

Regulating Communications Infrastructure for Growth

Version 1.1

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The Goal of Regulation:

Guarantee public access to a range of communications services at market prices

What Does this Mean?

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It's service providers' responsibility to guarantee the performance of their individual services, while it's the regulator's responsibility to guarantee the performance of the market overall.

What Does this Mean?

Guarantee public access to a range of communications services at market prices

The regulator's constituency is customers, not providers.

Unscrupulous service providers *always* try to convince the regulator that it's the regulator's responsibility to guarantee their profits.

What Does this Mean?

Guarantee public access to a range of communications services at market prices

Access is not just the right to be a customer, but the right to be a provider or peer. If a member of the public is unsatisfied with service providers' offerings, they must be able to build a competitive service for themselves and like-minded people.

What Does this Mean?

Guarantee public access to a range of communications services at market prices

There is no categorical difference between service providers and members of the public.

The service provider of the future is an entrepreneurial member of the public who sees a problem and solves it.

What Does this Mean?

Guarantee public access to a range of communications services at market prices

It's the responsibility of the *market*, not the regulator, to offer *quality*. An optimal market provides low-quality services at a low price and high-quality services at a high price. A market which provides no low-quality services is improperly regulated.

What Does this Mean?

Guarantee public access to a range of communications services at market prices

If you think that high-quality services can be offered at a low price, you need to recalibrate your definition of low price downward.

What Does this Mean?

Guarantee public access to a range of communications services at market prices

Service providers naturally attempt to “corner markets” or extract excess rent. They tend toward rent-seeking behavior, rather than market-size optimization. It’s the regulator’s responsibility to deny service providers these opportunities to plunder the public’s purse.

What Does this Mean?

Guarantee public access to a range of communications services at market prices

So How Do We Do It?

Guarantee public access to a range of communications services at market prices

Promote growth of the market

Promote diversity of the market

Prevent monopolization of any element

Promote Growth of the Market

Drive the component costs of Internet service as close to zero as possible, while maintaining competition.

Vigorous competitors sacrifice margin for market share, while low prices ensure the growth of the market overall.

Promote Diversity of the Market

In a vigorously competitive market free of encumbering regulation, service providers innovate in order to reach higher-margin niche markets.

Fixed and mobile services, wired and wireless, optical and electrical and radio-frequency, kiosks, hybrids, creative bundles, synergistic service offerings.

Prevent Monopolization of Any Element

This is the single most important concept I have for you today:

Lack of competition is the only way service providers can extract excess rent from the public, and it's the main way they can avoid the cost of innovating.

It's your job to prevent that situation.

Prevent Monopolization of Any Element

Lack of competition means that there's some barrier which prevents any random kid on the street from engaging in some sector of the market.

This is not a natural situation.

It results only from poor regulation or crime or, more commonly, both.

What Kind of Poor Regulation?

“Hey, kid, didn’t you know you need a license to do that? We don’t care whether you’re solving a problem; we only give licenses to people who can give us a lot of money, or foreigners, or relatives of government officials.”

It’s the regulator’s job to prevent this situation.

What Kind of Crime?

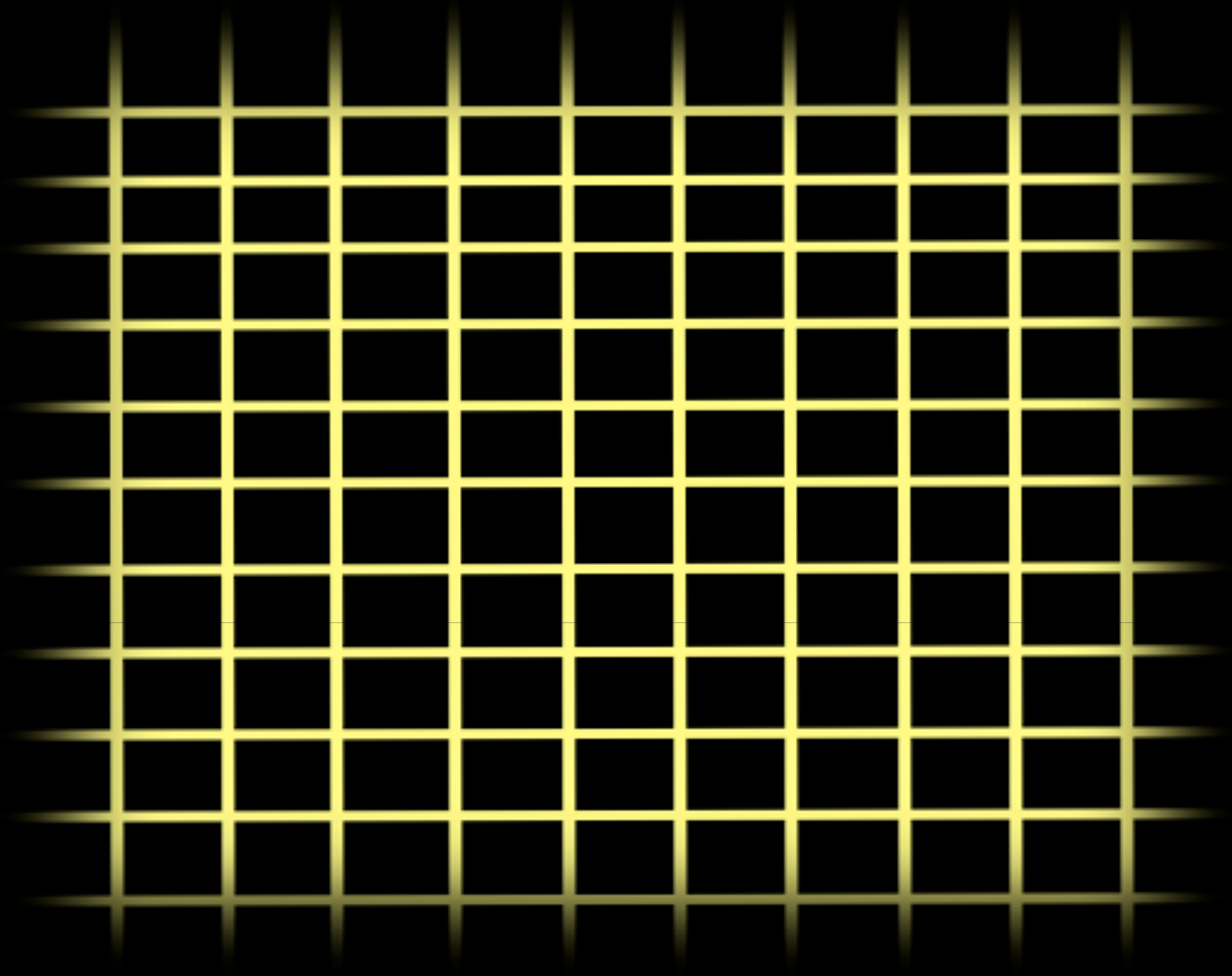
“Hey, kid, didn’t you know our family is already selling service in this town? You’ll get out of here if you know what’s good for you.”

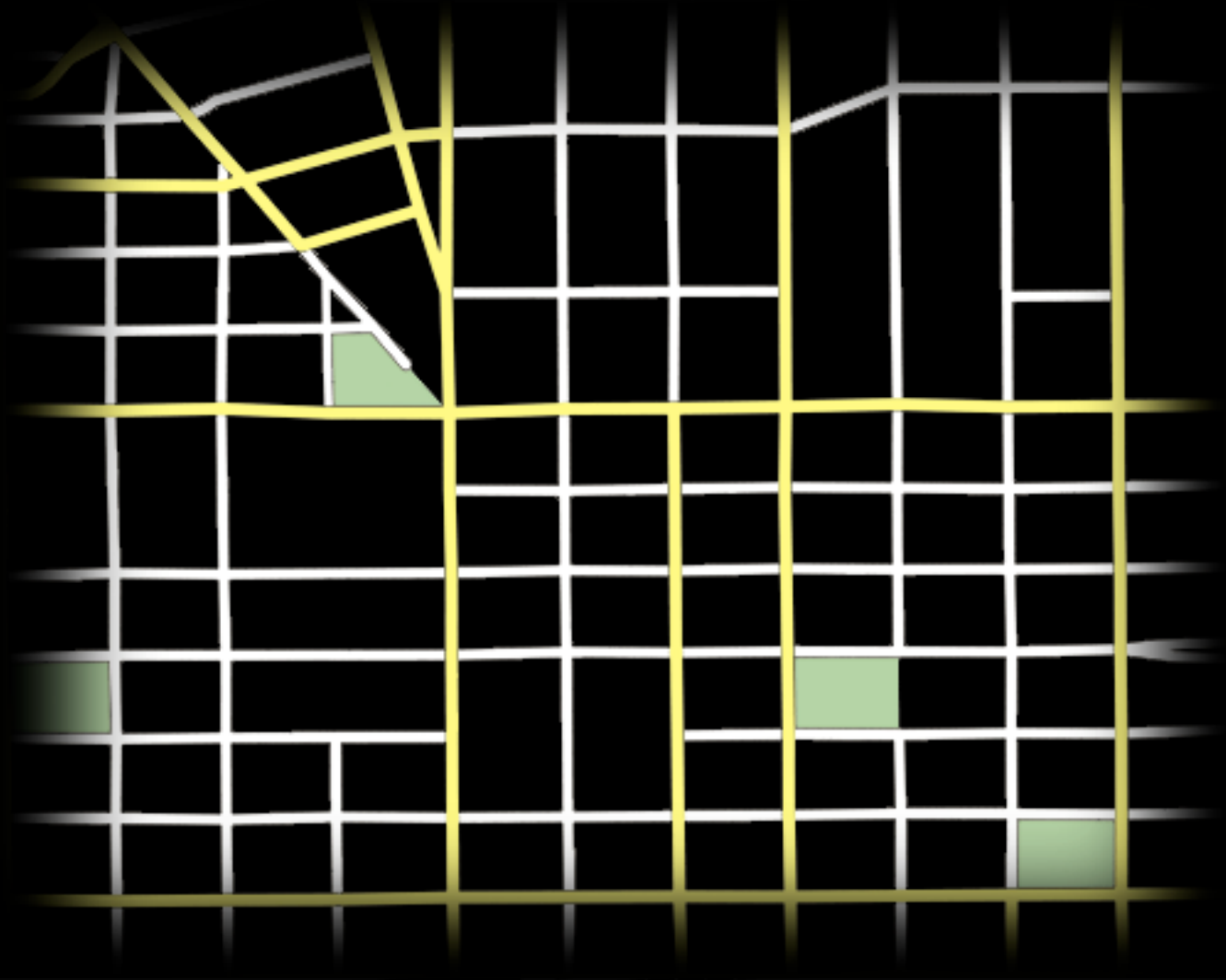
It’s the job of law enforcement to prevent this situation.

So What Does This Say About Regulation?

The overarching goals of regulation are conceptually broad, but in their practical, tangible form, essentially local.

Most of the important work is done by municipal utilities functionaries. The important thing that can be done by national policy-makers is to facilitate that work.













Use Case 1: Telco sells service to Municipal Government



IX

The background of the slide features a stylized grid map. The grid is composed of light gray lines on a dark background. A central cell is highlighted with a white background and contains the Roman numeral 'IX'. To the left of this cell, there is a small green triangle. Below the central cell, there are three small green squares. The grid lines are thicker in some areas, creating a sense of depth and structure.

Use Case 1: Telco sells service to Municipal Government



IX

Explain ROWUP, redundancy, etc

DRAFT

Right-of-Way Use Permit

Path-specific

Must use accredited laborers

Accreditation must be continuously available

Training must be available locally frequently

RoWUP rights

Install poles on any path which has

neither poles nor conduit

Replace any existing poles with conduit

Use any existing conduit

RoWUP Costs

Implicit in the cost of an aerial use permit is the assumption of the subsequent cost of undergrounding laterals.

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Need for wirecenter

“Central” in the sense that the average length of a fiber run should be minimized.

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Uses of revenue generated

Mitigation

Bulk-purchase fiber for subdivision

Manual-arts training in schools

Subsidy of accreditation

Subsidy of training

Subsidy of long-haul carrier entry

Accreditation Costs

Post a bond which gets called if you damage the infrastructure you're working on. Costs: outage notification, making-good of damage, whether to in-use infrastructure or not-yet-used infrastructure, review of accreditation in the wake of the incident. Inspection after each piece of work.

Explain consortium cables

DRAFT

Use Case 1: Telco sells service to Municipal Government

The telco is issued a RoWUP consisting of two paths:

One to enter the city and reach the IX...



Use Case 1: Telco sells service to Municipal Government

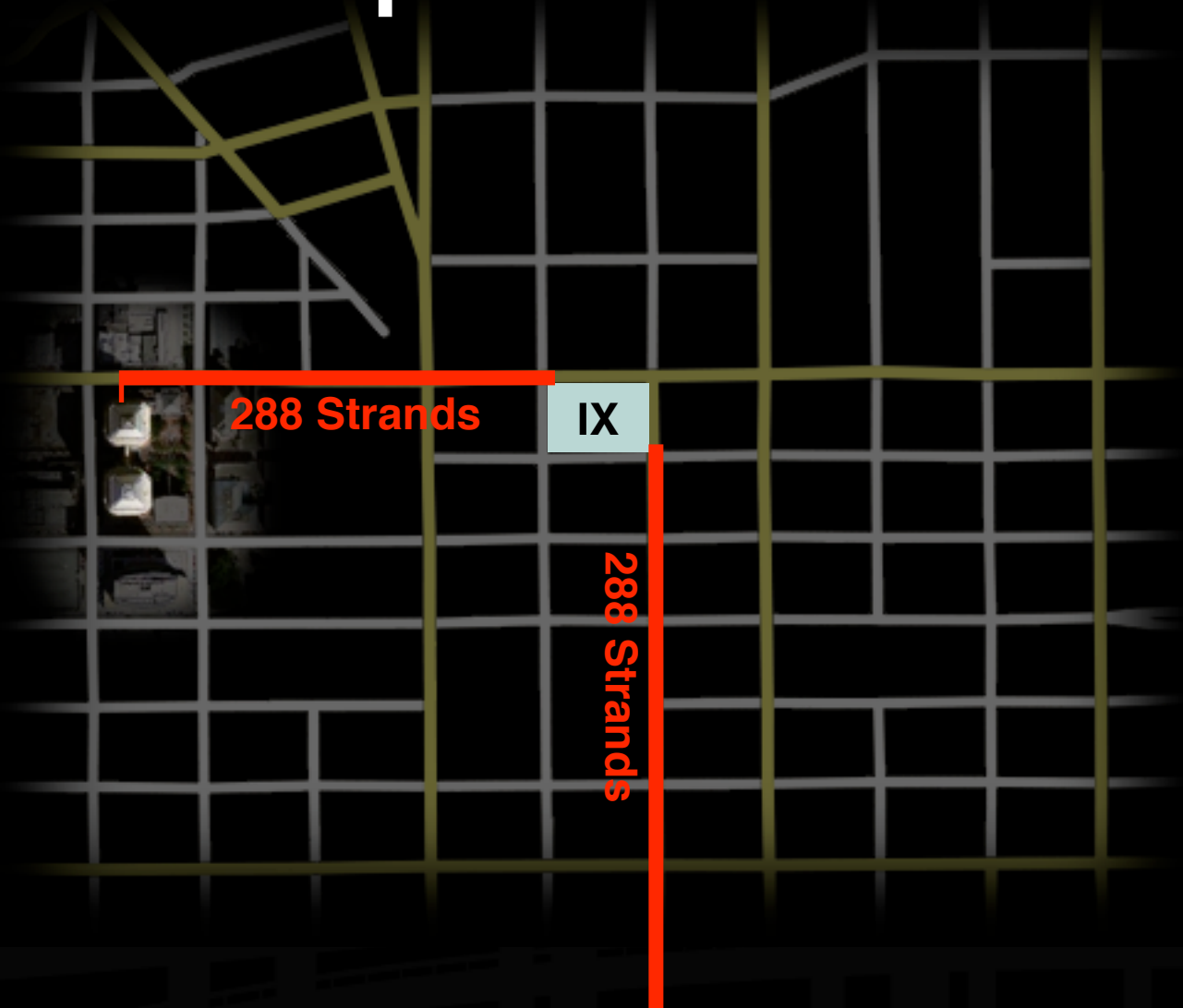
The telco is issued a RoWUP consisting of two paths:

One to enter the city and reach the IX, and a second to reach their customer from the IX.



