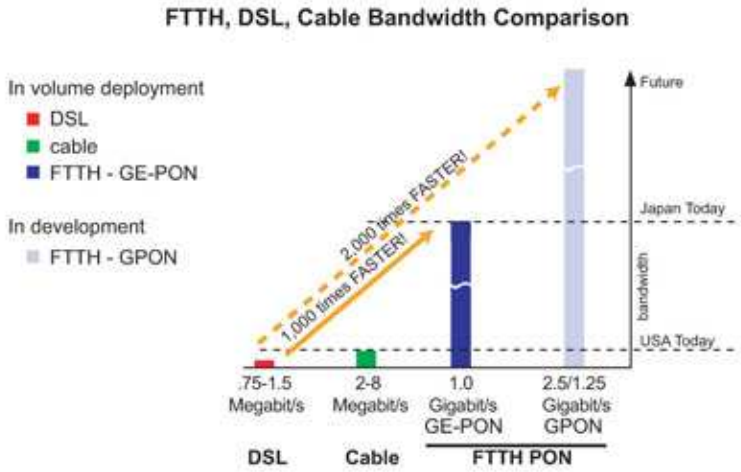
USE OF OPTIC FIBRE CABLES IN DELIVERING VARIOUS DATA AND CABLE SERVICES

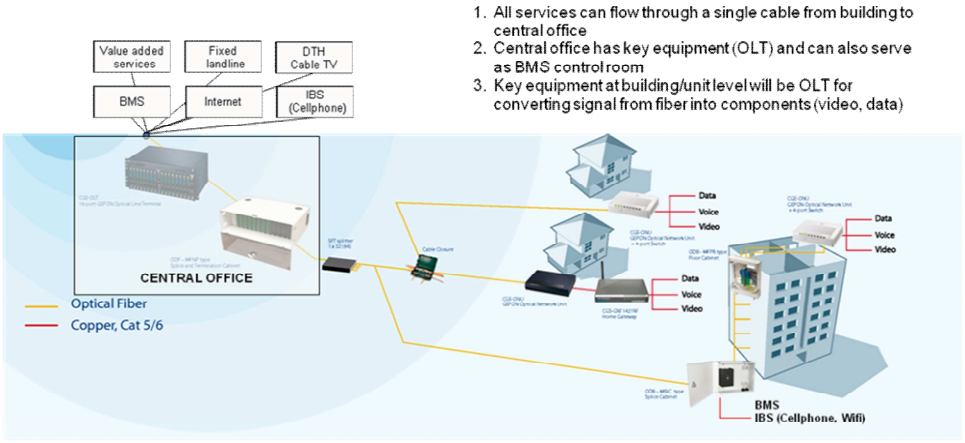
Optic Fibre (OF) cables are used for transmission of data (including voice and image) in a high quality and efficient fashion. The cables are capable of carrying a vast amount of data and hence, a single cable can be used for multiple applications which require transmission of data. Once it has been decided to lay a OF network, it is prudent to run as many services through it as possible (except Power, water and gas transmission).

Optic Fibre (OF) cables are much more efficient than copper cables.

	Copper	Optical fiber
BANDWIDTH	Max – 1 Gigabit	10 Gigabit and increasing
FUTURE NEEDS	Standards being defined (CAT 7)	Highly expandable and evolving
DISTANCE	100 Meters @ 1000 Mbps (Needs repeaters to increase signal strength as signal is active)	40 km+ @ 10,000 Mbps (Requires limited equipment to cover large distances)
NOISE	Higher loss in signal quality compared to fiber	
SECURITY	Easily tapped into	Almost impossible to tap
CAPACITY	Large quantity of cable needed compared to fiber	Lesser quantity of cable needed compared to copper
MAINTENANCE	Harder to maintain	Easier to maintain



