



Understand your space
like it's digital

Juganu Smart City Solution Connectivity Guide

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Introduction

This document presents Connectivity Guide for Juganu Smart city solution.

The network requirements include:

- Wired network requirements
- Wireless network requirements
- Throughput requirements

The key HW components in a standard outdoor installation are:

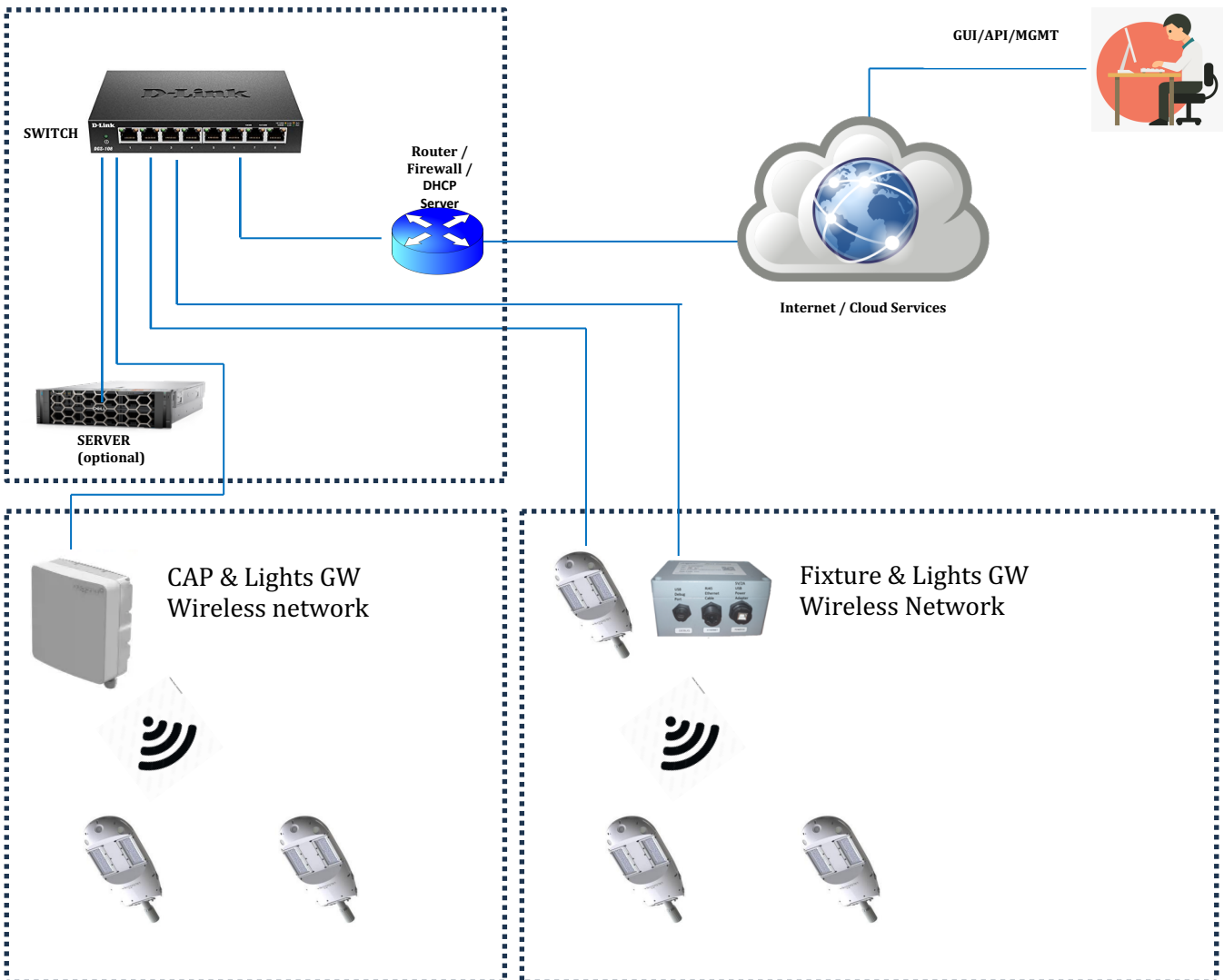
- Smart lighting fixtures
- Outdoor CAP (Centralized Access Point)/GW (JNET1 lighting Gateway)
- Optional server, depending on the service requirements

Network Diagram

Logical network diagram below.

