

Infrastructure Attribution

Downloadable reference generated from the NetOS Markdown documentation.

Xiber NetOS - Infrastructure Revenue & Expense Attribution

Operating model for measuring the financial performance of towers, rooftops, data centers, POPs, carrier hotels, and aggregation facilities.

Purpose

Infrastructure assets are not only places where equipment is installed. They are economic platforms that support revenue-producing services downstream. A rooftop, tower, data center, or aggregation site should be evaluated by the revenue it enables, the direct cost it carries, and the downstream costs required to deliver that revenue.

This guide defines how NetOS should attribute revenue and expenses through infrastructure relationships so the platform can eventually produce a full waterfall view of network economics.

The model separates three concepts:

CONCEPT	MEANING
Physical placement	Where a circuit, radio, or facility endpoint physically lands. Example: circuit A location is BSI 1America.
Subtended relationship	Which parent asset economically supports a customer endpoint, circuit, or child facility. Example: BSI 1America subtends Tower A over fiber.
Cost source	The object that contributes cost to the relationship. Example: the customer endpoint is served through the Lakota Lakes POP circuit, so the relationship is <code>customer endpoint</code> and the cost source is <code>Circuit: Lakota Lakes POP</code> .
Attribution period	The effective date range during which a relationship is financially true. Example: Tower A moved from Parent POP 1 to Parent POP 2 on 2026-05-01.

The same circuit endpoint can stay physically fixed while the business relationship changes over time.

Relationship Diagram

The diagram below shows the intent of the infrastructure attribution tool. Customer revenue is entered at the endpoint or downstream relationship that produces it. Facility costs stay with the asset that owns the obligation. Circuit costs stay on the circuit and are allocated through subtended links when that circuit supports a customer, tower, rooftop, or child facility. The waterfall output rolls those values up to the serving structure, parent facility, market, and portfolio.



Core Objects

Infrastructure Asset

An infrastructure asset is a site, facility, or structure that can carry its own cost and may support downstream revenue. Electrical utility accounts are not infrastructure assets; they are add-on service cost items attached to infrastructure or customer sites.

Examples:

ASSET TYPE	EXAMPLES	TYPICAL DIRECT COSTS
Tower	owned tower, leased tower, water tower attachment	rent, ground lease, power, backhaul, insurance

ASSET TYPE	EXAMPLES	TYPICAL DIRECT COSTS
Rooftop	building rooftop, hotel roof, MDU roof	roof lease, power, access fees
Data center	colocation facility, meet-me site	cabinet, cross-connects, power, remote hands
POP	aggregation point, hub cabinet, carrier hotel presence	rack, power, transport, cross-connects
Carrier hotel	interconnect facility	MMR fees, cross-connects, cabinet
Aggregation facility	cabinet, hut, shelter, central office	lease, utility, backhaul

Current NetOS fields that contribute to direct site cost:

FIELD	MEANING
<code>mrc_usd</code>	Monthly recurring site/facility cost
<code>nrc_usd</code>	One-time non-recurring site/facility cost
<code>price_escalator_pct</code>	Contractual recurring cost escalation
<code>term_end_date</code>	Renewal/expiration date
<code>agreement_url</code> and documents	Supporting contracts, invoices, floorplans, photos, MSA, service orders

Infrastructure assets also carry a `cost_classification` that determines how the facility MRC participates in financial reporting:

CLASSIFICATION	WATERFALL TREATMENT
<code>operating</code>	Default state. Facility MRC participates in normal structure economics and inherited donor cost attribution.
<code>pre_revenue</code>	Facility MRC is held as pre-revenue investment. It does not flow into downstream inherited cost. The asset carries target MRR, breakeven date, decision owner, notes, and optional review/promotion thresholds.
<code>strategic_redundancy</code>	Facility MRC is held as strategic redundancy investment. It does not flow into customer margin. The asset records the protected asset, SLA justification, and review date.
<code>market_overhead</code>	Facility MRC contributes to a market-level overhead pool and is excluded from direct structure/customer inherited cost.

This separates steady-state operating margin from deliberate strategic investment. The market waterfall now reports operating revenue, operating cost, and operating margin first. It then deducts pre-revenue investment, strategic redundancy, and market overhead to produce portfolio contribution. Non-operating assets can still appear in topology and inventory, but their facility rent does not distort a downstream tower, POP, or customer margin while the asset is still being justified.

Circuit

A circuit is transport, internet, fiber, cross-connect, or other carrier service. It has its own cost and may connect one infrastructure asset to another, or connect an infrastructure asset to a customer endpoint.

