Juganu Ltd.

Cellular Network Dynamic Offloading

Using Juganu ‘Network-on-Lights’

Confidential

JUGANU
BRIGHTER

Agenda

- Company Overview
- Network, Management & Services
- Cellular Infrastructure Support
  - Challenges
  - Solution
  - Use cases
- Summary

Vision & Mission

Mission

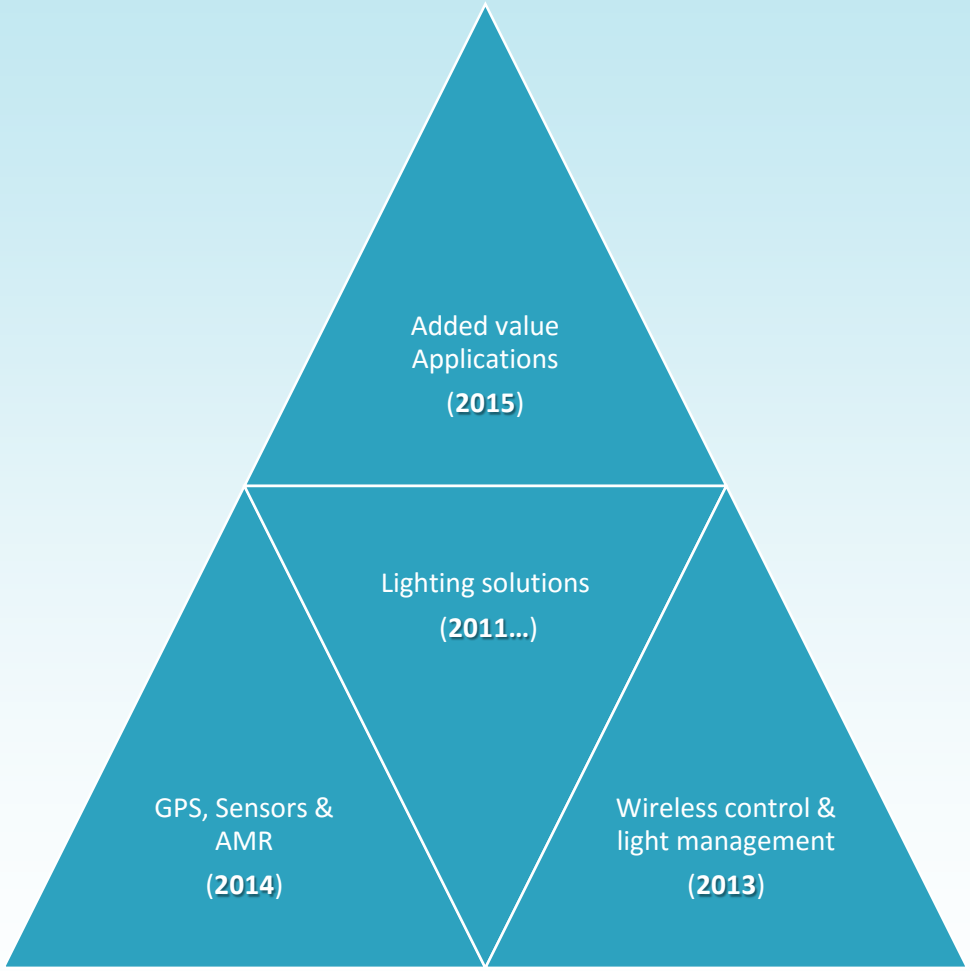
Make smart lighting and connectivity a reality through continuous innovation for a better tomorrow

Vision

Be a global leader in smart lighting, networking and sensing solutions for municipal and commercial markets to ensure aesthetics, safety and efficiency

Company Snapshot: Status and Go to Market

- **Status**
  - Established 2011
  - 40 employees
  - HQ in Israel;
  - Exponential growth in sales
  - 29 granted patents
- **Go-to-market strategy**
  - Local value-added resellers in territories & Juganu local sales & support field offices; Local assembly in territories
  - Upgradable, Wireless & GPS controlled lights;
  - Cooperation with 3rd parties to create applications and services