Use Case 1: Telco sells service to Municipal Government

On each of these two paths, the **telco** lays 288 strand fiber.

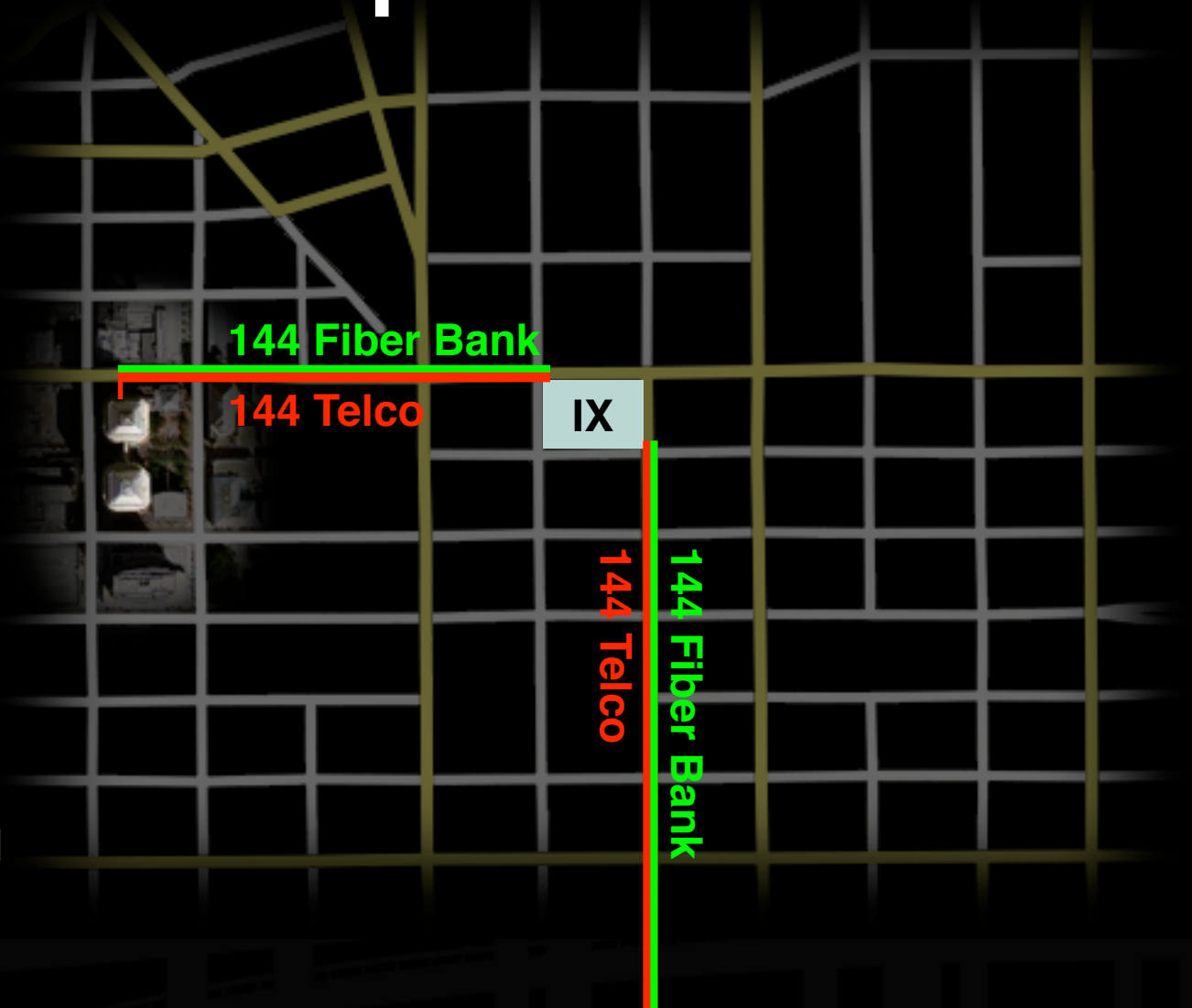


Use Case 1: Telco sells service to Municipal Government

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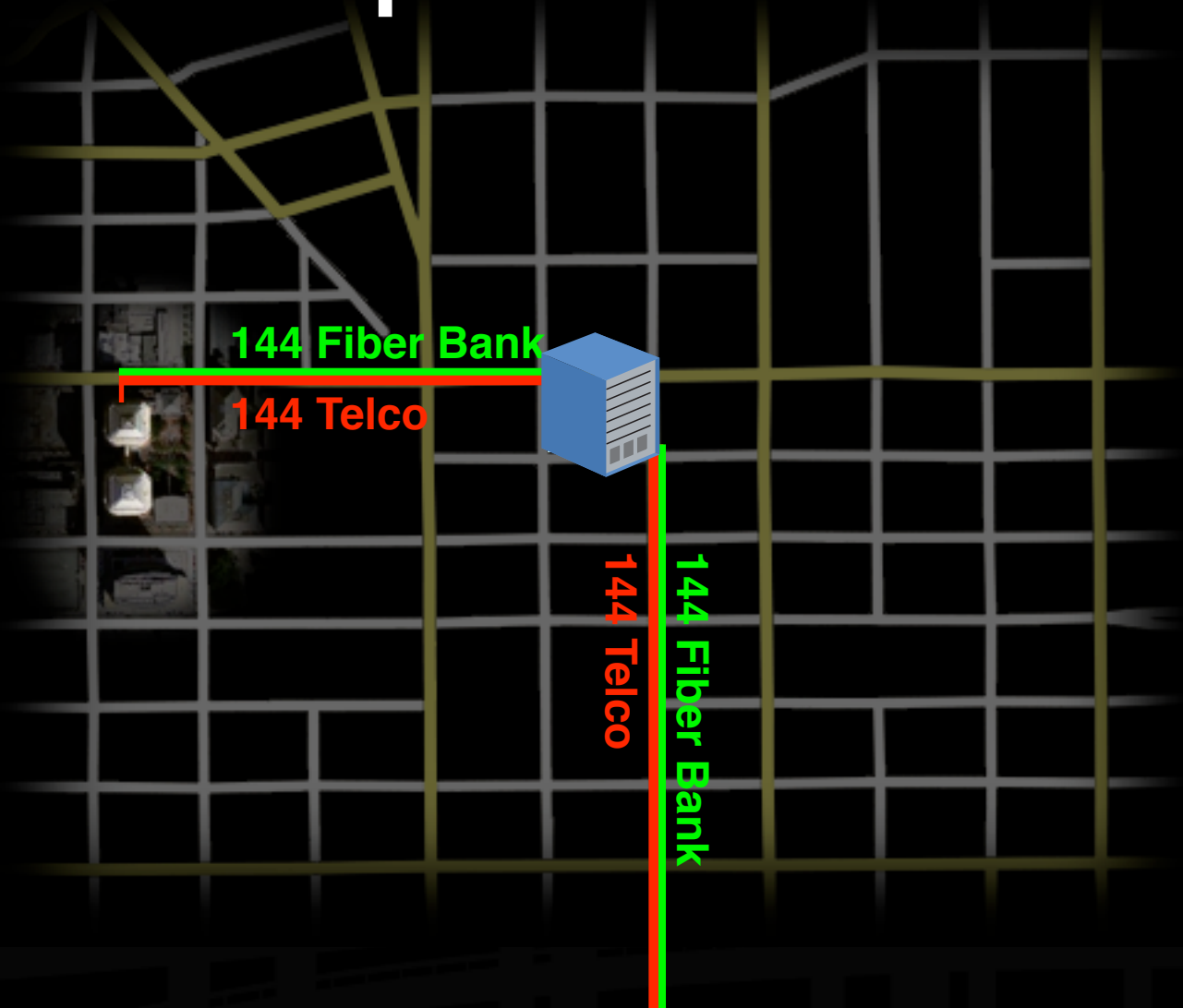
In exchange for each of the two RoWUPs, instead of cash, they pay 144 strands to the municipality.

These are held by the municipal “**fiber bank.**”



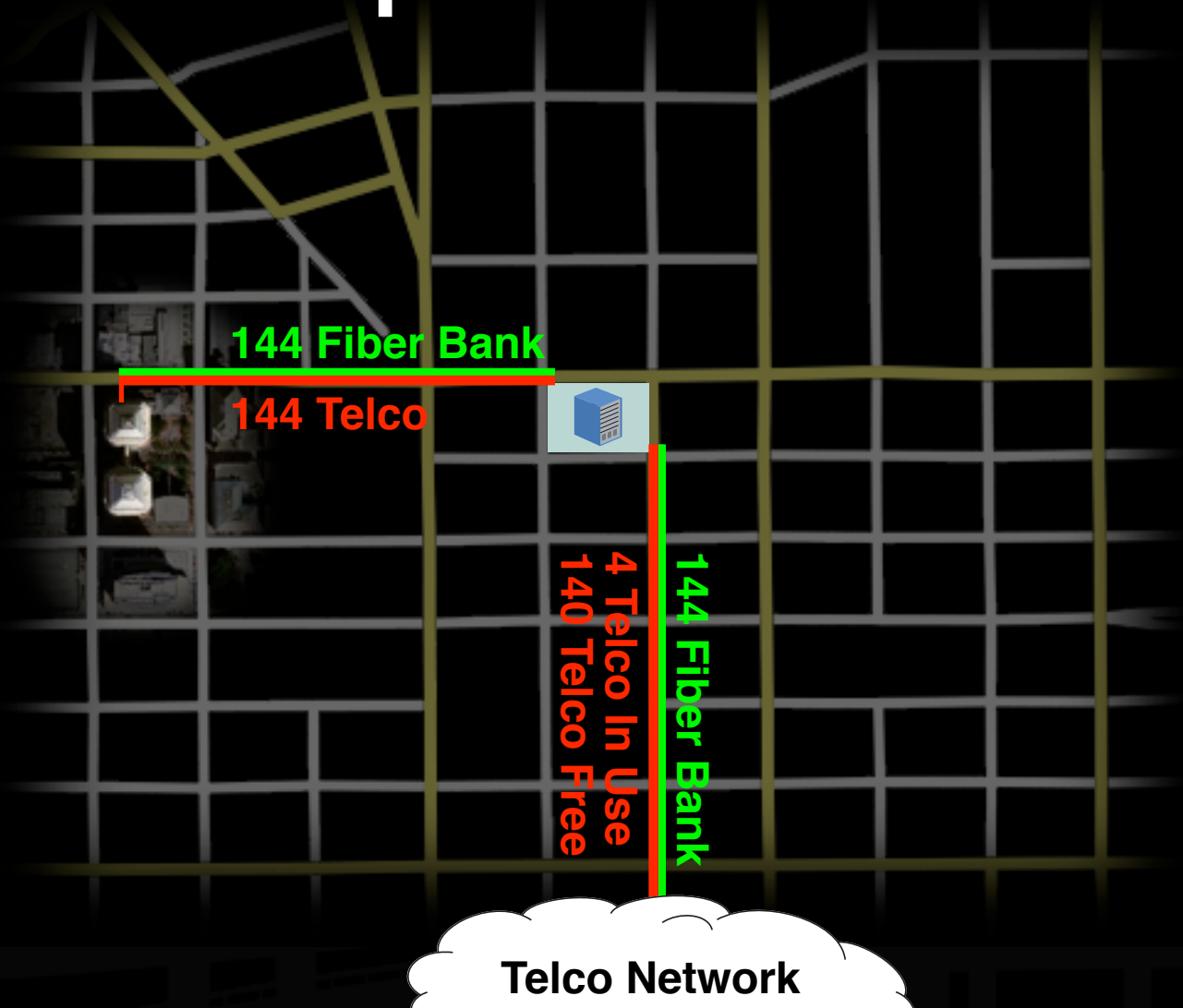
Use Case 1: Telco sells service to Municipal Government

In order to provide service to the customer, the telco places a router in the IX,



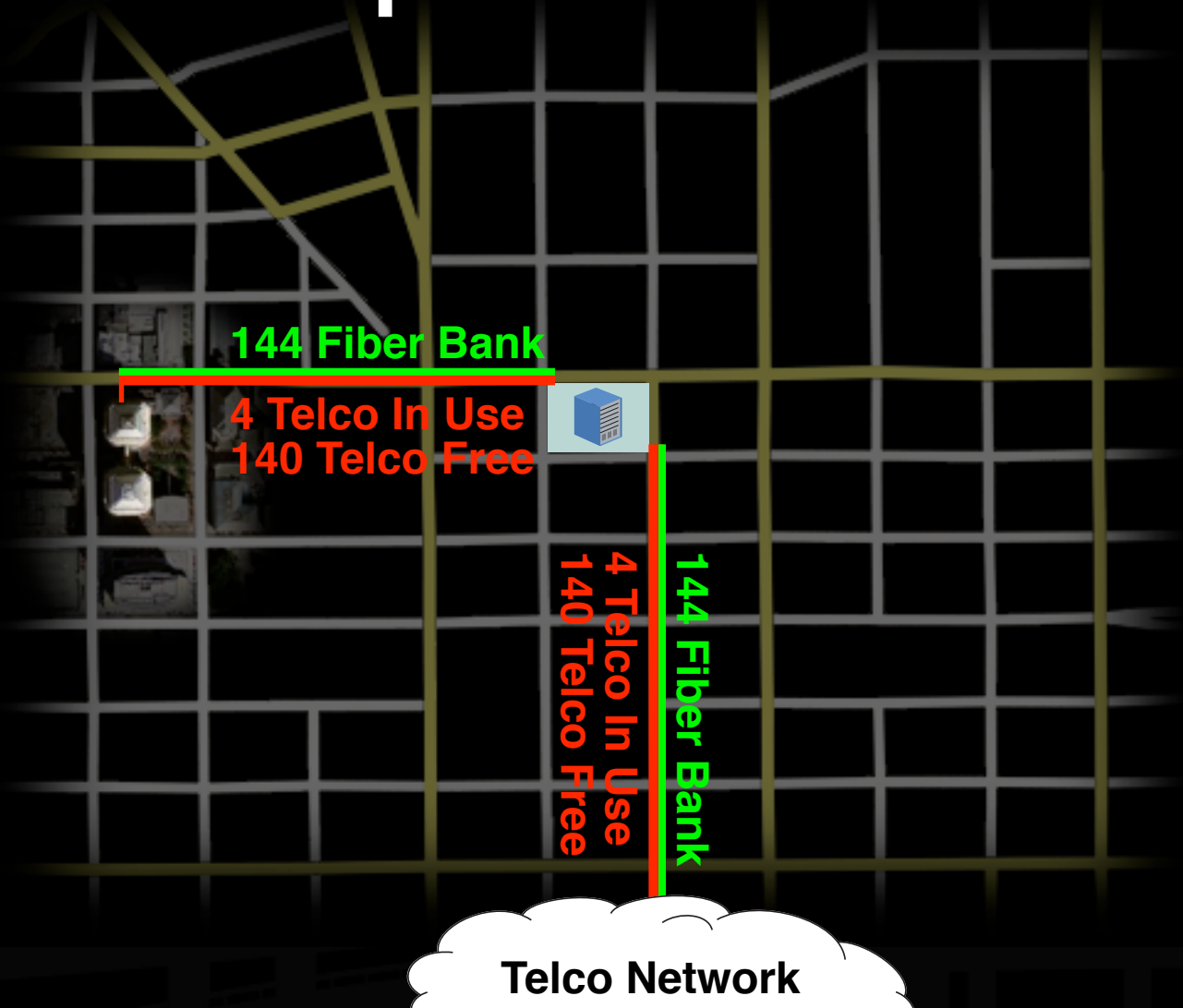
Use Case 1: Telco sells service to Municipal Government

In order to provide service to the customer, the telco places a router in the IX, and uses four strands to connect it to their network: Service Tx, Service Rx, Protect Tx, and Protect Rx.



