

Signal Infrastructure



**NextGen TV Implementation & SFN's
AFCCE Luncheon
September 17, 2021**

**“We know the past but cannot control it. We control the future but cannot know it.”
-Claude Shannon**

Great Promise for Rapid Adoption



HEARST



SINCLAIR
BROADCAST GROUP

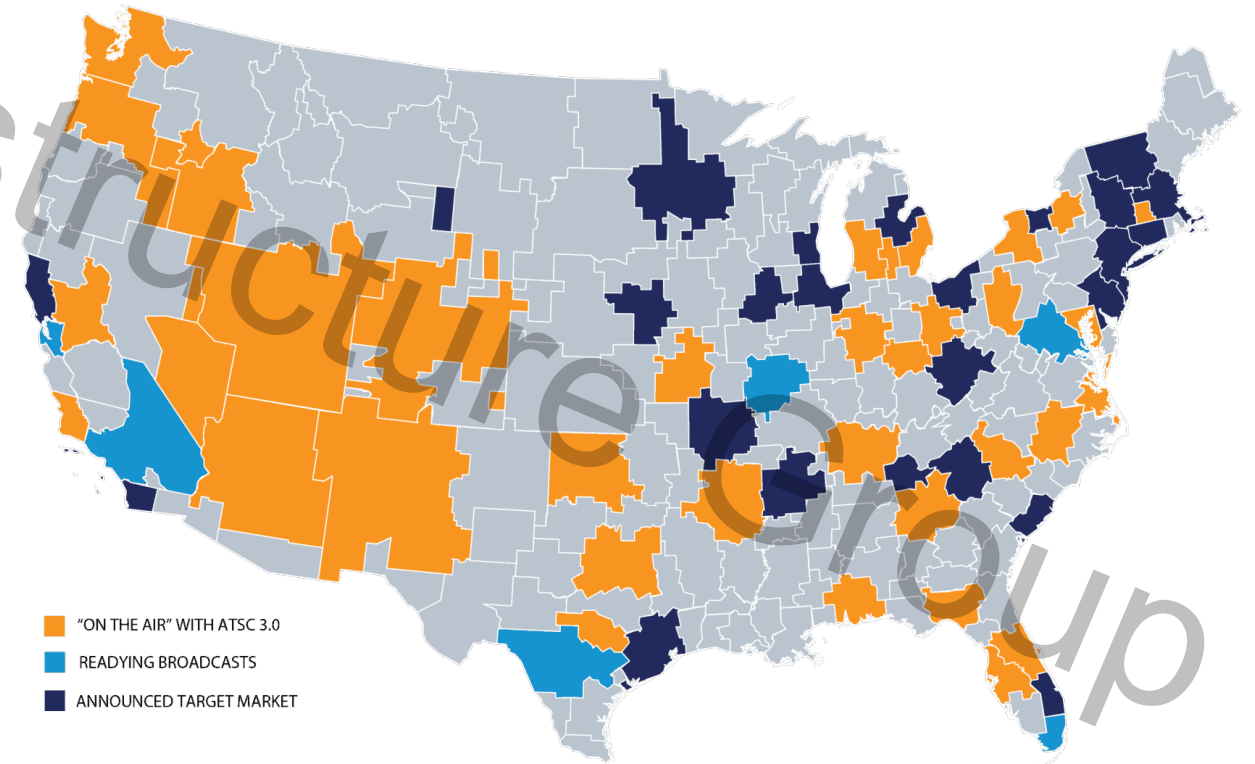


ATSC 3.0 Hosting

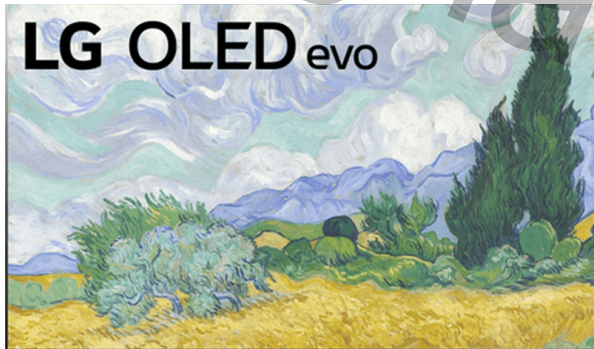
- 57 stations in 41 markets
 - 48 Full power and class A
 - 9 Low power
- 19 owners
- Almost all stations host other streams (160+)

ATSC 1.0 Hosting

- 3.0 host signals distributed amongst participants
- Sufficient bandwidth is challenging



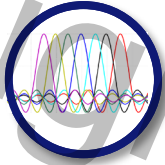
70+ Receiver Models Available and Price Ranges Dropping Quickly



Infrastructure, technology, and business cases are being tested:

- Detroit
 - Automotive testbed available
- Phoenix
 - Technology testbed and SFN tests completed
- Dallas
 - SFN buildout and testing completed
- Raleigh
 - Technology testbed completed
- Cleveland
 - Technology testbed completed
- Baltimore
 - SFN concept and demonstration completed

ATSC 3.0 Features



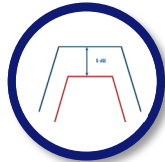
COFDM multi-carrier technology defies multipath



Multiple combinations of modulation and coding (mod-cods) from very robust to very high capacity



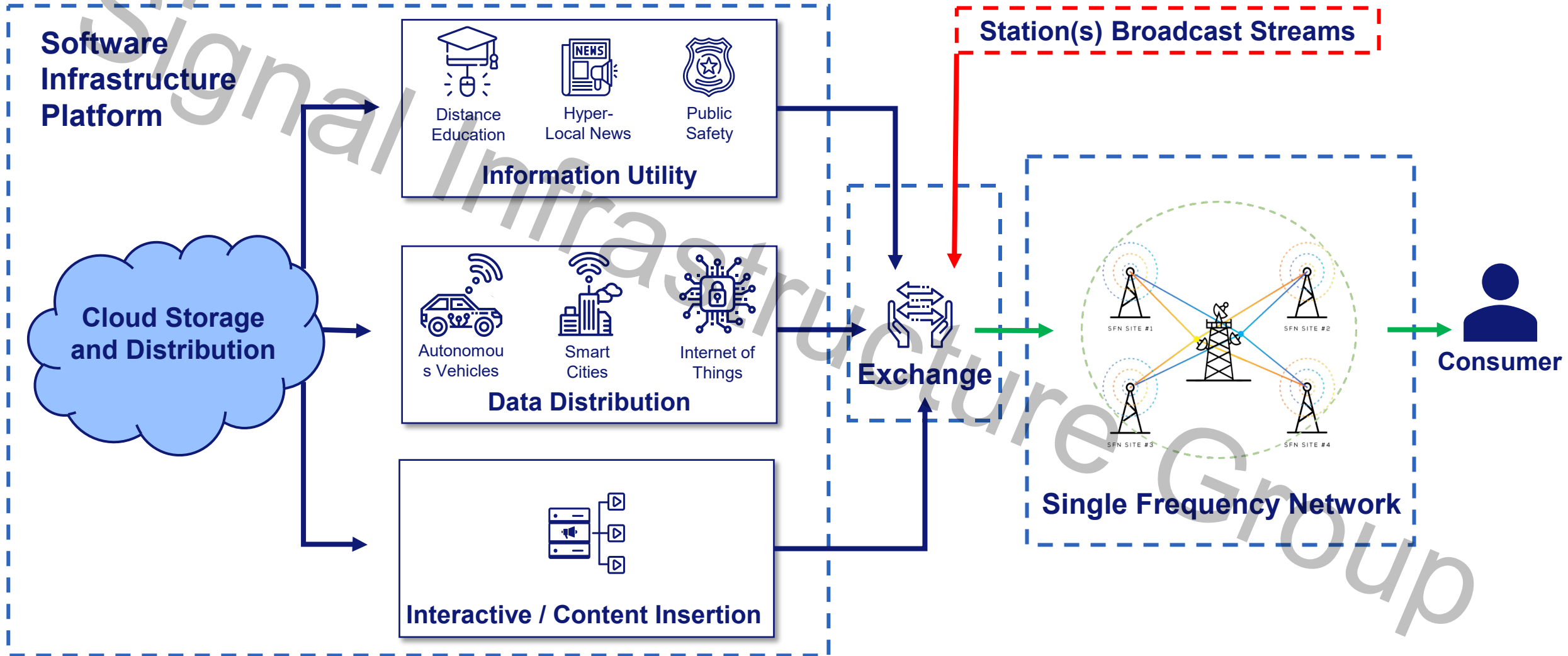
Time Division Multiplex different mod-cods for multiple pipes



