Agenda

➢ **Reliable Internet Transport Protocols**

➢ **Q&A**

➢ **Lucky Draw**

Reliable Internet Transport Protocols

AVW Broadcast

Contents

➢ Why should we use Internet Distribution?

➢ Reliable Internet Transport Protocol Overview

➢ SRT/RIST/Zixi Working Principle

➢ Relative Products

Typical Broadcast Methods

- **Satellite Distribution**
  - DVB-S/S2/S2X
  - CAM/Smart Card based Encryption
- **Pros**
  - High availability, even remote locations
  - Bandwidth exceeding 80Mbps
- **Cons**
  - Putting stuff in space is expensive!
  - Can be effected by weather, sun spots etc.

Typical Broadcast Methods

- **Fiber Distribution**
  - Leased Fiber, Dark Fiber
- **Pros**
  - High reliability
  - Low Latency
  - Bandwidth to 100Gbps+
- **Cons**
  - High cost to deploy and/or lease
  - Only available if infrastructure is present

Distributing Content Over the Internet

- **Broadband is easy to find!**
  - Diversity in the market (cable, DSL, cellular)
  - Competition driving down costs, increasing bandwidth
- **Consumer cable and wireless networks capable of 100Mbps+**
- **Higher compression = less bandwidth**

Challenges of Delivery

- **Packet loss, Corruption or Out of Order**
  - Packet retransmission
  - Reordering
- **Jitter or Packet Pacing**
  - Input buffers
  - Output buffers
- **Latency**
  - Buffers increase latency
  - Congestion on regional or local networks

Reliable Internet Transport Protocols

Overview

What is reliable internet transport?

- Technologies used to transport live video and audio over the open internet
- Quickly growing method of transport in all tiers of broadcast
- "Household" names such as Zixi, LTN and VideoFlow

- Open source alternatives creating new opportunities

How is Internet Transport being used?

- Alternative to traditional transport methods
  - MPLS Networks
  - Satellite
  - Leased Fiber Links
- Backup to primary transport methods
  - Backup paths should be inexpensive
- Inexpensive transport of non-"must carry" services
- Emerging transport method for distribution

Use Cases

- Point-to-Point Contribution

- Low-cost distribution over Internet

- Backup to primary distribution link
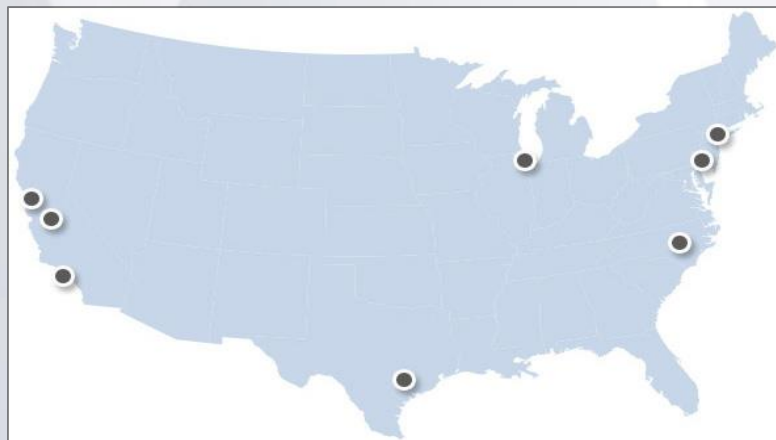
- Collection