Use Case 1: Telco sells service to Municipal Government

Four strands on the second path interconnect their customer to the router which is their local Point of Presence, or POP.



Use Case 1: Telco sells service to Municipal Government

This leaves the **telco** holding **140** free strands, and the **fiber bank** holding **144** free strands on each of the two paths.



Use Case 1: Telco sells service to Municipal Government

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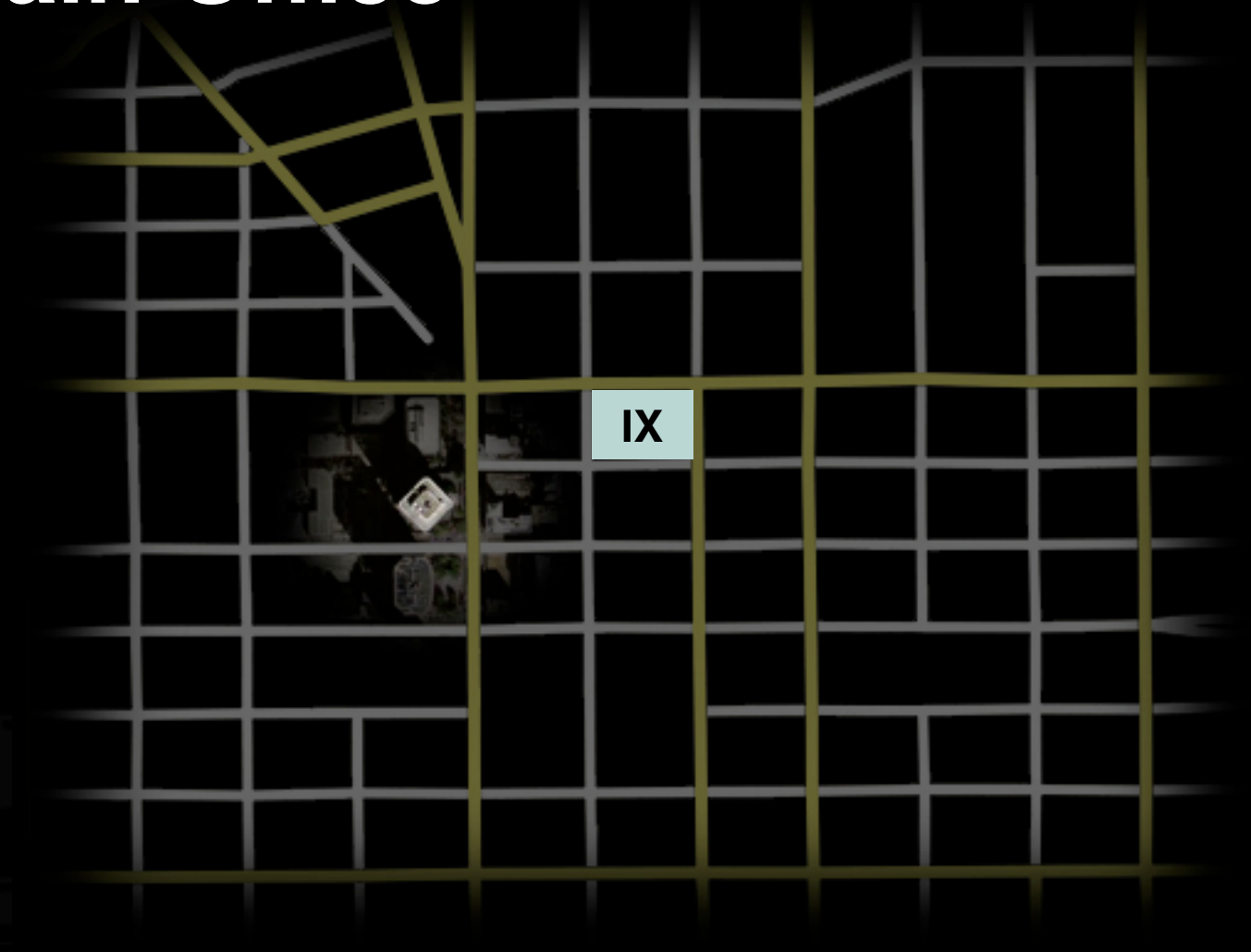
Cost:

Two miles of cable
at \$2/foot:
\$20,000

Two miles of
trenching and
resurfacing at \$40/
foot:
\$200,000

\$220,000 one-time

Use Case 2: Bank Interconnects Main Office



Use Case 2: Bank Interconnects Main Office with Branch Office



Use Case 2: Bank Interconnects Main Office with Branch Office

Because the distance from the **bank's** main office to the nearest available fiber...



Use Case 2: Bank Interconnects Main Office with Branch Office

Because the distance from the **bank's** main office to the nearest available fiber is approximately the same as the distance to the IX...



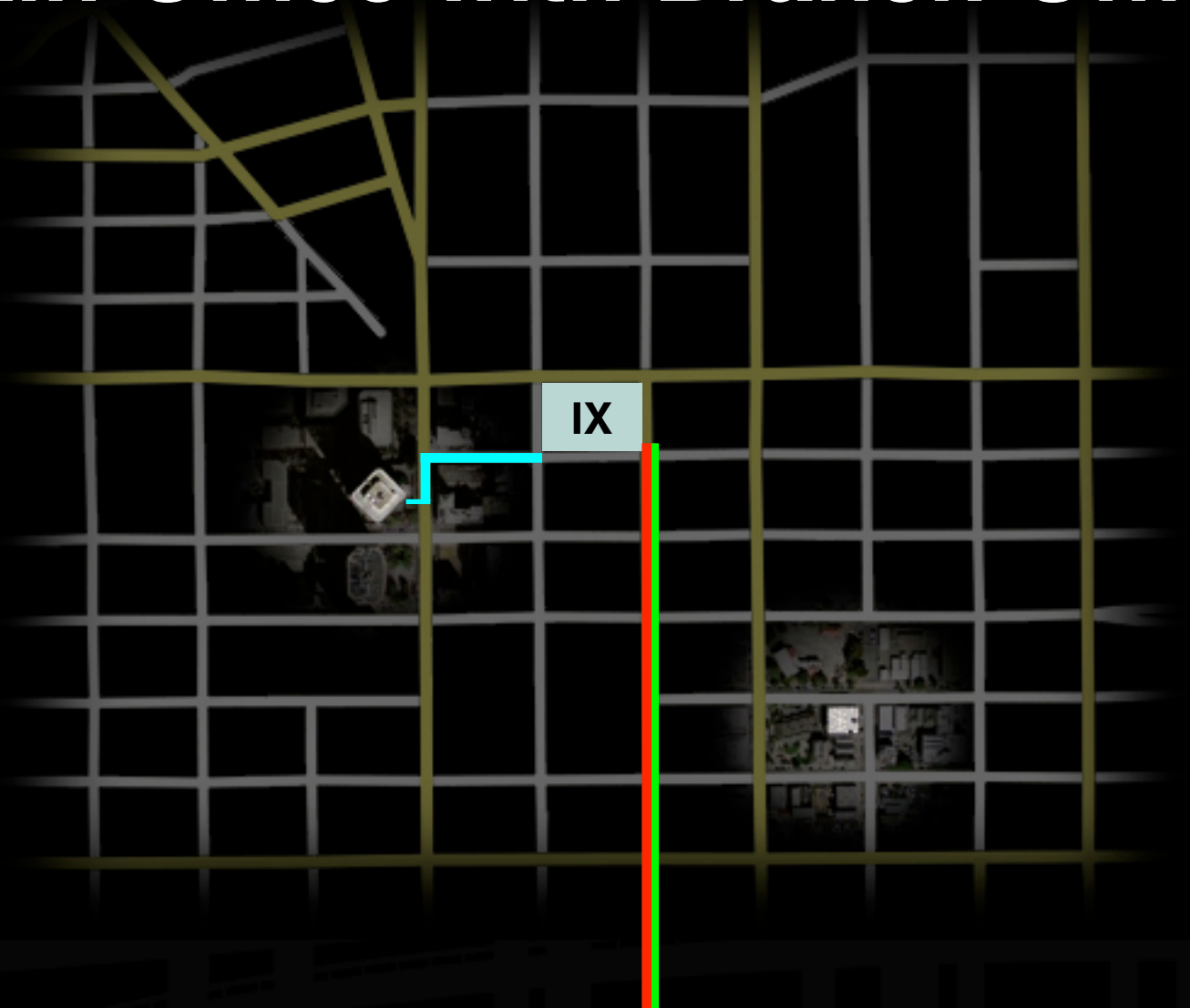
Use Case 2: Bank Interconnects Main Office with Branch Office

Because the distance from the **bank's** main office to the nearest available fiber is approximately the same as the distance to the IX, the municipality prefers to cover new ground, and issues this RoWUP.



Use Case 2: Bank Interconnects Main Office with Branch Office

For the **bank's** branch office, the most efficient path is to join the nearest existing fiber path...



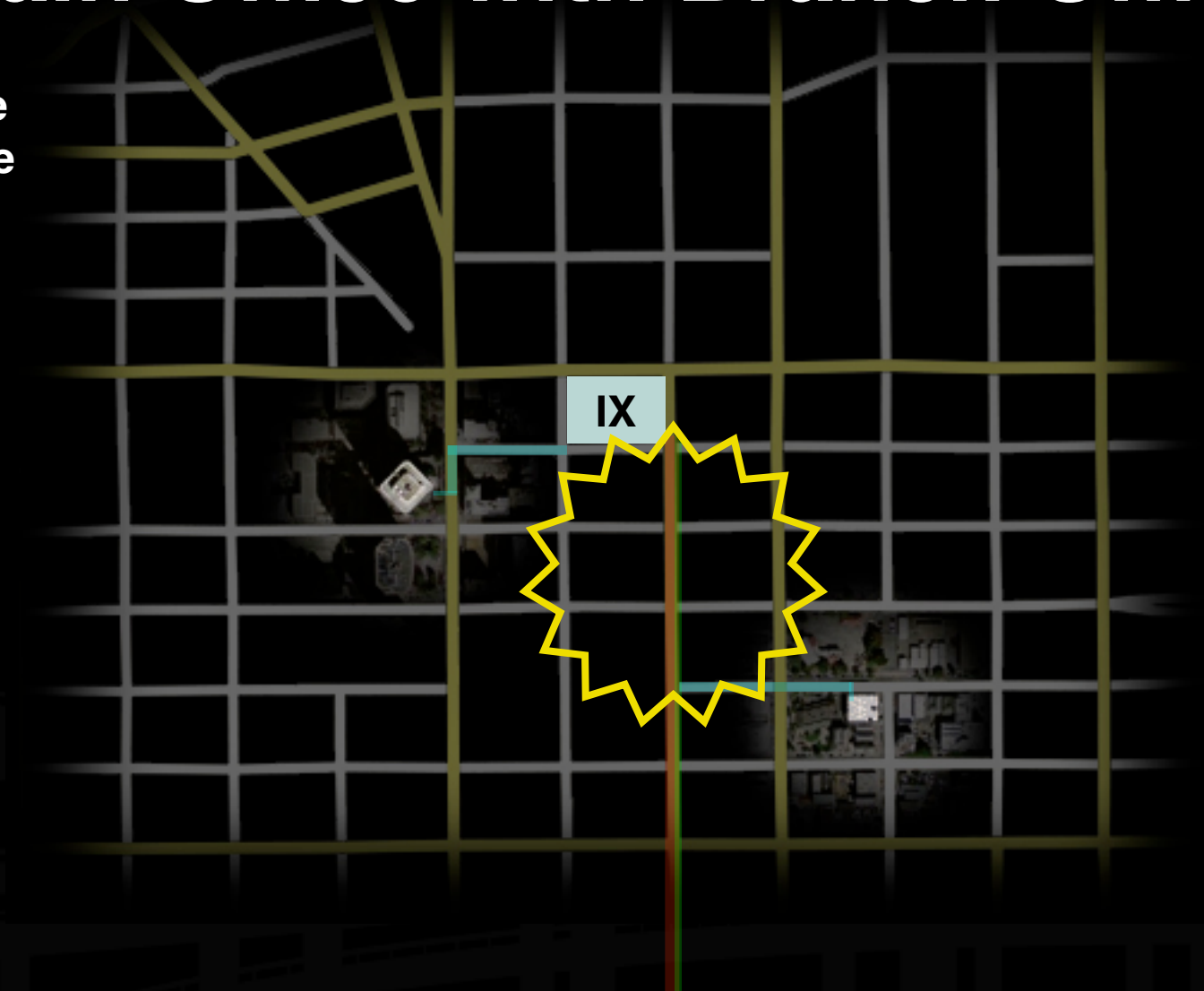
Use Case 2: Bank Interconnects Main Office with Branch Office

For the **bank's** branch office, the most efficient path is to join the nearest existing fiber path, so this second RoWUP is issued.



Use Case 2: Bank Interconnects Main Office with Branch Office

This leaves the
bank with three
blocks of their
path missing...



Use Case 2: Bank Interconnects Main Office with Branch Office

This leaves the **bank** with three blocks of their path missing, but both the **telco** and the **fiber bank** have available strands on that path.



Use Case 2: Bank Interconnects Main Office with Branch Office

The **telco** offers the **bank** four strands, for three blocks (0.6 miles) at \$100/strand/mile/year, or \$240/year.



Use Case 2: Bank Interconnects Main Office with Branch Office

The **telco** offers the **bank** four strands, for three blocks (0.6 miles) at \$100/strand/mile/year, or \$240/year.

The **fiber bank** offers the same path at the same price.



Use Case 2: Bank Interconnects Main Office with Branch Office

The **bank** pays
the **fiber bank**
for their two
RoWUPs in
strands, rather
than cash...