Current NetOS fields that contribute to circuit cost:

FIELD	MEANING
<code>mrc_usd</code>	Monthly recurring carrier cost
<code>nrc_usd</code>	One-time install or setup charge
<code>service_type</code>	DIA, broadband, EVPL, EPL, wave, dark fiber, etc.
A/Z endpoints	Physical locations where the circuit terminates
Agreement documents	Service orders, MSAs, amendments, invoices

RF Link

An RF Link is wireless transport between an A location and a Z location. It can represent PTP microwave, PtMP sectors, Tarana links, rooftop wireless links, or licensed backhaul. RF Links are separate from carrier circuits because their economics often include equipment CAPEX, tower or rooftop rent, spectrum/licensing data, and customer endpoint service delivered from a structure.

RF Links are built from existing site records and follow the same direction convention as circuits: the A side is the customer or downstream side, and the Z side is closer to the donor/core. For facility-to-facility backhaul, select an A infrastructure asset and a Z infrastructure asset. For customer PtP service, select the customer endpoint and the Z donor facility. NetOS classifies links with a customer endpoint as customer endlinks and links between two infrastructure assets as backhaul. The displayed link name is generated from the A side, Z side, and selected RF system or equipment type so users do not maintain a separate manual name.

When an RF Link is created from an infrastructure asset to a customer endpoint, NetOS should create or update the matching subtended customer endpoint relationship. The relationship remains `customer_endpoint`, but the transport becomes RF (`ptp_wireless`, `ptmp_wireless`, or `microwave`) and the cost source becomes the RF Link. This keeps the hierarchy drilldown clear: the endpoint is the revenue relationship, and the RF Link is the wireless transport/cost source serving it.

Current NetOS fields that contribute to RF Link attribution:

FIELD	MEANING
<code>rf_system_id</code> and <code>equipment_type</code>	RF system standard selected from Admin, plus the radio, antenna, sector, or platform used by the link
<code>network_role</code>	Generated role: customer endlink when one endpoint is a customer, or backhaul when both endpoints are infrastructure
<code>path_role</code> and <code>diversity_group</code>	Primary, secondary, backup, diverse, or grouped path metadata used to distinguish parallel connectivity
<code>map_color</code>	Optional display hint for differentiating multiple links that follow the same visual path
<code>frequency_mhz</code> and <code>channel_width_mhz</code>	Spectrum used by the path
<code>bandwidth_mbps</code>	Capacity available on the RF path
<code>capex_usd</code>	One-time equipment or construction cost, tracked separately from monthly margin
<code>salvage_value_usd</code> , <code>useful_life_months</code> , <code>depreciation_start_date</code>	Inputs for straight-line monthly depreciation

FIELD	MEANING
<code>mrc_usd</code>	Monthly recurring non-rent RF cost, if any
<code>tower_rent_mrc_usd</code>	Monthly rent incurred because this RF link uses a tower or rooftop
<code>fcc_call_sign</code> and documents	License reference and uploaded FCC license or coordination documents
A/Z locations	Existing infrastructure assets, with customer records acting as customer-site Z endpoints

For monthly waterfall reporting, NetOS treats RF Link MRC plus tower rent MRC as calculated link cost. CAPEX remains visible on the RF Link and NetOS calculates straight-line monthly depreciation when useful life data is present. Depreciation is an asset-cost lens, not a cash-cost replacement for MRC.

RF system standards live in Admin. Each RF system has a name, description, frequency used, capacity, cost, PTP/PtMP type, and equipment role. PtMP inventory is split into base/sector systems and subscriber/client systems. Infrastructure assets host PtMP nodes using base/sector systems, such as a Tarana BN, Siklu Terragraph DN, or Cambium ePMP AP. RF Links created from those PtMP nodes use compatible subscriber systems, such as Tarana RN/RNv, Siklu T280/T265, or Cambium Force 4600c. When a user selects a PtMP source node, NetOS limits the RF Link subscriber selector to radios compatible with that base system and preloads equipment, capacity, and CAPEX defaults. These are starting values; the actual saved CAPEX should be adjusted to match the bill of materials, labor, and site-specific installation cost.

For PtMP customer endlinks, NetOS filters the customer endpoint selector to mapped customer sites within 10 miles of the selected PtMP source node. Users can select multiple nearby customer endpoints and create one RF Link per selected customer in a single add action. Customers without valid coordinates are not shown in this PtMP proximity selector until their address or latitude/longitude is corrected.

When a site has multiple paths, create separate circuits and RF Links for each physical or logical path. Use `path_role` for operating intent, such as primary or backup, and `diversity_group` for paths that should be evaluated together. On maps, parallel lines that share an A/Z path should be visually separated by path role, color, and slight line offsets so primary, secondary, and backup paths remain distinguishable.

The same downstream structure can have multiple active subtended relationships to the same parent when each relationship has a distinct circuit or RF Link. This represents redundant transport such as two fibers, fiber plus RF, or primary and backup paths. Reporting should count the downstream structure's own revenue, facility cost, and child rollup once, then add the cost of every active transport path between the parent and downstream structure. A downstream structure should not be active under two different parent sites for the same period unless the old relationship is ended and a new effective-dated relationship is created.

