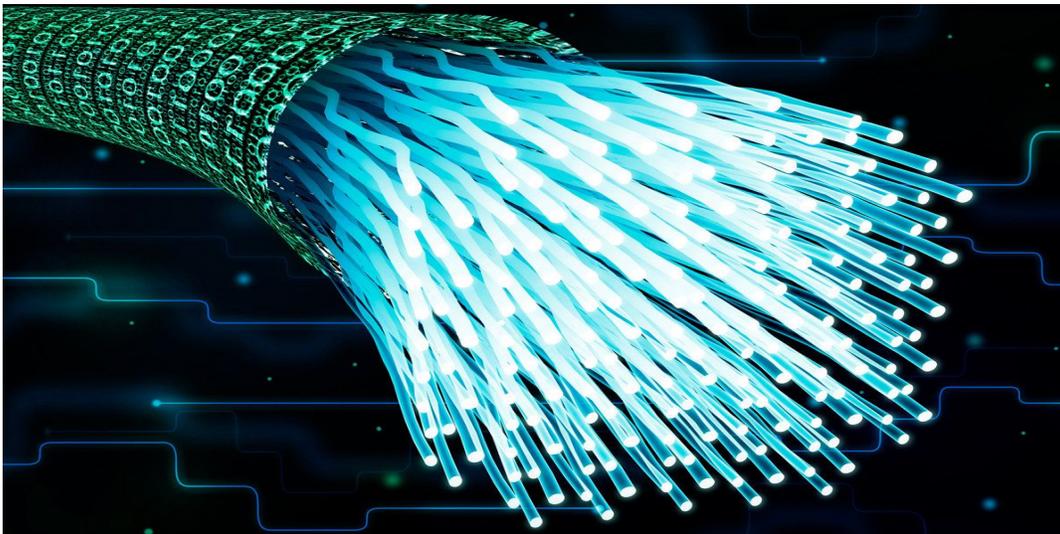


Providence City Technical Advisory Committee (TAC)

Second Recommendation to City Council

Municipal Fiber-Optic Network Technical Review



Introduction

The Providence City Technical Advisory Committee (TAC) is a volunteer advisory committee formed by Providence City Staff at the request of the Providence City Council to further advise the City Council on technical and logistical matters related to the pursuit of a municipal fiber-optic network. The TAC is made up of citizens and staff of Providence City and includes outside industry fiber-optic expertise. All citizens of Providence City have been invited to join the TAC based on interest and/or technical expertise related to the subject matter of municipal fiber optic networks. The TAC consists of members with expertise in the following minimum areas: electrical and computer engineering, public broadcast engineering, amateur and public radio, public works and construction, network engineering, and fiber-optic project management.

Background

In September 2020, the TAC provided a [first recommendation](#) to the City Council regarding a municipal fiber optic network. In the [City Council Meeting](#), the City Council accepted the first recommendation and directed the TAC to further pursue technical and logistical details for a municipal fiber optic network. Since this time, the TAC has met on a weekly basis or as information has become available. As part of the technical review, the TAC took part in considering and providing feedback on several of Strata's technical proposals including a substantial amount of detail. Strata subsequently provided the City Staff and the TAC with a first draft for proposed Network Construction and Network Operation agreements. The TAC met independently of Strata and then provided several concerns and feedback to Strata on several topics. Since this time, Strata has provided responses to the TAC and a second draft set of agreements in an effort to resolve those concerns. This document provides the TAC's second recommendation to the City Council regarding technical and logistical aspects of this new draft agreement being provided to the City Council. These recommendations are focused solely on technical and logistical considerations and in no way represent a legal review nor recommendation on legal aspects of the agreements.

Frequently Asked Questions (FAQs)

The TAC has provided, in addition to its first recommendation, a set of [frequently asked questions \(FAQs\)](#) and respective answers which can be found on the Providence City Website. The TAC invites the City Council and the public to review the FAQs and provide any additional feedback or questions that would help to clarify the municipal network construction and operation plans.