Layered Division Multiplex can add even more data

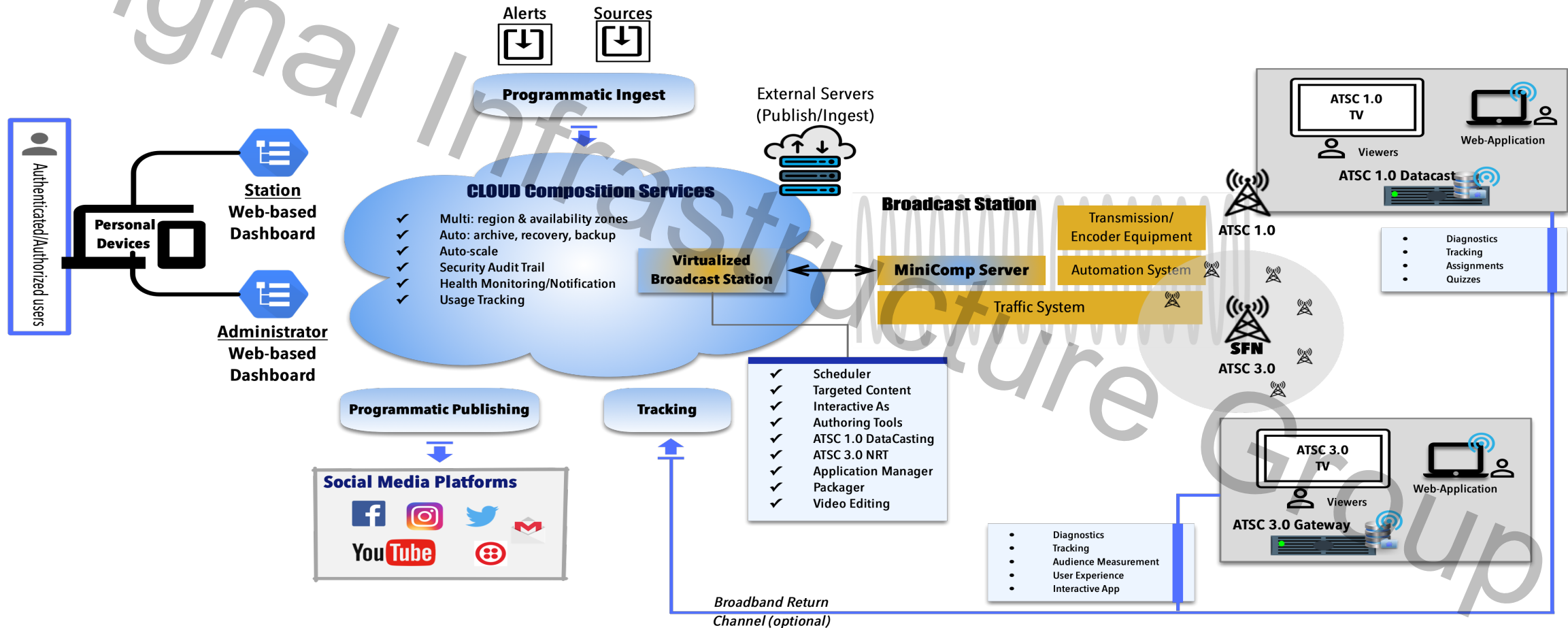


High efficiency codecs – HVEC, H.264, etc.