Electrical Service

An electrical service is a utility account or site power service attached to an existing infrastructure asset or customer site. It is separate from infrastructure because the service is an operating cost item, not a structure in the network hierarchy.

Current NetOS fields that contribute to electrical service cost:

FIELD	MEANING
<code>provider_id</code>	Electrical service provider selected from existing service providers
<code>infrastructure_id</code> or <code>customer_id</code>	Exactly one site where the electrical service is delivered
<code>service_type</code>	Commercial power, house power, dedicated meter, generator, solar, battery backup, or other service
<code>account_number</code> and <code>meter_number</code>	Utility account and meter identifiers
<code>service_voltage</code> , <code>service_amperage</code> , <code>phase</code>	Electrical characteristics for the delivered service
<code>delivery_location</code> and service address	Where at the site the service is delivered
<code>average_monthly_cost_usd</code>	Monthly cost used for attribution until actual bill data is integrated
<code>start_date</code>	Service start date
<code>monitoring_url</code>	Utility portal, metering, generator, UPS, or power monitoring link
Documents	Sample bills, invoices, service agreements, meter photos, and supporting documents

For attribution, electrical service cost should roll into the site it is attached to. If the service is attached to an infrastructure asset, it increases the direct site cost of that asset. If the service is attached to a customer site, it increases the customer endpoint cost. This keeps the physical hierarchy clean while still capturing the recurring cost required to operate the site.

Infrastructure and customer detail pages should show attached electrical services next to the other related services for that site. Users should be able to see the provider, account, meter, service characteristics, average monthly cost, monitoring link, and uploaded bills or supporting documents without leaving the site detail context.

Customer

A customer is the revenue owner for an endpoint-style service. NetOS separates customers from circuits and RF Links so the same commercial account or MFC property can have multiple paths, multiple services, and multiple supporting assets.

Commercial customer records describe the sold service. DIA and PTP include capacity because they are transport products. OTT services such as VoIP, IPTV, managed WiFi, and managed security are tracked as service flags on the customer. Customer records also carry contracted MRR, install NRC, and revenue source. MFC customer records describe the property model, including address, tenant count, access technology, property owner, property manager, and access rules.

Circuits, RF Links, and subtended links can reference `customer_id`. That selector should be preferred when the endpoint customer already exists. Free-form customer names remain useful for discovery records that have not yet been normalized into a customer record.

Customers also carry address and coordinates because they can act as the customer-site Z location for circuits and RF Links. This lets the map show customer sites alongside infrastructure assets and lets RF Links terminate at either a facility, a free-form Z location, or a customer site.

Revenue precedence is explicit: subtended link `revenue_mrr_usd` is the override when entered. If the customer has no explicit subtended link revenue, NetOS uses the customer's contracted MRR once for the customer summary. When several protected or parallel paths serve the same customer and no explicit path revenue is entered, the serving path table displays the fallback MRR evenly across paths for readability, but the customer financial summary does not multiply the customer revenue by the path count. This allows quick customer-site setup while preserving precise per-link revenue when a customer has multiple services.

Customer detail pages are the endpoint drilldown for the waterfall model. When a user clicks a customer endpoint in the hierarchy, subtended network list, dashboard attribution, or financial view, NetOS opens that customer and shows:

CUSTOMER DETAIL SECTION	MEANING
Customer Revenue	Contracted MRR from the customer record, unless a subtended link revenue override is present
Direct Serving Cost	Cost of the circuit or RF Link directly serving the customer endpoint
Inherited Donor Cost	Allocated share of shared facility MRC and upstream donor paths that feed the POP, tower, rooftop, or facility serving the customer
Total Attributed Cost	Direct serving cost plus inherited donor cost, maintenance reserve, and commission when present
Gross Margin	Customer revenue minus total attributed cost
Serving Paths	The donor structure, transport type, circuit/RF source, revenue, and cost for each path serving the customer
ROI Analysis	Customer revenue and attributed cost projected against total build CAPEX and serving path costs over 2-, 3-, 5-, and 10-year terms

The inherited donor cost model defaults to revenue pro rata allocation at each structure in the serving chain. If a POP has \$500 of facility MRC and an upstream circuit costing \$1,000 MRC, and that POP serves \$10,000 of unique active customer MRR, a customer generating \$1,500 MRR inherits 15% of the POP facility cost and 15% of the upstream circuit cost. If the POP itself is fed by a core site, the customer also inherits a revenue pro rata share of the core site's facility MRC using total customer revenue generated under that core site. This is explicit in the UI as `revenue_pro_rata`. It applies to shared circuits, RF transport, tower or rooftop rent represented through RF Link monthly cost, and facility rent/MRC.