Management: experienced technological and business team

- **Eran Ben Shmuel, Chairman & CEO – 3rd time entrepreneur** - 15 years experience in leading highly innovative high-tech companies from zero to mass production; Previous experience include GOJI and B3Nova; B.Sc. in Electrical Engineering & Physics, Technion - Israel Institute of Technology; multiple patents in Physics and Algorithms.
- **Alexander Bilchinsky, CTO & VP R&D – 3rd time entrepreneur** - 15 years experience in leading R&D and IP protection strategies; Previous experience include GOJI and B3Nova; B.Sc. in Computer Science & Physics from Technion; multiple patents in Physics and Algorithms.
- **Tamar Naor, Active Board member – Corporate Development** – 20 years of experience in managing high tech companies, and doing business with global F1000 companies. Previous experience include S&M Netdynamics **(Nasdaq: SUNW)**, CEO Sphera, Advisory Brd **Wix (Nasdaq: WIX)**, Board membership and business expansion advisor in several cleantech companies since 2006. MS.c Law, Bar Ilan U.
- **Yossi Bechor, Chief System Architect** – 25 years in developing & bringing to market state-of-the-art, mission critical communication systems for the defense industries; Dir. of Product Dev, Microelectronic, Elisra, VP Engineering & CTO, Talla-Com Industries, Tallahassee, Florida. B.Sc in Electrical Engineering and Mathematics
- **Bentsi Algazi, COO** – 20 years of executive experience in global operations and R&D management; Previous experience include Power [illegible] Metalink and Gilat Satellite Networks; B.Sc in Physics & Mathematics and an MS.c in Business Administration, Hebrew U.

Holistic company view

Juganu smart platform driven by years of field large deployments

Lighting solutions

Network, Management & Services

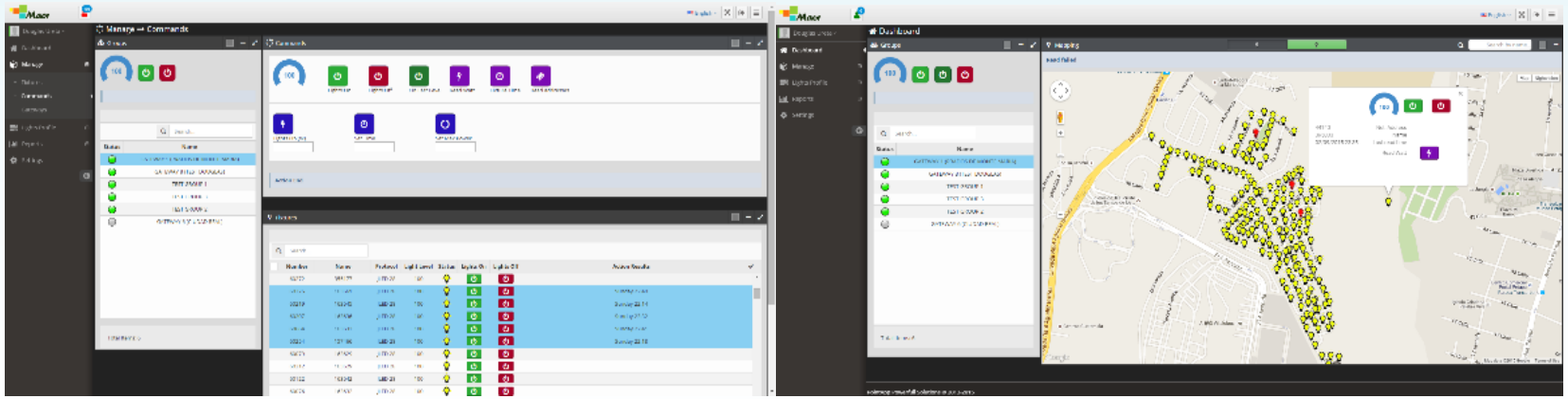
- **JLED quality fixtures and retrofits**
- **Light Cell**
  Viable Surface Lighting
- **Wireless network for management and plug-ins**
- **Lighting management software**
- **Interoperable platform for services**

