DESIGN CHALLENGES FOR CONNECTING REMOTE OILFIELDS

Speaker: Jhonny Villasmil

Sr. Telecom Engineer – From a Major International EPC Corporation

CONTENT

- Remote Oilfields Connectivity.
- Design Challenges on Brownfields.
  - Updating Legacy Wireless System to full IP-Gigabit Wireless System
- Design Challenges on Greenfields.
  - Designing Fiber Optic Backbone with Last Mile Radio Links
  - Designing a Fully Fiber Optic Network
- New Trends.
- Recommendations.

Remote Oilfields Connectivity

Oil Refinery

Long Distance Oil Pipeline

Onshore Flow Station

Oil Pipelines

Onshore Oil Wells

Downstream

Upstream

Connectivity for providing the following services:

SCADA, LAN, WLAN, IP-Telephony, Video Surveillance, Access Control, Intruder Detection, etc.

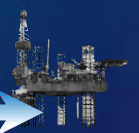
Oil Refinery

Long Distance Oil Pipeline

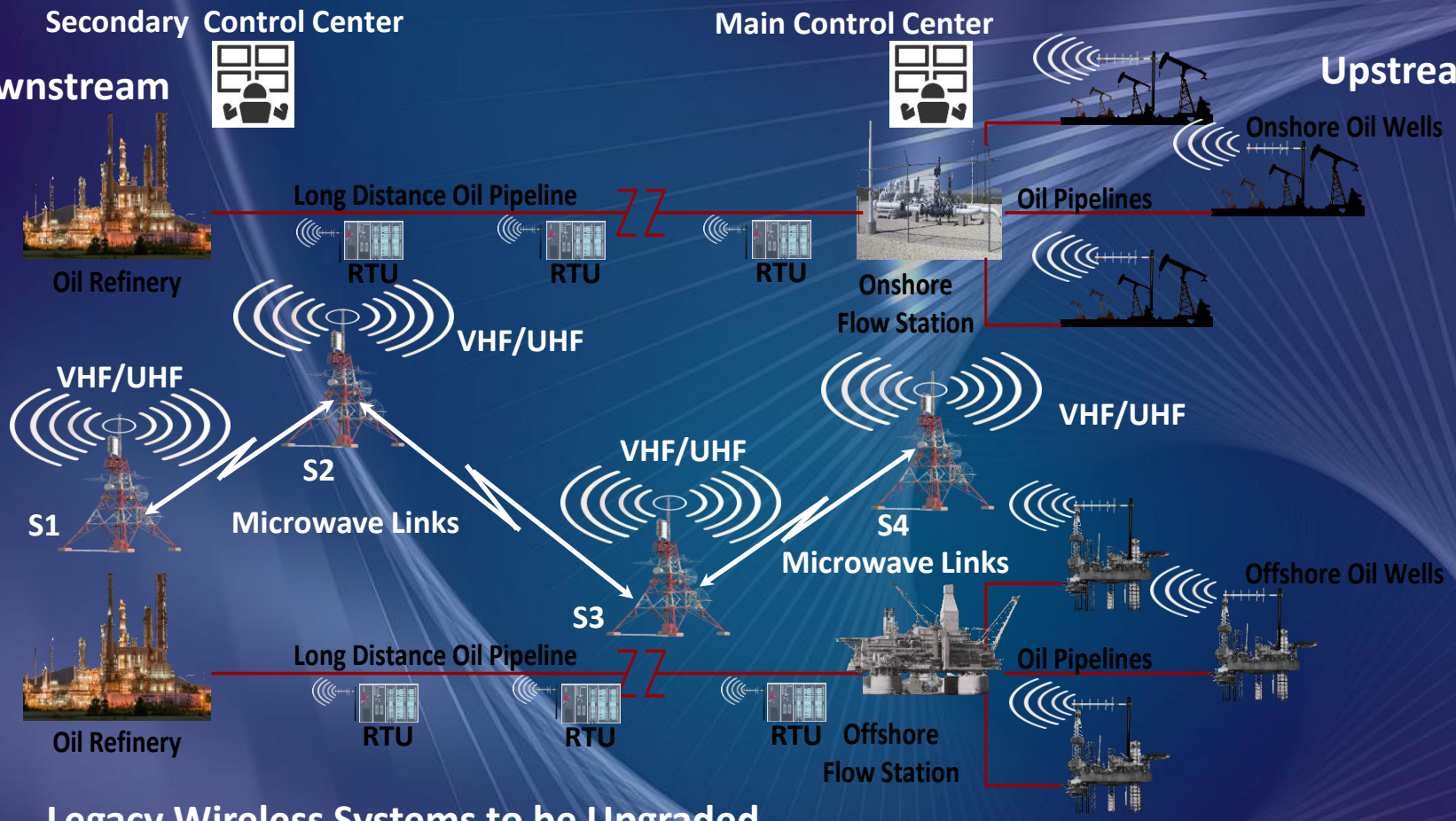
Offshore Flow Station

Oil Pipelines

Offshore Oil Wells



Design Challenges on Brownfields

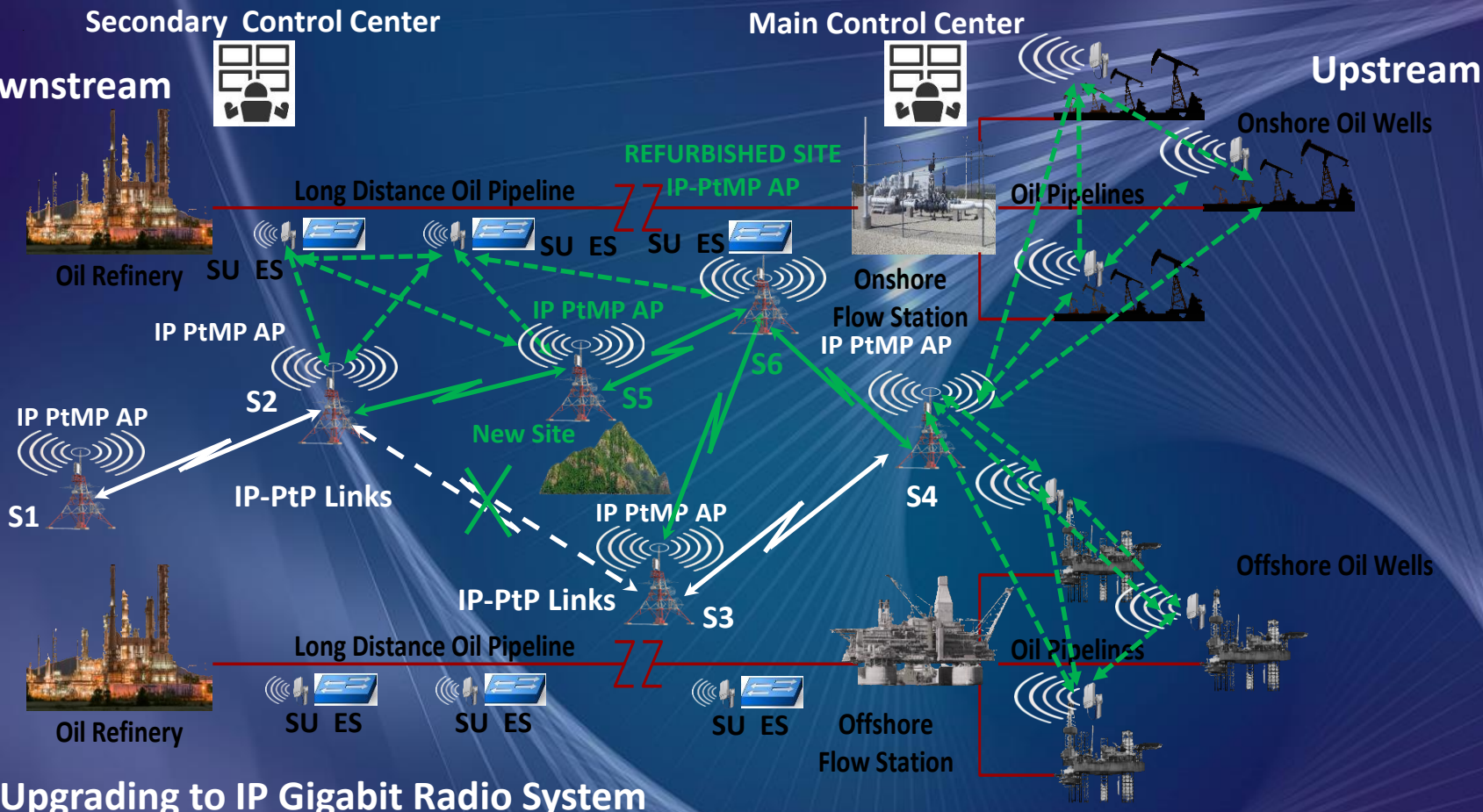


1. **Legacy Wireless Systems to be Upgraded**
   - Old VHF/UHF RTUs for connecting SCADA, Voice, Trunk Radio.
   - Old Microwave Radio Backbone

Challenges for Updating Legacy Wireless System to full IP-Wireless System

CHALLENGENS	RECOMMENDED SOLUTIONS
Operating frequency availability	- Usage of the original operating frequency. - Frequency refarming. - Apply for efficient new frequencies (if required)
Possibility of new required sites	- Assessing of the existing sites for proposing a new topology and routing with PtP and PtMP IP Gigabit Radios - Increase the antennas sizes (Gain) and/or the tower