

Network monitoring with simple network monitoring protocol in optical feeder network

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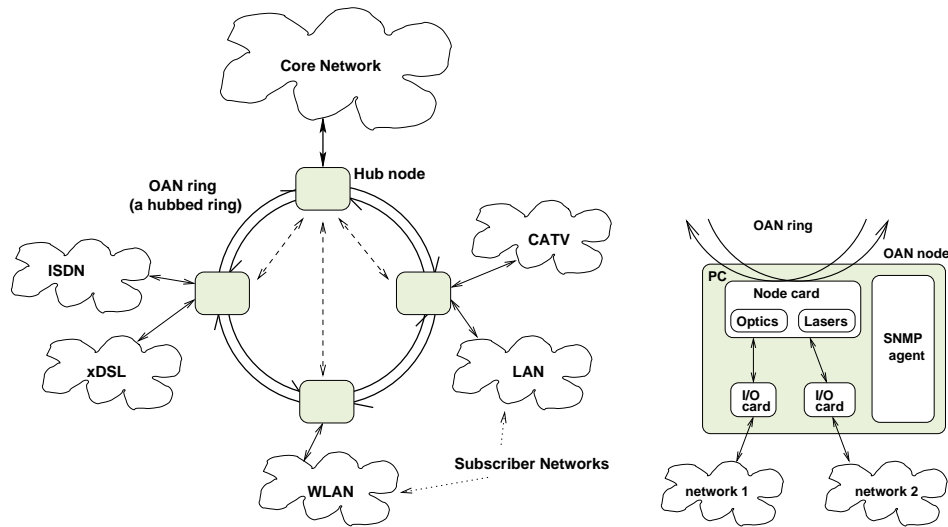
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- OAN (Optical Access Networking) project
- Network monitoring in OAN network
- Extending SNMP agent
- Conclusions and further work



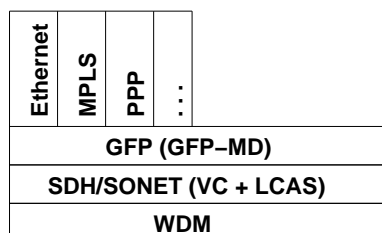
OAN (Optical Access Networking) project

- TEKES funded, 2001-2003 (VTT, HUT, Nokia, Elisa)



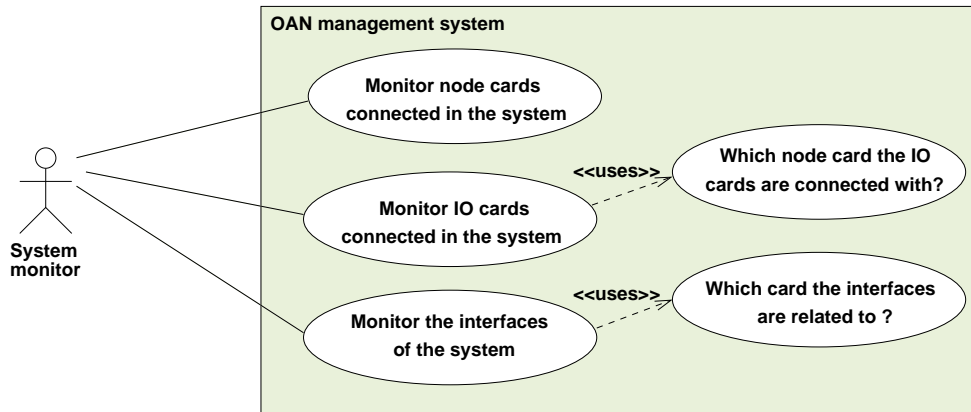
OAN protocol stack

- WDM, optics
- SDH, transport layer, prevailing protocol
 - + VC, efficient bandwidth allocation
 - + LCAS, dynamic bandwidth re-allocation,
- GFP, adaptation layer for both block-coded or packet-oriented data
 - + GFP-MD, VTT extension, supports multicast and provides faster packet forwarding