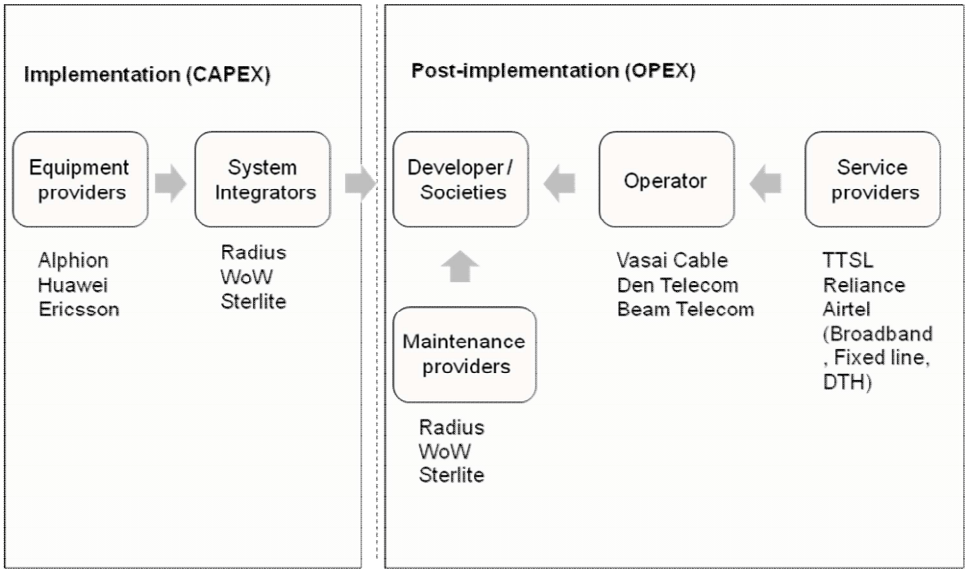
Basic Architecture of Optic Fibre Networks



There are 5 key entities in the OF ecosystem:

Equipment providers	1. Equipment providers provide necessary equipment for both the central office (OLT – Optical Line Terminal) and for at the building (ONT – Optical Network Terminal) and if implemented, in unit 2. Key equipment makers include Huawei, Ericsson, Alcatel
System Integrators	1. System integrators are essentially contractors who work with developer, equipment providers to install and test the entire system with chosen service providers. 2. Some system integrators who are currently carrying out projects in India are Radius, Sterlite, WoW
Maintenance providers	1. Typically the system integrators can also provide maintenance services post installation of the equipment 2. They can also provide customer integration services where in they can help ensure customers can access services and fix any problems in the network
Operator	1. Operators provide an interface between service providers (Tata Tele, Airtel etc.) and the customers. Operators manage the business of running the network by buying bandwidth and PRI in bulk and reselling to customers internally 2. Some operators upcoming FTTH projects in India are Den Telecom (Delhi), Beam Telecom (Hyderabad), Vasai Cable (Mumbai)
Service providers	1. Service providers can interact with residents directly or through the interface of the operator 2. Key service providers include Tata, Bharti, Reliance

System implementation is led by the integrators and equipment providers while the operators, service providers and maintenance providers lead operations post-implementation



Source: Interview with providers; Press search

Key Lodha objectives

a. Reduce costs by replacing multiple copper cables with a OF network to provide backbone for various services, which are otherwise required to be provided by Lodha e.g. intercom (/video doorphone), fire alarm, security, IBMS.
b. Get System integrators to put up this OF network for free/low cost since they get access to a captive audience (the residents) and can earn by providing them revenue generating services like:
    a. DTH/cable
    b. Telephone
    c. Wi-Fi/broadband
    d. Advanced media

OF network options

Final fibre termination and their placement decides the bandwidth available and hence the applications possible. The fibre optic architectures are generically referred to as Fibre To The x (FTTx) where x stands for point of fibre termination viz. Home/Floor/Kerb etc.

Architecture	Fibre termination (ONT placement)	Speed Range	Potential Applications
Fibre to The Floor (FTTF)	In shaft, catering to flats across multiple floors	15-20 Mbps	IPTV, Cable TV, DTH, Internet, Concierge, Landline, Intercom, IBMS, Security, Mobile booster (tall buildings higher than 30 floors)
Fibre to The Home (FTTH)	Inside Flat/customer premises	40-100 Mbps	Addition to FTTF: HDTV, 3DTV, Tele-medicine, IPTV (all related to higher bandwidth)

Any elements that are covered in FTTF will get covered in the FTTH model in any case.

