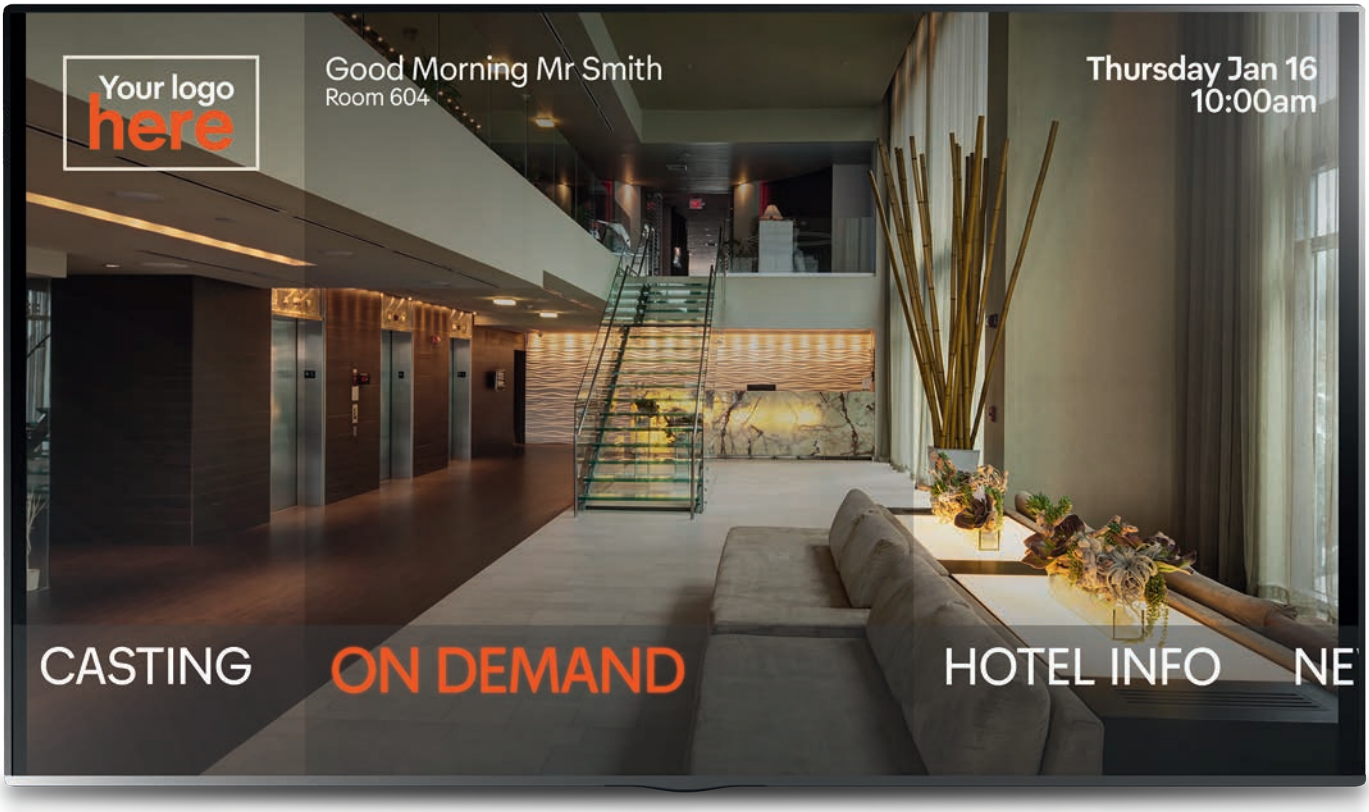
Business iQ In-Room Entertainment Technical Overview



For more information
1300 736 104
Business.iQ@foxtel.com.au

foxtel business

Business iQ Technology

Satellite

- Foxtel's satellite delivery pathway transports over 1Gb of data per second over 70,000 kms into space and back to every corner of Australia in 0.2 of a second.
- Three uplinks across Australia deliver an unrivalled uptime of 99.997%.
- Network has zero congestion, unlimited concurrency and is virtually maintenance free.
- Enables millions of simultaneous users to view live events (Game of Thrones, Royal Wedding etc.).
- Uncompromised Digital, HD (High Definition) and Ultra HD (4K) signal quality.
- Delivered by literally hundreds of millions of dollars of space-age infrastructure.
- Distributed onsite via coaxial and/or IP network.

Multi-stacker

- Combines up to four polarisations from a satellite dish and stacks frequencies on single coaxial cable for input either directly into the Set-Back-Box (or Mini-headend if an IP only solution is required).
- Coaxial cabling (RG6 Tri / RG11 Quad) is required from the satellite dish to the Multi-stacker.
- Requires Foxtel's proprietary Multi-stacker software on Set-Back-Box (or Mini-headend for IP only solution).
- Self-driven and retunes all managed satellite services from the Foxtel broadcast master headend.
- Maintains native signal format without compression or degradation (SD, HD and Ultra HD).

