Management of Vectored DSL

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Access Business Forum

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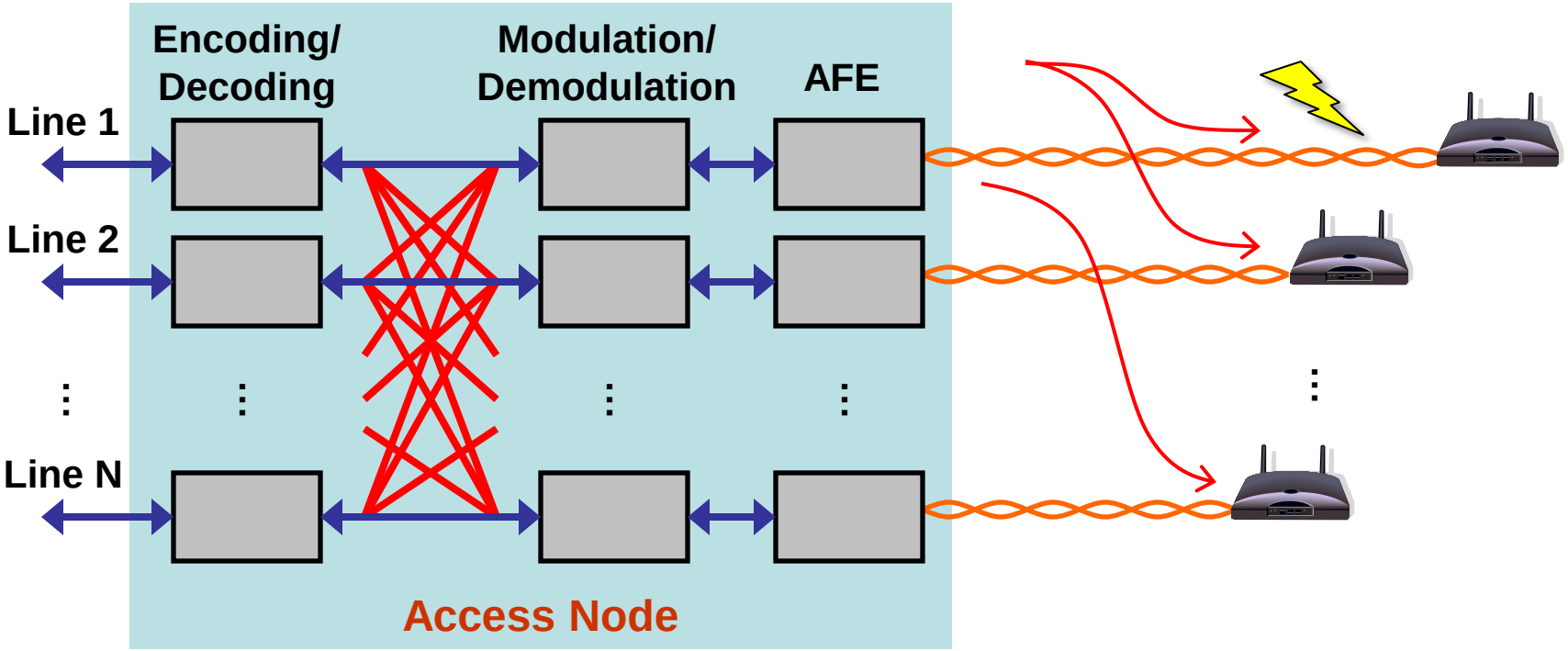
Vectored DSL