Users can override inherited cost allocation on the subtended relationship when revenue pro rata is not the right driver. The default should remain `revenue_pro_rata` unless there is a documented reason to use a different method. `manual_pct` applies the entered inherited allocation percentage to upstream facility and donor path cost. `equal_share` divides the inherited cost across the active revenue endpoints under that structure. `direct` assigns 100% of the inherited shared cost to the relationship. Customer inherited cost detail shows the method and percentage used for each row so manually adjusted attribution remains auditable.

ROI Analysis treats RF Link `capex_usd` when present plus customer property CAPEX as the upfront investment required to serve the customer. This keeps the model useful for RF-fed customers, circuit-fed customers with property build costs, and redundant serving paths with their own payoff requirements. Customer install NRC is treated as upfront revenue that offsets the payback requirement. The ROI table is a snapshot model: it adds an 8% annual RF CAPEX maintenance reserve when RF CAPEX exists plus any customer maintenance reserve MRC as monthly OPEX, generates monthly revenue from contracted MRR, term years, term start/end dates, revenue escalator, and ramp months, subtracts commission as either a percentage of monthly revenue or a fixed monthly

dollar amount, and compounds direct serving cost plus inherited donor cost upward by 3% annually starting in year 2. The ROI detail separates serving cost, maintenance reserve, commission, total attributed cost, and margin before CAPEX so the assumptions can be audited. The monthly schedule uses the same variables by month. Net cash after CAPEX is the sum of monthly escalated contribution margin plus install NRC minus total build CAPEX; ROI percentage is net cash after CAPEX divided by total build CAPEX. IRR uses the monthly cash-flow stream of upfront NRC less total build CAPEX at month 0 followed by monthly contribution margin for the selected term. NPV uses the same cash flows with a 10% annual discount rate. Margin multiple is total contribution margin before CAPEX divided by total build CAPEX. If there is no build CAPEX, NetOS still shows net cash, but ROI percentage, CAPEX/ARR, margin multiple, and IRR are not meaningful.

The customer detail **What If** calculator is intentionally not stored. It reuses the customer revenue schedule and lets the user enter a hypothetical Type 2 circuit, alternate RF build, or renewal scenario. This supports conversion decisions such as comparing an owned RF build against a leased circuit by modeling alternate monthly transport cost, build CAPEX, monthly OPEX/reserve, install NRC, and commission assumptions.

Subtended Link

A subtended link is the economic relationship between a parent infrastructure asset and a downstream revenue source or downstream asset.

Current NetOS fields:

FIELD	MEANING
parent_infrastructure_id	The structure/facility receiving attribution credit
downstream_infrastructure_id	Optional child structure/facility that rolls up to the parent
circuit_id	Optional circuit used by or associated with the relationship
rf_link_id	Optional RF Link serving a customer endpoint or downstream asset
customer_id	Optional customer record receiving or producing the endpoint service
customer_name	End customer or account name when the endpoint is customer revenue
endpoint_name	Site, subscriber, building, or endpoint served
relationship_type	Customer endpoint, child structure, backhaul, aggregation, etc.
transport_type	Fiber, PTP wireless, PtMP wireless, DIA, broadband, cross-connect, etc.
revenue_mrr_usd	Direct monthly revenue attributed to this link; overrides customer contracted MRR
cost_mrc_usd	Manual monthly cost override for this link when calculated allocation is unavailable or intentionally overridden
effective_from	First date the relationship is financially active
effective_to	Last date the relationship is financially active
allocation_method	How shared revenue/cost should be allocated
allocation_pct	Percent applied when using percentage allocation
inherited_allocation_method	How upstream facility and donor path cost should be attributed; defaults to revenue_pro_rata

FIELD	MEANING
<code>inherited_allocation_pct</code>	Percent applied when <code>inherited_allocation_method</code> is <code>manual_pct</code>
<code>reparented_from_link_id</code>	Prior relationship when a child/customer moves to a different parent

On an infrastructure detail page, the same relationship is shown from two directions:

VIEW	MEANING
Subtended Network	What this site serves downstream: customers, child structures, RF links, and circuits.
Upstream Donor & Paths	What serves this site upstream: donor structure, transport path, and attributed path cost.
Structure Financial Summary	The site-level financial view: upstream path cost, direct facility cost, downstream path/customer revenue, downstream cost, total cost, and margin.

Example: if BSI US Bank Cincinnati subtends Lakota Lakes POP over an Altafiber EVPL circuit, the BSI page shows Lakota Lakes POP in its subtended network. The Lakota page shows BSI US Bank Cincinnati as the upstream donor and the Altafiber circuit as the path/cost source.

The structure detail summary includes the upstream path cost for the site being viewed. Parent portfolio rollups do not double count that same path: the parent sees the parent-to-child path as its direct link cost, while the child detail page shows the same path as its upstream cost.

Attribution Principles

1. Attribute Revenue to the Structure That Enables Service

Revenue should be assigned to the lowest infrastructure asset that directly enables the service, then roll up through parents.

