The Open Access Network
Building for a Sustainable 21st Century Community By Maximizing Service Innovation

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Building for a Sustainable 21st Century Community
By
Maximizing Service Innovation
Seminar Discussion

• 2-Sessions
  – Open Access Discussions
  – Architectural Designs

• 1st Half
  – Open Access Business Model Understood
  – Open Access Network Model Defined

• 2nd Half
  – Fiber Architecture – Reference Models
  – Specifications and Fiber Applications

Key Findings and Conclusions
1st Half Discussion

- 1st Half
  - Open Access Business Model
    Origins
    Drivers
  - Open Access Defined
    Block Diagrams
    Interconnection and Open Access
Next Generation Network (NGN) is a broad term to describe some key architectural evolution in the telecommunications core and access networks that will be deployed over the next 5-10 years.

The general idea behind NGN is that one network transports all information and services such as voice, data, video and all sorts of applications by encapsulating these into packets, using techniques that are similar to the techniques used to access the Internet.
Changes in the NGN

NGN Involves Three Main Architectural Changes that Need to be Looked at Separately

1. Migration from the Public Switched Telephone Network (PSTN) to Voice over IP (VOIP) or Wireless

2. Migration of Legacy Services to a Commercial Migration of Constantly Changing Customer Applications

3. Consolidation of Several Networks Built for Varying/Multiple Services over One Core Transport/Access Network

The Focus of the Open Access Network Discussion
The term “Open Access Network” (OAN) was Coined by Roberto Battiti in 2003 in his Article “Global growth of open access networks: from war chalking and connection sharing to a sustainable business.”

- The OAN Refers to a Three Tiered, Horizontally Layered Network Architecture and Business Model
  - Separates the Physical Access of the Network from Service Provisioning
- The OAN will be used by a Number of Varying Communications and Applications Service Providers
  - May or May Not Share the Investment or the Maintenance Cost
Open Access Network Origins

Governments and Countries in Europe and Asia use Subsidies

Expand Telecommunications Networks and Extend their Physical Infrastructure

- The Theory for OAN
  - Foster Competition
  - Stimulate Economic Vitality
  - Guarantee “Best in Class” Architecture

- For Some this Required a Network that is Open to All
  - Similar to Concepts for “Open Source”
Open Access in Communications Network may be Dedicated to the Services of a Single Communications Service Provider (CSP), or made available to many CSPs.

The Open Access Network may Connect to the Communications Network at the Packet Layer or on a Wholesale Basis over a Separate Wavelength in the Optical Fiber Realm.

The Open Access Network may be Connected to the Communications Network within a Physical Layer Connection set by Separate or Multiple Physical Infrastructure Providers.
“Exclusive Access” refers to the condition where a single CSP has exclusive use of the Communications Network.

“Open Access (Packet)” refers to the condition where multiple CSPs may use the Communications Network by connecting at a packet layer interface, and compete to offer their services to end-users (EUs).

“Open Access (Wavelength)” refers to the condition where multiple CSPs or wholesale service providers may use the Communications Network by connecting at a wavelength layer interface, and compete to offer their services.

“Open Access (Fiber)” refers to the condition where multiple CSPs or wholesale service providers may use the Communications Network by connecting at a physical layer (“dark” fiber) interface, and compete to offer their services.

“Open Access (Duct)” refers to the condition where multiple CSPs or wholesale service providers may share the use of a communications duct network, each place their fiber through the shared ducts, and compete to offer their services.
Open Access Network North America

The Realization for an Open Access Network In North America

**has been Discussed, Dissected, and Discounted by Many**

Mainly as a Controversy

- Revolves Around Telecommunications Networks being Treated and Defined as a Utility

- Network Neutrality as a Means of Providing Fair and Equitable Solution to the Internet of Things (IoT)
Community Interests, Issues, and Technology Requirements

Communities are Faced with Single or Multiple CSPs

- First in Typically Dominates the Market – Monopoly Threats
- Could Compromise the Community from Extending their Networks
- Multiple Installations are Expensive to the Consumer – Rise in Service Costs
- Creating Digital Divide – Not all Communities will be Served Creating Social Inequities
- Not Enough Space in the ROW's to Accommodate Multiple Installations – ROW Congestion
Community/Municipal Objectives

- **Community** – Maintain a Sense of Community
- **Municipality** – Improve the Municipal Infrastructure
- **Services** – Develop Community Services Organization
- **Safety** – Improve Emergency Response and Management
- **Economic** – Ensure the Economic Viability of the Community
Open Access Governing Principles

- The existing monopoly/duopoly must not simply be rebuilt/reinforced by the network.