+

- **Sensors & Applications**
- **Cooperation with 3rd parties**

JLED – Lighting fixtures & retrofits

- **Superior JLED Fixtures & Modules:**
  - High reliability, light uniformity and 85% energy savings
  - Negligible light reduction of 1% per year
  - Unmatched lighting quality due to smart architecture (Cooling, Drivers & Optics)
  - ***Each lamp includes embedded Wireless Communication & GPS***
  - Viable surface lighting (alleviating OLED technology limitations)
  - Fully managed and controlled from one lamp to tens of thousands of lamps through single gateway

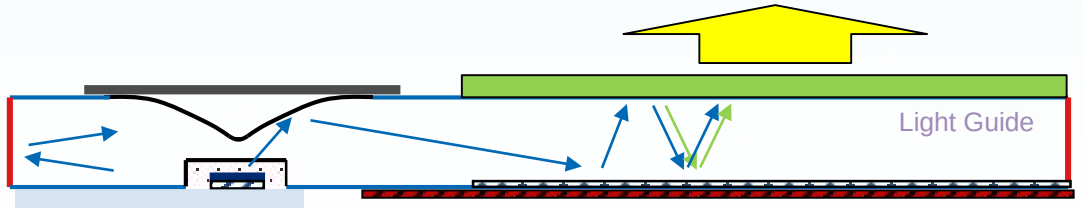


Paradigm shift in LED packaging, alleviating OLED technology limitations