Example:

RELATIONSHIP	DIRECT REVENUE
Tower A -> Customer 1	\$500 MRR
Tower A -> Customer 2	\$750 MRR
POP 1 -> Tower A	\$0 direct revenue, but receives Tower A rollup

Tower A gets \$1,250 direct revenue. POP 1 gets \$1,250 downstream revenue through Tower A.

2. Keep Facility Costs on the Asset That Owns the Obligation

Facility lease, cabinet, power, roof rent, or tower rent belongs to the asset that has the obligation.

Example:

ASSET	DIRECT FACILITY COST
Rooftop A	\$350 MRC roof lease
POP 1	\$1,800 MRC cabinet and power

The rooftop cost stays on Rooftop A. POP 1 only receives it as downstream cost if Rooftop A is subtended by POP 1.

3. Keep Circuit, RF Link, and Electrical Costs on the Source Record, Then Allocate Through the Relationship

Circuit MRC belongs to the circuit record. RF Link MRC, tower rent MRC, and CAPEX belong to the RF Link record. Electrical service average monthly cost belongs to the electrical service record attached to the site. A subtended link can reference the transport source to explain which circuit or RF Link supports the relationship, while site summaries include attached electrical services as add-on cost.

In the hierarchy drilldown, NetOS should distinguish the relationship from the cost source. A row may be a customer endpoint, downstream structure, or backhaul relationship, while the cost source may be a circuit, RF Link, electrical service, or manual override. This makes it clear what the node represents and which object is contributing cost to that segment of the network.

NetOS should calculate the attributed link cost automatically when it has the required driver data. Users should select the allocation method and provide the needed driver, such as allocation percentage, committed bandwidth, or subscriber count. Manual link cost should be treated as an override or fallback, not the normal workflow.

Attribution depends on how the circuit or RF Link is used:

USE CASE	RECOMMENDED ALLOCATION
Circuit serves one downstream endpoint	Direct allocation, 100% of linked circuit MRC
RF Link serves one customer endpoint	Direct allocation, 100% of RF Link MRC plus tower rent MRC
Circuit serves multiple customers on one tower	Calculate by revenue share or subscriber count
PtMP sector serves multiple customers	Calculate by revenue share, bandwidth share, or subscriber count
Backhaul circuit serves a child tower	Direct to child structure, then roll up
Aggregation circuit supports many facilities	Calculate by bandwidth, revenue, or configured percentage
Cross-connect supports one carrier handoff	Direct to the relevant circuit or facility

4. Never Rewrite History When Relationships Change

When a child facility or customer endpoint moves from one parent to another:

1. Set `effective_to` on the old subtended link.
2. Create a new subtended link under the new parent.
3. Set `reparented_from_link_id` on the new link.
4. Leave circuit endpoint history intact unless the physical circuit endpoint actually changed.

This preserves historical reporting and makes month-by-month waterfall views possible.

5. One Active Attribution Parent per Target

A circuit, RF Link, customer record, or downstream infrastructure asset should not be active under two parents for the same reporting period. NetOS blocks overlapping active assignments so revenue and cost are not counted twice in the hierarchy.

To move an attributed target:

1. Edit the existing subtended relationship and set `effective_to` to the last valid date.
2. Add the target under the new parent with a later `effective_from` date.
3. Use `reparented_from_link_id` when preserving the explicit move history is important.

NetOS also blocks circular hierarchy assignments, such as making a parent facility subtended by one of its own children.

Standard Rollup Formula

For each infrastructure asset:

```
direct_revenue = sum(active subtended link revenue_mrr_usd, or customer contracted_mrr_usd when
link revenue is blank)
direct_link_cost = sum(active subtended link cost_mrc_usd)
direct_facility_cost = infrastructure.mrc_usd

downstream_revenue = sum(child infrastructure total_revenue)
downstream_cost = sum(child infrastructure total_cost)

total_revenue = direct_revenue + downstream_revenue
total_cost = direct_facility_cost + direct_link_cost + downstream_cost
gross_margin = total_revenue - total_cost
gross_margin_pct = gross_margin / total_revenue
```

The current NetOS implementation uses this structure for infrastructure economics. Future versions should apply the same logic by accounting period and allocation method.

Allocation Methods

Allocation methods should produce calculated cost whenever NetOS has enough data.



Current implemented behavior:

METHOD	CALCULATION
direct	100% of linked circuit MRC unless a manual override is entered
manual_pct	linked circuit MRC multiplied by allocation_pct unless a manual override is entered
revenue_share	Uses full linked source MRC until revenue-share driver fields are modeled
bandwidth_share	Uses full linked source MRC until committed or measured bandwidth driver fields are modeled
equal	Uses full linked source MRC until sibling relationship group driver fields are modeled

The Subtended Network form shows a calculated direct link cost preview. When a manual override is entered, the override wins. When manual_pct is selected, the percentage controls the attributed cost. When a future method such as bandwidth_share, revenue_share, or equal is selected before its driver fields are modeled, NetOS uses the full linked source MRC rather than dropping the transport cost to zero.