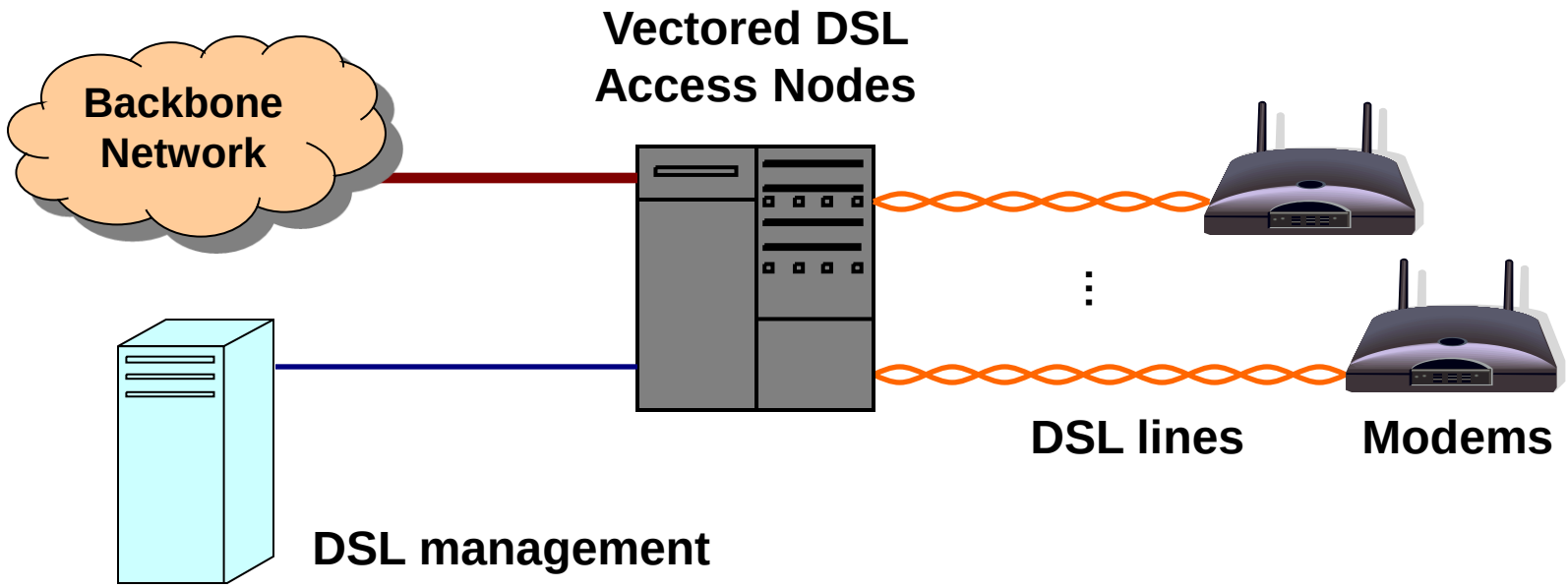


Limited resources for vectoring operations

Performance trade-offs among customers

Management system needed to realize full benefits

Dynamic Spectrum Management (DSM)



Collect

- management data from all lines;
- store for long period.

Analyze

- recent data and history;
- detect problems;
- project performance.

Act

- reconfigure lines to improve speed/stability;
- report faults.

New Management Challenges (DSM Level 3)