Set-Back-Box

- Smart hybrid Satellite / Terrestrial / IP / Wi-Fi commercial grade, energy efficient, Ultra HD Set-Back-Box.
- Simple, low cost and discreet installation utilising a property's existing cabling (e.g. CAT 5/6 Ethernet, RG6 Tri / RG11 Quad coaxial and optical fiber).
- Built for silent operation and vertical mounting (with thermal displacement) behind flat screen TVs.
- Compatible with all existing HDMI input TVs (no SmartTV or other TV panel upgrade required).
- Designed and certified to meet and exceed 26 global technology, performance and safety standards.
- Enables total service customisation per screen and fast channel change.
- Integrated Google Chromecast
- Future proofed; cloud driven, high performance chipset, Bluetooth capable, expanded memory.

Set-back-box accessories

Included accessories with Set-Back-Box

- External wall mount power supply unit.
- ‘All in one’ antimicrobial universal* remote (batteries included).
- VESA mounting kit.
- Infrared eye prism extender.
- HDMI 2.0 cable, supports Ultra HD and high frame refresh rate.
- Ethernet cable.

*Works with most standard TV models. Remote only works with Business iQ product, it does not work with Foxtel residential boxes.

Amazon Web Services Cloud Server

- Enterprise class technology for everyone.
- Scalable, reliable, and secure global computing infrastructure.
- Agile modular architecture integrates and seamlessly connects with Foxtel's applications, tools, content and data.
- More power than you will ever need (AWS Cloud services are larger than Microsoft, Google and IBM combined).
- Eliminates high cost hardware purchase, maintenance and replacement cycle (no additional server costs).
- Ensures technology is always up to date, providing auto data back up and instant recovery, plus data security.

Foxtel Managed Services

- Eliminates multiple supplier cost and complexity, with end to end support across install, configuration and operation.
- Provides access to best-in-industry skills, monitored by highly qualified and experienced expert team.
- Eliminates security / compliance / performance / quality risks with a monitored service at a fixed all inclusive rate.

Terrestrial TV Channels

- All free-to-air channels are acquired via property's local DTT (Digital Terrestrial Television) antenna on a single coaxial cable for input either directly into the Set-Back-Box or Mini-headend in case of an IP only solution.
- Content supported with full 14 day Now/Next and EPG (Electronic Programme Guide) metadata for all programming (title, synopsis, parental rating, etc.).
- Foxtel maintains metadata for all free-to-air regions across Australia.

In-house Channels

- Allows local welcome channel, promo channels and any other non-Foxtel additional content, such as foreign language channels, to be seamlessly integrated into a property's channel line-up.
- Additional in-house content is ingested as DTT channels or IP streams.

DTT Channels

- DVB-T/DVB-T2 COFDM terrestrial channels are supported.
- DTT channels shall be in the form of an SPTS (Single Programme Transport Stream) or MPTS (Multi Programme Transport Stream) and include a NIT (Network Information Table) with LCN (Logical Channel Number) descriptor plus SDT (Service Delivery Table).
- Ingestion of DTT channels requires a modulator.

IP Streams

- Ingestion of IP content shall be in the form of an SPTS via Unicast UDP (User Datagram Protocol), Multicast IGMP (Internet Group Management Protocol) / UDP or MPEG-DASH.
- IP content is delivered across Ethernet (preferred) or Wi-Fi and decoded by Set-Back-Box.
- Ingestion of IP channels requires a video streaming server.

In-house DTT Channels

- In-house DTT content may be modulated within the S-Band of the Australian channel plan (AS1367).
- In-house DTT channels can be modulated on Band channel numbers from S11 to S44.
- Modulation shall be on the digital channel centre frequency.

