecutors Office
Jersey City - Hudson County Sheriff
Jersey City - Jersey City EOD
Jersey City - Jersey City Medical Center
Jersey City - Jersey City Mobile Command Post
Jersey City - Jersey City PSCC
Jersey City - LeFrek
Jersey City - New Jersey City University
Jersey City - Newport Centre Mall
Jersey City - OEM
Jersey City - Port Authority
Jersey City - Saint Peters College
Jersey City PANYNJ Mobile
North Bergen - Palisades Medical Center
Secaucus - Hudson County OEM
Secaucus - Hudson County OEM Mobile Command
Secaucus - Meadowlands Hospital
Union City - N. Hudson Regional Fire & Rescue
Flemington - Hunterdon County MCV
Hunterdon County Health Department
Flemington - Hunterdon Medical Center
Hunterdon County
Somerville - Somerset Medical Center
Somerset County
Army National Guard
Hamilton - RWJUH
Hopewell Twnshp - Capital Hlth Med. Cntr, Hopewell
Trenton - Board of Public Utilities
Trenton - Capital Health
Trenton - Central High School
Trenton - Fire Department
Trenton - Fire Department MCV
Trenton - Health Command Center
Trenton - Housing Authority
Trenton - Police Department
Trenton - Police MCV
Trenton - St. Francis Medical Center
W. Trenton- NJ State Police - ROIC/ Watch Center
Trenton- NJ Office of Homeland Security/Preparedness
W. Trenton - New Jersey State Police HQ
Mercer County
Monmouth County
Freehold - Central State Medical Center
Freehold - OEM
Holmdel - Bay Shore Hospital
Long Branch - Monmouth Medical Center
Neptune - Jersey Shore University Medical Center
Red Bank - Police Department
Red Bank - First Energy Corporation
Red Bank - Riverview Medical Center
Middlesex County
Edison - JFK Medical Center
New Brunswick - Children's Specialized Hospital
New Brunswick - Middlesex County Prosecutor's Office
New Brunswick - Saint Peter's University Hospital
New Brunswick - Robert Wood Johnson University Hospital HCC
New Brunswick - Robert Wood Johnson University Hospital MCC
Old Bridge - Raritan Bay Medical Center OBD
Perth Amboy - Raritan Bay Medical Center PAD
Plainsboro - University Medical Center of Princeton-Plainsboro
Sayreville - Middlesex County OEM
McGuire Air Force Base, 87th Emergency Management
Moorestown - PSEG
Fort Dix - Army CERDEC Tested
Westhampton - Burlington County OEM
Burlington - Lourdes Health
Burlington County
Atlantic County
Atlantic City - ACPD Command Vehicle
Atlantic City - Atlantic City High School
Atlantic City - Atlantic City Police
Atlantic City - AtlanticCare
Atlantic City - Bally's Park Place (Wild Wild West & Claridge)
Atlantic City - Boardwalk Hall
Atlantic City - Caesars Atlantic City
Atlantic City - Golden Nugget Hotel & Casino
Atlantic City - Harrah's Atlantic City
Atlantic City - NJ State Police- Division of Gaming Enforcement
Atlantic City - Resorts International Hotel Casino
Atlantic City - The Borgata Hotel and Casino
Atlantic City - Tropicana Casino Resorts
Atlantic City - Trump Taj Mahal Casino Resort
Egg Harbor Twp - Atlanticare Command Vehicle (TSU)
Egg Harbor Twp - Atlantic County Command Vehicle
Egg Harbor Twp - Atlantic County OEM
Egg Harbor Twp - Atlanticare HQ
Atlantic City - Atlanticare MCC
Gloucester County
Clayton - Gloucester County OEM
Ocean County
Brick - Ocean Medical Center
Island Heights - The Rodgers Group LLC
Lakewood - Kimball Medical Center
Manahawkin - Southern Ocean MC
Ocean County PSAP
Ocean County Sheriff Mobile
Toms River - Community Medical Center
Toms River - Ocean County Sheriff's Dept/OEM
Salem County
Woodstown - Salem County OEM
Camden County
Camden - Cooper University MCC
Lindenwold - Camden County OEM
Camden - Lourdes Health
Cumberland County
Bridgeton - Cumberland County OEM
Cumberland County - Sheriff's Department
Cumberland County - Courthouse
Lawrence Township - NJ National Guard
Vineland - Inspira Medical Center Vineland
Cape May County
North Wildwood - OEM
Cape May County OEM
Cape May County Communications
Sussex
Passaic
Bergen
Warren
Morris
Hudson
Essex
Union
Somerset
Hunterdon
Middlesex
Monmouth
Mercer
Burlington
Ocean
Camden
Gloucester
Atlantic
Salem
Cumberland
Cape May
Rev. 9-21-15
Mutualink NJ Installations:
CUSTOMERS
PILOTS
EDGE TRIAL