Manage trade-offs among vectored lines

Achieve co-existence of non-vectored lines and vectored lines

Manage for noise sources that become dominant after eliminating the crosstalk

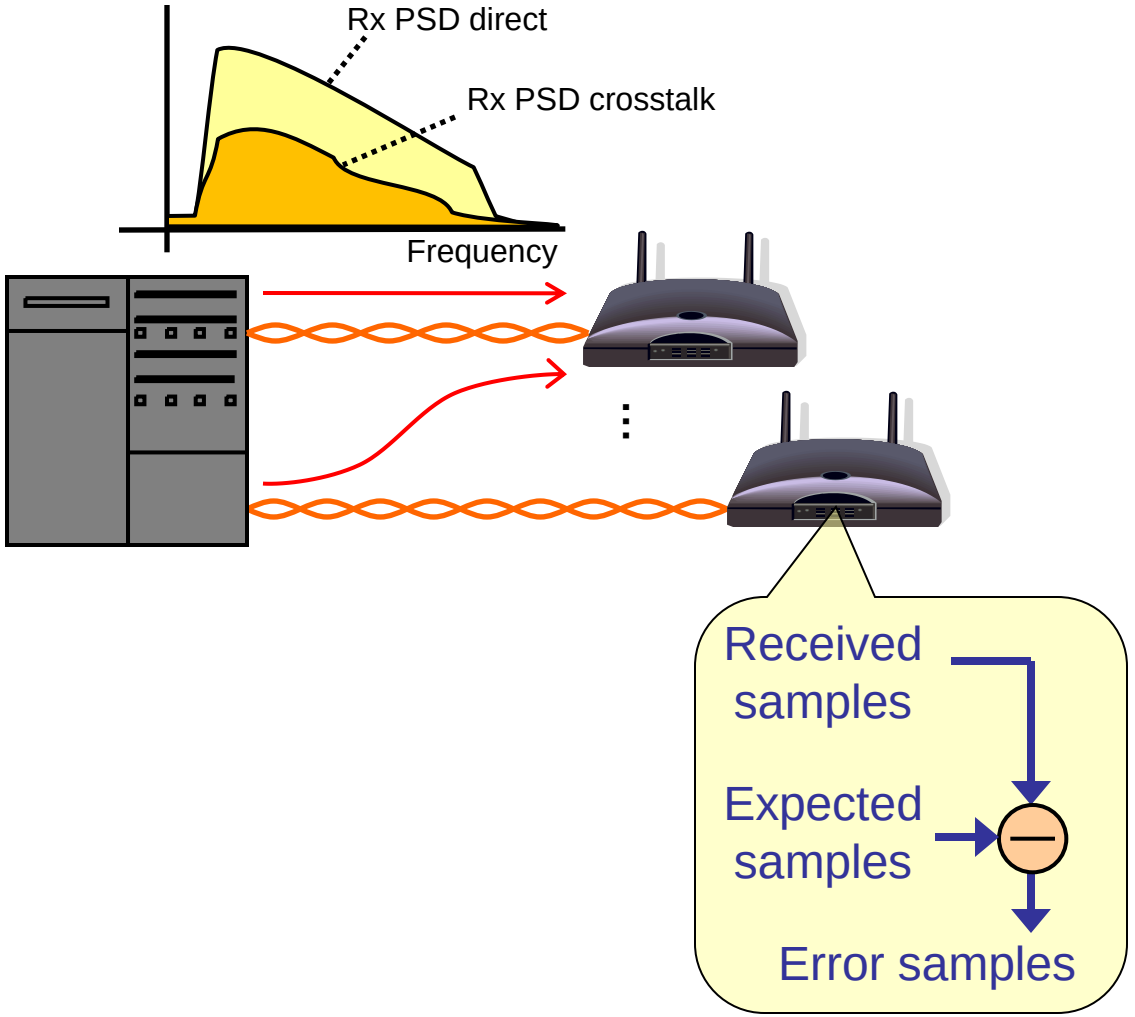
Data Parameters

Crosstalk coupling (XLOG)

- Received crosstalk PSD divided by received signal PSD

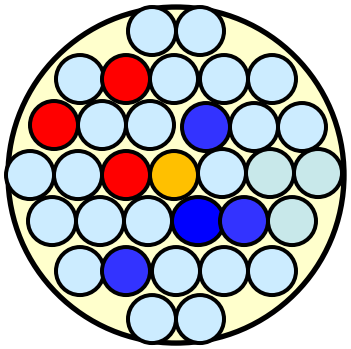
Noise correlation

- Correlation of error samples of different receivers



Crosstalk Diagnosis

Cable cross-section



- Vectored lines
- Vectored/non-vectored line creating strong crosstalk
- Non-vectored lines

Identify source pair for high crosstalk (“rogue” pair).

Noise correlation can indicate common outside source.

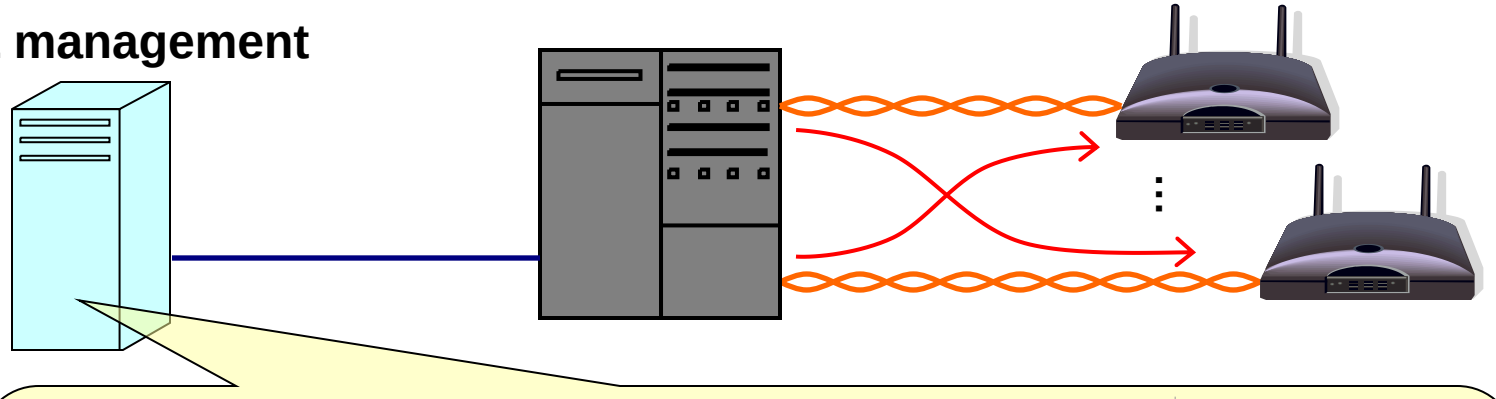
Pair likely causing disruption/degradation on non-vectored lines as well.