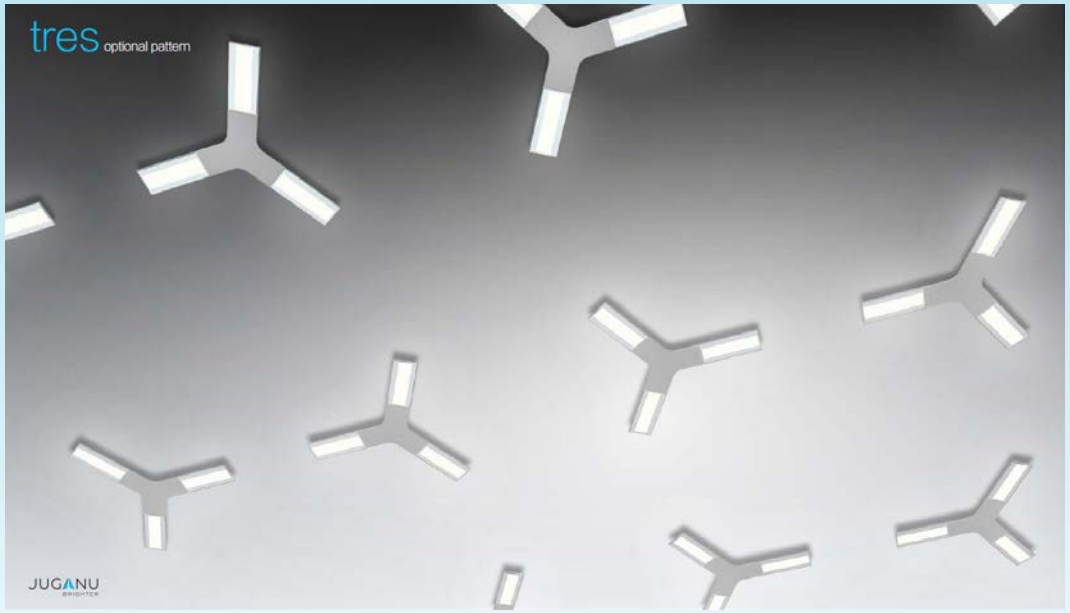
JUGANU BRIGHTER

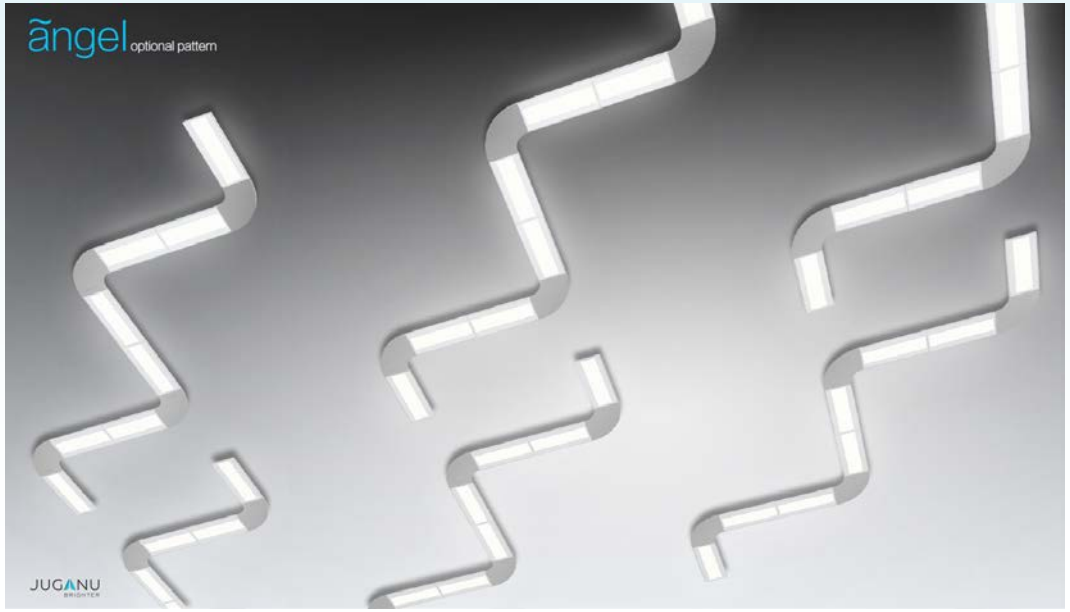
- LED bare-chip embedded in light-guide technology allows lighting products with superior efficiency, homogeneous defused lighting at a competitive pricing
- Providing surface lighting and high CRI at LED efficiency and cost

Property	JLED	OLED	Light Cell
Light output	Very high	Very Low	Very high
Efficiency	Very high	Medium	Very high
Diffused light	Needs diffuser	Very good	Very good
Reliability	Very good	Medium	Very good
Cost (for efficiency & CRI)	Competitive	Extremely high	Competitive
CRI (for efficiency and cost)	Medium	High	Very high
Thickness	Thick	Very thin	Little thicker than OLED