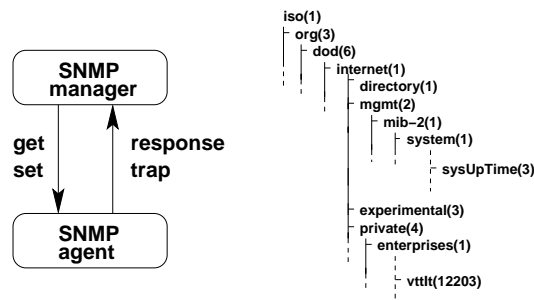
OAN network monitoring

- Mostly network performance monitoring
- Speeds up failure locating



OAN network monitoring with SNMP (Simple Network Monitoring Protocol)

- Standardized by IETF, kept as simple as possible
- Presents management information as objects defined in management information bases (MIBs)
- Third version (SNMPv3) offers security and data encryption
- Extendable SNMP agent/manager software available (Net-SNMP)



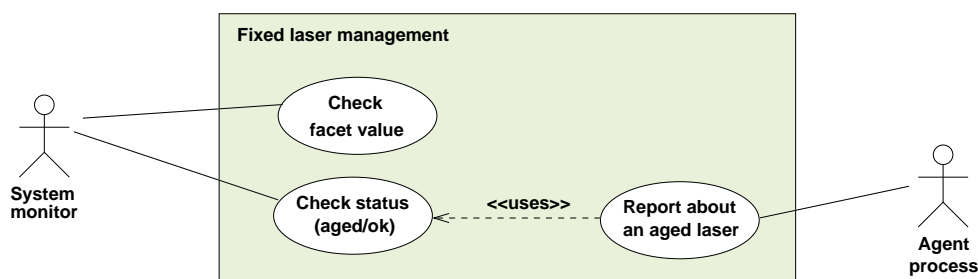
Layered Network Management Scheme

- Combination of readily standardized MIBs and OAN-specific MIBs
- System management information: MIB-II, IETF RFC 1213
- Interfaces management information:
 - + basic information: Interfaces MIB, IETF RFC 2863
 - + SDH information: SONET/SDH MIB, IETF RFC 2558
 - + VC, LCAS extensions: OAN project (further work)
 - + GFP, GFP-MD: OAN project (further work)
 - + overlay protocols: IETF RFCs
- OAN components management information
 - + node cards + lasers: VTT-IT-OAN-NODECARD-MIB
 - + IO cards: OAN project



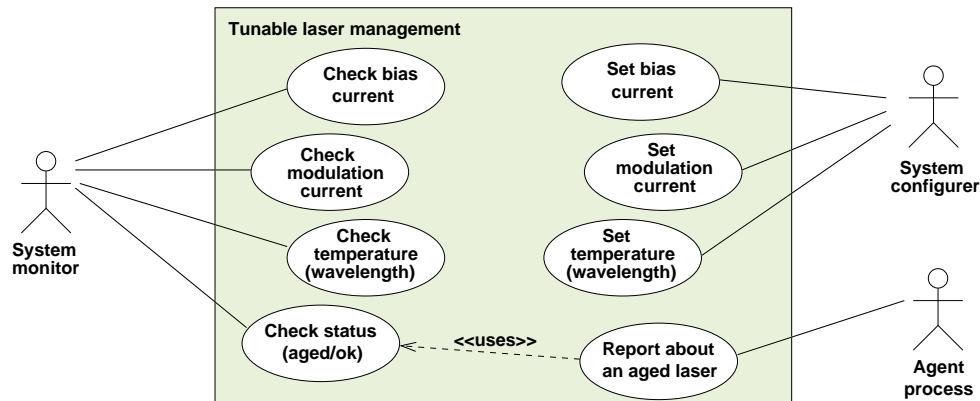
Monitoring OAN node cards and lasers 1/2

- One OAN management system may contain several nodes
- Each OAN node card includes four lasers: two tunable, two fixed
- OAN node card management information: index, name, description, status, type of laser A and laser B
- Laser management information: different for fixed and tunable lasers



Monitoring OAN node cards and lasers 2/2

- The operating point of a tunable laser is set with three values: temperature (wavelength), bias current, and modulation current



From use cases to SNMP MIBs

- MIBs are ASN.1 descriptions (readable both for machine and human)
- The needed management information (data-type, access rights) must be defined and placed into the MIB tree structure

```

voNcTLaserBTemperature OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION "A read-write integer representing the temperature
                (wavelength) of the laser B in the OAN node card.
                The temperature is in hundredths of degrees of
                Celcius (0,01 C)."
```