Performance Prediction

Use data parameters (XLOG, noise correlation) to estimate data rates

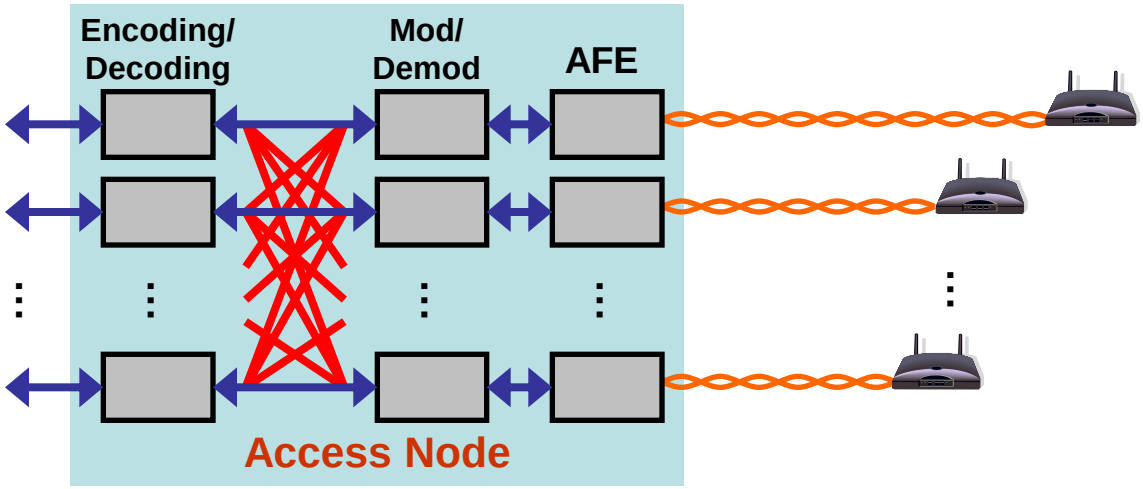
Understand performance trade-offs and make decisions on priorities

DSL management



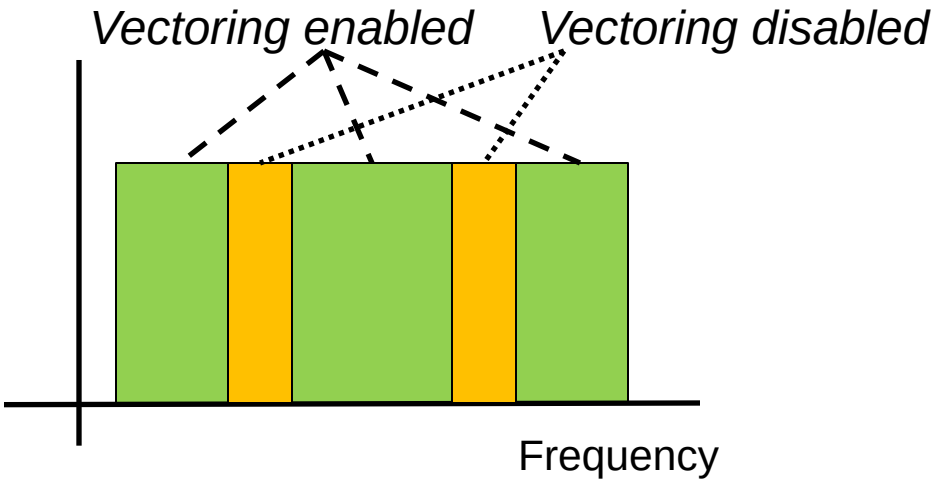
Line	Current Service	Service with vectoring – low priority	Service with vectoring – high priority
123-456-7890	50 Mbps	60 Mbps	65 Mbps
650-654-3400	30 Mbps	35 Mbps	42 Mbps
…	…	…	…

