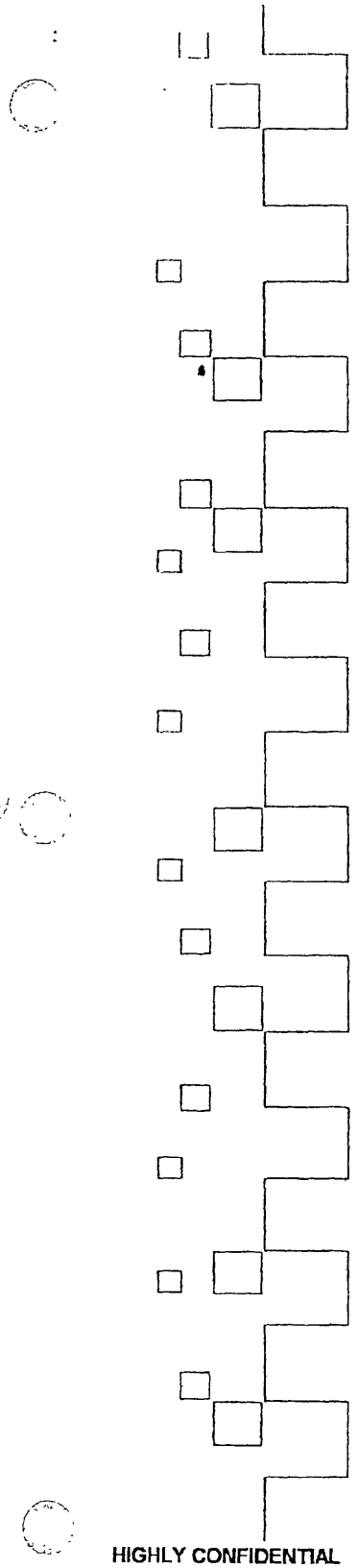

NDS Overview for a Digital Pay-TV System

Ricoh

Confidential

Doc No: RIC-A500
Release: A
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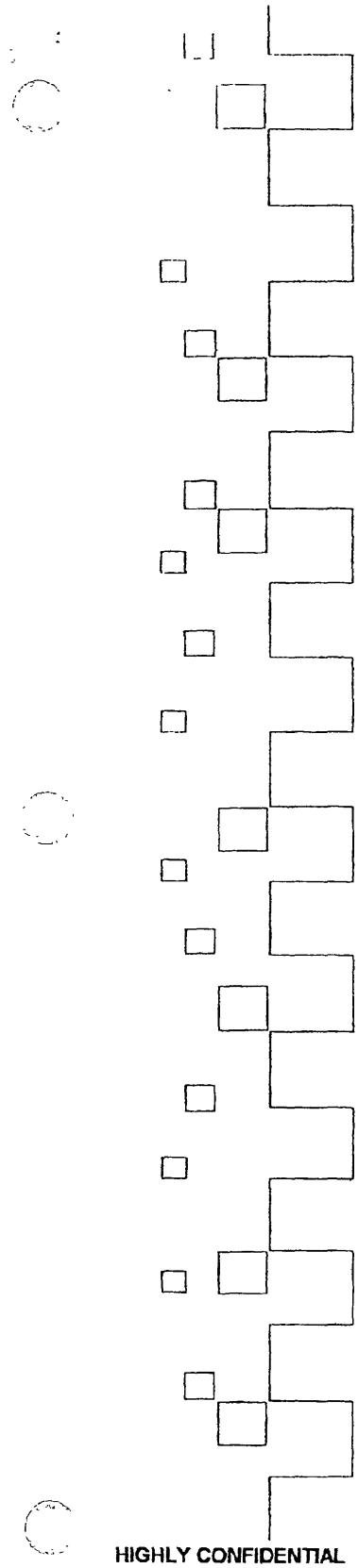

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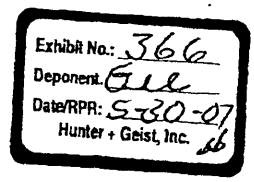


Contents

1 Introduction

NDS Open VideoGuard provides digital broadcasters with a flexible system and unique array of benefits, integrating the same business features on which the success of operators such as BSkyB and DirecTV depend. Due to the flexibility of Open VideoGuard it can be used for many applications, to securely deliver services for redistribution ie. Delivery to cable headends or directly to the end customer in satellite, cable and terrestrial areas.
The system incorporates features to:

- Maximise subscriber growth
- Reduce churn
- Increase per-subscriber revenues
- Minimise call-centre and other operational costs

This documents outlines many of the advantages and benefits that NDS can bring to Ricoh's business to support the goals outlined above.

In the Appendix there is a questionnaire for Ricoh that is based on the information provided in this document. In order for NDS to understand the initial requirements it would be very helpful if Ricoh could complete as many areas as possible in order to help NDS provide a proposal.

1.1 NDS System Scalability

The technologies NDS can propose for Ricoh are exactly the same as those used in large successful pay TV platforms such as BSkyB, DirecTV, StarTV and Cablevision. However, if required NDS can certainly offer a solution scaled down and modified to meet Ricoh's business requirements.

NDS can propose a small start-up platform, so as Ricoh's business develops, it can easily evolve without sacrificing the initial investment, and support enhancements such as an on-screen programme guide, Impulse Pay Per View (IPPV) and Order-ahead Pay Per View (OPPV) services, as well as a whole range of advanced interactive services including:

- Interactive applications
- Betting
- Digital Personal Video Recorder (PVR) control

1.2 NDS Delivers On Time

NDS understand that Ricoh require a system that can be implemented quickly and cost effectively and yet provide a firm foundation for success now and into the future. To achieve this goal, NDS believes that Ricoh will be looking for a technology partner that can provide an existing solution, with a proven track record in both innovative technology and systems integration.

NDS is justly proud of its record in delivering innovative, flexible, and reliable solutions to meet its many customers' varied needs. NDS systems offer rich functionality together with an unmatched security record.

NDS can propose a solution with an architecture that provides a conditional access platform with a cost-effective infrastructure capable of deploying advanced TV services to many hundreds of thousands of subscribers.

NDS has delivered over 14 major satellite systems and over 6 cable systems in North America, South America, the UK, Italy, China, Asia, Australia and New Zealand, including the two largest and most complex pay-TV platforms in the world, DirecTV and BSkyB.

We have a history of delivering working solutions on time, and recognise the importance to broadcasters of hitting publicised on-air dates. This means that Ricoh will be dealing with experienced personnel who know how to deal with the issues associated with launching a digital television system to very aggressive deadlines.

