



Understand your space
like it's digital

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:

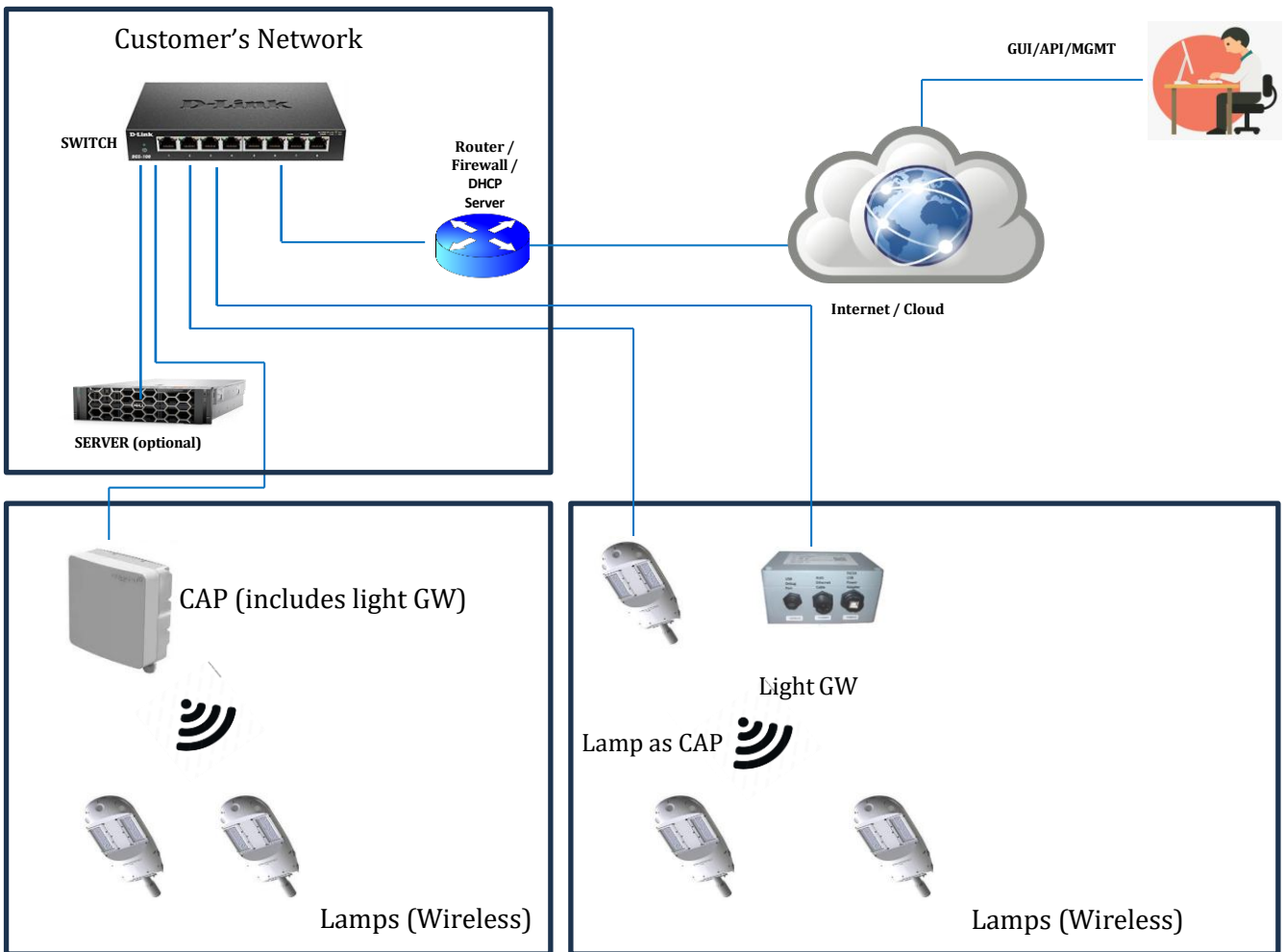
- Smart lighting fixtures
- Outdoor CAP (Centralized Access Point)/GW (JNET1 lighting Gateway)
- Optional server, depending on the service requirements

Network Diagram

Logical network diagram below.

