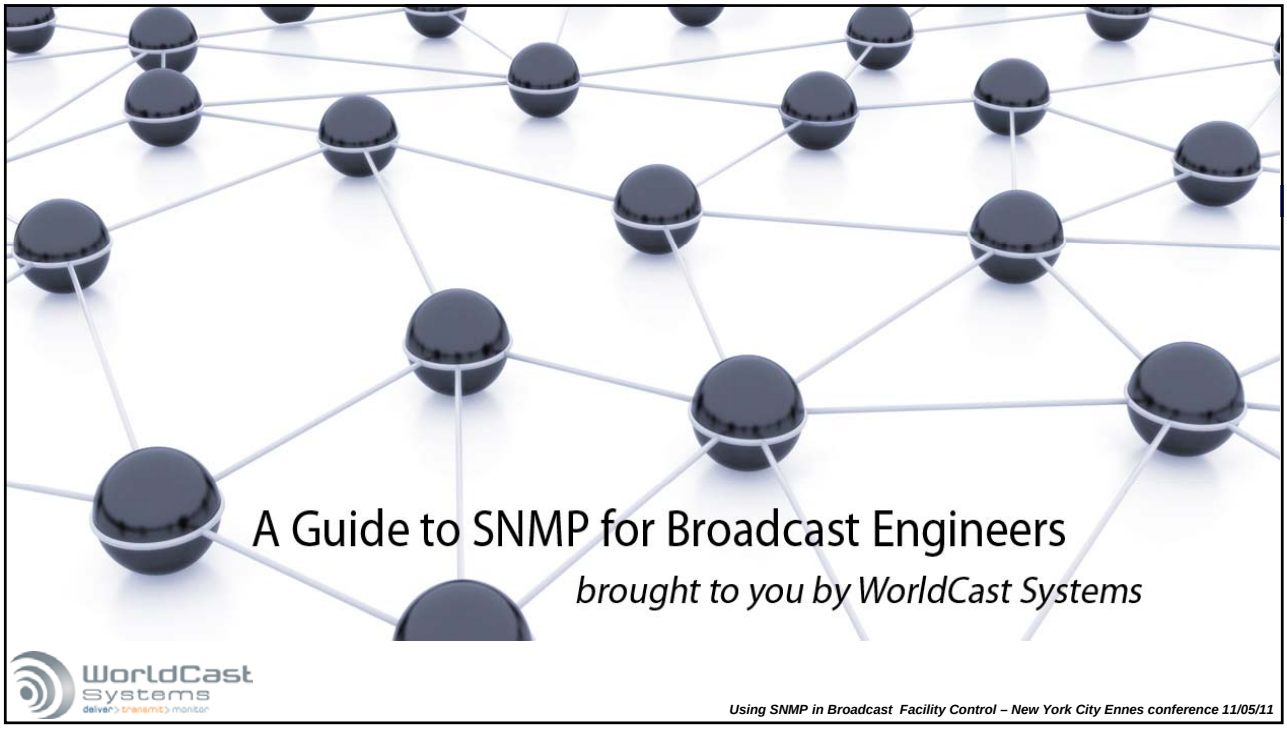
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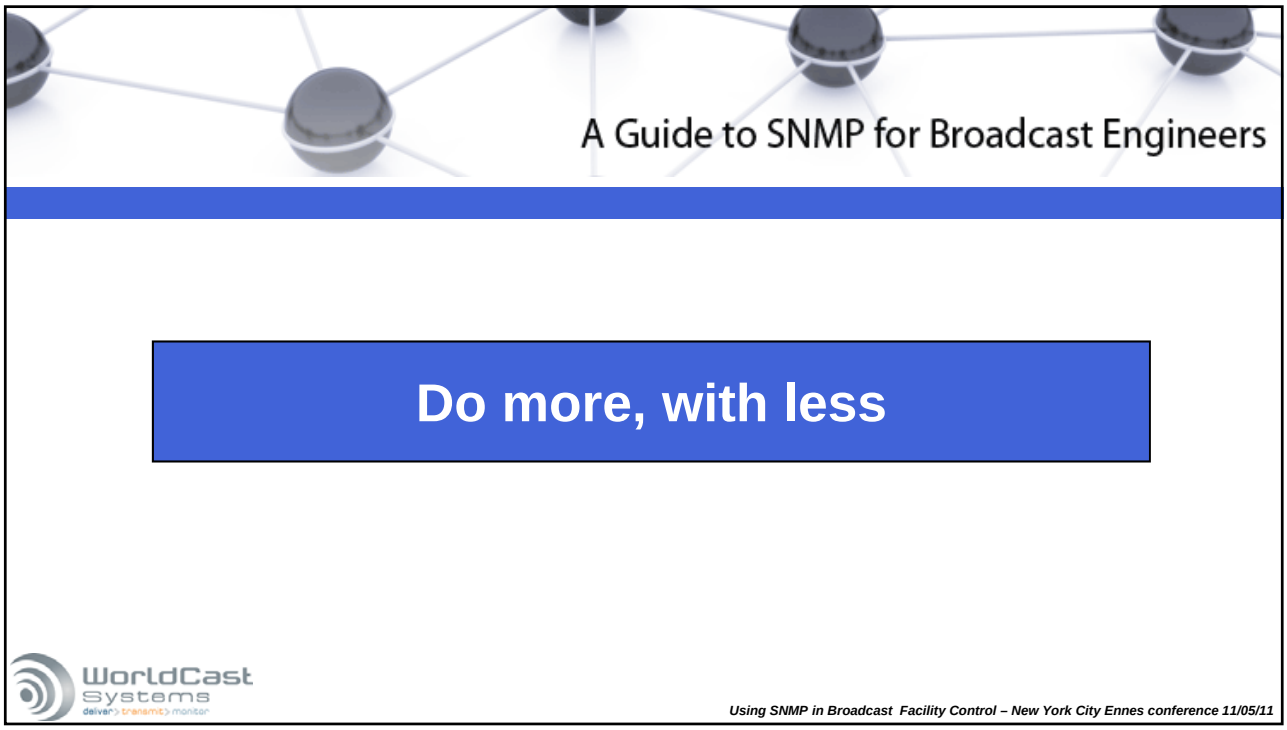
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Economic Challenges