heights at the existing sites for achieving the required Line of Side (LoS) - Propose as new sites existing facilities with available power and access roads owned by the Client or renting a third party site. - Last choice is to develop a complete new site
Provide Ethernet Interfaces to the existing systems	- Provide Ethernet Gateway Modules for the existing systems to be connected to the Wireless System. - Provide IP Radios

Design Challenges on Brownfields



2. **Upgrading to IP Gigabit Radio System**
   - IP-PtMP Radios for connecting RTUs, SCADA, LAN, WLAN, IP-Telephony, Trunked Radio, Videosurveilance, Access Control, Intruder Detection, PA/GA, etc.
   - IP-PtP Microwave Radio Links for Backbone

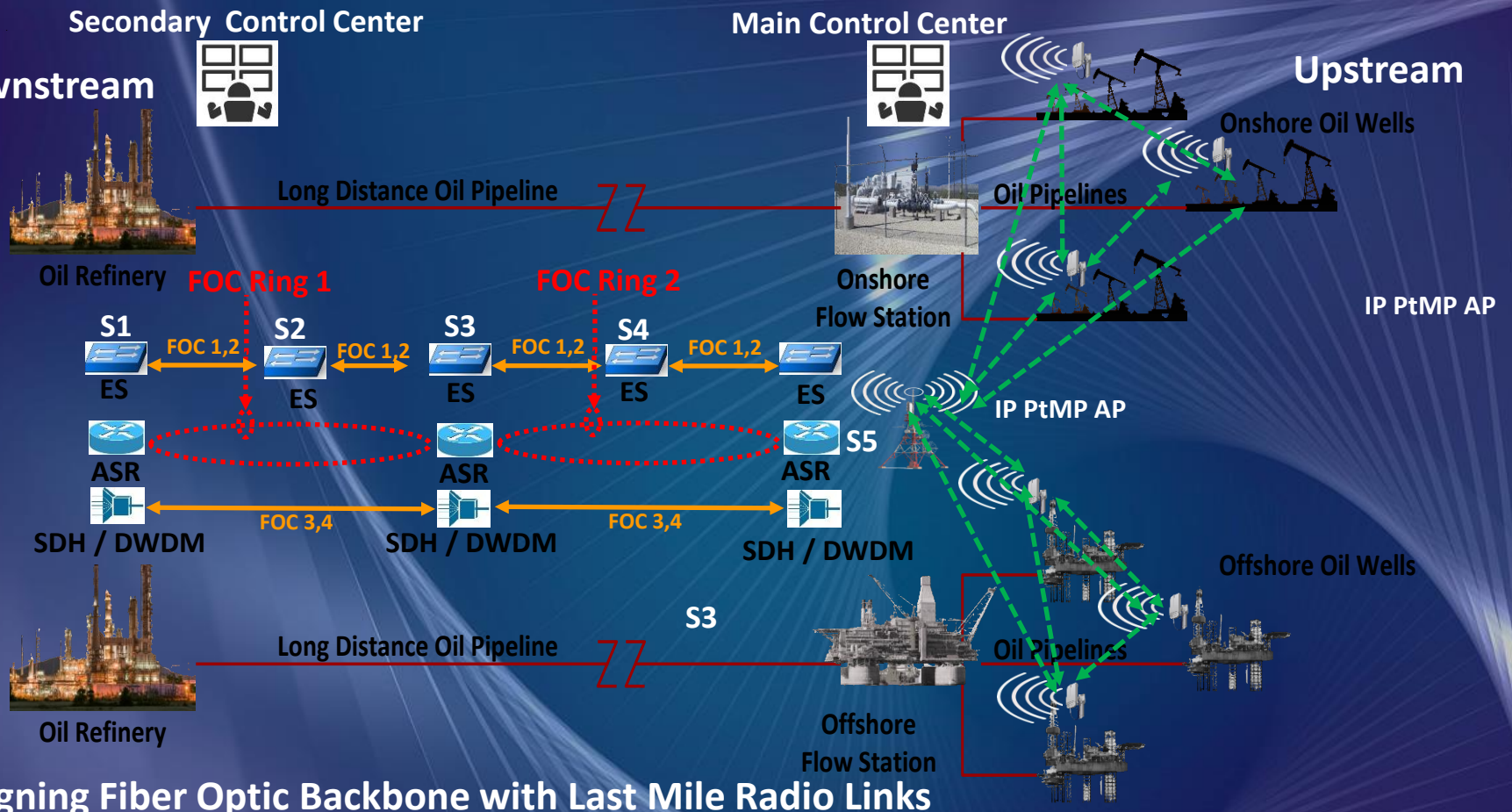
Comparison between Wireless Legacy and IP-Gigabit Wireless Systems