Key terms

NOC – Network Operating Centre (Central location from which has the critical fiber equipment and monitoring takes place)

ONT (Optical Network Terminal) – The box that resides within the shaft (in case of FTTF) or Home (FTTH); The ONT is 16 or 32 ports (typically) that determines how many flats / communication modes can be served from single ONT

OF – Fibre Optic

LVDB – Low voltage distribution box

Services on Fibre:

The recommendations below are based on technology and info available today (2012) – however, as a basic principle, once an OF network is put, one should try to run as many services through it as possible, subject only to cost constraints vis-à-vis CTC for conventional (non OF) solutions:

Services	**Part of**	**Cabling Scope of FTTF partner**	**Cabling Activity to be de-scoped from which (current) contract**
Voice - Landline Phone	FTTx	FTTF – OF cabling to ONT in the shaft + Cat5/6 cable from the shaft to one point in the flat (LVDB). FTTH – OF cabling terminating at ONT within the flat	Vertical cabling in the shaft and horizontal from shaft to the flat needs to be de-scoped from electrical vendor. Cabling inside the flat from LVDB remains in scope of electrical vendor
Intercom (if no VDP solution is planned in the building)	FTTx	IP enabled intercom instrument and all cabling thereto.	No 3rd party intercom vendor needed
VDP – if VDP is required to connect to entry level/other levels for security purposes	FTTx	All cabling for the same shall be done by FTTx vendor	All instruments shall be procured from separate vendors. The VDP instrument shall also serve as the intercom. In order to moderate costs of the VDP ODU being IP enabled, it should be explored as to whether the VDP's indoor unit can be such that it can be OF signals from other locations but take conventional signals from the ODU. (Note: if VDP only connects to the main door of the unit, OF is not needed and regular VDPs will suffice).
Mobile signal boosting	FTTx	Same OF cabling used to carry the signals; May require co-axial from OF in shaft to the equipment (remote antenna / BTS)	Vertical cabling in scope of vendor is not needed, but generally this service is free
Internet – Wi-Fi / wired	FTTx	Internet connectivity to be provided by FTTx vendor till LVDB.	Vertical cabling in the shaft and horizontal from shaft to the flat needs to be de-scoped from electrical vendor.

		Wi-Fi in individual residences will be done by the 3rd party broadband provider and resident will enter into their own arrangement with them. In projects where Wi-Fi is required inside the flat due to promise of home automation enablement via I-pad/tablet then customer needs to be informed (as part of amenity list) that wi-fi has to enabled by them directly.	Cabling inside the flat from LVDB to data points remains in scope of electrical vendor.
Home automation internet enablement	FTTx	Internet enablement for home automation will use the Wi-Fi network provided by FTTx vendor	Vertical and horizontal cabling to be de-scoped from IBMS vendor
Advanced Media - IPTV / Video on demand / Network Gaming / 3D Gaming / 3DTV / HDTV	FTTH	Wi-Fi enablement within home will take care of requirement by FTTx vendor; *(performance quality on Wi-Fi needs to be validated with FTTx)*	Cabling should be de-scoped from electrical vendor
Security systems– CCTV Monitoring, Lift CCTV, Lift intercom, Access control systems	Smart Building (SB) as part of FTTx	CCTV –Nearby CCTVs should be aggregated into one ONT. OF cabling from nearest ONT to BMS Room will be done by FTTx vendor. Fibre cable can be laid till 20-50 m. away from communication backbone. CCTVs need to be IP-enabled. Lift CCTV – If Lift CCTVs are IP-enabled then OF cabling from LMR to BMS. If Lift CCTV is Wi-Fi enabled then OF cabling from	CCTV –Vertical back bone Cabling should be de-scoped from IBMS vendor however horizontal cabling to nearest ONT to be included in IBMS vendor scope. Lift CCTV – Vertical Cabling should be de-scoped from IBMS vendor however horizontal cabling in Machine room shall be in IBMS scope. Non Wi-Fi CCTV cabling inside lift shaft shall be in the