Jacksonville - Prudential
Duval County
Tallahassee - City of Tallahassee
Tallahassee - Florida Highway Patrol
Leon County
Orlando - Central Florida Intelligence Exchange (CFIX)
Orlando - Loews Hotels at Universal Orlando
Orlando - Mall at Millenia
Orlando - Orange County Public Schools
Orlando - Orange County Sheriff's Office
Orlando - Orlando Police Department
Orlando - Orlando Regional Medical Center
Orlando - SunRail
Orlando - Universal Studios Theme Park
Orlando - University of Central Florida
Orlando - University of Central Florida University PD
Orlando - Valencia College
Orlando - Florida Hospital Orlando
Orange County
Daytona Beach - Volusia County Sheriff's Office
Volusia County
Altamonte - Seminole State College
Oviedo - Seminole State College
Sanford - Central Florida Regional Hospital
Sanford - Educational Support Center
Sanford - Millennium Middle School
Sanford - Seminole County Sheriff's Office
Sanford County OEM
Sanford - Seminole Towne Center Mall
Sanford - Seminole State College
Seminole-Dade County
Sunrise - Police Department
Sunrise - Sawgrass Mills Mall
Broward County
Miami Beach - City of Miami Beach DEM
Miami Beach - City Hall
Miami Beach - OEM
Miami Beach - PD
Miami Beach - Fire
Miami Beach - Mt Sinai Hosp
Miami Beach - Code Enforcement
Miami Beach - Public Works
Miami Beach - Parks & Recreation
Miami Beach - City Manger
Miami Beach - Mayor
Miami Beach - Building & Planing
Miami Beach - Finance
Miami Beach - Consituent Services
Miami Beach - Information Technology Dept.
Miami Beach - Capital Improvement
Miami Beach - Government Micsellaneous - Event 1,2,3
Miami-Dade County
Florida Hurricane Preparedness
Rev. 9-21-15
Mutualink FL Installations:
CUSTOMERS
PILOTS
EDGE TRIAL



Rev. 9-21-2015

Mutualink MA Installations: CUSTOMERS PILOTS EDGE TRIAL



Rev. 9-21-15

Confidential - Sensitive Information

Mutualink Global Deployments CUSTOMERS PILOTS EDGE TRIAL

Why 802.11 Is Not Suitable

- Supports too few nodes in a mesh topology
- Not enough “hops” per mesh for wireless backhaul
- Insufficient performance/range - Inability to handle the data throughputs per connection consistently and reliably
- NLOS reception inadequate
- Require too many nodes and frequencies

Why 802.11 Is Not Suitable

- Requires more towers and tower infrastructure than Needed amd more power per radio and many more radios thus lots more power
- As a result could not use solar as a power source when many of the nodes that need solar power
- Needed electrical amplifiers that put out lots of amps to achieve distance
- Train speeds of 65 km/h are a challenge for 802.11 solutions
- Harsh on-board environment would be fatal to many 802.11 radios.

Why K Mesh is the Right Choice for SOFSE

- Supports an unlimited number of nodes in a mesh topology as required by SOFSE's application
- Supports many "hops" per mesh without significant performance degradation
- Performance and range are exceptional and it handles the high data throughputs per connection consistently and reliably even at considerable distance from towers
- Handles NLOS reception better than other radios
- Requires fewer nodes and frequencies