- Market entrants & incumbents need/deserve equal access and opportunity to the network.

- Innovation to encouraged and challenge/disrupt the status quo service, pricing, and content models.
The OAN Refers to a Three Tiered, Horizontally Layered Network Architecture

The Open Access Network separates the management of the physical infrastructure from the transport/access network and the delivery of services to the end user (EU).

The Physical Layer Network – Management of the physical network is the Physical Infrastructure Provider the PIP, and is defined as the Network Operating Company or NetCo. The NetCo does not provide the transport or access mechanisms that deliver the capacity to the network or the applications that ride over the network.

The Transport/Access Network – Management of the transport/access network is over the active network equipment that delivers the bandwidth (BW) or capacity over the Physical Layer Network. This is defined as the Operating Company or OpCo. The OpCo does not provide the physical network or the applications that ride over the network.

Services – Management of the services and applications offered to the EU is delivered by the Retail Service Provider or RSP. The RSP services includes the triple play for voice/data/video, commercial applications and connections to the Internet of Things (IoT). The RSP is customer facing, directly to the EU and provides the initial EU customer care contact.
Open Access Models
Open Access Concepts – *Primary Operating Company, the OpCo*

**Model**

**OpCo** – Manages
- Active/Passive Components
- Optical Distribution Network (ODN)
  - Copper/Fiber OSP
- Provides/Manages
  - Applications & Services
  - Incumbent Tier 1 Carriers
  - Direct Customer Facing

“Exclusive Access” refers to the condition where a single CSP has exclusive use of the Communications Network.
Open Access Concepts – The OpCo and the RSP

Model

**OpCo** – Manages
- Active/Passive Components
- Optical Distribution Network (ODN) Copper/Fiber OSP

**RSP** – Manages
- Applications & Services Tier 2/3 or CLEC Carriers
- Direct Customer Facing

“Open Access (Packet)” Management of the Communications Network by connecting at a packet layer interface.

“Open Access (Wavelength)” Management of the Communications Network by connecting at a wavelength layer interface.
Open Access Concepts – The OpCo, NetCo, and the RSP

Model

**OpCo** – Manages
- Active Components

**NetCo** – Manages
- Connectivity
- Optical Distribution Network (ODN)
  - Copper/Fiber OSP

**RSP** – Manages
- Applications & Services
- CSPs
- Direct Customer Facing

“Open Access (Fiber)” Management of the Communications Network by connecting at a physical layer ("dark" fiber) interface.

“Open Access (Duct)” Management of the Communications Duct-Bank System and ROW.
Open Access Concepts – The OpCo and the RSPs

Model

**OpCo** – (Multiple) Manages
- Active Components

**NetCo** – Manages
- Connectivity
- Optical Distribution Network (ODN)
  - Copper/Fiber OSP

**RSP** – Manages
- Applications & Services
- CSPs
- Direct Customer Facing
Open Access Concepts — *Multiple OpCos/NetCos, and the RSP*

Model: Open Access to All

**OpCo** — Multiple Operating Companies
- Active Components Only

**NetCo** — Multiple Network Companies
- Connectivity
- Optical Distribution Network (ODN)

**RSP** — Multiple Retail Service Providers

Applications 3-Play
- Voice/Data/Video
Open Access Concepts – *Multiple OpCos/NetCos, and the RSP*