Summary of TAC Recommendations

The TAC continues to recommend that the City Council pursue the Utility Model for a fiber network as laid out in the [Strata PPP](#) and as included in the latest agreements provided to the City Council. The premise of this model is that all residents of Providence City would have a physical fiber presence or hookup to the fiber optic network upon completion of the fiber optic network deployment. As part of the Utility Model, every resident pays a

minimum (currently estimated/planned) \$10 utility fee. This fee would provide every resident minimal internet service at lower speeds yet to be determined (e.g., between 2-5 Mbps download and between 1-5 Mbps upload currently being considered by TAC). As part of the Network Operator's agreement, at a minimum, the network operator would act as an internet service provider (ISP) and provide this free service to all residents that do not subscribe to a higher rate of service (e.g., 250 Mbps or 1 Gbps symmetric download/upload). Other ISPs on the network could also choose to provide the minimum service for free to promote their services as well. The TAC and Strata continue to recommend that the municipal fiber optic network remain an Open Access Network (OAN) such that any ISP that meets the conditions set forth by Providence City (including signing an ISP agreement yet to be developed) can offer internet service on the fiber network.

Specifically, after reviewing the latest draft agreements, the Providence City TAC recommends that the City Council consider the following:

1. That Providence City continues to pursue the municipal fiber optic network outlined in the latest draft Network Construction and Network Operation agreements.
2. That the agreements undergo final review and signature once the following have been considered: the TACs risk considerations and mitigation strategies, legal counsel review, and financial bond and impact review, and appropriate public input.
3. That the TAC continues to meet with Strata to review engineering plans, consult with City Staff, and provide technical and logistical feedback on each of the engineering phases.
4. That the TAC provides input to the City Staff and City Legal Counsel toward development of an ISP agreement and pursuit of ISPs for the municipal fiber optic network.

The Providence City TAC continues to emphasize the importance of high-speed internet connectivity in today's fast-paced and communication-based world. The TAC believes that the Providence City municipal fiber optic network plans, as currently laid out, represents the start of a paradigm shift and hopes that Providence City will be a leader in using this newly developed model for municipal networks.

In addition to confirming the specific direction the city should pursue, the TAC invites the City Council to provide further feedback to the TAC regarding additional work and any concerns raised by the City Council or citizens of Providence City.

For this purpose, the TAC awaits further input and specific direction from the City Council on how to proceed.

Risk Consideration and Suggested Mitigation

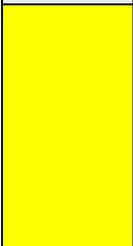
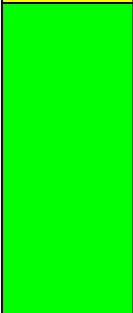
During review of the technical and logistic considerations as well as the draft agreements submitted by Strata Networks, the TAC recognized a number of risks and discussed some mitigation strategies for these risks. The listed set of risks is not intended to be comprehensive and only those risks associated with technical or logistical concerns, in accordance with the recommendations from the TAC, are provided. The TAC notes that a significant number of risks have already been mitigated in discussions with Strata and so these are not included in the list below. The low risk items have already undergone some mitigation through TAC input and efforts.

Risk Color Code:

 Low Risk

 Medium Risk

 High Risk

Risk Level	Potential Risks	Potential Mitigation Strategies
	GENERAL: Insufficient subscription / take-rate of enhanced Internet services to pay for build-out. Risk is somewhat low due to low take-rate required but impact is very high if take-rate is not met.	<ul style="list-style-type: none"> ● Marketing through basic Internet service and network ISPs. ● Pre-commitment priority fee option. ● Increased utility fee.
	GENERAL: Unforeseen problems or natural disasters during or after build-out	<ul style="list-style-type: none"> ● The additional revenue from fiber network is used for the network (as opposed for use in other areas of the city). ● Ensure agreements