	Legacy Wireless	IP-Gigabit Wireless
Bandwidth (Last Mile)	1200 bps (VHF, DPSK) 2400 bps (UHF, FSK)	70 Mbps (Wimax)
Bandwidth (Backbone)	32.768 Mbps (16xE1, PDH) 155.520 Mbps (STM-1, SDH)	1 Gbps 1.2 / 2.4 / 5.5 Gbps (Multiple Subcarriers)
Systems	SCADA, Analog, Telephony, Trunked Radio.	SCADA, F&G, Leak Detection, LAN, WLAN, IP-Telephony, Access Control Video Surveillance, Intruder Detection, PA/GA, RFID Tracking System, etc.
Last Mile Operating Frequency	Licensed: VHF (136/174 MHz) , UHF (403/470 MHz), MAS (928/960 MHz)	Licensed: Wimax (2.5 GHz, 3.65 GHz) Unlicensed: Wimax (5.8 GHz),
Backbone Operating Frequency	Licensed: 7, 8, 13, 15, 18, 23 GHZ (PDH) 4, 6, 7, 8, 11 GHz (SDH)	Licensed: 6, 7, 8, 10, 11, 13 GHz

Comparison between Wireless Legacy and IP-Gigabit Wireless Systems

	Legacy Wireless	IP-Gigabit Wireless
Reliability	Last Mile: 99.9%, 500 minutes/year downtime Backbone: 99.999%, 5 minutes/year downtime	Last Mile: 99.999% (Wimax), Backbone: 99.999% Gigabit Microwave
Flexibility	Limited	Full Redundancy Mesh Topology in PtMP Links (Last Mile). Easier Implementation of Rings in PtP Links (Backbone).
Managing.	No remote configuration or O&M	Total remote network managing.
O&M	Less complicated.	Qualified and certified staff required.
Coverage	Wider	Lower
Encryption	Very poor	High Level

Design Challenges on Greenfields



Designing Fiber Optic Backbone with Last Mile Radio Links

- IP-PtMP Radios for connecting RTUs, SCADA, LAN, WLAN, IP-Telephony, Trunked Radio, Videosurveilance, Access Control, Intruder Detection, PA/GA, etc.
- DWDM Fiber Optic Links for Backbone