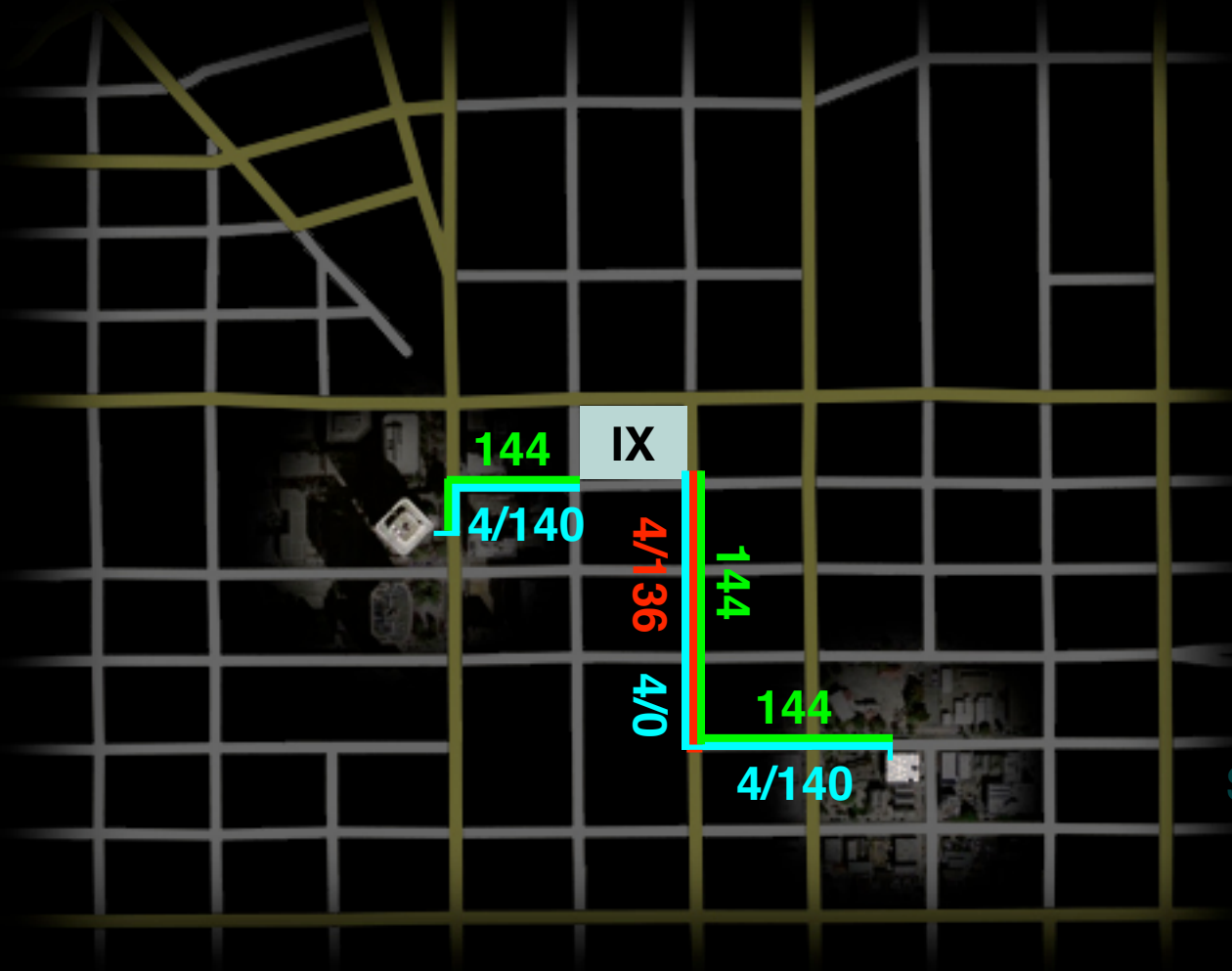
Use Case 2: Bank Interconnects Main Office with Branch Office

The **bank** pays the **fiber bank** for their two RoWUPs in strands, rather than cash, and leases the four IRUs from the **telco** for cash, completing their path.



Use Case 2: Bank Interconnects Main Office with Branch Office

The **bank** pays the **fiber bank** for their two RoWUPs in strands, rather than cash, and leases the four IRUs from the **telco** for cash, completing their path.



Cost:

3,000 feet of cable at \$2/foot:
\$6,000

3,000 feet of trenching and resurfacing at \$40/foot:
\$120,000

\$126,000 one-time

\$240 annually

Use Case 3: Landlord Provides Service to Two Apartment Buildings



IX

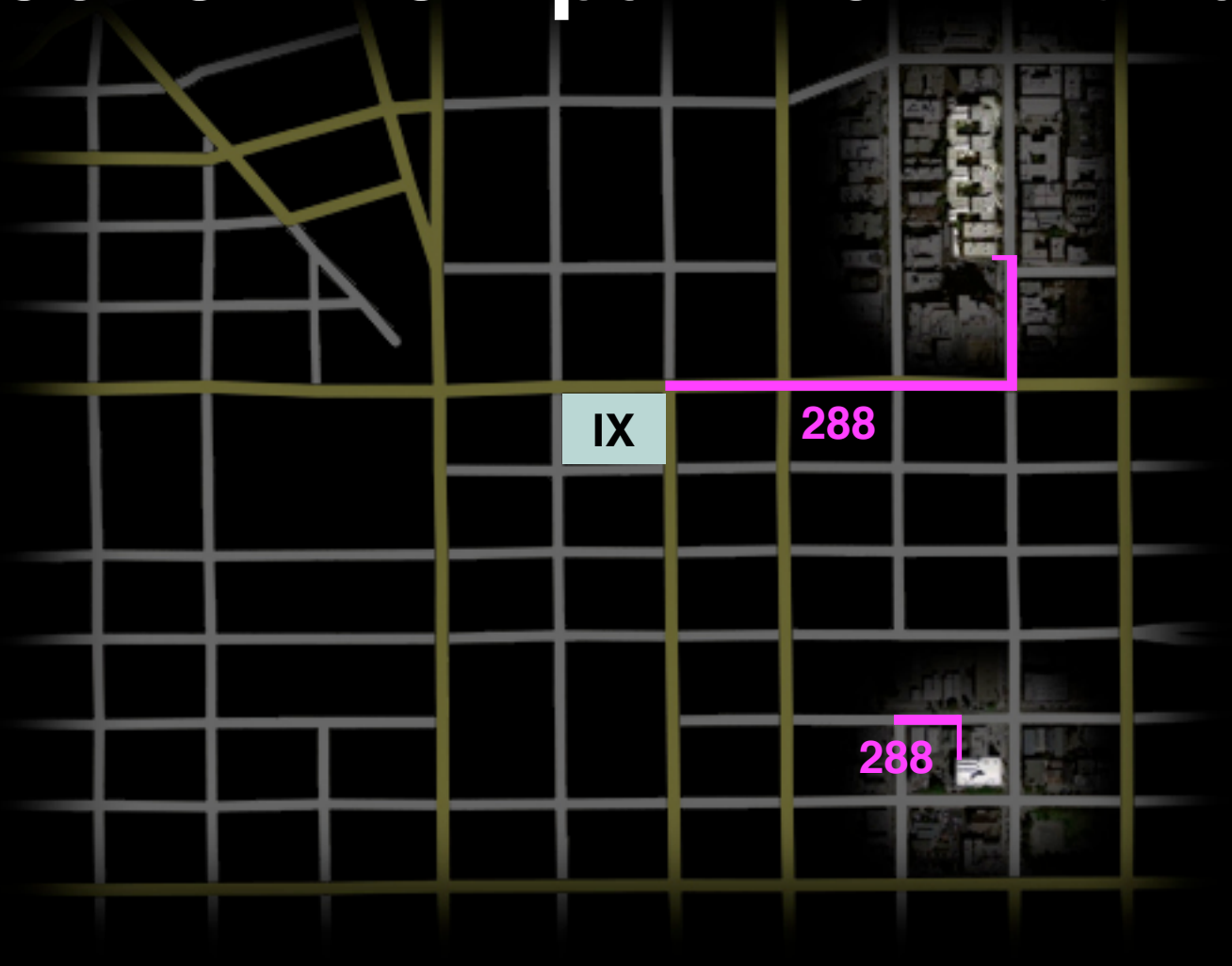
Use Case 3: Landlord Provides Service to Two Apartment Buildings

The **landlord** wishes to minimize his cost in connecting these two buildings to the network.



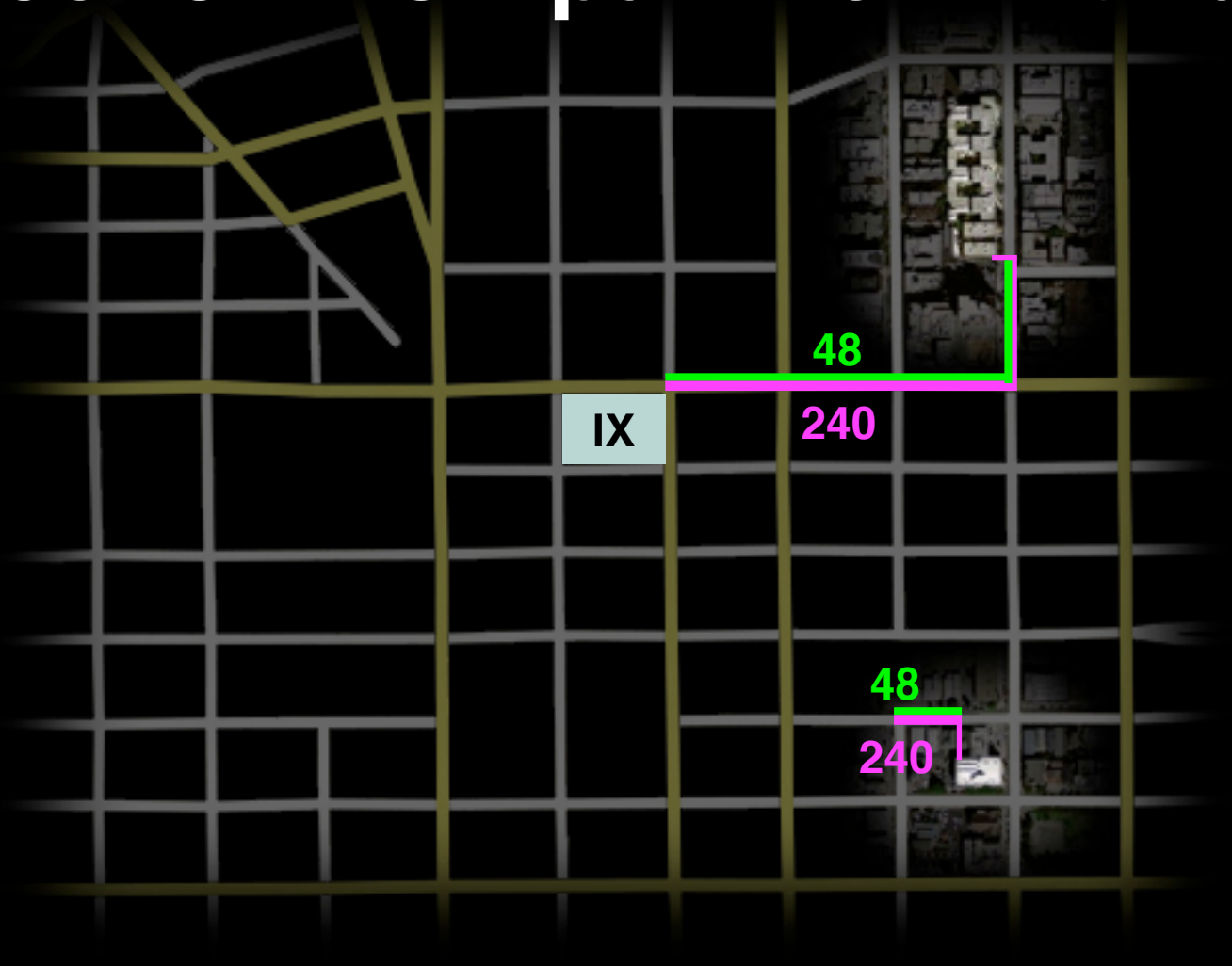
Use Case 3: Landlord Provides Service to Two Apartment Buildings

RoWUPs are issued for the two shortest paths which will allow the landlord to reach the IX.



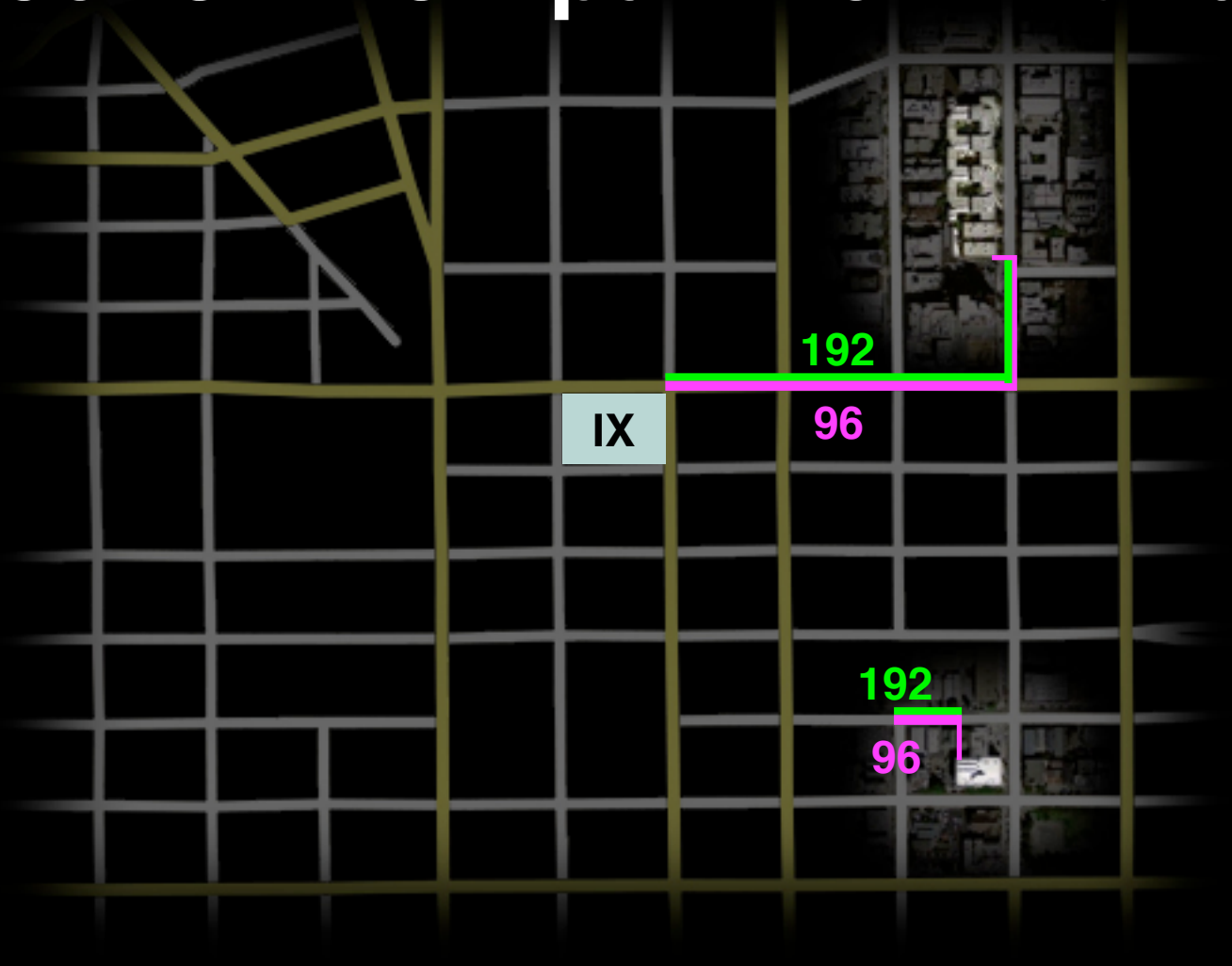
Use Case 3: Landlord Provides Service to Two Apartment Buildings

In order to minimize costs, the **landlord** purchases the 5,000 feet of fiber he'll need from the **fiber bank**, in exchange for futures on 48 installed strands, rather than cash.