The CAP is to be connected via Ethernet, fixtures can be connected via Ethernet (which then turns them into a "Lamp as a CAP").

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



Wired Network

IP network requirements:

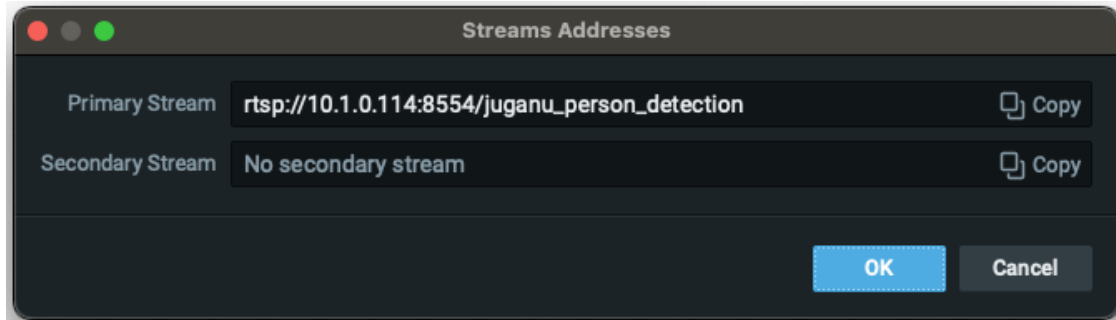
- Connectivity to the internet:
 - Cloud LMS
 - Cloud JNET2 Management
 - Cloud Device Manager
 - Cloud Analytics

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 rules
 - Cloud Data
 - pubsub.googleapis.com port 443/TCP
 - LMS (Light Management System)
 - 34.163.90.71 Port 51201
 - Network Management
 - 34.154.14.198 ports 5912,15002/TCP
 - Version control
 - 199.203.195.193 ports 443,5912/TCP
 - FTP (optional)
 - Endpoint URL/IP address port 21/TCP
 - NTP
 - Port 123/UDP
 - WebRTC - It uses Geo DNS, hence domains are solved based on fixture Geo Location.
 - Signaling: signaling.vms.juganu.cloud (34.163.202.153), ports 80,5000/TCP. Will be changed to Geo DNS so domain ip resolution may change
 - Stun: stun.l.google.com (74.125.250.129) port 19302/TCP
 - Turn:
 - USA customers: vms.juganu.cloud ([34.73.248.26](#)) ports 80,3478/TCP&UDP, 443/TCP and 4915-5099/UDP
 - EU customers: vms.juganu.cloud ([34.155.41.21](#)) ports 80,3478/TCP&UDP, 443/TCP and 4915-5099/UDP
 - Optional: “On edge video recording” access: hlsrelay.juganu.cloud, port 80 & 443

- Inbound Firewall rule
 - RTSP (video streams) only required if the VMS is on a separate network from fixtures
- VLAN for Public WiFi
 - VLAN configuration in UI
- 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.
- Number of CAPs depends on the fixtures’ actual location and will be finalized following site survey
- Assuming all fixtures are within a single connected location, one cap is required for each group of up to 25 Juganu smart fixtures.
- Each group should be situated within a 650-ft/200-meter radius from the connection point, with a maximum distance of 195-ft/60-meter between individual fixtures, ensuring a clear line of sight between them

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:
 - ~ 60 KB/s for an avg scenario (about 60 objects detected per lamp per second)
 - 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:

Total CAP BW = (Number of Fixtures) × (Peak BW required per service)

Example:

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

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

** There is typically ±10% overhead (waste) in standard video packet transmission.*

Internal network throughput calculation

- Refers to the traffic between all CAPs and the server
- In most installations, VMS is hosted locally on a server and is usually not consuming external backhaul bandwidth
- Over 50 fixtures => 1 Gbps traffic, upgraded to 10Gbps NIC on the server and switch

