数字和创新
Bristol: Open Programmable City

Paul Wilson
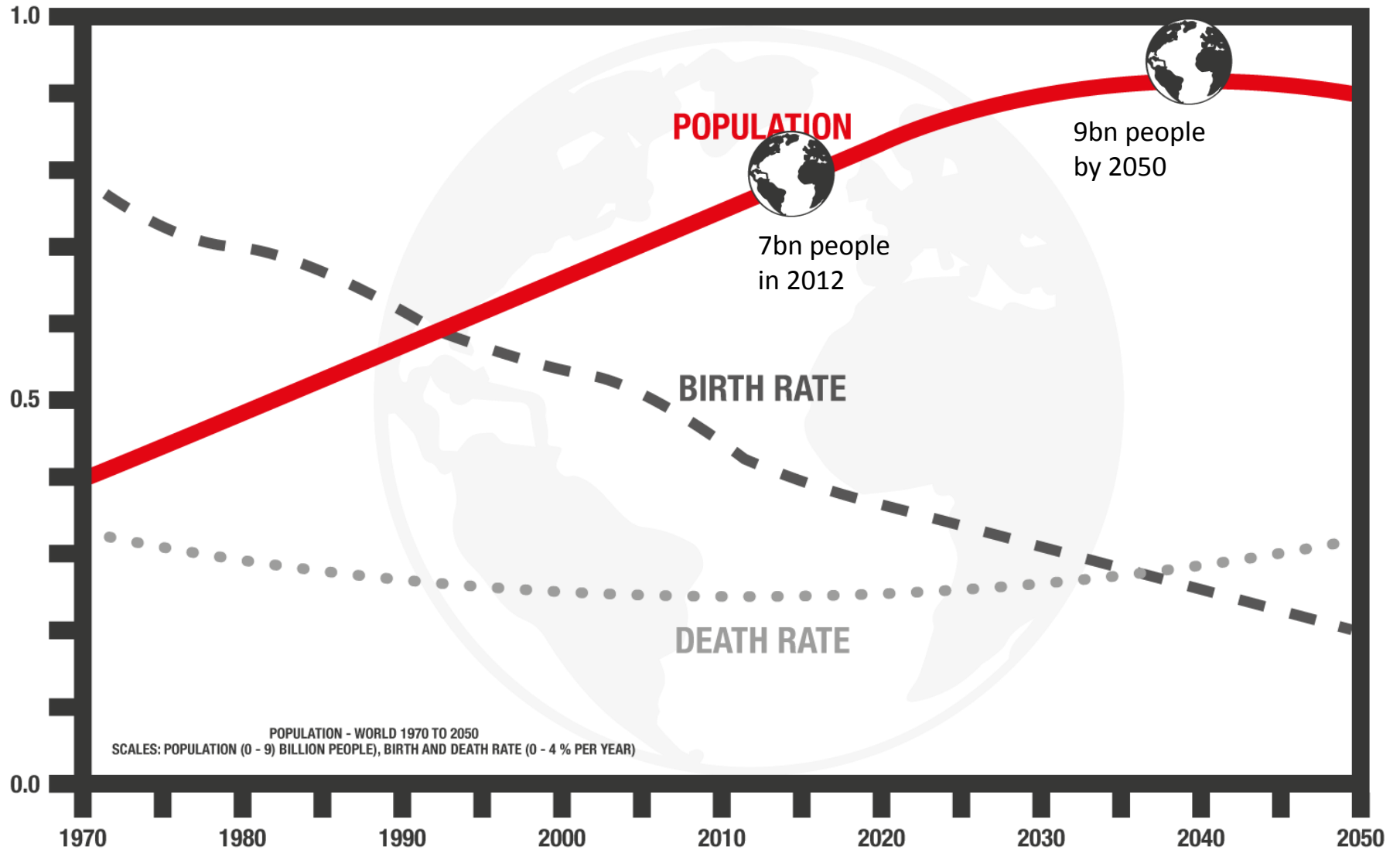Managing Director
Copenhagen
30-9-15
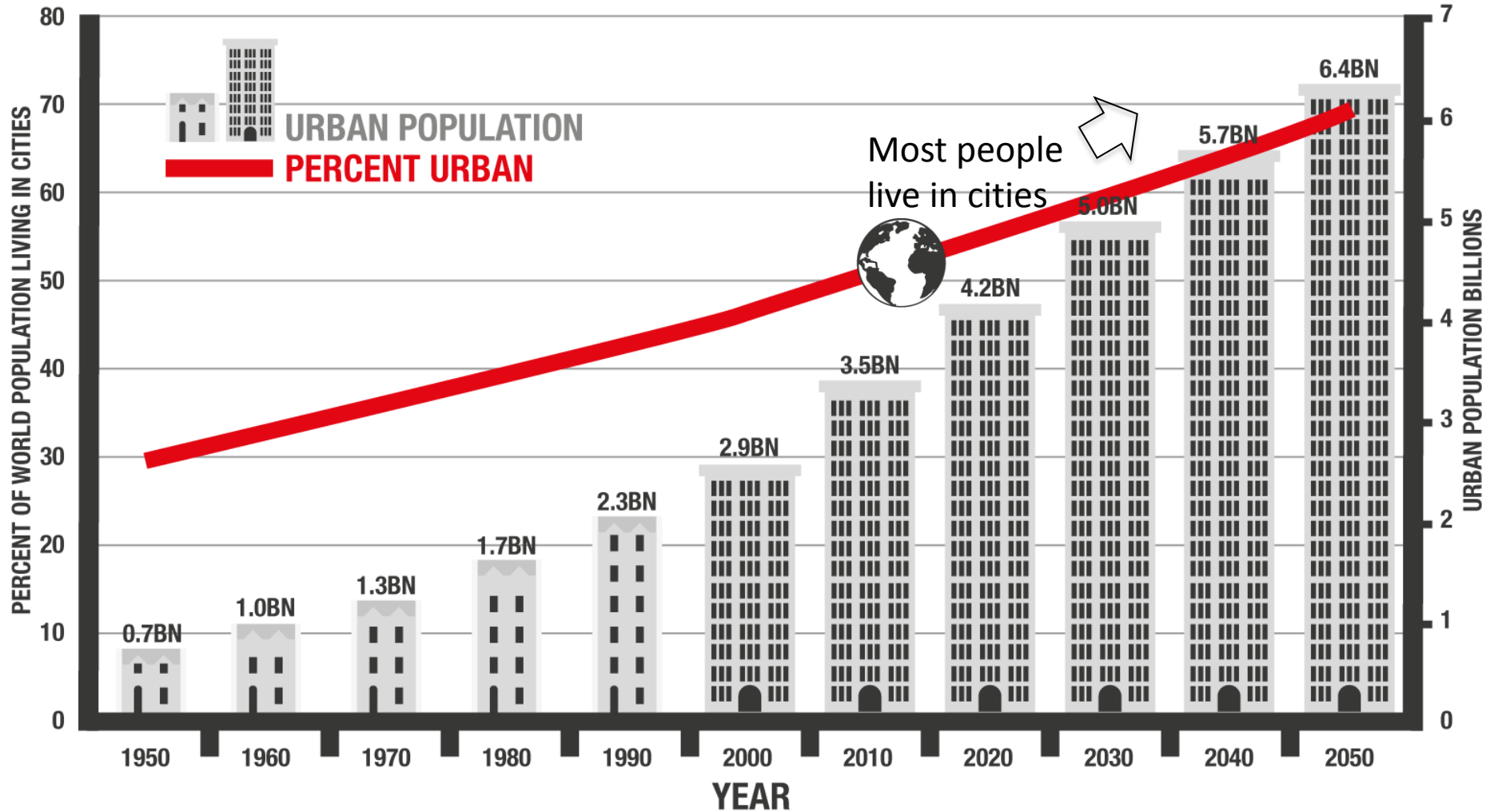
Rapid Growth In World Population
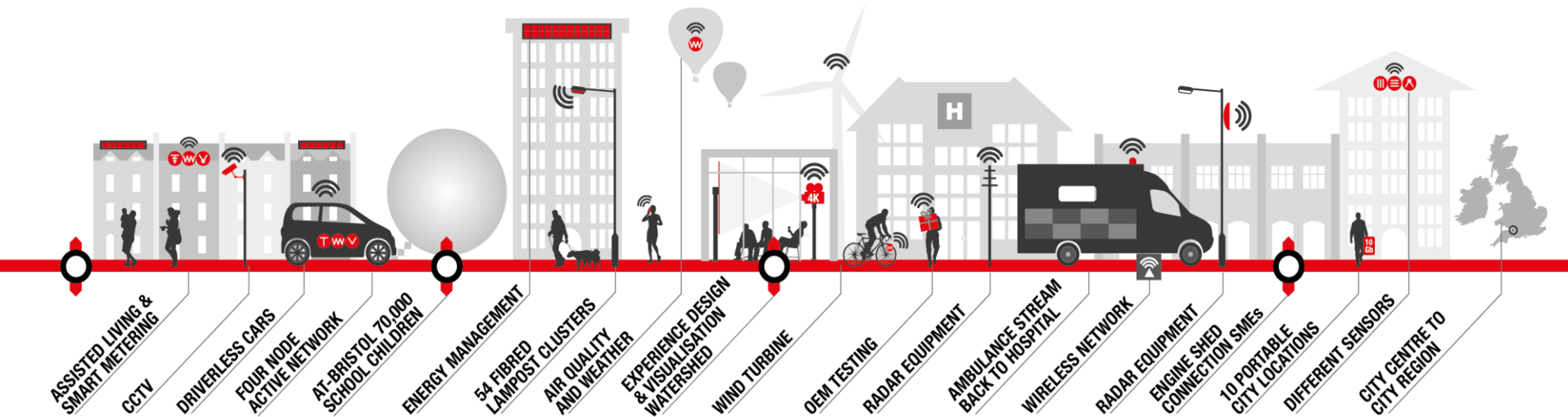

