



The Smart City Guidelines for the Administrative Capital for Urban Development

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Definitions

#	Term	Description
1	CCC	Command and control center
2	COC	City operation center
3	IOT	Internet of things
4	ACUD	Administrative company for urban development company
5	ITS	Intelligent traffic system
6	BMS	Building management system
7	SAAS	Software as a service
8	IAAS	Infrastructure as a service
9	FTTx	Fiber to the (X)
10	FTTh	Fiber to the home
11	CCTV	Closed circuit TV
12	GIS	Geographical information system
13	GPON	Giga passive optical network
14	ONT	Optical network terminal
15	ONU	Optical network unit
16	RFID	Radio frequency identification
17	WAN	Wide area network
18	PS	Public Safety
19	AITR	ACUD infrastructure telecom room
20	NTRA	National telecom regulatory authority
21	NN	Network Node
22	LC	Low Current
23	ABF	Air Blown Fiber
24	CAD	Computer Aided Dispatching
25	FMS	Fleet Management System
26	GoE	Government Of Egypt

Introduction

In February 2016, H.E. President Abdelfatah Elsisi, President of Egypt announced a project to build the new capital of Egypt as “Smart City”. The purpose of the project is to extend the inhabitant area in Egypt and to enhance the quality of life of citizens by providing them with seamless services based on the latest technologies.

This project is to be achieved by focusing on a smart and interconnected infrastructure, integration of systems and inter-connecting of the departments and entities of GoE while engaging the private sector to participate in a digital transformation journey of the offered services. It's also important to highlight the expected role to be played by small and medium business to leverage innovation and introduce new business models that can lower the costs and ensure maximum efficiency.

The project pillars

Following H.E. President Abdelfatah Elsisi vision, The Administrative Capital for Urban Development company – ACUD – was initiated to design, build, implement and operate the new capital. The company identified the smart city initiative to focus on seven pillars:

- 1- Infrastructure
- 2- Security
- 3- Transportation
- 4- Urban Planning
- 5- Energy & water
- 6- Environment
- 7- Financial services

Key projects of the smart city initiative by ACUD

- CCC

The CCC – Command and Control Center – will be the main control building to monitor and manage the safety and security of citizens across the whole city, and to oversee any emergency situations.

- COC

The COC – City Operation Center- will be the main building to follow-up the process of the smart city initiative and will be used to manage all city services and monitor their KPIs. It will be the main management center to ensure the success of the smart city initiative across the whole city.

- CDC

The CDC – Capital data Center – will be the main datacenter in the new administrative capital and will be certified from Uptime Tier IV to achieve all the customer requirements inside the new administrative capital (IaaS, PaaS, ...etc.) and will not be allowed for any other entity or Developer to establish any datacenter or host the data generated from the city in another datacenter outside the CDC.

- Intelligent traffic

Live updates on traffic to ensure smooth and easy trips for all citizens and to manage traffic lights, emergency situations and road directions based on real-time information.

- Smart meters and smart grids

Smart meters will help citizens monitor and manage their power and water consumption in real time. With the smart grid to better monitor and utilize the usage of power and water and reduce wasted resources.

- Smart parking

The smart parking system will help citizens to easily find parking spots and facilitate the payments and reservation of available parking spaces.

- Electric car charging stations

The electric car charging stations will be built and distributed across the city to encourage the use of electric cars with the focus on saving the environment and reducing pollution.

- Smart cards

A unified card will be used to manage access control, digital identity and payments for all services as utilities, parking, transportation, etc. This will be integrated to a mobile wallet application to help citizens across the whole city.

- Triple play services

The citizens will have access to high speed internet connectivity, IPTV and VOD services provided by ACUD across the whole city.

- Health management services

All hospitals and clinics will be interconnected through a unified system to ensure the quality of health services offered to citizens across the whole city.

- Citizens services portals

The digitization of services using the latest technologies and provided citizens with easy to use mobile applications and web portals to manage all their services digitally.

- Public Wi-Fi

With focus on infrastructure and connectivity, free Wi-Fi will be provided in public areas to help citizens in business and governmental districts stay connected.

Purpose of the guidelines of the smart city initiative

The following guidelines was developed by ACUD in co-ordination and collaboration with all its partners and stakeholders. The aim of the guidelines is to ensure a unified delivery of the smart city initiative projects across the whole city. These guidelines are obligatory and must be followed by any contractor, sub-contractor, investor, developer, land owner and citizens. All the mentioned projects and services will be managed and operated through ACUD. This file and all the attached files are confidential and intended solely for the use of the entity to whom they are addressed. The information contained are considered highly confidential information and should not be disseminated, distributed or copied. If you are not the intended recipient you are notified that disclosing, copying, distributing or taking any action in reliance on the contents of this information is strictly prohibited.

The guidelines for the smart city infrastructure

This document is considered as general high level guideline to the design and implementation of smart and telecom infrastructure in the new capital to guarantee the deliverability and survivability for every smart service presented within the city.

The information provided in this section is to help the design consultants to accommodate the containments and cabling requirements for smart services into their project development designs. However, it shall not be considered as a design document.

The information provided is to assist the design consultants understand the type and nature of containment requirement for smart services in their project developments within the new capital and to ensure the accomplishment of the smart city initiative.

All projects designs and planning documents must include the smart and telecom infrastructure as a deliverable and they must be approved by ACUD through any of its delegated and partners. Thus, all documents related to smart and telecom infrastructure must be submitted to ACUD for review and verification before starting any implementation, knowing that ACUD will be responsible for end to end services across the new capital to ensure the proper implementation of the smart city initiative.

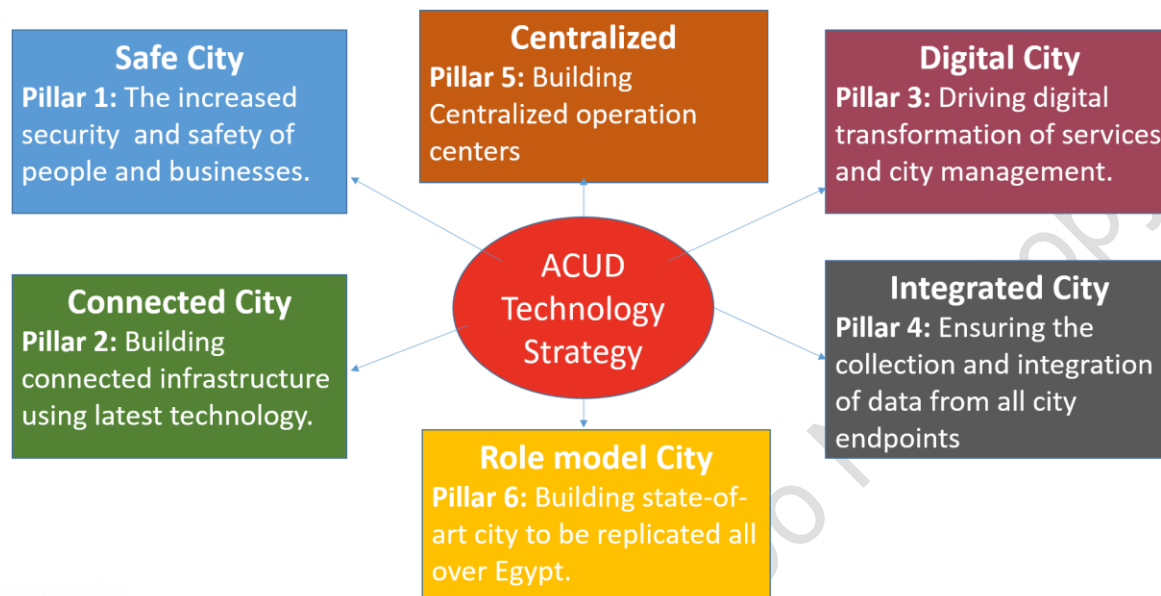
All designs must fulfil the standard guidelines and published guidelines for all items included in this document. The co-ordination of getting approvals from different stakeholders will be managed by ACUD including approvals if needed from MOI, NTRA, etc.