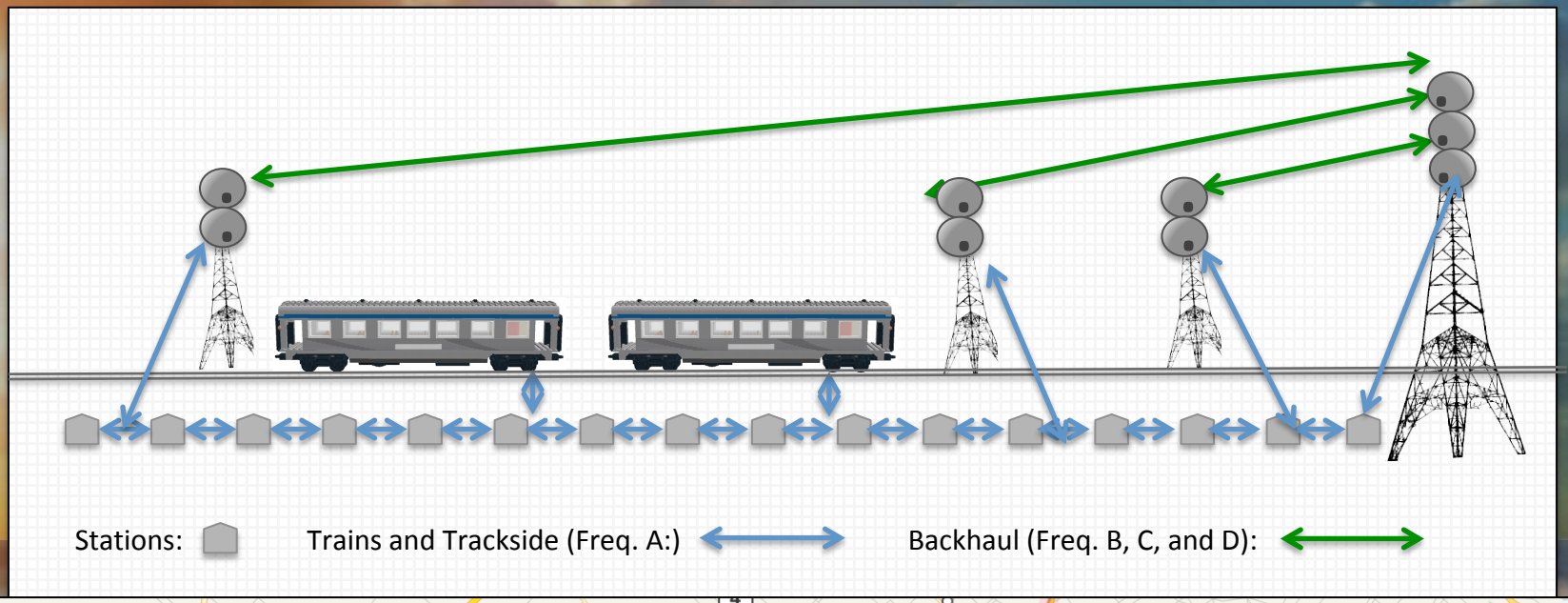
Why K Mesh is the Right Choice for SOFSE

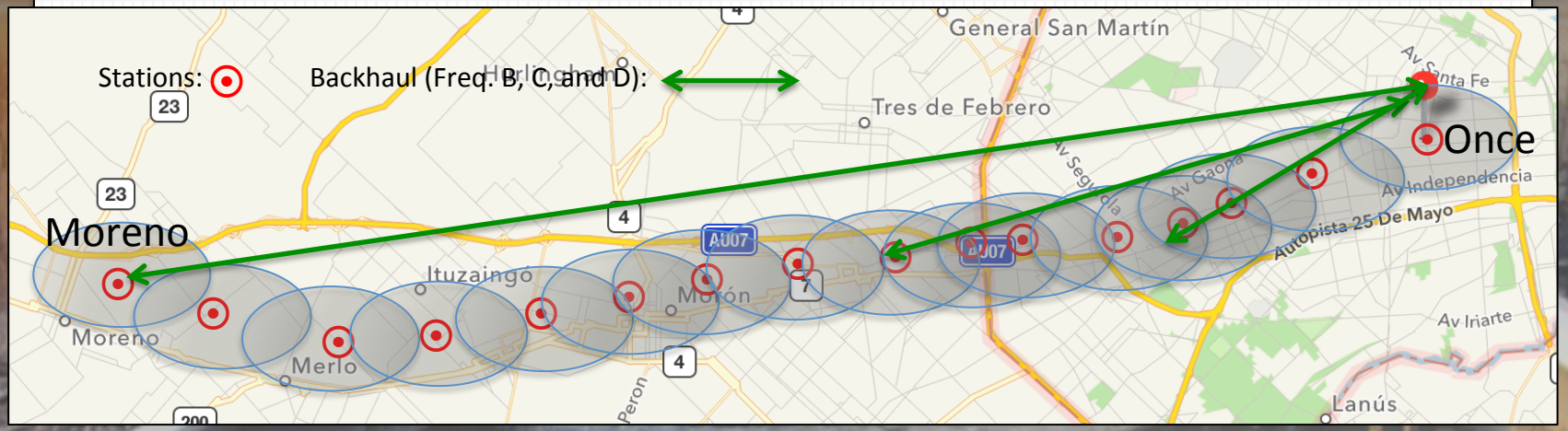
- Requires fewer towers and tower infrastructure and less power per radio and many fewer radios thus lots less power
- As a result K Mesh can use solar power for all nodes that need solar power
- No electrical amplifiers are needed to achieve distance
- Train speeds of 65 km/h are a not a challenge for K Mesh solutions
- K Mesh radios are built to handle extremely harsh environments

