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Wiring the Physical Network of the Next Generation Home Network

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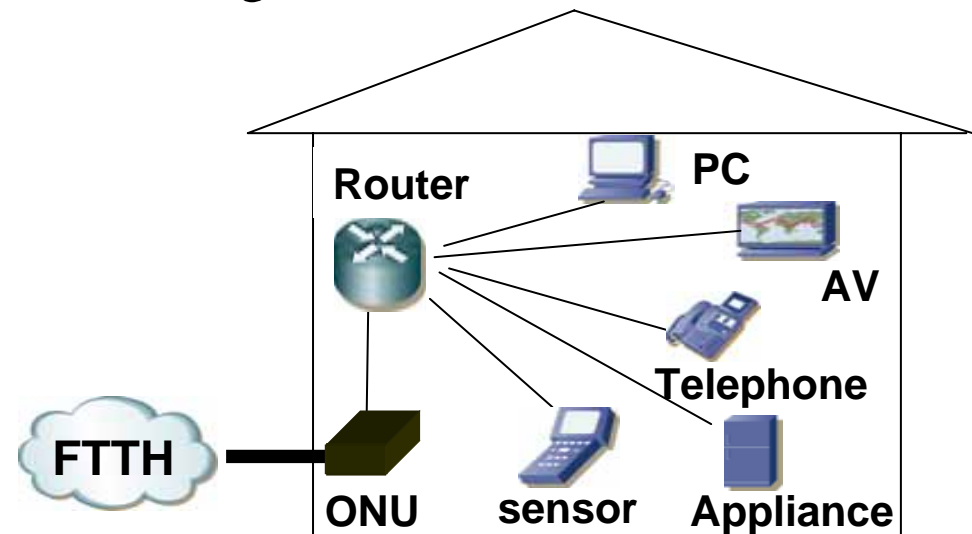
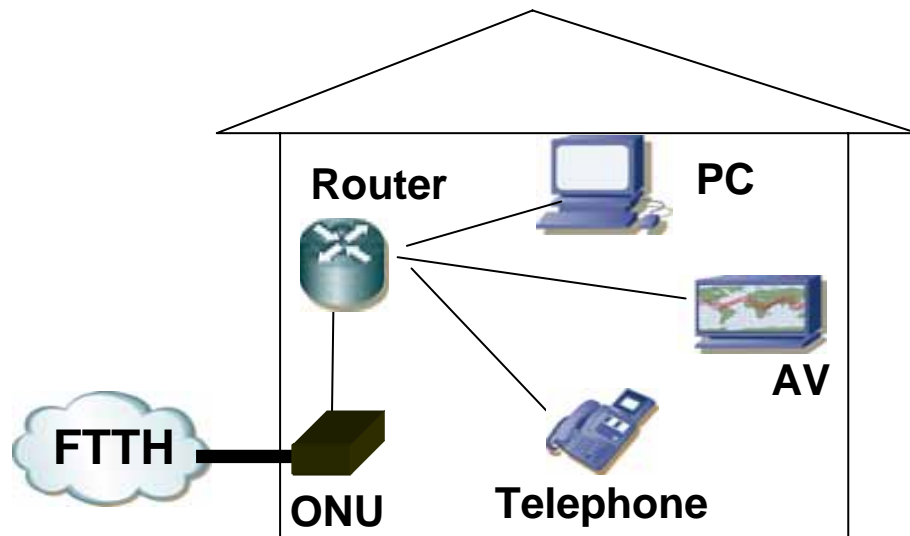
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Introduction

- Existing Home Network
 - Internet connection
 - Audio visual terminal and Telephone connection
- Next Generation Home Network
 - High resolution or large capacity data will be communicated
 - A variety of terminals will be emerged



Technical issue

Medium with wider bandwidth needed

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Optimum medium for next generation home network