Main Components

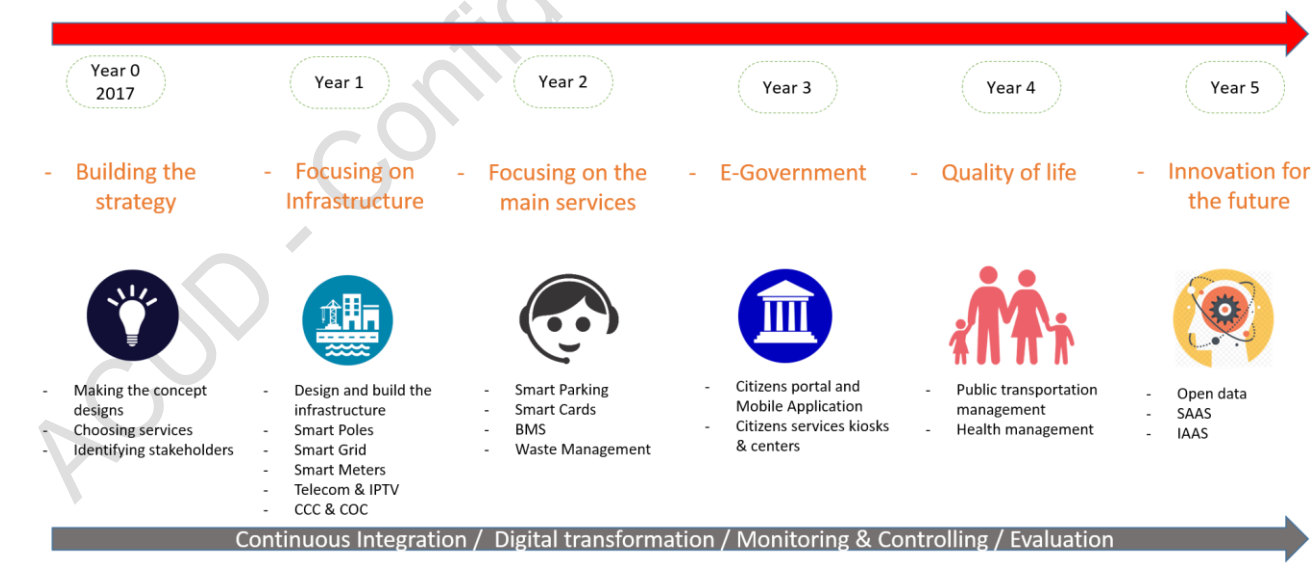
- ACUD Technology Strategy
- Planned Services
- Formation and data Model
- Smart Infrastructure
- Integration
- Connectivity
- Services Focal Point
- Requirements

ACUD Technology Strategy

Since the new capital of Egypt is the first smart city of its kind, ACUD had identified 6 pillars to focus on in regards to the smart city strategy as below:



In order to implement the mentioned strategy, the following roadmap has been developed for a five years plan to drive the activities of the technology and smart city projects.



Planned Services

The following section provides information about the planned services to be implemented across the new capital of Egypt with the restrictions and obligations that have to be considered by all stakeholders including investors, developers, sub-contractors and any entity participating in the development, construction and operation of the city. The planned services include:

- | | |
|---|---|
| 1- FTTx networks design & build | 13-Smart meters (Utilities Management) |
| 2- Data center services | 14-Mobile Tower sharing |
| 3- Smart pole services | 15-Building management system (BMS) |
| 4- CCTV systems | 16-Citizens Interaction portals |
| 5- Intelligent transportation system (ITS). | 17-Smart card |
| 6- Smart grid | 18-E-Health |
| 7- Smart parking | 19-E-Education |
| 8- Smart waste management | 20-E-payments (electronic cards and mobile wallets) |
| 9- public transportation management | 21-Digital advertisements and announcements |
| 10-Photovoltaic system | 22-Public safety services |
| 11-Smart irrigation system | |
| 12-Triple play | |

Smart Infrastructure

It is the telecom and information systems infrastructure responsible for delivering the services and applications management to the city, and consists of:

- Wired networks
- Wireless networks
- IoT devices
- Data warehousing and data analytics
- Systems and software applications related to infrastructure management
- Any activity (Civil – Power – architecture – Mechanical – etc.) related to the implementation of the smart infrastructure that may affect the service deliverability

Connectivity refers to any type of smart infrastructure connections required by the city operation center or service providers to connect the customer or the device to the COC/CCC to guarantee the service.

Connectivity Elements

1. ACUD Infrastructure Telecom Room

2. Network Nodes
3. Datacenters
4. FTTx Network
5. Wireless IoT / PS Network
6. Core optical transport Network

ACUD Infrastructure Telecom Room (AITR)

The AITR must be a standalone Room with dimensions at least 8m x 8m x 4m (W x D x H) including the raised floor or ceiling, dedicated for the termination of telecom fiber optic cables and to house telecom equipment, if needed, now or in the future.

Any complex should contain at least one AITR for each 50 Acres or less and on each connection point to the city for spaces more than 50 Acres depending on each Area's planning.

This Room should follow the NTRA Guidelines for Telecom rooms for the following:

- Safety considerations
- General specifications
- Environmental considerations
- Electro-Mechanical Requirements for MTR
- Telecom Rooms Specifications for MTR
- Pathways and output

To guarantee the proper connectivity ACUD infrastructure telecom Room must be available on premises where ACUD or its technicians can access anytime. And it will act as the distribution for the Campus network.

Network Nodes (NN)

The NN is the communication center and the distribution/termination point for FTTx networks in the city, the city contains 6 NN in phase one, each of them is serving specific geolocations that guarantees the service deliverability. All NNs are protected on all levels of hardware and LC redundancy to guarantee service survivability.

FTTx Network

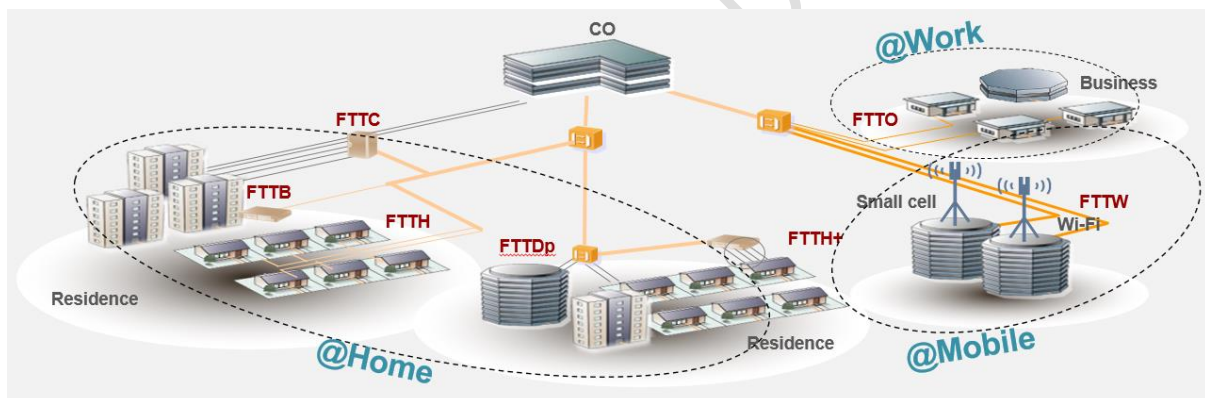
The FTTx network is the optical fiber network responsible for the connection of the fiber cables to (Homes, Offices, Building, Area, etc..), the fixed network solution architecture is to be FTTx and it must support GPON or 10G PON architectures. Optical fiber cables infrastructure design will be based on Air Blown Fiber (ABF)

installation technique in order to minimize the installation time and cost. The utilization rate of the micro-duct bundles used in ABF network is 50 %. (100 % spare capacity per micro-duct bundle). All FTTx network designs must be approved by ACUD before the start of installation.

A detailed Concept design for the design procedures will be handed over in case the developer will design on his own.