Control Parameters (1)



Vectoring enable/disable

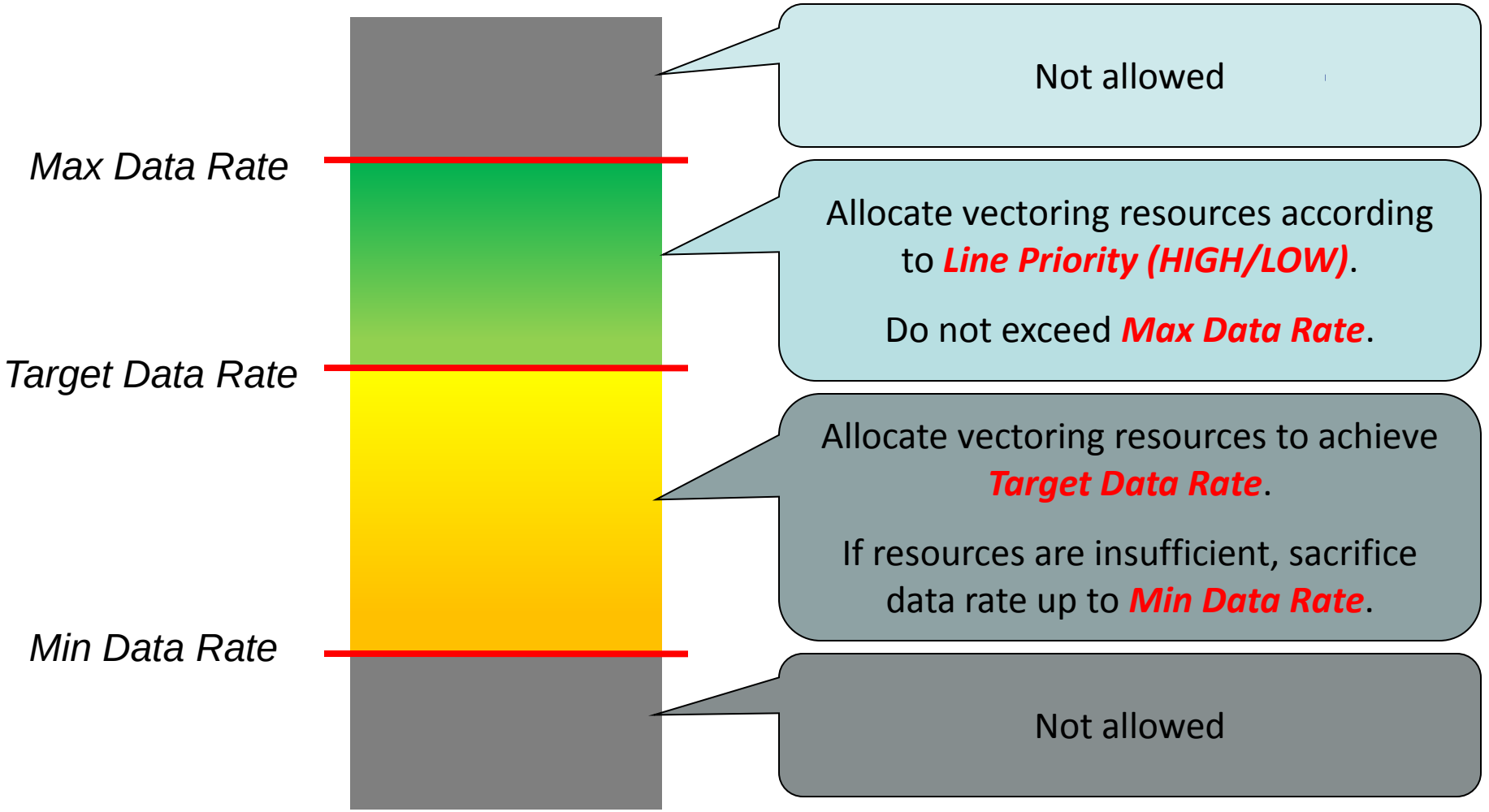
- Choose on which lines to allocate vectoring resources