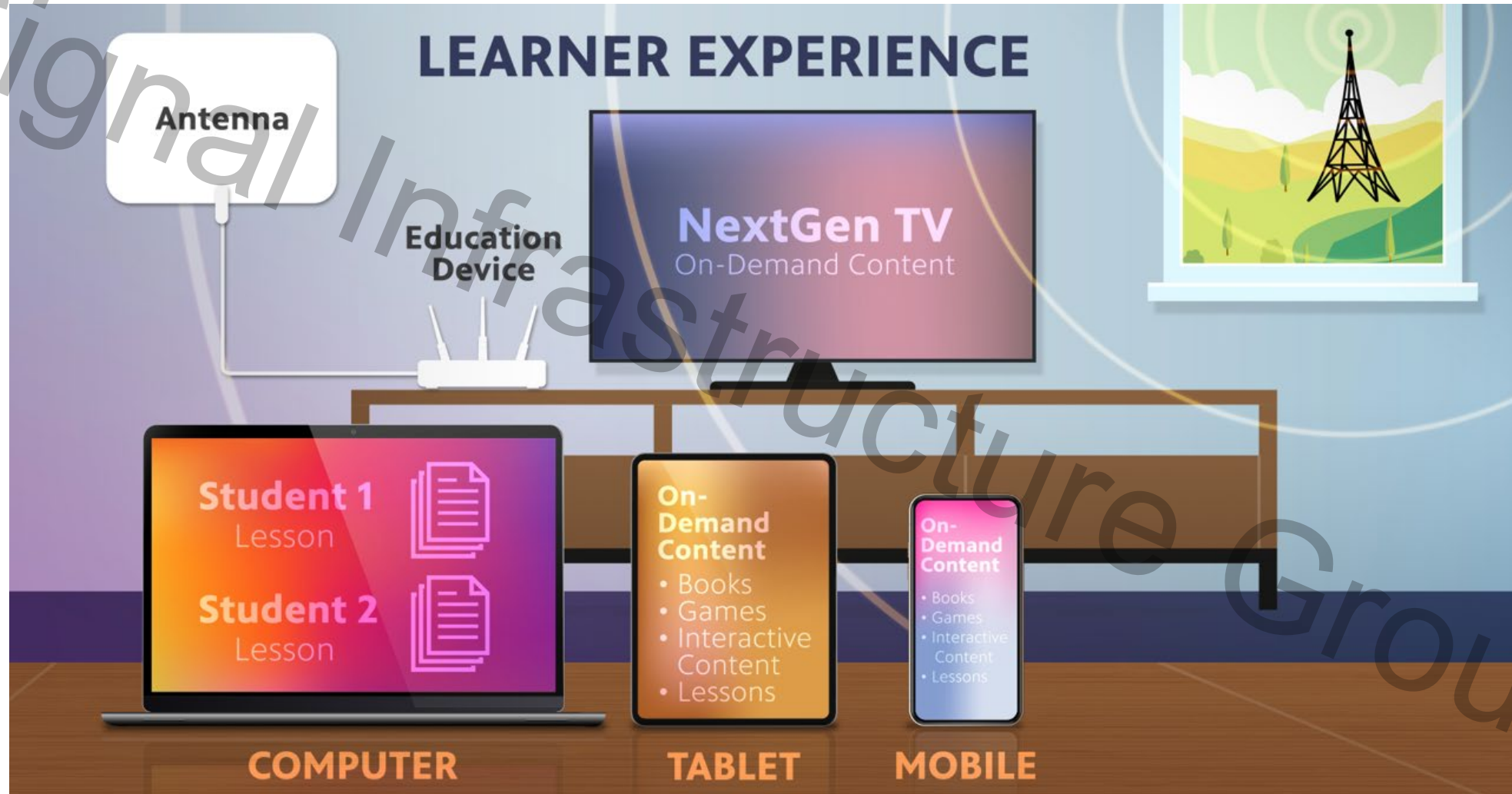


SIG Software Infrastructure Platform

A Complete Suite of Services and Software for New Revenue Drivers

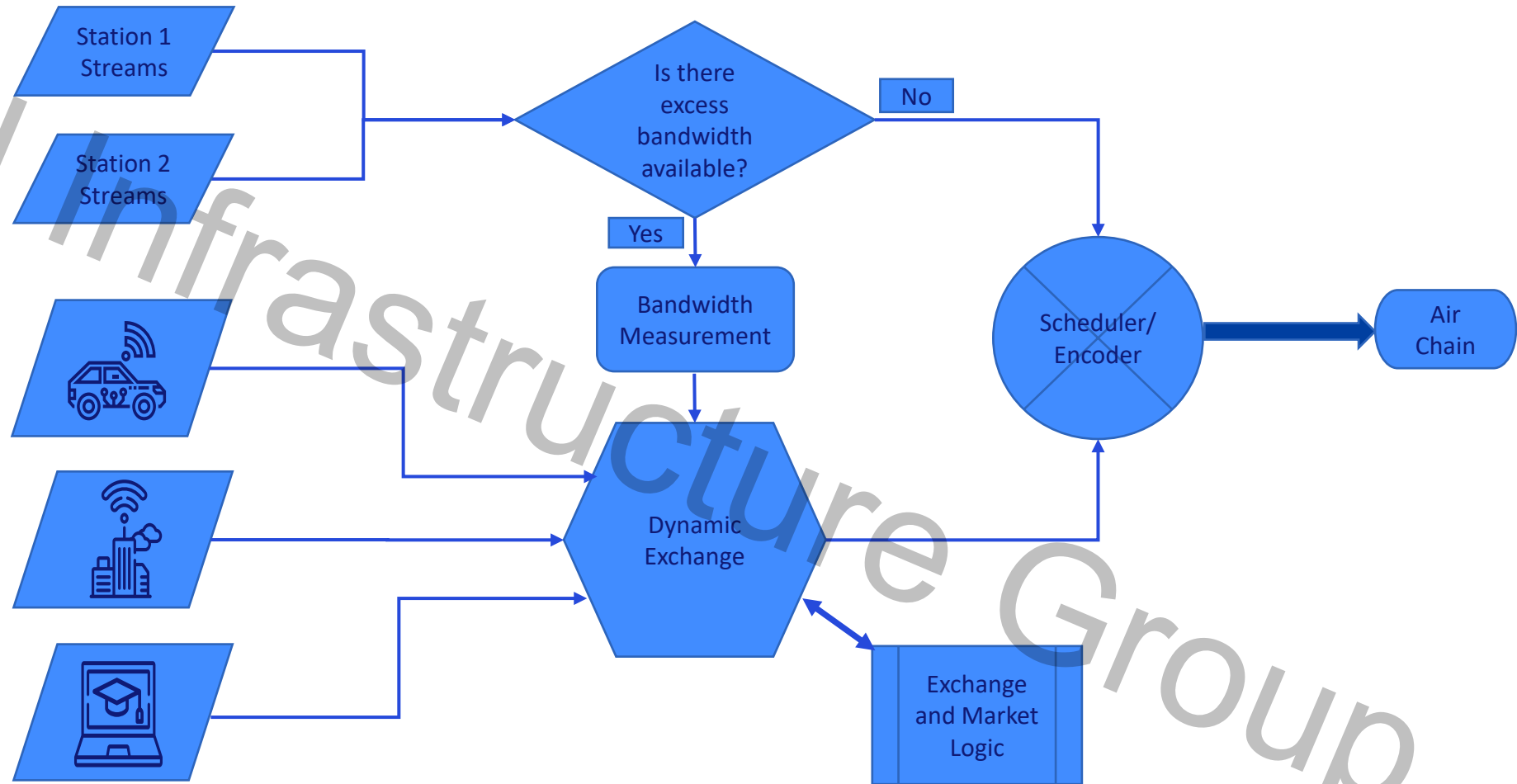


Education Use Case



An Exchange is needed to monetize spectrum capacity

- Modelled on financial markets
- Allows a platform for introducing new services
- Reallocates available bandwidth based on supply and demand
- Participation is voluntary
- Broadcasters maintain control of their spectrum

