

STATEMENT OF RIVADA NETWORKS

Joint Hearing: "On FirstNet"

Pennsylvania General Assembly

Senate Veterans Affairs and Emergency Preparedness Committees

Senate Communications and Technology Committee

House Veterans Affairs and Emergency Preparedness Committees

October 19, 2017

1. Opt for Pennsylvania  
Opting Out gives PA 180 more days to decide Negotiate this 25 Year Commitment

Thank you, Mr. Chairman, other Committee Chairs and members, of each Senate and House Committee here this morning.

On behalf of the Rivada team, we are pleased to present testimony this morning in support of Governor Tom Wolf choosing the Opt-Out FirstNet decision to maximize the FirstNet opportunity for Pennsylvania's Commonwealth Public Safety Broadband Network (CPSBN).

The federal FirstNet law gives Governors the right to extend their review and decision-making time-period beyond December 28, 2017 for an additional 180 days. The additional time gives Governors the opportunity to get all facts and figures from FirstNet, NTIA and the FCC, and review all aspects of alternate plans submitted to the State.

We encourage Governor Tom Wolf to negotiate the best solution for Pennsylvania by extending the December 28, 2017 deadline an additional 180-days to thoroughly review all aspects, opportunities, risks and consequences for Pennsylvania's CPSBN.



Figure 1: Timeline for final Governor's decision if Commonwealth opts-out before December 28.

With so much at-stake for this 25-year commitment, the best first step is a thorough review of all available options and plans.

To get started, let's clarify one urban legend. You've heard from AT&T that they will deploy FirstNet in Pennsylvania "at no cost to the state." But, what you haven't heard is that Pennsylvania's first responders will have to pay a monthly fee to access the AT&T network! Around the country we've heard AT&T plans charge first responders between \$40 to \$50 dollars per month, and different rates for different states. So let's be clear, Rivada proposes to charge: one cent.

## Why one cent?

While we wanted to offer free service to first responders, FirstNet told us we had to charge something. So, we're charging one cent for 25-years because we don't want price to be an obstacle that prevents any first responder in Pennsylvania from getting on our much-safer Band-14 network.

The other reason we're charging one cent is that Rivada believes—has always believed—that after 9-11, this project should be public safety's network. Public safety needs, and deserves, a purpose-built wireless broadband network of their own, not a rate plan on a commercial carrier's system. The special Band-14 spectrum was allocated for public safety nationwide, not to a carrier for its commercial use. FirstNet holds the Band-14 spectrum in trust for public safety. We believe the Band-14 spectrum should be free or near-free for our nation's firefighters, police officers, emergency medical personnel and other first responders.

We believe the best way for Governor Wolf to maximize the revenues, infrastructures, and public safety is to Opt-Out and negotiate the strongest public private partnership (3P) in the nation with Rivada.

## 2. Opt for Pennsylvania Opt for a Balanced and Equal Relationship with Federal FirstNet

Under the federal FirstNet law, Governor Wolf has two sharply divergent options:

- "Opt-In" and surrender Pennsylvania's license of the 20MHz Band-14 spectrum to AT&T, and hope for the best as all available revenue, control and decision-making goes to Washington.
- Or, "Opt-Out," to negotiate the strongest PPP that retains all revenues, control, decision-making and cost-savings in Pennsylvania and purpose-builds 1,162 new towers with Band-14 spectrum.

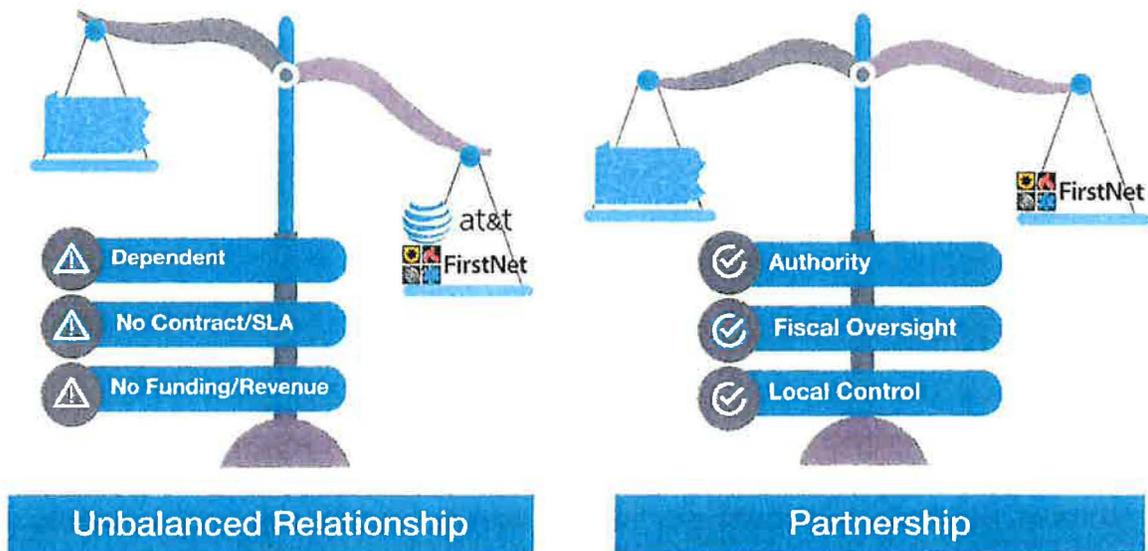


Figure 2: Opting-In to FirstNet & AT&T will create an unbalanced relationship. Choosing Rivada creates a true and balanced partnership between the Commonwealth, its Public Safety Stakeholders and FirstNet.

By Opting-Out, Governor Wolf keeps Pennsylvania's Public Safety Broadband Network, "Pennsylvania-centric." Simply put, Pennsylvania controls the network and establishes state committees, user and stakeholder groups that will regularly meet to develop and agree on a mutual Concept of Operations (CONOPs) for the Opt-Out Network, with full authority to implement the best solutions for Pennsylvania. Conversely, Opting-In, tips the scale and decision-making from Pennsylvania-centric to 49 other states and 7 territories. No matter how many meetings representatives from PA attend in Washington, every decision will be judged by a standard of "what's best for FirstNet and AT&T."

### 3. Opt for Pennsylvania Opt for Competition, Value and Infrastructure

Pennsylvania needs a PA-FirstNet partner to (1) maximize potential revenues and keep those revenues in state, (2) maintain control of its first responder and PSP communications, (3) invest in new communications infrastructure and economic development, (4) prevent the immediate devaluation of its multi-billion dollar investment in PA-STARNet and its County and Local Public Safety networks, and (5) uphold the Commonwealth's constitutional responsibilities, including, the Governor's role as commander-in-chief of the military forces of the Commonwealth.

The following table highlights the significant difference in value that the Rivada plan offers over the FirstNet AT&T plan. Consider that whether Pennsylvania opts in or out, AT&T's investments in the Commonwealth are negligibly impacted. In other words, AT&T, to meet commercial demand alone, will continue to invest in Pennsylvania whether the Commonwealth opts in or out. As they told a public meeting in New Hampshire; "no matter whether you opt in or out, we are here to stay." Opting in has no net gain or impact on Pennsylvania's GDP whereas Opting Out will trigger significant investment, innovation, job creation and development.

Comparative Value to the State of Pennsylvania :					
	 Spectrum Value	 New Jobs	 Federal Grants	 Revenue Sharing	 PS* Local Savings
 RIVADA	<b>\$520</b> MILLION	<b>6,000</b> + MORE	<b>\$168</b> MILLION	<b>\$383</b> MILLION	<b>\$1.14</b> BILLION
<b>at&amp;t</b>	NO	NO	NO	NO	NO

Figure 3: Matrix comparison of key measureable financial benefits to the Commonwealth if opting out.

- Band 14 spectrum valued at **\$520 Million** has 7 times more power than LTE to increase rural broadband coverage and penetrate thick buildings, walls, stairways.
- The Rivada plan creates **6,000** more JOBS than AT&T, drives economic development across 67 counties.
- At least **\$168 Million** in Federal grants to Pennsylvania to construct purpose-built Band-14 across 67 counties with 1,162 new towers.
- **\$383 Million** stays in Pennsylvania instead of being sent to Washington. The \$383 Million is used to maintain, operate and improve the system.
- More than **\$1.14 Billion** in cost-savings to PA State Police, state agencies, county and local governments due to reduced subscription fees, (\$01/month for 25-years).

#### 4. Opt for Pennsylvania

##### Keep the Spectrum – Serve and Protect PA Citizens Directly - National Priority Available Today

Originally recommended by the 9-11 Commission, the FirstNet national deployment is driving immediate competition and better results for public safety and first responders. This is clearly the result of competition that is best served if there is a balance between Opt-In and Opt-Out States!



In August, Verizon announced that they will deploy QPP services for first responders (Quality Priority and Preemption) starting immediately with 'priority' to match AT&T's offer. This action removes one of the major technical claim advanced by FirstNet and AT&T for Opting-In.

For months prior, FirstNet and AT&T advanced an argument that its QPP offering was unique and superior to AT&T's commercial network. When Verizon, with 70% of the public safety market share, has announced it will build a dedicated Public Safety Core and offer QPP on a nationwide basis, it made AT&T's QPP moot. In fact, Verizon already offers, priority access to public safety customers, today. Regardless of whether AT&T offers QPP in Pennsylvania or not, Verizon already does!

With Verizon and AT&T both offering QPP and charging \$40 to \$50 per month for access, the major reason to Opt-In is effectively negated, and Governor Wolf should negotiate the strongest PPP for Pennsylvania with Rivada to maximize public safety, Band-14, revenues and decision-making. **Keep FirstNet Competitive**

#### 5. Opt for Pennsylvania

##### Opt for Statewide Band 14

Band 14 was specifically set aside for public safety because it falls under a different set of rules and regulations in terms of power mobile and portable devices can transmit. Band 14 Public Safety Devices in the United States can operate in a very special "high power" mode. **High Power User Equipment (HPUE)**. Specifically, Band 14 devices can transmit at 6-7 times the power of the nearby commercial bands. Band-14 delivers more coverage range and better building penetration. It allows for different device configurations and facilitates future technologies such as direct mode over LTE. AT&T's commercial network is NOT Band-14. We believe public safety has earned and deserves a public safety grade, Band 14 network. The Rivada plan for its Statewide Band 14 network will be open and accessible all validated carriers including US Cellular, Verizon and AT&T.

We believe Band-14 is essential for public safety. We again express our concerns and reservations that in Pennsylvania, AT&T will not commit and in fact will not build out band-14 except where it needs *capacity* for its existing commercial operations.

Rivada's 1,162+ site statewide deployment of Band 14 means that Public Safety users will have 7x the operating power built into their mobile and portable radios.

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<sup>1</sup> The use of the AT&T, Verizon and FirstNet logos do not imply an affiliation nor explicitly or implicitly endorse Rivada or its partners. The logos are trademarked to their respective owners. The logos are used purely for illustrative purposes only.

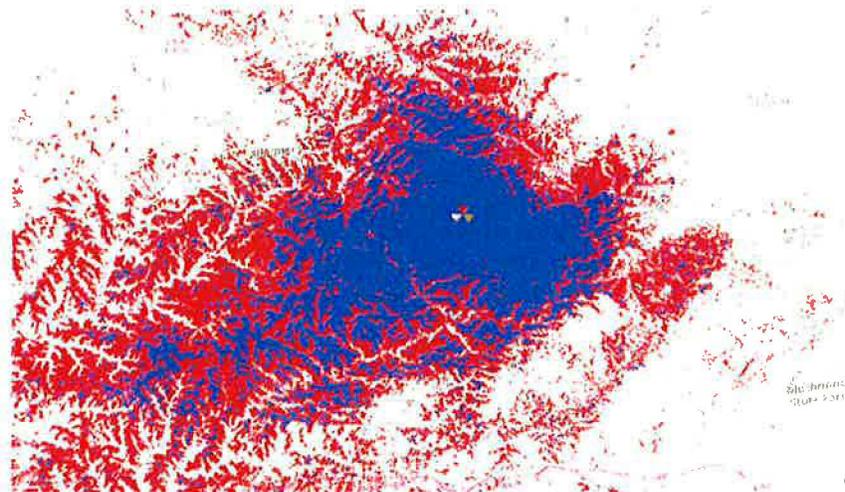


**Figure 4:** Power difference between offers from AT&T and Verizon's and proposed Rivada solution.

As an example, coverage from PA-STARNET site ELKC38 below demonstrates the difference in a rural area is one of life and death if a responder happens to be in a valley or shadow where his or her device cannot reach back out to a commercial LTE tower.