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- Do More, with Less

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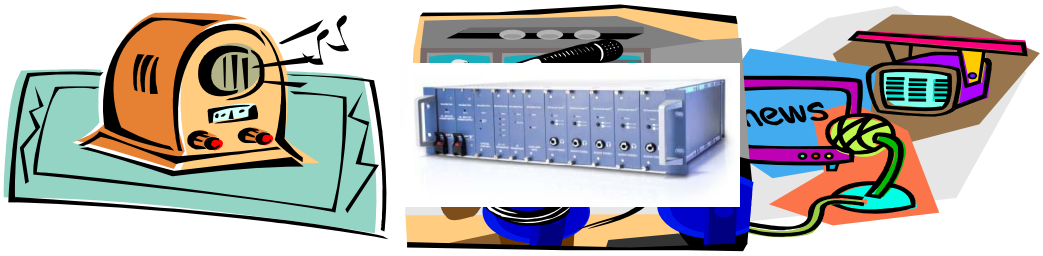
Broadcasters also finding ways to Economize



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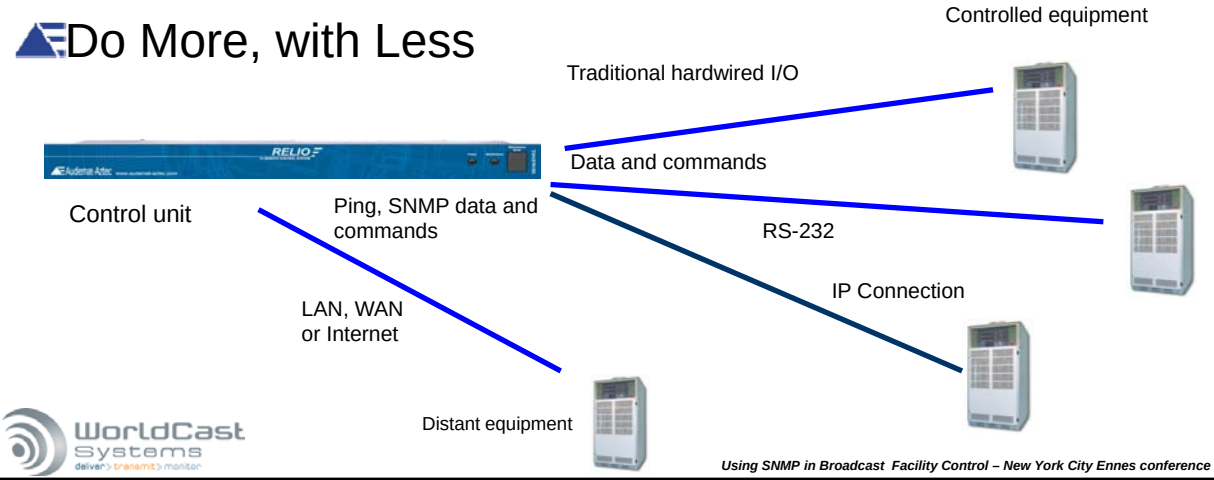
Connectivity – new Pathways = more productivity