::= { voNodeCardEntry 11 }

- ASN.1 description for node card management information in VTT-IT-OAN-NODECARD-MIB
- Two traps for reporting about aged lasers: voNcLaserAEndOfLife and voNcLaserBEndofLife

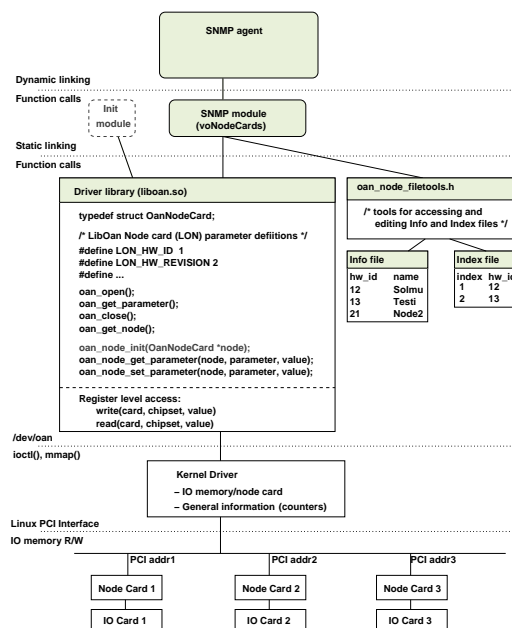


From MIBs to SNMP agent source code

- Net-SNMP package includes mib2c compiler that produces agent-attachable C code from ASN.1 MIB descriptions
- Command `mib2c voNodeCards` produces two code files: `voNodeCards.h` and `voNodeCards.c`
- Produced code is only a skeleton which has to be fleshed out
- Programmer does not need to understand the deep internals of the SNMP agent - extending the agent is straightforward
- Only functions for module initializing, variable handling, and value setting need to be augmented



System architecture

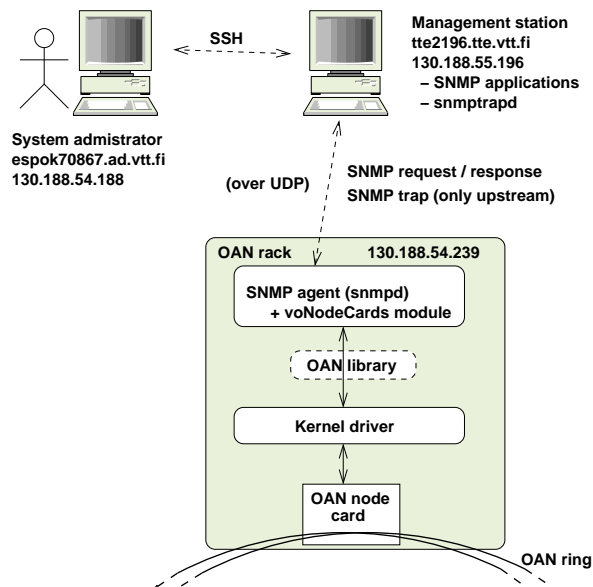


Including the module to SNMP agent

- Ready C-code must be compiled into a module and included into SNMP agent
- voNodeCards.c and the driver library liboan.so are compiled into shared object, voNodeCards.so
- voNodeCards module is linked dynamically into Net-SNMP agent by configuring agent configuration file
- Agent loads dynamic modules during re-start
- New module is tested by getting and setting the OAN node card management information
- Also the sending of laser A/B end-of-life traps must be tested



OAN test network



Conclusion

- SNMP is easy to take in use due to ready tools and standardized MIBs
- The MIB structure does not support complex data types (such as arrays) or advanced queries (such as, all active node cards)
- SNMP does not support creating or deleting rows, returning parameters or executing functions, which could be nice if the network should really be managed instead of bare monitoring
- SNMP is applicable for simple network monitoring, extensive network monitoring is difficult
- *The simple nature of SNMP makes things complex.*



Further work

- MIB for LCAS and VC extensions of SONET/SDH protocol
- MIB for GFP (and GFP-MD) protocols
- Extending the agent to support SONET/SDH MIB and OAN-specific MIBs
- Extending the driver to provide needed management information
- User interface hiding the complexity of MIB tree structure