That very same call will be able to reach one of the 1162 Rivada Band 14 sites and perhaps save a life or protect property.

Commercial LTE return signal path is limited to the area indicated in **blue** in the figure below. **Red** shows the tremendously larger coverage provided to HPUA Public Safety Devices. Let's not strand or abandon our first responders that are serving in remote environments because AT&T did not think such coverage was a worthy investment for their shareholders.



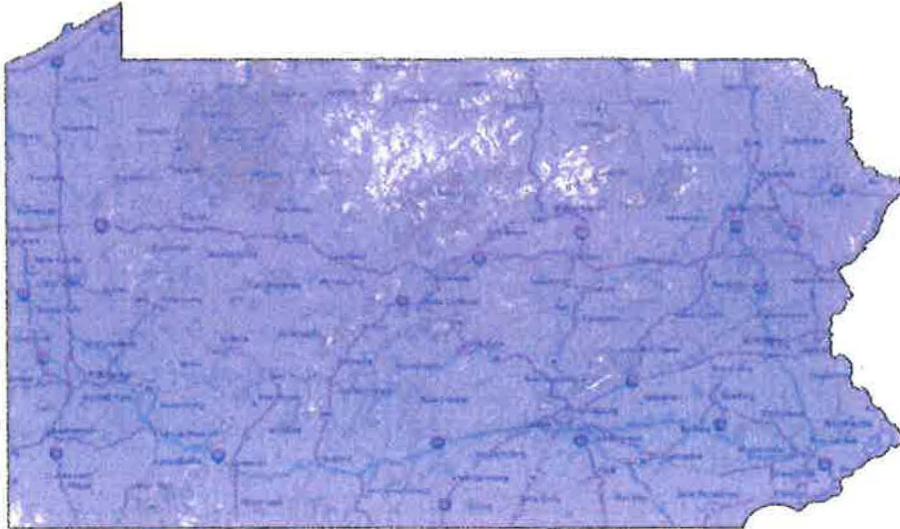
**Figure 5:** Commercial versus Band 14 coverage.

But it is not only rural coverage that is impacted. Band 14 affects coverage in buildings, schools, hospitals, homes, and factories. Because the 8dB is signal difference between Band 14 and all other LTE Bands is the difference of getting a signal out from a classroom, a stairwell, a basement, or an elevator.

After all the years we fought to get this very special channel, why now on the eve of finally achieving the vision of a dedicated purpose built broadband public safety network are we willing to compromise on a principal as fundamental as this one? This is exactly what the 9-11 Commission sought to achieve! We need Band-14 in Pennsylvania.

Just ask the family of Philadelphia Fire Captain Taylor what "poor coverage" means to them. On Aug. 20, 2004, Capt. John Taylor and firefighter Rey Rubio found themselves trapped and low on oxygen in a smoldering Port Richmond, Philadelphia basement. Taylor tried to call for help on three occasions that night to no avail. They both died of asphyxiation. Had Taylor's radio been functioning properly, both men would likely be alive, according to a lawsuit filed in 2006 by relatives of Taylor and Rubio.

Rivada's purpose-built statewide Band 14 coverage is exactly what first responders and citizens need.



**Figure 6:** Rivada's coverage solution to the Commonwealth.

Rivada's Band-14 network will enable AT&T and Verizon first responder customers to operate on Band-14 across Pennsylvania even where they don't have coverage.

The Rivada plan reduces risks and improves public safety.

## 6. Pennsylvania A Leader in FirstNet and Seeking a Viable OPT-OUT Approach



As one of only 8 States that commented on the NTIA's August 2016 Guidance on the State Alternative Plan Program (SAPP), Pennsylvania has already demonstrated leadership and a desire for a genuine alternative to the FirstNet Federal plan. Pennsylvania's comments, submitted by Major Diane Stackhouse of the Pennsylvania State Police and the State SPOC are thoughtful, thorough and presciently accurate in identifying the challenges a state would encounter, if the NTIA did not provide information on the grant demonstration process and other requirements in accordance a recommended timeline.

In Pennsylvania's comments to the NTIA (submitted as part of the record today); Pennsylvania identified a number of issues with the NTIA Guidance including:

- FirstNet requires a timeline from the states that they did not follow themselves.
- There is incomplete information for states to make a decision – A plan from FirstNet is not equivalent to a full RFP.
- NTIA can overrule the FCC but their process is opaque.
- The way a spectrum lease would be negotiated is unspecified and could be used to prevent a state from opting out.

The last item was especially prescient, since indeed, it appears that the draft spectrum lease terms, also known as the SMLA, that were recently released to governors are causing a lot of consternation and appear to be unreasonable, at best.

A significant portion of the comments deal with when final NTIA demonstration criteria should be provided to the states. Pennsylvania makes a clear argument that it should have been at least three months before draft state plans are received (that date ended up being June 15<sup>th</sup>) and attached a suggested timeline which we include as a figure below. Pennsylvania contends that such time is reasonably required to develop a funding plan, consider costs, and evaluate operational considerations. Now a number of weeks past the FINAL STATE PLAN submission, the complete and final NTIA State Alternative Plan Rules and Grant Guidance and SAPP Notice of Funding Opportunity are still not available<sup>2</sup>. It is not an exaggeration to say that these delays seriously jeopardize a state's right to Opt-Out.

Furthermore, Pennsylvania and Major Stackhouse raise further serious and important questions regarding the Opt-Out process after the FCC's approval and whether the NTIA can make determinations that have the effect of vetoing the FCC's approval? Rivada highly recommends that all parties interested in a fair and open process regarding Pennsylvania's right to Opt-Out familiarize themselves with Major Stackhouse's comments.

In the comments Pennsylvania makes a statement that is directly pertinent to today's hearing on the page 4: "We are also struck by the lack of time a state has under the Act to put out an RFP, secure a corporate partner to build the network, and submit a plan to the Commission: a state gets 180 days, yet FirstNet needed a year for this same process. For these reasons, the Commission and the NTIA must provide the aforementioned criteria three months before the **draft** state plans are delivered by FirstNet."

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<sup>2</sup> NTIA on the SAPP web page states "Details regarding the grant program will be provided in the upcoming SAPP Notice of Funding Opportunity." <https://www.ntia.doc.gov/other-publication/2017/ntia-release-funding-level-determination-each-state>

# Exhibit A State Alternative Plan Timeline

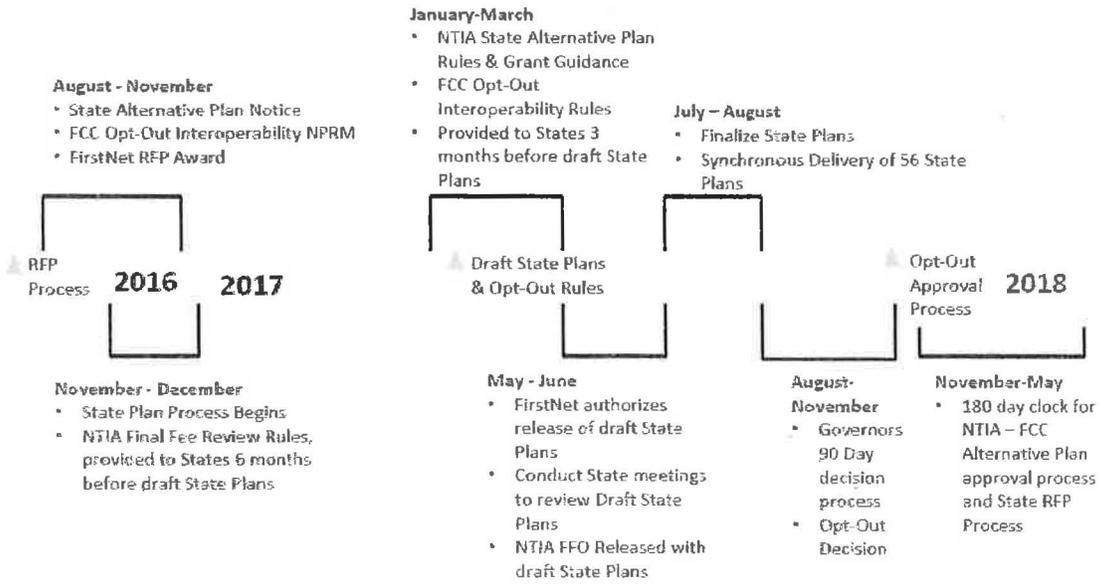


Figure 7: Alternative State Plan Timeline.

Source: Pennsylvania State Police – Major Diane Stackhouse Aug 2016 Comments on NTIA SAPP Guidance.

**Pennsylvania is a Leader in FirstNet - Maintain the Course.**

7. Pennsylvania  
Among the States Committed to Due Diligence

State RFP / RFI Tracker

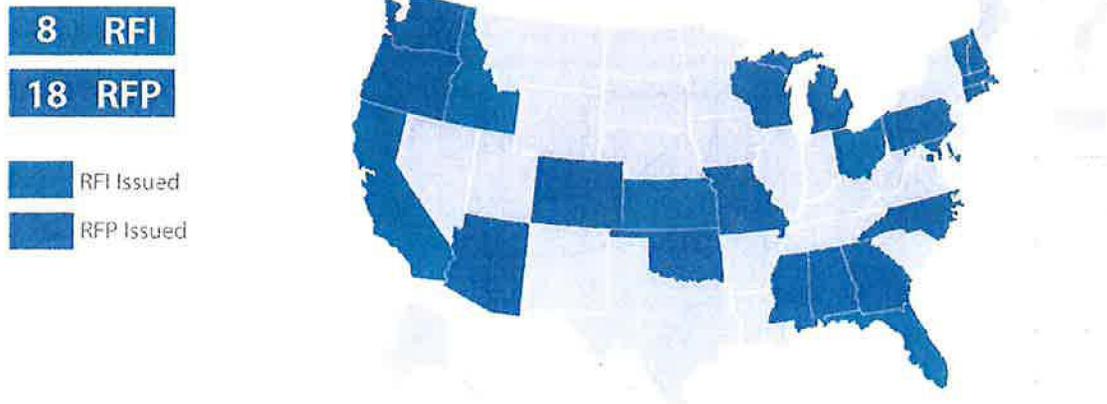


Figure 8: State RFP/RFI tracker as of October 17, 2017.

Pennsylvania has laid out a clear set of objectives, including: First Responder priority, population and expanded geographic coverage, utilization of Pennsylvania assets, guarantees of performance, network sustainability and performance, public safety grade hardening, resiliency, and design controlled public safety entity (PSE) priority access. These objectives are fully addressed and achieved by the Rivada solution. In addition, the Rivada solution provides monetization income that will sustain development and operational costs. Rivada's solution also provides users local control, and absolute priority and preemption.

This powerful and tailored solution surpasses the alternative FirstNet/AT&T offering and will benefit the Commonwealth of Pennsylvania and its principals.

8. Opt for Pennsylvania  
Opt to Leverage Existing Investments in PA-STARNet, Local, and County Assets to Generate New Revenues



Pennsylvania has made and continues to make significant investments in [PA-STARNet](#) and its associated backbone network as detailed on the website:

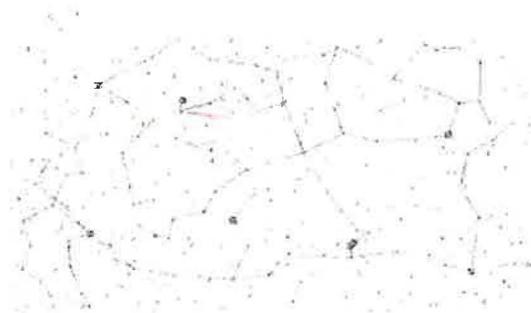


Figure 9: PA-STARNet.

