

Mayor of London: Supply-Chain Engagement for a Smart City

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International cities compete to engage talent so that they can host interactions that drive demand for property services. The rise of the smart phone and agile management processes have resulted in a large proportion of valuable human interactions taking place over the internet. This poses a challenge to traditional models of association. Competitive talent may now expect to make leading contributions working more independently, remote from colleagues, without the need to regularly attend a physical manifestation of a business environment. Consequently, property professionals have found it necessary to inspire these more agile professionals to engage with the manufactured devices that are regularly embedded in cities productive assets. Integrating the heart of urbanisation with the new capabilities offered by public internet networking.

An Ecosystem Lacking Clarity?

In December 2020, Sadiq Khan the Mayor of London considers how Greater London might approach innovations in industry to expose building systems to public networks over internet protocols, joining the domain of “*internet-of-things*”. This comes at a time where there is little consistency in device capabilities and network architectures for building systems.

There has been a lot of excitement about internet-of-things in recent times, with some announcing the “*sky is the limit*” in terms of the new opportunities that might be yielded to enhance user experience in the built environment. However, customers have been reluctant to adopt at scale because of a lack of competent human resource,

concerns for network reliability and security, and a lack of clarity about development options. Google are a particularly capable occupier of commercial space within central London and have publicly communicated their frustration in trying to scale internet-of-things solutions within the business ecosystem for building systems [1].

“A lot of it comes down to the customers... the customers need to be asking for secure devices, they need to be asking for standardised open protocols that don’t vary between vendors and mandating it in specifications, they need to start asking to own the data... as soon as the customers start asking, it’s going to start generating the interest... We are obviously trying to coordinate with others in the industry... That’s the way it’s going to have to move...”

How might the Mayor of London best support such coordination within industry? Are existing tools published for the open-source community inclusive options suitable for widespread adoption at scale? Is some form of international outreach required to support consistent and stable industry practice? Are there any potential risks to the public? Can the industry manage itself, or might some form of regional regulation or planning approval process better protect London’s occupiers (end-users)?

Advances in System Integration

Systems integration is a process of connecting sub-systems into one functional system, improving coherency by allowing all components to work together. This activity is particularly relevant to information technology, where different types of hardware and software act together as a coordinated system. However, it also has purpose in civil engineering and infrastructure projects, where it can be viewed as a distinct phase of the delivery process. Interactions between sub-systems enable the integration of what might initially appear disparate systems, adding overall value in terms of increased efficiency, accuracy and/or cost-effectiveness.

Systems integration techniques can be used to synthesise knowledge areas of expertise, roles and responsibilities. Data analytics is increasingly being used to visualise and understand relationships between components and the systematic consequences of any change within complex inter-dependent systems.

By 2020, it has become typical that more complex sites be fitted with siloed building sub-systems that execute automated systems control with devices networked over internet protocols. Some of these sub-systems have life-safety or security functions. Many organisations with influence in London have recently furthered their ambitions for integrating building sub-systems to support their organisations development goals. Pioneering buildings with knowledgeable operators may now expect to have these sub-systems connected to a common integrating enterprise network with data forwarded to public networks over internet protocols, so that the full potential for innovation in the software development and web-services communities can be leveraged upon. Such activity brings the discipline of systems integration together with an emerging topic

of information technology known as “internet-of-things”. This has already led to new products emerging on the market to enhance building services.

Automated Meter Reading

The Crown Estate installed Automatic Meter Reading (AMR) at their St James’s Market development in central London. The AMR systems recorded the pulse outputs from the water and gas meters, and Modbus protocol data from the electricity and heat meters. A hardwired system was chosen to ensure reliability of communications between the meters and logging equipment.

A connection was made to the internal local area network, which has a broadband link to enable remote access and export of data. Separate onsite head-ends were supplied, specific to each building. A dashboard function allowed the onsite building manager to analyse and manage energy on a day-to-day basis[2].

Demand Logic

Demand Logic provides live data intelligence on how a building operates, in particular the Heating, Ventilation and Air-Conditioning systems, utility meters and internal environmental sensors for temperature, CO2, air-quality, humidity and occupancy. It is intelligence which can be used for a range of property management use cases from portfolio benchmarking down to facilities optimization.