Network Topology as Deployed

- 26 Sarmiento trains equipped with a K Mesh radio in the two locomotive end cabs
- 16 stations – with no existing fiber links
- Supplemental relay points to resolve two problematic NLOS situations found to exist along curved and/or trenched sections of the line.
- A mesh network of over 70 individual nodes which may be active at any given point in time
- 4 Backhaul links high (up to 90 meters) towers at each end and at two intermediate points.
- 4 different frequencies, one network

Network Topology





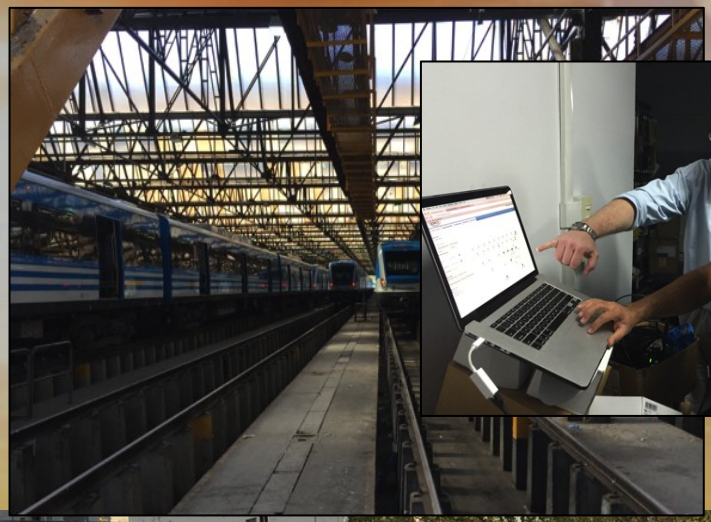
Outcome

- InterLink LA and local partners selected in early 2015
- Installations began in March 2015, completed by November 2015
- System as delivered met and/or exceeded all SOFSE's requirements -approved after a month of trials
- SOFSE created a video wall to showcase the live streams from the streaming video as well as a shared streams from the Mutualink Emergency Collaboration system

Outcome (Cont.)