- **Infrastructure:** 254 high-profile towers, 760 low-profile microcells.
- **Coverage:** Mobile radio coverage is greater than 95% signal strength in 65 of 67 counties
- **Users:** 25,756 subscriber devices are authorized for system use.
- **Traffic:** Users log an average of 141,640 calls (push-to-talks) daily.
- **Interoperability:** Gateways support data and voice communications among user groups, from state agencies to local first-responder dispatch centers, including all county 911 centers.

**PA-STARNet - Broadband Communications Opportunities:**

- System capacity increased, starting in 2012, funded by \$28.8 million federal broadband stimulus grant.
- An additional 150 Mbps capacity was added to the PA-STARNet digital microwave network, using Multi-Protocol Label Switching (MPLS).
- Connections are available to "last mile" providers (ISPs, telcos, cellular providers) and anchor institutions (schools, hospitals, public safety agencies).
- Available in 32 counties in northern Pennsylvania: MPLS Layer 2 Ethernet.
- Continuous network monitoring, 99.999% reliability and availability.

**PA-STARNet Tower Space Opportunities:**

- Tower space available for commercial rent at approximately 150 sites.
- Reciprocal agreements for public safety through county governments.

Rivada will lease space on PA-STARNet structures and capacity on the broadband communications network generating a significant return on investment for these systems. As the contracted operator of Pennsylvania FirstNet, Rivada as a matter of course and contract will take every necessary step to ensure that the addition of equipment on the towers in no way interferes with PA-STARNet's LMR system. In fact, Rivada will seamlessly and directly integrate into the existing systems for the benefit of both.

As revenues generated directly from PA-FirstNet subscribers is eligible to be reinvested in INFRASTRUCTURE in support of the Commonwealth Public Safety Broadband Network (CPSBN), enhancements made by Rivada to PA-STARNet sites and backbone will also benefit PA-STARNet while maintaining compliance with Federal Law.

**9. Opt for Pennsylvania  
Opt for Fiscal Responsibility, Control and Oversight**

**PA / Rivada PPP Attracts Investment  
Capital into the Commonwealth**



**Figure 10:** Rivada means Investment into the Commonwealth.

Fiscally, the contrast between Opting-In and Opting-Out are considerable. An Opt-Out state has complete visibility into funding, capital investment, revenues (both from operations and state asset leases), and allocation of reinvestments back into Pennsylvania's CPSBN. Opting-In is ostensibly ceding fiscal authority, responsibility, and oversight to an opaque Federal Program that must distribute profits realized in a relatively populous state like Pennsylvania to what Federal bureaucrats have determined are more deserving states.

Not only will Pennsylvania have little insight into how much revenue is generated within the Commonwealth's borders, but the fact is that FirstNet and AT&T have confirmed that they have no plans to deploy Band 14 except where AT&T needs capacity (not coverage). With the Federal plan, the potential for desperately needed revenue is unnecessarily and significantly limited. The Rivada Pennsylvania plan based on a complete statewide deployment of Band 14 delivers an economic benefit that surpasses AT&T by as much as \$1.6 billion.

Additionally, instead of benefiting a Federal monopoly, the Rivada plan by introducing new and needed infrastructure fosters robust market competition across local economies.

10. Opt for Pennsylvania  
Add to Pennsylvania's Leadership in PPP's

Rapid Bridge Replacement Program demonstrates Pennsylvania's prowess at PPP's.



[www.P3forPA.com](http://www.P3forPA.com)

**Opting-Out with Rivada offers comparable Statewide benefits:**

It is a natural question: *How can Rivada deploy a Statewide LTE Network in less than 48 Months?* But the answer is simply that it is no big deal for Pennsylvania! Pennsylvania is already, as part of the [Nationally recognized](#) Rapid Bridge Replacement Project, removing and replacing 558 bridges throughout the State.

Rivada is proposing to build 1,162 sites in less than 48 months. For the vast majority of these sites, the work entails adding antennas and radio equipment to already existing towers with very few new towers. Most people would agree, that the [Rapid Bridge Replacement Project](#) (RBRP) is a much bigger lift!

If Pennsylvania can achieve the RBRP, it can certainly select and trust Rivada and its team of experienced operators, builders, and financiers to get a great statewide network for its First Responders that will also act as a spur for Technological Innovation, Rural Broadband, and Economic Development.

The Table below shows the clear comparisons between the two projects:

Program Criteria	Rapid Bridge	PA-FirstNet/Rivada
Term	25 Years	25 Years
Deployment	36 Months	48 Months
Units	558	1162
Funding	Public/Private	Grant/Private (Zero Cost)
Asset	Statewide New Bridges	Statewide LTE System
Revenues	Tolls/PennDOT Fees	Commercialization
Benefits	Transportation Infrastructure	Economic Development, Innovation
Jobs	1000's	6000
Value	1 Billion	2.1 Billion

**Table 1:** Comparison between Rapid Bridge and PA-FirstNet/Rivada.

**Opting Out is the lowest risk, highest reward PPP available to States this Year.**

- a. Pennsylvania is acquiring an asset (Spectrum Lease) they otherwise forgo without a PPP by Law (i.e. there is no risk like with a Toll Road that the public is hindered since the State is not capitalizing and privatizing an asset it already owns).
- b. Pennsylvania benefits from existing brownfield asset investments (i.e. existing towers, backhaul, PSAPs) through direct leases and indirect economic efficiencies.
- c. Pennsylvania will also get a significant greenfield build of desperately needed broadband infrastructure.
- d. Rivada's unique wholesale model unleashes new market opportunities for businesses of all sizes – from local ISPs, to Comcast, to Google.
- e. Pennsylvania has a proven capacity to set up and successfully administer PPP's like Rivada/Macquarie and in so doing will benefit from additional investment interest, opportunities and projects.
- f. Opting Out generates "revenues" not otherwise realized by Opting In.
- g. In addition to the direct wholesale market benefits, indirect investments and spending on service companies, applications development, deployables, in vehicle installations (Police, Fire, and EMS), cameras, IoT, transportation, energy (Marcellus shale projects and monitoring), utilities, education, etc.
- h. As a bonded no cost arrangement Pennsylvania's downside is negligible to nonexistent, upside is tremendous for the reasons outlined above.
- i. Competitive QPP on commercial networks (available today) has removed ALL risk to Public Safety, FirstNet, and Responders for Opting Out.

**11. Opt for Pennsylvania**

>90% of Public Safety Incidents are 100% Local

There is a lack of appreciation for what Interoperability entails. Whether a State opts in or out it will by Law be fully interoperable with the nationwide network. The FCC will be the independent body that verifies that opt-out states' networks conform to interoperability standards as part of the opt out process. Since FirstNet and its policies are based on the 3GPP standards for LTE, the FCC's verification process is a reasonable and achievable means of assuring system interoperability.

But the interoperability and operability of these First Responder Networks that matters most is not between two LTE networks that can and will be able to communicate across state lines. The interoperability that matters most is at the local level. It is at this level where Police, Fire, and EMS responders must regularly and consistently interoperate. And it is here that the FirstNet/AT&T approach fails so spectacularly. Charged with building an interoperable nationwide public-safety broadband network, FirstNet has opted for an approach that requires first responders to be AT&T subscribers if they want the benefits of the network. So if the EMS in some town in PA is on Verizon, and the fire company is on Verizon, AT&T wants to deny those firefighters the ability to use the Band 14 network and the FirstNet apps in an emergency. That's not interoperability. It's another stovepipe, like the ones public safety fought to get away from when it fought for Band 14 for first responders.

And having adopted this non-interoperable, stovepiped approach to emergency communications, FirstNet is now they're trying to force states to accept this approach, rather than opt out.

Pennsylvania must have the Network Operational Capability to support its own local, county and state responders unhindered by an outside entity. Only in specific and very rare cases does the governor cede responsibility to federal authorities. And even as an opt-out state that option will exist. But for day to day

operations within the Commonwealth, Pennsylvania must not be in a position of being deprioritized because it elected to opt in to a federal system. Maintain the means to respond and handle our own incidents. It is the Commonwealth's solemn duty to its citizens.

## 12. Opt for Pennsylvania Pennsylvania Innovates

All of us here are familiar with Pittsburgh's continuous improvement process starting with investments and policies that promoted the City as a Hub for Medicine, Computer Science, Education and particularly Technology. It is Now Becoming the Innovative Hub of the Autonomous Vehicle. And as the original American frontier - Pennsylvania never sits still – its people and institutions are constantly adapting and changing in innovative ways to increase productivity, quality of life, and opportunity in the state.

For example in discussions with Carnegie Mellon's Stan Caldwell the Director of Carnegie Mellon's [Traffic21 Institute](#) and the Technologies for Safe and Efficient Transportation [University Transportation Center](#). Stan expressed interest and understands the advantages of our model which opens up spectrum for many more applications. The Rivada statewide 4G (that will be upgraded to 5G as features of 5G are made available) LTE network offers a unique wholesale access model that will unleash economic opportunity throughout the state. The network will be fully bonded and built at no cost to the state with funding coming from the wholesale commercialization of the bandwidth (actually using what are considered 5G techniques). A network that is ideally suited to cost effectively and competitively address the long range terrestrial communications needs of Autonomous Vehicles. Today's feudal spectrum system (where 4 operators control almost all the real estate), services like [a basic](#) On-board diagnostics (OBD) monitor for the connected car, cost a prohibitive \$10 a month. The wholesale open spectrum market as proposed uniquely by Rivada for FirstNet can drive those costs down to a dollar or less per month within Pennsylvania.

Future meetings are in the planning to discuss longer term goals with the Traffic 21 team and work on more specifics on how wide area communications play into the Autonomous Vehicle and Intelligent Highway Future.

Rivada's Wholesale Network Unleashes Innovation and Opportunity.

## 13. Opt for Pennsylvania Opt for No Technological Risk



There is no technological risk to Opting-Out. Whether a state opts in or out; the technology must be exactly the same by law. The networks are based on the worldwide 4G LTE standard and if Pennsylvania selects Rivada; we will source the equipment from the same vendors that predominantly supply Sprint, T-Mobile, Verizon, and yes AT&T's networks.

**14. Opt for Pennsylvania  
Conclusion**

In the next 70 days Pennsylvania Governor Tom Wolf will make the FirstNet decision for Pennsylvania. An opt-in decision shortchanges Pennsylvania for 25 years. We believe the best decision for Pennsylvania and Governor Wolf is to opt-out and partner with Rivada to optimize every FirstNet opportunity for Pennsylvania.

As the table below demonstrates Rivada offers the most complete deal for Pennsylvania, makes FirstNet Competitive which enhances innovation and interoperability, and provides AT&T and Verizon Public Safety Customers with Statewide Band 14... **Making 100% Pennsylvania User Adoption Truly Achievable!**

PSBN NETWORK KEY FEATURES	AT&T	Verizon	Rivada
Local Authority	X	X	✓
Contract / SLA	X	X	✓
Revenues	X	X	✓
<b>Band 14</b>	?	X	✓
New Job Creation	?	?	✓
PS Local Savings	?	?	✓
Purpose Built Network	X	X	✓
Bonding	X	X	✓

**Figure 11: PSBN Offers Key Network Features matrix.**



**Joint Hearing before the PA Senate and House Committees on Veterans Affairs and  
Emergency Preparedness and Senate Committee  
on Communications and Technology**

October 19, 2017

# Opt for Pennsylvania



Under federal law, the Opt-Out choice lets Governor Wolf make an Opt-Out election before December 28, 2017:

- Opting Out gives Pennsylvania more time to negotiate the best public safety solution
- By Opting Out, Pennsylvania can still choose either option for a further 180 Days
- The Opt-Out choice benefits Pennsylvania State Police, state agencies, county and local governments in control of their multi-billion communication assets.
- The Opt-Out choice ensures Pennsylvania gets a purpose-built Band-14 statewide public safety broadband network versus a commercial LTE network.