1.3 NDS Delivers Business Advantages

The success of a digital TV operation depends on growing the subscriber base, maximising per-subscriber revenues, ensuring due revenues are received, adding new and exciting revenue streams, and keeping operating costs to a minimum.

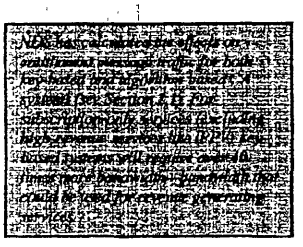
Major issues when deploying a digital pay-TV system are:

- Maximising subscriber revenue
- Protecting subscriber revenue
- Reducing system management costs
- Maximising bandwidth available for programming

NDS understands these issues, and can provide a solution that is designed specifically for the digital broadcast business to minimise operating overheads and maximise revenue generation.

1.4 NDS Provides a Scaleable 'Future Proof' Solution

NDS can propose an initial architecture that is scaleable to manage a small amount of channels and subscribers. Because the design is modular, the system can be expanded to easily accommodate many more channels and hundreds of thousands of subscribers.



Furthermore, this architecture incorporates the basic building blocks to support synchronised interactive services. This means that Ricoh will be able to roll out advanced interactivity in the future easily and smoothly. NDS have already proved this concept throughout the implementation of the BSkyB system.

BSkyB were the first broadcaster to implement an NDS interactive platform (for Interactive Soccer) and this proven track record has resulted in the selection of NDS interactive applications by other leading service providers, including:

- Discovery Network
- QVC Shopping Channel
- Flextech TV
- Music Choice Europe

NDS believes that its proposed solution represents the world's best choice of mature technology and experience for building a strong foundation to support Ricoh's new business requirements. Taking advantage of NDS' innovation and experience, Ricoh can easily implement flexible programme packaging options and support new and exciting ways of generating additional revenue.

In addition to its support for existing products, NDS designers and engineers are focussed on providing broadcasters with the means to exploit their digital broadcast infrastructure through new technologies such as secure interactivity and enhanced PVR (Personal Video Recorder) technology, known as XTV™. [Please refer to section 4.3 XTV].

1.5 NDS Service Support

NDS understands the needs of its customers in the highly competitive world of digital broadcasting and with these needs in mind NDS designs systems that are setting standards in the industry. At the same time, NDS is aware that to offer the utmost in technology is not enough, it must also provide services that are second to none to support its customers now and in the future. NDS is therefore committed to harness its expertise and experience to provide innovative, customer-oriented service products, backed up by a highly skilled and motivated support organisation.

The primary objective is to provide first class customer care that is tailored to Ricoh's specific business and operational requirements. NDS therefore believes that the key factors that it must take into account when proposing a services solution for Ricoh are:

- Providing prompt response and resolution to any technical problem or enquiry, ensuring system availability 24 hours a day, 365 days a year.
- Ensuring that the NDS system software is kept continually up to date and in step with other components of the system.
- Competitive pricing to meet Ricoh financial requirements.

1.6 What Makes NDS Unique?

NDS experience in the pay-TV arena spans more than ten years. NDS has an enviable and proven track record for delivering revenue-generating solutions to network operators and service providers worldwide on time and within budget. NDS customers recognise the benefit that this experience brings them, and trust NDS to provide them with an infrastructure that will allow them to efficiently expand their business and increase their revenue into the future.

2 NDS VideoGuard Features and Benefits

2.1 NDS Security Features and Benefits

All encryption and Conditional Access (CA) systems rely on the use of keys to encrypt and decrypt content. The measure of security for a pay-TV system is the degree of difficulty the hacker encounters in illegally retrieving keys to unlock content. The NDS system is unique in not broadcasting keys at any time, instead relying on algorithms hidden in the STB and Smart Card and at the Headend to generate identical keys at either end of the broadcast chain. For this reason, the NDS system can be described as being algorithm based, whilst all other CA systems can be described as key-based. The major differences between NDS and its competitors with regard to security are summarised below.

The NDS approach to secure conditional access is focussed on a number of important principles:

- **The NDS system is algorithm based and not key based** – Key based systems are inherently insecure in broadcast environments
- **NDS security algorithms are proprietary and unique to each customer** – With key based CA, pirate cards available externally could also be used on the Ricoh platform
- **NDS do not broadcast the Control Word (CW) used for scrambling services** – Key based systems have to broadcast the CW. The secret you are trying to protect is thus made freely available for pirates to receive, attack and de-cypher
- **NDS uses their own proprietary smart card technology** – By using proprietary smart cards, the cost of attacking the system becomes uneconomical for the hacker
- **Pro-active operational security support** – From experience, NDS knows that you cannot just rely on the technical aspects of security to protect your system. This must be supported by pro-active security measures targeted against fraud, piracy and other related criminal activity
- ***The Key Message: NDS CA is more secure because it uses 'Algorithm' based encryption and not 'Key' based. Key based CA providers include IRDETO, VIACCESS, NAGRA, and SECA.***

2.1.1 The NDS Algorithm is Unique and Remains a Secret

The central element in NDS security is its use of proprietary 'one-way' algorithms that eliminate the need for service keys. These algorithms are developed by a special research group at NDS and are based on cryptographic methods developed by world-renowned Professor Adi Shamir, of Israel's Weizmann Institute of Science.

The algorithms used to protect secrets in key-based conditional access systems use standard published algorithms such as Data Encryption Standard (DES). Algorithms are also unique for a given system, ***not*** unique to a customer.

In key-based systems, the service keys in the entitlement message are protected for each subscriber by encryption using each subscriber's Unique Key. However, once one Unique Key is hacked, service keys *for all subscribers* can be easily recovered from the Entitlement

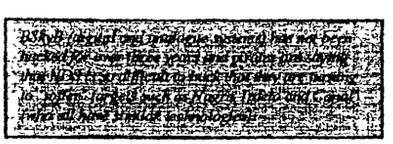
Management Message (EMM), since the encryption algorithm is in the public domain. Compromises in the security of one customer's system are therefore easily transferred to *all other customers* using the same system. Thus, pirate cards available in other countries could be used on Ricoh's platform.

The algorithms used for each NDS customer are unique. Therefore, if there should ever be a security breach of one NDS customer, it has no adverse effect on the security of any other customers.

One of the methods used by NDS to keep a step ahead of hackers, and continually improve the system, is to introduce algorithm changes in deployed smart cards from time to time. Key based systems do not have this flexibility. At most, all they can do is change the keys used. For a hacker if they were successful in obtaining the old keys, it won't take long to obtain the new ones – in many cases a matter of days!