POPULATION

7bn people in 2012

9bn people by 2050

BIRTH RATE

DEATH RATE

POPULATION - WORLD 1970 TO 2050
SCALES: POPULATION (0 - 9) BILLION PEOPLE), BIRTH AND DEATH RATE (0 - 4 % PER YEAR)

OPEN PROGRAMMABLE CITY REGION

Most Growth In Cities

Most people live in cities

'I see Bristol as a laboratory for urban change'
Mayor George Ferguson

BIG DATA GENERATION

Labels along timeline:
- ASSISTED LIVING & SMART METERING
- CCTV
- DRIVERLESS CARS
- FOUR NODE ACTIVE NETWORK
- AT-BRISTOL 70,000 SCHOOL CHILDREN
- ENERGY MANAGEMENT
- 54 FIBRED LAMPOST CLUSTERS
- AIR QUALITY AND WEATHER
- EXPERIENCE DESIGN & VISUALISATION WATERSHED
- WIND TURBINE
- OEM TESTING
- RADAR EQUIPMENT
- AMBULANCE STREAM BACK TO HOSPITAL
- WIRELESS NETWORK
- RADAR EQUIPMENT
- ENGINE SHED CONNECTION SMEs
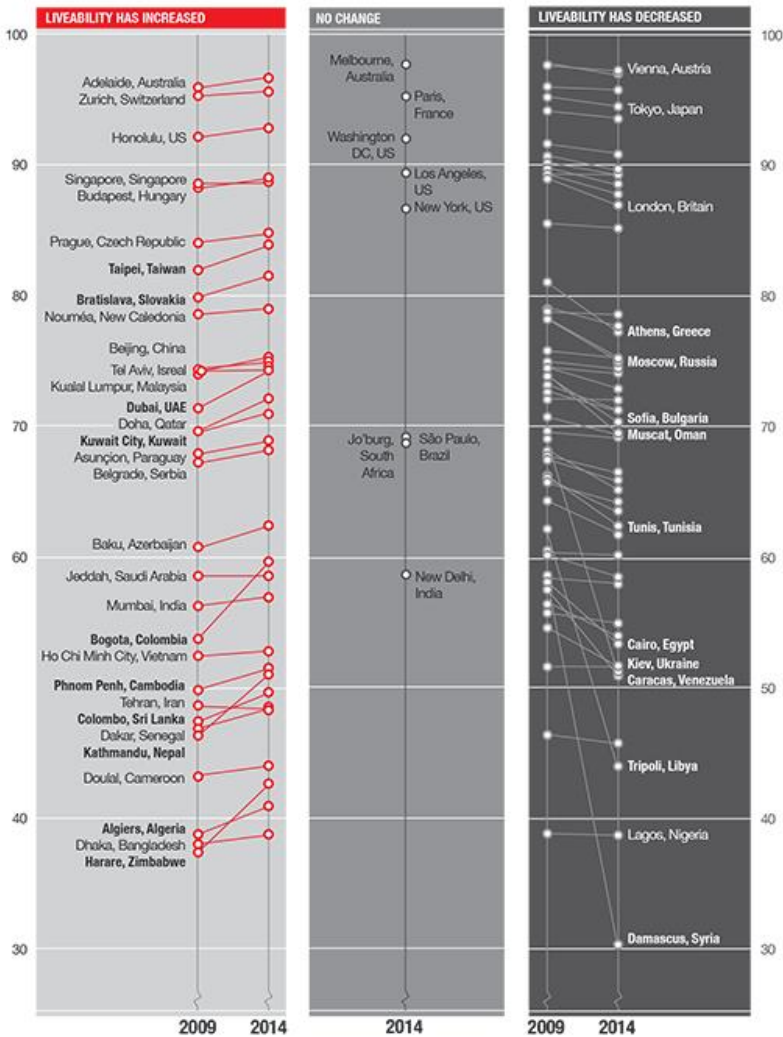- 10 PORTABLE CITY LOCATIONS
- DIFFERENT SENSORS
- CITY CENTRE TO CITY REGION

Liveable; Sustainable & Resilient Cities

CITY "LIVEABILITY" INDEX*

100=ideal, ten cities with ,ost change highlighted in **bold**

LIVEABILITY HAS INCREASED

- Adelaide, Australia
- Zurich, Switzerland
- Honolulu, US
- Singapore, Singapore
- Budapest, Hungary
- Prague, Czech Republic
- **Taipei, Taiwan**
- **Bratislava, Slovakia**
- Nouméa, New Caledonia
- Beijing, China
- Tel Aviv, Isreal
- Kualal Lumpur, Malaysia
- **Dubai, UAE**
- Doha, Qatar
- **Kuwait City, Kuwait**
- Asunçion, Paraguay
- Belgrade, Serbia
- Baku, Azerbaijan
- Jeddah, Saudi Arabia
- Mumbai, India
- **Bogota, Colombia**
- Ho Chi Minh City, Vietnam
- **Phnom Penh, Cambodia**
- Tehran, Iran
- **Colombo, Sri Lanka**
- Dakar, Senegal
- **Kathmandu, Nepal**
- Doual, Cameroon
- **Algiers, Algeria**
- Dhaka, Bangladesh
- **Harare, Zimbabwe**

2009 2014

NO CHANGE

- Melbourne, Australia
- Paris, France
- Washington DC, US
- Los Angeles, US
- New York, US
- Jo'burg, South Africa
- São Paulo, Brazil
- New Delhi, India

2014

LIVEABILITY HAS DECREASED

- Vienna, Austria
- Tokyo, Japan
- London, Britain
- Athens, Greece
- Moscow, Russia
- Sofia, Bulgaria
- Muscat, Oman
- Tunis, Tunisia
- Cairo, Egypt
- Kiev, Ukraine
- Caracas, Venezuela
- Tripoli, Libya
- Lagos, Nigeria
- Damascus, Syria

2009 2014

*Based on 30 factors spread across five areas: stability, infrastructure, education, health care and environment
Source: Economist Intelligence Unit

PLAYABLE

THE SUNDAY TIMES
BEST PLACES TO LIVE IN BRITAIN
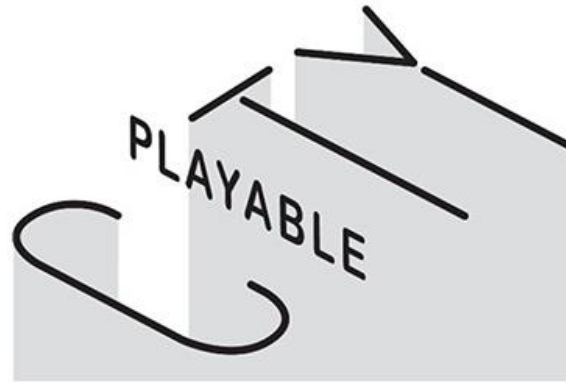
BRISTOL 2015 EUROPEAN GREEN CAPITAL

BRISTOL
winner 2015
EUROPEAN GREEN CAPITAL
An initiative of the European Commission