Use Case 3: Landlord Provides Service to Two Apartment Buildings

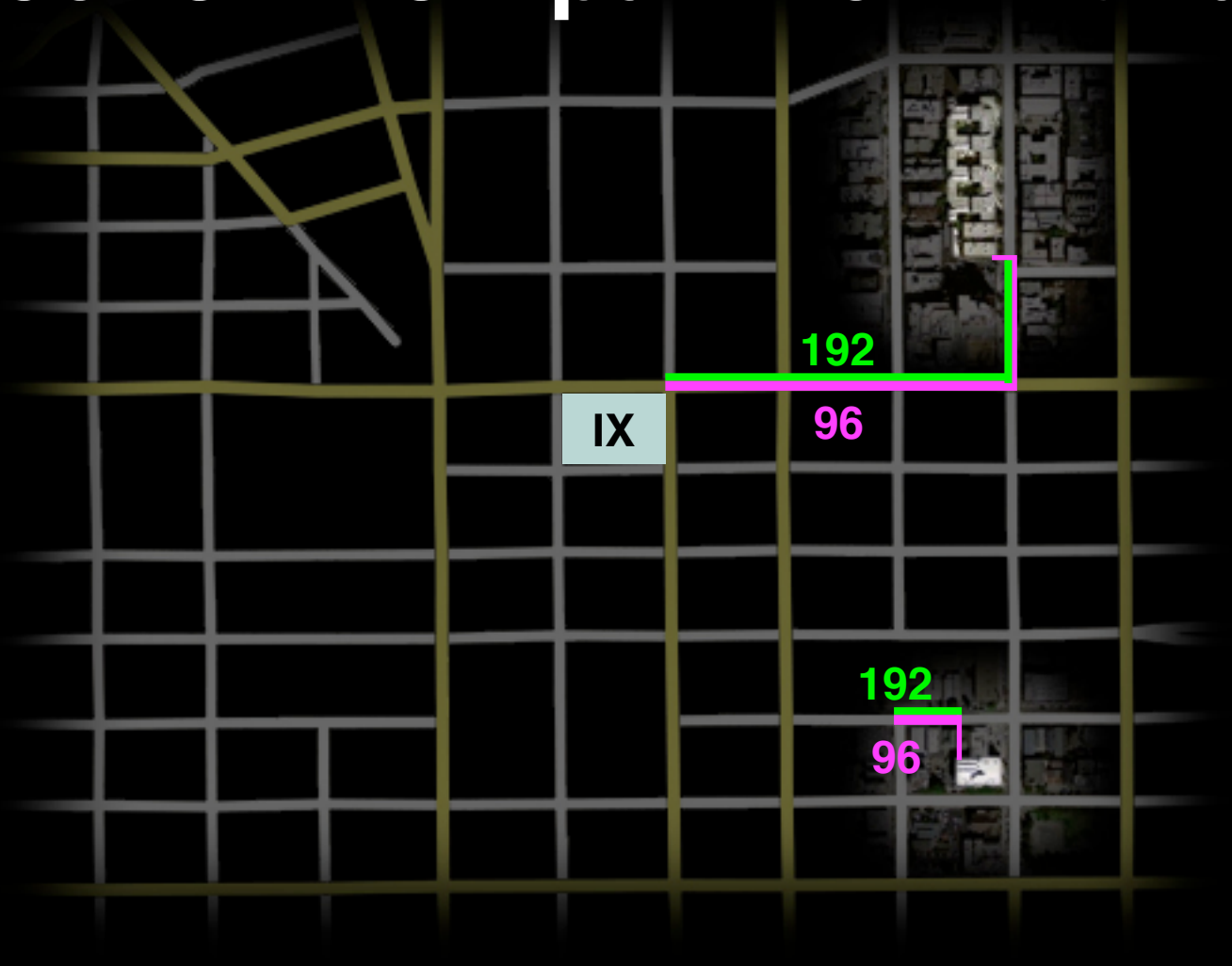
Likewise, he pays the RoWUP fee as **144** strands, rather than cash.



Use Case 3: Landlord Provides Service to Two Apartment Buildings

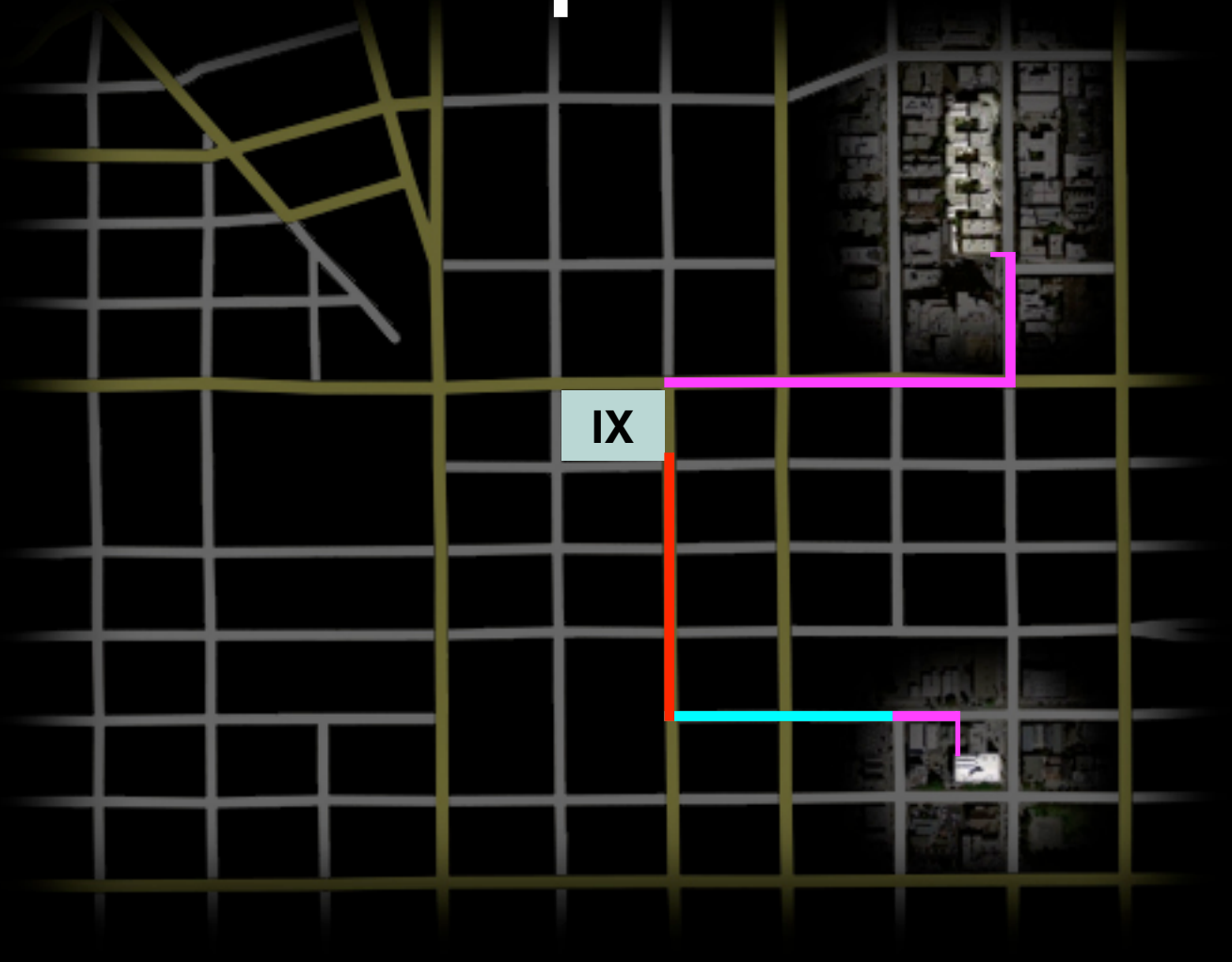
Likewise, he pays the RoWUP fee as **144** strands, rather than cash.

Instead of burying the fiber, he strings it aerially, on poles, to further reduce costs.



Use Case 3: Landlord Provides Service to Two Apartment Buildings

To cover the remaining 5,000 feet, he could deal with the **bank** and the **telco**...



Use Case 3: Landlord Provides Service to Two Apartment Buildings

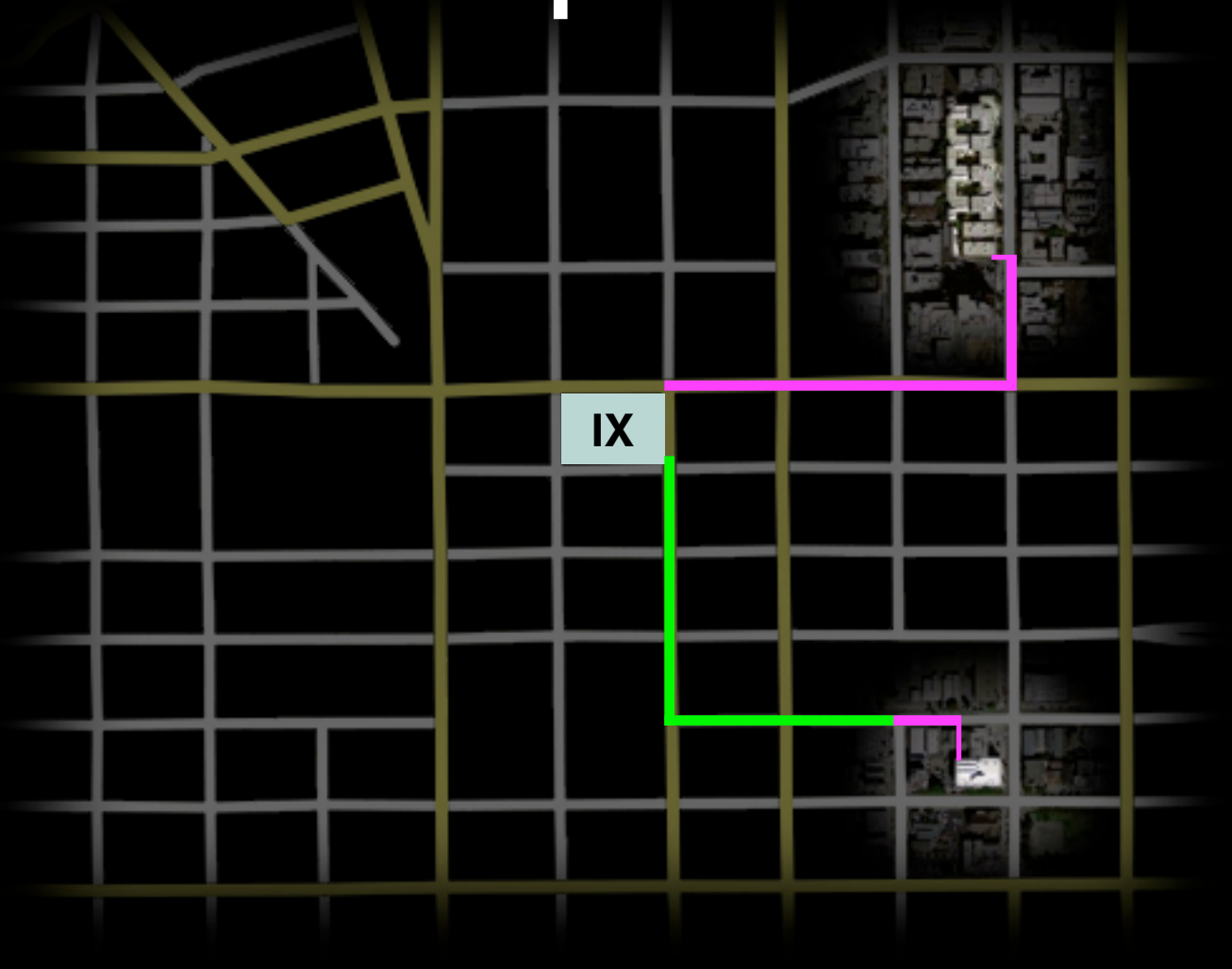
To cover the remaining 5,000 feet, he could deal with the **bank** and the **telco**, or just the **bank**...



IX

Use Case 3: Landlord Provides Service to Two Apartment Buildings

To cover the remaining 5,000 feet, he could deal with the **bank** and the **telco**, or just the **bank**, or just the **fiber bank**.



Use Case 3: Landlord Provides Service to Two Apartment Buildings

Since either the **fiber bank** or the **telco** is willing to trade the last four strands he needs, rather than leasing for cash, but only the **fiber bank** can provide the full path, he chooses to continue working with the **fiber bank**.



Use Case 3: Landlord Provides Service to Two Apartment Buildings



Use Case 3: Landlord Provides Service to Two Apartment Buildings



Cost:

5,000 feet of aerial pole-mounting at \$8/foot

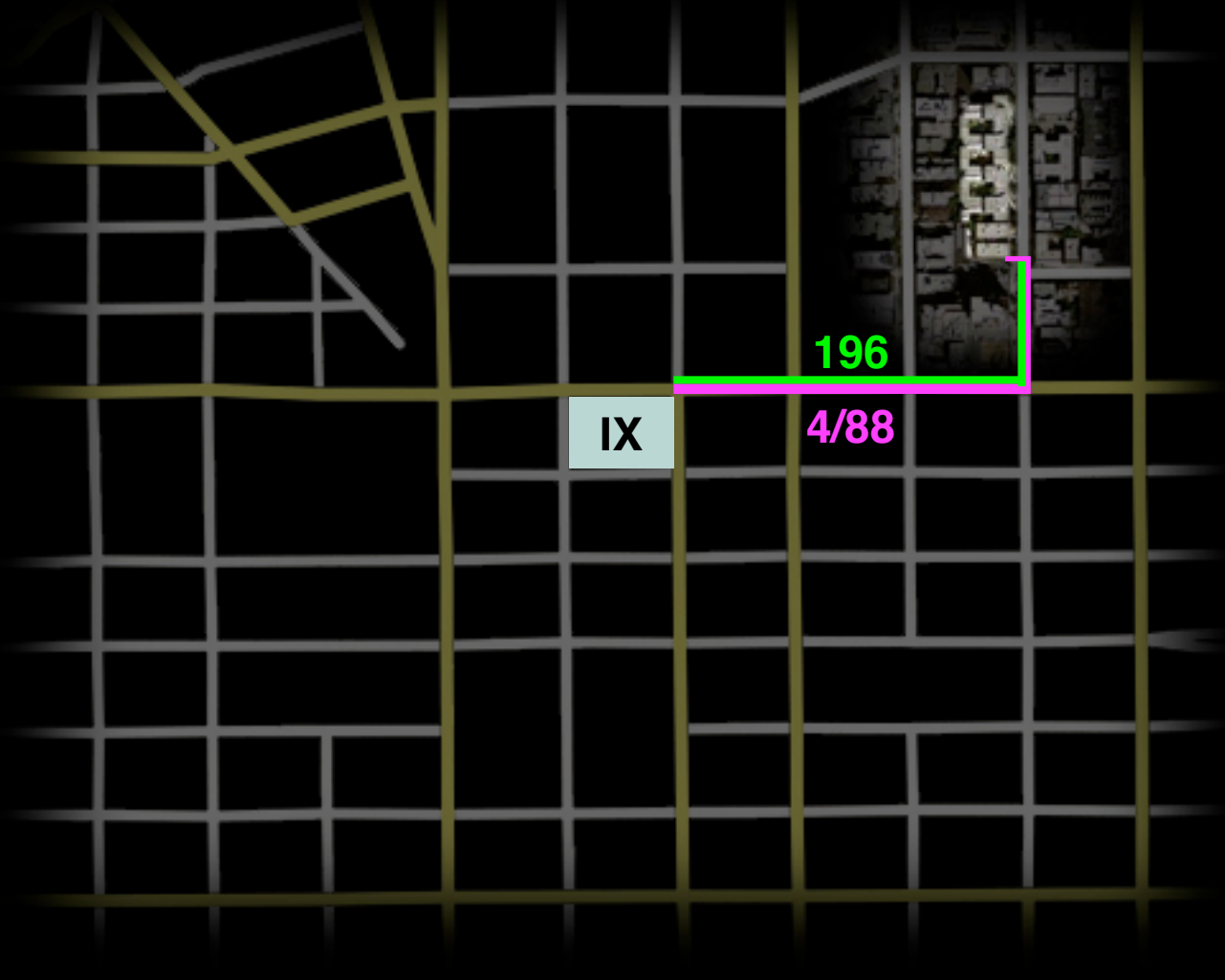
\$40,000 one-time

Use Case 4: Residential Tenant Wants Private Connection to IX



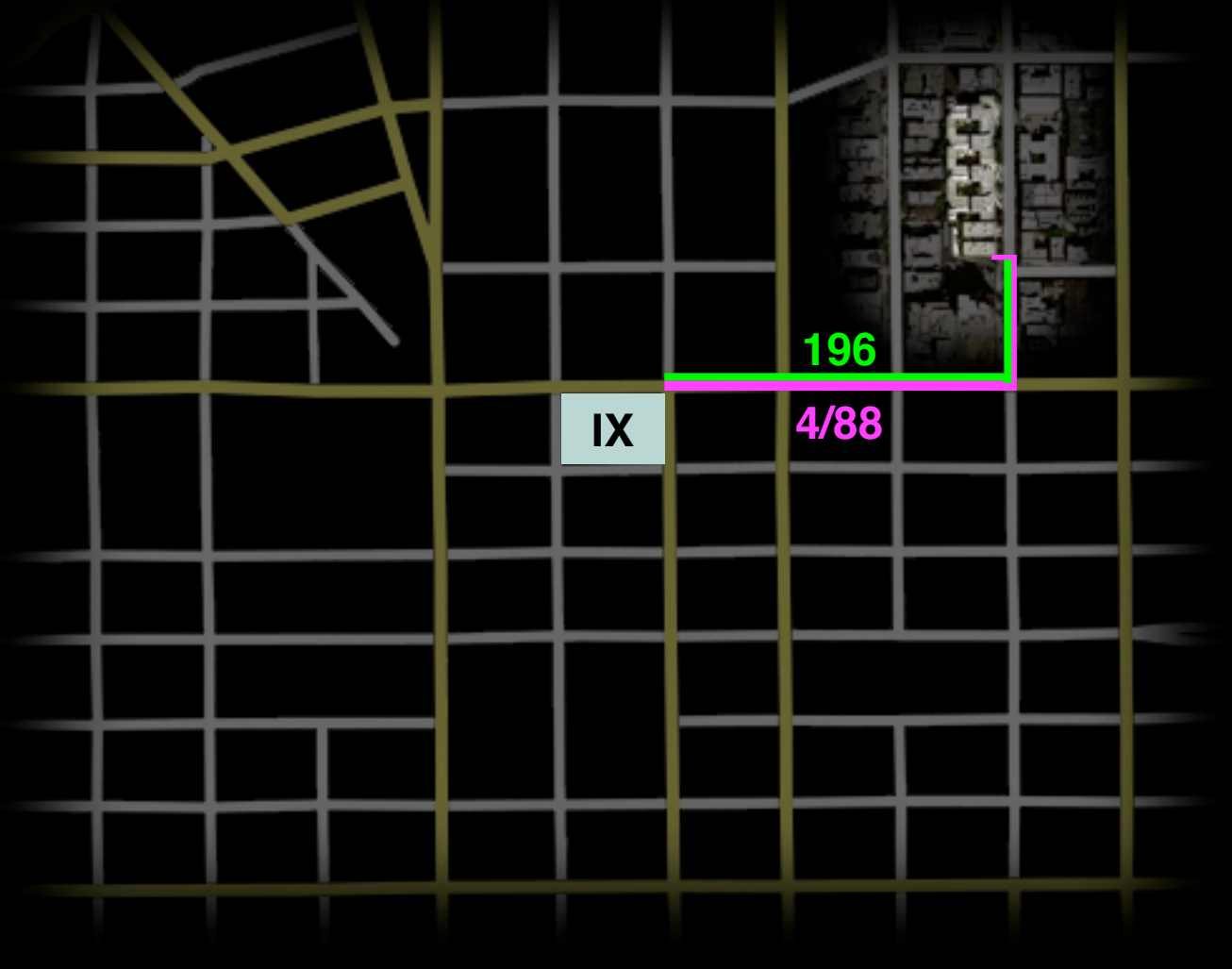
IX

Use Case 4: Residential Tenant Wants Private Connection to IX



Use Case 4: Residential Tenant Wants Private Connection to IX

The **tenant** has two choices: either his **landlord**, or the **fiber bank**.



Use Case 4: Residential Tenant Wants Private Connection to IX

The **tenant** has two choices: either his **landlord**, or the **fiber bank**.

The **fiber bank** offers IRUs at \$100/strand/mile/year, or \$160/year for two strands for four fifths of a mile.



Use Case 4: Residential Tenant Wants Private Connection to IX

The **tenant** has two choices: either his **landlord**, or the **fiber bank**.

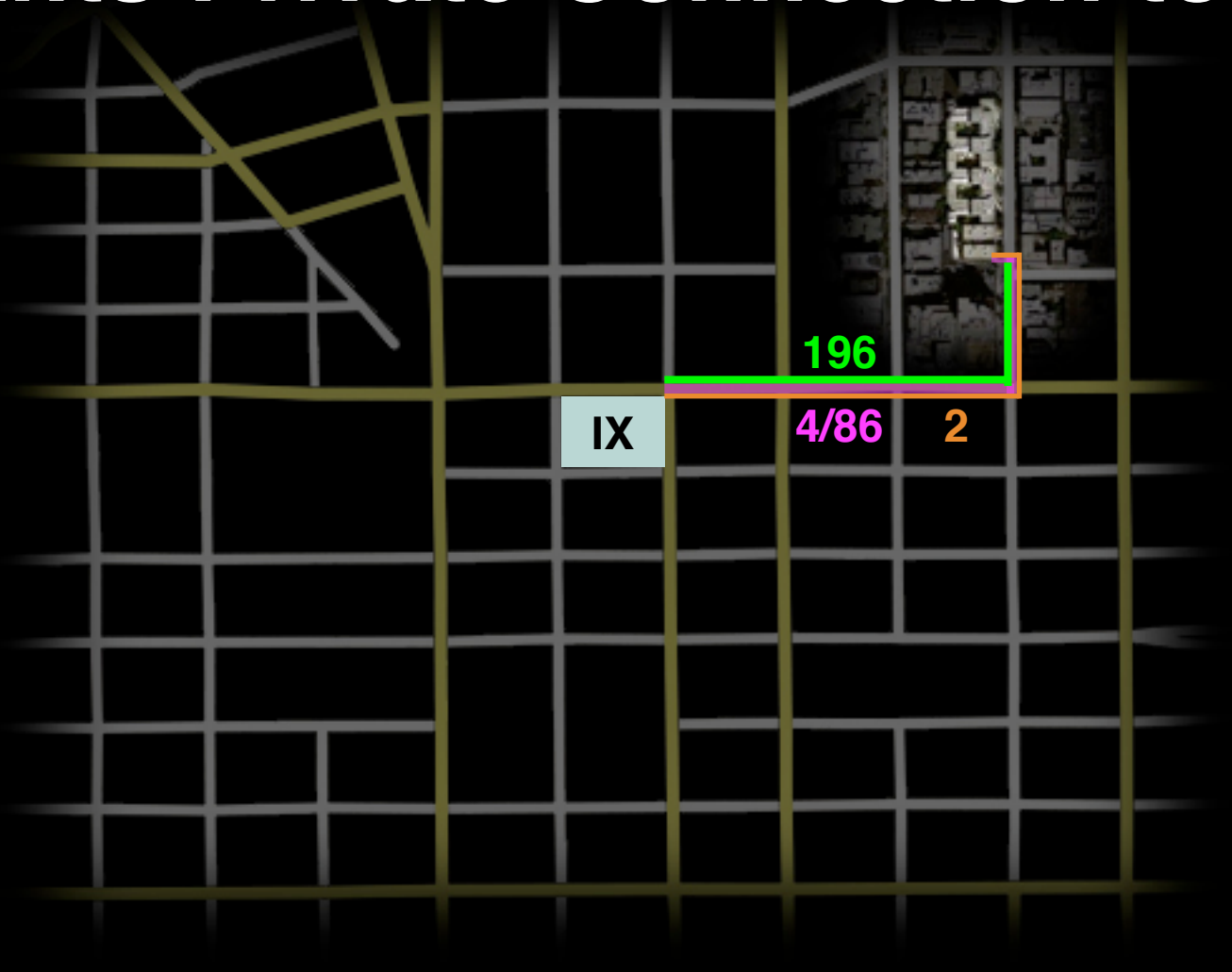
The **fiber bank** offers IRUs at \$100/strand/mile/year, or \$160/year for two strands for four fifths of a mile.



The **landlord** offers the same price, so the **tenant** chooses the simplicity of a single provider.

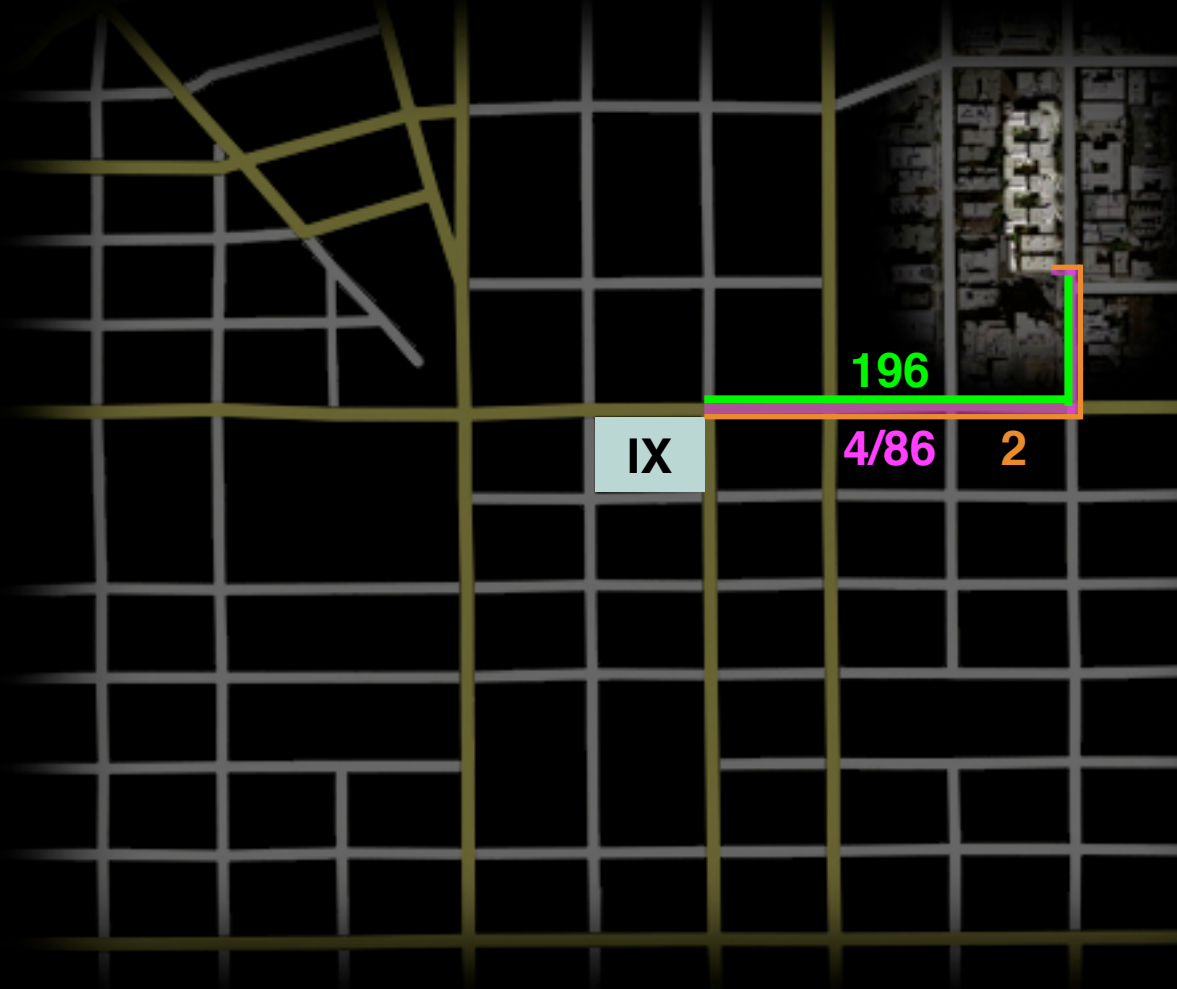
Use Case 4: Residential Tenant Wants Private Connection to IX

At this rate,
landlord's, 88
revenue-
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Use Case 4: Residential Tenant Wants Private Connection to IX

At this rate, landlord's, 88 revenue-producing strands are worth \$7,040/year.