- Hub and spoke

- Many edge devices transmitting to central aggregation site over Internet

Central Headend
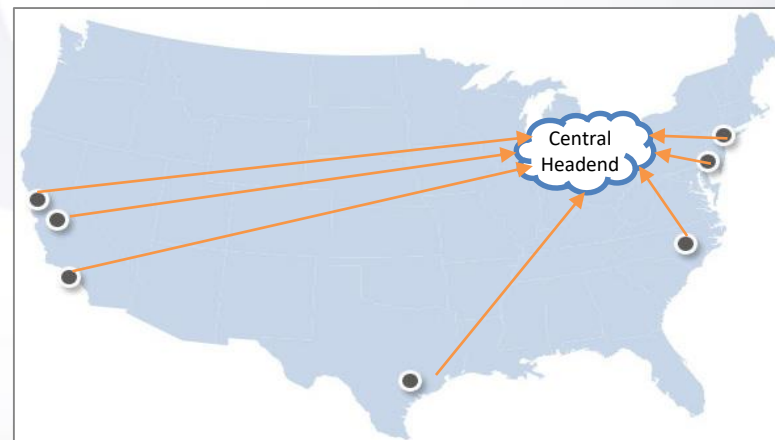
Major Players

- **ZiXi**
  - ZiXi Platform
    - Receive pay-per-use licensing
  - Zixi Feeder/Receiver devices tested with Sencore MRD products
- **LTN**
  - LTN SmartCloud delivery service
    - Pay-per-use licensing
  - LTN appliances tested with Sencore MRD products
- **VideoFlow**
  - DVP (Digital Video Protection)
  - VideoFlow Protector/Sentinel gateway products tested with Sencore MRD and Wellav products

- caton Engine R2TP For Video Transmission
- Caton R2TP streaming platform
- R2TP on MRD4400/5800 is under development

- **SRT ALLIANCE** — SECURE RELIABLE TRANSPORT
  - **S**ecure **R**eliable **T**ransport
    - SRT open source library
  - Founded by Haivision
  - Sencore is a member of the SRT Alliance
- **RIST** — RELIABLE INTERNET STREAM TRANSPORT
  - **R**eliable **I**nternet **S**tream **T**ransport
  - In progress by VSF activity group
    - Predicted draft by end of 2018
  - Sencore is a participant in the RIST activity group
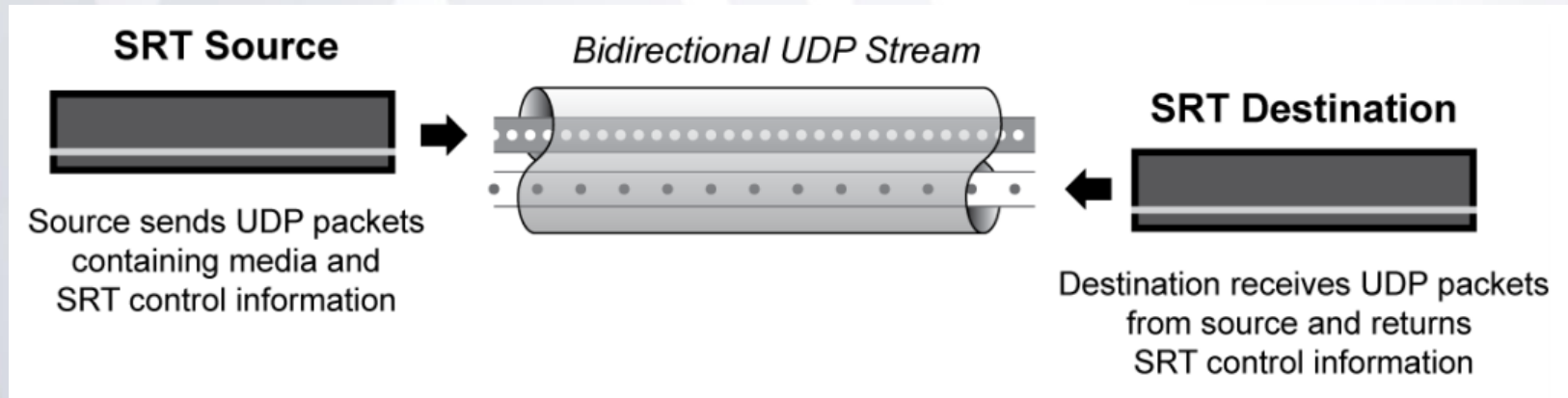
SRT Introduction

- **S**ecure **R**eliable **T**ransport

- Developed by Haivision and Wowza

- Announced as open source at NAB 2017

- SRT Alliance

  - Group of 100 vendors

SRT – How does it work?