2.1.2 NDS Does Not Broadcast the Control Word

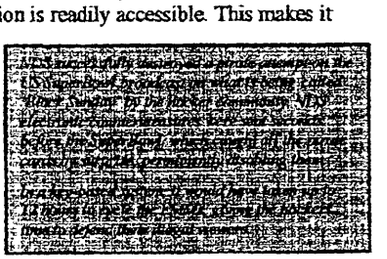
In key-based systems, the CW used for scrambling of an individual service is encrypted with the service key and broadcast to everyone in an Entitlement Control Message (ECM). The data packet containing the control word can be recorded, and since hackers can easily recover the service keys used to encrypt the control word, another tool is handed to the hackers to break the system.



The NDS Control Word is never broadcast. Instead, the control word is re-created in a highly secure environment within the subscriber's Set-Top Box (STB), and is therefore inaccessible to hackers

2.1.3 NDS Uses Pro-active Piracy Control in its Smart Cards

Many conditional access suppliers use similar, freely available chipsets in all their smart cards, for which functional and operational information is readily accessible. This makes it considerably easier for hackers to probe and analyse the chips' operation, revealing many clues to the CA system's secrets. Furthermore, because similar technology is also employed by other conditional access suppliers, a hack on any of these platforms results in cards being recycled in other countries for use on the other platforms using the same system.



NDS identified these problems over five years ago and stopped using off-the-shelf components for its smart cards. NDS now develops its own proprietary chip technology and each NDS customer receives its own unique smart card. This means that no NDS customer will be threatened even if an attack is made on another NDS customer.

2.1.4 Using Key-based CA can Severely Impact Revenue

NDS is currently advising a major Australian broadcaster using a key-based system that has been hacked. With less than 600,000 subscribers, this broadcaster is estimated to be losing US$300,000 every month that the hack continues. So far this hack has gone unchecked for over a year and the broadcaster is preparing to change to an NDS system.

2.1.5 NDS Maintains Global Security Operations

Hacking pay-TV systems is a global business, and the ease of transfer of information allowed by the Internet has magnified the problem for broadcasters. Any security operations that are restricted in-country to a broadcaster's business are therefore inadequate. NDS believes it is unique in offering this service. The scale of NDS operational security is unprecedented in the broadcast market, and has been built up over years as a direct result of NDS being employed by the largest digital operators in the world. Such an operation is economically unfeasible for other CA vendors.

NDS maintains a global operational security team with a background and experience in intelligence, and specialising in battling high-tech fraud and criminal activities. This allows NDS to foil potential hacks using proven electronic countermeasures, which deactivate pirate cards.

NDS believes it is unique in having global security operations. Many conditional access suppliers rely only on ongoing software upgrades to combat piracy, whereas NDS believes that only a proactive security plan, which NDS tailors to each customer's individual situation, can effectively pre-empt hacker activity.

2.2 NDS VideoGuard Business Features and Benefits

2.2.1 Viewer Card

The viewer card is the key element that provides Ricoh with business functionality and security for transaction revenues.

NDS philosophy is to ensure that the business functionality and security-related elements reside only in the viewer card and not in the set top box. In this way, new business or security requirements can be implemented through upgrading the relatively inexpensive card rather than the entire set top box.

The viewer card is an important element in ensuring that the system is future proof.

2.2.2 Multiple Set Top Box Suppliers

NDS appreciates that set top box pricing is of paramount importance to an operator offering digital pay TV services. A low price will reduce or preclude planned subsidies, improve viewer acceptance and increase subscriber up-take.

NDS is continually working to ensure that market forces work in favour of its customers to minimise the cost of set top boxes incorporating NDS technology.

Ricoh will benefit from the multiple sources for VideoGuard-compatible set top boxes (currently 18 different manufacturers) and from economies of scale resulting from production quantities in excess of 22 million units.

2.2.3 Flexible Event Pricing

The VideoGuard system offers complete flexibility on how content is priced. The Operator can have a price structure that takes in to account:

- How the event is purchased? For example, a premium for OPPV and a discount for IPPV
- When the event is purchased? For example, a discount for a purchase a month in advance and a premium for a purchase on the day of the event
- By who the event is purchased? For example, Ricoh may decide that its telephone subscribers benefit from a discount on certain TV products
- Where the subscriber lives? For example, a premium for local sports events
- The currency with which the subscriber pays. For example, a discount for payment is Euros

This flexibility will allow Ricoh to use pricing as a dynamic marketing tool and maximise the revenue from specific content.

2.2.4 Product Packaging

The VideoGuard system allows individual programme events to have more than one CA identifier. In this way, a particular event can be sold in different packages with different prices and different access conditions. For example, a football match could be sold as part of a sports package incorporating several sports channels. The same match could equally well be sold on its own as a PPV event.

The flexibility to package services, irrespective of whether they are video, radio, data or interactive services, is a powerful marketing tool to ensure that Ricoh has a product that targets each subscriber profile.

2.2.5 Freedom from Return Channel

VideoGuard provides secure operation with or without a return channel. With the presence of a physical return path (such as telephone line or wireless), IPPV purchase history is reported back to the broadcaster on regular basis. If no such return path is available, then reporting may be accomplished via the kiosk or verbal methods, as described below.

The subscriber is prompted to report IPPV purchase history by a broadcast mail message. This message is triggered automatically when IPPV purchases reach a set threshold or at a pre-set time (such as a particular day of the month).

Kiosk report-back:
The subscriber takes his viewing card to a nearby centre ("kiosk"), where the card is inserted into a smart card reader connected to a PC. This PC collects report-back data from numerous subscribers and reports it in bulk to the broadcaster.

Verbal report-back
The subscriber makes a telephone call to a customer service representative and verbally reports IPPV viewing activity by reading the data from the television screen.

If the subscriber does not perform a report-back within a specified period of time, the purchase of additional IPPV events and/or other services may be blocked by the broadcaster.

2.2.6 Smart Card Management

As Ricoh's business develops, it may from time to time be necessary to replace subscriber cards to implement new business features, or to ensure that the smart card technology copes with a new threat of piracy.

NDS has an unrivalled experience in managing the production, distribution and change over of smart cards on systems with many millions of subscribers.

The VideoGuard system copes with card chaining during the changeover such that the process is completed efficiently and securely.

In the event of a smart card changeover, Ricoh can be assured that their revenue stream will be unaffected and that during the changeover their customer care centre will not be swamped with customer complaints.

2.2.7 Logical and Group Addressing

VideoGuard provides subscriber addressability on an individual, group, or broadcast basis.

Groups of subscribers can be identified by a large number of parameters stored within the subscriber management system. Postcodes, viewing habits, account status, etc. are useful criteria in addressing subscriber groups.

