ACCELERATING INNOVATION

3-1137
bp's Path to Remote Operations and Unattended Facilities Using DeltaV Technology

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Agenda

Introduction and Background

Definitions and Types of Remote Access

Telecoms

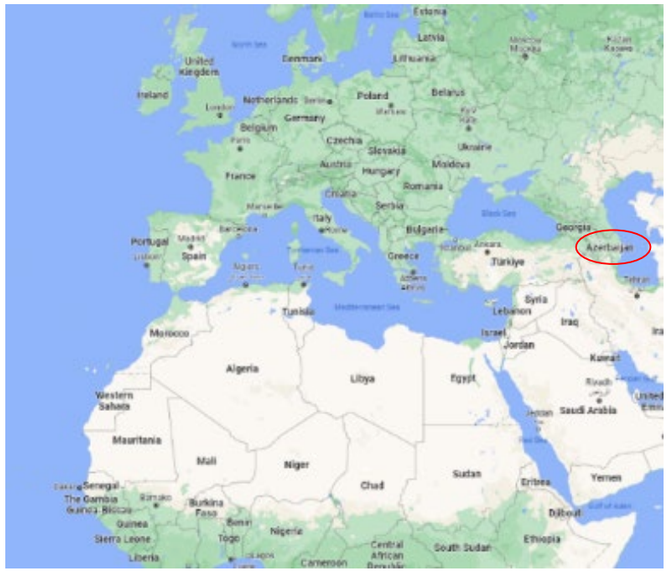
bp’s Pathway

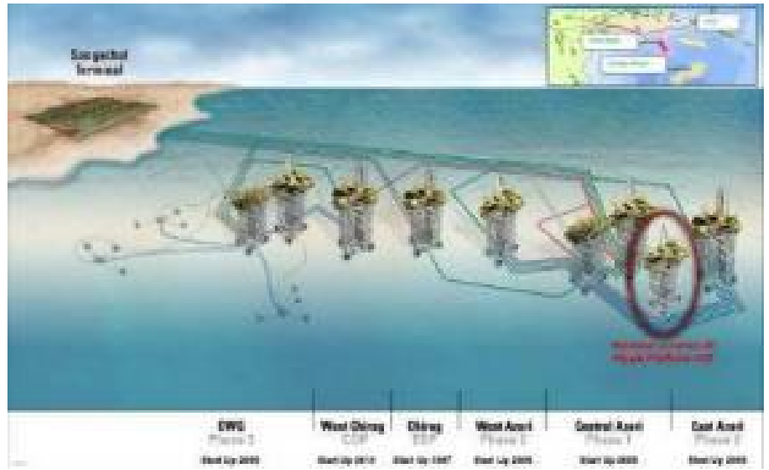
Recommendations and Lessons learned

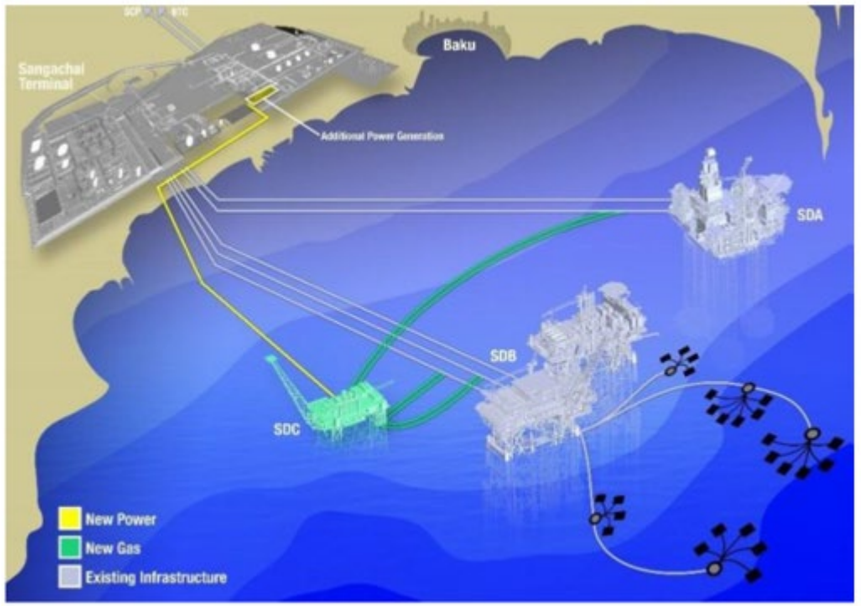
Introduction and Background

bp in Azerbaijan

- bp operates the Azeri-Chirag-Gunashli (ACG) and Shah Deniz Fields in the Caspian Sea, having first arrived in 1992.
- ACG consists of 7 offshore platforms, with the most recent Azeri Central East (ACE) achieving first oil in 2024
- Shah Deniz consists of 2 offshore platforms, with the most recent Shah Deniz Bravo achieving first gas in 2018
- ACG and Shah Deniz fields feed Sangachal terminal