		(near) Lift Pit where Wi-Fi receiver is placed to BMS. Lift intercom – OF cabling from LMR to Lobby/BMS room. Lift intercom may need to be IP-enabled if ONT does not support sip-enabled RJ-11 port Access Control Systems – From Access Control Panels to Server in BMS room. Access control panels are mostly IP-enabled Required ONT's to be provided by FTTx vendor to an agreed location such that minimum cabling required to be done by Lodha.	scope of Lift vendor integrated in the trailing cable of respective lift. Lift intercom – Vertical backbone Cabling should be de-scoped from electrical vendor however horizontal (inside LMR)& cabling inside lift shaft shall be in the scope of Lift vendor integrated in the trailing cable of respective lift. Access Control Systems – Vertical backbone Cabling should be de-scoped from IBMS vendor however horizontal cabling from floor/area Access Control Panel to the nearest ONT to be included in IBMS vendor scope
IBMS – HVAC mgmt, water supply mgmt, common area lights mgmt	Smart Building (SB) as part of FTTx	IBMS - OF cabling from BMS panels to BMS room. BMS panels need to be IP-enabled	IBMS – Horizontal Cabling from BMS DDC/Panel shall be in FTTx partner scope should be de-scoped from IBMS vendor.

Optional

Following can be evaluated based on cost economics and decision taken:

Services	**Part of**	**Cabling Scope of FTTF partner**	**Cabling Activity to be de-scoped from which (current) contract**
Media – DTH + Cable TV on fibre	FTTH – most likely to work only for luxury and hi-end residential projects only (e.g. Lodha Place) as incremental cost of 4,000 to 5,000 per flat.	Cable TV The cable provider will extend fiber to one point in the complex (or NOC). From that point on, all cabling will be in scope of FTTx vendor **Dish TV** Dish vendor will provide the connection at the NOC; all the equipment for signal conversions and integration on the OF network will be in scope of FTTx vendor	If Cable TV done on fibre then: Vertical cabling should be de-scoped from cable vendor. **Dish TV** + Horizontal inside flat from ONT to TV outlets shall be in the scope of electrical vendor. If this is provided, the connection cost should be recovered separately at time of possession (which customer would have otherwise paid the DTH vendor). Design needs to inform CC about this, at least 2 months prior to commencement of possession.
Alarm systems – Fire Alarms, Lift Alarms.	Smart Building (SB) as part of FTTx	Fire rate OF cables are available. However, the economics of these is not yet clear. Also, cost of convertor at repeater panel to ride on fibre would be incremental cost.	Township projects - Cabling from the fire-alarm panel / lift-alarm to BMS room is significant. Thus, cost of convertor is justified to use the OF network from the lobby to BMS room. 1. OF cabling from FA/LA repeater panels to BMS room (non-regulatory part). 2. FA/LA panels need to be IP-enabled Further, within building, the cost trade-off between IP enabled fire alarms + using OF network which is anyway going to be there (though fire rating costs may be higher) vs. standalone conventional Fire alarm network need to be evaluated.

- All Smart Building and Smart-township fiber backbone will be done by FTTx vendor
- All IP enabled devices (e.g. intercom, CCTV etc.) and/or "extra" convertors required for their IP enablement, should be part of the device vendor's scope
    - Intercom switch /server requires to be IP enabled and will cost 1 lac more per 1,000 lines
    - CCTV cameras (IP enabled) will cost 15,000 more per camera ; DVR costs will reduce by 50,000 per DVR (16 channel); NVR cost to be added
    - Fire alarm panel costs (for IP enablement) will cost 10 to 15% higher; Hence best suited for large townships where increased IP enablement costs are offset by the savings in additional wiring from buildings across township to single BMS room
    - BMS panels (for IP enablement) will cost 10 to 15% higher
- The monitoring panel/device/software required in BMS or HFM ops room to which all devices are connected in cases of SB or ST, needs to be in device vendor's scope
- Any integration required for the above should be in FTTx vendor's scope

Future changes that are being evaluated – not viable currently on FTTx due to cost / technical; for these we continue with current operating model (unless specifically approved by project):