Inherited shared cost allocation is separate from direct link-cost allocation. The subtended network list shows both the inherited attribution method and the calculated inherited cost applied to each relationship. The form includes a live inherited cost calculator that recalculates on each form change. It compares all inherited methods side by side using the current relationship revenue or downstream structure rollup revenue, sibling subtended relationships at the parent site, and the parent site's current shared monthly cost pool. The shared monthly cost pool includes the parent facility MRC plus the upstream donor-chain cost currently serving that parent, after applying the upstream relationship's own inherited allocation method. Parallel transport rows to the same downstream structure or customer count the revenue target once for inherited allocation. This lets the user compare revenue pro-rata, equal share, manual percent, and direct assignment before saving the relationship.

The infrastructure detail page also shows an inherited cost balance for the subtended network. Manual percentage and direct inherited allocations consume the shared cost pool first. Remaining cost is then assigned to calculated rows, such as revenue pro-rata or equal share rows. Calculated rows can never consume more than the remaining balance after manual/direct rows. If multiple manual or direct rows request more than the available pool, NetOS gives precedence to the row most recently changed and caps older fixed rows to the remaining balance. If manual adjustments leave cost unassigned, NetOS calls out the unallocated balance. Users can assign the remaining balance to the other calculated subtended links pro-rata or equally, which saves explicit manual percentages on those rows for auditability.

METHOD	CALCULATION
revenue_pro_rata	Default. Relationship share equals customer revenue or downstream rollup revenue divided by total revenue under the structure
manual_pct	Upstream facility and donor path cost multiplied by inherited_allocation_pct
equal_share	Upstream facility and donor path cost divided equally across active revenue endpoints under the structure
direct	100% of upstream facility and donor path cost assigned to the relationship

Direct Allocation

Use when a cost or revenue belongs completely to one relationship.

Example:

PARENT	LINK	REVENUE	COST	ALLOCATION
Tower A	Customer 1 via PTP radio	\$600	\$0	direct, 100%
Tower A	Dedicated DIA resale	\$1,200	\$650	direct, 100%

Percentage Allocation

Use when a known percentage of a shared cost belongs to a relationship.

Example:

SHARED CIRCUIT	TOTAL MRC	LINK	ALLOCATION %	ATTRIBUTED COST
POP 1 backhaul	\$2,000	Tower A	40%	\$800
POP 1 backhaul	Tower B	35%	\$700	
POP 1 backhaul	Tower C	25%	\$500	

Revenue Share Allocation

Use when a shared cost should follow revenue contribution.

Example:

LINK	REVENUE	SHARE OF REVENUE	ALLOCATED BACKHAUL COST
Customer A	\$500	25%	\$250
Customer B	\$1,000	50%	\$500
Customer C	\$500	25%	\$250

This is useful when capacity consumption is unknown but customer revenue is known.

Bandwidth Allocation

Use when a shared transport cost should follow committed or measured bandwidth.

Example:

LINK	COMMITTED MBPS	SHARE OF BANDWIDTH	ALLOCATED COST
Customer A	100 Mbps	10%	\$100
Customer B	400 Mbps	40%	\$400
Tower B uplink	500 Mbps	50%	\$500

This becomes more accurate after integration with monitoring or billing systems.

Subscriber Count Allocation

Use for PtMP systems where a shared AP/radio/backhaul supports many similar customers.

Example:

SECTOR	SUBSCRIBERS	SHARED SECTOR COST	COST PER SUBSCRIBER
Tarana Sector 1	20	\$1,000	\$50

Each customer link receives \$50 of shared sector cost.

Worked Examples

The worked examples below use the same basic pattern: revenue enters through customer or downstream links, direct facility costs stay on the owning asset, and transport costs are attributed through the relationship that uses the transport.



Example 1: Rooftop With PtMP Wireless Customers

Rooftop A has a Tarana base node serving five customer endpoints.

ITEM	AMOUNT
Rooftop lease	\$300 MRC
Power	\$75 MRC
Backhaul circuit	\$900 MRC
Customer revenue	\$2,750 MRR

Recommended modeling:

RECORD	MODEL
Rooftop A	Infrastructure asset with <code>mrc_usd = 375</code>
Backhaul	Circuit with <code>mrc_usd = 900</code>
Customer links	Five subtended links under Rooftop A
Backhaul allocation	Either direct to Rooftop A or allocated across customer links

Simple rooftop economics:

```

direct_revenue = 2750
direct_facility_cost = 375
direct_link_cost = 900
total_cost = 1275
gross_margin = 1475
gross_margin_pct = 53.64%

```

Example 2: Tower Subtended by a Data Center Over Fiber

Data Center POP 1 aggregates Tower A over an EVPL circuit. Tower A serves customers.