Greater Tortue Ahmeyim (GTA) on Mauritania and Senegal boarder

- Gas is produced from an ultra-deep-water production system, which is processed in mid-water by a floating production, storage and offloading (FPSO) vessel. The FPSO will process the gas, removing water and impurities.
- The gas is then exported ~35km via pipeline to an inshore Hub/Terminal (inclusive of a breakwater providing shelter) where it will be cryogenically cooled, liquefied and stored before being transferred to LNG carriers for export.
- First gas was announced on 2nd January 2025.

Definitions and Types of Remote Access

Definitions of Remote Access

- Remote Access means different things to different people depending on job function.

Terminology	Our Definition	Data Flow
Remote Control	Control from secondary location	Bi-Directional
Remote Engineering	Perform modifications to the system from remote location	Bi-Directional
Remote Monitoring	Perform analytical functionality from remote locations	Single Direction
Remote Maintenance	Perform maintenance tasks from a remote location	Bi-Directional

- System architectures and security controls will vary depending on what you want to implement.

- International standards and company standards help provide guidance and requirements to meet the challenges of Remote Access

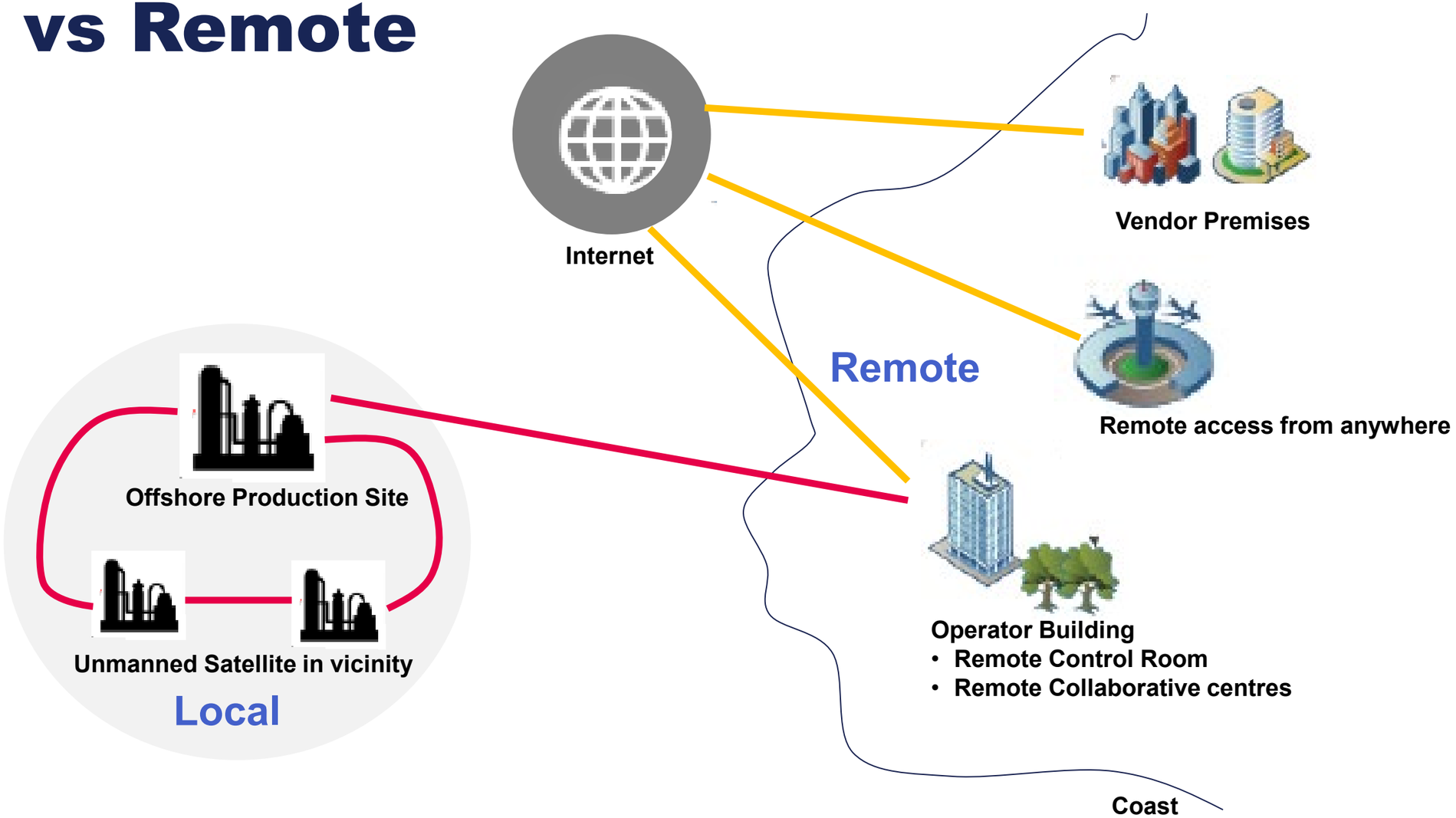
IOGP – Report 627

REPORT 627 | OCTOBER 2018

Selection of system and security architectures for remote control, engineering, maintenance, and monitoring

https://www.iogp.org/bookstore/product/iogp-report-627-selection-of-system-and-security-architectures-for-remote-control-engineering-maintenance-and-monitoring

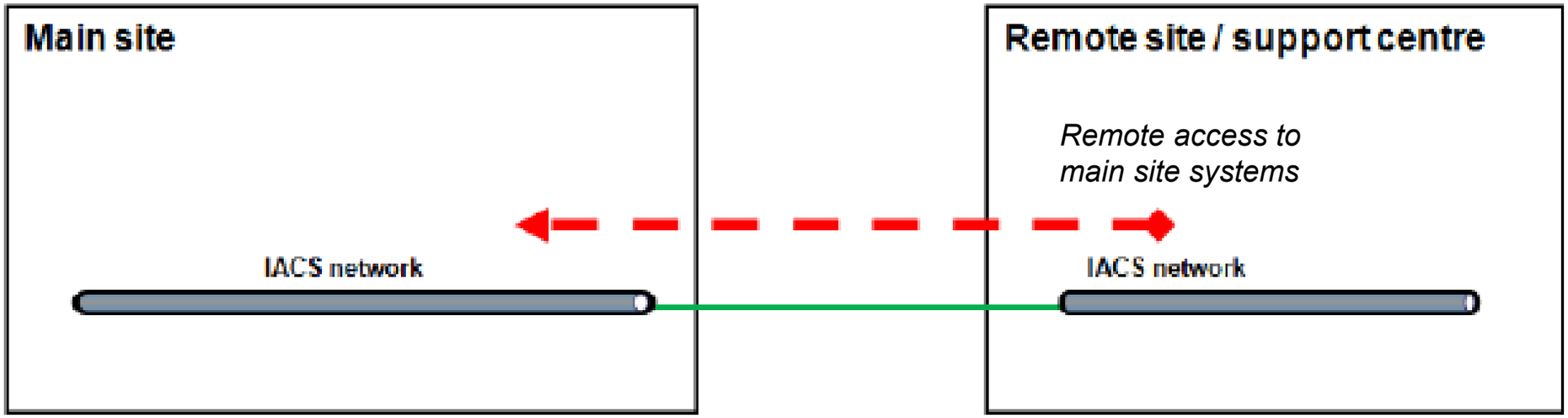
Local vs Remote



Horizontal Connectivity

- Extend the Control and Safety Network to the remote location
- Provides the same functionality as the local main site

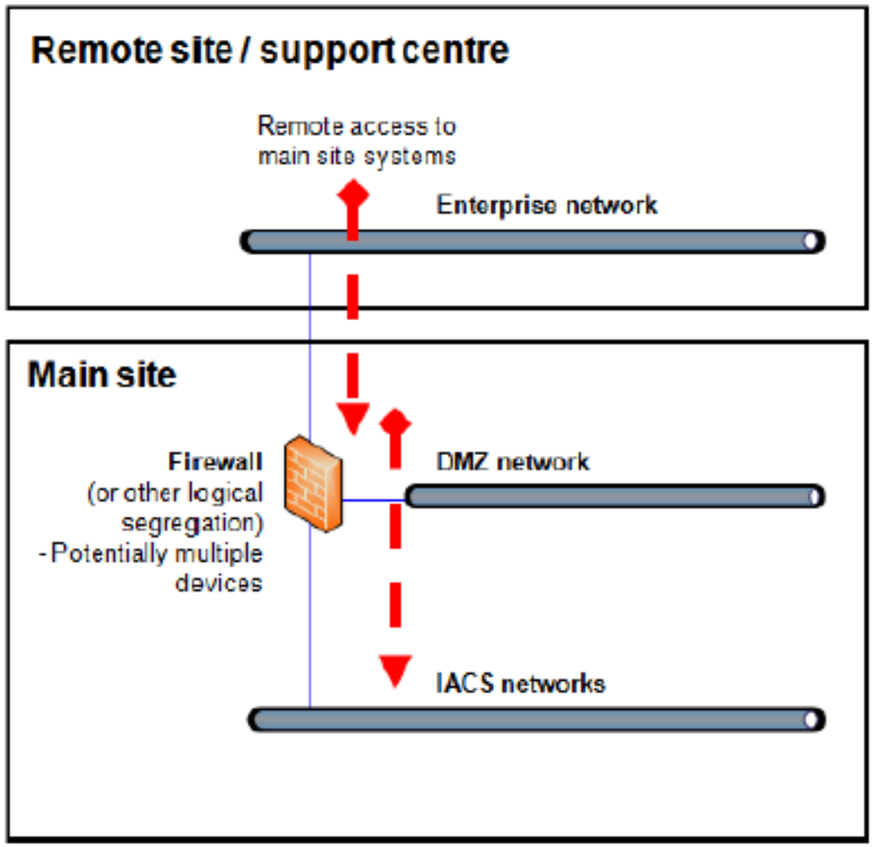
- Can be used for Real time control applications e.g. control room operators