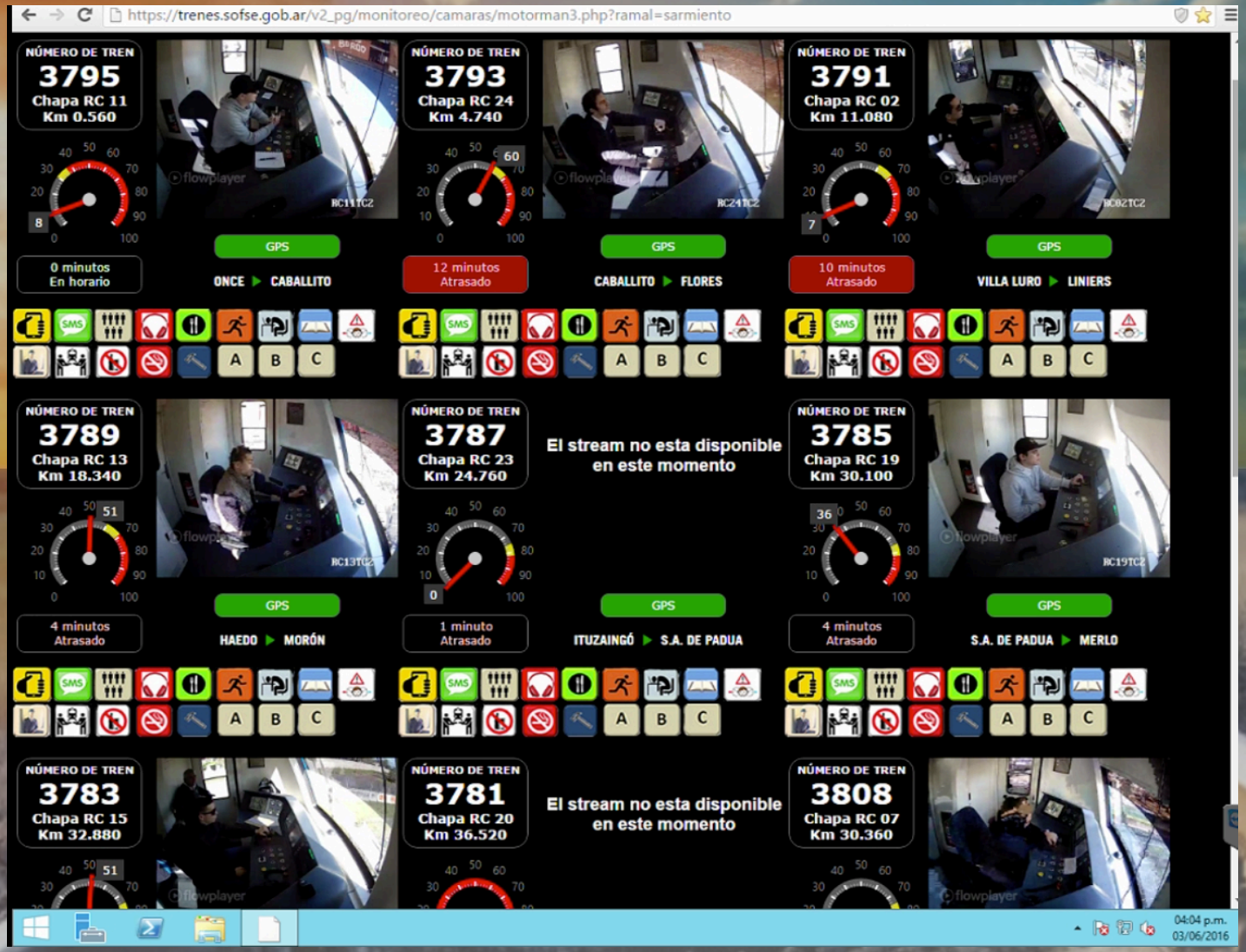
- Operators constantly view incoming streams and react immediately to safety infractions
- In the first month of operation on Sarmiento line alone, there were 136 observed infractions, some of them major
- After four months the number of infractions had dropped to only 22, most of them minor
- Additionally the timely notification of stations in the event of late running trains has led to a better rider experience

The K Mesh Solution



Video Wall

Video “Dashboard”



