

# Basic protection/restoration

## mechanisms and notation

(Pioro - Medhi : 9.1)

- A failure state (scenario)  $s$  is a vector of link availability coefficients

$$d^s = \left( \alpha_{(i_1, j_1)}^s, \alpha_{(i_2, j_2)}^s, \dots, \alpha_{(i_m, j_m)}^s \right) \quad m = |A|$$

where  $0 \leq \alpha_{(i, j)}^s \leq 1$  is the proportion of the normal capacity  $u_{ij}$  of link  $(i, j)$  that is available in scenario  $s$ , with  $s = 1, \dots, S$

$S$  predefined list of failure scenarios

- Failure scenarios are also characterized by

$$X^s = \left( X_{d_1}^s, \dots, X_{d_{|D|}}^s \right)$$

where  $X_d^s$  is the proportion of  $h_d$  ( $\equiv$  traffic volume of commodity  $d$ ) that must be realized in scenario  $s$  (it may be  $X_d^s < 1$  meaning decreased realized traffic volume for  $d$  under  $s$ )

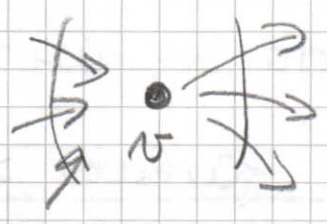
•  $s=0$  will be used to denote the normal state (no failures):

-  $\alpha_{(i,d)}^0 = 1 \quad \forall (i,d) \in A$

-  $\chi_d^0 = 1 \quad \forall d \in D$

example

• failure of a mode  $v$ :



$\alpha_{(i,v)}^s = 0 \quad \forall (i,v) \in BS(i)$

$\alpha_{(v,i)}^s = 0 \quad \forall (v,i) \in FS(i)$

$\chi_d^s = 0 \quad \forall d = (v,t) \text{ or } d = (t,v)$

• dynamic (multi-hour) networks (no failures):

$\forall d \in D \quad h_d^s = \chi_d^s \cdot h_d \quad s = \overbrace{1, \dots, S}^{\text{time}}$

gives the traffic volume of  $d$  for

different times of the day (i.e.  $s$  now denotes time slot) :  $u_i$  in this context it may be  $\chi_d^s > 1$  for some  $s$ .

• Protection versus restoration = concerns how resources are re-established in case of failure

▫ protection : mechanisms to "protect" the network "before" the failure happens  
e.g. path diversity

< these are robust approaches >

▫ restoration : mechanisms indicating actions to be performed "after" the failure (to try to re-establish resources)

\* The term re-establishment is generally used for both protection and restoration \*