Cloud DVR
Deployment Considerations

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Industry Evolution to Cloud DVR

DVR
Local DVR at home – limited capacity, content lost on HW failure

Multi-room DVR
Multiple rooms within same home share the central DVR

Network DVR
STBs at home leverages the remote storage for recordings

Cloud DVR
Access content from any device, any network, any place

But is this how consumers view these services?
Cloud DVR Service Definitions

- **Cloud DVR**
- **Network PVR**
- **Start-Over Restart TV**
- **Time Shift TV Catch-UP**

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Cloud DVR Network Models

Satellite
- Broadcast/Multicast
- Un-managed IP/ABR Unicast
- IP Devices
  - STB/DVR

Cable
- QAM Broadcast/Multicast/Unicast
- Managed IP ABR Unicast
  - IP Devices
  - STB/DVR

Telco
- IP Broadcast/Multicast/Unicast
- Managed IP/ABR Unicast
  - IP Devices
  - STB/DVR

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Business Drivers for Cloud DVR

**Optimize CAPEX and OPEX**
- Cheaper IP clients in the home
- Reduce hard disk failures, truck rolls and CSR calls
- Cost effectively scale infrastructure
- Drive efficiency with shared components across services

**Increase Revenue**
- Reduce subscriber churn with compelling experiences
- Up/cross-sell value-add services (storage, features)
- Expand advertising reach with broader viewing windows
- Increase advertising relevance with targeted ads

**Accelerate Service Velocity**
- Rapidly deploy new services
- Leverage third party applications
- Incorporate Internet models (DevOps)
- Increase workflow management flexibility and efficiency

**Introduce New Experiences**
- Unified search, discovery and recommendations across platforms and services
- Fine-grained business and policy management across channels, shows, users, devices

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Multiscreen Cloud DVR – Incremental Revenue Model
Up to 31% Increase in Monthly Revenue

Monthly Revenue Gain Per User

<table>
<thead>
<tr>
<th>Current</th>
<th>Incremental Revenue</th>
</tr>
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<tbody>
<tr>
<td>$70</td>
<td>$22</td>
</tr>
</tbody>
</table>

+31%

Incremental Revenue Breakout

- Churn Reduction* $15.26
- Cloud DVR Services Bundle** $6.77

*Revenue impact of reducing churn up to 25% over 6 years with multiscreen DVR service bundle
**Includes cloud DVR and Time-Shift TV revenue, personal content locker, broadband service upgrades, and advertising revenue
SP with 5m subs, 6 yr cumulative revenue with service penetration growing from 15% to 24%

Based on Cisco Business and Technology Architecture Model

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## Four Main Variables Impact DVR Economics

<table>
<thead>
<tr>
<th>Cost Area</th>
<th>Key Drivers</th>
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<tbody>
<tr>
<td>In Home Costs: CPE &amp; Truck Rolls</td>
<td>- STBs/Home</td>
</tr>
<tr>
<td></td>
<td>- Pre-existing STBs</td>
</tr>
<tr>
<td></td>
<td>- Deploying new STBs</td>
</tr>
<tr>
<td>Access &amp; Transport</td>
<td>- Access technology</td>
</tr>
<tr>
<td></td>
<td>- Concurrent usage</td>
</tr>
<tr>
<td></td>
<td>- Encoding scheme</td>
</tr>
<tr>
<td>Stream Delivery</td>
<td>- Concurrent usage</td>
</tr>
<tr>
<td></td>
<td>- Encoding scheme</td>
</tr>
<tr>
<td>Network Storage</td>
<td>- Subscriber base count</td>
</tr>
<tr>
<td></td>
<td>- Subscriber’s recording and viewing concurrency</td>
</tr>
<tr>
<td></td>
<td>- Volume of content offered, channel count and type</td>
</tr>
<tr>
<td></td>
<td>- Retention requirement / content popularity</td>
</tr>
<tr>
<td></td>
<td>- Encoding scheme, profiles and ABR modes</td>
</tr>
<tr>
<td></td>
<td>- Trick modes offered</td>
</tr>
<tr>
<td></td>
<td>- % Dedicated vs. Shared storage</td>
</tr>
</tbody>
</table>

### Subscriber Behavior

Service Definitions

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DVR Sizing – How Much, How Long

15-17% of Total TV Time

Genres Affect DVR Shelf Life

Source: Verizon Digital Media Services

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SPs Still Debating TVE Content Rights... cDVR is Next

North America
Mostly unique copy.
Some challenges to legal framework by SPs

Europe
Legal framework variance by country. Common and unique copy cases

Content Providers
Broadcasters

Content Rights
What the content owner will permit (contractual)

Legal Rights
Copyright Law & Exemptions
What the law allows without content owner permission

Business Rules
Policy Enforcement
Inside vs. outside the home streaming, download and device access

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Deployment Considerations

Management Systems

Operational Systems
- Cloud software
- Single management for configuration and provisioning

Control Systems
- NOC monitoring and diagnostics
- Help Desk

Reporting Systems
- Business analytics for marketing
- Operational analytics for optimization

Business Management

Rights Management
- Business rule enforcement for in-home and out-of home streaming

Advertising Management
- Measurement, linear parity, ad refresh and targeting

Storage Management
- Hierarchical storage for policy-based archiving of long-tail content
Videoscape Cloud Framework

Cloud Enabled Infrastructure

Cloud Applications Platform

Cloud Powered Applications

Applications

Orchestration

Infrastructure

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Cloud Infrastructure Advantage

