Communications Equipment
Interconnectivity and Interoperability

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Agenda

- Who are we and what do we do?
- Military applications & typical interfacing issues..
- Typical connectivity examples
- More advanced interfacing
  - Fibre Multiplexed Solution case-study
- Wrap-up

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Who we are and what we do!

- Metrodata Ltd, UK Datacoms Equipment Manufacturer est. 1989
  - Interface and Transport Specialists
  - SDH/PDH, Serial, ATM, Fibre & Ethernet
  - Terrestrial, Microwave, Satellite applications

- Clients worldwide include:
  - Telecommunications Service Providers
  - Public Sector (Central & Local Govt., Defence, Health, Edu)
  - Corporate Enterprises

- Integration Division, 'Metrodata Network Solutions'
  - Integrated customer solutions including Metrodata and 3rd Party Products & Services
  - "Solving Communications Problems"

Military applications

- Military sector customers:
  - USAF (e.g. Eglin AFB), US Navy / SPAWAR & US Army
  - UK MOD (various deployments)
  - Other NATO forces, e.g. RNLA TITAAN

- Typical interfacing requirements / issues:
  - Service interface conversion (e.g. Telco circuit interface to eqpt.)
  - 'Copper-fibre' interface conversion for service extension
  - Interface matching conversion (typically eqpt. to eqpt. often seen with crypto deployments)
  - Multi-service multiplexing over fibre (i.e. high bandwidth availability)
  - Multi-service convergence & multiplexing over restricted speed links (i.e. typically Radio or Satcom)
  - Backhaul circuit connectivity, Satcom to Terrestrial
Typical Terrestrial & µ-wave Solutions

Carrier 2Mbps Leased Line (E1) connection to Serial Router port

Fibre extension of Voice (eg ISDN-30 trunk) or Data (Serial, 10/100 or Gigabit E’Net)

Line-of-sight (µ-wave) equipment often presents with SDH/PDH interface - here interfaced to Serial Router port (typ. up to HSSI speeds)

Multiplexing & LAN Extension Solutions

Multiple E1 &/or E3 and Multiple Ethernet links over fibre

Ethernet (Layer 2) extension across variety of link media. Here showing Terrestrial 2Mbps 'Leased Line' circuit, alternatively Serial (various if types), E3/DS3, STM-1/OC3 etc.
Data Links over Satellite

Overcome terrestrial limitations and optimise data services over satellite

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Serial Link Cryptos

Note: Auto crypto-resync has proven to be a useful facility!
Eglin AFB: Converged Services over Satellite

USAF Eglin AFB: Voice, Video, Telemetry & IP Data Convergence via ATM transport for multi-site Communications

Central Location

Remote Site 1 (sea-going barge!)

Remote Site 2 Mobile truck

Metrodata AP8000 Access Processor

Inputs: Voice, Video, Telemetry Data, IP

Serial SAT Modem Interfaces

HSSI ATM UNI (x1 or x2)

QUAD T1 - CE

LAN (10/100) - CE

HSSI - CE

DS3 UNI

ATM STM-1 UNI

OC-3 ATM UNI

TYPICAL AP CONFIGURATION

Global Hawk Comms back-haul

FIBRE OPTIC LINK

UAV BACK-HAUL

EIA530 CRYPTO

AP

2.455Mbps

SLM6500 MODULATOR

SLM6500 DE-MODULATOR

9.312Mbps

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Satellite Backhaul for NASA LANDSAT

- Backhaul of customer application from Earth Station over Terrestrial Infrastructure to Data Centre
- This Solution Quadrupled the Resolution of Satellite Pictures

Example: multi-protocol fibre network

- Network required to converge Voice, Data and Alarm/Control signalling, via sub-sea fibre, between 3 North Sea Oil platforms
  - Key network aspects:
    - Distance: platforms up to ~ 50km apart
    - Versatility: Voice and multiple data types over the same network
    - Resilience: Critical aspect, resilience to multiple network/device failures
    - On-site deployment: Small window, limited and (relatively) unskilled resources
    - Low cost!