ITEM	AMOUNT
POP 1 cabinet/power	\$1,800 MRC
EVPL from POP 1 to Tower A	\$1,200 MRC
Tower A lease/power	\$600 MRC
Tower A customer revenue	\$4,500 MRR

Recommended modeling:

RECORD	MODEL
POP 1	Infrastructure asset with <code>mrc_usd = 1800</code>
Tower A	Infrastructure asset with <code>mrc_usd = 600</code>
EVPL	Circuit with A location POP 1 and Z location Tower A
POP 1 -> Tower A	Subtended link with <code>downstream_infrastructure_id = Tower A</code> , <code>circuit_id = EVPL</code> , <code>cost_mrc_usd = 1200</code>
Tower A -> customers	Customer subtended links totaling \$4,500

Tower A economics:

```

direct_revenue = 4500
direct_facility_cost = 600
total_revenue = 4500
total_cost = 600
gross_margin = 3900

```

POP 1 economics:

```

direct_revenue = 0
direct_link_cost = 1200
direct_facility_cost = 1800
downstream_revenue = 4500
downstream_cost = 600
total_revenue = 4500
total_cost = 3600
gross_margin = 900

```

Example 3: Aggregation Facility With Multiple Child Towers

Aggregation Facility A subtends three towers. Each tower has its own customers and costs.

CHILD	REVENUE	FACILITY COST	TRANSPORT COST FROM PARENT
Tower A	\$4,500	\$600	\$1,200
Tower B	\$3,200	\$500	\$900
Tower C	\$2,100	\$400	\$700

Parent facility direct cost is \$2,000 MRC.

Waterfall:

LAYER	REVENUE	COST	MARGIN
Tower A	\$4,500	\$600	\$3,900
Tower B	\$3,200	\$500	\$2,700
Tower C	\$2,100	\$400	\$1,700
Parent transport to children	\$0	\$2,800	-\$2,800
Parent facility	\$0	\$2,000	-\$2,000
Total parent rollup	\$9,800	\$6,200	\$3,600

This view answers whether the aggregation facility is economically successful after the child towers and required transport are included.

Example 4: Reparenting a Child Tower

Tower A originally rolls up to POP 1. On 2026-05-01, it is moved to POP 2.

LINK	PARENT	CHILD	EFFECTIVE FROM	EFFECTIVE TO
Link 1	POP 1	Tower A	2025-01-01	2026-04-30
Link 2	POP 2	Tower A	2026-05-01	null

Link 2 should store `reparented_from_link_id = Link 1`.

Reports for April 2026 attribute Tower A to POP 1. Reports for May 2026 attribute Tower A to POP 2. The physical EVPL circuit endpoint should only change if the actual circuit was moved.

Waterfall Reporting Model

A complete waterfall should show how revenue and expenses flow from customer endpoints to structures and then to parent aggregation points.

Use this example scenario:

1. Three customers are served from Tower A and generate \$4,500 MRR.
2. Tower A has \$600 MRC of direct facility cost.
3. POP 1 feeds Tower A with an EVPL backhaul circuit that costs \$1,200 MRC.
4. POP 1 has its own cabinet and power cost of \$1,800 MRC.

The waterfall answers two different questions. First, is Tower A locally profitable before upstream cost? Yes: \$4,500 revenue - \$600 facility cost = \$3,900 margin. Second, is POP 1 profitable after carrying Tower A, the EVPL backhaul, and its own facility cost? Yes, but only \$900 margin.



Recommended levels:

LEVEL	DESCRIPTION
Customer endpoint	End user or service endpoint revenue
Access link	PTP, PtMP, fiber drop, DIA resale, broadband, or cross-connect used by the endpoint
Serving structure	Tower, rooftop, MDU, POP, or data center directly serving the endpoint
Backhaul/transport	Circuits or wireless links connecting the structure upstream
Parent facility	Aggregation site, data center, POP, carrier hotel

LEVEL	DESCRIPTION
Regional/network rollup	Market, state, provider, service type, or entire infrastructure portfolio

Example waterfall output for the scenario above:

ROW	WHAT IT MEANS	REVENUE	COST	DOWNSTREAM	TOTAL COST	MARGIN
Customer links	The customer subtended links attached to Tower A	\$4,500	\$0	\$0	\$0	\$4,500
Tower A	The serving structure keeps the customer revenue and owns tower lease/power	\$4,500	\$600	\$0	\$600	\$3,900
POP 1 -> Tower A EVPL	The backhaul relationship required to support Tower A	\$0	\$1,200	\$0	\$1,200	-\$1,200
POP 1	The parent facility receives Tower A's economics and adds POP cabinet/power cost	\$0	\$1,800	\$4,500 revenue / \$1,800 cost	\$3,600	\$900
Market rollup	The portfolio layer sums POP 1 and other infrastructure assets in the market	\$0	\$0	\$4,500 revenue / \$3,600 cost	\$3,600	\$900

The key point is that the same revenue can look very profitable at the serving structure level, but the parent view is more honest about the full cost to deliver that revenue. Tower A's local margin is \$3,900. POP 1's rollup margin is \$900 after including the EVPL and POP costs.