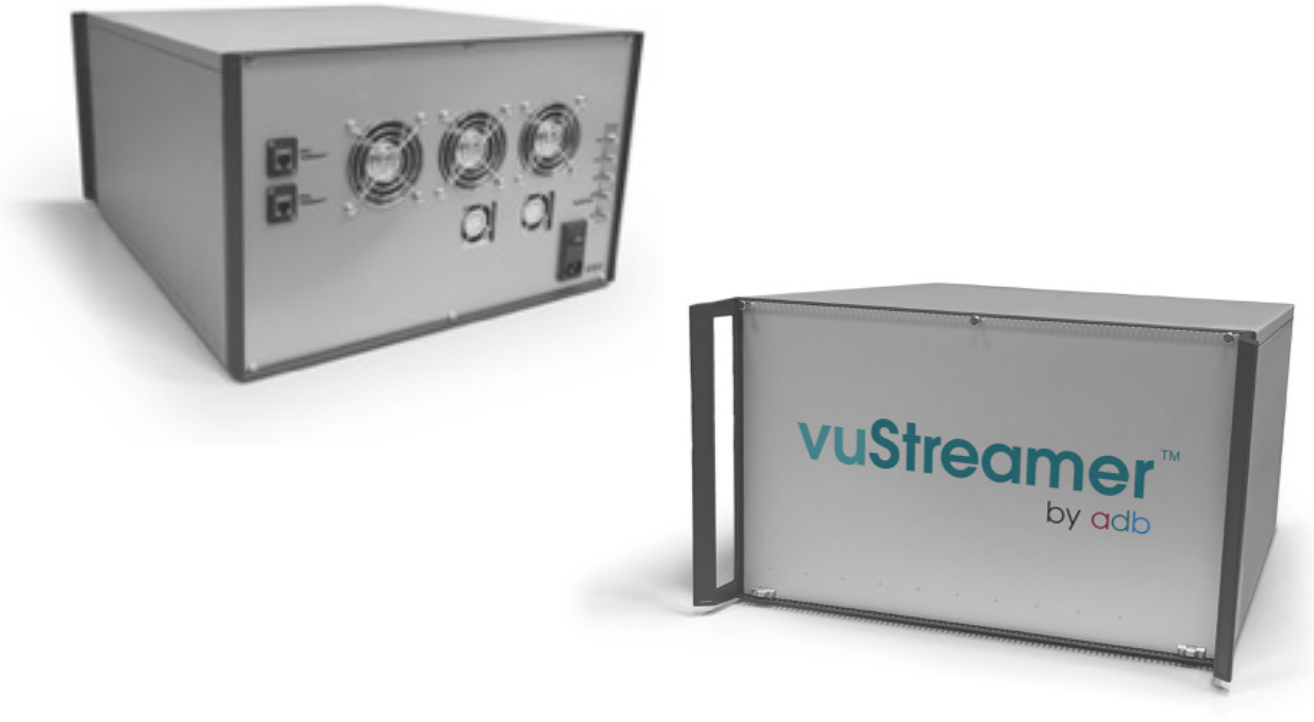
AUSTRALIAN TERRESTRIAL TELEVISION 7MHz BAND PLAN FTA Broadcast and Non-Broadcast Bands	
Band channel number (see notes)	Digital channel centre frequency MHz
VHF hyperband channels	
S11	233.5
S12	240.5
S13	247.5
S14	254.5
S15	261.5
S16	268.5
S17	275.5
S18	282.5
S19	289.5
S20	296.5
UHF hyperband channels	
S21	305.5
S22	312.5
S23	319.5
S24	326.5
S25	333.5
S26	340.5
S27	347.5
S28	354.5
S29	361.5
S30	368.5
S31	375.5
S32	382.5
S33	389.5
S34	396.5
S35	403.5
S36	410.5
S37	417.5
S38	424.5
S39	431.5
S40	438.5
S41	445.5
S42	452.5
S43	459.5
S44	466.5

Mini-headend

For sites without appropriate coaxial cabling the Foxtel solution can be deployed across Gigabit Ethernet (e.g. CAT 5e/6). To enable this operation the satellite & terrestrial signals shall be converted to IP (SPTS) for distribution around the premises.

Foxtel have developed a dedicated IPTV Mini-headend, vuStreamer. Designed specifically for Foxtel's Business iQ solution, this ensures compatibility, ownership and support of the full end-to-end system (Cloud server, Mini-headend and Set-Back-Box), plus full remote system troubleshooting and configuration.

- 80+ channels over IP.
- 30Mbps max. bitrate per channel (SPTS).
- Studio approved content security and encryption
- No CAM (Conditional Access Modules) or smartcards required.
- Connects to Set-Back-Box.



Business iQ Network

Network Introduction

- Each Set-Back-Box requires an internet connection to access the AWS Cloud server for tuning and configuration metadata information.
- For optimal performance and reliability, it is recommended the Set-Back-Box is connected via wired Ethernet to the property's broadband network (and Mini-headend in case of an IP-only solution).
- Within a property's in-house local network, a DHCP (Dynamic Host Configuration Protocol) server shall assign a local IP address to each Set-Top-Box (and Mini-headend in case of an IP-only solution) connected to the network. Typically a router within the local network shall be enabled to act as the DHCP server.
- To support VOD (Video On Demand) the Set-Back-Box dynamically adjusts the streaming video quality, ABR (Adaptive Bitrate) according to the available network bandwidth.
- A property's network vendor or IT department shall be responsible for upgrading, configuring and securing the on-site IP network at a property as appropriate to receive the Foxtel service.

Broadband Bandwidth Formula

The minimum downstream bandwidth for delivery of Foxtel's OTT (Over The Top) VOD streams is calculated as follows for Full HD (High Definition) quality video (1080p Widescreen):

Total bandwidth (Mbps) = VOD active Set-Back-Boxes x 6.3Mbps

Foxtel's Video On Demand solution uses adaptive streaming technology to deliver video to the guest in the highest usable quality dependent of the available network bandwidth.
If bandwidth is insufficient for Full HD delivery, then HD shall be delivered to a Set-Back-Box. The minimum bandwidth for delivery of Foxtel's OTT VOD streams is calculated as follows for HD quality video (720p Widescreen):

Total bandwidth (Mbps) = VOD active Set-Back-Boxes x 3.2Mbps

If bandwidth is insufficient for HD delivery, then SD (Standard Definition) shall be delivered to a Set-Back-Box. The minimum bandwidth for delivery of Foxtel's OTT VOD streams is calculated as follows for SD quality video (572p Widescreen):

Total bandwidth (Mbps) = VOD active Set-Back-Boxes x 2.7Mbps

If bandwidth is insufficient for SD delivery, then lower quality video shall be delivered, which is intended for mobile devices and not recommend for TV screen viewing.