- Bidirectional UDP data stream
  - One flow containing control info and data stream
- Control information used as negation and "keep alive"
- Data stream is SRT packaged transport stream

SRT Source — **Bidirectional UDP Stream** — **SRT Destination**

Source sends UDP packets containing media and SRT control information

Destination receives UDP packets from source and returns SRT control information
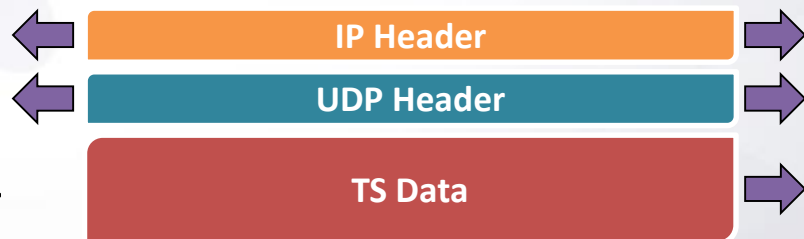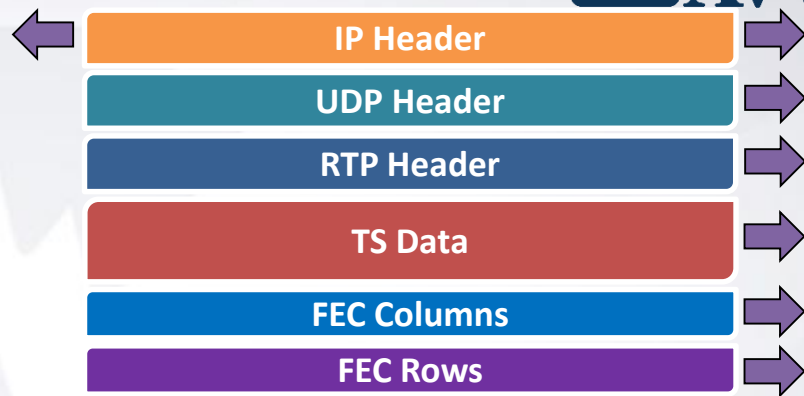
SRT UDP Stream Structure

- Transport stream as RTP with FEC
  - Uni-directional stream
  - Single IP Address with multiple ports
  - FEC data on +2 and +4 port

IP Header
UDP Header
RTP Header
TS Data
FEC Columns
FEC Rows

- Transport Stream as SRT
  - Bi-directional UDP stream
  - Control data contained in UDP header
  - Single IP address with single port