Model: Open Access to All

**OpCo** – Multiple Operating Companies
- Active Components and
- May Offer RSP Services

**NetCo** – Multiple Network Companies
- OSP & Passive Components Only
- Optical Distribution Network

**RSP** – Multiple Retail Service Providers
- Applications 3-Play Voice/Data/Video
• 2\textsuperscript{nd} Half
  – Fiber Architecture – Reference Models
    FTTx Plant – ODN Specifications
    P2P/P2MP Splitting the NetCo and OpCo
  – Specifications and Fiber Applications
    Fiber Types and Applications
    Interconnection and Open Access
Defining the Network – Architecture – vs – Topology

- Architecture
  - The Logical or Theoretical View of the Network
  - How the Components (Cable, Hardware, Splitters) Relate

- Topology
  - The Physical View and Defines How the Network Connects
  - How the Architecture is Actually Implemented and Placed on the Map

The Topology may look the same as the Architecture, or look very different, even though it provides the logical function dictated by the architecture.
Reference Model – Multiple Operator Network

Infrastructure as a Service (IaaS)

Fiber Network
- NetCo
- P2P/P2MP

Access
- Transport Network
- OpCo
- PON
- VDSL
- AE/EFM
The Passive Optical Network – *PON Defined*

In the Open Access Model, the Key Objective for the NetCo is to Provide a Purely Passive Network

- **Broadest Definition (P2P/P2MP)**
  - Any optical network in which there are no active devices between a provider’s central electronics and the subscriber’s premises.
  - “Central Electronics” usually refers to a Central Office or Head End type facility, but can include a remote terminal-type device if it serves a significant number of subscribers.

- **Most Common Definition (P2MP)**
  - Any optical network in which there are no active devices between a provider’s central electronics and the subscribers’ premises and which uses optical splitting devices to manage light, reduce feeder fiber counts and share optical transmitter (laser) port.

In the Open Access Model, Remote Terminals are used as a Point of Interconnect (POI) for the OpCo
## Reference Model — Access Transport

### Wavelength Requirements for Access Transport over Fiber

<table>
<thead>
<tr>
<th><strong>P2MP GPON/GEAPON Applications</strong></th>
<th><strong>Downstream</strong></th>
<th><strong>Upstream</strong></th>
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<tbody>
<tr>
<td>Voice/Data</td>
<td>1490 nm +/- 10 nm</td>
<td>1310 nm +/- 50 nm</td>
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<tr>
<td>Video</td>
<td>1550 nm +/- 10 nm</td>
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<tr>
<td>Video Return Path</td>
<td>1610 nm +/- 10 nm</td>
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<tr>
<td>Voice/Data</td>
<td>1577 nm +/- 3-5 nm</td>
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<td>Not Allowed</td>
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<td>Voice/Data/Video 100Base-LX10 Dual Fiber (Tx – Rx) [10km]</td>
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Reference Model – *Point to Multi-Point/Point to Point PON*

**Active Components**
- NetCo P2MP
  - Centralized Splitting
    - Line Termination Equipment
- NetCo P2P
  - Distributed Splitting
    - Line Termination Equipment
  - Fiber Service Area Interface
- P2P
  - Line Termination Equipment
  - 1x32 Coupler

**Passive Components**
- NetCo
  - 1x8 Coupler
  - Distributed Couplers
- OpCo/RSP
  - Access Terminal
  - 1x4 Coupler

**Access/Applications**
- NetCo
  - Fiber Cross Connect
- OpCo
  - Line Termination Equipment
  - 1x32 Coupler
- OpCo/RSP
  - 1x32 Coupler

**Centralized Coupler**
- Line Termination Equipment

**Distributed Couplers**
- Fiber Cross Connect
- NetCo
  - P2MP
  - P2P
- OpCo
  - Line Termination Equipment
  - Splitting in the CO/HE
  - Single/Multiple Coupler

**1x32 Coupler**
- Line Termination Equipment

**1x8 Coupler**
- Distributed Couplers

**1x4 Coupler**
- Access Terminal

**Point of Interconnect (POI)**

**Fiber Cross Connect**
- NetCo
  - P2MP
  - P2P
- OpCo
  - Line Termination Equipment
  - Splitting in the CO/HE
  - Single/Multiple Coupler