A Set-Back-Box requires a minimum bandwidth of 256Kbps to boot, which shall occur in under 10 minutes. If more bandwidth is allocated a SBB can boot in less time. If the Set-Back-Box cannot boot it has a randomized exponential back-off for retries, starting at a based of 30 seconds and increasing to a maximum of 30 minutes. What this means is the Set-Back-Boxes never stops retrying to boot and that even in very low bandwidth scenarios all Set-Back-Boxes shall eventually boot without manual intervention, but it might take quite some time dependent on the available bandwidth.

A property shall allocate bandwidth to the Foxtel service as appropriate for their VOD requirements, but it is recommend not less than 256Kbps per Set-Back-Boxes in order that all Set-Back-Boxes can boot simultaneously, such as after a power outage. If bandwidth is very limited, no less than 512Kbps for every 10 Set-Back-Boxes is advised.

Calculating Broadband Bandwidth

Considering a property with 50 rooms and one Set-Back-Box (SBB) per room. If occupancy rate was 75% and the bandwidth is to be allocated so that 10% of guests can simultaneously playback Foxtel's HD VOD content:

*Full HD VOD active Set-Back-Boxes = 50 rooms x 75% x 10% = 4**

**Rounded up to the nearest whole number (Set-Back-Box)*

Total bandwidth = 4 x 6.3Mbps = 26 Mbps

Alternatively this bandwidth would also support simultaneous playback of Foxtel's SD VOD content to:

SD VOD active SBBs = 26 Mbps ÷ 2.7Mbps = 9 Set-Back-Boxes
(i.e. 18% of rooms)

Check to ensure all Set-Back-Boxes can boot simultaneously with a minimum of 256Kbps per Set-Back-Box:

Bandwidth per Set-Back-Box = 26Mbps / 50 Set-Back-Boxes = 0.52Mbps (520Kbps)

Broadband Bandwidth Examples

The table below shows the bandwidth required when there is a 100% occupancy rate and 100% of guests are simultaneously playing back Foxtel's SD Video On Demand content.

Number of SBBs	Occupancy Rate	Percentage of VOD Active Guests	VOD Active SBBs	Bandwidth Required for SD VOD (Mbps)	Total Bandwidth (Mbps downstream)
10	100%	100%	10	2.7	27
50	100%	100%	50	2.7	135
100	100%	100%	100	2.7	270
250	100%	100%	250	2.7	675
500	100%	100%	500	2.7	1,350
1,000	100%	100%	1,000	2.7	2,700

The table below shows the bandwidth required when there is 75% occupancy and 15% of guests are simultaneously playing back Foxtel's Full HD Video On Demand content.

Number of SBBs	Occupancy Rate	Percentage of VOD Active Guests	VOD Active SBBs	Bandwidth Required for SD VOD (Mbps)	Total Bandwidth (Mbps downstream)
10	75%	15%	2	6.3	13
50	75%	15%	6	6.3	38
100	75%	15%	12	6.3	76
250	75%	15%	29	6.3	183
500	75%	15%	57	6.3	360
1,000	75%	15%	113	6.3	712

Local Network Bandwidth

- The bandwidth requirements for the LAN (Local Area Network) and WLAN (Wireless LAN) per Set-Back-Box are the same as the Broadband Internet requirements above.
- If an IP only solution is required, the bitrate from the Mini-Headed shall be added to the above bandwidth to support IP linear TV channels streamed from the Mini-Headend over the local area network (LAN).
- The Mini-Headend may output 80x SPTS IP streams, with one IPTV stream corresponding to one TV channel. The maximum bitrate of a single IPTV stream shall not exceed 30Mbps, which is the maximum network traffic a SBB should receive when multicast routing is configured.
- The total bitrate of all multicast IPTV streams shall not exceed 810Mbps. If desired the total bitrate may be reduced by removing channels from a channel line-up.

Network Configuration

The recommended guidelines for a property's network configuration are outlined below. However, network configurations across proprieties can vary and may need to be discussed with Foxtel on a case-by-case basis.

LAN Configuration:

- It is recommend the Set-Back-Boxes (and Mini-headend for an IP only solution) be on a private network, separate from the public network for guests, for security reasons as well as to control QoS (Quality of Service), to guarantee the desired bandwidth to each Set-Back-Box. This typically involves using VLANs (Virtual LANs) to keep Set-Back-Box and guest device traffic separate.
- To further protect the private network the Set-Back-Boxes (and Mini-headed for an IP only solution) from being used by the general public, the MAC (Media Access Control) addresses of the devices may be registered with the property's router and other devices should be denied by their MAC addresses from accessing the Set-Back-Box private network.
- All communications are outgoing on port 22, 80, 123, 443, or 8443, plus 53 if DNS is outside of firewall. These ports shall be open to any IP traffic from the Set-Back-Boxes (and Mini-headed for an IP only solution).