		include considerations for the “worst-case” for budget and thus build margin for error into the project.
	GENERAL: Unable to persuade ISPs to join the Providence City open-access fiber network	<ul style="list-style-type: none"> • Review terms in Network Operation agreement with Strata Networks for Strata Networks to be a minimum ISP option • Market opportunity to ISPs.
	GENERAL: ISPs might not provide the basic internet service for the utility fee to non-subscribers in the utility model	<ul style="list-style-type: none"> • Ensure basic internet terms in Strata agreement • Consider terms in future ISP agreements
	GENERAL: When there is an issue with Internet service it could be either the responsibility of the ISP, the network operator (e.g., Strata Networks in the PPP proposal), or the city. Who does the customer call?	<ul style="list-style-type: none"> • Add terms in the future ISP agreements to ensure the ISP is the point of contact for service issues. The ISP then works with the network operator and the city as-needed. • Consider whether the city can transfer calls to the city to appropriate ISP.
	GENERAL: The customer might be confused about the receipt of two separate bills - one from the city with the Internet utility / service fees and one from the ISP.	<ul style="list-style-type: none"> • Communicate early with Providence City citizens to educate them on the process for selecting an ISP and how billing will work. See also FAQs.

	<p>GENERAL: Technology evolves quickly and enhanced bandwidth above the 1Gbps may be required for some customers</p>	<ul style="list-style-type: none"> • TAC has reviewed oversubscription level of bandwidth in current proposed model by Strata • TAC / City Staff to ensure engineering plans include a minimum allowance for “jumpered” connections at a given Fiber Distribution Hub (FDH) to be converted to active ethernet or other options. • TAC recommends specifically utilizing XGS-PON equipment which has enhanced data-rate capability than traditional G-PON.
	<p>GENERAL: Providence City and its citizens are not satisfied with the services provided by a Network Operator or ISP (i.e., not meeting specific criteria)</p>	<ul style="list-style-type: none"> • Ensure agreements with ISPs and the Network Operator are set for appropriate term lengths and provide specific criteria to ensure citizens of Providence City receive the expected service. Allow for Providence City to seek immediate alternatives if criteria are not met.
	<p>NETWORK CONSTRUCTION AGREEMENT: The agreement supersedes all other negotiations and agreements including understandings reached between the TAC and Strata.</p>	<ul style="list-style-type: none"> • Ensure the agreement sufficiently covers appropriate detail to incorporate the City's expectations

		regarding the build-out of the municipal fiber network.
	NETWORK CONSTRUCTION AGREEMENT: If the City signs the Network Construction Agreement but does not give a "Notice to Proceed" in an appropriate timeframe or the City decides to terminate the agreement then the City must pay damages.	<ul style="list-style-type: none"> • Ensure appropriate detail in the agreement and then sign the agreement once City intends to proceed and immediately provide the official notice. • Consider amending agreement to indicate that the contract signing is the notice to proceed.
	NETWORK CONSTRUCTION AGREEMENT: There is no penalty in the agreement for undue delay caused by Strata. The current agreement results in completion within 1095 days.	<ul style="list-style-type: none"> • Add language to the agreement for penalty due to undue delay on the part of Strata.
	NETWORK CONSTRUCTION AGREEMENT: The scope of work in the draft agreement allows a significant amount of flexibility for the City and Contractor as the work plan is pursued. While some flexibility is required, the lack of detail also introduces risk in misunderstanding between the parties as to what is and is not included as part of the contract pricing and plan. The TAC has reviewed a significant amount of information from Strata regarding quality of materials, construction methods, and other items that would not be legally binding per the initial terms of this agreement.	<ul style="list-style-type: none"> • Consider the risk and determine whether acceptable. Some mutual trust between parties is required based on understandings developed; however, these may not be legally binding should problems arise.
	NETWORK CONSTRUCTION AGREEMENT: There is a general understanding, including Phase 1 review in Exhibit A, that every resident that is part of Providence City at the time of commencement will receive fiber to the premises, but this is not explicit in the agreement.	<ul style="list-style-type: none"> • Consider if additional explicit language is needed or if the Phase 1 details are sufficient, noting that if there are disputes then City may still be

