

Callisto Media Systems specializes in video content management and broadband streaming platforms that provide complete solutions, enabling service providers to focus on content and application development instead of technology and infrastructure issues.

MISSION

Callisto was founded in 1995 to provide innovative solutions for storing, managing and distributing digital video and audio content over IP networks.

APPLICATIONS

- Educational VoD
- Enterprise Communications
- Content Archiving (surveillance, learning)
- Digital Advertising Networks
- Repository / Asset Management
- Entertainment
- Medical
- Broadcast
- Hospitality

PRODUCT - VOYAGER

The *Voyager* video services platform is based on a distributed, scalable architecture supported by a comprehensive suite of video streaming, content and system management applications.

Voyager scales seamlessly from small desktop systems to large multi-unit servers, which can be configured as one operational video delivery platform or as a network of geographically distributed collaborative systems.

Key features:

- Flexible and easy to configure
- Load sharing / fault tolerant architecture
- Incrementally scalable
- Hierarchical or peer to peer content delivery configuration
- MPEG1, MPEG2, MPEG4, MP3, QuickTime
- Live stream capture and delivery
- On demand or scheduled delivery
- User configurable meta-data
- Scheduled delivery to cache servers
- Comprehensive content management
- Browser interface for system operation and management
- System administration tools
- Remote system administration
- Accounting and statistical data collection
- Customizable user interface
- API for user interface development



VOYAGER OVERVIEW



VOYAGER SYSTEM

Voyager provides a feature rich environment for management and delivery of digital video in a wide variety of applications and services. **Voyager** combines sophisticated video management and streaming software with high performance hardware to create an environment that offers high throughput, reliable video delivery and browser based management of video assets and system resources.

VIA - Voyager Interconnect Architecture

Voyager is based on a unique multi-processing architecture, which enables the assembly of a balanced, high aggregate bandwidth network from industry standard Off the Shelf hardware.

VCA - Voyager Collaborative Architecture

The VCA enables geographically distributed **Voyager** platforms to collaborate by sharing meta-data and content based on configurable content management policies.

VMA - Voyager Management Application

The VMA is a comprehensive tool suite to manage video content, user profiles and system operations through a browser based interface.

FLEXIBLE CONFIGURATIONS

Voyager can be configured to meet varied service requirements for content storage, network distribution and streaming capacity. Additional processing, storage or streaming resources can be added incrementally to meet growing demands while retaining the original investment.

VIDEO OVER IP

Voyager delivers video over IP. This enables service providers to support video delivery over Local and Wide Area networks such as Fast Ethernet, GBE, IP over ATM, point to point and point to multi-point wireless links and satellite networks.

QUALITY OF SERVICE (QoS)

Voyager ensures that all required resources and associated bandwidth are allocated before confirming a video stream delivery. Service is denied if sufficient resources are not available for stream delivery. Thus streams in progress are not affected by resource contention. End to end QoS between client and server is ensured by a client based application which regulates the data transfer and requests resends in case of missing or faulty data.

FAULT TOLERANCE

Voyager is inherently fault tolerant in a multi-node configuration (VIA). Every I/O and storage device is connected to two nodal processors and all nodal processors are connected to each other.

VOYAGER CONTENT SCHEDULER

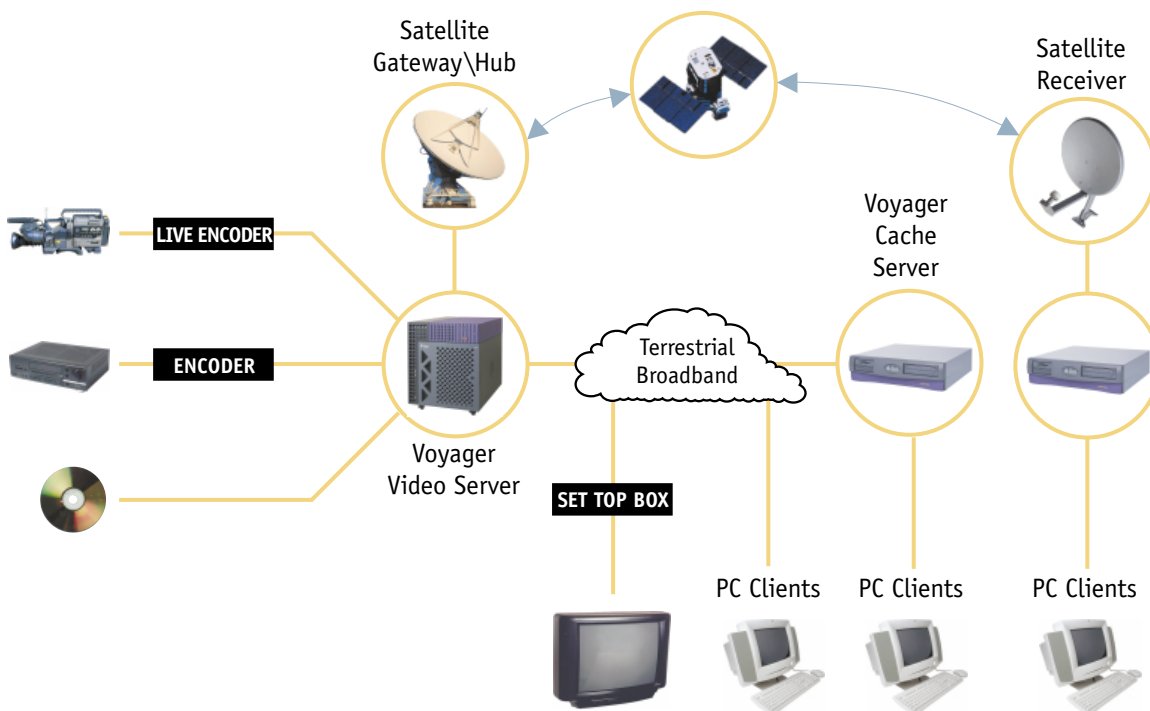
Voyager includes a complete scheduling and delivery system for migrating content from central to remote cache servers to overcome bandwidth and cost constraints. The **Voyager** Content Scheduler (VCS) allows remote users to browse content from central repositories and select required titles. The VCS automatically transfers content according to a specific schedule.