Do More, with Less



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CE, CC, NYC
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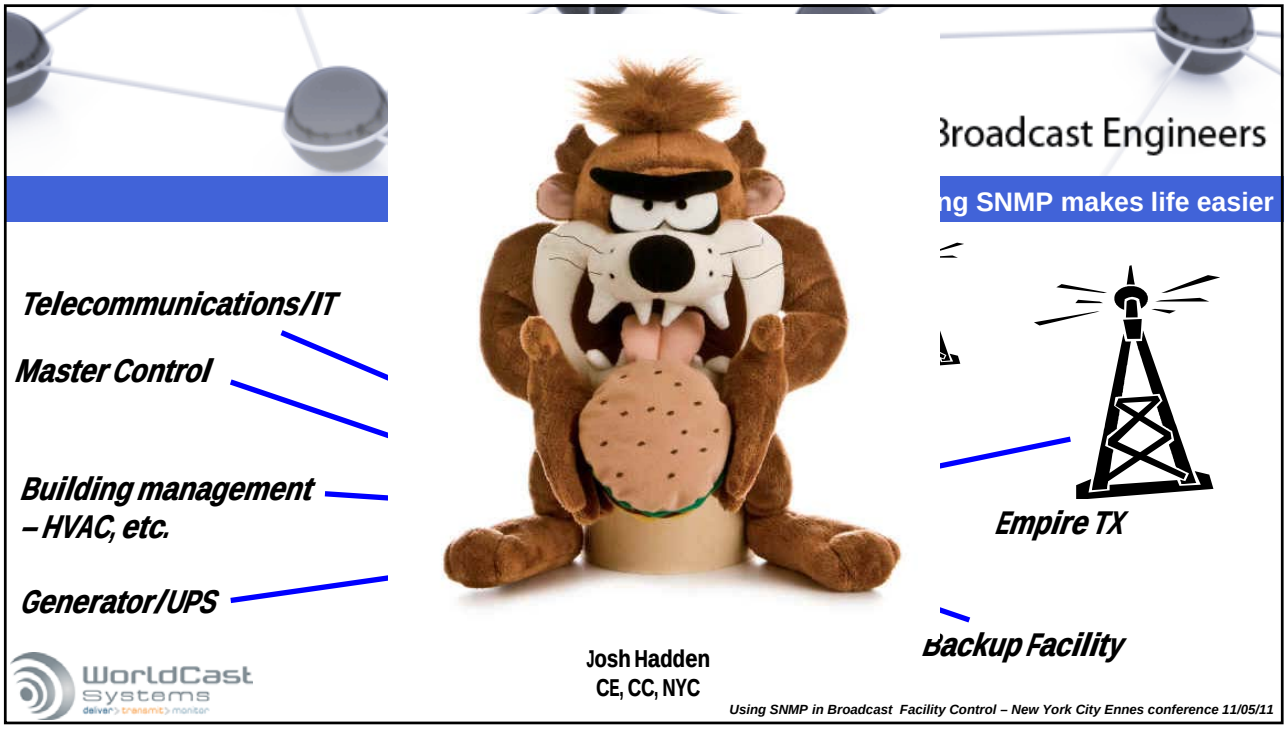
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ng SNMP makes life easier
Telecommunications/IT
Master Control
Building management – HVAC, etc.
Generator/UPS
Empire TX
Backup Facility
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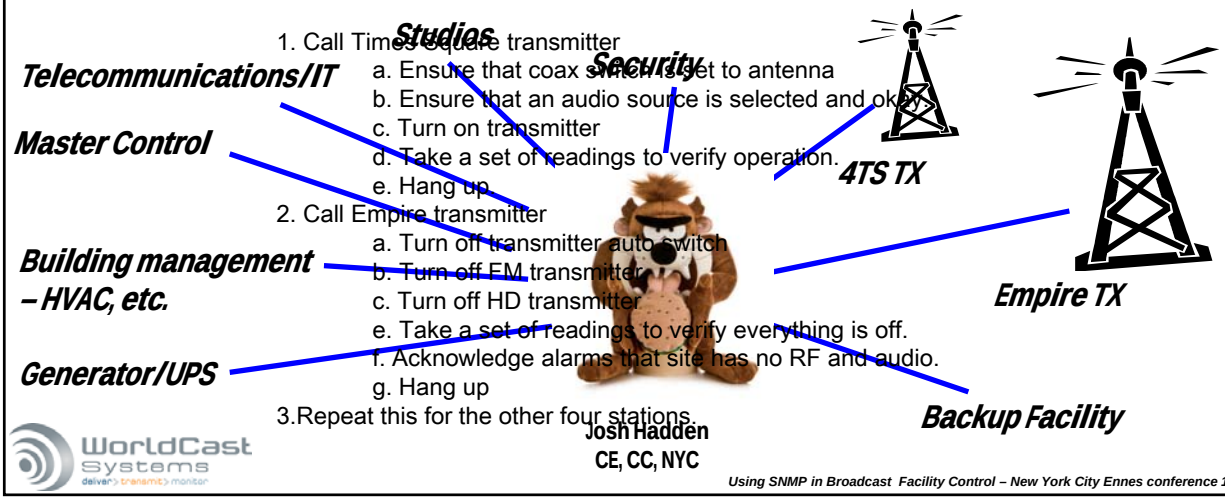
Using SNMP makes life easier



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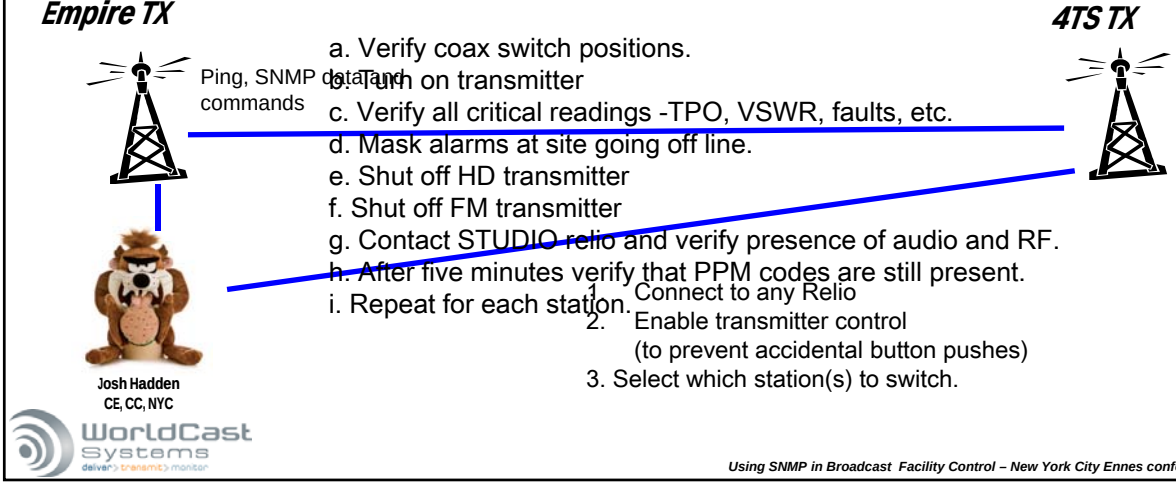
Switching between transmitter sites



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Switching between transmitter sites

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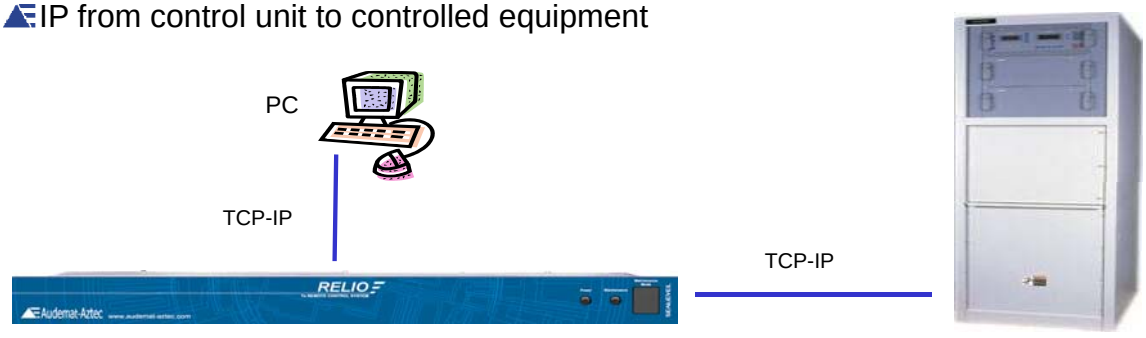
Advanced IP connectivity

