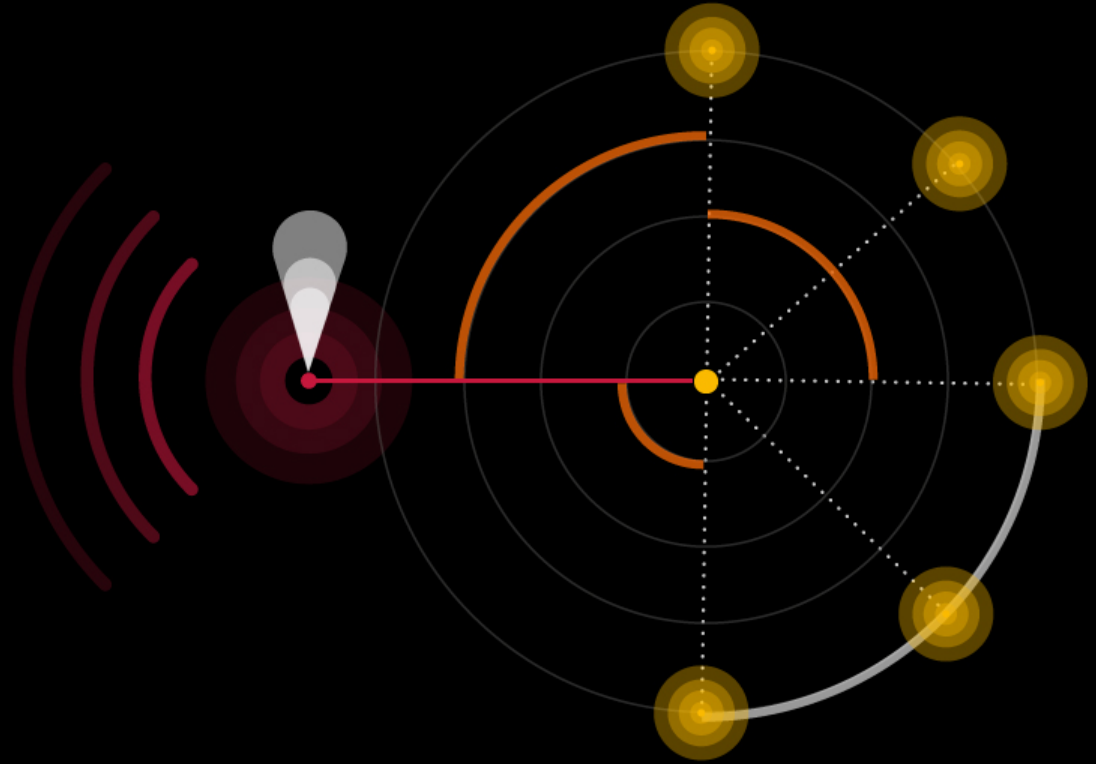# CDN & Live Linear Streaming

September 2015

COMCAST
WHOLESALE

**Comcast Wholesale is in the business of pioneering simple solutions for our customers.** Our video service platform allows you to maximize your audience reach while taking the complexity out of managing, monetizing and delivering your content in a multiplatform world. Scalable from small independents to global companies, our service portfolio creates a clear path to technologies that lets you do more and do more simply.

# COMCAST WHOLESALE:
## BUILT FOR STRONG PARTNERSHIP

We bring the strength of Comcast to deliver the scale and innovation you can count on.

As a customer in the market, we understand the challenges.

As a division of Comcast, we bring proven technology and platforms to provide distribution solutions for third parties.

# Digital Content Platform

Our Digital Content Platform marries massive carrier-grade infrastructure with open and flexible cloud services to deliver a suite of services that support the full media lifecycle.