		liable for payment of work completed.
	NETWORK CONSTRUCTION AGREEMENT: The fiber optic network design in Exhibit A includes minimum transport to Salt Lake City and an average of 1.5 fibers per household (50% budgeted overage).	<ul style="list-style-type: none"> Consider whether transport to local points of presence in Logan are also appropriate.
	NETWORK CONSTRUCTION AGREEMENT: There is no explicit mention of physical security of the network.	<ul style="list-style-type: none"> Consider whether the agreement should consider physical security of the fiber optic network. By nature fiber-optic physical security is less of a concern than wiring; however, some physical security of the termination points need review.
	NETWORK OPERATION AGREEMENT: The draft agreement includes a first right of refusal to the fiber optic network should the City decide to sell.	<ul style="list-style-type: none"> No particular issue. Consider if the City is okay with this or would like to request some sort of recompense for this clause.
	NETWORK OPERATION AGREEMENT: The draft agreement does not currently allow termination except for material breach.	<ul style="list-style-type: none"> Consider whether City should be allowed to pursue termination in case of quality / service issues.
	NETWORK OPERATION AGREEMENT: A basic no-fee service needs to be described and included as a requirement in the agreement to ensure all residents are guaranteed a minimum service for the utility payment.	<ul style="list-style-type: none"> Add terms to the agreement.
	NETWORK OPERATION AGREEMENT: City is responsible for all fiber drops not covered in the construction agreement (see above construction agreement associated risk).	<ul style="list-style-type: none"> Consider how the City will handle new fiber connections and ensure

		appropriate coverage of all existing residences in the Construction agreement.
	NETWORK OPERATION AGREEMENT: The city will pay \$20 per residential subscriber or \$30 per business subscriber. This is not intended to be applicable to residents receiving only the basic service covered for free, but the term "subscriber" is generalized to any "customer of retail Services being provided by a Retail Service Provider".	<ul style="list-style-type: none"> Clarify these fees do not apply to residents receiving the basic service covered only under the utility fee and provided by a retail service provider.
	NETWORK OPERATION AGREEMENT: The City is obligated to a minimum payment to the Network Operator of \$7,400.00 per month or the subscriber fee - whichever is greater.	<ul style="list-style-type: none"> This sets a minimum number of 370 subscribers required to cover the Network Operation fee.
	NETWORK OPERATION AGREEMENT: Exhibit A & B & F cannot be provided until created by Strata under draft Network Construction agreement.	<ul style="list-style-type: none"> Consider with Legal Counsel how to appropriately handle and whether exhibits will be continually added to the agreement during construction / operation.
	NETWORK OPERATION AGREEMENT: The draft Network Operations agreement indicates Strata will perform splicing / repairs as needed to the fiber network but minimum splicing quality criteria are only included for the construction.	<ul style="list-style-type: none"> Add splicing requirements for network operator.
	NETWORK OPERATION AGREEMENT: The agreement does not have any minimum quality standards nor specific indication of the equipment or type of network to be deployed. The TAC recommends explicitly calling out an XGS-PON network (or G-PON network in sub-parts of the city where there is no or little subscription). Furthermore, the TAC recommends explicitly setting a maximum fiber distribution split of 1:64 (though less is better) in	<ul style="list-style-type: none"> Consider how to handle it in agreement or include in Phase I engineering review.

	order to accommodate both the legacy and improved network type.	
	<p>NETWORK OPERATION AGREEMENT: STRATA has indicated in another document reviewed with the TAC that Network Operation will "manage over-subscription and ensure a non-blocking connection for each subscriber, STRATA monitors the baseline on the core and edge circuits and keeps that baseline at or below 70% of maximum. That 70% is calculated separate from redundant paths or circuits." STRATA has further indicated that they, "predict and make efforts to stay ahead of that 70% number by about 1 year." This is not in the agreement and needs to be considered. Furthermore, there are a lot of technical details that were provided to the TAC and were indicated that would be in the agreement (that are in the other document) but these are not. Detailed review and comparison needs to be done and the missing information added or an exhibit with this information needs to be added.</p>	<ul style="list-style-type: none"> • Add information as appropriate to ensure mutual understanding of expectations.
	<p>NETWORK OPERATION AGREEMENT: The draft Network Operations agreement does not contain any provisions or expectations regarding minimum cybersecurity protocols / standards required in order to mitigate security issues. Such cybersecurity also should consider social engineering techniques in addition to cyber-hacking techniques and needs to also be considered in the ISP agreement.</p>	<ul style="list-style-type: none"> • Add terms for cybersecurity in the agreement and review with TAC.

The TAC welcomes additional input and direction from the City Council regarding any additional risks or mitigation strategies that should also be considered related to technical or logistical aspects of the proposed municipal fiber-optic network.