- IP from control point to control unit
- IP from control unit to controlled equipment



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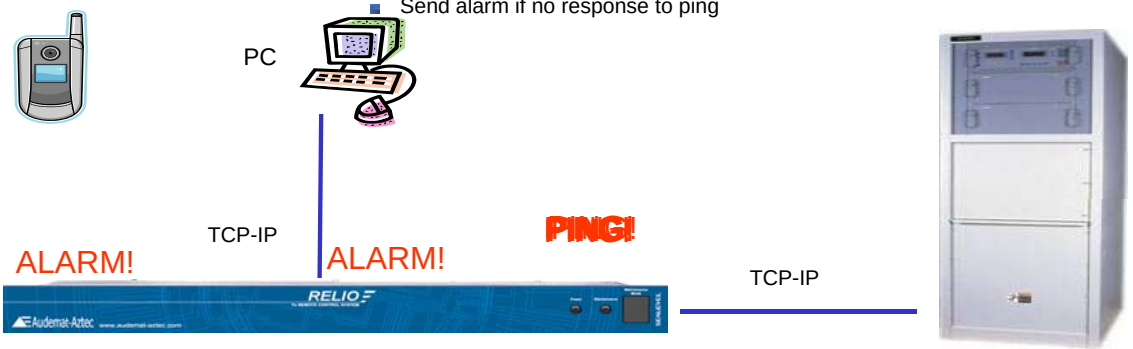
IP Ping command

- Ping sends simple data packet to another network address
  - Check that the target unit is on line
  - Send alarm if no response to ping



WorldCast Systems Control unit

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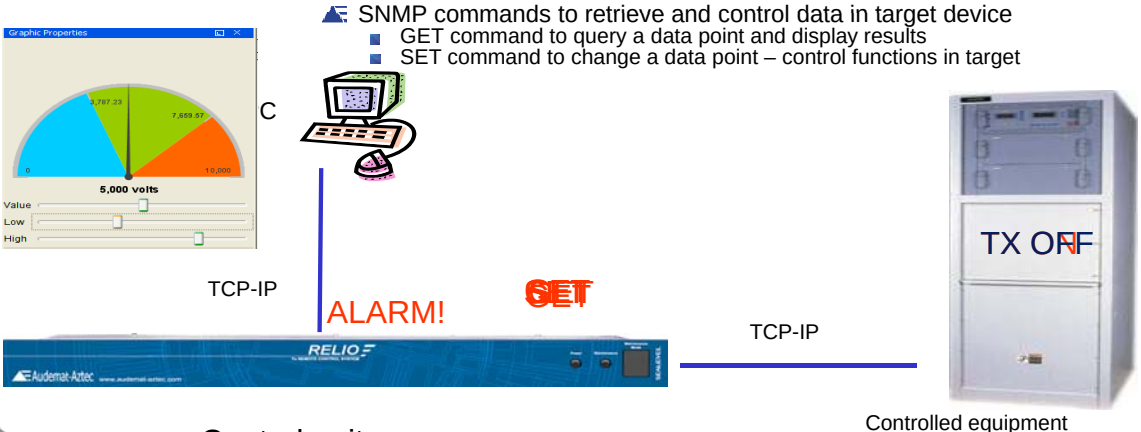
IP SNMP

- SNMP commands to retrieve and control data in target device
  - GET command to query a data point and display results
  - SET command to change a data point – control functions in target



WorldCast Systems Control unit

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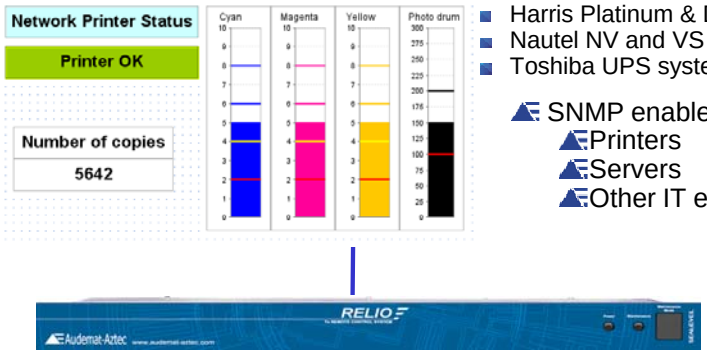
IP SNMP possibilities

- SNMP enabled broadcast equipment
  - Harris Platinum & Diamond ATSC
  - Nautel NV and VS series
  - Toshiba UPS systems
- SNMP enabled office equipment
  - Printers
  - Servers
  - Other IT equipment



TCP-IP

Control unit

SNMP enabled transmitter

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SNMP – The Simple Network Management Protocol

Simple Network Management Protocol

- Standardized protocol Created in 1988 for computerized equipment
- UDP based network protocol that defines a set of network standards including an application layer and a database
- Controlling equipment is called an SNMP ‘Manager’
- Controlled equipment is called an SNMP ‘Agent’
- Data Objects are each assigned a unit number called the Object Identifier, or OID

: := 1.3.6.1.4.1.5299.15.12.1.11.1.1.8

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SNMP Commands

- The **GET** family – to retrieve data objects from Agent equipment
  - **GET** – retrieve a single object
  - **GETNEXT** – retrieve next available object
  - **GETBULK** - retrieve a large number of objects
- **SET** – to change the value of a data object in the Agent equipment (this is how we control remote equipment with SNMP)
- **RESPONSE** – Agent reply to a Manager GET or SET command
- **TRAP** – initiated by the Agent software and sent to the Manager, usually indicating some sort of alarm condition
- **INFORM** – a more reliable version of the TRAP that requires acknowledgement from the Manager that the message has been received