IP Header
UDP Header
TS Data

SRT Packet Recovery Method

- Burst transmission replaces packets
- Bandwidth Overhead enables burst transmission
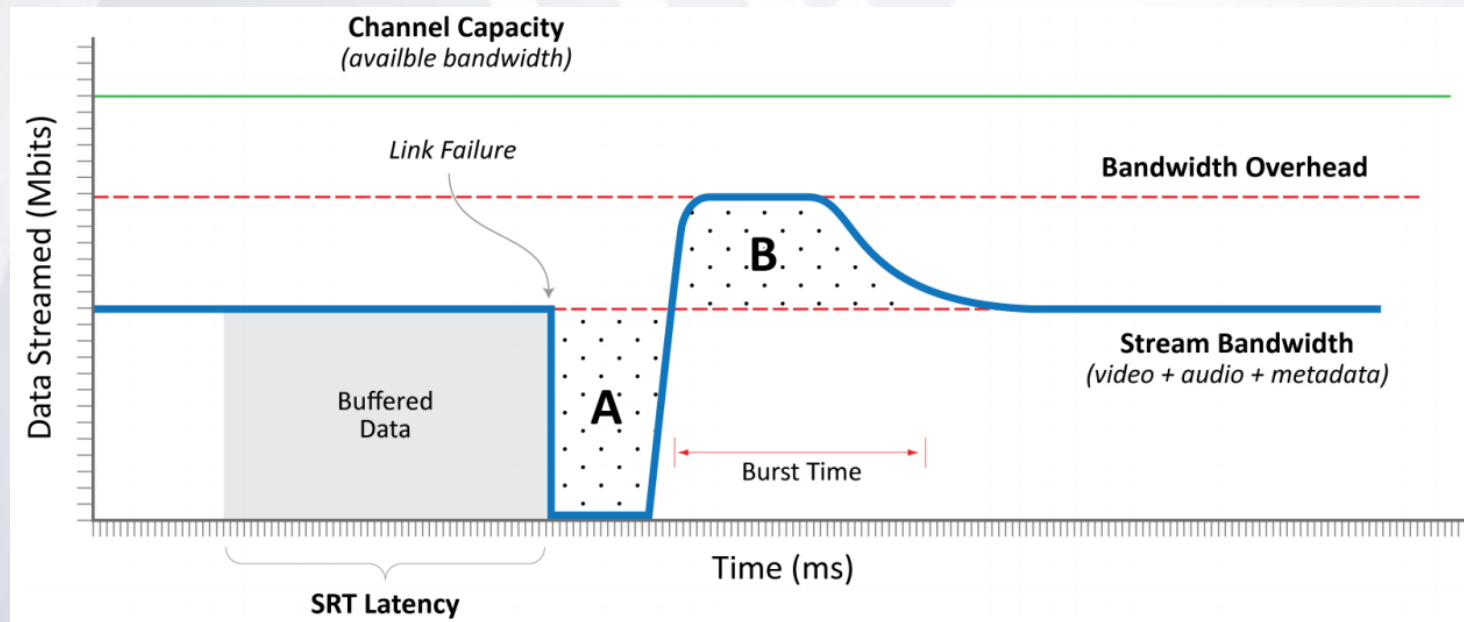
Calculating Latency and Bandwidth

- Round Trip Time or RTT (ms)
- Packet Loss Rate (%)
  - Sustained Packet Loss
  - Burst Packet Loss

| Worst Case Loss Rate (%)	RTT Multiplier	Bandwidth Overhead (%)	Minimum SRT Latency (for RTT <= 20 ms)
<= 1	3	33	60
<= 3	4	25	80
<= 7	5	20	100
<= 10	6	17	120

Encryption over open internet

- SRT protocol natively supports AES encryption
  - AES-128 and AES-256 fixed key
- Encryption does not add to Bandwidth Overhead
- Encryption does add to stream processing

SRT and Firewalls

- Network Address Translation (NAT)
  - Translate external IP to internal IP
- Rendezvous Mode for firewall tunneling
  - Stateful firewalls "connection tracking"
  - UDP control data originating within firewall are passed
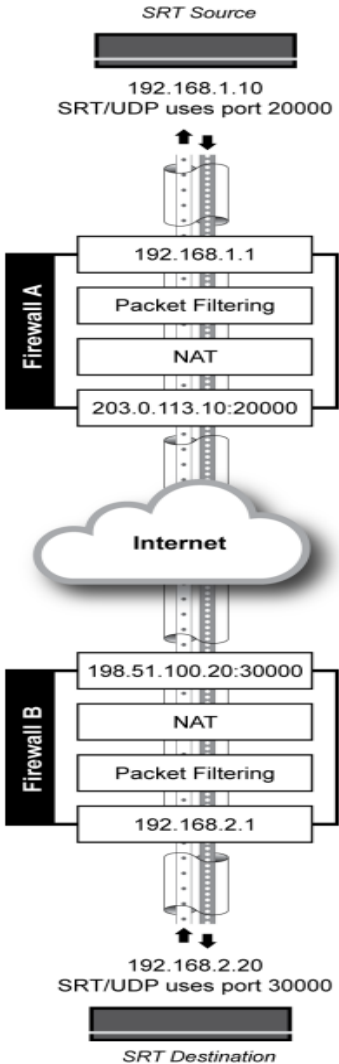
RIST Introduction

- **R**eliable **I**nternet **S**tream **T**ransport
  - Joint effort between industry vendors
  - Submitted to VSF as TR-06
- Built upon current SMPTE standards and IETF RFCs
- Intended to be backwards compatible

RIST – How does it work?