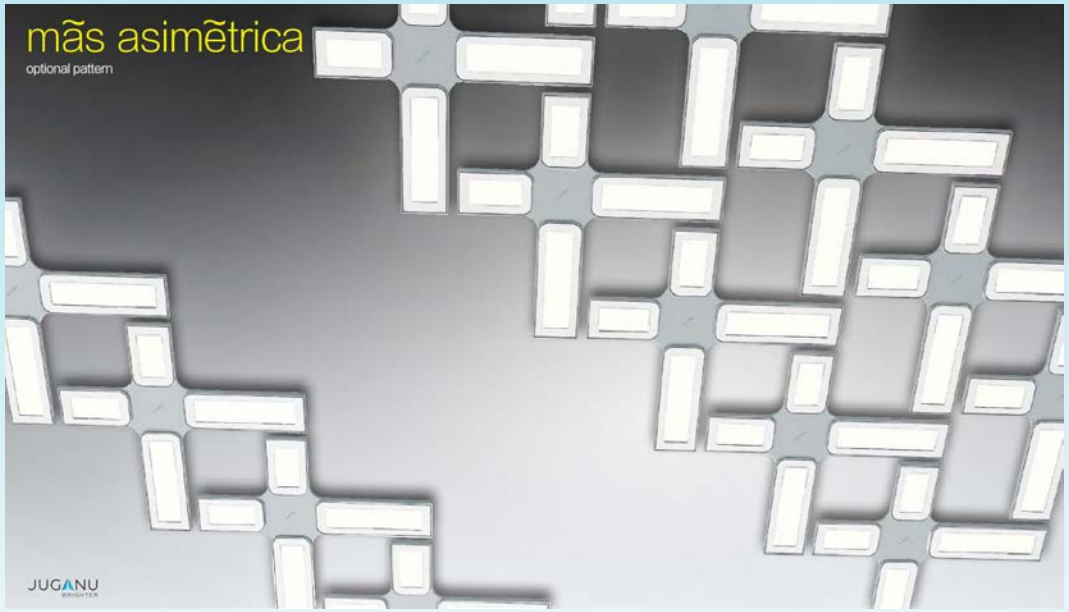


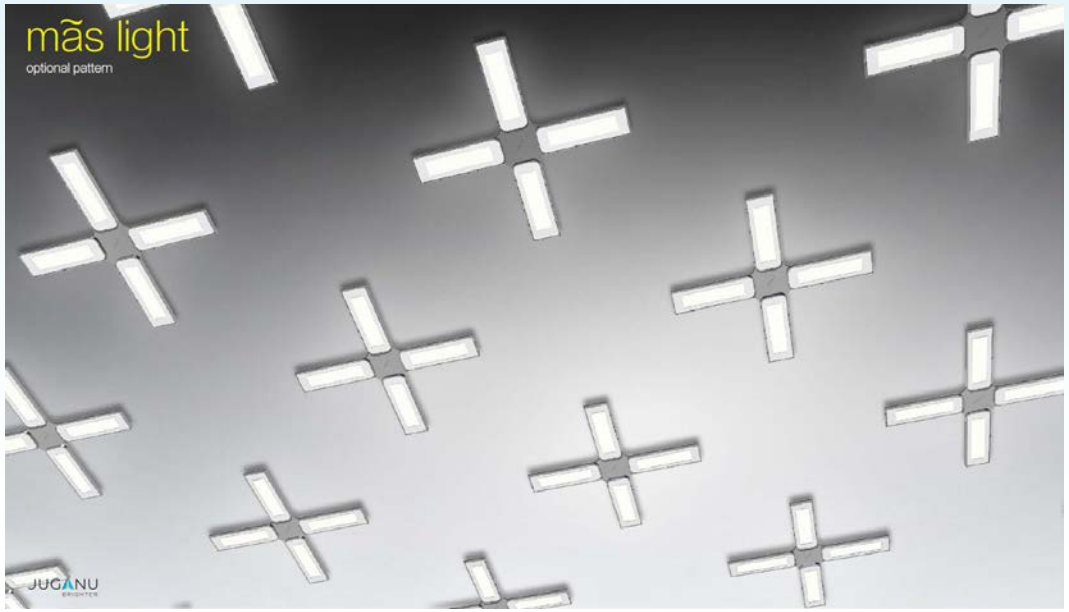
Surface lighting product line





Surface lighting product line

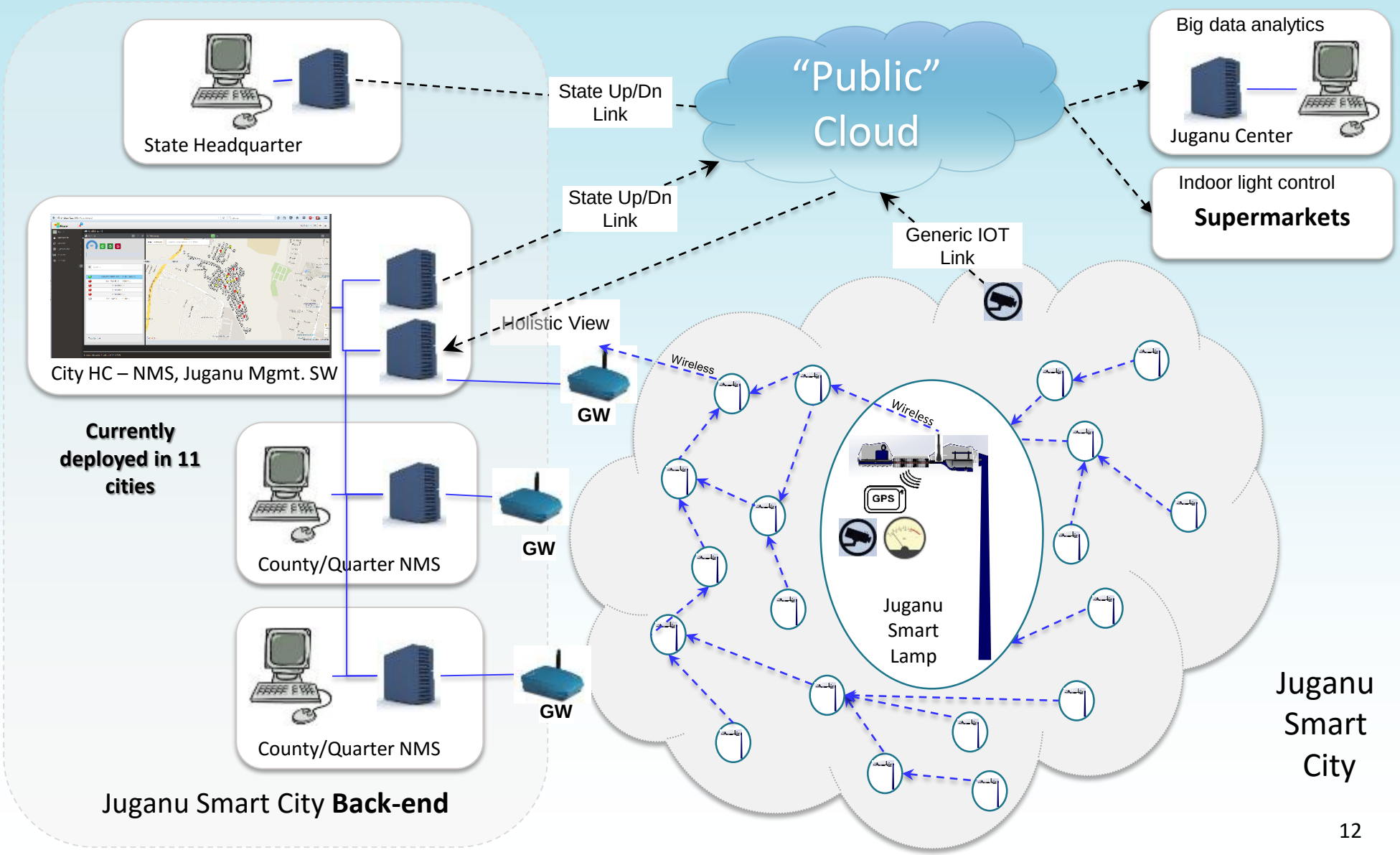




Network, Management & Services

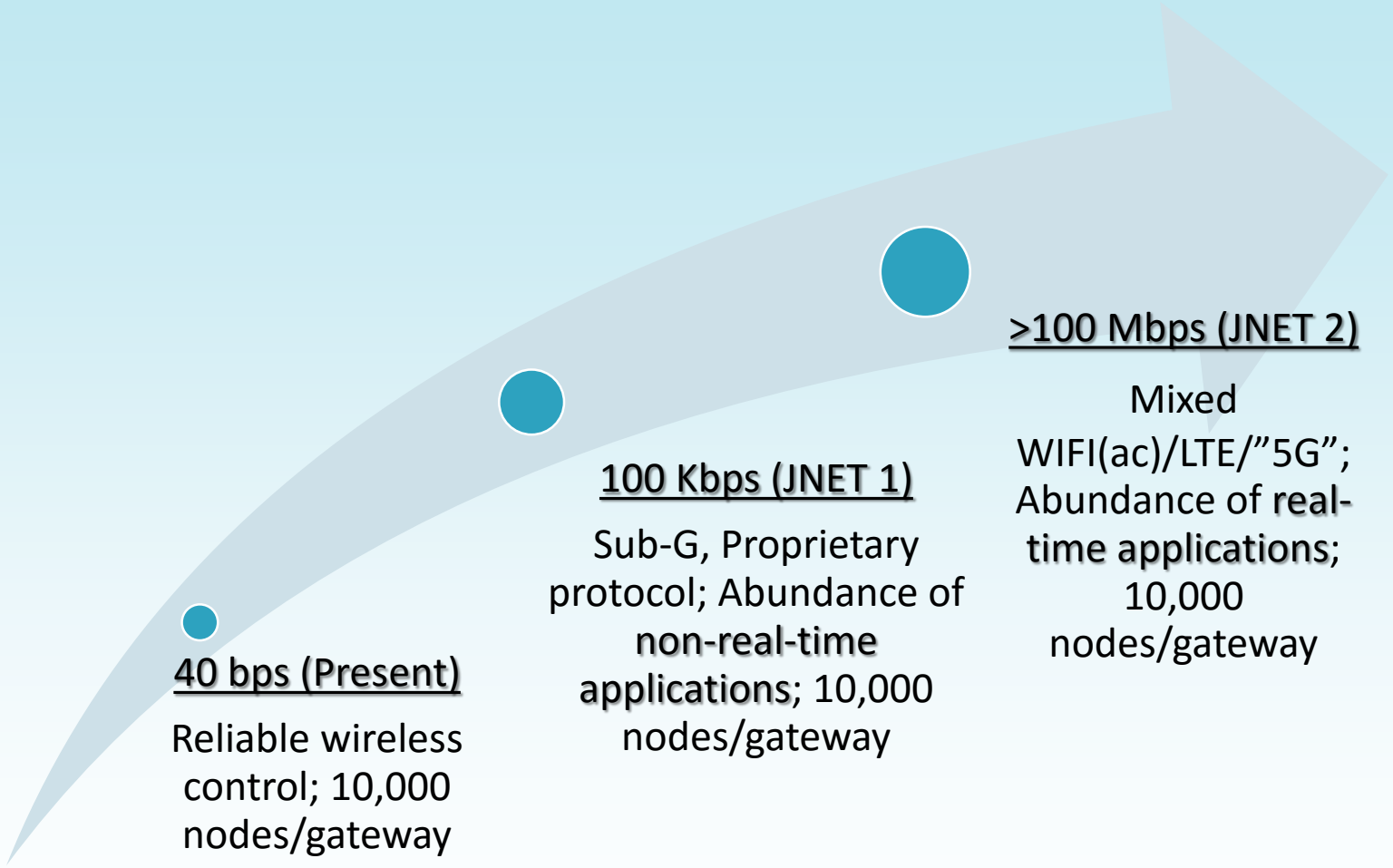
JLED SMART PLATFORM: JLED as a platform for value added services

- Juganu lamps are smart upgradable platforms to value added services: meter, camera, sensors
- JNET 1 - Juganu proprietary RF wireless network communication & GPS is embedded in each lamp
- Gateway: Up to 10,000 lamps per gateway: easy deployment and easy maintenance
- Security: compatible with highest industry standards



JLED SMART PLATFORM: Roadmap

- **Smart platform**
  - JLED lights are easily upgradable, to accommodate future sophisticated hardware
  - Expected massive install-base of upgradable JLED lights in cities and retail stores
  - Abundance of clients ready for pilots;
  - Cooperation with strong 3rd party companies to develop sensors and applications