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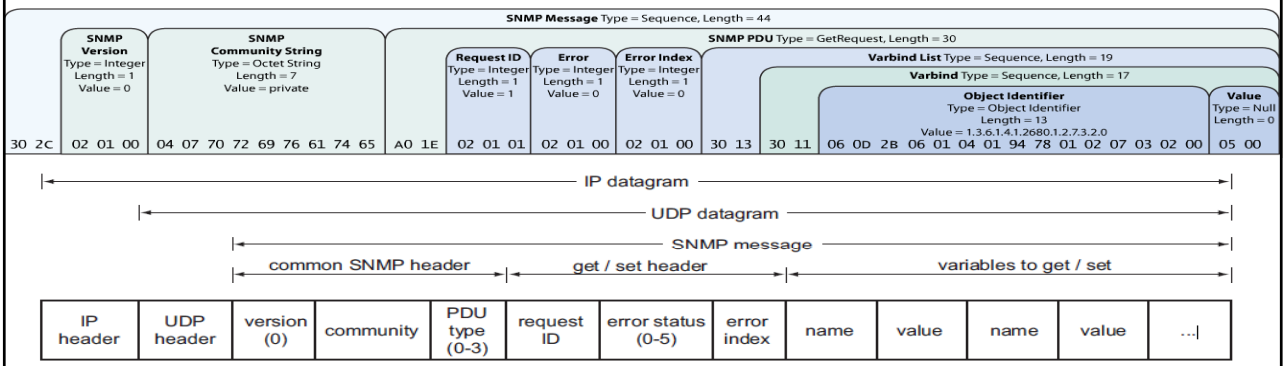
SNMP Packet Structure



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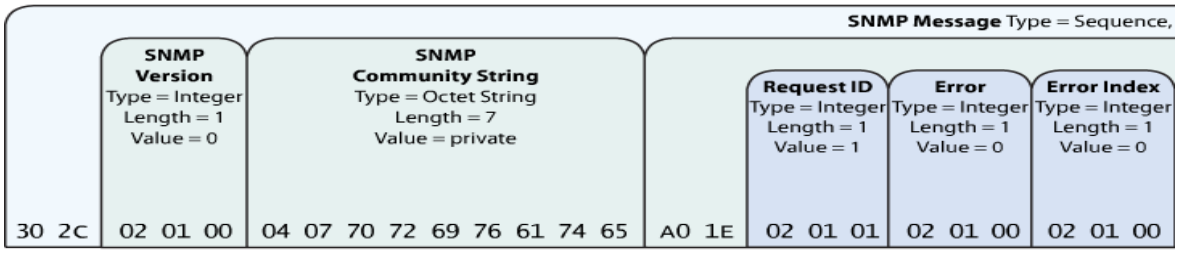
SNMP Packet Structure – notable items

- SNMP version number established in first part of message
- Community string – a basic authentication, usually set to public or private



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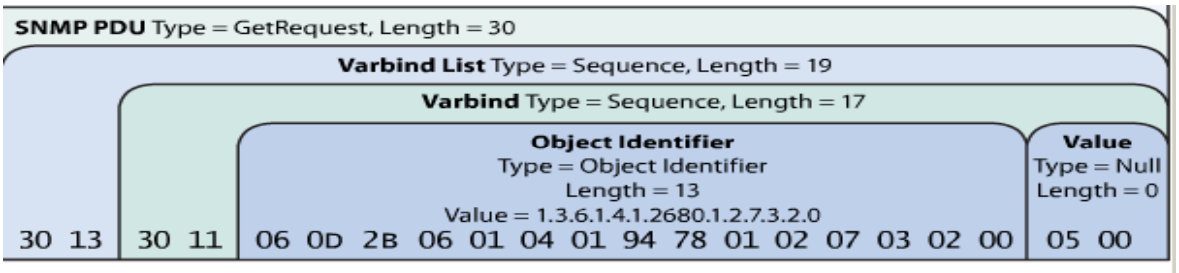
SNMP Packet Structure – notable items

- Data returned by an Agent in response to a GET request can take many forms – 0 or 1, integer, floating point number, OID, IP address or even text
- Since there is no standard amount of data, it is returned in a variable binding



- Object Identifier (OID) is contained in the SNMP Protocol Data Unit

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SNMP – It's all about the OIDs

Object Identifiers are the 'address' of each data point in the Agent

```
VALUE alarmPendingGenAlarmsalarmDescription
  Syntax: [UNIVERSAL 4] OCTET STRING
  Access: read-only
  Status: mandatory
  Description: No description
)
   ::= 1.3.6.1.4.1.5299.15.12.1.11.1.1.8
```

- Written in Abstract Syntax Notation 1 (ASN1) language
- OIDs and their descriptions are collected and published in a file called a Management Information Base, or MIB

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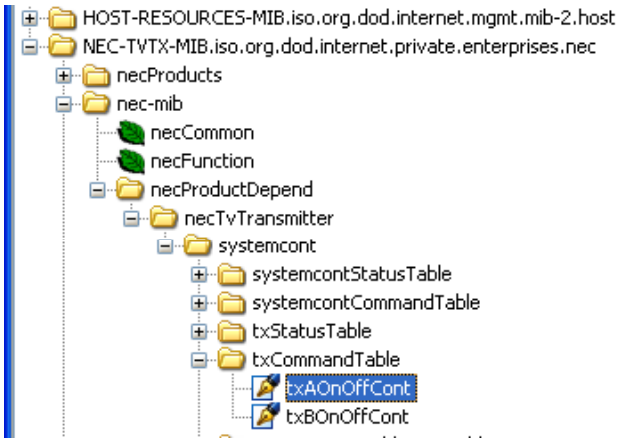
SNMP – It's all about the OIDs

- The Management Information Base, or MIB, is a directory tree 'menu' of the OIDs available on a particular SNMP Agent device.
- Some of the numbers of the OID represent 'branches' of the MIB tree.