Next Steps

The TAC awaits further direction and/or confirmation regarding the recommendations provided herein. Should the City Council choose to continue pursuing a municipal fiber-optic network, the following next steps are recommended:

1. The City Council and TAC should consider if further improvements or modifications to the draft agreements are sufficient or if further refinement is necessary.
2. The City Council is invited to direct the TAC regarding next steps and request specific review of any technical or logistical items requiring further explanation or understanding.
3. Once the agreements are finalized, the TAC recommends continuing its efforts by helping consult with City Staff regarding technical details for Phase I engineering design as they become available.

Conclusion

The Providence City volunteer Technical Advisory Committee (TAC) appreciates that the City Council continues to pursue a municipal fiber-optic network. Providence City is a beautiful place to live. By adding critical fiber infrastructure to the city, Providence City will be a front-runner and exemplar for other cities in Cache Valley. The TAC invites the City Council to consider the recommendations provided herein and to give direction and feedback on this matter.

Respectfully,

The Providence City Technical Advisory Committee (TAC)

Appendix 1: Related Fiber Network Definitions

Fiber-optic Cable	A glass cable that uses light waves to transmit data that consists of a fiber bundle or single fiber, strength members, and a cable jacket.
Open Access Network	An open-access network (OAN) separates the physical access to the network from the delivery of <u>services</u> . In an OAN, the owner or manager of the network does not supply services for the network; these services must be supplied by separate retail/content (ISP) service providers.
Utility Model	A business model whereby a city installs, operates and maintains a physical fiber network that is connected to all city addresses and all residents pay a minimum “utility” charge.
Subscription Model	A business model that installs fiber trunk lines to every city street, but only connects and charges those addresses that “subscribe” to the network.
Active Ethernet	An Active Ethernet network has a direct point to point connection that provides a dedicated link from the network to the subscriber.
PON/GPON	Passive Optical Network (PON) is a point-to-multipoint access network. Its main characteristic is the use of passive splitters in the fiber distribution network, enabling one single feeding fiber from the provider to serve multiple homes and small businesses. GPON is Gigabit Passive Optical Network.
Aerial Installation	Installation of cable above ground on existing power company poles.
Inground Installation	Underground installation of fiber conduit and cable.
Service Drops	A connection to a customer facility from the network cabinet.
Take-rate	The percentage of subscribers out of the total number of available service addresses.
Micro-Trenching	Micro-trenching is an installation method in which a narrow and relatively shallow trench is cut, usually on an asphalt roadway. Trench dimensions can range from .75 to 2.24 inches wide and 8 to 16 inches deep.
Nano-Trenching	A shallower trenching method than micro trenching; google fiber used this in some locations and cable was popping out of the asphalt.
Directional Drilling	Directional drilling (HDD), is a minimal impact <u>trenchless</u> method of installing underground utilities that offers significant environmental advantages over traditional cut and cover pipeline/utility installations. The technique is routinely used when conventional trenching or excavation is not practical or when minimal surface disturbance is required.

Missile Boring	Missile boring, also known as horizontal boring, underground pneumatic boring, or impact boring is a method of point to point underground boring. Missile boring has been utilized as a standard for installation of public utilities.
Pedestal	A telecommunications pedestal is a ground-level housing for a connection point for underground cables. Pedestals are used for CATV (known as a cable box in such a situation), telephone, <u>PONS</u> , and other telecommunications systems.
Franchise taxes	The term franchise tax refers to a tax paid by certain enterprises that want to do business in a government jurisdiction.
Backbone	A backbone interconnects and ties together diverse network locations together located at different geographical locations.
Ring Topology	In a ring network, every device has exactly two neighboring devices for communication purposes. It is called a ring topology as its formation is like a ring.
Star Topology	In a star topology there exists a <u>point-to-point connection</u> between a node and hub device. The hub device takes a signal from any node and passes it to all the other nodes in the network. The hub works as a server and it controls and manages the entire function of the network.
Symmetrical Connections	In a symmetrical internet connection, the upload and download speeds are the same.
Cabinet, Shed, Hut	An enclosure that houses electrical equipment.
Hub	A hub is a basic networking device that connects multiple computers or other network devices together. Unlike a network switch or router, a network hub has no routing tables or intelligence on where to send information and broadcasts all network data across each connection. Sometimes the term hub is also used to indicate a location where various interconnections occur physically in a star topology.
Churn / Replacement	Churn is customer turnover. Replacement is making up for lost customer business.
Main Line / Trunk Line	The primary fiber backbone or line from which feeder lines are split off.
Feeder Line	A feeder line is a peripheral route or branch in a <u>network</u> , which connects smaller or more remote nodes with a route or branch carrying heavier traffic.
Infrastructure Fee	A fee charged to pay for the cost of network infrastructure.
Network Refresh Fee	A fee paid to cover the cost of replacing equipment that fails, needs repair or becomes obsolete.