- Baseline Protocol is RTP
  - Media with existing RTP standards will use same header fields
  - SMPTE 2022-1/2 for transport streams
- Feedback/control messages use RTCP (IETF RFC 3550)
  - Keep alive and mechanism to recover from packet loss

RIST Stream Structure

- RTP packaged transport stream
  - Uni-directional stream
    - Unicast or multicast
  - SMPTE 2022-2
- Forward Error Correction
  - Port N+2 and N+4
  - SMPTE 2022-1
- RTCP
  - Packet retransmission request
  - Keep alive
  - Port N+1
  - RFC 3550

| IP Header |
| UDP Header |
| RTP Header |
| TS Data |

| FEC Columns |
| FEC Rows |

| RTCP Packets |
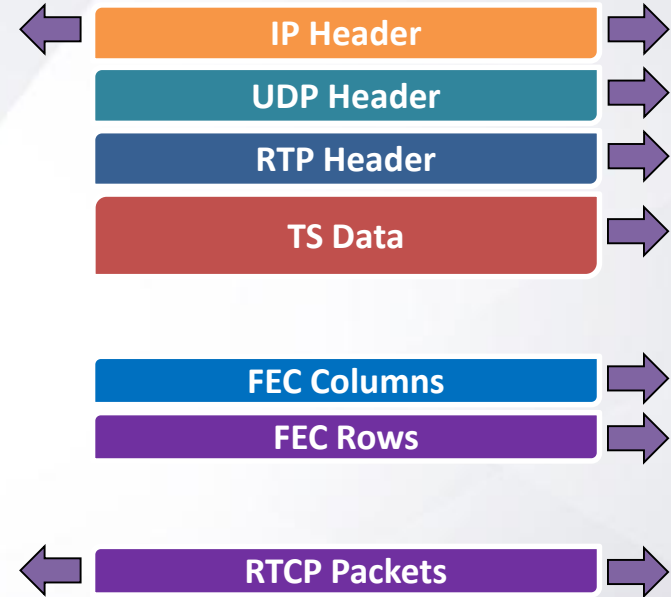
RTCP Function in RIST

- RIST Senders
  - Sender Report (SR) packets
  - Source Description (SDES) Packets with CNAME field
- RIST Receivers
  - Receiver Report (RR) packets
  - Source Description (SDES) packets with CNAME Field
  - NACK Packet

RIST and Firewalls

- Bidirectional RTCP data can tunnel firewalls
  - Stateful firewalls "connection tracking"
  - UDP control data originating within firewall are passed
- Firewall rules for RTP, FEC ?

Zizi Introduction

- **A proprietary reliable internet transport protocol**
  - Developed by Zizi and exists for more than 10 years
  - Focus on perfecting the IP video delivery
- Establish an ecosystem with 100+ partners and OEMs
- High quality, low latency and reliable video delivery over IP

Zixi – How does it work?