**Opting Out : Nothing to lose and MUCH MORE TO GAIN**

# Opt for Pennsylvania



## Comparative Value to the State of Pennsylvania :

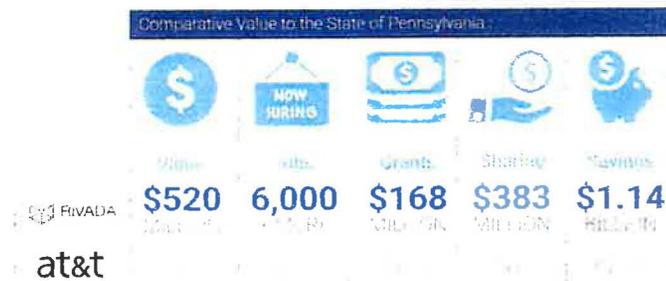
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<b>at&amp;t</b>	\$0	N/A	NO	NO	N/A

\*public safety

## Opt for Pennsylvania



- The badly needed \$520 Million spectrum is Band-14 which has 7 times more power than LTE to increase rural broadband coverage and penetrate thick buildings, walls, stairways.
- The Rivada plan creates 6,000 more JOBS than AT&T, drives economic development across 67 counties.
- At least \$168 Million in Federal grants to Pennsylvania to construct purpose-built Band-14 across 67 counties with 1,162 new towers.
- \$383 Million stays in Pennsylvania instead of sent to Washington. The \$383 Million is used to maintain, operate and improve the system.
- More than \$1.14 Billion in cost-savings to PA State Police, state agencies, county and local governments, plus they get better coverage and safety with Band-14.



# Opt for Pennsylvania

## PA-STARNet

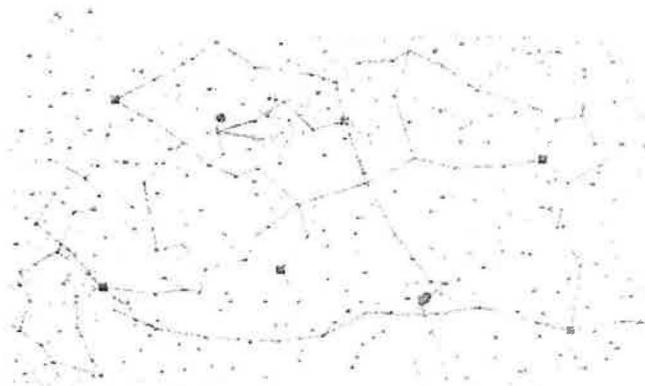


### PA-STARNet – Broadband Communications Opportunities:

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- An additional 150 Mbps capacity was added to the PA-STARNet digital microwave network, using Multi-Protocol Label Switching (MPLS)
- Connections are available to 'last mile' providers (ISPs, telcos, cellular providers) and anchor institutions (schools, hospitals, public safety agencies).
- Available in 32 counties in northern Pennsylvania: MPLS Layer 2 Ethernet
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- Tower space available for commercial rent at approximately 150 sites.
- Reciprocal agreements for public safety through county governments.



# Opt for Pennsylvania

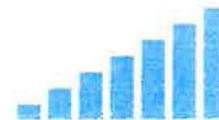


**Band 14 is Safer  
and Better for  
Pennsylvania  
Public Safety**

**More Rural  
Coverage and  
Greater Building  
Penetration**

**NO  
CHANGE**

**7x  
POWER**



at&t verizon

**Non-Band-14**



RIVADA

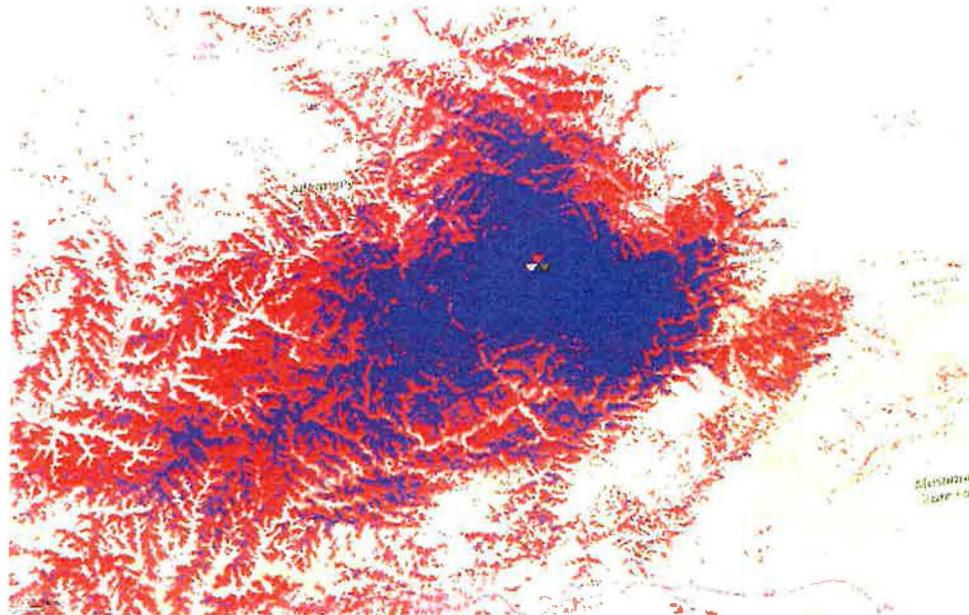
**Band-14**

Opt for Pennsylvania



**Band 14 is Safer  
and Better for  
Pennsylvania  
Public Safety**

**More Rural  
Coverage &  
Greater Building  
Penetration**



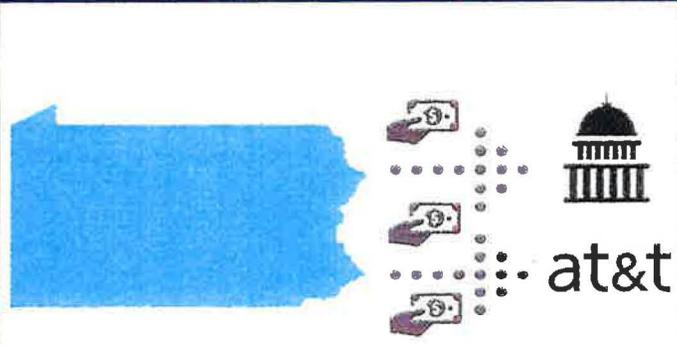
## Opt for Pennsylvania



**AT&T Offer**

**AT&T Opt-In Monopoly**

- Revenues collected in Pennsylvania benefit AT&T
- Fees paid by AT&T to FirstNet redistributed by Washington to 50 states and territories
- AT&T decides where and when to invest in Pennsylvania
- FirstNet controls all aspects of the Network from Washington
- AT&T has not disclosed monthly subscription fee
- AT&T not making a significant investment in Pennsylvania infrastructure
- Little or No BAND-14



The diagram illustrates the flow of investment from Pennsylvania to AT&T. On the left, a blue silhouette of the state of Pennsylvania is shown. Three hands are depicted holding dollar bills, with arrows pointing from the state towards the AT&T logo. The AT&T logo consists of a stylized building icon above the lowercase text "at&t".

Pennsylvania invests in AT&T

## Opt for Pennsylvania



### Opt-Out Plan with Rivada

- Revenues collected in Pennsylvania benefit Pennsylvania
- Pennsylvania Partner Rivada works with state, county and local officials to maximize investment into PA
- PA local and state officials control Public Safety Network
- Rivada will pay millions in lease payments to state, county and local government
- Rivada in mutual public/private agreement with Pennsylvania
- BAND-14
- Significant reduction in STATE, COUNTY and LOCAL budgets and a great benefit to Primary First Responders

### Rivada Solution



## Opt for Pennsylvania



Unbalanced Relationship



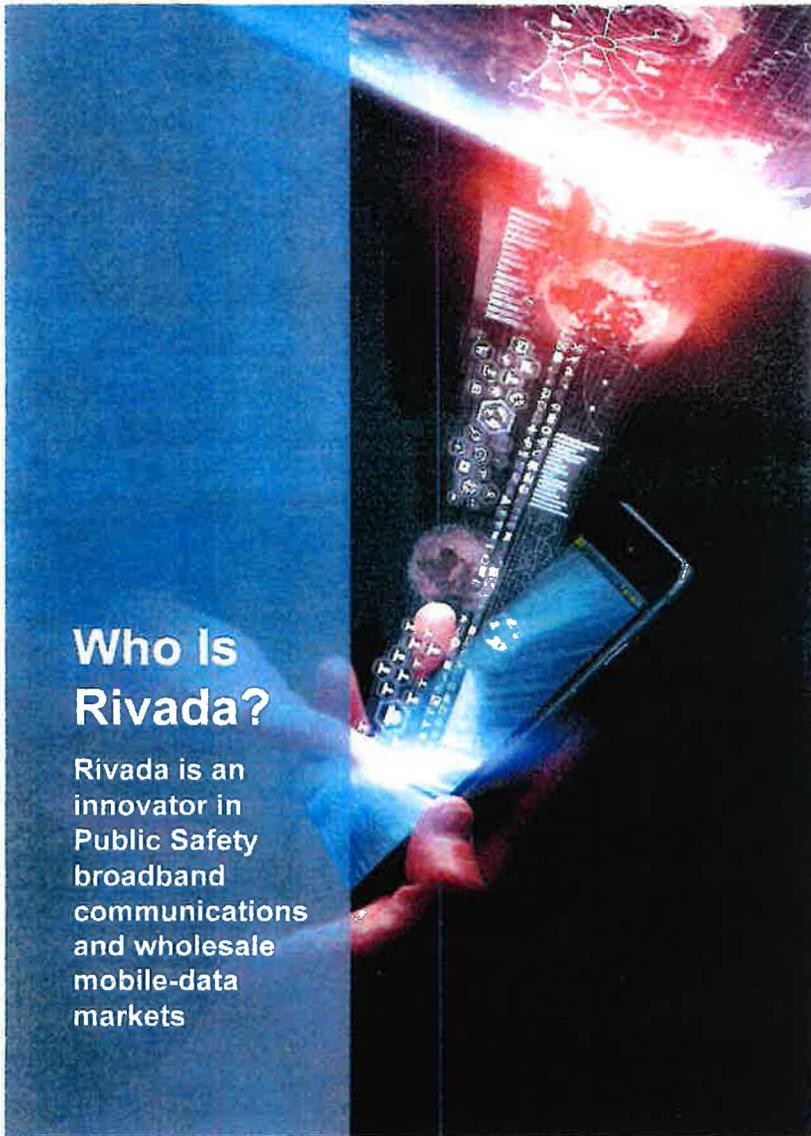
Partnership

Opt out states are in a balanced and empowered relationship with FirstNet



Pennsylvania's  
Commonwealth Public Safety Broadband Network (CPSBN)

October 2017



## Who Is Rivada?

Rivada is an innovator in Public Safety broadband communications and wholesale mobile-data markets



Specializing in Public Safety communications, Rivada will deliver a purpose-built Public Safety network that ensures financial sustainability of the CPSBN.

