

Press pack: Client-Application

## **Collaborative Working and Distance Learning** **Services Delivered Via Satellite To Agricultural** **Education Sites**

The Metafor project, as part of the European Union's TEN-TELECOM activity, has been successfully deployed using Alcatel Space receiver terminals, and UDcast software.

## **Project Background**

Following on from the experience gained in the 'OR' project (Optimisation des Réseaux (Network Optimization<sup>1</sup>)) sponsored by the CNES (the French Space Agency) and French Ministry of Education project, UDCast participated with Alcatel in the TEN-TELECOM<sup>2</sup> distance learning by satellite project, METAFOR.

The project name, METAFOR, is made up of the two words "META", representing the applicability and reach of the concept to multiple sectors, and "FOR" standing for "formation" (education).

METAFOR services, deployed to date at 58 educational sites across France, Spain and Sweden, targets the agricultural and rural market by offering high capacity access to both content providers and end users for real time and asynchronous services.

Based on a generic software platform, the services enabled include the creation of virtual classrooms with :

- Video and audio streaming (live and on-demand).
- Shared electronic documents, including whiteboards for problem based learning processes.
- Instant messaging.
- Simultaneous access to remote applications, for dynamic and shared interaction.
- Students' interventions can be included by sending messages that act as traditional hand raising.
- Use of multimedia databases (photo library, video library...) for the consultation of geographical information systems.

Additional functionality included for the application and network managers:

- VPNs can be created on demand.
- Customers pay for time used.
- Tracking and evaluation tools.
- Security: different access rights according to their profile (student, teacher, administrator etc...) (authentication).
- Stream discrimination. Within the caching and push services, avoidance of storage capacity overload because of irrelevant data.

## **Providing trans-European and cross-sector coverage**

The conception of the Metafor solution is particular in its suitability to any geographical location across Europe, irrespective of proximity to high-bandwidth terrestrial networks. Satellite access is unique in offering this connectivity reach, whilst maintaining uniformity of quality of service / bandwidth capacity.

The target market for this technology includes training centers, sizeable farms, SMEs and large companies (particularly for employee training), as well as governmental and non-governmental organizations with a need for education or access to professional information on agricultural or ecological matters. The connectivity

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<sup>1</sup> 30 university and college sites across France connected by satellite.

<sup>2</sup> TEN-Telecom is the European Community Programme designed to help the deployment of telecommunication networks based services (e-services) with a trans-European dimension. It focuses strongly on public services.

capacity and enterprise network compatibility of the Metafor solution makes it ideal for commercial applications. Agricultural commercial activities can benefit from the following types of application :

- Real-time inventory / yield / tracking for improved logistics planning and equipment utilization.
- Automation of a wide range of processes from administrative to industrial (remote monitoring and control).
- Access to rich and timely data such as weather, satellite imagery, medical and disease updates.

Additionally, the tourism sector presents a very suitable candidate for such technologies, with its strong representation in the rural areas.