IACS = Industrial Automation and Control Systems

Vertical Connectivity

- Provide level of access at the remote location
- Not intended to provide same level of functionality as the main local access
- Monitoring and support applications e.g. maintenance and reliability analysis



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Telecoms

Telecoms systems

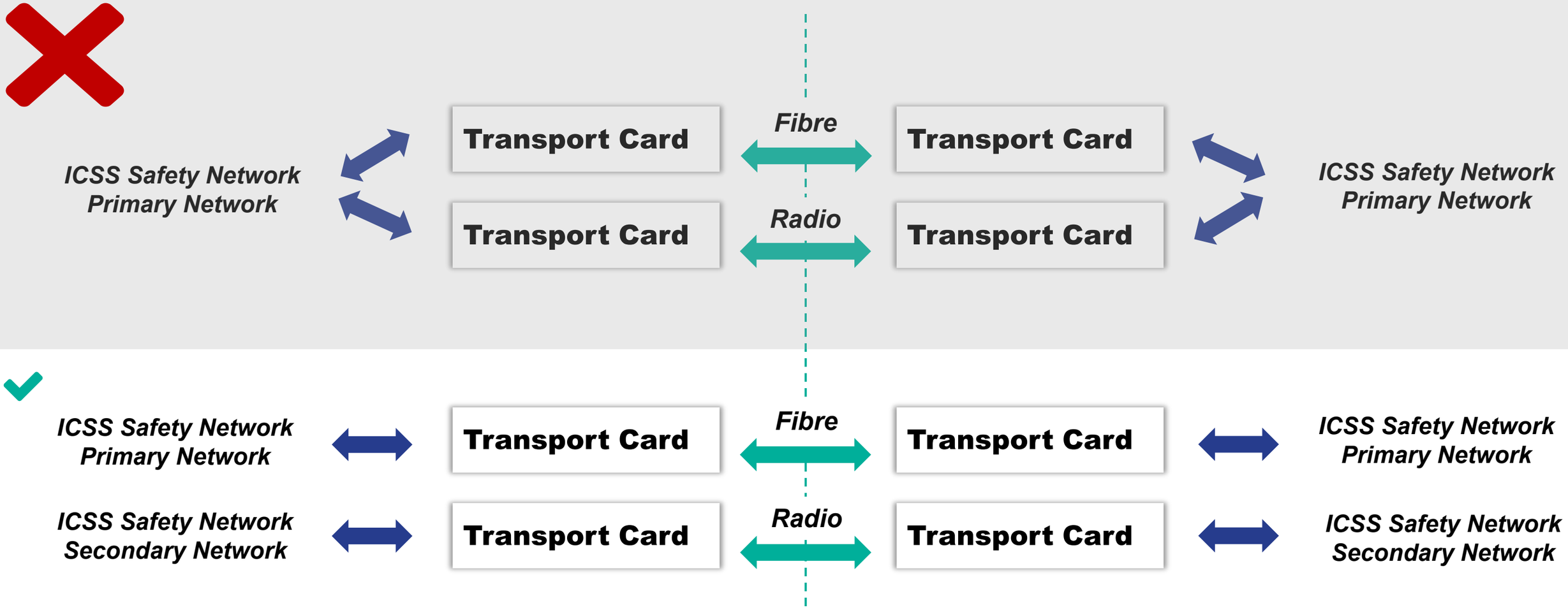
- The requirements will be based on the on type of connectivity required

- Horizontal
  - Recommended to have dedicated private systems
  - Redundancy requirements (Primary and Secondary networks down different routes)
  - Media type (fibre, radio)
  - Shorter distances