- An application protocol over UDP for reliable internet transport
  - Point to point/multi-point transmission
  - Cloud-based deployment
  - ZEN Master control plane and software platform
- Transmission and Error Correction
  - Unicast, Protected Multicast, Zixi ABR, OTT ABR
  - SMPTE 2022-1 FEC, Zixi Congestion Aware FEC, Zixi ARQ
- Encryption and Latency
  - DTLS or AES encryption
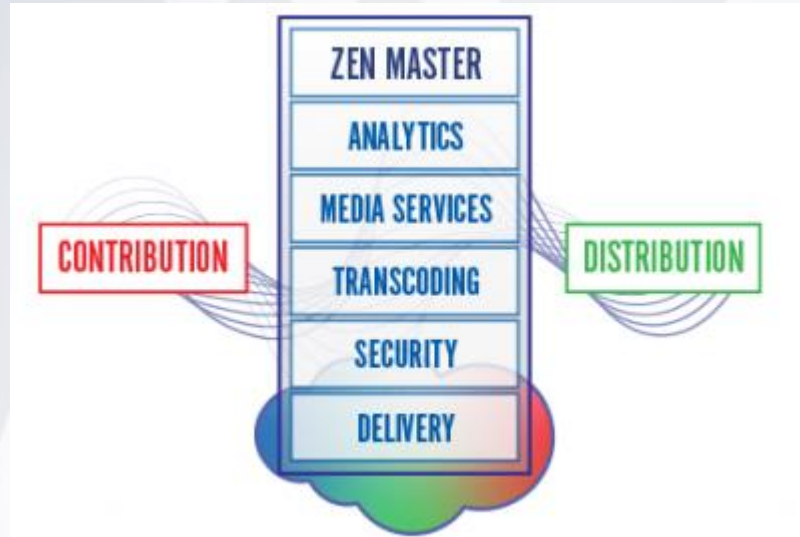 - Low latency HLS, User Defined Latency in Zixi Protocol

Zixi Enabled Network
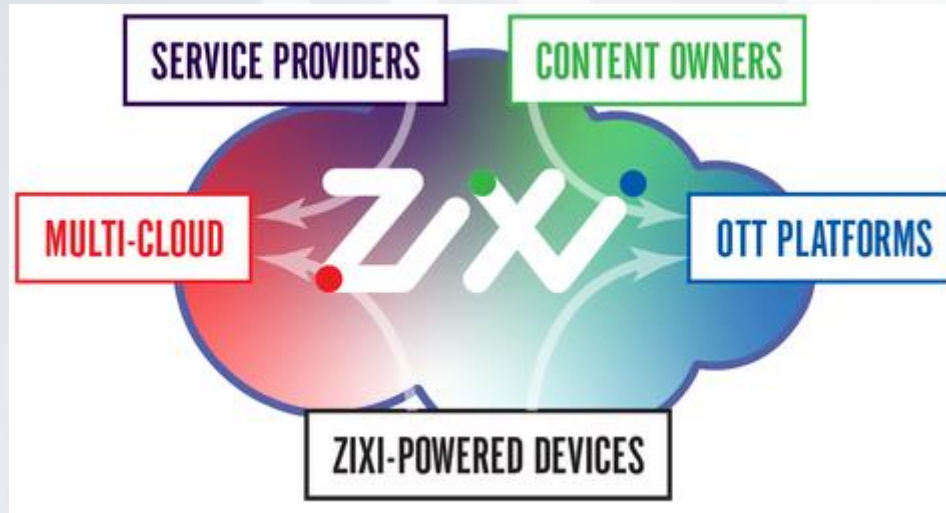
- Broadcast Quality Video Delivery over IP (Securely, Low Latency, Any Distance)
- Zixi protocol embedded to Encoder, Decoder and Media Gateway
- High interoperable due to 100+ partners and OEMs

The Zixi Platform

- A flexible broadcast-quality IP video delivery platform
- Low predictable latency, superior reliability and no packet loss
- Deployed on cloud, server or hybrid with analytics function