A CAP can be connected via Ethernet or Fiber, fixtures can be connected via Ethernet.

CAP contains a built-in lighting GW, while "Lamp as CAP" requires an external lighting GW, as illustrated in the diagram below.



Wired Network

IP network requirements:

- Connectivity to the internet:

- Cloud LMS
- Cloud JNET2 Management
- Cloud Device Manager
- Cloud Analytics

In case internet is disconnected – lights will remain on schedule and all other services are halted

- DHCP server to allocate IP addresses

- Reserved allocation is recommended for firewall rules and VMS settings, as stream settings in the VMS are per IP address
- 2 IP addresses per CAP, one for JNET1, the other for JNET2
- 2 IP addresses per fixture, one for JNET2 wireless connection, and one for edge analytics (used for video streams)

- Outbound Firewall rule

- Cloud connectivity: port 443
- LMS connectivity: unique port per lights GW
- JNET2 management: port 15002
- Remote debug (RTTY): port 5912
- FTP (optional snapshots service): port 21

- Inbound Firewall rule

- RTSP (video streams) only required if the VMS is on a separate network from fixtures

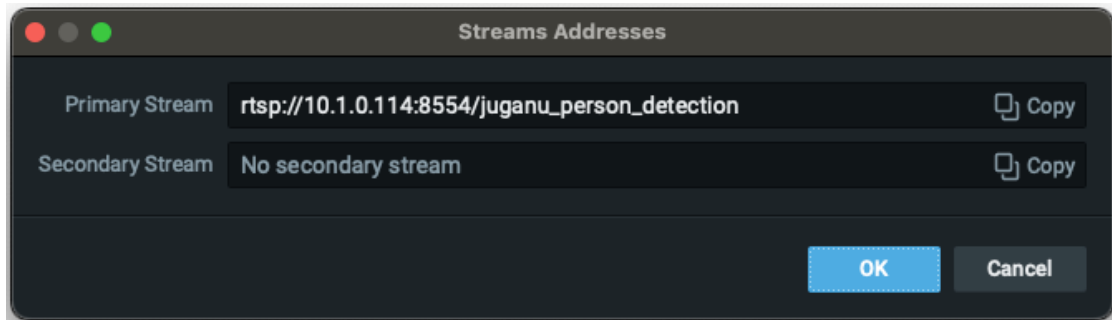
- VLAN for Public WiFi

- Server (if specified, based on use cases)

- VMS VM IP address
- FR VM IP address
- LPR VM IP address

Video Streams

- The edge analytics IP address will be used for the video streams in the following format:
rtsp://<IP address>:8554/juganu_person_detection
rtsp://<IP address>:8555/juganu_person_detection
example from NX Witness VMS settings:



- The default stream format:
 - Codec: H.264
 - Size: 5MP (2592x1944)
 - Rate: 10 FPS
 - IP protocol: UDP and TCP
- Other stream formats are available

Wireless connectivity

“Fixture as a CAP” refers to a fixture directly connected to the wired backhaul via Ethernet, serving other fixtures in the wireless domain.

Both CAPs and “Fixture as a CAP” have two wireless radios for connecting other fixtures.

CAP’s two radios can only be Access Points (AP) same goes for “Fixture as a CAP”.

Other fixture’s two radios can act as AP or station (client).

Backhaul connection:

- 1Gbps link, Ethernet or fiber (fiber supported for CAPs only)
- If only 100Base-T link is available, perform careful throughput calculation.

Bubble

- Defined as single radio from a device directly connected to wired backhaul (CAP or Fixture)
- Characteristics:
 - Up to 14 fixtures in a JNET2 bubble
 - Max distance: 60 meters (~196 feet) between fixtures

Throughput Requirement

Throughput calculation includes:

- Fixture throughput
- CAP throughput
- Internal network throughput
- External network throughput

Fixture throughput calculation

- Video streaming:
 - Most bandwidth-intensive continuous service
 - One stream: average of 4Mbps and peak of 5Mbps (for default characteristics)
 - Calculation assumes 10Mbps (equivalent to 2 cameras)
 - Adjust for different stream characteristics
- Public WiFi:
 - Depends on expected user load
 - Must be evaluated per installation
- Analytics Data:
 - Ranges from 200Kbps to 2Mbps
 - Varies with detected object volume
- Management and Control Data:
 - Minimal bandwidth requirements

CAP throughput calculation

Applies to both **CAPs (Central Access Points)** and **"Fixture as a CAP"** configurations.