Frequency controls

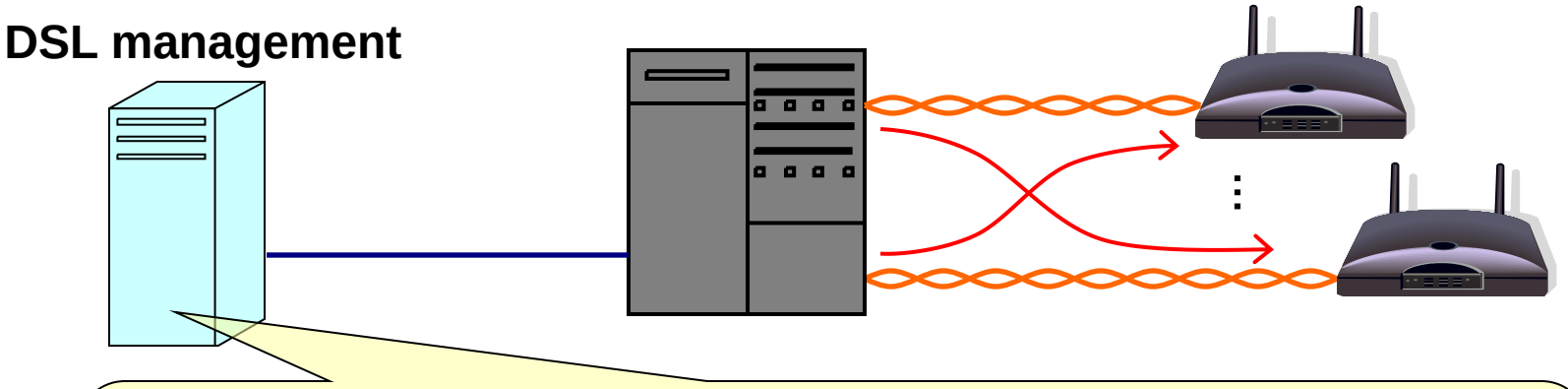
- Choose on which frequencies to allocate vectoring resources

Control Parameters (2)



Controlling the Lines

- Enable vectoring for lines that benefit the most
- Enable vectoring for customer with high-end services
- Disable vectoring for malfunctioning equipment

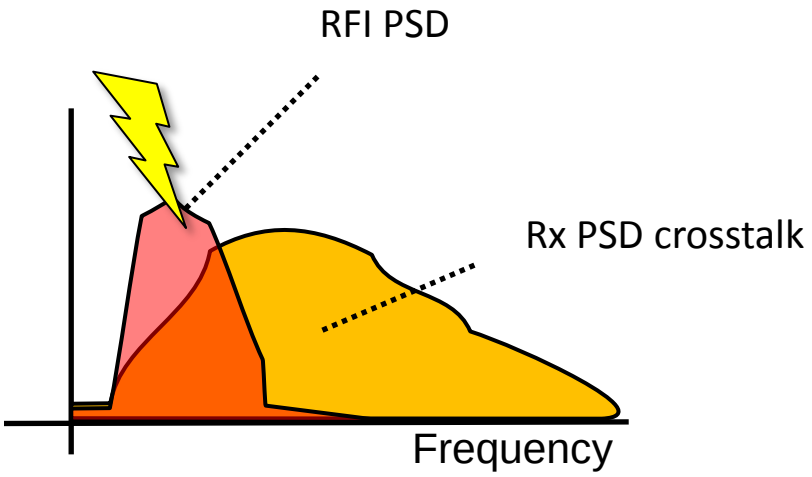


Line	Current Service	Benefit from vectoring	Purchased service	Enable vectoring?
123-456-7890	50 Mbps	15 Mbps	Premium	**YES**
650-654-3400	30 Mbps	2 Mbps	Basic	**NO**