372 CITIES THAT APPLIED TO BE PART OF THE 100 RESILIENT CITIES CHALLENGE

Rockefeller Foundation
Innovation for the Next 100 Years

A Joint Venture Ltd: City Govt & University;   (Industry & People)
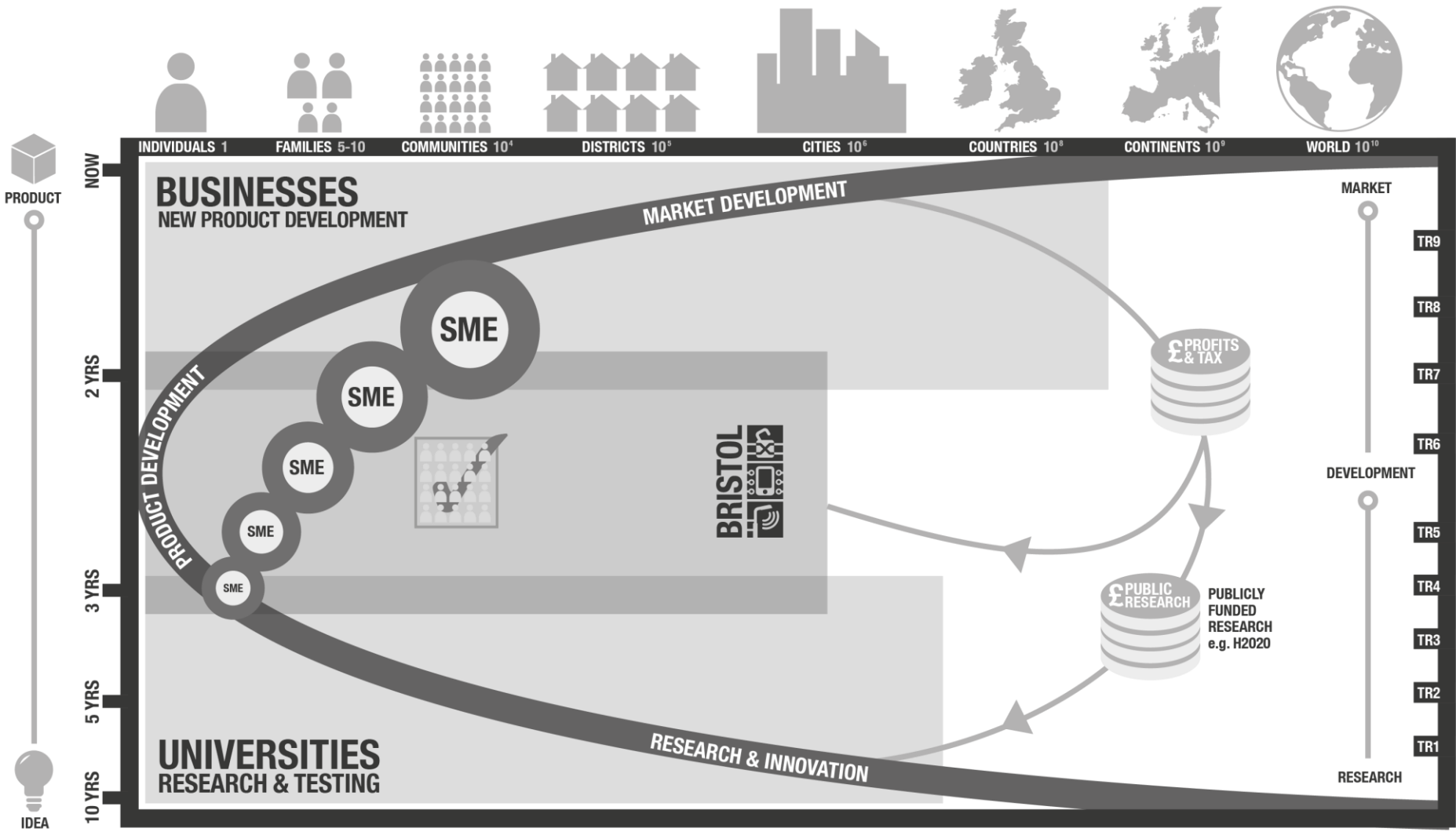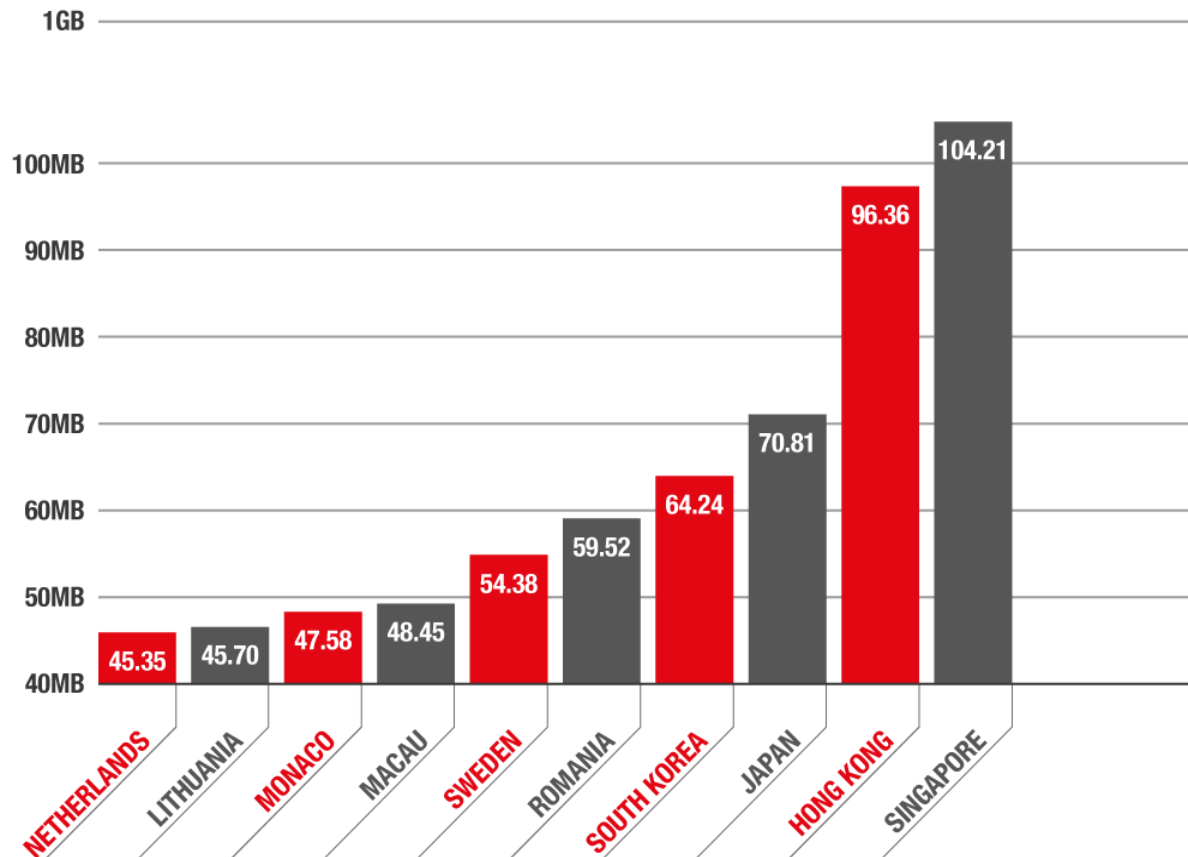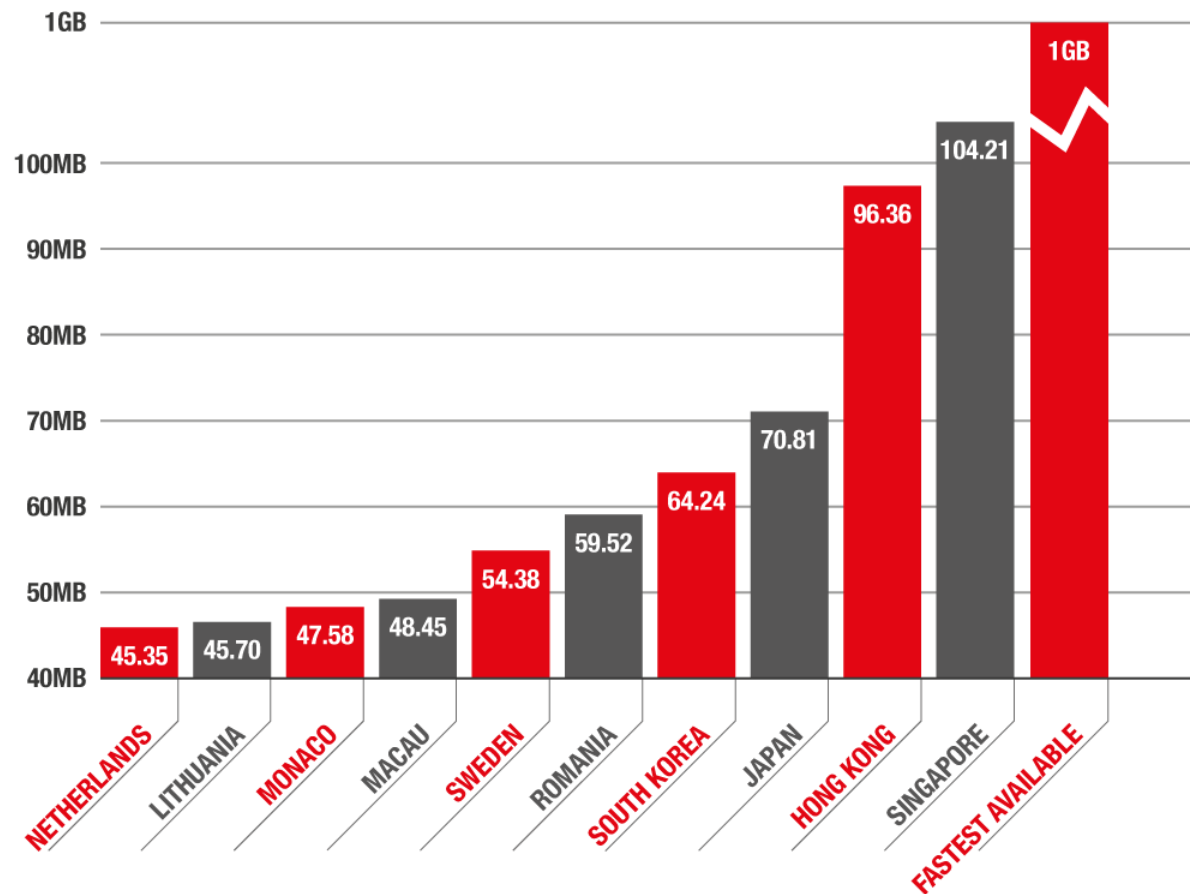
WE NEED:

A MASSIVE AMOUNT OF CONNECTIVITY

Top 10 Country Average Connection Rates

UK ranks 28th
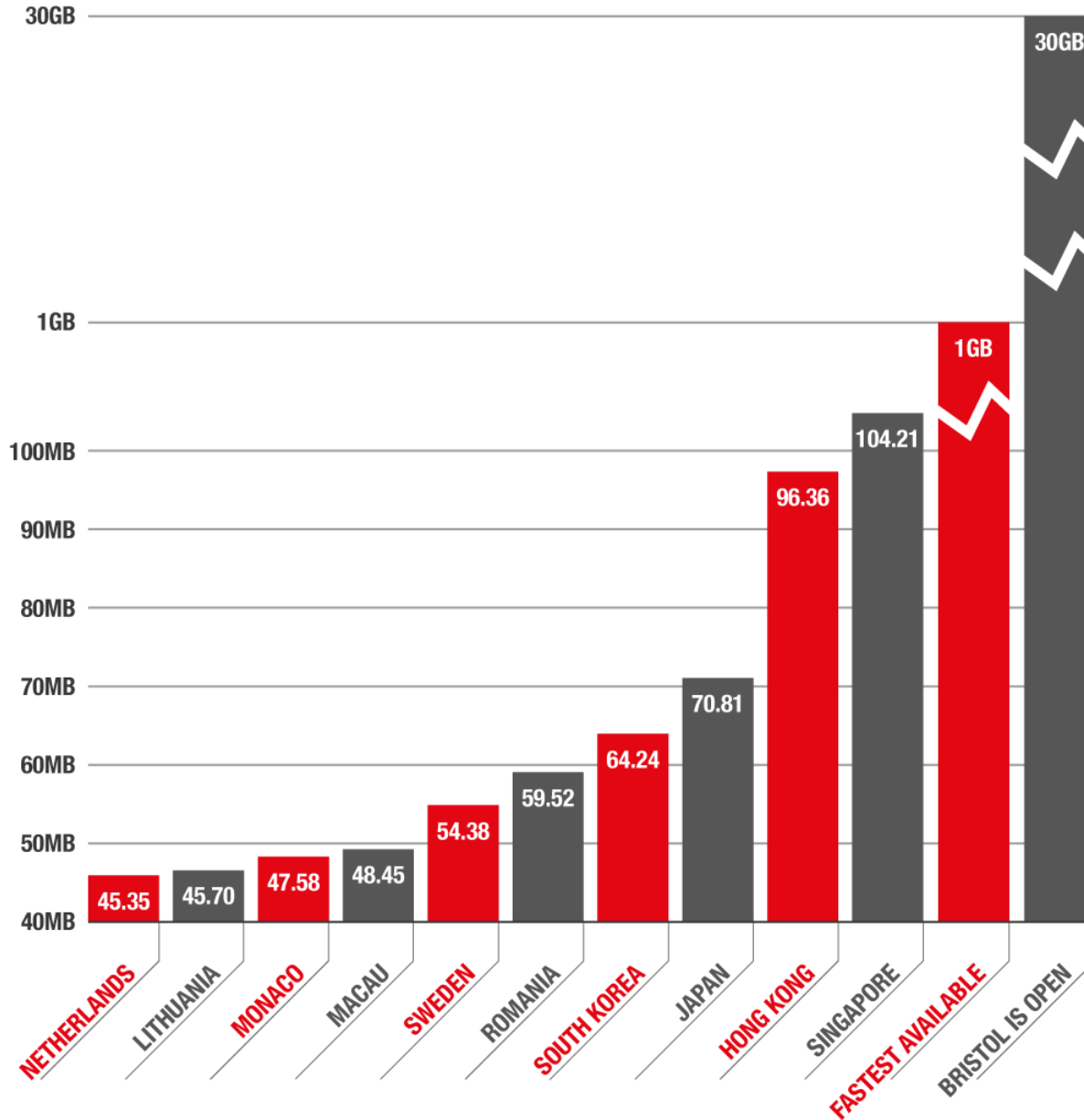with av. 29.4 Mb

Fastest Consumer Connection Rate in the World

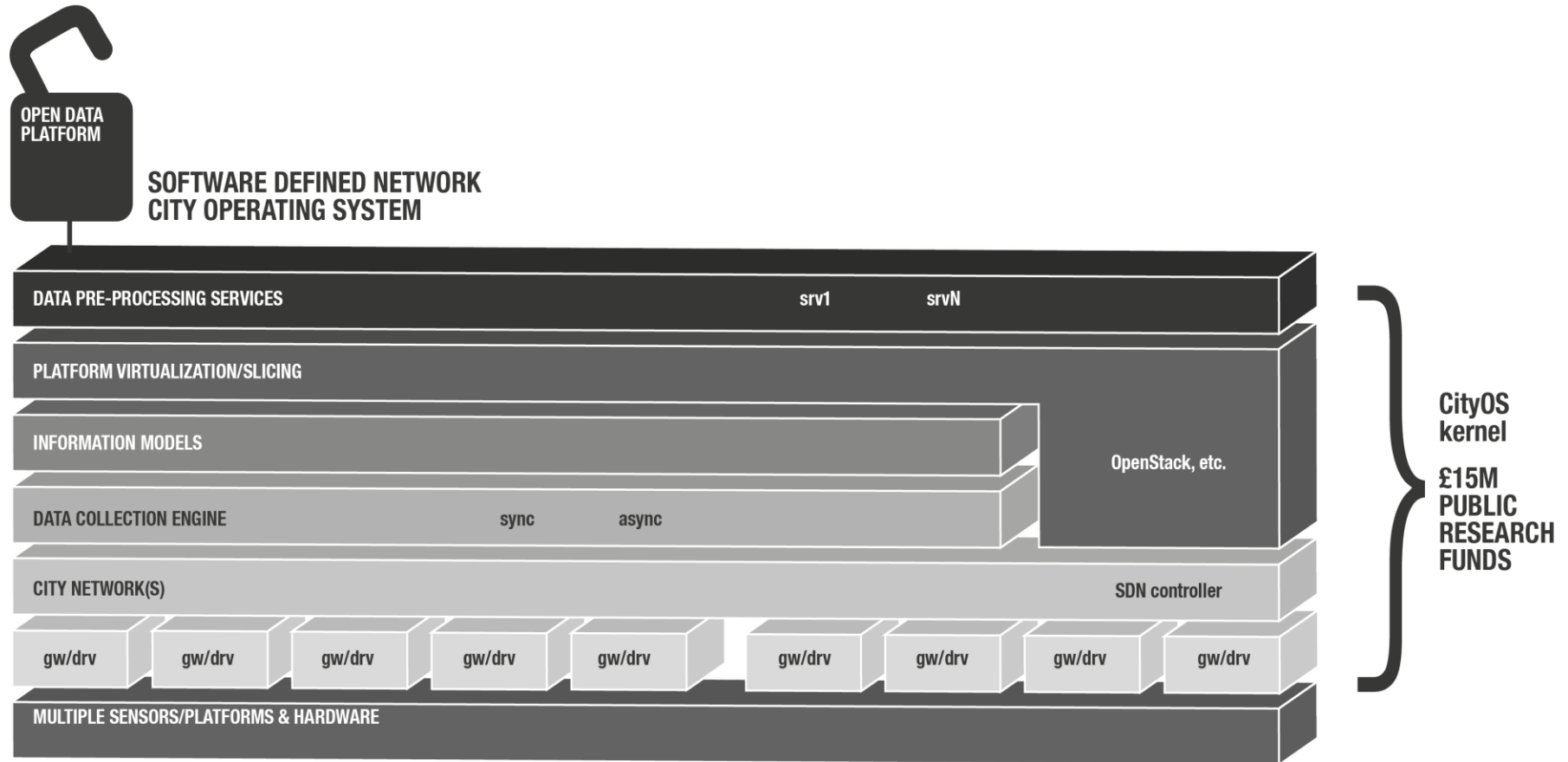South Korea offers 1Gb connection rate to consumers