**Bicsi**

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*NetCo* = Network Cooperator

*OpCo* = Operator Cooperator

*NetCo OpCo* = Network Cooperator/Operator Cooperator

*OpCo RSP* = Operator Cooperator/RSP
Open Access Concepts – From the Reference Model

Point-to-Point Architecture

- Feeder (F1)
- Distribution (F2)
- Drops (F3)

Bicsi
Open Access Concepts — Primary Operating Company End-to-End

Model 1

“Exclusive Access”
Separating the OpCo and NetCo

Is it possible to separate and technically split the OpCo and NetCo functions in a clean manner? **Yes**

If YES, what would the OpCo own? What would the NetCo own?

**Access Electronics**

**Transport Electronics**
Multiple OpCos

- In the event that there are multiple OpCos and one single NetCo, will your answers be different?
  - Yes Somewhat….

From the Architectural View

Open Access Concepts – *Multiple OpCo Separation*
Multiple OpCos and NetCos

Multiple P2P Distribution Fibers (2-4 fibers) from each EU will be Terminated at Individual (NetCo), Secure Fiber Frames inside the POI

The EU will Contact the RSP of Choice for Service or Applications
The RSP will Contact the Contracted OpCo to Manage the Access Equipment Connection and Service Provisioning (Bandwidth Requirements)
The OpCo Technicians and Engineers will now patch the corresponding Access Equipment to the Individual EU Cross Connection within the POI

Each RSP is typically working with a single OpCo.
If there are multiple RSPs working with a single OpCo, the bandwidth provisioning is typically handled at the IP or Wavelength Layers.
Open Access Topology
How the Architecture is Implemented on the Map

- Pull Box
- Fiber Access Terminal
- Traffic Controller/Security Community Owned
- Fiber Serving Hand/Hole
- Fiber Distribution Hub

Middle Mile/Plus Infrastructure
Last Mile Infrastructure
Last Mile Serving Infrastructure
Subscriber Serving Infrastructure
POI – Point-of-Interconnect
PII – Primary Infrastructure Interface
The Point of Interconnection is:

- The Local Interface Point within a Serving Area (SA)
- The Remote Interconnection between the Primary Interconnection Interface (PII)
  - The PII is the Transport Connection to DCs, COs, HEs and Local CSPs.
- Where the End User Physical Connections are Terminated and Managed by the NetCo
  - When Service is ordered by the RSP, the End User Connections are then Terminated at the Access Electronics and Capacity is Managed by the OpCo.
- Analogous to that of a CO/HE, or Remote Hut in a Telephony Network or HFC Node in the Cable Co
  - Not to be Confused with a Remote Terminal or Cabinet
Open Access – POI Fiber Management Concepts
The POI Dimensions and Equipment Bay Layout -
Equipped for 3000 Single Fiber EU Terminations
Or 750 Four Fiber EU Terminations

Note 1: Active Electronics Equipment Frames are assumed to be 58.42cm Wide,
(23-in.) relay racks with “Built-In” Inter-Frame Management Panels (IMPS). The
Fiber Frame dimensions are 76.2 cm Wide (30-in) x 60.96 cm Depth (24-in.)

Note 2: The Ladder Rack Configuration is to facilitate all OSP Cable, Inter-
Frame-Cabling and Power Cabling.

Note 3: The Fiber Raceway System is to facilitate all fiber jumper cabling
between the active equipment and the fiber connectivity equipment.

Note 4: The Inter-Facility Cable (IFC) will extend from the Primary Fiber Frame to
the Last Mile OSP Cable and be terminated (Spliced) at the primary splice vault.
The IFC Cable will be factory terminated with Indoor Rated US Connect Multi-
Fiber Push-On (MPO) Connectors at the Fiber Frame Side. An additional IFC will
extend from the Transport Equipment and Fiber Frame to the Middle Mile OSP
Cable and Terminated at the Primary Splice Vault. This IFC Cable will also be
factory terminated with Indoor Rated US Connect Multi-Fiber Push-On (MPO)
Connectors at the Fiber Frame Side.
The POI Relay Rack Layout

Fiber Optic Terminations and Active Equipment

- Sizing Defined by the Number of Subscribers Supported in a Given Serving Area (SA)
- View of Active Equipment Frames show support for 3000-P2P End User (EU) subscribers
- View of Fiber Frame shows support for 3,456 Fiber Optic Terminations
- Additional Racking for AC Power Transfer and Battery Plant
- Additional frame for Transport, other business opportunities, dark fiber, strategic partners, and dim fiber.