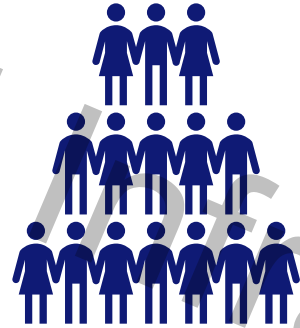


Consistent & Reliable Signal Key to New Opportunities

Reach more people

&

Reach more devices



Improve & increase traditional service, while creating new services and revenue



Software and cyber security updates



Geo zoned and targeted content

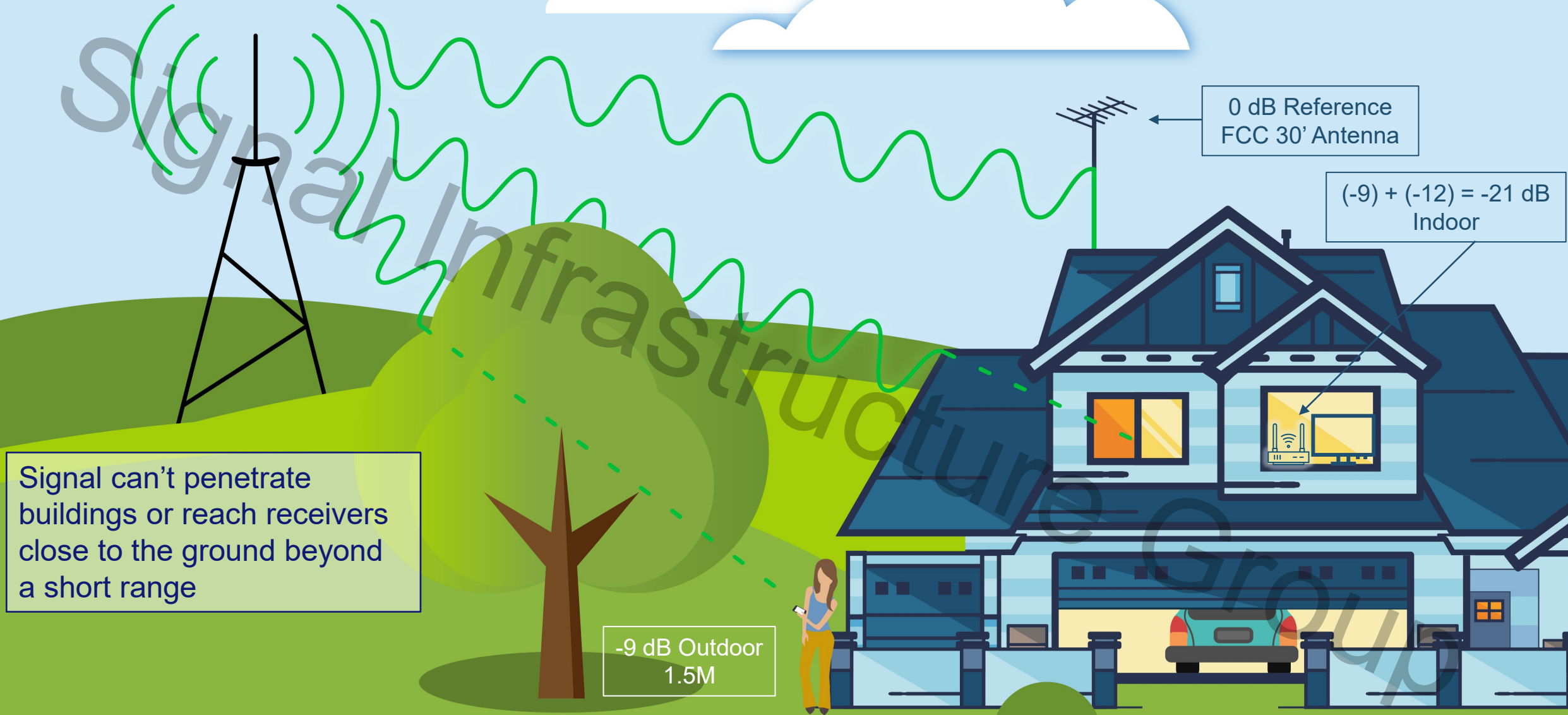


Public Safety



Distance learning

Losses Add Up

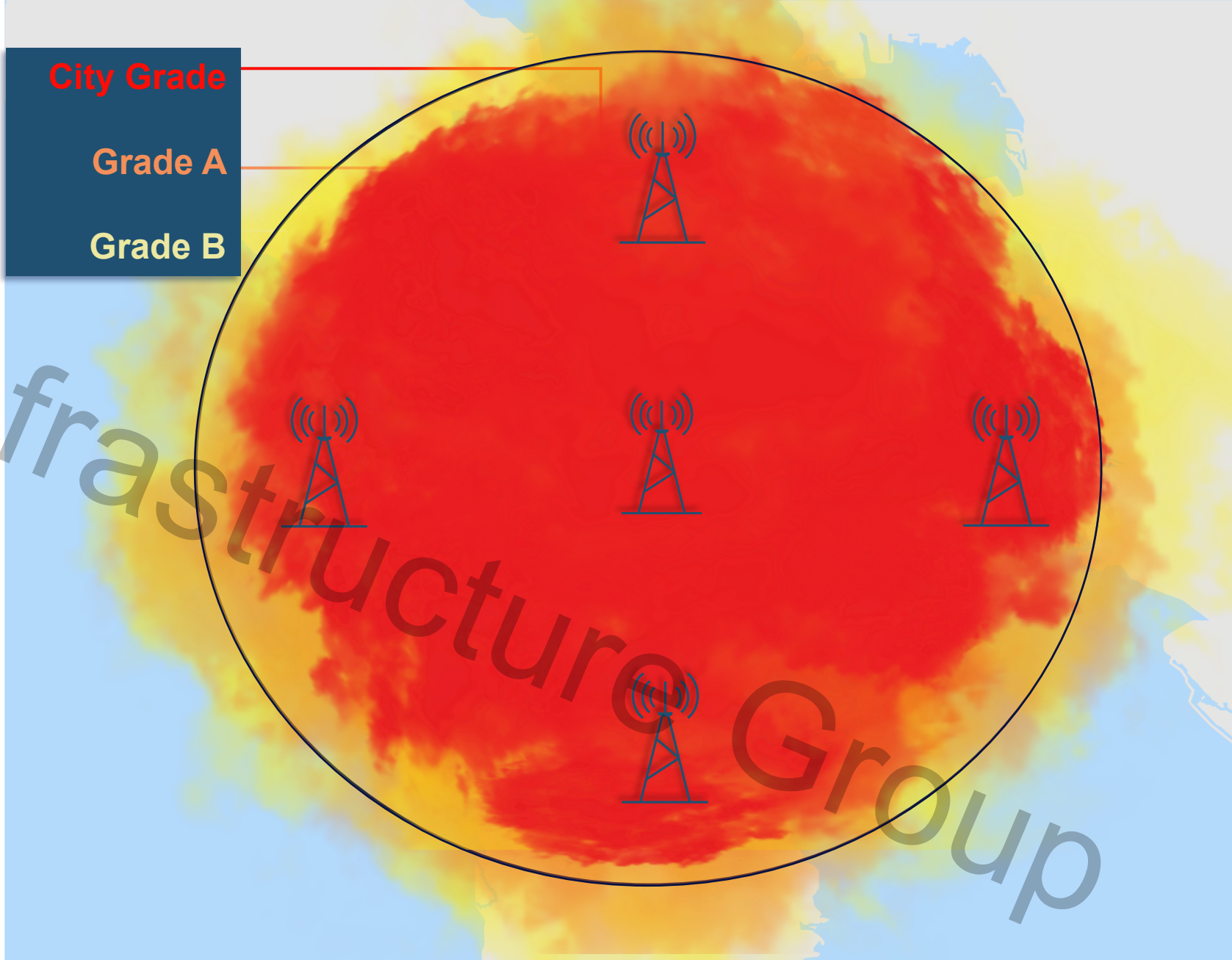


Better Service with SFNs

SFNs boost signal strength:

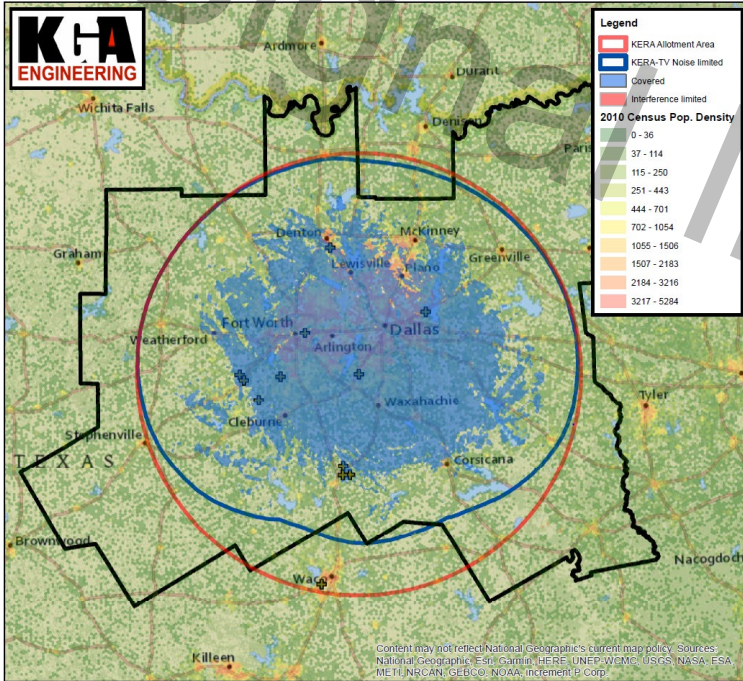
- Overcome terrain problems
- Provide consistent indoor reception
- Provide consistent portable and handheld reception
- Provide consistent mobile reception