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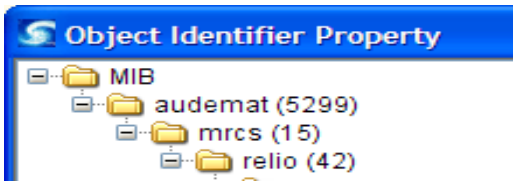
Reading an OID – the generic half

- OIDs specify a data point in a particular piece of equipment
  - BUT – they start with the broadest possible terms:

1.3.6.1.4.1.5299.15.42.1.10.3.4.1.3.552

1 –ISO, the international standards organization
3 – specifies an ISO-recognized organization
6 – Department of Defense, creator of the Internet
1 – Internet OID
4 – Private Organization
1 – Business Enterprise
5299 – Audemat/Worldcast Systems



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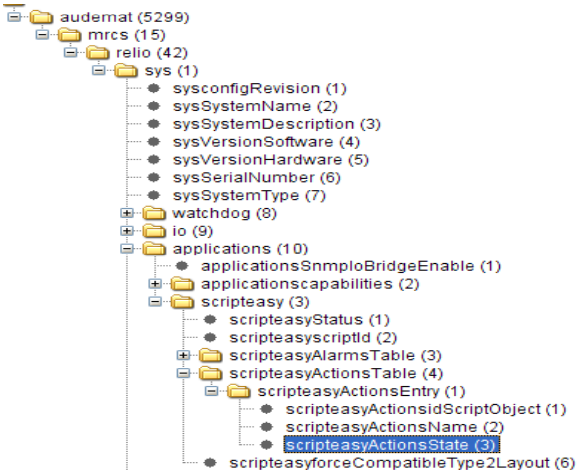
Reading an OID - Working down the MIB tree

1.3.6.1.4.1.5299.15.42.1.10.3.4.1.3.552

15 – MRCS
42 – Relio
1 – System
10 – Apps
3 – Scripteasy
4 – SE Actions Table
1 – SE Actions Entry
3 – SE Actions State
552 – Index value for that specific button



Special OIDs – the Index value

- Some OIDs cannot be completely defined in the MIB
  - Objects created in software after unit is designed
- Example – A software button in Scripteasy
  - OID for buttons in the MIB is generic
  - To define a specific button, add the Index value

Generic button OID from MIB: **1.3.6.1.4.1.5299.15.42.1.10.3.4.1.3**

OID of a specific button in the software: **1.3.6.1.4.1.5299.15.42.1.10.3.4.1.3.361**

Index Value

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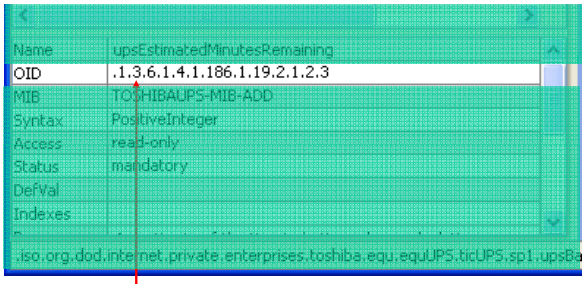
Truncated OIDs

- Some OIDs are only partially published in the MIB
  - Borrow structure and other elements from standard MIBs and RFC files
  - Example from MIB of Toshiba UPS

```
upsEstimatedMinutesRemaining OBJECT-TYPE
    SYNTAX PositiveInteger
    UNITS "minutes"
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
       "An estimate of the time to battery charge depletion
        under the present load conditions if the utility power
        is off and remains off, or if it were to be lost and
        remain off"
    ::= { upsBattery 3 }
```

OID in text form from MIB



OID as seen in MIB browser

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Importing structure from other MIBs

- Many standard industry MIBs help define structure of tables, format of data, etc.
- Manufacturers can import these definitions when designing their own MIB
- Reduces the time needed to create an entire MIB from scratch
- Also reduces the chance of syntax or other errors in the OIDs

```
IMPORTS
  DisplayString, TimeStamp, TimeInterval, TestAndIncr, AutonomousType
    FROM SNMPv2-TC
  enterprises
    FROM RFC1155-SMI
  OBJECT-TYPE
    FROM RFC-1212
  TRAP-TYPE
    FROM RFC-1215;
```

Imports from Toshiba MIB file

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Standard public MIBs

- Some of the common public MIB files used to create other MIBs
  - RFC-1155, which establishes basic syntax, object types and index structures
  - RFC-1212, type notations
  - SNMPV2-TC, textual conventions and table structures
  - SNMPV2-SMI, defines the Structure of Management Information
  - RFC-1215, updated object types
  - SNMP-FRAMEWORK, definitions and textual conventions

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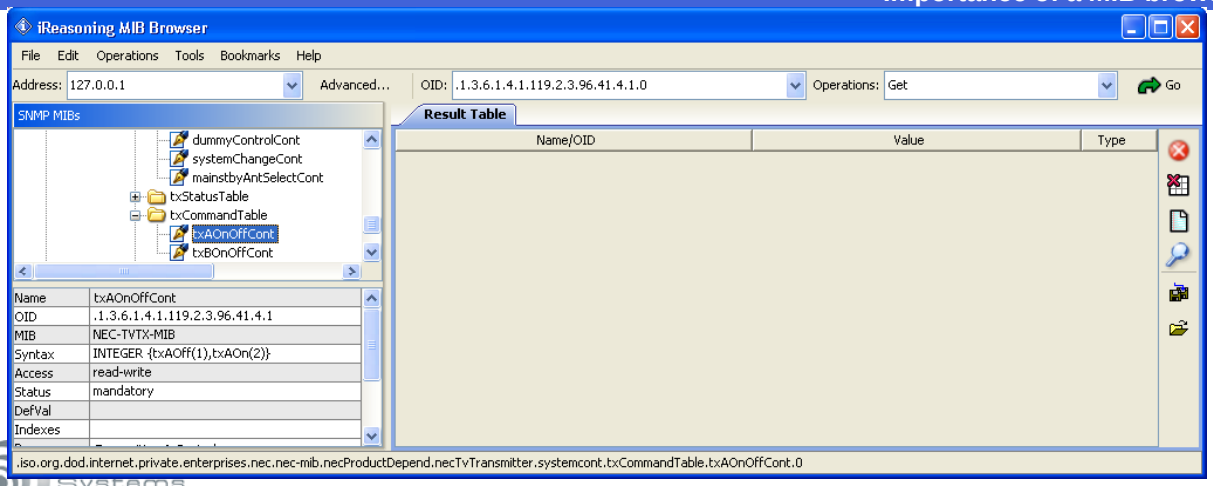
Importance of a MIB browser