Services	**Could be part of**	**Current Issue**	**Specific deviation**
ITMS - Parking mgmt, Irrigation mgmt, traffic mgmt, streetlight mgmt, Smart Metering for power and water	Smart Township (ST) as part of FTTx	Smart Metering – OF cabling from Data aggregators to central server	

FTTF+ service model

Segment	**Type of Provisioning**	**Commercial Model**	**Max Lodha Capex (2012 prices)* per flat**
Casa	FTTF + SB	Build-Own-Operate-Maintain model except for projects where Lodha may want to own network as long term asset like Dombivali	4,000
Aspirational			5,000 – 6,000
Hi-end	FTTH + SB		8,000 – 10,000
Luxury			10,000-15,000
Townships (>20 buildings and land area > 25 acres)	FTTF + SB		As per segment
Supremus**	FTTH + SB		To be determined

*Based on what it would cost Lodha to provide this infrastructure separately. Final budgets will be finalized in next 3 months based on actual project tenders that have been floated

**FTTx is not suitable for Excellus / iThink, as most customers have their own relationships with service providers. Lodha should only provide cable tray/conduit for communication service providers to lay cables.

Notes:

Design Related

1. FTTx design requirements need to be defined early on in the project (when finalizing MEP package) to keep provision for containment, riser space + clear scope demarcation between MEP vendors and FTTx vendors
2. Building MEP rooms and shafts should be sized taking into account the presence of FTTF+. In FTTx systems ONTs, Power backup devices and Splitters may be required to be put in a shaft. In general, 650mm x 450 mm shaft may suffice for OF equipment but should be verified with FTTx vendor before finalizing.
3. For FTTH, size of ONT and location should be finalized with vendor; Ideally, locate next to electrical closet
4. No interference between signals running on Optical Fibre and copper based LV/HV systems. So ideally, separate cable trays for fibre optic systems are not required. **Fibre optic cable can be laid next to power distribution cables and suffer no**

interference at all (both horizontal and vertical distribution, including between buildings). However, from a ease of maintenance perspective, if there is space for a separate shaft for fibre optic cables, same may be considered, since power cable and fibre optic cables will be serviced by different entities and if shafts are different, risk of one maintenance party damaging the other are lower.

Procurement Related

1. Home Automation & FTTF+ scope finalization and award should be done before MEP contract award. For following services, FTTF+ provider can provide duopoly to any two providers from a given list:
    a. Voice - Landline Phone
    b. Media – DTH / Cable
    c. Internet – Wi-Fi / wired
    d. Advanced Media - IPTV / Video on demand / Network Gaming / 3D Gaming / 3DTV / HDTV
    e. IBS (Distributed Antenna System for Mobility)

    In the event that the FTTF+ provider is unable to provide the chosen providers within 60 days of date of notice (as and when we commence possessions), Society/Lodha shall be free to allow any provider to lay infrastructure to lay that service and the FTTF+ provider shall not raise any objection in this regard.

    Comment [SB1]: R3

    This should enable the FTTF+ provider to generate revenues and consequently, provide the infrastructure and coordination to Lodha at low/no cost.
2. Contracts should provide that all services should be made available within 30 days of notice (as and when we commence possessions) and any delay will be penalized at INR 50000 /day.
3. Model with FTTF provider should be on build-operate-maintain model.
4. ONT provided by FTTx vendor should have inbuilt power back-up to avail communication for VDP/Intercom and shall be in scope of FTTx vendor. All other node equipments shall be provided with power back-up by Lodha.
5. FTTF+ provider can charge connection charges to consumers in line with regular market charges for such connections. Since several non-revenue services (which would otherwise be part of CAM) are also riding off this backbone, a certain monthly

fee can agreed to be paid to FTTF+ operator for the maintenance of the backbone – such fee should form part of Federation CAM (if applicable), else Building CAM.

6. It would be preferable for Lodha to tie-up with 2-3 players are 'strategic partners' and distribute projects amongst them. This will enable Lodha to enjoy better negotiation on account of scale + enable the strategic partners to grow along with us. Choice of strategic should be driven by:
    a. Links/relationships/credibility with 3rd party providers
    b. Technical competence to execute backend and provide good quality service on front end
    c. Financial ability to make investment to execute the backend.