Videoscape Multiscreen Cloud DVR

Videoscape Open API Framework

Orchestration & Management

Media Ingest
Media Preparation
Media Recording
Media Publish

Operational agility to rapidly deploy new services

Elastic provisioning of cloud applications

Flexible expansion from a virtualized resource pool
Service Operations, Control and Reporting
Single Management System to Optimize Service and TCO

Provisioning
Management
Assurance
Analytics

Single Configuration and Management System
NOC and Help Desk Monitoring and Diagnostics
Operational and Business Reporting

Business Value
Simplify Operations and Cost of Ownership
Improve Customer Experience
Optimize Service and Tune Marketing/Offers

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Service Monitoring and Diagnostics

Scorecards and Dashboards
- Conveys service information at-a-glance with personalized views

Reporting
- Provides Business Intelligence by delivering detailed information to decision-makers
- Scheduled, available in multiple forms (xls, pdf, mobile devices)

Advanced Analytics
- Gives power business users and information analysts full investigative reach into any corner of the data warehouse
- Drill downs, pivoting for effective troubleshooting chronic problems

Alerts
- Alert users based on threshold crossings when reports are run
Rights Management and Business Rule Enforcement

Streaming Policy
- Authentication, Concurrency, Per-Channel/Asset

Device Restrictions
- Concurrency, Downloading, Security

Home Networking
- Storage, Side-loading, Remote Streaming

Time Shifted
- Restart, Catch-up, Live-pause, Backward EPG, Cloud DVR

Monetization
- Subscribe, rent, own, share, live events

Policies
- Geo-validation, proximity, fingerprinting, watermarking

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Advertising Approach

First:
Do no harm

- Protect and sustain linear ad revenue
- Audience delivery and measurement across all viewing platforms
- “Linear Parity”: TV ads must accompany content proliferation to new devices

Then:
Generate enhanced value via capabilities of IP network

- New ad formats
- Precision audience targeting (higher value inventory)
- Dynamic decisioning and delivery
- Improved measurement and analytics
Storage Requirements

Adaptable storage policies based on content type, popularity, source, license window, security, migration, redundancy, etc.

Unique/ Common Copy
Hierarchical Storage and Tiers
Storage Regionalization
High Availability
Persistence
Bit rate profiles
De-duplication

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Deployment Options for Cloud DVR

Shared Copy

- **Shared-Copy Cloud DVR**
  - Content Stored in the Cloud
  - Recorded Content Shared across multiple users
- N/A

Unique Copy

- **Unique-Copy Cloud DVR**
  - Content Stored in the Cloud
  - Recorded Content is Unique for each User

- **Today's Home DVR**
  - Content Stored in the Home
  - Unique User Copies

Hybrid Storage

Combination of Cloud/and in-Home Recording driven by policies and resource availability

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Integrated Ecosystem Approach

- Workflow
  - Content Management
- Prepare
  - Encoder
  - Transcoder
- Protect
  - Content Security

Control
- Cloud DVR Applications and Policy

Originate
- Capture
- Store
- Playback

Open Stack
- Compute
- Network
- Storage

Storage
- DAS
- NAS
- Cloud Media Object Store
- Public/Private
- HTTP Archive

Advertise
- Advertising Analytics

Distribute
- CDN Core
  - CDN Edge
  - Edge Streamers

- End-to-end integrated solution design from the ground-up
- Simplified and open API set across all components
- Seamless integration with existing and 3rd party components
Unified Backend Supporting Multiple Systems/Solutions

Workflow
- Content Management

Prepare
- Encoder
- Transcoder

Protect
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Advertise
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Distribute
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Client
- Cloud DVR Applications and Policy

Video Everywhere
- Video Gateway
- IPTV
- Videoscape Express

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Winning cDVR Strategy

Service Type > Network > Revenue > Costs > Content Rights > Solution Considerations
## Videoscape Cloud DVR Solution

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplify</td>
<td>MOS management and control plane interface</td>
</tr>
<tr>
<td>Dynamic</td>
<td>Flexible schedule and resource management for workflow efficiency</td>
</tr>
<tr>
<td>Consolidate</td>
<td>Seamlessly integrate data plane components on a virtualized compute platform</td>
</tr>
<tr>
<td>Agile</td>
<td>Elastically instantiate data plane components for ingest, recording and delivery to adapt to changing demands</td>
</tr>
<tr>
<td>High Performance</td>
<td>Massive throughput for recording concurrence and playout</td>
</tr>
<tr>
<td>Storage Efficiency</td>
<td>Flexible, open storage options with elastic scale</td>
</tr>
</tbody>
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Cloud DVR Case Study
MAJOR NORTH AMERICA MSO

- Multicast MPEG/ATS Ingest, Recording, Playout at Large Scale
- Service Delivery to QAM based and IP based Devices
- Distributed Just-In-Time Packaging and DRM encryption; Recording System Resource Management
- Archival Storage and Retrieval
- Service crafted to be delivered from existing CDN elements
- Multi-vendor interop between TV recorders and edge streamers

- Initial market launch in 6 major metro regions in 2013; intentions are for nationwide rollout in 2014
- Approximately 30-40 TV recorders per market
A-B Testing for Business Analytics

Test new features or UI enhancements on sample populations and control group before rolling out fully

Business Use Cases
- Test pricing and promotion impact
- Test new feature uptake

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