Transmission medium
with much higher
bandwidth is needed



The optical fiber
cable can provide
enough bandwidth



Technical issue

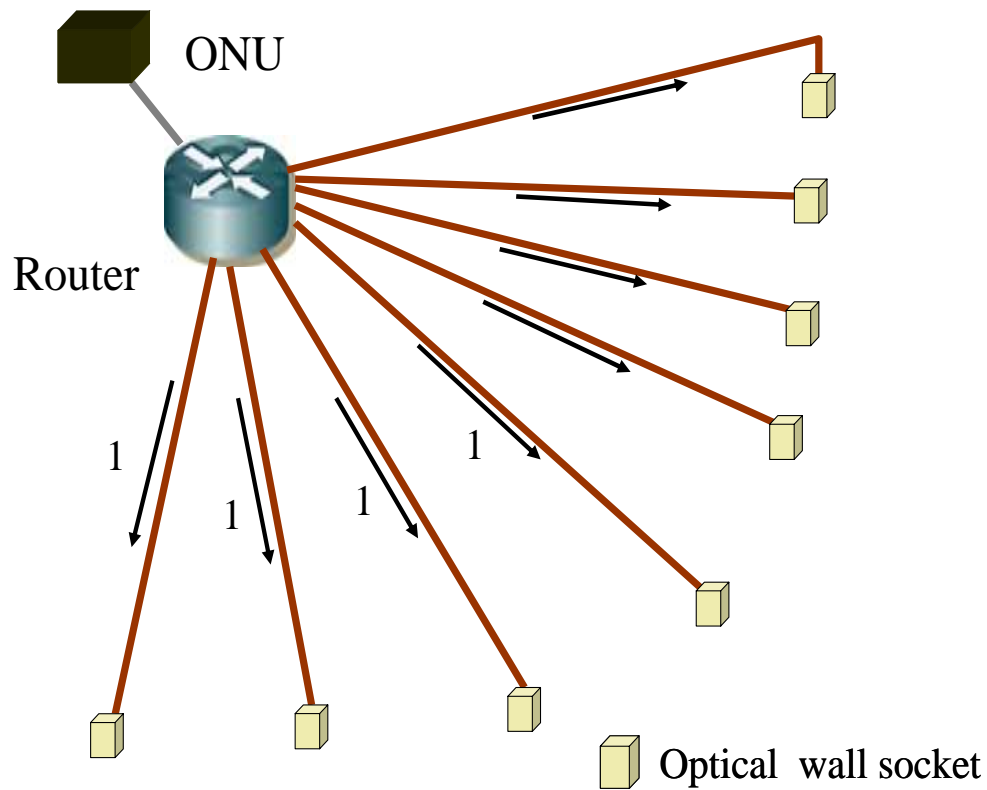
Clarifying the optimal physical network configuration
for next generation home network

	Wireless	Metallic	Optical fiber
Bandwidth [Mbps]	Several tens Mbps	A few Hundred Mbps	Several Giga bps (WDM applicable)
Security	Low	High	High

Outline

1. Features of next generation home network topology
2. Wiring route in home environment
3. Total wiring length formula for calculation
4. Calculation of longest transmission cable length
5. Conclusion

Single star topology



ONU (Optical Network Unit)

Characteristic

- An optical fiber cable wires between each optical wall socket and the router
- The wavelength used is one.