### Experience

Veteran team of global industry leaders and innovators with significant wireless, wholesale and Public Safety experience

### Purpose Built

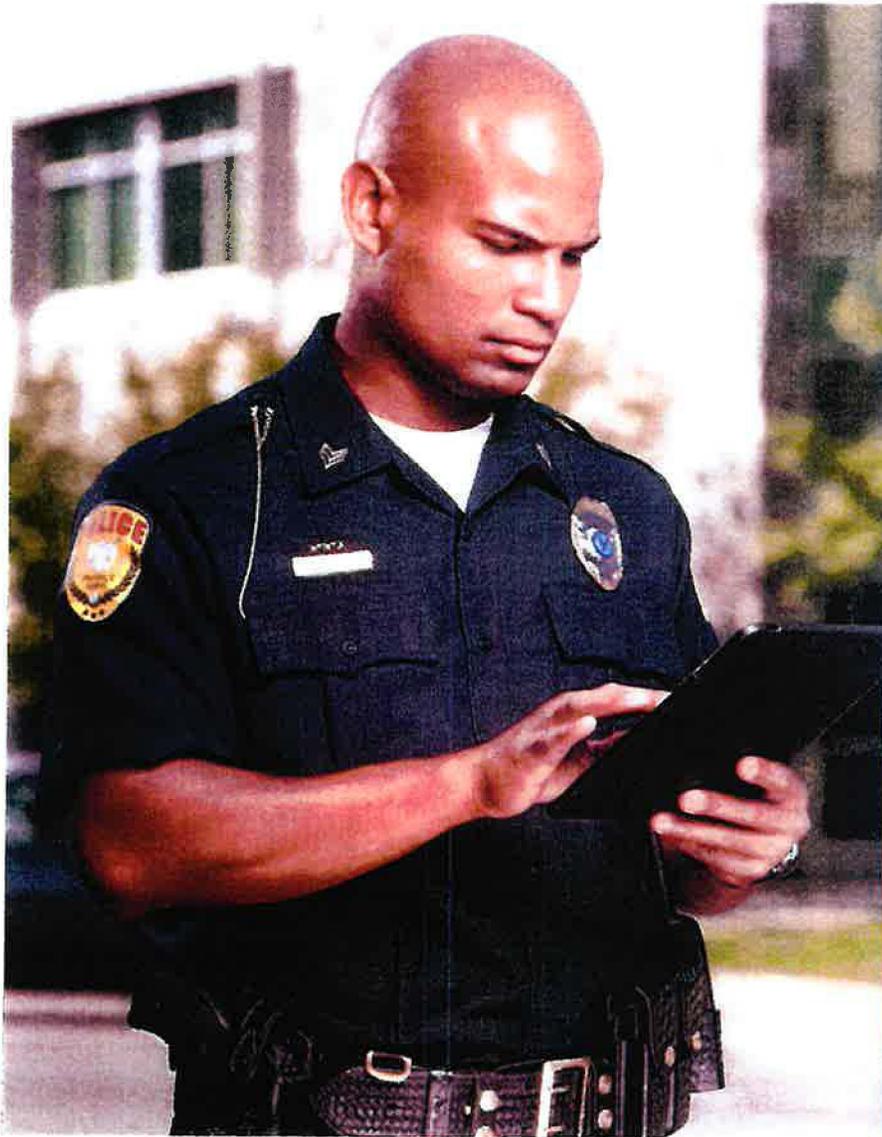
Purpose-built unified communications platform serving all Public Safety and driving innovation

### FirstNet Knowledge

Since 2006, Rivada Networks has been heavily involved in making the NPSBN a reality for Public Safety

### Open Market and eLBS IP

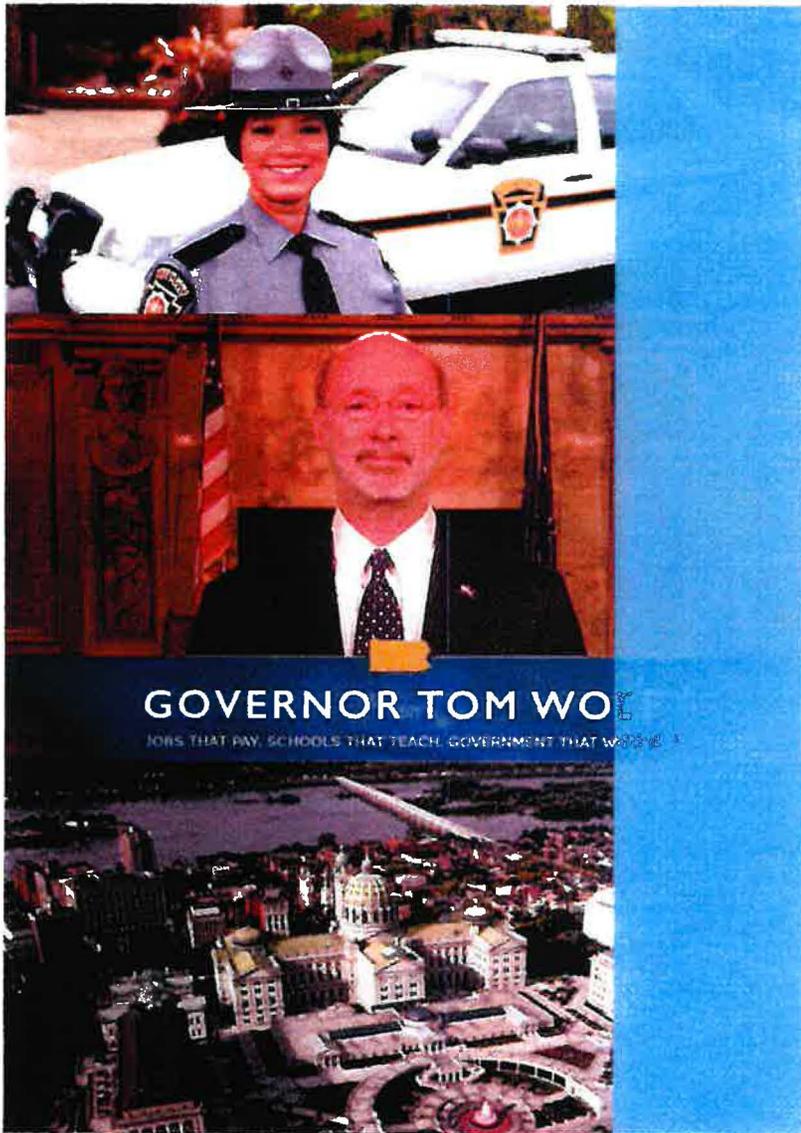
Innovative and revolutionary portfolio with over 300 patents covering wireless markets and enhanced-location services



## Opportunity: Rivada Will Build an Unprecedented Network in Pennsylvania

- Only network focused on Public Safety and only dedicated wholesale network in the Commonwealth
- Rivada will have the most extensive area and population coverage of any operator in Pennsylvania
- No legacy network and overhead = lower cost, higher performance
- Superior and best in-building coverage due to low frequency spectrum, broad deployment
- The only business model that provides sustainability over 25 years and the opportunity to reinvest in the network

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**GOVERNOR TOM WOLF**

JOBS THAT PAY. SCHOOLS THAT TEACH. GOVERNMENT THAT WORKS.



## What does this mean to Pennsylvania?

### A dedicated Band 14 wireless network for Public Safety

- Pennsylvania retains an asset (spectrum) that is worth as much as \$520M.
- Extended coverage and best technology for First Responders.
- Low cost to incentivize adoption.
- Public Safety grade and resilient to disasters.
- True local control: "A Pennsylvania Network for the Commonwealth".
- A self-sustainable business model that does not require money from Pennsylvania.

### Empowering Governor Wolf's Initiatives

- Generation of 6,000 direct, indirect and induced jobs.
- Enhanced connectivity for public schools and educational centers.
- Bring Internet access to unserved areas of the Commonwealth, residential and small business.
- Leveraging Commonwealth-owned fiber and other assets.

### Smart Connectivity

- Pennsylvania to become the leader of the Smart Cities movement, with the potential to lead the country in technological advancement and innovation.

### More Competition > Lower Prices

- Rivada's Neutral Carrier nature will foster more competition among wireless commercial networks, lowering prices and benefiting all Commonwealth residents.

## What Pennsylvania gains by “Opting Out”?

1. Retain 700 MHz spectrum for the benefit of all residents of the Commonwealth, and do not give a \$520M automatic gift to AT&T by opting in.
2. Build the dedicated, safety grade, purpose-built network that Public Safety in Pennsylvania deserves.
3. Exercise true Local Control. Decide who has priority/preemption. Do not let others control YOUR network.
4. Bring real savings to Public Safety at local and state level, foster competition, and exploit the network for technological advancement. The CPSBN should benefit ALL Pennsylvania.
5. No financial obligations for Pennsylvania. NO-COST Model.

**Opting Out : Nothing to lose and MUCH MORE TO GAIN**



RIVADA

TECHNICAL PLAN – OVERVIEW

## Deployment Schedule and Coverage

Year 1 - 85.2% Pops Coverage



Year 2 - 99.1% Pops Coverage



Year 3 - 99.3% Pops Coverage



Year 4 - 99.5% Pops Coverage



Rivada will offer the BEST  
LTE Coverage:  
**Area Coverage: 94.6%**  
**Pops Coverage: 99.5%**

**Rivada's Band 14 coverage footprint provides**

- Better than commercial coverage
- Ruthless Preemption for public safety
- Priority Access for public safety
- Mission Critical Services for public safety

### Cost

Build CAPEX (4 years): ~\$342M

CAPEX (25 years): ~\$1.6B



Coverage Sites

**1,284**



## Buildout Timeline and Methodology



- 4 teams of SME's deploying 440 sites over 3 yrs
- Borrowing from proven methodologies and tools used accelerate New LTE deployments across the US
- Follows same systematic approach across the Commonwealth
- High Transparency
- Leveraging Local Certified Contractors
- Site by Site Focus – daily updates
- Speed to Market - without compromising network design or capabilities
- Utilizing existing commercial and government assets when available
- Leasing infrastructure and transport capacity when practical and reliable
- Dynamic – senior team members ability to take corrective action in the field incl. automated reporting



## Comparability to AT&T's approach

	Rivada Approach	AT&T Approach
<b>Coverage</b>	<b>Better Rural Coverage. All coverage on band-14 Public Safety Spectrum.</b>	Leveraging their existing network footprint across multiple frequency bands.
<b>Interoperability</b>	<b>Uses proven tier-1 LTE infrastructure that is 3GPP standards compliant and inherently interoperable. We use the same vendors that AT&amp;T uses to ensure interoperability with FirstNet.</b>	The best way to ensure interoperability across the nation is using the same frequency band across the entire network. AT&T is not planning to build a state-wide Band 14 network.
<b>Priority &amp; Preemption</b>	<b>Only Rivada can guarantee Ruthless Preemption and true Tiered Priority Access, because we invented the technologies. They are fully 3GPP compliant and interoperable with LTE.</b>	AT&T leverages generic infrastructure vendor supplied features for very basic Priority and Preemption.
<b>Applications</b>	<b>The legislation only requires States to be responsible for their Radio Access Network (RAN). Rivada suggests that Pennsylvania use the FirstNet application ecosystem.</b>	AT&T is required to establish a public safety application store front as part of the FirstNet requirement. It is expected that more than 99% of FirstNet applications will be from 3 <sup>rd</sup> parties.
<b>Access to Commercial Bands</b>	<b>CPSBN users will have coverage from the Sprint network whenever Band-14 is unavailable as a temporary or fallback solution.</b>	AT&T provides access to non-public safety bands, on their commercial network, that do not have the same licensing benefits of LTE band-14. Commercial spectrum limits both network performance and interoperability with other States.
<b>Local Control</b>	<b>True Local Control – Allowing First Responder incident commanders to have policy controls for specific groups of public safety users, with high granularity if desired.</b>	Pre-set network-wide controls available to First Responders. Public Safety has no control over specific network policies, only high level toggles.
<b>Public Safety Grade</b>	<b>Establishing a comprehensive PSG plan that address both infrastructure and operational service reliability</b>	AT&T will operate NPSBN sites at the same grade as their commercial network.