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The POI Dimensions and Equipment Bay Layout - Equipped for 3000 Four Fiber EU Terminations

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As a reference, increasing the number of hubs/Remote Sites/POIs:

- Further distributes this risk of catastrophic hub failure to smaller groups of subscribers.

- Increases the aggregate cost of real-estate and support systems (backup power, climate control, etc.) for the remote sites.

- Reduces the average fiber distance from the hub to each subscriber, further increasing the average availability and reliability of the fiber as it relates to fiber damage.

- Allows service infrastructure (servers, etc.) to be deployed on a more distributed basis to increase scalability for demand, although likely at a higher initial cost in order to reduce operating cost.
Conversely, decreasing the number of hubs/Remote Sites/POI:

- Can increase the number of subscribers affected by a catastrophic hub failure.

- Reduces aggregate cost of hub location real-estate and support systems through certain economies of scale.

- Reduces the average fiber distance from the hub to each subscriber, further increasing the average availability and reliability of the fiber as it relates to fiber damage.

- Increases the average fiber distance from the hub to each subscriber, thereby decreasing the overall network availability as it relates to fiber damage (unless redundant paths are provided to a deeper intermediate aggregation point in the network).

  Redundancy is typically afforded only to the Strategic Partners and Cost Recovery Entities (Govt./Business).
Open Access – *Network Architecture (Layout)*

The OAN Layout

Logical View

- Data Center Support Throughout
- Protected Switched Ring Architecture
- Individual OpCo Protected Architecture
- Access ROADMs Scaled from 10Gbps – 40Gbps
- Backbone ROADMs Scaled from 10Gbps – 100Gbps
- Individual ROADM (Working/Protect) Within each POI
Open Access – *Network Architecture (Layout)*

The OAN Layout

Logical View

- Data Center Support Throughout
- Protected Switched Ring Architecture
- Individual OpCo Protected Architecture
- Access ROADM(s) Scaled from 10Gbps – 40Gbps
- Backbone ROADM(s) Scaled from 10Gbps – 100Gbps
- Individual ROADM (Working/Protect) Within each POI
OSP Review — Component Layout

Primary F3 Feeder Fiber

Secondary F2 Distribution Fiber

F2 Drop Cables

Access Terminal

POI

Fiber Distribution Hub

Primary F3 Drop Fiber

Working/Protect To PII/POI/DC

MTU/MDU

SFU Serving Area

FDH - Fiber Distribution Hub

AT – Access Terminal

SFU Serving Area

1

FDH - Fiber Distribution Hub

AT – Access Terminal

Working/Protect To PII/POI/DC

MTU/MDU

SFU Serving Area

1
Fiber Management

How much Feeder Fiber (F1) to place between PII and POI?  
(Full Redundancy Individual ROADM Working/Protect)

- Access ROADMs to Backbone ROADMs 2-Fibers - Access ROADMs Scaled from 10Gbps – 40Gbps
- Backbone ROADMs to DC/Exchanges 4-Fibers - Backbone ROADMs Scaled from 10Gbps – 100Gbps

How much Distribution Fiber (F2) to place between AT and POI?  
(Business/Critical/Government Protected by Policy)

- 1-Fiber/OpCo – Network Build from EU to Access Terminal/Access Terminal to FDH/FDH to POI P2P
- 2-Fibers/OpCo/NetCo – Network Build from EU to Access Terminal/Access Terminal to FDH/FDH to POI P2P

How much Drop Fiber (F3A) to place between AT and EU?