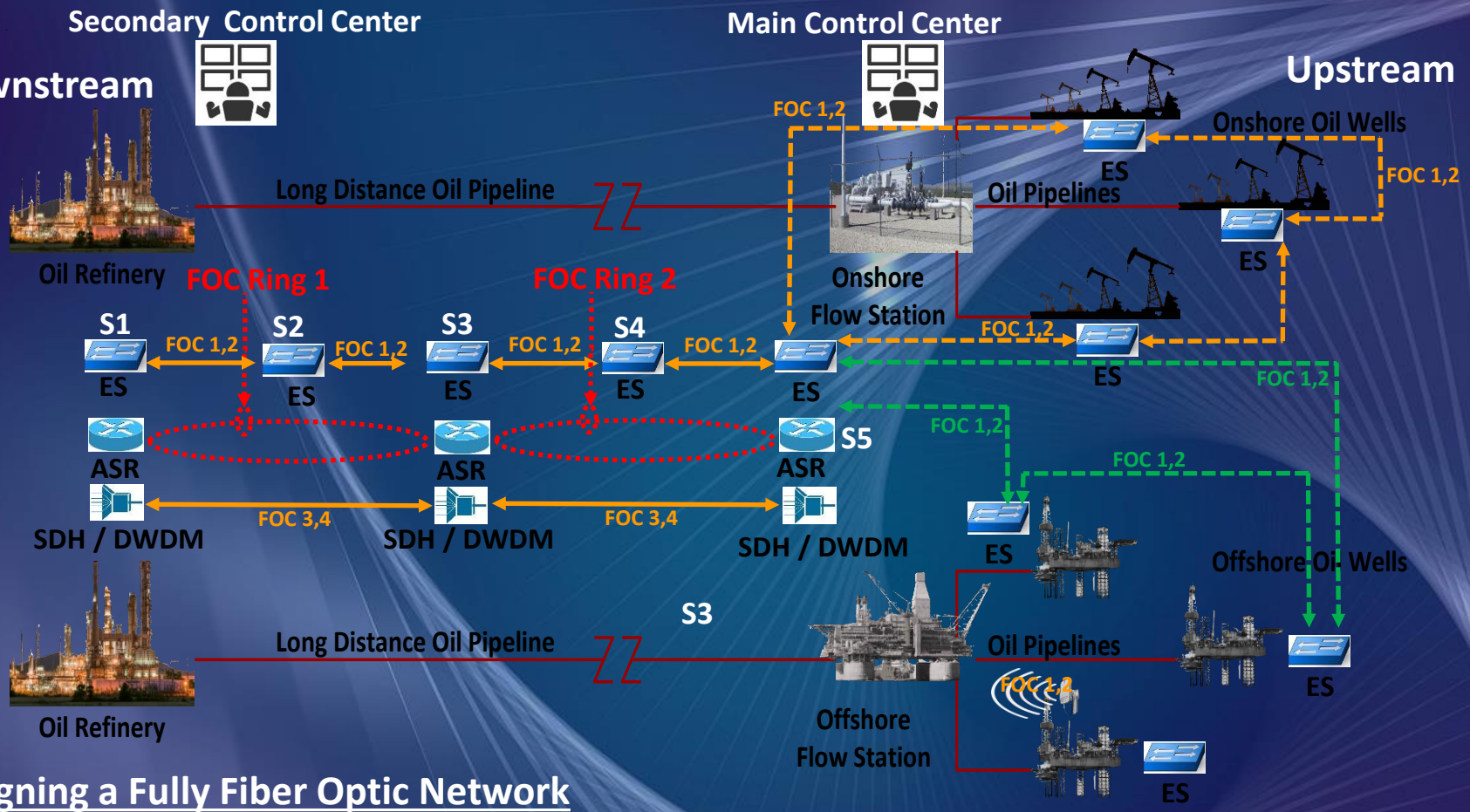
Main Characteristics for Fiber Optic Backbone with IP PtMP Access Radio Links