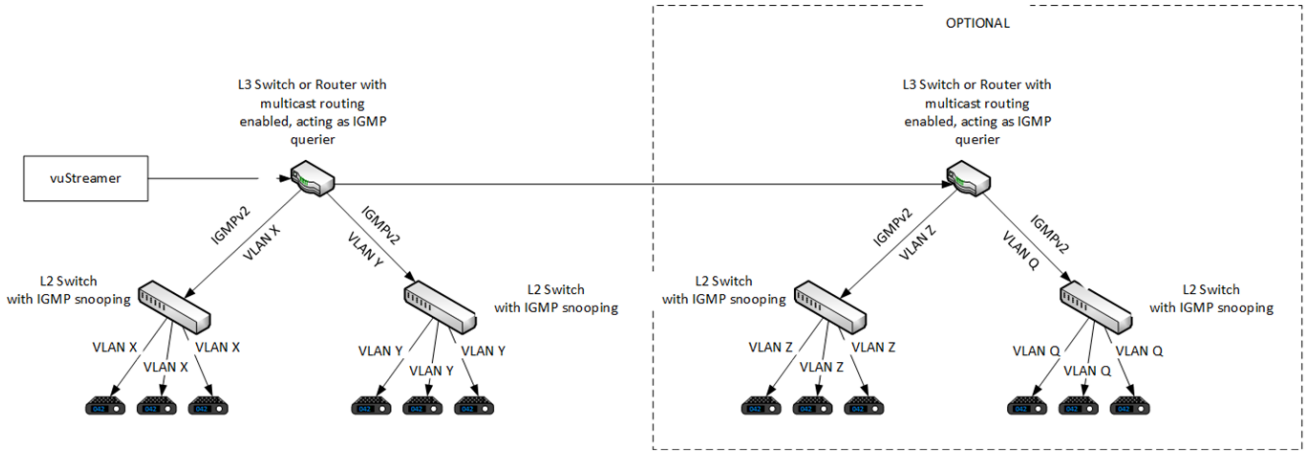
Additional Configuration for WLAN:

- If the Set-Back-Box is not connected to the Internet via wired Ethernet (preferred), it shall be connected wirelessly via Wi-Fi.
- It is recommend (but not mandatory) there be a dedicated Wi-Fi SSID (Service Set Identifier) only for the Set-Back-Boxes.
- The password for the SSID cannot change frequently.
- It is recommend (but not mandatory) the SSID be hidden after Set-Back-Box installation to avoid discovery and potential tampering with settings.
- The SSID for Set-Back-Box can be 2.4GHz or 5GHz.

Network Configuration

IPTV Mini-headend

The diagram below illustrates the basic network requirements of the vuStreamer Mini-Headend for an IP only solution.



Before the vuStreamer can be installed the following shall need to be configured by a property's network vendor or IT department:

- vuStreamer requires two Gigabit Ethernet ports connected into the same IP subnet. Ethernet connectivity is best established within the core of the network to better allow the multi-cast traffic to be distributed.
- Layer 3 devices require routing to be enabled. The vuStreamer statically streams out all the multicast groups to the L3 interface of the L3 device. Therefore, the L3 device must have the multicast routing functionality enabled, otherwise all multicast streams are blocked by the L3 device.
- L3 device shall have the IGMPv2 protocol enabled from the client side. If L2 switches do not support IGMPv2, when one client (i.e. Set-Back-Box) requests any multicast stream all other clients connected to the switch start receiving the stream as well. If say 20 clients request different streams, then all 20 streams are reaching all the clients Ethernet inputs, overloading them with data.
- L2 switches between the L3 device and the client Set-Back-Boxes shall have IGMP snooping enabled. This is so they can pass the IGMP join/leave requests to the L3 device and properly direct the multicast traffic, which prevents flooding the network with traffic.
- If another L3 device is connected into the network (option illustrated in diagram above), L3 devices shall communicate with each other using the multicast routing feature.

Cyber Security

- Adding BiQ won't weaken the network security at a commercial premise.
- All credentials are stored using strong encryption, where administrative access requires multi-factor authentication.
- The Set Back Boxes and Mini-headed are configured from an external management server via an authenticated encrypted connection.
- Commercial premises are not required to open any inbound network ports.
- The devices establish outgoing connections on standard network ports to the BiQ server and to all content related sources.
- The BiQ platform has been approved for use by the major Hollywood Studios and uses current best practices for content protection measures.
- The Set Back Boxes are physically designed to be highly tamper resistant.
- The BiQ system has been penetration tested by a highly regarded and independent penetration testing company.

Optical Fibre Networks

- When integrating Foxtel's linear satellite channels and free-to-air channels into a single mode optical fibre network, the components used must be capable of transmitting signals in the range of 5-2400MHz.
- Carrier networks that use RF (Radio Frequency) overlay for combining television services typically use the wavelength of 1,550nm for distribution through the network.
- Optical receivers should be capable of catering for a high channel load of 32 x 36MHz satellite carriers and a minimum of 12 x 7MHz RF free-to-air carriers.

Business iQ Property Management System

Property Management System Support

PMS (Property Management System) connectivity offers support for Guest Services, including:

- On-screen personalised guest name
- Express checkout
- Billing folio viewing
- Guest surveys

The following proprietary PMS platforms are certified as compatible with Business iQ:

- Oracle-MICROS – Fidelio Opera (min. V5.0.04.02 e19) /FIAS (min. V2.20.9) / IFC8 (min. V10.0.1)
- McComp – ProHOTT (Express Check-out and Room Charges not supported)
- Megasys / RDP – LodgeNet
- Marriott – FSPMS / Fosse
- Comtrol Lodging Link – UHLL

Other PMS platforms may be certified through integration with the HTNG Open Standard API.
Note: The HTNG (SOAP) API does not support Express Check-out. If Express Checkout is required, a proprietary extension is available to the HTNG API for this purpose.