### ***Architecture and Technology***

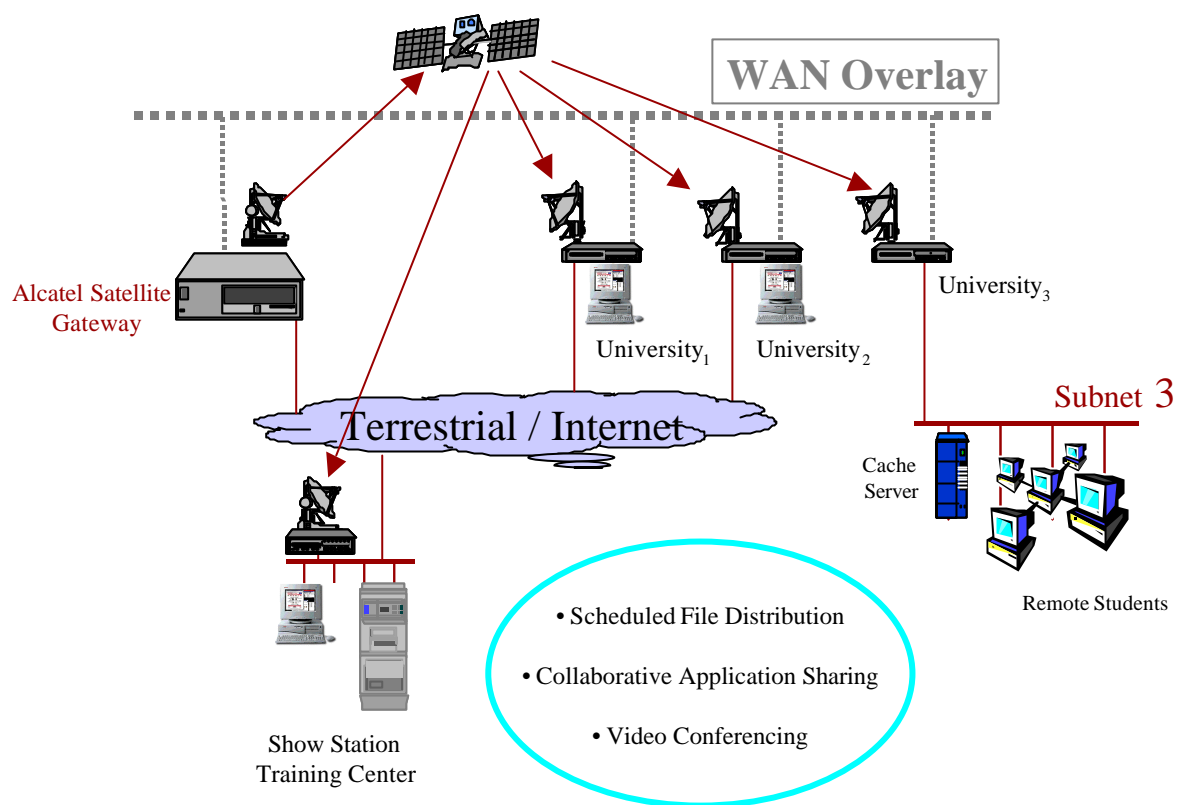
The key component in the architecture is an Alcatel satellite receiver – a set top box with enhanced network routing capabilities. All sites, including the training center, are equipped with a receiving station composed of a 1-metre dish and a router with the capabilities to decode the downlink signals and route the bit streams onto the local LAN.

Routers are connected to the broadcast station via the Internet using existing terrestrial networks such as ISDN or dial-up lines. Using the terrestrial return path avoids both the expensive 2-way satellite hardware and uplink satellite bandwidth costs. Backbone transit capacity is provided through the international Mbone, a natively multicast enabled network<sup>3</sup>.

A Ku-band satellite, which covers all of Europe, is used for transmissions using small dishes.

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<sup>3</sup> Made up of a range of interconnected networks run by public institutions, such as RENATER (Le Réseau National de Télécommunications pour la Technologie, l'Enseignement et la Recherche).



### Technology Used

- Alcatel 9722 satellite integrated decoder and router.
- UDLR (Uni-Directional Link Routing) standard protocol for asymmetric networks. Enables the creation of a homogeneous Wide-Area Network across an asymmetric architecture (where the return path is different from the reception path).
- UDroucast – providing a solution for multiple clients behind a private address to :
  - o Run standard multicast protocols without a fixed limitation to the number of satellite receivers.
  - o Contribute dynamically to a multicast group.
- UDpush – reliable file delivery with adaptive/explicit Forward Error Correction.

### Challenges Solved

- Using UDLR, rendering the asymmetric satellite and terrestrial links into a transparent bi-directional link, as seen by the application.
- Scaling of the standard multicast protocol PIM (Protocol Independent Multicast) to beyond its traditional limit of 64 receivers.
- Achieving smooth routing performance across heterogeneous networks, using native IP multicast protocols. Connectivity between the Mbone and the satellite network achieved by using address translation technologies through IP tunnels.
- Providing dynamic and multiple client access behind private IP addresses.

### Satellite Connectivity – the Economic Choice

When considering video transfer, simple comparisons can be made to illustrate the potential savings using asymmetric satellite (reception via satellite, terrestrial return). Taking standard pricing figures for bandwidth capacity, and using the following parameters:

- 50 sites
- 256 kbps required capacity between emission site (training center for example) and receivers.
- The terrestrial option is assumed to have Content Distribution Network technology, requiring caches in each location. Hence the peak bandwidth of 12.8Mbps is reduced to 6.4Mbps. The amortization of the capital expense (typically 1000 Euros per site) is not included in the table.