The fastest consumer rate in the UK is 152Mb

Connectivity for R&D partners

>30Gb/s of connectivity For Bristol Is Open R&D Partners

CityOS: OpenFlow Software Defined Network using NFV

OPEN DATA PLATFORM

SOFTWARE DEFINED NETWORK
CITY OPERATING SYSTEM

DATA PRE-PROCESSING SERVICES · srv1 · srvN

PLATFORM VIRTUALIZATION/SLICING

INFORMATION MODELS

OpenStack, etc.

DATA COLLECTION ENGINE · sync · async

CITY NETWORK(S) · SDN controller

gw/drv · gw/drv · gw/drv · gw/drv · gw/drv · gw/drv · gw/drv · gw/drv · gw/drv

MULTIPLE SENSORS/PLATFORMS & HARDWARE

CityOS kernel

£15M PUBLIC RESEARCH FUNDS

WE NEED:

FLEXIBLE,
PROGRAMMABLE
INFRASTRUCTURE
FOR MULTI-USER
INTERNET OF THINGS

A city-scale digital research infrastructure with 144 core fibre
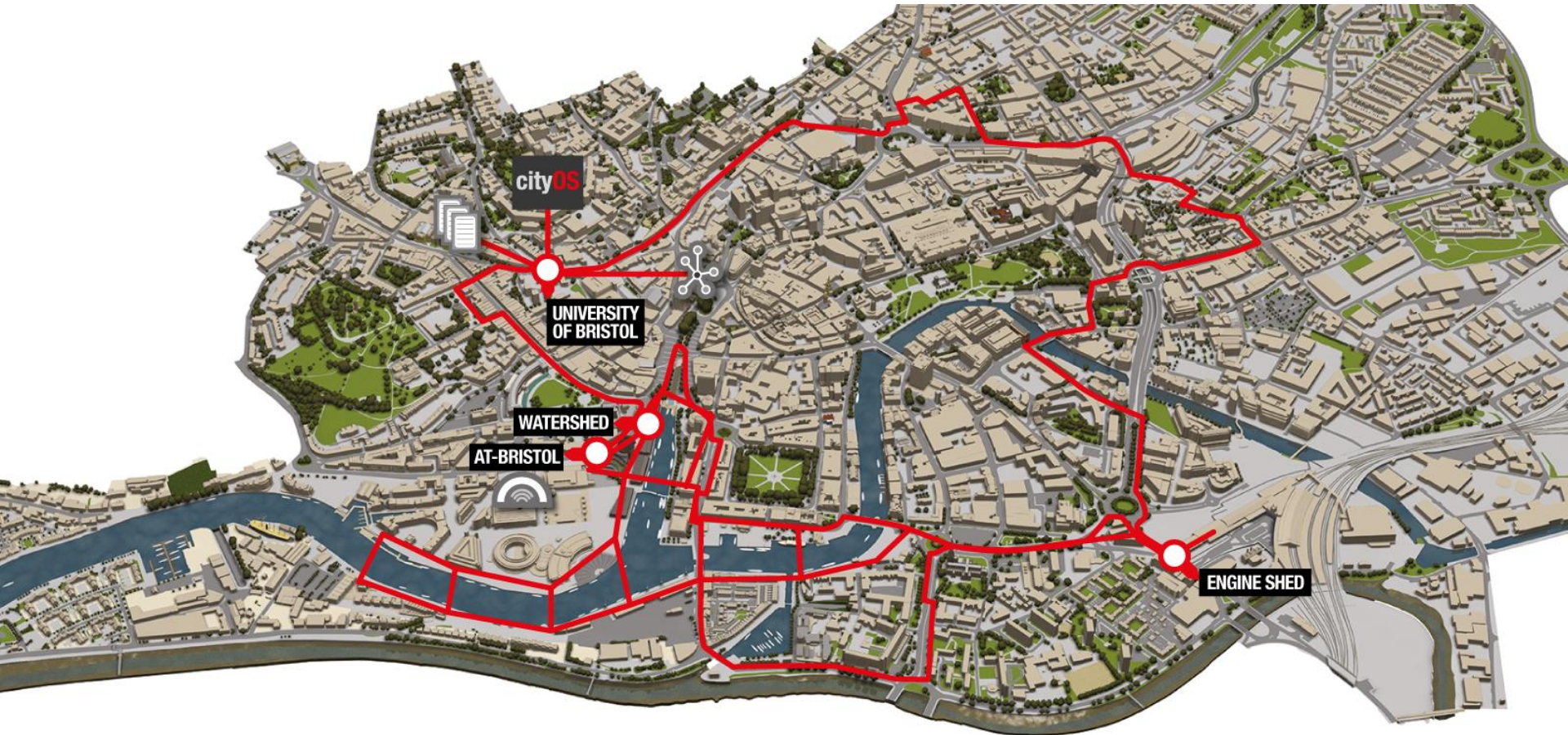
ACTIVE NETWORK

— Fibre network

🔴 Core network nodes with accessible rack space

⚛ Network emulator

📄 High performance computer

cityOS Software

📶 Data Dome

SDN Controlled Network
144 core fibre
30GB+ per second

Wireless connectivity: 3G, 4G, LTE & 5G Technologies
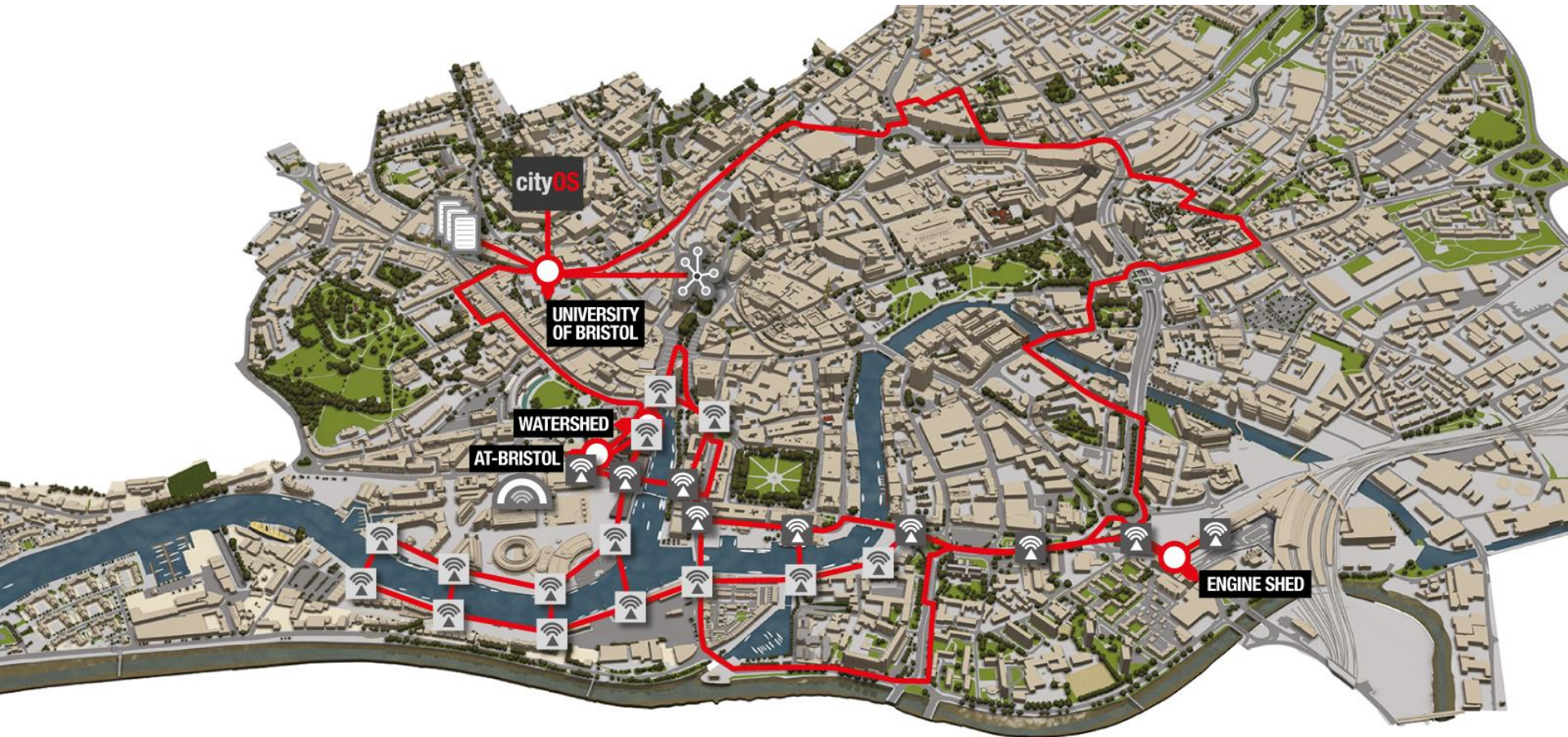
ACTIVE NETWORK