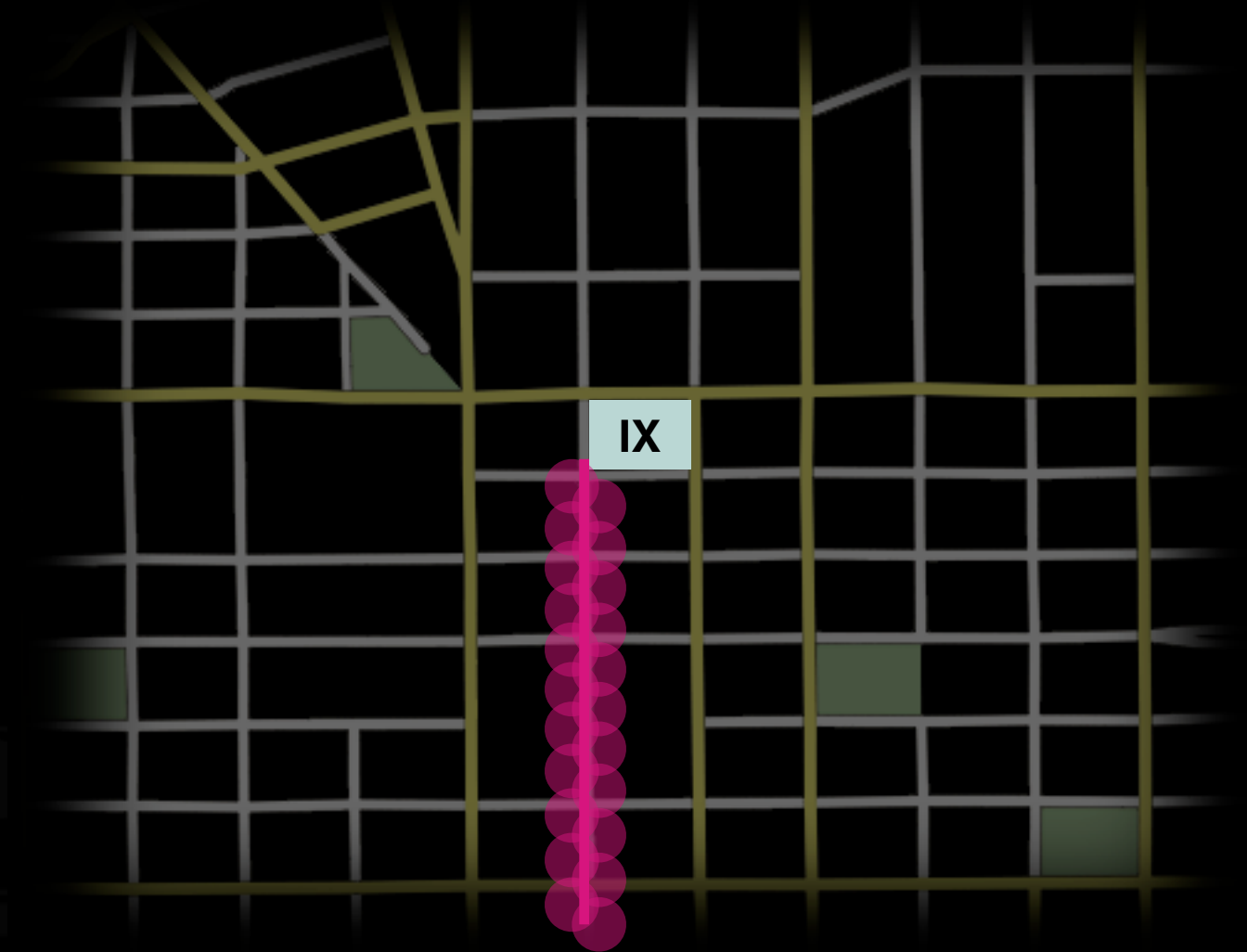


In addition to whatever value is being created with the four strands he's using for his own principal service, full occupancy would amortize his \$40,000 up-front expenditure in less than six years, compared to the traditional thirty.