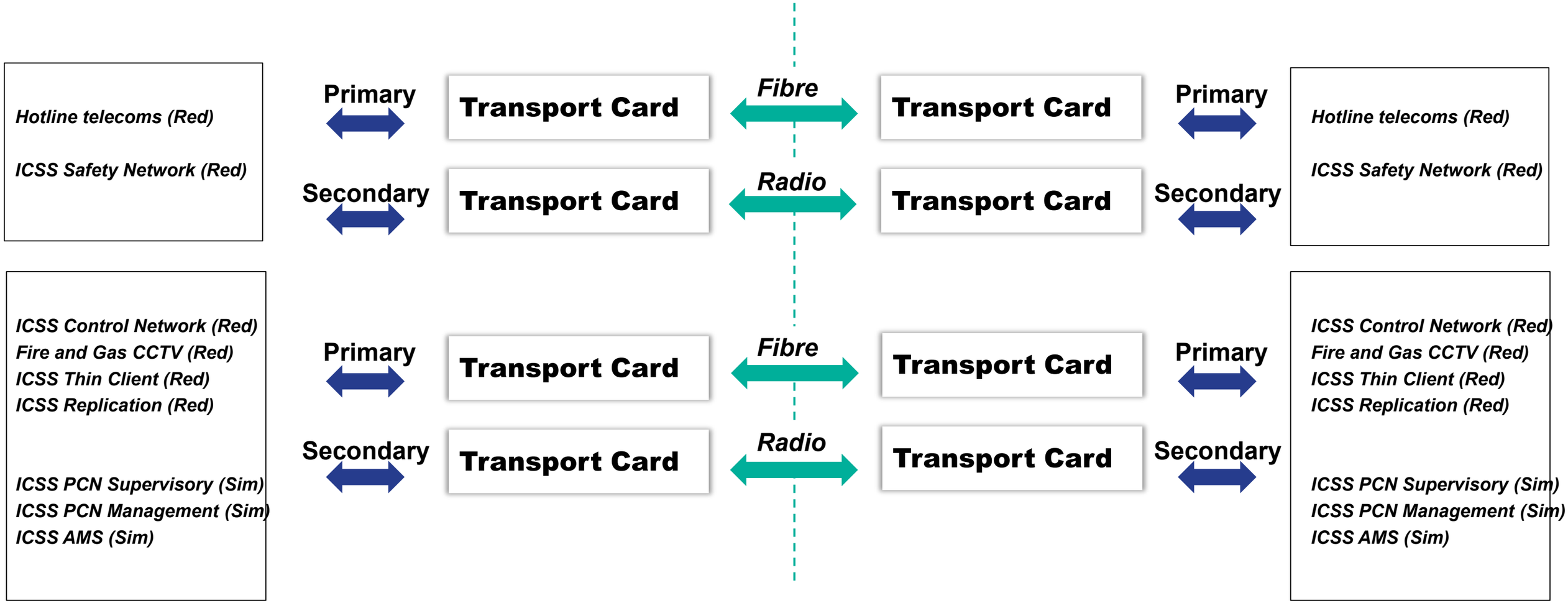
- Vertical
  - Layer on commercial networks (e.g. VPNs)
  - Simplex systems since can tolerate interruptions
  - Can cover longer distances