## mPX

### ACQUIRE
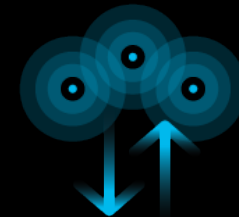
Channel Origination    Linear Acquistion

- IP
- Fiber
- Satellite

### MANAGE

Live Linear Streaming

- Process for HD
- Reformat for all devices
- Apply DRM, security & closed captioning

### DISTRIBUTE

CDN    VOD

- Dynamic ad insertion
- HTTP support for MSS, HLS, HDS, Smooth and Dash
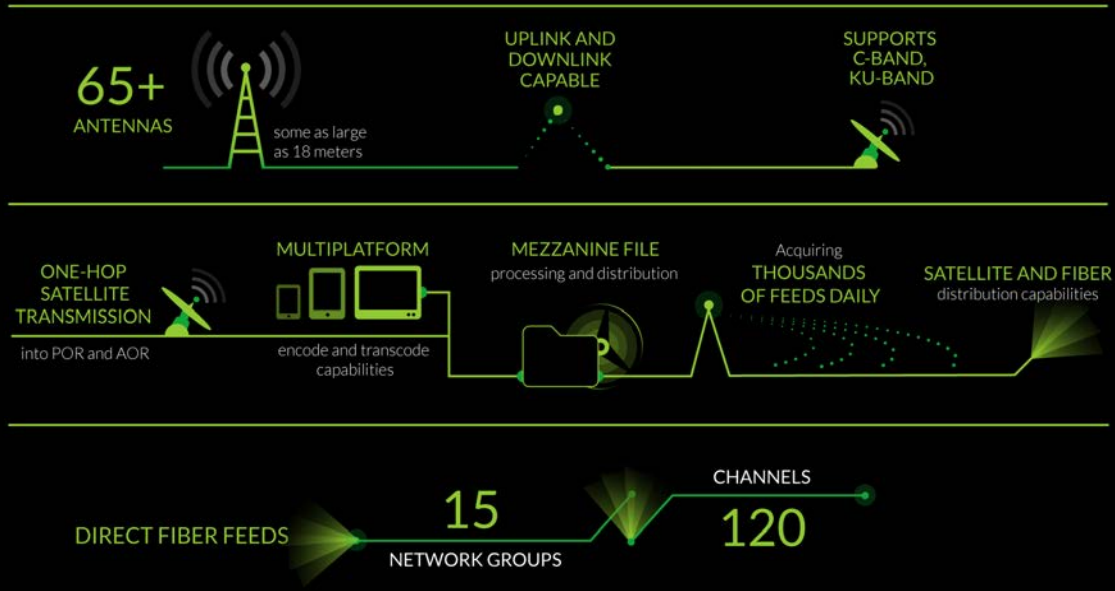- Delivery over Comcast's CDN

# INFRASTRUCTURE

# Global Broadcast & Teleport Facilities

Our global broadcast facilities provide fully-managed channel origination and serve as content acquisition hubs with global satellite and fiber facilities.