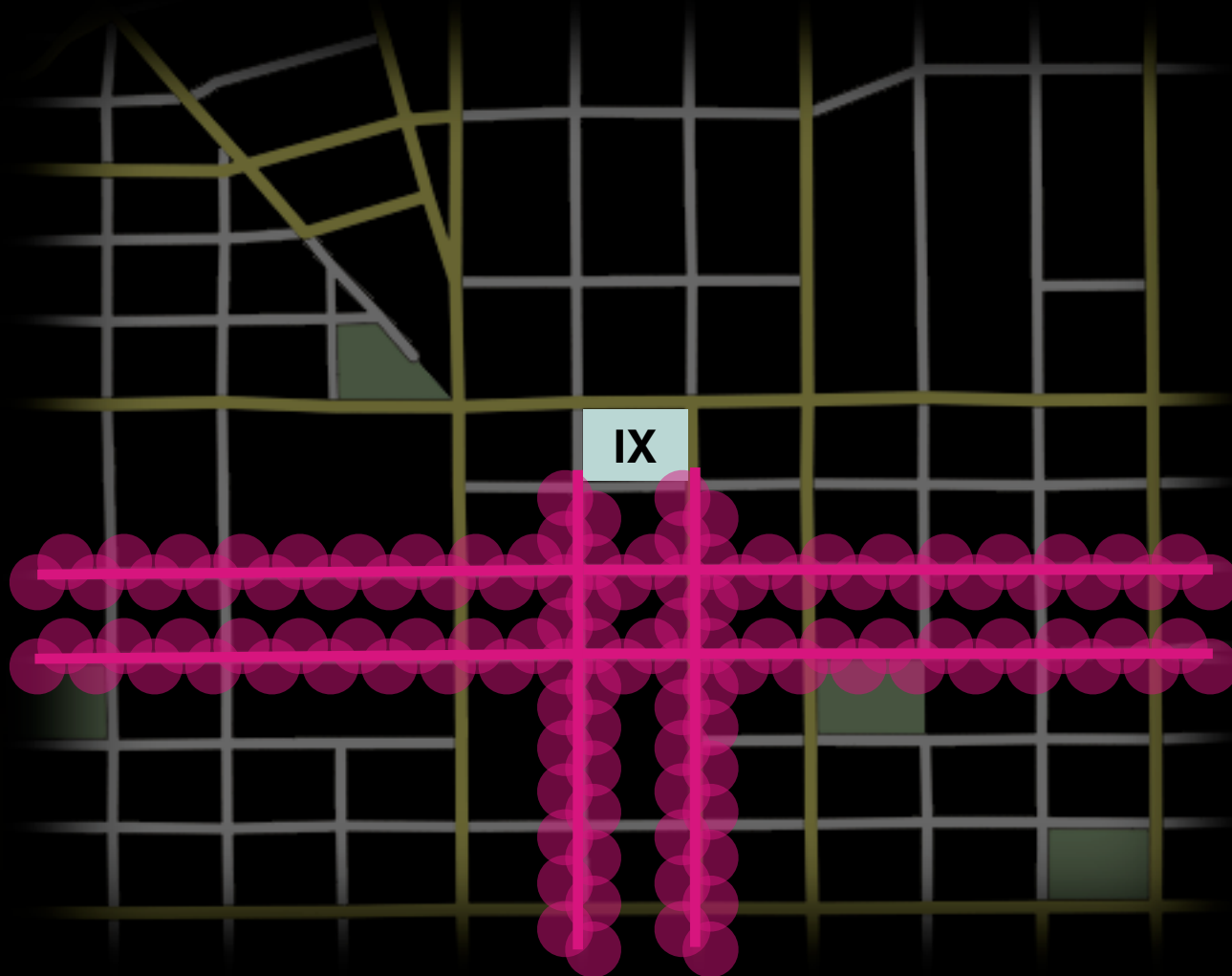
Under-Street Vaults

DRAFT

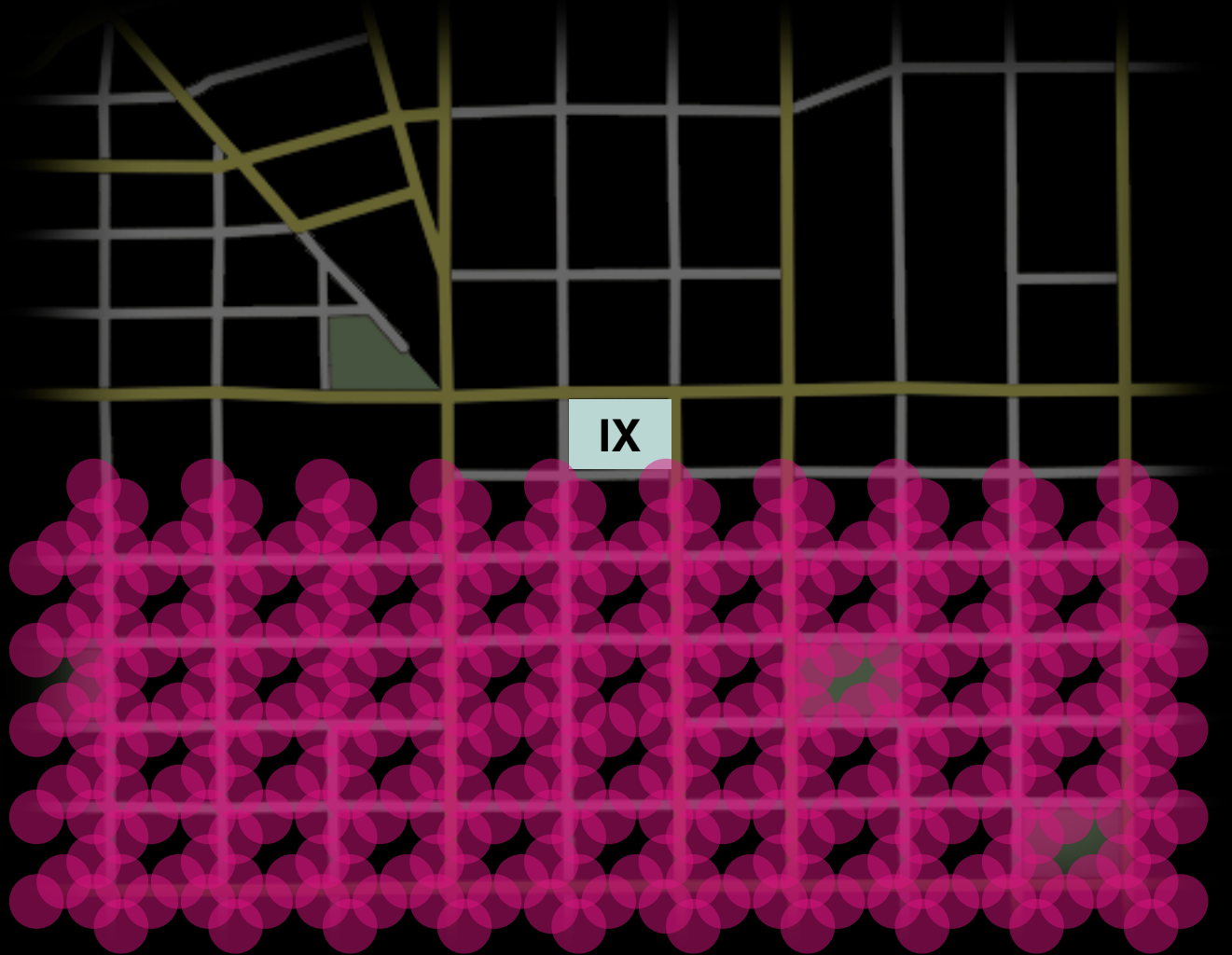
Use Case 5: Municipal WiFi FreeNet



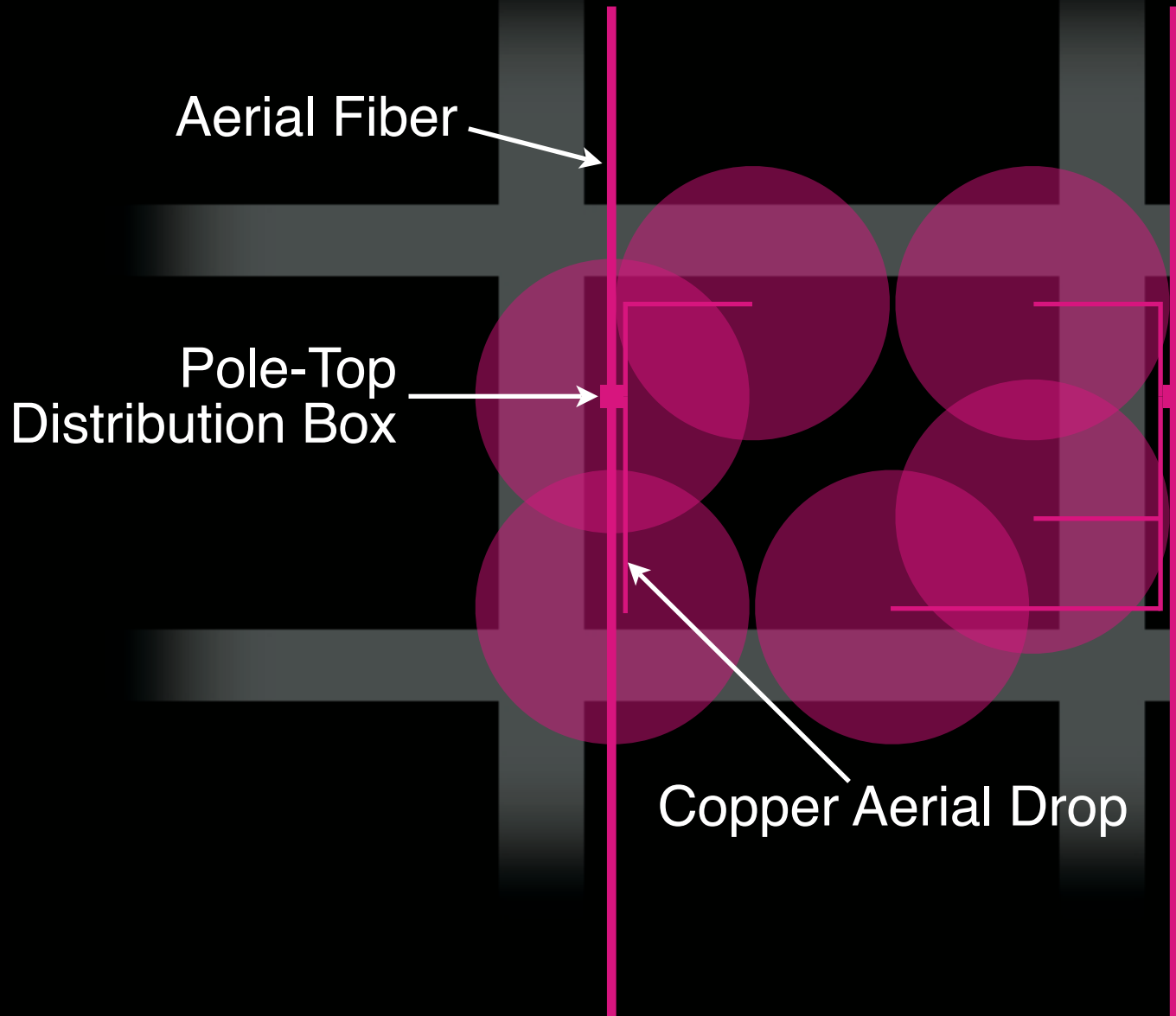
Use Case 5: Municipal WiFi FreeNet



Use Case 5: Municipal WiFi FreeNet



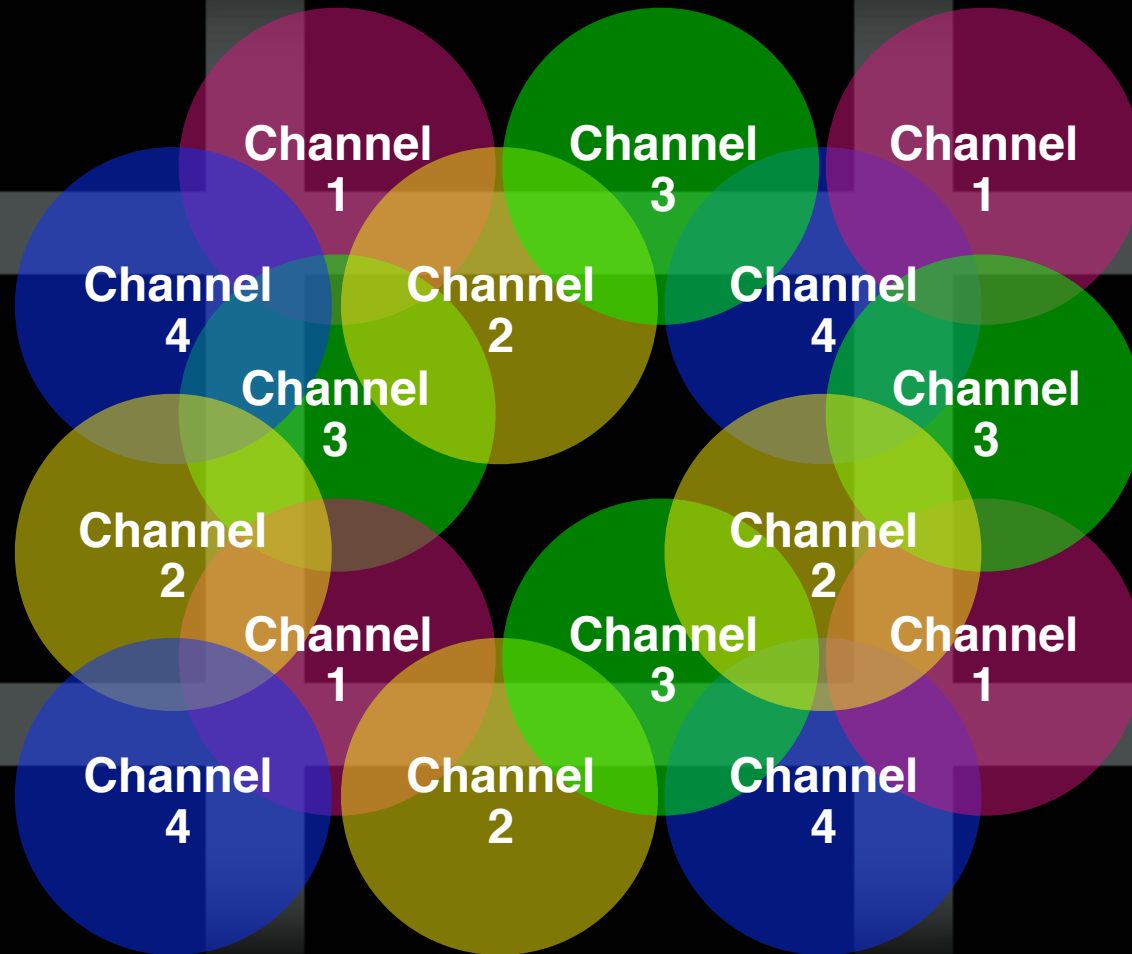
WiFi “Hotspot” Microcells



Overlapping Coverage Areas



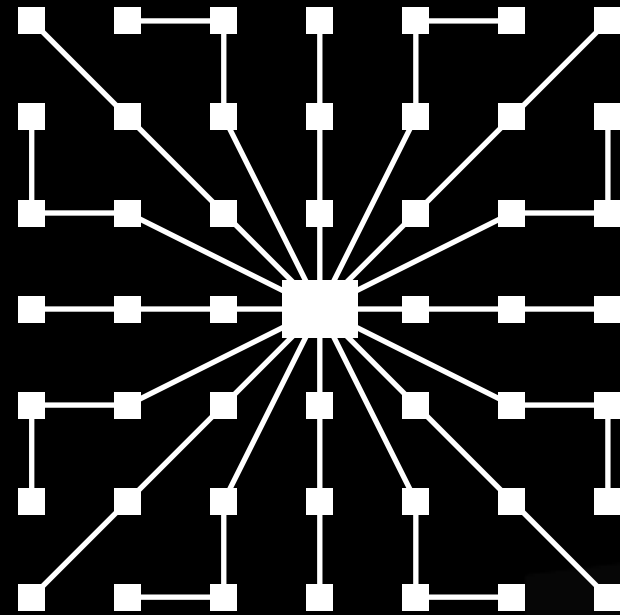
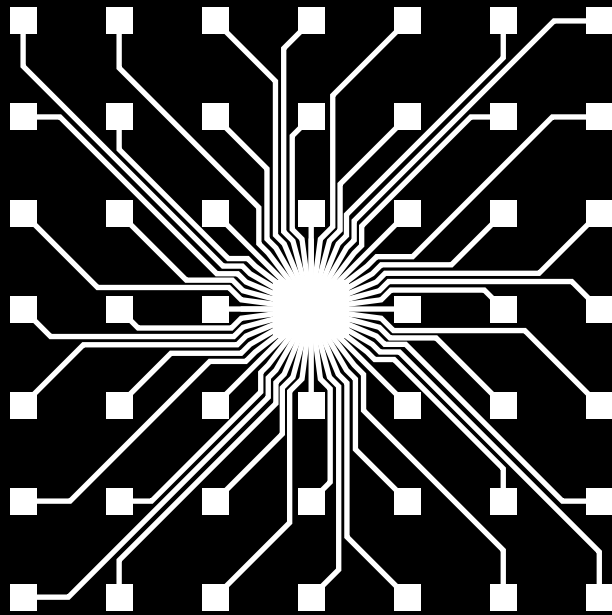
Spectrum Reuse



Spectrum Reuse

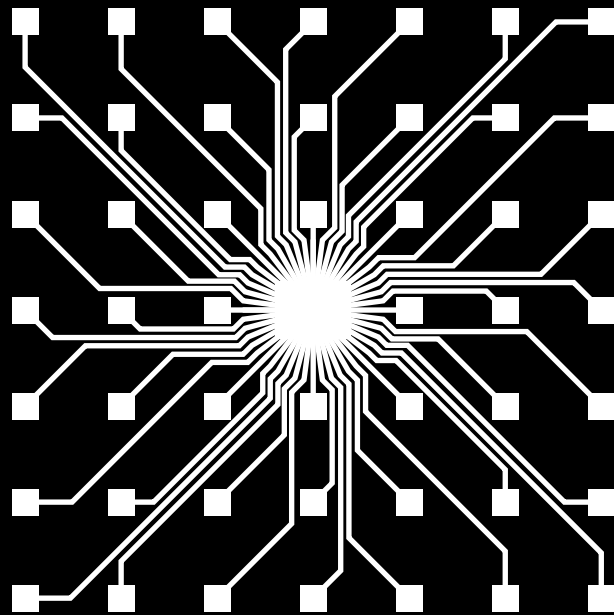
Topology

Home-run or Hub-and-Bus?

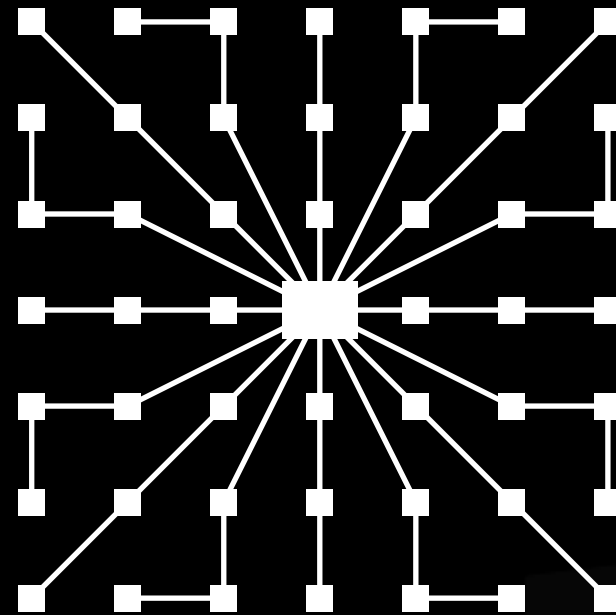


Topology

Home-run or Hub-and-Bus?



Faster/Cheaper



Fewer Strands

Recurring Costs

Our CBD consists of 100 blocks, which are an average of one mile from the IX.

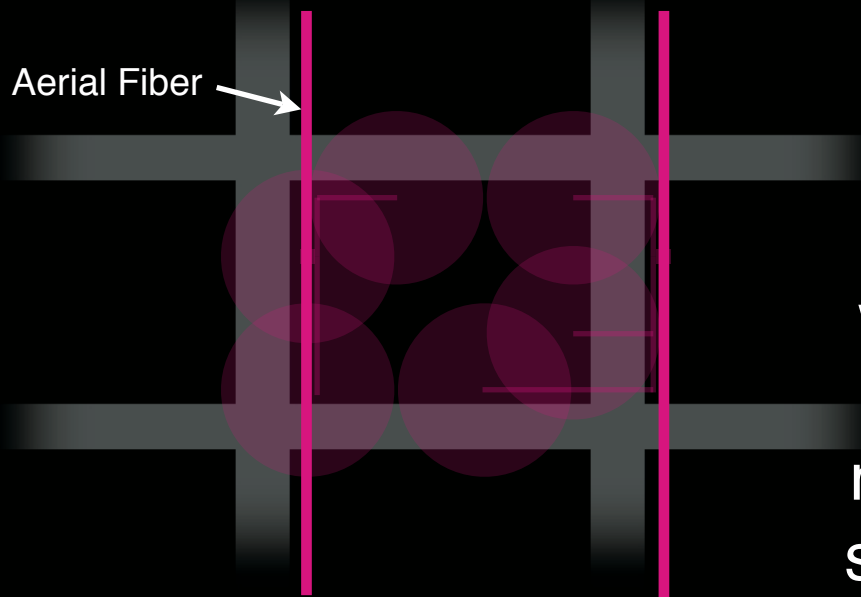
Aerial Fiber



In a home-run configuration, this will require 200 strand/miles for unprotected service, which would cost \$20K/year if leased...

One-Time Costs

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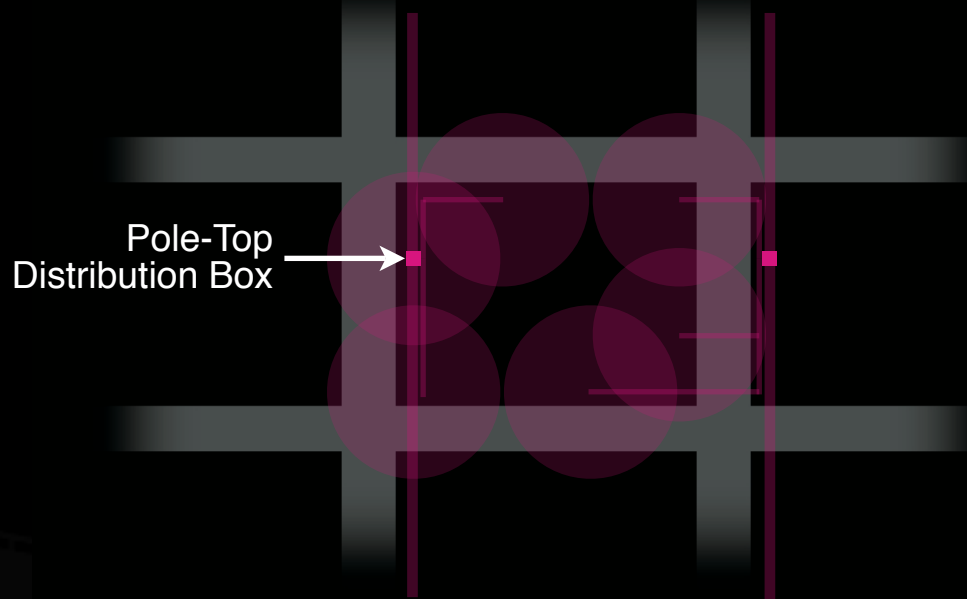
In a home-run configuration, this will require 200 strand/miles for unprotected service, which would cost \$20K/year if leased... or \$944K to build (23.6 path-miles and 28 cable-miles), with a surplus of 92 strands throughout.

This surplus would generate a maximum of \$258K/year if fully leased.

One-Time Costs

Each block requires a pole-top box to convert from fiber to copper for runs within the block.

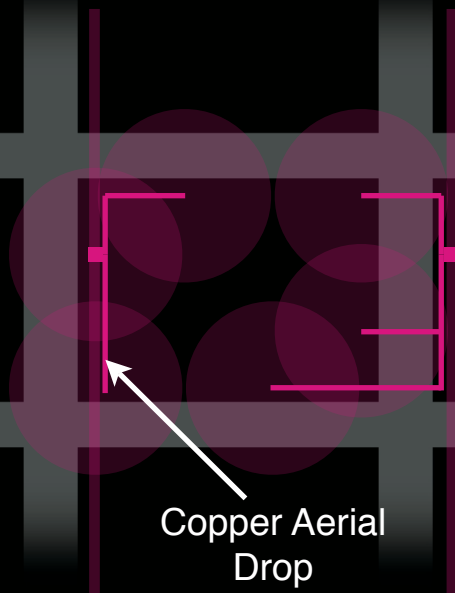
The switch, weatherproof enclosure, transformer or solar cells and battery, mounting hardware, and labor together cost about \$2,500 each, or \$250K overall.



One-Time Costs

The copper runs necessary to support WiFi Wireless Access Points (“WAPs”) or microcells cost about \$0.20/foot, and perhaps an additional \$0.80/foot to hang, if it’s being done at the same time as the rest of the aerial work.

Each block requires six runs at an average of 600 feet, for a total of \$3,600 per block, or \$360,000 overall.



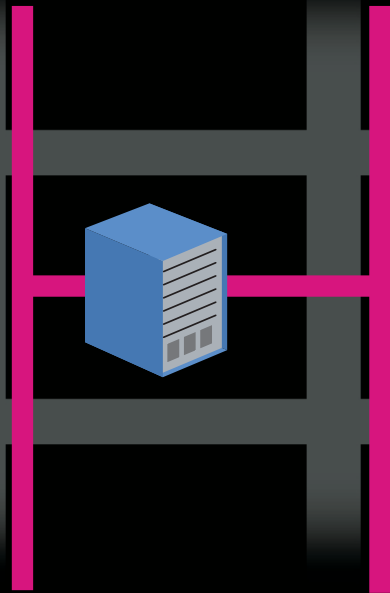
One-Time Costs

The access points themselves, including enclosure, antenna, and mounting brackets, cost about \$600 each, or \$3,600 per block, or \$360K overall.



One-Time Costs

The central router which will terminate the hundred 1-gigabit fiber runs and interconnect with the IX at 40 gigabits costs \$70K.



Costs Summary

Fiber runs	\$944K
Pole-top boxes	\$250K
Copper runs	\$360K
WAPs	\$360K
Router	\$70K
<hr/>	
	\$1.984M

Or...

Pole-top boxes	\$250K
Copper runs	\$360K
WAPs	\$360K
Router	\$70K
<hr/>	
	\$1.04M

Plus...

Fiber runs	\$20K / year
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Don't Violate Layer Boundaries

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Transparency Encourages the Market

All strand-counts must be public

All fiber-bank transactions must be public

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Indefeasible Rights of Use

Explain IRUs, difference between lease
and purchase

DRAFT

Explain formulas by which lease prices
may be arrived at

DRAFT

Explain exponential increase of price of remaining strands if sold to a current majority holder on a path.

Formula, graph

Explain that subsequent merger or finding of affiliation should trigger immediate application of exponential pricing.

What Happens When Something Goes Wrong?

...in Local Loop Construction?

Prevention often makes people happier than response. In some cases it may be more fiscally sound.

Emphasize quality in training and certification.

Optionally require that every job be insured or bonded against damage done to third-parties. If not, figure out how to deal with accidents.

...in Local Loop Construction?

The city can hire or employ other crews to do mitigation as a way of speeding repairs, and that expense can be charged to constructors' bonds or insurance.

...in the Street or on the Poles?

Certain major costs which result from natural deterioration or natural events, like pole replacement or flooding, may be absorbed by the municipality rather than individuals.

...in the Building Chosen as the IX?

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