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When data is not just data

- Manager device sends a GET request, Agent returns a GETRESPONSE
  Both contain the OID for the object
  - Many types of data could be in an Object:
    - Integer
    - Floating point number
    - String
    - OID
- So, data returned can be almost any length
  - Data returned in a GETRESPONSE is returned as a variable binding
  - First byte of response data informs Manager of length of data packet

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WTF data

- SNMP objects may return data in an atypical form
  - Example: Indicating the amount of free space on a hard drive
    - Integer 0 – 100 indicating percentage used or free
    - Integer 0 – ? indicating megabytes used or free
    - Integer 0 – ? indicating blocks used, cylinders…..
    - String
    - OID
- So, often it is necessary to shift our perspective, or perform some kind of mathematical manipulation on the data to make it comprehensible and useable in the real world

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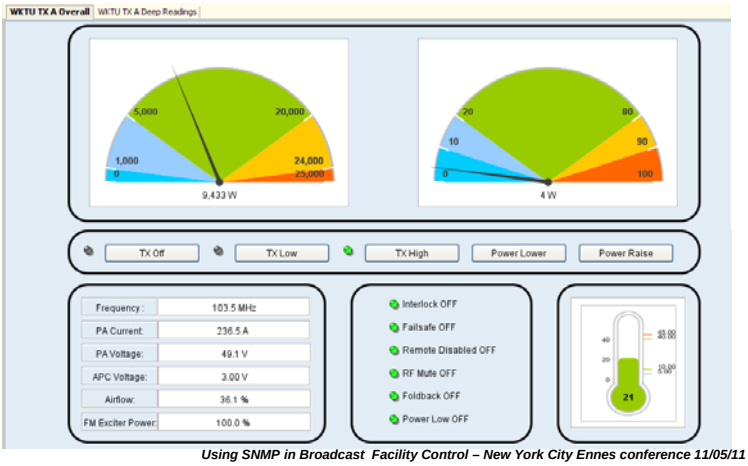
A.P.I. Scriptlet – designing the view

- Design view / control panel to display information

Data and control functions obtained using SNMP can be integrated with other data and controls from traditional I/O or from serial data.



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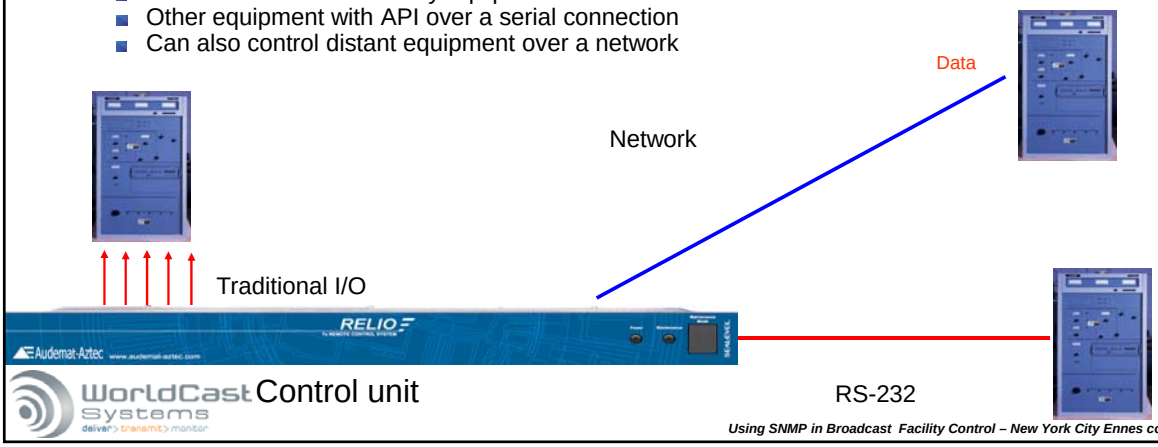
Many paths, many possibilities

- Using advanced connections – IP and serial
  - One unit can control nearby equipment with traditional IO
  - Other equipment with API over a serial connection
  - Can also control distant equipment over a network



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EasyLink

- Even small devices, or ones with limited traditional I/O connections, can still be powerful parts of a facility control plan