- Payload profile:
  - Data: 10/100 & Gigabit Ethernet
  - Voice: TDM PBX inter-connection via 2Mbps voice trunks
  - Alarm/Control: Proprietary (but relatively low speed) Serial data
1. Converged Ethernet/IP approach

- Resilient Ethernet/IP networks involving convergence of multiple communications protocols require advanced networking skills for support staff and addressing schema can be complex.

- Complex QoS configuration (if supported) to ensure effective prioritisation of Voice & Alarm/Control traffic vs 'general' IT Data.

- Resilient Fibre Ring using RSTP or other protocols for Ethernet 'loop avoidance'. These may take time to 're-converge' in the event of a failure.

2. Optical Multiplexing approach

- Passive 'CWDM' (Coarse Wavelength Division Multiplexed) solution offered the following:
  - Low cost
    - Using well established, low cost fibre interface converters
  - Low complexity
    - Config. & installation more akin to 'plumbing' than to complex data networking
  - High reliability & resilience
    - All systems 'dual homed' onto two separate fibre rings
    - Optical multiplexers are un-powered devices, minimal possibility of failure
    - Resultant network offers resilience to double fibre and/or equipment failures
    - Network could be fully deployed on a single Tx/Rx fibre pair between each location (although in fact two pairs used to give fully redundant resilience)
Resilient (dual-homed) Service Interfacing

Serial
- Serial (max 8Mbps) to dual SFP fibre
- RS-232/X.21/V.35/EIA-530

Data
- 10/100/1000 Ethernet to dual SFP fibre

Voice
- ISDN-30 (E1) to dual SFP fibre

Industrial Control
- SFP to dual SFP fibre (used typically for MMF to SMF matching, for both Ethernet and 'generic' signalling incl. Alarm/Control)
- Emux
- Multi E1 (4, 8, 16 ports) to dual SFP fibre

And more! (TV, SAN etc. etc.)

Resilient Ring Topology

Site A
- Serial i/f
- E'net i/f

Link 1
- Required Communications:
  - Serial (Alarm/Control): A <> C
  - Ethernet (Data): A <> B
  - Voice (TDM): B <> C

Link 2

Site B
- E'net i/f
- Voice Trunk i/f (E1 / ISDN-30)

Link 3

Site C
- Serial i/f
- Voice Trunk i/f (E1 / ISDN-30)

All Services resilient to failure of any of Link 1, 2 or 3 or to failure of any CWDM Mux/Demux unit
Packaged fibre communications solution offering fully resilient (dual fibre routed) connectivity for any combination of:

- Up to 16 x Copper to (MM or) SM Fibre 10/100/1000Mbps Ethernet
- Up to 16 x MM Fibre 10/100/1000Mbps Ethernet to SM Fibre 10/100/1000Mbps Ethernet
- Up to 13 x Serial (RS-232/X.21/V.35/EIA530) to (MM or) SM Fibre (**possibility to increase**?)
- Up to 16 x MM Non-Ethernet Fibre Signalling (e.g. Alarm/SCADA apps etc.) to SM Fibre
- Up to 13 x E1 (a.k.a. ISDN-30/ QSIG etc.) Copper to SM Fibre

**Typical config:**
- 2 x E1 (i.e. up to 60 Voice circuits)
- 4 x 100Mbps or Gigabit E'net
- 2 x Non-E'net Media Conversion
- 4 x Serial
- 1 x spare connection

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**Wrap up**

- Whilst today’s commercial communications infrastructure marches inexorably to ever higher speeds, military deployments demand a more careful approach:
  - Compatibility across multiple generations of equipment & infrastructure
  - Incorporation of a multitude of equipment, often with 'specialised' interface requirements
  - Rapid and simple deployment in theatre

- Metrodata, and Metrodata Network Solutions, can help!
  - Long-established company of high expertise in interface solutions
  - Metrodata equipment is designed and manufactured in the UK
  - COTS, KOTS(!) and fully bespoke developments undertaken

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Thank you!

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