The main function of the FTTx network is to connect all city components and endpoints to the NN. The main city components can be any of the below:

- | | |
|--|---|
| 1- Residential (triple Play – Smart Meters - BMS) | 6- Administrative and Mixed Use Buildings |
| 2- IoT sensors | 7- Main Roads |
| 3- Smart Poles | 8- Enterprises (SME – Corporates) |
| 4- Public Areas and services areas | 9- Development Areas |
| 5- Public transportation stations (Bus – Taxi – train) | 10- Malls – Clubs |
| | 11- Schools & Universities |
| | 12- Mobile networks |



The city has 2 networks:

- QPN: quarto play network which is responsible for the connectivity of:
 - o Internet
 - o Mobile
 - o Fixed lines
 - o IPTV
 - o Public WiFi
- SSN: smart & security network which is responsible for the internal network internet isolated for the internal connectivity for:
 - o Smart services (metering - grid control – lighting control – digital signage – parking management – BMS - etc.)
 - o Security services (ITS – CCTV – access control - etc.)
 - o outdoor elements (Smart poles - Bus station - etc)

All Networks must be ring protected on distribution level (2: N splitters) from NN to Fiber Distribution Terminal from two different paths.

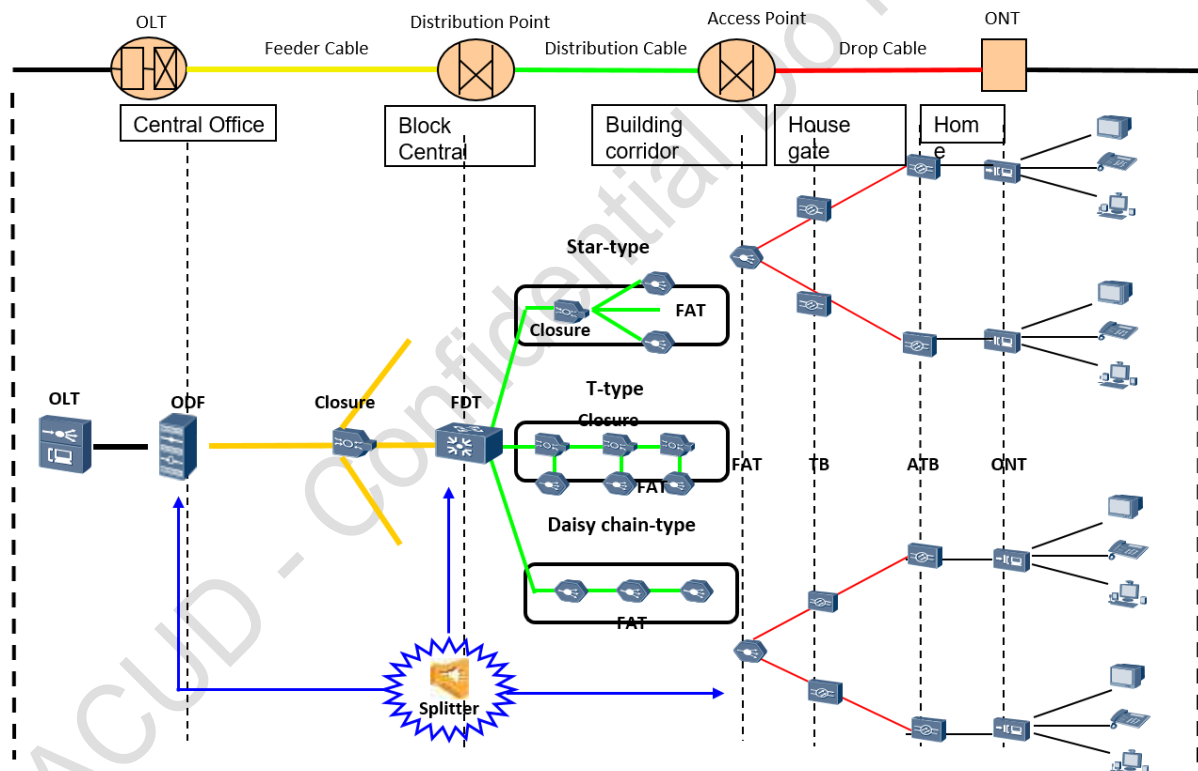
The design and implementation of the FTTx networks has 2 Main stages:

1) The civil work is divided into the following items:

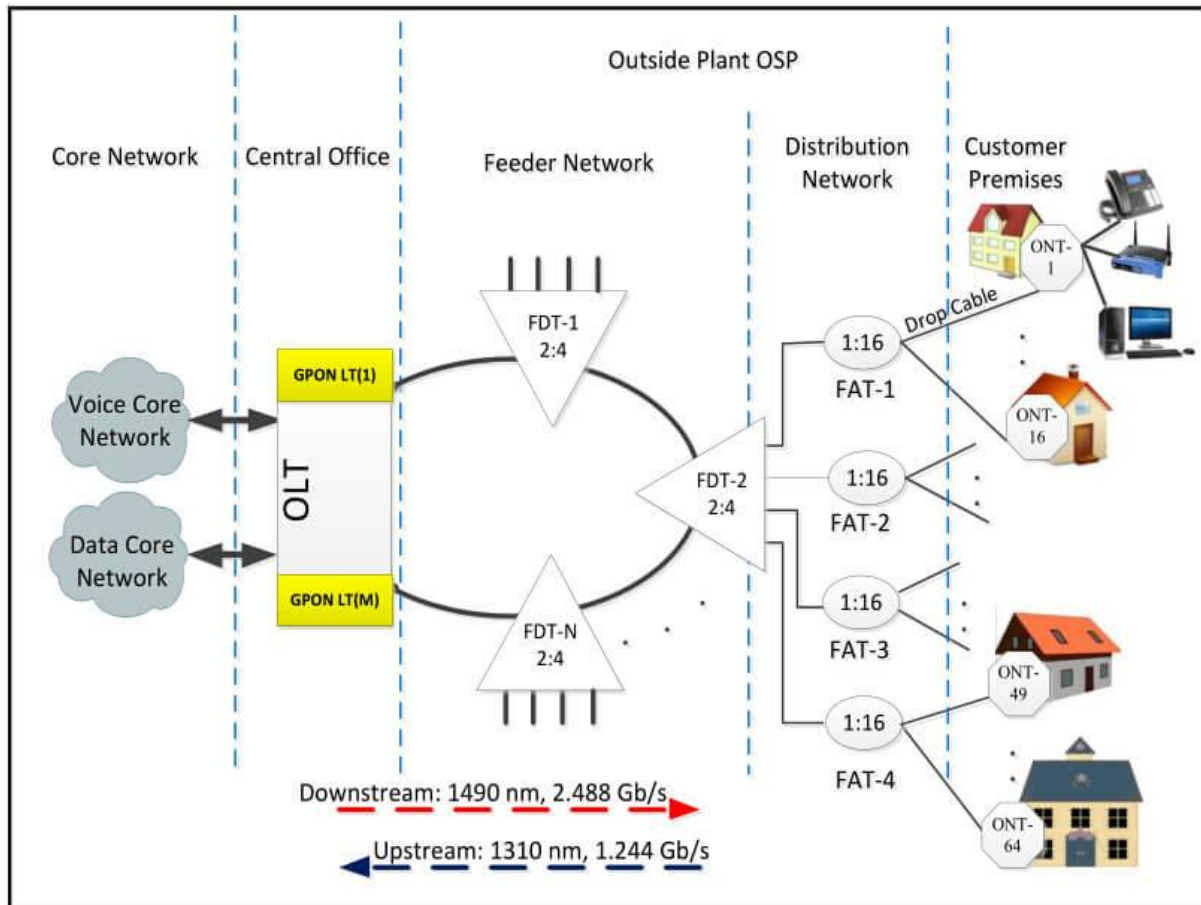
- Primary duct lines.
- Secondary duct lines.
- Trenches.
- Manholes & hand holes.