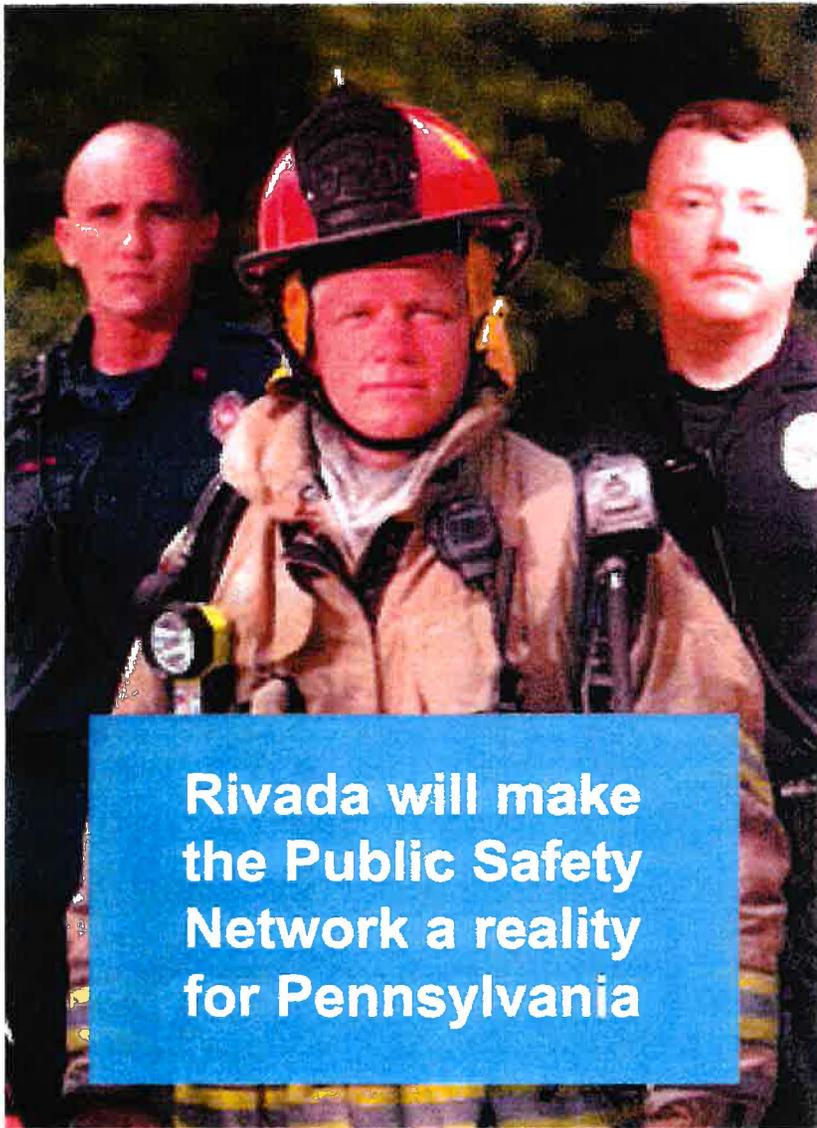
## Integration with FirstNet Core

<b>Compliant with FCC Requirements</b>	The CPSBN is fully compliant with the standards defined by law and presented in the FirstNet RFP, also known as the Required Minimum Technical Requirements (RMTR) and recently reaffirmed by the FCC.
<b>Seamless Service</b>	Seamless service between the networks is ensured by using the same standards that are used by operators to ensure interoperability across the world every day and that AT&T uses. Any incompatibility is manufactured by AT&T to raise false concerns. Verizon's public remarks validate this statement.
<b>Unified Security Standards</b>	The foundational security layers of the network are defined in the LTE standards and are completely compatible between the networks. In addition, Rivada's "defense in depth" security strategy is consistent with industry standards. Rivada fully supports any information exchange that will enhance security between the networks.
<b>Applications</b>	Rivada will host the same application services as FirstNet in the event that AT&T continues to deny access to their application servers by opt-out states. This approach will allow Pennsylvania to determine and control the deployment of applications according to the needs of Pennsylvania's public safety users.
<b>Quality of Service and Priority and Preemption (QPP)</b>	The Rivada implementation of the CPSBN allows local public safety entities to set and control the QPP settings for their first responders. The local incident commanders will need this control in the event of an emergency. Basic QPP parameters can be passed through through to the AT&T/FirstNet network in much the same way as subscriber plan information is passed between networks to enable roaming.
<b>Local Control</b>	Rivada gives Pennsylvania First Responders the ability to manage the user experience and priority levels for visiting first responders to ensure that, during an emergency, both visiting and local first responders can work together seamlessly as a team with the appropriate priority and access levels.



RIVADA

FINANCIAL PLAN – OVERVIEW



**Rivada will make  
the Public Safety  
Network a reality  
for Pennsylvania**



## Sustainable Financial Model

### Public Safety

- Free Voice and Text, low-priced Data plans, one unlimited plan and one pooled plan, including \$0.01 access fee and 2GB Free for Primary First Responders<sup>1</sup>
- Preferential Pricing Plans for Extended Primary Users

(1) Primary First Responders defined as Police, Fire, and EMS – Certain limitations apply.

### Self-Sustainable Network + Financing

- Excess Capacity Monetization of the Network
- Financing:
  - Project will need about \$418MM
  - About 36% of total funding covered by NTIA Grant (\$149M)
  - Remaining balance to be facilitated by Rivada and supported by wireless equipment providers and top financial institutions:

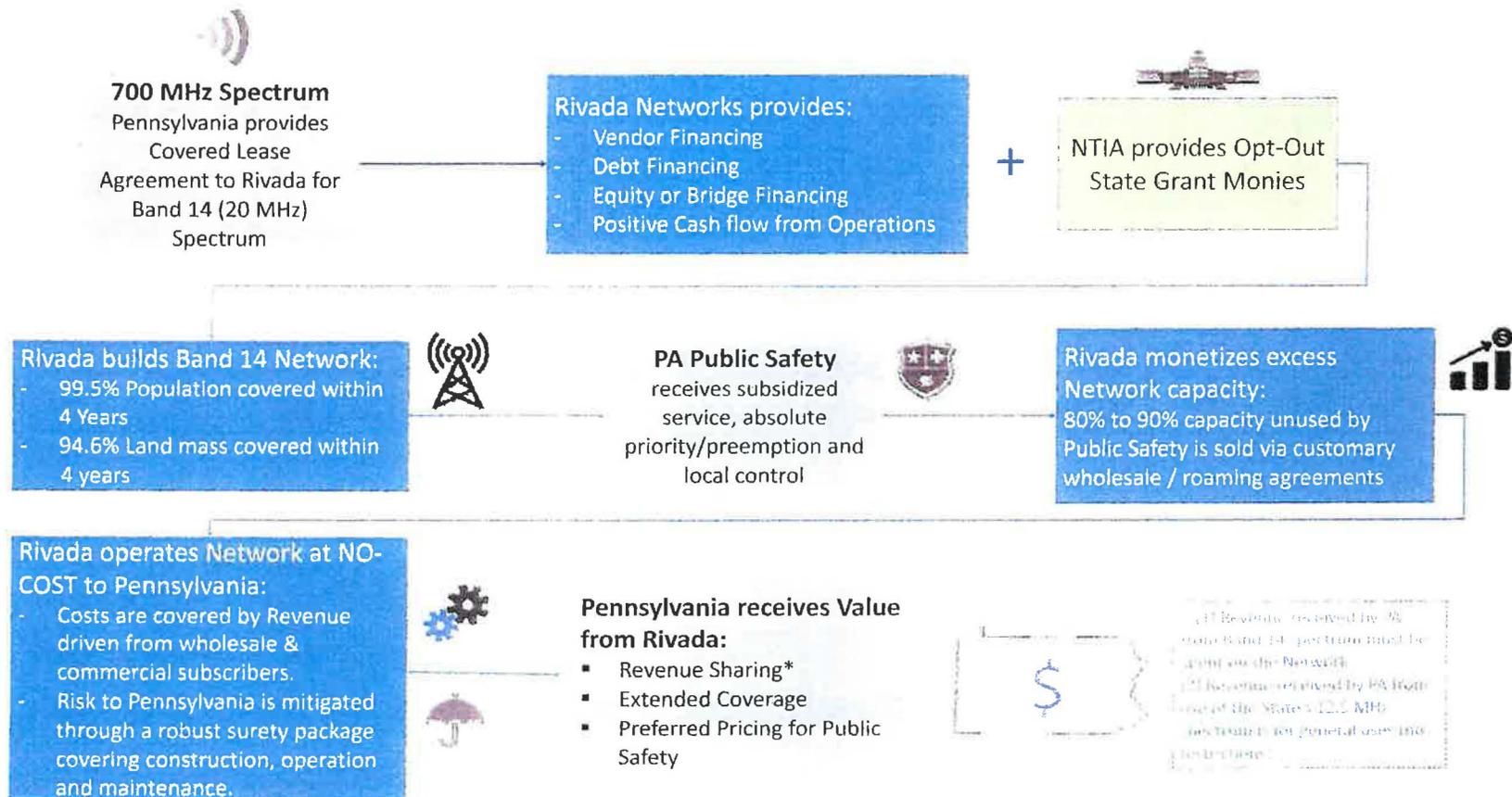
Morgan Stanley



Deutsche Bank

KKR

## Rivada's Business Model



## Expected Value to Pennsylvania

**Expected Cash Value – 3% Revenue Sharing with State** **\$382MM**

•Potential uses by Pennsylvania:

- Increase rural coverage overtime
- Cover cost of communication services: State budget savings
- Allocate funding to support local Public Safety communications programs

**Expected Cash Value – Payments to FirstNet and Taxes** **\$580MM**

•Payments to or on-behalf-of the State of Pennsylvania:

- Spectrum Leasing Fees
- FirstNet Core Payments
- App Ecosystem Payments

•State Taxes

**In-Kind Value (Preferential Pricing Plans – Public Safety)** **\$1,142MM**

**Total Expected Value Pennsylvania (25 years): \$2,104MM**



**JOBS** ~6,000 Direct, Indirect and Induced Jobs

## User Data Plans: Public Safety



**ONE**

- ☐ \$0.07 Monthly Service Charge
- ☐ \$/GB charge for usage beyond 25
- ☐ Unlimited Talk and Text
- ☐ First 2GB of Data Included Per Month, on Pooled Basis
- ☐ Includes Hotspot Capability, Quality of Service, Priority and Pre-emption (QPP)



**\$20 UNLIMITED**

- ☐ Unlimited Talk and Text
- ☐ Unlimited High Speed Data
- ☐ Includes Hotspot Capability, Quality of Service, Priority and Pre-emption (QPP)

- Simple Rate Structure
- Low entry barriers to overcome price sensitive thresholds
- Priority and Pre-emption at no cost for Primary First Responders
- Rivada to guarantee offer for 5 Years

(1) Notes:

- Data speeds may be temporarily slower at times of network congestion in a non-emergency scenario.
- Under no circumstance will Rivada slow down speeds when the network is congested in the event of an emergency.
- Rivada will offer a separate service whereby data speeds are guaranteed not to be slowed down in times of network congestion in a non-emergency situation. As part of this service, any incremental usage above the monthly data allowance or hotspot allowance will be charged at the prevailing rate with expected market rates per GB/month, e.g., 2018 pricing of \$8.26/GB, 2019 pricing of \$6.21/GB, 2020 pricing of \$4.85/GB. No throttling.

## Financing / Bonding

### Financing

- Requirements: \$418M
- Combination of:
  - NTIA Grant - \$149M (It is \$160M in Proposal)
  - Vendor Financing - \$77M
  - Debt / Equity (including 20% matching federal grants) - \$192M (It is \$181M in Proposal)
  - Positive Cash Flows from Operations > Capex Maintenance

### Bonding Package

- Completion and Ongoing Operational Risk Mitigation:
  - Performance and Payment Bonds
  - Financial Guarantee Bond
  - Annual Concessionaire Bond (Operation and Maintenance)

**No-COST and Low-RISK plan for Pennsylvania**

Notes:

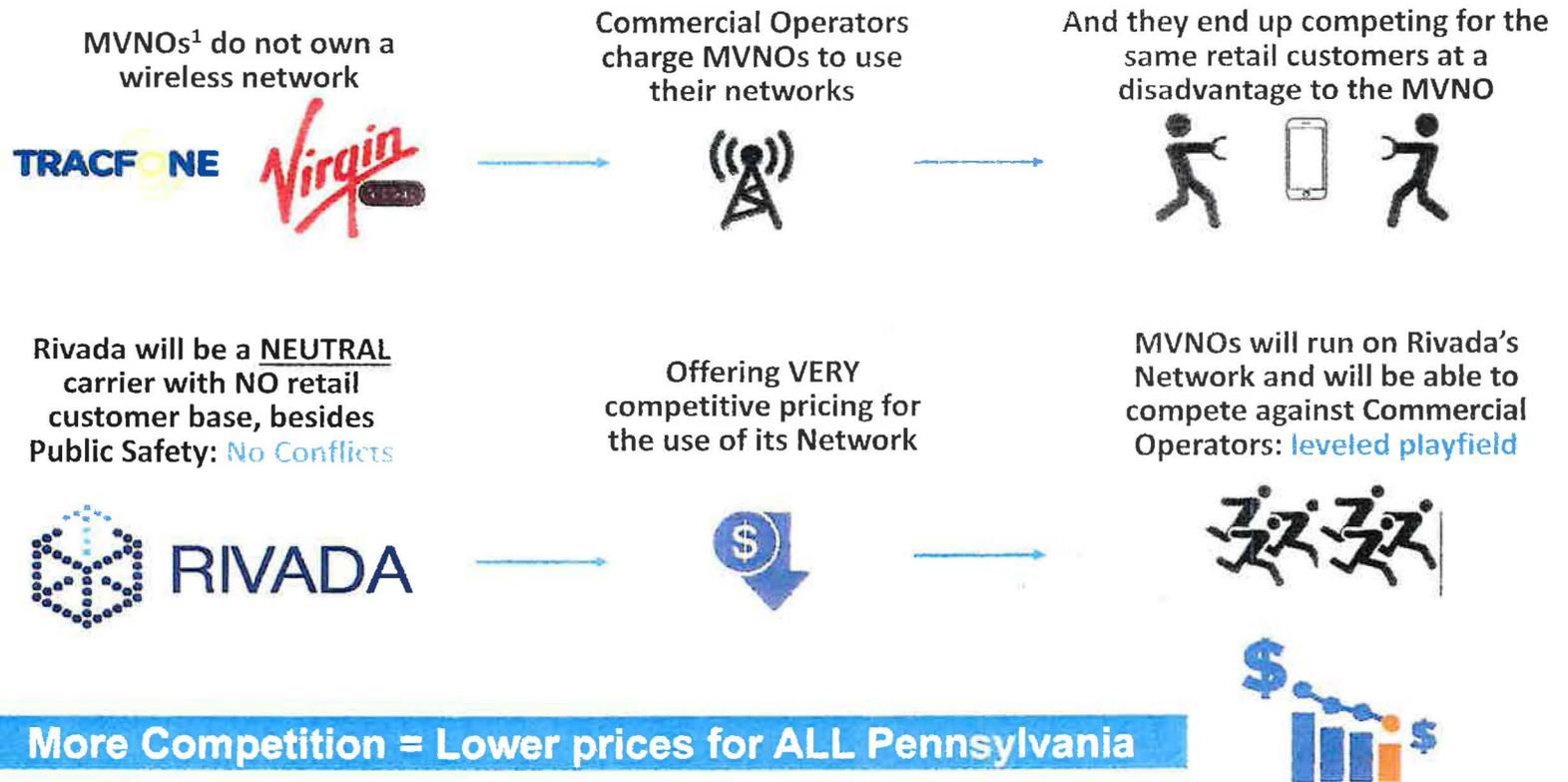
- Performance and Payment Bonds will remain in place throughout the entire construction period and will not be retired as and when coverage targets are met.
- Under no circumstance will Rivada slow down speeds when the network is congested in the event of an emergency.
- Rivada will offer a separate service whereby data speeds are guaranteed not to be slowed down in times of network congestion in a non-emergency situation. As part of this service, any incremental usage above the monthly data allowance or hotspot allowance will be charged at the prevailing rate. No throttling.



RIVADA

APPENDIX

## How Wholesale Networks Work



(1) MVNO = Mobile Virtual Network Operator

## Achieving Revenue Objectives

### Wholesale

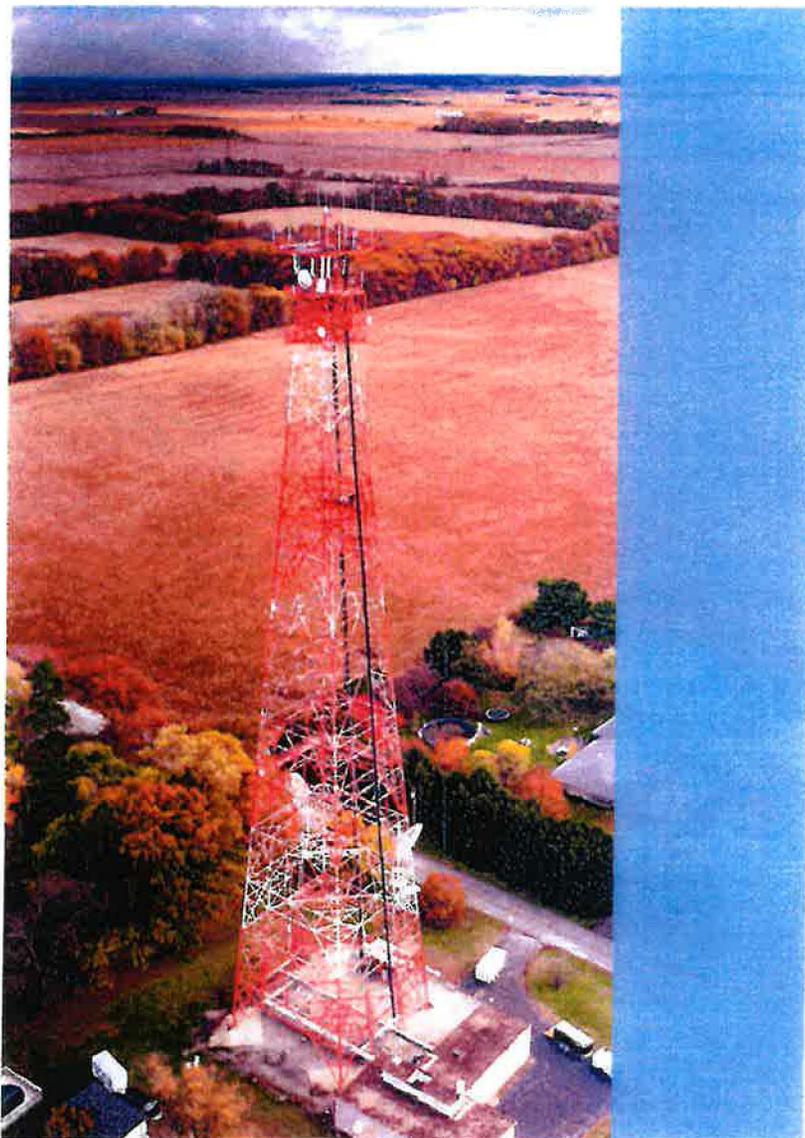
- Wholesale-only provider eliminates the conflict of interest in the carrier retail / wholesale market
- Wholesale creates attractive neutral network with transparent, non-discriminatory pricing to MVNOs

### Roaming

- Best network coverage will drive demand

### Extended Primary Users

- Best coverage and economics will drive volume



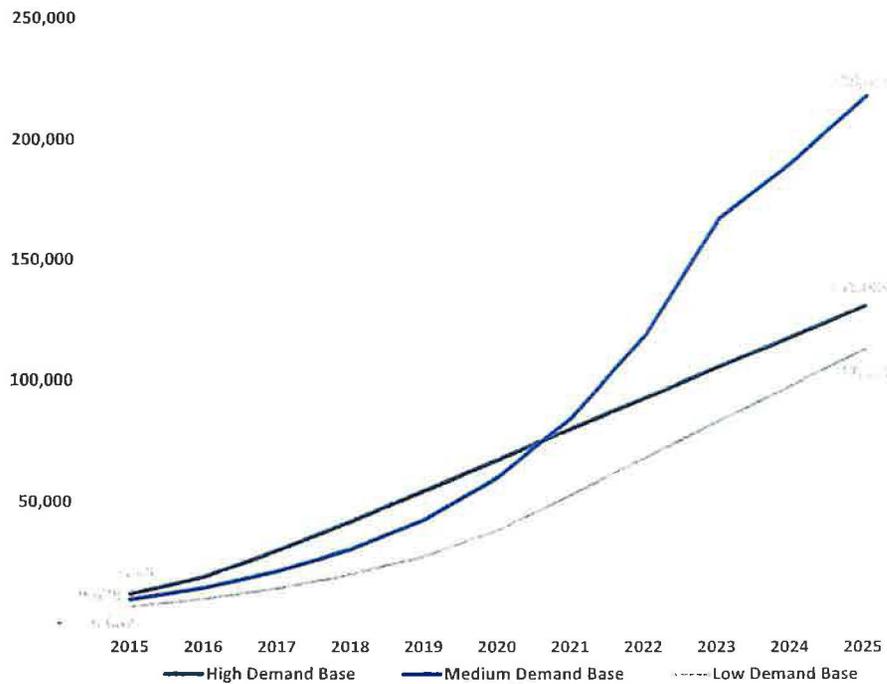
## Revenue Streams and Potential Customers



# Data Demand - Wireless

Wireless data growth in the U.S. has been explosive since 2011: using a conservative estimate, the wireless demand will grow from 20,402 PB/year in 2018 to over 113,000 PB/year by 2025 with a CAGR of 27%

Wireless Demand (2015-2025) PB/Year; 7-year CAGR



### Implications

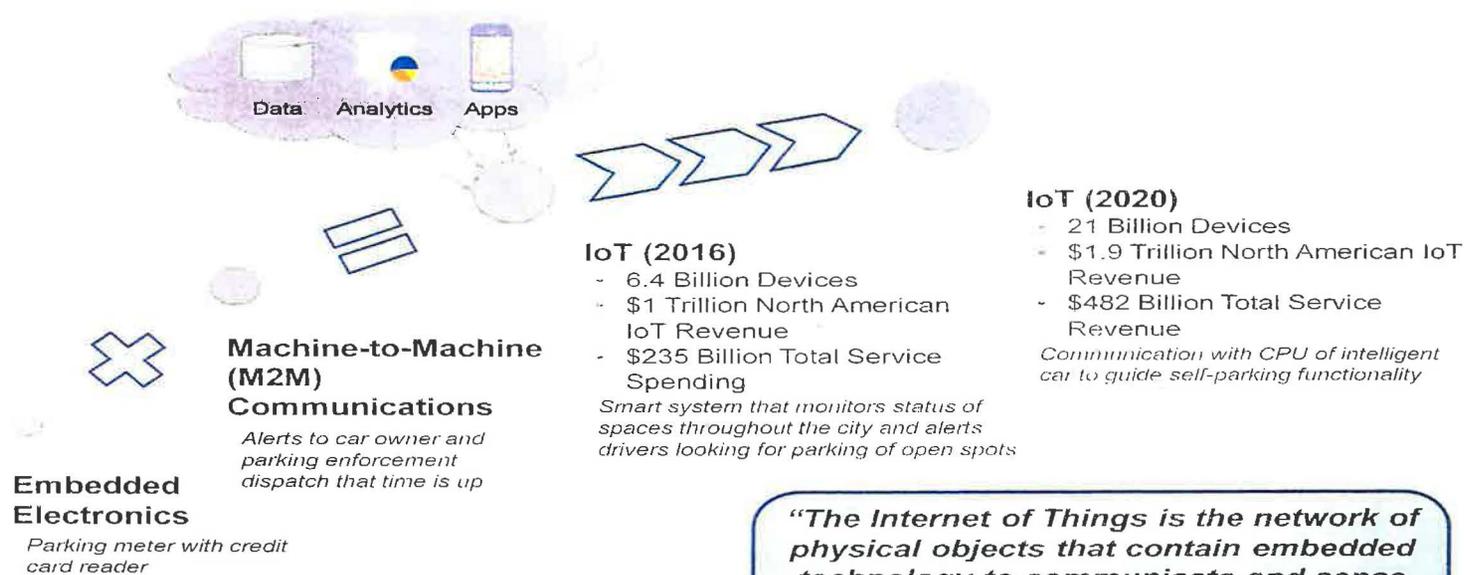
- The long build out of wireless infrastructure means stop-gap measures may be required in the interim to support mobile traffic growth in certain areas and times
  - Technological improvements may not be sufficient to address the growth demand
  - FirstNet add provides additional capacity for innovation and economic growth
- The medium demand base case has a higher CAGR beginning in 2020, driving its uptick

### Key Growth Drivers

	Devices	Uses
Human	<ul style="list-style-type: none"> <li>▪ Smartphones</li> <li>▪ Phablets</li> <li>▪ Tablets</li> <li>▪ Gaming devices</li> <li>▪ Cellular modems</li> <li>▪ Etc....</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mobile gaming</li> <li>▪ Video</li> <li>▪ MMS/SMS</li> <li>▪ Email/Web</li> <li>▪ Music/OTTs</li> <li>▪ Etc....</li> </ul>
Non-Human	<ul style="list-style-type: none"> <li>▪ Vertical-specific IoT</li> <li>▪ M2M communications</li> <li>▪ Connected cars</li> <li>▪ Sensors</li> <li>▪ Smart machines</li> <li>▪ Etc....</li> </ul>	<ul style="list-style-type: none"> <li>▪ Optimization</li> <li>▪ Sensing</li> <li>▪ Communication</li> <li>▪ Health and Safety</li> <li>▪ Operations</li> <li>▪ Etc....</li> </ul>

# Internet of Things (IoT / M2M)

Gartner's 2014 forecast: 2.4B IoT devices in 2015 to 8.4B in 2020



**“The Internet of Things is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal state or the external environment.”**  
 – Gartner (2014)

# Rivada Business Model



Our business model is based on being the premier public safety and wholesale service provider.