Lodging Link® by Comtrol

- The Lodging Link by Comtrol (a universal PMS interface) is also certified as compatible with Business iQ.
- Without further integration Lodging Link can provide connectivity with Foxtel's Cloud server for the following Property Management Systems:

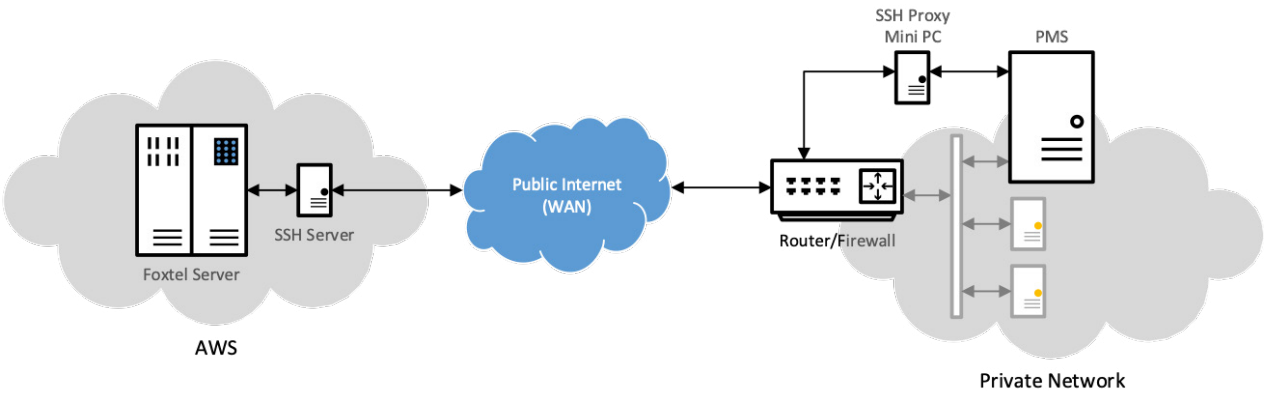
1. Agilysys – rGuest Stay
2. Agilysys – VisualOne
3. AutoClerk – MyHMS
4. BookingCenter – MyPMS
5. Cenium A/S – PMS
6. CIMSO – INNkeeper
7. Club Intrawest – RCC
8. Consolidated Resorts – PMS Cornerstone
9. Enablez – ResortSuite
10. Execu/Tech Systems – HOTEL Premium
11. Guestline – RezLynx
12. HSS – FrontClerk 2000
13. Hyatt Vacation Club
14. ICSS – ATRIUM
15. iHotelligence – Hotel Management Software
16. INNfinity
17. innRoad
18. IQWARE
19. LogiSoft – PHMS
20. MAiS – Fidelity
21. Multi-Systems, Inc. – CloudPM
22. NorthWind – Maestro PMS
23. Novexsys
24. ONETECH
25. PAR Springer-Miller – ATRIO
26. RezStream – RezStream Professional RMS
27. RSI International – RoomKey
28. Sabre Hospitality Solutions – SynXis Property Manager
29. Skyware Systems – Skyware PMX
30. Systems Products International – SPI Win
31. Wyndham Vacation Ownership – Focus

Property Management System Configuration

1. An arrangement is made between Foxtel, the property and the PMS vendor to allow Foxtel access to PMS data for the specific property.
2. Credentials for premises-specific access to the PMS shall be provided to Foxtel to establish a persistent network connection to the PMS (e.g. http://username:password@example.com:port_number).
3. For a PMS located in the Cloud, connection to Foxtel's Cloud server shall be over IP.
4. For a PMS installed on premises a secure IP connection shall be established via a private network.
5. If the on-premises PMS is accessible via a serial port (RS232) and not IP (Ethernet), a comm-bridge may be installed to convert serial communications to IP (e.g. Chiyu model BF-430).

Secure Connection to Property Management System

- Typically a premises' PMS is within a private network behind a firewall.
- The premises may supply a mini PC (e.g. Qotom model Q180S) placed inside the private network.
- The mini PC is not required to have a static IP address.
- CentOS Linux and Foxtel supplied custom scripts shall be installed onto the mini PC in order to create an SSH proxy device.
- The mini PC shall communicate to the Foxtel AWS server and setup an SSH proxy, which will then allow the Foxtel AWS server to communicate to the PMS via an SSH tunnel.
- An advantage of this solution is support for both Ethernet and RS-232 connected PMSs (without the need for additional comm-bridge equipment for the latter).
- A Virtual Machine (VM) may be used in place of a mini PC.



Architecture

Standard Architecture

Foxtel channels are broadcast to the property over satellite and distributed within the property over coaxial cable to the Set-Back-Box.