- 1-Fiber/OpCo/EU – 1-4 Fibers Placed/Owned by the NetCo to the NID at the EU. The OpCo/RSP to Place/Own the F3B Drop Fiber from the NID Location to the CPE Equipment
Fiber Management

How do we Determine the Standard Lengths for Slack Cables that are Suitable for the OAN?

Much Depends upon Cable Placement Type – Aerial Below Ground, Direct Burial

(NOTE: For the OAN, Best Practices Require Below Ground, Duct Protected Deployment Techniques.)

How much Slack Cable Should we Plan for and Where do we Place Them?

• For the Primary Distribution Fiber (F2) – The NetCo Owns and Manages (Policy and SOP will require all splice location to place additional cable at each FDH and Access Terminal.)

(NOTE: At the FDH and Access Terminal Locations Connector Methods May be used to Lower Cost and Speed Deployment.)

• For the F3A Drop Cable Placement, – The NetCo Owns and Manages (Policy and SOP will require connector methods to be used at each Access Terminal and EU NID Location.)

(F3A Drop Cable Lengths to be determined by the Distributor [Cable Vendor].)

• For the F3B Drop Cables, – The OpCo will Own and Manage the Active Component and the F3B Drop Cable. (Policy and SOP will require connector methods to be used at each EU NID Location and OpCo Access Equipment CPE.)

(F3B Drop Cable Lengths to be determined by the Distributor [Cable Vendor].)
Interconnection Management

How is Interconnection Designed in the NetCo Passive Layer?

- For the Point-to-Point (P2P), Multiple Primary and Secondary Distribution Cables are Inter-Connected at the FDH
- For the Point-to-Multi-Point (P2MP), Multiple Splitters and Multiple Splitter Inputs are Inter-Connected at the POI

(NOTE: All Distribution and F3B Cable will be P2P [Home Run] from the POI to the FDH/Access Terminal/EU Locations.)

How is Interconnection Designed in the NetCo Passive Layer to Ease Interconnection at the Active OpCo Layer?

- For the Point-to-Point (P2P), the Primary Distribution Cables (F2) are Terminated in Individual Fiber Optic Frames for each OpCo
- For the Point-to-Multi-Point (P2MP), Multiple Splitters/Multiple Splitter Inputs are Inter-Connected in the POI at each OpCo Fiber Frame

(Where the OpCo has Multiple – RSP Services to a Single EU, Interconnection is Accomplished with IP Enabled Software)
Key Findings and Conclusions
The History of Access

The “Broadband Highway has become as important to a city’s economic vitality ..... as the rivers, railways, highways, and interstates have been over the last 200 years”.

1800’s - Rivers
Late 1800’s – Early 1900’s Railways
Mid 1900’s – Today Highways/Interstates
Setting the Community and Municipality for Infrastructure as a Service (IaaS)

- Common IaaS offerings include the pipe and conduit that allow premises to access power, water, and services.

- Municipal IaaS is the unified delivery of basic community resources in the form of roads, right of ways, and governance.

- Many services found under the IaaS umbrella are typically provided by a municipal government for the benefit of its citizens.

- The typical citizen’s perception of a municipality, relative to infrastructure and services, can be layered in a similar fashion to the 7-Layer OSI Reference Model
  
  L1 – Physical (Roads, Pipes) ..... L2 – Data Link (Rights of Way) ..... L3 – Network (Traffic Signals) .....
In many communities, there are three typical layers responsible to a community’s IaaS:

- **Primary Infrastructure Provider (PIP)** – Analogous to the Network Operating Company (The NetCo)

- **Network Provider (NP)** - Analogous to the Operating Company (The OpCo)

- **Service Provider (SP)** - Analogous to the Retail Service Provider (The RSP)

We defined these earlier in the “Three Tiered, Horizontally Layered Network Architecture”
The NetCo as the Primary Infrastructure Provider (PIP) is typically going to be focused on ..... “Infrastructure & Governance” as their Core Business.