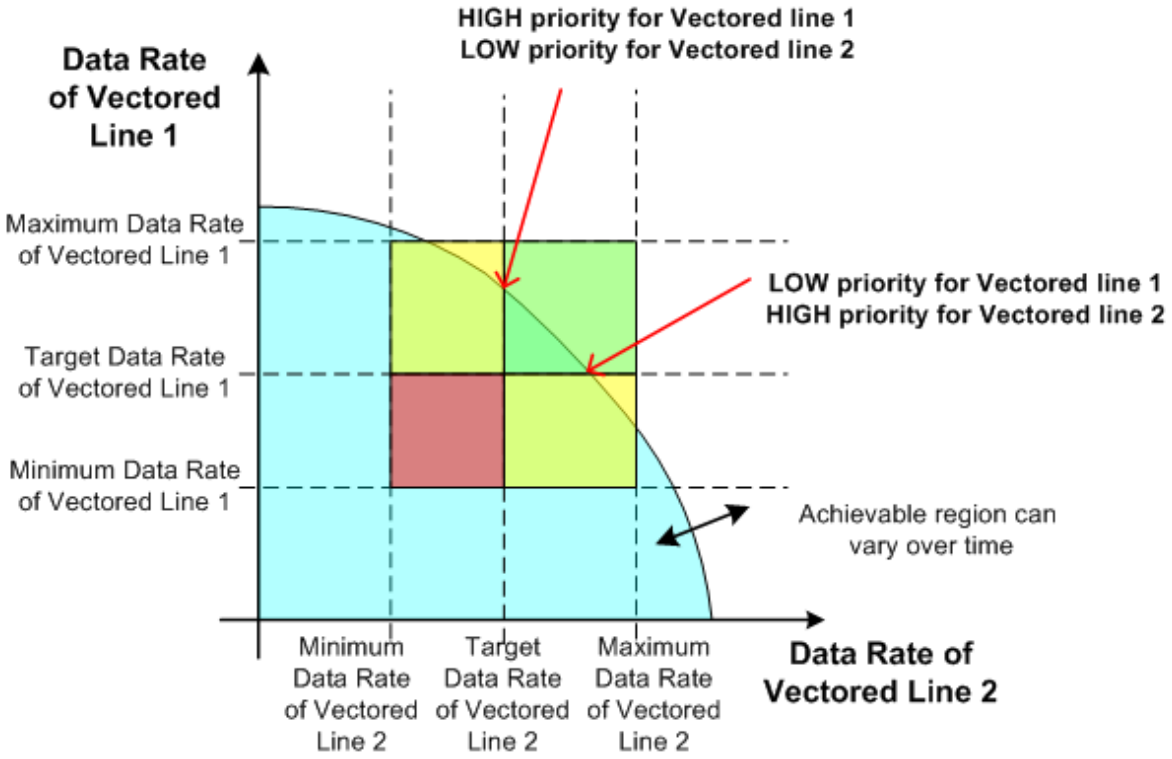
Controlling the Frequencies

Disable vectoring in frequencies dominated by RFI, AM, or other time-varying interference.

Disable vectoring in frequencies where crosstalk from non-vectored systems dominates.



Controlling Rates and Priorities

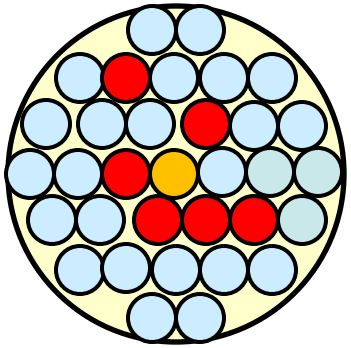


Achievable data rates depend on the allocation of vectoring resources

Must choose rate controls and line priorities based on achievable data rates and customer's purchased service