— Fibre network

Core network nodes with accessible rack space
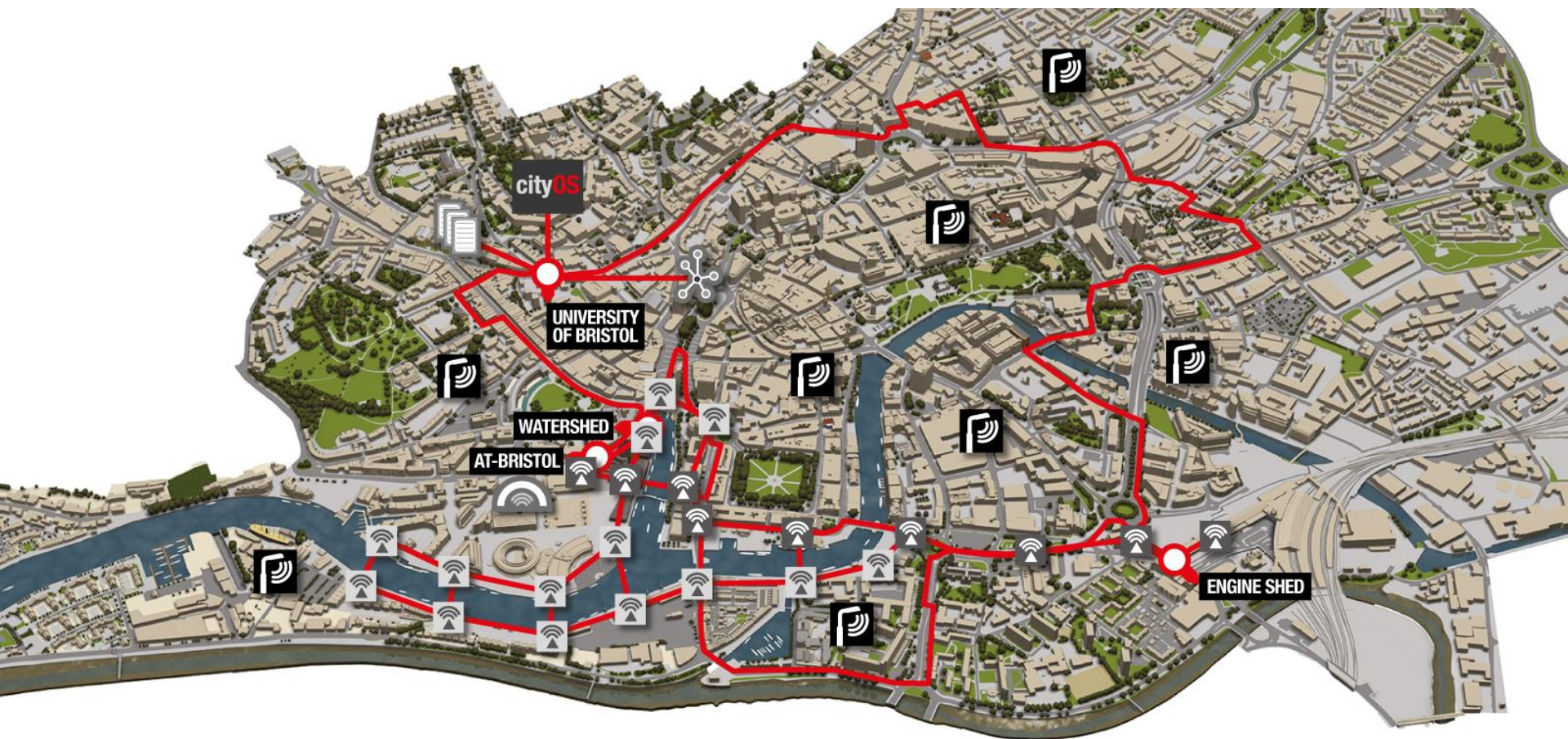
Network emulator

High performance computer

cityOS Software

Data Dome

WIRELESS NETWORK

Main hubs

'Sub-hubs'

3G, 4G, LTE & 5G Technologies
60GHz & Experimental wireless

Map labels: cityOS, UNIVERSITY OF BRISTOL, WATERSHED, AT-BRISTOL, ENGINE SHED

A mesh network IoT 'canopy of connectivity' across the city

ACTIVE NETWORK

— Fibre network

Core network nodes with accessible rack space

Network emulator

High performance computer

cityOS Software

Data Dome

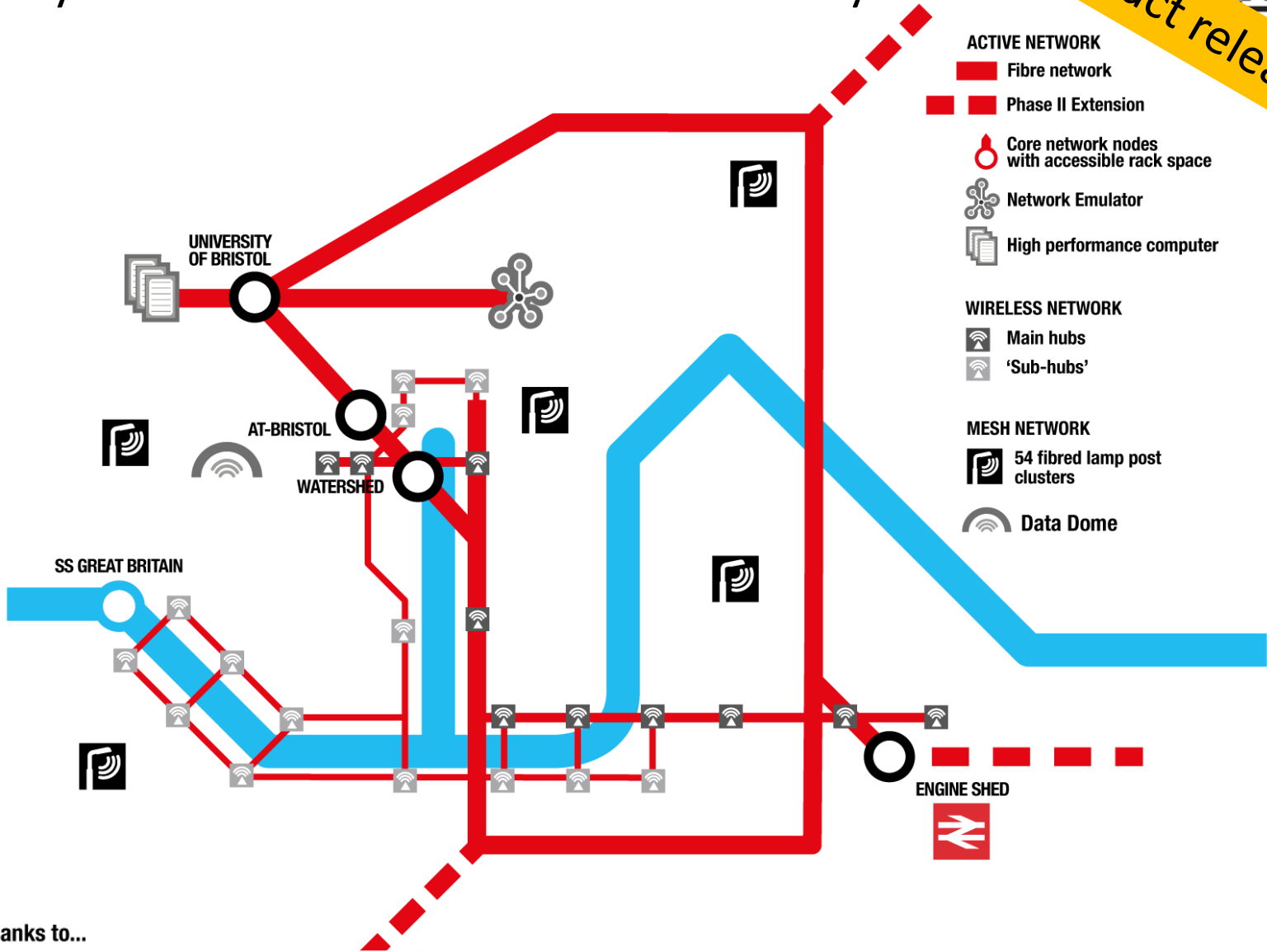**WIRELESS NETWORK**

Main hubs

'Sub-hubs'