- Municipalities are Mostly Infrastructure and Governance at their Core
  - Examples include things owned by the municipal government or private sector entity
    - Roads, Sewers, Landfills
The OpCo as the Network Provider (NP) is typically going to be focused on ….

“Interpretations of Governance and Infrastructure in Action” as their Core Business

- The council, policies, bylaws, and systems are realizations and interpretations of that governance and infrastructure in action
  - Examples include things managed or regulated by the municipal government or private sector entity

  ... Traffic Signals, Power Lines, Gas Lines, Airports ...
The OAN Layers – The RSP

The Retail Service Provider as the Service Provider (SP) is typically going to be focused on…..

“Management, Services, and Stable Delivery” as their Core Business

• The management, services, and delivery are the primary glue of the community’s stability

running on the platform of action

○ Examples include things delivered by the municipal government or private sector entity

... City Transit, Cable and Internet, Retails Services ...
Community IaaS—Three Layers of Responsibility

Community
- Power Services
- Gas Service
- Global Travel
- Retail Shops
- Taxi Service
- Data
- Bus/Train
- Permitting
- Management

Private Sector
- Malls
- Airport
- Gas Lines
- Power Lines
- Traffic Signals
- Sensors
- Water Lines
- Policies/By-Laws
- Council

Infrastructure
- Power
- Gas
- RoWs
- Roads
- Sewer
- Water
- Landfill
- Social Tools
- Governance

Service Provider
- RSP

Private Sector
- Network Provider
- OpCo

Municipality Managed
- Municipality Owned
Globally, communities are looking to migrate their aging communications infrastructures to a managed infrastructure that offers “Governance-in-Trust,” that is Future-Proofed and Flexible by Design……

The Open access network must be able to support four complex ecosystems:

- Support for Citizens and Consumer Groups
- Support for Business and Education
- Support for Government Agencies
- Support for Service Providers
The OAN Eco-System Support — *Citizens and Consumer Groups*

**Support for Citizens and Consumer Groups**

- Everyone is “On-Line” — The Network is Ubiquitous
- Unlimited Speed and Capacity — The Network is Unfettered
- Unlimited Provider Choices — The Network is Shared Across Platforms
- Equal Opportunity — The Network Provided to all Regardless of Affiliation
- Provide Global Education — Allows for Cross Training Between Continents
- Stimulate Job Creation — Open to Opportunities that Enhances Existing Technology
Support for Business and Education

- Everyone is “On-Line” – The Network is Ubiquitous
- Unlimited Speed and Capacity – The Network is Unfettered
- Research Strategies – Provides for R&D Cooperation and Collaboration
- New Market Options – Removes Barriers and Provides a Culture-of-Innovation
- Global Partnerships – The Network is a Global Reference-Model for Cooperation
- Lead Competition – The Network Provides for Unprecedented Access and Control
The OAN Eco-System Support – Government Agencies

Support for Government Agencies

- Economic Backbone – The Network Provides for the Digital Economy
- Standardized Build – The Network Provides for Smart Construction Practices
- Efficient Design – The Network Allows for the Establishment of a Smart Community
- Global Leadership – The Network is a Model that Other Communities Aspire to Follow
- New Jobs Growth – The Network Provides the Entrepreneurial Spirit for New Business
- Community Fabric – The Network is Community Focused Providing Essential Services
The OAN Eco-System Support – Service Providers

Support for Service Providers

- Operational Lease – The Network Allows for Complete Physical Layer Access
- Fully Managed – The Network is Managed for Equal Access and Equal Capacity
- Neutral Last Mile – The Network Protects all Providers’ and End Users (EUs) Equally
- 100% Market Deployment – The Network is Deployed Equally to all EUs from Day One
- National Growth – The Network Ensures Growth Availability for Changes in Technology
- Point-to-Point – The Network Provides Multiple/Direct Connections to all Providers & EUs
Case Studies
The OAN – The NA Developer Model 2006 - 2009

Developer Objectives

- Recurring Revenue
- Better ROW Controls
- Multiple Providers Offering Services
- Non-Management of Facilities and Electronics
- Non-Management of Applications and Services
The OAN – The NA Developer Architecture