The flexibility of the addressing system provides a number of important business features:

- Regional blackouts can be imposed for sporting events allowing Ricoh to overcome possible restrictions imposed by content providers
- E-mail messages can be sent individually, or to groups of subscribers; for example, account overdue messages
- Direct marketing messages can be sent with regional promotions, or to target specific viewer profiles
- Advertisements can be customised to include local content, such as the address of a local car dealer
- Ricoh could generate valuable revenue through offering e-mail access from its subscribers to third parties. For example, advertisers, utilities for account status information, and so on. Moreover, Ricoh could deliver its telecommunications and Pay-TV bills directly to the TV, thus reducing billing costs

3 NDS System Components

The following section provides an overview of the components NDS feel are required in a low cost solution and which NDS is confident will meet Ricoh's needs. The section will cover CA, Broadcast Control (Service Information (SI) Generation), Subscriber Management Systems (SMS), STB, System Integration Management.

3.1 System Configuration

A single NDS VideoGuard CA Headend can be implemented to control all phases of Ricoh's business plan. The whole NDS CA Headend solution as outlined below could all be installed on just two Hewlett Packard (HP) A-Class servers. NDS can offer Ricoh various hardware options dependant on specific requirements. i.e. redundancy, initial and projected subscriber levels, memory and performance. NDS will assess all of these options and propose the most economic and suitable platform to meet Ricoh's needs.

A high level schematic drawing of the overall NDS system is shown in Figure 1 and indicates the NDS Open VideoGuard components, and the elements which make up the Broadcast Control system.

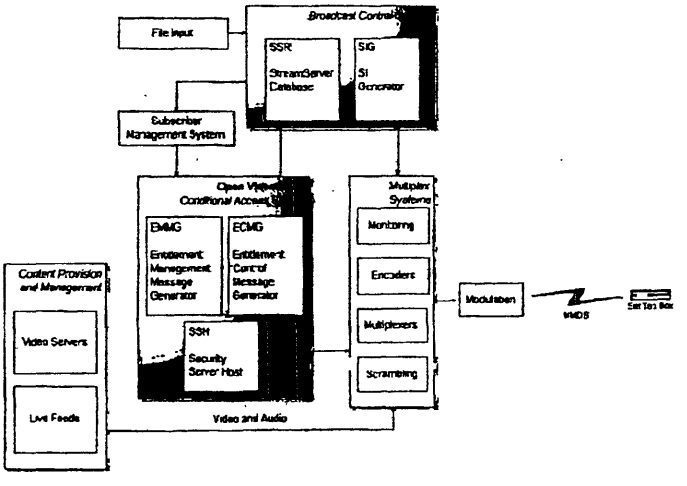


Figure 1 System Overview

3.2 VideoGuard CA and Content Protection

The NDS VideoGuard system

- Underpins the business functionality of the platform by ensuring that subscribers only pay for what is viewed and cannot view what they have not paid for
- Provides subscriber addressability, important for interactive applications and marketing purposes

- Ensures protection of the broadcast content. This will be mandated by the content provider

The two elements in the Broadcast control system are:

- NDS StreamServer (SSR)
- NDS SI Generator (SIG)

The CA system comprises the following elements:

- EMM Generator
- ECM Generator
- Security Server Host (SSH)

At the subscriber end, the STB comprises:

- Smart Card
- Associated STB and receiver software.

3.3 NDS StreamServer

The SSR database holds information on the programme data, such as schedule times and Access Criteria (AC), and also acts as an interface between the incoming feeds, the SMS and the ECMG.

If the requirement of the Ricoh system is to keep initial services to a minimum, the NDS SSR needs only to operate with static SI and AC, hence preliminary integration and implementation costs can be kept low.

The SIG produces the NIT (Network Information Table), BAT (Bouquet Association Table) and the SDT (Service Description Table). These DVB tables will enable channels to be selected at the STB without the aid of an Electronic Program Guide (EPG).

SSR is a powerful, flexible and easy-to-use solution for data management in digital broadcasting situations and is key in that it:

- Considerably improves the ease of use of a digital broadcast system
- Significantly reduces the overheads associated with operational costs

SSR bridges a critical gap in the range of studio control systems that are required to construct a multiplexed Digital Video Broadcast (DVB) system. Being fully DVB/MPEG-2 compliant, SSR can supports hundreds of channels of video, audio, and data services and is designed to:

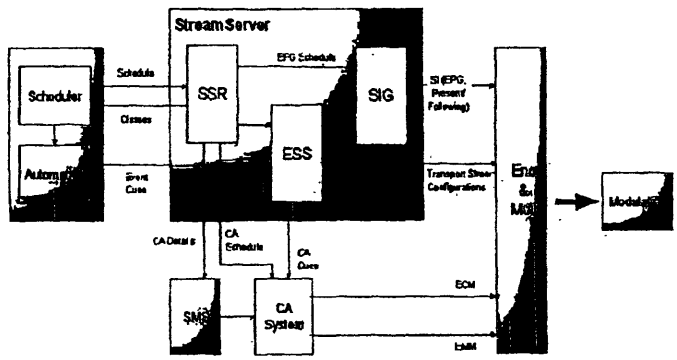
- Manage and synchronise configuration of transmission and conditional access equipment
- Generate supporting service information streams

SSR is not an automation system, in that it does not control program play-out. Instead, it monitors the state of all the on-air services, event by event, and formats the digital multiplex to accept them. The data is synchronised across all play-out systems, so that they reference each other correctly.

Without SSR, there is no easy method of evaluating the mix of services being transmitted within the digital transport stream. Whenever bandwidth is at a premium, bit-rates will need to be adjusted in order to allow the flexible addition and removal of services. SSR provides a method of viewing all multiplexes on a system, and consequently can be used to re-apportion bit-rates as business requirements develop.

3.3.1 Key Operational Benefits

- All EPG and CA data can be updated dynamically
- Bit Rates and statistical multiplex group changes can be scheduled (Tandberg Reflex)
- Turn-around channels and data services can be scheduled
- All multiplexer data can be locked to real programme timings (Tandberg)
- Single source of all event data including Pay-per-view prices



NDS StreamServer

Figure 2 NDS StreamServer

3.4 Integrated SMS Systems

Depending on the types of services offered and the degree of dynamic control of the business required, integration with the SMS can be carried out on different levels. Ricoh could undertake the simple modifications to interface with the NDS CA system using the NDS published interface CF-T020 protocol. This specification can be supplied to Ricoh as required providing them with a wide range of business models to maximise their revenues.