Network Operator Fee	A fee paid to the contractor that oversees and manages the network.
Internet Service Provider Fee	A fee charged by an Internet Service Provider (ISP) for content including an internet connection, phone service and programming.
Total Retail Fee	The total amount charged to the customer including the Infrastructure Fee, the Network Operator Fee, the Network Refresh Fee, and the Internet Service Provider Fee.
Internet Service Provider (ISP)	An Internet service provider (ISP) is a company that provides customers with Internet access, often referred to as “the provider.” Services, such as telephone and television services, or personal websites or home pages may be provided. The services and service combinations may be unique to each ISP.
Content Provider	An ISP that typically provides connection to Internet services.
Landline	A phone connection via a wired network as opposed to a wireless connection such as cell service.
Megabit (Mb), Gigabit (Gb)	Megabit = 1,000,000 one million bits; Gigabyte 1,000,000,000 one billion bits, a thousand times more than a megabit. Bit = a unit of computer information or data-storage capacity that consists of a one or a zero. A byte is made up of 8-bits and therefore a megabyte and gigabyte are 8 times larger than a megabit and gigabit respectively.
Megabits per Second (Mbps), Gigabits per Second (Gbps)	Common data-rate metrics which express the number of bits per second sent across a network [see also Megabit (Mb), Gigabit (Gb) above].
UTOPIA/UIA	A fiber network service in Utah started about 15 years ago that serves about a dozen cities. UTOPIA offers a turn-key service at no cost to a city government as long as a certain threshold number of subscribers is achieved.
Network Operations Center	A network operations center, or NOC (pronounced “knock”), is a centralized location where IT technicians directly support the efforts of <u>remote monitoring and management (RMM) software</u> .
Telemetry	Telemetry, in general, is a term for technologies that accommodate collecting information in the form of measurements or statistical data, and forward it to IT systems in a remote location.
Broadband	Broadband is data transmission that transports multiple signals and traffic types. The medium can be coaxial cable, optical fiber, radio or twisted pair. In the context of Internet access, broadband is used to mean any high-speed Internet access that is always on and faster than dial-up access.
FTTP	Fiber To The Premises (FTTP) is a fiber optic cable delivery medium that provides Internet access directly to a user or groups of users from an Internet service provider (ISP).

Public Private Partnership (PPP)	A public-private partnership is a cooperative arrangement between two or more public and private sectors, typically of a long-term nature. In other words, it involves government and business that work together to complete a project and/or to provide services to residents.
5G/Wifi Small Cells	Small cells are low power, short range wireless transmission systems (base stations) to cover a small geographical area or indoor / outdoor applications.
Smart City Initiatives	A smart city initiative uses different types of electronic sensors to collect data. Insights gained from that data are used to manage assets, resources and services efficiently; in return, that data is used to improve the operations across the city. This includes data collected from citizens, devices, buildings and assets that is then processed and analyzed to monitor and manage traffic and transportation systems utilities, water supply networks, waste, crime detection, information systems, schools, and other community services.
Redundant Network	Redundancy is the installation of additional or alternate network devices or equipment to ensure availability in the case of device or path failure to avoid an extended outage. A ring topology is redundant by nature because two paths exist to a given interface.
Backhaul	A backhaul is the communication and network infrastructure responsible for transporting communication data from end users or nodes to the central network or infrastructure and vice versa. It is the intermediate communication infrastructure that connects smaller networks with the backbone or the primary network.