Serving Area (SA)
- Fiber Distribution Hub (FDH Cabinet)
- F1 Carrier Infrastructure
- F1 Last Mile Infrastructure
- F2 Serving Infrastructure
- Operating Company

Primary F2/F3 Infrastructure
- Developer Placed
- Developer Owned
- Dev Controls ROW

Operating Company Incumbent Telephony Carrier (CO)
Operating Company Incumbent Cable-Co (MSO) (HE)
Key Policy Objectives of the Next Gen NBN

i. Promote Competition in Fixed Line Telecommunications Market

ii. Encourage the Open Access Environment
   • Industry Players have More Options to Adopt Models
     ✓ To Suit their Businesses and Respond to Market Needs
     • Lead to Long-Term Competition and Vibrancy in the Industry
     ✓ Consumers and Businesses to Benefit from Lower Prices and Innovative Services

iii. IDA Studied Overseas Deployments with Varying Models of Separation
    • Similar Projects in United Kingdom, Canada, Sweden, Italy & Netherlands
     ✓ Australia and New Zealand also Introduced Separations to Develop Vibrant and Competitive Market
Managing the Next Generation National Broadband Network

The Open Access Policy – *Industry Structure*

Managing the Next Generation National Broadband Network

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**Key NetCo Obligations**
- Structural Separation
- Price Control via ICO
- USO – Universal Services Obligation
- License Period for 25-years

**Government Support**
- Grant to $750-million (SD)

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**Key OpCo Obligations**
- Operational Separation
- Price Control via ICO
- USO – Universal Services Obligation
- License Period for 25-years

**Government Support**
- Grant to $250-million (SD)

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Operational Separation

To Facilitate Retail Service Providers (RSPs) the OpCo has Less Strict Operational Separation

Stricter Form of Separation

Because of Critical Role

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Structural Separation

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![Diagram](image-url)
The Next Generation National Broadband Network Measures

**Achieved Nationwide Fiber Coverage Since Mid-2013**
- Fiber Deployed to Residential/Non-Residential Buildings

**More than 500,000 Next Gen NBN subscribers**
- Consumer Take-Rate Increasing Faster than Global Average

Source: FTTH Councils – NA, Europe, APAC
Vibrant Next Gen NBN Landscape
Low Barriers of Entry and Non-Discriminatory Access
- Attract “New” Service Providers
- Provided “New” Business Opportunities

9 OpCos and 26 RSPs Enrolled and into the Next Gen NBN
- Competitive Residential and Non-Residential Services
- Cloud, SaaS Providers and Non-Telecom Providers Enter Market
RFP to Design, Build, Finance, Operate, Manage, and Maintain a Wireless and Fiber Optic Network

City of Fairlawn, OH – RFP February 12, 2015

RFP to Design, Build, Finance, Operate, Manage, and Maintain a Wireless and Fiber Optic Network

• Encourage Entrepreneurial, High Tech Ventures to Locate in Fairlawn
• Create a Competitive Advantage for Attracting Businesses and Residents
• Promote Commercial and Residential Growth and Stimulate Economic Development
• Improve City Services and Public Safety Communications, Awareness and Responsiveness
• Provide a Carrier-Grade Wireless and Fiber Network that Would Improve the Fairlawn Experience
• Make World-Class, Broadband Internet Services Available to all Residents and Businesses at Reasonable Prices
• Encourage Competition by Making the Fiber Optic Network “Open and Available” for use by Other Service Providers
Final Findings
OAN Key Findings

- Architectural and Topology Choices Driven By…
  - CAPEX/OPEX Expectations
  - Community Requirements and Serving Area Size

- Network Efficiency, Growth and Migration Strategies
  - Combined by Reliable use of Architectures and Applications
  - Network Efficiencies are Critical to the Business Case

- Design Must Take a Total System Approach
  - To Coordinate the Serving Area Size with the Correct POI Size
  - To Coordinate all of the Elements of Active and Passive Components

To Deploy the Most Cost Effective Solution, the OAN Network Combines all Network Elements