High Availability Telecoms Infrastructure

Traditional Media redundancy is not technically possible

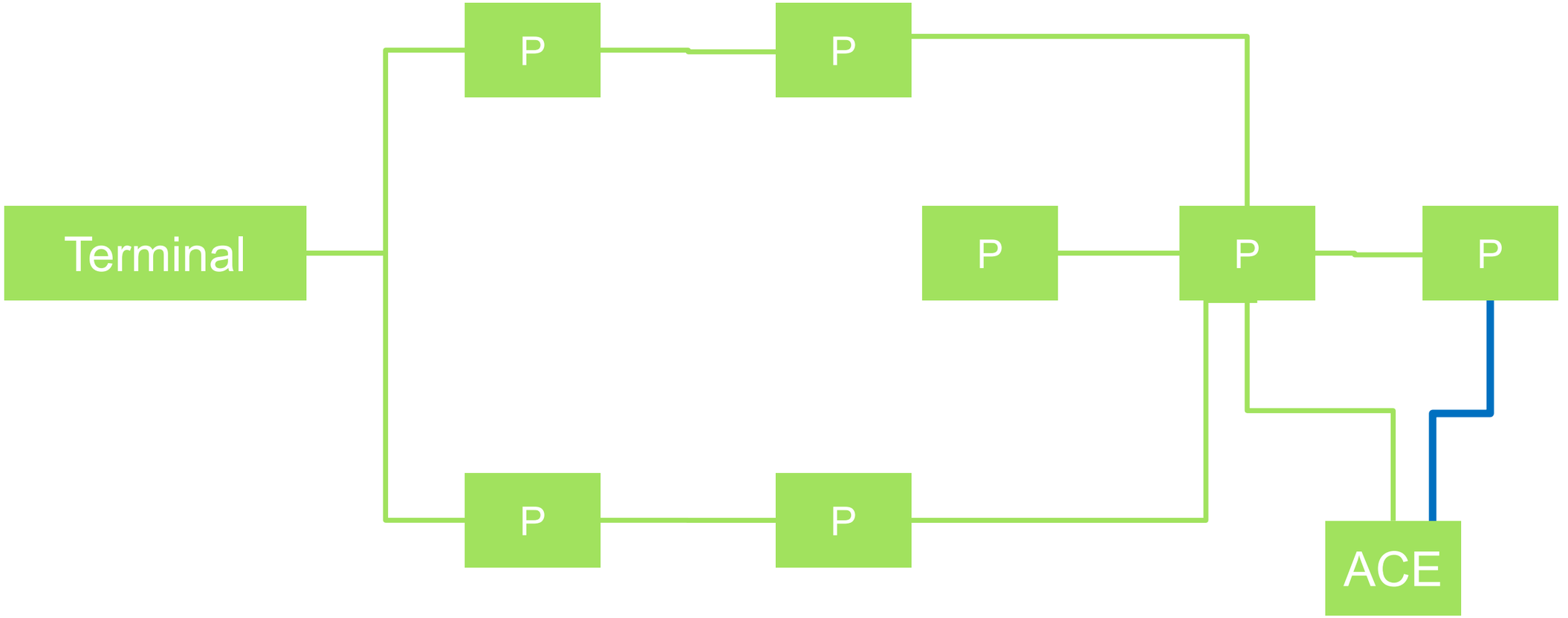


Typical Horizontal Telecoms Infrastructure



Red = Redundant network - communicates via Primary and Secondary networks
Sim = Simplex Network communicates via either Primary or Secondary network only
Safety critical networks are segregated from non safety networks over media and hardware