PACIFIC OPERATING REGION

ATLANTIC OPERATING REGION

THE DRY CREEK AND TITAN FACILITIES
Located on the 105th meridian

**65+** ANTENNAS
some as large as 18 meters

UPLINK AND DOWNLINK CAPABLE

SUPPORTS C-BAND, KU-BAND

ONE-HOP SATELLITE TRANSMISSION
into POR and AOR

MULTIPLATFORM
encode and transcode capabilities

MEZZANINE FILE
processing and distribution

Acquiring THOUSANDS OF FEEDS DAILY

SATELLITE AND FIBER
distribution capabilities

DIRECT FIBER FEEDS

**15** NETWORK GROUPS

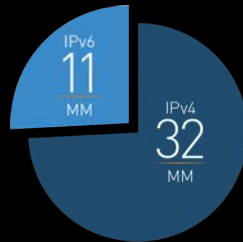CHANNELS **120**

Fully Owned & Operated Infrastructure

# IP Network

Comcast operates one of the largest IP backbones in the world, powering fast and massively scalable content delivery services.
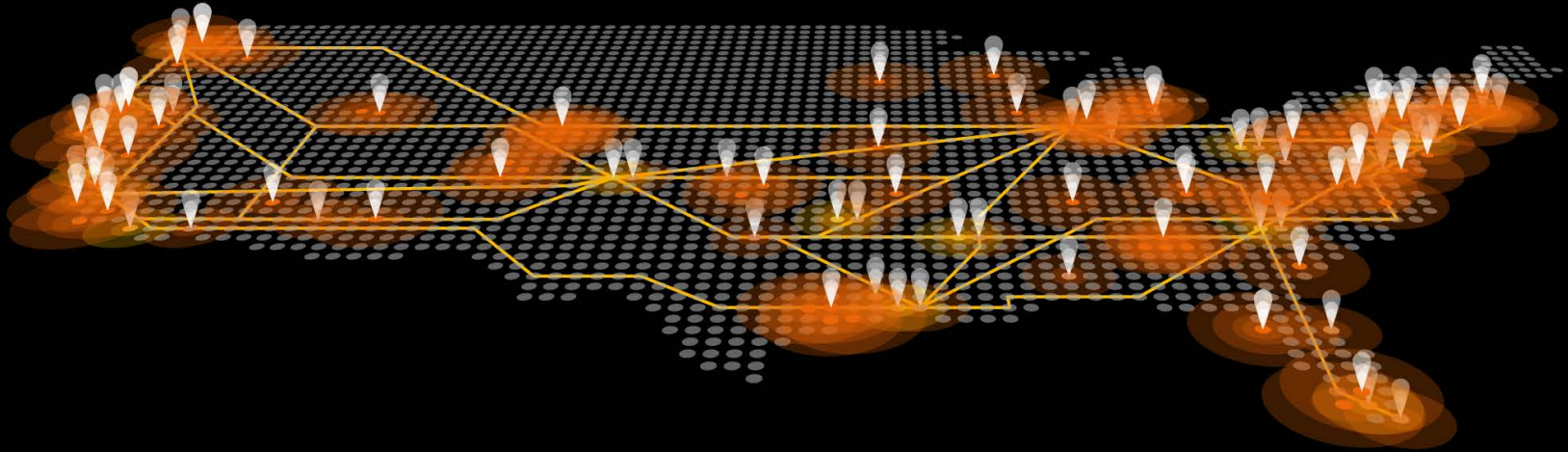


**LEADING THE WAY IN IPV6**
Over 25% of our active IP space is IPv6

IPv6
11
MM

IPv4
32
MM

MM MM MM MM MM MM MM MM

**OVER 8 MILLION WIFI HOTSPOTS**

28
METRO MARKETS

40,000
FIBER ROUTE MILES

# COMCAST CDN

# The Comcast CDN

Purpose built and optimized to deliver broadcast-quality media experiences.

Highly pervasive U.S. deployment with massive scale:

- 92 domestic CDN nodes provide unique breadth and depth
- Located in the 6 largest U.S. interconnect facilities to provide direct connectivity to all major ISPs
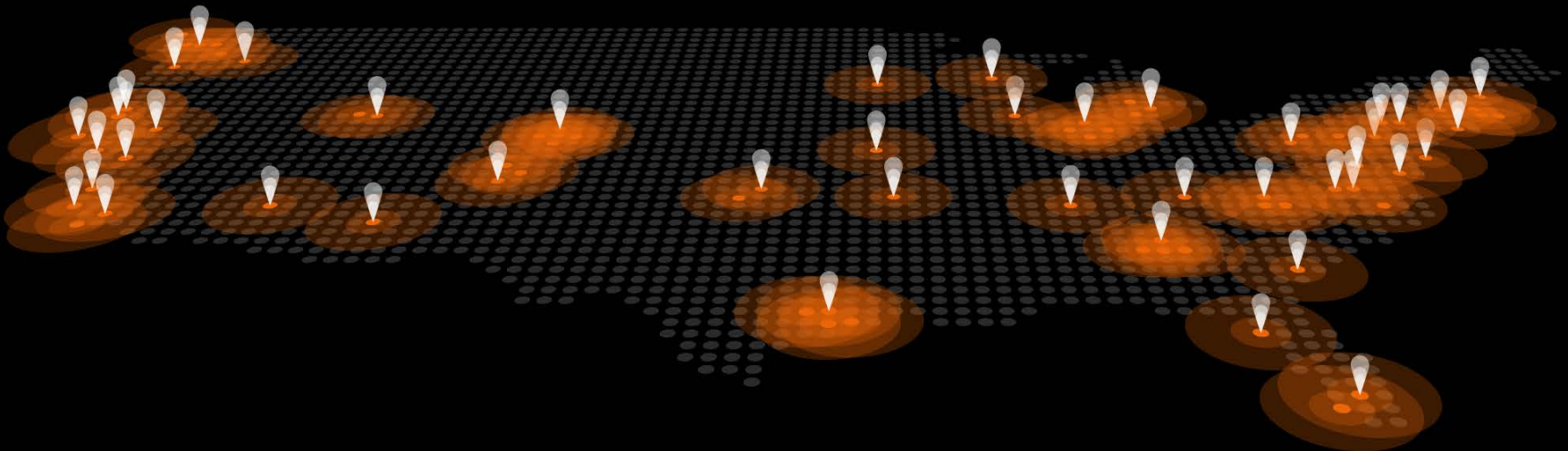
Powered by the Comcast Network – one of the largest multiservice backbone and metro networks in the world

Built from the ground-up to support media delivery

Robust security to protect your content

Intelligent, open and extensible architecture:

- Built on flexible & secure open-source technologies
- Multi-tiered architecture
- Optimized for large-file HTTP delivery

# Powered by the Comcast Network

The Comcast CDN couples state-of-the-art caching technology with the scale and reach of Comcast's IP Network, one of the largest and most advanced in North America.

16Tbps of daily peak traffic

92 CDN Nodes across Comcast's wholly-owned network, providing access to 28 Comcast Metro market and 250 interconnect partners.
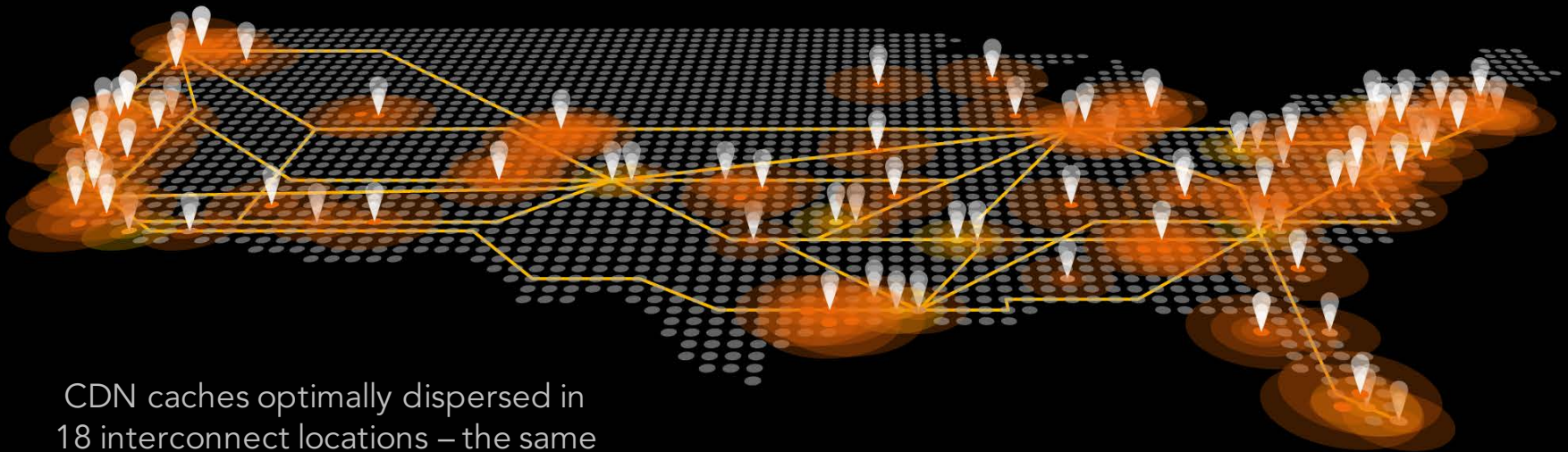