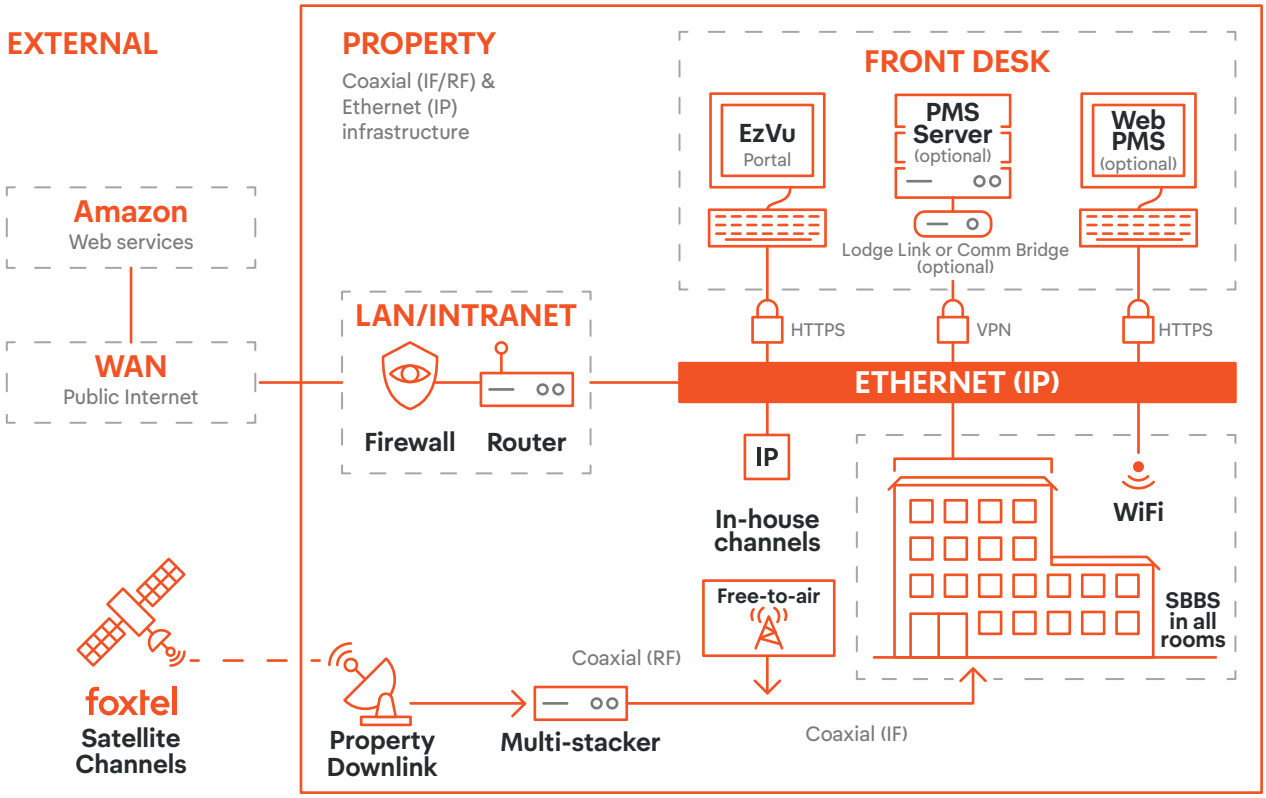
Free-to-air channels are broadcast terrestrially to the property and distributed within the property over coaxial cable to the Set-Back-Box.

In-house channels (optional) may be broadcast to the Set-Back-Box over the property's local area network (LAN or WLAN) and/or coaxial cable.

Foxtel Video On Demand content is delivered to the property over the public Internet (WAN) and distributed within the property to the Set-Back-Box over the local area network (LAN or WLAN).

Cast content shall be delivered to the property over the public Internet (WAN) and distributed within the property to the Set-Back-Box over the local area network (LAN or WLAN).

Metadata is delivered to the property over the public Internet (WAN) and distribute within the property to the Set-Back-Box over the local area network (LAN or WLAN).



IP Only Architecture

Foxtel channels are broadcast to the property over satellite and distributed within the property over coaxial cable to the Mini-headed.

Free-to-air channels are broadcast terrestrially to the property and distributed within the property over coaxial cable to the Mini-headed.

The Mini-headend streams the linear TV channels over the local area network (LAN) to the Set-Back-Box within the property.

In-house channels may be broadcast to the Set-Back-Box over the property's local area network (LAN).

Foxtel Video On Demand content is delivered to the property over the public Internet (WAN) and distributed within the property to the Set-Back-Box over the local area network (LAN).

Cast content shall be delivered to the property over the public Internet (WAN) and distributed within the property to the Set-Back-Box over the local area network (LAN).