Demand Logic install a single Data Acquisition Device gateway to connect existing Building Management Systems to an internet service over public networks. Within 24-48 hours Demand Logic can create a virtual Demand Logic Asset Model of all of the equipment on the network and every single data point. These points are then polled to log data, on average, every 15 minutes. The data frequency can be faster or slower depends on the data being collected[3].

Augmented Reality

Building Information Models are advanced 3D representations of buildings that include the properties of the assets displayed. Building Information Models can be very detailed and may act as a centralised source of information for a building throughout its lifecycle. There have recently been some early examples of contractors or managers visualising a Building Information Model and its dynamic properties overlaid on the real world using their mobile phone or an immersive headset. By doing so, they can compare what has been planned with what has been built and evaluate the work to support commissioning activities.

Universal Device Management Interface

It has been recognised that inconsistencies in device configuration may lead to system vulnerabilities. To address this, Google, Arup and RedstoneConnect have together sup-

ported development of a publicly available tool for automated network administration, available on Apache License 2.0. Operationalised testing of built-environment internet-of-things infrastructure was considered a key aspect of fostering security and development best practices. Through implementing end-to-end automation, ecosystems can be normalised, and time taken to make system improvements and updates can be reduced.

DAQ is an example framework designed to test and operate internet-of-things devices in an enterprise internet-of-things environment. Nominally about device testing and qualification, Device Automated Qualification (DAQ), provides a means to automate many capabilities, resulting in a more manageable, robust, and secure platform. The DAQ tool is designed for use with software defined network (SDN) compatible switches and runs on a Faucet OpenFlow network controller. SDN compatible switches are an advanced technology typically finding application for data centres that enable dynamic and programmatically efficient network configuration, they are a premium product. The Faucet Openflow SDN controller is publicly available on Apache License 2.0 [4].

There are several main categories of capabilities that DAQ addresses:

- Automatically testing the behaviour of a device against established security and network standards.
- Orchestration of "micro-segmentation" on the network for improved security.
- A suite of tools, consoles, and dashboards that help operate a robust ecosystem of IoT devices.

Specifying Network Requirements

Network architecture and network device standards for publicly exposed building systems currently fall outside the scope of planning and regulatory instruments governing the business ecosystem in Greater London. Therefore, organisations are normally left to develop bespoke specifications for their requirements which may be quite inconsistent with each other, often with the support of professional advice.

The London Plan

Greater London has a relatively skilled economy that specialises in real estate, professional services, science, technical activities and media which serve international markets. However, the city's particular specialism is in financial services and insurance which accounts for almost 20 percent of Greater London's gross value added alone. The metropolitan area contributes approximately one quarter of the United Kingdom's gross domestic product, whilst the City of Westminster is a specialist London Borough accommodating governance, diplomacy and administration for the United Kingdom and Commonwealth of Nations [5].

Strategic planning is the shared responsibility of the Mayor of London, 32 London Boroughs and the Corporation of the City of London. It is the Mayor of London's responsibility to produce a spatial development strategy, known as the "*London Plan*", and

keep it under review. It sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. It is intended to be an essential element of achieving sustainable development, a healthy economy and a more inclusive society. The London Plan reflects the intent of the National Planning Policy Framework enacted by the Parliament. The London Plan consists of 120 policies across eight themes [6].

Any significant alterations to the use of land within Greater London require planning approval from Local Planning Authorities (LPA's). LPA's refer to the Local Plan when considering applications for planning approval, which consists of Development Plan Documents (DPD's). In Greater London, these DPD's should be in general in conformity with the London Plan.

Building Regulations, England and Wales

The Buildings Regulations are set by a Statutory Instrument of the UK Parliament and intend to protect public safety, health and welfare when buildings are first constructed or significantly altered. Those responsible for carrying out such work have a duty to comply with the Building Regulations, which sets out standards that must be achieved. Guidance on satisfying the requirements of the building regulations can be found in 16 "parts" of an Approved Document published by HM Government. Local Authority Building Control or a Licensed Inspector is responsible for checking and inspecting building work, once they are satisfied that building work satisfies the Building Regulations they issue a certificate of completion [7].

Professional Institutions

Much of the ecosystem for the integration of building systems is standardised by professional institutions. For example, the Institute for Electrical and Electronics Engineers (IEEE) is highly influential for setting a broad range of international standards for network communications that include the IEEE 802 family. The Association of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) maintains a widely applied open standard broadcast internet protocol for building systems control known as BACnet.