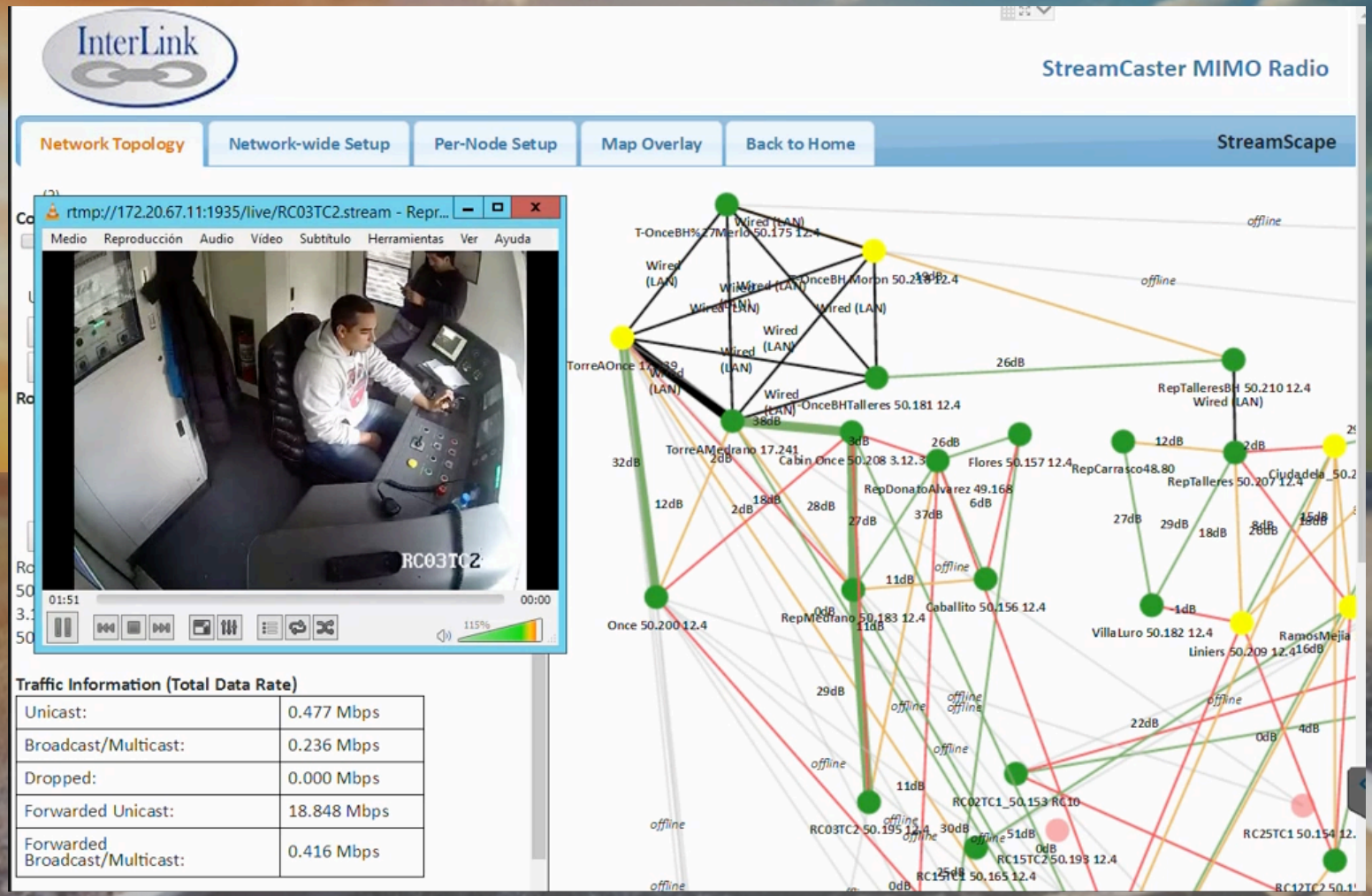
Customer Satisfaction

- Florencio Randazzo, Minister of Interior & Transport - December 3, 2015 press conference to announce the new system for monitoring train operations.
- The Minister explained how the new system
  - seeks to discourage reckless behavior by the train drivers
  - provides real-time video of the cabs of trains on the Sarmiento Line via a freely accessible website

Minister of Interior and Transport Randazzo:

"Six months after the tragedy of Once, we went to work tirelessly to rebuild the confidence in the rail system with the best of services"