- Good OTA reception
- Poor OTA reception



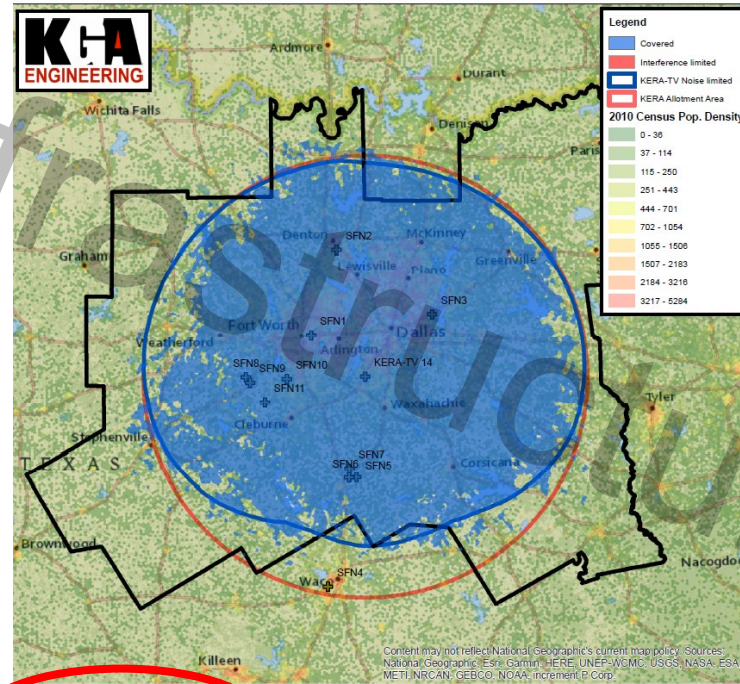
SFN's Maximize Bandwidth Capacity

1.5 Meter Outdoor, Main Transmitter



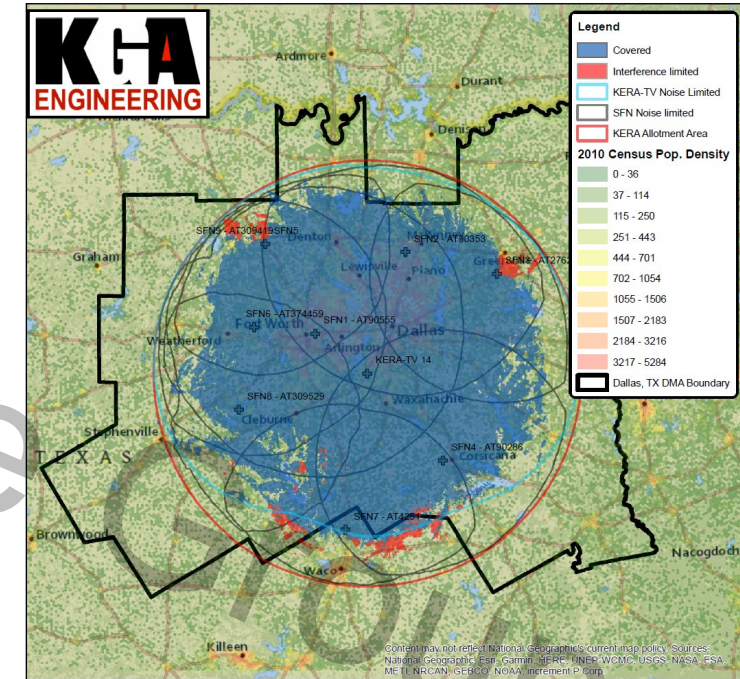
25 Mbps, 16K FFT, 256 NUQAM
5,597,813 POP covered

1.5 Meter Outdoor, Main, Adjusted ModCod



4.97 Mbps, 8K FFT, 16 NUQAM,
6,622,423 POP covered

1.5 Meter Outdoor, Seven-Site SFN

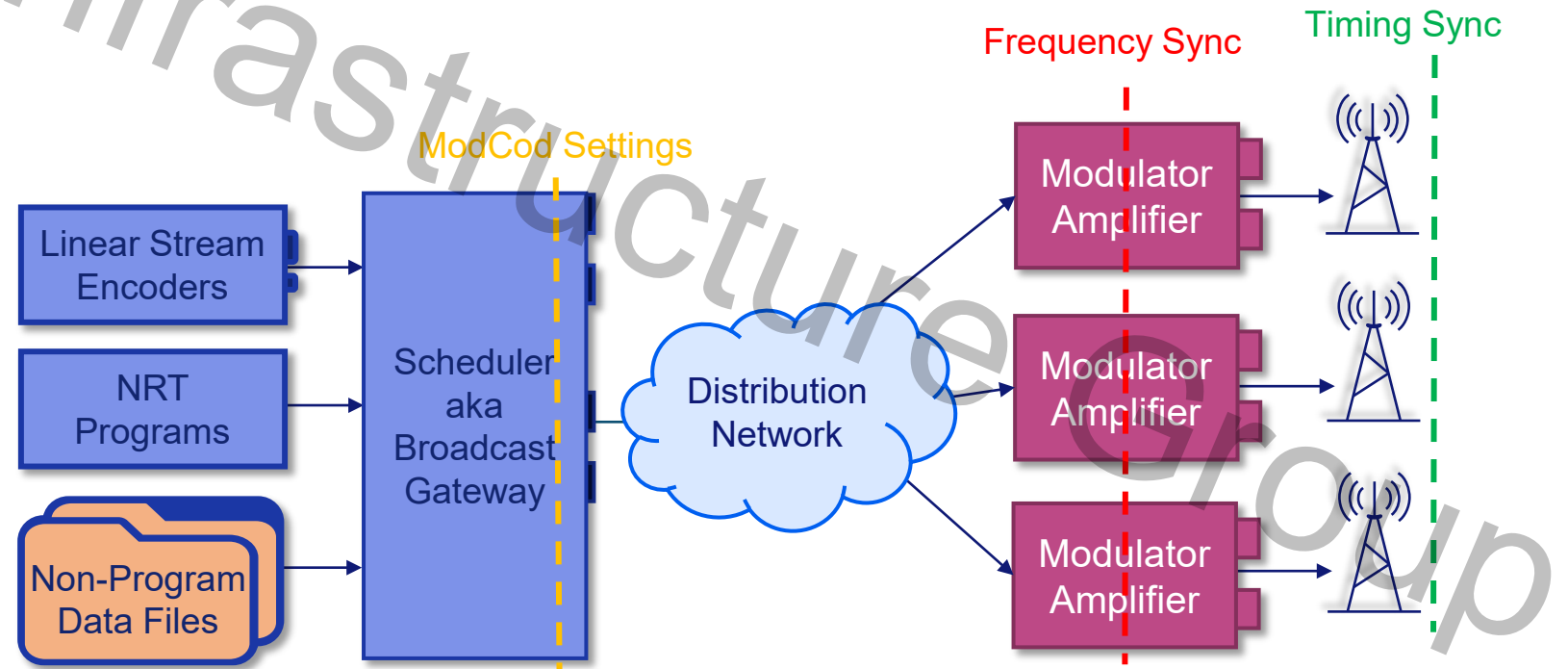


25 Mbps, 16K FFT, 256 NUQAM
6,463,335 POP covered

SFN Principles

All transmitters send the same signal at the same time on the same frequency

- Critical transmitter frequency synchronization
- Critical timing of bit streams at all transmitters
- Critical modcod settings for network configuration
- Careful network design & planning required!



- Transmitter Site Selection
- Transmission Losses
- Mod-Cods
- 1.5 Meter v. 10 Meter Antenna Height
- Building Penetration Loss
- Vehicular Penetration Loss
- Indoor Receive Antenna Gain
- Handheld Receiver Gain
- Transmission Losses

Design Scenario #1
Outdoor Fixed Lighthouse Video Service

PARAMETER	Reception Scenario	UNIT
Receiver Target	Fixed Outdoor	*
Target Service	5 x 1080P Video Lighthouse Scenario**	*
Thermal Noise Power (Ideal Receiver)	-106.2	dBm
Frequency Band	UHF	Band
Receiver Noise Figure	6.0	dB
Receiver Input Noise Floor	-100.2	dBm
Preamble Parameters:		
Symbols per Preamble	1	Symbols
FFT Size	16K	# of subcarriers
Guard Interval	2048 / 296	Samples / μ s
Scattered Pilot Spacing	3_1	Carriers / Symbols
L1-Basic & L1-Detail Mode	1	Mode #
Subframe Parameters:		
Frame Length	250.0	ms
Payload Symbols per Frame	92	Symbols
FFT Size	16K	# of subcarriers
Guard Interval	2048 / 296	Samples / μ s
Scattered Pilot Spacing	3_4	Carriers / Symbols
PLP Parameters:		
Constellation	256 QAM	QPSK or QAM
Code Rate	10/15	*
Code Length	64,800	bits
Time Interleaver Mode	CTI	*
Enhanced Layer Injection Mode	N.A.	dB
TOV Propagation Model: Channel Type	Ricean	*
Minimum AWGN C/N @ TOV (Laboratory Results)	18.30	dB
Minimum Ricean C/N @ TOV (Laboratory Results)	19.10	dB
Data Capacity	24.45	Mbps
Antenna gain	10.0	dB
Download loss	4.0	dB
Minimum Antenna Output Power	-87.1	dBm
Dipole Factor	129.8	dB μ V/m-dBm
Minimum Field Strength at Antenna Elements	42.7	dB μ V/m
Percentage of Time	90.0	%
Percentage of Locations	50.0	%
Polarization Discrimination Factor	0.0	dB
Fading Margin	3.0	dB
Penetration Loss	0.0	dB
Total Required Margin	3.0	dB
Recommended Field Strength at Antenna Elements	45.7	dB μ V/m
Receiving Antenna Elevation Correction (Height Loss at 1.5 meters)	0.0	dB
Field Strength Required at 10 meters AGL	45.7	dB μ V/m

* 1080P TV statistically-multiplexed services are assumed to consume ~4.5MB/sec per service on average.
 ** 720P TV statistically-multiplexed services are assumed to consume ~1.5MB/sec per mobile service on average.
 *** 4K TV statistically-multiplexed services are assumed to consume ~11MB/sec per service on average.