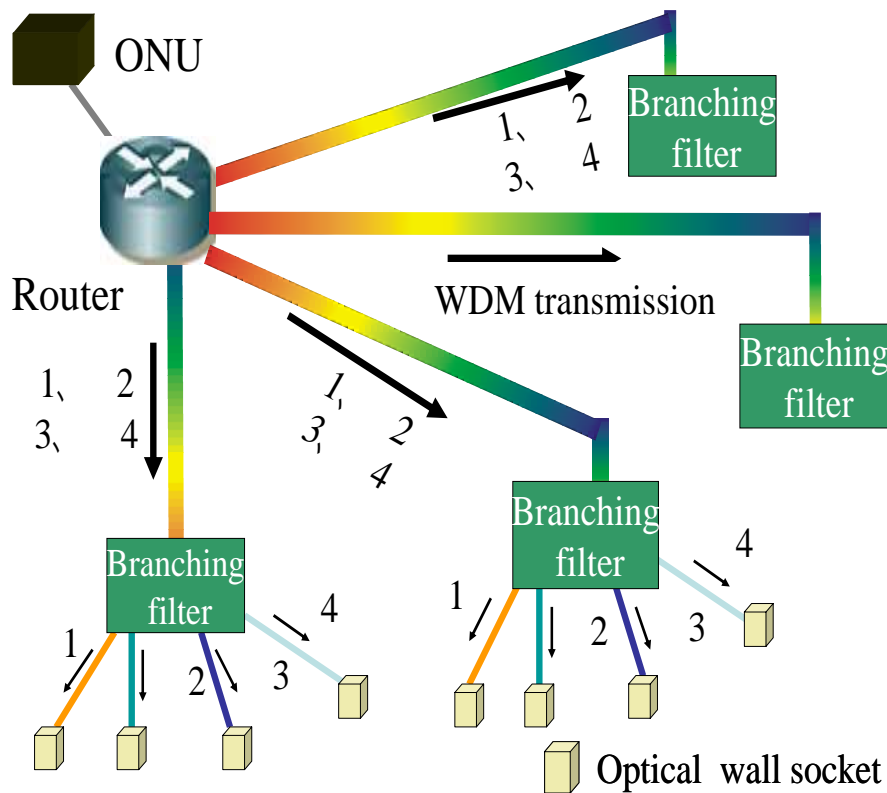
Advantage

- Needed number of wavelength is small

Disadvantage

- The total wiring length will increase along the number of optical wall socket

Double star topology



Characteristic

- WDM transmission between router and branching filter

Advantage

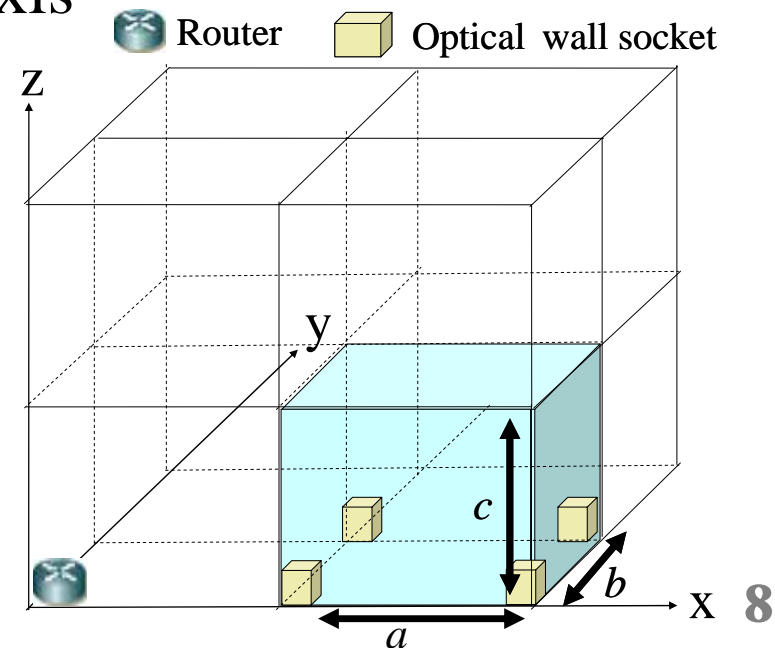
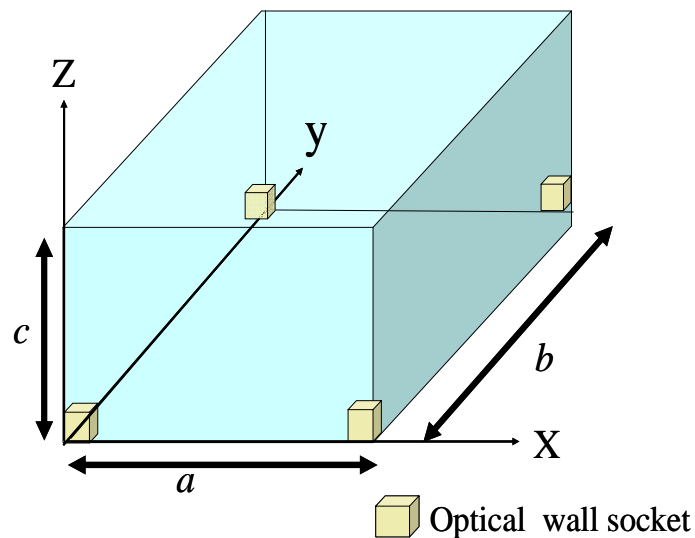
- The number of the optical fiber from the router to each room is smaller than the single star topology