**Annual Operating Cost Calculation Example:**

<b>Terrestrial</b>		<b>Two way satellite systems</b>		<b>UDLR</b>	
<b>Headquarter :</b>	50	<b>Headquarter :</b>	50	<b>Headquarter (forward)</b>	50
Terrestrial access	Leased Line	Bandwidth needed	256 Kb/s	Bandwidth needed	256 Kb/s
Peak Bandwidth needed	12 800 Kb/s	Satellite access	DVB-S provider	Satellite access	DVB-S provider
Peak Bandwidth CDN techn	6 400 Kb/s	Bandwidth	320 Kb/s	Bandwidth	320 Kb/s
Average Bandwidth	8 000 Kb/s	Fixed cost	€ 11 500	Fixed cost	€ 11 500
Fixed cost	€ 2 500	Annual cost	€ 39 040	Annual cost	€ 39 040
Annual cost	€ 176 000	Total	€ 42 873	Total	€ 42 873
Total HQ	€ 176 833	<b>Per Sales point</b>	50	<b>Headquarter (return)</b>	50
<b>Per Sales point</b>	50	Bandwidth needed	16 Kb/s	Bandwidth needed	800 Kb/s
Bandwidth needed	256 Kb/s	2-way return type	VSAT	Terrestrial end-point	Leased Line
Terrestrial access	ADSL professional	Bandwidth	29 Kb/s	Bandwidth	2 000 Kb/s
Bandwidth	1 024 Kb/s	Fixed cost	€ 11 000	Fixed cost	€ 2 500
Fixed cost	€ 1 130	Annual cost	€ 2 880	Annual cost	€ 44 000
Annual cost	€ 1 280	Total	€ 6 547	Total	€ 44 833
Total Sales Points	€ 1 657	<b>Total</b>	<b>€ 370 207</b>	<b>Per Sales point</b>	50
<b>Total</b>	<b>€ 259 667</b>			Bandwidth needed	16 Kb/s
				UDLR return channel	ADSL standard
				Bandwidth	512 Kb/s
				Fixed cost	€ 2 630
				Annual cost	€ 640
				Total	€ 1 517
				<b>Total</b>	<b>€ 163 540</b>

*It is important to note in the above comparison the following two points:*

- In standard unicast terrestrial networks, the emission location requires enough cumulative bandwidth to serve all receivers. By using a satellite hub architecture the following advantages are gained:
  - o Quality of the emission will be maintained irrespective of the number of viewers (which is not the case for emission via terrestrial connections).
  - o Any site can emit to the whole community of listening sites, by passing through the satellite uplink hub.

***Strengths of the Metafor Solution***

- Equality in bandwidth and quality of service across all sites.
- Using the broadcast satellite channel, the cost of content distribution is shared between users, as opposed to users paying individually for the same content (which is the case for terrestrial emissions).
- Affordable receiver equipment, directly compatible for integration with LANs.
- Asymmetric return path for maximum bandwidth economy.

## **Metafor partners and their role**

### **France :**

**Alcatel Space**, Cannes : Private subsidiary of Alcatel, satellite manufacturer and operator, offering value-added services such as multimedia communication tools. Metafor project leader and technical advisor.

**Enesad**, Dijon (Etablissement National d'Enseignement Supérieur Agronomique de Dijon), **Cnerta** (Centre National d'Etudes et de Ressources en Technologie Avancée) division of Enesad, supplier of content and training.

**Viviance**, Sophia Antipolis : Internet distance learning applications.

**Renater**, Paris : REseau NAtional pour la Technologie l'Enseignement et la Recherche ; Groupement d'Intérêt Public ; terrestrial transit.

### **Spain :**

**Món Blau Verd**, Barcelona: teaching association, research and engineering in the environmental sector; supplier of content and training.

**USC** : Université de Santiago de Compostela, APL (Aula de Productos Lácteos) ; supplier of content and training.

**Cesga** : CEntro de Supercomputacion de Galicia ; terrestrial transit and training content.

### **Sweden :**

**SLU** : Sveriges Lantsbruk Universitet ; The Swedish Agricultural University offering education on husbandry techniques, contributing as a content supplier.

## **About Alcatel Space**

Alcatel Space develops satellite technology solutions for telecommunications, navigation, optical and radar observation, meteorology, and scientific applications.

Alcatel Space plays an important role as prime contractor, operator, investor, or service provider in most of today's leading space programs. The company is also Europe's Number One prime contractor for Earth observation, meteorology and navigation ground segments, as well as space systems operations.

Alcatel Space generated 2001 revenues of 1.4 billion euros and almost 6,300 employees.

## **About UDcast**

UDcast provides best-of-breed software solutions which enable native IP protocols to run over broadcast satellite links and other one-way communication paths. UDcast offers an open, robust implementation of the UDLR protocol, standardized by the IETF as RFC3077, as well as a software suite designed to optimize the deployment of large numbers of remote sites. The software suite is a family of scalable solutions for multicast routing protocols, reliable data transfer, enhanced security, and remote site administration. The UDcast platform enables satellite services to be seamlessly integrated into terrestrial Internet-based networks, including corporate Intranets and VPNs.