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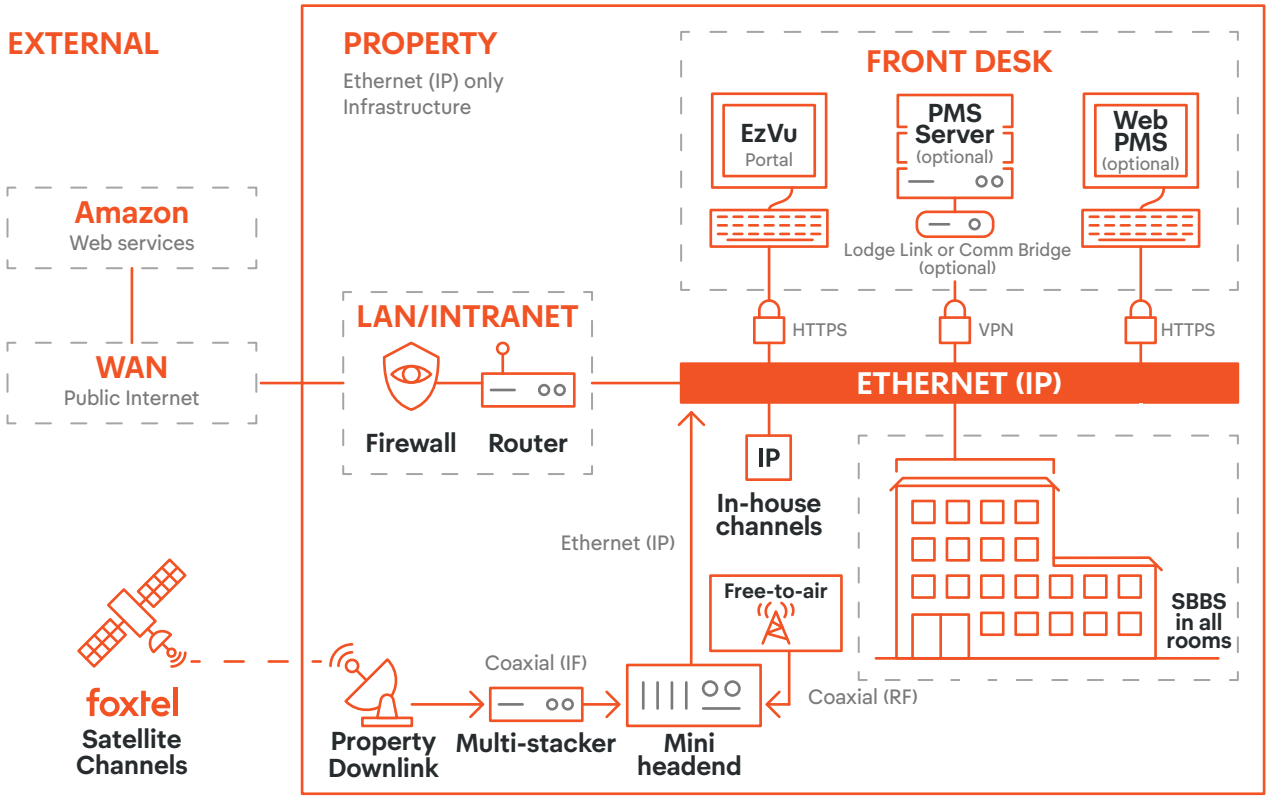

Business iQ Glossary

TERM	DEFINITION
1080p	1920 x 1080 (16:9) resolution Full HD video
4K	3840×2160 (16:9) resolution Ultra HD video
576p	1024 x 576 (16:9) resolution SD video
720p	1280 x 720 (16:9) resolution HD video
ABR	Adaptive Bitrate
AWS	Amazon Web Services
CAT 5 / CAT 5e / CAT 6	Categories of cable for computer networks
DHCP	Dynamic Host Configuration Protocol
DTT	Digital Terrestrial Television
EPG	Electronic Programme Guide
EzVu	Front desk Web portal
HD	High Definition
HDMI	High-Definition Multimedia Interface
HTNG	Hospitality Technology Next Generation
HTTPS	Hypertext Transfer Protocol Secure
IEEE 802.11ac	Institute of Electrical and Electronics Engineers wireless networking standard
IF	Intermediate Frequency
IGMP	Internet Group Management Protocol
IP	Internet Protocol
LAN	Local Area Network
LCN	Logical Channel Number
MAC	Media Access Control
MPEG	Moving Picture Experts Group
MPEG-DASH	MPEG's Dynamic Adaptive Streaming over HTTP video delivery technology standard

TERM	DEFINITION
MPTS	Multi Programme Transport Stream
NBN	National Broadband Network
NIT	Network Information Table
OTT	Over-The-Top
PC	Personal Computer
PMS	Property Management System
QoS	Quality of Service
RF	Radio Frequency
RG6 Tri / RG11 Quad	Types of coaxial cable for RF/IF networks
SBB	Set-Back-Box
SD	Standard Definition
SDT	Service Delivery Table
SPTS	Single Programme Transport Stream
SSH	Secure Shell
SSID	Service Set Identifier
UDP	User Datagram Protocol
Ultra HD	3840×2160 (16:9) resolution 4K video
VESA	Video Electronics Standards Association
VLAN	Virtual Local Area Network
VM	Virtual Machine
VOD	Video On Demand
VPN	Virtual Private Network
WA	Wide Area Network (Internet)
WLAN	Wireless Local Area Network
COFDM	Coded Orthogonal Frequency Division Multiplexing
DVB-T	Digital Video Broadcasting — Terrestrial
DVB-T2	Digital Video Broadcasting — Second Generation Terrestrial