Horizontal Telecoms Infrastructure

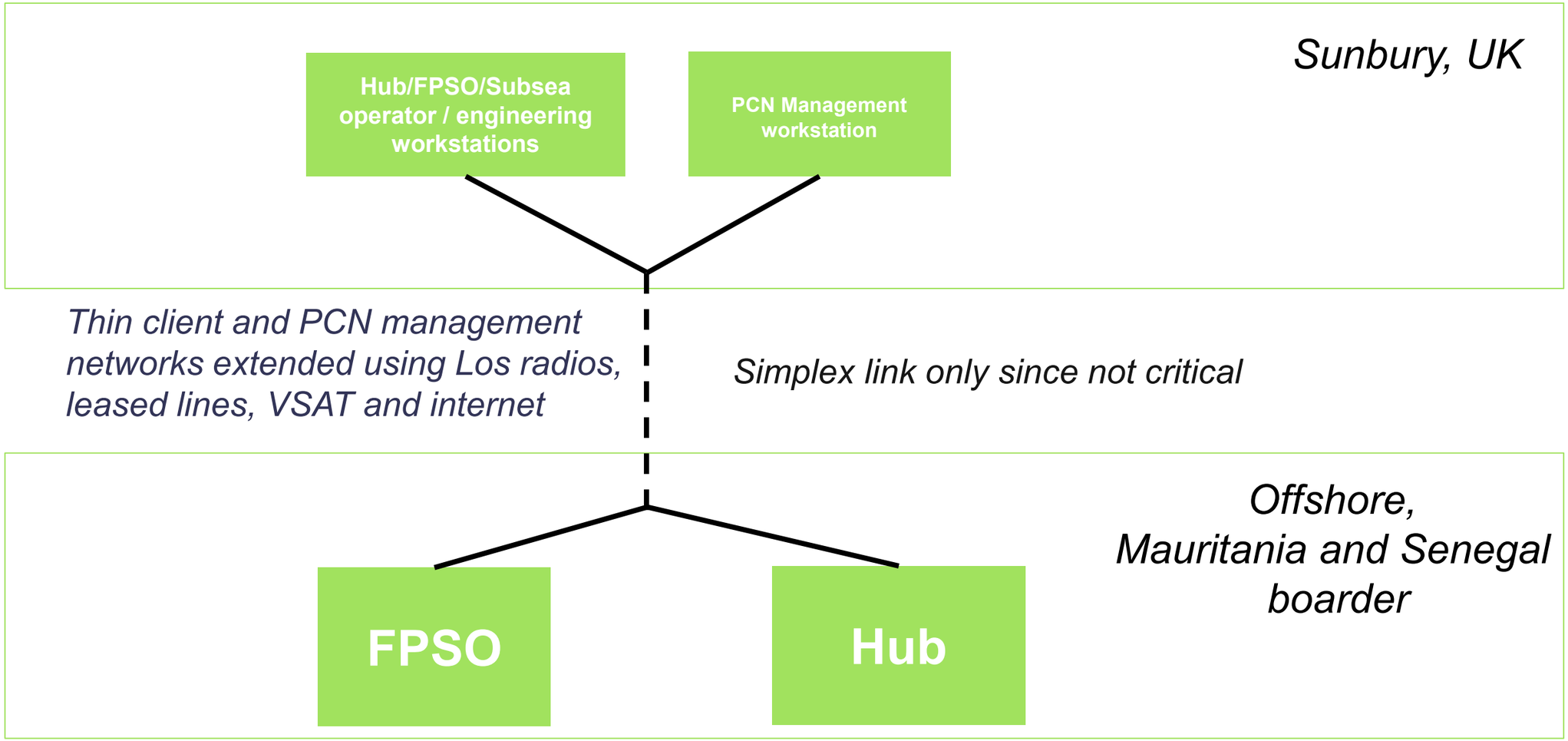


Fibre

Line of Sight

Link redundancy required for critical operations

Vertical Network & Thin Client Extension



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bp's Pathway (DeltaV Systems)

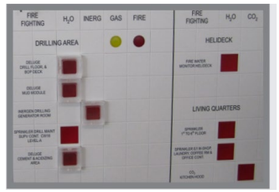
Why Remote Access

- Removes personnel from offshore
- Enables specialist support
  - Many of the operational sites for bp are in locations with limited ‘Persons on Board’ and difficult to get to
- Enables data analytics & process improvements

- But:
  - Has CAPEX costs
  - Digital security considerations
  - Requires additional expertise maintain

West Chirag Platform (2014)

Local Offshore

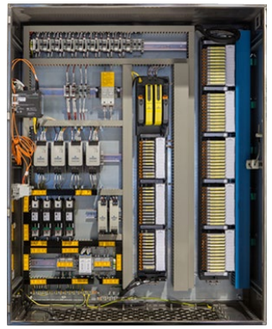


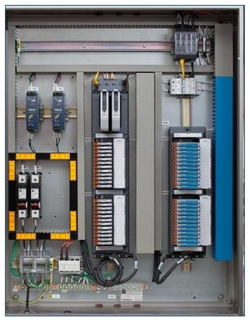
DeltaV

Remote Onshore

Engineering / Operator access

Cross project serial
Communications to other parts of facility





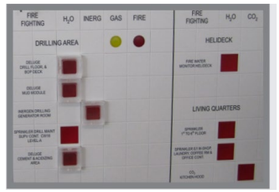
Offshore
Central Control Room
Delta V SIS
Delta V PAS
Matrix Panel
Servers/Switches

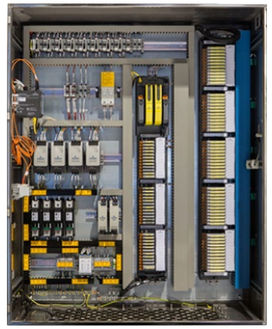
Onshore
Engineering Server
Connection to terminal systems

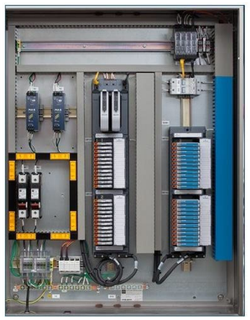
Shah Deniz Bravo Platform (2018)

Local Offshore

Permanently attended Control Room







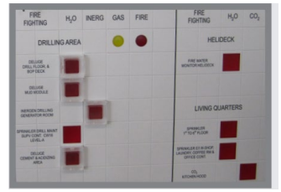
DeltaV

DeltaV SIS

AMS
CCTV
Backup and recovery

Remote Onshore

Full Onshore Control Available – shared with onshore CRTs



Offshore
Central Control Room
Delta V SIS
Delta V PAS
Matrix Panel
Virtual Servers (VRTX)