REMOTE MAINTENANCE AND SUPPORT

The browser based **Voyager** Management Application (VMA) enables operators to manage, monitor, update and reconfigure **Voyager** systems. Thus several **Voyager** systems can be managed from a central location through the public Internet.

BROWSER USER INTERFACE

Voyager enables subscribers, system administrators, content managers and application developers to access all applications and video content through a browser interface.



CALLISTO Media Systems 490 St-Joseph Boulevard, Suite 402, Gatineau, Quebec J8Y 3J7 Tel: 819.770.5738 Fax: 819.770.3998

WWW.CALLISTO.CA



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THE CHALLENGE

There are several key issues which VoD service providers need to address in order to provide services efficiently:

- Acquiring content from a variety of sources
- Cataloging content for easy user access
- Maintaining accurate usage statistics for royalty tracking, billing
- Local or remote web based system administration
- Customizing user interface for branding

THE SOLUTION

The **Voyager Management Application (VMA)** is a suite of browser based tools, which facilitates the operation and maintenance of the VoD service. **VMA** enables VoD service managers to organize and maintain both the library of video content and the database of users. Usage statistics provide insight in to user demands and content popularity.

THE FEATURES

Content Manager

The VMA provides a number of content management features:

- Add and edit of content meta-data;
- Ingest content;
- Delete content;
- Create virtual video clips / tags;
- Create Playlists;
- Embed links to content in Web documents.

Services

Enhanced applications distinguish **Voyager** from other streaming servers and provide a basis for premium services:

- Scheduled Play
- Live Stream Capture
- Community Setup
- Scheduled caching to remote servers

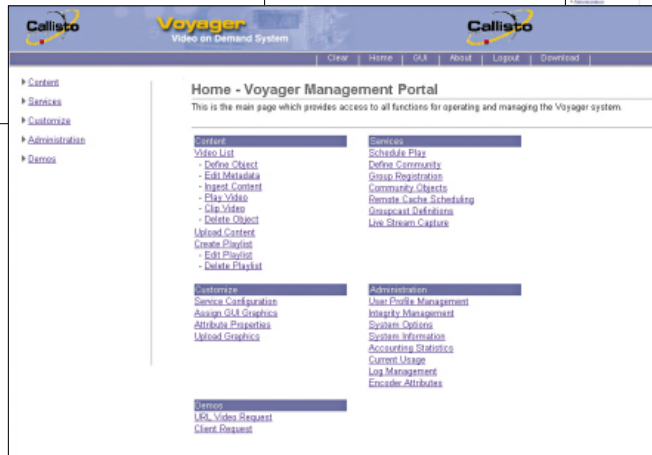
Service Configuration

The **Voyager** system has a web based interface for users to view video and for operators to execute system operation and maintenance tasks. The appearance and responsiveness of this interface is customizable for service branding and user convenience.

Systems Administration

Browser based tools simplify system administration and maintenance because there is no need for special operating systems skills and all tasks can be performed locally or remotely via the Internet.