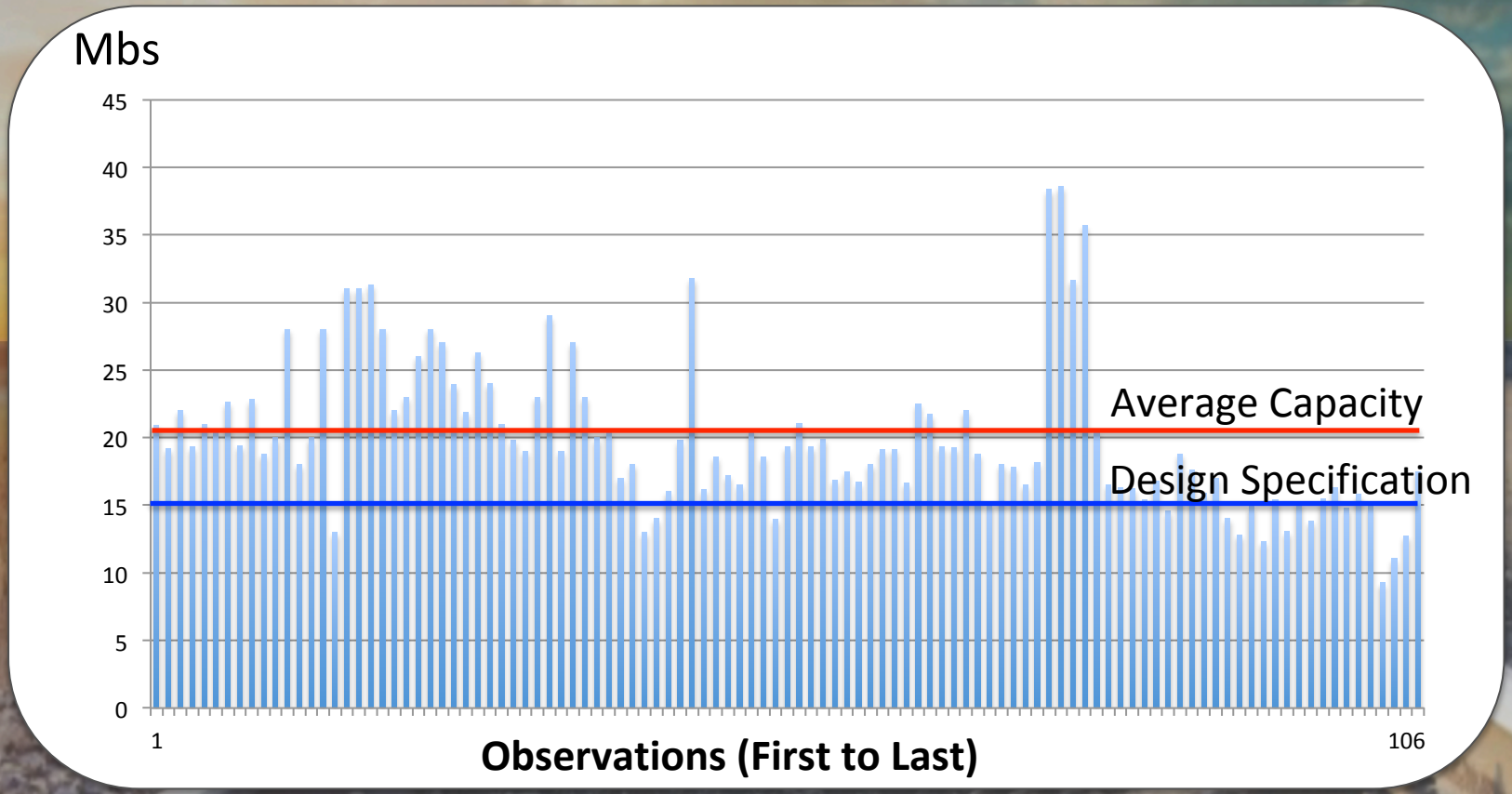
REMOTE ADMIN TOOLS



Sarmiento Line Train-to-Trackside Capacity

Sampled for 4 minutes and 10 seconds of travel = ~2.7 Miles

Sampled every 2.4 seconds



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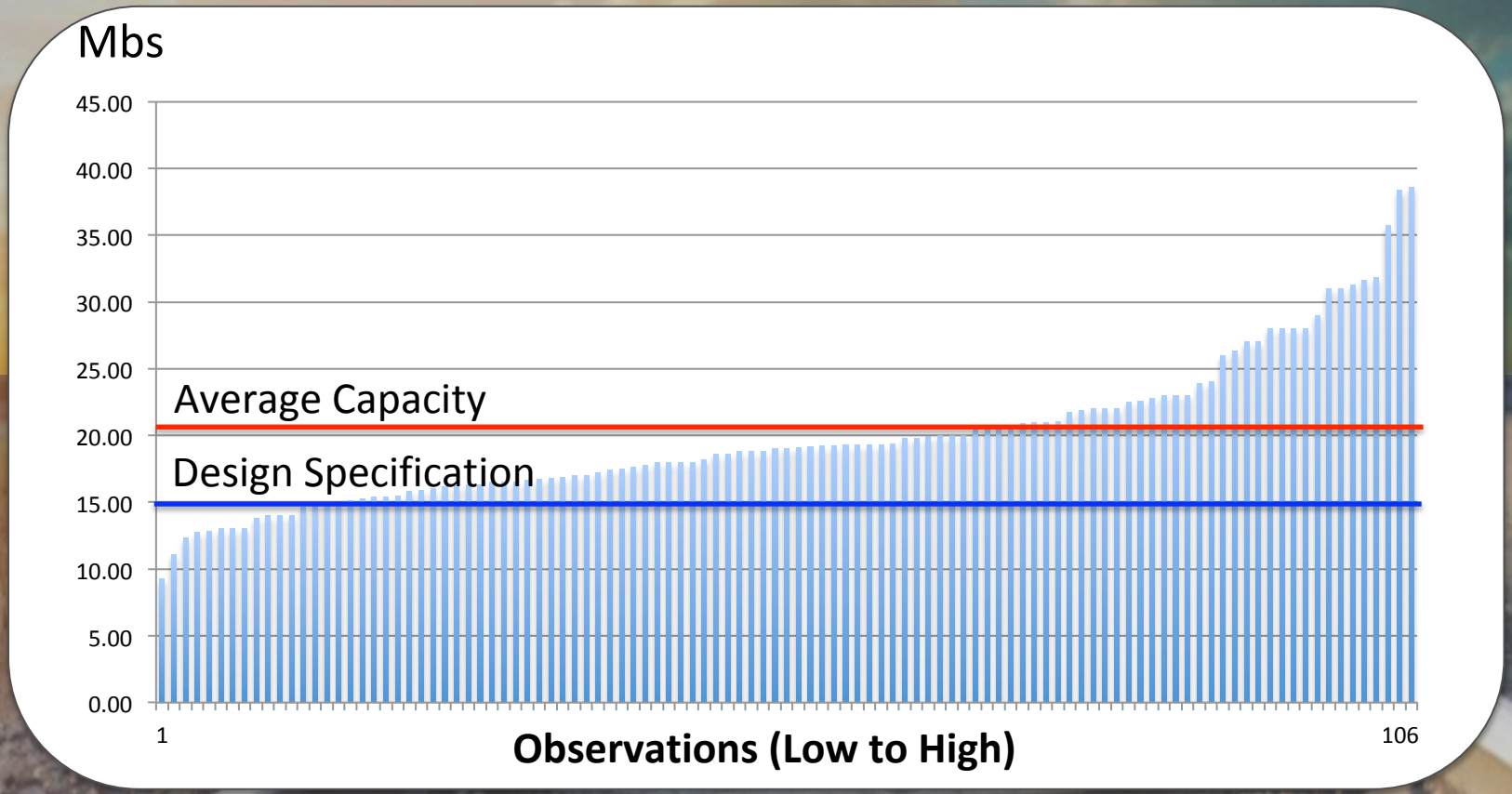

Cost and Performance

- We quote our products according to an agreed upon throughput of the system, not by the radio
- Our products are cost competitive with top tier 802.11 and Private LTE solutions
- Our greatest savings come from reduced radio counts, fewer towers, and greatly reduced overall infrastructure
- In head to head comparisons, the total deployment cost of K Mesh has generally shown a savings of 40% or greater compared to conventional 802.11 and Private LTE configurations

Conclusions

- System fully approved by SOFSE - met and/or exceeded all SOFSE's requirements
- Mutualink Emergency Collaboration system meets and exceeds all requirements, customer seeing more and more features and benefits
- Is being rolled out across four more lines
  - Mitre's three lines (Tigre, Mitre, and Suarez)
  - San Martin
- Video wall showcasing live streams is highly successful

Conclusions

- In four month of operation on Sarmiento line alone, infractions have been reduced by 84%
- Timely notification of stations in the event of late running trains has led to a better rider experience
- No recent incidences of crowd violence have been reported at stations on Sarmiento line
- The System has the capability to serve many more functions, including on board public and private wi-fi, signaling, telemetry, (especially including CBTC, PTC, ECTS, ERTMS, and other vital onboard systems "always on" applications) as the customer wishes to add them