3G, 4G, LTE & 5G Technologies
60GHz & Experimental wireless

RF MESH NETWORK

1,500 lamp posts

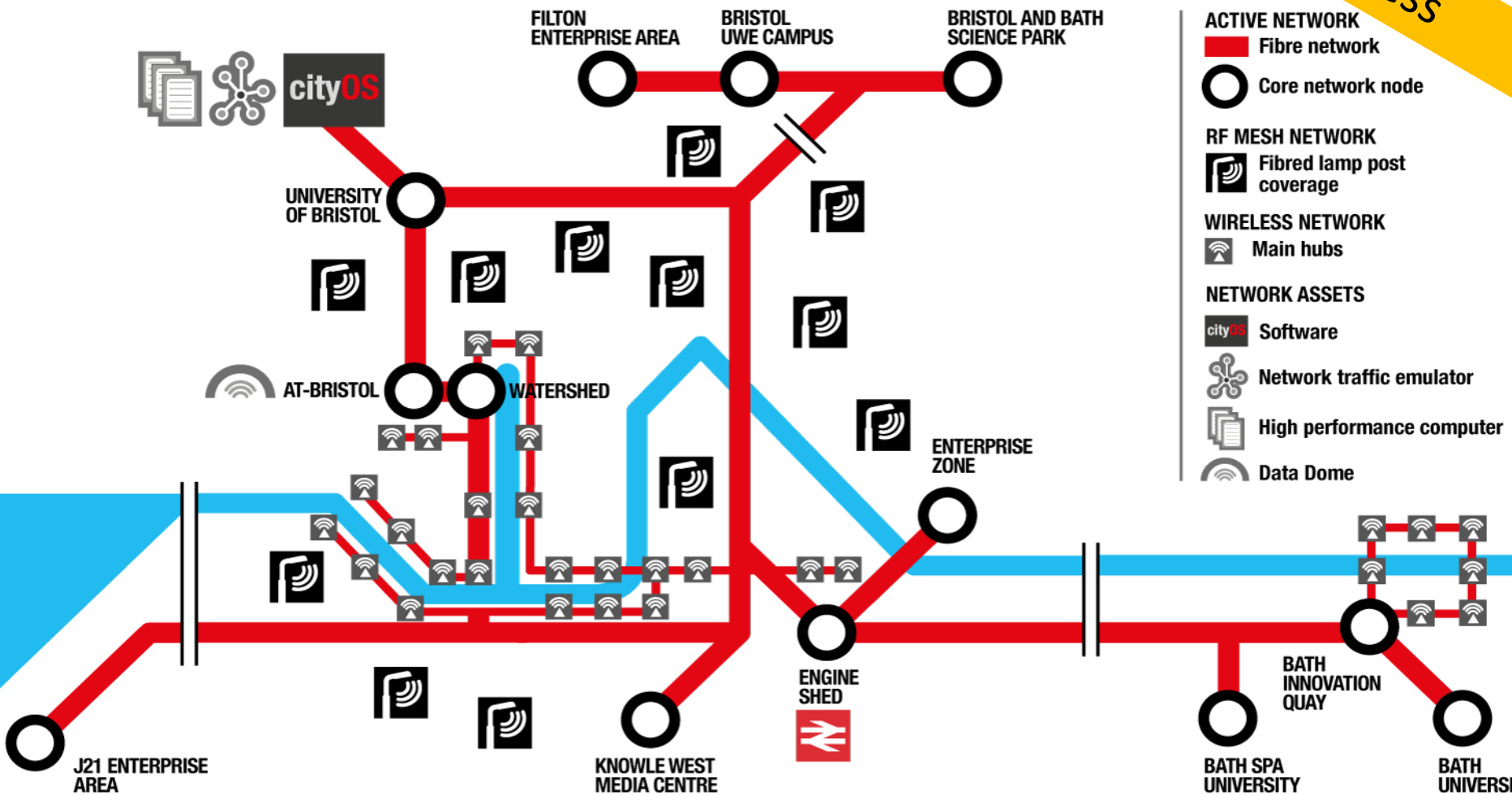# Deployed now – Product Release: Nov – July

Product release stage

ACTIVE NETWORK
- Fibre network
- Phase II Extension
- Core network nodes with accessible rack space
- Network Emulator
- High performance computer

WIRELESS NETWORK
- Main hubs
- 'Sub-hubs'

MESH NETWORK
- 54 fibred lamp post clusters
- Data Dome

UNIVERSITY OF BRISTOL

AT-BRISTOL

WATERSHED

SS GREAT BRITAIN

ENGINE SHED

With thanks to...

BLUWIRELESS   BROCADE   DELL   E&S   Finisar   IIT   GLOBAL HITECH   infivision   LASER 2000   MANTARO   Mellanox   NATIONAL INSTRUMENTS   NEC   PLDA   polatis   SilverSpring   zeetta NETWORKS

Phase II, wider City-Region, live in stages 2016-18

Work In Progress

ACTIVE NETWORK
Fibre network
Core network node

RF MESH NETWORK
Fibred lamp post coverage

WIRELESS NETWORK
Main hubs

NETWORK ASSETS
Software
Network traffic emulator
High performance computer
Data Dome

FILTON ENTERPRISE AREA
BRISTOL UWE CAMPUS
BRISTOL AND BATH SCIENCE PARK
UNIVERSITY OF BRISTOL
AT-BRISTOL
WATERSHED
ENTERPRISE ZONE
J21 ENTERPRISE AREA
KNOWLE WEST MEDIA CENTRE
ENGINE SHED
BATH INNOVATION QUAY
BATH SPA UNIVERSITY
BATH UNIVERSIT

IT NEEDS TO BE:

EASY FOR PEOPLE TO ENGAGE

Bristol Citizens' Sensor Box

Work in progress

- Architected

- Procured

- Assembled

- Installed

- Managed

- Maintained

BY CITIZENS

- 200 Open Data Sets now

- Transparent, Open Data

x

y

NODE ODI

Programmable FPGAs inside

Bristol Citizens' Sensor Box

Addressing Local and Global Issues

SME incubation,
Academic,
& Industrial Growth

_____

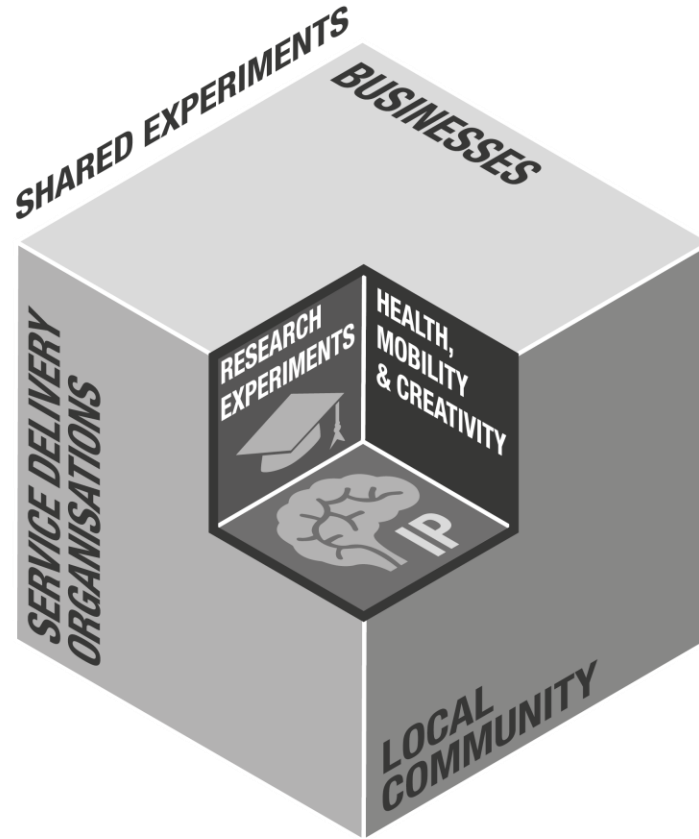Media, culture/fun
& digital design
content

_____

Health,
community &
energy

_____

Mobility/driverless
cars, congestion,
pollution, metrics
& city management

WE NEED:

INDUSTRIAL
PARTNERS
AND
OTHER CITIES...