- User Profile Management
- Log Management
- Real Time Usage Details
- System Management
- System Diagnosis



VIA / VCA VOYAGER ARCHITECTURE



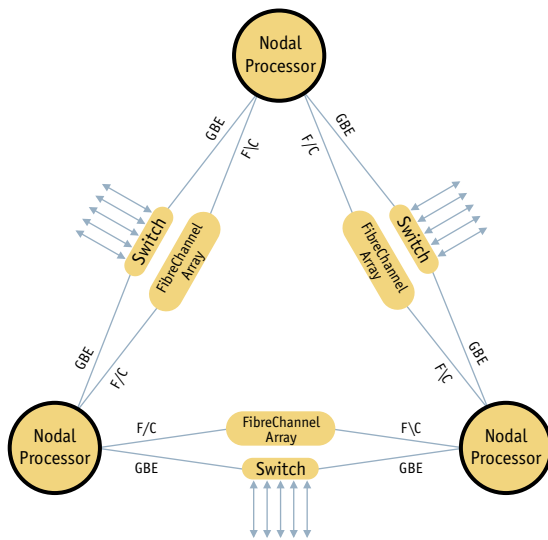
The **Voyager** video services platform is based on a flexible, scalable architecture. VoD service providers can start small and incrementally expand storage and streaming capacity while retaining their original investment. Typically, scalability is achieved by adding storage, memory and processors (CPU) to a single processing platform. **Voyager** is designed to scale beyond the hardware limits of individual processing units by combining multiple units.

The **Voyager** Interconnection Architecture (VIA) enables the interconnection of multiple processing units into a seamless platform in one location.

The **Voyager** Collaborative Architecture (VCA) enables geographically dispersed **Voyager** systems to collaborate over Wide Area Networks (WAN).

VOYAGER INTERCONNECTION ARCHITECTURE (VIA)

The VIA defines a fully connected network of computing nodes interconnected by independent load-sharing data paths (FibreChannel and Ethernet), which facilitate inter-processor communication and provides access to shared storage devices and user access ports. Every I/O device and user access port is connected to the shared interconnection bus and hence is equally accessible from both nodes. The figure below demonstrates how a 2-node system can be expanded to 3-nodes. Thus it is possible to create a **Family** of servers at any site.



Basic VIA Building Block (3 Nodes)

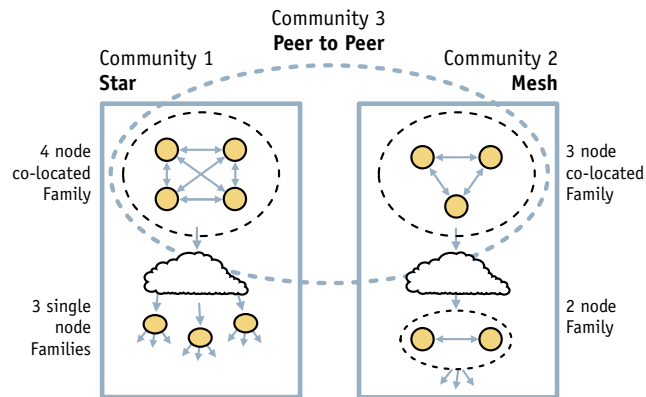
The VIA architecture defines a very flexible, cost effective way of combining Off the Shelf components to create systems with:

- A large number of storage devices
- A large number of simultaneous access trunks
- Intrinsic, multiple, load-sharing access to all devices
- Very high aggregate internal I/O and processing bandwidth
- Incremental scalability from a single to tens of units

VOYAGER COLLABORATIVE ARCHITECTURE (VCA)

The VCA is an extension to the VIA when it is necessary to expand beyond a local site for connectivity, bandwidth or economic reasons. It offers scalability by interconnecting **Voyager** systems across WANs enabling multiple geographically distributed **Voyager** systems to share their meta-data and video content. The VCA can be applied in a variety of configurations:

- Star configuration – A single large repository provides the archives for several remote servers
- Mesh Configuration – Multiple repositories may be selectively accessed by remote servers
- Peer to Peer - Communities of servers collaborating seamlessly thus providing users access to objects from all collaborating sites



Community & Family Connectivity

VCA flexibility is due to a distributed approach where there is no central definition of **Community**. Each server or family of servers defines the members of its Community. Collaboration is only possible if servers reciprocate by including selected Community members.

The concept of caching content close to the consumer is typically based on statistical methods such as usage patterns or anticipated demand. Callisto's approach is unique, in that it is demand driven. The viewer is presented with a view of the content in each repository.

Voyager's architectural features can be applied to configure cost-effective video distribution networks that can evolve incrementally. A typical scenario may be:

- Start with one or more self-contained independent server(s) and scale each site using VIA to meet market demands
- Create a central repository and provide access to small remote servers using VCA
- Multiple repositories may arise as individual sites develop and expand their content base.
- Communities may be created to balance transmission and storage costs.