Professional institutions have significant influence over the construction industry, with the standards and guidance developed by them often referred to as recognised good practice.

A Decision of the Mayor

The Mayor of London has track-record of championing local community decision-making citing:

"Quite simply, taking power away from local communities is the last thing the capital, or our country, needs. A one-size-fits-all planning system - dictated

from Whitehall and with decision-making taken away from communities – just doesn't work, whether you're in London, Liverpool or Leeds.”

The Mayor of London has been asked directly to respond to the industry call for a coordinated response from customers in making demands from the smart cities supply-chain. Might he:

- Adopt a liberal approach to political participation and allow property markets to deliver outcomes by themselves, allow occupiers to continue developing to their own standards?
- Host an event for stakeholders, regulators and professionals to explore options for establish the appropriate institution responsible for setting standards implemented within Greater London, or the potential of creating a new one where none exists?
- Introduce new policies for publicly exposed building systems over internet protocols within the London Plan?
- Recommend standards for the supply-chain be set nationally and lobby HM Government for extending the scope of the Building Regulations, England and Wales to cover internet-of-things?

References

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<https://www.ribaj.com/intelligence/updates-to-the-riba-plan-of-work-2019-dale-sinclair>

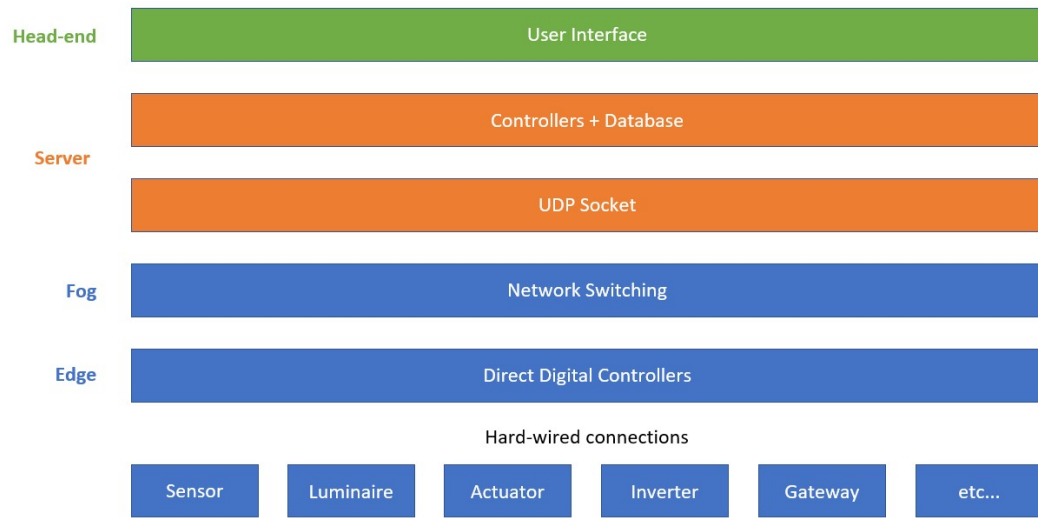


Exhibit 1: Typical UDP Technology Stack for Building Systems

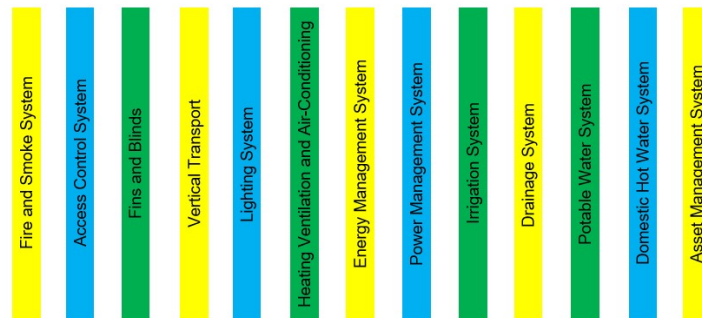


Exhibit 2: Typical Island Networks of Building Systems

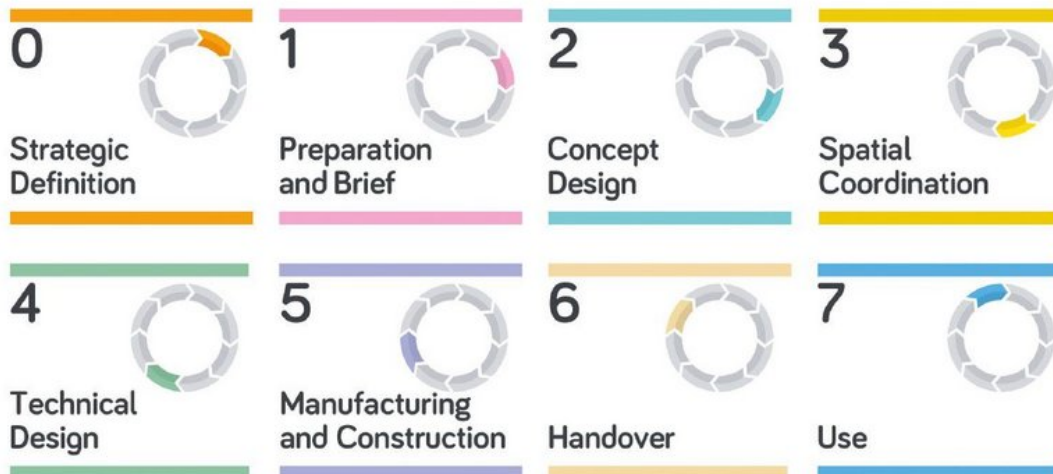


Exhibit 3: RIBA Plan of Work [9]

Exhibit 4.1: London Plan Policy Index, Page 1 [6]

Context and Strategy

Policy 1.1: Delivering the strategic vision and objectives of London

London's Places

Policy 2.1: London in its global, European and United Kingdom context

Policy 2.2: London and the wider metropolitan area

Policy 2.3: Growth areas and co-ordination corridors

Policy 2.4: The 2012 games and their legacy