The CF-T020 SMS-CA interface specification has already been adopted by SMS suppliers. These include:

- Cabledata
- IBM – ICMS
- Wiztec
- Sky-SCMS (BSkyB)

- Convergys (CBIS and Matrix Marketing)
- Mindport Solutions
- Objective Solutions
- RR Systems

3.5 Systems Integration

NDS Systems Integration Management can provide many functions including the following:

- Detail System Design
- Formulation of Detailed Project Implementation Plan
- Definition of Operational Requirements and Interfaces
- Installation and testing of secure network for NDS supplied components
- CA Configuration and Set-up
- SSR and Broadcast Control Configuration and Set-up
- Compression Integration Management
- Operational Systems Integration (SSR, CA and Compression Headend)
- Commissioning and Testing (On-site and Pre-Installation)

3.6 STB

NDS understands that the STB is an important decision for Ricoh and selection of the 'right' STB is fundamental to the success of the business.

NDS have integrated and worked with many of the leading industry suppliers but should Ricoh wish to choose a different supplier then NDS are willing to discuss any integration issues.

STBs can be produced in hundreds of types; from the high-end STBs with every possible gadget and application to the low-end STB that receives and processes the TV signal and not much more. Some of the possibilities are listed in Table 1 [Features of the STB range] bearing in mind that STBs need to last in the consumers home over a long period of time.

Low-End STB

This is the least expensive STB, and the viewer is able to watch digital TV programming and has no advanced functionality whatsoever.
The low-end model has only minimal conditional access: ordering subscriptions and PPV through a personal phone call, with no STB purchase interactions and no return path. The low-end model is used in markets with exceptionally low prices and where interactivity may not be an option.

Mid-Range STB

The Mid-range STB offers a fuller range of Pay TV functionality, but without advanced applications. This is the STB model that most TV operators offer in most developed markets today.

High-end STB

The high-end STB contains all features in Table 1 [Features of the STB range] and probably more. These boxes are used for enhanced and interactive TV, personalised TV, for home networking. The features which are offered in these boxes change rapidly, hence features that were "advanced" last year are in this years mid-range STBs.

Feature	Low-End	Mid-Range	High-End
Basic Viewing	✓	✓	✓
Current/Next schedule for current channel, program title	✓	✓	✓
EPG with graphic interface, advance schedule, program reservations		✓	✓
Subscriptions	✓	✓	✓
IPPV		✓	✓
Report-back via return path		✓	✓
Enhanced TV support		✓	✓
Interactive Application support		✓	✓
Hard Disk for Personalised TV			✓
Digital input/output (Home Network)			✓

Table 1 [Features of the STB range]

3.6.1 Business Models

Ricoh has many choices of how to put STBs into the hands of their viewers. One approach is to retail sale the STBs directly to consumers, therefore Ricoh can subsidise on the sale price, and thus tie the consumer to a minimum service contract. Often in this case several STB vendors are licensed which allows competition on pricing and features. The upgrade decisions are the consumers, so they would purchase a new STB if they can see an advantage.

An alternative model is to lease the STBs to the consumers as part of the subscription package. In this case Ricoh would own the STB and upgrading is a more expensive proposition. This is more likely to a model used if Ricoh was planning to invest more in future-proofing the STBs, so that new functionality can be added through software and smart card replacement.

In addition, it is possible that Ricoh may combine both models, to encourage early-adopters of to buy STBs with advanced features, whilst providing a standard STB as part of the subscription package.

3.6.2 Packaging

Regarding a STB, packaging is a general term used to cover all the external appearance aspects such as its size, colour, shape, button and LED layout, access and location of the smart card (i.e. maybe hidden from the user under a flap) etc. The packaging can either be determined by Ricoh, or left to the STB vendors, since this is the key area where vendors can differentiate their products.

3.7 Middleware

The STB Middleware layer provides the interface between the STB hardware and applications, such as the EPG and other interactive applications. It acts as a "virtual machine" that gives application developers the freedom to use all the features and functions of the STB without being tied to a specific hardware platform.

Middleware includes the API (Application Interface) that provides applications with a standard set of functions for accessing STB functionality, using a well-defined language. The trend today is to focus on open, well-known standards, such as HTML, Java and JavaScript. Ricoh may wish to consider integrating Middleware into the STB which can lay dormant and then be enabled in the future. As its subscriber base grows, this will allow Ricoh to introduce more revenue generating, enhanced TV experiences, cheaply and easily. NDS has integrated VideoGuard with Middleware vendors such as:

- Open TV
- Liberate
- Microsoft

NDS Core Middleware

NDS has also developed a low cost Middleware named NDS Core. NDS Core is fully integrated with NDS Value@TV (NDS interactive) applications.

Provided the STB has sufficient processor and memory capabilities and a return path option, the standard supported features of NDS Core include:

- Easy integration of an EPG
- PPV
- IPPV
- Advance Booking Capability
- Three-plane graphics
- MPEG I-frames
- HTML content processor
- Web Browser

3.8 EPG

NDS has extensive experience in the development and integration of EPG's for digital TV systems. The EPG is the most important point of contact with its customer, as via the EPG the customer will access and purchase services and products. Ricoh may like to consider integrating their services into an on-screen service guide to reinforce their brand and encourage cross service marketing.

NDS IPG

The NDS developed EPG, the Interactive Program Guide (iPG) runs on the NDS Core Middleware. This solution can offer Ricoh a quick and cost-effective route to market and can be easily customised in order to acquire a Ricoh look and feel.

The NDS iPG has been designed to:

- Quickly guide viewers to the programmes, information and options that they are most interested in finding without disrupting the programme they are watching
- Encourage maximum viewing over a sustained period of time, maintain maximum subscriber retention and encourage subscription upgrades
- Provide an effective channel for Ricoh network management communications, as well as viewer access to customer service and technical information assistance
- Offer programmes to the viewer for purchase through IPPV and Near-video-on-demand (NVOD)
- Serve as a gateway to access interactive applications