	Fiber Optic Links (Backbone)	PtMP Radio Links (Last Mile)
Bandwidth	**DWDM:** 2.5 - 40 Gbps (DWDM) **SDH:** 155.52 Mbps(STM-1) 622.08 Mbps (STM-4) 2488.32 Mbps (STM-16) 9953.28 Mbps(STM-64)	70 Mbps (Wimax)
Systems	SCADA, F&G, Leak Detection, LAN, WLAN, IP-Telephony, Access Control Video Surveillance, Intruder Detection, PA/GA, RFID Tracking System, etc.	
Last Mile Operating Frequency	N/A	Licensed: Wimax (2.5 GHz, 3.65 GHz) Unlicensed: Wimax (5.8 GHz),
Max. Distances/ Link	120 Km at 10 Gbps.	50 Km (Wimax)
Right of Way (RoW)	Required	No Required

Main Characteristics for Fiber Optic Backbone with IP PtMP Access Radio Links

	Fiber Optic Links (Backbone)	PtMP Radio Links (Last Mile)
Reliability	99.999%, 5 minutes/year downtime (SDH/DWDM). 99.9999%, 30 seconds/year downtime (SDH / DWDM) with full redundant active equipment.	Last Mile: 99.999% (Wimax),
Flexibility	Full Redundant Fiber Optic Rings Very Flexible Implementation of Fiber Optic Rings.	Full Redundancy Mesh Topology in PtMP Links (Last Mile).
Managing.	Total remote network managing.	
O&M	Qualified and certified staff required.	
Encryption	High Level	

Design Challenges on Greenfields



Designing a Fully Fiber Optic Network

- Industrial Ethernet Access Links for RTUs, SCADA, LAN, WLAN, IP-Telephony, Trunked Radio, Videosurveilance, Access Control, Intruder Detection, PA/GA, etc.
- SDH / DWDM Fiber Optic Links for Backbone

Main Characteristics for Fully Fiber Optic Network

	Fiber Optic Links (Backbone)	Fiber Optic Links (Last Mile)
Bandwidth	**DWDM:** 2.5 - 40 Gbps (DWDM) **SDH:** 155.52 Mbps(STM-1) 622.08 Mbps (STM-4) 2488.32 Mbps (STM-16) 9953.28 Mbps(STM-64)	1 – 10 Gbps (Ethernet)
Systems	SCADA, F&G, Leak Detection, LAN, WLAN, IP-Telephony, Access Control Video Surveillance, Intruder Detection, PA/GA, RFID Tracking System, etc.	
Max. Distances/ Link	120 Km at 10 Gbps.	50
Right of Way (RoW)	Required	No Required

Main Characteristics for Fiber Optic Backbone with IP PtMP Access Radio Links

	Fiber Optic Links (Backbone)	Fiber Optic Links (Last Mile)
Reliability	99.9999%, 30 seconds/year downtime (SDH / DWDM) with full redundant active equipment.	99.9999%, 30 seconds/year downtime (SDH / DWDM) with full redundant active equipment.
Flexibility	Full Redundant Fiber Optic Rings Very Flexible Implementation of future Fiber Optic Rings. Easy migration for future technologies.	
Managing.	Total remote network managing.	
O&M	Qualified and certified staff required.	
Encryption	High Level	

New Trends

- New bands 70/80 GHz allow IP-10 Gigabit Wireless System for short distance last mile links (around 5 Km).
- New DWDM equipment allowing 100 Gbps bandwidth.
- Usage of Compound Fiber Optic Cable for providing Power and Communications simultaneously for both terrestrial and marine paths.
- Wireless and Satellite communication as back-up.
- Inclusion of Fiber Optic for al new projects from the beginning.
- RoW requesting along all the utilities (Potable Water, Power, etc.).
- Fiber Optic Topology with several rings and/or spanning tree for providing full redundancy.
- Multilayer Network Equipment (Ethernet, SDH, DWDM and MPLS) for integrating existing and new networks

Recommendations

- Upgrading from legacy wireless system to new IP-Gigabit Wireless Systems for existing oil fields as first option.
- Install Fiber Optic Cable along the different pipelines for upgrading both Control and Communication Systems and upgrade the last mile radio links to IP-Gigabit technology for achieving a hybrid network, which provides a good cost-benefit relationship on compliance with the different international and local standards, same topology could be implemented for those medium size projects.
- Propose Fiber Optic Links for all the new projects with high number of oilfields, flow stations, pipelines, etc., which would guarantee the must sutenaible infrastructure for long time.