Policy 2.5: Sub-regions

Policy 2.6: Outer London: Vision and strategy

Policy 2.7: Outer London: Economy

Policy 2.8: Outer London: Transport

Policy 2.9: Inner London

Policy 2.10: Central activity zone: Strategic priorities

Policy 2.11: Central activity zone: Strategic functions

Policy 2.12: Central activity zone: Predominantly local activities

Policy 2.13: Central activity zone: Predominantly local activities

Policy 2.14: Areas of regeneration

Policy 2.15: Town centres

Policy 2.16: Strategic outer London development centres

Policy 2.17: Strategic industrial locations

Policy 2.18: Green infrastructure: The multi-functional network of green and open spaces

London's People

Policy 3.1: Ensuring equal life chances for all

Policy 3.2: Improving health and addressing health inequalities

Policy 3.3: Increasing housing supply

Policy 3.4: Optimising housing potential

Policy 3.5: Quality and design of housing developments

Policy 3.6: Children and young people's play and informal recreation facilities

Policy 3.7: Large residential developments

Policy 3.8: Housing choice

Policy 3.9: Mixed and balanced communities

Policy 3.10: Definition of affordable housing

Policy 3.11: Affordable housing targets

Policy 3.12: Negotiating affordable housing on individual private residential and mixed-use schemes

Policy 3.13: Affordable housing thresholds

Policy 3.14: Existing housing

Policy 3.15: Coordination of housing development and investment

Policy 3.16: Protection and enhancement of social infrastructure

Policy 3.17: Health and social care facilities

Policy 3.18: Education facilities 10

Policy 3.19: Sports facilities

Exhibit 4.2: London Plan Policy Index, Page 2 [6]

London's Economy

- Policy 4.1: Developing London's economy
- Policy 4.2: Offices
- Policy 4.3: Mixed-use development and offices
- Policy 4.4: Managing industrial land and premises
- Policy 4.5: London's visitor infrastructure
- Policy 4.6: Support for and enhancement of arts, culture, sport and entertainment
- Policy 4.7: Retail and town centre development
- Policy 4.8: Supporting a successful and diverse retail sector and related facilities and services
- Policy 4.9: Small shops
- Policy 4.10: New and emerging economic sectors
- Policy 4.11: Encouraging a connected economy
- Policy 4.12: Improving opportunities for all