2) Optical Distribution Network (between OLT and ONT) is composed of 5 parts:

- Feeder Optical Cable,
- Distribution Point,
- Distribution Optical Cable,
- Access Point
- Drop Cable.



Basic Structure of ODN Network (Logic Diagram)



IOT Sensors

The IOT sensors are the main components of any smart city for data collection and monitoring, in the new capital we have different types of sensors including:

- Infrastructure management sensors: (MH- HH –FDT- FAT)
- Water management sensors (Leakage – Flow control – Usage / misuse)
- Water Quality sensors
- Electricity management sensors (theft – Flow control – Usage / misuse)
- Gas Management sensors (Leakage – Flow control – Usage / misuse)
- Environmental sensors (CO2 emissions – Noise - Temperature – Humidity – Rains)
- Waste management sensors
- Parking management sensors
- Motion sensors (Crowds)
- ITS and traffic sensors
- Building management system sensors (Fire alarm, ...)

Public Safety Units

All public safety fixed units must be connected through the security network to the Command and Control Center (CCC) to satisfy the security needs for the cities. All public safety network must be isolated from any external interface with the internet. All wired / wireless networks related to the CAD of any PS unit will be provided by ACUD committee.

Services Focal Points

ACUD provides an optional service of designing the FTTx network for any complex scenario including the needed approvals from NTRA and Ministry of interior. ACUD provides an optional service of implementing fiber networks through ACUD partners for security and license purposes and digging permits. The Connectivity with NN & DC will be by case.

Datacenter Services

The city has cloud datacenter that will host all data generated and applications in the city (cloud services – IoT – hosting – CCTV – smart applications – etc.)

The datacenter will provide the below services:

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)
- Virtual Private Cloud (V.P.C)
- Virtual private Server (V.P.S)
- Managed Hosting (In special Cases)

Smart Poles

All smart poles controller and backend systems must be compatible with COC management platform in order to control all services from the COC main platform. All the components of the smart poles must be directly integrated through the IOT platform. The smart poles must be connected to centralized Uninterruptible Power Supply units (UPS's) to guarantee the cameras' service continuity. Smart poles applications can be implemented on more than one phase but the pole must be designed to fulfill the full requirement. The smart poles will be connected through the related FTTx networks depending on the services provided on the pole. Each smart pole must control a number of normal poles considered as slaves to guarantee the programmability of the LED lights preferably over PLC. All slave poles LED lights drivers must be DALI and compatible with the smart pole control units. The Controller will be centralized in the OLDP and The distance between the OLDP and The farthest lighting spot will be 280m and then extender will be needed

The smart poles designs and interoperability matrix must be approved by ACUD before the start of the installation and should be considering the below:

Component	Weight per unit	Height	Quantity	Power per unit	Mounting	Notes
Camera	12 Kg	5 m	4	120 Watt	Required	May need 4 cameras on same pole
Digital Signage	50 kg	3.5 m	1	1000 Watt	Required	
Public Address	10 kg	5 m	1	50 Watt	Required	
Microcell (with antenna)	33 kg	8 m (Top of pole)	1	20 Watt	Required	
Wifi access point	5 kg	6 m	1	30 Watt	Required	
Main cabinet	15 kg	0 m	1	500 Watt (for ONT & IOT gateway)	Required	should be 60 cm diameter should support ventilation IP67 cabinet Include access control and sensor to detect if opened should be decorated
LED Luminaire	20 kg	7.5 m (just below the top)	2		Required	May need 2 light arms
Wind speed	140 km / hr					
Pole height	Similar to surrounding poles					
Cabling	All cabling must be internal inside the pole, no external cabling is allowed. Electrical trays should be separated from telecom trays					
Total equipment load	Smart pole should support up to 300 kg of equipment load					
Connectivity	Smart pole should have the capability to incorporate backhaul for connectivity over optical fiber					
Protection	The smart pole should withstand partial flooding on the ground level					
Light arms	Smart pole should be able to support 1 light arm or 2 lights arms					
Minimum lifetime	The minimum lifetime requirement of the pole is 15 years with 2 years free of preventive maintenance					
Scalability	Smart pole should be able to cater to the space, power and functionalities of environmental sensors and EV charging as and when required					
UPS Requirement	The UPS cable should be connected to the ONT. Only the CCTV cameras use POE.					

Triple Play Service

All buildings must follow the NTRA Guidelines for residential and administrative offices Civil specification to guarantee service deliverability. The Triple play services will be provided by the City Operation Center (COC) through one service provider or more depending on ACUD business model. Indoor ONT must have a secure location inside the apartments far from any heating source. Internal cabling system must be designed in a way that guarantees all service deliverability from the ONT.

No satellites receivers are allowed on the building roof tops or indoors. Additionally, no dish farms are allowed to be built and installed by any of the developers or land owners, only one main dish farm will be built by ACUD and provides B2C and B2B services to all the new capital inhabitants.

CCTV System

All CCTV system must follow the requirements of the ministry of Interiors guidelines for visual surveillance to guarantee the fulfillment of security and safety. All CCTV cameras VMS must be compatible with CCC platforms. CCC must have an access for all indoor cameras for any facility with bandwidth equivalent to at least 20% at a time to control any incident or situation. CCC must have an access for locally hosted outdoor cameras related to compounds and BMS at any time with bandwidth equivalent to at least 10% at a time to control any incident or situation.

(Authorization will be obtained from an Authorized person depending on the facility type and its sensitivity).

Utilities Management

All utilities meters must be smart meters, connected to and controlled by the COC through the utility network. All smart meters are integrated with the COC management platform through a universal headend system. The procurement of the smart meters are the responsibility of ACUD and citizens will purchase their meters for installation and activation from ACUD. The smart meters should send different types of information including:

- Detailed usage information
- Monitoring data
- Alarms
- Pricing information
- Pre-pay information
- disconnect/reconnect instruction

The electricity smart meters will support working on two different connectivity channels (PLC, RS485), while the gas and water meters will support working on (mBus, RS485). A typical scenario is for the gas and water meters to be connected directly through mBus over the electricity meter of the apartment. All electricity

meters are then connected together back to the COC. Therefore, in order to easily install and maintain the smart meters, it is the responsibility of the developer to follow the below requirements in the design and construction of the compound.

For multi-storey buildings:

- Conduit with not less than 25 mm should be connected between the gas meter, water meter and electricity meter of each apartment.
- Conduit with not less than 25 mm should be connected between electricity meters of the apartments in each floor.
- Conduit with not less than 25 mm should be connected between electricity meters and telecom riser in each floor.

For single villas:

- Conduit with not less than 25 mm should be connected between the gas meter, water meter and electricity meter.
- Conduit with not less than 25 mm should be connected between electricity, water and gas meters and telecom room.

For the location of the meters, it should follow the below:

- Electricity, water and gas meter on each apartment.
- Additional electricity meter for the elevator and services of the building.
- One electricity, water and gas meter for the single villas.

The tower sharing mobile network

The location of the towers will be provided by ACUD according to the Tower planning team and all developers will be obligated to fulfill the requirement to ensure the mobile coverage. The design of the mobile network towers is based on the model of sharing of the tower among different operators (the same tower with the same connection points between different service providers). The coverage will depend on towers installed in the main squares and micro cells on the smart poles between buildings and in main streets. The tower will take into consideration the architecture design of the city.

All mobile stations will be connected based on FTTx (using different technologies) not Microwave links. And the tower will be designed to accommodate the 4 operators with full configuration.

No permanent towers are allowed to be built in the new administrative capital without ACUD approval and only COWs are allowed in the development phase.

ACUD reserve the right to establish a tower or DAS over the roof tops of All the Administrative and mixed use buildings (Government – Banks – Malls - etc.) if needed due to the architecture design of the city or any special Cases.