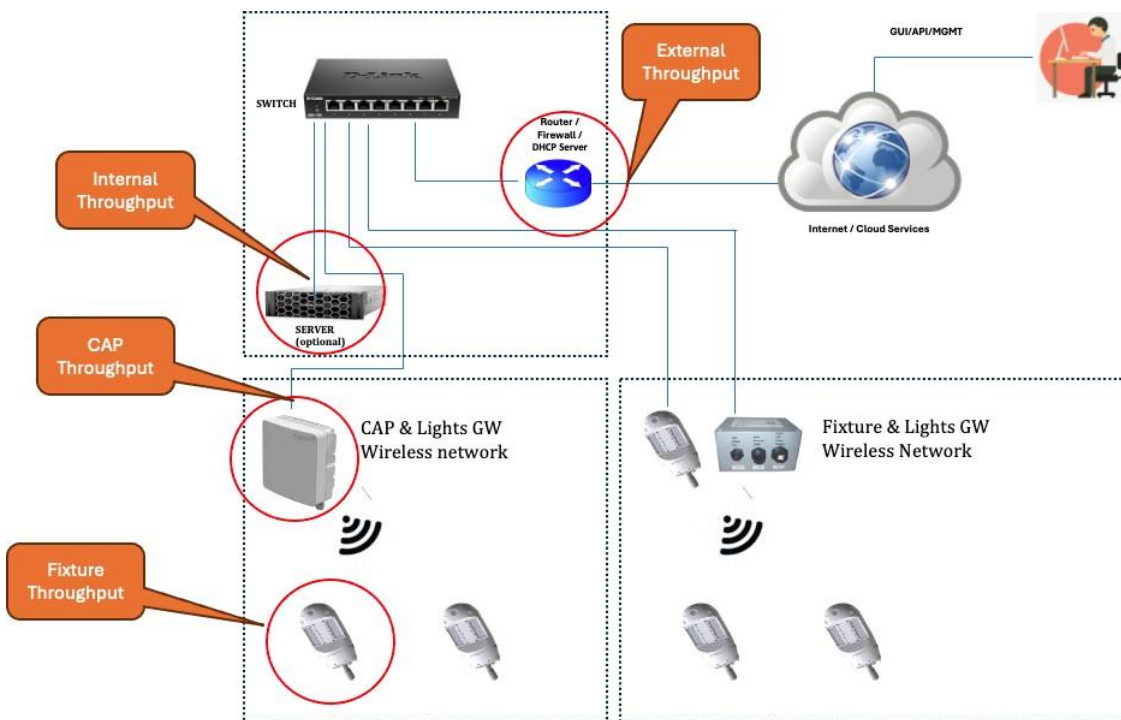
External network throughput calculation

Includes internet traffic for:

- AI analytical data
- Management communication
- Public WiFi

Estimate peak throughput to ensure sufficient internet bandwidth.

Throughput calculation location diagram:



Requirement for Add-On Services Hosted on a Local Server

For add on services that are hosted in a local server (e.g. VMS, LPR, Face Recognition), it is required to have **ESXi License and Server Preparation**

VMware **ESXi** license should be available in advance and provide the server with **ESXi already installed** prior to Juganu’s installation set up.

The server should meet the hardware and network requirements listed below and be accessible from the management network. If ESXi is not preinstalled, additional setup time and licensing coordination will be required.

Customer checklist (minimum):

- Procure a valid VMware ESXi license (version **7.x or later** — confirm desired version with the project owner).
- Install ESXi on the server (ESXi preinstalled, fully patched).
- Ensure hardware meets minimum specs (**sizing will be provided for projects that requires local compute*).
- Configure server management network with a static IP or DHCP reservation, DNS, and NTP.
- Provide vCenter or ESXi host management credentials and license key to our team prior to the engagement.
- Enable remote management (iLO/DRAC/IMM) or provide console access details for troubleshooting.
- Verify SSH/vSphere client access and that the ESXi host is reachable from the customer management network.
- Confirm RAID/storage configuration and ensure datastore(s) are presented to the ESXi host.

If the customer needs assistance with ESXi installation or licensing, please notify us in advance so we can coordinate.

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	