Disadvantage

- Branching filter cost

Wiring route in home environment

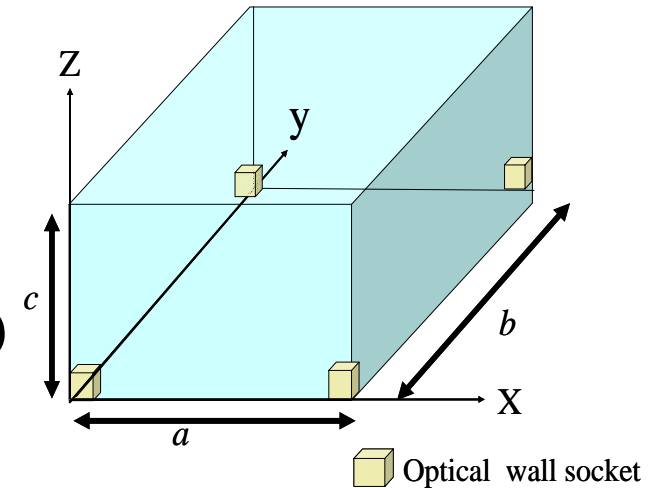
- The assumed room size is a ; x-axis, b ; y-axis and c ; z-axis
- Four optical wall sockets locate each at the four corner of each room
- A router locates at origin
- ONU locates in arbitrary
- Cable installation along each axis