Public transportation management

All Fleets including buses, trains and taxis must be equipped with a compatible FMS with COC management platforms which will be managed and operated by ACUD. All Bus, Train & Taxi stations must have the FTTx connectivity for below services:

- Digital Information signage (Buses No. - Routes - timing)
- Digital advertisement signage
- Public Wi-Fi
- Mobile Micro cell
- Cameras
- RFID Recognizer
- IoT Gateway for wireless sensors

All components must be shared and approved by ACUD before the installation of any stations.

Photovoltaic system

The system is to be On-Grid PV System connected to the low voltage side of the distribution substations of the project buildings. 50% of the roof top of each building must be reserved for PV system. All risers and pass-ways in buildings and to the main grid must be designed and implemented (even if the PV system is implemented at a later stage)

The system must be equipped with smart metering system connected to COC as described in the utilities management section. No batteries are required due to the high cost and inefficiencies of batteries.

- **Scope of Works:**

The work covered by this specification includes furnishing, delivering, receiving at site, unloading, storing, installing, testing, startup, commissioning, placing into operation including PV modules, inverters, wiring, combiner box(es), mounting structure, monitoring system cabling, switching devices and grounding for at least 50% of the roof area of the governmental, residential, administration and commercial buildings located in the new capital.

PV system shall feed AC power into the main distribution panel of the building, when solar energy is available and shall immediately disconnect from the grid upon loss of grid power.

Dust control materials must be applied to minimize soiling losses on PV system performance. Use only dust control mixtures specifically designed for PV systems. Dust control materials coating life shall be not less than 5 years. Contractor shall provide bird barriers (spikes) to prevent birds from roosting on and soiling modules.

All equipment supplied shall function properly under site conditions, e.g. ambient temperature, wind, humidity and seismic loads. The photovoltaic system shall include, but not limited to the following:

- A. Photovoltaic modules
- B. Inverter(s)
- C. Combiner box(es)
- D. DC cables and raceways
- E. Modules mounting system including supporting steel
- F. Grounding system
- G. Monitoring System

All system components must be included in the design (spaces, pass-ways, connectivity, etc.) regardless of the implementation phase. All designs must be approved by ACUD before the start of implementation.

BMS Services

All CCTV and access control systems must follow the ministry of interiors guidelines for security to guarantee the fulfillment of security and safety requirements. The main mechanical and electrical systems serving the building shall be connected to the Building Management System (BMS) main platform.

Unified software platform must be provided for all security functions and can be located either on premises or in COC datacenter but it must be managed and controlled by the COC management platform.

Also ACUD will provide an iBMS system as a service for all developers from the CDC datacenter, similar to the system used in the city.

The electrical systems / installations shall be equipped with the required interfaces in a way to be, at least, remotely monitored by the BMS system. All BMS system components must be connected to UPS to cater for critical cases.

All in-building drawings must be submitted to ACUD to be approved before the start of construction of any of the building.

BMS system modules includes the following items but can vary based on the building type:

- Smart control system for lighting fixtures and elevators.
- IP vidéo surveillance system (CCTV)
- IP access control system
- Fire detection and alarm system according to international life safety standards.
- Parking gate's control system.
- Energy conservation and efficiency
- Voice evacuation system (Optional)

- Monitoring & control system for building electrical network.

The lighting control components include:

- occupancy sensors
- Dimming system
- LED lighting fixtures in all spaces.
- Self-contained emergency lighting fixtures
- Lighting of outdoor and landscaping areas.
- Local switches are to be provided

The integration between buildings is a must and should consider the following points:

- The IP video surveillance system must be fully integrated with the security & access control System utilizing unified security platform, all building security systems shall be controlled & monitored from single graphical user interface.
- The IP video surveillance system as a part of the building security systems shall be monitored by the Building Management System.
- The IP video surveillance system as a part of the building security systems shall be interfaced with the fire alarm & voice evacuation system, this shall provide automatic recall of camera(s) / preset related to the area under fire alarm condition to a pre-defined screen.

BMS Integration with the CCC and the COC

Central control software provided by developers must be open for Integration, remote monitoring and control of the various systems at any administrative buildings from the CCC and the COC buildings over the utility network. This shall include the following sub systems:

- 1- Fire alarm & voice evacuation system
- 2- Building management system
- 3- Security and access control system
- 4- Video surveillance system

The Building Contractor shall be fully responsible for the following:

- 1- Coordinate with the central command control software supplier.
- 2- Provide all needed hardware, software, and licenses for full building systems integration, remote monitoring & control from the central command control / command operation center software over the utility network and via open protocols. Building systems that do not provide open APIs and protocols for integration, remote monitoring & control shall not be accepted.

Building Contractor must ensure that all licenses provided for the integration don't need any renewable fee.

Smart Grid

All utility lines (Water – Electricity – Gas – Sanitary – Rain drainage - Irrigation system) must be designed based on the smart utility codes for smart cities and integrated to COC. The whole grid must be controllable and manageable from the COC management platform. All Grid components (Meters, Transformers, distributors, Valves, etc..) must have connectivity for monitoring and controlling and must be compatible with COC management platforms

The utility systems can be either connected through wireless or wired network through City IoT platform. However, the specifications of the devices and network protocols used must be submitted to ACUD for approval along with the grid design.

Fixed Ultrasonic Flow meter

General

1. Measurement method: Ultrasonic Flow Meter Using Transit time and (Doppler or Hybrid Trek or Reflex or flight) method.
2. Measuring range: 0.01 m/s to 12 m/s.
3. Accuracy : $\pm 0.5\%$: 1% from measured Value (with field calibration).
4. Power Input : 220-230 VAC 50Hz with Electric Surge Protection.
5. Communication : Serial Interface (RS 485/RS232) TO USB.
6. Temperature (operation/storage): 0° C to + 60° C.
7. Output Current : 4-20 mA.
8. Degree of Protection: Not Less than IP68 for Transducer.
9. Display: LCD.
10. Pipe Size Suitable : 100mm to 1200mm.
11. Protection Degree for Controller : IP 65
12. Pipeline Type: work with all types of pipelines including Iron, Plastic, cement, and GRP pipes.
13. Data logger not less than 500000 reading
14. Measuring and Display Instantaneous Flow Rate and Totalized Flow together.
15. Easy installation. Clamp on
16. Original download data software in excel format , cable data
17. transmitter should have 2 relay outputs
18. complete numeric keypad

Flow meter are including (Transmitter, Transducer, and Programing Kit)

Quantity and unit of measurement

1. Common unit both Metric and Imperial (m³/s , m³/h , m³/min , L/h , L/min , L/s)
2. Flow Rate: m³/h.
3. Flow Velocity: m/s.

Supply and installation of pressure sensor according to the following specifications:

1. Robust design and stainless steel sensor
2. Accuracy : 0.5% FSO
3. Ambient temperature. -10 °C : 50°C
4. Nominal pressure 0: 10 bar
5. Output. 4:20 ma
6. IP protection : IP 65
7. Supply voltage: 9...35V DC or 220 VAC

ACTUATORS**General**

Actuators shall be designed for valve operation to ensure proper function in accordance to EN 15714-2:2010 electric actuators for industrial valves - basic requirements. Depending on application actuators shall be designed for ON-OFF, short-time duty (S2-15min) respectively Class A and B according to EN 15714-2 or MODULATING, intermittent duty (S4-25%) respectively Class C with up to 1.200 starts per hour; no. of starts depending on actuator size and output speed.

Actuator shall have a design life of 10.000 OPEN-CLOSE-OPEN cycles, each consisting of 30 turns per sense of rotation and must be suitable for operating in any mounting position. Actuator design must provide simple setting, testing, maintenance and repair.

Actuator settings shall be performed non-intrusive via push buttons at motor control without special tools or instruments (e.g., battery backed setting tool). A wireless Bluetooth interface shall be available. Microsoft Windows based software running on a conventional computer shall be available to allow actuator set-up and diagnoses.

Electrical connection of actuators to be multi pin plug and socket connector, allowing quick disconnection in case of maintenance or repair. In order to prevent loss of screws during commissioning or maintenance, all covers shall be fixed with captive screws. In order to minimize the amount of spare parts required, parts such as covers, plug and sockets, parts must be interchangeable throughout all model sizes.