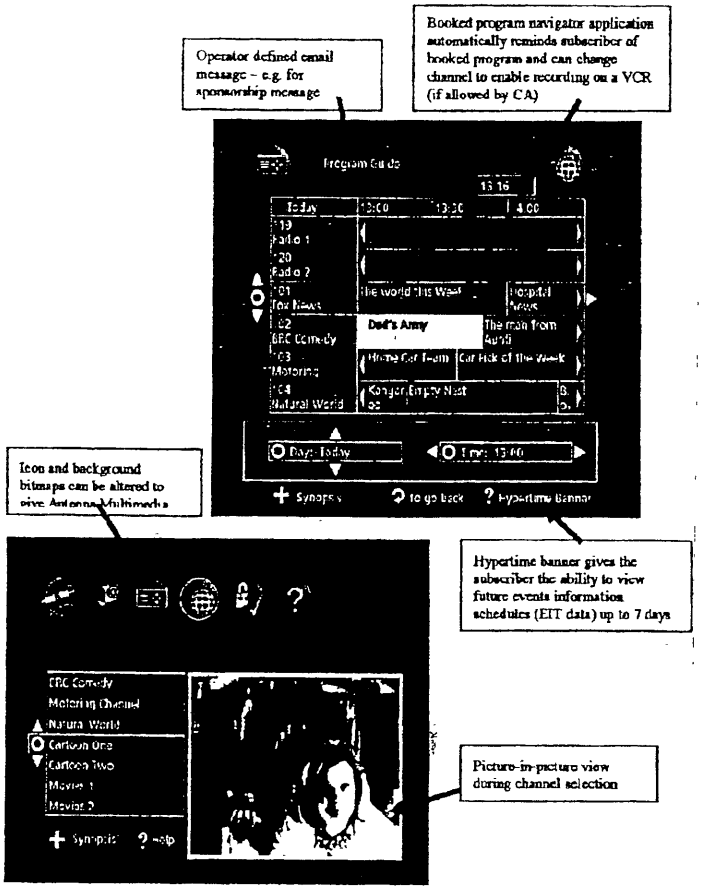


Figure 3 Interactive Programme Guide

Key Technical Features

The NDS iPG provides a multi-lingual, DVB compliant interface, which is platform independent. It includes local customisation to support the relevant TV standard, languages and logos.

The iPG supports all typical Pay TV scenarios including NVOD, IPPV, PPV, Broadcast email, Now and Next banner and iPG with synopsis.

NDS iPG features require support from the STB hardware for memory and graphics capabilities.

Table 2 NDS iPG Technical Features and Benefits

Feature	Benefit
Small STB memory footprint	Reduced and lower cost STB hardware requirements provides a lower cost STB
Reliable, fast, and efficient run time performance on inexpensive STB processors	Reduced zap times and fast electronic programme guide display for the viewer
Microsoft® Windows®-based emulation environment for use by application developers	Low-cost and easy to use application development environment
Tight integration with NDS Open VideoGuard™ Conditional Access, providing iPG access to IPPV, PPV, NVOD, and Parental Rating features	NDS advanced business features encourage and increase per-subscriber revenues by enabling easy interaction and purchasing via the iPG
Powerful customer addressing and messaging functionality	Allows highly accurate messaging or software downloads based either on regional or demographic information about the subscriber
Rich GUI features including 256-colour graphics and dynamic video scaling as well as MPEG still plane support	Attractive and Ricoh-specific interface links the Ricoh brand with quality broadcasting
Proven DVB SI/PSI support and management for satellite/cable/terrestrial/MMDS networks	Proven standards mean lower risks and greater compatibility
DVB subtitle support (coded and bitmap)	A proven subtitling solution makes foreign programming easily accessible to Ricoh viewers
DVB Mosaic support	Provides an easy to use interface and effective 'shop window' to Ricoh programming

3.9 Token PPVs

Using Tokens, the SMS system is able to allocate credit to a subscriber's card according to the subscribers instructions. The broadcaster then sends entitlement packets to the individual viewing card to record a purchase limit and balance under a 'Series ID'. Typically up to four Series or credit lines can be allocated independently. Whenever a new series is recorded, the old space on the card is cleared for re-use.

The subscriber is not receiving a true IPPV service, but can subscribe to regular services and order-ahead PPV events. Examples of this could be football matches, movies or even a full day of credit to watch an event such as the Olympic games, where the times are advertised in a magazine.

4 Enhanced Features

The NDS system will allow a range of business features for Ricoh including interactive, IPPV, OPPV, XTV (PVR) functions, etc, through a series of planned upgrades. This can be discussed in more detail if required. More information on what NDS can offer Ricoh for supporting such advanced functionality and services can be found in this section.

4.1 Interactive Applications

For reference, NDS provides here brief overviews of some typical interactive applications. There are numerous possibilities for generating additional revenue and increasing subscriber growth through interactive services. An area that is regarded often as high value to subscribers is information applications such as weather, news and traffic services, horoscope and sports applications. NDS can provide these popular services as generic applications. Although some of the applications listed below are classed as generic, there is always some scope for customisation.

One-way Interactive Applications

Interactive TV can often be thought of as a connection which is always open. Such continuous two-way communications are expensive to maintain even within the cable environment. An alternative method takes advantage of the multiple data streams available in the digital TV environment. By interacting with an application using personal information stored in the smart card, the viewer can seamlessly select specific content from the variety of transmitted data. This provides the illusion of a fully interactive service without an on-line connection, these include:

- Information services such as TeleText-like services, these include, weather reports, traffic reports and product catalogues
- Information tickers such as stock or news tickers, these provide a constant display of up-to-date information.
- Enhanced data, such as sports statistics, information about favourite actors, and so on which can be displayed along with the video signal.
- Interactive games use all the power and storage capacity of the STB to provide a standalone play station via their familiar remote control.

Bi-directional Interactive Applications

Some interactive services such as home banking and shopping, require the viewer to be on-line. The sensitive transactions rely on the secure back channel provided by the STB, for instance, through the NDS Value@TV infrastructure.

Applications under this category include:

- Home Shopping where the viewer can purchase products interactively. All personal details (mailing address, credit card) can be stored on the smart card.
- Home Banking turns the TV set in to a simple ATM machine. Viewer are able to check their balance and account status, pay monthly bills and eventually download cash to their cash cards.

Of course these applications require a highly secure mechanism for sending information to and from the viewers, over air and through a secure return path to the bank.

4.1.1 Interactive Sports (iSports)

Broadcaster's who have implemented interactive sports services have seen increasing numbers of new subscribers and reduced churn rates. A sports service can provide additional revenue through programme content and advertising.

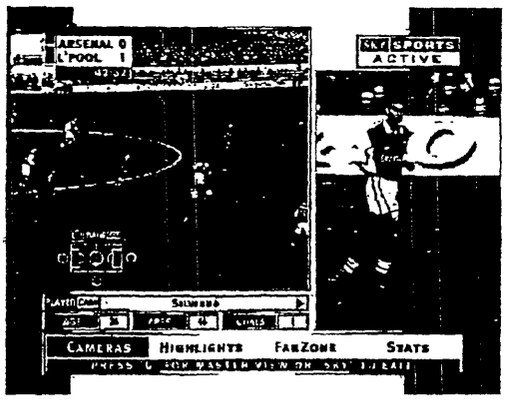


Figure 4 Interactive Football

The NDS isports application, already a proven success on BSkyB in the UK, incorporates features that will provide the sports enthusiast with an exciting new viewing experience. The application allows the viewer to select different camera angles during an event, read live statistics updated throughout a match and watch highlights. This NDS application has now been used to successfully enhance the viewing of football, cricket and tennis.
By combining and synchronising traditional broadcast video and audio content with data, viewers can access a variety of information about their teams league position and favourite players.