CDN caches optimally dispersed in 18 interconnect locations – the same facilities where all major network interconnect with each other – enabling direct, fast delivery to all major ISPs.

Robust, direct connectivity with over 250 of the largest networks.

# Broadcast Quality Delivery
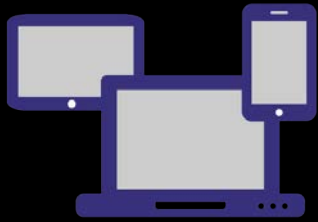


### Optimized performance required to power your online media experiences

- Purpose-built from the ground up to support broadcast quality video delivery.
- Hardened, robust platform – same technology utilized by Comcast for delivery of its own video service – one the largest IP Video services in the world.
- Pervasive deployment across 92 U.S. CDN nodes



### Layered Security to Protect your Content

- Broad suite of security features including authentication, SSL and DNSSec.
- Multiple, built-in origin protection methods to ensure survivability of your infrastructure



### Flexible, Multi-CDN ready solution

- Designed to integrate seamlessly to a multi-CDN environment..
- Flexible contracts that support (versus inhibit) your multi-CDN business objectives – no risk of vendor lock.
- The ideal complement to pure-play CDN partners



### Competitive and Transparent Pricing

- Competitive pricing based only on bits delivered.
- No hidden fees or a-la-carte premiums
  - No fees for requests
  - No ingest fees
  - "Origin Shield" bundled in

# CDN Features

## Live or On-Demand Delivery

**Universal HTTP support**
- HLS, HDS, Smooth, DASH
- Progressive downloads

**Optimized for HTTP large file delivery**
- Video
- Gaming
- File downloads and images

**Flexible configuration**
- DNS & HTTP client routing
- Extensive header manipulation and query string handling capabilities
- Unlimited host aliases

## Security & Origin Protection

**Broad suite of security features**
- Tokenization / URL signing
- Full HTTPS/SSL support
- DNSSEC support
- Key vault to secure API, tokenization, SSL, and DNSSEC credentials
- International geo-blocking

**Inherent Origin "shield" protection**
- Mid-tiers that are optimized for high-demand events are provided by default.
- Negative caching of errors
- Origin health checks

## Portal & APIs

**Comprehensive drill-down reporting**
- Usage and capacity
- Status codes, errors, and availability
- Origin offload
- Performance monitoring
- Health monitoring
- Status code breakdowns
- Raw log access

**Service management & operations**
- Configuration access
- Immediate content purging

# Self-service Portal and REST API

Our portal and companion API provide a high degree of service control and deep analytics.

## Visibility & Workflow

- Get delivery service configuration
- Content purge
- Detailed health views
- View routing methods

## Comprehensive, Drill-Down Reporting

- Capacity utilization
- Throughput and transactions per second
- Origin offload percentage
- Time to serve objects
- HTTP status codes and errors
- Availability

Responsive UX design including live updates of all data components

## REST APIs

- Core – Health, Routing, Metrics, Domains, Topology, Change Logs, ASNs
- Delivery Services – Configuration Parameters, Health, Metrics, Purge
- Security – DNSSEC, SSL Keys, Token-Based Auth Keys, Users and Groups