Creating proprietary and collaborative intellectual property

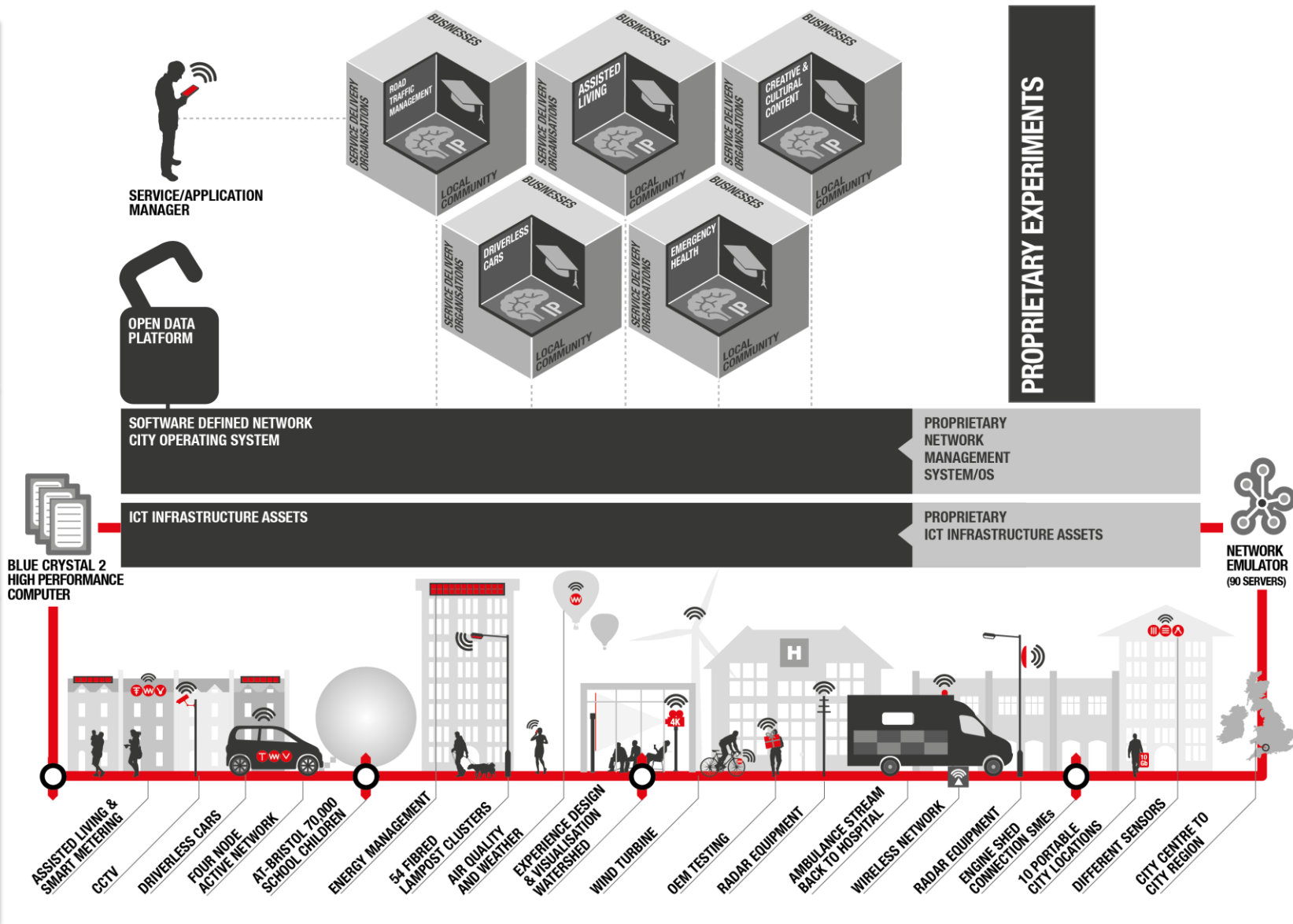# Co-locating is building an innovation cluster
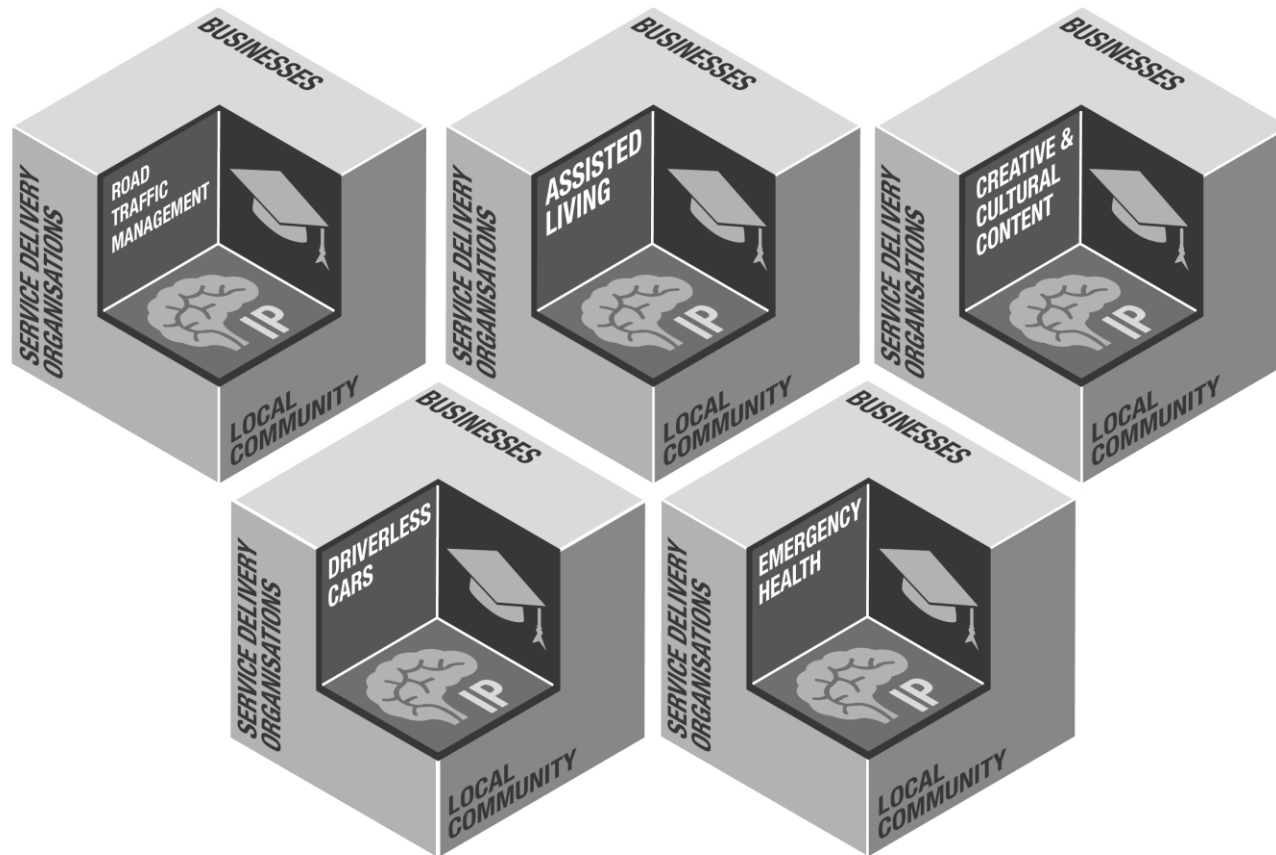
We provide: City-Experimentation-as-a-Service
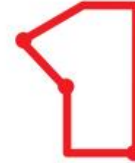

Algorithmic Decision Making

Innovative Data Transport

Data Harvesting & Programmable Infrastructure

£75m investment so far

	£m
DUCTING	11
NETWORK PHASE 1	4
NETWORK PHASE 2	14
SOFTWARE	6
SUPERCOMPUTER	3
NETWORK EMULATOR	2

HARDWARE/CAPITAL	40

RESEARCH FUNDS	£m
TOUCAN	15
NDFIS	10
PROBABLE	10

35	£75M (~$125M)

Long Term Partners and Pay-As-You-Go Innovators
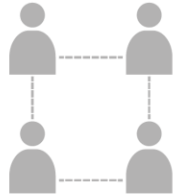
CURRENT RELATED PROJECTS IN BRISTOL:

DRIVERLESS CARS

ASSISTED LIVING HOUSES

AIR-QUALITY - CONGESTION - HEALTH

PLAYABLE CITIES

MEDIA DISTRIBUTION INNOVATION

MUNICIPAL ENERGY COMPANY

数字和创新

Bristol Is Open

Paul Wilson

Managing Director

bristolisopen.com/join