Torque-transmitting housings must be made of cast iron, except motor housing. No plastic parts of any type shall be used, except for electric / electronic components, operating knobs/levers, indicator mechanism and sealing elements as far as applicable.

Depending on valve application, actuators shall be self-locking. Self-locking shall remain active if actuator is switched to hand-operation-mode. For non-self-locking actuators with high output speeds a mechanical anti-back drive device shall be provided attached to the actuator.

Valve mounting dimensions shall be according to ISO 5210 with use of a plug sleeve connection adapting to valve shaft. For rising stem applications, actuator design must allow actuator removal from output drive without disturbing the valve function.

Electric motors

Motors must be suitable for operating at 3 phase power supply voltage of 415 Volt AC (+/- 10 %), 50 Hz (+/- 2 %) and shall be specifically designed for valve-actuator operation, characterized by high starting torque, low stall torque and low inertia. Motors shall be totally enclosed non-ventilated type (TENV). Motor housings and covers to be made of sea water resistant aluminum. Motor-insulation must be in accordance with IEC 85 Class F (155° C). Motors must be protected by three monitoring devices, which are embedded in motor windings. Motor connections shall be internal by means of plug and socket.

Motors must be totally separated from lubricant-filled gearing of actuator, allowing replacement of motor without loss of lubricant regardless of mounting position. Motors shall have a dog coupling as mechanical connection to actuators worm shaft.

Actuator motors must develop full torque when power is turned on. All motors shall be of high starting torque type to facilitate 'unseating' of the valve. Each motor shall have a rating plate marked in accordance with IEC 34.1 as far as applicable.

Sizing

One actuator size (same outside dimensions) shall be available covering output speeds from 4 to 180 rpm for a given torque range, to avoid over sizing and unnecessary weight load on valve stem, flange and yoke. An increase of actuator size caused by higher actuator output speed is not acceptable to avoid weight over sizing of actuators. Actuators must be selected to provide sufficient torque required for safe valve operation. Actuator output torque must be available at 90 % of nominal voltage. In order to enable proper sizing of applicable electric equipment, actuator supplier has to disclose current value at maximum setting torque. Actuator shall be capable of opening and closing the valve against full differential pressure within specified time on valve data sheet.

Limit and Torque Monitoring

No battery backed limit sensing shall be used to avoid actuator malfunction in case of power failure. Actuators shall have a hall sensor principle based absolute encoder for limit sensing with a resolution of 3° or better. Actuator shall not be equipped with a battery.

Torque sensing shall be of mechanical sliding worm principle with torque values independently settable for 'OPEN' and 'CLOSE' direction. No electronic torque sensing derived from motor current or piezo-electric torque sensing at worm shaft. Torque setting shall be possible for 40% to 100% of rated torque.

Diagnosis

Actuators installed in critical applications, shall be optionally equipped with a sensor package, consisting of torque, temperature and vibration diagnosis. In this case actuators shall also have a real time clock for event recording to support asset

management functions and life cycle analysis. Display indications shall follow NAMUR recommendations with simplified status indications, operation log and torque curves.

Motor and local controls

Integral motor controls shall be microprocessor based and include mechanically and electrically interlocked reversing contactors for ON-OFF duty and solid-state contacts (thyristors) for MODULATING duty actuators.

Local controls shall consist of motor controls, push buttons OPEN-STOP-CLOSE-RESET, lockable selector switch LOCAL-OFF-REMOTE and a wireless Bluetooth interface with separate indication showing wireless connection as active, as well as LCD graphic display clearly visible under all lighting conditions with plain text and in world languages, diagnosis symbols, graphs. Five indication lights, available in different color codes, showing status information such as end position open/close, torque fault in both directions and motor protection tripped.

Local controls shall be electrically attached to actuator via plug and socket connection. It shall be possible to re-position local controls at every 90°, so that push buttons and indication lights will face the operator.

In case actuators have to be mounted in difficult to access positions, it shall be possible to separate local controls (including motor controls) from actuator. A wall bracket shall be available to mount local controls / motor controls near valve actuator for distances up to 50 m cable length.

Communication to DCS shall be by digital two-wire control Modbus RTU. The Modbus RTU fieldbus interface shall support a high-speed data transfer of up to 115,2 Kbit/s in combination with an automatic baud rate adaptation and the parity/stop bit options E/1, O/1, N/2 and also N/1 for full interoperability and flexibility during commissioning and operation. The Modbus RTU communication shall be monitored by a configurable monitoring time to allow a swift reaction upon loss of Modbus communication. The detailed status of the Modbus RTU communication shall be available over Modbus RTU and shall be indicated on the graphic display.

The actuator shall provide as option an integral fiber optic connection for Modbus RTU communication as redundant fiber optic loop topology using single mode fibers for a distance of up to 15 km between the actuators. There shall be a warning signal available over the Modbus RTU communication once the fiber optic budget drops below a critical signal strength.

All relevant signals such as valve position (%), end positions (OPEN/CLOSE), selector switch position and high torque alarm in OPEN/CLOSE direction must be available via fieldbus. In addition to this, actuator must provide a dedicated fault signal if there is a phase failure, motor protection tripped and/or high torque in OPEN/CLOSE direction or if the hand wheel is engaged. Irrespective of the fieldbus interface selected the four major diagnosis signals according to NAMUR recommendation NE 107 (Failure, Function Check, Out of Specification and Maintenance Required) are to be provided within the cyclic feedback data to the DCS in order to fully support field diagnosis and asset management.

It must be possible to set the bus address at the actuator via push buttons and LCD display. Actuator behavior in case of bus communication failure must be programmable (fail as is, fail open, fail close, fail to present position and also fail to the last command received).

All control signals, communication signals as well as main power supply must be wired to a multi pin plug and socket for customer connection. Removal of the plug shall not require any re-wiring of the fieldbus cable to maintain the communication to the remaining field devices in order to ensure a quick, simple and target-oriented serviceability. Terminal compartment shall provide sufficient space to accommodate the possible maximum number of incoming wires. A minimum of three cable entries must be provided for motor power cable and digital/ analogue inputs and outputs. Each cable entry shall be properly sealed by cable glands during site installation. Cable glands shall be chosen by contractor, responsible for wiring during commissioning phase.

Each actuator shall provide an adequately sized internal and external connection for grounding.

Enclosures

Protection class of actuator, including motor, shall be IP 68, according to EN 60529 against submersion up to 8 m head of water for at least 96 hours. During submersion, it must be possible to operate the actuator at least 10 times.

Hand wheel

Actuators must be equipped with a hand wheel for manual operation. Clockwise operation of hand wheel shall cause clockwise movement of output drive. Hand wheel shall be clearly marked with an arrow and the word 'CLOSE'.

Hand wheel engagement shall be of spring loaded push mechanism type and required manual declutching. Actuator must provide a switch signal when in manual mode.

Under manual operation, hand wheel shall drive the worm shaft. Self-locking shall be maintained in hand operation. Motor must be disengaged during manual operation. Hand wheel shall automatically disengage when the electric motor is energized.

Hand wheel must be sized allowing easy manual operation of output drive. The over torque indication shall be active in manual operation as well as motor operation, thus allowing a signal to be provided when the set-torque has been reached.

Bearings and gears

Bearings shall be of antifriction or self-lubricating type. Bearings shall not require any maintenance between general overhauls. Power gears shall be made from heat-treated steel. Worm wheels shall be made of bronze material. Actuator gear housing shall be filled with an adequate quantity of lubricant. Re-lubrication between general overhauls shall not be required.

Noise level

Under all operating conditions the noise level of actuators shall not exceed 75 dB (A) at 1m.

Nameplates

Two nameplates, made of aluminum, shall be attached to each actuator; one on the motor housing, showing all relevant motor data, one on the actuator housing showing all relevant actuator data. Special information, such as valve tag no., shall be shown if required. Nameplates shall be securely fixed to actuator and motor, so that they cannot be removed or scratched off during shipment, installation, operation or maintenance.