Total wiring length formula for calculation

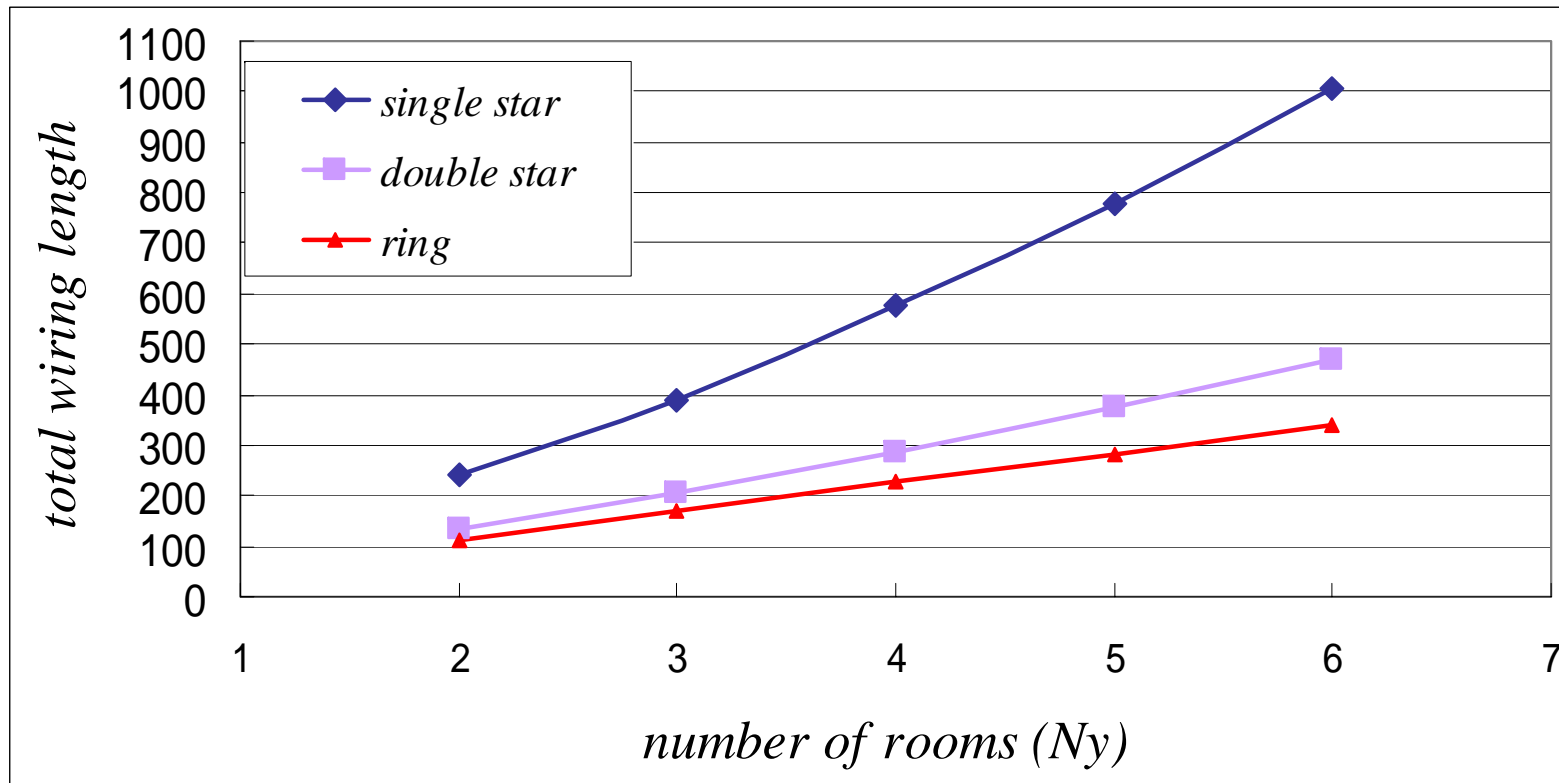
Parameters

- Total wiring length; L ($L=L_1+L_2+\dots+L_f$)
- Floor; f
- Total wiring length on the f -th floor; L_f
- The total number of rooms on the f -th floor; N_f
- The number of rooms in an x-axis on the f -th floor; N_{fx}
- The number of rooms in an y-axis on the f -th floor; N_{fy}
- Length between branching filter or ADM and a optical wall socket; l ($l=2a+2b+4c$)

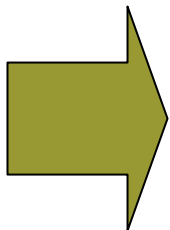


Comparison of total cable length for each network topology

Two floors, and $a=1$ $b=1$ $c=1$ $N_x=3$ $N_y>1$



It is observed that the ring has shortest length and the single star has about twice the length of the others



Conclusion

- Wiring route of the optical fiber cable was examined in each network topology
- Total wiring length of three basic network topologies was compared
- Formula to calculate the total wiring length was derived.
- Longest distance in each network topology between a router and optical wall socket was elucidated by using the average value of Japanese house

Conclusion (cont'ed)

- Both single star and double star will be feasible with sufficient power budgets, however, ring needs a more detailed estimation.
- Double star is optimum topology for next generation home network in terms of total cable length.
- Further study needed from the view point of cost.