# Portal Benefits
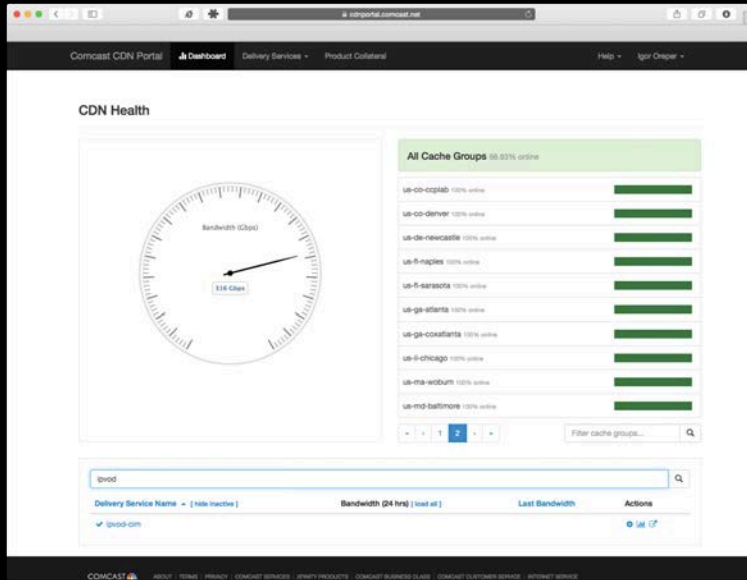


**Delivery Service Dashboard**
- dynamic throughput chart at mid and edge
- stats
- options to view the configuration
- invalidate/purge content
- navigate to other charts
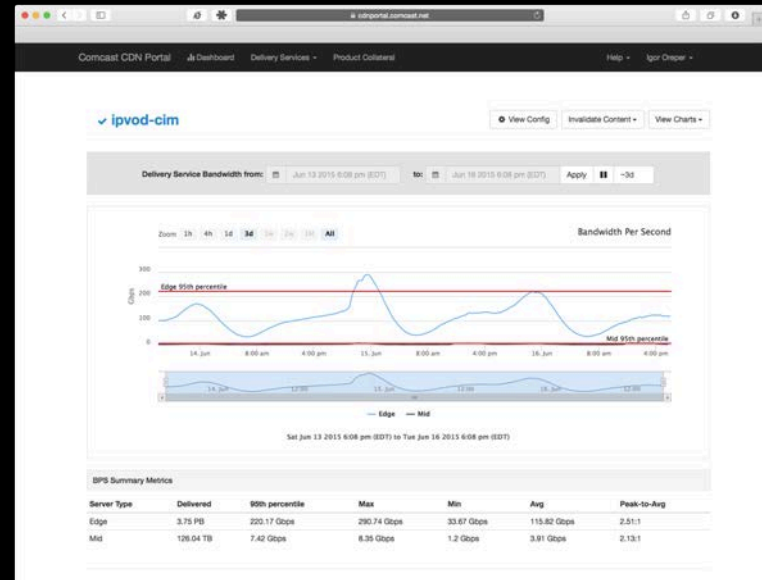


**CDN Dashboard**
- overall real-time usage
- cache groups & locations
- searchable list of available services

# Portal—Content Validation Views

# LIVE LINEAR STREAMING

# Live Linear Streaming Workflow



**mpx**

## Acquisition

Satellite

Fiber

*Mezzanine MPEG Transport Feed*
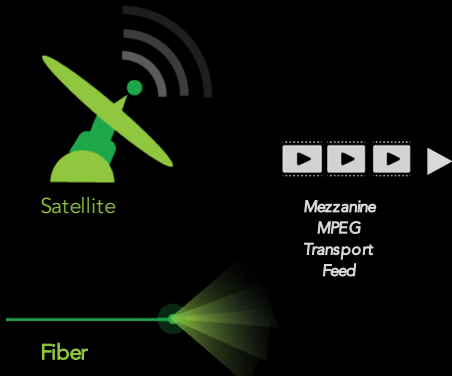
## Live Encoding
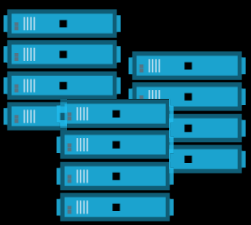
- H.264 and HEVC
- SD, HD and UHD bit rates
- Multiple language audio tracks
- Closed captions
- Ad markers