## Public Safety Focus

Purpose built unified communication platform serving all Public Safety and driving innovation



**Public Safety**  
First responders need access to real-time mission-critical connectivity and data services



**Best-in-Class Technology**  
LTE Technology that offers the best coverage and performance because it matters



**Preferential Pricing**  
A service that Public Safety can massively adopt due to very attractive rate plans

## Wholesale

Rivada's business model turns networks into markets



**Roaming**  
Demand for network roaming from other carriers will drive revenue



**Wholesale**  
MVNO's desire a neutral wholesale-only network provider



**Machine-to-Machine**  
M2M providers need on demand connectivity in the right place at the right time

## Neutral & Trusted Partner

Rivada is a truly neutral provider of wireless capacity



**No conflicts**  
As a wholesale operator Rivada is not conflicted and supports all providers



**Low Cost**  
Focused on delivering advanced connectivity at the lowest cost per bit



Efficient use of all spectrum resources available

## Dynamic Spectrum Arbitrage and Open Access



With Rivada's Open Access technology, capacity can be purchased in any combination of time, location and priority – driving the ability to monetize excess capacity of all carriers

Segmentation  
by Time of Day



Network capacity can  
be sliced by time of  
day for auction to  
buyers

+

Segmentation  
by Location



Network capacity can  
be sliced by location for  
auction to buyers

+

Traffic  
Prioritization



Traffic can be easily re-  
prioritized and users can be  
switched seamlessly to other  
systems in milliseconds

## Enhanced Location Based Solution (eLBS)

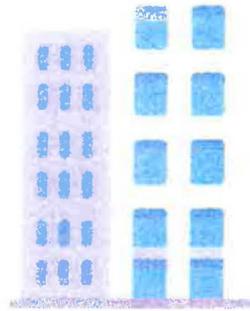
Rivada's eLBS offers distinct differentiation compared to current location based service solutions – driving the ability to monetize this solution

### Indoor and Underground



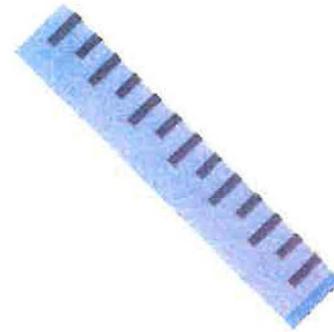
Rivada's can deliver indoor and underground location.

### Outdoor Urban and Obstructed



In urban areas with restricted view of the sky, Rivada can improve location accuracy.

### Enhanced Location Accuracy



Even in areas with a clear view of the sky, Rivada can deliver enhanced accuracy.

### Jamming and Interference Resistant



When GPS signals are not available, Rivada can use multiple inputs to distribute location information on a peer to peer basis.

## Patent Portfolio



Innovative and revolutionary portfolio with over 300 valuable and relevant patents developed over past 10 years

### Number of Patents Filed

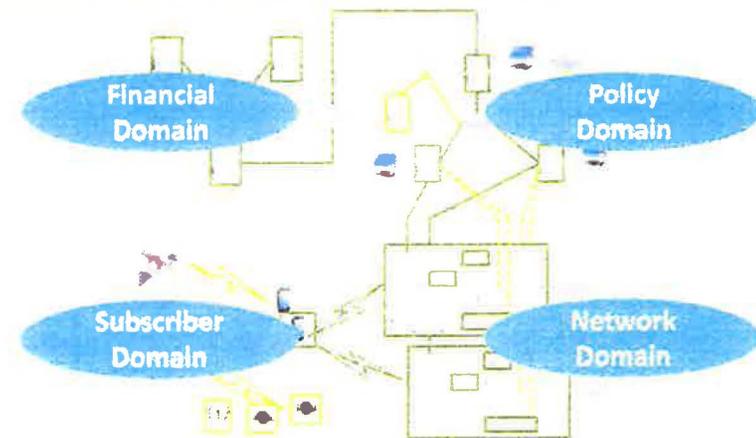
**313**  
Provisional 21



### Opportunities to Monetize Portfolio

- Further developing IPR
- Developing products and apps
- Pursuing partnerships and licensing deals
- IPR: Open Access Wireless Market and enhanced Location Based Services (e-LBS)

### Communication Value Chain by IP Domain



# Rivada's Board of Directors



Rivada's board has a powerful mix of seasoned public safety experts and communications investors



**Robert C. Sandley**, former Chairman and Chief Executive Officer of Rivada Networks  
 Sandley is primarily a telecommunications entrepreneur, having built businesses across Europe, Russia, and the United States. Representing Rivada Networks, Sandley received the Louisiana National Guard Distinguished Civilian Service Medal for his work of using Hurricane Katrina



**U. Michael Malley**, former Governor of Maryland  
 U. Malley served two terms as Governor of Maryland from 2002-2010. Prior to that, he served two terms as Mayor of Baltimore. He co-founded the National Governors' Association's Task Force on Homeland Security and was the first Maryland governor to deliver interoperable radio communications for all of Maryland's first responders.



**Tom Bush**, former Governor of Florida  
 In 1999, he was the 33rd governor of the state of Florida, serving from 1999 through 2007. Prior to and after his tenure as Governor, Bush was actively involved in the private sector helping to build the largest full service real estate company in South Florida and owning and operating successful consulting and investing businesses.



**Lippa Hubel**, former CEO of Acquia  
 Lippa Hubel co-founded Acquia and Acquia, two international investment management companies, and currently serves as the Chairperson of the Board at Acquia and CEO of Acquia. Prior to this, Lippa spent nearly 15 years at Swiss Re between Zurich and New York where, as a Managing Director, she held legal and risk management responsibilities that extended to Latin America.



**John J. Johnston**, former Under Secretary of Homeland Security  
 Johnston was appointed as America's first Under Secretary of Preparedness at the Department of Homeland Security in December 2005. On March 11, 2007, he became the first Under Secretary for National Protection and Programs at DHS.



**Richard G. Myers**, former Chairman of the Joint Chiefs of Staff  
 Gen. Myers became the 16th Chief of Staff of the Joint Chiefs of Staff on Oct. 4, 2001. In this capacity, he served as the principal military advisor to the President, the Secretary of Defense, and the National Security Council.



**Michael Jackson**, former Deputy Secretary of Homeland Security  
 Jackson served as Deputy Secretary from 2005 until 2007. In this role Jackson served as DHS's chief operating officer, with responsibility for managing day to day operations.



**Mark S. Marino**, Chairman, U.S. State Chamber of Commerce  
 De Marino is an international businessman and former government official. He served as Deputy Assistant Secretary of Commerce and as Director of the U.S. State Dept. Economic Commission. He is presently a chairman of the National U.S. Arab Chamber of Commerce.



**Peter G. Sussman**, Managing Partner, EPIC investment bank  
 Sussman has 25 years of experience as a senior executive in finance. Before jointly establishing EPIC, he was Vice President for Marketing and Sales and Member of the Board of Zurich Kosmas. He works regularly in Africa. He began his professional career with IBM Africa.



**Armand Loy**, former Deputy Secretary of Homeland Security  
 Armand Loy completed a 15 year career in public service in 2008, ending as the Deputy Secretary of Homeland Security, a position that he held from 2005 to 2009. In this capacity, he was tasked with the complex task of consolidating 22 separate agencies into one unified cabinet department as well as managing the day to day activities of the agency.



**Robert J. Lutenauer**, former Chief of the Defense Staff, the Joint Military Health Institute



**Peter G. Sussman**, CEO, Martel  
 Prior to joining Rivada's Board, Lutenauer served as Co-CEO and CFO of Antrix, a Rivada Networks. Previously, he served as Chief Financial Officer of Sprint Corporation from April 2011 until December 2015. Over the course of his nearly 15 year career in telecom and media, Lutenauer has held CEO and CFO positions at Sprint, Qwest Communications (now CenturyLink), XM Satellite Radio, and Comcast. He was appointed Martel's CEO in September 2017.

# Rivada's Management Team



We have built a strong management team with deep financial and operational experience



**Bill Farber, President, Technology and Services**  
 Bill Farber is primarily a telecommunications entrepreneur, having built businesses across Europe, Russia, and the United States. Representing Rivada Networks, Bill has received the Louisiana National Guard Distinguished Civilian Service Medal for his work during Hurricane Katrina.



**John O'Flaherty, CEO**  
 O'Flaherty is a founding member of the Rivada team and has over 20 years' experience in technology planning and operations. He has been a part of Bill Farber's management team for more than 14 years. Previously, he worked with Accenture in their High Tech Strategy group in London.



**Octavia Patrick, CFO**  
 Octavia is a senior finance professional with over 20 years' experience in the telecommunications sector. Previous senior management positions include Senior Finance Director at Nortel Networks from 1998 and Chairman of Director of M&A at Ciena from 2010. Octavia served on the Board of Directors for a number of Nortel Networks companies. She is a fellow member of the Institute of Chartered Accountants and an associate member of the Institute of Taxation in Ireland.



**Peter Campbell, COO**  
 Prior to joining Rivada, Campbell was COO with Sprint Corp. His management experience includes network engineering, construction, provisioning, maintenance, regulatory matters, labor relations, customer service and finance. He has significant experience in successful vendor management, outsourcing and contract negotiations and IT transformation.



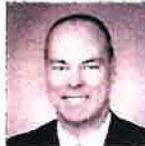
**Sarah Frotzel, Executive Vice President of Sales**  
 Frotzel is an experienced and accomplished sales executive, having previously served as Vice President of Sales for Ericsson, Vice President of Sales and Operations for Nortel, and most recently as President of Sprint Enterprise, Wholesale and Wireless Solutions.



**Ken Fields, Director of Market Development**  
 Ken has over 30 years of investment/risk management experience. He began his career on Wall Street managing proprietary capital for Shearman/Clinton Bruttles and Bankers Trust, then spent 10 years as an external portfolio manager for Goldman Sachs Alternative Assets.



**David Carney, Director of Corporate and Public Affairs**  
 Carney was a member of The Wall Street Journal's editorial board from 2004-2014 and editor of The Wall Street Journal Europe's editorial page from 2004, 2005 and 2009-2014. He has won several prestigious awards for his writing on economics and business.



**Bill Ewing, Chief Marketing Officer**  
 Bill brings over 27 years of experience in the telecommunications working for Sprint, Ameritech, and Level3 Communications. He served in Sprint's Global Wholesale organization as vice president of operations, product, marketing and global sales.



**Chris Moore, Director of Business Development**  
 Chris Moore leads the Rivada business development effort. He retired as the Chief of Police of the San Jose Police Department after serving for over 30 years as a police officer and after serving every rank within the Department. In 1999, Chris was selected as a White House Fellow and served one year as counsel to U.S. Attorney General Janet Reno. He joined Rivada in 2014.



**Peter Chantoin, Director of Finance**  
 Chantoin is a Professor of Economics at the University of Maryland and European University Institute. Since 1983, he has conducted widely cited research in economic theory and practice. He has advised numerous governments on market design and has advised dozens of holders of major public markets.



**John Rowley, Chief Network Development**  
 Rowley is leading strategy, planning and development opportunities for Rivada. He has over 30 years of experience in the telecommunications industry. He was most recently vice president of business development at Sprint, where he spent the past 10 years.



**Stephen Bye, Technology Advisor**  
 Bye, previously CTO for Sprint, has 24 years of senior management experience in network strategy, planning, product development and management, network and technology development, network and engineering, network operations, construction and deployment, telco core systems integration and testing.