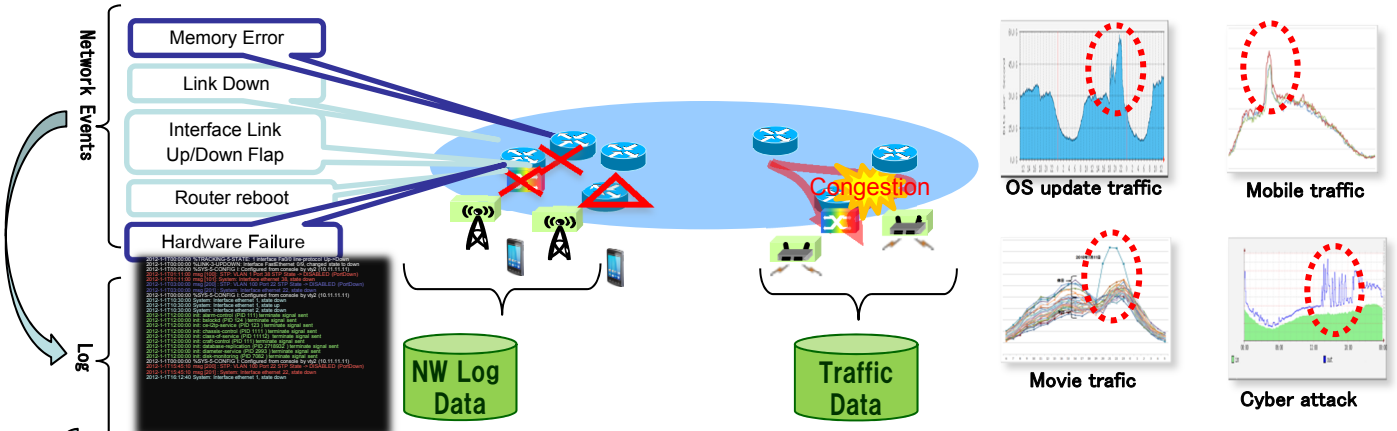
05 Optimizing network operation through NW data analytics

～ Inferring latent network status through machine learning ～

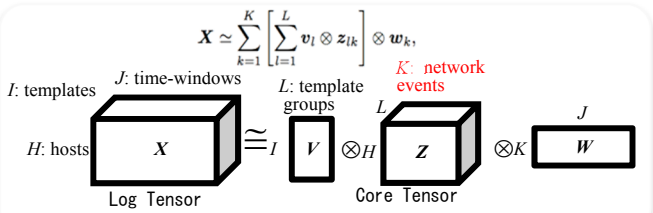
Abstract

Recently, sudden traffic spikes due to cyber attacks, flash crowds, and heavy content delivery traffic have often caused unpredictable congestion. Moreover, the congestion in large-scale networks can result in service outages that inflict a lot of damage on customers. To provide quality network service without such network anomalies, it is required to analyze network data, proactively detect the anomalies, and find root causes. We propose two technologies for performing such proactive network operation; 1) network fault diagnosis technology based on network log tensor factorization (LTF), and 2) predictive-based traffic engineering, i.e., traffic-route control technologies using the prediction of traffic variations based on the diagnosis. We examine these technologies through actual network data.



Technology 1 :Log Tensor Factorization (LTF) technology

$$\mathcal{X} \simeq \sum_{k=1}^{K} \left[\sum_{l=1}^{L} \boldsymbol{v}_l \otimes \boldsymbol{z}_{lk} \right] \otimes \boldsymbol{w}_k,$$



Extract Meeningful Network Event

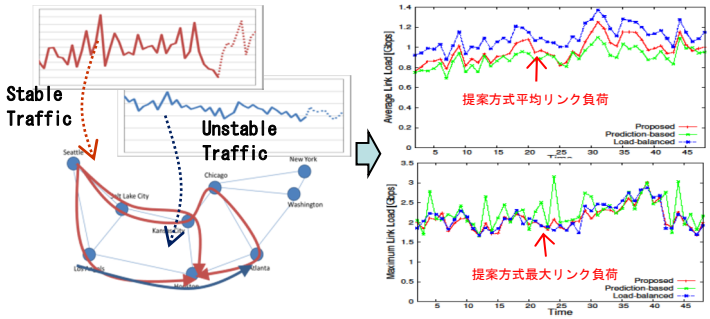
NEIGHBORING LINK FLAP EVENT

Host Name	TG Weights	Weights	Templates
CoreRouterA	0.666	0.4	TIME : ifmgr [*] : %PKT_INFRA-LINK-3-UPDOWN : Interface * , changed state to Up
		0.4	TIME : ifmgr [*] : %PKT_INFRA-LINK-3-UPDOWN : Interface * , changed state to Down
		0.2	TIME : %SYS-3-LOGGER_DROPPED : System dropped * console debug messages.
EdgeRouterB	0.333	0.4	* : * : %LINK-3-UPDOWN : Interface * , changed state to up
		0.17	* : TIME : %LINK-3-UPDOWN : Interface * , changed state to administratively down
		0.17	* : * : %LINEPROTO-5-UPDOWN : Line protocol on Interface * , changed state to up
		0.17	* : * : %LINEPROTO-5-UPDOWN : Line protocol on Interface * , changed state to down
		0.05	* : * : %LINK-3-UPDOWN : Interface * , changed state to down

Build a Network Event Extraction Technology that extract meaningful network events

Technology 2 :Predictive-based Traffic Engineering※1

Separating traffic into stable and unstable component



Achieves proactive and robust traffic engineering based on traffic

※1 A part of this study is supported by SCOPE “Predictive based traffic engineering based on flow mininge”

Related work

[1] T. Kimura, K. Ishiabshi, T. Mori, H. Sawada, T.Toyono, K. Nishimatsu, A. Watanabe, A. Shimoda, and K. Shiomoto, “Spatio-temporal factorization of log aata for understanding network events,” *In Proc. IEEE INFOCOM* 2014, June 2014.

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