Cellular Infrastructure Support

Challenges

- **Demand for Cellular QoS enforce huge investment in infrastructure**
  - Cellular networks may suffer service difficulties when presented with a data demand increase, whether temporary or static.
    - Dynamic load – temporary & local massive demand for data due to an unexpected event (e.g. terror event).
    - Static load – Known location and known timing for a possible demand for data (e.g. concert, protest, sport match).
  - Service difficulties pose a challenge for ISPs, where standard solution is a Microcell.
  - Microcell is a cheap and robust solution, but it can only be applied for static load, with known location, therefore it requires an installation and a wired IP Connection
  - Highways often presents bad cellular service.
  - Regulation
    - Increasing awareness for high radiation rates health risks, forces ISPs to install more cells with reduced output power, which introduces bad reception areas.

Solution

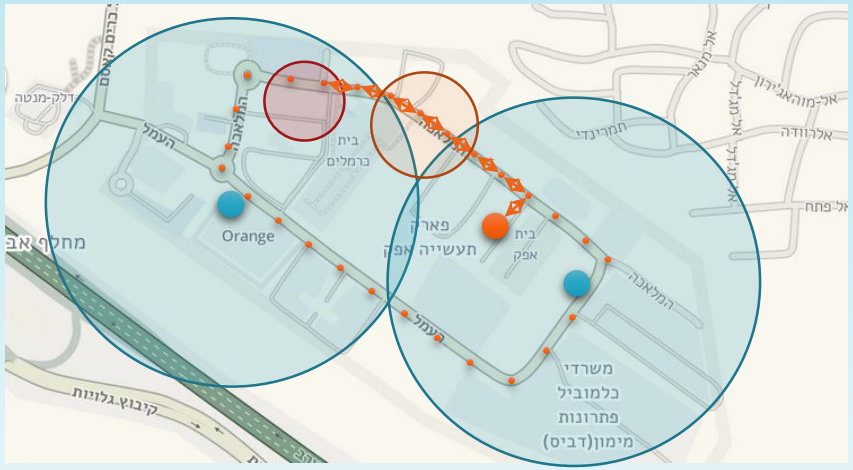
- **JNET Network on lighting is a natural solution**
  - Installed because of energy savings
  - Covers cities, roads and highways and actually every place, where man leave
  - Price per lamp is low due to integration with JLED systems

  - ultra-high bandwidth communication supported by an IP connected GW(s).
  - An ISP may choose to use JNET as a backup network to offload data demand situations and/or “fill” reception gaps instead of installing expensive cellular infrastructure.
  - The JNET enforces an intelligence to detect dynamic cellular loads and can decide to take over the data to ease and maintain service.

Use cases

The blue circles indicate cellular coverage generated by a cellular cell. The orange colored units are Juganu luminaries, where the big orange circle is JNET gateway with an IP connection.

All Juganu units communicates via JNET protocol and connected to the cloud via the gateway.



- The Red faded circle indicates a crowded location where the cellular network suffer heavy load. The JNET detects the load and tunnels the cellular data via Juganu GW.
- The Orange faded circle indicates a gap in the cellular coverage. The JNET units in this gap, provides Wi-Fi service that can be used by the ISP as service “patch” instead of installing additional cell just for this small gap.

Summary

Summary

- Lighting infrastructure deployments:
  - Dense and homogeneous distribution
  - Overlaps with cellular networks
- Juganu JLED:
  - Proven large citywide deployments
  - Each fixture equipped with latest broadband technologies (5G)
  - Juganu proprietary, with extensive networking capabilities, enables communication manipulation to interface with existing communication standards
- ISP benefits:
  - Data congestion offload
  - Service integrity
  - Eliminates the need for add-hoc temporary/permanent complimentary solutions (e.g. microcells)
  - Reduce installation and maintenance expenses. “Plug & play” unified solution with no need for fiber or any other landline solution.
  - JLED deployments covers unreachable-by-fiber areas, thus enabling service improvements also for places that could not have been resolved before