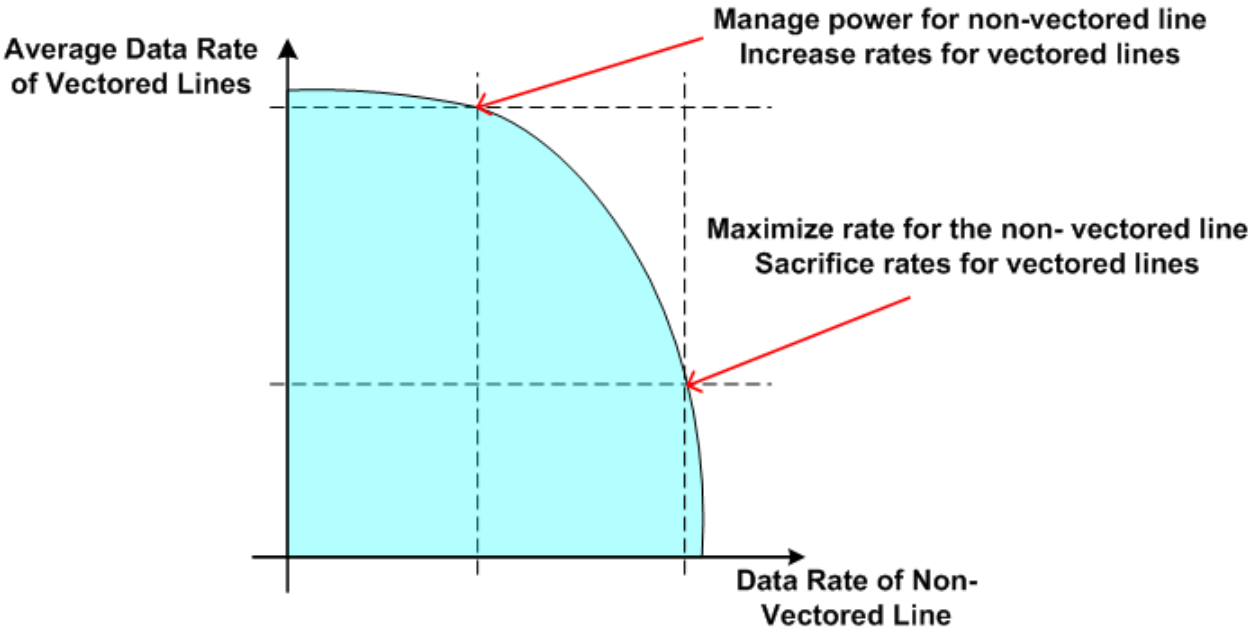
Co-existence of Vectored and Non-vectored lines (DSM Level 2+3)

Cable cross-section



Vectored lines

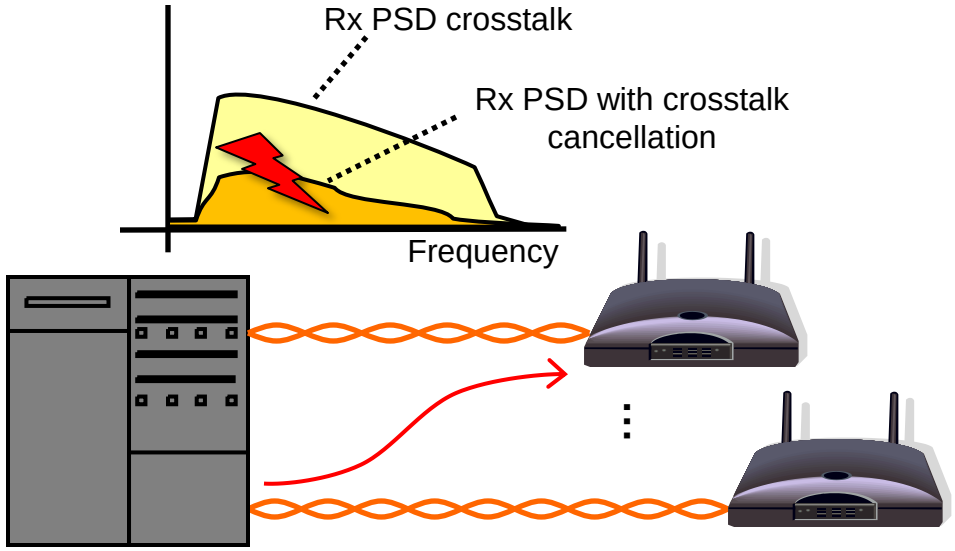
Non-vectored line



Non-vectored lines in the same binder increase the crosstalk level

Reducing power for non-vectored lines restores the rates of the vectored lines

Managing for External Noise (DSM Level 1+3)



Crosstalk often hides other noise sources

With crosstalk eliminated, lines are more sensitive to noise effects

Management for impulse and other time-varying noise becomes even more important

Conclusions

Vectored DSL brings copper pairs to the 100 Mbps performance region

Proper management brings out the full benefits of the technology