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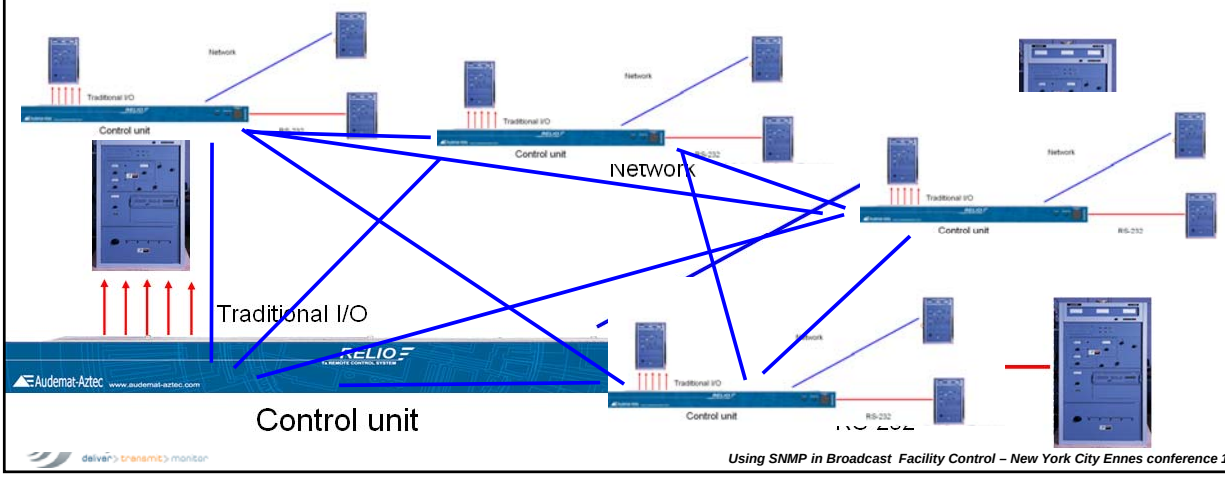
Many paths, many possibilities



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Facility Control Functions in other equipment

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Many paths, many possibilities

- Facility control device can be integrated into other equipment
  - Save space, energy and $$$
  - Act on specialized information and control unique functions
  - Can still use advanced serial and network connections

Traditional I/O

RF Monitor

Network

Data

RS-232

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Many paths, many possibilities

- Facility control integrated into Audio Processor
  - Loss of audio from STL
  - Trigger local audio source playback
  - Send SNMP command to Firewall to stream audio

STL

Audio Server

Network Firewall

Audio Processor

AES to TX

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CONCLUSION

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Advantages of using SNMP

- Save time and effort – connect with and control remote equipment using existing network connections
- Monitor and control vital IT systems – servers, routers, firewalls, switches, etc.
- Broadcast equipment increasingly supporting SNMP
  - Harris ATSC transmitters, Nautel NV and VS, more on the way (ZX10)
- Monitor and control a greater variety of equipment
  - Include UPS, HVAC, Security systems, office equipment in your overall plan
- Achieve greater detail of information
  - 100s of data points, detect small failures before they become big ones
- Monitor and control equipment anywhere on the network

Do More, with Less

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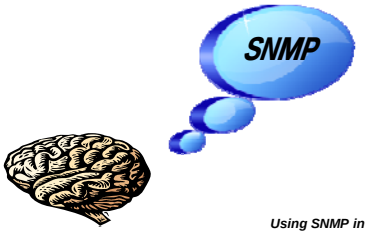
Don't panic

- SNMP is just one more way to connect with and control equipment
- WorldCast Systems Scripteasy software can make it easier
- Get a MIB browser and start investigating – see what you can find!



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Thank you

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    peterle@audemat.com

- Thanks also to
  - Josh Hadden, Clear Channel, New York

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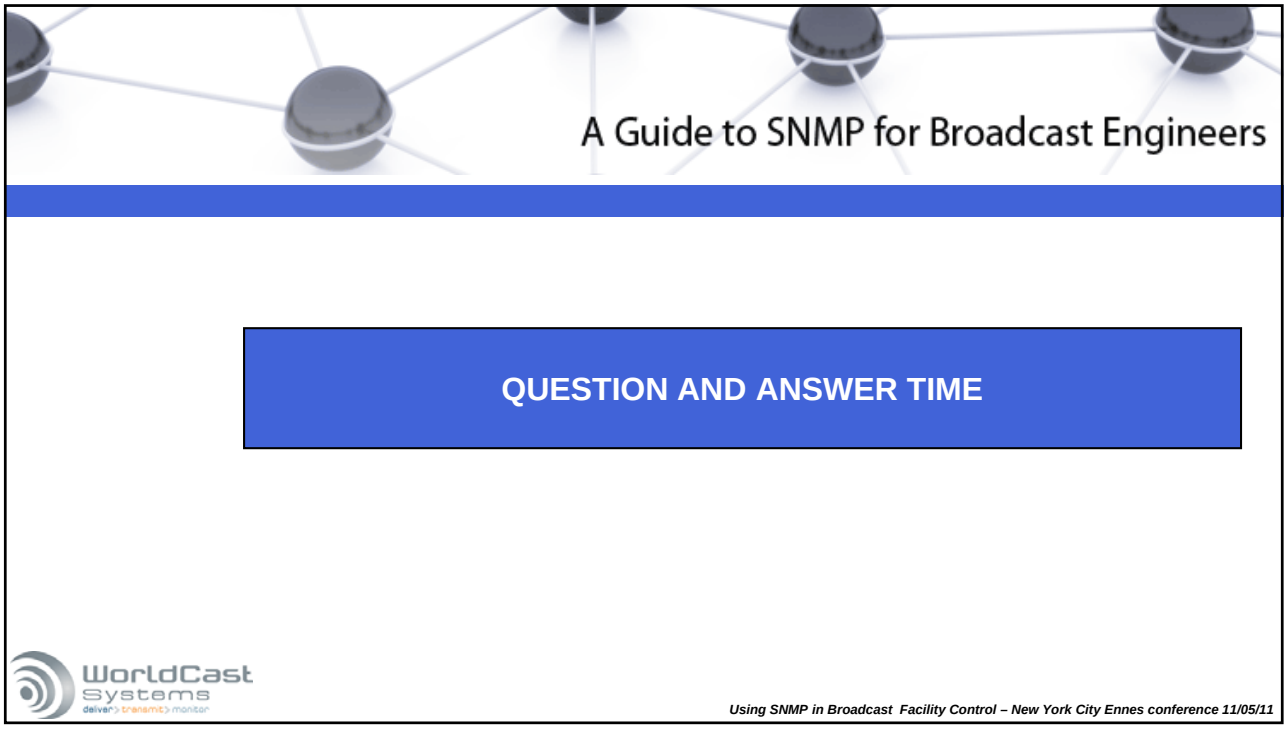
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