Onshore
Control Room
Matrix Panel
Virtual Servers (VTRX)
Interzone Server

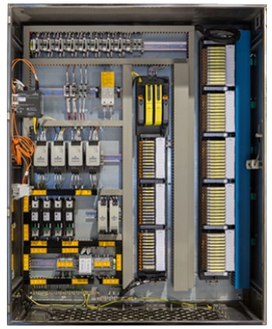
DeltaV Zones link to West Chirag

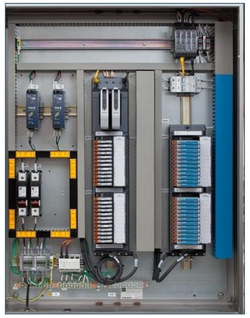
Cross project serial
Communications to other parts of facility

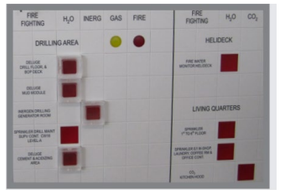
Azeri Central East Platform (2024)

Local Offshore

*Control Room - **unattended***







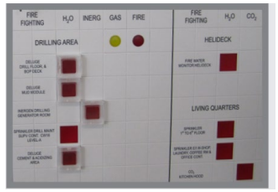
DeltaV

DeltaV SIS

AMS
CCTV
Backup and recovery

Remote Onshore

***Permanently attended** Control Room*



Offshore
Collaboration Room
Delta V SIS
Delta V PAS
Matrix Panel
Virtual Servers (VRTX)

Onshore
Main Control Room
Matrix Panel
Virtual Servers (VTRX)
Interzone Server

DeltaV Zones link to West Chirag

Cross project serial
Communications to other parts of facility

Shah Deniz Compression Platform Normally Unattended (Future startup)

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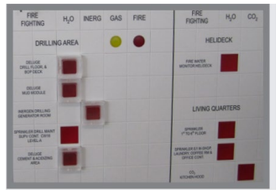
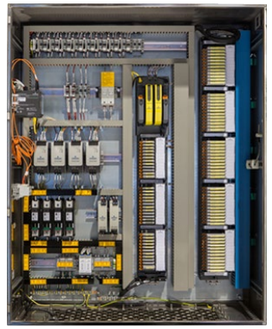
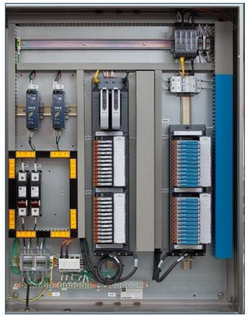
Local Offshore

Thin Client Engineering / Operator access







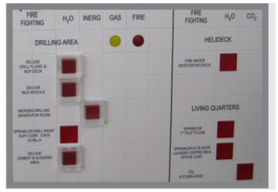
DeltaV

DeltaV SIS

AMS
CCTV
Backup and recovery

Remote Onshore

***Permanently attended** Control Room*



Offshore
Eng/Op station
Delta V SIS
DeltaV PAS
Matrix Panel

Onshore
Main Control Room
Matrix Panel
Virtual Servers (VTRX)
Interzone Server

DeltaV Zones link to West Chirag

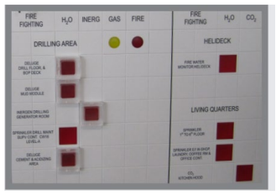
Cross project serial Communications to other parts of facility

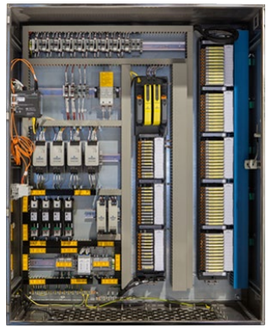
Tortue Project (2025)

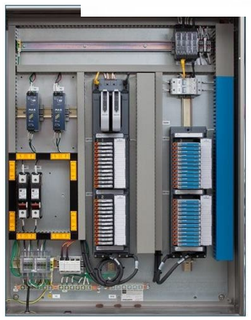
Remote Onshore in UK

Thin Client Engineering / Operator access

DeltaV thin client network and management network







Local Offshore

Recommendations and lessons learned

Lessons learned

- Be clear what type of access is required.
  - Permanent Operator control vs adhoc engineering capability vs monitoring only

- Clear **statement of requirements** for remote access including:
  - Type of remote access
  - User requirements
  - Emergency response procedures
  - Digital Security
  - Build Human factors, operator training from early engineering phase.
  - Ways of working
  - Maintenance Contract Requirements

Lessons learned

- Telecommunications systems key part of design:
  - Needs to replicate offshore environment and reliability aligned with the criticality
  - Digital Security key aspect
  - Latency and intermediate infrastructure requires assessing (early testing required)
  - Fail over design needs early engineering

- Plan to Start Production with remote system fully functional and used
  - Challenging to switch to remote (onshore) control room operation if not clearly designed, tested, commissioned and started-up from day one.

- Clearly identify vertical access operating procedures, access levels and controls.

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Thank You

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