4.1.2 Enhanced TV Applications

NDS has also developed a number of enhanced TV applications. Enhanced TV provides a value-added service to subscribers in the form of additional information that relates to the content currently being broadcast. There are no limits to the way in which information can be used to enhance a regular broadcast, for example, quizzes, puzzles, features and interviews.

One of NDS's enhanced live applications is for Discovery Networks Europe, which offers a enormous amount of flexibility. Discovery can provide detailed information about a program attached to, and synchronised with the video stream. This information can include sports statistics, biographies, questions and answers, in fact anything Discovery chooses. These program enhancements draw subscribers into the television viewing experience with a few presses of the remote control.

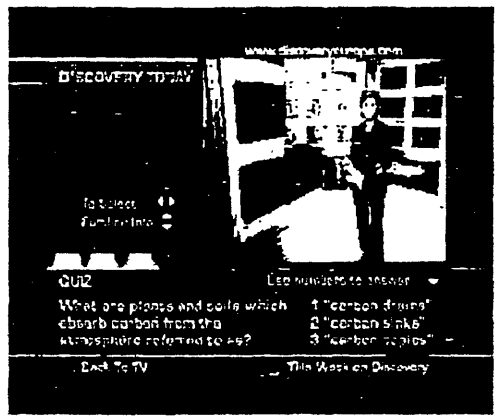


Figure 5 Quiz Scene from Discovery's Enhanced Application

4.1.3 Games and Entertainment

NDS are able to provide a number of exciting interactive games through a series of partnerships with some of the very best interactive TV games developers. These partners have been carefully chosen for their application development skills on different middleware and to provide a wide ranging interactive games portfolio from traditional board games, retro style games through to educational fun for kids.

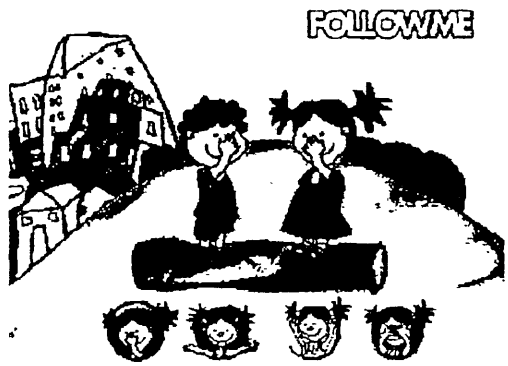


Figure 6 An Example of an Educational Interactive Game

NDS have also a developed an application for 'Banzai', a UK game show on Channel 4. The Banzai interactive application allows viewers to bet on the outcome of a series of sketches. Examples of the bets include which man in the line-up is wearing a wig? Two firemen point high-pressure hoses at each other to see who will fall first, How long can the Banzai interviewer shake a celebrity's hand for?

Figure 7 Banzai Interactive Game Application

4.1.4 Communication Services - Email, Chat, SMS and Voice Mail Services on a TV Portal

NDS are able to provide email, chat, SMS (short messages) and voice mail services via an interactive TV portal. Users receive broadcast notifications of newly received email, chat and even calendar appointments whilst watching TV. Broadcast notifications are enabled by integration with the NDS CA system. Subscribers log on to the service and connect to an application server that is closely integrated to the broadcaster's subscriber database, maintaining integrity of data between the two systems. The chat system is currently being integrated with some of the popular chat servers (MSN, ICQ).

4.2 Betting

The value of gambling through the Internet alone will increase in the US and Europe from $535m in 1998 to more than $10bn within 5 years. This is the finding of a recent report by Datamonitor Europe, a respected firm of management consultants. The report goes on to predict that 70% of this revenue, some $7bn, will be wagered in the US and $3bn in Europe. However, when compared to the $700bn spent annually on gambling across the two continents and once gambling across the rest of the world has been added in, the total potential online market is substantially larger.

In addition to providing gambling services on the internet, award winning NDS company Orbis is also able to provide the world's most successful online gambling and betting system for digital TV. For example, in July 2000 Orbis extended Blue Square's OpenBet interactive betting system to enable betting directly through a television remote control on Sky's Open interactive platform. The system went live on 4th July and took 1,000 bets in the first 24 hours of the soft launch. The system was able to take registrations for the previous 3 months and over 12,000 customers were ready to bet through their TV at launch.

Figure 8 Ladbrokes Betting Service through Open... on Sky Digital

So far, Orbis has helped the following customers establish themselves as leaders in the online betting market

- Ladbrokes
- Littlewoods
- SLOT (Macau)
- Paddy Power
- Blue Square
- planetfootball.com

4.3 NDS XTV®

XTV-*Xtended TV*-is the first and only fully digital, end-to-end, secure personal TV system, and puts TV operators in control. It combines the strengths of the pay-TV operator with the advantages of ever-cheaper digital storage technology to deliver both value and new viewing possibilities to benefit subscribers, advertisers, and service providers.

The aim of XTV has been to increase and maintain broadcaster revenues, either by increasing viewer satisfaction to minimise churn, or by allowing broadcasters to develop new and previously impossible business models to introduce new revenue streams.

As a pioneer of innovative solutions in digital broadcasting, NDS is ideally suited to offer this new technology for the home entertainment environment.

XTV integrates a large amount of local digital storage into a digital STB which, when combined with the smart software component of XTV, seeks out and stores programmes that viewers are likely to want to watch, without the viewers' intervention.

To enable broadcasters to introduce features on a rolling basis, and to enable timely supporting infrastructure and industry development, XTV features are being introduced in a phased manner. Please refer to Table 3 XTV Features.

XTV future developments are designed to allow broadcasters an unprecedented range of tools to develop their business and maximise their revenues from content, advertising, and interactive applications. These features are already under development, and are scheduled for introduction before end 2002.

4.3.1 PVR – VCR Functionality

XTV not only has digital VCR functionality (play, pause, record, fast forward, rewind, etc.) with the programme saved to disk, but also much more.