London's Response to Climate Change

- Policy 5.1: Climate change mitigation
- Policy 5.2: Minimising carbon dioxide emissions
- Policy 5.3: Sustainable design and construction
- Policy 5.4: Retrofitting
- Policy 5.4A: Electricity and gas supply
- Policy 5.5: Decentralised energy networks
- Policy 5.6: Decentralised energy in development proposals
- Policy 5.7: Renewable energy
- Policy 5.8: Innovative energy technologies
- Policy 5.9: Overheating and cooling
- Policy 5.10: Urban greening
- Policy 5.11: Green roofs and development sites environs
- Policy 5.12: Flood risk management
- Policy 5.13: Sustainable drainage
- Policy 5.14: Water quality and wastewater infrastructure
- Policy 5.15: Water use and supplies
- Policy 5.16: Waste net self-sufficiency
- Policy 5.17: Waste capacity
- Policy 5.18: Construction, excavation and demolition waste
- Policy 5.19: Hazardous waste
- Policy 5.20: Aggregates
- Policy 5.21: Contaminated land
- Policy 5.22: Hazardous substances and installations

Exhibit 4.3: London Plan Policy Index, Page 3 [6]

London's Transport

Policy 6.1: Strategic approach

Policy 6.2: Providing public transport capacity and safeguarding land for transport

Policy 6.3: Assessing effects of development on transport capacity

Policy 6.4: Enhancing London's transport connectivity

Policy 6.5: Funding Crossrail and other strategically important infrastructure

Policy 6.6: Aviation

Policy 6.7: Better streets and service transport

Policy 6.8: Coaches

Policy 6.9: Cycling

Policy 6.10: Walking

Policy 6.11: Smoothing traffic flow and managing congestion

Policy 6.12: Road network capacity

Policy 6.13: Parking

Policy 6.14: Freight

Policy 6.15: Strategic rail freight interchanges

Exhibit 4.4: London Plan Policy Index, Page 4 [6]

London's Living Places and Spaces

- Policy 7.1: Lifetime neighbourhoods
- Policy 7.2: An inclusive environment
- Policy 7.3: Designing out crime
- Policy 7.4: Local character
- Policy 7.5: Public realm
- Policy 7.6: Architecture
- Policy 7.7: Location and design of tall and large buildings
- Policy 7.8: Heritage assets and archaeology
- Policy 7.9: Heritage-led regeneration
- Policy 7.10: World heritage sites
- Policy 7.11: London view management framework
- Policy 7.12: Implementing the London view management framework
- Policy 7.13: Safety, security and resilience to emergency
- Policy 7.14: Improving air quality
- Policy 7.15: Reducing and managing noise, improving and enhancing the acoustic environment and promoting appropriate soundscapes
- Policy 7.16: Green belt
- Policy 7.17: Metropolitan open land
- Policy 7.18: Protecting open space and addressing deficiency
- Policy 7.19: Biodiversity and access to nature
- Policy 7.20: Geological conservation
- Policy 7.21: Trees and woodland
- Policy 7.22: Land for food
- Policy 7.23: Burial places
- Policy 7.24: Blue ribbon network
- Policy 7.25: Increasing the use of the blue ribbon network for passengers and tourism
- Policy 7.26: Increasing the use of the blue ribbon network for freight transport
- Policy 7.27: Blue ribbon network: Supporting infrastructure and recreational use
- Policy 7.28: Restoration of the blue ribbon network
- Policy 7.29: The River Thames
- Policy 7.30: London's canals and other rivers and waterspaces

Exhibit 4.5: London Plan Policy Index, Page 5 [6]
<i>Implementation and Monitoring Review</i>
Policy 8.1: Implementation Policy 8.2: Planning obligations Policy 8.3: Community infrastructure levy Policy 8.4: Monitoring and review

Exhibit 6: Guidance on Satisfying the Requirements of the Building Regulations, England and Wales [7]
Approved Document, Part A: Structure Approved Document, Part B: Fire safety Approved Document, Part C: Site preparation and resistance to contaminants and moisture Approved Document, Part D: Toxic substances Approved Document, Part E: Resistance to the passage of sound Approved Document, Part F: Ventilation Approved Document, Part G: Sanitation, hot water efficiency and water efficiency Approved Document, Part H: Drainage and water disposal Approved Document, Part J: Combustion appliances and fuel storage systems Approved Document, Part K: Protection from falling collision and impact Approved Document, Part L: Conservation of fuel and power Approved Document, Part M: Access to and use of buildings Approved Document, Part P: Electrical safety - dwellings Approved Document, Part Q: Security - dwellings Approved Document, Part R: Physical infrastructure for high-speed communications networks Approved Document, Part 7: Materials and workmanship