HD - 1280x720

HD – 640x360

SD- 480x270

*Multiple encoded bit rates*

## Origin & Stream Conditioning
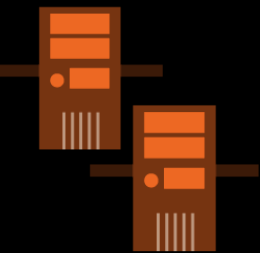
- Origin & Storage
- Multi-format packaging
- Multi-DRM support
- DAI and Blackout Management
- Replay TV and Live-to-VOD *(future)*

Microsoft     - MSS

              - HLS

Adobe         - HDS

MPEG DASH     - DASH

*Packaged ABR file segments and manifests*

## Delivery

COMCAST
Comcast CDN

3rd Party CDN

Push streams to 3rd party CDN origin.
3rd Party CDN responsible for all Origin & Stream Conditioning features.

# Live Linear Streaming Overview

**Comcast Wholesale has combined with thePlatform's mpx to create a solution that provides all the workflow orchestration, publishing, monetization policies, and real-time analytics that deliver a full multi-channel lineup of advanced TV Everywhere and direct-to-consumer needs.**

- Offered as a full turnkey solution or on a modular basis
- Readily access hundreds of existing linear feeds within our redundant, carrier-grade facilities
- Ensure high quality delivery of video across multiple platforms to any device to a diverse viewer base
- Support of OTT streaming services for the most advanced TV Everywhere applications
- Delivery over a the fully-owned and operated Comcast CDN

Live Linear Streaming service from Comcast Wholesale is the ideal solution for:

- Traditional Broadcasters & Cable Networks
- Sports & Special Event Broadcasters
- OTT Broadcasters
- Independent TV Networks

# Our Facilities

Comcast Wholesale has more than 19 years of experience in program acquisition and origination services. The Dry Creek, Titan Earth Station facilities are premier resources for disaster recovery operations for some of the nation's largest content owners and providers.

- Superior signal quality
- Diverse, low-risk geographic location
- Reliable and secure infrastructure
- Live event feeds and full-time linear programming
- 24x7x365 operations for proactive monitoring & problem management
- Active failover & redundancy

Because of its low disaster risk, the metro Denver region is the ultimate location to host acquisition and origination to support live linear streaming solutions for businesses located in the U.S. and around the world.  The benefits include:

- Location in the Mountain time zone on the 105th meridian, making it the largest U.S. region with one-bounce satellite transmission and visibility into both AOR and POR
- 300+ days of sunshine
- Semi-arid climate with short-lived winter storms, averaging just 8-18 inches of annual precipitation
- Minimal risk of natural disasters compared to locations on the east, west, and southern coasts
- Diverse power grid to both the east and west coasts
- Extensive, low-cost fiber optic network and capabilities
- Major transportation hub

# Values

### Quality

- Mezzanine feeds direct from broadcaster – same feeds that are used for traditional pay TV services.
- Lossless, high fidelity video and audio – not compressed OTT contribution feeds over the Internet.

### Simplicity

- Quick and easy access to hundreds of feeds.
- New feeds can be acquired via satellite downlinks or terrestrial fiber.
- Native mpx integration.
- One bill and one support destination.

### Reliability

- Hardened, redundant broadcast-quality infrastructure and support.
- One-touch Recovery 24x7x365 monitoring and operational framework.
- Intra-site and inter-site failover.

### Flexibility

- Breadth of acquisition capabilities.
- Ability to provide full turn-key solution or point solution.
- In turn-key mode, ability to readily support multi-CDN environments.