Painting and corrosion protection:

Actuator corrosion protection shall fulfill the requirements of EN ISO 12944-2, classification of environments C4 with a specified salt spray test of 720h. Actuator painting must be performed in such a way, that no corrosion takes place under ambient conditions as specified. All outside screws or bolts shall be made of stainless steel (A2). Actuators shall be corrosion protected with a primer coating and a two-layer powder coating consisting of an epoxy coating and a polyurethane top coating with a total film thickness of at least 140µm. Final color shall be silver grey similar to RAL 7037.

Inspection and Testing at Manufacturer's work

Each actuator shall be factory tested. Tests shall be performed in accordance with IEC standards as far as applicable. A final inspection record shall be supplied with each actuator showing general actuator data, nominal current, no load current, starting current, power factor at rated torque, output speed, torque setting, limit setting (turns/stroke), high voltage test, functional test (including all options) and visual test.

Documentation

Supplier to provide storage- installation- and operation instruction as well as electric wiring diagram, dimensional drawings and technical data sheet including motor data as per manufacturer standard.

Technical requirement for Remote Terminal Unit (RTU)**Remote Terminal Unit Overview**

The RTU should be modular, powerful and scalable controller capable of all remote automation and control applications. It is designed to communicate with any SCADA system.

The Remote Terminal Unit (RTU) shall be installed at valves locations to monitor and control equipment such as Flow meter, Actuator, etc.

Design Standards:

The RTUs shall be designed in accordance with applicable International Electro technical Commission (IEC), Institute of Electrical and Electronics Engineer (IEEE), American National Standards Institute (ANSI), and National Equipment Manufacturers association (NEMA) standards, unless otherwise specified in this Technical specification. In all cases, the provisions of the latest edition or revision of the applicable standards in effect shall apply.

The RTU shall be designed around microprocessor technology. For easy maintenance, the architecture shall support pluggable modules on backplane. The field wiring shall be terminated such that these are easily detachable from the I/O module.

RTU Functions:

All functional capability described herein shall be provided by the Contractor even if a function is not initially implemented. AS a minimum, the RTU shall be capable of performing the following functions:

- Acquiring analog values from Multifunction Transducers or alternatively through transducer- less modules and the status inputs of devices from the substation, processing and transmitting to Master stations. Capability to acquire analog inputs from analog input cards receiving standard signals via current loops 4-20Ma standard signals such as 0-5vdc etc for RTD , transducer etc.
- Receiving and processing digital commands from the master station(s)
- Data transmission rates - 300 to 19200 bps for Serial ports for MODBUS and 10/100 mbps for TCP/IP Ethernet ports
- IEC 60870-5-104protocol to communicate with the Master station(s), IEC 60870-5-101 for slave devices. & MODBUS protocol over RS485 interface, to communicate with other devices.
- RTU shall have the capability of automatic start-up and initialization following restoration of power after an outage without need of manual intervention. All restarts shall be reported to the connected master stations.
- Remote database downloading of RTU from master station/SCADA/DMS control center.
- Act as data concentrator on IEC60870-5-101/104/MODBUS protocols.
- Internal battery backup to hold data in SOE buffer memory & maintaining the time & date.
- It mandatory to guard the data/ equipment from intrusion/damage/breach of security & shall have SSL/VPN based security.
- Shall have SNMP

Communication ports

The RTUs shall have following communication ports to communicate with COC, flow meters, actuators and configuration & maintenance terminal.

- RTU shall have two TCP/IP Ethernet ports for communication with Master station(s) using IEC 60870-5-104.
- RTU shall have required number of RS 485 ports for communication with devices to be connected in daisy chain using MODBUS protocol. Minimum 15 analog values (including 4 energy values) to be considered per energy meter. The RTU shall be designed to connect maximum five devices. Further, bidder to demonstrate during testing that all analog values updated within 2 sec. The updating time shall be demonstrated during FAT (routine) & SAT testing. The bidder can offer MFT on IEC 60870-101/104 protocol to communicate with RTU.
- RTU shall have one port for connecting the portable configuration and maintenance tool for RTU.
- RTU as a data concentrator, then RTU shall have additional communication ports Ethernet or serial for IEC60870-5-104/101.
- SSL/VPN ,NERC/CIP complaint
It shall be possible to increase the number of communication ports in the RTU by addition of cards, if required in future. The RTU shall support the use of a different communication data exchange rate (bits per second) and scanning cycle on each port & different database for each master station. FRTUs & FPIs shall be communicating to SCADA/DMS Master control using IEC60870-5-104 /101 protocol over optical fiber.

Master Station Communication Protocol

RTU shall use IEC 60870-5-104 communication protocol for communicating to master station. The RTU communication protocol shall be configured to report analog (except energy values) & status changes by exception to master stations. However, RTU shall support periodic reporting of analog data and periodicity shall be configurable from 2 sec to 1 hour. Digital status data shall have higher priority than the Analog data. The dead-band for reporting Analog value by exception shall be initially set to 1% (user configurable) of the full-scale value. In addition, analog values shall also be reported to Master station by exception on violation of a defined threshold limit. All the analog values and status data shall also be assigned to scan groups for integrity check by Master stations at every 10 minutes configurable up to 60 minutes RTU wise. RTU shall report energy values to master station periodically. The periodicity shall be configurable from 5 minutes to 24 hours (initially set for 15 minutes)

Communication Protocol between RTU & other devices

The RTU shall acquire data from other devices (flow meter, actuator, etc) using the MODBUS protocol. In addition, usage of IEC 60870-5-101/104 protocols is also permitted. Other devices will act as slave to the RTU. The RTU shall transmit these values to the master station in the frame of IEC 60870-5-104/101 protocol. As an alternate approach, the utility/contractor may use RTU as a data concentrator & acquire all the required analog data from DCU installed & connected to energy meters using MODBUS protocol under IT scheme under R-APDRP. However, performance,

functional, availability & update time requirement shall be met in this case also. It is the responsibility of utility /contractor to assess this option & only opt in case it is found feasible.

Smart Parking

All parking CCTV and access control systems must follow the ministry of interiors guidelines for Security to guarantee the fulfillment of security and safety requirements.

All parking areas must have the ability to connect, analyze and automate data collected from devices, powered by and described as the IoT. All Ground parking slots must have smart poles that can be upgraded with electrical car charging stations