Total bandwidth:

$$\text{Tota CAP BW} = (\text{Number of Fixtures}) \times (\text{Peak BW required per service})$$

Example:

CAP serving 12 fixtures (24 video streams), streaming video without analytics or public WiFi:

$$12 \times 10\text{Mbps} = 120\text{Mbps (peak)}$$

Internal network throughput calculation

- Refers to the traffic between all CAPs and the server
- In most installations, VMS is hosted on the server
- Over 50 fixtures => 1 Gbps traffic, upgraded to 10Gbps NIC on the server and switch

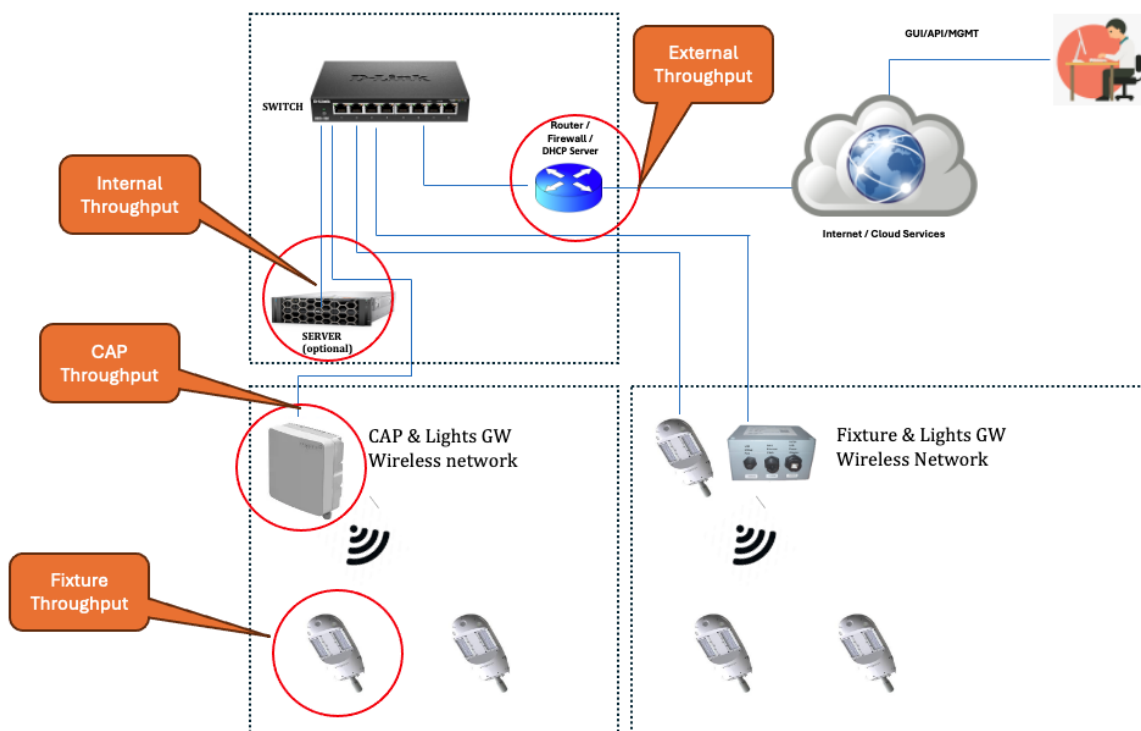
External network throughput calculation

Includes internet traffic for:

- AI analytical data
- Management communication
- Public WiFi

Estimate peak throughput to ensure sufficient internet bandwidth.

Throughput calculation location diagram:



Abbreviation

abbreviation	Definition	
CAP	Centralized Access Point	
JNET1	Juganu Network 1	Juganu Proprietary light network
JNET2	Juganu network 2	Juganu Proprietary wireless network
Bubble	---	Cluster of JNET2 devices (CAP/fixtures) sharing the same channel
GW	Gateway	Lights control gateway
LMS	Light Management System	
VMS	Video Management System	
LPR	License Plate Recognition	
VM	Virtual Machine	
MP	Mega Pixel	Video resolution size
FPS	Frame Per second	Number of frames per second in video stream
BW	Bandwidth	Refers to throughput calculation
Mbps	Mega bits per second	
AP	Access Point	