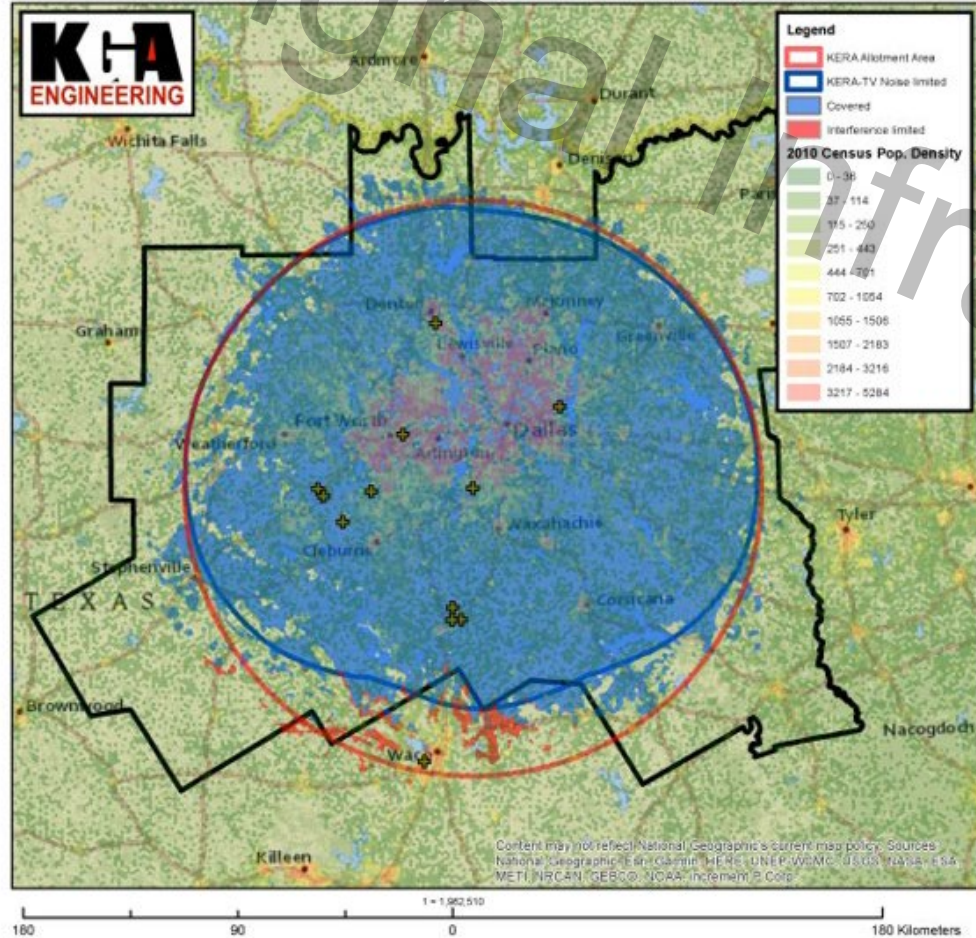
Dallas Market

Dallas 10 Meter Outdoor Maps

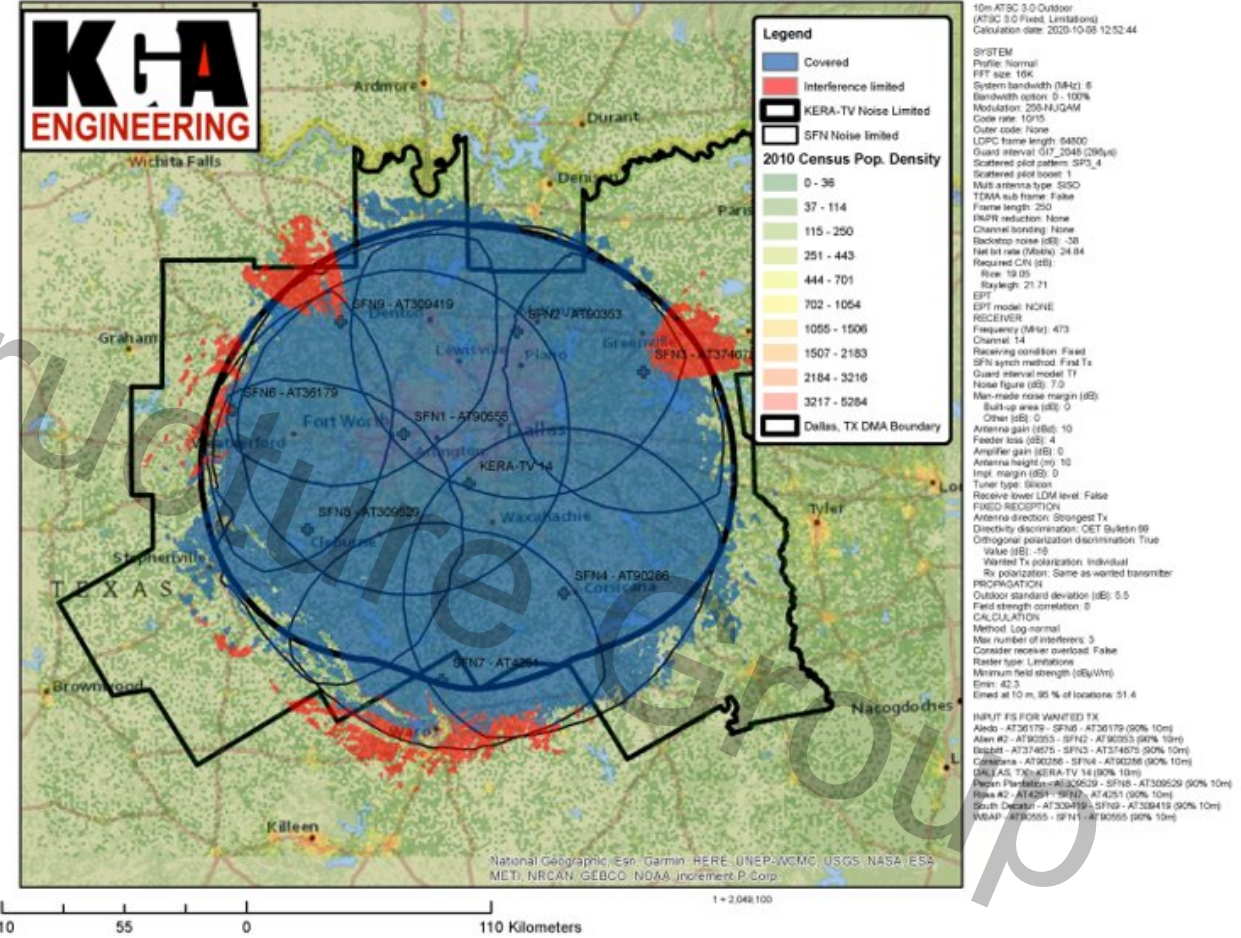
Single Stick - 10 Meter Outdoor

10 Meter Outdoor w/ SFN

KERA - Scenario 1 Baseline 10m Population - 6,700,006 IX Free People (allotment pop: 6,922,668)



KERA - ATSC 3.0 SFN 10m 2010 Outdoor Population - 6,829,979 IX Free People (allotment pop: 6,922,668)