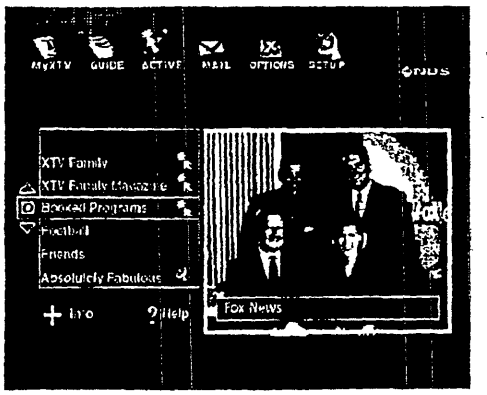


Figure 9 XTV Main Screen

With 'smart' software, XTV is much easier to use than a Video Cassette Recorder. XTV lets viewers choose programmes or series of programmes to record from an easy-to-use on-screen guide

XTV also learns viewers' habits and can automatically record programmes that the viewer is likely to want to watch. Since XTV STBs have two tuners, viewers are able to record two programmes that air at the same time.

Table 3 XTV Features

Current
■ Two tuners, allowing the handling of two separate broadcast services simultaneously, even on different multiplexes.
■ 'Live pause', allows recording to begin at any point, with immediate resumption of

viewing when required.

- Recording of one channel whilst viewing or live pausing another.
- Viewers are able to select programmes to record directly from the EPG, as many days in advance as the EPG schedule depth allows.
- Recording is triggered by the broadcast DVB SI Now/Next information to ensure the beginning and end of programmes are always captured.
- Recording and replay are secured by NDS VideoGuard CA, so no content is stored unsecured on the disk.
- Trick mode playback of CA secured content.
- Time-limited access to stored content can be controlled by the broadcaster through the CA system.

Near Future

- Disk storage support for interactive applications, allowing a wider variety and more sophisticated interactivity.
- Non-real-time (trickle/burst) mode delivery of video and data objects to the STB.
- Headend-initiated recording of video and data.
- Virtual Video on Demand, using pre-emptive push content delivery with CA support.
- Targeted delivery, based on parameters set by the broadcaster and held in the CA system.
- Targeted advertising substitution.
- Targeted/personalised delivery of recommendation listings and other EPG support.
- Viewing-data collection and return delivery to Headend.
- TV Anytime Forum functionality integration.

5 Summary

NDS once again thanks Ricoh for allowing the opportunity to present this document. This document has assumed the following requirements:

- A technologically advanced, highly secure CA solution
- A scalable solution, that will grow as subscriber numbers grow
- Modular architecture, allowing cost effective introduction of digital services with scope for adding further enhancements in the future using existing infrastructure wherever possible

NDS believes that this document addresses all of the above, detailing a highly secure system that will enable the introduction of digital services cost effectively, and begin generating revenues from those services from launch. In addition, NDS will be able to provide Ricoh key technologies to help grow the subscriber base and increase the per-subscriber revenues.

NDS looks forward to working with Ricoh. If you require any further information, please do not hesitate to contact any of the below.

5.1 Contacts

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Email	jmaddocks@ndsuk.com

6 Appendix

This section is designed to assist NDS in determining the requirements of Ricoh and allow NDS to provide Ricoh with an accurate and personalised proposal. All information regarding this questionnaire can be found within the main document body.

NDS would be grateful if this can be returned to your assigned NDS account manager of which details can be found in Section 5 of this document.

Ricoh System Requirements

Market Segment (Please tick all fields applicable)

- ❑ Cable (QAM)
- ❑ Satellite (QPSK)
- ❑ Terrestrial
- ❑ Data Broadcasting
- ❑ DSL
- ❑ Distribution

Required NDS Services (Initially)

- ❑ Conditional Access (NDS VideoGuard)
- ❑ Broadcast Control System (SSR)
- ❑ Interactive Applications
- ❑ EPG/Middleware (Please state preference if applicable) _____
- ❑ PPV
- ❑ Built in Hard Disk (XTV)

Required NDS Services (Future)

- ❑ Conditional Access (NDS VideoGuard)
- ❑ Broadcast Control System (SSR)
- ❑ Interactive
- ❑ EPG/Middleware (Please state preference if applicable) _____
- ❑ PPV
- ❑ Built in Hard Disk (XTV)

Current or Preferred Third Party Suppliers if applicable (please include names)

- ❑ SMS _____
- ❑ Compression _____
- ❑ STB _____
- ❑ EPG _____
- ❑ Middleware _____
- ❑ Scheduling/Traffic _____
- ❑ Play-out/Automation _____
- ❑ Integrated Hard Disk _____
- ❑ Other _____

EPG

Do you require an EPG? (Yes/No) _____
If Yes would you require it in to be displayed in a language other than English? (Yes/No)_____
If No would you just require Present/Following programme data to be displayed? (Yes/No) _____

TV Standards (please insert necessary values if applicable)

- ❑ PAL_____
- ❑ NTSC
- ❑ SECAM
- ❑ Other _____

STB Requirements

Model (Please tick all applicable)

- ❑ Low-End
- ❑ Mid-Range
- ❑ High-End

Suppliers

Would you require multiple suppliers and if so how many? _____?

Price Range

- ❑ <$100 (low cost)
- ❑ $100 - $150 (mid range)
- ❑ >$150 (high cost)
- ❑ Other _____

Return Path (please tick all that apply)

- ❑ None
- ❑ PSTN
- ❑ Docsis
- ❑ DVB-RC
- ❑ Two-way cable
- ❑ Other (Please state)_____

Delivery (please enter figures)

- ❑ Initial STB numbers_____
- ❑ How many over time _____
- ❑ When would Ricoh require first STBs? _____(approx. date)

Standards

- ❑ DVB
- ❑ ATSC
- ❑ Other_____

STB Business Model

- ☐ Retail
- ☐ Subsidised
- ☐ Leased
- ☐ Other_____

Smart Cards

Smart Card Details

What volume of cards would you require initially?

- ☐ < 10k
- ☐ 10K – 50K
- ☐ 50K – 100K
- ☐ 100K – 250K
- ☐ > 250K

Would you require Smart Card artwork design? Yes/No. _____

Subscriber Details

Subscriber Numbers (Present)

- ☐ < 10K
- ☐ 10K – 50K
- ☐ 50K – 100K
- ☐ 100K –250K
- ☐ _____ (Other)

Projected New Subscriber Numbers in First Year

- ☐ < 10K
- ☐ 10K – 50K
- ☐ 50K – 100K
- ☐ 100K – 250K
- ☐ 250K – 500K
- ☐ _____ (Other)

Projected New Subscriber Numbers in Second Year

- ☐ < 10K
- ☐ 10K – 50K
- ☐ 50K – 100K
- ☐ 100K – 250K
- ☐ 250K – 500K

_____ (Other)

Support

Support Requirements (Please tick all applicable)

- ☐ NDS Telephone Support 24x7
- ☐ Hardware Support – 1 Year
- ☐ Hardware Support – 3 Year

System Launch

What is the system launch date? _____