Drilldown Flow Labels

The financial drilldown exposes row-level revenue and expense detail so users can understand both the amount and the direction of attribution.

LABEL	MEANING
Rolls Up	Revenue produced by a customer endpoint or child structure contributes upward to the serving structure, parent POP, market, and portfolio rollup.
Flows Down	Cost from a circuit, RF Link, or other transport path is assigned downward into the structure or endpoint that depends on that path.
Local	Cost belongs to the current structure itself, such as facility MRC, cabinet cost, rooftop rent, or other site-level obligation.

For example, Lakota Lakes POP can show customer endpoint revenue as **Rolls Up** because the customer revenue contributes to Lakota's total revenue. Its upstream EVPL path can show as **Flows Down** because that transport cost is assigned from the donor path into Lakota's cost stack.

Accounting Periods

Future reporting should evaluate active relationships by period:

```
relationship is active for period when:  
effective_from <= period_end  
and (effective_to is null or effective_to >= period_start)
```

Monthly reports should prorate revenue and cost when a relationship starts or ends mid-month. Until proration is implemented, NetOS should use whole-month attribution and clearly label reports as non-prorated.

Recommended period rules:

SCENARIO	RULE
Link active full month	Attribute full monthly value
Link starts mid-month	Prorate by active days, future state
Link ends mid-month	Prorate by active days, future state
Link reparented	Old parent receives value through old <code>effective_to</code> ; new parent receives value from new <code>effective_from</code>
Facility contract escalates	Apply escalated MRC beginning on escalation date
Circuit billing variance exists	Use invoice actuals for closed accounting periods once invoice ingestion exists

Recommended Data Entry Workflow

Adding a Customer Endpoint Under a Structure

1. Open the serving infrastructure asset.
2. Add a subtended link.
3. Enter customer name, endpoint name, transport type, revenue MRR, and direct link cost if known.
4. Link an existing circuit if the customer service depends on one specific circuit.
5. Set `effective_from`.
6. Save supporting documents if available.

Adding a Child Facility Under a Parent

1. Open the parent infrastructure asset.
2. Add a subtended link with `downstream_infrastructure_id`.
3. Link the transport circuit if one exists.
4. Put the transport cost either on the circuit record or in `cost_mrc_usd` for the subtended link, depending on whether it is already represented as a circuit.
5. Set the relationship effective date.

Changing a Parent Relationship

1. Open the current parent relationship.
2. Set `effective_to` to the last valid date.

3. Create a new subtended link under the new parent.
4. Set `effective_from` to the first valid date.
5. Link the new record back to the prior record with `reparented_from_link_id`.
6. Only update circuit endpoints if the physical circuit path changed.

Open Modeling Decisions

These should be resolved before production financial reporting:

DECISION	OPTIONS
Source of customer revenue	Manual entry first, then Sonar integration
Cost source of truth	Contract MRC first, invoice actuals after invoice ingestion
Shared transport allocation	Direct, percentage, revenue share, bandwidth, subscriber count
Wireless equipment costs	Expense as direct link cost, facility cost, or depreciated asset
NRC treatment	Exclude from MRR margin, amortize across term, or report separately
Mid-month proration	Whole-month initially, daily proration later
Tax/surcharge treatment	Include in actual invoice cost or separate pass-through category

Current Implementation Status

Implemented:

- Infrastructure assets have direct `mrc_usd` and `nrc_usd`.
- Circuits have direct `mrc_usd` and `nrc_usd`.
- Infrastructure detail supports multiple supporting documents.
- Infrastructure detail supports subtended links.
- Subtended links can reference child infrastructure, customer endpoints, circuits, and RF Links.
- Subtended links include effective dates, allocation method, allocation percent, and reparent lineage.
- RF Link calculated monthly cost uses RF MRC plus tower rent MRC. CAPEX is tracked on the link and is not included in monthly margin unless a future amortization model includes it.
- Infrastructure economics roll up direct revenue, direct costs, downstream revenue, downstream costs, total cost, total revenue, and margin.

Next recommended implementation steps:

1. Add a guided "Change Parent" action that closes the old link and creates the new one atomically.
2. Add edit support for existing subtended links in the UI.
3. Add accounting-period filters and historical waterfall reporting.
4. Add allocation calculators for revenue share, bandwidth, and subscriber count.
5. Integrate Sonar customer revenue as the revenue source of truth.
6. Integrate invoice actuals as the expense source of truth for closed periods.

7. Add exportable waterfall reports by asset, market, provider, and month.