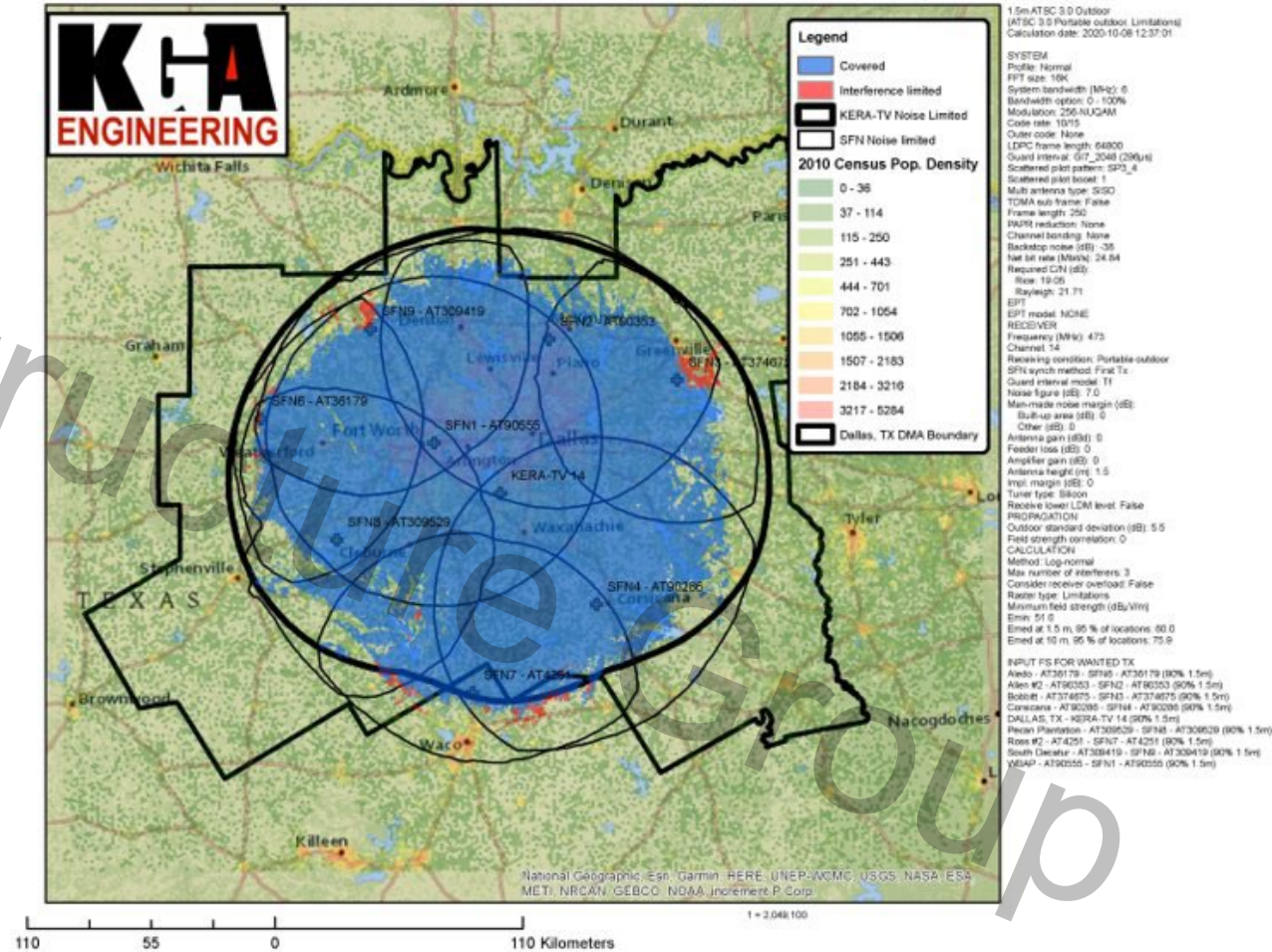
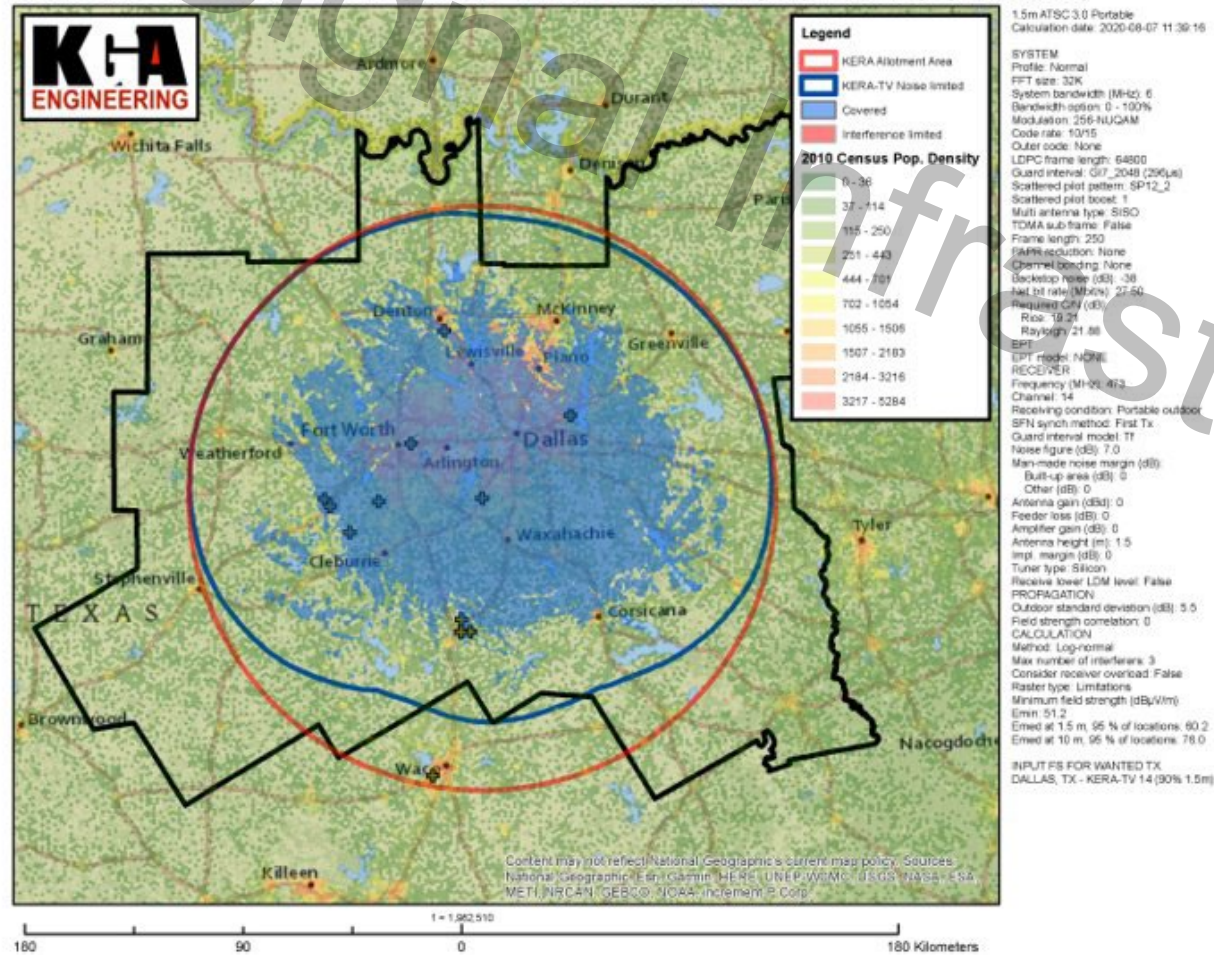
Dallas 1.5 Meter Outdoor Maps

Single Transmitter - 1.5 Meter Outdoor

1.5 Meter Outdoor w/ SFN

KERA - ATSC 3.0 Baseline 1.5m Population - 5,597,813 IX Free People (allotment pop: 6,922,668)

KERA - ATSC 3.0 SFN 1.5m 2010 Portable Outdoor Population - 6,470,111 IX Free People (allotment pop: 6,922,668)