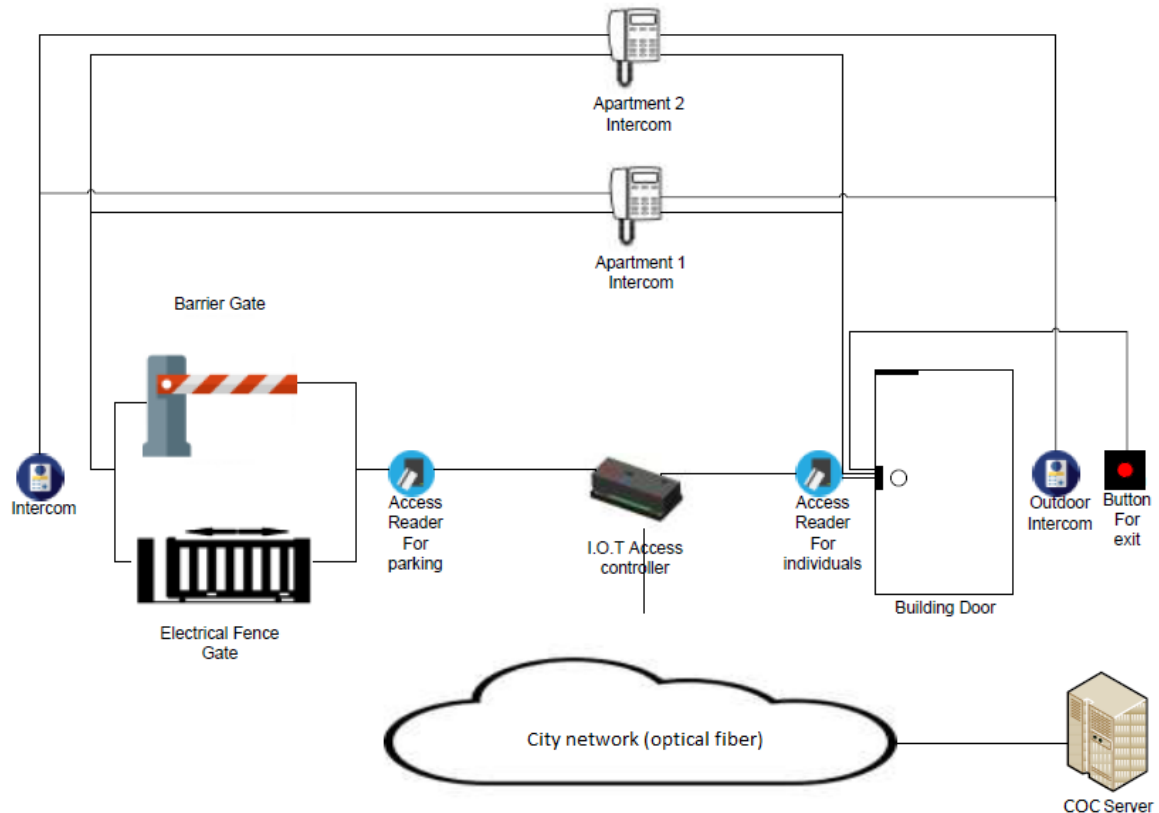
All public parking management systems must be integrated with the COC and the CCC management platforms. However, any parking must be registered and managed by the COC according to the usage (Public/ private). All public parking reservation and billing must be integrated to the new capital mobile application and smart cards to facilitate the reservation and payments process.

Below are the requirements for each type of parking:

1) Private parking:

The private parking purpose is to secure the residents of the new capital, and ensure that only allowed citizens are allowed to enter their private parking lots. The private parking and the access control of the buildings should be integrated together using the smart card of ACUD and will be connected to the intercom system of the building to allow visitors to enter the parking lot. The private parking should be free of charge and should enable the following use cases:

- When the resident approaches the barrier gate for the parking, he will swap his card on the reader next to the barrier gate.
- If the registered card is authorized, the reader will trigger the barrier gate to open. Otherwise, the electric gate will not open.
- The exit of the parking lot will not have a barrier gate but will have one-way spike barrier to ensure only the exit of cars.
- When the visitor approaches the barrier gate for the parking, he will find an intercom to call the resident he is visiting. The resident will press the unlock button on the intercom unit in his apartment to open the barrier gate.
- All the above events will be recorded with the date and time of each event in the COC platform.



2) Multi-storey parking lots

- In this scenario, payment system is considered in addition to the indoor guidance system. Entering this parking area will be through smart cards for city residents and issuing tickets for visitors.
- Entry and Exit units to issue and get the tickets with the barriers will be installed at the entrance and exit of the parking area.
- Inside the parking lanes Ultrasonic occupancy sensor with LED indicator will be installed to detect the occupied places. Navigation on-site by dynamic digital signage screen will guide to the unoccupied places.
- Payment will be done through automatic and manual pay stations to be distributed through the park in addition to the mobile wallet of ACUD.
- All sensors and endpoints are integrated with COC main platform through APIs.



COMPONENTS

- A Street barriers
- K Automatic pay-station
- V Magnetic sensor for detecting metal masses
- B Entry unit
- C Exit unit
- Y Light box or stop-go light
- Z Manual Pay-Station

3) Outdoor parking

In this scenario, ACUD will be responsible for all the outdoor parking in the streets of the new capital. All outdoor parking lots will be managed, controlled and billed by ACUD. This will require that the public parking areas have parking sensors in each parking slot or a camera to manage multiple parking slots at once. Acud will design and implement the outdoor parking areas and will manage them from the COC main platform. Some use cases for the outdoor parking include:

- a. Count of available parking slots.
- b. Count of occupied parking slots.
- c. Detection of illegal parking events.
- d. Management of payments for outdoor parking slots.

Smart Waste Management

System components will be managed by the COC through IoT platform to ensure operational efficiency and waste reduction across the city. All system components must have a connectivity to the COC through the related FTTx / IoT network based on the selected model and this should be submitted and approved by ACUD.

The system consists of:

- fleet management system
- data collection device inside of dumpsters
- trash cans which provides real-time trash level monitoring
- Garbage shoot sensors to prevent blocking
- Waste management Models:
 - Collection points
 - Street dumpsters
 - Basement dumpsters (Building must be designed to allow for Car entrance)

The buildings design and all the above components must be submitted to ACUD for approval before the start of installation.

Intelligent Transportation System

ACUD is responsible for building the traffic impact study along with the responsible stakeholders. This will include the traffic lights, bus stations, gates, speed limits, gas stations, etc. Similar study should be included by any developer in the master plan and provided for approval by ACUD. All data generated from the ITS components must be integrated to the ITS platform installed in the CCC and COC.

Digital advertisements and announcements

All signage whether for information or advertisements must be digital and have the proper connectivity to the FTTx network to be managed from COC. The digital signage rental, management and operation are only done through ACUD and no other developer can monitor and control the digital signage without the approval of ACUD.

The digital signage will be located at many locations including but not limited to:

- Parking areas
- Smart poles
- Roads
- Main squares
- Bus stations

Smart Cards

All access control gates must have a card reader integrated and compatible with the city inhabitants' smart cards and COC management platform. It's mandatory that any citizen working, living in the new capital to acquire a smart card from ACUD. This smart card will be compatible to work for access control, digital identification and electronic payments for utilities, public transportation and any other city services. Any service provider can integrate payments for his services with this smart card through ACUD.

E-Health and E-Education

All medical and educational facilities must have the proper connectivity through the FTTx network or IoT network to guarantee the e-Health and e-Education services deliverability according to their scope of work. Future integration between health and education information will be required by ACUD.

Systems interoperability and integration requirements

To ensure the interoperability of different system components and the integration between them, ACUD strictly intend to use open standard protocols and APIs that are internationally used and proprietary protocols are not allowed. A list of protocols (IP and industrial) that are allowed by different endpoints include:

- BACnet
- KNX/EIB
- Modbus
- M-Bus
- DALI
- oBIX
- OPC
- SNMP
- HTTP (HTML 5/ XML Mark-up Languages)
- CoAP
- MQTT (IMQTT ,MQTTS)
- DLMS
- Scada

Additionally, all endpoints purchased by the developer that are related to the scope of this code should be submitted to ACUD technology team for validation and approval.

Required Deliverables

It's required from any developer to provide the below list of documents in order to be revised and approved by ACUD before being officially granted the land:

- Master plan for the project
- Schematic design including the LC
- Units designs and drawings including the LC
- Services type and level for each end-user
- Bandwidth for the whole complex
- Waste management model
- TIS (Traffic impact Study) based on the residence and occupation rates
- Parking areas design and operation model
- All AutoCAD files must be ready for integration with GIS for the whole city including summary charts for buildings, units and spaces. A geo database will be shared as a guideline with the requested parameters.

List of Appendixes

- Appendix 1: Commercial smart infrastructure
- Appendix 2: Residential smart infrastructure
- Appendix 3: ACUD AutoCAD Standards
- الإشتراطات الخاصة بالهيئة القومية الدائمة للتنسيق الأمني لكاميرات الرصد المرئي يتم تسليمها طبقاً للمشروع المعروض و شروط الاستخدام مثل:
 - الإشتراطات العامة المنشآت الاقتصادية
 - الإشتراطات العامة المنشآت الحيوية
 - الإشتراطات العامة المنشآت الدينية
 - الإشتراطات العامة المنشآت الصحية
 - الإشتراطات العامة المنشآت الحكومية
 - الإشتراطات العامة للمحلات التجارية
 - المواصفات الفنية للميادين العامة والشوارع الرئيسية والمجمعات العمرانية الجديدة