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VCS VOYAGER CONTENT SCHEDULER



OVERVIEW

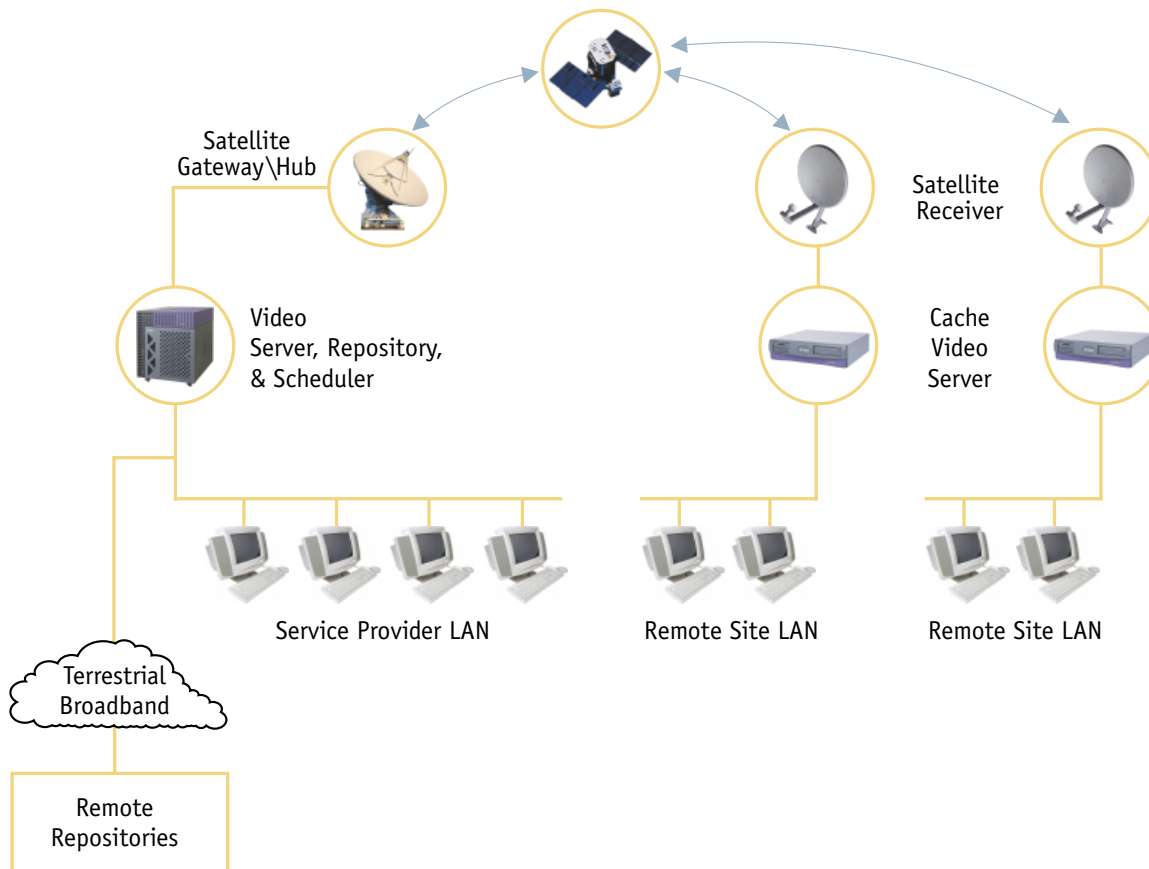
The **Voyager** Content Scheduler (VCS) enables service providers to deliver broadcast quality digital video material to remote sites (schools, libraries, hospitals, communities, theatres etc.) on demand. A central repository of video material is maintained at the service provider's hub. Each remote site is equipped with a caching server, which permits users to browse and request video material from local cache or from remote repositories. Requests from users are queued at the repository and delivered as a batch broadcast to the remote cache servers during allocated time slots. They are available for on demand streaming over the remote site's Local Area Network (LAN).

FUNCTIONAL DESCRIPTION

The figure below illustrates a central satellite site with a **Voyager** repository system and a typical remote site with the **Voyager** caching system. The systems are interconnected through the **Voyager** Collaborative Architecture. The terrestrial broadband connection can provide links to other repositories.

This implementation augments the traditional Video on Demand (VoD) model with a 2-stage process including scheduled delivery from a repository. The system offers the following advantages:

- Video delivery is not immediate but during a time slot when bandwidth is available/affordable
- Flexible GUI for allocating satellite time slots and for:
 - Bandwidth for a single date (e.g. January 1, 2004)
 - a day of the week (e.g. Mon, Tues)
 - Default allocated (i.e. operator defined)
- The **Voyager** Content Scheduler (at repository) manages all the scheduled content deliveries
- **Voyager** retains logs of all requests and deliveries
- While receiving a video, the caching system automatically verifies file integrity
- All requested material can be selectively delivered to any or all sites
- Remote sites can upload locally created videos into the repository to share with others
- Users can view locally cached videos or request transfer of selected videos from the repository to the local server
- All requested videos are retained permanently in primary storage at the requestor's server
- User is notified if there is insufficient space to store new videos on server.



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