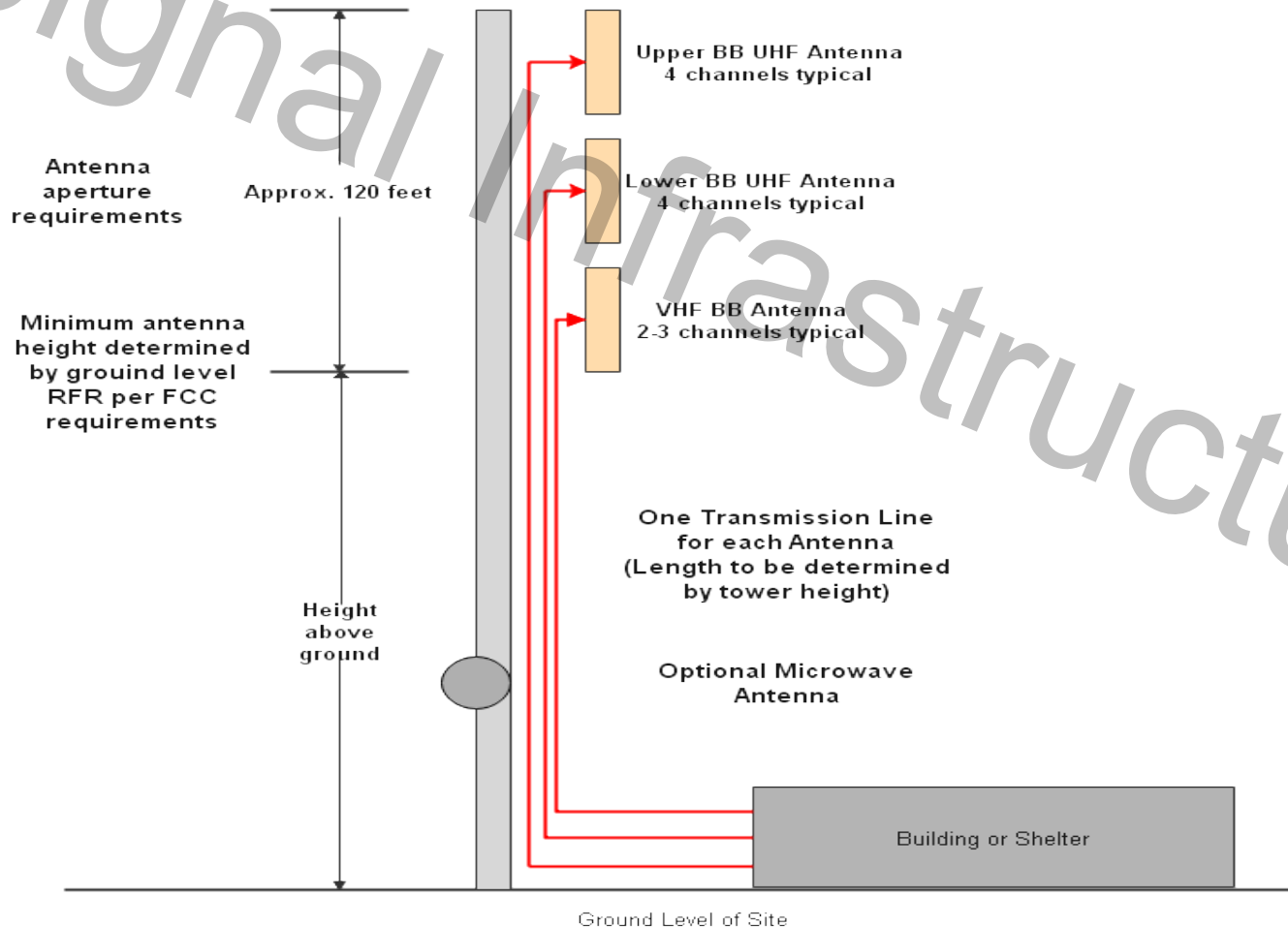


Dallas SFN Population Increases

2010 Estimate of Total in Allotment Area = 6,922,688						
Condition	10 M Outdoor Antenna	% of Total Pop Covered	1.5 M Outdoor Device	% of Total Pop Covered	1.5 M Indoor Device	% of Total Pop Covered
KERA	6,700,006	97%	5,597,813	81%	3,661,319	53%
KERA w/ SFN	6,829,979	99%	6,470,111	93%	5,991,546	87%
Increase (pop)	129,973		872,298		2,330,227	
Increase (%)	2%		16%		64%	

Shared Infrastructure Reduces Costs

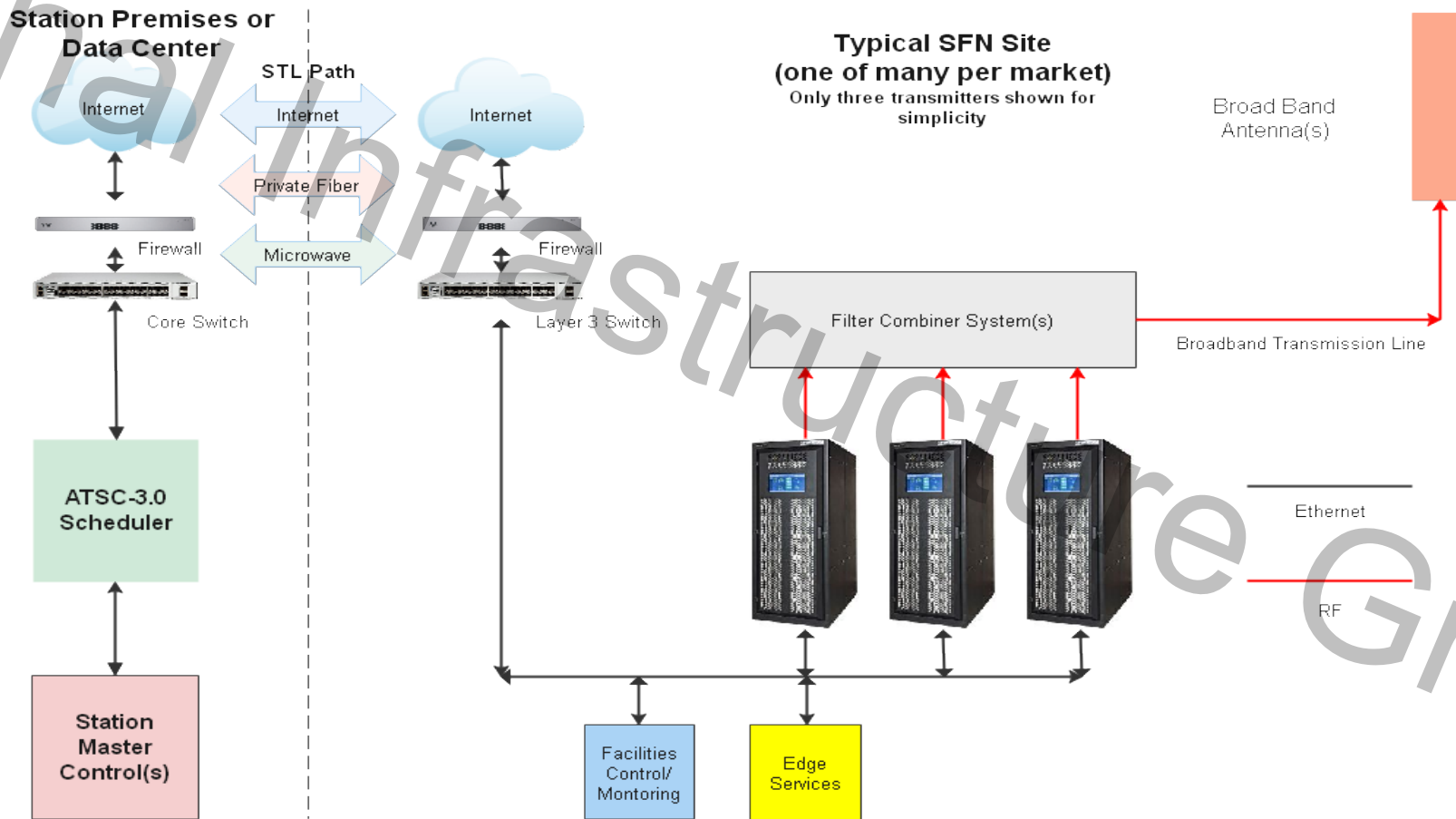
SFN transmitter collocation provides equal reception for all stations across coverage area



Example:
For ten 200 KW ERP channels,
the minimum height of
antennas above ground level
will be around 300 feet.

Managed Infrastructure Reduces Headaches

SIG designs, procures, installs, operates and services the entire system (Transmission-as-a-Service)



Let Us Know How We Can Work Together



Develop new services



Assist in transition planning



SFN operation



Generate new revenue

Thank You!



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