Zixi and Firewalls

- Zixi stream can tunnel firewalls
    - NAT is used to translate external IP to internal IP address
    - Data and FEC stream can pass through the firewall
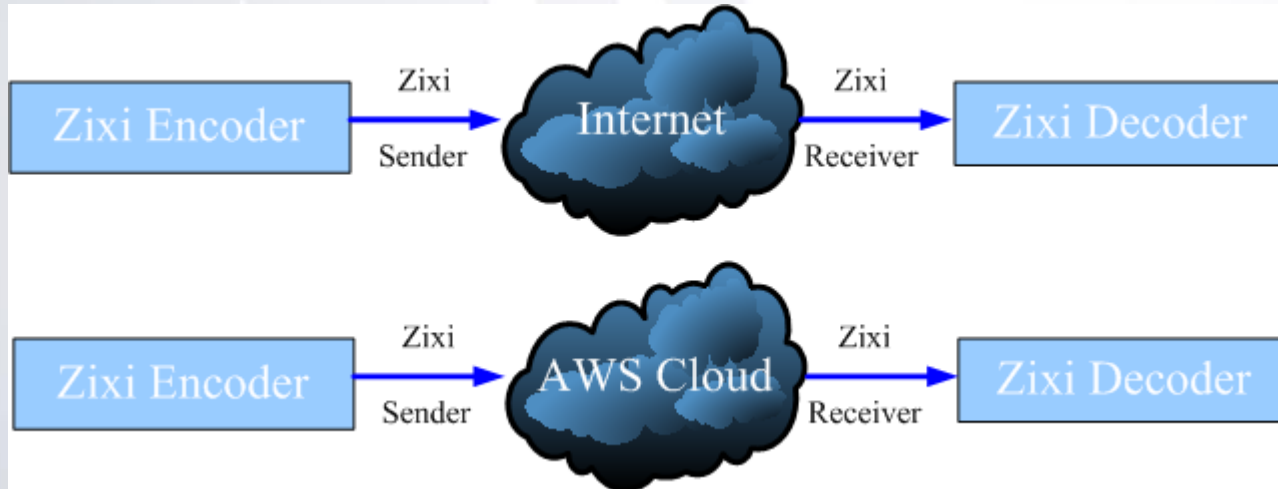
Relative Products

DMG 7000 – Software Media Gateway

- SRT/Zixi to MPEG/IP Gateway
  - Receive and Transmit SRT/Zixi over open internet
  - MPEG/IP <-> SRT/Zixi encap/de-encap
  - Single source to multiple destinations
- Flexible form factors
  - Small form factor for single channel
  - 1RU servers for up to 32 channels
- RIST support planned for 2019/2020

DMG7000 Part Numbers

Software Part Numbers

Part Number	Description
DMG 7000	DMG 7000 Base Software License
DMG 70701	SRT Protocol License, per unit
DMG 70702	ZiXi Protocol License, per unit
DMG 70703	RIST Protocol License, per unit
DMG 70991	Gateway License

Hardware Part Numbers

Part Number	Description
DMG 70010	DMG 70010 Mini Unit (Base Software, MPEG/IP, 1x Gateway License)
DMG 70020	DMG 70020 Field Unit (Base Software, MPEG/IP, 8x Gateway Licenses)
DMG 70030	DMG 70030 Headend Unit (Base Software, MPEG/IP, 32x Gateway Licenses)

MRD7000 H.264/HEVC 4K Decoder

- SRT to 4*3G SDI/12G SDI/HDMI2.0/SMPTE2110
  - Receive SRT over open internet
  - H.265/HEVC Decoding and SMPTE2110 Encapsulation
- Flexible and powerful
  - 1RU chassis for 1*UHD or 4*FHD
  - Scalable SW-based decoder
- RIST and ZiXi support planned for 2019/2020

MRD4400/5800 HD/UHD Receiver/Decoder

- R2TP to 3G-SDI/SDI/HDMI/CVBS Decoder
  - Receive SRT over open internet
  - HEVC, H.264, MPEG2 HD or SD video decoding
- Flexible and powerful
  - Support all common signal source (DVB-C/T/T2/S/S2/8VSB/IP)
  - Support 3G-SDI, 4:2:2 and up to 8 audio channel output(MRD5800)
  - Support HD/SD SDI, 4:2:0 and up to 4 audio channel output(MRD4400)
  - Fully complement of ancillary data in ANC and VBI